**3GPP TSG-RAN WG4 Meeting # 96-e R4-200XXXX**

**Electronic Meeting, 17 – 21 Aug., 2020**

**Agenda item:** 4.2.1

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [96e][102] NR\_NewRAT\_UE\_RF\_Part\_1

**Document for:** Information

# Introduction

This email discussion thread is for Release 15 NR maintenance on FR1 UE RF issues.

Note that the following documents are assigned to other agendas.

R4-2010340, R4-2010341, R4-2010342, R4-2010343 are moved to 4.1 (thread #101).

R4-2010628, R4-2011480, R4-2011481, R4-2011491 are moved 4.2.2 (thread 103)

# Topic #1: Transmitter requirement maintenance

## Companies’ contributions summary

Here’s the summary of the contributions to the transmitter requirements.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010626**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010626.zip)  CR to TS 38.101-1: Correction on the Aggregated Channel Bandwidth | ZTE Corporation | 1. Apply largest u for SCSlow, SCShigh, NRB,low, NRB,high and BWGB,Channel(k), aligned with Rel-16 spec. 2. On top of 1, apply μ=1 for SCSlow, SCShigh, NRB,low, NRB,high and BWGB,Channel(k) in the case of no common μ value for both of the channel bandwidths. |
| [**R4-2010810**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010810.zip)  On UL MIMO Tx EVM requirement | Huawei, HiSilicon | ***Observation 1: Not all crosstalk noise can be eliminated by gNB***  ***Observation 2: Antenna crosstalk does not exist for the conductive measurement***  ***Observation 3: PCB isolation should be guaranteed by UE design and the non-linear coupling noise cannot be eliminated***  ***Observation 4: MMSE has a better performance than ZF MIMO receiver, and no obvious performance degradation for non-MIMO receiver if the conductive crosstalk isolation is good enough.***  ***Proposal: It is proposed that TE vendors to further evaluate the feasibility of UL MIMO EVM measurement with MIMO receiver.*** |
| [**R4-2011520**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011520.zip)  On the Transmit EVM Requirement for UL MIMO Transmission | Lenovo, Motorola Mobility | **Proposal 1:** Use the linear zero-forcing MIMO equalizer to define and measure the transmit EVM for multi-layer MIMO transmission,  or  **Proposal 2:** Use the unbiased linear MMSE MIMO equalizer to define and measure the transmit EVM for the multi-layer MIMO transmission. |
| [**R4-2009655**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009655.zip)  Clarification of assumption on EVM measurement for UL-MIMO | Anritsu Corporation | ***Observation 1: There is a concern that companies are not aligned with assumptions of the words “per layer/ each layer/ each connector” with regards to a reference point for EVM calculation, variety of codebook to be applied, number of layers to be measured simultaneously, and mapping of logical antenna port and physical antenna connector.***  ***Proposal 1: Align an assumption of EVM measurement for UL-MIMO in a group***  ***Proposal 2: Clarify assumptions in TS38.101-x from viewpoints of a reference point of EVM calculation, number of configured layers for test, numbers of layers to be measured simultaneously and mapping between logical antenna port and physical antenna connector once the consensus has been created in the group.***  ***Observation 2: We assume that the mapping of logical antenna port and physical antenna connector in a UE is fixed 1:1 during the MIMO operation***  ***Observation 3: Calculated EVM at the UE antenna as a reference point includes at least 5.6% impairments of measurement antenna caused by XPD in FR2 OTA test system.***  ***Observation 4: As a final goal of EVM measurement for 2-layer UL-MIMO, reference point of EVM calculation should be at UE antenna port when measuring 2 layers simultaneously.*** |
| [**R4-2010114**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010114.zip)  Corrections of Japan-related CA co-ex tables for REL-15 combo | SoftBank Corp., NTT docomo INC., KDDI Corporation | 1) Protection to n74 is added to n3-n78 and n8-n78.  2) For n8-n78, Note 5 was removed since the protection is supported with A-MPR(NS\_43) in NR. |
| [**R4-2010126**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010126.zip)  Handling of additional requirements for UE co-ex in CA/DC | SoftBank Corp. | **[Proposal-1] We draw conclusions for the two questions below in this meeting and take necessary actions by the next meeting.**   1. **Whether we should add the info. or the table above?** 2. **Whether we should add/improve description (esp. if the table is not added)?** |
| [**R4-2010800**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010800.zip)  Correction to uplink antenna connectors | Rohde & Schwarz | Update the wording in section 6.1 |
| **[R4-2010804](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010804.zip)**  Discussion on the number of Tx connectors | Rohde & Schwarz | **Proposal:** RAN4 agrees on the accompanying CR R4-2010800. |
| [**R4-2011341**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011341.zip)  Applicability of DTRxSRS to SRS carrier switching and power class 2 | Qualcomm Incorporated | This contribution describes two shortcomings of the ∆TRxSRS allowance for PCMAX\_L when SRS carrier switching is required with a DL-only carrier and when the transmission on the primary antenna is PC2 but only PC3 on the diversity antennas. The proposed modification is described in this contribution and included in [2]. |
| [**R4-2011342**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011342.zip)  Correction to configured power with allowance for SRS switching | Qualcomm Incorporated | SRS carrier switching to DL-only carriers is added to applicability of DeltaT\_RxSRS and DeltaT\_RxSRS value is increased by 3 dB for the case when primary Tx is PC2. |
| [**R4-2011495**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011495.zip)  CR for 38.101-1 on minimum output power-Rel-15 | Huawei, HiSilicon | Adding one table for minimum output power for 256QAM which is aligned with EVM requirement. |
| [**R4-2011497**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011497.zip)  CR for 38.101-1 on corrections for AMPR-Rel-15 | Huawei, HiSilicon | Adding one table for minimum output power for 256QAM which is aligned with EVM requirement. |

## Open issues summary

### Sub-topic 1-1 UL MIMO EVM

R4-2010810, R4-2011520, and R4-2009655 discuss the issues on EVM measurement in UL MIMO. Some clarifications are needed to establish a common understanding how EVM is measured in UL MIMO. Huawei proposes to study the feasibility of MIMO receiver, Lenovo/Motorola proposes a specific MIMO receiver(s), and Anritsu summarizes the current understanding from TE vendor point of view including FR2. Anritsu summarize the test methods and reference point for EVM measurement in the following.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Method** | **Type of EVM measurement** | **Reference point for EVM calculation** | **Num. of configured layers for test** | **Other measurement conditions / remarks** | **Related paper/ Specs** |
| 1 | Definition of current FR1 EVM spec for MIMO. | UE antenna connector | 2 | EVM of two layers are measured simultaneously. UE RF front end impairments are included in the calculated EVM. | TS38.101-1 [10] |
| 2 | New proposal of EVM test for each layer | Layer / UE antenna port | 2 | EVM of two layers are measured simultaneously by MIMO receiver in the TE. UE RF front end impairments are cancelled by estimating unbiased symbols which are derived utilizing DM-RS. | [4][6][8]  Not clear if [3] applies. |
| 3 | Similar definition with current FR2 EVM spec. for MIMO | UE antenna connector | 1 | Test is carried out in series by configuring each layer separately.  UE RF front end impairments are included in the calculated EVM. | TS38.101-2 [11]  [5] with a compromise.  Not clear if [3] applies. |



Sub-topic 1-1 Please present your company view in 1.3.1 about the FR1 EVM reference point, EVM test method and reference receiver.

### Sub-topic 1-2 Handling of UE coexistence in CA/DC

R4-2010126 proposes clarifications in UE coexistence requirement in CA/DC as they are incomplete and unclear.

Sub-topic 1-2 Please present your company view in 1.3.1 whether we should add a new table or info (somehow), or how to clarify or fix the presented issues.

## Companies views’ collection for 1st round

### Open issues

Here’s to collect comments about two discussion topics

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Sub topic 1-1: UL MIMO EVM  Sub topic 1-2: UE coexistence in CA/DC |
| Rohde & Schwarz | Sub topic 1-1: We share a similar view to Anritsu. It is necessary to align the assumptions before defining the EVM measurement.  For Motorola, currently we would rather prefer Option 1, but before making this agreement, we should align the assumptions and then come back to this discussion. |
| Motorola | Sub topic 1-1: For Rohde & Schwarz, by Option 1, do you mean Proposal 1? If so, this is fine for us. However, we are also ok with an unbiased MMSE receiver as in Proposal 2. Our point is that if an MMSE receiver is used, it should be scaled to an unbiased receiver, as otherwise the error will be measured incorrectly. In any case, an unbiased receiver should be used to measure EVM. |
| Rohde & Schwarz | To Motorola: Yes, sorry, I meant Proposal 1. |
| Nokia | Sub topic 1-2: UE coexistence in CA/DC: No new UE to UE co-ex table is preferred option. A text proposed in paper “union of single band UE co-ex requirements, including additional requirements, are applied for CA/EN-DC” sounds good way. |
| Ericsson | Sub-topic 1-1:  We support Method 1, the existing measurement per antenna connector. We agree with Observation 1 and Observation 3 in R4-2010810.  We appreciate the comprehensive results and the clear assumptions presented in R4-2011520, but still doubt that the non-linear crosstalk in the UE can be eliminated by a linear receiver. Indeed, non-linear effects in MIMO systems can be modelled by modifying the channel matrix and adding correlated noise: e.g. would Observation 3 in R4.2011520 be met for uncorrelated noise due to non-linearities?  Notwithstanding, agreeing a reference receiver for the TE (gNB emulator) may not be trivial.  Internal crosstalk within the UE should be eliminated by UE design (Observation 3 in R4-2010820) and duly tested according to the existing specification. |
| Huawei, HiSilicon | Sub topic 1-1:  As noticed in Anritsu’s observation 4, i.e. “***As a final goal of EVM measurement for 2-layer UL-MIMO, reference point of EVM calculation should be at UE antenna port when measuring 2 layers simultaneously.***” , before we make a decision, we’d like to know what’s the TE implementation status so far? Any issues to implement MIMO receiver at TE side? |

### CRs/TPs comments collection

Here’s to collect comments to CRs (and companion discussion papers) to transmitter requirements.

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2010626**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010626.zip) | Nokia: Ok. This matches with what has been agreed for Rel-16.  Skyworks: Ok. |
| [**R4-2010114**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010114.zip) | Company A |
| Company B |
|  |
| [**R4-2010800**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010800.zip)  [**R4-2010804**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010804.zip) | Company A |
| Rohde & Schwarz: To Qualcomm, I checked for LTE conformance test spec 36.521-1 and there is no TC defined for this, so the issue does not exist there. Also using 4 different antennas for UL in our understanding violates the agreement from R4-2008462, stating that the max number of UL antenna connectors is 2.  Huawei: During the discussion of UL CA, it is possible that 2 PA are utilized to support a certain CA bandwidth class. Considering also UL MIMO capability, it may end up with 4 PA and 4 antennas.  Qualcomm: The CR in R4-2010800 limits the UE to two transmit antennas. This limitation is written on the UE, but maybe the intention is a limit of two antennas per band? The UE could and most likely does have separate antenna system for different frequency ranges.  Skyworks: same observation as Huawei. For intra-band non contiguous uplink CA, we are considering supporting 2x2 MIMO, which calls for 4 PAs and 4 antenna connectors. Also for the case of SRS antenna switching, in case of 1T4R, 1 PA is routed to 4 different antenna connectors. We note that both of these instances, perhaps there are ways of verifying core requirements with only 2 Rx ports: for UL NC CA, 2x2 MIMO could perhaps be verified CC per CC, and for 1T4R there are perhaps ways of testing all antenna ports with only 2 cables by adding extra external hardware between UE and TE? |
|  |
| [**R4-2011341**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011341.zip)  [**R4-2011342**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011342.zip) | Company A  OPPO: For clarification, does this increased IL only apply to 1T4R or both 1T4R and 2T4R?  Huawei: why SRS carrier switching needs to consider the increased delta SRS? In which scenario we need to consider the switching to a different antenna for a different carrier? Also we see no reason to remove the SRS resource information.  Qualcomm: For OPPO, I think the increased IL would apply for both 1T4R and 2T4R. It applies whenever you switch a PC3 PA to one of the antennas in the PC2 band for sounding. With multi-band PA’s, that PC3 PA may not be the one that is used for PUSCH/PUCCH transmission on the PC2 primary Tx but “borrowed” for transmitting SRS on the diversity Rx antenna.  For Huawei one scenario is that you have CA between Band A and Band B, each on a separate antenna. However, Band B is a DL only band so there is no dedicated PA for that band. In order to transmit SRS on carrier on Band B, then I need to switch a PA in to the antenna for Band B. We removed the SRS resource because we thought it didn’t add any new information and thought there might be an error. For example, if a 1T4R UE is configured with 2 SRS resources, then the DT\_RxSRS should apply since switching would be needed. However, the current clause states that the relaxation applies only when configured with 4 SRS resources.  Skyworks: Could you confirm if it is correct understanding that the rationale for an increasing DT\_RxSRS by 3dB is to account for an SRS transmission that would be made in a PC2 band with a PC3 PA ?  For information, we have contribution R4-2011527 that proposes to introduce DeltaTsrs for 36.101 in thread [105]. |
| [**R4-2011495**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011495.zip) | Company A  DISH: We can’t agree this CR. The same minimum output power shall apply for all movulations, like in LTE.  Nokia: Minimum output power requirement is needed to control interference in NW, should not be changed for 256-QAM.  Huawei: It is specifed in the spec that for EVM requirement, the applied minimum output power for 256QAM is 10dB higher than other modulation order. The change is to align the requriements in different clauses. |
| [**R4-2011497**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011497.zip) | Company A |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: Receiver requirement maintenance

Here’s the summary of the contributions to the receiver requirements.

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010814**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010814.zip)  CR for 38.101-1 FRC corrections (R15) | Huawei, HiSilicon | Correct the RFC parameter errors in Table A.3.2.2-1, Table A.3.2.2-2, Table A.3.2.2-3, Table A.3.2.3-1, Table A.3.2.3-2, Table A.3.2.3-3, Table A.3.2.4-1, Table A.3.2.4-2, Table A.3.2.4-3, Table A.3.3.2-1, Table A.3.3.2-2, Table A.3.3.2-3, Table A.3.3.3-1, Table A.3.3.3-2, Table A.3.3.3-3, Table A.3.3.4-1, Table A.3.3.4-2, and Table A.3.3.4-3. |
| [**R4-2009616**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009616.zip)  OOB blocking for Inter-band CA | Qualcomm Incorporated | Add statement to add in gap OOB blocking requirements to cover overlapping OOB ranges and exclusion zones.  Endorsed draft CR R4-2004399 in RAN4#94-bis-e |
| [**R4-2010022**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010022.zip)  CR to TS 38.101-1 R15: corrections on narrow band blocking for intra-band contiguous CA | Xiaomi | Add the interferer offset value for 30 kHz SCS case for narrow band blocking for CA bandwidth class C |
| [**R4-2010796**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010796.zip)  Correction to RMC for 256QAM | Rohde & Schwarz | Change MCS table from 64QAM to 256QAM |
| [**R4-2010926**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010926.zip)  CR for 38.101-1 to add the missing MSD for CA\_n41A-n78A (Rel-15) | Huawei, HiSilicon | 1. The exception due to cross band isolation is added for DL band n78 with UL band n41. 2. The exception values for 60MHz, 80MHz, 90MHz and 100MHz for CA\_n41-n78 are added. 3. Some editorial errors are corrected in Table 7.3A.6-1 and Table 7.3A.6-2. |

## Open issues summary

N/A

## Companies views’ collection for 1st round

### Open issues

Here’s to collect comments to CRs to receiver maintenance.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| [**R4-2010814**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010814.zip) | Anritsu:The idea to correct the allocated slots per frame is agreeable.  There are missing corrections and a typo.The values for 100MHz CBW in Table A.3.2.2-3/Table A.3.2.3-3 should also be 36 same as the other CBW.  There is a typo with the value for 10 MHz CBW in Table A.3.3.4-3. 246 should be 24. (6 was missed to be deleted.)  Huawei: we can make further revision based on the comments. |
|  |
| [**R4-2009616**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2009616.zip) |  |
| [**R4-2010022**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010022.zip) |  |
| [**R4-2010796**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010796.zip) | Huawei: the CR can be merged in R4-2010814, which already captures the correction. |
| [**R4-2010926**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010926.zip) | ZTE: It seems Rel-16 spec is correct, so it is no need to draft Rel-16 CR. In this case the question is the normal procedure is Rel-16 spec align with Rel-15 spec. Surprising to see inverting alignment CR. CR is not agreeable.  Huawei: If Rel-16 spec is correct and Rel-15 is wrong, we need to correct the Rel-15 spec. I can revise it if there is no any technical comments. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #3: LS reply

## Companies’ contributions summary

Here’s the summary of the contributions to the receiver requirements.

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2010827**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010827.zip)  Reply LS on RF testing of 4Rx capable UE | Huawei, HiSilicon | **1. Overall Description:**  RAN4 would like to thank RAN5 for the LS on questions on RF testing related to 4Rx, RAN4 would like to provide feedback as below.  1. Confirm RAN5 view that for requirements other than single carrier REFSENS, testing the UE with 4Rx antenna ports with corresponding requirements, would be sufficient to verify the Rx performance.  RAN4 answer: RAN4 shares the same view with RAN5 that for the requirements other than singel carrier REFSENS, 4Rx testing would be sufficient to verify the Rx performance. In order to simplify the measurement, no need to do duplicated tests for both 4Rx and 2Rx.  2. Confirm whether connecting UE declared 2Rx antenna ports suffices to test 2Rx requirements on 4Rx bands  RAN4 answer: In order to keep consistent receiving performance and UE behaviour, 2Rx antenna would not be selected randomly by UE implementation. Measurement based on OEM declaration can better reflect the UE implementation in real application.  **2. Actions:**  **To RAN5:**  **ACTION:** RAN4 respectfully asks RAN5 to take the above information into account. |
| [**R4-2011235**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011235.zip)  Views and reply LS on RF testing of 4Rx UEs | vivo | 1 Overall description  RAN4 would like to thank RAN5 for their LS R4-2009530 on RF testing of 4Rx capable UE.  RAN4 has discussed the receiver requirements testing for 4Rx capable UEs, and has made the following agreement:   * **For single carrier REFSENS requirement in 4Rx bands, both 2Rx and 4Rx requirements shall be tested. The 2Rx testing of REFSENS shall be performed with the connection of 2Rx antenna ports declared by UE.** * **For other Rx requirements, testing the UE with 4Rx antenna ports with corresponding requirements is sufficient to verify the Rx performance in 4Rx bands.**   2 Actions  **To** **RAN5:**  **ACTION:** RAN4 respectfully asks RAN5 to take the above decision into consideration in their future work.  draft CR is also attached. |
| [**R4-2010928**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010928.zip)  Discussion and reply draft LS on structure of NR CA reference sensitivity requirements in 38.101-1 | Huawei, HiSilicon | **Proposal 1: It’s proposed to inform RAN5 that the requirement structure in both clause 7.3A.4 and 7.3A.6 listing only aggressor and victim will be retained in future.**  **Proposal 2: It’s proposed to inform RAN5 that band combination specific manner will be used to specify IMD exception requirements in clause 7.3A.5.**  **Proposal 3: It’s proposed to move the SDL requirements in 7.3A.2.4 to 7.3. The exceptions for SDL band combinations can be specified in clause 7.3A.4, 7.3A.5 and 7.3A.6.**  1 Overall description  RAN4 thanks RAN5 LS on structure of NR CA reference sensitivity requirements in 38.101-1. RAN4 has discussed the structure of NR CA reference sensitivity requirements and achieved the following agreement:   1. **The requirement structure in both clause 7.3A.4 and 7.3A.6 listing only aggressor and victim will be retained in future.** 2. **Band combination specific manner will be used to specify IMD exception requirements in clause 7.3A.5 instead of NR CA configurations.** 3. **RAN4 accept RAN5’s suggestion that the SDL band REFSENS requirements will be moved to 7.3.**   2 Actions  **To TSG RAN WG5**  **ACTION:** RAN4 respectfully asks RAN5 to take account the above RAN4 agreements in the future. |

## Open issues summary

### Sub-topic 2-1 LS reply on 4 Rx UE

Both Huawei and vivo papers proposes to confirm RAN5 understanding.

Sub-topic 3-1: Please comments if you have a different view to confirm RAN5. Draft CR is attached in vivo’s paper. Please present your view if the CR should be recommended or not.

### Sub-topic 2-2 LS reply on CA REFSENS

Sub-topic 3-2: Please comments if you have a different view from the reply draft by Hauwei.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| ZTE | Sub topic 3-2: we agree with proposal 1.  For proposal 2, there were no agreements in RAN4 so far, it should be discussed in RAN4 first. In our view, if the configurations are removed, then companies may not know whether their configurations are completed or not, and it is hard to trace the configurations. In addition, we think in RAN4 discussion, inter-band NR CA and inter-band ENDC are the same approach and should be discussed together.  For proposal 3. SDL band cannot work alone, it should work together with other normal band. In our view, SDL band +normal band is inter-band scenario, not single band scenario, so it cannot be treated as single carrier requirement.  ….  Others: |
| OPPO | Sub-topic 2-1 LS reply on 4 Rx UE  Same view as HW/vivo. |
| DISH | Sub-topic 2-2, P3 is not ok. SDL REFSENS should not be defined alone |
| Huawei | Sub-topic 2-2:  To ZTE:  For IMD exception, we can use the band combination just like UE coexistence table. If possible, we are ok to use this method for both NR CA and ENDC.  To ZTE and Dish:  It doesn’t mean SDL band will be tested in single band scenario. SDL band combination will still be tested under the NR CA scenario. I suppose RAN5 has the same understanding. For SDL, as we said in this contribution, RAN4 doesn’t need to list SDL band REFSENS again and again such as band n75A for CA\_n8A-n75A, CA\_n20A-n75A, CA\_n28A-n75A and CA\_n75A-n78A. We just change the architecture of spec instead of the requirements.  To QC:  You can refer to R4-2001072 which we provided in RAN4#94. Seems we didn’t receive any comments from QC in that meeting. |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |