**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 |

### CRs/TPs comments collection

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

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2010626**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010626.zip) | Company A |
| [**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 |
| Company B |
|  |
| [**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 |
| [**R4-2011495**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2011495.zip) | Company A |
| [**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) | Sub topic 2-1:  Sub topic 2-2:  ….  Others: |
| [**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) |  |
| [**R4-2010926**](http://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_96_e/Docs/R4-2010926.zip) |  |

### 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** |
| XXX | Sub topic 3-1:  Sub topic 3-2:  ….  Others: |

### 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”* |