**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-210XXXX**

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

**Agenda item:** 12.2

**Source:** Moderator (Xiaomi)

**Title:** Email discussion summary for [98-bis-e][151] NR\_reply\_LS\_Part\_3

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

This email thread discusses the two topics on response to RAN5 LS R5-211826 and RAN5 LS R5-211609 as follow:

Topic #1: RAN5 LS on minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1

Back ground: RAN5 sent the LS (R5-211826) to RAN4 in asking for the clarification on the following interpretation of Transmit ON/OFF time mask requirements for UL MIMO

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| --- |
| The minimum requirements for Transmit ON/OFF time mask for UL MIMO in 38.101-1 sets that the requirements from the non-UL MIMO case apply at each transmit antenna connector:  **6.3D.3 Transmit ON/OFF time mask for UL MIMO**  For UE supporting UL MIMO, the ON/OFF time mask requirements in clause 6.3.3 apply at each transmit antenna connector.  In the Transmit ON/OFF time mask, both ON and OFF power need to be measured.  When measuring OFF power, that is consistent with the minimum requirements for the transmit OFF power for UL MIMO that also applies separately per transmit antenna connector.  However, for measuring the ON power, the requirement applicability to each transmit antenna connector seems inconsistent with the rest of test cases where ON power is measured for UL MIMO (maximum output power, minimum output power, (absolute, relative) power control tolerance...), where the requirement applies to the sum of the output power at each transmit antenna connector. The Absolute power tolerance for UL MIMO test case is the best to illustrate this inconsistency because both this test case and the Transmit ON/OFF time mask for UL MIMO test case are implemented using open loop power control.  Currently, Transmit ON/OFF time mask for UL MIMO test case in 38.521-1 is implemented measuring and checking ON power as the sum of the output power from both UE antenna connectors what in principle is inconsistent with current minimum requirements, therefore it’s important that RAN4 provides clear guidance on what is the right interpretation of the minimum requirements. |

Topic #2: RAN5 LS on exception requirements for Intermodulation due to Dual uplink (IMD)

Back ground: a LS (R4-211609) from RAN5 on clarification on exception requirements for Intermodulation due to Dual uplink (IMD) was agreed, which requires the following actions from RAN4:

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| **2. Actions:**  **To RAN4 group.**  **ACTION:** RAN5 kindly asks RAN4 group to clarify if the EN-DC IMD exceptions are applicable only when the IMD product falls into the victim carrier, and if SA requirements apply otherwise in the case of 2UL. Also, to clarify the criteria that need to be fulfilled in order for MSD=0 to apply. |

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

The candidate target of email discussion for 1st round and 2nd round are as follow for each topic:

* 1st round: Discussion on issues based on companies’ contribution input
* 2nd round: Achieve agreements on the reply LS. If not, a WF shall be strived for the next meeting.

# Topic #1: RAN5 LS on minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104543 | Vivo | In this paper, the LS is discussed and following observation and proposal is provided.  **Observation**: There is no specific requirement in RAN4 for the “ON” power defined in ON/OFF mask. The intention is to have a reasonable fully operational and steady status.  **Proposal**: Clarify there is no inconsistency issue for current definition.  Besides, a draft LS is also attached as annex in this paper |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 1-1-1: Clarification on “ON” power defined in on/off mask**

* **Observation**: There is no specific requirement in RAN4 for the “ON” power defined in ON/OFF mask. The intention is to have a reasonable fully operational and steady status
* Recommended WF
  + Encourage feedback on observation 1.

**Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**

* Proposals
  + Yes
  + No (Vivo)
* Recommended WF
  + Encourage feedback and explain why.

**Issue 1-1-3: How to reply LS?**

* Proposals
  + Option 1: Contents for the LS follows the annex of 4543 (Vivo)
  + Option 2: Others
* Recommended WF
  + Encourage feedback on the options.

## Companies views’ collection for 1st round

### Open issues

*One of the two formats, i.e. either example 1 or 2 can be used by moderators.*

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | **Issue 1-1-1: Clarification on “ON” power**  **ON power in ON/OFF mask is all output power requirements in the spec, max power among others**  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  **ON/OFF mask defines the boundaries and exclusion for transient periods. ON and OFF power is defined elsewhere in the spec.**  **Issue 1-1-3: How to reply LS?**  **RAN4 needs to discuss how this can be tested. One way is to test per connector time capture and then apply requirement to ON power as sum and OFF power per connector but this needs input from TE vendors since it seems obvious solution** |
| Xiaomi | **Issue 1-1-1: Clarification on “ON” power**  We tend to support the observation 1 though during on power period, all output requirement (maximum output power, minimum output power, (absolute, relative) power control tolerance...) also need to be met, but in on-off time mask, the intention is to test transient period length and location, no particular power requirements are expected for on power.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  Option 2: No  **Issue 1-1-3: How to reply LS?**  Option 1 can be acceptable for us. |
| OPPO | **Issue 1-1-1: Clarification on “ON” power defined in on/off mask**  The on power is ambiguous in RAN4 spec, however, max power can be used in testing which is the worst case. So the ON power in the on/off mask can be considered as the max power. For UL MIMO, the on/off mask is specified in each connector, then the ON power is max power – 3dB.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  No. As explained in issue 1-1-1.  **Issue 1-1-3: How to reply LS?**  Keep the core requirements as it is and explain to RAN5 about the half max power can be used in each connector. |
| Huawei | **Issue 1-1-1: Clarification on “ON” power defined in on/off mask**  On power is not specifically specified in the spec, the purpose of ON/OFF mask is not to test the max power for the mask. An appropriate power level for the test can be determined by RAN5.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  No inconsistency.  **Issue 1-1-3: How to reply LS?**  For UL MIMO, the power is equally split between two connectors, and the test can still be performed at each antenna connector. |
| Skyworks | **Issue 1-1-1:** Similar views than Huawei and Qualcomm. For On/Off conformance testing,UE output power level reaches a target level defined by RAN5, level at which the RAN4 Power level accuracy requirements apply.  **Issue 1-1-2:**  No inconsistency since the On/Off time mask is meant to define a RAN4 requirement measurement exclusion period that corresponds to the specified transient period. In the case of ON/OFF time mask, the ‘excluded” measurement is that of RF power level accuracy.  **Issue 1-1-3:** Same view than Qualcomm: time mask could be verified per antenna port, while power level conformance could be verified as the sum of powers of each antenna ports once the transient exclusion period is “settled” (ie at the end of the 10usec). |
| vivo | **Issue 1-1-1: Clarification on “ON” power defined in on/off mask**  As explained in the paper, we think the “ON” power never defined in RAN4 and actually there is no need to mandate it. RAN5 can have the flexibility as they prefer.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  No inconsistency as explained. Of cause there is a way for definition if we chose sum of the power for the ON power, but since there is no requirement, this “SUM” behaviour is seems meaningless, so more guidance on how to do “sum” seems not necessary.  **Issue 1-1-3: How to reply LS?**  It is proposed to reply the LS as proposed. If RAN5 do have further question, which seems not that likely, further feedback could be provided. |
| NTT DOCOMO, INC. | **Issue 1-1-1: Clarification on “ON” power defined in on/off mask**  Although we also think the purpose of ON/OFF mask is to test the transient period length and location, ON power should meet all output power requirements.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  As we proposed previously, since OFF power is a kind of emission radiated to outside of UE, we think OFF power should be also specified at sum of power from each antenna connecter.  **Issue 1-1-3: How to reply LS?**  Before replying LS, we would like to discuss whether transmit OFF power can be applied to sum of power form each antenna connecter for 2Tx cases (UL MIMO and TxD). |
| Apple | **Issue 1-1-1: Clarification on “ON” power**  “ON” power in ON/OFF time mask is not intended to test the Pcmax. It is meant to verify the transient period where the “ON” and “OFF” steady state power does not need to be fulfilled.  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**  In our view, there is no inconsistency.  **Issue 1-1-3: How to reply LS?**  The “ON/OFF” time mask is measured per antenna connector. There is no need to mix it with other requirements where summation from each antenna connect is specified. |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing 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:* |

### CRs/TPs

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

*Note: The tdoc decisions shall be provided in Section 3 and this table is optional in case moderators would like to provide additional information.*

|  |  |
| --- | --- |
| **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)

# Topic #2: RAN5 LS on exception requirements for Intermodulation due to Dual uplink (IMD)

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2104520 | Vivo | **Proposal 1**: Reply to RAN5 according to the understanding that IMD exception is actually similar to harmonics that SA requirements still serves as general requirements in case exception condition is not met  **Proposal 2**: RAN4 can revise certain wording to ease the misleading part.  A draft reply LS and draft CR were also attached.  RAN4’s understanding is that for 2UL IMD, the definition of requirements for exception did not preclude the case of general requirements applicability in case exception is not met. In this sense, for the case that no IMD is happened, the SA requirements corresponding to MSD=0 case are still applicable. This is similar to UL harmonic cases.  As for RAN4 requirements, RAN4 is planning to do some revision to avoid the misunderstanding |
| R4-2106776 | Ericsson | ***Answer (from RAN4):***  It is a correct observation that the IMD excepions are only applicable when the IMD product falls into the victim carrier. Otherwise MSD=0 (i.e. the default REFSENS values) applies.  MSD=0 applies when the IMD products generated are outside the borders of the victim band +/- 5 MHz.  RAN4 will consider to clarify this also for IMD requirements in a similar manner as have already been done for instance the harmonic requirements. |
| R4-2106551 | Xiaomi | **Proposal: It is proposed the following reply is for the clarification question exception requirements for Intermodulation due to Dual uplink (IMD).**  Yes, the EN-DC IMD exceptions are applicable only when the IMD product falls into the victim carrier, and if SA requirements apply otherwise in the case of 2UL. When carrier frequencies and bandwidths are selected such that there is no overlapping interference based on the equations defined in TR37.863, MSD=0 could be applied. |

## Open issues summary

*Before e-Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1

*Sub-topic description:*

*Open issues and candidate options before e-meeting:*

**Issue 2-1-1: Clarification on Q1**

**If the EN-DC IMD exceptions are applicable only when the IMD product falls into the victim carrier, and if SA requirements apply otherwise in the case of 2UL**

* Proposals
  + Option 1: Yes (Vivo, Ericsson, Xiaomi)
  + Option 2: No
* Recommended WF
  + Based on the contributions, there are no different views on Q1. Moderator suggests to go with option 1.

**Issue 2-1-2: Clarification on Q2**

**Clarify the criteria that need to be fulfilled in order for MSD=0 to apply**

* Proposals
  + Option 1: MSD=0 applies when the IMD products generated are outside the borders of the victim band +/- 5 MHz.(Ericsson)
  + Option 2: When carrier frequencies and bandwidths are selected such that there is no overlapping interference based on the equations defined in TR37.863, MSD=0 could be applied (Xiaomi)
  + Option 3: Others
* Recommended WF
  + TBA

**Issue 2-1-3: How to reply the LS?**

* Proposals
  + Option 1: Contents follows the annex of 4520 (Vivo)
  + Option 2: Contents follows 0776 (Ericsson)
  + Option 3: Contents follows the proposal in 6551 (Xiaomi)
  + Option 4: Others
* Recommended WF
  + TBA

**Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**

* Proposals
  + Option 1: Yes
    - 1a: Contents for the CR follows the annex of 4520 (Vivo)
    - 1b: Others
  + Option 2: No
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Example 1**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | **Issue 2-1-1: Clarification on Q1**  **Option 1**  **Issue 2-1-2: Clarification on Q2**  Option 2. IMD exceptions are applicable only when the IMD product falls into the victim carrier. In this sense, if there is no overlapping interference, there would be no MSD issue. In TR37.863, the equation give the rule to determine whether there is overlapping interference between IMD product and victim carrier, thus we prefer option 2. For option 1, we would like to know where the criteria comes from.  **Issue 2-1-3: How to reply the LS?**  **Option 3. The reason is same as above**  **Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**  **No strong view.** |
| OPPO | **Issue 2-1-1: Clarification on Q1**  **If the EN-DC IMD exceptions are applicable only when the IMD product falls into the victim carrier, and if SA requirements apply otherwise in the case of 2UL**  Option 1, yes.  **Issue 2-1-2: Clarification on Q2**  **Clarify the criteria that need to be fulfilled in order for MSD=0 to apply**  For clarification, in Option 1 the +/-5MHz is used, where is it coming from? |
| Huawei | Issue 2-1-1: Clarification on Q1  Option 1  Issue 2-1-2: Clarification on Q2  Option 3. We can recommend RAN5 to only test the worst-case self-desensitization for MSD exception due to IMD interference.  The MSDs due to dual UL IMD interference have been introduced into the specification since Rel-12 R4-147978. The principles for MSD test can be found in the WF R4-144031.  A specific carrier frequency allocation that IMD is centre-aligned with victim DL carrier can be chosen to test the worst-case self-desensitization based on current RAN4’s agreement and specification.  Generally, it’s only considered to test the worst-case self-desensitization for IMD exception. Furthermore, there is no IMD exception avoiding testing for UL LTE CA and NR UL CA.  In RAN4, we just specify some test cases for IMD exception. Similarly, we can’t provide a general criteria that need to be fulfilled in order for MSD=0 to apply.  Issue 2-1-3:  Option 4  Issue 2-1-4:  Option 2 |
| Qualcomm | **Issue 2-1-1: Clarification on Q1**  Option 1/2: Care must be taken so that there are no UL harmonic or harmonic mixing cases outside of the IMD region. Region definition must be clear with attention to special cases  **Issue 2-1-2: Clarification on Q2**  Option 3: Although 37.863 is close, it is not entirely correct. The |Fint| is at a RF frequency. To be more precise: So to be exact for no IMD only**, |n\*Ftx1+m\*Ftx2|+(n\*BW1+m\*BW2)/2<Frx-RXBW/2 or |n\*Ftx1+m\*Ftx2|-(n\*BW1+m\*BW2)/2>Frx+RXBW/2**. Also, care must be taken to avoid IMD ACLR for the IMD2 cases as well as UL harmonic and HM cases. This is not exactly clear cut.  **Issue 2-1-3: How to reply the LS?**  Option 4: It may be difficult to reply in this meeting alone. More time is required to vet the MSD=0 region of interest and how to actually implement the correct approach in the specification.  **Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**  Option 2: More time is needed. |
| Skyworks | **Issue 2-1-1: Clarification on Q1:**  Option2:  It is not true that REFSENS exceptions only apply when the IMD falls into the victim carrier. We have several cases where only the REFSENS exception is only specified for the highest order IMD product. Example DC\_1\_n77, MSD is specified for IMD2 but footnote 3 says this combination is subject to IMD5 for whciih MSD is not specified. This means that there are other band 1 and band n77 UL carrier configurations for which the UE will fail the SA requirements.  **Issue 2-1-2: Clarification on Q2:**  One way to ensure 0dB MSD is expected would be to ensure MSD due to all IM orders up to order 5 are specified. This is not the current approach taken by RAN4. Could this be in scope of RAN5 studies?  **Issue 2-1-3: How to reply?**  More time/discussions are needed. |
| AT&T | Issue 2-1-1: Clarification on Q1  Option 1  Issue 2-1-2: Clarification on Q2  Option 3. We can recommend to RAN5 the rules to determine whether there is overlapping interference between IMD product and victim carrier and let them decide on specific test points.  Issue 2-1-3:  Option 4. Use a merged version of the three reply LSs as each has content that informs RAN5 of the situation and how to treat the REFSENS exceptions. In either case, we should leave the test point definition up to RAN5.  Issue 2-1-4:  Option 1b. We should consider any additional clarifications that are required including the possible deletion of the word “only” as proposed in the Vivo contribution. |
| vivo | **Issue 2-1-1: Clarification on Q1**  Option 1. Still some more clarification can been considered.  **Issue 2-1-2: Clarification on Q2**  Option 3: It seems multiple proposals are raised and maybe a new more comprehensive one can be made.  **Issue 2-1-3: How to reply the LS?**  Option 4  **Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**  A CR is likely to be useful, and the contents can be discussed further with the LS itself. |
| CHTTL | **Issue 2-1-1: Clarification on Q1**  Option 1  **Issue 2-1-2: Clarification on Q2**  Option 2  **Issue 2-1-3: How to reply the LS?**  Maybe can be further discuss based on Issue 2-1-1 and 2-1-2  **Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**  Ok to have the CR |
| Apple | Issue 2-1-1: Option 1.  Issue 2-1-2: Option 2. In principle, if there is no any IMD product falling into certain DL band range, then MSD = 0 can be applied. However, we would not recommend such tests to be performed, in particular, for band combinations where MSD has been specified. The reason is besides the MSD test point, the IMD can still be anywhere. The non-IMD test configuration needs to be carefully selected. Also in RAN4, we only consider IMD up to 5th order. There could also be subtle impact to REFSENS with > 5th order IMD which had never been evaluated. If the intent is to verify non-IMD REFSENS, tests with single UL CA should be sufficient. |

### 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:* |

### 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)

*Moderator can provide summary of 2nd round here. Note that recommended decisions on tdocs should be provided in the section titled ”Recommendations for Tdocs”.*

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

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

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
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. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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