**3GPP TSG-RAN WG4 Meeting # 98-bis-e R4-2105486**

**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.*

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| --- | --- |
|  | **Status summary** |
| **Sub-topic #1-1** | **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   Most of companies (Vivo, [Qualcomm], Xiaomi, Huawei, Skyworks and Apple) share the similar view as above observation, the power level for “on” power during on/off time mask testing can be up to RAN5 decision. While there are also other views. One company (OPPO) think the “on” power can be considered as the max power, and one company (NTT DOCOMO) think ON power should meet all output power requirements.  *Tentative agreements:*  *None*  *Candidate options:*  *Recommendations for 2nd round:*  *Further discuss based on the content of the LS reply in 2nd round*  **Issue 1-1-2: Whether there is inconsistency issue for current definition in TS 38101-1?**   * Proposals   + Yes   + No   It seems no companies disagree that there is no inconsistency issue, and one company think off power should be changed from defining at each connector to defining at sum of power from each antenna connecter.  *Tentative agreements:*  *No inconsistency issue for current definition in TS 38101-1 between on off time mask requirement and other output power requirements*  *Candidate options:*  *Recommendations for 2nd round:*  **Issue 1-1-3: How to reply LS?**   * Proposals   + Option 1: Contents for the LS follows the annex of 4543 (Vivo, Xiaomi)   + Option 2: Others   It seems there is no much divergence for most of company views, but the wordings may be different.  *Recommendations for 2nd round:*  *Further discuss based on the content of the LS reply in 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)

The discussion in 2nd round will be based on the LS below.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Tdoc number assigned** | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | R4-2105437 | Reply LS On minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1 | Vivo |

This table will collect the comments for the LS of R4-2105437

|  |  |
| --- | --- |
| **Company** | **Comments for LS R4-2105437** |
| Xiaomi | As comment in 1st round, we support this LS. |
| OPPO | Regarding the contents it looks good in general but not clear of the meaning of the highlighted sentence which describes the intention of ON power in the spec. With this sentence goes to RAN5, they will design the tests according to the “RAN4’ intention”, but how to exactly interpret the “fully operation and steady status”? Maybe a clear definition could be better here, or just remove the whole sentence seems also good.  “*However, unlike OFF power, for the “ON” power defined here actually there is no specific requirement in RAN4. The intention is to have a reasonable fully operational and steady status, but no particular power requirements are expected.*” |
| vivo | In response to oppo: since a more precise description may not easy in such short notice, maybe we can remove it for simplicity. |
| Qualcomm | Our view that there indeed is inconsistency in the Ran4 specification, see the green text:  *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.*  *6.2D.1 UE maximum output power for UL MIMO*  *For UE with two transmit antenna connectors in closed-loop spatial multiplexing scheme, the maximum output power for any transmission bandwidth within the channel bandwidth is specified in Table 6.2D.1-1. The requirements shall be met with the UL MIMO configurations specified in Table 6.2D.1-2. For UE supporting UL MIMO, the maximum output power is defined as the sum of the maximum output power from both UE antenna connectors.*  So how the requirement for ON power is defined here. The Ran5 LS provides their interpretation of the test:  *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,*  Which to our view is correct and LS reply should reflect this aspect. However, ran4 should clarify what is ON power and how it is tested for UL MIMO since that 6.3D.3 seems to be worded differently than rest of the specification. It would not hurt to also define what ON power means in general.  We provided out version of the LS in here  https://www.3gpp.org/ftp/tsg\_ran/WG4\_Radio/TSGR4\_98bis\_e/Inbox/Drafts/%5B98bis-e%5D%5B151%5D%20NR\_reply\_LS\_Part\_3/Round%202/draft\_R4-210xxxx\_RAN5\_Mask\_LS\_v02\_qualcomm.doc |
| OPPO | We have similar understanding as QC about the LS from RAN5, however, whether the test method defined in RAN5 is proper or not is something out of RAN4 scope. What we RAN4 can do is to explain what the minimum requirements is and this is the LS Sanjun has provided.  Not quite sure whether changing the requirements from per antenna connector to sum of the power is agreed up to now. But we are open to further discuss if necessary. |
| Vivo | Dear Ville,It seems that the current revision is a overturn of previous discussion and tentative agreements. There is following descriptions in the draft summary:  *Tentative agreements:*  *No inconsistency issue for current definition in TS 38101-1 between on off time mask requirement and other output power requirements*  Based on this understanding, currently there is no consistency issues, and there is no need for RAN4 to do any revision and hardly any basis for the ON power to be exclusively defined or clarified as a sum for ON/OFF mask in RAN4.  The ON/OFF time mask requirement is actually do not really include ON power requirement at all, and is focused on the timing and OFF power.  It can be understood from LS that RAN5 is currently using sum of power in the UL-MIMO ON/OFF mask test implementation, this is also fine from RAN4 as a implementation but the use of per-connector should also not be precluded.  Based on these understanding, we cannot accept the latest revision version, and more general discussion / agreement may be needed.  In addition, response to the sentence which was questioned in the draft LS:  It can be revised to: “RAN4 discussed the LS and ~~has already~~ provide the following information to RAN5”. |
| NTT DOCOMO | We also prefer Qualcomm’s revision.  Although we would like to specify OFF power at each antenna connecter, we understand majority support at sum of antenna connecters in 1st round. So the following tentative agreements means, in our understanding, that majority companies confirm that the metric of OFF power is each antenna connecter while Tx requiremerent is measured for UL MIMO (maximum output power, minimum output power, (absolute, relative) power control tolerance...) at sum of antenna connecters.  We would like to just describe the aspect in LS, and thus Qualcomm revision is better aligned with our understanding.  No inconsistency issue for current definition in TS 38101-1 between on off time mask requirement and other output power requirements  From RAN5 LS  >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. |
| OPPO | Since this is the last minute and seem impossible to achieve consensus on the requirement itself, and this is a big step in UL MIMO requirement definition. We are also ok to postpone to next meeting with more discussion. |
| Vivo | The formal version of the LS was uploaded which is the same to previous draft version: [R4-2105437.zip](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_98bis_e/Inbox/R4-2105437.zip).  As explained, this would not be agreed and the discussion would be postponed to next meeting. |

# 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. |
| Verizon | **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?**  Option 4, It should be okay if RAN needs more time to discuss  **Issue 2-1-4: Is a CR on TS38.101-3 needed or not for the clarification?**  Option 1b. RAN4 should provide more clarifications after discussions |

### 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#2-1** | **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, Qualcomm, Xiaomi, OPPO, Huawei, AT&T, CHTTL, Apple, Verizon)   + Option 2: No (Qualcomm, Skyworks)   Most companies can accept option 1, meanwhile some companies think additional restrictions or clarifications are needed.  *Tentative agreements:*  *None*  *Candidate options for the clarification on Q1:*   * + Option 1: Yes   + Option 2: No, the EN-DC IMD exceptions are defined as worse case, which means for those band combinations that have other orders IMD product (up to 5th orders) falls into the victim carrier, the SA requirements still can’t be applied.   + Option 3: Others   *Recommendations for 2nd round:*  *Further discuss based on the candidate options*  **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, [OPPO], CHTTL, Verizon)   + Option 3: Others (Huawei, Qualcomm, Skyworks, AT&T, Vivo, Apple)   During the 1st round discussion, no companies support option 1 and most companies provide new views other than option 1 and 2.  *Tentative agreements:*  *None*  *Candidate options for the clarification on Q2 :*   * + Option 1: 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   + Option 2: Only test the worst-case self-desensitization for MSD exception due to IMD interference. MSD=0 case is not tested for band combinations have IMD exceptions   + Option 3: Others   *Recommendations for 2nd round:*  *Further discuss based on the candidate options*  **Issue 2-1-3: How to reply the LS?**   * Proposals   + Option 1: Contents follows the annex of 4520   + Option 2: Contents follows 0776 (Ericsson)   + Option 3: Contents follows the proposal in 6551 (Xiaomi)   + Option 4: Others (Huawei, Qualcomm, Skyworks, AT&T, Vivo, CHTTL, Verizon)   This issue depends on the outcome of issue 2-1-1 and 2-1-2. And several companies suggest to have more time on the reply LS.  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  *Focus on the discussion 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?**   * Proposals   + Option 1: Yes     - 1a: Contents for the CR follows the annex of 4520 (Vivo, [AT&T],)     - 1b: Others (CHTTL, Verizon)   + Option 2: No (Huawei, Qualcomm)   This issue also depends on the outcome of issue 2-1-1 and 2-1-2.  *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:*  *Focus on the discussion on issue 2-1-1 and 2-1-2.* |

### 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”.*

What needs to be discussed are captured in the WF below.

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| --- | --- | --- | --- |
|  | **Tdoc number assigned** | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 | R4-2105438 | WF on exception requirements for Intermodulation due to Dual uplink (IMD) | Xiaomi |

This table will collect the comments for the WF of R4-2105438

|  |  |
| --- | --- |
| **Company** | **Comments for WF R4-2105438** |
| Skyworks | In slide 3: Option 2 is the closest choice, but it seems to imply that SA requirements can never be applied, which is not true either. How about correcting option 2 or adopting option3 as:  “No, the EN-DC IMD exceptions are defined as worse case among all IMD orders, which means that, for those band combinations, order IMD products (up to 5th orders) may fall into the victim’s carrier. SA requirements can only be applied for dual UL carrier frequency combinations for which no IMD product falls in the victim’s RX CBW.” ?  Giving a practical example: In DC\_5\_n66, LTE band 5 is victim of an IM2 when n66 is transmitting at 1721MHz and when B5 is transmitting at 838MHz. Band5 is also victim of an IMD5 when n66 Tx=1714.5MHz and B5 Tx=846MHz. Note however that in 38.101-3, only the IMD2 test point is specified.  If n66 is transmitting at 1762MHz, and B5 Tx at 838MHz, then B5 Rx becomes free of both IMD2 and IMD5. In which case not only is SUO no longer allowed, but in addition, B5 SA requirements apply. |
| Ericsson | Q2 Option 2 in WF page 4 is not aligned with Issue 2-1-2 proposals in section 2.2.1 of this document. Suggest that the WF is updated according to the wording in this document. Assume that all company preference for option 2 refers to option 2 of this document and not option 2 of the WF. |
| Ericsson | We withdraw our comment above on the numbering of options.  This is our comment for Q2 slide 4 in the WF: Option 2 is not preferred since RAN4 defines requirements and it is up to RAN5 how to test the requirements. |
| Xiaomi | To Skyworks: we can accept your wording. And we also would like to other company’s view  To Ericsson: option 2 comes from the discussion in 1st round. We can take it as an option. |
| Skyworks | To Xiaomi: re-assessing the RAN5 question, instead of trying to find the combinations of carrier frequencies that guarantee an IMD free landscape, we wonder why is RAN 5 not adopting the RAN 4 anchor agnostic concept. RAN 4 initially considered to send continuous “down” power control commands to one of the CG to ensure that SA requirements are not impacted by the radio front-end non-linearities. We are not sure what is the exact latest status of RAN4 anchor agnostic agreements. Please check / confirm. In any case, in our view, this should be the preferred approach for RAN5 conformance test.  Otherwise, it may not be correct to inform RAN 5 to rely on RAN 4 TR self-desensitisation studies in order to specify which combination of carrier frequencies guarantee an IMD free landscape. The reason being that RAN4 does not necessarily capture all IMD products. |
| Huawei | Q1: Option 2  Q2: Option 2 |
| Xiaomi | To Skyworks: Thanks for the comments. Regarding the anchor agnostic approach you mentioned, the final status can be found at the agreed reply LS R4-1907491 in RAN4#91, where a corresponding CR is also included. However, it seems it is different with this IMD exceptions clarification topic. The intention of anchor agnostic approach is decreasing the number of test band combinations for one NR bands by assuming it is independent which LTE band is used as an anchor band. However, for this IMD exception clarification issue, it comes from the interpretation in RAN5 on the following sentence in RAN4 spec and RAN5 is considering to design exception avoiding testing for REFSENS, which means aggressor UL carriers keep active but MSD = 0. RAN4 may need to decide whether this MSD=0 test is needed or not, if needed, what is the condition. That is our understanding. Hope it can help to clarify a bit. Thanks.  Copied from RAN5 LS (R5-211609)   |  | | --- | | *In general, it is clear that the REFSENS requirements in 38.101-3 clause 7.3B are exceptions to the standalone (SA) requirements in 36.101 and 38.101-1, meaning the SA requirements apply if the exception condition is not met. This is supported by the statement in 38.101-3 V16.6.0 clause 7.3B.1:*  *For the case of inter-band EN-DC with a single carrier per cell group and multi carrier per cell group, in addition to the E-UTRA and NR single carrier, CA, and MIMO operation of REFSENS requirements defined in TS 38.101-1 [2], TS 38.101-2 [3], and TS 36.101 [4], the REFSENS requirements specified therein also apply with both downlink carriers and both uplink carriers active unless sensitivity exceptions are allowed in this clause of this specification, clause 7.3 in TS 38.101-1 [2] or clause 7.3 in TS 36.101 [4].* | |
| CHTTL | Q1: support Option 1  As the Q1 is 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,  🡪 There are some concerns that some of the MSD ex: for IMD5 might not be defined in the spec for some combinations, but even if they are not defined, they are still in the scope of “when the IMD product falls into the victim carrier”  How about the following alternative:  “Yes, SA requirements shall be applied for dual UL carrier frequency combinations when no IMD product (up to 5th orders) falls into the victim’s RX CBW.  Regarding skyworks alternative:  “No, the EN-DC IMD exceptions are defined as worse case among all IMD orders, which means that, for those band combinations, order IMD products (up to 5th orders) may fall into the victim’s carrier. SA requirements can only be applied for dual UL carrier frequency combinations for which no IMD product falls in the victim’s RX CBW.  🡪 There are some combinations that muliple MSDs are defined? (for example, DC\_2\_n77, MSDs for IMD2, IMD4, IMD5 on band 2 are defined.) but the first sentence implies only worst case is defined?  Q2: support Option 1  Option 2 seems not answering the question… |
| OPPO | Q1: Option 2  Q2: Option 2 |
| MediaTek | Q1: Option 2 with proposed modification from Skyworks seems best.  Q2: Option 2 seems most straightforward, given the issues raised with option 1. |
| vivo | Q1: Option 2  Q2: Option 2. Since there are many complexity issues that may beyond IMD exists. |
| Xiaomi | Based on the the comments, we made a reversion. Any comments are welcome.  [draft R4-210xxxx WF on exception requirements for Intermodulation due to Dual uplink (IMD) v01.pptx](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_98bis_e/Inbox/Drafts/%5B98bis-e%5D%5B151%5D%20NR_reply_LS_Part_3/Round%202/draft%20R4-210xxxx%20WF%20on%20exception%20requirements%20for%20Intermodulation%20due%20to%20Dual%20uplink%20(IMD)%20v01.pptx) |
| Skyworks | To Xiaomi: Thank you for the clarifications.  To CHTTL: Agree with you: RAN4 does not always systematically specify the MSD corresponding to all IMD orders. What I meant was RAN4 generally specifies at least the (highest) MSD that corresponds to the highest IMD order.  Q1: option 2  Q2: option 2. |
| Qualcomm | Q1: Option 2  Q2: Option 2 |
| Apple | Q1: Option 2  Q2: Option 2 |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| Reply LS On minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1 | Vivo | To RAN5 |
| WF on exception requirements for Intermodulation due to Dual uplink (IMD) | Xiaomi |  |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2104543 | Discussion and reply LS On minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1 | Vivo | Noted |  |
| R4-2104520 | Discussion and reply LS on Clarification on exception requirements for Intermodulation due to Dual uplink (IMD) | Vivo | Noted |  |
| R4-2106776 | draft LS reply to R5-211609 about IMD exceptions | Ericsson | Noted |  |
| R4-2106551 | Discussion on reply LS on Clarification on exception requirements for Intermodulation due to Dual uplink (IMD) | Xiaomi | Noted |  |

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** |
| R4-2105437 | Reply LS On minimum requirements for Transmit ON/OFF time mask in UL MIMO FR1 | Vivo | Postponed |  |
| R4-2105438 | WF on exception requirements for Intermodulation due to Dual uplink (IMD) | Xiaomi | Approved |  |

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