**3GPP TSG-RAN WG4 Meeting #100-e R4-21xxxxx**

**Electronic Meeting, Aug. 16 - 27, 2021**

**Agenda item:** 12

**Source:** Moderator (Apple)

**Title:** Email discussion summary for [100-e][149] NR\_reply\_LS\_UE\_RF

**Document for:** Information

# Introduction

This email thread treats the following topics:

1. Rel-17 related:
   1. BC for SDT in RRC\_INACTIVE: R4-2111912, R4-2112137, R4-2112832, R4-2113927, R4-2113974, R4-2114057, R4-2114489,
   2. Inclusive Language: R4-2114472
   3. FR2 power control for NR-DC: R4-2113908
2. Previous releases:
   1. FR2 requirement applicability over ETC: R4-2111910, R4-2112983, R4-2113658, R4-2113888, R4-2114393
   2. FR2 UE relative power control tolerance requirements: R4-2111911, R4-2113659
   3. Clarification on exception requirements for Intermodulation due to Dual uplink (IMD): R4-2112915, R4-2113302, R4-2113567, R4-2113402, R4-2113889

# Topic #1: BC with SDC in RRC\_INACTIVE

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

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111912 | Qualcomm | Proposal 1: Discuss mandatory SSB-based beam correspondence as a system enhancement and as an essential component of future inactive mode requirements in FR2. |
| R4-2112137 | Apple | Observation 1: For Configured Grant SDT in RRC\_INACTIVE, UEs need to measure SSBs to determine TX beam and TA validation before PUSCH transmission. Essentially, it requires the same beam correspondence capability from a UE as in RRC\_CONNECTED.  Observation 2: For Random Access SDT, UEs can reuse existing procedure in determining TX beam for RACH.  Proposal 1: There is no need to define the beam correspondence requirements for Small Data Transmission (Configured Grant SDT and/or Random Access SDT) in RRC\_INACTIVE state. |
| R4-2112832 | Ericsson | For RA-SDT, a beam correspondence requirement similar to that for connected mode could be specified. The UE should then meet a spherical coverage measurement for msg1. The PRACH would be configured such that maximum preamble power is reached for each direction, but a Random Access Response (msg2) is not sent until the preamble power stops increasing. This is similar to the test procedure used for connected mode and would also be relevant for initial access.  Support of SSB-based beam correspondence and compliance with the corresponding minimum requirement should be mandatory and also be relevant for CG-SDT in RRC\_INACTIVE.  The RAN4 work on enhanced beam correspondence requirements for Small Data Transmission (Configured Grant SDT and/or Random Access SDT) in RRC\_INACTIVE state, also relevant for initial access, could be carried out e.g. in the FR2 enhancement work item. |
| R4-2113927 | ZTE | in Rel-17 phase, it might be appropriate timing to define the corresponding requirements for initial access and this requirement could be also applied for RRC\_INACTIVE state for Configured Grant SDT and/or Random Access SDT. Regarding the specific BC requirements, Rel-16 SSB only based eBC requirement could be used as baseline. |
| R4-2113974 (not available) | Vivo |  |
| R4-2114057 | Nokia, Nokia Shanghai Bell | Proposal: Specify FR2 UE beam correspondence requirements for Random Access SDT and Configured Grant SDT in RRC\_INACTIVE in the Rel-17 specifications. |
| R4-2114489 | Huawei, HiSilicon | Observation 1: There is no conclusion in RAN1 on how UE decide the Tx beam for random access SDT during rach procedure and subsequent data transmission.  Proposal 1: there is no need to define beam correspondence requirement for Random Access SDT in RRC\_inactive state.  Proposal 2: there is no need to define beam correspondence requirement for configured grant SDT in RRC\_inactive state.  Proposal 3: Send reply LS to RAN1(CC RAN2) with the answer:  It is RAN4 understanding that there is no need to define beam correspondence requirement for both RA SDT and CG SDT before RAN1 or RAN2 clearly specify how UE select the Tx beam during RACH procedure and data transmission for SDT. |

## Open issues summary

### Sub-topic 1-1: If there is a need to define the beam correspondence requirements for Small Data Transmission (Configured Grant SDT and/or Random Access SDT) in RRC\_INACTIVE state.

* Proposals (when picking an option, please state reasons)
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | Yes. The beam correspondence in Rel-15/16 are verified only in active state, i.e., UE is expected to use reference signals that are continuously provided. The beam correspondence under discontinuous reception needs to be verified for SDT to work properly. |
| ZTE | We support option 1, based on the contributions from interested companies, almost all companies confirmed that this BC capability in connected mode could also been applied for idle or inactive mode, just with concerns the necessity of new requirement for inactive mode should be defined or not, from our understanding, this should be still defined to make sure the performance in idle or inactive mode could be ensured by reasonable requirements instead of purely left up to UE implementation. |
| OPPO | Option 2.  For the configured grant SDT, UE needs to measure the SSB then transmit the data on the corresponding CG resource. This procedure is similar as the connected mode SSB only beam correspondence. We don’t see the necessity to additional define requirements for this SDT.  For the RA beam correspondence this has been discussed for a long time. Need to understand better on why it is needed since UE beam correspondence behavior is always based on the RSRP measurement, there is no difference between RA or connected mode from UE perspective. |
| Huawei, HiSilicon | Option 2.  Because There is no conclusion in RAN1 on how UE decide the Tx beam for random access SDT during rach procedure and subsequent data transmission. RAN4 cannot decide anything before RAN1 BM decision for SDT. |
| Qualcomm | Option 1: Yes  In general, we feel there should be a requirement for any capability. In this case while there is large overlap in functionality with SSB-based beam correspondence in connected mode, there are certain aspects unique to RRC-INACTIVE state, which may warrant a unique set of requirements.  The RAN1 LS is already here, so we do not need to wait on further detail from RAN1 to make our decision. |
| vivo | Option 2: No  We think UE beam correspondence has been well verified in the connected mode. It’s not necessary and not practical to define new requirements for beam correspondence during initial access. If a UE can successfully enter the connected mode, that already implies the UE can pass the requirement for initial access. |
| Samsung | Option 2: No  For RF requirements beam correspondence has been verified in connected mode. The call connection setup itself already verified the beam management in initial access. For further verification, it is out of the scope of general RF requirements. |
| MediaTek | “Option 2: No”. In our understanding, similar topic was discussed and concluded in prior RAN4 meeting. |
| Sony | Option 1 Yes. |
| Ericsson | Option 1. The current BC requirements apply in connected mode and the SSB-based requirements of some relevance for PRACH, albeit not entirely, are not even mandatory. Beam sweeping is not available in RRC\_INACTIVE. RACH performance can be verified in a manner similar to connected mode – when requirements for BC were first discussed in an evening joint RAN1/RAN4 session, PRACH performance and coverage during initial access was used as a prime example of a relevant case! |
| Apple | Option 2  As analyzed in our paper, we don’t see a need. |

### Sub-topic 1-2: Is there is a need, how to specify the requirements?

* Proposals
  + Option 1: Use R16 SSB-based BC as a starting point, e.g., making it mandatory.
  + Option 2: Specify a PRACH based BC requirement, similar to that for connected mode
  + Option 3: Others
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | Option 1 is fine for configured grant SDT. Is option 1 also applicable to random access SDT? If it is not, then Option 2 may be also required. |
| ZTE | We support option 1, since in idle or inactive mode, only SSB might be available for BC, therefore option 1 is more preferred. |
| OPPO | Option 1. |
| Huawei, HiSilicon | For SDT, RAN1 does not have any assumption or agreement on the UL beam selection, whether the UL beam is based on SSB only should not decided by RAN4. So it is too early to discuss on requirement issue in RAN4. |
| Qualcomm | Option 1:  We are open to discussing whether an SDT requirement can be streamlined with the existing SSB-based beam correspondence requirement (i.e disregard the differences that make is specific to SDT) if it also makes sense to ‘collect’ other system enhancements at the same time. |
| vivo | Given the answer to Sub-topic 1-1 is NO, so we don’t think RAN4 need to discuss how to specify the requirements. |
| MediaTek | Option 3: Given the answer to Sub-topic 1-1 is NO, so we don’t think RAN4 need to discuss how to specify the requirements. |

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| Sony | In general, we prefer to specify a PRACH based BC requirement since Rel-16 BC is only for connected mode. However, we are also fine to go with Option 1 for now and further study it is applicable to random access BC and then decide. |

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| Ericsson | Option 2. Alternatively, leveraging on Sony’s idea, we could start with Option 1 in a first phase and then further consider PRACH performance. |
| Apple | Option 1, but we are open to further discussions. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 1.2.

### 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.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
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## 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** | *There seems to be no agreement yet, with 5 companies (Nokia, ZTE, Qualcomm, Sony, Ericsson) supporting option 1 and 6 companies (OPPO, Huawei, Samsung, vivo, MediaTek, Apple) supporting option 2.*  *Recommendations for 2nd round: Given the split views, there seems no need to further discuss it in second round* |
| **Sub-topic #1-2** | *There is a slight majority for option 1. However, since views are almost equally split on sub-topic 1-1. There is no need to further discuss it.* |

### 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.*

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| **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: Inclusive Language

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2114472 | Ericsson | Proposal: Specification Rapporteurs should consider the above, including the findings in Table 1, in their review activity, aiming toward an optimal alignment across WGs where possible, and coordinating as needed. |

## Open issues summary

### Sub-topic 2-1

We can use sub-topic 2-1 to collect comments and clarifications. If needed, a WF to capture the agreements/guidelines for specification rapporteurs can be recommended.

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| --- | --- |
| **Company** | **Comments** |
| XXX |  |
| Qualcomm | We appreciate the paper, and support the proposal |
| Ericsson | In RAN4 only one spec TS 36.133 with the inclusive language issue was identified. The Rel-17 CR in R4-2103254 to correct the inclusive language was agreed at RAN4#98-e and approved at the RAN. The RRM procedures related to requirements in TS 36.133 involving inclusive language are defined in RAN2 specs. The corrected language/terms in TS 36.133 (based on CR in R4-2103254) are the same as used in the RAN2 specs defining the corresponding RRM procedures.  Other spec rapporteurs are welcome to further check if there is any issue with inclusive language. But our conclusion is that in terms of inclusive language RAN4 specs are fully aligned with other WGs.  We propose to send LS to RAN to inform about the above observation. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 2.2.

### 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.*

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| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
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| YYY | Company A |
| Company B |
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## 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#2-1** | *Recommendations for 2nd round:it is recommended that Ericsson draft an LS to RAN informing RAN4’s review status* |

### CRs/TPs

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

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| **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”.*

### Comments on R4-2115067 LS on Inclusive Language Review Status and Consistency Check

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| **Company** | **Comments** |
| Apple | We appreciate the good efforts by Ericsson. Since each WG is asked to check potential inconsistency across WGs, a suggestion for wording:  “Therefore, no Rel-17 RAN4 specification contains any non-inclusive language.” changed to “Therefore, no Rel-17 RAN4 specification contains any non-inclusive language or inclusive language terms that are not consistent with those used other RAN WGs.” |

# Topic #3: FR2 power control for NR-DC

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2113908 | OPPO | Observation 1: FR2 NR-DC hasn’t been discussed in RAN4, but NR CA conclusion can be taken as reference.  Observation 2: Views are divergent on the definition of independent power control, and basically it should be per CG power control, and no total power limitation.  Observation 3: Total output power has been defined for FR2 intra-band UL CA, thus it is not independent power control.  Observation 4: Hardware are shared by CBM inter-band UL CA, thus it is not independent power control.  Observation 5: In real implementation, total UE power control is needed to cope with power consumption and thermal heating issues, thus “total UE power concept” is valid for IBM inter-band UL CA.  Observation 6: For IBM inter-band UL CA, it is not independent power control.  Proposal 1: It is proposed to confirm that FR2 NR DC power control is not independent, and reply to RAN1. |

## Open issues summary

### Sub-topic 3-1: Seeking to have a common understanding of “independent power control”

* Proposals
  + Option 1: “independent power control” means per CG power control and there is no total power limitation.
  + Option 2: Others
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | Option 1.  Although FR2 NR DC has not been specified yet in RAN4, it must be based on IBM (due to non-collocation). There is no need to consider CBM aspect.  The power sharing is not needed for the sake of power control, power consumption or MPE. |
| OPPO | Option 1. |
| Qualcomm | Option 1  NR-DC is likely to be based on independent resources, so we do not see the need to have a combined limit. |
| vivo | Option 1  This concept had already been agreed in last meeting and was documented in the final draft LS “[REV\_R4-2107780\_MR-DC\_replyLS\_v02\_DCM\_vivo.docx](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Inbox/Drafts/%5B99-e%5D%5B106%5D%20LTE_NR_DC_CA_enh_RF_Maintanence/Round%202/REV_R4-2107780_MR-DC_replyLS_v02_DCM_vivo.docx)”. Though the draft LS was not agreed, his understanding was aligned. |
| Samsung | Option 1 seems common understanding. Just for clarification, if going with Option 1, does that mean UE power consumption is almost doubled compared with standalone single CC? |
| Ericsson | Option 1. In general, power control on different serving cells is independent but in practice there is a limit e.g. PCMAX for CA that implies a dependence at maximum power, For NR-DC there is no limit and RAN4#99-e concluded (as mentioned in R4-2113908)  Power control is per CG. Absence of specified limit on the total NR-DC power (like PEN-DC for FR1), any actual limit on the total power [is] implementation specific e.g. hardware limit or MPE |
| Apple | Option 1 |

### Sub-topic 3-2: Will there be realistic total power limitation even without the definition of ”p-NR-FR2”? If so, what is the implication on the understanding of ” independent power control”?

*Sub-topic description*

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

**Issue 2-2: TBA**

* Proposals
  + Option 1: TBA
  + Option 2: TBA
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | We already agreed that there is no power limitation in p-NR-FR2. There is no point to introduce power limitation in FR2 NR-DC. |
| OPPO | For intra-band CA, there is total power limitation.  For inter-band CA, the total power limitation is under discussion, even finally without specifying the total power in RAN4 spec, UE still might control the total power to reduce the issues like power consumption, heating, SAR etc. |
| Huawei, HiSilicon | We need to wait for the outcome of inter-band UL CA discussed in FR2 RF enh WI. |
| vivo | Need to wait for the outcome of inter-band UL CA discussed in FR2 RF enh WI to use as reference.  Currently, the total power concept for UL CA is still under discussion. This the main reason that we cannot have an agreement in the last meeting. It is proposed to postpone the discussion here and wait until there is a conclusion in thread [129]. |
| Samsung | Better to wait for outcome of inter-band UL CA |
| MediaTek | Better to wait for outcome of inter-band UL CA |
| Ericsson | Regarding power control for NR DC, there are upper limits per CG (PCMAX for FR2) that govern the power prioritization per CG but a PNR-DC for the total FR2 power does not exist. Another difficulty is that the PCMAX is defined in an implementation-specific plane of reference for FR2 so absolute limits do not apply  One way is to specify an PNR-DC that is also defined in an implementation-specific plane of reference, essentially the “sum” of the PCMAX for inter-band FR2. Then the PCMAX could be modified by relative limits, that is, all cells in one of the cell groups are “attenuated” by a signaled value to leave power for cells in the other CG when the UE is power limited (the attenuation would also be visible in a lower EIRP when measured in the peak direction). All subject to that the EIRP in each band combined should not be exceeded. A similar solution is proposed in for intra-band UL CA for FR2 within a CG for which the SCells are dropped, “attenuate” the priority cells to leave power for other cells. |
| Apple | Agree that the ongoing discussion of inter-band UL CA can serve as a good reference. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 3.2.

### 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 |
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## 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#3-1** | *Tentative agreements:*  *Option 1 (“independent power control” means per CG power control and there is no total power limitation.) is agreeable.*  *Candidate options:*  *Recommendations for 2nd round:* |
| **Sub-topic#3-2** | *Recommendations for 2nd round: No clear agreement yet in the first round. Recommended to further discuss the following options regarding total power limitation:*  *Option 1: no need to introduce power limitation in FR2 NR-DC.*  *Option 2: wait for outcome of inter-band UL CA*  *Option 3: others* |

### CRs/TPs

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

|  |  |
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| **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”.*

### Sub-topic 3-2: To *discuss the following options regarding total power limitation:*

* *Option 1: no need to introduce power limitation in FR2 NR-DC.*
* *Option 2: wait for outcome of inter-band UL CA*
* *Option 3: others*

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| **Company** | **Comments** |
| OPPO | WF is provided for this topic in below link, and it is proposed:   * + - * Wait for the outcome of total power concept discussion in FR2 inter-band UL CA, then further discuss the possibility of independent power control for inter-band NR-DC       * LS will be sent to RAN1 after the conclusion can be reached for inter-band NR-DC   [Draft R4-2115081 WF on FR2 power control for NR-DC](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Inbox/Drafts/%5B100-e%5D%5B149%5D%20NR_reply_LS_UE_RF/Round%202/WF%20on%20NR%20DC%20independent%20power%20control/Draft%20R4-2115081%20WF%20on%20FR2%20power%20control%20for%20NR-DC.docx) |
| vivo | Support the contents of this WF, which is also aligned with last meeting’s understanding. |
| Apple | Option 2. |

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# Topic #4: FR2 requirement applicability over ETC

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111910 | Qualcomm | Observation 1: RAN4 agreed to limit verification of spherical coverage requirements to NTC, originally motivated by testability limitations.  Observation 2: RAN4’s directive to RAN5 to limit verification based on testability considerations is out of scope for RAN4.  Observation 3: RAN5 no longer has a testability limitation for ETC verification of spherical coverage requirements  Proposal 1: RAN4 to discuss if the exemption from verification over ETC of spherical coverage requirements is justified, considering both, RAN5 progress on ETC testing and lack of RAN4 authority to make testability related decisions. |
| R4-2112983 | vivo | Observation 1: From RAN4 perspective, the following core requirements should not be tested for extreme environmental testing conditions, i.e., EIRP/EIS spherical coverage, Power control, EVM/EVM equalizer spectrum flatness, Beam correspondence.  Proposal 1: RAN4 should confirm the observation from RAN5 that EIRP/EIS spherical coverage, Power control, EVM/EVM equalizer spectrum flatness, Beam correspondence, should not be tested under ETC condition.  Proposal 2: For all the other RF requirement without explicitly statement, those requirements apply to ETC condition. Clear feedback should be sent to RAN5.  Proposal 3: Testing time reduction should be considered for FR2 ETC, especially for CA and EN-DC combinations. |
| R4-2113658 | Ericsson | Proposal 1: Confirm in a response LS that the requirements are applicable to both Normal and Extreme temperature conditions unless explicitly stated. A draft LS response is available in Appendix  Proposal 2: Indicate to RAN5 in the LS response that the test methodology for extreme temperature conditions have been studied in the study item “Study on enhanced test methods for FR2 NR UEs” and captured in the draft TR 38.884 clause 5.4.  Proposal 3: Agree to remove the limit of verification of the UE maximum output power requirement in only normal conditions by voiding note 3 in the requirement tables for all power classes for FR2. |
| R4-2113888 | OPPO | RAN4 would like to thank RAN5 for the LS on FR2 Extreme temperature conditions clarification. And RAN4 would like to clarify that the applicability of ETC in TS38.101-2 is defined in Annex E.2 where it states that UE shall meet requirements in ETC unless otherwise stated. Therefore, RAN4 would like to confirm with RAN5 that the core requirements in TS38.101-2 without explicitly limited to Nominal Temperature conditions are applicable to Extreme Temperature Conditions. |
| R4-2114393 | Keysight Technologies UK Ltd | Observation 1: Unless otherwise stated explicitly, all core requirements are applicable under nominal and extreme environmental testing conditions.  Proposal 1: RAN4 confirms that, unless otherwise stated, all core requirements are applicable under nominal and extreme environmental testing conditions as shown in Annex 1 draft LS response. |

## Open issues summary

### Sub-topic 4-1: confirm the following two ways of testing exemption used in RAN4:

* The first category is a core requirement exemption from ETC applicability.
* The second category is verification exemption. In other words, core requirements themselves are not exempt from being applicable in ETC.
* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | Option 1: Yes |
| OPPO | Option 1, yes. |
| Qualcomm | Option 1: Yes  This is consistent with an unsuccessful WF in the last meeting R4-2107750. The WF was unsuccessful because it was deemed that there was no new agreement, just confirmation of existing status. |
| vivo | Option 1: Yes.  We echo Qualcomm comments, in last RAN4 meeting, the RF applicability for ETC were discussed and confirmed, even though the WF R4-2107750 driven by us was not finally approved due to no consensus on next-step action in RAN4. |
| Samsung | It is not a simple yes or no question. In annex E of 38101-2, “The UE shall fulfil all the requirements in the temperature range for extreme conditions, as defined in Table E.2.1-1, unless explicitly stated otherwise in any requirement.” The explicit statement exist in requirements for spherical coverage, power control, EVM, beam correspondence, etc. Wording are different: “verified”, “applicable”, “operation condition”. There are backgournds for specifying these exemptions, it is not only due to testability issue. When discussing the category of testing exemption, that does not mean to change the related specification. |
| Keysight Technologies | Option 1: Yes  In case Option 1 is finally agreed, next steps should be:   * To classify existing exemptions in any of these 2 categories. There are some proposals in R4-2111910 and R4-2113658 that can be further discussed * To decide whether for those core requirements classified as verification exemption, it is RAN5 who should decide whether they should be tested. * To inform RAN5 in the same LS response about agreements in this area. |
| NTT DOCOMO, INC | Option 1: Yes  The description on two categories is aligned with our understanding. And the approach described above by Keysight looks good. |
| Ericsson | Option 1 |
| Apple | Option 1: yes. |

### Sub-topic 4-2: For verification exemption, indicate to RAN5 in the LS response that the test methodology for extreme temperature conditions have been studied in the study item “Study on enhanced test methods for FR2 NR UEs” and captured in the draft TR 38.884 clause 5.4.

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| OPPO | Option 2. Suggest to focus on RAN5 LS questions, i.e. “whether core requirements not explicitly limited to Nominal Temperature conditions are applicable to Extreme Temperature Conditions”. |
| Qualcomm | Option 1: Yes, but we also need to respond to RAN5’s specific query. |
| Huawei, HiSilicon | Option 2. The ETC studied in draft TR 38.884 has no relation to question in RAN5 LS. |
| Vivo | Option 1: Yes. The testability conclusion can be added in the response LS, but this is not the key part to response.  In RAN5 LS, the core demand is asking the feedback from RAN4 on the RF applicability of ETC. therefore, we should first confirm the observation in RAN5 LS that the listed test cases should not be tested under ETC condition.  Regarding the question on other core requirements without explicit restrictions, confirm that other requirements are applicable to ETC, based on the statement in RAN4 spec “*The UE shall fulfil all the requirements in the temperature range for extreme conditions, as defined in Table E.2.1-1, unless explicitly stated otherwise in any requirement.*”  In addition, the concerns of ETC testing cases are also from whether it’s necessary to test all the FR2 requirements under ETC condition, especially many CA/EN-DC combinations, given the overall OTA-based FR2 conformance testing time is already unimaginable. Therefore, recommendation to RAN5 to consider the test cases reduction for ETC should also be suggested in the reply LS. |
| Samsung | Option 2: No  There are backgournds for specifying exemptions in RAN4 specification, it is not only due to testability issue. It is enough just to answer RAN5’s question. |
| Keysight Technologies | Agree with Qualcomm that first we need to respond to RAN5 query. Then, in case RAN4 agrees on Option 1 on Sub-topic 4-1, on which core requirements are classified as verification exemptions and on informing RAN5 about RAN4 progress on existing exemptions, the LS response could include this pointer to outcome of investigations carried out under Enhanced Testability SI but clearly indicating that ultimate responsibility on whether to test those verification exemptions belongs to RAN5. |
| Ericsson | Option 1: Yes, also agree with Qualcomm on addressing the specific RAN5 question. |
| Apple | Option 1: yes.  In addition, if option 1 for sub-topic 4-1 is agreeable, our understanding is RAN4 can answer “yes” to RAN5 LS questions, i.e. “whether core requirements not explicitly limited to Nominal Temperature conditions are applicable to Extreme Temperature Conditions”. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 4.2.

### 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.*

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|  | **Status summary** |
| **Sub-topic#4-1** | *Tentative agreements:*  *Based on the majority view (except one company), it seems RAN4 can confirm the following two ways of testing exemption used in RAN4:*   * The first category is a core requirement exemption from ETC applicability. * The second category is verification exemption. In other words, core requirements themselves are not exempt from being applicable in ETC.   *Candidate options:*  *Recommendations for 2nd round:If the above tentative agreement is ok, it is recommended to:*   * To classify existing exemptions in any of these 2 categories. There are some proposals in R4-2111910 and R4-2113658 that can be further discussed * To decide whether for those core requirements classified as verification exemption, it is RAN5 who should decide whether they should be tested. * To inform RAN5 in the same LS response about agreements in this area. |
| **Sub-topic#4-2** | *Recommendations for 2nd round: Given the different views, it is recommended to focus on the proposed topics in sub-topic 4-1. No further discussion is needed.* |

### CRs/TPs

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

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| --- | --- |
| **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”.*

### Sub-topic 4-1: confirm the following two ways of testing exemption used in RAN4:

* The first category is a core requirement exemption from ETC applicability.
* The second category is verification exemption. In other words, core requirements themselves are not exempt from being applicable in ETC.

**Issue 4-1-1: To classify existing exemptions in any of these 2 categories. There are some proposals in R4-2111910 and R4-2113658 that can be further discussed**

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| **Company** | **Comments** |
| Qualcomm | We think it is possible to merge the proposals. The baseline can be Ericsson’s 13658, as long this clarification can be included after the list of test cases with exemption:  ‘RAN4 would like to clarify that exemption of a requirement from verification over ETC conditions (example: spherical coverage requirements) is not equivalent to exemption of applicability of core requirement over ETC for that requirement.; |
| OPPO | OK |
| Huawei, HiSilicon | Only the first category exist in our understanding, RAN4 requirement do not have definition only for verification exemption. When we say verified under NTC, it means only NTC requirement applies. |
| Samsung | We share similar view as Huawei. No matter what the wording is, the specification itself is RAN4 requirement. We have spec language that requirements apply ETC unless explicitly stated otherwise in any requirement. At least we can see three kinds of wording explicitly stated but that does not make any difference from requirement point of view. “Verified only NTC” and “applicable only NTC” and “operating condition NTC” all indicate that these RAN4 requirements are only for NTC. If companies have concern on different wording, we can discuss to align the wording as refinement. More important is the requirement is not changed.  Companies are linking this issue to testability. As we have commented testability is one of the considerations but not the sole reason. Thinking of this issue in another way, peak EIRP and EIS of ETC is enabled in Rel-17 testability enhancement item, but Rel-15 requirement does not say peak EIRP and EIS is only verified NTC. There are also testability issues like High downlink power and Low UL power test cases which is resolved in Rel-17, but Rel-15 requirement does not say those cases only applicable for NTC. So we do not think RAN4 requirements are defined in a manner that depends on testability progress. |
| DISH | From operator perspective and in many cases, from regulatory bodies as well, it is highly important to understand what requirements apply across the temperature range and what not.  Now, from Huawei and Samsung comments we understand that RAN4 should remove all the text referring to “verified only NTC” and set these requirements only to NTC.  We are not sure “requirements are only NTC” is necessarily true, as we believe some of these requirements that include “verified only NTC” are essential in temperature conditions, from both deployment and regulatory applicability point of view. This also, because there was a debate if there is thermal mitigation or not. This Rel-15 originated discussion, we believe has not resulted in any agreement yet.  Whether DISH view is correct, we think RAN4 should clarify these as soon as possible.  A question for clarification. Traditionally, RAN4 has sent guidance to RAN5 on what requirements are expected to behave the same way if it is somehow independent of the changed condition/feature. Why is this not an option here? |
| Nokia | This is important clarification  RAN4 would like to clarify that exemption of a requirement from verification over ETC conditions (example: spherical coverage requirements) is not equivalent to exemption of applicability of core requirement over ETC for that requirement.; |
| Keysight technologies | I really think that when core requirements for spherical coverage (EIRP and EIS) and beam correspondence in Rel-15, test feasibility at that moment for FR2 ETC was considered, what led to verification exemptions. Now such FR2 ETC test feasibility has evolved: Hence we agree with the exemption classification indicating these 3 core requirements are verification exemptions.  In case the issue is the Release from which those requirements should be tested, RAN4 should be constructive and move the discussion in that direction as I think operators and infra-vendors have already commented on the importance on having such requirements in place. |
| NTT DOCOMO, INC | Based on the e-mail discussion, there are still different understanding on the meaning of “shall not be verified”. We think this discussion should not block from sending LS to RAN5, so we should use the same warding as we have in TS 38.101-2 in the LS at this moment.  And our understanding on “should not be verified” is that it should apply as core requirements but should not be tested.  Our understanding is derived from the previous contribution.   * Agreements captured in R4-1814841 in chairman report in RAN4#89:   + Agreement: At least EIS and EIRP spherical coverage and TRP requirements are not tested under ETC. * Coversheet of endorsed draft CR R4-1816644:   + Per agreements in RAN4#89, it was decided that at least following requirements will be tested under normal temperature conditions:   We understand that there are different views, and we guess there may be other contribution mentioning different things, but this is a reference from which our understanding comes. We can discuss further this aspect. |
| Apple | There are very long histories behind RAN4-adopted exemptions of ETC in the core requirements, and we don't see that any of them can be classified as a pure "verification exemption." If RAN4 decides to revisit any of them, then a new round of analysis is necessary to determine the delta in performance between NTC and ETC. To run down the list briefly:  - EIRP/EIS spherical coverage: the studies performed in Rel-15 on antenna array performance did not consider any temperature related factors in the spherical coverage gain drop analysis (e.g. beam forming gain degradation for all directions)  - EIS spherical coverage: also did not consider any temperature related factors in the companies' contributions on noise figure  - Beam correspondence: SNR side conditions were derived from nominal RSRP accuracy performance (at a higher SNR point than the RRM requirements), and there was no analysis performed on the impact of ETC on the ability by the UE to select the best UL beam (e.g. an ETC related beam correspondence tolerance)  - EVM: these requirements in 101-2 were explicitly derived based on the nominal temperature condition; furthermore, EVM is specified under NTC only for LTE and FR1  - EVM equalizer flatness: these requirements in 101-2 were explicitly derived based on the nominal temperature condition; a new core requirement would need to be introduced for EVM equalizer flatness under ETC based on new analysis  - Power control: these requirements in 101-2 were explicitly derived based on the nominal temperature condition; e.g., absolute power control tolerance relies on RSRP tolerance defined in RRM for NTC, and relative power control tolerance discussions did not address any temperature related impacts  In summary, we think RAN4 should study and quantify the deltas in the above core requirements between NTC and ETC; once these gaps are identified, then RAN4 should discuss how to handle the differences in the core requirements. One option is to define additional requirements under ETC (as an example, EVM equalizer flatness contains separate tables for NTC and ETC). Another option is to recommend to RAN5 to incorporate the delta into the test tolerance. In our understanding, only after RAN4 concludes the "homework" related to quantifying these deltas and agrees how they can be handled in core requirements, can RAN5 proceed with an expansion of ETC applicability to more test cases beyond the set they already verify under ETC. |

**Issue 4-1-2: To decide whether for those core requirements classified as verification exemption, it is RAN5 who should decide whether they should be tested.**

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| **Company** | **Comments** |
| Qualcomm | Agree, it should be RAN5. We believe RAN4 is responsible for determining the measurement principle and establishing side conditions when necessary. Test case feasibility is better left to RAN5. Previous agreements in RAN4 to limit verification-testing may be an example of WG over-reach, in retrospect. |
| OPPO | No agree, it is the agreement made in the Rel-15 requirement definition and can be considered as an compromise between parties who have joined the discussion. We don’t think this is simply an issue can be left to RAN5 decide. RAN5 testing shall follow core requirement agreements. |
| Huawei, HiSilicon | No agree. There is no verification exemption category existed for current RAN4 spec.  Furthermore, if RAN4 can decide the understanding of RAN4’s spec, they don’t need to send LS to RAN4. The decision should be based on RAN4’s understanding.  Additionally, the ETC measurement need further discuss on how to reduce unnecessary repeated test. |
| Qualcomm | To Oppo and Huawei. The original motivation of the second category was to accommodate testability challenges:  Oppo R4-1812721: **Observation 3:** Implementing extreme temperature condition in chamber is impractical.MTK R4-1812323: ‘Though UE RF requirements have traditionally been defined under both normal and extreme temperature conditions, there has been concerns on the testability of extreme conditions in OTA test environment for FR2.’  To claim now that verification exemption is the same as ‘no core requirement’ is incorrect: Why would RAN4 hide a ‘no requirement’ condition as a verification exemption when it can simply call it ‘no requirement’? The core requirement is the design goal and must be separated by what can or cannot be tested. The wording difference was deliberate.  To Huawei: Would you acknowledge or deny that 2 different types of exemption wordings exist? Excerpt from R4-2111910:   1. Core requirements applicability limited to NTC, which has wording of the form: (example: 6.3.4.1) ‘The requirements …. apply under normal conditions' – we take the sentence to mean ‘under normal conditions *only*’ although it is not included in the wording. 2. Verification testing limitations (directive to RAN5) to NTC, which has wording of the form: (Tables 6.2.1.x-3) ‘The requirements … are verified only under normal temperature conditions’ |
| Samsung | Not agree. Refer to our comments above in issue 4-1-1. |
| Ericsson | Since this restriction was originally motivated by testability issues we can now leave this decision to RAN5 if those testability issues have been resolved. This shall be reflected in the LSout. However RAN4 needs to lift those restrictions since RAN5 have to follow core specification requirements. RAN5 can not implement test cases for requirements where a “verification exception” exists. |
| DISH | We would also agree to this, but we also don’t understand why RAN4 would insist on doing so. RAN4 scope in UE OTA, is requirements and test methods. Not sure why it should extend it to test requirements. RAN4 can reflect this in an LS to RAN5. |
| Keysight Technologies | Agree with Qualcomm, Ericsson and Dish on letting RAN5 to decide on whether to test verification exemptions. |
| Apple | Please see our comments to Issue 4-1-1 above; we believe none of the exemptions are purely "verification exemptions," and any change in the verification of requirements shall begin with an analysis of the impact on the core requirement |

### Comments on R4-2115068 Reply LS on FR2 requirement applicability over ETC

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| **Company** | **Comments** |
| Keysight Technologies | 1. I think the LS should first address direct question from RAN5 and then provide further information in case any is agreed so it should start as shown below:   *RAN4 would like to thank RAN5 about the LS R4-2111716 on ETC.*  *RAN4 confirms that, as stated in 38.101-2, the UE shall fulfil all the requirements in the temperature range for extreme conditions, unless explicitly stated otherwise in any requirement.*   1. In case no further agreement is achieved for exemptions classification and whether they should be tested, some additional comment could be added to the LS to inform that RAN4 continues discussion.   *For explicit exemptions in 38.101-2, RAN4 continues discussing whether any can be removed and in which release and will update RAN5 as soon any conclusion is achieved.*   1. In case further agreement is achieved for exemptions classification, it would be convenient that initial text just describe agreed classification and which exemptions are behind each category:   *For explicit exemptions in 38.101-2, RAN4 identifies two categories:*   * + *The first category is a core requirement exemption from ETC applicability*     - *Power control*     - *EVM and EVM equalizer flatness*   + *The second category is verification exemption. In other words, core requirements themselves are not exempt from being applicable in ETC.*     - *EIRP spherical coverage*     - *Beam correspondence*     - *EIS spherical coverage*  1. In case further agreement is achieved for exemptions classifications and which exemptions rely under each category, RAN4 should inform RAN5 about ownership of finally deciding whether verification exemptions are tested or not:   Option 1:  *RAN4 has evaluated testability and recommendation for verification exemptions is RAN5 shall not test those core requirements under ETC. RAN5 should decide whether verification exemptions shall be finally tested.*  Option 2:  *RAN5 should decide whether verification exemptions shall be finally tested.*  Option 3:  *RAN4 has evaluated testability and conclusion for verification exemptions is RAN5 shall not test those core requirements under ETC.*  Option 4:  *RAN4 has evaluated testability and conclusion for verification exemptions is RAN5 shall not test those core requirements under ETC until Rel-17.* |
| Apple | Based on our comments to Issues 4-1-1 and 4-1-2 above, we propose to include the following statement for clarification into the LS:  " RAN4 would like to clarify that any changes in the temperature conditions when verifying the requirements in the list of exemptions incur impact on the corresponding core requirements." |

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# Topic #5: FR2 UE relative power control tolerance requirements

## Companies’ contributions summary

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| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2111911 | Qualcomm | Proposal 1: RAN4 to discuss if note 2 in table 6.3.4.3-2 can apply to table 6.3.4.3-1 also, towards accommodating the request in the LS from RAN5 [1]. |
| R4-2113659 | Ericsson | Observation 1: One additional improvement is to combine the two requirement tables Table 6.3.4.3-1 and Table 6.3.4.3-2 into one table also then addressing RAN5’s concern on having requirements in two tables.  Proposal 1: Add the content of NOTE 2 “For PUSCH to PUSCH transitions with the allocated resource blocks fixed in frequency and no transmission gaps other than those generated by downlink subframes, guard periods: for a power step ΔP = 1 dB, the relative power tolerance for transmission is ± 1.0 dB.” To Table 6.3.4.3-1 in TS38.101-2  Proposal 2: Send a LS reply to RAN5 based on the Appendix. |

## Open issues summary

### Sub-topic 5-1: Can note 2 in table 6.3.4.3-2 apply to table 6.3.4.3-1?

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | Option 1: Yes |
| Qualcomm | We think it is possible to introduce Note 2 to table 6.3.4.3-1 (low EIRP range), but since it must be backward compatible with UEs of older releases, the change cannot be made without additional considerations. From a UE implementation perspective, a UE may use multiple state changes to cover the entire EIRP range, and state transitions are a source of differential non-linearity that require ‘exception points’. By increasing the EIRP range over which the UE must comply with the monotonicity requirement of Note 2, more of these points of DNL can show up, necessitating more exception points. |
| MediaTek | Option 2: No.  In Rel-15, a conscious agreement was made to add the tighter tolerance associated to this NOTE 2 to higher output power levels and hence apply it only to table 6.3.4.3-2. This point was clearly captured in the RAN4#91 endorsed CR (R4-190744) cover sheet. Therefore RAN4 should clarify to RAN5 that the NOTE 2 is not intended to apply for Table 6.3.4.3-1, and the stated tolerances in 6.3.4.3-1 table apply for lower power levels.  Regarding the exceptions, these were only applicable for the NOTE 2 due to the tighter tolerance there.  We suggest to reply to RAN5 accordingly. |
| Huawei, HiSilicon | Option 2:No  The accuracy for different range is not the same, this is why RAN4 only apply the note to one table. We need to reply RAN5 that RAN4 intention. |
| Ericsson | Option 1: Yes |
| Apple | We have similar view with Qualcomm. The spec. defined this way is not by mistake. It was the outcome of a compromise during the earlier discussions on FR2 relative power tolerance. According to the current specifications, +/- 5dB tolerance in lower power range for 1dB power step condition as described in NOTE 2 could be excessive. But it should also not be as tight as +/- 1 dB. |

### Sub-topic 5-2: As further improvement, can table 6.3.4.3-1 and table 6.3.4.3-2 be combined?

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| XXX |  |
| Qualcomm | Can be revisited at a later date. It would be good to get feedback from infra if this is more valuable, or a requirement that keeps RBs unchanged (like note 2) |
| MediaTek | Not very clear what the objective is of this merging, and how it helps exactly. We should respond on the 5-1 point first of all. |
| Huawei, HiSilicon | Option 2. We don’t want to touch and revise the core requirement agreed in Rel-15. |
| Ericsson | Option 1: If not now maybe revisit this later. Could be part of improvement in later releases as a natural improvement of the requirement |
| Apple | Potentially. But any requirement changes, being it tightening or relaxing would always trigger some concern. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 5.2.

### 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.*

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|  | **Status summary** |
| **Sub-topic#5-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round: Continue to discuss in the second round.* |
| **Sub-topic#5-2** | *Recommendations for 2nd round:based on the views expressed in the first round, it seems we are not ready to take this task for the moment. So no further discussion is needed on combining table 6.3.4.3-1 and table 6.3.4.3-2.*  *Instead, let’s discuss the following issue from RAN5:*  *Whether 3 exceptions are for the whole dynamic range addressed in both tables 6.3.4.3-1 and 6.3.4.3-2 or whether 3 exceptions are allowed for each table.*   * *Option 1: for the whole dynamic range* * *Option 2: for each table* * *Option 3: for table 6.3.4.3-2 only* |

### CRs/TPs

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

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| **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”.*

### Sub-topic 5-1: Can note 2 in table 6.3.4.3-2 apply to table 6.3.4.3-1?

Note: no need to repeat the same comments in the first round. In the second round, companies are welcome to provide responses or proposals based on the first round comments, aiming to achieve consensus.

* Proposals
  + Option 1: Yes
  + Option 2: No
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| MediaTek | Option 2: No.   * The question from RAN5 is not whether RAN4 can enhance 38.101-2 requirements. The question is to clarify what is required from the UE, to which we provide a suggested answer below in line with our understanding of the specifications and the agreed intention when the specification text was agreed: * ***RAN5 question:*** *clarify which should be the value of relative power tolerance for PUSCH to PUSCH transitions for a power step* Δ*P=1dB for the case Pint ≥ P ≥ Pmin.*   ***Suggested response:*** The applicability of the NOTE2 to table 6.3.4.3-2 and not to table 6.3.4.3-1 was intentional. For PUSCH to PUSCH transitions with a power step ΔP=1dB where Pint ≥ P ≥ Pmin, a relative power tolerance value of ±5.0dB applies, as specified in table 6.3.4.3-1 for a power step of ΔP < 2dB. |
| Qualcomm | Option 1: yes  It is evident that RAN5 did not need to resort to an LS to determine the obvious: that the core requirement today does not have the monotonicity condition (Note 2) for the low EIRP range. We see it as a suggestion to consider note 2 in the low range table, which is a core requirement change. We think it behoves companies to revisit their ‘Note 2’ relative power chance tolerance budgets and determine in the next meeting if it is feasible for the low EIRP range, and what other conditions are reasonable to include as a package. |
| Ericsson | Agree with Qualcomm.  Some more details on the issues with testing the current requirements:  Test of relative power control by TPC commands is currently restricted to the upper power region which is at least (12-MBR) dB range. In order to guarantee that the UE is transmitting within this range the Measurement Uncertainty (MU) need to be subtracted at the lower end. Since MU is approximately 4 dB there is 7.3 dB left of usable range in the test for n257, meaning only 3 usable TPC steps can be guaranteed. On top of this up to 3 exceptions are allowed which may invalidate all of the usable power steps.  If note 2 is extended to apply in the full power range the range increases substantially to around 35 dB, where 31 dB can be used. This would dramatically increase the number of usable TPC steps in the test to around 15. |
| Nokia | Agree with Qualcomm, Option 1 |
| Apple | Option 2: No |

### Sub-topic 5-3: Whether 3 exceptions are for the whole dynamic range addressed in both tables 6.3.4.3-1 and 6.3.4.3-2 or whether 3 exceptions are allowed for each table.

* *Option 1: for the whole dynamic range*
* *Option 2: for each table*
* *Option 3: for table 6.3.4.3-2 only*

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| **Company** | **Comments** |
| MediaTek | Option 3 (with **clarification**): The 3 exceptions are only applicable **for the scenario covered by NOTE2** within table 6.3.4.3-2, as a consequence of the more stringent tolerance value in that scenario, and therefore not applicable to the range in table 6.3.4.3-1. |
| Qualcomm | Thankyou MTK for the CR reference that shows intent of the CR. We now agree with you, the intent of the exceptions was for the 1 dB steps. So we revise our stand to Option 3 |
| Apple | Option 3 |

### Comments on R4-2115069 Reply LS on FR2 UE relative power control tolerance requirements

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| **Company** | **Comments** |
| Qualcomm | We favor waiting for a meeting cycle to allow companies to check if they can support the monotonicity requirement for the low EIRP range. |
| Ericsson | Agree with Qualcomm, allow for more time to companies to evaluate the extension od the note to also lower range. No need to send an LS to RAN5 stating the obvious. |



# Topic #6: Clarification on exception requirements for Intermodulation due to Dual uplink (IMD)

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2112915 | ZTE | In this paper, we provide some discussions on the issue on exception requirements for Intermodulation due to Dual uplink (IMD). Another options by combining Option 5 and Option 6, i.e.:  Option 7: In RAN4 specs, no general criteria is defined in which REFSENS can be fulfilled with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active). However, whether it is meaningful to do this analysis is up to RAN5.  In addition, draft LS is attached in the Annex. |
| R4-2113302 | Xiaomi | 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.  Answer: 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 and no other EN-DC exception requirements are defined, i.e. no exception due to 1) harmonics (UL harmonic or Receiver harmonic mixing), 2) cross-band isolation, 3) counter-intermodulation (C-IM).  Clarification on Q2: Clarify the criteria that need to be fulfilled in order for MSD=0 to apply.  Answer: MSD=0 could be only applied when carrier frequencies and bandwidths are selected for each active UL band such that there is no any interference falling into Rx CBW under all the conditions in Question 1. However, whether it is meaningful to do this analysis is up to RAN5. |
| R4-2113567 | Ericsson | Observation 1: Option 2 above does not answer the question from RAN5. RAN4 should conclude whether there are any requirements or not in this case and leave the decision on how to test for RAN5.  Proposal 1: Re-word option 2 to say “there are no requirements without MSD in this scenario, i.e. refsens is defined only with the specific test frequency settings in tables under section 7.3B.2.3.5 of TS38.101-3 if 2 UL are active”  Observation 2: With Option 1/1b TR37.863 can be used by RAN5 to determine the test settings for MSD=0 dB for an EN-DC configuration if the TR contains a full Self-interference analysis where all possible IMD products are documented.  Observation 3: In addition to observation 2, it needs to be checked in RAN5 that no other exception is applicable, i.e. Cross band isolation exceptions.  Proposal 2: Select option 1/1b in the LS reply to RAN5. |
| R4-2113402 | Huawei, HiSilicon | Observation 1: 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.  Observation 2: Currently, in RAN4’s specification, there is no general criteria in which REFSENS can be fulfilled with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active).  Observation 3: Specifying the test configurations (MSD=0) in RAN4 can not only guarantee technical analysis accurately, but also take the interested test point from operators into account.  Proposal 1: RAN4 can establish a new basket WI to specify the test configurations with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active), based on operators’ request. |
| R4-2113889 | OPPO | Observation 1: RAN4 defined requirements/configurations for the worst case or for the case of up to 5th order IMD, but didn’t list all the MSD and interference cases.  Proposal 1: Clarify to RAN5 that there might be still interference even no MSD/configurations are defined in the spec and therefore SA requirements cannot always be applied.  Proposal 2: Clarify to RAN5 that basic criteria to apply MSD=0 is no IMD products fall into the victim carrier, however, whether it is meaningful to do this analysis is up to RAN5. |

## Open issues summary

### Sub-topic 6-1: For clarification on Q1, is the following answer agreeable:

### Answer: 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 and no other EN-DC exception requirements are defined, i.e. no exception due to 1) harmonics (Tx or RX), 2) cross-band isolation, 3) counter-intermodulation (C-IM)

* Proposals
  + Option 1: Yes
  + Option 2: No
  + Option 3: others
* Recommended WF
  + TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | Option 1. Actually, the answer here is based on the tentative agreements in the email discussion (R4-2107970) during the last meeting. For the sake of convergence, It is proposed not to reopen this discussion here. |
| Nokia | Option 2; No as the reference sensitivity is defined only for the specific uplink and downlink test points. |
| ZTE | Option 1. As Xiaomi said, it is based on the tentative agreements in the email discussion (R4-2107970). |
| OPPO | Option 1. |
| Qualcomm | The wording is not accurate, it says “no other EN-DC exception requirements are defined” but the practice for defining MSD has been that the MSD is specified according to dominant desentisation method so there maybe combinations where the bigger MSD masks other problems but those other problems are not defined in the spec. Alternative text would be:  “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 and no other EN-DC desentization mechanism is present, i.e. no exception due to 1) harmonics (Tx or RX), 2) cross-band isolation, 3) counter-intermodulation (C-IM). RAN4 has not specified all the overlapping desentization issues”  But this then will lead ran5 to ask what are those and then we come to the real problem, it will be a big work task for ran4 to go through all those combinations and identify possibly underlying MSD problems. This should be a basket WI if it is really needed. |
| CHTTL | Option 1, it was already agreed in the last RAN4 meeting as Xiaomi and ZTE commented. |
| vivo | Option 1. |
| Huawei | Option 1. |
| MediaTek | Option 1 with Qualcomm’s modification to “no other desensitization component present” is best. |
| Ericsson | Option 1: for EN-DC the following applies: “Unless otherwise stated, requirements for NR receiver written in TS 38.101-1 [2] and TS 38.101-2 [3] apply and are assumed anchor agnostic. Requirements are verified under conditions where anchor resources do not interfere NR operation.”  The answer would clarify these conditions. |
| Apple | We share the similar view with Qualcomm and would like to understand the intention for this clarification. |
| AT&T | Option 1. |

### Sub-topic 6-2: For clarification on Q2: is the following answer agreeable:

### Answer: In RAN4 specs, no general criteria is defined in which REFSENS can be fulfilled with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active). However, whether it is meaningful to do this analysis is up to RAN5.

* Proposals
  + Option 1: Yes
  + Option 2: No
  + Option 3: others
* Recommended WF
  + TBA

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | Option 1: Yes  The answer here clearly answers the question and accurately reflects the status in RAN4. However, based on the discussion in the last meeting, it seems operators don’t wants to preclude to check MSD=0 case, therefore the answer list in the following is also ok for us.  Answer: MSD=0 could be only applied when carrier frequencies and bandwidths are selected for each active UL band such that there is no any interference falling into Rx CBW under all the conditions in Question 1. However, whether it is meaningful to do this analysis is up to RAN5. |
| Nokia | Option 1: Yes. No criteria is defined in RAN4 specs for MSD=0. MSD=0 analysis maybe more RAN4 area than RAN5. |
| ZTE | Option 1: Yes  To Xiaomi: To our understanding, it is hard to say MSD=0 when there is no any interference falling into Rx CBW. Sometimes the MSD may not be defined in RAN4 spec if the MSD is negligible or there are no proper test point, or pending on the operator spectrum holding, also RAN4 only define up to IMD5 MSD, does not include higher order MSD if higher order interference falling into Rx CBW(RAN4 think such negligible interference would degrade REFSEN with negligible MSD value.), but it doesn’t mean there is no any interference. |
| OPPO | Option 1. Regarding the criteria for MSD=0, it should be “no any interference falling into Rx CBW”, this means for higher than 5th order interference may also need to be considered, since there is no guarantee from RAN4 that these interference will not cause MSD even they are not defined in RAN4. |
| Qualcomm | Yes. This underlines the comment we made on previous issue |
| CHTTL | Option 3. We prefer the alternative provided by Xaiomi. Thanks. |
| vivo | Option 1: Yes. |
| Huawei | Option 1. |
| MediaTek | Option 1. |
| Ericsson | Option 3: RAN5 is fully capable of defining test cases for cases in which the IMD fall in the vicinity but not overlapping with the victim RX channel. However, it is preferable to defined RAN4 core requirements.  We propose that  1. RAN4 to select some severe MSD cases and add another setting in clause 7.3B.2.3.5 of TS38.101-3 with lower (or 0 dB) MSD for the case mentioned above. This is in alignment with how it is already specified for 2nd order harmonics in clause 7.3B.2.3.1 of TS38.101-3.  2. and combine with a general enhancement of the MSD values for overlapping interference in Rel-17.  We propose that RAN4 replies along these lines. This means specifying requirement that are beneficial for deployment in cases where channels are configured so as to avoid RX degradation. |
| Apple | Option 1: Yes |
| AT&T | Option 3. Either the alternative proposal provided by Xiaomi or the Ericsson proposal. |

### Sub-topic 6-3: Besides the reply LS to RAN5, any additional actions to be taken in RAN4?

* Proposals
  + Option 1: RAN4 can establish a new basket WI to specify the test configurations with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active), based on operators’ request.
  + Option 2: others
* Recommended WF
  + TBA

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| **Company** | **Comments** |
| Nokia | We understand the need from operator perspective, but we are also worried about RAN4 workload. RAN4 has too many basket Wis. |
| ZTE | We have same feeling with Nokia. It seems the work may more or less overlap with the current basket WID work. We wonder if this work can be done in current basket WID but for non-block approval if operators have interesting on MSD=0 test configuration for their own combs. |
| OPPO | Not needed if we understand correctly. Current spec follows RAN4 requirement definition logic that the requirements in SA specs are defined as baseline, and some exception cases are additionally defined for the NSA due to issues caused by two bands working simultaneously like harmonics and IMD. |
| Qualcomm | Maybe this can be merged with MSD improvement work? |
| CHTTL | Wondering if this is a general work or it becomes a band combination specific work? |
| vivo | No need to do this in RAN4 considering the workload and actual meaning. |
| Huawei | We share the same view with Nokia. MSD=0 analysis is more RAN4 area than RAN5. If operators have the demands to test MSD=0 case, anyway RAN4 need a new WI to analysis it. |
| Ericsson | See answer to 6.2.2. Identifying the worst MSD cases does not require operator requests and simplified the procedure. |
| Apple | We do not see the benefit of specifying the test configurations with MSD = 0 for the EN-DC combinations which have MSD exceptions due to IMD interference but only see the downside to create more RAN4 workload and UE test burden. |

## Companies views’ collection for 1st round

### Open issues

Comments are collected in section 6.2.

### 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#6-1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:There is good support for option 1. It is recommended that proponents for option 1 try to improve/clarify to make it agreeable.* |
| **Sub-topic#6-2** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:There is good support for option 1. In addition, the proposal from Xiaomi is supported by some companies. It is recommended to focus on:*   * *Answer 1: In RAN4 specs, no general criteria is defined in which REFSENS can be fulfilled with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active). However, whether it is meaningful to do this analysis is up to RAN5.* * *Answer 2: MSD=0 could be only applied when carrier frequencies and bandwidths are selected for each active UL band such that there is no any interference falling into Rx CBW under all the conditions in Question 1. However, whether it is meaningful to do this analysis is up to RAN5.* |
| **Sub-topic#6-3** | *Recommendations for 2nd round:As many companies are not in favor, it is proposed to stop the discussion in the second 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”.*

### Sub-topic 6-2: For clarification on Q1: is the following answer agreeable:

### Answer: 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 and no other EN-DC exception requirements are defined, i.e. no exception due to 1) harmonics (Tx or RX), 2) cross-band isolation, 3) counter-intermodulation (C-IM)..

Note: In the second round, please focus on improve/clarify the above answer to make it agreeable.

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| **Company** | **Comments** |
| Xiaomi | For Q1, it is proposed the wording in option 1 “no other EN-DC exception requirements are defined” is replaced by “no other desensitization component is present” this minor change is based on comments from some companies. We think the change makes sense as exception requirements are usually defined only as worse case other than listing all the MSD cases, the original wording is not accurate.  **Answer:** 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 and no other desensitization component is present, i.e. no exception due to 1) harmonics (UL harmonic or Receiver harmonic mixing), 2) cross-band isolation, 3) counter-intermodulation (C-IM). |
| MediaTek | Small further clarification, building on Xiaomi’s proposal:  **Answer:** 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 and no other desensitization component is present, i.e. ~~no exception~~ due to 1) harmonics (UL harmonic or Receiver harmonic mixing), 2) cross-band isolation, 3) counter-intermodulation (C-IM). |
| ZTE | Small further clarification, building on MTK’s proposal:  **Answer:** 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 and no other desensitization components are ~~is~~ present, i.e. ~~no exception~~ due to 1) harmonics (UL harmonic or Receiver harmonic mixing), 2) cross-band isolation, 3) counter-intermodulation (C-IM). |
| AT&T | OK with the latest clarifications added. |
| Apple | To be on the safe side, we propose to consider IMD product up to 7th orders. One potential concern is the combination of DC\_71\_n77 (not proposed yet) where 6th order IMD could fall into B71 DL with non-trivial MSD as IMD6 is generated in B71 PA where B71 UL does not have any attenuation. |

### Sub-topic 6-2: For clarification on Q2: is one of the following two answers agreeable:

* *Answer 1: In RAN4 specs, no general criteria is defined in which REFSENS can be fulfilled with MSD=0 for the EN-DC combinations which have MSD exceptions due to IMD interference (2 UL active). However, whether it is meaningful to do this analysis is up to RAN5.*
* *Answer 2: MSD=0 could be only applied when carrier frequencies and bandwidths are selected for each active UL band such that there is no any interference falling into Rx CBW under all the conditions in Question 1. However, whether it is meaningful to do this analysis is up to RAN5.*

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| **Company** | **Comments** |
| Xiaomi | Answer 1  Based on the comments received from 1st round email discussion, the answer #1 has a clear majority support. As comments from many companies, in current spec, it is indeed there is no clear criteria on MSD=0 case due to IMD interference (2 UL active). Identifying MSD=0 case is very complicated which may need some dedicate analysis, it is therefore difficult to reach an agreement in a short time. We would like to emphasize that this reply LS has been discussed for 3 meetings, we encourage companies can accept the answer#1 which is more aligned with the current status in RAN4. |
| MediaTek | Answer 1. |
| ZTE | Answer 1 |
|  |  |
| Ericsson (PL) | The last sentence (in both answers) is not appropriate in the context of answer 1, because without any further guidance from RAN4 how MSD=0 is possible to reach, RAN5 is not able to perform any analysis. It is not in RAN5 scope to define core requirements. Therefore, the only viable answer is Answer 2. |
| CHTTL | Agree with Ericsson. |
| Xiaomi | Thanks comments from Ericsson and CHTTL, the last sentence is revised based on the suggestion from Qualcomm in the reflector, which has been reflected in the [draft R4-2115070 v1.doc](https://www.3gpp.org/ftp/tsg_ran/WG4_Radio/TSGR4_100-e/Inbox/Drafts/%5B100-e%5D%5B149%5D%20NR_reply_LS_UE_RF/Round%202/draft%20R4-2115070_Reply%20LS%20on%20exception%20requirements%20for%20IMD%20v1.doc). As we said in the reflector, this issue has been discussed for 3 meetings, it is the similar thing every time, we think we need to move forward, and it is better only to inform current status in RAN4. If some companies think MSD=0 case is needed to be studied, it is better to have a dedicated WI since it is not a simple work and could not reach an agreement in a short time based on comments received so far.  With this clarification, hope the latest version v1 be acceptable for you. Any further suggestions are welcome. Thanks. |
| AT&T | Answer 2. Based on RAN5’s input, we believe that RAN5 can select the proper test points for MSD=0 case based on this guidance from RAN4. |
| Orange | Answer 2 |
| Apple | Answer 1 |
| CMCC | Answer 2 |
| Skyworks | Answer 2 and proposal to re-word if that may help clarify the answer to Q2:  ***Answer 2****: The criteria to fulfill MSD=0 are captured in the conditions explained in the answer to question 1. However, whether it is meaningful to do this analysis is up to RAN5.* |

### Comments on R4-2115070 Reply LS on Clarification on exception requirements for Intermodulation due to Dual uplink (IMD)

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Xiaomi | The draft the LS is uploaded based on the moderator’s guideline and our above comments. Any further comments are welcome. |
| Ericsson (PL) | To avoid confusion for RAN5, the LS reply should include answer 2 instead of answer 1 |
| AT&T | We agree with Ericsson that the reply LS should include answer 2. This is also inline with the answer to Q1. |

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
| *LS on Inclusive Language Review Status and Consistency Check* | *Ericsson* | To: RAN |
| *Reply LS on FR2 requirement applicability over ETC* | *vivo* | To: RAN5 |
| *Reply LS on FR2 UE relative power control tolerance requirements* | *Qualcomm* | To: RAN5 |
| *Reply LS on Clarification on exception requirements for Intermodulation due to Dual uplink (IMD)* | *Xiaomi* | To: RAN5 |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-2111912, R4-2112137, R4-2112832, R4-2113927, R4-2113974, R4-2114057, R4-2114489,  R4-2114472,  R4-2113908,  R4-2111910, R4-2112983, R4-2113658, R4-2113888, R4-2114393,  R4-2111911, R4-2113659,  R4-2112915, R4-2113302, R4-2113567, R4-2113402, R4-2113889 |  |  | 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** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents

# Annex

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|  |  |  |
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Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)