**3GPP TSG-RAN WG4 Meeting # 98-e draft R4-2103292**

**Electronic Meeting, 25 Jan – 5 Feb., 2021**

**Agenda item:** 4.2.1

**Source:** Hisashi Onozawa (Nokia)

**Title:** Email discussion summary for [98e][102] NR\_NewRAT\_UE\_RF\_Part\_1

**Document for:** Information

# Introduction

Rel-15 NR UE RF requirement maintenance for FR1 is handled in this email discussion thread.

* Topic #1: Reply LS on ambiguity in deciding TL,C
* Topic #2: Simultaneous TxRx
* Topic #3: Other individual contributions

# Topic #1: Reply LS on ambiguity in deciding TL,C

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100138Reply LS on ambiguity in deciding TL,C | Nokia, Nokia Shanghai Bell | Proposal: remove ∆TC,c from relevant PCMAX\_L,f,c formulas.PCMAX\_L,f,c = MIN {PEMAX,c– ∆TC,c, (PPowerClass – ΔPPowerClass) – MAX(MAX(MPRc+∆MPRc, A-MPRc)+ ΔTIB,c + ∆TC,c + ∆TRxSRS, P-MPRc) } |
| R4-2100139CR REL15 on ambiguity in deciding TL,C | Nokia, Nokia Shanghai Bell | Reason for change: RAN4 received an LS on ambiguity in deciding TL,C from RAN5 R5-206676. This CR adresses the double counting of band edge relaxation which was discuvered by RAN5. Summary of change: dTc is removed from relevant PCMAX\_L,f,c formulas. |
| R4-2101717Draft Reply LS on ambiguity in deciding TL,C | Ericsson | Proposal 1: the ‘understanding 1’ in the RAN5 LS, The source of ∆TC,c is the same as NOTE 3 in table 6.2.1-1, therefore the 1.5dB relaxation shouldn’t be considered again when deciding TL,C.”, is the correct understanding.Proposal 2: RAN4 replies to RAN5 in accordance with the draft Reply LS attached. |
| R4-2101715Correction to the lower limit of Pumax | Ericsson | Correct the lower tolerance of the PUMAX (the measured PCMAX). When applicable, the 1.5 dB band-edge maximum output power (MOP) relaxation is accounted for both in the nominal power and in the lower tolerance. This makes the PUMAX inconsistent with the UE power-class definition when no relaxations other than the band-edge relaxation apply. Clauses 6.2.4, 6.2A.4, 6.2D.4: the band-edge relaxation is not accounted for the TL,c (from MOP tables) in the expression for the lower tolerancePCMAX\_L,f,c – MAX{TL,c, T(PCMAX\_L,f,c)}of PUMAX.Minor editorial changes are also made in PUMAX specification (making text consistent in the three clauses). |
| R4-2101811Discussion and reply draft LS on ambiguity in deciding TL,C | Huawei, HiSilicon | Proposal 1: The understanding 1 “The source of ∆TC,c is the same as NOTE 3 in table 6.2.1-1, therefore the 1.5dB relaxation shouldn’t be considered again when deciding TL,C” is RAN4’s common understanding.Proposal 2: In order to mitigate the ambiguity, it’s proposed to improve the wording on note 3 in table 6.2.1-1 as proposed. |

## Open issues summary

All contributions are trying to fix the issue pointed out by LS R5-206676/R4-2100020. A way how to fix the issue is slightly different in each contribution.

### Sub-topic 1-1 How to fix TL,C ambiguity

**Option 1: Remove ∆TC,c from relevant PCMAX\_L,f,c formulas. (Nokia)**

**Option 2: Table 6.2.1-1 NOTE 3 is not taken into account in Pumax (Ericsson)**

**Option 3: Table 6.2.1-1 NOTE 3 is modified. (Huawei)**

## Companies views’ collection for 1st round

### Open issues

Please clarify which option should be taken or should not be taken with your justifications.

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| **Company** | **Comments** |
| Ericsson | Sub-topic 1.2.1:Option 1 or Option 2, the outcome would be similar. Option 3 also removes the double application of the 1.5 dB band-edge relaxation, but a table note cannot refer to a provision/specification outside the table. |
| ZTE | We slight prefer Option 2. For option 1, we have a question: It seems the formulations in 38.101-1 are refer to 36.101. If there are problems for TS38.101, does it mean same problems are existed in TS36.101? whether it will impact the legacy LTE UE is the same problem are existed in LTE? |
| Qualcomm | Sub topic 1-1: We prefer option1. It seems this is the cause of confusion since the table in 6.2.1 refers to tolerance. Option 2 and option 3 still leave this less clear.  |
| Huawei, HiSilicon | Option 2 or option 3. Option 1 changes the output power in the formula and the applicable test tolerance could be different before and after the changes, which is not the intention of the issue identified by RAN5.  |
| NTT DOCOMO, INC. | Any one of these options is OK, but option 2 seems slightly more clear to us since CR for option 2 describe whether NOTE 3 should apply or not to ∆TC,c and TL,c , respectively. |

### CRs/TPs comments collection

Any general comment to the CR draft other than discussed in clause 1.3.1 can be commented. Agreement is not intended in the first round.

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| **CR/TP number** | **Comments collection** |
| R4-2100139 | Ericsson: agreeable. |
| Qualcomm: We support this CR |
| Huawei: Disagree with the CR as commented above. |
| R4-2101715 | Qualcomm: We would prefer not to take this change. This still leaves issue unclear. With this change, the note 3 in the Table 6.2.1-1 would need to be corrected not to refer to toleranceHuawei: prefer the changes in the CR, which is similar to our proposal in last meeting.  |

## 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 How to fix TL,C ambiguity | Option 1 is supported by Nokia, Ericsson, Qualcomm, NTT DOCOMOOption 2 is supported by Ericsson, ZTE, Huawei, NTT DOCOMOOption 3 is supported by Huawei, NTT DOCOMO*Recommendations for 2nd round:*Continue discussion. Moderator recommend on agreeing either option 1 or 2 as most companies are ok with either one.CR and LS drafts are available for option 1 and 2; No new document is assigned. |

*Recommendations on WF/LS assignment*

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

### CRs/TPs

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

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| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| R4-2100139 | Continue 2nd round. |
| R4-2101715 | Continue 2nd round. |

## Discussion on 2nd round (if applicable)

As companies are ok to take either option 1 or 2, please provide your preference on which option to be taken.

**Option 1: Remove ∆TC,c from relevant PCMAX\_L,f,c formulas. Approve R4-2100138/ R4-2100139 by Nokia**

**Option 2: Table 6.2.1-1 NOTE 3 is not taken into account in Pumax. Approve R4-2101715/ R4-2101717 by Ericsson**

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| **Company** | **Comments** |
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## Summary on 2nd round (if applicable)

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

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

# Topic #2: Simultaneous TxRx

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2100524On simultaneous TxRx for NR-DC | Apple Inc. | Observation 1: If the UE does not support simultaneous Tx/Rx for a particular CA configuration, then it cannot support simultaneous Tx/Rx for NR-DC (sync or async).Observation 2: If the UE supports simultaneous Tx/Rx for 2 UL CA, then UE also supports simultaneous Tx/Rx for NR-DC (sync and async) with the same bands as the CA configuration.Observation 3: For CA configurations with 1 UL, simultaneous Tx/Rx support can be dependent on the configured UL band.Proposal 1: It is proposed to further clarify the RF context related to the simultaneous Tx/Rx UE capabilities for CA and NR-DC with RAN2 based on the oservations in this paper. Toward that end, draft LS text is provided in the annex of this paper. |
| R4-2101713Correction to applicability of simultaneous RX/TX | Ericsson | Summary of change: The applicability is specified in the general clause 4.2: requirements for inter-band CA and SUL are specified for non-simultaneous TX/RX between cell groups unless otherwise stated. If requirements also apply for simultaneous TX/RX (in addtion to the case for non-simultanous TX/RX), this is specified in the band explicitly in the band combination tables. The relation between the applicaiblity of the requirements and the inclusion of the corresponding capability field for simultaneous TX/RX is clarified (the 38.306 contains a reference to 38.101-1).Clauses 5.2A.2, 5.2C, 6.2A.4.2.3: the applicability of requirements for simultaneous TX/RX is clarified (requirements shall be met i.e. the corresponding capability should be indicated as per 4.2).Clause 7.3A.6: redundant information in the note for CA\_n78-n79 is removed (specified in clause 5). |
| R4-2101743CR on simultaneous Tx-Rx for CA and SUL | OPPO | Summary of change: Add clarification sentence in section 5.1 to clarify that the simultaneous Tx/Rx for TDD-TDD and TDD-FDD band combinations are optionally supported unless otherwise stated. |
| R4-2102376CR for TS 38.101-1 correction CR for simultaneous TxRx operation (R15) | Huawei, HiSilicon | Summary of change: 1. In the applicability section, make it clear that the simultaneous Rx/Tx capability shall be reproted for combinations identified as mandatory in the spec as well as when the UE is capable of simultaneous Rx/Tx operation. Otherwise, if the capability is absent or not reported for capable of simultaneous Rx/Tx operation, it will have wrong restriction on the network scheduling. 2. Mandatory capability of simultaneous Rx/Tx also applies also for these carriers when applicable CA configuration is part of a higher order CA configuration since the capability should be a per band pair indicated capability.3. To avoid misinterpretation of the spec, remove the capability indication for TDD-FDD band combinations and by default, the simultaneous Rx/Tx capability shall be reported for two-band TDD-FDD band combination unless it indicated in the spec simultaneous Rx/Tx operation is not supported. |

## Open issues summary

### Sub-topic 2-1 Simultaneous TxRx for NR-DC

R4-2100524 discusses the further clarification of simultaneous TxRx capability for NR-DC and proposed a LS to RAN2.

### Sub-topic 2-2 Simultaneous TxRx for inter-band CA and SUL

There are change requests, R4-2101713, R4-2101743 and R4-2102376 to clarify simultaneous TxRx for inter-band CA and SUL. Comments to CR drafts will be collected in 2.3.2.

## Companies views’ collection for 1st round

### Open issues

Please leave comments to Sub-topic 2-1 Simultaneous TxRx for NR-DC

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| **Company** | **Comments to sub-topic 2-1 Simultaneous TxRx for NR-DC** |
| OPPO | Thanks for the observations on the relation between CA and DC, however, it is not clear of the intention or objective of informing RAN2 about such details. The simultaneous RxTx is a UE capability, and UE will report whether it can support or not. So there is no need for NW to double check the relation between CA and DC since they are all included in UE capability reporting. |
| Ericsson |  |
| Skyworks | We support that the simultaneous TxRx behavior of two bands should be consistent across ENDC, NRCA, NRDC but also SUL (ie an SUL band has the same simultaneous TxRx capability than the corresponding NR FDD/TDD band) . especially for TDD SUL bands the manadatoory TxRx support should not apply. CRs should clarify this |
| ZTE | W share similar view with SKW that simultaneous TxRx behavior of two bands should be consistent across ENDC, NRCA, NRDC, and we agree with Observation 1 and 2. For Observation 3, a question for clarification: in the contribution, it takes CA\_n1\_n40 as an example, the UE could support simultaneous Tx/Rx if UL is n1 but not if UL is n40. Why is it not supported simultaneous Tx/Rx if UL is n40? in our understanding, UL(Tx) in n40 and DL(Rx) in n1 is possible. |
| Qualcomm  | We agree with the observation and we support sending the LS to add this capability. We would like to point out that this limitation(supporting simultaneous Rx-Tx only when one of the ULs is active) will only be needed for a very small number of combinations so we should be careful not to create much signaling overhead. Signaling should be designed such that the capability is signaled only for the combinations that have this limitation.  |
| Huawei, HiSilicon | for CA\_n1\_n40, if the problem is on performance degradation for a specific band UL, the corresponding should be defined. Reporting the UE capability not supporting simultaneous Rx/Tx may not be an appropriate way.  |

### CRs/TPs comments collection

Please leave comments to the CR drafts regarding simultaneous TxRx for inter-band CA and SUL.

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| **CR/TP number** | **Comments collection** |
| R4-2101713 |  [OPPO]: Thanks for the CR. Comments are below:1. Applicability of minimum requirements statement is good.2. There are notes in the tables like NOTE1 and NOTE 4 in table 5.2A.2.1-1 are either changed or removed, which should be kept there. The reason is that all these notes are either with UE mandatory information or the requirements definition precondition in RAN4. We understand the intention of the author is to clarify all these information with the general applicability rule, however, the applicability just a statement of the minimum requirement applicability which can be used mainly for the cases that doesn’t have explicit notes (these cases are the most confusing part in RAN4 specs) rather than the band combinations with explicit notes (these notes includes important information to guide the industry implementations). Therefore, our preference is to keep these original notes.3. We also mentioned in CR R4-2101743 that since there are band combinations that are mandatory to support or not support simultaneous RxTx while some band combinations do not include such information. It would be helpful to clarify that it is optional for UEs to support simultaneous Tx/Rx unless otherwise stated. This will make the spec much clearer. |
| Ericsson: To OPPO: thanks for the comments!2. The modified NOTE 1 now states that the requirements for a band combination shall also be met with simultaneous RxTx (in addition to the non-simultaneous RxTx case). This is the scope of the RAN4 specifications. If the said band combination is supported by the UE, then the UE shall meet the requirements with simultaneous RxTx and include the *simultaneousRxTxInterBandCA* field according to the general applicability: “If the minimum requirements also apply for simultaneous RxTx for TDD-TDD and TDD-FDD inter-band NR CA band combination, the UE includes the field *simultaneousRxTxInterBandCA* for the band combination if supported.”NOTE4 is no longer needed since the general applicability (non-simultaneous RxTx) applies unless otherwise stated.We are open to improvements of the proposed text.3. On the optionality, we considered introducing a statement like “if the UE includes the *simultaneousRxTxInterBandCA* field for a supported band combination [for which requirements with simultaneous RxTx is not mandated by the notes], then the UE shall meet the requirements with simultaneous RxTx.However, the problem is that requirements for simultaneous RxTx is not specified for all band combinations [with an optional requirement]. |
| ZTE: 1. we find the terminologies are not consistence in the spec, some places use 'simultaneous Tx/Rx' , and some places use 'simultaneous Rx/Tx' , and in this CR, it uses 'simultaneous RxTx', The terminologies should be aligned 2. It seems different companies have different understanding for the 'simultaneous Tx/Rx', we suggest to add the definitions in the spec.3.We think same approach as NR inter-band CA can be applied to NR DC.4: For TDD-TDD NR CA combinations, it is ok that simultaneous Tx/Rx is optional. But for TDD-FDD inter-band CA, we are not sure why simultaneous Tx/Rx is optional? It seems when we do the analysis for FDD-TDD, the co-existence study is always needed to check whether the harmonic product will falls into its own Rx band(usually it is n\*FDD UL to TDD DL)1. Also, we have a question: what is the relationship between ‘simultaneous RxTx capability’ and “simultaneous RxTx operation”. In our understanding, the former one is RAN2 concept which means the capability itself is optional.
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| Qualcomm: The CR is very difficult to read and there are extensive changes. There are multiple CRs trying to address the same issue, we should take one as baseline and further discuss how to be organize the changes. TDD-TDD and TDD-FDD cases should be separated because for the large majority of TDD-TDD combinations(all of them?), simultaneous Rx-Tx is mandatory while for TDD-TDD this is not the case.  There are also some CRs from Softbank in other threads that are partly addressing this issue, those should be taken together with these ones as well. CHTTL: The change in Table 6.2A.4.2.3-1 “ The requirements do not apply for simultaneous RxTx for UEs supporting band n78 with a n77 implementation.” 🡨 is this sentence really needed? the previous sentence already says The requirements only apply for blablabla.In table 7.3A.6-1, there might need to have some superscript for NOTE 2 in the table? cuz NOTE 2 seems intend for n78-n79.Huawei: it is ambiguous in the current spec for FDD-TDD combinations which should be supported mandatorily and which are not since there is no clear principle to decide the applicability of the simultaneous Rx/Tx note. We think that this issue should be addressed for this topic.[NTT DOCOMO, INC.]Please see comments in R4-2102376. |
| R4-2101743 |  [OPPO]: The intention of this CR is to clarify the simultaneous RxTx capability for band combinations without any explicit information in the spec since now it has caused misunderstandings in RAN4. The general optionality is also aligned with the UE capability below in 38.306. |
| Ericsson: we agree with the intention of this CR, but general applicability should be expressed in terms of “compliance with requirements with simultaneous TxRx “. The current table notes in the tables of band combinations are unclear, should also be corrected. An alternative in R4-2101713. |
| ZTE: For TDD-TDD NR CA combinations, it is ok that simultaneous Tx/Rx is optional. But for TDD-FDD inter-band CA, we are not sure why simultaneous Tx/Rx is optional? It seems when we do the analysis for FDD-TDD, the co-existence study is always needed to check whether the harmonic product will falls into its own Rx band(usually it is n\*FDD UL to TDD DL).  |
| Qualcomm: The change is relatively simple but doesn’t seem to address all the issues raised in the other CRs on this topic. As commented on 1713, we should take one CR and fine tune the wording instead of working with many CRs at the same time. CHTTL: understand the intention and the background, but the table with the note is hard to maintain…Huawei: similar issue as that for CR in R4-2101713, the main issue for FDD-TDD combinations has not been addressed. [NTT DOCOMO, INC.]Please see comments in R4-2102376. |
| R4-2102376 | [OPPO] The following statement is not ok and not the common understanding in RAN4. The default simultaneous RxTx capability shall be optional.“Unless otherwise indicated in the specification, all two-band TDD-FDD inter-band NR CA or SUL configurations shall report the simultaneousRxTx capability.”Ericsson: the intent to clarify the applicability is recognized, but it appears more agreeable to use non-simultaneous RxTx as the default. This would also be more consistent with the capability indication. Skyworks: simultaneous TxRx mandatory assumption that was used for SUL when there was only FDD bands involved should not be the case for TDD SUL bands. In that case the SUL band should have the same simultaneous TxRx capability than the related TDD band.ZTE:How to report or what should be reported are pending on RAN2.  |
| Qualcomm: The wording in the applicability section is difficult to understand, needs to be simplified. As commented on the Ericsson CR, TDD-TDD and TDD-FDD cases should be separated because for the large majority of TDD-TDD combinations(all of them?), simultaneous Rx-Tx is mandatory while for TDD-TDD this is not the case. We should avoid multiple “if”s in the same sentence. Huawei: The main intention is to address the ambiguity of applicability of simultaneous Rx/Tx capability to FDD-TDD combinations. Even it is not mandatory to report this capability for FDD-TDD, we need to find a better way to simplify the specification and have a clear principle for applicability of the capability. [NTT DOCOMO, INC.]Regarding whether it is optional or mandatory for TDD-FDD band combinations unless otherwise indicated in the specification, in our understanding, the difference is number of NOTEs in the specification. This is because:Case 1: If it is **optional** unless otherwise indicated, we need to put NOTEs describing some band combinations are **mandatory** for simultaneous Rx/Tx.Case 2: If it is **mandatory** unless otherwise stated, we need to put a NOTE describing some band combinations are **optional** for simultaneous Rx/Tx. Regardless of the default assumption, if UE support simultaneous Rx/Tx, UE should to report the capability of simultaneous Rx/Tx.From this consideration, since FDD-TDD band combinations are more likely to be mandatory for simultaneous Rx/Tx, we prefer Case 2(R4-2102376) to reduce the number of NOTEs. |

## 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 Simultaneous TxRx for NR-DC | *Recommendations for 2nd round:*There are some supports to send the LS. LS is assigned to discuss whether and what to be informed to RAN2. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | LS on further clarification of simultaneous Rx/Tx capability | Apple |

### 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**  |
| R4-2101713 | To be Revised.Merged with R4-2101743 and R4-2102376 to have a single CR.Also consider a CR R4-2100876 by Softbank in Rel-16 maintenance thread [98e][113]. |
| R4-2101743 | Noted |
| R4-2102376 | Noted |

## Discussion on 2nd round (if applicable)

A LS and CR drat are to be discussed in the 2nd round.

* R4-2103118 LS on further clarification of simultaneous Rx/Tx capability, Apple
* R4-2103119 Correction to applicability of simultaneous RX/TX, Ericsson

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| **Company** | **Comments** |
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## Summary on 2nd round (if applicable)

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

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

# Topic #3: Other individual contributions

*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** |
| R4-2101174IBE mask for almost contiguous allocations | Qualcomm Incorporated | Proposal: For almost contiguous allocations defined in sub-clause 6.2.2, the in-band emissions limit applied to any non-allocated RBs shall be the less stringent of the in-band emissions masks per Table 6.4.2.3-1 applied to each of the contiguously allocated RB groups. |
| R4-2100164IBE\_mask\_almost\_contiguous\_CR\_rel15 | Qualcomm Incorporated | Reason for change: Missing IBE mask for almost contiguous allocations. There are no in-gap IBE requirements Summary of change: Apply IBE mask to each of the contiguously allocated RB groups and use the less stringent of the masks in any unallocated region. |
| R4-2100392CR for TS38 101-1 Rel-15 Correction for definition of P-MPR | CATT | Reason for change: In clause 3.2 and 6.2.4, the definitions of P-MPR as “Maximum allowed UE output power reduction” are incorrect. It is also not aligned with LTE and FR2 specification. In TS36.101 and TS38.101-2, it is defined as “Power Management Maximum Power Reduction”. Summary of change: The definitions of P-MPR are modified from “Maximum allowed UE output power reduction” to “Power Management Maximum Power Reduction”. |
| R4-2100395CR for TS38 101-1 Rel-16 Correction of condition for MPR and delta MPR | CATT | Reason for change: Current spec description leads misleading that the MPR tables only apply to the bands that relative channel bandwidth ≤ 4% for TDD bands or ≤ 3% for FDD bands. Summary of change: Correct the wording to make the MPR tables apply to both of the relative channel bandwidth conditions. |
| R4-2101005On applicability of additional emission requirement to CA/DC | SoftBank Corp. | [Proposal-1] Following sentences are agreed and captured in the minutes.It was agreed that RAN4 does not specify the relation between an additional requirement for UE unwanted emission and individual 2 band UL CA/DC in the form of positive listing, with an understanding that the relation shall be managed properly by an individual company. A negative listing is only allowed to indicate an exception to a rule.[Proposal-2] Endorse the contents of CRs to add applicability of additional emission requirement to CA/DC from REL-15. |
| R4-2101947Simplification of n70 | Dish Network | Reason for change: 295MHz TX/RX spacing is unnecessary. 5MHz UL / 10MHz DL should be 10MHz UL / 15MHz DL. n70 is going to be introduced in device ecosystem soon so this is good time to get rid of unnecessary requirements  Summary of change: Removing 295MHz TX/RX spacing and modifying asymmetric UL/DL configurations |
| R4-2101989CR for 38.307 to delete the redundant information "duplex mode" for band combinations(Rel-15) | Huawei, HiSilicon | Reason for change: The indication for duplex mode is unnecessary for the band combinations with mixing duplex mode, since RAN4 never discuss the requirements or capabilities based mixing duplex mode for the band combination. We may still lost the other mixing duplex mode as the band combinations are increasing. There is no need to add these complicated terms which never appear in the core specification.In addition, the “mixing duplex mode” is determined by corresponding band combintions.Reducing the “mixing duplex mode” can extend the industry.  Summary of change: 1. Delete the column “duplex mode” for band combinations |
| R4-2102091Improvement of UL RMC tables | Rohde & Schwarz | Proposal 1: Remove the TDD tables from the specification, make the FDD tables applicable for FDD and TDD and cover the TDD specific information in the general section.Proposal 2: Remove channel bandwidth and SCS information from the tables, since they provide no useful information.Proposal 3: Merge the separate tables for 15, 30 and 60 kHz SCS for the same modulation into a single table.Proposal 4: Remove the “target coding rate” information from the UL RMC tables, since it is conflicting with the information from TS 38.214 [2].Proposal 5: RAN4 agrees to apply the same principles to the RMC tables for FR2 in TS 38.101-2 as well. |
| R4-2102194CR to TS38.101-1: Correction on applicability of minimum requirements | ZTE Corporation | Reason for change: The RF requirements for intra-band contiguous and non-contiguous CA apply under the assumption of symmetric between CCs, i.e. same slot format. The slot format should be indicated by TDD-UL-DL-ConfigurationCommon and TDD-UL-DL-ConfigurationDedicated, where TDD-UL-DL-ConfigurationCommon is a cell-specific TDD UL/DL configuration, and TDD-UL-DL-ConfigurationDedicated is used to configure (add or modify) the TDD UL/DL configuration for UE with a serving cell, which may be the SpCell or an SCell of an MCG or SCG, according to the TS38.331.It should be noted that in TS38.101-2 and TS38.101-3, the above two IEs are used to describe the same slot format assumption in PCell and SCell for NR SA. Therefore, it needs to align descriptions among the specs. Summary of change: Correct the IEs for same slot format indication for intra-band CA. |
| R4-2102595CR for TS 38.101-1: Cleanup for spurious emissions for UE co-existence table | Apple | Summary of change: In Table 6.5.3.2-1,1. For n5, move protected Band 53 to the row with NOTE 2. 2. For n12, move protected Band 51 to the row with NOTE 2.3. For n28/n83, move protected Band 52 to the row without NOTE. |
| R4-2102597CR for TS 38.101-1: Correction to FR1 time mask for SRS antenna switching | Apple | Summary of change: Revise Figure 6.3.3.6-5 by adding a guard symbol between SRS (Ant. “y”, Ant. switch) and SRS (Ant. “x”, Ant. switch) and evenly splitting the 15s transient period between SRS (Ant. “x”, other sets) and SRS (Ant. “y”, Ant. switch). |
| R4-2102661On FR1 2L UL EVM Requirement | Qualcomm Incorporated, Lenovo, Motorola Mobility | Proposal 1: The reference receiver for the 2L UL MIMO EVM test case shall simultaneously measure the UE’s UL at both antenna connectors and implement a zero-forcing equalizer to diagonalize the channel.Proposal 2: For 2L UL, EVM equalizer spectrum flatness shall be evaluated per layer, based on the RMS value of all equalizer coefficients per SC for that layer. |
| R4-2102658CR to 38.101-1: UL MIMO requirements updateModerator: Multiple files are in zip file. Only R4-2102658\_ULMIMO\_F15.docx is handled. | Qualcomm Incorporated, Lenovo, Motorola Mobility | Summary of change: 1. Tx modulation quality requirements clarified as applying on per layer basis or per connector basis2. Add SRS carrier switching to the list when UE is not required to maintain coherence 3. EVM/ IBE Calculation block diagram for 2L inserted into Annex F |

## Open issues summary

### Sub-topic 3-1 On applicability of additional emission requirement to CA/DC

R4-2101005 discusses the applicability of single band NS in case of inter-band CA or DC and it assumes they are taken care by UE. The proponent requests that the understanding is taken in the minute and CR previously submitted are endorsed.

### Sub-topic 3-2 Improvement of UL RMC tables

R4-2102091 discussed the improvement in UL RMC.

For contributions other than in 3-1 and 3-2, please provide comments directly to the CR draft in 3.3.2

## Companies views’ collection for 1st round

### Open issues

Please provide comments to Sub-topic 3-1 regarding the contribution R4-2101005.

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| **Company** | **Comments to Sub topic 3-1:** |
| OPPO | General understanding is that the emission requirements signaled via NS signaling shall be met no matter in single band or band combinations. The problem is that according to this paper the AMPR is only defined for single band, thus AMPR for CA cases shall also be defined. The requirements and AMPR shall be defined in a package.The positive/negative approach is too general and give much room for interpretation thus not be suggested from our side. |
| Ericsson | If an NS value is indicated in a band, then the additional requirement must be met regardless if the UE has ULs configured in other bands. In case of IMD issues, A-MPR can be specified for the particular inter-band combination. This is also consistent with the proposed changes. Many of the additional requirements are regulatory and must be met. |
| Skyworks | If we agree that regulation (and thus NS) shall apply regardless of single CC or CA. A-MPR cannot be the same for single CC and intra band UL CA (contiguous or non contiguous). Furthermore when intra band UL CA is used as part of an interband UL CA (3 UL CCs) band protection should be further verified in some cases (if band separation is small or duplex distance of a FDD band is in the same order of mangnitude than the intra band UL total BW). Also Some NS AMPR already account for filter help and thus single A-MPR is relaxed for IMDs outside the filter BW then only -30dBm/MHz may be guaranteed in other bands. This needs further discussion as certainly some new A-MPR will be needed for some CA cases including intra-band UL CA vs single CC |
| ZTE | We share the same view with Ericsson. |
| Qualcomm  | Would like to clarify my understanding.  Regulations specify spurious emission requirements into protected frequency ranges.  So, let’s say that we have CA or DC between Band X and Band Y.  Regulations protect PHS for example, so there should be an NS already signaled in Band X and a different NS already signaled in Band Y to protect PHS.  When the two bands are CA or DC, then those NS’s that were signaled in each band still apply and PHS is protected.  In this case, there seems to be nothing needed.  One problem could be that the protection requirement of a frequency range only applies for regulations related to Band X, but not regulations related to Band Y.  In this case, there is an NS for Band X but there is not for Band Y.  When the two bands are aggregated, is the CA or DC required to protect the frequency range that is only associated with Band X?  Does this situation arise?  |
| SoftBank | [To all] Thank you very much for the valuable comments. I tend to agree with Ericsson and ZTE, and OPPO partially. Then, how about confirming the following agreements in place of our original proposal 1?It was agreed that:1. If an NS value is indicated in a band, then the additional requirement must be met regardless if the UE has ULs configured in other bands.
2. A new NS should be defined for a particular 2 band UL inter-band CA if 2 band UL specific issue violates an additional requirement (and a single band NS does not help).

The second item was also mentioned by Apple as a concern last time so I put it to capture the concerns from SkyWorks and Apple. [To Qualcomm]It is case-by-case. It is rare that both bands of 2 UL CA/DC have different NSs to protect the same range. In general, one band close to a victim needs an NS with a specific value (-40dBm/MHz for instance) while the other relies on a general requirement (-50dBm/MHz) as a single band. A typical case is 1+8 CA to Band 18 and 19 range(860-890MHz) with -40dBm/MHz. My original proposal 2 considered a case as such.In case of PHS, -41dBm/300kHz is almost uniformly required to Japan bands but NS is only needed for Band 1 as both are located so close. My intention last time was to clarify 1+20 does not have to protect PHS due to a region to be used but it seems sufficient if we confirm the new agreement 1) above.  |
| NTT DOCOMO, INC. | Our understanding is also that the emission requirements signaled via NS shall be met no matter in single band or band combinations. This aspect should be captured in the specification, as mentioned in proposal 2 in R4-2101005. It would be better to capture the common understanding at least in minutes, even if there are concerns on proposal 2 for some specific band combinations,We support the tentative agreements proposed by Softbank in 1st round comments mentioned above.. |
| Apple | Thanks to Softbank for the latest proposal.In case we would agree to the proposal, then 2) will be required for some CA/DC combinations. The question is who takes care of identifying and adding/modifying NS to match the given requirements. It seems that this is an important task which should not be left orphaned after agreeing on those wordings. Could a WI be needed to identify and take care of the issues? Furthermore, checking for potential NS requirement collisions might have to be integrated in the CA/DC TP process. |

Please provide comments to Sub-topic 3-2 regarding the contribution R4-2102091.

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| **Company** | **Comments to Sub topic 3-2:** |
| Qualcomm | Ok with proposals. Question to RnS: Will you be bringing CRs to update the references to RMC tables in RAN4 and RAN5 specs, if this gets agreed?  |
| Rohde & Schwarz | To Qualcomm: Yes, we plan to bring the RAN4 CRs in the next meeting in case the approach is agreed and then to update RAN5 once RAN4 CRs are agreed. Main changes will be the update of the RMC tables in the Annex. We checked the references to the tables and it seems they are mostly in some general sections in chapter 7, those will be then corrected in the same CR. |
| Huawei | Need more time to think about the possible simplification. The proposal here can be considered as a starting point.  |

### CRs/TPs comments collection

Please provide comments to CR drafts.

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| **CR/TP number** | **Comments collection** |
| R4-2101174IBE mask for almost contiguous allocationsR4-2100164IBE\_mask\_almost\_contiguous\_CR\_rel15 | [OPPO] It’s too late to changing Rel-15 with new requirements.Ericsson: agreed, in-band emissions should also apply in the gap.Nokia: We cannot accept. This IBE mask was already proposed in R4-2004401 (RAN4#94bis-e) and rejected.* This IBE mask ignores cross-cluster IMD components and thus does not properly approximate the spectral regrowth.
* This mask would require heavy MPR simulations and result in high MPR, especially in case of a rather narrow RB cluster at allocation edge.

Illustration of the problem:However, we could accept a constant mask in allocation gaps (plus the relaxations for image and carrier):Also in gaps, the appropriate slope term would be $-5\left(\left|∆\_{RB}\right|-1\right)/L\_{CRB}$, with $L\_{CRB}=N\_{RB\\_alloc}+N\_{RB\\_gap}$. In a gap, emissions from both sides add up, hence, the power sum of the overlapping masks would be appropriate (rather than max). (Compare this to the case of a gap between allocations of two UEs, with IBE from both.) The resulting sum mask is almost flat for all valid gap widths, especially for narrow ones. Thus, the second general formula in Table 6.4.2.3-1 would become $20 log\_{10}limit\_{EVM}$ (remove $-3$ and slope term), to make it sufficient for all gap widths. (Slope term vanishes with $∆\_{RB}=1$. The $-3$ term vanishes due to summation from two sides). With such constant mask in gaps, the current MPR spec should suffice.Outside the almost contiguous allocation, the IBE mask should remain as it is.Huawei: This note was added by QC in previous RAN4 meeting, considering there is a gap between RB allocations, we re-define the LCRB for almost contiguous allocation. The spec is not correct on almost contiguous allcoation if remove the note.Qualcomm: To HW, the spec is incomplete if you do not have a requirement in the gap. This should have never been accepted in the previous meeting in the first place. UEs cannot simply splatter emissions and degrade PUCCH transmissions.To OPPO, we can correct requirement for later release if there is consensus.To Nokia, as long as we can agree on a suitable requirement in the gap with LO leakage relaxation as with 1 cluster, we can accept. QC will further check your analysis. |
| R4-2100392CR for TS38 101-1 Rel-15 Correction for definition of P-MPR |  |
| R4-2100395CR for TS38 101-1 Rel-16 Correction of condition for MPR and delta MPR | Qualcomm. The Grammar in one of the sentences still needs work. Remove highlighted part. If the relative channel bandwidth ≤ 4% for TDD bands or ≤ 3% for FDD bands~~. Unless otherwise stated~~, the ∆MPR is set to zero. Huawei: "Unless otherwise stated" can be removed.CATT: Thanks for the comments. We can remove it in the revision. |
| R4-2101947Simplification of n70 | Ericsson: agreed. |
| R4-2101989CR for 38.307 to delete the redundant information "duplex mode" for band combinations(Rel-15) | Ericsson: this is overlapping with the CR in R4-2102207 (in [108])ZTE: We also have submitted a similar CR (R4-2102207, treated in thread #108), but we have opposite views. We think the duplex mode is important information for band combination release independence due to there are no release independence information in the WID. Actually the duplex modes for the band combination in each release 38.307 spec are aligned with the each release 38.101 specs .Qualcomm: this is overlapping with CR R4-2102207. We prefer to agree 2207, there is no point in removing the duplex mode from these tables. CHTTL: We share the same view as above, and we think the duplex mode should be kept to align with the 36.307.Nokia: Duplex mode is not essential information for release independence, so we are ok to remove it. This would also mean that maintenance burden would be reduced. But CR has comments thus it would need a revision if acceptable to all.Huawei: Share the same view with Nokia. The indication for duplex mode is unnecessary for the band combinations with mixing duplex mode, since RAN4 never discuss the requirements or capabilities based mixing duplex mode for the band combination. |
| R4-2102194CR to TS38.101-1: Correction on applicability of minimum requirements | Ericsson: could be acceptable with clarification that the U-D configuration is the same on all carriers as set by the common U-D and the dedicated U-D if the latter is present.ZTE: To Ericsson, actually we use the same wordings in TS38.101-2/3. We think it is same principle for intra-band CA/ENDC and the specs should be aligned. |
| R4-2102595CR for TS 38.101-1: Cleanup for spurious emissions for UE co-existence table |  |
| R4-2102597CR for TS 38.101-1: Correction to FR1 time mask for SRS antenna switching | Ericsson: the RAN4 specification is indeed inconsistent with the RAN1 specification 38.214, in which a guard symbol allowed for two SRS resources with switching in the same slot. But given the transient periods allowed in the current version of the 38.101-1, did RAN1 misunderstand the RAN4 time-mask specification when specifying the additional guard symbol? The additional guard symbol prevents use of some SRS configurations with antenna switching for some TDD configurations. Nevertheless, the RAN4 specification is not consistent with the 38.214.Qualcomm: This aligns ran4 spec with the ran1 spec. Ok to agree the CR.  Nokia: If R4 follows R1 spec, we understand the changes. If so, shouldn’t we use not “guard symbol” but rather “guard period”? If we go with this way, 60kHz SCS also needs to be included? We understand that 60kHz SCS case may be covered by Figure 6.3.3.6-4, but the figure is for “Consecutive SRS time mask for the case due to power change” and not due to SRS antenna switching.Huawei: the time mask adding a guard symbol in the figure is ambiguous. If the intention is to align with RAN1 spec, a Note with some clarification under time mask for SRS antenna switching would be better.Apple: Thanks for Nokia’s comments. We can revise the figure by changing “Guard symbol” to “Guard period” to follow RAN1 spec. Also 60 kHz can be added to the figure caption with additional indication that guard period is one symbol. |
| R4-2102661On FR1 2L UL EVM Requirement R4-2102658CR to 38.101-1: UL MIMO requirements update | Rohde & Schwarz: R4-2102661: In general we are ok with Proposal 1 to apply zero-forcing receiver as a MIMO receiver, as we propose the same approach in our contribution R4-2102089. However we have some concern with the details in the paper. It could happen that the autocorrelation matrix is not invertible, e.g. if on one SC the same modulation symbol (QPSK) is transmitted in all OFDM symbols and both layers. So we would like to have more time to properly evaluate the details.EVM equalizer spectrum flatness: We are ok with the proposal.IBE: The per connector requirement is fine from our side. However, all other power requirements related to power (e.g. max power, SEM) are defined based on the sum of both connectors, so applying the same principle here would also work from our side.Carrier leakage: Fine for us for the FR1 conducted case.R4-2102658: As stated before, we need more time to evaluate the details for the Annex F change and see how to prevent the issue of not being able to invert the autocorrelation matix. As such we propose to postpone the CR to the next meeting and introduce the changes to section 6 and the Annex as a package, as proposed in R4-2102089.[OPPO] Suggest to conclude this issue as soon as possible since it will have much impact on the RAN5 testing specification and also UE certification. Now many UEs with UL MIMO are on the market without proper testing.Ericsson: The discussion on EVM for UL-MIMO started with a discussion on the need for requirements on designing a UE with low cross talk between the branches. It was proposed that the UE should be verified only with single layer non-coherent precoders per layer that would not verify cross talk, claiming that the BS could eliminate cross talk. Non-linear cross talk e.g. coupling between output to input or reverse coupling between outputs cannot be eliminated by a conventional BS receiver, this has to be reduced by UE design. Now it is proposed to implement a ZF receiver in the TE for otherwise the UE cannot use virtualization with two TX connectors. Indeed, per-connector EVM measurements cannot be used for UL-MIMO with virtualization. Nevertheless, using conventional ZF and ignoring the non-linearities is still acceptable in view of typical receivers, the non-linear cross talk must then be suppressed by UE design. The ZF would allow measurements with virtualization. Another upside with the ZF receiver is that the measurement method is well specified (known) at that the MPR could be reduced if the EVM is measured per port/layer. The single-antenna connector EVM is indeed also based on inverting the channel.Are there any requirements on the TE receiver e.g. noise covariance estimation, and issues with inverting the channel? Feedback from TE vendors on the feasibility of implementing the proposed ZF MIMO receiver would be useful (some already provided by R&S above).On R4-2102661:Observation 3: is the converse true? Proposal 1: acceptable if implemented by TE equipment. Proposal 2: the IBE per connector presumably means that both connectors must meet the IBE mask as governed by the EVM requirement connector? (the port in many cases) On R4-2102658: we propose to postpone the CR but accept the ZF method with further clarification.Huawei: Firstly a specific MIMO receiver type is considered is not the appropriate manner adopted by RAN4. Secondly, based on the previous discussion, the intention to consider the MIMO receiver is to mitigate the influence of cross talk noise. However, for the conductive test, this kind of interference is negligible. Thirdly, the proposal is for Rel-15 and it will have impact for TE implementation. In our view, this is not an essential changes for Rel-15 specification, but will cause lots of additional development work, especially for the TE side. Rohde & Schwarz: Regarding Huawei comments, from our point of view it is necessary to specify the details for UL MIMO EVM measurement with a MIMO receiver in case RAN4 agrees to specify such requirements. This has essentially always been the case, also for single antenna, that the EVM calculation was specified in detail, otherwise you may get different results across different implementations. Therefor like we said, we can agree to use a ZF receiver like proposed by Qualcomm, Motorola and us. Details we still need to further evaluate, as stated earlier. From a release point of view, once the receiver is implemented in the TE, this implementation should be “Release independent”, so it can be used for any Release. If it helps, we can further discuss how to transition from current EVM measurement to the updated MIMO receiver measurements.Qualcomm:To Huawei: This is not about crosstalk anymore. There is a much more fundamental problem with the existing requirement because the test condition imposes an additional requirement that the UE implement a 1:1 relationship between its antenna connectors and its SRS ports, while RAN1 design intends for the relationship to be a UE degree of freedom. So our test needs to be redesigned. When EVM is measured, the receiver type has to be standardized, so do not agree with your opening comment.To R+S: EVM test is performed with UE generated pseudo random data. We think the probability of ‘. if on one SC the same modulation symbol (QPSK) is transmitted in all OFDM symbols and both layers’ happening is extremely low. Due to low probability we can address this occurrence (if it ever does manifest) with a workaround, which is to simply repeat the measurement. We are ok to align IBE with other emissions (sum of powers)To Ericsson:Converse of observation 3: A UE that does not use a rigid 1:1 mapping will not meet the existing requirement, which makes us question the validity of the requirement. This is precisely the motivation for the whole effort.Proposal2: Per R+S comment, it makes sense to align with how other emissions are treated.  |

## 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** | *Recommendations for 2nd round:*Common understanding needs to be captured. WF is assigned. |
| **Sub-topic 3-2** | *Recommendations for 2nd round:*UL RMC improvement/simplification should be further discussed. WF is assigned. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
| #1 | WF on applicability of additional emission requirement to CA/DC | Softbank |
| #2 | WF on Improvement of UL RMC tables | Rohde & Schwarz |

### 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**  |
| R4-2101174R4-2100164 | Continue the 2nd round.No consensus so far. |
| R4-2100392 | AgreeableCat A to Rel-16 R4-2100393Cat A to Rel-17 R4-2100394 |
| R4-2100395 | Revised. |
| R4-2101947 | AgreeableCat A to Rel-16 R4-2101988Cat A to Rel-17 R4-2101992 |
| R4-2101989 | Continue the 2nd round.Either this CR or R4-2102207 in [98e][108] to be agreed. |
| R4-2102194 | Continue the 2nd round.Is Ericsson ok to accept with the above clarification? |
| R4-2102595 | Agreeable |
| R4-2102597 | Revised. |
| R4-2102658 | Continue the 2nd round.No consensus so far. |

## Discussion on 2nd round (if applicable)

In the 2nd round two way-forwards and CR not yet agreed will be further discussed.

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| **CR/TP number** | **Comments** |
| R4-2103120 WF on applicability of additional emission requirement to CA/DC |  |
| R4-2103121 WF on Improvement of UL RMC tables |  |
| R4-2100164 |  |
| R4-2100395Revised to R4-2103122 |  |
| R4-2101989 |  |
| R4-2102194 |  |
| R4-2102597Revised to R4-2103123 |  |
| R4-2102661R4-2102658 |  |

## Summary on 2nd round (if applicable)

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

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