**3GPP TSG-RAN WG4 Meeting # 98-e R4-200XXXX**

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

### 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. |
| Company B |
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| R4-2101715 | 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

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|  | **WF/LS t-doc Title**  | **Assigned Company,****WF or LS lead** |
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### 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**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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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** |
| XXX |  |
| 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 |

### 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]. |
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| 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. |
|  |
| 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. |

## 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion on WF/LS assignment*

|  |  |  |
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### 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**  |
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## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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

# Topic #3: 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 |

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

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| **Company** | **Comments to Sub topic 3-2:** |
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### 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. |
| 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 |  |
| 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]) |
| 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. |
| 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. |
| 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. |

## 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** | *Tentative agreements:**Candidate options:**Recommendations for 2nd round:* |

*Suggestion 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 provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation**  |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

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

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