**3GPP TSG-RAN WG4 Meeting # 102-e R4-22XXXXX**

**Electronic Meeting, 21 February – 03 March 2022**

**Agenda item:** 10.7

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [128] NR\_TxD

**Document for:** Information

# Introduction

This document is a summary of discussions in thread [128] Tx Diversity that facilitates discussion targeted to complete objectives in WID RP-211940.

# Topic #1: Big CRs and TR maintenance

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| R4-2204595 | 3GPP TR 38.837 v0.4.0 | vivo | N/A, for email approval |
| [**R4-2204968**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204968.zip) | TP for TR 38.837 on Power Class Clarification for SA | vivo | TP for power class application for fallback DCI |
| R4-2205574 | Big CR for TS 38.101-1 Tx diversity requirements (phase 2) | Huawei, HiSilicon, Qualcomm, vivo | N/A, for 2nd round or email approval |
| [**R4-2205575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205575.zip) | Big CR for TS 38.307: release independent requirements for TxD | Huawei, HiSilicon | CR For Rel-17 TS 38.307. TxD release indep from Rel-15 with section G requirements |

### CRs/TPs comments collection

*For close-to-finalize WIs and maintenance work, comments collections can be arranged for TPs and CRs. For ongoing WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2205575 Big CR for TS 38.307: release independent requirements for TxD | ZTE: One question for clarification: TxD is not listed as one of the clauses in TS 38.307 Rel-15, how does it work if TxD is claimed to be release independent from Rel-15? |
| Huawei: to ZTE’s comments, the release independent manner is also discussed in the maintenance threads in this meeting. The general principle discussed there is only list the requirements in the latest specification, which is also aligned with our understanding. |
|  |
| R4-2204968 TP for TR 38.837 on Power Class Clarification for SA | ZTE: Reference [1] should be RP-211597, not RP-211587, though it is not intended for being included in the TR. |
| 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.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

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

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

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

## Discussion on 2nd round (if applicable)

# Topic #2: MPR

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2205578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205578.zip) | draft CR for TS 38.101-1: move 2Tx MPR to Clause 6.2D (Rel-16) | Huawei, HiSilicon, Qualcomm | R16 mirror of moving the MPR tables to section D |
| [**R4-2206133**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206133.zip) | TP to TR38.837 on MPR evaluation for 2Tx PC2 and PC1.5 operation | Skyworks Solutions Inc. | TP with MPR agreements |

## Open issues summary

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

### 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** |
| R4-2205578 draft CR for TS 38.101-1: move 2Tx MPR to Clause 6.2D (Rel-16 | Skyworks: in R17, Table 6.2D.2-1 is used for PC3 2Tx vs PC1.5 in R16. Can this cause issues? |
| Company B |
|  |
| R4-2206133 TP to TR38.837 on MPR evaluation for 2Tx PC2 and PC1.5 operation | Skyworks: due to heavy load before the meeting and during the meeting, it is not likely that we will be able to update the TP. Without a complete update, there is no real value in the TP, it can thus be noted. We will work on providing a section for the MR evaluation for May meeting. |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Topic #3: SRS IL

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2205224**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205224.zip) | Draft CR on SRS IL for NR TxD | ZTE Wistron Telecom AB | Draft CR with changes among others  3dB when UE indicating *txDiversity-r16* and *SRS-TxSwitch* capability t1r1-t1r2’ or ‘t1r1-t1r2-t1r4’' and applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ with configured SRS resources as the second resource in each SRS resource set(s) consisting of one SRS port;  - 3dB when UE indicating *txDiversity-r16* and *SRS-TxSwitch* capability 't2r4' and applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ with configured SRS resources as the second resource in each SRS resource set(s) consisting of two SRS ports;  The value of ∆TRxSRS is 4.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79 when the device is capable of power class 3 or power class 5 or power class 1.5 in the band, or when the device is capable of power class 2 in the band and ΔPPowerClass = 3 dB, or when UE indicating *txDiversity-r16*~~.~~  The value of ∆TRxSRS is 7.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 during SRS transmission occasions with configured SRS resources consisting of one SRS port when the device is capable of power class 2 in the band and ΔPPowerClass = 0 dB and not indicating *txDiversity-r16*. |
| [**R4-2204616**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204616.zip) | Pcmax for SRS usage set as antenna switching for TxD and UL-MIMO features | Ericsson | Draft CR with changes among others   * 3dB during SRS transmission occasions of configured SRS resources consisting of one SRS port in SRS resource set(s) with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ for a UE indicating *txDiversity-r16* or indicating the feature *ul-FullPwrMode1-r16* or power class 1.5 for a band entry;   The value of ∆TRxSRS is 4.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79, except for UEs supporting power class 2 and *ul-FullPwrMode2-TPMIGroup-r1*6 or *maxNumberMIMO-LayersCB-PUSCH* without indicating *txDiversity-r16* for which the value of ∆TRxSRS is 7.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 during SRS transmission occasions with configured SRS resources consisting of one SRS port in case ΔPPowerClass = 0 dB. |
| [**R4-2204836**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204836.zip) | Draft R17 CR on SRS IL for TxD | OPPO | Draft CR with changes among others   * 3dB when power class 2 or power class 1.5 capable UE indicating *txDiversity-r16* and *SRS-TxSwitch* capability 't1r1-t1r2' or 't1r1-t1r2-t1r4' and applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ with configured SRS resources in the SRS resource set(s) consisting of one SRS port;   The value of ∆TRxSRS is 4.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79 when the device is capable of power class 3 or power class 5 or power class 1.5 in the band, or when the device is capable of power class 2 in the band and ΔPPowerClass = 3 dB, or when UE indicating *txDiversity-r16*~~.~~  The value of ∆TRxSRS is 7.5dB for bands whose FUL\_high is higher than the FUL\_low of n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 during SRS transmission occasions with configured SRS resources consisting of one SRS port when the device is capable of power class 2 in the band and ΔPPowerClass = 0 dB and not indicating *txDiversity-r16*. |
| [**R4-2204837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204837.zip) | R17 FR1 TP to 38.837 for TxD SRS IL | OPPO | TP with CR 4836 contents |
| [**R4-2204921**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204921.zip) | R17 FR1 SRS IL for TxD and ULFPTx | OPPO | Observation 1: When UE is configured with 2 SRS port transmission, all ULFPTx modes have the same SRS IL, i.e. there is no need to consider ULFPTx modes in this case.  Observation 2: If follow RAN1 assumption that no restriction on UE implementation to achieve ULFPTx modes then there is no one to one mapping between ULFPTx modes and full power PA.  Observation 3: The concept of UE “implement” which kind of PAs are different from how UE “apply” PAs. And RAN4 can only define requirements based on UE “applied” PA but not “implemented” PA.  Proposal 1: Clarify that RAN4 can only define requirements based on the behavior of how UE “apply” PA but no restriction on how UE “implement” PA as long as requirements for the UE indicated capabilities are met.  Observation 4: Up to now there is agreed restriction on UE “apply” PA for TxD feature, i.e. only two half rated PAs applied but no restriction on ULFPTx feature, i.e. any kind of PAs (full or half rated) can be applied.  Observation 5: When configured for 1T4R SRS switch  • For UE indicates TxD with or w/o ULFPTx, the SRS power at main antenna has 3dB power back off  • For UE w/o indicating TxD, SRS full power can be reached at main antenna  Proposal 2: Update SRS IL according to TxD capabilities, i.e. if UE indicate TxD capability then delta Ppowerclass = 3dB is applied. |
| [**R4-2204969**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204969.zip) | Further discussion on SRS antenna switching for TxD | vivo | Observation 1: Considering the TxD architecture assumption for Rel-17, whether delta\_powerclass would only apply to Pcmax\_L should make no difference.  Proposal 1: Take the majority view and agree either option on whether Delta\_power class would apply only to Pcmax\_L.  Proposal 2: Prefer not to specifically mention ULFPTx modes for SRS insertion loss.  Proposal 3: Do not consider more clarification or LS to other WGs for SRS sharing. |
| [**R4-2203681**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203681.zip) | TxD and SRS antenna switching | Apple | Observation 1: The options from RAN4#101-e WF on ∆TRxSRS and ∆PPowerClass represent the fundamental decision between altering Pcmax lower bound only or the upper bound as well.  Observation 2: A UE with two half power amplifiers has no potential to transmit SRS with full power during antenna switching if it stays true to the agreement that no antenna virtualization is used. With using ∆PPowerClass the virtualization aspect would be ruled out entirely.  Proposal 1: To simplify the discussion and to simplify the specification work, it is proposed that the architecture assumption for deriving the TxD requirements is a UE with two half power amplifiers (e.g. for PC2 this would mean a 23+23 configuration).  Proposal 2: Use ∆PPowerClass to reduce the lower and upper Pcmax bounds. |
| [**R4-2205223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205223.zip) | Discussion on SRS sharing and antenna switching | ZTE Wistron Telecom AB | Proposal 1: One SRS resource can be indicated by two resource sets with different usages.  Proposal 2: RAN4 does not need to send an LS on the SRS sharing issue.  Proposal 3: SRS power difference for antenna switching is not dependent on other features than TxD |
| [**R4-2205576**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205576.zip) | On SRS IL for TxD | Huawei, HiSilicon | Observation 1: the 3dB SRS power reduction with impact to PCMAX,H is only valid for some specific power classes.  Proposal 1: Removing PCMAX\_L,f,c condition but with clear description for specific power classes or keep it as a general case not differentiating power classes.  Proposal 2: TxD indication is enough for the relevant SRS IL requirement, no need to consider ULFPTx modes additionally or mix them together in the spec. |

## Open issues summary

Everyone seems to be aligned that also the upper limit for power can be reduced for SRS transmission power so no need to discuss that. An agreement can be captured in the form of a CR. Two issues seem to have opposing proposals: if ULFPTx modes need to be coupled in the conditions on what SRS IL applies and if and what power classes need to be mentioned in the IL requirements.

It should be noted that we should concentrate in CR text in this meeting since WI will close.

### Sub-topic 3-1: Does supported ULFPTx mode have impact on SRS IL

*Sub-topic description:*

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

**Issue 3-1-1: Mode1 SRS IL**

* Proposals
  + Option 1: Mode1 SRS IL should be lower by 3 dB (Ericsson)
  + Option 2: Mode1 is not separately specified in the SRS IL section
* Recommended WF
  + TBA

**Issue 3-1-2: UEs supporting power class 2 and ul-FullPwrMode2-TPMIGroup-r16 or maxNumberMIMO-LayersCB-PUSCH without indicating txDiversity-r16 IL**

Proposals

* + Option 1: UEs supporting power class 2 and ul-FullPwrMode2-TPMIGroup-r16 or maxNumberMIMO-LayersCB-PUSCH without indicating txDiversity-r16 and ΔPPowerClass = 0 dB is the only case when SRS IL is 6/7.5 dB (Ericsson)
  + Option 2: UEs supporting power class 2 and ul-FullPwrMode2-TPMIGroup-r16 or maxNumberMIMO-LayersCB-PUSCH without indicating txDiversity-r16 is not mentioned specifically in the CR
* Recommended WF
  + TBA

### Sub-topic 3-2: Power class identifications in SRS IL sentence

*Sub-topic description*

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

**Issue 3-2: How are power classes mentioned in the spec**

* Proposals
  + Option 1: Only power class 2 is distinguished as a condition for the 6/7.5 dB and otherwise the power classes are left as is(ZTE, Oppo)
  + Option 2: Other, why
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 3-1-1: Mode1 SRS IL**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Option 1 |
| ZTE | Option 1 if no antenna virtualization is assumed for SRS. |
| Huawei | Option 2. |

**Issue 3-1-2: UEs supporting power class 2 and ul-FullPwrMode2-TPMIGroup-r16 or maxNumberMIMO-LayersCB-PUSCH without indicating txDiversity-r16 IL**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Option 1 |
| ZTE | Option 2. Need more time to check if Option 1 is the only case. However, the case described in Option 1 is included in Option 2, therefore a safer choice is Option 2 at this moment. |
| Huawei | Option 2. |

**Issue 3-2: How are power classes mentioned**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Option 1  We guess at this moment, PC2 alone can have such an assumption like 26 dBm + 23 dBm. PC1.5 is assumed 26 dBm x 2. PC3 does not have to dare to assume 23 dBm + 20 dBm. |
| ZTE | Option 1. |
| Huawei | Option 1 is ok for us. |

### 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** |
| R4-2205224  Draft CR on SRS IL for NR TxD | Nokia:  1st comment: we’d like to understand why the below text is needed. The total power stays when t2r4 is being used.  3dB when UE indicating *txDiversity-r16* and *SRS-TxSwitch* capability 't2r4' and applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ with configured SRS resources as the second resource in each SRS resource set(s) consisting of two SRS ports  ZTE: Yes, the total power stays when t2r4 is being used. However, since two SRS ports are transmitted simultaneously, the power for each SRS port is actually half of the total power. The purpose of this sub-bullet is to reflect this. If UE vendors assume already in the implementation, and there is no need to reflect this in specs, we are ok to remove it.  2nd comment: We think that mentioning t1r2 and t1r4 is enough. We understand the motivation of adding t1r1-t1r2 and t1r1-t1r2-t1r4. But without including of t1r2 and t1r4, the specification is non-backward compatible. In addition, RAN2 spec says that t1r1-t1r2 or t1r1-t1r2-t1r4 is indicated, the UE shall report t1r2 or t1r4, respectively. Thus, we don’t need to mention t1r1-t1r2 and t1r1-t1r2-t1r4. Otherwise, we will see many capability information in Rel-17… Or we even don’t mention capability of t1r2 or t1r4 as Ericsson’s CR. From the number of SRS port, which capability should be supported is already clear enough. Also the information on PC2 and PC1.5 must be needed.  3dB when UE indicating *txDiversity-r16* and *SRS-TxSwitch* capability t1r1-t1r2’ or ‘t1r1-t1r2-t1r4’' and applied during SRS transmission occasions with *usage* in *SRS-ResourceSet* set as ‘antennaSwitching’ with configured SRS resources as the second resource in each SRS resource set(s) consisting of one SRS port;  ZTE: Agree, only primitive usage is enough, applicable for a combined usage including the concerned primitive usage.  Huawei: Similar question as Nokia for t2r4. Also 3dB relaxation is only valid for PC2 and PC1.5 based on the agreed UE implementation assumption for TxD. |
| Company B |
|  |
| R4-2204837  R17 FR1 TP to 38.837 for TxD SRS IL | Nokia: This discussion should be postponed until the relevant draft CR is agreed. |
| Company B |
|  |
| R4-2204836  Draft R17 CR on SRS IL for TxD | We have a similar comment as mentioned in R4-2205224. We think that mentioning t1r2 and t1r4 is enough. We understand the motivation of adding t1r1-t1r2 and t1r1-t1r2-t1r4. But without including of t1r2 and t1r4, the specification is non-backward compatible. In addition, RAN2 spec says that t1r1-t1r2 or t1r1-t1r2-t1r4 is indicated, the UE shall report t1r2 or t1r4, respectively. Thus, we don’t need to mention t1r1-t1r2 and t1r1-t1r2-t1r4. Otherwise, we will see many capability information in Rel-17… Or we even don’t mention capability of t1r2 or t1r4 as Ericsson’s CR. From the number of SRS port, which capability should be supported is already clear enough.  ZTE: Similar comments to indicate primitive usage.  Huawei: In general we are ok with the CR. Regarding t1r2 and t1r4 or t1r1-t1r2 and t1r1-t1r2-t1r4 as mentioned by Nokia, we are open to use simplified manner in the spec. |
| R4-2204616  Pcmax for SRS usage set as antenna switching for TxD and UL-MIMO features | Nokia: We basically support this CR.  But the CR would not need to mention all the introduced capabilities in Rel-16 like ‘t1r1-t1r2’, ‘t1r1-t1r2-t1r4’ or ‘t1r1-t1r2-t2r2-t1r4-t2r4’ as we commented in other CRs.  ZTE: In addition to primitive usage, also relates to the conclusion of Issue 3-1-2 for SRS IL.  Huawei: We don’t think specific ULFPTx modes need to be considered in the draft CR. |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

## 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”.*

# Topic #3: ULFPTx

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2204618**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204618.zip) | TxD and UL-MIMO requirements for single-port antenna transmission | Ericsson | Draft CR output power requirements  TxD or Mode 1 -> G  Mode 2 -> 6.2 (no suffix) |
| [**R4-2204828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204828.zip) | Draft R17 CR on UL MIMO falllback to TxD | OPPO | Draft CR output power requirements  TxD->G only |
| [**R4-2204617**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204617.zip) | Single-antenna fallback for TxD and UL-MIMO (including ULFPTx) | Ericsson | Proposal 1: for 2 TX connectors, the single-antenna fallback requirements for UL-MIMO for TxD and the ULFPTx modes should be set as follows  • “Default” are the requirements in 6.2 per connector, where the UE can reach full power for a TX connector  • For Mode 0 and Mode 2 with full-power TPMI  o Mode 2 with full-power TPMI shall meet the requirements in 6.2 with MPR for 1 TX for at least one Tx connector, regardless of any TxD indication, since UEs with full power TPMI support should be able to transmit full power on a Tx connector  o Mode 0 shall meet 6.2 for both connectors, since such UEs will support full power on both Tx chains.  o Alternatively, a restriction in the RAN2 specifications (38.306) that UE indicating support of the features ul-FullPwrMode-r16 (Mode 0) or ul-FullPwrMode2-TPMIGroup-r16 for a band entry does not indicate txDiversity-r16 for this band.  • UEs supporting UL-MIMO with TxD and/or ULFPTx Mode 1 shall meet the requirements in 6.2G  • UEs that support Mode 2 without support of full-power TPMI are not specified in Table 6.2D.1-3 for two-port transmission so are therefore not specified for single-antenna port fallback. |
| [**R4-2204835**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204835.zip) | R17 FR1 TxD and ULFPTx fallback | OPPO | Observation 1: It was agreed that “the applicability of transparent TxD is NOT related to UE supporting or not supporting Rel-16 ULFPTx” and “no dependency between txDiversity-16 and ul-FullPowerTransmission”.  Observation 2: It was well recognized that when RAN4 define requirements certain UE architectures will be referred, however, there is no restriction in UE implementation as long as it can meet the requirements.  Proposal 1: No dependency in UE implementation of PAs between TxD and ULFPTx since these capabilities are independent as already agreed and RAN4 only use reference architecture to define requirements rather than limit UE implementations.  Proposal 2: Decouple TxD and ULFPTx UE requirement mapping, and only rely on UE capabilities to decided which requirement UE shall meet.  Proposal 3: For UE support TxD, when it fallback from ULFPTx modes, the TxD requirements apply. For UE not support TxD, when it fallback from ULFPTx modes, the 1Tx requirements apply. |
| [**R4-2205225**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205225.zip) | ULFPTx requirements for fallback and TxD | ZTE Wistron Telecom AB | Proposal: RAN4 to specify ULFPTx requirements for TxD as above table (None of the three listed alternatives). |
| [**R4-2205577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205577.zip) | On ULFPTx and applicable MPR requirements for different PA configurations | Huawei, HiSilicon | Observation 1: There is no one-to-one mapping relationship between the UE implementation architectures and the ULFPTx modes according to RAN1 confirmation.  Observation 2: Using ULFPTx mode 1 as exception indication would have the same issue as TxD for the concern if valid for using the relaxed requirements, and it causes more ambiguous situation.  Proposal 1: It is proposed to distinguish the applicable requirements for 2Tx implementation just based on TxD indication, and additional note is added in the specification to reflect the agreed UE implementation assumption for TxD. |
| [**R4-2205884**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205884.zip) | TxD and ULFPTx requirements | Qualcomm Incorporated | Observation 1: TxD and ULFPTx requirement setting is pending a principal agreement if possible combinations of feature are limited or not  Observation 2: Precluding TxD indication from ULFPTx mode 0 or mode 2 for same band is feasible with the assumptions what justified ULFPTx modes and TxD.  Observation 3: RAN4 has not agreed what requirements would apply for each combination of TxD and ULFPTx modes.  Proposal : RAN4 should agree what feature combinations are supported by specifications for TxD and ULFPTx |
| [**R4-2205887**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205887.zip) | Further discussion on transparent TxD – ULFPTx related | Samsung | Observation 1: ULPFTx Mode-1 is introduced to enable 1layer TPMI=2 transmission for UE not capable of 2TX fullCoherent CB.  Observation 2: Rel-15 UE capable of fullCoherent CB (which is already capable of 1layer TPMI = 2 transmission) needs to support full power by using 1TX antenna connector, if fallback DCI is scheduled.  Observation 3: The same treatment of fallback DCI behaviour shall be applied for (1) UE capable of ULFPTx Mode-1; (2) UE capable of fullCoherent CB.  Proposal-1: For UE supporting ULFPTx Mode-1 but not explicitly indicating its support of TxD, UE needs to use single Tx to fulfil MOP for “fallback DCI”.  Proposal-2: For UE supporting ULFPTx Mode-2 Mechanism-1 but not explicitly indicating its support of TxD, UE needs to use single Tx to fulfil MOP for “fallback DCI”.  Proposal-3: For UE supporting ULFPTx Mode-2 Moechansm-2 or ULFPTx Mode-0, but explicitly indicating its support of TxD, the following treatments are possible and acceptable:  (1) De-prioritized (no need to be mentioned explicitly in TS38.101);  (2) Not allowed (explicitly in TS38.306);  (3) Required to achieve full power for fallback DCI by using 1TX.  Proposal-4: The proposed applicability rule for fallback DCI with UE’s support of TxD and ULFPTx is summarized as:  Table 1. Single antenna-port (“fallback DCI”) Requirements applicability    Proposal-5: RAN4 adopt the following text proposal for the MOP requirement if UE is scheduled by fallback DCI and UE support TxD: |
| R4-2204970 | Discussion on ULFPTx with TxD | vivo | withdrawn |

## Open issues summary

Different possible approaches for setting requirements for TxD UE with ULFPTx are proposed.

1. Do not couple TxD with any ULFPTx modes (Huawei, Oppo, Samsung)
2. Mode 1 shall meet single port output power according to section G (Ericsson, ZTE)
3. Mode 2 shall meet single port output power according to sections 6.2 (no suffix) (Ericsson, ZTE)
4. Mode full power0 meets either suffix less or section G (ZTE). Note, this does not need to be written, result is same as option 1

Separate issue is if e.g. option 2 means UE supporting mode 1 shall also indicate TxD and if UE supporting mode 2 shall not indicate TxD.

The underlying assumptions in RAN4 discussion support detailing each ULFPTx mode to either TxD or 1Tx requirements but also if no coupling is made in requirements, it is up to the UE to meet the requirements based on its TxD indication.

The two draft CRs R4-2204618, R4-2204828 and change proposal 5 in R4-2205887 are good quality so group should agree which approach to take.

**Please comment your support on CRs in the CR comments sections.**

### Sub-topic 4-1: Requirement couplings

*Sub-topic description:*

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

**Issue 4-1-1: Will mode 1 direct to suffix G only?**

* Proposals
  + Option 1: Yes, CR will indicate that UE declaring mode 1 is required to meet 1-port power according to section G
  + Option 2: No, nothing is written in requirements but 1-port requirements are based on TxD indication alone regardless of ULFPTx mode
* Recommended WF
  + TBA

**Issue 4-1-2: Will mode 2 direct to suffixless only**

* Proposals
  + Option 1: Yes, CR will indicate that UE declaring mode 2 is required to meet 1-port power according to section 6.2
  + Option 2: No, nothing in TS but 1-port requirements are based on TxD indication alone
* Recommended WF
  + TBA

**Issue 4-1-3: Will mode0 1-port requirements be detailed directing somewhere?**

* Proposals
  + Option 1: Yes, CR will indicate that UE declaring mode 0 is required to meet 1-port power according to either section 6.2 or section under suffix G
  + Option 2: No, nothing in TS but 1-port requirements are based on TxD indication alone
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 4-1-1: Will mode 1 direct to suffix G only?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Yes, it will. |
| ZTE | Option 2. ULFPTx mode 1 is two-port-1-layer transmission. |
| Huawei | No. Option 2. It is also RAN1 understanding based on clarification from their LS that no specific implementation architecture can be mapped to certain ULFPTx mode. |

**Issue 4-1-2: Will mode 2 direct to suffixless only**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | Not all the mode 2, but rather only *ul-FullPwrMode2-TPMIGroup-r16* will be directed to suffix-less. |
| ZTE | Option 1. ULFPTx mode 2 is single port transmission with Rel-16 scaling factor. |
| Huawei | No. Option 2. |

**Issue 4-1-3: Will mode0 1-port requirements be detailed directing somewhere?**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Nokia | No. Since no exception applies. |
| Huawei | No. Option 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** |
| R4-2204618  TxD and UL-MIMO requirements for single-port antenna transmission  Ericsson | Nokia: In principle we support the CR. But we cannot agree with the following yellow. It seems that whatever features are implemented, once TxD is indicated, the requirements for TxD “only” applies. TxD should not be the basis. If UE wants to implement TxD as well as the other features like ULFPTx, both requirements shall be met.  with the following exceptions: for UEs indicating [*txDiversity-r16*] or the feature *ul-FullPwrMode1-r16* for a band entry, the requirements in clause 6.2G for the power class indicated by the *ue-PowerClass* |
| Huawei: Disagree with specific ULFPTx mdoes mentioned for the fall back requirements. If concern is just for the relaxation for the applicable requirements, some clarification can be considered. |
|  |
| R4-2204828  Draft R17 CR on UL MIMO falllback to TxD  OPPO | Nokia: Our preference is to take R4-2204618 as the basis. We could discuss an alternative from Huawei meaning that spec captures TxD implementation is allowed only for 23 dBm x 2 for PC2 and 26 dBm x 2 for PC1.5. But if we go with this, the spec should not mention in this way. But rather we need to mention in a way that the outpower power per antenna shall not exceed PC3 for PC2 TxD something like that. But this completely excludes the implementation of e.g., ULFPTx mode 0 and TxD. |
| Huawei: We support this CR. If needed, a clarification note for the agreement of TxD implementation assumption for PC2 and PC1.5 can be added. |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-2204595 | 3GPP TR 38.837 v0.4.0 | vivo | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| [**R4-2204968**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204968.zip) | TP for TR 38.837 on Power Class Clarification for SA | vivo |  |  |
| R4-2205574 | Big CR for TS 38.101-1 Tx diversity requirements (phase 2) | Huawei, HiSilicon, Qualcomm, vivo |  |  |
| [**R4-2205575**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205575.zip) | Big CR for TS 38.307: release independent requirements for TxD | Huawei, HiSilicon |  |  |
| [**R4-2205578**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205578.zip) | draft CR for TS 38.101-1: move 2Tx MPR to Clause 6.2D (Rel-16) | Huawei, HiSilicon, Qualcomm |  |  |
| [**R4-2206133**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2206133.zip) | TP to TR38.837 on MPR evaluation for 2Tx PC2 and PC1.5 operation | Skyworks Solutions Inc. |  |  |
| [**R4-2205224**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205224.zip) | Draft CR on SRS IL for NR TxD | ZTE Wistron Telecom AB |  |  |
| [**R4-2204616**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204616.zip) | Pcmax for SRS usage set as antenna switching for TxD and UL-MIMO features | Ericsson |  |  |
| [**R4-2204836**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204836.zip) | Draft R17 CR on SRS IL for TxD | OPPO |  |  |
| [**R4-2204837**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204837.zip) | R17 FR1 TP to 38.837 for TxD SRS IL | OPPO |  |  |
| [**R4-2204921**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204921.zip) | R17 FR1 SRS IL for TxD and ULFPTx | OPPO |  |  |
| [**R4-2204969**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204969.zip) | Further discussion on SRS antenna switching for TxD | vivo |  |  |
| [**R4-2203681**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2203681.zip) | TxD and SRS antenna switching | Apple |  |  |
| [**R4-2205223**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205223.zip) | Discussion on SRS sharing and antenna switching | ZTE Wistron Telecom AB |  |  |
| [**R4-2205576**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205576.zip) | On SRS IL for TxD | Huawei, HiSilicon |  |  |
| [**R4-2204618**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204618.zip) | TxD and UL-MIMO requirements for single-port antenna transmission | Ericsson |  |  |
| [**R4-2204828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204828.zip) | Draft R17 CR on UL MIMO falllback to TxD | OPPO |  |  |
| [**R4-2204617**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204617.zip) | Single-antenna fallback for TxD and UL-MIMO (including ULFPTx) | Ericsson |  |  |
| [**R4-2204835**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2204835.zip) | R17 FR1 TxD and ULFPTx fallback | OPPO |  |  |
| [**R4-2205225**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205225.zip) | ULFPTx requirements for fallback and TxD | ZTE Wistron Telecom AB |  |  |
| [**R4-2205577**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205577.zip) | On ULFPTx and applicable MPR requirements for different PA configurations | Huawei, HiSilicon |  |  |
| [**R4-2205884**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205884.zip) | TxD and ULFPTx requirements | Qualcomm Incorporated |  |  |
| [**R4-2205887**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_102-e/Docs/R4-2205887.zip) | Further discussion on transparent TxD – ULFPTx related | Samsung |  |  |
| R4-2204970 | Discussion on ULFPTx with TxD | vivo | widthdrawn |  |

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** |
| R4-22xxxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx | 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

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

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)