**3GPP TSG-RAN WG4 Meeting # 100-e R4-210XXXX**

**Electronic Meeting, Aug, 2021**

**Agenda item:** 9.7

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [100-e][131] NR\_TxD

**Document for:** Information

# Introduction

Tx diversity work was agreed to be organized under a new WI (RP-211597) in RAN#92e. The objective of the work is

This document is a summary of email discussion in RAN4#100e for the TxD WI.

Five distinct topics have been identified for the email discussion:

* Topic #1: General topics and documents
  + TR, WID revisions, rolling Cr that includes aspect from all agreed issues and other general issues are handled here
* Topic #2: Phase I open RF requriements
  + Requirements and open issues according to phase I in the WID are handled here
* Topic #3: Phase II SRS and ULFPTx
  + Issue according the phase II
* Topic #4: Power class ambiguity
  + Issues related to UE power class behaviour being unclear because of txd implementation
* Topic #5: Capability and LS
  + Issues related to capability and what ran4 should let other WGs know are discussed here

# Topic #1: General topics and documents

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2113009**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113009.zip) | TP for TR 38.837 on Annex part for Transparent Tx Diversity | vivo, Qualcomm, Huawei | This paper provides the text proposals for Annex part of the TR based on the TR skeleton, which including all the key related agreements up till now. |
| [**R4-2113010**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113010.zip) | TP for TR 38.837 on Requirements part for Transparent Tx Diversity | vivo, Qualcomm, Huawei | This paper provides the text proposals for performance part of the TR based on the TR skeleton. The contents are aligned with Annex part, but not all the sections have been completed. |
| [**R4-2114358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114358.zip) | TR 38.837 skeleton for Transparent Tx Diversity | vivo, Qualcomm, Huawei | Skeleton |
| [**R4-2114552**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114552.zip) | TxD work plan | Qualcomm Incorporated | Work plan according to TUs |
| [**R4-2114554**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114554.zip) | TxD WID revision | Qualcomm Incorporated | WID adds information and corrects mostly details. No change in objectives or justification |
| [**R4-2114511**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114511.zip) | CR for TS 38.101-1 Tx diversity requirements | Huawei, HiSilicon, vivo, OPPO, CMCC, Qualcomm | CR 38.101-1 Rel-17: includes basics + SRS antenna switch |
| [**R4-2114510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip) | On remaining TxD requirements | Huawei, HiSilicon | ***Proposal 1: Except for high modulation schemes, it is proposed to adopt the delta MPR value close to the lower bound for the ranges. No delta value is needed for inner RB allocation for QPSK/16QAM.***  ***Proposal 2: It is proposed that same set of A-MPR requirements for the same power class are applied for both UL MIMO and TxD***  ***Proposal 3: It is proposed that A-MPR requirements for bands supporting PC3 UL MIMO are also applicable for PC3 TxD***  ***Proposal 4: It is proposed that if new A-MPR requirements are identified for bands supporting UL MIMO/TxD, the corresponding study should be carried in the existing Rel-17 WI NR bands for UL-MIMO***  ***Proposal 5: PC1.5 should be considered together with TxD implementation for SRS antenna switching.***  ***Proposal 6: For UE indicates TxD capability, delta SRS is applicable for all antenna connectors at least for 1T2R, 1T4R and 1T4R/2T4R.***  ***Observation 1: The description of single port transmission in the spec include cases for both Rel-15 and Rel-16, i.e. the case UE supporting UL MIMO but not ULFPTs is also included.***  ***Observation 2: ULFPTx Mode 1 and Mode 2 could utilize TxD to reach the full power transmission.***  ***Proposal 7: It is proposed to redirect the applicable requirements for single antenna-port PUSCH transmission for some cases in UL MIMO clause to TxD specific clause, which include UE supporting UL MIMO but not ULFPTx and ULFPTx Mode 1 and Mode 2.***  ***Proposal 8: It is proposed to continue the Rel-16 TxD capability signalling design in RAN2, and reply to RAN2 with the clarification agreement in RAN4#99e that the capability signalling applies for all Power Classes for both Rel-15 and Rel-16.*** |
| [**R4-2114003**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114003.zip) | Discussion on requirements for Tx Diversity | Orange Spain | **Proposal 1: Agree on representative channel model(s) capturing the most problematic cases for TxDIV, e.g., high antenna correlation, low RMS delay spread.**  **Proposal 2: In order to ensure the correct implementation of Tx Diversity, its BLER performance needs to be at least as good as the performance of a single Tx with a full-power rated PA for a given channel model and allocation bandwidth of PRB.**  **Proposal 3: In order to ensure that gNodeB can synthetize the virtual SRS antenna port of TxD, the effective SINR of this virtual port should be the same as the one experienced by the following PUSCH transmission whatever its allocated bandwidth (greater than a minimum bandwidth to be defined).** |

## Open issues summary

Comment to the TPs below please. Huawei [**R4-2114510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip)proposals are discussed in the corresponding sections

### Sub-topic 1-1 Orange [**R4-2114003**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114003.zip) propsals

**Issue 1-1:** Are there any actionable requirement changes for UE or BS requirements based on proposals?

* Proposals
  + Option 1: Yes for UE, please comment what
  + Option 2: Yes for BS, please comment what
  + Option 3: Neither, proposals are for studies only
* Recommended WF
  + TBA

**Issue 1-2: Should RAN4 investigate advanced (dual) receivers for UE conformance testing?**

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

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### 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** |
| [**R4-2113009**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113009.zip)  TR Annex | Company A |
| Company B |
|  |
| [[**R4-2113010**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113010.zip)](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113009.zip)  TR requirements | Company A |
| Company B |
|  |
| [**R4-2114358**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114358.zip)  TR skeleton |  |
| [**R4-2114511**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114511.zip)  Rolling 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:* |

### 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: Phase I open RF requriements

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2114545**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114545.zip) | PC2 TxD MPR evaluation and SD-CDD waveform choice | Skyworks Solutions Inc. | **Observation: a SD-CDD delay of 600ns is used for 15 kHz SCS measurements**  **Observations:**   * **There are two inner case (orange highlight) where the limit changes from relative (ACLR) for PC3 to absolute (SEM) for 1TX PC2 and 2Tx PC2** * **There are inner cases (yellow highlight) where 1Tx PC3 and PC2 had margins for emissions but 2Tx PC2 needs MPR due to 3dB higher PSD, 1dB higher ACLR and addition of RIMD** * **Our measurements of edge cases (bold) do not show the need for large MPR as the edge allocation higher MPR was needed to account for a specific WOLA implementation with less aggressive filtering. Nevertheless for the small 5MHz guard band, the effect is 1:1 as it is not related to PA non-linearity and thus do not see RIMD impact.** * **For ACLR cases, 2Tx PC2 has to compensate for 1dB higher ACLR and the additional RIMD contribution** * **For SEM cases, the needed 2Tx PC2 backoff has to account for 3dB higher PSD vs 1Tx PC3 but also has to compensate for the 1dB lower linearity versus 1Tx PC2** * **RIMD impact is seen and varies with the slope of the SEM/ACLR and waveform PAPR. It is expected that this difference is higher for ET due to higher RIMD impact.** * **When comparing required back off with 1Tx PC2, 2Tx PC2 based on two PC3 PAs we observe that:**   + **The cases where the limit changes from relative (ACLR) to absolute (SEM) see the higher back-off increase (>1dB)**   + **Otherwise the additional back off is less than 1dB and in most inner cases emissions are not limiting and the cases that become emission limited need very little back off.** * **Note that inner allocation have not been retested for EVM but RIMD is not expected to have a large impact for QPSK**   **Proposal 1 on outer allocations for 2xPC3Tx PC2 MPR: 1Tx PC2 edge MPR can be reused for 2Tx PC2.**  **Proposal 2 on QPSK outer allocations: 1dB additional MPR is added for outer compared to 1Tx PC2.**  **Proposal 3 on QPSK inner allocations: 2Tx PC2 based on two PC3 PAs should have the following MPR**   * **0.5dB for DFT-s-OFDM QPSK inner (vs 0 for 1Tx PC2) due to SEM issue.** * **For CP-OFDM, the 1.5dB MPR seem sufficient to absorb the SEM issue**   **Proposal 4 on higher order modulation: The need for a small additional 2Tx PC2 back-off for inner and outer 256 QAM and 64QAM should be reassessed accounting for only RIMD contribution.**  **Proposal 5 on UL MIMO MPR: TxD MPR can be reused for UL MIMO using the same PA configuration and single port transmissions are supported via TxD.** |
| [**R4-2113891**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113891.zip) | R17 Discussion on UL MIMO fallback to TxD | OPPO | ***Proposal 1: It is proposed to clarify in the spec that for UE supporting TxD and UL MIMO, when it is scheduled for single antenna port transmission the UE only needs to meet the TxD requirements and exempt from the 1Tx basic requirements.***  38.101-1  If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply to UE without indicating IE [*Txdiversity-r16*] as defined in TS 38.331 [7], and requirements in clause [6.2G.1] apply to UE indicating IE [*Txdiversity-r16*]. |

## Open issues summary

### Sub-topic 2-1 MPR

Sub-topic description: MPR for Tx diversity PC2

Relevant proposals:

[**R4-2114510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip)

**Proposal 1: Except for high modulation schemes, it is proposed to adopt the delta MPR value close to the lower bound for the ranges. No delta value is needed for inner RB allocation for QPSK/16QAM*.***

[**R4-2114545**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114545.zip)

**Proposal 1 on outer allocations for 2xPC3Tx PC2 MPR: 1Tx PC2 edge MPR can be reused for 2Tx PC2.**

**Proposal 2 on QPSK outer allocations: 1dB additional MPR is added for outer compared to 1Tx PC2.**

**Proposal 3 on QPSK inner allocations: 2Tx PC2 based on two PC3 PAs should have the following MPR**

* **0.5dB for DFT-s-OFDM QPSK inner (vs 0 for 1Tx PC2) due to SEM issue.**
* **For CP-OFDM, the 1.5dB MPR seem sufficient to absorb the SEM issue**

**Proposal 4 on higher order modulation: The need for a small additional 2Tx PC2 back-off for inner and outer 256 QAM and 64QAM should be reassessed accounting for only RIMD contribution.**

Companies to indicate where changes are necessary. Intent is to down scope which MPR will be changed. 2nd round we intent o agree values

**Issue 2-1: Which MPRs to be changed**

* Proposals for changes for MPR
  + Option 1: Edge MPR
  + Option 2: Inner
  + Option 3: Outer
  + Option 4: Higher MCS (EVM driven)
* Recommended WF
  + TBA

### Companies comments for Sub topic 2-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 2-2 A-MPR

Sub-topic description: A-MPR for TxD

Companies are encouraged to comment if and how UL MIMO A-MPR should be handled. One possibility is to do bands one by one but how to manage which bands have been studies and which not. Where a list is maintained?

Relevant proposals

[**R4-2114510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip)

**Proposal 4: It is proposed that if new A-MPR requirements are identified for bands supporting UL MIMO/TxD, the corresponding study should be carried in the existing Rel-17 WI NR bands for UL-MIMO**

**Issue 2-2: UL MIMO A-MPR for UE’s with Tx diversity**

* Proposals
  + Option 1: Study band specific A-MPR requirements in the TxD WI
  + Option 2: Study band specific A-MPR requirements in the UL MIMO bands WI
* Recommended WF
  + TBA

### Companies comments for Sub topic 2-2

Sub topic 2-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 2-3 UL MIMO MPR and A-MPR

Sub-topic description: Relation of UL MIMO to Tx Diversity MPR

Relevant proposals

**[R4-2113177](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113177.zip)**

**Proposal 2: After MPR table for 2TX is introduced in Rel-17 transparent TxD requirement for per-UE emission requirement, the same MPR requirement should be applied to ULFPTx UE which relies on transparent TxD to achieve full power, i.e., ULFPTx Mode 1 UE and Mode-2 UE with Mechanism-1 (SRS port virtualization).**

[**R4-2114545**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114545.zip)

**Proposal 5 on UL MIMO MPR: TxD MPR can be reused for UL MIMO using the same PA configuration and single port transmissions are supported via TxD.**

**[R4-2114553](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114553.zip)**

**Proposal 1: MPR for Tx diversity UE should be applied for UL MIMO when UE declares it needs Tx diversity to fulfil maximum power requirements.**

**[R4-2114510](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip)**

**Proposal 2: It is proposed that same set of A-MPR requirements for the same power class are applied for both UL MIMO and TxD**

**Proposal 3: It is proposed that A-MPR requirements for bands supporting PC3 UL MIMO are also applicable for PC3 TxD**

**Issue 2-3-1: TxD MPR is applicable for UL MIMO**

* Proposals
  + Option 1: When UE declares txd (R4-2114545, R4-2114553, R4-2113177)
  + Option 2: For all UL MIMO implementations (R4-2114510)
  + Option 3: Other?
* Recommended WF
  + TBA

**Issue 2-3-2: MPR applicability for 2-layer UL MIMO and ULFPTx**

* Proposals
  + Option 1: Same MPR applies for 2-layer and ULFPTx
  + Option 2: Different MPR can apply between 2-layer and ULFPTx
* Recommended WF
  + TBA

### Companies comments for Sub topic 2-3

Issue 2-3-1 **TxD MPR is applicable for UL MIMO**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Issue 2-3-2 **MPR applicability for 2-layer UL MIMO and ULFPTx**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 2-4 UL MIMO with Tx diversity

Sub-topic description: What requirements apply for fall back DCI UE that implements UL MIMO. Change is proposed to refer to “G” suffix.

Relevant proposals [**R4-2113891**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113891.zip)

***Proposal 1: It is proposed to clarify in the spec that for UE supporting TxD and UL MIMO, when it is scheduled for single antenna port transmission the UE only needs to meet the TxD requirements and exempt from the 1Tx basic requirements.***

38.101-1 change

If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply to UE without indicating IE [*Txdiversity-r16*] as defined in TS 38.331 [7], and requirements in clause [6.2G.1] apply to UE indicating IE [*Txdiversity-r16*].

**Issue 2-4: Fall back reference to D suffix**

* Proposals
  + Option 1: Change as in [**R4-2113891**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113891.zip) Included in to big CR
  + Option 2: Other handling
* Recommended WF
  + TBA

### Companies comments for Sub topic 2-4

Sub topic 2-4

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## 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: Phase II SRS and ULFPTx

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2111904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111904.zip) | On enabling ULFPTx UEs to employ transparent TxD | Qualcomm Incorporated | **Observation 1: Sub-clauses 6.xD must ensure that any new tTxD requirement framework should also apply to mode 1 ULFPTx.**  **Proposal: For UEs that support both ULFPTx and tTxD, subclauses 6.xD shall include a redirection to the set of requirements designed specifically for UEs that support transparent TxD**  If UE does not support Tx diversity [xx, TS 38.306] and is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. If a UE supports Tx diversity and  is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2[G].x apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. |
| [**R4-2113894**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113894.zip) | R17 TxD and ULFPTx | OPPO | ***Observation 1: TxD and ULFPTx are two separate features in applicablility.***  ***Observation 2: UE is allowed to support TxD and ULFPTx simultaneously when configured with single SRS antenna port or multi SRS antenna ports.***  ***Observation 3: TxD and ULFPTx can be tested with corresponding requirements therefore function can be guaranteed.***  ***Observation 4: Mapping of TxD and ULFPTx is up to UE implementation as long as requirements are met.***  ***Observation 5: It is not necessary for NW to exactly know how the ULFPTx is achieved, e.g. with or without TxD.***  ***Proposal 1: It is proposed to confirm that there is no dependency between TxD and ULFPTx and no ULFPTx spec need to be changed due to the introduction of TxD.*** |
| [**R4-2112828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112828.zip) | ULFPTx and the TxD capability | Ericsson | **Proposal 1: RAN4 is to confirm which multi-antenna features have UE behavior and performance that is unaffected by TxD capability.**  **Proposal 2: Clarify in the RAN2 specification that the *ul-FullPowerTransmission* capability is not conditioned on indication of *txDiversity-16* for any full-power mode.**  **Proposal 3: for single-antenna fallback for full-power modes the following exception for full-power modes: “For UEs supporting ULFPTx Mode-1 or ULFPTx Mode-2 without full-power TPMI, the requirement in clause [6.2.1 for TxD] for the power class as indicated by the ue-PowerClass when the UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 and ul-FullPowerTransmission is provided.”** |
| [**R4-2113177**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113177.zip) | Discussion on Transparent TxD – Uplink Full Power Tx (ULFPTx) related | Samsung | ***Observation-1: Rel-16 ULFPTx feature can be categorized into Mode-0 (“fullpower” mode), Mode-1 and Mode-2, and in Mode-2 there are two mechanisms, i.e., Mechanism-1 for SRS port virtualization and Mechanism-2 for TPMI indication.***  ***Observation-2: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-1 UE needs no revisit.***  ***Observation-3: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-2 UE needs no revisit.***  ***Observation-3: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-0 UE needs no revisit.***  ***Observation 4: For ULFPTx Mode 1 UE and Mode-2 UE with Mechanism-1 (SRS port virtualization), if fallback DCI is scheduled, the MOP requirement needs to be redirected to suffix [G] to enable transparent TxD usage. But the same redirect is not only for ULPFTx but also for Rel-15 UL-MIMO UE which rely on transparent TxD.***  ***Proposal 1: The text proposal below is adopted for MOP requirement if fallback DCI is scheduled, after Rel-17 transparent TxD requirement is introduced:***   |  | | --- | | If UE not supporting Tx diversity [xx, TS38.306] is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. If UE supporting Tx diversity [xx, TS 38.306] is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause [6.2G.1] apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. |   ***Observation 5: For ULFPTx MPR requirement, it follows the same MPR requirement for 1TX and Rel-15 UL-MIMO because “per antenna connector”-based method is used when ULFPTx is introduced.***  **Proposal 2: After MPR table for 2TX is introduced in Rel-17 transparent TxD requirement for per-UE emission requirement, the same MPR requirement should be applied to ULFPTx UE which relies on transparent TxD to achieve full power, i.e., ULFPTx Mode 1 UE and Mode-2 UE with Mechanism-1 (SRS port virtualization).** |
| [**R4-2112827**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112827.zip) | SRS antenna switching with antenna virtualization | Ericsson | **Proposal 1: the ∆TRxSRS is a maximum allowance due to additional routing loss for RX antennas, the same value for all power classes (but can be band dependent)**  **Proposal 2: for UEs indicating *txDiversity-r16* (TxD) and ULFPTx except for Mode 0 and Mode 2 supporting full-power TPMI, ΔPPowerClass = 3 dB for single-port SRS transmissions with usage set to ‘antennaSwitching’**  **Observation 1: Non-codebook based UEs require full power PAs per Tx chain for power efficient operation, which is incompatible with the half power assumption driving the transparent TxD design.**  **Proposal 3: new values of ∆TRxSRS are not defined for non-codebook UEs, the same value for all power classes** |
| [**R4-2113178**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113178.zip) | Discussion on Transparent TxD – SRS antenna switching related | Samsung | * **Proposal 1: For 1T2R SRS antenna switching, UE capable of PC2 (with ΔPPowerClass = 0 dB) and tranparent TxD:**    + **needs to be allowed for 3dB on both 1st and 2nd ports due to non-full-rated PAs;**   + **whether or not still to take insertion loss (4.5dB for n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79) on the 2nd port into account needs FFS.** * **Proposal 2: For 1T4R SRS antenna switching, UE capable of PC2 (with ΔPPowerClass = 0 dB) and tranparent TxD:**    + **needs to be allowed for 3dB on both 1st and 2nd port due to non-full-rated PAs;**   + **whether or not still to take insertion loss (4.5dB for n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79) on the 2nd port into account needs FFS.**   + **no change on 3rd and 4th antenna port, i.e., The value of ∆TRxSRS is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79).** * **Proposal 3: For 2T4R SRS antenna switching, UE capable of PC2 (with ΔPPowerClass = 0 dB) and tranparent TxD:**    + **needs to be allowed for 3dB on both 1st and 2nd port due to non-full-rated PAs;**   + **No insertion loss is needed for 1st and 2nd ports;**   + **No change on 3rd and 4th antenna port, i.e., The value of ∆TRxSRS is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79).** |
| [**R4-2113306**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113306.zip) | Discussion on Tx diversity SRS antenna switching | Xiaomi | **Observation 1: ∆TRxSRS for the UE architecture 26dBm+23 dBm is already covered in the existing spec.**  **Proposal 1: it is proposed above change is adopted for ∆TRxSRS when UE supporting TxD is also considered.**  ∆TRxSRS is applied when  a) UE transmits SRS to other than first SRS port when the *SRS-TxSwitch* capability is indicated as '1T2R', '1T4R' or, '1T4R/2T4R'  b) UE transmits SRS to other than first or second SRS port when the *SRS-TxSwitch* capabilityis indicated as '2T4R' or '1T4R/2T4R', or  c) UE transmits SRS to a DL-only carrier  The value of ∆TRxSRS is 4.5dB for 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 in the band. The value of ∆TRxSRS is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 when the device is capable of power class 2 and power class 1.5 in the band.  For other SRS transmissions ∆TRxSRS is 3dB for UE supporting TxD, otherwise ∆TRxSRS is zero; |
| [**R4-2113892**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113892.zip) | R17 SRS IL for TxD | OPPO | ***Observation 1: It was agreed only one PA can be applied in the SRS switch transmission, and no antenna virtualization in the SRS antenna switch transmission.***  ***Observation 2: For PC3+PC3 UE when it is configured with 1T4R SRS switch, all antennas include the first antenna have 3dB lower power than the power class.***  ***Observation 3: For PC3+PC3 UE when it is configured with 2T4R SRS switch, only additional PCB IL needs to be defined when it is switched to SRS other than the 1st and 2nd SRS port.***  ***Observation 4: 1T2R SRS switch IL is same as 1T4R.***  ***Observation 5: Current spec already cover PC2+PC3 and PC2+PC2 cases for UE without TxD.***  ***Observation 6: New srs-TxSwitch capability including fallback modes has been introduced since Rel-16, and RAN4 spec needs to be updated according to 38.331.***  ***Proposal 1: It is proposed to define SRS IL as below:***   * **When the *SRS-TxSwitch* capability is indicated as 1T4R or 1T2R, the additional power back off for Ant 0 is 3dB, and for Ant 1/2/3 is 6 dB (bands below n79) and 7.5dB (n79);** * **When the *SRS-TxSwitch* capability is indicated as 2T4R, the additional power back off for antennas other than 1st and 2nd antenna is 3 dB (bands below n79) and 4.5dB (n79).** |
| [**R4-2113893**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113893.zip) | Draft Rel-15 CR for introduction of TxD SRS IL | OPPO | CR: 38.101-1 Rel-15  ∆TRxSRS is applied when  a) UE transmits SRS to other than first SRS port when the *SRS-TxSwitch* capability is indicated as ‘t1r2’ or ‘t1r4’ or ‘t1r4-t2r4’  b) UE transmits SRS to other than first or second SRS port when the *SRS-TxSwitch* capabilityis indicated as‘t2r4’ or ‘t1r4-t2r4’  c) UE transmits SRS to a DL-only carrier.  d) UE supporting TxD (*capability IE*)  The value of ∆TRxSRS is 4.5dB for 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 in the band. The value of ∆TRxSRS is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79 when the device is capable of power class 2 in the band without TxD (*capability IE*).  When the device is capable of TxD (*capability IE*), and   * when the *SRS-TxSwitch* capability is indicated as ‘t1r2’ or ‘t1r4’ or ‘t1r4-t2r4’, the value of ∆TRxSRS for first SRS port is 3dB, for SRS ports other than first SRS port is 7.5dB for n79 and 6 dB for bands whose FUL\_high is lower than the FUL\_low of n79; * when the *SRS-TxSwitch* capability is indicated as ‘t2r4’ or ‘t1r4-t2r4’, the value of ∆TRxSRS for SRS ports other than first and second SRS ports is 4.5dB for n79 and 3 dB for bands whose FUL\_high is lower than the FUL\_low of n79. |
| [**R4-2114590**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114590.zip) | On Transmit Power Relaxations for SRS Switching | Lenovo, Motorola Mobility | **Observation:** If it is found that SRS transmit power relaxations have a significant negative impact on the extracted downlink CSI, then methods should be considered which would allow the gNB to differentiate between the transmit power relaxations and the differences in antenna gains between the SRS ports so that the transmit power relaxations can be used to correct the channel measurement. |

## Open issues summary

### Sub-topic 3-1 Dependencies between capabilities for ULFPTx

Relevant proposals

[**R4-2113014**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113014.zip)

**Proposal 1: Even certain substitutes exist, it is unreasonable to exclude TxD as an implementation.**

**Proposal 2: There is no need to set dependencies between Full Tx Power / SRS antenna switching and TxD capability.**

**Proposal 3: Other multi-antenna features should be discussed explicitly and case by case, if consider capability dependencies.**

[**R4-2112828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112828.zip)

**Proposal 1: RAN4 is to confirm which multi-antenna features have UE behavior and performance that is unaffected by TxD capability.**

**Proposal 2: Clarify in the RAN2 specification that the *ul-FullPowerTransmission* capability is not conditioned on indication of *txDiversity-16* for any full-power mode.**

[**R4-2112827**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112827.zip)

**Proposal 2: for UEs indicating *txDiversity-r16* (****TxD) and ULFPTx except for Mode 0 and Mode 2 supporting full-power TPMI, ΔPPowerClass = 3 dB for single-port SRS transmissions with usage set to ‘antennaSwitching’**

**Issue 3-1: Dependencies between capabilities**

* Proposals
  + Option 1: There is a dependency other than in option 2 and up to discussion which features ([**R4-2112828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112828.zip)**,** [**R4-2113014**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113014.zip))
  + Option 2: No dependency between txDiversity-16 and ***ul-FullPowerTransmission*** ([**R4-2112828**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112828.zip))
  + Option 3: No dependency (R4-2113014)
  + Option 4: Dependency between TxD and ULFPTx for **ΔPPowerClass = 3 dB for single-port SRS transmissions with usage set to ‘antennaSwitching’, for ULFPTx Mode 1**
* Recommended WF
  + TBA

### Companies comments on issue 3-1

Sub topic 3-1

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 3-2 Changes to enable ULFPTx with TxD

Relevant proposals

[**R4-2113177**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113177.zip)

***Proposal 1: The text proposal below is adopted for MOP requirement if fallback DCI is scheduled, after Rel-17 transparent TxD requirement is introduced:***

|  |
| --- |
| If UE not supporting Tx diversity [xx, TS38.306] is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. If UE supporting Tx diversity [xx, TS 38.306] is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause [6.2G.1] apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. |

[**R4-2111904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111904.zip)

**Proposal: For UEs that support both ULFPTx and tTxD, subclauses 6.xD shall include a redirection to the set of requirements designed specifically for UEs that support transparent TxD**

If UE does not support Tx diversity [xx, TS 38.306] and is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. If a UE supports Tx diversity and  is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2[G].x apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.

**Issue 3-2: Spec changes for ULFPTx**

* Proposals for spec to be changed according to
  + Option 1 (Qualcomm) [**R4-2111904**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2111904.zip)
  + Option 2 (Samsung) [**R4-2113177**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113177.zip)
* Recommended WF
  + TBA

### Companies comments on issue 3-2

Sub topic 3-2

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Sub-topic 3-3 SRS

Changes to accommodate TxD UEs according to agreement in RAN4#99e GTW:

* *SRS antenna switching which was targeted for DL CSI would not use UL antenna virtualization, i.e. UL TxD*

**Issue 3-3:**

* Proposals for spec to be changed according to
  + Option 1 (Huawei, Qualcomm, vivo) [**R4-2114511**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114511.zip)
  + Option 2 (Samsung) [**R4-2113178**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113178.zip)
  + Option 3 (Xiaomi) [**R4-2113306**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113306.zip)
  + Option 4 (Oppo) [**R4-2113893**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113893.zip)
  + Option5 (Ericsson) [**R4-2112827**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112827.zip) No additional allowance for UE with TxD
* Recommended WF
  + TBA

### Companies comments on issue 3-3

Sub topic 3-3

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### 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** |
| [**R4-2113893**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113893.zip) | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#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 #4: Power class ambiguity

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2112318**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112318.zip) | On the remaining power ambiguity issue | ZTE Wistron Telecom AB | * Alt. #1: use the lower possible power class in Pcmax calculation for NR to decide the lower bound of the configured power. * Alt. #2: Revise Pcmax for NR according to the declared NR power capability for NSA to guarantee a correct PHR.   **Observation 1: Alt. #2 provides a flexibility for a UE to choose either PC2 or PC3 operation for the NR leg in the EN-DC combination, while Alt. #1 does not have such a flexibility.**  **Proposal 1: RAN4 to conclude the power ambiguity issue by Alt. #2, i.e., Revise Pcmax for NR according to the declared NR power capability for NSA to guarantee a correct PHR.**  **Propose 2: If RAN4 eventually goes for Alt. #1, a simpler correction is to remove power class 2 ambituity in the rooting sentence in order to keep specs consistency.** |
| [**R4-2112829**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112829.zip) | Correction of Pcmax for an NR PC2 UE supporting NR PC3 for EN-DC | Ericsson | CR 38.101-3 Rel-15  6.2B.4.1.1 Intra-band contiguous EN-DC  - ∆PPowerClass,NR = 3 dB if the UE indicates power class 2 in the *UE-NR-Capability* but only complies with power class 3 as specified in clause 6.2.1 of [2] for the NR part of the configured EN-DC band combination; ∆PPowerClass,NR = 0 dB otherwise;  6.2B.4.1.3 Inter-band EN-DC within FR1  - ∆PPowerClass,NR = 3 dB if the UE indicates power class 2 in the *UE-NR-Capability* but only complies with power class 3 as specified in clause 6.2.1 of [2] for the NR part of the configured EN-DC band combination; ∆PPowerClass,NR = 0 dB otherwise; |
| [**R4-2113011**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113011.zip) | Remaining issues in Power class related requirements and Reply LS to GCF | vivo | **Proposal 1: Agree the changes for general description of EN-DC power class as previously endorsed CR. (Resubmission CR in [**R4-2113013**])**  **Proposal 2: The Pcmax need to be adjusted to reflect the changes, and the TxD signalling need to be used.**  **Proposal 3: The Pcmax for NR is modified to use the lower possible power class to decide the lower bound of the configured power which is more conservative but simpler and possibly more reliable. The possible negative effect is also quite limited.**  **Proposal 4: Add the description of 1-port transmission fall back for SA in Rel-15 which is the same to Rel-16.**  **Proposal 5: Reply the Rel-15 conclusions to GCF based on approved CRs, and close the power class related issues.** |
| [**R4-2113012**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113012.zip) | Clarification of 1-port fall back SA power class for Rel-15 | vivo | CR 38.101-1 Rel-15  6.2D.1  If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.1 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.  6.2D.2  If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.2 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.  6.2D.3  If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.3 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling.  6.2D.4  If UE is scheduled for single antenna-port PUSCH transmission by DCI format 0\_0 or by DCI format 0\_1 for single antenna port codebook based transmission, the requirements in clause 6.2.4 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. |
| [**R4-2113013**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113013.zip) | Correction of general description of EN-DC related power class based on the TxD capability | vivo | CR 38.101-3 Rel-15  Unless otherwise stated, requirements for NR transmitter written in TS 38.101-1 [2] and TS 38.101-2 [3] apply and are assumed anchor agnostic. If UE indicates IE [*Txdiversity*] as defined in TS 38.331 [9], and UE indicates IE maxNumberSRS-Ports-PerResource = n2 in NR standalone operation mode, the said UE shall meet the NR requirements for either power class 2 or power class 3 in EN-DC within FR1 if UE indicates IE maxNumberSRS-Ports-PerResource = n1 for EN-DC on this NR band. If UE do not indicate IE [*Txdiversity*] as defined in TS 38.331 [9], the UE shall meet NR requirements according to its power class in NR standalone operation mode. Requirements are verified under conditions where anchor resources do not interfere NR operation. |
| [**R4-2114512**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114512.zip) | Discussion and draft reply LS on EN-DC power class | Huawei, HiSilicon | ***Observation 1: Without a power class to indicate the difference between SA and NSA for the NR band, it’s ambiguous which power class would be used for*** *PCMAX\_L,f,c,,NR****, consequently, UE may fail the Pcmax test for the NR part in an EN-DC band combination.***  ***Observation 2: The main issue of Pcmax identified by RAN5 is to address the measurement problem.***  ***Proposal: It is proposed to adopt the method to set a lower bound for PCMAX\_L,f,c,,NR if PPowerClass,NR is indicated as a higher power class rather than the default power class.*** |
| [**R4-2114513**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114513.zip) | draft CR for TS 38.101-3 correction of power class for EN-DC | Huawei, HiSilicon | CR: 38.101-3 Rel-15 6.2B.4.1.1 Intra-band contiguous EN-DC - ∆PPowerClass,NR = 3 dB for a power class 2 capable EN-DC UE in PCMAX\_L,f,*c,,NR* if PPowerClass,NR is indicated a higher power class other than the default power class and IE [*txDiversity-r16*] is indicated by the UE; otherwise ΔPPowerClass,NR = 0 dB;  6.2B.4.1.3 Inter-band EN-DC within FR1  - ∆PPowerClass,NR = 3 dB for a power class 2 capable EN-DC UE in PCMAX\_L,f,*c,,NR* if PPowerClass,NR is indicated a higher power class other than the default power class and IE [*txDiversity-r16*] is indicated by the UE; otherwise ΔPPowerClass,NR = 0 dB; |

## Open issues summary

There are proposals for SA with UL MIMO and EN-DC referring and without referring to tx diversity capability. For how to do the changes, we discuss based on CRs but few items are to be clarified with the issues and hopefully conclude after 1st round.

### Sub-topic 4-1 Applicable release

**Issue 4-1: Release where power class ambiguity needs to be corrected**

* Proposals
  + Option 1: Rel-15
  + Option 2: Same release as other tx diversity changes
* Recommended WF
  + TBA

### Sub-topic 4-2 Need to refer to tx diversity capability for power class

Does the power class ambiguity need to be fixed explicitly in pcmax calculation or if a general ambiguity is allowed (refer to discussion in [**R4-2112318**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112318.zip)) and see the change in [**R4-2113013**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113013.zip)vs the change in **R4-2114513 or R4-2112829**

**Issue 4-2: Power class ambiguity alt#1 (general) vs alt#2 (pcmax for tx div) as in** [**R4-2112318**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112318.zip)

* Proposals
  + Option 1: Alt#1 allow general ambiguity and use lowest possible power class
  + Option 2: Alt#2 define explicit pcmax reference for tx div UE’s
  + Option 3: Other
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Sub topic 4-1 **Release where power class ambiguity needs to be corrected**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Sub topic 4-2 **Power class ambiguity alt#1 (general) vs alt#2 (pcmax for tx div) as in** [**R4-2112318**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112318.zip)

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### CRs/TPs comments collection

If pcmax change is preferred especially focus on comments [**R4-2114513**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114513.zip) vs [**R4-2112829**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112829.zip) since they are close to each but the other is referring to tx div capability.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| [**R4-2114513**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114513.zip) | Company A |
| Company B |
|  |
| [**R4-2113013**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113013.zip) | Company A |
| Company B |
|  |
| [**R4-2113012**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113012.zip) |  |
| [**R4-2112829**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112829.zip) |  |

## 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 #5: Capability and LS

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2112319**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112319.zip) | Draft reply LS to RAN2 on the capability of transparent TxD | ZTE Wistron Telecom AB | RAN4 appreciates RAN2’s works on the signaling design to support NR TxD, and the reply LS on the corresponding capabilities.  Regarding the applicable power class for capability signaling in different releases, RAN4 has reached an agreement that the TxD capability signaling applies for all Power Classes for both Rel-15 and Rel-16.  RAN4 also discussed on the relationship between NR TxD and other relevant features, e.g., ULFPTx, SRS antenna switching, non-codebook based transmission and other multiple-antenna features, etc., and has identified no dependency required for the support of NR TxD. |
| [**R4-2113014**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113014.zip) | Discussion and Reply LS on the capability related to transparent TxD | vivo | **Proposal 1: Even certain substitutes exist, it is unreasonable to exclude TxD as an implementation.**  **Proposal 2: There is no need to set dependencies between Full Tx Power / SRS antenna switching and TxD capability.**  **Proposal 3: Other multi-antenna features should be discussed explicitly and case by case, if consider capability dependencies.**  **Proposal 4: RAN4 needs to confirm that the capability release is Rel-16 or Rel-17.**  **Proposal 5: Update the information to RAN2 on the capability release, and let RAN2 do further confirmation base the new situation.** |
| [**R4-2114514**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114514.zip) | draft CR for TS 38.307: release independent requirements for TxD | Huawei, HiSilicon | CR 38.307 Rel-17   |  |  |  |  | | --- | --- | --- | --- | | Transparent Tx diversity | Rel-15 | Table B.4.8-1 | Rel-17 WI NR\_RF\_TxD introduced transparent Tx diversity requirements: see Table B.4.8-1 | |
| [**R4-2114553**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114553.zip) | Legacy UE type handling with TX Diversity | Qualcomm Incorporated | **Proposal 1: MPR for Tx diversity UE should be applied for UL MIMO when UE declares it needs Tx diversity to fulfil maximum power requirements.**  **Observation 1: UE with 26 dBm PA may still implement Tx diversity.**  **Proposal 2: Capability for tx diversity will need a third type with UE that implements tx diversity but implements full power PA.**  **Observation 2: Extension of the tx diversity capability to also recognise UE with full power PA and tx diversity capability will benefit network for further information on UE behaviour.** |

## Open issues summary

### Sub-topic 5-1 Capability for TxD

Relevant proposals

[**R4-2114510**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114510.zip)

***Proposal 8: It is proposed to continue the Rel-16 TxD capability signalling design in RAN2, and reply to RAN2 with the clarification agreement in RAN4#99e that the capability signalling applies for all Power Classes for both Rel-15 and Rel-16.***

[**R4-2114553**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114553.zip)

**Proposal 2: Capability for tx diversity will need a third type with UE that implements tx diversity but implements full power PA.**

[**R4-2112319**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2112319.zip)

Regarding the applicable power class for capability signaling in different releases, RAN4 has reached an agreement that the TxD capability signaling applies for all Power Classes for both Rel-15 and Rel-16.

[**R4-2113014**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2113014.zip)

**Proposal 4: RAN4 needs to confirm that the capability release is Rel-16 or Rel-17.**

**Proposal 5: Update the information to RAN2 on the capability release, and let RAN2 do further confirmation base the new situation.**

**Issue 5-1-1: Capability release**

* Proposals
  + Option 1: TxD capability is introduced from Rel-16 and early implementation is adopted for Rel-15
  + Option 2: TxD capability is introduced from Rel-17 and early implementation is adopted for Rel-15
* Recommended WF
  + TBA

**Issue 5-1-2: Third state needed for capability**

* Proposals
  + Option 1: yes, three states are needed to distinguish UE with txd and full power PA
  + Option 2: no, only two are needed
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

Issue 5-1-1 **Capability release**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

Issue 5-1-2 **Third state needed for capability**

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### 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** |
| [**R4-2114514**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_100-e/Docs/R4-2114514.zip) | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

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

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#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** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

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

# Annex

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)