**3GPP TSG-RAN WG4 Meeting # 101-e R4-211XXXX**

**Electronic Meeting, 01 – 12 November, 2021**

**Agenda item:** 8.7

**Source:** Moderator (Qualcomm Incorporated)

**Title:** Email discussion summary for [101-e][123] NR\_TxD

**Document for:** Information

# Introduction

The scope of this document is to capture discussions in RAN4#101e on contributions to agenda 8.7 for WID [RP-211940] TX Diversity.

The following topics are identified:

* Topic#1: General. TR maintenance, workplan, WID updates and release independence aspect
* Topic #2: Phase 1, MPR and capability. MPR discussions and proposals, capabilities on which types of implementations are covered by specifications
* Topic #3: SRS antenna switching. How to capture SRS antenna switching requirements for UEs with TX diversity
* Topic #4: ULFPTx. How to specify requirements for UE that support ULFPTx.

Please make sure you follow chairs guidance on documentation management in slide 11 of R4-2117001, “RAN4#101e E-Meeting Arrangements and Guidelines”, RAN4 Chair (Huawei).

# Topic #1: General

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Title** | **Company** | **Proposals / Observations** |
| [**R4-2117790**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117790.zip) | 3GPP TR 38.837 v0.1.0 | vivo | TR based on agreed TPs from previous meeting |
| [**R4-2118282**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118282.zip) | TP for TR 38.837 on capability signaling and applicable release | vivo | TP for capability signalling and applicable release for it |
| [**R4-2119496**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119496.zip) | TxD work plan update | Qualcomm Incorporated | Work plan update based on WID update. |
| [**R4-2119525**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119525.zip) | On release independent requirements for TxD | Huawei, HiSilicon | Add TxD and suffix G in to rel-17 38.307 |
| [**R4-2119526**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119526.zip) | draft CR for TS 38.307: release independent requirements for TxD | Huawei, HiSilicon | CR to add the suffix G table to 38.307 |

## Open issues summary

*This topic handles general papers suchb as WID management related. No dedicated subtopics are identified but comments for papers for approval are invited.*

### CRs/TPs comments collection

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2117790  3GPP TR 38.837 v0.1.0 | Company A:  Company B: |
| R4-2118282  TP for TR 38.837 on capability signaling and applicable release | Company A:  Company B: |
| R4-2119496  TxD work plan update |  |
| R4-2119525  On release independent requirements for TxD |  |
| R4-2119526  draft CR for TS 38.307: release independent requirements for TxD |  |

## 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 1, MPR and capability

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** |  | **Company** | **Proposals / Observations** |
| [**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip) | 1CC 2Tx MPR for different PAs implementations and signaling for 1CC and 2CC cases | Skyworks Solutions Inc. | **2.2. Management of 2Tx MPR requirements in 38.101-1**  Observation: 2Tx MPR tables apply to both TxD and UL MIMO  Proposal on 2Tx MPR: 2Tx MPR tables should be placed in the general section 6.2.2 in 38.101-1 and the TxD and UL MIMO section point to these tables. Table 6.2G.2-1 should be moved to general section under Table 6.2.2-3  **2.3 PC2 2Tx 26dBm+26dBm MPR based on PC1.5 MPR**  Observation: 2Tx PC2 operation using two 26dBm PA is an important use case for UEs already implementing two 26dBm PAs for intra-band ENDC or UL CA but that are not able to support PC1.5 due to thermal or power management aspects.  Proposal on MPR for 2Tx PC2 with two 26dBm PAs: Following MPR equation is proposed for 26+26dBm architecture and restricted to the smartphone use case (10dB antenna isolation): MPR[dB]= Max (0, Table 6.2.2-4 MPR -3dB). For single Tx operation Table 6.2.2-2 MPR applies.  **2.4. Additional measurements for PC2 2Tx 26dBm+23dBm case**  Observations:   * As discussed in RAN4#100, edge allocations have similar performance for 1Tx or 2Tx as the limitation is linked to the waveform filtering rather than the PA linearity. Except for the 26+26dBm case where the two PAs already benefit from an intrinsic 3dB back-off. * Confirming the analysis in 2.3, the PC2 2Tx 26+26dBm case always achieves higher power capability than 26dBm, including for our edge allocation measurement which benefit from good waveform filtering. However, to account for designs with less filtering, the 1Tx PC2 edge MPR can be applied. * The PC2 2Tx 26+23dBm always achieve the same or higher power capability or margin than 1Tx PC2. This means that the 26dBm PA intrinsic 3dB back-off allows compensating for the lower linearity of the 23dBm PA and the RIMD contribution. * As discussed in [1] the 2Tx PC2 23+23dBm case requires additional MPR compared to 1Tx PC2 case to compensate for the lower 23dBm PA linearity and the additional contribution of RIMD.   Proposal on MPR for 2Tx PC2 with one 26dBm PA: 26+23dBm architecture shall fulfil the 1Tx PC2 MPR Table 6.2.2-2 in 38.101 for both single and dual Tx operation.  **2.5. Signaling aspect for the different cases**  Observation:  Additional signaling is needed to distinguish:   * The three PC2 2Tx 1CC cases (23+23, 26+23 and 26+26dBm) if all architectures are allowed to signal TxD support * The two PC2 2Tx 2CC cases (23+23 and 26+26dBm) if both are allowed to signal TxD support   Proposal on 2Tx signaling based on PC1.5 use of modified MPR bits   * Alternative 1 (preferred): TxD is only allowed for the 1CC and 2CC cases where there is no full power PA available and it is the only way to achieve full UL power. Full UL power capability is only declared for the architectures with at least one full power PA available. The one versus two full power PA cases are sorted by using modified MPR bit for the 26+26dBm case like for PC1.5 FWA case. * Alternative 2 (more complex but future proof): TxD signaling is allowed for all 1Cc and two CC architectures and modified MPR bits are used for the cases with at least one full power PA:   + Two modified MPR values are needed for 1CC 26+23dBm and 26+26dBm cases   + One modified MPR value is needed for 2CC 26+26dBm case * An LS is sent to Ran2 to inform them on RAN4 agreements on 2Tx architecture signaling * 38.101-1 1Cc and 2CC 2Tx MPR requirements are clarified with how the exact TxD, full UL power and modified MPR signaling maps to the 1Tx and 2Tx MPR tables/equations/values. |
| [**R4-2118474**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118474.zip) | MPR of Tx Diversity (TxD) PC2 for two PC3 PA architecture | LG Electronics Inc. | Observation 1: In the case of CP-OFDM(QPSK &16QAM) Edge RB allocations, 0.5 dB additional MPR value is required compared to the MPR value in WF[1].  Observation 2: In the case of CP-OFDM 256QAM, the 8.0dB MPR value can meet the required emission and EVM requirements.  Observation 3: For other test cases, those MPR values in WF[1] can be used.  Proposal 1: In the case of CP-OFDM(QPSK & 16QAM) Edge RB allocations, the 4.0 dB MPR value can be considered.  Proposal 2: In the case of CP-OFDM 256QAM, the 8.0 dB MPR value can be considered. |
| [**R4-2118550**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118550.zip) | Draft CR TS 38.101-1: Move PC1.5 MPR to Clause 6.2G | Huawei, HiSilicon, Qualcomm | CR for moving PC1.5 MPR tables under suffix G |
| [**R4-2118874**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118874.zip) | R17 FR1 UL MIMO fallback to TxD and draft LS | OPPO | Proposal 1: It is proposed to only test UE with TxD requirements for UE with 23+23 PAs in single antenna port mode  Observation 2: For UE with 23+26 PAs it can achieve 26dBm in TxD mode, and also in 1T 26dBm mode, and it is out of NW control which mode UE is using.  Observation 3: The most straight forward way to verify UE with 23+26 PAs performance in single antenna port mode is to test both 1Tx requirements and TxD requirements.  Proposal 2: It is proposed to define both 1Tx requirements and TxD requirements for UE with 23+26 PAs in single antenna port mode. [Draft CR is R4-2118875]  Observation 4: UE capability needs to be defined to distinguish TxD UE PA configurations whether it is 23+23 or 23+26.  Proposal 3: It is proposed to define a new UE capability for TxD UE to distinguish whether PA configuration is 1Tx or 2Tx in single antenna port mode. [Draft LS is in the annex]  Observation 5: It is transparent to NW whether the 23+26 UE is transmitting max power via the 1Tx 26dBm PA or via the 23+23 PAs and therefore may cause testing problems.  Proposed changes to TS38.101-1 and LS are in the paper |
| [**R4-2118875**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118875.zip) | Draft R17 CR on UL MIMO falllback to TxD | OPPO | CR to add the 23+26 requirement according to the paper 8874 |
| [**R4-2119593**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119593.zip) | On Using the Pseudo-Inverse to Define EVM for Transmit Diversity | Lenovo, Motorola Mobility | **Proposal:** Keep the existing agreement in which the EVM for transparent transmit diversity is defined as  where EVM1 and EVM2 denote the EVM measured at the first and second antenna connectors and P1 and P2 denote the power measured at the first and second antenna connectors.  Moderator note: There is no counterproposal that proposes to keep the existing agreement so no discussion is needed and paper will be noted after 1st round. |

## Open issues summary

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

### Sub-topic 2-1 MPR Table placement

*Sub-topic description:* Where to place TxD MPR table in the specification including PC1.5 tables.

[**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip)**:** Proposal on 2Tx MPR: 2Tx MPR tables should be placed in the general section 6.2.2 in 38.101-1 and the TxD and UL MIMO section point to these tables. Table 6.2G.2-1 should be moved to general section under Table 6.2.2-3

[**R4-2118550**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118550.zip)**:** CR to move PC1.5 tables to suffix G

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

**Issue 2-1: MPR table placement**

* Proposals
  + Option 1: Place all tables in the general subclause 6.2.2
  + Option 2: Place tables for dual TX in suffix G, 6.2G.2
  + Option 3: Other possible solutions, please only opt for this if you provide a conclusive solution
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 2-1: MPR table placement**

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

### Sub-topic 2-2: MPR values for TxD PC2

*Sub-topic description:* Proposal for the MPR modifications are as follows:

[**R4-2118474**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118474.zip)

* Proposal 1: In the case of CP-OFDM(QPSK & 16QAM) Edge RB allocations, the 4.0 dB MPR value can be considered.
* Proposal 2: In the case of CP-OFDM 256QAM, the 8.0 dB MPR value can be considered.

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

**Issue 2-2: TxD PC2 MPR changes**

* Proposals
  + Option 1: Change CP-OFDM(QPSK & 16QAM) Edge RB from 3.5 to 4.0 dB
  + Option 2: Change CP-OFDM 256QAM, from 8.5 to 8.0 dB
  + Option 3: No changes
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 2-2: TxD PC2 MPR changes**

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

### Sub-topic 2-3: MPR applicability when there is full power PA

*Sub-topic description:* Proposal for the MPR applicability as below. It should be also considered if 26+26 PC2 and 26+23 PC2 should both use 1Tx PC2 MPR. This has impact on the issue 2-4 and issue 2-4 has impact on MPR in this issue.

[**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip)

* Proposal on MPR for 2Tx PC2 with one 26dBm PA: 26+23dBm architecture shall fulfil the 1Tx PC2 MPR Table 6.2.2-2 in 38.101 for both single and dual Tx operation
* Proposal on MPR for 2Tx PC2 with two 26dBm PAs: Following MPR equation is proposed for 26+26dBm architecture and restricted to the smartphone use case (10dB antenna isolation): MPR[dB]= Max (0, Table 6.2.2-4 MPR -3dB). For single Tx operation Table 6.2.2-2 MPR applies.

Note that Table 6.2.2-4 is PC1.5 MPR table

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

**Issue 2-3-1: PC2 26+23 dBm MPR**

* Proposals
  + Option 1: 1Tx PC2 MPR Table 6.2.2-2 in 38.101-1 applies for 26+23 dBm
  + Option 2: Other, please provide how to change and justification for it
* Recommended WF
  + TBA

**Issue 2-3-2: PC2 26+26 dBm MPR**

* Proposals
  + Option 1: PC2 MPR[dB]= Max (0, Table 6.2.2-4 MPR - 3dB) for smartphones
  + Option 2: Other, please provide how to change and justification for it
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 2-3-1: PC2 26+23 dBm MPR**

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

**Issue 2-3-2: PC2 26+26 dBm MPR**

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

### Sub-topic 2-4: UE with full power PA and TxD

*Sub-topic description:* The following proposals were made. It should be noted that the proposal in[**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip) already assumes UE with at least one 26 dBm PA can declare TxD. Proposal discusses MPRs for that case.

Also it is moderators understanding that proposal in [**R4-2118874**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118874.zip)does not mean to define a parallel capability to the one already agreed but to define a capability to indicate that the UE which has full power PA can indicate if it meets requirements with 2Tx or 1Tx.

[**R4-2118874**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118874.zip)proposal 2and[**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip) (see issue 2-3-1 and 2-3-2) discuss how to set requirements for UE’s with TxD and full power PA. If agreement is to recognize this type of implementation, we can discuss in more detail on 2nd round. Issue 2-4-2 provides place for comments in 1st round.

[**R4-2117632**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117632.zip)**:** Proposal 1: The tTxD capability shall be extended to include a third type of UE (‘TxD\_singleTxMPR’) that implements Tx diversity but complies with single Tx PC2 MPR of 6.2.2 of TS38.101-2.

[**R4-2118874**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118874.zip)**:**  Proposal 3: It is proposed to define a new UE capability for TxD UE to distinguish whether PA configuration is 1Tx or 2Tx in single antenna port mode. [Draft LS is in the annex]

[**R4-2117200**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117200.zip)**:** Proposal on 2Tx signaling based on PC1.5 use of modified MPR bits. *Moderator note: this proposal is conditional if 26+23 and 26+26 architecture are distinguished in the requirements*

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

**Issue 2-4-1: Declaration of TxD for UE’s with at least one full power PA**

* Proposals
  + Option 1: Define a capability to declare UE support for TxD when it has at least one full power PA
  + Option 2: Leave TxD as implementation aspect and assume that UE that does not declare TxD meets 1Tx requirements and has at least one full power PA
* Recommended WF
  + TBA

**Issue 2-4-2: Requirements for UE with full power PA and TxD support**

* Proposals
  + Option 1: Define requirements separately for 26+23 and 26+26 implementations for TxD
  + Option 2: Test both 1Tx and TxD requirements for the UE that declares TxD and has full power PA
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 2-4-1: Declaration of TxD for UE’s with at least one full power PA**

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

**Issue 2-4-2: Requirements for UE with full power PA and TxD support**

|  |  |
| --- | --- |
| **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** |
| [**R4-2118875**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118875.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 #3: SRS antenna switching

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

SRS antenna switching topic seems complicated with many different proposals and CR’s. Intention is in the 1st round to agree on some bigger principles and comments on proposes CRs and then aim in the 2nd round to focus on one CR to capture what was agreeable.

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** |  | **Company** | **Proposals / Observations** |
| [**R4-2118133**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118133.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’  Proposal 3: for UEs indicating ULFPTx Mode 2 supporting full-power TPMI, a exceptional ∆TRxSRS = 6/7.5 dB allowed for single-port transmissions; for two-port SRS transmissions ∆TRxSRS = 3/4.5 dB.  Proposal 4: a capability indicating ∆TRxSRS = 0 dB or an indication of different SRS transmission power across T- and R-connectors for ULFPTx Mode 2 could be considered with a view to avoid exceptions and faciliate measurements of SRS antenna strength. |
| [**R4-2118134**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118134.zip) | CR: Correction to Pcmax for SRS usage set as antenna switching | Ericsson, Apple | CR with the changes proposed in 8133 |
| [**R4-2118218**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118218.zip) | Discussion on Transparent TxD – SRS antenna switching related | Samsung | * Proposal 1: For 1T2R SRS antenna switching, UE capable of both 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;   + 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 is no longer allowed. * Proposal 2: For 1T4R SRS antenna switching, UE capable of both 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;   + 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 is no longer allowed.   + 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 both PC2 (with ΔPPowerClass = 0 dB) and tranparent TxD:   + No change is needed for TxD UE, so still on 3rd and 4th antenna port, 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. * Observation 1: For UE capable of both PC3 and tranparent TxD, RAN4 clarify whether or not 20dBm + 20dBm implementation is allowed**.** |
| [**R4-2118219**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118219.zip) | Draft CR on configured power requirement for TxD UE with SRS antenna switching | Samsung | CR based on 8218 |
| [**R4-2118283**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118283.zip) | Discussion on SRS antenna switching for TxD | vivo | **Proposal 1:** With TxD capable UE that with only half-power PA compared to declared power class possible, new relaxation of 3dB should be introduced for the cases of optimum Tx chain, while 2T4R which adapt to TxD can still have no relaxation.  **Observation 1:** *SRS-TxSwtich* can be continued to use in Rel-17, while introducing *SRS-TxSwtich-v1610* parameters would make the requirements more complicated.  **Observation 2:** Requirements depend on other Rel-16 signalling such as *SRS-TxSwtich-v1610* may bring more difficulty for release independency of TxD to be achieved.  **Proposal 2:** Continue to use Rel-15 capability *SRS-TxSwtich* for Rel-17 TxD requirements and do not introduce *SRS-TxSwtich-v1610,* for simpler spec and easier release independency.  **Proposal 3:** Continue to consider lower possible PA configuration as current requirements did.  **Observation 3:** In current 38.101-1 V17.3.0, PC1.5 was simply added with PC2 in SRS swithicng part and no differentiation made.  **Proposal 4:** Define SRS switching requirements for PC1.5 in Rel-17 only (A CR to remove Rel-16 part of this is also provided in maintenance agenda), and the relaxation principle is similar to 23+23 for PC2.  **Proposal 5:** TxD would not impact the relaxation for DL-only carrier. |
| [**R4-2118284**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118284.zip) | Draft CR on SRS antenna switching for TxD | vivo | CR based on 8283 |
| [**R4-2118878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118878.zip) | R17 SRS IL for TxD | OPPO | 2.1 UE architecture  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.  2.2 SRS IL  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).   Observation 7: PC1.5 SRS IL can be covered by SRS IL for TxD.  Proposal 2: It is proposed to move PC1.5 SRS IL to SRS IL for TxD part since it inherently support TxD. |
| [**R4-2118879**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118879.zip) | Draft R17 CR on SRS IL for TxD | OPPO | CR based on 8878 |
| [**R4-2119287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119287.zip) | Discussion on TxD and SRS antenna switching | Apple | **Observation:** For SRS transmission with antenna switching there exist two competing approaches. One utilizes ∆TRxSRS with additional3dB while the other is based on deploying ∆PPowerClass with 3dB. The first approach would allow to use antenna virtualization which could potentially degrade DL-CSI estimation, while the second approach would prevent virtualization during SRS transmission.  **Proposal 1**: Use ∆PPowerClass with 3dB for TxD capable devices.  **Proposal 2**: Any solution on SRS antenna switching with TxD should account for PC1.5. |
| R4-2119524 | draft CR for TS 38.101-1 Tx diversity requirements (phase 2) | Huawei, HiSilicon | *Moderator note: will be used to capture agreements if merging is needed* |

## Open issues summary

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

### Sub-topic 3-1

*Sub-topic description:* Use of IL or use of delta P\_Powerclass for TxD implementation 3 dB lower SRS power compared to power class. Delta P\_Powerclass will keep the power window narrow. Some of the relevant proposals below. Most companies seem to assume Il is used so direct counter proposal to [**R4-2119287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119287.zip) does not exist.

[**R4-2119287**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2119287.zip)**:** Proposal 1: Use ∆PPowerClass with 3dB for TxD capable devices.

[**R4-2118133**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118133.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’

[**R4-2118283**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118283.zip)**: Proposal 1:** With TxD capable UE that with only half-power PA compared to declared power class possible, new relaxation of 3dB should be introduced for the cases of optimum Tx chain, while 2T4R which adapt to TxD can still have no relaxation.

[**R4-2118878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118878.zip)**:** 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).

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

**Issue 3-1: use of ∆PPowerClass or 3 dB bigger IL**

* Proposals
  + Option 1: use **∆PPowerClass** (Ericsson, Apple)
  + Option 2: use larger IL (Samsung)
  + Option 3: Other options?
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 3-1: use of ∆PPowerClass or 3 dB bigger IL**

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

### Sub-topic 3-2

*Sub-topic description:* Relation of delta SRS IL with UL MIMO. It was stated earlier that the UE may use lower power PA that is available for UL MIMO reasons and due to routing is easier if the main PA does not need to be routed to all antenna ports. If some of the allowed lower power for SRS ant sw should be coupled with the UL MIMO should be discussed. For 1st round intention is to discuss this aspect and then 2nd round see what modes and how to capture.

[**R4-2118133**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118133.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’
* Proposal 3: for UEs indicating ULFPTx Mode 2 supporting full-power TPMI, a exceptional ∆TRxSRS = 6/7.5 dB allowed for single-port transmissions; for two-port SRS transmissions ∆TRxSRS = 3/4.5 dB.

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

**Issue 3-2: Allow lower power SRS power for UL MIMO modes**

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

#### Companies views’ collection for 1st round

**Issue 3-2: Allow lower power SRS power for UL MIMO modes**

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

### Sub-topic 3-3

*Sub-topic description:* If PC1.5 should be handled part of TxD for SRS IL or not.

[**R4-2118878**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118878.zip)Proposal 2: It is proposed to move PC1.5 SRS IL to SRS IL for TxD part since it inherently support TxD.

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

**Issue 3-3: PC1.5 handling**

* Proposals
  + Option 1: yes, PC1.5 IL is conditional to TxD
  + Option 2: No, PC1,5 should be allowed extra 3dB only because of power class declaration
* Recommended WF
  + TBA

#### Companies views’ collection for 1st round

**Issue 3-3: PC1.5 handling**

|  |  |
| --- | --- |
| **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 (since all CRs have companioning discussion paper, comment here about CR details, not the content since we will have a discussion)** |
| [**R4-2118879**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118879.zip) **O**ppo | Company A  Company B |
| [**R4-2118284**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118284.zip)vivo | Company A  Company B |
| [**R4-2118134**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118134.zip)Ericsson, Apple |  |
| [**R4-2118219**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118219.zip)  Samsung |  |

## 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: ULFPTx

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

## Companies’ contributions summary

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** |  | **Company** | **Proposals / Observations** |
| [**R4-2117632**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117632.zip) | On enabling ULFPTx UEs to employ transparent TxD | Qualcomm Incorporated | Observation 1: In the case of a UE that declares a full power TPMI, the network cannot presume existence of a full-power PA if the UE also asserts the tTxD flag.  Observation 2: A PC2 UE can avail of relaxed MPRs in 6.2G.2 V17.3 simply by asserting tTxD, even if it possesses a full power PA.  Observation 3: A PC2 UE may need to assert tTxD while at the same time being compliant with single Tx MPRs rather than the relaxed MPRs in 6.2G.2.  Proposal 1: The tTxD capability shall be extended to include a third type of UE (‘TxD\_singleTxMPR’) that implements Tx diversity but complies with single Tx PC2 MPR of 6.2.2 of TS38.101-2.  Proposal 2: Redirection clause for UEs that support ULFPTx and assert tTxD:  If UE does not support Tx diversity or supports *TxD\_singleTxMPR* [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 6.2.1/2 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. For a UE that supports *TxD\_singleTxMPR* the output power is defined as the sum of the output power from both UE antenna connectors*.*  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 6.2G.1/2 apply for the power class as indicated by the *ue-PowerClass* field in capability signalling. |
| [**R4-2118135**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118135.zip) | CR: Correction to UL-MIMO requirements for single-port antenna transmission | Ericsson | Clause 6.2D.1:  The requirements in 6.2 are the baseline for single-port transmissions, exceptions granted for TxD or Mode 1  That shall meet requirements accoridng to 6.2G. Mode 2 with full-power shall meet the fallback rerquirement according to 6.2.  6.2D.2: Full power TPMI mode 2 verified against requirements according to 6.2 shall meet requirements with MPR according to 1 TX.  6.2D.3: Full power TPMI mode 2 verified against requirements according to 6.2 shall meet requirements with A-MPR according to 1 TX. |
| [**R4-2118220**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118220.zip) | Further Discussion on Transparent TxD – 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: In the Section 6.2D.1 MOP requirement for UL-MIMO, there is not requirement applicable to the UE supporting Tx diversity 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.  Observation-3: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-1 UE needs no revisit.  Observation-4: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-2 UE needs no revisit.  Observation-5: After TxD UE is introduced in Rel-17, MOP requirement of Rel-16 ULFPTx Mode-0 UE needs no revisit.  Observation 6: 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 MOP requirement for TxD UE (with or without ULFPTx configured) shall be referred to Section 6.2G.1.  Proposal 2: For UE supporting TxD (with or without ULFPTx configured), MPR requirement specified in Section 6.2G.2 shall be applied, while the requirement in Section 6.2D.2 only apply for non-TxD UE. |
| [**R4-2118221**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118221.zip) | TP to TR 38.837 for TxD’s impact on ULFPTx-related requirement | Samsung | TP for TR based on the 8220 |
| [**R4-2118601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118601.zip) | On the relationship between NR TxD and ULFPTx | ZTE Wistron Telecom AB | Observation 1: NR TxD and ULFPTx may have different rated power class capabilities for the same band.  Observation 2: NR TxD and ULFPTx mode 1 are different in terms of number of antenna port(s), though both have single layer with both PAs active.  Proposal 1: RAN4 does not establish any association between NR TxD and ULFPTx since they are two different independent UE features. |

## Open issues summary

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

### Sub-topic 4-1 Mode 1 and mode 2 with TxD

*Sub-topic description:* In general, is TxD generic regardless of ULFPTx or does Ran4 set conditions between capabilities. Following proposals discuss these issues

[**R4-2118220**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118220.zip)

* Proposal 1: The MOP requirement for TxD UE (with or without ULFPTx configured) shall be referred to Section 6.2G.1.
* Proposal 2: For UE supporting TxD (with or without ULFPTx configured), MPR requirement specified in Section 6.2G.2 shall be applied, while the requirement in Section 6.2D.2 only apply for non-TxD UE.

[**R4-2118135**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118135.zip) (CR) Excludes mode 2 UE from relying on TxD requirements. Also mandates mode 1 to support TxD

[**R4-2118601**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118601.zip) Proposal 1: RAN4 does not establish any association between NR TxD and ULFPTx since they are two different independent UE features.

[**R4-2117632**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2117632.zip) Proposal 2: Redirection clause for UEs that support ULFPTx and assert tTxD: (in generic, i.e. no conditionif it is mode 2 or not, see paper for text)

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

**Issue 4-1-1: Mode 2 and TxD**

* Proposals
  + Option 1: Mode 2 is excluded from using TxD (Ericsson)
  + Option 2: TxD is applicable for all ULFPTx modes (Qualcomm, Samsung, ZTE)
* Recommended WF
  + TBA

**Issue 4-1-2: Mode 1 and TxD**

* Proposals
  + Option 1: Supporting mode 1 mandates supporting TxD (Ericsson)
  + Option 2: Only TxD declaration defined when TxD requirements (suffix G) apply (Qualcomm, Samsung, ZTE)
* Recommended WF
  + TBA

## Companies views’ collection for 1st round

### Open issues

**Issue 4-1-1: Mode 2 and TxD**

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

**Issue 4-1-2: Mode 1 and TxD**

|  |  |
| --- | --- |
| **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** |
| [**R4-2118135**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118135.zip) | Company A |
| Company B |
|  |
| [**R4-2118221**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_101-e/Docs/R4-2118221.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** |
| R4-211xxxx | 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** |
| R4-211xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-211xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-211xxxx | 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)