**3GPP TSG-RAN WG4 Meeting #104-bis-e R4-22XXXXX**

**Electronic Meeting, Oct. 10th – 19th, 2022**

**Agenda item:** 6.6.5

**Source:** Moderator (vivo)

**Title:** Email discussion summary for [104-bis-e][128] FR1\_enh2\_part2

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

*List of candidate target of email discussion for 1st round and 2nd round*

* 1st round: TBA
* 2nd round: TBA

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

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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)

# Topic #1: Issues for 4Tx (Agenda 6.6.2)

## Companies’ contributions summary

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| --- | --- | --- | --- |
| **T-doc number** | **T-doc name** | **Company** | **Proposals / Observations** |
| [**R4-2215377**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215377.zip) | 4 Tx RF issues | Qualcomm Incorporated | **Observation 1:** It is possible to use MPR values for power class 2 with dual Tx given in table 6.2D.2.-1 of [2] for the 4 PA high antenna isolation scenario.**Proposal 1:** Vehicular UEs due to their large form factor compared to UE handheld devices should have high antenna isolation characteristics similar to CPE and FWA devices.**Observation 2:** current specifications define PC1.5 as the sum of the power from 2 PAs only for UEs that declare TxD capability**Proposal 2**: RAN4 to further discuss whether to redefine PC1.5 to be the sum of power from all PAs regardless of whether a UE supports TxD or not |
| [**R4-2215782**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215782.zip) | Discussion on 4Tx UE RF requirements | LG Electronics | **Proposal 1:** Consider MPR as provided in Table 3 for PC1.5 4Tx (4x23dBm) for Vehicular UE or other industrial devices with antenna isolation of 10dB.**Proposal 2:** Consider MPR as provided in Table 4 for PC1.5 4Tx (4x23dBm) for CPE/FWA or other industrial devices with antennal isolation of 20dB or above.Table 3. Proposed MPR for PC1.5 with quadruple Tx (Antenna Isolation = 10dB)

|  |  |
| --- | --- |
| Modulation | MPR (dB) |
|  | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 8.0 | ≤ 3.0 | ≤ 2.0 |
|  | QPSK | ≤ 8.5 | ≤ 3.5 | ≤ 2.0 |
|  | 16 QAM | ≤ 8.5 | ≤ 4.0 | ≤ 2.5 |
|  | 64 QAM | ≤ 8.5 | ≤ 4.7 | ≤ 4.5 |
|  | 256 QAM | ≤ 9.5 | ≤ 7.0 | ≤ 7.0 |
| CP-OFDM | QPSK | ≤ 9.5 | ≤ 5.0 | ≤ 3.5 |
|  | 16 QAM | ≤ 9.5 | ≤ 5.0 | ≤ 4.0 |
|  | 64 QAM | ≤ 9.5 | ≤ 7.0 | ≤ 7.0 |
|  | 256 QAM | ≤ 9.5 | ≤ 9.5 | ≤ 9.5 |

Table 4. Proposed MPR for PC1.5 with quadruple Tx (Antenna Isolation = 20dB)

|  |  |
| --- | --- |
| Modulation | MPR (dB) |
|  | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 7.5 | ≤ 1.5 | ≤ 0.5 |
|  | QPSK | ≤ 8.0  | ≤ 2.0  | ≤ 0.5  |
|  | 16 QAM | ≤ 8.0 | ≤ 2.5  | ≤ 1.5  |
|  | 64 QAM | ≤ 8.0  | ≤ 3.0 | ≤ 3.0  |
|  | 256 QAM | ≤ 8.0  | ≤ 6.0  | ≤ 6.0 |
| CP-OFDM | QPSK | ≤ 8.0  | ≤ 3.5  | ≤ 2.0  |
|  | 16 QAM | ≤ 8.0  | ≤ 3.5  | ≤ 2.5  |
|  | 64 QAM | ≤ 8.0  | ≤ 5.0  | ≤ 5.0  |
|  | 256 QAM | ≤ 8.0  | ≤ 8.0  | ≤ 8.0 |

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| [**R4-2215888**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215888.zip) | Discussion on CEP/FWA/vehicle/industrial devices | ZTE Corporation | ***Proposal 1.*** *The existing component assumptions for handheld UE can be reused, and the requirements which would be different with handheld UE which should be defined separately.****Proposal 2.*** *Additional regulation requirements may need to be considered when define the related RF requirements.*  |
| [**R4-2216115**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216115.zip) | Discussion on 4Tx UE RF requirements | vivo | **Proposal 1:** 1-layer configuration is used for ULFPTx mode 1 in the 1st stage.**Proposal 2:** Using the following TPMI=13 (1 layer, ) for ULFPTx mode 1 verification.**Proposal 3:** Clarify 4Tx co-exist with CA do not included in this WI. **Proposal 4:** A very draft text proposal attached in the Annex was submitted for review. |
| [**R4-2216143**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216143.zip) | Discussion on 4Tx on for CPE FWA vehicle industrial devices | Xiaomi | **Observation 1:** the UE types like FWA, CPE, vehicle has been already allowed in current spec. And the spec doesn’t differentiate the Tx RF requirements between these UE types and handset UE except MPR requirement**Observation 2:** whether separated requirements are needed or not rely on the further study on how much MPR difference among UE types considering the potential larger form factor comparted to handset UE**Observation 3**: although the form factor for CPE/FWA/vehicle/industrial devices may be greatly improved compared with normal handset UE, there should be little difference in the Form factor between them.**Proposal 1**: in order to simplify the spec, and to consider that RF requirement is just the minimum requirements, only defining one set of requirements for CPE/FWA/vehicle/industrial devices is preferred.**Proposal 2**: only P-MPR approach is considered for CPE/FWA/vehicle/industrial devices to comply with SAR compliance if needed. |
| [**R4-2216158**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216158.zip) | Views on 4Tx for Rel-18 RF FR1 enhancements | NTT DOCOMO INC. | **Proposal:** At least per UE basis requirements in case of 2Tx are also per UE basis in case of 4Tx.* Max power/MPR/A-MPR/Pcmax/Minimum output power/Power control/OBW/OOBE/SE
 |
| [**R4-2216436**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216436.zip) | R18 Discussion on 4Tx FWA | OPPO | *Observation 1: Vehicle UE has used different antenna isolation assumption comparing to CPE/FWA devices.**Proposal 1: No differentiation of CPE/FWA in FR1 enhancement requirements.**Proposal 2: Consider separate requirements for vehicle UE in FR1 when necessary.**Observation 2: Many types of industrial devices exist and form factors could be diverse, further clarifications are needed from proponents.**Proposal 3: Reuse CPE/FWA assumptions for industrial devices before clear definition is made for it.**Proposal 4: SAR issue can be left to UE implementation for at least CPE/FWA/vehicle devices.**Observation 3: Some of CPE devices could be roaming to other countries, while some may not.**Proposal 5: International roaming can be supported by some of CPEs, and the NS value based requirement definition approach can be applied if there is different requirements among countries.**Proposal 6: Align the understanding that UE power class is per band defined, rather than per antenna port.**Observation 5: It is not clear whether 4Tx UE has to meet 2Layer UL MIMO requirements.**Observation 6: Rel-17 TxD only defined for 2Tx and not support (4Tx TxD) or (2Tx TxD +UL MIMO).**Observation 7: 3Layer UL MIMO is supported in RAN1 for 4port UE by configuring three-layer four port codebooks.**Observation 8: 3Layer UL MIMO is not supported in Rel-18 RAN4 requirements though can be supported by UE in implementation.**Proposal 7: 4Tx capable UE only need to meet requirement for 4Layer UL MIMO and single antenna port. The 2Layer UL MIMO can be supported by UE but no need to be tested similar as handling of 3Layer UL MIMO where RAN1 support this feature but no requirement in RAN4.* |
| [**R4-2216673**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216673.zip) | Further consideration on 4Tx | Huawei, HiSilicon | ***Observation 1:*** *TxD is necessary for PC1.5 UE supporting 4Tx for 4x23dBm implementation assumption.****Observation 2:*** *The applicable PC2 fallback MPR requirement agreed in last meeting is only for 2Tx PC1.5 case.****Proposal 1****: TxD requirements shall be considered in phase 1 to support PC1.5 UE delivering the max output power.****Proposal 2:*** *It is proposed to consider dual Tx PC2 requirement as the fallback requirement for 4Tx PC1.5.****Proposal 3:*** *It is proposed to use MPR in Table 6.2D.2-2 as baseline to do the measurement evaluation for PC1.5 with 4Tx.* |
| [**R4-2216674**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216674.zip) | draft CR to TS 38.101-1 4Tx requirements (phase 1) | Huawei, HiSilicon |  |
| R4-2216874 | EVM Definition for Conductive MIMO Testing | Lenovo |  |
| [**R4-2216879**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216879.zip) | EVM Definition for 4x4 UL MIMO | Lenovo | **Proposal 1**: Define the EVM for 4 Tx UL MIMO transmission on a per layer basis. **Proposal 2**: For full-rank transmission, measure the EVM using a zero-forcing MIMO receiver.**Proposal 3**: For less than full-rank transmission, measure the EVM using a pseudo-inverse receiver.**Proposal 4**: To account for antenna correlation not observed in conductive measurements, increase the conductive EVM measurement by some fraction of the square root of the maximum combining gain so that$$EVM\_{i}^{'}=EVM\_{i} ∙f ∙\sqrt{G\_{i}}$$ where *f* is in the interval (0, 1].**Proposal 5**: Alternatively, in the case that increased MPR is defined for multi-antenna transmission, increase the conductive EVM measurement by $$EVM\_{i}^{'}=EVM∙f∙2^{ \left({∆MPR}/{2}\right)} ,$$where *f* is in the interval (0, 1]. |
| [[**R4-2215381**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2215381.zip)**]\*** | On international roaming possibility of CPE/FWA/vehicle/industrial devices | SoftBank Corp. | **[Proposal-1]** A clarification is requested whether four types of devices under this WID are subject to international roaming. |
| [[**R4-2216154**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216154.zip)**]\*** | Views on assumption for CPE/FWA/vehicle/industrial devices for 4Tx and 8Rx | NTT DOCOMO INC. | Observation 1: RF components assumptions for 4 types of UEs should be considered during discussion for 4Tx and 8Rx RF requirements, which is also mentioned in [2], and whether sets of requirements are different or not depends on how the requirements of 4 types of UEs look like based on the outcome of the discussion.Observation 2: Approved WF for 4Tx and 8Rx in last meeting already made some agreements on RF components for 4 types of UEs.Observation 3: In our view, it is preferable to have common requirements among 4 types of UEs, but it depends on what differences of the requirements will be identified and interested companies for each type of UE want to differentiate them.Observation 4: Although SAR compliance may be removed/relaxed for CPE/FWA/vehicle/industrial devices in some cases, it depends on those device types and use cases.Observation 5: Since values of P-MPR and UL duty cycle capability is up to UE implementation, if a device does not have any issues on SAR, the device can apply zero P-MPR and indicate larger UL duty cycle capability.Proposal: Confirm existing solutions such as P-MPR and UL duty cycle scheme are still valid for CPE/FWA/vehicle/industrial devices with 4Tx. |

\* The documents were moved from agenda 6.6.1.

## Open issues summary

### Sub-topic 1-1: Assumptions for different UE type

***Issue 1-1-1: RF parts/performance***

* **Proposal 1:** The existing component assumptions for handheld UE can be reused, and the requirements which would be different with handheld UE which should be defined separately. (ZTE, R4-2215888)
* **Proposal 2**: in order to simplify the spec, and to consider that RF requirement is just the minimum requirements, only defining one set of requirements for CPE/FWA/vehicle/industrial devices is preferred. (Xiaomi, [R4-2216143](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216143.zip))
* **Proposal 3:** Vehicular UEs due to their large form factor compared to UE handheld devices should have high antenna isolation characteristics similar to CPE and FWA devices. (Qualcomm, R4-2215377)
* **Proposal 4:** (OPPO, [R4-2216436](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216436.zip))
	+ No differentiation of CPE/FWA in FR1 enhancement requirements;
	+ separate requirements for vehicle UE in FR1 when necessary;
	+ CPE/FWA assumptions for industrial devices before clear definition is made for it.
* Proposal 5: It is preferred to have common requirements among 4 types of UEs, but depends on other factors (DCM, R4-2216154)
	+ Observation 1: RF components assumptions for 4 types of UEs should be considered during discussion for 4Tx and 8Rx RF requirements, and whether sets of requirements are different or not depends on how the requirements of 4 types of UEs look like based on the outcome of the discussion.
	+ Observation 2: Approved WF for 4Tx and 8Rx in last meeting already made some agreements on RF components for 4 types of UEs.
	+ Observation 3: In our view, it is preferable to have common requirements among 4 types of UEs, but it depends on what differences of the requirements will be identified and interested companies for each type of UE want to differentiate them.

***Moderator’s recommendation:***

* Recommended WF
	+ Reuse existing component assumptions for handheld UE unless otherwise stated;
	+ No differentiation of CPE/FWA;
	+ FFS whether vehicular UE should have high antenna isolation characteristics similar to CPE and FWA
	+ FFS one set of requirements for CPE/FWA/vehicle/industrial devices;

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| **Company** | **Comments** |
| OPPO | Ok with recommended WF. For the antenna isolation for vehicular UE, it was agreed in last meeting that same as handheld UE, this is different from CPE/FWA, and may lead to different requirements like MPR. But what does vehicular UE means actually is not quite clear, is it another kind of CPE/FWA? |
| Skyworks | We have a preference for Xiaomi ([R4-2216143](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216143.zip)) proposal 2 to define only one set of requirements for all device types. |
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***Issue 1-1-2: SAR compliance***

* Proposal 1: Additional regulation requirements may need to be considered when define the related RF requirements. (ZTE, R4-2215888)
* Proposal 2: only P-MPR approach is considered for CPE/FWA/vehicle/industrial devices to comply with SAR compliance if needed. (Xiaomi, [R4-2216143](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216143.zip))
* Proposal 3: SAR issue can be left to UE implementation for at least CPE/FWA/vehicle devices. (OPPO, [R4-2216436](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216436.zip))
* Proposal 4: Confirm existing solutions such as P-MPR and UL duty cycle scheme are still valid for CPE/FWA/vehicle/industrial devices with 4Tx. (DCM, R4-2216154)

***Moderator’s recommendation:***

* Recommended WF
	+ Option 1: Only consider P-MPR approach for CPE/FWA/vehicle/industrial devices
	+ Option 2: Confirm existing solutions including P-MPR and UL dutycycle scheme for CPE/FWA/vehicle/industrial devices since P-MPR number is flexible and dutycycle is or optional.

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| **Company** | **Comments** |
| OPPO | Option 1. Only consider PMPR approach for simplicity. |
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***Issue 1-1-3: International operation***

* Proposal 1: A clarification is requested whether four types of devices under this WID are subject to international roaming (SBM, R4- 2215381).
* Proposal 2: International roaming can be supported by some of CPEs, and the NS value based requirement definition approach can be applied if there is different requirements among countries. (OPPO, [R4-2216436](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216436.zip))

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | Proposal 2. And if understand correctly the purpose of this discussion is to decide whether global requirements/regulations need to be considered, if it is then the usual approach can be applied, i.e. NS based. |
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### Sub-topic 1-2: Scope and configurations

***Issue 1-2-1: Layer number and ULFPTx mode 1 configurations***

* Proposal 1: (vivo, R4-2216115)
	+ 1-layer configuration is used for ULFPTx mode 1 in the 1st stage.
	+ Using the following TPMI=13 (1 layer, ) for ULFPTx mode 1 verification.
* Proposal 2: 4Tx capable UE only need to meet requirement for 4Layer UL MIMO and single antenna port. The 2Layer UL MIMO can be supported by UE but no need to be tested similar as handling of 3Layer UL MIMO where RAN1 support this feature but no requirement in RAN4. (OPPO, [R4-2216436](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216436.zip))
* Proposal 3: 1/2/3 layer cases are considered for ULFPTx mode 1. (Huawei, draft CR R4-2216674)

***Moderator’s recommendation:***

* Recommended WF
	+ 1-layer configuration is considered for ULFPTx mode 1 and using the following TPMI=13 (1 layer, )
	+ FFS whether consider 2/3 layer case for ULFPTx mode 1.

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| **Company** | **Comments** |
| OPPO | To clarify, the proposal 2 is not for ULFPTx mode 1, it is a general discussion of fallback from 4Layer to 3Layer, 2Layer, and 1Layer. These are all supported by 4Tx UE in RAN1 and in the field. If we omit 3Layer requirements and tests for 4Tx UE then 2Layer can also be omitted in our view. This means 4Tx UE can be tested only for 4Layer requirements (UL MIMO) and 1Layer requirements (basic requirements). |
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***Issue 1-2-2: TxD support***

* **Proposal 1:** TxD requirements shall be considered in phase 1 to support PC1.5 UE delivering the max output power. (Huawei, R4-2216673)

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | Ok with proposal 1, and if understand correctly this means UE with 4x23 will apply TxD among the 4 antennas to achieve PC1.5. |
| Skyworks | Ok with proposal 1. Our understanding is that PC1.5 with 4x23 can only be supported for all uplink physical channels using TxDiv, this justifies proposal 1. |
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***Issue 1-2-3: Power class fallback***

* Proposal 1: It is proposed to consider dual Tx PC2 requirement as the fallback requirement for 4Tx PC1.5. (Huawei, R4-2216673)

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | FFS, because when UE has 26dBm PAs then when fallback to 2T, it still can achieve PC1.5. |
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### Sub-topic 1-3: Others

***Issue 1-3-1: MPR requirements***

* **Proposal 1:** It is proposed to use MPR in Table 6.2D.2-2 as baseline to do the measurement evaluation for PC1.5 with 4Tx. (Huawei, R4-2216673)
* **Proposal 2:** (LG, R4-2215782)
	+ Consider MPR as provided in Table 3 for PC1.5 4Tx (4x23dBm) for Vehicular UE or other industrial devices with antenna isolation of 10dB.
	+ Consider MPR as provided in Table 4 for PC1.5 4Tx (4x23dBm) for CPE/FWA or other industrial devices with antennal isolation of 20dB or above.

Table 3. Proposed MPR for PC1.5 with quadruple Tx (Antenna Isolation = 10dB)

|  |  |
| --- | --- |
| Modulation | MPR (dB) |
|  | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 8.0 | ≤ 3.0 | ≤ 2.0 |
|  | QPSK | ≤ 8.5 | ≤ 3.5 | ≤ 2.0 |
|  | 16 QAM | ≤ 8.5 | ≤ 4.0 | ≤ 2.5 |
|  | 64 QAM | ≤ 8.5 | ≤ 4.7 | ≤ 4.5 |
|  | 256 QAM | ≤ 9.5 | ≤ 7.0 | ≤ 7.0 |
| CP-OFDM | QPSK | ≤ 9.5 | ≤ 5.0 | ≤ 3.5 |
|  | 16 QAM | ≤ 9.5 | ≤ 5.0 | ≤ 4.0 |
|  | 64 QAM | ≤ 9.5 | ≤ 7.0 | ≤ 7.0 |
|  | 256 QAM | ≤ 9.5 | ≤ 9.5 | ≤ 9.5 |

Table 4. Proposed MPR for PC1.5 with quadruple Tx (Antenna Isolation = 20dB)

|  |  |
| --- | --- |
| Modulation | MPR (dB) |
|  | Edge RB allocations | Outer RB allocations | Inner RB allocations |
| DFT-s-OFDM | Pi/2 BPSK | ≤ 7.5 | ≤ 1.5 | ≤ 0.5 |
|  | QPSK | ≤ 8.0 | ≤ 2.0 | ≤ 0.5 |
|  | 16 QAM | ≤ 8.0 | ≤ 2.5 | ≤ 1.5 |
|  | 64 QAM | ≤ 8.0 | ≤ 3.0 | ≤ 3.0 |
|  | 256 QAM | ≤ 8.0 | ≤ 6.0 | ≤ 6.0 |
| CP-OFDM | QPSK | ≤ 8.0 | ≤ 3.5 | ≤ 2.0 |
|  | 16 QAM | ≤ 8.0 | ≤ 3.5 | ≤ 2.5 |
|  | 64 QAM | ≤ 8.0 | ≤ 5.0 | ≤ 5.0 |
|  | 256 QAM | ≤ 8.0 | ≤ 8.0 | ≤ 8.0 |

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | For clarification of Proposal 2, if understand correctly these are simulation results then how the cross impact among PAs are modeled in the simulation? |
| Skyworks | Proposal 1 seems a good baseline to start the evaluations. We also would like to suggest evaluating what is the minimum level of antenna isolation at which the reverse IMD contribution can be neglected. If this level is, say, greater than 10 and less than 20dB, and that the value can be representative of all UE types under consideration, we could eliminate the parameter “antenna isolation” and hence produce a single set of requirements as discussed in issue 1-1-1 proposal 2. This approach could also be in-line with proposal 3 issue 1-1-1 for the example of “vehicle” (Qualcomm, R4-2215377).  |
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***Issue 1-3-2: Per-UE basis requirements*** (NTT Docomo, R4-2216158)

* **Proposal:** At least per UE basis requirements in case of 2Tx are also per UE basis in case of 4Tx.
	+ Max power/MPR/A-MPR/Pcmax/Minimum output power/Power control/OBW/OOBE/SE

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | Ok |
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***Issue 1-3-3: EVM related*** *(Lenovo,* [*R4-2216879*](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216879.zip)*)*

* **Proposal 1**: Define the EVM for 4 Tx UL MIMO transmission on a per layer basis.
* **Proposal 2**: For full-rank transmission, measure the EVM using a zero-forcing MIMO receiver.
* **Proposal 3**: For less than full-rank transmission, measure the EVM using a pseudo-inverse receiver.
* **Proposal 4**: To account for antenna correlation not observed in conductive measurements, increase the conductive EVM measurement by some fraction of the square root of the maximum combining gain so that$EVM\_{i}^{'}=EVM\_{i} ∙f ∙\sqrt{G\_{i}}$ where f is in the interval (0, 1].
* **Proposal 5**: Alternatively, in the case that increased MPR is defined for multi-antenna transmission, increase the conductive EVM measurement by $EVM\_{i}^{'}=EVM∙f∙2^{ \left({∆MPR}/{2}\right)} ,$ where f is in the interval (0, 1].

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
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***Issue 1-3-4: PC 1.5 clarification***

* **Proposal 2:** RAN4 to further discuss whether to redefine PC1.5 to be the sum of power from all PAs regardless of whether a UE supports TxD or not. (Qualcomm, R4-2215377)
* **Proposal 6:** Align the understanding that UE power class is per band defined, rather than per antenna port.(OPPO, R4-2216436)

***Moderator’s recommendation:***

* Recommended WF
	+ TBA based on 1st round discussion

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| **Company** | **Comments** |
| OPPO | Proposal 6 is our understanding, i.e. power class is per band defined. Regarding proposal 2, for clarification of the meaning that PC1.5 is defined as the sum power from all PAs? Does it mean the concurrent transmission PAs? TxD is necessary for UE achieve PC1.5 in single antenna port. |
| Skyworks | Same question for clarification than Oppo on proposal 2. |
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## Companies views’ collection for 1st round

### Open issues

Please add the comments to the respective tables in previous clause.

### 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.*

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| **CR/TP number** | **Comments collection** |
| [**R4-2216674**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216674.zip)Huawei | Company A |
| Company B |
|  |
| [**R4-2216115**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_104bis-e/Docs/R4-2216115.zip)(Annex)vivo | 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** | Sub-topic 1-1:*Tentative agreements:**Candidate options:**Recommendations for 2nd round:*Sub-topic 1-2: *Tentative agreements:**Candidate options:**Recommendations for 2nd round:*Sub-topic 1-3:*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)

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
|  |  |  |

1. Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Tdoc number** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | 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** | **Revised to** | **Title** | **Source** | **Recommendation**  | **Comments** |
| R4-22xxxxx |  | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-22xxxxx |  | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-22xxxxx |  | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |  |

Notes:

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