**3GPP TSG-RAN WG4 Meeting #107 R4-230xxxx**

**Incheon, KR, May 22nd – May 26th, 2023**

**Agenda item:** 8.16.4

**Source:** Moderator (vivo)

**Title:** Topic summary for [107][332] NR\_FR1\_TRP\_TRS\_enh

**Document for:** Information

# Introduction

This summary covers the discussions in AI 8.16, 4.6, 5.2.2 topics for Rel-18 FR1 TRP TRS WI and TRP/TRS maintenance.

# Topic #1: Anechoic Chamber (AC) test methodology

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2307243**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307243.zip) | Huawei, HiSilicon | **Observation 1:** TRP is independent of channel bandwidth.  **Observation 2**: TRS at various channel bandwidths can be scaled using the formula in Table 7.3.2-1b in TS 38.101-1.  **Proposal 1**: state in reply to GSMA LS that TRP is independent of channel bandwidth and TRS values at various channel bandwidth can be scaled from that at a given channel bandwidth using Table 7.3.2-1b in TS 38.101-1. |
| [**R4-2307245**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307245.zip) | Huawei, HiSilicon | **Observation 1**: TRP is independent of destructive or constructive interaction between radiated energy from the two antennas in TxD.  **Observation 2**: The main source of uncertainty in TRP measurement under TxD is the phase difference variation over the measurement period.  **Proposal 1**: TRP measurement under TxD can be made using existing test procedure with variation due to phase drift over the measurement period accounted for in MU.  **Observation 3**: Option 3 and option 3a are essentially the same in terms of measurement time.  **Observation 4**: Option 2 and 4 give optimistic assessment while attempt to reflect the beam characteristics from precoding vectors.  **Observation 5**: TRP is not a suitable metric for UL MIMO with TPMI 2-5.  **Proposal 2**: measure and list UL MIMO TRP(TPMI i=2,3,4,5) separately without further processing them.  **Proposal 3**: use CA configurations in TS 38.521-1 regardless of MPR=0 or not as non-zero MPR reflects field conditions.  **Proposal 4**: include dual Tx configurations in CA tests  **Proposal 5**: limit the scope of CA tests to two UL and two DL CA combinations.  **Proposal 6**: Review and endorse the CA test procedure in Appendix of R4-2307245. |
| [**R4-2307936**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307936.zip) | Samsung | **Observation 1: legacy TRP concept was defined as an enhancement with active test to address the practical antenna radiation efficiency when non-idealities such as mismatch and losses in the antenna are taken into account.**  **Observation 2: In existing specifications and regulations, TRP is based on static radiation pattern in practice.**  **Proposal 1: TRP definition in FR1 TRP TRS should avoid inconsistency with FR2 TRP practice**  **Proposal 2: ‘TRP’ term if using alone should be based on static radiation pattern, which should be the basis of Rel-18**  **Proposal 3: If TRP variant for dynamic radiation pattern would be introduced, a full name like ‘combined TRP’ or ‘envelop TRP’ and so on should be used without omitting, which can be further discussed in future release**  Based on above proposals, our consideration for TRP of multi-antenna UE can be summarized as below table   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Multi-TX scenarios** | **Legacy TRP** | | **Envelop combined TRP** | | | **TAS** | TRP = max (TRP1, TRP2) | TAS off | Can be defined in future | TAS on | | **TxD** | To be defined in R18 | Test mode | Can be defined in future | TxD on | | **UL MIMO** | To be defined in R18 | TPMI index 2 | Can be defined in future | Dynamic TPMI | | **FR2** | TRP with fixed beam | Beam locked | Out of scope | Beam unlocked |   **Observation 3: both theory and measurement demonstrate that it is not necessary to test all TPMIs.**  **Proposal 4: adopt fixed TPMI index = 2 for single layer UL MIMO TRP test in Rel-18**  **Observation 4: TRP of TxD on mode is not legacy TRP but dynamic TRP due to potential phase variation versus direction.**  **Proposal 5: Apply test mode to disable phase variation versus direction for simultaneous 2Tx TRP test of TxD UE in Rel-18** |
| R4-2308250 | vivo | Reserved for TR v0.4.0 |
| [**R4-2308251**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308251.zip) | vivo | ***TP to TR 38.870 on supplement of coordinate system and phantom definition***  *(moderator: based TP work split, the coordinate system part in this TP can be removed)* |
| [**R4-2308252**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308252.zip) | vivo | **Proposal 1: The following aspects for TRP/TRS should be confirmed:**   * **TRP/TRS can be applied to multi-antennas (multi-elements)** * **Current TRP/TRS requirement is average of 6 cases (Left low/mid/high and Right low/mid/high), which presents the UE “averaged” radiated performance.**   **Proposal 2: The test method for TxD and RxD should be the same, with all the active antenna ON, without additional settings.**  **Proposal 3: It is reasonable to average multiple TRP values with different TPMI index to show the averaged radiated performance of UE configured under UL-MIMO condition.**  **Proposal 4: The test method can be different for different UE capability, e.g., if the UE only support TPMI 2, then just single test with TPMI index 2. If the UE can support the full set of TPMI index, the averaged-TRP measured with each TPMI is needed.**  **Proposal 5: Traditional averaged-TRP approach is a more proper way to specify minimum OTA requirements, this new averaged spherical coverage (option 2) for FR1 can be slelected as an informative test method listed in the TR.**  **Proposal 6:** **Test procedure similar to EN-DC TRP/TRS test can be adopted for FR1 2-band CA.**  **Observation 1: In LTE phase, the selected 10MHz and 20MHz CBWs for OTA performance testing are either mid CBW or highest CBW of each band.**  **Observation 2: For NR, the CBW has been increased greatly, follow the similar logic, it is reasonable to select also mid or highest CBW for each band.**  **Observation 3: RAN4 agreed the default channel bandwidth for TRP/TRS OTA testing as the Mid CBW, which is mainly to align the test parameters between RF conducted MOP (Maximum output power) /REFSENS (Reference sensitivity) and OTA TRP/TRS.**  **Proposal 7: Keep current test parameters for TRP and TRS OTA testing, to ensure that the output power and sensitivity performance for conducted testing and radiated testing in 3GPP are performed with the same testing parameters.**  **Proposal 8: To meet industry interests on narrow OTA bandwidth, RAN4 can add an additional set of test parameters for NR bands in the Annex part of TR 38.870 for information.**  **Proposal 9: Clarification feedback from GSMA on more technical background on selecting narrow CBW for wide NR bands is needed.** |
| [**R4-2308255**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308255.zip) | vivo | *Draft Reply LS to GSMA TSGAP on NR Bandwidth for OTA TRS testing* |
| [**R4-2308366**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308366.zip) | MediaTek Inc. | **Observation 1: Two observations in [2] are verified again by simulations and there is no mismatch between the average of 2TX TRP values and the sum of TRP values of two single antennas.**  **Observation 2: Simulation shows that the maximum 2TX TRP deviations and the ECC follow almost the same trend, they are closedly related.**  **Observation 3: ECC with value larger than 0.3 may correspond to up to 2dB 2TX TRP deviation.**  **Proposal: RAN4 to use average of 2TX TRP values to represent the TRP for one-layer UL MIMO with TPMI 2-5, preferably 2 TRP values from one pair TPMIs (TPMI 2/3, or TMPI 4/5) if considering the testing time.** |
| [**R4-2308977**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308977.zip) | OPPO | ***Proposal 1: Option 3/3a is the preferable option for one-layer UL MIMO TRP test.***  ***Proposal 2: Option 1 is the only choice for non-coherent UE supporting uplink full power transmission.*** |
| [**R4-2308981**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308981.zip) | OPPO | ***Proposal: It is proposed to update the WID with down-scoping the CA test methodology from the WI objectives, and submit the updated WID in RAN #100 meeting for RAN approval.*** |
| [**R4-2308982**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308982.zip) | OPPO | TP to TR 38.870 on Annex A: Reference coordinate system |
| [**R4-2309013**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309013.zip) | Xiaomi | **Observation 1: the nature way is to test all the TRP for each fixed TPMI index and define different requirements, it is however not efficient from both nomotive work and testing perspective.**  **Observation 2: option 1 and option 3 do not violate the current definition of TRP.**  **Observation 3: if option 3 is selected, a new TPR concept is needed and the test uncertainty would be greater than other options.** |
| [**R4-2309055**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309055.zip) | Apple | **Observation 1:** **The swept TPMI approach of calculating TRP for the coherent MIMO and non-coherent MIMO codebooks (Cases 1 and 2) demonstrates additional gains due to constructive superposition of signals.**  **Observation 2:** **The case of fixed TPMI=2 exceeds the single antenna radiated output power baseline but falls short of the simple power gain target without pattern superposition.**  **Observation 3:** **The difference between Case 1 and Case 3 of ~[3.5 to 2.6] dB represents the potential underestimation of the UE’s ability to deliver power to the gNB, if a UE capable of coherent MIMO were verified using the fixed TPMI approach.**  **Observation 4:** **A frequency-dependent fluctuation in TRP results is observed for both Case 2 and Case 3. Since both schemes are suboptimal ways to combine transmitted signals, these results point to the performance gap between coherent MIMO and other schemes.**  **Observation 5:** **Considering only a subset of the TPMIs (either the 2,3 pair or the 4,5 pair) results in a lower TRP metric when compared to the full coherent MIMO codebook, since these restricted modes fail to optimize the UE’s radiated response in all directions.**  **Observation 6:** **In a practical smartphone implementation, non-ideal antenna patterns, mutual coupling effects, and phase difference/flucturation between the Tx paths yield unique radiated patterns for each TPMI and invalidate any claims of equivalence or substitution among the TPMI pairs of {2,3} and {4,5}.**  **Proposal 1:** **RAN4 should de-prioritize the fixed TPMI option (Option 1) from further consideration of the radiated output power test method for UL MIMO devices.**  **Proposal 2:** **RAN4 should define the UL MIMO TRP metric as the surface integral of measured EIRP, given TPMI is swept over all applicable TPMI according to the UE capability, and EIRP is selected as the maximum (Option 2).**  **Proposal 3:** **The proposed metric to define TRP for one-layer UL MIMO with TPMI 2-5 as the average of two TRP values with TPMI 2 and 3, or 4 and 5 is applicable only to the hypothetical scenario of 2Tx with ideal dipoles and is not applicable to practical UE implementations.** |
| [**R4-2309056**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309056.zip) | Apple | **Observation 1:** **Destructive superposition of transmitted signals with the TxD scheme impacts the received signal at gNB (in the field) and at the test receiver (during the OTA test). Since TxD is a transmparent scheme, there is no mechanism for the network to configure the UE with a preferred transmit precoding matrix to overcome this challenge.**  **Observation 2:** **It may not be feasible to overcome the destructive superposition problem for TxD UEs within the scope of existing UE configurations and test methods.**  **Proposal 1:** **RAN4 should determine how to resolve the destructive superposition problem associated with testing radiated output power of TxD UEs before making any further conclusions related to the TxD radiated output power method. If this issue cannot be resolved, then the radiated output power requirement for TxD UEs might not be a feasible requirement to define.**  **Proposal 2:** **RAN4 should consider defining TRP for TxD devices based on measurements of TRP per antenna and summed up as a post-processing steps. A new test mode may be necessary to achieve this.**  **Proposal 3:** **RAN4 should introduce the 20 MHz TRS requirement for n78 by rescaling the existing value. An applicability rule should be included in TS38.161 to consider this requirement fulfilled if the UE is verified based on the existing 100 MHz CBW configuration.**  **Proposal 4:** **RAN4 should consider the GSMA 10 MHz CBW request for n28 when developing the related requirements. Similarly to Proposal 2, 3GPP should derive the n28 requirement based on measurements according to the existing CBW and then include an applicability rule for the scaled TRS requirement for 10 MHz.** |
| [**R4-2309243**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309243.zip) | Qualcomm Incorporated | **Proposal 1: RAN4 should not change the traditional TRP definition when defining UL MIMO radiated output power requirement to avoid confusion.**  **Proposal 2: For the non-coherent UL MIMO, option 1 is selected as the baseline.**  **Proposal 3: For the coherent UL MIMO, option 3a is selected as the baseline.** |
| [**R4-2309354**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309354.zip) | CAICT | **Proposal 1: For coherent UE, consider option 3/3a as baseline method, i.e., define TRP for one-layer UL MIMO as the average of TRP values corresponding to at least two selected TPMI indexes (2/3 or 4/5 or 2/3/4/5).**  **Proposal 2: Further discussion is needed on the single-layer UL MIMO TRP test method applicable to non-coherent UE.**  **Proposal 3: Include option 2 in the annex of the TR for information purpose only.** |
| [**R4-2309057**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309057.zip) | Apple | **Proposal 1: With significant technical work remaining before the prioritized core objectives of the Rel-18 TRP/TRS work item can be concluded, and with no recent progress on CA methodology apparent, it is reasonable to remove the scope for CA methodology for TRP/TRS methodology.** |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

### Sub-topic 1-1 NR bandwidth for TRP/TRS OTA testing (GSMA LS)

**Issue 1-1-1: How to address GSMA request on NR channel bandwidth for test and requirements**

* Proposals
  + Proposal 1: state in reply to GSMA LS that TRP is independent of channel bandwidth and TRS values at various channel bandwidth can be scaled from that at a given channel bandwidth using Table 7.3.2-1b in TS 38.101-1. (Huawei)
  + Proposal 2: RAN4 should introduce the 20 MHz TRS requirement for n78 by rescaling the existing value. An applicability rule should be included in TS38.161 to consider this requirement fulfilled if the UE is verified based on the existing 100 MHz CBW configuration. (Apple)
  + Proposal 3: RAN4 should consider the GSMA 10 MHz CBW request for n28 when developing the related requirements. Similarly to Proposal 2, 3GPP should derive the n28 requirement based on measurements according to the existing CBW and then include an applicability rule for the scaled TRS requirement for 10 MHz. (Apple)
  + Proposal 4: Keep current test parameters for TRP and TRS OTA testing, to ensure that the output power and sensitivity performance for conducted testing and radiated testing in 3GPP are performed with the same testing parameters. To meet industry interests on narrow OTA bandwidth, RAN4 can add an additional set of test parameters for NR bands in the Annex part of TR 38.870 for information. (vivo)
* Recommended WF
  + TBA

**Issue 1-1-2: If Rel-17 10MHz/20MHz requirements are scaled from 100MHz requirement, how to define corresponding 10MHz/20MHz test parameters**

* Proposals
  + Option 1: If the CBW is scale to 10/20MHz for each band requirement, then the corresponding test parameters (i.e., low/mid/high test frequency unchanged, but using new UL/DL RB allocations) should be added in TR/TS. (moderator)
  + Option 2: Just scale the requirements, but not define corresponding test parameters. (moderator)
* Recommended WF
  + O1 or O2

**Issue 1-1-3: If both 100MHz and 10/20MHz requirements are in the TR/TS, how to define the requirement applicability**

* Proposals
  + Option 1: Current test parameters and requirements as normative specification for 3GPP RAN4 requirements and RAN5 conformance testing. New requirements and CBW (scaled) as informative Annex in TR and TS. (moderator)
  + Option 2: others
* Recommended WF
  + TBA

**Issue 1-1-4: Whether clarification question should be mentioned in the reply LS to GSMA**

* Proposals
  + Option 1: Clarification feedback from GSMA on more technical background on selecting narrow CBW for wide NR bands is needed. (vivo)
  + Option 2: No.
* Recommended WF
  + TBA

### Sub-topic 1-2 Single-layer UL-MIMO TRP test method

*Moderator: In TS 38.212, for non-coherent UE, TPMI index 2 can be supported if fullpowerMode1 is supported. For fully coherent UE, all the TPMI 2~5 can be supported.*

*Table 7.3.1.1.2-5: Precoding information and number of layers or Second Precoding information, for 2 antenna ports, if transform precoder is enabled and ul-FullPowerTransmission is not configured or configured to fullpowerMode2 or configured to fullpower, or if transform precoder is disabled, maxRank = 1, and and ul-FullPowerTransmission is not configured or configured to fullpowerMode2 or configured to fullpower*

|  |  |  |  |
| --- | --- | --- | --- |
| *Bit field mapped to index* | *codebookSubset = fullyAndPartialAndNonCoherent* | *Bit field mapped to index* | *codebookSubset = nonCoherent* |
| *0* | *1 layer: TPMI=0* | *0* | *1 layer: TPMI=0* |
| *1* | *1 layer: TPMI=1* | *1* | *1 layer: TPMI=1* |
| *2* | *1 layer: TPMI=2* |  |  |
| *3* | *1 layer: TPMI=3* |  |  |
| *4* | *1 layer: TPMI=4* |  |  |
| *5* | *1 layer: TPMI=5* |  |  |
| *6-7* | *reserved* |  |  |

*Table 7.3.1.1.2-5A: Precoding information and number of layers, for 2 antenna ports or Second Precoding information, if transform precoder is enabled and ul-FullPowerTransmission = fullpowerMode1, or if transform precoder is disabled, maxRank = 1, and ul-FullPowerTransmission = fullpowerMode1*

|  |  |
| --- | --- |
| *Bit field mapped to index* | *codebookSubset= nonCoherent* |
| *0* | *1 layer: TPMI=0* |
| *1* | *1 layer: TPMI=1* |
| *2* | *1 layer: TPMI=2* |
| *3* | *Reserved* |

*Besides, in the agreed WF, 4 options for 1-layer UL-MIMO test method discussion:*

***TPMI-index configuration for singe-layer UL-MIMO TRP OTA test***

* + *Option 1: Surface integral of measured EIRP, given fixed TPMI = 2 (NOTE: this metric is TRP-like if normalized by the radiated power of an ideal isotropic radiator)*
  + *Option 2: Surface integral of measured EIRP, given TPMI is swept over all applicable TPMI according to the UE capability, and EIRP is selected as the maximum.*
  + *Option 3: Surface integral of measured EIRP for each TPMI swept over all applicable TPMI according to the UE capability to obtain TRP-like metric for each TPMI and then average the TRP-like metrics.* 
    - *Option 3a: Define TRP for one-layer UL MIMO with TPMI 2-5 as the average of two TRP values with TPMI 2 and 3, or 4 and 5.*
  + *Option 4: Spherical coverage CDF of measured EIRP, given TPMI is swept over all applicable TPMI according to the UE capability, and EIRP is selected as the maximum.*

**Issue 1-2-1: For non-coherent UE support fullpowerMode1 just single TPMI index 2**

* Proposals
  + Option 1: Given only TPMI index 2 is supported, the test procedure should follow single-TPMI based test method, i.e. TPMI index 2 TRP testing.
  + Option 2: other
* Recommended WF
  + Option 1

*Moderator: for UE supporting multi-TPMI, companies share quite diverged views on 1-layer UL-MIMO test method and performance metric. All the related proposals are re-summarized by moderator instead of listing each one separately, aim to accelerate the discussions.*

*Besides, for legacy TRP, the final performance metric for RAN4 requirement is averaged TRP from 6 different TPP patterns, in TS 38.161.*

**Issue 1-2-2: For fully Coherent UE support multiple TPMI index 2~5**

* New summarized Proposals
  + Option 1: multi-TPMI based test method
    - Option 1a: measure TRP under each TPMI, and then average TRPs as final performance metric. FFS TPMI index: TPMI 2~5 or 2&3 or 4&5;
    - Option 1b: measure TRP under each TPMI with index 2~5, no further processing. How to define requirement is FFS.
    - Option 1c: measure and record best EIRP at each test point (swept over all applicable TPMIs at each measurement grid), and then integrate all the measured best EIRPs into a TRP-like performance metric. TPMI index 2~5;
  + Option 2: single-TPMI based test method
    - Option 2a: measure TRP under TPMI index 2, as the final performance metric;
    - Option 2b: measure TRP under one of TPMI index within 3~5, as the final performance metric;
* Recommended WF
  + Down-selection

**Issue 1-2-3: Naming of the performance metric for above Option 1a in multi-TPMI based test method**

* Proposals
  + Option 1: Yes. Use a new name, e.g., combined-TRP.
  + Option 2: No. Existing TRP requirement is the averaged TRP. Use current in TS 38.161 is sufficient.
* Recommended WF
  + O2

**Issue 1-2-4: Naming of the performance metric for above Option 1c in multi-TPMI based test method**

* Proposals
  + Option 1: Yes. Use a new name, e.g., FR1 averaged spherical coverage.
  + Option 2: other
* Recommended WF
  + TBA

### Sub-topic 1-3 TxD test method

*Moderator: it was agreed 2Tx simultaneously is the first priority for 2Tx TRP testing.*

**Issue 1-3-1: TxD test procedure for 2Tx simultaneously (2Tx-based TxD)**

* New summarized Proposals
  + Option 1: TRP measurement under 2Tx-based TxD can be made using existing test procedure. Similar to current 4Rx-based TRS measurement procedure in TS 38.161 with 4 antennas activated to support RxD.
  + Option 2: other
* Recommended WF
  + O1

**Issue 1-3-2: TxD phase shift issue for 2Tx-based TxD**

* Proposals
  + Option 1: A new 2Tx test mode can resolve/stabilize potential 2Tx-based TxD phase variation.
  + Option 2: A new 2Tx test mode can not resolve/stabilize the phase variation, given this could be physical basis of some TxD implementation approaches. Similar to RxD, no test mode is needed currently.
* Recommended WF
  + O2

**Issue 1-3-3: If 2Tx-based TxD power variation is not resolved fundamentally, how to consider this impact**

* Proposals
  + Option 1: A MU element and additional TT for 2Tx-based TxD test case.
  + Option 2: No new MU element is needed, similar to RxD test case.
  + Option 3: new test procedure to ensure a more statistical TxD measurement, e.g. define a min. EIRP averaging time.
* Recommended WF
  + TBA

**Issue 1-3-4: TxD test procedure for 1Tx-based TxD measurement**

* Proposals
  + Option 1: RAN4 confirm that 2Tx-based testing for TxD can not be achieved. 1Tx-based measurement with a new 1Tx-based test mode is a must.
  + Option 2: Keep 1Tx-based TxD measurement as low priority.
* Recommended WF
  + O2

**Issue 1-3-5: If Option 1 in Issue 1-3-4 is confirmed. What would be Test mode target for 1Tx-based TxD measurement**

* Proposals
  + Option 1: 1Tx-based Test mode should ensure TxD operation state but with 1Tx power radiated from single antenna each time.
  + Option 2: other
* Recommended WF
  + TBA

**Issue 1-3-6: Naming of the performance metric for 2Tx-based TxD measurement**

* Proposals
  + Option 1: For 2Tx-based TxD, same as RxD, use current TRP.
  + Option 2: new name, e.g. combined-TRP.
* Recommended WF
  + O1

**Issue 1-3-7: Naming of the performance metric for 1Tx-based TxD measurement**

* Proposals
  + Option 1: For 1Tx-based TxD, use current TRP.
  + Option 2: new name, e.g. sum-TRP.
* Recommended WF
  + O2

### Sub-topic 1-4 CA test method

*Moderator: in the WID, the CA test configuration for Rel-18 is limited as 2DL/2UL cases:*

* *Independent measurements of each CC can be the baseline approach*
* *Limited to Inter-band CA with up to 2DL/2UL cases*

**Issue 1-4-1: CA test parameters**

* Proposals
  + Option 1: use CA configurations in TS 38.521-1 regardless of MPR=0 or not as non-zero MPR reflects field conditions.
  + Option 2: other
* Recommended WF
  + TBA

**Issue 1-4-2: CA test case scope**

* Proposals
  + Proposal 1: limit the scope of CA tests to two UL and two DL CA combinations. Include 2Tx configurations in CA test.
* Recommended WF
  + TBA

**Issue 1-4-3: CA test procedure**

* Proposals
  + Proposal 1: Review and endorse the CA test procedure in Appendix of R4-2307245.
  + Proposal 2: Test procedure similar to EN-DC TRP/TRS test can be adopted for FR1 2-band CA.
* Recommended WF
  + TBA

**Issue 1-4-4: general for CA test method**

* Proposals
  + Proposal 1: down-scoping the CA test methodology.
* Recommended WF
  + TBA

# Topic #2: Reverberation Chamber (RC) test methodology

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307247 | EMITE, BlueTest, Huawei, HiSilicon | TP for CBW and spatial uniformity test procedures in TR38.870 |
| R4-2308253 | vivo | **Observation 1:** There is no clear trends for 50MHz and 100MHz TRS comparison between AC and RC with different coherent bandwidth. Gap between AC and RC results are small, i.e. within 1dB.  **Observation 2:** Increasing the coherence bandwidth of RC larger than 2MHz does not provides much difference.  **Proposal 1: RAN4 should confirm at least 2MHz coherence bandwidth of RC system is sufficient for NR FR1 measurement.**  **Proposal 2: Encourage companies to provide more measurement or analysis to confirm 5 time of SCS is sufficient for NR FR1.**  **Proposal 3: RC harmonization test scope should consider both Rel-17 and Rel-18, i.e. at least browsing mode and talk mode at band n28 and n78.**  **Proposal 4: Collect and confirm the volunteered test labs for harmonization activity:**   * Confirm the following volunteer labs for Rel-18 RC harmonization activity.  |  |  |  | | --- | --- | --- | | **Volunteer lab** | **City** | **Contact** | | vivo | Dongguan, Guangdong | ruixin. wang@vivo.com | | *To be added* |  |  | |  |  |  | |  |  |  | |  |  |  |   **Note** that the volunteered test lab for harmonization activity just needs to provide RC measurement results. |
| [**R4-2309355**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309355.zip) | CAICT | **Proposal 1: RAN4 should update the work plan or provide a schedule for AC lab alignment, RC lab alignment, RC and AC harmonization and performance test campaigns based on the current progress of Rel-18 TRP TRS WI.**  **Proposal 2:** **RAN4 should conclude the detailed framework for RC harmonization activity before RAN4#108.**  **Proposal 3: The volunteer labs should use the same method, such as measurement grids and TRP TRS summation form, as the test campaign phase to carry out lab alignment activities.** |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

### Sub-topic 2-1 RC test method

**Issue 2-1-1: CBW and spatial uniformity test procedures**

* Proposals
  + Proposal 1: Check and endorse the TP in R4-2307247.
* Recommended WF
  + TBA

**Issue 2-1-2: Coherence bandwidth of RC**

* Proposals
  + Proposal 1: RAN4 should confirm at least 2MHz coherence bandwidth of RC system is sufficient for NR FR1 measurement.
  + Proposal 2: Encourage companies to provide more measurement or analysis to confirm 5 time of SCS is sufficient for NR FR1.
* Recommended WF
  + TBA

### Sub-topic 2-2 Harmonization and lab alignment activity for RC

**Issue 2-2-1: RC harmonization and alignment scope**

* Proposals
  + Proposal 1: RC harmonization test scope should consider both Rel-17 and Rel-18, i.e. at least browsing mode and talk mode at band n28 and n78.
* Recommended WF
  + TBA

**Issue 2-2-2: Rel-18 RC harmonization test labs**

* Proposals
  + Proposal 1: Collect and confirm the volunteered test labs for harmonization activity:
    - Confirm the following volunteer labs for Rel-18 RC harmonization activity.

|  |  |  |
| --- | --- | --- |
| **Volunteer lab** | **City** | **Contact** |
| vivo | Dongguan, Guangdong | ruixin. wang@vivo.com |
| *To be added* |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

**Note** that the volunteered test lab for harmonization activity just needs to provide RC measurement results.

* Recommended WF
  + Collect interested test labs for Rel-18 activity

**Issue 2-2-3: RC harmonization timeline**

* Proposals
  + Proposal 1: RAN4 should conclude the detailed framework for RC harmonization activity before RAN4#108.
* Recommended WF
  + TBA

# Topic #3: Testing time reduction and MU update

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2308824**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308824.zip) | MVG Industries | TP to TR 38.870 on measurement grids related aspects |
| **[R4-2309231](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309231.zip)** | MVG Industries | Text proposal on MU for measurement grids |
| [**R4-2309288**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309288.zip) | ROHDE & SCHWARZ | **Observation 1:** traditional Fast TRS methods based on RSS (e.g. RSRP for NR) cannot be used for devices implementing Rx Diversity.  **Observation 2:** separate TRS testing per receiver based on RSS is unpractical.  **Proposal 1:** approve the usage of Fast TRS method based on RSRPB as described in section 3. |
| R4-2309289 | ROHDE & SCHWARZ | Reserved for RAN5 outcome |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

### Sub-topic 3-1 Measurement grid reduction for AC method

**Issue 3-1-1: measurement Grid update for TR 38.870**

* Proposals
  + Proposal 1: check and endorse the TP in R4-2308824 for TR 38.870 update.
* Recommended WF
  + TBA

**Issue 3-1-2: MU for measurement grid update for TS 36.161**

* Proposals
  + Proposal 1: check and endorse the Text Proposal in R4-2309231for TS 38.161 update.
* Recommended WF
  + TBA

### Sub-topic 3-2 Test time reduction solutions

**Issue 3-2-1: Fast TRS method**

* Proposals
  + Proposal 1: approve the usage of Fast TRS method based on RSRPB as described in section 3 of R4-2309288.
* Recommended WF
  + TBA

# Topic #4: Rel-18 TRP TRS requirements

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2308256**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308256.zip) | vivo | **Proposal 1: Collect and confirm the following volunteered test labs for Rel-18 Anechoic Chamber lab alignment activity for head and hand scenario (talk mode).**   * Confirm the following volunteer labs for Rel-18 RC harmonization activity.  |  |  |  | | --- | --- | --- | | **Volunteer lab** | **City** | **Contact** | | vivo | Dongguan, Guangdong | ruixin. wang@vivo.com | | *To be added* |  |  | |  |  |  | |  |  |  | |  |  |  |   **Proposal 2: Rel-17 and Rel-18 anechoic chamber lab alignment outcome should be recorded in the TR with a dedicated Annex part, for information.**  **Proposal 3: RAN4 needs feedback from operators on which bands are urgent in Rel-18 phase.** |
| [**R4-2308257**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308257.zip) | vivo,CTIA Certification | TP on forearm phantom |
| [**R4-2309057**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309057.zip) | Apple | **Observation 1:** **It is now clarified that both PC2 and PC3 requirements are needed in bands where PC2 is defined; however, in Rel-17 only PC2 TRP requirements were specified for bands n41 and n78. The objective to specify PC3 TRP requirements for these bands needs to be added to the Rel-18 WID.**  **Observation 2:** **It is now clarified that RAN4 will specify both browsing and talk mode requirements per band; however, in Rel-17 only browsing mode requirements were specified for bands n41 and n78. The objective to specify talk mode OTA requirements for these bands needs to be added to the Rel-18 WID.**  **Observation 3:** **Lab alignment procedures and performance requirement work for band n28 did not conclude in the Rel-17 work item, and OTA requirements for this band need to be defined in Rel-18.**  **Observation 4:** **As recommended by RAN4, RedCap requirement work needs to be postponed to a future release of the TRP/TRS work due to the lack of availability of RedCap devices for measurement.**  **Observation 5:** **Disclosing the number of models tested by the labs is not feasible to implement, since it would require the disclosure of exact device model lists tested in each lab.**  **Observation 6:** **It is feasible for the neutral party to summarize the number of vendors per lab, without disclosing the vendor names, in a report to 3GPP.**  **Observation 7:** **It is feasible for the neutral party to summarize the percentage of tested devices per vendor, without disclosing the device model and vendor names, in a report to 3GPP. Only the complete list to be shared publicly (no per lab list or information).**  **Observation 8:** **It is feasible for the neutral party to summarize the percentage of models per production year, without disclosing the device model and vendor names, in a report to 3GPP. Only the complete list to be shared publicly (no per lab list or information).**  **Observation 9:** **Power class information is already provided in the lab reports as part of the performance requirement framework, and it is not necessary to additionally collect this information via the neutral party.**  **Proposal 2:** **The Rel-18 TRP/TRS work item shall aim to complete full coverage of band n28, n41, and n78 requirements, including performance objectives which were not concluded in Rel-17, and it shall also aim to define requirements for band n77.**  **Proposal 3:** **RAN4 should reach a decision on the exact scope of the performance phase of the Rel-18 TRP/TRS activities in order to allow lab alignment and measurement campaigns to proceed without delay.**  **Proposal 4:**  **Update the Rel18 TRP TRS Work Plan [4] with details on lab alignment framework and focus over next two RAN4 meetings.**  **Proposal 5:** **RAN4 should continue to use the same neutral observer for the collection of additional device pool information for the Rel-18 OTA data as it had already been agreed to do for the Rel-17 OTA data.**  **Proposal 6:** **It is proposed to continue to use the Rel-17 Template for Device Information Collection in the development of Rel-18 OTA requirements without any further modification.** |
| [**R4-2309350**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309350.zip) | TELECOM ITALIA S.p.A. | ***Observation 1: The statistical sample set must be sufficiently representative of the market status/devices present in the network. Therefore, a comprehensive set of information describing the statistical sample is necessary to evaluate its validity.***  ***Proposal 1: It is proposed to consider the following information in the framework of the performance part:***   * ***Total number of devices*** * ***Total number of models*** * ***Total number of devices’ vendors*** * ***Percentage of devices per vendor*** * ***Percentage of devices per Power Class*** * ***Percentage of devices per each supported band*** * ***Percentage of devices per year of production*** * ***Percentage of the devices that are certified by PTCRB and GCF*** * ***Percentage of the devices per market segment (i.e. low, mid or high)*** * ***Percentage of devices that are commercially available***   ***Proposal 2: It is proposed to include the following fields in the datasheet that will be provided to the laboratories for collecting the measurement results:***   * ***Device model*** * ***Device vendor*** * ***Power Class*** * ***Supported bands*** * ***Year of production*** * ***Device certification (PTCRB, GCF, N/A)*** * ***Market segment (low, mid or high)*** * ***Commercially available (YES or NO)***   ***Observation 2: Sensitive information cannot be disclosed to the RAN4 group. An appropriate methodology and a trusted third party need to be defined to collect and manage the device data.***  ***Proposal 3: It is proposed that RAN4 Secretary will cover the role of the trusted third party to collect the measurements results provided by the laboratories and forward them to the RAN4 group after anonymizing the sensitive data***  ***Proposal 4: It is proposed that each device model will be identified by a generic label, e.g. “Model A”, “Model B”, etc. If different laboratories will measure the same device model (not necessarily the same physical device), this will be anyway identified under the same label. For example, with reference to Proposal 1, 4 devices of the same model will count as 4 measured devices and 1 measured model.***  ***Proposal 5: The information reported in the Proposal 1 will be provided by the WI rapporteur together with the curves analysis of the measurements results.***  ***Proposal 6: It is proposed to adopt the following thresholds to be satisfied for the statistical relevance validation of the measurement campaign:***   * ***Total number of devices: >= 50*** * ***Total number of models: >= 40*** * ***Total number of devices’ vendors: >=5*** * ***Percentage of devices per vendor: [>= 10%]*** * ***Percentage of devices per Power Class: TBD*** * ***Percentage of devices per each supported band: TBD*** * ***Percentage of devices per year of production: from second-half 2021 to 2023, percentage TBD*** * ***Percentage of the devices that are certified by PTCRB and GCF: 100%*** * ***Percentage of the devices per market segment (i.e. low, mid or high): TBD*** * ***Percentage of devices that are commercially available: 100%***   ***Proposal 7: It is proposed to adopt sections 2.1, 2.2 and 2.3 also for the performance part framework of the MIMO OTA enhancement WI.*** |
| [**R4-2309355**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2309355.zip) | CAICT | **Proposal 1: RAN4 should update the work plan or provide a schedule for AC lab alignment, RC lab alignment, RC and AC harmonization and performance test campaigns based on the current progress of Rel-18 TRP TRS WI.**  **Proposal 2: RAN4 should conclude the detailed framework for RC harmonization activity before RAN4#108.**  **Proposal 3: The volunteer labs should use the same method, such as measurement grids and TRP TRS summation form, as the test campaign phase to carry out lab alignment activities.**  **Observation 1: The gap between the maximum output power that PC2 and PC3 UEs can achieve is less than 3dB.**  **Proposal 4: After specifying the PC2 requirements based on measurement campaign, RAN4 can consider to specify the PC3 requirement for that band, based on the [2]dB offset. Further refinement based on measurement results is not precluded.** |

## Open issues summary

### Sub-topic 4-1 Rel-18 AC lab alignment activity

**Issue 4-1-1: Test lab information collection and confirmation**

* Proposals
  + Proposal 1: Collect and confirm the following volunteered test labs for Rel-18 Anechoic Chamber lab alignment activity for head and hand scenario (talk mode).
    - Confirm the following volunteer labs for Rel-18 RC harmonization activity.

|  |  |  |
| --- | --- | --- |
| **Volunteer lab** | **City** | **Contact** |
| vivo | Dongguan, Guangdong | ruixin. wang@vivo.com |
| *To be added* |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

* Recommended WF
  + Collect and confirm in this meeting

**Issue 4-1-2: Timeline and workplan for Rel-18 AC lab alignment activity**

* Proposals
  + Proposal 1: Update the Rel18 TRP TRS Work Plan [4] with details on lab alignment framework and focus over next two RAN4 meetings.
  + Proposal 2: RAN4 should update the work plan or provide a schedule for AC lab alignment, RC lab alignment, RC and AC harmonization and performance test campaigns based on the current progress of Rel-18 TRP TRS WI.
* Recommended WF
  + TBA

**Issue 4-1-3: How to manage outcome of lab alignment activity**

* Proposals
  + Proposal 1: Rel-17 and Rel-18 anechoic chamber lab alignment outcome should be recorded in the TR with a dedicated Annex part, for information.
* Recommended WF
  + TBA

**Issue 4-1-4: update of working procedure for lab alignment activity**

* Proposals
  + Proposal 1: The volunteer labs should use the same method, such as measurement grids and TRP TRS summation form, as the test campaign phase to carry out lab alignment activities.
* Recommended WF
  + TBA

### Sub-topic 4-2 Rel-18 TRP TRS requirement scope

**Issue 4-2-1: Band prioritization to gather group efforts**

* Proposals
  + Proposal 1: RAN4 needs feedback from operators on which bands are urgent in Rel-18 phase.
  + Proposal 2: The Rel-18 TRP/TRS work item shall aim to complete full coverage of band n28, n41, and n78 requirements, including performance objectives which were not concluded in Rel-17, and it shall also aim to define requirements for band n77.
  + Proposal 3: RAN4 should reach a decision on the exact scope of the performance phase of the Rel-18 TRP/TRS activities in order to allow lab alignment and measurement campaigns to proceed without delay.
* Recommended WF
  + TBA

### Sub-topic 4-3 Framework for Rel-18 TRP TRS requirement

**Issue 4-3-1: Disclosed UE information (and thresholds) for Rel-18 TRP TRS requirement work**

* Proposals
  + Proposal 1: It is proposed to consider the following information in the framework of the performance part:
* ***Total number of devices***
* Total number of models
* Total number of devices’ vendors
* Percentage of devices per vendor
* Percentage of devices per Power Class
* Percentage of devices per each supported band
* Percentage of devices per year of production
* Percentage of the devices that are certified by PTCRB and GCF
* Percentage of the devices per market segment (i.e. low, mid or high)
* Percentage of devices that are commercially available
  + Proposal 2: It is proposed to include the following fields in the datasheet that will be provided to the laboratories for collecting the measurement results:
* Device model
* Device vendor
* Power Class
* Supported bands
* Year of production
* Device certification (PTCRB, GCF, N/A)
* Market segment (low, mid or high)
* Commercially available (YES or NO)
  + Proposal 3: It is proposed to adopt the following thresholds to be satisfied for the statistical relevance validation of the measurement campaign:
    - Total number of devices: >= 50
    - Total number of models: >= 40
    - Total number of devices’ vendors: >=5
    - Percentage of devices per vendor: [>= 10%]
    - Percentage of devices per Power Class: TBD
    - Percentage of devices per each supported band: TBD
    - Percentage of devices per year of production: from second-half 2021 to 2023, percentage TBD
    - Percentage of the devices that are certified by PTCRB and GCF: 100%
    - Percentage of the devices per market segment (i.e. low, mid or high): TBD
    - Percentage of devices that are commercially available: 100%
* Recommended WF
  + TBA

**Issue 4-3-2: How to differentiate the device model**

* Proposals
  + Proposal 1: It is proposed that each device model will be identified by a generic label, e.g. “Model A”, “Model B”, etc. If different laboratories will measure the same device model (not necessarily the same physical device), this will be anyway identified under the same label. For example, with reference to Proposal 1, 4 devices of the same model will count as 4 measured devices and 1 measured model.
* Recommended WF
  + TBA

**Issue 4-3-3: How to manage UE information disclosure activity for Rel-18**

* Proposals
  + Proposal 1: RAN4 should continue to use the same neutral observer for the collection of additional device pool information for the Rel-18 OTA data as it had already been agreed to do for the Rel-17 OTA data.
  + Proposal 2: It is proposed that RAN4 Secretary will cover the role of the trusted third party to collect the measurements results provided by the laboratories and forward them to the RAN4 group after anonymizing the sensitive data.
* Recommended WF

**Issue 4-3-4: Rel-18 device template for Device information collection**

* Proposals
  + Proposal 1: It is proposed to continue to use the Rel-17 Template for Device Information Collection in the development of Rel-18 OTA requirements without any further modification.
* Recommended WF
  + TBA

**Issue 4-3-5: How to specify PC3 requirements for the band also support PC2**

* Proposals
  + Proposal 1: After specifying the PC2 requirements based on measurement campaign, RAN4 can consider to specify the PC3 requirement for that band, based on the [2]dB offset. Further refinement based on measurement results is not precluded.
* Recommended WF
  + TBA

# Topic #5: TRP TRS maintenance

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2308262**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308262.zip) | vivo | CR to TS 37.144 on sampling grid  Based on RAN4 agreements, update new measurement grids for legacy TRP/TRS requirements verification |
| R4-2308263 | vivo | *Cat A CR for Rel-15* |
| R4-2308264 | vivo | *Cat A CR for Rel-16* |
| R4-2308265 | vivo | *Cat A CR for Rel-17* |
| [**R4-2307937**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2307937.zip) | Samsung | CR to TS 38.161 on EN-DC decision tree |
| [**R4-2308254**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308254.zip) | vivo | CR to TS 38.161 on measurement grids and editorial correction |
| [**R4-2308976**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_107/Docs/R4-2308976.zip) | OPPO | CR to TS 38.161 on Clenshaw-Curtis Quadrature |

## Open issues summary

### Sub-topic 5-1 update for legacy TRP TRS

**Issue 5-1-1: is the CR R4-2308262 to TS 37.144 agreeable?**

* Proposals
  + Yes
  + No. provide technical reasons and how to update
* Recommended WF
  + TBA

### Sub-topic 5-2 update for Rel-17 TRP TRS

**Issue 5-2-1: is the CR R4-2307937 to TS 38.161 on EN-DC tree agreeable?**

* Proposals
  + Yes
  + No. provide technical reasons and how to update
* Recommended WF
  + TBA

**Issue 5-2-2: is the CR R4-2308254 to TS 38.161 on measurement grids agreeable?**

* Proposals
  + Yes
  + No. provide technical reasons and how to update
* Recommended WF
  + TBA

**Issue 5-2-3: is the CR R4-2308976 to TS 38.161 on Clenshaw-Curtis Quadrature agreeable?**

* Proposals
  + Yes
  + No. provide technical reasons and how to update
* Recommended WF
  + TBA