**3GPP TSG-RAN WG4 Meeting #99-e R4-210XXXX**

**Electronic Meeting, May 19-27, 2021**

**Agenda item:** 9.2.1

**Source:** Moderator (vivo)

**Title:** Email discussion summary for [99-e][335] FR1\_TRP\_TRS

**Document for:** Information

# Introduction

*In RAN#91e meeting, Work Item on FR1 TRP TRS was approved. An LS from GSMA on FR1 OTA test method is received, technical discussions are needed to provide timely feedback before the response deadline.*

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

* 1st round: Finalize Workplan, TR skeleton.
* 2nd round: Finalize the LSs and other items.

# Topic #1: General and Work plan

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2110792 | vivo, OPPO, CMCC | Workplan of FR1 TRP TRS WI**Proposal: Approve the proposed work plan for Rel-17 FR1 TRP TRS WI.** |
| [R4-2110029](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110029.zip) | Xiaomi | On How to organize the TRP TRS project**Proposal 2: Performance part can start early once the test methodology for NR FR1 TRP and TRS work finished with the rest core part work going parallel.** |
| [R4-2111459](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111459.zip) | Huawei,HiSilicon | This document provides our view on the workplan for this new work item |
| [R4-2110803](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110803.zip) | vivo | TR Skeleton for FR1 TRP TRS OTA test methods (TR 38.834) |
| [R4-2110793](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110793.zip) | vivo | General views on TRP TRS WI**Observation 1**: The scope of test methods development includes SA and EC-DC which is greater than LTE, care needs to be taken to prioritize the work in order that timely progress is made towards the WI objectives within Rel-17. **Observation 2**: From the latest 5G report of GSA, more than 431 commercially available devices are in the market, with smartphone accounting for the largest proportion. **Proposal 1: Select smartphone as the first priority of the device type to finalize the work.** **Observation 3**: The phantoms defined in 3GPP is not applicable for FR1 TRP TRS testing, new phantoms should be considered to cover >72mm wide devices and >3GHz frequency bands.**Proposal 2: Sent an LS to CTIA to ask for the licence of body phantoms to be referenced in 3GPP FR1 TRP TRS spec.** **Proposal 3: RAN5 is responsible for MU assessment as secondary responsibility working group. The agreements and text proposals on MU assessment in RAN5 can be sent to RAN4 via LSs with attachment to draft the TR MU Annex.** **Proposal 4: An LS to RAN5 is needed to inform the work plan of TRP TRS WI, TR skeleton and MU work handling.**  |

## Open issues summary

### Sub-topic 1-1 Workplan

Views on workplan of this WI have been shared in R4-2110792, [R4-2110029](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110029.zip), [R4-2111459](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2111459.zip), the contribution from Rapporteurs R4-2110792 is selected as basis for discussion. Further discuss on whether we need to finetune the workplan or not.

**Issue 1-1: Workplan for FR1 TRP TRS WI**

* Proposals
	+ Proposal: Approve the proposed workplan for FR1 TRP TRS WI in [R4-2110792]
* Recommended WF
	+ Discuss on how to finetune the workplan, if needed.
	+ Stabilize the workplan after 1st round discussion.

### Sub-topic 1-2 TR skeleton

**Issue 1-2: TR skeleton for FR1 TRP TRS test method**

* Proposals
	+ Proposal: Approve the proposed skeleton for FR1 TRP TRS test method in [R4-2110803]
* Recommended WF
	+ Stabilize the TR skeleton after 1st round discussion.

### Sub-topic 1-3 General part for TRP TRS WI

**Issue 1-3-1: UE type**

* Proposals
	+ Proposal: Select smartphone as the first priority of the device type to finalize the work
* Recommended WF
	+ TBA.

**Issue 1-3-2: Head&Hand phantoms**

* Proposals
	+ Proposal: Sent an LS to CTIA to ask for the licence of head&hand phantoms to be referenced in 3GPP FR1 TRP TRS spec
* Recommended WF
	+ TBA.

### Sub-topic 1-4 MU work in RAN4 and RAN5

**Issue 1-4: MU work**

* Proposals
	+ Proposal 1: RAN5 is responsible for MU assessment as secondary responsibility working group. The agreements and text proposals on MU assessment in RAN5 can be sent to RAN4 via LSs with attachment to draft the TR MU Annex.
	+ Proposal 2: An LS to RAN5 is needed to inform the work plan of TRP TRS WI, TR skeleton and MU work handling.
* Recommended WF
	+ TBA.

## Companies views’ collection for 1st round

### Open issues

Sub topic 1-1 Workplan

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| **Company** | **Comments** |
| R&S | Proposed workplan in R4-2110792 seems reasonable but further tuning might be required on the MU part as discussed in Sub topic 1-4. In addition, and following the RAN planning, there is no RAN5 meeting scheduled for January 2022, so there most probably won’t be any progress from RAN5 in the MU. |
| Huawei | Overall the plan in R4-2110792 looks fine. However more time should be allocated between step 6 and 7 because discussion on measurement result may take longer. |
| vivo | Clarification question to Huawei, step 6 and 7 means RAN4 meeting#102-bis-e and #103e? |

Sub topic 1-2 TR skeleton

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| **Company** | **Comments** |
| R&S | Overall the proposed skeleton in R4-2110803 looks ok, but the following improvements are proposed:* It is not expected to have huge differences for the test setup or calibration procedure between SA and EN-DC. Therefore, a combined section could be useful.
* TRP and TRS method, both for SA and EN-DC, will require very specific test conditions (i.e. frequencies, RB allocation, power handling…). Therefore, having dedicated subsections under 7 and 8 are recommended.

Based on these comments, the following changes to the skeleton are recommended:1 Scope2 References3 Definitions of terms, symbols and abbreviations3.1 Terms3.2 Symbols3.3 Abbreviations4 General4.1 Device types4.2 Testing configuration4.3 Testing bands5 Performance metrics5.1 Definition of the Total Radiated Power (TRP)5.2 Definition of Total Radiated Sensitivity (TRS)6 UE positioning guidelines6.1 Free space6.2 Head phantom only6.3 Hand phantom only6.4 Head and Hand phantom7 Test setup and calibration7.1 General7.2 Test setup *(incl. specifics for SA and EN-DC)*7.3 Calibration procedure *(incl. specifics for SA and EN-DC)*8 SA test methodology8.1 General8.2 Total Radiated Power (TRP)8.2.1 Test Conditions8.2.2 UE configurations8.2.3 Test procedure8.2 Total Radiated Power (TRP)8.2.1 Test Conditions8.2.2 UE configurations8.2.3 Test procedure9 EN-DC test methodology9.1 General9.2 Total Radiated Power (TRP)9.2.1 Test Conditions9.2.2 UE configurations9.2.3 Test procedure9.2 Total Radiated Power (TRP)9.2.1 Test Conditions9.2.2 UE configurations9.2.3 Test procedure10 Alternate test procedure to reduce test time10.1 General10.2 Test procedureAnnex A: UE coordinate systemAnnex B: Measurement uncertaintyAnnex C: Environmental requirementsAnnex D: Phantom DefinitionAnnex E: Configurations for multi-antenna UEAnnex F (informative): Change history |
| CAICT | In general, we are ok I the TR skeleton.Two more suggestion/clarification question as following:* In addition to device types, it is also necessary to define the mechanical mode of the device. For different phantoms, the mechanical mode required for testing may be different (e.g., folding screen devices)
* Not sure if test system set-up (e.g., anechoic chamber, reverberation chamber) and corresponding validation procedure are included in current skeleton?

We also share similar views as R&S: Having dedicated subsections under SA and EN-DC for TRP and TRS measurement is preferred. |
| Samsung | Agree with CAICT to define mechanical mode for devices, especially foldable devices. |
| vivo | Thanks for the suggestions. We can revise the skeleton and consider the above aspects. |

Sub topic 1-3 General part for TRP TRS WI

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| **Company** | **Comments** |
| Qualcomm | Issue 1-3-1: UE type:Issue 1-3-2: Head&Hand phantoms: In addition to the wide device, would RAN4 specify the requirements for narrow device, i.e., width<72mm, in this WI? |
| CAICT | For sub-topic 1-3Support the proposals. |
| Huawei | If narrow devices are also to be considered, this needs to be accounted for in the work plan. |
| Xiaomi | Issue 1-3-1: UE type:Agree with the proposal. |
| vivo | Test methods and phantoms will cover narrow and wide UEs. But for the requirements, whether RAN4 needs to specify requirements for narrow devices, this will be discussed in the “performance framework”, at the beginning of performance part. |
| OPPO | Issue 1-3-1: UE type:Support the proposal.Issue 1-3-2: Head&Hand phantoms:Wide hand phantom >72mm should be introduced to match the needs of wider smartphones. Meanwhile, RAN4 should consider the UE performance gap between narrow and wide hand phantoms, and reflect it in the performance requirement. |

Sub topic 1-4 MU work in RAN4 and RAN5

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| **Company** | **Comments** |
| Qualcomm | RAN4 to send an LS to RAN5 indicating RAN5 should contribute the same TR. The TR number and skeleton which includes the clause that RAN5 should contribute should be included. The LS should also include the RAN4 agreed workplan so that RAN5 can plan for the contributions and create a WP. |
| R&S | We agree to both Proposals and the comments from Qualcomm. If the LS process is agreed as the best solution for the contributions from RAN5 to this TR, we have to be careful about the impact to the workplan given that the actual text proposals for MU will arrive to RAN4 through LS one meeting after RAN5 agree them. In addition, the fact that RAN5 does not have a meeting scheduled for January 2022 might also affect the expected progress. |
| Huawei | Agree with the Qualcomm comment. |
| Apple | In our understanding, the WID clearly states that the MU objective is RAN5 responsibility and that RAN5 is the secondary WG for this WI. However, RAN4 is indicated as the leading WG for the test methodology TR. There is no precedent in 3GPP of a WG approving TPs or CRs to a specification within the responsibility of a different WG. Thus, the Qualcomm suggestion is not possible, and we also request feedback from the MCC on such a procedure.This leaves two other possibilities: the LS approach, as suggested in the Moderator summary, and a new specification (led by RAN5). Our preference is to have a RAN5-led specification. This could be a document with very narrow scope of measurement uncertainty for RAN4-defined test methods. If the group adopts the LS approach, then we recommend relying on after-meeting email approval process to merge RAN5 endorsed TPs, which are sent via LS, into the TR. |
| vivo | Thanks for all the suggestions. I would like to clarify the co-operation plan a bit. In our understanding, as Apple commented, RAN5 can not modify the RAN4 specs directly with RAN5 Tdocs, however, RAN5 can still endorse the Text Proposals and send them to RAN4 via LSs as WG recommendation. Then RAN4 needs a big RAN4-TP/CR for MU part (prepared by rapporteur, same content with RAN5 endorsed TPs) to accommodate the outcomes in RAN5.Given some meeting time in RAN4 and RAN5 may be in parallel, after-meeting email approval process of “The” RAN4 TP and new-version TR is a good approach. (The assumption is there will no further discussions in RAN4 on RAN5 endorsed text proposals). |

### CRs/TPs comments collection

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| **CR/TP number** | **Comments collection** |
| XXX | 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.*

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|  | **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: Reply LS to GSMA

*Given the response deadline is 30 June 2021, reply LS should be sent out in this meeting.*

## Companies’ contributions summary

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| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2108729 | GSMA | **2 Request to 3GPP**Can you define an OTA test method for 5G NR for frequency range FR1 please?Following use scenarios are required:- Talk mode using head & hand phantom for narrow devices between 56 mm and 72 mm and for wide devices with a width >72 mm.- Browsing mode using hand phantom for narrow and wide phones- Free Space for devices not used in talk or browsing modeIf 3GPP has already started a WI on this, can you provide details of the scope of the work and your estimated schedule for completion.It would be appreciated if the following items could be included in the 3GPP work:- Measure TRP for both LTE and NR with a 50%-50% equal power sharing between LTE and NR (simultaneous or one by one)**3 Technical Questions**- Will Dynamic Power Sharing (DPS) be used for the 3GPP OTA testing and will there be a special test method for that?Will self-interference be considered for TRS testing? |
| R4-2110804 | vivo | Discussion and reply LS to GSMA**Proposal 1: Approve the reply LS to GSMA to ensure the timely feedback.** |
| R4-2110179 | CAICT | **Proposal 1:** **the p-MAX configuration of FR1 EN-DC TRP and TRS need to be discussed. The preference is using 50% power split between NR and LTE.** |
| R4-2110802 | vivo | **Observation 1**: The study of EN-DC test method is limited to 1CC LTE with 1CC NR, as agreed in the WID. **Observation 2**: For EN-DC mode, only specify NR requirements. **Observation 3**: For TRS testing, using a 50% uplink output power split between LTE and NR is an aligned configuration among different SDOs.**Proposal 1: For TRS testing in EN-DC mode, 50% uplink output power split between LTE and NR should be configured.****Observation 4**: For TRP testing, how to configure the LTE and NR power is different in CTIA and CCSA.**Proposal 2: For TRP testing in EN-DC mode, RAN4 needs further study on how to configure the UE power splitting between LTE and NR.****Proposal 3: For EN-DC mode, no additional LTE requirements will be introduced, RAN4 should make decision whether LTE path need to be measured or not.****Proposal 4: To reduce the total measurement time of EN-DC combinations, mechanism on testing time reduction should be defined in RAN4.** |
| R4-2110842 | OPPO | **Proposal: the power configuration for EN-DC is setting Pmax of LTE as half of maximum output power for EN-DC defined in TS 38.101-3 Table 6.2B.1.3-1.** |

## Open issues summary

### Sub-topic 2-1 Use scenarios

**Issue 2-1: Phantom use scenarios for FR1 TRP TRS testing**

* Proposals
	+ Option1 (from GSMA): Following use scenarios are required
		- Talk mode using head & hand phantom for narrow devices between 56 mm and 72 mm and for wide devices with a width >72 mm.
		- Browsing mode using hand phantom for narrow and wide phones
		- Free Space for devices not used in talk or browsing mode
	+ Option 2: others?
* Recommended WF
	+ TBA

### Sub-topic 2-2 EN-DC power configuration

**Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing**

* Proposals
	+ Option 1: Fixed power splitting
	+ Option 2: Dynamic power sharing
* Recommended WF
	+ TBA

**Issue 2-2-2: EN-DC Tx Power Splitting for TRS** **(if fixed power splitting is selected)**

* Proposals
	+ Option 1: LTE and NR with a 50%-50% equal power sharing between LTE and NR
	+ Option 2: others?
* Recommended WF
	+ TBA.

**Issue 2-2-3: EN-DC Tx Power Splitting for TRP (if fixed power splitting is selected)**

* Proposals
	+ Option 1: LTE and NR with a 50%-50% equal power sharing between LTE and NR
	+ Option 2: others?
* Recommended WF
	+ TBA.

**Issue 2-2-4: EN-DC measurement**

* Proposals
	+ Option 1 (from GSMA): Measure TRP for both LTE and NR simultaneous or one by one
	+ Option 2: Only measure NR, given only NR requirement will be defined
	+ Option 3: others?
* Recommended WF
	+ TBA.

**Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS) (if fixed power splitting is selected for EN-DC)**

* Should RAN4 develop an additional special test methodology to test DPS function?
	+ Yes
	+ No

### Sub-topic 2-3 EN-DC testing time reduction

**Issue 2-3-1: Reduce testing time of EN-DC combinations**

* Proposal:
	+ RAN4 should define a mechanism on testing time reduction of EN-DC combinations
* Recommended WF
	+ TBA.

## Companies views’ collection for 1st round

### Open issues

Sub topic 2-1 use scenarios

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| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Option 1 |
| Vodafone | Option 1 |
| TIM | Option 1Does this mean that different sets of minimum TRP/TRS performance requirements will be defined according to the use scenario (i.e. talk mode, browsing mode and Free Space)? |
| Samsung | Option 1 |
| Apple | Option 1 |
| Xiaomi | Option 1 |
| Huawei2 | Fine with Option 1Most phones are wider than 72mm. It may be more efficient to concentrate on >72mm. However, we could agree on developing OTA requirements for both narrow and wide devices. |
| vivo | Option 1Response to TIM, in my understanding, this is the test configuration of the test methodology. Which requirement from the above use scenario will be defined should be discussed in the “performance framework” during performance part. (In the WID, phantom-based requirement is the 1st priority for smartphone UE type) |
| OPPO | Option 1 |

Sub topic 2-2 EN-DC power configuration

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| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Issue 2-2-4: EN-DC measurement:Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS): |
| Qualcomm | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Option 1Issue 2-2-2: EN-DC Tx Power Splitting for TRS:RAN4 needs to further discuss the test method for EN-DC with DPS. By now, two options will be considered: Option 1: 50%-50% power split for LTE and NR. Option 2: Set a relative power for LTE.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:RAN4 needs to further discuss the test method for EN-DC with DPS. By now, two options will be considered: Option 1: 50%-50% power split for LTE and NR. Option 2: Set a relative power for LTE.Issue 2-2-4: EN-DC measurement:It depends on the power splitting for EN-DC. For example, 50%-50% is used, then both LTE and NR should be measured. Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):RAN4 needs to further discuss on this. |
| MediaTek | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Support Option 1 (Fixed power splitting) |
| R&S | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:In order to ensure stable testing conditions for OTA, we recommend Option 1.Issue 2-2-2: EN-DC Tx Power Splitting for TRS:In our understanding, Option 1: 50%-50% power sharing represents a realistic case for the usage in the field when the UE is at cell edge for both bands (what is typically the use case considered for OTA testing).Issue 2-2-3: EN-DC Tx Power Splitting for TRP:In our understanding, Option 1: 50%-50% power sharing represents a realistic case for the usage in the field when the UE is at cell edge for both bands (what is typically the use case considered for OTA testing).Issue 2-2-4: EN-DC measurement:We agree with Option 1 recommended by GSMA on their LS. Even though this WI won’t define requirements for LTE, other SDOs (e.g. ETSI for RED harmonized standards) will rely on the methodology defined here and may define later on additional requirements for LTE.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):If this is of interest to operators and UE vendors, and assuming the radiation pattern will not change between fixed power splitting and DPS, there is always the option to develop a simple DPS methodology as an optional step in the procedure using different test conditions for power and applying typical test time reduction techniques (i.e. single test point offset method). The downside of DPS is the unpredictable UE behavior, what could drive into unstable test setup and/or differences between different test systems implementations. |
| Vodafone | Issue 2-2-1:Option 1 (fixed power splitting)Issue 2-2-2:Option 2.Issue 2-2-3:Option 2.Issue 2-2-4:Option 1Issue 2-2-5:If would probably be desirable to validate the DPS behavior, but agree further discussion is needed. |
| CAICT | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Support option 1.Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Support option 1.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Support option 1. 50%-50% power split may be more in line with the actual situation in the existing network, and can better evaluate the actual performance of the UEs.Issue 2-2-4: EN-DC measurement:Support to measure TRP for both LTE and NR simultaneously or one by one. This is not conflict with specifying NR performance requirements only.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):Consider fixed power splitting as 1st priority to finalize the work. Special test methodology for DPS is not precluded in the future. |
| TIM | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Option 1 (fixed power splitting)Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Slight preference for Option 1Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Slight preference for Option 1Issue 2-2-4: EN-DC measurement:Option1 (from GSMA)Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):Special test methodology for DPS can be considered at a second stage; further discussion is needed how to address it. |
| Samsung | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:For fixed power splitting, we would like to know how to implement in test. E.g., for 50%-50% equal power sharing, how is the configuration? For a UE supporting DPS, we wonder how to achieve equal power splitting while NR side can achieve maximum output power.Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Agree with Qualcomm that RAN4 needs to further discuss the test method for EN-DC with DPS.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Agree with Qualcomm that RAN4 needs to further discuss the test method for EN-DC with DPS.Issue 2-2-4: EN-DC measurement:Depends on agreement on power splitting. For now prefer Option 2.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):Further discussion needed |
| Apple | In general, we prefer to de-prioritize the complexity associated with EN-DC test methodology and to focus on the very minimum necessary to enable OTA testing for EN-DC UEs. The WID clarifies the scope of requirements we can introduce on LTE as: - For EN-DC, only NR requirements will be specified and no additional LTE requirements will be introduced. Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing: in our understanding, dynamic power sharing introduces requirements both on the NR and LTE carriers by mandating certain UE behavior on power control for each carrier. Since this behavior goes beyond just an intitial configuration to enable a test, its inclusion in TRP/TRS scope would mean that RAN4 would need to define additional requirements on the LTE carrier in a DPS EN-DC configuration. Thus, we understand that Issue 2-2-1 is out of scope of the WI.Issue 2-2-2: EN-DC Tx Power Splitting for TRS: in our understanding, there are regional standards that define OTA performance (e.g. CCSA, CTIA), and these standards may have already made a selection of the EN-DC Tx power splitting configuration for the TRS test. Since this configuration can have an impact on the TRS performance of the NR carrier, RAN4 should take care not to introduce a configuraiton which would preclude the global harmonization of OTA requirements. Thus, we prefer to request CCSA and CTIA to share this configuration so that RAN4 can take it into account.Issue 2-2-3: EN-DC Tx Power Splitting for TRP: in our understanding, there are regional standards that define OTA performance (e.g. CCSA, CTIA), and these standards may have already made a selection of the EN-DC Tx power splitting configuration for the TRP test. Since this configuration can have an impact on the TRP performance of the NR carrier, RAN4 should take care not to introduce a configuraiton which would preclude the global harmonization of OTA requirements. Thus, we prefer to request CCSA and CTIA to share this configuration so that RAN4 can take it into account.Issue 2-2-4: EN-DC measurement: Given the WID restriction of the applicability of requirements to NR only, only Option 2 is possible.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS): No |
| Xiaomi | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Option 1.Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Option 1.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Option 1.Issue 2-2-4: EN-DC measurement:Option 2. As we won’t define LTE requirements.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):No. We only have one year to finalize all the Rel-17 WID and we believe the SA mode for couple of bands are the most important part to be finished.  |
| Huawei2 | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Option1. Note: the “PLTE = 20 dBm，PNR= None and PEMAX, EN-DC= None” mentioned in R4-2110179 from CAICT is also a kind of “fixed power splitting”Issue 2-2-2: EN-DC Tx Power Splitting for TRS:FFS.Currently, they are several options on the table, e.g. 50%-50% as option 1, 20dBm-none as mentioned in R4-2110179 from CAICT, or Set a relative power for LTE from QC, other options are not precluded.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:FFS. Same comment as in above issue 2-2-2.Issue 2-2-4: EN-DC measurement:Option 2.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):No |
| vivo | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Option 1: fixed power splitting. The reason is that, from our understanding, DPS is more related to baseband function, but not Antenna performance. For checking the antenna performance of each RAT, measuring the TRP and TRS with fixed power is sufficient.Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Option 1. Agree with Apple that, harmonized configuration will be helpful for the industry. By now, as observed in our contribution R4-2110802, CCSA and CTIA have defined nearly the same Tx configuration for TRS measurement: In CTIA: C-TIS is measured for each RAT using a 50% uplink output power split between LTE and NRIn CCA: for PC3, assume the 20dBm LTE and 20dBm NR, the maximum output power shall be configured as PLTE = 20 dBm，PNR= None.Therefore, the only slight difference is upper bound for NR is not specified.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Further discussion is needed, prefer to configure the same Tx power splitting for TRS and TRP. In CCSA, TRP is measured with 50-50 power splitting, however in CTIA, EN-DC TRP is treated somehow similar to CA test case, measured RAT is operated with High power and other RAT is minimized.Issue 2-2-4: EN-DC measurement:Prefer option 2. If we split the discussion for TRP and TRS, Option 1 also acceptable for TRP measurement if equal Tx power splitting is adopted.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):No. As commented in Issue 2-2-1, we believe DPS is baseband performance, conducted testing is sufficient, if RAN4 would like to develop a special test case for this UE feature.  |
| OPPO | Issue 2-2-1: Dynamic Power Sharing (DPS) for EN-DC OTA testing:Have similar concern with Samsung. What is the relationship between the function of DPS and power configuration for EN-DC?Issue 2-2-2: EN-DC Tx Power Splitting for TRS:Option 1.Issue 2-2-3: EN-DC Tx Power Splitting for TRP:Option 1.Issue 2-2-4: EN-DC measurement:Option 2 is preferred considering only NR performance requirement will be specified.Issue 2-2-5: Special test methodology for Dynamic Power Sharing (DPS):No. The functionality of DPS can be tested under conducted mode. |

Sub topic 2-3 EN-DC testing time reduction

|  |  |
| --- | --- |
| **Company** | **Comments** |
| R&S | Reduction of test points (i.e. frequencies) or use scenarios (BHHR/BHHL, HR/HL, FS) could be useful to control the total test time effort for different EN-DC band combinations but care must be taken to ensure that critical band combinations are tested given the fact the UE’s may change antenna tuning parameters depending on the band combination being used.  |
| Samsung | Support the proposal. |
| Huawei2 | Support the proposal |
| OPPO | Support the proposal. |

### CRs/TPs comments collection

*For the suggested wording of reply LS, please share comments in the table below.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| Reply LSR4-2110804 | Qualcomm: The GSMA LS is sending to 3GPP RAN4 and RAN5, and RAN5 is the secondary WG for this WI, it would be good if we can also include the information regarding RAN5 timeline in the reply LS. For example, RAN5 will work together with RAN4 to contribute the MU and a new WI on conformance test will be started in RAN5 when the completion level in RAN4 is [80%]. The TR and TS number should be captured if any in the reply LS that would be the helpful info. for GSMA to follow the status. |
| CAICT: agree |
| TIM: Any eventual agreement on specific issues coming out from the ongoing discussion should be captured in the LS to GSMA. Therefore, it is suggested to wait the outcomes of the second round to finalize the LS text.  |
| Samsung: all is fine except the answer to the question about Dynamic Power Sharing test method. Test method for dynamic power sharing should not be precluded at this stage. Fixed power splitting is only one of the considerations. |
| Apple: we agree with the proposed LS except the aspects related to DPS (please see our comments to sub-topic 2-2) |
| Huawei2: fine with the proposed LS except the DPS part which needs more discussion. |
| Vivo: response to QC, the workplan for WI generally covers both RAN4 and RAN5.The TR number and WI workplan can be added in the reply LS. Regarding the conformance test WI in RAN5, we believe we do not need to inform GSMA this information, given this is RAN5 task, most importantly when to start the conformance work is RAN5 and RAN-P decision in the future. |

## 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: SA test method

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2110794**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110794.zip) | vivo | **Observation 1**: For FR1 SA test method, UE configuration with 1Tx is the first priority. **Observation 2**: For FR1 SA, the test system and test procedure are nearly the same as traditional SISO OTA test method, conclusions from LTE SISO OTA can be reused as much as possible. **Proposal 1: for FR1 SA, the test system and test procedure for LTE can be reused as much as possible.** **Proposal 2: The effective antenna approach defined in TR 38.827 for RTS method should be adopted for FR1 TRP TRS testing, the minimum range length is suggested to be 1.2m.** **Proposal 3: A MU element related to frequency flatness needs to be considered for FR1 TRP TRS test system.** **proposal 4: RAN4 need to study how to configure the UE with Tx switching function.**  |
| [**R4-2110166**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110166.zip) | Apple | **Observation 1: Compared to test methodologies necessary to verify LTE TRP/TRS requirements in TS37.144, an extension in frequency range down to 700 MHz (from 830 MHz) and up to 5000 MHz (up from 2690 MHz) can be prioritized.****Observation 2: RAN4 should discuss how to ensure consistent TRP test results can be achieved for UEs which implement Tx antenna selection.****Observation 3: Test time reduction techniques are desired to avoid measuring full TRP scans of a device which supports PC2 using a single port for each power class, PC2 and PC3.****Observation 4: Further study is needed to determine how to test TRP of devices which implement PC3 or PC2 with the TxD feature, and this study should not start until the TxD feature is fully defined by RAN4.****Observation 5: Further study is needed to ensure consistent TRS test results can be achieved for UEs which support 4 Rx ports in bands above 2.5 GHz.****Proposal 1: RAN4 should define the TRP/TRS requirements for NR FR1 UEs in stand-alone mode as a priority, although effort to define EN-DC test methodology can proceed in parallel with the SA work.** |
| [**R4-2110029**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110029.zip) | Xiaomi | On prioritize TRP TRS test method**Observation 1: Further prioritization is needed for the core part work.****Proposal 1: To prioritize the test methodology for NR FR1 TRP and TRS.** |
| [**R4-2110793**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_99-e/Docs/R4-2110793.zip) | vivo | views on SA test method**Observation 4**: The signalling and RF requirements related to FR1 TxD feature has not been concluded. RAN4 should be very careful on starting this part of work before finalizing the general test methodology for SA and EN-DC to avoid the delay of the whole progress.**Proposal 5: UL Tx switching is a function widely used in smartphone, RAN4 should discuss how the treat this function properly during TRP TRS measurement.** **Proposal 6: RAN4 should define a proper way to reduce the TRP TRS OTA testing time for SA and EN-DC bands and band combinations.**  |

## Open issues summary

### Sub-topic 3-1 Prioritization of SA test methodology development

**Issue 3-1: Priority of SA test methodology development**

* Proposals
	+ Proposa1: RAN4 should define the TRP/TRS requirements for NR FR1 UEs in stand-alone mode as a priority, although effort to define EN-DC test methodology can proceed in parallel with the SA work
* Recommended WF
	+ TBA

### Sub-topic 3-2 SA test system

**Issue 3-2-1: Test setup**

* Proposals
	+ For FR1 SA, the test system and test procedure for LTE can be reused as much as possible
* Recommended WF

**Issue 3-2-2: Measurement distance**

* Proposals
	+ The effective antenna approach defined in TR 38.827 for RTS method should be adopted for FR1 TRP TRS testing, the minimum range length is suggested to be 1.2m.
* Recommended WF

**Issue 3-2-3: Impact of large bandwidth**

* Proposals
	+ Option 1: A MU element related to frequency flatness needs to be considered for FR1 TRP TRS test system
	+ Option 2: others?
* Recommended WF

### Sub-topic 3-3 Tx/Rx antenna selection

**Issue 3-3-1: How to configure UE with Tx switching**

* Proposals
	+ Option 1: Function Off. (i.e. Fixed-antenna is selected for each band declared by manufacturer. How to lock the antenna should be provided by manufacturer to test lab.)
	+ Option 2: Function on. How to test the TRP is FFS.
	+ Option 3: Further study in RAN4 on how to treat Tx switching.
* Recommended WF
	+ TBA.

**Issue 3-3-2: How to configure UE with Rx antenna selection**

* Proposals
	+ Further study is needed to ensure consistent TRS test results can be achieved for UEs which support 4 Rx ports in bands above 2.5 GHz.
* Recommended WF
	+ TBA.

### Sub-topic 3-4 Test time reduction for SA UEs

**Issue 3-4: SA test time reduction**

* Proposals
	+ Test time reduction techniques are desired to avoid measuring full TRP scans of a device which supports PC2 using a single port for each power class, PC2 and PC3
* Recommended WF
	+ TBA.

## Companies views’ collection for 1st round

### Open issues

Sub topic 3-1 Prioritization of SA test methodology development

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | Should not deprioritize EN-DC. SA and NSA should be equally treated in this WI. |
| R&S | We agree with Qualcomm’s view. The methodology development should be handled equally for SA and EN-DC. |
| Vodafone | Agree with QC and R&S. EN-DC should not be deprioritized. |
| CAICT | We believe there is no conflict between SA and EN-DC discussion, we can handle the discussion of these two topics in parallel. |
| TIM | Same view of the other companies. EN-DC should not be deprioritized. |
| Apple | In general, we are not against proceeding with EN-DC and SA methodology in parallel; however, the test method for SA TRP/TRS is clearly less complex, and effort to deliver SA TRP/TRS requirements should not be held back by the complexity associated with EN-DC testability. The discussion related to EN-DC power control and DPS actually makes our point very clearly. |
| Xiaomi | Thanks Apple for the clarification. As proponent, we share the same view especially considering the SA system design as topic 3-2 where most companies agree with re-using the LTE system. But for LTE, the test system, configuration, and series of other issues are all blank. So the proposal here can be translated as the SA work and EN-DC work can be two parallel lines and SA work will progress faster than EN-DC work hence corresponding test result can be provided earlier. Hope this is the common understanding of the group. |
| Huawei2 | Agree with the proposal 1. The discussion of these two can go in parallel, but we believe SA part is more straightforward, related requirements can be studied firstly. |
| vivo | For EN-DC, the key part is the power configurations, for other aspects, we do not see significant different compared with SA system. So, we think handling SA and EN-DC in parallel would be possible in this WI.  |
| OPPO | Agree with Apple and Xiaomi’s comments. |

Sub topic 3-2 SA test system

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-2-1 Test setup:Issue 3-2-2 Measurement distance:Issue 3-2-3 Impact of large bandwidth: |
| Qualcomm | Issue 3-2-1 Test setup:OK with proposal. |
| MediaTek | Issue 3-2-1 Test setup:In principle, reuse legacy test system as much as possible is preferred |
| R&S | Issue 3-2-1 Test setup:We agree with the proposal.Issue 3-2-2 Measurement distance:We agree with the proposal.Issue 3-2-3 Impact of large bandwidth:We agree with Option 1, but this depends on the channel BW selected. In LTE, 10MHz bandwidth was selected as the reference for almost all bands in an effort to harmonize the test conditions and obtain comparable results among frequencies for the radiated efficiency. |
| Vodafone | Issue 3-2-1 Test setup:Ok with the proposal. |
| CAICT | Issue 3-2-1 Test setup:Support.Issue 3-2-2 Measurement distance:Ok with the proposal.Issue 3-2-3 Impact of large bandwidth:The proposal make sense if a larger CBW is adopted for FR1 SISO OTA (e.g., 100MHz). |
| Samsung | Issue 3-2-1 Test setup:OK with proposal. |
| Apple | Issue 3-2-1 Test setup: agree with the Moderator's proposalIssue 3-2-2 Measurement distance: agree with the Moderator's proposalIssue 3-2-3 Impact of large bandwidth: agree with the Moderator's proposal |
| Xiaomi | Issue 3-2-1/-2/-3:Agree with Moderator’s proposal. |
| Huawei2  | Issue 3-2-1 Test setup: Agree with the proposal Issue 3-2-2 Measurement distance:Agree with the proposalIssue 3-2-3 Impact of large bandwidth:Agree with the proposal. The details can be left to RAN5 |
| OPPO | Issue 3-2-1 Test setup:Support the proposal.Issue 3-2-3 Impact of large bandwidth:Support the proposal. |

Sub topic 3-3 Tx/Rx antenna selection

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX | Issue 3-3-1 How to configure UE with Tx switching:Issue 3-3-2 How to configure UE with Rx selection: |
| Qualcomm | Issue 3-3-1 How to configure UE with Tx switching:Need further discussion.Issue 3-3-2 How to configure UE with Rx selection:Need further discussion. |
| MediaTek | Issue 3-3-1 How to configure UE with Tx switching:Support Option1 (Function Off)Issue 3-3-2 How to configure UE with Rx selection:Support “FFS”. |
| R&S | Issue 3-3-1 How to configure UE with Tx switching:In our understanding, Option 1 is currently the most common approach. Even though, the methodology to test TRP with Tx antenna switching active could be further discussed if the UE behavior can be defined. E.g. whether the UE select the antenna based on human proximity, received power from different angles, etc. |
| Vodafone | Issue 3-3-1 How to configure UE with Tx switching:Ok with option 1. |
| CAICT | Issue 3-3-1 How to configure UE with Tx switching:Support option 3, further study is needed. At present, our preference is “Function off”, which is currently the method widely used in OTA testing. However, we are interest in whether there is a simple way to accurately evaluate UEs’ performance with “Tx switching” on.Issue 3-3-2 How to configure UE with Rx selection:FFS. |
| TIM | Issue 3-3-1 How to configure UE with Tx switching:Option 1 (Function off) since TX switching method is likely to be different from device to device  |
| Samsung | Further discussion is needed for this difficult technical issue. Based on RAN plenary agreement, this meeting is focusing on work plan discussion. |
| CMCC | Issue 3-3-1 How to configure UE with Tx switching:Support Option 3. Tx switching off may not be suitable for all operator labs, even there is no reasonable method to evaluate UE's TRP with function on at present. So how to treat this issue should be considered in RAN4. |
| Apple | Issue 3-3-1 How to configure UE with Tx switching: needs further discussionIssue 3-3-2 How to configure UE with Rx selection: further study is needed to ensure consistent TRS test results can be achieved for UEs which support 4 Rx ports in bands above 2.5 GHz. |
| Xiaomi | Issue 3-3-1 How to configure UE with Tx switching:Support Option 1. |
| Huawei2 | Issue 3-3-1 How to configure UE with Tx switching:Currently we prefer option1. This topic can be complicated, Perhaps RAN4 should avoid it or only consider this after everything else has finished.Issue 3-3-2 How to configure UE with Rx selection:Question for clarification. Is this about “Rx selection” or “4Rx”?  |
| vivo | Issue 3-3-1 How to configure UE with Tx switching:Support Option 1. Function off can be the 1st priority. Further study a proper test procedure/setup for Option 2 could be 2nd priority but within the scope of the WID.Issue 3-3-2 How to configure UE with Rx selection:Support further study. Response to Huawei, this is about Rx selection. For the 4Rx, are we saying the same Rx selection/switching issue? Or other 4Rx related aspects? |
| OPPO | Issue 3-3-1 How to configure UE with Tx switching:Support Option 3. Further study is needed. |

Sub topic 3-4 Test time reduction for SA UEs

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Qualcomm | OK with proposal. |
| MediaTek | We are positive on test time reduction topic. However, the exact method and details shall be FFS. |
| Samsung | Share similar view as MediaTek. Due to PA output impedance status change, it is necessary to further study its affection to antenna pattern. |
| Huawei2 | Agree with the proposal. The exact techniques are FFS. |
| OPPO | Echo with MediaTek and Samsung. It is not easily power scaling between different power classes. |

## Summary for 1st round

### Open issues

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

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

### CRs/TPs

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

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

## Discussion on 2nd round (if applicable)

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

# Recommendations for Tdocs

## 1st round

**New tdocs**

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

**Existing tdocs**

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

Notes:

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

## 2nd round

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

Notes:

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