**3GPP TSG RAN Meeting #106 RP-243311**

**Madrid, Spain, December 9-12, 2024** (revision of RP-241623)

*NOTE: RAN specific additions are added in blue.*

**Source: vivo, CAICT**

**Title: Revised WID:** **WI on FR1 TRP (Total Radiated Power), TRS (Total Radiated Sensitivity) and MIMO OTA (Over the Air) testing enhancement Phase 3**

**Document for: Approval**

**Agenda Item: 9.3.4.8**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: WI on FR1 TRP (Total Radiated Power), TRS (Total Radiated Sensitivity) and MIMO OTA (Over the Air) testing enhancement Phase 3

Acronym: TRP\_TRS\_MIMO\_OTA\_Ph3

Unique identifier:1030085

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** | **X** |
| **This WID includes a Performance part** | **X** |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: *Rel-19*

NOTE: In case of contradiction with the target dates of clause 5, clause 5 determines the target release.

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | X |  |  |  |
| **No** | X |  | X | X | X |
| **Don't know** |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This description is either a …

|  |  |
| --- | --- |
|  | Study Item |

or a

|  |
| --- |
| Normative Work Item:*tick applicable boxes below* |
|  | Stage 1 |
|  | Stage 2 |
| x | Stage 3 |
|  | Other (e.g. testing) |

### 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| NR\_FR1\_TRP\_TRS\_enh | RAN4 | 970082 | Enhancement of UE TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) requirements and test methodologies for FR1 (NR SA and EN-DC) |
| NR\_FR1\_TRP\_TRS | RAN4 | 911010 | Introduction of UE TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) requirements and test methodologies for FR1 (NR SA and EN-DC) |
| NR\_MIMO\_OTA\_enh | RAN4 | 970081 | Enhancement of Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirement for NR UEs |
| NR\_MIMO\_OTA | RAN4 | 880078 | Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirements for NR UEs |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore the table above should include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work/Study Items (if any) |
| **Acronym** | Unique ID | Title | Nature of relationship |
| NR\_FR1\_TRP\_TRS\_enh | 970082 | Enhancement of UE TRP (Total Radiated Power) and TRS (Total Radiated Sensitivity) requirements and test methodologies for FR1 (NR SA and EN-DC) |  |
| NR\_MIMO\_OTA\_enh | 970081 | Enhancement of Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirement for NR UEs |  |
| NR\_NTN\_solutions | 860046 | Solutions for NR to support non-terrestrial networks (NTN) | *Rel-17 NR NTN* |
| LTE\_NBIOT\_eMTC\_NTN | 920069 | NB-IoT/eMTC support for Non-Terrestrial Networks | *Rel-17 IoT NTN* |
| NR\_XR\_enh | 981039 | XR (eXtended Reality) enhancements for NR | *Rel-18 XR* |

NOTE: Also related or dependent WIs/SIs in other TSGs shall be indicated here.

# 3 Justification

**TRP and TRS enhancements**

In the field of OTA performance verification, there exists significant interest from the industry concerning XR (Extended Reality) and NTN (Non-Terrestrial Network) devices. Specifically, in Rel-18, it was collectively decided to specify OTA requirements for XR devices considering both 4Rx XR and 2Rx XR for the NR bands, which are mandatory to support 4Rx. Consequently, it holds substantial value to study and develop the OTA test methodology specifically for XR devices.

However, there might be a challenge to reuse the current head and hand phantom used for handheld UE testing for XR devices OTA measurement. For example, the current head and hand phantom may not accurately position XR devices on the ears during measurements. Therefore, an enhanced phantom or a new design is necessary to ensure proper positioning of XR devices in OTA testing.

In addition, the current 3GPP RF Requirements for FR1-NTN bands are only based on conductive tests. However, there is considerable variability in antenna implementations and resulting performance for NTN devices available in the market. Additionally, the antenna of NTN devices are primarily designed for satellite tracking with beamforming, which significantly differs from traditional terrestrial networks (TN). Consequently, the conventional FR1 UE OTA performance metrics, such as TRP and TRS, which assume an omni-directional antenna pattern, may not be suitable for NTN devices. As a result, it is necessary to define new performance metrics and corresponding test methodologies for NTN devices in Rel-19.

Furthermore, addressing TRP and TRS requirements, additional NR band requirements need to be defined based on operators’ requests.

**MIMO OTA enhancements**

In Rel-17, NR MIMO OTA WI specified the test methodology for FR1 and corresponding requirements were defined for bands n41 and n78. As we move to Rel-18, the NR MIMO OTA WI enhancement aims to specify requirements for more FR1 bands, specifically n1, n5, and n28 with the test methodology defined in Rel-17.

However, the current test methodology only considers stationary test scenarios, limiting its ability to verify UE MIMO performance under static channel models. For static MIMO OTA testing, factors such as UE orientation, MCS (Modulation and Coding Scheme), and Angle of Arrival (AoA) remain fixed. Consequently, the existing FR1 MIMO OTA test system cannot adequately verify UE performance in realistic environments. Therefore, it is essential to study dynamic channel models and develop corresponding channel validation solution in Rel-19 to create more realistic FR1 MIMO OTA test scenarios.

Furthermore, addressing MIMO OTA requirements, additional NR band requirements need to be defined based on operators’ requests, considering the current Rel-17 static test methodology.

# 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

Objectives for this core part work item are as follows

* Define test methodology for FR1 non-RedCap headworn XR devices
	+ Define TRP and TRS test methodology and configuration
* The performance metric of XR (1Tx and 2Tx) is aligned with the definition up to Rel-18 handheld UE
	+ - Testing time reduction solutions can be considered (further measurement grid optimization is precluded)
	+ Study and specify the proper head phantom if needed, consider the coordination with CTIA on this aspect
	+ Develop preliminary Measurement Uncertainty (MU)  (RAN5)
* Study and define test methodology and radiated performance metric for FR1 NTN devices (including NR NTN and IoT NTN)
	+ Study the usage scenarios and develop enhanced test methodology
	+ Study and specify the proper performance metric
	+ Develop preliminary Measurement Uncertainty (MU)  (RAN5)
* Study and develop FR1 dynamic MIMO OTA test methodology with the following aspects
	+ Reusing Rel-17 16-probes FR1 MPAC system layout
	+ Study and define dynamic channel model parameters. CDL channel models defined in TR 38.901 and TR 38.827 should be considered as the starting point
	+ Specify channel model validation procedures and pass/fail limits
	+ Decide environmental conditions
		- Noise-limited environmental condition is the baseline
	+ Study and define appropriate performance metric under dynamic channel model
	+ Develop the preliminary Measurement Uncertainty (MU) assessment for the test system (RAN5)
* Study and develop OTA test methodology for A-IoT devices
	+ Take test system reuse, test system complexity and test time into account to keep the whole test costs within a reasonable level
	+ Develop the preliminary Measurement Uncertainty (MU) assessment for the test system (RAN5)

During the course of this work item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group, CCSA TC9, GCF, GSMA TSG-AP, ETSI MSG TFES, and PTCRB shall be maintained to ensure industry coordination on this topic.

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

Objectives for this performance part work item are as follows

* Specify TRP and TRS requirements:
	+ Specify FR1 TRP and TRS requirements for NR bands for UE based on operators demand
		- Handheld UEs with 1Tx at new bands n3, n5, n7, n8, n20 are first priority. n38 and n77 are second priority.
			* 4 bands are targeted for introducing requirements depending on measurement data availability
		- Handheld UEs with 2Tx (non-coherent UL MIMO) at n41 and n78 depending on measurement data availability are first priority. Additionally, n77 and n79 are second priority.
		- Headworn XR OTA requirements will not be considered until development of suitable head phantom and sufficient number of commercial devices become available
		- Coherent UL MIMO UE OTA requirements will not be considered until sufficient number of commercial devices become available
		- Size 2 Handheld UEs with 1Tx at legacy bands n1, n28, n41, n78 are first priority
	+ RC harmonization at low band frequency, e.g., n28

Note: Handheld UEs includes Size 1 (wide, width >72mm and ≤92mm) and Size 2 (narrow, width ≥56mm and ≤72mm);

* Specify MIMO OTA requirements:
	+ Specify FR1 MIMO OTA requirements for new bands for handheld UE based on operators demand (2 layers or 4 layers)
		- Band n3, n7, n8, n20, n77, are first priority
			* 4 bands are targeted for introducing requirements depending on measurement data availability
		- The requirements are specified based on Rel-17 static MPAC test method

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

# 5 Expected Output and Time scale

*{If this WID covers both stage 2 and stage 3, clearly indicate the different completion dates.}*

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
| Internal TR | TR 38. 762 | Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) dynamic test methodology for FR1 UEs | TSG#108 | TSG#109 | *Core part**RAN4 led**Rapporteur:**Xuan, Yi, CAICT, yixuan@caict.ac.cn* |
|  |  |  |  |  |  |

*{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}*

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

|  |
| --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| TS 38.161 | TRP TRS requirements related test aspects | TSG #109 | Core part |
| TS 38.151 | NR MIMO OTA requirements related test aspects | TSG #109 | Core part |
| TR 38.870 | TRP TRS test method | TSG #109 | Core part |
| TS 38.161 | TRP TRS 1Tx and 2Tx requirements  | TSG #111 | Performance part |
| TR 38.870 | TRP TRS lab alignment and harmonization outcome | TSG #111 | Performance part |
| TS 38.151 | NR MIMO OTA requirements for other bands | TSG #111 | Performance part |
| TR 38.761 | Including FR1 and FR2 lab alignment aspects  | TSG #111 | Performance part |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

# 6 Work item Rapporteur(s)

Primary: Wang, Ruixin, vivo, ruixin.wang@vivo.com

Secondary: Zhu, Siting, CAICT, zhusiting@caict.ac.cn

NOTE: The first listed Rapporteur has the overall responsibility for this WI (incl all secondary tasks).

# 7 Work item leadership

RAN WG4

Secondary responsibility: RAN WG5

# 8 Aspects that involve other WGs

NOTE: For RAN WIs: Section 8 applies only toWGs outside of TSG RAN because all RAN WG aspects have to be covered in section 4.

# 9 Supporting Individual Members

*{At least 4 supporting Individual Members are needed. There is an expectation that these companies will provide resources to progress the work. Note that having 4 supporting companies is a necessary but not sufficient condition: the usual TSG approval process by consensus is needed for the WID approval.}*

|  |
| --- |
| Supporting IM name |
| Qualcomm Incorporated |
| Meta Ireland |
| Apple |
| Samsung |
| OPPO |
| ZTE |
| Sanechips |
| vivo |
| CAICT |
| SAICT |
| China Telecom |
| Intel Corporation |
| CMCC |
| Huawei |
| HiSilicon |
| Inmarsat |
| Viasat |
| Gatehouse Satcom |
| Xiaomi |
| Telecom Italia |
| AT&T |
| Sony |
| New H3C |
| Orange |
| Keysight |