**3GPP TSG-RAN Meeting #93-e RP-2XXXXX**

**Electronic Meeting, September 13-17, 2021 (revision of RP-201800)**

**Source: CAICT, OPPO**

**Title: Revised WID: Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirements for NR UEs**

**Document for: Approval**

**Agenda Item: 9.3.4.1**

3GPP™ Work Item Description

For guidance, see [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39; and [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm).  
Information about Work Items can be found at <http://www.3gpp.org/Work-Items>

# Title: Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) requirements for NR UEs

## Acronym: NR\_MIMO\_OTA

## Unique identifier: 880078

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

## 1 Impacts

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

## 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

|  |  |
| --- | --- |
|  | Feature |
| X | Building Block |
|  | *Work Task* |
|  | Study Item |

### 2.2 Parent and child Work Items

|  |  |  |
| --- | --- | --- |
| Parent and child Work Items | | |
| Unique ID | Title | Nature of relationship |
| 801001 | Study on radiated metrics and test methodology for the verification of multi-antenna reception performance of NR UEs | SI code: FS\_NR\_MIMO\_OTA\_test  Study item prior to Work item |

### 2.3 Other related Work Items and dependencies

|  |  |  |
| --- | --- | --- |
| Other related Work Items (if any) | | |
| Unique ID | Title | Nature of relationship |
| 750267 | Perf. part: New Radio Access Technology |  |
| 750044 | Study of test methods for New Radio |  |
| 850071 | Study on enhanced test methods for FR2 NR UEs |  |

## 3 Justification

Radiated multi-antenna reception performance is one of the most important characteristic to verify the MIMO receiver of the UE under conditions more closely resembling the end user’s interaction with the device. The RAN WG4 has been working on the Rel-16 study item “Study on radiated metrics and test methodology for the verification of multi-antenna reception performance of NR UEs” with the objective to define the radiated metrics and test methodology for measuring NR MIMO OTA, both FR1 and FR2. Since RAN WG4 has completed the work on test methodologies for NR MIMO OTA testing, the next step is to finalize the performance requirement of NR UEs based on the outcome of the SI.

Therefore, it is proposed to finalize the performance requirement work for NR MIMO OTA in a new Work Item.

## 4 Objective

### 4.1 Objective of Core part WI

The objective of this Work Item is to specify MIMO OTA performance requirements for NR FR1 and FR2 UEs， including both SA and NSA. The Work Item’s outcome shall be captured in TS 38.151.

Investigate and specify the following aspects:

- The work is based on the outcome of SI in TR38.827.

- Define requirements for the following device types:

- Smartphone is the first priority

- Tablet

- Wearable device

- Fixed wireless access (FWA) terminal

- Laptops

- The performance requirement shall include both NSA and SA

- Down-selecting of parameters for RMC in TR38.827

- Down-selecting of Channel models in TR38.827 for performance requirement

- Specify up to spatial multiplexing rank 4 requirements for FR1 and up to spatial multiplexing rank 2 requirements for FR2

- Define the pass/fail limit for FR1 and FR2 channel model validation

* Comparison among radius of 5cm and 10cm PSP validation results is needed for FR2 3D-MPAC systems.
* Further check if we need to specify the reference antenna for FR2 validation
* Further check whether vertical polarization is sufficient for FR1 Spatial Correlation validation

- Consider the SNR analysis for RMC down selection and FR2 requirements definition

- MIMO OTA performance requirement with head/hand phantoms is second priority – this will be in collaboration with CTIA who plan to work on these aspects

- Consider positioner blocking effect on specifying performance requirement for FR2

- Identify exceptional requirements that need to be tested for NSA TRMS

* Example: NSA TRMS requirements for potential UE self-interference due to IMD3 in EN-DC

- Define how to process the measurement data for FR2

* Averaging of the measured sensitivity points, or define sensitivity value based on the CCDF
* Other approach is not precluded

- Potential optimization of test methods for FR1 and FR2 is not precluded: e.g.

* Further work is suggested to illustrate the DUT rotations
* For FR2, further work to check if test points rotations are to be implemented per channel model to compensate for channel model rotations
* For FR2, re-positioning of the NR MIMO probes to align the probes with NR FR2 RRM probe configurations.
* For FR2, alternative probe configurations (different locations and different number of probes) regardless of probe implementation.

- Develop the preliminary Measurement Uncertainty (MU) assessment for FR1 and FR2 MIMO OTA

* Example expanded uncertainty for test method shall be defined.

The final MU and test tolerances (TT) will be decided by RAN5. During the course of this work item, ongoing communication with 3GPP RAN WG5, CTIA OTA Working Group (MOSG, 5G mm-wave OTA Sub-Working group and MUSG), and CCSA TC9 WG1 shall be maintained to ensure industry coordination on this topic.

### 4.2 Objective of Performance part WI

Specify the FR1 MIMO OTA requirements:

* FR1 TRMS requirements for NSA and SA
  + - For NSA mode, only NR MIMO OTA requirements will be specified and no additional LTE MIMO OTA requirements will be introduced.
    - Define the detailed Figure of Merit for TRMS, e.g. TRMS@70% or 95% Max-Throughput
    - Band n41, n77, n78 and n79 are the first priority
    - Requirements for SA are the first priority
* Only specify 4x4 MIMO OTA requirement for 4Rx antenna bands

Specify the FR2 MIMO OTA requirements:

* Define the detailed Figure of Merit for FR2
  + - Based on how to process the data, specify the sensitivity value
* FR2 requirements
  + - Band n257, n258, n260 and n261 are the first priority

## 5 Expected Output and Time scale

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **New specifications** | | | | | |
| Type | Series | Title | For info  at TSG# | For approval at TSG# | Remarks |
| TS | 38.151 | NR; User Equipment (UE) Multiple Input Multiple Output (MIMO) Over-the-Air (OTA) performance requirements | TSG#96  June 22 | TSG#97  Sep.22 | Created by core part  Rapporteur: Wang, Ruixin, vivo, [ruixin.wang@vivo.com](mailto:ruixin.wang@vivo.com)  Co-rapporteur: Xing, Jinqiang, OPPO, xingjinqiang@oppo.com |

|  |  |  |  |
| --- | --- | --- | --- |
| **Impacted existing TS/TR** | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| TS 38.151 | Including Perf. Part aspects | TSG#97  Sep.22 | Impacted by Perf. part |
| TR 38.827 | Including the preliminary MU assessment | TSG#97  Sep.22 | Impacted by preliminary MU assessment |

## 6 Work item Rapporteur(s)

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

Xing, Jinqiang, OPPO, [xingjinqiang@oppo.com](mailto:xingjinqiang@oppo.com)

## 7 Work item leadership

RAN4

## 8 Aspects that involve other WGs

## 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| CAICT |
| Huawei |
| HiSilicon |
| CMCC |
| OPPO |
| China Telecom |
| Spirent Communications |
| Rohde & Schwarz |
| MVG Industries |
| Keysight Technologies |
| SAICT |
| ETS-Lindgren |
| Samsung |
| ZTE |
| Sanechip |
| Qualcomm Incorporated |
| Apple Inc. |
| vivo |
| Intel Corporation |
| Xiaomi |