3GPP TSG RAN Meeting#102
Edinburgh, UK, December 11-15, 2023

RP-233745

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# Views on RAN4 Rel-19 OTA topics

Source: CAICT
Document for: Discussion
Agenda Item: 9.1.4.2

# Background of MIMO OTA testing

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- **From Rel-11 to Rel-18, 3GPP methodologies for measuring multi-antenna reception performance of UEs have been pursuing:**
  - test conditions more closely resembling the realistic channel environment
  - support for more advanced technologies/UE features/frequencies.
- **HSPA and LTE MIMO OTA**
  - A set of comparable methodologies were defined in TR 37.977.
  - The utilization of Variable Reference Channels and other-cell interference was included in the WID, but it was agreed to be studied at a later stage.
- **NR MIMO OTA**
  - In Rel-16, metrics and end-to-end testing methodology for MIMO OTA performance of FR1 and FR2 UEs were defined in TR38.827.
  - MIMO OTA performance under dynamic geometry environment was included, however, is unfinished due to lack of time
    - ✓ For FR2 testing methodology, study the MIMO throughput under a dynamic geometry environment
    - ✓ Extension of Rel-15 RRM tests to include dynamic geometry
    - ✓ The agreement is to further stuty dynamic testing in a future release.

# Background of MIMO OTA testing

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- **NR MIMO OTA (cont.)**
  - In Rel-16, study of head/hand/body blocking and its impact on test methods is considered as second priority but no conclusion is made.
  - In Rel-17, FR1 performance requirements were defined in TS 38.151
    - only focused on bands n41 and n78
  - In Rel-18, the measurement methodologies and performance requirements for FR1 and FR2 are being enhanced
    - ✓ based on stationary channel models
    - ✓ test methodology for scenarios with hand phantoms was studied but no agreement was reached
    - ✓ performance requirements for more FR1 and FR2 bands

# Rel-19 NR MIMO OTA — Dynamic OTA testing

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- **Motivation**
  - Legacy MIMO OTA test plans only specified stationary channel models, i.e., the large scale channel characteristics in the test zone are fixed during testing, which do not correspond to very realistic use cases.
  - Dynamic (non-stationary) channel conditions can provide much more realistic use cases and allow for a much more accurate measure of the overall link performance. Such test conditions are important for AI/ML enabled features.
  - Multi-transmission/reception point (multi-TRP) technology brings capacity gains and improves cell edge performance, meeting the needs of operators. Rel-16 and Rel-17 support intra- and inter- cell m-TRP, respectively.
- **Potential Rel-19 objectives:**
  - **NR MIMO OTA test methodology under dynamic channel models**
    - Channel models defined in TR38.901 and TR38.827 can be used as the starting point to develop dynamic channel conditions
    - Channel models and verification framework in TR38.827 can be taken as the baseline
    - Define figure of merit (FoM) for dynamic channel based test methodology
    - Up to spatial multiplexing rank 4 scenarios for FR1
    - FFS the environmental conditions, noise-limited and interference-limited scenarios should be considered
    - Reuse the legacy system configuration as much as possible
    - Develop the preliminary measurement uncertainty for test methodologies
  - **NR MIMO OTA test methodology for multi-TRP with NCJT (Non Coherent Joint Transmission) under dynamic channel**

# Rel-19 NR MIMO OTA — Phantom based testing

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- **Motivation**
  - Body phantom based testing are far more relevant to real-world use scenarios than testing under free-space conditions.
  - In Rel-18, enhancements for scenarios with body phantoms were investigated, several observations were raised by companies, but no agreement was reached on the test methodology.
  - Existing test plans are only applicable to UEs smaller than 20cm, free-space scenarios, FR1 and FR2-1.
- **Potential Rel-19 objectives:**
  - **Rel-18 down-scoped objectives**
    - phantom-based test methodology
      - hand phantom is the first priority
      - test methdology defined in TR38.827 and TS38.151 is the baseline
  - **Further enhancement on test methodology**
    - implement a future-proof quite/test zone size
    - test methodology to cover FR2-2 ?
    - reuse the legacy system configuration as much as possible.

# Rel-19 NR MIMO OTA — Requirements for new bands

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- **Motivation**
  - The Rel-18 WI targets to FR1 and FR2  MIMO OTA performance requirements with few test frequencies.
    - For FR1, requirements development for some bands were deprioritized due to limited time
    - For FR2, only one band (n261) is under discussion
- **Potential Rel-19 objectives:**
  - **FR1 MIMO OTA requirements**
    - FR1 new bands requirements (based on operators' interest)
    - FR1 unfinished bands in Rel-18
      - n8, n77 and others (if any)
  - **FR2 MIMO OTA requirements**
    - FR2 new bands requirements (based on operators' interest)
    - FR2 unfinished bands in Rel-18 (if any)

# Rel-19 NTN OTA

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- **Motivation**
  - NTN devices are being released to the market, antenna transmission/reception capability of UE is important to ensure NTN coverage and stable connectivity.
  - Traditional FR1 UE adopted omni-directional antenna radiation pattern, and corresponding OTA performance metric is also based on spherical integrated method (TRP/TRS). However, for NTN UE, the directional radiation pattern is commonly adopted and the corresponding test method and performance metrics need to be studied.
- **Potential Rel-19 objectives:**
  - OTA Test method for NTN UEs
  - Figure of merits for NTN OTA performance
    - the metrics may differ from TRP/TRS, therefore it is not included in TRP TRS enhancement topics
    - note: whether NTN OTA can be included into an OTA umbrella SI/WI can be further discussed

# Rel-19 FR1 TRP TRS enhancement

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- **Motivation**
  - For the leftovers of Rel-18, as well as requirements for more bands, UE types can be further considered as part of Rel-19 WI.
- **Potential Rel-19 objectives:**
  - **Test methodology enhancement**
    - more UE types, e.g., XR...
    - CA
      - support more UL/DL configurations
    - futher optimization on test methodologies
      - 2Tx (potential R18 leftovers)
      - other test time reduction solutions
  - **TRP TRS requirements**
    - potential Rel-18 leftovers
      - unfinished Rel-18 bands for 1Tx (if any)
      - PC2 requirements for 2Tx
    - New requirements
      - new FR1 bands for handheld UE based on operators' interest
      - Redcap UE requirements

# Rel-19 FR2 OTA enhancement

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- **Motivation**
  - Rel-18 FR2 OTA enhanced SI focus on FR2-1 OTA testing for UEs with multi-panel reception and 4DL layer. RAN4 is discussing the requirements for multi-Tx, the corresponding test method can be considered in Rel-19.
- **Potential Rel-19 objectives:**
  - RF/RRM/Demod test methodology to support simultaneous transmission with multi-panel

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# THANKS

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