3GPP TSG RAN Meeting #91-e
22nd – 26th March 2021

RP-210682

OTA Test Methods for NR 52.6 - 71 GHz

Agenda Item: 9.7.2
Source: Intel Corporation
Document for: Discussion/Decision

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Introduction

- Background
  - Conventional conducted test methodology is not applicable to NR FR2 mmWave device testing and Over-The-Air (OTA) test methodology is used as the baseline approach for RAN4 BS and UE RF/RRM/Demodulation requirements
  - The existing Rel-17 NR FR2 mmWave OTA test methods are applicable for FR2 frequency bands up to 49 GHz only
  - The NR 52.6-71GHz WID (RP-202925) approved in RAN #90e does not explicitly include OTA test methods aspects
  - OTA test methods definition may have impact on RAN4 core/performance requirements definition for NR 52.6-71GHz and is a pre-requisite for conformance requirements introduction
- Initial discussion on NR 52.6-71 GHz OTA test methods took place in RAN #90e:
  - RP-202661 "Motivation to study NR 52.6 - 71 GHz UE OTA test methods" Intel Corporation, RAN #90e.
  - RP-202662 "New SID: Test methods for NR 52.6 – 71 GHz frequency range" Intel Corporation, RAN #90e.
  - RP-202873 "Moderator's summary for email discussion [90E][43][60GHz_OTA]"
- In this contribution we provide further proposals on how to handle OTA test methods work for the NR 52.6-71GHz frequency range

RAN #90e Discussion Summary (1)

- RAN #90e email discussion on 60GHz OTA test methods is summarized in RP-202873, where no official agreements were reached
- Majority view was that 3GPP needs to develop NR 52.6-71GHz UE and BS OTA test methods in Rel-17 timeframe
- For UE test methods
  - The discussion focused on work organization aspects and several options on how to handle the objective were identified (e.g., initiate a new SI, merge into existing FR2 test methods SI, etc.)
  - Most companies confirmed that existing FR2 test methods can be used as the baseline and the main objective of the studies shall be to identify the required changes. Also, it was mentioned that the relation to the currently developed Rel-17 methods shall be clarified.
  - Several companies commented that target device types should be identified and prioritized
  - Several companies commented that the exact frequency range to be covered by the test system needs to be clarified (e.g., whether FR2 shall be covered)
- For BS test methods, the common understanding was that the work can be done as part of the RAN4 BS conformance objective of the Rel-17 NR 52.6-71GHz WI and no concerns were raised

RAN #90e Discussion Summary (2)

Tentative conclusions (not endorsed)

- Proposal #1: Agree to study and define NR 52.6-71GHz UE OTA test methods in Rel-17
  - Further discus how to handle NR 52.6-71GHz UE OTA test methods objectives in RAN #91e:
    - Option 1: Include NR 52.6-71GHz UE OTA test methods objectives in the scope of Rel-17 NR FR2 Test Methods Enhancements SI (FS_FR2_enhTestMethods)
    - Option 2: Include NR 52.6-71GHz UE OTA test methods objectives in the scope of a new "umbrella" SI on OTA topics (if such new item is approved)
    - Option 3: Include NR 52.6-71GHz UE OTA test methods objectives in the scope of Rel-17 NR 52.6-71GHz WI
    - Option 4: RAN4 define the core requirements for 52.6-71GHz and leave the test related issues to RAN5 WI, co-ordination between RAN4 and RAN5 can be triggered by LS if needed
    - Other options are not precluded
  - Further discuss the timelines of the work
    - Option A: Wait until the NR 52.6-71 GHz RF Core requirements framework is stable
    - Option B: Start work in parallel with NR 52.6-71 GHz RF Core requirements definition
    - Other options are not precluded
  - Objectives
    - At least identify the applicability of the existing FR2 OTA test methods in to 52.6-71GHz frequency range
    - Further discuss and refine detailed objectives of the studies before RAN #91e.
- Proposal #2: Study and define NR 52.6-71GHz BS OTA test methods in Rel-17
  - The work will be done the scope of Rel-17 NR 52.6 – 71 GHz WI as a part of RAN4 BS conformance requirements objective
  - The work can progress during the Rel-17 Performance stage

BS OTA Test Methods

- The baseline BS FR1 and FR2 OTA test methods were studied and defined by RAN4 in the scope of the Rel-15 NR WI and Rel-16 NR OTA BS Testing SI
- In RAN #90e, most companies' understanding was that the work can be done as part of the RAN4 BS conformance objective of the Rel-17 NR 52.6-71GHz WI

Proposal #1: Study and define NR 52.6-71 GHz BS OTA methods within the scope of Rel-17 NR 52.6 – 71 GHz WI, as a part of RAN4 BS conformance requirements objectives

UE OTA Test Methods (1)

In the past, RAN4 conducted multiple studies on the definition of mmWave UE OTA test methods, which are further used by RAN5 as the basis for the definition of the conformance requirements.

Rel-15/16 NR Test Methods SI [RP-180546] / TR 38.810

- NR OTA testing methodology for UE RF, UE RRM, and UE demodulation requirements and the corresponding measurements uncertainty (MU) assessment
- Multiple permitted test methods including Direct Far Field (DFF), Indirect Far Field (IFF), Near field to far field transform (NFTF)
- Many device types within scope, but focused on handheld devices for preliminary assessments
- Upper frequency around 43.5GHz (considered FR2 bands defined at the time)

Rel-17 NR FR2 test methods enhancements SI [RP-201862] / TR 38.884

- Test methodology for high DL power and low UL power test cases
- Minimize impact of polarization basis mismatch between TE and DUT (RF testing)
- Support extreme temperature conditions for applicable FR2 RF test cases
- Support verification of RF requirements for inter-band (FR2+FR2) CA, and DL 256QAM
- Reduce test time
- Extend test methods up to 49GHz

UE OTA Test Methods (2)

- General
  - mmWave OTA test methods definition may potentially impact RAN4 Core requirements definition and is a pre-requisite for UE conformance test introduction
  - Lack of NR 52.6-71 GHz OTA test methods will delay the NR technology adoption for the new range and test methods need to be defined in the Rel-17 timeframe
- Work organization
  - Several alternatives on work organization were identified in RAN #90e meeting (e.g., initiate a new SI, merge into existing SI, keep in NR 52GHz WI, etc.)
  - The NR 52.6-71GHz WI may not be the best place to fit the studies work, since the OTA studies typically span across the WI Core/Performance parts
  - During RAN #90e it was pointed out that other RAN1/2/4-led WIs may impact mmWave OTA test methods and a systematic approach with an "umbrella" OTA SI to handle the potential testability issues is needed (e.g., single OTA SI per release handling impacts from multiple items)
  - The "umbrella" SI approach is a reasonable way forward to keep the OTA work focused and it is recommended to be used. An ongoing Rel-17 NR FR2 Test Methods Enhancements SI can be used as a general placeholder for such OTA topics. Alternatively, a new "umbrella" OTA test methods item can be considered.

UE OTA Test Methods (3)

- Timelines
  - Work on developing OTA test methods can be performed in parallel with the RF/RRM Core requirements definition, similar to Rel-15 and ongoing work on Rel-17 48GHz band OTA test methods
  - Due to possible impact of test methods on the Core requirements aspects, it is recommended to start the respective OTA studies in Aug 2021 and have a work plan discussion in May 2021

Proposal #2: Further study NR > 52GHz UE OTA testability aspects within the Rel-17 timeframe

- Option 1: Add NR 52.6-71GHz UE OTA test methods objectives into the scope of the ongoing RAN4-led Rel-17 NR FR2 Test Methods Enhancements SI
- Option 2: Add NR 52.6-71GHz UE OTA test methods objectives into the scope of a newly created “umbrella” SI on mmWave OTA test methods
- The studies can start in Aug 2021 and work plan discussion can take place in May 2021

UE OTA Test Methods Objectives

In RAN #90e, additional comments on the UE OTA test methods objectives were provided. Below we provide the updated objectives to last plenary proposal to address the comments (changes are marked in blue)

Proposal #3: Adopt the following study objectives of UE OTA test methods

- Study and define the over the air (OTA) test methods for UE RF, RRM, and demodulation requirements for the 52.6GHz-71GHz frequency range:
- Extend the applicability of the FR2 OTA UE RF/RRM/demodulation test methods defined in TR 38.810 and TR 38.884 wherever possible
- Identify any changes needed, including general testing and calibration, permitted test methods, multi-path fading propagation conditions, measurement applicability criteria.
- Establish applicable frequency range for system
  - Determine whether the test system need to test different frequency ranges in the same system (e.g., 24GHz to 71GHz)
- Target device types
  - First priority: Handheld UE, laptop, tablet
  - Focus on devices prioritized in the NR > 52GHz WI
- Utilize free space testing configuration for test methods definition.

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