Test Plan for Wireless Device Over-the-Air Performance

CTIA 01.01 Test Scope, Requirements, and Applicability

Version 5.0.0

December 2022

Use Instructions

All testing shall be performed in a CTIA Certification Authorized Test Lab and shall be initiated through one of the following methods:

1. By submitting a PTCRB or IoT Network Certified device certification request at https://certify.ptcrb.com/

2. By submitting an OTA Test Plan use request at https://certify.ctiacertification.org/

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Section 1 Introduction

1.1 Purpose

The purpose of this test plan is to define the CTIA Certification program test requirements for performing Radiated RF Power and Receiver Performance measurements on wireless devices.

This document is written in a normative context, but all or portions of the text may be considered normative or informative based on the certification body that incorporates this test plan.

Normative	Mandatory aspect for CTIA Certification testing
Informative	Optional testing/condition that is not part of CTIA Certification testing

1.2 Scope

This test plan defines general requirements for equipment configurations, laboratory techniques, test methodologies, and evaluation criteria that must be met in order to ensure the accurate, repeatable, and uniform testing of wireless devices to ensure that they meet CTIA Certification standards. This test plan also defines a portion of the requirements that a laboratory must satisfy to qualify for and maintain Authorized Testing Laboratory (ATL) status (complete ATL requirements may be found at https://ctiacertification.org/test-labs/).

This test plan provides high-level test procedures and basic test equipment configuration information but does not include detailed test instructions by which to execute certification testing. Such documentation and procedures must be presented by the test lab as part of the ATL authorization process and subsequently maintained and employed by the ATL to remain authorized to perform certification testing.

This test plan consists of a suite of documents; see Section 1.7.

This document specifies all the test requirements except carrier aggregation and dual-connectivity band combinations which are based on operator priorities and are further defined in *CTIA 01.02* [1]. All normative reporting tables are included in *CTIA 01.03* [2]. Some informative reporting tables are included in *CTIA 01.04* [4]. Details of various wireless technologies are described in *CTIA 01.50* [10], *CTIA 01.51* [11] and *CTIA 01.52* [12] which are applicable to multiple test methodologies. Additional normative requirements are described in *CTIA 01.70* [13], *CTIA 01.71* [14], *CTIA 01.72* [15] and *CTIA 01.73* [16] which are applicable to multiple test methodologies. Informative content is described in *CTIA 01.90* [17].

1.3 Scope of Test Methods

This test plan includes several test methodologies and in some cases multiple test methodologies may be used to perform certain tests.

Table 1.3 1 shows the 3GPP wireless technologies supported by each of the different test methodologies. Table 1.3-2 shows the location based wireless technologies supported by each of the different test methodologies. Table 1.3-3 shows the non-3GPP wireless technologies supported by each of the different test methodologies. Table 1.3-4 shows the device types supported by each of the different test methodologies. Table 1.3-5 shows the tests supported by each of the different test methodologies.

Table 1.3-1 Support of 3GPP Wireless Technologies by Test Methodology

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
GSM	Yes	Yes	No	No	No
GPRS	Yes	Yes	No	No	No
EGPRS	Yes	Yes	No	No	No
UMTS	Yes	Yes	No	No	No
LTE	Yes	Yes	No	Yes	Yes
LTE 2DL CA	Yes	No	No	No	No
LTE 3DL CA	Yes	No	No	No	No
LTE LAA	Yes	No	No	No	No
LTE Category M1	Yes	Yes	No	No	No
LTE Category NB1	Yes	Yes	No	No	No
NR FR1 SA	Yes	No	No	No	No
NR FR1 EN-DC	Yes	No	No	No	No
NR FR2 EN-DC	No	No	Yes	No	No

Table 1.3-2 Support of Location Based Wireless Technologies by Test Methodology

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
A-GPS L1	Yes	No	No	No	No
A-GPS L5	Yes	No	No	No	No
A-GALILEO E1	Yes	No	No	No	No
MBS	Yes	No	No	No	No
Stand Alone (SA) GPS L1	Yes	No	No	No	No

Table 1.3-3 Support of Non-3GPP Wireless Technologies by Test Methodology

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
Bluetooth® BR	Yes	No	No	No	No
Bluetooth LE	Yes	No	No	No	No
Zigbee	Yes	No	No	No	No

Table 1.3-4 Support of Device Types by Test Methodology

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
Hand-Held Device	Yes	No	Yes[1]	Yes	Yes
Wrist-Worn Device	Yes	Yes	No	No	No
Chest-Worn Device	Yes	No	No	No	No
Ankle-Worn Device	Yes	No	No	No	No
IoT devices fitting within Notebook-sized test volume[2]	Yes	Yes[3]	No	No	No
Tablets	Yes	No	Yes[1]	Yes	Yes
Notebooks	Yes	No	No	No	No
IoT devices larger than Notebook-sized test volume[2]	No	Yes[3]	No	No	No

Note 1: Devices must fit within the 30 cm quiet zone. Devices must meet the requirement of having antenna arrays with a radiating aperture less than 5 cm. Measurement grids and measurement uncertainties for DUTs with antenna apertures greater than 5 cm have not been defined yet and can therefore not be certified using this test plan.

Note 2: The Notebook-sized test volume is defined in *CTIA 01.73* [16] Section 5.4.

Note 3: Only IoT devices that do not require partial surface radiated quantities may be tested using the reverberation chamber test method.

Table 1.3-5 Tests Supported by Test Methodology

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
Total Radiated Power (TRP)	Yes	Yes	No	No	No
Near Horizon Partial Radiated Power (NHPRP)	Yes	No	No	No	No
Relative power on intermediate channels	Yes	No	No	No	No
Total Isotropic Sensitivity (TIS) or Combined Total Isotropic Sensitivity (C-TIS)	Yes	Yes	No	No	No
Near Horizon Partial Isotropic Sensitivity (NHPIS)	Yes	No	No	No	No
Partial Isotropic GPS Sensitivity (PIGS)	Yes	No	No	No	No
Upper Hemisphere Isotropic Sensitivity (UHIS)	Yes	No	No	No	No
Average 3D C/N_0	Yes	No	No	No	No
Partial Integrated GPS (PIG) 3D C/N_0	Yes	No	No	No	No
Upper Hemisphere (UH) 3D C/N_0	Yes	No	No	No	No
Relative sensitivity on intermediate channels	Yes	Yes	No	No	No
Intermediate Channel Degradation to Location Based Wireless Technologies	Yes	No	No	No	No
LAA Un-Licensed Degradation (LUD) Test	Yes	No	No	No	No
Cellular desensitization due to simultaneous operation of 802.11n radios	Yes	No	No	No	No
Maximum Output Power - EIRP (MOP-EIRP)	No	No	Yes	No	No

	SISO, Anechoic Chamber	SISO, Reverberation Chamber	SISO, Millimeter Wave	MIMO, Multi-Probe Anechoic Chamber	MIMO, Radiated Two Stage
Maximum Output Power - TRP (MOP-TRP)	No	No	Yes	No	No
Maximum Output Power -spherical coverage (MOP-spherical coverage)	No	No	Yes	No	No
REFSENS - EIS	No	No	Yes	No	No
REFSENS - spherical coverage	No	No	Yes	No	No
MIMO average radiated SIR sensitivity (MARSS)	No	No	No	Yes	Yes

1.3.1 SISO Test Methodologies for Wireless Technologies below 6 GHz

Good radiated performance is critical to the effective operation of a wireless device in today's networks. As devices become smaller, radiated performance can often become compromised. For example, achieving an efficient antenna in a small size and over multiple frequency bands is a difficult task. A comprehensive and accurate characterization of radiated performance will enable carriers and manufacturers to determine how well wireless devices will work within the constraints of a specific cellular network design.

Generally, peak Effective Isotropic Radiated Power (EIRP) is not a good indication of wireless performance in the field. For example, if the radiation pattern of the Device Under Test's (DUT) antenna system is highly directive, the peak EIRP would be high (since the antenna gain is high in one direction), but coverage would be poor in other directions. In a cellular environment it is best to maximize the spatial coverage of the antenna system so that the user does not have to point the antenna in one particular direction to get good call performance. Further, the human body (e.g. head, hand, and forearm) can alter the shape and peak value of the DUT radiation pattern. Losses due to the body can vary significantly with frequency, device size, and antenna design implemented. From a field performance perspective, measurement of the average EIRP on a body model is more meaningful than measurement of peak EIRP in free-space conditions. This test plan requires average spherical effective isotropic radiated power (termed Total Radiated Power or TRP) to be measured.

Receiver performance, or Effective Isotropic Sensitivity (EIS) is as important to the overall system performance as transmitter performance. The downlink receive path is integral to the quality of the device's operation. Poor receiver radiated performance will cause the user of the subscriber unit to hear a low quality voice signal. This can also cause the subscriber unit to lose the base station signal resulting in abrupt termination of the call. This test plan requires average spherical effective radiated receiver sensitivity (termed, in the general sense, Total Isotropic Sensitivity or TIS) to be measured. A frequent cause of poor sensitivity on a single channel, or a small number of channels, is due to receiver in-band noise, or spurious signals from the transmitter itself being radiated back into the receiver. The receiver sensitivity will be measured with the transmitter set to the maximum power output allowed by the particular DUT and technology combination.

For all air interfaces and devices, TIS shall be measured with all receivers active. This measurement method and result is referred to as Combined Total Isotropic Sensitivity, or C-TIS. The C-TIS test is agnostic to whether the device under test actually has only one or multiple receivers; all that matters is that the receivers are all active during the test. The performance metrics (pass/fail criteria) are given in terms of C-TIS for all device types. Different categories of devices, having differing performance

expectations based on e.g., number of receivers, may be defined, each having its own appropriate pass/fail criteria expressed in terms of C-TIS.

1.3.1.1 Applicability of SISO, Anechoic Chamber Test Methodology

CTIA 01.20 [5] is used to measure total radiated quantities (e.g. TRP and TIS), partial radiated quantities (e.g. near horizon partial radiated power (NHPRP), near horizon partial isotropic sensitivity (NHPIS), partial isotropic GPS sensitivity (PIGS), upper hemisphere isotropic sensitivity (UHIS)), relative sensitivity on intermediate channels, relative power on intermediate channels, intermediate channel degradation for location based wireless technologies, and LAA (License-Assisted Access) Un-Licensed Degradation (LUD) test. Wireless protocols in New Radio Frequency Range 1 (NR FR1) or below 6 GHz are supported in this test plan. Wireless protocols operating in New Radio Frequency Range 2 (NR FR2), or the millimeter wave frequency range are not supported in this test plan. Most device types are supported by this test methodology except for devices larger than the Notebook-sized test volume defined in *CTIA 01.73* [16] Section 5.4. This test methodology also covers testing of cellular desensitization due to simultaneous operation of 802.11 radios in Integrated Devices.

1.3.1.2 Applicability of SISO, Reverberation Chamber Test Methodology

The SISO, Reverberation Chamber Test Methodology is used to measure total radiated quantities (e.g. TRP and TIS), and relative sensitivity on intermediate channels. This test method does not cover any of the partial surface quantities such as NHPRP and NHPIS. This test plan only covers the following 3GPP wireless technologies below 6 GHz: GSM, GPRS, EGPRS, UMTS, LTE, LTE Category NB1 and LTE Category M1. The test method does not cover LTE carrier aggregation nor location based wireless technology testing at this time. Wireless protocols operating in FR2, or the millimeter wave frequency range are not supported in this test plan. Many device types are supported by this test methodology including large form factor devices that are larger than the Notebook-sized test volume defined in *CTIA 01.73* [16] Section 5.4. This test method only supports a limited selection of phantoms including the forearm phantom.

1.3.2 SISO, Millimeter Wave Test Methodology

A notable difference in devices operating in FR2 compared to devices operating in FR1 is the ability of the devices that support FR2 to support antenna beam forming. Consequently, this test method measures the following transmit characteristics: Maximum Output Power (MOP) – EIRP, MOP – TRP, and MOP – spherical coverage. This test method measures the following receive characteristics: REFSENS (Reference Sensitivity power level) – EIS, and REFSENS – spherical coverage.

1.3.2.1 Applicability of SISO, Millimeter Wave Test Methodology

CTIA 01.22 [7] is used to measure radiated performance of wireless devices supporting NR FR2 in the EN-DC (E-UTRAN New Radio – Dual Connectivity) mode (using the LTE network).

1.3.3 MIMO Test Methodologies

Downlink 2x2 MIMO allows LTE wireless devices with MIMO spatial multiplexing receiver implementations to support data rates almost twice as high as the data rates available from a 2x1 MISO (Multiple Input Single Output) downlink. This higher data rate is possible through the use of spatial multiplexing, where the device's serving network simultaneously transmits two independent, spatially-diverse data streams to the wireless device. In order to realize the full benefit of spatial multiplexing, the wireless device must be able to differentiate between the two downlink data streams. In order to assess radiated downlink 2x2 MIMO performance, this test methodology creates a standardized spatial channel within the test zone, with characteristics similar to real-world radio environments. Currently, the test system creates the SCME (Spatial Channel Model Extended) Urban Macro propagation channel. However, any spatial channel model can be created within the test zone should future industry demands require the use of alternative models.

The test system used to create a spatial radio channel is thoroughly described in *CTIA 01.40* [8]. In addition to describing the creation of a spatial radio environment, *CTIA 01.40* [8] also describes a means by which the Signal to Interference Ratio (SIR) can be controlled. The control of SIR is very important, as it allows labs to evaluate the wireless device's spatial multiplexing performance under operating conditions the device will experience in actual networks. SIR control also allows labs to render a performance metric which can be used as a benchmark for each device's spatial multiplexing performance in actual wireless networks.

This test method is intended to determine the average MIMO receiver performance of a DUT for a given usage case and RF environmental condition. The test evaluates the DUT in a range of typical orientations for a given usage case and then determines a single figure of merit for that model and usage case combination. The MIMO Average Radiated SIR Sensitivity (MARSS) orientation dependent performance should not be thought of as a radiation pattern, since at each orientation of the DUT, signals from multiple directions are received simultaneously and combined by the antennas and radio receivers in whatever manner the DUT supports. There is no single direction around the DUT for which a given measurement defines the receiver performance in that direction. Instead, the MARSS orientation dependent information simply reflects the receiver performance for a given DUT orientation relative to the origin coordinates of the simulated RF environment in which it is being tested. The selection of orientations to be tested are intended to reflect a uniform distribution of the most common range of orientations such that no additional weighting is required to determine average performance.

1.3.3.1 Applicability of MIMO, Multi-Probe Anechoic Chamber Test Methodology

CTIA 01.40 [8] is used to test wireless devices capable of supporting LTE 2x2 downlink MIMO.

1.3.3.2 Applicability of MIMO, Radiated Two Stage Test Methodology

CTIA 01.41 [9] is an alternative method to the MIMO, Multi-Probe Anechoic Chamber Test Methodology.

1.4 DUT and Accessories—The Wireless Device

All DUTs submitted to an ATL for radiated performance testing shall be representative of typical production units and will be able to comply with the regulatory requirements of the countries in which the device is targeted to be sold. At the manufacturer's discretion, one or multiple DUTs may be submitted. All DUTs shall be provided to a single ATL responsible for OTA testing of the device, known as the "primary" ATL. The primary ATL may distribute the DUT(s) to labs acting as a subcontractor to the primary ATL.

The primary ATL and its subcontractors shall ensure that all of the requirements listed below are met:

- All DUTs shall be capable of supporting all applicable radiated performance test cases.
- If conducted measurements are required to be made for a given protocol, they shall be performed on the DUT and documented for each DUT for each of the test frequencies, bands, and protocols utilized.
- When multiple samples are provided, the DUT shall be randomly selected from among the submitted samples such that a single DUT will be employed for tests within a:
    - Test Methodology (e.g., SISO, Anechoic Chamber or MIMO, Multi-Probe Anechoic Chamber)
    - Radio Mode (e.g., 3GPP Wireless Technology, Non-3GPP Wireless Technology, Location Based Wireless Technology)
    - Band

- Test Type (e.g., TRP, or TIS)
- Test Condition (e.g., FS (free space), BHHL (beside head and hand left) or BHHR (beside head and hand right))

Example: If a manufacturer provides four sample devices to the ATL (Device A, B, C and D) and the lab randomly selects Device C for execution of *CTIA 01.20* [5] for BHHR testing for TIS in UMTS Band II, then all radiated performance tests associated with this test method, test condition, test type, band and cellular radio mode must be executed with Device C only. In this example, BHHL testing for TIS using *CTIA 01.20* [5] in UMTS Band II could be executed with a different randomly-selected sample device. BHHR testing for TIS using *CTIA 01.20* [5] in UMTS Band V could be executed using yet another randomly-selected sample device, etc.

- The test report shall unambiguously state which sample and test system was used for each test in order to comply with the traceability requirements of ISO/IEC 17025:2017.
- One or more authorized test systems may be utilized.
- For devices supporting an eSIM, the eSIM shall be configured with the 3GPP test eSIM profile to enable connections to communication testers.
- For devices which support a time-averaging algorithm to control RF output in real-time for the purpose of RF exposure compliance or for other reasons, the manufacturer is required to provide a mechanism for the test lab to disable the algorithm, so that during OTA testing, the DUT can consistently operate at maximum power level for the corresponding usage mode under test. For MIMO OTA testing, the time-averaging algorithm shall be disabled so that the DUT can consistently operate at the power level required for MIMO OTA testing.
- The sample devices for A-GNSS (Assisted Global Navigation Satellite System) OTA for LTE shall be prepared by the manufacturer to ensure compatibility with the test procedure herein which utilizes the Open Mobile Alliance (OMA) Secure User Plane (SUPL) 2.0 protocol. Specifically, the manufacturer shall:
  - Install the SUPL certificate(s) for the corresponding LTE A-GNSS test equipment used at the “primary” ATL and at any labs acting as a subcontractor to the primary ATL. Ideally, the manufacturer should install the SUPL certificates for all LTE A-GNSS test equipment manufacturers referenced on the authorized equipment list.
  - Provide a mechanism (application, hidden menu, support tool, etc.) that allows the ATL to specify the SUPL server address and port or have this information pre-set on the device for the corresponding LTE A-GNSS test equipment used at the “primary” ATL and at any labs acting as a subcontractor to the primary ATL.
  - Alternatively, the manufacturer shall provide tools and detailed instructions that allow the ATLs to install the SUPL certificates and set the SUPL server and ports themselves on any of the provided sample devices for A-GNSS OTA for LTE.
- Units for test shall be supplied with all required peripherals and accessories, including the standard battery and charger as supplied with the unit. For protocols requiring conducted measurements and where an RF port is available on the DUT, a calibrated RF adapter cable terminating in a common SMA or “type N” connector shall be supplied for conducted measurements. The associated RF insertion loss for that cable connection shall be included.

1.4.1 Additional Requirements for SISO, Anechoic Chamber Test Methodology

For tests that employ relative measurements, such as single point offset test (SPOT) for carrier aggregation (CA), a different chamber and sample may be used regardless of which was used for the original test. Both the Test Configuration A and Test Configuration B tests which make up the SPOT shall be performed in the same OTA chamber using the peak position and polarization from the original (full) radiated test, regardless of which chamber the original radiated test was performed in. The delta between Test Configuration A and Test Configuration B shall be applied to the original (full) radiated test as specified in *CTIA 01.20* [5]. If the laboratory chooses to utilize this option, the measurement uncertainty for the alternate procedure shall be updated to reflect any differences in chamber equipment or setup.

1.4.2 Additional Requirements for SISO, Millimeter Wave Test Methodology

No samples for conducted testing are required for this test method. The DUT's antennas shall not be configured or enabled/disabled in a manner that is contrary to the normal operation of the DUT. The DUT can, however, also be pre-configured by disabling UL TX diversity schemes similar to what 3GPP is currently mandating for conformance testing (see *3GPP TS 38.521-2* [18].)

This test plan is currently applicable only to DUT antennas with radiating aperture less than or equal to 5 cm. Measurement grids and measurement uncertainties for DUTs with antenna apertures greater than 5 cm have not been defined yet and therefore cannot be certified using this test plan.

1.4.3 Additional Requirements for MIMO, Test Methodologies

The manufacturer shall not indicate support for any operating band where the MIMO antenna system is not completely contained within the validated spatial correlation sphere as defined in Section 2.3.3 of *CTIA 01.40* [8]. If the DUT supports more than 2 antennas, then the DUT shall be tested in the antenna configuration used for normal device operation. The DUT's antennas shall not be configured or enabled/disabled in a manner that is contrary to the normal operation of the DUT.

1.5 Wireless Device Documentation

All documentation and accessories associated with the installation and operation of the DUT shall be supplied. This includes, at a minimum:

- User guides or manuals
- Programming instructions
- Installation guides or manuals
- Service manuals, including manual control of DUT from Test Interface Unit and/or keypad
- All Base Station Simulator settings required to register the DUT and establish a call
- Manufacturer declaration of primary mechanical mode of operation, i.e., portrait slide open, fold open, or other mechanical configuration
- Manufacturer declaration of all mechanical use modes that are representative use cases
- Manufacturer declaration if the DUT supports a time-averaging algorithm to control RF output power in real-time for the purpose of RF exposure compliance or for other reasons.

- For Wrist-Worn Devices:
  - Declaration of the wristband to be used during the testing. The wristband to be used shall be the wristband packaged with the end product. If wristbands are provided separately, the wristband selection shall be based on the expected worst-case wristband.
  - Declaration of the housing material to be used during the test based on the expected worst-case material.
  - Declaration of the single arm orientation (WL (wrist left) or WR (wrist right)) to be used for test, based on the expected worst-case orientation and based on input from target operators.

In addition to the documentation, the manufacturer shall provide contact information including telephone number and e-mail address of an individual responsible for providing technical and operational assistance.

1.5.1 Additional Documentation for SISO Test Methodologies for Wireless Technologies Below 6 GHz

- List of all antennas used for SISO sub-6 GHz OTA testing as supplied by the manufacturer:
  - Each antenna shall be labelled with a letter, starting with the letter "A". These antenna labels are used in *CTIA 01.03* [3] Table RA.1-2.
  - Each unique antenna feed shall be associated with a unique label
  - These labels shall be used by the ATL when completing the reporting tables described in *CTIA 01.03* [3] Section RA.
- Table RA.1-2 in *CTIA 01.03* [3] as completed by the manufacturer:
  - Declaration of all bands and protocols supported by each antenna, and to which transceiver functions the antenna are connected (transmitter, primary receiver, secondary receiver)
  - Declaration of all antenna, band and protocol combinations that are activated dynamically for RX functionality
  - Declaration of which antennas are dynamically tuned in such a way that offset - tests (see *CTIA 01.20* [5]) cannot be used when offset tests are being considered for use.)
  - Declaration of the baseline antenna receiver combination (switch state) to be used as a baseline for testing devices supporting RX antenna switching (see Section 2.1.5.2). Declaration of which switch states require testing according to Section 2.1.5.2.
- Instructions for enabling testing of devices supporting antenna switching (see Section 2.1.5).
- Instructions for which channel(s) to test A-GPS L1 with LTE Band 12 (see *CTIA 01.51* [11]*).*
- Manufacturer to report the targeted operators in order for the CA and DC testing to be determined according to the operator priority list (see *CTIA 01.02* [2]).

- When submitting a device for LTE A-GNSS testing, the device manufacturer shall include a declaration statement that identifies one of the options specified in Section 2.1.8.1.2 to define the testing to be performed by the test lab.

- When submitting an LTE Category M1 device for A-GNSS testing, the device manufacturer shall include a declaration statement that identifies one of the options specified in Section 2.1.8.1.3 to define the testing to be performed by the test lab.

    - In cases where multiple antennas integrated in the DUT radiate coherently and have an effective radiating aperture greater than what is assumed in this test plan, the device manufacturer shall inform the test lab of this fact, and the test lab will include that information in the test report. See Section 2 of *CTIA 01.73* [16] for more details.

1.5.2 Additional Documentation for SISO, Millimeter Wave Test Methodology

To allow for test time reduction with the beam peak search measurements, the manufacturer is allowed to declare that the beam peak at the mid test frequency range is applicable for the remaining (low, high) test frequency ranges. Beam peak search results cannot be re-used across different bands.

Device manufacturers may use their knowledge of the antenna locations within the device to declare specific keep out areas with the intent that those areas are not covered or blocked by DUT mounting fixtures in order to minimize their impact on measured device performance in free space. ATLs shall collaborate with the manufacturer to try to meet the provided guidance.

The vendor shall submit a declaration of the primary mechanical mode as referenced in this test plan to the ATL.

1.5.3 Additional Documentation for MIMO, Test Methodologies

Wireless devices submitted to an ATL for MIMO performance evaluation shall include information concerning the antenna placement for each band in which MIMO is supported by the DUT. The specific information required is described in Section 2.3.3 of *CTIA 01.40* [8]. In addition, the number of device receive antennas for each band to be tested shall be included in the information submitted to an ATL for MIMO performance evaluation.

1.6 Acronyms and Definition

Acronym/Term	Definition
A-GNSS	Assisted Global Navigation Satellite System
ATL	Authorized Test Lab
BER	Bit Error Rate
BLER	Block Error Rate
BH	Beside Head
BHHL	Beside Head and Hand Left Side
BHHR	Beside Head and Hand Right Side
BHL	Beside Head Left

Acronym/Term	Definition
BHR	Beside Head Right
Bluetooth BR	Bluetooth Basic Rate
Bluetooth LE	Bluetooth Low Energy
C-TIS	Combined Total Isotropic Sensitivity
CA	Carrier Aggregation
CAT-M1	Category M1
CAT-NB1	Category NB1
CC	Component Carrier
CCDF	Complementary Cumulative Distribution Function
ChW	Chest Worn
DC	Dual Connectivity
DL	Downlink
DML	Data Mode Landscape
DMP	Data Mode Portrait
DMSU	Data Mode Screen-Up
DUT	Device Under Test
EGPRS	Enhanced General Packet Radio Service
EIRP	Effective Isotropic Radiated Power
EIS	Effective Isotropic Sensitivity
EN-DC	E-UTRAN New Radio – Dual Connectivity
eSIM	Embedded Subscriber Identity Module
FCC	Federal Communications Commission
FER	Frame Error Rate
FR1	Frequency Range 1
FR2	Frequency Range 2
FS	Free Space
GPRS	General Packet Radio Service

Acronym/Term	Definition
GSM	Global System for Mobiles
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
HL	Hand Left
HR	Hand Right
IoT	Internet of Things
LTE	Long Term Evolution
LAA	License Assisted Access
LUD	LTE LAA Un-Licensed Degradation Test
MARSS	MIMO Average Radiated SIR Sensitivity
MBS	Metropolitan Beacon System
MCG	Master Cell Group
MIMO	Multiple Input Multiple Output
MOP	Maximum Output Power
NHPIS	Near Horizon Partial Isotropic Sensitivty
NHPRP	Near Horizon Partial Radiated Power
NR	New Radio
OEM	Original Equipment Manufacturer
OMA	Open Mobile Alliance
OTA	Over-the-Air
PCC	Primary Component Carrier
PCMCIA	Personal Computer Memory Card International Association
PDA	Personal Digital Assistant
PER	Packet Error Rate
PIG	Partial Integrated GPS
PIGS	Partial Isotropic GPS Sensitivity
PTCRB	PCS Type Certification Review Board

Acronym/Term	Definition
RB	Resource Block
RF	Radio Frequency
RSS	Receive Signal Strength
RX	Receive
SA	Stand Alone
SCC	Secondary Component Carrier
SCG	Secondary Cell Group
SCME	Spatial Channel Model Extended
SCS	Subcarrier spacing
SIR	Signal to Interference Ratio
SISO	Single Input Single Output
SPOT	Single Point Offset Test
SUPL	Secure User Plane
TIS	Total Isotropic Radiation
TRP	Total Radiated Power
TX	Transmit
UE	User Equipment
UHIS	Upper Hemisphere Isotropic Sensitivity
UL	Uplink
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
VoIP	Voice over IP
VoLTE	Voice over LTE
WL	Wrist-worn Left
WR	Wrist-worn Right
WWAN	Wireless Wide Area Network

1.7 Document References

This test plan is composed of a suite of the following documents:

Document Number, *Document Name*
[1] CTIA 01.01, *Test Scope, Requirements, and Applicability*
[2] CTIA 01.02, *Operator Priority List*
[3] CTIA 01.03, *Normative Reporting Table*
[4] CTIA 01.04, *Informative Reporting Tables*
[5] CTIA 01.20, *Test Methodology, SISO (Single Input Single Output), Anechoic Chamber*
[6] CTIA 01.21, *Test Methodology, SISO, Reverberation Chamber*
[7] CTIA 01.22, *Test Methodology, SISO, Millimeter Wave*
[8] CTIA 01.40, *Test Methodology, MIMO (Multiple Input Multiple Output), Static Channel Model, Multi-Probe Anechoic Chamber*
[9] CTIA 01.41, *Test Methodology, MIMO, Radiated Two Stage*
[10] CTIA 01.50, *Wireless Technology, 3GPP Radio Access Technologies*
[11] CTIA 01.51, *Wireless Technology, Location Based Technologies*
[12] CTIA 01.52, *Wireless Technology, Non-3GPP Radio Access Technologies*
[13] CTIA 01.70, *Measurement Uncertainty*
[14] CTIA 01.71, *Device Setup and Positioning Guidelines*
[15] CTIA 01.72, *Near-Field Phantoms*
[16] CTIA 01.73, *Supporting Procedures*
[17] CTIA 01.90, *Informative Reference Material*

The following additional documents are referenced in this test plan:

Document Number, *Document Name*
[18] 3GPP TS 38.521-2, *User Equipment (UE) Conformance Specification, Radio Transmission and Reception; Part 2: Range 2 Standalone.*
[19] CTIA Certification and Wi-Fi Alliance, *Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices*, 2020.
[20] 3GPP TS 45.005, GSM/EDGE Radio transmission and reception

Section 2 Test Requirements

2.1 SISO Test Methodologies for Wireless Technologies below 6 GHz

This section outlines test requirements for devices supporting wireless technologies below 6 GHz.

Products supporting multiple air-interface technologies shall be tested in accordance with all relevant test procedures for the following metrics, as applicable:

- Total Radiated Power (TRP)
- Near-Horizon Partial Radiated Power considered over ±45 degrees ($NHPRP_{\pm 45}$)
- Near-Horizon Partial Radiated Power considered over ±30 degrees ($NHPRP_{\pm 30}$)
- Relative power on intermediate channels
- Total Isotropic Sensitivity (TIS)
- Near-Horizon Partial Isotropic Sensitivity considered over ±45 degrees ($NHPIS_{\pm 45}$)
- Near-Horizon Partial Isotropic Sensitivity considered over ±30 degrees ($NHPIS_{\pm 30}$)
- Partial Isotropic GPS Sensitivity (PIGS)
- Upper Hemisphere Isotropic Sensitivity (UHIS)
- Relative sensitivity on intermediate channels
- Intermediate channel degradation to location based wireless technologies
- LTE LAA Un-Licensed Degradation (LUD) Test
- Cellular desensitization due to simultaneous operation of 802.11n radios

Devices shall be tested with the applicable phantoms as defined below.

In general, all supported bands below 6 GHz will tested with exceptions defined in this section.

2.1.1 Definitions

2.1.1.1 Device Definitions

Ankle-Worn Device- A device that is typically worn on the user's wrist. This device category includes ankle monitors.

Chest-Worn Device- A device that is typically worn on the user's chest. This device category includes personal emergency response devices.

Hand-Held Device- A device that is typically used in the user's hand. This device category includes mobile phones and smart phones.

Integrated Device- A device that embeds a Module. Notebook computers and Tablets are special categories of Integrated Devices and are additionally defined below.

Integration Component- A device that meets the definition of an Integrated Device but is intended to be completely self-contained and incorporated “into” or “part of” a “host device” without any electrical interaction with the host device.

Module- A finished WWAN radio device that does not directly connect to a host via a standardized external interface such as PCMCIA, RS-232, USB, PCIExpress, etc.

Notebook- A portable personal computer combining the computer, keyboard and display in one form factor. Typically, the keyboard is built into the base and the display is hinged along the back edge of the base. A convertible Notebook is a form factor that enables configuration as a Notebook or as a Tablet.

Tablet- A portable personal computer combining the computer and display in a single form factor resembling a writing slate. User input is typically accomplished via a touchscreen or stylus pen.

USB Modem- A modem that plugs into the USB port of a computer. Its primary use case is while directly connected to the computer without the need for additional cabling.

Wrist-Worn Device- A device that is worn on the user’s wrist. This device class includes smartwatches.

2.1.1.2 Use Case Definitions

FS = Free Space

BH = Beside Head (Head Phantom Only)

BHL = Beside Head Left Side (Head Phantom Only)

BHR = Beside Head Right Side (Head Phantom Only)

HL = Hand Left (Hand Phantom Only)

HR = Hand Right (Hand Phantom Only)

BHHL = Beside Head and Hand Left Side (Head and Hand Phantom)

BHHR = Beside Head and Hand Right Side (Head and Hand Phantom)

WL = Wrist-Worn Left (Forearm Phantom)

WR = Wrist-Worn Right (Forearm Phantom)

ChW = Chest Worn (Chest Phantom)

AL = Ankle-Worn Left (Ankle Phantom)

2.1.1.3 Other Definitions

Target Operator- An operator is considered a “target operator” for a device if either of the following criteria is satisfied:

- The device is sold through the operator's supply chain (e.g. operator store, operator online website, etc.). ***Note:*** *The device may also be sold through other outlets in addition to the operator's supply chain; and/or*

- The device is expected to access an operator's network where that operator requires OTA testing before the device is allowed to access the operator's network. ***Note:*** *An operator may waive off some aspects of OTA testing or OTA testing in its entirety, in which case this clause does not apply.*

If neither of these criteria is satisfied, then the device is considered to have no “target operator”.

2.1.2 Devices Tested with a Phantom

Phantoms are defined in *CTIA 01.72* [15]. Device setup and positioning guidelines, including the use of phantoms, are defined in *CTIA 01.71* [14].

2.1.2.1 Hand-Held Devices

Perform OTA testing with the DUT antenna extended and retracted, as applicable.

2.1.2.1.1. Hand Phantom Selection

If available (based on the DUT dimensions and form factor), an appropriate standard hand phantom shall be employed when testing the “Talk Mode” (head-and-hand, voice call) and “Data Mode” (hand-only, browsing).

Figure 2.1.2.1-1 illustrates a flowchart for selecting the appropriate hand phantom for a given DUT. If the device exceeds 72 mm but does not exceed 92 mm in width, then the “Wide Grip” shall be used for testing both “Talk Mode” and “Data Mode”. If the device width is between 56 mm and 72 mm (inclusive), then the “PDA Grip” shall be used for both modes. If the device is less than 56 mm in width, then “data” (hand-only) mode will be tested in the “Narrow Data Grip”, and the hand phantom used for testing “Talk Mode” (against the head) is determined by form factor: monoblock and closed slide/rotator DUTs use the “Monoblock Grip”, while fold and open slide/rotator DUTs use the “Fold Grip”.

Devices not fitting the aforementioned criteria (e.g., devices wider than 92 mm, those held in a landscape orientation or with two hands) are not required to be tested with a hand phantom under this test method at this time.

Network operators or other customers may request additional testing with non-standard hand phantoms. In such cases, standard fixturing and positioning is to be observed to the extent possible, and the additional data can be included and marked as supplemental in the test report.

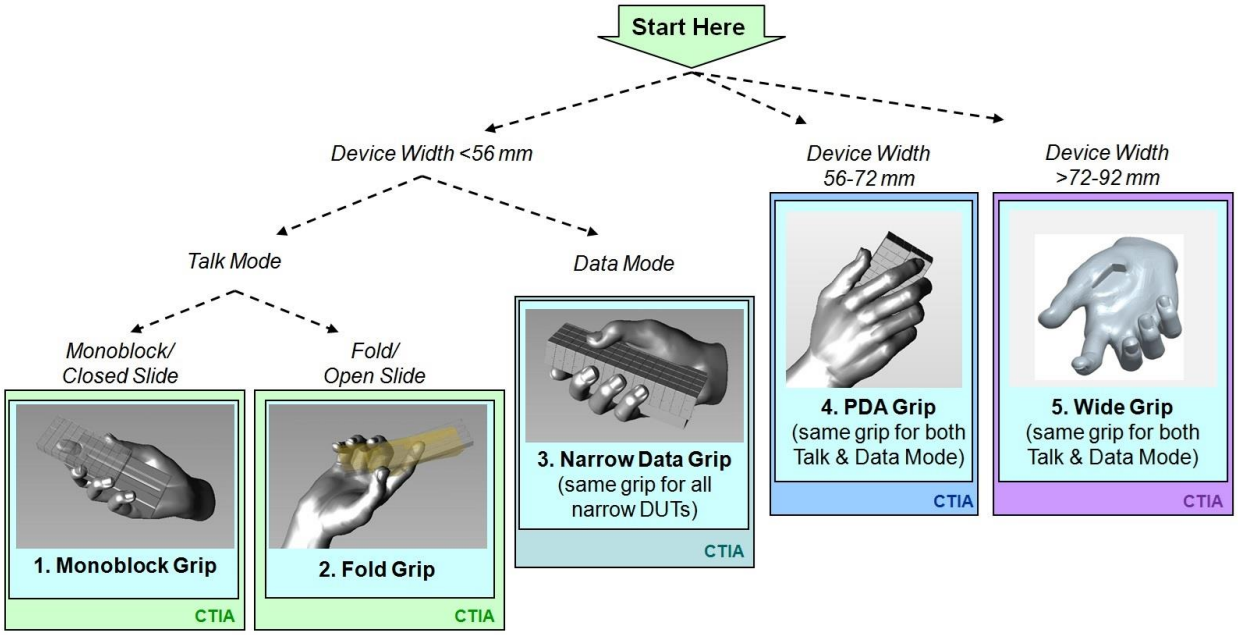

Figure 2.1.2.1-1 Choosing the Correct Hand Phantom

2.1.2.1.2. Devices Supporting Usage against the Head

In general, testing against the head (e.g., BHHR and BHHL) and in free space is required, unless otherwise noted below.

Different measurement results may be obtained between positioning the DUT on the left or right ear of the head phantom. As a result, this test method requires the measurement of performance against both ears for the head and hand phantom tests. In the interest of managing the overall test time, head phantom only tests are no longer required.

Head-adjacent testing (e.g., BHHR and BHHL) is only required for cellular protocols that support voice (including VoIP or VoLTE) as manufactured against the head, except for guidance listed below. Head-adjacent testing is not required for LTE CA, LTE LAA CA, and NR FR1 EN-DC.

The relative sensitivity test on intermediate channels and relative power test on intermediate channels will be limited to the right side head and hand phantom (BHHR) and free space (FS) test configurations for 3GPP wireless technologies. Intermediate Channel Degradation testing for Location Based Technologies (e.g., A-GNSS and MBS) shall be tested in the right side head and hand phantom (BHHR) and right hand phantom only (HR) configurations. The following rules determine which types of devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

- If a device has multiple mechanical modes in which to make a voice call, each mechanical mode representative of end use, where the receiver is placed on the ear, shall be tested (e.g., a portrait slide phone shall be tested in both slide open and slide closed positions, a side slide phone shall be tested only in the slide closed position, a fold phone shall be tested only in the open position). Device mechanical modes that are not representative of end use do not need to be tested in head and hand phantom, and free-space test conditions.

The vendor shall submit to the ATL a declaration of the primary mechanical mode as referenced in this test plan. The ATL shall use the primary mechanical mode when applying the pass/fail limits.

- Testing in non-primary mechanical modes is only required on the middle channel (e.g. low and high-channel testing is not required). Note that for relative sensitivity on intermediate channel testing and relative power on intermediate channel testing of non-primary mechanical modes, the middle channel is used as the reference channel for all intermediate channel tests because TIS/TRP is not tested at the other reference channels.

- In the free-space test condition, all 3GPP wireless technologies capable of voice and data operation shall be tested for all the mechanical modes representative of end use.

- In the head-adjacent test conditions, all 3GPP wireless technologies capable of voice operation shall be tested for all the mechanical modes representative of end use. In the case of 3GPP wireless technologies data modes in the head-adjacent test conditions, these radio modes would be tested only if the device, as manufactured, supports voice operation over the data connection (e.g., VoIP).

- Devices that exceed the maximum dimensions specified for the hand phantom test conditions defined in this test plan do not need to be tested in the head and hand phantom test conditions.

- For NR FR1 SA, LTE, UMTS, and GSM, TRP and TIS testing across the entire band is required for FS, BHHR, and HL. For UMTS, and GSM, BHHL and HR testing is not required. For NR FR1 SA and LTE, only mid-channel testing is required for BHHL and HR for TRP and TIS (i.e., no low/high channel testing is required for BHHL and HR unless requested by the manufacturer).

  Note: This item does not apply to Location Based Wireless Technology OTA testing.

- GSM relative sensitivity tests on intermediate channels are not required for GSM devices that support voice operation against the head.

- For GSM devices that support voice operation against the head that meet the following conditions, GSM OTA and A-GPS L1 with GSM OTA testing may be reduced.

  - The device supports LTE, and is fully tested (all applicable use cases) in the equivalent LTE band (including bands with wider frequency coverage, e.g. LTE 2 or 25 for GSM 1900) as GSM.

  - Each TX antenna for GSM is the same as a TX antenna that was fully tested for LTE.

  - Each RX antenna for GSM is the same as a RX antenna that was fully tested for LTE.

  - Each GNSS RX antenna for A-GPS L1 with GSM is the same RX antenna that was fully tested for A-GPS L1 with LTE

  Under these conditions, the GSM TRP/TIS and A-GPS L1 with GSM OTA testing may be reduced as follows:

- Test GSM TRP/TIS in low, mid and high channels only in FS, except for non-primary mechanical modes where only the middle channel is tested in FS. GSM TRP/TIS is not required for BHHR and BHHL

- A-GPS L1 TIS with GSM testing is not required (BHHR, BHHL). A-GPS L1 with GSM intermediate channel degradation testing is not required (BHHR).

- Head-adjacent TRP/TIS testing is only required for GPRS, EGPRS and NR FR1 SA if the DUT supports usage against the head in this mode (e.g. VoIP).

- Relative sensitivity tests on intermediate channels in GPRS and EGPRS are not required if GSM is supported for the same frequency bands.

- GPRS and EGPRS OTA (TRP/TIS/relative sensitivity on intermediate channels) testing is not required for GSM devices that support voice operation against the head.

- UMTS OTA and A-GPS L1 with UMTS OTA testing may be reduced for devices which meet the following criteria:

  - The device supports LTE and is fully tested (all applicable use cases) in the equivalent LTE band as UMTS.

  - Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.

  - Each RX antenna for UMTS is the same as a RX antenna that was fully tested for LTE.

  - Each GNSS RX antenna for A-GPS L1 with UMTS is the same RX antenna that was fully tested for A-GPS L1 with LTE

  Under these conditions, UMTS OTA and A-GPS L1 with UMTS OTA testing may be reduced as follows:

  - Test UMTS TRP/TIS (low, mid, high channel) for only the BHHR use case. UMTS TRP/TIS is not required for BHHL and FS use cases.

  - Relative sensitivity testing on intermediate channels for UMTS is not required (BHHR and FS).

  - A-GPS L1 with UMTS TIS testing is not required (BHHR, BHHL). A-GPS L1 with UMTS intermediate channel degradation testing is not required (BHHR).

- For devices that support both LTE operation against the head (e.g., VoLTE) and LTE carrier aggregation, head-adjacent testing is only required in LTE standalone mode. Head-adjacent testing is not required in LTE carrier aggregation mode (LTE CA and LTE LAA) for these devices.

- LTE OTA testing may be reduced for devices which meet the following criteria:
  - The device supports NR FR1 SA and is fully tested for NR FR1 SA OTA (all applicable use cases) in the NR band equivalent to the LTE band.
  - Each TX antenna for LTE is the same as a TX antenna that was fully tested for NR FR1 SA.

- Each RX antenna for LTE is the same as a RX antenna that was fully tested for NR FR1 SA.

Under these conditions, LTE OTA testing may be reduced as follows:

- Test LTE TRP/TIS (low, mid, high channel) for only the BHHR and FS use cases. LTE TRP/TIS is not required for BHHL use case.
- For the purposes of determining what other test reductions are allowed, each TX antenna and RX antenna for LTE that meets this test reduction is considered to be fully tested for LTE for BHHR, BHHL and FS.

- A-GPS L1 and A-Galileo E1 with LTE OTA testing and A-GPS L1 and A-Galileo E1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:
  - The device supports A-GPS L1 and A-Galileo E1 with NR FR1 SA and is tested for A-GPS L1 and A-Galileo E1 with NR FR1 SA TIS (BHHR, BHHL) with the NR band equivalent to the LTE band.
  - The device supports A-GPS L1 and A-Galileo E1 with LTE and is tested for A-GPS L1 and A-Galileo E1 with LTE intermediate channel degradation (BHHR) with the LTE band equivalent to the NR FR1 SA band.
  - Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.
  - Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE is the same RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 SA.

  Under these conditions, A-GPS L1 and A-Galileo E1 with LTE OTA testing may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with LTE TIS testing is not required (BHHR, BHHL).
  - For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with LTE for BHHR and BHHL.

  Under these conditions, A-GPS L1 and A-Galileo E1 with NR FR1 SA OTA testing may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with NR FR1 SA intermediate channel degradation testing is not required (BHHR).
  - For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 SA for BHHR and BHHL.

- Relative sensitivity tests on intermediate channels are not required for NR FR1 EN-DC.

- For A-GNSS with LTE testing on devices which do not support dynamically tuned GPS receivers, choose any reference band (except Band 13 / Band 14) as per *CTIA 01.51* [11] section 2.5.4.1 and measure all the orientations (i.e. BHHR and BHHL). The worst-case orientation between BHHR and BHHL shall be tested based on the measured data and the selected orientation shall be used to perform testing on the rest of the supported

bands. Band 13 and Band 14 requires testing on both BHHR and BHHL for all transmitters as applicable.

- A-GNSS and MBS OTA testing are, in general, not required in the free-space test conditions for devices tested with a phantom as specified in this test plan. BHHL, BHHR, HL, and HR are required for A-GNSS and MBS TIS testing.

- A-GPS L1, A-GPS L5 and A-GALILEO E1 with NR FR1 EN-DC TIS testing is not required for BHHR and BHHL.

- Head-adjacent MBS TIS testing is only required for LTE if the DUT supports usage against the head in this mode (e.g. VoLTE).

2.1.2.1.3. Devices Supporting Data Usage in the Hand

In general, testing in the hand (e.g., HR and HL) is required, unless otherwise noted below.

The following rules determine which types of devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

- If a device has multiple mechanical modes in which it can be held in the hand for data usage scenarios where the display is visible to the end user, each mechanical mode representative of end use shall be tested. Device mechanical modes that are not representative of end use in the hand for data usage scenarios, do not need to be tested in the hand phantom test conditions. The vendor shall submit to the ATL a declaration of the primary mechanical mode as referenced in this test plan. The ATL shall use the primary mechanical mode when applying the pass/fail limits.

- In the hand phantom test conditions, all cellular radio modes capable of voice and data operation shall be tested for all the mechanical modes representative of end use.

- Testing in non-primary mechanical modes is only required on the middle channel (e.g. low- and high-channel testing is not required). Note that for relative sensitivity on intermediate channel testing and relative power on intermediate channel testing of non-primary mechanical modes, the middle channel is used as the reference channel for all intermediate channel tests because TIS/TRP is not tested at the other reference channels.

- Devices that exceed the maximum dimensions specified for the hand phantom test conditions defined in this test plan do not need to be tested in the hand phantom test conditions.

- Relative sensitivity tests on intermediate channels in the hand phantom are not required for GSM, GPRS, EGPRS, UMTS, LTE (all variants) and NR (all variants).
- For devices that support voice operation against the head, NR FR1 SA, LTE, UMTS, and GSM, TRP and TIS testing across the entire band is required for HL. For UMTS, and GSM, HR testing is not required. For LTE and NR FR1 SA, only mid-channel testing is required for HR for TRP and TIS (i.e., no low/high channel testing is required for HR unless requested by the manufacturer). Note: This paragraph does not apply to A-GNSS OTA testing.

- GSM OTA (TRP/TIS/relative sensitivity on intermediate channels) testing for HR/HL is not required for GSM devices that support voice operation against the head.

- GSM relative sensitivity tests on intermediate channels are not required for GSM devices that support voice operation against the head.

- Relative sensitivity tests on intermediate channels in GPRS and EGPRS are not required if GSM is supported for the same frequency bands.

- For GSM devices that support voice operation against the head that meet the following conditions, A-GPS L1 with GSM OTA testing may be reduced.

    - The device supports an equivalent LTE band (including bands with wider frequency coverage, e.g. LTE 2 or 25 for GSM 1900).

    - Each TX antenna for GSM is the same as a TX antenna for LTE.

    - Each RX antenna for GSM is the same as a RX antenna for LTE.

    - Each GNSS RX antenna for A-GPS L1 with GSM is the same RX antenna that was fully tested for A-GPS L1 with LTE.

  Under these conditions, the A-GPS L1 with GSM OTA testing may be reduced as follows:

    - A-GPS L1 with GSM TIS testing is not required (HR, HL). A-GPS L1 with GSM intermediate channel degradation testing is not required (HR).

- GPRS and EGPRS OTA (TRP/TIS/relative sensitivity on intermediate channels) testing is not required for GSM devices that support voice operation against the head.

- UMTS OTA and A-GPS L1 with UMTS OTA testing may be reduced for devices which meet the following criteria:

    - The device supports LTE and is fully tested (all applicable use cases) in the equivalent LTE band as UMTS.

    - Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.

    - Each RX antenna for UMTS is the same as a RX antenna that was fully tested for LTE.

    - Each GNSS RX antenna for A-GPS L1 with UMTS is the same RX antenna that was fully tested for A-GPS L1 with LTE

  Under these conditions, the UMTS OTA and A-GPS L1 with UMTS OTA testing may be reduced as follows:

    - UMTS OTA (TRP/TIS/relative sensitivity on intermediate channels) testing in HR and HL is not required.

    - A-GPS L1 with UMTS TIS testing is not required (HR and HL). A-GPS L1 with UMTS intermediate channel degradation testing is not required (HR).

- LTE OTA testing may be reduced for devices which meet the following criteria:
    - The device supports NR FR1 SA and is fully tested (all applicable use cases) in the NR band equivalent to the LTE band.

- Each TX antenna for LTE is the same as a TX antenna that was fully tested for NR FR1 SA.
- Each RX antenna for LTE is the same as a RX antenna that was fully tested for NR FR1 SA.

Under these conditions, the LTE OTA testing may be reduced as follows:

- LTE TRP/TIS testing in HR and HL is not required.
- For the purposes of determining what other test reductions are allowed, each TX antenna and RX antenna for LTE that meets this test reduction is considered to be fully tested for LTE for HR and HL.

- A-GPS L1 and A-Galileo E1 with LTE OTA testing and A-GPS L1 and A-Galileo E1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:
  - The device supports A-GPS L1 and A-Galileo E1 with NR FR1 SA and is tested for A-GPS L1 and A-Galileo E1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.
  - The device supports A-GPS L1 and A-Galileo E1 with LTE and is tested for A-GPS L1 and A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.
  - Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.
  - Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE is the same RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 SA.

  Under these conditions, the A-GPS L1 and A-Galileo E1 with LTE OTA testing may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with LTE TIS testing is not required (HR, HL).
  - For the purposes of determining what other test reductions are allowed, each TX antenna and RX antenna for LTE that meets this test reduction is considered to be fully tested for LTE for HR and HL.

  Under these conditions, A-GPS L1 and A-Galileo E1 with NR FR1 SA OTA testing may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with NR FR1 SA intermediate channel degradation testing is not required (HR).
  - For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 SA for HR and HL.

- A-GPS L1 and A-Galileo E1 with LTE OTA testing may be reduced for devices which meet the following criteria:
  - The device does not support NR FR1 SA but does support NR FR1 EN-DC.
  - The device supports A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC and is tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC TIS (HR, HL) with the NR band equivalent to the LTE band.
  - The device supports A-GPS L1 and A-Galileo E1 with LTE and is tested for A-GPS L1 and A-Galileo E1 with LTE intermediate channel

degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.
- Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.
- Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC.

Under these conditions, A-GPS L1 and A-Galileo E1 with LTE OTA testing may be reduced as follows:
- A-GPS L1 and A-Galileo E1 with LTE TIS testing is not required (HR, HL).
- For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with LTE for HR and HL.

- A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC OTA testing for the first test with NR only at maximum TX power may be reduced for devices which meet the following criteria:
  - The device does not support NR FR1 SA but does support NR FR1 EN-DC.
  - The device supports A-GPS L1 and A-Galileo E1 with LTE and is tested for A-GPS L1 and A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.
  - Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC.
  - Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.

  Under these conditions, A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC OTA testing for the first test with NR only at maximum TX power may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC intermediate channel degradation testing for the first test with NR only at maximum TX power is not required (HR).
  - For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC for the first test with NR only at maximum TX power for HR and HL.

- A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC OTA testing for the second test with LTE and NR at maximum balanced TX power may be reduced for devices which meet the following criteria:
  - The device does not support NR FR1 SA but does support NR FR1 EN-DC.
  - The device supports A-GPS L1 and A-Galileo E1 with LTE and is tested for A-GPS L1 and A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.

- Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC.
- Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.
- The NR FR1 EN-DC band combination does not have a known IMD interference to A-GPS L1 or A-Galileo E1

Under these conditions, A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC OTA testing for the second test with LTE and NR at maximum balanced TX power may be reduced as follows:

- A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC intermediate channel degradation testing for the second test with LTE and NR at maximum balanced TX power is not required (HR).
- For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC for the second test with LTE and NR at maximum balanced TX power for HR and HL.

- A-GPS L1 and A-Galileo E1 OTA with NR FR1 EN-DC testing may be reduced for devices which meet the following criteria:
  - The device supports NR FR1 SA and NR FR1 EN-DC for the same NR band.
  - The device supports A-GPS L1 and A-Galileo E1 with NR FR1 SA is fully tested (HR, HL) for A-GPS L1 and A-Galileo E1 with NR FR1 SA with the same NR band used in NR FR1 EN-DC.
  - Each TX antenna for NR FR1 SA is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.
  - Each GNSS RX antenna for A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC is the same RX antenna that was fully tested for A-GPS L1 and A-Galileo E1 with NR FR1 SA.

  Under these conditions, A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC OTA testing may be reduced as follows:
  - A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC TIS testing is not required for the first test with NR only at maximum power (HR, HL).
  - A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC intermediate channel degradation testing is not required for the first test with NR only at maximum power (HR).
  - A-GPS L1 and A-Galileo E1 with NR FR1 EN-DC TIS testing and intermediate channel degradation testing for the second test with maximum NR-LTE balanced power is not required for non-IMD bands (HR).

- For devices that support both LTE operation against the head (e.g., VoIP) and LTE carrier aggregation, hand-only testing is required in both LTE standalone mode and LTE carrier aggregation mode for these devices. Per Table 2.1.2.1.3-1 below, full TRP and TIS testing across the entire band is required for HL per the table below; and only mid-channel testing is required for HR for TRP and TIS (i.e., no low/high channel testing is required for HR unless requested by the manufacturer).

Table 2.1.2.1.3-1 CA Test Reduction Table

PCC Test Channel[1]	HL		HR	
	TRP	TIS	TRP	TIS
Low Channel	PCC	PCC/SCC(s)[1,2]	Optional[3]	Optional[3]
Mid Channel	PCC	PCC/SCC(s)[1,2]	PCC[4]	PCC/SCC(s)[1,2,5]
High Channel	PCC	PCC/SCC(s)[1,2]	Optional[3]	Optional[3]

Note 1: PCC and SCC test channels are per Table 4.1.9.1-1, Table 4.1.12.1-1 and tables in *CTIA 01.50* [10]

Note 2: Testing is required on the PCC and all SCC's unless indicated otherwise in Section 2.1.7.3.

Note 3: Not required unless requested by the manufacturer.

Note 4: For bands which only support one channel (e.g., bands 13, 30, the mid-channel TRP test point for HR shall be the TRP test point with the mid-channel uplink RB allocation.

Note 5: For bands which only support one channel (e.g., bands 13, 30), the mid-channel TIS test point for HR shall be the TIS test point where the SCC/SCC1 is mid-band.

- Intermediate Channel Degradation testing for GNSS shall be tested in HR.
- For A-GNSS with LTE testing on devices which do not support dynamically tuned GPS receivers, choose any reference band (except Band 13 / Band 14) as per *CTIA 01.51* [11] Section 2.5.4.1 and measure all the orientations i.e. HR and HL. The worst-case orientation between HR and HL shall be tested based on the measured data and the selected orientation shall be used to perform testing on the rest of the supported bands. Band 13 and Band 14 requires testing on both HR and HL for all transmitters as applicable.
- A-GPS L1, A-GPS L5 and A-GALILEO E1 with NR FR1 EN-DC TIS testing is limited to HR and HL.

2.1.2.2 Wrist-Worn Devices

Wrist-Worn Devices are used primarily in the wrist worn position. Wrist-Worn Devices shall only be tested in the wrist worn configuration using the Forearm Phantom and not in the free space condition.

Perform OTA testing with the DUT antenna extended and retracted, as applicable.

The following rules determine which types of devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

- The manufacturer shall declare the wristband to be used during the testing. The wristband to be used shall be the wristband packaged with the end product. If wristbands are provided separately, the wristband selection shall be based on the expected worst-case wristband.

- The manufacturer shall declare the housing material to be used during the test based on the expected worst-case material.

- If a device has multiple mechanical modes in which it can be used, each mechanical mode representative of end use shall be tested. Device mechanical modes that are not representative of end use while worn on the wrist, do not need to be tested in the forearm phantom test conditions. The vendor shall submit to the ATL a declaration of the primary mechanical mode as referenced in this test plan. The ATL shall use the primary mechanical mode when applying the pass/fail limits.

- Wrist-Worn Devices shall only be tested in the wrist worn configuration using the Forearm Phantom defined in *CTIA 01.72* [15] and not in the free space condition.

- The manufacturer shall declare the single arm orientation (WL or WR) for test, based on the expected worst-case orientation and based on input from target operators.

- It is not necessary to measure nor report the following quantities for Wrist-Worn Devices: NHPRP, NHPIS, UHIS, nor PIGS, primarily because the orientation of the Wrist-Worn Device varies so much in normal usage that these partial quantities don't have much bearing on the user experience. Note that while UHIS measurements are not required, measurements at the peak in the upper hemisphere pattern will still be used instead of the peak in the entire pattern in order to avoid complicating the test implementation.

- Relative sensitivity on intermediate channel testing and relative power on intermediate channel testing for Wrist-Worn Devices shall be performed on the single arm orientation (WL or WR) declared by the manufacturer.

- In the forearm phantom test conditions, all NR FR1 SA, LTE, LTE Category M1 (CAT-M1), LTE Category NB1 (CAT-NB1), A-GNSS with NR FR1 SA, and A-GNSS with LTE modes shall be tested for all the mechanical modes representative of end use. Testing of Wrist-Worn Devices in MBS, GSM, GPRS, EGPRS, UMTS and NR FR1 EN-DC and A-GPS L1 with NR FR1 EN-DC is not required.

- Testing in non-primary mechanical modes is only required on the middle channel (e.g. low and high-channel testing is not required). Note that for relative sensitivity on intermediate channel testing and relative power on intermediate channel testing of non-primary mechanical modes, the middle channel is used as the reference channel for all intermediate channel tests because TIS/TRP is not tested at the other reference channels.

2.1.2.3 Chest-Worn Devices (Informative)

Chest-Worn Devices are used primarily in the chest-worn position. Chest-Worn Devices shall only be tested in the chest-worn configuration using the Chest Phantom defined in *CTIA 01.72* [15] and not in the free space condition.

Only a single Chest-Worn (ChW) orientation shall be tested. The Chest-Worn Device is tested in one position on the chest phantom, which shall be centered on the chest phantom.

Some Chest-Worn Devices can be worn in the same position on the chest in multiple orientations and/or multiple positions on the chest. The manufacturer shall declare the orientation and position of the device on the chest phantom for test 1) based on the recommended use guidelines when a single orientation and position are identified, or 2) based on the expected worst-case orientation/position within the recommended or reasonable use case guidelines and input from target operators. Relative sensitivity on

intermediate channel testing and relative power on intermediate channel testing shall be performed on the single device orientation/position declared by the manufacturer.

Some Chest-Worn Devices are configured to make E911 calls or restricted to call certain phone numbers. These devices will in general need to be and may be modified prior to OTA testing to enable making a connection with a communication tester. Instructions shall be provided for these devices to ensure that accidental calls to E911 are avoided.

Note that the current relative sensitivity on intermediate channels test procedure cannot be directly applied to Chest-Worn Devices until chest-worn OTA limits are adopted. For relative sensitivity on intermediate channels in LTE, Section 3.1.1 shall apply to Chest-Worn Devices. For relative sensitivity on intermediate channels in NR FR1 SA, Section 3.1.4 3.1.1shall apply to Chest-Worn Devices.

2.1.2.4 Ankle-Worn Devices (Informative)

Ankle-Worn Devices are used primarily in the ankle-worn position. Ankle-Worn Devices shall only be tested in the ankle-worn configuration using the Ankle Phantom defined in *CTIA 01.72* [15] and not in the free space condition.

Only a single ankle orientation (AL) shall be tested. The Ankle-Worn Device is tested and mounted only on the left side of the (left) ankle phantom, as Ankle-Worn Devices are typically worn on outer side of the ankle.

In general, Ankle-Worn Devices can be worn in the same position on the ankle in two orientations. For example, if a device had a single button on the side of the device, the device could be worn on the ankle with the button point upwards or downwards. The manufacturer shall declare the orientation of the device for test 1) based on the recommended use guidelines, or 2) based on the expected worst-case orientation and input from target operators. Relative sensitivity on intermediate channel testing shall be performed on the single device orientation declared by the manufacturer.

Note that the current relative sensitivity on intermediate channels test procedure cannot be directly applied to Ankle-Worn Devices until ankle-worn OTA limits are adopted. For LTE, Section 3.1.1 shall apply to Ankle-Worn Devices. For NR FR1 SA, Section 3.1.4 3.1.1shall apply to Chest-Worn Devices.

2.1.2.5 Integrated Devices that Are Body-Worn

The following rules determine how Integrated Devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

Integrated Devices and Integration Components shall be tested in a free space configuration per Section 2.1.3, unless specific phantom testing is defined such as body worn.

Integration Components are commonly integrated into clothing and in cases where an Integration Component is intended to be used with clothing then no free space testing is required if body worn testing is performed. An Integration Component should be tested in a “host device” declared by the manufacturer as being one of the most common “host devices”.

OTA testing shall be performed with the applicable body phantoms as defined in this test plan. In addition, network operators, or other customers may request testing with non-standardized body phantoms when standardized body phantoms are not applicable or not defined. In such cases, standard fixturing and positioning shall be observed to the extent possible, and the data shall be included and marked as supplemental in the test report. When non-standardized body phantoms are used, the test requirements in Section 2.1.3 shall be followed except that testing shall be done with the applicable body phantom.

Certain devices support usage in more than one physical configuration. Each configuration may produce different radiated performance due to possible changes in antenna orientation. Consequently, such devices

may require testing in more than one configuration. At a minimum, the device shall be tested in the manufacturer's recommended configuration(s).

Some retractable antennas used for Integrated Devices are functional only in the extended position. In such cases, the device shall only be tested with the antenna in the manufacturer's recommended configuration.

Embedded data Modules commonly support multiple protocols or air interfaces (e.g., GPRS/ EGPRS/UMTS) within the same frequency band. In cases where particular modes are not relevant to the intended use of the DUT, it is allowable to test only a subset of the supported protocols. The device manufacturer shall specify the intended use cases (e.g., test mode, data rate, channel set up).

Note that these guidelines shall not preclude using the alternative single-point and multi-point offset test procedures for TIS and TRP described in *CTIA 01.20* [5]. For example, in the event that the manufacturer and operator agree that voice-mode results are not required for certification, the ATL may nevertheless opt to measure TIS and TRP in a voice mode to take advantage of the test time optimization provided by those alternative procedures. The manufacturer should be aware that certain protocols not required by the operator for certification may nonetheless be needed by the ATL and should be enabled on the device submitted for testing.

2.1.2.5.1. Testing of Cellular Desensitization due to Simultaneous Operation of 802.11 Radios for Integrated Devices

Integrated devices that are not required to complete testing per the *CTIA Certification-Wi-Fi Alliance Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices* [19] shall perform testing of cellular desense due to simultaneous operation of 802.11 radios per Section 4.9 in *CTIA 01.20* [5]. For devices where the 802.11 radio will never operate during communication over 3GPP wireless technologies, this test is not required. This test does not measure the impact of cellular communication on the 802.11 wireless interface.

2.1.3 Devices Tested without a Phantom

Device setup and positioning guidelines are defined in *CTIA 01.71* [14].

Radiated performance testing of devices that do not meet the criteria in Section 2.1.2 is limited to free-space only. The applicability of free-space testing is summarized by Table 2.1.3-1 and Table 2.1.3-2:

Table 2.1.3-1 Data-Only Integrated Device Radiated Test Applicability

Data-Only Integrated Device (No Circuit-Switched Voice or VOLTE Support)	Applicable Notes
Integrated, Non-Removable Antenna	See Notes 1, 2, 3, 4 and 5
Removable Antenna Physically Attached to Device	See Notes 1, 2, 3, 4 and 5
Removable Antenna Connected to Device via Transmission line less than 20 cm	See Notes 1, 2, 3, 4 and 5

Table 2.1.3-2 Circuit-Switched Voice or VOLTE-Capable Integrated Device Radiated Test Applicability

Circuit-Switched Voice or Volte-Capable Integrated Device	Applicable Notes
Integrated, Non-Removable Antenna	See Notes 1, 2 and 4

Removable Antenna Physically Attached to Device	See Notes 1, 2 and 4
Removable Antenna Connected to Device via Transmission line less than 20 cm	See Notes 1, 2 and 4

Note 1: Devices larger than the Notebook-sized test volume defined in *CTIA 01.73* [16] Section 5.4 can only be tested in suitable reverberation chambers as long as they still meet the size criteria for the reverberation chamber. Heavy devices that cannot be placed in an OTA chamber are excluded.

Note 2: Some devices include sensors which reduce the transmitter's RF output power when in close proximity to the user. TRP measurements of any device that includes user proximity RF power reduction shall be made when the proximity sensor is not activated (e.g. device is operating at full RF output power). The PTCRB lab shall also measure the device's RF output power when the proximity sensor is activated. This measurement may be made using either conducted or radiated techniques, and the lab shall document the proximity sensor's RF power reduction in dB.

Note 3: WWAN radiated performance testing of data-only devices (no support for voice nor VoLTE) shall be executed on every band supported. In addition, radiated performance testing of data-only devices shall be executed for every cellular radio mode supported according to Table 2.1.3-3 below.

Note 4: A-GNSS OTA testing is required in the free-space configurations as specified in Section 2.1.3. Also, the vendor shall submit to the ATL a declaration of the primary mechanical mode as referenced in this test plan. The ATL shall use the primary mechanical mode when applying the pass/fail limits.

Note 5: Simple IoT devices meet the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. Relative sensitivity on intermediate channel tests and relative power on intermediate channel tests shall be performed on simple IoT devices. However the relative sensitivity intermediate channel test results will be informative and not used for failing a device.

Table 2.1.3-3 Cellular Radio Mode Test Requirements for Data-Only Devices

Cellular Radio Modes Supported By DUT	Cellular Radio Modes Subject To Radiated Performance Testing
GPRS, EGPRS, UMTS, LTE (not VoLTE-capable), NR FR1	LTE, NR FR1
EGPRS, UMTS, LTE (not VoLTE-capable), NR FR1	LTE, NR FR1
UMTS, LTE (not VoLTE-capable), NR FR1	LTE, NR FR1
GPRS, UMTS, LTE (not VoLTE-capable), NR FR1	LTE, NR FR1
GPRS, EGPRS, UMTS, LTE (not VoLTE-capable)	UMTS, LTE
EGPRS, UMTS, LTE (not VoLTE-capable)	UMTS, LTE
UMTS, LTE (not VoLTE-capable)	UMTS, LTE
GPRS, UMTS, LTE (not VoLTE-capable)	UMTS, LTE
GPRS, EGPRS, UMTS	EGPRS, UMTS

EGPRS, LTE (not VoLTE-capable), NR FR1	LTE, NR FR1
EGPRS, LTE (not VoLTE-capable)	EGPRS, LTE
EGPRS, UMTS	EGPRS, UMTS
GPRS, EGPRS	GPRS, EGPRS

2.1.3.1 Large IoT Devices

OTA testing of large IoT devices is limited to TRP and TIS for GSM, GPRS, EGPRS, UMTS and LTE. Large IoT devices are defined as being larger than the Notebook sized test volume defined in *CTIA 01.73* [16] Section 5.4. Near horizon quantities do not need to measured, and relative sensitivity on intermediate channels and relative power on intermediate channels do not need be tested.

2.1.3.2 Notebook and Tablet Devices

The following rules determine how Notebooks and Tablets with embedded Modules will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

Certain devices support usage in more than one physical configuration, such as convertible Notebooks. Each configuration may produce different radiated performance due to possible changes in antenna performance and self-interference. Consequently, such devices may require testing in more than one configuration. At a minimum, the device shall be tested in the manufacturer's recommended configuration(s).

Some retractable antennas used for embedded Notebooks and Tablets are functional only in the extended position. In such cases, the device shall only be tested with the antenna in the manufacturer's recommended configuration.

Embedded WWAN data modules commonly support multiple protocols or air interfaces (e.g. GPRS/ EGPRS/UMTS) within the same frequency band. In cases where particular modes are not relevant to the intended use of the DUT, it is allowable to test only a subset of the supported protocols. The device manufacturer shall specify the intended use cases.

Note that these guidelines shall not preclude using the alternative single-point and multi-point offset test procedures for TIS and TRP described in *CTIA 01.02* [2].For example, in the event that the manufacturer and operator agree that voice-mode results are not required for certification, the ATL may nevertheless opt to measure TIS and TRP in a voice mode to take advantage of the test time optimization provided by those alternative procedures. The manufacturer should be aware that certain protocols not required by the operator for certification may nonetheless be needed by the ATL and should be available on the device submitted for testing.

Since Notebooks and Tablets are not body-worn devices and they are not recommended for use placed directly on the lap, the DUT shall be tested in a Free Space configuration per Section 2.1.3.

2.1.3.3 Integrated Devices that Are Not Body-Worn

The following rules determine how Integrated Devices with embedded WWAN radio modules will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels.

Integrated Devices and Integration Components that are not body-worn shall be tested in a Free Space configuration per Section 2.1.3.

An Integration Component should be tested in a “host device” declared by the manufacturer as being one of the most common “host device”.

Certain devices support usage in more than one physical configuration, such as an Integrated Device placed on a wall or on a desk in normal operating mode (vertical and horizontal plane). Each configuration may produce different radiated performance due to possible changes in antenna orientation (e.g., horizontal and vertical polarization measurements could change). Consequently, such devices may require testing in more than one configuration. At a minimum, the device shall be tested in the manufacturer's recommended configuration(s).

Some retractable antennas used for Integrated Devices are functional only in the extended position. In such cases, the device shall only be tested with the antenna in the manufacturer's recommended configuration.

Embedded data Modules commonly support multiple protocols or air interfaces (e.g., GPRS/ EGPRS/UMTS) within the same frequency band. In cases where particular modes are not relevant to the intended use of the DUT, it is allowable to test only a subset of the supported protocols. The device manufacturer shall specify the intended use cases (e.g., test mode, data rate, channel set up).

Note that these guidelines shall not preclude using the alternative single-point and multi-point offset test procedures for TIS and TRP described in *CTIA 01.20* [5]. For example, in the event that the manufacturer and operator agree that voice-mode results are not required for certification, the ATL may nevertheless opt to measure TIS and TRP in a voice mode to take advantage of the test time optimization provided by those alternative procedures. The manufacturer should be aware that certain protocols not required by the operator for certification may nonetheless be needed by the ATL and should be enabled on the device submitted for testing.

2.1.3.3.1. Testing of Cellular Desensitization due to Simultaneous Operation of 802.11 Radios for Integrated Devices

Integrated Devices that are not required to complete testing per the *CTIA Certification-Wi-Fi Alliance Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices* [19] shall perform testing of cellular desense due to simultaneous operation of 802.11 radios per Section 5.9 in *CTIA 01.20* [5]. For devices where the 802.11 radio will never operate during communication over 3GPP wireless technologies, this test is not required. This test does not measure the impact of cellular communication on the 802.11 wireless interface.

2.1.4 Devices Not Requiring Testing

This section applies to following types of devices:

- Integrated Devices without a defined antenna.
- Integrated Devices with a removable antenna that is connected to the device through an RF transmission line (such as a coaxial cable) greater than 20 cm in length and not physically attached to the host device. The no-testing-required justification document noted above shall include a vendor-provided list of recommended external antennas. The vendor shall also include this list in the product user manual.
- Modules
- PCMCIA cards
- USB Modems

- Variants or re-branded devices having no altered RF performance from their parent device

Note: *The vendor shall consult with the operator(s) to which it intends to sell the device to determine whether operator-specific testing may be required. If no testing is conducted, the lab shall provide a detailed justification document stating that the device falls into one or more of the categories listed above*.

2.1.5 Devices Supporting Antenna Switching

2.1.5.1 Transmit Performance Testing of Devices Containing Multiple TX Antennas

2.1.5.1.1. Devices where the Active TX Antenna Could Switch during the Execution of the Test Cases

These are devices where the choice of which TX antenna is active is not a function of the use case of the device. Instead, TX antenna selection is made according to other parameters such as, but not limited to base station control, user control, RX signal level or other means that originate external to the device. Such a device may switch from one TX antenna to another, but requires specific inputs from an external control source to do so. At this time, devices of this type must measure TRP for each TX antenna individually and the measured values shall be reported accordingly in the Test Report. Devices supporting TX switched diversity are in this device category as well.

1. The manufacturer shall provide either:

    a. Equipment and/or software which will allow the test lab to control which TX antenna is used. Or,

    b. Otherwise identical test devices which are pre-configured for each TX antenna selection.

2. The device manufacturer shall indicate which frequency bands and air interfaces support TX antenna switching in Table RA.1-2 in *CTIA 01.03* [3].

The antenna with better TRP will be used to determine the pass/fail compliance. The better antenna between the two transmitting antennas is always identified as the primary antenna, and the weaker antenna is the secondary antenna.

2.1.5.1.2. Devices where the Active TX Antenna Does Not Switch during the Execution of the Test Cases

These are devices where the choice of which TX antenna is active is a function of the proximity to the user's hand, head or body, or nearby object and is usually determined by sensors contained within the device. Such a device will switch from one TX antenna to another based on the inputs it receives from its own self-contained sensors. The sensors may detect proximity of human tissue (hand, head or body) or may detect proximity of external objects (tables, seats, etc.). In such a device, it is required that the choice of TX antenna of the device remains the same during the TRP test. Below are listed the basic requirements and conditions for two testing mode options, autonomous and non-autonomous defined for FS, BHHL, BHHR, HR, and HL test cases.

1. Autonomous Mode

    a. If the manufacturer chooses, the device is allowed to operate in a fully autonomous mode where it actively chooses the TX antenna depending on the test case during the TRP test.

2. Non-Autonomous Mode

a. The device manufacturer shall supply a “truth table” that clearly identifies which TX antenna will be used for all of the test cases (FS, BHHL, BHHR, HL, HR). The truth table shall be consistent with the software control algorithms activated in the commercial device.

b. In addition, the manufacturer shall provide either:

i. Equipment and/or software which will allow the test lab to control which TX antenna is used for each test case, per the truth table. Or,

ii. Otherwise identical test devices which are pre-configured for the TX antenna selections per the truth table.

c. The device is allowed to change the TX antenna that it uses at different RF frequencies within the same band, or when different TX power levels are chosen, or when a different air interface is chosen, or other manufacturer declared conditions, as long as this is clearly indicated in the truth table and is consistent with the SW control algorithms activated in the commercial device.

2.1.5.2 Receiver Performance Testing of Devices with Antenna Switching

This section deals with devices that may switch one or more receivers between more than one antenna. The most common current application of such a scheme is in incidental support of TX Switched Diversity, wherein the transmit path is switched dynamically between different antennas, in order to optimize TX performance vs. hand presence or other time-variant impairment factors.

A common implementation for such a scheme is to switch the RF front-end path between a main and a diversity antenna, and a main transceiver port and diversity receiver port of the radio. Consequently, when the switch is toggled to direct the transmitter (main transceiver port) to one or the other antenna, the receivers are incidentally also swapped between the two antennas. In most implementations, both receivers remain active for either switch state; that is, the device continuously operates as a diversity receiver. In this case, assuming modern receiver technology like max-ratio-combining is implemented in the device and the receivers have equal conducted performance, the Combined TIS of the device would not change regardless of the switch state (to an ideal first order). In practice, with receiver impairments like transmit desensitization affecting each receiver to a different degree, the C-TIS values of the two switch states may diverge.

There are of course many other hypothetical scenarios whereby antennas may be switched between receivers. For example, there may be cases where there is only one receiver and multiple antennas are switched to it (classically known as Antenna Switched RX Diversity, but could conceivably result from a TX Switched Diversity scheme where the device only has one receiver for the band/mode in question). In a most general case, a diversity device may have N receivers that are always active, and M >= N antennas that are mapped to those receivers at any point in time.

In general, the C-TIS value should be measured for each available switch state that is applicable to the use case under test, to ensure the full range of TIS performance possible in the field is characterized. Exceptions for test time reduction are made where applicable, for example if the manufacturer affirms that C-TIS (at maximum transmit power) is invariant across switch states.

For test time reduction, note that a single-point offset measurement can be used to characterize C-TIS for one cellular radio mode based on the fully measured C-TIS of another cellular radio mode only if the same antenna/receiver combination (switch state) is applied in both cellular radio modes.

Test reports shall be based on the existing reporting tables and also include the receiver/antenna and transmitter/antenna combination used.

2.1.5.2.1. Devices Where the Receiver Could Switch to a Different RX Antenna During the Execution of the Test Cases

These are devices where the choice of which RX antenna is connected to a receiver is either:

- Not a function of the use case of the device, e.g., the decision is made according to other parameters such as, but not limited to base station control, user control, RX signal level or other means that originate external to the device, or

- A function of both the use case of the device and parameters that are not a function of the use case of the device, e.g., the decision depends on both body (head, hand) loading as well as the RX signal level.

Such a device may change the connection of a receiver from one RX antenna to another antenna, but requires specific inputs from an external control source to do so. At this time, devices of this type must measure C-TIS for each antenna/receiver combination that produces a unique value as follows:

1. For the given device use case (i.e., FS, BHHR/BHHL, HR/HL), band, and cellular radio mode wherein the device supports RX antenna switching, measure C-TIS (including relative sensitivity on intermediate channel testing) for the baseline antenna/receiver combination (switch state) as declared by the device manufacturer. The pass/fail criteria shall apply to this test case.
2. For the additional antenna/receiver combinations (switch states) supported in the band and cellular radio mode:
    a. if the device manufacturer declares that the free space C-TIS in step 1 differs by more than 1 dB from the free space C-TIS that would be obtained in the additional antenna/receiver combination in question: Results for additional antenna configurations shall be reported using duplicate tables with each table labeled to identify the antenna configuration tested.

       Measure the free space C-TIS for the additional antenna/receiver combination (switch state). No pass/fail criteria shall be applied to this test case.

    b. Otherwise, no additional testing is needed.
3. If step 2 doesn't apply, then no additional C-TIS testing is required for any additional receiver/antenna combinations.

The manufacturer shall provide either:

- Equipment and/or software which will allow the test lab to control which RX switch state is used. Or,
- Otherwise identical test devices which are pre-configured for each RX switch state selection.

The device manufacturer shall indicate which frequency bands and cellular radio mode support RX antenna switching in Table RA.1-2 in *CTIA 01.03* [3] and specify the baseline antenna/receiver combination (switch state) to be tested first in the procedure above.

2.1.5.2.2. Devices Where the Receiver Does Not Switch to a Different Antenna During the Execution of the Test Cases

These are devices where the choice of which RX antenna is active is a function of the proximity to the user's hand, head or body, or nearby object and is usually determined by sensors contained within the device. Such a device will switch from one RX antenna to another based on the inputs it receives from its own self-contained sensors. The sensors may detect proximity of human tissue (hand, head or body) or may detect proximity of external objects (tables, seats, etc.). In such a device, it is required that the choice of RX antenna of the device remains the same during the C-TIS testing of the receiver/antenna combination (switch state) under test. Below are listed the basic requirements and conditions for two testing mode options, autonomous and non-autonomous defined for FS, BHHL, BHHR, HR, and HL test cases.

1. Autonomous Mode
    a. If the manufacturer chooses, the device is allowed to operate in a fully autonomous mode where it actively chooses the receiver antenna combination depending on the test case during the C-TIS test.
2. Non-Autonomous Mode

a. The device manufacturer shall supply a “truth table” that clearly identifies which receiver-antenna combination will be used during C-TIS testing for all of the test cases (FS, BHHL, BHHR, HL, HR).
b. In addition, the manufacturer shall provide either:
    i. Equipment and/or software which will allow the test lab to control which receiver-antenna combination is used for each test case, per the truth table. Or
    ii. Otherwise identical test devices which are pre-configured for the receiver-antenna selections per the truth table.
c. The device is allowed to change the receiver-antenna combination that it uses at different RF frequencies within the same band, or when different TX power levels are chosen, or when a different air interface is chosen, or other manufacturer declared conditions, as long as this is clearly indicated in the truth table.

2.1.6 Requirements on Partial Surface Radiated Quantities

Most DUTs subject to CTIA CERTIFICATION OTA performance testing are required to report both average radiated quantities (TRP and TIS) and partial surface radiated quantities (e.g., NHPRP, NHPIS, UHIS, and PIGS). While this level of detail is appropriate for many DUTs, some DUTs could benefit from a reduction in test time if only one of these measurements was required. The determination of which DUTs require partial surface radiated measurements is defined according to the requirements in Table 2.1.6-1 below:

This requirement applies to all 3GPP FR1 wireless technologies and MBS.

Table 2.1.6-1: DUTs Requiring Average vs. Partial Surface Radiated Performance Evaluation

DUT Type	Partial Surface Radiated Measurements Required for These Use Cases	Applicable Test Methods	Notes
Handsets; Smartphones	BHHR, BHHL, HR, HL	SISO, Anechoic Chamber	Near horizon measurements needed for BHH and hand only because actual usage matches the OTA test position. Wireless links to base stations are often in directions near the horizon for these use cases. Wireless links to satellites will still be in the upward direction (UHIS, PIGS).
Notebooks; Wireless Access Points; IoT devices where OTA performance in the near horizon is important except large devices (e.g. fixed outdoor installations)	FS	SISO, Anechoic Chamber	Near horizon measurements needed for FS because actual usage matches the OTA test position. Wireless links to base stations are often in directions near the horizon for these use cases. Wireless links to satellites will still be in the upward direction (UHIS, PIGS).
Large IoT devices	None	SISO, Reverberation Chamber	Partial surface quantity measurements are not required because the reverberation chamber is currently the only methodology for testing large IoT devices.

DUT Type	Partial Surface Radiated Measurements Required for These Use Cases	Applicable Test Methods	Notes
Tablets; Wrist-Worn Devices; IoT devices not defined elsewhere in this table	None	SISO, Anechoic Chamber; SISO, Reverberation Chamber	Partial surface quantity measurements are not needed because either 1) multiple orientations are used (not fixed) or 2) devices are installed indoors (not outdoors) where multi-path makes near horizon performance less important.

2.1.7 Test Requirements That Are 3GPP FR1 Wireless Technology Specific

In general, all supported 3GPP FR1 Wireless Technology protocols and bands shall be tested, unless otherwise specified within this document. In general, all channels specified in *CTIA 01.50* [10] for applicable protocols and bands shall be tested, unless otherwise specified within this document. In general, the relative sensitivity or TIS of all the intermediate channels specified in *CTIA 01.50* [10] for applicable protocols and bands shall be tested, unless otherwise specified within this document. In the case of fully measured TIS, the same limit as that channel's reference channel shall be applied with a 3 dB margin as per the intermediate channel test procedure. Regardless of test method, intermediate channel results shall be reported as PASS/FAIL.

Relative power on intermediate channel testing is not required unless otherwise specified in this section.

Table 2.1.7-1 provides a generic summary of the OTA test requirements for 3GPP FR1 wireless technologies by device type. Test requirements listed elsewhere in the section will supersede this table.

Table 2.1.7-1 Generic Test Requirements by Device Type for 3GPP FR1 Wireless Technologies

DUT Type	Use Case	Comment	TRP	NHPRP	TIS	NHPIS	Relative Sensitivity on Intermediate Channels	Relative Power on Intermediate Channels
Hand-Held Devices	FS		Yes	No	Yes	No	Yes	Yes
	HR	If the device supports data usage in the hand	Yes	Yes	Yes	Yes	No	No
	HL		Yes	Yes	Yes	Yes	No	No
	BHHR	If the device supports voice calls against the head	Yes	Yes	Yes	Yes	Yes	Yes
	BHHL		Yes	Yes	Yes	Yes	No	No
Notebooks; Wireless Access Points; IoT devices where OTA performance in the near horizon is important except large devices (e.g. fixed outdoor installations)	FS		Yes	Yes	Yes	Yes	Yes	Yes

DUT Type	Use Case	Comment	TRP	NHPRP	TIS	NHPIS	Relative Sensitivity on Intermediate Channels	Relative Power on Intermediate Channels
Large IoT devices	FS		Yes	No	Yes	No	No	No
Tablets; IoT devices not defined elsewhere in this table	FS		Yes	No	Yes	No	Yes	Yes
Wrist-Worn Devices	WR or WL	Side with worse OTA performance	Yes	No	Yes	No	Yes	Yes

2.1.7.1 UMTS

This section is intentionally left empty.

2.1.7.2 LTE Single Carrier

If the device supports LTE Band 25 and LTE Band 2, then testing is only required to be completed in LTE Band 25. If the device supports LTE Band 26 and LTE Band 5, then testing is only required to be completed in LTE Band 26. If the device supports LTE Band 66 and LTE Band 4, then testing is only required to be completed in LTE Band 66.

These test reductions also apply to A-GNSS and MBS.

2.1.7.3 LTE CA and LAA

The LTE CA/LAA band combination shall always list the PCC first, and then all SCCs will be listed in ascending order.

When submitting a device for CA and LAA testing, the device manufacturer shall declare the target operator(s) for the device, and the LTE CA and LAA testing shall be limited as described in this section.

The operator CA and LAA priority list is included in *CTIA 01.02* [2].

If the device supports both CA_66A-xA and CA_4A-xA (where x is the band number of the SCC), then testing is only required in CA_66A-xA. Similarly, if the device supports both CA_xA-66A and CA_xA-4A (where x is the band number of the PCC), then testing is only required in CA_xA-66A.

DUTs incapable of supporting the aggregated channel BW associated with the CA or LAA CA modes specified in *CTIA 01.50* [10] do not need to be tested.

Relative sensitivity on intermediate channel testing is not required for LTE LAA and LTE CA.

2.1.7.3.1. LTE CA TRP Test Requirements

Full TRP testing is required in the 2 DL and 3 DL CA combinations identified as high priority combinations by the operator CA priority lists (see *CTIA 01.02* [2]) for all of the target operators for the UE under test. Single point offset testing shall not be used for high priority combinations.

TRP testing is required in the 2 DL and 3 DL CA combinations identified as high priority combinations and secondary priority combinations by the operator CA priority lists for all of the target operators for the UE under test. Single point offset testing may be used for secondary priority combinations. However, if a single point offset test results in a TRP value that deviates more than 2 dB from the TRP of the fully tested reference, then a full TRP measurement is required.

No additional TRP testing is required for any CA combinations not identified as high priority or secondary priority.

2.1.7.3.2. LTE CA TIS Test Requirements

Full TIS testing of the SCC is required for any CA combinations with known self-desensitization issues that are identified as “Essential” in the operator CA priority lists (see *CTIA 01.02* [2]) and are supported on the device (no TIS testing of the PCC is required). Single point offset testing shall not be used for CA combinations with known self-desensitization issues that are identified as “Essential” in the operator CA priority lists.

TIS testing (PCC and all SCC's) is required in the 2 DL and 3 DL CA combinations identified as high priority combinations and secondary priority combinations by the operator CA priority lists for all of the target operators for the UE under test. Single point offset testing may be used for both high priority and secondary priority combinations. However, if a single point offset test results in a TIS value that deviates more than 3 dB from the TIS of the fully tested reference, then a full TIS measurement is required.

No additional TIS testing is required for any CA combinations not identified as “Essential”, high priority or secondary priority.

2.1.7.3.3. LTE LAA TIS Test and LAA un-Licensed Degradation Test Requirements (Informative)

Full TIS testing is required on Band 46 for one 2 CC LAA combination as defined by the logic in Figure 2.1.7.3.3-1.

Band 46 radiated sensitivity performance for all other 2 CC and 3 CC LAA combinations that are identified by the operator LAA priority lists for all of the target operators for the UE under test shall be evaluated using the LAA Un-Licensed Degradation Test defined in *CTIA 01.50* [10].

No additional Band 46 TIS testing is required.

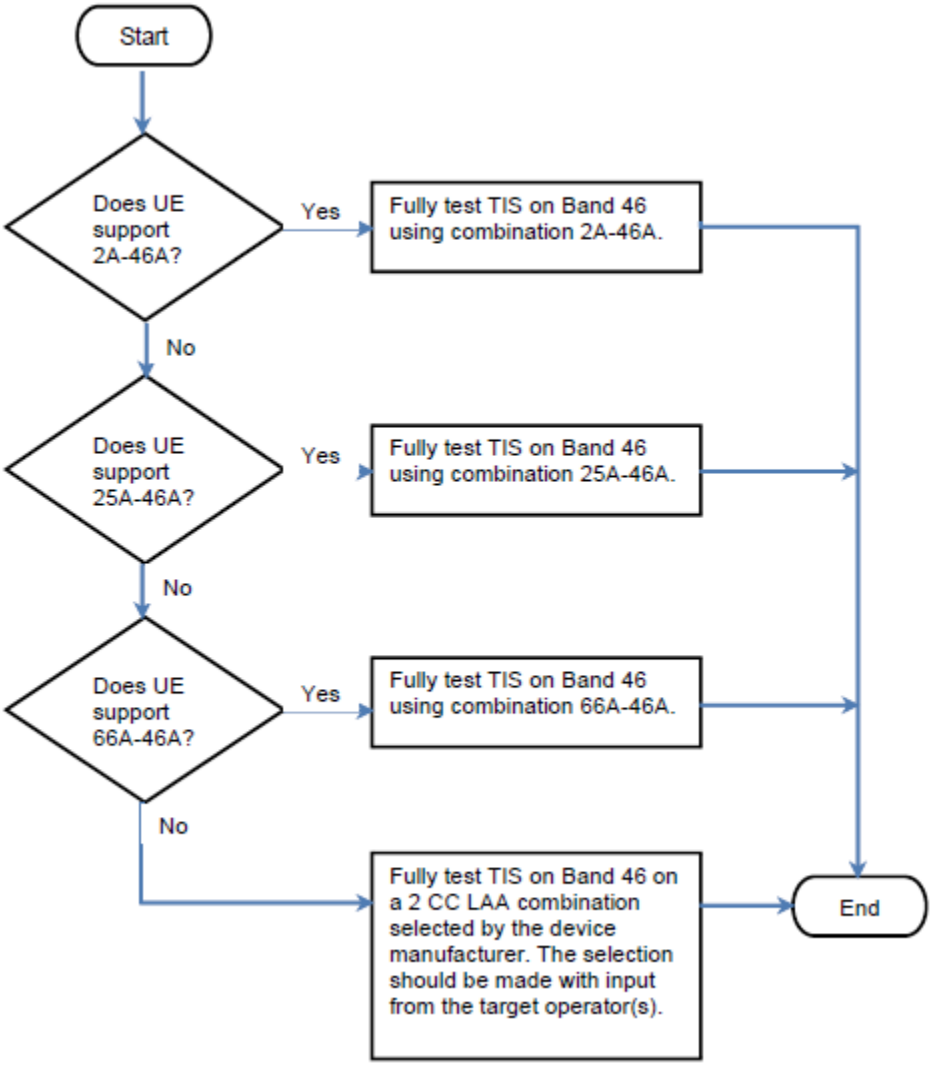

Figure 2.1.7.3.3-1 Logic for Determining the LAA Combination Used for Full TIS Testing of Band 46

2.1.7.4 LTE Category M1 and Category NB1

Relative sensitivity on intermediate channel testing is not required for LTE Category M1 and LTE Category NB1.

If the device supports LTE Category M1 Band 26 and LTE Category M1 Band 5, then testing is only required to be completed in LTE Category M1 Band 26.

If the device supports LTE Category NB1 Band 25 and LTE Category NB1 Band 2, then testing is only required to be completed in LTE Category NB1 Band 25. If the device supports LTE Category NB1 Band 26 and LTE Category NB1 Band 5, then testing is only required to be completed in LTE Category NB1 Band 26. If the device supports LTE Category NB1 Band 66 and LTE Category NB1 Band 4, then testing is only required to be completed in LTE Category NB1 Band 66.

LTE Category M1 and LTE Category NB1 device vendors should consult the target operator(s) prior to device submission. If LTE Category M1 and/or LTE Category NB1 TRP and TIS testing is required by the

target operator(s), the device vendor shall provide specific information concerning the frequency bands, cellular radio mode and mechanical use cases to be evaluated when submitting the device for testing.

If the LTE Category M1 and/or LTE Category NB1 device is not targeted for a specific operator(s), then perform testing as follows:

- If LTE Category M1 is supported, then TRP/TIS testing shall be executed in all supported bands included in the list below:
    - Band 4
    - Band 5
    - Band 12
    - Band 13

  Note: If LTE Category M1 and LTE Category NB1 are both supported in one or more bands, then LTE Category M1 testing is the only cellular radio mode required in the supported bands.

- If LTE Category NB1 is supported, then TRP/TIS testing shall be executed in all supported bands included in the list below unless otherwise noted:
    - Band 4
    - Band 5
    - Band 12
    - Band 13
    - Band 66

  Note: If Bands 4 and 66 are supported in LTE Category NB1, then testing shall be executed in Band 66; Band 4 testing is not required in this case.

2.1.7.5 NR FR1 SA Single Carrier

If the device supports NR Band n25 and NR Band n2, then testing is only required to be completed in NR Band n25. If the device supports NR Band n26 and NR Band n5, then testing is only required to be completed in NR Band n26.

Relative sensitivity on intermediate channel testing is required for NR FR1 SA single carrier.

Relative power on intermediate channel testing is required for wide frequency bands in NR FR1 SA single carrier as defined in *CTIA 01.51* [11] Section 5.1.1.1.1.

2.1.7.6 NR FR1 EN-DC (1 LTE Carrier with 1 NR Carrier)

When submitting a device for NR FR1 EN-DC testing, the device manufacturer shall declare the target operator(s) for the device, and the NR FR1 EN-DC testing shall be limited as described in the operator priority list included in *CTIA 01.02* [2].

The PTCRB Variant ID is used to uniquely identify settings associated with a particular combination of bands in NR FR1 EN-DC. The PTCRB Variant ID defines 1) the MCG/SCG and PCC/SCC, 2) bandwidths of each CC in the band combination, and 3) the SCS for NR bands.

Relative sensitivity on intermediate channel testing is not required for NR FR1 EN-DC.

2.1.8 Test Requirements That Are Location Based Wireless Technologies Specific

2.1.8.1 Generic A-GNSS Test Requirements

A-GNSS devices shall be tested for A-GPS L1, A-GPS L5 and A-GALILEO E1 if applicable.

The test applies to both UE-based and UE-assisted A-GNSS devices. If both UE-based and UE-assisted A-GNSS are supported by a device, then both modes will be tested unless otherwise specified.

If a device supports both UE-based and UE-assisted GNSS methods, then the radiated A-GNSS intermediate channel degradation measurement will be limited to UE-assisted A-GNSS. In this case, the radiated A-GNSS intermediate channel degradation results will apply to both UE-assisted and UE-based A-GNSS.

More specific test requirements listed elsewhere in the document will supersede the tables in this section.

Table 2.1.8.1-1 provides a generic summary of the OTA test requirements for A-GNSS by device type.

Table 2.1.8.1-1 Generic Test Requirements by Device Type for A-GNSS

DUT Type	Use Case	Comment	TIS / Average 3D C/N_0	UHIS / UH 3D C/N_0	PIGS / PIG 3D C/N_0	Intermediate Channel Degradation to A-GNSS
Hand-Held Devices	FS		No	No	No	No
	HR	If the device supports data usage in the hand	Yes	Yes	Yes	Yes
	HL		Yes	Yes	Yes	No
	BHHR	If the device supports voice calls against the head	Yes	Yes	Yes	Yes
	BHHL		Yes	Yes	Yes	No
Notebooks; Wireless Access Points; IoT devices where OTA performance in the near horizon is important except large devices (e.g. fixed outdoor installations)	FS		Yes	Yes	Yes	Yes
Large IoT devices	FS		No	No	No	No

Tablets; IoT devices not defined elsewhere in this table	FS		Yes	No	No	Yes
Wrist-Worn Devices	WR or WL	Side with worse OTA performance	Yes	No	No	Yes

Table 2.1.8.1-2 provides a summary of the OTA test requirements for A-GNSS when different cellular protocols are used for assistance.

Table 2.1.8.1-2 A-GNSS Test Requirements When Different Cellular Protocols Are Used for Assistance

	Control Plane		**User Plane**			
			RRLP		**LPP**	
	UE-Based	**UE-Assisted**	**UE-Based**	**UE-Assisted**	**UE-Based**	**UE-Assisted**
GSM	Required If Supported	Required If Supported	Not Supported	Not Supported	Not Supported	Not Supported
UMTS	Required If Supported	Required If Supported	Not Supported	Not Supported	Not Supported	Not Supported
LTE	Required[1,2]	Required[1,2]	Not Required	Required[1,3]	Not Required	Required[1,3]
LTE Category M1	Required[1,2]	Required[1,2]	Not Required	Required[1,3]	Not Required	Required[1,3]
NR FR1 EN-DC	Required[1,2]	Required[1,2]	Not Required	Required[1,3]	Not Required	Required[1,3]
NR FR1 SA	Required[1,2]	Required[1,2]	Not Required	Not Required	Not Required	Required[1,3]
Note 1: A-GNSS testing is only required in either User Plane or Control Plane and the positioning procedure used for test shall be selected by the manufacturer. The selection should be made with input from the target operators. In the absence of operator input, then User Plane Positioning procedures should be used.						
Note 2: When utilizing Control Plane Positioning procedures, the test applies to both UE-based and UE-assisted A-GNSS devices. If both UE-based and UE-assisted A-GNSS is supported by a device, then both modes will be tested.						
Note 3: If user plane testing is selected, then either RRLP or LPP positioning protocol may be used during the test.						

Table 2.1.8.1-3 Test Requirements for Different Cellular Protocols Used for Assistance for Different GNSS Services

	A-GPS L1	**A-GPS L5**	**A-GALILEO E1**
GSM	Required	Not Required	Not Required
UMTS	Required	Not Required	Not Required
LTE	Required	Required	Required
LTE Category M1	Required	Not Required	Not Required

NR FR1 EN-DC	Required	Required	Required
NR FR1 SA	Required	Required	Required

2.1.8.1.1. UMTS

A-GNSS testing of UMTS 2100/1700 is not required.

2.1.8.1.2. LTE

If the device supports LTE Band 25 and LTE Band 2, then A-GNSS testing is only required to be completed with LTE Band 25. If the device supports LTE Band 26 and LTE Band 5, then A-GNSS testing is only required to be completed with LTE Band 26. If the device supports LTE Band 66 and LTE Band 4, then A-GNSS testing is only required to be completed with LTE Band 66.

2.1.8.1.3. LTE Category M1

If the device supports LTE Category M1 Band 26 and LTE Category M1 Band 5, then A-GNSS testing is only required to be completed with LTE Category M1 Band 26.

No A-GNSS intermediate channel degradation measurements are required for LTE Category M1 devices.

LTE Category M1 device vendors should consult the target operator(s) prior to device submission. If A-GNSS testing with LTE Category M1 is required by the target operator(s), the device vendor shall provide specific information concerning the frequency bands, cellular radio mode and mechanical use cases to be evaluated when submitting the device for testing.

If the LTE Category M1 device is not targeted for a specific operator(s), then perform testing as follows:

- If LTE Category M1 is supported, then A-GNSS testing shall be executed in all supported bands included in the list below:
  - Band 4
  - Band 5
  - Band 12
  - Band 13

2.1.8.2 A-GPS L1 Test Requirements

2.1.8.2.1. LTE

For devices that support transmitter antenna switching, the sensitivity search in Band 13 and Band 14 and the calculation of TIS, UHIS, and PIGS shall be performed with the transmitter connected to each transmit antenna independently. TIS, UHIS, and PIGS results shall be provided for both transmit antennas. Results shall pass for both transmit antennas or the test for Band 13/Band 14 shall be failed.

2.1.8.2.2. LTE Category M1

For devices that support transmitter antenna switching, the sensitivity search in Band 13 and the calculation of TIS, UHIS, and PIGS shall be performed with the transmitter connected to each transmit

antenna independently. TIS, UHIS, and PIGS results shall be provided for both transmit antennas. Results shall pass for both transmit antennas or the test for Band 13 shall be failed.

2.1.8.2.3. NR FR1 EN-DC (1 LTE Carrier with 1 NR Carrier)

When submitting a device for A-GPS L1 with NR FR1 EN-DC OTA testing, the device manufacturer shall declare the target operator(s) for the device, and the A-GPS L1 with NR FR1 EN-DC OTA testing shall be limited as described in the operator priority list included in *CTIA 01.02* [2].

2.1.8.3 A-GPS L5 Test Requirements

The same positioning procedures and positioning protocol shall be used when testing A-GPS L5 as was used for reference mode testing in A-GPS L1.

2.1.8.4 A-GALILEO E1 Test Requirements

The same positioning procedures and positioning protocol shall be used when testing A-GALILEO E1 as was used for reference mode testing in A-GPS L1.

2.1.8.4.1. LTE

For devices that support transmitter antenna switching, the sensitivity search in Band 13 and Band 14 and the calculation of TIS, UHIS, and PIGS shall be performed with the transmitter connected to each transmit antenna independently. TIS, UHIS, and PIGS results shall be provided for both transmit antennas. Results shall pass for both transmit antennas or the test for Band 13/Band 14 shall be failed.

2.1.8.5 MBS Test Requirements

Table 2.1.8.5-1 provides a generic summary of the OTA test requirements for MBS by device type. Test requirements listed elsewhere in the section will supersede this table.

Table 2.1.8.5-1 Generic Test Requirements by Device Type for MBS

DUT Type	Use Case	Comment	TIS	NHPIS	Intermediate Channel Degradation To MBS
Hand-Held Devices	FS		No	No	No
	HR	If the device supports data usage in the hand	Yes	Yes	Yes
	HL		Yes	Yes	No
	BHHR	If the device supports voice calls against the head	Yes	Yes	Yes
	BHHL		Yes	Yes	No

Notebooks; Wireless Access Points; IoT devices where OTA performance in the near horizon is important except large devices (e.g. fixed outdoor installations)	FS		Yes	Yes	Yes
Large IoT devices	FS		No	No	No
Tablets; IoT devices not defined elsewhere in this table	FS		Yes	No	Yes
Wrist-Worn Devices	WR or WL	Side with worse OTA performance	No	No	No

Table 2.1.8.5-2 MBS Test Requirements When Different Cellular Protocols Are Used for Assistance

	Control Plane	User Plane
LTE	Required[1]	Required[1]
Note 1: MBS testing is only required in either User Plane or Control Plane and the positioning procedure used for test shall be selected by the manufacturer. The selection should be made with input from the target operators. In the absence of operator input, then User Plane Positioning procedures should be used.		

2.1.8.5.1. LTE

MBS testing for LTE Devices will use either User Plane or Control Plane Positioning procedures. Testing is only required in either User Plane or Control Plane and the positioning procedure used for test shall be selected by the manufacturer. The selection should be made with input from the target operators. In the absence of operator input, then Control Plane Positioning procedures shall be used.

If the device supports LTE Band 25 and LTE Band 2, then MBS testing is only required to be completed with LTE Band 25. If the device supports LTE Band 26 and LTE Band 5, then MBS testing is only required to be completed with LTE Band 26. If the device supports LTE Band 66 and LTE Band 4, then MBS testing is only required to be completed with LTE Band 66.

2.2 SISO, Millimeter Wave Test Methodology

Devices supporting NR FR2 EN-DC shall complete the following tests:

- Maximum output power - EIRP
- Maximum output power - TRP
- Maximum output power -spherical coverage
- REFSENS – EIS
- REFSENS - spherical coverage

All supported normative FR2 bands shall be tested.

Device mechanical modes that are not representative of end use do not need to be tested. The ATL shall use the primary mechanical mode to test low, mid, and high frequency ranges and use these results when applying the pass/fail limits (if applicable). Testing in non-primary mechanical modes is only required in the low and high frequency ranges; mid frequency range testing is not required.

2.2.1 Devices Tested with a Phantom

For future study.

2.2.2 Devices Tested without a Phantom

Testing shall be performed in free space.

2.3 MIMO Test Methodologies

Devices supporting MIMO in LTE shall complete the MIMO average radiated SIR sensitivity (MARSS) performance tests. All supported normative LTE bands shall be tested considering the test reduction below.

If the device supports both Band 2 and Band 25, then testing is only required in Band 25. If the device supports both Band 4 and Band 66, then testing is only required in Band 66. If the device supports both Band 5 and Band 26, then testing is only required in Band 26.

Testing is not required in any band where the maximum antenna spacing is greater than one wavelength. For LTE 4 RX devices where the antenna separation of any two antennas exceeds one wavelength, 2x2 MIMO testing is not required for that band.

2.3.1 Devices Tested with a Phantom

For future study.

2.3.2 Devices Tested without a Phantom

MIMO OTA performance testing of Hand-Held Devices and Tablets in free-space shall be performed in Date Mode Portrait (DMP) and Data Mode Landscape (DML) - Right Tilt for all normative operating bands. Testing in DML - Left Tilt and Date Mode Screen-Up (DMSU) shall be limited to all normative operating bands below 1 GHz. The MIMO OTA performance assessment of Notebooks is not currently normative.

Section 3 Temporary Test Requirements

All test requirements included in the section are intended to be temporary in nature, and supersede existing requirements in this test plan where applicable.

3.1 SISO Test Methodologies for Wireless Technologies below 6 GHz

3.1.1 LTE Relative Sensitivity on Intermediate Channels Test

Until such time that OTA limits are added for LTE TIS, the relative sensitivity on intermediate channels testing process shall be modified to report the FS $EIS_{(IC)}$, BHHR $EIS_{(IC)}$, and WL/WR $EIS_{(IC)}$, if applicable, at each LTE Intermediate Channel test channel (including the reference test channels) as defined in *CTIA 01.50* [10]. FS $EIS_{(IC)}$, BHHR $EIS_{(IC)}$, and WL/WR $EIS_{(IC)}$, are equivalent to FS $EIS_{(peak),}$ BHHR $EIS_{(peak)}$, and WL/WR $EIS_{(peak),}$ respectively, for the reference channels. Please refer to the relative sensitivity testing process in *CTIA 01.20* [5] for a general definition of FS $EIS_{(peak)}$, BHHR $EIS_{(peak),}$ and WL/WR $EIS_{(peak)}$. The same position and polarization shall be used for the intermediate channels as used for the corresponding reference channels. If the optional full TIS method was used at an intermediate channel, the EIS value obtained from the full TIS measurement associated with the peak position and polarization for the closest reference channel shall be reported. The results shall be reported using the following template, Table 3.1.1-1. The full TIS results at the intermediate channels may be included as additional data and marked as supplemental in the test report.

Table 3.1.1-1 LTE Relative Sensitivity on Intermediate Channels

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
2	10	650	1935			
2	10	740	1944			
2	10	820	1952			
2	10	900	1960			
2	10	980	1968			
2	10	1060	1976			
2	10	1150	1985			
4	10	2000	2115			
4	10	2090	2124			
4	10	2175	2132.5			
4	10	2260	2141			
4	10	2350	2150			

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
12	5	5035	731.5			
12	5	5065	734.5			
12	5	5095	737.5			
12	5	5125	740.5			
12	5	5155	743.5			
25	5	8065	1932.5			
25	5	8105	1936.5			
25	5	8145	1940.5			
25	5	8185	1944.5			
25	5	8225	1948.5			
25	5	8265	1952.5			
25	5	8305	1956.5			
25	5	8345	1960.5			
25	5	8365	1962.5			
25	5	8385	1964.5			
25	5	8425	1968.5			
25	5	8465	1972.5			
25	5	8505	1976.5			
25	5	8545	1980.5			
25	5	8585	1984.5			
25	5	8625	1988.5			
25	5	8665	1992.5			
26	5	8715	861.5			
26	5	8755	865.5			
26	5	8795	869.5			

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
26	5	8835	873.5			
26	5	8865	876.5			
26	5	8895	879.5			
26	5	8935	883.5			
26	5	8975	887.5			
26	5	9015	891.5			
7	20	2850	2630			
7	20	2975	2642.5			
7	20	3100	2655			
7	20	3225	2667.5			
7	20	3350	2680			
41	20	39750	2506			
41	20	39930	2524			
41	20	40110	2542			
41	20	40280	2559			
41	20	40450	2576			
41	20	40620	2593			
41	20	40790	2610			
41	20	40960	2627			
41	20	41130	2644			
41	20	41310	2662			
41	20	41490	2680			
48	10	55290	3555			
48	10	55380	3564			
48	10	55470	3573			

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
48	10	55560	3582			
48	10	55650	3591			
48	10	55740	3600			
48	10	55830	3609			
48	10	55910	3617			
48	10	55990	3625			
48	10	56070	3633			
48	10	56150	3641			
48	10	56240	3650			
48	10	56330	3659			
48	10	56420	3668			
48	10	56510	3677			
48	10	56600	3686			
48	10	56690	3695			
66	10	66486	2115			
66	10	66566	2123			
66	10	66636	2130			
66	10	66706	2137			
66	10	66786	2145			
66	10	66866	2153			
66	10	66936	2160			
66	10	67006	2167			
66	10	67086	2175			
71	10	68636	622			
71	10	68706	629			

Band	Channel Bandwidth (MHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
71	10	68761	634.5			
71	10	68816	640			
71	10	68886	647			

3.1.2 Waiver for MBS OTA Testing

MBS OTA testing is waived until MBS test equipment is added to the Authorized Equipment List.

3.1.3 Waiver for n77 Canada Testing

5G NR Stand Alone (SA) single carrier TRP and C-TIS test channels for n77 Canada are included as informative only in Section 5.1.1 of *CTIA 01.50* [10]. 5G NR SA testing of n77 Canada is not currently required. n77 Canada is expected to become normative at a later date.

3.1.4 NR FR1 SA Relative Sensitivity on Intermediate Channels Test

Until such time that OTA limits are added for NR FR1 SA, the relative sensitivity on intermediate channels testing process shall be modified to report the FS $EIS_{(IC)}$, BHHR $EIS_{(IC)}$, and WL/WR $EIS_{(IC)}$, if applicable, at each NR FR1 SA Intermediate Channel test channel (including the reference test channels) as defined in *CTIA 01.50* [10]. FS $EIS_{(IC)}$, BHHR $EIS_{(IC)}$, and WL/WR $EIS_{(IC)}$, are equivalent to FS $EIS_{(peak),}$ BHHR $EIS_{(peak)}$, and WL/WR $EIS_{(peak),}$ respectively, for the reference channels. Please refer to the relative sensitivity testing process in *CTIA 01.20* [5] for a general definition of FS $EIS_{(peak)}$, BHHR $EIS_{(peak),}$ and WL/WR $EIS_{(peak)}$. The same position and polarization shall be used for the intermediate channels as used for the corresponding reference channels. If the optional full TIS method was used at an intermediate channel, the EIS value obtained from the full TIS measurement associated with the peak position and polarization for the closest reference channel shall be reported. The results shall be reported using the following template, Table 3.1.4-1. The full TIS results at the intermediate channels may be included as additional data and marked as supplemental in the test report.

Table 3.1.4-1 NR FR1 SA Relative Sensitivity on Intermediate Channels

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
n2	10	15	387000	1935			
			388400	1942			
			389800	1949			
			391200	1956			
			392000	1960			

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
			392800	1964			
			394200	1971			
			395600	1978			
			397000	1985			
n25	10	15	387000	1935			
			388400	1942			
			389800	1949			
			391200	1956			
			392500	1962.5			
			393800	1969			
			395200	1976			
			396600	1983			
			398000	1990			
n26	10	15	172800	864			
			174200	871			
			175300	876.5			
			176400	882			
			177800	889			
n41	20	30	501204	2506.02			
			504204	2521.02			
			507204	2536.02			
			510198	2550.99			
			513198	2565.99			
			516198	2580.99			
			518998	2592.99			

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
			520998	2604.99			
			523998	2619.99			
			526998	2634.99			
			529998	2649.99			
			532998	2664.99			
			535998	2679.99			
n48	20	30	637334	3560.01			
			638500	3577.5			
			639500	3592.5			
			640500	3607.5			
			641666	3624.99			
			642834	3642.51			
			643834	3657.51			
			644834	3672.51			
			646000	3690			
n66	10	15	423000	2115			
			424600	2123			
			426000	2130			
			427400	2137			
			429000	2145			
			430600	2153			
			432000	2160			
			433400	2167			
			435000	2175			
n71	10	15	124400	622			

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
			125800	629			
			126900	634.5			
			128000	640			
			129400	647			
n77 (Canada)	20	30	630668	3460.02			
			631668	3475.02			
			632668	3490.02			
			633668	3505.02			
			634668	3520.02			
			635668	3535.02			
			636668	3550.02			
			637668	3565.02			
			638668	3580.02			
			639668	3595.02			
			640668	3610.02			
			641668	3625.02			
			642666	3639.99			
n77 (USA Range A)	20	30	647334	3710.01			
			648500	3727.5			
			649500	3742.5			
			650500	3757.5			
			651666	3774.99			
			652834	3792.51			
			653834	3807.51			
			654834	3822.51			

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
			656000	3840			
			657166	3857.49			
			658166	3872.49			
			659166	3887.49			
			660334	3905.01			
			661500	3922.5			
			662500	3937.5			
			663500	3952.5			
			664666	3969.99			
n77 (USA Range B)	20	30	630668	3460.02			
			631534	3473.01			
			632400	3486			
			633334	3500.01			
			634266	3513.99			
			635134	3527.01			
			636000	3540			
n78	20	30	620668	3310.02			
			621668	3325.02			
			622668	3340.02			
			623668	3355.02			
			624668	3370.02			
			625668	3385.02			
			626668	3400.02			
			627668	3415.02			
			628668	3430.02			

3GPP Config. Identifier	CC BW (MHz)	SCS (kHz)	Channel	Frequency (MHz)	FS $EIS_{(IC)}$ (dBm)	BHHR $EIS_{(IC)}$ (dBm)	WR/WL $EIS_{(IC)}$ (dBm)
			629668	3445.02			
			630668	3460.02			
			631668	3475.02			
			632666	3489.99			
			633666	3504.99			
			634666	3519.99			
			635666	3534.99			
			636666	3549.99			
			637666	3564.99			
			638666	3579.99			
			639666	3594.99			
			640666	3609.99			
			641666	3624.99			
			642666	3639.99			
			643666	3654.99			
			644666	3669.99			
			645666	3684.99			
			646666	3699.99			
			647666	3714.99			
			648666	3729.99			
			649666	3744.99			
			650666	3759.99			
			651666	3774.99			
			652666	3789.99			

3.2 SISO, Millimeter Wave Test Methodology

There are no additional, temporary test requirements for this test methodology at this time.

3.3 MIMO Test Methodologies

There are no additional, temporary test requirements for these test methodologies at this time.

Section 4 Test Criteria

4.1 Test Criteria for SISO Test Method for 3GPP FR1 Wireless Technologies

The TRP and TIS criteria are protocol specific and specified in this section.

The criteria for the relative sensitivity on intermediate channels are defined as follows:

- When full TIS measurements are performed on intermediate channels, the intermediate channel passes if the full TIS result is better than 1) the TIS limit or 2) the TIS result at either of the neighboring reference channels plus 1 dB. The full TIS results at the intermediate channels may be included as additional data and marked as supplemental in the test report.
- When the single point sensitivity measurements are performed on intermediate channels, the intermediate channel passes if the single point sensitivity passes the standard sensitivity threshold at a reference downlink signal power. The reference downlink signal power is defined as the EIS of the nearest reference TIS measurement increased by 3 dB plus the M1 dB. M1 is defined as the larger of 0 dB or the amount the TIS exceeds the target. Full details of how the perform the relative sensitivity on intermediate channels can be found in *CTIA 01.20* [5].

4.1.1 GSM

4.1.1.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted (if applicable).

The limits in Table 4.1.1.1-1 are recommended.

Table 4.1.1.1-1 GSM Minimum TRP Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR[3]
GSM 850	Yes[4]	2	≤72	32	TBD	N/A
		2	>72	32	TBD	N/A
		3	≤72	30	TBD	N/A
		3	>72	30	TBD	N/A
		4	≤72	26	TBD	N/A
		4	>72	26	TBD	N/A
		5	≤72	22	TBD	N/A
		5	>72	22	TBD	N/A
		2	All	32	N/A	N/A

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR[3]
	No[5]	3	All	30	N/A	N/A
		4	All	26	N/A	N/A
		5	All	22	N/A	N/A
GSM 1900	Yes[4]	1	≤72	24.5	TBD	N/A
		1	>72	24.5	TBD	N/A
		2	≤72	18.5	TBD	N/A
		2	>72	18.5	TBD	N/A
		3	≤72	27.5	TBD	N/A
		3	>72	27.5	TBD	N/A
	No[5]	1	All	24.5	N/A	N/A
		2	All	18.5	N/A	N/A
		3	All	27.5	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: GSM HL and HR tests are optional and are currently not a requirement of this Test Plan, but may be used for single and multiple offset point reference tests including GPRS/EGPRS.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

Note: Device Power shall comply with the power levels specified in the relevant industry standard(s).

4.1.1.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

The limits in Table 4.1.1.2-1 are recommended. However, they shall be used to determine the mandatory pass/fail limits for the relative sensitivity on intermediate channel tests.

Relative sensitivity on intermediate channels test results shall be provided in a file format specified in Section 5. The reported RF level that produces a 2.44% RBER for each channel shall be less than the level determined in *CTIA 01.50* [10].

Table 4.1.1.2-1 GSM Maximum C-TIS Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR[3]
GSM 850	Yes[4]	2	≤72	-99	TBD	N/A
			>72	-99	TBD	N/A
		3	≤72	-99	TBD	N/A
			>72	-99	TBD	N/A
		4	≤72	-99	TBD	N/A
			>72	-99	TBD	N/A
		5	≤72	-99	TBD	N/A
			>72	-99	TBD	N/A
	No[5]	2	All	-99	N/A	N/A
		3	All	-99	N/A	N/A
		4	All	-99	N/A	N/A
		5	All	-99	N/A	N/A
GSM 1900	Yes[4]	1	≤72	-101.5	TBD	N/A
			>72	-101.5	TBD	N/A
		2	≤72	-101.5	TBD	N/A
			>72	-101.5	TBD	N/A
		3	≤72	-101.5	TBD	N/A
			>72	-101.5	TBD	N/A
	No[5]	1	All	-101.5	N/A	N/A
		2	All	-101.5	N/A	N/A
		3	All	-101.5	N/A	N/A

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR[3]
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor). Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB. Note 3: GSM HL and HR tests are optional and are currently not a requirement of this Test Plan, but may be used for single and multiple offset point reference tests including GPRS/EGPRS. Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode. Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.						

4.1.2 GPRS

4.1.2.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted (if applicable).

The limits in Table 4.1.2.1-1 are recommended.

Table 4.1.2.1-1 GPRS Minimum TRP Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1 2]

Band	Device Held Up to Head for Voice (Yes/ No)	Device Power Class	Device Width (mm)[3]	FS	BHHL and BHHR	HL and HR
GPRS 850	Yes[4]	2	≤72	32	TBD	TBD
		2	>72	32	TBD	TBD
		3	≤72	30	TBD	TBD
		3	>72	30	TBD	TBD
		4	≤72	26	TBD	TBD
		4	>72	26	TBD	TBD
		5	≤72	22	TBD	TBD
		5	>72	22	TBD	TBD
	No[5]	2	All	32	N/A	N/A
		3	All	30	N/A	N/A
		4	All	26	N/A	N/A
		5	All	22	N/A	N/A

Band	Device Held Up to Head for Voice (Yes/ No)	Device Power Class	Device Width (mm)[3]	FS	BHHL and BHHR	HL and HR
GPRS 1900	Yes[4]	1	≤72	24.5	TBD	TBD
		1	>72	24.5	TBD	TBD
		2	≤72	18.5	TBD	TBD
		2	>72	18.5	TBD	TBD
		3	≤72	27.5	TBD	TBD
		3	>72	27.5	TBD	TBD
	No[5]	1	All	24.5	N/A	N/A
		2	All	18.5	N/A	N/A
		3	All	27.5	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: The associated TRP value is based on measurements made with one uplink slot. Devices tested using two uplink time slots are allowed a TRP reduction of 3 dB, devices tested using three uplink slots are allowed a TRP reduction of up to 4.8 dB and devices tested using four uplink slots are allowed a TRP reduction of up to 6 dB. These allowances for uplink slot counts greater than one are based on an DUT capable of meeting the minimum TRP performance in single slot operation. This allowance is in alignment with 3GPP TS 45.005 [20], Section 4.1.1, Table 4.1-5.

Note 3: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

Note: Device Power shall comply with the power levels specified in the relevant industry standard(s).

4.1.2.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

The limits in Table 4.1.2.2-1 are recommended. However, they shall be used to determine the mandatory pass/fail limits for the intermediate channel desensitization tests.

Relative sensitivity on intermediate channels test results shall be provided in a file format specified in Section 5. The reported RF level that produces a 10% BLER for each channel shall be less than the level determined in *CTIA 01.50* [10].

Table 4.1.2.2-1 GPRS Maximum C-TIS Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
GPRS 850	Yes[3]	2	≤72	-99	TBD	TBD
		2	>72	-99	TBD	TBD
		3	≤72	-99	TBD	TBD
		3	>72	-99	TBD	TBD
		4	≤72	-99	TBD	TBD
		4	>72	-99	TBD	TBD
		5	≤72	-99	TBD	TBD
		5	>72	-99	TBD	TBD
	No[4]	2	All	-99	N/A	N/A
		3	All	-99	N/A	N/A
		4	All	-99	N/A	N/A
		5	All	-99	N/A	N/A
GPRS 1900	Yes[3]	1	≤72	-101.5	TBD	TBD
		1	>72	-101.5	TBD	TBD
		2	≤72	-101.5	TBD	TBD
		2	>72	-101.5	TBD	TBD
		3	≤72	-101.5	TBD	TBD
		3	>72	-101.5	TBD	TBD
	No[4]	1	All	-101.5	N/A	N/A
		2	All	-101.5	N/A	N/A
		3	All	-101.5	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.3 EGPRS

4.1.3.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted (if applicable).

The limits in Table 4.1.3.1-1 are recommended.

Table 4.1.3.1-1 EGPRS Minimum TRP Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1] [2]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[3]	FS	BHHL and BHHR	HL and HR
EGPRS 850	Yes[4]	E1	≤72	26	TBD	TBD
		E1	>72	26	TBD	TBD
		E2	≤72	20	TBD	TBD
		E2	>72	20	TBD	TBD
		E3	≤72	16	TBD	TBD
		E3	>72	16	TBD	TBD
	No[5]	E1	All	26	N/A	N/A
		E2	All	20	N/A	N/A
		E3	All	16	N/A	N/A
EGPRS 1900	Yes[4]	E1	≤72	24.5	TBD	TBD
		E1	>72	24.5	TBD	TBD
		E2	≤72	20.5	TBD	TBD
		E2	>72	20.5	TBD	TBD
		E3	≤72	16.5	TBD	TBD
		E3	>72	16.5	TBD	TBD
	No[5]	E1	All	24.5	N/A	N/A
		E2	All	20.5	N/A	N/A
		E3	All	16.5	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: The associated TRP value is based on measurements made with one or two uplink slots. Devices tested using three uplink slots are allowed a TRP reduction of up to 1.8 dB and devices tested using four uplink slots are allowed a TRP reduction of up to 3 dB. These allowances for uplink slot counts greater than two are based on an DUT capable of meeting the minimum TRP performance in single or dual-slot operation.

Note 3: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

Note: Device Power shall comply with the power levels specified in the relevant industry standard(s).

4.1.3.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

The limits in Table 4.1.3.2-1 are recommended. However, they shall be used to determine the mandatory pass/fail limits for the intermediate channel desensitization tests.

Relative sensitivity on intermediate channels test results shall be provided in a file format specified in Section 5 The reported RF level that produces a 10% BLER for each channel shall be less than the level determined in *CTIA 01.50* [10].

Table 4.1.3.2-1 EGPRS Maximum C-TIS Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
EGPRS 850	Yes[3]	E1	≤72	-94	TBD	TBD
		E1	>72	-94	TBD	TBD
		E2	≤72	-94	TBD	TBD
		E2	>72	-94	TBD	TBD
		E3	≤72	-94	TBD	TBD
		E3	>72	-94	TBD	TBD
	No[4]	E1	All	-94	N/A	N/A
		E2	All	-94	N/A	N/A
		E3	All	-94	N/A	N/A
EGPRS 1900	Yes[3]	E1	≤72	-97	TBD	TBD
		E1	>72	-97	TBD	TBD
		E2	≤72	-97	TBD	TBD
		E2	>72	-97	TBD	TBD
		E3	≤72	-97	TBD	TBD
		E3	>72	-97	TBD	TBD
	No[4]	E1	All	-97	N/A	N/A
		E2	All	-97	N/A	N/A
		E3	All	-97	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.4 UMTS (WCDMA)

4.1.4.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted (if applicable).

The limits in Table 4.1.4.1-1 are recommended.

Table 4.1.4.1-1 UMTS Minimum TRP Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
UMTS 850	Yes[3]	3	≤72	17	TBD	TBD
		3	>72	17	TBD	TBD
		4	≤72	14	TBD	TBD
		4	>72	14	TBD	TBD
	No[4]	3	All	17	N/A	N/A
		4	All	14	N/A	N/A
UMTS 1900	Yes[3]	3	≤72	18.5	TBD	TBD
		3	>72	18.5	TBD	TBD
		4	≤72	15.5	TBD	TBD
		4	>72	15.5	TBD	TBD
	No[4]	3	All	18.5	N/A	N/A
		4	All	15.5	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

Note: Device Power shall comply with the power levels specified in the relevant industry standard(s).

4.1.4.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

The limits in Table 4.1.4.2-1 are recommended. However, they shall be used to determine the mandatory pass/fail limits for the intermediate channel desensitization tests.

Relative sensitivity on intermediate channels test results shall be provided in a file format equivalent to that specified in Section 5. The reported RF level that produces a 1.2% BER for each channel shall be less than the level determined in *CTIA 01.50* [10].

Table 4.1.4.2-1 UMTS Maximum C-TIS Level (in dBm) Recommended Limits for the Primary Mechanical Mode[1]

Band	Device Held Up to Head for Voice (Yes/No)	Device Power Class	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
UMTS 850	Yes[3]	3	≤72	-100	TBD	TBD
		3	>72	-100	TBD	TBD
		4	≤72	-100	TBD	TBD
		4	>72	-100	TBD	TBD
	No[4]	3	All	-100	N/A	N/A
		4	All	-100	N/A	N/A
UMTS 1900	Yes[3]	3	≤72	-102	TBD	TBD
		3	>72	-102	TBD	TBD
		4	≤72	-102	TBD	TBD
		4	>72	-102	TBD	TBD
	No[4]	3	All	-102	N/A	N/A
		4	All	-102	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.5 LTE Single Carrier

4.1.5.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations and/or wrist-worn configurations, across all channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

The TRP value for each LTE band shall meet the limits in Table 4.1.5.1-1. The limits for simple IoT devices in Table 4.1.5.1-1 are recommended.

Table 4.1.5.1-1 LTE Minimum TRP Level (in dBm) Requirements for the Primary Mechanical Mode[1]

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
LTE Band 71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 12	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 13	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 14	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 26	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	16	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 70	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 25	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
LTE Band 4	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 30	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 7	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 41	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 48	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	18	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Held to head for voice" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "Wrist worn" applies to devices that are worn on the wrist, e.g., smartwatches.

Note 5: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for Simple IoT devices are recommended.

Note 6: Applicable to any device not meeting the criteria for Note 3, Note 4 or Note 5.

4.1.5.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations and/or wrist-worn configurations across all channels measured with the DUT antenna extended and retracted.

Relative sensitivity on intermediate channels test results shall be provided in a file format equivalent to that specified in Section 5.

The C-TIS value for each LTE band shall meet the limits in Table 4.1.5.2-1. The limits for simple IoT devices in Table 4.1.5.2-1 are recommended.

Table 4.1.5.2-1 LTE Maximum C-TIS Level (in dBm) Requirements for the Primary Mechanical Mode[1]

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
LTE Band 71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	Simple IoT Devices[5]	All	-87	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 12	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-90	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 13	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-87	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 14	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-87	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 26	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-90.5	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 5		≤72	TBD	N/A	TBD	TBD

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-88	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 70	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-90.2	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-90	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 25	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-91.5	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 4	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	Simple IoT Devices[5]	All	-92	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-91.5	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 30	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-91	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 7	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-87	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 41	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
		>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-87	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A
LTE Band 48		≤72	TBD	N/A	TBD	TBD

Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
	Wrist worn[4]	All	N/A	TBD	N/A	N/A
	Simple IoT Devices[5]	All	-91	N/A	N/A	N/A
	Other[6]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Held to head for voice" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "Wrist worn" would be applicable to devices that are worn on the wrist, e.g., smartwatches.

Note 5: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 6: Applicable to any device not meeting the criteria for Note 3, Note 4 or Note 5.

4.1.6 LTE Two Downlink Carrier Aggregation (Single Uplink Carrier)

The number and type of measurements required to support TRP and TIS performance evaluation shall be determined based on the CA specific test requirements for carrier aggregation testing as described in Section 2.1.7.3.

4.1.6.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and hand only configurations (if applicable) across all applicable channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

The TRP value for each applicable LTE 2 DL band combination shall meet the limits in Table 4.1.6.1-1.

Table 4.1.6.1-1 LTE Carrier Aggregation Mode (2 Downlink Carriers, 1 Uplink Carrier) TRP Criteria Table for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-29A	Yes[3]	≤72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_4A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5B	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
CA_5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-66A	Yes[3]	≤72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_25A-25A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_25A-26A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_25A-41A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_26A-25A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_26A-41A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_30A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_41A-25A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_41A-26A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_41C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_41A-41A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
CA_48A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-30A	Yes[3]	≤72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_70C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.6.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and hand only configurations (if applicable) across all applicable channels. When applicable, the receiver performance in all applicable CA band combinations shall be measured once with the DUT antenna extended and again with it retracted.

C-TIS shall meet the limits for the PCC and the SCC as shown in Table 4.1.6.2-1.

Table 4.1.6.2-1 LTE Maximum C-TIS Level Requirements for PCC and SCC In Carrier Aggregation Mode (2 Downlink Carriers, 1 Uplink Carrier) for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_2A-2A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_2A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
		Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_2A-66A	PCC	No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_4A-12A	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_5A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5B	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_5A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-4A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
		Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_12A-30A	PCC	No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_13A-48A	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_25A-25A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_25A-26A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_25A-41A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_26A-25A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_26A-41A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_30A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
		Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_41A-25A	PCC	No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_41A-26A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_41C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_41A-41A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_48A-2A	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_66A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_66A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)2	Free Space	HL and HR
CA_70C		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: Different limits for different channel combinations may be needed since the desensitization effects will be channel dependent.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.7 LTE Three Downlink Carrier Aggregation (Single Uplink Carrier)

The number and type of measurements required to support TRP and TIS performance evaluation shall be determined based on the CA specific test requirements for carrier aggregation testing as described in Section 2.1.7.3.

4.1.7.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and hand only configurations (if applicable) across all applicable channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in secondary mechanical modes as reference information.

TRP shall meet the limits as shown in Table 4.1.7.1-1 below.

Table 4.1.7.1-1 LTE Carrier Aggregation Mode (3 Downlink Carriers, 1 Uplink Carrier) TRP Criteria Table for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_2A-2A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-2A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-4A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-4A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-4A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-4A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-5A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_2A-5A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-12A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-12A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-13A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-13A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-29A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-48A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_2A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_2A-66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-2A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-2A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-4A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-4A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_4A-4A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-5A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-12A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_4A-29A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-2A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-2A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_5A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-4A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-4A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-29A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-30A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-48A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_5A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_5A-66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-2A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-4A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-4A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-29A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_12A-30A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_12A-66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_13A-4A-4A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-48A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_13A-66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_25A-41C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-2A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-2A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_30A-4A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-4A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-4A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-5A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-12A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-29A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_30A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_30A-66A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_41D	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-2A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_48A-13A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_66A-2A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C-2A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-2A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-5A-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-5A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_66A-5A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C-5A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-5A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-12A-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-12A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C-12A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-12A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-13A-48A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_66C-13A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-13A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-29A-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C-29A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-29A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66C-30A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-30A-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66D	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD

Carrier Aggregation Combination	Device Held to Head for Voice	Device Width (mm)[2]	Free Space	HL and HR
	No[4]	All	TBD	N/A
CA_66C-66A	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A
CA_66A-66C	Yes[3]	≤72	TBD	TBD
	Yes[3]	>72	TBD	TBD
	No[4]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.7.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and hand only configurations (if applicable) across all applicable channels. When applicable, the receiver performance in all applicable CA band combinations shall be measured once with the DUT antenna extended and again with it retracted.

C-TIS shall meet the limits for the PCC, SCC1, and SCC2 as shown in Table 4.1.7.2-1 below.

Table 4.1.7.2-1 LTE Maximum C-TIS Level Requirements for PCC, SCC1, and SCC2 in Carrier Aggregation Mode (3 Downlink Carriers, 1 Uplink Carrier) for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-2A-4A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-2A-5A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-2A-12A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-2A-13A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-2A-66A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-4A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-4A-5A	SCC1	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-4A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-4A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-5A-30A	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-5A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-5A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-12A-30A		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-12A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-13A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-13A-66A	PCC	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-29A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-48A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-2A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_4A-2A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-2A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-2A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-4A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-4A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-4A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-5A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-12A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-29A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-2A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-2A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_5A-2A-30A	SCC1	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-2A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-2A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_5A-4A-4A	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-4A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-5A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_5A-29A-30A		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-30A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-48A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_5A-66C	PCC	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-2A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_12A-2A-4A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-2A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-2A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_12A-4A-4A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-4A-30A[3]	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-29A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-30A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-2A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-2A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-2A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-2A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-4A-4A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_13A-48A-66A	SCC1	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_13A-66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_25A-41C	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-2A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-2A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_30A-2A-29A		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-4A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-4A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_30A-4A-29A	PCC	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-5A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-5A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_30A-12A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-29A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_30A-66A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_41D	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-2A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-2A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-2A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-5A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_48A-13A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A-12A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66A-2A-48A	SCC1	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66C-2A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-2A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66A-5A-5A	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-5A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66C-5A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66A-5A-66A		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-12A-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-12A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66C-12A	PCC	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-12A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-13A-48A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66C-13A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-13A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-29A-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_66C-29A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-29A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66C-30A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-30A-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66D	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66C-66A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head For Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-66C	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: Different limits for different channel combinations may be needed since the desensitization effects will be channel dependent.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.8 LTE LAA Downlink Carrier Aggregation

4.1.8.1 TIS Criteria

Results shall be reported for the Band 46 radiated sensitivity as specified in as specified in Section 5. Results shall include cases where Band 46 TIS is fully measured for a given downlink LTE LAA carrier aggregation combination and where Band 46 radiated sensitivity is evaluated using the LAA un-licensed degradation test for a given downlink LTE LAA carrier aggregation combination. Reports shall include results for free-space and hand only configurations (if applicable) across all applicable channels defined in Table 4.1.8.1-1 and Table 4.1.8.1-2. When applicable, the Band 46 receiver performance in all LTE LAA CA band combinations shall be measured once with the DUT antenna extended and again with it retracted.

Table 4.1.8.1-1 LTE LAA Maximum C-TIS Level for all Antennas (in dBm) Requirements for PCC and SCC in Carrier Aggregation Mode (2 Downlink Carriers, 1 Uplink Carrier) for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_13A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_25A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_26A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up to Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_41A-46A		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: Different limits for different channel combinations may be needed since the desensitization effects will be channel dependent.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

Table 4.1.8.1-2 LTE LAA Maximum C-TIS Level for All Antennas (in dBm) Requirements for PCC, SCC1, and SCC2 in Carrier Aggregation Mode (3 Downlink Carriers, 1 Uplink Carrier) for the Primary Mechanical Mode[1]

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_2A-4A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
CA_2A-5A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-13A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-29A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_2A-66A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-5A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_4A-13A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_5A-12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_30A-12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_41C-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
			≤72	TBD	TBD

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66A-5A-46A	SCC1	Yes[4]	>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-12A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
CA_66A-13A-46A	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	PCC	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Carrier Aggregation Combination	PCC/SCC	Device Held Up To Head for Voice (Yes/No)	Device Width (mm)[2]	Free Space	HL and HR
CA_66A-66A-46A	SCC1	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A
	SCC2	Yes[4]	≤72	TBD	TBD
			>72	TBD	TBD
		No[5]	All	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: Different limits for different channel combinations may be needed since the desensitization effects will be channel dependent.

Note 4: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.

Note 5: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions.

4.1.9 LTE Category M1

4.1.9.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space and/or wrist-worn configurations across all channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

TRP shall meet the limits as shown in Table 4.1.9.1-1 below. The limits for simple IoT devices in Table 4.1.9.1-1 are recommended.

Table 4.1.9.1-1 LTE Category M1 Minimum TRP Level (in dBm) Requirements for the Primary Mechanical Mode[1]

Band	Use Case Supported	Power Class	FS	WL and WR
LTE Band 71	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 12	Wrist Worn[2]	3	N/A	TBD

Band	Use Case Supported	Power Class	FS	WL and WR
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 13	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 26	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 5	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 2	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A

Band	Use Case Supported	Power Class	FS	WL and WR
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 4	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 7	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 41	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches

Note 3: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 4: Applicable to any devices that do not meet the criteria for Note 2 or Note 3.

4.1.9.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space and/or wrist-worn configurations across all channels and RB allocations measured

with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

TIS shall meet the limits as shown in Table 4.1.9.2-1 below. The limits for simple IoT devices in Table 4.1.9.2-1 are recommended.

Table 4.1.9.2-1 LTE Category M1 Maximum C-TIS Level (in dBm/1080 KHz) Requirements for the Primary Mechanical Mode[1]

Band	Use Case Supported	FS	WL and WR
LTE Band 71	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-93.2	N/A
	Other[4]	TBD	N/A
LTE Band 12	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-93	N/A
	Other[4]	TBD	N/A
LTE Band 13	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-93	N/A
	Other[4]	TBD	N/A
LTE Band 26	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-94	N/A
	Other[4]	TBD	N/A
LTE Band 5	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-94.5	N/A
	Other[4]	TBD	N/A
LTE Band 4	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-98	N/A
	Other[4]	TBD	N/A
LTE Band 2	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-96	N/A
	Other[4]	TBD	N/A
LTE Band 7	Wrist Worn[2]	N/A	TBD

Band	Use Case Supported	FS	WL and WR
	Simple IoT Devices[3]	-96	N/A
	Other[4]	TBD	N/A
LTE Band 41	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-97	N/A
	Other[4]	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches

Note 3: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 4: Applicable to any devices that do not meet the criteria for Note 2 or Note 3.

4.1.10 LTE Category NB1

4.1.10.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space and/or wrist-worn configurations across all relevant channels measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

TRP shall meet the limits as shown in Table 4.1.10.1-1 below. The limits for simple IoT devices in Table 4.1.10.1-1 are recommended.

Table 4.1.10.1-1 LTE Category NB1 Minimum TRP Level (dBm) for Stand-Alone (SA) Operation Using $\pi/4$ QPSK (15 KHZ Sub-Carrier Spacing) in the Primary Mechanical Mode[1]

Band	Use Case Supported	Power Class	FS	WL and WR
LTE Band 71	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 12	Wrist Worn[2]	3	N/A	TBD

Band	Use Case Supported	Power Class	FS	WL and WR
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 13	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 14	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 26	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 5	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	16	N/A
		5	13	N/A

Band	Use Case Supported	Power Class	FS	WL and WR
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 25	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 2	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 4	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
LTE Band 66	Wrist Worn[2]	3	N/A	TBD
		5	N/A	TBD
	Simple IoT Devices[3]	3	18	N/A
		5	15	N/A
	Other[4]	3	TBD	N/A
		5	TBD	N/A
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).				

Band	Use Case Supported	Power Class	FS	WL and WR
Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches Note 3: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended. Note 4: Applicable to any devices that do not meet the criteria for Note 2 or Note 3.				

4.1.10.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space and/or wrist-worn configurations across all relevant channels measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

TIS shall meet the limits as shown in Table 4.1.10.2-1 below. The limits for simple IoT devices in Table 4.1.10.2-1 are recommended.

Table 4.1.10.2-1 LTE Category NB1 Maximum TIS Level (dBm) for Stand-Alone (SA) Operation Using QPSK (15 kHz Sub-Carrier Spacing) in the Primary Mechanical Mode[1]

Band	Use Case Supported	FS	WL and WR
LTE Band 71	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 12	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 13	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 14	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 26	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 5	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-101.2	N/A
	Other[4]	TBD	N/A
LTE Band 25	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-103.2	N/A

Band	Use Case Supported	FS	WL and WR
	Other[4]	TBD	N/A
LTE Band 2	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-103.2	N/A
	Other[4]	TBD	N/A
LTE Band 4	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-103.2	N/A
	Other[4]	TBD	N/A
LTE Band 66	Wrist Worn[2]	N/A	TBD
	Simple IoT Devices[3]	-103.2	N/A
	Other[4]	TBD	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches

Note 3: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 4: Applicable to any devices that do not meet the criteria for Note 2 or Note 3.

4.1.11 NR FR1 SA Single Carrier

4.1.11.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations and/or wrist-worn configurations, across all channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

The TRP value for each NR FR1 SA band shall meet the limits in Table 4.1.11.1-1.

Table 4.1.11.1-1 NR FR1 SA Minimum TRP Level (dBm) in the Primary Mechanical Mode[1]

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
n2	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n5	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n12	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n14	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n25	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n30	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n41	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
n66	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	3	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n70	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n71	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n77 (Canada)	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n77 (USA)	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n78	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2		≤72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Held to head for voice" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: "Wrist worn" applies to devices that are worn on the wrist, e.g., smartwatches.

Note 5: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 6: Applicable to any device not meeting the criteria for Note 3, Note 4 or Note 5.

4.1.11.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations and/or wrist-worn configurations across all channels measured with the DUT antenna extended and retracted.

Relative sensitivity on intermediate channels and relative power on intermediate channels test results shall be provided in a file format equivalent to that specified in Section 5.

The C-TIS value for each NR FR1 SA band shall meet the limits in Table 4.1.11.2-1.

Table 4.1.11.2-1 NR FR1 SA Maximum TIS Level (dBm) in the Primary Mechanical Mode[1]

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
n2	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n5	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n12	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n14	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n25	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n30	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n41	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n66	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	3	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n70	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n71	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n77 (Canada)	1		≤72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n77 (USA)	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
n78	1	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A
	2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
			>72	TBD	N/A	TBD	TBD
		Wrist worn[4]	All	N/A	TBD	N/A	N/A
		Simple IoT Devices[5]	All	TBD	N/A	N/A	N/A
		Other[6]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: “Held to head for voice” applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

3GPP Config. Identifier	VAR.	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR

Note 4: "Wrist worn" applies to devices that are worn on the wrist, e.g., smartwatches.

Note 5: Simple IoT devices meet all of the following criteria: 1) only support data, 2) are non-CA devices, 3) are 60mm or larger in size, and 4) are not wearable devices. The limits for simple IoT devices are recommended.

Note 6: Applicable to any device not meeting the criteria for Note 3, Note 4 or Note 5.

4.1.12 NR FR1 EN-DC (1 LTE Carrier with 1 NR Carrier)

4.1.12.1 TRP Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations configurations, across all channels and RB allocations measured with the DUT in primary mechanical mode, and (if applicable) in non-primary mechanical modes as reference information.

The TRP value for each NR FR1 EN-DC band shall meet the limits in Table 4.1.12.1-1.

Table 4.1.12.1-1 LTE Minimum TRP Level (dBm) for EN-DC in the Primary Mechanical Mode[1]

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
DC_2A_n5A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n66A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n71A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n78A	1			≤72	TBD	TBD	TBD

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
		LTE Band 2	Held to head for voice[3]	>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	LTE Band 2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_5A_n66A	1	LTE Band 5	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_5A_n78A	1	LTE Band 5	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	LTE Band 5	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_7A_n78A	1	LTE Band 7	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	LTE Band 7	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_12A_n66A	1	LTE Band 12	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_13A_n2A	1	LTE Band 13	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
			Other[4]	All	TBD	N/A	N/A
DC_13A_n66A	1	LTE Band 13	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n2A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n5A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n71A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n78A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	LTE Band 66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_(n)71AA	1	LTE Band 71	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A

Table 4.1.12.1-2 NR FR1 Minimum TRP Level (dBm) for EN-DC in the Primary Mechanical Mode[1]

3GPP Config. Identifier	Var.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
DC_2A_n5A	1	NR n5	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n71A	1	NR n71	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_2A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_5A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_5A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD

3GPP Config. Identifier	Var.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
			Other[4]	All	TBD	N/A	N/A
DC_7A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_12A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_13A_n2A	1	NR n2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_13A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n2A	1	NR n2	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n5A	1	NR n5	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_66A_n71A	1	NR n71	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A

3GPP Config. Identifier	Var.	Band	Use Cases Supported	Device Width (mm)[2]	FS	BHHL and BHHR	HL and HR
DC_66A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A
DC_(n)71AA	1	NR n71	Held to head for voice[3]	≤72	TBD	TBD	TBD
				>72	TBD	TBD	TBD
			Other[4]	All	TBD	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: “Held to head for voice” applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: Applicable to any device not meeting the criteria for Note 3.

4.1.12.2 TIS Criteria

Results shall be reported as specified in Section 5. Reports shall include results for applicable use cases, including free-space, head/hand configurations across all channels measured with the DUT antenna extended and retracted.

Relative sensitivity on intermediate channels test results shall be provided in a file format equivalent to that specified in Section 5.

The C-TIS value for each NR FR1 EN-DC band shall meet the limits in Table 4.1.12.2-1.

Table 4.1.12.2-1 LTE Maximum C-TIS Level (dBm) for EN-DC in the Primary Mechanical Mode[1]

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
DC_2A_n5A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n66A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n71A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n78A	1	LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	LTE Band 2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_5A_n66A	1	LTE Band 5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
DC_5A_n78A	1	LTE Band 5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	LTE Band 5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_7A_n78A	1	LTE Band 7	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	LTE Band 7	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_12A_n66A	1	LTE Band 12	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_13A_n2A	1	LTE Band 13	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_13A_n66A	1	LTE Band 13	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n2A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n5A	1			≤72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
		LTE Band 66	Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n71A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n78A	1	LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	LTE Band 66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_(n)71AA	1	LTE Band 71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: “Held to head for voice” applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: Applicable to any device not meeting the criteria for Note 3.

Table 4.1.12.2-2 NR FR1 Maximum C-TIS Level (dBm) for EN-DC in the Primary Mechanical Mode[1]

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
DC_2A_n5A	1	NR n5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n71A	1	NR n71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_2A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_5A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_5A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
DC_7A_n78A	1	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_12A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_13A_n2A	1	NR n2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_13A_n66A	1	NR n66	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n2A	1	NR n2	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n5A	1	NR n5	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n71A	1	NR n71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_66A_n78A	1	NR n78		≤72	TBD	N/A	TBD	TBD

3GPP Config. Identifier	VAR.	Band	Use Cases Supported	Device Width (mm)[2]	FS	WL and WR	BHHL and BHHR	HL and HR
			Held to head for voice[3]	>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
	2	NR n78	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A
DC_(n)71AA	1	NR n71	Held to head for voice[3]	≤72	TBD	N/A	TBD	TBD
				>72	TBD	N/A	TBD	TBD
			Other[4]	All	TBD	N/A	N/A	N/A

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Note 3: "Held to head for voice" applies if the device supports voice operation in the talking position against the head in any cellular radio mode.

Note 4: Applicable to any device not meeting the criteria for Note 3.

4.1.13 Cellular Desensitization Due to Simultaneous Operation of 802.11 Radios for Integrated Devices

No pass/fail criteria exist for cellular desensitization due to simultaneous operation of 802.11 radios.

4.2 Test Criteria for SISO Test Method for Location Based Wireless Technologies

4.2.1 A-GPS L1

4.2.1.1 TIS, UHIS and PIGS and Intermediate Channel Degradation Test Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) or wrist-worn configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

A-GPS L1 intermediate channel degradation test results shall be provided in a file format equivalent to that specified in Section 5.

Table 4.2.1.1-1, Table 4.2.1.1-2 and Table 4.2.1.1-3 contain the pass/fail limits for A-GPS L1 for devices held to the head for voice, Integrated Devices and wrist-worn devices, respectively.

Table 4.2.1.1-1 A-GPS L1 Maximum TIS/UHIS/PIGS Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice[1]

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
GSM 850	Control Plane / UE-Based	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
GSM 1900		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
UMTS 850		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
UMTS 1900		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)²	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
GSM 850	Control Plane / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
GSM 1900		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
UMTS 850		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
UMTS 1900		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)²	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)²	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)²	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Table 4.2.1.1-2 A-GPS L1 Maximum TIS/UHIS/PIGS Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices[1]

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
GSM 850	Control Plane / UE-Based	TBD	TBD	TBD
GSM 1900		TBD	TBD	TBD
UMTS 850		TBD	TBD	TBD
UMTS 1900		TBD	TBD	TBD
LTE Band 71		TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
GSM 850	Control Plane / UE-Assisted	TBD	TBD	TBD
GSM 1900		TBD	TBD	TBD
UMTS 850		TBD	TBD	TBD
UMTS 1900		TBD	TBD	TBD
LTE Band 71		TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD

Table 4.2.1.1-3 A-GPS L1 Maximum TIS Level (in dBm) Requirements for the Primary Mechanical Mode for Wrist-Worn Devices[1]

Band	Positioning Method	WL and WR
		TIS
LTE Band 71	Control Plane / UE-Based	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD

Band	Positioning Method	WL and WR
		TIS
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
LTE Band 71	Control Plane / UE-Assisted	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD

Band	Positioning Method	WL and WR
		TIS
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD

Band	Positioning Method	WL and WR
		TIS
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD

4.2.2 A-GPS L5

4.2.2.1 Average 3D C/N_0 / UH 3D C/N_0 / PIG 3D C/N_0 and Intermediate Channel Degradation Test Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) or wrist-worn configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

A-GPS L5 intermediate channel degradation test results shall be provided in a file format equivalent to that specified in Section 5.

Table 4.2.2.1-1, Table 4.2.2.1-2 and Table 4.2.2.1-3 contain the pass/fail limits for A-GPS L5 for devices held to the head for voice, Integrated Devices and Wrist-Worn Devices, respectively.

Table 4.2.2.1-1 A-GPS L5 Minimum Average 3D C/N_0 / UH 3D C/N_0 / PIG 3D C/N_0 Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice[1]

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 71	Control Plane / UE-Based	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71	Control Plane / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0	Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Table 4.2.2.1-2 A-GPS L5 Minimum Average 3D C/N_0 / UH 3D C/N_0 / PIG 3D C/N_0 Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices[1]

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 71	Control Plane / UE-Based	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
LTE Band 71	Control Plane / UE-Assisted	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD

Band	Positioning Method	FS		
		Average 3D C/N_0	UH 3D C/N_0	PIG 3D C/N_0
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input).				

Table 4.2.2.1-3 A-GPS L5 Minimum Average 3D C/N_0 Level (in dBm) Requirements for the Primary Mechanical Mode for Wrist-Worn Devices[1]

Band	Positioning Method	WL and WR
		Average 3D C/N_0
LTE Band 71	Control Plane / UE-Based	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD

Band	Positioning Method	WL and WR
		Average 3D C/N_0
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
LTE Band 71	Control Plane / UE-Assisted	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD

Band	Positioning Method	WL and WR
		Average 3D C/N_0
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD

Band	Positioning Method	WL and WR
		Average 3D C/N_0
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input).

4.2.3 A-GALILEO E1

4.2.3.1 TIS, UHIS and PIGS and Intermediate Channel Degradation Test Criteria

Results shall be reported as specified in Section 5. Reports shall include results for free-space and head/hand configurations (if applicable) or wrist-worn configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

A-GALILEO E1 intermediate channel degradation test results shall be provided in a file format equivalent to that specified in Section 5.

Table 4.2.3.1-1, Table 4.2.3.1-2 and Table 4.2.3.1-3 contain the pass/fail limits for A-GALILEO E1 for devices held to the head for voice, Integrated Devices and Wrist-Worn Devices, respectively.

Table 4.2.3.1-1 A-GALILEO E1 with Maximum TIS/UHIS/PIGS Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice[1]

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
LTE Band 71	Control Plane / UE-Based	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
		≤72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_5A_n66A		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71	Control Plane / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
		≤72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_66A_n71A		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
		≤72	N/A	N/A	N/A	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
NR FR1 EN-DC DC_12A_n66A		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		≤72	N/A	N/A	N/A	TBD	TBD	TBD
		>72	N/A	N/A	N/A	TBD	TBD	TBD
NR FR1 SA n2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n26		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	UHIS	PIGS	TIS	UHIS	PIGS
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n77		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
NR FR1 SA n78		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.

Table 4.2.3.1-2 A-GALILEO E1 with Maximum TIS/UHIS/PIGS Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices[1]

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
LTE Band 71	Control Plane / UE-Based	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
LTE Band 71	Control Plane / UE-Assisted	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD	TBD	TBD
LTE Band 12		TBD	TBD	TBD
LTE Band 13		TBD	TBD	TBD
LTE Band 14		TBD	TBD	TBD
LTE Band 26		TBD	TBD	TBD
LTE Band 5		TBD	TBD	TBD
LTE Band 70		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
LTE Band 4		TBD	TBD	TBD
LTE Band 66		TBD	TBD	TBD
LTE Band 2		TBD	TBD	TBD
LTE Band 25		TBD	TBD	TBD
LTE Band 30		TBD	TBD	TBD
LTE Band 7		TBD	TBD	TBD
LTE Band 41		TBD	TBD	TBD
LTE Band 48		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n71A		TBD	TBD	TBD
NR FR1 EN-DC DC_2A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_5A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_7A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_12A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_13A_n66A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n2A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n5A		TBD	TBD	TBD
NR FR1 EN-DC DC_66A_n71A		TBD	TBD	TBD

Band	Positioning Method	FS		
		TIS	UHIS	PIGS
NR FR1 EN-DC DC_66A_n78A		TBD	TBD	TBD
NR FR1 EN-DC DC_(n)71AA		TBD	TBD	TBD
NR FR1 SA n2		TBD	TBD	TBD
NR FR1 SA n5		TBD	TBD	TBD
NR FR1 SA n12		TBD	TBD	TBD
NR FR1 SA n14		TBD	TBD	TBD
NR FR1 SA n25		TBD	TBD	TBD
NR FR1 SA n26		TBD	TBD	TBD
NR FR1 SA n30		TBD	TBD	TBD
NR FR1 SA n41		TBD	TBD	TBD
NR FR1 SA n48		TBD	TBD	TBD
NR FR1 SA n66		TBD	TBD	TBD
NR FR1 SA n70		TBD	TBD	TBD
NR FR1 SA n71		TBD	TBD	TBD
NR FR1 SA n77		TBD	TBD	TBD
NR FR1 SA n78		TBD	TBD	TBD
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input).				

Table 4.2.3.1-3 A-GALILEO E1 with Maximum TIS Level (in dBm) Requirements for the Primary Mechanical Mode for Wrist-Worn Devices[1]

Band	Positioning Method	WL and WR
		TIS
LTE Band 71	Control Plane / UE-Based	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD

Band	Positioning Method	WL and WR
		TIS
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
LTE Band 71	Control Plane / UE-Assisted	TBD
LTE Band 12		TBD

Band	Positioning Method	WL and WR
		TIS
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD

Band	Positioning Method	WL and WR
		TIS
LTE Band 71	SUPL 2.0 / UE-Assisted	TBD
LTE Band 12		TBD
LTE Band 13		TBD
LTE Band 14		TBD
LTE Band 26		TBD
LTE Band 5		TBD
LTE Band 70		TBD
LTE Band 4		TBD
LTE Band 66		TBD
LTE Band 2		TBD
LTE Band 25		TBD
LTE Band 30		TBD
LTE Band 7		TBD
LTE Band 41		TBD
LTE Band 48		TBD
NR FR1 SA n2		TBD
NR FR1 SA n5		TBD
NR FR1 SA n12		TBD
NR FR1 SA n14		TBD
NR FR1 SA n25		TBD
NR FR1 SA n26		TBD
NR FR1 SA n30		TBD
NR FR1 SA n41		TBD
NR FR1 SA n48		TBD
NR FR1 SA n66		TBD
NR FR1 SA n70		TBD
NR FR1 SA n71		TBD

Band	Positioning Method	WL and WR
		TIS
NR FR1 SA n77		TBD
NR FR1 SA n78		TBD
Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input).		

4.2.4 MBS

4.2.4.1 TIS and Intermediate Channel Degradation Test Criteria

Results shall be reported as specified in Section 5. Reports shall include results for head/hand configurations (if applicable) across all channels measured with the DUT antenna extended and retracted.

MBS intermediate channel degradation test results shall be provided in a file format equivalent to that specified in Section 5.

Table 4.2.4.1-1 contain the pass/fail limits for MBS for devices held to the head for voice devices.

Table 4.2.4.1-1 MBS Maximum TIS/NHPIS±45/NHPIS±30 Level (in dBm) Requirements for the Primary Mechanical Mode[1]

Cellular Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	NHPIS ±45	NHPIS ±30	TIS	NHPIS ±45	NHPIS ±30
LTE Band 71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 14		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Cellular Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	NHPIS ±45	NHPIS ±30	TIS	NHPIS ±45	NHPIS ±30
LTE Band 70	Control Plane/UE-Assisted	≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 71		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 12		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 13		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
		≤72	TBD	TBD	TBD	TBD	TBD	TBD

Cellular Band	Positioning Method	Device Width (mm)[2]	BHHL and BHHR			HL and HR		
			TIS	NHPIS ±45	NHPIS ±30	TIS	NHPIS ±45	NHPIS ±30
LTE Band 14	SUPL 2.0/ UE-Assisted	>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 26		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 5		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 70		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 4		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 66		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 2		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 25		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 30		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 7		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 41		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD
LTE Band 48		≤72	TBD	TBD	TBD	TBD	TBD	TBD
		>72	TBD	TBD	TBD	TBD	TBD	TBD

Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically means antenna extended, fold or portrait slide open, but depends on form factor).

Cellular Band	Positioning Method	Device Width $(mm)^2$	BHHL and BHHR			HL and HR		
			TIS	NHPIS ±45	NHPIS ±30	TIS	NHPIS ±45	NHPIS ±30
Note 2: Differences between requirements for devices wider and narrower than 72 mm reflect observed differences in OTA performance with different hand phantoms of up to 6 dB.								

4.3 Test Criteria for SISO, Millimeter Wave Test Method

Limits for *CTIA 01.22* [7] are for future study.

4.4 Test Criteria for MIMO Test Methodologies

Limits for *CTIA 01.40* [8] and *CTIA 01.41* [9] are for future study.

Section 5 Reporting of Test Results

Test reports and files shall be provided as described in this section. Deliverables consist of a Range Reference Measurement data file and DUT Measurement data files (as described in this section) for each DUT characterized.

Data from the tests on every product shall be reported in the following ways:

1. A complete set of the measurement data for every test supplied electronically in a format that can be easily read (e.g., Excel, etc.).
2. A complete set of test report forms from the spreadsheet *CTIA 01.03* [3]. Test reports forms are in the spreadsheet *CTIA 01.04* [4] for informative tests.

Please note the following abbreviations are used in the tables in the spreadsheet *CTIA 01.03* [3] and *CTIA 01.04* [4].

FS = Free Space

BH = Beside Head (Head Phantom Only)

BHL = Beside Head Left Side (Head Phantom Only)

BHR = Beside Head Right Side (Head Phantom Only)

HL = Hand Left (Hand Phantom Only)

HR = Hand Right (Hand Phantom Only)

BHHL = Beside Head and Hand Left Side (Head and Hand Phantom)

BHHR = Beside Head and Hand Right Side (Head and Hand Phantom)

WL = Wrist-Worn Left (Forearm Phantom)

WR = Wrist-Worn Right (Forearm Phantom)

5.1 Test Result Tables for SISO Test Methodologies for Wireless Technologies below 6 GHz

The list of reporting tables for SISO test methodologies for wireless technologies below 6 GHz is in “RA Content” in *CTIA 01.03* [3]. All reporting tables for SISO test methodologies for wireless technologies below 6 GHz start with “RA”.

1. A series of 3D plots based on Table RA.3-5, Table RA.4-7 to Table RA.4-9, Table RA.4-16 to Table RA.4-18, Table RA-4-30 of the mid-channel cellular patterns, GPS L1 patterns, GPS L5 patterns, and MBS patterns as applicable, as seen from a representative viewing angle

2. The Summation Test Report (Table in RA.3, Tables in RA.4 and Table in RA.5) shall be included as a separate file and also be included at the beginning of the main test report submitted. When multiple test configurations and/or antennas are tested, then these tables shall be completed multiple times with the appropriate test configurations and antennas included in the table header.

The results of the calculations for expanded uncertainty for both TRP and TIS measurements shall be reported. The test performance requirements shall not be adjusted by the measurement uncertainty when determining compliance of the DUTs.

The tables include:

RA.1: General Reporting Tables

Table RA.1-1 Device Under Test (DUT) Information

Table RA.1-2 Bands and Protocols Supported by Each Antenna

Table RA.1-3 DUTs Used for Each Test

RA.2: Example DUT Tables

Table RA.2-1 Example DUT (Top)

Table RA.2-2 Example DUT (Bottom)

RA.3: Summary Reporting Tables for 3GPP Technologies

Table RA.3-1 Cellular Radio Mode OTA Summation Test Report for Devices Held to the Head for Voice

Table RA.3-2 Cellular Radio Mode OTA Summation Test Report for Integrated Devices

Table RA.3-3 Cellular Radio Mode OTA Summation Test Report for Wrist-Worn Devices

Table RA.3-4 Intermediate Channel Relative Sensitivity

Table RA.3-5 Summation Test Report Plot Matrix

Table RA.3-6 LTE Carrier Aggregation Mode (2 DL, 1 UL) TRP Summary Table for the Primary Mechanical Mode

Table RA.3-7 LTE Carrier Aggregation Mode (3 DL, 1 UL) TRP Summary Table for the Primary Mechanical Mode

Table RA.3-8 LTE Carrier Aggregation Mode (2 DL, 1 UL) TIS Summary Table for the Primary Mechanical Mode

Table RA.3-9 LTE Carrier Aggregation Mode (3 DL, 1 UL) TIS Summary Table for the Primary Mechanical Mode

Table RA.3-10 NR FR1 EN-DC TRP Summary Table for the Primary Mechanical Mode

Table RA.3-11 NR FR1 EN-DC C-TIS Summary Table for the Primary Mechanical Mode

Table RA.3-12 Intermediate Channel Relative Power

For Table RA.3-1 to Table RA.3-3 and Table RA.3-6 to Table RA.3-11, when multiple test configurations and/or antennas are tested, then these tables shall be completed multiple times with the appropriate test configurations and antennas included in the table header. In the case where a test case has been noted as “Re-use”, there is no need to provide the corresponding test case result in the carrier aggregation result tables.”

RA.4: Summary Reporting Tables for Location Based Wireless Technologies

Table RA.4-1 A-GPS L1 Summation Test Report for Devices Held to the Head for Voice

Table RA.4-2 A-GPS L1 Summation Test Report for Integrated Devices

Table RA.4-3 A-GPS L1 Summation Test Report for Wrist-Worn Devices

Table RA.4-4 A-GPS L1 Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-5 A-GPS L1 Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-6 A-GPS L1 Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table RA.4-7 A-GPS L1 Summation Test Report Plot Matrix for Devices Held to the Head for Voice

Table RA.4-8 A-GPS L1 Summation Test Report Plot Matrix for Integrated Devices

Table RA.4-9 A-GPS L1 Summation Test Report Plot Matrix for Wrist-Worn Devices

Table RA.4-10 A-GPS L5 Summation Test Report for Devices Held to the Head for Voice

Table RA.4-11 A-GPS L5 Summation Test Report for Integrated Devices

Table RA.4-12 A-GPS L5 Summation Test Report for Wrist-Worn Devices

Table RA.4-13 A-GPS L5 Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-14 A-GPS L5 Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-15 A-GPS L5 Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table RA.4-16 A-GPS L5 Summation Test Report Plot Matrix for Devices Held to the Head for Voice

Table RA.4-17 A-GPS L5 Summation Test Report Plot Matrix for Integrated Devices

Table RA.4-18 A-GPS L5 Summation Test Report Plot Matrix for Wrist-Worn Devices

Table RA.4-19 A-GALILEO E1 Summation Test Report for the Reference Band for Devices Held to the Head for Voice

Table RA.4-20 A-GALILEO E1 Summation Test Report for the Reference Band for Integrated Devices

Table RA.4-21 A-GALILEO E1 Summation Test Report for the Reference Band for Wrist-Worn Devices

Table RA.4-22 A-GALILEO E1 Summation Test Report for Devices Held to the Head for Voice

Table RA.4-23 A-GALILEO E1 Summation Test Report for Integrated Devices

Table RA.4-24 A-GALILEO E1 Summation Test Report for Wrist-Worn Devices

Table RA.4-25 A-GALILEO E1 Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-26 A-GALILEO E1 Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-27 A-GALILEO E1 Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table RA.4-28 MBS Summation Test Report

Table RA.4-29 MBS Intermediate Channel Relative Sensitivity

Table RA.4-30 MBS Summation Test Report Plot Matrix

Table RA.4-31 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Devices Held to the Head for Voice (first test)

Table RA.4-32 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Devices Held to the Head for Voice (second test)

Table RA.4-33 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Integrated Devices (first test)

Table RA.4-34 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Integrated Devices (second test)

Table RA.4-35 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice (first test)

Table RA.4-36 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice (second test)

Table RA.4-37 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (first test)

Table RA.4-38 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (second test)

Table RA.4-39 A-GPS L5 with NR FR1 EN-DC Summation Test Report for Devices Held to the Head for Voice

Table RA.4-40 A-GPS L5 with NR FR1 EN-DC Summation Test Report for Integrated Devices

Table RA.4-41 A-GPS L5 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-42 A-GPS L5 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-43 A-GPS L5 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (first test)

Table RA.4-44 A-GPS L5 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (second test)

Table RA.4-45 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Reference Band for Devices Held to the Head for Voice (first test)

Table RA.4-46 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Reference Band for Devices Held to the Head for Voice (second test)

Table RA.4-47 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Reference Band for Integrated Devices (first test)

Table RA.4-48 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Reference Band for Integrated Devices (second test)

Table RA.4-49 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Devices Held to the Head for Voice (first test)

Table RA.4-50 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Devices Held to the Head for Voice (second test)

Table RA.4-51 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Summation Test Report for Integrated Devices (first test)

Table RA.4-52 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Summation Test Report for Integrated Devices (second test)

Table RA.4-53 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice (first test)

Table RA.4-54 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice (second test)

Table RA.4-55 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (first test)

Table RA.4-56 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Intermediate Channel Relative Sensitivity for Integrated Devices (second test)

RA.5: Machine Readable Report

Table RA.5-1 Machine Readable Report

The columns of Table RA.5-1 are defined as follows:

Column A; "ATL ID": Enter the ATL ID of the OTA lab which performed this test. This field is included to improve traceability of which OTA lab performed testing especially when OTA testing is outsourced to multiple OTA labs for a single device model.

Column B; "Technology": Align the available choices with the airlink technologies currently defined in this document and active CWG Test Plan using the same syntax. LTE Category NB1/M1/1bis is for single receiver. LTE Category 1 and higher is for two or more receivers. The technology of only the band under test is listed in this column.

Column C; "Test Metric": Align the enumerated values with the metrics currently defined in CTIA 01.01 using the same syntax. The example entries are TRP, TIS, C-TIS. TIS is used for single receiver technologies such as EGPRS, GPRS, GSM, LTE Cat 1bis, LTE Cat M1, and LTE Cat NB1. C-TIS is used for multiple receiver technologies such as LTE Category 1 and higher, as well as NR, and UMTS.

Column D; "Radio Band": Align the enumerated values with the bands currently defined in CTIA 01.01 and active CWG Test Plan using the same syntax. All possible bands for Cellular and WiFi are listed. Roman numerals are used for UMTS bands. Regular numbers are used for LTE and NR Bands i.e. band xx is used for LTE Bands, and band with nXX is used for NR Bands.

Column E; "Carrier Aggregation": This field indicates when the test case pertains to carrier aggregation (denoted "CA"), no carrier aggregation (denoted "Single Carrier" for protocols that support CA), or Not Applicable (denoted "N/A") for protocols that don't support CA.

- If this field equals "Single Carrier", then Column F "Single Carrier Test Channel Configuration ID" shall be populated and Columns G, H, I, J and K shall be marked "N/A".
- If this field equals "LTE CA", then 1) Column G "LTE Carrier Aggregation Test Configuration" and Column K "Multiple Component Carrier Test Configuration ID" shall be populated, and 2) Columns F, H, I, and J shall be marked "N/A".
- NR CA testing is not defined in the CTIA OTA Test Plan v4.0, but will be added in future test plan releases.
- If this field equals "EN-DC", then 1) Column H "NR EN-DC 3GPP Test Configuration", Column I "NR EN-DC Variant ID", Column J "UL CCs" and Column K "Multiple Component Carrier Test Configuration ID" shall be populated, and 2) Columns F, G shall be marked "N/A".
- NR-DC testing is not defined in the CTIA OTA Test Plan v4.0, but will be added in future test plan releases.
- If this field equals "N/A", then Column F "Single Carrier Test Channel Configuration ID" shall be populated and Columns G, H, I, J and K shall be marked "N/A". For example, WIFI technology shall be filled with "N/A" for Carrier Aggregation Column E.

Column F; "Single Carrier Test Channel Configuration ID": The purpose of this enumerated field is to indicate what type of test will be executed. For example, this proposal includes entries such as "TRP_1DL-1UL_1", where "TRP_1DL-1UL" indicates a SISO measurement with one downlink carrier and one uplink carrier. For 802.11a/n(5GHz)/ac technologies, _1 indicates the lowest channel, _2 indicates the next channel for the next higher frequency, _3 indicates the next channel after _2, _4 indicates the next channel after _3, and _5 indicates the highest channel. All cellular technology and some 802.11(x) technologies follow the 802.11 example but typically uses a test channel configuration ID from _1 to _3, except for certain wide TDD bands (e.g. n77) that may use test channel configuration ID up to _5. In CWG test plan v2.2.1, the WiFi TRP/TIS measurement is made on:

- Channel 6, for 2.4 GHz. MRR channel shall be only _1.
- Channel listed in following table, for 5 GHz. MRR channel shall follow the following table which matches the content in Table 4.1-1 in Test Plan for RF Performance Evaluation of Wi-Fi Mobile Converged Devices Version 2.2.1.

Sub Band	Frequency Range	Channel Range	TIS/TRP Channel	MRR Channel
US U-NII-1, ETSI Sub-band 1	5.150-5.250 GHz	36 to 48	44	1
US U-NII-2A, ETSI Sub-band 1	5.250-5.350 GHz	52 to 64	60	2
US U-NII-2C, ETSI Sub-band 2	5.470-5.725 GHz	100 to 140	120	3
US U-NII-3, Ofcom	5.725-5.850 GHz	149 to 165	157	4
			165	5

Column G; "LTE Carrier Aggregation Test Configuration": The purpose of this enumerated Column is to indicate which LTE CA combination is being tested. The LTE CA Test Configuration shall be selected from the CTIA Operator Priority List for OTA Test Plan. Note that the LTE CA configuration shall follow the CTIA 01.01 for LTE CA combinations. Note 1: ATL is required to fill the LTE Carrier Aggregation Test Configuration in Column G following the LTE CA format used in the CTIA 01.01. The LTE Carrier Aggregation Test Configuration will eventually be covered by the 3GPP Test Configuration and Variant ID in a future test plan release. This column will be marked "Obsolete" at that time.

Column H; "NR EN-DC 3GPP Test Configuration": This enumerated Column is used to indicate which 3GPP test configuration is being tested. The NR EN-DC Test Configuration shall be selected from the CTIA Operator Priority List for the OTA Test Plan. The 3GPP test configurations are the 3GPP Test Identifiers in 3GPP 38.521-3 and are defined in the CTIA OTA Test Plan. Note 2: ATL is required to fill the NR EN-DC 3GPP Test Configuration in Column H following the 3GPP Nomenclature. This enumerated Column will be renamed "3GPP Test Configuration" in a future test plan release, and will be used to cover LTE CA, NR EN-DC, NR DC, NR CA, etc.

Column I; "NR EN-DC Variant ID": This enumerated Column is used to indicate which PTCRB Variant ID is being tested. The PTCRB Variant ID defines 1) the MCG/SCG and PCC/SCC, 2) bandwidths of each CC in the band combination, and 3) the SCS for NR bands. The PTCRB Variant IDs used for OTA testing are defined in the CTIA OTA Test Plan. This enumerated Column will be renamed "Variant ID" in a future test plan release, and will be used to cover LTE CA, NR EN-DC, NR DC, NR CA, etc. When the DUT supports "Single Uplink operation" then append an "S" to the Variant ID with no space between them.

Column J; "UL CCs": This enumerated Column is used to indicate which CCs are used in the UL. The MCG/PCC is listed first. Remaining LTE CCs are then listed in ascending band order. Remaining NR CCs are then listed in ascending band order. Note 3: ATL is required to fill for NR EN-DC the UL CCs Configuration in Column J with MCG/PCC first, with the remaining LTE CCs in ascending order next, and then the remaining NR CCs in ascending order.

Column K; "Multiple Component Carrier Test Configuration ID": This enumerated column is used to indicate which Component Carriers were used. This is the CA equivalent of Column F.

Naming entries in format of TRP/TIS_xDL_yUL_u-v, in which x denotes number of downlink carriers; y denotes number of uplink carriers; u denotes carrier under test; and v denotes channel under test. For LTE u denotes the carrier under test in the order of PCC, SCC1, SCC2 and so on, while for EN-DC u denotes the carrier under test in the order bands are listed in the 3GPP Test Configuration. For example for LTE, TRP_3DL_3UL_2-4 represents the test case is a TRP test case, channel under test is highest channel in SCC1 and it is a 3DL and 3UL CA combo case. Note: TRP_2DL_2UL_x-x and C-TIS_2DL_2UL_x-x are listed for information only as they are for UL CA test cases which are not normative at this time.

Column L; "UE Power Class": Align the available choices in this enumerated column with the Power Classes currently defined in CTIA 01.01 0 using the same syntax. Also, ensure that the power classes unique to NB-IoT are included. PC1-PC6 is for LTE technology, I-V is for UMTS technology, 1-5 is for GSM/GPRS technology, E1-E3 is for EGPRS technology, and 1-4 is for NR technology.

Column M; "Number of Receive Antenna(s)": This enumerated Column can be used on a limited basis to indicate single receiver or multiple receivers. 1 is for single receiver. 2 is for two active receivers. 3 is for three active receivers. 4 is for four active receivers. 5, 6, 7, 8 is for 5, 6, 7, 8 active receivers, respectively. Note 4: The Machine Readable Report format only includes the baseline receive antenna switch state when switching is used with the DUT's receive antennas.

Column N; "Label of Transmit Antenna Under Test": This enumerated column will be used to associate TRP with a specific antenna when transmit diversity is supported for a particular test case. When transmit diversity is not supported for a particular test case, then "N/A" shall be entered. Section 1.5 of the CTIA 01.01 defines antenna labels as 'Each antenna shall be labelled with a letter, starting with the letter "A" '. This same antenna label shall be used in the column when transmit diversity is supported for a particular test case. Note that these antenna labels are also used in Table RA.1-2 of the CTIA 01.03.

Column O; "Radiated Test Configuration": This enumerated column will be used to associate a test configuration (e.g. free-space, HL/HR, BHHL/BHHR, WL/WR, ChW, etc.) per record. This includes different types of hand phantom and head and hand phantom i.e. monoblock, fold, narrow data, PDA, wide.

Column P; "Parametric Test Result": This numeric column will be used to report the measurement value according to the metrics currently defined in CTIA 01.01 using the same syntax.

Column Q; "Binary Test Result": This binary column will be used to associate a pass/fail/info status with the test in that record assuming limits are eventually defined and published in CTIA 01.01.

Column R; "Comments": This will be the only free-form text field in the file. This Column can be used to refer to GPRS/EGPRS multi-slot class, test reduction such as single point offset test (SPOT), LAA Un-licensed Degradation (LUD), and CA Test Reduction, or other details.

RA.10: GSM Tables

Table RA.10-1 to Table RA.10-2 GSM Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.10-3 to Table RA.10-4 GSM Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.10-5 to Table RA.10-6 GSM Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For GSM devices, only provide Table RA.10-3 to Table RA.10-4 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.10-1 to Table RA.10-2 for those bands requiring reporting TRP for 1 antenna.

RA.11: GPRS Tables

Table RA.11-1 to Table RA.11-2 GPRS Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.11-3 to Table RA.11-4 GPRS Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.11-5 to Table RA.11-6 GPRS Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For GPRS devices, only provide Table RA.11-3 to Table RA.11-4 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.11-1 to Table RA.11-2 for those bands requiring reporting TRP for 1 antenna.

RA.12: EGPRS Tables

Table RA.12-1 to Table RA.12-2 EGPRS Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.12-3 to Table RA.12-4 EGPRS Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.12-5 to Table RA.12-6 EGPRS Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For EGPRS devices, only provide Table RA.12-3 to Table RA.12-4 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.12-1 to Table RA.12-2 for those bands requiring reporting TRP for 1 antenna.

RA.13: UMTS Tables

Table RA.13-1 to Table RA.13-2 UMTS Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.13-3 to Table RA.13-4 UMTS Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.13-5 to Table RA.13-6 UMTS Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For UMTS devices, only provide Table RA.13-3 to Table RA.13-4 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.13-1 to Table RA.13-2 for those bands requiring reporting TRP for 1 antenna.

RA.20: LTE Tables

Table RA.20-1 to Table RA.20-16 LTE Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.20-17 to Table RA.20-32 LTE Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.20-33 to Table RA.20-48 LTE Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For LTE devices, only provide Table RA.20-17 to Table RA.20-32 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.20-1 to Table RA.20-16 for those bands requiring reporting TRP for 1 antenna.

RA.21: LTE 2 DL CA Tables

Table RA.21-1 to Table RA.21-66 LTE Minimum TRP Level Requirements for the PCC IN 2 DL CA for Primary Mechanical Mode

Table RA.21-67 to Table RA.21-132 LTE Minimum TRP Level Requirements for the PCC IN 2 DL CA for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.21-133 to Table RA.21-264 LTE Maximum C-TIS Level Requirements for the PCC/SCC IN 2 DL CA for the Primary Mechanical Mode

For LTE devices supporting 2 DL CA, only provide Table RA.21-67 to Table RA.21-132 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.21-1 to Table RA.21-66 for those bands requiring reporting TRP for 1 antenna.

RA.22: LTE 3 DL CA Tables

Table RA.22-1 to Table RA.22-107 LTE Minimum TRP Level Requirements for the PCC IN 3 DL CA for Primary Mechanical Mode

Table RA.22-108 to Table RA.22-214 LTE Minimum TRP Level Requirements for the PCC IN 3 DL CA for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.22-215 to Table RA.22-535 LTE Maximum C-TIS Level Requirements for the PCC/SCC1/SCC2 IN 3 DL CA for the Primary Mechanical Mode

For LTE devices supporting 3 DL CA, only provide Table RA.22-108 to Table RA.22-214 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.22-1 to Table RA.22-107 for those bands requiring reporting TRP for 1 antenna.

RA.23: LAA 2 DL CA Tables

Table RA.23-1 to Table RA.23-3 LTE Band 46 Maximum C-TIS Level Requirements for the SCC IN 2 DL CA for the Primary Mechanical Mode

Table RA.23-4 to Table RA.23-13 LTE Band 46 LUD Requirements for the SCC IN 2 DL CA for the Primary Mechanical Mode

Band 46 TIS shall be fully measured for one supported LAA CA combination with 2 CC's and are reported using one of the tables from Table RA.23-1 to RA.23-3. For all other LAA 2 DL CA

combinations that require testing, Band 46 EIS performance shall be evaluated using the LAA Un-Licensed Degradation (LUD) test and reported using tables from Table RA.23-4 to RA.23-13.

RA.24: LAA 3 DL CA Tables

Table RA.24-1 to Table RA.24-16 LTE Band 46 LUD Requirements for the SCC2 IN 3 DL CA for the Primary Mechanical Mode

RA.30: LTE Category M1 Tables

Table RA.30-1 to Table RA.30-9 LTE Category M1 Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.30-10 to Table RA.30-18 LTE CAT-M1 Maximum C-TIS Level Requirements for the Primary Mechanical Mode

RA.35: LTE Category NB1 Tables

Table RA.35-1 to Table RA.35-11 LTE CAT-NB1 Stand-Alone Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.35-12 to Table RA.35-22 LTE CAT-NB1 Stand-Alone Maximum C-TIS Level Requirements for the Primary Mechanical Mode

RA.40: NR FR1 SA Tables

Table RA.40-1 to Table RA.40-15 NR FR1 SA Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.40-16 to Table RA.40-30 NR FR1 SA Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.40-31 to Table RA.40-45 NR FR1 SA Maximum C-TIS Level Requirements for the Primary Mechanical Mode

RA.50: NR FR1 EN-DC Tables

Table RA.50-1 to Table RA.50-38 NR FR1 EN-DC Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.50-39 to Table RA.50-76 NR FR1 EN-DC Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.50-77 to Table RA.50-114 NR FR1 EN-DC Maximum C-TIS Level Requirements for the Primary Mechanical Mode

RA.70: A-GPS L1 Tables

Table RA.70-1 A-GPS L1 with GSM/UMTS Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.70-2 A-GPS L1 with GSM/UMTS Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.70-3 A-GPS L1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.70-4 A-GPS L1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.70-5 A-GPS L1 with LTE Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

Table RA.70-6 A-GPS L1 with LTE CAT-M1 Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.70-7 A-GPS L1 with LTE CAT-M1 Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.70-8 A-GPS L1 with LTE CAT-M1 Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

Table RA.70-9 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice (first test)

Table RA.70-10 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice (second test)

Table RA.70-11 A-GPS L1 with NR FR1 EN-DC with NR only at Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices (first test)

Table RA.70-12 A-GPS L1 with NR FR1 EN-DC with NR & LTE at Balanced Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices (second test)

Table RA.70-13 A-GPS L1 with NR FR1 SA Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.70-14 A-GPS L1 with NR FR1 SA Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.70-15 A-GPS L1 with NR FR1 SA Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

RA.71: A-GPS L5 Tables

Table RA.71-1 A-GPS L5 with LTE Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.71-2 A-GPS L5 with LTE Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.71-3 A-GPS L5 with LTE Minimum Average 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

Table RA.71-4 A-GPS L5 with NR FR1 EN-DC Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.71-5 A-GPS L5 with NR FR1 EN-DC Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.71-6 A-GPS L5 with NR FR1 SA Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.71-7 A-GPS L5 with NR FR1 SA Minimum Average 3D C/N0 / UH 3D C/N0 / PIG 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Integrated Devices

Table RA.71-8 A-GPS L5 with NR FR1 SA Minimum Average 3D C/N0 Level (in dBm) Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

RA.72: A-GALILEO E1 Tables

Table RA.72-1 A-GALILEO E1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.72-2 A-GALILEO E1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Integrated Devices

Table RA.72-3 A-GALILEO E1 with LTE Maximum TIS Level Requirements for the Reference Band for the Primary Mechanical Mode for Wrist-Worn Devices

Table RA.72-4 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Devices Held to the Head for Voice (first test)

Table RA.72-5 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Max Balanced Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Devices Held to the Head for Voice (second test)

Table RA.72-6 A-GALILEO E1 with NR FR1 EN-DC with NR only at Max Power Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Integrated Devices (first test)

Table RA.72-7 A-GALILEO E1 with NR FR1 EN-DC with NR & LTE at Max Balanced Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Integrated Devices (second test)

Table RA.72-8 A-GALILEO E1 with NR FR1 SA Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table RA.72-9 A-GALILEO E1 with NR FR1 SA Maximum TIS/UHIS/PIGS Level Requirements for the Reference Band for the Primary Mechanical Mode for Integrated Device

Table RA.72-10 A-GALILEO E1 with NR FR1 SA Maximum TIS Level Requirements for the Reference Band for the Primary Mechanical Mode for Wrist-Worn Devices

RA 80: MBS Table

Table RA.80-1 MBS with LTE Maximum TIS/NHPIS±45/NHPIS±30 Level Requirements for the Reference Band for the Primary Mechanical Mode

RA.90 Cellular Desensitization Due to 802.11 Operation Tables

Table RA.90-1 Cellular Desensitization Test Results for 802.11 Operation (2.4 GHz Band) with Cellular Free-Space Limits

Table RA.90-2 Cellular Desensitization Test Results for 802.11 Operation (5 GHz Band) with Cellular Free-Space Limits

Table RA.90-3 Cellular Desensitization Test Results for 802.11 Operation (2.4 GHz Band) without Cellular Free-Space Limits

Table RA.90-4 Cellular Desensitization Test Results for 802.11 Operation (5 GHz Band) without Cellular Free-Space Limits

5.1.1 DUT Measurement Data Files

Spherical-scan pattern data shall be supplied in a format accessible (i.e., readable) for additional examination and computation as outlined in Table RA.2-1 and Table RA.2-2. The pattern data reported are Effective Isotropic Radiated Power (EIRP) for transmit tests and Effective Isotropic Sensitivity (EIS) for receive tests, as defined in *CTIA 01.90* [17]. Both EIRP and EIS quantities shall be reported in units of dBm. In case of RSS-based measurements, the pattern data shall also be reported as the raw RSS values. For example report C/N_0 values for A-GPS, see *CTIA 01.51* [11]. Relative phase quantities shall be reported in radians. For each cellular radio mode and frequency band combination that the DUT supports, complete spherical pattern files shall be provided for the following transmit and receive tests, for each applicable channel, DUT configuration and test condition (3 different channels[1]) (N different DUT configurations[2], if applicable) (up to 5 different test conditions[3]).

Each transmit-test spherical-scan file shall contain measurements for 11 theta cuts, 24 phi cuts, and 2 polarizations. Based on samples measured every 15 degrees of rotation for each cut, 528 measurements are thus recorded in each transmit test file. Each receive-test spherical-scan file shall contain measurements for 5 theta cuts, 12 phi cuts, and 2 polarizations. Based on samples measured every 30 degrees of rotation for each cut, 120 measurements are recorded in each receive test file.

In cases where the spiral scan TRP method has been used, the raw data shall contain measurements for a minimum of 350 points of 2 polarizations (700 total measurement points). There shall be a maximum spacing between subsequent spirals of 15 degrees in theta in each polarization. Ideally, points shall be measured between theta=0 degrees and theta=180 degrees. In cases where the measurement system does not allow measurements at the poles, measurements shall be performed between at least theta=15 degrees and theta=165 degrees and additional measurement points shall be collected at the minimum and/or maximum theta values at no less than 6 phi values. The measurements near the extreme theta values are then used to interpolate the point values between the extreme values of the measurement system and the pole(s), e.g., 165-180 degrees. In the reported pattern data, all points shall be labeled as to whether they are a measured or interpolated. Alternatively, it shall be stated in the report which measurement range for theta the test system supports.

In cases where theta dependent phi optimization has been used for TRP measurements, each transmit-test spherical-scan file shall contain measurements for 11 theta, variable phi cuts and 2 polarizations. In addition, the theta and phi angles shall be recorded for every measurement. In cases where theta dependent phi optimization has been used for TIS measurements, each receive-test spherical-scan file

[1] "Channel" refers to the appropriate frequency pair for transmit and receive.

[2] "DUT configuration" refers to antenna stowed or deployed, slide opened or closed, etc. for those DUTs that support multiple configurations.

[3] "Test conditions" are free-space, right hand only, right hand and head, etc. as specified in *CTIA 01.72* [15]

shall contain measurements for 5 theta, variable phi cuts, and 2 polarizations. In addition, the theta and phi angles shall be recorded for every measurement.

In addition to the spherical pattern data, for each cellular radio mode and band that the DUT supports, a file showing the appropriate BER, BLER, FER, or PER outcome per channel for the additional intermediate-channel, single-point receive tests is also required. The contents and number of channels reported in the intermediate-channel receive-test file will vary depending on the cellular radio mode.

For RSS-based measurements, in addition, the data for the linearization (see *CTIA 01.20* [1]) and for the sensitivity search shall be supplied.

5.1.2 3-D Plots

Plots shall be submitted for each DUT reported. Plot EIRP in units of dBm. Plot the inverted EIS in units of dBm (-EIS).

5.1.3 Range Reference Measurement Data File

Files containing the path loss terms employed for the measurements shall be provided as part of the ATL authorization process. Tables in *CTIA 01.73* [16] illustrate the data file format for these files.

5.1.4 Photographs and Identification of Hand and Forearm Phantoms

Photographs of the configurations in which the DUT has been tested with hand or forearm phantoms, shall be included in the test report. Photographs of the configurations in which the DUT has been tested with the hand phantom mounted to the head phantom, shall be included in the test report.

In addition, the model and serial numbers of each hand or forearm phantom with which the DUT has been tested, shall also be included in the test report.

5.1.5 Testing of Cellular Desensitization due to Simultaneous Operation of 802.11 Radios for Integrated Devices

Cellular desensitization due to simultaneous operation of 802.11 radios shall be provided in a file format equivalent to that specified in Section 5. Separate reporting tables shall be created for each 802.11 interferer and labeled with the 802.11 interferer.

5.1.6 Informative Reporting Tables

The list of informative reporting tables for SISO test methodologies for wireless technologies below 6 GHz is in “IA Content” in *CTIA 01.04* [4]. All informative reporting tables for SISO test methodologies for wireless technologies below 6 GHz start with “IA”.

The tables include:

IA.1: Bluetooth Classic Tables

Table IA.1-1 Bluetooth Basic Rate TRP Test Results

Table IA.1-2 Bluetooth Basic Rate TIS Test Results

IA.2: Bluetooth LE Tables

Table IA.2-1 Bluetooth LE TRP Test Results

Table IA.2-2 Bluetooth LE TIS Test Results

IA.10 Zigbee Tables

Table IA.10-1 ZigBee TRP Test Results

Table IA.10-2 ZigBee TIS Test Results

IA.20 Summary Reporting Tables for Location Based Wireless Technologies

The informative reporting tables below can be created from the normative reporting tables with the same title in *CTIA 01.03* [3] by adding one column to the right of the "Positioning Method" column and titling the new column "SIB".

Table IA.20-1 A-GPS L1 non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table IA.20-2 A-GPS L1 non-CA/DC Summation Test Report for Integrated Devices

Table IA.20-3 A-GPS L1 non-CA/DC Summation Test Report for Wrist-Worn Devices

Table IA.20-4 A-GPS L1 non-CA/DC Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table IA.20-5 A-GPS L1 non-CA/DC Intermediate Channel Relative Sensitivity for Integrated Devices

Table IA.20-6 A-GPS L1 non-CA/DC Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table IA.20-7 A-GPS L1 Summation Test Report Plot Matrix for Devices Held to the Head for Voice

Table IA.20-8 A-GPS L1 Summation Test Report Plot Matrix for Integrated Devices

Table IA.20-9 A-GPS L1 Summation Test Report Plot Matrix for Wrist-Worn Devices

IA.21 A-GPS L1 Tables

The informative reporting tables below can be created from the normative reporting tables with the same title in *CTIA 01.03* [3] by adding one column to the right of the "Positioning Method" column and titling the new column "SIB".

Table IA.21-1 A-GPS L1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table IA.21-2 A-GPS L1 with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table IA.21-3 A-GPS L1 with LTE Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

Table IA.21-4 A-GPS L1 with LTE CAT-M1 Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Devices Held to the Head for Voice

Table IA.21-5 A-GPS L1 with LTE CAT-M1 Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table IA.21-6 A-GPS L1 with LTE CAT-M1 Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

5.2 Test Report Tables for SISO, Millimeter Wave Test Methodology

The list of reporting tables for SISO, Millimeter Wave Test Methodology is in “RB Content” in *CTIA 01.03* [3]. All reporting tables for SISO, Millimeter Wave Test Methodology start with “RB”.

The tables include:

RB.1: General Reporting Tables

Table RB.1-1 Device Under Test (DUT) Information

Table RB.1-2 Bands and Protocols Supported by DUT

Table RB.1-3 DUTs Used for Each Test

RB.2: TX Tests

Table RB.2-1 TX Beam Peak Search

Table RB.2-2 TX Beam Peak Summary

Table RB.2-3 MOP - EIRP Summary

Table RB.2-4 MOP - TRP Results

Table RB.2-5 MOP - TRP Summary

Table RB.2-6 MOP - Spherical Coverage Results

Table RB.2-7 MOP - Spherical Coverage CDF Results

Table RB.2-8 MOP - Spherical Coverage Summary

RB.3: RX Tests

Table RB.3-1 RX Beam Peak Search

Table RB.3-2 RX Beam Peak Summary

Table RB.3-3 REFSENS - EIS Summary

Table RB.3-4 REFSENS - Spherical Coverage Results

Table RB.3-5 REFSENS - Spherical Coverage CCDF Results

Table RB.3-6 REFSENS - Spherical Coverage 50% CCDF Results

5.2.1 Informative Reporting Tables

The list of informative reporting tables for SISO, Millimeter Wave Test Methodology is in “IB Content” in *CTIA 01.04* [4]. All informative reporting tables for SISO, Millimeter Wave Test Methodology start with “IB”.

There are currently no informative tables for SISO, Millimeter Wave Test Methodology.

5.3 Test Report Tables for MIMO Test Methodologies

The list of reporting tables for MIMO Test Methodologies is in “RC Content” in *CTIA 01.03* [3]. All reporting tables for MIMO Test Methodologies start with “RC”.

The tables include:

RC.1: General Reporting Tables

Table RC.1-1 Device Under Test (DUT) Information

Table RC.1-2 DUTs Used for Each Test

RC.2: MARSS Reporting Tables

Table RC.2-1 MARSS Measurement Data Table Format

5.3.1 Informative Reporting Tables

The list of informative reporting tables for MIMO Test Methodologies is in “IC Content” in *CTIA 01.04* [4]. All informative reporting tables for MIMO Test Methodologies start with “IC”.

There are currently no informative tables for MIMO Test Methodologies.

Appendix A Revision History

Date	Version	Description
February 2022	4.0.0	Initial release of the 4.0.0 suite of OTA documents
May 2022	4.0.1	Added first paragraph to Section 2.1.7.6. Added Section 2.1.8.2.3. Added clarification regarding EN-DC testing according to CTIA 01.02 on Section 2.1.7.6 and new section 2.1.8.2.3. Miscellaneous editorial fixes
November 2022	4.0.2	**Section 3:** Added Section 3.1.3 to modify UL RB Allocation for Band 14 A-GNSS testing. **Section 5:** Updated Column K definition (added last sentence) in 5.1.
December 2022	5.0.0	Section 1: • Added LTE Cat-M1 and LTE Cat-NB1 protocol support for reverberation chambers. • Updates to make A-GNSS testing with SIB8/SIB16 informative. • Added Fast TIS Test Methodologies for wireless technologies below 6 GHz. • Added relative power on intermediate channel testing. • Added ankle phantom as informative. • Clarified in Table 1.3-4 that the MIMO OTA test methods only apply to Hand-Held Devices and Tablets. Section 2: • Added test reductions in LTE when NR SA is supported. • Allowed use of reverberation chambers for LTE Category M1 and LTE Category NB1. • Updates to make A-GNSS testing with SIB8/SIB16 informative. • Added A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC. • Added A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA. • Removed testing LTE Band 17 and UMTS 1700/2100. Added test time reductions for A-GNSS OTA with LTE and NR. • Minor editorial clarifications and corrections. • Added relative power on intermediate channel testing. • Added intermediate channel testing for relative sensitivity for NR FR1 SA. • Reduced testing on data-only devices to the 2 most recent cellular radio modes. • Added ankle phantom as informative. Section 3: • Section 3.1.3 Modification to UL RB Allocation for Band 14 A-GNSS Testing in V4.0.x was removed and CTIA 01.51 was updated. • Section 3.1.4 NR FR1 SA Relative Sensitivity on Intermediate Channels Test was added. Section 4: • Updates to make A-GNSS testing with SIB8/SIB16 informative.

		• Added A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC. • Added A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA. • Removed testing LTE Band 17 and UMTS 1700/2100. • Added new NR bands including: n12, n14, n26, n30, n48, n77 (n77 Canada added as informative). • Removed test limits for A-GPS L5 and A-GALILEO E1 with NR FR1 EN-DC for wrist-worn devices. • Added A-GALILEO E1 limit tables. • Added relative power on intermediate channel testing. Section 5: • Added sub-sections for informative reporting tables. • Added tables for A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA. • Added tables for A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC. • Corrected some table numbering in RA.71 and RA.72. • Added table for intermediate channel relative power. • Updated RA.5 Machine Readable Report, including identification of the type of hand phantom used in testing. • Updates to make A-GNSS testing with SIB8/SIB16 informative. • Added reporting tables in RA.40 for new NR FR1 SA bands.