# Test Plan for Wireless Device Over-the-Air Performance

## CTIA 01.01 Test Scope, Requirements, and Applicability

Version 6.0.6

June 2025

# 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.

These Documents use terms for the 3GPP Radio Access Technologies (RATs) that sometimes differ from those used by the Standards Body themselves. While readers of these documents may fully understand that the terms mean the same thing, we offer this cross reference to avoid any confusion.

This version includes all RAT references currently used in the CTIA OTA Test Plan.

| CTIA OTA NOMENCLATURE | PTCRB NOMENCLATURE |
|---|---|
| GSM | GERAN |
| GPRS | |
| EGPRS | |
| UMTS (WCDMA) | UTRA |
| LTE | E-UTRA |
| NR | NR |

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. Note that the SISO, Reverberation Chamber Test Methodology is informative.

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 |
| NR FR1 SA 2DL CA | Yes | No | No | No | No |
| NR FR1 SA 3DL CA | Yes | No | No | 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 |

| | SISO, Anechoic Chamber | SISO, Reverberation Chamber | SISO, Millimeter Wave | MIMO, Multi-Probe Anechoic Chamber | MIMO, Radiated Two Stage |
|---|---|---|---|---|---|
| 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 |
| 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 including Fast TIS, where applicable), 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 (Informative)

The SISO, Reverberation Chamber Test Methodology *CTIA 01.21* [6] is used to measure total radiated quantities (e.g. TRP and TIS including Fast TIS, where applicable), 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.

#### 1.3.1.3 Fast TIS Test Methodologies for Wireless Technologies below 6 GHz

Due to the proliferation of narrowband IoT devices, bands, and testing time associated with these protocols, certain devices may be tested using the Fast TIS testing method. For this category of measurements, one or more of the following measurement techniques may be utilized: device-reported RSS values; theta-dependent phi point reduction; single or multi-point offset methods in anechoic chambers, and continuous-mode stirring in reverberation chambers.

Fast TIS testing is limited to:

1. LTE Category M1/M2, and Category NB1.
2. IoT devices which
    a. utilize a single RX antenna and a single receiver per supported WWAN band(s), and
    b. do not support real-time voice communications for human body-worn devices.

Examples of devices that meet the above criteria include:

- Utility, parking meter, or other sensor-centric devices using LTE Cat-NB1
- Ankle, arm, chest, or wrist-worn devices using LTE Cat-M1 that do not support voice calling
- Pet tracking devices using LTE Cat-M1 or NB1 regardless of whether or not they support real-time audio.

Employing these Fast TIS time-saving techniques generally increases measurement uncertainty. In order to ensure that the additional allowed uncertainty is providing the expected measurement time benefits, a maximum test time for a reference device is prescribed. Labs must demonstrate ability to meet test time and uncertainty requirements during an audit or certification in order to utilize a Fast TIS method. Actual test time for test objects may vary and exceed this time in some cases due to device instability, device pattern characteristics, or battery limitations. Maximum test times for reference devices are given in Table 1.3.1.3-1.

Table 1.3.1.3-1: Test Time Limits for Fast TIS for Applicable Protocols

| Protocol | Maximum Test Time Per Channel (Minutes) |
|---|---|
| LTE Category M1/M2 | 20 |
| Category NB1 | 20 |

### 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.

- Testing shall be performed solely with the standard battery (if field replaceable) or internal battery, i.e., no charging cable or accessory cable shall be utilized during the testing, unless explicitly permitted or required elsewhere in the suite of test plans (see Section 1.7), e.g., devices requiring external power supply to operate.

#### 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 2.1.8.1.2 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 zones of the DUT 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.

A vendor declaration is necessary in case the gray-box positioning approach is used, where a declared positioning reference point is aligned with the center of the quiet zone as described in Section 4.1 of *CTIA 01.71* [14]. The sample vendor declaration for the gray-box approach is highlighted in Table 1.5.2-1 and relies on the declaration of a reference point and the minimum quiet zone required to contain all active antennas.

Table 1.5.2-1: Sample Vendor Declaration for Gray-Box Approach

| Band | Positioning Reference Point: Offset (*X*/*Y*/*Z*) from Geometric Center of DUT | Min. QZ Required to Contain All Active Antennas Within the Quiet Zone |
|---|---|---|
| n258 | | |
| n260 | | |
| n261 | | |
| Note: The only available QZ sizes are 30 cm and 40 cm in diameter as defined in Section 2.1.3 of *CTIA 01.22* [7]. | | |

Laptops and FWAs shall be scanned for beam peak searches and spherical coverage test cases by default in both hemispheres. As an alternative, OEMs are allowed to declare only one hemisphere to be tested. This vendor declaration shall specify the DUT test condition (Alignment Option and DUT Orientation) as shown in Table 1.5.2-2.

Table 1.5.2-2: Sample Vendor Declaration to Test Single Hemisphere for Laptops or FWAs.

| Band | Alignment Option (Note 1) | DUT Orientation (Note 2) |
|---|---|---|
| n258 | | |
| n260 | | |
| n261 | | |
| Note 1: For FWAs, the available alignment options are #1, #4, and #5, while for laptops, the available alignment options are #1 and #6. The alignment options are defined in Section 4.1 of *CTIA 01.71* [14]<br>Note 2: Either DUT Orientation 1 or DUT Orientation 2 shall be selected. | | |

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 |
| **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 |

| Acronym/Term | Definition |
|---|---|
| **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 |
| **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 |

| Acronym/Term | Definition |
|---|---|
| **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 |
| **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 |

| Acronym/Term | Definition |
|---|---|
| **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 (Informative)* |
| [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* |

| **Document Number, *Document Name*** |
|---|
| [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 ($NHPRP_{\pm45}$)
- Near-Horizon Partial Radiated Power considered over ±30 degrees ($NHPRP_{\pm30}$)
- Relative power on intermediate channels
- Total Isotropic Sensitivity (TIS)
- Near-Horizon Partial Isotropic Sensitivity considered over ±45 degrees ($NHPIS_{\pm45}$)
- Near-Horizon Partial Isotropic Sensitivity considered over ±30 degrees ($NHPIS_{\pm30}$)
- 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 be 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 ankle. 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 when using an External Interface, 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.

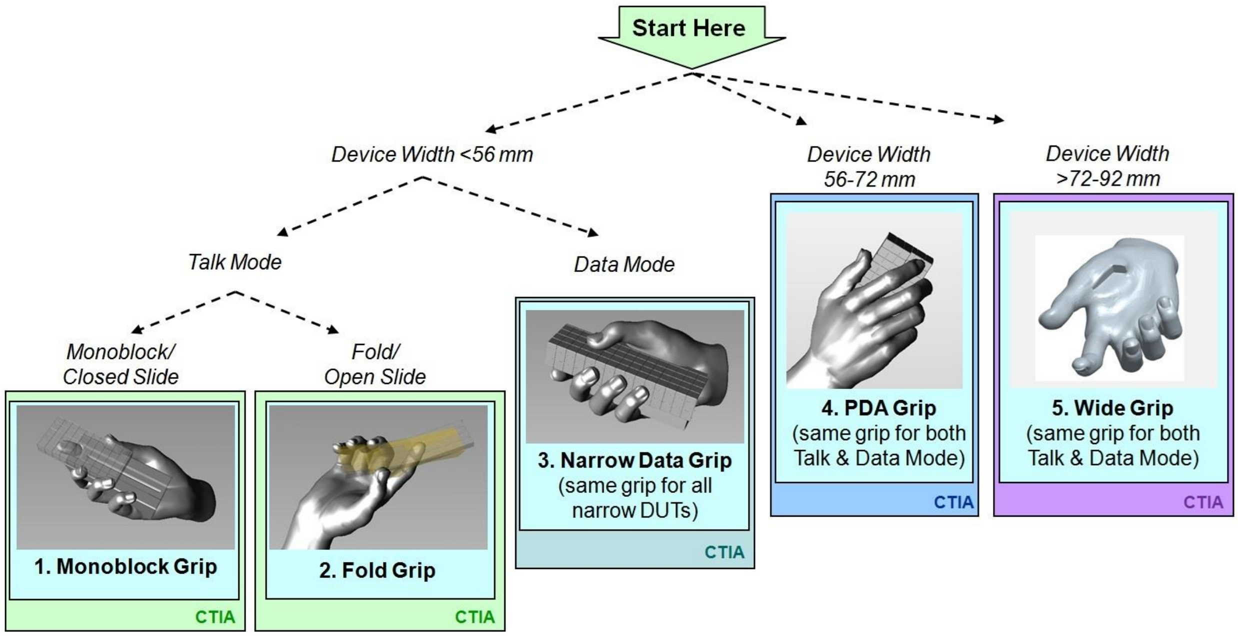


Figure 2.1.2.1-1 Choosing the Correct Hand Phantom

2.1.2.1.2. Devices Supporting Usage against the Head

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.

Table 2.1.2.1.2-2 list the rules that determine which types of devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels. The test IDs in Table 2.1.2.1.2-1 have the format AAB.C.D-E and are defined in Table 2.1.2.1.2-1.

Table 2.1.2.1.2-1 Definition of Test IDs

| AA | B | C | D | E |
|---|---|---|---|---|
| BH = beside head and hand | 1 = all cellular protocols | If B=1, then C=1 for all location based technologies | 0 = N/A for location based technologies | Index for test ID |
| H = hand only | 2 = 2G cellular protocols | If B=1, then C=0 when N/A for location based technologies | 1 = A-GPS L1 | |
| W = wrist-worn | 3 = 3G cellular protocols | if B=2, then index for 2G cellular protocol | 2 = A-Galileo E1 | |
| C = chest-worn | 4 = 4G cellular protocols | if B=3, then index for 3G cellular protocol | 3 = A-GPS L5 | |

| AA | B | C | D | E |
|---|---|---|---|---|
| A = ankle-worn | 5 = 5G cellular protocols | if B=4, then index for 4G cellular protocol | | |
| L = large IOT device | | if B=5, then index for 5G cellular protocol | | |
| N = notebook | | | | |
| T = tablet | | | | |
| I = Integrated devices not body worn | | | | |

Table 2.1.2.1.2-2 Test Requirements for Devices Supporting Usage against the Head

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH1.1-1 | all | all | Testing against the head (BHHR and BHHL) is required for all cellular protocols that support voice (e.g., VoIP, VoLTE or VoNR) as manufactured against the head, unless otherwise noted. Testing against the head is not required for any cellular protocol that does not support voice against the head.<br><br>Head phantom only tests are no longer required. |
| BH1.1-2 | all | all | Intermediate Channel Degradation testing for Location Based Technologies (e.g., A-GNSS) shall be tested in the right side head and hand phantom (BHHR) configurations. |
| BH1.1-3 | all | all | 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 conditions.<br><br>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.<br><br>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. |
| BH1.1-4 | all | all | 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. |
| BH1.1-5 | all | all | Location based wireless protocol OTA testing is not required in the free-space test conditions for devices tested against the head. |

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH1.1.0-1 | all | N/A | Testing in free space is required for all cellular protocols that support 1) voice (e.g., VoIP or VoLTE) as manufactured against the head and 2) data operation, unless otherwise noted. |
| BH1.1.0-2 | all | N/A | 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 |
| BH1.1.0-3 | all | N/A | If a device has multiple mechanical modes in which to use data, each mechanical mode representative of end use, shall be tested in free space (e.g., a portrait slide phone shall be tested in both slide open and slide closed positions, 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 free-space test conditions.<br><br>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.<br><br>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. |
| BH2.1.0-1 | GSM | N/A | For GSM, TRP and TIS testing across the entire band is required for FS, and BHHR. BHHL testing is not required. |
| BH2.1.0-2 | GSM | N/A | GSM relative sensitivity tests on intermediate channels are not required for GSM devices that support voice operation against the head. |
| BH2.1.0-3 | GSM | N/A | For GSM devices that support voice operation against the head that meet the following conditions, GSM OTA testing may be reduced.<br>o 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.<br>o Each TX antenna for GSM is the same as a TX antenna that was fully tested for LTE.<br>o Each RX antenna for GSM is the same as a RX antenna that was fully tested for LTE.<br>Under these conditions, the GSM TRP/TIS testing may be reduced as follows:<br>o 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 |
| BH2.1.1-1 | GSM | A-GPS L1 | 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.<br>o The device supports LTE, and is fully tested for A-GPS L1 OTA (all applicable use cases) with the equivalent LTE band (including bands with wider frequency coverage, e.g. LTE 2 or 25 for GSM 1900) as GSM.<br>o Each TX antenna for GSM is the same as a TX antenna that was fully tested for LTE.<br>o 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<br>Under these conditions, the A-GPS L1 with GSM OTA testing may be reduced as follows:<br>o 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). |

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH2.2.0-1 | GPRS | N/A | Head-adjacent TRP/TIS testing is only required for a GPRS band if the DUT supports usage against the head in this mode (e.g. VoIP) and GSM is not supported in the same band. |
| BH2.2.0-2 | GPRS | N/A | GPRS OTA (TRP/TIS/relative sensitivity on intermediate channels) testing is not required for GSM devices that support voice operation against the head in the same band. |
| BH2.3.0-1 | EGPRS | N/A | Head-adjacent TRP/TIS testing is only required for a EGPRS band if the DUT supports usage against the head in this mode (e.g. VoIP) and GSM is not supported in the same band. |
| BH2.3.0-2 | EGPRS | N/A | EGPRS OTA (TRP/TIS/relative sensitivity on intermediate channels) testing is not required for GSM devices that support voice operation against the head in the same band. |
| BH3.1.0-1 | UMTS | N/A | For UMTS, TRP and TIS testing across the entire band is required for FS, and BHHR.  BHHL testing is not required. |
| BH3.1.0-2 | UMTS | N/A | UMTS OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports LTE and is fully tested (all applicable use cases) in the equivalent LTE band as UMTS.<br>o Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.<br>o Each RX antenna for UMTS is the same as a RX antenna that was fully tested for LTE.<br>Under these conditions, UMTS OTA testing may be reduced as follows:<br>o 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.<br>o Relative sensitivity testing on intermediate channels for UMTS is not required (BHHR and FS). |
| BH3.1.1-1 | UMTS | A-GPS L1 | A-GPS L1 with UMTS OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-GPS with LTE and is fully tested (all applicable use cases) with the equivalent LTE band as UMTS.<br>o Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.<br>o 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<br>Under these conditions, A-GPS L1 with UMTS OTA testing may be reduced as follows:<br>o 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). |
| BH4.1.0-1 | LTE (single carrier) | N/A | For LTE, TRP and TIS testing across the entire band is required for FS, and BHHR. For LTE, only mid-channel testing is required for BHHL for TRP and TIS (i.e., no low/high channel testing is required for BHHL unless requested by the manufacturer). |
| BH4.1.0-2 | LTE (single carrier) | N/A | LTE OTA testing may be reduced for devices which meet the following criteria:<br>o 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.<br>o Each TX antenna for LTE is the same as a TX antenna that was fully tested for NR FR1 SA.<br>o Each RX antenna for LTE is the same as a RX antenna that was fully tested for NR FR1 SA.<br>Under these conditions, LTE OTA testing may be reduced as follows:<br>o 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.<br>o 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. |

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH4.1.1-1 | LTE (single carrier) | A-GPS L1 | A-GPS L1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-GPS L1 and is tested for A-GPS L1 with NR FR1 SA TIS (BHHR, BHHL) with the NR band equivalent to the LTE band.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (BHHR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna for A-GPS L1 with NR FR1 SA.<br>Under these conditions, A-GPS L1 with LTE OTA testing may be reduced as follows:<br>o A-GPS L1 with LTE TIS testing is not required (BHHR, BHHL).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with LTE that meets this test reduction is considered to be fully tested for A-GPS L1 with LTE for BHHR and BHHL. |
| BH4.1.1-2 | LTE (single carrier) | A-GPS L1 | For A-GPS L1 with LTE testing on devices which do not support dynamically tuned GPS antennas, 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. |
| BH4.1.2-1 | LTE (single carrier) | A-Galileo E1 | A-Galileo E1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-Galileo E1 and is tested for A-Galileo E1 with NR FR1 SA TIS (BHHR, BHHL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (BHHR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, A-Galileo E1 with LTE OTA testing may be reduced as follows:<br>o A-Galileo E1 with LTE TIS testing is not required (BHHR, BHHL).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with LTE that meets this test reduction is considered to be fully tested for A-Galileo E1 with LTE for BHHR and BHHL. |
| BH4.1.2-2 | LTE (single carrier) | A-Galileo E1 | For A-Galileo E1 with LTE testing on devices which do not support dynamically tuned GPS antennas, 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. |
| BH4.1.3-1 | LTE (single carrier) | A-GPS L5 | For A-GPS L5 with LTE testing on devices which do not support dynamically tuned GPS antennas, 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. |
| BH4.2.0-1 | LTE CA | N/A | Head-adjacent testing is not required in LTE carrier aggregation mode (LTE CA). |
| BH4.3.0-1 | LTE LAA | N/A | Head-adjacent testing is not required in LTE carrier aggregation mode (LTE LAA). |

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH5.1.0-1 | NR FR1 SA (single carrier) | N/A | Head-adjacent TRP/TIS testing is only required for NR FR1 SA if the DUT supports usage against the head in this mode (e.g. VoIP). |
| BH5.1.0-2 | NR FR1 SA (single carrier) | N/A | For NR FR1 SA, TRP and TIS testing across the entire band is required for FS, and BHHR. For NR FR1 SA, only mid-channel testing is required for BHHL for TRP and TIS (i.e., no low/high channel testing is required for BHHL unless requested by the manufacturer). |
| BH5.1.1-1 | NR FR1 SA (single carrier) | A-GPS L1 | A-GPS L1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-GPS L1 with NR FR1 SA and is tested for A-GPS L1 with NR FR1 SA TIS (BHHR, BHHL) with the NR band equivalent to the LTE band.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (BHHR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna for A-GPS L1 with NR FR1 SA.<br>Under these conditions, A-GPS L1 with NR FR1 SA OTA testing may be reduced as follows:<br>o A-GPS L1 with NR FR1 SA intermediate channel degradation testing is not required (BHHR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-GPS L1 with NR FR1 SA for BHHR and BHHL. |
| BH5.1.2-1 | NR FR1 SA (single carrier) | A-Galileo E1 | A-Galileo E1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-Galileo E1 with NR FR1 SA and is tested for A-Galileo E1 with NR FR1 SA TIS (BHHR, BHHL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (BHHR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, A-Galileo E1 with NR FR1 SA OTA testing may be reduced as follows:<br>o A-Galileo E1 with NR FR1 SA intermediate channel degradation testing is not required (BHHR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-Galileo E1 with NR FR1 SA for BHHR and BHHL. |
| BH5.2.0-1 | NR FR1 EN-DC | N/A | Relative sensitivity tests on intermediate channels are not required for NR FR1 EN-DC. |
| BH5.2.0-2 | NR FR1 EN-DC | N/A | Head-adjacent testing is not required in NR FR1 EN-DC. |
| BH5.2.1-1 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 with NR FR1 EN-DC TIS testing is not required for BHHR and BHHL. |
| BH5.2.2-3 | NR FR1 EN-DC | A-GALILEO E1 | A-GALILEO E1 with NR FR1 EN-DC TIS testing is not required for BHHR and BHHL. |

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| BH5.2.3-2 | NR FR1 EN-DC | A-GPS L5 | A-GPS L5 with NR FR1 EN-DC TIS testing is not required for BHHR and BHHL. |
| BH5.3.0-1 | NR FR1 SA CA | N/A | Head-adjacent testing is not required in NR FR1 SA CA. |

Table 2.1.2.1.2-3 lists which test IDs apply to the various test cases associated with devices supporting usage against the head.

Table 2.1.2.1.2-3 Test IDs Applying to Various Test Cases for Devices Supporting Usage against the Head

| 3GPP Protocol | Location Based Protocol | FS TRP | FS TIS | BHHL TRP | BHHL TIS | BHHR TRP | BHHR TIS | BHHR REL. Sense. | FS REL. Sense. | BHHR REL. Power | FS REL. Power | Inter. Channel Degrad. BHHR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| all | all | | BH1.1-5 | BH1.1-1, BH1.1-3, BH1.1-4 | BH1.1-1, BH1.1-3, BH1.1-4 | BH1.1-1, BH1.1-3, BH1.1-4 | BH1.1-1, BH1.1-3, BH1.1-4 | BH1.1-4 | | BH1.1-4 | | BH1.1-2, BH1.1-4 |
| all | N/A | BH1.1.0-1, BH1.1.0-3 | BH1.1.0-1, BH1.1.0-3 | | | | | BH1.1.0-2 | BH1.1.0-2 | BH1.1.0-2 | BH1.1.0-2 | |
| GSM | N/A | BH2.1.0-1, BH2.1.0-3 | BH2.1.0-1, BH2.1.0-3 | BH2.1.0-1, BH2.1.0-3 | BH2.1.0-1, BH2.1.0-3 | BH2.1.0-1, BH2.1.0-3 | BH2.1.0-1, BH2.1.0-3 | | | | | |
| GSM | A-GPS L1 | | | | BH2.1.1-1 | | BH2.1.1-1 | | | | | |
| GPRS | N/A | BH2.2.0-2 | BH2.2.0-2 | BH2.2.0-1, BH2.2.0-2 | BH2.2.0-1, BH2.2.0-2 | BH2.2.0-1, BH2.2.0-2 | BH2.2.0-1, BH2.2.0-2 | BH2.2.0-2 | | BH2.2.0-2 | | |
| EGPRS | N/A | BH2.3.0-2 | BH2.3.0-2 | BH2.3.0-1, BH2.3.0-2 | BH2.3.0-1, BH2.3.0-2 | BH2.3.0-1, BH2.3.0-2 | BH2.3.0-1, BH2.3.0-2 | BH2.3.0-2 | | BH2.3.0-2 | | |
| UMTS | N/A | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-1, BH3.1.0-2 | BH3.1.0-2 | BH3.1.0-2 | | | |
| UMTS | A-GPS L1 | | | | BH3.1.1-1 | | BH3.1.1-1 | | | | | |
| LTE (single carrier) | N/A | BH4.1.0-1, BH4.1.0-2 | BH4.1.0-1, BH4.1.0-2 | BH4.1.0-1, BH4.1.0-2 | BH4.1.0-1, BH4.1.0-2 | BH4.1.0-1, BH4.1.0-2 | BH4.1.0-1, BH4.1.0-2 | | | | | |

| 3GPP Protocol | Location Based Protocol | FS TRP | FS TIS | BHHL TRP | BHHL TIS | BHHR TRP | BHHR TIS | BHHR REL. Sense. | FS REL. Sense. | BHHR REL. Power | FS REL. Power | Inter. Channel Degrad. BHHR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LTE (single carrier) | A-GPS L1 | | | | BH4.1.1-1, BH4.1.1-2 | | BH4.1.1-1, BH4.1.1-2 | | | | | |
| LTE (single carrier) | A-Galileo E1 | | | | BH4.1.2-1, BH4.1.2-2 | | BH4.1.2-1, BH4.1.2-2 | | | | | |
| LTE (single carrier) | A-GPS L5 | | | | | | | | | | | |
| LTE CA | N/A | | | BH4.2.0-1 | BH4.2.0-1 | BH4.2.0-1 | BH4.2.0-1 | BH4.2.0-1 | | BH4.2.0-1 | | BH4.2.0-1 |
| LTE LAA | N/A | | | BH4.3.0-1 | BH4.3.0-1 | BH4.3.0-1 | BH4.3.0-1 | BH4.3.0-1 | | BH4.3.0-1 | | BH4.3.0-1 |
| NR FR1 SA (single carrier) | N/A | BH5.1.0-2 | BH5.1.0-2 | BH5.1.0-1, BH5.1.0-2 | BH5.1.0-1, BH5.1.0-2 | BH5.1.0-1, BH5.1.0-2 | BH5.1.0-1, BH5.1.0-2 | | | | | |
| NR FR1 SA (single carrier) | A-GPS L1 | | | | | | | | | | | BH5.1.1-1 |
| NR FR1 SA (single carrier) | A-Galileo E1 | | | | | | | | | | | BH5.1.2-1 |
| NR FR1 SA (single carrier) | A-GPS L5 | | | | | | | | | | | |
| NR FR1 EN-DC | N/A | | | BH5.2.0-2 | BH5.2.0-2 | BH5.2.0-2 | BH5.2.0-2 | BH5.2.0-1 | BH5.2.0-1 | | | |
| NR FR1 EN-DC | A-GPS L1 | | | | BH5.2.1-1 | | BH5.2.1-1 | | | | | |
| NR FR1 EN-DC | A-Galileo E1 | | | | BH5.2.2-1 | | BH5.2.2-1 | | | | | |
| NR FR1 EN-DC | A-GPS L5 | | | | BH5.2.3-1 | | BH5.2.3-1 | | | | | |
| NR FR1 SA CA | N/A | | | BH5.3.0-1 | BH5.3.0-1 | BH5.3.0-1 | BH5.3.0-1 | | | | | |

#### 2.1.2.1.3. Devices Supporting Data Usage in the Hand

Table 2.1.2.1.3-1 list the rules that determine which types of devices will be tested for which mechanical modes, which test conditions, which cellular radio modes and which channels. The test IDs in Table 2.1.2.1.3-1 have the format AAB.C.D-E and are defined in Table 2.1.2.1.2-1.

Table 2.1.2.1.3-1 Test Requirements for Devices Supporting Data Usage in the Hand

| Test Req. ID | 3GPP Protocol | Location Based Protocol | Test Requirement |
|---|---|---|---|
| H1.1-1 | all | all | Testing in the hand (e.g. HR and HL) is required, unless other noted. |
| H1.1-2 | all | all | 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. |
| H1.1-3 | all | all | 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.<br><br>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. |
| H1.1-4 | all | all | 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. |
| H1.1-5 | all | all | Intermediate Channel Degradation testing for A-GNSS shall be tested in HR. |
| H2.1.0-1 | GSM | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for GSM. |
| H2.1.0-2 | GSM | N/A | GSM TRP/TIS testing for HR/HL is not required for GSM devices that support voice operation against the head. |

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| H2.1.1-1 | GSM | A-GPS L1 | 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.<br>o The device supports an equivalent LTE band (including bands with wider frequency coverage, e.g. LTE 2 or 25 for GSM 1900).<br>o Each TX antenna for GSM is the same as a TX antenna for LTE.<br>o 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.<br>Under these conditions, the A-GPS L1 with GSM OTA testing may be reduced as follows:<br>o 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). |
| H2.2.0-1 | GPRS | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for GPRS. |
| H2.2.0-2 | GPRS | N/A | GPRS TRP/TIS testing for HR/HL is not required for GSM devices that support voice operation against the head. |
| H2.3.0-1 | EGPRS | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for EGPRS. |
| H2.3.0-2 | EGPRS | N/A | EGPRS TRP/TIS testing for HR/HL is not required for GSM devices that support voice operation against the head. |
| H3.1.0-1 | UMTS | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for UMTS. |
| H3.1.0-2 | UMTS | N/A | For devices that support voice operation against the head, UMTS TRP and TIS testing across the entire band is required for HL. For UMTS, HR testing is not required. |
| H3.1.0-3 | UMTS | N/A | UMTS OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports LTE and is fully tested (all applicable use cases) in the equivalent LTE band as UMTS.<br>o Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.<br>o Each RX antenna for UMTS is the same as a RX antenna that was fully tested for LTE.<br>Under these conditions, the UMTS OTA testing may be reduced as follows:<br>o UMTS OTA (TRP/TIS) testing in HR and HL is not required. |
| H3.1.1-1 | UMTS | A-GPS L1 | A-GPS L1 with UMTS OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports LTE and is fully tested (all applicable use cases) in the equivalent LTE band as UMTS.<br>o Each TX antenna for UMTS is the same as a TX antenna that was fully tested for LTE.<br>o 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<br>Under these conditions, the A-GPS L1 with UMTS OTA testing may be reduced as follows:<br>o 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). |
| H4.1.0-1 | LTE (single carrier) | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for LTE (all variants). |
| H4.1.0-2 | LTE (single carrier) | N/A | For devices that support both LTE operation against the head (e.g., VoIP) and LTE carrier aggregation, hand-only testing is required in LTE single carrier mode for these devices. |

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| | | | For LTE (single carrier), 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). |
| H4.1.0-3 | LTE (single carrier) | N/A | LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports NR FR1 SA and is fully tested (all applicable use cases) in the NR band equivalent to the LTE band.<br>o Each TX antenna for LTE is the same as a TX antenna that was fully tested for NR FR1 SA.<br>o Each RX antenna for LTE is the same as a RX antenna that was fully tested for NR FR1 SA.<br>Under these conditions, the LTE OTA testing may be reduced as follows:<br>o LTE TRP/TIS testing in HR and HL is not required.<br>o 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. |
| H4.1.1-1 | LTE (single carrier) | A-GPS L1 | A-GPS L1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-GPS L1 with NR FR1 SA and is tested for A-GPS L1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna for A-GPS L1 with NR FR1 SA.<br>Under these conditions, the A-GPS L1 with LTE OTA testing may be reduced as follows:<br>o A-GPS L1 with LTE TIS testing is not required (HR, HL).<br>o 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. |
| H4.1.1-2 | LTE (single carrier) | A-GPS L1 | A-GPS L1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-GPS L1 with NR FR1 EN-DC and is tested for A-GPS L1 with NR FR1 EN-DC TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna that was fully tested for A-GPS L1 with NR FR1 EN-DC.<br>Under these conditions, A-GPS L1 with LTE OTA testing may be reduced as follows:<br>o A-GPS L1 with LTE TIS testing is not required (HR, HL).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with LTE that meets this test reduction is considered to be fully tested for A-GPS L1 with LTE for HR and HL. |
| H4.1.1-3 | LTE (single carrier) | A-GPS L1 | For A-GPS L1 with LTE testing on devices which do not support dynamically tuned GPS L1 antennas, 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. |

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| H4.1.2-1 | LTE (single carrier) | A-Galileo E1 | A-Galileo E1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-Galileo E1 with NR FR1 SA and is tested for A-Galileo E1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, the A-Galileo E1 with LTE OTA testing may be reduced as follows:<br>o A-Galileo E1 with LTE TIS testing is not required (HR, HL).<br>o 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. |
| H4.1.2-2 | LTE (single carrier) | A-Galileo E1 | A-Galileo E1 with LTE OTA testing may be reduced for devices which meet the following criteria:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-Galileo E1 with NR FR1 EN-DC and is tested for A-Galileo E1 with NR FR1 EN-DC TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-Galileo E1 with NR FR1 EN-DC.<br>Under these conditions, A-Galileo E1 with LTE OTA testing may be reduced as follows:<br>o A-Galileo E1 with LTE TIS testing is not required (HR, HL).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with LTE that meets this test reduction is considered to be fully tested for A-Galileo E1 with LTE for HR and HL. |
| H4.1.2-3 | LTE (single carrier) | A-Galileo E1 | For A-Galileo E1 with LTE testing on devices which do not support dynamically tuned Galileo E1 antennas, 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. |
| H4.2.0-1 | LTE CA | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for LTE (all variants). |
| H4.2.0-2 | LTE CA | N/A | For devices that support both LTE operation against the head (e.g., VoIP) and LTE carrier aggregation, hand-only testing is required in LTE carrier aggregation mode for these devices. Per Table 2.1.2.1.3-2, full TRP and TIS testing across the entire band is required for HL; 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). |
| H4.3.0-1 | LTE LAA | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for LTE (all variants). |
| H4.4.0-1 | LTE Category M1 | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for LTE (all variants). |

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| H4.5.0-1 | LTE Category NB1 | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for LTE (all variants). |
| H5.1.0-1 | NR FR1 SA (single carrier) | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for NR (all variants). |
| H5.1.0-2 | NR FR1 SA (single carrier) | N/A | For devices that support voice operation against the head (e.g., VoNR), NR FR1 SA TRP and TIS testing across the entire band is required for HL. For 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). |
| H5.1.1-1 | NR FR1 SA (single carrier) | A-GPS L1 | A-GPS L1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-GPS L1 with NR FR1 SA and is tested for A-GPS L1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna for A-GPS L1 with NR FR1 SA.<br>Under these conditions, A-GPS L1 with NR FR1 SA OTA testing may be reduced as follows:<br>o A-GPS L1 with NR FR1 SA intermediate channel degradation testing is not required (HR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-GPS L1 with NR FR1 SA for HR and HL. |
| H5.1.2-1 | NR FR1 SA (single carrier) | A-Galileo E1 | A-Galileo E1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-Galileo E1 with NR FR1 SA and is tested for A-Galileo E1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, A-Galileo E1 with NR FR1 SA OTA testing may be reduced as follows:<br>o A-Galileo E1 with NR FR1 SA intermediate channel degradation testing is not required (HR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-Galileo E1 with NR FR1 SA for HR and HL. |

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| H5.1.2-1 | NR FR1 SA (single carrier) | A-Galileo E1 | A-Galileo E1 with NR FR1 SA OTA testing may be reduced for devices which meet the following criteria:<br>o The device supports A-Galileo E1 with NR FR1 SA and is tested for A-Galileo E1 with NR FR1 SA TIS (HR, HL) with the NR band equivalent to the LTE band.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR FR1 SA band.<br>o Each TX antenna for LTE is the same TX antenna for NR FR1 SA for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, A-Galileo E1 with NR FR1 SA OTA testing may be reduced as follows:<br>o A-Galileo E1 with NR FR1 SA intermediate channel degradation testing is not required (HR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with NR FR1 SA that meets this test reduction is considered to be fully tested for A-Galileo E1 with NR FR1 SA for HR and HL. |
| H5.2.0-1 | NR FR1 EN-DC | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for NR (all variants). |
| H5.2.0-2 | NR FR1 EN-DC | N/A | For devices that support both LTE operation against the head (e.g., VoLTE) and NR FR1 EN-DC mode, hand-only testing is required in NR FR1 EN-DC mode. Per Table 2.1.2.1.3-4 below, full TRP and TIS testing across the entire band is required for HL; 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). |
| H5.2.1-1 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 with NR FR1 EN-DC TIS testing is limited to HR and HL. |
| H5.2.1-2 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna that was fully tested for A-GPS L1 with NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>Under these conditions, A-GPS L1 with NR FR1 EN-DC OTA testing for the first test with NR only at maximum TX power may be reduced as follows:<br>o A-GPS L1 with NR FR1 EN-DC intermediate channel degradation testing for the first test with NR only at maximum TX power is not required (HR).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for A-GPS L1 with NR FR1 EN-DC for the first test with NR only at maximum TX power for HR and HL. |

| | | | |
|---|---|---|---|
| H5.2.1-3 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-GPS L1 with LTE and is tested for A-GPS L1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each GNSS RX antenna for A-GPS L1 with LTE is the same RX antenna that was fully tested for A-GPS L1 with NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o The NR FR1 EN-DC band combination does not have a known IMD interference to A-GPS L1 or A-Galileo E1<br>Under these conditions, A-GPS L1 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:<br>o A-GPS L1 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).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-GPS L1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for A-GPS L1 with NR FR1 EN-DC for the second test with LTE and NR at maximum balanced TX power for HR and HL. |
| H5.2.1-4 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 OTA with NR FR1 EN-DC testing may be reduced for devices which meet the following criteria:<br>o The device supports NR FR1 SA and NR FR1 EN-DC for the same NR band.<br>o The device supports A-GPS L1 with NR FR1 SA is fully tested (HR, HL) for A-GPS L1 with NR FR1 SA with the same NR band used in NR FR1 EN-DC.<br>o Each TX antenna for NR FR1 SA is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o Each GNSS RX antenna for A-GPS L1 with NR FR1 EN-DC is the same RX antenna that was fully tested for A-GPS L1 with NR FR1 SA.<br>Under these conditions, A-GPS L1 with NR FR1 EN-DC OTA testing may be reduced as follows:<br>o A-GPS L1 with NR FR1 EN-DC TIS testing is not required for the first test with NR only at maximum power (HR, HL).<br>o A-GPS L1 with NR FR1 EN-DC intermediate channel degradation testing is not required for the first test with NR only at maximum power (HR).<br>o A-GPS L1 with NR FR1 EN-DC TIS testing (HR, HL) and intermediate channel degradation testing (HR) for the second test with maximum NR-LTE balanced power is not required for non-IMD bands. |
| H5.2.1-5 | NR FR1 EN-DC | A-GPS L1 | A-GPS L1 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports more than one EN-DC band combination with same NR band<br>Under these conditions, A-GPS L1 with NR FR1 EN-DC OTA testing for the first test with NR only at maximum TX power may be reduced as follows:<br>o Only one EN-DC band combination is required for A-GPS L1 with NR FR1 EN-DC intermediate channel degradation testing for the first test with NR only at maximum TX power. |
| H5.2.2-1 | NR FR1 EN-DC | A-Galileo E1 | A-GALILEO E1 with NR FR1 EN-DC TIS testing is limited to HR and HL. |

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| H5.2.2-2 | NR FR1 EN-DC | A-Galileo E1 | 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-Galileo E1 with NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>Under these conditions, 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:<br>o 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).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for A-Galileo E1 with NR FR1 EN-DC for the first test with NR only at maximum TX power for HR and HL. |
| H5.2.2-3 | NR FR1 EN-DC | A-Galileo E1 | 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports A-Galileo E1 with LTE and is tested for A-Galileo E1 with LTE intermediate channel degradation (HR) with the LTE band equivalent to the NR band used in NR FR1 EN-DC.<br>o Each GNSS RX antenna for A-Galileo E1 with LTE is the same RX antenna that was fully tested for A-Galileo E1 with NR FR1 EN-DC.<br>o Each TX antenna for LTE is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o The NR FR1 EN-DC band combination does not have a known IMD interference to A-GPS L1 or A-Galileo E1<br>Under these conditions, 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:<br>o 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).<br>o For the purposes of determining what other test reductions are allowed, each GNSS RX antenna for A-Galileo E1 with NR FR1 EN-DC that meets this test reduction is considered to be fully tested for 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. |

| | | | |
|---|---|---|---|
| H5.2.2-4 | NR FR1 EN-DC | A-Galileo E1 | A-Galileo E1 OTA with NR FR1 EN-DC testing may be reduced for devices which meet the following criteria:<br>o The device supports NR FR1 SA and NR FR1 EN-DC for the same NR band.<br>o The device supports A-Galileo E1 with NR FR1 SA is fully tested (HR, HL) for A-Galileo E1 with NR FR1 SA with the same NR band used in NR FR1 EN-DC.<br>o Each TX antenna for NR FR1 SA is the same TX antenna for NR used in NR FR1 EN-DC for the equivalent band.<br>o Each GNSS RX antenna for A-Galileo E1 with NR FR1 EN-DC is the same RX antenna that was fully tested for A-Galileo E1 with NR FR1 SA.<br>Under these conditions, A-Galileo E1 with NR FR1 EN-DC OTA testing may be reduced as follows:<br>o 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).<br>o 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).<br>o A-Galileo E1 with NR FR1 EN-DC TIS testing (HR, HL) and intermediate channel degradation testing (HR) for the second test with maximum NR-LTE balanced power is not required for non-IMD bands. |
| H5.2.2-5 | NR FR1 EN-DC | A-Galileo E1 | 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports more than one EN-DC band combination with same NR band<br>Under these conditions, 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:<br>o Only one EN-DC band combination is required for A-Galileo E1 with NR FR1 EN-DC intermediate channel degradation testing for the first test with NR only at maximum TX power. |
| H5.2.3-1 | NR FR1 EN-DC | A-GPS L5 | A-GPS L5 with NR FR1 EN-DC TIS testing is limited to HR and HL. |
| H5.2.3-2 | NR FR1 EN-DC | A-GPS L5 | A-GPS L5 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:<br>o The device does not support NR FR1 SA but does support NR FR1 EN-DC.<br>o The device supports more than one EN-DC band combination with same NR band<br>Under these conditions, A-GPS L5 with NR FR1 EN-DC OTA testing for the first test with NR only at maximum TX power may be reduced as follows:<br>o Only one EN-DC band combination is required for A-GPS L5 with NR FR1 EN-DC intermediate channel degradation testing for the first test with NR only at maximum TX power. |
| H5.3.0-1 | NR FR1 SA CA | N/A | Relative sensitivity tests on intermediate channels in the hand phantom are not required for NR (all variants). |
| H5.3.0-2 | NR FR1 SA CA | N/A | For devices that support both NR FR1 SA operation against the head (e.g., VoNR) and NR FR1 SA carrier aggregation, hand-only testing is required in NR FR1 SA DL carrier aggregation mode for these devices. Per Table 2.1.2.1.3-3 below, for NR FR1 SA DL CA, full TRP and TIS testing across the entire band is required for HL; 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 2.1.2.1.3-2 LTE 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 4.2.1-1, Table 4.2.2-1, Table 4.3.1-1, and Table 4.3.2-1 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.

Table 2.1.2.1.3-3 NR FR1 SA DL 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 | PCC/SCC(s)[1,2] |
| High Channel | PCC | PCC/SCC(s)[1,2] | Optional[3] | Optional[3] |

**Note 1:** PCC and SCC test channels are per Table 5.1.3.1-1, Table 5.1.3.2-1, Table 5.1.4.1-1, and Table 5.1.4.2-1 in *CTIA 01.50* [10]

**Note 2:** Testing is required on the PCC and all SCC's unless indicated otherwise in *CTIA 01.70* [13]

**Note 3**: Not required unless requested by the manufacturer.

Table 2.1.2.1.3-4 NR FR1 EN-DC Test Reduction Table

| **Test Channel[1]** | **HL** | | **HR** | |
|---|---|---|---|---|
| | **TRP** | **TIS** | **TRP** | **TIS** |
| Low Channel | LTE PCell<br>NR PSCell | LTE PCell/SCell(s)[1,2]<br>NR PSCell/SCell(s)[1,2] | Optional[3] | Optional[3] |

| | | | | |
|---|---|---|---|---|
| Mid Channel | LTE PCell<br>NR PSCell | LTE PCell/SCell(s)[1,2]<br>NR PSCell/SCell(s)[1,2] | LTE PCell<br>NR PSCell | LTE PCell/SCell(s)[1,2]<br>NR PSCell/SCell(s)[1,2] |
| High Channel | LTE PCell<br>NR PSCell | LTE PCell/SCell(s)[1,2]<br>NR PSCell/SCell(s)[1,2] | Optional[3] | Optional[3] |

**Note 1:** PCell, PSCell, and SCell test channels are per Table 5.1.2.1-1 and Table 5.1.2.2.1-1 in *CTIA 01.50* [10]

**Note 2:** Testing is required on the LTE PCell and all LTE SCell's unless indicated otherwise in *CTIA 01.70* [13]. Testing is required on the NR PSCell and all NR SCell's unless indicated otherwise in *CTIA 01.70* [13].

**Note 3**: Not required unless requested by the manufacturer.

Table 2.1.2.1.3-5 lists which test IDs apply to the various test cases associated with devices supporting data usage in the hand..

Table 2.1.2.1.3-5 Test IDs Applying to Various Test Cases for Devices Supporting Data Usage in the Hand

| 3GPP Protocol | Location Based Protocol | HL TRP | HL TIS OR HL 3D C/N0 | HR TRP | HR TIS OR HR 3D C/N0 | HL/HR REL. Sense. | HL/HR REL. Power | Inter. Channel Degrad. HR |
|---|---|---|---|---|---|---|---|---|
| all | all | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4 | H1.1-1, H1.1-2, H1.1-3, H1.1-4, H1.1-5 |
| all | N/A | | | | | | | |
| GSM | N/A | H2.1.0-2 | H2.1.0-2 | H2.1.0-2 | H2.1.0-2 | H2.1.0-1 | | |
| GSM | A-GPS L1 | | H2.1.1-1 | | H2.1.1-1 | | | |
| GPRS | N/A | H2.2.0-2 | H2.2.0-2 | H2.2.0-2 | H2.2.0-2 | H2.2.0-1 | | |
| EGPRS | N/A | H2.3.0-2 | H2.3.0-2 | H2.3.0-2 | H2.3.0-2 | H2.2.0-1 | | |
| UMTS | N/A | H3.1.0-2, H3.1.0-3 | H3.1.0-2, H3.1.0-3 | H3.1.0-2, H3.1.0-3 | H3.1.0-2, H3.1.0-3 | H3.1.0-1 | | |
| UMTS | A-GPS L1 | | H3.1.1-1 | | H3.1.1-1 | | | H3.1.1-1 |
| LTE (single carrier) | N/A | H4.1.0-2, H4.1.0-3 | H4.1.0-2, H4.1.0-3 | H4.1.0-2, H4.1.0-3 | H4.1.0-2, H4.1.0-3 | H4.1.0-1 | | |
| LTE (single carrier) | A-GPS L1 | | H4.1.1-1, H4.1.1-2, H4.1.1-3 | | H4.1.1-1, H4.1.1-2, H4.1.1-3 | | | |
| LTE (single carrier) | A-Galileo E1 | | H4.1.2-1, H4.1.2-2, H4.1.2-3 | | H4.1.2-1, H4.1.2-2, H4.1.2-3 | | | |

| 3GPP Protocol | Location Based Protocol | HL TRP | HL TIS OR HL 3D C/N0 | HR TRP | HR TIS OR HR 3D C/N0 | HL/HR REL. Sense. | HL/HR REL. Power | Inter. Channel Degrad. HR |
|---|---|---|---|---|---|---|---|---|
| LTE (single carrier) | A-GPS L5 | | | | | | | |
| LTE CA | N/A | H4.2.0-2 | H4.2.0-2 | H4.2.0-2 | H4.2.0-2 | H4.2.0-1 | | |
| LTE LAA | N/A | | | | | H4.3.0-1 | | |
| LTE Category M1 | N/A | | | | | H4.4.0-1 | | |
| LTE Category NB1 | N/A | | | | | H4.5.0-1 | | |
| NR FR1 SA (single carrier) | N/A | H5.0.1-2 | H5.0.1-2 | H5.0.1-2 | H5.0.1-2 | H5.0.1-1 | | |
| NR FR1 SA (single carrier) | A-GPS L1 | | | | | | | H5.1.1-1 |
| NR FR1 SA (single carrier) | A-Galileo E1 | | | | | | | H5.1.2-1 |
| NR FR1 SA (single carrier) | A-GPS L5 | | | | | | | |
| NR FR1 EN-DC | N/A | H5.2.0-2 | H5.2.0-2 | H5.2.0-2 | H5.2.0-2 | H5.2.0-1 | | |
| NR FR1 EN-DC | A-GPS L1 | | H5.2.1-1, H5.2.1-4 | | H5.2.1-1, H5.2.1-4 | | | H5.2.1-2, H5.2.1-3, H5.2.1-4, H5.2.1-5 |
| NR FR1 EN-DC | A-Galileo E1 | | H5.2.2-1, H5.2.2-4 | | H5.2.2-1, H5.2.2-4 | | | H5.2.2-2, H5.2.2-3, H5.2.2-4, H5.2.2-5 |
| NR FR1 EN-DC | A-GPS L5 | | H5.2.3-1 | | H5.2.3-1 | | | H5.2.3-2 |
| NR FR1 SA CA | N/A | H5.3.0-2 | H5.3.0-2 | H5.3.0-2 | H5.3.0-2 | H5.3.0-1 | | |

#### 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 shall be tested for all the mechanical modes representative of end use. Testing of Wrist-Worn Devices in 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 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.

##### 2.1.2.4.1. 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]. The cellular desense testing is limited to single carrier cellular radio modes (e.g. GSM, GPRS, EGPRS, UMTS, LTE single carrier, LTE Cat-M1, LTE Cat-NB1, NR FR1 SA single carrier). The test method is not applicable for CA/DC modes. 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.

#### 2.1.2.5 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.

### 2.1.3 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 normative 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 (device does not fit in a 60 mm diameter sphere), 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 |

| Cellular Radio Modes Supported By DUT | Cellular Radio Modes Subject To Radiated Performance Testing |
|---|---|
| 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 |

For Table 2.1.3-3, LTE includes LTE single carrier, LTE CA, LTE LAA, LTE Category M1, and LTE NB-IoT; and NR FR1 includes NR FR1 SA single carrier, NR FR1 SA CA, and NR FR1 EN-DC. If the cellular radio modes in the left column are supported by the DUT, then the testing listed in the right column is required and all test reductions (across cellular radio modes) described in this document apply.

#### 2.1.3.1 Large IoT Devices (Informative)

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 4.9 in *CTIA 01.20* [5]*.* The cellular desense testing is limited to single carrier cellular radio modes (e.g. GSM, GPRS, EGPRS, UMTS, LTE single carrier, LTE Cat-M1, LTE Cat-NB1, NR FR1 SA single carrier). The test method is not applicable for CA/DC modes. 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 and PCIExpress when using External Interface
- 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. In cases where the TX antenna is not uniquely defined based on the which antennas are used in the C-TIS measurement, the device manufacturer shall supply a “truth table” that clearly identifies which TX antenna shall be used for each of the C-TIS test cases (e.g., FS, BHHL, BHHR, HL, HR). The truth table shall be consistent with the software control algorithms activated in the commercial device. For example, in the situation where 1) the TX can switch between antennas A and B, 2) antennas A and B are used for RX for both TX switch states, and 3) the C-TIS is the same for both TX switch states, then the device manufacturer shall specify which antenna will be used for TX.

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 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.

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, and LTE Band 2 is considered fully tested for the purposes of evaluating other test reductions. If the device supports LTE Band 26 and LTE Band 5, then testing is only required to be completed in LTE Band 26, and LTE Band 5 is considered fully tested for the purposes of evaluating other test reductions. If the device supports LTE Band 66 and LTE Band 4, then testing is only required to be completed in LTE Band 66, and LTE Band 4 is considered fully tested for the purposes of evaluating other test reductions.

These test reductions also apply to A-GNSS.

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 “Non-essential, 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 “Non-essential, high priority” combinations.

No additional TRP testing is required for any CA combinations not identified as “Non-essential, high 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.

Full TIS testing of the SCC is required for any CA combinations with known self-desensitization issues that are identified as “Essential Conditional” (no testing of the PCC is required). However, CA combinations that are identified as “Essential Conditional” may be tested as part of a higher order, non-essential CA combination that includes the corresponding LTE PCC and SCC combination. Single point offset testing shall not be used for CA combinations with known self-desensitization issues that are identified as “Essential Conditional” 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 “Non-essential, high 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 ”Non-essential, high priority” combinations unless a higher order, non-essential combination is used to test an “Essential Conditional” combination. When testing an “Essential Conditional” combination as part of a “Non-essential, high priority” combination, full TIS testing is required for the SCC that corresponds to the “Essential Conditional” combination (single point offset testing may be used for TIS testing of any other CC’s).. 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”, “Essential Conditional”, or “Non-essential, high 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.

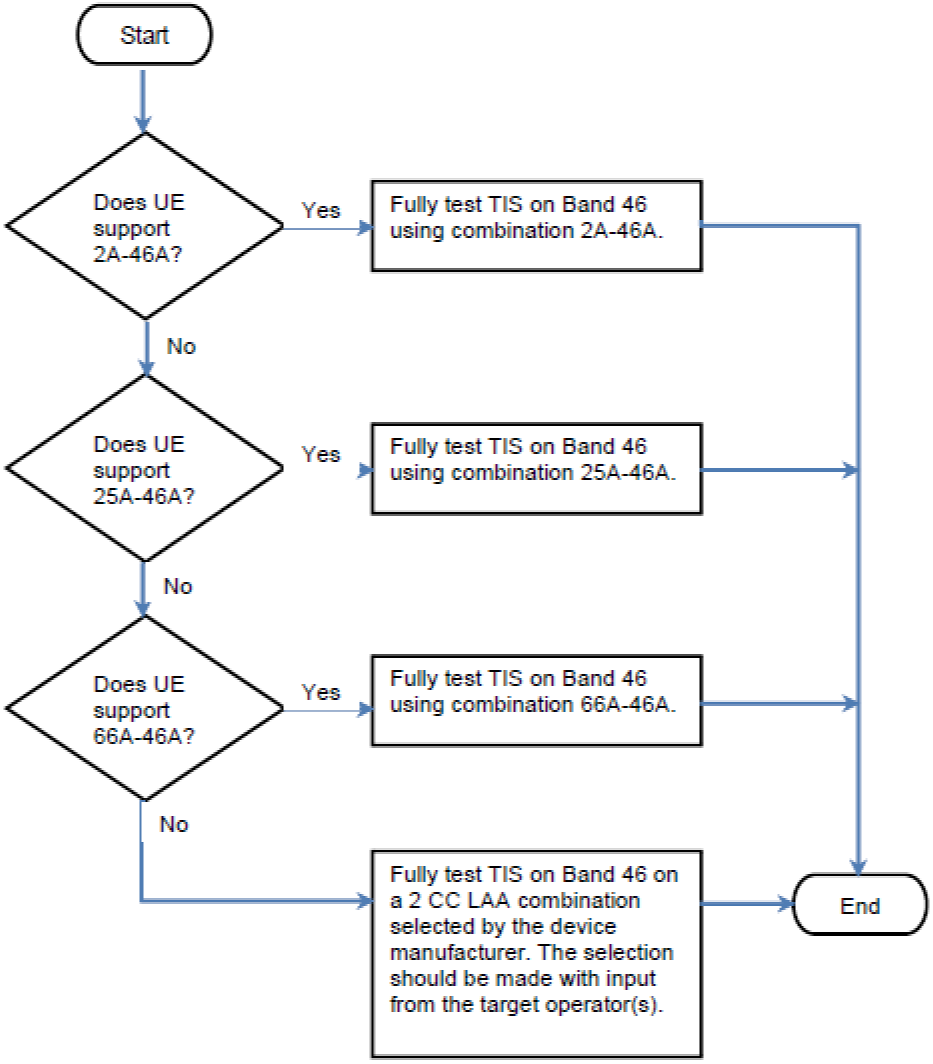


Figure 2.1.7.3.3-1 Logic for Determining the LAA Combination Used for Full TIS Testing of Band 46

### 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, and LTE Category M1 Band 5 is considered fully tested for the purposes of evaluating other test reductions.

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, and LTE Category NB1 Band 2 is considered fully tested for the purposes of evaluating other test reductions. 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, and LTE Category NB1 Band 5 is considered fully tested for the purposes of evaluating other test reductions. 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, and LTE Category NB1 Band 4 is considered fully tested for the purposes of evaluating other test reductions.

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, and NR Band n2 is considered fully tested for the purposes of evaluating other test reductions. If the device supports NR Band n26 and NR Band n5, then testing is only required to be completed in NR Band n26, and NR Band n5 is considered fully tested for the purposes of evaluating other test reductions.

These test reductions also apply to A-GNSS.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 01.50* [10] 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 this section.

The operator NR FR1 EN-DC priority list is included in *CTIA 01.02* [2].

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.

##### 2.1.7.6.1. NR FR1 EN-DC TRP Test Requirements

Full TRP testing is required for the NR FR1 EN-DC combinations identified as “Non-essential, high priority” combinations by the operator NR FR1 EN-DC 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 “Non-essential, high priority” combinations.

No additional TRP testing is required for any NR FR1 EN-DC combinations not identified as “Non-essential, high priority”.

##### 2.1.7.6.2. NR FR1 EN-DC TIS Test Requirements

Full TIS testing of the LTE PCell and the NR PSCell is required for any NR FR1 EN-DC combinations with known self-desensitization issues that are identified as “Essential” in the operator NR FR1 EN-DC priority lists (see *CTIA 01.02* [2]) and are supported on the device. Single point offset testing shall not be used for NR FR1 EN-DC combinations with known self-desensitization issues that are identified as “Essential” in the operator NR FR1 EN-DC priority lists.

Full TIS testing of the LTE PCell and the NR PSCell is required for any NR FR1 EN-DC combinations with known self-desensitization issues that are identified as “Essential Conditional”. However, NR FR1 EN-DC combinations that are identified as “Essential Conditional” may be tested as part of a higher order, non-essential FR1 EN-DC combination that includes the corresponding LTE PCell and NR PSCell combination. Single point offset testing shall not be used for NR FR1 EN-DC combinations with known self-desensitization issues that are identified as “Essential Conditional” in the operator NR FR1 EN-DC priority lists.

TIS testing of all LTE and NR CC’s is required for the NR FR1 EN-DC combinations identified as “Non-essential, high priority” combinations by the operator NR FR1 EN-DC priority lists for all of the target operators for the UE under test. Single point offset testing may be used for “Non-essential, high priority” combinations unless a higher order, non-essential NR FR1 EN-DC combination is used to test an “Essential Conditional” combination. When testing an “Essential Conditional” combination as part of a non-essential NR FR1 EN-DC combination, full TIS testing is required for the LTE PCell and NR PSCell that correspond to the “Essential Conditional” combination (single point offset testing may be used for TIS testing of any other CC’s). 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 NR FR1 EN-DC combinations not identified as “Essential”, “Essential Conditional”, or “Non-essential, high priority”.

#### 2.1.7.6.3. Test Reduction for LTE CA

For devices that support both NR FR1 EN-DC and LTE CA, LTE CA testing may be reduced when the LTE CA combination overlaps with an equivalent NR FR1 EN-DC combination as described below:

1> Does the device under test support NR FR1 EN-DC?
  2> Test all NR FR1 EN-DC combinations per the Operator Priority List.

1> Does the device under test support LTE CA?
  2> For a supported LTE CA combination on the Operator Priority List, if ALL of the following are true:
    a) There is a fully tested (based on device type) FR1 EN-DC combination with the same bands (LTE and equivalent NR FR1 bands) as the LTE CA combination. The total number of CC's is the same between the LTE CA combination and the FR1 EN-DC combination. Each CC in the LTE CA combination maps to one and only one CC in the FR1 EN-DC combination.
    b) The LTE PCC is the same between the LTE CA combination and the FR1 EN-DC combination, or the NR PSCell in the FR1 EN-DC combination is the NR equivalent band for the LTE PCC in the LTE CA combination.
    c) For the LTE PCC in the LTE CA combination, each TX antenna is the same as a TX antenna that was fully tested (based on device type) for the corresponding CC (LTE PCC or NR PSCell) in the FR1 EN-DC combination. For devices that support TX antenna switching, the TX antenna switch state is the same between the LTE PCC in the LTE CA combination and the corresponding CC (LTE PCC or NR PSCell) in the FR1 EN-DC combination.
    d) For the individual LTE PCC and SCC(s) in the LTE CA combination, each RX antenna is the same as a RX antenna that was fully tested (based on device type) for the corresponding CC in the FR1 EN-DC combination. The RX antenna topology (i.e. 2 RX, 4 RX, 8 RX) is the same for each CC in the LTE CA combination and the corresponding CC in the FR1 EN-DC combination.
    e) Per device manufacturer declaration, the antenna tuning state is the same for each CC in the LTE CA combination and the corresponding CC in the FR1 EN-DC combination.
    3> LTE CA testing may be omitted for the given LTE CA combination with the following exception: If the LTE CA combination is either an "essential" or an "essential conditional" combination per the Operator Priority List, the C-TIS testing prescribed by the "essential" and "essential conditional" sections of the Operator Priority List is still required, but a single point offset test using the pattern measurement from the EN-DC C-TIS testing may be used.
  2> Else
    3> If all of the criteria above (i.e. a, b, c, d, e) are met except the device supports TX antenna switching, and a TX antenna switch state for the LTE PCC in the LTE CA combination is not fully tested for the corresponding CC (LTE PCC or NR PSCell) in the FR1 EN-DC combination:
      4> Full testing of the LTE CA combination for the un-tested TX antenna switch state(s) is required. No other LTE CA testing is required for the given combination. If the LTE CA combination is either an "essential" or an "essential conditional" combination per the Operator Priority List, the C-TIS testing prescribed by the "essential" and "essential conditional" sections of the Operator Priority List is still required for all TX antenna switch states, but a single point offset test using the pattern measurement from the EN-DC C-TIS testing may be used.

3> Else
    4> Full testing of the LTE CA combination is required.

### 2.1.7.7 NR FR1 SA DL CA (Single UL Carrier)

When submitting a device for CA testing, the device manufacturer shall declare the target operator(s) for the device, and the NR FR1 SA DL CA (single UL carrier) testing shall be limited as described in this section.

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

DUTs incapable of supporting the aggregated channel BW associated with the NR FR1 SA DL CA modes specified in *CTIA 01.50* [10] do not need to be tested.

Relative sensitivity on intermediate channel testing is not required for NR FR1 SA DL CA.

#### 2.1.7.7.1. NR FR1 SA DL CA TRP Test Requirements

Full TRP testing is required in the 2 DL and 3 DL CA combinations identified as “Non-essential, 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 “Non-essential, high priority” combinations.

No additional TRP testing is required for any DL CA combinations not identified as “Non-essential, high priority”.

#### 2.1.7.7.2. NR FR1 SA DL CA TIS Test Requirements

Full TIS testing of the SCC is required for any DL 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 DL CA combinations with known self-desensitization issues that are identified as “Essential” in the operator CA priority lists.

Full TIS testing of the SCC is required for any DL CA combinations with known self-desensitization issues that are identified as “Essential Conditional” (no TIS testing of the PCC is required). However, DL CA combinations that are identified as “Essential Conditional” may be tested as part of a higher order, non-essential DL CA combination that includes the corresponding NR PCC and SCC combination. Single point offset testing shall not be used for DL CA combinations with known self-desensitization issues that are identified as “Essential Conditional” 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 “Non-essential, high 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 “Non-essential, high priority” combinations unless a higher order, non-essential combination is used to test an “Essential Conditional” combination. When testing an “Essential Conditional” combination as part of a “Non-essential, high priority” combination, full TIS testing is required for the SCC that corresponds to the “Essential Conditional” combination (single point offset testing may be used for TIS testing of any other CC’s). 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 DL CA combinations not identified as “Essential”, “Essential Conditional”, or “Non-essential, high priority”.

### 2.1.7.7.3. Test Reduction for LTE CA

For devices that support both NR FR1 SA DL CA and LTE CA, LTE CA testing may be reduced when the LTE CA combination overlaps with an equivalent 5G NR FR1 SA DL CA or 5G NR FR1 EN-DC combination as described below:

1> Does the device under test support NR FR1 SA DL CA?
  2> Test all NR FR1 SA DL CA combinations per the Operator Priority List.

1> Does the device under test support NR FR1 EN-DC?
  2> Test all NR FR1 EN-DC combinations per the Operator Priority List.

1> Does the device under test support LTE CA?
  2> For a supported LTE CA combination on the Operator Priority List, if ALL of the following are true:
    a) There is a fully tested (based on device type) FR1 SA DL CA combination with the LTE equivalent NR FR1 SA bands. The total number of CC's is the same between the LTE CA combination and the FR1 SA DL CA combination. Each CC in the LTE CA combination maps to one and only one CC in the FR1 SA DL CA combination
    b) The LTE PCC and SCC bands are the same as the equivalent NR FR1 SA PCC and SCC bands.
    c) For the PCC, each TX antenna for LTE is the same as a TX antenna that was fully tested (based on device type) for the PCC in the equivalent NR FR1 SA DL CA combination. For devices that support TX antenna switching, the TX antenna switch state is the same between the LTE PCC in the LTE CA combination and the PCC in the equivalent NR FR1 SA DL CA combination.
    d) For the individual PCC and SCC(s), each RX antenna for LTE is the same as a RX antenna that was fully tested (based on device type) for the corresponding CC in the equivalent NR FR1 SA DL CA combination. The RX antenna topology (i.e. 2 RX, 4 RX, 8 RX) is the same for each CC in the LTE CA combination and the corresponding CC in the equivalent NR FR1 SA DL CA combination.
    e) Per device manufacturer declaration, the antenna tuning state is the same for each CC in the LTE CA combination and the corresponding CC in the equivalent NR FR1 SA DL CA combination.
    3> LTE CA testing may be omitted for the given combination.
  2> Else
    3> If all of the criteria above (i.e. a, b, c, d, e) are met except the device supports TX antenna switching, and a TX antenna switch state for the LTE PCC in the LTE CA combination is not fully tested for the PCC in the equivalent NR FR1 SA DL CA combination:
      4> Full testing of the LTE CA combination for the un-tested TX antenna switch state(s) is required. No other LTE CA testing is required for the given combination.
    3> Else
      4> Can testing of the LTE CA combination be omitted or reduced based on the criteria in section 2.1.7.6.3 for an overlapping FR1 EN-DC combination?
        5> LTE CA testing may be omitted or reduced for the given combination as prescribed by section 2.1.7.6.3. **NOTE:** All of the stipulations in section 2.1.7.6.3 shall apply.
      4> Else

5> Full testing of the LTE CA combination is required.

### 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 this document will supersede the tables in this section.

There are test requirements in Section 2.1.7 that also apply to location based wireless technologies.

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] |
| 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 |
| 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

2.1.8.1.3. VOID

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. VOID

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

2.1.8.3 For A-GPS L1 with NR FR1 EN-DC testing, the device shall be tested according to CTIA 01.51 [11] 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 VOID

## 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.

Certification testing is currently only required for PC3 devices.

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.

The following percentiles are the spherical coverage testing requirements when testing is performed over the full sphere (default):

- For PC3 devices, the spherical coverage CDF/CCDF percentile shall be 50%

When only a single hemisphere shall be tested (based on an optional vendor declaration), see Section 1.5.2, the following percentiles are the spherical coverage testing requirements:

- For laptops (PC3), the spherical coverage CDF/CCDF percentile shall be 50% and 20%

If the vendor declares that only a single hemisphere shall be tested, see Section 1.5.2, the spherical coverage test cases and beam peak searches shall not be performed over the full sphere.

The spherical coverage testing requirements are summarized in Table 2.2 1.

Table 2.2 1: Overview of Spherical Coverage Testing Requirements

| UE Type/Device Type | Spherical Coverage CDF/CCDF Testing Requirements | |
|---|---|---|
| | Full Sphere (Default) | Single Hemisphere (Optional) |
| PC3 (general) | 50% | N/A |
| PC3 (laptops) | 50% | 50% & 20% |
| Note: When an optional vendor declaration to test a single hemisphere only is provided, testing over the full sphere shall not be performed. | | |

### 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 | | | |
| 12 | 5 | 5035 | 731.5 | | | |

| Band | Channel Bandwidth (MHz) | Channel | Frequency (MHz) | FS EIS$_{(IC)}$ (dBm) | BHHR EIS$_{(IC)}$ (dBm) | WR/WL EIS$_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|
| 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 | | | |
| 26 | 5 | 8835 | 873.5 | | | |
| 26 | 5 | 8865 | 876.5 | | | |

| Band | Channel Bandwidth (MHz) | Channel | Frequency (MHz) | FS EIS$_{(IC)}$ (dBm) | BHHR EIS$_{(IC)}$ (dBm) | WR/WL EIS$_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|
| 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 | | | |
| 48 | 10 | 55560 | 3582 | | | |
| 48 | 10 | 55650 | 3591 | | | |
| 48 | 10 | 55740 | 3600 | | | |

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

### 3.1.2 Waiver for MBS OTA Testing

MBS OTA testing has been changed to informative and this waiver is no longer required.

### 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 | | | |
| | | | 392800 | 1964 | | | |
| | | | 394200 | 1971 | | | |
| | | | 395600 | 1978 | | | |
| | | | 397000 | 1985 | | | |
| n25 | 10 | 15 | 387000 | 1935 | | | |
| | | | 388400 | 1942 | | | |

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | Channel | Frequency (MHz) | FS $EIS_{(IC)}$ (dBm) | BHHR $EIS_{(IC)}$ (dBm) | WR/WL $EIS_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|---|
| | | | 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 | | | |
| | | | 520998 | 2604.99 | | | |
| | | | 523998 | 2619.99 | | | |
| | | | 526998 | 2634.99 | | | |
| | | | 529998 | 2649.99 | | | |
| | | | 532998 | 2664.99 | | | |
| | | | 535998 | 2679.99 | | | |
| n48 | 20 | 30 | 637334 | 3560.01 | | | |

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | Channel | Frequency (MHz) | FS $EIS_{(IC)}$ (dBm) | BHHR $EIS_{(IC)}$ (dBm) | WR/WL $EIS_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|---|
| | | | 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 | | | |
| | | | 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 | | | |

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | Channel | Frequency (MHz) | FS $EIS_{(IC)}$ (dBm) | BHHR $EIS_{(IC)}$ (dBm) | WR/WL $EIS_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|---|
| | | | 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 | | | |
| | | | 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 | | | |

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | Channel | Frequency (MHz) | FS $EIS_{(IC)}$ (dBm) | BHHR $EIS_{(IC)}$ (dBm) | WR/WL $EIS_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|---|
| 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 | | | |
| | | | 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 | | | |

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | Channel | Frequency (MHz) | FS $EIS_{(IC)}$ (dBm) | BHHR $EIS_{(IC)}$ (dBm) | WR/WL $EIS_{(IC)}$ (dBm) |
|---|---|---|---|---|---|---|---|
| | | | 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 | | | |

### 3.1.5 Modification to Broadband Power Mode Measurement Requirements for NR FR1 TRP Testing

The updates for the channel bandwidths and RB allocations for NR FR1 TRP testing in *CTIA 01.50* [10] require a modification to the broadband power mode measurement requirements in *CTIA 01.73* [16].

The broadband power mode measurement requirements in *CTIA 01.73* [16] Table 9.13-1 is modified to use the measurement settings in Table 3.1.5-1.

Table 3.1.5-1 Broadband Power Mode Measurement Requirements

| Channel BW (MHz) | SCS [kHz] | $N_{RB}$ | RB Allocation | RB Start | Frequency Offset (MHz) | $f_{span}$ (MHz)[1] | $f_{Gaussian}$ (MHz) | $f_{flat\ top}$ (MHz)[1] |
|---|---|---|---|---|---|---|---|---|
| 5 | 15 | 25 | 12 | 6 | -0.09 | 2.4 | 8 | 3 |
| 10 | 15 | 52 | 12 | 6 | -2.52 | 2.4 | 8 | 3 |
| | | | | 20 | 0.0 | | | |

| Channel BW (MHz) | SCS [kHz] | $N_{RB}$ | RB Allocation | RB Start | Frequency Offset (MHz) | $f_{span}$ (MHz)[1] | $f_{Gaussian}$ (MHz) | $f_{flat\ top}$ (MHz)[1] |
|---|---|---|---|---|---|---|---|---|
| | | | | 34 | +2.52 | | | |
| 20 | 30 | 51 | 9 | 4 | -6.12 | 3.6 | 12 | 4.5 |
| | | | | 21 | 0.0 | | | |
| | | | | 38 | +6.12 | | | |
| $f_{RBW}$ | | | | 30 kHz | | | | |
| $T_{dwell}$ or $T_{sweep}$ | | | | 100 ms | | | | |
| $T_{short\ dwell}$ or $T_{short\ sweep}$ | | | | 20 ms | | | | |
| $P_{flat}$ | | | | 70% | | | | |

### 3.1.6 NR FR1 SA A-GNSS Testing: General

The A-GNSS radiated receiver sensitivity measurements will be performed for the NR bands, channel numbers, and the allocations specified in Section 2.5.7.1 in *CTIA 01.51* [11] except that for NR band n14, the settings in Table 3.1.6-1 are used instead of the settings in Table 2.5.7.1-2 in *CTIA 01.51* [11].

Table 3.1.6-1 A-GNSS Radiated Receiver Sensitivity Test Channel Settings for NR band n14

| 3GPP Config. Identifier | CC BW (MHz) | SCS (kHz) | NR DL Channel | RX Frequency (MHz) [center of RX channel bandwidth] | NR UL RB Allocation | NR DL RB Allocation |
|---|---|---|---|---|---|---|
| n14 | 10 | 15 | 152600 | 763 | 12@0 | 52@0 |
| | | | 152600 | 763 | 1@2 | 52@0 |

### 3.1.7 Use of Legacy Measurement Grids for Certain Devices

The following device classes shall use the legacy measurement grids:

- Hand held devices
- Devices that support operation against the head
- Tablets
- Laptops
- Devices that support Wi-Fi access point functionality
- Fixed wireless broadband access devices
- Body worn wearable devices
- LTE capable data devices that are LTE category 4 or higher.

- 5G NR capable devices

TRP and TIS testing of these devices shall use the measurements grids defined in Table 3.1.7-1 and Table 3.1.7-2 below. For these devices, Table 3.1.7-1 and Table 3.1.7-2 replace Tables 3.1-2 and 4.1-1 of *CTIA 01.20* [5], respectively. For TIS testing of these devices, Table 3.1.7-3 and Table 3.1.7-4 below replace Tables 2.20.1-2 and 2.21.1-1 of *CTIA 01.70* [13], respectively.

Table 3.1.7-1: Applicability of TRP Measurement Grids for Devices Requiring the Use of Legacy Measurement Grids

| Applicability Condition | Measurement Grid Step Size Δθ [°] | Unique Number of Measurement Points with Constant Angular Step Size, Section 3.1.1 of *CTIA 01.90* [9] Δθ=Δϕ [°] | Unique Number of Measurement Points with Theta Dependent Phi Optimization, Section 2.7 and Section 3.1.2 of *CTIA 01.90* [9] |
|---|---|---|---|
| Below 3 GHz and Device Size ≤ 30 cm | 15 | 266 | 182 |
| Below 3 GHz and Device Size > 30 cm | 15 | 266 | 182 |
| Above 3 GHz | 15 | 266 | 182 |

Table 3.1.7-2: Applicability of TIS Measurement Grids for Devices Requiring the Use of Legacy Measurement Grids

| Applicability Condition | Measurement Grid Step Size Δθ [°] | Unique Number of Measurement Points with Constant Angular Step Size, Section 3.1.1 of *CTIA 01.90* [9] Δθ=Δϕ [°] | Unique Number of Measurement Points with Theta Dependent Phi Optimization, Section 2.7 and Section 3.1.2 of *CTIA 01.90* [9] |
|---|---|---|---|
| Below 3 GHz and Device Size ≤ 30 cm | 30 | 62 | 46 |
| Below 3 GHz and Device Size > 30 cm | 30 | 62 | 46 |
| Above 3 GHz | 30 | 62 | 46 |

Table 3.1.7-3: Uncertainty Contributions and Step Sizes for Devices Requiring the Use of Legacy Measurement Grids

| Applicability Condition | Δθ=Δϕ [°] | Step Size [dB] | Standard Uncertainty Contribution [dB] |
|---|---|---|---|
| Below 3 GHz and Device Size ≤ 30 cm | 30 | 0.5 | 0.14 |
| Below 3 GHz and Device Size > 30 cm | 30 | 0.5 | 0.14 |
| Above 3 GHz | 30 | 0.5 | 0.14 |

Table 3.1.7-4: Uncertainty Contributions and Step Sizes for Devices Requiring the Use of Legacy Measurement Grids

| Applicability Condition | Δθ [°] | Standard Uncertainty Contribution [dB] |
|---|---|---|
| Below 3 GHz and Device Size ≤ 30 cm | 30 | 0.23 |
| Below 3 GHz and Device Size > 30 cm | 30 | 0.23 |
| Above 3 GHz | 30 | 0.23 |
| Note: The uncertainty distribution shall be assumed to be actual | | |

Testing of devices not covered by this section may use the measurement grids as defined in Tables 3.1-2 and 4.1-1 of *CTIA 01.20* [5] .

### 3.1.8 LTE Broadband Power Mode Measurement Requirements

The following clarifications and changes are necessary in Section 9.10 of *CTIA 01.73* [16].

*The following text replaces the first paragraph of Section 9.10 of* CTIA 01.73 [16]. *The text in the second paragraph of Section 9.10 of* CTIA 01.73 [16] *remains as is.*

LTE uses SC-FDMA to produce a digital spread spectrum where specific sub-channels may be used or unused depending on the configuration information provided by the eNodeB base station. Thus, the occupied bandwidth is configurable by the number of specified resource blocks (RBs) independent of the actual channel bandwidth, allowing multiple UEs to share one channel.

The sub-channel bandwidth $(fspan)$ should be calculated as follows:

Equation 3.1.8-1

$$f_{span}(kHz) = 180(kHz) * N(RB) * (10/9)$$

Where the quantity (10/9) is the adjustment factor to ensure that the span is adequate to capture the power contribution from the band edges in the final integrated channel power measurement.

Accordingly, the current TRP requirements specify sub-channel bandwidths of 18 RBs or 3.6 MHz for 20 MHz channels, 16 RBs or 3.2 MHz for 15 MHz channels, 12 RBs or 2.4 MHz for 10 MHz channels, 8 RBs or 1.6 MHz for 5 MHz channels, respectively. While there are a number of different power control options for LTE, the test plan expects maximum power to be produced by sending the “up” command constantly. After a few hundred milliseconds, the device will be at maximum power.

*The following text replaces the third paragraph of Section 9.10 and Table 9.10-1 of* CTIA 01.73 [16]. *All other text below the table remains as is.*

For the purposes of characterizing antenna performance, the resulting power may be measured with either the total power (CTIA 01.73 [16] Section 9.4) or integrated channel power (CTIA 01.73 [16] Section 9.5) methods using the parameters in Table 3.1.7-1, centered on the occupied bandwidth defined by the resource block allocation.  A stable trace is defined as all points within ±0.5 dB of the midpoint value. In either case, the required frequency offsets specified in Table 3.1.8-1 may be determined generally as $[\text{RBStart} + (\text{RBAllocation} - \text{Total RBs})/2] * 0.18\ \text{MHz}$.

Table 3.1.8-1  Broadband Power Mode Measurement Requirements

| Channel BW (MHz) | Total RBs | RB Allocation | RB Start | Frequency Offset (MHz) | $f_{span}$ | $f_{Gaussian}$ | $f_{flat\ top}$ |
|---|---|---|---|---|---|---|---|
| 5 | 25 | 8 | 0 | -1.53 | 1.6 | 4 | 2 |
| | | | 8 | -0.09 | | | |
| | | | 17 | +1.53 | | | |
| 10 | 50 | 12 | 0 | -3.42 | 2.4 | 8 | 3 |
| | | | 19 | 0.0 | | | |
| | | | 38 | +3.42 | | | |
| 15 | 75 | 16 | 0 | -5.31 | 3.2 | 9 | 4 |
| | | | 29 | -0.09 | | | |
| | | | 59 | +5.31 | | | |
| 20 | 100 | 18 | 0 | -7.38 | 3.6 | 12 | 4.5 |
| | | | 41 | 0.0 | | | |
| | | | 82 | +7.38 | | | |
| $f_{RBW}$ | | | 30 kHz | | | | |
| $T_{dwell}$ or $T_{sweep}$ | | | 100 ms | | | | |
| $T_{short\ dwell}$ or $T_{short\ sweep}$ | | | 20 ms | | | | |
| $P_{flat}$ | | | 70% | | | | |
| **Note 1:** The Sub-channel BW may be reconsidered in future versions as number of RBs may not be appropriate. | | | | | | | |

## 3.2 SISO, Millimeter Wave Test Methodology

### 3.2.1 Use of Charging Cables

The use of charging cables is permitted for the TX and RX beam peak search only with a corresponding vendor declaration as follows (which augments the vendor declarations described in Section 1.5.2).

#### 3.2.1.1 For Beam Peak Search Tests Performed with a Charging Cable

As described in Section 4 of *CTIA 01.22* [7] the device manufacturer shall declare:

- Their intent which bands and channels shall utilize a charging cable
- The zones of the DUT with the intent that those areas are not covered or blocked by the charging cable and cable routing fixtures to minimize their impact on measured device performance. ATLs shall collaborate with the manufacturer to try to meet the provided guidance.

Based on this allowance, the following clarifications are necessary in *CTIA 01.22* [7] (unless otherwise noted, the following text should be appended at the end of the respective sections in *CTIA 01.22* [7]):

- Section 4: The DUT may be tested with a charging cable for any band and channel if declared by the vendor and proper cable routing instructions are provided. The corresponding vendor declaration is listed in Section 1.5.2. The following applicability rules shall be considered when a charging cable is used:
    - The charging cable can only be used for the RX beam peak search procedure, i.e., the charging cable shall not be used for the test cases: REFSENS – EIS (Section 4.2), and REFSENS – Spherical Coverage (Section 4.3).
    - The EIS100%-CCDF result from the beam peak search procedure, performed with the charging cable, shall be within 1.5 dB of the peak EIS result from test case REFSENS – EIS (Section 4.2), performed without charging cable, for each band and channel tested with the charging cable. If the absolute difference is not within the 1.5 dB limit, the RX beam peak search and all applicable test cases shall be repeated without the charging cable for given band and channel.
- Section 4.2: If a charging cable was used for the RX beam peak search, it is recommended to follow the test sequences as outlined below:
    1. Perform RX beam peak search procedure with the charging cable while following the guidelines of the vendor declaration outlined in Section 1.5.2.
    2. Following the RX beam peak search, Section 4.1/Step 1, remove the charging cable with as few changes to the device and test setup as possible.
    3. Perform the REFSENS – EIS test immediately after the conclusion of the RX beam peak search, Step 1, and the removal of the charging cable, Step 2.
    4. Determine the absolute difference between the $EIS_{100\%\text{-CCDF}}$ result from the beam peak search, performed with the charging cable (Step 1), and the peak EIS result, performed without the charging cable (Step 3).
- Section 4.3: The sentence in the third paragraph should have the following clarification (underlined): The $\mathrm{EIS}_{target\%-\mathrm{CCDF}}$ is obtained from the Complementary Cumulative Distribution Function (CCDF) computed from the EISavg measurements for all grid points collected during the RX beam peak search in Section 4.2, if the DUT was tested with the standard battery, i.e., without the charging cable, see Section 4.

#### 3.2.1.2 TX Beam Peak Search Tests Performed with a Charging Cable

As described in Section 3 of *CTIA 01.22* [7], the device manufacturer shall declare:

- Their intent regarding which bands and channels shall utilize a charging cable

- The zones of the DUT with the intent that those areas are not covered or blocked by the charging cable and cable routing fixtures to minimize their impact on measured device performance. ATLs shall collaborate with the manufacturer to try to meet the provided guidance.

- TX testing with the charging cable is allowed by the target operator(s) for the device and band under test.

Based on this allowance, the following clarifications are necessary in *CTIA 01.22* [7] (unless otherwise noted, the following text should be appended at the end of the respective sections in *CTIA 01.22* [7]):

- Section 3: The DUT may be tested with a charging cable for any band and channel if declared by the vendor and proper cable routing instructions are provided. The corresponding vendor declaration is listed in Section 1.5.2 of *CTIA 01.01* [1] The following applicability rules shall be considered when a charging cable is used:

    - The charging cable can only be used for the TX beam peak search procedure, i.e., the charging cable shall not be used for the test cases: Maximum Output Power – EIRP (Section 3.2), Maximum Output Power – TRP (Section 3.3), and Maximum Output Power - Spherical Coverage (Section 3.4).

    - The $EIRP_{100\%-CDF}$ result from the beam peak search procedure, performed with the charging cable, shall be within 0.75 dB of the peak EIRP result from test case (Section 3.2), performed without charging cable, for each band and channel tested with the charging cable. If the absolute difference is not within the 0.75 dB limit, the TX beam peak search and all applicable test cases shall be repeated without the charging cable for given band and channel.

- Section 3.2: If a charging cable was used for the TX beam peak search measurement, it is recommended to follow the test sequences as outlined below:

    1. Perform TX beam peak search procedure with the charging cable while following the guidelines of the vendor declaration outlined in Section 1.5.2 of *CTIA 01.01* [4].

    2. Following the TX beam peak search from Section 3.1/Step 1, remove the charging cable with as few changes to the device and test setup as possible.

    3. Perform the Maximum Output Power - EIRP immediately after the conclusion of the TX beam peak search, Step 1, and the removal of the charging cable, Step 2.

    4. Determine the absolute difference between the $EIRP_{100\%-CDF}$ result from the beam peak search, performed with the charging cable (Step 1), and the peak EIRP result, performed without the charging cable (Step 3).

- Section 3.4: The sentence in the third paragraph should have the following clarification (underlined): The $\mathrm{EIRP}_{target\%-\mathrm{CDF}}$ is obtained from the Cumulative Distribution Function (CDF) computed using maximum $(\mathrm{EIRP}(Pol_{Link} = \theta, \mathrm{EIRP}(Pol_{Link} = \phi))$for all grid points collected during the TX beam peak search in Section 3.1 <u>if the DUT was tested with the standard battery, i.e., without the charging cable, see Section 3.</u>

### 3.2.2 UL and DL Test Configuration Tables

To align with updated test configurations for TX and RX testing from [18] more closely, the following clarifications/corrections are necessary in *CTIA 01.50* [10]:

Replace Table 5.2.1.1-1 with the following table instead.

Table 3.2.2-1 Test Conditions for NR Operating Bands n258, n260 and n261

| Band | Bandwidth [MHz] | SCS [kHz] | Range | Modulation | UL RB Allocation (Note 1) | DL Config. | Center Frequency of Carrier [MHz] | RF Channel Number [ARFCN] |
|---|---|---|---|---|---|---|---|---|
| n258 | 100 | 120 | Low | DFT-s-OFDM QPSK | PC3:<br>20@23 (Note 2)<br>20@20 (Note 3) | N/A | 24300 | 2017499 |
| | | | Mid | | | | 25875 | 2043749 |
| | | | High | | | | 27450 | 2069999 |
| n260 | 100 | 120 | Low | DFT-s-OFDM QPSK | | N/A | 37050 | 2229999 |
| | | | Mid | | | | 38499.96 | 2254165 |
| | | | High | | | | 39949.92 | 2278331 |
| n261 | 100 | 120 | Low | DFT-s-OFDM QPSK | | N/A | 27550.08 | 2071667 |
| | | | Mid | | | | 27924.96 | 2077915 |
| | | | High | | | | 28299.96 | 2084165 |

Note 1: For PC3, the Inner_Full RB allocation shall be tested.

Note 2: Applicable to Rel-15 PC3 devices which do not support *modifiedMPR-Behaviour* bit 0 capability (according to Annex P.1 of [18]).

Note 3: Applicable to Rel-15 PC3 devices which supports *modifiedMPR-Behaviour* bit 0 capability (according to Annex P.1 of [18]) and Rel-16 and forward PC3 devices.

## 3.3 MIMO Test Methodologies

### 3.3.1 Systematic offset for MIMO average radiated SIR sensitivity (MARSS) tests

The final result shall represent the measured value and not include a systematic offset. Based on this, the text in the last paragraph of Section 2.3.5.2 of *CTIA 01.40* [8] is replaced with the following:

“The power and SIR validation shall be performed to ensure that all of the system corrections have been applied properly. When determining the SIR, the interference level can easily be biased by the noise floor of the instrumentation. Care should be taken not to introduce invalid offsets due to noise in the validation test.”

### 3.3.2 Removing LTE Band 17 from Normative Bands

LTE band 17 shall be removed from normative FDD bands of operation in Table 5.1-1 of *CTIA 01.40* [8].

# 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 |

| 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] | 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 |
| 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 Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| LTE Band 71 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 12 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 17 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 13 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 14 | Held to head for voice[3] | 1 | ≤72 | N/A | N/A | N/A | TBD |
| | | | >72 | N/A | N/A | N/A | TBD |
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |

| Band | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1 | All | N/A | N/A | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1 | All | N/A | N/A | N/A | N/A |
| | | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 1 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 26 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 5 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 16 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 70 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 2 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |

| Band | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 25 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 4 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 66 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 30 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 7 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |

| Band | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| LTE Band 41 | Held to head for voice[3] | 2 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 2 | All | N/A | TBD | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| LTE Band 48 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | 18 | N/A | N/A | N/A |
| | Other[6] | 3 | 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 (device does not fit in a 60 mm diameter sphere), 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, 2]

| Band | Use Cases Supported | Device Width (mm)[3] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| LTE Band 71 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -87 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 12 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -90 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 13 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -87 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 14 | | ≤72 | TBD | N/A | TBD | TBD |

| Band | Use Cases Supported | Device Width (mm)[3] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| | Held to head for voice[4] | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -87 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 26 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -90.5 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 5 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -88 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 70 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -90.2 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 2 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |

| Band | Use Cases Supported | Device Width (mm)[3] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| | Simple IoT Devices[6] | All | -90 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 25 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -91.5 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 4 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -92 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 66 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -91.5 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 30 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -91 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 7 | | ≤72 | TBD | N/A | TBD | TBD |

| Band | Use Cases Supported | Device Width (mm)[3] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| | Held to head for voice[4] | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -87 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 41 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -87 | N/A | N/A | N/A |
| | Other[7] | All | TBD | N/A | N/A | N/A |
| LTE Band 48 | Held to head for voice[4] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[5] | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[6] | All | -91 | N/A | N/A | N/A |
| | Other[7] | 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: TIS performance is expected to be about 3 dB worse for LTE Category 1bis devices because they only have a single RX antenna.

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: “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 5: “Wrist worn” would be applicable to devices that are worn on the wrist, e.g., smartwatches.

Note 6: 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 (device does not fit in a 60 mm diameter sphere), and 4) are not wearable devices.  The limits for simple IoT devices are recommended.

Note 7: 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 |
| CA_4A-12A | PCC | Yes[4] | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No[5] | All | TBD | N/A |
| | | Yes[4] | ≤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 |
|---|---|---|---|---|---|
| | SCC | | >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 |
| | | 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 | 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 |
| | | 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-48A | PCC | 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 |
| CA_12A-30A | PCC | Yes[4] | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No[5] | All | TBD | N/A |
| | | Yes[4] | ≤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 |
|---|---|---|---|---|---|
| | SCC | | >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 |
| CA_13A-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 |

| 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-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 |
| | | 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_26A-25A | PCC | 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 |
| CA_30A-5A | PCC | Yes[4] | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No[5] | All | TBD | N/A |
| | | Yes[4] | ≤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 |
|---|---|---|---|---|---|
| | SCC | | >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 |
| CA_41A-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 |

| 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-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 |
| CA_48A-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 |
| | | 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_48A-5A | PCC | 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 |
| | | No[5] | All | TBD | N/A |
| CA_66A-5A | PCC | Yes[4] | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No[5] | All | TBD | N/A |
| | | Yes[4] | ≤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 |
|---|---|---|---|---|---|
| | SCC | | >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 |
| 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 |

| 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-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 |
| CA_70C | 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 |
|---|---|---|---|---|---|
| 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).<br>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.<br>Note 3: Different limits for different channel combinations may be needed since the desensitization effects will be channel dependent.<br>Note 4: “Yes” applies if the device supports voice operation in the talking position against the head in LTE mode.<br>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 |
| | 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 |

| Carrier Aggregation Combination | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|
| 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 |
| | 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 |

| 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-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 |
| | 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 |

| 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-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 |
| | 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 |

| Carrier Aggregation Combination | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|
| 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 |
| | 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 |

| 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_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 |
| | 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 |

| 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-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 |
| | 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 |

| Carrier Aggregation Combination | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|
| 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 |
| | 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 |

| 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-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 |
| | 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 |

| 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-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 |
| | 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 |

| Carrier Aggregation Combination | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|
| 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 |
| | 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 |

| 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-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 |
| | 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 |

| 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-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 |
| | 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 |

| Carrier Aggregation Combination | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|
| 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 |
| | 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 |
| | 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 |

| 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-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 |
| | | 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 |

| 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-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_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 |
| | 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-13A | 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-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_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 |
| | 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-66A | 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-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-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 |
| | 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-13A-48A | | 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-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-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 |
| | | | ≤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-48A-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-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 |

| 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-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_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 |

| 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-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_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 |
| | | | ≤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-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_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 |

| 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-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_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 |

| Carrier Aggregation Combination | PCC/SCC | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|
| | | No⁵ | All | TBD | N/A |
| | SCC2 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| CA_5A-2A-30A | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC1 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC2 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| CA_5A-2A-48A | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC1 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC2 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | 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-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_5A-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 |
| 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 |
| | 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-5A-66A | 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-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_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 |
| | 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-48A-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_5A-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_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 |
| | | | ≤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-2A-2A | 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_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 |

| 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-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-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 |

| 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-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_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 |
| | | | ≤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-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_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 |

| 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-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_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 |

| 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-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 |
| 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 |
| | 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-66A-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_25A-41C | 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-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 |
| | | 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-2A-12A | 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-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-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 |
| | 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-4A-12A | | 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-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-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 |
| | | | ≤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-5A-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_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 |

| 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-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_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 |

| Carrier Aggregation Combination | PCC/SCC | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|
| | | No⁵ | All | TBD | N/A |
| CA_48A-2A-5A | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC1 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC2 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| CA_48A-2A-13A | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC1 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC2 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| CA_48A-2A-66A | PCC | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | All | TBD | N/A |
| | SCC1 | Yes⁴ | ≤72 | TBD | TBD |
| | | | >72 | TBD | TBD |
| | | No⁵ | 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-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 |
| 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 |

| 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-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_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 |

| 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-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-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 |
| | 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-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_66A-5A-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_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 |
| | 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_66C-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-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-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 |
| | 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-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_66C-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-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 |
| | | | ≤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-13A-48A | 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_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 |

| 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-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_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 |

| 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-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_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 |
| | | | ≤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_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 |
| | 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 |

| 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-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_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 |
| | | | ≤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-46A | PCC | Yes[4] | >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-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_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 |
|---|---|---|---|---|---|
| | | | ≤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-46A | 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-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 |

| 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-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-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 |

| 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-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_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 |
| | | | ≤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_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 |
| | | 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 |

| 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-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_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 |

| 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-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 |

**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 |
| | | 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 |

| Band | Use Case Supported | Power Class | FS | WL and WR |
|---|---|---|---|---|
| | 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 |
| | 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 |

| Band | Use Case Supported | Power Class | FS | WL and WR |
|---|---|---|---|---|
| | | 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 (device does not fit in a 60 mm diameter sphere), 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 |

| Band | Use Case Supported | FS | WL and WR |
|---|---|---|---|
| | 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 |
| | 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).<br><br>Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches<br><br>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 (device does not fit in a 60 mm diameter sphere), and 4) are not wearable devices. The limits for simple IoT devices are recommended.<br><br>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 |
| | | 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 |

| 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 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 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 |

| Band | Use Case Supported | Power Class | FS | WL and WR |
|---|---|---|---|---|
| | 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).<br><br>Note 2: Applicable to devices that are worn on the wrist, e.g. smartwatches<br><br>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 (device does not fit in a 60 mm diameter sphere), and 4) are not wearable devices. The limits for simple IoT devices are recommended.<br><br>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 (device does not fit in a 60 mm diameter sphere), 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 | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| n2 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n5 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n12 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n14 | Held to head for voice[3] | 1 | ≤72 | N/A | N/A | N/A | N/A |
| | | | >72 | N/A | N/A | N/A | N/A |

| 3GPP Config. Identifier | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1 | All | N/A | N/A | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1 | All | N/A | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| n25 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n26 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n30 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |

| 3GPP Config. Identifier | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| n41 | Held to head for voice[3] | 1.5 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 2 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1.5 | All | N/A | N/A | N/A | N/A |
| | | 2 | All | N/A | TBD | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| n48 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n66 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |

| 3GPP Config. Identifier | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n70 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n71 | Held to head for voice[3] | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 3 | All | TBD | N/A | N/A | N/A |
| n77 (Canada) | Held to head for voice[3] | 1.5 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 2 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1.5 | All | N/A | N/A | N/A | N/A |
| | | 2 | All | N/A | TBD | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |

| 3GPP Config. Identifier | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| n77 (USA) | Held to head for voice[3] | 1.5 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 2 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1.5 | All | N/A | N/A | N/A | N/A |
| | | 2 | All | N/A | TBD | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| n78 | Held to head for voice[3] | 1.5 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | | 2 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |

| 3GPP Config. Identifier | Use Cases Supported | Device Power Class | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | | 3 | ≤72 | TBD | N/A | TBD | TBD |
| | | | >72 | TBD | N/A | TBD | TBD |
| | Wrist worn[4] | 1.5 | All | N/A | N/A | N/A | N/A |
| | | 2 | All | N/A | TBD | N/A | N/A |
| | | 3 | All | N/A | TBD | N/A | N/A |
| | Simple IoT Devices[5] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |
| | Other[6] | 1.5 | All | TBD | N/A | N/A | N/A |
| | | 2 | All | TBD | N/A | N/A | N/A |
| | | 3 | All | TBD | N/A | N/A | N/A |

#### 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 | Use Cases Supported | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| n2 | 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 | 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 | 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 | 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 | Held to head for voice[3] | ≤72 | TBD | N/A | TBD | TBD |
| | | >72 | TBD | N/A | TBD | TBD |

| 3GPP Config. Identifier | 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 |
| n26 | 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 | 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 | 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 |
| n48 | 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 | Use Cases Supported | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|
| n66 | 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 | 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 | 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) | 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) | 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 | 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 |
| n78 | 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 |

### 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 | HL and HR |
|---|---|---|---|---|---|---|
| DC_2A_n5A | 1 | LTE Band 2 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_2A_n66A | 1 | LTE Band 2 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_2A_n71A | 1 | | | ≤72 | TBD | TBD |

| 3GPP Config. Identifier | VAR. | Band | Use Cases Supported | Device Width (mm)[2] | FS | HL and HR |
|---|---|---|---|---|---|---|
| | | LTE Band 2 | Held to head for voice[3] | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_2A_n77A (n77 USA Range B) | 1 | LTE Band 2 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_2A_n77A (n77 USA Range A) | 1 | LTE Band 2 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_2A_n78A | 1 | LTE Band 2 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_5A_n66A | 1 | LTE Band 5 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_5A_n78A | 1 | LTE Band 5 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_7A_n78A | 1 | LTE Band 7 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_12A_n66A | 1 | LTE Band 12 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_13A_n2A | 1 | LTE Band 13 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |

| 3GPP Config. Identifier | VAR. | Band | Use Cases Supported | Device Width (mm)[2] | FS | HL and HR |
|---|---|---|---|---|---|---|
| | | | Other[4] | All | TBD | N/A |
| DC_13A_n5A | 1 | LTE Band 13 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_13A_n66A | 1 | LTE Band 13 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_13A_n77A (n77 USA Range B) | 1 | LTE Band 13 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_13A_n77A (n77 USA Range A) | 1 | LTE Band 13 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_48A_n5A | 1 | LTE Band 48 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_66A_n2A | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_66A_n5A | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_66A_n71A | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |

| 3GPP Config. Identifier | VAR. | Band | Use Cases Supported | Device Width (mm)[2] | FS | HL and HR |
|---|---|---|---|---|---|---|
| DC_66A_n77A (n77 USA Range B) | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_66A_n77A (n77 USA Range A) | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_66A_n78A | 1 | LTE Band 66 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[4] | All | TBD | N/A |
| DC_(n)71AA | 1 | LTE Band 71 | Held to head for voice[3] | ≤72 | TBD | TBD |
| | | | | >72 | TBD | TBD |
| | | | Other[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: "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 4.1.12.1-2 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_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | Held to head for voice[3] | ≤72 | TBD | TBD | TBD |
| | | | | >72 | TBD | TBD | TBD |
| | | | Other[4] | All | TBD | N/A | N/A |
| DC_2A_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | 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 |
| 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 |

| 3GPP Config. Identifier | Var. | Band | Use Cases Supported | Device Width (mm)[2] | FS | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| 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_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_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_13A_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | Held to head for voice[3] | ≤72 | TBD | TBD | TBD |
| | | | | >72 | TBD | TBD | TBD |
| | | | Other[4] | All | TBD | N/A | N/A |
| DC_13A_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | Held to head for voice[3] | ≤72 | TBD | TBD | TBD |
| | | | | >72 | TBD | TBD | TBD |
| | | | Other[4] | All | TBD | N/A | N/A |
| DC_48A_n5A | 1 | NR n5 | | ≤72 | TBD | TBD | TBD |

| 3GPP Config. Identifier | Var. | Band | Use Cases Supported | Device Width (mm)[2] | FS | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| | | | Held to head for voice[3] | >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 |
| DC_66A_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | Held to head for voice[3] | ≤72 | TBD | TBD | TBD |
| | | | | >72 | TBD | TBD | TBD |
| | | | Other[4] | All | TBD | N/A | N/A |
| DC_66A_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | 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 | 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). | | | | | | | |

| 3GPP Config. Identifier | Var. | Band | Use Cases Supported | Device Width (mm)[2] | FS | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|
| 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.<br>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.<br>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_n77A (n77 USA Range B) | 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_n77A (n77 USA Range A) | 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 |

| 3GPP Config. Identifier | VAR. | Band | Use Cases Supported | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|---|
| 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 |
| 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 |
| 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 |
| 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_n5A | 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_13A_n77A (n77 USA Range B) | 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_n77A | 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 |
|---|---|---|---|---|---|---|---|---|
| (n77 USA Range A) | | LTE Band 13 | Held to head for voice[3] | >72 | TBD | N/A | TBD | TBD |
| | | | Other[4] | All | TBD | N/A | N/A | N/A |
| DC_48A_n5A | 1 | LTE Band 48 | 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 | 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_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_n77A (n77 USA Range B) | 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_n77A (n77 USA Range A) | 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 |
| 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 |

| 3GPP Config. Identifier | VAR. | Band | Use Cases Supported | Device Width (mm)[2] | FS | WL and WR | BHHL and BHHR | HL and HR |
|---|---|---|---|---|---|---|---|---|
| | | | 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_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | 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_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | 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 |
| 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 |

| 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 |
| 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_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_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_13A_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | 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_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | 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_48A_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_n2A | 1 | NR n2 | | ≤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 |
| 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_n77A (n77 USA Range B) | 1 | NR n77 (USA Range B) | 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_n77A (n77 USA Range A) | 1 | NR n77 (USA Range A) | 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 | 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.

### 4.1.14 NR FR1 EN-DC (2 LTE Carriers with 1 NR Carrier)

Planned for a future release.

### 4.1.15 NR FR1 SA 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 DL CA specific test requirements for carrier aggregation testing as described in Section 2.1.7.7.

#### 4.1.15.1 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 NR FR1 SA 2 DL band combination shall meet the limits in Table 4.1.15.1-1.

Table 4.1.15.1-1 NR FR1 SA Carrier Aggregation Mode (2 Downlink Carriers, 1 Uplink Carrier) Minimum TRP Criteria Table for the Primary Mechanical Mode[1]

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| CA_n2A-n5A | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A | 2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A<br>(n77 USA Range B) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A<br>(n77 USA Range B) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A<br>(n77 USA Range A) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A<br>(n77 USA Range A) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| CA_n5A-n66A | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range B) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range B) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range A) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range A) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A | 1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A | 1 | n48 | Yes[3] | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| (n77 USA Range B) | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range B) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range A) | 1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range A) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range B) | 1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range B) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range A) | 1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range A) | 2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| 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).<br>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.<br>Note 3: “Yes” applies if the device supports voice operation in the talking position against the head in LTE mode.<br>Note 4: “No” would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions. | | | | | | |

#### 4.1.15.2 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 4.1.15.2-1.

Table 4.1.15.2-1 NR FR1 SA 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 | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n5A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A | 2 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n66A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A (n77 USA Range B) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A (n77 USA Range B) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n77A (n77 USA Range A) | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n77A (n77 USA Range A) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n66 | Yes[3] | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range B) | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range B) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n77A (n77 USA Range A) | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n5A-n77A (n77 USA Range A) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A | 1 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range B) | 1 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n48A-n77A (n77 USA Range B) | | | | No[4] | All | TBD | N/A |
| | | SCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range A) | 1 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n77A (n77 USA Range A) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range B) | 1 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range B) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n66 | Yes[3] | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up to Head for Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range A) | 1 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n66A-n77A (n77 USA Range A) | 2 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >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.

### 4.1.16 NR FR1 SA 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 DL CA specific test requirements for carrier aggregation testing as described in Section 2.1.7.7.

#### 4.1.16.1 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 4.1.16.1-1 below.

Table 4.1.16.1-1 NR FR1 SA Carrier Aggregation Mode (3 Downlink Carriers, 1 Uplink Carrier) Minimum TRP Criteria Table for the Primary Mechanical Mode[1]

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| CA_n2A-n5A-n48A | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n48A | 2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n48A | 3 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 3 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range B) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A | 2 | n5 | Yes[3] | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| (n77 USA Range B) | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range B) | 3 | n77 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range A) | 1 | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range A) | 2 | n5 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range A) | 3 | n77 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n66A | 1 | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n66A | 2 | n48 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n66A | 3 | n66 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |
| | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range B) | 1 | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | Yes³ | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range B) | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range B) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range A) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range A) | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range A) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range B) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range B) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range B) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| CA_n2A-n66A-n77A (n77 USA Range A) | 1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range A) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range A) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 3 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range B) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range B) | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| (n77 USA Range B) | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range B) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range B) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range B) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range A) | 1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range A) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range A) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range B) | 1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range B) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range B) | 3 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range A) | 1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range A) | 2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | Yes[3] | >72 | TBD | TBD |
| | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range A) | 3 | n77 | 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.

| Carrier Aggregation Combination | VAR. | PCC Band | Device Held to Head for Voice | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|
| 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. | | | | | | |

4.1.16.2 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 4.1.16.2-1 below.

Table 4.1.16.2-1 NR FR1 SA 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 | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n5A-n48A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n48A | 2 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n48 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC2 | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n48A | 3 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 2 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n66A | 3 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range B) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range B) | 2 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range A) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 2 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n2 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n5A-n77A (n77 USA Range A) | | SCC1 | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n5A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n66A | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)² | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n48A-n66A | | SCC1 | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | | SCC2 | n66 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n66A | 3 | PCC | n66 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | | SCC1 | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | | SCC2 | n48 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range B) | 1 | PCC | n2 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | | SCC1 | n48 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | | SCC2 | n77 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No⁴ | All | TBD | N/A |
| | 2 | PCC | n48 | Yes³ | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n48A-n77A (n77 USA Range B) | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range A) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 2 | | n48 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n48A-n77A (n77 USA Range A) | | PCC | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n48A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range B) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n2A-n66A-n77A (n77 USA Range B) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range A) | 1 | PCC | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range A) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n2A-n66A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n2 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n66 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC2 | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n66A | 3 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range B) | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range B) | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 2 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n48A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | | n66 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n5A-n66A-n77A (n77 USA Range B) | | SCC1 | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range B) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 1 | PCC | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n5A-n66A-n77A (n77 USA Range A) | | SCC1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range A) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n5A-n66A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n5 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 1 | PCC | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n48A-n66A-n77A (n77 USA Range B) | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range B) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range B) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | 1 | | n48 | | ≤72 | TBD | TBD |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| CA_n48A-n66A-n77A (n77 USA Range A) | | PCC | | Yes[3] | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range A) | 2 | PCC | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| CA_n48A-n66A-n77A (n77 USA Range A) | 3 | PCC | n77 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC1 | n48 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |
| | | SCC2 | n66 | Yes[3] | ≤72 | TBD | TBD |
| | | | | | >72 | TBD | TBD |
| | | | | No[4] | All | TBD | N/A |

| Carrier Aggregation Combination | VAR. | PCC/SCC | Band | Device Held Up To Head For Voice (Yes/No) | Device Width (mm)[2] | Free Space | HL and HR |
|---|---|---|---|---|---|---|---|
| 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).<br>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.<br>Note 3: "Yes" applies if the device supports voice operation in the talking position against the head in LTE mode.<br>Note 4: "No" would be applicable to data-centric devices that are not held up against the head, e.g., embedded laptop solutions. | | | | | | | |

#### 4.1.17 NR FR1 SA Uplink Carrier Aggregation Desense (with 2-3 DL CA)

Planned for a future release.

## 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 |

| 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 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 |
| LTE Band 7 | | ≤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 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 |
| | | ≤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 |
| 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 |
| NR FR1 SA n48 | | ≤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 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 |
| 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 |

| 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 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 |
| 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 |
| | | ≤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_2A_n66A | | >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 |
| 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 |
| | | ≤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_(n)71AA | | >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 |
| 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 |

| 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 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 |
| | | >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 |

| 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 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 |
| | | ≤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_13A_n66A | | >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 | UHIS | PIGS | TIS | UHIS | PIGS |
| | | >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 |

| 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 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 4.2.1.1-2 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 |
| Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input). | | | | |

Table 4.2.1.1-3 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 |
| Note 1: Primary Mechanical Mode refers to device configured in preferred mode per manufacturer instructions (typically depends on form factor and OEM input).. | | |

### 4.2.2 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 |
| LTE Band 7 | | TBD | TBD | TBD |

| Band | Positioning Method | FS | | |
|---|---|---|---|---|
| | | Average 3D $C/N_0$ | UH 3D $C/N_0$ | PIG 3D $C/N_0$ |
| 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 |
| NR FR1 SA n12 | | 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 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/N0 |
| 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 | | TBD | TBD | TBD |

| Band | Positioning Method | FS | | |
|---|---|---|---|---|
| | | TIS | UHIS | PIGS |
| LTE Band 12 | Control Plane / UE-Based | 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 |
| 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 |

| Band | Positioning Method | WL and WR |
| --- | --- | --- |
| | | TIS |
| 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 |
| LTE Band 71 | Control Plane / UE-Assisted | TBD |

| Band | Positioning Method | WL and WR |
|---|---|---|
| | | TIS |
| 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 |
| NR FR1 SA n77 | | TBD |

| Band | Positioning Method | WL and WR |
|---|---|---|
| | | TIS |
| 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 |
| 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 |

| Band | Positioning Method | WL and WR |
|---|---|---|
| | | TIS |
| 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). | | |

#### 4.2.4 VOID

### 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, and GPS L5 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

Table RA.3-13 NR FR1 SA Carrier Aggregation Mode (2 DL, 1 UL) TRP Summary Table for the Primary Mechanical Mode

Table RA.3-14 NR FR1 SA Carrier Aggregation Mode (3 DL, 1 UL) TRP Summary Table for the Primary Mechanical Mode

Table RA.3-15 NR FR1 SA Carrier Aggregation Mode (2 DL, 1 UL) TIS Summary Table for the Primary Mechanical Mode

Table RA.3-16 NR FR1 SA Carrier Aggregation Mode (3 DL, 1 UL) TIS Summary Table for the Primary Mechanical Mode

For Table RA.3-1 to Table RA.3-3,Table RA.3-6 to Table RA.3-11 and Table RA.3-13 to Table RA.3-15, 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 non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table RA.4-2 A-GPS L1 non-CA/DC Summation Test Report for Integrated Devices

Table RA.4-3 A-GPS L1 non-CA/DC Summation Test Report for Wrist-Worn Devices

Table RA.4-4 A-GPS L1 non-CA/DC Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-5 A-GPS L1 non-CA/DC Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-6 A-GPS L1 non-CA/DC 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 non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table RA.4-11 A-GPS L5 non-CA/DC Summation Test Report for Integrated Devices

Table RA.4-12 A-GPS L5 non-CA/DC Summation Test Report for Wrist-Worn Devices

Table RA.4-13 A-GPS L5 non-CA/DC Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-14 A-GPS L5 non-CA/DC Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-15 A-GPS L5 non-CA/DC 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 non-CA/DC Summation Test Report for the Reference Band for Devices Held to the Head for Voice

Table RA.4-20 A-GALILEO E1 non-CA/DC Summation Test Report for the Reference Band for Integrated Devices

Table RA.4-21 A-GALILEO E1 non-CA/DC Summation Test Report for the Reference Band for Wrist-Worn Devices

Table RA.4-22 A-GALILEO E1 non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table RA.4-23 A-GALILEO E1 non-CA/DC Summation Test Report for Integrated Devices

Table RA.4-24 A-GALILEO E1 non-CA/DC Summation Test Report for Wrist-Worn Devices

Table RA.4-25 A-GALILEO E1 non-CA/DC Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table RA.4-26 A-GALILEO E1 non-CA/DC Intermediate Channel Relative Sensitivity for Integrated Devices

Table RA.4-27 A-GALILEO E1 non-CA/DC Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table RA.4-28 Void

Table RA.4-29 Void

Table RA.4-30 Void

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

Note: Measurement results with the DUT in primary mechanical mode shall be reported per Table RA.5-1 Machine Readable Report, and measurement results with the DUT in non-primary mechanical modes are not required to be reported per Table RA.5-1.

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 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* [1] 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* [1] using the same syntax. All possible bands for Cellular 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/Dual Connectivity (CADC)":** This field indicates when the test case pertains to 1) Carrier Aggregation (denoted "CA"), 2) Dual Connectivity (denoted "DC"), 3) no Carrier Aggregation and no Dual Connectivity (denoted "Single Carrier" for protocols that support CA or DC), or 4) Not Applicable (denoted "N/A") for protocols that don't support CA nor DC.

- 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".
- If this field equals "NR CA", then 1) Column H "NR CADC 3GPP Test Configuration", Column I "NR CADC 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".
- If this field equals "EN-DC", then 1) Column H "NR CADC 3GPP Test Configuration", Column I "NR CADC 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 current CTIA OTA Test Plan, 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, LTE Category NB1 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 example, the Test Channel Configuration IDs for NR FR1 SA Band n77 USA Range A are _1, _2, _3, _4 and _5 which correspond to the lowest to highest channels.

**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 CADC 3GPP Test Configuration":** This enumerated Column is used to indicate which 3GPP test configuration is being tested. The NR EN-DC or NR FR1 SA CA 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 CADC 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 CADC 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. For NR EN-DC and NR SA CA u denotes the carrier under test in the order bands are listed in the 3GPP Test Configuration. For example, for LTE, TRP_3DL_1UL_2-4 represents a TRP test case, where the channel configuration under test is the 4th channel configuration in SCC1 and it is a 3DL and 1UL CA combo case. For LTE, the channel configurations are defined in *CTIA 01.50* [x] in Table 4.2.1-1, Table 4.2.2-1, Table 4.3.1-1, Table 4.3.2-1, Table 4.4.1-1, and Table 4.4.1-2. For NR EN-DC, the channel configurations are defined in *CTIA 01.50* [10] in Table 5.1.2.1-1, and Table 5.1.2.2.1-1. For NR SA CA, the channel configurations are defined in *CTIA 01.50* [10] in Table 5.1.3.1-1, Table 5.1.3.2-1, Table 5.1.4.1-1, and Table 5.1.4.2-1. 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.

Some relevant examples include:

In the case of narrow frequency bands (e.g. LTE Band 13), there is only one channel defined to be tested for the 3 channel configurations in the case of CA or DC. See the example from Table 5.1.2.2.1-1 in *CTIA 01.50* [10].

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DC_13A_n2A | 1 | DC_13A_n2A | 13 | MCG / PCC | 10 | 15 | 20 | 20 | Inter-band EN-DC | No | 5230 | 15 RB with RBstart=0 | 50 RB with RBstart=0 | 387000 | 50@2 | 52@0 |
| | | | n2 | SCG / PCC | 10 | 15 | | | | | 5230 | 15 RB with RBstart=0 | 50 RB with RBstart=0 | 392000 | 50@2 | 52@0 |
| | | | | | | | | | | | 5230 | 15 RB with RBstart=0 | 50 RB with RBstart=0 | 397000 | 50@2 | 52@0 |

The testing for this band combination produces a total of 6 entries in this column corresponding to the 3 channel configuration, which are as follows:

C-TIS_2DL_2UL_1-1 → for LTE 13, Channel 5230 (mid channel)

C-TIS_2DL_2UL_2-1 → for n2, Channel 387000 (low channel)

C-TIS_2DL_2UL_1-2 → for LTE 13, Channel 5230 (mid channel)

C-TIS_2DL_2UL_2-2 → for n2, Channel 392000 (mid channel)

C-TIS_2DL_2UL_1-3 → for LTE 13, Channel 5230 (mid channel)

C-TIS_2DL_2UL_2-3 → for n2, Channel 397000 (high channel)

Another interesting case is for intra-band non-contiguous CA cases. The channel combinations for intra-band non-contiguous cannot follow a low-low, mid-mid, high-high structure since there will be an overlap between the channels for each carrier within the same band. See the example from Table 4.2.2-1 in *CTIA 01.50* [10] for CA_4A-4A:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CA_4A-4A[5] | 4 | 4 | 10 | 10 | 2000 | 2175 | 50 RB with RBstart=0 | 50 RB with RBstart=0 | 50 RB with RBstart=0 |
| | | | | | 2175 | 2350 | 50 RB with RBstart=0 | 50 RB with RBstart=0 | 50 RB with RBstart=0 |
| | | | | | 2350 | 2000 | 50 RB with RBstart=0 | 50 RB with RBstart=0 | 50 RB with RBstart=0 |

In this case, the entries in Column K would be as follows:

C-TIS_2DL_1UL_1-1 → for LTE 4, Channel 2000 (low channel)

C-TIS_2DL_1UL_2-1 → for LTE 4, Channel 2175 (mid channel)

C-TIS_2DL_1UL_1-2 → for LTE 4, Channel 2175 (mid channel)

C-TIS_2DL_1UL_2-2 → for LTE 4, Channel 2350 (high channel)

C-TIS_2DL_1UL_1-3 → for LTE 4, Channel 2350 (high channel)

C-TIS_2DL_1UL_2-3 → for LTE 4, Channel 2000 (low channel)

Another interesting case is for intra-band contiguous EN-DC cases. See the example from Table 5.1.2.1-1 in *CTIA 01.50* [10] for DC_(n)71AA:

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DC_(n)71AA | 1 | DC_(n)71AA | 71 | MCG / PCC | 10 | 15 | 20 | 20 | Intra-band EN-DC | No[4] | 133272 | 12 RB with RBstart=19 | N/A[2] | 133600 | 25@12 | N/A[2] |
| | | | n71 | SCG / PCC | 10 | 15 | | | | | 133197 | 12 RB with RBstart=19 | N/A[2] | 136100 | 25@12 | N/A[2] |
| | | | | | | | | | | | 133322 | 12 RB with RBstart=19 | N/A[2] | 138600 | 25@12 | N/A[2] |

In this case the entries in column K would be as follows:

TRP_2DL_2UL_1-1 → for LTE 71, Channel 133272 (next to low channel)

TRP_2DL_2UL_2-1 → for n71, Channel 133600 (low channel)

TRP_2DL_2UL_1-2 → for LTE 71, Channel 133197 (previous to mid channel)

TRP_2DL_2UL_2-2 → for n71, Channel 136100 (mid channel)

TRP_2DL_2UL_1-3 → for LTE 71, Channel 133322 (previous to high channel)

TRP_2DL_2UL_2-3 → for n71, Channel 138600 (high channel)

**Column L; "UE Power Class":** Align the available choices in this enumerated column with the Power Classes currently defined in *CTIA 01.01* [1] 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 (includes also PC1.5).

**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(s) 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* [1] 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* [3]. In test cases where multiple antennas are transmitting at the same time (e.g., PC1.5) then list each label for each antenna being measured separated with a plus sign (e.g., A+C).

**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* [1] 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* [1].

**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), CA Test Reduction, TRPs for NR PC 1.5 devices with UL MIMO (ULFPTx Mode 1) or UL TxD, 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.20-17 LTE Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.20-18 to Table RA.20-34 LTE Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.20-35 to Table RA.20-49 LTE Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For LTE devices, only provide Table RA.20-18 to Table RA.20-34 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.20-1 to Table RA.20-17 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.40-24 NR FR1 SA Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.40-25 to Table RA.40-48 NR FR1 SA Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.40-49 to Table RA.40-63 NR FR1 SA Maximum C-TIS Level Requirements for the Primary Mechanical Mode

For NR FR1 SA devices, only provide Table RA.40-25 to Table RA.40-48 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.40-1 to Table RA.40-24 for those bands requiring reporting TRP for 1 antenna.

RA.41: NR FR1 SA 2 DL CA Tables

Table RA.41-1 to Table RA.41-28 NR FR1 SA Minimum TRP Level Requirements for the PCC IN 2 DL CA for Primary Mechanical Mode

Table RA.41-29 to Table RA.41-56 NR FR1 SA Minimum TRP Level Requirements for the PCC IN 2 DL CA for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.41-57 to Table RA.41-112 NR FR1 SA Maximum C-TIS Level Requirements for the PCC/SCC IN 2 DL CA for the Primary Mechanical Mode

For NR FR1 SA devices supporting 2 DL CA, only provide Table RA.41-29 to Table RA.41-56 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.41-1 to Table RA.41-28 for those bands requiring reporting TRP for 1 antenna.

RA.42: NR FR1 SA 3 DL CA Tables

Table RA.42-1 to Table RA.42-48 NR FR1 SA Minimum TRP Level Requirements for the PCC IN 3 DL CA for Primary Mechanical Mode

Table RA.42-49 to Table RA.42-96 NR FR1 SA Minimum TRP Level Requirements for the PCC IN 3 DL CA for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.42-97 to Table RA.42-240 NR FR1 SA Maximum C-TIS Level Requirements for the PCC/SCC1/SCC2 IN 3 DL CA for the Primary Mechanical Mode

For NR FR1 SA devices supporting 3 DL CA, only provide Table RA.42-49 to Table RA.42-96 for those bands requiring reporting TRP for 2 antennas, and only provide Table RA.42-1 to Table RA.42-48 for those bands requiring reporting TRP for 1 antenna.

RA.50: NR FR1 EN-DC Tables

Table RA.50-1 to Table RA.50-46 NR FR1 EN-DC Minimum TRP Level Requirements for Primary Mechanical Mode

Table RA.50-47 to Table RA.50-92 NR FR1 EN-DC Minimum TRP Level Requirements for the Primary Mechanical Mode for the Primary and Secondary Antennas

Table RA.50-93 to Table RA.50-138 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 Void

Table RA.70-7 Void

Table RA.70-8 Void

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 VOIDRA.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 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.

[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]

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, Table IA.20-1 to Table IA.20-3, can be created from the informative reporting tables, Table IA.20-10 to Table IA.20-12, with similar titles in *CTIA 01.04* [4] 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 with SIB non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table IA.20-2 A-GPS L1 with SIB non-CA/DC Summation Test Report for Integrated Devices

Table IA.20-3 A-GPS L1 with SIB non-CA/DC Summation Test Report for Wrist-Worn Devices

The informative reporting tables, Table IA.20-4 to Table IA.20-9, can be created from the normative reporting tables, Table RA.4-4 to Table RA.4-9, with similar titles 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.20-4 A-GPS L1 with SIB non-CA/DC Intermediate Channel Relative Sensitivity for Devices Held to the Head for Voice

Table IA.20-5 A-GPS L1 with SIB non-CA/DC Intermediate Channel Relative Sensitivity for Integrated Devices

Table IA.20-6 A-GPS L1 with SIB non-CA/DC Intermediate Channel Relative Sensitivity for Wrist-Worn Devices

Table IA.20-7 A-GPS L1 with SIB non-CA/DC Summation Test Report Plot Matrix for Devices Held to the Head for Voice

Table IA.20-8 A-GPS L1 with SIB non-CA/DC Summation Test Report Plot Matrix for Integrated Devices

Table IA.20-9 A-GPS L1 with SIB non-CA-DC Summation Test Report Plot Matrix for Wrist-Worn Devices

The informative reporting tables, Table IA.20-10 to Table IA.20-12, include A-GPS L1 with LTE Category M1.

Table IA.20-10 A-GPS L1 non-CA/DC Summation Test Report for Devices Held to the Head for Voice

Table IA.20-11 A-GPS L1 non-CA/DC Summation Test Report for Integrated Devices

Table IA.20-12 A-GPS L1 non-CA/DC Summation Test Report for Wrist-Worn Devices

IA.21 A-GPS L1 Tables

The informative reporting tables, Table IA.21-1 to Table IA.21-3, can be created from the normative reporting tables, Table RA.70-3 to Table RA.70-5, with similar titles 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 SIB 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 SIB with LTE Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table IA.21-3 A-GPS L1 with SIB with LTE Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

The informative reporting tables, Table IA.21-4 to Table IA.21-6, can be created from the informative reporting tables, Table IA.21-7 to Table IA.21-9, in *CTIA 01.04* [4] by adding one column to the right of the "Positioning Method" column and titling the new column "SIB".

Table IA.21-4 A-GPS L1 with SIB 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 SIB 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 SIB with LTE CAT-M1 Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

Table IA.21-7 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.21-8 A-GPS L1 with LTE Cat-M1 Maximum TIS/UHIS/PIGS Level Requirements for the Primary Mechanical Mode for Integrated Devices

Table IA.21-9 A-GPS L1 with LTE Cat-M1 Maximum TIS Level Requirements for the Primary Mechanical Mode for Wrist-Worn Devices

IA.30 MBS Tables

Table IA.30-1 MBS non-CA/DC Summation Test Report

Table IA.30-2 MBS non-CA/DC Intermediate Channel Relative Sensitivity

Table IA.30-3 MBS non-CA/DC Summation Test Report Plot Matrix

Table IA.30-4 MBS with LTE Maximum TIS/NHPIS±45/NHPIS±30 Level Requirements for the Reference Band for the Primary Mechanical Mode

## 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

The change history only tracks changes that were directly applied to this document. Changes to earlier document versions that became necessary after a new major version was created are not tracked in this document's change history. For example, CTIA 01.01 v8.0.0 was based off of CTIA 01.01 v6.0.2 and subsequent revisions to CTIA 01.01 v6.0.2 are not included in the change history for CTIA 01.01 v8.0.x.

| 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.<br>Added Section 2.1.8.2.3.<br>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.<br>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.<br>**Section 5:** Updated Column K definition (added last sentence) in 5.1. |
| December 2022 | 5.0.0 | Section 1:<br>• Added LTE Cat-M1 and LTE Cat-NB1 protocol support for reverberation chambers.<br>• Updates to make A-GNSS testing with SIB8/SIB16 informative.<br>• Added Fast TIS Test Methodologies for wireless technologies below 6 GHz.<br>• Added relative power on intermediate channel testing.<br>• Added ankle phantom as informative.<br>• Clarified in Table 1.3-4 that the MIMO OTA test methods only apply to Hand-Held Devices and Tablets.<br>Section 2:<br>• Added test reductions in LTE when NR SA is supported.<br>• Allowed use of reverberation chambers for LTE Category M1 and LTE Category NB1.<br>• Updates to make A-GNSS testing with SIB8/SIB16 informative.<br>• Added A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC.<br>• Added A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA.<br>• Removed testing LTE Band 17 and UMTS 1700/2100. Added test time reductions for A-GNSS OTA with LTE and NR.<br>• Minor editorial clarifications and corrections.<br>• Added relative power on intermediate channel testing.<br>• Added intermediate channel testing for relative sensitivity for NR FR1 SA.<br>• Reduced testing on data-only devices to the 2 most recent cellular radio modes.<br>• Added ankle phantom as informative.<br>Section 3:<br>• 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. |

| Date | Version | Description |
| --- | --- | --- |
| | | • Section 3.1.4 NR FR1 SA Relative Sensitivity on Intermediate Channels Test was added.<br>Section 4:<br>• Updates to make A-GNSS testing with SIB8/SIB16 informative.<br>• Added A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC.<br>• Added A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA.<br>• Removed testing LTE Band 17 and UMTS 1700/2100.<br>• Added new NR bands including: n12, n14, n26, n30, n48, n77 (n77 Canada added as informative).<br>• Removed test limits for A-GPS L5 and A-GALILEO E1 with NR FR1 EN-DC for wrist-worn devices.<br>• Added A-GALILEO E1 limit tables.<br>• Added relative power on intermediate channel testing.<br>Section 5:<br>• Added sub-sections for informative reporting tables.<br>• Added tables for A-GNSS (A-GPS L1, A-GPS L5 and A-GALILEO E1) with NR FR1 SA.<br>• Added tables for A-GPS L5 and A-GALILEO E1 testing with NR FR1 EN-DC.<br>• Corrected some table numbering in RA.71 and RA.72.<br>• Added table for intermediate channel relative power.<br>• Updated RA.5 Machine Readable Report, including identification of the type of hand phantom used in testing.<br>• Updates to make A-GNSS testing with SIB8/SIB16 informative.<br>• Added reporting tables in RA.40 for new NR FR1 SA bands. |
| March 2023 | 6.0.0 | Section 1<br>• Added NR FR1 SA 2DL CA and NR FR1 SA 3DL CA as new 3GPP wireless technologies.<br>• Added Fast TIS category of measurements for wireless technologies below 6 GHz.<br>• Added new vendor declaration requirements for devices being tested with the SISO, Millimeter Wave Test Methodology.<br>Section 2<br>• Rewrote the test requirements for devices supporting usage against the head.<br>• Rewrote the test requirements for devices supporting data usage in the hand.<br>• Added test requirements for NR FR1 SA CL CA and NR FR1 EN-DC.<br>• Added test reduction for A-GPS L1, A-GPS L5 and A-Galileo E1with NR FR1 EN-DC under certain conditions.<br>• Clarified cellular radio mode test requirements for data only devices.<br>• Clarified receiver performance testing of devices with antenna switching. |

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| | | • Updated operator priority list requirements, including updating high-priority combinations to “Non-essential, high priority” combinations, removing secondary priority combinations and defining “Essential Conditional” combinations.<br>• Added use of operator priority list for NR FR1 EN-DC testing.<br>• Added allowance for reducing LTE CA OTA testing when NR FR1 EN-DC is OTA tested under specific conditions.<br>• Added use of operator priority list for NR FR1 DL CA.<br>• Added allowance for reducing LTE CA OTA testing when NR FR1 SA CL CA is OTA tested under specific conditions.<br>• Stated that SISO, Millimeter Wave certification testing is only required for PC3 devices.<br>• Defined spherical coverage CDF/CCDF test requirements for SISO, Millimeter Wave testing.<br>• MBS references were removed in clauses 2.1.2, 2.1.6 and 2.1.7.<br>• Section 2.1.8.5 MBS Test Requirements was marked VOID in V6.0.0 since testing for MBS was moved from Normative to Informative.<br>Section 3:<br>• Section 3.1.2 Waiver for MBS OTA Testing was modified since testing for MBS was moved from Normative to Informative.<br>Section 4<br>• Added TRP test criteria for band class 1 and 2 for some LTE bands.<br>• Indicated that TIS performance is expected to be 3 dB lower for LTE Category 1bis devices.<br>• Added TRP test criteria for band class 1, 1.5 and 2 for some NR FR1 SA bands.<br>• Added OTA test criteria for several band combinations of NR FR1 EN-DC.<br>• Added placeholder for NR FR1 EN-DC with 2 LTE carriers and 1 NR carrier.<br>• Added NR FR1 SA 2DL CA.<br>• Added NR FR1 SA 3DL CA.<br>• Added placeholder for NR FR1 SA UL CA desense.<br>• Section 4.2.4 MBS was marked VOID in V6.0.0 since testing for MBS was moved from Normative to Informative.<br>Section 5<br>• Added references to tables for NR FR1 SA CA.<br>• Modified definitions for RA.5: Machine Readable Report to indicate that NR FR1 SA CA will be added to the MRR in a future release.<br>• MBS references were removed in Section 5.1.<br>• List of reporting tables were updated to make MBS testing informative<br>• Updated numbering for tables in RA.20, RA.40 and RA.50. |
| July 2023 | 4.0.3 | **Section 1:**<br>• In Section 1.2, added definitions of the CTIA OTA nomenclature and the PTCRB nomenclature for all 3GPP Radio Access Technologies. |

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| | | **Section 2:**<br>• In Section 2.1.5.2, clarified C-TIS testing when TX antenna switching is supported.<br>**Section 3:**<br>• Added Section 3.1.4, Modification to Channel Bandwidths and RB Allocations for NR FR1 TRP and C-TIS Testing.<br>• Added Section 3.1.5, Modification to Channel Bandwidths and RB Allocations for NR FR1 EN-DC TRP and C-TIS Testing.<br>Added Section 3.1.6, Modification to Broadband Power Mode Measurement Requirements for NR FR1 TRP Testing. |
| September 2023 | 6.0.1 | **Section 1:**<br>• In Section 1.2, added definitions of the CTIA OTA nomenclature and the PTCRB nomenclature for all 3GPP Radio Access Technologies.<br>**Section 2:**<br>• In Section 2.1.2.1.3, corrected some references to tables in CTIA 01.40 in Table 21.2.1.3-3.<br>• In Section 2.1.8, References to LTE Category M1 were removed as normative testing of A-GNSS with LTE Category M1 is no longer required.<br>**Section 3:**<br>• Added Section 3.1.5, Modification to Broadband Power Mode Measurement Requirements for NR FR1 TRP Testing.<br>• Added Section 3.1.6, NR FR1 SA A-GNSS Testing: General<br>**Section 5:**<br>• Tables RA.70-6 through RA.70-8 were changed to Void as normative testing of A-GNSS with LTE Category M1 is no longer required.<br>• The instructions for creating some of the Tables in IA.20 were clarified. Table IA.20-10 to Table IA.20-12 were added for A-GPS L1 with LTE Category M1.<br>• The instructions for creating some of the Tables in IA.21 were clarified. Table IA.21-7 to Table IA.21-9 were added for A-GPS L1 with LTE Category M1. |
| December 2023 | 6.0.2 | **Section 2:**<br>• Clarified references to “PCIExpress” to “PCIExpress when using an External Interface”.<br>**Section 3:**<br>• Section 3.1.7 Use of Legacy Measurement Grids for Certain Devices was added. This section identifies which devices require the use of legacy measurement grids.<br>**Section 5:**<br>• Description of Column K “Multiple Component Carrier Test Configuration ID” of RA.5 Machine Readable Report updated to be more clear. |

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| June 2024 | 6.0.3 | **Section 1:**<br>• Section 1.3 modified to make the SISO, Reverberation Chamber Test Methodology informative.<br>• Section 1.3.1.2 updated to reflect that the informative Reverberation Chamber Test Methodology supports chest and ankle phantoms.<br>• In Section 1.4, added clarification regarding testing with the standard battery.<br>• In Section 1.7, title of CTIA 01.21 changed to “Test Methodology, SISO, Reverberation Chamber (Informative)”.<br>**Section 2:**<br>• In Section 2.1.2.4.1, added clarification that cellular desense testing is limited to single carrier modes.<br>• Section 2.1.2.4 Ankle-Worn Devices was moved to Section 2.1.2.5 in order to avoid renumbering the following sub-sections so that the sub-section numbering matches what is in Version 4.0.x.<br>• Changed Section 2.1.3.1 Large IoT Devices to informative.<br>• In Section 2.1.3.3.1, added clarification that cellular desense testing is limited to single carrier modes.<br>**Section 3:**<br>• Added Section 3.3.1 Systematic Offset for MIMO Average Radiated SIR Sensitivity (MARSS) Tests.<br>**Section 4:**<br>• Added missing notes to the bottom of Table 4.1.12.1-1.<br>• Added missing notes to the bottom of Table 4.2.1.1-1.<br>• Added missing note to the bottom of Table 4.2.1.1.-2.<br>• Added missing note to the bottom of Table 4.2.1.1-3.<br>• The tables in Table 4.2.3.1-1, Table 4.2.3.1-2, and Table 4.2.3.1-3 were missing and are now added. |

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| December 2024 | 6.0.4 | **Section 1:**<br>• In Section 1.5.2, changed "specific keep out areas" to "zones of the DUT".<br>**Section 2:**<br>• Section 2.1.8.2.3 updated to remove references to an operator priority list for A-GPS L1 with NR FR1 EN-DC because there is no list for A-GPS L1 with NR FR1 EN-DC.<br>• Clarified that simple IoT devices do not fit inside a 60mm diameter sphere.<br>**Section 3:**<br>• Added Section 3.1.8: LTE Broadband Power Mode Measurement Requirements.<br>• Added Section 3.2.1: Use of Charging Cables.<br>• Added Section 3.2.2: UL and DL Test Configuration Tables.<br>**Section 4:**<br>• In the tables of Section 4.11, n26 and n48 were added.<br>• In the tables of Section 4.11, the column for Variant was removed and all rows for variants other than 1 were removed, as these variants are associated with informative alternative channel bandwidths.<br>• In the tables of Section 4.12, all rows for variants other than 1 were removed, as these variants are associated with informative alternative channel bandwidths.<br>• Clarified that simple IoT devices do not fit inside a 60mm diameter sphere. |
| April 2025 | 6.0.5 | **Section 2:**<br>• Clarifications made in Section 2.1.7.2 that overlapping LTE bands that do not need to be tested are considered fully tested for evaluating other test reductions.<br>• Clarifications made in Section 2.1.7.4 that overlapping LTE Category M1 and LTE Category NB1 bands that do not need to be tested are considered fully tested for evaluating other test reductions.<br>• Clarifications made in Section 2.1.7.5 that overlapping NR FR1 SA bands that do not need to be tested are considered fully tested for evaluating other test reductions.<br>• Added statement in Section 2.1.8.1 that there are test requirements in Section 2.1.7 that also apply to location based wireless technologies.<br>• The content in Section 2.1.8.1.2 LTE is covered by the content in Section 2.1.7.2.<br>**Section 3:**<br>• Section 3.2.1 was updated to allow the usage of charging cables for RX and TX beam peak search tests.<br>• Added Section 3.3.2 Removing LTE Band 17 from Normative Bands.<br>**Section 5:**<br>• Added notes to Table RA.5-1 clarifying reporting requirements for primary and non-primary mechanical modes. |
| June 2025 | 6.0.6 | **Section 2:**<br>• Updated requirement in Test ID H4.1.0-2. |