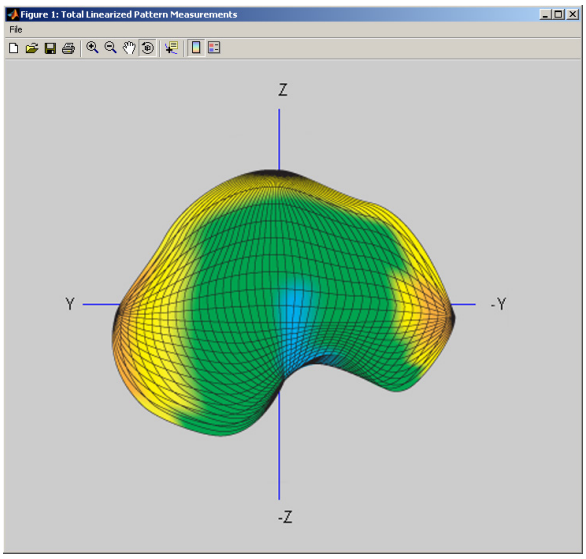
8100 Mobile Device Test System for OTA Test

GNSS OTA Test Solutions for Mobile Devices

Keysight extends its industry-leading Global Navigation Satellite System (GNSS) expertise into the Over-the-Air (OTA) test environment with comprehensive standalone and assisted GNSS OTA test solutions. Powered by the OTA Test Pack option, the system fully automates all GNSS OTA test cases defined in the latest CTIA Test Plan — covering A-GPS L1, A-GPS L1+L5, A-GPS L5 only, A-Galileo E1, A-Galileo E5a and standalone GPS L1, GPS L5, Galileo E1 and Galileo E5a, and GLONASS. China Communications Standards Association (CCSA) defined A-BeiDou, standalone BeiDou, GPS+BeiDou, Beidou only and Beidou prefer with signal B1i, B1c, B2a, B2i, B2b and B3i OTA test requirements. Keysight is the only solution in the industry that is certified to fully cover both CTIA and CCSA OTA GNSS requirements. Customizable parameters enable test time optimization, as well as testing beyond the requirements of these industry standards.

OTA test capability is supported on Keysight's 8100 Location Technology Solution (LTS) for GSM, UMTS, CDMA, LTE, and 5G NR devices. Due to its flexibility, the system can be configured to support testing of all devices in a single solution.

The Keysight LTS solution provides Keysight GNSS OTA automation software and incorporates automation software from the leading suppliers of radiated test solutions: SATIMO's SMM and ETS-Lindgren's EMQuest. Using Keysight's OTA solution requires custom chamber integration, available through Keysight Professional Services, enabling integration of any customer-supplied chamber and associated hardware with the Keysight GNSS OTA solution.



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Applications

Test Labs and Carriers

- Testing to the CTIA OTA
- Test Plan, including A-GPS L1, A-GPS L1 + L5, A-GPS L5 only, A-Galileo E1, A-Galileo E5a, and standalone GPS L1, GPS L5, Galileo E1, and Galileo E5a requirements
- CCSA standalone and assisted GPS+BeiDou, BeiDou only, and BeiDou prefer with signal B1i, B1c, B2a, B2i, B2b, and B3i requirements for devices serving the China-based market
- Operator-specific OTA testing
- Future standards-based OTA testing

Device and chipset manufacturers

- GNSS antenna characterization and performance evaluation
- Overall device GNSS performance
- Impact of antenna placement and device form factor
- Degradation due to interference of A-GNSS and other radiation sources

Benefits

- **Comprehensive radiated GNSS antenna testing:** OTA testing measures the true radiated GNSS performance of mobile devices, unlike conducted testing where GNSS signals bypass the GNSS antenna and key RF components.
- **Automated CTIA and CCSA standalone/A-GNSS OTA testing:** Full automation executes all the test procedures required by the CTIA and CCSA Test Plans with minimum user intervention.
- **Flexible parameters maximize test efficiency:** Optimize test time by modifying parameters and scheduling only the tests that are needed.
- **Testing capability beyond industry standards:** Extensive customization options enable advanced performance testing.

Key Features

- Fully supports CTIA's standalone/A-GNSS OTA Test Plan v9.0 including new A-GPS L1+L5, A-GPS L 5 only, A-Galileo E1, A-Galileo E5a, and 5G NR NSA/SA and 5G Redcap requirements.
- Supports OTA performance testing beyond CTIA Test Plan requirements, e.g., TIS calculation for A-GPS L1+L5.

- Uses standard cellular signaling channels for direct over-the-air measurements with IMS and E911 support for VoLTE and VoNR.
- Conducts tests using standard positioning protocols as required by the specific cellular technology: LPP/SUPL for 5G NR; LPP for LTE; RRLP for GSM; RRC for WCDMA; and IS-801 for CDMA.
- Supports reliable operation with SUPL2.0 using RRLP and LPP protocol.
- Supported by ETS-Lindgren's EMQuest automation software.
- Supported by SATIMO's SMM automation software.
- OTA Open API option for advanced customization and test case development.
- Allows easy integration of Keysight's LTS for a combined GSM, CDMA, UMTS, LTE, and 5G NR GNSS OTA test solution.
- Scalable to industry-leading coverage of conducted standalone/A-GNSS conformance and performance test capability for GSM, CDMA, UMTS, LTE, and 5G NR devices.

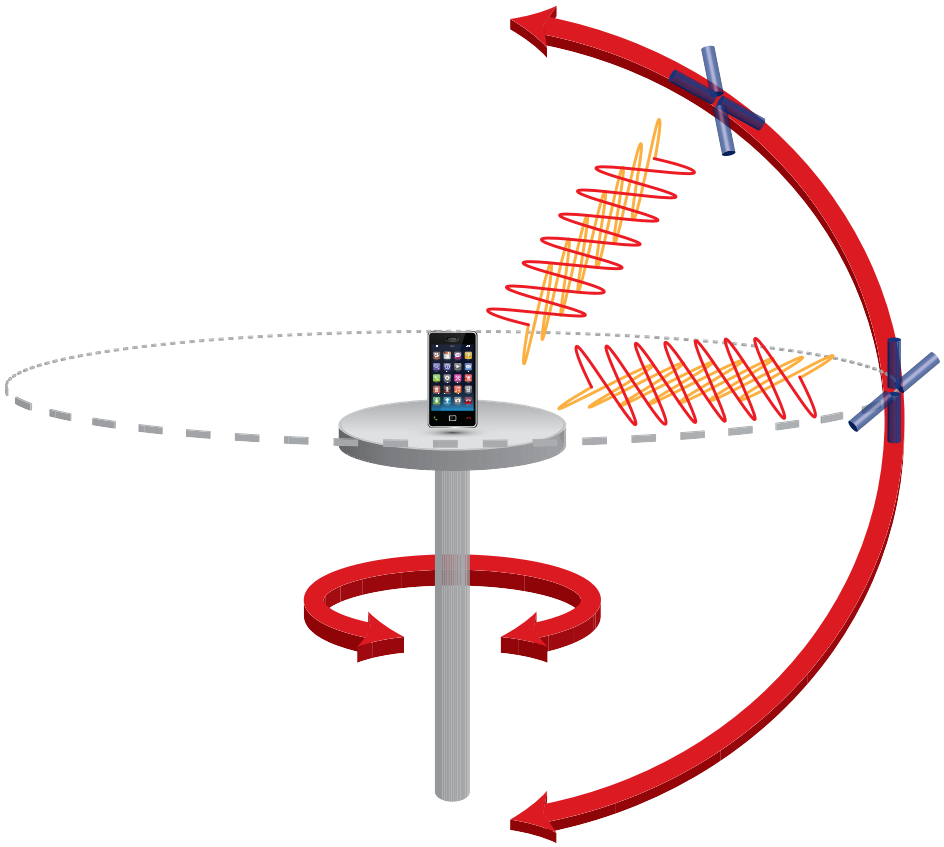

Figure 1. GPS antenna pattern testing at different angles of arrival and signal polarizations

Technical Specifications

- Anechoic chamber with turntable/positioning system, GNSS antenna, and cellular communication antenna
- Typical GNSS OTA path loss range: 30-80dB. Note: Max. 80dB OTA Loss supported
- Linearly polarized GNSS antenna, able to transmit two orthogonal polarizations supporting the frequency 1575.42 MHz for GPS L1, GGLONASS, Galileo E1, BeiDou, B1i, B1c, 1176.45 MHz for GPS L5 and Galileo E5a, 1207.14 MHz for Beidou B2i, and 1278.75 MHz for Beidou B3i
- Minimum of one cellular antenna (two-antenna configuration also supported)
- Uplink Limiting Amplifier
- Turntable or other method of changing angle of arrival

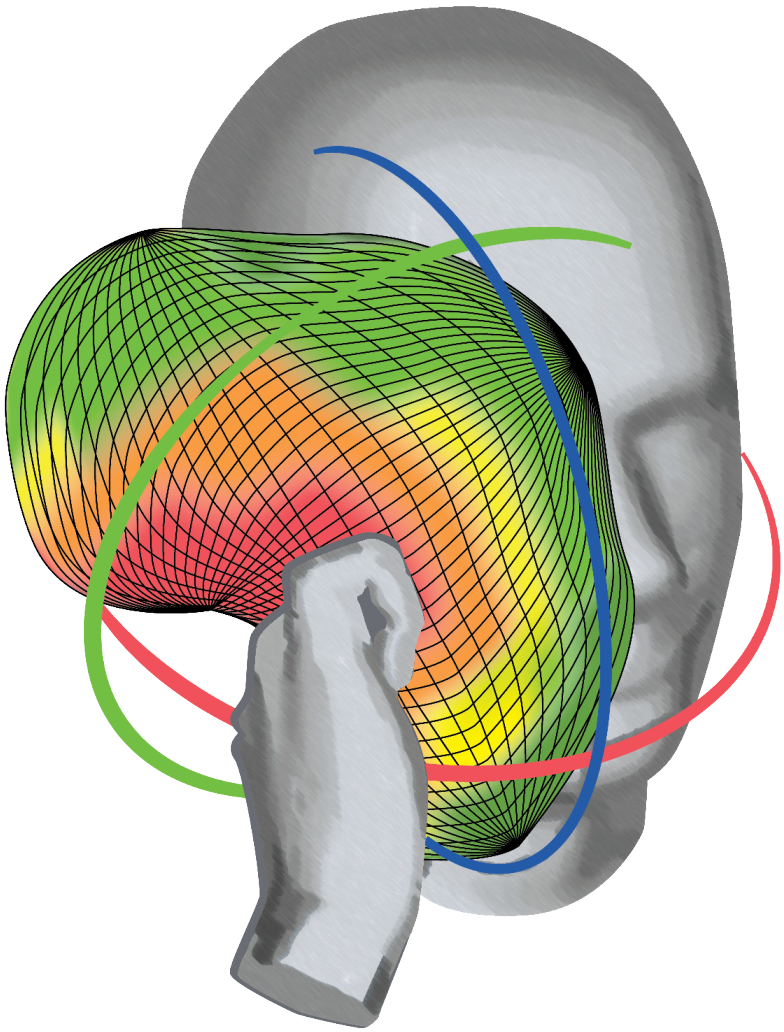

Figure 2. GNSS antenna pattern illustrating the impact of a human head and hand

The CTIA Test Plan

Keysight's OTA test solutions automate the CTIA's OTA Test Plan for standalone/A-GNSS, which includes the following key steps:

- Establish the **Antenna Pattern** by radiating a reference GNSS Signal to the Device Under Test (DUT) and varying the angle of arrival in two planes using the chamber's positioning system.
- Carry out a **Linearization** procedure to characterize and remove any non-linearities introduced by the DUT's measurements.
- Measure **Radiated Sensitivity** by lowering the GNSS signal until the DUT is unable to meet the performance requirements of the Test Plan.
- Calculate Total **Isotropic Sensitivity (TIS), Upper Hemispheric Isotropic Sensitivity (UHIS), and Partial Isotropic GNSS Sensitivity (PIGS)**, metrics which combine the Antenna Pattern and Radiated Sensitivity.
- Calculate Average 3D C/N0 (Avg 3D C/N0), Upper Hemispheric 3D C/N0 (UH 3D C/N0) and Partial Isotropic 3D C/N0 (PIG 3D C/N0), metrics to compare antenna pattern for A-GPS L1, A-GPS L5 and A-Galileo E5a.
- Test **Intermediate Channel Degradation (ICD)** to establish A-GNSS performance across a range of cellular channels likely to be encountered by the DUT while roaming.

Keysight features support for the latest CTIA OTA test plan v4.0, which includes 5G SA Redcap A-GPS L1 and 5G/4G A-GPS L5 Standalone.

List of Keysight A-GNSS OTA solutions approved and placed on the CTIA Authorized Equipment List:

- Keysight UMTS+GSM A-GNSS
- Keysight NR/LTE A-GNSS
- ETS-Lindgren's EMQuest & Keysight UMTS+GSM +A-GPS
- ETS-Lindgren's EMQuest & Keysight NR/LTE/CDMA A-GNSS
- Satimo SMM & Keysight UMTS+LTE A-GPS

Table 1. System Requirements

LTS	All OTA test options are available on the following LTS configurations: 8100- Q750 5G, 8100-Q750, 8100-B750, 8100-A750, 8100-B500, 8100-A500
PLTS	All OTA test options are available on the following PLTS configurations: C2K-CFG[6, 7, 8, 9, 12, 13, and 14]-SYS

Table 2. Keysight A-GNSS OTA Test Solutions

Solution Option	SATIMO SMM	ETS-Lindgren EMQuestTM	Keysight TestDrive-OTA Automation Software	OTA API for Custom Development
8100-LTS (5G, LTE, and UMTS)	√	√	√	√
PLTS (CDMA Devices)	√	√	√	
Custom chamber integration*			√	√

Ordering Information

Due to the modularity and wide range of available 8100 Location Test Solution configurations, please contact your regional Keysight sales representative for detailed ordering information.