

F9650A Compact Antenna Test Range (CATR)

Millimeter-wave over-the-air measurement chamber

Introduction

The Keysight F9650A Compact Antenna Test Range (CATR) chamber fulfills the 5G FR2 RF and RRM one Angle of Arrival (AoA) test demands for design and verification as per 3GPP, and device acceptance as per certification bodies like GCF, PTCRB, and CTIA. It also provides a measurement environment for characterizing wireless and antenna system performance of 5G devices, at millimeter-wave (mmWave) frequencies.



Overview

The Keysight F9650A Over-The-Air (OTA) Compact Antenna Test Range (CATR) chamber provides a measurement environment for characterizing wireless and antenna system performance of devices at millimeter-wave (mmWave) frequencies. Use the chamber with Keysight test and measurement equipment in a range of applications including device R&D and 3GPP / CTIA conformance tests.

Key Features

The key features of Keysight F9650A CATR are:

- Compact antenna test range (CATR)
 - Shielded anechoic chamber
 - Rolled-edge parabolic reflector
 - Dual polarized feed horn assembly with roll motor
 - Roll-over-azimuth DUT positioner
- Controller for feed and device under test (DUT) positioners with triggered data acquisition capability
- Probe feed options for in-band and spurious test frequency ranges
- Calibration kits for chamber validation and calibration
- LED lighting
- USB camera
- Crosshair laser guide for DUT alignment
- Chamber control software
- 3GPP FR1 and/or FR2 link antenna options
- Optional DUT and Phantom mounting fixtures
- Optional extreme temperature condition (ETC) testing
- Optional RF/RRM DVT and Conformance Toolset
- Optional Antenna Measurement Toolset

Supported Use Cases

Keysight F9650A CATR supports, for example, the following use cases:

- Antenna characterization
- Signaling and non-signaling device characterization
- Used with Keysight S8705A RF/RRM DVT & Conformance Toolset for devices:
 - RF & RRM design and verification test
 - RF conformance test, in-band and spurious
 - RF demodulation
 - Radio resource management (RRM) one angle of arrival (AoA)
 - RF regulatory test, in-band and spurious
- Used with Keysight S8707A RF/RRM Carrier Acceptance Toolset for devices
- RF testing under extreme temperature condition (ETC)
- Used with S7601A Antenna Measurement Toolset
 - F7601001A Antenna Pattern Measurement

Contact Keysight for a comprehensive analysis of your custom use case(s).

System Specifications

F9650A: Anechoic chamber

Description	Specification (nominal)	Supplemental information
Construction	Not applicable	Aluminum frame and panels
Height	2000 mm	Fully assembled
Width	2800 mm	Fully assembled
Depth	1600 mm	Fully assembled
Weight	585 kg (1290 lbs)	Fully assembled
Anechoic treatment	120 mm pyramidal anechoic foam	
Isolation		
600 MHz – 7.125 GHz	>70 dB	
7.125 GHz – 18 GHz	>80 dB	
18 GHz – 50 GHz	>80 dB	
Supported Quiet Zone sizes	30 & 40 cm	Depends on Positioner version and In-band feed antenna
Operating voltage	110 – 220 V AC	
Power consumption	320 W input power	
Illumination	LED-based	
Camera	HDMI DVR output	
Ventilation	Dual intakes at the front of the chamber and dual exhausts at the top of the chamber	

F9650A-001: DUT connector panel

Description	Specification (nominal)	Supplemental information
Power ports	4 x DC feedthroughs	100 W max. each
Connectivity ports	2 x Ethernet RJ45 4 x USB 3.0 Type A	100/1000/10 G, PoE 10 G

F9650A-002: DUT connector panel

Description	Specification (nominal)	Supplemental information
Power ports	1 x AC power 4 x DC feedthroughs	120/220 V, 8 Amp max. 100 W max. each
Connectivity ports	1 x Ethernet RJ45 1 x USB 3.0 Type A 1 x USB 3.1 Gen 2 Type C, filtered, powered 1 x Waveguide 2 x BNC	100/1000/10 G, PoE 10 G 10 G, includes external power supply 6-Bore 44.2 GHz, 3 mm optical fiber

F9650A-0R1: RF connector panel

Description	Specification (nominal)	Supplemental information
RF connections	1 x SMA 50 Ω 18 GHz 2 x SMA 50 Ω 18 GHz 3 x 1.85 mm	Used for FR1 / LTE link antennae

F9650A-0P1: MCB connector panel

F9650A: Reflector

Description	Specification (nominal)	Supplemental information
Frequency range	6 – 110 GHz	
Focal length	1.02 m	
Edge treatment	Rolled edge	
Supported Quiet Zone sizes	30 & 40 cm	Depends on Positioner version and In-band feed antenna

F9630A-DL1: Laser guide for 30 cm QZ

Description	Specification (nominal)	Supplemental information
DUT positioning	Laser-based	Two crosshair class 1 laser for exact positioning of the DUT

F9630A-DL2: Laser guide for 40 cm QZ

Description	Specification (nominal)	Supplemental information
DUT positioning	Laser-based	Two crosshair class 1 laser for exact positioning of the DUT

F9630A-P01: Motor control box for the Positioner

F9630A-PG1: DUT positioner for 30 cm QZ

Description	Specification (nominal)	Supplemental information
Azimuth Axis		
Range	$\pm 180^\circ$	
Resolution	0.01°	
Accuracy	$\pm 0.1^\circ$	
Speed	$20^\circ/\text{s}$	
Roll Axis		
Range	$\pm 180^\circ$	
Resolution	0.01°	
Accuracy	$\pm 0.1^\circ$	
Speed	$40^\circ/\text{s}$	
DUT max weight	4.5 kg (10 lbs) 2.0 Nm max torque	
Communications	USB 3.0	
Power requirements	110/220 V AC	320 W input power

F9630A-P04: Motor control box for the Positioner

F9630A-PJ2: DUT positioner for 30 & 40 cm QZ

Description	Specification (nominal)	Supplemental information
Azimuth Axis		
Range	$\pm 180^\circ$	
Resolution	0.01°	
Accuracy	$\pm 0.1^\circ$	
Speed	$80^\circ/\text{s}$ maximum	Requires F9629003A license
Roll Axis		
Range	$\pm 180^\circ$	
Resolution	0.01°	
Accuracy	$\pm 0.1^\circ$	
Speed	$80^\circ/\text{s}$ maximum	Non-triggered for direct move. Triggered for continuous sweep $40^\circ/\text{s}$ maximum speed at $\Rightarrow 2^\circ$ steps
DUT max weight	10 kg (22 lbs) 5.0 Nm max torque	
Communications	USB 3.0	
Power requirements	110/220 V AC	320 W input power

F9630A-AG1: FR1 Link antenna

Description	Specification (nominal)	Supplemental information
Antenna frequency range	600 – 5200 MHz	Includes quantity 2

F9630A-AQ2: FR2 Link antenna

Description	Specification (nominal)	Supplemental information
Antenna frequency range	24 – 50 GHz	

F9630A-AJ2: 24 – 42 GHz In-band feed antenna

Description	Specification (nominal)	Supplemental information
Type	Corrugated dual-polarized horn	
Gain	15 dBi	Varies with frequency
Cross-polarization	30 dB	
Cable loss (to bulkhead)	~5 dB	Varies with frequency
Feed roll	-90 ° to 180 °	

F9630A-AM1: 24 – 55 GHz In-band feed antenna

Description	Specification (nominal)	Supplemental information
Type	Corrugated dual-polarized horn	
Gain	11.5 dBi	Varies with frequency
Cross-polarization	30 dB	
Cable loss (to bulkhead)	~5 dB	Varies with frequency
Feed roll	-90 ° to 180 °	

F9630A-AK2: 6-110 GHz Spurious feed horn assembly with 24-42 GHz In-band feed antenna

Description	Specification (nominal)	Supplemental information
24-42 GHz Main feed antenna	Corrugated dual-polarized horn	
Gain	15 dBi	Varies with frequency
Cross-polarization	30 dB	
Cable loss (to bulkhead)	~5 dB	Varies with frequency
Feed roll	-90 ° to 180 °	
6-24 GHz Spurious feed antenna	Rectangular dual-polarized horn	
Gain	14 dBi	
40-60 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	
50-75 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	
75-110 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	

F9630A-AR1: 6-110 GHz Spurious feed horn assembly with 24-55 GHz In-band feed antenna

Description	Specification (nominal)	Supplemental information
24-55 GHz Main feed antenna	Corrugated dual-polarized horn	
Gain	11.5 dBi	Varies with frequency
Cross-polarization	30 dB	
Cable loss (to bulkhead)	~5 dB	Varies with frequency
Feed roll	-90 ° to 180 °	
6-24 GHz Spurious feed antenna	Rectangular dual-polarized horn	
Gain	14 dBi	
40-60 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	
50-75 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	
75-110 GHz Spurious feed antenna	Corrugated dual-polarized horn	
Gain	13 dBi	

30 cm Quiet Zone performance

Description	Specification (nominal)	Supplemental information
Quiet zone dimensions	30 cm diameter	
24-42 GHz main horn maximum amplitude variation	1.2 dB at 24 GHz 1.2 dB at 32 GHz 1.3 dB at 41 GHz	Varies with frequency F9630A-AJ2 (In-band feed) F9630A-AK2 (Spurious feed)
24-42 GHz main horn maximum phase variation	8 ° at 24 GHz 12 ° at 32 GHz 18 ° at 41 GHz	Varies with frequency F9630A-AJ2 (In-band feed) F9630A-AK2 (Spurious feed)
24-42 GHz main horn path loss	45 dB at 24 GHz 47 dB at 32 GHz 52 dB at 41 GHz	OTA path loss varies with frequency F9630A-AJ2 (In-band feed) F9630A-AK2 (Spurious feed)
24-55 GHz main horn maximum amplitude variation	1.5 dB at 24 GHz 1.6 dB at 32 GHz 2.3 dB at 41 GHz 2.1 dB at 49 GHz	Varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)
24-55 GHz main horn maximum phase variation	9 ° at 24 GHz 8.5 ° at 32 GHz 15 ° at 41 GHz 14 ° at 49 GHz	Varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)
24-55 GHz main horn path loss	50 dB at 24 GHz 50 dB at 32 GHz 53 dB at 41 GHz 55 dB at 49 GHz	OTA path loss varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)

40 cm Quiet Zone performance

Description	Specification (nominal)	Supplemental information
Quiet zone dimensions	40 cm diameter	
24-55 GHz main horn maximum amplitude variation	1.9 dB at 24 GHz 2.3 dB at 32 GHz 2.3 dB at 41 GHz 2.2 dB at 49 GHz	Varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)
24-55 GHz main horn maximum phase variation	11 ° at 24 GHz 9 ° at 32 GHz 17 ° at 41 GHz 16.5 ° at 49 GHz	Varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)
24-55 GHz main horn path loss	50 dB at 24 GHz 50 dB at 32 GHz 53 dB at 41 GHz 55 dB at 49 GHz	Varies with frequency F9630A-AM1 (In-band feed) F9630A-AR1 (Spurious feed)

F9630A-Dxx: DUT holders for 30 cm QZ

Description	Specification (nominal)	Supplemental information
Alignment Option	DUT type	Model option
1	Small smartphone	F9630A-D11
1	Large smartphone	F9630A-D12
1	Tablet	F9630A-D14
1	Mobile Reference Design	F9630A-D15
1	Large Mobile Ref Design	F9630A-D16
2	Smartphone or tablet	F9630A-D21
3	Small smartphone	F9630A-D31
3	Large smartphone	F9630A-D32
3	Small tablet	F9630A-D33
3	Large tablet	F9630A-D34

F9630A-DFx: Phantom fixtures for 30 cm QZ

Description	Specification (nominal)	Supplemental information
Phantom type	DUT type	Model option
Single hand / head	Smartphones	F9630A-DF0
Dual hand	Smartphones	F9630A-DF1
Single hand	Smartphones	F9630A-DF2

F9630A-M03: DUT adaptor for 45 cm sphere

Description	Specification (nominal)	Supplemental information
DUT adaptor	For 30 cm sphere DUT holders and Phantom fixtures to be used in 45 cm sphere	Required with F9630A-PJ2 Positioner

F9630A-MB1: Security brackets

Description	Specification (nominal)	Supplemental information
OTA chamber security bracket	To secure the chamber to the floor	Set of 4

F9631A: Temperature control unit

Description	Specification (nominal)	Supplemental information
Facility requirements	Clean Dry Air	See site preparation guide for more details
Electrical requirements	240 V / 30 A, single phase	See site preparation guide for more details
Minimum inlet air pressure to TCU	120 PSIG (8.3 BAR)	See site preparation guide for more details
Minimum inlet air flow to TCU	30 CFM	See site preparation guide for more details
Maximum outlet air flow to 30 cm sphere DUT temperature enclosure kit	12 CFM	
Maximum outlet air flow to 45 cm sphere DUT temperature enclosure kit	24 CFM	

F9631TA1A: DUT temperature enclosure kit 30 cm sphere

Description	Specification (nominal)	Supplemental information
Enclosure size	DUT within 30 cm sphere centered on azimuth and roll axes	Polymethacrylimide (PMI) based structural foam material
Standard temperature range	-10 °C to +55 °C	Requires F9629040A license
Transmission loss	0.3 dB at 39 GHz	

F9631TB1A: DUT temperature enclosure kit 45 cm sphere

Description	Specification (nominal)	Supplemental information
Enclosure size	DUT within 45 cm sphere centered on azimuth and roll axes	Polymethacrylimide (PMI) based structural foam material
Standard temperature range	-10 °C to +55 °C	Requires F9629040A license
Extended temperature range	-40 °C to +100 °C	Requires F9629041A license
Transmission loss	0.3 dB at 39 GHz	

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