

Keysight Technologies

Remote Radio Head Tester

E6610A

700 MHz to 2.7 GHz

Data Sheet



Definitions and Conditions

Specification (spec): represents warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range of 0 to 45 °C, unless otherwise stated, and after a 1 hour warm-up period. The specifications include measurement uncertainty. Data represented in this document are specifications unless otherwise noted.

Typical (typ): describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 80% of the units exhibit with a 95% confidence level at room temperature (approximately 25 °C). Typical performance does not include measurement uncertainty.

Nominal (nom): describes the expected mean or average performance, or an attribute whose performance is by design, such as the 50 Ω connector. This data is not warranted and is measured at room temperature (approximately 25 °C).

Measured (meas): describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drive vs. time. This data is not warranted and is measured at room temperature (approximately 25 °C).

Specifications¹

Frequency	
Range	
Option 503	700 MHz to 2.7 GHz
CW frequency resolution	100 kHz
Frequency reference	
Aging rate, stability	Refer to timebase specifications
Frequency switching speed	< 5 ms, nominal
Triggering	
Trigger types	Free run, external (sync input)
Trigger delay	0 to 10 ms
Trigger resolution	32.55 ns
Internal timebase reference oscillator (TCXO)	
Reference frequency	10 MHz, nominal
Aging rate	< ± 1 ppm, first year @ 25 °C
Temperature stability	< ± 2.5 ppm, -40 °C to +70 °C
Frequency reference	
Input	
Frequency	10 MHz only, AC coupled (square wave or sine wave)
Lock range	± 50 ppm, nominal (relative to internal TCXO frequency)
Amplitude	0 dBm, nominal
Impedance	50 Ω, nominal
Output (the unit will route either internal TCXO or external 10 MHz signal to this connector)	
Frequency	10 MHz only
Amplitude	0 dBm, nominal
Impedance	50 Ω, nominal

1. Specifications apply over a temperature of 25 ± 10 °C unless otherwise noted.

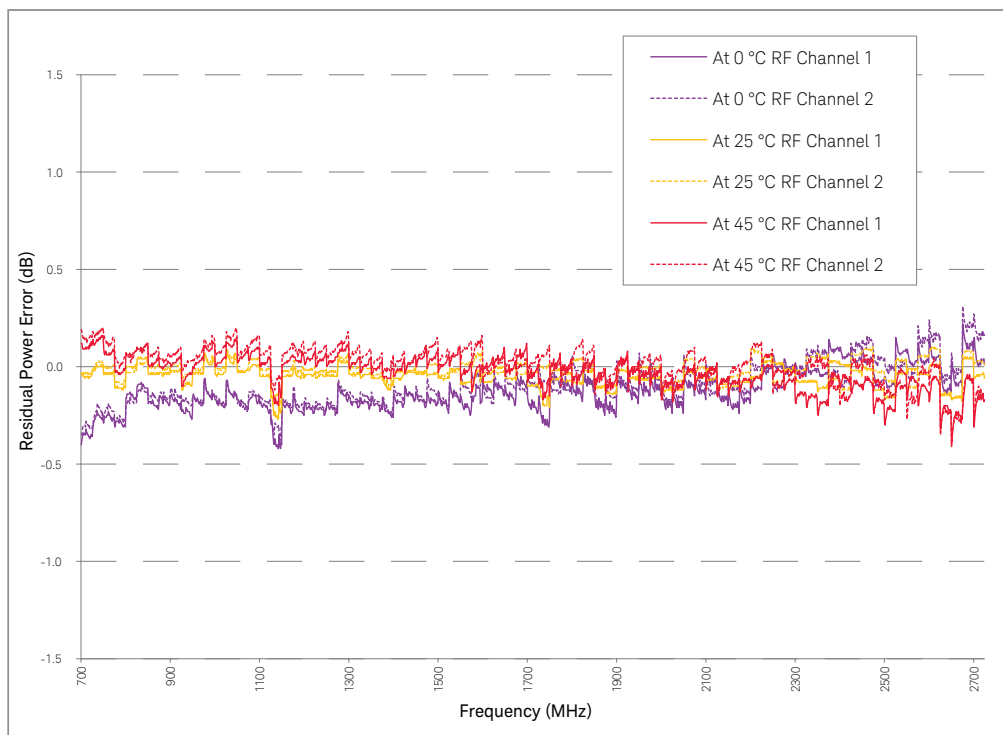


Figure 1. Measured CW absolute level accuracy vs. frequency over temperature

Vector signal generator performance**General**

Number of channels	2 RF channels, independent or synchronized operation
Synchronization between channels	< 65 ns, nominal

Amplitude

Output level ranges	
700 MHz to 2.7 GHz	-80 dBm to 0 dBm (+10 typical), CW -80 dBm to 0 dBm, typical, LTE modulation

Absolute level accuracy, CW	
-40 to 0 dBm	< ± 0.75 dBm typical, (Load SWR < 1.2:1)

Setting resolution	0.1 dB
--------------------	--------

Amplitude switching speed	< 5 ms, nominal
---------------------------	-----------------

VSWR	
700 MHz to 2.7 GHz	< 1.9:1, nominal

Baseband generator

Bandwidth	60 MHz, nominal
Frequency response	< ± 1 dB pass band response over bandwidth, nominal

Sample rate	Bandwidth
7.68 MSa/s	5 MHz
15.36 MSa/s	10 MHz
30.72 MSa/s	20 MHz

DAC resolution	16 bits
----------------	---------

Memory	64 MB, total storage for both baseband generators
--------	---

The following shows the approximate number of LTE waveforms that can be stored:

LTE bandwidth	Number of 10 ms waveforms
5 MHz	128
10 MHz	64
20 MHz	32

Vector signal analyzer performance**General**

Number of channels	2 RF channels, both must be tuned to the same frequency
Synchronization between channels	< 65 ns, nominal

Digitizer

Volatile (RAM) memory (shared between signal generation and capture)	128 MB
---	--------

Memory usage per 10 ms frame, per channel

	5 MHz bandwidth	10 MHz bandwidth	20 MHz bandwidth
Baseband signal source	307.2 KB	614.4 KB	1.2288 MB
Baseband signal capture	307.2 KB	614.4 KB	1.2288 MB
RF signal capture	2.4576 MB	2.4576 MB	2.4576 MB
RF signal generator	307.2 KB	614.4 KB	1.2288 MB

Example (1): Bidirectional, two-channel operation with 10 MHz BW = $2 * (3 * 614.4 \text{ KB} + 2.4576 \text{ MB}) = 8.6016 \text{ MB/frame}$

Example (2): Uplink only, two-channel operation with 10 MHz BW = $2 * (2 * 614.4 \text{ KB}) = 2.4576 \text{ MB/frame}$

Non-volatile (Flash) memory	64 MB
-----------------------------	-------

ADC resolution	12 bits
----------------	---------

Frequency and time specifications

Frequency range	
-----------------	--

Option 503	700 MHz to 2.7 GHz
------------	--------------------

Resolution	100 kHz
------------	---------

Frequency switching speed	< 5 ms, nominal
---------------------------	-----------------

Analysis bandwidth	60 MHz, nominal
--------------------	-----------------

Frequency response	< ± 1 dB pass band response over analysis bandwidth, nominal
--------------------	--

Triggering	
------------	--

Trigger types	Free run, external
---------------	--------------------

Trigger delay	10 ms (same as signal generator)
---------------	----------------------------------

Trigger resolutions	32.55 ns (same as signal generator)
---------------------	-------------------------------------

Amplitude accuracy and range specification

Input level range	-25 dBm to +5 dBm (range over which best measurements are made)
-------------------	---

Input attenuator range	30 dB in 1 dB steps (set automatically based on input level selected)
------------------------	---

CW absolute amplitude accuracy ¹	< ± 0.75 dB typical (input -40 to 0 dBm)
---	--

Input voltage standing wave ratio (VSWR)	
--	--

700 MHz to 2.7 GHz	< 1.9:1 nominal
--------------------	-----------------

Dynamic range	
---------------	--

Displayed average noise level	< -83 dBm/MHz, nominal
-------------------------------	------------------------

1. Accuracy applies when source SWR < 1.2:1

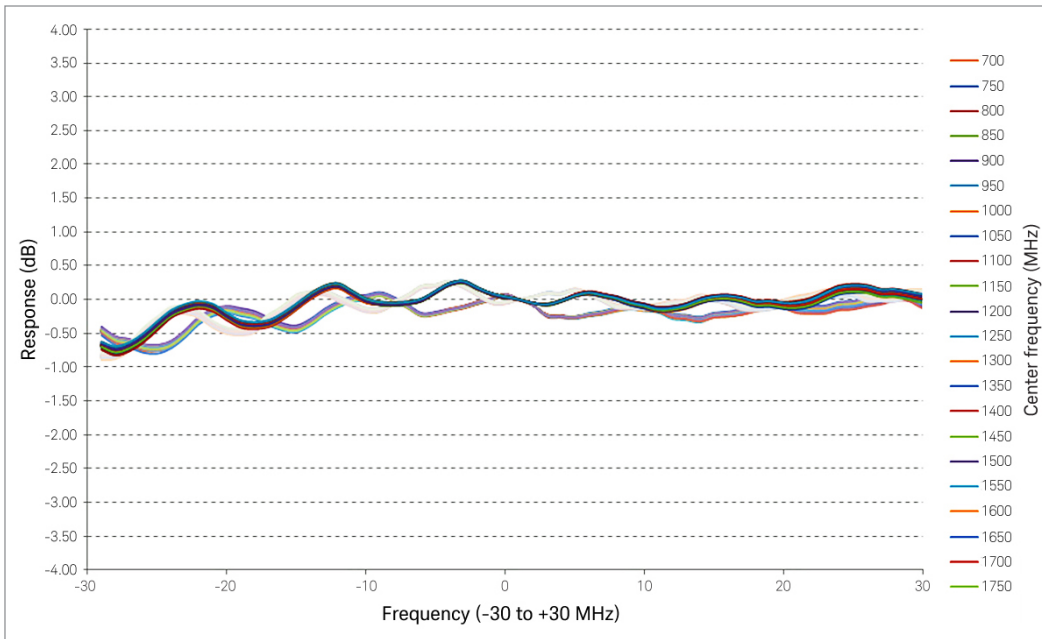


Figure 2. Frequency response over signal capture bandwidth, MHz

RF port isolation

Transmit branch to transmit branch isolation	50 dB, nominal
Transmit branch to receiver branch isolation	60 dB, nominal

CPRI specifications

CPRI specification	V4.2
Operating mode	Radio equipment (CPRI master)
Line rate	1-7 (614.4 Mbps to 9830.4 Mbps)
Number of CPRI generators	2
SFP port 1	SFP+ type, active
SFP port 2	SFP+ type, inactive, reserved for future use
IQ sample width	15 or 16 bit, signed
IQ bit order	LSB
Mapping method	IQ interleaved and non-interleaved
Scrambling	Supported for CPRI line rate of 4915.2 Mbps or higher
Tunneled Ethernet	Fast C&M plane tunnel Ethernet providing pass-through of data packets for device control under test, e.g. RRH

Application specifications

Base application capabilities

Signal creation	Playback of user created waveform files over RF and CPRI ports CW output over RF ports
Signal analysis	Signal analysis spectrum Time domain, IQ capture from RF and CPRI ports

N5121A LTE FDD signal creation and analysis software

Key measurements	Channel power Occupied BW EVM constellation EVM versus subcarrier EVM versus time ACLR Spectrum emissions mask CCDF Option BR1: Bit error rate on CPRI receivers
------------------	--

Generation specifications

Included waveforms	Downlink: E-TM 1.1 and 3.1, at 5, 10, 20 MHz BW Uplink: FRC A3-4, A3-5, and A3-7 (QPSK)	
Error vector magnitude (EVM), nominal	Measurement conditions: E-TM 3.1 64QAM modulation -25 to 0 dBm	
Bandwidth	EVM at 700 MHz, nominal	EVM at 2700 MHz, nominal
5 MHz	< 2%	< 2.5%
10 MHz	< 1.5%	< 2.5%
20 MHz	< 1.5%	< 2.5%
Distortion performance		
Harmonics	-40 dBc	
ACLR		
Measurement conditions	-3 dBm output power, E-TM 1.1, QPSK modulation, 5, 10, or 20 MHz bandwidth	
E-UTRA ACLR, adjacent and alternate	-61 dBc nominal	

Analysis specifications

Transmit power		
Measurement conditions	Bandwidths: 5, 10, 20 MHz 20 °C to 25 °C, -25 dBm to +5 dBm, unless otherwise stated	
Absolute power accuracy	< ± 0.75 dB, typical	
Error vector magnitude (EVM)		
Measurement conditions	E-TM 3.1 64QAM modulation Bandwidths: 5, 10, 20 MHz 0°C to +45°C, -25 dBm to +5 dBm	
EVM	< 1.0% nominal at 700 MHz, < 2.0% nominal at 2.7 GHz	

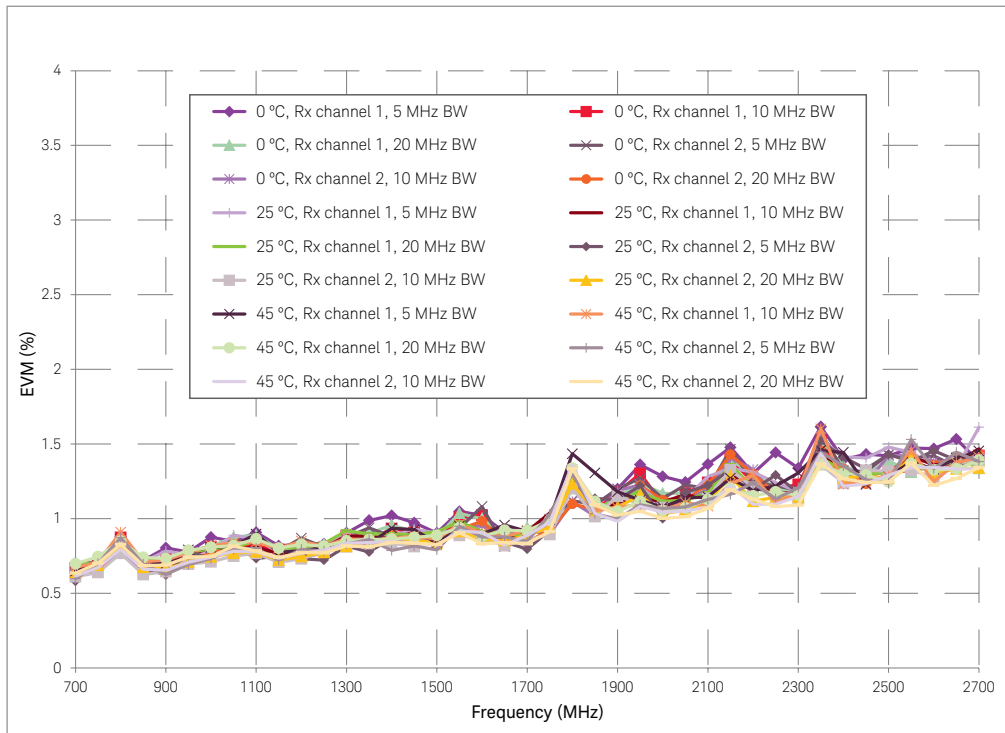


Figure 3. 64QAM measured EVM at 0, 25 & 45 °C

Distortion performance:	
Measurement conditions	E-TM 1.1 with QPSK modulation, 0 dBm input signal, 5, 10, or 20 MHz bandwidths, after 15 s stabilization time
ACLR (E-UTRA, adjacent & alternate)	<-55 dBc, nominal
Supported Spectrum Emission Mask (SEM) definitions	Category A, E-UTRA bands < 1 GHz Category A, 1 GHz < E-UTRA bands < 3 GHz Category B (Option 2)
N5122A LTE TDD signal creation and analysis software	
Same as N5121A specifications	TDD multiplex modes: 1 4, 1 7, 2 5, 2 7, 3 8 ¹

		Special subframe configuration										
		0	1	2	3	4	5	6	7	8	9	
UL/DL config	0											
	1											
	2											
	3											
	4											
	5											
	6											
		Waveforms included in N5122A										
		Supported with user-supplied waveforms										

Figure 4. Supported TDD frame configurations

- The TDD multiplex modes supported by the included waveform files are denoted by X|Y, where X indicates the uplink/downlink configuration, and Y indicates the special subframe configuration.

General specifications	
Power requirements	
Voltage and frequency	100 to 240 V, 50/60 Hz nominal
Power consumption	60 W max, 30 W typical
Size and weight	
Dimensions	50 mm H x 485 mm W x 370 mm D (2" H x 19" W x 14.6" D)
Rack space	1U x 1 rack width
Weight	5.9 kg (13 lb)
Environmental characteristics	
Operating temperature	0 to 45 °C, 10% to 95% RH non-condensing
Storage temperature	-40 to +70 °C, 10% to 95% RH non-condensing
EMC: Complies with the essential requirements of the European EMC Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity)	IEC/EN 61326-1 CISPR Pub 11 Group 1, class A AS/NZS CISPR 11 ICES/NMB-001 This ISM device complies with Canadian ICES-001. Cet appareil ISM est conforme a la norme NMB-001 du Canada
South Korean Class A EMC declaration: This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home	A 급 기기 (업무용 방송통신기자재)이 기기는 업무용 (A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으로 합니다 .
SAFETY: Complies with the essential requirements of the European Low Voltage Directive as well as current editions of the following standards (dates and editions are cited in the Declaration of Conformity)	IEC/EN 61010-1 Canada: CSA C22.2 No. 61010-1 USA: UL std no. 61010-1
Acoustic statement: (European Machinery Directive)	Acoustic noise emission LpA < 70 dB Operator position Normal operation mode per ISO 7779
Calibration cycle	The recommended calibration cycle is one year; calibration services available through Keysight service centers
Maximum applied reverse power TX1/TX2 & RX1/RX2	+10 dBm, 0 V _{dc}
Warranty	Standard 3-year warranty
Remote programming Interface	LAN RJ45

Control of the E6610A requires application software to be installed on a remote PC based controller. For PC requirements and to download the software please visit: http://www.keysight.com/find/E6610A_Software. The application software supports programming via SCPI.

Verify your PC meets the system requirements listed in the following table.

Characteristic	Requirement
Operating system	Microsoft Windows 7 Professional, Enterprise, or Ultimate (32 bit or 64 bit)
CPU	1 GHz (> 2 GHz recommended)
RAM	2 GB (4 GB recommended)
Video RAM	128 MB (512 MB recommended)
Hard disk	1 GB available
Interface support	LAN

To find a current Declaration of Conformity for a specific Keysight product, go to: <http://www.keysight.com/go/conformity>

Front panel

Status indicators	
SYS PLL	Frequency reference: Orange = Internal Green = External
SFP1	SFP module status: Orange = Initializing Green = Link active
SFP2	Reserved for future use: Orange = Initializing
AxC TX	Transmit baseband configuration status: Orange = Awaiting config Green = Configured
AxC RX	Receiver data capture: Green = Successful data capture
RF TX	Front panel Tx port(s): Green = active
RF RX	Front panel Rx port(s): Green = Rx port(s) configured for data capture
STS	CPRI link to DUT status: Orange = Link initialized Flashing Green = Network discovery Green = DUT configured to network
LAN TCP/IP interface	RJ45 100 Base-T
Serial	DB9 RS-232, for factory use only
Tx1/Tx2 & Rx1/Rx2	SMA female 3.5 mm, 50 Ω , nominal
Trig Connector Impedance	Reserved for future use BNC female > 50 Ω nominal
SFP1/SFP2 connector type	SFP+ module socket for CPRI interface (fiber or copper)

Rear panel

AUX1	Reserved for future use
AUX2	Reserved for future use
SYNC OUT Connector Impedance Purpose	BNC female High Z (LV TTL) output, capable of driving 50 Ω (no T-pieces) Frame trigger output
SYNC IN Connector Impedance Purpose	BNC female High Z (LV TTL) input, capable of driving 50 Ω (no T-pieces) Frame trigger input
10 MHz IN Frequency Lock range Amplitude Impedance	10 MHz only, AC coupled (square wave or sine wave) \pm 50 ppm, nominal (relative to internal TCXO frequency) 0 dBm, nominal 50 Ω , nominal
10 MHz OUT (the unit will route either internal TCXO or external 10 MHz signal to this connector) Frequency Amplitude Impedance	10 MHz only 0 dBm, nominal 50 Ω , nominal

E6610A-AK1 accessory kit

SFP+ transceiver modules

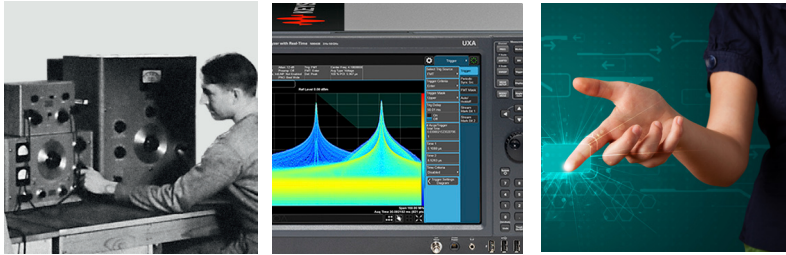
Wavelength	1310 nm Class 1 DFB laser
Connector	LC duplex
Max link length	10 km
Max data rate	10.5 Gb/s
Temperature range	-40 to +85 °C

Cable

Type	Single-mode fiber with yellow 2 mm jacket
Length	3 m
Connector	LC duplex

Evolving

Our unique combination of hardware, software, support, and people can help you reach your next breakthrough. **We are unlocking the future of technology.**



From Hewlett-Packard to Agilent to Keysight



myKeysight
www.keysight.com/find/mykeysight
 A personalized view into the information most relevant to you.

Keysight Infoline
www.keysight.com/find/Infoline
 Keysight's insight to best in class information management. Free access to your Keysight equipment company reports and e-library.

KEYSIGHT SERVICES
Keysight Services
www.keysight.com/find/services
 Our deep offering in design, test, and measurement services deploys an industry-leading array of people, processes, and tools. The result? We help you implement new technologies and engineer improved processes that lower costs.

Three-Year Warranty
www.keysight.com/find/ThreeYearWarranty
 Keysight's committed to superior product quality and lower total cost of ownership. Keysight is the only test and measurement company with three-year warranty standard on all instruments, worldwide. And, we provide a one-year warranty on many accessories, calibration devices, systems and custom products.



Keysight Assurance Plans
www.keysight.com/find/AssurancePlans
 Up to ten years of protection and no budgetary surprises to ensure your instruments are operating to specification, so you can rely on accurate measurements.



Keysight Channel Partners
www.keysight.com/find/channelpartners
 Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/E6610A

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 11 2626
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
 (BP-06-08-16)



www.keysight.com/go/quality
 Keysight Technologies, Inc.
 DEKRA Certified ISO 9001:2015
 Quality Management System