E6640A EXM

Wireless test set

A Cost-Effective and Repeatable Wireless Device Manufacturing Solution

In wireless device manufacturing, meeting ever-tougher goals and tighter schedules is easier when you have access to the best resources. The Keysight E6640A EXM Wireless Test Set scales with your production needs and is in sync with the latest cellular and wireless local area network (WLAN) chipsets. Better yet, it delivers the speed, accuracy, and port density you need to ramp up rapidly and optimize full-volume manufacturing. The EXM is designed for multi-device testing with up to four transceivers (TRX), each with vector signal analyzer (VSA), vector signal generator (VSG), and four-port radio frequency input and output connections (RFIO). Multi-format cellular and WLAN devices are easily tested with this one solution.

- Optimize multi-device testing with up to four TRX channels per EXM
- Easily test multi-format devices with standards-based Keysight PathWave X-Series Measurement Applications
- Achieve maximum throughput with raw hardware speed and advanced sequencing
- Increase yield with superior signal quality and measurement accuracy

KEYSIGHT

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Scale your production line with TRX modules

Each TRX module contains fully integrated VSA, VSG, and RFIO. The RFIO uses rugged N-type connectors with four full-duplex (FD) ports (default) and is designed for the demanding wireless device manufacturing environment.

Each TRX module supports cellular and wireless connectivity bands and bandwidths. New TRX modules can be added to existing chassis to contain up to four TRX.

Software applications test many technologies

Get consistent and repeatable results with standards-based PathWave X-Series Measurement Applications from Keysight. One application license covers up to four TRX units per chassis. Test the following technologies.

Cellular

- 5G NR (Figures 1 and 2)
- C-V2X
- LTE and LTE-Advanced TDD and FDD with carrier aggregation for inter- and intra-band scenarios
- NB-IoT and eMTC
- W-CDMA and HSPA+
- GSM, EDGE, and EDGE Evo

Wireless connectivity

- WLAN 802.11a/b/g/j/p/n/af/ah/ac/ax with MIMO (2x2, 3x3, 4x4), switched MIMO for manufacturing test, and true MIMO using multiple TRX for design verification
- *Bluetooth*®, EDR, BLE, and BT 5.2
- GNSS: GPS, Galileo, GLONASS, Beidou, SBAS, and QZSS
- Digital video

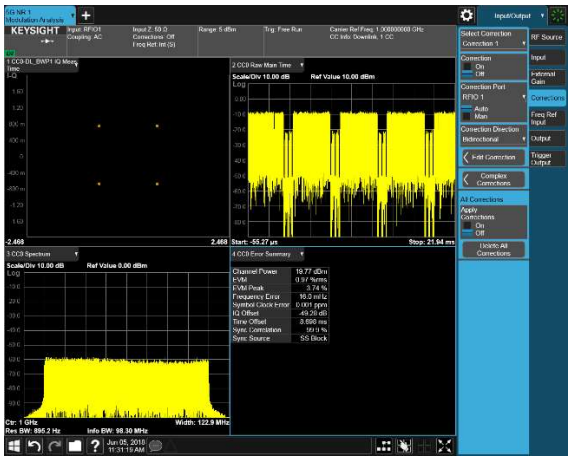

Figure 1. 5G NR modulation analysis results

Figure 2. 5G NR adjacent channel power (ACP) results

Performance Characteristics

Definitions

Specification (spec)

The warranted performance of a calibrated instrument that has been stored for a minimum of 2 hours within the operating temperature range and after a 45-minute warm up period. Specifications are valid from 20 to 35 °C unless otherwise noted.

Typical (typ)

The characteristic performance, that 95 percent of the units exhibit with a 95 percent confidence level. This data, shown in Italics, is not warranted, does not include measurement uncertainty, and is valid only at room temperature (approximately 25 °C).

Nominal

The mean or average characteristic performance, or the value of an attribute that is determined by design. This data is not warranted and is measured at room temperature (approximately 25 °C).

Conditions

These additional conditions are required for the test set to meet its specifications.

- RF, IF, and source alignments have been run within the previous 7 days
- ALL alignment has been run either within the previous 8 hours or if the temperature has changed more than 5 °C from the previous ALL alignment

Vector signal analyzer performance

All options apply to TRX modules unless otherwise noted.

Memory and sampling	Performance	Conditions
Capture depth	4 GB memory 512 MSa of IQ data	

Frequency	Performance	Conditions
Frequency ranges	380 MHz to 3.8 GHz	All RF ports for E6640A-504
	380 MHz to 6.0 GHz	All RF ports for E6640A-506
	380 MHz to 6.0 GHz with 5G NR bands	All RF ports for E6640A-5B0
	1.1 to 1.8 GHz, 2.3 to 2.6 GHz, 4.8 to 6.0 GHz	All RF ports for E6640A-5WC
Specified frequency ranges	380 to 495 MHz 495 to 695 MHz[1] 695 to 920 MHz 920 to 960 MHz[1] 1425 to 1485 MHz 1485 to 1560 MHz[1] 1620 to 2030 MHz 2100 to 2200 MHz[1] 2300 to 2700 MHz 2700 to 3400 MHz[2] 3400 to 3800 MHz 3800 to 4900 MHz[2] 4900 to 6000 MHz	Dependent on selected frequency range option
Frequency reference	Refer to timebase	
CW measurement frequency accuracy	*(Transmitter frequency x frequency reference accuracy) ± 50 Hz, typical*	
CW measurement frequency resolution	*1 Hz, typical*	
Maximum analysis bandwidth	40 MHz	E6640A-B40, E6640A-B85 or E6640A-B1X over 380 to 694 MHz
	60 MHz	E6640A-B85 over 695 to 800 MHz and all other specified frequency ranges, E6640A-B1X over 695 to 800 MHz
	100 MHz	E6640A-B1X over 3400 to 3800 MHz
	160 MHz	E6640A-B1X over all other specified frequency ranges
Trigger types	Free run, external 1/2, RF burst, video, internal	Sequence analyzer
	Free run, external 1/2, RF burst, video, line, periodic	IQ analyzer
Trigger delay range	-15 to 500 ms	
Trigger resolution	0.1 µs	

1. Frequencies are not supported on M9430A and M9431A TRX modules
2. Frequencies supported only on M9433A TRX module with option E6640A-5B0

Amplitude	Performance	Conditions
Input level ranges (average power)	-70 to 30 dBm	E6640A-2HD (half duplex) RF3 I|O and RF4 I|O inputs
	-65 to 36 dBm	E6640A-2FD (full duplex) RFIO1 and RFIO2 inputs, E6640A-4FD for all inputs
Input VSWR	*< 1.4:1, typical* *< 1.25:1, typical*	380 to 2030 MHz RF3 I|O and RF4 I|O inputs RFIO1 and RFIO2 inputs
	< 1.6:1, typical *< 1.5:1, typical*	2100 to 2200 MHz, 2300 to 3800 MHz RF3 I|O and RF4 I|O inputs RFIO1 and RFIO2 inputs
	< 1.7:1, typical	3800 to 4900 MHz RFIO1 and RFIO2 inputs
	< 1.6:1, typical *< 1.7:1, typical*	4900 to 6000 MHz RF3 I|O and RF4 I|O inputs RFIO1 and RFIO2 inputs
Residual responses	*< -85 dBm, typical* *< -82 dBm, typical*	380 to 5790 MHz, < -30 dBm input > 5790 to 6000 MHz, < -30 dBm input
Other spurious	*< -62 dBc, typical*	Offsets from 10 MHz up to half the maximum analysis bandwidth from the signal with analyzer ranged to peak signal power level
Phase noise	< -110 dBc/Hz, nominal < -130 dBc/Hz, nominal	Noise sidebands for 900 MHz center frequency 10 kHz offset 1 MHz offset

CW absolute amplitude accuracy performance

Measured at E6640A-2FD/2HD RF3/4 I|O ports configured to input mode over specified frequencies.

Frequency range	Input level -70 to ≤ -8 dBm	Input level > -8 to 24 dBm
380 to < 490 MHz	< ±0.55 dB, < *±0.30 dB, typical*	< ±0.45 dB, < *±0.20 dB, typical*
490 to < 600 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.40 dB, < *±0.20 dB, typical*
600 to < 640 MHz	< ±0.60 dB, < *±0.40 dB, typical*	< ±0.90 dB, < *±0.45 dB, typical*
640 to < 695 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
695 to < 800 MHz	< ±0.60 dB, < *±0.30 dB, typical*	< ±0.60 dB, < *±0.30 dB, typical*
800 to < 920 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
920 to 960 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
1425 to < 1485 MHz	< ±0.65 dB, < *±0.30 dB, typical*	< ±0.55 dB, < *±0.25 dB, typical*
1485 to 1560 MHz	< ±0.50 dB, < *±0.20 dB, typical*	< ±0.60 dB, < *±0.25 dB, typical*
1620 to 2030 MHz • 40 MHz BW • 160 MHz BW	 < ±0.45 dB, < *±0.20 dB, typical* < ±0.70 dB, < *±0.35 dB, typical*	 < ±0.45 dB, < *±0.25 dB, typical* < ±0.70 dB, < *±0.35 dB, typical*
2100 to 2200 MHz	< ±0.55 dB, < *±0.25 dB, typical*	< ±0.65 dB, < *±0.20 dB, typical*
2300 to 2700 MHz • 40 MHz BW • 160 MHz BW	 < ±0.55 dB, < *±0.25 dB, typical* < ±0.80 dB, < *±0.45 dB, typical*	 < ±0.50 dB, < *±0.20 dB, typical* < ±0.65 dB, < *±0.30 dB, typical*
3400 to 3800 MHz	< ±0.65 dB, < *±0.30 dB, typical*	< ±0.65 dB, < *±0.25 dB, typical*
4900 to 6000 MHz • 40 MHz BW • 160 MHz BW	 < ±0.75 dB, < *±0.30 dB, typical* < ±0.90 dB, < *±0.50 dB, typical*	 < ±0.60 dB, < *±0.25 dB, typical* < ±0.75 dB, < *±0.40 dB, typical*

Measured at RFIO1/2 inputs, and E6640A-4FD RFIO3/4 inputs over specified frequencies.

Frequency range	Input level -65 to < -8 dBm	Input level ≥ -8 to 33 dBm
380 to < 490 MHz	< ±0.50 dB, < *±0.25 dB, typical*	< ±0.50 dB, < *±0.25 dB, typical*
490 to < 600 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.45 dB, < *±0.20 dB, typical*
600 to < 640 MHz	< ±0.75 dB, < *±0.40 dB, typical*	< ±1.20 dB, < *±0.60 dB, typical*
640 to < 695 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.55 dB, < *±0.30 dB, typical*
695 to < 800 MHz	< ±0.60 dB, < *±0.40 dB, typical*	< ±0.60 dB, < *±0.35 dB, typical*
800 to < 920 MHz	< ±0.50 dB, < *±0.20 dB, typical*	< ±0.45 dB, < *±0.25 dB, typical*
920 to 960 MHz	< ±0.40 dB, < *±0.20 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
1425 to < 1485 MHz	< ±0.65 dB, < *±0.30 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
1485 to 1560 MHz	< ±0.45 dB, < *±0.20 dB, typical*	< ±0.50 dB, < *±0.20 dB, typical*
1620 to 2030 MHz • 40 MHz BW • 160 MHz BW	 < ±0.50 dB, < *±0.25 dB, typical* < ±0.65 dB, < *±0.35 dB, typical*	 < ±0.45 dB, < *±0.20 dB, typical* < ±0.60 dB, < *±0.30 dB, typical*
2100 to 2200 MHz	< ±0.60 dB, < *±0.20 dB, typical*	< ±0.60 dB, < *±0.25 dB, typical*
2300 to 2700 MHz	< ±0.55 dB, < *±0.25 dB, typical*	< ±0.50 dB, < *±0.25 dB, typical*
2700 to < 3400 MHz	< ±0.55 dB, < *±0.30 dB, typical*	< ±0.57 dB, < *±0.25 dB, typical* ≥ -8 to 20 dBm input
3400 to 3800 MHz	< ±0.65 dB, < *±0.30 dB, typical*	< ±0.65 dB, < *±0.25 dB, typical*
3800 to < 4900 MHz	< ±0.66 dB, < *±0.40 dB, typical*	< ±0.70 dB, < *±0.30 dB, typical*
4900 to 6000 MHz • 40 MHz BW • 160 MHz BW	 < ±0.85 dB, < *±0.45 dB, typical* < ±0.95 dB, < *±0.55 dB, typical*	 < ±0.65 dB, < *±0.30 dB, typical* < ±0.90 dB, < *±0.45 dB, typical*

Vector signal generator performance

All options apply to TRX modules unless otherwise noted.

Arbitrary waveforms	Performance	Conditions
Maximum arb bandwidth	200 kHz	76 to 110 MHz
	20 MHz	207 to 222 MHz
	40 MHz	380 to 490 MHz
	80 MHz	490 to 800 MHz
	160 MHz	All other frequency ranges
Arb sample memory	4 GB memory 512 MSa of IQ data	Storage capacity

Frequency	Performance	Conditions
Frequency ranges	< 380 MHz	All RF ports for E6640A-5LF
	380 MHz to 3.8 GHz	All RF ports for E6640A-504
	380 MHz to 6.0 GHz	All RF ports for E6640A-506
	380 MHz to 6.0 GHz with 5G NR bands	All RF ports for E6640A-5B0
	1.1 to 1.8 GHz, 2.3 to 2.6 GHz, 4.8 to 6.0 GHz	All RF ports for E6640A-5WC
Specified frequency ranges	76 to 110 MHz[3] 207 to 222 MHz[3] 380 to 490 MHz 490 to 695 MHz[4] 695 to 960 MHz 1100 to 1325 MHz 1425 to 2180 MHz 2180 to 2200 MHz[5] 2300 to 2700 MHz 2700 to 3400 MHz[5] 3400 to 3800 MHz 3800 to 4900 MHz[5] 4900 to 6000 MHz	Dependent on selected frequency range option
Frequency reference	Refer to timebase	

Amplitude	Performance	Conditions
Output level ranges	-120 to 5 dBm -130 to 5 dBm	RF3 I|O and RF4 I|O outputs 76 to 110 MHz, 207 to 222 MHz 380 MHz to 6 GHz
	-120 to -15 dBm -130 to -15 dBm -130 to -20 dBm	RFIO1 and RFIO2 outputs 76 to 110 MHz, 207 to 222 MHz 380 MHz to 3.8 GHz 3.8 to 6 GHz
Setting resolution	0.01 dB	
Output VSWR	*< 1.9:1, typical* *< 1.45:1, typical* *< 1.4:1, typical* *< 1.7:1, typical*	RF3 I|O and RF4 I|O outputs 76 to 110 MHz, > 5800 to 6000 MHz 207 to 222 MHz 380 to 2030 MHz > 2030 to 5800 MHz
	< 1.25:1, typical *< 1.5:1, typical* *< 1.7:1, typical*	RFIO1 and RFIO2 outputs 76 to 2030 MHz > 2030 to 3800 MHz > 3800 to 6000 MHz
Harmonics and sub-harmonics	*< -30 dBc, typical*	RF3 I|O and RF4 I|O at 0 dBm output RFIO1 and RFIO2 at -15 dBm output
Non-harmonic spurious, CW mode	< -45 dBc, nominal < -62 dBc, nominal < -58 dBc, nominal	< 110 MHz 207 to 222 MHz 380 MHz to 6 GHz
Phase noise	< -125 dBc, nominal < -123 dBc, nominal < -121 dBc, nominal	RF3 I|O and RF4 I|O at 0 dBm output, RFIO1 and RFIO2 at -10 dBm output, 1 MHz offset 380 MHz to 3 GHz > 3 to 3.8 GHz > 3.8 to 6 GHz

3. Frequencies supported only on M9432A and M9433A TRX modules with option E6640A-5LF (ordered at E6640A-5FM)
4. Frequencies are not supported on M9430A and M9431A TRX modules
5. Frequencies supported only on M9433A TRX module with option E6640A-5B0

CW absolute level accuracy performance

Measured at E6640A-2FD/2HD RF3 I|O and RF4 I|O ports configured to output mode in specified frequencies.

Frequency range	Performance	Conditions
76 to 110 MHz 207 to 222 MHz	< ±0.50 dB, < *±0.20 dB, typical*	-15 to ≤ 5 dBm
	< ±0.65 dB, < *±0.25 dB, typical*	-80 to ≤ -15 dBm
	< ±0.85 dB, < *±0.35 dB, typical*	-120 to ≤ -80 dBm
380 to 1325 MHz	< ±0.50 dB, < *±0.15 dB, typical*	-15 to ≤ 5 dBm
	< ±0.50 dB, < *±0.20 dB, typical*	-80 to ≤ -15 dBm
	< ±0.65 dB, < *±0.30 dB, typical*	-120 to ≤ -80 dBm
1425 to 2700 MHz	< ±0.55 dB, < *±0.20 dB, typical*	-15 to ≤ 5 dBm
	< ±0.75 dB, < *±0.35 dB, typical*	-80 to ≤ -15 dBm
	< ±0.85 dB, < *±0.50 dB, typical*	-120 to ≤ -80 dBm
3400 to 3800 MHz	< ±0.60 dB, < *±0.20 dB, typical*	-15 to ≤ 5 dBm
	< ±0.60 dB, < *±0.30 dB, typical*	-80 to ≤ -15 dBm
	< ±1.10 dB, < *±0.55 dB, typical*	-110 to ≤ -80 dBm
4900 to 6000 MHz	< ±0.70 dB, < *±0.25 dB, typical*	-15 to ≤ 5 dBm
	< ±0.75 dB, < *±0.30 dB, typical*	-80 to ≤ -15 dBm
	< ±1.10 dB, < *±0.50 dB, typical*	-100 to ≤ -80 dBm

Measured at RFIO1 and RFIO2 outputs, and E6640A-4FD RFIO3 and RFIO4 outputs in specified frequencies.

Frequency range	Performance	Conditions
76 to 110 MHz 207 to 222 MHz	< ±0.70 dB, < *±0.30 dB, typical*	-80 to -15 dBm
	< ±1.00 dB, < *±0.40 dB, typical*	-120 to ≤ -80 dBm
380 to 1325 MHz	< ±0.65 dB, < *±0.30 dB, typical*	-80 to ≤ -15 dBm
	< ±0.75 dB, < *±0.35 dB, typical*	-120 to ≤ -80 dBm
1425 to < 2700 MHz	< ±0.65 dB, < *±0.40 dB, typical*	-80 to ≤ -15 dBm
	< ±0.80 dB, < *±0.50 dB, typical*	-120 to ≤ -80 dBm
2700 to < 3400 MHz	< ±0.80 dB, < *±0.35 dB, typical*	-80 to ≤ -15 dBm
	< ±1.1 dB, < *±0.55 dB, typical*	-120 to ≤ -80 dBm
3400 to < 3800 MHz	< ±0.60 dB, < *±0.30 dB, typical*	-80 to ≤ -15 dBm
	< ±1.10 dB, < *±0.55 dB, typical*	-110 to ≤ -80 dBm
3800 to < 4900 MHz	< ±0.80 dB, < *±0.35 dB, typical*	-80 to ≤ -20 dBm
	< ±1.10 dB, < *±0.50 dB, typical*	-100 to ≤ -80 dBm
4900 to 6000 MHz	< ±0.90 dB, < *±0.30 dB, typical*	-80 to ≤ -20 dBm
	< ±1.10 dB, < *±0.60 dB, typical*	-100 to ≤ -80 dBm

Timebase Performance

Internal timebase	Performance	Conditions
Accuracy	± [(time since last adjustment x aging rate) + temperature stability + calibration accuracy]	
Achievable initial calibration accuracy	±5 x 10^{-8}	
Frequency stability – aging rate	< ±*0.5 ppb/day, typical*	Daily, after 72-hour warmup
	< ±0.10 ppm/year	Annually
	< ±0.6 ppm/10 years	Over 10 years
Frequency stability – temperature effects	< ±10 ppb	20 to 30 ºC
	< ±50 ppb	Full temperature range
Frequency stability - warmup	< ±*0.1 ppm, typical*	5 minutes over 20 to 30 °C, 1 hour
	< ±*0.01 ppm, typical*	15 minutes over 20 to 30 °C, 1 hour
Recommended calibration cycle[6]	2 years	

External reference input	Performance	Conditions
Frequency range	1 to 50 MHz	Sine wave
Lock range	±1 ppm, nominal	
Amplitude	0 to 10 dBm, nominal	
Impedance	50 ohms, nominal	
Connector type	BNC female	

General Performance

Power	Performance	Conditions
Voltage and frequency	100/120 V, 50/60 Hz, nominal	
	220/240 V, 50/60 Hz, nominal	
Power consumption	720 W (100 to 120 VAC input)	100 to 120 VAC input
	870 W	220 to 240 VAC input
Maximum applied reverse power	< 30 dBm, CW	RF3 I|O and RF4 I|O ports with E6640A-2FD
	< 36 dBm, CW	RFIO3 and RFIO4 ports with E6640A-4FD, RFIO1 and RFIO2 ports
RF I/O port isolation	> 90 dB, nominal > 85 dB, nominal > 80 dB, nominal	1 TRX measured from input port to output port with E6640A-SSX < 2700 MHz 3400 to 3800 MHz > 4900 MHz

Size and weight	Performance	Conditions
Dimensions (W x H x D)	444 x 197 x 581 mm 444 x 188 x 561 mm	With feet installed With feet removed
Weight	21.4 kg, 47 pounds 22.7 kg, 50 pounds 24.5 kg, 54 pounds 25.9 kg, 57 pounds	1 TRX installed 2 TRX installed 3 TRX installed 4 TRX installed

6. At time of shipment, each TRX module in the E6640A may have a different calibration due date, which matches the Certificate of Calibration. All module calibration due dates are within 60 days of each other. TRX modules added after the initial instrument purchase will have different calibration due dates and different warranty end dates from the modules that were originally purchased with the E6640A instrument. On the E6640A EXM, go to the System, Show, Hardware screen to view the TRX module calibration dates.

Environmental	Performance
Operating temperature	5 to 45 ºC
Storage temperature	-40 to 65 ºC
EMC	Complies with European EMC Directive 2004/108/EC • IEC/EN 61326-1, IEC/EN 61326-2-1 • CISPR Pub 11 Group 1, class A • AS/NZS CISPR 11:2002 • ICES/NMB-001 This ISM device complies with Canadian ICES-00 Cet appareil ISM est conforme a la norme NMB-001 du Canada
Environmental stress	Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation, and end-use. Those stresses include, but are not limited to, temperature, humidity, shock, vibration, altitude, and power line conditions. Test methods are aligned with IEC 60068-2 and levels are similar to MILPRF28800F Class 3.
Safety	Complies with European Low Voltage Directive 2006/95/EC • IEC/EN 61010-1 • Canada: CSA C222 No 61010-1-04 • USA: UL Std 61010-1

Audio noise	German translation
Acoustic noise emission	Geraeuschemission
LpA < 70 dB	LpA < 70 dB
Operator position	Am Arbeitsplatz
Normal position	Normaler Betrieb
Per ISO 7779	Nach DIN 45635 t19

Controller	M9037A performance[7]	M9035A performance[8]
CPU	Intel i7-4700EQ	Intel i3-8100H quad-core
CPU clock frequency	2.4 GHz	3.0 GHz
Memory - L3 cache	6 MB	6 MB
Memory - RAM type	DDR3L, 1600 204-pin SODIMM sockets	DDR4-2400 204-pin SODIMM sockets
Memory - RAM capacity	16 GB	16 GB
Operating system	Microsoft Windows 7 Professional, 64-bit Microsoft Windows 10 Enterprise LTSC, 64-bit[9]	Microsoft Windows 7 Professional, 64-bit Microsoft Windows 10 Enterprise LTSC, 64-bit[9]
Data storage type	2.5-inch SATA III SSD	2.5-inch SATA SSD
Data storage size	240 GB	256 GB
Remote programming interface	LAN RJ45	LAN RJ45

7. Applies to E6640A units with serial numbers before MY62430000
8. Applies to E6640A units with serial number MY62430000 and later
9. Applies to E6640A units with serial number MY57150909 and later

Front Panel

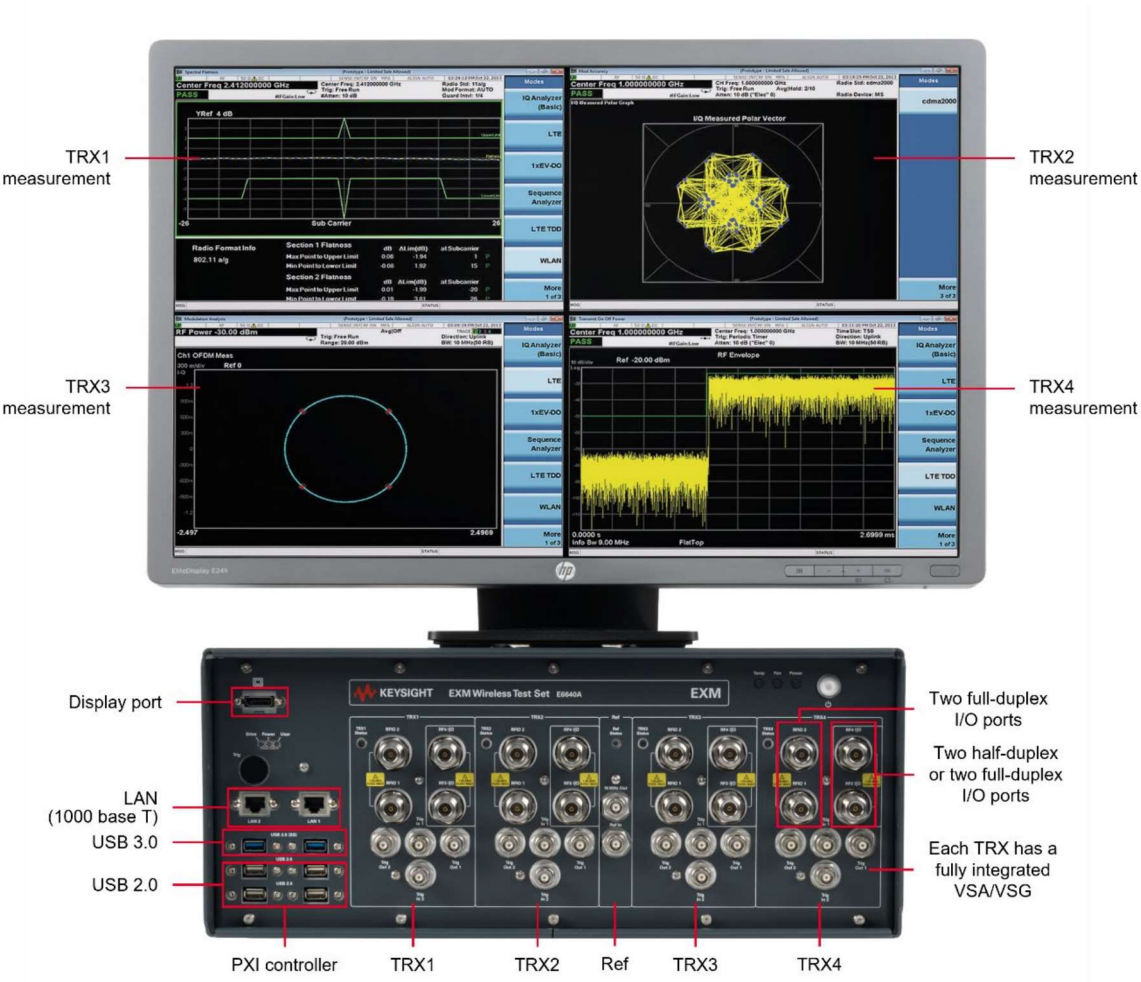

Figure 3. E6640A EXM front panel and application display features

Controller status	Description
Power	Green LED indicating power supply is performing normally
Hard drive	Yellow LED indicating disc drive activity

Controller trigger[10]	Description
Connector	BNC female
Trigger	Programmable direction

LAN TCP/IP interface	Description
Standard x 2	1000 Base-T
Connector x 2	RJ45 Ethertwist

10. Applies to units with serial numbers before MY62430000

Monitor output	Description
Connector	DisplayPort, compatible with DisplayPort to VGA adapter

USB ports	Description and performance
USB 3.0 standard	2 ports compatible with USB 3.0/2.0
USB 2.0 standard	4 ports compatible with USB 2.0
Connector	USB Type-A female
Output current	0.5 A, nominal

10 MHz out	Description and performance
Connector	BNC female
Impedance	50 ohms, nominal
Output amplitude	9.5 dBm, nominal

Ref in	Description
Connector	BNC female
Impedance	50 ohms, nominal
Characteristics	Refer to timebase performance

TRX module RF connections	Description and performance
Impedance for all connectors	50 ohms, nominal
E6640A-2FD/2HD • RF3 I|O and RF4 I|O ports (HD) • RFIO1 and RFIO2 ports (FD)	Optional configuration N-Type female N-Type female
E6640A-4FD • RFIO1, RFIO2, RFIO3, RFIO4 ports (FD)	Default configuration N-Type female

TRX module triggers	Description and performance
Connectors	BNC female
Impedance	> 10 kohms, nominal
Trigger in 1	For triggering a received waveform measurement
Trigger in 2	For triggering the start of a waveform transmission
Trigger in 1 and 2 level range	-3.5 to 3.5 V
Trigger out 1 and 2 level range	-3.3 V LVTTL

TRX module status	Description
Status indicator	LED

Application Performance

GSM, EDGE, and EDGE Evo applications

Measurement performance

Measured over frequencies of 450 to 490 MHz, 820 to 920 MHz, and 1710 to 1910 MHz.

Measurement	Performance	Conditions
Power versus time (PVT)		
Absolute power accuracy	*< ±0.36 dB, typical*	0 dBm input
Phase error		
Noise floor	*< 0.36 ° rms, typical* *< 0.85 ° peak, typical*	0 dBm input, GMSK modulation
EDGE error vector magnitude (EVM)		
Noise floor	*< 0.65 % rms, typical* *< 2.0 % peak, typical*	0 dBm input
Output RF spectrum (ORFS)		
Residual relative power, spectrum due to modulation	*< -70 dBc, typical* *< -75 dBc, typical* *< -73 dBc, typical*	0 dBm input 600 kHz offset 1.2 MHz offset 1.8 MHz offset
Residual relative power, spectrum due to switching	*< -67 dBc, typical* *< -74 dBc, typical* *< -76 dBc, typical*	0 dBm input 600 kHz offset 1.2 MHz offset 1.8 MHz offset

Source performance

Measured over frequencies of 380 to 490 MHz, 695 to 960 MHz, and 1425 to 2180 MHz.

Signal quality	Performance	Conditions
GMSK phase error	< 0.3 degrees rms, nominal < 2.0 degrees peak, nominal	RF I|O ports at 0 dBm output RFIO ports at -15 dBm output
EDGE EVM	< 1.0 % rms, nominal	

W-CDMA, HSPA+ applications

Measurement performance

Measured over frequencies of 695 to 920 MHz, and specified ranges from 1425 to 2700 MHz.

Measurement	Performance	Conditions
Channel power		
Absolute power accuracy	*< ±0.36 dB, typical*	0 dBm input
QPSK EVM		
Residual EVM	*< 0.85 %, typical*	-10 dBm input
Adjacent channel leakage ratio (ACLR)		
Residual relative power	*< -65 dBc, typical*	5 MHz offsets, 3.84 MHz measurement bandwidth, 0 dBm input
Spectrum emission mask (SEM)		
Residual relative power	*< -80 dBc, typical*	2.515 to 3.485 MHz offsets, 30 kHz measurement bandwidth, 0 dBm input
	< -65 dBc, typical	4.0 to 7.5 MHz offsets, 1 MHz measurement bandwidth, 0 dBm input
	< -70 dBc, typical	7.5 to 8.5 MHz and 8.5 to 12 MHz offsets, 1 MHz measurement bandwidth, 0 dBm input

Source performance

Measured over frequencies of 695 to 960 MHz, and 1425 to 2180 MHz.

Signal quality	Performance	Conditions
Composite EVM	< 1 % rms, nominal	RF I|O ports at 0 dBm output RFIO ports at -15 dBm output

cdma2000® and 1xEV-DO applications

Measurement performance

Measured over frequencies of 410 to 484 MHz, 776 to 920 MHz, and 1710 to 1980 MHz.

Measurement	Performance	Conditions
Channel power		
Absolute power accuracy	*< ±0.36 dB, typical*	0 dBm input
EVM		
Residual EVM	*< 0.85 %, typical*	-10 dBm input
Adjacent channel power (ACP)		
Residual relative power	*< -71 dBc, typical*	885 kHz offsets, 30 kHz measurement bandwidth, 0 dBm input
	< -83 dBc, typical	1.98 MHz offsets, 30 kHz measurement bandwidth, 0 dBm input
	< -82 dBc, typical	4.0 MHz offsets, 30 kHz measurement bandwidth, 0 dBm input

Source performance

Measured over frequencies of 380 to 490 MHz, 695 to 960 MHz, and 1425 to 2180 MHz.

Signal quality	Performance	Conditions
Composite EVM	< 1.1 % rms, nominal	RF I|O ports at 0 dBm output RFIO ports at -15 dBm output

TD-SCDMA and TD-HSPA+ applications

Measurement performance

Measured over specified frequency ranges between 695 and 3800 MHz.

Measurement	Performance	Conditions
Channel power		
Absolute power accuracy	*< ±0.36 dB, typical*	0 dBm input
EVM		
Residual EVM	*< 0.75 %, typical*	1.6 MHz channel bandwidth, 0 dBm input
ACLR		
Residual relative power	*< -55 dBc, typical*	1.6 MHz offsets, 1.28 MHz measurement bandwidth, 0 dBm input
	< -70 dBc, typical	3.2 MHz offsets, 1.28 MHz measurement bandwidth, 0 dBm input
SEM		
Residual relative power	*< -54 dBc, typical*	2.515 to 3.485 MHz offsets, 30 kHz measurement bandwidth, 0 dBm input
	< -68 dBc, typical	4.0 to 7.5 MHz offsets, 1 MHz measurement bandwidth, 0 dBm input
	< -71 dBc, typical	7.5 to 8.5 MHz offsets, 1 MHz measurement bandwidth, 0 dBm input

Source performance

Measured over specified frequency ranges between 1620 and 2700 MHz.

Signal quality	Performance	Conditions
Composite EVM	< 0.5 % rms, nominal	RF I|O ports at 0 dBm output RFIO ports at -20 dBm output

LTE and LTE-advanced TDD and FDD applications

Measurement performance

Measured over specified frequency ranges between 695 and 6000 MHz.

Measurement	Performance	Conditions
Transmit power		
Absolute power accuracy	*< ±0.36 dB, typical*	0 dBm input
EVM		
Residual EVM	*< 0.8 %, typical*	5, 10, 15 and 20 MHz bandwidths, -10 dBm input
ACP		
Minimum carrier power	> -20 dBm > -5 dBm	RF I|O ports RFIO ports
Dynamic range	< -58 dBc, nominal < -60 dBc, nominal	E-UTRA UTRA

Source performance

Measured over specified frequency ranges between 695 and 6000 MHz.

Signal quality	Performance	Conditions
Composite EVM	*< 0.6 % rms, typical* *< 1.5 % rms, typical*	RF I|O ports at 0 dBm output RFIO ports at -15 dBm output 380 MHz to 3.9 GHz > 3.9 to 6 GHz

5G NR applications

Measurement performance

Measured over specified frequency ranges between 600 MHz and 6 GHz.

Measurement	Performance	Conditions
64QAM EVM	*< -40 dB, typical*	1 carrier, 100 MHz signal bandwidth, -10 dBm input

Source performance

Signal quality	Performance	Conditions
64QAM EVM		1 carrier, -15 dBm output
	< -40 dB, typical	600 to < 800 MHz, 80 MHz signal bandwidth
	< -40 dB, typical	Specified ranges between 800 and < 3900 MHz, 100 MHz signal bandwidth
	< -38 dB, typical	3.9 to 6 GHz, 100 MHz signal bandwidth

WLAN applications

Measurement performance

Measurement	Performance	Conditions
Modulated power		
Absolute power accuracy	*< ±0.27 dB, typical* *< ±0.49 dB, typical*	0 dBm input 2400 to 2483.5 MHz 5150 to 5185 MHz
EVM, preamble only, RF I|O HD ports at -20 dBm		
802.11b	*< -40.9 dB, typical*	2.4 GHz
802.11g	*< -47 dB, typical*	2.4 GHz
802.11a	*< -48 dB, typical*	5.8 GHz
802.11n	*< -48 dB, typical* *< -44 dB, typical*	5.8 GHz 20 MHz bandwidth 40 MHz bandwidth
802.11ac	*< -45 dB, typical* *< -43 dB, typical*	5.57 GHz 80 MHz bandwidth 160 MHz bandwidth
802.11af[11]	*< -51 dB, typical*	700 MHz, 8 MHz bandwidth
802.11ah[11]	*< -51 dB, typical*	900 MHz, 16 MHz bandwidth
802.11ax[11]	*< -47 dB, typical* *< -45 dB, typical*	5.775 GHz 80 MHz bandwidth 160 MHz bandwidth
EVM, preamble only, RFIO FD ports at -10 dBm		
802.11b	*< -42 dB, typical*	2.4 GHz
802.11g	*< -50 dB, typical*	2.4 GHz
802.11a	*< -48 dB, typical*	5.8 GHz
802.11n	*< -49 dB, typical* *< -47 dB, typical*	5.8 GHz 20 MHz bandwidth 40 MHz bandwidth
802.11ac	*< -45 dB, typical* *< -43 dB, typical*	5.57 GHz 80 MHz bandwidth 160 MHz bandwidth
802.11af[11]	*< -51 dB, typical*	700 MHz, 8 MHz bandwidth
802.11ah[11]	*< -50 dB, typical*	900 MHz, 16 MHz bandwidth
802.11ax[11]	*< -46 dB, typical* *< -44 dB, typical*	5.775 GHz 80 MHz bandwidth 160 MHz bandwidth

11. Measurements made on M9430A and M9431A for 802.11af, ah, and ax may return invalid results

Spectrum emission mask

Refer to Figures 4 to 10 for nominal SEM performance. The SEM transmitter test signal was generated by the Keysight N5182B MXG signal generator.

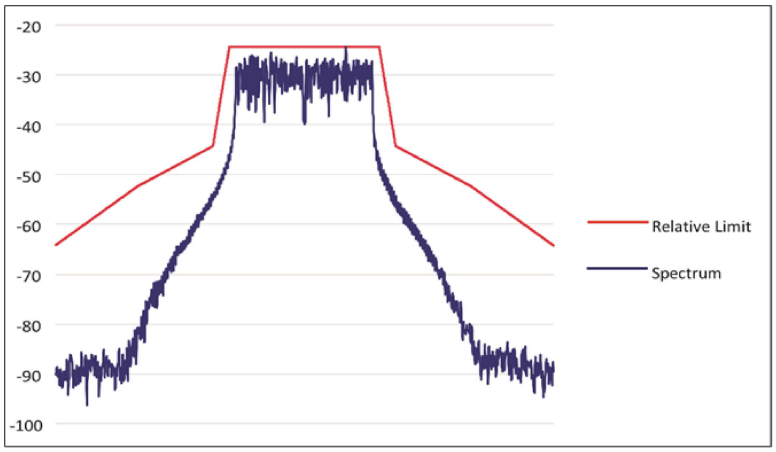

Figure 4. 802.11a/g SEM nominal performance at 2.4 GHz with 20 MHz bandwidth at RF I|O ports

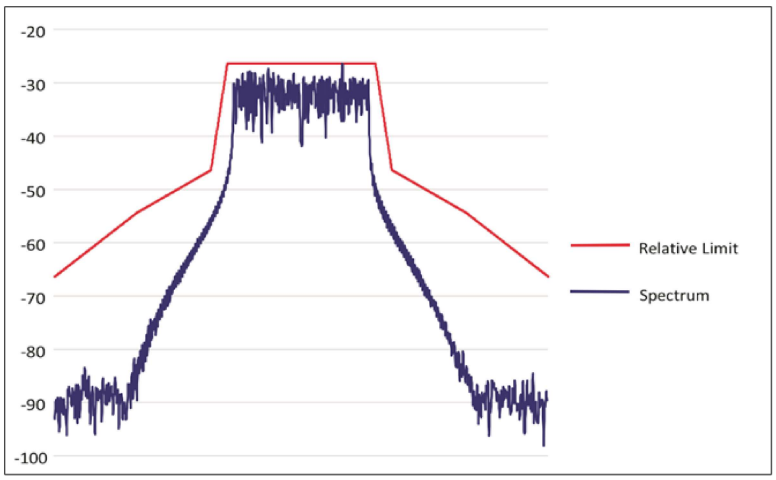

Figure 5. 802.11a/g SEM nominal performance at 5.8 GHz with 20 MHz bandwidth at RF I|O ports

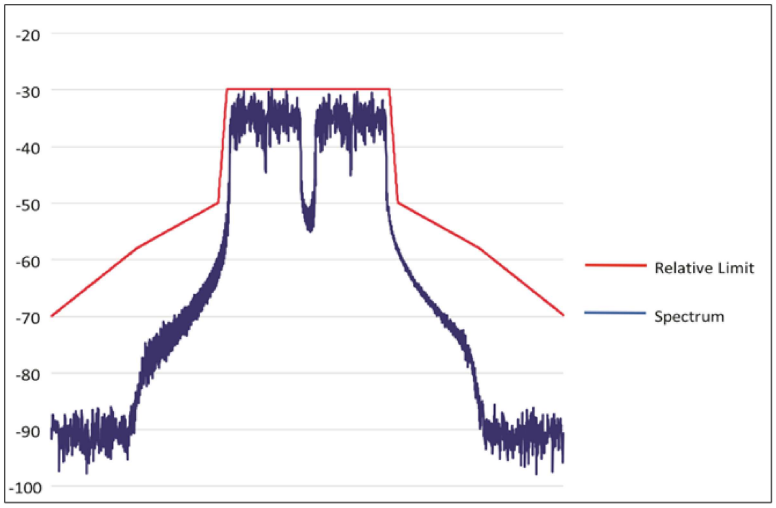

Figure 6. 802.11n SEM nominal performance at 5.8 GHz with 40 MHz bandwidth at RF I|O ports

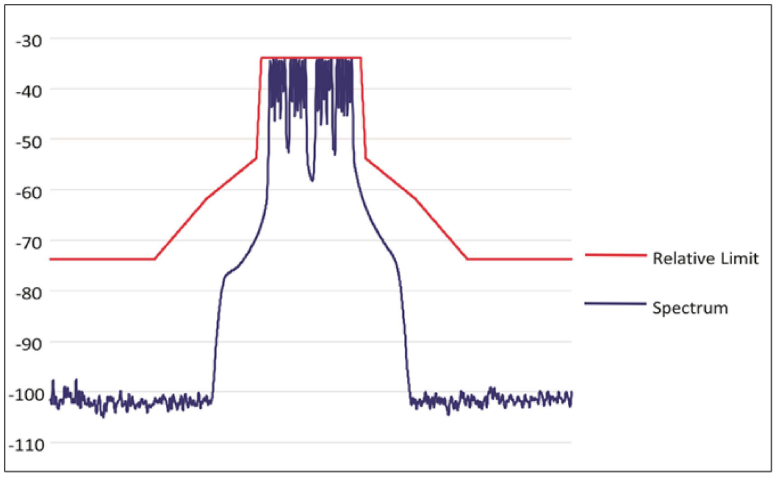

Figure 7. 802.11af SEM nominal performance at 700 MHz with 8 MHz bandwidth at RF I|O ports

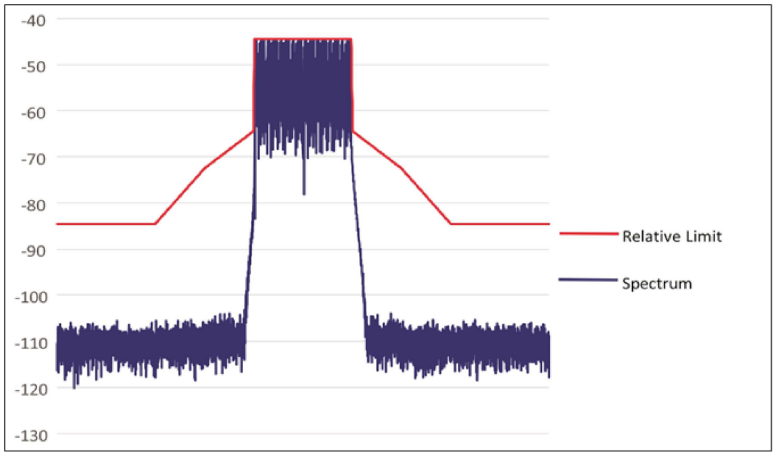

Figure 8. 802.11ah SEM nominal performance at 900 MHz with 16 MHz bandwidth at RF I|O ports

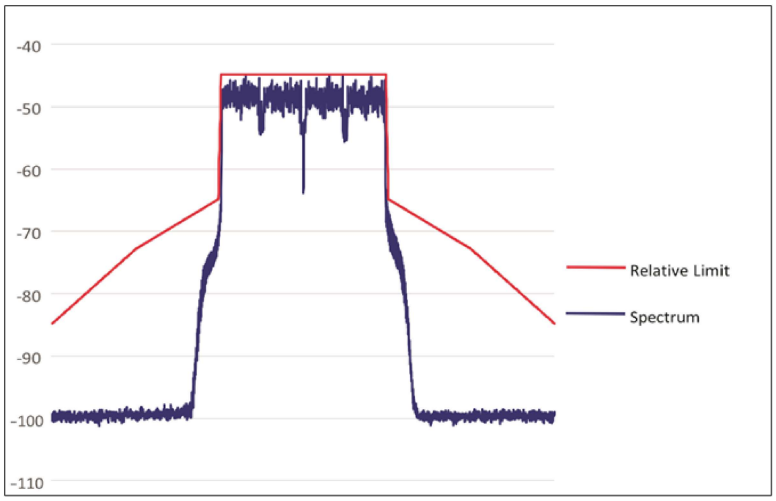

Figure 9. 802.11ax SEM nominal performance at 5.775 GHz with 80 MHz bandwidth at RF I|O ports

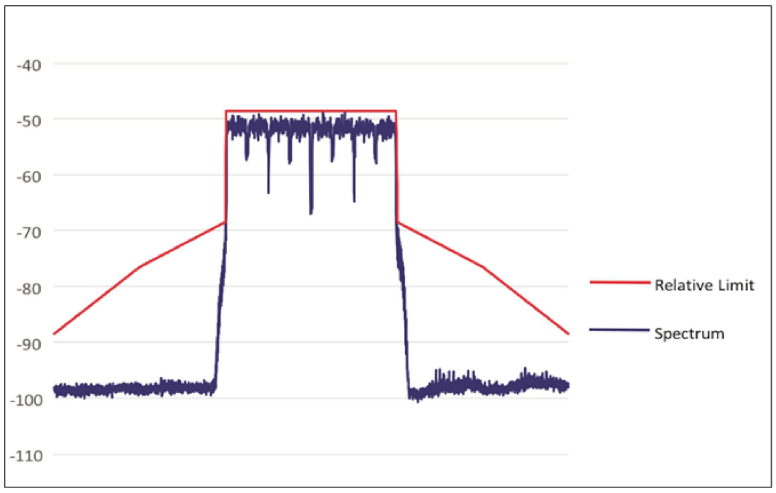

Figure 10. 802.11ax SEM nominal performance at 5.57 GHz with 160 MHz bandwidth at RF I|O ports

Source performance

Signal quality	Performance	Conditions
EVM, preamble only, RF I|O HD ports		
802.11b	< *-28 dB, typical*	2.4 GHz, -30 to 0 dBm output
802.11g	< *-50 dB, typical*	2.4 GHz, -15 to -5 dBm output
802.11a	< *-44 dB, typical*	5.8 GHz, -15 to -5 dBm output
802.11n	< *-43 dB, typical* < *-44 dB, typical*	5.8 GHz, -15 to -5 dBm output 20 MHz bandwidth 40 MHz bandwidth
802.11ac	< *-42 dB, typical*	5.57 GHz, 80 and 160 MHz bandwidths, -15 to -5 dBm output
802.11af[12]	< *-54 dB, typical*	700 MHz, 8 MHz bandwidth, -15 to -5 dBm output
802.11ah[12]	< *-54 dB, typical*	900 MHz, 16 MHz bandwidth, -15 to -5 dBm output
802.11ax[12]	< *-40 dB, typical*	-15 to -5 dBm output 5.775 GHz, 80 MHz bandwidth 5.57 GHz, 160 MHz bandwidth
EVM, preamble only, RFIO FD ports		
802.11b	< *-28 dB, typical*	2.4 GHz, -30 to -10 dBm output
802.11g	< *-49 dB, typical*	2.4 GHz, -20 to -15 dBm output
802.11a	< *-39 dB, typical*	5.8 GHz, -20 to -15 dBm output
802.11n	< *-40 dB, typical*	5.8 GHz, 20 and 40 MHz bandwidths, -20 to -15 dBm output
802.11ac	< *-40 dB, typical* < *-38 dB, typical*	5.57 GHz, -20 to -15 dBm output 80 MHz bandwidth, 160 MHz bandwidth
802.11af[12]	< *-54 dB, typical*	700 MHz, 8 MHz bandwidth, -20 to -15 dBm output
802.11ah[12]	< *-55 dB, typical*	900 MHz, 16 MHz bandwidth, -20 to -15 dBm output
802.11ax[12]	< *-40 dB, typical* < *-39 dB, typical*	-20 to -15 dBm output 5.775 GHz, 80 MHz bandwidth 5.57 GHz, 160 MHz bandwidth

12. Measurements made on M9430A and M9431A for 802.11af, ah, and ax may return invalid results

Bluetooth applications

Measurement performance

Measured over frequencies of 2400 to 2486 MHz.

Measurement	Performance	Conditions
Channel power		
Absolute power accuracy	< *±0.26 dB, typical*	0 dBm input
Modulation		
Deviation range	< ±250 kHz, nominal	
Enhanced data rate (EDR) modulation accuracy		
Range	0 to 12 % rms, nominal	
Noise floor	< *0.6 %, typical*	-20 dBm input

Source performance

Measured over frequency ranges between 1620 and 2700 MHz.

Signal quality	Performance	Conditions
FSK error	< 0.65 %, nominal	Basic data rate (ACL), DH1 packet, GFSK, standard packet, 2402 MHz, RF I|O ports at -10 dBm output
ACP	< -69 dBm, nominal for k=2	Enhanced data rate, 3-DH1 packet, GFSK + D8PSK, standard packet, 2402 MHz, RF I|O ports at -10 dBm output
	< -72 dBm, nominal for k=3,4,5,…78	
EDR DEVM error	< 1 %, nominal	

Test Multiple Formats in Manufacturing

Keysight's E6640A EXM wireless test set is a multi-channel platform that supports 5G NR device manufacturing testing of up to four devices in parallel. The versatile test solution supports 5G NR and legacy wireless and connectivity technologies, including LTE-A, 802.11ac/ax, *Bluetooth* 5.0, 2G, and 3G. Verification of multi-format device RF performance is possible without the need for additional test equipment.

Integrated Keysight waveform and measurement software ensures accurate device performance. A single software application provides waveforms for device receiver verification that enables the user to perform a wide range of measurements, including EVM, ACP, SEM, power, and occupied bandwidth (OBW).

Source and analyzer sequencing techniques deliver fast test capability by enabling the users to optimize test plans by selecting the most efficient sequence for the device under test. Automation based on the Keysight PathWave test platform provides quick and simple test plan execution as well as OTA chamber control with software that is easily maintained over time.

The E6640A EXM non-signaling manufacturing solutions reduces the cost of device manufacturing through use of an industry-proven platform to test multiple devices in multiple formats. The solution implements streamlined automation and sequencing to optimize test speed and bring devices to market faster.

For more information, please visit Keysight's websites:

E6640A EXM

5G Non-Signaling Manufacturing Test Solution

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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