DATA SHEET

# 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 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 TRX, each a complete vector signal analyzer (VSA), vector signal generator (VSG), and four-port RFIO. Multi-format cellular and WLAN devices can be 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 X-Series measurement applications
- Maximum throughput with raw hardware speed and advanced sequencing
- Increase first-pass yield with superior signal purity and measurement accuracy
- Get up and running in hours, not days, with validated chipset solutions


KEYSIGHT TECHNOLOGIES

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## Scale your production line with TRX modules

Each TRX module contains fully integrated VSA, VSG and RFIO. Choose between two configurations of RFIO: 1) with four full-duplex (FD) ports, and 2) with two FD and two half-duplex (HD) ports. The RFIO uses rugged N-type connectors and is designed for the demanding wireless device manufacturing environment.

Each TRX module has configurable frequency range and bandwidth and can be upgraded later using license keys to add frequency ranges and bandwidths.[1] New TRX modules can be added to existing chassis to contain up to four TRX.

## E6640A EXM Software Applications

### Cellular

- 5G NR
- C-V2X
- LTE and LTE-Advanced TDD and FDD
- NB-IoT and eMTC
- W-CDMA and HSPA+
- TD-SCDMA and TD-HSPA+
- cdma2000® and 1xEV-DO
- GSM, EDGE, and EDGE Evo

### Wireless Connectivity

- WLAN 802.11ac/ax
- WLAN 802.11a/b/g/j/p/n/af/ah
- Bluetooth® and BT 5.0
- GNSS: GPS, Galileo, GLONASS, Beidou, SBAS, and QZSS
- Digital video

### MIMO (2x2, 3x3, 4x4) and carrier aggregation

- Switched MIMO for manufacturing test
- True MIMO (multi-TRX) for design validation
- LTE-Advanced CA inter- and intra-band

**Application Flexibility**

- Consistent repeatability of standards-based X-Series measurement applications
- One application license covers up to four TRX units per mainframe
- SCPI-controlled PXIe OBT

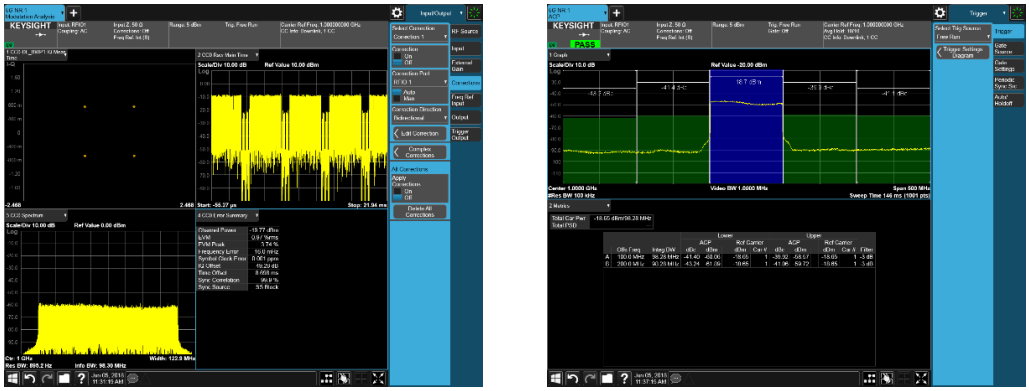

Figure 1: 5G NR modulation analysis and ACP measurement application screens

[1] Frequency range upgrades to support bands defined specifically for 5G NR are not available. New TRX modules supporting all 5G NR frequency bands are available.

# 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 (nom)**
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 stated.

| Memory and Sampling | Performance | Conditions |
|---|---|---|
| Capture depth | 4 GB memory<br>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, and 4.8 to 6.0 GHz | All RF ports for E6640A-5WC |
| Specified frequency ranges | 380 to 495 MHz<br>495 to 695 MHz[2]<br>695 to 920 MHz<br>920 to 960 MHz[3]<br>1425 to 1485 MHz<br>1485 to 1560 MHz[4]<br>1620 to 2030 MHz<br>2100 to 2200 MHz[5]<br>2300 to 2700 MHz<br>2700 to 3400 MHz[6]<br>3400 to 3800 MHz<br>3800 to 4900 MHz[7]<br>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, |

[2] Frequencies are not supported on M9430A and M9431A TRX modules
[3] Frequencies are not supported on M9430A and M9431A TRX modules
[4] Frequencies are not supported on M9430A and M9431A TRX modules
[5] Frequencies are not supported on M9430A and M9431A TRX modules
[6] Frequencies supported only on M9433A TRX module with option E6640A-5B0
[7] Frequencies supported only on M9433A TRX module with option E6640A-5B0

| Frequency | Performance | Conditions |
|---|---|---|
| | | 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 | |

| 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 (full duplex) for all inputs |
| Input VSWR | *< 1.4:1, typical*<br>*< 1.25:1, typical* | 380 to 2030 MHz<br>RF3 I\|O and RF4 I\|O inputs<br>RFIO1 and RFIO2 inputs |
| | *< 1.6:1, typical*<br>*< 1.5:1, typical* | 2100 to 2200 MHz, 2300 to 3800 MHz<br>RF3 I\|O and RF4 I\|O inputs<br>RFIO1 and RFIO2 inputs |
| | *< 1.7:1, typical* | 3800 to 4900 MHz<br>RFIO1 and RFIO2 inputs |
| | *< 1.6:1, typical*<br>*< 1.7:1, typical* | 4900 to 6000 MHz<br>RF3 I\|O and RF4 I\|O inputs<br>RFIO1 and RFIO2 inputs |
| Residual responses | *< -85 dBm, typical*<br>*< -82 dBm, typical* | 380 to 5790 MHz, < -30 dBm input<br>> 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 |

| Amplitude | Performance | Conditions |
|---|---|---|
| | | signal, analyzer ranged to peak signal power level |
| Phase noise | < -110 dBc/Hz, nominal<br>< -130 dBc/Hz, nominal | Noise sidebands for 900 MHz center freq.<br>10 kHz offset<br>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<br>40 MHz BW<br>160 MHz BW | <br>< ±0.45 dB, < *±0.20 dB, typical*<br>< ±0.70 dB, < *±0.35 dB, typical* | <br>< ±0.45 dB, < *±0.25 dB, typical*<br>< ±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<br>40 MHz BW<br>160 MHz BW | <br>< ±0.55 dB, < *±0.25 dB, typical*<br>< ±0.80 dB, < *±0.45 dB, typical* | <br>< ±0.50 dB, < *±0.20 dB, typical*<br>< ±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<br>40 MHz BW<br>160 MHz BW | <br>< ±0.75 dB, < *±0.30 dB, typical*<br>< ±0.90 dB, < *±0.50 dB, typical* | <br>< ±0.60 dB, < *±0.25 dB, typical*<br>< ±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<br>40 MHz BW<br>160 MHz BW | <br>< ±0.50 dB, < ±*0.25 dB, typical*<br>< ±0.65 dB, < ±*0.35 dB, typical* | <br>< ±0.45 dB, < ±*0.20 dB, typical*<br>< ±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,* over ≥ -8 to 20 dBm |
| 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<br>40 MHz BW<br>160 MHz BW | <br>< ±0.85 dB, < ±*0.45 dB, typical*<br>< ±0.95 dB, < ±*0.55 dB, typical* | <br>< ±0.65 dB, < ±*0.30 dB, typical*<br>< ±0.90 dB, < ±*0.45 dB, typical* |

## Vector signal generator performance

All options apply to TRX modules unless otherwise stated.

| 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<br>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, and 4.8 to 6.0 GHz | All RF ports for E6640A-5WC |
| Specified frequency ranges | 76 to 110 MHz[8]<br>207 to 222 MHz[9]<br>380 to 490 MHz<br>490 to 695 MHz[10]<br>695 to 960 MHz<br>1100 to 1325 MHz<br>1425 to 2180 MHz<br>2180 to 2200 MHz[11]<br>2300 to 2700 MHz<br>2700 to 3400 MHz[12] | Dependent on selected frequency range option |

[8] Frequencies supported only on M9432A and M9433A TRX modules with option E6640A-5LF (ordered at E6640A-5FM)
[9] Frequencies supported only on M9432A and M9433A TRX modules with option E6640A-5LF (ordered at E6640A-5FM)
[10] Frequencies are not supported on M9430A and M9431A TRX modules
[11] Frequencies supported only on M9433A TRX module with option E6640A-5B0
[12] Frequencies supported only on M9433A TRX module with option E6640A-5B0

| Frequency | Performance | Conditions |
|---|---|---|
| | 3400 to 3800 MHz<br>3800 to 4900 MHz[13]<br>4900 to 6000 MHz | |
| Frequency reference | Refer to timebase | |

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

[13] 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<br>207 to 222 Mz | < ±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<br>207 to 222 Mz | < ±0.70 dB, < *±0.30 dB, typical* | -80 to -15 dBm |
| | < ±1.00 dB, < *±0.40 dB, typical* | -120 to ≤ -80 dBm |

| Frequency Range | Performance | Conditions |
|---|---|---|
| 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[14] | 2 years | |

| External Reference Input | Performance | Conditions |
|---|---|---|
| Frequency range | 1 to 50 MHz | Sine wave |
| Lock rage | ±1 ppm, nominal | |
| Amplitude | 0 to 10 dBm, nominal | |
| Impedance | 50 ohms, nominal | |
| Connector type | 1 BNC | |

[14] 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.

## 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, and RFIO1 and RFIO2 ports |
| RF I/O port isolation | > 90 dB, nominal<br>> 85 dB, nominal<br>> 80 dB, nominal | 1 TRX measured from input port to output port with E6640A-SSX<br>< 2700 MHz<br>3400 to 3800 MHz<br>> 4900 MHz |

| Size and Weight | Performance | Conditions |
|---|---|---|
| Dimensions<br>(W x H x D) | 444 x 197 x 581 mm<br>444 x 188 x 561 mm | With feet installed<br>With feet removed |
| Weight | 214 kg, 47 pounds<br>227 kg, 50 pounds<br>245 kg, 54 pounds<br>259 kg, 57 pounds | 1 TRX installed<br>2 TRX installed<br>3 TRX installed<br>4 TRX installed |

| Environmental | Performance |
|---|---|
| Operating temperature | 5 to 45 ºC |
| Storage temperature | -40 to 65 ºC |
| EMC | Complies with European EMC Directive 2004/108/EC<br>– IEC/EN 61326-1, IEC/EN 61326-2-1<br>– CISPR Pub 11 Group 1, class A<br>– AS/NZS CISPR 11:2002<br>– ICES/NMB-001<br>This ISM device complies with Canadian ICES-00<br>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. |

| Environmental | Performance |
|---|---|
| | 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<br>– IEC/EN 61010-1<br>– Canada: CSA C222 No 61010-1-04<br>– USA: UL Std 61010-1 |

| Audio Noise | Performance |
|---|---|
| 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 | Performance |
|---|---|
| CPU | Intel i7-3610QE quad-core |
| CPU clock frequency | 23 GHz, 33 GHz (single-core Turbo Boost) |
| Memory - L3 cache | 6 MB |
| Memory - RAM type | DDR3, PC3-12800 204-pin SODIMM sockets |
| Memory - RAM capacity | 16 GB |
| Operating system | Microsoft Windows 7 Professional, 64-bit |
| Data storage type | 25-inch SATA II |
| Data storage size | 240 GB |
| Remote programming interface | LAN RJ45 |

## Front Panel

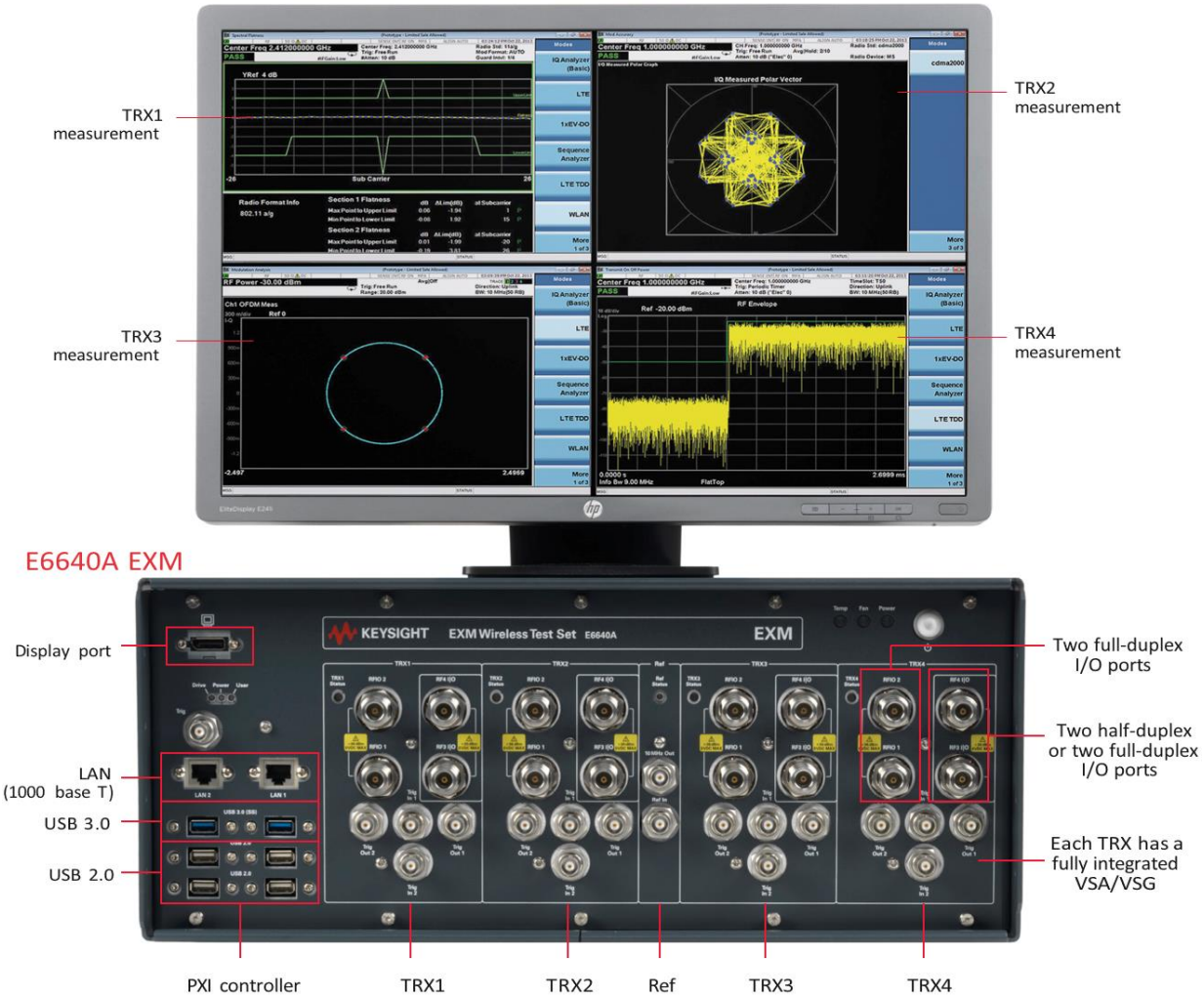


Figure 2: E6640A EXM front panel and application display features

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

| Controller Trigger | Description |
|---|---|
| Connector | BNC female |
| Trigger | Programmable direction |

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

| 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 | Type-BNC female; 50 ohms, nominal |
| Output amplitude | 9.5 dBm, nominal |

| Ref In | Description |
|---|---|
| Connector | Type-BNC female; 50 ohms, nominal |
| Characteristics | Refer to timebase performance |

| TRX Module RF Connections | Description and Performance |
|---|---|
| E6640A-2FD/2HD | Default configuration |
| RF3 I\|O and RF4 I\|O ports (HD)<br>RFIO1 and RFIO2 ports (FD) | N-Type female; 50 ohms, nominal |
| E6640A-4FD | Optional configuration |
| RFIO1, RFIO2, RFIO3, RFIO4 ports (FD) | N-Type female; 50 ohms, nominal |

| TRX Module Triggers | Description and Performance |
|---|---|
| Connectors | BNC female |
| Impedance | > 10 kohms, nominal |
| 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.

| Power versus Time (PvT) | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.36 dB, typical* | 0 dBm input |

| Phase Error | Performance | Conditions |
|---|---|---|
| Noise floor | *< 0.36 ° rms, typical*<br>*< 0.85 ° peak, typical* | 0 dBm input, GMSK modulation |

| EDGE Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| Noise floor | *< 0.65 % rms, typical*<br>*< 2.0 % peak, typical* | 0 dBm input |

| Output RF Spectrum (ORFS) | Performance | Conditions |
|---|---|---|
| Residual relative power, spectrum due to modulation | *< -70 dBc, typical*<br>*< -75 dBc, typical*<br>*< -73 dBc, typical* | 0 dBm input<br>600 kHz offset<br>1.2 MHz offset<br>1.8 MHz offset |
| Residual relative power, spectrum due to switching | *< -67 dBc, typical*<br>*< -74 dBc, typical*<br>*< -76 dBc, typical* | 0 dBm input<br>600 kHz offset<br>1.2 MHz offset<br>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<br>< 2.0 degrees peak, nominal | RF I\|O ports at 0 dBm output<br>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.

| Channel Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.36 dB, typical* | 0 dBm input |

| QPSK EVM | Performance | Conditions |
|---|---|---|
| Residual EVM | *< 0.85 %, typical* | -10 dBm input |

| ACLR and ACPR | Performance | Conditions |
|---|---|---|
| Residual relative power | *< -65 dBc, typical* | 5 MHz offsets, 3.84 MHz measurement BW, 0 dBm input |

| Spectrum Emission Mask (SEM) | Performance | Conditions |
|---|---|---|
| Residual relative power | *< -80 dBc, typical* | 2.515 to 3.485 MHz offsets, 30 kHz measurement BW, 0 dBm input |
| | *< -65 dBc, typical* | 4.0 to 7.5 MHz offsets, 1 MHz measurement BW, 0 dBm input |
| | *< -70 dBc, typical* | 7.5 to 8.5 MHz and 8.5 to 12 MHz offsets, 1 MHz measurement BW, 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<br>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.

| Channel Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.36 dB, typical* | 0 dBm input |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| Residual EVM | *< 0.85 %, typical* | -10 dBm input |

| Adjacent Channel Power (ACP) | Performance | Conditions |
|---|---|---|
| Residual relative power | *< -71 dBc, typical* | 885 kHz offsets, 30 kHz measurement BW, 0 dBm input |
| | *< -83 dBc, typical* | 1.98 MHz offsets, 30 kHz measurement BW, 0 dBm input |
| | *< -82 dBc, typical* | 4.0 MHz offsets, 30 kHz measurement BW, 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<br>RFIO ports at -15 dBm output |

## TD-SCDMA and TD-HSPA+ Applications

### Measurement Performance

Measured over specified frequency ranges between 695 and 3800 MHz.

| Channel Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.36 dB, typical* | 0 dBm input |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| Residual EVM | *< 0.75 %, typical* | 1.6 MHz channel bandwidth, 0 dBm input |

| ACLR and ACPR | Performance | Conditions |
|---|---|---|
| Residual relative power | *< -55 dBc, typical* | 1.6 MHz offsets, 1.28 MHz measurement BW, 0 dBm input |
| | *< -70 dBc, typical* | 3.2 MHz offsets, 1.28 MHz measurement BW, 0 dBm input |

| Spectrum Emission Mask (SEM) | Performance | Conditions |
|---|---|---|
| Residual relative power | *< -54 dBc, typical* | 2.515 to 3.485 MHz offsets, 30 kHz measurement BW, 0 dBm input |
| | *< -68 dBc, typical* | 4.0 to 7.5 MHz offsets, 1 MHz measurement BW, 0 dBm input |
| | *< -71 dBc, typical* | 7.5 to 8.5 MHz offsets, 1 MHz measurement BW, 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<br>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.

| Transmit Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.36 dB, typical* | 0 dBm input |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| Residual EVM | *< 0.8 %, typical* | 5, 10, 15 and 20 MHz bandwidths, -10 dBm input |

| Adjacent Channel Power (ACP) | Performance | Conditions |
|---|---|---|
| Minimum carrier power | > -20 dBm<br>> -5 dBm | RF I\|O ports<br>RFIO ports |
| Dynamic range | < -58 dBc, nominal<br>< -60 dBc, nominal | E-UTRA<br>UTRA |

### Source Performance

Measured over specified frequency ranges between 695 and 6000 MHz.

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

## 5G NR Applications

### Measurement Performance

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

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

### Source Performance

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

## WLAN Applications

### Measurement Performance

| Modulated Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.27 dB, typical*<br>*< ±0.49 dB, typical* | 0 dBm input<br>2400 to 2483.5 MHz<br>5150 to 5185 MHz |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| EVM | Preamble only, RF I\|O HD ports at -20 dBm input | |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| 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*<br>*< -44 dB, typical* | 5.8 GHz<br>20 MHz bandwidth<br>40 MHz bandwidth |
| 802.11ac | *< -45 dB, typical*<br>*< -43 dB, typical* | 5.57 GHz<br>80 MHz bandwidth<br>160 MHz bandwidth |
| 802.11af | *< -51 dB, typical* | 700 MHz, 8 MHz bandwidth |
| 802.11ah | *< -51 dB, typical* | 900 MHz, 16 MHz bandwidth |
| 802.11ax | *< -47 dB, typical*<br>*< -45 dB, typical* | 5.775 GHz<br>80 MHz bandwidth<br>160 MHz bandwidth |
| EVM | Preamble only, RFIO HD ports at -10 dBm input | |
| 802.11b | *< -42 dB, typical* | 2.4 GHz |
| 802.11g | *< -50 dB, typical* | 2.4 GHz |
| 802.11a | *< -49 dB, typical* | 5.8 GHz |
| 802.11n | *< -49 dB, typical*<br>*< -47 dB, typical* | 5.8 GHz<br>20 MHz bandwidth<br>40 MHz bandwidth |
| 802.11ac | *< -45 dB, typical*<br>*< -43 dB, typical* | 5.57 GHz<br>80 MHz bandwidth<br>160 MHz bandwidth |
| 802.11af | *< -51 dB, typical* | 700 MHz, 8 MHz bandwidth |
| 802.11ah | *< -50 dB, typical* | 900 MHz, 16 MHz bandwidth |
| 802.11ax | *< -47 dB, typical*<br>*< -45 dB, typical* | 5.775 GHz<br>80 MHz bandwidth<br>160 MHz bandwidth |

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

## Spectrum Emission Mask

Refer to Figures 3 to 9 for nominal SEM performance. SEM transmitter test signal was generated by the Keysight N5182B MXG signal generator.

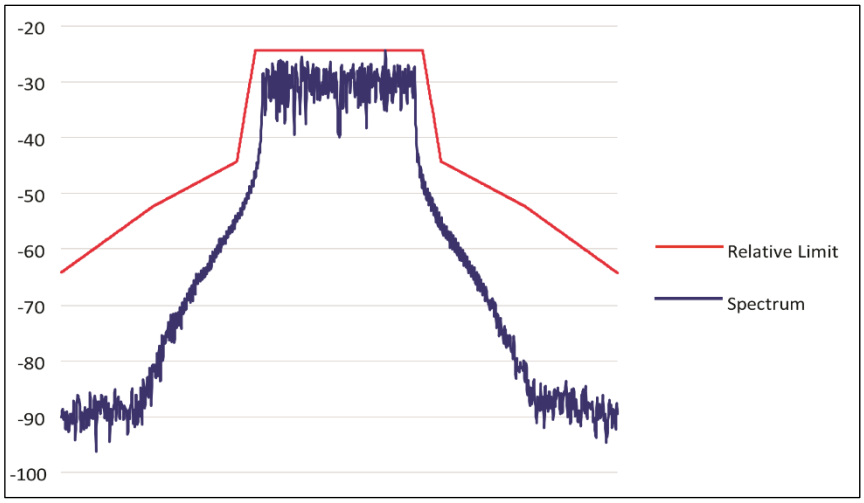


Figure 3: 802.11a/g SEM nominal performance at 2.4 GHz with 20 MHz bandwidth at RF I|O ports

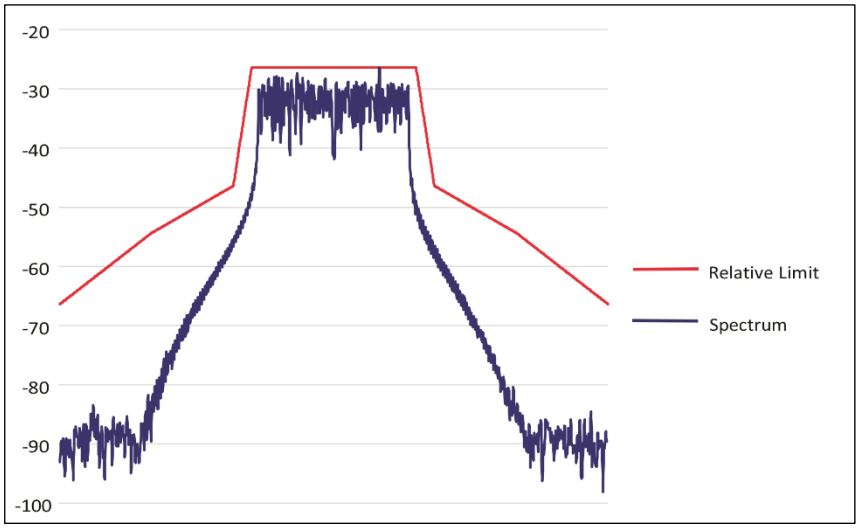


Figure 4: 802.11a/g SEM nominal performance at 5.8 GHz with 20 MHz bandwidth at RF I|O ports

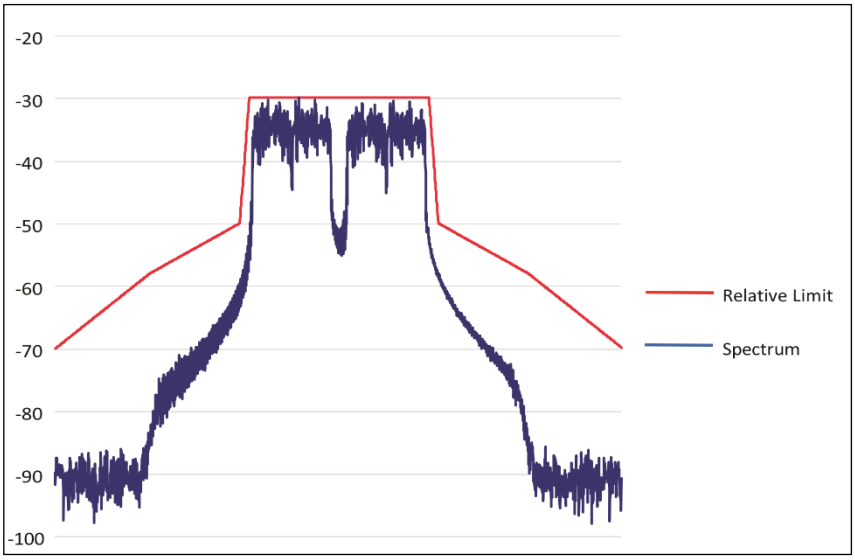


Figure 5: 802.11n SEM nominal performance at 5.8 GHz with 40 MHz bandwidth at RF I|O ports

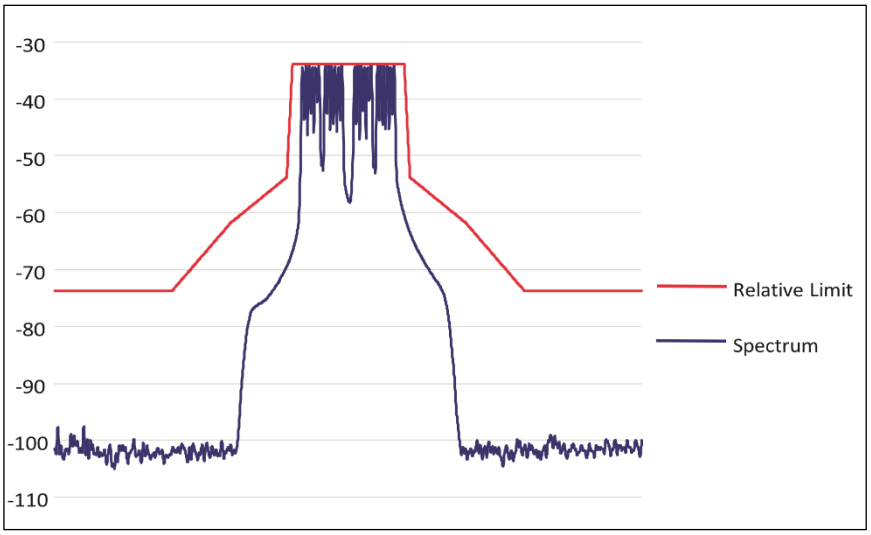


Figure 6: 802.11af SEM nominal performance at 700 MHz with 8 MHz bandwidth at RF I|O ports

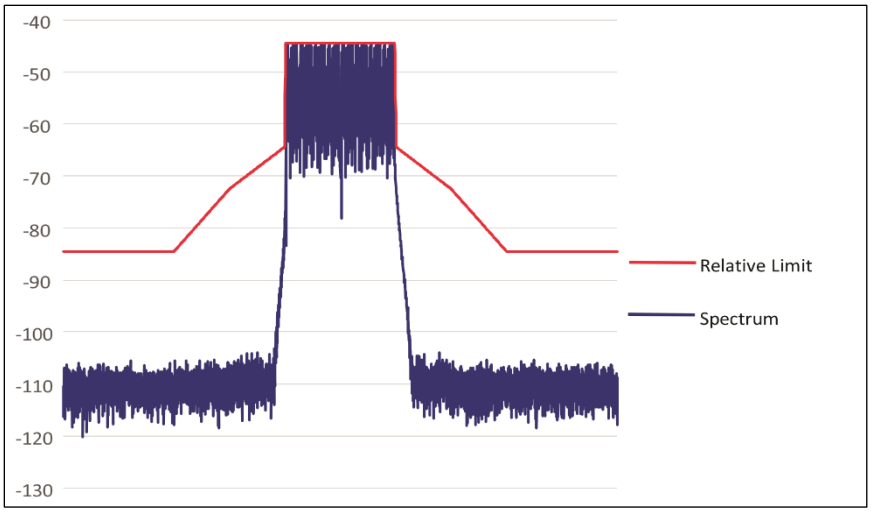


Figure 7: 802.11ah SEM nominal performance at 900 MHz with 16 MHz bandwidth at RF I|O ports

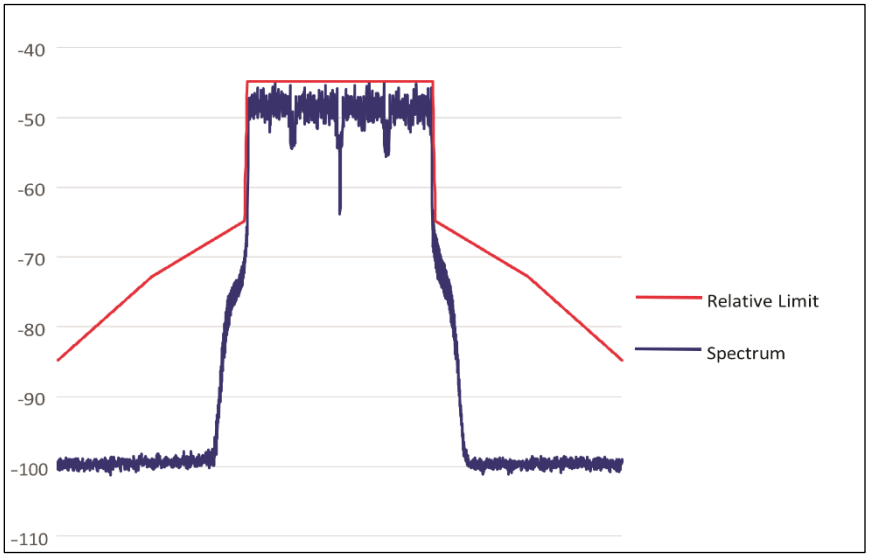


Figure 8: 802.11ax SEM nominal performance at 5.775 GHz with 80 MHz bandwidth at RF I|O ports

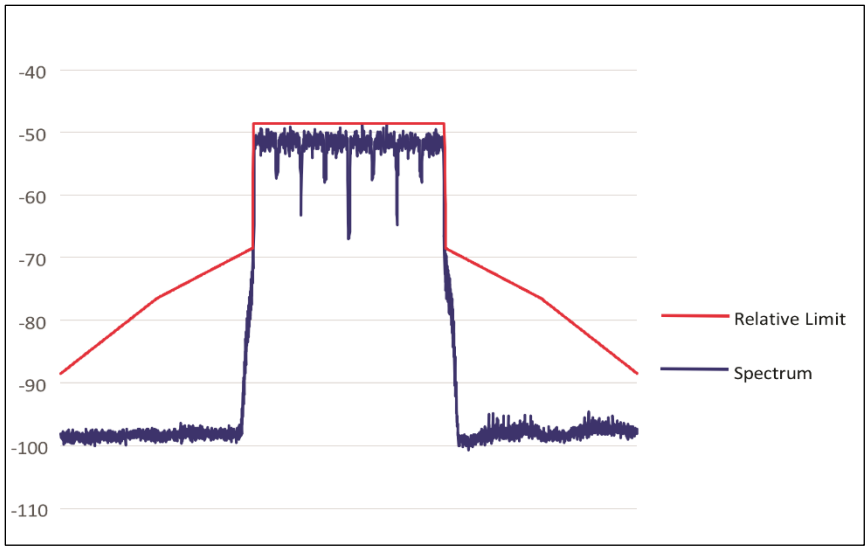


Figure 9: 802.11ax SEM nominal performance at 5.57 GHz with 160 MHz bandwidth at RF I|O ports

## Source Performance

| Error Vector Magnitude (EVM) | 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*<br>*< -44 dB, typical* | 5.8 GHz, -15 to -5 dBm output<br>20 MHz bandwidth<br>40 MHz bandwidth |
| 802.11ac | *< -42 dB, typical* | 5.57 GHz, 80 and 160 MHz bandwidths, -15 to -5 dBm output |
| 802.11af* | *< -54 dB, typical* | 700 MHz, 8 MHz bandwidth, -15 to -5 dBm output |
| 802.11ah* | *< -54 dB, typical* | 900 MHz, 16 MHz bandwidth, -15 to -5 dBm output |
| 802.11ax* | *< -40 dB, typical* | 15 to -5 dBm output<br>5.775 GHz, 80 MHz bandwidth<br>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 |

| Error Vector Magnitude (EVM) | Performance | Conditions |
|---|---|---|
| 802.11n | *< -42 dB, typical* | 5.8 GHz, 20 and 40 MHz bandwidths, -20 to -15 dBm output |
| 802.11ac | *< -40 dB, typical*<br>*< -38 dB, typical* | 5.57 GHz, -20 to -15 dBm output<br>80 MHz bandwidth,<br>160 MHz bandwidth |
| 802.11af* | *< -54 dB, typical* | 700 MHz, 8 MHz bandwidth, -20 to -15 dBm output |
| 802.11ah* | *< -55 dB, typical* | 900 MHz, 16 MHz bandwidth, -20 to -15 dBm output |
| 802.11ax* | *< -40 dB, typical*<br>*< -39 dB, typical* | -20 to -15 dBm output<br>5.775 GHz, 80 MHz bandwidth<br>5.57 GHz, 160 MHz bandwidth |

* 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.

| Channel Power | Performance | Conditions |
|---|---|---|
| Absolute power accuracy | *< ±0.26 dB, typical* | 0 dBm input |

| Modulation | Performance | Conditions |
|---|---|---|
| Deviation range | < ±250 kHz, nominal | |

| EDR Modulation Accuracy | Performance | Conditions |
|---|---|---|
| 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 | |

## Solution Overview

The 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 both 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.

## Summary

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 see Keysight's websites:

E6640A EXM

5G Non-Signaling Manufacturing Test Solution

## Learn more at: www.keysight.com

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

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