

M9416A VXT PXIe Vector Transceiver

380 MHz to 12.3 GHz



Table of Contents

- Technical Specifications..... 3
- Vector Signal Analyzer..... 4
- Vector Signal Generator..... 8
- Front Panel..... 14
- General Specifications 15
- WLAN Measurement Application Key Specifications..... 16
- WLAN Source Key Specifications 16
- 5G NR Measurement Application Key Specifications 18
- 5G NR Source Key Specifications 19
- LTE/LTE-Advanced FDD & LTE/LTE-Advanced TDD Measurement Application Key Specifications 22
- LTE Source Key Specifications..... 22
- W-CDMA/HSPA+ Measurement Application Key Specifications..... 24
- W-CDMA/HSPA+ Source Key Specifications 24
- Related Literature..... 25
- Web 25

Technical Specifications

Definitions and conditions

Specifications describe the warranted performance of calibrated instruments. Data represented in this document are specifications under the following conditions unless otherwise noted.

- Specifications are valid from 45 to 75 °C for individual module temperature, as reported by the module, and 20 to 35 °C for environment temperature unless otherwise noted
- Calibrated instrument has been stored for a minimum of 2 hours within the allowed operating range
- If instrument has previously been stored at a temperature range inside the allowed storage range, but outside the allowed operating range, instrument must have been stored for a minimum of 2 hours within the allowed operating range before turn-on
- 45-minute warm-up time with the Modular TRX application running
- Calibration cycle maintained
- When used with Keysight M9300A frequency reference and Keysight interconnect cables
- An “All Alignment” has been run within the previous 7 days
- A “Fast Alignment” has been run:
 - Within the previous 8 hours
 - If the environmental temperature has changed more than 5°C from the previous Fast Alignment

Typical describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 95 percent of the units exhibit with a 95 percent confidence level. This data does not include measurement uncertainty and is valid only at room temperature (approximately 25 °C) after alignment within the stated alignment time and temperature limits.

Nominal values indicate expected performance or describe product performance that is useful in the application of the product but are not covered by the product warranty.

Recommended best practices in use

- Use slot blockers and EMC filler panels in empty module slots to ensure proper operating temperatures. Keysight chassis and slot blockers optimize module temperature performance and reliability of test.
- Set chassis fan to high at environmental temperatures above 35 °C.

Vector Signal Analyzer

Performance

| Capture depth | | |
|---------------------------------|--|---------|
| Standard (Option M02) | 256 MSa of IQ data | |
| Option M05 | 512 MSa of IQ data | |
| Frequency | | |
| Frequency range | | |
| Option F06 | 380 MHz to 6 GHz | |
| Option F08 | 380 MHz to 8 GHz | |
| Option F12 | 380 MHz to 12.3 GHz | |
| Frequency reference | | |
| Accuracy, aging rate, stability | Refer to M9300A specifications | |
| Frequency readout accuracy | | |
| CW | \pm (marker frequency x frequency reference accuracy + 0.10% x span + 5% x RBW + 2 Hz + 0.5 x horizontal resolution) | |
| Demodulation | \pm (center frequency x frequency reference accuracy + 1 Hz) | |
| Resolution | 1 Hz | |
| Analysis Bandwidth | | |
| Standard (Option B4X) | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| | 1.31 to 12.3 GHz | 400 MHz |
| Option B8X | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| | 1.31 to 2 GHz | 600 MHz |
| | 2 to 12.3 GHz | 800 MHz |
| Option B12 | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| | 1.31 to 2 GHz | 600 MHz |
| | 2 to 12.3 GHz | 1.2 GHz |
| Triggering | | |
| Trigger | | |
| IQ analyzer | Free run, External 1, External 2, RF burst, Video, Periodic, PXI, Internal | |
| Trigger delay range | -150 to 500 ms | |
| Resolution | 1/sample rate | |
| Maximum safe input level | | |
| Average power input | | |
| RF input port | +27 dBm | |
| Option HDX, Half duplex port | +27 dBm | |
| DC volts | | |
| RF input port | 30 Vdc | |
| Option HDX, Half duplex port | 30 Vdc | |

Absolute Amplitude Accuracy (CW mode) ¹

| RF input port | | | |
|---------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Frequency Range | -70 dBm ≤ Input level < +10 dBm | +10 dBm ≤ Input level ≤ +20 dBm | +20 dBm < Input level ≤ +27 dBm |
| 380 MHz to 1.31 GHz | < ± 0.50 dB, < ± 0.20 dB typical | < ± 0.60 dB, < ± 0.30 dB typical | < ± 1.00 dB, < ± 0.70 dB typical |
| 1.31 to 4.3 GHz | < ± 0.60 dB, < ± 0.25 dB typical | < ± 0.65 dB, < ± 0.30 dB typical | < ± 1.00 dB, < ± 0.65 dB typical |
| 4.3 to 8.4 GHz | < ± 0.55 dB, < ± 0.25 dB typical | < ± 0.55 dB, < ± 0.25 dB typical | < ± 0.75 dB, < ± 0.40 dB typical |
| 8.4 to 11.4 GHz | < ± 0.60 dB, < ± 0.30 dB typical | < ± 0.80 dB, < ± 0.40 dB typical | < ± 0.90 dB, < ± 0.50 dB typical |
| 11.4 to 12.3 GHz | < ± 0.70 dB, < ± 0.35 dB typical | < ± 0.85 dB, < ± 0.45 dB typical | < ± 1.25 dB, < ± 0.70 dB typical |

| Half duplex port, Option HDX | | | |
|------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| Frequency Range | -70 dBm ≤ Input level < +10 dBm | +10 dBm ≤ Input level ≤ +20 dBm | +20 dBm < Input level ≤ +27 dBm |
| 380 MHz to 1.31 GHz | < ± 0.50 dB, < ± 0.25 dB typical | < ± 0.60 dB, < ± 0.30 dB typical | < ± 1.15 dB, < ± 0.85 dB typical |
| 1.31 to 4.3 GHz | < ± 0.60 dB, < ± 0.25 dB typical | < ± 0.65 dB, < ± 0.30 dB typical | < ± 1.30 dB, < ± 0.80 dB typical |
| 4.3 to 8.4 GHz | < ± 0.70 dB, < ± 0.30 dB typical | < ± 0.60 dB, < ± 0.30 dB typical | < ± 0.85 dB, < ± 0.50 dB typical |
| 8.4 to 11.4 GHz | < ± 0.75 dB, < ± 0.40 dB typical | < ± 0.75 dB, < ± 0.35 dB typical | < ± 0.95 dB, < ± 0.55 dB typical |
| 11.4 to 12.3 GHz | < ± 0.80 dB, < ± 0.40 dB typical | < ± 0.90 dB, < ± 0.45 dB typical | < ± 1.15 dB, < ± 0.65 dB typical |

Input Voltage Standing Wave Ratio (VSWR)

| | RF input port | Half Duplex Port (configured to input mode) |
|--------------------|---------------------------|---|
| 380 MHz to 4.3 GHz | < 1.55:1, < 1.4:1 typical | < 1.55:1, < 1.4:1 typical |
| 4.3 to 5.8 GHz | < 1.4:1, < 1.3:1 typical | < 1.55:1, < 1.4:1 typical |
| 5.8 to 7.2 GHz | < 1.8:1, < 1.6:1 typical | < 1.9:1, < 1.7:1 typical |
| 7.2 to 10.2 GHz | < 1.6:1, < 1.4:1 typical | < 1.6:1, < 1.4:1 typical |
| 10.2 to 12.3 GHz | < 2.0:1, < 1.9:1 typical | < 2.0:1, < 1.9:1 typical |

Displayed Average Noise Floor (DANL) ²

| | RF input port, with analyzer ranged to -70 dBm | Half duplex port, Option HDX, with analyzer ranged to -70 dBm |
|--------------------|--|---|
| 380 MHz to 4.3 GHz | -165 dBm, -167 dBm typical | -160 dBm, -162 dBm typical |
| 4.3 to 10.2 GHz | -165 dBm, -167 dBm typical | -158 dBm, -161 dBm typical |
| 10.2 to 12.3 GHz | -162 dBm, -165 dBm typical | -155 dBm, -157 dBm typical |

Third-order Intermodulation Distortion (TOI, with analyzer ranged to +10 dBm)

| | |
|--------------------|--------------------------|
| 380 MHz to 4.3 GHz | +30 dBm, +32 dBm typical |
| 4.3 to 6 GHz | +28 dBm, +30 dBm typical |
| 6 to 12.3 GHz | +27 dBm, +29 dBm typical |

1. Signal is measured at 1.1 MHz offset from the center frequency. Otherwise, an IF flatness error must be added.

2. Input terminated, LNA on, log power average, and normalized to 1 Hz bandwidth.

Phase Noise Sidebands (CF = 1 GHz)

| | |
|----------------|----------------------------------|
| 1 kHz offset | -114 dBc/Hz, -116 dBc/Hz typical |
| 10 kHz offset | -128 dBc/Hz, -130 dBc/Hz typical |
| 100 kHz offset | -132 dBc/Hz, -134 dBc/Hz typical |
| 1 MHz offset | -135 dBc/Hz, -137 dBc/Hz typical |
| 10 MHz offset | -139 dBc/Hz, -141 dBc/Hz typical |

Phase noise at 1 GHz, versus offset frequency, measured

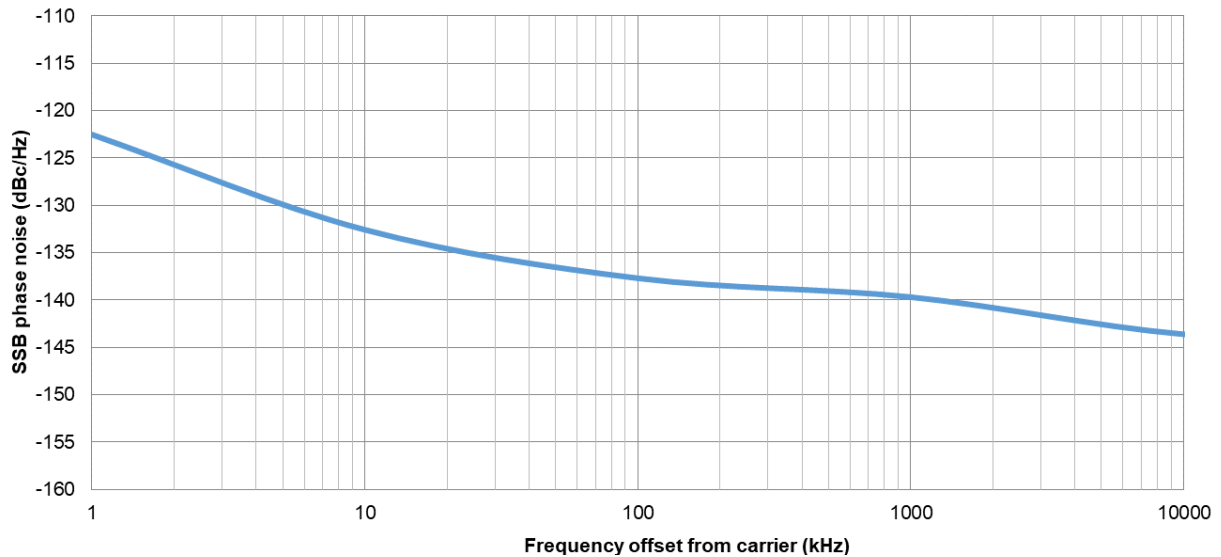


Figure 1. Phase noise from 1 kHz to 10 MHz offset at 1 GHz

Spurious Responses

Residual responses

RF input port; Option HDX, half duplex port; with analyzer ranged to +10 dBm; offset from 10 MHz to 1/2 × analysis bandwidth

| | |
|------------------|------------------------------|
| 380 MHz to 9 GHz | < -79 dBm, < -82 dBm typical |
| 9 to 9.6 GHz | < -76 dBm, < -80 dBm typical |
| 9.6 to 12.3 GHz | < -81 dBm, < -83 dBm typical |

Image responses, nominal

| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
|---------------------|------------|------------|------------|------------|------------|------------|
| 380 to 550 MHz | -63 dBc | N/A | N/A | N/A | N/A | N/A |
| 550 MHz to 1.31 GHz | -62 dBc | -60 dBc | N/A | N/A | N/A | N/A |
| ≤1.31 to 2 GHz | -62 dBc | -60 dBc | -60 dBc | -60 dBc | N/A | N/A |
| 2 to 4.3 GHz | -62 dBc | -60 dBc | -60 dBc | -60 dBc | -58 dBc | -56 dBc |
| 4.3 to 4.6 GHz | -63 dBc | -63 dBc | -60 dBc | -60 dBc | -58 dBc | -56 dBc |
| 4.6 to 12.3 GHz | -63 dBc | -63 dBc | -60 dBc | -60 dBc | -59 dBc | -58 dBc |

Sideband spurs, nominal

| | |
|------------------------|---------|
| 1 kHz to 10 MHz offset | -85 dBc |
|------------------------|---------|

LO Feedthrough (dBr ¹)

| | RF input port, with analyzer ranged from -30 to +27 dBm | Option HDX, half duplex port, with analyzer ranged from -25 to +27 dBm |
|---------------------|---|--|
| 380 MHz to 12.3 GHz | -52 dBr, -62 dBr typical | -52 dBr, -62 dBr typical |

IF Flatness

| RF input port, -25 dBm ≤ Input level ≤ +10 dBm, typical indicated by <i>italics</i> | | | | | | |
|--|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
| 380 to 550 MHz | ± 0.90 dB, ± 0.50 dB | N/A | N/A | N/A | N/A | N/A |
| 550 MHz to 1.31 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.70 dB, ± 0.40 dB | N/A | N/A | N/A | N/A |
| 1.31 to 1.62 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.70 dB, ± 0.40 dB | ± 1.20 dB, ± 0.70 dB | ± 1.50 dB, ± 0.95 dB | N/A | N/A |
| 1.62 to 2 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.70 dB, ± 0.40 dB | ± 0.65 dB, ± 0.30 dB | ± 0.65 dB, ± 0.30 dB | N/A | N/A |
| 2 to 3.5 GHz | ± 0.50 dB, ± 0.15 dB | ± 0.55 dB, ± 0.25 dB | ± 0.65 dB, ± 0.30 dB | ± 0.65 dB, ± 0.30 dB | ± 0.60 dB, ± 0.25 dB | ± 0.75 dB, ± 0.35 dB |
| 3.5 to 4.3 GHz | ± 0.55 dB, ± 0.20 dB | ± 0.55 dB, ± 0.25 dB | ± 0.80 dB, ± 0.40 dB | ± 0.80 dB, ± 0.40 dB | ± 0.80 dB, ± 0.40 dB | ± 0.85 dB, ± 0.45 dB |
| 4.3 to 12.3 GHz | ± 1.00 dB, ± 0.50 dB | ± 1.00 dB, ± 0.50 dB | ± 1.10 dB, ± 0.65 dB | ± 1.15 dB, ± 0.70 dB | ± 1.15 dB, ± 0.70 dB | ± 1.25 dB, ± 0.80 dB |
| Half duplex port, Option HDX, -25 dBm ≤ Input level ≤ +10 dBm, typical indicated by <i>italics</i> | | | | | | |
| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
| 380 to 550 MHz | ± 0.90 dB, ± 0.55 dB | N/A | N/A | N/A | N/A | N/A |
| 550 MHz to 1.31 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.80 dB, ± 0.40 dB | N/A | N/A | N/A | N/A |
| 1.31 to 1.62 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.80 dB, ± 0.40 dB | ± 1.15 dB, ± 0.70 dB | ± 1.55 dB, ± 0.95 dB | N/A | N/A |
| 1.62 to 2 GHz | ± 0.70 dB, ± 0.35 dB | ± 0.80 dB, ± 0.40 dB | ± 0.60 dB, ± 0.30 dB | ± 0.60 dB, ± 0.30 dB | N/A | N/A |
| 2 to 3.5 GHz | ± 0.45 dB, ± 0.15 dB | ± 0.55 dB, ± 0.25 dB | ± 0.60 dB, ± 0.25 dB | ± 0.60 dB, ± 0.25 dB | ± 0.65 dB, ± 0.30 dB | ± 0.70 dB, ± 0.35 dB |
| 3.5 to 4.3 GHz | ± 0.50 dB, ± 0.20 dB | ± 0.60 dB, ± 0.20 dB | ± 0.75 dB, ± 0.40 dB | ± 0.75 dB, ± 0.40 dB | ± 1.00 dB, ± 0.55 dB | ± 1.35 dB, ± 0.80 dB |
| 4.3 to 12.3 GHz | ± 0.85 dB, ± 0.40 dB | ± 1.00 dB, ± 0.50 dB | ± 1.10 dB, ± 0.60 dB | ± 1.25 dB, ± 0.70 dB | ± 1.30 dB, ± 0.75 dB | ± 1.35 dB, ± 0.80 dB |

1. dBr is LO feedthrough power relative to the range level of the receiver.

Vector Signal Generator

Performance

| Arb sample memory (storage capacity) | | |
|---|-----------------------------------|--------------------------|
| Standard (Option M02) | 256 MSa of IQ data | |
| Option M05 | 512 MSa of IQ data | |
| Frequency range | | |
| Option F06 | 380 MHz to 6 GHz | |
| Option F08 | 380 MHz to 8 GHz | |
| Option F12 | 380 MHz to 12.3 GHz | |
| Frequency reference | | |
| Accuracy, aging rate, stability | Refer to M9300A specifications | |
| Frequency accuracy | | |
| \pm (output frequency \times frequency reference accuracy + 0.001 Hz) | | |
| Frequency switching speed ¹ | | |
| SCPI mode | \leq 14 ms nominal | |
| IVI mode | \leq 6 ms nominal | |
| Signal generation bandwidth | | |
| | Center frequency | Maximum bandwidth |
| Standard (Option B4X) | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| | 1.31 to 12.3 GHz | 400 MHz |
| Option B8X | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| | 1.31 to 2 GHz | 600 MHz |
| Option B12 | 2 to 12.3 GHz | 800 MHz |
| | 380 to 550 MHz | 100 MHz |
| | 550 MHz to 1.31 GHz | 200 MHz |
| Option B12 | 1.31 to 2 GHz | 600 MHz |
| | 2 to 12.3 GHz | 1.2 GHz |
| | | |
| Output level range (CW mode) | | |
| RF output port | | |
| 380 MHz to 12.3 GHz | -120 to +5 dBm | |
| Option HDX, half duplex port (configured to output mode) | | |
| 380 MHz to 12.3 GHz | -120 to +5 dBm | |
| RF output port, Option 1EA | | |
| 380 MHz to 12.3 GHz | -120 to +20 dBm, +25 dBm settable | |
| Option HDX, half duplex port (configured to output mode), Option 1EA | | |
| 380 MHz to 12.3 GHz | -120 to +10 dBm | |
| Maximum reverse power | | |
| Average power input | +27 dBm | |
| DC volts | 30 Vdc | |
| Amplitude switching speed ¹ | | |
| SCPI mode | \leq 10 ms nominal | |
| IVI mode | \leq 5 ms nominal | |

1. Switching speed depends highly upon the hardware and controller that is used. Measurements were made with the M9416A in an M9018B chassis with the M9037A embedded controller, Windows 10 Operating System.

Measured relative level accuracy at 1 GHz initial power +20 dBm, 1 dB step

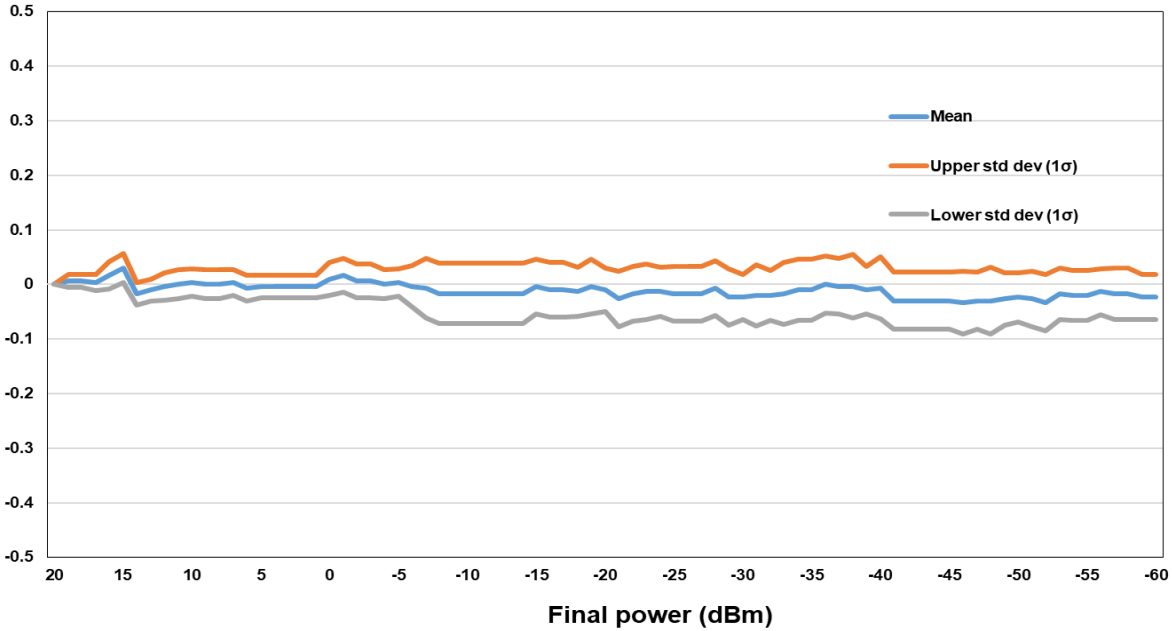


Figure 2. Measured relative level accuracy at 1 GHz

Absolute level accuracy (CW mode)

| RF output port, typical indicated by <i>italics</i> | | | | | | |
|---|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Frequency range | 380 to 550 MHz | 550 MHz to 4.3 GHz | 4.3 to 6 GHz | 6 to 7.8 GHz | 7.8 to 10.2 GHz | 10.2 to 12.3 GHz |
| +10 dBm < Level ≤ +20 dBm | < ± 0.60 dB, < ± 0.25 <i>dB</i> | < ± 0.75 dB, < ± 0.35 <i>dB</i> | < ± 0.90 dB, < ± 0.45 <i>dB</i> | < ± 1.00 dB, < ± 0.45 <i>dB</i> | < ± 0.85 dB, < ± 0.45 <i>dB</i> | < ± 0.85 dB, < ± 0.45 <i>dB</i> |
| 0 dBm < Level ≤ +10 dBm | < ± 0.55 dB, < ± 0.25 <i>dB</i> | < ± 0.65 dB, < ± 0.30 <i>dB</i> | < ± 0.80 dB, < ± 0.40 <i>dB</i> | < ± 0.85 dB, < ± 0.45 <i>dB</i> | < ± 0.75 dB, < ± 0.35 <i>dB</i> | < ± 0.65 dB, < ± 0.30 <i>dB</i> |
| -60 dBm ≤ Level ≤ 0 dBm | < ± 0.55 dB, < ± 0.25 <i>dB</i> | < ± 0.55 dB, < ± 0.25 <i>dB</i> | < ± 0.60 dB, < ± 0.25 <i>dB</i> | < ± 0.60 dB, < ± 0.20 <i>dB</i> | < ± 0.75 dB, < ± 0.25 <i>dB</i> | < ± 0.70 dB, < ± 0.20 <i>dB</i> |
| -90 dBm ≤ Level < -60 dBm | < ± 0.55 dB, < ± 0.25 <i>dB</i> | < ± 0.55 dB, < ± 0.25 <i>dB</i> | < ± 0.65 dB, < ± 0.35 <i>dB</i> | < ± 0.95 dB, < ± 0.50 <i>dB</i> | < ± 0.75 dB, < ± 0.35 <i>dB</i> | < ± 1.00 dB, < ± 0.50 <i>dB</i> |
| -100 dBm ≤ Level < -90 dBm | < ± 0.75 dB, < ± 0.35 <i>dB</i> | < ± 0.75 dB, < ± 0.40 <i>dB</i> | < ± 0.70 dB, < ± 0.30 <i>dB</i> | < ± 0.95 dB, < ± 0.50 <i>dB</i> | < ± 0.75 dB, < ± 0.35 <i>dB</i> | < ± 1.10 dB, < ± 0.50 <i>dB</i> |
| -110 dBm ≤ Level < -100 dBm | < ± 0.85 dB, < ± 0.45 <i>dB</i> | < ± 0.90 dB, < ± 0.55 <i>dB</i> | < ± 0.90 dB, < ± 0.50 <i>dB</i> | < ± 0.95 dB, < ± 0.55 <i>dB</i> | < ± 0.85 dB, < ± 0.45 <i>dB</i> | < ± 1.10 dB, < ± 0.60 <i>dB</i> |

Option HDX, half duplex port, typical indicated by *italics*

| Frequency range | 380 to 550 MHz | 550 MHz to 4.3 GHz | 4.3 to 6 GHz | 6 to 7.8 GHz | 7.8 to 10.2 GHz | 10.2 to 12.3 GHz |
|-----------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 0 dBm < Level ≤ +10 dBm | < ± 0.50 dB, < ± 0.20 dB | < ± 0.50 dB, < ± 0.20 dB | < ± 0.65 dB, < ± 0.30 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.60 dB, < ± 0.25 dB | < ± 0.70 dB, < ± 0.40 dB |
| -60 dBm ≤ Level ≤ 0 dBm | < ± 0.50 dB, < ± 0.20 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.65 dB, < ± 0.30 dB | < ± 0.50 dB, < ± 0.25 dB | < ± 0.70 dB, < ± 0.25 dB | < ± 0.70 dB, < ± 0.30 dB |
| -90 dBm ≤ Level < -60 dBm | < ± 0.50 dB, < ± 0.20 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.65 dB, < ± 0.30 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.60 dB, < ± 0.25 dB |
| -100 dBm ≤ Level < -90 dBm | < ± 0.65 dB, < ± 0.35 dB | < ± 0.65 dB, < ± 0.35 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.55 dB, < ± 0.25 dB | < ± 0.60 dB, < ± 0.30 dB |
| -110 dBm ≤ Level < -100 dBm | < ± 0.80 dB, < ± 0.40 dB | < ± 0.95 dB, < ± 0.55 dB | < ± 0.70 dB, < ± 0.40 dB | < ± 0.70 dB, < ± 0.40 dB | < ± 0.65 dB, < ± 0.40 dB | < ± 0.80 dB, < ± 0.50 dB |

Measured amplitude repeatability

RF output port, 0 dBm output power, 1 GHz, 25 °C

Delta from initial value < ± 0.10 dB nominal

Setting resolution

0.01 dB

Output Voltage Standing Wave Ratio (VSWR)

RF output port

| | |
|---------------------|-----------------------------------|
| 380 MHz to 1.31 GHz | < 1.90:1, < 1.70:1 <i>typical</i> |
| 1.31 to 7.8 GHz | < 1.75:1, < 1.65:1 <i>typical</i> |
| 7.8 to 10.2 GHz | < 1.75:1, < 1.60:1 <i>typical</i> |
| 10.2 to 12.3 GHz | < 2.00:1, < 1.70:1 <i>typical</i> |

Option HDX, half duplex port (configured to output mode)

| | |
|---------------------|-----------------------------------|
| 380 MHz to 1.31 GHz | < 1.90:1, < 1.75:1 <i>typical</i> |
| 1.31 to 6 GHz | < 1.75:1, < 1.40:1 <i>typical</i> |
| 6 to 10.2 GHz | < 1.65:1, < 1.50:1 <i>typical</i> |
| 10.2 to 12.3 GHz | < 1.90:1, < 1.55:1 <i>typical</i> |

Harmonics

RF output port

0 dBm output power

| | |
|--------------------|-------------------------------------|
| 380 MHz to 4.3 GHz | < -41 dBc, < -45 dBc <i>typical</i> |
| 4.3 to 5.8 GHz | < -36 dBc, < -42 dBc <i>typical</i> |
| 5.8 to 10.2 GHz | < -34 dBc, < -39 dBc <i>typical</i> |
| 10.2 to 12.3 GHz | < -41 dBc, < -46 dBc <i>typical</i> |

+10 dBm output power, with Option 1EA

| | |
|--------------------|---------------------------------------|
| 380 MHz to 4.3 GHz | < -31 dBc, < -35 dBc <i>typical</i> |
| 4.3 to 5.8 GHz | < -27 dBc, < -33 dBc <i>typical</i> |
| 5.8 to 9 GHz | < -26 dBc, < -31 dBc <i>typical</i> |
| 9 to 10.2 GHz | < -24 dBc, < -29 dBc <i>typical</i> |
| 10.2 to 12.3 GHz | < -29.5 dBc, < -35 dBc <i>typical</i> |

Option HDX, half duplex port, -5 dBm output power

| | |
|--------------------|------------------------------|
| 380 MHz to 4.3 GHz | < -36 dBc, < -40 dBc typical |
| 4.3 to 5.8 GHz | < -33 dBc, < -38 dBc typical |
| 5.8 to 10.2 GHz | < -32 dBc, < -37 dBc typical |
| 10.2 to 12.3 GHz | < -36 dBc, < -42 dBc typical |

Non-harmonic spurious (CW mode)

RF output port, Option HDX, half duplex port, 0 dBm output power

| | |
|--------------------|------------------------------|
| 380 MHz to 4.3 GHz | < -65 dBc, < -70 dBc typical |
| 4.3 to 6.5 GHz | < -47 dBc, < -52 dBc typical |
| 6.5 to 9.6 GHz | < -57 dBc, < -62 dBc typical |
| 9.6 to 11.4 GHz | < -50 dBc, < -56 dBc typical |
| 11.4 to 12.3 GHz | < -51 dBc, < -60 dBc typical |

LO feedthrough

RF output port, Option HDX, half duplex port, 0 dBm output power

| | |
|---------------------|--------------------------|
| 380 MHz to 1.31 GHz | -51 dBc, -65 dBc typical |
| 1.31 to 1.62 GHz | -46 dBc, -59 dBc typical |
| 1.62 to 2 GHz | -44 dBc, -58 dBc typical |
| 2 to 4.3 GHz | -42 dBc, -54 dBc typical |
| 4.3 to 12.3 GHz | -46 dBc, -52 dBc typical |

Image responses

RF output port, 0 dBm output power, typical indicated by *italics*

| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
|---------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 380 to 550 MHz | -55 dBc, <i>-61 dBc</i> | N/A | N/A | N/A | N/A | N/A |
| 550 MHz to 1.31 GHz | -54 dBc, <i>-60 dBc</i> | -54 dBc, <i>-59 dBc</i> | N/A | N/A | N/A | N/A |
| 1.31 to 2 GHz | -53 dBc, <i>-59 dBc</i> | -52 dBc, <i>-58 dBc</i> | -51 dBc, <i>-57 dBc</i> | -49 dBc, <i>-54 dBc</i> | N/A | N/A |
| 2 to 12.3 GHz | -52 dBc, <i>-58 dBc</i> | -51 dBc, <i>-57 dBc</i> | -51 dBc, <i>-54 dBc</i> | -50 dBc, <i>-54 dBc</i> | -49 dBc, <i>-53 dBc</i> | -46 dBc, <i>-50 dBc</i> |

Option HDX, half duplex port, 0 dBm output power, typical indicated by *italics*

| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
|--------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 380 to 550 MHz | -55 dBc, <i>-61 dBc</i> | N/A | N/A | N/A | N/A | N/A |
| 550 MHz to 1.31 Hz | -54 dBc, <i>-60 dBc</i> | -53 dBc, <i>-57 dBc</i> | N/A | N/A | N/A | N/A |
| 1.31 to 2 GHz | -51 dBc, <i>-58 dBc</i> | -50 dBc, <i>-57 dBc</i> | -50 dBc, <i>-56 dBc</i> | -49 dBc, <i>-55 dBc</i> | N/A | N/A |
| 2 to 12.3 GHz | -51 dBc, <i>-57 dBc</i> | -49 dBc, <i>-58 dBc</i> | -48 dBc, <i>-54 dBc</i> | -48 dBc, <i>-53 dBc</i> | -47 dBc, <i>-51 dBc</i> | -45 dBc, <i>-48 dBc</i> |

Sideband spurious

| RF output port, Option HDX, half duplex port, 0 dBm output power | | | | |
|--|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Offset | 380 MHz to 4.3 GHz | 4.3 to 6 GHz | 6 to 10.2 GHz | 10.2 to 12.3 GHz |
| 1 to 100 kHz | -70 dBc, -76 dBc typical | -66 dBc, -72 dBc typical | -62 dBc, -69 dBc typical | -60 dBc, -65 dBc typical |
| 100 kHz to 1 MHz | -89 dBc, -95 dBc typical | -86 dBc, -92 dBc typical | -84 dBc, -89 dBc typical | -70 dBc, -75 dBc typical |
| 1 to 10 MHz | -90 dBc, -96 dBc typical | -88 dBc, -94 dBc typical | -87 dBc, -93 dBc typical | -81 dBc, -86 dBc typical |

Phase noise

| RF output port, 0 dBm; Option HDX, half duplex port, 0 dBm; Option 1EA, +10 dBm; Center frequency = 1 GHz | |
|---|----------------------------------|
| 1 kHz offset | -105 dBc/Hz, -115 dBc/Hz typical |
| 10 kHz offset | -126 dBc/Hz, -133 dBc/Hz typical |
| 100 kHz offset | -134 dBc/Hz, -139 dBc/Hz typical |
| 1 MHz offset | -141 dBc/Hz, -145 dBc/Hz typical |
| 10 MHz offset | -142 dBc/Hz, -145 dBc/Hz typical |

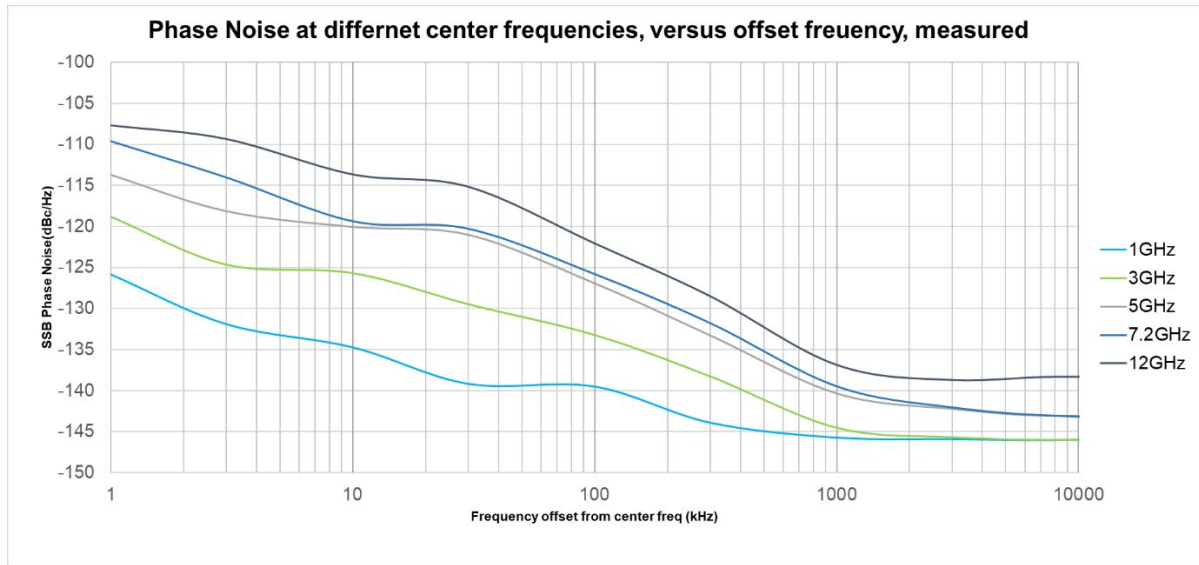


Figure 3. Measured phase noise from 1 kHz to 10 MHz offset at 1, 3, 5, 7.2 and 12 GHz

Broadband noise floor ¹

| RF output port, output level = 0 dBm | |
|--|----------------------------------|
| 380 to 550 MHz | -131 dBm/Hz, -135 dBm/Hz typical |
| 550 MHz to 4.3 GHz | -133 dBm/Hz, -137 dBm/Hz typical |
| 4.3 to 10.2 GHz | -131 dBm/Hz, -135 dBm/Hz typical |
| 10.2 to 12.3 GHz | -133 dBm/Hz, -136 dBm/Hz typical |
| Option HDX, half duplex port, output level = -10 dBm | |
| 380 to 550 MHz | -142 dBm/Hz, -147 dBm/Hz typical |
| 550 MHz to 4.3 GHz | -143 dBm/Hz, -147 dBm/Hz typical |
| 4.3 to 10.2 GHz | -139 dBm/Hz, -144 dBm/Hz typical |
| 10.2 to 12.3 GHz | -141 dBm/Hz, -145 dBm/Hz typical |

1. Measured at 10.1 MHz offset from the center frequency.

Third-order Intermodulation distortion (TOI)

| RF output port, output level = 0 dBm | |
|--|---------------------------------|
| 380 MHz to 7.8 GHz | +24 dBm, +27 dBm <i>typical</i> |
| 7.8 to 10.2 GHz | +23 dBm, +25 dBm <i>typical</i> |
| 10.2 to 12.3 GHz | +21 dBm, +24 dBm <i>typical</i> |
| Option HDX, half duplex port, output level = 0 dBm | |
| 380 to 550 MHz | +25 dBm, +28 dBm <i>typical</i> |
| 550 MHz to 4.3 GHz | +23 dBm, +26 dBm <i>typical</i> |
| 4.3 to 7.8 GHz | +20 dBm, +24 dBm <i>typical</i> |
| 7.8 to 10.2 GHz | +18 dBm, +22 dBm <i>typical</i> |
| 10.2 to 12.3 GHz | +17 dBm, +20 dBm <i>typical</i> |

IF flatness

| RF output port, $-30 \text{ dBm} \leq \text{Level} \leq +10 \text{ dBm}$, sample rate = 1.25 x bandwidth, typical indicated by <i>italics</i> | | | | | | |
|--|--|--|--|--|--|--|
| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
| 380 to 550 MHz | $\pm 0.80 \text{ dB}$, <i>$\pm 0.35 \text{ dB}$</i> | N/A | N/A | N/A | N/A | N/A |
| 550 to 680 MHz | $\pm 0.75 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | N/A | N/A | N/A | N/A |
| 680 to 730 MHz | $\pm 0.75 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | N/A | N/A | N/A | N/A |
| 730 MHz to 1.31 GHz | $\pm 0.65 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | N/A | N/A | N/A | N/A |
| 1.31 to 1.62 GHz | $\pm 0.75 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 1.10 \text{ dB}$, <i>$\pm 0.75 \text{ dB}$</i> | $\pm 1.25 \text{ dB}$, <i>$\pm 0.90 \text{ dB}$</i> | N/A | N/A |
| 1.62 to 2 GHz | $\pm 0.65 \text{ dB}$, <i>$\pm 0.20 \text{ dB}$</i> | $\pm 0.65 \text{ dB}$, <i>$\pm 0.30 \text{ dB}$</i> | $\pm 0.65 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | N/A | N/A |
| 2 to 3.5 GHz | $\pm 0.65 \text{ dB}$, <i>$\pm 0.30 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.85 \text{ dB}$, <i>$\pm 0.55 \text{ dB}$</i> |
| 3.5 to 4.3 GHz | $\pm 0.65 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.65 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.90 \text{ dB}$, <i>$\pm 0.60 \text{ dB}$</i> | $\pm 1.25 \text{ dB}$, <i>$\pm 0.85 \text{ dB}$</i> | $\pm 1.25 \text{ dB}$, <i>$\pm 0.85 \text{ dB}$</i> | $\pm 1.30 \text{ dB}$, <i>$\pm 0.90 \text{ dB}$</i> |
| 4.3 to 6 GHz | $\pm 0.80 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.85 \text{ dB}$, <i>$\pm 0.50 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.55 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.55 \text{ dB}$</i> | $\pm 1.20 \text{ dB}$, <i>$\pm 0.85 \text{ dB}$</i> |
| 6 to 9 GHz | $\pm 0.75 \text{ dB}$, <i>$\pm 0.30 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.30 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.30 \text{ dB}$</i> | $\pm 0.70 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.75 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.50 \text{ dB}$</i> |
| 9 to 10.2 GHz | $\pm 0.65 \text{ dB}$, <i>$\pm 0.20 \text{ dB}$</i> | $\pm 0.70 \text{ dB}$, <i>$\pm 0.25 \text{ dB}$</i> | $\pm 0.70 \text{ dB}$, <i>$\pm 0.35 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.85 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 1.30 \text{ dB}$, <i>$\pm 0.75 \text{ dB}$</i> |
| 10.2 to 12.3 GHz | $\pm 0.80 \text{ dB}$, <i>$\pm 0.40 \text{ dB}$</i> | $\pm 0.80 \text{ dB}$, <i>$\pm 0.45 \text{ dB}$</i> | $\pm 0.85 \text{ dB}$, <i>$\pm 0.50 \text{ dB}$</i> | $\pm 0.90 \text{ dB}$, <i>$\pm 0.60 \text{ dB}$</i> | $\pm 0.90 \text{ dB}$, <i>$\pm 0.60 \text{ dB}$</i> | $\pm 0.90 \text{ dB}$, <i>$\pm 0.60 \text{ dB}$</i> |

Half duplex port, Option HDX, $-20 \text{ dBm} \leq \text{Level} \leq +5 \text{ dBm}$, sample rate = 1.25 x bandwidth, typical indicated by *italics*

| Center frequency | 100 MHz BW | 200 MHz BW | 400 MHz BW | 600 MHz BW | 800 MHz BW | 1.2 GHz BW |
|---------------------|--|--|--|--|--|--|
| 380 to 550 MHz | $\pm 0.70 \text{ dB}$, $\pm 0.35 \text{ dB}$ | N/A | N/A | N/A | N/A | N/A |
| 550 to 680 MHz | $\pm 0.60 \text{ dB}$, $\pm 0.25 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.40 \text{ dB}$ | N/A | N/A | N/A | N/A |
| 680 to 730 MHz | $\pm 0.60 \text{ dB}$, $\pm 0.25 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.40 \text{ dB}$ | N/A | N/A | N/A | N/A |
| 730 MHz to 1.31 GHz | $\pm 0.65 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.50 \text{ dB}$ | N/A | N/A | N/A | N/A |
| 1.31 to 1.62 GHz | $\pm 0.70 \text{ dB}$, $\pm 0.35 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.40 \text{ dB}$ | $\pm 1.00 \text{ dB}$, $\pm 0.70 \text{ dB}$ | $\pm 1.15 \text{ dB}$, $\pm 0.85 \text{ dB}$ | N/A | N/A |
| 1.62 to 2 GHz | $\pm 0.60 \text{ dB}$, $\pm 0.25 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.25 \text{ dB}$ | $\pm 0.60 \text{ dB}$, $\pm 0.20 \text{ dB}$ | $\pm 0.50 \text{ dB}$, $\pm 0.35 \text{ dB}$ | N/A | N/A |
| 2 to 3.5 GHz | $\pm 0.60 \text{ dB}$, $\pm 0.30 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.40 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.40 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.45 \text{ dB}$ |
| 3.5 to 4.3 GHz | $\pm 0.60 \text{ dB}$, $\pm 0.35 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.35 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.50 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.55 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.55 \text{ dB}$ |
| 4.3 to 6 GHz | $\pm 0.65 \text{ dB}$, $\pm 0.30 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.85 \text{ dB}$, $\pm 0.50 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.55 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.55 \text{ dB}$ | $\pm 1.10 \text{ dB}$, $\pm 0.85 \text{ dB}$ |
| 6 to 9 GHz | $\pm 0.65 \text{ dB}$, $\pm 0.35 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.35 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.40 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.40 \text{ dB}$ | $\pm 0.70 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.50 \text{ dB}$ |
| 9 to 10.2 GHz | $\pm 0.55 \text{ dB}$, $\pm 0.20 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.30 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.55 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.65 \text{ dB}$ | $\pm 1.00 \text{ dB}$, $\pm 0.75 \text{ dB}$ | $\pm 1.15 \text{ dB}$, $\pm 0.75 \text{ dB}$ |
| 10.2 to 12.3 GHz | $\pm 0.55 \text{ dB}$, $\pm 0.20 \text{ dB}$ | $\pm 0.65 \text{ dB}$, $\pm 0.30 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.45 \text{ dB}$ | $\pm 0.75 \text{ dB}$, $\pm 0.50 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.55 \text{ dB}$ | $\pm 0.80 \text{ dB}$, $\pm 0.50 \text{ dB}$ |

Front Panel

Reference

| | |
|-----------------|---|
| Ref In, Ref Out | Frequency: 100 MHz |
| | Connector: MMPX female, 50 Ω nominal |
| | Lock range: ± 1 ppm, nominal |
| | Input amplitude: $>+10$ dBm, nominal |
| | Output amplitude: $>+10$ dBm, nominal |

LO reference

| | |
|-------------------------|---|
| 2.4 GHz In, 2.4 GHz Out | Connector: MMPX female, 50 Ω nominal |
| | Input amplitude: $>+10$ dBm, nominal |
| | Output amplitude: $>+12$ dBm, nominal |

RF connections

| | |
|-------------|---|
| RF Input | Connector: 3.5 mm female, 50 Ω nominal |
| RF Output | Connector: 3.5 mm female, 50 Ω nominal |
| Half Duplex | Connector: 3.5 mm female, 50 Ω nominal |

Trigger connections

| | |
|--|--|
| Trigger 1, Trigger 2 (Input/Output, selectable) | Connector: MMPX female |
| | Input impedance: 1 k Ω or 50 Ω nominal |
| | Input level range: 0 to +3.3 V |
| | Output impedance: 50 Ω nominal |
| | Output level range: 3.3 V LVTTTL |

DIO connections

| | |
|----------------|---------------------------------|
| Ctrl M, Ctrl S | Connector: Micro-HDMI female |
| | Level range: 3.3 V LVTTTL, LVDS |

General Specifications

Environmental characteristics

| | |
|-----------------------|--|
| Operating temperature | 0 to +45 °C |
| Storage temperature | -40 to +65 °C |
| EMC | Complies with European EMC Directive 2014/30/EU <ul style="list-style-type: none">• IEC/EN 61326-1• CISPR 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 |
| 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 MILPRF-28800F Class 3. |

Maximum power consumption

| | |
|--------|---------------|
| M9416A | 152 W nominal |
|--------|---------------|

Weight

| | |
|-----|------------------|
| Net | 1.8 kg (4.0 lbs) |
|-----|------------------|

Dimension

| | |
|-----------|-------------------------------|
| H x W x D | 130.2 mm x 80.8 mm x 209.6 mm |
|-----------|-------------------------------|

Warranty

The VXT PXIe vector transceiver is supplied with a 1-year warranty

Calibration cycle

The recommended calibration cycle is one year; calibration services are available through Keysight service centers

WLAN Measurement Application Key Specifications

Modulated power

| Absolute power accuracy | |
|---|---------------------------------------|
| 802.11be, 2.4 to 7.1 GHz | ± 0.4 dB nominal at 0 dBm input power |
| Error Vector Magnitude (EVM) | |
| EVM floor conditions Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input, at -20 dBm input power, optimized range, nominal | |
| 802.11ac 5.8 GHz 80 MHz | < -51 dB |
| 802.11ac 5.8 GHz 160 MHz | < -50 dB |
| 802.11ax 5.8 GHz 80 MHz | < -52 dB |
| 802.11ax 5.8 GHz 160 MHz | < -50 dB |
| 802.11ax 7 GHz 80 MHz | < -51 dB |
| 802.11ax 7 GHz 160 MHz | < -50 dB |
| EVM floor conditions Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input, at -15 dBm input power, optimized range, nominal | |
| 802.11be, 5 GHz, 160 MHz, 1024 QAM | < -50 dB |
| 802.11be, 5.8 GHz, 160 MHz, 1024 QAM | < -51 dB |
| 802.11be, 7 GHz, 160 MHz, 1024 QAM | < -50 dB |
| 802.11be, 5 GHz, 320 MHz, 4096 QAM | < -46 dB |
| 802.11be, 5.8 GHz, 320 MHz, 4096 QAM | < -47 dB |
| 802.11be, 7 GHz, 320 MHz, 4096 QAM | < -47 dB |

WLAN Source Key Specifications

Error Vector Magnitude (EVM)

| RF output port, at -5 dBm to -15 dBm output power, nominal | |
|---|----------|
| 802.11ac 5.8 GHz 80 MHz | < -51 dB |
| 802.11ac 5.8 GHz 160 MHz | < -50 dB |
| 802.11ax 5.8 GHz 80 MHz | < -52 dB |
| 802.11ax 5.8 GHz 160 MHz | < -50 dB |
| 802.11ax 7 GHz 80 MHz | < -51 dB |
| 802.11ax 7 GHz 160 MHz | < -49 dB |
| EVM floor conditions Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input, at -15 dBm input power, optimized range, nominal | |
| 802.11be, 5 GHz, 160 MHz, 1024 QAM | < -50 dB |
| 802.11be, 5.8 GHz, 160 MHz, 1024 QAM | < -51 dB |
| 802.11be, 7 GHz, 160 MHz, 1024 QAM | < -50 dB |
| 802.11be, 5 GHz, 320 MHz, 4096 QAM | < -46 dB |
| 802.11be, 5.8 GHz, 320 MHz, 4096 QAM | < -47 dB |
| 802.11be, 7 GHz, 320 MHz, 4096 QAM | < -47 dB |

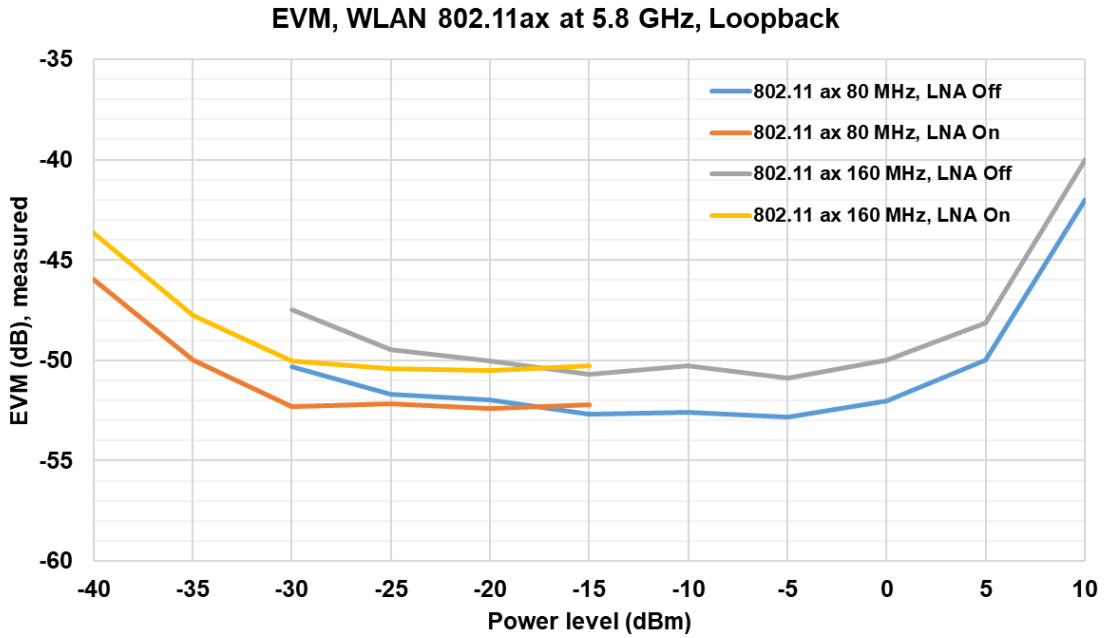


Figure 4. WLAN 802.11ax EVM vs. output power level at 5.8 GHz, loopback

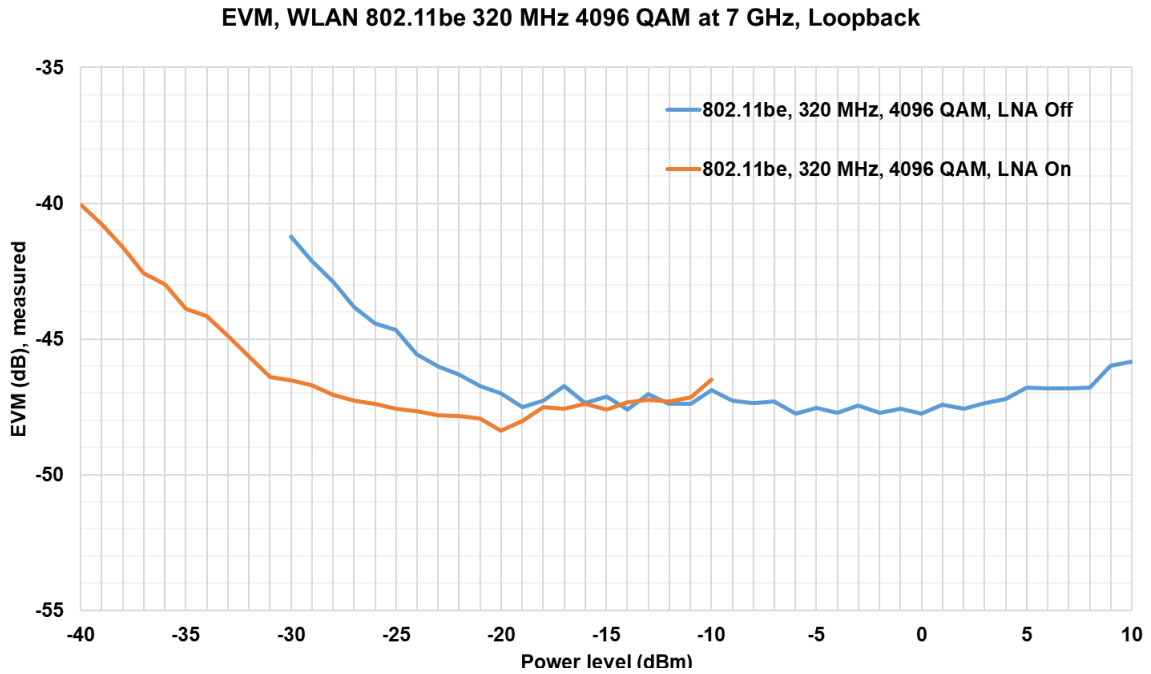


Figure 5. WLAN 802.11be EVM vs. output power level at 7 GHz, loopback

5G NR Measurement Application Key Specifications

Transmit power

| | |
|-------------------------|--|
| Absolute power accuracy | ± 0.35 dB nominal at 0 dBm input power |
|-------------------------|--|

Error Vector Magnitude (EVM)

Residual EVM, at -10 dBm or 0 dBm input power

| | |
|--------------------------------------|-------|
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | 0.33% |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | 0.38% |
| 30 kHz SCS, 7 GHz, 100 MHz (256QAM) | 0.46% |
| 30 kHz SCS, 12 GHz, 100 MHz (256QAM) | 0.42% |

Residual EVM, RF output loopback to RF input, at -5 dBm input power

| | |
|---|---------------|
| 120 kHz SCS, 4 GHz, 200 MHz (256QAM) | 0.28% nominal |
| 120 kHz SCS, 5 GHz, 200 MHz (256QAM) | 0.36% nominal |
| 120 kHz SCS, 7 GHz, 200 MHz (256QAM) | 0.35% nominal |
| 120 kHz SCS, 12.3 GHz, 200 MHz (256QAM) | 0.41% nominal |

Residual EVM, RF output loopback to RF input, at -5 dBm input power

| | |
|---|---------------|
| 120 kHz SCS, 4 GHz, 400 MHz (256QAM) | 0.42% nominal |
| 120 kHz SCS, 5 GHz, 400 MHz (256QAM) | 0.50% nominal |
| 120 kHz SCS, 7 GHz, 400 MHz (256QAM) | 0.43% nominal |
| 120 kHz SCS, 11 GHz, 400 MHz (256QAM) | 0.50% nominal |
| 120 kHz SCS, 7 GHz, 100 MHz 8CC (256QAM) | 0.65% nominal |
| 120 kHz SCS, 12.3 GHz, 100 MHz 8CC (256QAM) | 0.74% nominal |

Adjacent channel power

RF input port, at -10 dBm or 0 dBm input power, LNA off, noise correction on

| | |
|-------------------------------------|-----------------|
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | -66 dBc typical |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | -66 dBc typical |

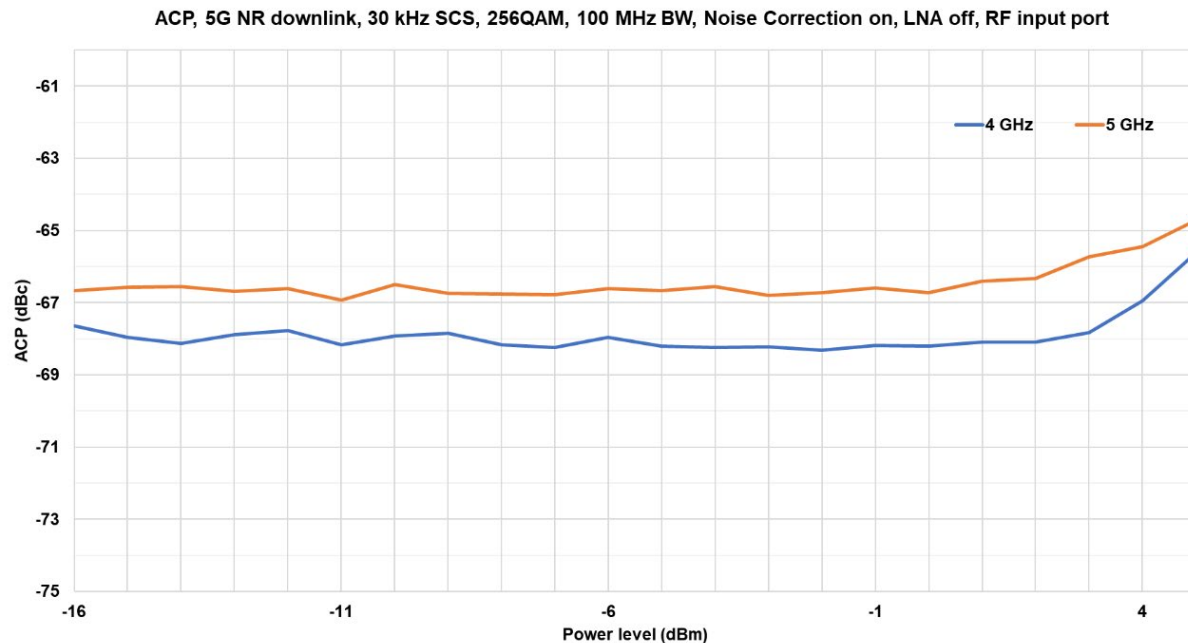


Figure 6. 5G NR downlink ACP vs. input power level at RF input port, LNA off

ACP, 5G NR downlink, 30 kHz SCS, 256QAM, 100 MHz BW, Noise Correction on, LNA on, RF input port

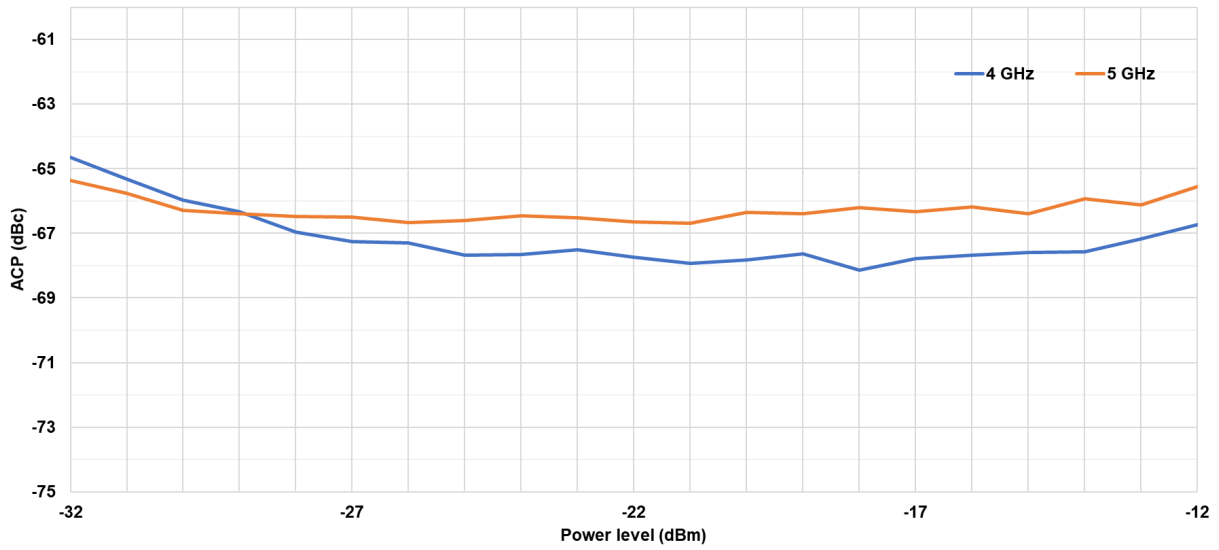


Figure 7. 5G NR downlink ACP vs. input power level at RF input port, LNA on

5G NR Source Key Specifications

Modulation signal level accuracy

| | |
|---------------------|-----------|
| 600 MHz to 12.3 GHz | ± 0.45 dB |
|---------------------|-----------|

Error Vector Magnitude (EVM)

Composite EVM, RF output port, half duplex port, at -10 dBm output power

| | |
|--------------------------------------|----------------------|
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | 0.28%, 0.24% typical |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | 0.28%, 0.26% typical |
| 30 kHz SCS, 7 GHz, 100 MHz (256QAM) | 0.30%, 0.27% typical |
| 30 kHz SCS, 12 GHz, 100 MHz (256QAM) | 0.40%, 0.35% typical |

Composite EVM, RF output port, at 0 dBm output power

| | |
|--------------------------------------|----------------------|
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | 0.33%, 0.28% typical |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | 0.33%, 0.29% typical |
| 30 kHz SCS, 7 GHz, 100 MHz (256QAM) | 0.33%, 0.29% typical |
| 30 kHz SCS, 12 GHz, 100 MHz (256QAM) | 0.67%, 0.56% typical |

Composite EVM, RF output port loopback to RF input, at -5 dBm output power

| | |
|---|---------------|
| 120 kHz SCS, 4 GHz, 200 MHz (256QAM) | 0.28% nominal |
| 120 kHz SCS, 5 GHz, 200 MHz (256QAM) | 0.36% nominal |
| 120 kHz SCS, 7 GHz, 200 MHz (256QAM) | 0.35% nominal |
| 120 kHz SCS, 12.3 GHz, 200 MHz (256QAM) | 0.41% nominal |

Composite EVM, RF output port loopback to RF input, at -10 dBm output power

| | |
|---|---------------|
| 120 kHz SCS, 4 GHz, 400 MHz (256QAM) | 0.42% nominal |
| 120 kHz SCS, 5 GHz, 400 MHz (256QAM) | 0.50% nominal |
| 120 kHz SCS, 7 GHz, 400 MHz (256QAM) | 0.43% nominal |
| 120 kHz SCS, 11 GHz, 400 MHz (256QAM) | 0.50% nominal |
| 120 kHz SCS, 7 GHz, 100 MHz 8CC (256QAM) | 0.65% nominal |
| 120 kHz SCS, 12.3 GHz, 100 MHz 8CC (256QAM) | 0.74% nominal |

Adjacent channel power

| RF output port, at -10 dBm output power | |
|---|------------------------------|
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | -59.5 dBc, -60.5 dBc typical |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | -55.0 dBc, -56.0 dBc typical |
| 30 kHz SCS, 7 GHz, 100 MHz (256QAM) | -57.0 dBc, -58.0 dBc typical |
| 30 kHz SCS, 12 GHz, 100 MHz (256QAM) | -53.0 dBc, -55.5 dBc typical |
| RF output port, at 0 dBm output power | |
| 30 kHz SCS, 4 GHz, 100 MHz (256QAM) | 0.33%, 0.28% typical |
| 30 kHz SCS, 5 GHz, 100 MHz (256QAM) | 0.33%, 0.29% typical |
| 30 kHz SCS, 7 GHz, 100 MHz (256QAM) | 0.33%, 0.29% typical |
| 30 kHz SCS, 12 GHz, 100 MHz (256QAM) | 0.67%, 0.56% typical |
| RF output port, at -10 dBm output power | |
| 120 kHz SCS, 4 GHz, 200 MHz (256QAM) | -58.0 dBc nominal |
| 120 kHz SCS, 5 GHz, 200 MHz (256QAM) | -54.0 dBc nominal |
| 120 kHz SCS, 7 GHz, 200 MHz (256QAM) | -56.5 dBc nominal |
| 120 kHz SCS, 11 GHz, 200 MHz (256QAM) | -54.5 dBc nominal |
| 120 kHz SCS, 4 GHz, 400 MHz (256QAM) | -54.0 dBc nominal |
| 120 kHz SCS, 5 GHz, 400 MHz (256QAM) | -51.0 dBc nominal |
| 120 kHz SCS, 7 GHz, 400 MHz (256QAM) | -52.0 dBc nominal |
| 120 kHz SCS, 11 GHz, 400 MHz (256QAM) | -52.0 dBc nominal |
| 120 kHz SCS, 7 GHz, 100 MHz 8CC (256QAM) | -50.5 dBc nominal |
| 120 kHz SCS, 11 GHz, 100 MHz 8CC (256QAM) | -49.0 dBc nominal |

ACP, 5G NR downlink, 30 kHz SCS, 256QAM, 100 MHz BW, RF output port

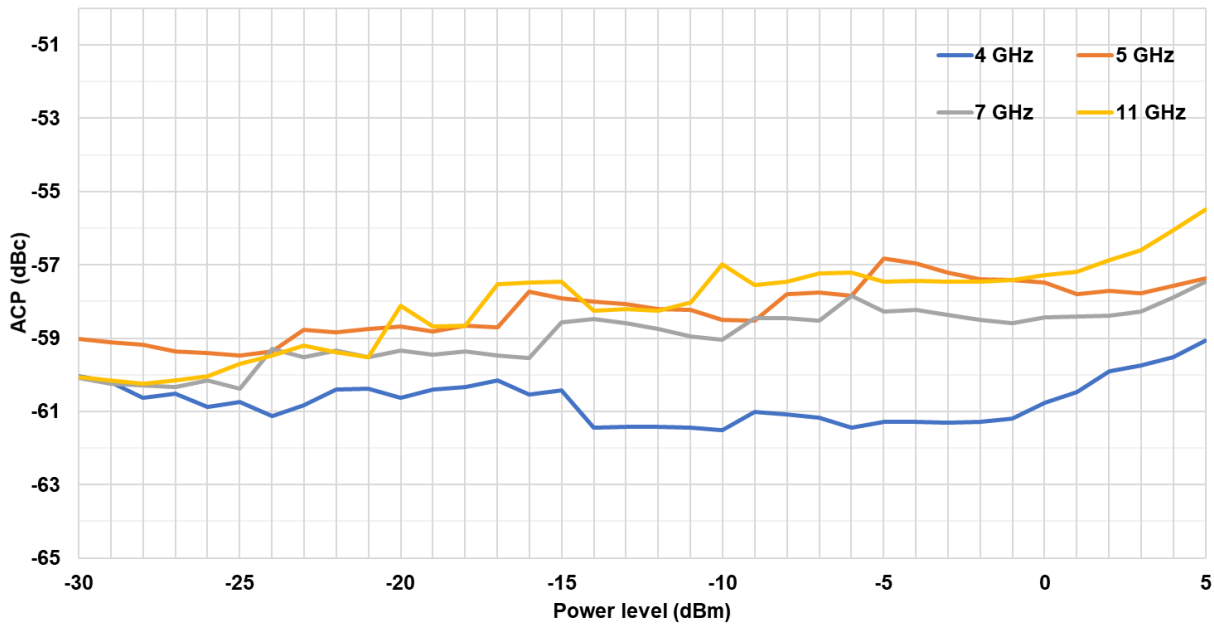


Figure 8. 5G NR downlink ACP vs. output power level, 100 MHz bandwidth, 30 kHz SCS, 256 QAM

EVM, 5G NR downlink, 30 kHz SCS, 256QAM, 100 MHz bandwidth, LNA Off, Loopback

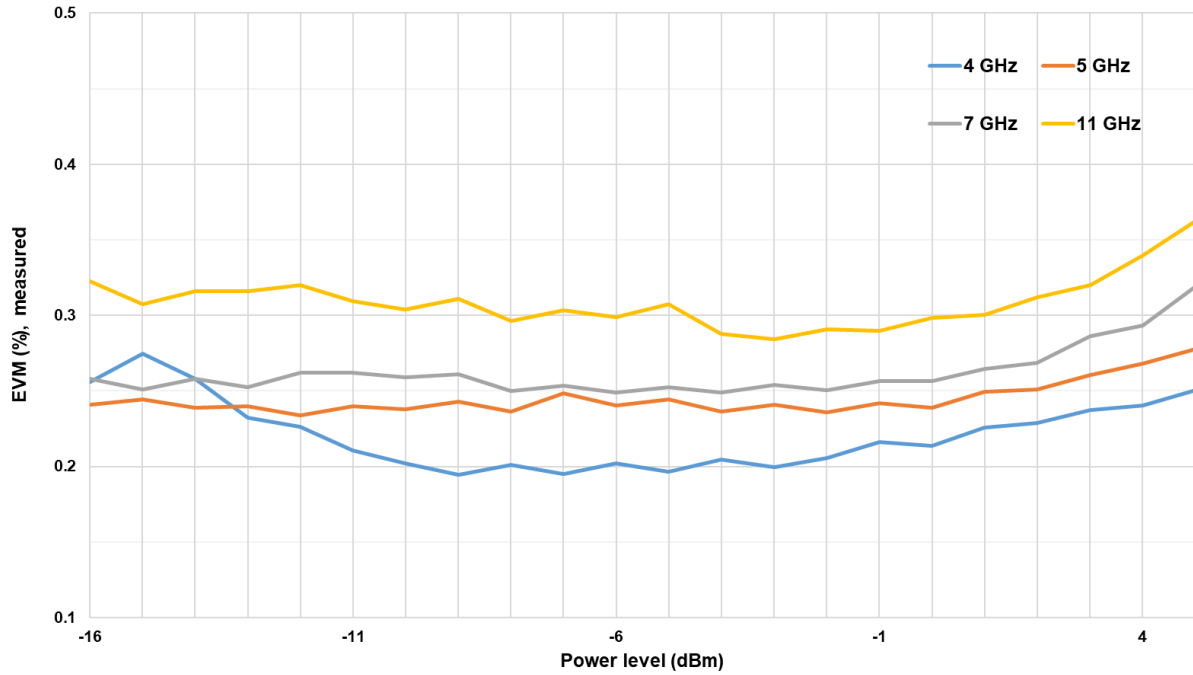


Figure 9. 5G NR downlink EVM vs. output power level, LNA off, loopback, with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

EVM, 5G NR downlink, 30 kHz SCS, 256QAM, 100 MHz bandwidth, LNA On, Loopback

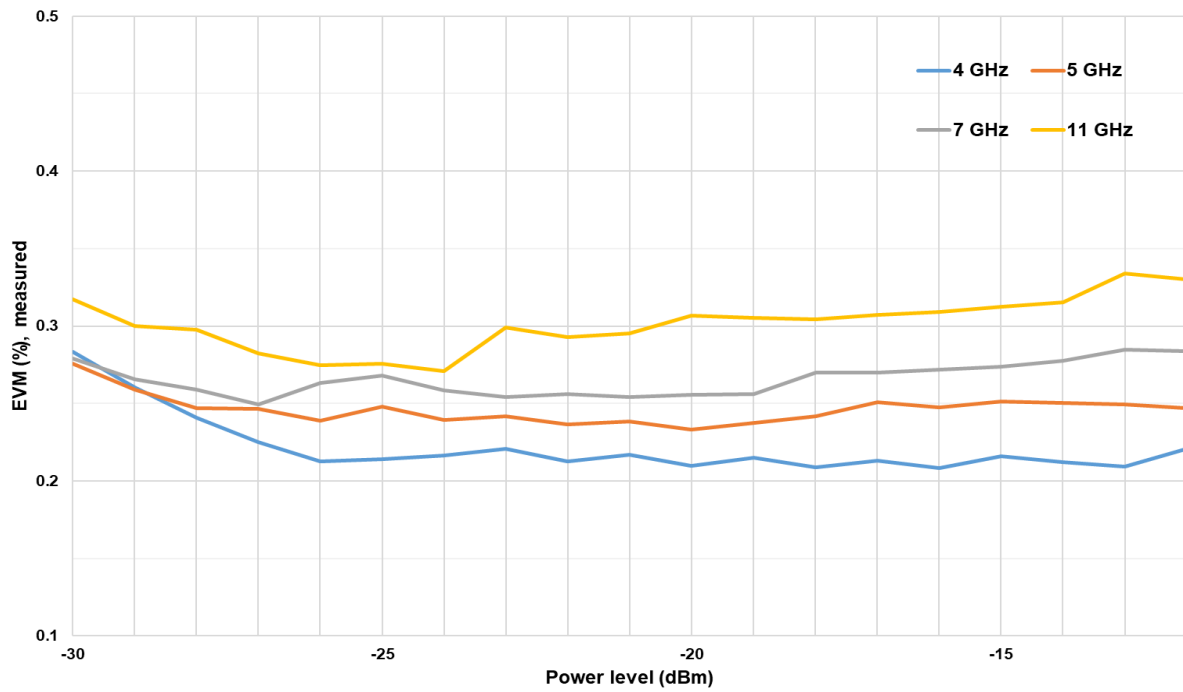


Figure 10. 5G NR downlink EVM vs. output power level, LNA on, loopback, with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

LTE/LTE-Advanced FDD & LTE/LTE-Advanced TDD Measurement Application Key Specifications ¹

Error Vector Magnitude (EVM)

| Residual EVM, at -10 dBm or 0 dBm input power | | |
|---|------------------|------------------------------|
| 900 MHz | 5 MHz bandwidth | 0.21% downlink, 0.19% uplink |
| | 20 MHz bandwidth | 0.24% downlink, 0.26% uplink |
| 2000 MHz | 5 MHz bandwidth | 0.21% downlink, 0.22% uplink |
| | 20 MHz bandwidth | 0.29% downlink, 0.26% uplink |

1. For frequencies from 695 to 3800 MHz

Adjacent channel power

| RF input port; Half duplex port (option HDX); at -10 dBm or 0 dBm input power | | | | |
|---|---------------------------------|----------|------------------|-----------------|
| FDD | E-UTRA (Uplink and Downlink) | 900 MHz | 5 MHz bandwidth | -63 dBc typical |
| | | 2000 MHz | 20 MHz bandwidth | |
| FDD | UTRA (Uplink and Downlink) | 900 MHz | 5 MHz bandwidth | -69 dBc typical |
| | | 2000 MHz | 20 MHz bandwidth | |
| TDD | E-UTRA (Uplink and Downlink) | 900 MHz | 5 MHz bandwidth | -62 dBc typical |
| | | 2000 MHz | 20 MHz bandwidth | |
| TDD | UTRA (Uplink and Downlink) | 900 MHz | 5 MHz bandwidth | -68 dBc typical |
| | | 2000 MHz | 20 MHz bandwidth | |

LTE Source Key Specifications

Modulated signal level accuracy

| | |
|--------------------|-----------|
| 410 MHz to 3.3 GHz | ± 0.51 dB |
| 3.3 to 5.8 GHz | ± 0.66 dB |

Error Vector Magnitude (EVM)

| Residual EVM, at -10 dBm or 0 dBm output power | | | |
|--|----------|------------------|---------|
| FDD | 900 MHz | 5 MHz bandwidth | < 0.24% |
| | | 20 MHz bandwidth | < 0.35% |
| | 2000 MHz | 5 MHz bandwidth | < 0.28% |
| | | 20 MHz bandwidth | < 0.39% |
| TDD | 900 MHz | 5 MHz bandwidth | < 0.32% |
| | | 20 MHz bandwidth | < 0.29% |
| | 2000 MHz | 5 MHz bandwidth | < 0.35% |
| | | 20 MHz bandwidth | < 0.34% |

Adjacent channel power

| RF input port; Half duplex port (option HDX); at -10 dBm output power | | | Adjacent | Alternate |
|--|----------|------------------|-----------------|------------------|
| FDD | 900 MHz | 5 MHz bandwidth | -67 dBc | -69 dBc |
| | | 20 MHz bandwidth | -62 dBc | -63 dBc |
| | 2000 MHz | 900 MHz | -66 dBc | -70 dBc |
| | | 2000 MHz | -65 dBc | -66 dBc |
| TDD | 900 MHz | 5 MHz bandwidth | -66 dBc | -68 dBc |
| | | 20 MHz bandwidth | -62 dBc | -63 dBc |
| | 2000 MHz | 900 MHz | -65 dBc | -69 dBc |
| | | 2000 MHz | -64 dBc | -66 dBc |
| RF input port; Half duplex port (option HDX); at -0 dBm output power | | | Adjacent | Alternate |
| FDD | 900 MHz | 5 MHz bandwidth | -64 dBc | -68 dBc |
| | | 20 MHz bandwidth | -62 dBc | -62 dBc |
| | 2000 MHz | 5 MHz bandwidth | -63 dBc | -70 dBc |
| | | 20 MHz bandwidth | -62 dBc | -66 dBc |
| TDD | 900 MHz | 5 MHz bandwidth | -63 dBc | -68 dBc |
| | | 20 MHz bandwidth | -62 dBc | -63 dBc |
| | 2000 MHz | 5 MHz bandwidth | -62 dBc | -70 dBc |
| | | 20 MHz bandwidth | -62 dBc | -66 dBc |

W-CDMA/HSPA+ Measurement Application Key Specifications ²

Channel power

| | |
|-------------------------|--------------------------------------|
| Absolute power accuracy | ±0.1 dB nominal at 0 dBm input power |
|-------------------------|--------------------------------------|

QPSK EVM

| | |
|--------------|-------------------------------------|
| Residual EVM | 0.7% nominal at -10 dBm input power |
|--------------|-------------------------------------|

Adjacent Channel Power Ratio (ACPR)

Residual relative power in 3.84 MHz BW

| | |
|--------------|--------------------------------------|
| 5 MHz offset | -66 dBc nominal at 0 dBm input power |
|--------------|--------------------------------------|

Spectrum Emission Mask (SEM)

Residual relative power (offset), at 0 dBm input power

Downlink

| | |
|--------------------|--------------------------------|
| 2.515 to 2.715 MHz | -83 dBc nominal in a 30 kHz BW |
| 2.715 to 3.515 MHz | -85 dBc nominal in a 1 MHz BW |
| 3.515 to 4 MHz | -85 dBc nominal in a 1 MHz BW |
| 4 to 8 MHz | -71 dBc nominal in a 1 MHz BW |
| 8 to 12.5 MHz | -72 dBc nominal in a 1 MHz BW |

Uplink

| | |
|--------------------|--------------------------------|
| 2.515 to 3.485 MHz | -84 dBc nominal in a 30 kHz BW |
| 4 to 7.5 MHz | -72 dBc nominal in a 1 MHz BW |
| 7.5 to 8.5 MHz | -73 dBc nominal in a 1 MHz BW |
| 8.5 to 12 MHz | -73 dBc nominal in a 1 MHz BW |

W-CDMA/HSPA+ Source Key Specifications

Error Vector Magnitude (EVM) ²

Composite EVM, RF output port, half duplex port, at 0 dBm output power

| | |
|-----|----------------|
| RMS | < 0.6% nominal |
|-----|----------------|

Adjacent Channel Leakage Ratio (ACLR), RF output port, half duplex port, at 0 dBm output power

| Offset | Configuration | Frequency (MHz) | ACLR |
|-----------------|-------------------|-----------------|----------------|
| Adjacent 5 MHz | 1 DPCH 1 carrier | 900 | -66 dB nominal |
| Adjacent 10 MHz | | | -69 dB nominal |
| Adjacent 5 MHz | | 1800 to 2000 | -65 dB nominal |
| Adjacent 10 MHz | | | -71 dB nominal |
| Adjacent 5 MHz | 64 DPCH 1 carrier | 900 | -67 dB nominal |
| Adjacent 10 MHz | | | -69 dB nominal |
| Adjacent 5 MHz | | 1800 to 2000 | -66 dB nominal |
| Adjacent 10 MHz | | | -72 dB nominal |

2. For frequencies from 730 to 2650 MHz

Related Literature

For more detailed product and specification information refer to the following literature and web pages:

- M9416A VXT PXIe Vector Transceiver Configuration Guide (literature no. 3122-2155.EN)
- M9300A PXIe Frequency Reference Data Sheet (literature no. 5991-0898EN)
- M9018B and M9019A PXIe 18 slot Chassis Data Sheet (literature no. 5992-1481EN)
- M9035A PXIe Embedded Controller Data Sheet (literature no. 3121-1327.EN)
- M9037A PXIe Embedded Controller Data Sheet (literature no. 5991-3661EN)
- M9038A PXIe Embedded Controller Data Sheet (literature no. 3122-1717.EN)
- X-Series Measurement Applications Brochure (literature no. 5989-8019EN)
- Signal Studio Software Brochure (literature no. 5989-6448EN)

Web

Product page:

- www.keysight.com/find/M9416A