DATA SHEET

# M9410A and M9411A VXT PXIe Vector Transceivers

## 1 MHz to 6 GHz


KEYSIGHT TECHNOLOGIES

# Table of Contents

# 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 range** | | | |
| Standard (Option F06) | 380 MHz to 6 GHz | | |
| Option M9411A-LFE | 1 to 380 MHz | | |
| **Frequency reference** | | | |
| Accuracy, aging rate, stability | Refer to M9300A specifications | | |
| **Measurement Frequency Accuracy (CW mode)** | | | |
| Accuracy | (Transmitter frequency x frequency reference accuracy) ± 50 Hz, typical | | |
| Resolution | 1 Hz | | |
| **Analysis bandwidth** | | | |
| | Center frequency | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| Standard (Option B3X) | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MHz | 200 MHz |
| | 1310 to 5930 MHz | 300 MHz | 300 MHz |
| | 5930 to 6000 MHz | (6080 MHz – center frequency) × 2 | 300 MHz |
| Option B6X | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MH | 200 MHz |
| | 1310 to 5780 MHz | 600 MHz | 600 MHz |
| | 5780 to 6000 MHz | (6080 MHz – center frequency) × 2 | 600 MHz |
| Option B12 | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MHz | 200 MHz |
| | 1310 to 1900 MHz | 600 MHz | 600 MHz |
| | 1900 to 2000 MHz | 600 MHz | 1200 MHz |
| | 2000 to 5480 MHz | 1200 MHz | 1200 MHz |
| | 5480 to 6000 MHz | (6080 MHz – center frequency) × 2 | 1200 MHz |
| **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)** | | | |
| **Serial prefix < MY6020** [1] | | | |
| **RF input port** | | | |
| Frequency range | –70 dBm ≤ Input level < –30 dBm | –30 dBm ≤ Input level ≤ –8 dBm | –8 dBm < Input level ≤ +27 dBm |
| 380 to 680 MHz | < ± 0.45 dB | < ± 0.45 dB | < ± 0.45 dB |
| | < ± *0.20 dB typical* | < ± *0.20 dB typical* | < ± *0.20 dB typical* |
| 680 to 910 MHz | < ± 0.45 dB | < ± 0.45 dB | < ± 0.50 dB |
| | < ± *0.25 dB typical* | < ± *0.20 dB typical* | < ± *0.25 dB typical* |
| 910 to 1310 MHz | < ± 0.55 dB | < ± 0.55 dB | < ± 0.60 dB |
| | < ± *0.30 dB typical* | < ± *0.30 dB typical* | < ± *0.35 dB typical* |
| 1310 to 2000 MHz | < ± 0.60 dB | < ± 0.65 dB | < ± 0.65 dB |
| | < ± *0.35 dB typical* | < ± *0.35 dB typical* | < ± *0.35 dB typical* |
| 2000 to 3500 MHz | < ± 0.70 dB | < ± 0.80 dB | < ± 0.60 dB |
| | < ± *0.40 dB typical* | < ± *0.45 dB typical* | < ± *0.30 dB typical* |
| 3500 to 4500 MHz | < ± 0.65 dB | < ± 0.70 dB | < ± 0.75 dB |
| | < ± *0.35 dB typical* | < ± *0.35 dB typical* | < ± *0.35 dB typical* |
| 4500 to 5400 MHz | < ± 0.90 dB | < ± 0.95 dB | < ± 0.85 dB |
| | < ± *0.45 dB typical* | < ± *0.45 dB typical* | < ± *0.45 dB typical* |
| 5400 to 6000 MHz | < ± 1.20 dB | < ± 1.15 dB | < ± 1.05 dB |
| | < ± *0.60 dB typical* | < ± *0.60 dB typical* | < ± *0.55 dB typical* |
| **Half duplex port, Option HDX** | | | |
| Frequency range | –70 dBm ≤ Input level < –30 dBm | –30 dBm ≤ Input level ≤ –8 dBm | –8 dBm < Input level ≤ +27 dBm |
| 380 to 910 MHz | < ± 0.50 dB | < ± 0.35 dB | < ± 0.45 dB |
| | < ± *0.25 dB typical* | < ± *0.20 dB typical* | < ± *0.25 dB typical* |
| 910 to 1310 MHz | < ± 0.60 dB | < ± 0.45 dB | < ± 0.55 dB |
| | < ± *0.35 dB typical* | < ± *0.25 dB typical* | < ± *0.30 dB typical* |
| 1310 to 3500 MHz | < ± 0.75 dB | < ± 0.70 dB | < ± 0.65 dB |
| | < ± *0.40 dB typical* | < ± *0.35 dB typical* | < ± *0.30 dB typical* |
| 3500 to 4500 MHz | < ± 0.95 dB | < ± 0.80 dB | < ± 0.80 dB |
| | < ± *0.50 dB typical* | < ± *0.40 dB typical* | < ± *0.35 dB typical* |
| 4500 to 5400 MHz | < ± 1.15 dB | < ± 0.95 dB | < ± 1.00 dB |
| | < ± *0.65 dB typical* | < ± *0.50 dB typical* | < ± *0.55 dB typical* |
| 5400 to 6000 MHz | < ± 1.35 dB | < ± 1.10 dB | < ± 1.05 dB |
| | < ± *0.75 dB typical* | < ± *0.55 dB typical* | < ± *0.55 dB typical* |

1. Signal is measured at 100 kHz offset from the center frequency, Otherwise, an IF flatness error must be added.

| Serial prefix ≥ MY6020, with Opt. EP6 [1] | | |
|---|---|---|
| **RF input port, Half duplex port (Option HDX)** | | |
| Frequency range | –70 dBm ≤ Input level < –30 dBm | –30 dBm ≤ Input level ≤ +27 dBm |
| 1 to 10 MHz | < ± *0.15 dB typical* | < ± *0.15 dB typical* |
| 10 to 150 MHz | < ± 0.95 dB, < ± *0.40 dB typical* | < ± 0.40 dB, < ± *0.15 dB typical* |
| 150 to 380 MHz | < ± 0.70 dB, < ± *0.25 dB typical* | < ± 0.45 dB, < ± *0.15 dB typical* |
| Frequency range | –70 dBm ≤ Input level ≤ +27 dBm | |
| 380 to 680 MHz | < ± 0.45 dB, < ± *0.20 dB typical* | |
| 680 to 1900 MHz | < ± 0.60 dB, < ± *0.30 dB typical* | |
| 1900 to 2700 MHz | < ± 0.70 dB, < ± *0.30 dB typical* | |
| 2700 to 4700 MHz | < ± 0.85 dB, < ± *0.40 dB typical* | |
| 4700 to 5200 MHz | < ± 0.80 dB, < ± *0.35 dB typical* | |
| 5200 to 6000 MHz | < ± 0.85 dB, < ± *0.45 dB typical* | |
| **Input Voltage Standing Wave Ratio (VSWR)** | | |
| **Serial prefix < MY6020** | **RF input port, nominal** | **Half Duplex Port (configured to input mode), nominal** |
| 380 to 1310 MHz | < 1.7:1 | < 1.4:1 |
| 1310 to 2000 MHz | < 1.8:1 | < 1.4:1 |
| 2000 to 3500 MHz | < 1.6:1 | < 1.4:1 |
| 3500 to 4500 MHz | < 1.7:1 | < 1.7:1 |
| 4500 to 5200 MHz | < 1.7:1 | < 1.6:1 |
| 5200 to 6000 MHz | < 2.1:1 | < 1.6:1 |
| **Serial prefix ≥ MY6020, with Opt. EP6** | **RF input port** | **Half Duplex Port (configured to input mode)** |
| 1 to 380 MHz | < 2.5:1 typical, < 2.5:1 nominal | < 2.2:1 typical, < 2.2:1 nominal |
| 380 to 1310 MHz | < 1.7:1 typical, < 1.6:1 nominal | < 1.5:1 typical, < 1.4:1 nominal |
| 1310 to 2000 MHz | < 1.5:1 typical, < 1.5:1 nominal | < 1.4:1 typical, < 1.3:1 nominal |
| 2000 to 3500 MHz | < 1.8:1 typical, < 1.6:1 nominal | < 1.5:1 typical, < 1.5:1 nominal |
| 3500 to 4500 MHz | < 1.7:1 typical, < 1.6:1 nominal | < 1.6:1 typical, < 1.6:1 nominal |
| 4500 to 5200 MHz | < 1.4:1 typical, < 1.3:1 nominal | < 1.4:1 typical, < 1.4:1 nominal |
| 5200 to 6000 MHz | < 1.7:1 typical, < 1.6:1 nominal | < 1.8:1 typical, < 1.6:1 nominal |
| **Phase Noise Sidebands (CF = 1 GHz), typical (nominal, when using M9300A-S01)** | | |
| 1 kHz offset | –112 dBc/Hz | |
| 10 kHz offset | –130 dBc/Hz | |
| 100 kHz offset | –132 dBc/Hz | |
| 1 MHz offset | –134 dBc/Hz | |
| 5 MHz offset | –137 dBc/Hz | |

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

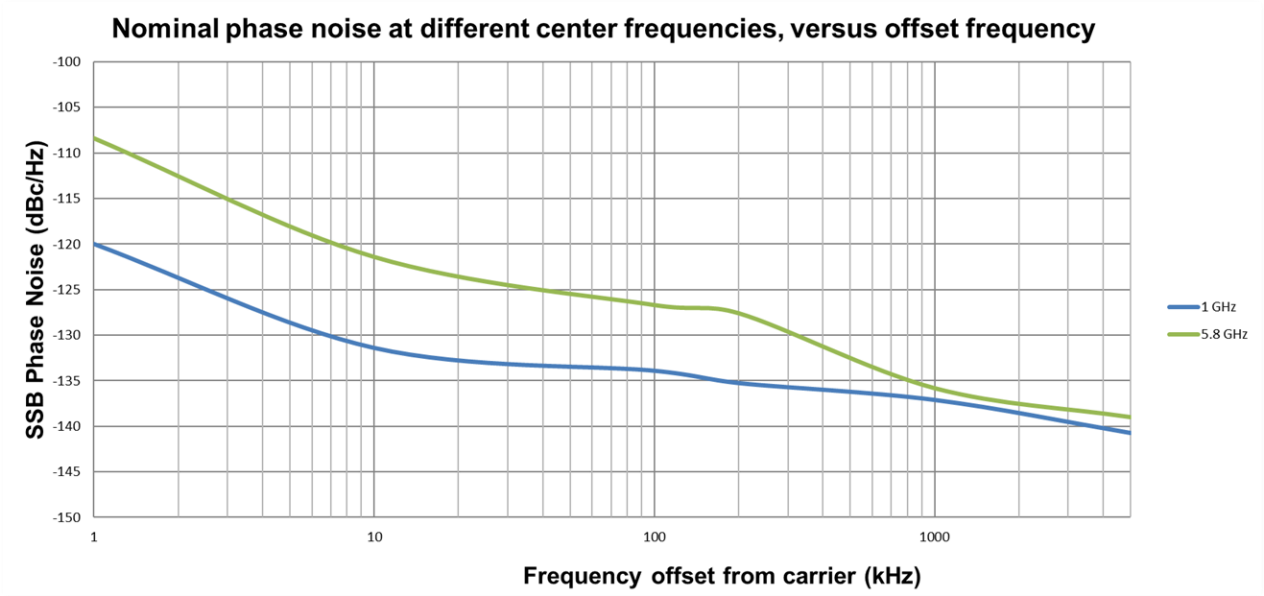



Figure 1. Nominal phase noise from 1 kHz to 5 MHz offset at 1 and 5.8 GHz

| Residual responses, typical | | |
|---|---|---|
| RF input port; Option HDX, half duplex port; with analyzer ranged to 0 dBm | | |
| 1 to 380 MHz | < –81 dBm | |
| 380 to 6000 MHz | < –81 dBm, offset from 10 MHz to ½ × analysis bandwidth | |
| **Image responses, typical** | | |
| Maximum bandwidth | Center frequency | Serial prefix < MY6020 |
| 100 MHz | 380 to 550 MHz | –57 dBc |
| 200 MHz | 550 to 1310 MHz | –59 dBc |
| 300 MHz | 1310 to 5930 MHz | –56 dBc [1] |
| 600 MHz | 1310 to 5780 MHz | –48 dBc |
| 1200 MHz | 2000 to 5480 MHz | –49 dBc |
| Maximum bandwidth | Center frequency | Serial prefix ≥ MY6020, with Opt. EP6 |
| 100 MHz | 380 to 460 MHz | –53 dBc |
| | 460 to 550 MHz | –57 dBc |
| 200 MHz | 550 to 650 MHz | –60 dBc |
| | 650 to 1310 MHz | –63 dBc [2] |
| 300 MHz | 1310 to 6000 MHz | –55 dBc |
| 600 MHz | 1310 to 6000 MHz | –54 dBc |
| 1200 MHz | 1900 to 6000 MHz | –54 dBc |

1. –50 dBc for frequencies from 5100 to 5930 MHz.
2. –57 dBc for frequencies from 1300 to 1310 MHz.

| Sideband spurs, nominal | | |
|---|---|---|
| Frequency range | Offset | |
| 1 to 10 MHz | 1 to 250 kHz | –85 dBc |
| 10 to 20 MHz | 1 kHz to 2.5 MHz | –85 dBc |
| 20 to 60 MHz | 1 kHz to 5 MHz | –85 dBc |
| 60 to 6000 MHz | 1 kHz to 10 MHz | –85 dBc |
| **LO Feedthrough (dBr [1]), typical** | | |
| Serial prefix < MY6020 | RF input port, with analyzer ranged from –10 to +27 dBm | Option HDX, half duplex port, with analyzer ranged from 0 to +27 dBm |
| 380 to 450 MHz | –58 dBr | –58 dBr |
| 450 to 550 MHz | –56 dBr | –53 dBr |
| 550 to 680 MHz | –53 dBr | –54 dBr |
| 680 to 910 MHz | –55 dBr | –57 dBr |
| 910 to 1310 MHz | –53 dBr | –55 dBr |
| 1310 to 2000 MHz | –52 dBr | –53 dBr |
| 2000 to 3500 MHz | –50 dBr | –49 dBr |
| 3500 to 4500 MHz | –50 dBr | –52 dBr |
| 4500 to 5100 MHz | –47 dBr | –45 dBr |
| 5100 to 6000 MHz | –44 dBr | –42 dBr |
| Serial prefix ≥ MY6020, with Opt. EP6 | RF input port, with analyzer ranged from –10 to +27 dBm | Option HDX, half duplex port, with analyzer ranged from 0 to +27 dBm |
| 380 to 4600 MHz | –53 dBr | –53 dBr |
| 4600 to 6000 MHz | –51 dBr | –51 dBr |

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

| Displayed Average Noise Floor (DANL) [1] | | |
|---|---|---|
| **Serial prefix < MY6020** | | |
| Frequency range | RF input port, with analyzer ranged to –70 dBm | Half duplex port, Option HDX, with analyzer ranged to –70 dBm |
| 380 to 680 MHz | –157 dBm, *–160 dBm typical* | –151 dBm, *–154 dBm typical* |
| 680 to 910 MHz | –160 dBm, *–163 dBm typical* | –154 dBm, *–157 dBm typical* |
| 910 to 1310 MHz | –156 dBm, *–159 dBm typical* | –151 dBm, *–154 dBm typical* |
| 1310 to 2000 MHz | –162 dBm, *–165 dBm typical* | –156 dBm, *–159 dBm typical* |
| 2000 to 3500 MHz | –158 dBm, *–162 dBm typical* | –153 dBm, *–156 dBm typical* |
| 3500 to 4500 MHz | –158 dBm, *–162 dBm typical* | –151 dBm, *–154 dBm typical* |
| 4500 to 6000 MHz | –152 dBm, *–155 dBm typical* | –145 dBm, *–148 dBm typical* |
| **Serial prefix ≥ MY6020, with Opt. EP6** | | |
| Frequency range | RF input port, with analyzer ranged to –70 dBm | Half duplex port, Option HDX, with analyzer ranged to –70 dBm |
| 1 to 10 MHz | –157 dBm, *–162 dBm typical* | –156 dBm, *–161 dBm typical* |
| 10 to 380 MHz | –160 dBm, *–164 dBm typical* | –158 dBm, *–163 dBm typical* |
| 380 to 680 MHz | –159 dBm, *–162 dBm typical* | –157 dBm, *–160 dBm typical* |
| 680 to 1310 MHz | –160 dBm, *–163 dBm typical* | –158 dBm, *–161 dBm typical* |
| 1310 to 2000 MHz | –162 dBm, *–166 dBm typical* | –161 dBm, *–164 dBm typical* |
| 2000 to 3500 MHz | –161 dBm, *–164 dBm typical* | –158 dBm, *–161 dBm typical* |
| 3500 to 4500 MHz | –160 dBm, *–163 dBm typical* | –157 dBm, *–160 dBm typical* |
| 4500 to 6000 MHz | –158 dBm, *–161 dBm typical* | –154 dBm, *–157 dBm typical* |
| **Third-order Intermodulation Distortion (TOI, with analyzer ranged to 0 dBm), nominal** | | |
| 10 to 380 MHz | +25 dBm | |
| 380 to 4000 MHz | +27 dBm | |
| 4000 to 6000 MHz | +23 dBm | |
| **IF Flatness** | | |
| **Maximum bandwidth** | **Maximum error** | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 100 MHz | ± 1.10 dB, ± *0.80 dB typical* | ± 0.75 dB, ± *0.40 dB typical* |
| 200 MHz | ± 1.35 dB, ± *1.00 dB typical* | ± 0.80 dB, ± *0.40 dB typical* |
| 300 MHz | ± 1.25 dB, ± *0.90 dB typical* | ± 0.80 dB, ± *0.45 dB typical* |
| 600 MHz | ± 1.45 dB, ± *0.90 dB typical* | ± 1.20 dB, ± *0.70 dB typical* |
| 1200 MHz | ± 1.80 dB, ± *1.00 dB typical* | ± 1.20 dB, ± *0.70 dB typical* |

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

# Vector Signal Generator

| Performance | | | |
|---|---|---|---|
| **Arb sample memory (storage capacity)** | | | |
| Standard (Option M02) | 256 MSa of IQ data | | |
| Option M05 | 512 MSa of IQ data | | |
| **Signal Generation Bandwidth** | | | |
| | **Center frequency** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Standard (Option B3X) | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MHz | 200 MHz |
| | 1310 to 5930 MHz | 300 MHz | 300 MHz |
| | 5930 to 6000 MHz | (6080 MHz – center frequency) × 2 | 300 MHz |
| Option B6X | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MHz | 200 MHz |
| | 1310 to 5780 MHz | 600 MHz | 600 MHz |
| | 5780 to 6000 MHz | (6080 MHz – center frequency) × 2 | 600 MHz |
| Option B12 | 380 to 550 MHz | 100 MHz | 100 MHz |
| | 550 to 1310 MHz | 200 MHz | 200 MHz |
| | 1310 to 1900 MHz | 600 MHz | 600 MHz |
| | 1900 to 2000 MHz | 600 MHz | 1200 MHz |
| | 2000 to 5480 MHz | 1200 MHz | 1200 MHz |
| | 5480 to 6000 MHz | (6080 MHz – center frequency) × 2 | 1200 MHz |
| **Frequency range** | | | |
| Standard (Option F06) | 380 MHz to 6 GHz | | |
| Option M9411A-LFE | 1 to 380 MHz | | |
| **Frequency reference** | | | |
| Accuracy, aging rate, stability | Refer to M9300A specifications | | |
| **Frequency Switching Speed [1]** | | | |
| Baseband frequency offset change [2] | ≤ 50 µs, nominal | | |
| Arbitrary frequency change [3] | ≤ 200 µs, nominal | | |

1. Switching speed depends highly upon the hardware and controller that is used. Measurements were made with the M9410A in an M9018B chassis with the M9037A embedded controller.
2. Mean time from IVI command until baseband frequency changed within single frequency band.
3. Mean time from IVI command until RF frequency changed from 4.4 to 3.6 GHz.

| Output Level Range (CW mode) | |
|---|---|
| **RF output port** | |
| 1 to 20 MHz | –120 to +0 dBm |
| 20 MHz to 6 GHz | –120 to +5 dBm |
| **Option HDX, half duplex port (configured to output mode)** | |
| 380 MHz to 6 GHz | –120 to +5 dBm |
| **RF output port, Option 1EA** | |
| 60 MHz to 6 GHz | –120 to +20 dBm, +25 dBm settable |
| **Amplitude Switching Speed [1]** | |
| Baseband power level change [2] | ≤ 50 µs, nominal |
| Arbitrary power level change [3] | ≤ 2 ms, nominal |

1. Switching speed depends highly upon the hardware and controller that is used. Measurements were made with the M9410A in an M9018B chassis with the M9037A embedded controller.
2. Mean time from IVI command until baseband amplitude changed by 5 dB without attenuator or amplifier change.
3. Mean time from IVI command until RF amplitude changed from –100 dBm to +10 dBm.

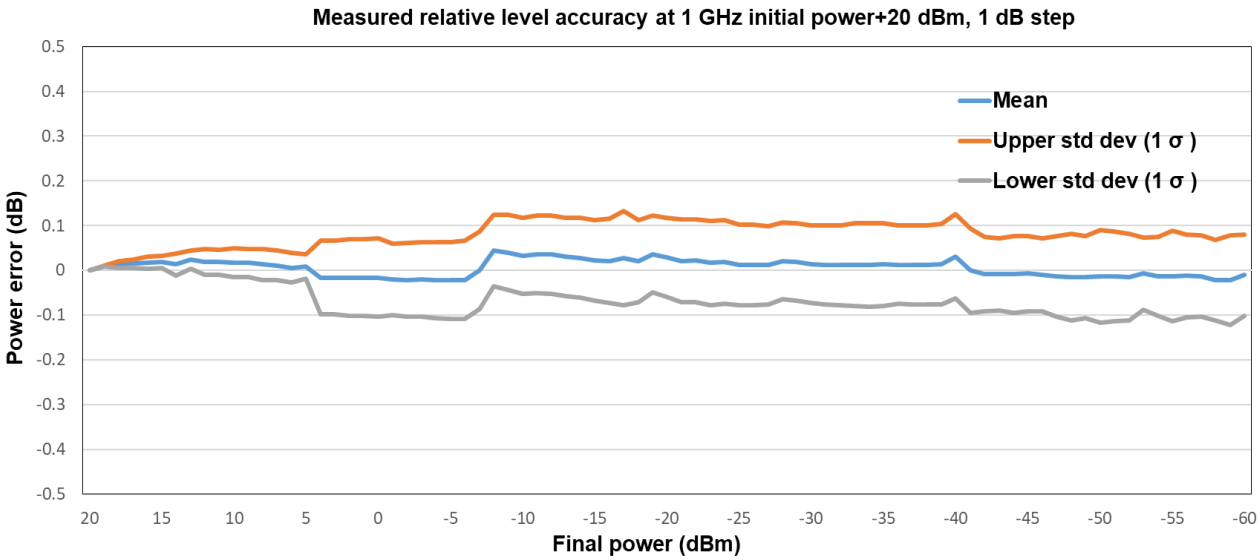



Figure 2. Measured relative level accuracy at 1 GHz

| Absolute Level Accuracy (CW mode) | | |
|---|---|---|
| **RF output port** | | |
| **1 to 20 MHz** | | |
| Level ≤ +0 dBm to –15 dBm | < ± *0.70 dB typical* | |
| Level ≤ –15 dBm to –80 dBm | < ± *0.50 dB typical* | |
| Level ≤ –80 dBm to –120 dBm | < ± *0.50 dB typical* | |
| **20 to 60 MHz** | | |
| Level ≤ +5 dBm to –15 dBm | < ± 0.40 dB, < ± *0.25 dB typical* | |
| Level ≤ –15 dBm to –80 dBm | < ± 0.55 dB, < ± *0.35 dB typical* | |
| Level ≤ –80 dBm to –120 dBm | < ± 0.55 dB, < ± *0.35 dB typical* | |
| **60 to 380 MHz** | | |
| Level ≤ +20 dBm to –15 dBm | < ± 0.45 dB, < ± *0.25 dB typical* | |
| Level ≤ –15 dBm to –80 dBm | < ± 0.50 dB, < ± *0.30 dB typical* | |
| Level ≤ –80 dBm to –120 dBm | < ± 0.55 dB, < ± *0.30 dB typical* | |
| **380 to 550 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +20 dBm to –15 dBm | < ± 0.55 dB, < ± *0.35 dB typical* | < ± 0.60 dB, < ± *0.25 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.55 dB, < ± *0.35 dB typical* | < ± 0.70 dB, < ± *0.30 dB typical* |
| Level ≤ –80 dBm to –120 dBm | < ± 0.80 dB, < ± 0.40 dB typical | < ± 0.80 dB, < ± *0.40 dB typical* |
| **550 to 2000 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +20 dBm to –15 dBm | < ± 0.70 dB, < ± *0.40 dB typical* | < ± 0.60 dB, < ± *0.30 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.55 dB, < ± *0.40 dB typical* | < ± 0.70 dB, < ± *0.35 dB typical* |
| Level ≤ –80 dBm to –110 dBm | < ± 0.85 dB, < ± *0.50 dB typical* | < ± 0.75 dB, < ± *0.35 dB typical* |
| **2000 to 3900 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +20 dBm to –15 dBm | < ± 0.60 dB, < ± *0.35 dB typical* | < ± 0.60 dB, < ± *0.30 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.70 dB, < ± *0.45 dB typical* | < ± 0.80 dB, < ± *0.40 dB typical* |
| Level ≤ –80 dBm to –110 dBm | < ± 1.30 dB, < ± *0.75 dB typical* | < ± 1.00 dB, < ± *0.50 dB typical* |
| **3900 to 5700 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +20 dBm to –15 dBm | < ± 0.80 dB, < ± *0.40 dB typical* | < ± 0.70 dB, < ± *0.35 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 1.10 dB, < ± *0.60 dB typical* | < ± 1.10 dB, < ± *0.55 dB typical* |
| Level ≤ –80 dBm to –100 dBm | < ± 1.20 dB, < ± *0.65 dB typical* | < ± 1.20 dB, < ± *0.55 dB typical* |
| **5700 to 6000 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +20 dBm to –15 dBm | < ± 0.80 dB, < ± *0.40 dB typical* | < ± 0.70 dB, < ± *0.35 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 1.10 dB, < ± *0.60 dB typical* | < ± 1.10 dB, < ± *0.55 dB typical* |
| Level ≤ –80 dBm to –90 dBm | < ± 1.20 dB, < ± *0.65 dB typical* | < ± 1.20 dB, < ± *0.55 dB typical* |
| Level ≤ –90 dBm to –100 dBm | | < ± 1.20 dB, < ± *0.55 dB typical* |

| Option HDX, half duplex port | | |
|---|---|---|
| **380 to 550 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +5 dBm to –15 dBm | < ± 0.50 dB, < ± *0.30 dB typical* | < ± 0.50 dB, < ± *0.25 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.50 dB, < ± *0.35 dB typical* | < ± 0.75 dB, < ± *0.35 dB typical* |
| Level ≤ –80 dBm to –90 dBm | < ± 0.65 dB, < ± *0.45 dB typical* | < ± 0.75 dB, < ± *0.35 dB typical* |
| Level ≤ –90 dBm to –110 dBm | | < ± 0.75 dB, < ± *0.35 dB typical* |
| **550 to 2000 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +5 dBm to –15 dBm | < ± 0.55 dB, < ± *0.35 dB typical* | < ± 0.55 dB, < ± *0.25 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.60 dB, < ± *0.45 dB typical* | < ± 0.70 dB, < ± *0.35 dB typical* |
| Level ≤ –80 dBm to –90 dBm | < ± 0.75 dB, < ± *0.55 dB typical* | < ± 0.80 dB, < ± *0.40 dB typical* |
| Level ≤ –90 dBm to –110 dBm | | < ± 0.80 dB, < ± *0.40 dB typical* |
| **2000 to 3900 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +5 dBm to –15 dBm | < ± 0.50 dB, < ± *0.30 dB typical* | < ± 0.60 dB, < ± *0.30 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 0.80 dB, < ± *0.55 dB typical* | < ± 0.80 dB, < ± *0.45 dB typical* |
| Level ≤ –80 dBm to –90 dBm | < ± 1.10 dB, < ± *0.75 dB typical* | < ± 0.90 dB, < ± *0.50 dB typical* |
| Level ≤ –90 dBm to –100 dBm | | < ± 0.90 dB, < ± *0.50 dB typical* |
| **3900 to 6000 MHz** | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| Level ≤ +5 dBm to –15 dBm | < ± 0.90 dB, < ± *0.55 dB typical* | < ± 0.80 dB, < ± *0.45 dB typical* |
| Level ≤ –15 dBm to –80 dBm | < ± 1.25 dB, < ± *0.80 dB typical* | < ± 1.15 dB, < ± *0.65 dB typical* |
| Level ≤ –80 dBm to –90 dBm | | < ± 1.35 dB, < ± *0.70 dB typical* |
| **Measured Amplitude Repeatability** | | |
| **RF output port, +0 dBm output power, 1 GHz, 24 hours elapsed time without alignment, 25 °C** | | |
| Delta from initial value | < ± 0.10 dB nominal | |
| **Setting Resolution** | | |
| 0.01 dB | | |
| **Output Voltage Standing Wave Ratio (VSWR)** | | |
| **RF output port, typical** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 1 to 380 MHz | | < 1.7:1, < 1.6:1 nominal |
| 380 to 4200 MHz | < 1.7:1, < 1.6:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 4200 to 5000 MHz | < 1.8:1, < 1.7:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 5000 to 6000 MHz | < 1.8:1, < 1.7:1 nominal | < 1.7:1, < 1.6:1 nominal |
| **Option HDX, half duplex port (configured to output mode), typical** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 380 to 4000 MHz | < 1.7:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 4000 to 5000 MHz | < 2.1:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 5000 to 6000 MHz | < 2.4:1 nominal | < 2.0:1, < 1.8:1 nominal |

| Harmonics, typical | | |
|---|---|---|
| **RF output port** | | |
| **+0 dBm output power** | | |
| 1 to 10 MHz | < –36 dBc | |
| 10 to 380 MHz | < –42 dBc | |
| 380 to 6000 MHz | < –44 dBc | |
| **+10 dBm output power, with Option 1EA** | | |
| 60 to 380 MHz | < –38 dBc | |
| 380 to 6000 MHz | < –35 dBc | |
| **Option HDX, half duplex port** | | |
| +0 dBm output power | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 380 to 6000 MHz | < –42 dBc | < –45 dBc |
| **Non-harmonic Spurious (CW mode), typical** | | |
| **RF output port** | | |
| +0 dBm output power | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 10 to 380 MHz | | < –60 dBc |
| 380 to 6000 MHz | < –65 dBc | < –75 dBc |
| +10 dBm output power, with Option 1EA | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 60 to 380 MHz | | < –60 dBc |
| 380 to 6000 MHz | < –65 dBc | < –75 dBc |
| **Option HDX, half duplex port** | | |
| +0 dBm output power | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 380 to 3900 MHz | < –65 dBc | < –75 dBc |
| 3900 to 6000 MHz | < –63 dBc | < –75 dBc |
| **LO Feedthrough, nominal** | | |
| **RF output port, > –30 dBm output power** | | |
| 380 to 3000 MHz | –65 dBc | |
| 3000 to 5000 MHz | –55 dBc | |
| 5000 to 6000 MHz | –50 dBc | |
| **Image Responses, nominal** | | |
| **Maximum bandwidth** | **Center frequency** | **Serial prefix < MY6020** |
| 100 MHz | 380 to 550 MHz | –55 dBc |
| 200 MHz | 550 to 1310 MHz | –55 dBc |
| 300 MHz | 1310 to 5930 MHz | –50 dBc |
| 600 MHz | 1310 to 5780 MHz | –50 dBc |
| 1200 MHz | 2000 to 5480 MHz | –50 dBc |

| Maximum bandwidth | Center frequency | Serial prefix ≥ MY6020, with Opt. EP6 |
|---|---|---|
| 100 MHz | 380 to 550 MHz | –60 dBc |
| 200 MHz | 550 to 1310 MHz | –60 dBc |
| 300 MHz | 1310 to 6000 MHz | –55 dBc |
| 600 MHz | 1310 to 6000 MHz | –50 dBc |
| 1200 MHz | 1900 to 6000 MHz | –50 dBc |
| **Sideband Spurious, nominal** | | |
| Offset | 20 to 380 MHz | 380 to 6000 MHz |
| 1 to 100 kHz | –75 dBc | –75 dBc |
| 100 kHz to 1 MHz | –75 dBc | –80 dBc |
| 1 to 10 MHz | –75 dBc | –80 dBc |
| **Phase Noise, typical (nominal, when using M9300A-S01)** | | |
| **RF output port, +0 dBm; Option HDX, half duplex port, +0 dBm; Option 1EA, +10 dBm; Center frequency = 1 GHz** | | |
| 1 kHz offset | ≤ –115 dBc/Hz | |
| 10 kHz offset | ≤ –133 dBc/Hz | |
| 100 kHz offset | ≤ –138 dBc/Hz | |
| 1 MHz offset | ≤ –140 dBc/Hz | |
| 5 MHz offset | ≤ –139 dBc/Hz | |

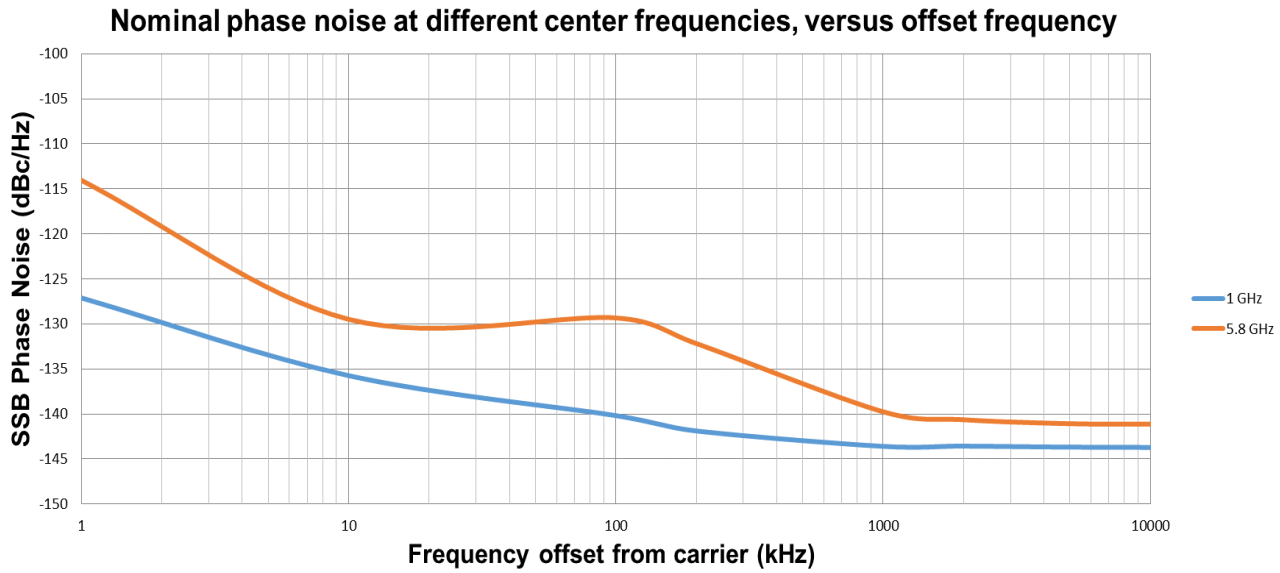



Figure 3. Nominal phase noise from 1 kHz to 10 MHz offset at 1 and 5.8 GHz

| Broadband Noise Floor [1], nominal | | |
|---|---|---|
| **RF output port, output level = +0 dBm** | | |
| Frequency range | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 20 to 380 MHz | | –133 dBm/Hz |
| 380 to 550 MHz | –136 dBm/Hz | –136 dBm/Hz |
| 550 to 1000 MHz | –140 dBm/Hz | –138 dBm/Hz |
| 1000 to 4500 MHz | –141 dBm/Hz | –140 dBm/Hz |
| 4500 to 6000 MHz | –137 dBm/Hz | –139 dBm/Hz |
| **Option HDX, half duplex port, output level = –10 dBm** | | |
| Frequency range | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 380 to 550 MHz | –146 dBm/Hz | –145 dBm/Hz |
| 550 to 1000 MHz | –149 dBm/Hz | –147 dBm/Hz |
| 1000 to 4500 MHz | –147 dBm/Hz | –148 dBm/Hz |
| 4500 to 6000 MHz | –145 dBm/Hz | –147 dBm/Hz |
| **Third-order Intermodulation Distortion (TOI), typical** | | |
| **RF output port, output level = +0 dBm** | | |
| 1 to 20 MHz | +13 dBm | |
| 20 to 380 MHz | +19 dBm | |
| 380 to 3900 MHz | +28 dBm | |
| 3900 to 4500 MHz | +27 dBm | |
| 4500 to 6000 MHz | +25 dBm | |
| **Option HDX, half duplex port, output level = –10 dBm** | | |
| 380 to 4500 MHz | +18 dBm | |
| 4500 to 6000 MHz | +15 dBm | |
| **IF Flatness, typical** | | |
| **Maximum bandwidth** | **Maximum error** | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 20 MHz | ± 0.24 dB [2] | ± 0.24 dB |
| 100 MHz | ± 0.50 dB | ± 0.35 dB |
| 200 MHz | ± 0.80 dB | ± 0.35 dB |
| 300 MHz | ± 1.00 dB | ± 0.60 dB |
| 600 MHz | ± 1.00 dB | ± 0.80 dB |
| 1200 MHz | ± 1.50 dB | ± 1.00 dB |

1. Measured at 13.1 MHz offset from the center frequency.
2. The value is typical for RF output port, or nominal for half duplex port.

## General Specifications

| Environmental Characteristic | |
|---|---|
| Operating temperature | +5 to +45 °C |
| Storage temperature | –40 to +65 °C |
| EMC | Complies with European EMC Directive 2014/30/EU<br>• IEC/EN 61326-1<br>• CISPR 11, Group 1, Class A<br>• AS/NZS CISPR 11<br>• ICES/NMB-001<br>This ISM device complies with Canadian ICES-001<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; 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** | |
| M9410A | 88 W nominal |
| M9411A | 114 W nominal |
| **Weight** | |
| Net | |
| M9410A | 1.0 kg (2.2 lbs) |
| M9411A | 1.3 kg (2.9 lbs) |
| **Dimension** | |
| M9410A (H x W x D) | 130.1 mm x 40.6 mm x 210 mm |
| M9411A (H x W x D) | 130.1 mm x 60.9 mm x 210 mm |
| **Calibration Cycle** | |
| The recommended calibration cycle is one year; calibration services are available through Keysight service centers | |

## Front Panel

| Reference | |
|---|---|
| 100 MHz In, 100 MHz Out | Connector: MMPX female, 50 Ω nominal |
| | Lock range: ± 1 ppm, nominal |
| | Input amplitude: > +10 dBm, nominal |
| | Output amplitude: > +10 dBm, nominal |
| **LO Reference** | |
| 4.8 GHz In, 4.8 GHz Out | Connector: MMPX female, 50 Ω nominal |
| | Input amplitude: > +10 dBm, nominal |
| | Output amplitude: > +12 dBm, nominal |
| **RF Connections** | |
| RF Input | Connector: SMA female, 50 Ω nominal |
| RF Output | Connector: SMA female, 50 Ω nominal |
| Half Duplex | Connector: SMA female, 50 Ω nominal |
| **Trigger Connections** | |
| Trigger 1, Trigger 2 (Input/Output, selectable) | Connector: MMPX female |
| | Input impedance: 1 kΩ or 50 Ω nominal |
| | Input level range: 0 to +3.3 V |
| | Output impedance: 50 Ω nominal |
| | Output level range: 3.3 V LVTTL |
| **DIO Connections** | |
| Ctrl M, Ctrl S | Connector: Micro-HDMI female |
| | Level range: 3.3 V LVTTL, LVDS |

## MIMO Timing Synchronization Specifications

| Channel to Channel Timing Synchronization, Option MMO, nominal | | |
|---|---|---|
| | **Signal analyzer** | **Signal generator** |
| Timing skew | ≤ 200 ps | ≤ 200 ps |
| Timing jitter [1] | ≤ 50 ps | ≤ 50 ps |
| Repeatability [2] | ≤ 50 ps | ≤ 50 ps |

1. Jitter indicates measurement-to-measurement variation and applies over short time interval at room temperature without resetting or reinitializing a driver session.
2. Repeatability indicates stability of alignment between channels across power cycles and IVI sessions, with identical cabling and hardware settings (frequency, span, sample rate, etc.)

# Spectrum Analyzer Measurement Application Key Specifications

| Absolute Amplitude Accuracy (CW mode) [1] | |
|---|---|
| **RF input port, input level from –70 dBm to +27 dBm** | |
| **Frequency range** | **Serial prefix < MY6020** |
| 380 to 660 MHz | < ± 0.75 dB, < ± *0.30 dB typical* |
| 660 to 720 MHz | < ± 0.80 dB, < ± *0.45 dB typical* |
| 720 to 1900 MHz | < ± 0.85 dB, < ± *0.35 dB typical* |
| 1900 to 4770 MHz | < ± 1.05 dB, < ± *0.65 dB typical* |
| 4770 to 4950 MHz | < ± 1.30 dB, < ± *0.70 dB typical* |
| 4950 to 6000 MHz | < ± 1.10 dB, < ± *0.60 dB typical* |
| **Frequency range** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| 380 to 410 MHz | < ± 0.75 dB, < ± *0.45 dB typical* |
| 410 to 1900 MHz | < ± 0.70 dB, < ± *0.30 dB typical* |
| 1900 to 3550 MHz | < ± 0.95 dB, < ± *0.50 dB typical* |
| 3550 to 3950 MHz | < ± 1.05 dB, < ± *0.70 dB typical* |
| 3950 to 4500 MHz | < ± 1.05 dB, < ± *0.65 dB typical* |
| 4500 to 4570 MHz | < ± 1.20 dB, < ± *0.70 dB typical* |
| 4570 to 5320 MHz | < ± 0.90 dB, < ± *0.50 dB typical* |
| 5320 to 5660 MHz | < ± 1.10 dB, < ± *0.60 dB typical* |
| 5660 to 6000 MHz | < ± 0.95 dB, < ± *0.50 dB typical* |

| Input Voltage Standing Wave Ratio (VSWR), typical | | |
|---|---|---|
| **RF input port** | | |
| | **Serial prefix < MY6020** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| 380 to 1310 MHz | < 1.8:1, < 1.7:1 nominal | < 1.7:1, < 1.6:1 nominal |
| 1310 to 2000 MHz | < 1.6:1, < 1.5:1 nominal | < 1.4:1, < 1.4:1 nominal |
| 2000 to 3500 MHz | < 1.8:1, < 1.7:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 3500 to 4500 MHz | < 1.6:1, < 1.5:1 nominal | < 1.6:1, < 1.5:1 nominal |
| 4500 to 5200 MHz | < 2.0:1, < 1.8:1 nominal | < 1.4:1, < 1.4:1 nominal |
| 5200 to 6000 MHz | < 2.3:1, < 2.0:1 nominal | < 1.7:1, < 1.6:1 nominal |

| Phase Noise Sidebands (CF = 1 GHz), nominal | |
|---|---|
| 1 kHz offset | –121 dBc/Hz |
| 10 kHz offset | –133 dBc/Hz |
| 100 kHz offset | –135 dBc/Hz |
| 1 MHz offset | –137 dBc/Hz |
| 5 MHz offset | –140 dBc/Hz |

1. Signal at the center frequency, in 40 MHz span (380 to 550 MHz) or 80 MHz span (550 to 6000 MHz). Otherwise, an additional ± 0.6 dB nominal IF flatness error must be added.

| Spurious Responses | |
|---|---|
| **Residual responses, nominal** | |
| **RF input port; with analyzer ranged to 0 dBm** | |
| 380 to 550 MHz, 40 MHz span | < –90 dBm |
| 550 to 6000 MHz, 80 MHz span | < –90 dBm |
| **Input related spurs, nominal** | |
| **RF input port; input CW signal within span, with analyzer ranged to 0 dBm** | |
| 380 to 550 MHz, 40 MHz span | < –76 dBc |
| 550 to 6000 MHz, 80 MHz span | < –76 dBc |
| **Sideband spurs, nominal** | |
| 1 kHz to 10 MHz offset | –80 dBc |
| **Displayed Average Noise Floor (DANL) [1]** | |
| **RF input port, with analyzer ranged to –70 dBm** | |
| **Frequency range** | **Serial prefix < MY6020** |
| 380 to 1320 MHz | –155 dBm, *–160 dBm typical* |
| 1320 to 2540 MHz | –153 dBm, *–158 dBm typical* |
| 2540 to 3070 MHz | –152 dBm, *–157 dBm typical* |
| 3070 to 3570 MHz | –153 dBm, *–157 dBm typical* |
| 3570 to 5200 MHz | –152 dBm, *–156 dBm typical* |
| 5200 to 5750 MHz | –150 dBm, *–154 dBm typical* |
| 5750 to 6000 MHz | –146 dBm, *–152 dBm typical* |
| **Frequency range** | **Serial prefix ≥ MY6020, with Opt. EP6** |
| 380 to 1900 MHz | –156 dBm, *–160 dBm typical* |
| 1900 to 5200 MHz | –152 dBm, *–157 dBm typical* |
| 5200 to 6000 MHz | –151 dBm, *–156 dBm typical* |
| **Third-order Intermodulation Distortion (TOI), nominal** | |
| **RF input port, with analyzer ranged to +0 dBm** | |
| 380 to 4000 MHz | +27 dBm |
| 4000 to 6000 MHz | +23 dBm |
| **1 dB Gain Compression Point, nominal** | |
| **RF input port, two-tone with 100 kHz spacing, with analyzer ranged to +0 dBm** | |
| 380 to 6000 MHz | +2 dBm |
| **Display Scale Fidelity, typical** | |
| **RF input port, relative to +0 dBm input level, with analyzer ranged to +0 dBm** | |
| −80 dBm ≤ input level ≤ +0 dBm | ± 0.07 dB |

1. Input terminated, log power average, SW preselection off, and normalized to 1 Hz bandwidth.

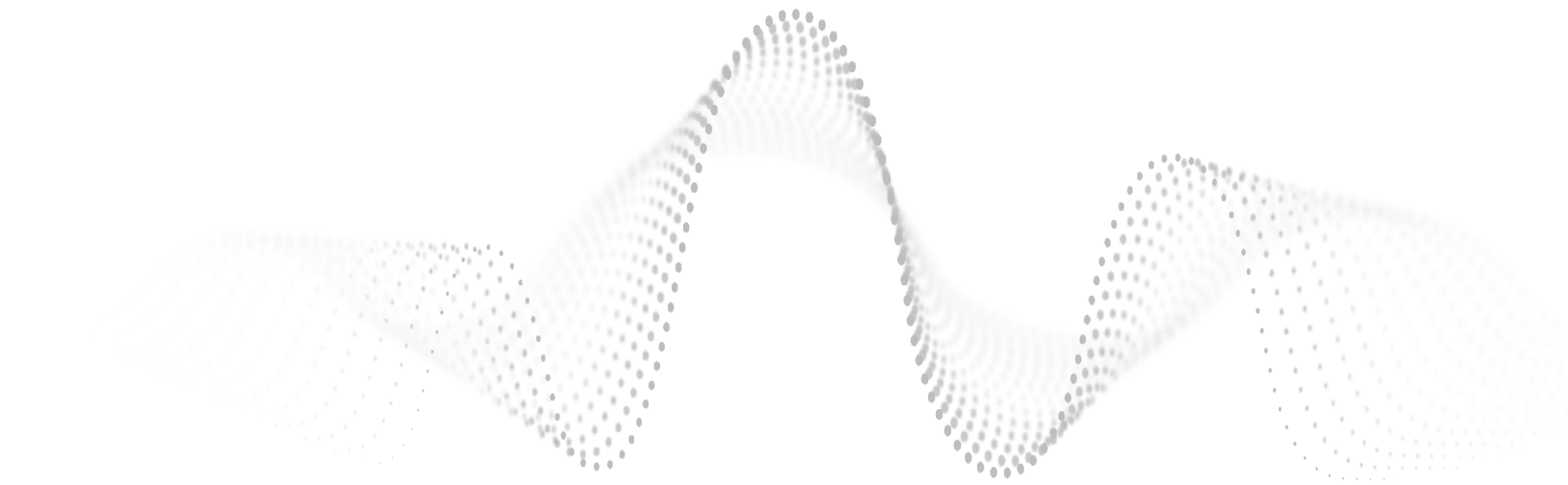
## Analog Demodulation Measurement Application Key Specifications

| | |
|---|---|
| **Frequency modulation** | |
| FM deviation | Peak deviation [1] 200 Hz to 400 kHz |
| Deviation accuracy [2] | $\pm(0.01 \times reading + 0.002 \times Rate)$ $[Hz]$ |
| FM rate | 20 Hz to 50 kHz |
| Channel BW | ≤ 1 MHz |
| **Rate accuracy [3]** | |
| 10 to 1310 MHz | $\pm((8 \times 10^{-6}/ModIndex + 2 \times 10^{-6}) \times Reading) + rfa$ $[Hz]$ |
| 1310 to 3000 MHz | $\pm((1.5 \times 10^{-5}/ModIndex + 3 \times 10^{-6}) \times Reading) + rfa$ $[Hz]$ |
| **Residual distortion [4]** | |
| 10 to 380 MHz | $0.8/(ModIndex)^{\frac{1}{2}} + 0.1$ [%] |
| 380 to 1310 MHz | $1.7/(ModIndex)^{\frac{1}{2}} + 0.1$ [%] |
| 1310 to 3000 MHz | $1.0/(ModIndex)^{\frac{1}{2}} + 0.1$ [%] |
| **Amplitude modulation** | |
| AM depth | 1% to 99% |
| **Depth accuracy [2]** | |
| 10 to 380 MHz | $\pm(0.004 \times reading + 0.02)$ [%] |
| 380 to 1310 MHz | $\pm(0.007 \times reading + 0.02)$ [%] |
| 1310 to 3000 MHz | $\pm(0.005 \times reading + 0.02)$ [%] |
| AM rate | 50 Hz to 100 kHz |
| Channel BW | 5 times of rate |
| Rate accuracy [3] | $\pm((0.8 \times 10^{-6} \times reading) \times (100\%/Depth) + rfa$ $[Hz]$ |
| **Residual distortion [4]** | |
| 10 to 380 MHz | $0.03 \times (100\%/Depth) + 0.02$ [%] |
| 380 to 3000 MHz | $0.03 \times (100\%/Depth) + 0.01$ [%] |
| **Phase modulation** | |
| PM deviation | Peak deviation 0.2 to 100 rad |
| Deviation accuracy [2] | $\pm(0.001 \times reading + 0.007)$ $[rad]$, rate ≥ 100 Hz |
| PM rate | 50 Hz to 50 kHz |
| Channel BW | ≤ 1 MHz |

1. Peak deviation, modulation index (“beta”), and modulation rate are related by Peak Deviation = Modulation Index × Rate. Beta: 0.2 to 2000
2. This specification applies to the result labeled “(Pk-Pk)/2”.
3. rfa = Modulation Rate × frequency reference accuracy.
4. SINAD [dB] can be derived by 20 × $\log_{10}$(1/ Distortion). SINAD bandwidth: (Channel BW)/2.

| Rate accuracy [1] | |
|---|---|
| **10 to 1310 MHz** | |
| Rate ≤ 500 Hz | $\pm(0.0005/Deviation) + rfa\ [Hz]$ |
| Rate > 500 Hz | $\pm(0.008/Deviation) + rfa\ [Hz]$ |
| **1310 to 3000 MHz** | |
| Rate ≤ 500 Hz | $\pm(0.0015/Deviation) + rfa\ [Hz]$ |
| Rate > 500 Hz | $\pm(0.01/Deviation) + rfa\ [Hz]$ |
| **Residual distortion [2]** | |
| 10 to 380 MHz | $0.4/Deviation + 0.01\ [\%]$ |
| 380 to 1310 MHz | $0.7/Deviation + 0.01\ [\%]$ |
| 1310 to 3000 MHz | $0.4/Deviation + 0.01\ [\%]$ |

1. rfa = Modulation Rate × frequency reference accuracy.
2. SINAD [dB] can be derived by 20 × $\log_{10}$(1/ Distortion). SINAD bandwidth: (Channel BW)/2.



# Analog Modulation Source Key Specifications

| Frequency modulation | |
|---|---|
| Deviation accuracy,1 kHz rate, 1 to 100 kHz deviation, +0 dBm output power | |
| 1 to 3000 MHz | < 1.3% |
| Residual distortion, 1 kHz rate, 5 to 100 kHz deviation, +0 dBm output power | |
| 1 to 3000 MHz | < 0.6% |
| FM residual, 15 kHz channel bandwidth | |
| 1 to 3000 MHz | < 4 Hz |
| **Amplitude modulation** | |
| **Depth error, 1 kHz rate, 30% to 95% depth** | |
| 1 to 30 MHz, –10 dBm output power | < 2.6% |
| 30 to 60 MHz, –5 dBm output power | < 1.1% |
| 60 to 3000 MHz, +0 dBm output power | < 1.4% |
| **Residual distortion, 1 kHz rate** | |
| **1 to 30 MHz, –10 dBm output power** | |
| 30% depth | < 1.0% |
| 50% depth | < 1.0% |
| 90% depth | < 1.3% |
| **30 to 60 MHz, –5 dBm output power** | |
| 30% depth | < 0.6% |
| 50% depth | < 0.5% |
| 90% depth | < 0.5% |
| **60 to 3000 MHz, +0 dBm output power** | |
| 30% depth | < 0.7% |
| 50% depth | < 0.7% |
| 90% depth | < 0.9% |
| **Phase modulation** | |
| Deviation accuracy, 1 kHz rate, rad ≥ 0.5, +0 dBm output power | |
| 1 to 3000 MHz | < 1.2% |
| Residual distortion, 1 kHz rate, rad ≥ 1, +0 dBm output power | |
| 1 to 3000 MHz | *< 0.2% typical* |

## Noise figure measurement application key specifications [1]

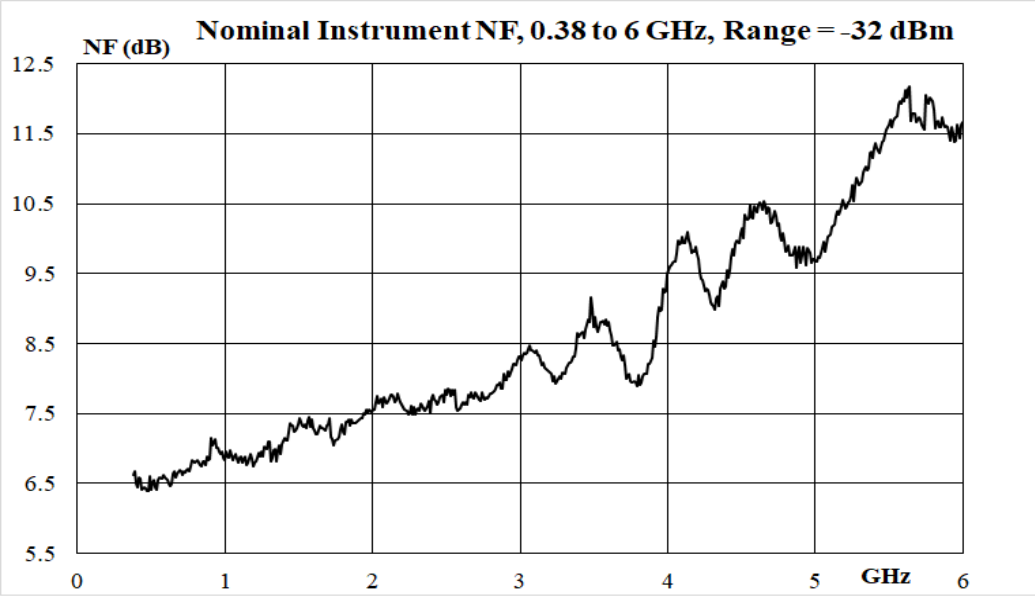



Figure 4. Nominal instrument noise figure

1. For M9411A with serial prefix ≥ MY6020, with Opt. EP6.

## GSM/EDGE/Evo measurement application key specifications [1]

| Power versus time (PvT) | |
|---|---|
| Absolute power accuracy | ± 0.49 dB nominal at 0 dBm input power |
| **Phase error (GMSK modulation)** | |
| Average floor | 0.30º nominal at 0 dBm input power |
| Peak floor | 0.85º nominal at 0 dBm input power |
| **EDGE error vector magnitude (EVM)** | |
| RMS floor | 0.65% nominal at 0 dBm input power |
| Peak floor | 2.0% nominal at 0 dBm input power |
| **Output RF spectrum (ORFS for GMSK and 8PSk modulation)** | |
| **Residual relative power, spectrum due to modulation** | |
| **Offset frequency** | |
| 600 kHz | –75 dBc nominal at 0 dBm input power |
| 1.2 MHz | –77 dBc nominal at 0 dBm input power |
| 1.8 MHz | –74 dBc nominal at 0 dBm input power |
| **Residual relative power, spectrum due to switching** | |
| **Offset frequency** | |
| 600 kHz | –72 dBc nominal at 0 dBm input power |
| 1.2 MHz | –74 dBc nominal at 0 dBm input power |
| 1.8 MHz | –75 dBc nominal at 0 dBm input power |

## GSM/EDGE/Evo source key specifications [2]

| Signal quality (RF output port, Half duplex port: +0 dBm) | | |
|---|---|---|
| **Phase error (GMSK)** | | |
| RMS | < 0.3° nominal | |
| Peak | < 2.0° nominal | |
| **EVM (EDGE)** | | |
| RMS | < 1% nominal | |
| **Output RF spectrum (ORFS)** | | |
| **Residual relative power, spectrum due to modulation** | | |
| Offset | GSM, nominal<br>Half duplext/RF output (0 dBm) | EDGE, nominal<br>Half duplext/RF output (0 dBm) |
| 200 kHz | –35 dBc | –36 dBc |
| 400 kHz | –68 dBc | –68 dBc |
| 600 kHz | –76 dBc | –76 dBc |
| 1200 kHz | –80 dBc | –80 dBc |
| 1800 kHz | –76 dBc | –76 dBc |

1. For frequencies from 450 to 490 MHz, 820 to 920 MHz, and 1710 to 1910 MHz.
2. For frequencies from 380 to 490 MHz, 695 to 960 MHz, and 1425 to 2180 MHz.

## W-CDMA/HSPA+ Measurement Application Key Specifications [1]

| Channel Power | | |
|---|---|---|
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| Absolute power accuracy | ± 0.48 dB nominal at 0 dBm input power | ± 0.40 dB nominal at 0 dBm input power |
| **QPSK EVM** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| Residual EVM | 0.90% nominal at –10 dBm input power | 0.70% nominal at –10 dBm input power |
| **Adjacent Channel Power Ratio (ACPR)** | | |
| **Residual relative power in 3.84 MHz BW** | | |
| 5 MHz offsets | –65 dBc nominal at 0 dBm input power | |
| **Spectrum Emission Mask (SEM)** | | |
| **Residual relative power (offset)** | | |
| **Downlink, nominal** | | |
| 2.515 to 2.715 MHz | –75 dBc in a 30 kHz BW at 0 dBm input power | |
| 2.715 to 3.515 MHz | –77 dBc in a 1 MHz BW at 0 dBm input power | |
| 3.515 to 4 MHz | –77 dBc in a 1 MHz BW at 0 dBm input power | |
| 4 to 8 MHz | –67 dBc in a 1 MHz BW at 0 dBm input power | |
| 8 to 12.5 MHz | –66 dBc in a 1 MHz BW at 0 dBm input power | |
| **Uplink, nominal** | | |
| 2.515 to 3.485 MHz | –80 dBc in a 30 kHz BW at 0 dBm input power | |
| 4 to 7.5 MHz | –65 dBc in a 1 MHz BW at 0 dBm input power | |
| 7.5 to 8.5 MHz | –70 dBc in a 1 MHz BW at 0 dBm input power | |
| 8.5 to 12 MHz | –70 dBc in a 1 MHz BW at 0 dBm input power | |

## W-CDMA/HSPA+ Source Key Specifications

| Error Vector Magnitude (EVM) [1] | | | |
|---|---|---|---|
| Composite EVM, RF output port, half duplex port, at 0 dBm output power | | | |
| RMS | < 1% nominal | | |
| **Adjacent Channel Leakage Ratio (ACLR), RF Output Port, Half Duplex Port, at 0 dBm Output Power, nominal** | | | |
| Offset | Configuration | Frequency (MHz) | ACLR |
| Adjacent 5 MHz | 1 DPCH 1 carrier | 900 | –70 dB |
| Adjacent 10 MHz | | | –71 dB |
| Adjacent 5 MHz | | 1800 to 2000 | –70 dB |
| Adjacent 10 MHz | | | –72 dB |
| Adjacent 5 MHz | 64 DPCH 1 carrier | 900 | –69 dB |
| Adjacent 10 MHz | | | –70 dB |
| Adjacent 5 MHz | | 1800 to 2000 | –67 dB |
| Adjacent 10 MHz | | | –71 dB |

1. For frequencies from 695 MHz to 920 MHz and from 1425 MHz to 2700 MHz.

# LTE/LTE-Advanced FDD & LTE/LTE-Advanced TDD Measurement Application Specifications [1]

| Transmit Power | | | | | |
|---|---|---|---|---|---|
| | | Serial prefix < MY6020 | | Serial prefix ≥ MY6020, with Opt. EP6 | |
| Absolute power accuracy | | ± 0.65 dB nominal at 0 dBm input power | | ± 0.52 dB nominal at 0 dBm input power | |
| **Error Vector Magnitude (EVM)** | | | | | |
| **Residual EVM** | | | | | |
| 20 MHz bandwidth | | 0.4% nominal at –10 dBm input power | | | |
| **Adjacent Channel Power** | | | | | |
| **RF input port; Option HDX, half duplex port; at –20 dBm input power** | | | | | |
| | | RF input port, nominal | | Half duplex port, nominal | |
| | | Serial prefix < MY6020 | Serial prefix ≥ MY6020 | Serial prefix < MY6020 | Serial prefix ≥ MY6020 |
| E-UTRA (Uplink and downlink) | 695 to 910 MHz | –58 dBc | –57 dBc | –57 dBc | –57 dBc |
| | 910 to 1310 MHz | –55 dBc | –60 dBc | –54 dBc | –60 dBc |
| | 1310 to 2350 MHz | –60 dBc | –60 dBc | –60 dBc | –60 dBc |
| | 2350 to 3800 MHz | –60 dBc | –60 dBc | –56 dBc | –60 dBc |
| UTRA (Uplink and downlink) | 695 to 3800 MHz | –60 dBc | –62 dBc | –60 dBc | –62 dBc |

1. For frequencies from 695 and 3800 MHz.

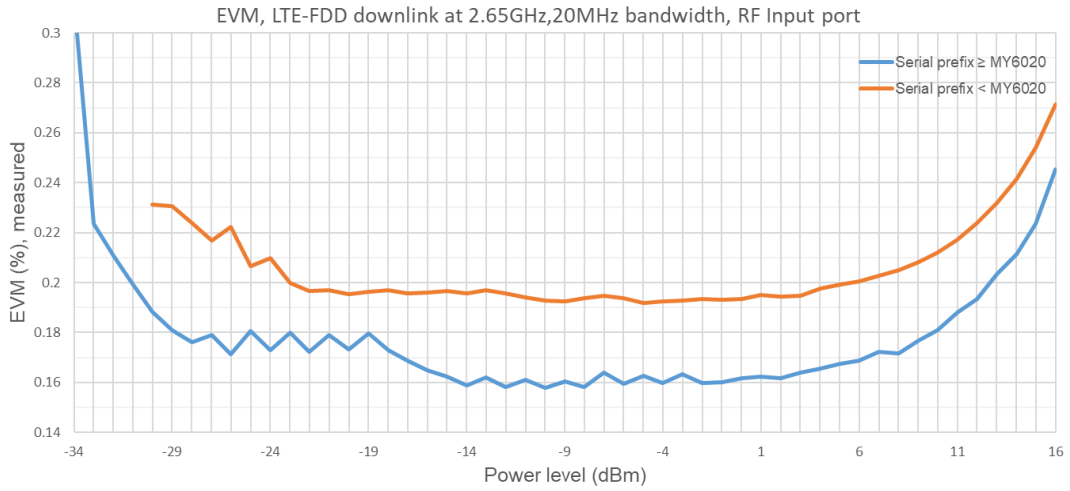



Figure 5. LTE-FDD downlink EVM vs. input power level at 2.65 GHz with 20 MHz bandwidth

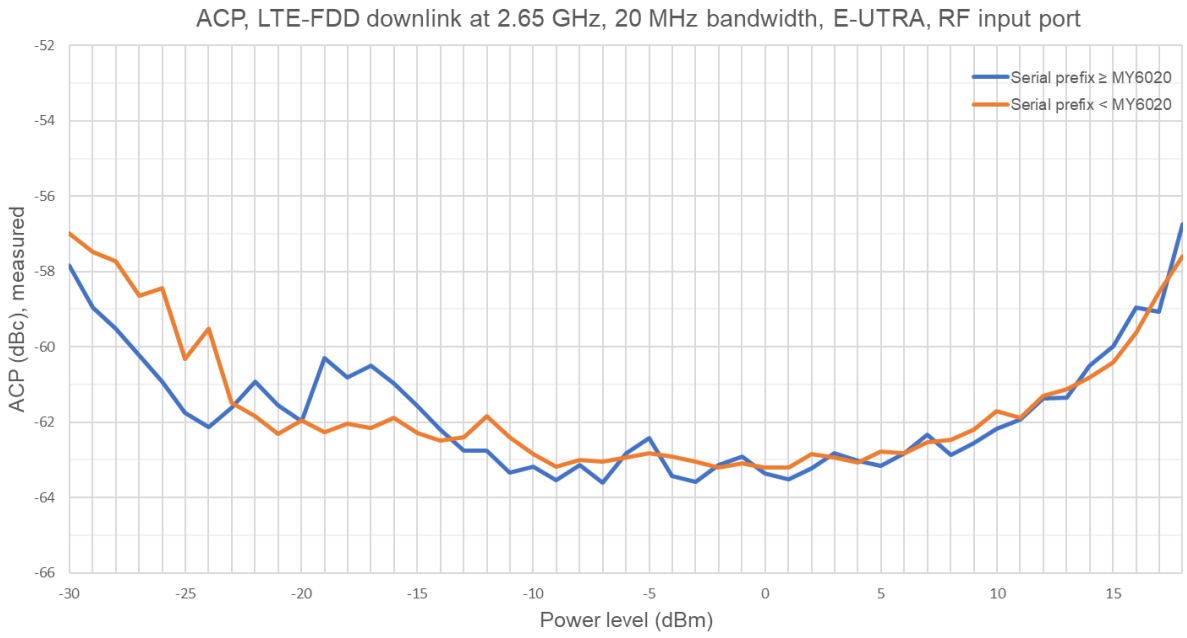



Figure 6. LTE-FDD downlink ACP vs. input power level at 2.65 GHz with 20 MHz bandwidth

## LTE Source Key Specifications

| Error Vector Magnitude (EVM) [1] | | |
|---|---|---|
| **Composite EVM, RF output port, half duplex port, at 0 dBm output power** | | |
| RMS, 20 MHz bandwidth | < 0.4% nominal | |
| **Adjacent channel power, RF output port, half duplex port, at 0 dBm output power** | | |
| | Adjacent, nominal | Alternate, nominal |
| 900 MHz | –64 dBc | –64 dBc |
| 2 GHz | –65 dBc | –65 dBc |

1. For specified frequency ranges between 695 and 3800 MHz.

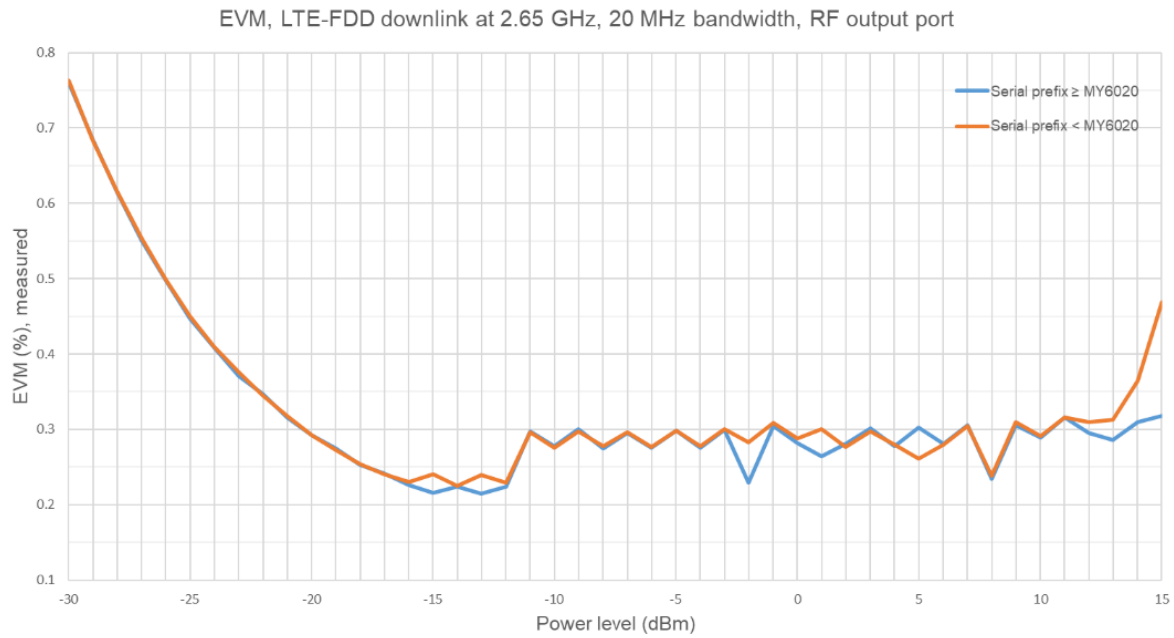



Figure 7. LTE-FDD downlink EVM vs. output power level at 2.65 GHz with 20 MHz bandwidth


Figure 8. LTE-FDD downlink ACP vs. output power level at 2.65 GHz with 20 MHz bandwidth

## WLAN Measurement Application Key Specifications

| Modulated Power | | |
|---|---|---|
| **Absolute power accuracy** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 2400 MHz to 2483.5 MHz | ± 0.29 dB nominal at 0 dBm input power | ± 0.33 dB nominal at 0 dBm input power |
| 5150 MHz to 5185 MHz | ± 0.61 dB nominal at 0 dBm input power | ± 0.50 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 input port, half duplex port, at –20 dBm input power, optimized range, nominal** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 802.11a 5.8 GHz | < –48 dB | < –51 dB |
| 802.11b 2.4 GHz | < –50 dB | < –53 dB |
| 802.11g 2.4 GHz | < –50 dB | < –53 dB |
| 802.11n 5.8 GHz 20 MHz | < –48 dB | < –52 dB |
| 802.11n 5.8 GHz 40 MHz | < –46 dB | < –51 dB |
| 802.11ac 5.8 GHz 80 MHz | < –46 dB | < –48 dB |
| 802.11ac 5.8 GHz 160 MHz | < –44 dB | < –46 dB |
| 802.11ax 5.8 GHz 80 MHz | < –46 dB | < –48 dB |
| 802.11ax 5.8 GHz 160 MHz | < –44 dB | < –46 dB |

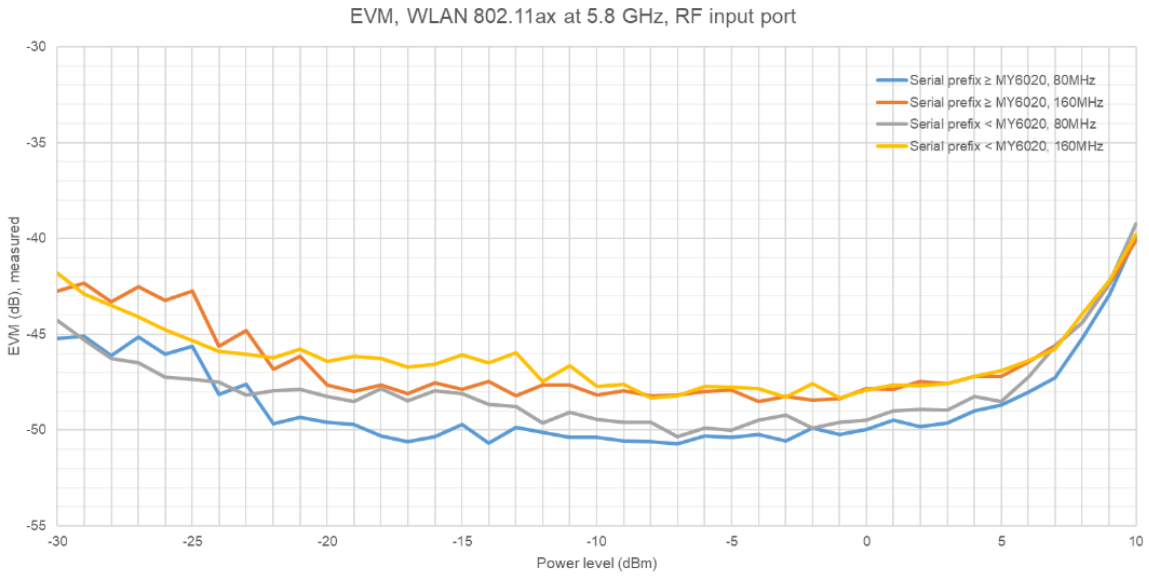



Figure 9. WLAN 802.11ax EVM vs. input power level at 5.8 GHz

## WLAN Source Key Specifications

| Error Vector Magnitude (EVM) | |
|---|---|
| **RF output port , half duplex port, at –5 dBm to –15 dBm output power, nominal** | |
| 802.11a 5.8 GHz | < –46 dB |
| 802.11b 2.4 GHz | < –50 dB |
| 802.11g 2.4 GHz | < –50 dB |
| 802.11n 5.8 GHz 20 MHz | < –46 dB |
| 802.11n 5.8 GHz 40 MHz | < –46 dB |
| 802.11ac 5.8 GHz 80 MHz | < –47 dB |
| 802.11ac 5.8 GHz 160 MHz | < –45 dB |
| 802.11ax 5.8 GHz 80 MHz | < –47 dB |
| 802.11ax 5.8 GHz 160 MHz | < –45 dB |

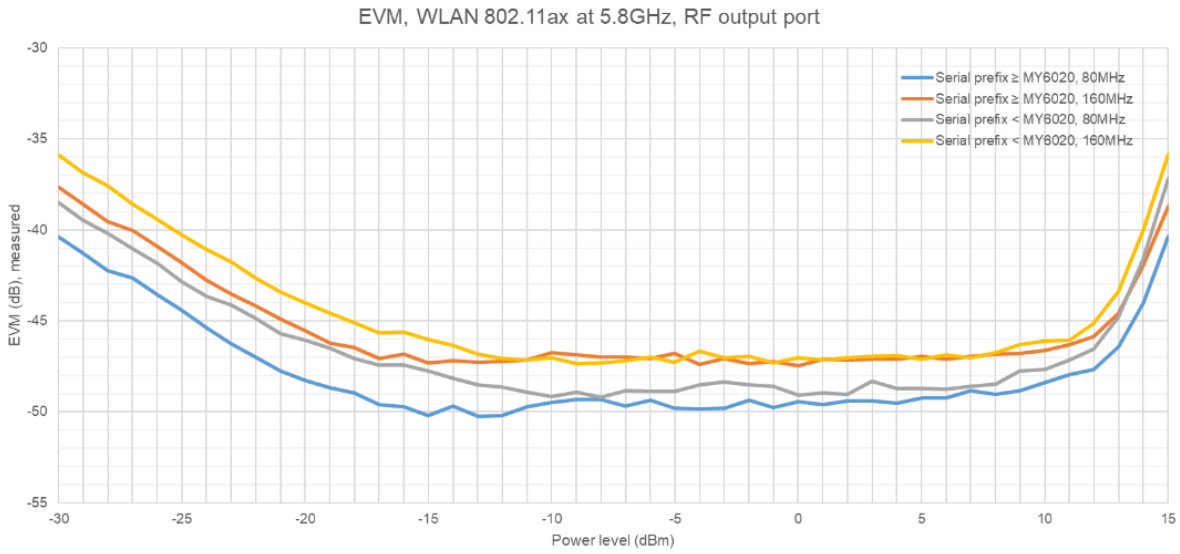



Figure 10. WLAN 802.11ax EVM vs. output power level at 5.8 GHz

# 5G NR Measurement Application Specifications

| Transmit Power | | |
|---|---|---|
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| Absolute power accuracy | ± 0.48 dB nominal at 0 dBm input power | ± 0.43 dB nominal at 0 dBm input power |
| **Error Vector Magnitude (EVM)** | | |
| **Residual EVM, RF input port, half duplex port, at –10 dBm input power** | | |
| 30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM) | 0.3% nominal | |
| **Adjacent Channel Power** | | |
| **RF input port, half duplex port, at 0 dBm input power** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM) | –56 dBc nominal, noise correction off | –56 dBc nominal, noise correction off |
| | –63 dBc nominal, noise correction on | –65 dBc nominal, noise correction on |

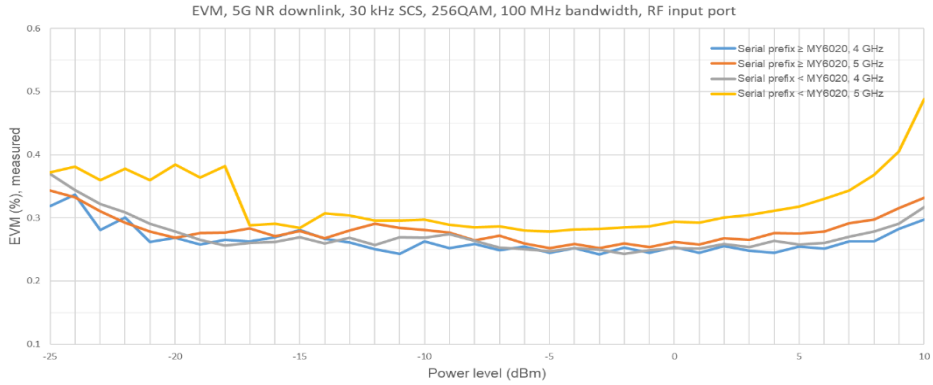



Figure 11. 5G NR downlink EVM vs. input power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

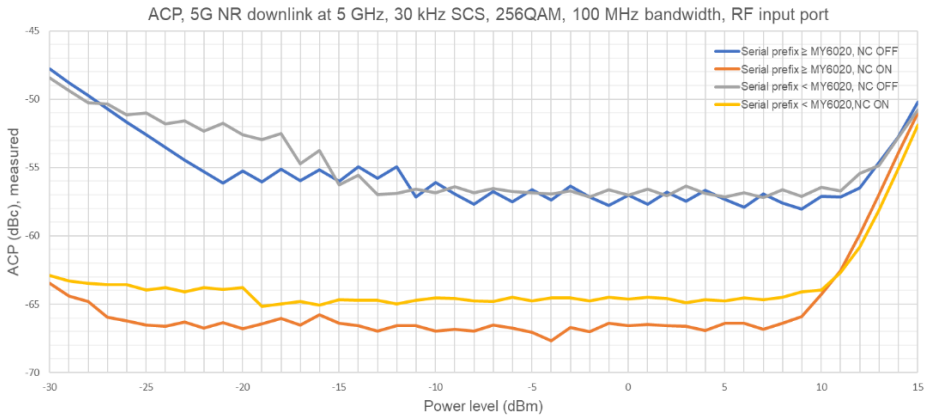



Figure 12. 5G NR downlink ACP vs. input power level at 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

## 5G NR Source Key Specifications

| Error Vector Magnitude (EVM) | | |
|---|---|---|
| **Composite EVM, RF output port, half duplex port, at –10 dBm output power** | | |
| | Serial prefix < MY6020 | Serial prefix ≥ MY6020, with Opt. EP6 |
| 30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM) | 0.4% nominal | 0.3% nominal |
| 30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM) | 0.6% nominal | 0.4% nominal |
| **Adjacent Channel Power** | | |
| **RF output port, half duplex port, at 0 dBm output power** | | |
| 30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM) | –57 dBc nominal | |
| 30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM) | –55 dBc nominal | |

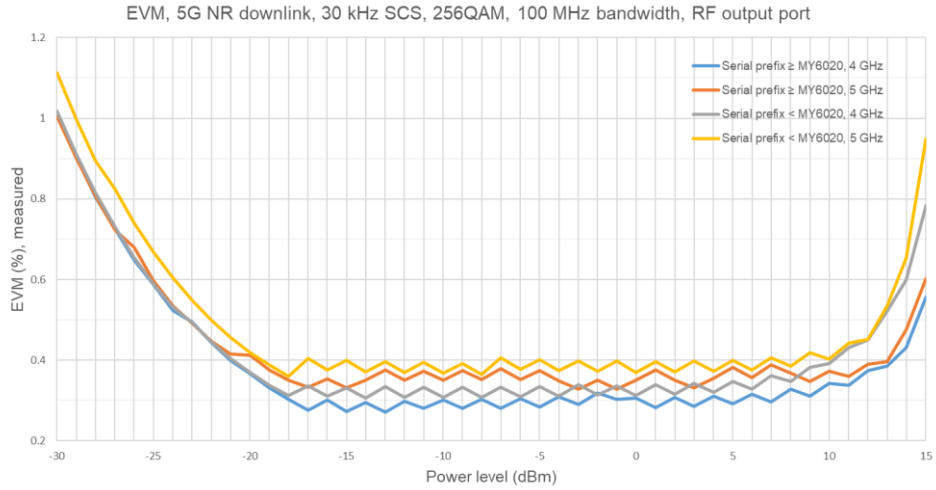



Figure 13. 5G NR downlink EVM vs. output power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256QAM

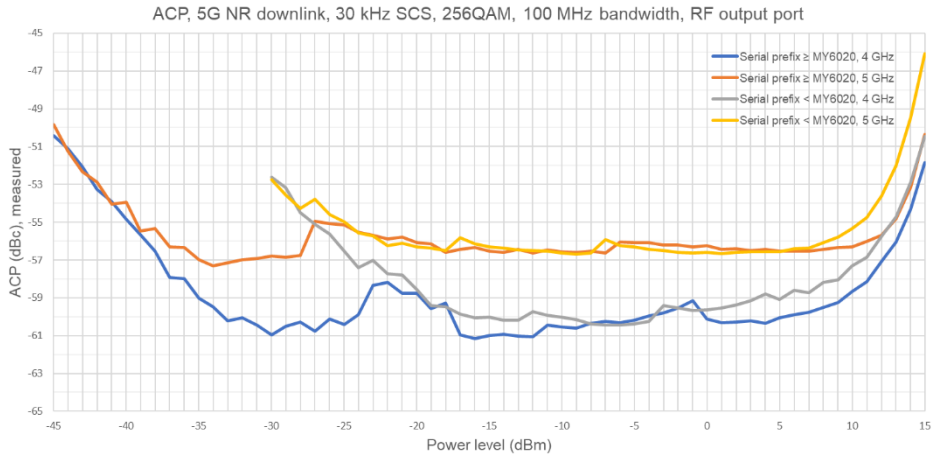



Figure 14. 5G NR downlink ACP vs. output power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

## Related Literature

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

- M9410A and M9411A VXT PXIe Vector Transceivers Configuration Guide (literature no. 5992-3303EN)
- M9018B PXIe 18 slot Chassis Data Sheet (literature no. 5992-1481EN)
- M9037A PXIe High Performance Embedded Controller Data Sheet (literature no. 5991-3661EN)
- X-Series Measurement Applications Brochure (literature no. 5989-8019EN)
- Signal Studio Software Brochure (literature no. 5989-6448EN)

## Web

Product page:

- www.keysight.com/find/M9410A
- www.keysight.com/find/M9411A

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