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		
Frequency Readout Accuracy			
CW	± (marker frequency x frequency reference accuracy + 0.10% x span + 5% x RBW + 2 Hz + 0.5 x horizontal resolution)		
Demodulation	± (center frequency × frequency reference accuracy + 1 Hz)		
Resolution	1 Hz		
Maximum signal 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, 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**
1 to 380 MHz	< 2.8:1, < *2.5:1 typical*	<2.4:1, < *2.2:1 typical*
380 to 1310 MHz	< 1.9:1, < *1.7:1 typical*	< 1.6:1, < *1.5:1 typical*
1310 to 2000 MHz	< 1.7:1, < *1.5:1 typical*	< 1.5:1, < *1.4:1 typical*
2000 to 3500 MHz	< 2.0:1, < *1.8:1 typical*	< 1.7:1, < *1.5:1 typical*
3500 to 4500 MHz	< 1.9:1, < *1.7:1 typical*	< 1.8:1, < *1.6:1 typical*
4500 to 5200 MHz	< 1.6:1, < *1.4:1 typical*	< 1.6:1, < *1.4:1 typical*
5200 to 6000 MHz	< 2.0:1, < *1.7:1 typical*	< 2.1:1, < *1.8:1 typical*
Phase Noise Sidebands (CF = 1 GHz)		
Frequency offset	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6 Used with M9300A or M9300A-S01**
1 kHz	*–110 dBc/Hz, typical* [2]	–100 dBc/Hz, *–110 dBc/Hz typical*
10 kHz	*–129 dBc/Hz, typical* [2]	–123 dBc/Hz, *–129 dBc/Hz typical*
100 kHz	*–132 dBc/Hz, typical* [2]	–126 dBc/Hz, *–132 dBc/Hz typical*
1 MHz	*–134 dBc/Hz, typical* [2]	–129 dBc/Hz, *–134 dBc/Hz typical*
5 MHz	*–137 dBc/Hz, typical* [2]	–133 dBc/Hz, *–137 dBc/Hz typical*

1. Signal is measured at 1.1 MHz offset from the center frequency, Otherwise, an IF flatness error must be added.
2. nominal, when used with M9300A-S01

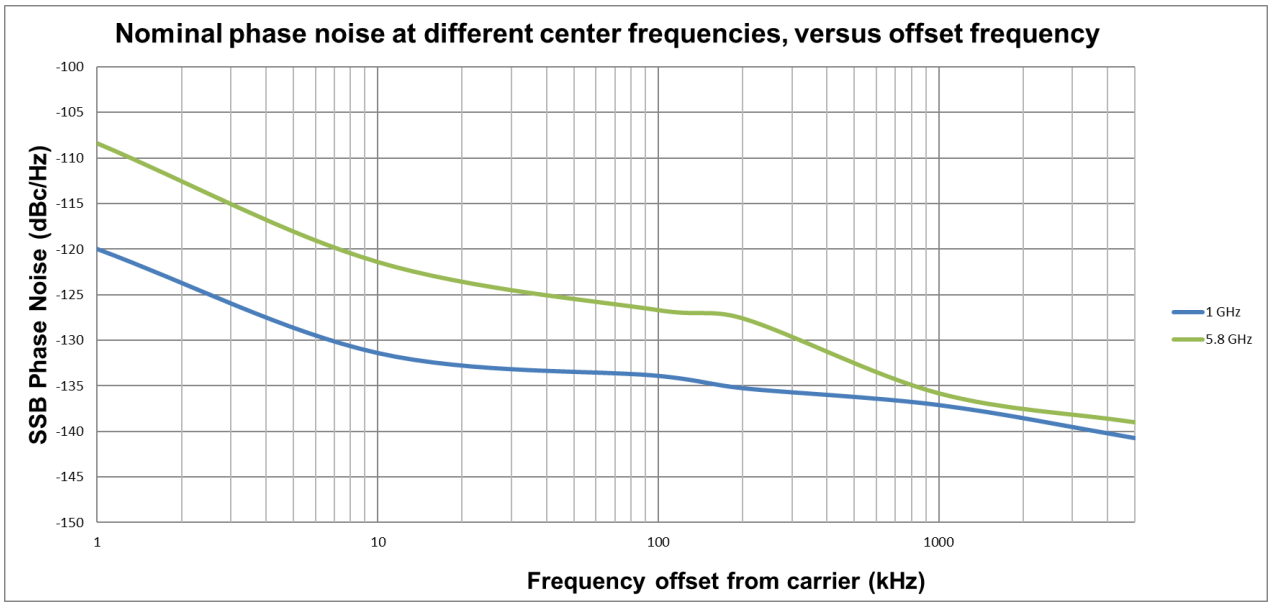

Figure 1. Nominal phase noise from 1 kHz to 5 MHz offset at 1 and 5.8 GHz

Residual responses		
RF input port; Option HDX, half duplex port; with analyzer ranged to 0 dBm		
Serial prefix < MY6020		
1 to 380 MHz	< *–81 dBm typical*	
380 to 6000 MHz	< *–81 dBm typical*, offset from 10 MHz to ½ × analysis bandwidth	
Serial prefix ≥ MY6020, with Opt. EP6		
1 to 380 MHz	< –75 dBm, < *–81 dBm typical*	
380 to 6000 MHz	< –75 dBm, < *–81 dBm typical*, 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*

1. –50 dBc for frequencies from 5100 to 5930 MHz.

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* [1]
300 MHz	1310 to 6000 MHz	*–55 dBc*
600 MHz	1310 to 6000 MHz	*–54 dBc*
1200 MHz	1900 to 6000 MHz	*–54 dBc*

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 [2])		
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, typical*	*–58 dBr, typical*
450 to 550 MHz	*–56 dBr, typical*	*–53 dBr, typical*
550 to 680 MHz	*–53 dBr, typical*	*–54 dBr, typical*
680 to 910 MHz	*–55 dBr, typical*	*–57 dBr, typical*
910 to 1310 MHz	*–53 dBr, typical*	*–55 dBr, typical*
1310 to 2000 MHz	*–52 dBr, typical*	*–53 dBr, typical*
2000 to 3500 MHz	*–50 dBr, typical*	*–49 dBr, typical*
3500 to 4500 MHz	*–50 dBr, typical*	*–52 dBr, typical*
4500 to 5100 MHz	*–47 dBr, typical*	*–45 dBr, typical*
5100 to 6000 MHz	*–44 dBr, typical*	*–42 dBr, typical*
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 450 MHz	–35 dBr, *–46 dBr typical*	–35 dBr, *–46 dBr typical*
450 to 4600 MHz	–41 dBr, *–53 dBr typical*	–41 dBr, *–53 dBr typical*
4600 to 6000 MHz	–41 dBr, *–51 dBr typical*	–41 dBr, *–51 dBr typical*

1. –57 dBc for frequencies from 1300 to 1310 MHz.
2. 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/Hz, *–160 dBm/Hz typical*	–151 dBm/Hz, *–154 dBm/Hz typical*
680 to 910 MHz	–160 dBm/Hz, *–163 dBm/Hz typical*	–154 dBm/Hz, *–157 dBm/Hz typical*
910 to 1310 MHz	–156 dBm/Hz, *–159 dBm/Hz typical*	–151 dBm/Hz, *–154 dBm/Hz typical*
1310 to 2000 MHz	–162 dBm/Hz, *–165 dBm/Hz typical*	–156 dBm/Hz, *–159 dBm/Hz typical*
2000 to 3500 MHz	–158 dBm/Hz, *–162 dBm/Hz typical*	–153 dBm/Hz, *–156 dBm/Hz typical*
3500 to 4500 MHz	–158 dBm/Hz, *–162 dBm/Hz typical*	–151 dBm/Hz, *–154 dBm/Hz typical*
4500 to 6000 MHz	–152 dBm/Hz, *–155 dBm/Hz typical*	–145 dBm/Hz, *–148 dBm/Hz 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/Hz, *–162 dBm/Hz typical*	–156 dBm/Hz, *–161 dBm/Hz typical*
10 to 380 MHz	–160 dBm/Hz, *–164 dBm/Hz typical*	–158 dBm/Hz, *–163 dBm/Hz typical*
380 to 680 MHz	–159 dBm/Hz, *–162 dBm/Hz typical*	–157 dBm/Hz, *–160 dBm/Hz typical*
680 to 1310 MHz	–160 dBm/Hz, *–163 dBm/Hz typical*	–158 dBm/Hz, *–161 dBm/Hz typical*
1310 to 2000 MHz	–162 dBm/Hz, *–166 dBm/Hz typical*	–161 dBm/Hz, *–164 dBm/Hz typical*
2000 to 3500 MHz	–161 dBm/Hz, *–164 dBm/Hz typical*	–158 dBm/Hz, *–161 dBm/Hz typical*
3500 to 4500 MHz	–160 dBm/Hz, *–163 dBm/Hz typical*	–157 dBm/Hz, *–160 dBm/Hz typical*
4500 to 6000 MHz	–158 dBm/Hz, *–161 dBm/Hz typical*	–154 dBm/Hz, *–157 dBm/Hz typical*
Third-order Intermodulation Distortion (TOI, with analyzer ranged to 0 dBm)		
Serial prefix < MY6020		
380 to 4000 MHz	+27 dBm, nominal	
4000 to 6000 MHz	+23 dBm, nominal	
Serial prefix ≥ MY6020, with Opt. EP6		
10 to 380 MHz	+19 dBm, *+22 dBm typical*	
380 to 4000 MHz	+19 dBm, *+25 dBm typical*	
4000 to 6000 MHz	+17dBm, *+21 dBm typical*	
IF Flatness		
Maximum bandwidth	**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		
Maximum 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 accuracy			
± (output frequency × frequency reference accuracy + 0.001 Hz)			
Frequency switching speed [1]			
SCPI mode	≤ 14 ms nominal		
IVI mode	≤ 10 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, Windows 10 Operating System.

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
Maximum reverse power	
Average power input	+27 dBm
DC volts	30 Vdc
Amplitude Switching Speed [1]	
SCPI mode	≤ 14 ms nominal
IVI mode	≤ 10 ms nominal

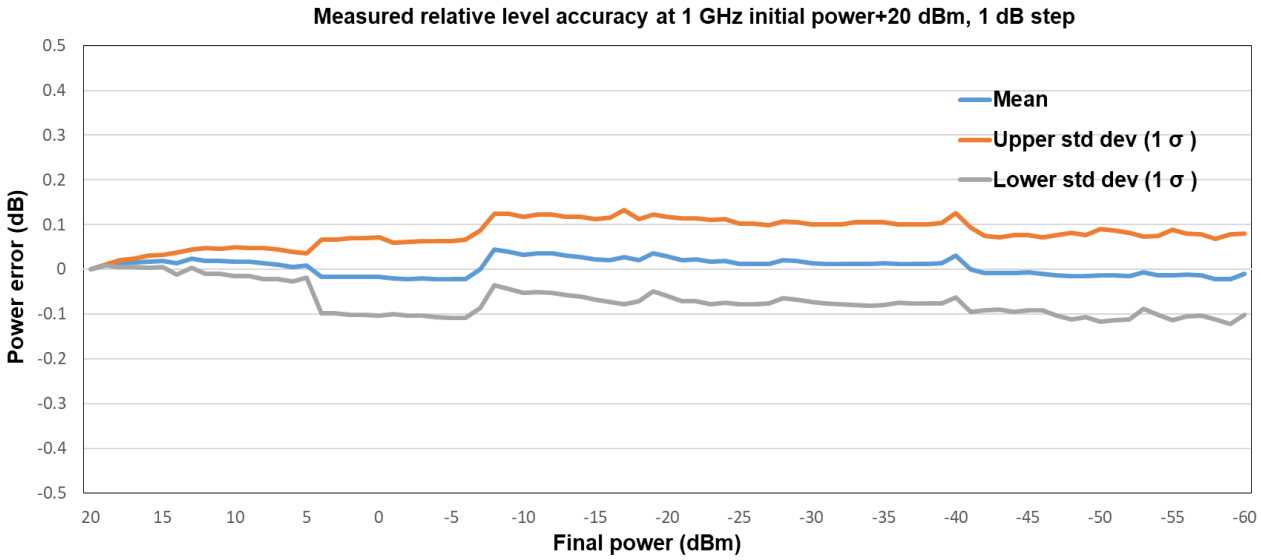

Figure 2. Measured relative level accuracy at 1 GHz

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, Windows 10 Operating System.

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	< ± 0.60 dB, < ± *0.35 dB typical*	< ± 0.60 dB, < ± *0.25 dB typical*
Level ≤ –15 dBm to –80 dBm	< ± 0.70 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	< ± 0.70 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	< ± 0.80 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	< ± 0.75 dB, < ± *0.35 dB typical*	< ± 0.75 dB, < ± *0.35 dB typical*
Level ≤ –80 dBm to –90 dBm	< ± 0.75 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	< ± 0.70 dB, < ± *0.45 dB typical*	< ± 0.70 dB, < ± *0.35 dB typical*
Level ≤ –80 dBm to –90 dBm	< ± 0.80 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		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**
1 to 380 MHz		< 1.9:1, < *1.7:1 typical*
380 to 4200 MHz	< 1.7:1 typical, < 1.6:1 nominal	< 1.8:1, < *1.6:1 typical*
4200 to 5000 MHz	< 1.8:1 typical, < 1.7:1 nominal	< 1.7:1, < *1.6:1 typical*
5000 to 6000 MHz	< 1.8:1 typical, < 1.7:1 nominal	< 1.9:1, < *1.7:1 typical*
Option HDX, half duplex port (configured to output mode)		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 4000 MHz	< 1.7:1 nominal	< 1.8:1, < *1.6:1 typical*
4000 to 5000 MHz	< 2.1:1 nominal	< 1.8:1, < *1.6:1 typical*
5000 to 6000 MHz	< 2.4:1 nominal	< 2.3:1, < *2.0:1 typical*

Harmonics		
RF output port		
0 dBm output power	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
1 to 10 MHz	< *–36 dBc typical*	< –32 dBc, < *–36 dBc typical*
10 to 380 MHz	< *–42 dBc typical*	< –38 dBc, < *–42 dBc typical*
380 to 6000 MHz	< *–44 dBc typical*	< –39 dBc, < *–44 dBc typical*
+10 dBm output power, with Option 1EA	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
60 to 380 MHz	< *–38 dBc typical*	< –35 dBc, < *–38 dBc typical*
380 to 6000 MHz	< *–35 dBc typical*	< –32 dBc, < *–35 dBc typical*
Option HDX, half duplex port		
0 dBm output power	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 6000 MHz	< *–42 dBc typical*	< –42 dBc, < *–45 dBc typical*
Non-harmonic Spurious (CW mode)		
RF output port		
0 dBm output power	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
10 to 380 MHz		< –50 dBc, < *–60 dBc typical*
380 to 6000 MHz	< *–65 dBc typical*	< –65 dBc, < *–75 dBc typical*
+10 dBm output power, with Option 1EA	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
60 to 380 MHz		< –50 dBc, < *–60 dBc typical*
380 to 6000 MHz	< *–65 dBc typical*	< –65 dBc, < *–75 dBc typical*
Option HDX, half duplex port		
0 dBm output power	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 3900 MHz	< *–65 dBc typical*	< –65 dBc, < *–75 dBc typical*
3900 to 6000 MHz	< *–63 dBc typical*	< –65 dBc, < *–75 dBc typical*
LO Feedthrough		
RF output port		
0 dBm output power	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 3000 MHz	–65 dBc nominal	< –43 dBc, < *–55 dBc typical*
3000 to 5000 MHz	–55 dBc nominal	< –40 dBc, < *–50 dBc typical*
5000 to 6000 MHz	–50 dBc nominal	< –35 dBc, < *–45 dBc typical*

Image Responses		
RF output port, –10 dBm output power		
Maximum bandwidth	**Center frequency**	**Serial prefix < MY6020**
100 MHz	380 to 550 MHz	–55 dBc nominal
200 MHz	550 to 1310 MHz	–55 dBc nominal
300 MHz	1310 to 5930 MHz	–50 dBc nominal
600 MHz	1310 to 5780 MHz	–50 dBc nominal
1200 MHz	2000 to 5480 MHz	–50 dBc nominal
Maximum bandwidth	**Center frequency**	**Serial prefix ≥ MY6020, with Opt. EP6**
100 MHz	380 to 550 MHz	–50 dBc, *–55 dBc typical*
200 MHz	550 to 1310 MHz	–50 dBc, *–55 dBc typical*
300 MHz	1310 to 6000 MHz	–45 dBc, *–50 dBc typical*
600 MHz	1310 to 6000 MHz	–40 dBc, *–47 dBc typical*
1200 MHz	1900 to 6000 MHz	–40 dBc, *–45 dBc typical*
Sideband Spurious		
RF output port, 0 dBm; Option HDX, half duplex port, 0 dBm; Option 1EA, +10 dBm		
Serial prefix < MY6020		
Offset		380 to 6000 MHz
1 to 100 kHz		–75 dBc nominal
100 kHz to 1 MHz		–80 dBc nominal
1 to 10 MHz		–80 dBc nominal
Serial prefix ≥ MY6020, with Opt. EP6		
Offset	20 to 380 MHz	380 to 6000 MHz
1 to 100 kHz	–65 dBc, *–75 dBc typical*	–65 dBc, *–80 dBc typical*
100 kHz to 10 MHz	–65 dBc, *–75 dBc typical*	–70 dBc, *–80 dBc typical*
Phase Noise		
RF output port, 0 dBm; Option HDX, half duplex port, 0 dBm; Option 1EA, +10 dBm; Center frequency = 1 GHz		
Frequency offset	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6 Used with M9300A or M9300A-S01**
1 kHz	*–113 dBc/Hz, typical*	–105 dBc/Hz, *–113 dBc/Hz typical*
10 kHz	*–130 dBc/Hz, typical*	–124 dBc/Hz, *–130 dBc/Hz typical*
100 kHz	*–137 dBc/Hz, typical*	–133 dBc/Hz, *–137 dBc/Hz typical*
1 MHz	*–140 dBc/Hz, typical*	–137 dBc/Hz, *–140 dBc/Hz typical*
5 MHz	*–139 dBc/Hz, typical*	–137 dBc/Hz, *–139 dBc/Hz typical*

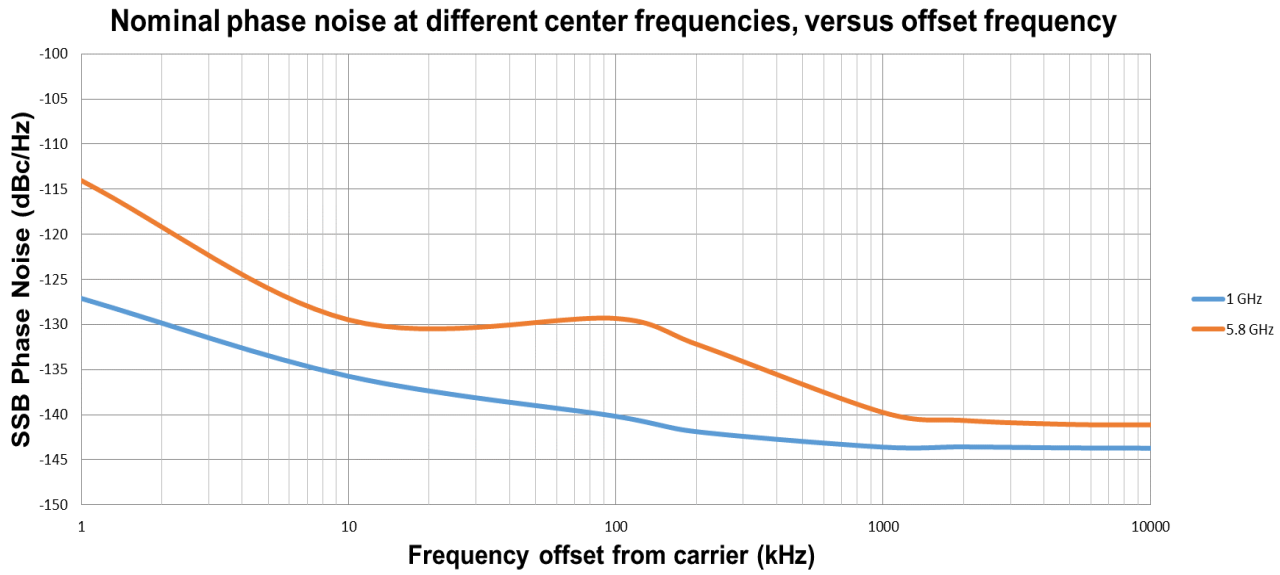

Figure 3. Nominal phase noise from 1 kHz to 10 MHz offset at 1 and 5.8 GHz

Broadband Noise Floor [1]		
RF output port, output level = 0 dBm		
Frequency range	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**
20 to 380 MHz		–129 dBm/Hz, *–132 dBm/Hz typical*
380 to 550 MHz	–136 dBm/Hz, nominal	–132 dBm/Hz, *–135 dBm/Hz typical*
550 to 1000 MHz	–140 dBm/Hz, nominal	–134 dBm/Hz, *–136 dBm/Hz typical*
1000 to 4500 MHz	–141 dBm/Hz, nominal	–134 dBm/Hz, *–138 dBm/Hz typical*
4500 to 6000 MHz	–137 dBm/Hz, nominal	–134 dBm/Hz, *–137 dBm/Hz typical*
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, nominal	–141 dBm/Hz, *–144 dBm/Hz typical*
550 to 1000 MHz	–149 dBm/Hz, nominal	–143 dBm/Hz, *–145 dBm/Hz typical*
1000 to 4500 MHz	–147 dBm/Hz, nominal	–143 dBm/Hz, *–146 dBm/Hz typical*
4500 to 6000 MHz	–145 dBm/Hz, nominal	–143 dBm/Hz, *–146 dBm/Hz typical*
Third-order Intermodulation Distortion (TOI)		
RF output port, output level = 0 dBm		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**
1 to 20 MHz	*+13 dBm typical*	+12 dBm, *+13 dBm typical*
20 to 380 MHz	*+19 dBm typical*	+17 dBm, *+19 dBm typical*
380 to 3900 MHz	*+28 dBm typical*	+26 dBm, *+28 dBm typical*
3900 to 4500 MHz	*+27 dBm typical*	+26 dBm, *+27 dBm typical*
4500 to 6000 MHz	*+25 dBm typical*	+22 dBm, *+25 dBm typical*

1. Measured at 13.1 MHz offset from the center frequency.

Option HDX, half duplex port, output level = –10 dBm			
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**	
380 to 4500 MHz	*+18 dBm typical*	+16 dBm, *+18 dBm typical*	
4500 to 6000 MHz	*+15 dBm typical*	+12 dBm, *+15 dBm typical*	
IF Flatness			
RF output port, Option HDX, half duplex port, output level = –10 dBm			
Maximum amplitude error			
Maximum bandwidth	**Serial prefix < MY6020**	**Serial prefix ≥ MY6020, with Opt. EP6**	
20 MHz	± *0.24 dB typical* [1]	± 0.40 dB, ± *0.26 dB typical*	
100 MHz	± *0.50 dB typical*	± 0.65 dB, ± *0.39 dB typical*	
200 MHz	± *0.80 dB typical*	± 0.80 dB, ± *0.45 dB typical*	
300 MHz	± *1.00 dB typical*	± 0.95 dB, ± *0.60 dB typical*	
600 MHz	± *1.00 dB typical*	± 1.45 dB, ± *0.80 dB typical*	
1200 MHz	± *1.50 dB typical*	± 1.80 dB, ± *1.00 dB typical*	
Maximum phase error			
Serial prefix ≥ MY6020, with Opt. EP6			
Frequency	**Maximum bandwidth**	**Peak-to-peak (nominal)**	**RMS (nominal)**
1000 MHz	100 MHz	1.5°	0.3°
4000 MHz	100 MHz 300 MHz 600 MHz 1200 MHz	1.0° 2.2° 5.9° 14.1°	0.3° 0.6° 1.3° 3.4°
5000 MHz	100 MHz 300 MHz 600 MHz 1200 MHz	1.5° 6.2° 11.2° 14.8°	0.4° 2.0° 3.5° 4.2°

1. 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 • 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	
M9410A	88 W nominal
M9411A	114 W nominal
Weight	
Net	
M9410A	1.2 kg (2.6 lbs)
M9411A	1.5 kg (3.3 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	< 1.9:1, < *1.7:1 typical*
1310 to 2000 MHz	< 1.6:1, < 1.5:1 nominal	< 1.6:1, < *1.4:1 typical*
2000 to 3500 MHz	< 1.8:1, < 1.7:1 nominal	< 1.9:1, < *1.6:1 typical*
3500 to 4500 MHz	< 1.6:1, < 1.5:1 nominal	< 1.8:1, < *1.6:1 typical*
4500 to 5200 MHz	< 2.0:1, < 1.8:1 nominal	< 1.7:1, < *1.4:1 typical*
5200 to 6000 MHz	< 2.3:1, < 2.0:1 nominal	< 2.0:1, < *1.7:1 typical*

Phase Noise Sidebands (CF = 1 GHz)		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6; Used with M9300A or M9300A-S01**
1 kHz offset	–121 dBc/Hz nominal	–104 dBc/Hz, *–113 dBc/Hz typical*
10 kHz offset	–133 dBc/Hz nominal	–125 dBc/Hz, *–131 dBc/Hz typical*
100 kHz offset	–135 dBc/Hz nominal	–130 dBc/Hz, *–135 dBc/Hz typical*
1 MHz offset	–137 dBc/Hz nominal	–131 dBc/Hz, *–136 dBc/Hz typical*
5 MHz offset	–140 dBc/Hz nominal	–135 dBc/Hz, *–139 dBc/Hz typical*

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		
RF input port; with analyzer ranged to 0 dBm		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 550 MHz, 40 MHz span	< –90 dBm nominal	< –90 dBm, < *–95 dBm typical*
550 to 6000 MHz, 80 MHz span	< –90 dBm nominal	< –90 dBm, < *–95 dBm typical*
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/Hz, *–160 dBm/Hz typical*	
1320 to 2540 MHz	–153 dBm/Hz, *–158 dBm/Hz typical*	
2540 to 3070 MHz	–152 dBm/Hz, *–157 dBm/Hz typical*	
3070 to 3570 MHz	–153 dBm/Hz, *–157 dBm/Hz typical*	
3570 to 5200 MHz	–152 dBm/Hz, *–156 dBm/Hz typical*	
5200 to 5750 MHz	–150 dBm/Hz, *–154 dBm/Hz typical*	
5750 to 6000 MHz	–146 dBm/Hz, *–152 dBm/Hz typical*	
Frequency range	**Serial prefix ≥ MY6020, with Opt. EP6**	
380 to 1900 MHz	–156 dBm/Hz, *–160 dBm/Hz typical*	
1900 to 5200 MHz	–152 dBm/Hz, *–157 dBm/Hz typical*	
5200 to 6000 MHz	–151 dBm/Hz, *–156 dBm/Hz typical*	
Third-order Intermodulation Distortion (TOI)		
RF input port, with analyzer ranged to 0 dBm		
	Serial prefix < MY6020	**Serial prefix ≥ MY6020, with Opt. EP6**
380 to 4000 MHz	+27 dBm nominal	+24 dBm, *+28 dBm typical*
4000 to 6000 MHz	+23 dBm nominal	+18 dBm, *+22 dBm typical*
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, 5]	
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	$1.0/(ModIndex)^{\frac{1}{2}} + 0.1\ [\%]$
Distortion Accuracy [6]	
Distortion (SINAD) and THD	$\pm(0.02 \times reading + DistResidual)\ [\%]$
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 × log10(1/ Distortion). SINAD bandwidth: (Channel BW)/2.
5. 10 to 1310 MHz, 1 kHz rate, 1 kHz deviation, residual distortion < 0.11%
6. 2nd and 3rd harmonics, Rate: 1 to 10 kHz, ModIndex: 0.2 to 100

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 × log10(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]

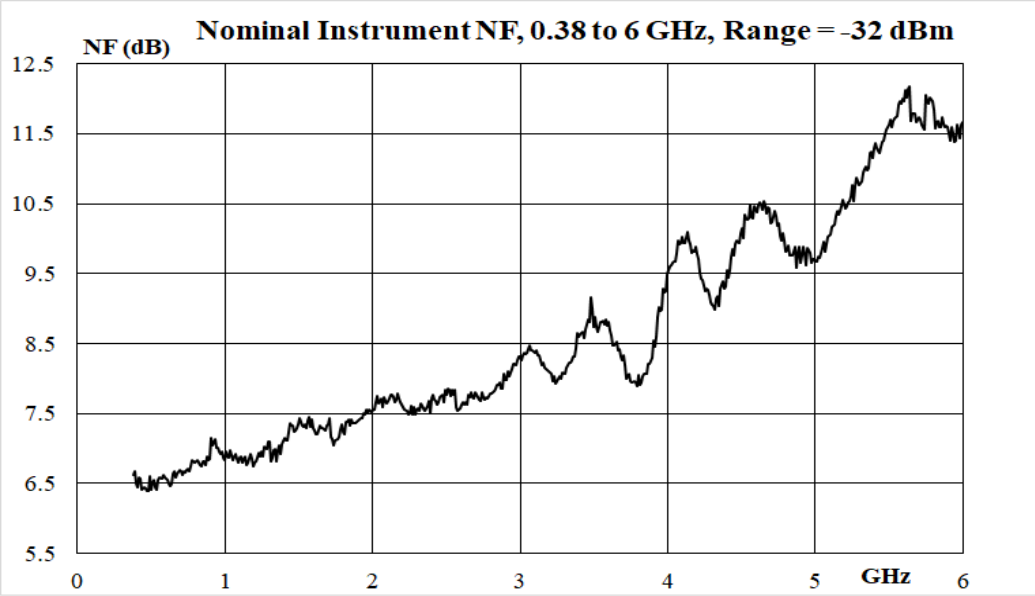

Figure 4. Nominal instrument noise figure

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 Half duplext/RF output (0 dBm)	EDGE, nominal 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	
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm or 0 dBm input power			
900 MHz	5 MHz bandwidth	0.17% downlink, 0.17% uplink	
	20 MHz bandwidth	0.22% downlink, 0.26% uplink	
2000 MHz	5 MHz bandwidth	0.25% downlink, 0.24% uplink	
	20 MHz bandwidth	0.29% downlink, 0.31% uplink	

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
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm or 0 dBm input power, typical					
E-UTRA (Uplink and downlink)	900 MHz, 2000 MHz	5 MHz bandwidth, 20 MHz bandwidth		–61 dBc	
UTRA (Uplink and downlink)	900 MHz, 2000 MHz	5 MHz bandwidth, 20 MHz bandwidth		–66 dBc	

1. For frequencies from 695 and 3800 MHz.

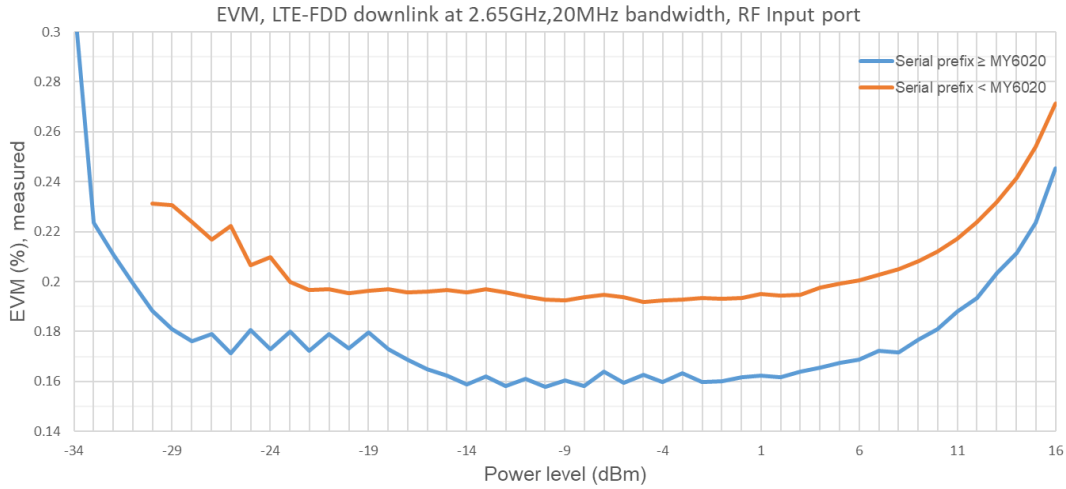

Figure 5. LTE-FDD downlink EVM vs. input power level at 2.65 GHz with 20 MHz bandwidth

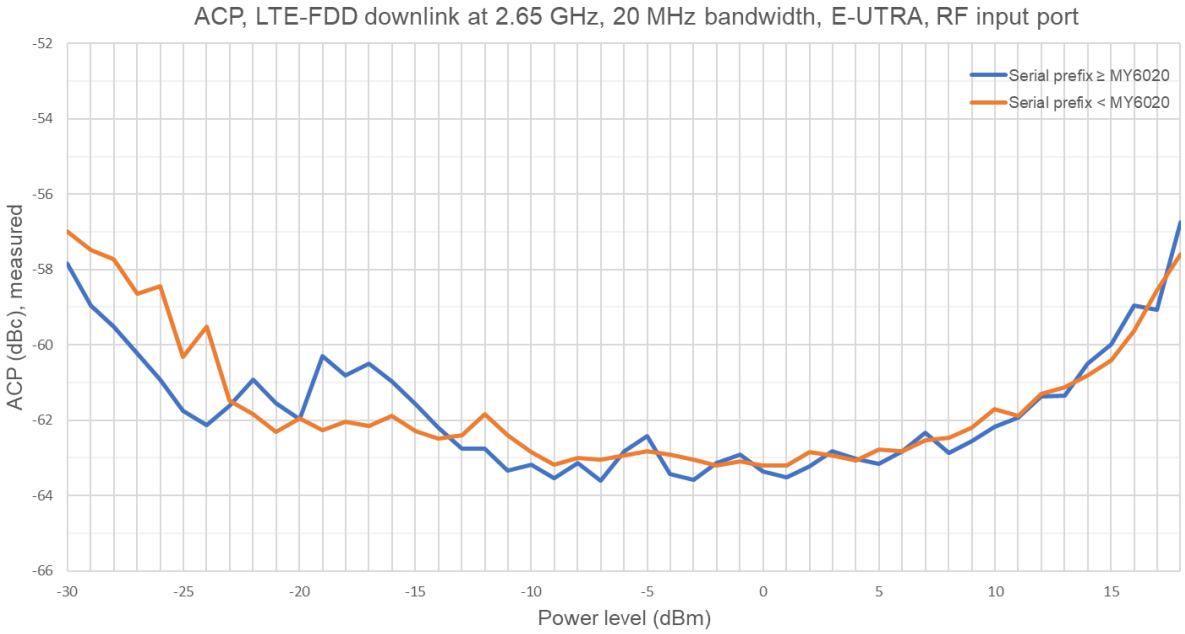

Figure 6. LTE-FDD downlink ACP vs. input power level at 2.65 GHz with 20 MHz bandwidth

LTE Source Key Specifications

Modulated signal level accuracy				
RF output port, half duplex port, FDD, relative to CW, at –10 to +5 dBm output power				
600 to 3800 MHz	±0.4 dB, ±0.26 dB typical			
Error vector magnitude (EVM)				
Composite EVM, RF output port, half duplex port, at 0 dBm output power				
RMS [1], 20 MHz bandwidth	< 0.3% nominal			
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm or 0 dBm input power				
FDD	900 MHz	5 MHz bandwidth	< 0.3%, < *0.2% typical*	
		20 MHz bandwidth	< 0.3%, < *0.2% typical*	
	2000 MHz	5 MHz bandwidth	< 0.3%, < *0.2% typical*	
		20 MHz bandwidth	< 0.35%, < *0.25% typical*	
TDD	900 MHz	5 MHz bandwidth	< 0.4%, < *0.25% typical*	
		20 MHz bandwidth	< 0.4%, < *0.25% typical*	
	2000 MHz	5 MHz bandwidth	< 0.4%, < *0.25% typical*	
		20 MHz bandwidth	< 0.4%, < *0.25% typical*	
Adjacent channel power (RF Output Port, Half Duplex Port)				
Serial prefix < MY6020, at 0 dBm output power			**Adjacent, nominal**	**Alternate, nominal**
900 MHz			–64 dBc	–64 dBc
2000 MHz			–65 dBc	–65 dBc
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm input power			**Adjacent**	**Alternate**
FDD	900 MHz	5 MHz bandwidth	–67 dBc, *–70 dBc typical*	–68 dBc, *–71 dBc typical*
		20 MHz bandwidth	–63 dBc, *–66 dBc typical*	–63 dBc, *–66 dBc typical*
	2000 MHz	5 MHz bandwidth	–66 dBc, *–69 dBc typical*	–69 dBc, *–73 dBc typical*
		20 MHz bandwidth	–64 dBc, *–67 dBc typical*	–64 dBc, *–68 dBc typical*
TDD	900 MHz	5 MHz bandwidth	–66 dBc, *–69 dBc typical*	–68 dBc, *–71 dBc typical*
		20 MHz bandwidth	–62 dBc, *–65 dBc typical*	–63 dBc, *–66 dBc typical*
	2000 MHz	5 MHz bandwidth	–65 dBc, *–68 dBc typical*	–68 dBc, *–72 dBc typical*
		20 MHz bandwidth	–63 dBc, *–67 dBc typical*	–64 dBc, *–68 dBc typical*
Serial prefix ≥ MY6020, with Opt. EP6, at 0 dBm input power			**Adjacent**	**Alternate**
FDD	900 MHz	5 MHz bandwidth	–66 dBc, *–69 dBc typical*	–68 dBc, *–72 dBc typical*
		20 MHz bandwidth	–62 dBc, *–64 dBc typical*	–63 dBc, *–66 dBc typical*
	2000 MHz	5 MHz bandwidth	–64 dBc, *–67 dBc typical*	–69 dBc, *–73 dBc typical*
		20 MHz bandwidth	–63 dBc, *–66 dBc typical*	–64 dBc, *–68 dBc typical*
TDD	900 MHz	5 MHz bandwidth	–65 dBc, *–68 dBc typical*	–68 dBc, *–71 dBc typical*
		20 MHz bandwidth	–62 dBc, *–64 dBc typical*	–63 dBc, *–66 dBc typical*
	2000 MHz	5 MHz bandwidth	–64 dBc, *–67 dBc typical*	–68 dBc, *–72 dBc typical*
		20 MHz bandwidth	–63 dBc, *–66 dBc typical*	–64 dBc, *–68 dBc typical*

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

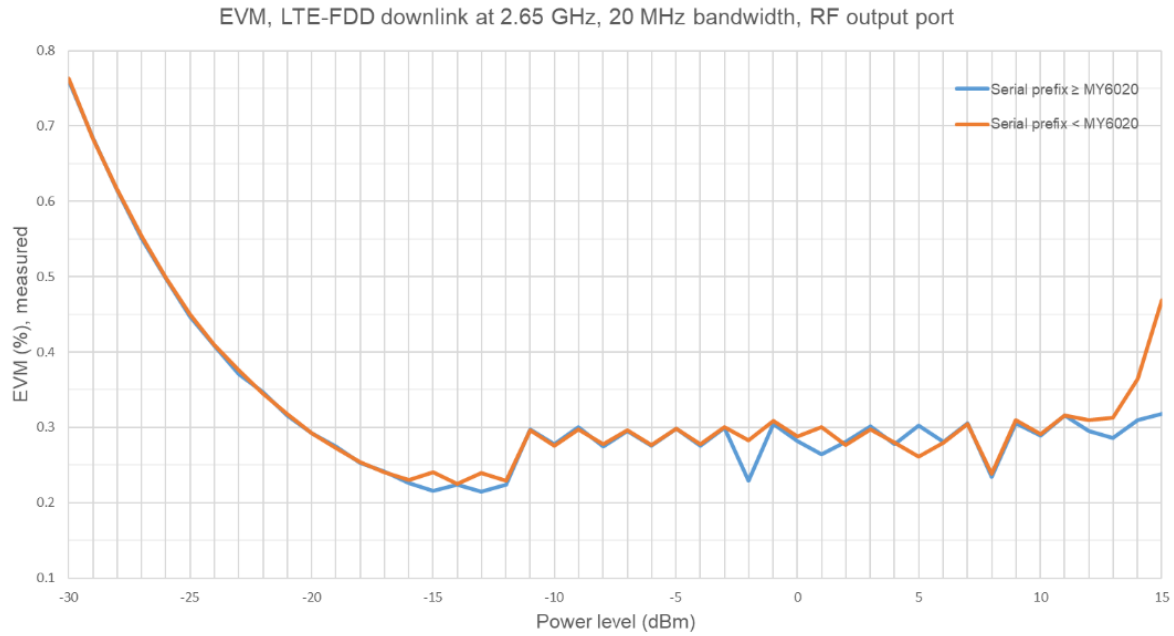

Figure 7. LTE-FDD downlink EVM vs. output power level at 2.65 GHz with 20 MHz bandwidth

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

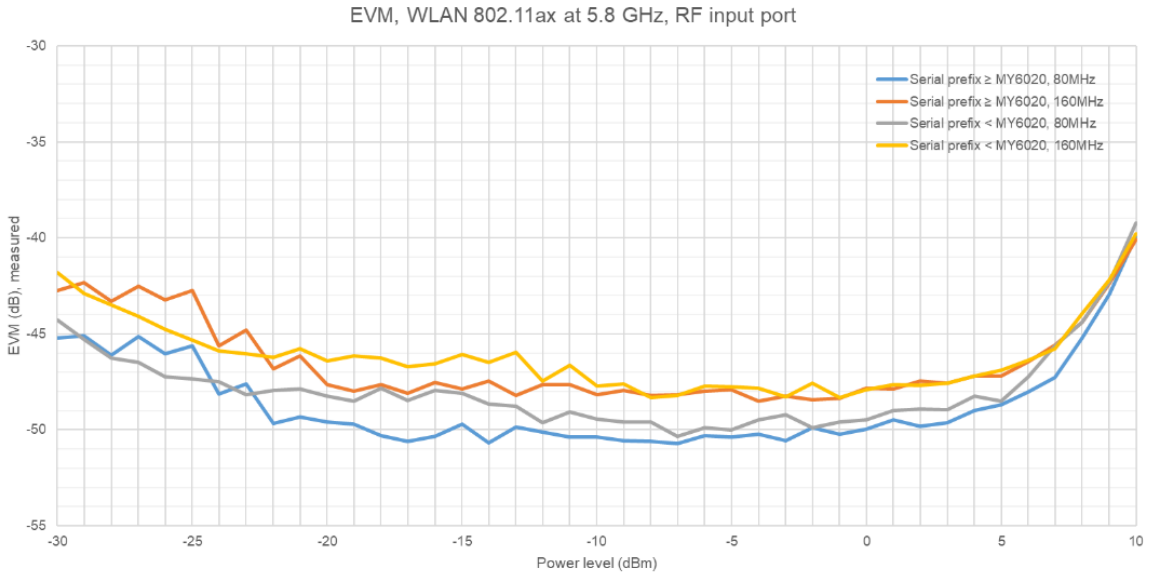

Figure 9. WLAN 802.11ax EVM vs. input power level at 5.8 GHz

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

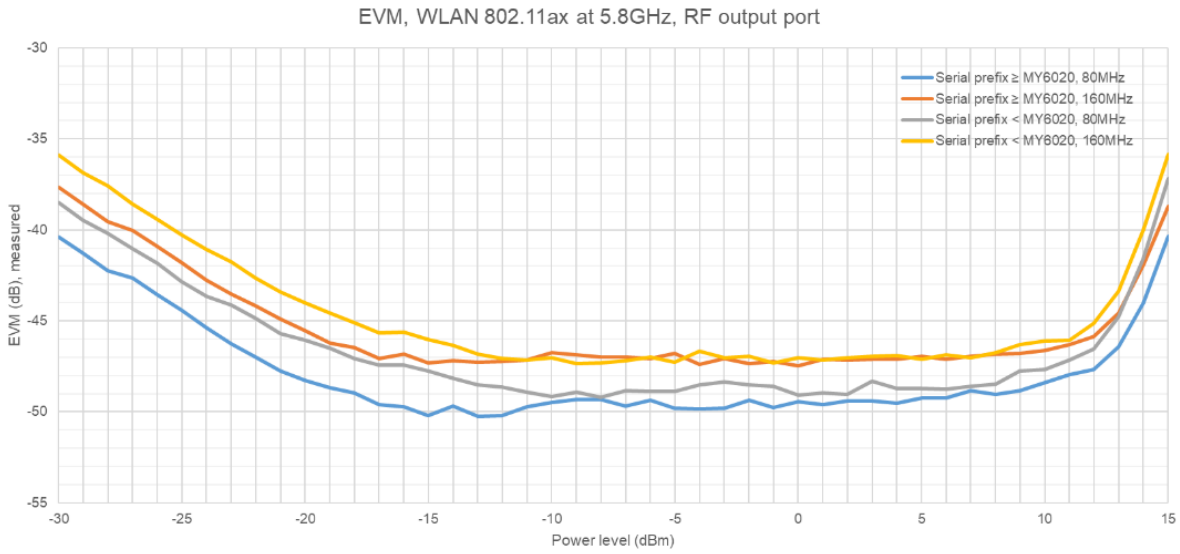

Figure 10. WLAN 802.11ax EVM vs. output power level at 5.8 GHz

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		
Serial prefix < MY6020, at –10 dBm input power		
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	0.3% nominal	
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm or 0 dBm input power		
30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM)	0.49% downlink, 0.44% uplink	
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	0.50% downlink, 0.44% uplink	
Adjacent channel power		
RF input port, half duplex port		
Serial prefix < MY6020, at 0 dBm input power		
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	–56 dBc nominal, noise correction off	
	–63 dBc nominal, noise correction on	
Serial prefix ≥ MY6020, with Opt. EP6, at –10 dBm or 0 dBm input power		
30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM), 30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	–54 dBc typical, –55 dBc nominal, noise correction off	
	–64 dBc typical, –65 dBc nominal, noise correction on	

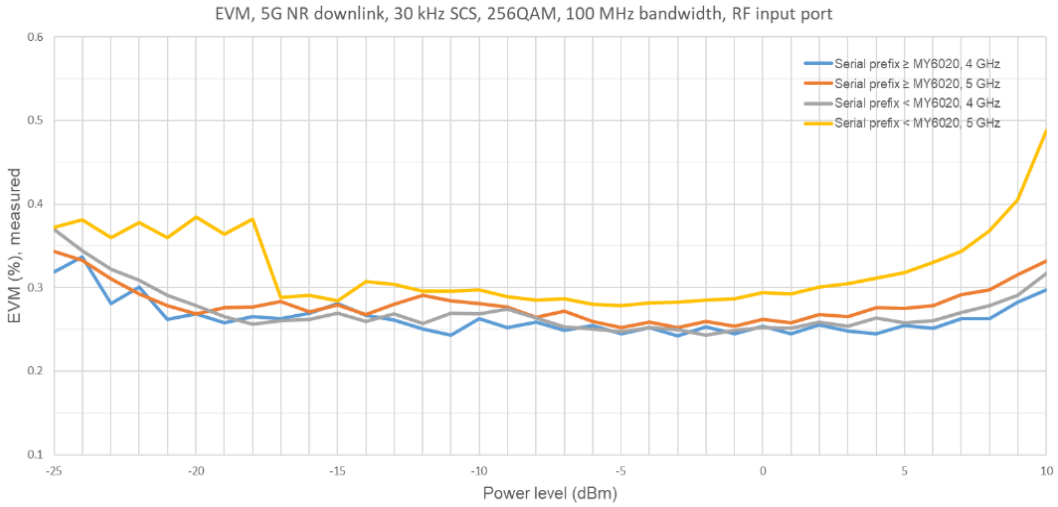

Figure 11. 5G NR downlink EVM vs. input power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

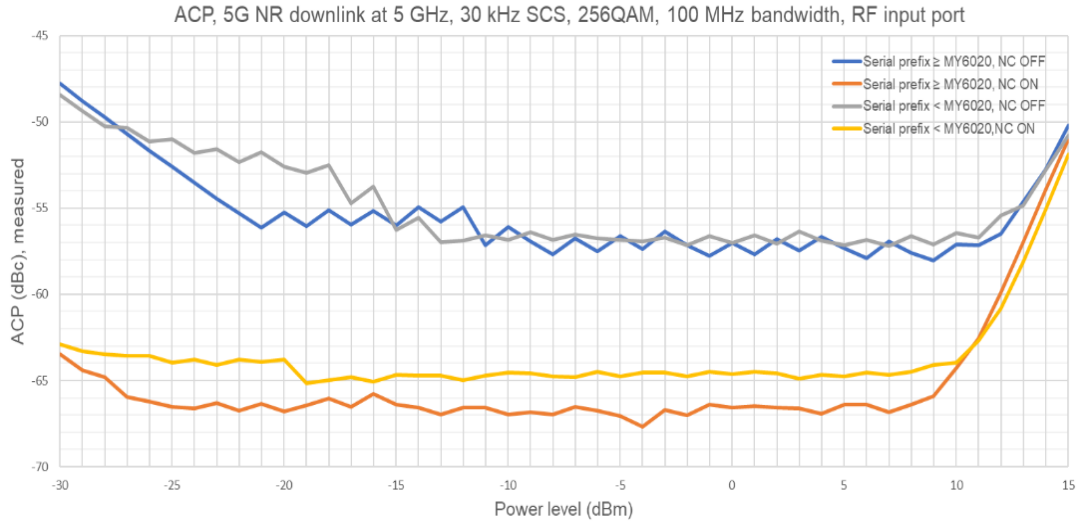

Figure 12. 5G NR downlink ACP vs. input power level at 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

5G NR Source Key Specifications

Modulated signal level accuracy		
RF output port, half duplex port, relative to CW, at –10 to +5 dBm output power		
600 to 5000 MHz	± 0.35 dB, ± 0.17 dB typical	
Error vector magnitude (EVM)		
Composite EVM, RF output port, half duplex port		
Serial prefix < MY6020	**at –10 dBm output power**	
30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM)	0.4% nominal	
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	0.6% nominal	
Serial prefix ≥ MY6020, with Opt. EP6	**at –10 dBm output power**	**at 0 dBm output power**
30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM)	0.5%, *0.35% typical*	0.55%, *0.40% typical*
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	0.5%, *0.35% typical*	0.55%, *0.40% typical*
Adjacent channel power		
RF output port, half duplex port		
Serial prefix < MY6020	**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	
Serial prefix ≥ MY6020, with Opt. EP6	**at –10 dBm output power**	**at 0 dBm output power**
30 kHz SCS, 4 GHz, 100 MHz (64 QAM, 256 QAM)	–56 dBc, *–58 dBc typical*	–54 dBc, *–57 dBc typical*
30 kHz SCS, 5 GHz, 100 MHz (64 QAM, 256 QAM)	–50 dBc, *–53 dBc typical*	–50 dBc, *–53 dBc typical*

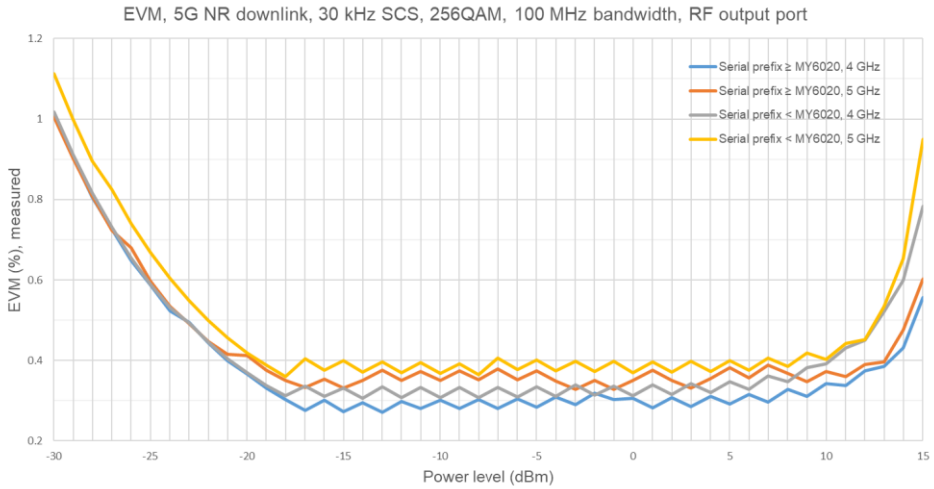

Figure 13. 5G NR downlink EVM vs. output power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256QAM

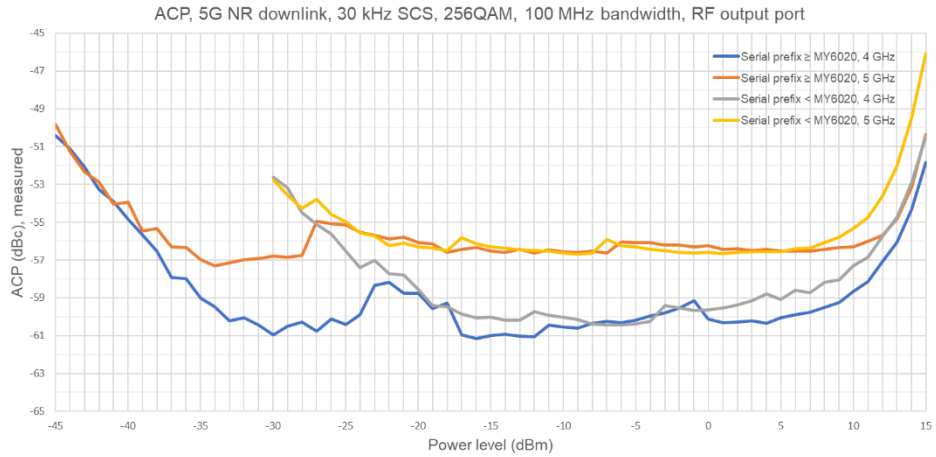

Figure 14. 5G NR downlink ACP vs. output power level at 4 GHz and 5 GHz with 100 MHz bandwidth, 30 kHz SCS, 256 QAM

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

Learn more at: www.keysight.com

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

KEYSIGHT TECHNOLOGIES