M9471A PXIe Vector Transceiver

1 MHz to 26.5 GHz

Introduction

The Keysight M9471A PXIe vector transceiver, working with the M9410A, M9411A, M9415A, or M9416A VXT PXIe vector transceiver, offers full frequency coverage from 1 MHz to 26.5 GHz which makes it the ideal choice for developing and characterizing components and devices for 5G NR, Wi-Fi and many other applications.

KEYSIGHT

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Definitions and Conditions

This data sheet provides performance information for Keysight M9471A PXIe vector transceiver. Data applies when working with Keysight M9410A, M9411A, M9415A, or M9416A VXT PXIe vector transceiver, M9300A PXIe frequency reference and Keysight interconnect cables, unless noted otherwise.

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
- The system has been powered on continuously for at least 45 minutes warm-up time, with the IQ Analyzer or X-Series application (e.g. 5G NR) running (verify that LEDs are on and refer to “Time since start up” on the module GUI). If the system met these warm-up requirements and there is a brief power shutdown, such as a system reboot, allow 20 minutes of warm-up time after the system is powered back on
- 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
- If the module internal temperature has changed more than 5 °C from when the previous alignment was performed

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.

M9471A Block Diagram

When working with M9410A/M9411A/M9415A/M9416A VXT vector transceivers, M9471A is used as up/down convertor to extend the frequency coverage of M941xA VXT transceivers up to 26.5 GHz.

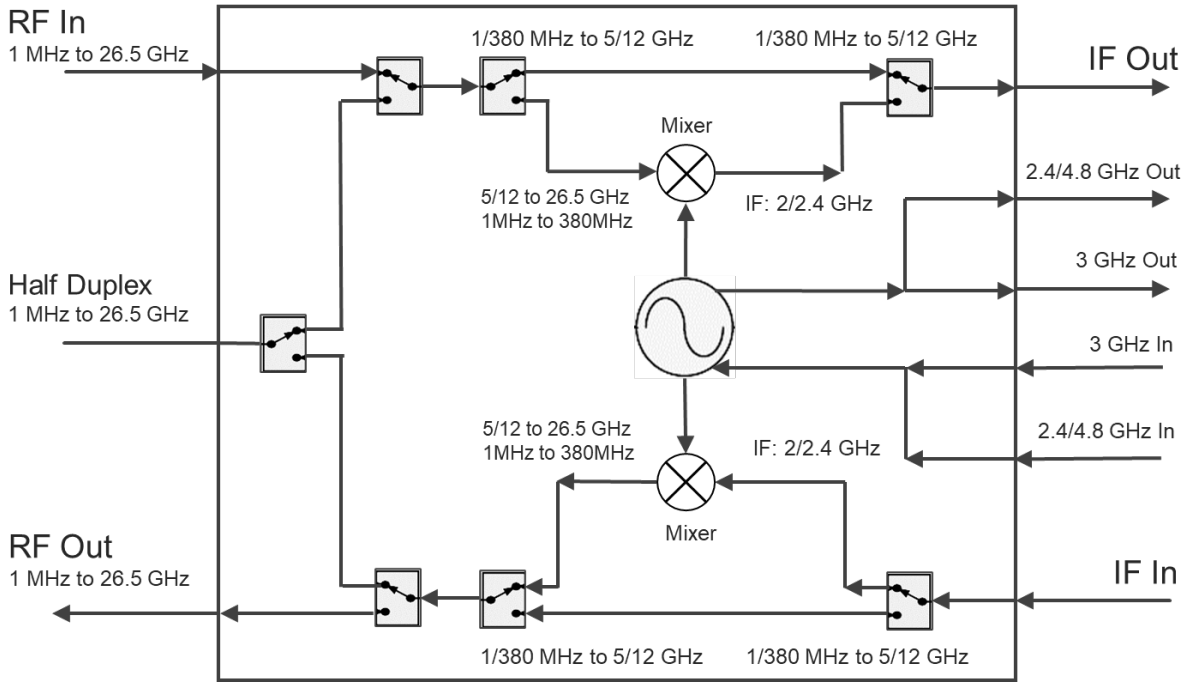

Figure 1. M9471A block diagram

Vector Signal Analyzer

Frequency range	
Option M9471A-001	380 MHz to 26.5 GHz
Option M9471A-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

Capture depth	
Option M9410A/11A/15A/16A-M02	256 MSa of IQ data
Option M9410A/11A/15A/16A-M05	512 MSa of IQ data

Maximum signal analysis bandwidth

	Center frequency	Bandwidth
Option M9471A-LFE	1 to 10 MHz	500 kHz
	10 to 20 MHz	5 MHz
	20 to 60 MHz	10 MHz
	60 to 80 MHz	20 MHz
	80 to 380 MHz	40 MHz
Option M9410A/11A-B3X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GH	200 MHz
	1.31 to 26.35 GHz	300 MHz
	26.35 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9410A/11A-B6X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 26.2 GHz	600 MHz
	26.2 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9410A/11A-B12	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 1.9 GHz (M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6)	600 MHz
	1.31 to 2 GHz (M9410A/M9411A with serial prefix < MY6020)	
	1.9 to 25.9 GHz (M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6)	1.2 GHz
	2 to 25.9 GHz (M9410A/M9411A with serial prefix < MY6020)	
	25.9 to 26.5 GHz	2 x (26.5 GHz – center frequency)

Option M9415A/16A-B4X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GH	200 MHz
	1.31 to 26.3 GHz	400 MHz
	26.3 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9415A/16A-B8X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 2 GHz	600 MHz
	2 to 26.1 GHz	800 MHz
	26.1 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9415A/16A-B12	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 2 GHz	600 MHz
	2 to 25.9 GHz	1.2 GHz
	25.9 to 26.5 GHz	2 x (26.5 GHz – center frequency)

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
DC volts	
RF input port	30 Vdc

Gain (level) accuracy (CW mode), for M9471A

RF input port, −70 dBm to +20 dBm, nominal	
1 MHz to 26.5 GHz	< ± 2.0 dB

Linearity referenced to 0 dBm (CW mode), for M9471A

RF input port, −70 dBm to +20 dBm	
1 to 380 MHz (Option LFE)	< ± 0.9 dB, mixer path
1 to 380 MHz (Option LFE)	N/A, through path. This path does not have any tunable amplifier or attenuator.
380 MHz to 12 GHz	N/A, through path (380 MHz to 5 GHz for M9410A/11A; 380 MHz to 12 GHz for M9415A/16A). This path does not have any tunable amplifier or attenuator.
5 to 26.5 GHz	< ± 1.6 dB, mixer path (5 to 26.5 GHz for M9410A/11A; 12 to 26.5 GHz for M9415A/16A)

Absolute amplitude accuracy (CW mode)

RF input port, nominal		
Frequency range	**Range < 20 dBm**	**Range ≥ 20 dBm**
1 to 380 MHz (Option LFE)	< ± 0.4 dB, LNA off	< ± 0.8 dB
	< ± 0.8 dB, LNA on	
380 MHz to 26 GHz	< ± 0.4 dB	< ± 0.6 dB
26 to 26.5 GHz	< ± 0.5 dB, LNA off	< ± 0.6 dB
	< ± 1.1 dB, LNA on	

Input Voltage Standing Wave Ratio (VSWR)		
RF input port, nominal		
1 to 380 MHz (Option LFE)	< 2.0:1	
380 MHz to 9 GHz	< 1.8:1	
9 to 26.5 GHz	< 2.0:1	
Phase noise sidebands (center frequency = 1 GHz), nominal		
Frequency offset	with M9410A/M9411A	with M9415A/M9416A
1 kHz	–110 dBc/Hz	–116 dBc/Hz
10 kHz	–129 dBc/Hz	–130 dBc/Hz
100 kHz	–132 dBc/Hz	–134 dBc/Hz
1 MHz	–134 dBc/Hz	–137 dBc/Hz
10 MHz	–137 dBc/Hz	–141 dBc/Hz

Residual responses		
RF input port, with analyzer ranged to 0 dBm, offset from 10 MHz to ½ × analysis bandwidth, nominal		
1 MHz to 10 GHz	< –95 dBm	
10 to 13.6 GHz	< –85 dBm	
13.6 to 14.4 GHz	< –75 dBm	
14.4 to 17.4 GHz	< –85 dBm	
17.4 to 18.7 GHz	< –80 dBm	
18.7 to 21.6 GHz	< –85 dBm	
21.6 to 22.4 GHz	< –75 dBm	
22.4 to 26.5 GHz	< –85 dBm	

Sideband spurs, nominal	
Frequency range, 1 kHz to 10 MHz offset	
1 MHz to 26.5 GHz	–90 dBc

Image response, nominal		
Maximum bandwidth	**Center frequency**	**Serial prefix < MY6020, M9410A/11A**
100 MHz	380 to 550 MHz	–57 dBc
200 MHz	550 MHz to 1.31 GHz	–59 dBc
300 MHz	1.31 to 26.35 GHz	–56 dBc (–50 dBc for 5.1 to 5.93 GHz)
600 MHz	1.31 to 26.2 GHz	–48 dBc
1.2 GHz	2 to 25.9 GHz	–49 dBc
Maximum bandwidth	**Center frequency**	**Serial prefix ≥ MY6020, with Opt. EP6, M9410A/11A**
100 MHz	380 to 460 MHz	–53 dBc
	460 to 550 MHz	–57 dBc
200 MHz	550 to 650 MHz	–60 dBc
	650 MHz to 1.31 GHz	–63 dBc (–57 dBc for 1.3 to 1.31 GHz)
300 MHz	1.31 to 26.35 GHz	–55 dBc
600 MHz	1.31 to 26.2 GHz	–54 dBc
1.2 GHz	1.9 to 25.9 GHz	–54 dBc
Maximum bandwidth	**Center frequency**	**M9415A/M9416A**
≤ 40 MHz	1 to 380 MHz	–62 dBc

100 MHz	380 to 550 MHz	–63 dBc
	550 MHz to 4.3 GHz	–62 dBc
	4.3 to 12 GHz	–63 dBc
	12 to 26.5 GHz	–62 dBc
200 MHz	550 MHz to 4.3 GHz	–60 dBc
	4.3 to 12 GHz	–63 dBc
	12 to 26.5 GHz	–60 dBc
400 MHz	1.31 to 26.5 GHz	–60 dBc
600 MHz	1.31 to 26.5 GHz	–60 dBc
800 MHz	2 to 4.6 GHz	–58 dBc
	4.6 to 12 GHz	–59 dBc
	12 to 26.5 GHz	–58 dBc
1.2 GHz	2 to 4.6 GHz	–56 dBc
	4.6 to 12 GHz	–58 dBc
	12 to 26.5 GHz	–56 dBc

Displayed Average Noise Floor (DANL)

RF input port, with analyzer ranged to –70 dBm, LNA on, nominal

Frequency range	with M9410A/M9411A	with M9415A/M9416A
1 to 60 MHz	–161 dBm/Hz	–162 dBm/Hz
60 to 380 MHz	–168 dBm/Hz	–169 dBm/Hz
380 MHz to 5 GHz	–165 dBm/Hz	–167 dBm/Hz
5 to 9 GHz	–167 dBm/Hz	–165 dBm/Hz
9 to 12 GHz	–165 dBm/Hz	–161 dBm/Hz
12 to 17.5 GHz	–165 dBm/Hz	–164 dBm/Hz
17.5 to 20 GHz	–162 dBm/Hz	–163 dBm/Hz
20 to 25 GHz	–160 dBm/Hz	–160 dBm/Hz
25 to 26.5 GHz	–159 dBm/Hz	–159 dBm/Hz

Third-order Intermodulation distortion (TOI)

Frequency range	RF input port, with analyzer ranged to 10 dBm, nominal
1 MHz to 26.5 GHz	+31 dBm

IF flatness

RF input port, with M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6, nominal							
Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.6 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.5 dB	± 0.5 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	N/A	N/A	N/A	N/A
1.31 to 1.9 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	± 0.8 dB	± 0.8 dB	N/A	N/A
1.9 to 3 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB
3 to 5 GHz	± 0.7 dB	± 0.7 dB	± 0.7 dB	± 0.8 dB	± 0.9 dB	± 0.9 dB	± 1.0 dB
5 to 18 GHz	± 0.3 dB	± 0.3 dB	± 0.3 dB	± 0.5 dB	± 0.5 dB	± 0.6 dB	± 0.8 dB
18 to 25.5 GHz	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.6 dB	± 0.6 dB	± 0.7 dB
25.5 to 26.5 GHz	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.5 dB	± 1.1 dB	± 1.1 dB

RF input port, with M9410A/M9411A with serial prefix < MY6020, nominal							
Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.4 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.8 dB	± 0.8 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.8 dB	± 0.8 dB	± 0.8 dB	N/A	N/A	N/A	N/A
1.31 to 2 GHz	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	N/A	N/A
2 to 3 GHz	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.9 dB
3 to 5 GHz	± 0.7 dB	± 0.7 dB	± 0.7 dB	± 1.0 dB	± 1.0 dB	± 1.0 dB	± 1.3 dB
5 to 18 GHz	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.7 dB	± 0.7 dB	± 0.7 dB	± 1.1 dB
18 to 25.5 GHz	± 0.3 dB	± 0.3 dB	± 0.3 dB	± 0.6 dB	± 0.9 dB	± 0.9 dB	± 1.4 dB
25.5 to 26.5 GHz	± 0.3 dB	± 0.3 dB	± 0.3 dB	± 1.3 dB	± 1.9 dB	± 1.9 dB	± 1.9 dB

RF input port, with M9415A/M9416A, nominal							
Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.6 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.5 dB	± 0.5 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	N/A	N/A	N/A	N/A
1.31 to 2 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	± 0.8 dB	± 0.8 dB	N/A	N/A
2 to 3 GHz	± 0.5 dB	± 0.5 dB	± 0.5 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB	± 0.8 dB
3 to 5 GHz	± 0.7 dB	± 0.7 dB	± 0.7 dB	± 0.8 dB	± 0.9 dB	± 0.9 dB	± 1.0 dB
5 to 12 GHz	± 0.3 dB	± 0.3 dB	± 0.3 dB	± 0.5 dB	± 0.5 dB	± 0.6 dB	± 0.8 dB
12 to 25.8 GHz	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.6 dB	± 0.6 dB	± 0.6 dB	± 0.7 dB
25.8 to 26.5 GHz	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.4 dB	± 0.5 dB	± 1.1 dB	± 1.1 dB

Vector Signal Generator

Frequency range	
Option M9471A-001	380 MHz to 26.5 GHz
Option M9471A-LFE	1 to 380 MHz
Frequency reference	
Accuracy, aging rate, stability	Refer to M9300A specifications
Frequency readout accuracy	
± (output frequency × frequency reference accuracy + 0.001 Hz)	
Frequency switching speed	
IVI mode	≤ 3 ms nominal
Arb sample memory (storage capacity)	
Option M9410A/11A/15A/16A-M02	256 MSa of IQ data
Option M9410A/11A/15A/16A-M05	512 MSa of IQ data

Maximum signal generation bandwidth

	Center frequency	Bandwidth
Option M9471A-LFE	1 to 10 MHz	500 kHz
	10 to 20 MHz	5 MHz
	20 to 60 MHz	10 MHz
	60 to 80 MHz	20 MHz
	80 to 380 MHz	40 MHz
Option M9410A/11A-B3X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 26.35 GHz	300 MHz
	26.35 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9410A/11A-B6X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 26.2 GHz	600 MHz
	26.2 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9410A/11A-B12	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 1.9 GHz (M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6)	600 MHz
	1.31 to 2 GHz (M9410A/M9411A with serial prefix < MY6020)	
	1.9 to 25.9 GHz (M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6)	1.2 GHz
	2 to 25.9 GHz (M9410A/M9411A with serial prefix < MY6020)	
	25.9 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9415A/16A-B4X	380 to 550 MHz	100 MHz

	550 MHz to 1.31 GH	200 MHz
	1.31 to 26.3 GHz	400 MHz
	26.3 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9415A/16A-B8X	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 2 GHz	600 MHz
	2 to 26.1 GHz	800 MHz
	26.1 to 26.5 GHz	2 x (26.5 GHz – center frequency)
Option M9415A/16A-B12	380 to 550 MHz	100 MHz
	550 MHz to 1.31 GHz	200 MHz
	1.31 to 2 GHz	600 MHz
	2 to 25.9 GHz	1.2 GHz
	25.9 to 26.5 GHz	2 x (26.5 GHz – center frequency)

Output level range (CW mode)

RF output port	
1 to 380 MHz (Option LFE)	–110 to +10 dBm
380 MHz to 21 GHz	–110 to +20 dBm
21 to 26.5 GHz	–110 to +17 dBm

Maximum reverse power

Average power input	+27 dBm
DC volts	30 Vdc

Amplitude switching speed

IVI mode	≤ 2 ms nominal

Gain (level) accuracy (CW mode), for M9471A

RF output port, –60 dBm to +10 dBm, nominal	
1 MHz to 26.5 GHz	< ± 2.0 dB

Linearity referenced to 0 dBm (CW mode), for M9471A

RF output port, –60 dBm to +10 dBm	
1 to 380 MHz (Option LFE)	< ± 1.5 dB, mixer path
	< ± 0.8 dB, through path
380 MHz to 12 GHz	< ± 1.1 dB, through path (380 MHz to 5 GHz for M9410A/11A; 380 MHz to 12 GHz for M9415A/16A)
5 to 26.5 GHz	< ± 2.1 dB, mixer path (5 to 26.5 GHz for M9410A/11A; 12 to 26.5 GHz for M9415A/16A)

Absolute level accuracy (CW mode)

RF output port, with M9410A/11A, nominal		
1 to 380 MHz (Option M9471A-LFE)	–110 dBm < Level ≤ +10 dBm	< ± 0.5 dB
380 MHz to 5 GHz	–80 dBm < Level ≤ +20 dBm	< ± 0.5 dB
	–110 dBm < Level ≤ –80 dBm	< ± 0.6 dB
5 to 21 GHz	–30 dBm < Level ≤ +20 dBm	< ± 0.4 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.5 dB
	–110 dBm < Level ≤ –80 dBm	< ± 1.0 dB

21 to 25.9 GHz	–30 dBm < Level ≤ +17 dBm	< ± 0.4 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.6 dB
	–110 dBm < Level ≤ –80 dBm	< ± 1.0 dB
25.9 to 26.5 GHz	–30 dBm < Level ≤ +17 dBm	< ± 0.5 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.6 dB
	–110 dBm < Level ≤ –80 dBm	< ± 1.0 dB
RF output port, with M9415A/M9416A, nominal		
1 to 380 MHz (Option M9471A-LFE)	–110 dBm < Level ≤ +10 dBm	< ± 0.5 dB
380 MHz to 5 GHz	–80 dBm < Level ≤ +20 dBm	< ± 0.5 dB
	–110 dBm < Level ≤ –80 dBm	< ± 0.6 dB
5 to 12 GHz	–80 dBm < Level ≤ +20 dBm	< ± 0.6 dB
	–100 dBm < Level ≤ –80 dBm	< ± 0.7 dB
	–110 dBm < Level ≤ –100 dBm	< ± 1.5 dB
12 to 21 GHz	–30 dBm < Level ≤ +20 dBm	< ± 0.4 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.5 dB
	–100 dBm < Level ≤ –80 dBm	< ± 1.0 dB
	–110 dBm < Level ≤ –100 dBm	< ± 1.3 dB
21 to 25.9 GHz	–30 dBm < Level ≤ +17 dBm	< ± 0.4 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.6 dB
	–100 dBm < Level ≤ –80 dBm	< ± 0.7 dB
	–110 dBm < Level ≤ –100 dBm	< ± 0.9 dB
25.9 to 26.5 GHz	–30 dBm < Level ≤ +17 dBm	< ± 0.5 dB
	–80 dBm < Level ≤ –30 dBm	< ± 0.6 dB
	–110 dBm < Level ≤ –80 dBm	< ± 1.0 dB

Measured amplitude repeatability

RF output port, 0 dBm output power	
Delta from initial value	< ± 0.1 dB nominal

Setting resolution

0.01 dB

Output Voltage Standing Wave Ratio (VSWR)

RF output port, nominal	
1 to 380 MHz (Option M9471A-LFE)	< 1.8:1
380 MHz to 5 GHz	< 2.0:1
5 to 12 GHz	< 1.8:1
12 to 26.5 GHz	< 2.0:1

Harmonics

Output power	Frequency range	With M9410A/11A	With M9415A/16A
RF output port, nominal			
0 dBm	1 to 380 MHz (Option M9471A-LFE)	< –62 dBc	< –54 dBc
	380 MHz to 5 GHz	< –41 dBc	< –42 dBc
	5 to 12 GHz	< –40 dBc	< –42 dBc
	12 to 13.25 GHz	< –40 dBc	< –40 dBc
+10 dBm	1 to 380 MHz (Option M9471A-LFE)	< –46 dBc	< –44 dBc

	380 MHz to 5 GHz	< –26 dBc	< –27 dBc
	5 to 12 GHz	< –30 dBc	< –27 dBc
	12 to 13.25 GHz	< –30 dBc	< –30 dBc

Non-harmonic spurious (CW mode)

RF output port, nominal

Output power	Frequency range	With M9410A/11A	With M9415A/16A
0 dBm	1 to 380 MHz (Option M9471A-LFE)	< –47 dBc	< –65 dBc
	380 MHz to 5 GHz	< –67 dBc	< –74 dBc
	5 to 12 GHz	< –54 dBc	< –63 dBc
	12 to 26.5 GHz	< –54 dBc	< –58 dBc

Sideband spurious

RF output port, 0 dBm output power, nominal

Center frequency	Offset	with M9410A/M9411A
1 to 200 MHz (Option M9471A-LFE)	1 to 100 kHz	–96 dBc
	100 kHz to 1 MHz	–94 dBc
	1 to 10 MHz	–95 dBc
20 to 380 MHz (Option M9471A-LFE)	1 to 100 kHz	–102 dBc
	100 kHz to 1 MHz	–96 dBc
	1 to 10 MHz	–98 dBc
380 MHz to 5 GHz	1 to 100 kHz	–106 dBc
	100 kHz to 1 MHz	–92 dBc
	1 to 10 MHz	–95 dBc
5 to 12 GHz	1 to 100 kHz	–98 dBc
	100 kHz to 1 MHz	–92 dBc
	1 to 10 MHz	–94 dBc
12 to 26.5 GHz	1 to 100 kHz	–90 dBc
	100 kHz to 1 MHz	–85 dBc
	1 to 10 MHz	–89 dBc
Center frequency	**Offset**	**with M9415A/M9416A**
1 to 20 MHz (Option M9471A-LFE)	1 to 100 kHz	–96 dBc
	100 kHz to 1 MHz	–90 dBc
	1 to 10 MHz	–72 dBc
20 to 380 MHz (Option M9471A-LFE)	1 to 100 kHz	–107 dBc
	100 kHz to 1 MHz	–98 dBc
	1 to 10 MHz	–99 dBc
380 MHz to 5 GHz	1 to 100 kHz	–107 dBc
	100 kHz to 1 MHz	–98 dBc
	1 to 10 MHz	–100 dBc
5 to 12 GHz	1 to 100 kHz	–90 dBc
	100 kHz to 1 MHz	–78 dBc
	1 to 10 MHz	–93 dBc
12 to 26.5 GHz	1 to 100 kHz	–90 dBc
	100 kHz to 1 MHz	–85 dBc

	1 to 10 MHz	–92 dBc

Image response, nominal

Maximum bandwidth	Center frequency	Serial prefix < MY6020, M9410A/11A
100 MHz	380 to 550 MHz	–55 dBc
200 MHz	550 MHz to 1.31 GHz	–55 dBc
300 MHz	1.31 to 26.35 GHz	–50 dBc
600 MHz	1.31 to 26.2 GHz	–50 dBc
1200 MHz	2 to 25.9 GHz	–50 dBc
Maximum bandwidth	**Center frequency**	**Serial prefix ≥ MY6020, with Opt. EP6, M9410A/11A**
100 MHz	380 to 550 MHz	–55 dBc
200 MHz	550 MHz to 1.31 GHz	–55 dBc
300 MHz	1.31 to 26.35 GHz	–50 dBc
600 MHz	1.31 to 26.2 GHz	–47 dBc
1200 MHz	1.9 to 25.9 GHz	–45 dBc

With M9415A/M9416A

Center frequency	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
380 to 550 MHz	–61 dBc	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	–60 dBc	–59 dBc	N/A	N/A	N/A	N/A
1.31 to 2 GHz	–59 dBc	–58 dBc	–57 dBc	–54 dBc	N/A	N/A
2 to 26.5 GHz	–58 dBc	–57 dBc	–54 dBc	–54 dBc	–53 dBc	–50 dBc

Phase noise sidebands (center frequency = 1 GHz), nominal

Frequency offset	with M9410A/M9411A	with M9415A/M9416A
1 kHz	–113 dBc/Hz	–118 dBc/Hz
10 kHz	–130 dBc/Hz	–135 dBc/Hz
100 kHz	–137 dBc/Hz	–141 dBc/Hz
1 MHz	–141 dBc/Hz	–146 dBc/Hz
10 MHz	–142 dBc/Hz	–146 dBc/Hz

Broadband noise floor

RF output port, 0 dBm output power, nominal

Frequency range	With M9410A/M9411A	With M9415A/M9416A
1 to 380 MHz (Option M9471A-LFE)	–138 dBm/Hz	–138 dBm/Hz
380 MHz to 5 GHz	–135 dBm/Hz	–138 dBm/Hz
5 to 12 GHz	–136 dBm/Hz	–136 dBm/Hz
12 to 18.8 GHz	–134 dBm/Hz	–134 dBm/Hz
18.8 to 26.5 GHz	–131 dBm/Hz	–131 dBm/Hz

Third-order Intermodulation distortion (TOI)

RF output port, 0 dBm output power, nominal	
1 to 380 MHz (Option M9471A-LFE)	+29 dBm
380 MHz to 5 GHz	+28 dBm
5 to 12 GHz	+27 dBm
12 to 26.5 GHz	+24 dBm

IF flatness

RF output port, with M9410A/M9411A with serial prefix ≥ MY6020 and Opt. EP6, nominal

Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.50 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.66 dB	± 0.66 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.35 dB	± 0.35 dB	± 0.47 dB	N/A	N/A	N/A	N/A
1.31 to 1.9 GHz	± 0.34 dB	± 0.34 dB	± 0.77 dB	± 0.80 dB	± 0.87 dB	N/A	N/A
1.9 to 5 GHz	± 0.55 dB	± 0.55 dB	± 0.55 dB	± 0.61 dB	± 0.66 dB	± 0.66 dB	± 0.71 dB
5 to 26.5 GHz	± 0.30 dB	± 0.30 dB	± 0.30 dB	± 0.45 dB	± 0.62 dB	± 0.64 dB	± 0.82 dB

RF output port, with M9410A/M9411A with serial prefix < MY6020, nominal

Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.50 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.70 dB	± 0.70 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.48 dB	± 0.48 dB	± 0.80 dB	N/A	N/A	N/A	N/A
1.31 to 2 GHz	± 0.40 dB	± 0.40 dB	± 0.48 dB	± 0.55 dB	± 0.82 dB	N/A	N/A
2 to 5 GHz	± 0.63 dB	± 0.63 dB	± 0.63 dB	± 0.64 dB	± 0.76 dB	± 0.78 dB	± 1.21 dB
5 to 26.5 GHz	± 0.33 dB	± 0.33 dB	± 0.33 dB	± 0.55 dB	± 0.77 dB	± 0.87 dB	± 1.55 dB

RF output port, with M9415A/M9416A, nominal

Center frequency	≤ 40 MHz BW	100 MHz BW	200 MHz BW	400 MHz BW	600 MHz BW	800 MHz BW	1.2 GHz BW
1 to 380 MHz	± 0.50 dB	N/A	N/A	N/A	N/A	N/A	N/A
380 to 550 MHz	± 0.50 dB	± 0.50 dB	N/A	N/A	N/A	N/A	N/A
550 MHz to 1.31 GHz	± 0.40 dB	± 0.40 dB	± 0.50 dB	N/A	N/A	N/A	N/A
1.31 to 2 GHz	± 0.70 dB	± 0.70 dB	± 0.70 dB	± 0.80 dB	± 0.80 dB	N/A	N/A
2 to 5 GHz	± 0.80 dB	± 0.80 dB	± 0.80 dB	± 0.80 dB	± 0.80 dB	± 0.80 dB	± 0.80 dB
5 to 12 GHz	± 0.40 dB	± 0.40 dB	± 0.40 dB	± 0.50 dB	± 0.60 dB	± 0.60 dB	± 0.60 dB
12 to 25.6 GHz	± 0.40 dB	± 0.40 dB	± 0.40 dB	± 0.45 dB	± 0.60 dB	± 0.80 dB	± 0.80 dB
25.6 to 26.5 GHz	± 0.33 dB	± 0.33 dB	± 0.33 dB	± 0.40 dB	± 0.60 dB	± 0.80 dB	± 1.20 dB

General Specifications

Environmental characteristic	
Operating temperature	0 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	
M9471A	117 W nominal
Weight	
Net	1.74 kg (3.84 lbs)
Dimensions	
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

RF connections	
RF Input	Connector: 3.5 mm female, 50 Ω nominal
RF Output	Connector: 3.5 mm female, 50 Ω nominal
Half Duplex (reserved for future use)	Connector: 3.5 mm female, 50 Ω nominal
IF connections	
IF Input	Connector: 3.5 mm female, 50 Ω nominal
IF Output	Connector: 3.5 mm female, 50 Ω nominal
LO reference	
2.4/4.8 GHz In, 2.4/4.8 GHz Out	Connector: MMPX female, 50 Ω nominal
	Input amplitude: > +10 dBm, nominal
	Output amplitude: > +12 dBm, nominal

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

Error Vector Magnitude (EVM)

RF input port, 20 MHz bandwidth, at –10 dBm input power, nominal		
	With M9410A/M9411A	With M9415A/M9416A
Residual EVM	< 0.3%	< 0.25%

Adjacent channel power

RF input port, 20 MHz bandwidth, at –20 dBm input power, noise correction on, nominal			
	Frequency	With M9410A/M9411A	With M9415A/M9416A
E-UTRA (Uplink and downlink)	695 MHz to 1.31 GHz	–63 dBc	–63 dBc
	1.31 to 2.35 GHz	–65.5 dBc	–66 dBc
	2.35 to 3.8 GHz	–64.5 dBc	–65 dBc
UTRA (Uplink and downlink)	695 MHz to 3.8 GHz	–71 dBc	–71 dBc

LTE Source Key Specifications

Error Vector Magnitude (EVM)

RF output port, 20 MHz bandwidth, at 0 dBm output power, nominal		
	With M9410A/M9411A	With M9415A/M9416A
Composite EVM	< 0.3%	< 0.28%

Adjacent channel power

RF output port, 20 MHz bandwidth, at 0 dBm output power, nominal				
Frequency	With M9410A/M9411A		With M9415A/M9416A	
	Adjacent	Alternate	Adjacent	Alternate
900 MHz	–65 dBc	–67 dBc	–63.4 dBc	–65.2 dBc
2 GHz	–64.5 dBc	–68.5 dBc	–63.8 dBc	–68.5 dBc

5G NR Measurement Application Specifications

Error Vector Magnitude (EVM)

RF input port, 30 kHz SCS, 100 MHz, 256 QAM, at –10 dBm input power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	< 0.27%	< 0.27%
5 GHz	< 0.32%	< 0.29%

Adjacent channel power

RF input port, 30 kHz SCS, 100 MHz, 256 QAM, at 0 dBm input power, noise correction on, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	–64 dBc	–67 dBc
5 GHz	–63 dBc	–66 dBc

5G NR Source Key Specifications

Error Vector Magnitude (EVM)

RF output loopback to RF input, 30 kHz SCS, 100 MHz, 256 QAM, at –10 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	< 0.23%	< 0.27%
5 GHz	< 0.40%	< 0.29%
7 GHz	< 0.38%	< 0.29%
12 GHz	< 0.36%	< 0.29%
15 GHz	< 0.38%	< 0.43%
18 GHz	< 0.43%	< 0.51%

RF output loopback to RF input, 120 kHz SCS, 200 MHz, 256 QAM, at –10 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	< 0.30%	< 0.35%
5 GHz	< 0.47%	< 0.37%
7 GHz	< 0.43%	< 0.36%
12 GHz	< 0.43%	< 0.54%
15 GHz	< 0.45%	< 0.55%
18 GHz	< 0.51%	< 0.65%

RF output loopback to RF input, 120 kHz SCS, 400 MHz, 256 QAM, at –10 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	< 0.36%	< 0.37%
5 GHz	< 0.53%	< 0.51%
7 GHz	< 0.50%	< 0.45%
12 GHz	< 0.57%	< 0.60%
15 GHz	< 0.57%	< 0.66%
18 GHz	< 0.63%	< 0.75%

RF output loopback to RF input, 120 kHz SCS, 100 MHz, 8CC, 256 QAM, at –10 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	< 0.60%	< 0.70%
5 GHz	< 0.75%	< 0.65%
7 GHz	< 0.71%	< 0.64%
12 GHz	< 1%	< 0.89%
15 GHz	< 0.90%	< 0.87%
18 GHz	< 1%	< 1%

Adjacent channel power

RF output, 30 kHz SCS, 100 MHz, 256 QAM, at 0 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	–58 dBc	–59 dBc
5 GHz	–55 dBc	–57 dBc
7 GHz	–55.5 dBc	–57 dBc
12 GHz	–55 dBc	–54 dBc
15 GHz	–54.5 dBc	–55 dBc
18 GHz	–53.5 dBc	–53 dBc

RF output, 120 kHz SCS, 200 MHz, 256 QAM, at 0 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	–56 dBc	–58 dBc
5 GHz	–53 dBc	–55 dBc
7 GHz	–54 dBc	–56 dBc
12 GHz	–52 dBc	–52 dBc
15 GHz	–52 dBc	–53 dBc
18 GHz	–51.5 dBc	–51 dBc

RF output, 120 kHz SCS, 400 MHz, 256 QAM, at 0 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	–49.5 dBc	–57 dBc
5 GHz	–52 dBc	–53 dBc
7 GHz	–52.5 dBc	–54 dBc
12 GHz	–48.5 dBc	–50 dBc
15 GHz	–48.5 dBc	–51 dBc
18 GHz	–50 dBc	–49 dBc

RF output, 120 kHz SCS, 100 MHz, 8CC, 256 QAM, at 0 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
4 GHz	–45.5 dBc	–53 dBc
5 GHz	–46.5 dBc	–49 dBc
7 GHz	–48 dBc	–51 dBc
12 GHz	–43.5 dBc	–47 dBc
15 GHz	–43.5 dBc	–48 dBc
18 GHz	–45.5 dBc	–45 dBc

WLAN Measurement Application Specifications

Error Vector Magnitude (EVM)

EVM floor conditions: Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input,

at –20 dBm output power, optimized range, LNA on, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
802.11ax, 5 GHz, 80 MHz	–47 dB	–52 dB
802.11ax, 5.8 GHz, 80 MHz	–48.5 dB	–52.5 dB
802.11ax, 7 GHz, 80 MHz	–48.5 dB	–51 dB
802.11ax, 5 GHz, 160 MHz	–46 dB	–50 dB
802.11ax, 5.8 GHz, 160 MHz	–47 dB	–50 dB
802.11ax, 7 GHz, 160 MHz	–47 dB	–50 dB
802.11be, 5 GHz, 160 MHz	–47.5 dB	–50 dB
802.11be, 5.8 GHz, 160 MHz	–48.5 dB	–50.5 dB
802.11be, 7 GHz, 160 MHz	–48.5 dB	–50 dB

EVM floor conditions: Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input, at –15 dBm output power, optimized range, Wiener filter on, delay spread 0.001, LNA on, nominal

802.11be, 5.8 GHz, 160 MHz	–48.5 dB	–50.5 dB
802.11be, 7 GHz, 160 MHz	–48.5 dB	–50 dB
Frequency	**With M9410A/M9411A**	**With M9415A/M9416A**
802.11be, 6.905 GHz, 320 MHz	–46.5 dB	–47 dB

WLAN Source Key Specifications

Error Vector Magnitude (EVM)

RF output, at –20 dBm output power, nominal

Frequency	With M9410A/M9411A	With M9415A/M9416A
802.11ax, 5 GHz, 80 MHz	–47 dB	–52 dB
802.11ax, 5.8 GHz, 80 MHz	–48.5 dB	–52.5 dB
802.11ax, 7 GHz, 80 MHz	–48.5 dB	–51 dB
802.11ax, 5 GHz, 160 MHz	–46 dB	–50 dB

EVM floor conditions Phase Tracking on, Eq Smoothing on, Eq Training Seq only, RF output loopback to RF input, at –15 dBm output power, optimized range, Wiener filter on, delay spread 0.001, LNA on, nominal

802.11ax, 5.8 GHz, 160 MHz	–47 dB	–50 dB
802.11ax, 7 GHz, 160 MHz	–47 dB	–50 dB
Frequency	**With M9410A/M9411A**	**With M9415A/M9416A**
802.11be, 5 GHz, 160 MHz	–47.5 dB	–50 dB
802.11be, 5.8 GHz, 160 MHz	–48.5 dB	–50.5 dB
802.11be, 7 GHz, 160 MHz	–48.5 dB	–50 dB
802.11be, 6.905 GHz, 320 MHz	–46.5 dB	–47 dB

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)
- M9415A VXT PXIe Vector Transceiver - Configuration Guide (literature no. 3120-1477EN)
- M9416A VXT PXIe Vector Transceiver - Configuration Guide (literature no. 3122-2155EN)
- M9410A and M9411A VXT PXIe Vector Transceivers – Data Sheet (literature no. 5992-3331EN)
- M9415A VXT PXIe Vector Transceiver – Data Sheet (literature no. 3120-1518EN)
- M9416A VXT PXIe Vector Transceiver – Data Sheet (literature no. 3122-2221EN)
- M9010A PXIe 10-slot chassis - Data Sheet (literature no. 5992-1707EN)
- M9019A PXIe 18-slot chassis - Data Sheet (literature no. 5992-1481EN)
- M9035A PXIe Embedded Controller - Data Sheet (literature no. 3121-1327EN)
- M9038A PXIe Embedded Controller - Data Sheet (literature no. 3122-1717EN)
- X-Series Measurement Applications Brochure (literature no. 5989-8019EN)
- Signal Studio Software Brochure (literature no. 5989-6448EN)