

S9108A

5G FR1 Multi-Port Vector Transceiver

380 MHz to 6 GHz



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System Performance

Conditions

Information and data contained in this data sheet is subject to change without notice.

In addition to the following conditions, the S9108A system performance documented in this data sheet, is valid for an ambient temperature of 22 to 28 °C unless otherwise noted.

- The system is within its calibration cycle.
- The system has been stored at an ambient temperature within the allowed operating range for at least two hours before being powered 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. 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.
- The alignments have been run in order of “Align Now All” for the first use, after the warm-up period.
- The “Align Now All” alignments have been run within the previous 7 days, after the warm-up period.
- A “Fast Alignment” has been run:
 - within the previous 8 hours
 - if the temperature has changed more than 5 °C from when the previous “Fast Alignment” was performed

Definitions

Specification	Warranted performance. Specifications include guard bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions. All specifications and characteristics apply over an ambient temperature range of 22 to 28 °C (unless otherwise stated).
Typical	Describes additional product performance information that is not covered by the product warranty. It is performance beyond specifications that 95% of the units exhibit with a 95% confidence level at room temperature (approximately 25 °C). Typical performance does not include measurement uncertainty. Typical performance is not warranted.
Nominal	Describes the expected mean or average performance, or an attribute whose performance is by design, such as the 50 Ω connector. This data is measured at room temperature (approximately 25 °C). Nominal performance is not warranted.
Measured	Describes an attribute measured during the design phase for purposes of communicating expected performance, such as amplitude drift vs. time. This data is measured at room temperature (approximately 25 °C). Measured performance is not warranted.

Characteristics

The basic RF performance of the 5G Multi-port FR1 Solution with Blocker is expected to be similar to the performance of the M9410A/M9411A VXT PXI transceivers, subject to the additional insertion loss of the passive components (coupler, combiner, switches, attenuators, cables, and connectors/adapters) in the system. Refer to the data sheet of the M9410A/M9411A (<https://www.keysight.com/find/M9410A> / <https://www.keysight.com/find/M9411A>) for details.

The nominal insertion loss of the passive components is as follows:

- Main source output path, from Main M9411A VXT front panel to DUT connector on system front panel: 18 dB
- Blocker source output path, from Blocker M9410A VXT front panel to DUT connector on system front panel: 32 dB
- Main VXT Half Duplex path, from Main M9411A VXT front panel to HD port on system front panel: 1 dB
- Blocker VXT Half Duplex path, from Blocker M9410A VXT front panel to HD port on system front panel: 1 dB
- CW source path, from Aux I/O connector to DUT connector: 17.9 dB
- Receiver normal path, from system front panel DUT connector to Main M9411A VXT front panel: 28.5 dB
- Receiver low loss path, from system front panel DUT connector to Main M9411A VXT front panel: 9.5 dB

Based on these insertion losses, the expected source power levels for the blocker system are as follows:

- Max Main VXT output power at DUT connector on system front panel: 2 dBm
- Max Blocker VXT output power at DUT connector on system front panel: -12 dBm
- Max Main VXT output power at HD port on system front panel: 4 dBm
- Max Blocker VXT output power at HD port on system front panel: 4 dBm
- CW source output power at DUT connector on system front panel: 2.1 dBm

Note:

Amplitude correction of these insertion loss have been settled in the S9108A firmware. Users are not required to manually compensate the insertion loss.

S9108A Configurations

This data sheet contains system performance for the S9108A base system that is available in the following four standard configurations:

- **S9108A-001:** 5G FR1 Multi-port Vector Transceiver
- **S9108A-002:** 5G FR1 Multi-port Vector Transceiver with Blocker Solution
- **S9108A-003:** 5G FR1 Multi-port Transceiver Solution with Blocker and HD Port MIMO
- **S9108A-006:** 5G FR1 Multi-port Transceiver 600 MHz BW with Blocker and HD Port MIMO

S9108A Overview

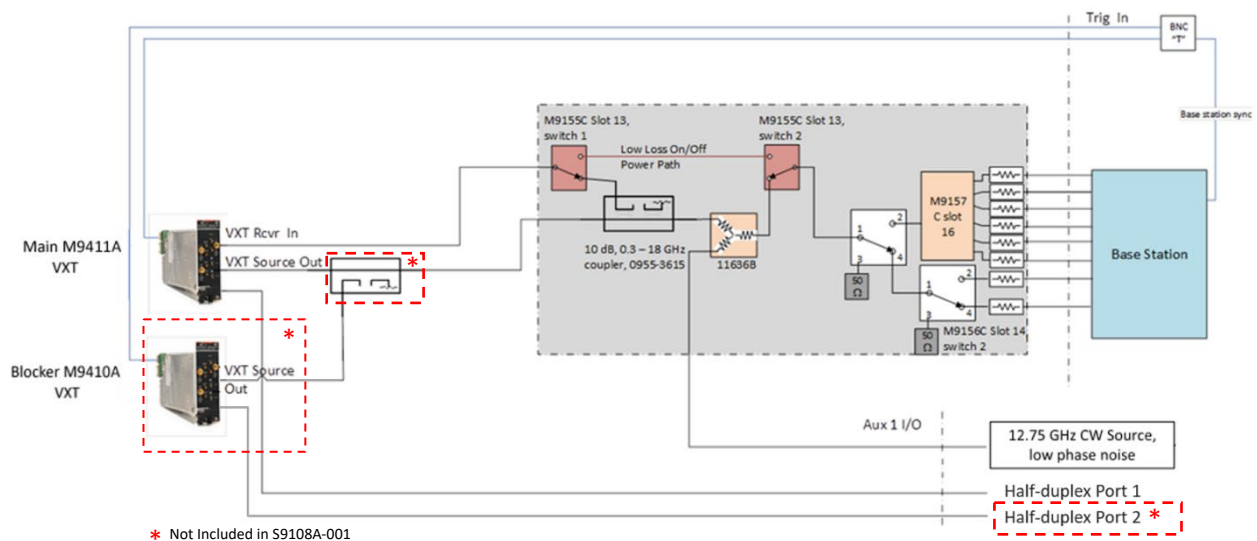


Figure 1. Block diagram of S9108A-002, S9108A-003, and S9108A-006 5G multi-port FR1 Solution with Blocker

System capabilities

Figure 1 shows the block diagram of the S9108A-002, S9108A-003, and S9108A-006 5G FR1 multi-port solution with Blocker. These systems provide a Main VXT for generating the “wanted” signal and a Blocker VXT for generating the interfering signal for testing the receiver of a base station. Both signals are combined and available at the system’s test ports. The receiver of the Main VXT, M9411A is used for all signal analysis measurements. The switching/signal conditioning components shown in the shaded box provide signal routing and switching to 8 bidirectional RF ports for connection to the base station under test, with attenuation to protect the VXT modules from the base station’s high transmit power. A low-loss path is provided to facilitate measurements of Transmit On/Off Power.

An Aux I/O port is shown in the diagram for connecting an additional CW source.

The Aux I/O port can also be used to connect a separate spectrum analyzer.

Half-duplex (HD) port connections are provided on the front panel to connect to the HD ports on the Main and Blocker (M9410A) VXTs. The HD Port 1 for the Main VXT is used for system calibration. Optionally, HD Port 2 can be used in combination with HD Port 1 to make 2x2 MIMO measurements on S9108A-003 and S9108A-006 model configurations, subject to the following:

- Since the ports are half-duplex, they can only be used as either Tx or Rx ports. Simultaneous MIMO signal generation and analysis are not supported.
- MIMO operation requires option MMO, Timing Synchronization for MIMO, to be installed on each VXT module. This option is not included in the S9108A-002 system.

Note:

The Y9085EM0E 5G NR Waveform and Measurement Application does not support MIMO measurements. The 89600 VSA software with 89601200C and 89601BHNC licenses are required for 5G NR MIMO measurements and need to be purchased separately.

The signal generation and analysis capabilities of the blocker system are based on the hardware characteristics of the M9410A and M9411A VXT PXIe vector transceivers, in combination with the Signal Studio and 5G NR measurement software applications. The blocker system is designed to perform most in-band conducted FR1 transmitter tests for Local Area Base Stations as specified in 3GPP TS 38.141-1 Chapter 6, with the following limitations:

- **6.4 Transmit ON/OFF power:** System noise floor is about -100 dBm/MHz at some frequencies, which may not be adequate to verify the OFF power level in some cases, depending on the base station's ON power level.
- **6.6.5 Transmitter spurious emissions:** Not supported. Test requires measurement up to 12.75 GHz which is beyond the frequency range of the M9411A, and system dynamic range/spurious performance may not be adequate for some measurements.
- **6.7 Transmitter intermodulation:** Not supported. Test requires high power interfering signal and circulator, and out-of-band spurious measurements.

For conducted FR1 testing of the receiver for Local Area Base Stations as specified in 3GPP TS 38.141-1 Chapter 7, the blocker system can be used for most of the tests, with the following limitations:

- **7.3 Dynamic Range:** This test requires AWGN as the interfering signal. The system can generate AWGN by playing back a waveform file, but it does not support real-time AWGN.
- **7.6 Receiver Spurious Emissions:** Not supported. This requires a microwave spectrum analyzer that can measure beyond the frequency range of the blocker system. A customer-supplied spectrum analyzer can be connected to the system using the Aux I/O port to perform this test.

All S9108A models provide single channel measurements only at the 8 RF DUT ports.

The systems cover testing of single carrier signal configurations. Some carrier aggregation configurations are also covered, but there may be more complex configurations (e.g. non-contiguous carrier aggregation) that are not supported.

The blocker system is NOT intended for testing of Wide Area or Medium Range Base Stations, which require input/output power levels that may exceed the capabilities of this system and could damage the instruments.

Periodic calibration/recertification of the blocker system consists of calibration of the individual system components. There is no system-level calibration for the complete solution.

Vector Signal Analyzer Performance

Performance			
Capture depth	512 MSa		
Frequency			
Frequency range			
All S9108A Standard Configurations RF Transceiver RF I/O ports and HD Ports	380 to 6000 MHz		
Frequency reference			
Accuracy, aging rate, stability	Refer to Frequency Reference information in General Performance section.		
Signal analysis bandwidth			
	Center frequency	Maximum bandwidth	
S9108A-001, S9108A-002, S9108A-003 Configurations	380 to 550 MHz	100 MHz	
	550 to 1310 MHz	200 MHz	
	1310 to 6000 MHz	300 MHz	
S9108A-006 Configuration	380 to 550 MHz	100 MHz	
	550 to 1310 MHz	200 MHz	
	1310 to 6000 MHz	600 MHz	
Maximum Safe Input Level			
All S9108A Standard Configurations RF Transceiver RF I/O ports	+33 dBm		
Half Duplex Connector	+27 dBm		
Absolute amplitude accuracy (CW mode)			
All S9108A Standard Configurations RF Transceiver RF I/O ports	Frequency range	Level	Accuracy
	380 to 3000 MHz	-40 to -10 dBm	$\leq \pm 0.85$ dB, $\leq \pm 0.40$ dB (typical)
	3000 to 6000 MHz	-40 to -10 dBm	$\leq \pm 0.85$ dB, $\leq \pm 0.45$ dB (typical)
Half Duplex Ports	Frequency range	Level	Accuracy
	380 to 3000 MHz	-40 to -10 dBm	$\leq \pm 0.85$ dB, $\leq \pm 0.40$ dB (typical)
	3000 to 6000 MHz	-40 to -10 dBm	$\leq \pm 0.85$ dB, $\leq \pm 0.45$ dB (typical)
IF Flatness			
	Frequency range	Bandwidth	Flatness (typical)
S9108A-001, S9108A-002, S9108A-003 Configurations	380 to 6000 MHz	100 MHz	± 0.50 dB
		200 MHz	± 0.50 dB
		300 MHz	± 0.50 dB
S9108A-006 Configuration	380 to 6000 MHz	100 MHz	± 0.50 dB
		200 MHz	± 0.50 dB
		300 MHz	± 0.50 dB
		600 MHz	± 0.70 dB

Error vector magnitude (EVM)

Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256QAM

	Frequency range 3.5 to 4.2 GHz	EVM (typical)
	100 MHz BW	≤ -25 dB, -30 to -25 dBm input power ≤ -30 dB, -25 to -20 dBm input power ≤ -35 dB, -20 to -15 dBm input power ≤ -40 dB, -15 to -10 dBm input power ≤ -43 dB, -10 to -5 dBm input power
All S9108A Standard Configurations RF Transceiver Connectors	Frequency range 3.5 to 4.2 GHz	EVM (typical)
	100 MHz BW	≤ -44 dB, -30 to -20 dBm input power ≤ -50 dB, -20 to -5 dBm input power

Adjacent channel leakage ration (ACLR)

Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256 QAM

	Frequency range	ACLR 100 MHz Bandwidth (typical)
	3.5 – 4.0 GHz	-43 dBc, -30 to -25 dBm input power -45 dBc, -25 to -20 dBm input power -49 dBc, -20 to -15 dBm input power -53 dBc, -15 to -5 dBm input power
All S9108A Standard Configurations RF Transceiver RF I/O ports	4.0 - 4.2 GHz	-37 dBc, -30 to -25 dBm input power -42 dBc, -25 to -20 dBm input power -47 dBc, -20 to -15 dBm input power -50 dBc, -15 to -5 dBm input power
	3.5 – 4.2 GHz	-54 dBc, -30 to -5 dBm input power

Vector Signal Generator Performance

Performance

ARB depth	512 MSa
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Frequency

Frequency range

All S9108A Standard Configurations RF Transceiver RF I/O ports and HD Ports	380 to 6000 MHz
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Frequency reference

Accuracy, aging rate, stability	Refer to Frequency Reference information in General Performance section.
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Signal generation bandwidth

	Center frequency	Maximum bandwidth (typical)
	380 to 550 MHz	100 MHz
S9108A-001, S9108A-002, S9108A-003 Configurations	550 to 1310 MHz	200 MHz
	1310 to 6000 MHz	300 MHz
S9108A-006 Configurations	380 to 550 MHz	100 MHz
	550 to 1310 MHz	200 MHz
	1310 to 6000 MHz	600 MHz

Amplitude range

	Frequency range	Output Power (nominal)
S9108A-001 Configurations	380 to 6000 MHz	CW: -120 dBm to +5 dBm Modulated: Depends on Crest Factor
S9108A-002, S9108A-003, S9108A-006 RF Transceiver RF I/O ports	380 to 6000 MHz	CW: Primary Transceiver "wanted" signal: -120 dBm to +5 dBm Secondary Transceiver "Blocker" signal: -120 dBm to -10 dBm Modulated: Depends on Crest Factor
S9108A Configuration HD Ports	380 to 6000 MHz	CW: -120 dBm to +5 dBm

Absolute amplitude accuracy (CW mode)

	Frequency range	Level	Accuracy
All S9108A Standard Configurations RF Transceiver RF I/O ports, Primary Transceiver, "Wanted" signal	380 to 550 MHz	≤ -10 to -40 dBm	$\leq \pm 0.75$ dB, $\leq \pm 0.35$ (typical)
	550 to 2000 MHz	≤ -10 to -40 dBm	$\leq \pm 0.75$ dB, $\leq \pm 0.35$ (typical)
	2000 to 3900 MHz	≤ -10 to -40 dBm	$\leq \pm 0.80$ dB, $\leq \pm 0.40$ (typical)
	3900 to 6000 MHz	≤ -10 to -40 dBm	$\leq \pm 1.10$ dB, $\leq \pm 0.55$ (typical)
S9108A-002, S9108A-003, S9108A-006 Configurations RF I/O ports Secondary Transceiver, "Blocker" signal	Frequency range	Level	Accuracy
	380 to 550 MHz	≤ -10 to -40 dBm	$\leq \pm 0.35$ (typical)
	550 to 2000 MHz	≤ -10 to -40 dBm	$\leq \pm 0.35$ (typical)
	2000 to 3900 MHz	≤ -10 to -40 dBm	$\leq \pm 0.40$ (typical)
Half Duplex Connector	Frequency range	Level	Accuracy
	380 to 2000 MHz	≤ -10 to -40 dBm	$\leq \pm 0.75$ dB, $\leq \pm 0.35$ (typical)
	2000 to 3900 MHz	≤ -10 to -40 dBm	$\leq \pm 0.80$ dB, $\leq \pm 0.45$ (typical)
	3900 to 6000 MHz	≤ -10 to -40 dBm	$\leq \pm 1.15$ dB, $\leq \pm 0.65$ (typical)

IF Flatness

	Frequency range	Bandwidth	Flatness (typical)
S9108A-001, S9108A-002, S9108A-003 Configurations	380 to 6000 MHz	100 MHz	± 0.4 dB
		200 MHz	± 0.4 dB
		300 MHz	± 0.6 dB
S9108A-006 Configuration	380 to 6000 MHz	100 MHz	± 0.4 dB
		200 MHz	± 0.4 dB
		300 MHz	± 0.6 dB
		600 MHz	± 0.8 dB

Error vector magnitude (EVM)

Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256 QAM

	Frequency range	EVM (typical)
All S9108A Standard Configurations RF Transceiver RF I/O ports	3500 to 4200 MHz	≤ -40 dB, -40 to -35 dBm output power
		≤ -44 dB, -35 to -30 dBm output power
		≤ -47 dB, -30 to -25 dBm output power
		≤ -50 dB, -25 to -20 dBm output power
	Frequency range	EVM (typical)
All S9108A Standard Configurations HD Ports	3500 to 4200 MHz	≤ -44 dB, -40 to -30 dBm output power
		≤ -47 dB, -30 to -25 dBm output power
		≤ -50 dB, -25 to -20 dBm output power
		≤ -50 dB, -25 to -20 dBm output power

Adjacent channel leakage ratio (ACLR)

Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256 QAM

	Frequency range	ACLR 100 MHz Bandwidth (typical)
All S9108A Standard Configurations RF Transceiver RF I/O ports	3.5 – 3.7 GHz	≤ -56 dBc, -40 to -25 dBm output power
		≤ -57 dBc, -25 to -20 dBm output power
	3.7 – 4.0 GHz	≤ -54 dBc, -40 to -25 dBm output power
		≤ -56 dBc, -25 to -20 dBm output power
All S9108A Standard Configurations HD Ports	4.0 – 4.2 GHz	≤ -55 dBc, -40 to -25 dBm output power
		≤ -56 dBc, -25 to -20 dBm output power
	Frequency range	ACLR 100 MHz Bandwidth (typical)
	3.5 – 3.7 GHz	≤ -56 dBc, -40 to -25 dBm output power
		≤ -57 dBc, -25 to -20 dBm output power
	3.7 – 4.0 GHz	≤ -54 dBc, -40 to -25 dBm output power
		≤ -56 dBc, -25 to -20 dBm output power
	4.0 – 4.2 GHz	≤ -55 dBc, -40 to -25 dBm output power
		≤ -56 dBc, -25 to -20 dBm output power

General Performance

Environmental characteristics

S9108A 5G Multi-Port Vector Transceiver	For indoor use only Altitude up to 6,561.68 ft (2,000 m) Operating temperature 10 to 40° C maximum relative humidity (non-condensing): 85% RH
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Power requirements

	Voltage & frequency	Power consumption
S9108A Base System (PXle chassis with modules, rugged panel, and cables)	100/120 V, 50/60 Hz 220/240 V, 50/60 Hz	1200 W Max (lower range) 1300 W Max (upper range)
M1749B	120 VAC (via supplied 0950-6166 AC/DC adapter)	105 W

Size and weights

Dimensions

S9108A	Height: 197.8 mm (7.79 in); with feet installed Width: 449.5 mm (17.70 in); with rugged panel Depth: 568.9 mm (22.40 in); with rugged panel (from back bumper to front BNC)
S9108A Rack Space	2 X 2U x 1 rack width

Weight

S9108A-001	20.4 kg (45.0 lbs)
S9108A-002	22.6 kg (49.8 lbs)
S9108A-003	24.0 kg (53.0 lbs)
S9108A-006	24.0 kg (53.0 lbs)

Remote programming

Interface	LAN RJ-45
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Warranty

Standard 1-year warranty

Calibration cycle

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

LAN, Display Port, and USB Connectors, M9038A PXle Embedded Controller

LAN 1 and LAN2 (TCP/IP interface)

Connectors (Ethernet)	One 10/100/1000BASE-T (RJ45), One 100/1000/10GBASE-T (RJ45)
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Video/Dual Display Ports

Connectors (Video)	One DisplayPort++, Two Thunderbolt-3 (TB1 & TB2)
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USB 2.0 and 3.0

Connectors (USB)	Four, USB 2.0 (Type A)
Connectors (USB)	Two, USB 3.0 (Type A)

Thunderbolt

Connector (Thunderbolt)	Two Thunderbolt 3.0 ports (USB-C with PD 3.0) TB1 Port: Max. 37.5W, supports USB PD 5V @ 3A, 9V @ 3A, 12V @ 3A, 15V @ 2.5A, and daisy-chain capability TB2 Port: Max. 15W, supports USB PD 5V @ 3A and daisy-chain capability
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GPIB

Connector	GPIB (Micro-D 25-pin)
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S9108A Base System Front Panel

Frequency reference, 100 MHz Ref Out and 10 MHz Ref In/Out connectors above the rugged front panel

100 MHz Ref Out, frequency reference (if available)	
Accuracy	± 16 Hz, typical, within 1 year since last calibration, from 20 to 30°C. Refer to the Keysight M9300A PXIe Frequency Reference Data Sheet for details on accuracy, aging rate, and stability.
Recommended Calibration Cycle	1 year
Connector	BNC (f)
Amplitude	9.5 dBm (nominal)
10 MHz Ref Out, Frequency Reference	
Accuracy	± 1.6 Hz, typical, within 1 year since last calibration, from 20 to 30°C. Refer to the Keysight M9300A PXIe Frequency Reference Data Sheet for details on accuracy, aging rate, and stability.
Recommended Calibration Cycle	1 year
Connector	BNC (f)
Amplitude	9.5 dBm (nominal)
10 MHz Ref In	
Connects behind rugged panel to M9300A PXIe Reference Ref In and locks to another reference with a value from 1 to 110 MHz.	
Connector	BNC (f)
Frequency	1 MHz to 110 MHz, sine wave
Lock range	± 1 ppm (nominal)
Input amplitude	0 to 10 dBm (nominal)
Impedance	50 Ω (nominal)

Trig 1 and Trig 2 Connectors above the rugged front panel

Trig 1 and Trig 2	
Connects behind rugged panel to M9019A PXIe Chassis Trig 1 and Trig 2. These two front panel trigger connectors (Trig 1 and Trig 2) above the rugged front panel connect to the PXI [0:7] backplane trigger bus in the M9019A chassis and can be configured as Input or Output. To learn more about these connectors, see the Keysight PXIe Chassis Family, User Guide (M9019-90003).	
Connector	BNC (f)
Direction control	Input or output (configurable)
Output level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Output impedance	50 Ω (typical)
Output trigger source	PXI_Trig0 - PXI_Trig7 (Segment 2 or 3)
Input level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Input impedance	3 k Ω (typical)
Input trigger destination	PXI_Trig0 - PXI_Trig7 (Segment 2 or 3)
Input threshold	1.65 V (typical)
Minimum swing	250 mV (typical)
Minimum pulse width	100 ns (typical)

Transceiver Connectors, RF 380 MHz to 6 GHz on the rugged front panel

RF I/O Ports	
Connector	SMA (f), 50 Ω (nominal)
Frequency range	380 MHz to 6 GHz
Amplitude	30 VDC, +33 dBm maximum safe input power
RF Out	
Connector	SMA (f), 50 Ω (nominal)
Frequency range	380 MHz to 6 GHz
Amplitude	30 VDC, +33 dBm maximum applied reverse input power
Half Duplex Ports	
Connector	Type-N (f), 50 Ω (nominal)
Frequency range	380 MHz to 6 GHz
Amplitude	30 VDC, +27 dBm maximum safe input power
Trig 1 and Trig 2	
Connector	BNC (f)
Direction control	Input or Output
Input impedance	1 k Ω or 50 Ω nominal
Input level	Range: 0 to +3.3v
Output impedance	50 Ω nominal
Output Level	+3.3V LVTTTL, LVDS

Related Literature

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

Title	Publication number
Keysight M9019A PXle 18 slot Chassis, Data Sheet	5992-1481EN
Keysight M9038A PXle High Performance Embedded Controller, Data Sheet	3122-1717.EN
Keysight M9410A and M9411A PXle VXT Vector Transceivers, Data Sheet	5992-3331EN
Keysight X-Series Measurement Applications, Brochure	5989-8019EN
Keysight Signal Studio Software, Brochure	5989-6448EN

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