

S9101A

5G Multi-Band Vector Transceiver

380 MHz to 6 GHz and 24.25 to 43.5 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 S9101A system performance, documented in this data sheet, is valid for an ambient temperature of 25 °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 two hours warm-up time, with the IQ Analyzer or X-Series application (e.g. 5G NR) running, and the S9101RH mmWave Transceiver powered on (verify that LEDs are on). If the system met these warm-up requirements and there is a brief power shutdown, such as a system reboot, allow 45 minutes of warm-up time after the system is powered back on.
- The “Align Now All” alignments have been run in the M9410A PXIe VXT module, 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
- Amplitude accuracy characteristics apply after system calibration has been performed in the current environment and humidity has not changed by more than $\pm 10\%$.

Characteristics

Notes

- The characteristics provided in this data sheet for operation at or below 6 GHz are a subset of the specifications for the Keysight M9410A PXIe VXT Vector Transceiver module. For the most recent detailed performance information, refer to the M9410A Data Sheet (literature no. 5992-3331EN). Note that the performance characteristics in that data sheet apply at the input/output connectors of the M9410A module, but in the S9101A system, there is approximately 0.25 to 0.5 dB of insertion loss between the S9101A front panel connectors and the M9410A due to the M9155C switch module and cabling.
- The S9101A-BK1 system includes both a Primary Transceiver (M9410A PXIe VXT) that generates a “Wanted” signal and a Secondary Transceiver (M9410A PXIe VXT) that generates a “Blocker” signal (interfering signal) for testing the performance of a base station receiver.
- These RF signals are combined in a hybrid combiner before being routed to the S9101A-BK1 front panel. In these systems, there is approximately 3 dB of insertion loss between the Primary Transceiver and the S9101A-BK1 front panel RF Out connector, and there is approximately 18 dB of loss between the Secondary Transceiver and the S9101A-BK1 front panel RF Out connector.
- The Sub 6 GHz amplitude characteristics in this data sheet include the effects of the added system insertion loss.

- The M9410A-001 in this S9101A 5G Multi-Band Vector Transceiver is configured with:
 - Option F06 (Frequency Range, 380 MHz to 6 GHz),
 - Option B12 (1.2 GHz BW),
 - Option M05 (512 MSa memory),
 - Option 1EA (High Output Power).

Definitions

Typical (typ)
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 (nom)
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 (meas)
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.

Recommended Best Practices

- Set chassis fan to high at environmental temperatures above 45 °C.

S9101A Standard Configurations

This data sheet contains system performance for the S9101A base system that is available in three standard configurations with multiple input and output connectors:

- Keysight S9101A-TR1 5G Multi-Band Vector Transceiver
- Keysight S9101A-BK1 5G Multi-Band Vector Transceiver TR1 with Blocker
- Keysight S9101A-TR2 5G Multi-Band Vector Transceiver

S9101A Connectors (Ports 1 to 6)

Each S9101A standard configuration has a different set of output and input connectors (ports):

- **All** S9101A-TR1 and **S9101A-BK1** standard configurations have mmWave ports on the **S9101RH mmWave Transceiver** that are **RF Tx/Rx 1 ①** and **RF Tx/Rx 2 ②**
- **All** S9101A-TR1 standard configurations have **RF Transceiver** RF ports **RF Out ③** and **RF In ④**
- **All** **S9101A-BK1** standard configurations have **RF Transceiver** RF ports **RF Out ⑤** and **RF In ⑥**

Although output and input ports **RF Out ⑤** and **RF In ⑥** with a Blocker on an **S9101A-BK1** have the same name on the external labeling as ports **RF Out ③** and **RF In ④** without a Blocker on an S9101A-TR1, they have different system performance.

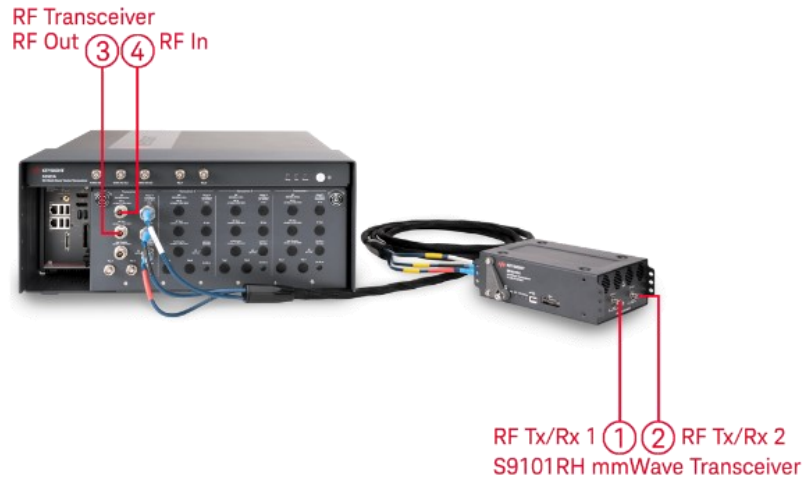
The differences are because the **S9101A-BK1** has different source system performance than an S9101A-TR1. On an **S9101A-BK1**, the Transmit (Tx) **RF Out ⑤**, 380 MHz to 6 GHz, signal path is routed through a hybrid combiner with additional cabling and switching that combines the RF Out of a Primary Transceiver (M9410A PXIe VXT), “Wanted” signal, with the RF Out of a Secondary Transceiver (M9410A PXIe VXT), “Blocker” signal.

The **RF In ⑥** path is not affected by the Blocker on an **S9101A-BK1**.

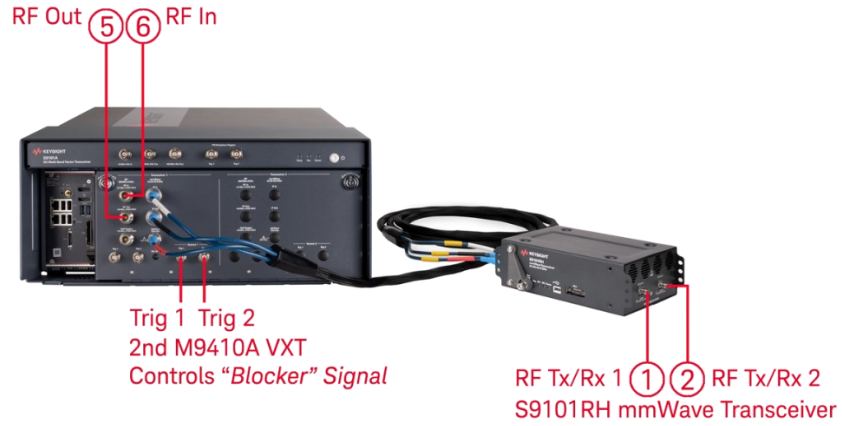
- **All** S9101A-TR2 standard configurations have two sets of mmWave ports and two sets RF ports:
 - **S9101RH mmWave Transceiver 1** has ports **RF Tx/Rx 1 ①** and **RF Tx/Rx 2 ②**
 - **RF Transceiver 1** has ports **RF Out ③** and **RF In ④**
 - **S9101RH mmWave Transceiver 2** has ports **RF Tx/Rx 1 ①** and **RF Tx/Rx 2 ②**
 - **RF Transceiver 2** has ports **RF Out ③** and **RF In ④**

Output / Input Ports	
RF Tx/Rx 1 ① RF Tx/Rx 2 ②	All S9101A Standard Configurations S9101RH mmWave Transceiver Connectors (RF Tx/Rx 1 & RF Tx/Rx 2)
RF Out ③ RF In ④	S9101A-TR1 and S9101A-TR2 RF Transceiver Connectors (RF Out & RF In)
RF Out ⑤ RF In ⑥	S9101A-BK1 RF Transceiver Connectors (RF Out & RF In)

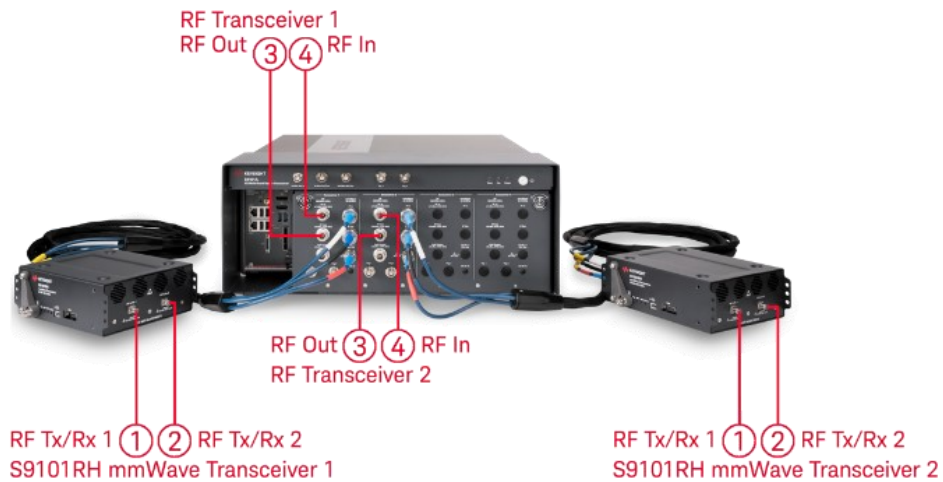
S9101A-TR1
5G Multi-Band Vector Transceiver



S9101A-BK1
5G Multi-Band Vector Transceiver
TR1 with Blocker



S9101A-TR2
5G Multi-Band Vector Transceiver



Vector Signal Analyzer (Rx) Performance

Performance		
Capture Depth	512 MSa	
Frequency		
	Frequency Range	
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.7 to 43.5 GHz, settable	
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	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, nominal
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 30.5 GHz 30.5 to 43.5 GHz	800 MHz 1.2 GHz
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	380 to 550 MHz 550 to 1310 MHz 1310 to 2000 MHz 2000 to 5480 MHz 5480 to 6000 MHz	100 MHz 200 MHz 600 MHz 1200 MHz (6080 MHz – Center Frequency) × 2 MHz
Amplitude Range		
	Frequency Range	Settable Input Level Ranges
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.7 to 43.5 GHz	–70 dBm to +5 dBm
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	380 to 6000 MHz	–150 dBm to +27 dBm
Half Duplex Connector (Option HD1, HD2)	380 to 6000 MHz	–150 dBm to +27 dBm

Absolute Amplitude Accuracy (CW mode)				
	Frequency Range	Level	Accuracy, typical	
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 33 GHz	-70 dBm to 0 dBm	± 1.75 dB	
	33 to 37 GHz	-70 dBm to 0 dBm	± 2.50 dB	
	37 to 43.5 GHz	-70 dBm to 0 dBm	± 1.75 dB	
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	380 to 680 MHz	-70 to +27 dBm	$\leq \pm 0.45$ dB	
	680 to 910 MHz	-70 to -8 dBm -8 to +27 dBm	$\leq \pm 0.45$ dB $\leq \pm 0.50$ dB	
	910 to 1310 MHz	-70 to -8 dBm -8 to +27 dBm	$\leq \pm 0.55$ dB $\leq \pm 0.60$ dB	
	1310 to 2000 MHz	-70 to -30 dBm -30 to +27 dBm	$\leq \pm 0.60$ dB $\leq \pm 0.65$ dB	
	2000 to 3500 MHz	-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.70$ dB $\leq \pm 0.80$ dB $\leq \pm 0.60$ dB	
	3500 to 4500 MHz	-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.65$ dB $\leq \pm 0.70$ dB $\leq \pm 0.75$ dB	
	4500 to 5400 MHz	-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.90$ dB $\leq \pm 0.95$ dB $\leq \pm 0.85$ dB	
	5400 to 6000 MHz	-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 1.20$ dB $\leq \pm 1.15$ dB $\leq \pm 1.05$ dB	
		Frequency Range	Level	Accuracy, typical
	Half Duplex Connector (Option HD1, HD2)	380 to 910 MHz	-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.50$ dB $\leq \pm 0.35$ dB $\leq \pm 0.45$ dB
910 to 1310 MHz		-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.60$ dB $\leq \pm 0.45$ dB $\leq \pm 0.55$ dB	
1310 to 3500 MHz		-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 0.75$ dB $\leq \pm 0.70$ dB $\leq \pm 0.65$ dB	
3500 to 4500 MHz		-70 to -30 dBm -30 to +27 dBm	$\leq \pm 0.95$ dB $\leq \pm 0.80$ dB	
4500 to 5400 MHz		-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 1.15$ dB $\leq \pm 0.95$ dB $\leq \pm 1.00$ dB	
5400 to 6000 MHz		-70 to -30 dBm -30 to -8 dBm -8 to +27 dBm	$\leq \pm 1.35$ dB $\leq \pm 1.10$ dB $\leq \pm 1.05$ dB	

Linearity (CW mode)			
	Frequency Range	Input Level	Linearity
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.75 to < 24.25 GHz	-50 to -30 dBm -30 to -25 dBm -25 to -17 dBm -17 to -10 dBm -10 to 0 dBm	$\leq \pm 0.90$ dB typical $\leq \pm 0.70$ dB typical $\leq \pm 0.50$ dB typical $\leq \pm 0.40$ dB typical $\leq \pm 0.30$ dB typical
	24.25 to < 33.3 GHz	-50 to -45 dBm -45 to -30 dBm -30 to -20 dBm -20 to 0 dBm	$\leq \pm 1.4$ dB, $\leq \pm 0.60$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.50$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.30$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.20$ dB typical
	33.3 to < 37.0 GHz	-50 to -30 dBm -30 to -25 dBm -25 to -17 dBm -17 to -10 dBm -10 to 0 dBm	$\leq \pm 0.90$ dB typical $\leq \pm 0.70$ dB typical $\leq \pm 0.50$ dB typical $\leq \pm 0.40$ dB typical $\leq \pm 0.30$ dB typical
	37.0 to 43.5 GHz	-50 to -30 dBm -30 to -27 dBm -27 to -10 dBm -10 to 0 dBm	$\leq \pm 1.4$ dB, $\leq \pm 0.70$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.50$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.40$ dB typical $\leq \pm 1.4$ dB, $\leq \pm 0.30$ dB typical
Scale Fidelity (CW mode)			
	Frequency Range	Input Level	Scale Fidelity
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.75 to < 24.25 GHz	-50 to -48 dBm -48 to -40 dBm -40 to 0 dBm	$\leq \pm 0.23$ dB typical $\leq \pm 0.20$ dB typical $\leq \pm 0.10$ dB typical
	24.25 to < 33.3 GHz	-50 to -40 dBm -40 to 0 dBm	$\leq \pm 0.7$ dB, $\leq \pm 0.20$ dB typical $\leq \pm 0.7$ dB, $\leq \pm 0.10$ dB typical
	33.3 to < 37.0 GHz	-50 to -48 dBm -48 to -40 dBm -40 to 0 dBm	$\leq \pm 0.23$ dB typical $\leq \pm 0.20$ dB typical $\leq \pm 0.10$ dB typical
	37.0 to 43.5 GHz	-50 to -48 dBm -48 to -40 dBm -40 to 0 dBm	$\leq \pm 0.7$ dB, $\leq \pm 0.22$ dB typical $\leq \pm 0.7$ dB, $\leq \pm 0.20$ dB typical $\leq \pm 0.7$ dB, $\leq \pm 0.10$ dB typical

IF Flatness			
	Frequency Range	Bandwidth	Flatness
S9101RH mmWave Connectors ¹ RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz 37 to 40 GHz	800 MHz 1200 MHz	± 1.75 dB, typical ± 2.20 dB, typical
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	380 to 6000 MHz	100 MHz	± 1.10 dB, typical
		200 MHz	± 1.35 dB, typical
		400 MHz	± 1.25 dB, typical
		800 MHz	± 1.45 dB, typical
		1200 MHz	± 1.80 dB, typical

Error Vector Magnitude (EVM)		
Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256QAM		
Test signal for FR2: 5G NR, 120 kHz subcarrier spacing, 256QAM		
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz	EVM, typical
	100 MHz BW	≤ -40 dB, -40 to -24 dBm input power ≤ -39 dB, -24 to -4 dBm input power ≤ -38 dB, -4 to 0 dBm input power
	400 MHz BW	≤ -36 dB, -40 to 0 dBm input power
	37 to 40 GHz	EVM, typical
	100 MHz BW	≤ -39.5 dB, -40 to -13 dBm input power ≤ -37.5 dB, -13 to -10 dBm input power ≤ -39 dB, -10 to -3 dBm input power ≤ -37 dB, -3 to 0 dBm input power
	400 MHz BW	≤ -35 dB, -40 to -38 dBm input power ≤ -36 dB, -38 to -2 dBm input power ≤ -35 dB, -2 to 0 dBm input power
All S9101A Standard Configurations RF Transceiver Connectors RF In ④ or RF In ⑥	FR1 (Sub 6 GHz)	EVM, nominal
	100 MHz BW signal at 5000 MHz	$< 0.3\%$ at -10 dBm input power

¹ Performance can be improved at a specific frequency by performing an IF Flatness Calibration using the Keysight S910xA System Calibration software application.

Adjacent Channel Leakage Ratio (ACLR)		
Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256QAM, noise correction ON		
Test signal for FR2: 5G NR, 120 kHz subcarrier spacing, 256QAM, noise correction ON		
S9101RH mmWave Connectors		
RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz	ACLR, typical
	100 MHz BW	≤ -45 dBc, -40 to 0 dBm input power
	400 MHz BW	< -39 dBc, -40 to 0 dBm input power
	37 to 40 GHz	ACLR, typical
	100 MHz BW	< -44 dBc, -40 to -14 dBm input power < -43 dBc, -14 to -2 dBm input power < -41 dBc, -2 to 0 dBm input power
	400 MHz BW	≤ -38 dBc, -40 to -12 dBm input power ≤ -37 dBc, -12 to 0 dBm input power
All S9101A Standard Configurations		
RF Transceiver Connectors		
RF In ④ or RF In ⑥	FR1 (Sub 6 GHz)	ACLR, nominal
	100 MHz BW signal at 5 GHz	< -63 dBc at 0 dBm input power

Vector Signal Generator (Tx) Performance

Performance		
ARB Depth	512 MSa	
Frequency		
	Frequency Range	
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.7 to 43.5 GHz, settable	
All S9101A Standard Configurations RF Transceiver Connectors RF Out ③ or RF Out ⑤	380 MHz to 6000 MHz	
	Frequency Reference	
Accuracy, aging rate, stability	Refer to Frequency Reference information in General Performance section.	
Signal Generation Bandwidth		
	Center Frequency	Maximum Bandwidth, <i>nominal</i>
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 30.5 GHz 30.5 to 43.5 GHz	800 MHz 1.2 GHz
All S9101A Standard Configurations RF Transceiver Connectors RF Out ③ or RF Out ⑤	380 to 550 MHz 550 to 1310 MHz 1310 to 2000 MHz 2000 to 5480 MHz 5480 to 6000 MHz	100 MHz 200 MHz 600 MHz 1200 MHz (6080 MHz – Center Frequency) × 2 MHz

Amplitude Range		
	Frequency Range	Settable Output Level Range
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.7 to 43.5 GHz	CW: –70 dBm to +10 dBm Modulated: –40 dBm to +5 dBm
S9101A Option TR1 or Option TR2 RF Transceiver Connectors RF Out ③	380 to 6000 MHz	CW: –120 dBm to +20 dBm Modulated: Depends on the Crest Factor
S9101A-BK1 RF Transceiver Connectors RF Out ⑤	380 to 6000 MHz	CW: Primary Transceiver (M9410A PXIe VXT) “Wanted” signal: –120 dBm to +17 dBm Secondary Transceiver (M9410A PXIe VXT) “Blocker” signal: –120 dBm to +2 dBm Modulated: Depends on the Crest Factor
Half Duplex Connector, Option HD1, HD2 (configured to output mode)	380 to 6000 MHz	CW: –120 dBm to +5 dBm

Absolute Amplitude Accuracy (CW mode)			
	Frequency Range	Level	Accuracy, typical
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 33.3 GHz 33.3 to 37.0 GHz 37.0 to 43.5 GHz	-70 dBm to +10 dBm	± 2.0 dB
S9101A Option TR1 or Option TR2 RF Transceiver Connectors RF Out ③	380 to 550 MHz	≤ +20 to -80 dBm ≤ -80 to -120 dBm	≤ ± 0.55 dB ≤ ± 0.80 dB
	550 to 2000 MHz	≤ +20 to -15 dBm ≤ -15 to -80 dBm ≤ -80 to -110 dBm	≤ ± 0.70 dB ≤ ± 0.55 dB ≤ ± 0.85 dB
	2000 to 3900 MHz	≤ +20 to -15 dBm ≤ -15 to -80 dBm ≤ -80 to -110 dBm	≤ ± 0.60 dB ≤ ± 0.70 dB ≤ ± 1.30 dB
	3900 to 5700 MHz	≤ +20 to -15 dBm ≤ -15 to -80 dBm ≤ -80 to -100 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB
	5700 to 6000 MHz	≤ +20 to -15 dBm ≤ -15 to -80 dBm ≤ -80 to -90 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB
S9101A-BK1 RF Transceiver Connectors RF Out ⑤ Primary Transceiver, “Wanted” signal	380 to 550 MHz	≤ +17 to -83 dBm ≤ -83 to -120 dBm	≤ ± 0.55 dB ≤ ± 0.80 dB
	550 to 2000 MHz	≤ +17 to -18 dBm ≤ -18 to -83 dBm ≤ -83 to -113 dBm	≤ ± 0.70 dB ≤ ± 0.55 dB ≤ ± 0.85 dB
	2000 to 3900 MHz	≤ +17 to -18 dBm ≤ -18 to -83 dBm ≤ -83 to -113 dBm	≤ ± 0.60 dB ≤ ± 0.70 dB ≤ ± 1.30 dB
	3900 to 5700 MHz	≤ +17 to -18 dBm ≤ -18 to -83 dBm ≤ -83 to -103 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB
	5700 to 6000 MHz	≤ +17 to -18 dBm ≤ -18 to -83 dBm ≤ -83 to -93 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB
S9101A-BK1 RF Transceiver Connectors RF Out ⑤ Secondary Transceiver, “Blocker” signal	380 to 550 MHz	≤ +2 to -98 dBm ≤ -98 to -120 dBm	≤ ± 0.55 dB ≤ ± 0.80 dB
	550 to 2000 MHz	≤ +2 to -33 dBm ≤ -33 to -98 dBm ≤ -98 to -120 dBm	≤ ± 0.70 dB ≤ ± 0.55 dB ≤ ± 0.85 dB
	2000 to 3900 MHz	≤ +2 to -33 dBm ≤ -33 to -98 dBm ≤ -98 to -120 dBm	≤ ± 0.60 dB ≤ ± 0.70 dB ≤ ± 1.30 dB
	3900 to 5700 MHz	≤ +2 to -33 dBm ≤ -33 to -98 dBm ≤ -98 to -118 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB
	5700 to 6000 MHz	≤ +2 to -33 dBm ≤ -33 to -98 dBm ≤ -98 to -108 dBm	≤ ± 0.80 dB ≤ ± 1.10 dB ≤ ± 1.20 dB

	Frequency Range	Level	Accuracy, typical
Half Duplex Connector (Option HD1, HD2)	380 to 550 MHz	≤ +5 to –80 dBm ≤ –80 to –90 dBm	≤ ± 0.50 dB ≤ ± 0.65 dB
	550 to 2000 MHz	≤ +5 to –15 dBm ≤ –15 to –80 dBm ≤ –80 to –90 dBm	≤ ± 0.55 dB ≤ ± 0.60 dB ≤ ± 0.75 dB
	2000 to 3900 MHz	≤ +5 to –15 dBm ≤ –15 to –80 dBm ≤ –80 to –90 dBm	≤ ± 0.50 dB ≤ ± 0.80 dB ≤ ± 1.10 dB
	3900 to 6000 MHz	≤ +5 to –15 dBm ≤ –15 to –80 dBm	≤ ± 0.90 dB ≤ ± 1.25 dB

Linearity (CW mode)			
	Frequency Range	Level	Linearity
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	22.75 to < 24.25 GHz	–50 to –40 dBm –40 to –30 dBm –30 to –3 dBm –3 to +5 dBm	≤ ± 0.40 dB typical ≤ ± 0.30 dB typical ≤ ± 0.25 dB typical ≤ ± 0.40 dB typical
	24.25 to < 33.3 GHz	–50 to –40 dBm –40 to –18 dBm –18 to –12 dBm –12 to +5 dBm	≤ ± 2.0 dB, ≤ ± 0.45 dB typical ≤ ± 2.0 dB, ≤ ± 0.40 dB typical ≤ ± 2.0 dB, ≤ ± 0.30 dB typical ≤ ± 2.0 dB, ≤ ± 0.15 dB typical
	33.3 to < 37.0 GHz	–50 to –40 dBm –40 to –30 dBm –30 to –3 dBm –3 to +5 dBm	≤ ± 0.40 dB typical ≤ ± 0.30 dB typical ≤ ± 0.25 dB typical ≤ ± 0.40 dB typical
	37.0 to 43.5 GHz	–50 to –30 dBm –30 to –20 dBm –20 to +5 dBm	≤ ± 2.0 dB, ≤ ± 0.50 dB typical ≤ ± 2.0 dB, ≤ ± 0.40 dB typical ≤ ± 2.0 dB, ≤ ± 0.30 dB typical

IF Flatness			
	Frequency Range	Bandwidth	Flatness, typical
S9101RH mmWave Connectors RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz	800 MHz	± 2 dB
	37 to 40 GHz	1.2 GHz	
All S9101A Standard Configurations RF Transceiver Connectors RF Out ③ or RF Out ⑤	380 to 6000 MHz	100 MHz	± 0.5 dB
		200 MHz	± 0.8 dB
		400 MHz	± 1.0 dB
		800 MHz	± 1.0 dB
		1200 MHz	± 1.5 dB

Error Vector Magnitude (EVM)		
Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256QAM		
Test signal for FR2: 5G NR, 120 kHz subcarrier spacing, 256QAM		
S9101RH mmWave Connectors		
RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz	EVM, typical
	100 MHz BW	< -42 dB, -20 to +5 dBm output power
	400 MHz BW	< -36 dB, -20 to -12 dBm output power < -36.5 dB, -12 to +5 dBm output power
	37 to 40 GHz	EVM, typical
	100 MHz BW	< -40 dB, -20 to -14 dBm output power < -41 dB, -14 to +5 dBm output power
	400 MHz BW	< -35 dB, -20 to -19 dBm output power < -36 dB, -19 to -3 dBm output power < -34 dB, -3 to -1 dBm output power < -36.5 dB, -1 to +5 dBm output power
All S9101A Standard Configurations		
RF Transceiver Connectors		
RF Out ③ or RF Out ⑤ ¹	FR1 (Sub 6 GHz)	EVM, nominal
	100 MHz BW signal at 4 GHz	< 0.4% at -10 dBm output power
	100 MHz BW signal at 5 GHz	< 0.6% at -10 dBm output power
Adjacent Channel Leakage Ratio (ACLR)		
Test signal for FR1: 5G NR, 30 kHz subcarrier spacing, 256QAM, noise correction ON		
Test signal for FR2: 5G NR, 120 kHz subcarrier spacing, 256QAM, noise correction ON		
S9101RH mmWave Connectors		
RF Tx/Rx 1 ① RF Tx/Rx 2 ②	24.25 to 29.5 GHz	ACLR, typical
	100 MHz BW	< -44 dBc at -20 to -16 dBm output power < -45 dBc at -16 to +5 dBm output power
	400 MHz BW	< -38 dBc at -20 to +5 dBm output power
	37 to 40 GHz	
	100 MHz BW	< -45 dBc at -20 to -18 dBm output power < -46 dBc at -18 to +5 dBm output power
	400 MHz BW	< -38 dBc at -20 to -18 dBm output power < -39.5 dBc at -18 to +5 dBm output power
RF Transceiver Connectors		
RF Out ③ or RF Out ⑤ ¹	FR1 (Sub 6 GHz)	ACLR, nominal
	100 MHz BW signal at 4 GHz	< -57 dBc at 0 dBm output power
	100 MHz BW signal at 5 GHz	< -55 dBc at 0 dBm output power

¹ The S9101A-BK1 systems include both a Primary Transceiver (M9410A PXIe VXT) that generates a "Wanted" signal and a Secondary Transceiver (M9410A PXIe VXT) that generates a "Blocker" signal. EVM characteristics apply to the RF Output of the Primary Transceiver.

General Performance

Environmental Characteristics		
S9101A ¹	<ul style="list-style-type: none"> 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 	
Power Requirements		
	Voltage & frequency	Power consumption
S9101A Base System ²	100/120 V, 50/60 Hz 220/240 V, 50/60 Hz	1200 W Max (Lower range) 1300 W Max (Upper range)
S9101RH	36 VDC	34 W
Size and Weights		
Dimensions		
S9101A Base System	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)	
S9101RH	Height: 66 mm (2.60 in) Width: 139 mm (5.47 in) Depth: 183 mm (7.20 in)	
S9101A Rack Space	2 X 2U x 1 rack width	
Weight		
S9101A-TR1 Base System	20.4 kg (45.0 lbs)	
S9101A-TR2 Base System	22.6 kg (49.8 lbs)	
S9101A-BK1 Base System	24.0 kg (53.0 lbs)	
S9101RH	2.2 kg (4.85 lbs)	
Remote programming		
Interface	LAN RJ-45	
Warranty		
Standard 1-year warranty		
Calibration Cycle		
The recommended calibration cycle is one year; calibration services are available through Keysight service centers.		

¹ Keysight S9101A 5G Multi-Band Vector Transceiver

² Keysight S9101A Base System is a PXIe chassis with modules, rugged panel, and cables

LAN, Display Port, and USB Connectors, M9037A PXIe Embedded Controller

LAN 1 and LAN 2 (TCP/IP Interface)	
Connectors	Two, 10/100/1000BASE-T (RJ-45) Gigabit Ethernet ports
Video/Dual Display Ports	
Connector	Two, Dual Mode DisplayPort++ connectors can support either a DisplayPort or DVI-D monitor
USB 2.0 and 3.0	
Connectors	Four, USB 2.0 (Type A)
Connectors	Two, USB 3.0
Trig (PXI Trigger In/Out)	
Connector	SMB (m) snap-on, bi-directional trigger connector for routing an external trigger signal to/from PXI backplane
GPIB	
Connector	GPIB (Micro-D 25-pin)
PCIe	
Connector	x8 Gen 3 PCIe IPASS connector for controlling a second PXIe or AXIe chassis or RAID storage

S9101A Base System¹ Front Panel (with Rugged Front Panel)

Frequency Reference, 100 MHz Ref Out & 10 MHz Ref In/Out Connectors above the Rugged Front Panel

100 MHz Ref Out, Frequency Reference (if available)	
Accuracy	< ± 16 Hz, <i>typical</i> , within 1 year since last calibration, from 20 to 30°C. Refer to the <i>Keysight M9300A PXIe Frequency Reference Data Sheet</i> for details on accuracy, aging rate, and stability.
Recommended Calibration Cycle	1 year
Connector	BNC (f)
Amplitude	9.5 dBm, <i>nominal</i>
10 MHz Ref Out, Frequency Reference	
Accuracy	< ± 1.6 Hz, <i>typical</i> , within 1 year since last calibration, from 20 to 30°C. Refer to the <i>Keysight M9300A PXIe Frequency Reference Data Sheet</i> for details on accuracy, aging rate, and stability.
Recommended Calibration Cycle	1 year
Connector	BNC (f)
Amplitude	9.5 dBm, <i>nominal</i>
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, <i>nominal</i>
Input Amplitude	0 to 10 dBm, <i>nominal</i>
Impedance	50 Ω , <i>nominal</i>

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.)	
Connector	BNC (f)
Direction control	Input or output (configurable)
Output level	3.3 V CMOS (TTL compatible, 5 V tolerant)
Output impedance	50 Ω (typ)
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 (typ)
Input trigger destination	PXI_Trig0 - PXI_Trig7 (Segment 2 or 3)
Input threshold	1.65 V (typ)
Minimum swing	250 mV (typ)
Minimum pulse width	100 ns (typ)

Note

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 \(M9019-90003\)](#).

¹ Keysight S9101A Base System is a PXIe chassis with modules, rugged panel, and cables

Transceiver Connectors, RF 380 MHz to 6 GHz on the Rugged Front Panel

RF In	
Connector	Type-N (f), 50 Ω , <i>nominal</i>
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +27 dBm Maximum Safe Input Power
RF Out	
Connector	Type-N (f), 50 Ω , <i>nominal</i>
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +30 dBm Maximum Applied Reverse Input Power
Half Duplex, Option HD1, HD2	
Connector	Type-N (f)
Frequency Range	380 MHz to 6 GHz
Amplitude	0 VDC, +30 dBm Maximum Safe Input Power

Transceiver Connectors, Head mmWave 24.25 to 43.5 GHz on the Rugged Front Panel

IF In	
Connector	Type-N (f), 50 Ω , <i>nominal</i>
Frequency Range	380 MHz to 6 GHz
Amplitude	\pm 10 VDC, +33 dBm Maximum
IF Out	
Connector	Type-N (f), 50 Ω , <i>nominal</i>
Frequency Range	380 MHz to 6 GHz
Amplitude	\pm 10 VDC, +33 dBm Maximum
LO/Pwr/Ctrl Out	
Connector	TNC (f)
Ch 1A In	
Connector	SMA (f) This connector is not used in S9101A configurations and is reserved for future use.

Note

IF In, IF Out, and LO/Pwr/Ctrl Out connect to the S9101RH.

S9101RH mmWave Transceiver

RF Tx/Rx 1 and RF Tx/Rx 2	
Connector	2.4 mm (f), 50 Ω , <i>nominal</i> These ports can be configured either to supply a mmWave signal to a Device Under Test (DUT) or to receive a mmWave signal from a DUT.
Amplitude	15 VDC, +20 dBm Maximum Input

Note

Although the S9101RH mmWave Transceiver is operational from 22.7 to 43.5 GHz, the performance information for the S9101A is only provided for the frequency bands called out in this Data Sheet.

LO/IF Out (In the S9101A configuration, this port is not used.)	
Connector	SMA (f), 50 Ω , nominal This port provides the IF output of the downconverter in the S9101RH. This port also accepts an LO input to be used by the downconverter.
IF In/Out (In the S9101A configuration, this port is used as the IF output from the S9101RH.)	
Connector	SMA (f), 50 Ω , nominal This port can be used either to accept an IF input to the upconverter in the S9101RH or to provide the IF output of the downconverter in the S9101RH.
IF frequency range	2.5 to 4 GHz
IF input power range	-20 to -30 dBm minimum, CW
IF output power range	-24 to -8 dBm, CW
IF In (In the S9101A configuration, this port is used as the IF input to the S9101RH.)	
Connector	SMA (f), 50 Ω , nominal This port accepts an IF input to the upconverter in the S9101RH.
IF frequency range	2.5 to 4 GHz
IF input power range	-20 to -30 dBm minimum, CW
LO/Pwr/Ctrl/IF In (In the S9101A configuration, this port is used as the power, control, and LO input to the S9101RH.)	
Connector	SMA (f), 50 Ω , nominal This port accepts the following combined inputs: <ul style="list-style-type: none"> An LO input to be used by the upconverter and/or downconverter in the S9101RH. A +36 VDC voltage input to power the S9101RH. A control signal to operate the S9101RH. This port can also accept an IF input to the upconverter in the S9101RH, but this function is not used in the S9101A configuration.
LO frequency range	6 to 12 GHz
LO power level	-20 dBm, minimum
DC power	+36 VDC, 1A

Caution

Do not connect or disconnect the LO/Pwr/Ctrl cable while the connected S9101RH mmWave Transceiver is powered on.

Related Literature

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

Keysight S9101A 5G Multi-Band Vector Transceiver, Startup Guide
(literature no. [S9101-90001](#))

Keysight S9101A 5G Multi-Band Vector Transceiver, Configuration Guide
(literature no. [5992-4355EN](#))

Keysight M9019A PXIe 18 slot Chassis, Data Sheet
(literature no. [5992-1481EN](#))

Keysight M9037A PXIe High Performance Embedded Controller, Data Sheet
(literature no. [5991-3661EN](#))

Keysight M9410A and M9411A PXIe VXT Vector Transceivers, Data Sheet
(literature no. [5992-3331EN](#))

Keysight X-Series Measurement Applications, Brochure
(literature no. [5989-8019EN](#))

Keysight Signal Studio Software, Brochure
(literature no. [5989-6448EN](#))

Web

Product page:

<http://www.keysight.com/find/S9101A>

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

