

M9379A RF Amplifier

Overview

The M9379A RF Amp Module includes two amplifiers, RF switches, and a programmable step attenuator designed to operate with the M9485A and M980xA PXIe vector network analyzer (VNA). One of the internal amplifiers works as a programmable pre-amp containing two user-selectable paths, either an amplifier path with a variable gain using a step attenuator or bypass path.

The M9379A can improve the noise floor of the measurement system with the M980xA PXIe VNA. For example, the M9379A with a pre-amp is an ideal solution for noise figure (NF) measurements using the M980xA's standard receivers up to 13.5 GHz. The 1-slot module also includes internal switches which are directly controlled by the M980xA's firmware, enabling synchronized fast measurements for both S-parameters and NF with the PXI system.

When combined with the direct access receivers and high-power coupler in the M9485A, the dynamic range can be increased which is suited for high-rejection filter measurements.



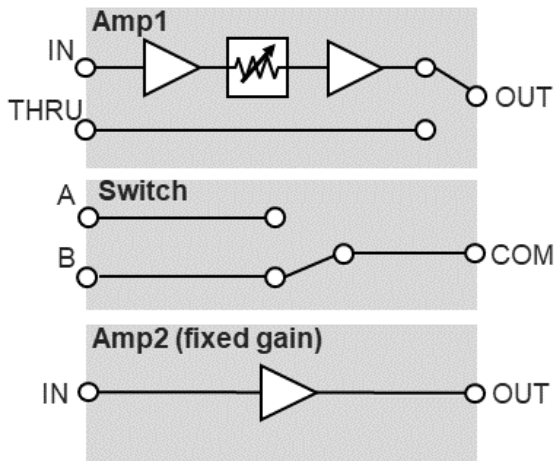


Figure 1. Keysight M9379A block diagram

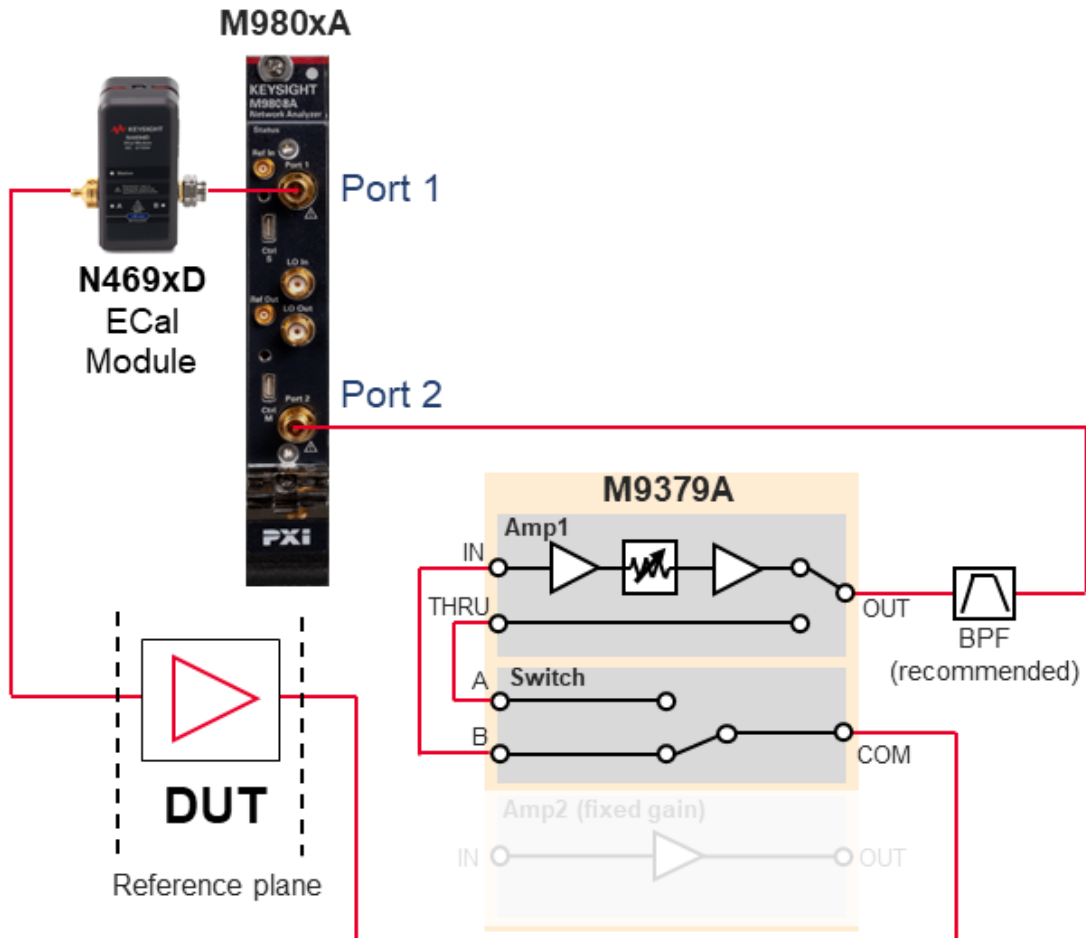


Figure 2. Vector-calibrated NF measurement with M980xA and M9379A

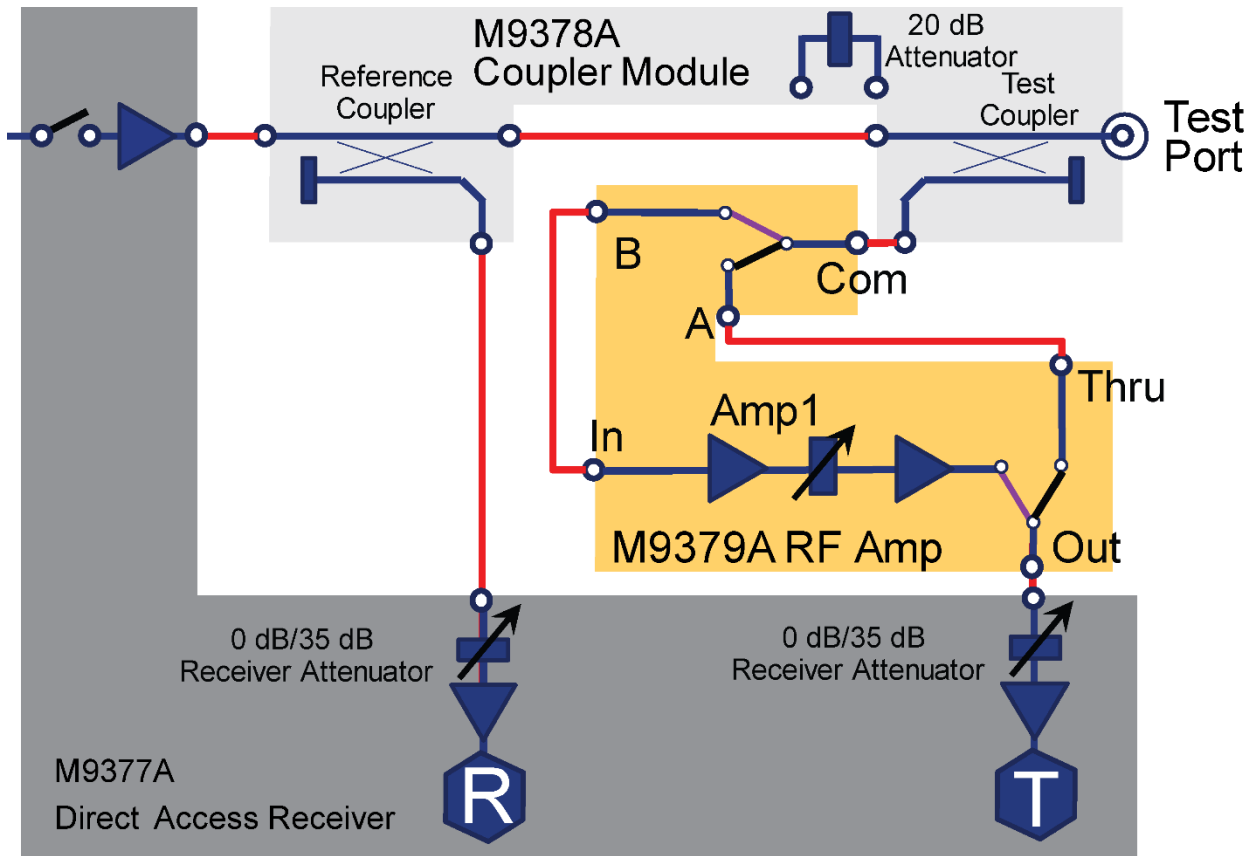


Figure 3. Extending dynamic range of the M9485A PXle VNA using the M9379A

Key specifications/features

- 50 MHz to 13.5 GHz
- Dual amplifiers (programmable gain and fixed gain)
- Fast path control with built-in solid-state switches
- +21 dBm saturated output power at 3 GHz (typ.)
- 25 dB forward gain at 3 GHz (typ.)
- 5 dB noise figure at 3 GHz (typ.)

Specifications

Definitions

Specification (spec.):

Warranted performance. All specifications apply at 25 °C (± 5 °C) range ambient and module temperature between 28 °C to 42 °C as reported by the module, unless otherwise stated, and 45 minutes after the M9379A amplifiers and switches have been turned on ¹. Specifications include guard bands to account for the expected statistical performance distribution, measurement uncertainties, and changes in performance due to environmental conditions.

Typical (typ.):

Expected performance of an average unit which does not include guardbands.

General characteristics:

A general, descriptive term that does not imply a level of performance.

Boundary conditions

If the same boundary conditions fall under more than one category in a table, apply the best value.



1. It is needed before using to turn on the amplifiers and switches by PXI VNA firmware, Soft Front Panel or IVI-driver. Refer to the help for more information.

Amp1 (Amplifier 1)

In-Out

Description	Specifications	Typical
Forward gain		
(Path: Amp, Attenuator: 0 dB)		
50 MHz to 1 GHz	+19 dB	+27 dB
1 to 3 GHz	+19 dB	+25 dB
3 to 6.5 GHz	+16 dB	+22 dB
6.5 to 12 GHz	+7 dB	+18 dB
12 to 13.5 GHz	+5 dB	+14 dB
Reverse gain		
(Path: Amp, Attenuator: 0 dB)		
50 MHz to 13.5 GHz		-40 dB
Return loss		
IN (Path: Amp or Thru, Attenuator: 0 dB)		
50 to 100 MHz	5 dB	8 dB
100 to 300 MHz	5 dB	11 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	6 dB	13 dB
9 to 13.5 GHz	5 dB	9 dB
OUT (Path: Amp, Attenuator: 0 dB)		
50 to 300 MHz	5 dB	8 dB
300 MHz to 6.5 GHz	8 dB	11 dB
6.5 to 9 GHz	8 dB	11 dB
9 to 13.5 GHz	5 dB	10 dB
Attenuator settable range		
	0 to 28 dB, 2 dB step	
Attenuator accuracy		
50 MHz to 9 GHz	$\pm (0.4 + 5\% \text{ of setting})$ dB	$\pm (0.2 + 5\% \text{ of setting})$ dB
9 to 13.5 GHz		$\pm (0.4 + 5\% \text{ of setting})$ dB

Isolation (Thru-Out)		
50 M to 6.5 GHz		30 dB
6.5 G to 9 GHz		20 dB
9 G to 13.5 GHz		10 dB
Noise figure		
50 to 300 MHz		$[5+10\log_{10}(0.3/f)]$ dB ¹
300 MHz to 6.5 GHz	8 dB	5 dB
6.5 to 9 GHz	9 dB	7 dB
9 to 13.5 GHz	11 dB	9 dB
Output 1 dB Compression (P1dB)		
50 to 100 MHz	17 dBm	19 dBm
100 MHz to 4 GHz	17.5 dBm	19.5 dBm
4 to 6.5 GHz	16 dBm	18.5 dBm
6.5 to 9 GHz	14 dBm	17 dBm
9 to 13.5 GHz	12 dBm	16 dBm
Saturated Output Power (Psat)		
50 to 100 MHz		21 dBm
100 MHz to 4 GHz		21.5 dBm
4 to 6.5 GHz		20.5 dBm
6.5 to 9 GHz		19 dBm
9 to 13.5 GHz		18 dBm
Output Intercept Point (OIP3) ²		
50 M to 13.5 GHz		20 dBm
Harmonics (2nd and 3rd)		
50 M to 13.5 GHz, +10 dBm output		< -20 dBc
Gain Temperature Coefficient		
(Attenuator: 0 dB)		
50 MHz to 6.5 GHz		-0.06 dB/°C
6.5 to 13.5 GHz		-0.08 dB/°C

1. f in GHz.
2. Tested with 10 MHz tone separation.

Thru-Out

Description	Specifications	Typical
Return loss		
OUT (Path: Thru), Thru (Path:Thru)		
50 to 100 MHz	3 dB	8 dB
100 to 300 MHz	5 dB	11 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	8 dB	13 dB
9 to 13.5 GHz	5 dB	9 dB
THRU (Path: Amp)		
50 to 300 MHz	5 dB	8 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	8 dB	11 dB
9 to 12 GHz	5 dB	8 dB
12 to 13.5 GHz	3 dB	6 dB
Insertion loss		
(Path: Thru)		
50 to 100 MHz	5.5 dB	3 dB
100 MHz to 3 GHz	5 dB	3 dB
3 to 6.5 GHz	6 dB	3.5 dB
6.5 to 9 GHz	7 dB	4.5 dB
9 to 13.5 GHz	9 dB	6.5 dB
Isolation (In-Out)		
(Attenuator: 0 dB)		
50 MHz to 6.5 GHz		30 dB
6.5 to 9 GHz		20 dB
9 to 13.5 GHz		10 dB

Amp2 (Amplifier 2)

In-Out

Description	Specifications	Typical
Forward gain		
50 MHz to 1 GHz	+19 dB	+27 dB
1 to 3 GHz	+19 dB	+25 dB
3 to 6.5 GHz	+16 dB	+22 dB
6.5 to 12 GHz	+9 dB	+18 dB
12 to 13.5 GHz	+6 dB	+17 dB
Reverse gain		
50 M to 13.5 GHz		-40 dB
Return loss		
Input		
50 to 100 MHz	5 dB	8 dB
100 to 300 MHz	5 dB	10 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	6 dB	10 dB
9 to 13.5 GHz	5 dB	10 dB
Output		
50 to 100 MHz	5 dB	8 dB
100 MHz to 300 MHz	5 dB	10 dB
300 to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	8 dB	11 dB
9 to 13.5 GHz	5 dB	8 dB
Noise figure		
50 to 300 MHz		$[5+10\log_{10}(0.3/f)]$ dB ¹
300 MHz to 6.5 GHz	8 dB	5 dB
6.5 to 9 GHz	9 dB	7 dB
9 to 13.5 GHz	11 dB	9 dB

1. f in GHz.

Output 1 dB Compression (P1dB)		
50 to 100 MHz	17.5 dBm	19 dBm
100 MHz to 4 GHz	18 dBm	20 dBm
4 to 6.5 GHz	16.5 dBm	19 dBm
6.5 to 9 GHz	15 dBm	18 dBm
9 to 13.5 GHz	12 dBm	16 dBm
Saturated Output Power (Psat)		
50 to 100 MHz		21 dBm
100 MHz to 4 GHz		22 dBm
4 to 6.5 GHz		21 dBm
6.5 to 9 GHz		20 dBm
9 to 13.5 GHz		18 dBm
Output Intercept Point (OIP3) ²		
50 MHz to 13.5 GHz		20 dBm
Harmonics (2nd and 3rd)		
50 MHz to 13.5 GHz		< -20 dBc
Gain Temperature Coefficient		
50 MHz to 6.5 GHz		-0.06 dB/°C
6.5 to 13.5 GHz		-0.08 dB/°C

2. Tested with 10 MHz tone separation.

Switch

Description	Specifications	Typical
Insertion loss		
(Switch: Path A)		
50 to 100 MHz	5.5 dB	3 dB
100 MHz to 3 GHz	5 dB	3 dB
3 to 6.5 GHz	6 dB	3.5 dB
6.5 to 9 GHz	7 dB	4.5 dB
9 to 13.5 GHz	9 dB	6.5 dB
(Switch: Path B)		
50 to 100 MHz	5.5 dB	3 dB
100 MHz to 3 GHz	5 dB	3 dB
3 to 6.5 GHz	6 dB	4 dB
6.5 to 9 GHz	8 dB	5 dB
9 to 13.5 GHz	10 dB	7 dB
Return loss		
Selected Ports and COM		
50 to 100 MHz	3 dB	8 dB
100 to 300 MHz	5 dB	8 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	8 dB	11 dB
9 to 13.5 GHz	5 dB	6 dB
Unselected Ports		
50 to 100 MHz	5 dB	8 dB
100 to 300 MHz	5 dB	10 dB
300 MHz to 6.5 GHz	10 dB	13 dB
6.5 to 9 GHz	8 dB	10 dB
9 to 13.5 GHz	3 dB	10 dB
Isolation (Unselected Port to COM)		
50 MHz to 6.5 GHz		30 dB
6.5 to 9 GHz		20 dB
9 to 13.5 GHz		10 dB

Switch and Amp1 (COM to Amp1 OUT)

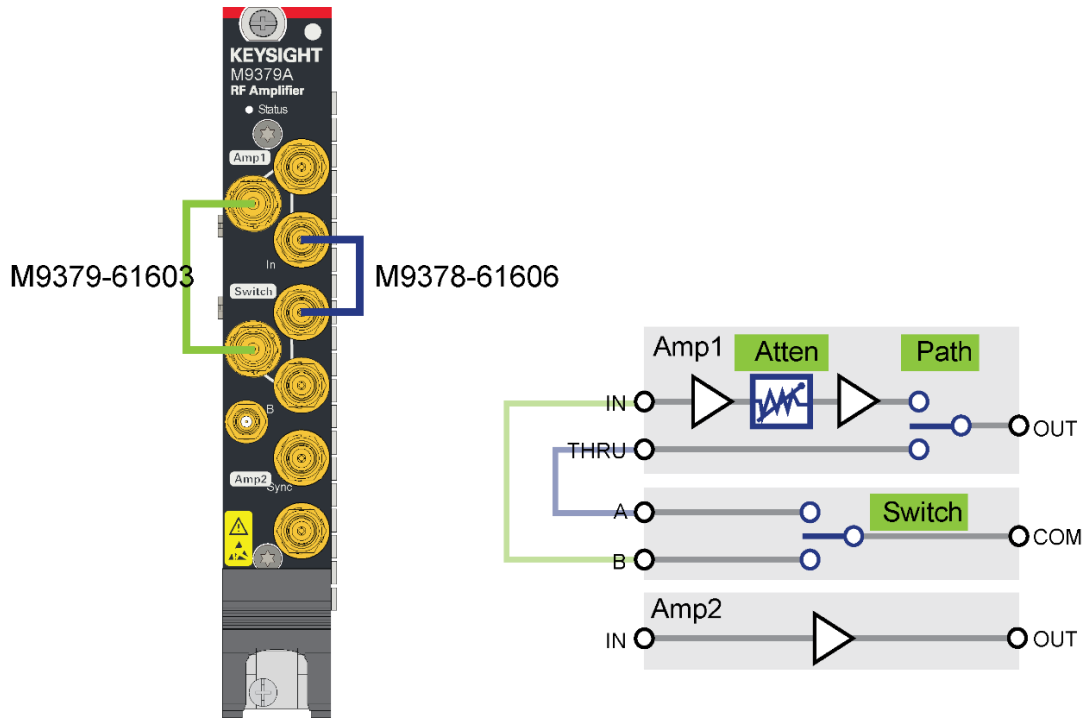


Figure 4. The connectors are connected with the furnished cables. Amp1 THRU - Switch A: M9378-61606, Amp 1 IN – Switch B: M9379-61603.

Description	Specifications	Typical
Insertion loss		
(Amp1: Path THRU, Switch: Path A)		
50 to 100 MHz		8 dB
100 MHz to 3 GHz		6 dB
3 to 6.5 GHz		7 dB
6.5 to 9 GHz		8 dB
9 to 12 GHz		12 dB
12 to 13.5 GHz		13 dB
Forward gain		
(Amp1: Path Amp, Attenuator 0 dB, Switch: Path B)		
50 MHz to 3 GHz		22 dB
3 to 6.5 GHz		18 dB
6.5 to 9 GHz		13 dB
9 to 12 GHz		11 dB
12 to 13.5 GHz		7 dB

Noise figure		
(Amp1: Path Amp, Attenuator 0 dB, Switch: Path B)		
50 to 300 MHz		$[8+10\log_{10}(0.3/f)]$ dB ¹
300 MHz to 4 GHz	11 dB	8 dB
4 to 6.5 GHz	12 dB	9 dB
6.5 to 9 GHz	14 dB	12 dB
9 to 13.5 GHz	18 dB	16 dB

1. f in GHz.

General Characteristics

Front panel connector

Description	Connector type	Typical
Amp 1 IN	SMA female	
Amp 1 OUT, THRU	3.5 mm female	
Switch A	3.5 mm female	
Switch B	SMA female	
Amp 2 IN, OUT	3.5 mm female	
Sync	SMB male	
Damage Level	3.5 mm and SMA Port	+30 dBm or \pm 35 VDC
	Hot Switching	+20 dBm

Isolation ¹

Description	Specification	Typical
Between Amp 1 and Switch		
50 MHz to 8.5 GHz		120 dB
8.5 to 13.5 GHz		110 dB
Between (Amp 1+Switch) and Amp2		
50 MHz to 8.5 GHz		140 dB
8.5 to 13.5 GHz		130 dB

1. The unused ports are terminated with 50 Ω .




Miscellaneous

Description	General characteristics
Dimensions	210 mm x 22 mm x 130 mm
Weight (net)	550 g
Power drawn from chassis	14.7 W max.
	+3.3V: 0.71 A
	+5 V: 0 A
	+12 V: 1.025 A
	-12 V: 0 A
Warm up time	45 minutes ¹

1. Not only chassis power-on but also turning on the amplifiers by software (PXI VNA firmware, soft front panel or IVI-driver) are required. Refer to the help for more information.

EMC, safety, environment and compliance

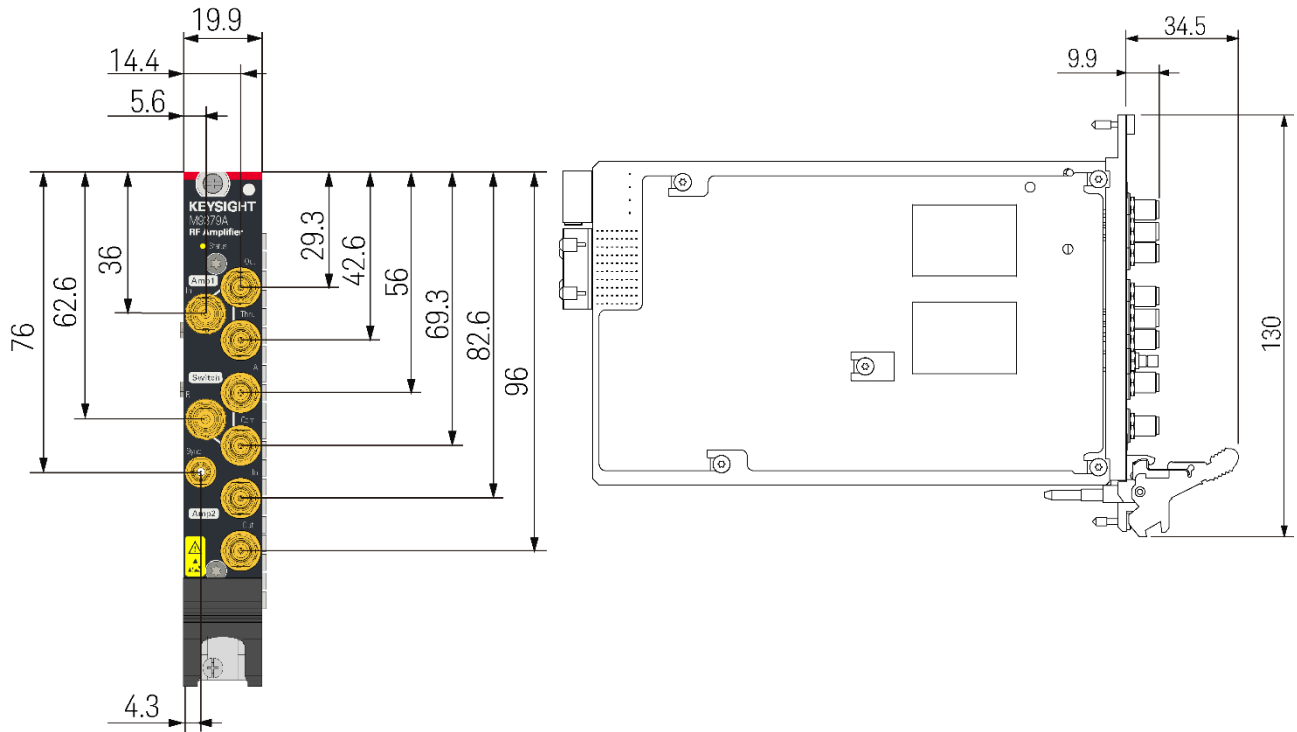
Description	Specifications
EMC	
	<p>European Council Directive 2014/30/EC IEC 61326-1:2012 EN 61326-1:2013 CISPR 11:2009 +A1:2010 EN 55011: 2009 +A1:2010 Group 1, Class A IEC 61000-4-2:2008 EN 61000-4-2:2009 4 kV CD / 8 kV AD IEC 61000-4-3:2006 +A1:2007 +A2:2010 EN 61000-4-3:2006 +A1:2008 +A2:2010 3 V/m, 80-1000 MHz, 1.4 - 2.0 GHz / 1V/m, 2.0 - 2.7 GHz, 80% AM IEC 61000-4-4:2004 +A1:2010 EN 61000-4-4:2004 +A1:2010 2 kV power lines / 0.5 kV signal lines IEC 61000-4-5:2005 EN 61000-4-5:2006 1 kV line-line / 2 kV line-ground IEC 61000-4-6:2008 EN 61000-4-6:2009 3 V, 0.15-80 MHz, 80% AM IEC 61000-4-8:2009</p>

	EN 61000-4-8:2010 30A/m, 50/60 Hz IEC 61000-4-11:2004 EN 61000-4-11:2004 0.5-300 cycle, 0% / 70%
ICES/NMB-001	ICES-001:2006 Group 1, Class A
	AS/NZS CISPR11:2004 Group 1, Class A
	KN11, KN61000-6-1 and KN61000-6-2 Group 1, Class A
Environment	
	<p>This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste.</p> <p>Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as a "Monitoring and Control instrumentation" product.</p> <p>Do not dispose in domestic household waste.</p> <p>To return unwanted products, contact your local Keysight office, or see http://www.keysight.com/environment/product/ for more information.</p>

Analyzer environmental specifications

Operating environment	General characteristics
Temperature	0 to 55 °C ambient 0 to 55 °C module temperature
Humidity	20% to 80% at wet bulb temperature < +29 °C (non-condensation)
Altitude	0 to 2,000 m (0 to 6561 feet)
Vibration	0.21 G maximum, 5 Hz to 500 Hz
Non-operating environment	General characteristics
Temperature	-40 °C to +70 °C
Humidity	20% to 90% at wet bulb temperature < +40 °C (non-condensation)
Altitude	0 to 4,572 m (0 to 15,000 feet)
Vibration	0.5 G maximum, 5 Hz to 500 Hz

Dimensions



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