

# Keysight Technologies

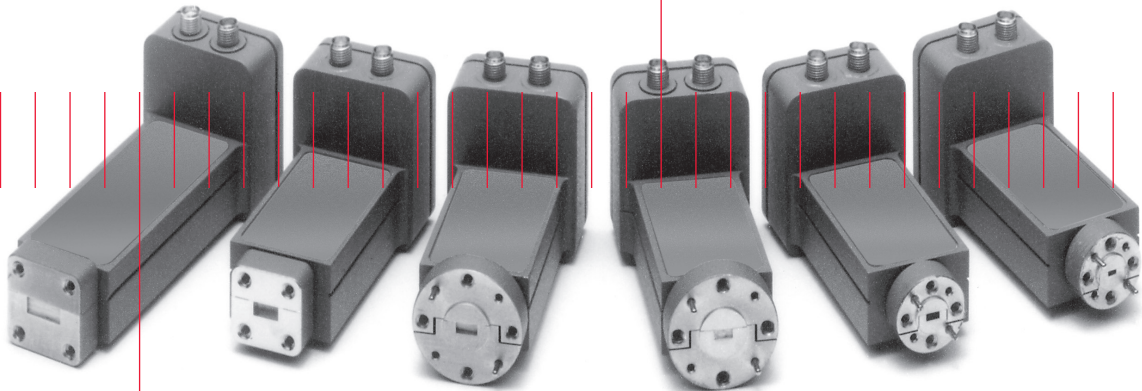
## 11970 Series

### Harmonic Mixers

18 to 110 GHz

11970K\*, 11970A, 11970Q,  
11970U, 11970V, 11970W

[Data Sheet](#)



For use with the Keysight E4407B, 8560E/EC Series, 8566B, 71000 Series, and PSA Series spectrum analyzers, plus the N9030A PXA signal analyzer

## Exceptional performance

The Keysight Technologies, Inc. 11970 Series harmonic mixers are general purpose mixers employing a dual-diode design to achieve very flat frequency response and low conversion loss. Each mixer is calibrated across its full band:

11970K*	18 to 26.5 GHz	11970Q	33 to 50 GHz	11970V	50 to 75 GHz
11970A	26.5 to 40 GHz	11970U	40 to 60 GHz	11970W	75 to 110 GHz

This series of mixers has been designed for a local oscillator frequency of 3 to 6.1 GHz. Accurate absolute amplitude measurements can be made by using the mixer's conversion loss calibration chart. The SWR of the waveguide input is typically 2.2:1 to further minimize measurement uncertainty. The combination of high gain-compression level and low conversion loss provides the maximum dynamic range for measuring input signals.

\* 11970K is excluded from PXA support

## Easy to use

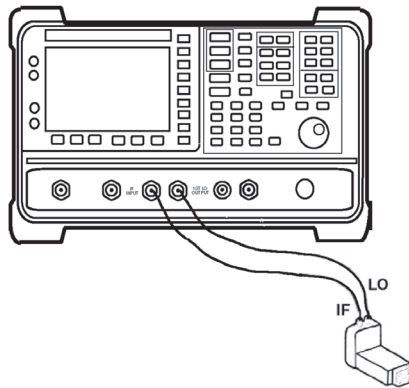
The excellent frequency response and low conversion loss are achieved without external dc bias or tuning stubs. Since bias and tuning stubs are not required, manual operation is simplified, and the complexity of hardware and software for automatic systems is greatly reduced. The repeatability of amplitude measurements is also enhanced. The dual-diode design of the mixers further simplifies measurements by suppressing the odd-order harmonics by more than 20 dB, which makes identification of the mixing products easier.



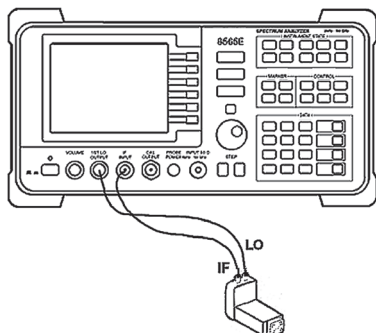
Figure 1. The 11970 Series mixers have separate LO input and IF output ports

## Rugged

The rugged Keysight 11970 Series mixers will survive input levels up to 100 milliwatts (+20 dBm) with no damage to the mixer diodes. They will withstand shocks up to 30 G's and the vibration required by MIL-STD 28800C, Type III, Class 3 tests



Keysight 8560E/EC Series spectrum analyzer  
Extended frequency  
8560E/EC Series



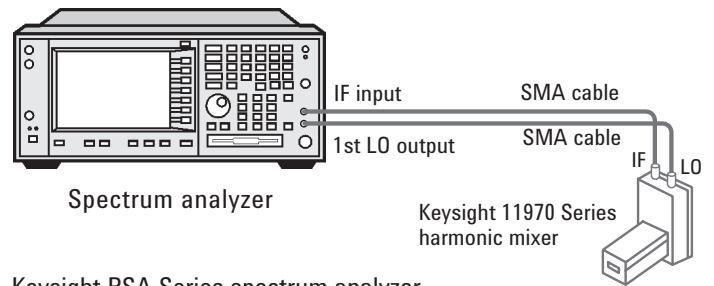
Keysight E4407B spectrum analyzer  
Extended frequency  
E4407B ESA-E Series

## Frequency extension for the Keysight E4407B, 8560E/EC Series, 8566B, and 71000 Series and PSA Series spectrum analyzers

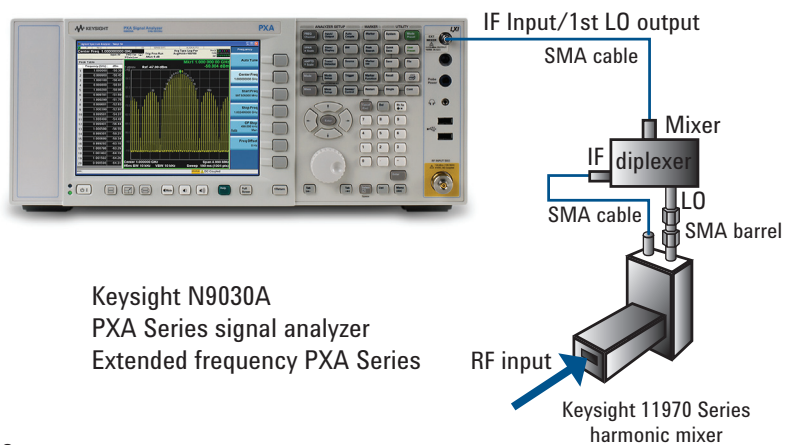
The 11970 Series harmonic mixers are fully compatible with the Keysight E4407B, 8560E/EC Series, 8566B (requires a preamplifier), 71000, and PSA Series spectrum analyzers. Accurate frequency and amplitude measurements are made directly from the spectrum analyzer's display after calibration using the mixer's calibration chart.

## Frequency extension for the Keysight N9030A PXA Series signal analyzer

The 11970 Series harmonic mixers (11970K excluded) are also compatible with the N9030A PXA Series highperformance signal analyzer. The PXA offers optional external mixing (Option EXM), enabling it to work with the 11970 Series and other external mixers for frequency extension. An external diplexer is required because the PXA external mixing has a single SMA LO/IF port, whereas the 11970 Series mixers have separate LO and IF ports. Recommended diplexers can be purchased from Keysight as N9029AE13, or from OML Inc. as DLP.313B.



Keysight PSA Series spectrum analyzer  
Extended frequency PSA Series

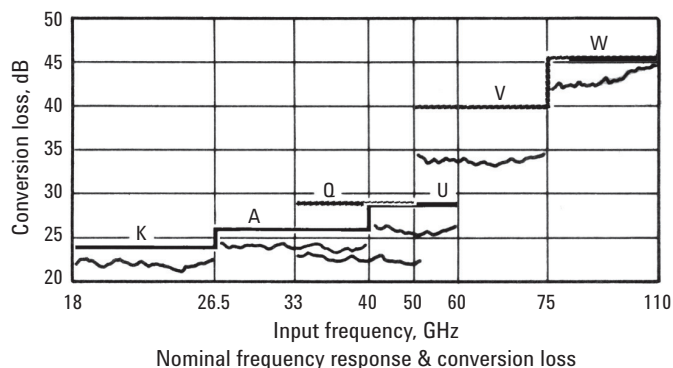


Keysight N9030A  
PXA Series signal analyzer  
Extended frequency PXA Series

## Specifications

Specifications describe the device's warranted performance over the temperature range 0 to 55° C (except where noted).

IF range	DC to 1300 MHz
LO amplitude range	+14 to +18 dBm <sup>1</sup>
Calibration accuracy (with IF of 321.4 MHz or 322.5 MHz)	
11970A/Q/U	±2.0 dB with LO amplitude range of +14.5 to +16 dBm; ±3.0 dB with LO amplitude range of +16 to +18 dBm
11970V/W	±2.6 dB with LO amplitude range of +14.5 to +16 dBm; ±3.2 dB with LO amplitude range of +16 to +18 dBm
Nominal RF input SWR	
11970A/Q/U	< 2.2:1
11970V/W	< 2.6:1
Bias requirements	None.
Nominal odd-order suppression	
11970A/Q/U	> 20 dB
11970V/W	> 15 dB
Maximum CW RF input level	+20 dBm (100 mW)
Maximum peak pulse power	+24 dBm (250 mW) with < 1 μs pulse (average power +20 dBm)



Nominal performance, as noted in the following tables, while not warranted, provides information useful in applying the device

### 11970 Series tested with Keysight PSA spectrum analyzers

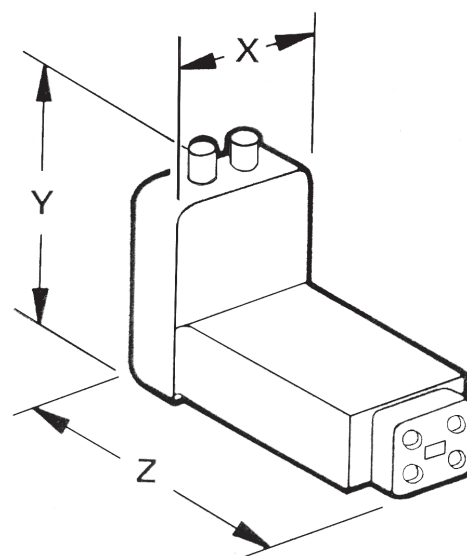
Keysight model number	Frequency range (GHz)	LO harmonic number	Maximum conversion loss (dB)	Nominal spectrum analyzer noise (dBm) 1 kHz BW	Frequency response (dB)	Temperature Coefficient 28 °C–55 °C
11970K	18 to 26.5	6-	24	-105	±1.9	-3
11970A	26.5 to 40	8-	26	-102	±1.9	-5
11970Q	33 to 50	10-	28	-101	±1.9	-7
11970U	40 to 60	10-	28	-101	±1.9	-7
11970V	50 to 75	14-	40	-92	±2.1	-3
11970W	75 to 110	18-	46	-85	±3.0	-1

1. An LO power of between 14.5 to 16 dBm at the mixer's LO input is necessary to achieve the given frequency response and spectrum analyzer amplitude accuracy specifications. When LO power varies between 14 to 18 dBm at the mixer's LO input, add ±1 dB to the frequency response and spectrum analyzer amplitude accuracy specification.

## 11970 Series tested with Keysight PXA spectrum analyzers

Keysight model number	Frequency range (GHz)	LO harmonic number <sup>1</sup>	Maximum conversion loss (dB)	Nominal spectrum analyzer noise (dBm) <sup>2</sup> 1 kHz BW	Frequency response (dB)	Nominal gain compression (dBm)
11970A	26.5 to 40	6-/8-	26	-110/-108	±1.9	-5
11970Q	33 to 50	8-/10-	28	-108/-106	±1.9	-7
11970U	40 to 60	10-	28	-106	±1.9	-7
11970V	50 to 75	12-/14-	40	-96/-94	±2.1	-3
11970W	75 to 110	18-	46	-88	±3.0	-1

Keysight model number	Flange	Weight	X	Y	Z
11970K	UG-595/U	0.17 kg	36 mm	51 mm	90 mm
	WR-42	0.36 lb	1.4 in	2.0 in	3.5 in
11970A	UG-599/U	0.14 kg	36 mm	51 mm	71 mm
	WR-28	0.32 lb	1.4 in	2.0 in	2.8 in
11970Q	UG-383/U	0.14 kg	36 mm	51 mm	76 mm
	WR-22	0.32 lb	1.4 in	2.0 in	3.0 in
11970U	UG-383/U-M	0.14 kg	36 mm	51 mm	76 mm
	WR-19	0.32 lb	1.4 in	2.0 in	3.0 in
11970V	UG-385/U	0.14 kg	36 mm	51 mm	76 mm
	WR-15	0.32 lb	1.4 in	2.0 in	3.0 in
11970W	UG-387/U	0.14 kg	36 mm	51 mm	76 mm
	WR-10	0.32 lb	1.4 in	2.0 in	3.0 in



## Ordering Information

11970K*	18 to 26.5 GHz mixer
11970A	26.5 to 40 GHz mixer
11970Q	33 to 50 GHz mixer
11970U	40 to 60 GHz mixer
11970V	50 to 75 GHz mixer
11970W	75 to 110 GHz mixer

## Options

11970X-009	Mixer connection kit containing three 1-meter SMA cables, wrench, and allen driver. Note: X = K, A, Q, U, V or W
11970X-C01	Improved EMC radiated susceptibility. Note: X = K, A, Q, U, V or W
N9029A-E13**	Ordering convenience for one OML INC. LO/IF diplexer with cables and adapter

\* Not compatible with N9030A PXA

\*\* Required if the 11970 mixer is used with the Keysight PXA

## Warranty and Service

Standard warranty for 11970 mixers is 12 months

Standard warranty for N9029A-E13 diplexer is 3 months, provided by OML, Inc.

- When used with 11970 Series mixer in A-, Q-, or V-band, the PXA's LO harmonics are automatically switched between two different numbers as listed to optimize conversion loss.
- If the LO harmonics are switched, the noise levels for the signal analyzer/mixer combination will change, corresponding to the different LO harmonic numbers.

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