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Agilent 11974 Series Preselected Millimeter Mixers

RF Sections Available in Four Bands from 26.5 to 75 GHz

Data Sheet



For the first time, preselected signal analysis is available to 75 GHz. With preselection, you can quickly and easily characterize all signals of interest. No images or multiples are displayed to confuse the measurement. Time consuming signal-identification routines are eliminated.

Figure 1 shows how true signals can be obscured by displayed multiples and images in an unpreselected system. Figure 2 shows how only the true signals are displayed when an Agilent Technologies 11974 Series preselected millimeter mixer is used in making the measurement.

Whether your millimeter-frequency application is component or system testing, signal surveillance or EMI measurements, your software development and verification time will be reduced and your measurement times will be decreased. Simply place a marker on a signal—all responses are real—and perform a preselector peak. The analyzer then displays the amplitude and frequency of the signal. No time is lost creating and running signal identification routines, which used to be required to separate true responses from multiples and images.

Each 11974 Series preselected millimeter mixer is characterized for conversion loss versus frequency. Calibration accuracy ranges from 1 dB at 26.5 GHz to 2 dB at 75 GHz. Just enter the conversion loss data into your host spectrum analyzer and then make amplitude-calibrated measurements.

Choose your host spectrum analyzer

Agilent 11974 Series preselected millimeter mixers are compatible with Agilent's 8566B, 8560 Series and E4407B of rugged portables[1], 70000 Series modular spectrum analyzers and the E4440A/46A/48A PSA Series[1].

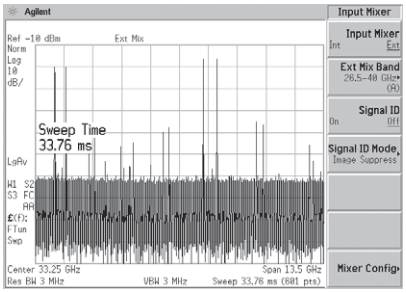


Figure 1.

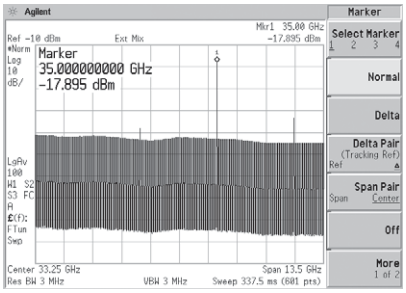


Figure 2.

1. *Requires Option AYZ (external mixing).*

Agilent Technologies

Added Benefits of Preselected Millimeter Measurements

Reduced overload from many signals

Preselected millimeter mixers reduce susceptibility to overloading by numerous signals. Overloading can cause your measurements to be uncalibrated.

System amplitude accuracy

Millimeter preselection improves system amplitude accuracy by reducing the level of local oscillator (LO) emissions back to the device under test. Option 001 further improves system amplitude accuracy by adding an isolator in front of the input filter. With Option 001, the RF input VSWR is <1.6:1 in A, Q, and U bands and <2.3:1 in V Band.

System configuration

To operate your 11974 Series preselected millimeter mixer, simply connect the tune+span output, local oscillator output,[1] and the IF input of the spectrum analyzer to the mixer. Select the appropriate analyzer using the switch on the rear panel of the mixer. Make two easy adjustments, and you're ready to make millimeter measurements.

The 11974 Series connect to a standalone power supply with a convenient 6-foot cable. Use the same power supply with any 11974 Series preselected mixer.

A full set of upgrade kits is available to ensure compatibility with your existing spectrum analyzers including Agilent 8560A, 8561A/B, 8562A/B, 8566A/B, and E4440A/46A/48A PSA Series. Refer to the compatibility table to determine whether your spectrum analyzer requires an upgrade.

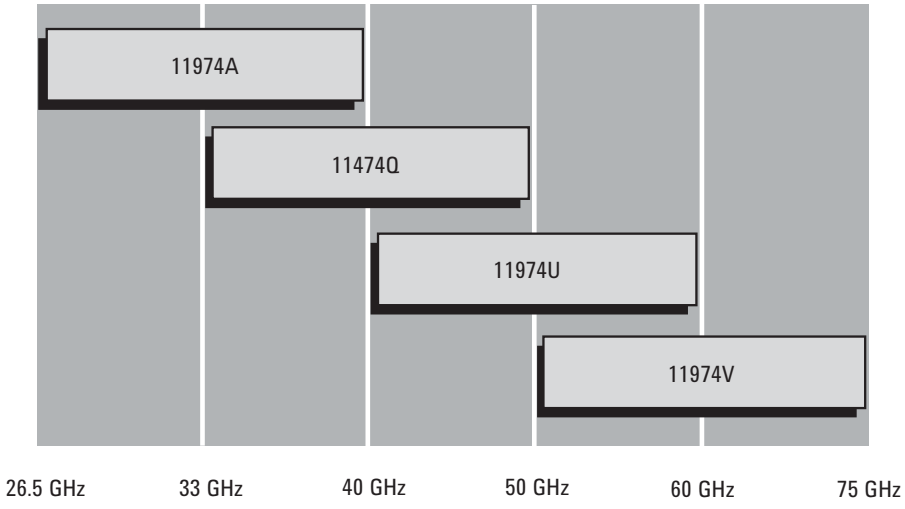
All versions of 8563A spectrum analyzers and 70907B external mixer interface modules are fully compatible with the 11974 Series.

Greater dynamic range

Preselection improves dynamic range when signals are sufficiently spaced. The preselector allows only one of these signals to reach the mixer at a time. So internally produced distortion products, such as third order intermodulation, are reduced.

Ease of use

Operators no longer need to learn techniques of signal identification. Anyone familiar with preselected microwave spectrum analyzers can quickly and easily make millimeter measurements. Spurs from a device under test are easily found. They are not hidden by images or multiple responses.



1. Operation with 8566B spectrum analyzers requires the use of an 11975A LO amplifier to provide sufficient local oscillator power to the 11974 Series LO input.

Specifications

Unless noted, all specifications describe warranted performance under the following conditions: 5-minute warm-up from ambient conditions; 1-year calibration cycle; environmental requirements met; IF and LO connections between the Agilent 11974 and a compatible spectrum analyzer are made with one length of coax cable (part number 5061-5458). Typical performance is non-warranted. Supplemental characteristics are denoted by "nominal"; these constitute non-warranted functional performance information derived during the design process and are not tested on a continuing basis.

Frequency

Frequency range
(LO harmonic number)

11974A (n = 8)	26.5 GHz to 40 GHz
11974Q (n = 10)	33 GHz to 50 GHz
11974U (n = 10)	40 GHz to 60 GHz
11974V (n = 14)	50 GHz to 75 GHz

Preselector bandwidth
(3 dB points)

	Minimum	Typical
11974A	80 MHz	130 MHz
11974Q	100 MHz	150 MHz
11974U	100 MHz	150 MHz
11974V	100 MHz	200 MHz

Center frequency accuracy, residual FM, span accuracy
Using specifications of the spectrum analyzer, evaluate characteristics with reference to the harmonic numbers listed below.

	Harmonic number
11974A	n = 8
11974Q	n = 10
11974U	n = 10
11974V	n = 14

Amplitude

Displayed average noise level
Spectrum analyzers: 8566B, 71000C, PSA Series (RBW = 10 Hz)

	Maximum	Typical
11974A	–111 dBm	–118 dBm
11974Q	–106 dBm	–116 dBm
11974U	–109 dBm	–117 dBm
11974V	–100 dBm	–109 dBm

Displayed average noise level
Spectrum analyzers: 8563A/62A/61B/60A (RBW = 300 Hz)[1]

	Maximum	Typical
11974A	–96 dBm	–103 dBm
11974Q	–91 dBm	–101 dBm
11974U	–94 dBm	–104 dBm
11974V	–85 dBm	–94 dBm

Maximum conversion loss
RF to IF port (includes 1-m IF cable, part number 5061-5458)

11974A	44 dB
11974Q	46 dB
11974U	43 dB
11974V	57 dB

Conversion loss chart accuracy
20 °C to 30 °C: RSS of calibration equipment errors (Add 0.7 dB if used with 8563A/62A/61B/60A.)

0 °C to 55 °C: RSS of calibration equipment errors plus worst-case temperature effects of 11974 (Add 0.7 dB if used with 8563A/62A/61B/60A.)

	0 °C to 55 °C	20 °C to 30 °C
11974A	≤ ±2.3 dB	≤ ±1.0 dB
11974Q	≤ ±2.3 dB	≤ +1.0 dB
11974U	≤ ±2.6 dB	≤ +1.1 dB
11974V	≤ ±4.5 dB	≤ ±2.0 dB

Amplitude

Image rejection (image positioned 2x fIF above tuned response)
Spectrum analyzers: 8566B, 71000C, PSA Series

	0 °C to 55 °C	20 °C to 30 °C
11974A	≤ –54 dBc	≤ –59 dBc
11974Q	≤ –50 dBc	≤ –55 dBc
11974U	≤ –50 dBc	≤ –55 dBc
11974V (50 to 67 GHz)	≤ –50 dBc	≤ –55 dBc
11974V (67 to 75 GHz)	≤ –40 dBc	≤ –45 dBc

Image rejection (image positioned 2x fIF above tuned response)
Spectrum analyzers: 8563A/62A/61B/60A

	0 °C to 55 °C	20 °C to 30 °C
11974A	≤ –50 dBc	≤ –55 dBc
11974Q	≤ –45 dBc	≤ –50 dBc
11974U	≤ –45 dBc	≤ –50 dBc
11974V (50 to 67 GHz)	≤ –45 dBc	≤ –50 dBc
11974V (67 to 75 GHz)	≤ –35 dBc	≤ –40 dBc

Multiple response
(Due to in-range applied signals mixing with LO harmonics other than order n)

11974A (n = 8)	≤ –63 dBc
11974Q (n = 10)	≤ –60 dBc
11974U (n = 10)	≤ –60 dBc
11974V (n = 14)	
(applied signal: 50 to 67 GHz)	≤ –60 dBc
(applied signal: 67 to 75 GHz)	≤ –55 dBc

1 dB gain compression (nominal)

11974A	≥ +6 dBm
11974Q	≥ 0 dBm
11974U	≥ 0 dBm
11974V	≥ +3 dBm

1. *The minimum usable resolution bandwidth of the 8563A/61B/60A in external mixing mode is 300 Hz. The 8562A can be used with its minimum resolution band width of 100 Hz in external mixing mode.*

Specifications

Amplitude

Third-order intercept (nominal)
(For two signals spaced less than 200 MHz apart)

11974A	≥ +13 dBm
11974Q	≥ +13 dBm
11974U	≥ +13 dBm
11974V	≥ +13 dBm

IF subharmonic response (nominal)
Intercept (2nd order; response at $f_{IF}/2$ above input signal)

$f_{IF}/2$ = 160.7 MHz (8566B/71000C)

$f_{IF}/2$ = 155.35 MHz (8563A/62A/61B/60A)

11974A	≥ +45 dBm
11974Q	≥ +45 dBm
11974U	≥ +45 dBm
11974V	≥ +30 dBm

Dynamic range

Refer to Figure 3

Inputs and outputs (all values are nominal)

RF input
Waveguide size, flange type

	Size	Flange
11974A	WR-28	UG 599/U
11974Q	WR-22	UG 383/U
11974U	WR-19	UG 383/U-M
11974V	WR-15	UG 385/U
Maximum RF input level (CW, peak, or average)	+25 dBm	
VSWR (at peak of preselector filter)	< 3.0:1	

Inputs and outputs (all values are nominal)

LO input

Connector type	SMA (f)
Frequency range	
11974A	3.3 GHz to 5 GHz
11974Q	3.3 GHz to 5 GHz
11974U	4 GHz to 6 GHz
11974V	3.5 GHz to 5.3 GHz
Maximum LO input level	+14.5 dBm to 16 dBm
VSWR	< 2.0:1 (50 Ω)

IF output

Connector type	SMA (f)
Match	< 1.6:1 (50 Ω)

Tune + span input

Connector type	BNC (f)

Options

Option 001: Input isolator attached and included in calibration. An input isolator provides a specified broadband RF input match. This is important when the device under test requires protection from out-of-band reflections off the 11974's input tracking filter. With Option 001, the 11974 conversion loss is calibrated with the input isolator in place so that system amplitude accuracy is maintained.

Specifications changes for Option 001

Amplitude

Displayed average noise level and maximum conversion loss: Add +2 dB to the standard specifications for A, Q, and U bands; add +3 dB for V band.

RF input VSWR
(across full waveguide band)

11974A, Q, U	< 1.6:1
11974V	< 2.3:1

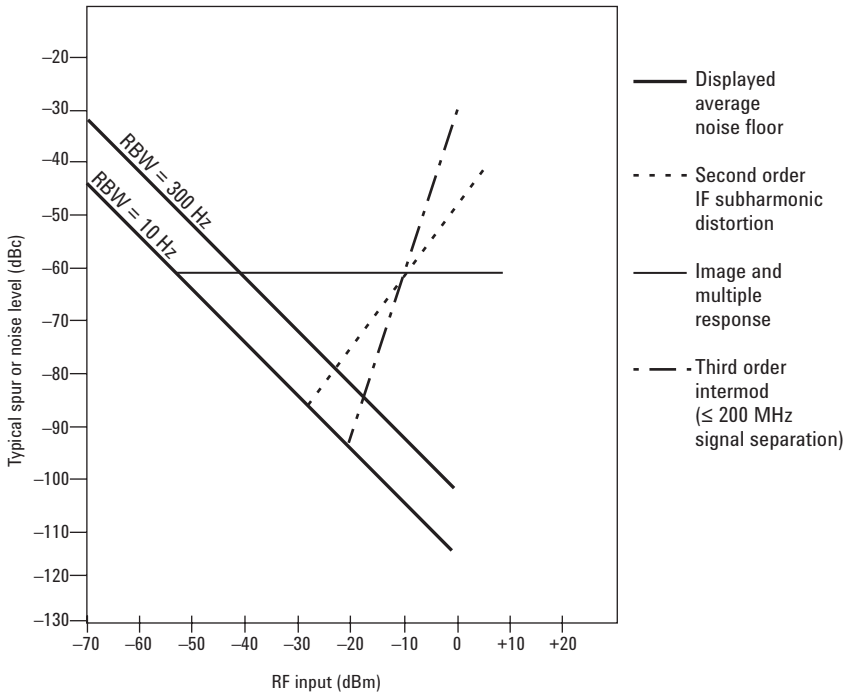


Figure 3. Agilent 11974A system dynamic range

Specifications

General specifications

Environmental specifications type tested to MIL-T-28800C, Class 5 environmental conditions as listed below:

Temperature	
Non-operating	–40 °C to +75 °C
Operating	0 °C to +55 °C

Relative humidity
95% ± 5% up to +40 °C

Altitude	
Non-operating	< 12,195 m (< 40,000 feet)
Operating	< 3,048 m (< 10,000 feet)

Maximum vibration level	
5 Hz to 55 Hz	2 g

Maximum shock
30 g

Electromagnetic compatibility
Meets radiated and conducted emissions of MIL-STD-461B, Part 7, methods CE03 (Air Force) and RE02, FTZ 526/527/79

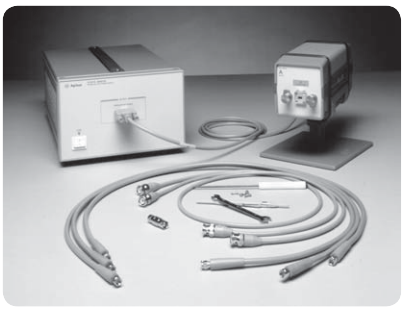
General specifications

Power requirements: 11974-60028 power supply (nominal)

Output	+50 V, 0.6 A dc ±15 V, 0.2 A dc
Input	100/120/220/240 V ac 50 to 60 Hz
Power consumption	130 VA maximum
Max. power dissipation	
11974 Series	35 W
11974-60028	25 W

Weight (nominal)	
11974 Series	6.5 kg (14.3 lb)
11974-60028 preselector power supply	11.9 kg (26.21 lb)

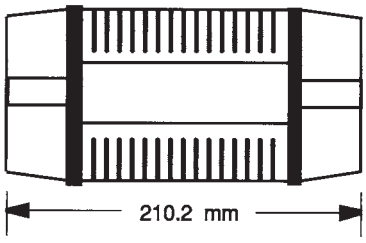
Dimensions (nominal)	
11974 Series	210.2 mm (8.3″) x 84.7 mm (3.3″) x 101.5 mm (4.0″)
11974-60028 preselector power supply	346.1 mm (13.6″) x 212.7 mm (8.4″) x 133.4 mm (5.25″)

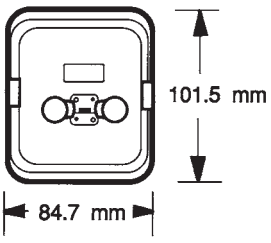


Accessories supplied

The following is a list of all accessories and their part numbers supplied at shipment:

Accessory description	Part number
Power supply	11974-60028
Ball Driver, 3/32 inch	8710-1539
Wrench, 5/16 inch	8710-0510
Alignment tool	8710-0630
Four standard #4-40 screws for A band	3030-0221
Captive screws for Q, U, and V bands, 4 each	1390-0671
3 cables with SMA (m) connectors (1 m)	5061-5458
1 cable with BNC (m) connectors (48 inches)	8120-1839
1 cable with BNC (m) connectors (24 inches)	8120-2582
1 adapter with BNC (f) connectors	1250-0080
1 stand for the 11974	83556-60010







Compatibility Information

The following table lists compatibility requirements of host spectrum analyzers. Installation by a service center or personnel qualified by Agilent is required for the E4440A, E4446A, E4448A, and E4407B Option AYZ upgrade kits.

70000 modular measurement system with 70907 external mixer interface module

Model	S/N prefix	Compatibility kit
70907A	all	70907A-K74 upgrade kit required[1]
70907B	all	Fully compatible provided 70900A/B LO meets the following requirements: **Firmware date code YYMMDD** — **LO upgrade kit required** 850730 — 70907B-098 860203 — (Firmware + CPU) 861015 — 70907B-099 870501 — (Firmware only) 880314 880901 890606 — Fully compatible

Rugged portable spectrum analyzers

Model	S/N prefix	Compatibility kit
8560A	< 3003A	8560A-K74 upgrade kit required[2]
8560A	≥ 3003A	Fully compatible[2]
8561A	all	8561A-K74 upgrade kit required[3]
8561B	< 3003A	8561 B-K74 upgrade kit required
8561B	≥ 3003A	Fully compatible
8562A/B	all	8562A-K74 upgrade kit required[3]
8560E/EC	all	Fully compatible
8561E/EC	all	Fully compatible
8562E/EC	all	Fully compatible
8563A/E/EC	all	Fully compatible
E4407B[5]	all	Fully compatible

PSA Series with Option AYZ

Model	S/N prefix	Compatibility kit
E4440A/46A/48A	all	Fully compatible

8566A/B with 11975A LO amplifier

Model	S/N prefix	Compatibility kit
8566A	< 2007A[4]	No upgrade kit available
8566A	≥ 2007A[4]	8566AB conversion kit previously installed: Firmware datecode < 89.10.10: 8566B-K74 upgrade kit required Firmware datecode ≥ 89.10.10: 8566B-K75 upgrade kit required 8566AB conversion kit NOT previously installed: (two kits required) 8566AB conversion kit, 8566B-K75 upgrade kit
8566B	< 2948[4]	8566B-K74 upgrade kit required
8566B	≥ 2948[4]	Fully compatible

1. *Mixer bias capability is converted to preselector peak, resulting in activation of a preselector peaking with the BIAS PEAK function. Sweep times must be manually controlled in wide spans to avoid oversweeping the preselector.*
2. *External mixing is not available with the 8560EC if a built-in tracking generator, Option 8560EC-002, has been installed.*
3. *Operation with 11974 Series will require entry of a frequency offset. Preselector peaking is performed manually with a screwdriver adjustment. Sweep times must be manually controlled in wide spans to avoid oversweeping the preselector.*
4. *The serial number prefix on the 8566A/B refers to the RF section.*
5. *Requires Option AYZ (external mixing).*

Ordering Information

11974A 26.5 to 40 GHz

11974Q 33 to 50 GHz

11974U 40 to 60 GHz

11974V 50 to 75 GHz

Option 11974X-001: Input isolator attached and included in calibration (Note: X = A, Q, U or V)

Option 11974X-003: Exclusion of power supply (Note: X = A, Q, U or V)

5062-3989: Front handle kit for power supply

5062-3957: Rack mount kit with extended flange for power supply (half-width)

Warranty and service

Standard warranty is 12 months.

Option R-51B: Return-to-Agilent warranty and service

Calibration

R-50C-001: Standard calibration

R-50C-002: Standard compliant calibration

Compatible spectrum analyzers

E4440A 3 Hz to 26.5 GHz high-performance

E4446A 3 Hz to 44 GHz high-performance

E4448A 3 Hz to 50 GHz high-performance

8560EC 2.9 GHz rugged portable

8561EC 6.5 GHz rugged portable

8562EC 13.2 GHz rugged portable

8563EC 26.5 GHz rugged portable

8564EC 40 GHz rugged portable

8565EC 50 GHz rugged portable

E4407B 26.5 GHZ rugged portable

71100C 2.9 GHz modular

71200C 22/26.5 GHz modular

71210C 22 GHz modular

70907B external mixer interface module

8566B 22 GHz benchtop

11975A LO amplifier

Note: An 8562A can be made hardware compatible with the 11974 Series by installing the 8562A-K74 upgrade kit. Limitations of using an 8562A with the 11974 Series are indicated in footnote 1 below.

Other related accessories available from Agilent Technologies:

281A/B waveguide with 2.4-mm coax adapters

382A attenuators for R, Q, and U bands only

373D/G 20/50 dB fixed attenuators

370A/B/C 3 dB, 6 dB, and 10 dB fixed attenuators for Q and U bands only

800 Series waveguide bends, twists, and straight sections

365A Series waveguide isolators for R, Q, U, and V bands

1. *Operation with 11974 Series will require entry of a frequency offset. Preselector peaking is performed manually with a screwdriver adjustment. Sweep times must be manually controlled in wide spans to avoid oversweeping the preselector.*

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