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User's Guide

11974 Series Preselected Millimeter Mixers



Manufacturing Part Number: 11974-90012
Supersedes 11974-90010
Printed in USA
October 2003

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This guide uses the following conventions:

Instrument Key This represents a key physically located on the instrument, or a key with a label that is determined by the instrument firmware.

`Screen Text` This indicates text displayed on the spectrum analyzer screen.

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1 General Information

Introduction

The *11974 Series Preselected Millimeter Mixers Installation, Verification, and Operation Manual* describes how to configure an 11974 in a system, what to do to verify its performance, and how to operate an 11974.

This manual contains the following chapters:

- Chapter 1, "General Information," provides a quick overview of the 11974 Series Preselected Millimeter Mixer and all operating specifications and characteristics tables.
- Chapter 2, "Installation," describes power requirements, spectrum-analyzer compatibility, installation requirements, packaging information, and the Agilent Technologies Sales and Service Office listing.
- Chapter 3 , "Operation," describes operating precautions, operating hints, and complete operating procedures with the most commonly-used spectrum analyzers.
- Chapter 4, "Performance Tests," provides the tests to verify the electrical performance of the 11974 Series mixers.
- Chapter 5, "Safety and Regulatory Information," provides safety warnings and cautions, explanations of the various symbols appearing on the instrument, regulatory compliance information.

What You'll Find in this Chapter

This chapter introduces you to the 11974 Series Preselected Millimeter Mixers and provides other general information regarding the 11974 Series. This chapter contains the following topics:

- "11974 Series Preselected Millimeter Mixers Overview" on page 10.
- "Accessories Supplied" on page 11.
- "Specifications and Characteristics" on page 14.
- "Calibration Cycle" on page 13.

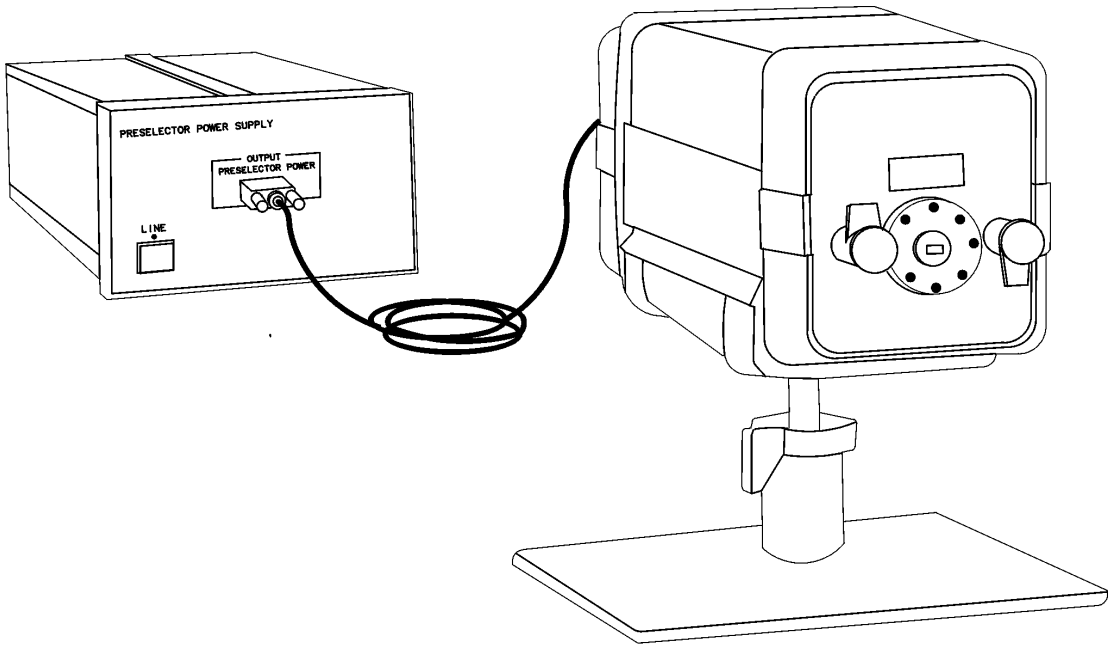
11974 Series Preselected Millimeter Mixers Overview

The 11974 Series Preselected Millimeter Mixers are preselected RF front-end sections used to extend the frequency range of the Agilent Technologies high performance, portable, and modular spectrum analyzers. The 11974 Series are fully calibrated, system compatible, and cover a frequency range from 26.5 to 75 GHz in four waveguide bands — A, Q, U, and V. Control of the 11974 is provided by the host spectrum analyzer's sweep ramp and first local-oscillator output. The 11974 is packaged as an external module with flexible cables to the spectrum analyzer in order to facilitate connection to the waveguide device under test.

The tracking preselector of the 11974, based on barium hexa-ferrite technology, eliminates the image and multiple harmonic responses that clutter the spectrum display. The tracking preselector in front of the harmonic mixer eliminates the need for the time-consuming process of signal identification.

A stand-alone power supply provides the tuning current for the filter. The included accessory kit contains the cables and tools necessary to make connections to the host spectrum analyzer.

Figure 1-1 11974 Series with a Power Supply



Options Available

Input Isolator (Option 001) This option provides an 11974 Series Preselected Millimeter Mixer that has been calibrated with an isolator attached to the RF input. The addition of the isolator improves input match, reducing measurement uncertainties and protects the device under test (DUT) from off-resonant reflections from the input tracking filter.

Accessories Supplied

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

Accessory Description	Part Number
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 (1.0 m)	5061-5458
1 Cable with BNC (m) Connectors (24 inches)	8120-1839
1 Cable with BNC (m) Connectors (48 inches)	8120-2582
1 Adapter with BNC (f) Connectors	1250-0080
1 Stand for the 11974	83556-60010
1 Conversion-Loss Data Disk	*Custom for each mixer*

Other related accessories available from Agilent Technologies are:

Accessory Description	Part Number
Waveguide with 2.4 mm coax adapters	281C
Attenuators for R, Q, and U bands only	382A
20/50 dB Fixed Attenuators	373D/G
3 dB, 6 dB, and 10 dB Fixed Attenuators for Q and U bands only	370A/B/C
Waveguide bends, twists, and straight sections	800 Series
Waveguide isolators for R, Q, U, and V bands	365A Series
Rack mounting flange for power supply	5062-3957

Serial Numbers Covered by This Manual

This manual applies to 11974 Series Preselected Millimeter Mixers with the serial number prefixes 3001A and above.

Agilent Technologies makes frequent improvements to its products to enhance their performance, usability, or reliability. Agilent Technologies service personnel have access to complete records of design changes to each type of equipment, based on the equipment's serial number. Whenever you contact Agilent Technologies about your 11974, have the complete serial number available to ensure that you are obtaining the most complete and accurate information possible.

The serial number label is attached to the rear of the 11974. The serial number has two parts: the prefix (the first four numbers and a letter), and the suffix (the last five numbers). See Figure 1-2.

The first four numbers of the prefix are a code identifying the date of the last major design change incorporated in your unit. The letter identifies the country in which the unit was manufactured. The five-digit suffix is a sequential number and is different for each unit. Whenever you list the serial number or refer to it in obtaining information about your 11974, be sure to use the complete number, including the full prefix and the suffix.

Figure 1-2 Typical Serial Number Label



Calibration Cycle

Use the performance tests in Chapter 4 every 12 months to check the unit against the specifications listed in Table 1-1 on page 15.

Specifications and Characteristics

Table 1-1 lists the specifications for the 11974 Series Preselected Millimeter Mixers. Unless stated otherwise, all specifications describe the warranted performance of the 11974 under the following conditions:

- Five minute warm-up for ambient conditions.
- Ambient temperature 0°C to 55°C.
- One year calibration cycle.
- Environmental requirements met.
- Connections to the host spectrum analyzer are made with one length of coax cable, part number 5061-5458.
- The 11974 is used with the following spectrum analyzers:
  - ❏ E4440A, E4446A, E4448A PSA Series with Option AYZ installed.
  - ❏ E4407A with Option AYZ installed.
  - ❏ 8560 Series.
  - ❏ 71000C with 70907B External Mixer Interface Module.
  - ❏ 8566B with 11975A Amplifier.

Characteristics provide useful, but nonwarranted, information in the form of typical, nominal, or approximate values for band performance. Refer to Table 1-2 on page 19 for a list of band characteristics.

Table 1-1 11974 Specifications

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
RF Preselector Bandwidth (3 dB points)			
	Typical		**Min.**
11974A	130 MHz		80 MHz
11974Q	150 MHz		100 MHz
11974U	150 MHz		100 MHz
11974V	200 MHz		100 MHz
AMPLITUDE MEASUREMENT RANGE			
Displayed Average Noise Level			
Host Spectrum Analyzers: 8566B/11975A, 71000C/70907B, PSA Series E4440A			
(RBW = 10 Hz)			
11974A	–111 dBm max.		
11974Q	–106 dBm max.		
11974U	–109 dBm max.		
11974V	–100 dBm max.		
Option 001			
11974A	–109 dBm max.		
11974Q	–104 dBm max.		
11974U	–107 dBm max.		
11974V	–97 dBm max.		
Host Spectrum Analyzers: 8560 Series Portable Spectrum Analyzers			
(RBW = 300 Hz)			
11974A	–96 dBm max.		
11974Q	–91 dBm max.		
11974U	–94 dBm max.		
11974V	–85 dBm max.		
Option 001			
11974A	–94 dBm max.		
11974Q	–89 dBm max.		
11974U	–92 dBm max.		
11974V	–82 dBm max.		

Table 1-1 11974 Specifications (Continued)

Conversion Loss		
RF to IF port (includes 1 m IF cable, part number 5061-5458)		
11974A	44 dB max.	
11974Q	46 dB max.	
11974U	43 dB max.	
11974V	57 dB max.	
RF Input Match (across full waveguide band)		
Option 001 only		
11974A, Q, U	<1.6:1	
11974V	<2.3:1	
Conversion Loss Chart Accuracy		
20°C to 30°C: RSS of calibration equipment errors (Add 0.7 dB if used with 8560 Series Portable Spectrum Analyzers.)		
0°C to 55°C: RSS of calibration equipment errors plus worst-case temperature effects of 11974 (Add 0.7 dB if used with 8560 Series Portable Spectrum Analyzers.)		
	0°C to 55°C	**20°C to 30°C**
11974A	±2.3 dB max.	±1.0 dB max.
11974Q	±2.3 dB max.	±1.0 dB max.
11974U	±2.6 dB max.	±1.1 dB max.
11974V	±4.5 dB max.	±2.0 dB max.
Image Rejection		
(Image positioned 2x f_{IF} above tuned response)		
Host Spectrum Analyzers: 8566B/11975A, 71000C/70907B, PSA Series E4440A		
	0°C to 55°C	**20°C to 30°C**
11974A	–54 dBc max.	–59 dBc max.
11974Q	–50 dBc max.	–55 dBc max.
11974U	–50 dBc max.	–55 dBc max.
11974V (50 to 67 GHz)	–50 dBc max.	–55 dBc max.
11974V (67 to 75 GHz)	–40 dBc max.	–45 dBc max.
Host Spectrum Analyzers: 8560 Series Portable Spectrum Analyzers		
11974A	–50 dBc max.	–55 dBc max.
11974Q	–45 dBc max.	–50 dBc max.
11974U	–45 dBc max.	–50 dBc max.
11974V (50 to 67 GHz)	–45 dBc max.	–50 dBc max.
11974V (67 to 75 GHz)	–35 dBc max.	–40 dBc max.

Table 1-1 11974 Specifications (Continued)

Multiple Response [a]	
(Due to in-range applied signals mixing with LO harmonics other than order *N*)	
11974A (*N* = 8)	–63 dBc max.
11974Q (*N* = 10)	–60 dBc max.
11974U (*N* = 10)	–60 dBc max.
11974V (*N* = 14) (applied signal: 50 to 67 GHz)	–60 dBc max.
11974V (*N* = 14) (applied signal: 67 to 75 GHz)	–55 dBc max.

a. Multiple response displayed frequency, f'_{RF}, due to input signal f_{RF}.

$$f'_{RF} = \left(\frac{N}{N'}\right) f_{RF} + f_{IF}\left(\frac{N' \pm N}{N'}\right)$$

where:

N = Band Harmonic number

N′ = Unwanted Harmonic

= …N–2, N–1, N+1, N+2,…

f_{IF} = 321.4 MHz for 8566B and 71000C Spectrum Analyzers

= 310.7 MHz for 8560 Series Portable Spectrum Analyzers

Table 1-1 11974 Specifications (Continued)

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 +30°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 26/527/79

Table 1-2 11974 Characteristics

Note: These are not specifications. Characteristics provide useful, but nonwarranted information about instrument performance.	
FREQUENCY	
Center Frequency Accuracy **Residual FM** **Span Accuracy**	Using Table 1-1, "11974 Specifications," for the spectrum analyzer being used, evaluate these characteristics with reference to the harmonic numbers listed below.
	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
AMPLITUDE MEASUREMENT RANGE	
Frequency Response (uncorrected) (With respect to mean value of Conversion Loss chart)	
11974A 11974Q 11974U 11974V	±4.5 dB max. ±4.0 dB max. ±4.0 dB max. ±4.0 dB max.
1 dB Gain Compression (RF Input for 1 dB increase in conversion loss)	
11974A 11974Q 11974U 11974V	+6 dBm min. 0 dBm min. 0 dBm min. +3 dBm min.
Third Order Intercept (TOI) (For two signals spaced less than 200 MHz apart)	
11974A 11974Q 11974U 11974V	+13 dBm min. +13 dBm min. +13 dBm min. +13 dBm min.

Table 1-2 11974 Characteristics (Continued)

AMPLITUDE MEASUREMENT RANGE (continued)	
IF Subharmonic Response	
Intercept (2nd Order)	
(Response at $f_{IF}/2$ above input signal)	
$f_{IF}/2$ = 160.7 MHz (8566B, 71000C, PSA Series)	
= 155.35 MHz (8560 Series Portable Spectrum Analyzer)	
11974A	+45 dBm min.
11974Q	+45 dBm min.
11974U	+45 dBm min.
11974V	+30 dBm min.
Dynamic Range	
Refer to Figure 1-3 on page 23, Figure 1-4 on page 24, Figure 1-5 on page 25, and Figure 1-6 on page 26.	
INPUTS AND OUTPUTS	
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	+25 dBm
(CW, Peak, or Average)	<3.0:1
Match (at peak of preselector)	
LO Input	
Connector Type	SMA (f)
Frequency Range	
11974A	3.3 GHz to 5.0 GHz
11974Q	3.3 GHz to 5.0 GHz
11974U	4.0 GHz to 6.0 GHz
11974V	3.5 GHz to 5.3 GHz
Optimal LO Input Level	+14.5 dBm to 16 dBm
Match	<2.0:1 (50Ω)

Table 1-2 11974 Characteristics (Continued)

INPUTS AND OUTPUTS (continued)	
IF Output	
Connector Type	SMA (f)
Match	<1.6:1 (50Ω)
Bandwidth (Total 11974 BW limited by preselector.)	Nominal >100 MHz Typical >150 MHz
Tune + Span Input	
Connector Type	BNC (f)
Sensitivity (Spectrum Analyzer Type) (PSEL PK DAC at mid-value)	
8566B/11975A 8560 Series Portable Spectrum Analyzer	-2 V/GHz $\times f_{LO} - 0.32$ V $+1.5$ V/GHz $\times f_{LO} - 0.21$ V
71000/70907B, E4407B, PSA Series	$+1.5$ V/GHz $\times f_{LO}$ V
Input Impedance	20 kΩ min.
Power Supply (11974-60028)	
Output	+50 V, 0.6 A ±15 V, 0.2 A
Input	100/110/220/240 V ac 47 Hz to 63 Hz
Power Consumption	130 VA max.

GENERAL CHARACTERISTICS

Weight

11974 Series	14.3 kg (6.5 lb)
11974-60028 Preselector Power Supply	26.2 kg (11.9 lb)
Size	Length (A) × Width (B) × Height (C)
11974 Series	210.2 mm × 84.7 mm × 101.5 mm
11974-60028 Preselector Power Supply	346.1 mm × 212.7 mm × 133.4 mm

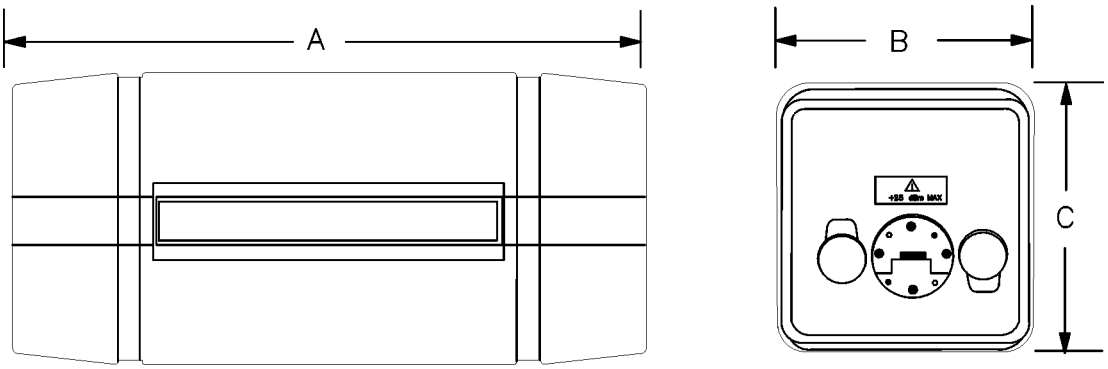
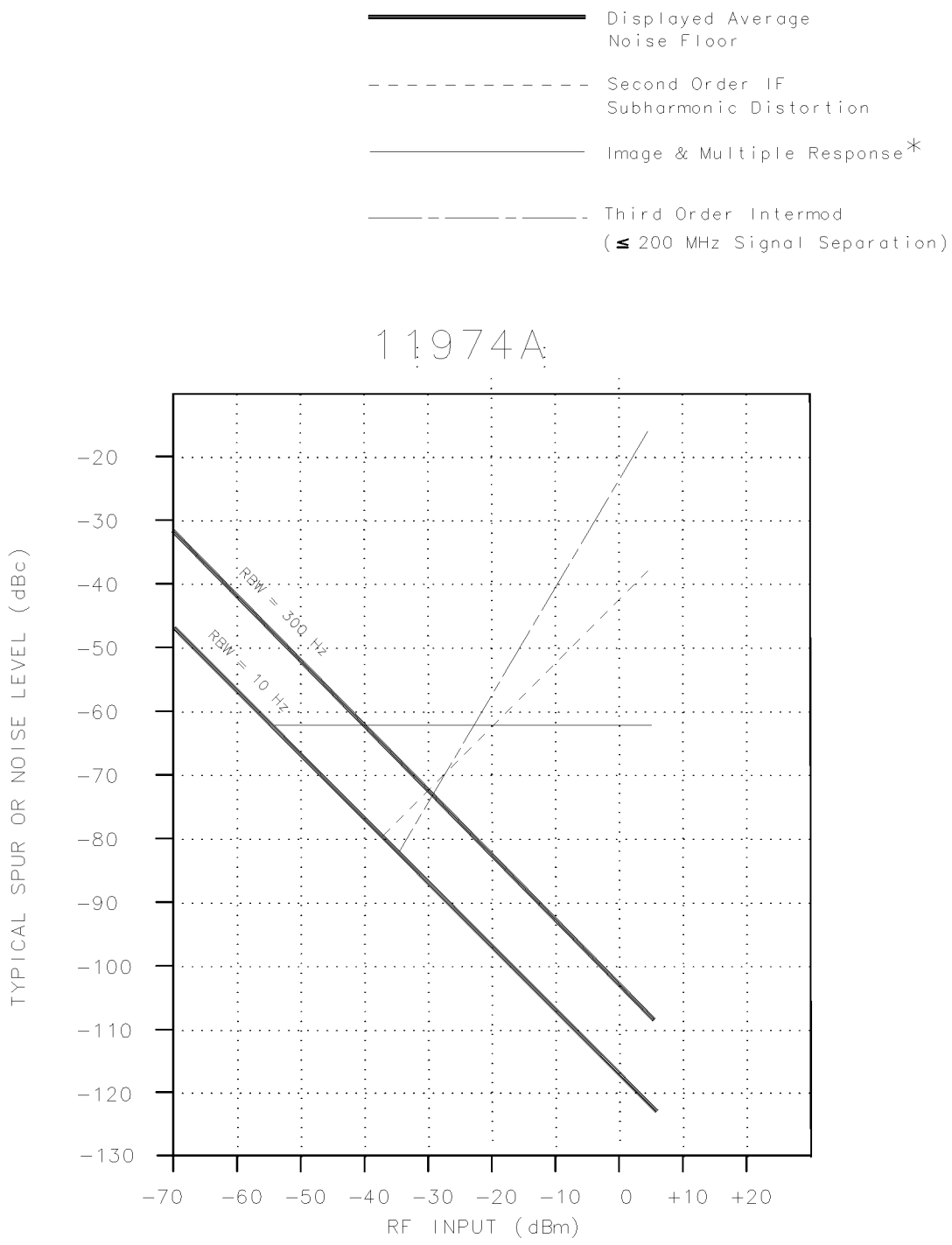


Figure 1-3 11974A Minimum System Dynamic Range



* Image Response is −58 dBc when using an HP 8563A/E, HP 8561B/E, or HP 8560A/E Spectrum Analyzer.

yg31a

Figure 1-4 11974Q Minimum System Dynamic Range

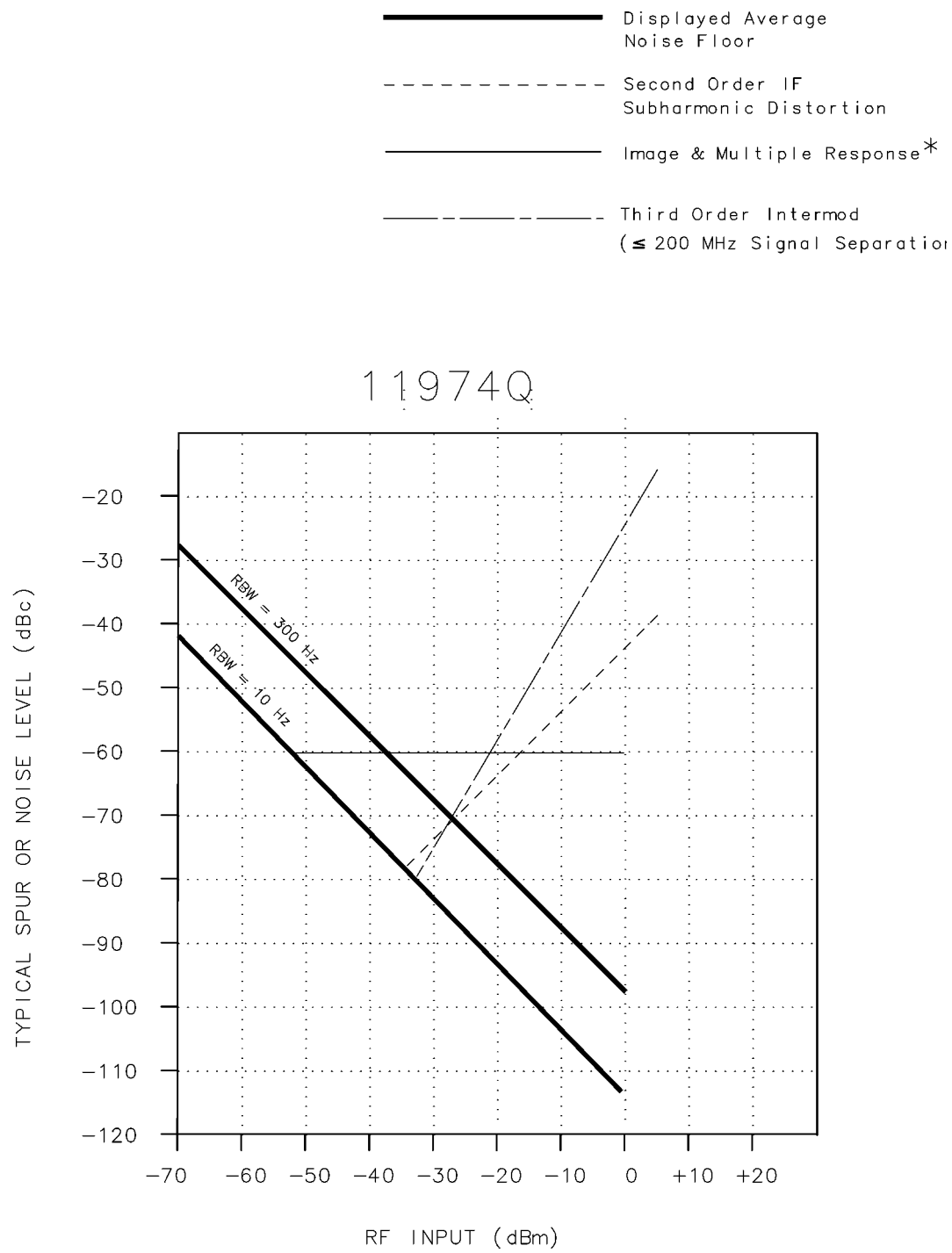


*Image Response is −57 dBc when using an HP 8563A/E, HP 8561B/E, or HP 8560A/E Spectrum Analyzer.

Figure 1-5 11974U Minimum System Dynamic Range

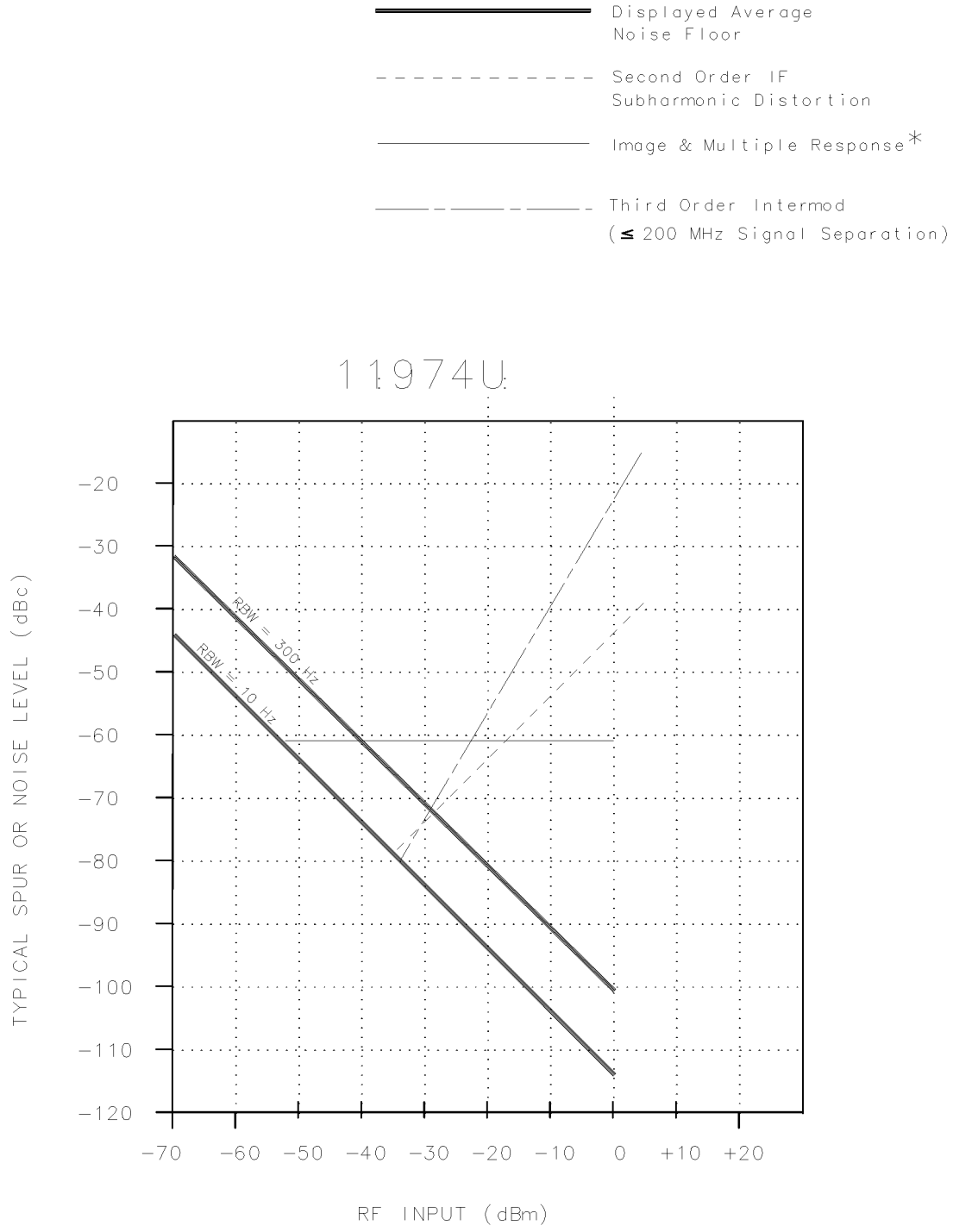
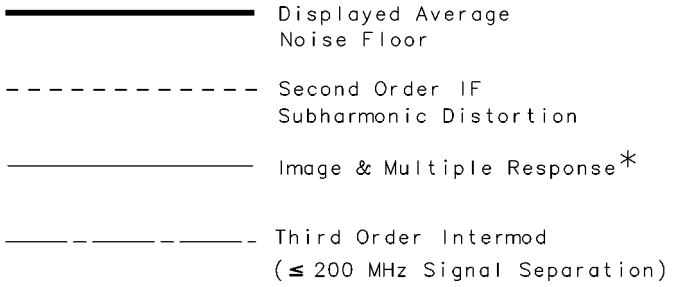


*Image Response is −56 dBc when using an HP 8563A/E, HP 8561B/E, or HP 8560A/E Spectrum Analyzer.

Figure 1-6 11974V Minimum System Dynamic Range



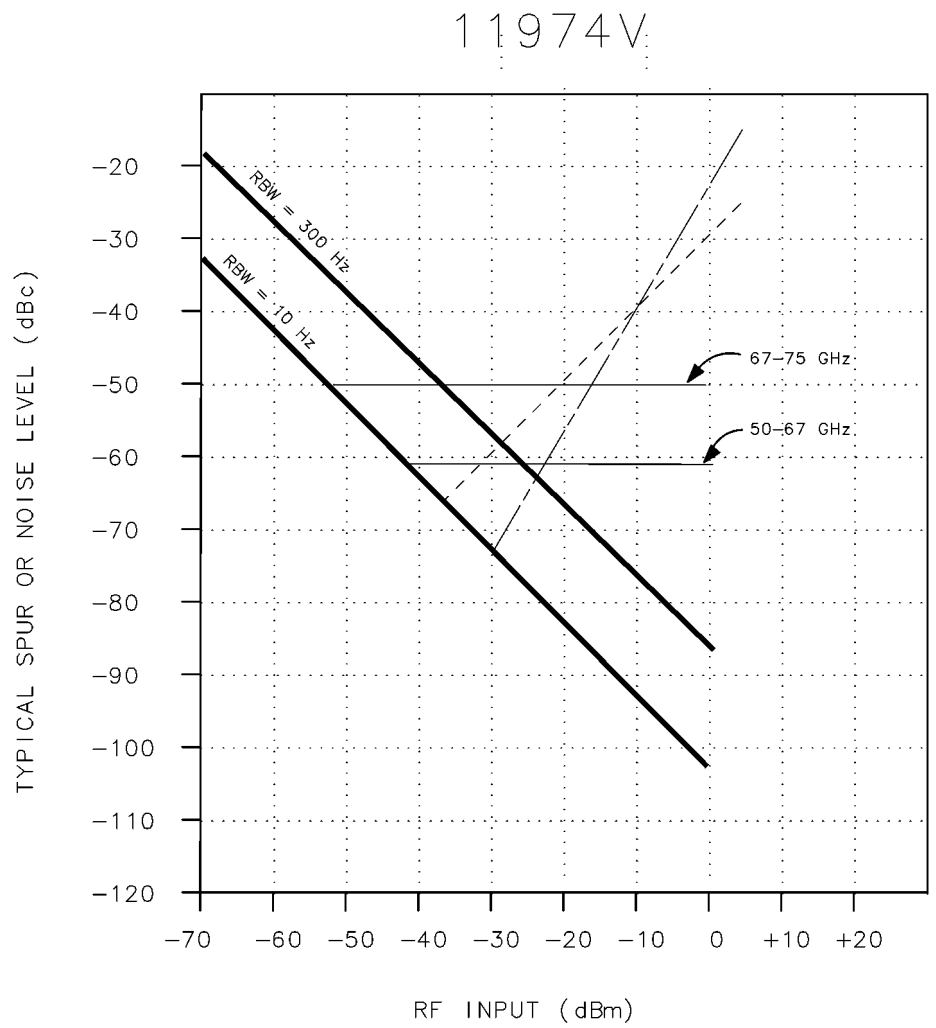


*Image Response is −54 dBc (50–67 GHz) and −35 dBc (67–75 GHz) when using an HP 8563A/E, HP 8561B/E, or HP 8560A/E Spectrum Analyzer.

2 Installation

What You'll Find in This Chapter

This chapter describes how to set up an 11974 Series Preselected Millimeter Mixer for operation. This chapter contains the following topics.

"Spectrum Analyzer Compatibility" on page 29

"Initial Inspection" on page 31

"Preparing the 11974 for Use" on page 32

- "Power Requirements" on page 33
- "Setting the Line-Voltage Selector Switch" on page 33
- "Using a Conversion-Loss Data Disk with the ESA or PSA Series Analyzers" on page 38

"Electrostatic Discharge Information" on page 39

"Returning Equipment for Service" on page 42

Spectrum Analyzer Compatibility

The 11974 Series mixers are compatible with the spectrum analyzers listed in the following table.

Table 2-1. 11974 Compatibility with Spectrum Analyzers

71000 MODULAR SPECTRUM ANALYZER WITH 70907 EXTERNAL MIXER INTERFACE MODULE		
Model	**S/N Prefix**	**Compatibility**
70907A	all	70907-K74 Upgrade Kit required (1) (2)
70907B	all	Fully compatible (3)
8560 SERIES PORTABLE SPECTRUM ANALYZER		
Model	**S/N Prefix**	**Compatibility**
8560A	<3003A	8560A-K74 Upgrade Kit required (4) (cannot be used with option 002)
8560A	≥3003A	Fully compatible with non-option 002
8560E/EC	all	Fully compatible with non-option 002
8561A	all	8561A-K74 Upgrade Kit required (1) (5)
8561B	<3003A	8561B-K74 Upgrade Kit required (4)
8561B	≥3003A	Fully compatible
8561E/EC	all	Fully compatible
8562A/B	all	8562A-K74 Upgrade Kit required (1) (5)
8562E	all	Fully compatible
8563A/E/EC	all	Fully compatible
8564E/EC	all	Fully compatible
8565E/EC	all	Fully compatible
ESA SERIES SPECTRUM ANALYZER		
Model	**S/N Prefix**	**Compatibility**
E4407BA	all	Option AYZ required
E7405A	all	Option AYZ required

Table 2-1. 11974 Compatibility with Spectrum Analyzers

PSA SERIES SPECTRUM ANALYZER ***Note:*** *E4443A and E4445A do not support external mixing.*		
Model	**S/N Prefix**	**Compatibility**
E4440A	all	Option AYZ required
E4446A	all	Option AYZ required
E4448A	all	Option AYZ required
R&D BENCH HIGH PERFORMANCE SPECTRUM ANALYZER WITH 11975A LO AMPLIFIER		
Model	**S/N Prefix**	**Compatibility**
8566A	<2007A (6)	External mixing is not available
8566A	≥2007A (6)	Only compatible if the 8566A to 8566B Conversion Kit and either K74 or K75 upgrade kit are previously installed **NOTE** The 8566A to 8566B Conversion, 8566B-K74, and 8566B-K75 upgrade kits for these analyzers are no longer available.
8566B	<2948A (6)	Only compatible if the 8566B-K74 upgrade kit is previously installed.
8566B	≥2948A (6)	Fully compatible

(1) Retrofit kit contains materials and instructions for hardware modifications and an operating procedure update for the 11974.

(2) 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 over sweeping the preselector.

(3) 70900 Local Oscillator firmware/hardware requirements:

Firmware Date Code (YYMMDD)	**LO Upgrade Kit Required**
850730	70907B-Option 098
860203	(Firmware and CPU board)
861015	70907B-Option 099
870501	(Firmware on RAM/ROM card)
880314	
880901	
890606	Fully compatible, no kit required

(4) Retrofit kit contains firmware update and new operation manual.

(5) Operation with 11974s 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 over sweeping the preselector.

(6) The serial number prefix on the 8566A/B refers to the RF section.

Initial Inspection

Inspect the shipping container upon receipt. Retain it and the cushioning materials. If the container or cushioning material is damaged, verify that the contents are complete and that the unit functions correctly both mechanically and electrically.

If the contents are incomplete or the 11974 fails the performance tests in Chapter 4, "Performance Tests," on page 97, notify one of the Agilent Technologies Sales and Service Offices listed on page 45. Show any container or cushioning materials damages to the carrier. The Agilent Technologies Sales and Service Office will arrange for repair or replacement without waiting for a claim settlement.

The shipping container and cushioning materials are shown in Figure 2-3 on page 43 and Figure 2-4 on page 44. Instructions for repackaging the 11974 are included under "Returning Equipment for Service" on page 42.

WARNING **To prevent electrical shock, disconnect the 11974 Series equipment from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

Preparing the 11974 for Use

When installing equipment, ensure that the 11974-60028 Power Supply ac power switch and the power cord are easily accessible to allow for disconnecting the equipment from the mains power supply. The power switch will remove power from the 11974, but the power must be disconnected to remove the 11974-60028 from the mains power supply.

Position the equipment to protect it from moisture because the instrument case does not protect against the ingress of water.

WARNING **The front panel LINE switch disconnects the mains circuits from the mains supply after the EMC filters and before other parts of the instrument.**

CAUTION **Ventilation Requirements**: When installing the product in a cabinet, the air flow into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

The 11974 must be properly connected to one of the compatible spectrum analyzers listed in Table 2-1. on page 29. Use the next four sections of this chapter to:

- Select the appropriate power source.
- Set the line-voltage selector switch correctly.
- Check the fuse.
- Select the appropriate power cable.

After preparing the 11974 for use, refer to Chapter 3 , for complete operation procedures for the most commonly-used compatible spectrum analyzers. These procedures include configuration setups listing all connections and giving step-by-step procedures describing how to operate an 11974.

CAUTION *Before this instrument is switched on*, make sure that:

- the line voltage selector is set to the voltage of the mains supply;
- the correct fuse is installed;
- the supply voltage is in the specified range.

Power Requirements

The power requirements for the 11974 are listed below.

Table 2-2 Operating Power Requirements

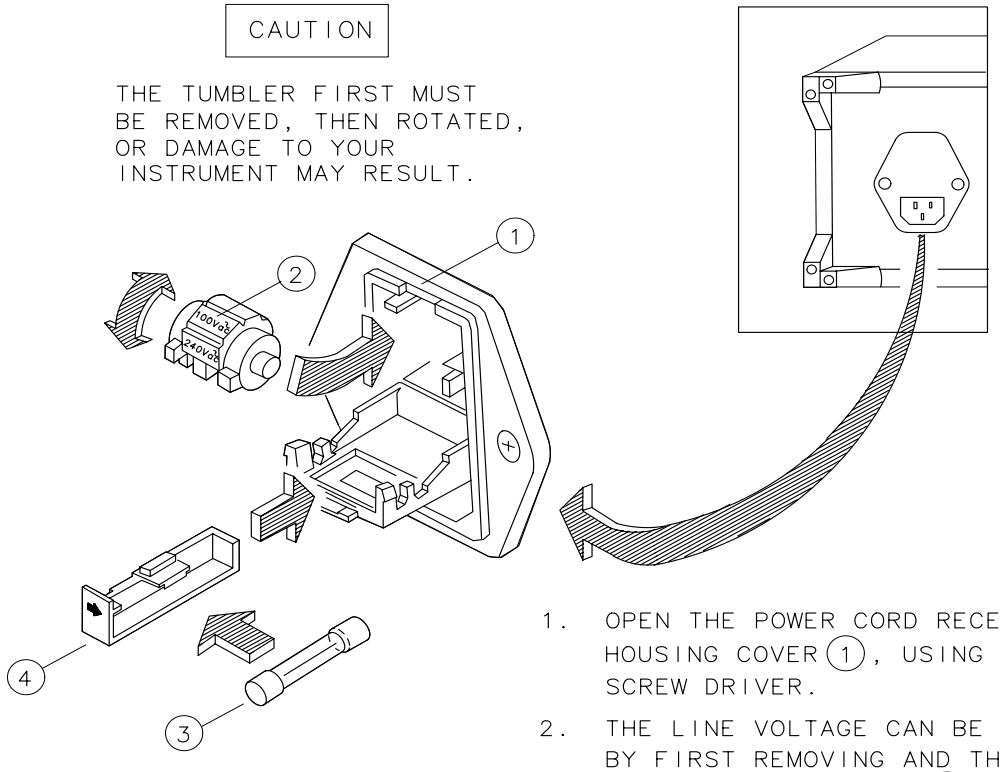
Line Input	Power Requirements	
	100/120 V ac Operation	**220/240 V ac Operation**
Line Voltage	100 V to 120 V, ±10%	220 V to 240 V, ±10%
Line Current	1 A rms max.	0.5 A rms max.
Line Frequency	47 Hz to 66 Hz	47 Hz to 66 Hz

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

Setting the Line-Voltage Selector Switch

The 11974-60028 Preselector Power Supply contains the voltage-selector switch for the 11974. Set the power supply's rear-panel voltage-selector switch to the line-voltage range (100, 120, 220, or 240 V) corresponding to the available ac voltage. Refer to Figure 2-1 on page 34.

Figure 2-1 Voltage Selection Switch and Line Fuse Locations



Checking the Fuse

The type of ac-line input fuse depends on the input-line voltage. Use the following fuses:

100 V to 120 V Operation:	1 A 250 V UL/CSA (TIME DELAY) (part number 2110-0674) (for use in the United States)
220 V to 240 V Operation:	0.5 A 250 V IEC (TIME DELAY) (part number 2110-0458) (for use in other countries)

The line fuse is housed in a small container located inside the rear-panel power-connector module of the 11974-60028 Preselector Power Supply. When replacing a fuse, be sure that the arrows on the container match the direction of the arrows on the power-connector door. Refer to Figure 2-1 on page 34.

Power Cable

The 11974-60028 Preselector Power Supply is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power-source outlet, this cable grounds the instrument cabinet.

WARNING **Failure to ground the instrument properly can result in personal injury. Before turning on the preselector power supply, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power-cable plug only into a socket outlet that has a protective earth contact. *Do not* defeat the earth-grounding protection by using an extension cable, power cable, or auto transformer. Make sure its common terminal is connected to the protective earth contact of the power source socket.**

Various power cables are available to connect the power supply to the types of ac power outlets unique to specific geographic areas. The cable appropriate for the area to which the power supply is originally shipped is included with the unit. You can order additional ac power cables for use in different areas. The following table lists the available ac power cables, illustrates the plug configurations, and identifies the geographic area in which each cable is appropriate.

Table 2-3. Power Cables

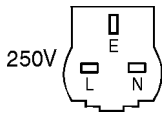
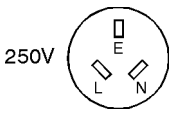
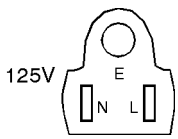
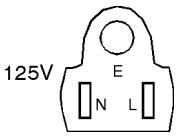
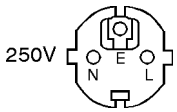
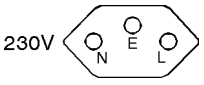
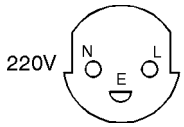
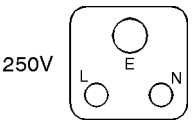
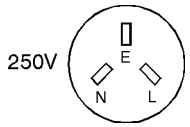
Plug Type [a]	Cable Part Number	Plug [b] Description	Length cm (in.)	Cable Color	For Use in Country
	8120-8705 8120-8709	Straight BS 1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Option 900 United Kingdom, Hong Kong, Cyprus, Nigeria, Singapore, Zimbabwe
	8120-1369 8120-0696	Straight AS 3112 90°	210 (79) 200 (78)	Gray Gray	Option 901 Argentina, Australia, New Zealand, Mainland China
	8120-1378 8120-1521	Straight NEMA 5-15P 90°	203 (80) 203 (80)	Jade Gray Jade Gray	Option 903 United States, Canada, Brazil, Colombia, Mexico, Philippines, Saudi Arabia, Taiwan
	8120-4753 8120-4754	Straight NEMA 5-15P 90°	229 (90) 229 (90)	Gray Gray	Option 918 Japan
	8120-1689 8120-1692	Straight CEE 7/VII 90°	200 (78) 200 (78)	Mint Gray Mint Gray	Option 902 Continental Europe, Central African Republic, United Arab Republic
	8120-2104 8120-2296	Straight SEV Type 12 90°	200 (78) 200 (78)	Gray Gray	Option 906 Switzerland

Table 2-3. Power Cables (Continued)

Plug Type [a]	Cable Part Number	Plug [b] Description	Length cm (in.)	Cable Color	For Use in Country
	8120-2956 8120-2957	Straight SR 107-2-D 90°	200 (78) 200 (78)	Gray Gray	Option 912 Denmark
	8120-4211 8120-4600	Straight IEC 83-B1 90°	200 (78) 200 (78)	Mint Gray Mint Gray	Option 917 South Africa, India
	8120-5182 8120-5181	Straight SI 32 90°	200 (78) 200 (78)	Jade Gray Jade Gray	Option 919 Israel

a. E = earth ground, L = line, and N = neutral.
b. Plug identifier numbers describe the plug only. The part number is for the complete cable assembly.

Using a Conversion-Loss Data Disk with the ESA or PSA Series Analyzers

The conversion-loss data for your mixer can be quickly loaded in the memory of an ESA or PSA series analyzer from a floppy disk. The following process works with the floppy disk provided by the factory with your new mixer, or with one that you have stored the correction data. This process eliminates the time consuming and sometimes error-prone process of manually entering the data from a table.

Loading Data

1. Insert the conversion-loss data disk (from the factory or your own) into the floppy drive of the analyzer.
2. Press **File**, then **Load**.
3. Press **Type**, **More**, then select **Corrections**.
4. Press **Directory Select**, highlight drive -A-, then press **Directory Select** again.
5. Use the down arrow to select the file. The factory supplied disk has a file with the OTH extension which places the data in the corrections set “other” location.
6. Press **Load Now** to load the conversion loss values into the correction table of the analyzer.

Viewing Data

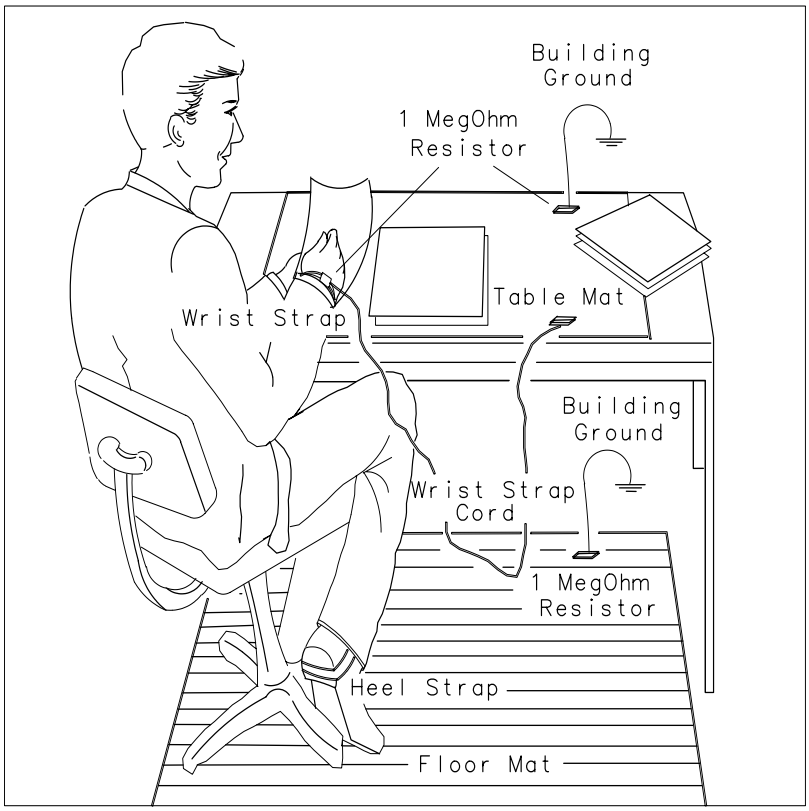
1. Press **Amplitude**, **More**, **Corrections**, **Other** (ON) and **Edit** to view the correction values.
2. Use the front-panel knob or up/down arrows to scroll through the list of correction values.

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-safe workstation.

Figure 2-2 shows an example of a static-safe workstation. Two types of ESD protection are shown: (a) conductive table mat and wrist strap combination, and (b) conductive floor mat and heel strap combination. The two types must be used together to ensure adequate ESD protection. Refer to Table 2-4 on page 41 for a list of static-safe accessories and their part numbers.

Figure 2-2 Static-Safe Workstation



Reducing ESD Damage

The following are suggestions that may help reduce the amount of ESD damage that can occur during testing and servicing instruments.

PC Board Assemblies and Electronic Components

- Handle these items at a static-safe workstation.
- Store or transport these items in static-shielding containers.

CAUTION Do not use erasers to clean the edge-connector contacts. Erasers generate static electricity and degrade the electrical quality of the contacts by removing the thin gold plating.

Do not use paper of any kind to clean the edge-connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

Do not touch the edge-connector contacts or trace surfaces with bare hands. Always handle board assemblies by the edges.

PC board assembly edge-connector contacts may be cleaned by using a lint-free cloth with a solution of 80 percent electronics-grade isopropyl alcohol and 20 percent deionized water. This procedure should be performed at a static-safe workstation.

WARNING **Isopropyl alcohol is extremely flammable, causes irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Keep away from heat, sparks, and flame. Avoid contact with eyes, skin, clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, or carbon dioxide: water may be ineffective. In case of spill, soak up with sand or earth. Flush spill area with water.**

Disposal Instructions: Dispose in accordance with all applicable federal, state, and local environmental regulations.

Test Equipment

- Before connecting any coaxial cable to an instrument connector for the first time each day, *momentarily* short together the center and outer conductors of the cable.
- Before touching the center pin of any connector and before removing any assembly from the instrument, ensure proper use of a grounded, resistor-isolated, wrist strap.
- To prevent buildup of static charge, ensure that all instruments are properly earth-grounded.

Static-Safe Accessories

Table 2-4 Static-Safe Accessories

Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).

Returning Equipment for Service

Repackaging equipment requires original shipping containers and materials or their equivalents. Agilent Technologies offices can provide packaging materials identical to the original. Figure 2-3 on page 43 and Figure 2-4 on page 44 identify the original packaging materials and their part numbers. When ordering packaging materials, it is necessary to order the proper number of foam inserts.

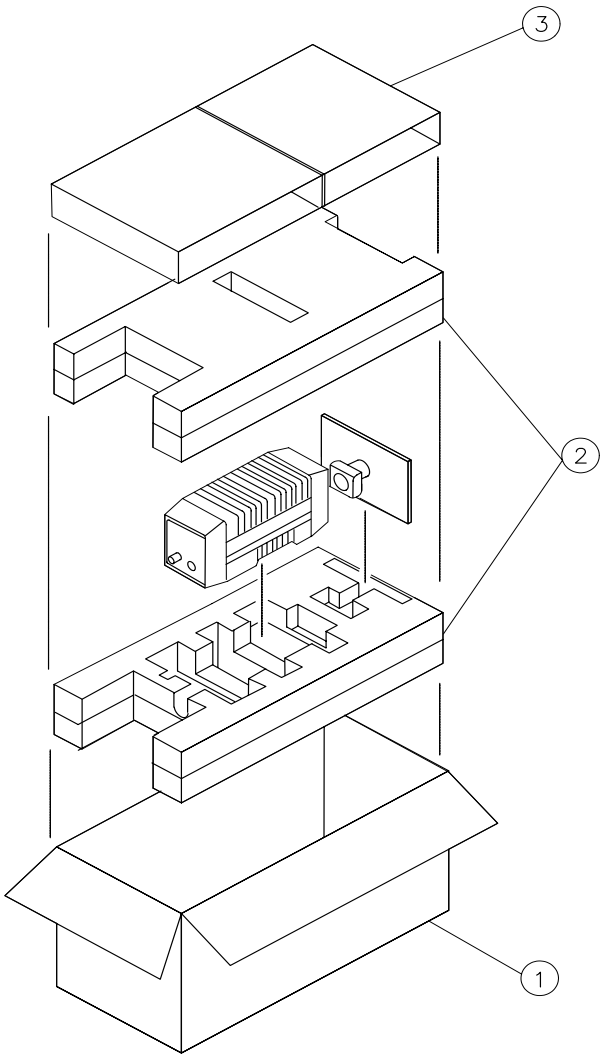
CAUTION Packaging materials not specified can result in instrument damage. Never use styrene pellets to package electronic equipment. The pellets do not adequately cushion the equipment, do not prevent all equipment movement, and can generate static electricity.

Use the following procedure to prepare equipment for shipment:

1. Fill out a blue repair card (located at the end of this chapter) and attach it to the equipment. Send a copy of any noted error messages or other helpful performance data. If a blue repair card is *not* available, include at least the following information:
   a. Type of service required
   b. Description of the problem and whether it is constant or intermittent
   c. Name and telephone number of technical contact person
   d. Return address
   e. Model number of returned equipment
   f. Full serial number of returned equipment
   g. List of any accessories returned with equipment
2. To help prevent damage during transit, pack the equipment in the appropriate packaging materials as shown in Figure 2-3 on page 43 and Figure 2-4 on page 44. Original shipping materials or equivalents are best; however, compliance with the following instructions will result in acceptable packaging.
   a. Wrap equipment in anti-static plastic to reduce the possibility of ESD damage.
   b. For equipment that weighs less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength. The carton must be both large enough and strong enough to accommodate the equipment. Allow at least three to four inches on all sides of the equipment for packing material.
   c. Surround the equipment with 3 to 4 inches of packing material to protect the equipment and to prevent movement in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation, Commerce, California 90001. Air Cap is plastic sheeting filled with 1-1/4 inch air bubbles. Use pink anti-static Air Cap. Wrapping the equipment several times in this material should provide sufficient protection and also prevent movement in the carton.

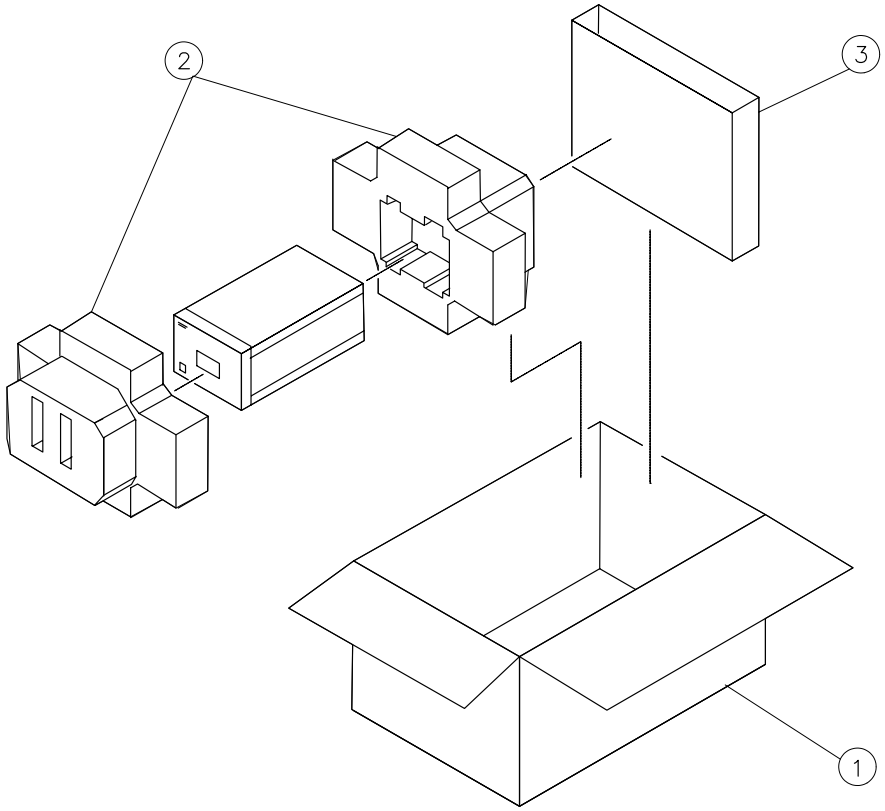
3. Seal the shipping container securely with strong nylon adhesive tape.
4. Mark the shipping container "**FRAGILE, HANDLE WITH CARE**" to ensure careful handling.
5. Retain copies of all shipping papers.

Figure 2-3 Packaging Materials for 11974 Series



Item	Qty	Part Number	Description
1	1	9211-5594	Corrugated Outer Carton
2	1	5180-7865	Foam Pads (set)
3	1	5180-7885	Corrugated Pad

Figure 2-4 Packaging Materials for 11974-60028 Power Supply



Item	Qty	Part Number	Description
1	1	9211-4893	Corrugated Outer Carton
2	1	5180-7809	Foam Pads (set)
3	1	9220-4421	Corrugated Sleeve

Sales and Service Offices

Agilent Technologies Sales and Service Offices provide worldwide support for Agilent Technologies products. To obtain servicing information or to order replacement parts, contact the nearest office listed on page 45.

In any correspondence, always provide essential information, which includes model numbers, serial numbers, or assembly part numbers.

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Table 2-5. Contacting Agilent

Online assistance: www.agilent.com/find/assist

United States *(tel)* 1 800 452 4844	**Latin America** *(tel)* (305) 269 7500 *(fax)* (305) 269 7599	**Canada** *(tel)* 1 877 894 4414 *(fax)* (905) 282-6495	**Europe** *(tel)* (+31) 20 547 2323 *(fax)* (+31) 20 547 2390
New Zealand *(tel)* 0 800 738 378 *(fax)* (+64) 4 495 8950	**Japan** *(tel)* (+81) 426 56 7832 *(fax)* (+81) 426 56 7840	**Australia** *(tel)* 1 800 629 485 *(fax)* (+61) 3 9210 5947	**Singapore** *(tel)* 1 800 375 8100 *(fax)* (65) 836 0252
Malaysia *(tel)* 1 800 828 848 *(fax)* 1 800 801 664	**Philippines** *(tel)* (632) 8426802 *(tel) (PLDT subscriber only):* 1 800 16510170 *(fax)* (632) 8426809 *(fax) (PLDT subscriber only):* 1 800 16510288	**Thailand** *(tel) outside Bangkok:* (088) 226 008 *(tel) within Bangkok:* (662) 661 3999 *(fax)* (66) 1 661 3714	**Hong Kong** *(tel)* 800 930 871 *(fax)* (852) 2506 9233
Taiwan *(tel)* 0800-047-866 *(fax)* (886) 2 25456723	**People's Republic of China** *(tel) (preferred):* 800-810-0189 *(tel) (alternate):* 10800-650-0021 *(fax)* 10800-650-0121	**India** *(tel)* 1-600-11-2929 *(fax)* 000-800-650-1101	

3 Operation

What You'll Learn in this Chapter

This chapter introduces you to basic *preselected* external-mixing functions available using an 11974 Series Preselected Millimeter Mixer. After a brief discussion of operating precautions and hints, operation procedures using the most commonly-used "host" spectrum analyzers are described. This chapter contains the following topics:

- "11974Q Front-Panel Features" on page 50
- "11974Q Rear-Panel Features" on page 51
- "Operating Precautions" on page 53
  - "Maximum RF Input Level" on page 53
  - "Maximum LO Input Level" on page 53
  - "Electrostatic Discharge" on page 53
- "Operating Hints" on page 54
  - "Preventing Erroneous Preselector Peaking or Centering During Spur Searches" on page 54
  - "Remote Location of an 11974" on page 55
  - "RF Port Voltage Standing Wave Ratio (VSWR) Effects" on page 57
  - "Dynamic Range Optimization" on page 57
- Preliminary Operation for Each Spectrum Analyzer

  Compatibility Reference lists all compatible spectrum analyzers with the 11974 Series and defines any requirements necessary.

  Equipment Connection lists all input and output connections for operation.

  Frequency Tracking Calibration mates the 11974 Series to the spectrum analyzer. This part of the preliminary operation aligns the frequency of the 11974 tracking filter to the tuned frequency of the spectrum analyzer.

NOTE Once the Frequency Tracking Calibration has been performed on a designated setup (that is, a specific 11974 band matched to a specific spectrum analyzer), and as long as the equipment remains connected, this calibration procedure only needs to be performed occasionally to keep the setup matched properly.

Operation for Each Spectrum Analyzer

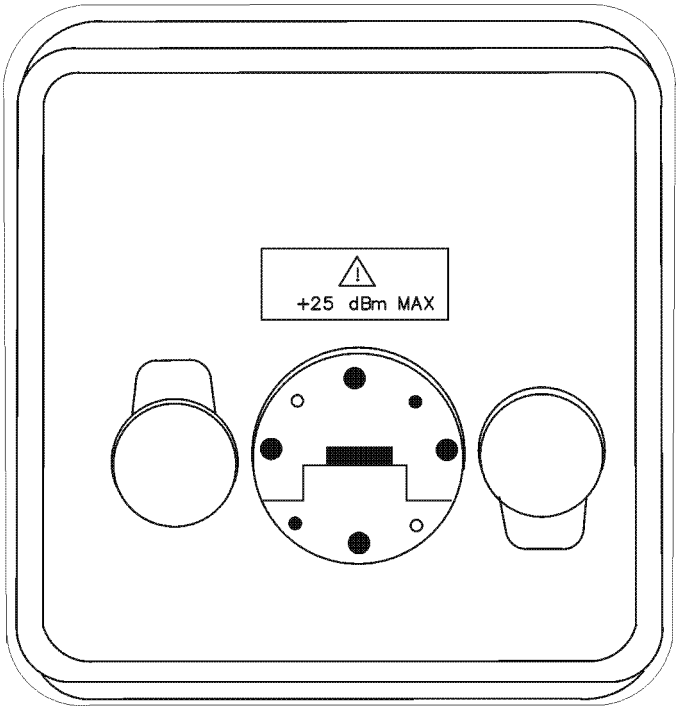
Band Selection describes how to select the desired millimeter band for operation.

Amplitude Calibration allows you to enter in conversion-loss values for your specific operating frequency. Each 11974 band is individually characterized and labeled at the factory with a calibration chart of its conversion loss versus frequency.

Preselector Peaking or Centering quickly maximizes the amplitude accuracy of a signal of interest.

11974Q Front-Panel Features

Figure 3-1. 11974Q Front Panel



The front panel of an 11974 Series mixer consists of an RF input port flange and two flange clamps. The following table lists the RF input port flange types.

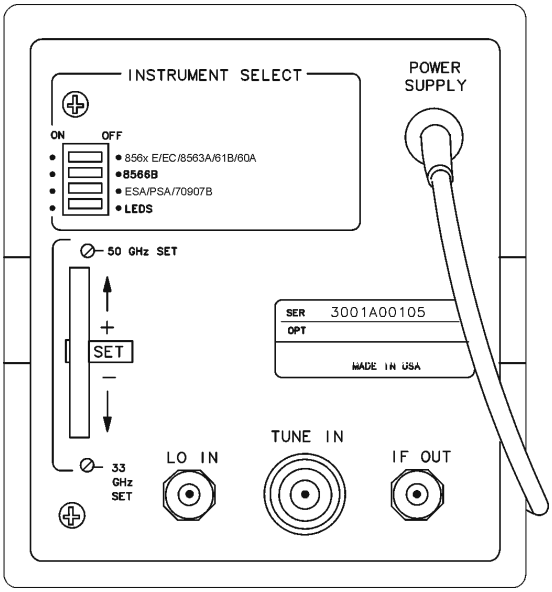
Table 3-1. RF Input Port Flange Types

Model	Size	Flange Type
11974A[a]	WR-28	UG599/U
11974Q[a]	WR-22	UG383U
11974U[a]	WR-19	UG383/U-M
11974V[a]	WR-15	UG385U

a. Refer to Table 1-2 for the ratings of these input and output connectors.

11974Q Rear-Panel Features

Figure 3-2. 11974Q Rear Panel



POWER SUPPLY receives power from the 11974-60028 Preselector Power Supply.[a]

INSTRUMENT SELECT switches allow the 11974 to properly scale the tune ramp of the specified spectrum analyzer.

IF OUT requires an SMA type cable and supplies the IF INPUT for the spectrum analyzer. [a]

TUNE IN requires a BNC type cable and receives the TUNE + SPAN sweep output from the spectrum analyzer. [a]

LO IN requires an SMA type cable and receives the first LO output from the spectrum analyzer. [a]

33 GHz SET is the low-end of the band adjustment for mating the 11974 to the spectrum analyzer. This adjustment frequency directly corresponds to the low-end frequency of each band.

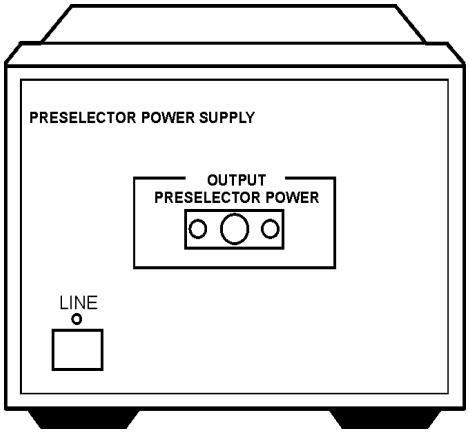
50 GHz SET is the high-end of the band adjustment for mating the 11974 to the spectrum analyzer. This adjustment frequency directly corresponds to the high-end frequency of each band.

LED SET are the LEDs used to adjust the low-end and high-end of each band so that the 11974 is mated properly to the spectrum analyzer.

a. Refer to Table 1-2 on page -19 for the ratings of these input and output connectors.

11974-60028 Front-Panel Features

Figure 3-3. 11974-60028 Front Panel



OUTPUT PRESELECTOR POWER provides power for the 11974 Preselector RF Mixer.

LINE switch applies power to the OUTPUT PRESELECTOR POWER jack.

Operating Precautions

CAUTION To avoid damaging your 11974 and to assure accurate measurements, be sure to follow the recommendations in this section.

Maximum RF Input Level

The maximum RF input level, as stated in Table 1-2 on page 19, is +25 dBm CW, Peak, or Average. However, since the 1 dB compression point at the RF input is between 0 and +6 dBm depending on the band, meaningful measurements will end long before the damage level is reached. Therefore, for amplitude accuracy and protection against damage, limit the input power to the 1 dB compression point level.

Maximum LO Input Level

The maximum LO input level is +18 dBm. Care should be taken when using the 11975A Microwave Amplifier as an LO booster for the 8566B Spectrum Analyzer or when using the 11975A for remote-location connections with the 11974 Series.

CAUTION When using an 11975A Amplifier with an 11974, the rear-panel ALC switch must be set to the ON position and the OUTPUT POWER LEVEL set to the stop at +16 dBm before connecting the amplifier. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

Electrostatic Discharge

CAUTION When configuring the 11974 with a spectrum analyzer, *always* connect the SMA cables to the spectrum analyzer BEFORE connecting them to the 11974. This will minimize the danger of electrostatic discharge damaging the 11974.

Operating Hints

The following operating hints are provided for your convenience.

Preventing Erroneous Preselector Peaking or Centering During Spur Searches

When performing spurious response tests on a device under test (DUT), the spectrum to be measured typically contains both large and small signals. If the spurs are smaller than –60 to –65 dBc, they may be confused with the image or multiple response of the large signal. In this type of test, activate the preselector-peak routine only on the larger signals. This will avoid attempting to peak on small unwanted 11974 responses of the large signals which can result in amplitude errors. Another way to avoid this potential problem is to calculate the frequency of the image or multiple response and avoid measurements at these precise frequencies.

The frequency of the image response can be found in Table 1-1 on page 15, and the frequencies of the multiple responses can be found in Table 1-2 on page 19.

Listed below are the symptoms of errors caused by peaking on image or multiple responses:

- Large amplitude errors for the large signals after peaking or centering on a suspected small DUT spur which is actually an unwanted 11974 response,
- Preselector peak DAC numbers or Presel Adjustment frequencies consistently at or near one extreme of range (due to peaking or centering on an image response of a large signal),

DAC Number After Peaking	Spectrum Analyzer
0	71000C with 70907B
255	8560 Series Portable
63 with message “Peak Not Found” displayed	8566B
Presel Adjustment Frequency After Centering	Spectrum Analyzer
Frequency near –350 Hz *or* Frequency 0.0 Hz “Preselector centering failed”	E4440A, E4446A, E4448A, E4407B

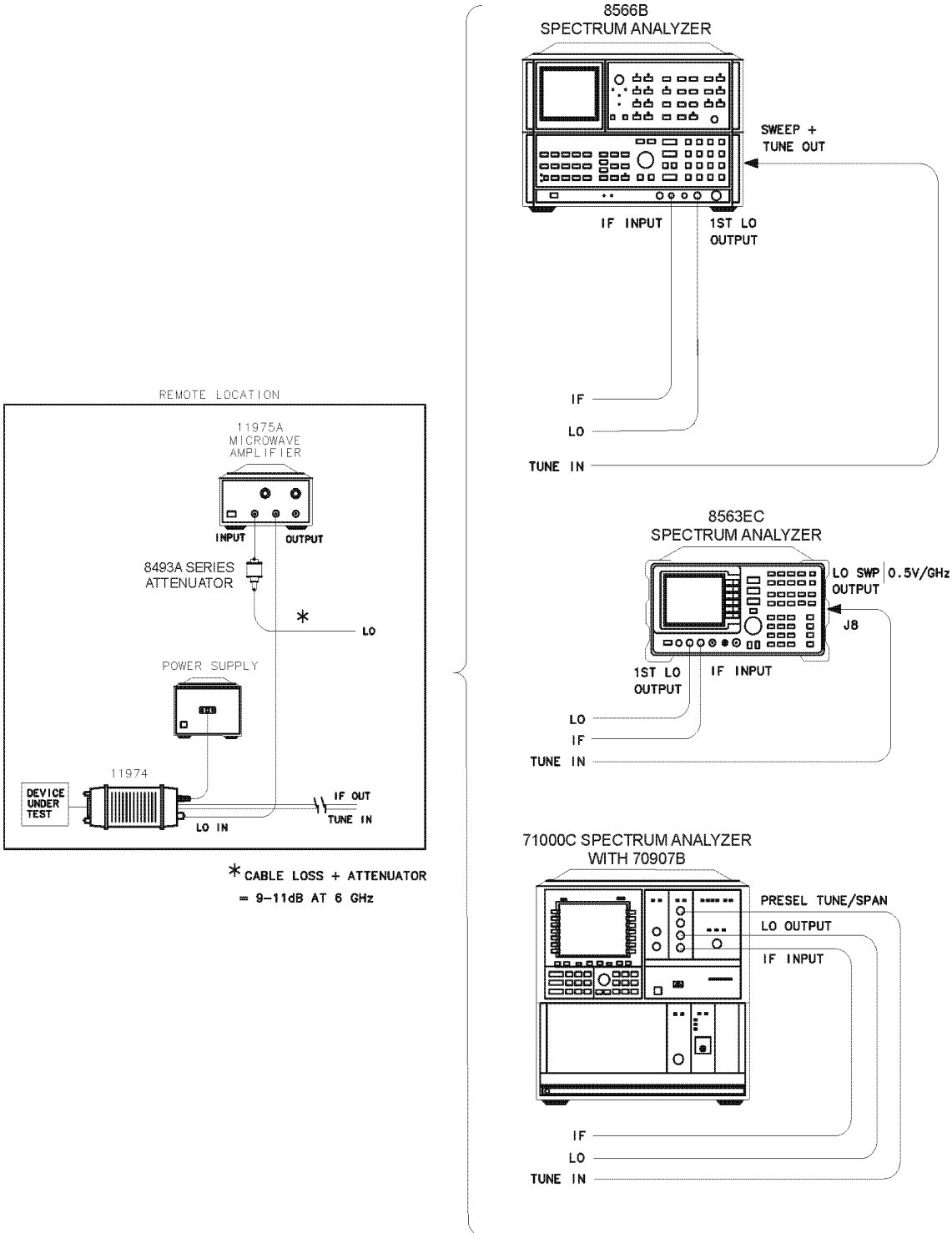
- Random DAC numbers over a wide range when peaking is repeated (due to peaking on a multiple response of a large signal).

Remote Location of an 11974

In cases where the device-under-test (DUT) is farther away than the 1 meter LO and IF cables can accommodate, place the 11974 close to the DUT, but place the host spectrum analyzer the desired distance away. In order to preserve the excellent amplitude accuracy of the 11974, the +14.5 to 16 dBm LO power must be supplied even though the LO cables may become quite long.

To supply the LO power, insert an 11975A Amplifier at the 11974 location. (Refer to Figure 3-4. on page 56.) To provide the proper input power level for the 11975A Amplifier, a coax attenuator is also required at the input of the 11975A such that the sum of the loss of the extended LO cable and the attenuator value add up to a range of 9–11 dB at 6 GHz. Set the OUTPUT POWER LEVEL on the 11975A for +16 dBm. The extra IF cable loss at 321 MHz should be added to the conversion loss value of the 11974. Perform the Frequency Tracking Calibration procedure after connection of all cables.

Figure 3-4. Setup Configuration for Remote Location of an 11974



RF Port Voltage Standing Wave Ratio (VSWR) Effects

As with most bandpass filters, the magnetically tunable Barrium-Ferrite bandpass filter of the 11974 is reflective out of its passband. In addition, the 11974 does not have a programmable RF port attenuator to improve the VSWR in band or out of band. This may cause measurement errors when testing VSWR sensitive DUTs outside of their operating frequency range. One measurement example in which VSWR effects should be minimized is when searching for spurious signals in an oscillator. To improve the accuracy of the measurement, use an 365 Series waveguide isolator (included in Option 001) or an attenuator at the RF port of the 11974 to reduce this particular VSWR effect.

Dynamic Range Optimization

An attenuator at the RF port of the 11974 can be used to set the RF input power level for maximum dynamic range, approximately –30 dBm, as shown in Figure 1-3 on page 23, Figure 1-2 on page 12, Figure 3-5. on page 59, and Figure 1-6 on page 26.

Using an 8566B Spectrum Analyzer

Preliminary Operation

Compatibility Reference

Refer to Chapter 2, “Installation,” on page 27 for information relating to retrofit requirements for 8566A and older 8566B Spectrum Analyzers.

Equipment Connection

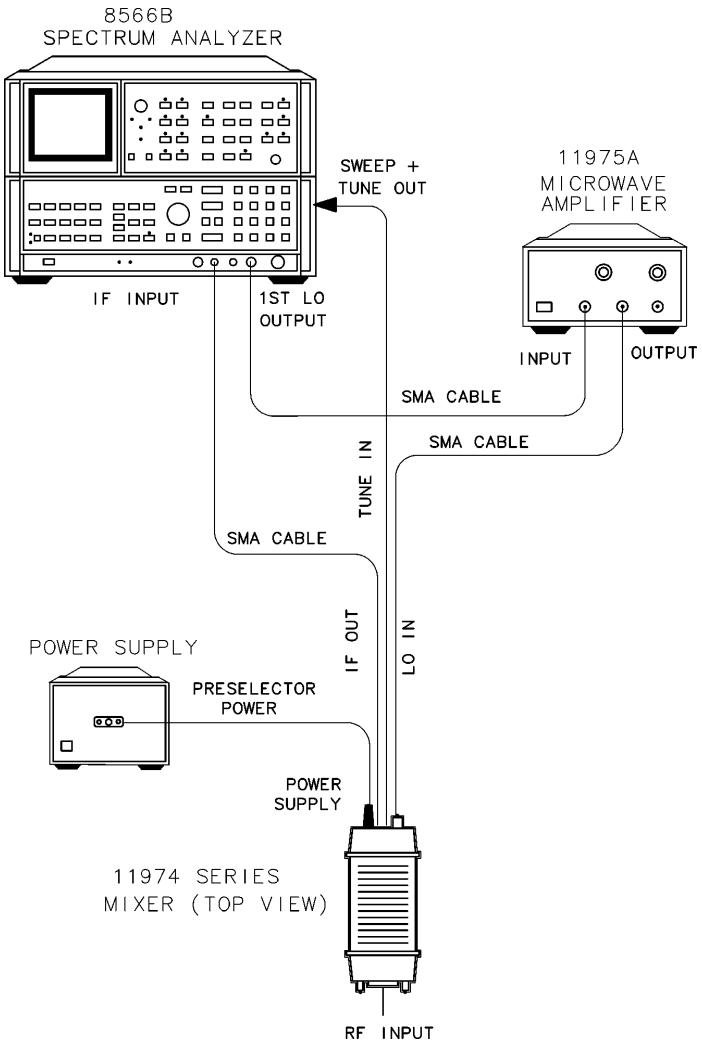
Connect the equipment as shown in Figure 3-5. on page 59 and use the following checklist to verify the connections.

- 11974 LO IN to 11975A OUTPUT (SMA cable, 5061-5458)
- 11974 IF OUT to 8566B IF INPUT (SMA cable, 5061-5458)
- 11974 TUNE IN to 8566B SWEEP + TUNE OUT (BNC cable, 8120-1839; BNC f–f adapter, 1250-0080; BNC cable, 8120-2582)
- 11974 POWER SUPPLY to 11974-60028 PRESELECTOR POWER
- 8566B 1ST LO OUTPUT to 11975A INPUT (SMA cable, 5061-5458)

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier into the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

Set the 11975A output power to +16 dBm and verify that the amplifier's front-panel unleveled indicator is not lit.

Figure 3-5. 11974 Connections Using an 8566B



Frequency Tracking Calibration

Use this procedure to align the frequency of the 11974 tracking filter to the tuned frequency of the 8566B. Fo0llow this procedure anytime the 11974 is connected to a different spectrum analyzer. Periodically check the calibration.

1. Set the 11974 rear-panel switches **8566B** and **LEDS** to the ON position, and the other two switches to the OFF position, to properly scale the tune ramp of the analyzer.
2. Set the spectrum analyzer to the appropriate millimeter band by using the following key sequence for the appropriate mixer:

   for an 11974A: **SHIFT** ⇑ ⇑

   for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

   for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

   for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

3. On the spectrum analyzer, set the preselector DAC to 32 (the center of its 0–63 range) by pressing **SHIFT**, **GHz**, 32, and **Hz**.
4. Set the spectrum analyzer to a frequency span of 0 Hz by pressing **FREQUENCY, SPAN**, 0, and **Hz**.

NOTE Due to the repetitive nature of this procedure, it may be helpful to save the center-frequency settings as indicated in steps 5 and 7 in unused state registers.

---

5. Set the spectrum analyzer center frequency to the low end of the band by pressing **CENTER FREQUENCY** and entering the corresponding value for the mixer listed below, then save this setting in an unused register.

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz

6. On the rear panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

   for an 11974A: “26.5 GHz SET”

   for an 11974Q: “33.0 GHz SET”

   for an 11974U: “40.0 GHz SET”

   for an 11974V: “50.0 GHz SET”

7. Change the spectrum analyzer center frequency to the high end of the band as indicated below; then save this setting in an unused register:

   for an 11974A: 40 GHz

   for an 11974Q: 50 GHz

   for an 11974U: 60 GHz

   for an 11974V: 75 GHz

8. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

   for an 11974A: “40 GHz SET”

   for an 11974Q: “50 GHz SET”

   for an 11974U: “60 GHz SET”

   for an 11974V: “75 GHz SET”

9. Repeat step 5 through step 8 until green lights are lit at both frequencies without any additional adjustments.

Operation

Band Selection

1. If necessary, mate the 11974 to the spectrum analyzer being used for preselected external mixing by using the Frequency Tracking Calibration procedure above.
2. Set the spectrum analyzer to the appropriate millimeter band by using the key sequence listed below:

   for an 11974A: **SHIFT** ⇑ ⇑

   for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

   for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

   for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

NOTE The above band selection key sequence must be used to enter the external mixing band of operation. Do not enter in the center frequency of the band directly.

Amplitude Calibration

The 8566B uses a single-point conversion-loss factor per band. The conversion-loss number is saved with an instrument preset, when the band is exited, and with the SAVE and RECALL functions.

Enter the conversion loss at the desired frequency from either the calibration label on the bottom of the 11974 or the supplied calibration sheet using the following key sequences.

1. **SHIFT**, 5, and **MHz**
2. Enter the conversion loss value of the desired frequency, then terminate the entry with **dB**.

Preselector Peaking

1. Place the active marker on the desired signal to be peaked using **PEAK SEARCH** or MARKER **NORMAL**.

TIP To complete the preselector-peaking routine more quickly, place the signal at center screen and reduce the frequency span until the sweep time is approximately 200 ms.

---

2. Peak the desired signal by pressing **PRESEL PEAK**.

General Descriptions of 8566B External-Mixing Functions

SHIFT, ⇑	selects the first millimeter frequency "lettered" band, K-band (18 – 26.5 GHz). (Note: K-band is not available in the 11974 Series.) Each succeeding press of the ⇑ key advances to the next lettered band. For example, A band can be displayed by pressing **SHIFT** ⇑ ⇑. The lettered bands are paired with harmonic numbers. Due to some overlap between bands, always enter the millimeter band by using the **SHIFT** ⇑ keys to select the lettered band. Do not enter in the center frequency of the band directly.
SHIFT, **GHz**	calls the preselector-peak DAC number to the active function. The DAC provides a vernier offset to the TUNE + SPAN to account for slight preselector mistracking with time, temperature, and so on. For the 0 to 63 DAC number range, the frequency range is approximately *n* times 46 MHz, where *n* is the harmonic number. The DAC number is saved with instrument preset (IP), but it is not saved using the SAVE/RECALL function or with a learn string.
SHIFT, **5**, **MHz**	calls CONVERSION LOSS to the active function. This is a single-point amplitude correction for each millimeter band, and each band's conversion loss is saved with IP, when the band is exited, and with the SAVE/RECALL functions.
SHIFT, **2**, **MHz**	calls the FULBAND number to the active function. This is an alternative function to **SHIFT**, ⇑, ⇑ in which each millimeter lettered band can be entered by a FULBAND number. For example, A band is equivalent to FULBAND 7, Q band is equivalent to FULBAND 8, and so on.
SHIFT, **1**, **MHz**	displays the **MHz** key menu on the display screen for reference purposes.

NOTE **SHIFT 3**, **4**, **6**, **7**, and **8 MHz** keys are *NOT* used with the 11974 Series.

Using an 71000 Series Spectrum Analyzer with an 70907B, 70909A, or 70910A

Preliminary Operation

NOTE This section provides information for the 70907B, however the operation of the 70909A and 70910A is similar. Minor differences may be noted, but the necessary deviations from these exact instructions will be obvious.

Compatibility Reference

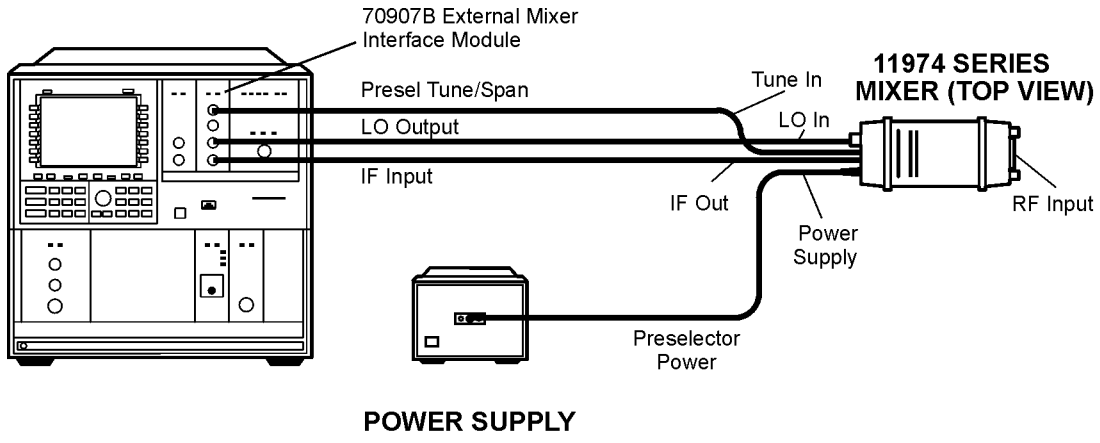
Refer to Chapter 2, "Installation," on page 27 for information relating to 71000 Series Modular Spectrum Analyzer System compatibility with the 11974 Series.

Equipment Connection

Connect the equipment as shown in Figure 3-6. and use the following checklist to verify the connections.

- 11974 LO IN to 70907B LO OUTPUT (SMA cable, 5061-5458)
- 11974 IF OUT to 70907B IF INPUT (SMA cable, 5061-5458)
- 11974 TUNE IN to 70907B PRESEL TUNE/SPAN (BNC cable, 8120-1839)
- 11974 POWER SUPPLY to 11974-60028

Figure 3-6. 11974 Connections to the 71000 Series Spectrum Analyzer



Frequency Tracking Calibration

Use this procedure to align the frequency of the 11974 tracking filter to the tuned frequency of the spectrum analyzer. Follow this procedure whenever the 11974 is connected to a different spectrum analyzer. Periodically check the calibration.

1. Set the 11974 rear-panel switches **70907B** (this switch also applies to the 70909 and 70910A) and **LEDS** to the ON position, and the other two switches to the OFF position, to properly scale the tune ramp of the spectrum analyzer.
2. When the 71000 is set up with multiple active input ports available, configure the analyzer for a preselected external mixer by using the following key sequence:

   MENU

   State

   select input

   IN "n" EM "Model Number"[1]

NOTE If the State key is not available when you press MENU, skip configuration step 2.

---

3. Select the frequency band of operation by using the following key sequence:

   State

   ext mixer

   fulband KAQUVE

   Press the softkey for the appropriate frequency band. (**INSTR PRESET** will reset this to the default active input, see INSTR PRESET on page 68.)
4. Initialize the preselector-peak DAC to the center of its range by pressing **State, pre-select**, **PRESEL DAC**, and 128, then terminate the entry with the **ENTER** softkey.
5. Set the analyzer to zero span by pressing **Freq** and **SPAN** and entering 0 Hz.

NOTE Due to the repetitive nature of this procedure, it may be helpful to save the center-frequency settings in unused state registers after performing step a and step c.

---

1. "Model Number" will be either 70907A, 70909A, or 70910A; "n" is a number indicating the order in which the input devices were found by the input device search.

6. To adjust the tracking between the 71000 and the 11974, perform the following steps:

   a. Set the spectrum analyzer center frequency by pressing **Freq** and **CENTER** and entering the corresponding start frequency value for the mixer listed below, then save this setting in an unused register.

      for an 11974A: 26.5 GHz

      for an 11974Q: 33.0 GHz

      for an 11974U: 40.0 GHz

      for an 11974V: 50.0 GHz

   b. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

      for an 11974A: “26.5 GHz SET”

      for an 11974Q: “33.0 GHz SET”

      for an 11974U: “40.0 GHz SET”

      for an 11974V: “50.0 GHz SET”

   c. Change the spectrum analyzer center frequency to the stop frequency value indicated below, then save this setting in an unused register:

      for an 11974A: 40 GHz

      for an 11974Q: 50 GHz

      for an 11974U: 60 GHz

      for an 11974V: 75 GHz

   d. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

      for an 11974A: “40 GHz SET”

      for an 11974Q: “50 GHz SET”

      for an 11974U: “60 GHz SET”

      for an 11974V: “75 GHz SET”

   e. Repeat step a through step d until green lights are lit at both frequencies without additional adjustments.

Operation

Band Selection

1. If necessary, mate the 11974 to the spectrum analyzer being used for preselected external mixing by using the procedure “Frequency Tracking Calibration” on page 64.
2. Use the following key sequence to enter the external mixing mode and to select the desired band of operation.

   MENU

   State

   ext mixer

   fulband KAQUVE

   Press the softkey for the desired band.

NOTE The above band selection key sequence *must* be used to enter the external mixing band of operation. Do not enter in the center frequency of the band directly.

Amplitude Calibration for a Single Frequency

Enter the conversion loss at the desired frequency from either the calibration label on the bottom of the 11974 or the supplied calibration sheet by using the following key sequence.

State

ext mixer

CONV LOSS

Enter the conversion loss value of the desired frequency, then terminate the entry with **dB**.

NOTE The above procedure is a single-point conversion-loss correction. For an alternative procedure, available by remote programming only, refer to “Conversion Loss Versus Frequency Correction” on page 69.

Preselector Peaking

1. Place the active marker on the desired signal to be peaked.

   Hint: To complete the preselector-peaking routine more quickly, place the signal at center screen and reduce the frequency span until the sweep time is approximately 100 ms.

2. Peak the desired signal by using the following key sequence.

   State

   pre-select

   PRESEL PEAK

General Descriptions of 71000 Series Spectrum Analyzer External-Mixing Functions

ext mixer allows access to the following softkey functions that control the measurement range when an external mixer extends the spectrum-analyzer frequency range. The **ext mixer** softkey can be found under the **State** firmkey.

fulband KAQUVE **PRESEL PEAK**

fulband WFDGYJ **PRESEL DAC**

CONV LOSS

fulband KAQUVE and **fulband WFDGYJ** specify the frequency range for measurements made with external mixers. Twelve frequency bands are available. Table 3-2. lists the start and stop frequencies of each band and also shows which local-oscillator harmonic (*N*) is used for the mixing process. Once a band is selected, the frequency range is locked and the spectrum analyzer tunes with the local-oscillator harmonic for that band only. (Selecting a new band presets the instrument in that band.)

Table 3-2. External Mixing Bands and Associated Mixing Harmonics

Band	Harmonic Number (*N*)	Frequency Range (GHz)
K	6–	18.0 to 26.5
A	8+	26.5 to 40.0
Q	10+	33.0 to 50.0
U	10+	40.0 to 60.0
V	14+	50.0 to 75.0
E	16+	60.0 to 90.0
W	18+	75.0 to 110.0

Table 3-2. External Mixing Bands and Associated Mixing Harmonics

Band	Harmonic Number (*N*)	Frequency Range (GHz)
F	24+	90.0 to 140.0
D	30+	110.0 to 170.0
G	36+	140.0 to 220.0
Y	42+	170.0 to 260.0
J	50+	220.0 to 330.0

CONV LOSS (conversion loss) offsets the reference level to compensate for amplitude losses at the active input port. If necessary, use **select input** to activate the desired input port before specifying its conversion-loss offset.

To clear the offset, enter a conversion loss of zero.

After instrument preset, a default value of 30 dB is activated automatically for the input port of the external-mixer-interface module.

PRESEL PEAK (preselector peak) adjusts the tracking of the preselector filter to yield maximum amplitude accuracy at the active marker position. If a marker is not present, **PRESEL PEAK** places a marker at the highest signal level.

Whenever a measurement is made, the current preselector DAC value corresponding to the selected measurement range determines the preselector tracking. Press **PRESEL PEAK** to repeak the preselector and store a new value in the preselector DAC. When measuring frequency spans greater than 0 Hz, the analyzer must be swept several times to peak the preselector. Thus, the analyzer requires several minutes to peak the preselector when measuring with slow sweep times. To execute the peaking function quickly, change the span to either 0 Hz or such that the sweep time is approximately 100 ms, before pressing **PRESEL PEAK**.

PRESEL DAC (preselector DAC) enters a value into the preselector DAC for the frequency range corresponding to the frequency at the marker. If a marker is not present, **PRESEL DAC** places a marker at the center of the display.

pre-select allows access to the preselector functions when a preselector module is in the system. The **pre-select** softkey can be accessed by pressing **State**.

preset input sets which active input port will be selected when the INSTR PRESET is pressed. The preset input softkey can be accessed by pressing **State**, then **MORE**.

INSTR PRESET resets to the preset input and to the lowest full frequency range available. (For an external mixer, this is band A.) This is a front panel hardkey.

Conversion Loss Versus Frequency Correction

The 71000 Series Spectrum Analyzers with the 70907B External Mixer Interface Module installed has the amplitude-correction function (AMPCOR) available by remote programming.

Use AMPCOR to compensate for the 11974 frequency-dependent conversion-loss variations. Up to 200 pairs of frequency-amplitude correction points can be entered, depending on the amount of available internal memory. The frequency values entered must be in increasing order, or an error condition results. Whenever AMPCOR is on, the correction values are added to all measurement results.

The values of the correction points are applied across the active measurement range. Between points, the correction values are interpolated. When measuring at frequencies outside the first and last correction points, these values are used as the correction value.

When AMPCOR is executed, the frequency pairs are stored in internal memory. The remote commands DISPOSE ALL, FORMAT, PERASE, and DISPOSE AMP COR erase the amplitude-correction pairs from memory.

NOTE DISPOSE ALL, FORMAT, and PERASE erases much more then the amplitude-correction pairs from memory. Do not use these commands without referring to the programmer's manual for the 70000 and 70900B to determine their effect on instrument programming.

Because AMPCOR adjusts IF gain and attenuation, AMPCOR should be used with care when measuring signals near the compression level that are also at a frequency that is corrected by the AMPCOR command.

To use AMPCOR for the 11974 conversion loss correction, first set the single-point conversion-loss function to zero with the following command:

```
OUTPUT 718; "CNVLOSS 0DB;"
```

Then build the AMPCOR table with frequency conversion loss pairs. The following example program line shows three pairs of frequency conversion-loss values for a typical 11974V.

```
OUTPUT 718; "AMPCOR 50GHZ, 49.6DB, 51GHZ, 49.1DB, 52GHZ,48.6DB;"
```

The conversion loss corrections are activated by the AMPCOR ON command; use AMPCOR OFF to deactivate the function. (Be sure to manually enter a single-point conversion-loss value if AMPCOR has been used.)

To print out an existing AMPCOR table, use the program listed below.

```
10  DIM A$(1:20)[30]
20  OUTPUT 718;"CNVLOSS 0DB;"
30  OUTPUT 718;"AMPCOR 50GHZ, 46.1DB, 52GHZ, 46.7DB, 53GHZ,47.2DB;"
40  !
50  OUTPUT 718;"AMPCOR?;"
60  ENTER 718 USING "%,K";A$(*)
70  !
80  FOR I=1 TO 10
90    PRINT "Point ";I,A$(I)
100 NEXT I
110 END
```

Line 30: Generates an AMPCOR table.

Line 60: % specifies that an EOI terminates the entire statement. K specifies that an L_F terminates the individual string entry.

Returned values are in the format where the frequency in Hz is listed first, followed by the conversion loss in dB. See the following example.

```
Point  1  50.00000000E+9,46.1
Point  2  52.00000000E+9,46.7
Point  3  53.00000000E+9,47.2
Point  4
Point  5
Point  6
Point  7
Point  8
Point  9
Point  10
```

Returned values are 0,0 when AMPCOR is set to OFF.

To dispose of an AMPCOR table, use the following command:

```
OUTPUT 718; "DISPOSE AMP COR;"
```

NOTE Be sure that there is a space between AMP and COR when using the DISPOSE command.

For further information, consult the 70900B Local-Oscillator-Controlled Modules Programming Manual, part number 70900-90137.

Using 8563A, 8561B, 8560A, or 8560 E/EC-Series Spectrum Analyzers

NOTE External mixing cannot be performed on instruments with Option 002 Tracking Generator.

Preliminary Operation

Compatibility Reference

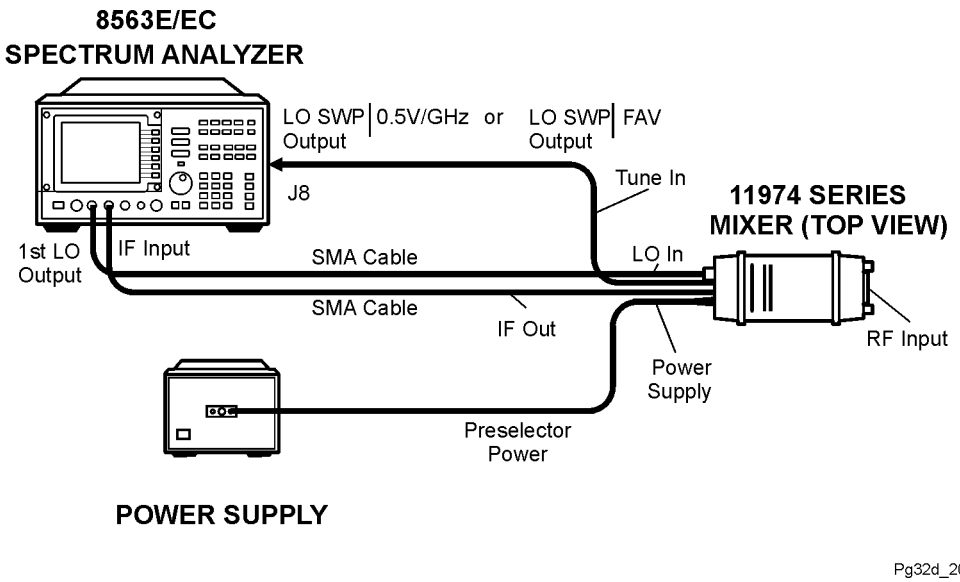
Refer to Chapter 1, "General Information," on page 7 for information relating to retrofit requirements for 8561B and 8560A Spectrum Analyzers.

Equipment Connections

Connect the equipment as shown in Figure 3-7. on page 71 and use the following checklist to verify the connections.

- 11974 LO IN to the analyzer 1ST LO OUTPUT (SMA, 5061-5458)
- 11974 IF OUT to the analyzer IF INPUT (SMA, 5061-5458)
- 11974 TUNE IN to the analyzer J8, LO SWP | 0.5V/GHz OUTPUT (BNC cable, 8120-1839; BNC f-f adapter, 1250-0080; BNC cable, 8120-2582)
- 11974 POWER SUPPLY to 11974-60028 PRESELECTOR POWER

Figure 3-7. 11974 Connections Using an 8563A, 8561B, 8560A, or 8560E-Series Spectrum Analyzers



Frequency Tracking Calibration

Use this procedure to align the frequency of the 11974 tracking filter to the tuned frequency of the spectrum analyzer Follow this procedure anytime the 11974 is connected to a different spectrum analyzer. Periodically check the calibration.

1. Set the 11974 rear-panel switches “8563/61/60” and “LEDS” to the ON position, and the other two switches to the OFF position, in order for the 11974 to properly scale the tune ramp of the spectrum analyzer.
2. Configure the analyzer for a preselected external mixer by pressing **CONFIG** and setting **EXT MXR PRE UNPR** to PRE.
3. Set the LO tuning sensitivity as follows:

   For the 8564E or 8565E, press **AUX CTRL**, **REAR PANEL**, and setting **V/GHz .25 .50** to **.50**

   For all other analyzers, press **AUX CTRL**, **REAR PANEL**, and **.5 V/GHz (FAV)**
4. Enter the full-band selection mode by using the following key sequence:

   AUX CTRL

   EXTERNAL MIXER

   FULL BAND

   Use the ⇑ or ⇓ key until the desired band is reached.
5. Set the spectrum analyzer to zero span by pressing **SPAN, ZERO SPAN**.
6. Set the spectrum analyzer center frequency by pressing **FREQUENCY, CENTER FREQ** and entering the corresponding value for the mixer listed below:

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz
7. Initialize the preselector-peak DAC at the start of the band by using the following key sequence:

   AUX CTRL

   EXTERNAL MIXER

   PRESEL PEAK

   PRESEL MAN ADJ

   128 **Hz**

8. Set the spectrum analyzer center frequency by pressing **FREQUENCY, CENTER FREQ** and entering the corresponding value for the mixer listed below:

   for an 11974A: 40 GHz

   for an 11974Q: 50 GHz

   for an 11974U: 60 GHz

   for an 11974V: 75 GHz

9. Initialize the preselector-peak DAC at the end of the band by using the following key sequence:

   AUX CTRL

   EXTERNAL MIXER

   PRESEL PEAK

   PRESEL MAN ADJ

   128 **Hz**

NOTE Due to the repetitive nature of this procedure, it may be helpful to save the center-frequency settings in unused state registers as indicated in step 9 and step 11.

---

10. Set the spectrum analyzer center frequency by pressing **FREQUENCY, CENTER FREQ** and entering the corresponding value for the mixer listed below, then save this setting in an unused register.

    for an 11974A: 26.5 GHz

    for an 11974Q: 33.0 GHz

    for an 11974U: 40.0 GHz

    for an 11974V: 50.0 GHz

11. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

    for an 11974A: “26.5 GHz SET”

    for an 11974Q: “33.0 GHz SET”

    for an 11974U: “40.0 GHz SET”

    for an 11974V: “50.0 GHz SET”

12. Change the spectrum analyzer center frequency to the value indicated below, then save this setting in an unused register:

    for an 11974A: 40 GHz

    for an 11974Q: 50 GHz

    for an 11974U: 60 GHz

    for an 11974V: 75 GHz

13. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

    for an 11974A: “40 GHz SET”

    for an 11974Q: “50 GHz SET”

    for an 11974U: “60 GHz SET”

    for an 11974V: “75 GHz SET”

14. Repeat step 10 through step 13 until green lights are lit at both frequencies without any additional adjustments.

Operation

Band Selection

1. If necessary, configure the analyzer for a preselected external mixer by pressing **CONFIG** and setting **EXT MXR PRE UNPR** to PRE.
2. Set the LO tuning sensitivity as follows:

   For the 8564E or 8565G, press **AUX CTRL**, **REAR PANEL**, and setting **V/GHz .25 .50** to **.50**

   For all other analyzers, press **AUX CTRL**, **REAR PANEL**, and **.5 V/GHz (FAV)**
3. If necessary, mate the 11974 to the spectrum analyzer being used for preselected external mixing by using the Frequency Tracking Calibration procedure above.
4. Use the following key sequence to enter the external mixing mode and to select the desired band of operation.

   AUX CTRL

   EXTERNAL MIXER

   FULL BAND

   Use the ⇑ or ⇓ key until the desired band is reached.

NOTE The above band-selection key sequence must be used to enter the external mixing band of operation. Do not enter in the center frequency of the band directly.

Amplitude Calibration

Enter the conversion loss table at the preset frequencies from either the calibration label on the bottom of the 11974 or the supplied calibration sheet by using the following key sequence. (Note: the analyzer automatically interpolates between the preset frequencies.)

AUX CTRL

EXTERNAL MIXER

AMPTD CORRECT

CNV LOSS VS FREQ

Enter the conversion loss value of the indicated preset frequency, then terminate the entry with **dB**.

Advance to the next preset frequency by pressing ⇑ and enter the conversion loss of the indicated frequency. Continue until the highest frequency is reached, then use the ⇑ and ⇓ keys to scan through the frequencies to verify or edit the conversion-loss values entered.

NOTE For V band, it may be necessary to first use the following key sequence to initialize the average of the conversion loss versus frequency table near the values for this band.

- **AUX CTRL**
- **EXTERNAL MIXER**
- **AMPTD CORRECT**
- **AVERAGE CNV LOSS**
- Enter in 47 and terminate with **dB**.

Preselector Peaking

1. Access the preselector-peak functions by pressing the following keys:

   AUX CTRL

   EXTERNAL MIXER

   PRESEL PEAK

2. Place the active marker on the desired signal to be peaked.
3. Peak the desired signal by pressing **PRESEL AUTO PK**.

General Description of External-Mixing Functions

CONFIG, EXT MXR PRE UNPR selects either preselected external mixing mode or unpreselected external mixing mode. This softkey sets the external mixer configuration used by the softkey menu found under the **EXTERNAL MIXER** softkey under **AUX CTRL**.

If the preselected external mixer mode is selected, rear-panel output J8 of the analyzer is automatically switched to provide an output of 1.5 V/GHz of the LO frequency, when 0.5V/GHz (FAV) is selected. The 1.5 V/GHz of the LO frequency definition is required for the 11974 Series preselected external mixers.

NOTE There are two different types of external mixers available, preselected and unpreselected. The **EXT MXR PRE UNPR** softkey function applies only to the selection of the type of external mixer to be used. It does not switch the analyzer from internal to external mixing.

EXTERNAL MIXER accesses a menu of functions that allow you to extend the frequency range using external mixers. These functions are described below.

NOTE No external mixing capabilities are available with an 8560A/E Option 002. Resolution bandwidths less than or equal to 100 Hz are not available with external mixers.

FULL BAND allows you to select a commonly-used frequency band above 18 GHz. These bands are shown in Table 3-3. on page 77. Use the step keys or the knob to select a desired frequency band; the selected band appears in the active function block. Activating **FULL BAND** also activates the harmonic-lock function.

AMPTD CORRECT displays a menu of functions that set conversion losses and flatness data.

AVERAGE CNV LOSS displays the mean conversion loss for the current harmonic and allows you to enter new conversion loss data. In a full frequency band (such as A band), the mean conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. To change the maximum and minimum values, use the **CNV LOSS VS FREQ** softkey. Any change to the average conversion loss also affects the flatness data, which is described below.

The default conversion loss value for each band is 30 dB.

CNV LOSS VS FREQ displays the stored conversion loss for a specific frequency in the current band. This allows amplitude correction to be entered to compensate for changes in conversion loss with frequency. To enter a new value, use the data keys. To change the displayed frequency, use the step keys. Any changes to the data also affect the mean conversion loss stored under **AVERAGE CNV LOSS**. Table 3-3. on page 77 shows the number of flatness points for each band and the default flatness values. To view the correction, connect a 310.7 MHz signal of a known amplitude (approximately –30 dBm) to the IF input and set the analyzer to sweep the associated band.

Table 3-3. Flatness Points and Conversion Losses for Frequencies above 18 GHz

Frequency Band	Frequency Range (GHz)	Number of Flatness Points	Point Spacing	Default Conversion Loss
K	18.0 to 26.5	6	2 GHz	30 dB
A	26.5 to 40.0	8	2 GHz	30 dB
Q	33.0 to 50.0	7	3 GHz	30 dB
U	40.0 to 60.0	6	4 GHz	30 dB
V	50.0 to 75.0	6	5 GHz	30 dB
E	60.0 to 90.0	7	5 GHz	30 dB
W	75.0 to 110.0	8	5 GHz	30 dB
F	90.0 to 140.0	6	10 GHz	30 dB
D	110.0 to 170.0	7	10 GHz	30 dB
G	140.0 to 220.0	9	10 GHz	30 dB
Y	170.0 to 260.0	7	15 GHz	30 dB
J	220.0 to 325.0	8	15 GHz	30 dB

PRESEL PEAK *(available only with preselected external mixing)* displays the *preselected* external mixer softkey menu, which is described below. This softkey menu is only available when the **EXT MXR PRE UNPR** softkey under **CONFIG** is set to “preselected” mode.

NOTE The **PRESEL PEAK** softkey and its lower-level softkeys are only for use with preselected external mixers. The preselected configuration must initially be set up using the **EXT MXR PRE UNPR** softkey under **CONFIG**.

PRESEL AUTO PK

automatically peaks the preselector of the external mixer on a desired signal on a trace. Set the trace to clear-write mode, place a marker on the desired point, then press **PRESEL AUTO PK**. The peaking routine zooms to zero span, peaks the preselector tracking, then returns to the original span. To read the new preselector peaking number, press **PRESEL MAN ADJ**.

The **PRESEL AUTO PK** softkey appears under three different menus—**AMPLITUDE**, **INTERNAL MIXER**, and **EXTERNAL MIXER**. This **PRESEL AUTO PK** softkey is only available for use with preselected external mixing. Refer to the **PRESEL AUTO PK** softkey under **AMPLITUDE** or the **INTERNAL MIXER** menu of functions for use with internal mixers.

PRESEL MAN ADJ

allows the user to adjust the external preselector tracking. Pressing **PRESEL MAN ADJ** causes the preselector tracking number that applies to the marker frequency to be displayed in the active function block. If no marker is active, pressing **PRESEL MAN ADJ** automatically activates a marker at the peak.

When the tracking number is displayed in the active function block, it can be changed using the data keys, the step keys, or the knob. This tracking number ranges from 0 to 255. It is initialized to 128 when entering the external mixer mode of operation or whenever the band number is changed. Changing the tracking number affects the data in the current data table, which may be a previously saved user data table. The resulting value, after changing this function, is only valid for the current band. To save this data, use the **SAVE PRSEL PK** softkey found under **SAVE**. This overwrites any previously saved preselector data regardless of whether that data was generated while using internal or external preselectors.

The **PRESEL MAN ADJ** softkey appears under three different menus—**AMPLITUDE**, **INTERNAL MIXER**, and **EXTERNAL MIXER**. This **PRESEL MAN ADJ** softkey is only available for use with preselected external mixing. Refer to the **PRESEL MAN ADJ** softkey under **AMPLITUDE** or the **INTERNAL MIXER** menu of functions for use with internal mixers.

MARKER NORMAL activates a single marker and places it at the center of the trace. This softkey is also annotated as **MARKER DELTA**, if delta-marker mode has been previously activated by the **MARKER DELTA** softkey under the **MKR** menus.

If one marker is already on, no operation takes place. If two markers are on (as in **MARKER DELTA** mode), pressing **MARKER DELTA** deletes the anchor marker and makes the active one the new, single marker. The marker reads the amplitude and the frequency (or relative time, when the frequency span equals 0 Hz), and displays these values in the active function block and in the upper-right corner of the display. To move the marker, use either the knob, the step keys, or the data keys.

The marker reads data from the currently active trace. (An active trace is one in either the clear-write or max-hold mode; this may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the marker reads data from trace A.

PEAK SEARCH places a marker on the highest point on a trace. The frequency and amplitude of the marker are displayed in the upper-right corner of the screen; **PEAK SEARCH** does not alter the active function.

NEXT PEAK moves the active marker to the next highest trace point relative to the current marker position. This function finds successively lower peaks when the key is pressed repeatedly. The peak excursion and the peak threshold criteria are applied to determine the next highest peak.

Using an E4407B Spectrum Analyzer or 7405A EMC Analyzer

Preliminary Operation

Compatibility Reference

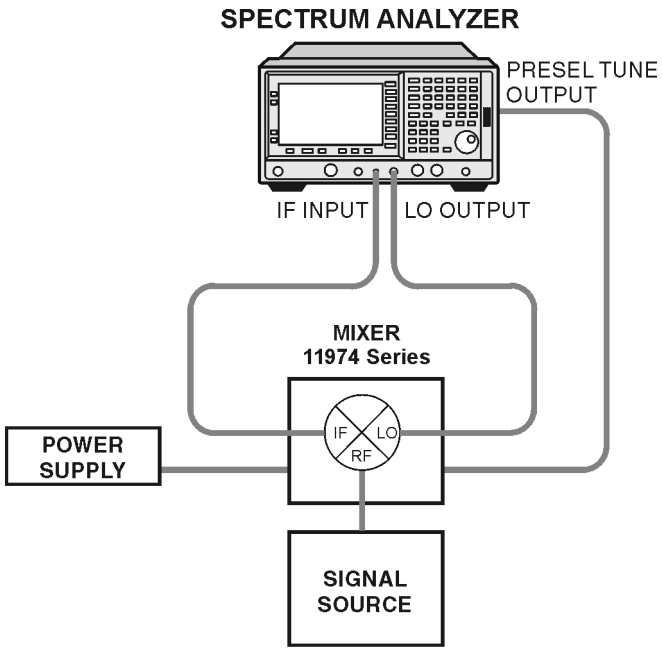
Refer to Chapter 2, "Installation," on page 27 for information relating to retrofit requirements for E4407B or E7405A analyzer. The E4407B is used in the following procedure.

Equipment Connection

Connect the equipment as shown in Figure 3-8. and use the following checklist to verify the connections.

- 11974 LO IN to E4407B LO OUTPUT (SMA cable, 5061-5458)
- 11974 IF OUT to E4407B IF INPUT (SMA cable, 5061-5458)
- 11974 TUNE IN to E4407B Preselector Tune Output (BNC cable, 8120-1839; BNC f–f adapter, 1250-0080; BNC cable, 8120-2582)
- 11974 POWER SUPPLY to 11974-60028 PRESELECTOR POWER

Figure 3-8. 11974 Connections Using an E4407B or E7405A



bl71b

Frequency Tracking Calibration This procedure is used to align the frequency of the preselector filter of the Agilent 11974 to the tuned frequency of the analyzer. This procedure should be followed any time that the Agilent 11974 is connected to a different analyzer. The calibration should be periodically checked.

1. Set the Agilent 11974 rear-panel switches "ESA/PSA/70907B" and "LEDS" to the ON position, and the other two switches to the OFF position, in order for the Agilent 11974 to properly scale to the tune signal of the analyzer.
2. Configure the analyzer for a preselected external mixer by pressing the following keys:

   Preset, **Factory Preset** (if present), **Input/Output**, **Input Mixer** (Ext), **Mixer Config**, **Mixer Type** (Presel)
3. Set the desired band of operation. Press **Return**, **Ext Mix Band**, **A**, **Q**, **U**, or **V**. (Note that only A,Q,U, and V bands are available.)
4. Set the Presel Adjust to 0 MHz by pressing **AMPLITUDE**, **Presel Adjust**, 0, **MHz**.
5. Set the analyzer to zero span by pressing **SPAN**, **Zero Span**.
6. Set the analyzer center frequency by pressing **FREQUENCY**, **Center Freq**, and enter the corresponding value for the appropriate mixer. (Refer to Table 3-4.) On the rear panel of the Agilent 11974, adjust the corresponding potentiometer until one or both of the green LEDs are lit.

Table 3-4.

Mixer Agilent P/N	Analyzer Center Frequency	Potentiometer
11974A	26.5 GHz	"26.5 GHz Adjust"
11974Q	33.0 GHz	"33.0 GHz Adjust"
11974U	40.0 GHz	"40.0 GHz Adjust"
11974V	50.0 GHz	"50.0 GHz Adjust"

7. Change the analyzer center frequency to the value indicated in Table 3-5. and again adjust the corresponding potentiometer on the rear panel of the 11974 until one or both of the green LEDs are lit.

Table 3-5.

Mixer Agilent P/N	Analyzer Center Frequency	Potentiometer
11974A	40.0 GHz	"40.0 GHz Adjust"
11974Q	50.0 GHz	"50.0 GHz Adjust"
11974U	60.0 GHz	"60.0 GHz Adjust"
11974V	75.0 GHz	"75.0 GHz Adjust"

8. Repeat steps 6 and 7 until the green LEDs are lit at both frequencies without additional adjustments.

Band Selection

1. If necessary, configure the analyzer for preselected external mixing by pressing the following keys:

   Input/Output, **Input Mixer** (Ext), **Mixer Config**, **Mixer Type** (Presel)

2. If necessary, adjust the tracking of the Agilent 11974 to the analyzer being used for preselected external mixing, by using the Frequency Tracking Calibration procedure above.

3. Press the following keys to select the desired mixing band: (In this example, we will use an Agilent 11974Q (33.0 to 50.0 GHz) to view a 40 GHz, -15 dBm signal.)

   Input/Output, **Input Mixer**, **Ext Mix Band**, **33-50 GHz** (Q)

Amplitude Calibration

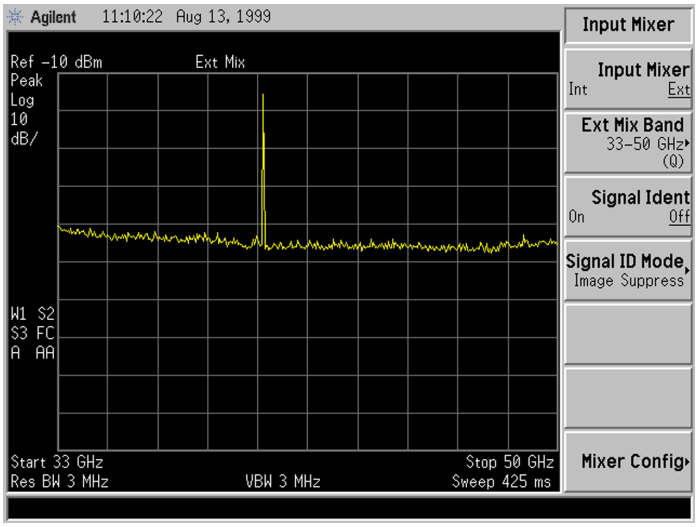
1. Enter the conversion loss versus frequency data from one of three sources.

   - From a *Conversion Loss Data Disk*, supplied with your mixer. See "Using a Conversion-Loss Data Disk with the ESA or PSA Series Analyzers" on page 38.
   - Data from the calibration sheet supplied with your mixer.
   - From conversion-loss data located on the mixer body label. See "Manually Entering Conversion-Loss Data" on page 84

2. To correct for the conversion-loss of the harmonic mixer in use, the analyzer amplitude correction feature is used. Access this feature by pressing, **Amplitude Y Scale**, **More**, **Corrections**. Select a correction set for use with external mixing. The recommended set to use is **Other** although any available set could be used. Press **Correction** until On is underlined.

3. The full Q band display is shown in Figure 3-9.

Figure 3-9.



4. To complete the amplitude calibration process, the preselector must be adjusted at each frequency of interest. Before making final amplitude measurements with the analyzer, perform the following:

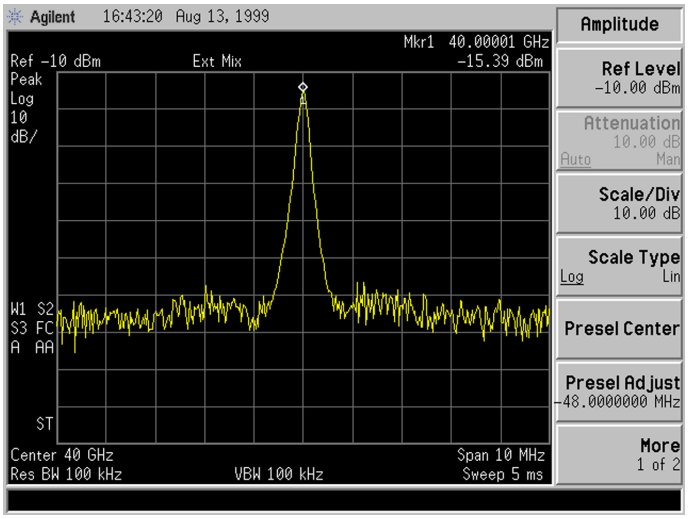
   a. Place a marker on the signal of interest.

   b. Press **SPAN**, **Span Zoom**, 10, **MHz** to zoom in on the signal.

   c. Press **AMPLITUDE**, **Presel Center**.

   The final amplitude measurement can now be read out with the marker. See Figure 3-10..

Figure 3-10.



Manually Entering Conversion-Loss Data

1. Press **AMPLITUDE Y Scale**, **More**, **Corrections**. Select a correction set for use with external mixing. The recommended set to use is **Other** although any available set could be used.

NOTE To correct for the conversion-loss of the harmonic mixer in use, the analyzer amplitude correction feature is used.

---

2. Press **Edit** to enter the appropriate conversion loss data for the mixer in use. These values are listed on the mixer, or a calibration sheet that is supplied with the mixer.

   More correction points entered across the band in use will improve frequency response accuracy. Up to 200 points may be defined for each set.

3. Once the desired correction points are entered, press **Return**, **Correction (On)** to activate correction set **Other**. This will also turn corrections on resulting in a calibrated display. It is recommended that the correction set entered be saved on the internal memory or the floppy drive for future reference. See the ESA User's and Programmer's Reference guide for information on saving correction values.

Using a PSA Series Spectrum Analyzer

Preliminary Operation

Compatibility Reference

Refer to Chapter 2, “Installation,” on page 27 for information relating to retrofit requirements for E4440A, E4446A, or E4448A analyzer.

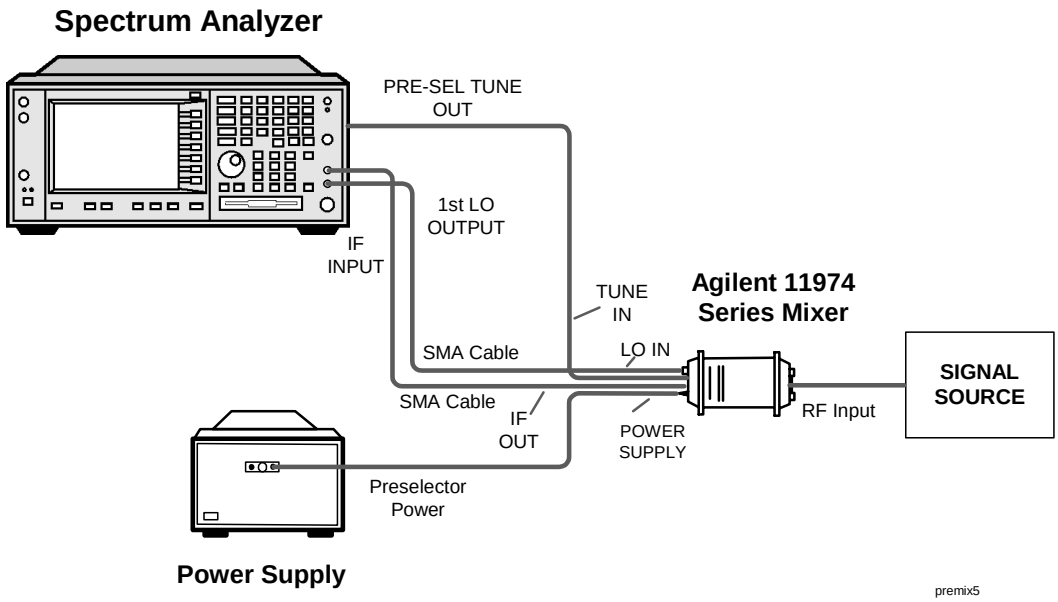
NOTE Option AYZ is required. The E4443A and E4445A do not support external mixing.

Equipment Connection

Connect the equipment as shown in Figure 3-11. and use the following checklist to verify the connections.

- 11974 LO IN to the LO OUTPUT of the PSA (SMA cable, 5061-5458)
- 11974 IF OUT to the IF INPUT of the PSA (SMA cable, 5061-5458)
- 11974 TUNE IN to the PRE-SEL TUNE OUT of the PSA (BNC cable, 8120-1839; BNC f–f adapter, 1250-0080; BNC cable, 8120-2582)
- 11974 POWER SUPPLY to 11974-60028 PRESELECTOR POWER

Figure 3-11. 11974 Connections Using an E4440A, E4446A, or E4448A



Frequency Tracking Calibration This procedure is used to align the frequency of the preselector filter of the Agilent 11974 to the tuned frequency of the analyzer. This procedure should be followed any time that the Agilent 11974 is connected to a different analyzer. The calibration should be periodically checked.

1. Set the Agilent 11974 rear-panel switches "ESA/PSA/70907B" and "LEDS" to the ON position, and the other two switches to the OFF position, in order for the Agilent 11974 to properly scale to the tune signal of the analyzer.
2. Configure the analyzer for a preselected external mixer by pressing the following keys:

   Preset, **Factory Preset** (if present), **Input/Output**, **Input Mixer**, **Input Mixer** (Ext)
3. Set the desired band of operation. Press **Ext Mix Band**, **A**, **Q**, **U**, or **V**. (Note that only A,Q,U, and V bands are available.)
4. Press, **Mixer Config**, **Mixer Type** (Presel).
5. Set the Presel Adjust to 0 MHz by pressing **AMPLITUDE**, **Presel Adjust**, 0, **MHz**.
6. Set the analyzer to zero span by pressing **SPAN**, **Zero Span**.
7. Set the analyzer center frequency by pressing **FREQUENCY**, **Center Freq**, and enter the corresponding value for the appropriate mixer. (Refer to Table 3-6.) On the rear panel of the Agilent 11974, adjust the corresponding potentiometer until one or both of the green LEDs are lit.

Table 3-6.

Mixer Agilent P/N	Analyzer Center Frequency	Potentiometer
11974A	26.5 GHz	"26.5 GHz Adjust"
11974Q	33.0 GHz	"33.0 GHz Adjust"
11974U	40.0 GHz	"40.0 GHz Adjust"
11974V	50.0 GHz	"50.0 GHz Adjust"

8. Change the analyzer center frequency to the value indicated in Table 3-7. and again adjust the corresponding potentiometer on the rear panel of the 11974 until one or both of the green LEDs are lit.

Table 3-7.

Mixer Agilent P/N	Analyzer Center Frequency	Potentiometer
11974A	40.0 GHz	"40.0 GHz Adjust"
11974Q	50.0 GHz	"50.0 GHz Adjust"
11974U	60.0 GHz	"60.0 GHz Adjust"
11974V	75.0 GHz	"75.0 GHz Adjust"

9. Repeat steps 7 and 8 until the green LEDs are lit at both frequencies without additional adjustments.

Band Selection

1. If necessary, configure the analyzer for preselected external mixing by pressing the following keys:

   Input/Output, **Input Mixer** (Ext), **Mixer Config**, **Mixer Type** (Presel)

2. If necessary, adjust the tracking of the Agilent 11974 to the analyzer being used for preselected external mixing, by using the Frequency Tracking Calibration procedure above.

3. Press the following keys to select the desired mixing band: (In this example, we will use an Agilent 11974Q (33.0 to 50.0 GHz) to view a 40 GHz, -15 dBm signal.)

   Input/Output, **Input Mixer**, **Ext Mix Band**, **33-50 GHz** (Q)

Amplitude Calibration

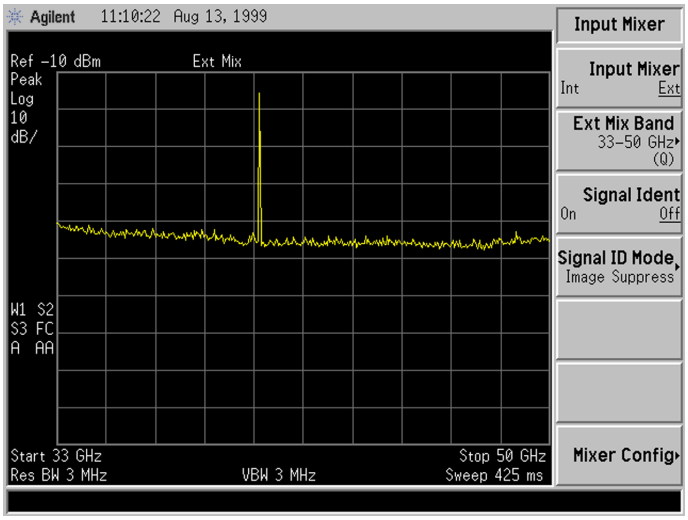
1. Enter the conversion loss versus frequency data from one of three sources.

   - From a *Conversion Loss Data Disk*, supplied with your mixer. See "Using a Conversion-Loss Data Disk with the ESA or PSA Series Analyzers" on page 38.
   - Data from the calibration sheet supplied with your mixer.
   - From conversion-loss data located on the mixer body label. See "Manually Entering Conversion-Loss Data" on page 89

2. To correct for the conversion-loss of the harmonic mixer in use, the analyzer amplitude correction feature is used. Access this feature by pressing, **Amplitude Y Scale**, **More**, **Corrections**. Select a correction set for use with external mixing. The recommended set to use is **Other** although any available set could be used. Press **Correction** until On is underlined.

3. The full Q band display is shown in Figure 3-12.

Figure 3-12.



4. To complete the amplitude calibration process, the preselector must be adjusted at each frequency of interest. Before making final amplitude measurements with the analyzer, perform the following:

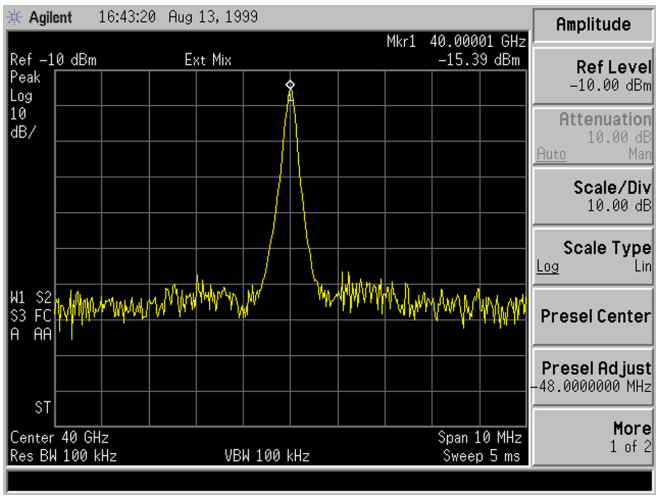
   a. Place a marker on the signal of interest.

   b. Press **SPAN**, **Span Zoom**, 10, **MHz** to zoom in on the signal.

   c. Press **AMPLITUDE**, **Presel Center**.

   The final amplitude measurement can now be read out with the marker. See Figure 3-13..

Figure 3-13.



Manually Entering Conversion-Loss Data

1. Press **AMPLITUDE Y Scale**, **More**, **Corrections**. Select a correction set for use with external mixing. The recommended set to use is **Other** although any available set could be used.

NOTE To correct for the conversion-loss of the harmonic mixer in use, the analyzer amplitude correction feature is used.

---

2. Press **Edit** to enter the appropriate conversion loss data for the mixer in use. These values are listed on the mixer, or a calibration sheet that is supplied with the mixer.

   More correction points entered across the band in use will improve frequency response accuracy. Up to 200 points may be defined for each set.

3. Once the desired correction points are entered, press **Return**, **Correction (On)** to activate correction set **Other**. This will also turn corrections on resulting in a calibrated display. It is recommended that the correction set entered be saved on the internal memory or the floppy drive for future reference. See the PSA User's and Programmer's Reference guide for information on saving correction values.

Using 8561A/62A/62B Spectrum Analyzers

Preliminary Operation

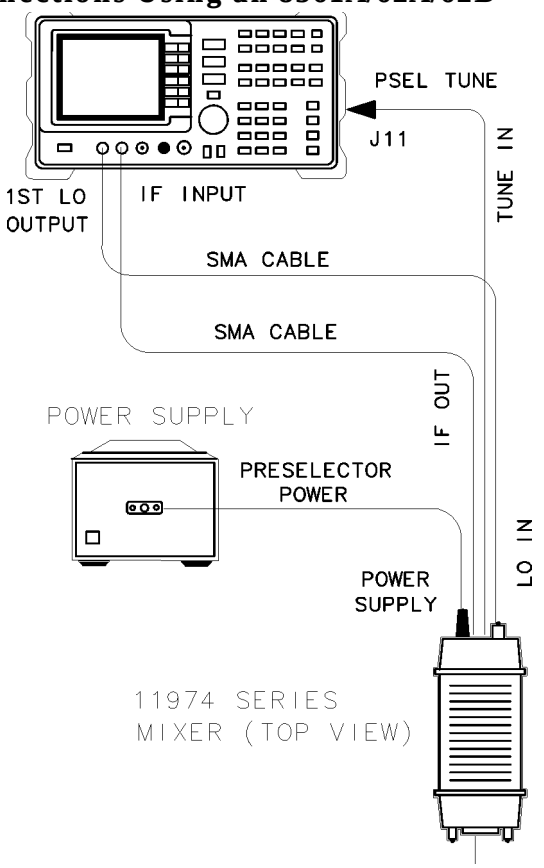
NOTE For compatibility using an 8561A/62A/62B Spectrum Analyzer as a host to the 11974, the appropriate Option K74 retrofit kit *must* be installed.

Equipment Connections

Connect the equipment as shown in Figure 3-14. on page 90 and use the following checklist to verify the connections.

- 11974 LO IN to the analyzer 1ST LO OUTPUT (SMA, 5061-5458)
- 11974 IF OUT to the analyzer IF INPUT (SMA, 5061-5458)
- 11974 TUNE IN to the analyzer J11, PSEL TUNE (BNC cable, 8120-1839; BNC f-f adapter, 1250-0080; BNC cable, 8120-2582)
- 11974 POWER SUPPLY to 11974-60028 PRESELECTOR POWER

Figure 3-14. 11974 Connections Using an 8561A/62A/62B



Frequency Tracking Calibration

Use this procedure to align the frequency of the 11974 tracking filter to the tuned frequency of the spectrum analyzer. Follow this procedure anytime that the 11974 is connected to a different spectrum analyzer. Periodically check the calibration.

1. Set the 11974 rear-panel switches 8563/61/60 and LEDS to the ON position, and the other two switches to the OFF position, in order for the 11974 to properly scale the tune ramp of the spectrum analyzer.
2. Enter the full-band selection mode by using the following key sequence:

   EXT

   FULL BAND

   Use the ⇑ or ⇓ key until the desired band is reached.
3. Apply a frequency offset of 621.4 MHz by using the following key sequence:

   FREQUENCY

   OFFSET

   Enter 621.4 and terminate with **MHz**. (An F should appear at the left side of the display screen to indicate that an offset is applied.)
4. Set the spectrum analyzer to zero span by pressing **SPAN ZERO SPAN**.

NOTE Due to the repetitive nature of this procedure, it may be helpful to save the center-frequency settings in unused state registers as indicated in step 5 and step 7.

---

5. Set the spectrum analyzer center frequency by pressing **FREQUENCY CENTER FREQ** and entering the corresponding value for the mixer listed below, then save this setting in an unused register.

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz
6. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

   for an 11974A: “26.5 GHz SET”

   for an 11974Q: “33.0 GHz SET”

   for an 11974U: “40.0 GHz SET”

   for an 11974V: “50.0 GHz SET”

7. Change the spectrum analyzer center frequency to the value indicated below, then save this setting in an unused register:

   for an 11974A: 40 GHz

   for an 11974Q: 50 GHz

   for an 11974U: 60 GHz

   for an 11974V: 75 GHz

8. On the rear-panel of the 11974, adjust the corresponding potentiometer for the mixer listed below until one or both of the green LEDs are lit.

   for an 11974A: “40 GHz SET”

   for an 11974Q: “50 GHz SET”

   for an 11974U: “60 GHz SET”

   for an 11974V: “75 GHz SET”

9. Repeat step 5 through step 8 until green lights are lit at both frequencies without any additional adjustments.

Operation

Band Selection

1. If necessary, mate the 11974 to the spectrum analyzer being used for preselected external mixing by using the Frequency Tracking Calibration procedure above.
2. Use the following key sequence to enter the external mixing mode and to select the desired band of operation.

   EXT

   FULL BAND

   Use the ⇑ or ⇓ key until the desired band is reached.

NOTE The above band-selection key sequence must be used to enter the external mixing band of operation. Do not enter in the center frequency of the band directly.

---

3. Apply a frequency offset of 621.4 MHz by using the following key sequence:

   FREQUENCY

   OFFSET

   Enter 621.4 and terminate with **MHz**. (An F should appear at the left side of the display screen to indicate that an offset is applied.)

Amplitude Calibration

Enter the conversion loss table at the preset frequencies from either the calibration label on the bottom of the 11974 or the supplied calibration sheet, by using the following key sequence. (Note: the analyzer automatically interpolates between the preset frequencies.)

EXT

AMPTD CORRECT

CNV LOSS VS FREQ

Enter the conversion loss value of the indicated preset frequency, then terminate the entry with **dB**.

Advance to the next preset frequency by pressing ⇑ and enter the conversion loss of the indicated frequency. Continue until the highest frequency is reached, then use the ⇑ and ⇓ keys to scan through the frequencies to verify or edit the conversion-loss values entered.

NOTE For V band, it may be necessary to first use the following key sequence to initialize the average of the conversion loss versus frequency table near the values for this band.

EXT

AMPTD CORRECT

AVERAGE CNV LOSS

Enter 47 and terminate with **dB**.

Preselector Peaking

There is no **PRESEL AUTO PK** or **PRESEL MAN ADJ** softkey function for the 8561A/62A/62B, when in the external mixing mode. Therefore, to maximize the amplitude of the desired signal, use an adjustment tool to vary the corresponding low-frequency potentiometer located on the rear panel. The low-frequency potentiometer for mixer bands are listed below:

for an 11974A: “26.5 GHz SET”

for an 11974Q: “33.0 GHz SET”

for an 11974U: “40.0 GHz SET”

for an 11974V: “50.0 GHz SET”

Sweep Time Considerations

For optimum amplitude accuracy, the sweep rate must be less than 40 MHz/ms, according to the table below.

Table 3-8. Minimum Sweep Time

Frequency Span (GHz)	Minimum Sweep Time (ms)
25	625
20	500
17	425
15	375
13.5	338
10	250
5	125
< 2	50

General Description of 8561A/62A/62B External-Mixing Functions

FULL BAND allows you to select a commonly-used frequency band above 18 GHz. These bands are shown in Table 3-9. on page 95. Use the step keys or the knob to select a desired frequency band; the selected band appears in the active function block. Activating **FULL BAND** also activates the harmonic-lock function.

AMPTD CORRECT displays a menu of functions that set conversion losses and flatness data.

AVERAGE CNV LOSS displays the mean conversion loss for the current harmonic and allows you to enter new conversion loss data. In a full frequency band (such as A band), the mean conversion loss is defined as the minimum loss plus the maximum loss for that band divided by two. To change the maximum and minimum values, use the **CNV LOSS VS FREQ** softkey. Any change to the average conversion loss also affects the flatness data, which is described below.

The default conversion loss value for each band is 30 dB.

CNV LOSS VS FREQ displays the stored conversion loss for a specific frequency in the current band. This allows amplitude correction to be entered to compensate for changes in conversion loss with frequency. To enter a new value, use the data keys. To change the displayed frequency, use the step keys. Any changes to the data also affect the mean conversion loss stored under **AVERAGE CNV LOSS**. Table 3-9. on page 95 shows the number of flatness points for each band and the default flatness values. To view the correction, connect a 310.7 MHz signal of a known amplitude (approximately –30 dBm) to the IF input and set the analyzer to sweep the associated band.

Table 3-9. Flatness Points and Conversion Losses for Frequencies above 18 GHz

Frequency Band	Frequency Range (GHz)	Number of Flatness Points	Point Spacing	Default Conversion Loss
K	18.0 to 26.5	6	2 GHz	30 dB
A	26.5 to 40.0	8	2 GHz	30 dB
Q	33.0 to 50.0	7	3 GHz	30 dB
U	40.0 to 60.0	6	4 GHz	30 dB
V	50.0 to 75.0	6	5 GHz	30 dB
E	60.0 to 90.0	7	5 GHz	30 dB
W	75.0 to 110.0	8	5 GHz	30 dB
F	90.0 to 140.0	6	10 GHz	30 dB
D	110.0 to 170.0	7	10 GHz	30 dB
G	140.0 to 220.0	9	10 GHz	30 dB
Y	170.0 to 260.0	7	15 GHz	30 dB
J	220.0 to 325.0	8	15 GHz	30 dB

MARKER NORMAL activates a single marker and places it at the center of the trace. This softkey is also annotated as **MARKER DELTA**, if delta-marker mode has been previously activated by the **MARKER DELTA** softkey under the Marker menus.

If one marker is already on, no operation takes place. If two markers are on (as in **MARKER DELTA** mode), pressing **MARKER DELTA** deletes the anchor marker and makes the active one the new, single marker. The marker reads the amplitude and the frequency (or relative time, when the frequency span equals 0 Hz), and displays these values in the active function block and in the upper-right corner of the display. To move the marker, use either the knob, the step keys, or the data keys.

The marker reads data from the currently active trace. (An active trace is one that is in either the clear-write or max-hold mode; this may be either trace A or trace B.) If both traces are active, or if both traces are in view mode, the marker reads data from trace A.

PEAK SEARCH places a marker on the highest point on a trace. The frequency and amplitude of the marker are displayed in the upper-right corner of the screen; **PEAK SEARCH** does not alter the active function.

4 Performance Tests

Introduction

This section contains instructions for testing the performance of the 11974 Series Preselected Millimeter Mixers. Performance tests are used to check the mixers at incoming inspection and for periodic evaluation. The tests verify the specifications listed for the 11974 Series in Table 1-1 on page 15.

Test equipment required for the performance tests is listed in the following tables:

11974A—Table 4-1 on page 101,

11974Q—Table 4-2 on page 102,

11974U—Table 4-3 on page 103,

11974V—Table 4-4 on page 104.

You may use test instruments other than those listed, provided their performance equals or exceeds the critical specifications in these tables.

Test Record Summary

The performance test record summary (Table 4-6 on page 135), which is used for recording and summarizing the performance test data, at the end of this chapter. The test record summary includes the measurement uncertainty for each band, calculated as the root sum square of the error terms. A test record summary has been provided for each band, therefore use the appropriate pages in Table 4-6 for your band.

Data tables (Table 4-7 on page 140, Table 4-8 on page 143, Table 4-9 on page 144, Table 4-10 on page 146, and Table 4-11 on page 146) immediately follow the performance test record summary. Make copies of these tables and use them as worksheets when performing the tests. The data tables can then be used to summarize the results for the performance test record summary.

Performance Test Procedures

Each performance test is contained in a single paragraph. All specifications for the parameters being measured are described in Table 1-1 on page 15. This is followed by a general description of the test and any special instructions or problem areas. Appropriate test setup illustrations are included in this section and are referenced in the test procedures.

NOTE The performance test procedures *must* be performed in the order that they appear.

"1. Conversion Loss" on page 109

"2. Image Rejection Test" on page 114

"3. Multiple Response Rejection Test" on page 118

"4. Displayed Average Noise Level" on page 126

"5. 3 dB Bandwidth" on page 130

Table 4-1 Recommended Test Equipment for 11974A

Instrument	Critical Specifications	Recommended Model
Spectrum Analyzer	LO and IF ranges compatible with 11974A SWEEP + TUNE voltage compatible with 11974A.	8566B w/serial prefix 2948 or later
Synthesized Sweeper	Frequency: 13.25 to 20 GHz External leveling capability Sub harmonics and multiples thereof: <–25 dBc	8340B[a]
Amplifier	Frequency Range: 3 to 5 GHz Output Level: +16 dBm leveled	11975A
Amplifier	15 dB gain from 13.25 to 20 GHz Compatible with mm-wave source module Non-harmonic spurious: <–50 dBc	8349B
Power Meter	Compatible with thermistor mount	432A
Thermistor Mount	SWR: <2.0 from 26.5 to 40 GHz	R486A
Power Sensor	SWR: <1.2 at 5 GHz	8481A
Power Meter	Compatible with power sensor	436A
Directional Coupler	Coupling: 10 dB Directivity: >40 dB Primary line SWR: 1.04 Auxiliary arm SWR: 1.05	R752CS
Isolator	Insertion Loss: <1.5 dB Isolation: >25 dB SWR: <1.4	R365A
Millimeter-Wave Source Module	Output power: +2 dBm leveled Output SWR: <2.0 Harmonically related spurious signals: <–20 dBc	83554A
Waveguide Straights	5 cm minimum SWR: <1.016	R896B

a. If an 8340A is used, the 1.0 V/GHz output will have to be modified to a 0.5 V/GHz output for proper display accuracy, leveling flatness, and harmonic suppression. Provided with your mm-wave source module is a set of modification instructions. This modification procedure will enable you to properly convert your 8340A to a 0.5 V/GHz output.

Table 4-2 Recommended Test Equipment for 11974Q

Instrument	Critical Specifications	Recommended Model
Spectrum Analyzer	LO and IF ranges compatible with 11974Q SWEEP + TUNE voltage compatible with 11974Q.	8566B w/serial prefix 2948 or later
Synthesized Sweeper	Frequency: 11 to 17 GHz External leveling capability Sub harmonics and multiples thereof: <–25 dBc	8340B[a]
Amplifier	Frequency Range: 3 to 5 GHz Output level: +16 dBm leveled	11975A
Amplifier	15 dB gain from 11 to 17 GHz Compatible with mm-wave source module Non-harmonic spurious: <–50 dBc	8349B
Power Meter	Compatible with thermistor mount	432A
Thermistor Mount	SWR: <2.0 from 33 to 50 GHz	Hughes 45772H-1100
Power Sensor	SWR: <1.2 at 5 GHz	8481A
Power Meter	Compatible with power sensor	436A
Directional Coupler	Coupling: 10 dB Directivity: >40 dB Primary line SWR: <1.05 Auxiliary arm SWR: <1.1	Q752C
Isolator	Insertion Loss: <1.6 dB Isolation: >25 dB SWR: <1.4	Q365A
Millimeter-Wave Source Module	Output power: +2 dBm leveled Output SWR: <2.0 Harmonically related spurious signals: <–20 dBc	83555A
Waveguide Straights	5 cm minimum SWR: <1.016	Q896B

a. If an 8340A is used, the 1.0 V/GHz output will have to be modified to a 0.5 V/GHz output for proper display accuracy, leveling flatness, and harmonic suppression. Provided with your mm-wave source module is a set of modification instructions. This modification procedure will enable you to properly convert your 8340A to a 0.5 V/GHz output.

Table 4-3 Recommended Test Equipment for 11974U

Instrument	Critical Specifications	Recommended Model
Spectrum Analyzer	LO and IF ranges compatible with 11974U SWEEP + TUNE voltage compatible with 11974U.	8566B w/serial prefix 2948 or later
Synthesized Sweeper	Frequency: 13 to 20 GHz External leveling capability Sub harmonics and multiples thereof: <–25 dBc	8340B[a]
Amplifier	Frequency Range: 4 to 6 GHz Output Level: +16 dBm leveled	11975A
Amplifier	15 dB gain from 13 to 20 GHz Compatible with mm-wave source module Non-harmonic spurious: <–50 dBc	8349B
Power Meter	Compatible with thermistor mount	432A
Thermistor mount	SWR: <2.0 from 40 to 60 GHz	Hughes 45773H-1100
Power Sensor	SWR: <1.2 at 5 GHz	8481A
Power Meter	Compatible with power sensor	436A
Directional Coupler	Coupling: 10 dB Directivity: >39 dB Primary line SWR: 1.06 Auxiliary arm SWR: 1.1	U752C
Isolator	Insertion Loss: <1.8 dB Isolation: >25 dB SWR: <1.4	U365A
Millimeter-Wave Source Module	Output power: +2 dBm leveled Output SWR: <2.0 Harmonically related spurious signals: <–20 dBc	83556A
Waveguide Straights	5 cm minimum SWR: <1.016	U896B

a. If an 8340A is used, the 1.0 V/GHz output will have to be modified to a 0.5 V/GHz output for proper display accuracy, leveling flatness, and harmonic suppression. Provided with your mm-wave source module is a set of modification instructions. This modification procedure will enable you to properly convert your 8340A to a 0.5 V/GHz output.

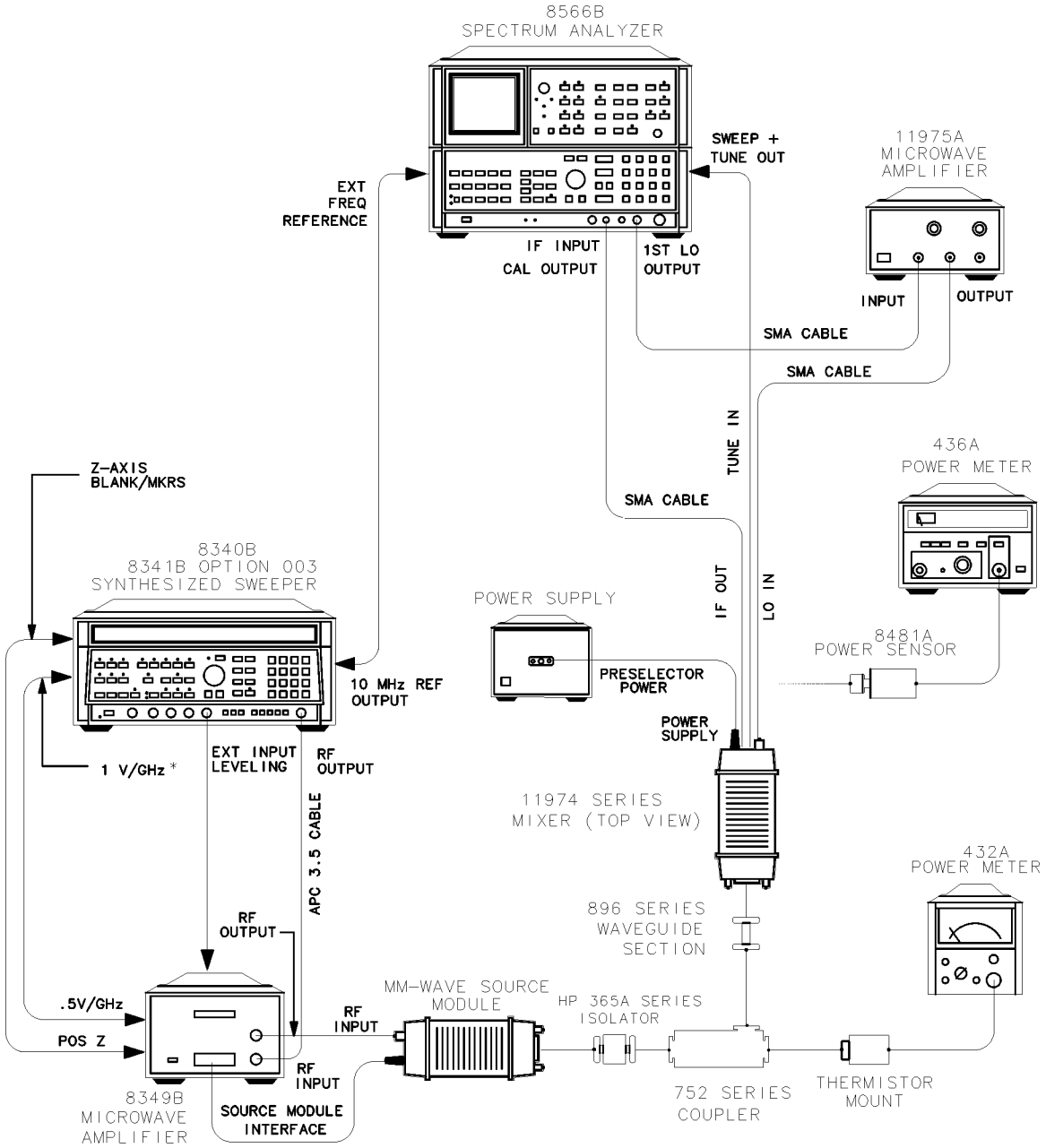
Table 4-4 Recommended Test Equipment for 11974V

Instrument	Critical Specifications	Recommended Model
Spectrum Analyzer	LO and IF ranges compatible with 11974V SWEEP + TUNE voltage compatible with 11974V.	8566B w/serial prefix 2948 or later
Synthesized Sweeper	Frequency: 12.5 to 19 GHz External leveling capability Sub harmonics and multiples thereof: <–25 dBc	8341B Option 003
Amplifier	Frequency Range: 4 to 6 GHz Output level: +16 dBm leveled	11975A
Amplifier	15 dB gain from 13 to 20 GHz Compatible with mm-wave source module Non-harmonic spurious: <–50 dBc	8349B
Power Meter	Compatible with thermistor mount	432A
Thermistor Mount	SWR: <2.0 from 50 to 75 GHz	Hughes 45774H-1100
Power Sensor	SWR: <1.2 at 5 GHz	8481A
Power Meter	Compatible with power sensor	436A
Directional Coupler	Coupling: 10 dB Directivity: >36 dB Primary line SWR: 1.08 Auxiliary arm SWR: 1.14	V752C
Isolator	Insertion Loss: <2.0 dB Isolation: >25 dB SWR: <1.5	V365A
Millimeter-Wave Source Module	Output power: +2 dBm leveled Output SWR: <2.0 Harmonically related spurious signals: <–20 dBc	83557A
Waveguide Straights	5 cm minimum SWR: <1.02	V896B

Table 4-5 Recommended Accessories for All Bands

Accessory	Critical Specifications	Recommended Model
Adapter *(1 required)*	SMA (f) to Type N (f)	1250-1772
Adapter *(1 required)*	Type N (m) to APC 3.5 (f)	1250-1744
Cables *(3 required)*	Connectors: SMA (m)	5061-5458
Cable *(1 required)*	Connectors: APC 3.5 (m)	11500E
Cables *(5 required)*	Connectors: BNC (m)	10503A

Figure 4-1 Performance Tests Setup



* For proper display accuracy, leveling flatness, and harmonic suppression, the 1.0V/GHz output on your 8340B will have to be modified for a 0.5V/GHz output. Provided with your mm-wave source module is a set of modification instructions. This modification procedure will apply to your source, enabling you to properly convert your instrument to 0.5V/GHz output operation.

Frequency Tracking Calibration with an 8566B Spectrum Analyzer

NOTE In order for the 8566B to be compatible with the 11974 Series Preselected Millimeter Mixer, it must have a serial prefix of 2948 or later. If not, retrofit kit 8566B K74 must be installed before using an 8566B for the testing of the 11974.

1. Connect the IF OUT of the 11974 to the IF INPUT of the spectrum analyzer, the spectrum analyzer 1ST LO OUTPUT to the INPUT of the 11975A Amplifier, and the 11975A Amplifier OUTPUT to the LO IN of the 11974.

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

2. Connect the SWEEP + TUNE OUT of the spectrum analyzer to the TUNE IN of the 11974.
3. Set the 11974 rear-panel switches **8566B** and **LEDS** to the ON position, and the **8563A/61B/60A** and **70907B** switches to the OFF position, for the 11974 to properly scale the tune ramp of the analyzer.
4. Set the spectrum analyzer to the correct millimeter band using the following key sequence for the appropriate mixer:

   for an 11974A: **SHIFT** ⇑ ⇑

   for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

   for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

   for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑
5. On the spectrum analyzer, set the preselector DAC to 32 (the center of its 0–63 range) by pressing **SHIFT GHz** 32 **Hz**.
6. Set the spectrum analyzer to a frequency span of 0 Hz by pressing

   FREQUENCY SPAN 0 **Hz**.

NOTE Due to the repetitive nature of this procedure, it may be helpful to save the center-frequency settings as indicated in step 7 and step 9 in unused state registers.

7. Set the spectrum analyzer center frequency to the low end of the band by pressing **CENTER FREQUENCY** and entering the corresponding value for the mixer listed below. Save this setting in an unused register.

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz

8. On the rear panel of the 11974, adjust the corresponding potentiometer for the mixer listed below, until one or both of the green LEDs are lit.

   for an 11974A: “26.5 GHz Set”

   for an 11974Q: “33.0 GHz Set”

   for an 11974U: “40.0 GHz Set”

   for an 11974V: “50.0 GHz Set”

9. Change the spectrum analyzer center frequency to the high end of the band as indicated below, then save this setting in an unused register:

   for an 11974A: 40 GHz

   for an 11974Q: 50 GHz

   for an 11974U: 60 GHz

   for an 11974V: 75 GHz

10. On the rear panel of the 11974, adjust the corresponding potentiometer for the mixer listed below, until one or both of the green LEDs are lit.

    for an 11974A: “40 GHz Set”

    for an 11974Q: “50 GHz Set”

    for an 11974U: “60 GHz Set”

    for an 11974V: “75 GHz Set”

11. Repeat step 7 through step 10 until the green LEDs are lit at both frequencies without additional adjustments.

NOTE Upon completion of this adjustment procedure, and before taking data, use the spectrum analyzer preselector-peak function to peak the 11974 filter on signals to be measured.

1. Conversion Loss

Description

The conversion loss is checked at a nominal local-oscillator power level. A known input power is applied to the input of the 11974. The IF output power is measured on an 8566B Spectrum Analyzer. From the measurements, the conversion loss is calculated. The calibration factors versus frequency of the millimeter-wave power-meter sensor and the coupling factors versus frequency of the coupler are needed in this measurement.

Procedure

1. Connect an SMA cable from the 1ST LO OUTPUT of the spectrum analyzer to the INPUT of the 11975A Amplifier. Connect a second SMA cable to the OUTPUT of the amplifier.
2. Connect the 8481A Power Sensor to the power-meter sensor cable, then zero and calibrate the 436A Power Meter.
3. Set the spectrum analyzer controls as follows:

   SHIFT ⇑ ⇑ ⇑ ⇑ (selects U Band)

   FREQUENCY SPAN . . . . . .0 Hz

   CENTER FREQUENCY (sets the LO frequency to 5.0 GHz). . . . . .50.3 GHz

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

4. On the 11975A Amplifier, set the rear-panel ALC switch to ON. Connect the 8481A Power Sensor to the free end of the cable installed on the OUTPUT connector of the amplifier listed in step 1. Set the 436A Power-Meter Cal Factor % to the appropriate value for a frequency of 5 GHz.
5. Adjust the amplifier OUTPUT POWER LEVEL for a reading of +15.2 dBm ±0.1 dBm on the power meter.
6. Set the 432A Power Meter Cal Factor % to 100 percent.
7. Connect the equipment as shown in Figure 4-1 on page 106.

CAUTION Turn off the ac power on the 8349B Amplifier prior to connecting or disconnecting the source module interface cable.

Turn off the ac power on the 11974-60028 Preselector Power Supply when either connecting or disconnecting the 11974 from it.

On the 11974 rear panel, set the instrument select switches to the appropriate settings before applying power to the 11974.

8. Turn off the RF power on the synthesized sweeper and zero the 432A Power Meter.
9. Enter the appropriate millimeter-wave source module frequency multiplication factor into the synthesized sweeper by pressing **SHIFT START FREQ** and then press the following keys (on the synthesized sweeper) for the appropriate band listed below:

   for an 11974A: **2 Hz**

   for an 11974Q: **3 Hz**

   for an 11974U: **3 Hz**

   for an 11974V: **4 Hz**

10. Set the synthesized sweeper for a CW signal at the frequency listed below:

    for an 11974A: 26.5 GHz

    for an 11974Q: 33.0 GHz

    for an 11974U: 40.0 GHz

    for an 11974V: 50.0 GHz

11. Set the synthesized sweeper frequency step to 500 MHz by pressing **SHIFT CF** 500 MHz.
12. Activate external leveling on the synthesized sweeper by pressing **XTAL**.
13. Adjust the output power of the synthesized sweeper for a reading of approximately 0 dBm on the 8349B display.
14. Set the spectrum analyzer to the appropriate millimeter band by using the appropriate key sequence listed below:

    for an 11974A: **SHIFT** ⇑ ⇑

    for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

    for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

    for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

15.Set the spectrum analyzer controls as follows:

SHIFT, **5**, **MHz**, **0**, and **dB** (sets external mixer conversion loss to 0 dB)

FREQUENCY SPAN . . . . . 5 MHz

ENTER dB/DIV . . . . . 5 dB

CF STEP SIZE . . . . . 500 MHz

16.Set the reference level of the spectrum analyzer by pressing **REFERENCE LEVEL** and entering the corresponding value for the appropriate band listed below:

for an 11974A: –40 dBm

for an 11974Q: –40 dBm

for an 11974U: –40 dBm

for an 11974V: –55 dBm

17.Set the center frequency of the spectrum analyzer by pressing **CENTER FREQUENCY** and entering the corresponding value for the appropriate band listed below:

for an 11974A: 26.5 GHz

for an 11974Q: 33 GHz

for an 11974U: 40 GHz

for an 11974V: 50 GHz

18.On the spectrum analyzer, press MARKER **PEAK SEARCH** and **PRESEL PEAK**.

19.Record the following values in Table 4-7 on page 140.

Marker Frequency

Marker Amplitude

Power Meter Reading

Cal Factor % or Correction Factor (dB)

Directional Coupler Coupling Factor

NOTE For the purpose of this measurement, the directional coupler coupling factor is defined as the ratio of the power at the output flange to the power at the coupled flange.

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20. Calculate the conversion loss (CL) of the 11974 with the equations given below.

If the power meter calibration factor is given in % or decimal form, for example, 93% or 0.93, then:

CL = Power Meter Reading – 10 × log (Cal Factor) – SA Marker Amplitude – Coupling Factor

If the power meter correction factor is given in dB, then:

CL = Pwr Mtr Reading + Pwr Mtr Correction Factor – SA Marker Amplitude – Coupling Factor

For Example:

Power Meter Reading =	–0.03 dBm
Cal Factor =	94.8%
or	
Correction Factor =	0.23 dB
Spectrum Analyzer Reading =	–44.78 dBm
Coupling Factor =	8.93 dB

then:

Conversion Loss = (–0.03) – 10 × log(.948) – (–44.78 dBm) –8.93 dB = 36.05 dB

or

Conversion Loss = (–0.03) + (0.23 dB) – (–44.78 dBm) –8.93 dB = 36.05 dB.

Record the conversion loss in Table 4-7 on page 140.

NOTE The conversion loss indicated on the 11974 calibration label includes the loss in the IF cable. If another cable other than the specified cable is used, then the loss in that cable must be compensated for when making amplitude measurements.

21. Increase the frequency of the synthesized sweeper 500 MHz by pressing **CW** ⇑.

22. Turn off the RF power on the synthesized sweeper by pressing **RF** and zero the 432A Power Meter, then turn the synthesized sweeper RF power back on again.

23. On the spectrum analyzer, press **CENTER FREQUENCY** ⇑ to increase the spectrum analyzer frequency.

24. On the spectrum analyzer, press MARKER **PEAK SEARCH** and **PRESEL PEAK**.
25. Repeat step 19 through step 24 until data has been recorded for the appropriate maximum frequency listed below:

    for an 11974A: 40 GHz

    for an 11974Q: 50 GHz

    for an 11974U: 60 GHz

    for an 11974V: 75 GHz
26. Record the Maximum Conversion Loss in Table 4-7 on page 140.

2. Image Rejection Test

Description

The image rejection is checked at an LO power level of +15.2 dBm. A known input power is applied to the input of the mixer. The IF output power is measured on an 8566B Spectrum Analyzer at the input signal frequency and at the image response frequency. From the measurements, the image rejection is determined. The image response appears on the spectrum analyzer at a frequency of two times the IF frequency higher than the actual signal frequency. In the case of the 8566B, the image response appears 642.8 MHz above the actual frequency of the signal.

Procedure

1. Connect an SMA cable from the 1ST LO OUTPUT of the spectrum analyzer to the INPUT of the 11975A Amplifier. Connect a second SMA cable to the OUTPUT of the amplifier.
2. Connect the 8481A Power Sensor to the power meter sensor cable, then zero and calibrate the 436A Power Meter.
3. Set the spectrum analyzer controls as follows:

   SHIFT ⇑ ⇑ ⇑ ⇑ (selects U Band)

   FREQUENCY SPAN . . . . . 0 Hz

   CENTER FREQUENCY (sets LO frequency to 5.0 GHz) . . . . . 50.3 GHz

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

4. On the 11975A Amplifier, set the rear-panel ALC switch to ON, then connect the 8481A Power Sensor to the free end of the cable installed on the OUTPUT connector of the amplifier. Set the 436A Power Meter Cal Factor % to the appropriate value for a frequency of 5 GHz.
5. Adjust the amplifier OUTPUT POWER LEVEL for a reading of +15.2 dBm ±0.1 dBm on the power meter.
6. Connect the equipment as shown in Figure 4-1 on page 106.

CAUTION Turn off the ac power on the 8349B prior to connecting or disconnecting the source module interface cable.

Turn off the ac power on the 11974-60028 Preselector Power Supply prior to connecting or disconnecting the 11974.

On the 11974 rear panel, set the instrument select switches to the appropriate settings before applying power to it.

7. Enter the appropriate millimeter-wave source module frequency multiplication factor into the synthesized sweeper by pressing **SHIFT** and **START FREQ** and entering the corresponding value for the band listed below:

   for an 11974A: **2 Hz**

   for an 11974Q: **3 Hz**

   for an 11974U: **3 Hz**

   for an 11974V: **4 Hz**

8. Set the synthesized sweeper for a CW signal at the frequency listed below:

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz

9. Set the synthesized sweeper frequency step to 500 MHz by pressing **SHIFT**, **CF**, 500, and **MHz**.

10. Activate external leveling on the synthesized sweeper by pressing **XTAL**.

11. Adjust the output power of the synthesized sweeper for a reading of approximately 0 dBm on the 8349B display.

12. Set the spectrum analyzer to the appropriate millimeter band using the following keys:

    for an 11974A: **SHIFT** ⇑ ⇑

    for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

    for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

    for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

13. Set the spectrum analyzer controls as follows:

    SHIFT, **5**, **MHz**, **0**, and **dB** (sets external mixer conversion loss to 0 dB)

    FREQUENCY SPAN . . . . . .50 kHz

    ENTER dB/DIV . . . . . .10 dB

    CF STEP SIZE . . . . . 642.8 MHz

14. Set the spectrum analyzer reference level by pressing **REFERENCE LEVEL** and entering the corresponding value for the band listed below:

    for an 11974A: –40 dBm

    for an 11974Q: –40 dBm

    for an 11974U: –40 dBm

    for an 11974V: –55 dBm

15. Set the spectrum analyzer center frequency by pressing **CENTER FREQUENCY** and entering the corresponding value for the band listed below:

    for an 11974A: 26.5 GHz

    for an 11974Q: 33 GHz

    for an 11974U: 40 GHz

    for an 11974V: 50 GHz

16. On the spectrum analyzer, press the following keys:

    MARKER **NORMAL**

    PEAK SEARCH

    PRESEL PEAK

17. When the preselector-peak routine is complete, press **PEAK SEARCH**.

18. Record the marker frequency in Table 4-8 on page 143.

19. On the spectrum analyzer, press MARKER Δ.

20. On the spectrum analyzer, press **CENTER FREQUENCY** and use the ⇑ key to tune to the image response. Press **PEAK SEARCH** to place the delta marker at the top of the image response. The absolute value of the delta marker amplitude is the Image Rejection.

NOTE If the signal is buried in the noise floor, reduce the video bandwidth to 100 Hz to help identify the signal. At some frequencies, however, instrument performance is so good that an image response may not be visible.

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21. Record the Image Rejection in Table 4-8 on page 143.

22. On the synthesized sweeper, press **CW** and ⇑ to increase the frequency of the synthesized sweeper 500 MHz higher.

23. On the spectrum analyzer, set the **CENTER FREQUENCY** to match the output frequency of the signal source.

24. Repeat step 16 through step 23 until data has been recorded for the appropriate maximum frequency listed below:

    for an 11974A: 40 GHz

    for an 11974Q: 50 GHz

    for an 11974U: 60 GHz

    for an 11974V: 75 GHz

25. Record the Minimum Image Rejection value in Table 4-8 on page 143.

NOTE For the 11974V, record the Minimum Image Rejection in each portion of the band.

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3. Multiple Response Rejection Test

Description

The multiple response rejection is checked at an LO power level of +15.2 dBm. A known input power is applied to the input of the mixer. The IF output power is measured on an 8566B Spectrum Analyzer at the input signal frequency and at the multiple response frequencies. From the measurements, the multiple response rejection is determined. For each mixer, the spectrum analyzer/mixer combination is calibrated in frequency and amplitude for mixing with a certain harmonic of the local oscillator. Multiple responses are a result of the RF input's mixing with a harmonic of the local oscillator other than the harmonic that the spectrum analyzer is calibrated for. The multiple responses appear on the spectrum analyzer at frequencies described by the following equation:

$$f'_{RF} = f_{RF}\left(\frac{n}{n'}\right) + f_{IF}\left(\frac{n' \pm n}{n'}\right) \text{GHz}$$

where n represents the harmonic number for calibrated operation, as listed below.

for an 11974A: 8

for an 11974Q: 10

for an 11974U: 10

for an 11974V: 14

and n' = Harmonic number producing unwanted multiple responses. The harmonics that produce the highest level multiple responses tend to be $n' = n + 2$ and $n' = n - 2$. For example, for the 11974U, these would be $n' = 8$ and $n' = 12$. This test measures the rejection of multiple responses caused by $n' = n - 2$ and $n' = n + 2$ for signals at the lowest, middle, and highest frequencies of each band.

Procedure

1. Connect an SMA cable from the 1ST LO OUTPUT of the spectrum analyzer to the INPUT of the 11975A Amplifier. Connect a second SMA cable to the OUTPUT of the amplifier.
2. Connect the 8481A Power Sensor to the 436A Power Meter sensor cable, then zero and calibrate the 436A Power Meter.
3. Set the spectrum analyzer controls as follows:

   SHIFT ⇑ ⇑ ⇑ ⇑ (selects U Band)

   FREQUENCY SPAN . . . . . 0 Hz

   CENTER FREQUENCY (sets LO frequency to 5.0 GHz) . . . . . 50.3 GHz

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

4. On the 11975A Amplifier, set the rear-panel ALC switch to ON, then connect the 8481A Power Sensor to the free end of the cable installed on the OUTPUT connector of the amplifier. Set the 436A Power Meter Cal Factor % to the appropriate value for a frequency of 5 GHz.
5. Adjust the amplifier OUTPUT POWER LEVEL for a reading of +15.2 dBm ±0.1 dBm on the power meter.
6. Connect the equipment as shown in Figure 4-1 on page 106.

CAUTION Turn off the ac power on the 8349B prior to connecting or disconnecting the source module interface cable.

Turn off the ac power on the 11974-60028 Preselector Power Supply prior to connecting or disconnecting the 11974.

On the 11974 rear panel, set the instrument select switches to the appropriate settings before applying power to the 11974.

7. Enter the appropriate millimeter-wave source module frequency multiplication factor into the synthesized sweeper by pressing **SHIFT** and **START FREQ** and entering the corresponding value for the band listed below:

   for an 11974A: **2 Hz**

   for an 11974Q: **3 Hz**

   for an 11974U: **3 Hz**

   for an 11974V: **4 Hz**

8. Set the synthesized sweeper for a CW signal at the frequency listed below:

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz

9. Activate external leveling on the synthesized sweeper by pressing **XTAL**.
10. Adjust the output power of the synthesized sweeper for a reading of approximately 0 dBm on the 8349B display.

11. Set the spectrum analyzer to the appropriate millimeter band by using the following key sequence:

    for an 11974A: **SHIFT** ⇑ ⇑

    for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

    for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

    for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

12. Set the spectrum analyzer controls as follows:

    SHIFT, **5**, **MHz**, **0**, and **dB** (sets external mixer conversion loss to 0 dB)

    FREQUENCY SPAN . . . . . 50 kHz

    ENTER dB/DIV . . . . . 10 dB

13. Set the spectrum analyzer reference level by pressing **REFERENCE LEVEL** and entering the corresponding value for the band listed below:

    for an 11974A: –40 dBm

    for an 11974Q: –40 dBm

    for an 11974U: –40 dBm

    for an 11974V: –55 dBm

14. Set the spectrum analyzer center frequency by pressing **CENTER FREQUENCY** and entering the corresponding value for the band listed below:

    for an 11974A: 26.5 GHz

    for an 11974Q: 33 GHz

    for an 11974U: 40 GHz

    for an 11974V: 50 GHz

15. On the spectrum analyzer, press the following keys:

    MARKER **NORMAL**

    PEAK SEARCH

    PRESEL PEAK

16. When the preselector-peak routine is complete, press **PEAK SEARCH**.

17. Record the marker frequency in Table 4-9 on page 144 as Signal Frequency #1.

18. On the spectrum analyzer, press MARKER Δ.

19. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to a multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 35.226200 GHz (n' = 6+)

    for an 11974Q: 41.169650 GHz (n' = 8+)

    for an 11974U: 49.919650 GHz (n' = 8+)

    for an 11974V: 58.279767 GHz (n' = 12+)

20. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #1. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

NOTE If the signal is buried in the noise floor, reduce the video bandwidth to 100 Hz to help identify the signal. At some frequencies, however, instrument performance is so good that an image response may not be visible.

---

21. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #1.

22. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the next multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 36.083269 GHz (n' = 6–)

    for an 11974Q: 41.973150 GHz (n' = 8–)

    for an 11974U: 50.723150 GHz (n' = 8–)

    for an 11974V: 59.029700 GHz (n' = 12–)

23. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #2. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

24. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #2.

25. Set the synthesized sweeper for a CW signal at the frequency listed below for the corresponding band:

    for an 11974A: 33.25 GHz

    for an 11974Q: 41.50 GHz

    for an 11974U: 50.00 GHz

    for an 11974V: 62.50 GHz

26. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the frequency listed below for the corresponding band:

    for an 11974A: 33.25 GHz

    for an 11974Q: 41.50 GHz

    for an 11974U: 50.00 GHz

    for an 11974V: 62.50 GHz

27. On the spectrum analyzer, press the following keys:

    MARKER **NORMAL**

    PEAK SEARCH

    PRESEL PEAK

28. When the preselector-peak routine is complete, press **PEAK SEARCH**.

29. Record the marker frequency in Table 4-9 on page 144 as Signal Frequency #2.

30. On the spectrum analyzer, press MARKER Δ.

31. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to a multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 26.664280 GHz (n' = 10+)

    for an 11974Q: 34.636900 GHz (n' = 12+)

    for an 11974U: 41.720233 GHz (n' = 12+)

    for an 11974V: 65.665175 GHz (n' = 16+)

32. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #3. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

33. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #3.

34. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the next multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 27.178520 GHz (n' = 10–)

    for an 11974Q: 35.172567 GHz (n' = 12–)

    for an 11974U: 42.255900 GHz (n' = 12–)

    for an 11974V: 55.290125 GHz (n' = 16–)

35. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #4. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

36. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #4.

37. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the next multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: Response not in band. Skip to step 40.

    for an 11974Q: Response not in band. Skip to step 40.

    for an 11974U: Response not in band. Skip to step 40.

    for an 11974V: 72.863100 GHz (n' = 12+)

38. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #5. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

39. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #5.

40. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the next multiple response by entering the frequency value for the corresponding mixer listed below:

    for an 11974A: Response not in band. Skip to step 43.

    for an 11974Q: Response not in band. Skip to step 43.

    for an 11974U: Response not in band. Skip to step 43.

    for an 11974V: 73.613033 GHz (n' = 12–)

41. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #6. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

42. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #6.

43. Set the synthesized sweeper for a CW signal at the frequency listed below for the corresponding band:

    for an 11974A: 40.00 GHz

    for an 11974Q: 50.00 GHz

    for an 11974U: 60.00 GHz

    for an 11974V: 75.00 GHz

44. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the frequency for the corresponding band listed below:

    for an 11974A: 40.00 GHz

    for an 11974Q: 50.00 GHz

    for an 11974U: 60.00 GHz

    for an 11974V: 75.00 GHz

45. On the spectrum analyzer, press the following keys:

    MARKER **NORMAL**

    PEAK SEARCH

    PRESEL PEAK

46. When the preselector-peak routine is complete, press **PEAK SEARCH**.

47. Record the marker frequency in Table 4-9 on page 144 as Signal Frequency #3.

48. On the spectrum analyzer, press MARKER Δ.

49. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to a multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 32.064280 GHz (n' = 10+)

    for an 11974Q: 41.720233 GHz (n' = 12+)

    for an 11974U: 50.053567 GHz (n' = 12+)

    for an 11974V: 65.665175 GHz (n' = 16+)

50. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #7. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

51. Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #7.

52. On the spectrum analyzer, press **CENTER FREQUENCY** and tune to the next multiple response by entering the frequency value for the corresponding band listed below:

    for an 11974A: 32.578520 GHz (n' = 10–)

    for an 11974Q: 42.255900 GHz (n' = 12–)

    for an 11974U: 50.589233 GHz (n' = 12–)

    for an 11974V: 66.227625 GHz (n' = 16–)

53. Record the above frequency in Table 4-9 on page 144 as Multiple Response Frequency #8. Press **PEAK SEARCH** to place the delta marker at the top of the multiple response. The absolute value of the delta marker amplitude is the multiple response rejection.

54.Record the multiple response rejection in Table 4-9 on page 144 as Multiple Response Rejection #8.

55.Record the Minimum Multiple Response Rejection in Table 4-9 on page 144.

NOTE For the 11974V, record the Minimum Multiple Response Rejection for signal frequencies in each portion of the band.

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4. Displayed Average Noise Level

Description

The displayed average noise level is checked at three frequencies with an LO power level of +15.2 dBm. The RF source is turned off and, at each frequency, the conversion loss measured in the Conversion Loss Test is entered into the spectrum analyzer. The spectrum analyzer is put in zero span and the average noise level is measured. The displayed average noise level is measured at the lowest and highest frequency in the band, as well as the frequency at which the mixer has the maximum conversion loss.

Procedure

1. Connect an SMA cable from the 1ST LO OUTPUT of the spectrum analyzer to the INPUT of the 11975A Amplifier. Connect a second SMA cable to the OUTPUT of the amplifier.
2. Connect the 8481A Power Sensor to the 436A Power Meter sensor cable, then zero and calibrate the 436A Power Meter.
3. Set the spectrum analyzer controls as follows:

   SHIFT ⇑ ⇑ ⇑ ⇑ (selects U Band)

   FREQUENCY SPAN . . . . . 0 Hz

   CENTER FREQUENCY (sets the LO frequency to 5.0 GHz) . . . . . 50.3 GHz

CAUTION When you are using an 11975 Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

4. On the 11975A Amplifier, set the rear-panel ALC switch to ON, then connect the 8481A Power Sensor to the free end of the cable installed on the OUTPUT connector of the amplifier. Set the 436A Power Meter Cal Factor % to the appropriate value for a frequency of 5 GHz.
5. Adjust the amplifier OUTPUT POWER LEVEL for a reading of +15.2 dBm ±0.1 dBm on the power meter.
6. Connect the equipment as shown in Figure 4-1 on page 106. Turn off the 8349B Amplifier and the RF power on the synthesized sweeper. They will remain off for this entire test.

CAUTION Turn off the ac power on the 11974-60028 Preselector Power Supply prior to connecting or disconnecting it from the 11974.

On the 11974 rear panel, set the instrument select switches to the appropriate settings before applying power to the 11974.

7. Set the spectrum analyzer to the appropriate millimeter band by using the following controls:

   for an 11974A: **SHIFT** ⇑ ⇑

   for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

   for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

   for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

8. Set the spectrum analyzer controls as follows:

   FREQUENCY SPAN . . . . . .0 Hz

   RES BW . . . . . .10 Hz

   VIDEO BW. . . . . .3 Hz

   ENTER dB/DIV . . . . . .5 dB

9. Set the spectrum analyzer center frequency by pressing **CENTER FREQUENCY** and entering the corresponding frequency value for the band listed below:

   for an 11974A: 26.5 GHz

   for an 11974Q: 33 GHz

   for an 11974U: 40 GHz

   for an 11974V: 50 GHz

10. Set the conversion loss to the value recorded for this frequency in Table 4-7 on page 140 by pressing **SHIFT**, 5, and **MHz**, and entering the conversion loss value from Table 4-7 on page 140. Press **dB** to terminate the entry. Record this value in Table 4-10 on page 146.

11. Set the spectrum analyzer reference level by pressing **REFERENCE LEVEL** and entering the corresponding value for the band listed below:

    for an 11974A: –80 dBm

    for an 11974Q: –80 dBm

    for an 11974U: –80 dBm

    for an 11974V: –80 dBm

12. On the spectrum analyzer, press **SHIFT**, **VIDEO BW**, 10, and **Hz** to activate the video average function to average 10 traces.

13. After the video average counter reaches 10, press MARKER **NORMAL** and **PEAKSEARCH**. The marker amplitude is the displayed average noise level.

14. Record the following in Table 4-10 on page 146.

    Center Frequency

    Displayed Average Noise Level (Marker Amplitude)

15. On the spectrum analyzer, press **SHIFT** and **SWEEP TIME** to turn off the video average function.

16. On the spectrum analyzer, press **CENTER FREQUENCY** and enter the corresponding value for the band listed below:

    for an 11974A: 40 GHz

    for an 11974Q: 50 GHz

    for an 11974U: 60 GHz

    for an 11974V: 75 GHz

17. Set the conversion loss to the value recorded for this frequency in Table 4-7 on page 140. Press **SHIFT**, 5, and **MHz**, then enter the conversion loss value from Table 4-7 on page 140. Press **dB** to terminate the entry. Record this value in Table 4-10 on page 146.

18. On the spectrum analyzer, press **SHIFT**, **VIDEO BW**, 10, and **Hz** to activate the video average function to average 10 traces.

19. After the video average counter reaches 10, press MARKER **NORMAL** and **PEAK SEARCH**. The marker amplitude is the displayed average noise level.

20. Record the following in Table 4-10 on page 146.

    Center Frequency

    Displayed Average Noise Level (Marker Amplitude)

21. On the spectrum analyzer, press **SHIFT SWEEP TIME** to turn off the video average function.

22. On the spectrum analyzer, press **CENTER FREQUENCY** and enter the frequency corresponding to the maximum conversion loss measured in Table 4-7 on page 140.

23. Set the conversion loss to the value recorded for this frequency in Table 4-7 on page 140. Press **SHIFT 5 MHz**, then enter the conversion loss value from Table 4-7 on page 140. Press **dB** to terminate the entry. Record this value in Table 4-10 on page 146.

24. On the spectrum analyzer, press **SHIFT**, **VIDEO BW**, 10, and **Hz** to activate the video average function to average 10 traces.

25. After the video average counter reaches 10, press MARKER **NORMAL** and **PEAK SEARCH**. The marker amplitude is the displayed average noise level.

26. Record the following in Table 4-10 on page 146.

    Center Frequency

    Displayed Average Noise Level (Marker Amplitude)

27. On the spectrum analyzer, press **SHIFT** and **SWEEP TIME** to turn off the video average function.

28. Record the Maximum Displayed Average Noise Level in Table 4-10 on page 146.

5. 3 dB Bandwidth

Description

The preselector peak digital-to-analog converter (DAC) is used to tune the center frequency of the preselector filter until the input signal is 3 dB down on the skirts of the filter. The 3 dB bandwidth is calculated from the DAC values.

Procedure

1. Connect an SMA cable from the 1ST LO OUTPUT of the spectrum analyzer to the INPUT of the 11975A Amplifier. Connect a second SMA cable to the OUTPUT of the amplifier.
2. Connect the 8481A Power Sensor to the power-meter sensor cable, then zero and calibrate the 436A Power Meter.
3. Set the spectrum analyzer controls as follows:

   SHIFT ⇑ ⇑ ⇑ ⇑ (selects U Band)

   FREQUENCY SPAN . . . . . 0 Hz

   CENTER FREQUENCY (sets the LO frequency to 5.0 GHz) . . . . . 50.3 GHz

CAUTION When you are using an 11975A Amplifier with an 11974, you *must* set the amplifier rear-panel ALC switch to ON before you connect the amplifier to the test setup. If the ALC switch is left in the OFF position, the amplifier output power is high enough to destroy the mixer diodes.

4. On the 11975A Amplifier, set the rear-panel ALC switch to ON, then connect the 8481A Power Sensor to the free end of the cable installed on the OUTPUT connector of the amplifier. Set the 436A Power Meter Cal Factor % to the appropriate value for a frequency of 5 GHz.
5. Adjust the amplifier OUTPUT POWER LEVEL for a reading of +15.2 dBm ±0.1 dBm on the power meter.
6. Connect the equipment as shown in Figure 4-1 on page 106.

CAUTION Turn off the ac power on the 8349B Amplifier prior to connecting or disconnecting the source module interface cable.

Turn off the ac power on the 11974-60028 Preselector Power Supply prior to connecting or disconnecting it from the 11974.

On the 11974 rear panel, set the instrument select switches to the appropriate settings before applying power to the 11974.

7. Enter the appropriate millimeter-wave source module frequency multiplication factor into the synthesized sweeper by pressing **SHIFT** and **START FREQ**. Press the following keys (on the synthesized sweeper) for the appropriate band:

   for an 11974A: **2 Hz**

   for an 11974Q: **3 Hz**

   for an 11974U: **3 Hz**

   for an 11974V: **4 Hz**

8. Set the synthesized sweeper for a CW signal at the frequency listed below:

   for an 11974A: 26.5 GHz

   for an 11974Q: 33.0 GHz

   for an 11974U: 40.0 GHz

   for an 11974V: 50.0 GHz

9. Activate external leveling on the synthesized sweeper by pressing **XTAL**.

10. Adjust the output power of the synthesized sweeper for a reading of approximately 0 dBm on the 8349B display.

11. Set the spectrum analyzer to the appropriate millimeter band by using the following key sequence for the appropriate band:

    for an 11974A: **SHIFT** ⇑ ⇑

    for an 11974Q: **SHIFT** ⇑ ⇑ ⇑

    for an 11974U: **SHIFT** ⇑ ⇑ ⇑ ⇑

    for an 11974V: **SHIFT** ⇑ ⇑ ⇑ ⇑ ⇑

12. Set the spectrum analyzer controls as follows:

    SHIFT, **5**, **MHz**, 0, and **dB** (sets external mixer conversion loss to 0 dB)

    FREQUENCY SPAN . . . . . 5 MHz

    ENTER dB/DIV . . . . . 5 dB

13. Set the reference level of the spectrum analyzer by pressing **REFERENCE LEVEL** and entering the corresponding value for the band listed below:

    for an 11974A: –40 dBm

    for an 11974Q: –40 dBm

    for an 11974U: –40 dBm

    for an 11974V: –55 dBm

14. Set the center frequency of the spectrum analyzer by pressing **CENTER FREQUENCY** and entering the corresponding value for the band listed below:

    for an 11974A: 26.5 GHz

    for an 11974Q: 33 GHz

    for an 11974U: 40 GHz

    for an 11974V: 50 GHz

15. On the spectrum analyzer, press the following keys:

    MARKER **NORMAL**

    PEAK SEARCH

    PRESEL PEAK

16. When the preselector-peak routine is complete, press MARKER **PEAK SEARCH** and Δ.

17. On the spectrum analyzer, press **SHIFT** and **GHz** to activate the preselector DAC number.

18. On the spectrum analyzer, use the ⇓ key to reduce the DAC number by one step at a time until the delta-marker amplitude is less than or equal to –3.0 dB.

19. Record the Center Frequency and the preselector Low DAC number in Table 4-11 on page 146.

20. On the spectrum analyzer, use the ⇑ key to tune to the other side of the filter by increasing the DAC number until the delta marker amplitude goes back to 0. Continue to increase the DAC number until the delta-marker amplitude is less than or equal to –3.0 dB.

21. Record the preselector DAC number in Table 4-11 on page 146 under High DAC Number.

22.Calculate the 3 dB bandwidth at this frequency using the following equation:

$$\frac{\text{High DAC number} - \text{Low DAC number} - 1}{63} \times 46 \times n(\text{MHz})$$

where *n* represents the harmonic number listed below:

11974A: 8

11974Q: 10

11974U: 10

11974V: 14

NOTE The above equation applies only when the spectrum analyzer is an 8566B. When using an 8563A or 71000C spectrum analyzer, use the following equation:

$$\frac{\text{High DAC number} - \text{Low DAC number} - 1}{255} \times 65 \times n(\text{MHz})$$

23.Set the synthesized sweeper for a CW signal at the frequency listed below:

for an 11974A: 33.25 GHz

for an 11974Q: 41.5 GHz

for an 11974U: 50 GHz

for an 11974V: 62.5 GHz

24.Set the center frequency of the spectrum analyzer by pressing **CENTER FREQUENCY**, then entering the corresponding value for the band listed below:

for an 11974A: 33.25 GHz

for an 11974Q: 41.5 GHz

for an 11974U: 50 GHz

for an 11974V: 62.5 GHz

25.Repeat step 15 through step 22 for this center frequency and record the results in Table 4-11 on page 146.

26.Set the synthesized sweeper for a CW signal at the frequency listed below:

for an 11974A: 40 GHz

for an 11974Q: 50 GHz

for an 11974U: 60 GHz

for an 11974V: 75 GHz

27. Set the center frequency of the spectrum analyzer by pressing **CENTER FREQUENCY**, then entering the corresponding value for the band listed below:

    for an 11974A: 40 GHz

    for an 11974Q: 50 GHz

    for an 11974U: 60 GHz

    for an 11974V: 75 GHz

28. Repeat step 15 through step 22 for this center frequency and record the results in Table 4-11 on page 146.

29. Record the Minimum 3 dB Bandwidth in Table 4-11 on page 146.

Table 4-6 Performance Test Record Summary (1 of 2) for 11974A, Q, U, and V

Calibration Entity:

_____ Report No. _____

_____

_____ Date _____

_____ (e.g. 10 SEP 1989)

Model Number _____

Serial No. _____

Options _____

Customer _____ Tested by _____

Ambient temperature _____ °C Relative humidity _____%

Power mains line frequency _____ Hz (nominal)

Test Equipment Used:

Description	Model No.	Trace No.	Cal Due Date
Spectrum Analyzer			
Power Meter			
Power Sensor (mm)			
Power Sensor (µW)			
Directional Coupler			

Special Notes:

_____

_____

_____

_____

Table 4-6 Performance Test Record Summary (2 of 2) for 11974A

Model **11974A**	Report No. _____
Serial No. _____	Date _____

Test No.	Test Description	Results			Measurement Uncertainty
		Min.	Measured	Max.	
1.	Conversion Loss				
	26. Maximum Conversion Loss		_____	44 dB	±1.5 dB
2.	Image Rejection Test				
	25. Minimum Image Rejection	59 dB[a]	_____		±1.6 dB
3.	Multiple Response Rejection Test				
	55. Minimum Multiple Response Rejection	63 dB	_____		±1.6 dB
4.	Displayed Average Noise Level				
	28. Maximum Displayed Average Noise Level		_____	–111 dBm[a]	±2.0 dB
5.	3 dB Bandwidth				
	29. Minimum 3 dB Bandwidth	80 MHz	_____		±11 MHz

a. This level only applies to an 8566B or an 71000C spectrum analyzer. When using any other spectrum analyzer, refer to Table 1-1, “11974 Specifications,” on page 15.

Table 4-6 Performance Test Record Summary (2 of 2) for 11974Q

Model **11974Q**	Report No. _____
Serial No. _____	Date _____

Test No.	Test Description	Results			Measurement Uncertainty
		Min.	Measured	Max.	
1.	Conversion Loss				
	26. Maximum Conversion Loss		_____	46 dB	±1.5 dB
2.	Image Rejection Test				
	25. Minimum Image Rejection	55 dB[a]	_____		±1.6 dB
3.	Multiple Response Rejection Test				
	55. Minimum Multiple Response Rejection	60 dB	_____		±1.6 dB
4.	Displayed Average Noise Level				
	28. Maximum Displayed Average Noise Level		_____	–106 dBm[a]	±2.0 dB
5.	3 dB Bandwidth				
	29. Minimum 3 dB Bandwidth	100 MHz	_____		±13 MHz

a. This level only applies to an 8566B or an 71000C spectrum analyzer. When using any other spectrum analyzer, refer to Table 1-1, “11974 Specifications,” on page 15.

Table 4-6 Performance Test Record Summary (2 of 2) for 11974U

Model **11974U**	Report No. _____
Serial No. _____	Date _____

Test No.	Test Description	Results			Measurement Uncertainty
		Min.	Measured	Max.	
1.	Conversion Loss				
	26. Maximum Conversion Loss		_____	43 dB	±1.6 dB
2.	Image Rejection Test				
	25. Minimum Image Rejection	55 dB[a]	_____		±1.6 dB
3.	Multiple Response Rejection Test				
	55. Minimum Multiple Response Rejection	60 dB	_____		±1.6 dB
4.	Displayed Average Noise Level				
	28. Maximum Displayed Average Noise Level		_____	–109 dBm[a]	±2.1 dB
5.	3 dB Bandwidth				
	29. Minimum 3 dB Bandwidth	100 MHz	_____		±13 MHz

a. This level only applies to an 8566B or an 71000C spectrum analyzer. When using any other spectrum analyzer, refer to Table 1-1, “11974 Specifications,” on page 15.

Table 4-6 Performance Test Record Summary (2 of 2) for 11974V

Model **11974V**	Report No. _____
Serial No. _____	Date _____

Test No.	Test Description	Results			Measurement Uncertainty
		Min.	Measured	Max.	
1.	Conversion Loss				
	26. Maximum Conversion Loss		_____	46 dB	±1.5 dB
2.	Image Rejection Test				
	25. Minimum Image Rejection				
	(50 to 67 GHz)	55 dB[a]	_____		±1.7 dB
	(67 to 75 GHz)	45 dB[a]	_____		±1.7 dB
3.	Multiple Response Rejection Test				
	55. Minimum Multiple Response Rejection				
	(50 to 67 GHz)	60 dB	_____		±1.7 dB
	(67 to 75 GHz)	55 dB	_____		±1.7 dB
4.	Displayed Average Noise Level				
	28. Maximum Displayed Average Noise Level		_____	–94 dBm[a]	±2.1 dB
5.	3 dB Bandwidth				
	29. Minimum 3 dB Bandwidth	100 MHz	_____		±15 MHz

a. This level only applies to an 8566B or an 71000C spectrum analyzer. When using any other spectrum analyzer, refer to Table 1-1, “11974 Specifications,” on page 15.

Table 4-7 Conversion Loss Test Data (1 of 3)

Model _____	Report No. _____
Serial No. _____	Date _____

Marker Frequency GHz	Marker Amplitude dBm	Power Meter Readings dBm	Power Sensor Cal Factor % or dB	Directional Coupler Coupling Factor dB	Conversion Loss dB

Table 4-7 Conversion Loss Test Data (2 of 3)

Model _____	Report No. _____
Serial No. _____	Date _____

Marker Frequency GHz	Marker Amplitude dBm	Power Meter Readings dBm	Power Sensor Cal Factor % or dB	Directional Coupler Coupling Factor dB	Conversion Loss dB

Table 4-7 Conversion Loss Test Data (3 of 3)

Model _____	Report No. _____
Serial No. _____	Date _____

Marker Frequency GHz	Marker Amplitude dBm	Power Meter Readings dBm	Power Sensor Cal Factor % or dB	Directional Coupler Coupling Factor dB	Conversion Loss dB

Maximum Conversion Loss = _____ dB

Marker Frequency GHz	Marker Amplitude dBm	Power Meter Readings dBm	Power Sensor Cal Factor % or dB	Directional Coupler Coupling Factor dB	Conversion Loss dB

Table 4-8 Image Rejection Test Data

Model _____	Report No. _____
Serial No. _____	Date _____

Marker Frequency GHz	Image Rejection dB	Marker Frequency GHz	Image Rejection dB	Marker Frequency GHz	Image Rejection dB
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Marker Frequency GHz	Image Rejection dB	Marker Frequency GHz	Image Rejection dB	Marker Frequency GHz	Image Rejection dB

Minimum Image Rejection = _____ dB

11974V (67–75 GHz):

Minimum Image Rejection = _____dB

Table 4-9 Multiple Response Rejection Test Data

Model _____	Report No. _____
Serial No. _____	Date _____

Signal Frequency GHz	Multiple Response Frequency GHz	Multiple Response Rejection dB
#1 _____	#1 _____ #2 _____	_____ _____
#2 _____	#3 _____ #4 _____ #5 _____ #6 _____	_____ _____ _____ _____
#3 _____	#7 _____	_____

Signal Frequency **GHz**	**Multiple Response Frequency** **GHz** **#8** _____	**Multiple Response Rejection** **dB** _____
Minimum Multiple Response Rejection = _____ **dB** 11974V (applied signal: 67 to 75 GHz): **Minimum Multiple Response Rejection =** _____ **dB**		

Model _____	Report No. _____
Serial No. _____	Date _____

Table 4-10 Displayed Average Noise Level Data

Conversion Loss Value from Table 4-7 dB	Center Frequency GHz	Displayed Average Noise Level dBm
_____ _____ _____	_____ _____ _____	_____ _____ _____
Maximum Displayed Average Noise Level = _____ dBm		

Table 4-11 3 dB Bandwidth Data

Center Frequency (GHz)	Low DAC Number	High DAC Number	3 dB Bandwidth (MHz)
_____ _____ _____	_____ _____ _____	_____ _____ _____	_____ _____ _____
Minimum 3 dB Bandwidth = _____ dBm			

5 Safety and Regulatory Information

Safety Symbols

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and it's meaning before operating this instrument.

WARNING	**Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

CAUTION	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.



The instruction document symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the manual.



The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)



The CSA mark is a registered trademark of the Canadian Standards Association.

ISM1-A

This is a symbol of an Industrial Scientific and Medical Group 1 Class A product.



This C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.



This symbol indicates that the input power required is AC.

This symbol is used to mark the ON position of the power line switch.



This symbol is used to mark the OFF position of the power line switch.

General Safety Considerations

WARNING ***Before this instrument is switched on,*** **make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.**

WARNING **For continued protection against fire hazard, replace fuse only with same type and ratings, (type 1A/120V or 0.5A/240V). The use of other fuses or materials is prohibited.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

WARNING **Servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any service unless you are qualified to do so.**

WARNING **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

WARNING **The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.**

WARNING **There are many points inside the instrument which can, if contacted, cause personal injury. Be extremely careful. Any adjustments or service procedures that require operation of the instrument with the protective covers removed should be performed only by trained service personnel. This product conforms to Enclosure Protection Standard IP 2 0 according to IEC-529, and protects against finger access to hazardous parts within the enclosure.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

WARNING **This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited.**

WARNING **This product presents a *significant risk of electrical shock* if operated when wet. This product conforms to Enclosure Protection Standard IP 2 0 according to IEC-529, and therefore, it does not protect against the admittance of water into the interior of the product.**

WARNING **To prevent electrical shock, disconnect the 11974 Series equipment from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING **Isopropyl alcohol is extremely flammable, causes irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Keep away from heat, sparks, and flame. Avoid contact with eyes, skin, clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, or carbon dioxide: water may be ineffective. In case of spill, soak up with sand or earth. Flush spill area with water.**

Disposal Instructions: Dispose in accordance with all applicable federal, state, and local environmental regulations.

CAUTION This product has been designed and tested in accordance with IEC Publication 1010, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

CAUTION This product is designed for use in Installation Category II and Pollution Degree 2 per IEC-1010 and IEC-664 respectively.

CAUTION *Before this instrument is switched on,* make sure its primary power circuitry has been adapted to the voltage of the ac power source. Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

CAUTION Before switching on this instrument, make sure that the line voltage selector switch is set to the voltage of the power supply and the correct fuse is installed.

CAUTION **Ventilation Requirements**: When installing the product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Compliance with German Noise Requirements

This is to declare that this instrument is in conformance with the German Regulation on Noise Declaration for Machines (Laermangabe nach der Maschinenlaermrerordnung –3.GSGV Deutschland.)

Acoustic Noise Emission/Geraeuschemission	
LpA <70 dB	LpA <70 dB
Operator position	am Arbeitsplatz
Normal position	normaler Betrieb
per ISO 7779	nach DIN 45635 t.19

Declaration of Conformity

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

Manufacturer´s Name:	Hewlett-Packard Co.
Manufacturer´s Address:	1400 Fountaingrove Parkway Santa Rosa, CA 95403-1799 USA

Declares that the product:

Product Name:	Preselected Millimeter Mixer
Model Number:	HP 11974A, HP 11974Q, HP 11974U, HP 11974V
Product Options:	This declaration covers all options of the above product.

Conforms to the following product specifications:

Safety: IEC 61010-1:1990 / EN 61010-1:1993
CAN/CSA-C22.2 No. 1010.1-92

EMC: CISPR 11:1990/EN 55011:1991 Group 1, Class A
IEC 801-2:1984/EN 50082-1:1992 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1:1992 3 V/m, 27-500 MHz
IEC 801-4:1988/EN 50082-1:1992 0.5 kV sig. lines, 1 kV power lines

IEC 1000-3-2:1995/EN 61000-3-2:1995
IEC 1000-3-3:1994/EN 61000-3-3:1995

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.



Santa Rosa, CA, USA 12 Mar. 1999

Greg Pfeiffer/Quality Engineering Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH Department HQ-TRE, Herreneberger Strasse 130, D71034 Boblingen, Germany (FAX +49-7031-14-3143)

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