

HP 8349B MICROWAVE AMPLIFIER

SERIAL NUMBERS

This manual applies to HP 8349B Microwave Amplifier having serial numbers prefixed 2513A and 2548A.

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY MANUAL in Section I.

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1400 Fountaingrove Parkway, Santa Rosa, CA 95401, U.S.A.

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CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation. This product has been designed and tested in accordance with international standards.

SAFETY SYMBOLS



Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (refer to Table of Contents).



Indicates hazardous voltages.



Indicates earth (ground) terminal.

WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

SAFETY EARTH GROUND

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and be secured against any unintended operation.

BEFORE APPLYING POWER

Verify that the product is configured to match the available main power source per the input power configuration instructions provided in this manual.

If this product is to be energized via an autotransformer, make sure the common terminal is connected to the neutral (grounded) side of mains supply.

SERVICING

WARNING

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel.

Adjustments described in this manual may be performed with power supplied to the product while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside this product may still be charged even when disconnected from its power source.

To avoid a fire hazard, only fuses with the required current rating and of the specified type (normal blow, time delay, etc.) are to be used for replacement.

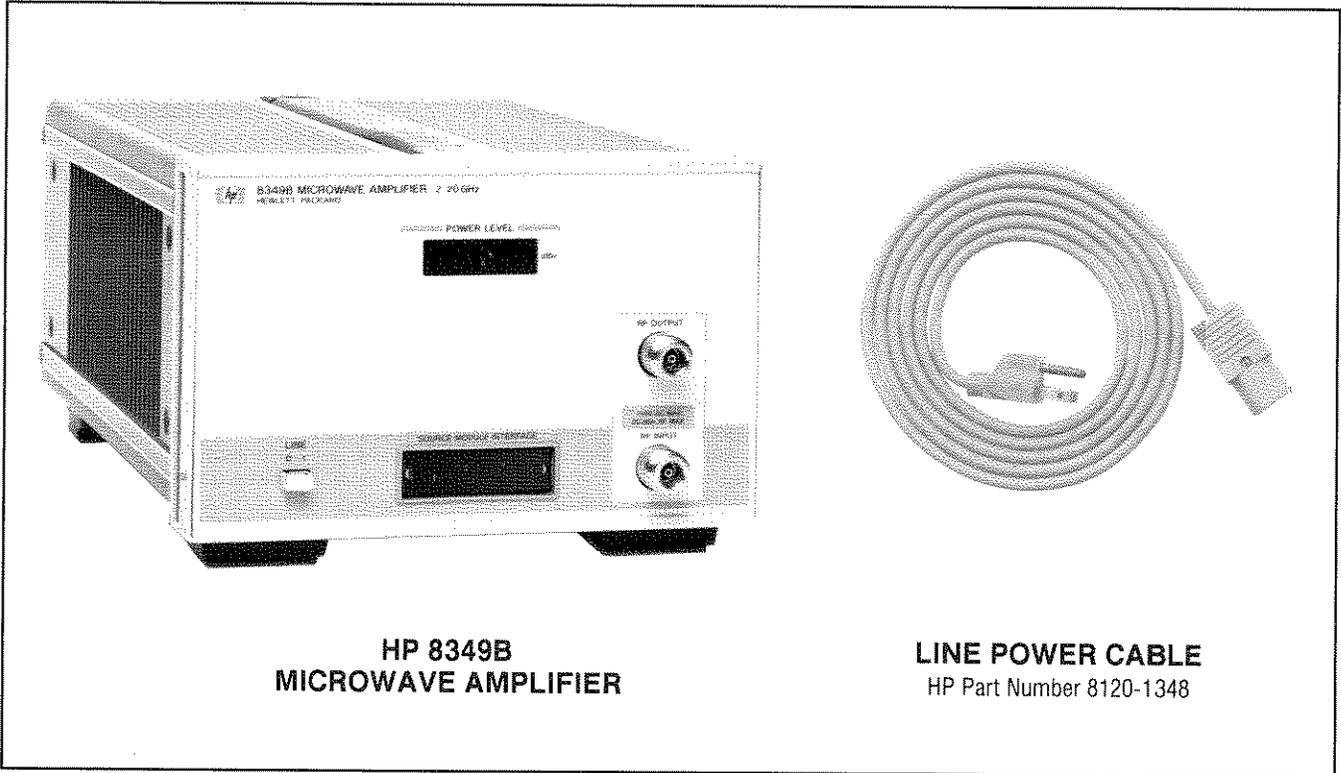


Figure 1-1. HP 8349B Microwave Amplifier with Accessory Power Cable

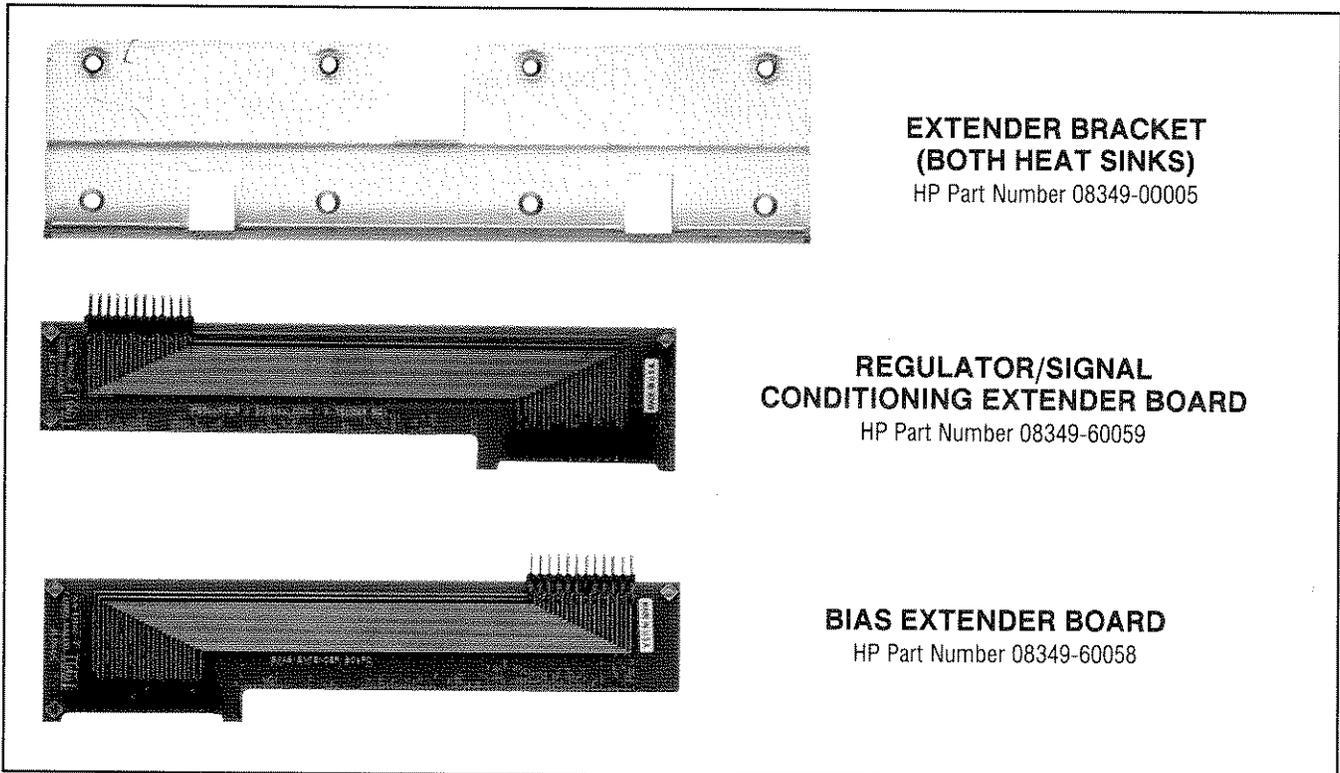


Figure 1-2. HP 8349B Service Accessories

SECTION I GENERAL INFORMATION

INTRODUCTION

This manual contains operating and service information for the Hewlett-Packard 8349B microwave amplifier. Figure 1-1 and Figure 1-2 show the standard instrument and accessories supplied. The differences between a standard instrument and options are discussed later in this section.

MANUAL ORGANIZATION

This manual is divided into eight sections as follows:

SECTION I, GENERAL INFORMATION, contains the instrument description and specifications, supplemental characteristics, explains accessories and options, and lists recommended test equipment.

SECTION II, INSTALLATION, contains information concerning the initial mechanical inspection, preparation for use, operating environment, and packaging and shipping.

SECTION III, OPERATION, contains instructions for operating the instrument.

SECTION IV, PERFORMANCE TESTS, contains the tests to verify that the electrical performance of the instrument meets the specifications.

SECTION V, ADJUSTMENTS, contains the adjustment procedures.

SECTION VI, REPLACEABLE PARTS, contains parts lists and ordering information.

SECTION VII, MANUAL BACKDATING CHANGES, contains backdating information to make this manual compatible with earlier equipment configurations, if such configurations exist.

SECTION VIII, SERVICE, contains schematic diagrams, block diagrams, component locations illustrations, circuit illustrations, circuit descriptions, and troubleshooting information to aid in repair of the instrument.

INSTRUMENTS COVERED BY MANUAL

Serial Numbers

Attached to the back of your instrument is a serial number label (Figure 1-3). The serial number is in two parts. The first four digits and the letter are the serial number prefix; the last five digits are the suffix. The prefix changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument.

The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page. A backdating section, if any, makes the manual compatible with instruments having serial number prefixes earlier than listed on the title page.

Manual Changes Supplement

An instrument manufactured after the printing of this manual may have a serial number prefix not listed on the title page. This unlisted serial prefix indicates the instrument is different from those described in this manual. A yellow Manual Changes supplement contains the information necessary to adapt the manual to a newer instrument.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with this manual's print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from your nearest Hewlett-Packard Sales/Service office.

Refer any questions regarding this manual, the Manual Changes supplement, or the instrument to the nearest HP Sales/Service office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a listing of HP Sales/Service offices.

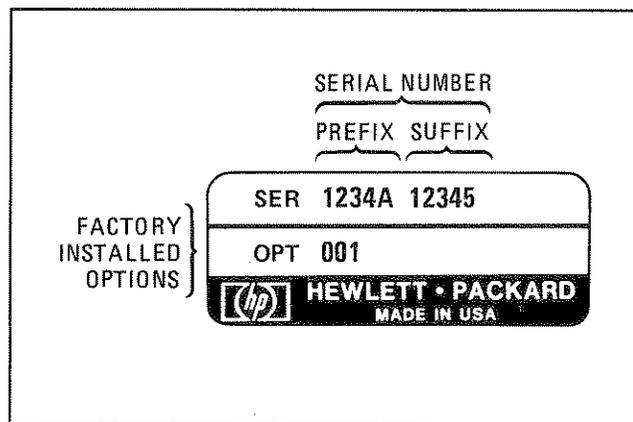


Figure 1-3. Typical Serial Number Plate

INSTRUMENT DESCRIPTION

The HP 8349B is a general purpose, fully self-contained, class A microwave amplifier that delivers a minimum of 80 mW (+19 dBm) of leveled power from 2 to 18.6 GHz, and 40 mW (+16 dBm) from 18.6 to 20 GHz. It may be used with a fixed or swept frequency source. Leveled flatness is $\pm .25$ dB, and small signal (-5 dBm) gain is 15 dB. Equipped with a source module interface, the HP 8349B is capable of driving the HP 83550-series millimeter-wave source modules.

SPECIFICATIONS

Specifications for the HP 8349B are listed in Table 1-1. These are the performance standards against which the amplifier is tested (performance tests are provided in Section IV). Table 1-2 lists typical or nominal values, they are included as additional information only and are not the warranted performance standards (specifications) for the instrument.

Manufacturer's Declaration**NOTE**

This is to certify that this product meets the radio frequency interference requirements of Directive FTZ 1046/1984. The German Bundespost has been notified that this equipment was put into circulation and has been granted the right to check the product type for compliance with these requirements.

Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements on open set-ups, the user must insure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Model _____

NOTE

Hiermit wird bescheinigt, dass dieses Gerät/System in Übereinstimmung mit den Bestimmungen von Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

Zusatzinformation für Mess- und Testgeräte:

Werden Mess- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Messaufbauten verwendet, so ist vom Betreiber sicherzustellen, dass die Funk-Entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Table 1-1. Specifications

The following specifications describe the instruments warranted performance over the temperature range 0 to 55°C (except where noted).

FREQUENCY RANGE: 2.0 to 20.0 GHz

INPUT AND OUTPUT (25°C ± 5°C):

Minimum Output Power (at +5 dBm input)

Frequency Range (GHz)	Output	
	Leveled	Unleveled
2.0 to 18.6	19 dBm (80 mW)	20 dBm (100 mW)
18.6 to 20.0	16 dBm (40 mW)	17 dBm (50 mW)

Minimum Small Signal Gain (at -5 dBm input)

Frequency Range (GHz)	Gain
2.0 to 18.6	15 dB
18.6 to 20.0	12 dB

VSWR (2-18 GHz):

Input: ≤2.8:1

Output: ≤2.5:1 (Leveled)

Output Power Temperature Stability (Unleveled): -0.1 dB/°C

Power Flatness (Leveled): ± 1.25 dB

Gain Temperature Stability: -0.1 dB/°C

Maximum Continuous Input: +26 dBm (RF), ± 10 VDC

SPECTRAL PURITY (25°C ± 5°C):

Harmonics (dB below the fundamental at maximum specified output power): 2.0 to 11.0 GHz < -20 dBc

Non-Harmonic Spurious (dB below the fundamental at maximum specified output power): < -55 dBc

GENERAL:

LED Display Accuracy (25°C ± 5°C), CW Frequencies and Full Band Sweep Times > 4 sec:

Calibrated Range: 0 dBm to +20 dBm

Calibrated Accuracy: ±1.5 dB

RF Input/Output Connectors: Type-N Female

RF Input/Output Connectors: Type-N Female

Power Requirements: 50 to 400 Hz, 100, 120, 200, or 240 Volts (±10%); 85 VA maximum

Weight: Net 7 kg (15 lb). Shipping 14 kg (31 lb).

Dimensions:

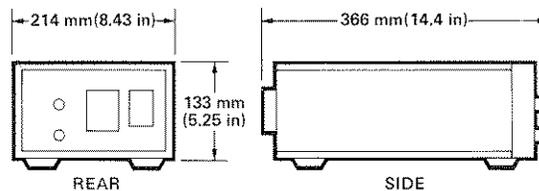
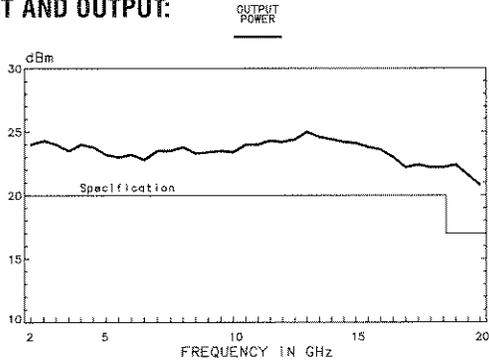


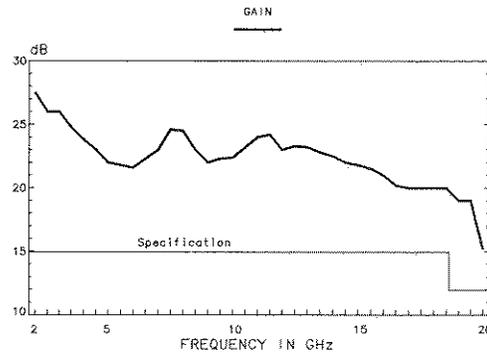
Table 1-2. Supplemental Characteristics

Supplemental Characteristics are intended to provide information useful in applying the instrument by giving typical but not warranted performance parameters.

INPUT AND OUTPUT:



Maximum Unleveled Output Power



Small Signal Gain (at -5 dBm input)

VSWR:

Frequency Range (GHz)	Output Unleveled
2.0 to 5.0	≤4.8:1
5.0 to 11.0	≤3.8:1
11.0 to 18.0	≤3.2:1
18.0 to 20.0	≤3.2:1

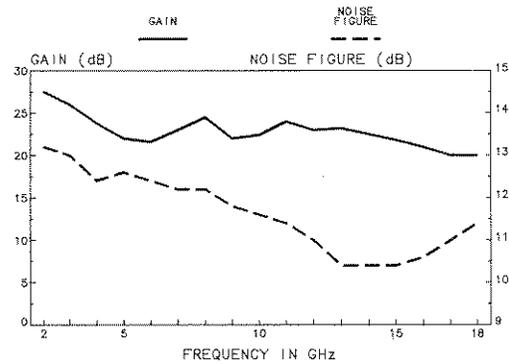
1 dB Compression Point: +21 dBm

Noise Figure: <13 dB

Impedance (input and output): 50 ohm

Output Power Detector Voltage (used for leveled mode):

Low Level Sensitivity: >-1.0 mV/mW



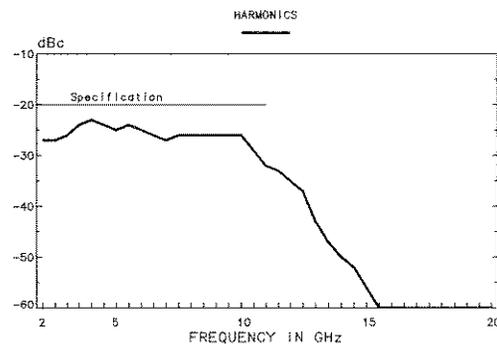
Gain and Noise Figure

SPECTRAL PURITY:

Harmonics (dB below the fundamental at maximum specified output power):

11.0 to 20.0 GHz: <-30 dBc

Third Order Intercept: +33 dBm



Harmonic Content

PULSE TRANSMISSION CAPABILITY:

Rise/Fall Time: <10 ns

Delay Time (input to output): <8 ns

GENERAL SPECIFICATIONS:

Reverse Isolation: >50 dB

EQUIPMENT SUPPLIED

The HP 8349B microwave amplifier is supplied with a power cable as shown in Figure 1-1. Additionally, as in Figure 1-2, the following service accessories are supplied:

- 1 Extender Bracket (both heat sinks)
HP Part No. 08349-00005
- 1 Bias Extender Board
HP Part No. 08349-60058
- 1 Regulator/Signal Conditioning Extender Board
HP Part No. 08349-60059

OPTIONS**Option 001, Rear Panel RF Input/Output**

Option 001 places the input and output connectors on the rear panel of the HP 8349B amplifier. Refer to Figure 1-4a.

Option 002, Rear Panel RF Input and Front Panel RF Output

Option 002 places the input connector on the rear panel and the output connector on the front panel. Refer to Figure 1-4b.

Option 910, Additional Operation and Service Manual

Instruments ordered with Option 910 are supplied with two Operation and Service Manuals. Additional manuals are also available through your nearest Hewlett-Packard Sales/Service office by ordering the HP part number listed on the title page.

RACK MOUNTING KITS AND CABINET ACCESSORIES

Rack mounting kits are available for mounting the instrument in a rack 482.6 mm (19 inch) wide. Other accessories such as filler panels, joining kits, shelves, and bail handles are also available. Refer to your current Hewlett-Packard Electronics Instrument Catalog for details. All of these kits and accessories are available through your nearest Hewlett-Packard Sales/Service office.

RECOMMENDED TEST EQUIPMENT AND ACCESSORIES

Test equipment and accessories recommended for servicing and testing the HP 8349B microwave amplifier are listed in Table 1-3. If substitute equipment is used, it must meet the minimum specifications shown in the table. You can also use this list as a reference for the equipment necessary to make reflection and transmission measurements.

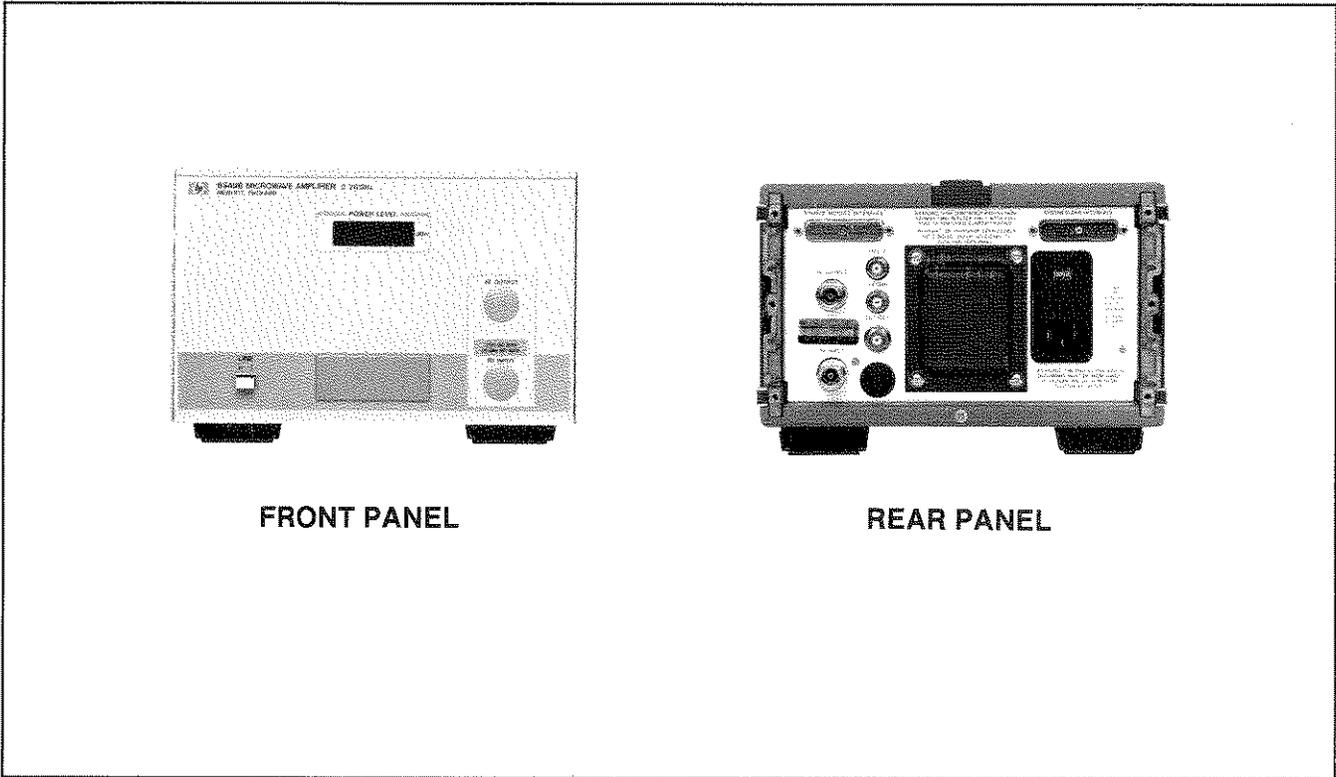


Figure 1-4a. HP 8349B Option 001

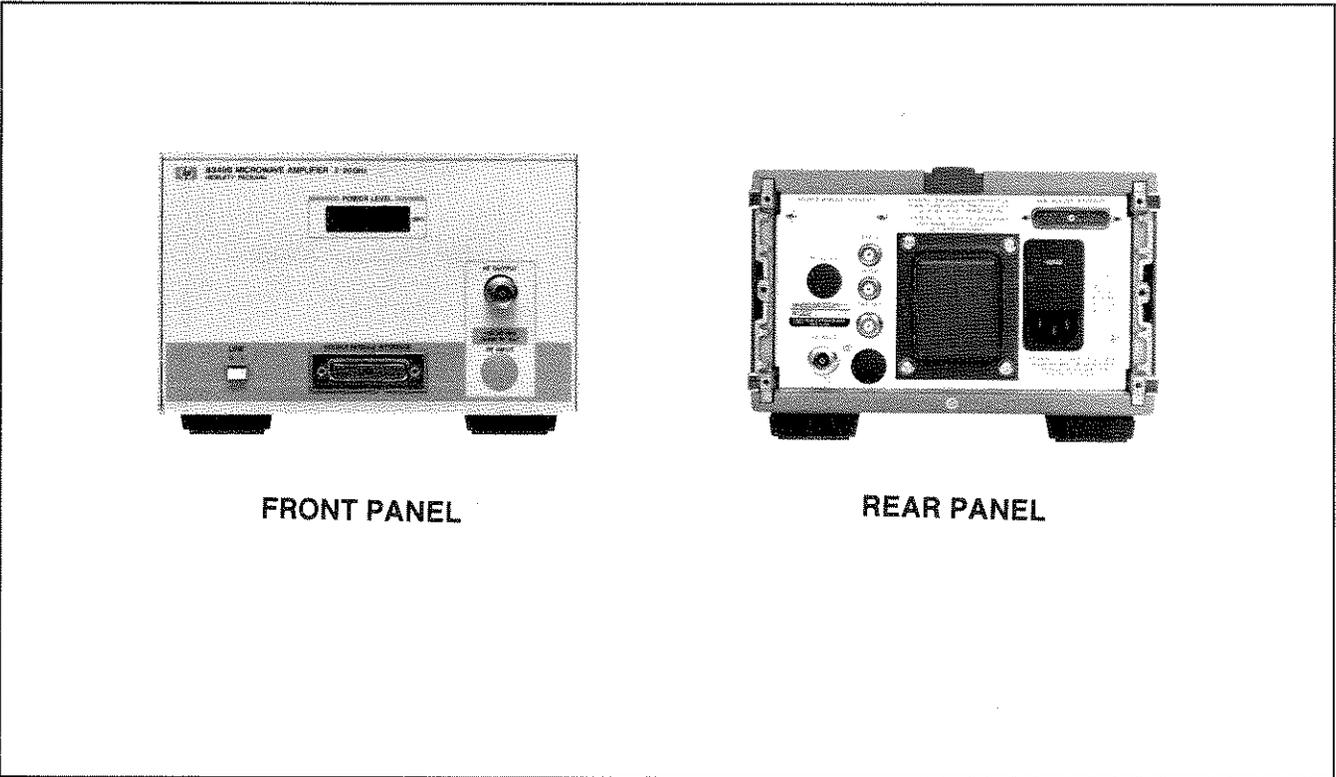


Figure 1-4b. HP 8349B Option 002

Table 1-3. Recommended Test Equipment (1 of 2)

Instrument	Critical Specifications	Recommended Model	Use ¹
Sweep Oscillator	Compatible with Plug-in	HP 8350B	P, A, T
RF Plug-In*	2 to 20 GHz Coverage, ≥+7 dBm Leveled Output Power, External Leveling Capability	HP 83590A	P, A, T
RF Plug-In*	Non-Harmonic Spurious: ≤ -55 dBc	HP 83592C	P
Scalar Network Analyzer	Capable of Transmission/Reflection Measurement, Waveform Storage and Normalization	HP 8757A	P, T
Spectrum Analyzer	2 to 20 GHz Coverage, 2 Channel Display, Waveform Storage and Normalization Capability	HP 8566B	P, T
Power Meter	-10 to +20 dBm	HP 436A	P, A, T
Power Sensor	2 to 20 GHz Coverage, Calibrated Range -10 to +20 dBm, Maximum Input +24 dBm	HP 8485A	P, A, T
Digital Voltmeter	Range: -50V to +50V Accuracy: ±0.01% Input Impedance: ≥10M ohms	HP 3456A	A, T
Dual Directional Coaxial Coupler	2 to 18 GHz Coverage, 30 dB Directivity, Type-N Male Test Port	HP 11692D Option 002	P
Directional Coaxial Coupler	2 to 20 GHz Coverage	HP P/N 0955-0125	P
Detector	2 to 20 GHz Coverage +10 dBm Max Input, Compatible with Plug-In	HP 8473C	P
Detectors (2)	2 to 18 GHz Coverage, Compatible with Network Analyzer Range: -20 to +10 dBm	HP 11664A	P
Detector	2 to 20 GHz Coverage, Compatible with Network Analyzer Range: -20 to +20 dBm	HP 11664E	P
Attenuator	10 dB, 2 to 20 GHz Coverage	HP 8493C Option 010	P
Airlines (2)	20 cm, SWR ≤1.08 at 18 GHz	HP 11567A	P

*Must Have 0.5V/GHz Input Connector Modification.

Table 1-3. Recommended Test Equipment (2 of 2)

Instrument	Critical Specifications	Recommended Model	Use ¹
50 Ohm Load	Type-N Male, SWR \leq 1.30 at 18 GHz	HP 909A Option 012	P
50 Ohm Load	APC-7 ² SWR \leq 1.25 at 18 GHz	HP 909A	P
Extender Boards(2)	Supplied with Instrument	HP P/N 08349-60058 HP P/N 08349-60059	A, T
Brackets (2)	Supplied with Instrument	HP P/N 08349-00005	A, T
Open	Type-N Female	HP P/N 85032-20001	P, A, T
Short	Type-N Female	HP 11511A	P, A, T
Short	APC-7	HP 11565A	P, A, T
Adapter (4)	Type-N Male to Precision 3.5 mm Female	HP P/N 1250-1744	P, A, T
Adapter	Type-N Male to Precision 3.5 mm Male	HP P/N 1250-1743	P, A, T
Adapter	Type-N Male to APC-7	HP 11525A	P, A, T
Adapter	APC-7 to Precision 3.5 mm Female	HP P/N 1250-1747	P, A, T
Cable	BNC Connectors 61 cm (24 in)	HP 11170B	P, A, T
Cable (3)	BNC Connectors 122 cm (48 in)	HP 11170C	P, A, T
Cable (2)	SMA Connectors 61 cm (24 in)	HP P/N 8120-3124	P, A, T
Cable	Type-N Male Connectors, 61 cm (24 in)	HP 11500B	P, A, T

1. P = Performance Test; A = Adjustment; T = Troubleshooting
2. APC-7 is a registered trademark of Bunker Ramo Corporation.



SECTION II INSTALLATION

INTRODUCTION

This section contains information on initial inspection, preparation for use, storage and packaging.

INITIAL INSPECTION

If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment are checked for completeness, and the instrument has been checked both mechanically and electrically.

First, check for completeness. Figure 1-1 and Figure 1-2 show all of the items you should receive per amplifier.

Second, check connectors, cable, and body for mechanical damage.

Third, test the amplifier electrically by either making measurements or testing to the specifications. Refer to **OPERATION** or **PERFORMANCE TESTS** in this manual.

Notify your nearest Hewlett-Packard office, if any of the following conditions exist:

- a. Shipping contents are incomplete.
- b. There is mechanical damage or defect.
- c. The instrument does not pass electrical tests.

Also, notify the carrier if the shipping container is damaged or the cushioning material shows signs of stress. Keep all shipping materials for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement without waiting for a claim settlement.

SAFETY CONSIDERATIONS

Before operating this instrument, you should familiarize yourself with the safety markings on the instrument and safety instructions in this manual. This instrument has been manufactured and tested according to international safety standards. However, to ensure safe operation of the instrument and personnel, the cautions and warnings in this manual must be followed. Refer to the summary of safety notations near the front of this manual. Refer also to individual sections of this manual for detailed safety instructions.

PREPARATION FOR USE

Power Requirements

The HP 8349B requires a power source of 100, 120, 220, or 240 volts, $\pm 10\%$; 50 to 400 Hz. Power consumption is 85VA maximum.

WARNING

BEFORE THIS INSTRUMENT IS SWITCHED ON, its protective earth terminals must be connected to the protective conductor of the (mains) power cable (cord). The (mains) power cable plug should only be inserted in a socket outlet provided with a protective earth contact. **DO NOT** negate the earthing protection by using an extension cable, power cable, or autotransformer without a protective ground conductor. Failure to ground the instrument properly may result in serious personal injury.

CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT, make sure it is adapted to the voltage of the AC power source. On the rear panel check that power line module indicates the voltage of the AC power source. Failure to set the AC power input of the instrument for the correct voltage level could cause damage to the instrument when it switched on.

Line Voltage and Fuse Selection

Adapt the instrument to the AC line voltage level as follows:

1. Determine the AC line voltage.
2. Refer to Figure 2-1. At the instrument's rear panel power line module, pry open the module door to reveal a rotating cam. **Do not rotate the cam in the module!** Remove the cam from the module, select the required voltage and replace it before power on. Note that the available line voltage must be within $\pm 10\%$ of the line voltage selected on the rotating cam. If it is not, you must use an autotransformer between the AC source and the HP 8349B.
3. The rated fuse for all AC line voltage is 1 ampere.
4. Close the module cover door.

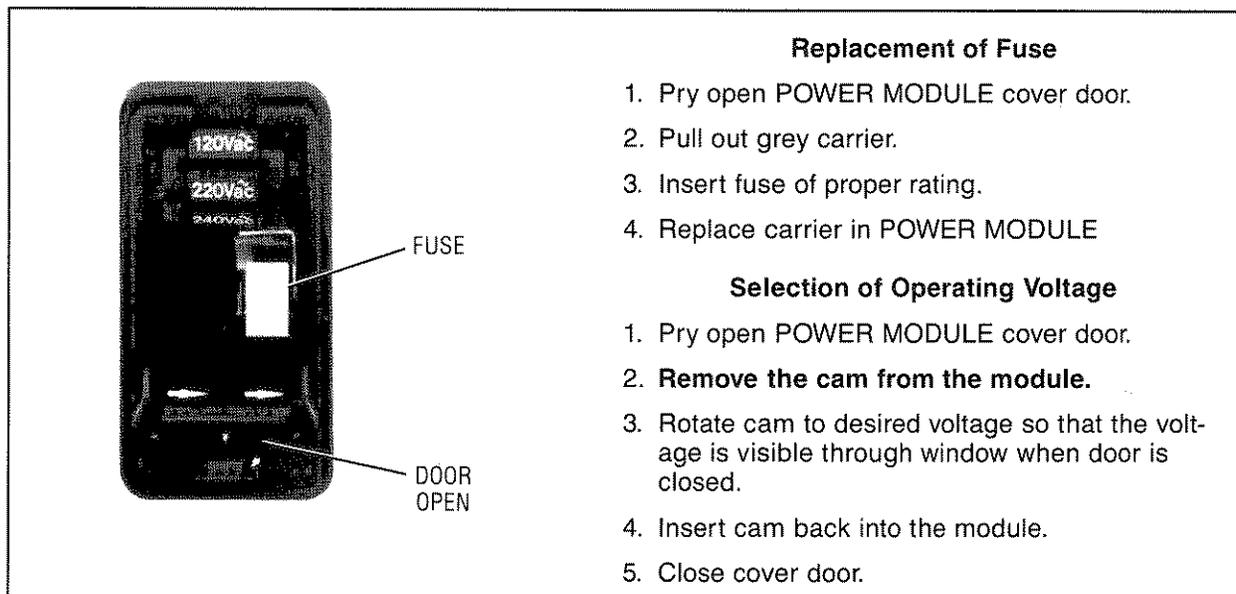


Figure 2-1. Line Voltage Selection with Power Module Rotating Cam

Power Cable

In accordance with international safety standards, this instrument is equipped with a three wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Table 2-1 depicts the various plug types and their respective HP part number.

WARNING

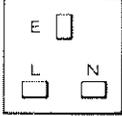
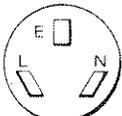
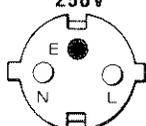
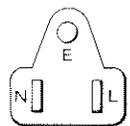
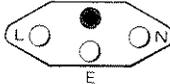
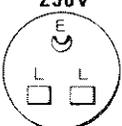
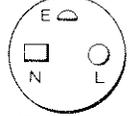
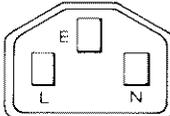
Instrument grounding may be lost if any power cable other than the 3-prong type is used to couple the AC line voltage to the instrument.

Operating Environment

This instrument should be operating within the following limits:

Temperature	0 to 55°C
Altitude	<4572 metres (15,000 feet)
Humidity	5% to 80% relative at +25 degrees°C to +40 degrees°C

Table 2-1. AC Power Cables and Plugs

Plug Type ¹	Cable HP Part Number ²	CD ³	Plug Description ²	Cable Length (inches)	Cable Color	For Use in Country
250V 	8120-1351 8120-1703	0 6	Straight BS1363A 90°	90 90	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Zimbabwe, Singapore
250V 	8120-1369 8120-0696	0 4	Straight NZSS198/ASC112 90°	79 87	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	7 2	Straight CEE7-VII 90°	79 79	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, Egypt, Republic of So. Africa, India (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754 8120-1378 8120-1521 8120-1676	5 5 7 1 6 2	Straight NEMA5-15P 90° Straight NEMA5-15P Straight NEMA5-15P 90° Straight NEMA5-15P	80 80 36 80 80 36	Black Black Black Jade Gray Jade Gray Jade Gray	United States, Canada, Japan (100V or 200V), Mexico, Philippines, Taiwan
250V 	8120-2104	3	Straight SEV1011.1959 24507, Type 12	79	Gray	Switzerland
250V 	8120-0698	6	Straight NEMA6-15P			United States, Canada
220V 	8120-1957 8120-2956	2 3	Straight DHCK 107 90°	79 79	Gray Gray	Denmark
250V 	8120-1860	6	Straight CEE22-VI (System Cabinet Use)			

1. E = Earth Ground; L = Line; N = Neutral
2. Part number shown for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.
3. The Check Digit (CD) is a coded digit that represents the specific combination of numbers used in the HP Part Number. It should be supplied with the HP Part Number when ordering any of the power assemblies listed above, to expedite speedy delivery.

STORAGE AND SHIPMENT

Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature	-40°C to +75°C
Altitude	<7620 metres (25,000 feet)
Humidity	5% to 95% relative at 0°C to +40°C

Packaging

Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. Figure 2-2 illustrates the proper method of packaging the instrument for shipment.

If, however, you choose to package the instrument with commercially available materials, follow these instructions:

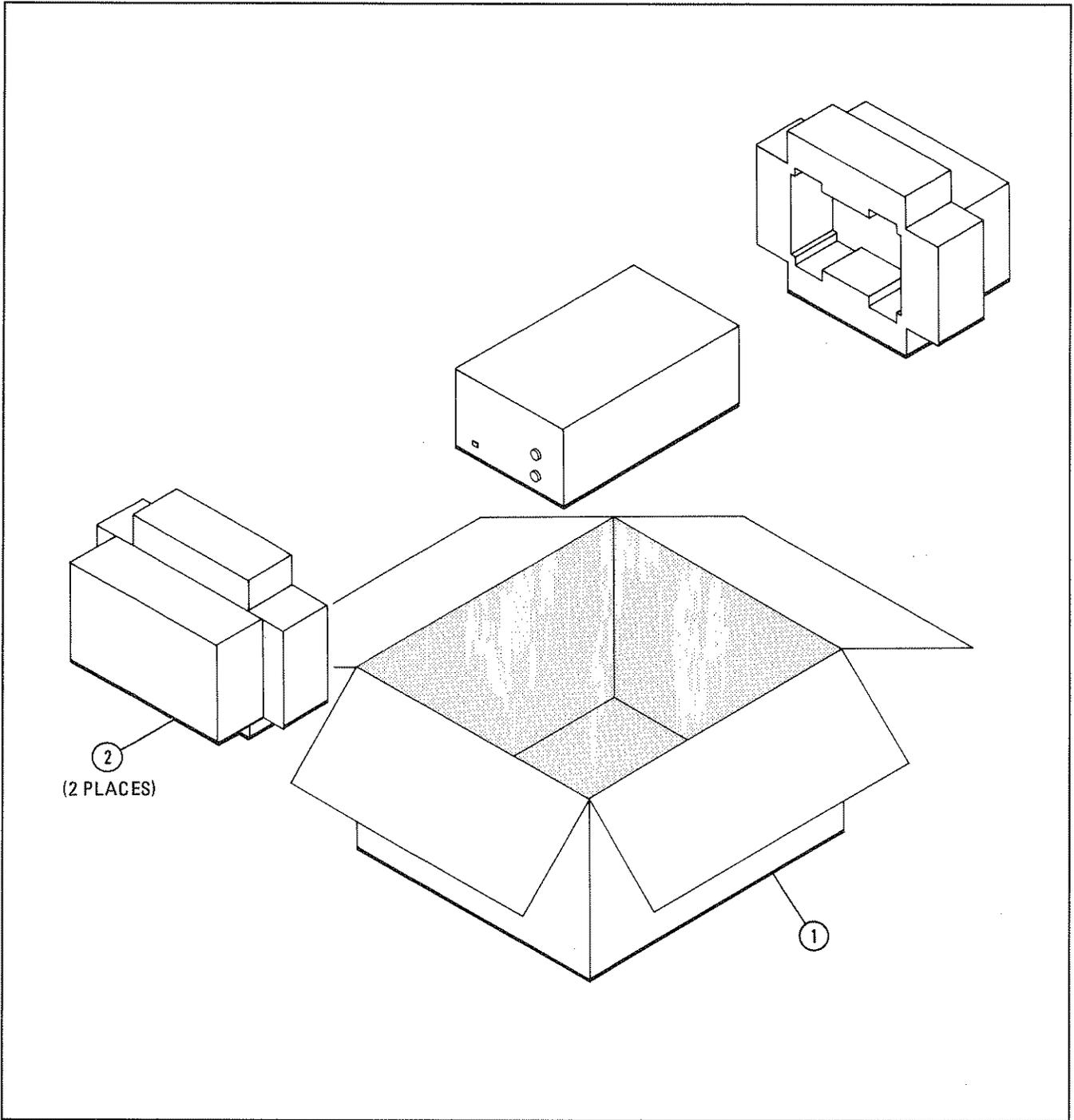
1. Wrap the instrument in heavy paper.
2. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.
3. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside the container. Protect the front panel with cardboard.
4. Mark the shipping container **FRAGILE**.

Returning for Service

If you are shipping the instrument to a Hewlett-Packard office or Service Center please include the following information:

1. Your company name and address.
2. Technical contact person with complete phone number.
3. Complete model and serial number of the instrument.
4. Type of service required (calibration vs. repair).
5. Any other information that may expedite service.

A page of preprinted fill-in tags are provided for your convenience at the end of this section. When making inquiries, either by correspondence or by telephone, please refer to the instrument by model and full serial number.



Item	Quantity	HP Part Number	Description
1	1	9211-4893	Outer Carton
2	2	5180-7809	Foam Pads

Figure 2-2. HP 8349B Factory Packaging

SECTION III OPERATION

CAUTION

SUSCEPTIBLE TO DAMAGE FROM STATIC DISCHARGE.

Repeated electrostatic discharge (ESD) as low as 250 volts can destroy microwave devices.

If discharge is noticed by the operator, it indicates a voltage of 20,000 volts or more.

Materials conducive to static build-up include carpeting, nylon, dry air, paper, adhesive tape, styrofoam and vinyl.

The best method of preventing ESD is for the operator to wear a grounding strap connector to a conductive bench mat that provides a path to ground of between 1 and 2.5 Megohms.

Alternatively, the operator can ground him/herself by touching any grounded instrument before touching any HP 8349B RF connectors.

Never touch the center contacts.

INTRODUCTION

This section provides information that will enable you to utilize the HP 8349B microwave amplifier in a variety of applications. Included are hookup diagrams that illustrate the HP 8349B used as both an amplifier and a dedicated source driver for the HP 83550-series millimeter-wave source modules. Identified in the back of this section are the amplifier's front and rear panel features, including controls and connectors.

OPERATOR'S CHECK

Figure 3-1 is an operator's check of the HP 8349B, which allows the operator to make a quick check of the amplifier prior to use. The procedures cover the entire measurement system, and incorrect indications may be caused by any portion of the system. If the amplifier and/or its source module interface is suspected, use the performance tests in Section IV to determine if they are working correctly. If not, refer to Section VIII, Service, to isolate the problem.

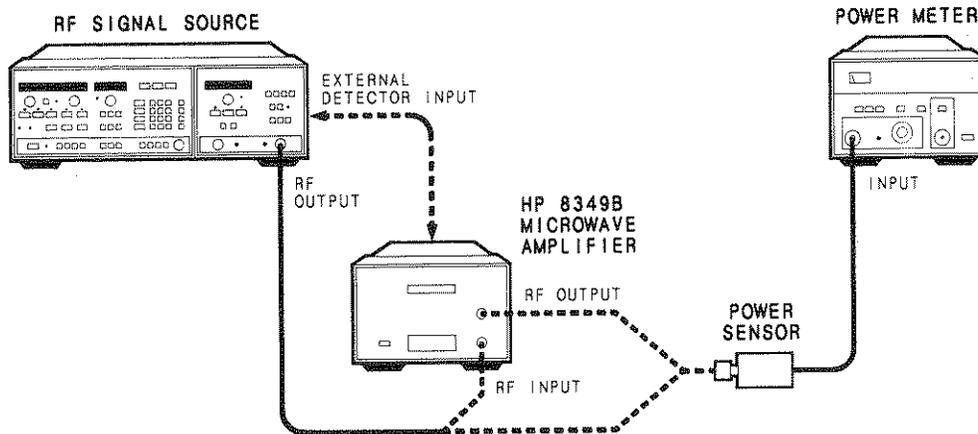
Rack Mounted Operation

The physical configuration of the HP 8349B makes it compatible with EIA and IEC racking standards. The half rack configuration of the HP 8349B allows for mounting in a rack by itself, or closely alongside another instrument. Mounted either way, the effective convection cooling system of the HP 8349B enables it to operate at less than 10 degrees (C) above the ambient temperature of the rack environment.

APPLICATIONS

The HP 8349B microwave amplifier may be used in a wide range of applications. The following descriptions and illustrations (Figures 3-2 through 3-5) explain four possible applications.

HP 8349B OPERATOR'S CHECK



EQUIPMENT

RF Signal Source	See Table 1-3
Amplifier	HP 8349B
Power Meter	See Table 1-3

PROCEDURE

1. Set signal source to desired frequency (or frequency range).
2. Connect power sensor to source output. Set source output power to approximately +5 dBm.
3. Connect source output to amplifier input. Connect power sensor to amplifier output. Power meter should read approximately +19 dBm from 2 to 18.6 GHz and +16 dBm from 18.6 GHz to 20 GHz. In the unlevelled mode, the power meter should read approximately +20 dBm from 2 to 18.6 GHz and +17 dBm from 18.6 to 20 GHz.

NOTE

This is only a rough check. For a more complete check, go to Section IV, Performance Tests.

Figure 3-1. HP 8349B Operator's Check

Remember that the HP 8349B is a portable extension of the source. The spectral purity of the amplifier output will depend primarily on the power levels of the fundamental and harmonic input signals from the source. However, there will be some low power harmonically related spurious signals generated by the HP 8349B during high power inputs. These spurious signals are specified to be below the power level of the fundamental input signal by at least 20 dB (see specifications, Table 1-1). As with all amplifiers and sources, the spectral purity of the output may be improved by using low pass, high pass, bandpass, or tracking filters.

POWER AMPLIFIER

Figure 3-2 shows a general equipment configuration with the HP 8349B used as a power amplifier. The power level at the output of the amplifier is adjusted with the signal source power control and is read on the HP 8349B power display.

As a power amplifier, the HP 8349B microwave amplifier may be used in an unlevelled or an externally leveled mode when combined with a microwave source. When used in an unlevelled mode, the power display may not respond to rapid power variations such as a fast sweep rate. Sweep rate has no effect on the power output of the HP 8349B but should be at least 22 ms per GHz to maintain instantaneous power display accuracy.

To use the HP 8349B in the externally leveled mode, connect the detector output of the HP 8349B to the external detector input of the source (up to +19 dBm of leveled power from 2.0 to 18.6 GHz or +16 dBm from 18.6 to 20.0 GHz is available). The external leveling circuitry of the source must be compatible with the amplifier's built-in detector. The HP 8349B's detector has a sensitivity of greater than -1.0 mV/mW and is able to drive impedances as low as 100 ohms. Leveled output power is indicated by the state of the "UNLEVELED" indicator on the source. To achieve maximum leveled power, increase source output power until the "UNLEVELED" indicator on the source lights, then back off until the light goes out. The HP 8349B is now delivering maximum leveled power.

Utilizing the HP 8349B as a power amplifier, you can do the following: TWT amplifier testing, antenna pattern analysis, long RF cable testing, RFI measurements, and mixer driving. Sources used in high power pulsed microwave applications can also benefit from the minimal pulse rise/fall time (typically less than 10 ns) and input to output delay time (typically less than 8 ns).

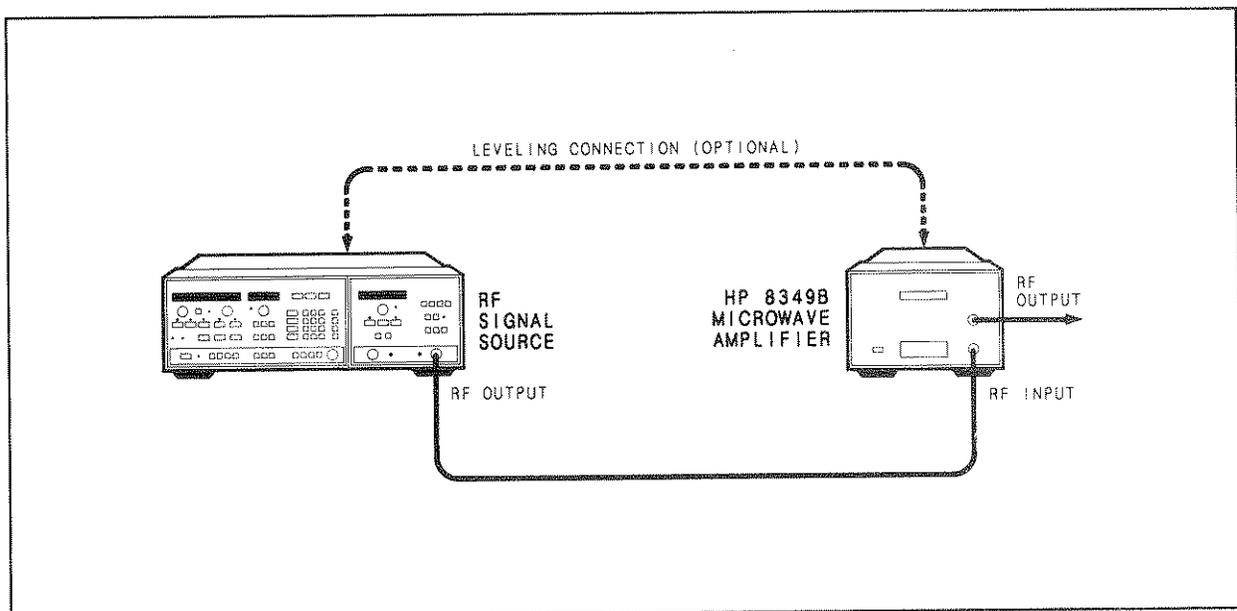


Figure 3-2. HP 8349B Used as a Power Amplifier

WIDEBAND PREAMPLIFIER

CAUTION

With a +5 dBm input, output power from the amplifier may be as high as +26 dBm. Therefore, it is very important to ensure adequate protection of the following device or instrument input circuitry.

The HP 8349B microwave amplifier may be used as a wideband preamplifier for spectrum analyzers, microwave frequency counters, and scalar network analyzers. Spectrum analyzers with 30 dB noise figures may typically realize 15 to 20 dB signal to noise ratio improvements (Figure 3-3).

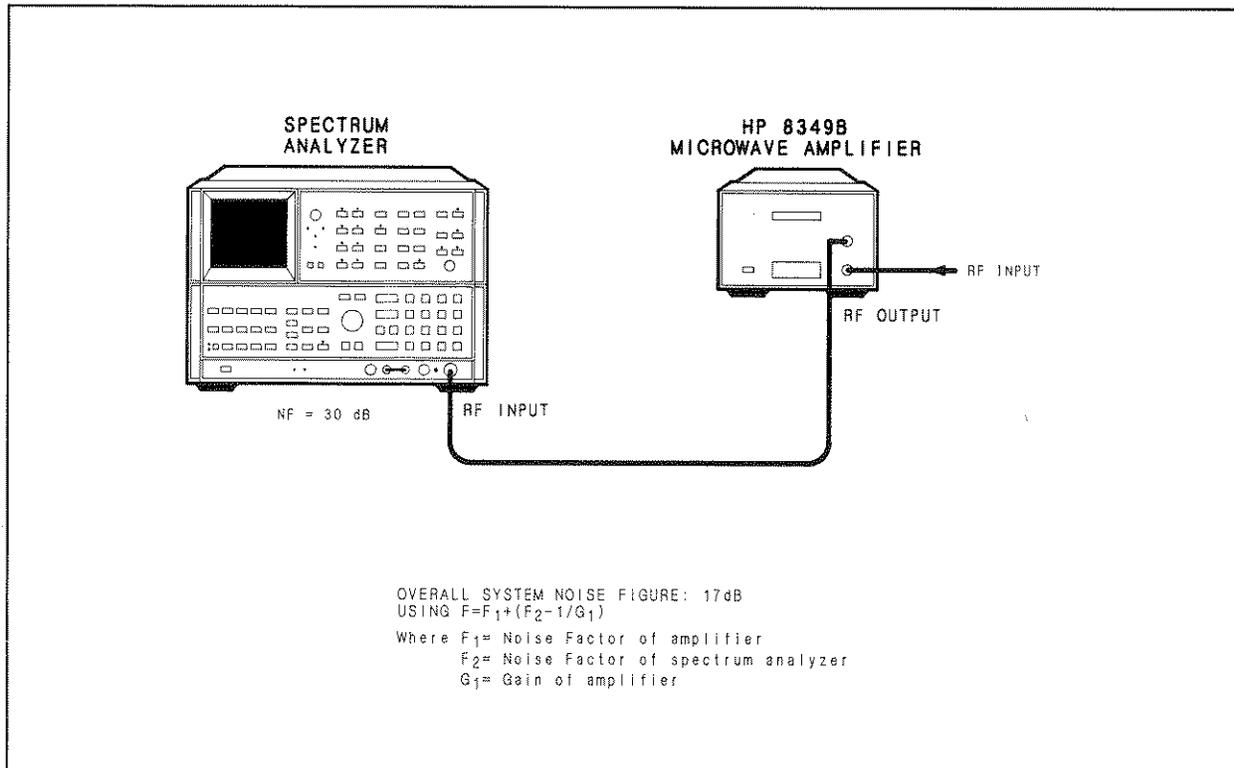


Figure 3-3. HP 8349B Used as Preamplifier for a Spectrum Analyzer

Microwave frequency counters with -25 dBm sensitivity may typically realize a 10 to 20 dB sensitivity improvement (Figure 3-4).

Scalar network analyzers may go beyond the typical 60 dB dynamic range and achieve greater than 80 dB dynamic range when using the HP 8349B in an extended dynamic range configuration (Figure 3-5).

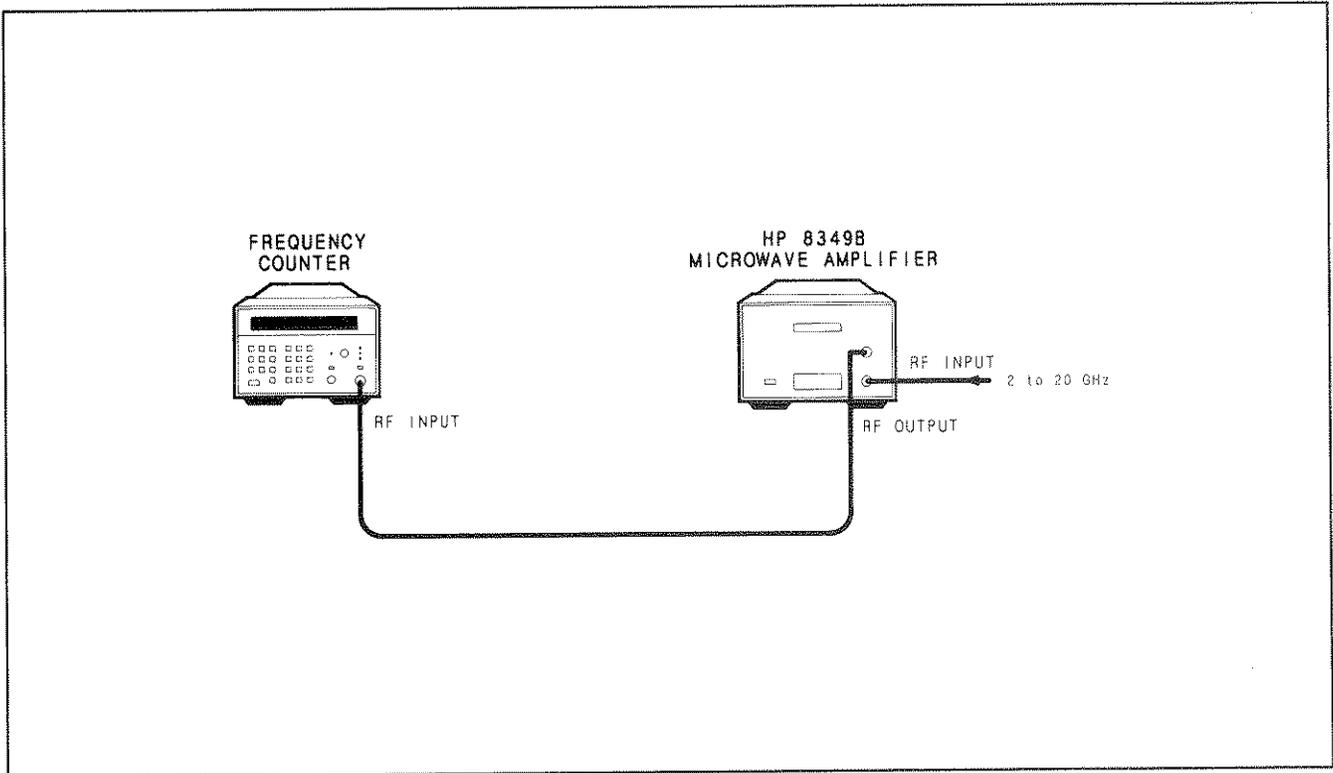


Figure 3-4. HP 8349B Used as a Preamplifier for a Frequency Counter

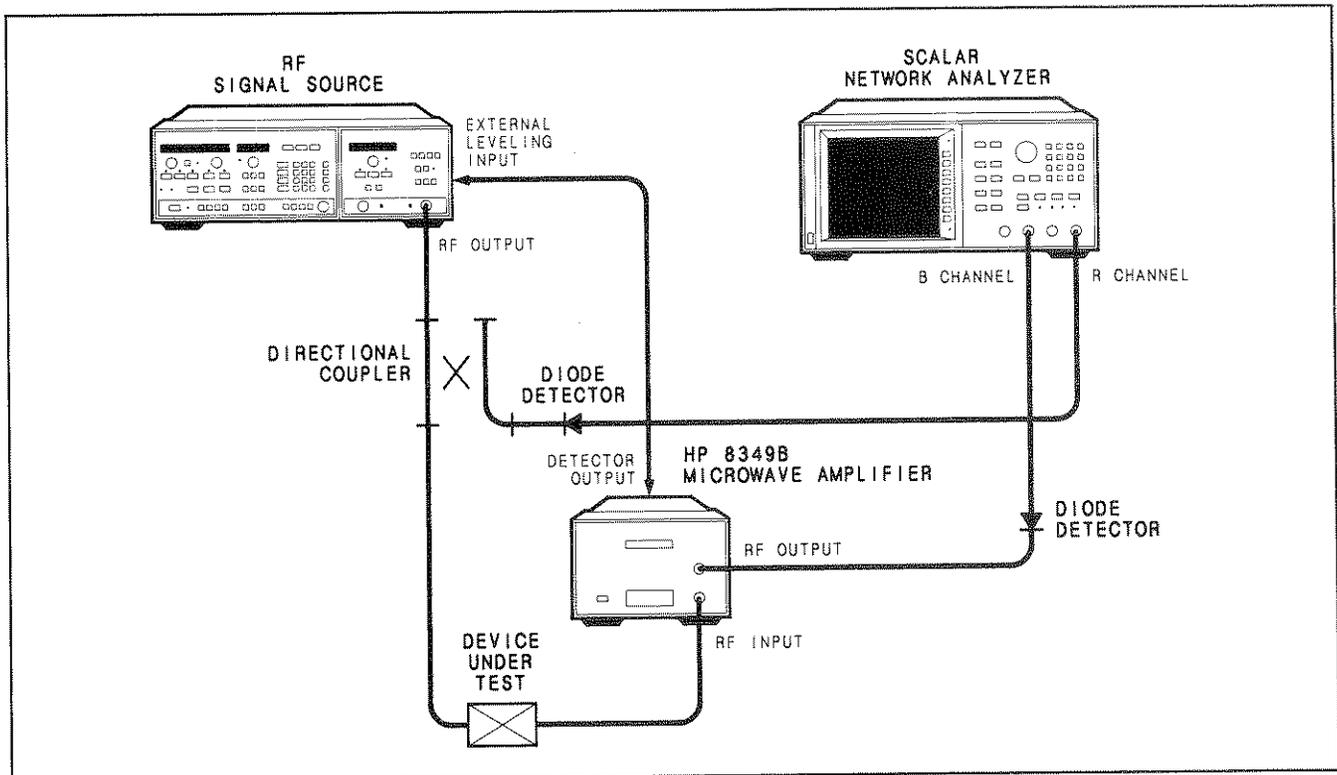


Figure 3-5. HP 8349B Used as a Dynamic Range Extender with a Scalar Network Analyzer

DEDICATED HP MILLIMETER-WAVE SOURCE MODULE DRIVER

The HP 8349B amplifier may also be used to drive the HP 83550-series millimeter-wave source modules. The HP 8349B amplifies an 11 to 20 GHz microwave signal to >+16 dBm. A built-in source module interface provides DC bias and control signals required by the source modules.

For applications that require a millimeter-wave sweep oscillator, the HP 8349B and HP 83550-series source module combination can be used with the HP 8350B and an 11 to 20 GHz RF plug-in (Figure 3-6).

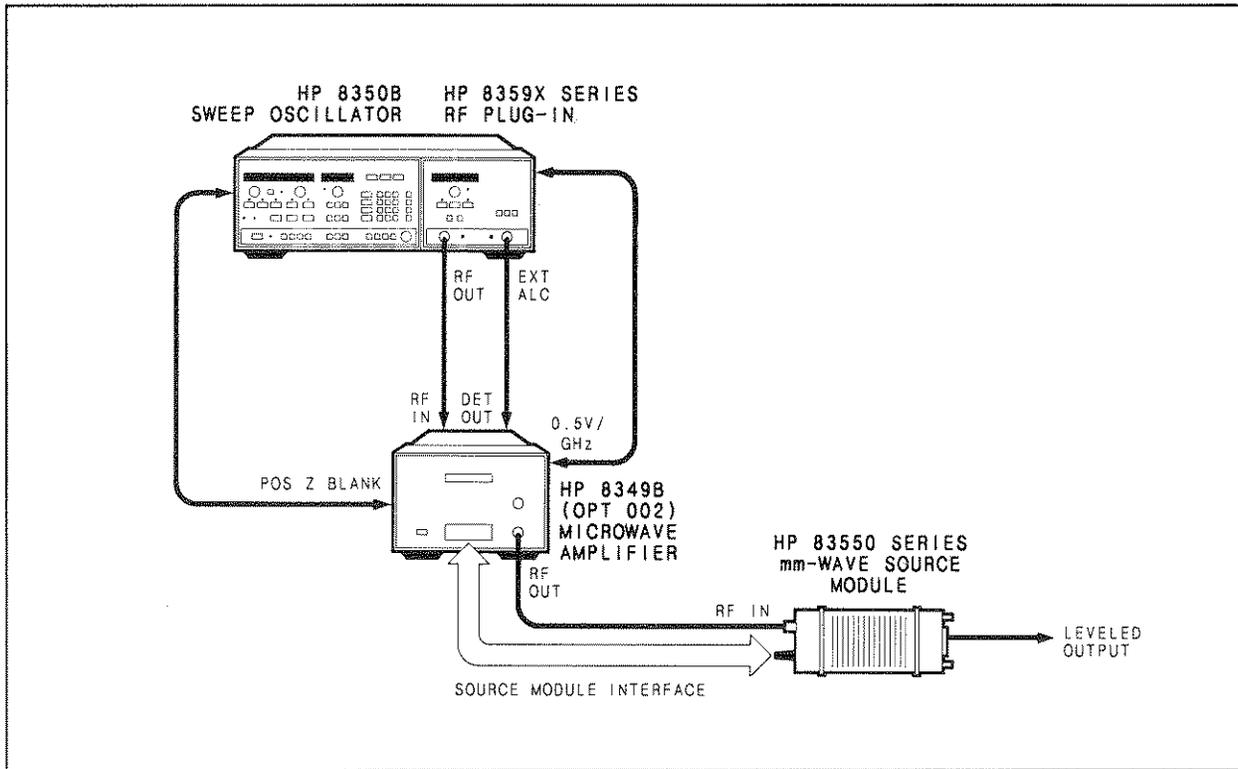


Figure 3-6. HP 8350B/8359X/8349B/83550-Series Source Configuration

For applications that require a millimeter-wave synthesizer, the HP 8349B and HP 83550-series source module combination can be used with either the HP 8340A/41A synthesized sweep oscillators (Figure 3-7), or the HP 8672A/S and HP 8673B/C/D synthesized signal generators (Figure 3-8).

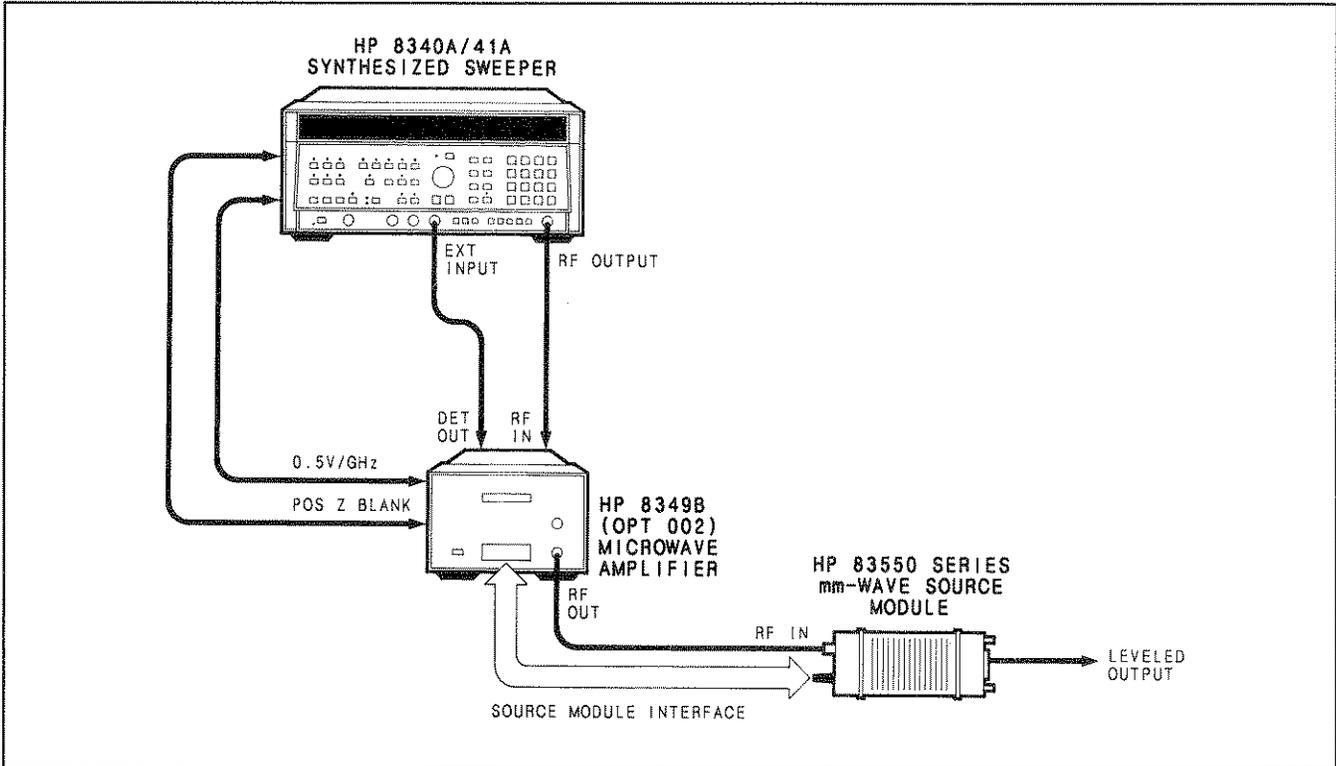


Figure 3-7. HP 8340A/41A/8349B/83550-Series Source Configuration

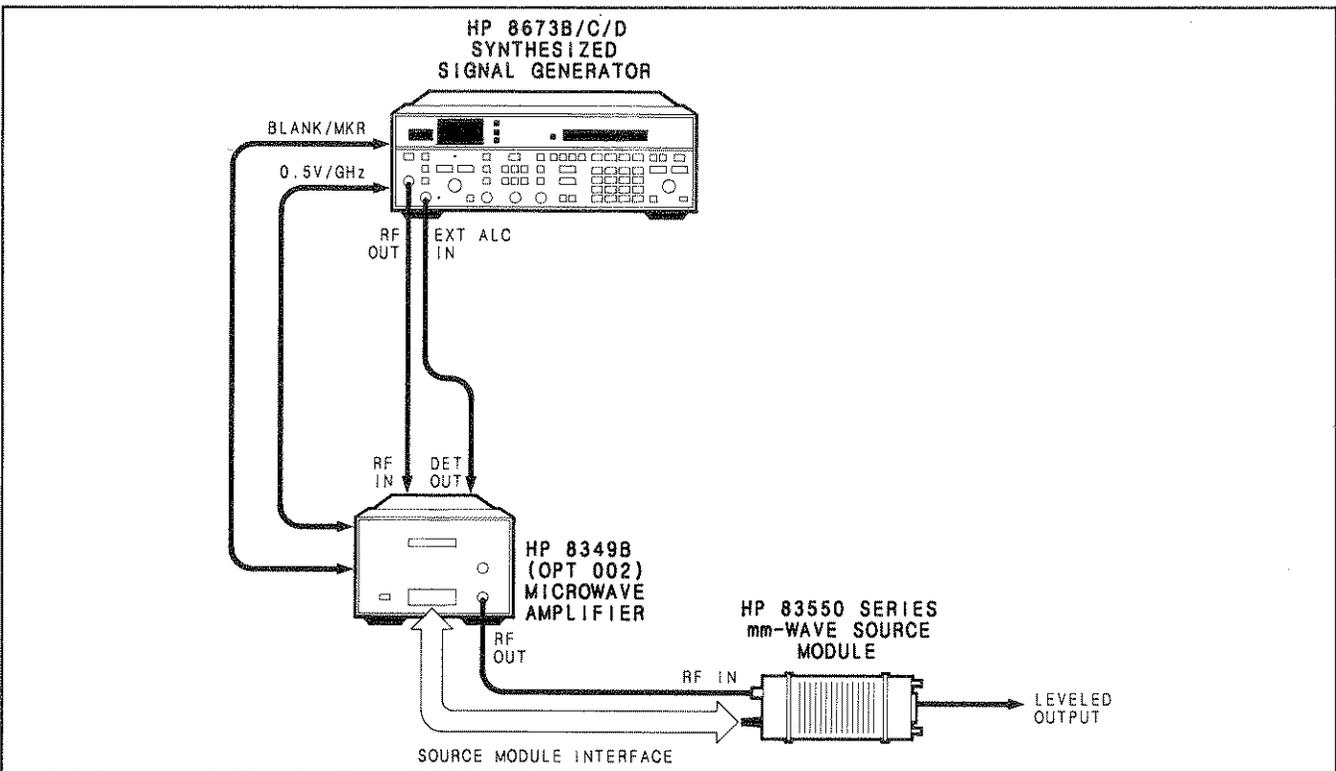


Figure 3-8. HP 8673B/C/D/8349B/83550-Series Source Configuration

PANEL FEATURES

The amplifier's front and rear panel controls and connectors are identified and functionally described in Figure 3-9.

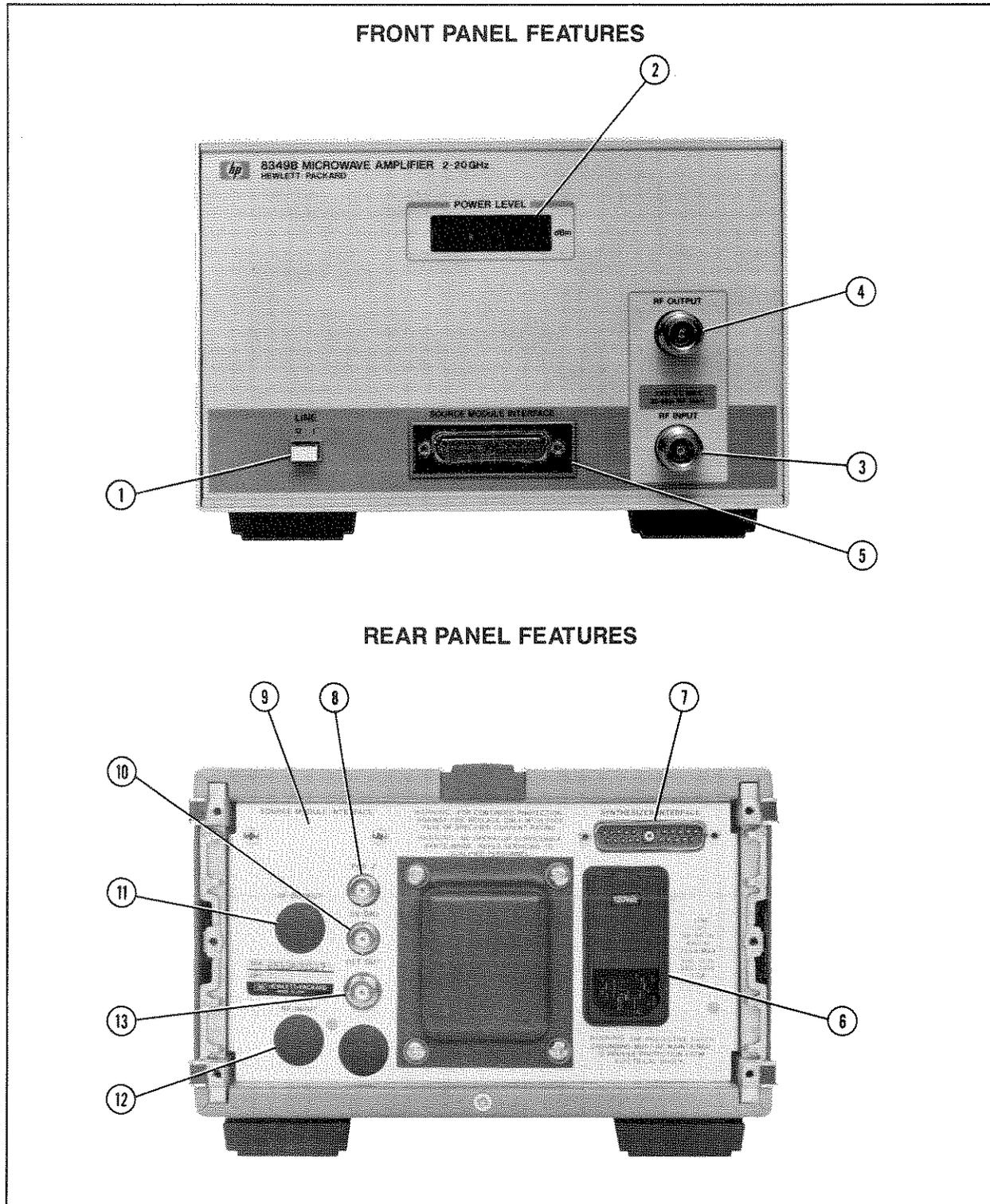


Figure 3-9. Front and Rear Panel Controls, Connectors, and Indicators (1 of 2)

1. **AC MAINS ON-OFF.** AC MAINS Switch. Turns the instrument's ac power (ac mains) on or off.
2. **POWER LEVEL.** An internal power indicator displays output power to tenths of dBm, from 0 to +20 dBm.
3. **RF INPUT (standard).** A type N (female) connector supplies RF input power to the amplifier.

WARNING

To avoid damaging the amplifier's circuitry, signals applied to the INPUT connector must not exceed +27 dBm RF, or $\pm 10V$.

4. **RF OUTPUT (standard and Option 002).** A type N (female) connector supplies amplified RF output power.
5. **SOURCE MODULE INTERFACE.** 20-pin D connector, connects the HP 8349B and the HP 83550-series millimeter-wave source modules together via a cable. This provides the source modules with the necessary DC bias and control signals from the HP 8349B and microwave source for proper operation. The interface also enables the source modules to send leveling and other signals back to the HP 8349B.
6. **AC POWER MODULE.** Contains the three-wire ac power receptacle, line voltage (100, 120, 220, 240 volts) selector, line fuse, and line filter.
7. **SYNTHESIZER INTERFACE.** 20-pin D connector, connects the HP 8349B to a compatible source, enabling the source to pass information directly to and from the millimeter-wave source modules.
8. **POS Z BLANK.** Holds the amplifier's LED power display while the swept source passes switch points and retraces.
9. **SOURCE MODULE INTERFACE (Option 001).** 20-pin D connector, same as standard configuration except located on rear panel.
10. **0.5V/GHz.** Accepts a voltage proportional to the frequency of the microwave source. This signal is used in the power flatness correction feature.
11. **RF OUTPUT (Option 001).** A type N (female) connector supplies amplified RF output power, at the rear panel.
12. **RF INPUT (Option 001 and 002).** A type N (female) connector supplies RF input power to the amplifier, at the rear panel.
13. **DETECTOR OUTPUT.** A BNC (female) connector outputs approximately -1.0 mV/mW for use when leveling.

Figure 3-9. Front and Rear Panel Controls, Connectors, and Indicators (2 of 2)

