

**8348A Microwave Amplifier**  
**Operating and Service Manual**  
**2 to 26.5 GHz**

**SERIAL NUMBERS**

This manual applies to all HP 8348A amplifiers with serial prefix 3111A.



**Agilent Technologies**

**Part No. 08348-90001**  
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**Edition 1.0**

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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 Institute of Standards and Technology (NIST, formerly NBS), to the extent allowed by the Institute'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 delivery. 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, 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.*

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## 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.

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### 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.

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### 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.

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### 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 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 used with an autotransformer make sure the common terminal is connected to the neutral (grounded) side of the main supply.

### **Servicing**

Any servicing, adjustment, maintenance, or repair of this product must be performed only by qualified personnel. Capacitors inside this product may still be charged even when disconnected from their power source.

To avoid a fire hazard, replacement fuses must have the required current rating and be of the type specified in this manual.

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## The HP 8348A amplifier

This instrument (shown in Figure 1-1) is a broad-band, high-gain, amplifier. Its high output power allows proper device operation of, or complete characterization of, very level-sensitive devices that require high power-driven signals (mixers, power amplifiers, and optical modulators, for example).

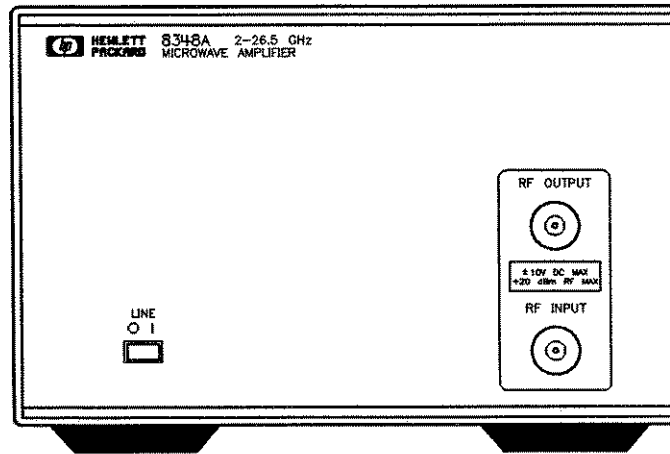


Figure 1-1. HP 8348A Amplifier

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## Accessories

Two 3.5 mm(f) to 3.5 mm(f) adapters are supplied with the amplifier. Table 5-3 lists accessory part numbers.

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## Options Available

### Option 001, Rear Panel RF Input/Output

### Option 002, Rear Panel RF Input/Front Panel RF Output

### Option 910, Extra Operating and Service Manual

### Option 1BN, MIL-STD 45662A Calibration

This option provides an instrument calibration and a certificate of calibration in full compliance with MIL-STD 45662A.

### Option 1BP, MIL-STD 45662A Calibration with Data

This option provides an instrument calibration, a certificate of calibration, and test data in full compliance with MIL-STD 45662A.

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## Specifications and Operating Characteristics

### Specifications

Specifications (listed in Table 1-1) are the performance standards or limits against which the instrument is tested. Specifications apply from +20 to +30°C (unless otherwise noted), and only after the instrument's temperature stabilizes after one hour continuous operation. Unless otherwise noted, corrected limits are given when specifications are subject to optimization with error-correction routines.

### Operating Characteristics

Operating characteristics (listed in Table 1-2) are non-warranted parameters. They are not specifications, but are typical performance parameters that most units meet from +20 to +30°C.

Table 1-1. HP 8348A Specifications

| <b>FREQUENCY</b>  |   |
|---|---|
| <b>Frequency Range</b>                                    | 2.0 to 26.5 GHz   |
| <b>AMPLITUDE</b>  |   |
| <b>Maximum Output Power (at 0 dBm input power)</b>        |   |
| 2.0 to 20.0 GHz   | $\geq +25$ dBm  |
| 20.0 to 26.5 GHz  | $\geq +23$ dBm  |
| <b>Minimum Small Signal Gain (at -15 dBm input power)</b> |   |
| 2.0 to 20 GHz   | $\geq 25$ dB  |
| 20.0 to 26.5 GHz  | $\geq 23$ dB  |
| <b>INPUT AND OUTPUT</b>                                   |   |
| <b>Maximum Continuous Input</b>                           |   |
| Microwave Power:  | +22 dBm   |
| DC Voltage:   | $\pm 10$ V  |
| <b>GENERAL</b>  |   |
| <b>Input and Output Connectors</b>                        | 3.5 mm male   |
| <b>Power Requirements</b>                                 | 100, 120, 200, or 240V ( $\pm 10\%$ ),<br>50 to 400 Hz; 85 VA maximum |
| <b>Temperature Range</b>                                  |   |
| Operation   | +20 to +30°C  |
| Storage   | -40 to +75°C  |
| <b>Weight</b>   |   |
| Net   | 7 kg (15 lb)  |
| Shipping  | 14 kg (31 lb)   |
| <b>Dimensions</b>   |   |
| Height  | 133 mm (5.2 in)   |
| Width   | 214 mm (8.4 in)   |
| Depth   | 366 mm (14.4 in)  |

Table 1-2. HP 8348A Operating Characteristics

| <b>FREQUENCY</b>  |                           |
|---|---------------------------|
| <b>Frequency Range</b>  | 1.0 to 26.5 GHz           |
| <b>AMPLITUDE</b>  |                           |
| <b>Maximum Output Power (at 0 dBm input power)</b>                |                           |
| 1.0 to 2.0 GHz  | ≥+20 dBm                  |
| <b>Output Power Flatness (at 0 dBm input power)</b>               |                           |
| 1.0 to 26.5 GHz   | ±4 dB                     |
| <b>Minimum Small Signal Gain (at -15 dBm input power)</b>         |                           |
| 1.0 to 2.0 GHz  | ≥20 dB                    |
| <b>Harmonics and Spurious (at maximum specified output power)</b> |                           |
| 1.0 to 2.0 GHz  | >20 dB below the carrier. |
| 2.0 to 26.5 GHz   | >15 dB below the carrier. |
| <b>Third Order Intercept</b>                                      |                           |
| 2.0 to 20.0 GHz   | +36 dBm (nominal)         |
| 20.0 to 26.5 GHz  | +31 dBm (nominal)         |
| <b>INPUT AND OUTPUT</b>   |                           |
| <b>Impedance</b>  | 50Ω (nominal)             |
| <b>Input SWR</b>  | <3:1                      |
| <b>Output SWR</b>   |                           |
| 1.0 to 2.0 GHz  | <6:1                      |
| 2.0 to 20.0 GHz   | <4.5:1                    |
| 20.0 to 26.5 GHz  | <2:1                      |
| <b>Noise Figure</b>   |                           |
| 1.0 to 20 GHz   | <10 dB                    |
| 20 to 26.5 GHz  | <13 dB                    |
| <b>Reverse Isolation</b>  | >50 dB                    |
| <b>PULSE TRANSMISSION CAPABILITY</b>                              |                           |
| <b>Rise/Fall Time:</b>  | <5 ns                     |
| <b>Delay Time (input to output):</b>                              | <5 ns                     |
| <b>GENERAL</b>  |                           |
| <b>Temperature Range</b>  |                           |
| Operation   | 0 to +50°C                |

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## Storing and Shipping

### Environment

You may store or ship the instrument in environments within the following limits:

|                   |                            |
|-------------------|----------------------------|
| Temperature ..... | -40 to + 75°C              |
| Altitude .....    | <7600 metres (25,000 feet) |
| Humidity .....    | 5 to 95% relative          |

### Packaging

Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If 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 control panel with cardboard.
4. Seal the shipping container securely.
5. Mark the shipping container "FRAGILE".

### Returning an Instrument for Service

If your amplifier requires service, contact the HP office nearest you for information on where to send it (Table 6-5 lists sales and service offices). When you send the amplifier to Hewlett-Packard, include a service tag (located at the end of this manual), on which you provide the following information:

1. Your company name and address (do not give a post office box).
2. A technical contact person within your company, and their complete phone number.
3. The complete model and serial number of the instrument.
4. Indicate the type of service required (calibration or repair).
5. Include any applicable information.

When making inquiries, either by correspondence or by telephone, please refer to the instrument by model number and full serial number.

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## Manufacturer's Declaration

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**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 ensure that under these operating conditions, the radio frequency interference limits are met at the border of his premises.

Model HP 8348A

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**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.

Zustuzinformation 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.

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## Installation

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This chapter provides the following information:

|   | Page |
|---|------|
| How to initially check the amplifier .....                              | 2-2  |
| Instrument serial number information .....                              | 2-2  |
| The instrument's environmental requirements .....                       | 2-4  |
| An explanation of electrostatic discharge hazards and precautions ..... | 2-4  |
| The instrument's power requirements .....                               | 2-6  |
| How to set the line voltage selector switch .....                       | 2-6  |
| How to check the fuse .....   | 2-7  |
| How to check for the proper power cable .....                           | 2-8  |

## Initial Inspection

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, keep it until you have verified that the contents are complete and you have tested the amplifier mechanically and electrically.

The shipping container and packaging material are shown in Figure 2-2 (part numbers are provided in Table 5-2). If the contents are incomplete or if the amplifier does not pass the performance tests (Chapter 4) notify the nearest HP office. If the shipping container is damaged or the cushioning material shows signs of stress, notify the carrier. Keep the shipping materials for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for a claim settlement.

If the shipping container and cushioning material are in good condition, retain them for possible future use. You may wish to ship the amplifier to another location or to return it to Hewlett-Packard for service. Instructions for repackaging and shipping the instrument are located at the end of this chapter.

## Serial Numbers

Hewlett-Packard makes frequent improvements to its products to enhance their performance, usability, or reliability, and to control costs. Hewlett-Packard service personnel have access to records of design changes to each type of equipment, based on the equipment's serial number. If you contact Hewlett-Packard about your amplifier, have the complete serial number available to make sure that you receive the most complete and accurate information possible.

A serial number label is attached to the rear panel of the amplifier. A typical serial number label is shown in Figure 2-1. The first four digits followed by a letter comprise the serial number prefix; the last five digits are the sequential suffix, unique to each instrument.

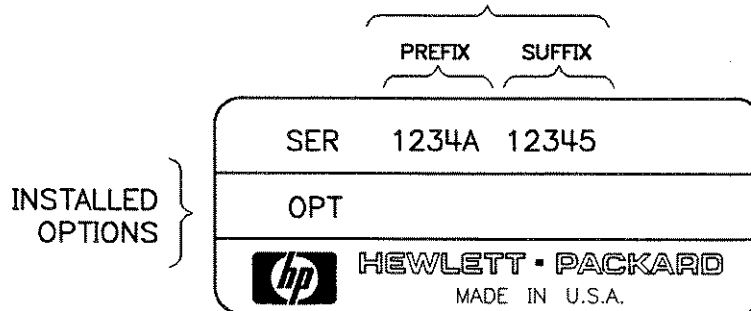


Figure 2-1. Typical Serial Number Label

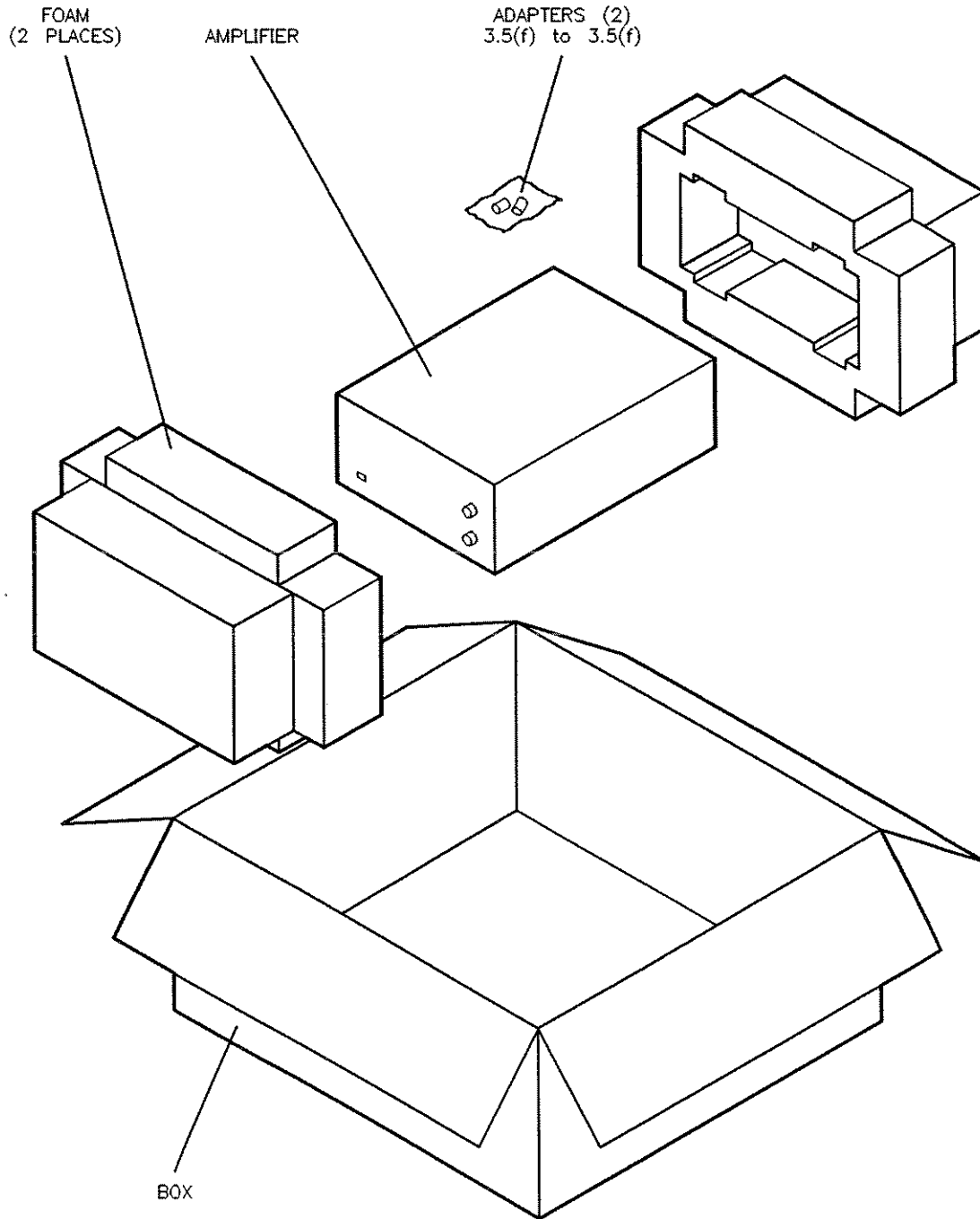


Figure 2-2. HP 8348A Shipping Container and Contents

## Operating Environment

To meet the specifications listed in Table 1-1, you must operate this instrument within the following limits:

|                   |                            |
|-------------------|----------------------------|
| Temperature ..... | +20 to +30°C               |
| Altitude .....    | <4500 metres (15,000 feet) |
| Humidity .....    | 5 to 80% relative          |

## Electrostatic Discharge

Because electrostatic discharge (ESD) can damage or destroy electronic components, perform all work on assemblies consisting of electronic components at a static-free work station.

Figure 2-3 is an example of a static-safe work station using two types of ESD protection that can be used either together or separately:

1. A conductive table mat and wrist-strap combination.
2. A conductive floor mat and heel-strap combination.

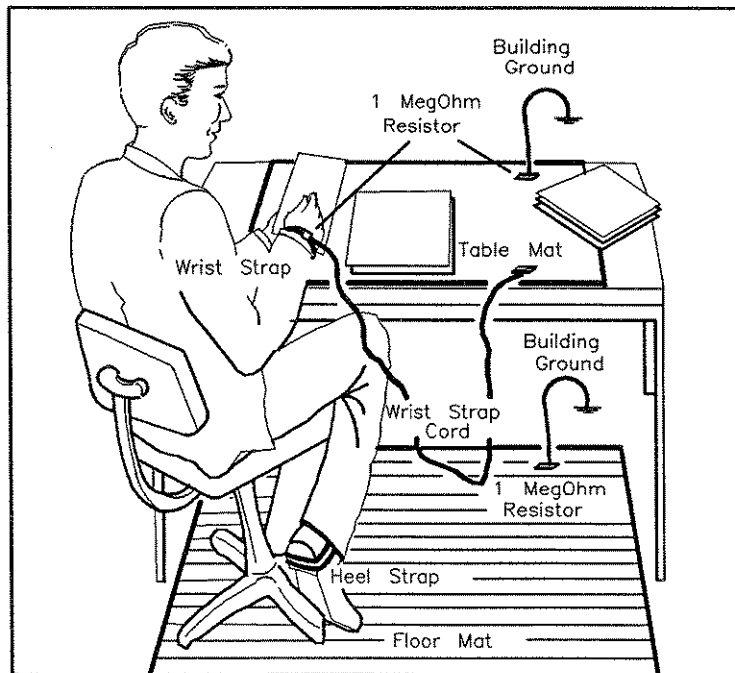


Figure 2-3. Example of a Static-Safe Work Station

### Reducing Damage Caused by ESD

The following can help reduce ESD damage that occurs during testing and servicing operations:

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

**Static-Safe Accessories.** See chapter 5 for static-safe accessories that can be obtained from Hewlett-Packard.

## Power Requirements

Table 2-1. HP 8348A Power Requirements

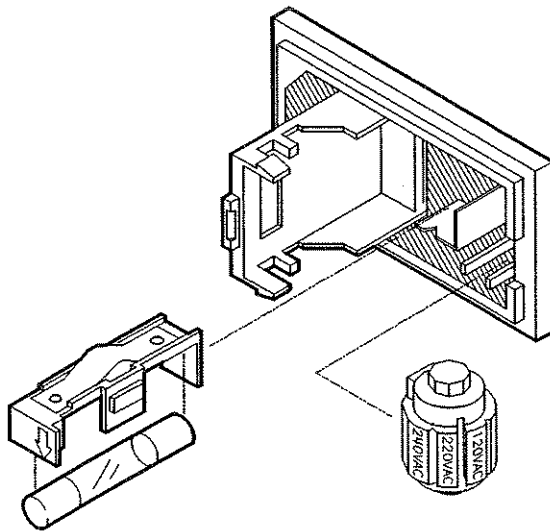
| Characteristic | Requirement                           |
|----------------|---------------------------------------|
| Input Voltage  | 100, 120, 200, or 240V ( $\pm 10\%$ ) |
| Frequency      | 50 to 400 Hz                          |
| Power          | 85 VA (max)                           |

### Setting the Line Voltage Selector Switch

#### Caution



Before connecting the HP 8348A to the power source, set the rear-panel voltage selector switch correctly to adapt the amplifier to the power source. An improper selector switch setting can damage the unit when it is turned on. The selected voltage range (100 to 120V, or 200 to 240V) is visible through the small "window."



#### CAUTION:

Do not attempt to rotate the voltage selector cam while it is installed in the line module or non-repairable damage will result. The cam must be completely removed from the line module, rotated to the proper position, and reinstalled. Refer to the instruction below.

#### REPLACEMENT OF FUSE

1. Pry open line module cover door.
2. Pull out fuse carrier.
3. Insert fuse of proper rating.
4. Place carrier back into line module.

#### SELECTION OF OPERATING VOLTAGE

1. Pry open line module cover door.
2. REMOVE CAM FROM THE LINE MODULE.
3. Rotate the cam to the desired voltage.  
(When the line module cover is closed, the selected voltage will be visible through a small window).
4. Insert the cam back into the line module.
5. Close the line module cover door.

Figure 2-4. Setting the Voltage Selector Switch and Checking the Fuse

## Checking the Fuse

The line fuse is housed in a small container in the rear-panel ac power module (see Figure 2-4).

---

**Note**

The ac line input fuse is the same value regardless of the input line voltage. It is rated at 1.0A, 250V. See Chapter 5 for the part number.

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## Checking the Power Cable

The HP 8348A is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power line outlet, this cable grounds the amplifier chassis.

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### Warning



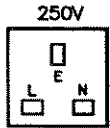




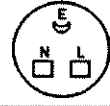
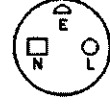

**Failure to ground the amplifier properly can result in personal injury or death.**

**Before turning on the HP 8348A, 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 without a protective ground conductor. If you are using an auto transformer, make sure its common terminal is connected to the protective earth contact of the power source outlet socket.

---

Various power cables are available to connect the HP 8348A to the types of ac power outlets unique to specific geographic areas. The cable appropriate for the area to which the amplifier is originally shipped is included with the unit. You can order additional ac power cables for use in different areas. Figure 2-5 lists the available ac power cables, illustrates the plug configurations, and identifies the geographic area in which each cable is appropriate.

| PLUG TYPE <sup>1</sup>  | CABLE HP PART NUMBER <sup>2</sup>  | PLUG DESCRIPTION <sup>2</sup>  | CABLE LENGTH (inches)            | CABLE COLOR  | FOR USE IN COUNTRY   |
|---|--|--|----------------------------------|--|--|
|    | 8120-1351<br>8120-1703   | Straight BS1363A<br>90°  | 90<br>90                         | Mint Gray<br>Mint Gray   | United Kingdom,<br>Cyprus, Nigeria,<br>Zimbabwe, Singapore   |
|    | 8120-1369<br>8120-0696   | Straight ZNSS198/ASC112<br>90°   | 79<br>87                         | Gray<br>Gray   | Australia,<br>New Zealand  |
|    | 8120-1689<br>8120-1692   | Straight CEE7-VII<br>90°   | 79<br>79                         | Mint Gray<br>Mint Gray   | East and West Europe,<br>Saudi Arabia, Egypt,<br>Republic of So. Africa,<br>India (unpolarized in<br>many nations) |
|    | 8120-1348<br>8120-1398<br>8120-1754<br>8120-1378<br>8120-1521<br>8120-1676 | Straight NEMA5-15P<br>90°<br>Straight NEMA5-15P<br>Straight NEMA5-15P<br>90°<br>Straight NEMA5-15P | 80<br>80<br>36<br>80<br>80<br>36 | Black<br>Black<br>Black<br>Jade Gray<br>Jade Gray<br>Jade Gray | United States,<br>Canada, Japan,<br>(100V or 200V),<br>Mexico, Philippines,<br>Taiwan                              |
|   | 8120-2104  | Straight SEV1011.1959<br>24507, Type 12  | 79                               | Gray   | Switzerland  |
|  | 8120-0698  | Straight NEMA6-15P   |                                  |  | United States, Canada  |
|  | 8120-1957<br>8120-2956   | Straight DHCK 107<br>90°   | 79<br>79                         | Gray<br>Gray   | Denmark  |
|  | 8120-1860  | Straight CEE22-VI<br>(System Cabinet Use)  |                                  |  |  |

1. E = Earth Ground; L = Line; N = Neutral.  
2. Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable including plug.

Figure 2-5. AC Power Cables Available



## Operation

---

This chapter provides the following information:

|  | Page |
|--|------|
| A description of the front panel ..... | 3-2  |
| A description of the rear panel .....  | 3-3  |
| An operator's check .....              | 3-5  |

---

### Note



The equipment required to perform the operator's check is illustrated in Figure 3-3. Refer to Table 4-1 for critical specifications and recommended model numbers. Other equipment may be substituted if it meets or exceeds the critical specifications listed.

---



---

### Reducing ESD



- Before you connect a coaxial cable to an amplifier connector for the first time each day, momentarily ground the cable center and outer conductors.
  - Ground yourself with a resistor-isolated wrist strap before touching the center pin of *any* connector.
  - To prevent a buildup of static charge, ensure that all instruments are properly earth-grounded.
-

## Front Panel Features

- ① **RF OUTPUT** 3.5 mm male connector supplies the amplified RF output from the amplifier. See Table 1-1 and Table 1-2 for detailed information.
- ② **RF INPUT** 3.5 mm male connector to apply an RF input to the amplifier. See Table 1-1 and Table 1-2 for detailed information.

### Caution



The amplifier input is sensitive to static electricity. Ground any cable before you connect it. Also read “Electrostatic Discharge” in Chapter 2 and follow the recommendations provided.

- ③ **LINE** AC line switch. This switch turns the instrument primary power on and off.

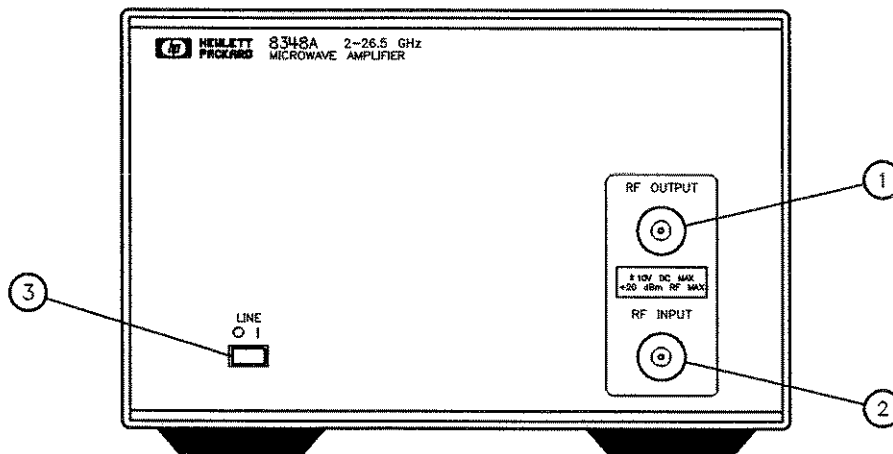


Figure 3-1. HP 8348A Front Panel

## Rear Panel Features

- ① **AC POWER MODULE** Contains a three-wire ac power receptacle, a line voltage selector (100, 120, 200, or 240 volts), and a line fuse.
- ② **SERIAL NUMBER LABEL** Has a 10-digit serial number (use this in any correspondence concerning the instrument) and, if applicable, an option number.
- ③ **RF INPUT** Replaces the front panel RF input in options 001 and 002.
- ④ **RF OUTPUT** Replaces the front panel RF output in option 001.

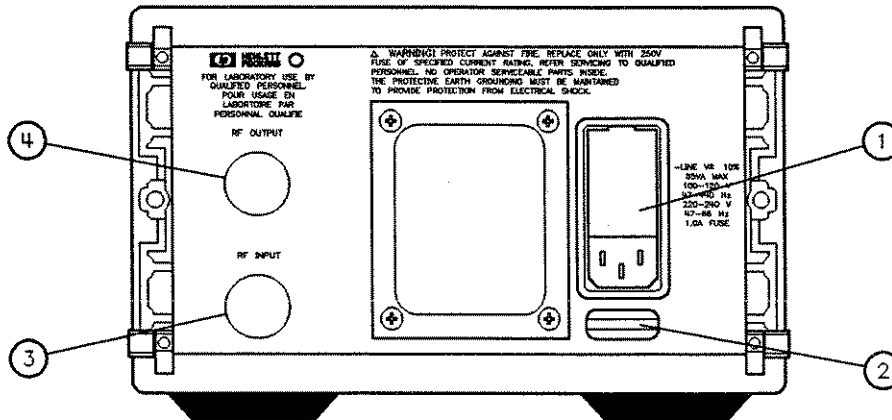
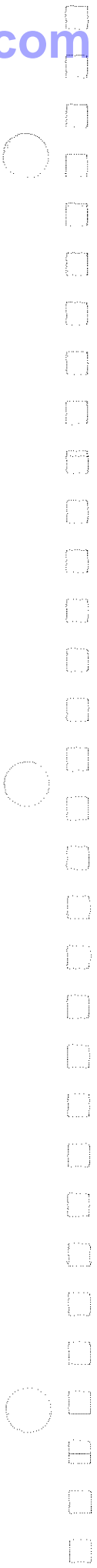


Figure 3-2. HP 8348A Rear Panel



## Operator's Check

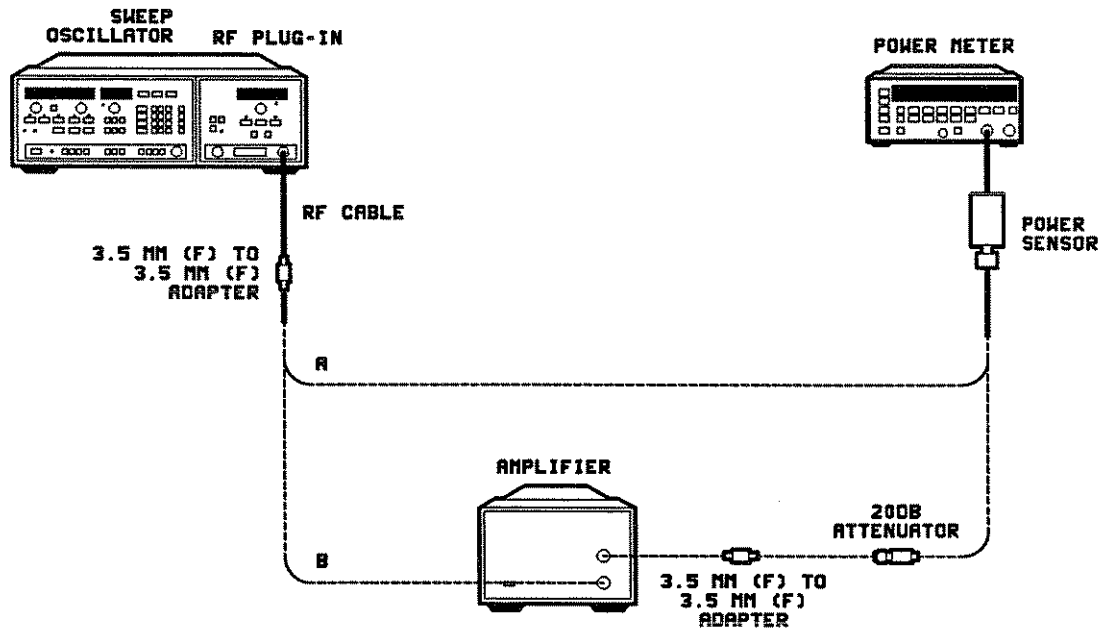


Figure 3-3. Operator's Check Test Setup

### Description and Procedure

Use the operator's check to verify that the amplifier is operational. It is not intended to verify all specifications, but to verify basic operation by measuring the amplifier output power.

1. Calibrate the power meter:
  - a. Enter the power sensor calibration factor for 50 MHz (Ref CF).
  - b. Using the internal 50 MHz reference on the front panel of the power meter, calibrate the power sensor/power meter.
  - c. Enter the power sensor calibration constant at the CW frequency of interest.
  - d. Zero the power meter.
2. Connect the equipment as shown in Figure 3-3, point A, with the power sensor connected to the RF plug-in through a 3.5 mm(f) to 3.5 mm(f) adapter (without the amplifier, the second 3.5 mm(f) to 3.5 mm(f) adapter, or the 20 dB attenuator).
3. On the source:
  - a. Set a CW frequency between 2 and 20 GHz.
  - b. Set the power for a 0 dBm reading on the power meter.
4. Disconnect the power sensor from the adapter and connect the equipment as shown in Figure 3-3, point B, with the amplifier, the second 3.5 mm(f) to 3.5 mm(f) adapter, and the 20 dB attenuator connected between the first 3.5 mm(f) to 3.5 mm(f) adapter and the power sensor.
5. The power meter reading should be greater than 5 dBm (25 dBm – 20 dB).

6. Repeat the preceding steps with a CW frequency between 20 and 26.5 GHz. The power meter reading should be greater than 3 dBm (23 dBm – 20 dB).

**In Case of Difficulty**

If the amplifier fails this test, refer to Chapter 6 to troubleshoot the problem.

## Performance Tests

---

This chapter provides the following information:

|  | Page |
|--|------|
| A list of test equipment.....  | 4-2  |
| <p>Table 4-1 lists specifications and recommended model numbers of required test equipment. You may substitute other equipment if it meets or exceeds the critical specifications listed.</p>                |      |
| Instructions on what to do if the instrument fails a performance test .....  | 4-2  |
| A test for maximum output power .....  | 4-3  |
| <p>The specifications tested are listed in Table 1-1, and on the test record.</p>  |      |
| A test for small signal gain .....   | 4-7  |
| <p>The specifications tested are listed in Table 1-1, and on the test record.</p>  |      |
| A test record.....   | 4-11 |
| <p>Make a copy of Table 4-4, record the complete test results on the copy, and keep the copy for your calibration test record. This record can help you track gradual changes in test results over time.</p> |      |

---

### Operator's Check

An operator's check is provided in Chapter 3. Use that check if you wish simply to verify that the amplifier is operational.



The equipment required for the operator's check is listed in Table 4-1. Other equipment may be substituted if it meets or exceeds the listed specifications.

---

### Reducing ESD



- Before you connect a coaxial cable to an amplifier connector for the first time each day, momentarily ground the cable center and outer conductors.
  - Ground yourself with a resistor-isolated wrist strap before touching the center pin of *any* connector.
  - To prevent a buildup of static charge, ensure that all instruments are properly earth-grounded.
-

Table 4-1. Recommended Test Equipment

| Instrument                                       | Critical Specifications  | Recommended HP Model or Part Number <sup>1</sup> | Use <sup>2</sup> |
|--|--|--|------------------|
| RF Signal Source:<br>Sweep Oscillator/RF Plug-in | Power Range: $\geq -15$ dBm<br>Frequency Range: 2.0 to 26.5 GHz      | 8350B with an<br>83595A Opt 002                  | O,P,T            |
| Power Meter                                      | Power Range: 1 $\mu$ W to 100 mW<br>Accuracy: $\pm 0.02$ dB          | 437A, or 438A                                    | O,P,T            |
| Power Sensor                                     | Power Range: 1 $\mu$ W to 100 mW<br>Frequency Range: 2.0 to 26.5 GHz | 8485A  | O,P,T            |
| Adapter <sup>3</sup>                             | 3.5 mm(f) to 3.5 mm(f)   | 85027-60005                                      | O,P,T            |
| Attenuator                                       | Attenuation: 20 dB   | 8493C Opt 020                                    | O,P,T            |
| Screwdriver                                      | Phillips #0  | 8710-0978  | T                |
| Screwdriver                                      | Small Pozi-driv  | 8710-0899  | T                |
| Screwdriver                                      | Large Pozi-driv  | 8710-0900  | T                |
| Wrench   | 5/16-inch combination  | 8720-0015  | T                |
| Wrench   | 9/16-inch open-end   | 8720-0010  | T                |
| Wrench   | 5/8-inch open-end  | 8720-0010  | T                |
| Wrench   | 7-mm combination   | 8710-1258  | T                |
| Wrench   | 5/16 inch torque (8 in/lb)   | 8710-1765  | T                |
| Wire Cutter                                      |  | 8710-0012  | T                |
| Pliers   | Long-nose  | 8710-0030  | T                |
| Cable  | 3.5 mm(f) to 3.5 mm(m), low-loss                                     | 08513-60009                                      | O,P,T            |

<sup>1</sup> You may substitute other equipment if it meets or exceeds the critical specifications listed.

<sup>2</sup> O=Operator's Check; P=Performance Test; T=Troubleshooting

<sup>3</sup> Two are supplied as accessories with the amplifier.

## If the Amplifier Doesn't Meet Specifications

If the amplifier fails one or more specifications, complete all tests and record the results on a copy of the performance test record. Then refer to Chapter 6 for instructions on how to solve the problem.

## Maximum Output Power

### Description and Procedure

This performance test verifies worst-case output power.

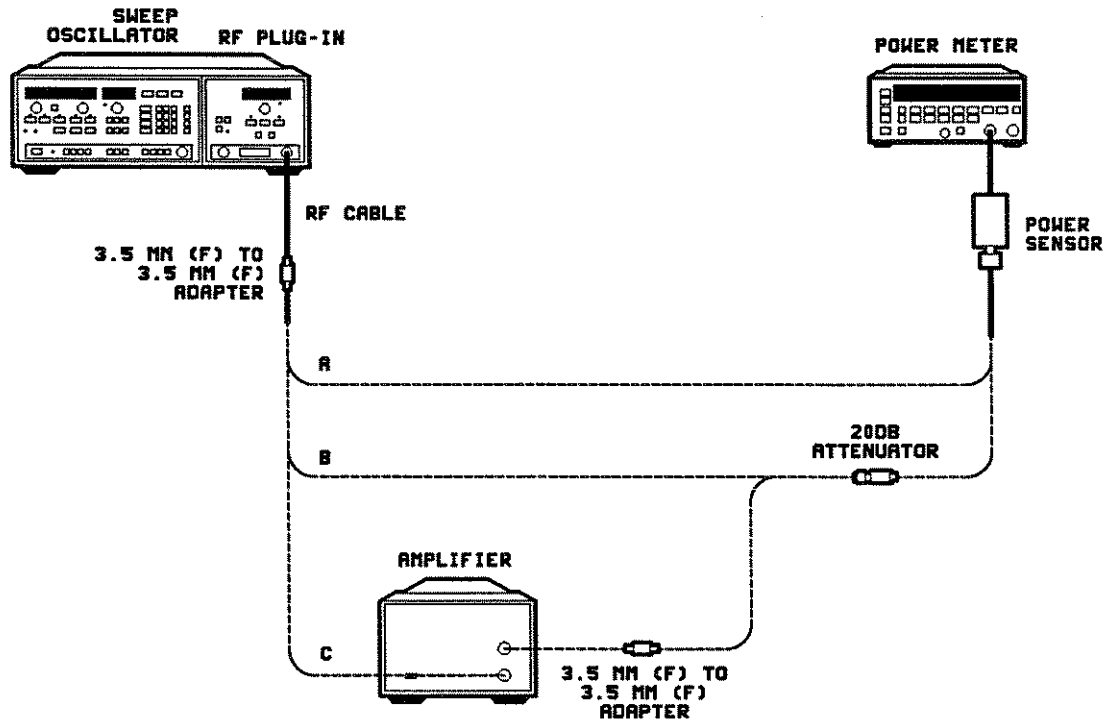


Figure 4-1. Maximum Output Power Test Setup

1. In column 2 of Table 4-2, record the power sensor calibration factors for the frequencies listed.
2. Calibrate the power meter:
  - a. Enter the power sensor calibration factor for 50 MHz (Ref CF).
  - b. Using the internal 50 MHz reference on the front panel of the power meter, calibrate the power sensor/power meter.
  - c. Zero the power meter.
3. Set the input power to the amplifier:
  - a. Connect the equipment as shown in Figure 4-1, point A, with the power sensor connected to the 3.5 mm(f) adapter (without the amplifier, the second 3.5 mm(f) adapter, or the 20 dB attenuator).
  - b. Set the source to a CW frequency of 2 GHz.
  - c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-2).
  - d. Set the source power for a 0 dBm reading on the power meter.

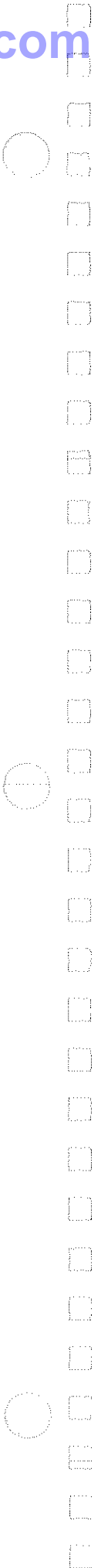
**Maximum Output Power**

- e. In column 3 of Table 4-2, record the power reading displayed on the *source*.
- f. Repeat from step 3b for the remaining frequencies listed in Table 4-2.
4. Calculate the actual attenuation:
  - a. Connect the 20 dB attenuator between the adapter and the power sensor, as shown in Figure 4-1, point ③.
  - b. Set the source to a CW frequency of 2 GHz.
  - c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-2).
  - d. Set the source power to the corresponding power value in *column 3* in Table 4-2.
  - e. Record the power meter reading in column 4.
  - f. Repeat from step 4b for the remaining frequencies.
  - g. In column 5, record the *absolute value* of numbers in column 4 (this gives the actual attenuation and will be used later).
5. Measure the amplifier output power:
  - a. Connect the equipment as shown in Figure 4-1, point ④, with the amplifier and the second 3.5 mm(f) adapter connected between the first 3.5 mm(f) adapter and the power sensor (you must use the same 20 dB attenuator as in the previous steps).
  - b. Set the source to a CW frequency of 2 GHz.
  - c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-2).
  - d. Set the source power to the corresponding power value in *column 3* in Table 4-2.
  - e. Record the power meter reading in column 6.
  - f. Repeat from step 5b for the remaining frequencies.
  - g. Add the number in column 5 (the actual attenuation) to the number in column 6 (the amplifier output power) and record the sum in column 7.
6. On the test record, record the lowest value in column 7 for frequencies between 2 and 20 GHz.
7. On the test record, record the lowest value in column 7 for frequencies between 20 and 26.5 GHz.

Table 4-2. Maximum Output Power Data

| 1<br>Frequency<br>(GHz) | 2<br>Calibration<br>Factor | 3<br>Source Power<br>(dBm) | 4<br>Power Meter<br>with 20 dB Pad | 5<br>Actual Pad<br>Attenuation | 6<br>Output Power<br>(dBm) | 7<br>Actual Output<br>(dBm) |
|-------------------------|----------------------------|----------------------------|------------------------------------|--------------------------------|----------------------------|-----------------------------|
| 2                       |                            |                            |                                    |                                |                            |                             |
| 3                       |                            |                            |                                    |                                |                            |                             |
| 4                       |                            |                            |                                    |                                |                            |                             |
| 5                       |                            |                            |                                    |                                |                            |                             |
| 6                       |                            |                            |                                    |                                |                            |                             |
| 7                       |                            |                            |                                    |                                |                            |                             |
| 8                       |                            |                            |                                    |                                |                            |                             |
| 9                       |                            |                            |                                    |                                |                            |                             |
| 10                      |                            |                            |                                    |                                |                            |                             |
| 11                      |                            |                            |                                    |                                |                            |                             |
| 12                      |                            |                            |                                    |                                |                            |                             |
| 13                      |                            |                            |                                    |                                |                            |                             |
| 14                      |                            |                            |                                    |                                |                            |                             |
| 15                      |                            |                            |                                    |                                |                            |                             |
| 16                      |                            |                            |                                    |                                |                            |                             |
| 17                      |                            |                            |                                    |                                |                            |                             |
| 18                      |                            |                            |                                    |                                |                            |                             |
| 19                      |                            |                            |                                    |                                |                            |                             |
| 20                      |                            |                            |                                    |                                |                            |                             |
| 21                      |                            |                            |                                    |                                |                            |                             |
| 22                      |                            |                            |                                    |                                |                            |                             |
| 23                      |                            |                            |                                    |                                |                            |                             |
| 24                      |                            |                            |                                    |                                |                            |                             |
| 25                      |                            |                            |                                    |                                |                            |                             |
| 26.5                    |                            |                            |                                    |                                |                            |                             |

**Maximum Output Power**



## Small Signal Gain

### Description and Procedure

This test measures the small signal gain of the amplifier over its frequency range. First, the source and power meter are connected without the amplifier in the circuit to establish a reference level. Then the amplifier is added to the circuit and the gain is compared to the original reference level.

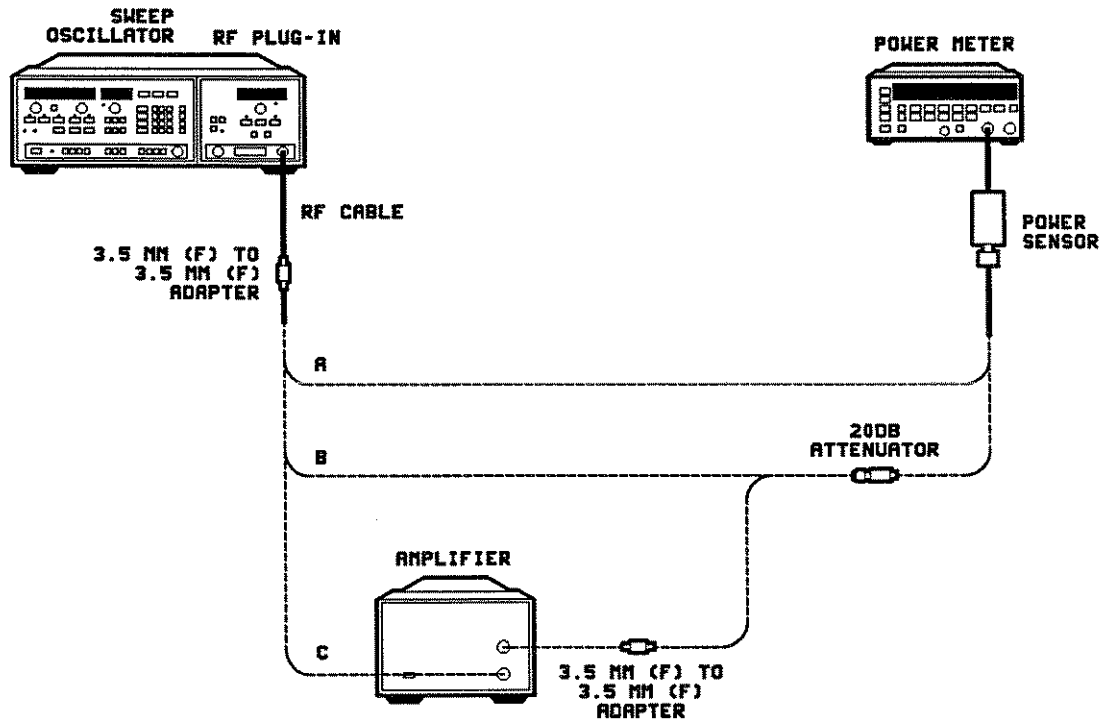


Figure 4-2. Small Signal Gain Test Setup

1. In column 2 of Table 4-3, record the power sensor calibration factors for the frequencies listed.
2. Calibrate the power meter:
  - a. Enter the power sensor calibration factor for 50 MHz (Ref CF).
  - b. Using the internal 50 MHz reference on the front panel of the power meter, calibrate the power sensor/power meter.
  - c. Zero the power meter.

## Small Signal Gain

Table 4-3. Small Signal Gain Data

| 1<br>Frequency<br>(GHz) | 2<br>Calibration<br>Factor | 3<br>Source Power<br>(dBm) | 4<br>Power Meter<br>with 20 dB Pad | 5<br>Actual Pad<br>Attenuation | 6<br>Output Power<br>(dBm) | 7<br>Actual Output<br>(dBm) |
|-------------------------|----------------------------|----------------------------|------------------------------------|--------------------------------|----------------------------|-----------------------------|
| 2                       |                            |                            |                                    |                                |                            |                             |
| 3                       |                            |                            |                                    |                                |                            |                             |
| 4                       |                            |                            |                                    |                                |                            |                             |
| 5                       |                            |                            |                                    |                                |                            |                             |
| 6                       |                            |                            |                                    |                                |                            |                             |
| 7                       |                            |                            |                                    |                                |                            |                             |
| 8                       |                            |                            |                                    |                                |                            |                             |
| 9                       |                            |                            |                                    |                                |                            |                             |
| 10                      |                            |                            |                                    |                                |                            |                             |
| 11                      |                            |                            |                                    |                                |                            |                             |
| 12                      |                            |                            |                                    |                                |                            |                             |
| 13                      |                            |                            |                                    |                                |                            |                             |
| 14                      |                            |                            |                                    |                                |                            |                             |
| 15                      |                            |                            |                                    |                                |                            |                             |
| 16                      |                            |                            |                                    |                                |                            |                             |
| 17                      |                            |                            |                                    |                                |                            |                             |
| 18                      |                            |                            |                                    |                                |                            |                             |
| 19                      |                            |                            |                                    |                                |                            |                             |
| 20                      |                            |                            |                                    |                                |                            |                             |
| 21                      |                            |                            |                                    |                                |                            |                             |
| 22                      |                            |                            |                                    |                                |                            |                             |
| 23                      |                            |                            |                                    |                                |                            |                             |
| 24                      |                            |                            |                                    |                                |                            |                             |
| 25                      |                            |                            |                                    |                                |                            |                             |
| 26.5                    |                            |                            |                                    |                                |                            |                             |

3. Set the input power to the amplifier:
  - a. Connect the equipment as shown in Figure 4-2, point (A), with the power sensor connected to the 3.5 mm(f) adapter (without the amplifier, the second 3.5 mm(f) adapter, or the 20 dB attenuator).
  - b. Set the source to a CW frequency of 2 GHz.

- c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-3).
- d. Set the source power for a  $-15$  dBm reading on the power meter.
- e. In column 3 of Table 4-3, record the power reading displayed on the *source*.
- f. Repeat from step 3b for the remaining frequencies listed in Table 4-3.

4. Calculate the actual attenuation:

**Note**



If you are using the same attenuator in this test that was used to test the maximum output power in the previous test, copy the information from column 5 of Table 4-2 to column 5 of Table 4-3, and go to step 5.

- a. Connect the 20 dB attenuator between the adapter and the power sensor, as shown in Figure 4-2, point ②.
- b. Set the source to a CW frequency of 2 GHz.
- c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-3).
- d. Set the source power to the corresponding power value in *column 3* in Table 4-3.
- e. Record the power meter reading in column 4.
- f. Repeat from step 4b for the remaining frequencies.
- g. Add 15 dB to each value in column 4 and record the *absolute value* of the results in column 5 (this gives the actual attenuation and will be used later).

5. Measure the amplifier gain:

- a. Connect the equipment as shown in Figure 4-2, point ③, with the amplifier and the second 3.5 mm(f) adapter connected between the first 3.5 mm(f) adapter and the power sensor (you must use the same 20 dB attenuator as in the previous steps).
  - b. Set the source to a CW frequency of 2 GHz.
  - c. On the power meter, enter the calibration factor for the frequency to be measured (see Table 4-3).
  - d. Set the source power to the corresponding power value in *column 3* in Table 4-3.
  - e. Record the power meter reading in column 6.
  - f. Repeat from step 5b for the remaining frequencies.
  - g. Add the number in column 5 (the actual attenuation) to the number in column 6 (the amplifier output power) and record the sum in column 7.
6. Add 15 dB (subtract  $-15$  dB) to the lowest value in column 7 for frequencies between 2 and 20 GHz and record that number on the test record.
  7. Add 15 dB (subtract  $-15$  dB) to the lowest value in column 7 for frequencies between 20 and 26.5 GHz and record that number on the test record.

**Small Signal Gain**

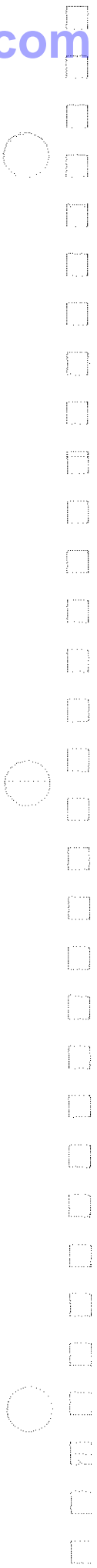


Table 4-4. HP 8348A Test Record (1 of 3)

|                      |                           |                     |
|----------------------|---------------------------|---------------------|
| Test Facility: _____ |                           | Report Number _____ |
| _____                |                           | Date _____          |
| _____                |                           | Customer _____      |
| _____                |                           | Tested by _____     |
| Model _____          | Ambient temperature _____ | °C                  |
| Serial Number _____  | Relative humidity _____   | %                   |
| Options _____        | Line frequency _____      | Hz (nominal)        |
| Special Notes:       |                           |                     |
| _____                |                           |                     |
| _____                |                           |                     |
| _____                |                           |                     |
| _____                |                           |                     |
| _____                |                           |                     |

Test Record

Table 4-4. HP 8348A Test Record (2 of 3)

|                            |                     |                     |                     |
|----------------------------|---------------------|---------------------|---------------------|
| Model _____                | Report Number _____ | Date _____          |                     |
| <b>Test Equipment Used</b> | <b>Model Number</b> | <b>Trace Number</b> | <b>Cal Due Date</b> |
| 1. RF Signal Source        | _____               | _____               | _____               |
| 2. Power Splitter          | _____               | _____               | _____               |
| 3. Power Sensor            | _____               | _____               | _____               |
| 4. Power Meter             | _____               | _____               | _____               |
| 5. _____                   | _____               | _____               | _____               |
| 6. _____                   | _____               | _____               | _____               |
| 7. _____                   | _____               | _____               | _____               |
| 8. _____                   | _____               | _____               | _____               |
| 9. _____                   | _____               | _____               | _____               |
| 10. _____                  | _____               | _____               | _____               |
| 11. _____                  | _____               | _____               | _____               |
| 12. _____                  | _____               | _____               | _____               |
| 13. _____                  | _____               | _____               | _____               |
| 14. _____                  | _____               | _____               | _____               |
| 15. _____                  | _____               | _____               | _____               |
| 16. _____                  | _____               | _____               | _____               |
| 17. _____                  | _____               | _____               | _____               |
| 18. _____                  | _____               | _____               | _____               |
| 19. _____                  | _____               | _____               | _____               |
| 20. _____                  | _____               | _____               | _____               |

Table 4-4. Test Record HP 8348A (3 of 3)

| Model/Options:              | Report Number:                    |                  | Date:                                     |
|-----------------------------|-----------------------------------|------------------|---|
| Test Description            | Specification (dBm)               | Measured Results | Measurement Uncertainty <sup>1</sup> (dB) |
| <b>MAXIMUM OUTPUT POWER</b> |                                   |                  |   |
|                             | Frequency Range:<br>2.0 to 20 GHz | ≥25              | ±1.1                                      |
|                             | 20 to 26.5 GHz                    | ≥23              | ±1.1                                      |
| <b>GAIN</b>                 |                                   |                  |   |
|                             | Frequency Range:<br>2.0 to 20 GHz | ≥25              | ±0.9                                      |
|                             | 20 to 26.5 GHz                    | ≥23              | ±0.9                                      |

<sup>1</sup> Using the equipment and procedures documented in this manual. With HP 8485A power sensor calibration uncertainties listed in power sensor manual (table 2) — traceable to NBS.



## Replaceable Parts and Accessories

---

This chapter provides the following information:

|  | Page |
|--|------|
| Instructions on how to order replacement parts by mail .....                         | 5-2  |
| Instructions on how to order replacement parts by phone.....                         | 5-2  |
| A list of exchange assemblies .....  | 5-3  |
| A list of assembly replacement kits .....  | 5-3  |
| A list of replaceable parts.....   | 5-4  |
| An illustration of replaceable assemblies .....                                      | 5-5  |
| A list of static-safe accessories, troubleshooting tools, and cleaning supplies..... | 5-6  |

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### Reducing ESD



- Ground yourself with a resistor-isolated wrist strap before touching the center pin of *any* connector, and before removing *any* assembly from the instrument.
-

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## Ordering Parts

To order a part or assembly, provide the Hewlett-Packard part number and the quantity required; send the order to the nearest Hewlett-Packard sales and service office (see Table 6-5).

To order a part that is not listed in the replaceable parts table, include the instrument model number, a description and function of the part, and the number of parts required. Send the order to the nearest Hewlett-Packard sales and service office (Table 6-5).

### Direct Mail Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Mail order forms and specific ordering information are available through your local Hewlett-Packard sales and service office.

Advantages of using the mail order system are as follows:

- Direct ordering and shipment from the Hewlett-Packard parts center.
- No maximum or minimum order on any mail order (there is a minimum order quantity for parts ordered through a local HP office when the orders require billing and invoicing).
- Prepaid transportation (there is a small handling charge for each order).
- No invoices.

### Direct Phone Order System

Within the USA, a phone order system is available for regular and hotline replacement parts service. A toll-free phone number is available, and Mastercard and Visa are accepted.

**Regular Orders**      The toll-free phone number, (800) 227-8164, is available from 6 AM to 5 PM, Pacific time, Monday through Friday; a separate number, (415) 968-2347, is available after-hours, weekends, and holidays. Regular orders have a 4-day delivery time.

**Hotline Orders**      Hotline service for ordering emergency parts is available 24 hours a day, 365 days a year. Hotline orders are normally delivered the following business day. There is an additional hotline charge to cover the cost of freight and special handling.

## Exchange Assemblies

The following assemblies are available on an exchange basis. Exchange, factory-repaired and tested assemblies are available only on a trade-in basis; you must return the defective assembly for credit. See Table 6-5 for part numbers.

- A1 Amplifier (Std)
- A1 Amplifier (Opt 001)
- A1 Amplifier (Opt 002)

## Assembly Replacement Kits

The amplifier (A1) and the power supply (A2) are available only as *fully-assembled* replacement kits. Table 5-1 lists the contents of each.

### Note



The cables and connectors in this instrument are part of a *fully-assembled* amplifier replacement kit (see Table 5-1).

**Table 5-1. Assembly Replacement Kit Contents**

| Replacement Kit | Comprises  |
|-----------------|--|
| A1 Amplifier    | Amplifier<br>Amplifier Bias Assemblies<br>Input Cable<br>Output Cable<br>Input Connector<br>Output Connector<br>Sheet Metal Parts<br>Heat Sink<br>Attaching Hardware |
| A2 Power Supply | Regulator Assembly<br>Transistors<br>ICs<br>Fuses<br>Heat Sink<br>Attaching Hardware   |

Table 5-2. Replaceable Parts

| Reference Designator               | Description                      | Qty | HP Part Number |
|------------------------------------|----------------------------------|-----|----------------|
| A1 (Includes J1 & J2)              | Amplifier Kit (Std)              | 1   | 08348-60001    |
|                                    | Exchange Amplifier Kit (Std)     |     | 08348-69001    |
|                                    | Amplifier Kit (Opt 001)          | 1   | 08348-60002    |
|                                    | Exchange Amplifier Kit (Opt 001) |     | 08348-69002    |
|                                    | Amplifier Kit (Opt 002)          | 1   | 08348-60003    |
|                                    | Exchange Amplifier Kit (Opt 002) |     | 08348-69003    |
| A2                                 | Power Supply Kit                 | 1   | 08348-60004    |
| A2F1                               | Fuse 3A 125V                     | 1   | 82110-0332     |
| A2F2,5                             | Fuse 2A 125V                     | 2   | 2110-0425      |
| A2F3,6,7                           | Fuse 0.75A 125V                  | 3   | 2110-0424      |
| A2F4                               | Fuse 4A 125V                     | 1   | 2110-0476      |
| A3                                 | Motherboard Assembly             | 1   | 08348-60095    |
| FL1                                | Line Module Filter               | 1   | 9135-0217      |
| F1                                 | Line Fuse                        | 1   | 2110-0001      |
| MP3                                | Top Cover                        | 1   | 08349-60088    |
| MP4                                | Bottom Cover                     | 1   | 5062-3872      |
| MP5                                | Bottom Feet                      | 4   | 5041-8801      |
| MP6                                | Front Frame                      | 1   | 5021-8415      |
| MP7                                | Rear Frame                       | 1   | 08349-20043    |
| MP8                                | Trim Side                        | 2   | 5001-0539      |
| MP9                                | Strap Assembly                   | 1   | 5062-3702      |
| MP10                               | Front Panel                      | 1   | 08348-00001    |
| MP11                               | Rear Panel                       | 1   | 08348-00005    |
| MP12                               | Pushbutton Rod                   | 1   | 08349-20012    |
| MP13 (part of J1 & J2)             | 3.5 mm(m) Bulkhead Connector     | 2   | 5061-5316      |
| MP14 (part of J1 & J2)             | Washer                           | 2   | 2190-0104      |
| MP15 (part of J1 & J2)             | Nut                              | 2   | 2950-0132      |
| MP16 (part of J1 & J2)             | Spacer                           | 2   | 83595-20004    |
| MP17                               | Front Panel Plug (painted)       | 2   | 08348-20006    |
| MP18                               | Rear Panel Plug (black)          | 2   | 6960-0024      |
| Packaging Material                 | Outer Carton                     | 1   | 9211-4893      |
|                                    | Foam Pads                        | 2   | 5180-7809      |
| S1                                 | Switch-PB DPST                   | 1   | 3101-2779      |
| T1                                 | Power Transformer                | 1   | 9100-4481      |
| W1 (part of J1)<br>W2 (part of J2) | Power Cable see Figure 2-5       | 1   |                |
|                                    | Output Cable                     | 1   | 08348-20002    |
|                                    | Input Cable (Std)                | 1   | 08348-20001    |
|                                    | Input Cable (Opt 001)            | 1   | 08348-20003    |
|                                    | Input Cable (Opt 002)            | 1   | 08348-20004    |

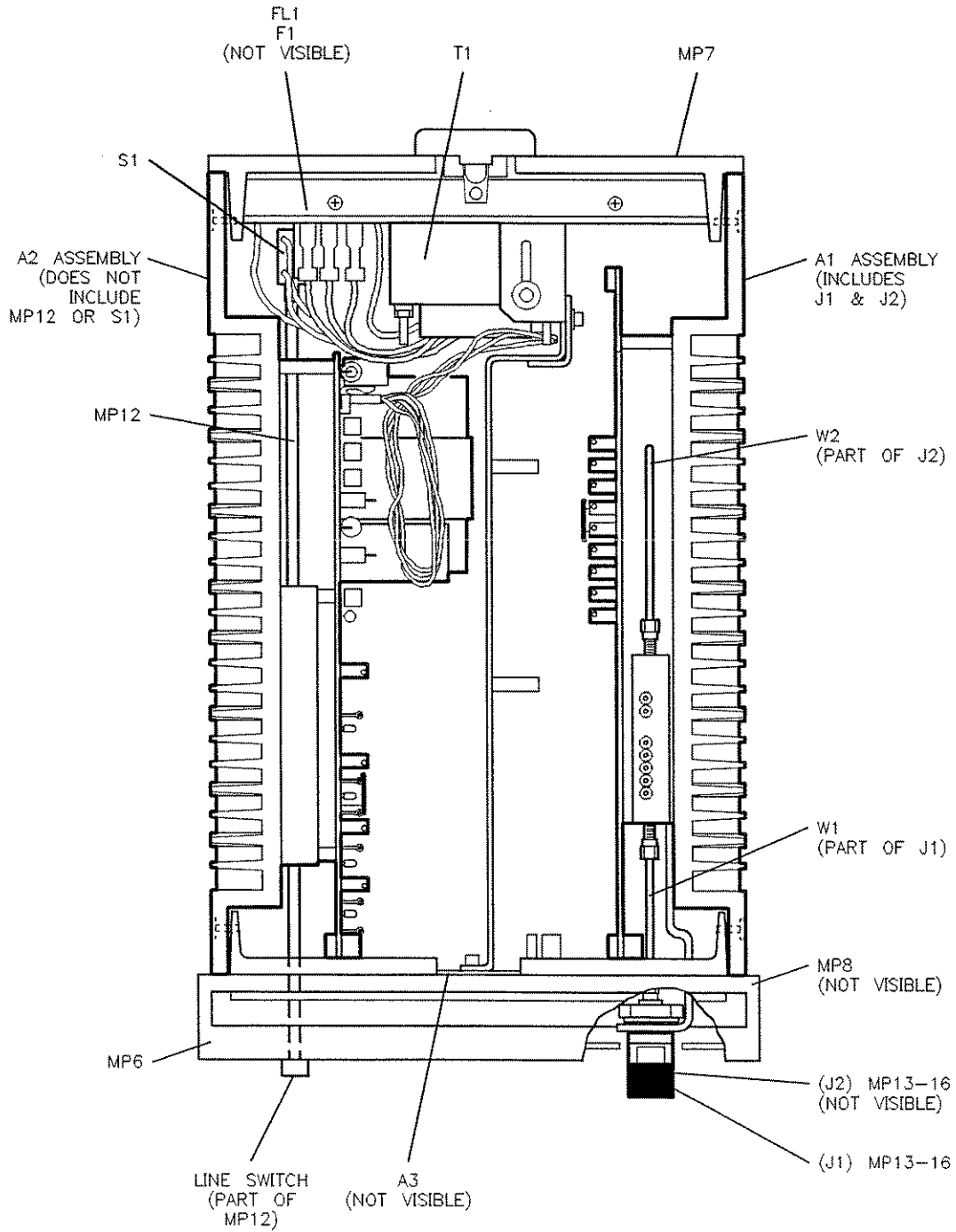


Figure 5-1. HP 8348A Assembly Locations

Table 5-3. Accessories and Cleaning Supplies

| Item                             | Description  | HP Part Number |        |
|----------------------------------|--|----------------|--------|
| Adapter <sup>1</sup>             | 3.5 mm(f) to 3.5 mm(f)   | 85027-60005    |        |
| Touch-up paint                   | Dove gray (front frame)  | 6010-1146      |        |
|                                  | French gray (covers, heat sinks)   | 6010-1147      |        |
| Static-control mat & ground wire | Set includes:<br>3M static-control mat, 0.6m x 1.2m (2 ft x 4 ft)<br>Ground wire, 4.6m (15 ft)<br><br>(The wrist strap and wrist-strap cord are <i>not</i> included. They must be ordered separately.) | 9300-0797      |        |
| Wrist strap                      | Black, stainless steel with 4 adjustable links and 7-mm post-type connector (The wrist-strap cord is <i>not</i> included).   | 9300-1383      |        |
| Wrist-strap cord                 | 1.5m (5 ft)  | 9300-0980      |        |
| ESD heel strap                   | Reusable 6 to 12 months  | 9300-1169      |        |
| Hard-surface static-control mat  | Large, black, 1.2m x 1.5m (4 ft x 5 ft)  | 92175A         |        |
|                                  | Small, black, 0.9m x 1.2m (3 ft x 4 ft)  | 92175C         |        |
| Soft-surface static-control mat  | Brown, 1.2m x 2.4m (4 ft x 8 ft)   | 92175B         |        |
| Tabletop static-control mat      | 58 cm x 76 cm (23 in x 30 in)  | 92175T         |        |
| Antistatic carpet                | Small, 1.2m x 1.8m (4 ft x 6 ft)   | Natural color  | 92176A |
|                                  |  | Russet color   | 92176C |
|                                  | Large, 1.2m x 2.4m (4 ft x 8 ft)   | Natural color  | 92176B |
|                                  |  | Russet color   | 92176D |
| Compressed air                   |  | 8500-5262      |        |
| Isopropyl alcohol                | 30 ml squeeze bottle 99.5% pure  | 8500-5344      |        |
| Foam swabs                       | 500  | 9300-1270      |        |

<sup>1</sup> Two included with the instrument.

## Service

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This chapter provides the following information:

|   | Page |
|---|------|
| How to fix simple problems .....              | 6-3  |
| How to isolate a problem to an assembly ..... | 6-5  |
| How to check the power supply .....           | 6-6  |
| How to adjust the regulator assembly .....    | 6-10 |
| How to test the amplifier microcircuit .....  | 6-11 |
| How to remove and replace assemblies .....    | 6-12 |
| How to clean 3.5 mm connectors .....          | 6-18 |
| A list of HP sales and service offices .....  | 6-19 |

---

### Caution



This instrument contains static-sensitive components. Read the electrostatic discharge information in “Electrostatic Discharge” in Chapter 2 before you remove any assembly.

---

### Troubleshooting Tools

Table 4-1 lists the tools you may need to troubleshoot the amplifier.

### Assembly Locations

Figure 6-1 shows the location of the amplifier microcircuit and the power supply.

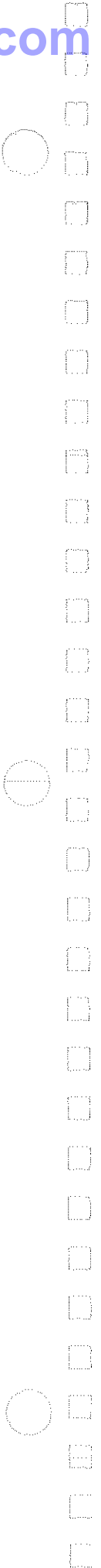
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### Caution



Avoid bending or distorting any semi-rigid cables when you remove or reinstall assemblies. Loosening the cables can cause power holes. Follow the procedures *exactly*.

---



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## Initial Troubleshooting

You can often solve a problem by rechecking what you were doing when the problem occurred. A few minutes spent performing simple checks can save you unnecessary downtime. Before you call Hewlett-Packard or return the amplifier for service, make the following checks:

- Is the amplifier connected to the proper ac power source?
- Does the line receptacle have power?
- Is the rear-panel voltage selector switch set correctly?
- Is the line fuse intact?
- Is the amplifier turned on?
- Are the four LEDs on the power supply regulator lit?

If not, go to “Checking the Fuses”.

- Are both 3.5 mm RF connectors clean and undamaged?

If a connector is dirty, go to “Cleaning 3.5 mm Connectors”, then go to chapter 4 and run the performance tests. Cleaning the connectors may solve the problem.

If a connector is damaged, go to “Removing and Replacing an RF Connector Assembly”, then go to chapter 4 and run the performance tests. Replacing the damaged connector may solve the problem.

- Are the equipment, cables, and connectors used with the amplifier connected properly and operating correctly?
- Review the test procedure you were following when the problem appeared. Are all switch settings correct?

If the answer to *all the above* is yes, and the amplifier is still not working properly, go to “Assembly-Level Troubleshooting”.

---

### Reducing ESD



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

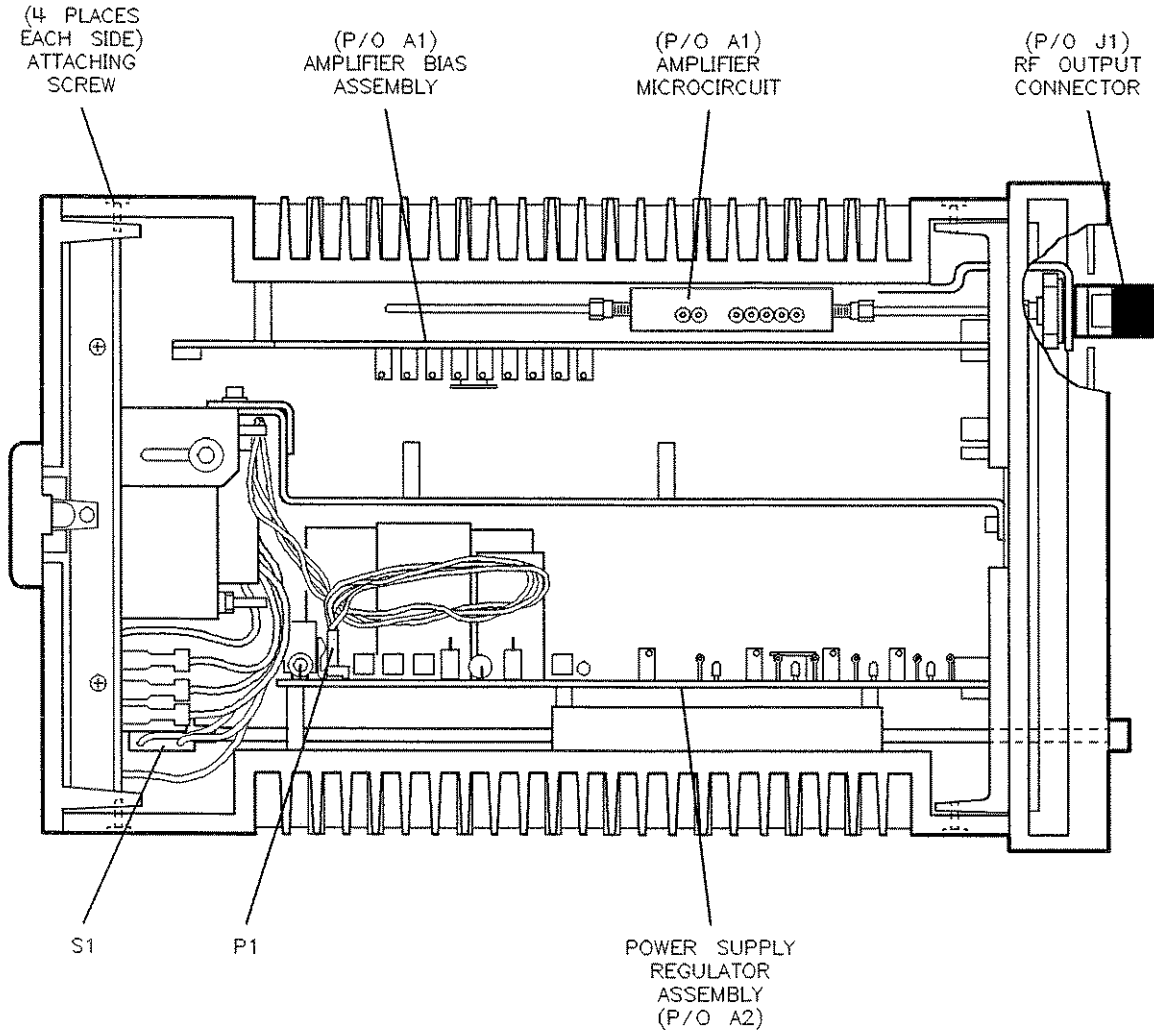


Figure 6-1. Assembly Locations

## Assembly-Level Troubleshooting

The first step in troubleshooting is to check the items listed under “Initial Troubleshooting”. If the amplifier is still not working properly, continue with this section.

The amplifier has two basic internal elements (see Figure 6-2):

1. The amplifier microcircuit.
2. The power supply.

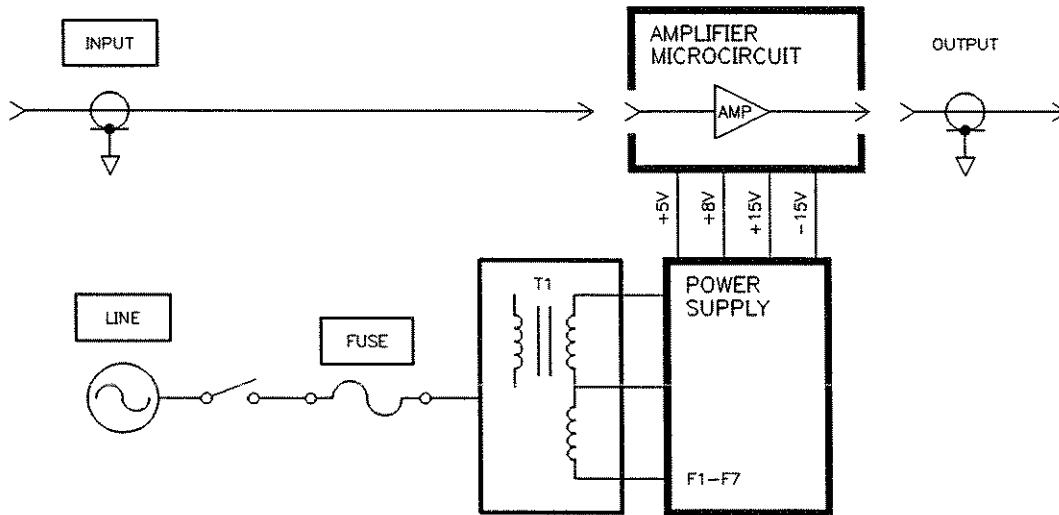


Figure 6-2. HP 8348A Amplifier Block Diagram

Except for the power supply fuses, neither of these elements is repairable. Each is also part of a larger unit, and that larger unit must be replaced if a component part fails (see Table 5-1). Begin troubleshooting with “Step 1. Run the Performance Tests”.

### Step 1. Run the Performance Tests

Perform the tests in Chapter 4, and record *all* test results (for a quicker approximation of microcircuit operation, test only the low, high, and mid-frequency levels). If the performance tests fail, continue with “Step 2. Test the Power Supply”.

---

## Step 2. Test the Power Supply

---

**Warning**

Service of this instrument should be performed only by trained personnel. Use extreme care; the exposed terminals on the power supply transformer carry ac line voltage; you can be killed or seriously injured if you contact them when power is applied.

---

### Checking the Fuses

1. Are *all four* LEDs at the top of the power supply regulator assembly lit (you can see them through the top cover)? If they are, go to “Checking the Regulator Assembly Voltages”. If not, continue with step 2.
  2. Turn the amplifier off.
  3. Disconnect any input RF to the amplifier.
  4. Disconnect the amplifier from line power.
  5. Remove the top cover.
- 

**Caution**

*Do not* remove the instrument handle screw that is closest to the front panel (refer to “Removing the Top Cover”).

---

6. Refer to Figure 6-3. Using long-nose pliers to remove the fuses, check each one and replace any that are open.
7. Reconnect the amplifier to line power.
8. Turn on the amplifier.
9. Are *all four* LEDs at the top of the power supply regulator assembly lit? If they are, replace the top cover and go to “Step 1. Run the Performance Tests”. If not, continue with “Checking the Transformer”.

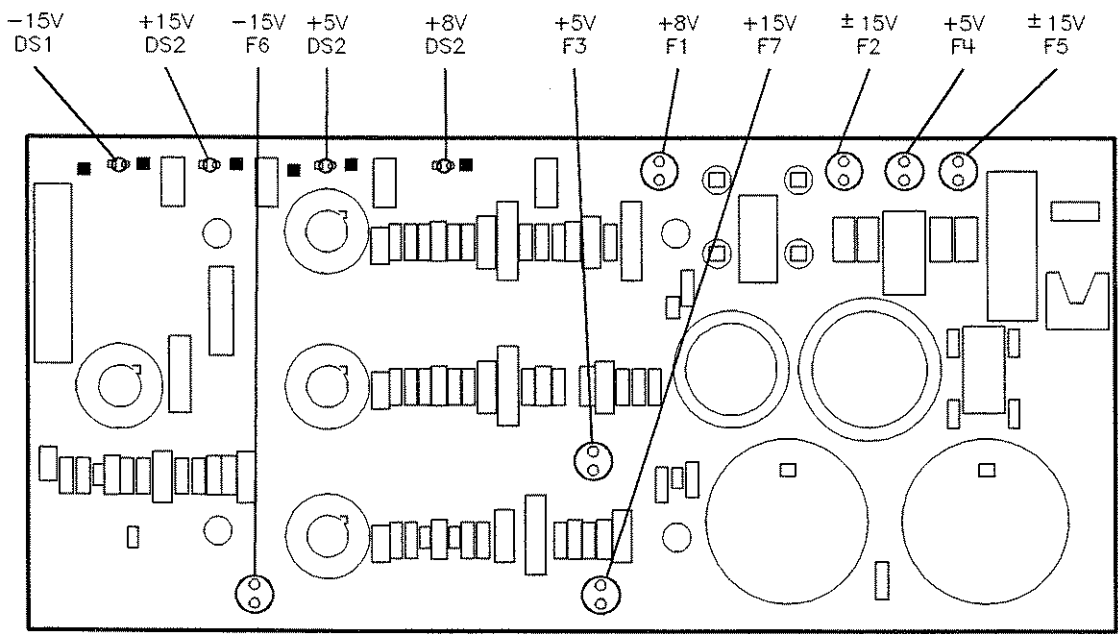


Figure 6-3. Power Supply LED and Fuse Locations

**Assembly-Level Troubleshooting****Checking the Transformer**

1. Turn the instrument off.
2. Disconnect any RF input to the amplifier.
3. Disconnect the amplifier from line power.
4. Remove the top cover.
5. Remove the transformer connector (P1) from the regulator assembly.
6. Reconnect the amplifier to line power and turn the instrument on.
7. Measure the points listed in Table 6-1. If any value is incorrect, replace the transformer and run the performance tests in chapter 4.
8. If the values are correct, continue with "Checking the Regulator Assembly Voltages".

**Table 6-1. Transformer Voltage Values**

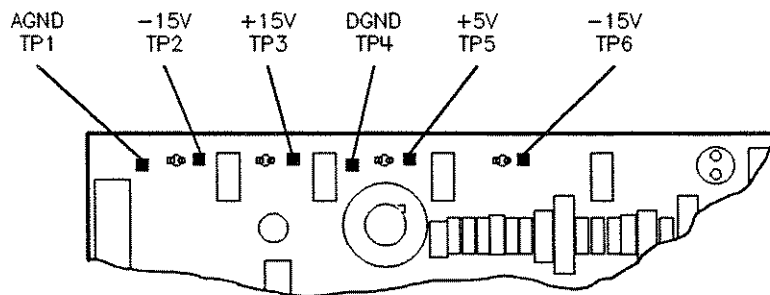
| P1 Pins | Correct Value (V <sub>PP</sub> ) | Supply Checked (Vdc) |
|---------|----------------------------------|----------------------|
| 1 and 2 | ±13                              | +8                   |
| 3 and 4 | ±13                              | +5                   |
| 5 and 6 | ±22                              | ±15                  |

### Checking the Regulator Assembly Voltages

1. Turn the instrument off.
2. Disconnect any RF input to the amplifier.
3. Disconnect the amplifier from line power.
4. Remove the top cover.
5. Reconnect the amplifier to line power and turn the instrument on.
6. Measure the points listed in Table 6-2. If any value is incorrect, go to "Step 3. Adjust the Regulator Assembly".

**Table 6-2. Regulator Assembly Voltage Values**

| Reference Point | Measured Point | Correct Value (Vdc) |
|-----------------|----------------|---------------------|
| TP1             | TP2            | -15 ±0.015          |
|                 | TP3            | +15 ±0.015          |
|                 | TP6            | +8 ±0.015           |
| TP4             | TP5            | +5 ±0.015           |



**Figure 6-4. Power Supply Regulator Test Point Locations**

## Assembly-Level Troubleshooting

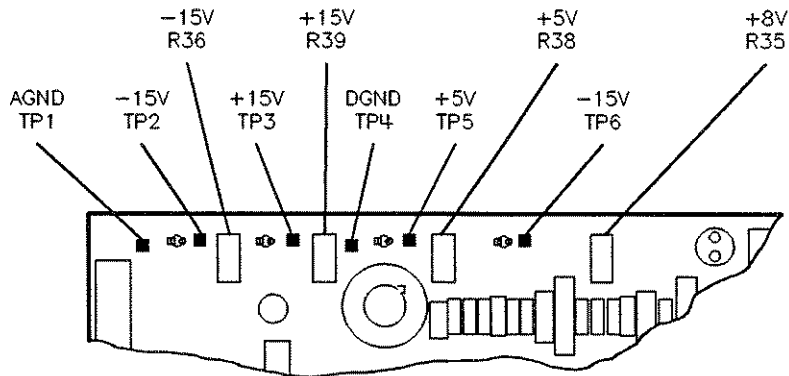
**Step 3. Adjust the Regulator Assembly**

1. Ensure that there is no RF input to the amplifier.
2. Ensure that the amplifier is connected to line power.
3. Turn on the amplifier.
4. Make the adjustments listed in Table 6-3.

**Table 6-3. Power Supply Regulator Voltage Adjustments**

| Reference Point | Measured Point | Adjustment | Value (Vdc)     |
|-----------------|----------------|------------|-----------------|
| TP1             | TP2            | R36        | -15 $\pm$ 0.002 |
|                 | TP3            | R39        | +15 $\pm$ 0.002 |
|                 | TP6            | R35        | +8 $\pm$ 0.002  |
| TP4             | TP5            | R38        | +5 $\pm$ 0.005  |

5. Return to "Checking the Regulator Assembly Voltages" and recheck the values.
6. If you cannot bring the power supply regulator assembly output voltages within tolerance, replace the complete power supply assembly (A2).
7. If the voltages are correct and the performance test results still are not within specification, check the RF cable connections. If problems still persist, continue with "Step 4. Check the Amplifier Microcircuit Bias".

**Figure 6-5. Power Supply Regulator Test Point and Adjustment Locations**

## Step 4. Check the Amplifier Microcircuit Bias

1. Turn the instrument off.
2. Disconnect any RF input to the amplifier.

### Note



To successfully troubleshoot the amplifier microcircuit, it is *critical* that you remove any RF input to the instrument.

3. Disconnect the amplifier from line power.
4. Remove the top cover.
5. Reconnect the amplifier to line power.
6. Turn on the amplifier.
7. Measure the points listed in Table 6-4. If any value is incorrect, replace the amplifier microcircuit (see “Removing and Replacing the A1 Assembly”) and return to “Step 1. Run the Performance Tests”.
8. If all measurements are correct but the instrument still does not meet specifications, suspect the RF input and output connector assemblies.

**Table 6-4. Amplifier Bias Voltage and Current Values**

| Reference Point | Measured Point | Correct Value      |                   |
|-----------------|----------------|--------------------|-------------------|
|                 |                | (Vdc) <sup>1</sup> | (mA) <sup>1</sup> |
| TP1             | TP2            | 0.75               | 250               |
|                 | TP3            | 0.225              | 225               |
|                 | TP4            | 0.225              | 450               |
|                 | TP5            | 0.23               | 460               |
|                 | TP6            | 0.23               | 460               |
|                 | TP7            | 8.0 ±0.05          | —                 |

<sup>1</sup> With *no* RF input applied to the instrument.

## Removing & Replacing Assemblies

### Removing and Replacing Assemblies

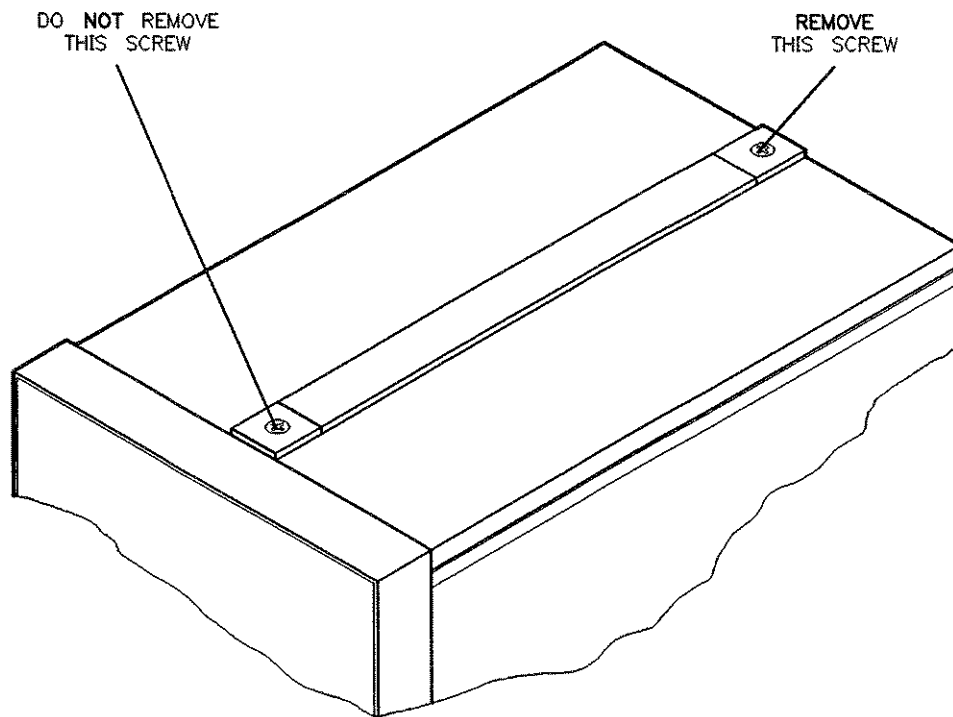
## Removing the Top Cover

Use the following procedure to remove the instrument's top cover.

**Caution** Do not remove the instrument handle screw that is closest to the front panel.



1. Remove the *rear* screw on the instrument handle (see Figure 6-6).



**Figure 6-6. Locating the Top Cover Screw**

2. Set both the screw and the plastic end-piece aside (Figure 6-7(A)).
3. Place just the tip of the screwdriver down through the hole in the instrument handle (Figure 6-7(B)).
4. Using the screwdriver as a lever, carefully slide the top cover out from under the front panel casting.
5. Lift the top cover off the instrument from the *front* edge.

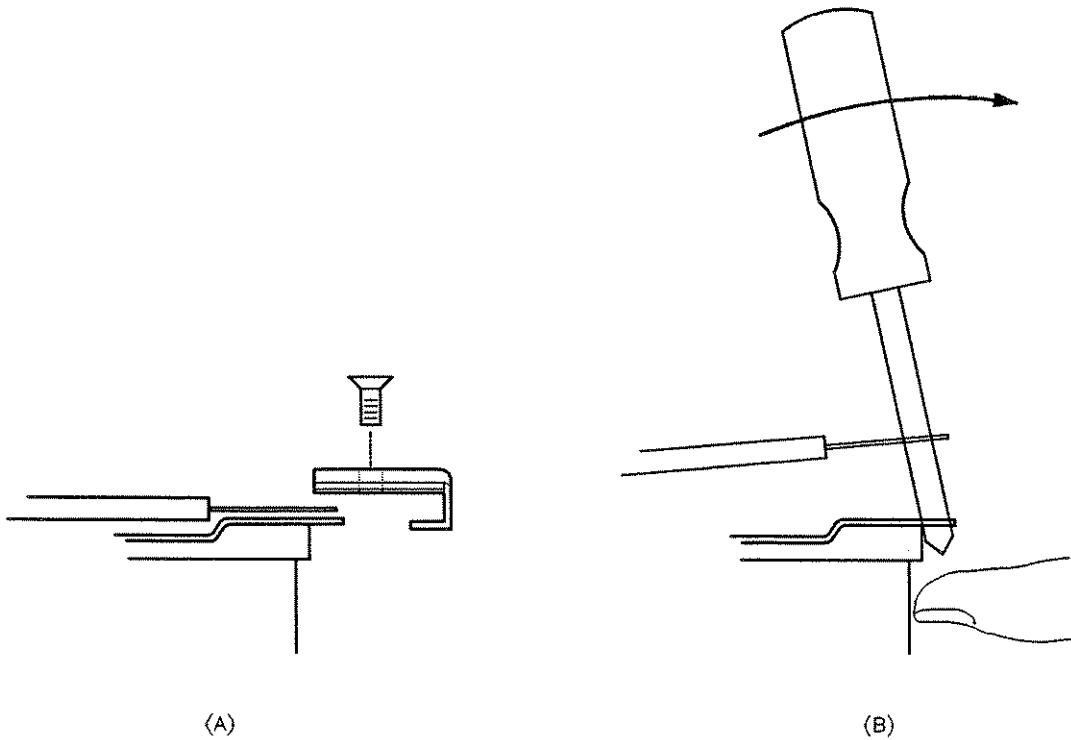


Figure 6-7. Removing the Top Cover

## Removing &amp; Replacing Assemblies

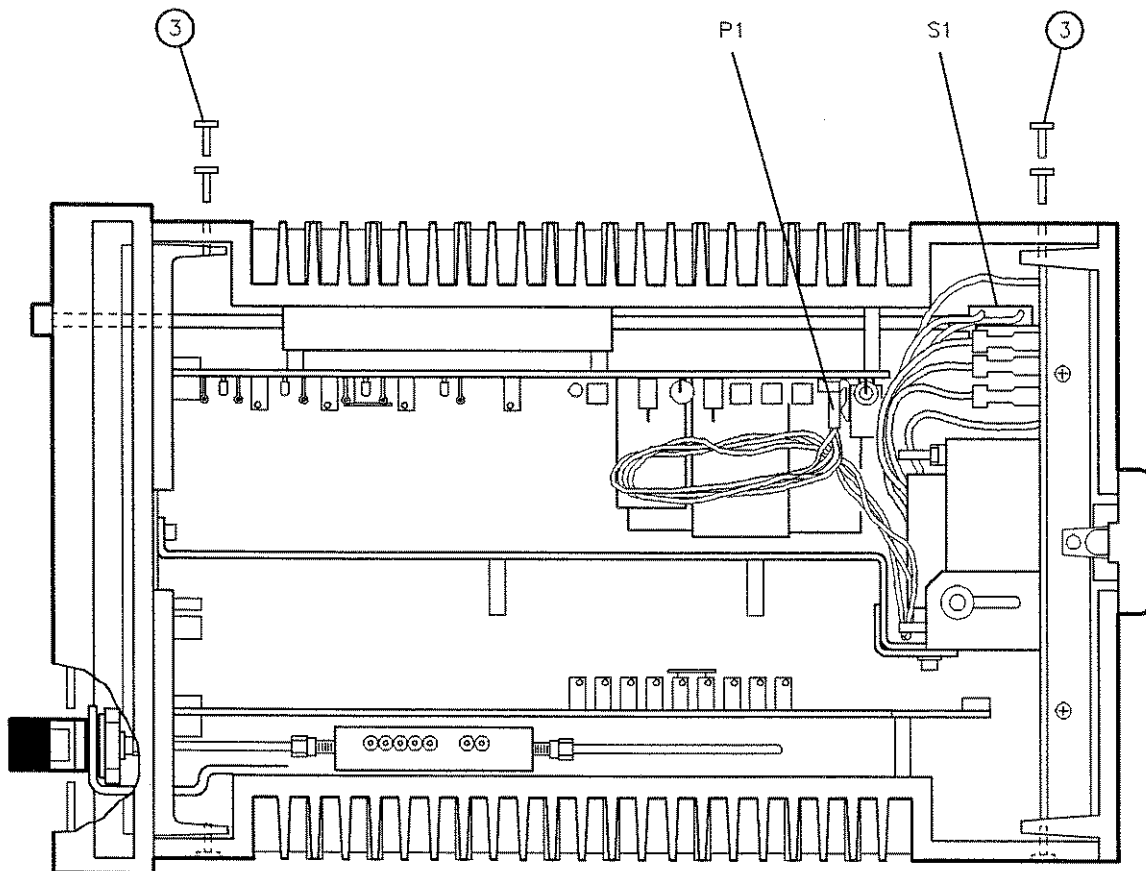
**Removing and Replacing the Power Supply Assembly**

1. Refer to Figure 6-8.
2. Disconnect the transformer from the power supply regulator assembly (P1).
3. Remove the four screws that attach the side casting to the front and rear castings (see ③, two places).

**Caution** Be careful not to damage S1 as you perform the next step.



4. Carefully slide out the assembly, pulling at an angle, toward the rear of the instrument.
5. To reinstall the assembly, reverse this procedure.



**Figure 6-8. Removing the Power Supply Assembly**

## Removing and Replacing the A1 Assembly

1. Place the instrument on its right side, as shown in Figure 6-9.
2. Remove the four screws that attach the side casting to the front and rear castings (see ②).
3. *Partially* disconnect the amplifier bias assembly from the motherboard connector (see ③).
4. Lift the assembly up so that the amplifier bias assembly clears the rear casting (see ④).
5. Completely disconnect the amplifier bias assembly from the motherboard connector, and pull the assembly straight out. Be very careful as you move the RF connectors through the front panel (see ⑤).
6. To reinstall the new assembly, reverse this procedure.

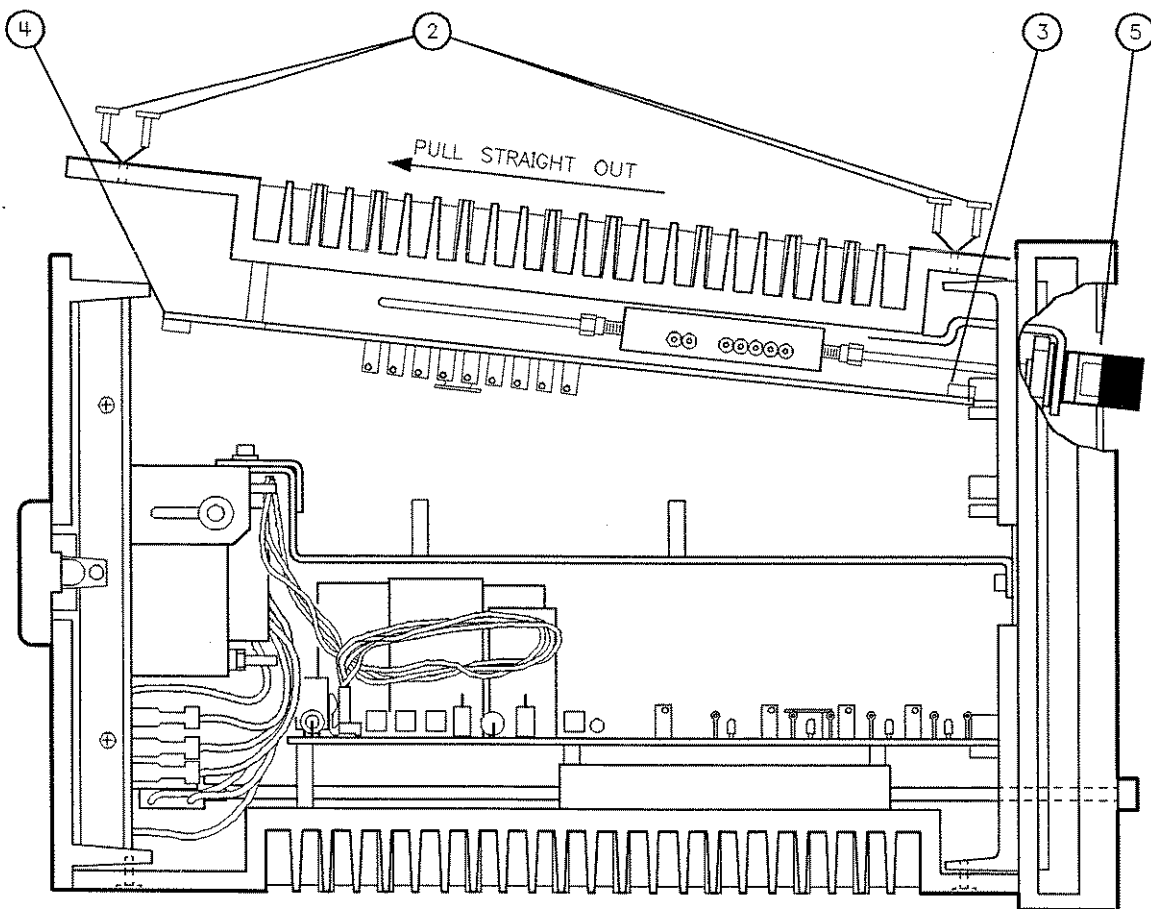


Figure 6-9. Removing the A1 Assembly

## Removing & Replacing Assemblies

### Removing and Replacing an RF Connector Assembly

1. Remove the A1 assembly (see "Removing and Replacing the A1 Assembly").
2. Refer to Figure 6-10.
3. To remove either RF connector:
  - a. At the connector-end, *loosen* the RF cable.
  - b. Disconnect the large nut behind the connector bracket.
  - c. Slide off the large nut and washer.
  - d. Loosen the cable at the microcircuit end.
  - e. Gently rocking the connector to disengage it from the cable, slide the connector and spacer out the front of the connector bracket.
4. To reinstall a connector assembly, reverse this procedure.

#### Note



When you slide the connector into the bracket, ensure that the flat on the threaded portion of the connector lines up properly with the flat portion of the hole in the bracket (refer to Figure 6-11).

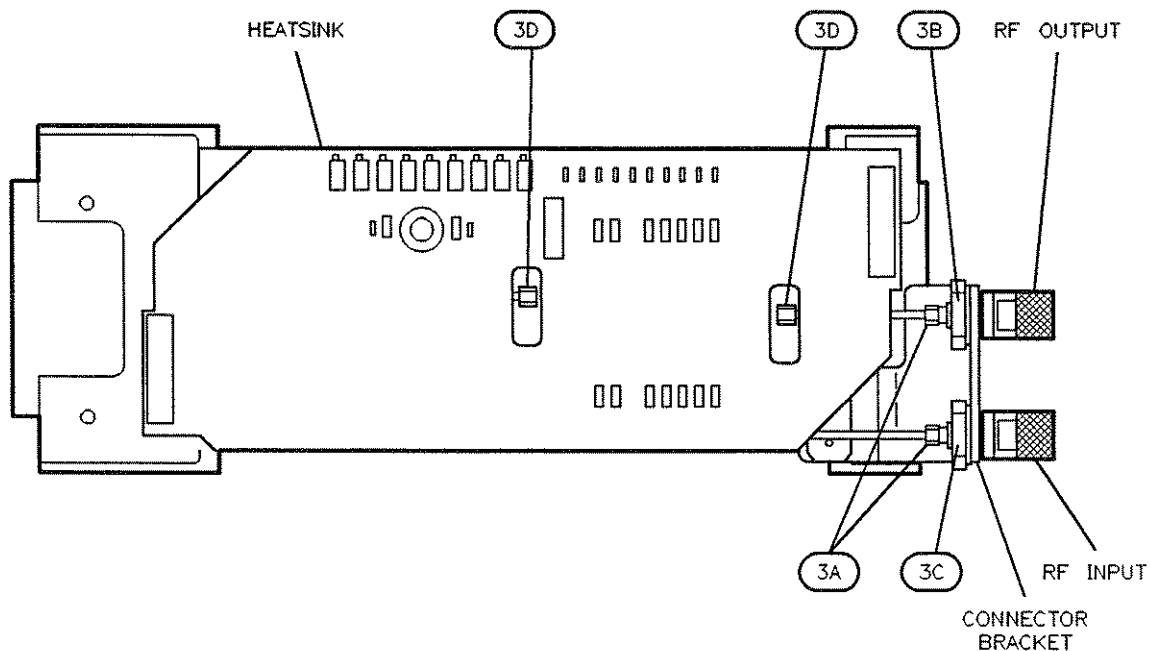


Figure 6-10. Removing a Connector Assembly

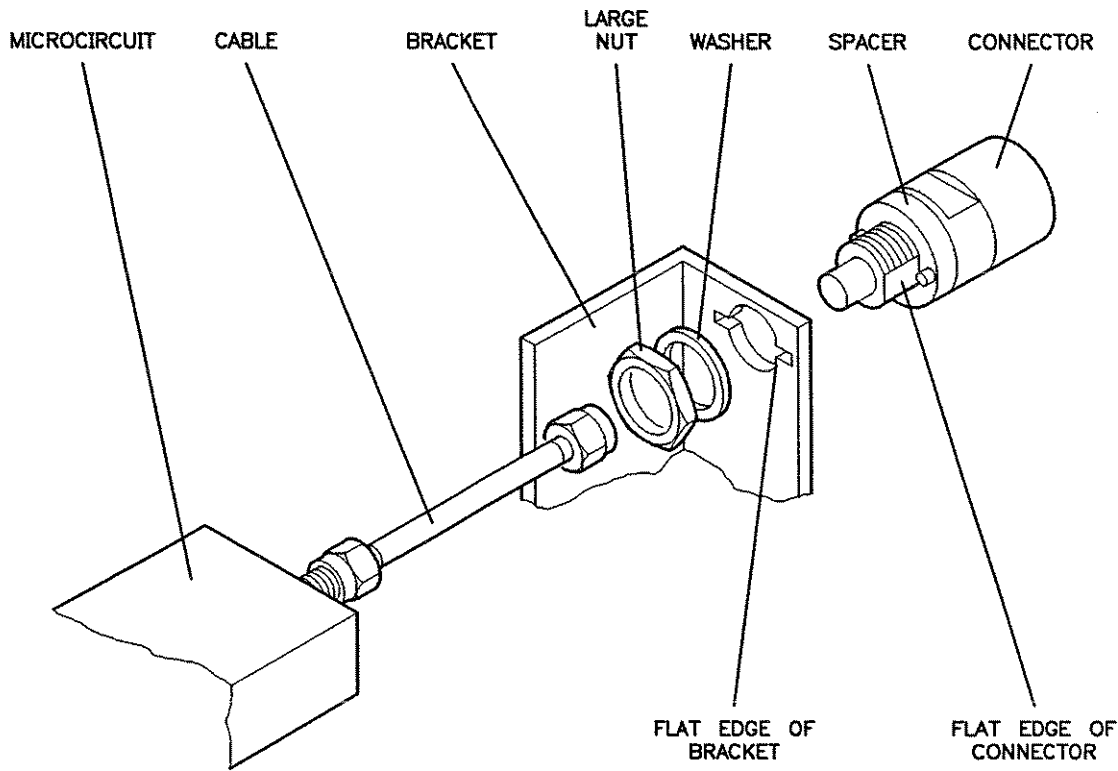


Figure 6-11. Connector Assembly Details

*Preventive Maintenance*

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**Cleaning 3.5 mm Connectors**

To assure long, reliable connector life carefully clean all connectors. Part numbers for recommended cleaning supplies are listed in Chapter 5.

1. Try compressed air first.

Use compressed air to loosen particles on the connector mating plane surfaces. Clean air cannot damage a connector, or leave particles or residues behind.

2. If a solvent is necessary, use *only* isopropyl alcohol.

If there is dirt or stubborn contaminants on a connector that you cannot removed with compressed air, try a foam swab or lint-free cleaning cloth moistened with isopropyl alcohol.

- a. Use the smallest amount of alcohol possible.
- b. Do not wet any plastic parts in the connectors with the alcohol.
- c. Never spray alcohol directly into a connector.

Table 6-5. Hewlett-Packard Sales and Service Offices

|                             |                                |                                 |
|-----------------------------|--------------------------------|---------------------------------|
| <b>IN THE UNITED STATES</b> | <b>IN AUSTRALIA</b>            | <b>IN JAPAN</b>                 |
| <b>California</b>           | Hewlett-Packard Australia Ltd. | Yokogawa-Hewlett-Packard Ltd.   |
| Hewlett-Packard Co.         | 31-41 Joseph Street            | 29-21 Takaido-Higashi, 3 Chome  |
| 1421 South Manhattan Ave.   | Blackburn, Victoria 3130       | Suginami-ku Tokyo 168           |
| P.O. Box 4230               | 895-2895                       | (03) 331-6111                   |
| Fullerton, CA 92631         |                                |                                 |
| (714) 999-6700              | <b>IN CANADA</b>               | <b>IN PEOPLE'S REPUBLIC</b>     |
|                             | Hewlett-Packard (Canada) Ltd.  | <b>OF CHINA</b>                 |
| Hewlett-Packard Co.         | 17500 South Service Road       | China Hewlett-Packard, Ltd.     |
| 301 E. Evelyn               | Trans-Canada Highway           | P.O. Box 9610, Beijing          |
| Mountain View, CA 94039     | Kirkland, Quebec H9J 2X8       | 4th Floor, 2nd Watch Factory    |
| (415) 694-2000              | (514) 697-4232                 | Main Bldg.                      |
|                             |                                | Shuang Yu Shu, Bei San Huan Rd. |
| <b>Colorado</b>             | <b>IN FRANCE</b>               | Beijing, PRC                    |
| Hewlett-Packard Co.         | Hewlett-Packard France         | 256-6888                        |
| 24 Inverness Place, East    | F-91947 Les Ulis Cedex         |                                 |
| Englewood, CO 80112         | Orsay                          |                                 |
| (303) 649-5000              | (6) 907-78-25                  |                                 |
|                             | <b>IN GERMAN FEDERAL</b>       | <b>IN SINGAPORE</b>             |
| <b>Georgia</b>              | <b>REPUBLIC</b>                | Hewlett-Packard Singapore       |
| Hewlett-Packard Co.         | Hewlett-Packard GmbH           | Pte. Ltd.                       |
| 2000 South Park Place       | Vertriebszentrale Frankfurt    | 1150 Depot Road                 |
| P.O. Box 105005             | Berner Strasse 117             | Singapore 0410                  |
| Atlanta, GA 30339           | Postfach 560 140               | 273 7388                        |
| (404) 955-1500              | D-6000 Frankfurt 56            | Telex HPSGSO RS34209            |
|                             | (0611) 50-04-1                 | Fax (65) 2788990                |
| <b>Illinois</b>             | <b>IN GREAT BRITAIN</b>        | <b>IN TAIWAN</b>                |
| Hewlett-Packard Co.         | Hewlett-Packard Ltd.           | Hewlett-Packard Taiwan          |
| 5201 Tollview Drive         | King Street Lane               | 8th Floor, Hewlett-Packard      |
| Rolling Meadows, IL 60008   | Winnersh, Wokingham            | Building                        |
| (312) 255-9800              | Berkshire RG11 5AR             | 337 Fu Hsing North Road         |
|                             | 0734 784774                    | Taipei                          |
| <b>New Jersey</b>           | <b>IN OTHER EUROPEAN</b>       | (02) 712-0404                   |
| Hewlett-Packard Co.         | <b>COUNTRIES</b>               | <b>IN ALL OTHER LOCATIONS</b>   |
| 120 W. Century Road         | Hewlett-Packard (Schweiz) AG   | Hewlett-Packard Inter-Americas  |
| Paramus, NJ 07653           | Allmend 2                      | 3495 Deer Creek Rd.             |
| (201) 265-5000              | CH-8967 Widen (Zurich)         | Palo Alto, California 94304     |
|                             | (0041) 57 31 21 11             |                                 |
| <b>Texas</b>                |                                |                                 |
| Hewlett-Packard Co.         |                                |                                 |
| 930 E. Campbell Rd.         |                                |                                 |
| Richardson, TX 75081        |                                |                                 |
| (214) 231-6101              |                                |                                 |

