

# **HP 83550A RF PLUG-IN (Including Options 002, 004, and 006)**

## **SERIAL NUMBERS**

This manual applies directly to HP 83550A RF plug-in having serial number prefix 2611A.

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

- Manual Changes Supplement Print Date: 26 APRIL 1990
  - Change 1 documents serial number prefix 2639A.
  - Change 1A applies to all serial prefixes.
  - Change 2 documents serial number prefix 2717A.
  - Change 3 documents serial number prefix 2718A.
  - Change 4 documents serial number prefix 2741A.
- Change 5 documents serial number prefix 3017A.

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**HEWLETT  
PACKARD**

## **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 delivery, or, in the case of certain major components listed in section six of this Operating and Service manual, for the specified period. 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.

## **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.

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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.

**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.



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.

### 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 auto-transformer make sure the common terminal is connected to the neutral (grounded side of the 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 their 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.*

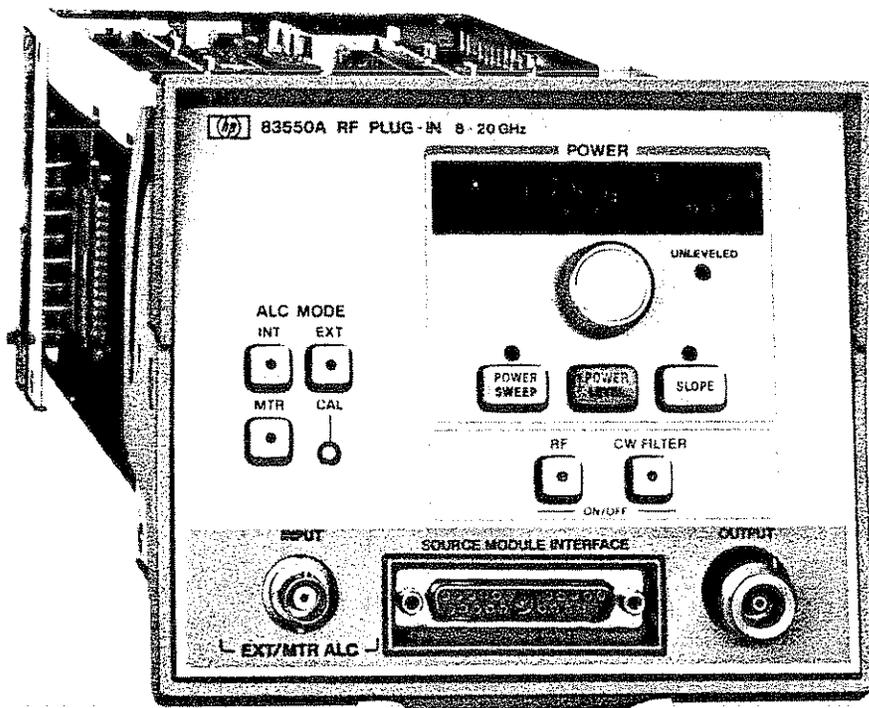


Figure 1-1. HP 83550A RF Plug-in

# Section I. General Information

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## INTRODUCTION

This manual contains the information required to install, operate, test, adjust, and service the Hewlett-Packard 83550A RF plug-in, shown in Figure 1-1. This manual is divided into eight major sections:

**SECTION I, GENERAL INFORMATION.** This section contains:

- A brief description of the instrument
- Safety considerations
- Specifications
- Supplemental characteristics
- Instrument identification
- Options available
- Accessories available
- Recommended test equipment

**SECTION II, INSTALLATION.** This section contains:

- Initial inspection
- Preparation for use
- Storage
- Shipment

**SECTION III, OPERATION.** This section contains:

- RF plug-in configuration switch settings
- Frequency reference selection switch settings
- Frequency resolution characteristics in CW and swept frequency modes
- External crystal and power meter leveling instructions
- Front and rear panel features
- Error codes

**SECTION IV, PERFORMANCE TESTS.** This section contains procedures to verify published HP 83550A specifications.

**SECTION V, ADJUSTMENTS.** This section contains procedures to adjust and align the HP 83550A after repair, or if the instrument fails a performance test.

**SECTION VI, REPLACEABLE PARTS.** This section contains information required to order all replaceable parts and assemblies.

**SECTION VII, MANUAL BACKDATING.** This section contains information on earlier shipment configurations.

**SECTION VIII, SERVICE.** This section contains:

- Overall instrument block diagram
- Troubleshooting and repair procedures
- Information on each assembly within the instrument

## SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument is tested. Specifications apply after 1 hour warm-up. Table 1-2 lists supplemental performance characteristics, which are not specifications, but are intended to provide additional information useful to your application by giving typical (but not warranted) performance parameters.

Table 1-1. HP 83550A Specifications (1 of 2)

**FREQUENCY CHARACTERISTICS**

Frequency Range .....	8.0 to 20.0 GHz
Frequency Accuracy (20° to 30° C)	
CW Mode <sup>2</sup> .....	±20 MHz
All Sweep Modes (sweep ≥100 ms) .....	±50 MHz
Frequency Markers (sweep ≥100 ms) .....	±50 MHz ±0.5% of sweep width
Stability (CW mode)	
With 10 dB Power Level Change .....	±500 kHz
With 3:1 Load SWR .....	±500 kHz
Residual FM (0.02 – 15 kHz BW) .....	<25 kHz peak (with CW Filter on)

**OUTPUT POWER<sup>1</sup>**

Maximum Levelled Output Power (20° to 30° C) <sup>3</sup>		
	<b>8.0 to 18.0 GHz</b>	<b>18.0 to 20.0 GHz</b>
Standard	+20 dBm	+18 dBm
With Option 002 (50 dB step attenuator)	+17 dBm	+15 dBm
With Option 006 (auxiliary output)	+20 dBm	+17 dBm
With Options 002 and 006	+17 dBm	+14 dBm
Power Level Accuracy (20° to 30° C)		
Internally Levelled .....	< ±1.5 dB	
With Option 002 .....	< ±1.7 dB (at 0 dB attenuator step)	
Power Variation (at specified maximum levelled power)		
Internally Levelled .....	±1.25 dB	

Resolution	
Displayed .....	±0.1 dB
Programmable/Settable .....	±0.01 dB
Power .....	±0.01 dB
Power Sweep (with Option 002, power sweep cannot cross an attenuator step) <sup>4</sup>	

	<b>8.0 to 18.0 GHz</b>	<b>18.0 to 20.0 GHz</b>
Calibrated Range	+20 dB	+18 dB
Option 002 <sup>5</sup>	+17 dB	+15 dB
Option 006	+20 dB	+17 dB
Options 002 and 006 <sup>5</sup>	+17 dB	+14 dB
Resolution (displayed)	0.1 dB/GHz	
Slope Compensation (with Option 002, slope compensation cannot cross an attenuator step) <sup>4</sup>		

Calibrated Range	Maximum ±5 dB/GHz	
	<b>8.0 to 18.0 GHz</b>	<b>18.0 to 20.0 GHz</b>
Standard	+20 dB	+18 dB
Option 002 <sup>5</sup>	+17 dB	+15 dB
Option 006	+20 dB	+17 dB
Options 002 and 006 <sup>5</sup>	+17 dB	+14 dB
Resolution (displayed)	0.01 dB/GHz	

Attenuator Accuracy (±dB referenced from the 0 dB setting):	<b>Attenuator Setting (dB)</b>				
	<b>10</b>	<b>20</b>	<b>30</b>	<b>40</b>	<b>50</b>
8.0 to 12.4 GHz	0.5	0.7	0.9	1.2	1.5
12.4 to 18.0 GHz	0.6	0.8	1.2	1.6	2.0
18.0 to 20.0 GHz	0.8	1.2	1.7	2.5	3.0

Minimum Settable Power .....	0.0 dBm
Option 002: .....	-50.0 dBm
Millimeter-wave Operation .....	-5.0 dBm

**OUTPUT CHARACTERISTICS**

Spurious Signals (below fundamental at specified maximum levelled power; 20° to 30° C)	
Harmonics	
8.0 to 11.0 GHz .....	>15 dBc
11.0 to 20.0 GHz: .....	>20 dBc
Non-Harmonics .....	>50 dBc
Output SWR (levelled) .....	8.0 to 18.0 GHz
Standard .....	≤2.5
Option 002 .....	≤3.0

Table 1-1. HP 83550A Specifications (2 of 2)

MODULATION CHARACTERISTICS	GENERAL SPECIFICATIONS <sup>1</sup>
<b>External AM</b> Maximum Input ..... $\pm 20V$	<b>Minimum Sweep Time</b> ..... 10 ms
<b>Internal Square Wave Modulation</b> (1 kHz or 27.8 kHz square wave modulation is selectable with an internal jumper in the HP 8350.) On/Off Ratio (leveled) ..... $\geq 30$ dB Symmetry ..... 45/55	<b>Auxiliary Output</b> (Option 006) Connector ..... Rear panel Type-N female Output ..... 8.0 to 20.0 GHz
<b>External Pulse and External Square Wave Modulation</b> Pulse Input ..... TTL compatible On/Off Ratio (leveled) ..... $\geq 30$ dB	<b>RF Output Connector</b> ..... Type-N female
<b>External FM</b> Maximum Deviation 0 to 100 Hz ..... $\pm 75$ MHz pk 100 Hz to 6 MHz ..... $\pm 12.0$ MHz pk	<b>Source Module Interface</b> ..... 20 pin Type-D connector (connects the HP 83550A and an 83550 series millimeter-wave source module.) For specifications that apply to the HP 83550A and an 83550 series millimeter-wave source module (system specifications), refer to the applicable <i>HP 83550A Source System Guide</i> .
	<b>Weight</b> Net ..... 4.5 kg (10 lb) Shipping ..... 7.7 kg (17 lb)

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- 1 Unless otherwise noted, all specifications are at the RF OUTPUT connector, and are at 0° to 55° C.
- 2 Approach desired frequency from the lowest programmable frequency; includes up to  $\pm 4$  MHz frequency offset when a millimeter-wave source module is connected.
- 3 Power variation with temperature:  $\pm 0.1$  dB/°C, typically.
- 4 Power sweep and slope compensation total must not exceed the specified power sweep calibrated range.
- 5 With Option 002, in power sweep or slope functions, power can exceed attenuator step by 4 dB.

Table 1-2. HP 83550A Supplemental Characteristics (1 of 2)

**FREQUENCY CHARACTERISTICS**

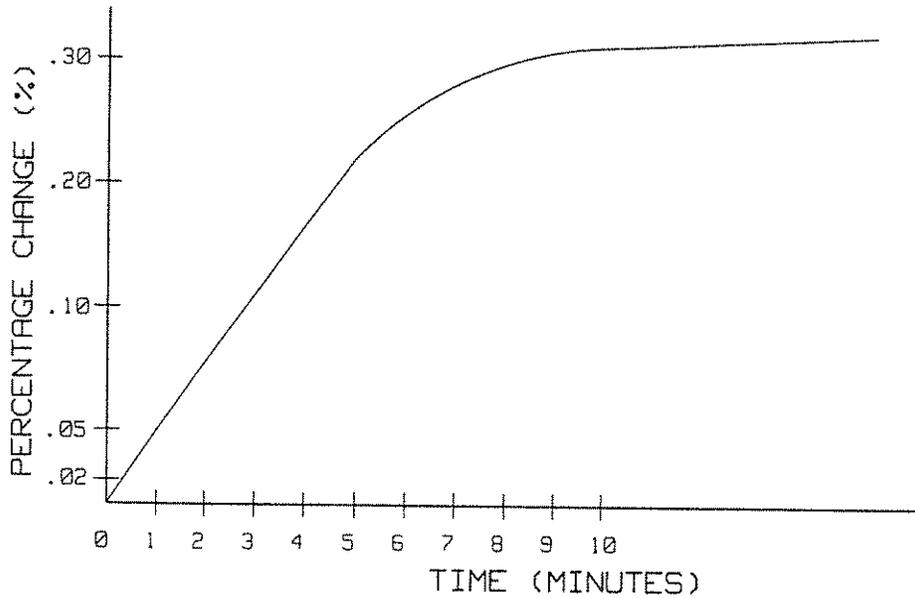
**Linearity** .....  $\pm 5$  MHz  
(with respect to the SWEEP OUT voltage.)

**Post Tuning Drift**

Transient heating effects in the YIG oscillator may affect short term CW frequency accuracy when the selected frequency is incremented by more than a few GHz. For optimum frequency stability allow sufficient time for YIG stabilization. The following figure is a graphical representation of the typical response of an 8.0 to 20.0 GHz (complete frequency span) frequency change. Note that a smaller frequency increment will result in a smaller percent change.

**Stability (CW mode)**

With Temperature .....  $\pm 1$  MHz/ $^{\circ}$ C  
With 10% Line Voltage Change .....  $\pm 150$  kHz  
With Time .....  $\pm 1$  MHz  
(10 minute period after 1 hour at the same frequency)



*Response of an 8.0 to 20.0 GHz Frequency Change*

**OUTPUT POWER**

**Power Variation**

Externally Levelled (excludes coupler/detector variations.)  
Negative Crystal Detector<sup>1</sup> .....  $\pm 0.1$  dB  
(sweep time  $\geq 100$  ms)  
Power Meter<sup>2</sup> .....  $\pm 0.1$  dB  
(sweep time = 100 s) (HP 432A/B/C, 436A, or 438A)

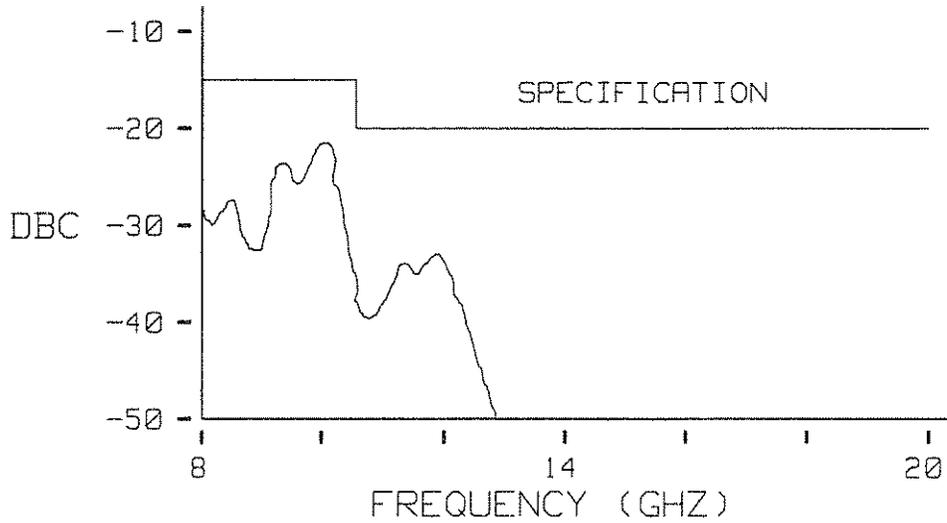
**Power Sweep** (with Option 002, power sweep cannot cross an attenuator step)

Accuracy (including linearity) .....  $< \pm 1.5$  dB

Table 1-2. HP 83550A Supplemental Characteristics (2 of 2)

**OUTPUT CHARACTERISTICS**

**Spurious Signals** (below fundamental at specified maximum leveled power; 20° to 30° C)



*Harmonic Content*

Output SWR	Standard	Option 002	Residual AM in 100 kHz BW	> 50 dBc
Leveled				
18.0 to 20.0 GHz	≤2.5	≤3.0		
Unleveled				
8.0 to 11.0 GHz	≤3.8	≤3.8		
11.0 to 20.0 GHz	≤3.2	≤3.2		

**MODULATION CHARACTERISTICS**

External AM	External Pulse and Square Wave Modulation
Frequency Response	DC to 100 kHz
Range of Amplitude Control	20 dB
Sensitivity	1 dB/V
Input Impedance	35 kohms
	Rise/Fall Times
	Minimum RF Pulse Width
	Leveled
	Unleveled <sup>3</sup>
	On/Off Ratio (unleveled) <sup>3</sup>
	Repetition Rate
	Leveled
	Unleveled
External FM	
Sensitivity	
FM Mode	-20 MHz/V
Phase-Lock Mode	-6 MHz/V
Input Impedance	2000 ohms

**GENERAL SPECIFICATIONS**

Frequency Reference Output		Auxiliary Output:
Output (selectable)	0.5 V/GHz ± 25 mV	Option 006 only
	1V/GHz ± 50 mV	0.0 dBm ± 7.0 dB

- Crystal detector output should be between -10 and -200 mV.
- The HP 436A and 438A must be used on the top 3 ranges.
- With power set to maximum programmable power.

## SAFETY CONSIDERATIONS

Become familiar with all safety instructions in this manual before you use the HP 83550A RF plug-in. This product was designed and tested in accordance with international standards.

### 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 HP 83550A

#### 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.

## Safety Symbols

### WARNING

This indicates a personal hazard. **WARNING** calls attention to a procedure, practice, etc., that, if not performed correctly, can cause personal injury. Do not continue past a **WARNING** until you fully understand and meet the stated conditions.

### CAUTION

This indicates a mechanical or electrical hazard. **CAUTION** calls attention to an operating procedure, practice, etc., that, if not correctly performed or adhered to, can cause damage to (or destruction of) part or all of the instrument. Do not continue past a **CAUTION** until you fully understand and meet the stated conditions.

## INSTRUMENTS COVERED BY THIS MANUAL

Attached to the rear panel of the HP 83550A is a serial number label (see Figure 1-2). The serial number is in two parts:

1. First four digits followed by a letter comprise the serial number prefix.
2. The last five digits form a sequential suffix, unique to each instrument.

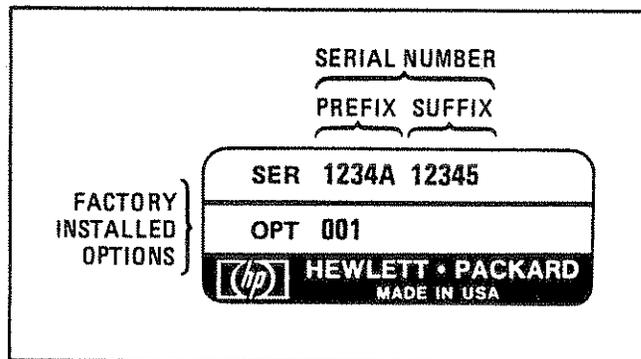


Figure 1-2. Typical Serial Number Label

The contents of this manual apply directly to instruments having the same serial number prefix as those listed on the title page, under SERIAL NUMBER.

An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. An unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for the instrument is supplied with a manual changes supplement that contains information documenting the differences.

In addition to change information, the supplement may contain replacement information that applies to all instruments, regardless of their serial number.

To keep this manual as current as possible, periodically request the latest manual changes supplement. The supplement for this manual is keyed to its print date and part number, which appear on the title page. Complimentary copies of the supplement are available from your local Hewlett-Packard office.

## ORDERING MANUAL/MICROFICHE

On the title page of this manual is a manual part number and a microfiche part number. Both can be used to order extra copies of this manual.

Microfiche are 10 X 15 cm (4 X 6 in) microfilm transparencies. Each microfiche contains reduced photocopies of the manual pages. Also included in the microfiche package are the latest manual changes supplement.

The manual part number also appears on the back cover, in the lower left hand corner.

## DESCRIPTION

The HP 83550A is an RF plug-in designed to be used with the HP 8350 sweep oscillator. The standard HP 83550A covers the frequency range of 8.0 to 20.0 GHz, with a maximum leveled power of +20 dBm from 8.0 to 18.6 GHz, and +18 dBm from 18.6 to 20 GHz.



The HP 83550A maximum power may exceed +24 dBm.

## OPTIONS

### Option 002 — 50 dB Attenuator

Option 002 instruments have a digitally controlled attenuator, positioned just before the RF output. Up to 50 dB of attenuation (in 10 dB steps) is automatically selected as required, to obtain the output power indicated on the HP 83550A power display.

### Option 004 — Rear Panel RF Output

On Option 004 instruments, the Type-N RF output connector, the BNC EXT/MTR ALC input connector, and the SOURCE MODULE INTERFACE are on the rear panel instead of the front panel.

### Option 006 — Auxiliary RF Output

Option 006 instruments have a portion of the YIG oscillator RF output coupled to the rear panel through a Type-N RF output connector.

### Option 910 — Extra Operating and Service Manual

A standard instrument is supplied with one operating and service manual. Option 910 provides an additional operating and service manual. To order extra operating and service manuals after initial shipment, order by the manual part number listed on the title page and the rear cover of this manual.

## EQUIPMENT REQUIRED BUT NOT SUPPLIED

For a complete sweep oscillator unit, the HP 83550A RF plug-in must be installed in an HP 8350 sweep oscillator (see Section II, Installation).

## **EQUIPMENT AVAILABLE**

### **Service Accessories**

A service accessory kit is available to facilitate servicing the HP 83550A and the HP 8350. For a complete list of available service accessories, see Table 1-3.

### **Power Meters and Crystal Detectors**

An HP 436A or 438A power meter, or a negative polarity crystal detector can be used to externally level the HP 83550A RF output. See Section III, Operation, for detailed information.

### **HP 8756A/8757A Scalar Network Analyzer**

The HP 8350/83550A combination is compatible with the HP 8756A and 8757A scalar network analyzers.

### **HP 8510A Vector Network Analyzer**

The HP 8350/83550A combination is compatible with the HP 8510A vector network analyzer.

### **Millimeter-Wave Source Modules**

The HP 8350/83550A combination is compatible with the HP 83550 series millimeter-wave source modules.

## **RECOMMENDED TEST EQUIPMENT**

Table 1-4 lists the equipment required to test and adjust the HP 83550A. Other equipment may be substituted if it meets or exceeds the indicated critical specifications.

Table 1-3. Service Accessories Available

Name	HP Part Number	Description
38-pin printed circuit board extender	83550-60021*	Extends printed circuit boards
RF Plug-in extender cables	08350-60034* 08350-60035*	Extends RF Plug-in Interface connector (P2) Extends RF Plug-in Power Supply Interface connector (P1)
Adjustment tool	8830-0024	Fits miniature adjustment slot on potentiometers
Wrenches	08555-20097 8710-0946	5/16" slotted box/open end 15/64" open end
Service cables	8120-1578	18" Coax with SMA (m) connector on each end
Adapters	1250-1743 1250-1750 1250-1404 1250-1158 1250-1744 1250-1745 1250-1748 1250-1749	3.5mm (m) to Type-N (m) 3.5mm (m) to Type-N (f) Type-N (f) to SMA (f) SMA (f) to SMA (f) 3.5mm (f) to Type-N (m) 3.5mm (f) to Type-N (f) 3.5mm (m) to 3.5mm (m) 3.5mm (f) to 3.5mm (f)
IC test clip	1400-0734* 1400-0979* 1400-1097*	16-pin IC test clip 20-pin IC test clip 40-pin IC test clip
*These items are included in a Service Accessories Kit, HP Part No. 08350-60020. Also included is HP Part No. 08350-60031, 44-pin printed circuit board extender (2 each).		

Table 1-4 Recommended Test Equipment (1 of 3)

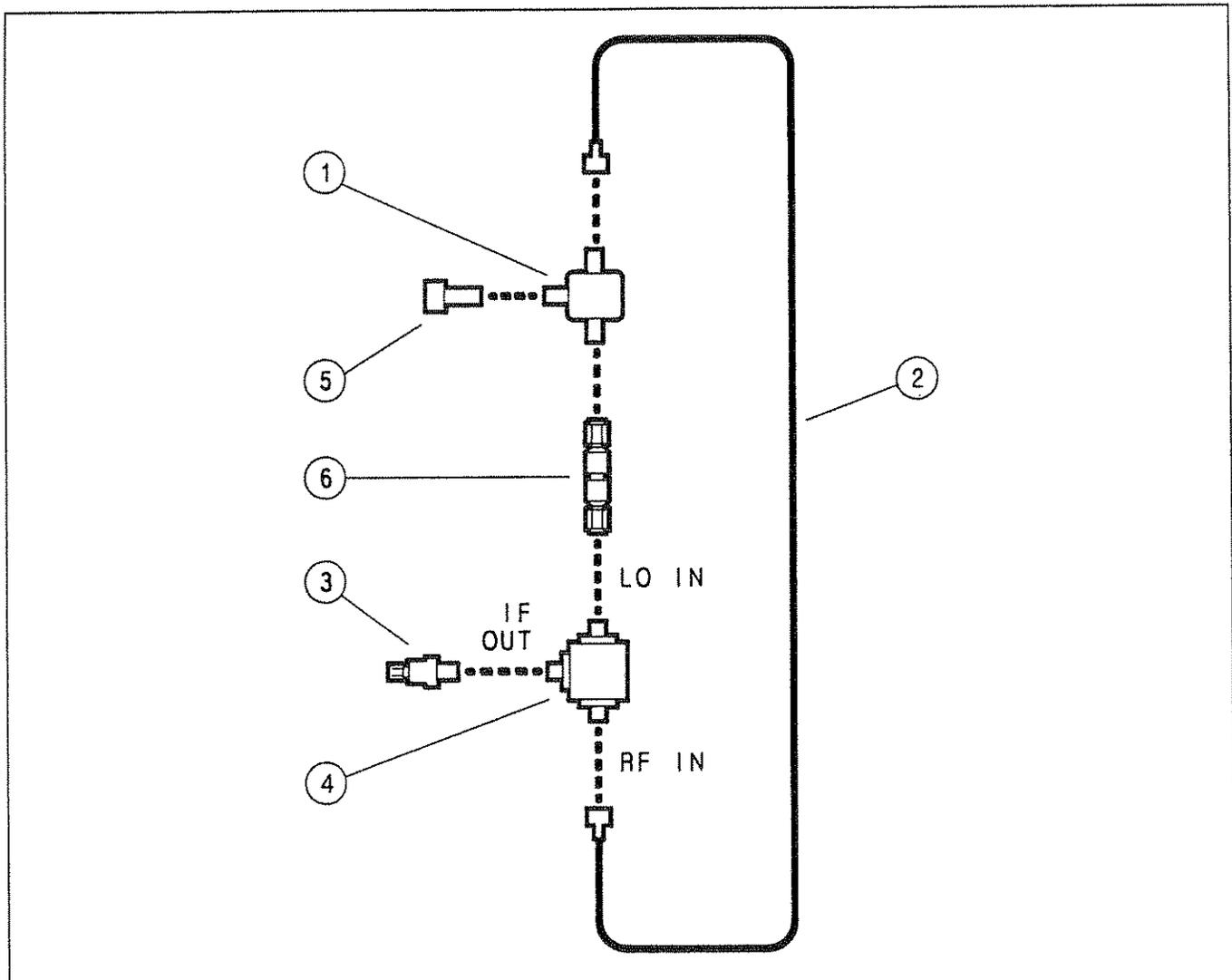
Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8350	P, A, T
Digital Voltmeter (DVM)	Range: -50V to +50V Accuracy: $\pm 0.01\%$ Input Impedance: $\geq 10M$ Ohms Computing Math	HP 3456A	A, T
Oscilloscope	Dual Channel Bandwidth: DC to 100 MHz Vertical Sensitivity: $\leq 5$ m V/DIV Horizontal Sweep Rate: $\leq 0.1\mu S/DIV$ External Sweep Capability	HP 1740A or HP 1741A	P, A, T
Oscilloscope Probe	1:1 General Purpose Probe	HP 10009B	A
Frequency Counter	Frequency Range: 8.0 to 20.0 GHz Input Impedance: 50 Ohms Resolution: $\leq 1$ Mhz	HP 5343A	P
Spectrum Analyzer	Frequency Range: 8.0 to 20.0 GHz Residual FM: $< 100$ Hz	HP 8566B	P, A, T

Table 1-4. Recommended Test Equipment (2 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Detector (2 each)	Compatible with Scalar Network Analyzer Frequency Range: 8.0 to 20.0 GHz Power Range: -20 +10 dBm	HP 85025B	A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sinewave and squarewave output Output Level: 10V p-p into 50 Ohms Output Level Flatness: $\leq \pm 3\%$ from 10 Hz to 100 kHz $\leq \pm 10\%$ from 100 kHz to 10 MHz	HP 3325A	P, A, T
Power Meter	Power Range: +20 to -10 dBm	HP 436A	P, A
Scalar Network Analyzer	Capable of both modulated and unmodulated (AC/DC detection) Transmission Measurements Power Resolution: $\leq 0.25$ dB	HP 8757A	P, A
Oscilloscope Probe (2 each)	10:1 Standard Divider	HP 10016B	A
Power Divider	Frequency Range: 8 to 20 GHz Maximum Input Power: +27 dBm	HP 11636B	P, A
Power Sensor	Frequency Range: 8.0 to 20.0 GHz Maximum VSWR: 1.25:1	HP 8485A	P, A
Crystal Detector	Frequency Response: 8.0 to 20.0 GHz Maximum Input Power: 200 mW	HP 8473C	P, A
Attenuator	Frequency Range: 8.0 to 20 GHz Maximum Input Power: +20 dBm Attenuation: 20 dB $\pm$ 0.6 dB 10 dB $\pm$ 0.5 dB 6 dB $\pm$ 0.6 dB 3 dB $\pm$ 0.5 dB	HP 8493C Option 020 HP 8493C Option 010 HP 8493C Option 006 HP 8493C Option 003	P P, A P P
Power Splitter	Frequency Range: 8.0 to 20.0 GHz Maximum Input Power: $\geq$ +27 dBm	HP 11667B	P, A
Directional Coupler	Frequency Range: 8.0 to 18 GHz Nominal Coupling: $\geq 22$ dB Maximum Coupling Variation: $\pm 1$ dB Minimum Directivity: 26 dB	HP 11691D	P
Adapter	3.5mm (f) to Type-N (m)	HP Part No. 1250-1744	P, A
Adapter	Precision 7mm to Type-N (m)	HP 11525A	P, A
RMS Voltmeter	dB Range: -20 to -70 dBm (0 dBm = 1 mV into 600 ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: $\pm 5\%$ of full scale	HP 3400A	P

Table 1-4. Recommended Test Equipment (3 of 3)

Instrument	Critical Specifications	Recommended Model	Use*
Air Line Extension (2 required)	Impedance: 50 Ohms Frequency Range: DC to 18 GHz Reflection Coefficient: $\leq 0.036$	HP 11567A	P
Step Attenuator	Frequency Range: 8 to 20. GHz Incremental Attenuation: 0 to 50 dB in 10 dB steps Calibration Accuracy: $\leq \pm 0.1$ at all steps	HP 8495D Option 890	P
Short	Frequency Range: 8 to 18 GHz Impedance: $50 \pm 1.5$ Ohms	HP 11565A	P
Adapter (2 required, 1 each)	3.5mm to Waveguide SWR $\leq 1.2$	HP K281C HP K281C Option 012	P, A
50 Ohm Termination	Type-N, $50 \pm 0.5$ Ohms	HP 909A	P
Delay Line Discriminator	Refer to Figure 1-3.		P, A
PC Board Extender (2 required)	38-pin, extends printed circuit boards	HP Part No. 83550-60021	T
*P=Performance Test; A=Adjustments; T=Troubleshooting			



Item	Description	HP Part Number
1	Power Splitter	HP 11667B
2	Delay Line: 23.5cm (9.2 inches) in length, SMA male connectors	83550-20034
3	Adapter: BNC female to SMA male	1250-1200
4	Mixer: Double Balanced RHG Electronics Part No. DMS 1-26 RHG Electronics Laboratories, Inc. Deer Park, NY 11729	
5	Adapter: Type-N male to 3.5mm male	1250-1743
6	Adapter: 3.5mm male to 3.5mm male	1250-1748

Figure 1-3. Delay Line Discriminator



## Section II. Installation

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### INTRODUCTION

Along with HP 83550A installation instructions, this section provides information on:

- Initial inspection.
- Damage claims.
- Preparation for use.
- Packaging.
- Storage
- Shipment.

### INITIAL INSPECTION

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

Procedures for checking electrical performance are given in Section IV, Performance Tests. If the plug-in and mainframe do not pass the electrical performance tests, refer to Troubleshooting in Section VIII, Service.

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

- The instrument does not pass the performance tests and, using the troubleshooting procedures in Section VIII, Service, you cannot correct the problem.
- The instrument does not pass the performance tests and you do not wish to troubleshoot the instrument yourself.
- The shipping contents are incomplete.
- There is mechanical damage or defect.

Notify the carrier if the shipping container is damaged or if 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.

### PREPARATION FOR USE

#### Power Requirements

When properly installed, the HP 83550A RF plug-in receives all power from the HP 8350 sweep oscillator, through the rear panel interface connectors.

## Configuration Switch

The RF plug-in configuration switch (A3S1) is an 8-section multiple switch located on the HP 83550A A3 digital interface assembly. Three of the eight sections correspond to separate RF plug-in functions, and can be modified, as required, for your application. Refer to Section III, Operation, for a complete description of the configuration switch and instructions on how to set each function.

## Frequency Reference Selection Switch

The HP 83550A is shipped with the frequency reference selection switch (A5S1) set to the 1.0 V/GHz position. You can select either, a 1.0 V/GHz or a 0.5 V/GHz frequency reference depending on the application desired. See Section III for instructions on setting this switch.

## Interconnections

The HP 83550A has three interconnections:

- Two rear panel interconnections to the HP 8350 sweep oscillator:
  - The power supply interface connector (P1)
  - The RF plug-in interface connector (P2)
- A front/rear panel source module interface connector (J6).

Figures 2-1, 2-2, and 2-3 provide complete listings of pins and associated signals for these connectors.

## Mating Connectors

Table 2-1 lists:

- All HP 83550A externally mounted connectors.
- The HP part number for each connector.
- An industry identification.
- The HP part number of a mating connector.
- The part number of an alternate source for the mating connector.

Table 2-1. HP 83550A Mating Connectors

HP 83550A Connector			Mating Connector	
Connector Name	HP Part No.	Industry Identification	HP Part No.	Alternate Source
J1 SOURCE MODULE INTERFACE	Part of W2 Not Separately Replaceable	N/A	83556-60001	N/A
J2 RF OUTPUT	5061-5304	Type-N (f)	1250-0882	Specialty Connector 25-P117-2
J3 EXT/MTR ALC INPUT	1250-0118	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J4 1.0V/0.5V/GHz	1250-0118	BNC (f)	1250-0256	Specialty Connector 25-P1181
J5 PULSE IN	1250-0118	BNC (f)	1250-0256	Specialty Connector 25-P118-1
J6 AUX OUTPUT	5061-5304	Type-N (f)	1250-0882	Specialty Connector 25-P117-2
P1 POWER SUPPLY INTERFACE	Part of W20 Not Separately Replaceable	N/A	08350-60010	N/A
P2 RF PLUG-IN INTERFACE	Part of W21 Not Separately Replaceable	N/A	08350-60052	N/A

## Operating Environment

The HP 83550A RF plug-in operates within the following environmental limits:

**Temperature:** 0° to +55°C (+32° to +131°F)

**Humidity:** 5% to 80% relative at +25° to +40°C (+77° to +105°F).

Provide protection from temperature extremes. Condensation can occur within the instrument if it is exposed to temperature extremes or to higher humidity levels.

**Altitude:** Up to 4,572 metres (15,000 feet).

**Cooling:** When the HP 83550A is properly installed in the HP 8350 sweep oscillator, the RF plug-in obtains all its airflow cooling by forced ventilation from the HP 8350 fan.

A diagram of the various airflow cooling paths within the sweep oscillator is given in the *HP 8350 Sweep Oscillator Operating and Service Manual*, Section II, Installation. Ensure that all airflow passages in both instruments are clear before installing the RF plug-in in the sweep oscillator.

## Installation Instructions

To be functional, the HP 83550A RF plug-in must be installed in an HP 8350 sweep oscillator:

1. Turn the HP 8350 off.
2. To prevent damage, remove all connectors and accessories from the HP 83550A front and rear panel connectors.
3. Position the plug-in latching handle in the fully raised position. The handle should raise easily and hold in that position by spring tension.
4. Ensure that the HP 8350 plug-in channel is clear; align the RF plug-in in the channel and slide it carefully into place. It should slide back easily, without binding.
5. The latching handle slot engages with the locking pin just before the plug-in is fully seated in position.
6. Press the latching handle downward, while still pushing in on the RF plug-in, until the handle is fully latched (down) and the plug-in front panel is aligned with the sweep oscillator front panel.

## STORAGE AND SHIPMENT

### Environment

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

**Temperature:** -40° to +75°C (-40° to +167°F).

**Humidity:** 5% to 95% relative at 0° to +40°C (+32° to +105°F).

Protect the instrument from temperature extremes, which can cause condensation in the instrument.

**Altitude:** Up to 15,240 metres (50,000 feet).

### Packaging

Containers and materials identical to those used in factory packaging are available through your Hewlett-Packard office (see Figure 2-4). 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 159 kg (350 lb) test material is adequate.
3. Use shock absorbing material, a 76 to 102 mm (3 to 4 in) layer, around all sides of the instrument to provide a firm cushion and to prevent movement inside the container.
4. Seal the shipping container securely.
5. Mark the shipping container **FRAGILE**.

## Returning Instrument for Service

If you ship the instrument to a Hewlett-Packard office or service center, please include a blue service tag (found at the end of Section III), on which you provide the following information:

1. Your company name and address.
2. A technical contact person within your company, and their complete phone number.
3. The complete model and serial number of the instrument.
4. The type of service required.
5. Any other information that may expedite service.

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

### POWER SUPPLY PLUG-IN INTERFACE CONNECTOR P1

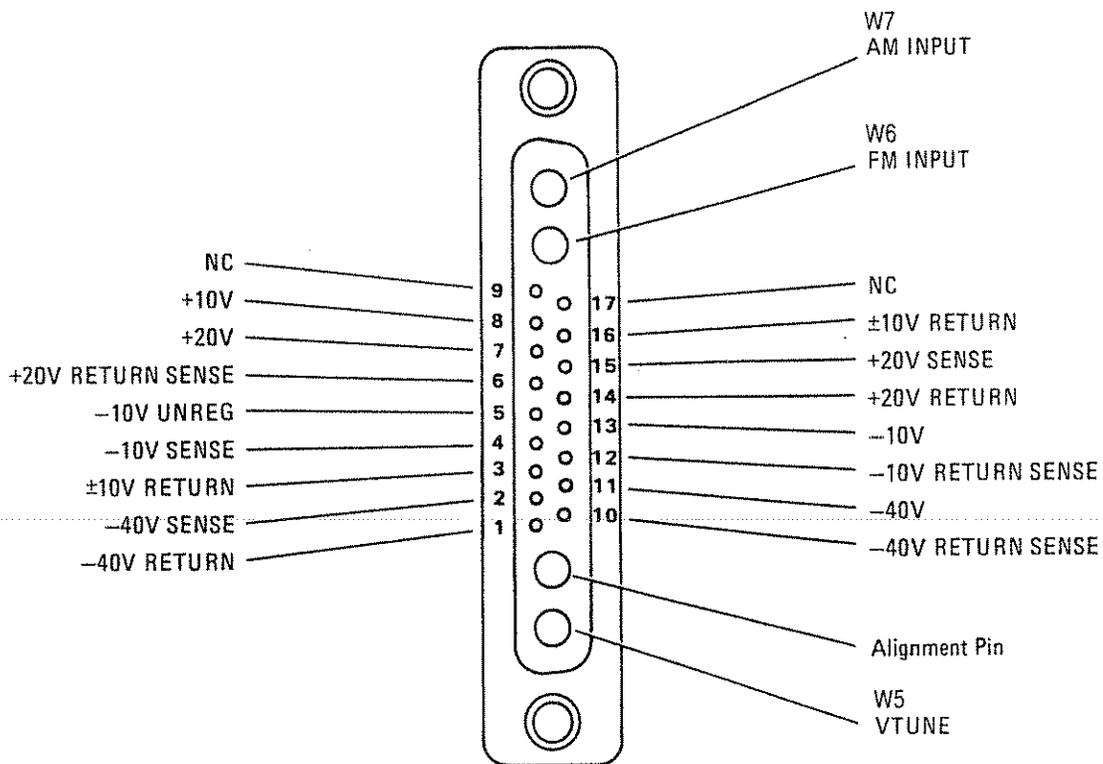


Figure 2-1. Interface Signals on Rear Panel Connector P1 (Front View)

## PLUG-IN INTERFACE CONNECTOR P2

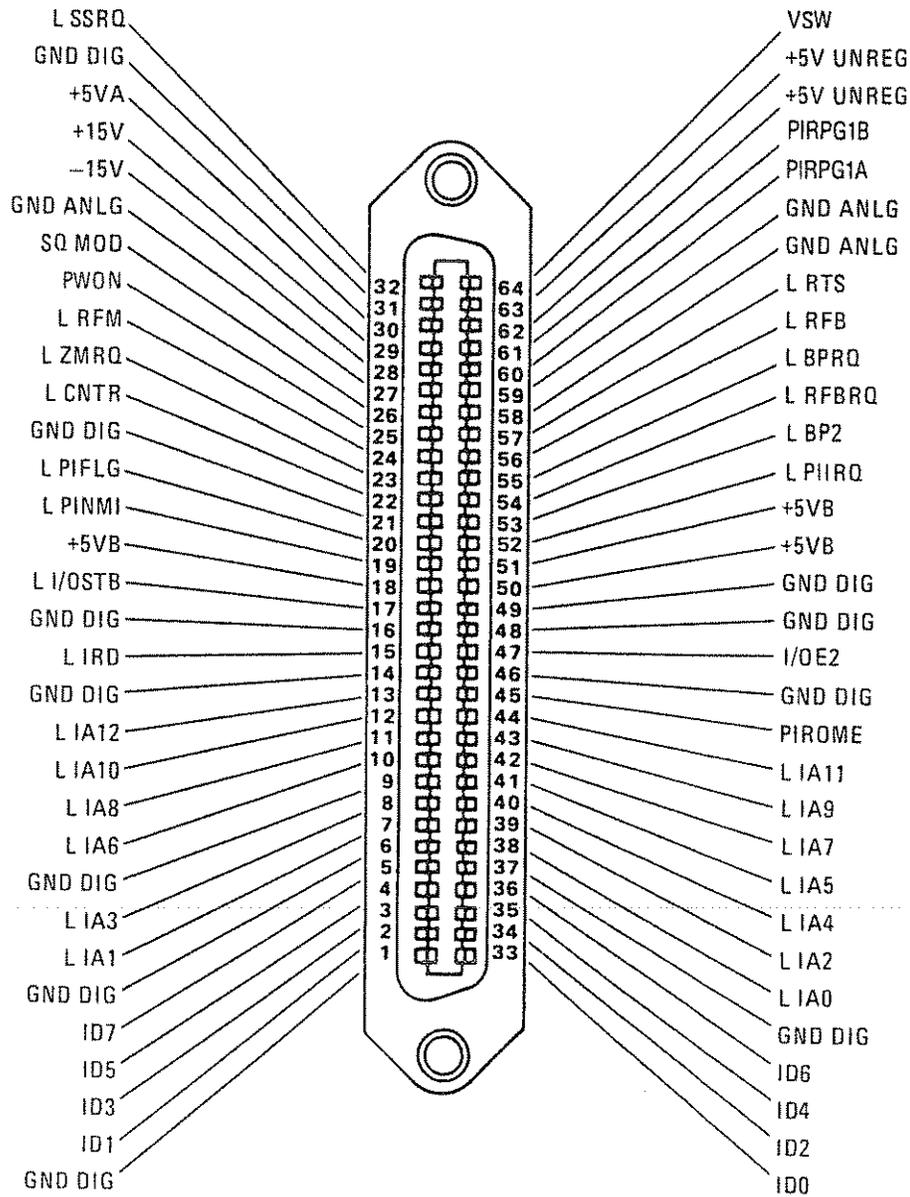


Figure 2-2. Interface Signals on Rear Panel Connector P2 (Front View)

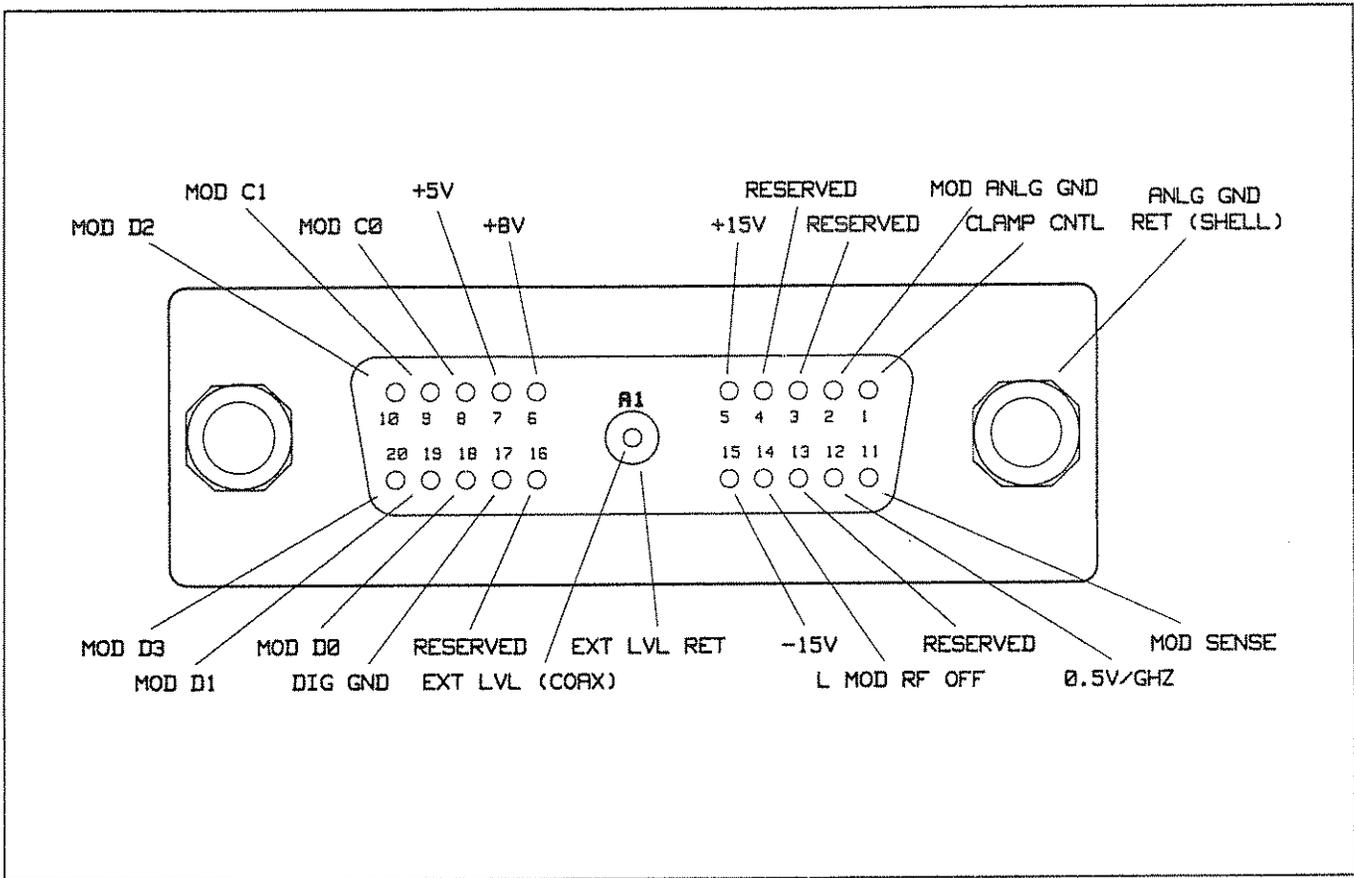
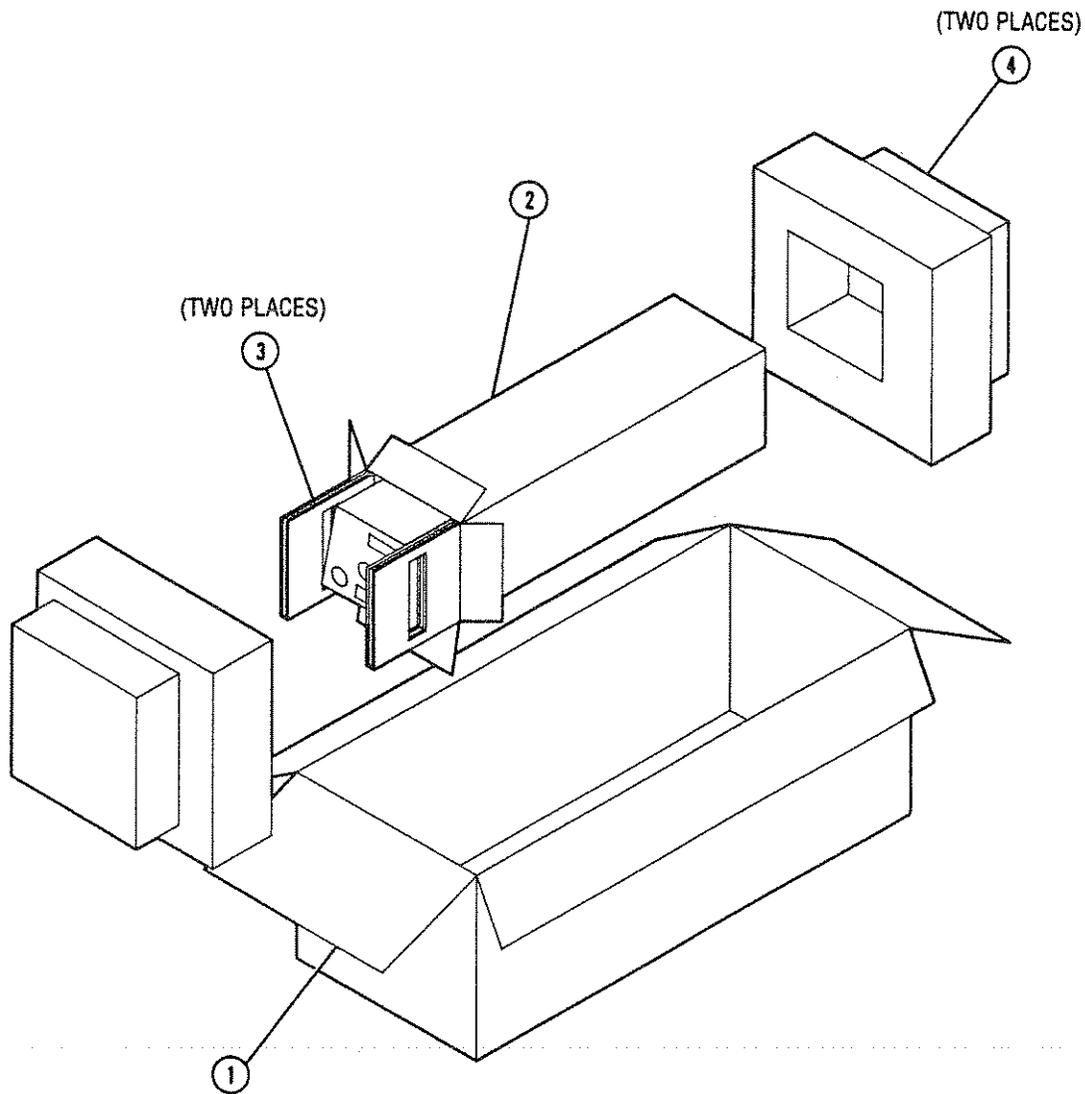


Figure 2-3. Interface Signals on Front Panel (Standard) Connector J1 (Front View)



Item	Quantity	HP Part Number	C D	Description
1	1	9211-3515	6	Outer Carton
2	1	9211-3514	5	Inner Carton
3	2	9220-3409	6	Side Pads - Corrugated Cardboard
4	2	9220-3406	3	Foam Pads
Not Shown	1	9222-0943	1	Poly Bag - to cover instrument

Figure 2-4. Packaging for Shipment Using Factory Packaging Materials

## Section III. Operation

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### INTRODUCTION

This section is divided into four major sections:

**OPERATING CHARACTERISTICS** explains the frequency resolution characteristics in CW and swept modes.

**FRONT AND REAR PANEL FEATURES.**

**OPERATING INSTRUCTIONS** provides information on:

- RF plug-in configuration switch.
- Frequency reference selection switch.
- Operator's checks.
- Millimeter-wave applications.
- Internal, external detector, and power meter leveling.
- External FM and AM modulation.
- RF power control.
- Option 002 step attenuator.
- Option 006 auxiliary output.
- Alternate sweep mode.
- HP-IB.
- Firmware revision number.
- Phase-lock operation.

**OPERATOR'S MAINTENANCE** includes information on:

- Plug-in error codes.
- Fuses.
- Service tags.

## Operating Characteristics

### FREQUENCY RESOLUTION

Two areas relating to frequency resolution must be considered; these are input resolution and displayed resolution. Input resolution refers to the number of bits (8 bits = 256 points) used in the HP 8350's digital to analog converters (DACs) to generate the tuning voltage for a particular mode of operation. Table 3-1 cross references input resolution with each DAC used. Displayed frequency resolution refers to the number of digits displayed on the HP 8350 FREQUENCY displays.

#### Input Resolution

Figure 3-1 is a simplified block diagram of the frequency tuning circuits in the HP 8350. The net tuning voltage results from the summation of the three DAC outputs. With this DAC configuration the START/STOP sweep mode is computed by the microprocessor into a center frequency (CF) and a  $\Delta F$  sweep width. Therefore the operation of all sweeps are set with a center frequency and sweep width. The center frequency is specified by the center frequency (CF) DAC and the vernier DAC, and the sweep width is determined by the  $\Delta F$  DAC.

The CF DAC has 12 bits, hence 4096 points across the plug-in frequency band (including a 2% overrange and a 2% underrange of the band). The analog output ranges from zero to ten volts, which is used to specify the center frequency output of the plug-in. These parameters give the CF DAC a resolution of 0.024% (2.4mV) over the full band (including overrange).

Resolution of center frequency is enhanced by a summed voltage generated by an 8-bit (256 points) vernier DAC. Vernier range is set to  $\pm 0.048\%$  of RF plug-in bandwidth (including overrange). Vernier resolution is determined by dividing  $\pm 0.048\%$  bandwidth by 256 points (128 points either side of CF). The voltage range of the total 256 points on the vernier DAC is equal to four points on the 12-bit CF DAC (two points on either side of CF). This increases CF resolution from 0.024% (2.4mV) to 0.00038% (.04mV), and improves the relative accuracy of the CF by a similar factor. The absolute resolution accuracy still depends on the CF DAC.

**NOTE:** When adjusting the vernier through its end point, the CF DAC is incremented or decremented by the total value of the vernier (2 points on the CF DAC). At this time the accuracy of the center frequency is again entirely dependent on the linearity of the CF DAC, 0.005% of bandwidth.

Table 3-1. Input Resolution

DAC Used	Voltage Resolution	Frequency Resolution
CF	2.44 mV	3.047 MHz
Vernier	38 $\mu$ V	47.6 kHz
$\Delta F$ 1 – 1/8 of band	19.53 mV	12.19 MHz
$\Delta F$ 1/8 – 1/64 of band	2.44 mV	1.52 MHz
$\Delta F \leq 1/64$ of band	0.305 mV	190 kHz

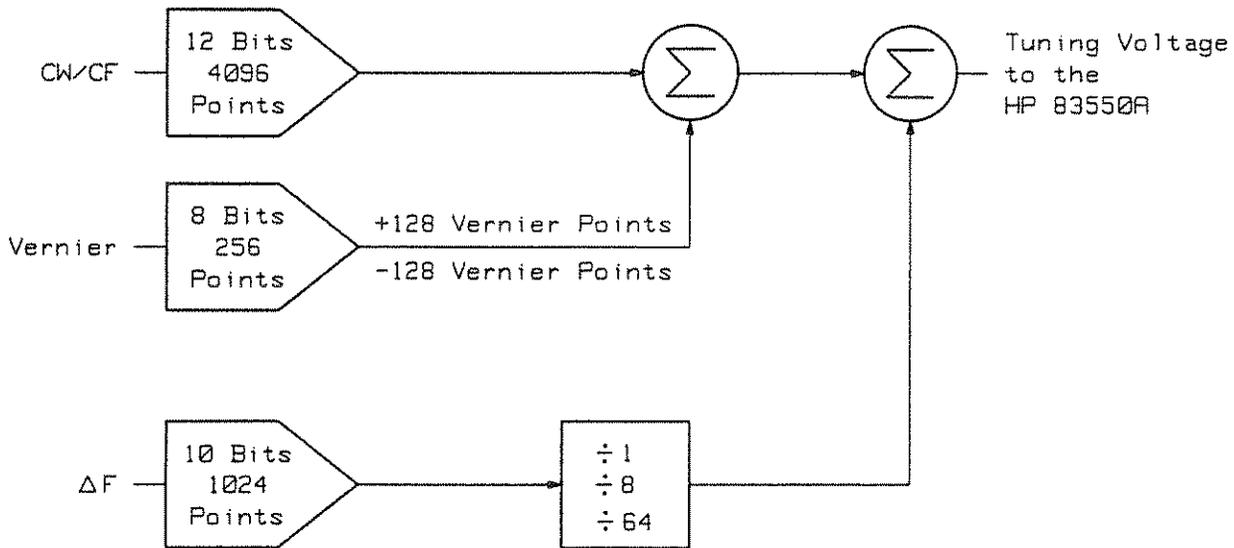


Figure 3-1. Simplified Tuning Voltage Block Diagram

The  $\Delta F$  DAC has 10 bits (1024 points). The analog input to this DAC ranges from  $-10$  to  $+10$  volts to produce an even sweep on either side of the center frequency. The  $\Delta F$  resolution improves with narrower sweep widths. For broad sweeps, the resolution is 0.1% of the full band. Greater resolution is provided for sweep widths less than  $1/8$  of the full band range. At these sweep widths, the resolution is improved to 0.012% of the full band. The greatest resolution is provided for sweep widths less than  $1/64$  of the full band range. At these sweep widths, the resolution is further improved to 0.0015% of the full band.

## Display Resolution

Center frequency in the CW mode, is always displayed with 1 MHz resolution. The display resolution for center frequency varies from 10 MHz to 1 MHz depending on the span width (for  $\Delta F \geq 8.53$  GHz, 1 MHz) when in the CF mode. Likewise, Vernier values are always displayed at a 100 kHz resolution. The display resolutions for  $\Delta F$  values vary with sweep width (Table 3-2 shows the  $\Delta F$  mode displayed resolution values versus displayed  $\Delta F$  frequency sweep widths).

Table 3-2.  $\Delta F$  Sweep Mode Displayed Resolution

	0 MHz	517 MHz	4.23 GHz	12.48 GHz
<b>DISPLAYED RESOLUTION</b>	100 KHz	1 MHz	10 MHz	
<b><math>\Delta</math> DISPLAY INDICATION</b>	X.X MHz XX.X MHz XXX.X MHz	XXX MHz X.XXX GHz	X.XX GHz XX.XX GHz	

## Front Panel Features

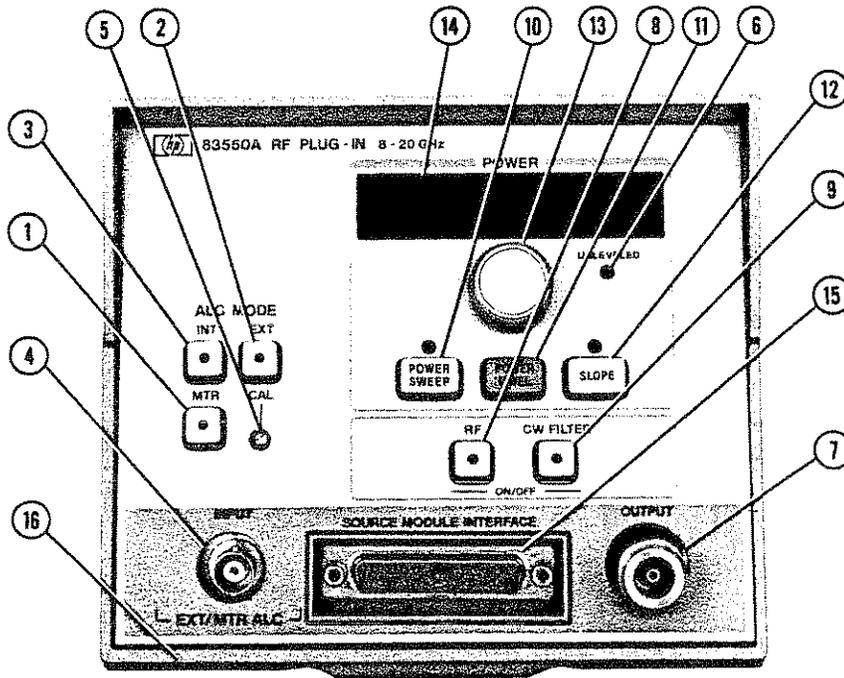


Figure 3-2. Standard Front Panel

1. **[MTR]**. Power meter automatic leveling control selection.
2. **[EXT]**. External automatic leveling control selection (negative crystal detector).
3. **[INT]**. Internal automatic leveling control selection. Selects the RF plug-in's internal crystal detector/coupler for leveling the output power at the front panel output connector. For millimeter-wave applications this defaults to internal ALC mode using a detector/coupler internal to the HP 83550 series millimeter-wave source modules.
4. **ALC INPUT**. BNC connector for power meter or external crystal leveling inputs (rear panel on option 004).
5. **CAL**. Offset control for calibrating output power when leveling with a power meter or an external crystal detector.
6. **UNLEVELED** lamp. This lights if the output power is unleveled.
7. **RF OUTPUT**. Type-N, 50 ohm RF output connector (rear panel on option 004).
8. **[RF ON/OFF]**. Turns RF power on or off. Used when zeroing a power meter, or zeroing an AC/DC detector in DC mode or referencing an X-Y recorder.
9. **[CW FILTER]**. In CW mode, enables an oscillator tuning voltage filter to remove FM noise at the RF output (automatically disabled in swept mode).
10. **[POWER SWEEP]**. Used to set an increase or decrease in the power relative to sweep (dB/SWP).
11. **[POWER LEVEL]**. Used to set the RF output power level.

12. **[SLOPE]**. Used to set the frequency slope compensation in  $\pm$ dB/GHz (for use with lossy devices or waveguide).
13. **POWER CONTROL KNOB**. Used to control power level, power sweep, or slope.
14. **POWER DISPLAY**. Provides a readout of the selected power in dBm (to a tenth of a dB), db/GHz (to a hundredth of a dB), or dB/SWP (to a tenth of a dB).
15. **SOURCE MODULE INTERFACE**. Connector through which the RF plug-in sends and receives digital and analog signals to and from an HP 83550 series millimeter-wave source module (rear panel on Option 004). With the source module connected to the interface the HP 83550A assumes the characteristics of the source module.
16. **PLUG-IN LATCH HANDLE**. Used to remove, install, and latch the RF plug-in into the HP 8350 sweep oscillator.

## Rear Panel Features

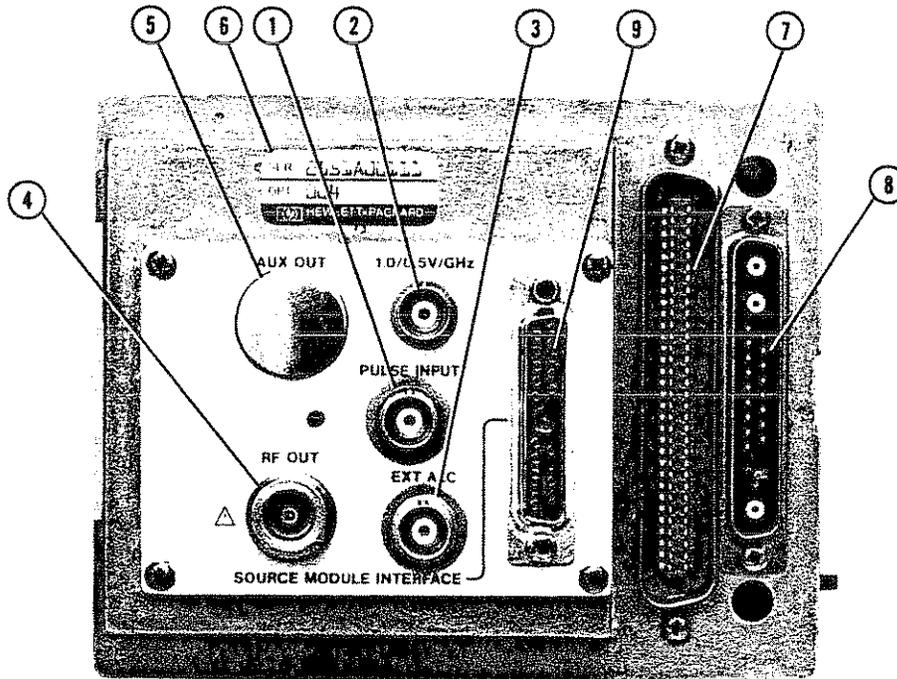


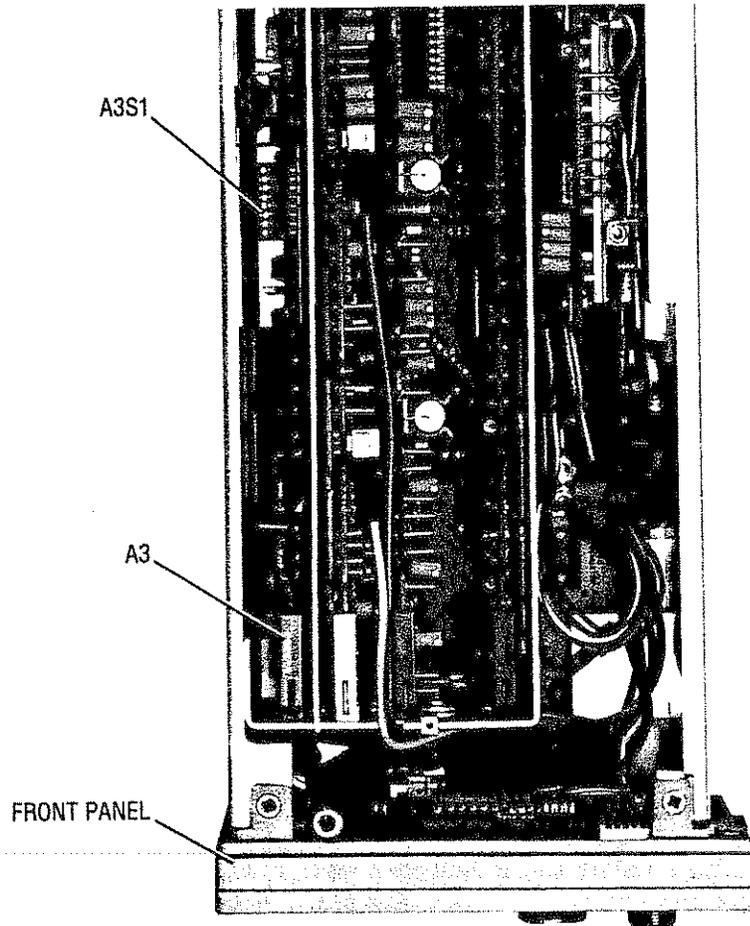
Figure 3-3. Option 004 Rear Panel

1. **PULSE INPUT.** External pulse or square wave modulation input (TTL levels).
2. **1.0/0.5 V/GHz.** Internally switch selectable (1 V/GHz or 0.5 V/GHz) with a BNC connector output that corresponds to the RF output frequency (8.0 to 18 GHz for 1 V/GHz and 8.0 to 20 GHz for 0.5 V/GHz). The HP 8410B/8411A network analyzer utilizes the 1.0 V/GHz output for phase-locking. See Figure 3-3 for instructions on how to set the frequency reference selection switch (A5S1).
3. **EXT ALC.** Replaces front panel EXT ALC connector on Option 004 plug-ins.
4. **RF OUTPUT.** Replaces front panel RF output connector on Option 004 plug-ins.
5. **AUX OUTPUT.** Type-N, 50 ohm connector that provides an 8.0 to 20.0 GHz fundamental Oscillator output at approximately 0 dBm on Option 006 plug-ins.
6. **SERIAL NUMBER LABEL.** Contains a ten digit serial number (for use in any correspondence concerning the plug-in) and applicable option number(s).
7. **RF PLUG-IN INTERFACE CONNECTOR.** Connector through which the RF plug-in receives and sends digital and analog signals from and to the HP 8350.
8. **RF PLUG-IN POWER SUPPLY INTERFACE CONNECTOR.** Connector through which the RF plug-in receives required power supplies, AM input, FM input, and VTUNE from the HP 8350.
9. **SOURCE MODULE INTERFACE.** Replaces front panel Source Module Interface connector on Option 004 plug-ins.

# Operating Instructions

## RF PLUG-IN CONFIGURATION SWITCH

The RF plug-in configuration switch is located on the digital interface assembly (A3), as shown in Figure 3-4.



*Figure 3-4. RF Plug-In Configuration Switch Location*

Configuration switch A3S1 is set at the factory for a combination of operating modes (see Table 3-3). Using three of the eight switch sections, you can select other operating modes. Table 3-3 defines each switch segment and the position of each for the different operating modes.

**NOTE:** Configuration switch settings override the HP 8350 memory settings at instrument preset. If you change the switch settings, you must press [INSTR PRESET] to load memory with the new configuration.

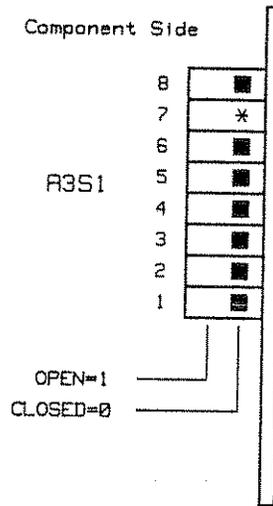
Table 3-3. RF Plug-In Configuration Switch Settings

Description	Switch Number							
	1	2	3	4	5	6	7	8
No RF Power at INSTRUMENT PRESET	x	x	x	1	x	x	x	x
RF Power at INSTRUMENT PRESET	x	x	x	0	x	x	x	x
-6 MHz/V Fm Sensitivity	x	x	x	x	1	x	x	x
-20 MHz/V FM Sensitivity	x	x	x	x	0	x	x	x
Step Attenuator, Option 002, Installed	x	x	x	x	x	x	1	x
No Step Attenuator, Option 002, Installed	x	x	x	x	x	x	0	x

Switch A3S1 is set from the factory as follows:

Switch No.	Position
1	0
2	0
3	0
4	0
5	0
6	0
7	*
8	0

\*"1" if Option 002 installed; "0" if Option 002 not installed.



**NOTES:**

Switch positions:

- 1 = Open = High
- 0 = Closed = Low (Ground)
- X = Don't Care

## FREQUENCY REFERENCE SELECTION SWITCH

Use position 2 on the frequency reference selection switch on the A5 assembly to set the desired frequency reference for your application. See Figure 3-5.

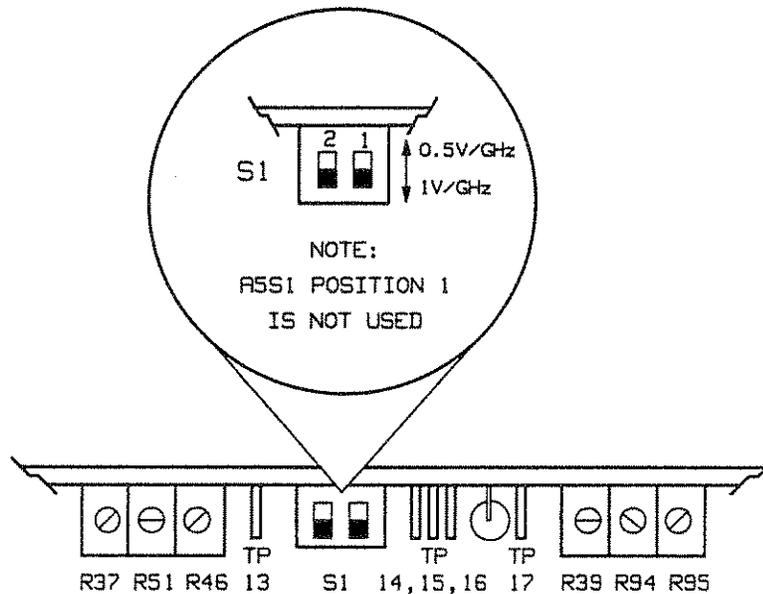


Figure 3-5. Frequency Reference Selection Switch, A5S1

## OPERATOR'S CHECKS

The Operator's Checks found under the Operating Information portion of the *HP 8350 Sweep Oscillator Operating and Service Manual* provides a quick evaluation (Local and Remote) of the main functions of both the HP 8350 and the 83550A.

If the instruments do not pass the operator's checks, the trouble may be in either unit. If you suspect the RF plug-in, refer to Section VIII, Service.

## MILLIMETER-WAVE APPLICATIONS

Figure 3-6 shows a typical millimeter-wave test set up using an HP 83550A. Note that the HP 83550 series millimeter-wave source modules use the 0.5 V/GHz as a frequency reference, this 0.5 V/GHz output is independent of the rear panel output and is not switch selectable. The 0.5 V/GHz in this application is routed from the source module interface, through the interface cable to the source module. The rear panel 1.0 V/0.5 V/GHz connector is not used for this purpose.

For details on millimeter-wave applications, refer to the *HP 83550A Source System Guide* portion of any of the millimeter-wave source module system manuals.

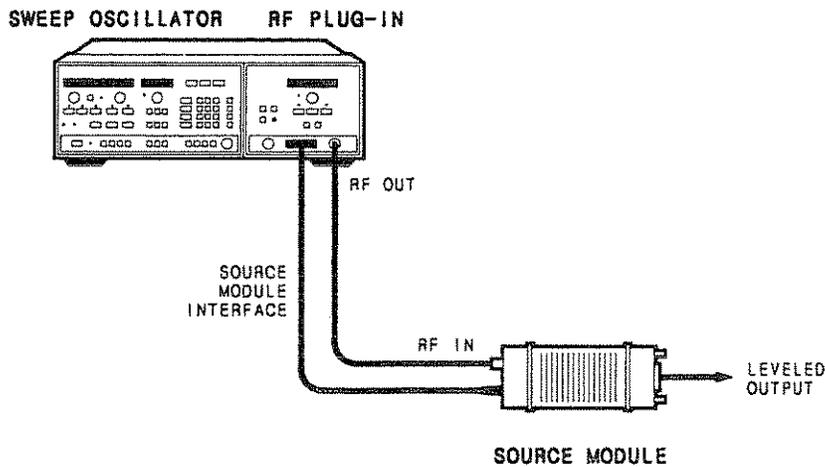


Figure 3-6. Typical Millimeter-wave Test Set Up



Turn HP 8350 AC power OFF before connecting or disconnecting the source module interface cable.

## INTERNAL LEVELING

Internal leveling is the most convenient method of RF output leveling (the default mode at INSTRUMENT PRESET). A portion of the RF output power is internally coupled/detected and the resulting DC voltage is applied to the automatic leveling control circuit (ALC) to maintain a constant power output. The DC voltage is proportional to the RF power at low power levels and at high power levels the voltage is proportional to the RF voltage.

## EXTERNAL CRYSTAL DETECTOR LEVELING

The RF output power can be leveled externally using a two resistor power splitter (or external directional coupler) and a negative output crystal detector. The advantage of a directional coupler is that it does not have as great a coupled loss as the 6 dB insertion loss of the power splitter, so you can obtain a higher maximum leveled output power, however it will typically have more ripple and slope.

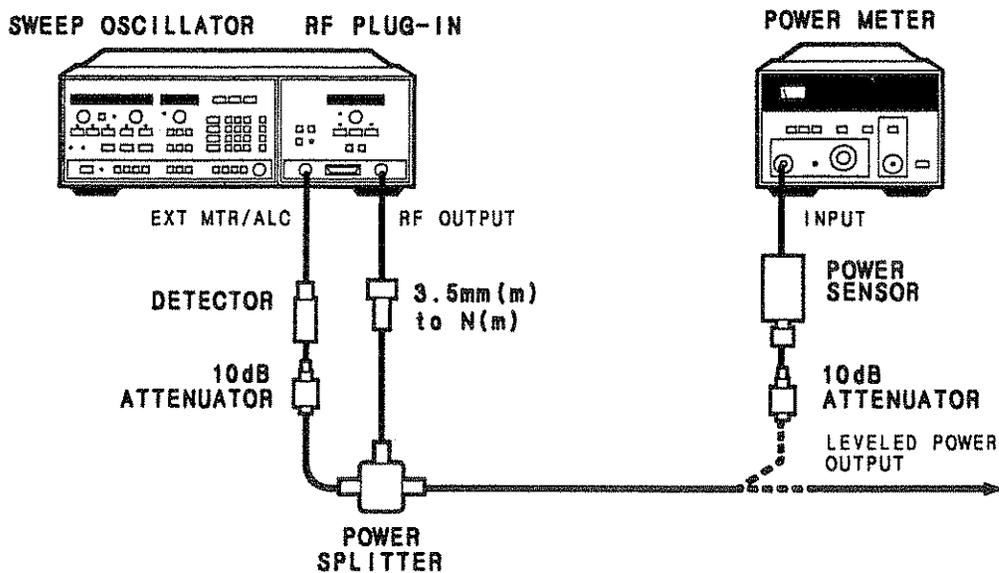


Figure 3-7. External Crystal Detector Leveling Set Up



Unleveled output power may exceed +24 dBm.

### Equipment

Sweep Oscillator	HP 8350
Power Meter	HP 436A
Power Sensor	HP 8485A
Crystal Detector	HP 8473C
Power Splitter	HP 11667B
10 dB Attenuator (2 required)	HP 8493C, Option 010
Adapter Type-N (m) to 3.5mm (m)	HP Part No. 1250-1743

### Procedure

1. Connect the equipment as shown in Figure 3-7. Turn the instruments on and allow them to warm up for at least 30 minutes.
2. On the HP 8350, press [INSTR PRESET] [CW].
3. On the HP 83550A, press [EXT], and adjust the CAL adjustment for a power meter reading equal to the reading on the plug-in front panel (subtract out the losses due to the power splitter).
4. To use leveled RF power output to test external equipment, make the connection at the point marked Levelled Power Output in Figure 3-7.

## EXTERNAL POWER METER LEVELING

RF output power can be leveled using a power meter and a power splitter (or directional coupler). When using power meter leveling, limit the sweep time to 100 seconds for best power level accuracy.

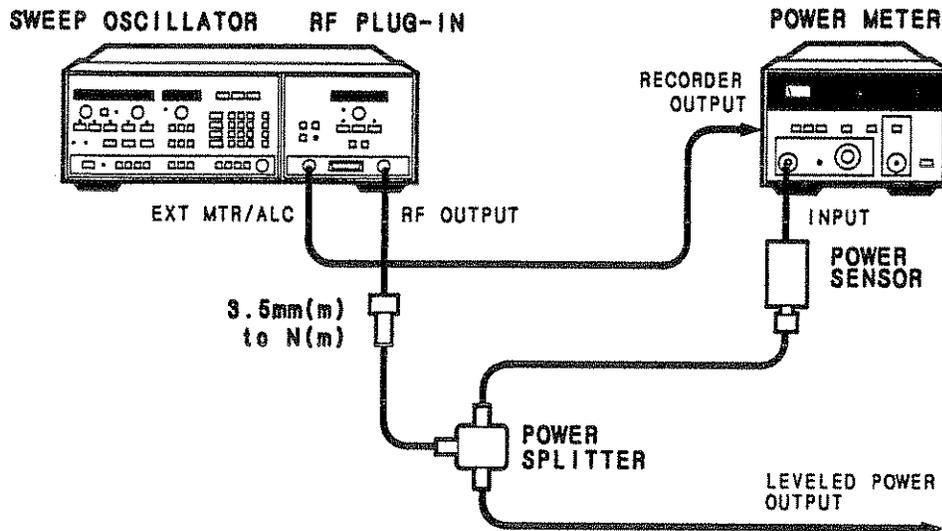


Figure 3-8. External Power Meter Leveling Set Up



Unleveled output power may exceed +24 dBm.

### Equipment

Sweep Oscillator	HP 8350
Power Meter	HP 436A
Power Sensor	HP 8485A
Power Splitter	HP 11667B
Adapter Type-N (m) to 3.5mm (m)	HP Part No. 1250-1743

### Procedure

1. Turn on the instruments and allow 30 minutes for warm-up.
2. Zero and calibrate the power meter/sensor.
3. Connect the equipment as shown in Figure 3-8. Select the +20 dBm range on the power meter.
4. On the HP 8350:
  - Press [INSTR PRESET].
  - Set SWEEP TIME to 100 sec.
  - Press [STOP] [1] [8] [GHz].

5. On the HP 83550A:

Set the power to maximum specified leveled output power (+20 dBm).

Press **[MTR]** to select external power meter leveling.

Adjust the ALC CAL for a +14 dBm reading on the power meter.

6. On the HP 8350:

Press **[SINGLE]** to set the single sweep mode. Press **[SINGLE]** again to start a sweep. Note that if you press **[SINGLE]** a third time, the sweep stops. Once single sweep is set, this key acts like an on/off switch for the sweep.

To use leveled RF output power for testing external equipment, make the connection at the point marked Leveled Power Output, in Figure 3-8.

## EXTERNAL FM

You can frequency modulate (FM) the HP 83550A RF output signal by applying an external modulation signal to the HP 8350 rear panel FM INPUT connector. A positive going voltage at the FM INPUT causes the output frequency to decrease, while a negative going voltage causes the output frequency to increase.

You can set the sensitivity of the modulating signal via the RF plug-in configuration switch (A3S1) (refer to Table 3-3). The coupling is set for cross-over coupling and is not changeable. The CW filter may be turned on while using the FM input.

## EXTERNAL AM

There are two types of external amplitude modulation:

### Pulse Modulation

Pulsed or square wave modulation can be applied to the HP 83550A rear panel PULSE IN connector. This input provides an on/off power ratio of greater than 30 dB below specified maximum leveled power and repetition rates from DC to 500 kHz, at any power setting.

For the best pulse modulation performance, set the RF output power at +30 dBm (unleveled). With this power setting, a pulse repetition rate of up to 5 MHz (square wave) is possible.

See Specifications and Supplemental Characteristics in Section I for more details on the modulation characteristics for this input.

### Amplitude Modulation

The HP 8350 rear panel AM INPUT provides logarithmic amplitude changes (14 to 20 dB depending on the options installed) proportional to the modulating input voltage. Frequency response is limited to approximately 100 kHz.

For maximum depth of modulation (maximum modulation index), set the power level to the middle of the output power range.

A positive DC voltage at the AM INPUT causes a decrease in the RF output power; a negative DC voltage causes an increase in the RF output power.

## RF POWER CONTROL

### Power Level

The standard HP 83550A provides a maximum leveled RF output power of +20 dBm (to 18.6 GHz), or +18 dBm (to 20 GHz). A front panel LED indicates when the RF output becomes unleveled. The power level is controlled by the front panel rotary pulse generator (RPG), the HP 8350 data entry controls (keypad and step keys), or through HP-IB control via the HP 8350. This function when enabled allows setting the output power level for all ALC modes. Calibrated power level is available during internal leveling only.

You can turn off the RF output with the **[RF ON/OFF]** key. Power ON is indicated by the LED in the center of the key. You can set the HP 83550A to have either 0 dBm output power or RF power OFF at INSTRUMENT PRESET. Refer to Table 3-3 for the proper configuration switch setting.

When you enter +30 dBm the high pulse performance mode is turned on. This mode turns off the sample and hold circuits so narrower pulse widths can be achieved. This mode also reduces AM noise.

### Power Sweep

When this function is enabled (LED on) the RF output power can be swept both positively and negatively over a selected power range. The level of the power sweep starting point is the power level programmed before the power sweep function is turned on. The settable range is -20 to +20 dB/SWP and is limited by the dynamic range of the ALC loop.

The power sweep width can be entered via the keyboard, step keys, or the RF plug-in RPG. The level of the power sweep end point is determined by the sum of the starting power level and the sweep width. Power sweep is turned off and reset to 0 dB/SWP whenever INSTRUMENT PRESET is initiated.

### Slope

When this function is enabled (LED on) the frequency slope compensation can be set via the keyboard, step keys or the RF plug-in RPG. It allows positive slope compensation for devices with linear losses proportional to frequency (cables) and negative slope compensation for devices with losses inversely proportional to frequency (waveguide). The settable range is -5 to +5 dB/GHz and is limited by the dynamic range of the ALC loop. Slope is turned off and reset to 0 dB/GHz whenever INSTRUMENT PRESET is initiated.

Because of hardware/firmware limitations, the level of the power sweep end point due to slope compensation, can not be greater than 20 dB above/below the starting level of power sweep. That is, effective values of slope compensation must be between +20 dB divided by the frequency span and -20 dB divided by the frequency span being swept.

### Option 002 — Attenuator

With Option 002, the RF output power can be continuously controlled from maximum leveled output power down to -50 dBm. Within the individual 10 dB attenuation steps, the ALC loop adjusts the output power to ensure optimum modulator range and stable output characteristics.

**[SHIFT] [POWER SWEEP].** When an HP 8350 front panel **[SHIFT]** function is used together with an HP 83550A **[POWER SWEEP]** function, you can control power within the ALC range without changing the attenuator settings. Data can be entered using the keyboard, step keys, or the RF plug-in RPG and the display disregards the attenuator settings and only displays the ALC setting.

The sum of the independent ALC power level (SHIFT POWER SWEEP) and the independent attenuator setting (SHIFT SLOPE) equal the RF power level (power displayed with the POWER LEVEL key).

This mode is exited by pressing either POWER LEVEL, POWER SWEEP, or SLOPE keys. The ALC and attenuator step setting are now automatically controlled by the firmware.

**[SHIFT] [SLOPE].** When an HP 8350 front panel **[SHIFT]** function is used together with an HP 83550A **[SLOPE]** function, you can control the attenuator step settings without affecting the ALC settings. Data can be entered using the keyboard, step keys, or the RF plug-in RPG and the display indicates the attenuator setting (0.0, -10.0, -20.0, -30.0, -40.0, or -50.0 are the possible values). Note that the keyboard entries are truncated down to a multiple of 10 dB.

The sum of the independent ALC power level (SHIFT POWER SWEEP) and the independent attenuator setting (SHIFT SLOPE) equal the RF power level (power displayed with the POWER LEVEL key).

This mode is exited by pressing either POWER LEVEL, POWER SWEEP, or SLOPE keys. The ALC and attenuator step setting are now automatically controlled by the firmware.

## **ALTERNATE SWEEP MODE**

If the Option 002 attenuator is installed and you select alternate sweep mode, a default condition of 1 second/sweep can occur. This default condition happens only when the POWER settings of the two alternate sweeps require that the attenuator switch after each sweep. So that the attenuator relay coils do not overheat, the attenuator is prevented from switching faster than 1 step per second.

## **HP-IB**

All front panel functions, except for the ALC CAL adjustment can be altered by computer control via the HP-IB connection on the HP 8350.

## **FIRMWARE REVISION NUMBER**

Press **[SHIFT] [9] [9]** on the HP 8350. The plug-in firmware revision number appears in the HP 83550A POWER display window. Various measurement systems (scalar, vector network analyzers) require a specific firmware revision. For compatibility requirements contact your local HP sales/service office for further information.

## PHASE-LOCK OPERATION

The required CW frequency for the HP 83550A is automatically tuned and locked by the HP 5344S microwave source synchronizer, with the HP 5344S acting as an HP-IB controller. No manual tuning is required. The HP 8350 sweep oscillator and the HP 5344S microwave source synchronizer must be set to the same HP-IB address.

**NOTE:** This set up can be used for phase-locking from 8.0 to 18.0 GHz, the range of the HP 11691D directional coupler. If the HP 83550A has Option 006 installed, the rear panel AUX OUTPUT signal can be used for phase-locking.

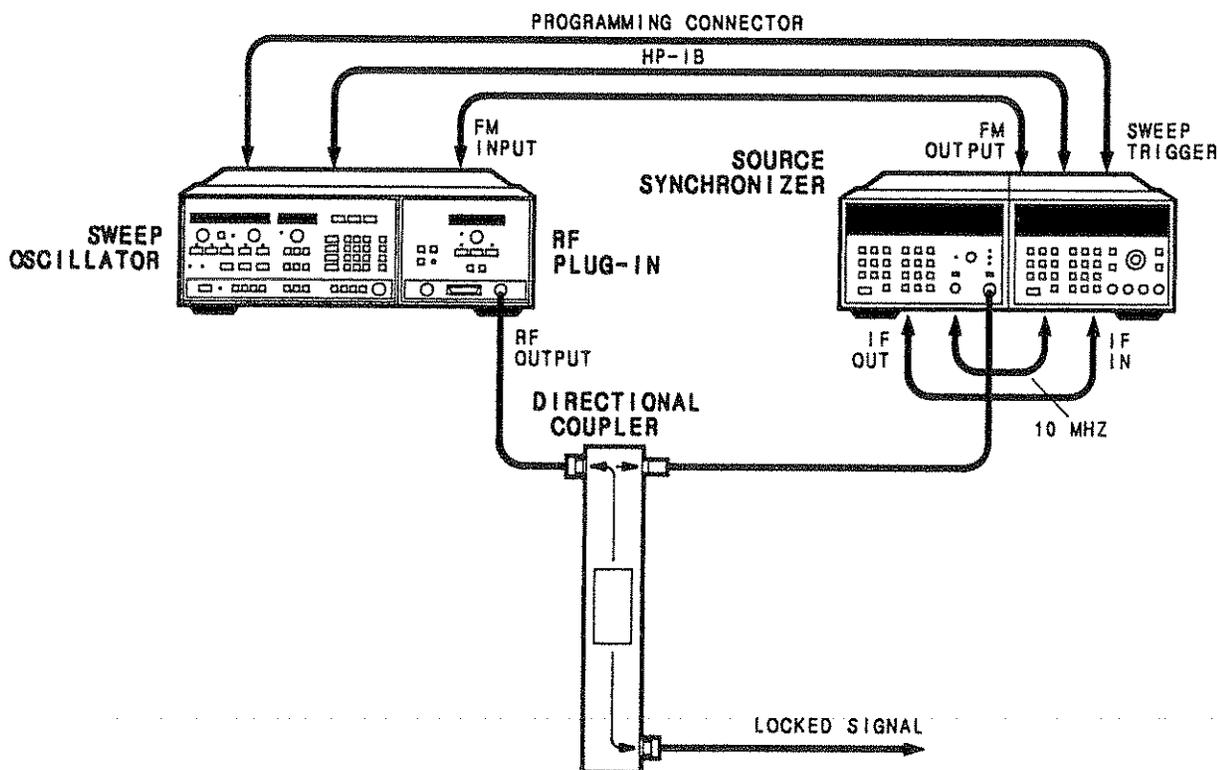


Figure 3-9. Phase-Locking Using the HP 5344S Microwave Source Synchronizer

### Equipment

Sweep Oscillator .....	HP 8350
Source Synchronizer .....	HP 5344S Option 043
Directional Coupler .....	HP 11691D

### Procedure

1. Set the HP 83550A configuration switch (A3S1) for an FM sensitivity of  $-6 \text{ MHz/V}$  (see Table 3-3).
2. Connect the equipment as shown in Figure 3-9. Turn the instruments on and let them warm up for at least one hour.

3. On the sweep oscillator, check the HP-IB address:

Press **[SHIFT] [LCL]**. The HP-IB address will be shown on the HP 8350 FREQUENCY/TIME display.

4. On the microwave source synchronizer:

Set the HP 5344S HP-IB address to the same address as the HP 8350 (factory set at 19, 10011).

Set the HP 5344S to the System Controller mode by setting the top HP-IB switch to the left (SYS CONT).

5. On the sweep oscillator/RF plug-in:

Press **[INSTR PRESET]**.

Press **[CW FILTER]** to turn it off.

Press **[POWER LEVEL]** and set a power level between 0 and +5 dBm.

6. On the microwave source synchronizer:

Check that both MANUAL LOCK and AUTO LOCK are set to off (pushbutton LEDs off). Verify that the front panel CONT lamp is on.

7. Press **[MODE]** until the CW annunciator lights. The **MODE** key will scroll through four modes of operation. If you pass CW, continue pressing **MODE** until you return to CW.

8. Enter the frequency required for the HP 83550A RF output signal.

Press **[AUTO LOCK]**. The HP 83550A RF output signal will now be programmed and locked to the specified CW frequency.

## **OPERATOR'S MAINTENANCE**

### **PLUG-IN ERROR CODES**

The HP 8350 sweep oscillator and the HP 83550A RF plug-in have a series of internal power-on self tests which will indicate an error code on either the HP 8350 frequency or the HP 83550A power displays, should a failure occur.

Error codes E001 through E016 are specific to the HP 8350 and indicate a possible failure in the sweep oscillator. Refer to the *HP 8350 Operating and Service Manual* for information and troubleshooting procedures.

Error code E050 through E079 are specific to the HP 83550A and indicate a possible failure in the RF plug-in. Refer to Section VIII, *Service* for more information.

Error codes E080 through E086 are specific to the HP 83550 series millimeter-wave source modules. The power-on tests are only performed if a source module is connected to the HP 83550A. Refer to Section VIII, *Service* for more information.

### **FUSES**

HP 83550A power supplies are fused in the HP 8350 sweep oscillator. Refer to the *HP 8350 Sweep Oscillator Operating and Service Manual* for fuse locations and replacement instructions.

### **BLUE SERVICE TAGS**

If the HP 83550A requires service, you can send the instrument to your local HP service organization, as described in Section II, *Installation*. Before sending the instrument in, fill out and attach one of the blue service tags. On the **FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS** portion of the tag, record any error codes noted.

