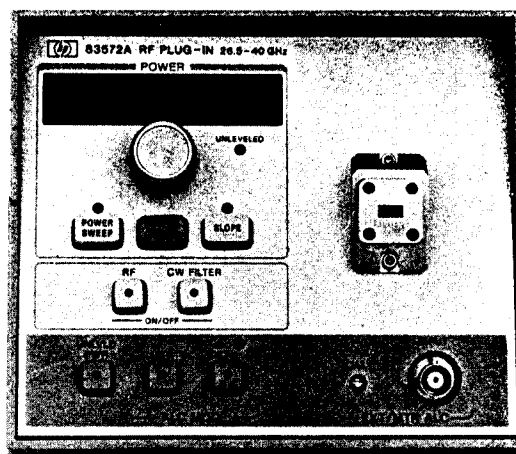


OPERATING AND SERVICE MANUAL

HP 83572A/B RF PLUG-IN 26.5 to 40 GHz



 HEWLETT
PACKARD

HP 83572A/B RF PLUG-IN (Including Options 001 and 006)

SERIAL NUMBERS

This manual applies directly to any HP Model 83572A RF Plug-In having a serial number with the prefix 2343A, or to any HP Model 83572B having a serial number with the prefix 2346A.

With changes described in Section VII, this manual also applies to any Model 83572A with a serial number prefixed 2304A or lower.

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

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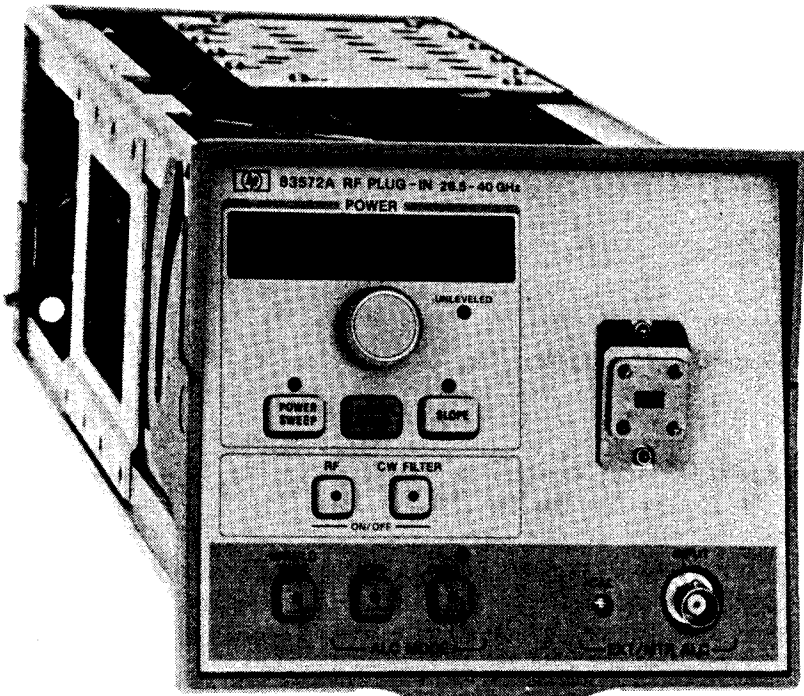


Figure 1-1. Model 83572A RF Plug-In

SECTION I GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard model 83572A/B RF Plug-In. The information provided here applies to both the 83572A and the 83572B unless specified otherwise. Figure 1-1 shows the model 83572A.

1-3. This manual is divided into eight major sections which provide the following information:

- a. SECTION I, GENERAL INFORMATION, includes a brief description of the instrument, safety considerations, specifications, supplemental characteristics, instrument identification, options available, accessories available, and a list of recommended test equipment.
- b. SECTION II, INSTALLATION, provides information for initial inspection, preparation for use, storage, and shipment.
- c. SECTION III, OPERATION, explains the frequency resolution characteristics of the RF Plug-In in CW and swept frequency modes. Operating instructions include FM switch parameter settings, and crystal and power meter leveling instructions. A description of front and rear panel features and Plug-In error codes is also given.
- d. SECTION IV, PERFORMANCE TESTS, presents procedures required to verify that performance of the RF Plug-In is in accordance with published specifications.
- e. SECTION V, ADJUSTMENTS, presents procedures required to properly adjust and align the model 83572A/B RF Plug-In after repair.
- f. SECTION VI, REPLACEABLE PARTS, provides information required to order all parts and assemblies.
- g. SECTION VII, MANUAL BACKDATING CHANGES, provides backdating information required to make this manual compatible with earlier shipment configurations of the model 83572A.
- h. SECTION VIII, SERVICE, provides an overall instrument block diagram with troubleshooting and repair procedures. Each assembly within the instrument is covered on a separate Service Sheet which contains a circuit description, schematic diagram, component location diagram, and troubleshooting information to aid in the proper maintenance of the instrument.

1-4. Supplied with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of the manual, which should be kept with the instrument for use by the instrument operator.

1-5. On the title page of this manual is a Microfiche part number. This number may be used to order 10- by 15-centimeter (4- by 6-inch) microfilm transparencies of the manual. Each microfiche contains up to 60 photo duplicates of the manual pages. The microfiche package also includes the latest Manual Changes sheet as well as all pertinent Service Notes.

1-6. Refer any questions regarding this manual, the Manual Changes sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a worldwide listing of HP Sales/Service Offices.

1-7. SPECIFICATIONS

1-8. Listed in Table 1-1 are the specifications for the model 83572A and 83572B RF Plug-Ins. Where the specifications for the model 83572A and 83572B are different, they are listed separately. Where the specifications for both instruments are the same, only one listing is supplied.

These specifications are the performance standards, or limits, against which the instrument may be tested. Table 1-2 lists the 83572A/B supplemental performance characteristics. Supplemental performance characteristics are not specifications but are typical characteristics included as additional information for the user.

1-9. SAFETY CONSIDERATIONS

1-10. This product has been manufactured and tested in accordance with international safety standards. Before operation, this product and related documentation must be reviewed for familiarization with safety markings and instructions. A complete listing of Safety Considerations precedes Section I of this manual.

1-11. INSTRUMENTS COVERED BY MANUAL

1-12. Attached to the rear panel of the instrument is a serial number plate. A typical serial number plate is shown in Figure 1-2. The serial number is in two parts. The first four digits followed by a letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The content of this manual applies directly to instruments having a serial number prefix that is listed on the title page of this manual under SERIAL NUMBER.

1-13. 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. In this case, the manual for the instrument is supplied with a Manual Changes supplement that contains information which documents the differences.

1-14. In addition to change information, the Manual Changes supplement may contain information for correcting errors in the manual. To keep this manual as current as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to the manual's print date and part number, both of which appear on the title page. Complimentary copies of the Manual Changes supplement are available on request from Hewlett-Packard.

1-15. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes Supplement, contact your nearest Hewlett-Packard Sales/Service Office.

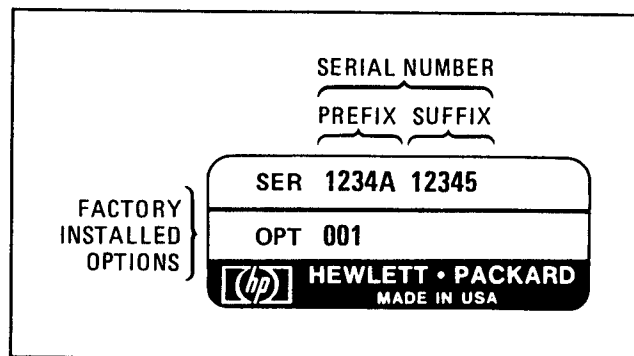


Figure 1-2. Typical Serial Number Plate

1-16. DESCRIPTION

1-17. The model 83572A/B is an RF Plug-In which has been designed for use with the model 8350A/B Sweep Oscillator. The model 83572A/B covers the frequency range of 26.5 to 40.0 GHz in a single band. A YIG Oscillator is used as the tunable RF frequency source.

1-18. The model 83572A/B front panel functional controls, pushbuttons, and the rotary pulse generator (RPG) are monitored by the model 8350A/B through the RF Plug-In interface circuits. The model 8350 generates a tuning voltage according to the mode of operation (CW, START/STOP, CF/ Δ F). This signal is scaled and offset by the Plug-In to provide a voltage ramp (in swept modes) proportional to the YIG Oscillator frequency. The model 83572A/B tuning circuits accept the tuning ramp output from the model 8350 and convert it to a current which drives the YIG Oscillator.

1-19. The standard model 83572A offers an unlevelled RF output power of at least +3 dBm (typically +4 to +5 dBm). The standard Model 83572B offers an unlevelled RF output power of at least +7 dBm (typically +8 dBm). The RF output power level is controlled by the model 83572A/B RPG, by the model 8350A/B data entry controls (keypad and step keys), or through HP-IB (Hewlett-Packard Interface Bus) control via the model 8350. A front panel LED indicates when the RF output is unlevelled. Front panel pushbuttons select either unlevelled power (UNLVLD

PWR), power meter leveling (MTR), or external crystal detector leveling (DET). A front panel EXT/MTR ALC input connector and gain control (CAL) are provided to use with an external leveling loop. Calibrated externally leveled power can be achieved with a standard model 83572A/B, by making internal adjustments to calibrate the instrument to an appropriate external coupler and crystal detector connected to the waveguide output. Refer to Section V, Adjustments, for the calibration procedure. The calibrated externally leveled output power mode is accessed by pressing [SHIFT] [DET]. In the SHIFT DET mode the CAL light above the DET pushbutton is lit, and the displayed power level is calibrated across the entire frequency band.

1-20. The RF output may be turned off with the [RF] ON/OFF pushbutton. An internal switch is set to select whether the RF is on or off at turn-on. RF power ON is indicated by the LED in the center of the pushbutton. Additionally, in CW mode, the [CW FILTER], when selected, places a capacitor across the YIG Oscillator tuning coil to filter high frequency noise which would appear at the RF output. All front panel functions, with the exception of the EXT/MTR ALC CAL adjustment, may be set or altered via the HP-IB bus connection on the model 8350. HP-IB is Hewlett-Packard's hardware, software, documentation, and support for IEEE-488 and IEC-625, worldwide standards for interfacing instruments.

1-21. The RF output may be externally amplitude or frequency modulated. An external mod-

ulation signal is applied to the 8350A/B rear panel AM INPUT or FM INPUT connector. FM coupling (direct coupled or cross-over) and sensitivity are selected by an internal configuration switch in the model 83572A/B. Refer to Section III, Operation, of this manual for detailed information on the configuration switch.

1-22. OPTIONS

1-23. The 83572A Option 001 offers calibrated externally leveled output power of at least +2 dBm in the SHIFT DET mode, the 83572B Option 001 at least +6 dBm. In this mode the CAL light above the DET pushbutton is lit, and the displayed power level is calibrated across the entire frequency band. The Option 001 incorporates a 10-dB directional coupler, a crystal detector, a BNC cable calibrated to the Plug-In, and a package of hex screws for attaching the waveguide flanges. Figure 1-3 illustrates the front panel attachments of the Option 001.

1-24. In the 83572A Option 001 a power sweep function allows the RF output power to be swept at least 7 dB, in the 83572B at least 11 dB, during CW or swept frequency modes. Power sweep is selected with the front panel [POWER SWEEP] pushbutton. Slope compensation control up to 5 dB/GHz (7 dB total calibrated dynamic range in the 83572A, 11 dB in the 83572B) is also available by selecting the [SLOPE] pushbutton and rotating the model 83572A/B RPG or manipulating the model 8350A/B data entry controls. LEDs above the [POWER SWEEP] and [SLOPE]

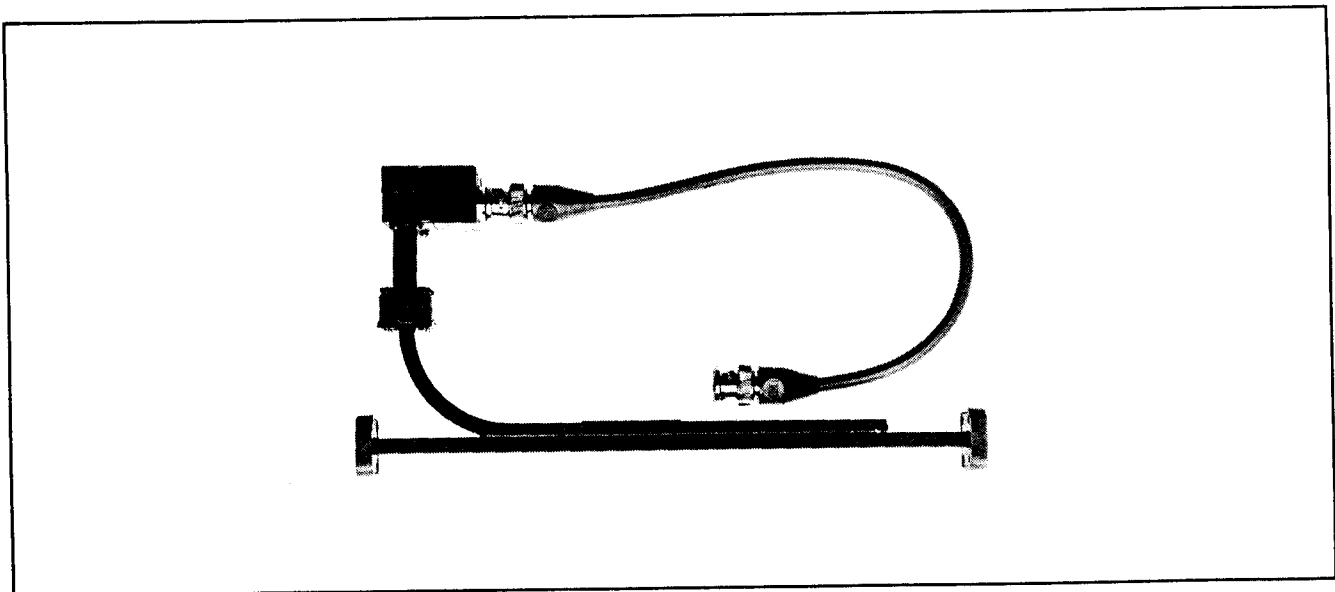


Figure 1-3. Option 001 Front Panel Attachments

pushbuttons indicate when these functions are operative. The power sweep function and slope compensation may both be selected and modified through HP-IB control with the model 8350.

1-25. The 83572A/B Option 006 provides internal squarewave modulation and external pulse and squarewave modulation capabilities, as well as RF amplitude markers. Internal squarewave modulation can be accessed by the 8350 front panel or through HP-IB. The modulation frequency is preset with a jumper in the 8350 either to 1 kHz or to 27.8 kHz for compatibility with Hewlett-Packard scalar network analyzers. For external pulse or squarewave modulation, a rear panel BNC connector accepts a modulating signal up to 1 MHz.

1-26. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-27. To have a complete operating Sweep Oscillator unit, the model 83572A/B RF Plug-In must be installed in a model 8350A/B Sweep Oscillator mainframe. Refer to Section II, Installation, of this manual for a detailed description of RF Plug-In installation.

1-28. EQUIPMENT AVAILABLE

1-29. Service Accessories

1-30. A service accessory kit (HP part number 08350-60020) is available for servicing the model 83572A/B RF Plug-In and the model 8350A/B Sweep Oscillator. HP part numbers for the individual pieces of the kit are provided in Table 1-3. The accessory kit includes:

- Two 44-pin printed circuit board extenders. These boards have keyed slots which allow them to be used in each of the keyed PC board receptacles in the model 83572A/B, and in the model 8350A/B as well.
- An RF Plug-In extender cable set that provides all electrical connections when the RF Plug-In is removed from the Sweep Oscillator. The RF Plug-In interface connector (P2) and the power supply interface connector (P1) are extended by separate cables.
- One hex balldriver for use in model 8350 front panel repairs.

- One 16-pin and one 20-pin I.C. test clip for probing integrated circuits.

1-31. A listing of service accessories available including service cables, wrenches, and extender boards is given in Table 1-3.

1-32. Model 8756A and Model 8755 Network Analyzers

1-33. The model 8350 Sweep Oscillator with the model 83572A/B RF Plug-In installed is compatible with the model 8756A programmable microprocessor-based network analyzer or the model 8755 network analyzer for broadband swept scalar measurements. The model 8350 provides internal 27.8 kHz squarewave amplitude modulation of the RF output (when the 83572A/B is an Option 006), eliminating unnecessary cable connections to the network analyzer or the use of an external modulator. The model 8350 can also produce alternate sweeps through use of the ALT n function which works in conjunction with the channel switching circuits in the model 8755C. This permits channel 1 on the 8755C to respond only to the model 8350 current state and channel 2 to the alternate state. A single cable (HP part number 8120-3174) connects between the model 8350 rear panel ALT SWP INTERFACE connector and the model 8755C front panel ALT SWP INTERFACE connector. Alternate sweep capability is also available between the 8756A and the 8350B through the HP 8756 System Interface.

1-34. Power Meters and Crystal Detectors

1-35. The RF output can be externally leveled using the HP model 432A Power Meter or negative polarity output crystal detectors. Refer to Section III, Operation, of this manual for detailed information on leveling techniques that may be used with the model 8350/RF Plug-In combination.

NOTE

The model 435A and 436A Power Meters should not be used for external leveling of the HP 83572A/B.

1-36. RECOMMENDED TEST EQUIPMENT

1-37. Equipment required for testing and adjusting the instrument is listed in Table 1-4. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table.

Table 1-1. Specifications for Model 83572A/B Installed in Model 8350A/B (1 of 2)

NOTE	
<p>The specifications provided here apply to both the 83572A and the 83572B except in the cases where separate listings are given.</p>	
<p>FREQUENCY¹ Range: 26.5 to 40.0 GHz</p>	
Accuracy (25°C ±5°C)	Stability
<p>CW Mode:² ±100 MHz</p> <p>All Sweep Modes: (Sweep time ≥100 ms) ±150 MHz</p> <p>Frequency Markers: (Sweep time ≥100 ms) ±150 MHz ±0.5% of sweep width</p>	<p>With 10% Line Voltage Change: ±1 MHz</p> <p>With 10 dB Power Level Change: ±200 kHz</p> <p>With 3:1 Load SWR: ±100 kHz</p> <p>Residual FM, Peak: (10 Hz to 10 kHz Bandwidth) (CW Mode with CW Filter) <60 kHz</p>
<p>POWER OUTPUT¹ (25°C ±5°C)³</p>	
<p>Minimum Unleveled Output Power:</p> <p>83572A +3 dBm 83572B +7 dBm</p> <p>Option 001 (at output of external leveling coupler) 1.0 dB less than standard Option 006 (at waveguide output of plug-in) 1.5 dB less than standard Option 001/006 (at output of external leveling coupler) 2.5 dB less than standard</p>	
<p>Power Variation:</p> <p>Externally Leveled: Negative Crystal Detector ALC Mode:^{4,5} ±0.2 dB Power Meter ALC Mode:⁶ ±0.2 dB</p>	
<p>Residual AM in 100 kHz Bandwidth: (in dB below carrier) ≥50 dB</p>	
<p>Spurious Signals: (in dB below carrier) Inband: ≥50 dB</p>	
<p>Output SWR</p> <p>Unleveled: <2.0 Option 001 (externally leveled)⁴: <1.5</p>	
<p>Resolution (displayed): 0.1 dB/GHz</p>	
<p>Remote Programming (Settable): ±0.01 dB</p>	

Table 1-1. Specifications for Model 83572A/B Installed in Model 8350A/B (2 of 2)

MODULATION											
<p>External AM</p> <p>Maximum Input: 15 V</p>											
<p>Internal Square Wave Modulation (Option 006 Only)</p> <p>Selectable (by internal jumper in 8350A/B) to 1 kHz or 27.8 kHz squarewave modulation. 27.8 kHz modulation ensures operation with Hewlett-Packard scalar network analyzers.</p> <p>On/Off Ratio: Symmetry: 50% ±5% (25°C ±5°C) ≥20 dB</p>											
<p>External FM</p> <p>Maximum Deviation for Modulation Frequencies:</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; width: 80%;"> <thead> <tr> <th style="padding: 5px;">Modulation Frequency</th> <th style="padding: 5px;">Cross-Over Coupled</th> <th style="padding: 5px;">Direct Coupled⁷</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">DC to 100 Hz</td> <td style="padding: 5px;">±150 MHz</td> <td style="padding: 5px;">±6 MHz</td> </tr> <tr> <td style="padding: 5px;">100 Hz to 200 kHz</td> <td style="padding: 5px;">±3.5 MHz</td> <td style="padding: 5px;">±3.5 MHz</td> </tr> </tbody> </table>			Modulation Frequency	Cross-Over Coupled	Direct Coupled ⁷	DC to 100 Hz	±150 MHz	±6 MHz	100 Hz to 200 kHz	±3.5 MHz	±3.5 MHz
Modulation Frequency	Cross-Over Coupled	Direct Coupled ⁷									
DC to 100 Hz	±150 MHz	±6 MHz									
100 Hz to 200 kHz	±3.5 MHz	±3.5 MHz									
GENERAL SPECIFICATIONS											
<p>Minimum Sweep Time (over full range): 10 ms</p> <p>RF Output Waveguide Connector: EIA size WR 28 waveguide. Mates with JAN UG-599 flange.</p>											
<ol style="list-style-type: none"> 1. Unless otherwise noted, all specifications are at the RF OUTPUT waveguide connector and at 0° to 55°C. 2. Approach desired frequency from low end of band. 3. For temperatures greater than 30°C, output power typically degrades 0.1 dB/°C. 4. Sweep time ≥100 msec. 5. Excludes coupler and detector variation. For external leveling crystal detector output should be between -10 mV and -200 mV. 6. Use HP Model 432A/B/C Power Meter. Sweep duration ≥100 seconds. 7. Crossover-coupled and direct-coupled external FM capabilities are selectable by internal switch in the RF Plug-In. 											

Table 1-2. Supplemental Performance Characteristics for Model 83572A/B
Installed in Model 8350A/B (1 of 2)

NOTE	
<p>Values in this table are not specifications, but are intended to provide information useful in applying the instrument by giving typical but non-warranted performance parameters.</p>	
NOTE	
<p>The performance characteristics provided here apply to both the 83572A and the 83572B except in the cases where separate listings are given.</p>	
FREQUENCY CHARACTERISTICS¹	
Accuracy (25°C ±5°C)	Stability
CW Mode: ² ±20 MHz	With Temperature: ±8 MHz/°C
Manual Sweep: ≤±100 MHz	With Time: ±4 MHz (in a 10-minute period after one hour warmup at the same frequency setting)
All Sweep Modes: ≤±100 MHz (sweep time 10 ms to 100 ms)	Residual FM, Peak: <10 kHz (10 Hz to 10 KHz bandwidth) (CW Mode with CW Filter)
Sweep Mode Linearity: ≤±50 MHz	
OUTPUT CHARACTERISTICS¹	
<p>Power Output: Stability with Temperature: ±0.1 dB/°C</p> <p>Range of Power Level Control Unleveled Output: 30 dB Externally Leveled (Option 001): 83572A 7 dB 83572B 11 dB Option 001/006 1.5 dB less</p> <p>Power Level Accuracy (25°C) Option 001 (externally leveled): ±1.5 dB</p> <p>Power Variation Unleveled Output: ±3 dB</p> <p>Spurious Signals (in dB below carrier) Second Harmonic: ≥20 dB</p>	<p>Output SWR: Unleveled: <1.6 Option 001 (externally leveled): <1.3</p> <p>Power Sweep (Option 001 only)³ Calibrated Range 83572A ≥7 dB 83572B ≥11 dB Option 001/006 1.5 dB less Accuracy (including linearity): ±1.5 dB</p> <p>Slope Compensation (Option 001 only)³ Linearity: <0.2 dB Calibrated Range: up to 5 dB/GHz For Full Sweep Width 83572A 7 dB 83572B 11 dB Option 001/006 1.5 dB less</p>

Table 1-2. Supplemental Performance Characteristics for Model 83572A/B
Installed in Model 8350A/B (2 of 2)

MODULATION CHARACTERISTICS			
External AM			
Frequency Response: DC to 10 kHz			
Input Impedance: 30k Ohms nominal			
Range of Amplitude Control: Unleveled 30 dB			
Externally Leveled (Option 001):			
83572A 7 dB			
83572B 11 dB			
(Option 001/006) 1.5 dB less			
Sensitivity: Externally leveled (Option 001): 1 dB/V			
External Pulse and Square Wave Modulation (Option 006 only, unleveled output)			
TTL Compatible: Logic HIGH=RF ON, Logic LOW=RF OFF			
Rise Time: 300 ns			
Fall Time: 50 ns			
Minimum Pulse Width: 500 ns			
Modulation Rate: 500 Hz to 1 MHz			
On/Off Ratio: 26 dB			
External FM			
Frequency Response (DC to 200 kHz): ± 3 dB			
Sensitivity (switch selectable):			
FM Mode: -20 MHz/V			
Phase-Lock Mode: -6 MHz/V			
Direct Coupled: -20 MHz/V			
Input Impedance: 2k Ohms nominal			
GENERAL CHARACTERISTICS			
Weight: Net 5.1 kg (11.3 lb.), Shipping 8.4 kg (18.6 lb.)			
83572-60071 DC1 DIRECTIONAL COUPLER 10 dB			
Frequency (GHz)	26.5 to 40	Directivity	≥ 36 dB
Mean Coupling Accuracy ⁴	$\leq \pm 0.8$ dB	SWR (Main Guide)	≤ 1.05
Coupling Variation	$\leq \pm 0.6$ dB	SWR (Auxiliary Arm)	≤ 1.2
<ol style="list-style-type: none"> 1. Unless otherwise noted, all characteristics are at the RF OUTPUT connector and at 0° to 55°C. 2. Approach desired frequency from low end of band. 3. Power sweep and slope compensation total must not exceed 7 dB for the 83572A or 11 dB for the 83572B (1.5 dB less for Option 001/006). 4. Mean coupling is the average of the maximum and minimum coupling values. 			

Table 1-3. Service Accessories Available

Name	HP Part Number	Description
44-pin printed circuit board extender	08350-60031*	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 in slotted box/open end 15/64 in open end
Service Cables	8120-1578 83525-60019	18 in Coax with SMA (m) connector on each end 10 in Coax with SMB snap on (f) and SMA (m)
Hex Balldriver	8710-0523*	Removes front panel hold down plate hex screws in 8350A/B
IC Test Clip	1400-0734* 1400-0979*	16-pin IC test clip 20-pin IC test clip

*These items are included in a Service Accessories Kit HP Part No. 08350-60020 (2 board extenders are included in this kit).

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

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	No substitute	HP 8350A/B	P,A,T
Digital Voltmeter (DVM)	Range: -50V to +50V Accuracy: $\pm 0.01\%$ Input Impedance: $\geq 10\text{M Ohms}$	HP 3456A	A,T
Oscilloscope	Dual Channel Bandwidth: DC to 100 MHz Vertical Sensitivity: $\leq 5\text{mV/DIV}$ Horizontal Sweep Rate: $\leq 0.1 \text{ uS/DIV}$ External Sweep Capability	HP 1740A	P,A,T
Oscilloscope Probes	1:1 General Purpose Probe 10:1 Probe	HP 10008B HP 10040A	A,T A,T
Spectrum Analyzer	Frequency Range: 18.6 to 40.0 GHz Residual FM: <100 Hz peak Compatible with HP 11970A External Harmonic Mixer	HP 8566A	P,A,T
Microwave Power Amplifier	No Substitute	HP 11975A	P,A,T
External Harmonic Mixer	No Substitute	HP 11970A	P,A,T
Crystal Detector	Frequency Response: 26.5 to 40.0 GHz Maximum Input Power: 100 mW Waveguide connector size WR28	HP R422A	P,A
Frequency Meter	Frequency Accuracy: $\leq 0.12\%$ Calibration Increments: $\leq 10 \text{ MHz}$ Frequency Range: 26.5 to 40.0 GHz Waveguide connector size WR28	HP R532A	P,A
Function Generator	Frequency Range: 0.1 Hz to 10 MHz Sinewave and squarewave output Output Level: 10 Vp-p into 50 Ohms Output Level Flatness: $< \pm 3\%$ from 10 Hz to 100 kHz $< \pm 10\%$ from 100 kHz to 10 MHz	HP 3312A	P,A,T
Power Meter	Power Range: -20 to +10 dBm (No substitute when used for external power meter leveling.)	HP 432A	P,A
Power Sensor	Frequency Range: 26.5 to 40.0 GHz Maximum SWR: ≤ 2.0 Waveguide connector size WR28	HP R486A	P,A

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

Instrument	Critical Specifications	Recommended Model	Use*
Directional Coupler	Frequency Range 26.5 to 40.0 GHz Nominal Coupling: 10 dB Maximum Coupling Variation: ± 0.6 dB Minimum Directivity: 40 dB Waveguide connector size WR28	HP R752C	P
RMS Voltmeter	dB Range: -20 to -70 dBm (0 dBm = 1 mW into 600 Ohms) Frequency Range: 10 Hz to 10 MHz Accuracy: $\pm 5\%$ of full scale	HP 3400A	P
Vane Attenuator	Frequency Range: 26.5 to 40.0 GHz Incremental Attenuation 0 to 50 dB Calibration Accuracy: $\leq \pm 0.1$ dB Waveguide connector size WR28	HP R382A	P,A,T
Adjustable Short	Frequency Range: 26.5 to 40.0 GHz Waveguide connector size WR28	HP R920B	P
60 cm (24 in) cable	Limits bandwidth to approx 100 Hz	HP 11170B	P
Adjustable AC Line Transformer	100-120V 220-240V	General Radio W5MTB W10HM73	P
Line Monitor	120V 240V	RCA WV 120B RCA WV 503A	P
PC Board Extender	44-pin, extends printed circuit boards	HP Part No. 08350-60031	A,T

*P = Performance Test; A = Adjustments; T = Troubleshooting

SECTION IV PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the 83572 RF plug-in/8350 sweep oscillator combination with the specifications of the plug-in used as the performance standards. These specifications may be found in Section I of this manual. Due to the extended frequency range of the 83572A/B, the performance tests in the 8350A/B Operating and Service Manual do not apply. None of the tests require access to the interior of the 83572A/B RF plug-in.

NOTE

Allow the 83572A/B RF plug-in and the 8350A/B sweep oscillator to warm up for one hour prior to doing any performance tests.

4-3. EQUIPMENT REQUIRED

4-4. Equipment required for testing or adjusting the 83572A/B is listed in Section I, Table 1-4. Any equipment which satisfies the critical specifications listed in Table 1-4 may be substituted for the recommended model.

4-5. TEST RECORD

4-6. The Performance Test Record, Table 4-2, provides a tabulated index of the performance

tests, their acceptable limits, and a column for recording actual measurements.

4-7. The test procedures should be performed in the order they are documented in this manual.

4-8. RELATED ADJUSTMENTS

4-9. Table 4-1 lists the performance tests, and references associated adjustments that are provided in Section V of this manual. If the result of a performance test is out of the specified limits, the associated adjustment may correct this condition.

4-10. CALIBRATION CYCLE

4-11. The performance tests listed in Table 4-1 should be performed at intervals of one year or less.

4-12. OPERATION VERIFICATION

4-13. Operation Verification is a subset of the performance tests, providing reasonable assurance that the 8350A/B sweep oscillator and the RF plug-in are operating properly and should meet the needs of an incoming inspection (80% verification). Paragraph 4-5 in the 8350B Operating and Service Manual specifies these tests and includes an HP-IB Operation Verification program for use with a 9825A/B desktop computer.

Table 4-1. Performance Tests and Associated Adjustments

Performance Test	83572A/B Adjustment Paragraph	8350B Adjustment Paragraph
4-14. Frequency Range and Accuracy CW Accuracy Swept Frequency Accuracy Marker Accuracy	5-14 through 5-16 5-14 through 5-17 5-14 through 5-17	5-19
4-15. Output Amplitude Minimum Unleveled Output Power Power Variation Crystal Detector Leveling Power Meter Leveling	5-18 5-18 through 5-22 5-18 through 5-23	
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4-14. FREQUENCY RANGE AND ACCURACY TEST

SPECIFICATION:

Range: 26.5 to 40.0 GHz	
Accuracy (25°C ±5°C)	
CW Mode	±100 MHz
All Sweep Modes (Sweep Time ≥100 ms)	±150 MHz
Frequency Markers (Sweep Time ≥100 ms)	±150 MHz ±0.5% of sweep width

DESCRIPTION:

A spectrum analyzer is used to check frequency range and accuracy in the CW mode. An external harmonic mixer extends the frequency range of the spectrum analyzer into the 26.5 to 40 GHz range. A frequency meter is used to check swept frequency accuracy and markers in the START/STOP mode.

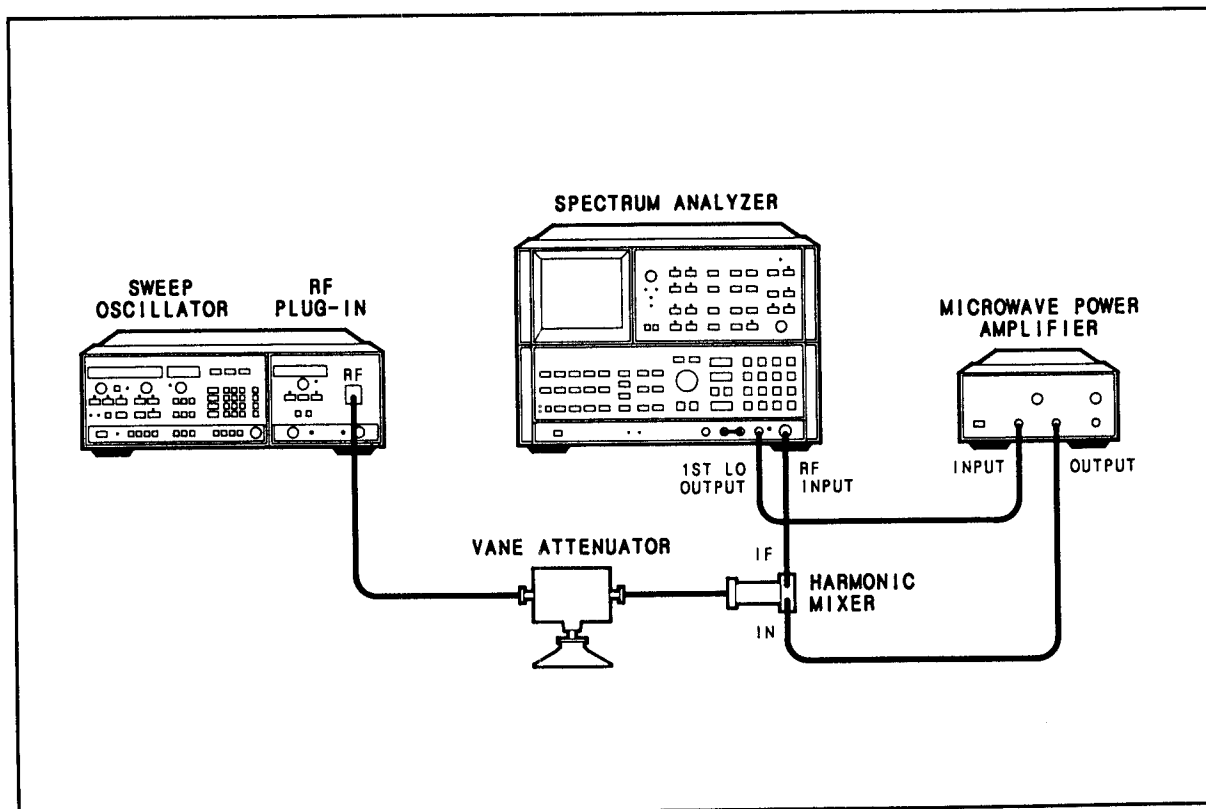


Figure 4-1. Frequency Range and CW Accuracy Test Setup

4-14. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

EQUIPMENT:

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Frequency Meter	HP R532A
Oscilloscope	HP 1740A
Crystal Detector	HP R422A

NOTE

When the frequency range of the spectrum analyzer is extended using the external harmonic mixer, the response is unpreselected. Many signals are displayed, and a signal identification procedure is required. The signals of interest are an identical pair with a separation of 642.8 MHz, and the left one of the pair is frequency calibrated. To center the RF signal from the 83572A/B on the CRT of the spectrum analyzer, press 8566A [PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN].

PROCEDURE

1. Connect the equipment as shown in Figure 4-1. Set the vane attenuator to 20 dB.
2. Set the spectrum analyzer controls as follows:

Press [SHIFT] [▲]
 CENTER FREQUENCY 26.5 GHz
 FREQUENCY SPAN 300 MHz

3. Press 8350A/B [INSTR PRESET]. Note that the START frequency displayed is 26.5 GHz and the STOP frequency displayed is 40 GHz.

Frequency Range

4. Press 8350A/B [CW] [2] [6] [.] [5] [GHz]. If the frequency observed on the spectrum analyzer is greater than 26.50 GHz, rotate the 8350A/B CW control counterclockwise until the frequency on the spectrum analyzer is at or below 26.50 GHz. Enter the spectrum analyzer reading on the test record.
5. On the spectrum analyzer enter [CENTER FREQUENCY] [4] [0] [GHz]. Press 8350A/B [4] [0] [GHz]. If the frequency observed on the spectrum analyzer is lower than 40.00 GHz, rotate the 8350A/B CW control clockwise until the spectrum analyzer indicates a frequency of 40 GHz or above. Enter the spectrum analyzer reading on the test record.

Frequency Accuracy

6. Set the 8350A/B to the three following CW frequencies (28.00, 32.00, and 39.00 GHz), and check that the spectrum analyzer reading at each frequency is accurate ± 100 MHz. Record the spectrum analyzer readings on the performance test record.

4-14. FREQUENCY RANGE AND ACCURACY TEST (Cont'd)

Swept Frequency Accuracy

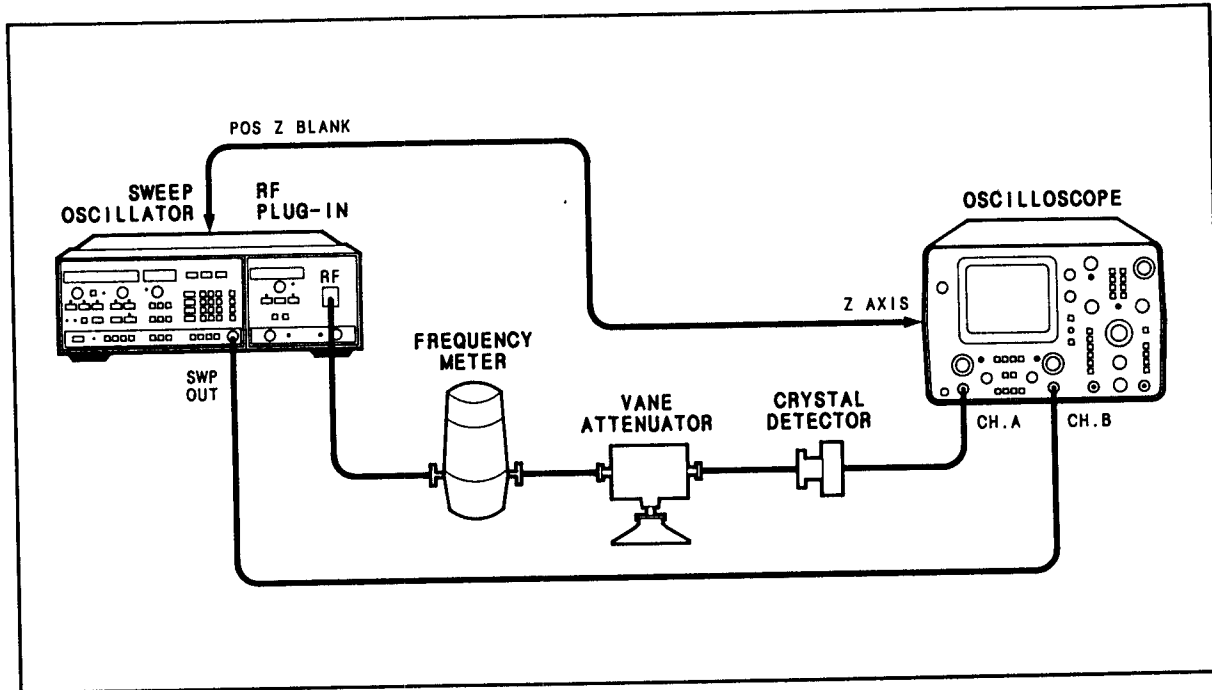


Figure 4-2. Swept Frequency Accuracy Test Setup

7. Connect the equipment as shown in Figure 4-2. Set the vane attenuator to 15 dB. Set the oscilloscope to A vs B mode; set channel A to 50 mV/DIV and channel B to 1V/DIV. Press 8350A/B [INSTR PRESET] [SWEEP TIME] [1] [0] [5] [msec].
8. Set the frequency meter to position the lowest point of the dip at the start of the oscilloscope trace (left edge).
9. Verify the frequency meter indication is 26.5 GHz \pm 150 MHz. Enter the reading on the test record.
10. Set the frequency meter to position the lowest point of the dip at the end of the oscilloscope sweep (right edge of the trace).
11. Verify the frequency meter indication is 40 GHz \pm 150 MHz. Enter the reading on the test record.

Frequency Marker Accuracy

12. Press 8350A/B [INSTR PRESET] and set the sweep time to 105 msec.
13. On the 8350A/B enter three marker frequencies as follows:

[M1] [2] [7] [GHz]
 [M2] [3] [3] [GHz]
 [M3] [3] [9] [GHz]

14. Set the frequency meter dip coincident with each marker and verify that the frequency meter indicates the marker frequency \pm 217 MHz (\pm 150 MHz \pm 0.5% of sweep width). Enter the frequency meter indications on the test record.

4-15. OUTPUT AMPLITUDE TEST

SPECIFICATION:

Power Output (25°C ±5°C)	
Minimum Unleveled Output Power	83572A +3 dBm 83572B +7 dBm
Option 001 (at output of external leveling coupler)	1.0 dB less than standard
Option 006 (at waveguide output of plug-in)	1.5 dB less than standard
Option 001/006 (at output of external leveling coupler)	2.5 dB less than standard
Power Variation	
Externally Leveled	
Negative Crystal Detector (excluding coupler and detector variation)	±0.1 dB
Power Meter	±0.1 dB

DESCRIPTION:

The 8350A/B is set to a 100 second sweep time and the minimum power point is measured with a power meter.

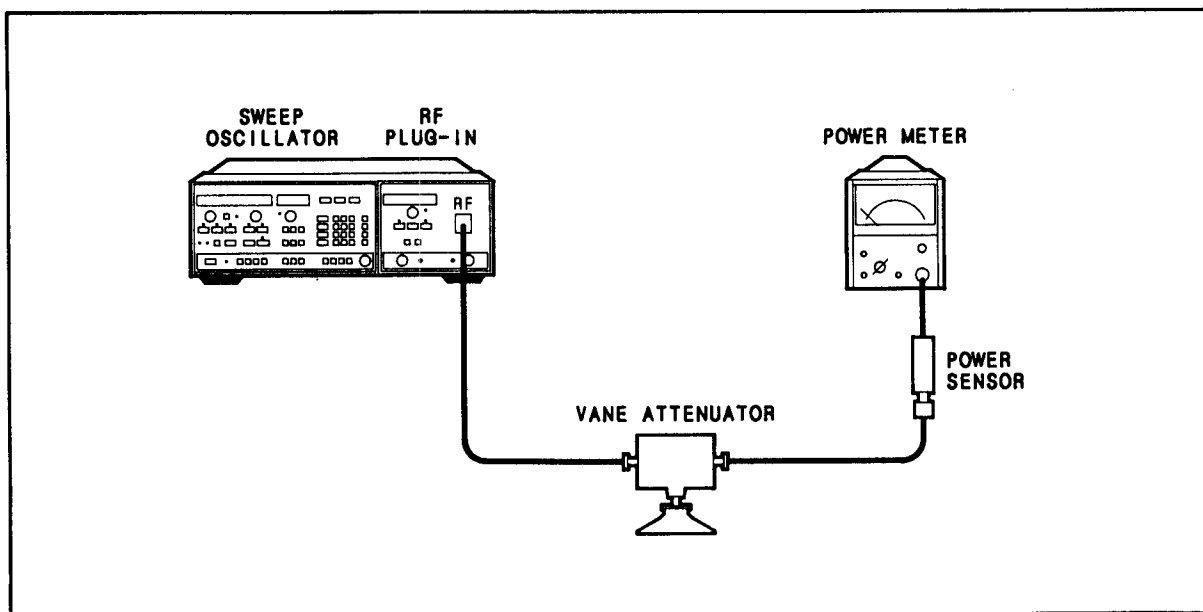


Figure 4-3. Output Amplitude Test Setup

4-15. OUTPUT AMPLITUDE TEST (Cont'd)

EQUIPMENT:

Power Meter	HP 432A
Power Sensor	HP R486A
Vane Attenuator	HP R382A
Oscilloscope	HP 1740A
Directional Coupler	HP R752C
Crystal Detector	HP R422A

PROCEDURE:

Minimum Unleveled Output Power

1. Connect the equipment as shown in Figure 4-3. Set the vane attenuator to 10 dB. Calibrate the power meter.
2. On the 8350A/B, make the following entries:

```
[INSTR PRESET]
[SINGLE TRIGGER]
[SWEEP TIME] [1] [0] [0] [s]
[POWER LEVEL] [1] [5] [dBm]
```

3. Press [SINGLE] to initiate a sweep and note the minimum power level indication on the power meter during the forward sweep. (Be aware of the calibration factor of the power sensor.) Add 10 dB to the power meter reading to account for the 10 dB loss through the attenuator. Enter this calculated power level on the test record.

Power Variation (Externally Leveled)

A. Negative Crystal Detector Leveling

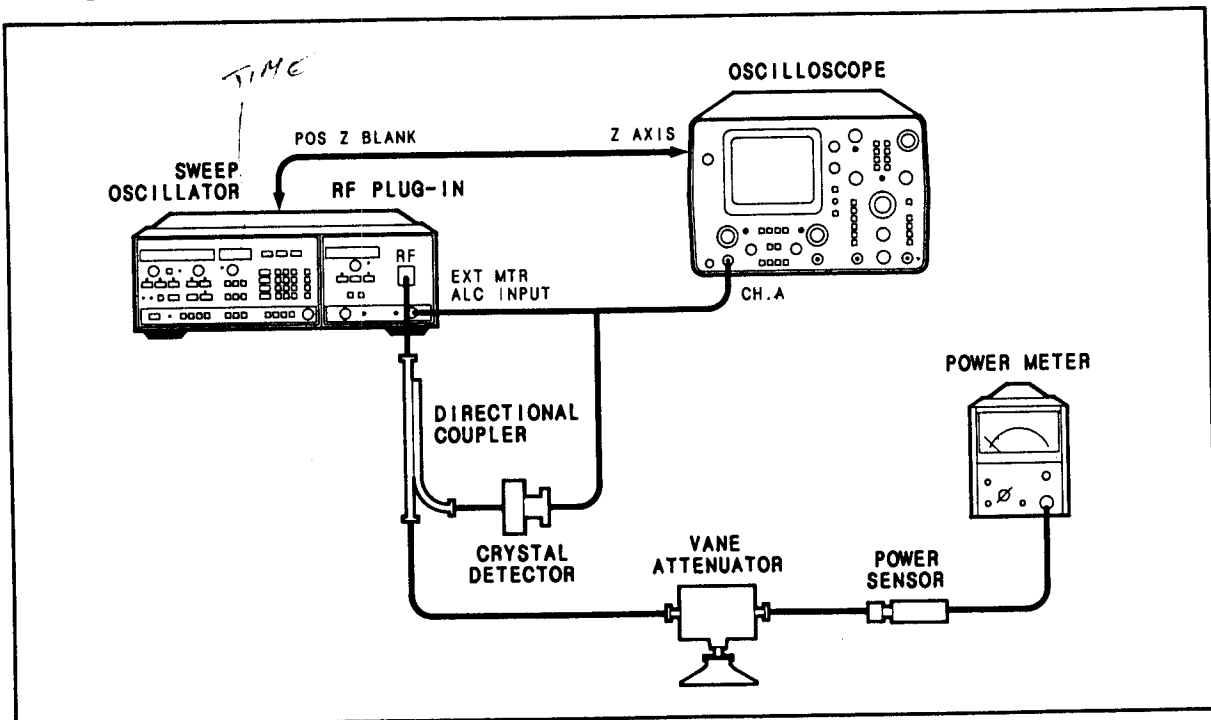


Figure 4-4. Crystal Detector Leveling Test Setup

4-15. OUTPUT AMPLITUDE TEST (Cont'd)

4. Connect the equipment as shown in Figure 4-4. Set the vane attenuator to 10 dB.
5. On the 8350A/B press **[INSTR PRESET] [TIME] [.] [1] [s] [CW]**. On the RF plug-in, reduce the displayed power level by 1 dB unless the instrument is an Option 001.
6. On the 83572A/B press **[EXT] ALC MODE**. Adjust the ALC CAL to calibrate the power meter reading with the plug-in POWER display, taking into account the 10 dB loss through the vane attenuator.
7. Vary the 83572A/B RF output power ± 0.1 dB from this reference as noted on the power meter, and mark the level of the oscilloscope trace at both extremes.
8. Return the 83572A/B RF output power to its original setting. Press 8350A/B **[START]**. The entire trace on the oscilloscope should be within the window between the two marks.

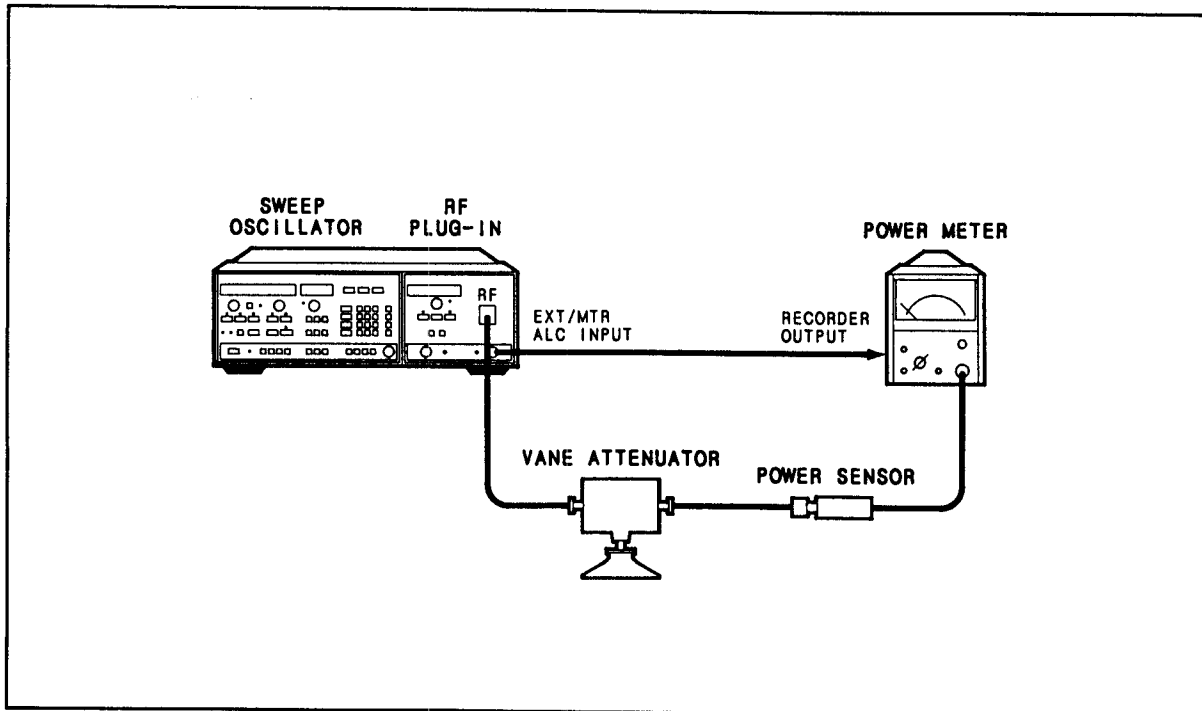
B. Power Meter Leveling

Figure 4-5. Power Meter Leveling Test Setup

9. Connect the equipment as shown in Figure 4-5. Set the vane attenuator to 10 dB.
10. Press 8350A/B **[INSTR PRESET] [TIME] [1] [0] [0] [s] [CW]**.
11. Press 83572A/B **[MTR] ALC MODE** and adjust the ALC CAL for a power meter reading equal to the plug-in POWER reading plus 10 dB (to account for the loss through the vane attenuator).
12. Press 8350A/B **[START]**. The entire sweep should be within a 0.2 dB window on the power meter.

4-16. RESIDUAL AM

SPECIFICATION:

In 100 kHz bandwidth: ≥ 50 dB below carrier

DESCRIPTION:

The RF output signal from the 83572A/B is amplitude modulated with a square wave applied from a function generator. The modulated signal is used to establish a reference on the RMS voltmeter that is 9 dB below the actual carrier signal. The 9 dB reduction occurs because of the voltmeter's response to the square wave and the square-law response of the crystal detector. The modulating signal is then removed and the magnitude of the residual AM component is measured with respect to the established reference.

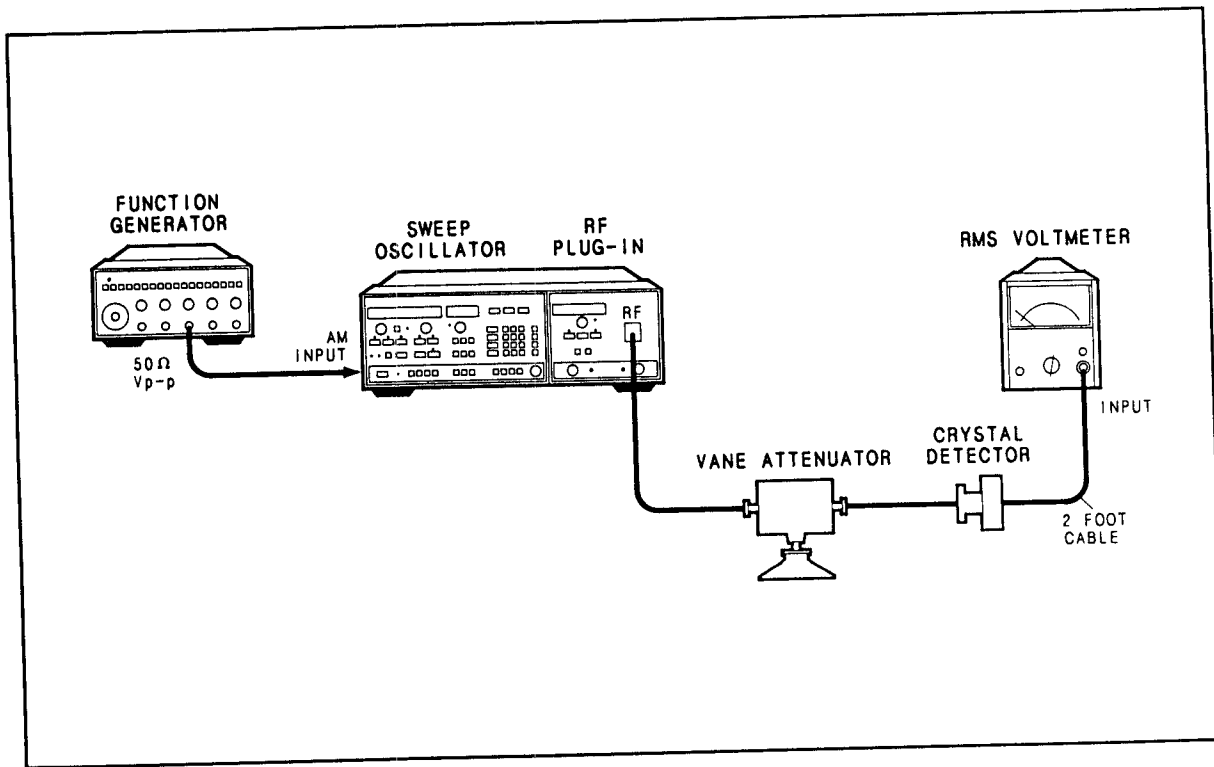


Figure 4-6. Residual AM Test Setup

EQUIPMENT:

RMS Voltmeter	HP 3400A
Crystal Detector	HP R422A
Vane Attenuator	HP R382A
60 cm (24 in) cable (Limits bandwidth to approximately 100 kHz)	HP 11170B
Function Generator	HP 3312A

4-16. RESIDUAL AM (Cont'd)**PROCEDURE:**

1. Connect the equipment as shown in Figure 4-6. Set the vane attenuator to 20 dB.
2. Press 8350A/B [INSTR PRESET] [CW], and disengage [DISPL BLANK]. Set the function generator for a 0 to -10 volt 1 kHz squarewave output.

NOTE

A 41 dB decrease in the RMS voltmeter indication corresponds to a 50 dB reduction in signal level. A correction factor of -9 dB is added because of the RMS voltmeter's response to a square wave and the square-law response of the crystal detector.

3. Vary the attenuation of the vane attenuator to obtain a reading on the RMS voltmeter of $-28 \text{ dB} \pm 3 \text{ dB}$. This ensures that the signal is in the square-law region of the crystal detector. Enter the voltmeter reading in the test record.
4. Disconnect the function generator from the 8350A/B. Change the range of the RMS voltmeter to obtain an on-scale reading. Calculate the difference between this and the reading noted in step 3, and add -9 dB to compensate for square-law inequities. The result should be at least 50 dB below the 83572A/B RF output signal. Enter this result in the test record.

4-17. FREQUENCY STABILITY TEST

SPECIFICATION:

With 10% line voltage change: $\leq \pm 1$ MHz

With 10 dB power level change: $\leq \pm 200$ kHz

With 3:1 load SWR: $\leq \pm 100$ kHz

DESCRIPTION:

A spectrum analyzer is used to check changes in frequency due to line voltage changes, output power level changes, and load impedance changes.

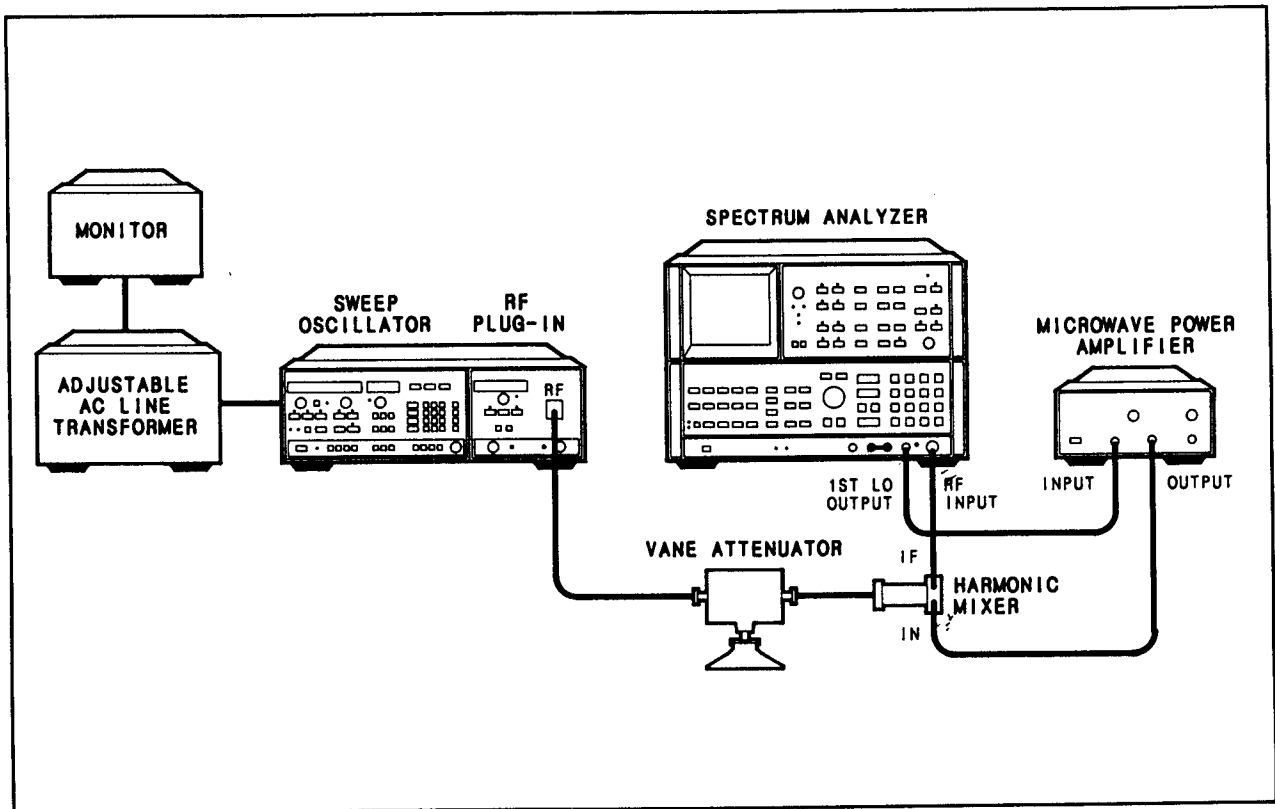


Figure 4-7. Frequency Change with Line Voltage Change

4-17. FREQUENCY STABILITY TEST (Cont'd)

EQUIPMENT:

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Directional Coupler	HP R752C
Adjustable AC Line Transformer and Monitor (Select for line voltage needed)	
100-120 volt	General Radio W5MTB
120V Monitor	RCA WV 120B
220-240 volt	General Radio W10HM73
240V Monitor	RCA WV 503A
Adjustable Short	HP R920B

PROCEDURE:

Frequency Change with Line Voltage Change

1. Connect the equipment as shown in Figure 4-7 and set the 8350A/B LINE switch to ON. Set the vane attenuator to 20 dB.
2. Check the line voltage setting on the 8350A/B power module. Using the appropriate monitor, set the adjustable line transformer to the same voltage as the 8350. Press 8350A/B [INSTR PRESET] [CW] [3] [3] [GHz].

Table 4-3. High and Low Line Voltage Selection Table

Nominal Line Voltage	100V	120V	220V	240V
Low Line Voltage	90V	108V	198V	216V
High Line Voltage	105V	126V	231V	252V

3. Set the spectrum analyzer controls as follows:

Press [SHIFT] [▲]
 CENTER FREQUENCY 33 GHz
 FREQUENCY SPAN 500 MHz
 Press [PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN].

Wait five minutes to allow the RF output signal frequency to stabilize, then change the spectrum analyzer frequency span to 10 MHz. Note the RF output frequency on the spectrum analyzer, and enter this in the test record.

4. Set the adjustable line transformer to the low line voltage shown in Table 4-3, using the appropriate monitor for the selected nominal line voltage. Note the difference in frequency from the reading in step 3 (this should be $\leq \pm 1$ MHz), and enter this difference in the test record.

4-17. FREQUENCY STABILITY TEST (Cont'd)

5. Set the adjustable line transformer to the high line voltage shown in Table 4-3, using the appropriate monitor for the selected nominal line voltage. Note the difference in frequency from the reading in step 3 (this should be $\leq \pm 1$ MHz), and enter this difference in the test record.

Frequency Change with 10 dB Power Level Change

6. Set the adjustable line transformer voltage to nominal. On the 83572A/B enter [UNLVLD PWR] [POWER LEVEL] [1] [5] [dBm].
7. Slowly decrease the 83572A/B power level with the control knob until the RF power indication on the spectrum analyzer starts to decrease. On the 8350A/B enter [SAVE] [1].
8. Note the signal amplitude on the spectrum analyzer, then use the 83572A/B power level control knob to decrease the actual RF power 10 dB. Enter [SAVE] [2].
9. On the spectrum analyzer, set the frequency span to 5 MHz and recenter the signal.
10. On the 8350A/B, alternate between [RECALL] [1] and [RECALL] [2]. Note the actual frequency difference between the two recall registers (this should be $\leq \pm 200$ kHz). Enter this difference in the test record.

Frequency Change With 3:1 Load SWR

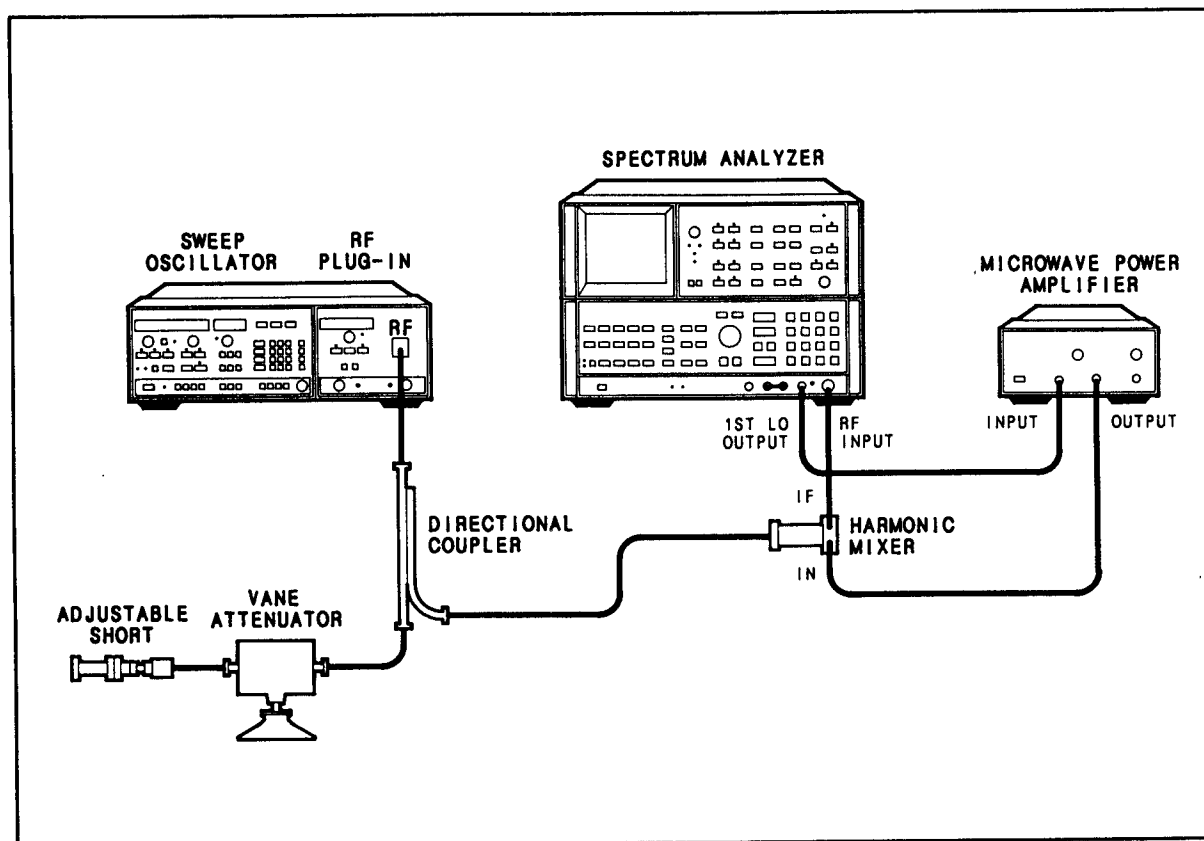


Figure 4-8. Frequency Change with 3:1 Load SWR Test Setup

4-17. FREQUENCY STABILITY TEST (Cont'd)

11. Connect the equipment as shown in Figure 4-8. Set the vane attenuator to 3 dB. Press 8350A/B [INSTR PRESET] [CW] [3] [3] [GHz].

12. Set the spectrum analyzer controls as follows:

Press [SHIFT] [▲]
 CENTER FREQUENCY 33 GHz
 FREQUENCY SPAN 300 MHz
 Press [PEAK SEARCH] [SIGNAL TRACK] [SHIFT] [FREE RUN].

13. Reduce the spectrum analyzer frequency span to 2 MHz and recenter the signal.

14. Note the RF output frequency on the spectrum analyzer, and enter this in the test record.

15. Vary the adjustable short through its range while observing the spectrum analyzer for the greatest plus and minus frequency change (this should be $\leq \pm 100$ kHz). Note the frequency difference between the maximum plus and minus frequency changes, and enter this difference in the test record.

4-18. RESIDUAL FM TEST

SPECIFICATION:

(10 Hz to 10 kHz Bandwidth)
(CW Mode with CW Filter)

Peak: <60 kHz

DESCRIPTION:

The demodulation sensitivity of the spectrum analyzer is determined using slope detection. The filtered CW RF output of the 83572A/B is then displayed on the vertical axis using the zero-span mode of the spectrum analyzer. The residual FM of the 83572A/B corresponds directly to the vertical deviation of the spectrum analyzer display, measured in units of kHz/div.

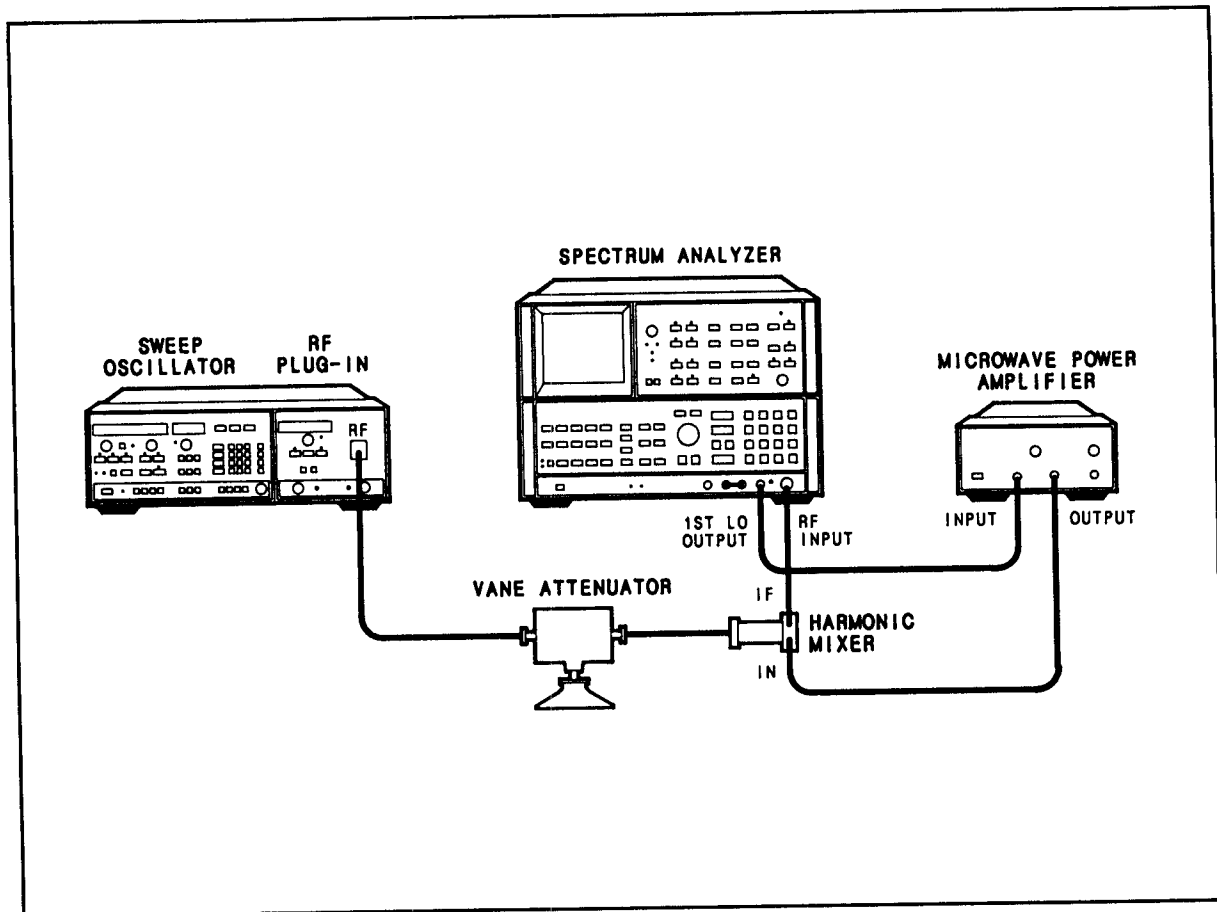


Figure 4-9. Residual FM Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A

4-18. RESIDUAL FM TEST (Cont'd)**PROCEDURE:**

1. Connect the equipment as shown in Figure 4-9, but do not connect the mixer output yet. Set the vane attenuator to 20 dB.
2. Press 8350A/B [INSTR PRESET] [CW] [4] [0] [GHz].

NOTE

To minimize drift, allow five minutes warmup time before continuing with this test.

Slope Detection

3. On the spectrum analyzer, press [INSTR PRESET], and set the controls as follows:

CENTER FREQUENCY	0.0 MHz
FREQUENCY SPAN	5 MHz
RESOLUTION BW	300 kHz
REFERENCE LEVEL	-10 dBm
LOG	10 dB/DIV
VIDEO BW	10 kHz
ATTENUATION	MANUAL

4. Center the L.O. feedthrough signal on the spectrum analyzer display and set the peak of the expanded trace at the reference level (top) graticule line by pressing the following key sequence:

[SHIFT] [PEAK SEARCH] [SIGNAL TRACK]
 [ENTER dB/DIV] [1] [dB]
 [MKR-REF LEVEL] [MARKER OFF]

5. Demodulation sensitivity is measured over an 8 dB section of the linear portion of the IF bandwidth skirt. To obtain a good display of this linear portion of the signal, make the following entries on the spectrum analyzer:

Press [REF LEVEL] [▼] [▼] [▼] [▼] [▼] [▼] [▼] [▼].
 Press [FREQ SPAN] [1] [MHZ].
 Press [CENTER FREQUENCY] and adjust the center frequency to center one side of the filter on the CRT.
 Press [FREQ SPAN] [200] [kHz]

6. Observe a linear ramp centered on the CRT display.
7. On the spectrum analyzer, press [NORMAL], and adjust the RPG knob to place a marker 1 dB down from the top reference line. Press [Δ] to activate the delta marker function, and tune the second marker 1 dB above the bottom of the trace. The portion of the trace between the markers should be linear.
8. Observe the delta marker frequency (difference in frequency between the markers), and divide by 8 divisions. This will give a demodulation sensitivity typically of about 20 kHz/div.

4-18. RESIDUAL FM TEST (Cont'd)

Measuring Residual FM

9. Connect the HP 83572/8350 through the vane attenuator to the external mixer. Set the spectrum analyzer controls as follows:

Press [INSTR PRESET]
 Press [SHIFT] [▲]
 CENTER FREQUENCY 40 GHz
 FREQUENCY SPAN 100 MHz
 LOG 10 dB/DIV
 REFERENCE LEVEL +10 dBm
 RESOLUTION BW 300 kHz

10. Both the upper and the lower sidebands of the 83572A/B 40 GHz signal are displayed on the spectrum analyzer CRT. Adjust the spectrum analyzer REFERENCE LEVEL to place the peak of the lower sideband signal trace at the reference level (top) graticule line.
11. Expand the spectrum analyzer display scale to 1 dB/DIV and repeat step 10 if necessary.
12. Reduce the FREQUENCY SPAN to 0 while keeping the signal centered on the CRT with the TUNING control.
13. Decrease the REFERENCE LEVEL by 8 dB and position the trace at midscreen by adjusting the CENTER FREQUENCY.
14. Reduce the sweep time to 1 sec. Observe the maximum peak-to-peak deviation in divisions of the spectrum analyzer trace. The peak deviation is one-half the peak-to-peak deviation. Multiply the peak deviation by the modulation sensitivity calculated in step 7 to arrive at the amount of residual FM.

$$\begin{aligned} &\text{Residual FM (kHz)} \\ &= (\text{peak-to-peak deviation}/2) \times (\text{demodulation sensitivity}) \\ &= \underline{\hspace{2cm}} \text{ kHz} \end{aligned}$$

15. Verify that the residual FM is less than 60 kHz peak, and enter in the test record.

4-19. SPURIOUS SIGNALS TEST

SPECIFICATION:

Inband: ≥ 50 dB below carrier

DESCRIPTION:

The RF output signal from the HP 83572A/B is displayed on a spectrum analyzer. When the frequency range of the spectrum analyzer is extended using an external harmonic mixer, the response is unpreselected and multiple signals are displayed. Responses are examined to determine whether they are true in-band spurious signals and to verify that they are at or below the specified level.

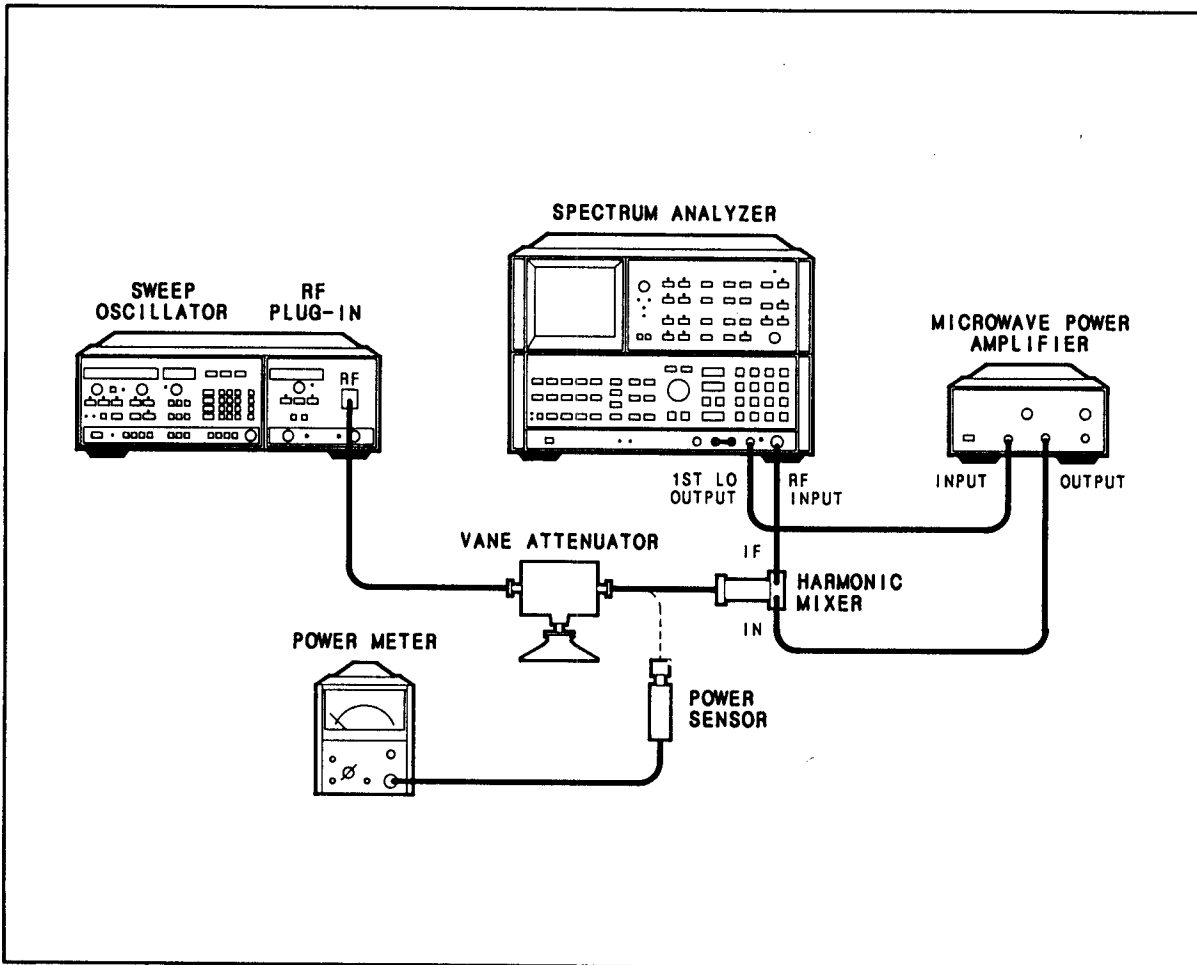


Figure 4-10. Spurious Signals Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Vane Attenuator	HP R382A
Power Meter	HP 432A
Power Sensor	HP R486A
Directional Coupler	HP R752C
Crystal Detector	HP R422A

4-19. SPURIOUS SIGNALS TEST (Cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-10, with the HP 83572A/B RF output connected through the external mixer to the spectrum analyzer. Set the vane attenuator to 20 dB.
2. On the 8350A/B, press [INSTR PRESET] [SHIFT] [DET] and adjust the POWER LEVEL for maximum leveled power. Then press [CW] [3] [3] [.] [2] [5] [GHz].
3. On the spectrum analyzer make the following entries:

Press [SHIFT] [▲]
 START FREQ 26.5 GHz
 STOP FREQ 40 GHz
 FREQUENCY SPAN 300 MHz
 RES BW 1 MHz
 Press [CENTER FREQUENCY] and adjust the signal to the center of the display.

4. On the microwave power amplifier, adjust the output power level to maximize the signal, but do not exceed +16 dBm.
5. Calculate the reference level offset for the spectrum analyzer as follows: On the external harmonic mixer, find the average value of conversion loss from the table on the side panel. This is a minus dB value. Add +20 dB to this value to compensate for the loss through the vane attenuator. The total is the adjusted reference line offset.

Example: -7 dB +20 dB = +13 dB adjusted reference line offset

6. On the spectrum analyzer press [SHIFT] [REFERENCE LEVEL], and enter the adjusted reference line offset calculated above.
7. On the spectrum analyzer set the controls as follows:

REFERENCE LEVEL Adjust signal to top line
 LOG 10 dB/DIV
 START FREQ 26.5 GHz
 STOP FREQ 40 GHz
 DISPLAY LINE Adjust to center of CRT
 (5 divisions down from top)
 THRESHOLD Adjust to 4 divisions
 above bottom line
 SAVE 1

8. On the 8350A/B press [START]. Set the SWEEP to [MAN], and manually tune across the frequency range, verifying that the power is leveled across the band within ±2 dB.
9. On the spectrum analyzer make the following entries:

START FREQ 26.5 GHz; STOP FREQ 32.928 GHz; SAVE 2
 START FREQ 30 GHz; STOP FREQ 36.428 GHz; SAVE 3
 START FREQ 33.572 GHz; STOP FREQ 40 GHz; SAVE 4

4-19. SPURIOUS SIGNALS TEST (Cont'd)

Storage registers 2, 3, and 4 in the spectrum analyzer store three frequency bands, covering the total range from 26.5 to 40 GHz. Each frequency band covers a span of 6.428 GHz. Each signal displayed on the spectrum analyzer appears twice, in the form of the upper and lower sideband mixing products. Therefore, any true in-band signal appears as an identical pair with a frequency spacing of 642.8 MHz, or exactly one division.

To examine a signal, use the spectrum analyzer **[NORMAL]** and **[Δ]** keys to place markers on the upper and lower sidebands (it may be necessary to narrow the frequency span for better resolution). If the frequency spacing is not 642.8 MHz, the signal is not a true in-band signal. Rather it is either a local oscillator or mixer induced harmonic product, and it should be ignored.

10. On the spectrum analyzer, press **[RECALL 2]**.
11. Manually tune the 83572A/B slowly from 26.5 to 40 GHz, checking for identical pairs of spurious signals that have a spacing of exactly one division. These are true spurious signals. Any spurious signal that is above the display line on the spectrum analyzer exceeds specifications. If a spurious signal is between the threshold and the display line, it is in the ambiguity region and must be checked further (see steps 14 to 20 below) to determine whether it exceeds specifications.
12. On the spectrum analyzer, press **[RECALL 3]** and repeat step 11.
13. On the spectrum analyzer, press **[RECALL 4]** and repeat step 11.
14. If any pair of spurious signals appears in the ambiguity region on the spectrum analyzer, note the displayed frequency of the 83572A/B. Also note the frequency of the lower sideband of the pair of signals.
15. Disconnect the harmonic mixer from the vane attenuator. Connect the power sensor to the vane attenuator as shown in Figure 4-10. Verify that the vane attenuator is set to 20 dB.
16. Use the power meter to measure the absolute power in dBm of the 83572A/B RF output signal. Note this reference power level.
17. Tune the 83572A/B to the frequency of the spurious signal noted in step 15. Adjust the vane attenuator to obtain a power meter reading at this frequency equal to the level noted in step 17.

Example: If a fundamental signal at 29 GHz with an absolute power level of +3 dBm (−17 dBm at the output of the attenuator) causes a spurious signal at 30 GHz, tune the 83572A/B to 30 GHz and use the vane attenuator to set the power meter reading to −17 dBm.

18. Disconnect the power sensor from the vane attenuator. Do not change the vane attenuator setting or the 83572 frequency. Reconnect the harmonic mixer and spectrum analyzer. Center the lower sideband of the 83572A/B fundamental signal on the spectrum analyzer CRT and use the spectrum analyzer REFERENCE LEVEL to set the peak of the signal to the top of the screen. (In the example, this would give a reference level of −17 dBm.)
19. Tune the 83572A/B back to the frequency that originally caused the spurious signal (29 GHz in the example). Set the vane attenuator back to 20 dB.
20. Check the level of the spurious signals on the spectrum analyzer CRT. If the spurious signals are at least 50 dB below the top of the screen they are within specification.

4-20. OUTPUT SWR TEST

SPECIFICATION:

Unleveled: <2.0
 Option 001 (externally leveled): <1.5

DESCRIPTION:

Output SWR is a measure of the impedance mismatch of the 83572A/B RF OUTPUT waveguide connector. The RF output signal is measured using a directional coupler, crystal detector, and oscilloscope. The signal at the oscilloscope contains (1) the incident signal from the oscillator, and (2) the reflected signal. The reflected signal is developed as follows: The incident signal travels down the waveguide, encounters the open end, and is reflected back to the source. If the reflected signal at the RF OUTPUT connector encounters a perfect source match, no signal is reflected back. However, the greater the mismatch, the greater the reflected signal. This reflected signal either adds to or subtracts from the incident signal. This variation is displayed on the oscilloscope.

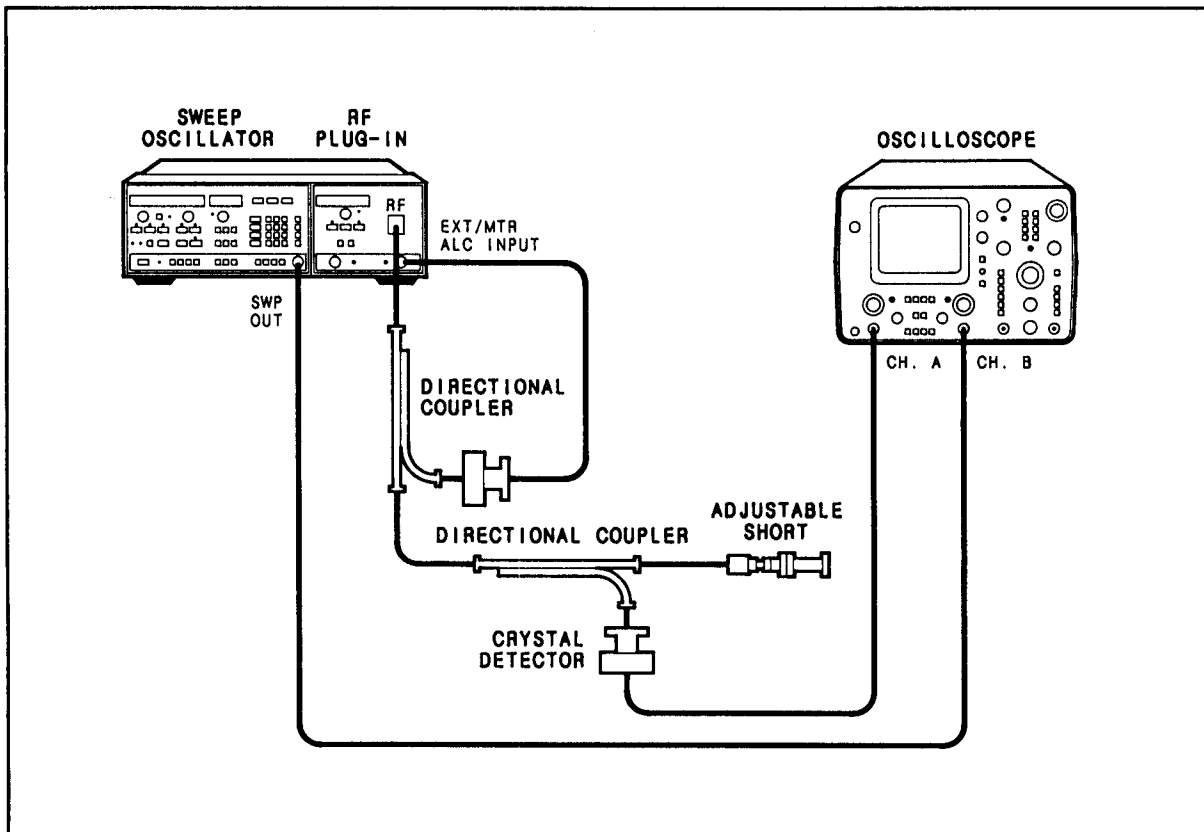


Figure 4-11. Output SWR Test Setup

EQUIPMENT:

Oscilloscope	HP 1740A
Crystal Detector	HP R422A
Directional coupler	
26.5 to 40 GHz	HP R752C
Adjustable Short	HP R920B

4-20. OUTPUT SWR TEST (Cont'd)**PROCEDURE:**

1. Connect equipment as shown in Figure 4-11. If the 83572A/B is not an Option 001, connect the directional coupler directly to the waveguide RF output connector.
2. Press 8350A/B [INSTR PRESET] [DET]. Set DISPL BLANKING off and RF BLANKING on.
3. Adjust the POWER control on the RF plug-in to obtain a maximum trace amplitude of -25 millivolts peak on the oscilloscope display, in order to keep the crystal detector in the square law output range.
4. Vary the adjustable short through its entire range and select points on the trace where V MAX and V MIN appear to have the greatest separation and calculate V MAX/V MIN for each point.
5. Convert the greatest V MAX/V MIN ratio noted in step 4 into source match SWR using the 1.0 dB loss line in Figure 4-12. The SWR should be less than 2.0 for a standard instrument or less than 1.5 for an Option 001. Enter the calculated SWR in the test record.
6. To check the output SWR of an Option 001 in the unleveled condition, remove the Option 001 directional coupler and crystal detector and connect the test coupler to the RF output of the plug-in.
7. On the 83572A/B, enter [UNLVLD PWR].
8. Repeat steps 3 through 5. The SWR should be less than 2.0 for an Option 001 with unleveled power. Enter the calculated SWR in the test record.

4-20. OUTPUT SWR TEST (Cont'd)

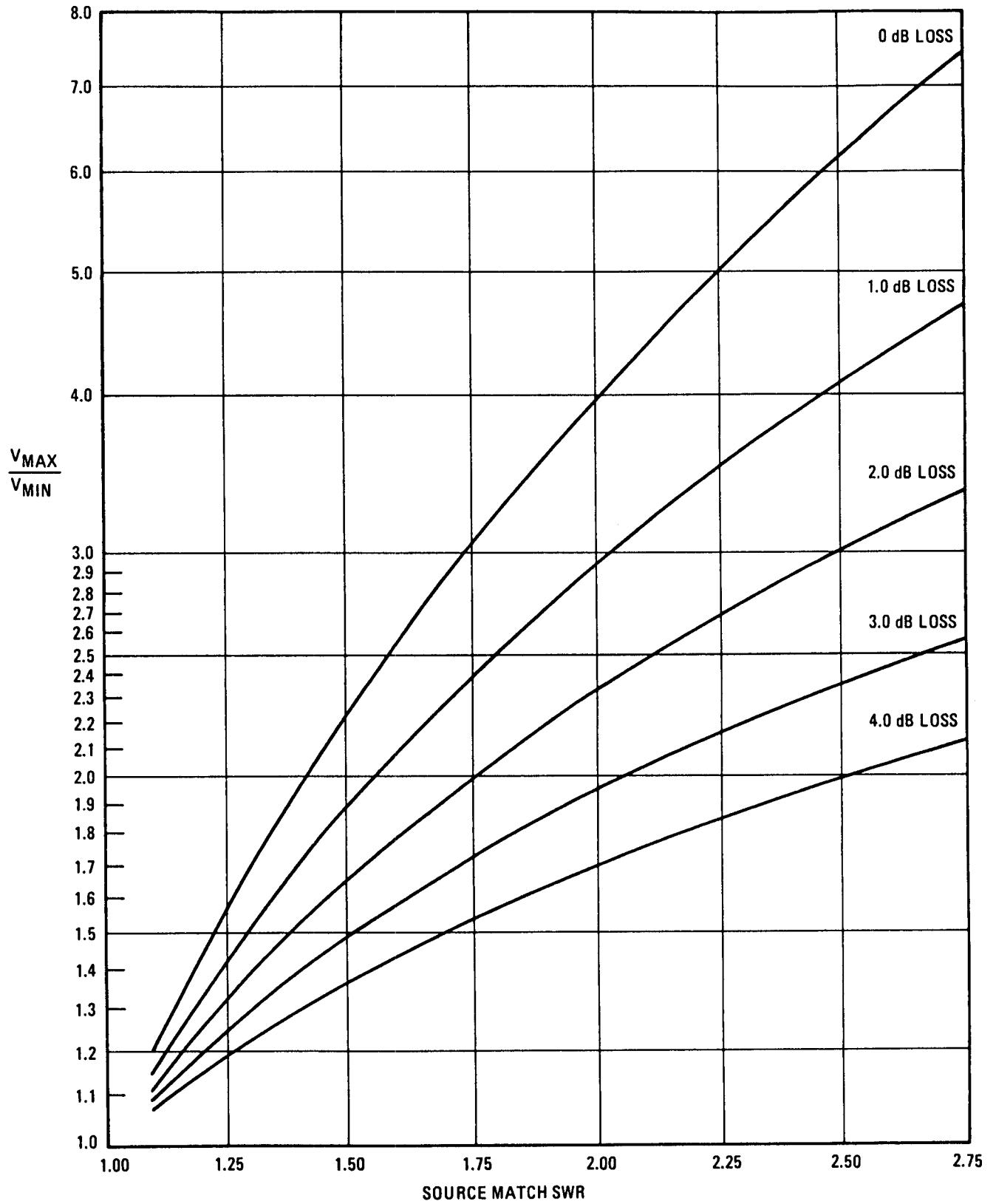


Figure 4-12. Conversion of Oscilloscope Trace to Source Match SWR

4-21. EXTERNAL FREQUENCY MODULATION TEST

SPECIFICATION:

Maximum Deviation for Modulation Frequencies:

Modulation Frequency	Cross-Over Coupled	Direct Coupled
DC to 100 Hz	$\geq \pm 150$ MHz	$\geq \pm 6$ MHz
100 Hz to 200 kHz	$\geq \pm 3.5$ MHz	$\geq \pm 3.5$ MHz

DESCRIPTION:

The RF output is modulated with an external signal at 100 Hz and at 200 kHz. The deviations are measured directly on a spectrum analyzer.

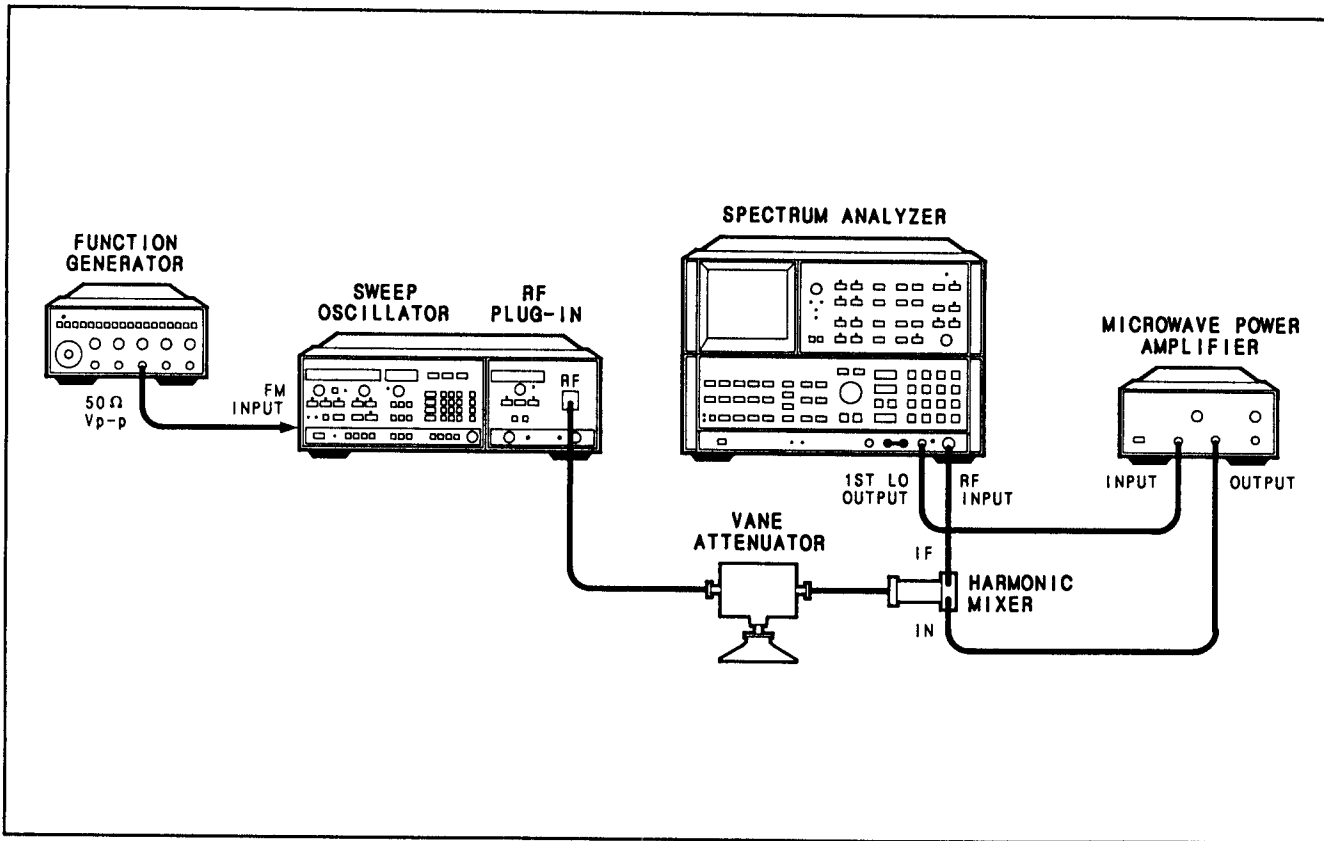


Figure 4-13. External Frequency Modulation Test Setup

4-21. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)

EQUIPMENT:

Spectrum Analyzer	HP 8566A
Microwave Power Amplifier	HP 11975A
External Harmonic Mixer	HP 11970A
Function Generator	HP 3312A
Vane Attenuator	HP R382A

PROCEDURE:

Direct Coupled. 100 Hz Modulation

1. Ensure that the RF plug-in modulation sensitivity is set to -20 MHz/volt and the modulation coupling to DC. Refer to section III of this manual for information on setting the configuration switch. Connect the equipment as shown in Figure 4-13. Set the vane attenuator to 20 dB.
2. Press 8350A/B [**INSTR PRESET**] [**CW**] and turn off the RF plug-in **CW FILTER**.
3. On the spectrum analyzer, make the following entries:

Press [**SHIFT**] [**▲**]
CENTER FREQUENCY 33.25 GHz
FREQUENCY SPAN 20 MHz

Center the fundamental signal on the spectrum analyzer display.

4. Set the function generator frequency to 100 Hz sinewave and the amplitude full counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Deviation from the center line should be symmetrical at first, then become non-symmetrical as deviation increases.
5. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 6$ MHz). Record the highest observed symmetrical deviation frequency on the test record. Disconnect the function generator.

Direct Coupled. 200 kHz Modulation

6. On the spectrum analyzer, press [**FREQUENCY SPAN**] [**1**] [**0**] [**MHz**]. Center the fundamental signal on the spectrum analyzer display.
7. Reconnect the function generator and set the frequency to 200 kHz sinewave and the amplitude full counterclockwise. Adjust the function generator amplitude slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 3.5$ MHz). Enter the highest observed symmetrical deviation frequency in the test record. Disconnect the function generator.

4-21. EXTERNAL FREQUENCY MODULATION TEST (Cont'd)**Crossover Coupled. 200 kHz Modulation**

8. Turn the 8350A/B LINE switch off. Remove the RF plug-in and reset the configuration switch for crossover modulation coupling (refer to Section III of this manual). Reinstall the RF plug-in and turn the 8350A/B line switch on.
9. Leave the spectrum analyzer frequency span set to 10 MHz. Center the fundamental signal on the spectrum analyzer display. Reconnect the function generator. Leave the function generator frequency set to 200 kHz and set the amplitude full counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 3.5$ MHz). Enter the highest observed symmetrical deviation frequency in the test record. Disconnect the function generator.

Crossover Coupled. 100 Hz Modulation

10. Set the spectrum analyzer frequency span to 500 MHz. Center the fundamental signal on the spectrum analyzer display. Reconnect the function generator and set its frequency to 100 Hz and amplitude full counterclockwise. Adjust the function generator amplitude control slowly clockwise while monitoring the display on the spectrum analyzer. Note the point at which deviation becomes non-symmetrical or stops increasing (this should be $\geq \pm 150$ MHz). Enter the highest observed symmetrical deviation frequency in the test record.

**4-22. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST
(OPTION 006 or 001/006 ONLY)**

SPECIFICATON:

AM On/Off Ratio: ≥ 20 dB

Symmetry: $50\% \pm 5\%$

DESCRIPTION:

The AM ON/OFF ratio is checked on the amplitude axis of a video triggered spectrum analyzer display. The symmetry is checked by calculating the on/off time ratio on the frequency axis.

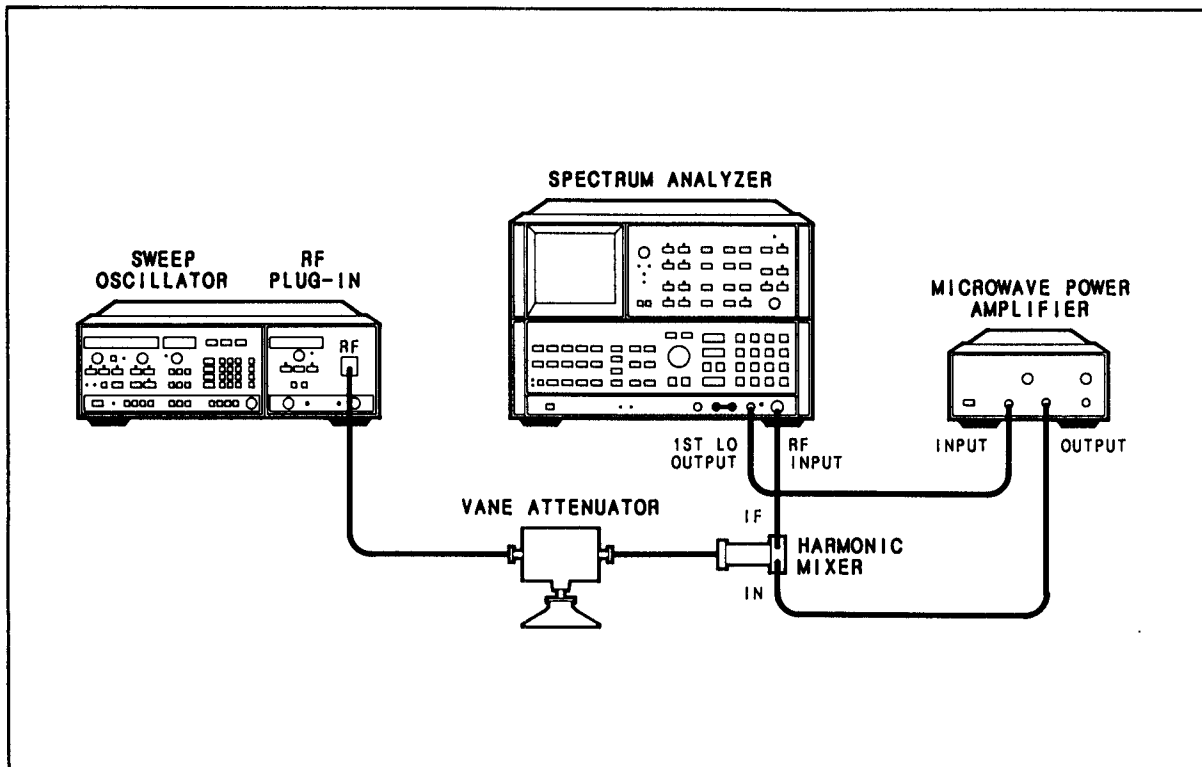


Figure 4-14. AM ON/OFF Ratio and Square Wave Symmetry Test Setup

EQUIPMENT:

- Spectrum Analyzer HP 8566A
- Microwave Power Amplifier HP 11975A
- External Harmonic Mixer HP 11970A
- Vane Attenuator HP R382A

4-22. AM ON/OFF RATIO AND SQUARE WAVE SYMMETRY TEST (Cont'd) (OPTION 006 or 001/006 ONLY)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-14. Set the vane attenuator to 20 dB. Press 8350A/B [INSTR PRESET] [CW] [\square] MOD].

2. Set the spectrum analyzer controls as follows:

Press [INSTR PRESET]
Press [SHIFT] [\blacktriangle]
CENTER FREQUENCY 33.25 GHz
FREQUENCY SPAN 500 MHz

3. Adjust the spectrum analyzer TUNING control to center the signal on the CRT. Adjust the REFERENCE LEVEL to set the peak of the signal on the top graticule.

4. Make the following entries on the spectrum analyzer:

[FREQUENCY SPAN] [1] [0] [MHz]
[ENTER dB/DIV] [5] [dB]

5. Repeat step 3.

6. Set the spectrum analyzer controls as follows:

RESOLUTION BW 3 MHz
VIDEO BW 3 MHz
SWEEP TIME 100 us
FREQUENCY SPAN 0 MHz
VIDEO TRIGGER (Adjust LEVEL)

7. The AM on/off ratio is the amplitude difference between the on and off portions of the square wave. Verify that the on/off ratio is at least 20 dB. Enter the AM on/off ratio in the test record.

8. The symmetry of the square wave is the percentage of on time to off time. Verify that the symmetry of the modulated signal is 50% \pm 5%. Record the symmetry in the test record.

Table 4-2. Performance Test Record (2 of 2)

SPECIFICATION TESTED Limits	Step	TEST Conditions	Lower Limit	Measured Value	Upper Limit
4-18. Residual FM 26.5-40 GHz: <60 kHz	2. 15.	CW frequency = 40 GHz		_____	<60 kHz
4-19. Spurious Signals Inband: ≥50 dB	20.	In dB below carrier	≥50 dB	_____	
4-20. Output SWR Unleveled: <2.0 Leveled: <1.5	5.	Range 26.5-40 GHz		_____ _____	<2.0 <1.5
4-21. External FM Direct Coupled: DC-100 Hz: ±6 MHz	1. 5.	A3S1: Close switch 5, open 6	±6 MHz	_____	
Direct/Cross Over Coupling: 100 Hz-200 kHz: ±3.5 MHz	7. 8. 9.	A3S1: Close switch 6	±3.5 MHz ±3.5 MHz	_____ _____ _____	
Cross Over Coupled: DC-100 Hz: ±150 MHz	10.		±150 MHz	_____	
4-22. AM On/Off Ratio Squarewave Symmetry (Opt. 006 or Opt. 001/006) On/Off Ratio: ≥20 dB Symmetry: 50% ±5%	2. 7. 8.	CW frequency = 33.25 GHz	<20 dB 45%	_____ _____	55%