

---

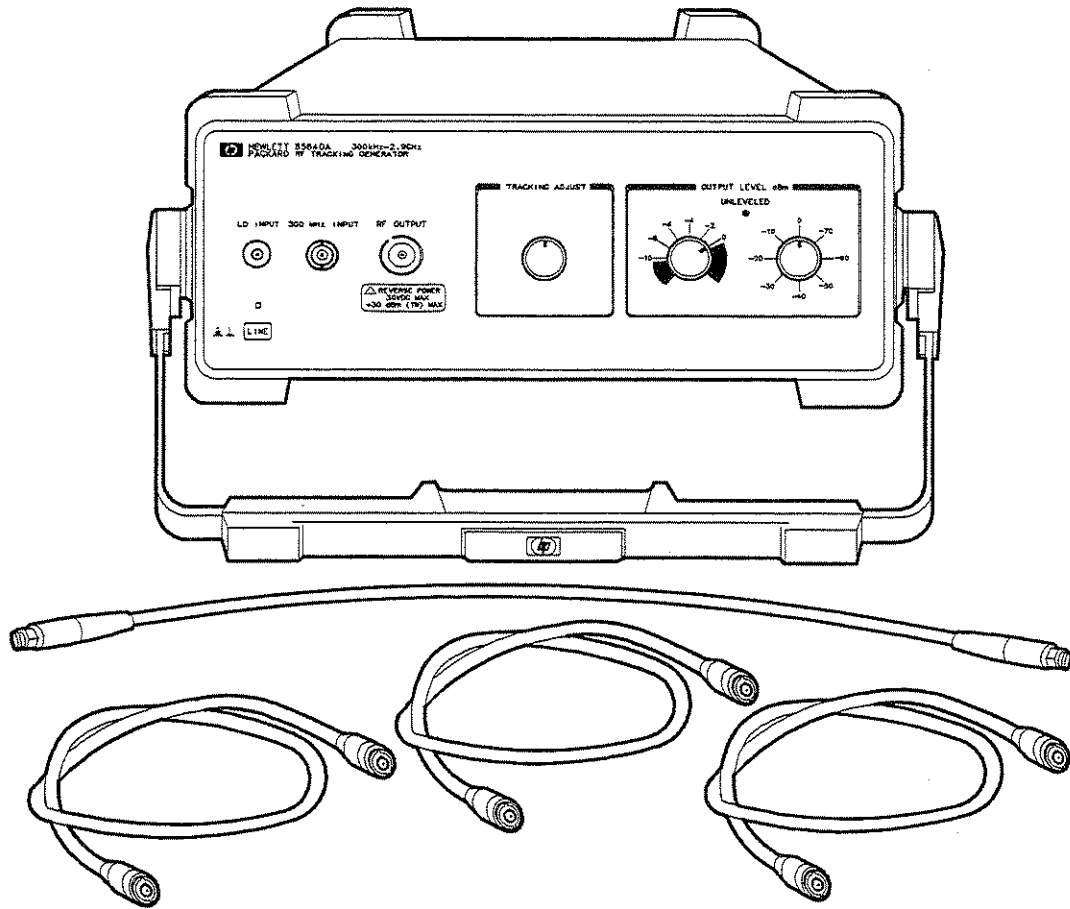
## **Quick Overview of the HP 85640A RF Tracking Generator**

The HP 85640A RF tracking generator provides a tracking source covering the 300 kHz to 2.9 GHz frequency range. It is compatible with HP 8560A/E, HP 8561A/B/E, HP 8562A/B, and HP 8563A/E spectrum analyzers.

A 70 dB step attenuator combined with an 11 dB vernier provide continuously variable output power levels from 0 dBm to -80 dBm. The tracking generator's output frequency is controlled by the spectrum analyzer. The front-panel tracking control enables the tracking generator's output frequency to be matched exactly to the spectrum analyzer input frequency, minimizing tracking errors. Tracking errors appear as a decrease in the displayed signal amplitude when the resolution bandwidth of the spectrum analyzer signal is decreased.

The HP 85640A can be leveled externally with a negative-polarity detector improving effective source match. A rear-panel switch selects between internal and external leveling.

## Accessories Supplied



Accessories (some not shown)	HP Part Number
3 cables with BNC(m) connectors	8120-1839
1 cable with SMA(m) connectors	5061-9038
2 fuses, 1A 250V UL/CSA (for 100/120V operation)	2110-0823
<i>or</i>	
2 fuses, 0.5A 250V IEC (for 220/240V operation)	210-0824

**Figure 1-1. HP 85640A with Accessories Supplied**

---

## RF Tracking Generators Covered by This Manual

This manual applies to tracking generators with the serial number prefixes listed inside the title page.

### Serial Numbers

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

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

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

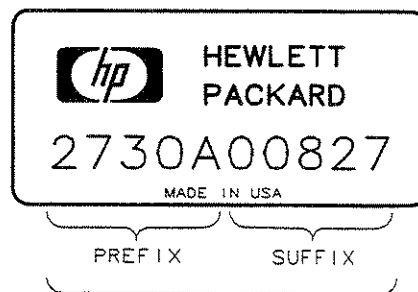


Figure 1-2. An Example of a Serial Number Label

---

## Calibration Cycle

The performance tests located in Chapter 4, "Performance Tests," should be used every 12 months to check the analyzer against the specifications listed in Table 1-1.

---

## Specifications and Characteristics

Table 1-1 lists the tracking generator's specifications. Unless stated otherwise, all specifications describe the tracking generator's warranted performance under these conditions:

- a five-minute warmup for ambient conditions.
- a one-year calibration cycle.
- all environmental requirements met.
- tracking generator used with one of the compatible spectrum analyzers listed in Table 1-1, "HP 85640 Specifications."

Characteristics provide useful, but non-warranted, information in the form of typical, nominal, or approximate values for tracking generator performance. See Table 1-2 for a list of tracking generator characteristics.

**Table 1-1. HP 85640A Specifications**

**Frequency Specifications**

<b>Frequency Range</b>	300 kHz to 2.9 GHz
<b>Minimum Resolution Bandwidth Supported</b>	
HP 8561A, HP 8562A/B	100 Hz
HP 8560A/E, HP 8561B/E, HP 8563A/E	300 Hz

## Amplitude Specifications

<p><b>Output Level</b></p> <p>Range</p> <p>Vernier</p> <p>Attenuator</p> <p>Maximum leveled output power</p> <p>Resolution</p> <p>Attenuator</p> <p>Vernier</p> <p>Accuracy</p> <p>Level flatness (referenced to 300 MHz, vernier at 0 dB, attenuator at -10 dB)</p> <p>Output attenuator</p> <p>Switching Accuracy (10 dB to 70 dB settings, referenced to 0 dB setting)</p>	<p>0 dBm to -80 dBm</p> <p>&gt;10 dB</p> <p>70 dB</p> <p>≥0 dBm</p> <p>10 dB steps</p> <p>Continuously adjustable</p> <p>&lt;±2.0 dB</p> <p>&lt;±0.8 dB per 10 dB step, to a maximum of ±1.5 dB</p>
<p><b>Spurious Outputs</b></p> <p>Unless otherwise specified, with vernier set to 0 dBm and attenuator set to -10 dB (-10 dBm output power)</p> <p>Harmonic spurious</p> <p>300 kHz to 2.9 GHz</p> <p>Non-harmonic spurious</p> <p>300 kHz to 2.0 GHz</p> <p>2.0 GHz to 2.9 GHz</p> <p>LO feedthrough</p> <p>3.9 GHz to 6.8 GHz</p>	<p>&lt;-25 dBc</p> <p>&lt;-27 dBc</p> <p>&lt;-23 dBc</p> <p>&lt;-26 dBm</p>
<p><b>Dynamic Range</b></p> <p>Tracking generator feedthrough*</p> <p>(Spectrum analyzer set to 300 Hz resolution bandwidth and 0 dB input attenuation.)</p> <p>300 kHz to 1 MHz</p> <p>1 MHz to 2.0 GHz</p> <p>2.0 GHz to 2.9 GHz</p>	<p>&lt;-95 dBm</p> <p>&lt;-115 dBm</p> <p>&lt;-110 dBm</p>
<p>* Leakage measured on spectrum analyzer with tracking generator delivering maximum leveled output power into a 50Ω termination, and spectrum analyzer input terminated in 50Ω.</p>	

## Electromagnetic Specifications

<b>Electromagnetic Compatibility</b>	
Military specification	<p>Conducted and radiated interference complies with CISPR Publication 11 (1985), and Messemphaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen).</p> <p>Meets the requirements of MIL-STD-461B, Part 4, with the exceptions shown below:</p>
Conducted emissions	
CE01 (narrowband)	1 kHz to 15 kHz only
CE03 (narrowband)	Full limits
CE03 (broadband)	20 dB relaxation from 15 kHz to 100 kHz
Conducted susceptibility	
CS01	Full limits
CS02	Full limits
CS06	Full limits
Radiated emissions	
RE01	<p>15 dB relaxation of 30 kHz (excepted from 30 kHz to 50 kHz)</p>
RE02	Full limits to 1 GHz
Radiated susceptibility	
RS03	<p>Limited to 1 V/m from 14 kHz to 1 GHz, with 20 dB relaxation IF frequencies (30 dB relaxation at spectrum analyzer IF frequencies for Option 001 spectrum analyzers).</p>
RS01	Full limits
RS02	Excepted

## General Specifications

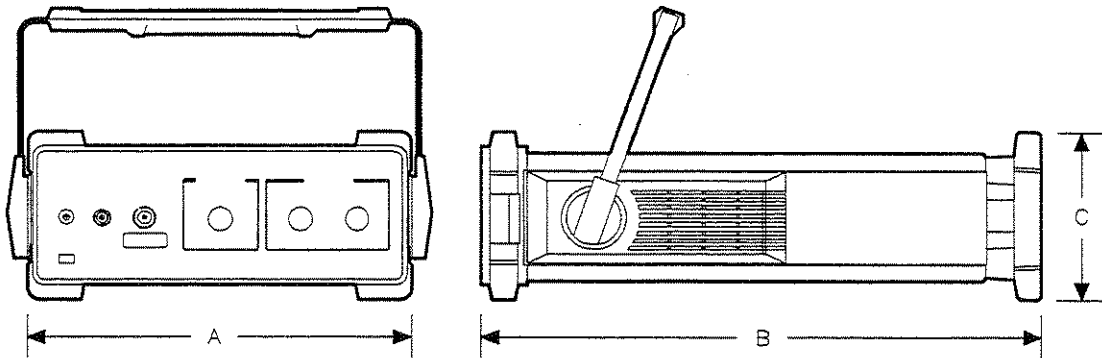
Type-tested to MIL-T-28800C, Class 5 environmental conditions as listed below:

<b>Warmup</b>	5 min. from ambient conditions
<b>Temperature</b>	
Operating	-10°C to +50°C
Non-operating	-62°C to +85°C
<b>Humidity</b>	95% at 40°C for 5 days
<b>Altitude</b>	
Operating	15,000 ft
Non-operating	50,000 ft
<b>Vibration</b>	
5 to 15 Hz	0.060 in. peak-to-peak excursion
15 to 25 Hz	0.040 in. peak-to-peak excursion
25 to 55 Hz	0.020 in. peak-to-peak excursion
<b>Pulse Shock</b>	
Half Sine	30 g for 11 ms duration
<b>Transit Drop</b>	8-in. drop on 6 faces and 8 corners




## Physical and Mechanical Specifications

<b>Power Requirements</b>	
Voltage	100, 120, 220, or 240 V ac, $\pm 10\%$
Current	47 to 66 Hz
Maximum power dissipation	130 VA, 35 W
<b>Compatibility</b>	Works with HP 8560A/E*, HP 8561A/B/E, HP 8562A/B, and HP 8563A/E portable spectrum analyzers.
<b>Weight</b>	8.4 kg (18.5 lb)
<b>Dimensions</b>	Ⓐ 337.6 mm (13.5 in) wide Ⓑ 461.1 mm (18.3 in) long Ⓒ 138.6 mm (5.5 in) deep
* Except HP 8560A/E Option 002. This option does not provide sufficient 1st LO drive to the HP 85640A.	



## Table 1-2. HP 85640A Characteristics

**Note**  These are not specifications. Characteristics provide useful, but nonwarranted, information about instrument performance.

### Frequency Characteristics

<b>Frequency Drift</b> (after 30-min. warmup)	300 Hz per hour
<b>Tracking Drift</b>	Usable in a 1 kHz RES BW after 5 min. Usable in a 300 Hz RES BW after 30 min.

### Amplitude Characteristics

<b>Output Range</b>	+2.8 dBm to -80 dBm
<b>Output Attenuator Repeatability</b>	<±0.2 dB
<b>Effective Source Match</b>	
0 dB attenuator setting	<1.92:1
10 dB attenuator setting	<1.33:1
<b>Dynamic Range</b> (300 Hz RES BW, 0 dB input attenuation)	
300 kHz to 1 MHz	>95 dB
1 MHz to 2.0 GHz	>115 dB
2.0 GHz to 2.9 GHz	>110 dB

## Inputs and Outputs

<b>300 MHz INPUT</b> Connector Impedance Input amplitude	BNC female, front panel 50 $\Omega$ -10 dBm $\pm$ 1.0 dB
<b>LO INPUT</b> Connector Impedance Frequency Input amplitude	SMA female, front panel 50 $\Omega$ 3.9107 GHz to 6.8107 GHz +16.5 dBm $\pm$ 2.0 dB
<b>0.5V/GHz INPUT</b> Connector Impedance Input amplitude	BNC female, rear panel >100 k $\Omega$ 0.5 V/GHz of tuned frequency
<b>BLANKING INPUT</b> Connector Input amplitude During sweep During retrace	BNC female, rear panel  Low TTL level High TTL level
<b>EXT ALC INPUT</b> Connector Impedance Polarity	BNC female, rear panel >10 k $\Omega$ Negative
<b>RF OUTPUT</b> Connector Impedance Maximum safe reverse level Output VSWR	Type N female, front panel 50 $\Omega$ +30 dBm, 30 V dc See Table 1-1, "HP 85640A Characteristics: Amplitude Characteristics, Effective Source Match."

## Installation

---

### What You'll Find in This Chapter ...

This chapter explains how to set up the HP 85640A tracking generator for operation. You'll also find:

- Serial numbers of host spectrum analyzers that can be used with the tracking generator.
- Line power and line fuse requirements.
- Illustrations of front- and rear-panel connections.
- HP sales and service office addresses.

---

### Compatibility with Portable Spectrum Analyzers

The HP 85640A is compatible with these portable spectrum analyzers:

**Table 2-1.**  
**Host Spectrum Analyzer-to-Tracking Generator Compatibility**

Spectrum Analyzer Model Numbers	Serial Number
HP 8560A	all serials of non-Option 002
HP 8560E	all serials of non-Option 002
HP 8561A	all serials
HP 8561B	all serials
HP 8561E	all serials
HP 8562A	all serials
HP 8562B	all serials
HP 8563A	all serials
HP 8563E	all serials

---

## Initial Inspection

### Is the Shipment Complete?

Figure 1-1 shows the parts and accessories that are shipped with your HP 85640A RF tracking generator. If any part or accessory is missing, contact your sales representative.

### Is the Shipping Container in Good Condition?

Inspect the shipping container. If the container or cushioning material is damaged, verify that the contents are complete and that the analyzer functions correctly, both mechanically and electrically.

If the contents are incomplete or if the HP 85640A fails the verification tests in Chapter 4, notify any Hewlett-Packard sales and service office (see Table 2-3). The HP sales and service office will arrange for repair or replacement without waiting for a claim settlement.

Save all packaging materials; show any damages to the container or cushioning materials to the carrier.

### Save the Packaging Materials

The shipping container and cushioning materials are shown in Figure 7-2. Save these materials, to use when you ship your instrument, or return it for service or repair. If the original materials are not available, you may order replacements from any HP sales and service office (see Table 2-3).

Instructions for repackaging the HP 85640A are in "Returning the RF Tracking Generator for Service" in Chapter 7.

---

## Preparing the RF Tracking Generator for Use

The RF tracking generator must be properly connected to one of the compatible portable spectrum analyzers listed in Table 2-1. You also need to connect it to an ac power source. If you want to install your tracking generator in an HP System II cabinet or a standard 19 inch (486.2 mm) equipment rack, complete instructions are provided with the Option 908 and Option 909 rack mounting kits.

---

### Caution



*Before* you connect your tracking generator to an ac power source, make sure that the line voltage is correct, the line-voltage selector switch located on the tracking generator rear panel is set to the correct voltage (refer to the following paragraphs), and the proper fuse is installed. You can damage the instrument if you connect it to the wrong voltage.

---

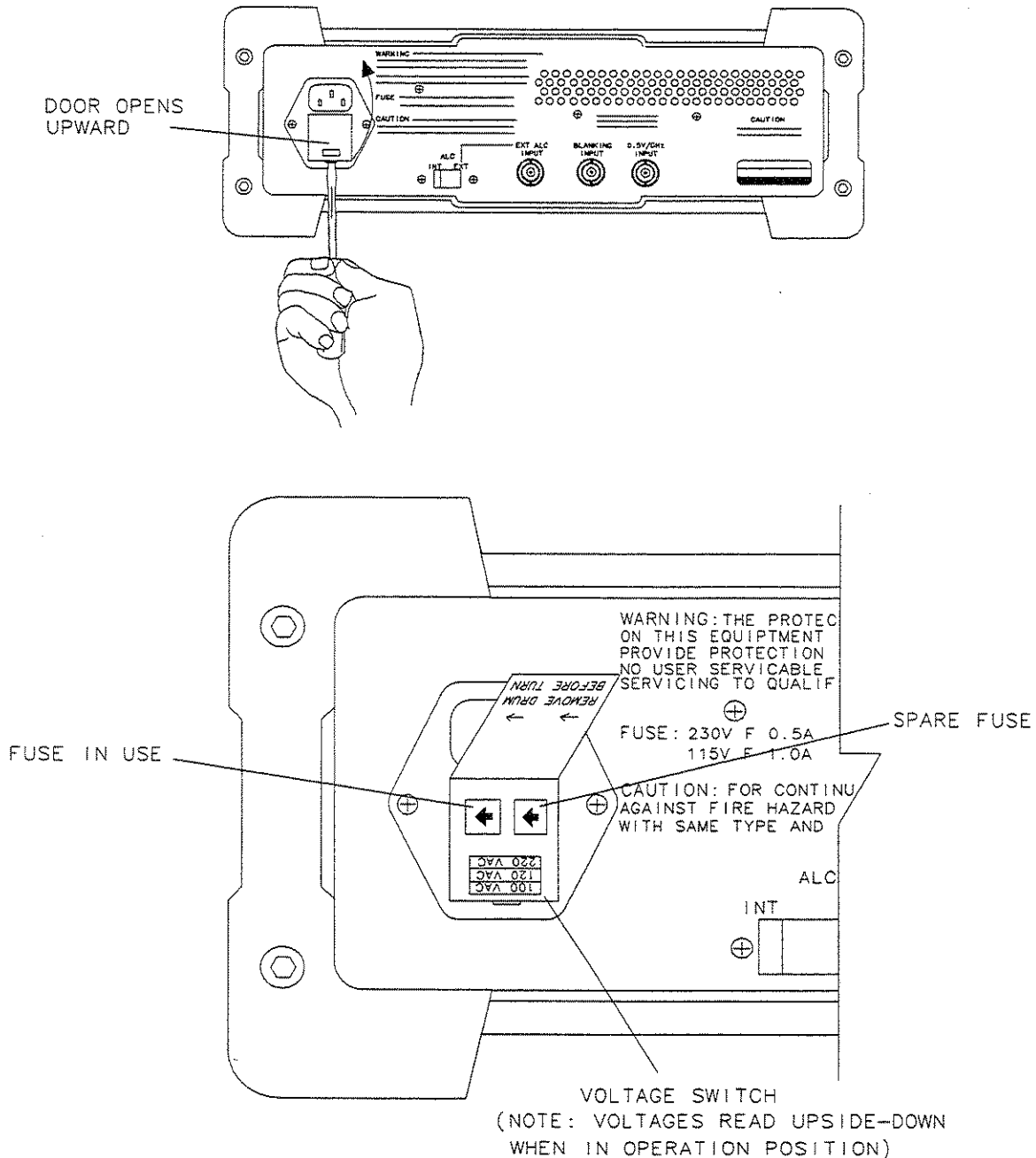
## Power Requirements

**Table 2-2. Operating Power Requirements**

	<b>100/120 V ac Operation</b>	<b>220/240 V ac Operation</b>
<b>Line Voltage</b>	100 V to 120 V, $\pm 10\%$	220 V to 240 V, $\pm 10\%$
<b>Line Current</b>	1 A rms max	0.5 A rms max
<b>Line Frequency</b>	47 Hz to 66 Hz	47 Hz to 66 Hz

## Setting the Line-Voltage Selector Switch

Set the tracking generator's rear-panel voltage selector switch to the line voltage range (100, 120, 220, or 240 V) corresponding to the available ac voltage. Insert a small screwdriver or similar tool in the line-module door slot and gently pry open the door. Rotate the voltage barrel to the appropriate value.



wk24

**Figure 2-1. Voltage Selection Switch and Line Fuse Locations**

## Checking the Fuse

The type of ac line input fuse depends on the input line voltage. Use the correct fuse for your voltage:

<b>100 V to 120 V operation:</b>	1 A 250 V UL/CSA (HP part number 2110-0823) (for use in any of the United States)
<b>220 V to 240 V operation:</b>	0.5 A 250 V IEC (HP part number 2110-0458) (for use in other countries)

The line fuse is housed in a small container located inside the rear-panel power-connector module. When replacing a fuse, be sure the arrows on the container match the direction of the arrows on the power-connector door. See Figure 2-1.

## Power Cable

The HP 85640A is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power source outlet, this cable grounds the instrument cabinet.

---

### Warning



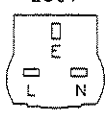
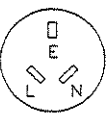
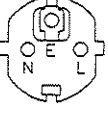

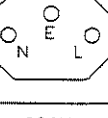
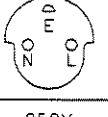
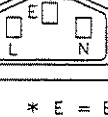
**Failure to ground the instrument properly can result in personal injury. Before turning on the tracking generator, you must connect its protective earth terminals to the protective conductor of the main power cable. Insert the main power cable plug only into a socket outlet that has a protective earth contact.**

*Do not defeat the earth-grounding protection by using an extension cable, power cable, or auto transformer without a protective ground conductor. If you are using an auto transformer, make sure its common terminal is connected to the protective earth contact of the power source socket.*

---

Various power cables are available for the power outlets unique to specific geographic areas. The appropriate cable is included with the instrument when it is shipped to an area requiring one of these cables. You can order additional ac power cables listed in Figure 2-2 for use in different areas. Figure 2-2 also illustrates the plug configurations and identifies the geographic area in which each cable is appropriate.



PLUG TYPE *	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight**BS1363A 90°	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Rhodesia, Singapore, So.Africa, India
250V 	8120-1369 8120-0696	Straight**NZSS198/ASC112 90°	201 (79) 221 (87)	Gray Gray	Australia, New Zealand
250V 	8120-1689 8120-1692	Straight**CEE7-Y11 90°	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Saudi Arabia, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1398 8120-1754	Straight**NEMA5-15P 90° Straight**NEMA5-15P	203 (80) 203 (80) 91 (36)	Black Black Black	United States Canada, Japan (100 V or 200 V), Mexico, Philippines, Taiwan
	8120-1378 8120-1521 8120-1676	Straight**NEMA5-15P 90° Straight**NEMA5-15P	203 (80) 203 (80) 91 (36)	Jade Gray Jade Gray Jade Gray	
250V 	8120-2104	Straight**SEV1011 1959-24507 Type 12	201 (79)	Gray	Switzerland
220V 	8120-0698	Straight**NEMA6-15P			
250V 	8120-1860	Straight**CEEE22-V1			
<p>* E = Earth Ground; L = Line; N = Neutral.  ** Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.</p>					

wk25

**Figure 2-2. AC Power Cables Available**

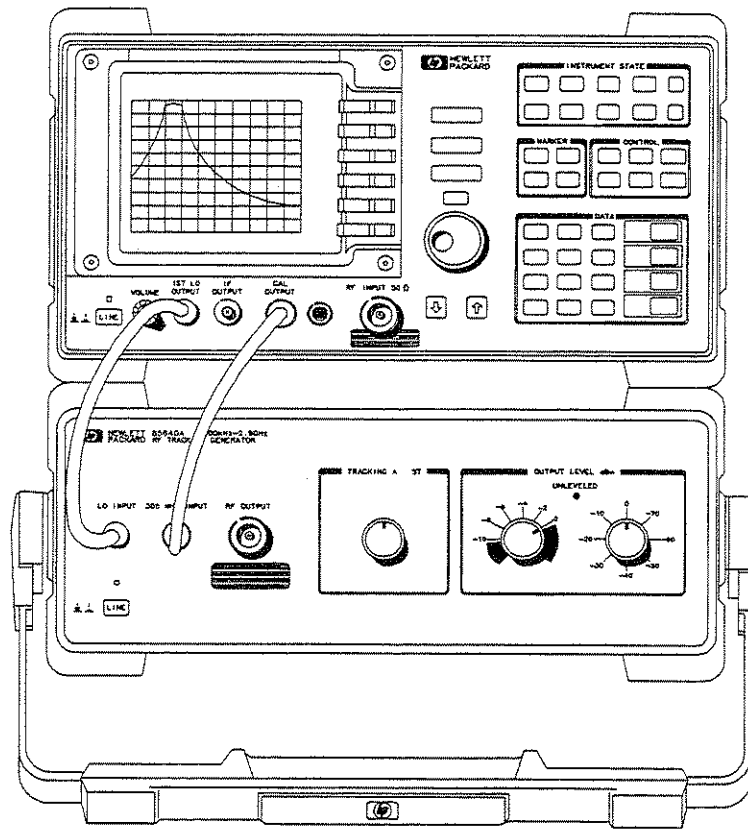
## Connecting an HP 85640A to a Compatible Spectrum Analyzer

Figure 1-1 contains the cable part numbers included with your tracking generator at shipment. Use these cables to connect your portable tracking generator to a compatible spectrum analyzer. Figure 2-3 and Figure 2-4 illustrate the proper cable connections between the tracking generator and an HP 8561B spectrum analyzer. Any of the compatible spectrum analyzers is connected to the same inputs and outputs as illustrated in these figures.

### Note

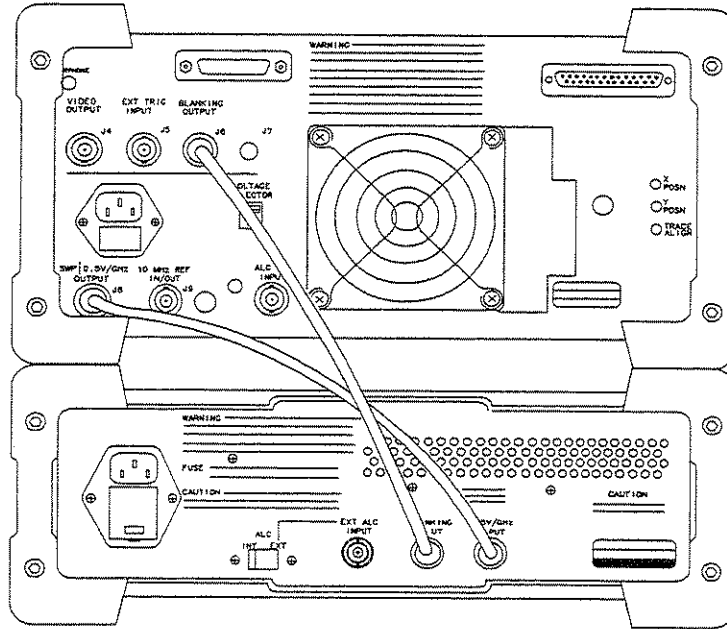


Connect the cables with the tracking generator placed beneath the portable spectrum analyzer to prevent the cables from obscuring your view of the display during operation.



wk26

Figure 2-3. Front-Panel Cable Connections



wk 27

**Figure 2-4. Rear-Panel Cable Connections**

**Note**



On HP 8560 E-Series spectrum analyzers, BLANKING OUTPUT is labeled BLKG/GATE OUTPUT.

**Turning On the Tracking Generator**

If the tracking generator does not seem to function properly the first time you turn it on, turn the power off and refer to the cable connection illustrations in Figure 2-3 and Figure 2-4. If the cable connections appear to be correct, contact one of the HP sales and service offices listed in Table 2-3.

---

## **Sales and Service Offices**

Hewlett-Packard has sales and service offices around the world providing complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard sales and service office listed in Table 2-3.

In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, or assembly part numbers.

**Table 2-3. Hewlett-Packard Sales and Service Offices**

US FIELD OPERATIONS		
<p><b>Customer Information</b> Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014, USA (800) 752-0900</p>	<p><b>California, Northern</b> Hewlett-Packard Co. 301 E. Evelyn Mountain View, CA 94041 (415) 694-2000</p>	<p><b>California, Southern</b> Hewlett-Packard Co. 1421 South Manhattan Ave. Fullerton, CA 92631 (714) 999-6700</p>
<p><b>Colorado</b> Hewlett-Packard Co. 24 Inverness Place, East Englewood, CO 80112 (303) 649-5000</p>	<p><b>Georgia</b> Hewlett-Packard Co. 2000 South Park Place Atlanta, GA 30339 (404) 955-1500</p>	<p><b>Illinois</b> Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 255-9800</p>
<p><b>New Jersey</b> 120 W. Century Road Paramus, NJ 07653 (201)599-5000</p>	<p><b>Texas</b> 930 E. Campbell Rd. Richardson, TX 75081 (214) 231-6101</p>	
EUROPEAN FIELD OPERATIONS		
<p><b>Headquarters</b> Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (41 22) 780.8111</p>	<p><b>France</b> Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60</p>	<p><b>Germany</b> Hewlett-Packard GmbH Berner Strasse 117 6000 Frankfurt 56 West Germany (49 69) 500006-0</p>
<p><b>Great Britain</b> Hewlett-Packard Ltd Eskdale Road, Winnersh Triangle Wokingham, Berkshire RF11 5DZ England (44 734) 696622</p>		
INTERCON FIELD OPERATIONS		
<p><b>Headquarters</b> Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, California 94304-1316 (415) 857-5027</p>	<p><b>Australia</b> Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895</p>	<p><b>Canada</b> Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232</p>
<p><b>China</b> China Hewlett-Packard Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888</p>	<p><b>Japan</b> Yokogawa-Hewlett-Packard Ltd. 1-27-15 Yabe, Sagami-hara Kanagawa 229, Japan (81 427) 59-1311</p>	<p><b>Singapore</b> Hewlett-Packard Singapore (Pte.) Ltd 1150 Depot Road Singapore 0410 (65) 273-7388</p>
<p><b>Taiwan</b> Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404</p>		

## **Operation**

---

### **What You'll Find in This Chapter ...**

After a quick overview of the HP 85640A RF tracking generator, you'll learn about:

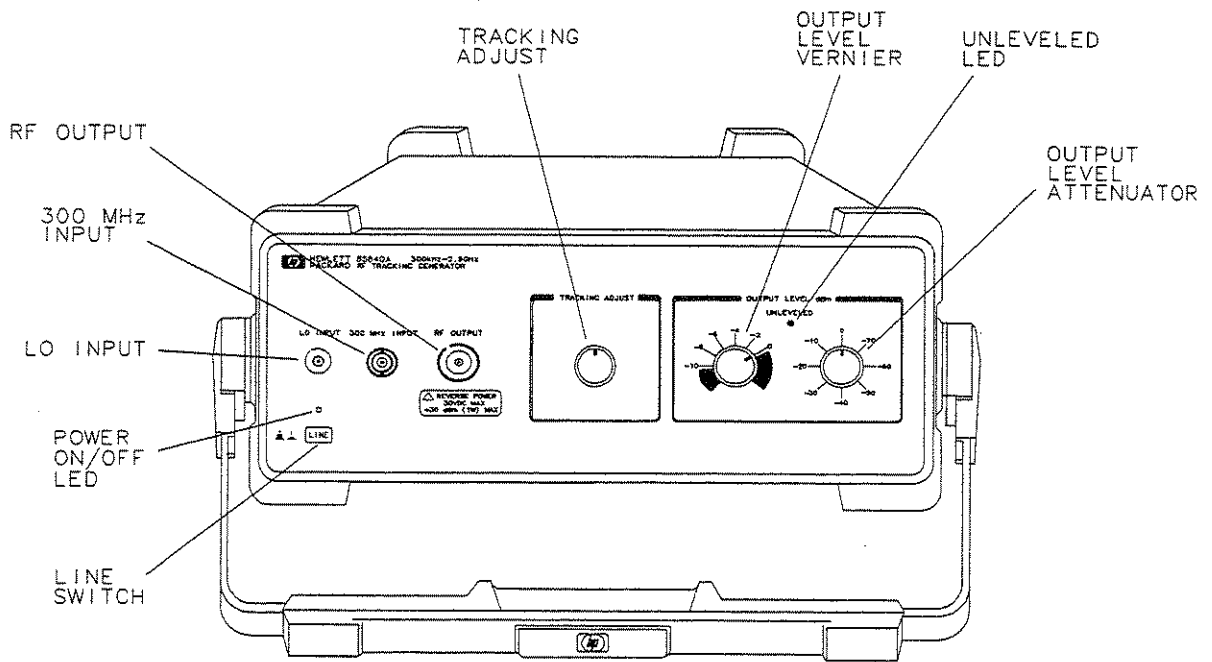
- Using front- and rear-panel features.
- Connecting the tracking generator to an HP host portable spectrum analyzer.
- Making a simple transmission measurement.
- Making a simple reflection measurement.

## Front-Panel Features

<b>LINE SWITCH</b>	turns the instrument on or off. The LED above the switch indicates whether or not ac power is applied to the tracking generator.
<b>LO INPUT</b>	uses the 1st LO output from the host spectrum analyzer to drive the tuning of the tracking generator.
<b>300 MHz INPUT</b>	uses the 300 MHz calibrator signal (3rd LO) of the host spectrum analyzer to drive the tracking generator.
<b>RF OUTPUT</b>	is the output signal of the tracking generator.
<b>TRACKING ADJUST knob</b>	allows you to adjust for any tracking errors that may result from differences between the tracking generator output frequency and the frequency to which the spectrum analyzer is tuned.  The tracking adjust knob is non-linear; clockwise and counter-clockwise rotation will not necessarily have an equal effect on the displayed signal.
<b>OUTPUT LEVEL knobs</b>	adjust the tracking generator's output power. The vernier (left-hand) knob makes fine-resolution adjustments, while the right-hand knob adjusts the attenuator from 0 dB to -70 dB in 10 dB increments.
<b>UNLEVELED LED</b>	lights when an unleveled condition is detected (except during retrace).

**Table 3-1. Front-Panel Interconnections**

Connector	Frequency Range	Amplitude Limits
LO INPUT (SMA female)	3.9107 GHz – 6.8107 GHz	+16.5 dBm ±2.0 dB
300 MHz INPUT (BNC female)	N/A	-10 dBm ±1.0 dB
RF OUTPUT (Type N female)	300 kHz – 2.9 GHz	Maximum output power: 0 dBm Minimum output power: -80 dBm



wk 29

**Figure 3-1. Front-Panel Feature Overview**

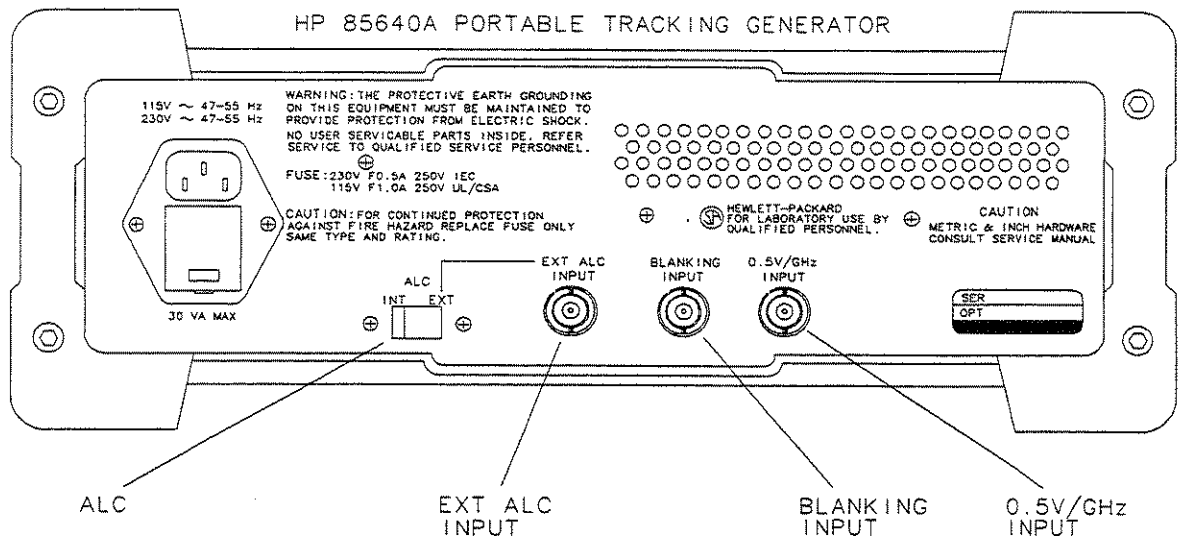


## Rear-Panel Features

- Input power** The appropriate power cable is included with your tracking generator. Connect the main-power plug only to a socket outlet that has protective ground contact.
- ALC INT EXT** allows you to select between internal and external leveling.
- EXT ALC INPUT** allows you to form an external leveling loop, using a negative-polarity detector.
- BLANKING INPUT** uses the spectrum analyzer's blanking output to deactivate the unlevelled LED during retrace.
- 0.5V/GHZ INPUT** uses the 0.5 V/GHz output from the spectrum analyzer for flatness compensation.

**Table 3-2. Rear-Panel Interconnections**

Connector	Amplitude Voltage Limits
<b>EXT ALC INPUT</b> (BNC female)	0 to -1 V (operating) ±15 V (damage level)
<b>BLANKING INPUT</b> (BNC female)	TTL high during retrace TTL low during sweep
<b>0.5 V/GHz INPUT</b> (BNC female)	0.5 V/GHz of tuned frequency



wk210

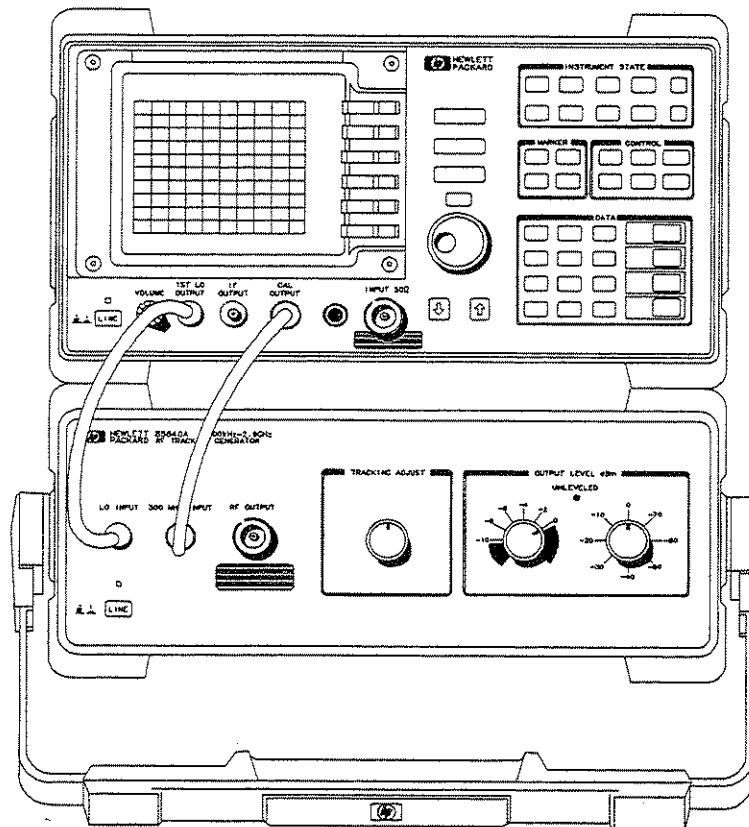
**Figure 3-2. HP 85640A Rear-Panel Feature Overview**

## HP 85640A and Host Spectrum Analyzer Connections

One SMA cable and three BNC cables connect the tracking generator to a host spectrum analyzer, as shown in Figure 3-3 and Figure 3-4.

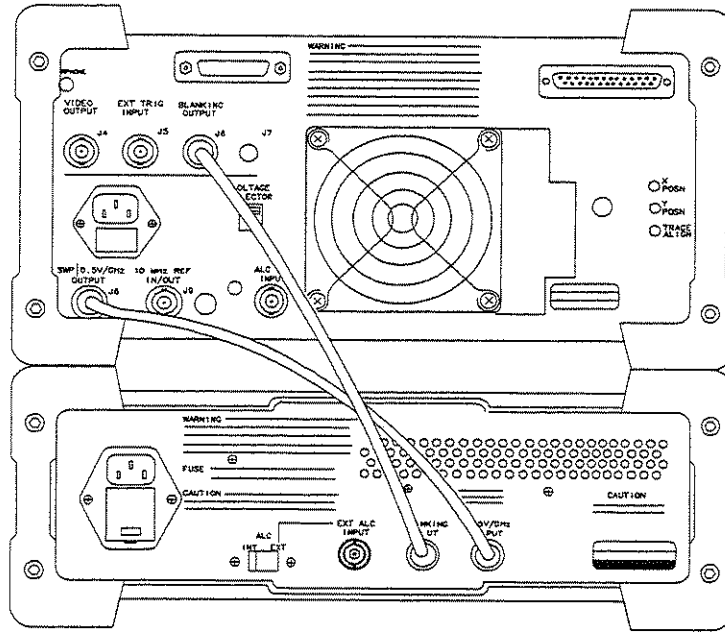
**Table 3-3. HP 85640A and Host Spectrum Analyzer Connections**

Tracking Generator to Spectrum Analyzer	
<b>Front-panel connections</b>	1ST LO INPUT to 1ST LO OUTPUT 300 MHz INPUT to CAL OUTPUT
<b>Rear-panel connections</b>	0.5 V/GHz INPUT to LO SWP 0.5V/GHz OUTPUT BLANKING INPUT to BLANKING OUTPUT or BLKG/GATE OUTPUT



wk249

**Figure 3-3. Tracking Generator-to-Host Analyzer Front-Panel Connections**



wk212

**Figure 3-4. Tracking Generator-to-Host Analyzer Rear-Panel Connections**

When you have made these connections, select the 0.5 V/GHz output on the spectrum analyzer:

- On an HP 8561A or HP 8562A/B, select **[SWEEP] REAR PNL OUTPUT .5V/GHZ(FAV)**.
- On an HP 8560A/E, HP 8561B/E, or HP 8563A/E press **[AUX CTRL] REAR PANEL .5V/GHZ (FAV)**.

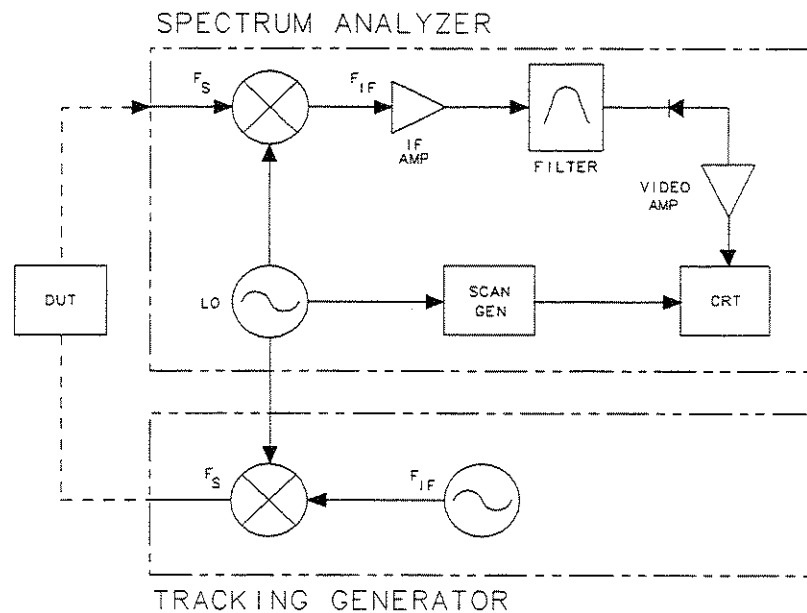
To view the tracking generator's output, connect the tracking generator's RF OUTPUT directly to the host spectrum analyzer's INPUT 50Ω connector. The spectrum analyzer should be tuned between 300 kHz and 2.9 GHz, within the specified range of the tracking generator.

- On an HP 8560E, HP 8561E, or HP 8563E, press **[SWEEP] GATE OFF**.

## Measurement Overview

A spectrum analyzer combined with a tracking generator forms a stimulus-response measurement system. With the tracking generator as the swept source and the spectrum analyzer as the receiver, operation is analogous to a single-channel scalar network analyzer. It can be used to characterize a device under test (DUT) in terms of transmission or reflection parameters. Transmission measurements include ripple, flatness, and rejection. Return loss is a typical reflection measurement.

Because it is a narrowband system, the tracking generator's output frequency tracks the spectrum analyzer's input frequency, resulting in a wide dynamic range. This wide dynamic range is illustrated in the following simplified block diagram.



wk213

Figure 3-5. Host Spectrum Analyzer and Tracking Generator System Block Diagram

### Making a Stimulus-Response Measurement

There are four basic steps to perform when doing stimulus-response measurements, whether transmission or reflection measurements:

- Set up the spectrum analyzer settings.
- Calibrate.
- Normalize.
- Measure.

## Equipment Needed

The DUT used in the transmission and reflection measurements shown in this chapter is a bandpass filter with a 321.4 MHz center frequency and a specified rejection of  $-80$  dB. For the test setups in Figure 3-8, Figure 3-22, Figure 3-33, and Figure 3-43, you also will need a directional bridge with sufficient range to accommodate the frequency of the DUT, a  $50\Omega$  termination, a short and an open, a barrel or bullet connector (to replace the DUT when making the reference trace), and appropriate cables and adapters.

---

### Note



- If you have an HP 8560A/E, HP 8561B/E, or HP 8563A/E spectrum analyzer, follow the instructions starting on page 3-9 for a transmission measurement and on page 3-30 for a reflection measurement. These spectrum analyzers have tracking generator-related softkeys included in their firmware.
  - If you have an HP 8561A or HP 8562A/B spectrum analyzer, follow the instructions starting on page 3-21 for a transmission measurement and on page 3-37 for a reflection measurement.
-

---

## Transmission Measurements

### Making a Transmission Measurement Using an HP 8560A/E, HP 8561B/E, or HP 8563A/E Spectrum Analyzer

---

#### Note



Instructions for making transmission measurements using an HP 8561A or HP 8562A/B begin on page 3-21.

The examples in this section were made using an HP 8560A spectrum analyzer, but are similar to results you may expect with an HP 8560E, HP 8561B/E or HP 8563A/E.

---

#### Set up the System.

To measure the rejection of a bandpass filter:

1. Make the necessary connections between the spectrum analyzer and the tracking generator (see Figure 3-3).
2. Examine the tracking generator's output power by connecting its RF OUTPUT directly to the spectrum analyzer's INPUT 50Ω.
3. On the spectrum analyzer, press **PRESET** **FREQUENCY** **START FREQ** 300 **kHz** **STOP FREQ** 2.9 **GHz**.
4. Select the 0.5 V/GHz OUTPUT on the spectrum analyzer by pressing **AUX CONTROL** **REAR PANEL** **.5V/GHZ (FAV)**.
  - On an HP 8560E, HP 8561E, or HP 8563E, press **SWEEP** **GATE OFF**.
5. Adjust the tracking generator's output power with the OUTPUT LEVEL controls: set the output power of the tracking generator to -10 dBm by setting the attenuator (right-hand) knob to -10 dBm, and the vernier (left-hand) knob to 0 dBm. (The filter we are testing will not be damaged by the -10 dBm power level.)

Figure 3-6 shows the spectrum analyzer display with these settings.

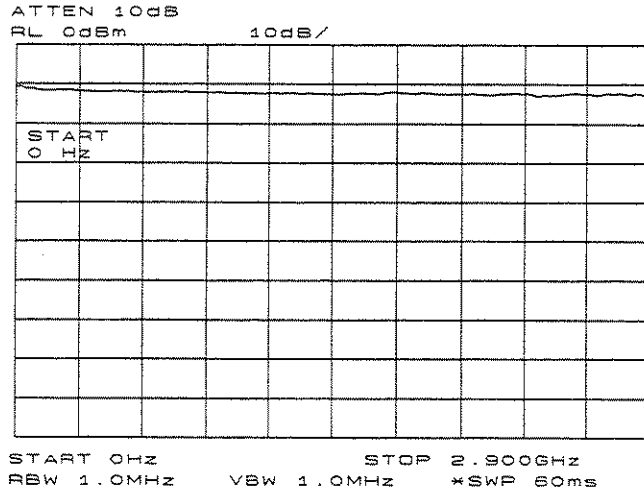
---

#### Note



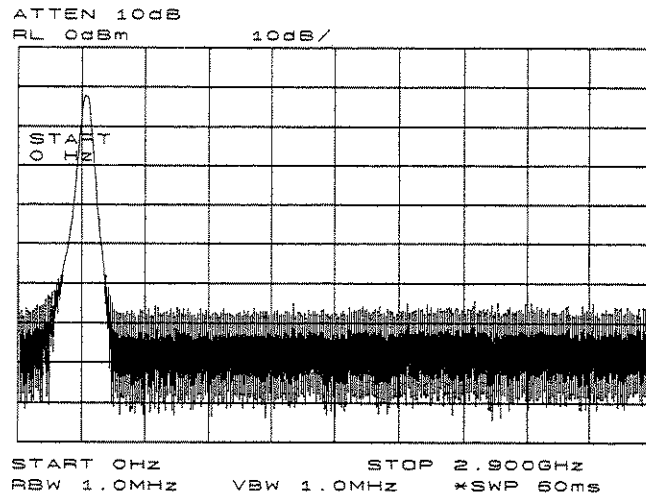
Although the displayed start frequency annotation was set to 300 kHz, notice that it remains at 0 Hz. This is due to the resolution of the display. If the stop frequency is decreased to 1 GHz, the start frequency reads 300 kHz.

---

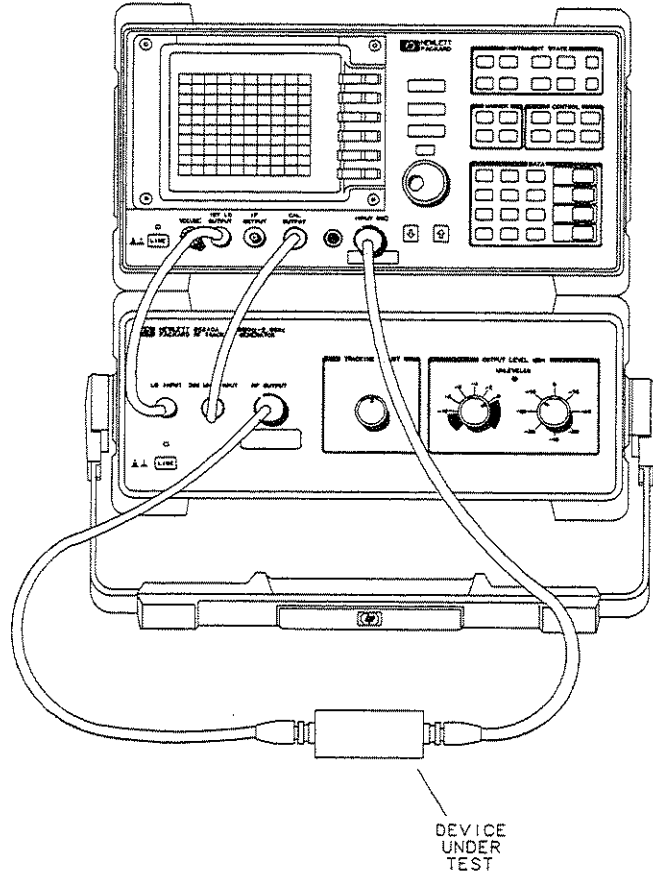


**Figure 3-6. Tracking Generator Power over Specified Frequency Range**

6. Connect the DUT as shown in Figure 3-8. Figure 3-7 shows the corresponding display.



**Figure 3-7. Display of DUT Response**



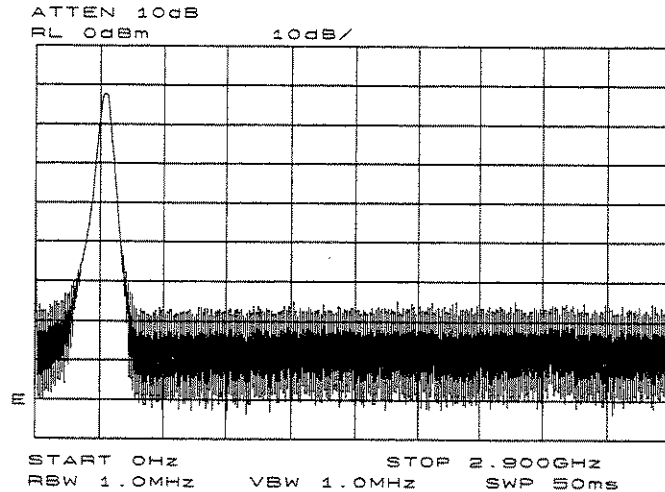
wk250

**Figure 3-8. System Setup for Transmission Measurement**

7. Access tracking generator-related keys by pressing **AUX CTRL** **TRACKING GENERATOR**.
8. Set the spectrum analyzer's sweep time to stimulus-response auto-coupled mode by pressing **SWP CPL SR SA** until SR is selected.

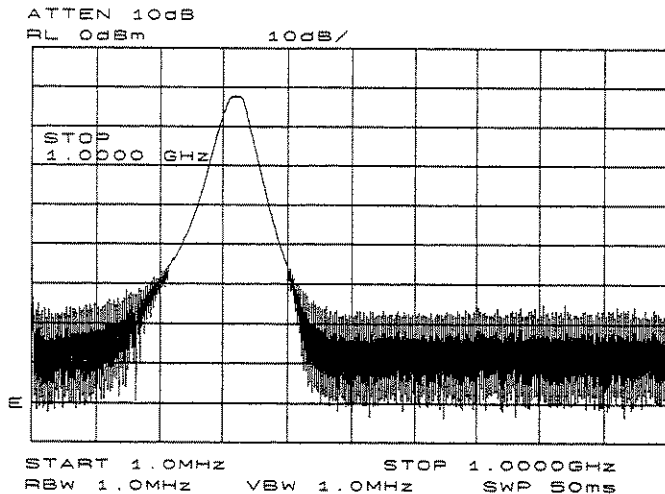
In stimulus-response mode, the auto-coupled sweep times usually are much faster for swept-response measurements. Stimulus-response auto-coupled sweep times typically are valid in stimulus-response measurements where the system's frequency span is less than 20 times the bandwidth of the DUT. When a stimulus-response sweep time is chosen, an E appears in the special functions area at the left-hand side of the display screen. Figure 3-9 illustrates the faster sweep time of 50 ms instead of 60 ms for the same analyzer settings.





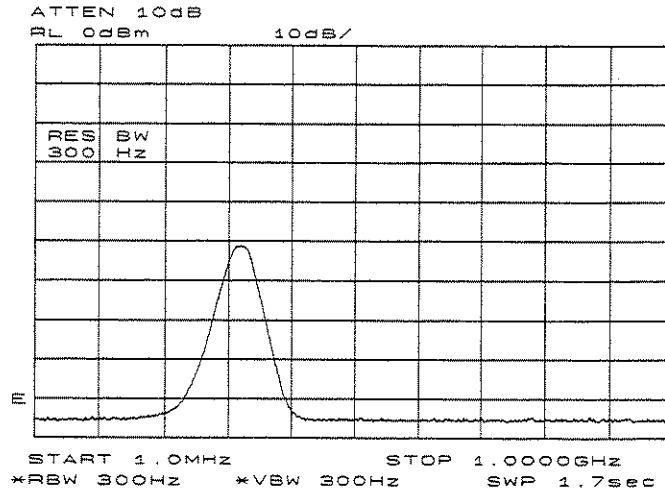
**Figure 3-9. Faster Sweep Times in Stimulus-Response Auto-Coupled Mode**

9. Because this test is for bandpass filter rejection only, tune the spectrum analyzer so the filter's roll-off takes up most of trace on the display. Set the start frequency to 1 MHz and the stop frequency to 1 GHz, as shown in Figure 3-10.



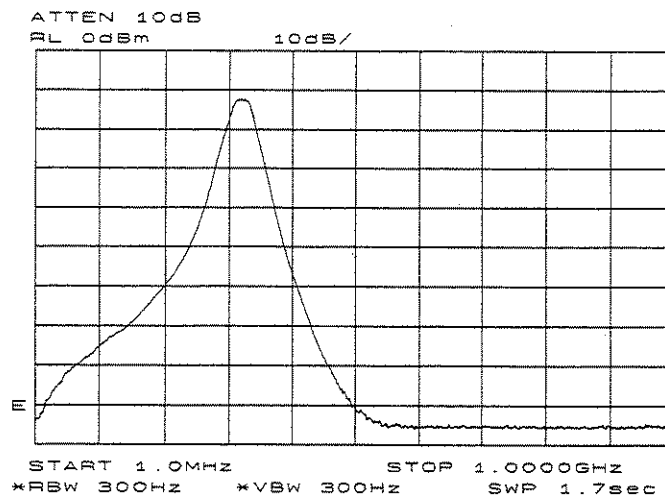
**Figure 3-10. Adjusting the Spectrum Analyzer for Measurement Requirements**

10. Decrease resolution bandwidth to reduce the displayed average noise level. Press **BW RES BW** (to select MAN), then press **↓** on the spectrum analyzer. In Figure 3-11, resolution bandwidth is set at 300 kHz.
11. Narrow video bandwidth to smooth the noise; press **VIDEO BW** (to select MAN), then press **↓** on the spectrum analyzer. In Figure 3-11, video bandwidth is set at 300 Hz.



**Figure 3-11. Decrease Resolution Bandwidth to Improve Sensitivity**

- Note the decrease in amplitude due to the tracking error. Compensate for any tracking errors with the TRACKING ADJUST vernier knob on the HP 85640A (see Figure 3-12).



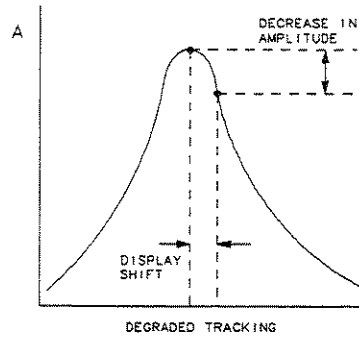
**Figure 3-12. Using Tracking Adjust to Compensate for Tracking Error**

---

**Note**

Tracking errors occur when the tracking generator's output frequency does not exactly match the input frequency of the spectrum analyzer. The resulting product from the spectrum analyzer's input mixer is not at the center of the IF bandwidth. The degradation in tracking causes a decrease of the displayed amplitude, as shown in Figure 3-13.

Because a small error in tracking causes a larger change in amplitude, tracking errors are most noticeable in narrow resolution bandwidths. Use the TRACKING ADJUST vernier knob on the HP 85640A to compensate for tracking errors. Adjust the knob until the displayed signal increases to its maximum amplitude.



wk215

**Figure 3-13. Tracking Error**

---

## Calibrate.

Notice that the output power of the tracking generator is not perfectly flat, as previously shown in Figure 3-6. This is due in part to the frequency response error, inherent in all scalar network measurement systems. Normalization is a technique used to eliminate frequency response errors, thereby increasing the amplitude accuracy of the measurement.

Before normalizing, a reference trace must be taken. For transmission measurements, this reference trace is referred to as a "thru," because the reference trace is measured with the DUT removed from the system. For reflection measurements, an open/short average is used. Because you are making a transmission measurement, a thru-reference trace must be stored.

To store the thru trace:

13. Press **AUX CTRL** **TRACKING GENRATOR** **SOURCE CAL MENU** **CAL THRU**.
14. The guided calibration routine illustrated in Figure 3-14 prompts you to connect the thru. Remove the DUT, replacing it with a barrel connector for optimum measurement integrity, and connect the thru as shown in Figure 3-15.

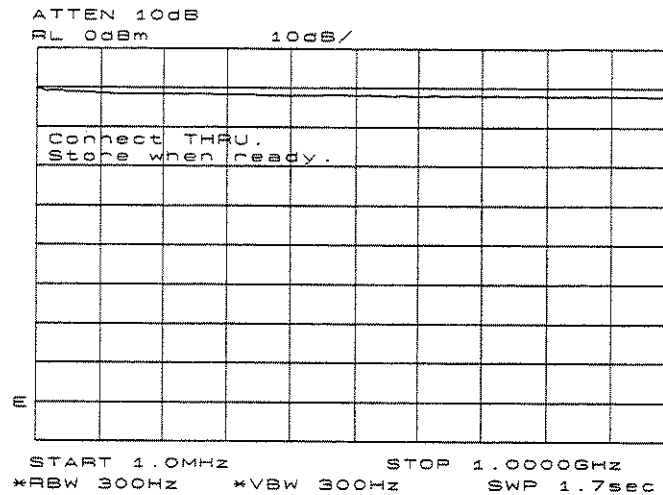
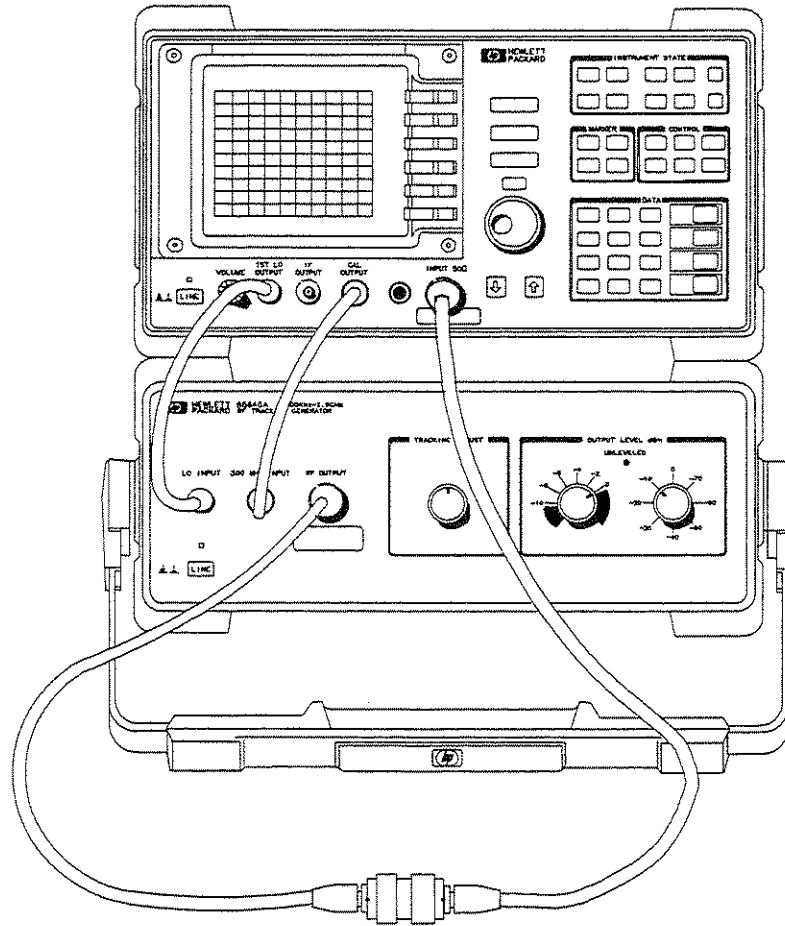


Figure 3-14. Guided Calibration Prompt



wk 251

**Figure 3-15. Thru Connected for Guided Calibration Routines**

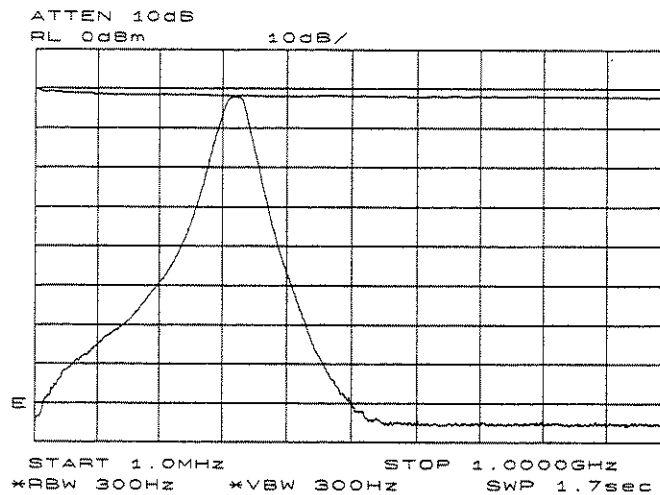
15. Press **STORE THRU** when ready. The thru trace is stored in trace B. It is also stored in an internal memory location in the analyzer. The state information of the thru-reference trace is stored in state register #9. This trace can be recalled for future use. In Figure 3-16, the DUT is reconnected and trace B is in view, showing the thru trace.

**Note**

If **SAVE LOCK** is on, pressing **STORE THRU** causes the message **SAVELOCK ON** to appear in the active function area. If this happens, press:



- a. **SAVE SAVE LOCK OFF**.
- b. **AUX CTRL TRACKING GENERATOR SOURCE CAL MENU CAL THRU STORE THRU**.



**Figure 3-16. Display of Thru-Reference Trace in Trace B**

**Normalize.**

16. To normalize, press **AUX CTRL TRACKING GENERATOR NORMLIZE ON OFF** until **ON** is selected. Notice that an arrow appears on each side of the graticule when normalization is activated. These arrows mark the normalized reference position, or the position where 0 dB insertion loss (transmission measurements) or 0 dB return loss (reflection measurements) normally resides.

When normalization is **ON**, trace math is being performed on the active trace:

$$A - B + \text{NRP} \rightarrow A$$

where:

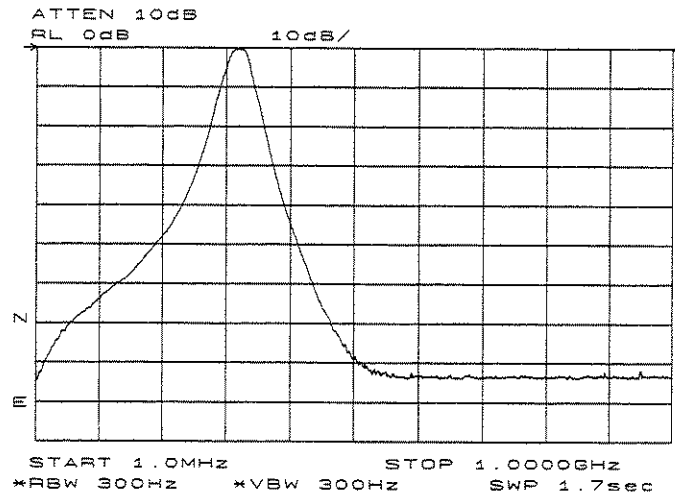
- A is the active trace,
- B is the stored thru-reference trace,
- NRP is the normalized reference position.

When normalization is on, an **N** appears in the special function section of the display screen. Notice that the reference level reading changes to **dB** to reflect this relative measurement (see Figure 3-17).

**Note**



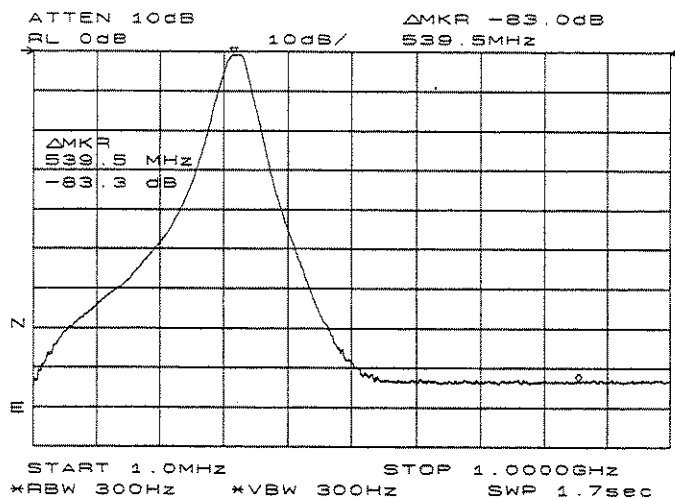
After a reference trace is saved, changing the settings of the spectrum analyzer, then activating normalization, will cause an ERR 902 BAD NORM. Error messages are displayed in the lower right-hand corner of the spectrum analyzer's display. To clear the error (and obtain a valid measurement), either reset the analyzer to the same settings as the reference trace, or save a new reference trace.



**Figure 3-17. Normalized Trace**

**Measure.**

17. Measure the rejection range using the spectrum analyzer's delta markers. Press **PEAK SEARCH** **MARKER DELTA**, and adjust the vernier knob on the front panel of the spectrum analyzer to position the second marker in the rejection area of the bandpass filter. See Figure 3-18.



**Figure 3-18. Measuring Rejection Range with Delta Markers**

18. Press **AMPLITUDE**; note that activating normalization changes the **REF LVL** softkey label to **NORM REF LVL**. **NORM REF LVL**, like **NORM REF POSN**, is a trace math function that allows you to change the position of the normalized trace within the range of the

graticule without changing spectrum analyzer settings. See Figure 3-19. As a result, your measurement remains calibrated. However, using these two trace math functions may mean that the top of the screen does not represent the gain-compression limit.

19. **RANGE LVL** increases the dynamic range of the measurement by changing the input attenuator and IF gain. It is equivalent to **REF LVL** used in signal analysis measurements. Both **RANGE LVL** and **REF LVL** ensure the input signal is not in gain compression.

To increase dynamic range of the measurement, press **RANGE LVL**. Note that, while increasing the dynamic range, more errors are introduced into the measurement, such as attenuator switching. However, as shown in Figure 3-20, dynamic range level has increased when using **RANGE LVL**.

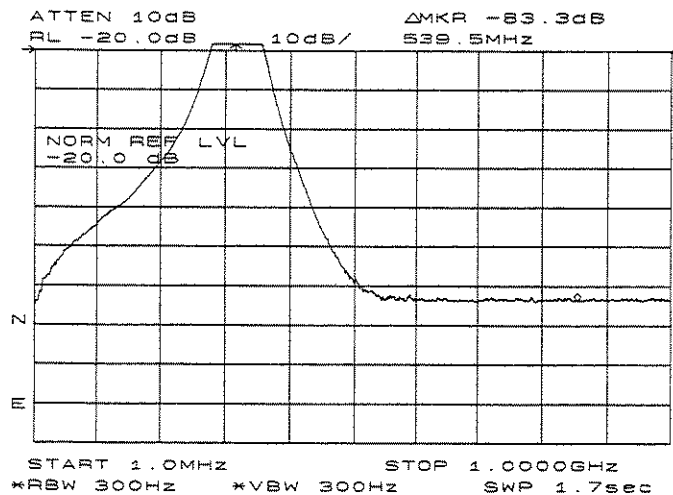


Figure 3-19. **NORM REF LVL** Adjusts the Trace and Retains Analyzer Settings

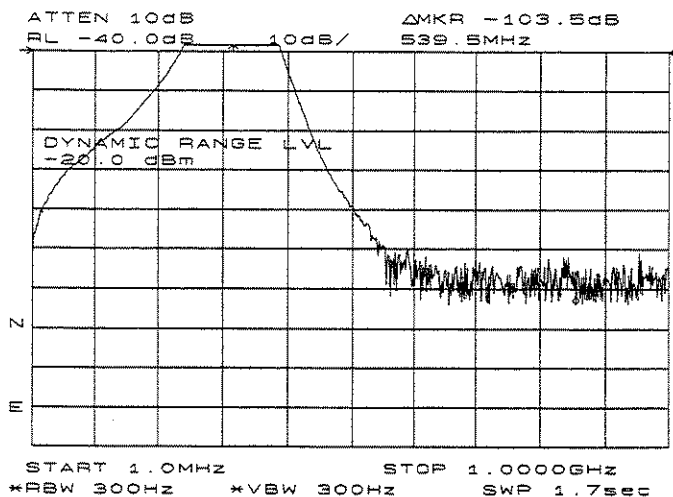


Figure 3-20. **RANGE LVL** Increases Dynamic Measurement Range



---

**Note**

If the actual signal measurement is beyond the gain-compression limit, or below the bottom graticule of the display, an error message appears in the lower right-hand corner of the display. In the case shown in Figure 3-20, the passband information has been adjusted off-screen in order to view the rejection range with better resolution. Changing the analyzer settings to raise the pass-band information above the top of the screen causes an ERR 903 A>DLMT.

---

## Making a Transmission Measurement Using an HP 8561A or HP 8562A/B Spectrum Analyzer

**Note** Instructions for making transmission measurements using an HP 8560A/E, HP 8561B/E, or HP 8563A/E begin on page 3-9.



The examples in this section were made using an HP 8562B spectrum analyzer, but are similar to results you may expect with an HP 8561A or HP 8562A.

### Set up the System.

To measure the rejection of a bandpass filter:

1. Make the necessary connections between the spectrum analyzer and the tracking generator (see Figure 3-3).
2. Examine the tracking generator's output power by connecting its RF OUTPUT directly to the spectrum analyzer's INPUT 50Ω. On the spectrum analyzer, press **PRESET** **FREQUENCY** **START FREQ** 300 **kHz** **STOP FREQ** 2.9 **GHz**.
3. Select the 0.5 V/GHz OUTPUT on the spectrum analyzer by pressing **SWEEP** **REAR PNL OUTPUT** **.5V/GHZ(FAV)**.
  - On an HP 8560E, HP 8561E, or HP 8563E, press **SWEEP** **GATE OFF**.
4. Adjust the tracking generator's output power with the OUTPUT LEVEL controls; set the output power of the tracking generator to -10 dBm by setting the attenuator (right-hand) knob to -10 dBm, and the vernier (left-hand) knob to 0 dB. (The filter we are testing will not be damaged by the -10 dBm power level.)

Figure 3-21 shows the spectrum analyzer display with these settings.

**Note** Although the displayed start frequency annotation was set to 300 kHz, notice that it remains at 0 Hz. This is due to the resolution of the display. If the stop frequency is decreased to 1 GHz, the start frequency reads 300 kHz.

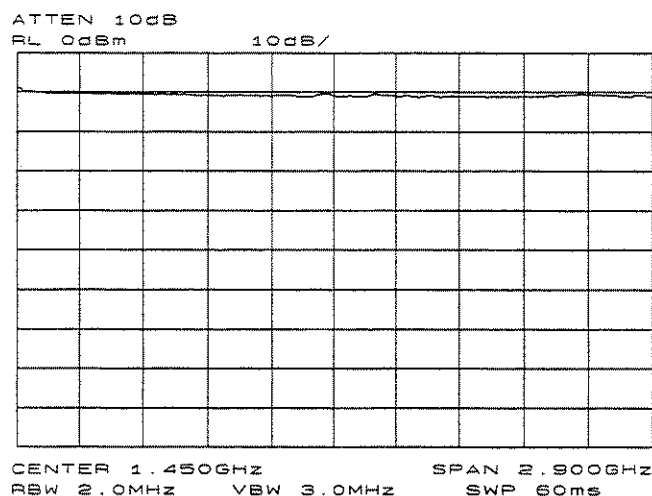
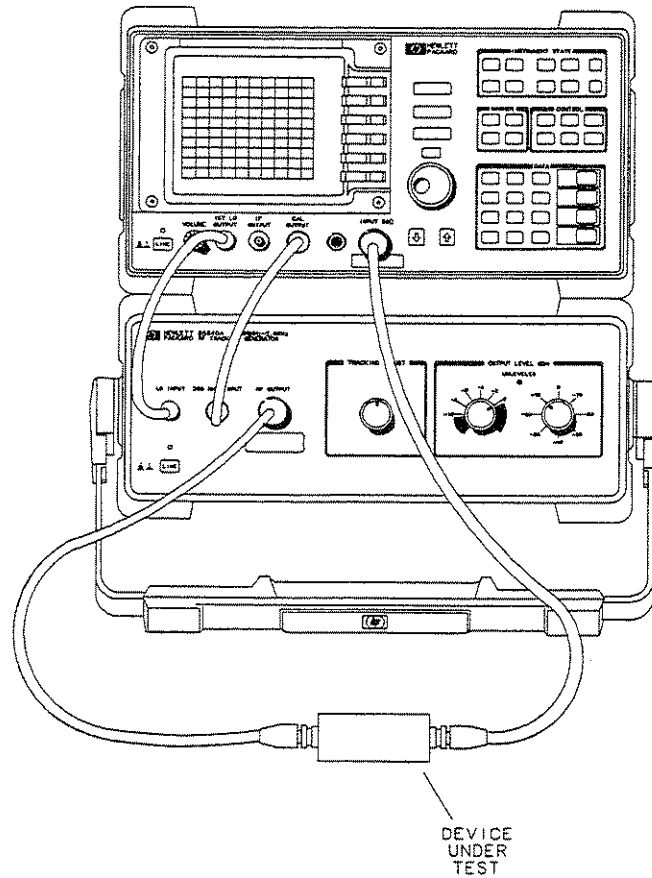


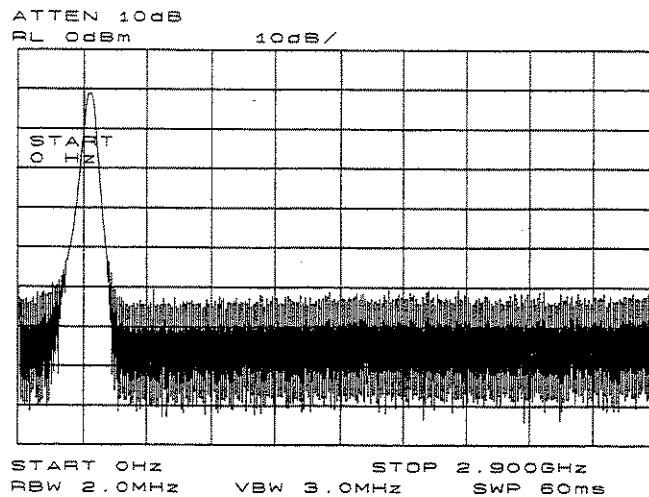
Figure 3-21. Tracking Generator Power over Specified Frequency Range

5. Connect the DUT as shown in Figure 3-22. Figure 3-23 shows the corresponding display.



wk252

**Figure 3-22. System Setup for Transmission Measurement**



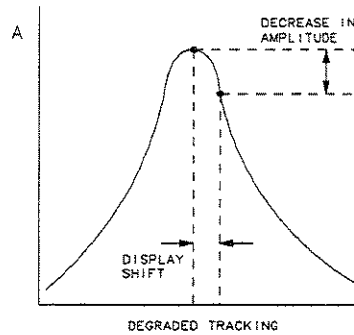
**Figure 3-23. Display of DUT Response**

---

**Note**

Tracking errors occur when the tracking generator's output frequency does not exactly match the input frequency of the spectrum analyzer. The resulting product from the spectrum analyzer's input mixer is not at the center of the IF bandwidth. The degradation in tracking causes a decrease of the displayed amplitude, as shown in Figure 3-27.

Because a small error in tracking causes a larger change in amplitude, tracking errors are most noticeable in narrow resolution bandwidths. Use the TRACKING ADJUST vernier knob on the HP 85640A to compensate for tracking errors. Adjust the knob until the displayed signal increases to its maximum amplitude.



wk215

**Figure 3-27. Tracking Error**

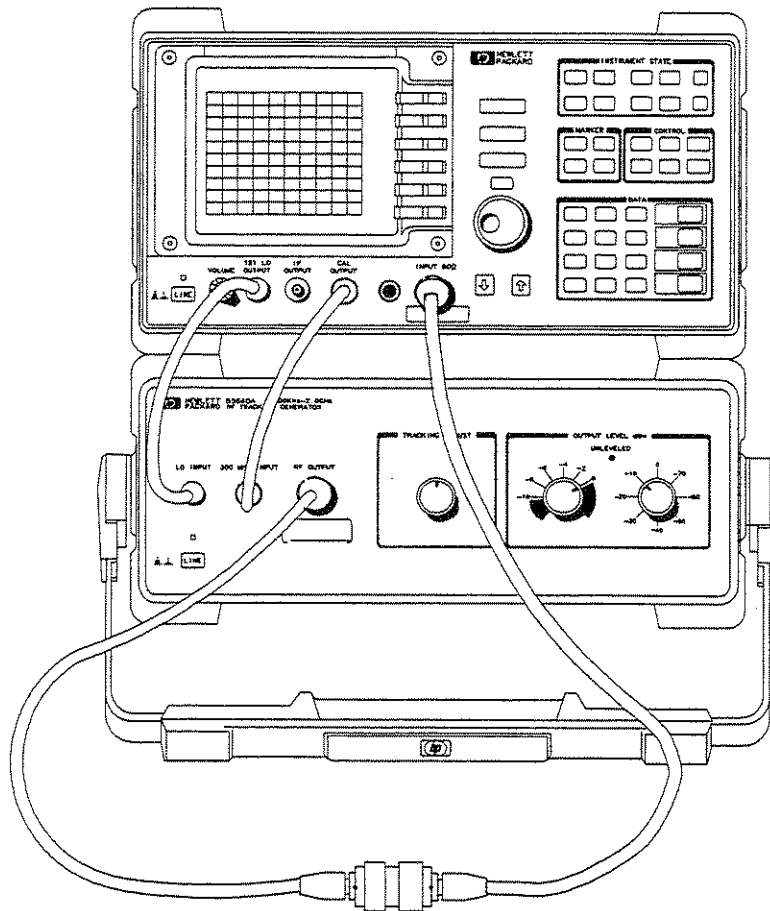
## Calibrate.

Notice that the output power of the tracking generator is not perfectly flat, as previously shown in Figure 3-21. This is due in part to the frequency response error, inherent in all scalar network measurement systems. Normalization is a technique used to eliminate frequency response errors, thereby increasing the amplitude accuracy of the measurement.

Before normalizing, a reference trace must be taken. For transmission measurements, this reference trace is referred to as a "thru," because the reference trace is measured with the DUT removed from the system. For reflection measurements, an open/short average is used. Because you are making a transmission measurement, a thru-reference trace must be stored.

To store the thru trace:

11. Remove the DUT, replacing it with a barrel connector for optimum measurement integrity. Connect the thru, as shown in Figure 3-28.



wk253

Figure 3-28. Thru Connected for Calibration Routine

12. Store the thru trace in trace B by pressing **TRACE** **TRACE B** **CLR-WRT B**. Wait for the new speed to finish, then **VIEW B**.
13. For future reference, store the thru trace in a trace register. Press **SAVE** **SAVE TRACE B** **TRACE n** (where  $n$  is the number of the trace register.)

---

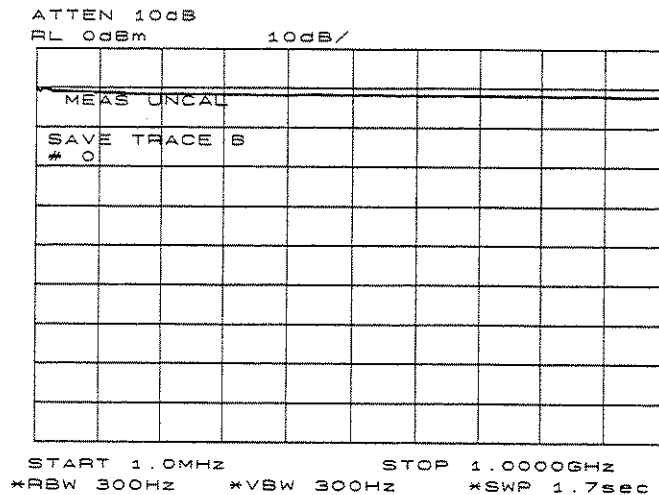
**Note**

If SAVE LOCK is on, pressing **TRACE n** on an HP 8561A/62A causes the message SAVELOCK ON to appear in the active function area.

If this happens, press **SAVE** **SAVELOCK OFF** **SAVE TRACE B** **TRACE n**

---

Figure 3-29 shows the on-screen condition after a thru trace is stored. In the illustration, the DUT is reconnected and trace B is in view, displaying the thru trace.



**Figure 3-29. Display of Thru-Reference Trace in Trace B**

**Normalize.**

- To normalize, activate the trace math function,  $A-B+DL \rightarrow A$ , by pressing **TRACE** **MORE**. Press **A-B+DL→A ON OFF** to select ON.

---

**Note**

When trace math is on, an **M** will appear in the special functions section of the display.

---

- If necessary, make adjustments to the position of the trace by changing the position of the display line. Access the display line by pressing **DISPLAY** **DSPL LIN ON OFF**. The preset value of the display line is 0 dBm.

16. Reconnect the DUT. Figure 3-30 shows the normalized trace.

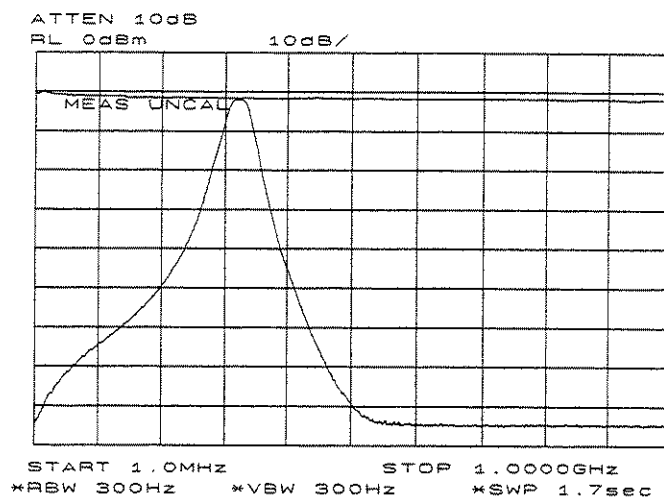


Figure 3-30. Normalized Trace

### Measure.

17. Measure the rejection range using the spectrum analyzer's delta markers. Press **PEAK SEARCH** **MARKER DELTA**, and adjust the vernier knob on the front panel of the spectrum analyzer to position the second marker in the rejection area of the bandpass filter. See Figure 3-31.

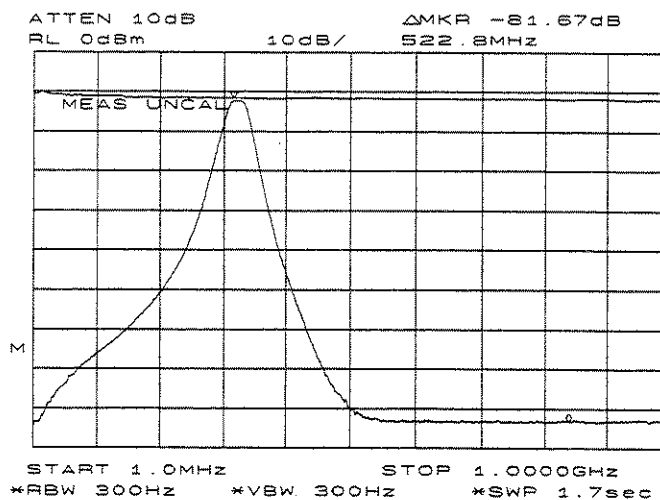
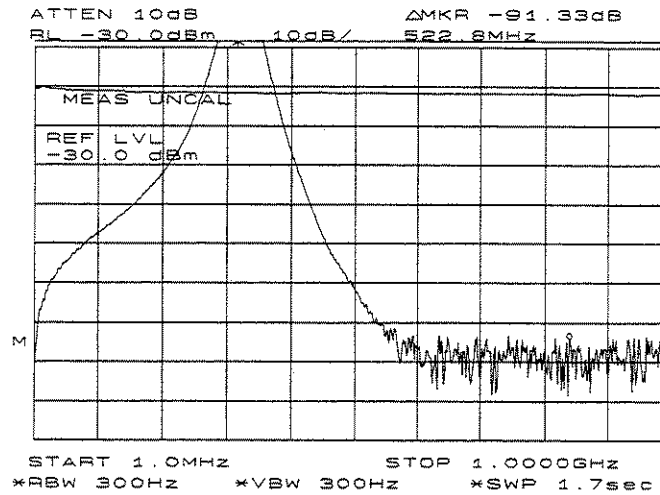


Figure 3-31. Measuring Rejection Range with Delta Markers

18. **REF LVL** increases the dynamic range of the measurement by changing the input attenuator and IF gain. It makes sure the input signal is not in gain compression. To increase the dynamic range of the measurement, press **(AMPLITUDE) REF LVL (↓)**. Note that while increasing the dynamic range, more errors are introduced into the measurement. Figure 3-32 shows the results of increasing the dynamic range. Notice that the top of the screen does not necessarily represent the gain-compression limit.



**Figure 3-32. Increased Dynamic Measurement Range**



---

## Reflection Measurements

### Making a Reflection Measurement Using an HP 8560A/E, HP 8561B/E, or HP 8563A/E Spectrum Analyzer

---

**Note**      Instructions for making reflection measurements using an HP 8561A or HP 8562A/B begin on page 3-37.



The examples in this section were made using an HP 8560A spectrum analyzer, but are similar to results you may expect with an HP 8560E, HP 8561B/E or HP 8563A/E.

---

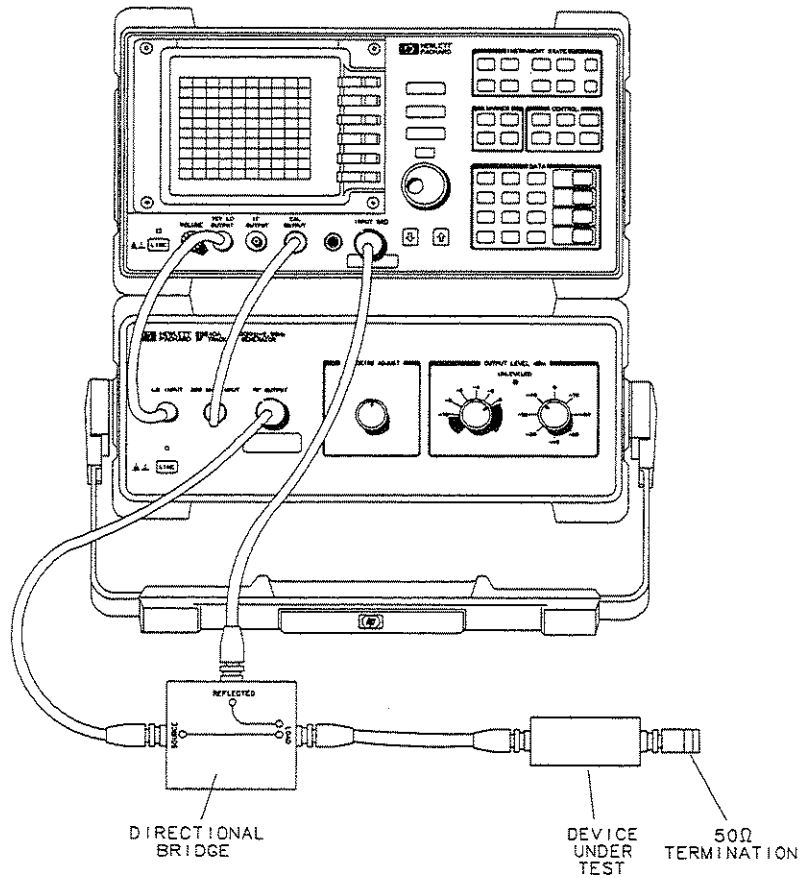
#### Set up the System.

To measure the return loss of a bandpass filter:

1. Make the necessary connections between the spectrum analyzer and the tracking generator (see Figure 3-3).
2. Select the 0.5 V/GHz OUTPUT on the spectrum analyzer by pressing **[SWEEP]** **[REAR PNL OUTPUT]** **[.5V/GHZ(FAV)]**.
  - On an HP 8560E, HP 8561E, or HP 8563E, press **[SWEEP]** **[GATE OFF]**.
3. Examine the tracking generator's output power by connecting its RF OUTPUT directly to the spectrum analyzer's INPUT 50Ω.
4. On the spectrum analyzer, Press **[PRESET]** **[FREQUENCY]** **[START FREQ]** 300 **[kHz]** **[STOP FREQ]** 2.9 **[GHz]**.

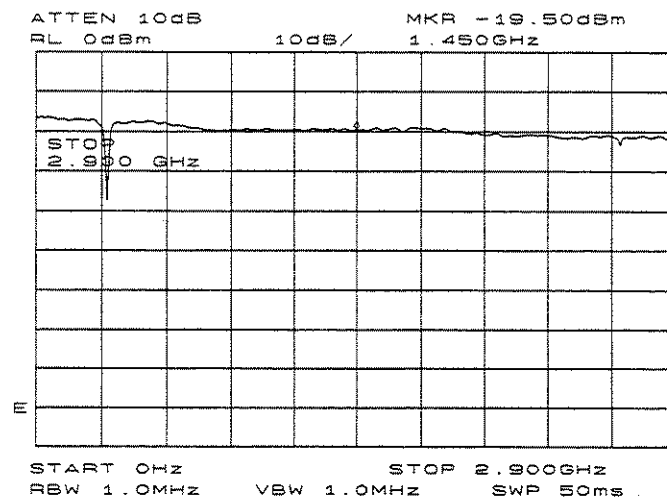
#### Calibrate.

5. Connect the DUT as shown in Figure 3-33. The corresponding display is illustrated in Figure 3-34.



wk254

**Figure 3-33. System Setup for a Reflection Measurement**



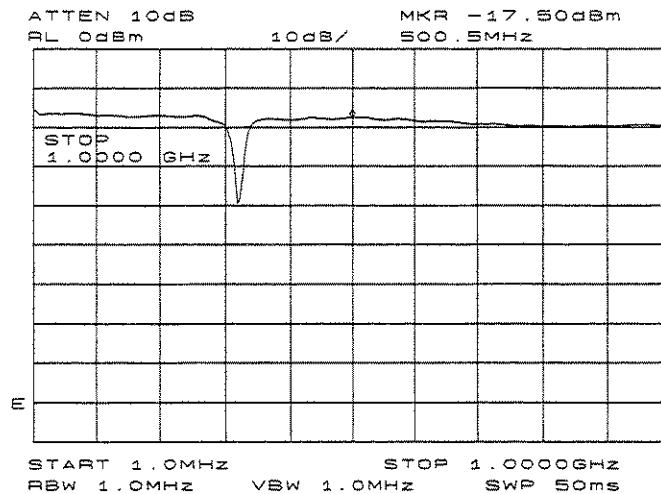
**Figure 3-34. Display with System Configured for a Reflection Measurement**

6. Adjust the tracking generator's output power with the OUTPUT LEVEL controls: increase the output power 6 dB by setting the attenuator (right-hand) knob to 0 dBm and the vernier (left-hand) knob to -4 dBm. This output-power level differs from the level used for the transmission measurement example because a 6 dB coupler is used in the reflection measurement setup.
7. Select stimulus-response auto-coupled sweep time mode for the spectrum analyzer by pressing **AUX CTRL TRACKING GENERATOR SWP CPL SA SR** until SR is selected.
8. Adjust the spectrum analyzer settings according to the measurement requirements. For this measurement, set the analyzer to frequencies around the minimum reflection region of the filter. Change the start frequency to 1 MHz and the stop frequency to 1 GHz. Figure 3-35 illustrates what should appear on-screen.

**Note**



On the HP 8560A/E, HP 8561B/E, or HP 8563A/E, the minimum resolution bandwidth supported in stimulus-response measurements is 300 Hz.



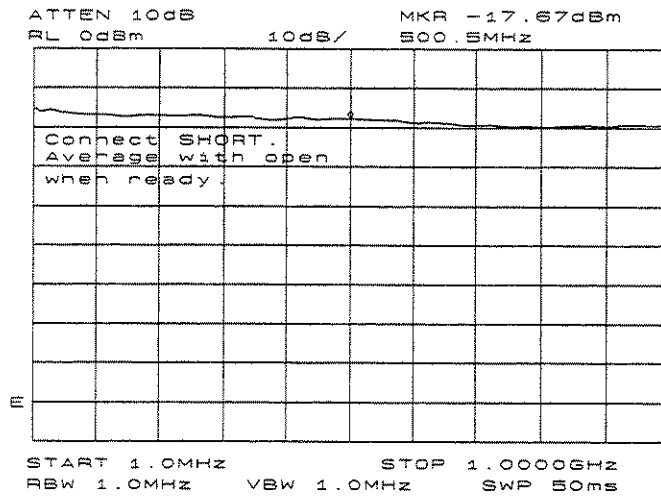
**Figure 3-35. Spectrum Analyzer Display of Bandpass Filter Region**

To store an open/short-average reference trace:

9. Remove the DUT.
10. Press **AUX CTRL TRACKING GENERATOR SOURCE CAL MENU CAL OPN/SHRT**.
11. The analyzer will prompt you to connect the open (Figure 3-36).

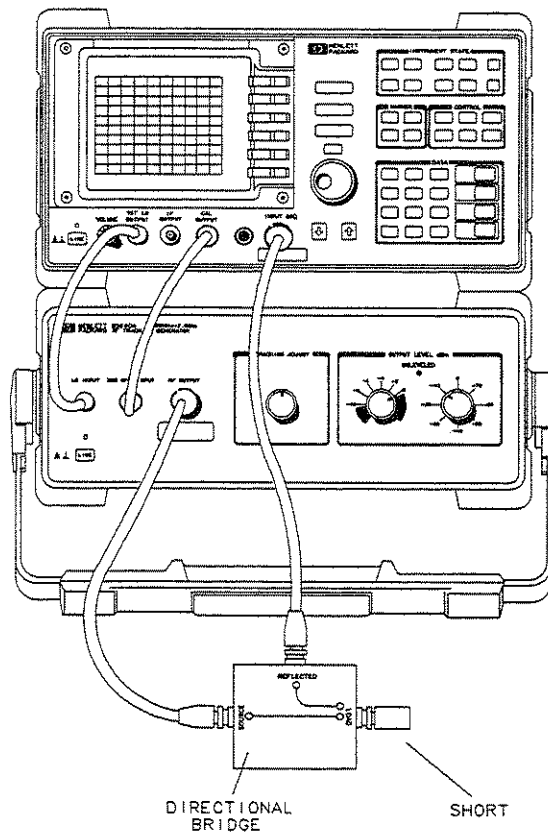


12. After connecting the open as shown in Figure 3-27, press **STORE OPEN**.
13. The analyzer will prompt you to connect the short (Figure 3-38).



**Figure 3-38. On-Screen Prompts to Connect an Short**

14. Connect the short as shown in Figure 3-39.



wk255

**Figure 3-39. Connect the Short**

15. Press **AVERAGE SHORT**. The analyzer takes the average of the open and short traces, then stores the averaged trace in the analyzer's internal memory and in trace B. The corresponding state information is stored in state register #8.

**Note**

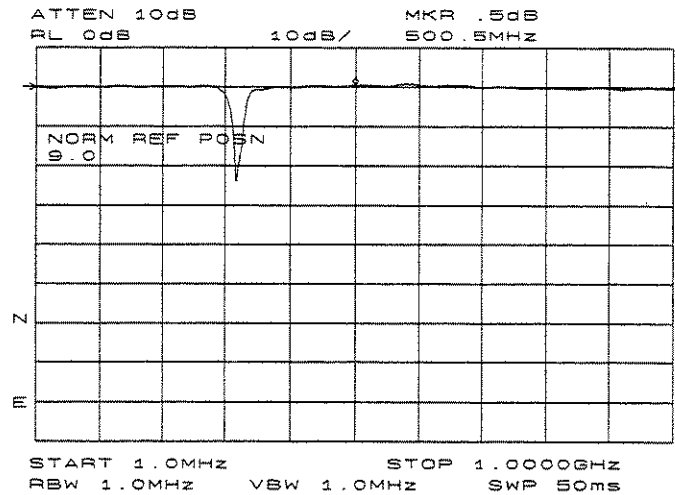


If **SAVE LOCK** is on, pressing **AVERAGE SHORT** causes the message **SAVELOCK ON** to appear in the active function area. If this happens, press:

- a. **SAVE SAVE LOCK OFF**.
- b. **AUX CTRL TRACKING GENERATOR SOURCE CAL MENU CAL SHORT STORE SHORT**.

**Normalize.**

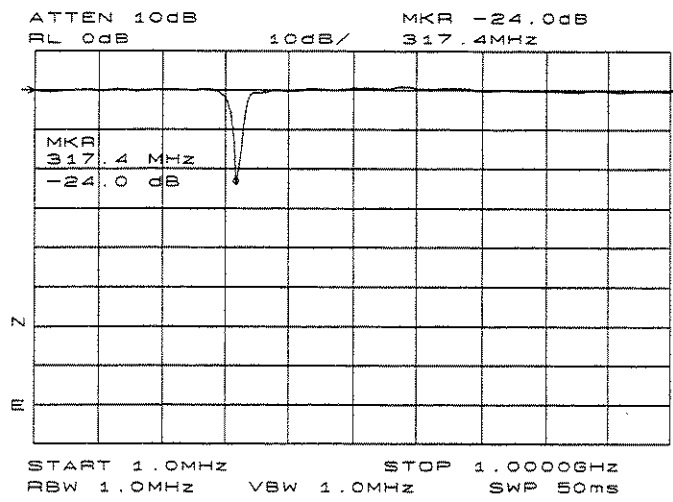
16. Reconnect the DUT, and normalize by pressing **NORMALIZE ON OFF** until **ON** is selected. The normalized trace is shown in Figure 3-40. In this case, **NORM REF POSN** was adjusted for better viewing of the signal.



**Figure 3-40. Normalized Return Loss Measurement**

**Measure.**

17. Read the return loss by activating the marker. Press **(MKR)**. Use the analyzer's knob to position the marker at the frequency of interest. See Figure 3-41.



**Figure 3-41. Return Loss Reading Using the **(MKR)** Function**

## Making a Reflection Measurement Using an HP 8561A or HP 8562A/B Spectrum Analyzer

---

### Note



Instructions for making reflection measurements using an HP 8560A/E, HP 8561B/E, or HP 8563A/E begin on page 3-30.

The examples in this section were made using an HP 8562B spectrum analyzer, but are similar to results you may expect with an HP 8561A or HP 8562A.

---

### Set up the System.

To measure the return loss of a bandpass filter:

1. Make the necessary connections between the spectrum analyzer and the tracking generator (see Figure 3-3).
  2. Examine the tracking generator's output power by connecting its RF OUTPUT directly to the spectrum analyzer's INPUT 50Ω. On the spectrum analyzer, Press **PRESET** **FREQUENCY** **START FREQ** 300 **kHz** **STOP FREQ** 2.9 **GHz**.
  3. Select the 0.5 V/GHz OUTPUT on the spectrum analyzer by pressing **SWEEP** **REAR PNL OUTPUT** **5V/GHZ(FAV)**.
- 

### Note



HP 8561A and HP 8562A/B spectrum analyzers do not have tracking generator-related keys. Sweep-time settings during a stimulus-response measurement are highly dependent on the device under test. Any changes to resolution bandwidth, span, or other analyzer settings may cause a change in sweep time.

#### Setting Sweeptimes

Accurate stimulus-response measurements typically can use sweeptimes much faster than auto-coupled sweeptimes. The following procedure calculates the fastest sweeptime for stimulus-response measurements, assuming the span is less than 20 times the bandwidth for the DUT:

1. Note the autocoupled sweeptime.
2. Calculate each of the following:
  - a.  $\text{span (Hz)} / 156 \text{ GHz}$
  - b.  $500 / \text{resolution bandwidth (Hz)}$
  - c.  $200 / \text{video bandwidth (Hz)}$
3. Determine the greatest of the values in steps 2a, 2b, and 2c.
4. Set sweeptime to the smaller of the values in steps 1 and 3. The analyzer will limit sweeptime to 50 msec or less in non-zero spans.

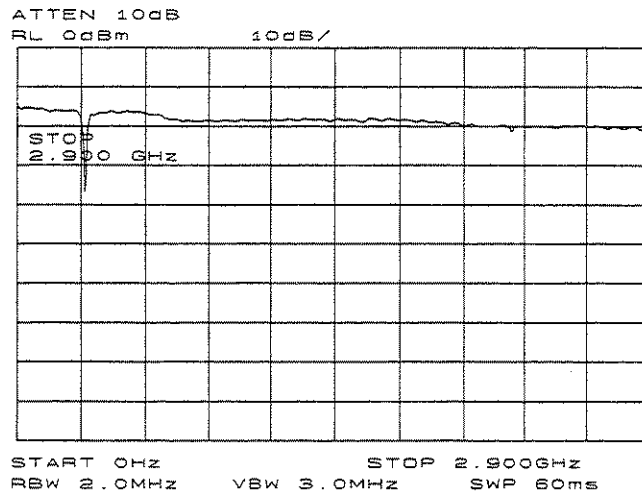
If the value in step 4 is less than the auto-coupled sweeptime, the MERS UNCAL indicator will be displayed; this message may be ignored, as it has no effect on the outcome of the measurement.

---

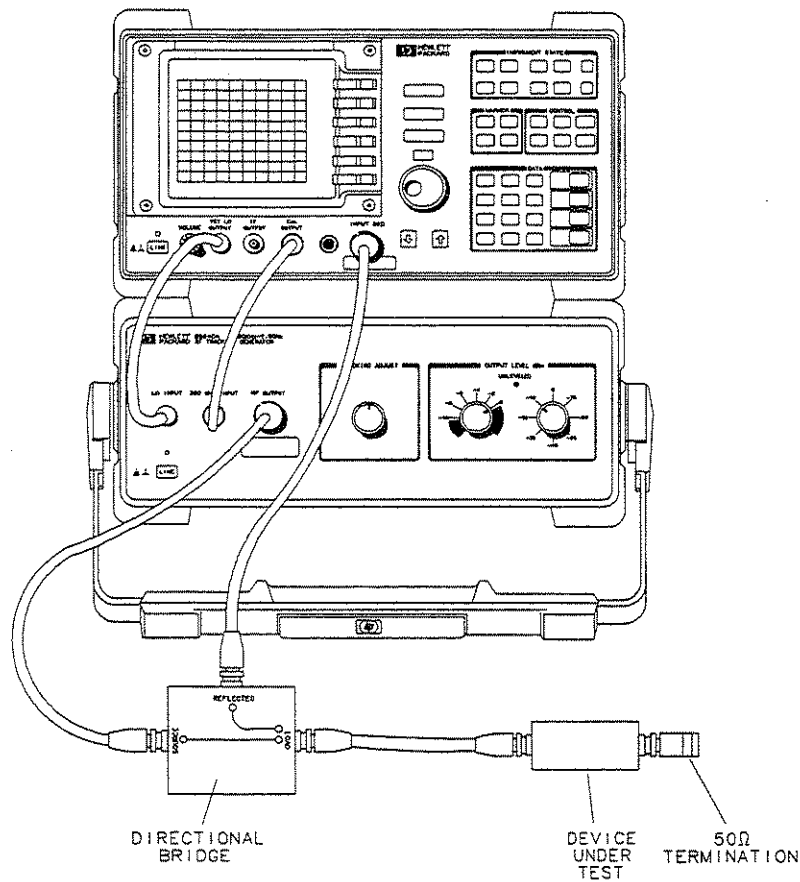


**Calibrate.**

4. Connect the DUT as shown in Figure 3-43. The corresponding display is illustrated in Figure 3-42.



**Figure 3-42. Display with the System Configured for a Reflection Measurement**



wk257

**Figure 3-43. System Setup for a Reflection Measurement**

5. Adjust the tracking generator's output power with the OUTPUT LEVEL controls: increase the output power 6 dB by setting the attenuator (right-hand) knob to 0 dBm and the vernier (left-hand) knob to -4 dBm. This output-power level differs from the level used for the transmission measurement example because a 6 dB coupler is used in the reflection measurement setup.
6. Adjust the host analyzer's settings according to the measurement requirements. For this measurement, set the analyzer to frequencies around the minimum reflection region of the filter. Change the start frequency to 1 MHz and the stop frequency to 1 GHz. Figure 3-44 shows what should appear on the display.

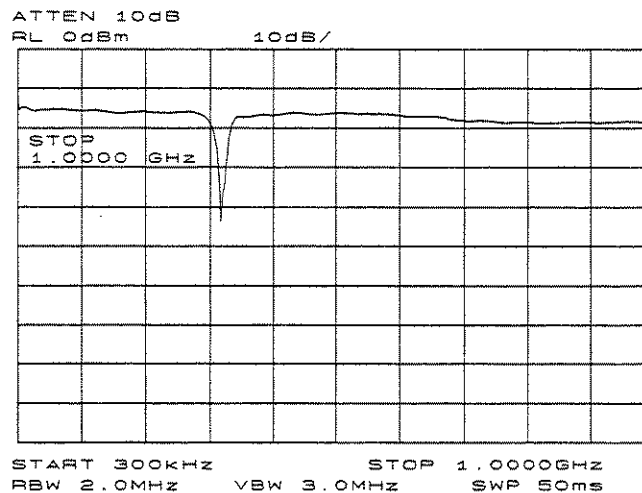


Figure 3-44. Spectrum Analyzer Display of Bandpass Filter Region

**Note**



Unlike the thru-reference trace, an open/short average-reference trace cannot be performed from the front panel of an HP 8561A or HP 8562A/B. However, this measurement can be done via remote operation.

The program should perform the following steps:

1. Read the open trace.
2. Read the short trace.
3. Average the two traces.
4. Put the average trace into trace B.

For more information, refer to the host analyzer's operating and programming manual, and to the *HP 85620A Mass Memory Module Operating and Programming Manual*.

7. On HP 8561A and HP 8562A/B host analyzers, an open/short average-reference trace can only be performed via remote operation (see note). If a controller is not available, steps 8 through 10 will establish a reference trace using only a short.
8. Remove the DUT. Replace it with a short.
9. Press **TRACE** **TRACE B** **CLR-WRT B**. Wait for a new sweep to finish. Press **VIEW B**.
10. For future reference, store the short trace in a trace register. Press **SAVE** **SAVE TRACE B** **TRACE n** (where *n* is the number of the trace register).

## Note



If SAVE LOCK is on, pressing **TRACE n** on an HP 8561A/62A causes the message SAVELOCK ON to appear in the active function area.

If this happens, press **SAVE SAVELOCK OFF SAVE TRACE B TRACE n**.

## Normalize.

11. Reconnect the DUT.
12. To normalize, activate the trace math function  $A - B + DL \rightarrow A$ , by pressing **TRACE MORE**. Press **A-B+DL→A ON OFF** until ON is selected.
13. If necessary, make adjustments to the position of the trace by changing the position of the display line. Access the display line by pressing **DISPLAY DSPL LIN ON OFF**. The preset value of the display line is 0 dBm.

## Measure.

14. Read the return loss by activating the marker. Press **PEAK SEARCH ON MARKER DELTA**, then use the analyzer's adjustment knob to position the marker at the frequency of interest (typically the point of maximum return loss). See Figure 3-45.

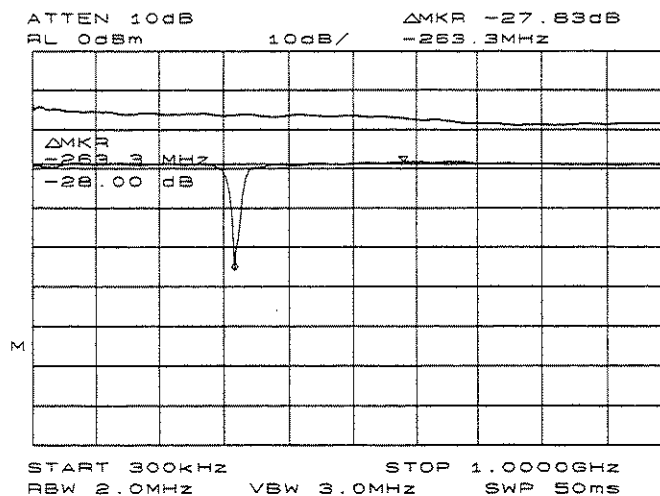


Figure 3-45. Return Loss Reading Using the **MKR** Function

## Performance Tests

---

### What You'll Find in This Chapter . . .

This chapter contains performance test procedures that verify the electrical performance of the HP 85640A RF tracking generator against the specifications in Table 1-1. None of the test procedures requires removing the instrument cover.

To test the tracking generator, you must connect it to a powered-on Hewlett-Packard spectrum analyzer. Any one of the following may serve as the "host" spectrum analyzer:

- HP 8560A/E spectrum analyzer (non-Option 002)
- HP 8561A/B/E spectrum analyzer
- HP 8562A/B spectrum analyzer
- HP 8563A/E spectrum analyzer

---

### What is Performance Verification?

The highest-level testing, called **performance verification**, tests the tracking generator's performance against all its specifications listed in Table 1-1. Table 4-1 lists all performance verification tests and test equipment required to perform each test. Refer to each test for appropriate adapters and cables.

**Table 4-1. Performance Tests**

<b>Test Number</b>	<b>Test Name</b>	<b>Equipment Used</b>
1	Output attenuator accuracy	Measuring receiver Host spectrum analyzer*
2	Maximum leveled output power	50Ω termination Host spectrum analyzer*
3	Level flatness	Measuring receiver Power sensor Host spectrum analyzer*
4	Harmonic spurious outputs	Microwave spectrum analyzer Host spectrum analyzer*
5	Non-harmonic spurious outputs	Microwave spectrum analyzer Host spectrum analyzer*
6	LO feedthrough amplitude	Microwave spectrum analyzer Host spectrum analyzer
7	Tracking generator feedthrough	50Ω termination Host spectrum analyzer*
8	Frequency tracking range	Frequency counter Power splitter Host spectrum analyzer*

---

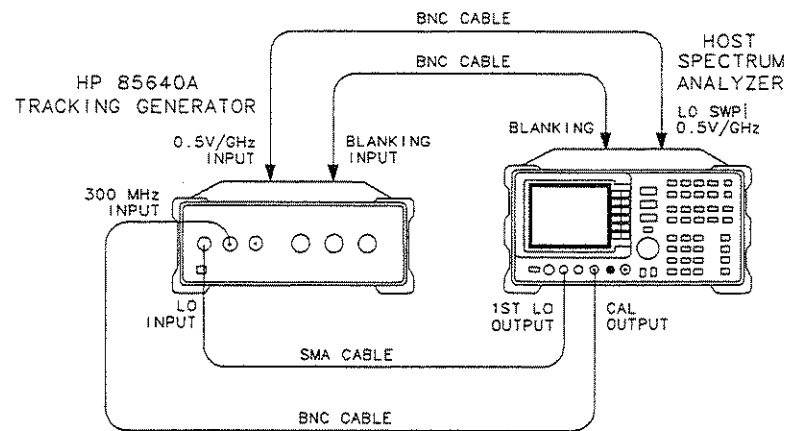
\* A host spectrum analyzer can be any one of these models:  
 HP 8560A or HP 8560E spectrum analyzer (non-Option 002)  
 HP 8561A, HP 8561B or HP 8561E spectrum analyzer  
 HP 8562A or HP 8562B spectrum analyzer  
 HP 8563A or HP 8563E spectrum analyzer

---

## Before Beginning

The HP 85640A RF tracking generator requires at least a five-minute warm-up before beginning the performance tests.

Figure 4-1 illustrates the connections to make between the host spectrum analyzer and the tracking generator. You must also set the rear-panel sweep output to 0.5 V/GHz as instructed in each performance test. Retain the cable configuration illustrated in Figure 4-1 unless a test procedure specifies otherwise.



wk220

Figure 4-1. HP 85640A RF Tracking Generator Connections

### Test Equipment You'll Need

Refer to Table 4-2 for the recommended test equipment model numbers. Any equipment that meets the critical specifications given in the table may be substituted for the recommended model(s). The table also lists the recommended test equipment for the tracking generator's adjustment procedures located in Chapter 5, "Adjustment Procedures," and the troubleshooting procedures in Chapter 7, "Service Information."

---

#### Note



Each host spectrum analyzer has a required warm-up time; refer to Table 1-1 in the appropriate installation and verification manual for specifications.

Each performance test in this section describes setting your host spectrum analyzer for 0.5 V/GHz output.

---

### Recording Test Results

Record test results in the performance test record located at the end of this chapter. The table lists test specifications and acceptable limits. We recommend that you make a copy of this table, record the complete test results on the copy, and keep the copy for your calibration test record. This record could prove invaluable in tracking gradual changes in test results over long periods of time.

**Table 4-2. Recommended Test Equipment**

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use
Host spectrum analyzer	Compatible with the tracking generator (See Table 1-1)	HP 8560A/E, HP 8561A/B/E, HP 8562A/B HP 8563A/E	P,A,T
Microwave spectrum analyzer	Frequency range: 300 kHz to 7 GHz Relative amplitude accuracy: 300 kHz to 2.7 GHz: $<\pm 1.8$ dB 300 kHz to 7 GHz: $<\pm 4.0$ dB Absolute amplitude accuracy: 3.9 GHz to 6.9 GHz: $<\pm 2.7$ dB Frequency accuracy: $<\pm 10$ kHz at 7 GHz	HP 8566A/B*	P,T
Microwave frequency counter	Frequency range: 1 MHz to 2.9 GHz Timebase accuracy (aging): $<5 \times 10^{-10}$ /day External frequency reference input	HP 5343A* Option 001	P,A,T
Measuring receiver	Compatible with power sensor dB-relative mode Resolution: 0.01 dB Reference accuracy: $<\pm 1.2\%$ Tuned RF level mode Tuned RF level accuracy: $<\pm 0.15$ dB Tuned RF level frequency range: 300 MHz $\pm 1$ MHz	HP8902A*	P,A,T
Power sensor	Frequency range: 300 kHz to 2.9 GHz Maximum SWR: 1.1 (1 MHz to 2.0 GHz) 1.30 (2.0 GHz to 2.9 GHz)	HP 8482A*	P,A,T
Digital Voltmeter	Range: -15 V dc to +15 V dc Accuracy: $<\pm 10$ mV on 100 V range Input impedance: $\geq 1$ M $\Omega$	HP 3456A*	A,T
Power splitter	Frequency range: 300 kHz to 2.9 GHz Insertion loss: 6 dB (nominal) Output tracking: $<0.25$ dB Equivalent output SWR: $<1.22$	HP 11667A	P,A,T

P = Performance tests; A = Adjustments; T = Troubleshooting; \*Part of microwave workstation

**Table 4-2. Recommended Test Equipment (continued)**

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use
DVM test leads	≥36 inches, alligator clips, probe tips	HP 34118A	A,T
Termination	Frequency range: dc to 2.9 GHz Impedance: 50Ω Maximum SWR: <1.05 Connector: Type N	HP 908A	P,A
Adapters	BNC (f) to SMB (f) Type N (f) to APC 3.5 (f) Type N (m) to BNC (f)	HP 1250-1236 HP 1250-1745 HP 1250-1476	A P P,A
Cable, RG-214/U (two required)	Connectors: Type N (m) Length: ≥61 cm (24 in)	HP 11500B/C	P,A
Cable, 50Ω Coaxial (two required)	Connectors: BNC (m) Length: ≥ 23 cm (9 in)	HP 10502A	P,A
Cable, 50Ω Coaxial (two required)	Connectors: BNC (m) Length: ≥ 122 cm (48 in)	HP 10503A	P,A,
Cable (three required)	Frequency range: dc to 300 MHz Connectors: BNC (m), both ends Length: ≥62 cm (24 in)	HP 8120-1839	P,A
Cable	Frequency range: 3.9 to 6.9 GHz Maximum SWR: <1.4:1 Maximum insertion loss: 1.5 dB Connectors: SMA(m), both ends Length: ≥52 cm (20 in.)	HP 5061-9038	P,A,T
Non-metallic alignment tool	N/A	HP 8710-0033	A
Balldriver	0.050 in	HP 8710-1199	A
Hexdriver	0.050 in	HP 8710-1250	T
P = Performance tests; A = Adjustments; T = Troubleshooting			



# 1. Output Attenuator Accuracy

## Specification

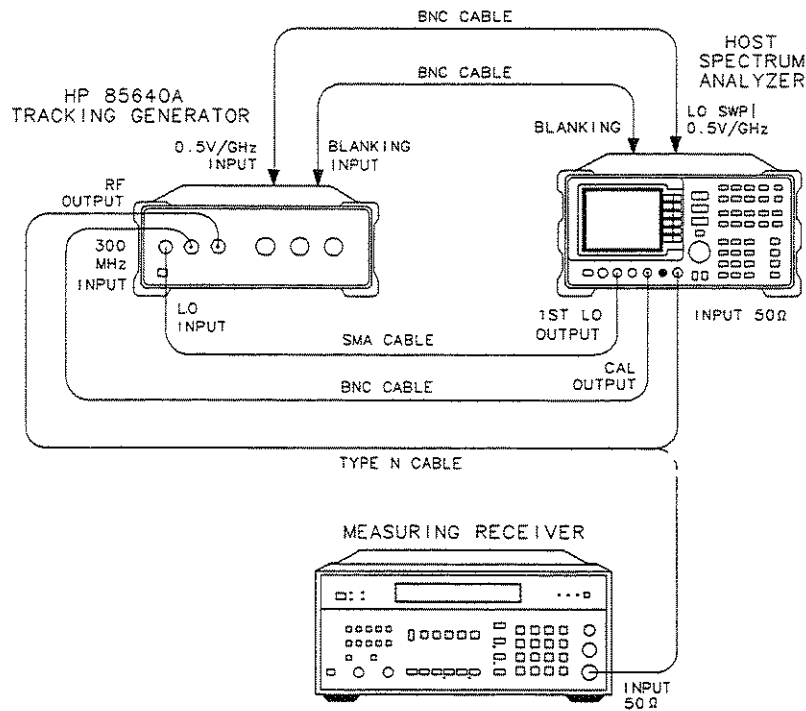
$<\pm 0.8$  dB/10 dB step  $<\pm 1.5$  dB maximum for attenuator settings 10 to 70 dB, referenced to 0 dB setting

## Related Adjustment

There is no related adjustment for this performance test.

## Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT  $50\Omega$ . Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is then connected to the input of a measuring receiver. The measuring receiver, used in its tuned RF level (TRFL) mode, measures the tracking generator's output attenuator accuracy relative to the 0 dB attenuator setting. The step-to-step error is calculated.



wk221

Figure 4-2. Output Attenuator Accuracy Test Setup

## Equipment

Measuring receiver ..... HP 8902A  
 Host spectrum analyzer ... HP 8560A/E, 8561A/B/E, HP 8562A/62B, or HP 8563A/E

### Cables

Type N, 62 cm (24 in) ..... HP 11500B/C  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038

## Procedure

1. Connect the equipment as shown in Figure 4-2. Use the type N cable to connect the tracking generator RF OUTPUT to the host spectrum analyzer's INPUT 50 $\Omega$ .
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ .....	300 MHz
SPAN .....	0 Hz
RES BW .....	300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT .5 V/GHz (FAV)**.  
 If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press  
**AUX CTRL REAR PANEL .5V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.
5. Set the tracking generator OUTPUT LEVEL vernier to 0 dBm. *Do not* readjust the OUTPUT LEVEL vernier control for the remainder of this test.
6. Connect the type N cable to the tracking generator RF OUTPUT and the measuring receiver INPUT 50 $\Omega$  connectors.
7. On the measuring receiver, press the blue shift-key AUTOMATIC OPERATION (INSTR PRESET), FREQ **MHz** (INPUT FREQ), gold shift-key, RF POWER (TUNED RF LEVEL), 4.4, **SPCL**, 32.0, **SPCL**, blue shift-key, ZERO (SET REF), LOG/LIN. The display should read 0.00 dB  $\pm$  0.01 dB.
8. Set the tracking generator OUTPUT LEVEL attenuator control to each of the settings listed in Table 4-3. If RECAL is displayed on the measuring receiver, press CALIBRATE. At each attenuator setting, subtract the attenuator setting (always negative) from the measuring receiver reading and record the result as the cumulative attenuator accuracy (CAA) in Table 4-3.
 

CAA = measuring receiver reading - attenuator setting
9. Calculate the step-to-step attenuator accuracy for each setting other than 0 dB by subtracting the previous CAA from the current CAA. Record the result in Table 4-3 as the step-to-step attenuator accuracy (SSAA) for the current attenuator setting.
 

SSAA = current CAA - previous CAA

## 1. Output Attenuator Accuracy

Table 4-3. Output Attenuator Accuracy

Output Level Attenuator Setting	Attenuator Accuracy		Measurement Uncertainty
	(dB)	Cumulative (dB)	
0	0 (Ref)	0 (Ref)	0 (Ref)
-10	_____	_____	±0.40
-20	_____	_____	+0.07/-0.08
-30	_____	_____	±0.09
-40	_____	_____	±0.10
-50	_____	_____	±0.11
-60	_____	_____	±0.12
-70	_____	_____	+0.12/-0.13

## 2. Maximum Leveled Output Power

### Specification

Maximum leveled output power:  $\geq 0$  dBm

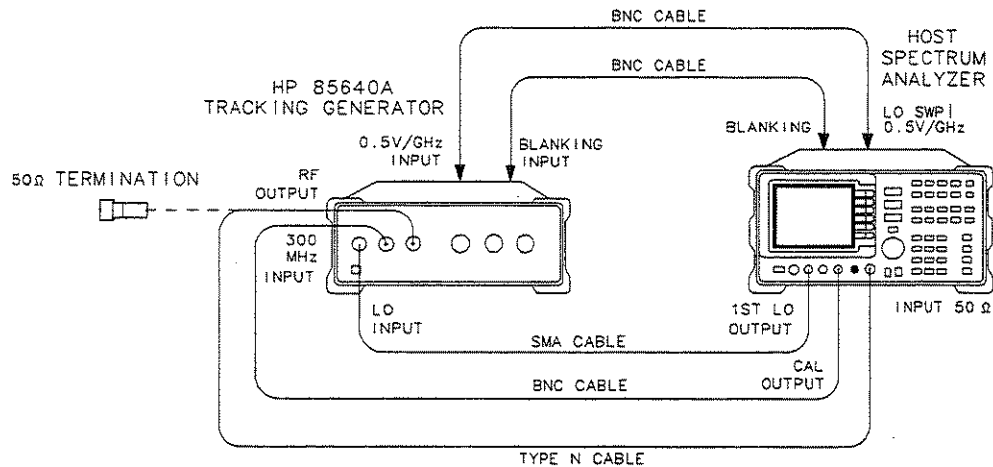
### Related Adjustment

Tracking generator power level adjustments

### Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT 50 $\Omega$ . Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is then terminated in 50 $\Omega$ .

The tracking generator is set to specified output level settings and slowly swept from 300 kHz to 2.9 GHz. The UNLEVELED indicator is monitored to check for an unlevelled condition. If the UNLEVELED indicator is not activated during the sweep, the tracking generator meets this specification. If the UNLEVELED indicator is activated during the sweep, the OUTPUT LEVEL vernier setting is decreased until the output remains leveled during the entire sweep. This setting is recorded.



wk222

Figure 4-3. Maximum Leveled Output Power Test Setup

### Equipment

Host spectrum analyzer ..... HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E  
 50 $\Omega$  termination ..... HP 908A

### Cables

Type N, 62 cm (24 in) ..... HP 11500B/C  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038

## 2. Maximum Leveled Output Power

### Procedure

1. Connect the equipment as shown in Figure 4-3. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:  
CENTER FREQ ..... 300 MHz  
SPAN ..... 0 Hz  
RES BW ..... 300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP** **REAR PNL OUTPUT** **.5 V/GHz (FAV)**.  
If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **AUX CTRL** **REAR PANEL** **.5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.

---

### Note



The OUTPUT LEVEL vernier is prone to parallax error. To minimize parallax when setting the knob, view the pointer and the scale marking directly from the front of the instrument panel. The ridges on the knob are also useful for properly aligning the pointer with the scale marking.

---

5. Set the tracking generator OUTPUT LEVEL vernier precisely to 0 dBm. Locate the groove on the vernier knob closest to the pointer on the knob. Follow this groove down the knob to the front panel. Align this groove with the front-panel "0" mark.
6. Disconnect the type N cable from the tracking generator RF OUTPUT. Terminate the RF OUTPUT using the 50Ω termination.
7. Set the host spectrum analyzer controls as follows:  
START FREQ ..... 300 kHz  
STOP FREQ ..... 2.9 GHz  
SWEEP TIME ..... 10 sec
8. Check the UNLEVELED indicator function by temporarily disconnecting the BNC cable between the host spectrum analyzer CAL OUTPUT and the tracking generator 300 MHz INPUT connectors. The UNLEVELED indicator should light when this cable is disconnected. Reconnect the BNC cable.
9. Watch the UNLEVELED indicator as the host spectrum analyzer sweeps. If the UNLEVELED indicator does not light during a sweep, proceed to step 13 and enter > 0 dBm as the maximum leveled output power in the space provided below.
10. If the UNLEVELED indicator does light anytime during a sweep, reduce the OUTPUT LEVEL vernier setting by 1 dB.
11. Watch the UNLEVELED indicator as the host spectrum analyzer sweeps. If the UNLEVELED indicator does not light during a sweep, proceed to step 13.

## 2. Maximum Leveled Output Power

12. Repeat steps 9 through 11 until an OUTPUT LEVEL vernier setting is achieved that results in a leveled output during the entire sweep.
13. Record the power level value indicated by the OUTPUT LEVEL vernier as the maximum leveled output power.

Maximum leveled output power \_\_\_\_\_ dBm

### 3. Level Flatness

#### Specification

Flatness:  $<\pm 2.0$  dB referenced to 300 MHz, 10 dB attenuation, 0 dB vernier setting

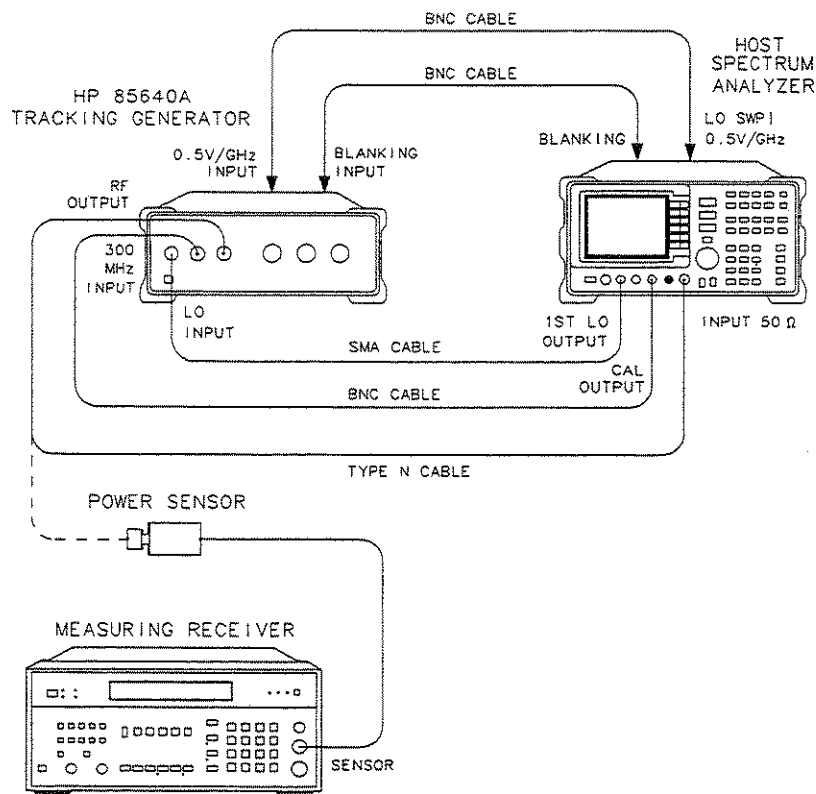
#### Related Adjustment

Power level adjustment

#### Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT 50 $\Omega$ . Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is then connected to a calibrated power sensor and the power level is measured at 300 MHz. The measuring receiver is set to RATIO mode so that subsequent power-level readings are dB relative to the power level at 300 MHz.

The tracking generator is stepped through several frequencies within its range. The output-power difference relative to the power level at 300 MHz is measured at each frequency and recorded.



wk223

Figure 4-4. Level Flatness Test Setup

**Equipment**

Host spectrum analyzer	..... HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E
Measuring receiver	..... HP 8902A
Power sensor	..... HP 8482A

**Cables**

Type N, 62 cm (24 in)	..... HP 11500B/C
BNC, 62 cm (24 in) (3 required)	..... 8120-1839
SMA, 52 cm (20 in)	..... 5061-9038

**Procedure**

1. Connect the equipment as shown in Figure 4-4. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	..... 300 MHz
CF STEP	..... 100 MHz
SPAN	..... 0 Hz
RES BW	..... 300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP** **REAR PNL OUTPUT** **5 V/GHz (FAV)**.  
 If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **AUX CTRL** **REAR PANEL** **5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal amplitude on the host spectrum analyzer.
5. Zero and calibrate the measuring-receiver/power-sensor combination in log mode (power level readings are in dBm). Enter the power sensor's 300 MHz calibration factor into the measuring receiver.
6. Replace the type N cable on the RF OUTPUT with the power sensor.
7. On the tracking generator, set the OUTPUT LEVEL vernier knob to 0 dBm and the OUTPUT LEVEL attenuator knob to -10 dB.
8. On the host spectrum analyzer, press **TRIG** **SINGLE**.
9. Press RATIO on the measuring receiver. The measuring receiver readings are now relative to the power level at 300 MHz.
10. Set the spectrum analyzer center frequency to 300 kHz. Press **TRIG** **SINGLE**.
11. Enter the appropriate power sensor calibration factor into the measuring receiver as indicated in Table 4-4.
12. Record the measuring receiver power level reading as the flatness in Table 4-4.



### 3. Level Flatness

13. Repeat steps 10 through 12 to measure the flatness at each CENTER FREQ setting listed in Table 4-4. The  $\uparrow$  key can be used to tune to center frequencies above 100 MHz.
14. Record the most positive flatness reading in Table 4-4 as the maximum flatness.

Maximum flatness \_\_\_\_\_ dB

15. Record the most negative flatness reading in Table 4-4 as the Minimum Flatness.

Minimum flatness \_\_\_\_\_ dB

Table 4-4. Flatness Relative to 300 MHz

Center Frequency	Flatness (dB)	CAL Factor Frequency (MHz)	Measurement Uncertainty (dB)
300 kHz	_____	0.3	+0.28/-0.28
500 kHz	_____	0.3	+0.28/-0.28
1 MHz	_____	1	+0.28/-0.28
2 MHz	_____	3	+0.28/-0.28
5 MHz	_____	3	+0.28/-0.28
10 MHz	_____	10	+0.24/-0.24
20 MHz	_____	30	+0.24/-0.24
50 MHz	_____	50	+0.24/-0.24
100 MHz	_____	100	+0.24/-0.24
200 MHz	_____	300	+0.24/-0.24
300 MHz	_____	300	+0.24/-0.24
400 MHz	_____	300	+0.24/-0.24
500 MHz	_____	300	+0.24/-0.24
600 MHz	_____	300	+0.24/-0.24
700 MHz	_____	1000	+0.24/-0.24
800 MHz	_____	1000	+0.24/-0.24
900 MHz	_____	1000	+0.24/-0.24
1000 MHz	_____	1000	+0.24/-0.24
1100 MHz	_____	1000	+0.24/-0.24
1200 MHz	_____	1000	+0.24/-0.24
1300 MHz	_____	1000	+0.24/-0.24
1400 MHz	_____	1000	+0.24/-0.24
1500 MHz	_____	2000	+0.24/-0.24
1600 MHz	_____	2000	+0.24/-0.24
1700 MHz	_____	2000	+0.24/-0.24
1800 MHz	_____	2000	+0.24/-0.24
1900 MHz	_____	2000	+0.24/-0.24
2000 MHz	_____	2000	+0.41/-0.41
2100 MHz	_____	2000	+0.41/-0.41
2200 MHz	_____	2000	+0.41/-0.41
2300 MHz	_____	2000	+0.41/-0.41
2400 MHz	_____	2000	+0.41/-0.41
2500 MHz	_____	3000	+0.41/-0.41
2600 MHz	_____	3000	+0.41/-0.41
2700 MHz	_____	3000	+0.41/-0.41
2800 MHz	_____	3000	+0.41/-0.41
2900 MHz	_____	3000	+0.41/-0.41

## 4. Harmonic Spurious Outputs

### Specification

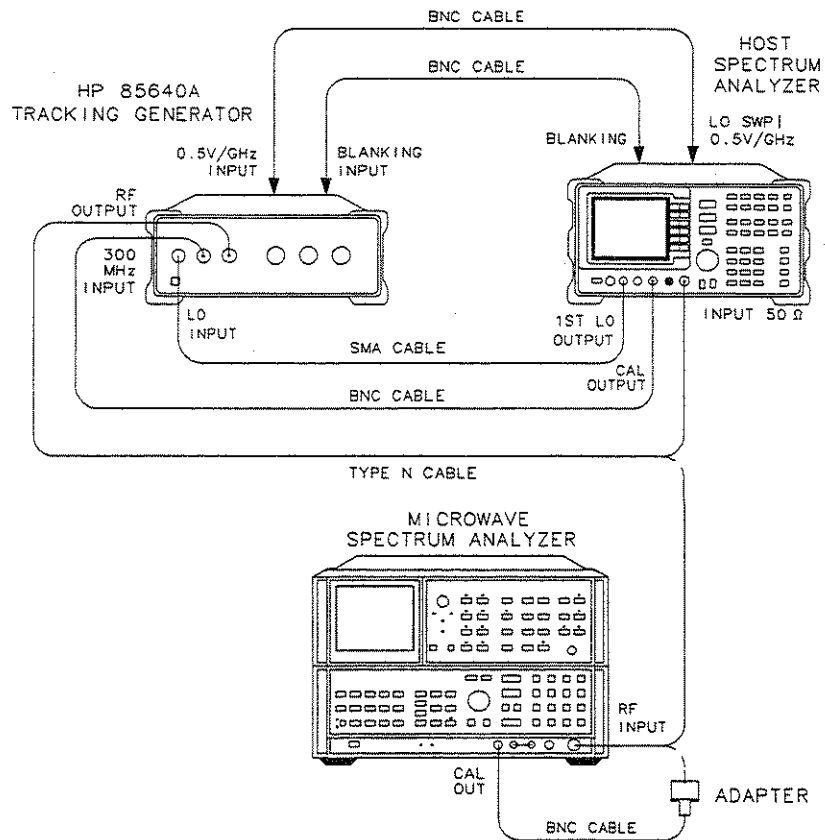
Harmonic spurious outputs:  $< -25$  dBc

### Related Adjustment

There is no related adjustment for this performance test.

### Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT 50 $\Omega$ . Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is then connected to the input of an HP 8566A/B spectrum analyzer. The spectrum analyzer is tuned to different frequencies and the amplitude of the second and third harmonics relative to the fundamental are measured at each frequency.



wk224

Figure 4-5. Harmonic Spurious Outputs Test Setup

**Equipment**

Microwave spectrum analyzer ..... HP 8566A/B  
 Host spectrum analyzer ..... HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E

**Cables**

Type N, 62 cm (24 in) ..... HP 11500B/C  
 BNC, 23 cm (9 in) ..... HP 10502A  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038

**Adapter**

Type N (m) to BNC (f) ..... 1250-1476

**Procedure**

1. Connect the equipment as shown in Figure 4-5. Use the type N cable to connect the tracking generator RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	.....	300 MHz
SPAN	.....	0 Hz
RES BW	.....	300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP** **REAR PNL OUTPUT** **.5 V/GHz (FAV)**.  
 If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **AUX CTRL** **REAR PANEL** **.5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.
5. Set the tracking generator OUTPUT LEVEL vernier knob to 0 dBm. Set the OUTPUT LEVEL attenuator knob to -10 dB.
6. Press **TRIG** **SINGLE** on the host spectrum analyzer.

**Note**

It is only necessary to perform step 7 if more than two hours have elapsed since a front-panel calibration of the HP 8566A/B has been performed. The HP 8566A/B needs to be allowed to warm up for at least 30 minutes before proceeding.

7. Perform a front-panel calibration of the HP 8566A/B as follows:
  - a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
  - b. Press **2-22 GHz** (INSTR PRESET), then **RECALL** **8**. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
  - c. Press **RECALL** **9**. Adjust FREQ ZERO for maximum amplitude response.
  - d. Press **SHIFT** **FREQUENCY SPAN** to start the 30 second internal error correction routine.
  - e. Press **SHIFT** **START FREQ** to use the error correction factors just calculated.
8. Connect the type N cable from the tracking generator RF OUTPUT to the HP 8566A/B RF INPUT as shown in Figure 4-5.

#### 4. Harmonic Spurious Outputs

9. Set the HP 8566A/B controls as follows:

CENTER FREQUENCY ..... 300 kHz  
 SPAN ..... 100 kHz  
 REFERENCE LEVEL ..... -5 dBm  
 RES BW ..... 30 kHz

10. On the HP 8566A/B do the following:

- a. Press **PEAK SEARCH** and **SIGNAL TRACK** (ON). Wait for the signal to be displayed at center screen. Press **SIGNAL TRACK** (OFF).
- b. If the marker frequency is less than 2.5 GHz, press **PEAK SEARCH** **MKR → CF STEP** **MARKER DELTA**.
- c. If the marker frequency is greater than 2.5 GHz, press **PEAK SEARCH** **PRESEL PEAK**. Wait for the PEAKING! message to disappear. Then press **MKR → CF STEP** **MARKER DELTA**.
- d. Press **CENTER FREQUENCY** **↑** to tune to the second harmonic. Press **PEAK SEARCH**. If the center frequency value is greater than 2.5 GHz, press **PRESEL PEAK** and wait for the PEAKING! message to disappear. Record the marker amplitude reading in Table 4-5 as the 2nd harmonic level for the 300 kHz tracking generator output frequency.
- e. If the tracking generator output frequency is less than 1 GHz, press **CENTER FREQUENCY** **↑** on the HP 8566A/B to tune to the third harmonic. Press **PEAK SEARCH**. If the center frequency is greater than 2.5 GHz, press **PRESEL PEAK** and wait for the PEAKING! message to disappear. Record the marker amplitude reading in Table 4-5 as the 3rd harmonic level for the 300 kHz tracking generator output frequency.
- f. On the HP 8566A/B, press **MARKER** **OFF**.

11. Repeat steps 9 and 10 for the remaining tracking generator output frequencies listed in Table 4-5. Note that the host spectrum analyzer's center frequency is the same as the tracking generator output frequency.

12. Locate the most positive 2nd harmonic level in Table 4-5 and record the value below.

2nd harmonic level \_\_\_\_\_ dBc

13. Locate the most positive 3rd harmonic level in Table 4-5 and record the value below.

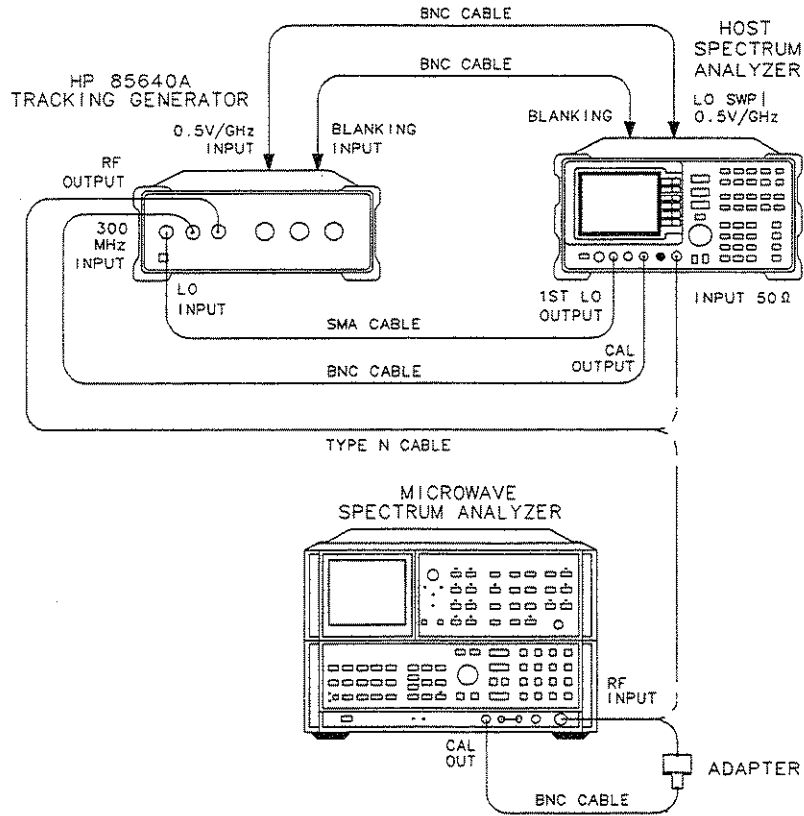
3rd harmonic level \_\_\_\_\_ dBc

**Table 4-5. Harmonic Spurious Outputs**

Tracking Generator Frequency	2nd Harmonic Level (dBc)	3rd Harmonic Level (dBc)	Measurement Uncertainty (dB)
300 kHz	_____	_____	+1.55/-1.80
100 MHz	_____	_____	+1.55/-1.80
300 MHz	_____	_____	+1.55/-1.80
900 MHz	_____	_____	+1.55/-1.80
1.4 GHz	_____	N/A	+3.45/-4.01



## 5. Non-Harmonic Spurious Outputs



wk225

Figure 4-6. Non-Harmonic Spurious Outputs Test Setup

### Equipment

Host spectrum analyzer ..... HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E  
 Microwave spectrum analyzer ..... HP 8566A/B

### Cables

Type N, 62 cm (24 in) (2 required) ..... HP 11500B/C  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038  
 BNC, 23 cm (9 in) ..... HP 10502A

### Adapters

Type N (m) to BNC (f) ..... 1250-1476

**Procedure**

1. Connect the equipment as shown in Figure 4-6. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	.....	300 MHz
SPAN	.....	0 Hz
RES BW	.....	300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT** **.5 V/GHz (FAV)**.
- If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press  
**AUX CTRL** **REAR PANEL** **.5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.
5. On the tracking generator, set the OUTPUT LEVEL vernier knob to 0 dBm and the OUTPUT LEVEL attenuator knob to -10 dB.
6. On the host spectrum analyzer, press **TRIG** **SGL SWP**.

**Note**

You need to perform step 8 only if more than 2 hours have elapsed since a front-panel calibration of the HP 8566A/B has been performed.

The HP 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.

7. Perform a front-panel calibration of the HP 8566A/B as follows:
  - a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
  - b. Press **2 - 22 GHz** (INSTR PRESET) **RECALL** **8**. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
  - c. Press **RECALL** **9**. Adjust FREQ ZERO for a maximum amplitude response.
  - d. Press **SHIFT** **FREQUENCY SPAN** to start the 30 second internal error correction routine.
  - e. Press **SHIFT** **START FREQ** to use the error correction factors just calculated.
8. Connect the type N cable from the tracking generator output to the HP 8566A/B RF INPUT. See Figure 4-6.



## 5. Non-Harmonic Spurious Outputs

### Measure fundamental amplitudes.

9. Set the host spectrum analyzer's center frequency to the fundamental frequency listed in Table 4-6.
10. Set the HP 8566A/B controls as follows:

SPAN .....	100 kHz
REFERENCE LEVEL .....	-5 dBm
ATTEN .....	10 dB
11. Set the HP 8566A/B center frequency to the fundamental frequency listed in Table 4-6.
12. On the HP 8566A/B, press **PEAK SEARCH**. If the marker frequency is greater than 2.5 GHz, press **PRESEL PEAK** and wait for the PEAKING! message to disappear. Press **MKR → REF LVL**. Wait for another sweep to finish.
13. Record the HP 8566A/B marker amplitude reading in Table 4-6 as the fundamental amplitude.
14. Repeat steps 9 through 13 for all fundamental frequency settings in Table 4-6.

### Measure non-harmonic responses.

15. On the host spectrum analyzer, set the center frequency to 300 kHz.
16. Set the HP 8566A/B **START FREQ**, **STOP FREQ**, and **RES BW** as indicated in the first row of Table 4-7.
17. Press **SINGLE** on the HP 8566A/B and wait for the sweep to finish. Press **PEAK SEARCH**. If the marker frequency is greater than 2.5 GHz, press **PRESEL PEAK** and wait for the PEAKING! message to disappear.
18. Verify that the marked signal is not the fundamental or a harmonic of the fundamental as follows:
  - a. Divide the marker frequency by the fundamental frequency (the host spectrum analyzer center frequency setting). For example, if the marker frequency is 880 kHz and the fundamental frequency is 300 kHz, dividing 880 kHz by 300 kHz yields 2.933.
  - b. Round the number calculated in step a to the nearest whole number. In the example above, 2.933 should be rounded to three.
  - c. Multiply the fundamental frequency by the number calculated in step b. Following the example, multiplying 300 kHz by three yields 900 kHz.
  - d. Calculate the difference between the marker frequency and the frequency calculated in step c above. Continuing the example, the difference would be 20 kHz.
  - e. Due to span accuracy uncertainties in the HP 8566A/B, the marker frequency might not equal the actual frequency. Given the marker frequency, check if the difference calculated in step d is within the appropriate tolerance:
    - For marker frequencies <5 MHz, tolerance = ±200 kHz.
    - For marker frequencies <55 MHz, tolerance = ±750 kHz.
    - For marker frequencies >55 MHz, tolerance = ±10 MHz.
  - f. If the difference in step d is within the indicated tolerance, the signal in question is the fundamental signal (if the number in step b equals 1) or a harmonic of the fundamental (if the number in step b is greater than 1). This response should be ignored.
19. Press **SINGLE** on the HP 8566A/B to verify that the marked signal is a true response and not a random noise peak. Wait for the sweep to complete, then press **PEAK SEARCH**. A true

## 5. Non-Harmonic Spurious Outputs

response remains at the same frequency and amplitude on successive sweeps, but a noise peak does not.

20. If the marked signal is either the fundamental (or a harmonic of the fundamental—see step 18) or a noise peak (see step 19), move the marker to the next highest signal by pressing **SHIFT**, then **PEAK SEARCH**. Continue with step 18.
21. If the marked signal is not the fundamental or a harmonic of the fundamental (see step 16) and is a true response (see step 17), calculate the difference between the amplitude of marked signal and the fundamental amplitude as listed in Table 4-6.
  - a. For example, if the fundamental amplitude for a fundamental frequency of 300 kHz is +1.2 dBm, and the marker amplitude is -30.8 dBm, the difference is -32 dBc.
  - b. Record this difference as the non-harmonic response amplitude for the appropriate host spectrum analyzer CENTER FREQ and HP 8566A/B START and STOP FREQ settings in Table 4-7.

$$\text{non-harmonic amplitude} = \text{marker amplitude} - \text{fundamental amplitude}$$

22. If a true non-harmonic spurious response is not found, record "NOISE" as the non-harmonic response amplitude in Table 4-7 for the appropriate host spectrum analyzer CENTER FREQ and HP 8566A/B START and STOP FREQ settings.
23. Repeat steps 17 through 22 for the remaining HP 8566A/B settings for START FREQ, STOP FREQ, and RES BW for the host spectrum analyzer CENTER FREQ setting of 300 kHz.
24. Repeat steps 16 through 23 with the host spectrum analyzer CENTER FREQ set to 1.5 GHz.
25. Repeat steps 16 through 23 with the host spectrum analyzer CENTER FREQ set to 2.9 GHz.
26. Locate in Table 4-7 the most-positive non-harmonic response amplitude for HP 8566A/B STOP FREQ settings of  $\leq 2000$  MHz. Record this amplitude below:

Non-harmonic response amplitude ( $\leq 2000$  MHz) \_\_\_\_\_ dBc

27. Locate in Table 4-7 the most-positive non-harmonic response amplitude for the HP 8566A/B START FREQ settings  $\geq 2000$  MHz. Record this amplitude below:

Non-harmonic response amplitude ( $\geq 2000$  MHz) \_\_\_\_\_ dBc

**Table 4-6. Fundamental Response Amplitudes**

Fundamental Frequency	Fundamental Amplitude (dBm)
300 kHz	_____
1.5 GHz	_____
2.9 GHz	_____

## 5. Non-Harmonic Spurious Outputs

**Table 4-7. Non-Harmonic Spurious Responses**

HP 8566A/B Settings			Non-Harmonic Response Amplitude (dBc)			Measurement Uncertainty
Start Frequency (in MHz)	Stop Frequency (in MHz)	RES BW	at 300 kHz CENTER FREQ	at 1.5 GHz CENTER FREQ	at 2.9 GHz CENTER FREQ	(in dB)
0.3	5.0	30 kHz	_____	_____	_____	+1.55/-1.80
5.0	55	100 kHz	_____	_____	_____	+1.55/-1.80
55	1240	1 MHz	_____	_____	_____	+1.55/-1.80
1240	2000	1MHz	_____	_____	_____	+1.55/-1.80
2000	2900	1 MHz	_____	_____	_____	+3.48/-4.01

## 6. LO Feedthrough Amplitude

### Specification

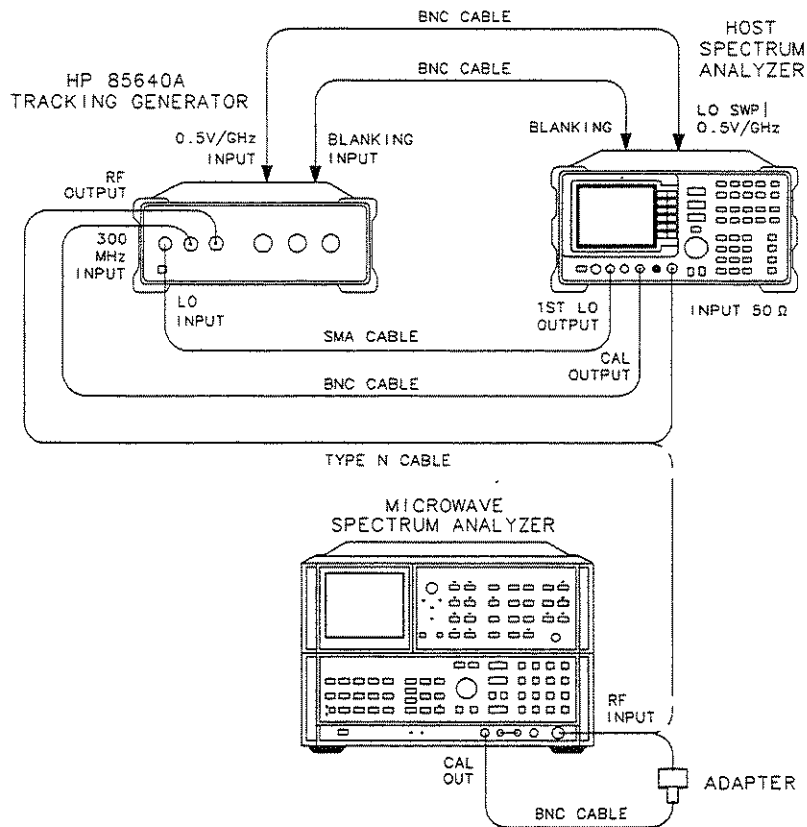
LO feedthrough:  $< -26$  dBm with output level vernier knob set to 0 dBm and attenuator knob set to  $-10$  dB.

### Related Adjustment

There is no related adjustment for this performance test.

### Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT 50 $\Omega$ . Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is then connected to the input of an HP 8566A/B spectrum analyzer. The tracking generator is tuned to several frequencies and the LO feedthrough is measured at each frequency.



wk226

Figure 4-7. LO Feedthrough Test Setup

## 6. LO Feedthrough Amplitude

### Equipment

Host spectrum analyzer .....HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E  
Microwave spectrum analyzer ..... HP 8566A/B

### Cables

Type N, 62 cm (24 in) (2 required) ..... HP 11500B/C  
BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
SMA, 52 cm (20 in) ..... 5061-9038  
BNC, 23 cm (9 in) ..... HP 10502A

### Adapters

Type N (m) to BNC (f) ..... 1250-1476

### Procedure

1. Connect the equipment as shown in Figure 4-7. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:  
CENTER FREQ ..... 300 MHz  
SPAN ..... 0 Hz  
RES BW ..... 300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT .5 V/GHz (FAV)**.  
If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press  
**AUX CTRL REAR PANEL .5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.

### Note



It is only necessary to perform step five if more than two hours have elapsed since a front-panel calibration of the HP 8566A/B has been performed.

The HP 8566A/B should be allowed to warm up for at least 30 minutes before proceeding.

5. Perform a front-panel calibration of the HP 8566A/B as follows:
  - a. Connect a BNC cable between CAL OUTPUT and RF INPUT.
  - b. Press **2--22 GHz** (INSTR PRESET) **RECALL** **8**. Adjust AMPTD CAL for a marker amplitude reading of -10 dBm.
  - c. Press **RECALL** **9**. Adjust FREQ ZERO for a maximum amplitude response.
  - d. Press **SHIFT** **FREQUENCY SPAN** to start the 30 second internal error correction routine.
  - e. Press **SHIFT** **START FREQ** to use the error correction factors just calculated.
6. Connect the type N cable from the tracking generator output to the HP 8566A/B RF INPUT. See Figure 4-7.
7. Set the tracking generator OUTPUT LEVEL vernier knob to 0 dBm and the OUTPUT LEVEL attenuator knob to -10 dB. Set the host spectrum analyzer CENTER FREQ to 300 kHz.

## 6. LO Feedthrough Amplitude

8. Set the HP 8566A/B controls as follows:

CENTER FREQUENCY ..... 3.911 GHz  
SPAN ..... 100 kHz  
REFERENCE LEVEL ..... 0 dBm  
RES BW ..... 1 kHz

9. On the HP 8566A/B, press **PEAK SEARCH** **SIGNAL TRACK** (ON). Wait for the signal to be centered on the display. Press **SIGNAL TRACK** (OFF).
10. On the HP 8566A/B, press **PEAK SEARCH** **PRESEL PEAK**. Wait for the PERKING! message to disappear.
11. Record the HP 8566A/B marker amplitude below:

LO feedthrough (at 3.911 GHz) \_\_\_\_\_ dBm  
(Measurement uncertainty:  $< +2.02/-2.50$  dB)

12. Set the host spectrum analyzer CENTER FREQ to 2.9 GHz.
13. Set the HP 8566A/B CENTER FREQUENCY to 6.8107 GHz.
14. On the HP 8566A/B, press **PEAK SEARCH** **SIGNAL TRACK** (ON). Wait for the signal to be centered on the display. Press **SIGNAL TRACK** (OFF).
15. On the HP 8566A/B, press **PEAK SEARCH** **PRESEL PEAK**. Wait for the PERKING! message to disappear.
16. Record the HP 8566A/B marker amplitude below:

LO feedthrough (at 6.8107 GHz) \_\_\_\_\_ dBm  
(Measurement uncertainty:  $< +2.10/-2.67$  dB)

## 7. Tracking Generator Feedthrough

### Specification

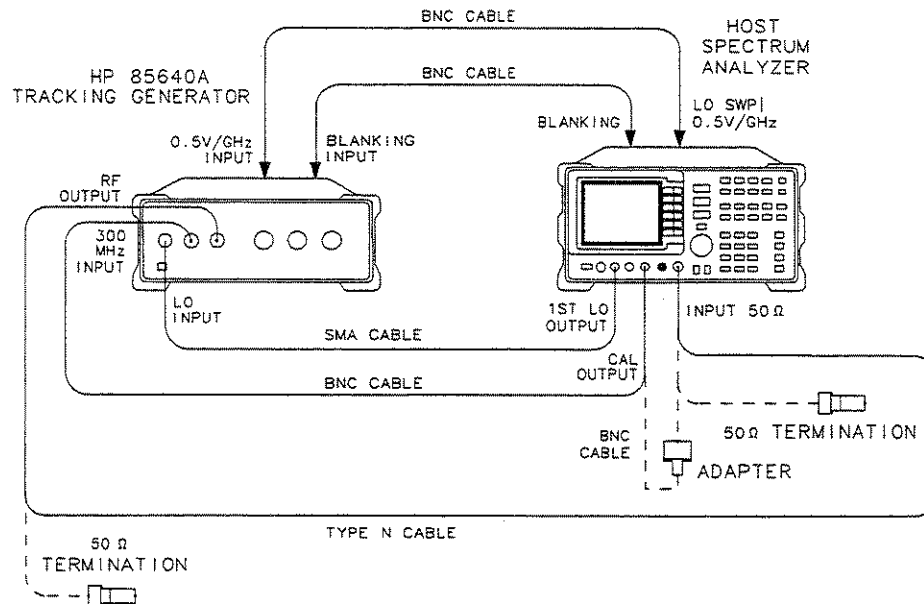
Tracking generator feedthrough: 300 kHz to 1 MHz <-95 dBm  
1 MHz to 2.0 GHz <-115 dBm  
2.0 GHz to 2.9 GHz <-110 dBm

### Related Adjustment

There is no related adjustment for this performance test.

### Description

The tracking generator's RF OUTPUT is connected to the host spectrum analyzer's INPUT 50Ω. Tracking is adjusted at 300 MHz for a maximum signal level. The tracking generator's RF OUTPUT is terminated in 50Ω and the output power is set for 0 dBm (maximum leveled output power). The spectrum analyzer's INPUT 50Ω is also terminated in 50Ω. The displayed average noise level of the spectrum analyzer is measured and recorded at several frequencies.



wk227

Figure 4-8. Tracking Generator Feedthrough Test Setup

**Equipment**

Host spectrum analyzer ..... HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E  
 50 $\Omega$  termination (2 required) ..... HP 908A

**Cables**

Type N, 62 cm (24 in) (2 required) ..... HP 11500B/C  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038  
 BNC, 23 cm (9 in) ..... HP 10502A

**Adapters**

Type N (m) to BNC (f) ..... 1250-1476

**Procedure**

1. Connect the equipment as shown in Figure 4-8. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50 $\Omega$ .
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	.....	300 MHz
SPAN	.....	0 Hz
RES BW	.....	300 Hz
3. If the host spectrum analyzer is an HP 8561A, HP 8562A, HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT .5 V/GHz (FAV)**.  
 If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press  
**AUX CTRL REAR PANEL .5 V/GHz (FAV)**.
4. On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.
5. Connect the CAL OUTPUT to the INPUT 50 $\Omega$ . Set the host spectrum analyzer controls as follow:
 

REF LVL	.....	-10 dBm
ATTEN	.....	0 dB
RES BW	.....	300 Hz
VIDEO BW	.....	1 Hz
6. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **MARKER ON**  
**AMPLITUDE MORE REF LVL CAL**.  
 If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **MKR**  
**CAL REF LVL ADJ**.
7. Use the knob or step keys to adjust the REF LEVEL ADJ # for a marker amplitude reading of -10.00 dBm  $\pm$ 0.17 dB.
8. Connect one HP 908A 50 $\Omega$  termination to the host spectrum analyzer's INPUT 50 $\Omega$  and another to the tracking generator's RF OUTPUT. Reconnect the BNC cable from the CAL OUTPUT to the 300 MHz INPUT on the tracking generator.
9. Set the tracking generator OUTPUT LEVEL vernier knob to 0 dBm.



## 7. Tracking Generator Feedthrough

10. Set the host spectrum analyzer controls as follows:

CENTER FREQ ..... 300 kHz  
SPAN ..... 0 Hz  
REF LVL ..... -50 dBm  
Markers ..... OFF  
RES BW ..... 300 Hz  
VIDEO BW ..... 1 Hz

11. On the host spectrum analyzer, press **TRIG** **SINGLE** and wait for the sweep to finish. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **MARKER** **ON**. Press **MKR** on an HP 8560A/E, HP 8561B/E, or HP 8563A/E. Record the marker amplitude reading in Table 4-8 for the 300 kHz tracking generator output frequency.
12. Repeat step 12 for the remaining tracking generator output frequencies listed in Table 4-8.
13. In Table 4-8, locate the most positive noise level amplitude for the 300 kHz to 1 MHz frequency range. Record this amplitude value here:

Tracking generator feedthrough, 300 kHz to 1 MHz \_\_\_\_\_ dBm

14. In Table 4-8, locate the most positive noise level amplitude for the 1 MHz to 2.0 GHz frequency range. Record this amplitude value here:

Tracking generator feedthrough, 1 MHz to 2.0 GHz \_\_\_\_\_ dBm

15. In Table 4-8, locate the most positive noise level amplitude for the 2.0 GHz to 2.9 GHz frequency range. Record this amplitude value here:

Tracking generator feedthrough, 2.0 GHz to 2.9 MHz \_\_\_\_\_ dBm

7. Tracking Generator Feedthrough

Table 4-8. Tracking Generator Feedthrough

Frequency Range	Tracking Generator Output Frequency	Noise Level Amplitude (dBm)	Measurement Uncertainty (dB)
300 kHz to 1 MHz	300 kHz		+1.74/-1.98
	400 kHz		+1.74/-1.98
	500 kHz		+1.74/-1.98
	600 kHz		+1.74/-1.98
	700 kHz		+1.74/-1.98
	800 kHz		+1.74/-1.98
	900 kHz		+1.74/-1.98
	1 MHz		+1.74/-1.98
1 MHz to 2.0 GHz	1.01 MHz		+1.74/-1.98
	2 MHz		+1.74/-1.98
	5 MHz		+1.74/-1.98
	10 MHz		+1.74/-1.98
	20 MHz		+1.74/-1.98
	50 MHz		+1.74/-1.98
	100 MHz		+1.74/-1.98
	299 MHz		+1.74/-1.98
	500 MHz		+1.74/-1.98
	700 MHz		+1.74/-1.98
	899 MHz		+1.74/-1.98
	1100 MHz		+1.74/-1.98
	1300 MHz		+1.74/-1.98
	1499 MHz		+1.74/-1.98
	1700 MHz		+1.74/-1.98
1900 MHz		+1.74/-1.98	
2000 MHz		+1.74/-1.98	
2.0 GHz to 2.9 GHz	2001 MHz		+1.74/-1.98
	2099 MHz		+1.74/-1.98
	2300 MHz		+1.74/-1.98
	2500 MHz		+1.74/-1.98
	2699 MHz		+1.74/-1.98
	2800 MHz		+1.74/-1.98
2900 MHz		+1.74/-1.98	

## 8. Frequency Tracking Range

### Characteristic

Tracking range:  $>\pm 5$  kHz, referenced to output frequency after TRACKING ADJUST is optimized (*Characteristic*)

### Related Adjustment

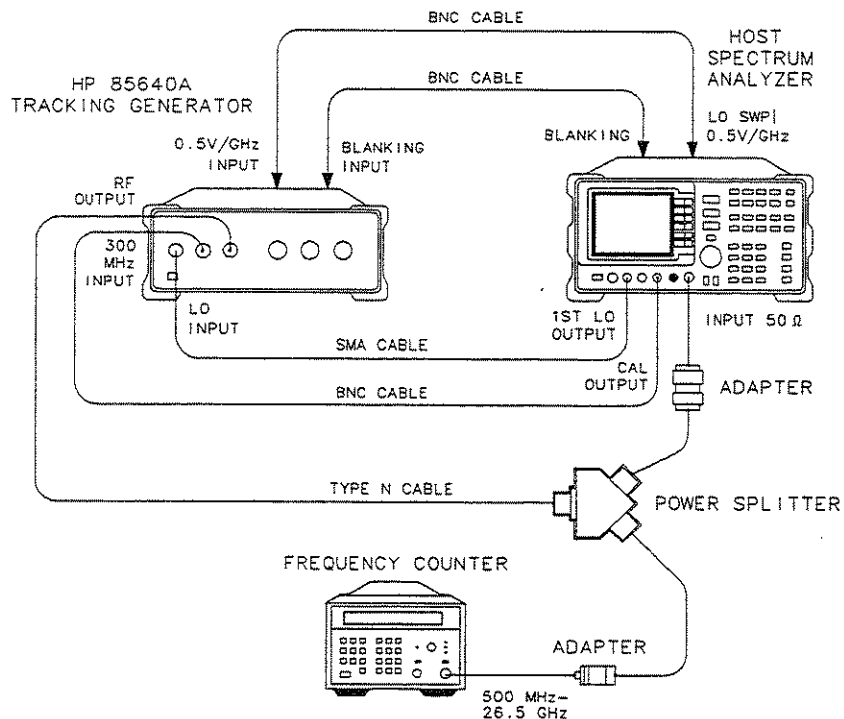
Tracking oscillator range adjustment

### Description

The tracking generator's RF OUTPUT is connected through a power splitter to the host spectrum analyzer's INPUT 50 $\Omega$ . Tracking is adjusted at 500 MHz for a maximum signal level. The other output of the power splitter is connected to a frequency counter. The frequency value displayed on the counter is recorded.

The TRACKING ADJUST vernier knob is set fully clockwise, then the frequency value is recorded and compared with the first frequency measurement. TRACKING ADJUST vernier knob is then set fully counterclockwise. The frequency value is recorded and compared with the first frequency measurement.

If the frequency tracking range does not meet the characteristic, perform the tracking oscillator range adjustment located in Chapter 5, "Adjustment Procedures."



wk228

Figure 4-9. Frequency Tracking Range Test Setup

**Equipment**

Host spectrum analyzer	.....HP 8560A/E, 8561A/B/E, HP 8562A/B, or HP 8563A/E
Power splitter	..... HP 11667A
Frequency counter	..... HP 5343A

**Cables**

Type N, 62 cm (24 in) (2 required)	..... HP 11500B/C
BNC, 62 cm (24 in) (3 required)	..... 8120-1839
SMA, 52 cm (20 in)	..... 5061-9038
BNC, 122 cm (48 in)	..... HP 10503A

**Adapters**

Type N (m) to Type N (m)	..... 1250-1475
Type N (m) to APC 3.5 (f)	..... 1250-1745

**Procedure**

1. Connect the equipment as shown in Figure 4-9. Use the type N cable to connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	..... 500 MHz
SPAN	..... 0 Hz
RES BW	..... 300 Hz

3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT** .5 V/GHz (FAV).
4. If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press  
**AUX CTRL** **REAR PANEL** .5 V/GHz (FAV).

On the tracking generator, set the OUTPUT LEVEL vernier knob to -5 dBm. Set the OUTPUT LEVEL attenuator knob to 0 dB, then adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer.

5. Set the frequency counter controls as follow:
 

SAMPLE RATE	..... midrange
10Hz-500MHz / 500MHz-26.5GHz Switch	..... 500MHz-26.5GHz
RESOLUTION	..... 1 Hz
6. Wait for the counter to gate two or three times and record the counter reading below as the peaked frequency.

Peaked frequency \_\_\_\_\_ MHz

7. On the tracking generator, set the TRACKING ADJUST control fully clockwise. Notice that this is a multi-turn control.

## 8. Frequency Tracking Range

8. Wait for the counter to gate two or three times, then record the counter reading below as the maximum frequency.

Maximum frequency \_\_\_\_\_ MHz

9. On the tracking generator, set the TRACKING ADJUST control fully counterclockwise.

10. Wait for the counter to gate two or three times, then record the counter reading below as the minimum frequency.

Minimum frequency \_\_\_\_\_ MHz

11. Subtract the minimum frequency from the peaked frequency and record the result as the negative frequency variation. The variation should be greater than 5 kHz. Perform the tracking oscillator range adjustment if the variation is less than 5 kHz.

Negative frequency variation \_\_\_\_\_ kHz

12. Subtract the maximum frequency from the peaked frequency and record the result as the positive frequency variation. The variation should be greater than 5 kHz. Perform the tracking oscillator range adjustment if the variation is less than 5 kHz.

Positive frequency variation \_\_\_\_\_ kHz

Table 4-9. Performance Test Record (Page 1 of 3)

Hewlett-Packard Company  
 Address: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Report No. \_\_\_\_\_  
 Date \_\_\_\_\_  
 (e.g. 10 FEB 1992)

Model HP 85640A  
 Serial No. \_\_\_\_\_  
 Options \_\_\_\_\_

Customer \_\_\_\_\_ Tested by \_\_\_\_\_

Ambient temperature \_\_\_\_\_ °C Relative humidity \_\_\_\_\_ %  
 Power main line frequency \_\_\_\_\_ Hz (nominal)

**Test Equipment Used:**

Description	Model No.	Trace No.	Cal Due Date
Host spectrum analyzer	_____	_____	_____
Measuring receiver	_____	_____	_____
Power sensor	_____	_____	_____
Microwave spectrum analyzer	_____	_____	_____
Frequency counter	_____	_____	_____
Power splitter	_____	_____	_____

Special notes:  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## 8. Frequency Tracking Range

Table 4-9. Performance Test Record (Page 2 of 3)

Hewlett-Packard Company		Report No. _____
Model HP 85640A		
Serial No. _____	Date _____	

Test No.	Test Description	Results			Measurement Uncertainty
		Min	Measured	Max	
1.	Output attenuator accuracy				
	8. Maximum cumulative attenuator accuracy				
	-10 dB	-1.5 dB	_____	+1.5 dB	±0.40 dB
	-20 dB	-1.5 dB	_____	+1.5 dB	+0.07/-0.08 dB
	-30 dB	-1.5 dB	_____	+1.5 dB	±0.09 dB
	-40 dB	-1.5 dB	_____	+1.5 dB	±0.10 dB
	-50 dB	-1.5 dB	_____	+1.5 dB	±0.11 dB
	-60 dB	-1.5 dB	_____	+1.5 dB	±0.12 dB
	-70 dB	-1.5 dB	_____	+1.5 dB	+0.12/-0.13 dB
	9. Maximum step-to-step attenuator accuracy				
	-10 dB	-0.8 dB	_____	+0.8 dB	±0.40 dB
	-20 dB	-0.8 dB	_____	+0.8 dB	±0.41 dB
	-30 dB	-0.8 dB	_____	+0.8 dB	+0.11/-0.12 dB
	-40 dB	-0.8 dB	_____	+0.8 dB	+0.13/-0.14 dB
	-50 dB	-0.8 dB	_____	+0.8 dB	±0.15 dB
	-60 dB	-0.8 dB	_____	+0.8 dB	±0.16 dB
	-70 dB	-0.8 dB	_____	+0.8 dB	+0.17/-0.18 dB
2.	Maximum leveled output power				
	13. Maximum leveled output power	0 dBm	_____		±0.46 dB
3.	Level flatness				
	14. Maximum flatness		_____	+2.0 dB	±0.41 dB
	15. Minimum flatness	-2.0 dB	_____		±0.41 dB
4.	Harmonic spurious outputs				
	12. 2nd harmonic level				
	300 kHz		_____	-25 dBc	+1.55/-1.80 dB
	100 MHz		_____	-25 dBc	+1.55/-1.80 dB
	300 MHz		_____	-25 dBc	+1.55/-1.80 dB
	900 MHz		_____	-25 dBc	+1.55/-1.80 dB
	1.4 GHz		_____	-25 dBc	+3.45/-4.01 dB

8. Frequency Tracking Range

Table 4-9. Performance Test Record (Page 3 of 3)

Hewlett-Packard Company Model HP 85640A	Report No. _____
Serial No. _____	Date _____

Test No.	Test Description	Results			Measurement Uncertainty
		Min	Measured	Max	
4.	13. 3rd harmonic level				
	300 kHz			-25 dBc	+1.55/-1.80 dB
	100 MHz			-25 dBc	+1.55/-1.80 dB
	300 MHz			-25 dBc	+1.55/-1.80 dB
	900 MHz			-25 dBc	+1.55/-1.80 dB
5.	Non-harmonic spurious outputs				
	26. Non-harmonic response amplitude, < 2000 MHz			-27 dBc	+1.55/-1.80 dB
	27. Non-harmonic response amplitude, > 2000 MHz			-23 dBc	+3.45/-4.01 dB
6.	LO feedthrough amplitude				
	11. LO feedthrough at 3.911 GHz			-26 dBm	+2.02/-2.50 dB
	16. LO feedthrough at 6.8107 GHz			-26 dBm	+2.10/-2.67 dB
7.	Tracking generator feedthrough				
	13. TG feedthrough, 300 kHz to 1 MHz			-95 dBm	+1.74/-1.98 dB
	14. TG feedthrough, 1 MHz to 2 GHz			-115 dBm	+1.74/-1.98 dB
	15. TG feedthrough, 2 GHz to 2.9 GHz			-110 dBm	+1.74/-1.98 dB
8.	Frequency tracking range				
	11. Negative frequency variation			-5 kHz	±1 Hz
	12. Positive frequency variation	+ 5 kHz			±1 Hz



## Adjustment Procedures

---

### What You'll Find in This Chapter . . .

This chapter contains adjustment procedure information for the HP 85640A RF tracking generator. Use adjustment procedures after repairing the tracking generator, or if performance test results fail specifications.

---

### Safety Considerations

---

#### Warning



Adjustments in this section are performed with power supplied to the instrument and protective covers removed. There are voltages at many points in the instrument that can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by trained service personnel.

Power is still applied to this instrument with the LINE switch in the OFF position. Before removing or installing any assembly or printed circuit board, remove the instrument's line-power cord. Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of supply. Use a nonmetallic adjustment tool whenever possible.

---

#### Note



Before beginning the adjustment procedures, allow the instrument to warm up for at least five minutes (see *General Specifications* in Table 1-1).

---

### Which Adjustment Should Be Performed?

Refer to Table 5-2 for the list of adjustment procedures you should perform after instrument repairs or after performance test results fail specification.

### Test Equipment

Refer to Table 4-1, "Recommended Test Equipment," for a list of equipment needed to perform these adjustment procedures. Any equipment that satisfies the critical specifications provided in the table may be substituted for the preferred test equipment.

## Adjustable and Factory-Selected Components

Refer to Table 5-3 for a list of the adjustable components, organized by reference designator and name. The table provides an adjustment description and lists the adjustment number for each component.

Refer to Table 5-4 for information about the factory-selected component used in the tracking generator. Factory-selected components are identified with an asterisk on the schematic diagram.

## Adjustment Tools

For adjustments requiring a nonmetallic tuning tool, refer to the equipment list in Chapter 4 for the fiber tuning tool part number. Never try to force an adjustment control. This is especially critical when tuning variable capacitors and slug-tuned inductors. Refer to Table 4-1 for any other required service accessory part numbers.

**Table 5-1. Adjustment Procedures and Equipment Used**

<b>Adjustment Number</b>	<b>Adjustment Name</b>	<b>Equipment Used</b>
1	Power supply adjustments and checks	Digital voltmeter
2	600 MHz level adjustment	Host spectrum analyzer*
3	Power level adjustments	Host spectrum analyzer* Power sensor Measuring receiver Digital voltmeter 0.05 in. balldriver
4	Tracking oscillator range adjustment	Microwave frequency counter Host spectrum analyzer* Non-metallic alignment tool

\* A host spectrum analyzer can be any one of these models:  
HP 8560A or HP 8560E spectrum analyzer (non-Option 002)  
HP 8561A, HP 8561B or HP 8561E spectrum analyzer  
HP 8562A or HP 8562B spectrum analyzer  
HP 8563A or HP 8563E spectrum analyzer

**Table 5-2. Post-Repair or Specification Failure Adjustment List**

<b>Assembly Changed or Repaired</b>	<b>Perform adjustment(s) in the order listed</b>	<b>Adjustment Number</b>
A1 output attenuator	Power level adjustments	3
A2 tracking generator assembly	Power level adjustments	3
	Tracking oscillator range adjustment	4
A3 interface assembly	600 MHz level adjustment	2
	Power level adjustments	3
	Tracking oscillator range adjustments	4
A4 power supply assembly	Power supply adjustments and checks	1
A5 line filter/switch assembly	None	N/A

**Table 5-3. Adjustable Components**

<b>Reference Designator</b>	<b>Adjustment Name</b>	<b>Adjustment Number</b>	<b>Adjustment Description</b>
+15V ADJ	+15V ADJ	1	Adjusts the +15 V dc supply voltage
-15V ADJ	-15V ADJ	1	Adjusts the -15 V dc supply voltage
A2C3	TRACK OSC	4	Sets center frequency of tracking oscillator
A3R1	COR TRACK	4	Coarse adjustment of +TUNE voltage to tracking oscillator
A3R2	S + T GAIN	3	Adjusts gain of sweep-plus-tune voltage for slope (flatness) compensation
A3R3	LVL OFFSET	3	Sets output level at -20 dBm setting
A3R4	LVL GAIN	3	Sets output level at -10 dBm setting

**Table 5-4. Factory Selectable Component**

<b>Reference Designator</b>	<b>Adjustment Number</b>	<b>Basis of Selection</b>
A3U4	2	Sets 600 MHz level at A3J5 to -8 dBm $\pm$ 1 dB

# 1. Power Supply Adjustments and Checks

## Assembly Adjusted

A4 power supply

## Related Performance Test

There is no related performance test for this adjustment.

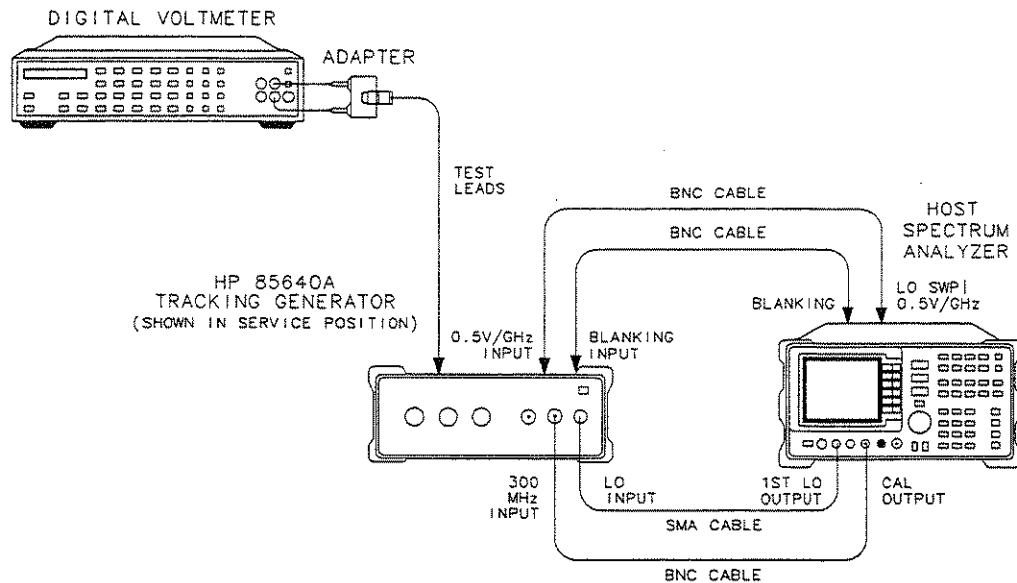
## Description

The +15 V and -15 V supplies are adjusted. The adjustments are located on A4 power supply, but the measurements are made on the A3 interface assembly. Other voltages on the interface assembly are also checked.

## Caution



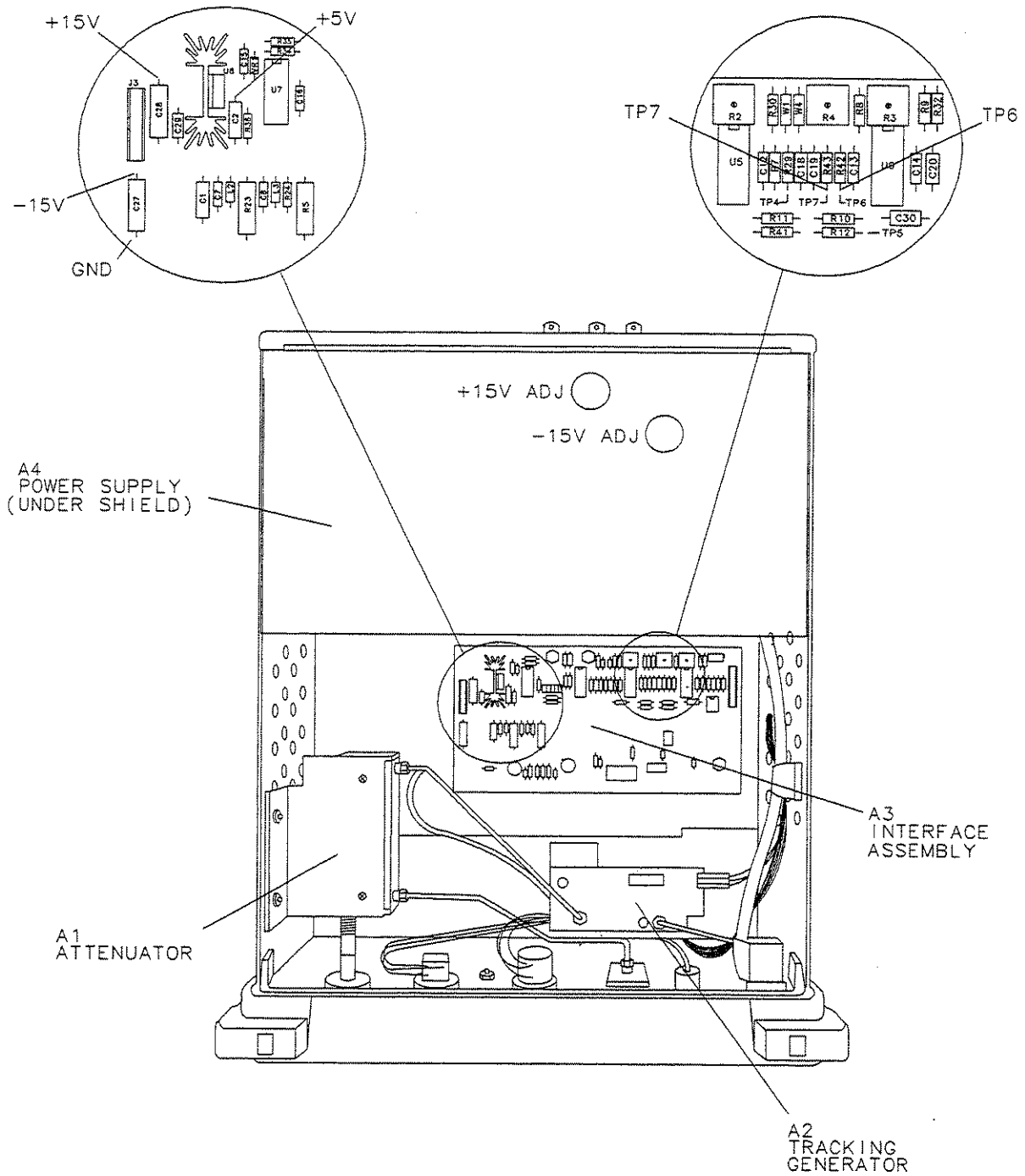
The tracking generator assemblies are static sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.



wk229

Figure 5-1. Power Supply Adjustments and Checks Setup

# 1. Power Supply Adjustments and Checks



wk230

**Figure 5-2. Power Supply Adjustments and Test Point Locations**

## 1. Power Supply Adjustments and Checks

### Equipment

Digital voltmeter ..... HP 3456A

### Cables

Test lead kit ..... HP 34118A

### Procedure

1. Set the HP 85640A LINE switch to OFF. Disconnect all cables from the tracking generator and remove the cover assembly (refer to "Removing and Replacing the Instrument Cover" in Chapter 7). Place the tracking generator in the service position illustrated in Figure 5-1.
2. Connect the negative test lead from the DVM to the negative end of A3C27. See Figure 5-2. Connect the positive DVM test lead to the positive end of A3C27 (the end labeled "+15V").
3. Reconnect the tracking generator's power cord and set the LINE switch to ON.
4. Set the DVM controls as follows:

FUNCTION .....	DC VOLTS
RANGE .....	100 VOLTS
5. Locate +15V ADJ (see Figure 5-1). Adjust +15V ADJ for a DVM reading of  $+15\text{ V} \pm 0.05\text{ V}$ .
6. Remove the positive test lead from the DVM from A3C27. Connect it to the negative end of A3C28 (the end labeled "-15V"). See Figure 5-2.
7. Locate -15V ADJ (see Figure 5-1). Adjust -15 V ADJ for a DVM reading of  $-15\text{ V} \pm 0.05\text{ V}$ .
8. Connect the positive test lead from the DVM to the positive end of A3C2 (the end labeled "+5V"). See Figure 5-1. Check that the DVM reads  $+5\text{ V} \pm 0.2\text{ V}$ .
9. Connect the positive test lead from the DVM to A3TP6. Check that the DVM reads  $+10.000\text{ V} \pm 0.030\text{ V}$ .
10. Connect the positive test lead from the DVM to A3TP7. Check that the DVM reads  $-10.000\text{ V} \pm 0.030\text{ V}$ .
11. Remove the DVM test leads.

## 2. 600 MHz Level Adjustment

### Assembly Adjusted

A3 interface assembly

### Related Performance Test

There is no related performance test for this adjustment.

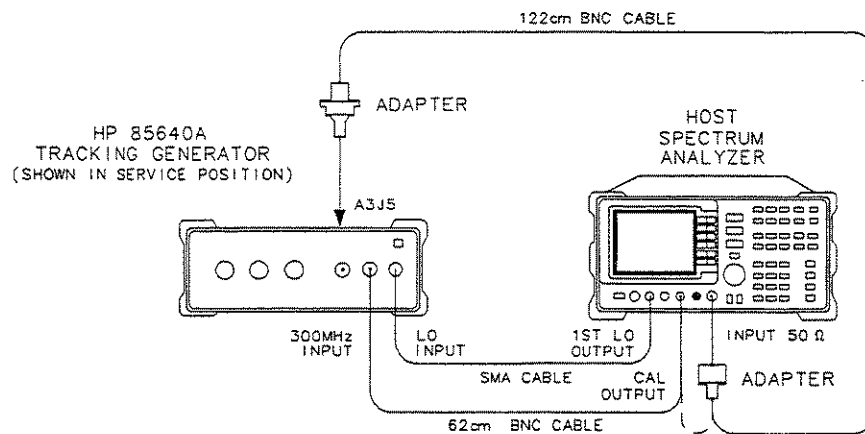
### Description

The A3U4 attenuator-pad value is selected to adjust the 600 MHz drive signal power level at A3J5 to  $-8 \text{ dBm} \pm 1 \text{ dB}$ . The host spectrum analyzer's CAL OUTPUT amplitude is checked first. The level of undesired harmonics at A3J5 are also checked.

### Caution



The tracking generator assemblies are static-sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.

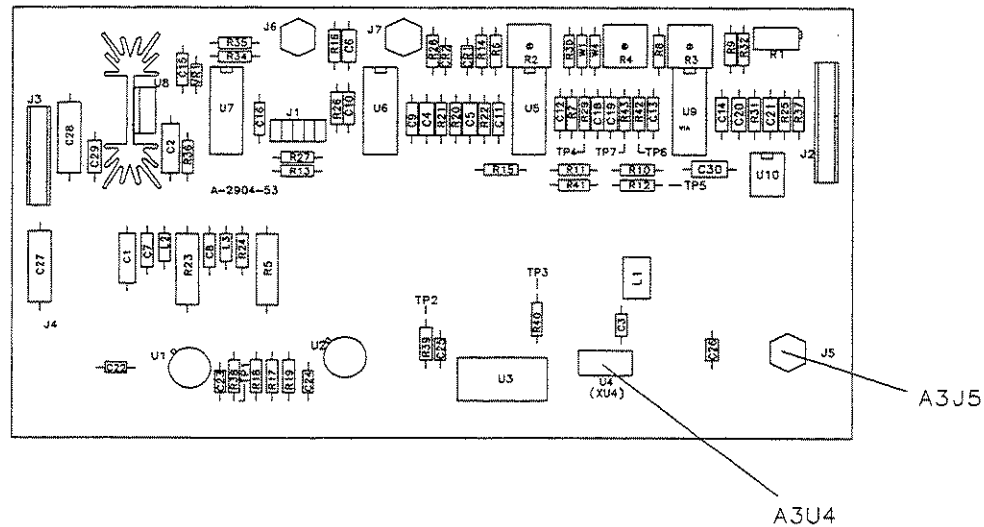


wk231

Figure 5-3. 600 MHz Level Adjustment Setup

## 2. 600 MHz Level Adjustment

A3 INTERFACE ASSEMBLY  
85640-60001



wk32

Figure 5-4. Attenuator A3U4 Location

### Equipment

Host spectrum analyzer ..... HP 8560A/E, HP 8561A/B/E, HP 8562A/B, HP 8563A/E

### Cables

BNC, 62 cm (24 in) ..... 8120-1839  
BNC, 122 cm (48 in) ..... HP 10503A

### Adapters

Type N (m) to BNC (f) ..... 1250-1476  
BNC (f) to SMB (f) ..... 1250-1236

### Procedure

1. Set the HP 85640A LINE switch to OFF. Disconnect all cables from the tracking generator and remove the cover assembly (refer to "Removing and Replacing the Instrument Cover" in Chapter 7). Place the tracking generator in the service position. See Figure 5-3.
2. Disconnect W5 from A3J5 (see Figure 5-4). Turn the tracking generator LINE switch ON.
3. Check the host spectrum analyzer's CAL OUTPUT amplitude using the appropriate performance test in the spectrum analyzer's installation and verification manual. If the amplitude does not meet the specification, correct the problem before continuing with this procedure.
4. Connect the equipment as shown in Figure 5-3 with the 122 cm BNC cable between the host spectrum analyzer's CAL OUTPUT and INPUT 50Ω connectors.



## 2. 600 MHz Level Adjustment

5. Press **PRESET** on the host spectrum analyzer and set the controls as follows:  
CENTER FREQ ..... 300 MHz  
CF STEP ..... 300 MHz  
SPAN ..... 20 MHz
6. If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **PEAK SEARCH** **CAL** **REF LVL ADJ**.  
If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **PEAK SEARCH** **AMPLITUDE** **MORE** **REF LVL CAL**.
7. Use the knob or step keys to adjust the displayed REF LEVEL ADJ # for a marker amplitude reading of  $-10.00 \text{ dBm} \pm 0.17 \text{ dB}$ .
8. Connect the 62 cm BNC cable between the host spectrum analyzer CAL OUTPUT and the tracking generator 300 MHz INPUT. Connect the 122 cm BNC cable between A3J5 (using an adapter) on the tracking generator and the INPUT 50 $\Omega$  on the spectrum analyzer.
9. Press **FREQUENCY** **CENTER FREQ** 600 **MHz** **PEAK SEARCH** on the host spectrum analyzer and record the marker amplitude reading below.

Initial 600 MHz amplitude: \_\_\_\_\_ dBm

10. Calculate the amount of difference in attenuation required to set the amplitude to  $-8 \text{ dBm}$  as indicated below. *Round the calculated value to the nearest whole number.*

attenuation difference = initial 600 MHz amplitude + 8 dBm

Attenuation difference (rounded): \_\_\_\_\_ dBm

11. If the attenuation difference (rounded) is  $\leq \pm 1 \text{ dB}$ , disconnect the BNC cable from A3J5 and reconnect W5 to A3J5; a new value of A3U4 need not be selected. If the attenuation difference is greater than  $\pm 1 \text{ dB}$ , continue with this procedure.

---

### Note

The following steps should be performed only if the attenuation difference is greater than  $\pm 1 \text{ dB}$ .



- 
12. Set the tracking generator LINE switch to OFF. Remove the top shield from the A3 interface assembly. See Figure 5-4. The bottom shield should remain in position. See Figure 5-3. Locate A3U4 and note the HP part number (0955-0311, for example) or the manufacturer's part number (MAT-4, for example). Refer to Table 5-5 to determine the current attenuation value of A3U4. Record the value below.

Current attenuation value: \_\_\_\_\_ dB

## 2. 600 MHz Level Adjustment

13. Calculate the desired attenuation value by adding the current attenuation value to the attenuation difference.

$$\text{desired attenuation} = \text{current attenuation value} + \text{attenuation difference}$$

Desired attenuation: \_\_\_\_\_ dB

14. Select a new value for pad A3U4 using Table 5-5, based on the desired attenuation calculated above.
15. Replace the A3 interface assembly top shield. Set the LINE switch to ON.
16. On the host spectrum analyzer, press **PEAK SEARCH** **MARKER DELTA** **FREQUENCY** **CENTER FREQ.** Use the step keys to set the spectrum analyzer to each of the center frequencies listed in Table 5-6. At each frequency setting, press **PEAK SEARCH** and record the marker amplitude in Table 5-6 for the appropriate frequency. The marker amplitude should be less than the specification listed.
17. Replace the BNC cable at A3J5 with the W5 cable.

**Table 5-5. Attenuation Values of Pad A3U4**

<b>HP Part Number</b>	<b>Manufacturer's Part Number*</b>	<b>Attenuation (dB)</b>
0955-0308	MAT-1	1
0955-0309	MAT-2	2
0955-0310	MAT-3	3
0955-0311	MAT-4	4
0955-0312	MAT-5	5
0955-0313	MAT-6	6
0955-0314	MAT-7	7

\*These manufacturer's part numbers are for Mini Circuits Lab, Inc. parts. Part numbers for other manufacturers' parts may be different.

Table 5-6. Harmonic and Subharmonic Levels

Frequency (MHz)	Marker Amplitude (dBc)	Specification (dBc)
300	_____	-25
900	_____	-25
1200	_____	-10
1500	_____	-25
1800	_____	-10
2100	_____	-25
2400	_____	-10

### 3. Power Level Adjustments

#### Assembly Adjusted

A3 interface assembly

#### Related Performance Test

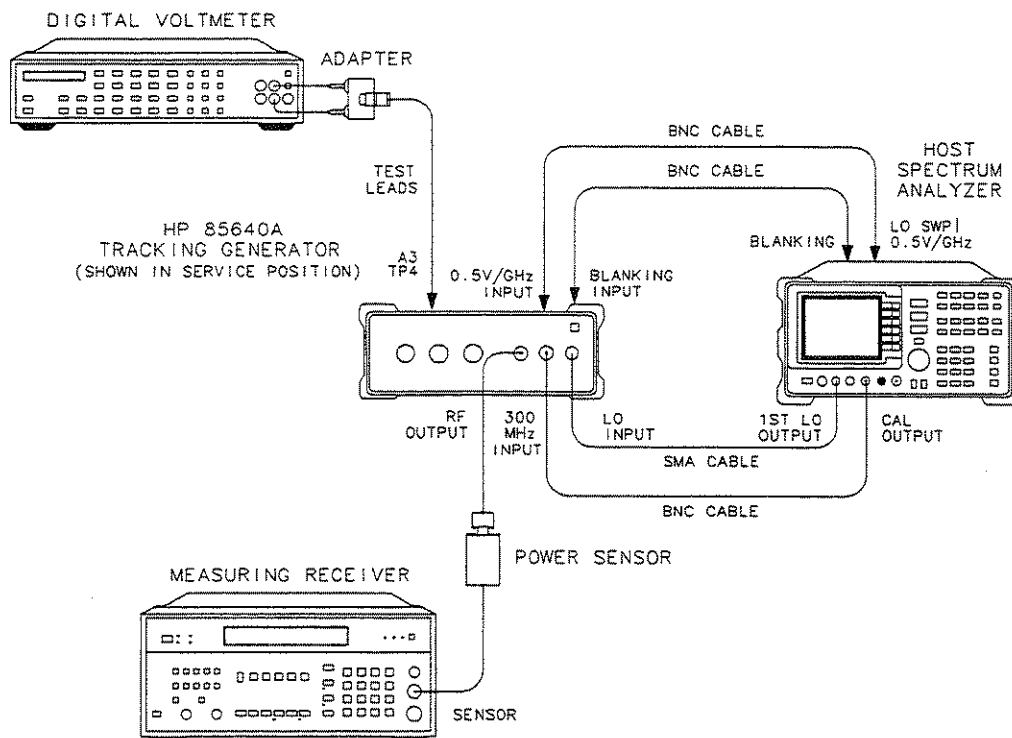
Level flatness

#### Description

The OUTPUT LEVEL vernier is set to  $-4$  dBm and the voltage at the vernier control's wiper is checked for  $+2.5$  V (the electrical center of the control). If necessary, the vernier control knob is reset. The gain and offset of the power level control circuitry is adjusted to yield  $-10$  dBm at the 0 dBm vernier setting and  $-20$  dBm at the  $-10$  dBm vernier setting (the OUTPUT LEVEL attenuator is set to  $-10$  dB).

The sweep-plus-tune gain (S+T GAIN) is adjusted for the same amplitude at 2.9 GHz as at 300 MHz.

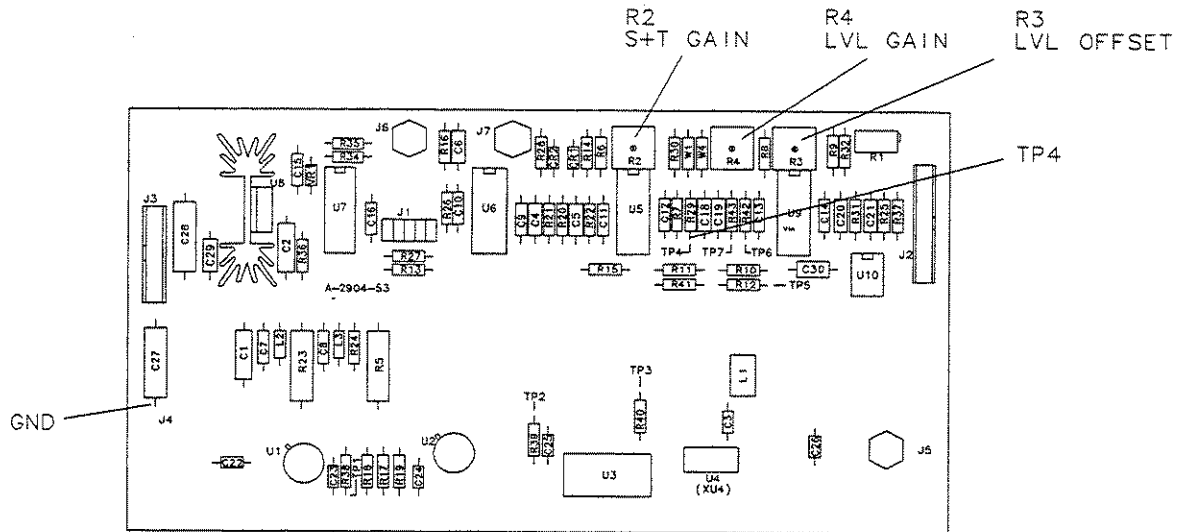
**Caution** The tracking generator assemblies are static sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.



wk233

Figure 5-5. Power Level Adjustment Setup

### 3. Power Level Adjustments



wk234

Figure 5-6. Power Level Adjustment and Test Point Locations

#### Equipment

Host spectrum analyzer ..	HP 8560A/E, HP 8561A/B/E, HP 8562A/B, or HP 8563A/E
Measuring receiver ..	HP 8902A
Power sensor ..	HP 8482A
Digital voltmeter ..	HP 3456A
Ball driver, 0.05 in ..	HP 8710-1199

#### Cables

Type N, 62 cm (24 in) ..	HP 11500B/C
BNC, 62 cm (24 in) (3 required) ..	HP 8120-1839
SMA, 52 cm (20 in) ..	HP 5061-9038
Test lead kit ..	HP 34118A

#### Procedure

1. Remove the tracking generator cover (refer to "Removing and Replacing the Instrument Cover" in Chapter 7). Connect the equipment as shown in Figure 5-5 with the Type N cable connected between the tracking generator RF OUTPUT and the host spectrum analyzer INPUT 50Ω connectors. Set the LINE switch to ON.
2. Connect the positive DVM test lead to A3TP4 and the negative DVM test lead to the negative side of A3C27. Refer to Figure 5-6.
3. Set the OUTPUT LEVEL attenuator to -10 dB and the OUTPUT LEVEL vernier to -4 dBm.

### 3. Power Level Adjustments

#### Note



The OUTPUT LEVEL vernier is prone to parallax error. To minimize parallax when setting the knob, view the pointer and the scale marking directly from the front of the instrument panel. The ridges on the knob are also useful for properly aligning the pointer with the scale marking.

4. Set the DVM controls as follows:

FUNCTION .....	DC VOLTS
RANGE .....	10 V

5. If the DVM reads  $+2.5\text{ V} \pm 0.1\text{ V}$ , continue at step 8. Otherwise, continue to step 6.
6. Loosen the set-screws that secure the OUTPUT LEVEL vernier knob to the vernier control shaft. Remove the vernier knob.
7. Adjust the shaft for a DVM reading of  $+2.5\text{ V} \pm 0.1\text{ V}$ . Without moving the position of the control shaft, replace the vernier control knob with the pointer set to  $-4\text{ dBm}$ . Repeat step 5.
8. Press **PRESET** on the host spectrum analyzer and set the controls as follows:

CENTER FREQ .....	300 MHz
SPAN .....	0 Hz
RES BW .....	300 Hz
TRIG .....	SINGLE

9. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **SWEEP**  
**REAR PNL OUTPUT**  $.5\text{ V/GHz (FAV)}$ .

If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press

**AUX CTRL** **REAR PANEL**  $0.5\text{ V/GHz (FAV)}$ .

10. Adjust TRACKING ADJUST to display a maximum signal level on the host spectrum analyzer screen.
11. Zero and calibrate the measuring receiver and power sensor. Enter the power sensor's 300 MHz Cal Factor into the measuring receiver.
12. Disconnect the Type N cable from the tracking generator RF OUTPUT and connect the power sensor to the RF OUTPUT.
13. Set the OUTPUT LEVEL vernier to  $-10\text{ dBm}$ . Adjust A3R3 LVL OFFSET for a  $-20\text{ dBm} \pm 0.2\text{ dB}$  reading on the measuring receiver.
14. Set the OUTPUT LEVEL vernier to  $0\text{ dBm}$ . Adjust A3R4 LVL GAIN for a  $-10\text{ dBm} \pm 0.2\text{ dB}$  reading on the measuring receiver.
15. Repeat steps 13 and 14 until the power level at each vernier setting is within tolerance.
16. Set the OUTPUT LEVEL vernier for a  $-10\text{ dBm} \pm 0.05\text{ dB}$  reading on the measuring receiver.
17. Set the host spectrum analyzer **CENTER FREQ** to 2.9 GHz.
18. Enter the power sensor's 3 GHz Cal Factor into the measuring receiver.
19. Adjust A3R2 S+T GAIN for a  $-10\text{ dBm} \pm 0.2\text{ dB}$  reading on the measuring receiver.
20. Disconnect the DVM test leads from A3TP4 and A3C27.

## 4. Tracking Oscillator Range Adjustments

### Assemblies Adjusted

A2 tracking generator assembly  
A3 interface assembly

### Related Performance Test

Tracking adjustment range

### Description

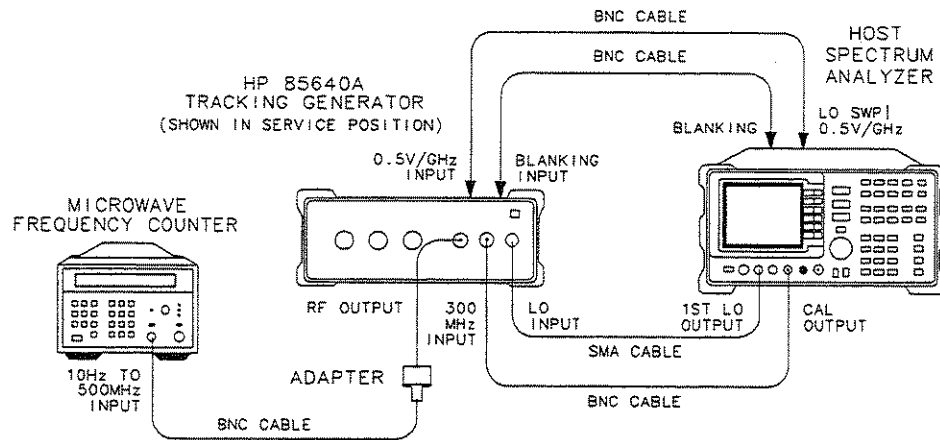
The centering of the tracking oscillator range is adjusted in the factory to ensure that the tracking adjustment works properly. Over a period of 5 years, however, the center frequency of the tracking oscillator range may drift outside of acceptable limits. These limits are tested with the tracking adjustment range performance test in Chapter 4 of this manual. Perform this adjustment only if the tracking adjustment range performance test has failed.

This adjustment centers the tracking oscillator range. Typically, performing the fine adjustment on the A3 interface assembly is sufficient. In some cases, however, adjusting the A2 tracking generator coarse adjustment is necessary. The coarse adjustment, A2C3, is rated for a maximum of 10 adjustment cycles. Because of this limitation, adjust A2C3 only when absolutely necessary.

### Caution



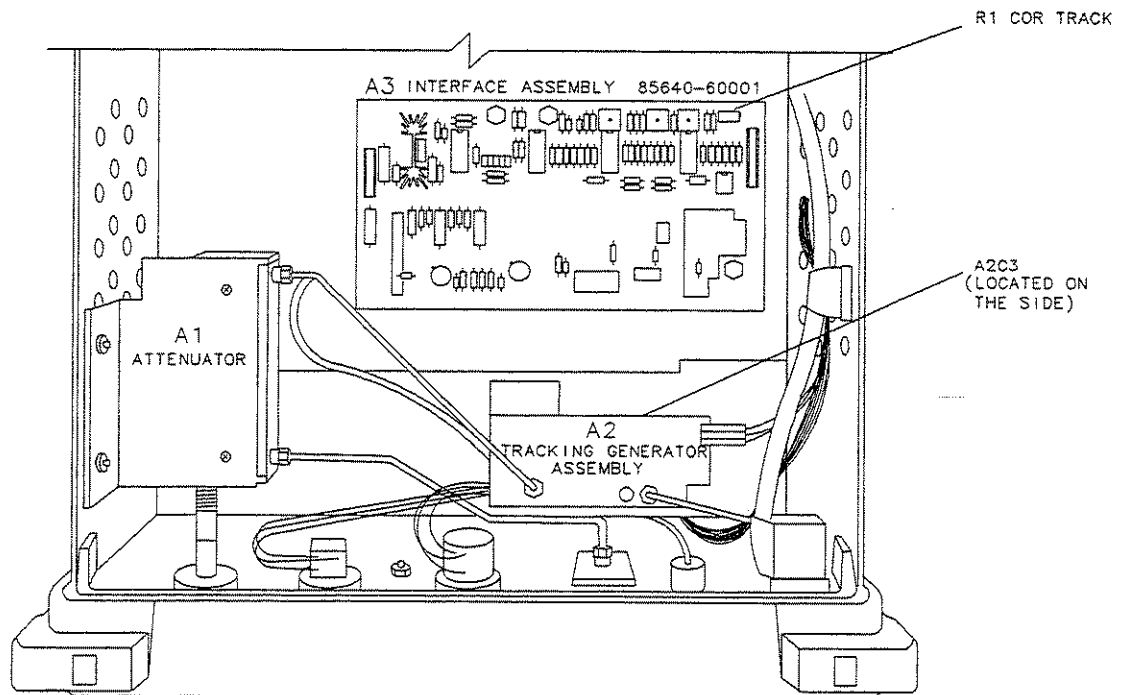
The tracking generator assemblies are static-sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.



wk235

Figure 5-7. Tracking Oscillator Range Adjustment

#### 4. Tracking Oscillator Range Adjustments



wk236

**Figure 5-8. Tracking Oscillator Range Adjustment Locations**

#### Equipment

Host spectrum analyzer ... HP 8560A/E, HP 8561A/B/E, HP 8562A/B or HP 8563A/E  
 Microwave frequency counter ..... HP 5343A  
 Alignment tool, nonmetallic ..... 8710-0033

#### Cables

BNC, 122 cm (48 in) (2 required) ..... HP 10503A  
 BNC, 62 cm (24 in) (3 required) ..... 8120-1839  
 SMA, 52 cm (20 in) ..... 5061-9038

#### Adapter

Type N (m) to BNC (f) ..... 1250-1476

#### Procedure

1. Remove the cover from the tracking generator (refer to "Removing and Replacing the Instrument Cover" in Chapter 7). Connect the equipment as shown in Figure 5-7. Also connect a BNC cable between the frequency counter FREQ STD OUT and the host spectrum analyzer 10 MHz REF IN/OUT. Set the tracking generator LINE switch to ON and allow it to warm up for at least 10 minutes.
2. Press **PRESET** on the host spectrum analyzer and set the controls as follows:
 

CENTER FREQ	.....	300 MHz
SPAN	.....	0 Hz



#### 4. Tracking Oscillator Range Adjustments

3. If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **[SWEEP]** **[REAR PNL OUTPUT]** **.5 V/GHz (FAV)** **[FREQUENCY]** **[MORE]** **10 MHz EXT** **[TRIG]** **[SINGLE]**.

If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E, press **[AUX CTRL]** **[REAR PANEL]** **0.5 V/GHz (FAV)** **10 MHz EXT** **[SGL SWP]**.

#### Fine Adjustment

4. Set the microwave frequency counter controls as follows:

SAMPLE RATE ..... FULLY Counterclockwise  
50Ω -1 MΩ Switch ..... 50Ω  
10Hz-500MHz/500MHz-26.5 GHz Switch ..... 10Hz-500MHz

5. Offset the counter's displayed frequency by 300 MHz by pressing **[SET]** **[OFS MHz]** **300** **[CHS]** **[ENTER]**.

---

**Note** Pressing **[OFS MHz]** toggles between offset and normal modes.



- 
6. Rotate the TRACKING ADJUST control fully counterclockwise. Note the frequency counter reading.
7. Rotate the TRACKING ADJUST control fully clockwise.
8. Access A3R1 COR TRACK through the right-hand side of the chassis (see Figure 5-8). Adjust A3R1 COR TRACK for a counter reading equal to the absolute value of the frequency noted in step six above  $\pm 100$  Hz.
9. Repeat steps six through eight at least once more until the absolute values of the counter readings with the TRACKING ADJUST control fully clockwise and fully counterclockwise are within 500 Hz of each other. If the absolute values of the counter readings cannot be set to within 500 Hz of each other, continue with step 11 to check the absolute tracking range. It is acceptable for the absolute values of the counter readings to not be within 500 Hz of each other as long as the tracking generator has sufficient absolute tracking range.
10. Press **[OFS MHz]** on the counter. The counter should display a frequency of approximately 300 MHz.
11. Rotate the TRACKING ADJUST fully counterclockwise. The frequency counter should read less than 299.993 MHz. If the frequency counter reads greater than 299.993 MHz, perform the Coarse Adjustment.
12. Rotate the TRACKING ADJUST fully clockwise. The frequency counter should read greater than 300.007 MHz. If the frequency counter reads less than 300.007 MHz, perform the Coarse Adjustment.

#### Coarse Adjustment

13. Remove the dust-cap screw used to seal the tracking oscillator adjustment. See Figure 5-7.
14. Rotate A3R1 COR TRACK fully clockwise. Rotate A3R1 COR TRACK three turns counterclockwise.
15. Rotate the TRACKING ADJUST control fully clockwise. Record the frequency counter reading in Table 5-7 as F1.

16. Rotate the TRACKING ADJUST control fully counterclockwise. Record the frequency counter reading in Table 5-7 as F2.

17. Calculate  $F_{\text{CENTER}}$  as shown below and record the result in Table 5-7.

$$F_{\text{CENTER}} = (F1 + F2) / 2$$

18. Set TRACKING ADJUST for a frequency counter reading of  $F_{\text{CENTER}} \pm 100$  Hz.

**Note**



The coarse adjustment, A2C3, is rated for a maximum of 10 adjustment cycles. Because of this limitation, adjust A2C3 only when absolutely necessary.

19. Adjust A2C3 until the frequency counter reads 300 MHz  $\pm 500$  Hz.

20. Repeat steps 15 through 19 at least once more until no further adjustment of A2C3 is necessary.

21. Set the tracking generator LINE switch to OFF. Replace A2 dust- cap screw.

22. Repeat the fine adjustment procedure, steps four through 12.

**Table 5-7. Tracking Oscillator Range Centering**

F1 (MHz)	F2 (MHz)	$F_{\text{CENTER}}$ (MHz)

## Assembly Replaceable Parts

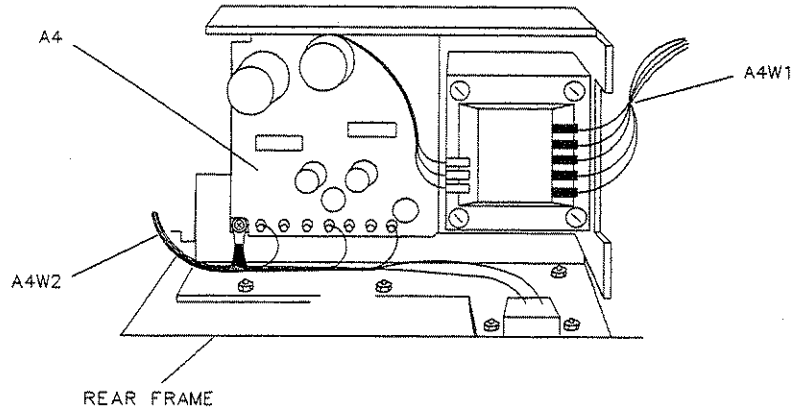
---

### What You'll Find in This Chapter

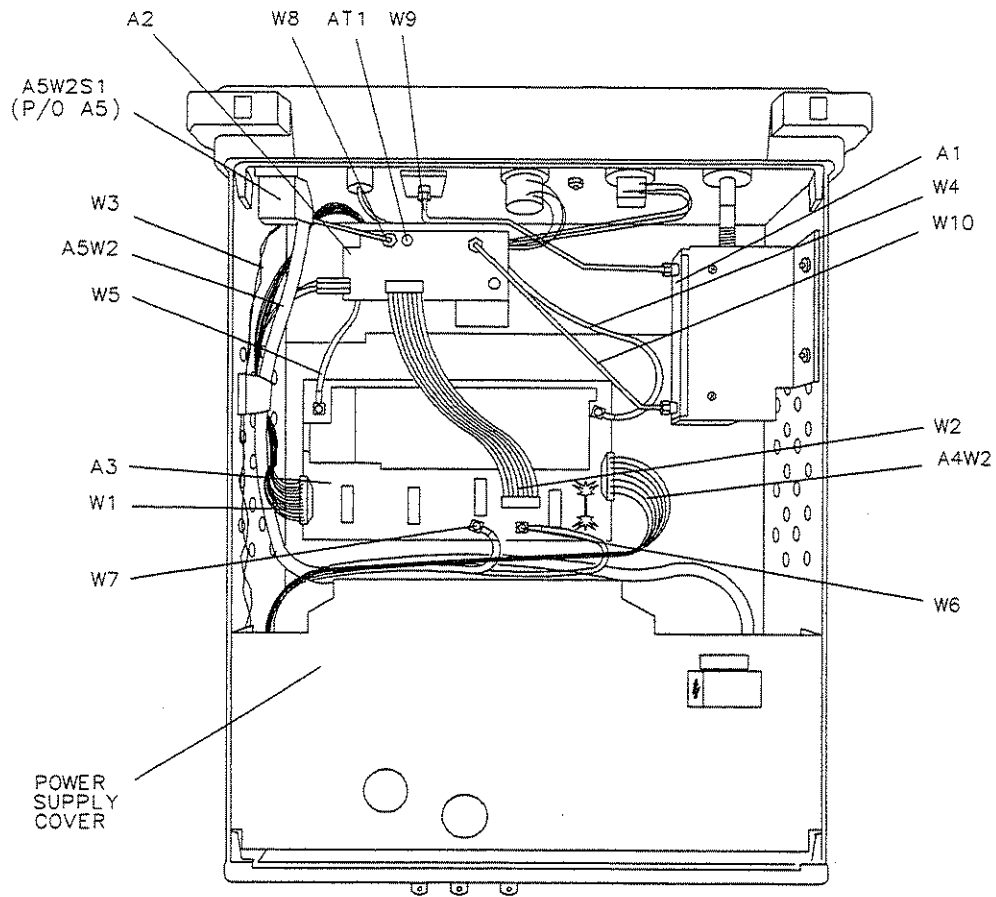
The replaceable parts and assemblies of the HP 85640A tracking generator are listed in tables, some with accompanying illustrations, in this chapter. Rebuilt-exchange assembly part numbers are included here as well. Refer to Chapter 7 for replacement procedures and the rebuilt-exchange assembly procedure.

## Major Assembly and Cable Locations

Description	HP Part Number	CD
A1 attenuator, 70 dB w/blocking capacitor	5086-7845	2
A2 tracking generator	5086-7879	2
Rebuilt A2, exchange required	5086-6879	0
A3 interface assembly	85640-60001	5
A4 power supply assembly	85640-60006	0
A4W1 cable assembly, power supply primary	85640-60004	8
A4W2 cable assembly, power supply to interface	85640-60003	7
A5 line filter/switch assembly	5062-4853	6
A5W1 cable assembly, A5FL1 to A4W1	(p/o A5)	N/A
A5W2 cable assembly, line switch	(p/o A5)	N/A
A5W3 cable assembly, grounding	5062-1903	1
A5W2S1 switch DPST	3101-2905	7
AT1 50Ω terminator	1810-0118	1
W1 cable assembly, front panel controls	85640-60002	6
W2 cable assembly, tracking generator drive	8120-4157	0
W3 cable assembly, EXT ALC input	08560-60001	6
W4 cable assembly, 300 MHz input	85640-60008	2
W5 cable assembly, 600 MHz input	85640-60007	1
W6 cable assembly, blanking input	85640-60009	3
W7 cable assembly, 0.5V/GHz input	85640-60010	6
W8 cable assembly, LO input to TG	85640-20004	4
W9 cable assembly, ATTEN to RF output	08560-20002	2
W10 cable assembly, TG to ATTEN	08560-20003	3
Power supply cover	5002-0611	0



wk237



wk238

**Figure 6-1. Major Assemblies and Cable Locations**

## Mechanical Replaceable Parts

Table 6-1. Part Numbers for Figure 6-2

Item	Description	HP Part Number	CD
1	W1DS1 LED GRN BAR 0.56 MCD (p/o W1)	85640-40004	6
2	Bumper (4 per)	5041-8928	0
3	Screw 3.0 mm×6 mm panhead	0515-1146	0
4	Front dress panel	85640-00001	9
5	Front frame	5021-8693	4
6	W1DS2 LED RED 1 MCD (p/o W1)	1990-0486	6
7	Lock-washer 0.384-in ID	2190-0022	1
8	Hex nut 3/8×32 mm	2950-0001	8
9	Knob, round .75 jade gray	0370-3215	0
10	Set screw .125-in	3030-0007	5
11	Bulkhead connector, type N (f)	1250-2191	6
12	Hex nut 15/32×32 mm	0590-1251	6
13	W4 cable assembly 300 MHz IN	85640-60008	5
14	Not assigned		
15	Hex nut 3/8×32 mm	2950-0001	8
16	Lock-washer .314-in ID	2190-0033	4
17	Adapter SMA(f) to SMA(f)	1250-1666	8

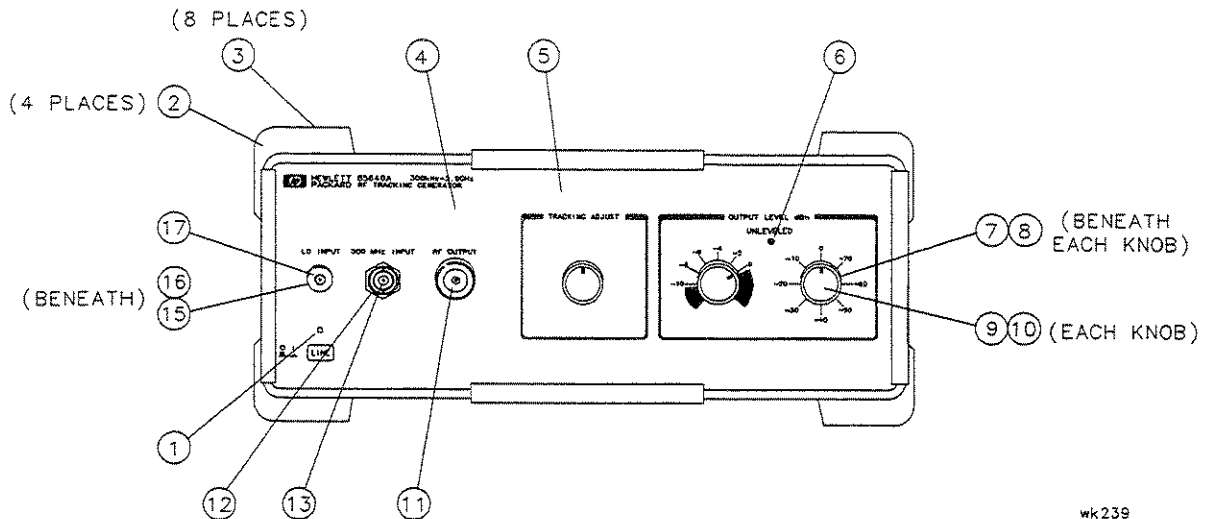
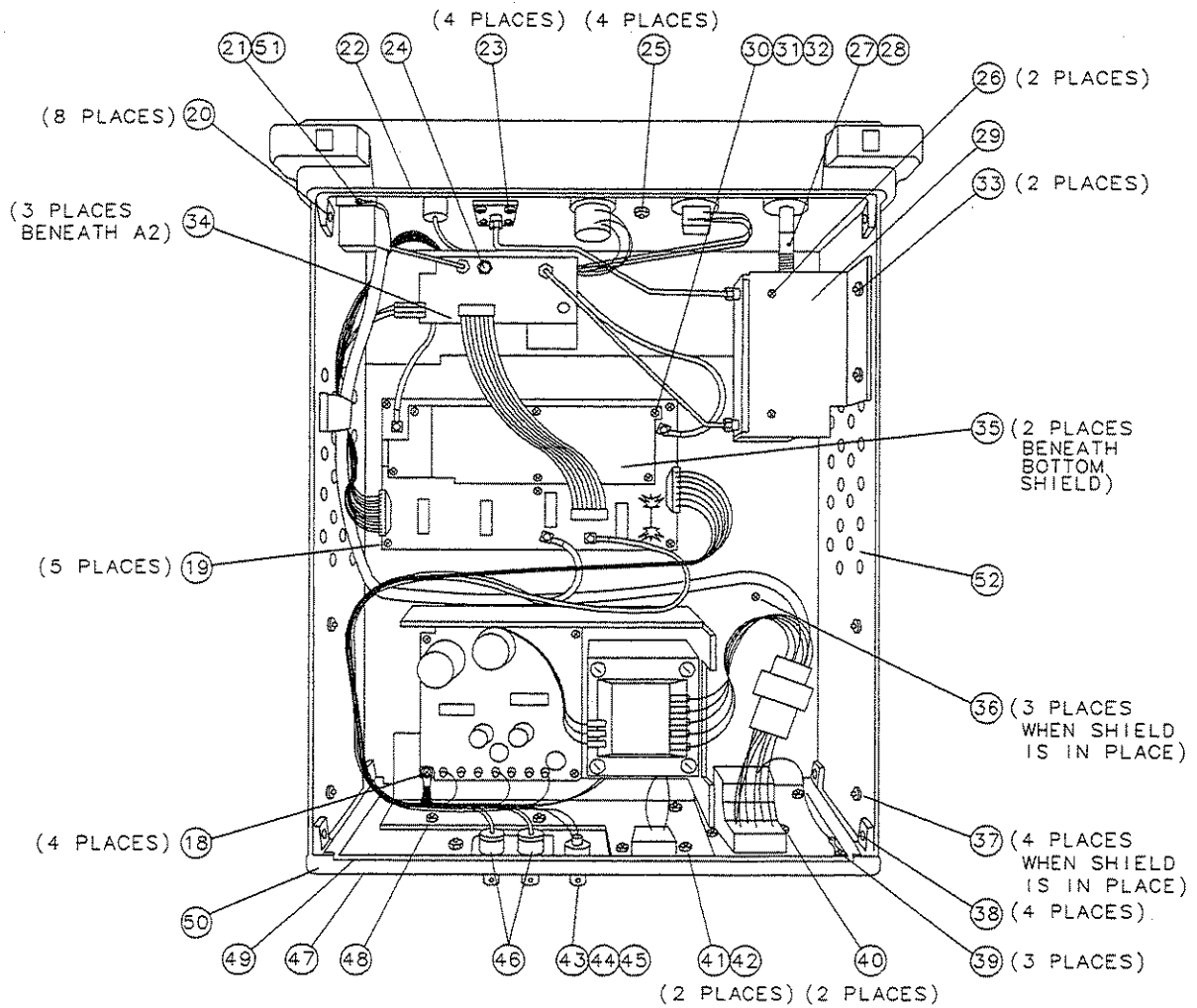


Figure 6-2. Mechanical Replaceable Parts (1 of 2)

**Part Numbers for Figure 6-3**

<b>Item</b>	<b>Description</b>	<b>HP Part Number</b>	<b>CD</b>
18	Screw 4.0×10 mm panhead	0515-1069	6
19	Screw 3.0×8 mm panhead	0515-1079	8
20	Screw 4.0×8 mm flathead	0515-1367	7
21	Screw 3.0×12 mm panhead	0515-1552	2
22	RFI gasket (front) (3 feet required)	8160-0662	8
23	Screw 3.0×6 mm panhead	0515-1146	0
24	AT1 50Ω termination	1810-0118	1
25	Nut with lock-washer 4 mm	0535-0082	3
26	Screw 4-40 .312-in panhead	2200-0105	4
27	Set screw .125-in, 4-40	3030-0007	5
28	Attenuator-knob shaft adapter	5021-8695	6
29	Attenuator bracket	5002-0603	0
30	Shield screws (2 center) 2.5×16 mm panhead	0515-0951	3
	Shield screws (4 outer) 2.5×14 mm panhead	1390-0745	8
31	Lock-washer 2.5 mm ID	2190-0583	9
32	O-ring 0.070-in ID	0905-0375	2
33	Screw 3.0×8 mm flathead	0515-1459	8
34	Screw 3.0×6 mm panhead	0515-1146	0
35	Hook and loop fastener	0510-1303	1
36	Screw 3.0×8 mm panhead	0515-1079	8
37	Screw 3.0×8 mm flathead	0515-1459	8
38	Screw 4.0×8 mm flathead	0515-1367	7
39	Hex nut with lock-washer 4 mm	0535-0082	3
40	Screw 3.0×10 mm flathead	0515-1460	1
41	Flat-washer 2.5 mm ID	3050-0890	6
42	Screw 2.5×8 mm panhead	0515-1548	6
43	Hex nut 3/8×32 mm	2950-0001	8
44	Connector insulator	5040-0345	7
45	Connector BNC(f)	1250-0186	5
46	Hex nut 15/32×32 mm	2950-0035	8
47	Rear dress panel	85640-00002	0
48	Screw 4.0×8 mm flathead	0515-1367	7
49	RFI gasket (rear) (3 feet required)	8160-0662	8
50	Rear frame	5021-8694	5
51	O-ring .101-in ID	0900-0010	2
52	Center deck	5002-0602	9



wk240

**Figure 6-3. Mechanical Replaceable Parts (2 of 2)**