

# Notice

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**HP 85640A**  
**RF Tracking Generator**  
**Operation and Service Manual**



Printed in USA

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HP part number: 85640-90005

Printed July 1992

This manual applies to HP 85640A RF tracking generators with serial numbers prefixed 2918A and below.

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## Safety Symbols

The following safety symbols are used throughout this manual. Familiarize yourself with each of the symbols and its meaning before operating this instrument.

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**Caution**      The *caution* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a *caution* sign until the indicated conditions are fully understood and met.

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**Warning**      The *warning* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

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## General Safety Considerations

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**Warning**      *Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.*

**Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.**

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**Warning**      **There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.**

**Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.**

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**Caution**      *Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.*

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

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## General Information

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### What You'll Find in This Operation and Service Manual . . .

- Chapter 1, “General Information,” gives specifications and characteristics for the instrument.
- Chapter 2, “Installation,” discusses power requirements, spectrum analyzer compatibility, and interconnect requirements, and gives a list of HP sales and service offices.
- Chapter 3, “Operation,” explains the use of front- and rear-panel features and gives the steps for transmission and reflection measurements using the tracking generator with a host spectrum analyzer.
- Chapter 4, “Performance Tests,” describes the tests you'll use to verify the electrical performance of the tracking generator.
- Chapter 5, “Adjustment Procedures,” provides steps to adjust assemblies of the tracking generator.
- Chapter 6, “Assembly Replaceable Parts,” shows the replaceable parts of the tracking generator.
- Chapter 7, “Service Information,” describes replacement procedures, suggests methods for troubleshooting, and explains how to return the instrument for service or repair. In this chapter you'll also find lists of component-level replaceable parts, instrument block diagrams, and schematic and component location diagrams for the A3 interface assembly.

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### What You'll Find in This Chapter

This chapter introduces you to the HP 85640A RF tracking generator. Figure 1-1 shows the accessories supplied with the instrument at shipment; Table 1-1, “HP 85640 Specifications” and Table 1-2, “HP 85640 Characteristics,” describe the instrument's performance under specified conditions.

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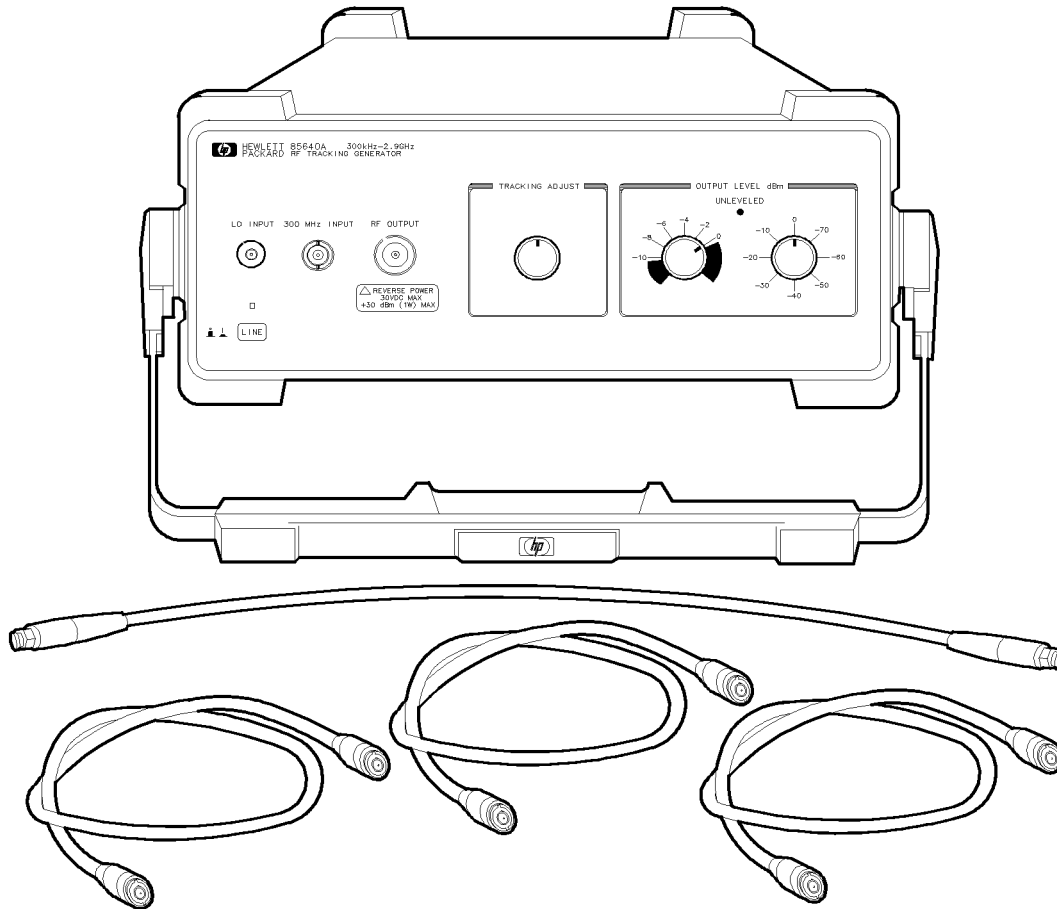
## Quick Overview of the HP 85640A RF Tracking Generator

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**

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## RF Tracking Generators Covered by This Manual

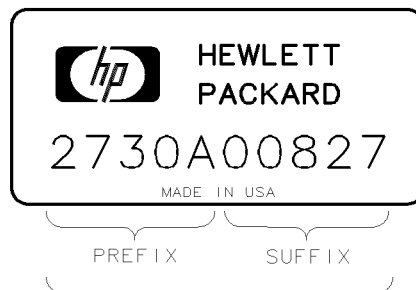
This manual applies to tracking generators with the serial number prefixes listed inside the title page.

### 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**

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## 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.

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## 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.



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**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

<b>Output Level</b>	
Range	0 dBm to -80 dBm
Vernier	>10 dB
Attenuator	70 dB
Maximum leveled output power	$\geq 0$ dBm
Resolution	
Attenuator	10 dB steps
Vernier	Continuously adjustable
Accuracy	
Level flatness (referenced to 300 MHz, vernier at 0 dB, attenuator at -10 dB)	$< \pm 2.0$ dB
Output attenuator Switching Accuracy (10 dB to 70 dB settings, referenced to 0 dB setting)	$< \pm 0.8$ dB per 10 dB step, to a maximum of $\pm 1.5$ dB

<b>Spurious Outputs</b>	
Unless otherwise specified, with vernier set to 0 dBm and attenuator set to -10 dB (-10 dBm output power)	
Harmonic spurious 300 kHz to 2.9 GHz	$< -25$ dBc
Non-harmonic spurious 300 kHz to 2.0 GHz	$< -27$ dBc
2.0 GHz to 2.9 GHz	$< -23$ dBc
LO feedthrough 3.9 GHz to 6.8 GHz	$< -26$ dBm

<b>Dynamic Range</b>	
Tracking generator feedthrough* (Spectrum analyzer set to 300 Hz resolution bandwidth and 0 dB input attenuation.)	
300 kHz to 1 MHz	$< -95$ dBm
1 MHz to 2.0 GHz	$< -115$ dBm
2.0 GHz to 2.9 GHz	$< -110$ dBm

\* Leakage measured on spectrum analyzer with tracking generator delivering maximum leveled output power into a 50 $\Omega$  termination, and spectrum analyzer input terminated in 50 $\Omega$ .

## Electromagnetic Specifications

<b>Electromagnetic Compatibility</b>	
Military specification	Conducted and radiated interference complies with CISPR Publication 11 (1985), and Messemphaenger-Postverfuegung 526/527/79 (Kennzeichnung Mit F-Nummer/Funkschutzzeichen). Meets the requirements of MIL-STD-461B, Part 4, with the exceptions shown below:
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	15 dB relaxation of 30 kHz (excepted from 30 kHz to 50 kHz)
RE02	Full limits to 1 GHz
Radiated susceptibility	
RS03	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).
RS01	Full limits
RS02	Excepted

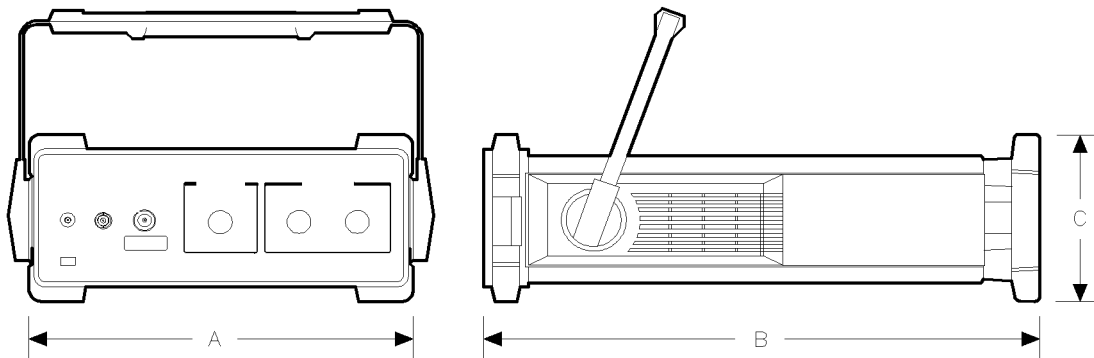
## General Specifications

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

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

## 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**

<b>Spectrum Analyzer Model Numbers</b>	<b>Serial Number</b>
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



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## 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.

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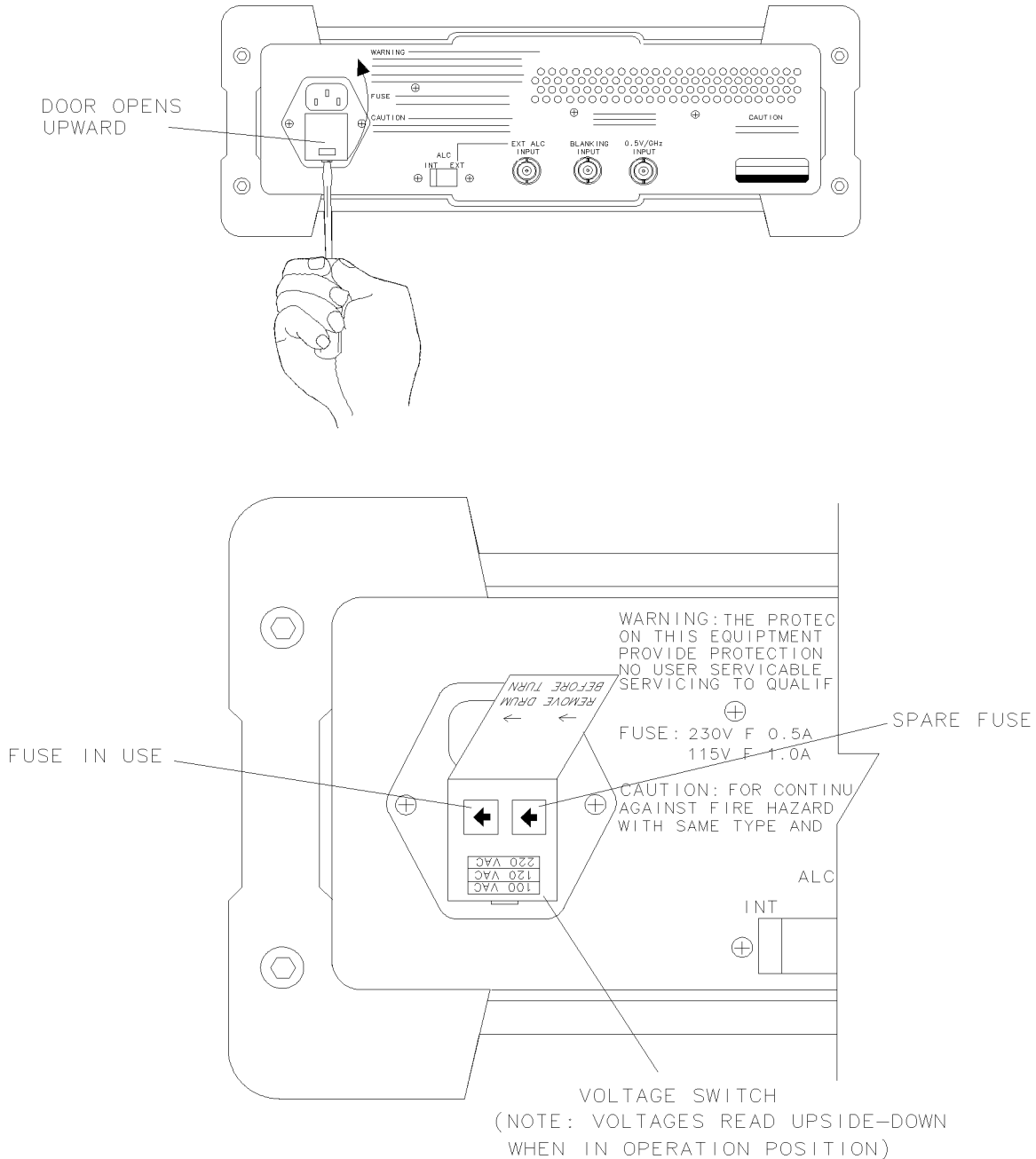
## Power Requirements

**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.



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**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

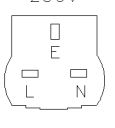

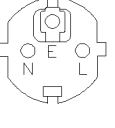
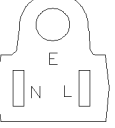
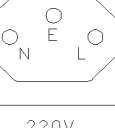
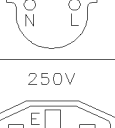
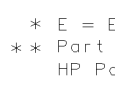
The HP 85640A is equipped with a three-wire power cable, in accordance with international safety standards. When connected to an appropriate power source outlet, this cable grounds the instrument cabinet.

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<b>Warning</b>	<b>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.</b>  <b><i>Do not</i> 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.</b>
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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-VI			
<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>					

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

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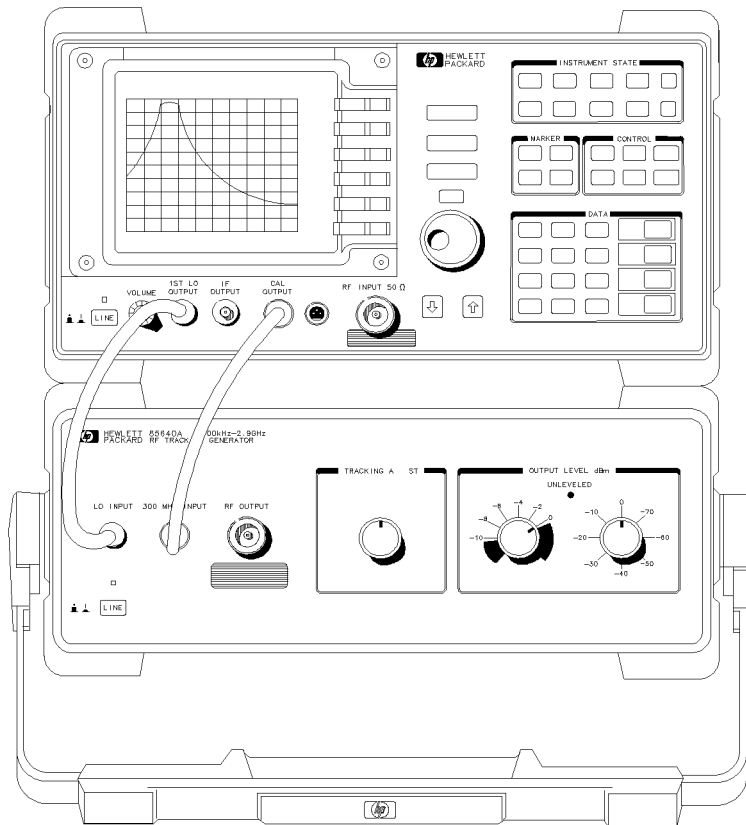
## Connecting an HP 85640A to a Compatible Spectrum Analyzer

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.

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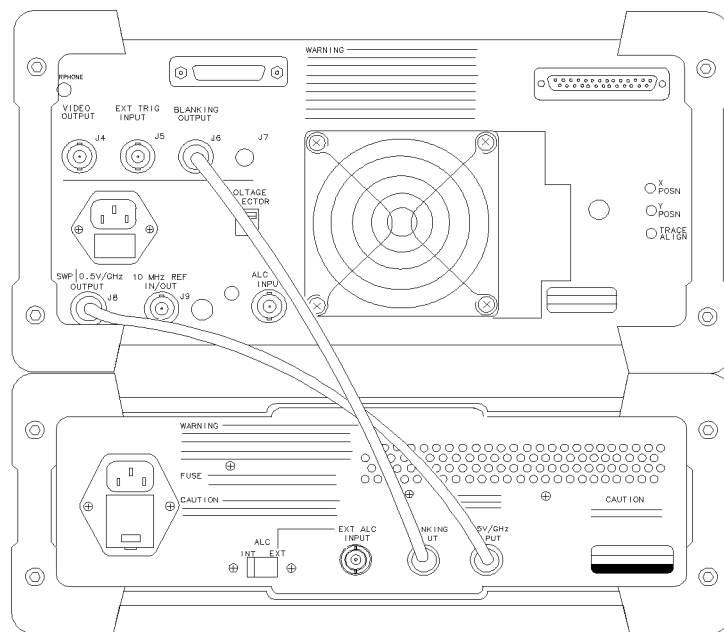
**Note** Connect the cables with the tracking generator placed beneath the portable spectrum analyzer to prevent the cables from obscuring your view of the display during operation.

---



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**Figure 2-3. Front-Panel Cable Connections**



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

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

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## 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.

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## **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, Sagamihara 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

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### 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.

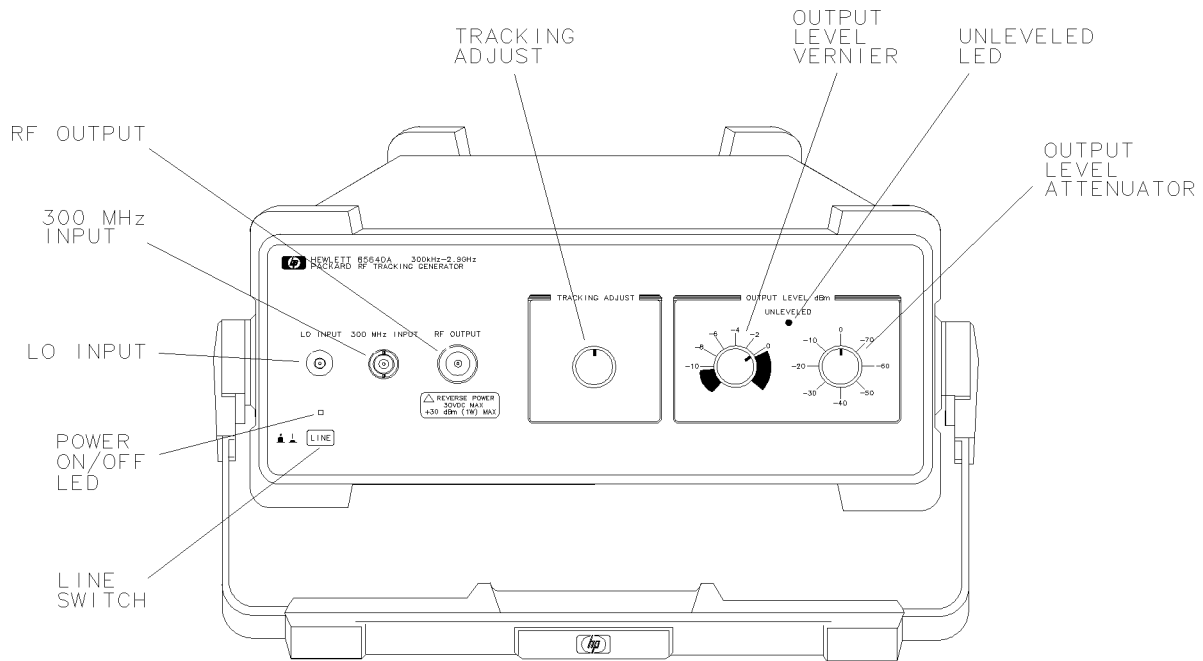
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## Front-Panel Features

<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 unlevelled condition is detected (except during retrace).

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

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



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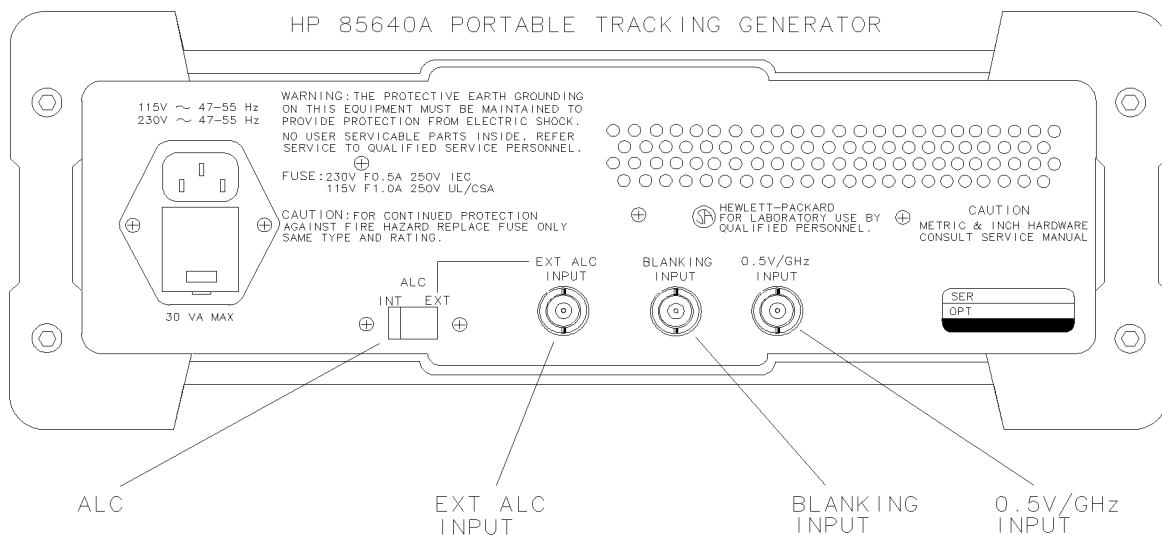
**Figure 3-1. Front-Panel Feature Overview**

## 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) $\pm 15$ 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



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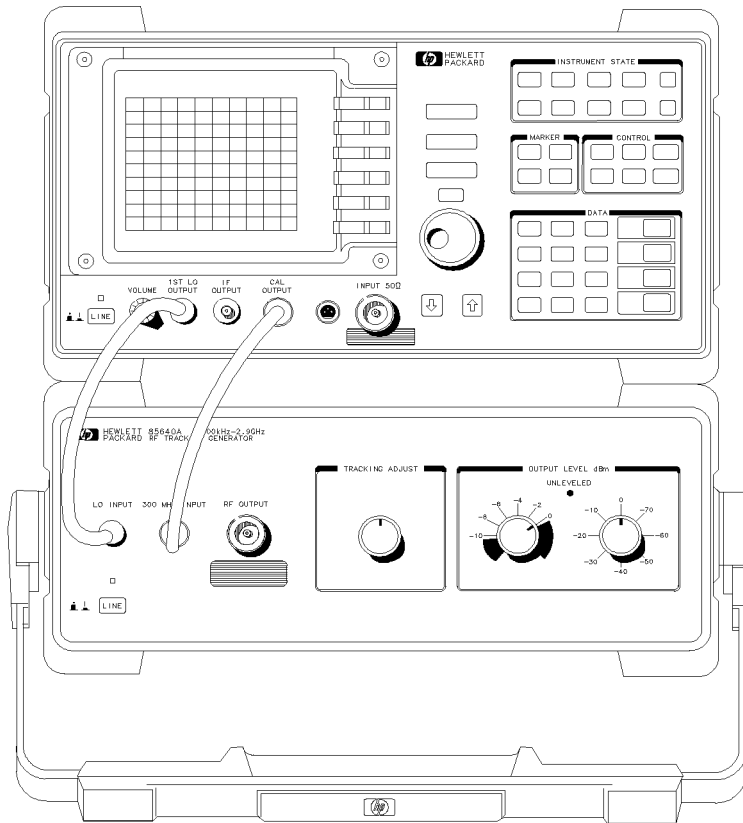
**Figure 3-2. HP 85640A Rear-Panel Feature Overview**

# 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.

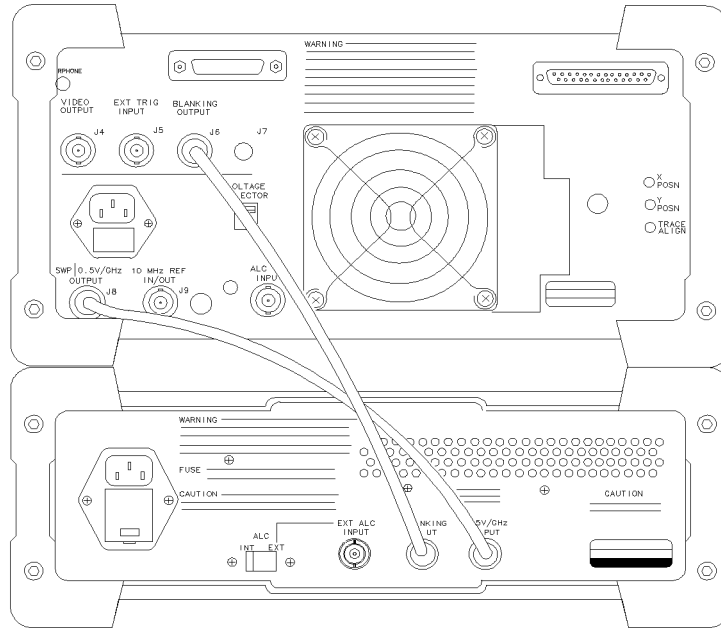
**Table 3-3. HP 85640A and Host Spectrum Analyzer Connections**

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



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



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**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)**.

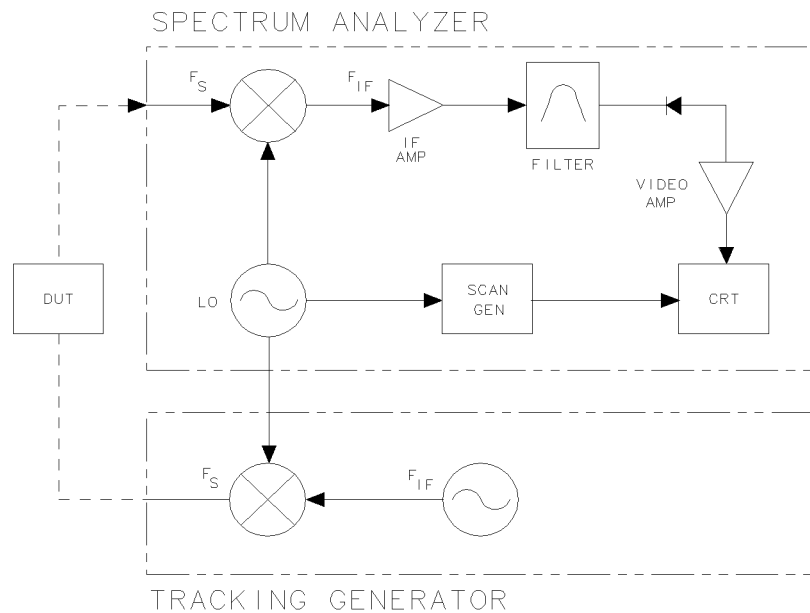
To view the tracking generator's output, connect the tracking generator's RF OUTPUT directly to the host spectrum analyzer's INPUT 50Ω connector. The spectrum analyzer should be tuned between 300 kHz and 2.9 GHz, within the specified range of the tracking generator.

- 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.



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**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.

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**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.
-

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## Transmission Measurements

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

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**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.

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#### Set up the System.

To measure the rejection of a bandpass filter:

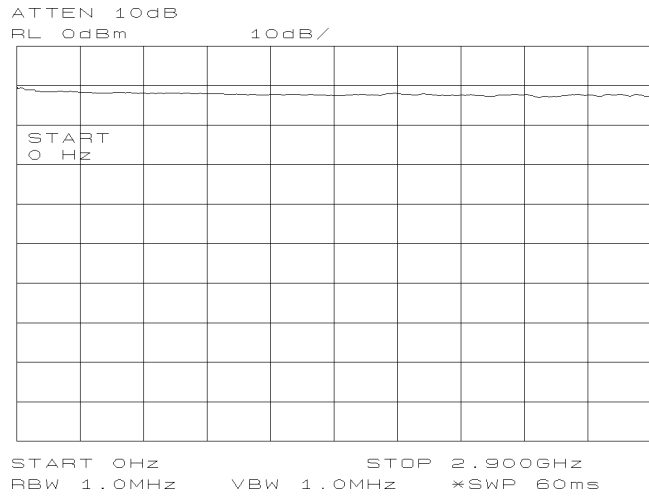
1. Make the necessary connections between the spectrum analyzer and the tracking generator (see Figure 3-3).
2. Examine the tracking generator's output power by connecting its RF OUTPUT directly to the spectrum analyzer's INPUT 50Ω.
3. On the spectrum analyzer, press (PRESET) (FREQUENCY) START FREQ 300 (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.

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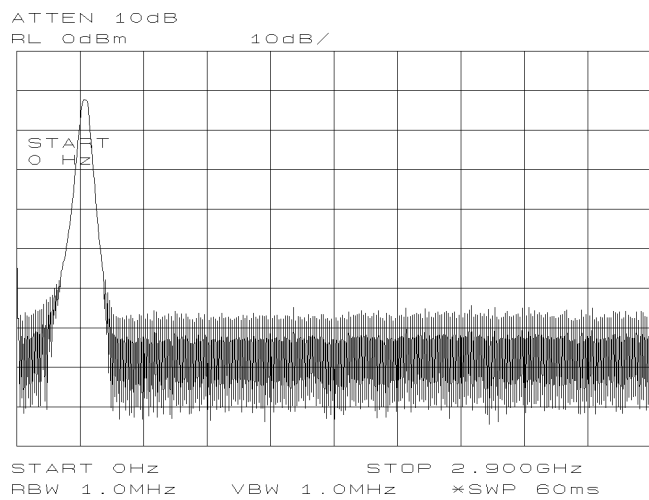
**Note** Although the displayed start frequency annotation was set to 300 kHz, notice that it remains at 0 Hz. This is due to the resolution of the display. If the stop frequency is decreased to 1 GHz, the start frequency reads 300 kHz.

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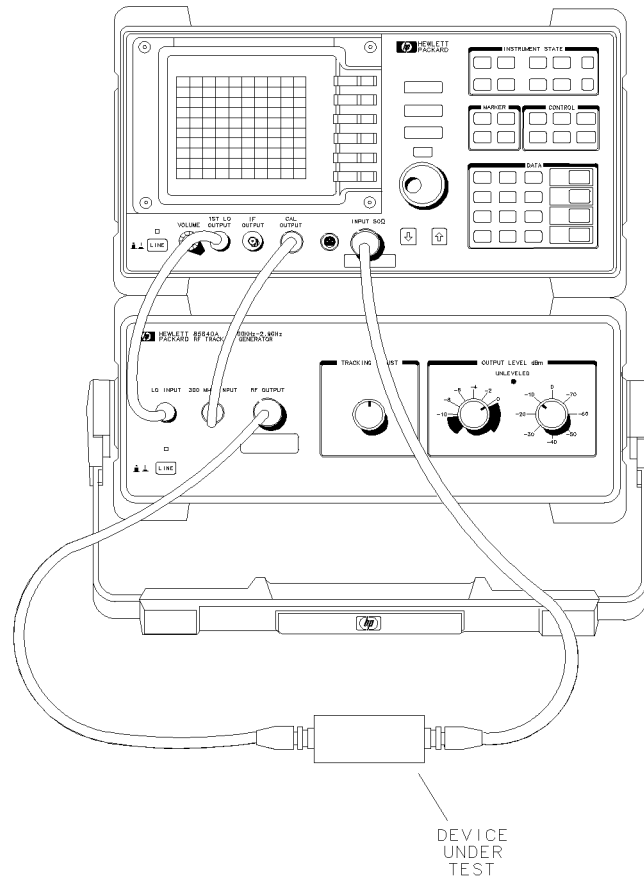


**Figure 3-6. Tracking Generator Power over Specified Frequency Range**

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



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

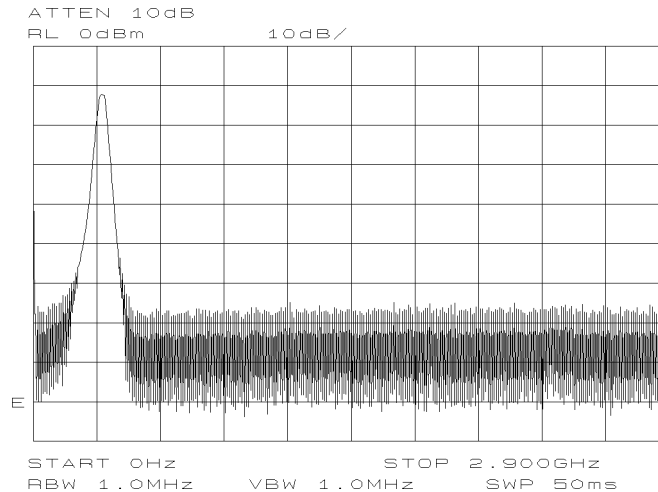


wk250

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

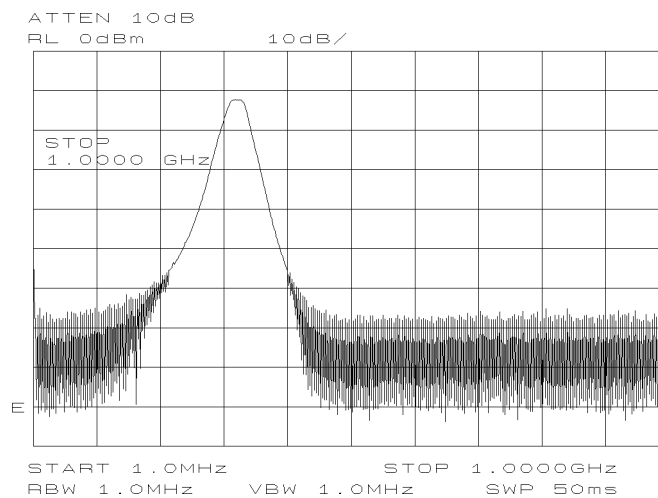
7. Access tracking generator-related keys by pressing **AUX CTRL** **TRACKING GENRATOR**.
8. Set the spectrum analyzer's sweep time to stimulus-response auto-coupled mode by pressing **SWP CPL SR SA** until SR is selected.

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.



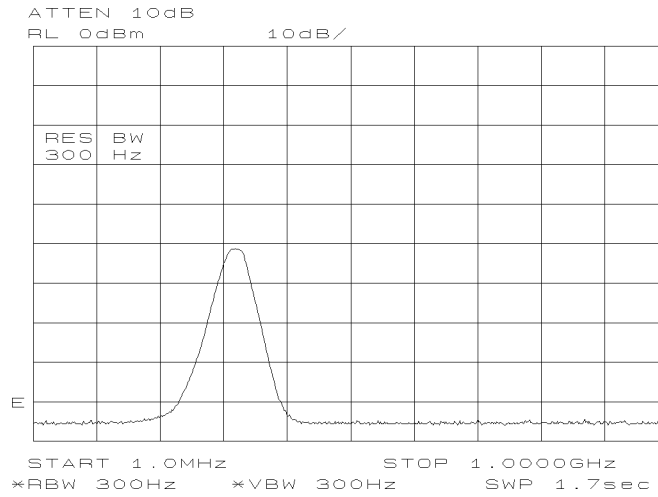
**Figure 3-9. Faster Sweep Times in Stimulus-Response Auto-Coupled Mode**

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.



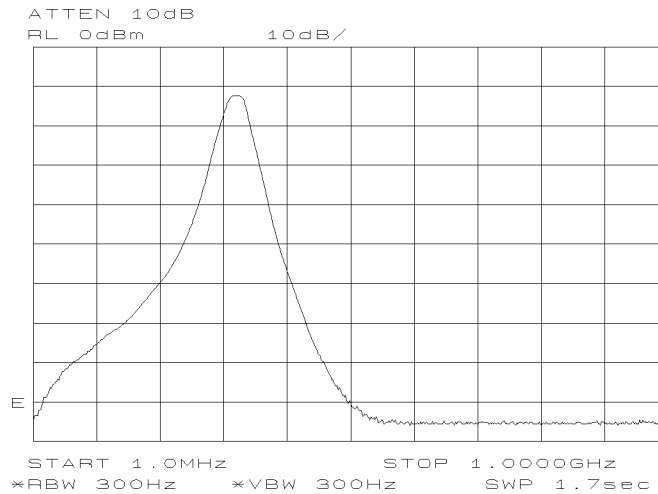
**Figure 3-10. Adjusting the Spectrum Analyzer for Measurement Requirements**

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**

12. 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).



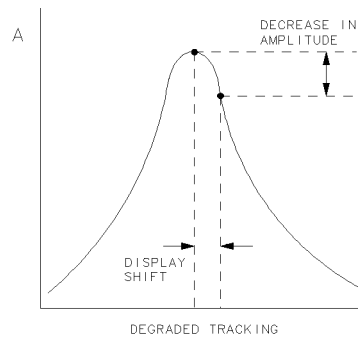
**Figure 3-12. Using Tracking Adjust to Compensate for Tracking Error**

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**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.



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**Figure 3-13. Tracking Error**

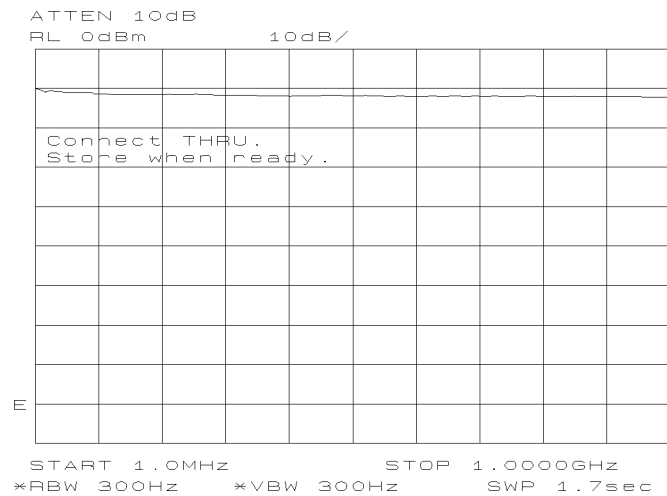
## Calibrate.

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.

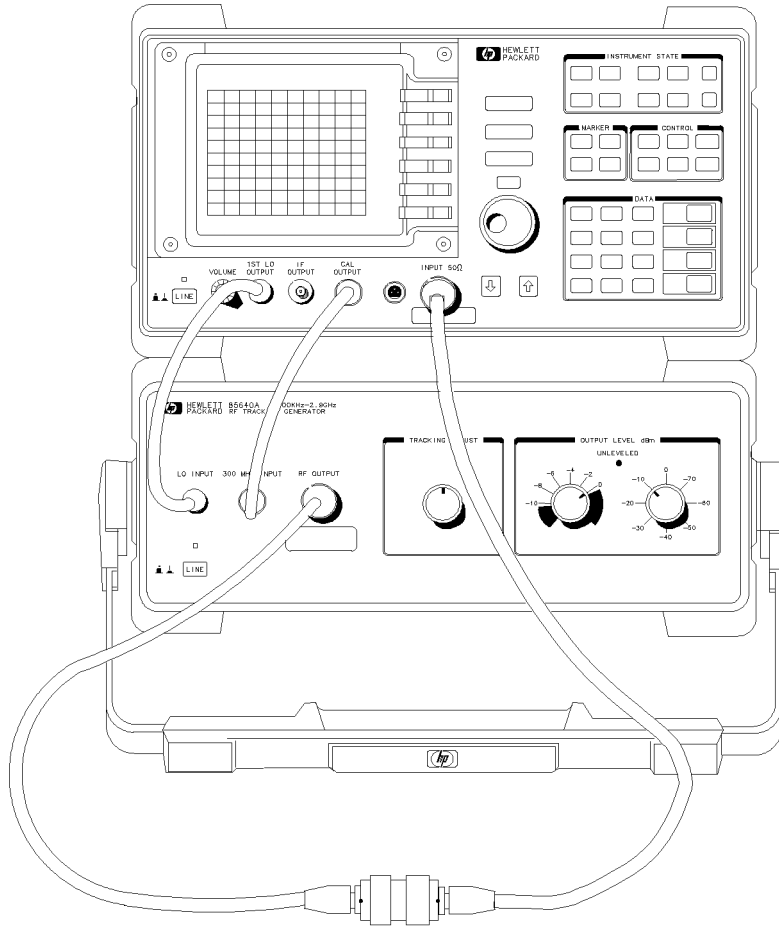
To store the thru trace:

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**





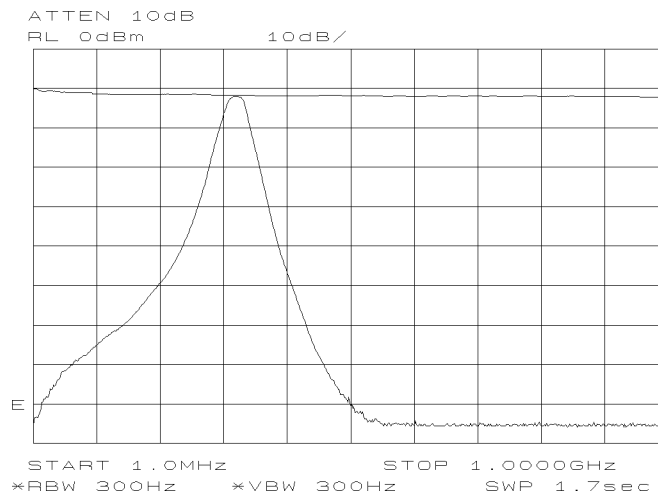
wk251

**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:

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

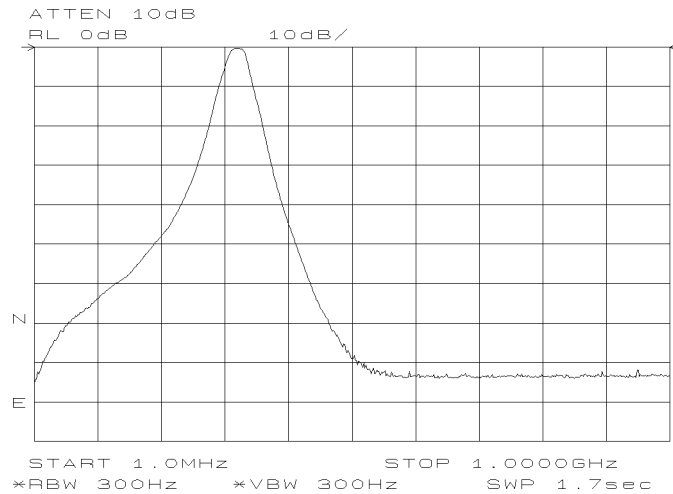
where:

- 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**

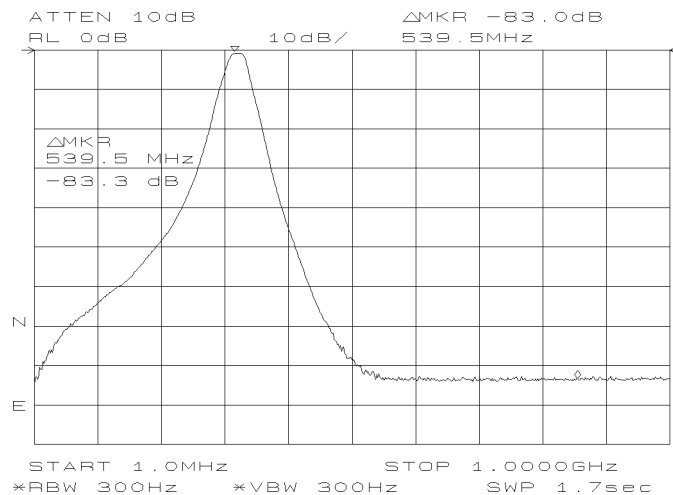
After a reference trace is saved, changing the settings of the spectrum analyzer, then activating normalization, will cause an ERR 902 BAD NORM. Error messages are displayed in the lower right-hand corner of the spectrum analyzer's display. To clear the error (and obtain a valid measurement), either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



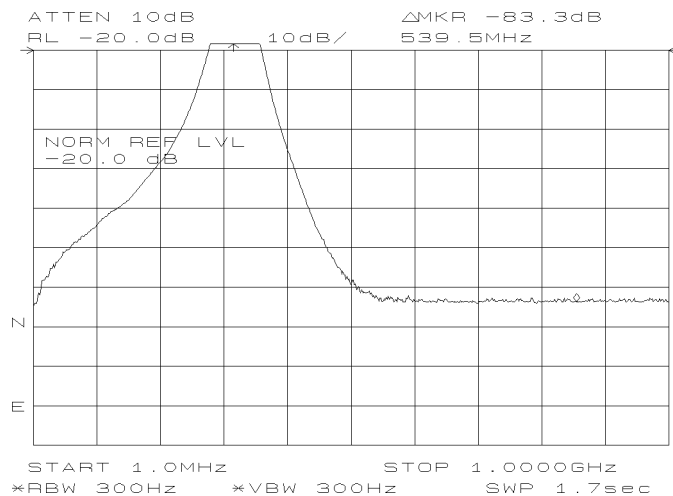
**Figure 3-18. Measuring Rejection Range with Delta Markers**

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

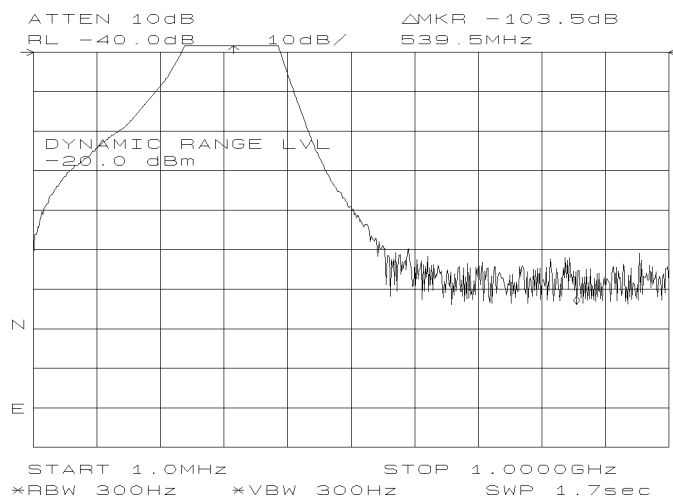
graticule without changing spectrum analyzer settings. See Figure 3-19. As a result, your measurement remains calibrated. However, using these two trace math functions may mean that the top of the screen does not represent the gain-compression limit.

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**

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**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.

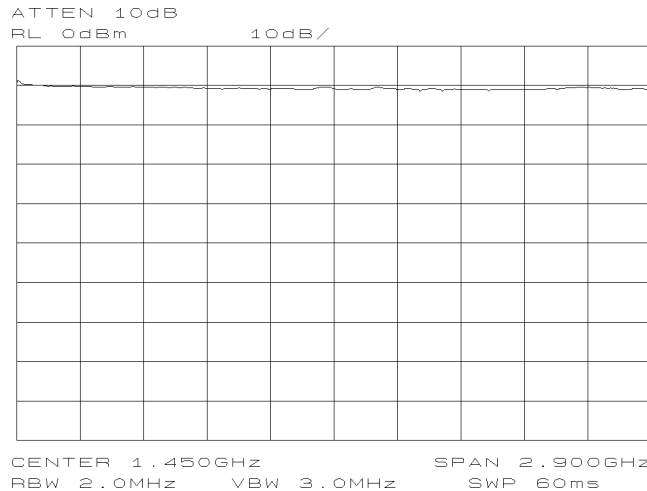
### Set up the System.

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.)

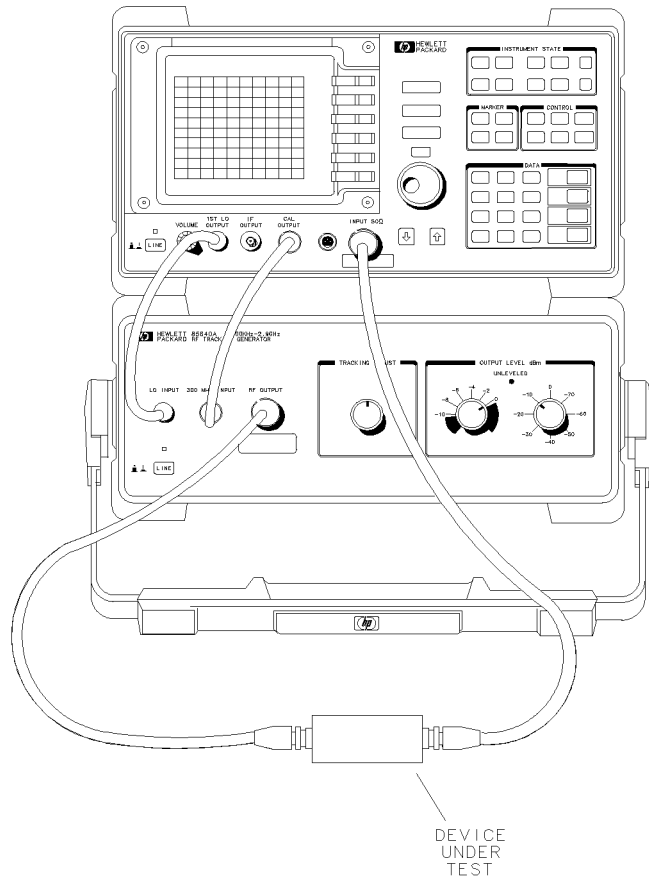
Figure 3-21 shows the spectrum analyzer display with these settings.

**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.



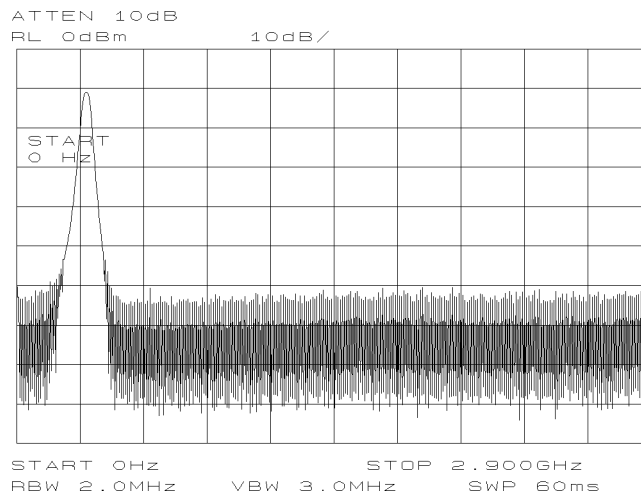
**Figure 3-21. Tracking Generator Power over Specified Frequency Range**

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



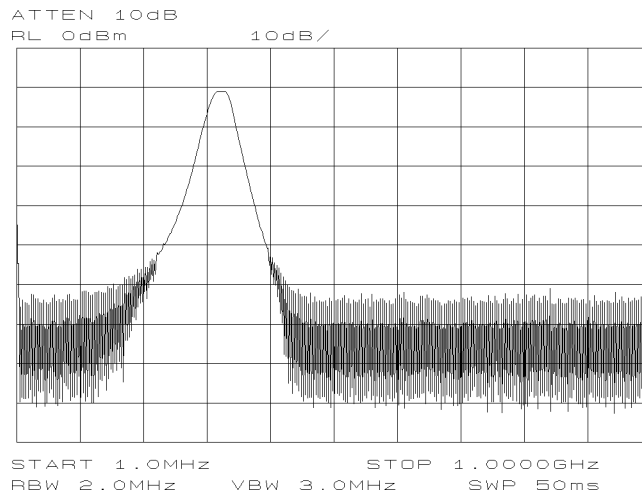
wk252

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



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

6. 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 3-24.



**Figure 3-24. Adjusting the Spectrum Analyzer for Measurement Requirements**

**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 of the DUT:

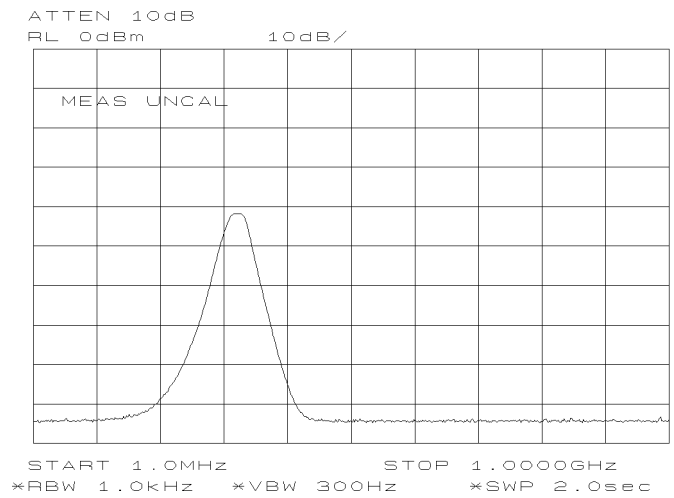
1. Note the autocoupled sweeptime.
2. Calculate each of the following:
  - a. span (Hz) / 156 GHz
  - b. 500 / resolution bandwidth (Hz)
  - c. 200 / video bandwidth (Hz)
3. Determine the greatest of the values in steps 2a, 2b, and 2c.
4. Set sweeptime to the smaller of the values in steps 1 and 3. The 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 MEAS UNCAL indicator will be displayed; this message may be ignored, as it has no effect on the outcome of the measurement.

7. Decrease resolution bandwidth to reduce the displayed average noise level. Press **[BW]** **RES BW** **[↓]** on the spectrum analyzer. Note the decrease in amplitude due to the tracking error.

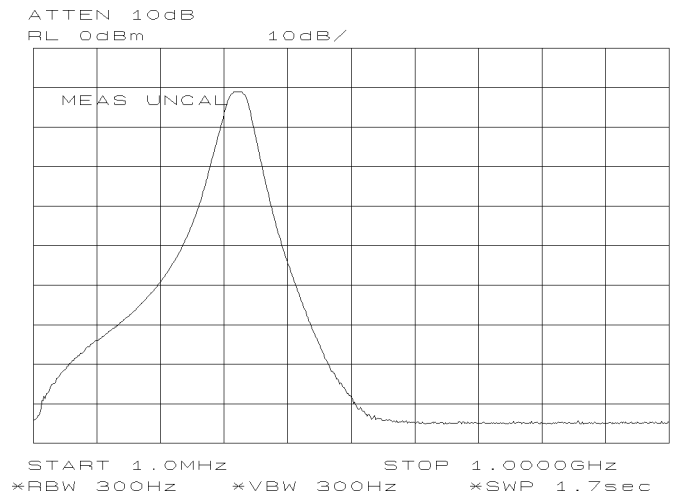


8. Narrow the video bandwidth to smooth the noise; press **[BW]** **VIDEO BW** **[↓]** on the spectrum analyzer. In Figure 3-25, video bandwidth is set at 300 Hz.
9. Recalculate the sweptime, as described in the note above.



**Figure 3-25. Decrease Resolution Bandwidth to Improve Sensitivity**

10. Use TRACKING ADJUST on the HP 85640A to compensate for any tracking errors (see Figure 3-26).



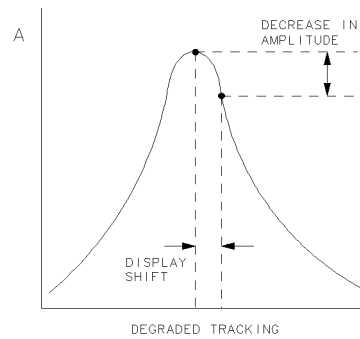
**Figure 3-26. Using TRACKING ADJUST to Compensate for Tracking Error**

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**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.



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**Figure 3-27. Tracking Error**

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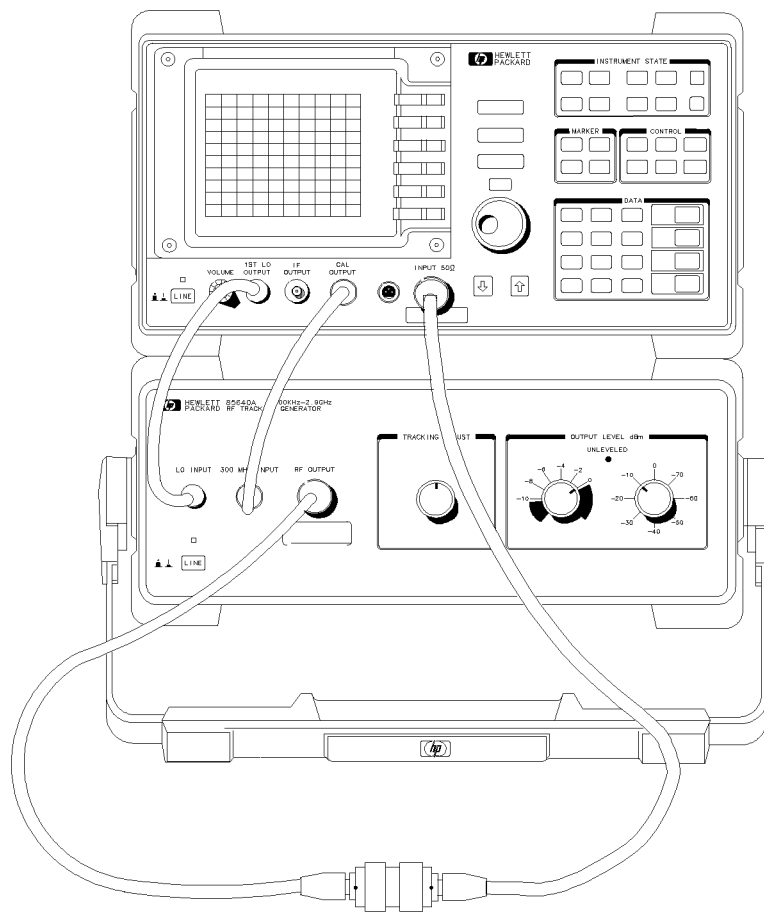
## Calibrate.

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.



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**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.)

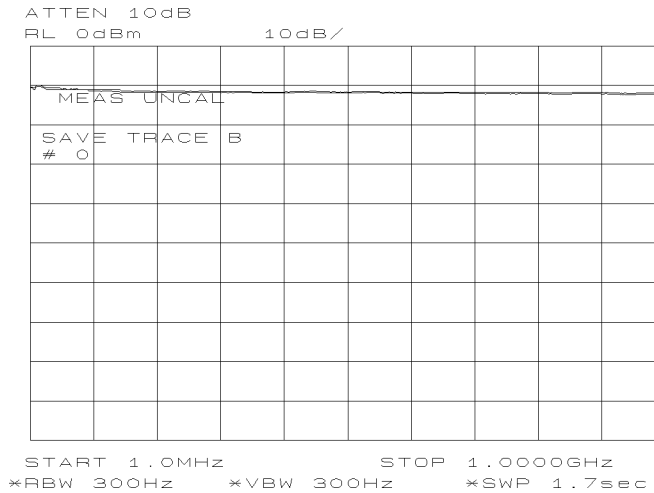
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**Note** If SAVE LOCK is on, pressing **TRACE n** on an HP 8561A/62A causes the message SAVELOCK ON to appear in the active function area.

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.**

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

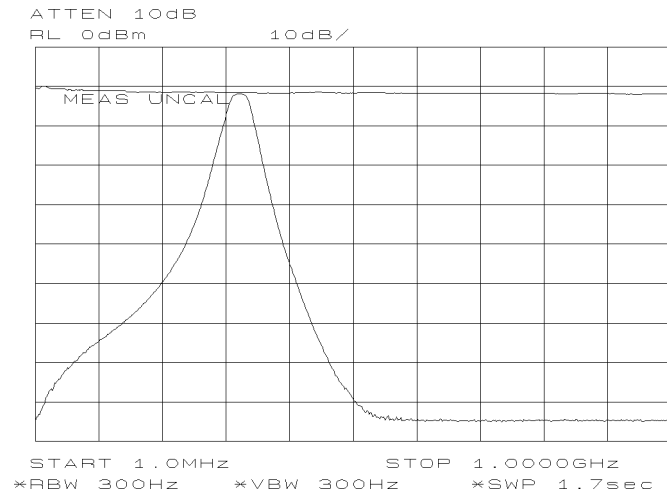
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**Note** When trace math is on, an **M** will appear in the special functions section of the display.

---

15. 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.

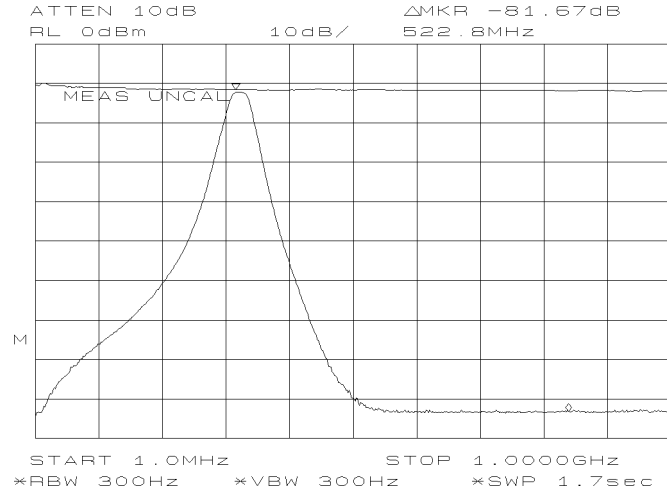
16. Reconnect the DUT. Figure 3-30 shows the normalized trace.



**Figure 3-30. Normalized Trace**

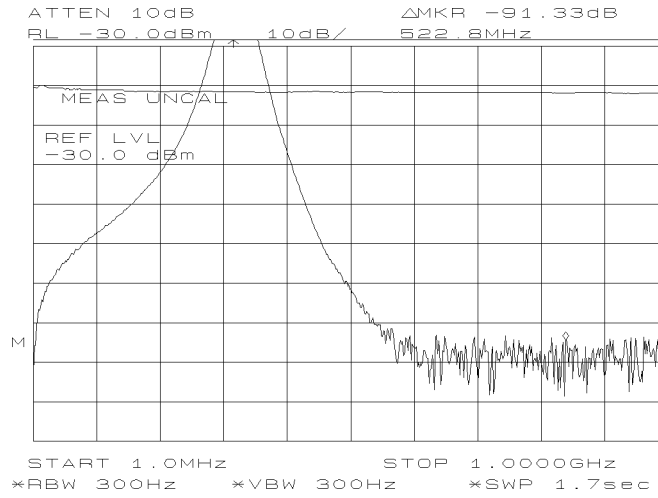
**Measure.**

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**

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## Reflection Measurements

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

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**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.

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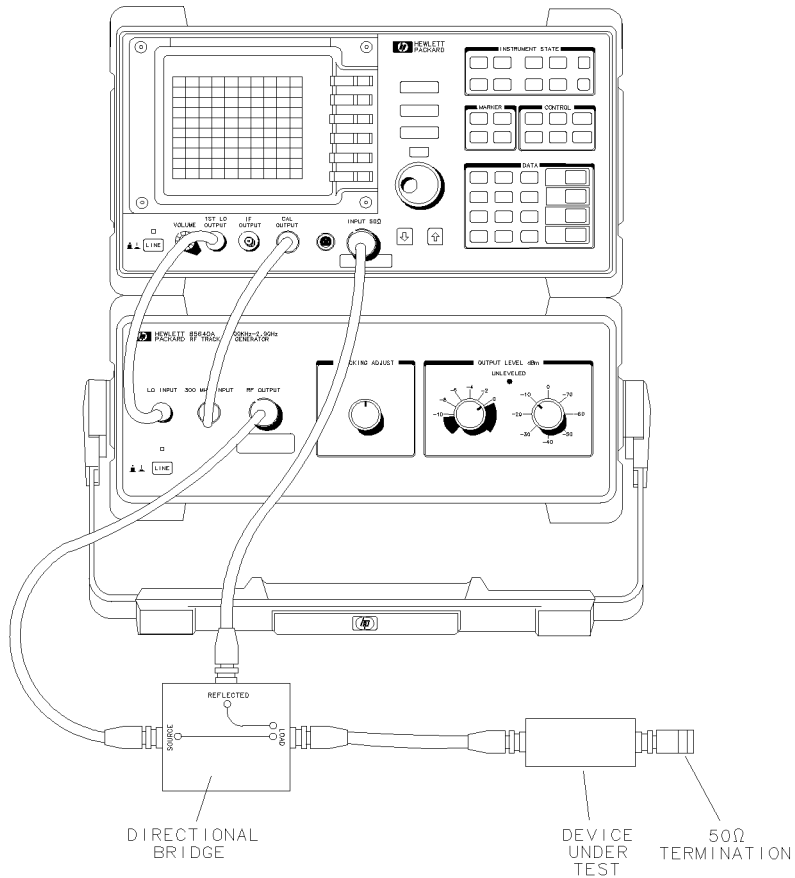
#### Set up the System.

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]**.

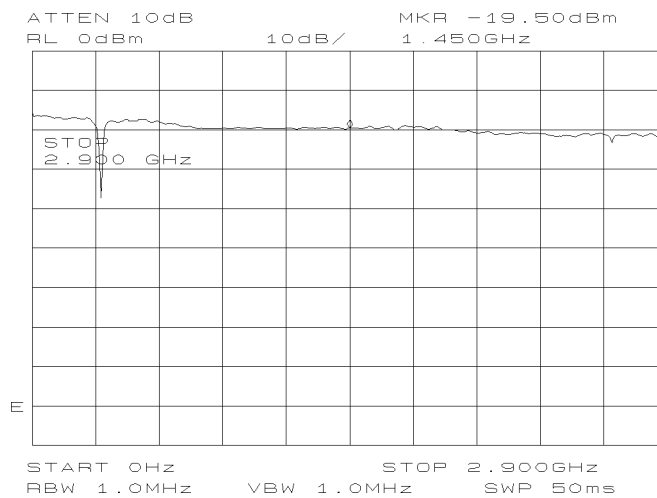
#### Calibrate.

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**

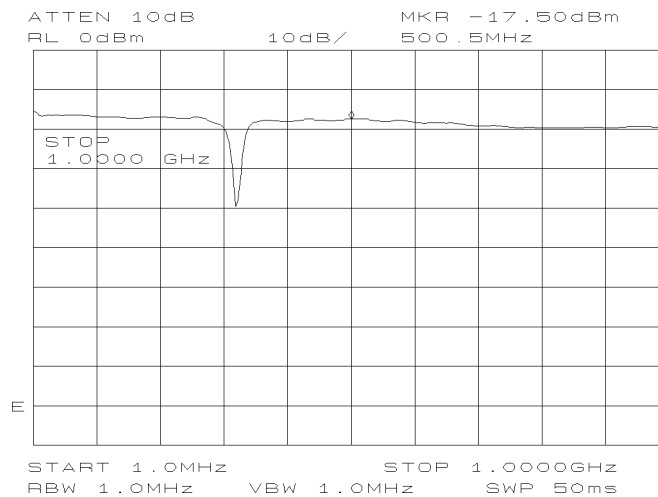


6. Adjust the tracking generator's output power with the OUTPUT LEVEL controls: increase the output power 6 dB by setting the attenuator (right-hand) knob to 0 dBm and the vernier (left-hand) knob to -4 dBm. This output-power level differs from the level used for the transmission measurement example 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 GENRATOR 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.

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**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.

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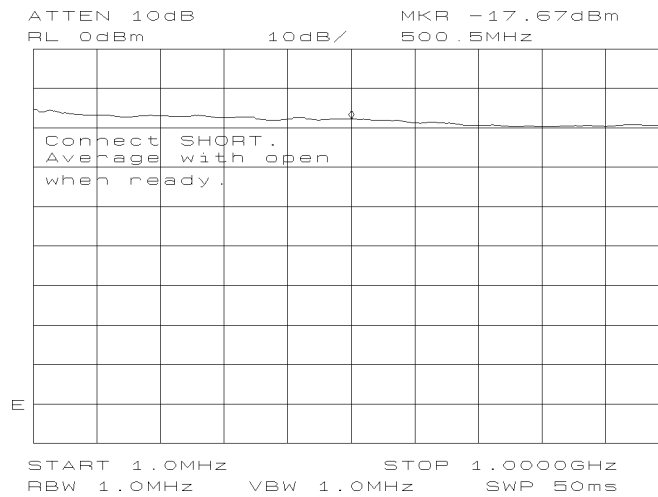
**Figure 3-35. Spectrum Analyzer Display of Bandpass Filter Region**

To store an open/short-average reference trace:

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

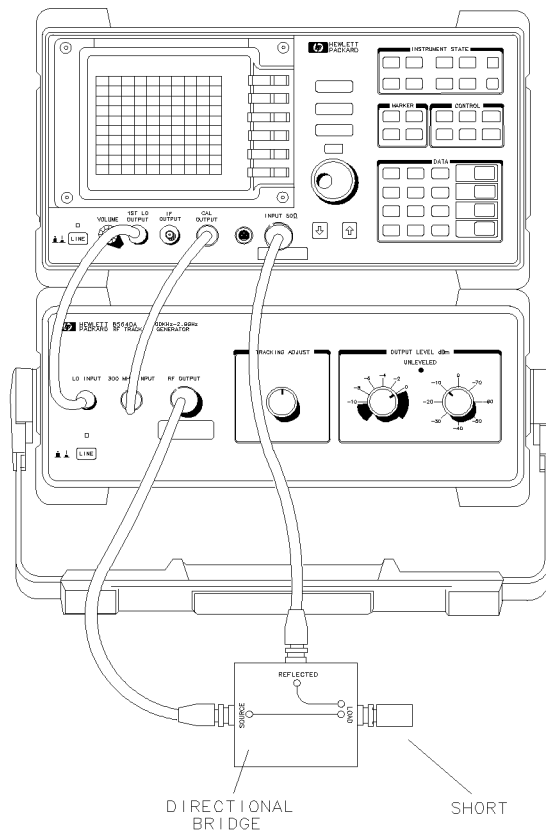


12. After connecting the open as shown in Figure 3-27, press **STORE OPEN**.
13. The analyzer will prompt you to connect the short (Figure 3-38).



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

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



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

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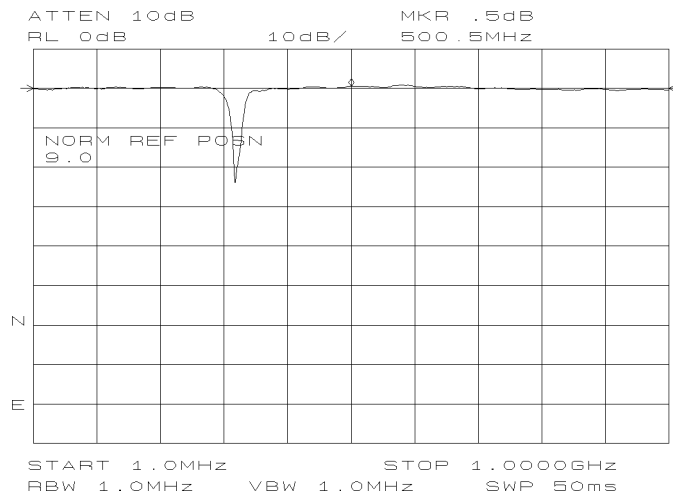
15. Press **AVERAGE SHORT**. The analyzer takes the average of the open and short traces, then stores the averaged trace in the analyzer's internal memory and in trace B. The corresponding state information is stored in state register #8.

**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.**

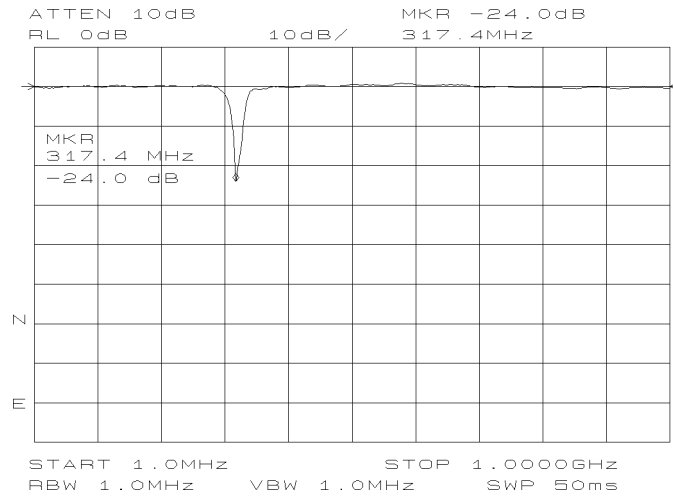
16. Reconnect the DUT, and normalize by pressing **NORMLIZE ON OFF** until **ON** is selected. The normalized trace is shown in Figure 3-40. In this case, **NORM REF POSN** was adjusted for better viewing of the signal.



**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

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**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.

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### 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:

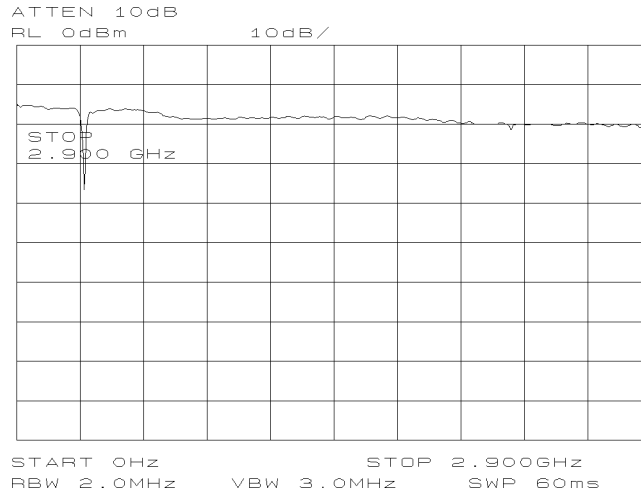
1. Note the autocoupled sweeptime.
2. Calculate each of the following:
  - a.  $\text{span (Hz)} / 156 \text{ GHz}$
  - b.  $500 / \text{resolution bandwidth (Hz)}$
  - c.  $200 / \text{video bandwidth (Hz)}$
3. Determine the greatest of the values in steps 2a, 2b, and 2c.
4. Set sweeptime to the smaller 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 MEAS UNCAL indicator will be displayed; this message may be ignored, as it has no effect on the outcome of the measurement.

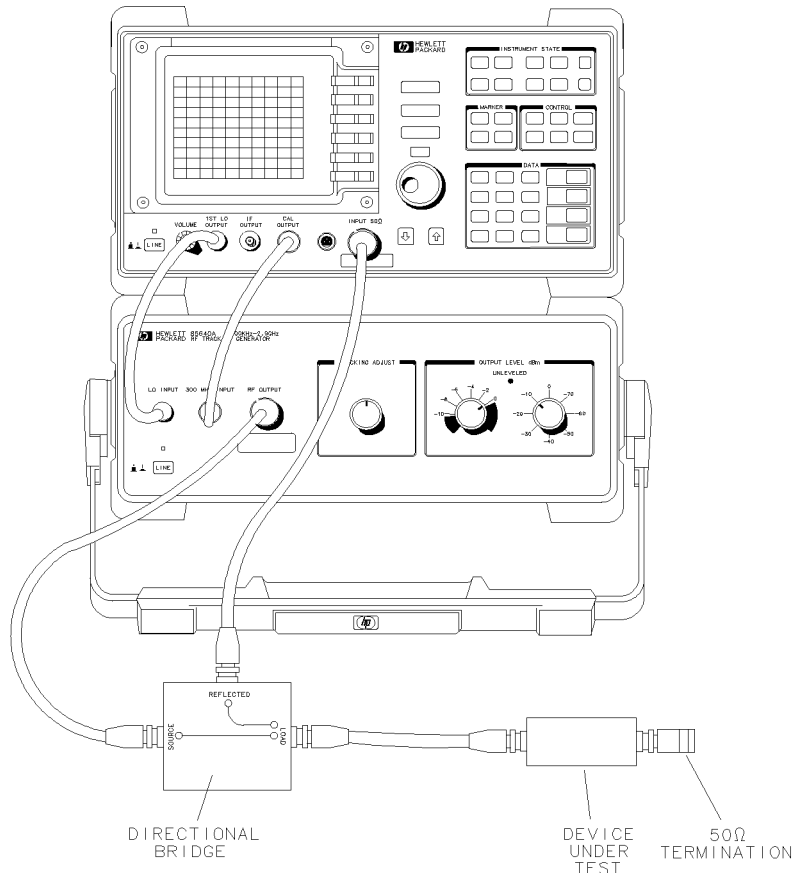
---

**Calibrate.**

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



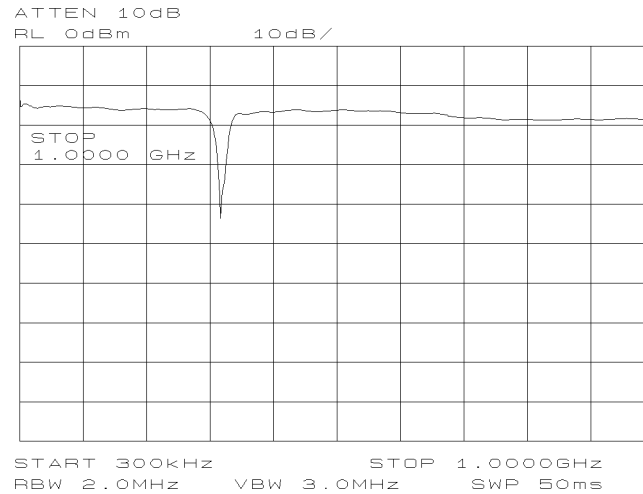
**Figure 3-42. Display with the System Configured for a Reflection Measurement**



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**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.

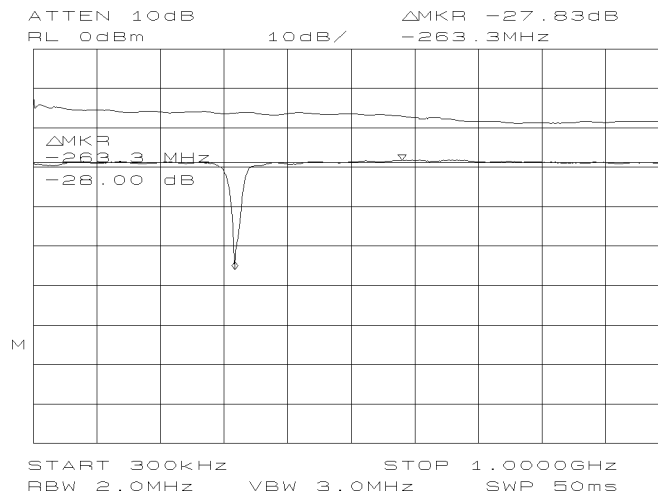
If this happens, press (SAVE) SAVELOCK OFF SAVE TRACE B TRACE n.

**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

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### 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	50 $\Omega$ 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	50 $\Omega$ termination Host spectrum analyzer*
8	Frequency tracking range	Frequency counter Power splitter Host spectrum analyzer*

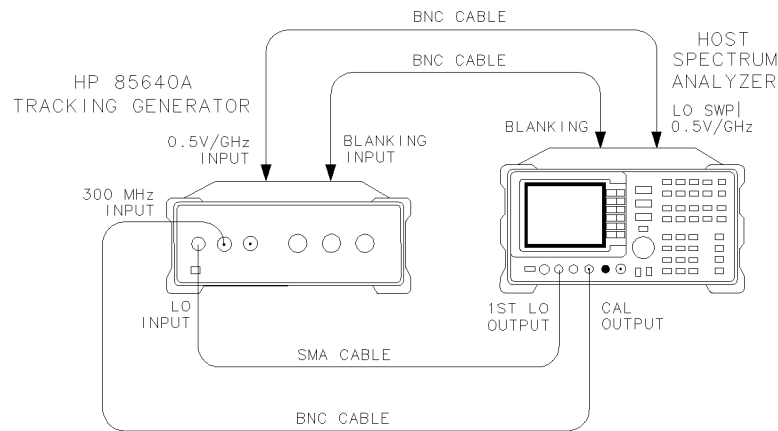
\* A host spectrum analyzer can be any one of these models:  
HP 8560A or HP 8560E spectrum analyzer (non-Option 002)  
HP 8561A, HP 8561B or HP 8561E spectrum analyzer  
HP 8562A or HP 8562B spectrum analyzer  
HP 8563A or HP 8563E spectrum analyzer

---

## 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.



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**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**

<b>Instrument</b>	<b>Critical Specifications for Equipment Substitution</b>	<b>Recommended Model</b>	<b>Use</b>
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)**

<b>Instrument</b>	<b>Critical Specifications for Equipment Substitution</b>	<b>Recommended Model</b>	<b>Use</b>
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 <i>(two required)</i>	Connectors: Type N (m) Length: ≥61 cm (24 in)	HP 11500B/C	P,A
Cable, 50Ω Coaxial <i>(two required)</i>	Connectors: BNC (m) Length: ≥ 23 cm (9 in)	HP 10502A	P,A
Cable, 50Ω Coaxial <i>(two required)</i>	Connectors: BNC (m) Length: ≥ 122 cm (48 in)	HP 10503A	P,A,
Cable <i>(three required)</i>	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

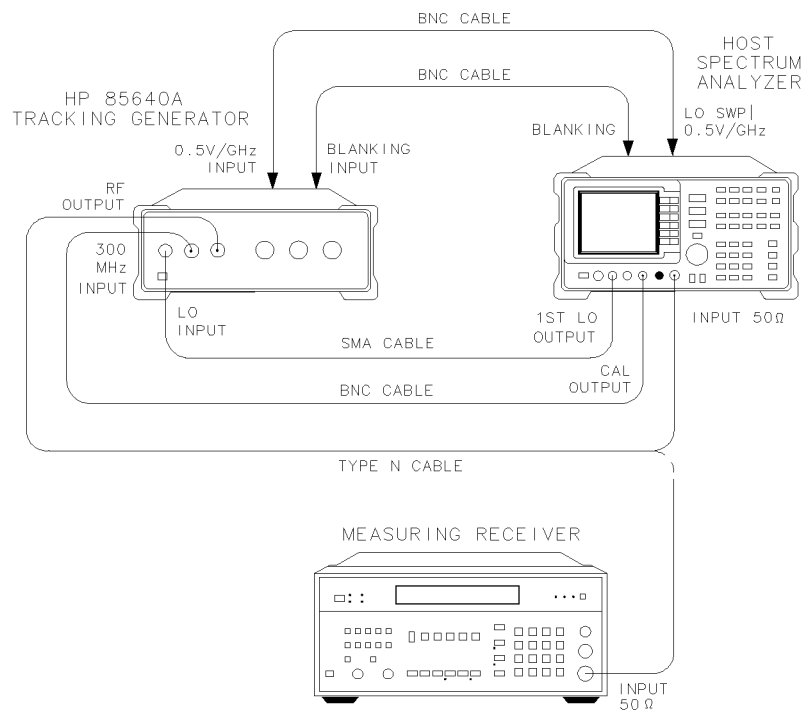
$<\pm 0.8$  dB/10 dB step  $<\pm 1.5$  dB maximum for attenuator settings 10 to 70 dB, referenced to 0 dB setting

## 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 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 .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 50Ω 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 ±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)	Step-to-Step (dB)	(dB)
0	0 (Ref)	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

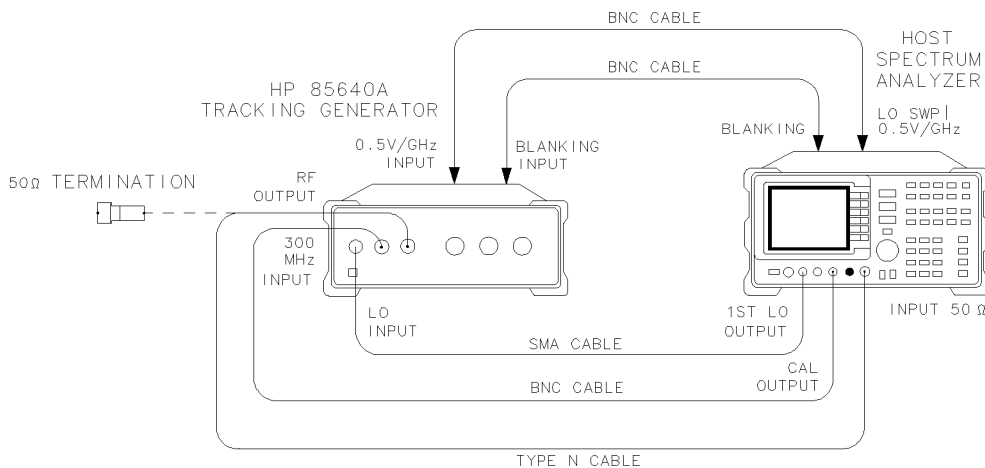
### Related Adjustment

Tracking generator power level adjustments

### Description

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

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  
 50Ω 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

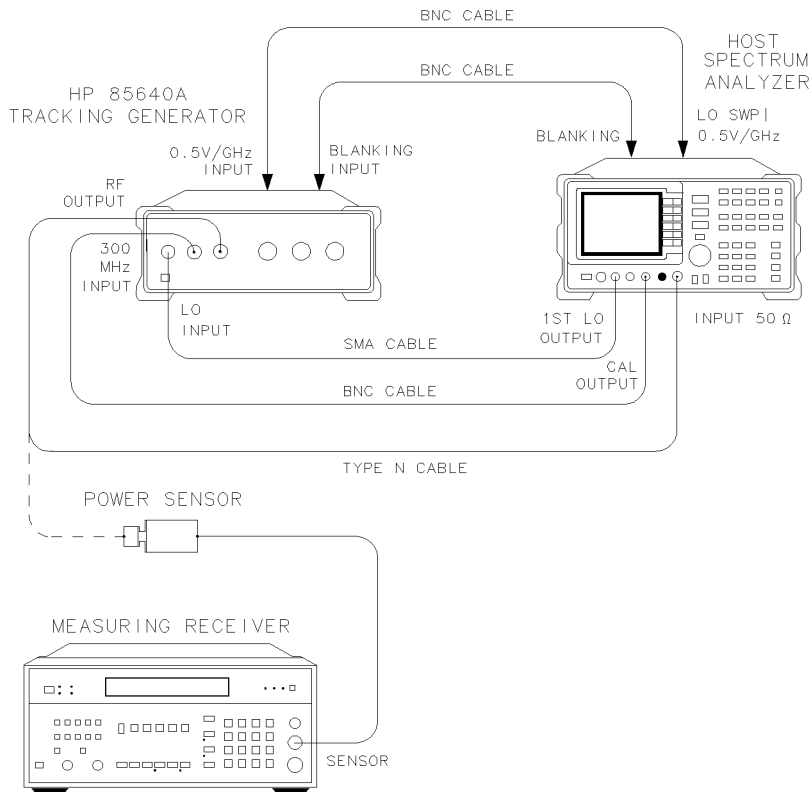
#### Related Adjustment

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  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

### 3. Level Flatness

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

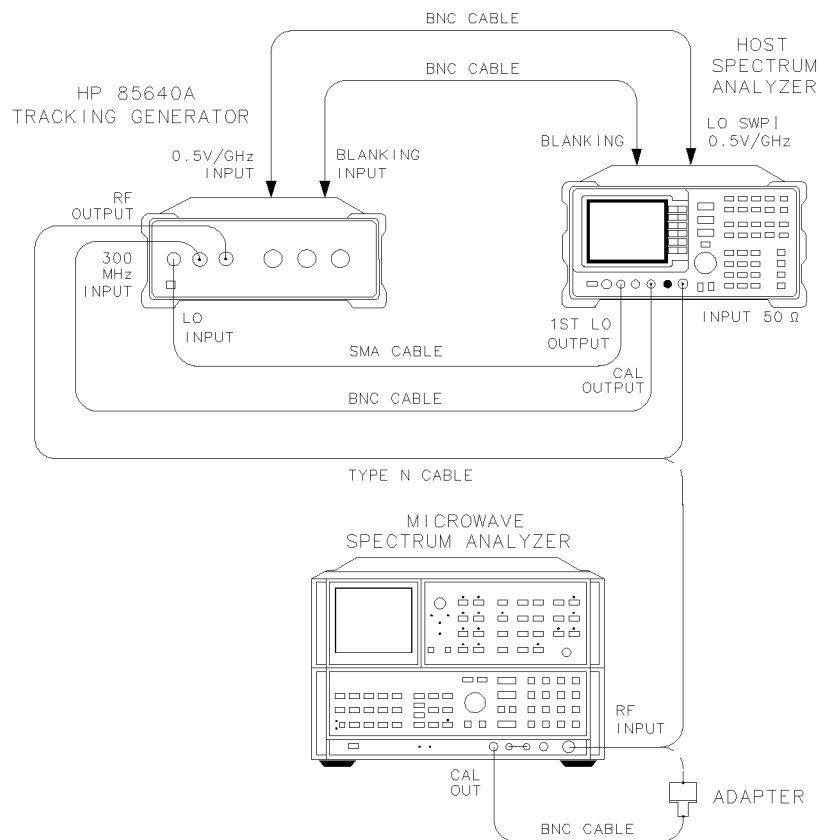
Harmonic spurious outputs:  $< -25$  dBc

### 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 50Ω. 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

### Specification

Non-harmonic spurious outputs: 300 kHz to 2.0 GHz:  $<-27$  dBc

2.0 GHz to 2.9 GHz:  $<-23$  dBc

### Related Adjustment

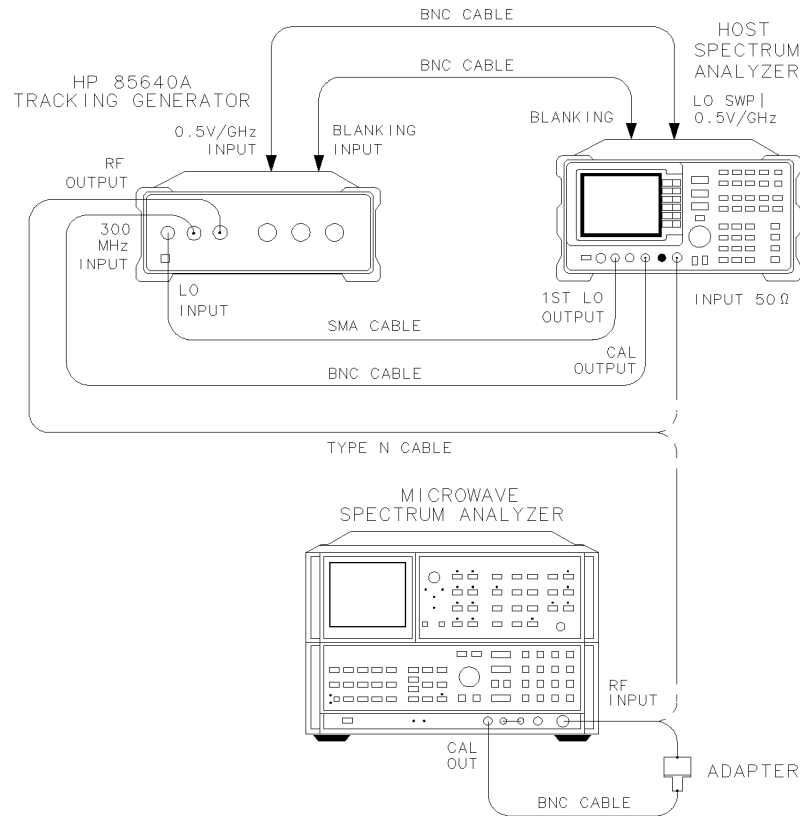
There is no related adjustment for this performance test.

### 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 tracking generator is set to various output frequencies.

At each output frequency, several sweeps are taken with an HP 8566A/B at different span settings. The highest displayed spurious output is measured in each span. Responses at the fundamental frequency of the tracking generator output, or their harmonics, are ignored. The amplitude of the highest spurious response is recorded.

## 5. Non-Harmonic Spurious Outputs



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**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 (in dB)
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	
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	1 MHz	_____	_____	_____	+1.55/−1.80
2000	2900	1 MHz	_____	_____	_____	+3.48/−4.01

## 6. LO Feedthrough Amplitude

### Specification

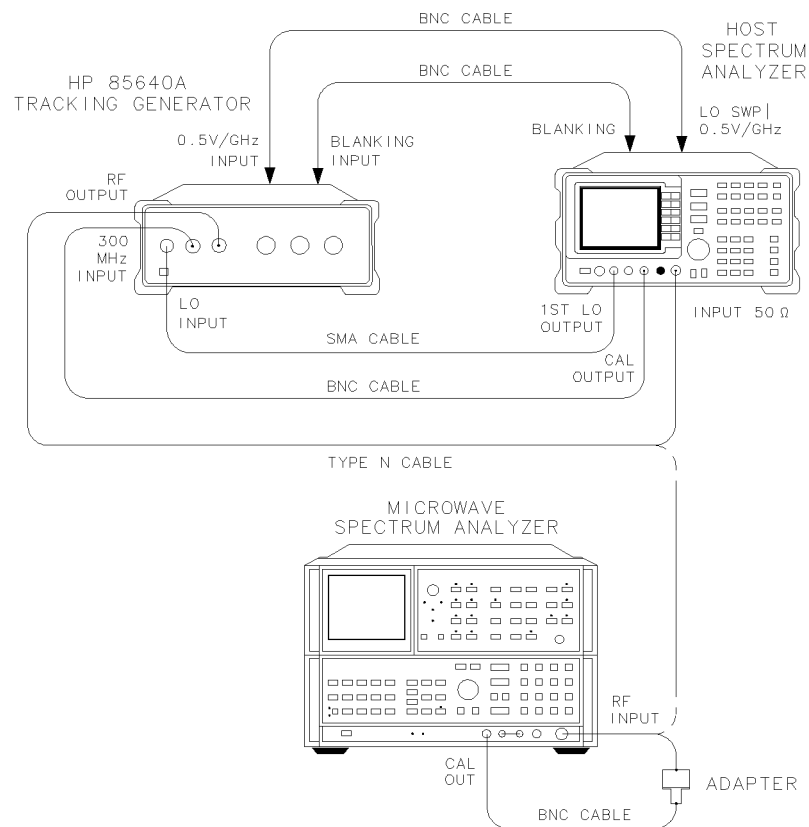
LO feedthrough:  $< -26$  dBm with output level vernier knob set to 0 dBm and attenuator knob set to  $-10$  dB.

### 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 50Ω. 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.



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**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 AMP TD 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

- Set the HP 8566A/B controls as follows:

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

- 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).
- On the HP 8566A/B, press **PEAK SEARCH** **PRESEL PEAK**. Wait for the PEAKING! message to disappear.
- Record the HP 8566A/B marker amplitude below:

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

- Set the host spectrum analyzer CENTER FREQ to 2.9 GHz.
- Set the HP 8566A/B CENTER FREQUENCY to 6.8107 GHz.
- 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).
- On the HP 8566A/B, press **PEAK SEARCH** **PRESEL PEAK**. Wait for the PEAKING! message to disappear.
- 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

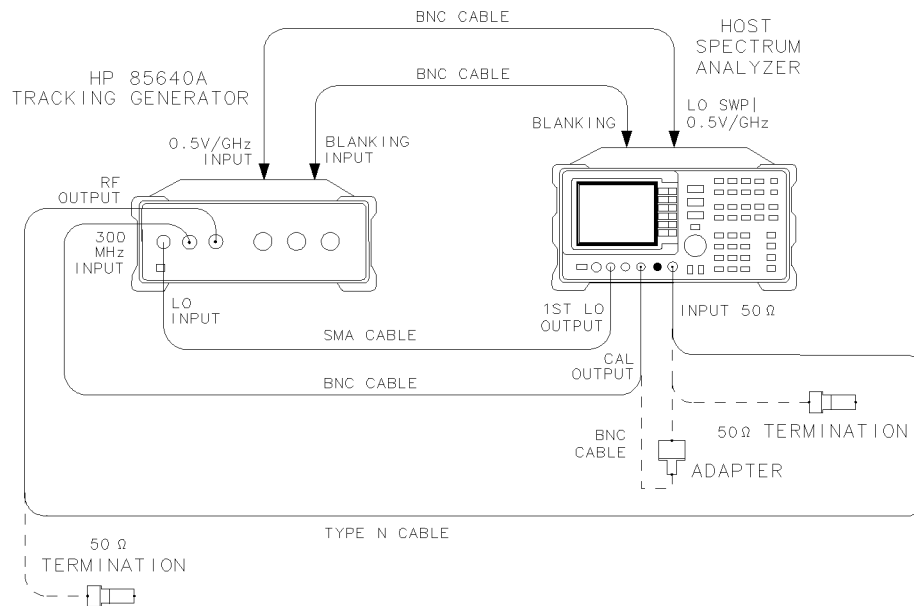
Tracking generator feedthrough:    300 kHz to 1 MHz  $<-95$  dBm  
    1 MHz to 2.0 GHz  $<-115$  dBm  
    2.0 GHz to 2.9 GHz  $<-110$  dBm

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



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**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  
 50Ω 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 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, 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 50Ω. 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 ±0.17 dB.
8. Connect one HP 908A 50Ω termination to the host spectrum analyzer's INPUT 50Ω 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

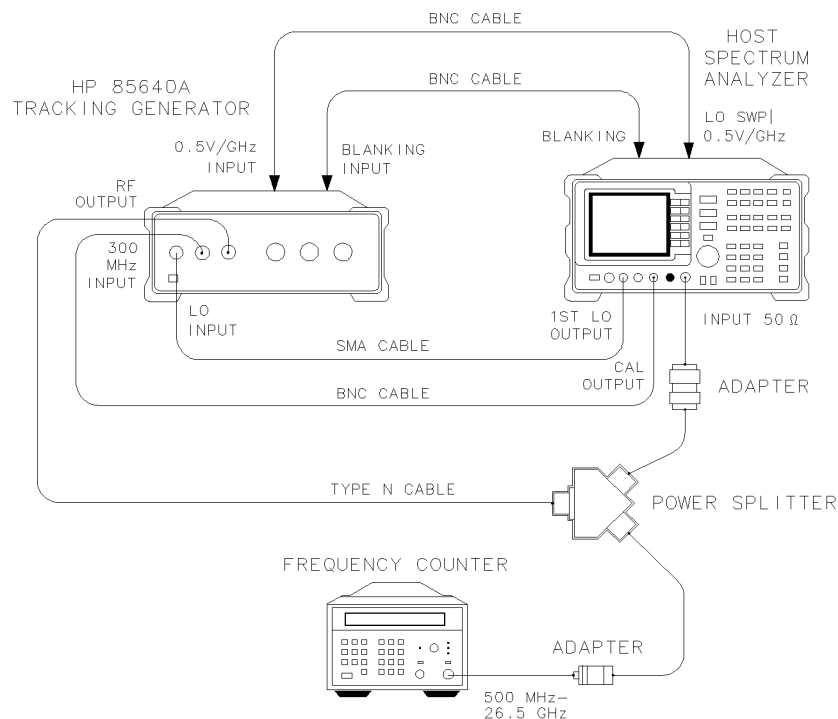
Tracking oscillator range adjustment

### 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."



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Figure 4-9. Frequency Tracking Range Test Setup

## 8. Frequency Tracking Range

### 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 50 $\Omega$ .
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

8. Frequency Tracking Range

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
5.	13. 3rd harmonic level				
	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
6.	27. Non-harmonic response amplitude, > 2000 MHz		_____	-23 dBc	+3.45/-4.01 dB
	6. LO feedthrough amplitude				
7.	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
8.	15. TG feedthrough, 2 GHz to 2.9 GHz		_____	-110 dBm	+1.74/-1.98 dB
	8. Frequency tracking range				
8.	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

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**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.

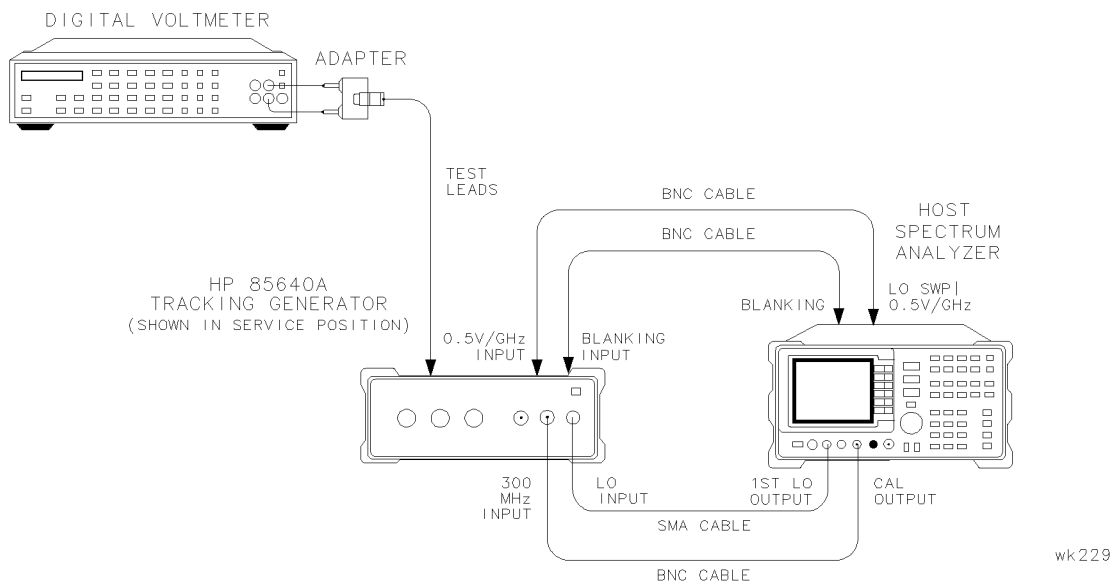
## Description

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.

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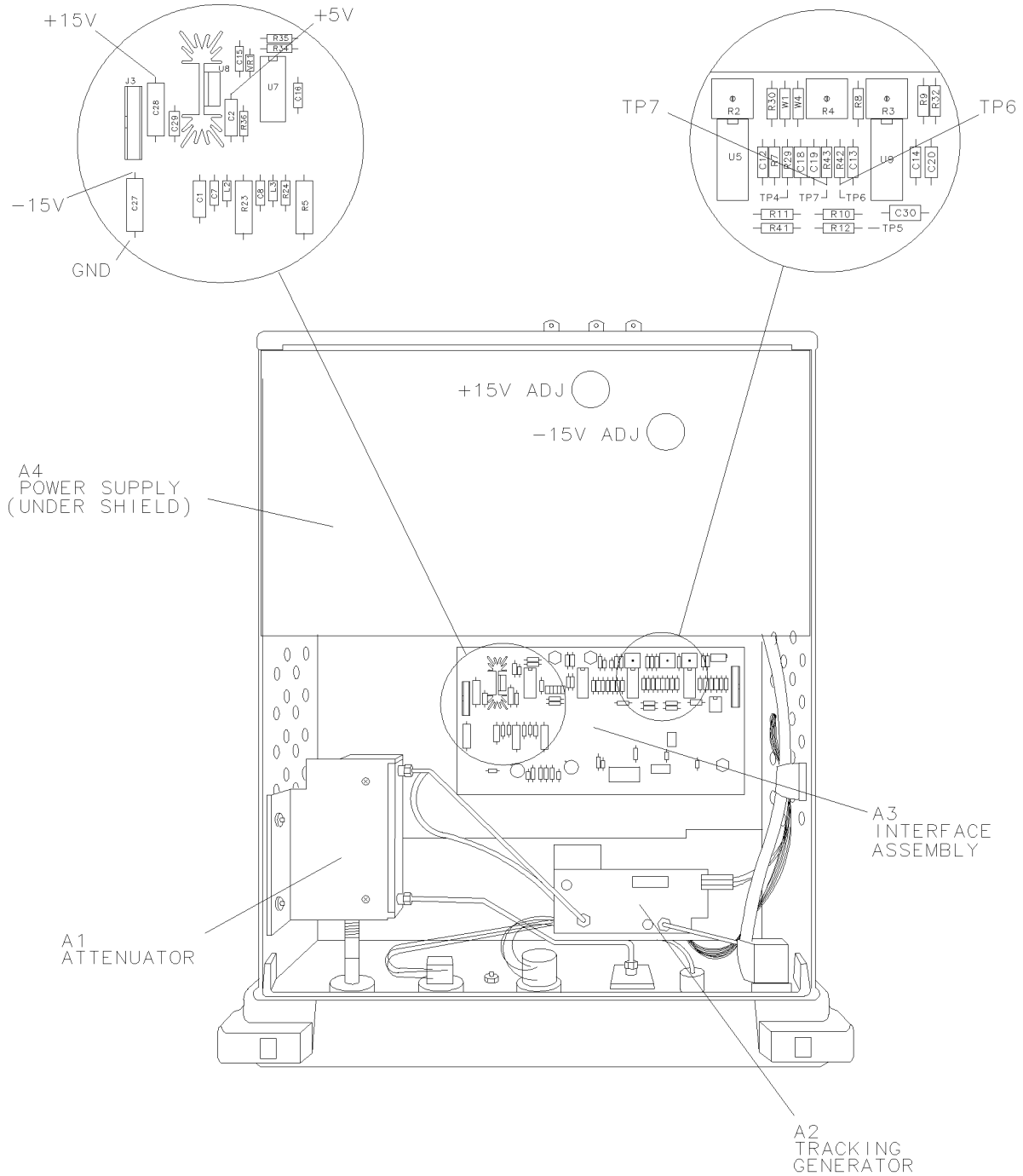
**Caution** The tracking generator assemblies are static sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.

---



**Figure 5-1. Power Supply Adjustments and Checks Setup**

# 1. Power Supply Adjustments and Checks



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**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

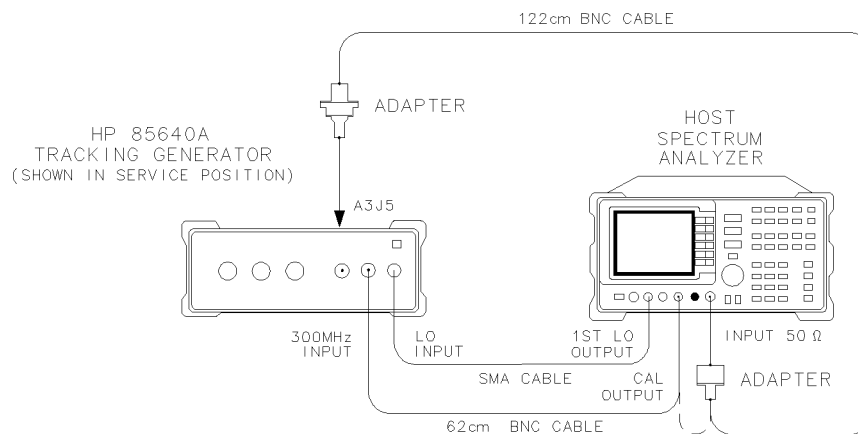
### Related Performance Test

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.

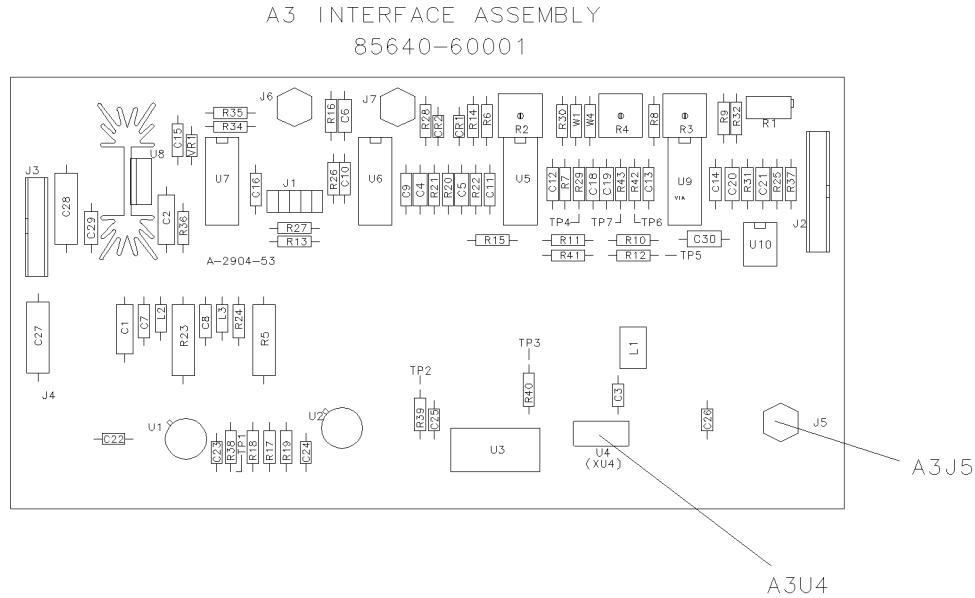
**Caution** The tracking generator assemblies are static-sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.



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**Figure 5-3. 600 MHz Level Adjustment Setup**

## 2. 600 MHz Level Adjustment



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**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

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

desired attenuation = current attenuation value + attenuation difference

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

- Select a new value for pad A3U4 using Table 5-5, based on the desired attenuation calculated above.
- Replace the A3 interface assembly top shield. Set the LINE switch to ON.
- 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.
- 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.

## 2. 600 MHz Level Adjustment

**Table 5-6. Harmonic and Subharmonic Levels**

<b>Frequency (MHz)</b>	<b>Marker Amplitude (dBc)</b>	<b>Specification (dBc)</b>
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.

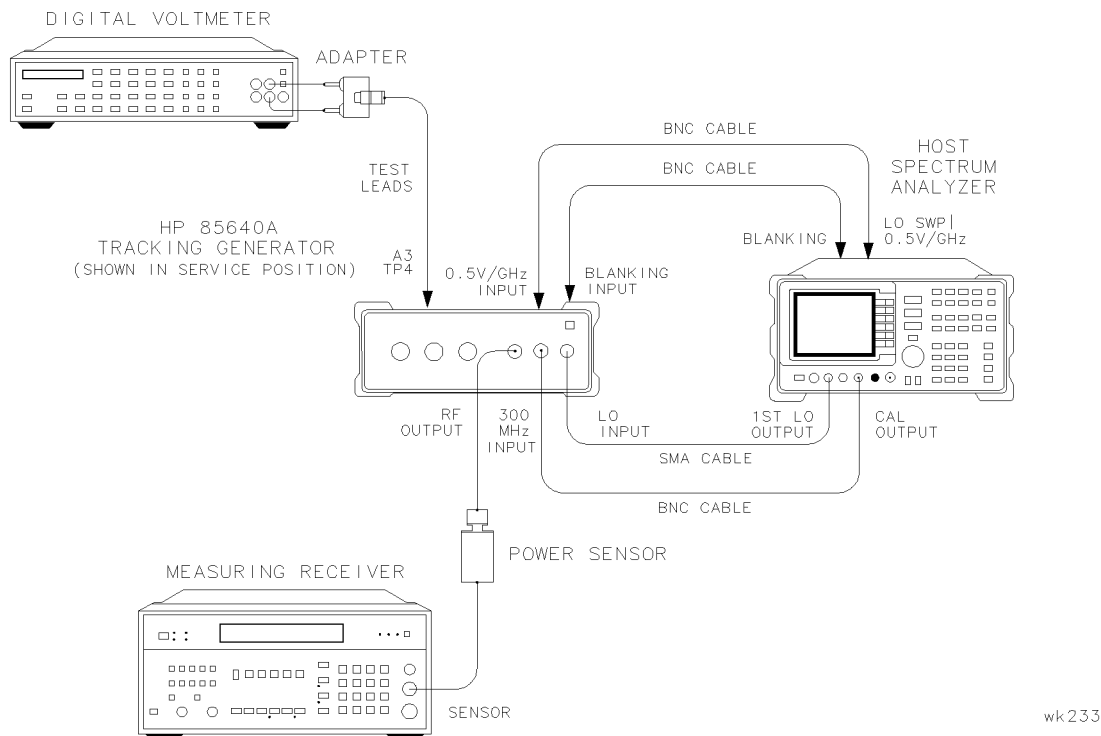
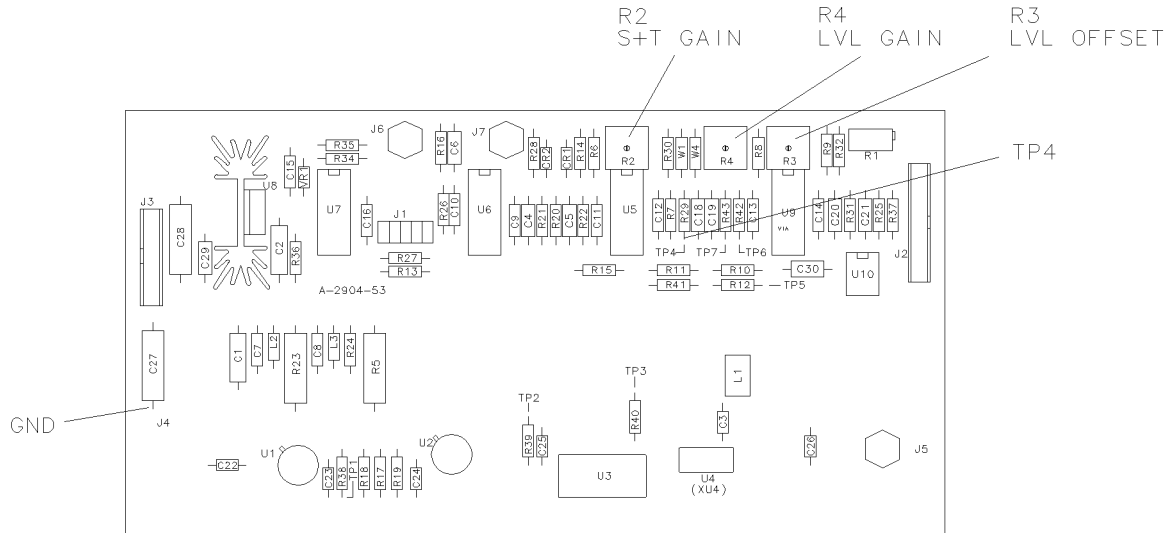


Figure 5-5. Power Level Adjustment Setup

### 3. Power Level Adjustments



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**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 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 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

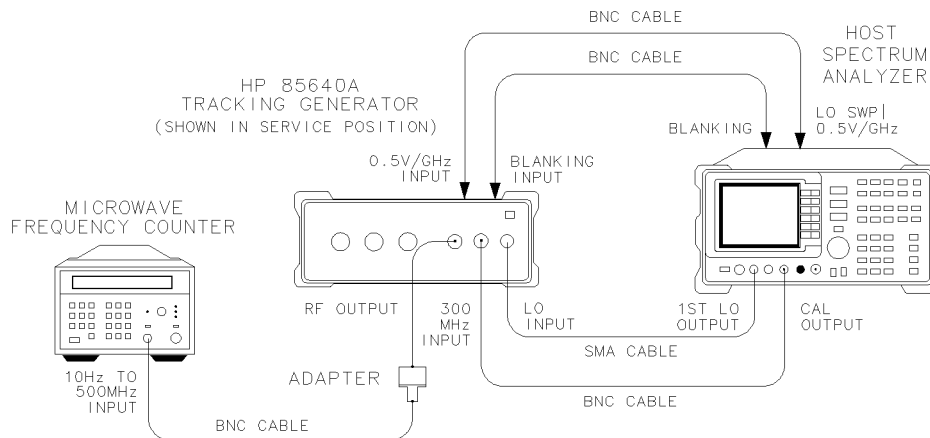
Tracking adjustment range

### 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.

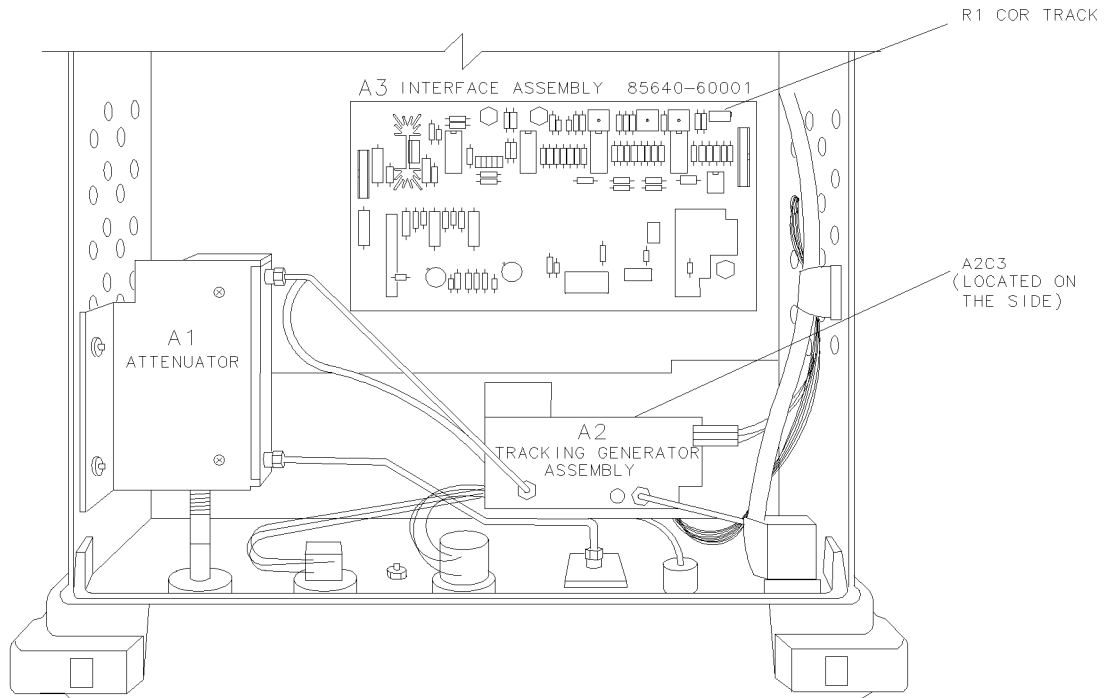
**Caution** The tracking generator assemblies are static-sensitive. Perform this adjustment procedure at a static-safe workstation. Refer to Figure 7-1 for an example of a static-safe workstation.



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**Figure 5-7. Tracking Oscillator Range Adjustment**

## 4. Tracking Oscillator Range Adjustments



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**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:
 

<b>CENTER FREQ</b>	..... 300 MHz
<b>SPAN</b>	..... 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  
50 $\Omega$  –1 M $\Omega$  Switch ..... 50 $\Omega$   
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 <sub>CENTER</sub> (MHz)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## Assembly Replaceable Parts

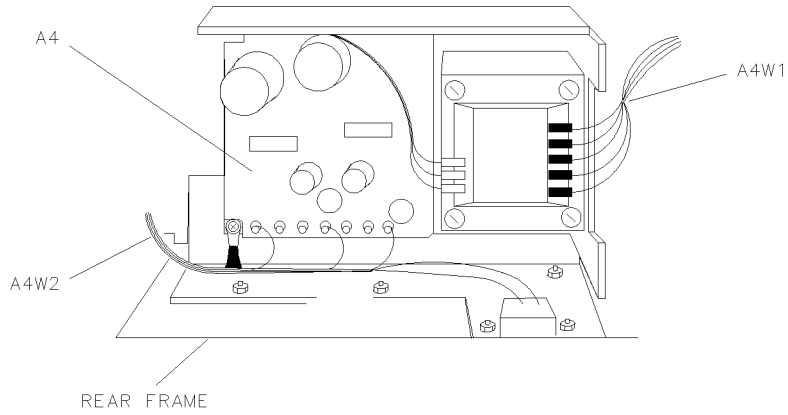
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### What You'll Find in This Chapter

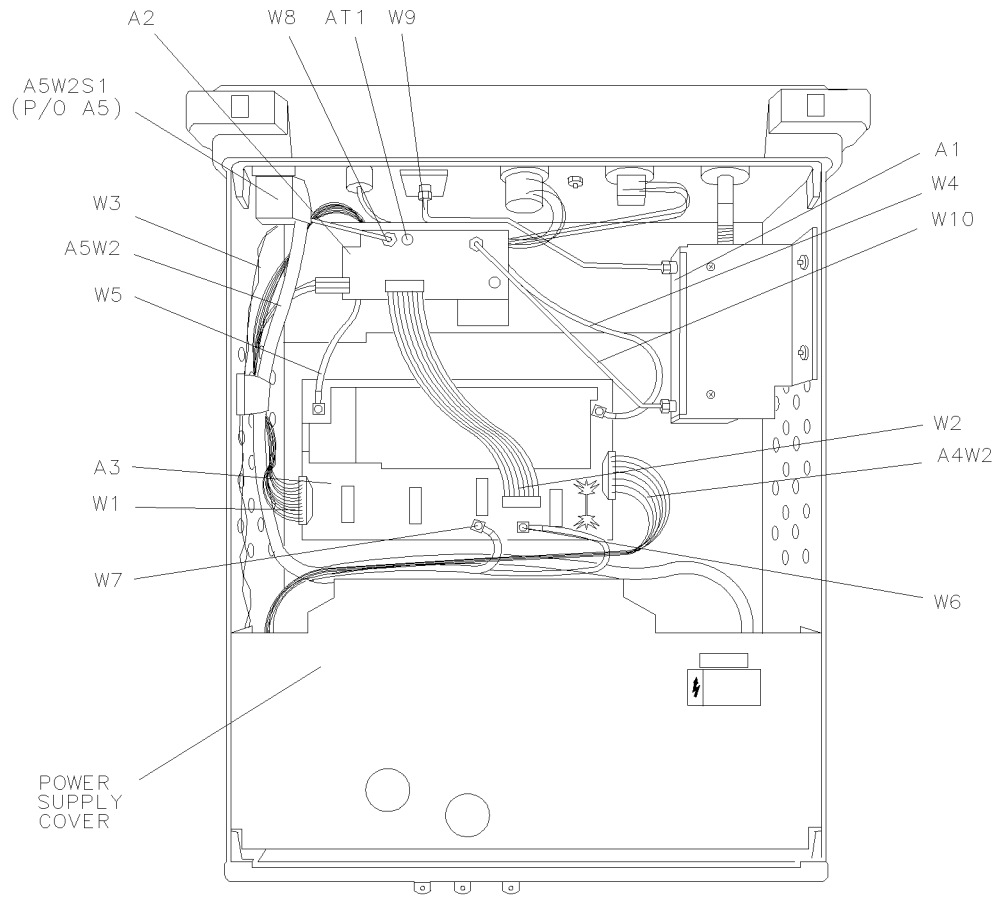
The replaceable parts and assemblies of the HP 85640A tracking generator are listed in tables, some with accompanying illustrations, in this chapter. Rebuilt-exchange assembly part numbers are included here as well. Refer to Chapter 7 for replacement procedures and the rebuilt-exchange assembly procedure.

## 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



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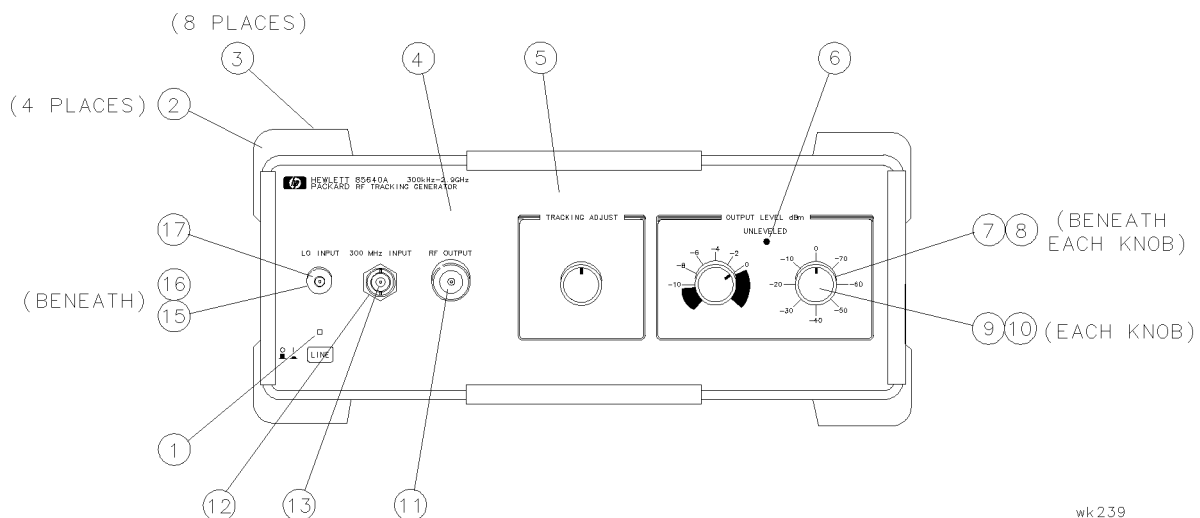
wk238

**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

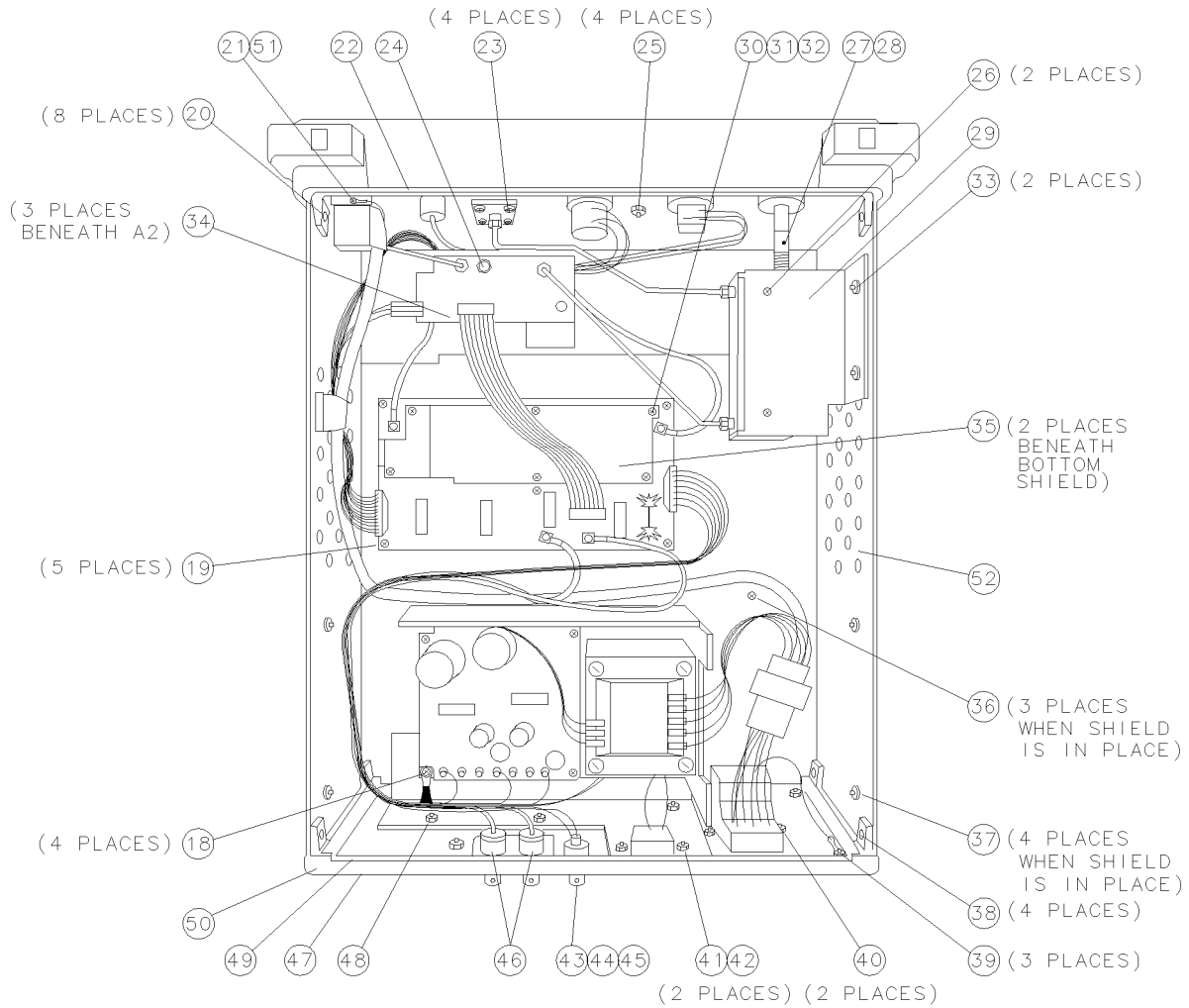


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**Figure 6-2. Mechanical Replaceable Parts (1 of 2)**

**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



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

## Service Information

---

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

This chapter tells you how to service the tracking generator:

- How to avoid damage from electrostatic discharge.
- How to replace assemblies in the instrument.
- What to do if you have a problem with the tracking generator.

You'll also find:

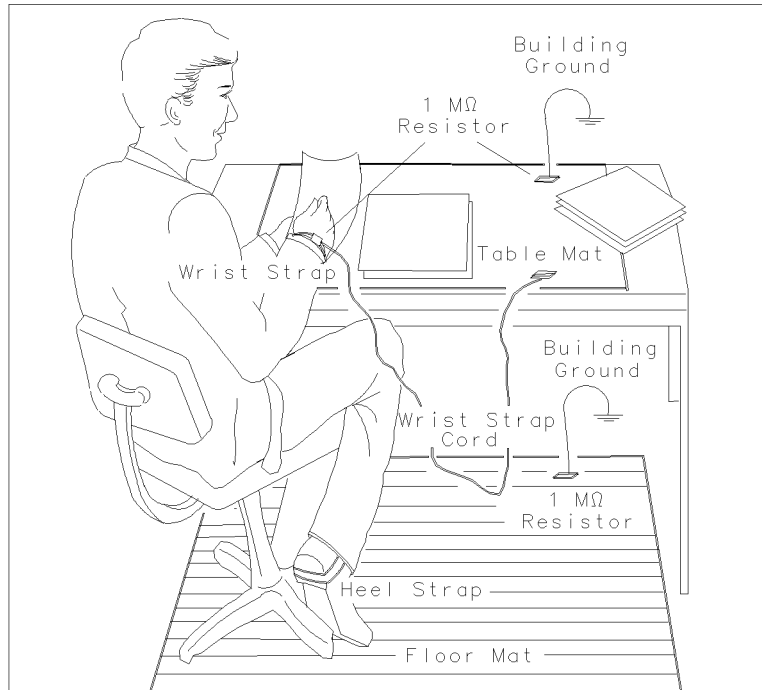
- A system-level block diagram.
- An instrument-level block diagram.
- An instrument-level wiring diagram.
- An A3 interface assembly component-level replaceable parts list.
- An A3 interface assembly component location diagram.
- An A3 interface assembly schematic diagram.



---

## Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. All work performed on assemblies containing electronic components should be done *only* at a static-safe work station.



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**Figure 7-1. A Static-Safe Workstation**

## PC Board Assemblies and Electronic Components

---

**Caution** Handle these items *only* at a static-safe work station.

Store or transport these items *only* in static-shielding containers.

Personnel should be grounded with a resistor-isolated wrist strap before touching any connector pins or before removing any assembly from the instrument.

Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.

---

**Table 7-1. Static-Safe Accessories**

<b>HP Part Number</b>	<b>Description</b>
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1383	Wrist-strap, black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).

---

## Returning the RF Tracking Generator for Service

Repackage the tracking generator in the original packaging materials, or with commercially available materials as described in steps 3, 4 and 5.

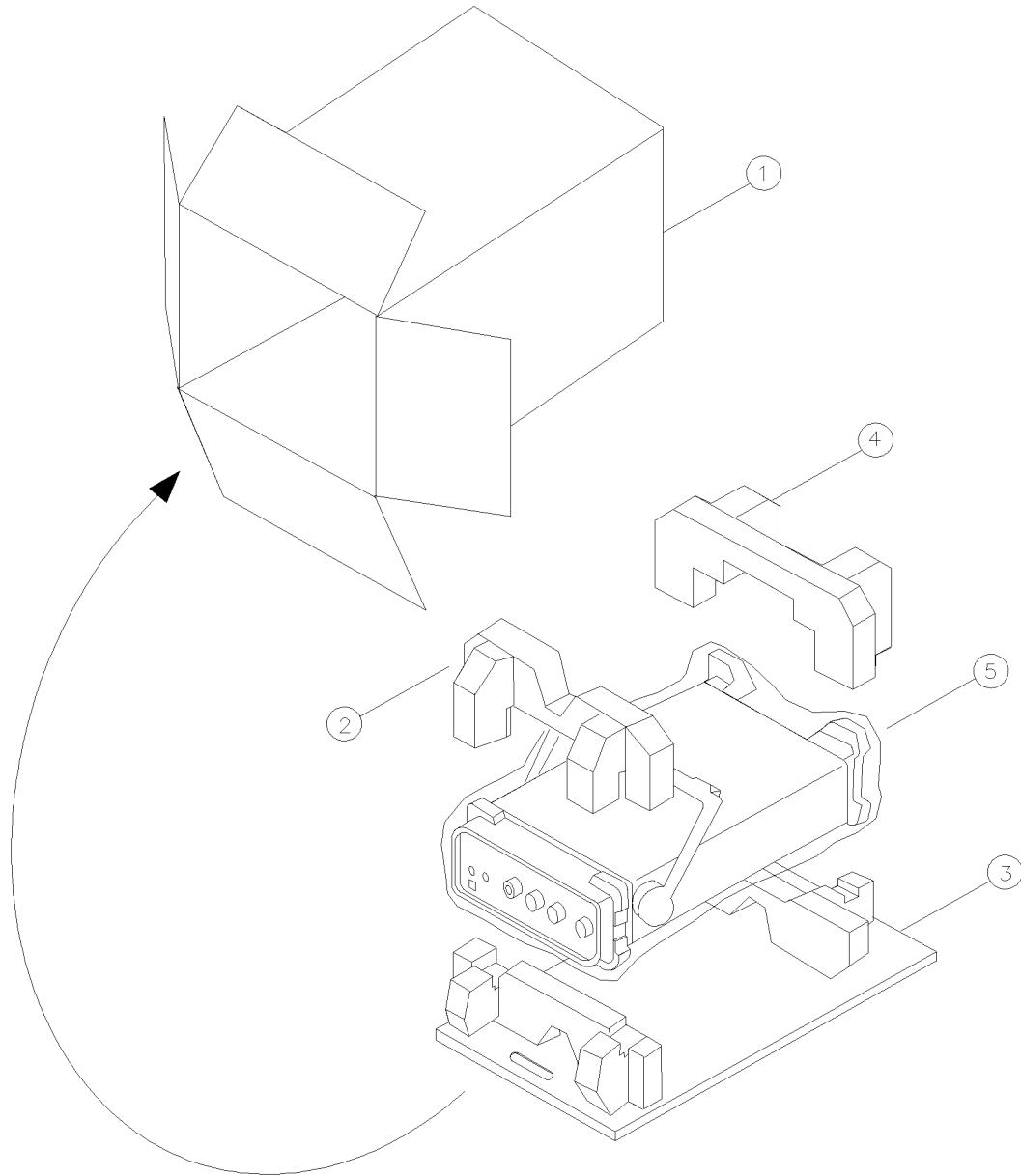
1. Fill in a blue service tag (located at the back of this manual) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Include:
  - Any error messages that appeared on the display.
  - A completed performance test record.
  - Any other information about the performance of the instrument.
2. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by electrostatic discharge.

---

**Caution** Tracking generator damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. Pellets cause equipment damage by generating static electricity.

---

3. Use the original materials (see Figure 7-2) or a strong shipping container of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The carton must be large enough and strong enough to accommodate the instrument and to allow at least three to four inches on all sides of the instrument for packing material.
4. Surround the equipment with at least three to four inches of packing material; use enough to prevent the equipment from moving in the carton. If rigid packing foam is unavailable, you may use any anti-static brand of bubble packaging (sheet plastic formed with air-filled bubbles). Wrap the equipment several times in this material to protect the equipment and to keep it from moving in the carton.
5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.
7. Keep copies of all shipping papers.



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**Figure 7-2. HP 85640A Shipping Container and Cushioning Materials**

<b>Item</b>	<b>HP Part Number</b>	<b>Description</b>
1	Outer carton	9211-6065
2	Front foam pad	9220-4620
3	Bottom tray	9220-4621
4	Rear foam pad	9220-4622
5	Anti-static vinyl bag (large)	85901-80002

---

## Replacement Procedures

- A1 attenuator replacement
- A2 tracking generator assembly replacement
- A3 interface board assembly replacement
- A4 Power supply replacement
- A5 FL1 line filter/switch assembly replacement

## Rebuilt Exchange Assemblies

Table 6-1 lists part numbers for rebuilt exchange assemblies. Exchange assemblies (factory repaired and tested) are available only on a trade-in basis; therefore, the defective assembly must be returned for credit.

To return a defective exchange assembly:

1. Record the nature of the assembly's defect.
2. Wrap the defective assembly in its static-safe wrapping and replace it in the original shipping container. Enclose a copy of the recorded defect information.
3. Place the pre-addressed label on the package, and return the defective assembly to receive credit.

---

## Removing and Replacing the Instrument Cover

---

**Caution** The tracking generator assemblies are sensitive to static. Perform assembly procedures at static-safe work stations. See Figure 7-1 for an example of a static-safe work station.

---

The cover assembly is removed and replaced the same way for each replacement procedure. Follow these steps when performing any of the other replacement procedures:

### Removal

1. Remove any adapters and cables from the front-panel connectors.
2. Place the tracking generator on its front panel.
3. Use a 4 mm hex key to loosen the four screws in the rear bumper feet. (These feet are secured to the instrument cover assembly. It is not necessary to remove them now.)
4. Pull the instrument cover toward the rear of the tracking generator to remove it.

### Replacement

5. Turn the cover assembly so the vent holes are on the bottom of the tracking generator. With the tracking generator sitting on its front panel, slide the instrument cover assembly onto the tracking generator.
6. Place the four screws in the rear bumper feet. Use the 4 mm hex key to start tightening the screws.
7. Alternately tighten the screws on each bumper foot to ensure that the cover is seated in the front frame.
8. Torque each set screw to 40 or 50 inch-pounds.

---

## A1 Attenuator Replacement

---

**Caution** The tracking generator assemblies are static sensitive. Perform assembly procedures at static-safe work stations. Refer to Figure 7-1 for an example of a static-safe work station.

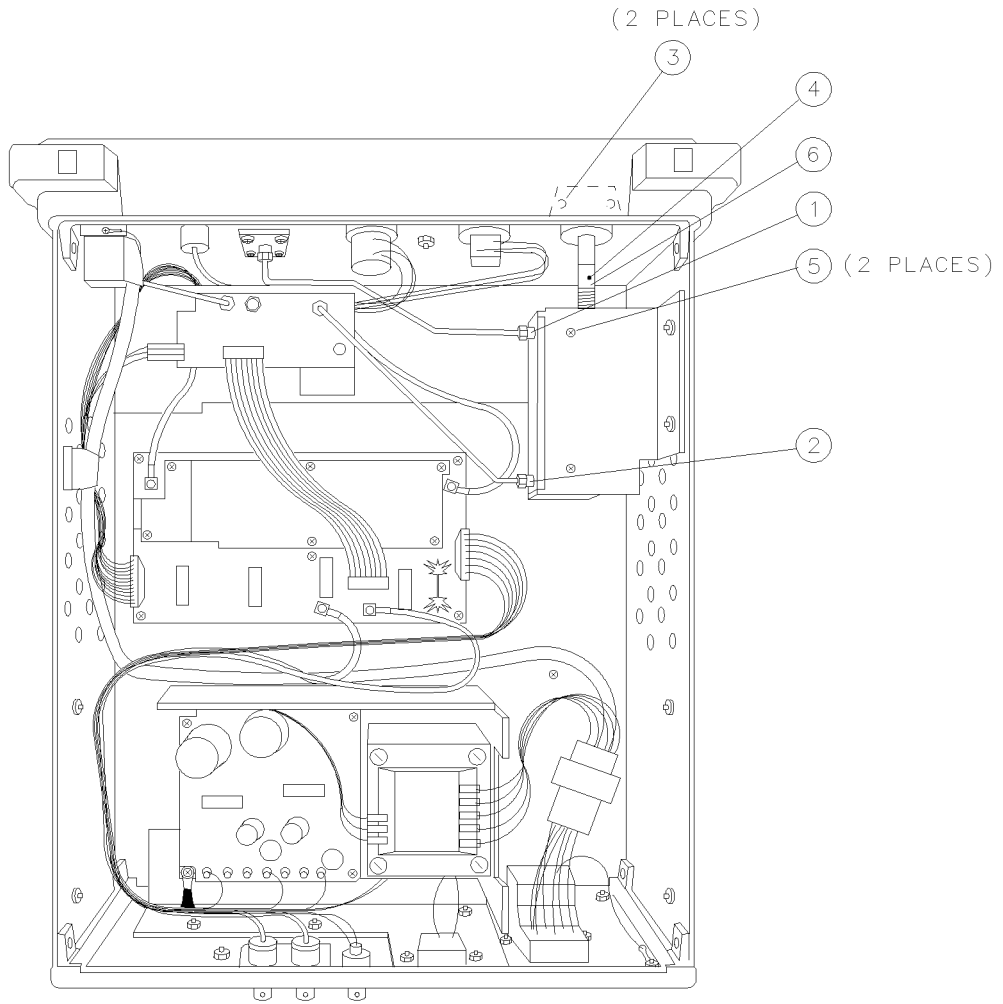
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### Removal

1. Remove the instrument cover as described on page 7-7.
2. Remove W9 ① and W10 ②. See Figure 7-3.
3. Use a 0.05-inch hex driver to loosen the two set screws ④ on the attenuator shaft adapter ⑥. Pull the attenuator knob ③ and attenuator shaft adapter forward as far as it can go.
4. Remove the two screws ⑤ holding the attenuator to the attenuator bracket.

### Replacement

5. Rotate the attenuator shaft fully clockwise.
6. Connect the replacement attenuator to the attenuator bracket by replacing and start tightening the two screws ⑤.
7. Replace the attenuator adapter and secure it with the two allen screws ④.
8. Move the attenuator to align the knob properly with the front-panel markings. Tighten the set screws ⑤ to six inch-pounds.
9. Reconnect W9 ① and W10 ②. Tighten them to eight inch-pounds each.



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**Figure 7-3. A1 Attenuator Replacement**



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## A2 Tracking Generator Assembly Replacement

---

**Caution** The tracking generator assemblies are static sensitive. Perform assembly procedures at static-safe work stations. Refer to Figure 7-1 for an example of a static-safe work station.

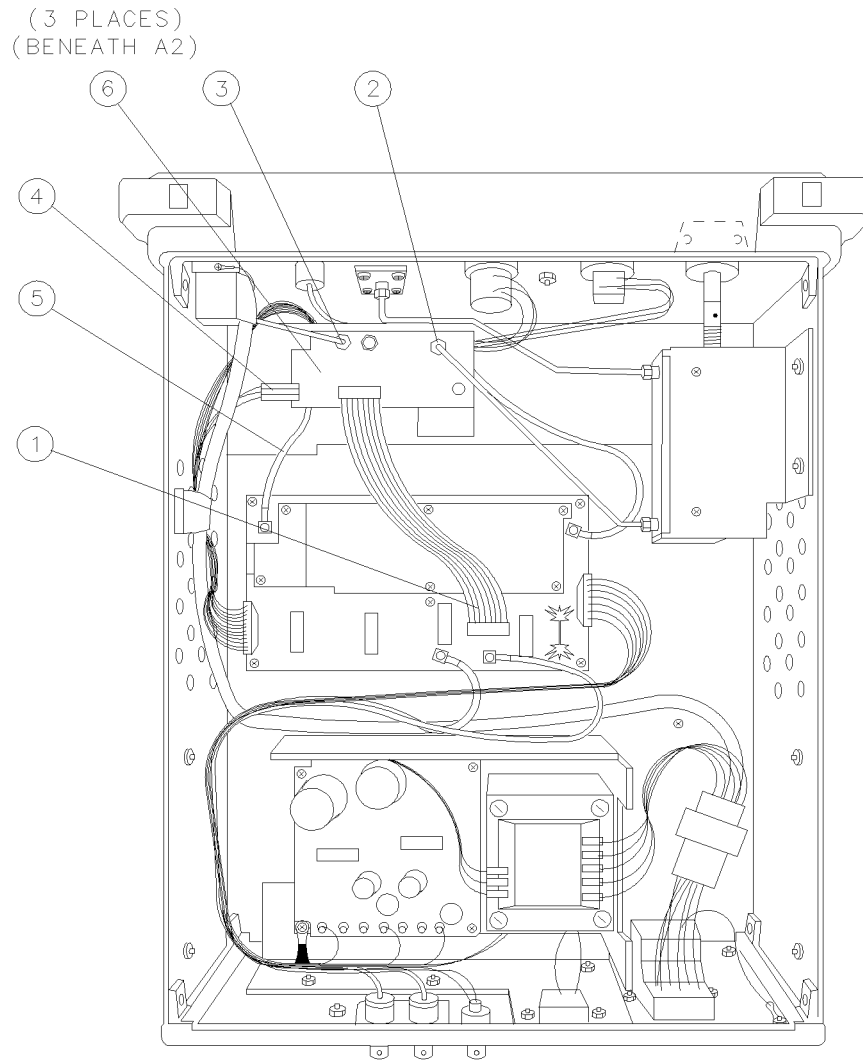
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### Removal

1. Remove the instrument cover as described on page 7-7.
2. Refer to Figure 7-4 and remove the following five cable assemblies from the tracking generator circuitry. Use caution when handling the semirigid cables; they should not be bent.
  - ① W2 from A2J1
  - ② W10 from A2J2
  - ③ W8 from A2J4
  - ④ W3 from A2J6
  - ⑤ W5 from A2J8
3. Rotate the instrument onto its front panel. Hold the A2 tracking generator as you remove the three screws ⑥ that attach it to the chassis.

### Replacement

4. Orient A2 with A2J2, A2J3, and A2J4 facing toward the front of the instrument.
5. Attach A2 to the instrument chassis with the three screws ⑥ tightened to six inch-pounds.
6. Replace the following five cable assemblies. Use caution when handling the semirigid cables; they should not be bent.
  - ① W2 to A2J1
  - ② W10 to A2J2
  - ③ W8 to A2J4
  - ④ W3 to A2J6
  - ⑤ W5 to A2J8
7. Tighten the semirigid cable assemblies to eight inch-pounds.



wk243

**Figure 7-4. A2 Tracking Generator Assembly Replacement**

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## A3 Interface Board Assembly Replacement

---

**Caution** The tracking generator assemblies are static sensitive. Perform assembly procedures at static-safe work stations. Refer to Figure 7-1 for an example of a static-safe work station.

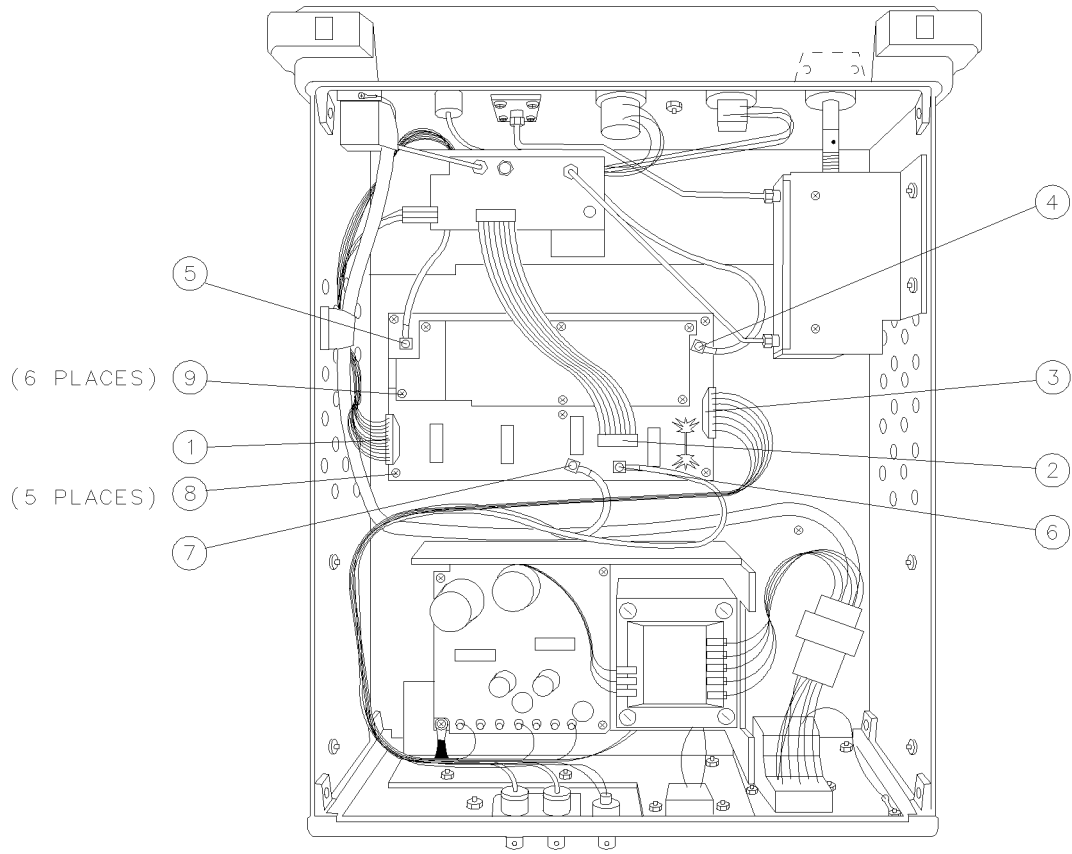
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### Removal

1. Remove the instrument cover as described on page 7-7.
2. Refer to Figure 7-5 to disconnect the following seven cable assemblies from the A3 interface board assembly:
  - ① W1 from A3J2
  - ② W2 from A3J1
  - ③ A4W2 from A3J3
  - ④ W4 from A3J4
  - ⑤ W5 from A3J5
  - ⑥ W6 from A3J6
  - ⑦ W7 from A3J3
3. Remove the five screws ⑧ (washers are attached to the screws) from the A3 board assembly.
4. Loosen the board assembly from the hook and loop fastener then lift the board assembly from the instrument.

### Replacement

5. If you are replacing the bottom shield or installing a new board assembly, attach either the hook or loop side to the bottom shield so it aligns with the fastener remaining on the chassis.
6. Replace the top and bottom shields to the A3 board assembly, then tighten the six screws ⑨.
7. Align the A3 board assembly in the chassis. The hook and loop fasteners hold the board in position temporarily. Secure the board assembly with the five screws ⑧ and washers tightened to six inch-pounds.
8. Reconnect the following seven cable assemblies to the A3 interface board assembly:
  - ① W1 to A3J2
  - ② W2 to A3J1
  - ③ A4W2 to A3J3
  - ④ W4 to A3J4
  - ⑤ W5 to A3J5
  - ⑥ W6 to A3J6
  - ⑦ W7 to A3J3



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**Figure 7-5. A3 Interface Board Assembly Replacement**

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## A4 Power Supply Replacement

---

**Caution** The tracking generator assemblies are static sensitive. Perform assembly procedures at static-safe work stations. Refer to Figure 7-1 for an example of a static-safe work station.

---

**Note** If replacing only the power supply board assembly (not including A4W1 and A4W2), remove the jumpers between the transformer terminals marked 1 and 3, and 2 and 4.

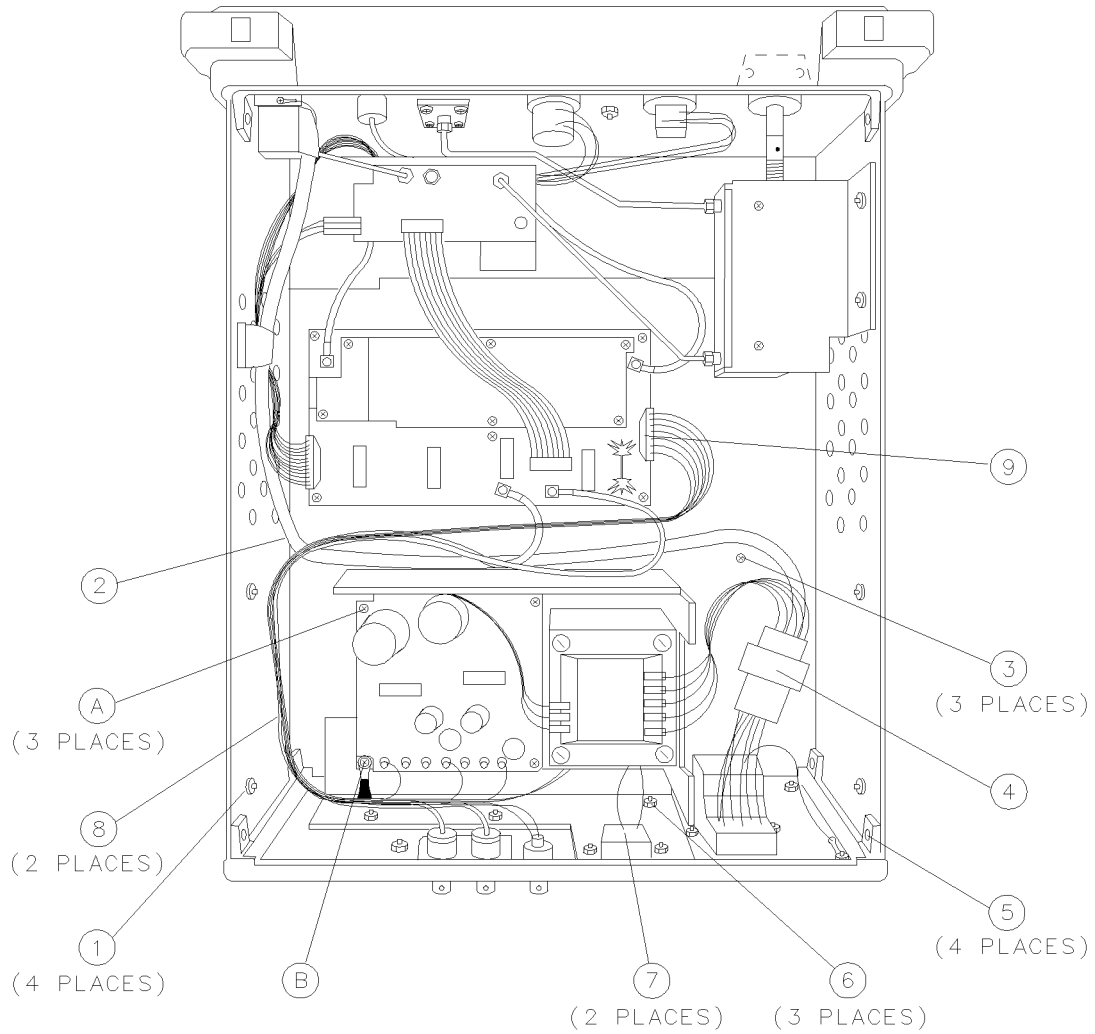
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### Removal

1. Remove the instrument cover as described on page 7-7.
2. Remove the four screws ① (two per side) from the power supply shield. See Figure 7-6.
3. Remove the cables from the cable clips ② on the power supply shield.
4. Remove the three screws ③ connecting the power supply shield to the chassis. Remove the shield.
5. Depress the clips on the sides of A5W1P1 connector ④ between A5W1 and A4W1 to disconnect the cables.
6. Remove the three screws ⑥ from the back panel and lower the rear frame.
7. Desolder the two wires ⑦ on the ALC switch, making note of the proper connections. Lift the switch out of its slot.
8. Clip the two cable ties ⑧ to free A4W2 cable assembly and disconnect it from A3J3 ⑨.
9. Remove the four screws ⑩ and ⑪ that secure the power supply bracket to the chassis. Lift the power supply assembly out of the instrument.

### Replacement

10. Replace the A4 power supply in the chassis and lightly tighten three of the four screws ⑩.
11. Replace the grounding wire with the fourth screw ⑪. Alternately tighten all four screws to 7 inch-pounds.
12. Resolder the two wires from A4W2 to the ALC switch ⑦. The wires should be connected between the closed contacts when the ALC switch is set to INT.
13. Connect A4W1 to A5W1 ④.
14. Replace the cable ties ⑧ with A4W2 included.
15. Replace the power supply cover, loosely tighten the four side screws ① and the three chassis screws ②. Alternately tighten all screws to six inch-pounds.
16. Replace the cables into the cable clips ②.



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**Figure 7-6. A4 Power Supply Replacement**

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## A5 Line Filter/Switch Assembly Replacement

---

**Caution** The tracking generator assemblies are static sensitive. Perform assembly procedures at static-safe work stations. Refer to Figure 7-1 for an example of a static-safe work station.

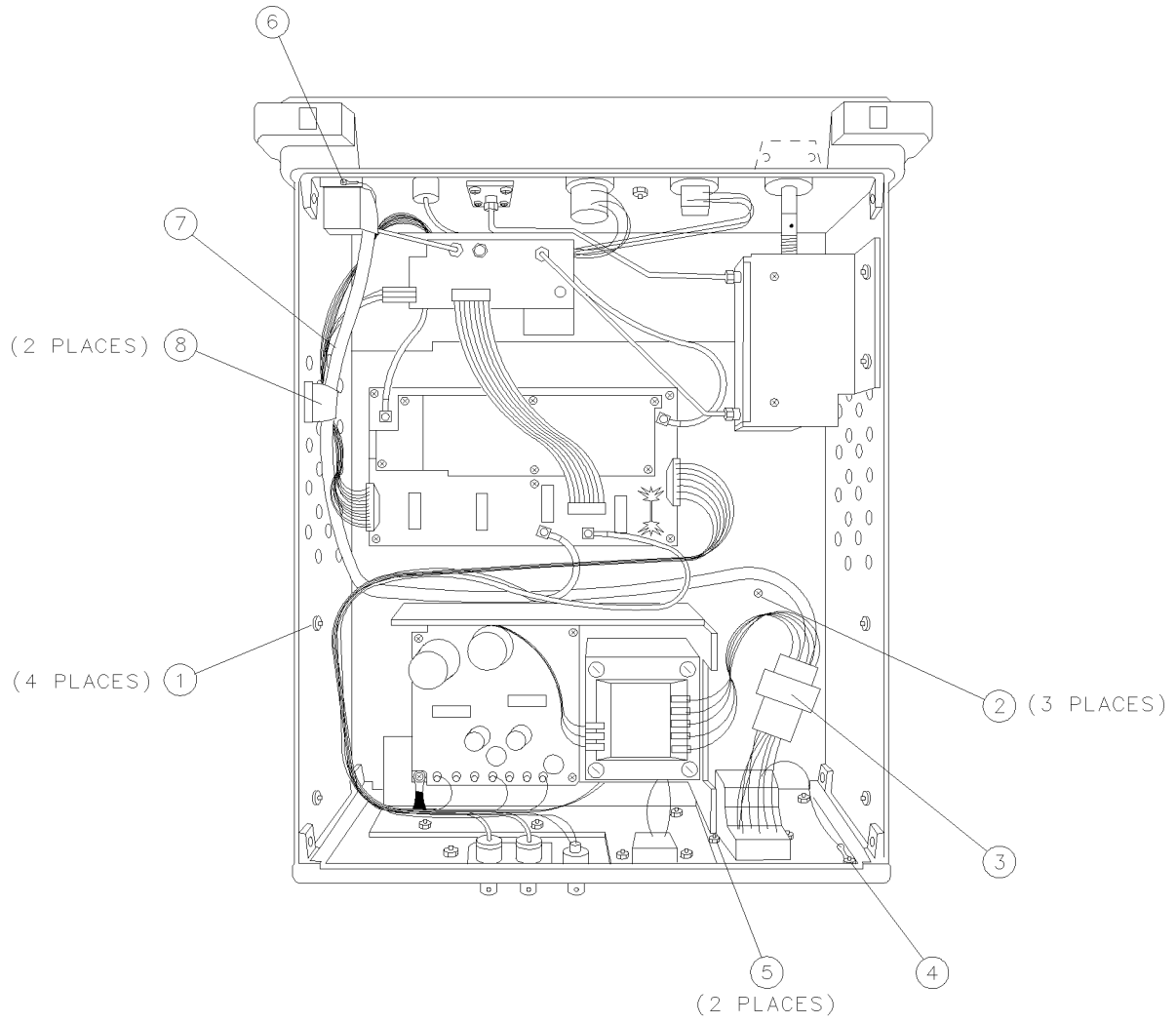
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### Removal

1. Remove the instrument cover as described on page 7-7.
2. Remove the four screws ① (two per side) from the power supply shield.
3. Remove the three screws ② connecting the power supply shield to the chassis. Remove the shield.
4. Depress the clips on the sides of A5W1 P1 connector ③ to disconnect A5W1 from A4W1.
5. Remove the line module grounding nut ④ to disconnect A5W3.
6. To remove the front-panel line switch, remove the screw ⑥ securing the grounding wire to the frame.
7. Pull the line switch away from the front frame, and slip the LED out of its socket.
8. Remove the two screws ⑤ that connect the line module to the chassis.
9. Carefully pull A5W2 ⑦ out of the harness clips ⑧ and remove the A5 assembly.

### Replacement

10. Replace the line module into the chassis with the plug prongs toward the top of the tracking generator and the voltage selection switch toward the bottom. Alternately tighten the two screws ⑤.
11. Reconnect A5W3 grounding wire with the nut ④ and tighten it to six inch-pounds.
12. Lay A5W2 ⑦ along its path near the harness clips ⑧, and slip the LED into its slot on the line switch.
13. Orient the line switch so that “LINE” reads correctly from the outside. Tighten the grounding screw ⑥ to six inch-pounds.
14. Press A5W2 into the harness clips ⑧. Reconnect A5W1 to A4W1 ③.
15. Replace the power supply cover, loosely tighten the four side screws ① and the three chassis screws ②. Alternately tighten all screws to six inch-pounds.
16. Check that the fuse in A5FL1 and the voltage selector are correct for your power mains. Refer to Chapter 2, “Installation,” for additional power requirement information.



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**Figure 7-7. A5 FL1 Line Filter Module Replacement**



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## HP 85640A RF Tracking Generator Circuit Descriptions and Troubleshooting Procedures

The HP 85640A RF tracking generator is designed for operation with:

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

These instruments, referred to as “host” spectrum analyzers, may have a much wider frequency range than the tracking generator’s range of 300 kHz to 2.9 GHz.

The simplified block diagram of a spectrum analyzer/tracking generator system, Figure 7-8, shows only the host spectrum analyzer’s low band (<2.9 GHz). The tracking generator accepts two RF signals from the host spectrum analyzer (1ST LO OUTPUT and CAL OUTPUT), and two control signals (0.5V/GHz OUTPUT and BLANKING OUTPUT). Although Figure 7-8 does not show these two control signals, they appear as 0.5V/GHz INPUT and BLANKING INPUT in Figure 7-9. Their operation is explained in “HP 85640A Block Diagram Circuit Descriptions,” below.

The tracking generator amplifies the 300 MHz CAL OUTPUT signal from the host spectrum analyzer and doubles it to 600 MHz. The 91.07 MHz tracking oscillator (VCXO) output is doubled to 182.14 MHz, then mixed with the 600 MHz signal. The sum of these two signals, 782.14 MHz, is multiplied by five to generate 3.9107 GHz. Notice that 3.9107 GHz is the same frequency as the host spectrum analyzer’s first IF.

The 3.9107 GHz signal is applied to a modulator, which levels the output and provides fine adjustment of the output power level (using the OUTPUT LEVEL vernier). The modulator output is mixed with the 1st LO signal from the host spectrum analyzer and amplified.

Since the host spectrum analyzer’s 1st LO is always greater than the tuned frequency by 3.9107 GHz (the 1st IF), and the tracking generator mixes this 1st LO signal with 3.9107 GHz, the tracking generator output frequency will be the same as the host spectrum analyzer’s tuned frequency. The spectrum analyzer’s 1st IF does not need to be exactly 3.9107 GHz, as long as the tracking generator’s 1st IF is equal to the 1st IF of the host spectrum analyzer. Use the TRACKING ADJUST control to set the tracking generator’s 1st IF equal to the analyzer’s 1st IF.

The output power of the HP 85640A RF tracking generator can be adjusted in 10 dB steps using the 70 dB step attenuator.

### HP 85640A Block Diagram Circuit Descriptions

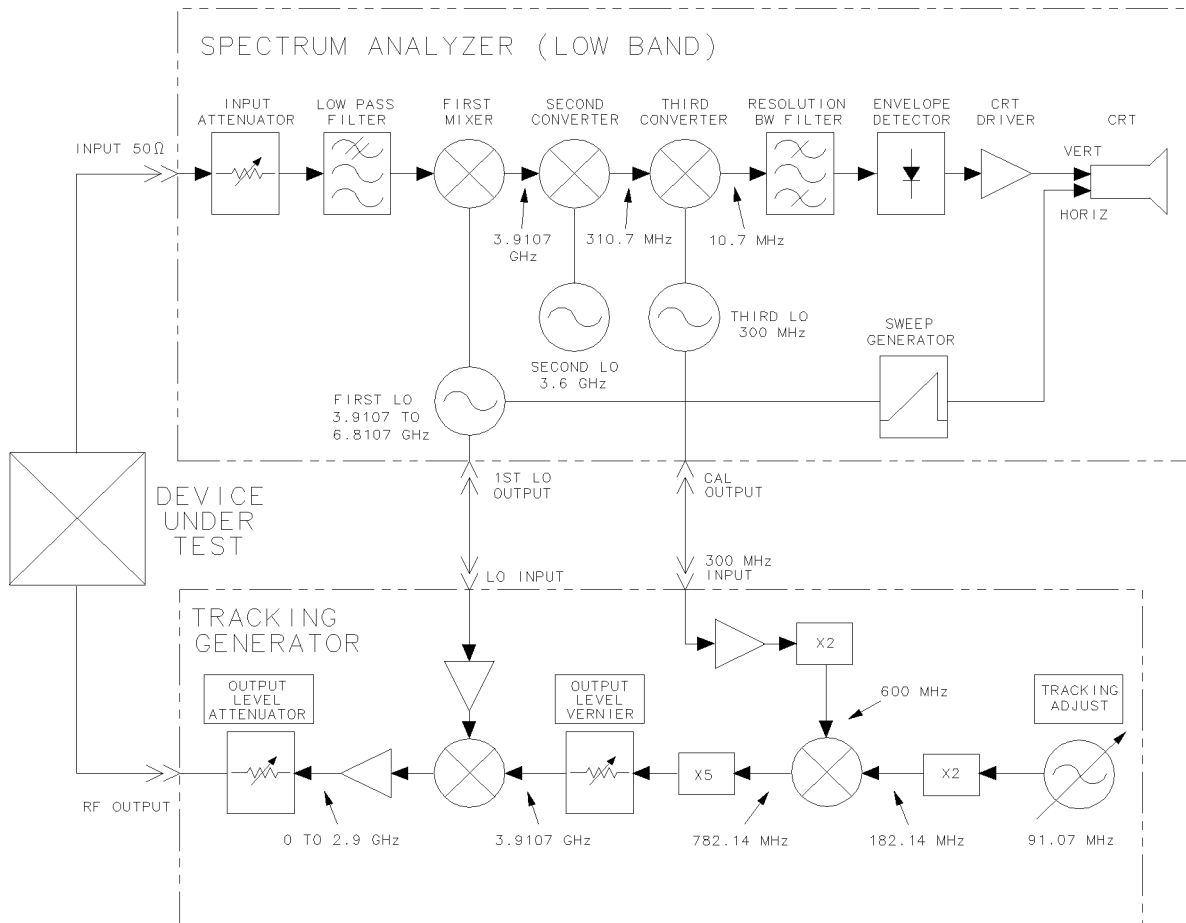
A block diagram of the HP 85640A RF tracking generator is shown in Figure 7-9. Most of the RF circuitry is contained in the A2 tracking generator assembly. The A3 interface assembly provides the control signals for the A2 tracking generator assembly. A3 also monitors A2’s ALC loop (ALC\_MON) for unlevelled conditions, and multiplies the 300 MHz CAL OUTPUT signal from the host spectrum analyzer to 600 MHz for use by A2. The A1 Attenuator includes a dc blocking capacitor on its output to prevent damage due to reverse input voltages in less than  $\pm 30$  V dc.

The 0.5V/GHz INPUT is routed to the power level control circuitry (refer to Figure 7-9) on the A3 interface assembly. This signal is used for flatness compensation. As the tuned frequency increases, the 0.5V/GHz INPUT voltage also increases, causing A2 tracking generator’s output power level to increase. This helps compensate for increased power losses at higher frequencies.

The unlevel detector circuitry on A3 monitors the ALC\_MON line from the A2 tracking generator. It lights the UNLEVELED LED on the instrument’s front panel when an unlevelled

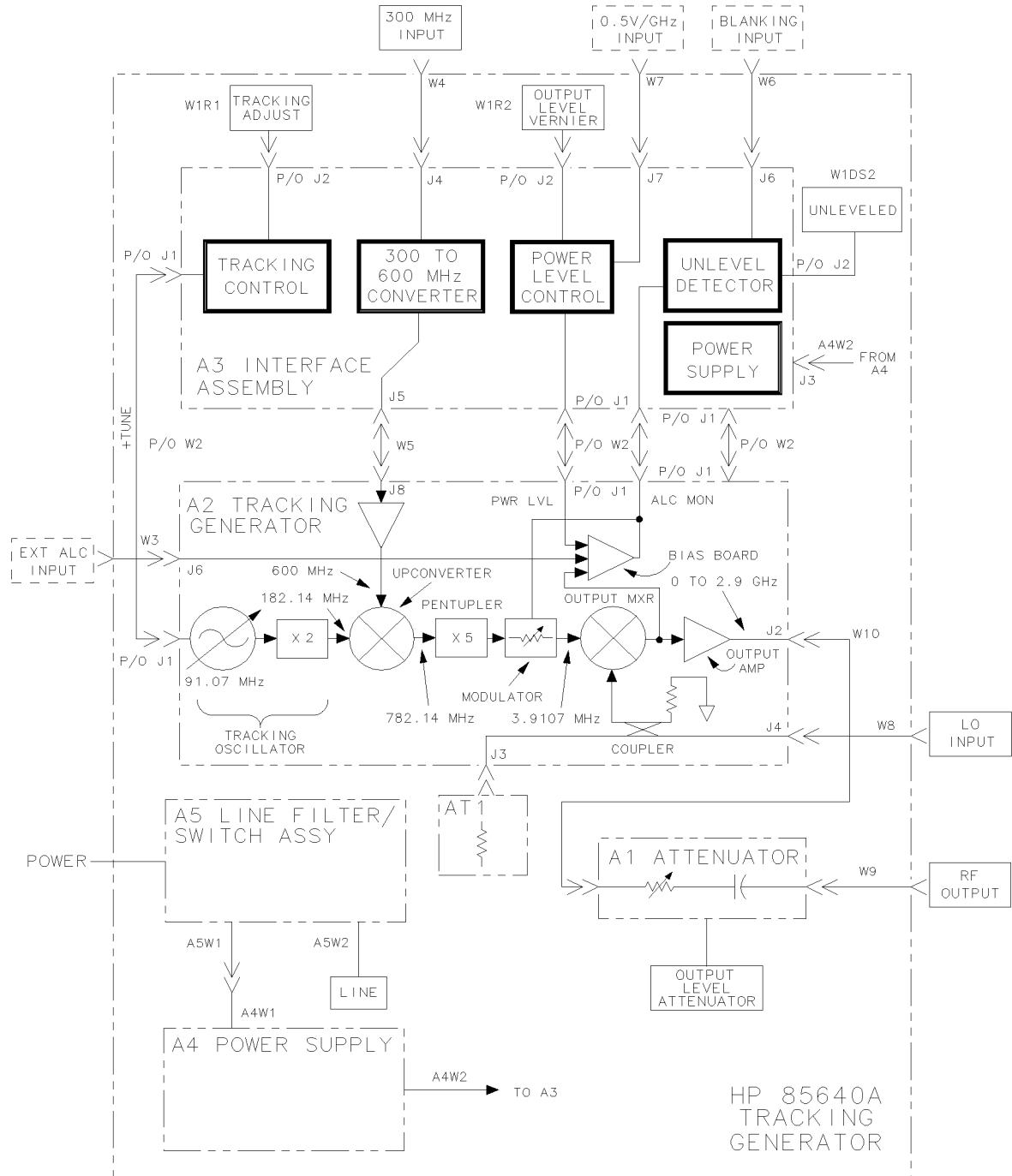
condition is detected. Under certain conditions, it is normal for the output to be unlevelled during retrace. The BLANKING INPUT signal prevents the UNLEVELED LED from flashing during retrace when these conditions exist.

The tracking generator output may be leveled externally by using a negative-polarity crystal detector. A rear-panel switch on the tracking generator can be used to select between internal and external leveling. The EXT ALC\_INPUT connector on the rear-panel routes the detector output directly to the A2 tracking generator assembly.



wk247

**Figure 7-8. Simplified HP 85640A to Host Spectrum Analyzer System Block Diagram**



wk248

**Figure 7-9. Simplified HP 85640A RF Tracking Generator Block Diagram**

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## Troubleshooting the HP 85640A RF Tracking Generator Circuits

The A2 tracking generator, A1 attenuator assemblies, and A4 power supply may be replaced if they are defective; these assemblies are not field serviceable. The A2 tracking generator assembly is available as a rebuilt exchange assembly. Refer to the rebuilt exchange assembly procedure in this chapter for more information about obtaining rebuilt, factory-tested assemblies.

### A1 Attenuator

The A1 Attenuator is a 70 dB step attenuator, with three sections that provide attenuation values of 10, 20 and 40 dB. The attenuator includes a dc blocking capacitor on its output to prevent damage from reverse input voltages less than  $\pm 30$  V dc.

### A2 Tracking Generator

The A2 tracking generator consists of several smaller circuits. The A2 is not component-level repairable; a rebuilt exchange assembly is available. Part numbers are in Table 6-1 and the rebuilt exchange assembly procedure is at the beginning of this chapter.

The tracking generator is unique because it recreates only one host-analyzer intermediate frequency, thereby minimizing isolation problems associated with the tracking generator. The function blocks of the A2 tracking generator circuitry are described below. Refer to Figure 7-9 for the location of these circuits in the block diagram.

<b>Tracking oscillator</b>	The tracking oscillator enables the fine adjustment of the tracking generator output frequency to compensate for the frequency inaccuracies of the host spectrum analyzer's 10.7 MHz IF. The tracking oscillator determines the residual FM and frequency drift of the tracking generator. The 182.14 MHz output frequency is obtained by doubling the output of a crystal oscillator operating at 91.07 MHz.
<b>Upconverter</b>	The upconverter mixes the tracking oscillator output with the 600 MHz signal coming from the A3 Interface Assembly. The upconverter also contains a filter which passes only the 782.14 MHz upper sideband.
<b>Pentupler</b>	The pentupler multiplies the 782.14 MHz signal by five to generate 3.9107 GHz, which equals the host spectrum analyzer's 1st IF. A dual-cavity band-pass filter centered at 3.9107 GHz eliminates all unwanted harmonics of 782.14 MHz.
<b>Modulator</b>	The output of the pentupler passes through a modulator which adjusts the power level going into the output mixer. The modulator is controlled by an ALC circuit on the bias board controlled by a detector in the output amplifier. If the detected output power is too high, the ALC drives the modulator to decrease the input level into the output mixer, which decreases the output power.
<b>Coupler</b>	The 1st LO INPUT signal from the host spectrum analyzer is coupled and buffered to drive the output mixer. The main line of the coupler is terminated in 50 $\Omega$ by AT1. The loss through the coupler main line is less than 2.5 dB.
<b>Output mixer</b>	The 3.9107 GHz signal from the modulator goes into the RF port of the output mixer. The LO port of the output mixer is driven by the

buffered 1st LO signal from the coupler. The mixer output is then amplified.

**Output amplifier** The signal from the output mixer passes through the low-pass filter of the output amplifier, which then amplifies the signal to a usable range. The amplifier also contains a detector for leveling the output.

**Bias board** The bias board houses the ALC circuitry for the tracking generator. It also distributes dc power to the rest of A2. ALC inputs originate from the A3 Interface Assembly (for power level control), from the rear-panel EXT ALC INPUT, and from the output amplifier detector. The ALC loop drives the modulator.

### **A3 Interface Assembly**

The A3 interface assembly provides control signals for the A2 tracking generator's power level and tracking oscillator. A3 also monitors A2's ALC\_MON (ALC monitor) line to check for unlevelled output. The A2 tracking generator 600 MHz drive signal originates on A3.

**300 MHz to 600 MHz converter** This circuitry receives the host spectrum analyzer's 300 MHz, -10 dBm CAL OUTPUT signal. The signal is doubled to 600 MHz to drive the A2 tracking generator. The converter consists of two amplification stages followed by a frequency doubler and A3U4, a factory-selected attenuator. A3U4 is used to set the output power from the converter to -8 dBm at 600 MHz. The circuit's 300 MHz notch filter eliminates the 300 MHz fundamental signal.

**Power level control** The power level of the A2 tracking generator is controlled by both the front panel OUTPUT LEVEL vernier and the rear panel 0.5V/GHz INPUT from the host spectrum analyzer. The 0.5V/GHz INPUT provides slope (flatness) compensation to the output power level.

**Unlevel detector** The A2 tracking generator provides the ALC\_MON (ALC monitor) control line to the A3 interface. The A2 output is leveled when ALC\_MON is between -0.545 V and +1.09 V. The unlevel detector buffers ALC\_MON and feeds this signal to a window comparator. The window comparator output is low when the output is unlevelled.

It is normal for the output to be unlevelled momentarily during retrace. The host spectrum analyzer's BLANKING signal prevents a flashing UNLEVELED LED during retrace. The BLANKING signal is high during retrace and low during a sweep.

**Power supply** The power supply circuitry provides added filtering for the +15 V and -15 V supplies and regulators for the +5 V and ±10 V supplies.

**Tracking control** The tracking control circuitry generates the +TUNE control line. This control line determines the A2 tracking generator's tracking oscillator frequency. Tracking is controlled by setting the front panel TRACKING ADJUST potentiometer and A3R1 COR TRACK (coarse tracking). Noise on the +TUNE line may cause residual FM on the tracking generator output.

## **A4 Power Supply**

The A4 power supply provides  $\pm 15$  V dc at up to 1.5 A. The power supply operates from power mains of 100, 120, 200 or 240 V ac at line frequencies between 47 and 66 Hz. Refer to the interconnect diagram in this chapter for A4 to A4W1 and A4W2 connections.

## **A5 Line Filter/Switch Assembly**

The A5 line filter/switch assembly consists primarily of A5FL1, the line filter module, and A5W2S1, the instrument line switch. A5FL1 line filter module filters incoming ac power, fuses the power-line side of the ac power, and sets the proper transformer taps on the A4 power supply for the required line voltage. A spare fuse is included in the line filter module. The instrument line switch switches both the line and neutral sides of ac power.

---

## Troubleshooting Tracking Generator-Related Faults

This section will help you isolate tracking generator-related faults to a specific assembly in the HP 85640A or in the host spectrum analyzer.

### Output Unleveled

The unlevel-detector circuitry on the A3 interface assembly is used to monitor the control line ALC\_MON (ALC monitor) from A2. If ALC\_MON is greater than +1.091 V dc or less than -0.545 V dc, the UNLEVELED LED on the front panel lights. When lit, it indicates that the tracking generator output is unleveled. The tracking generator can typically provide up to +2.8 dBm of output power and remain leveled. In any case, the output should remain leveled for output power settings less than the specified maximum leveled output power. Refer to the specifications in Table 1-1 for more information.

It is normal for the tracking generator to be unleveled at frequencies below 300 kHz.

The ALC\_MON line is monitored continuously; therefore, if the output is unleveled for only part of a sweep, the UNLEVELED LED only lights during the unleveled condition. The LED may turn off before the sweep is completed.

If the UNLEVELED LED remains lit, proceed as follows:

1. Determine which frequencies cause the unleveled condition.
  - a. Do this by setting the host spectrum analyzer to zero span and a 5 second sweep time.
  - b. Step the center frequency in 50 MHz increments.
  - c. Note and record which frequencies cause the unleveled condition.
2. Determine which power levels cause the unleveled condition.
  - a. Connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
  - b. Set the host spectrum analyzer to zero span and CENTER FREQ to 300 MHz, or to one of the frequencies noted in step 1.
  - c. Maximize the amplitude response displayed on the host spectrum analyzer with the TRACKING ADJUST control.
  - d. Increase the OUTPUT POWER vernier setting from -10 dBm to 0 dBm.
  - e. Note and record the power levels that cause the unleveled condition.

---

**Note** It is acceptable for the output to be unleveled at power levels greater than the specified maximum leveled output power level.

---

3. Check the maximum power available from the tracking generator.
  - a. Connect the tracking generator's RF OUTPUT to the host spectrum analyzer's INPUT 50Ω.
  - b. Set the host spectrum analyzer to sweep from 300 kHz to 2.9 GHz.
  - c. Set the reference level to +10 dBm and the log scale to 5 dB/Div.
  - d. Set the ALC switch on the tracking generator's rear panel to EXT. Make no connection to the rear-panel EXT ALC INPUT.
  - e. The available power should always be greater than +1 dBm. If the output is only unleveled at specific frequencies, a power hole is usually visible at those frequencies.

4. Refer to the host spectrum analyzer's installation and verification manual and perform the 1ST LO OUTPUT amplitude performance test for the host spectrum analyzer. Examine the host spectrum analyzer if it fails this test.

---

**Note** The HP 8560A/E Option 002 spectrum analyzer does not provide sufficient LO drive for the HP 85640A RF tracking generator.

---

5. If the spectrum analyzer passes the 1st LO output amplitude test, repeat the test, but measure the output power at A2J3 (remove AT1) on the tracking generator. The power level at this point should be +14.5 dBm  $\pm$ 3 dB.
  - a. Note and record any 1st LO frequency setting(s) at which the power level is out of tolerance.
  - b. Determine the equivalent center frequency setting for any 1st LO frequency at which the amplitude is out of tolerance by subtracting 3.9107 GHz from the 1st LO frequency.
  - c. If the equivalent center frequency setting for any out-of-tolerance 1st LO amplitude (measured at A2J3) is close to the CENTER FREQ setting(s) that caused an unlevelled condition, suspect either A2 or W8.
6. If the output is unlevelled only at certain power level settings or certain frequencies, monitor A3U5 pin 1 with a digital voltmeter (DVM).
  - a. Connect the negative DVM lead to the negative end of A3C27.
  - b. Vary the tracking generator OUTPUT LEVEL vernier or host spectrum analyzer CENTER FREQ settings, as appropriate, and plot the voltage variation versus power level or frequency. A discontinuity in the plot near the power level causing the unlevelled condition indicates a problem on the A3 interface assembly.
  - c. A discontinuity in the plot near the frequency which caused the unlevelled condition may indicate a problem on A3 (in the power level control function block) or on the 0.5 V/GHz signal from the host spectrum analyzer.
  - d. Check the 0.5 V/GHz signal. Monitor the 0.5 V/GHz signal voltage with a DVM.
  - e. Vary the spectrum analyzer frequency and plot the voltage variation versus frequency. If a discontinuity exists near the frequency causing the unlevelled condition, examine the host spectrum analyzer.



## Excessive Residual FM

The tracking oscillator or the ALC circuitry may be responsible for excessive residual FM. Residual FM can be measured on another spectrum analyzer, such as an HP 8566A/B or HP 8568A/B, using slope detection with the host spectrum analyzer set to zero span.

1. Perform the residual FM performance test for the host spectrum analyzer, as described in the analyzer's installation and verification manual. If the analyzer passes this test, the analyzer's LO INPUT and 300 MHz INPUT signals probably are acceptable. If the analyzer fails the test, examine the host spectrum analyzer's synthesizer section.
2. Monitor A3J1 pin 5 (+TUNE ) with an oscilloscope.
  - a. Connect the ground lead of the oscilloscope probe to the negative end of A3C27.
  - b. The voltage at this point should be greater than 500 mV. If the voltage is less than 500 mV, perform the tracking oscillator range performance test in Chapter 4 of this manual.
  - c. If the instrument fails this test, perform the tracking oscillator range adjustment in Chapter 5 of this manual.
  - d. If noise on this tune line is greater than 10 mV, examine the tracking control circuitry on A3.
3. Monitor the output of the tracking generator with another spectrum analyzer.
  - a. Check for high-amplitude spurious responses from 100 kHz to at least 3 GHz.
  - b. If the spurious responses amplitudes are too high, the (broadband) ALC detector may be causing ALC loop oscillations, generating FM sidebands.
  - c. If any spurious responses are excessively high, refer to "Harmonic/Spurious Outputs Too High" later in this section.
4. If no spurious responses are present or are sufficiently low in amplitude to not cause a problem, suspect A2.

## Flatness Out of Tolerance

The output level flatness of the tracking generator is specified at a  $-10$  dBm output power setting (vernier set to 0 dBm, attenuator set to  $-10$  dB). In general, most flatness problems result from a failure in the A2 tracking generator microcircuit. However the POWER LVL signal from the A3 interface assembly and the LO INPUT signal from the host spectrum analyzer can also contribute to flatness problems.

1. Check the function of the POWER LVL signal from the A3 interface assembly.
  - a. Set the tracking generator's OUTPUT LEVEL vernier to a level at which the flatness is out of tolerance.
  - b. Monitor A3U5A pin 1 with a DVM while stepping the CENTER FREQ from 100 MHz to 2.9 GHz in 100 MHz increments.
  - c. Plot the voltage variation versus frequency.
  - d. A discontinuity in the plot near the frequency at which the flatness is out of tolerance indicates a problem on the host spectrum analyzer's 0.5 V/GHz OUTPUT.
2. Check the flatness of the LO INPUT signal.
  - a. Perform the 1ST LO OUTPUT amplitude performance test for the host spectrum analyzer.
  - b. If the spectrum analyzer passes this test, the fault most likely is with the A2 tracking generator.
  - c. If the spectrum analyzer fails this test, determine the equivalent CENTER FREQ setting at which the power level was out of tolerance by subtracting 3.9107 from the 1st LO frequency. Compare the result with the frequency(ies) at which the flatness was out of tolerance.
  - d. Repeat the test with the power sensor connected to A2J3 (remove AT1) noting the equivalent center frequency of any out-of-tolerance power levels.
  - e. The power level should be  $+14.5$  dBm  $\pm 3$  dB.
  - f. If the power level is acceptable at the spectrum analyzer's 1ST LO OUTPUT but out of tolerance at A2J3 and the CENTER FREQ setting of the out of tolerance power levels is close to the frequencies that caused the unlevelled condition, suspect A2.
  - g. If the power level at the 1ST LO OUTPUT is also out of tolerance, suspect the host spectrum analyzer.
3. Check all coax cables, especially semirigid cables. A fault in one of these cables can cause a very high-Q power hole.

## Harmonic/Spurious Outputs Too High

Harmonic and spurious outputs may be generated by A2 itself or may be present in either the 300 MHz INPUT or LO INPUT signals. There is a direct relationship between spurious signals on the 1st LO and spurious signals on the tracking generator output—if the 1st LO moves 1 MHz, the tracking generator output will move 1 MHz.

There is a five-to-one relationship between the 600 MHz drive spurious outputs and tracking generator output spurious signals because of the pentupler multiplication. For example, if the 600 MHz signal moves 1 MHz, the tracking generator output signal moves 5 MHz.

### If the harmonic spurious outputs performance test has failed:

1. If the harmonic spurious outputs performance test has failed, disconnect the tracking generator and connect a spectrum analyzer, such as an HP 8566A/B, to the host spectrum analyzer's 1ST LO OUTPUT.
2. Set the host spectrum analyzer frequency as indicated in the performance test, with SPAN set to 0 Hz.
3. At each frequency setting, press **TRIG** **SINGLE**.

4. If the host spectrum analyzer is an HP 8560A/E, HP 8561B/E, or HP 8563A/E press **CAL** **MORE 1 OF 2** **FREQ DIAGNOSE** **LO FREQ**.

If the host spectrum analyzer is an HP 8561A, HP 8562A, or HP 8562B, press **RECALL** **MORE** **FREQ DIAGNOSE** **LO FREQ**.

5. The frequency displayed is the 1ST LO OUTPUT fundamental frequency. Use the HP 8566A/B to measure the 1st LO signal's second and third harmonics levels.

---

**Note** The 1st LO typically has a higher harmonic content than does the tracking generator output. For this check, the variation in harmonic content versus frequency is the factor of interest.

---

6. If the 1st LO harmonic level variation versus frequency tracks the tracking generator output harmonic level variation, replace the host spectrum analyzer connection to the LO INPUT on the tracking generator and repeat step one while measuring the 1st LO signal at A2J3 (temporarily remove AT1).
7. If the 1st LO harmonic level variation measured at A2J3 relative to the 1ST LO OUTPUT is slight and the relative harmonic variation tracks the tracking generator's output harmonic level, suspect the host spectrum analyzer's 1ST LO OUTPUT.
8. If the 1st LO harmonic level variation versus frequency does not track the tracking generator output harmonic level variation, suspect the A2 assembly.

If sidebands are present at the same frequency offset at every output frequency, check the spectral purity of the LO INPUT and 600 MHz drive signals with another spectrum analyzer. Set the host spectrum analyzer to zero span when checking the 1st LO. Use the method described above to determine the 1st LO frequency. A 1 MHz sideband on the 1st LO appears as a 1 MHz sideband on the output signal.

1. To verify whether the 600 MHz drive or 1st LO signal is responsible for sidebands, substitute a clean signal for the 600 MHz drive or LO INPUT.
2. If the sidebands on the output disappear when using the clean signal, the substituted signal is responsible for the sidebands.

---

**Note**            The 600 MHz drive signal should be  $-8 \text{ dBm} \pm 3.5 \text{ dB}$ . The 1st LO signal should be  $+16 \text{ dBm} \pm 2 \text{ dB}$ .

---

## No Output Power

The A2 requires power supplies, a 1st LO signal, and a 600 MHz drive signal in order to provide output power.

1. Check power supply voltages at A3J1 and A2J1. Refer to the A3 interface assembly schematic diagram in this chapter.
2. Check that ALC\_EXT measured at A3J1 pin 10 is a TTL low when the tracking generator is set to ALC INT and TTL high when the tracking generator is set to ALC EXT.
3. Check that the 600 MHz drive signal is  $-8 \text{ dBm} \pm 3.5 \text{ dB}$ . If the signal is outside this range, examine the A3 interface assembly.
4. Check that the LO INPUT signal measures  $+16 \text{ dBm} \pm 2 \text{ dB}$ . If not, perform the 1ST LO OUTPUT amplitude performance test for the host spectrum analyzer.
5. Check the tracking adjustment controls. Monitor A3U5 pin 8 with a DVM. Rotate the TRACKING ADJUST control from fully counterclockwise to fully clockwise. The voltage measured should increase from 0 V to  $>+8 \text{ V}$ .

---

**Caution** The following step requires adjustment of A2C3. The lifetime of A2C3 is rated for less than 10 cycles. Do not adjust A2C3 unless it is absolutely necessary.

---

6. If all the above checks are acceptable, then the tracking oscillator may be malfunctioning.
  - a. Set up the host spectrum analyzer as indicated in the tracking oscillator adjustment procedure (coarse adjustment) found in Chapter 5 of this manual.
  - b. Use a spectrum analyzer such as an HP 8566A/B in place of a frequency counter.
  - c. Try to adjust A2C3 until a signal is displayed on the HP 8566A/B.
  - d. If the tracking oscillator does not start by adjusting A2C3, suspect A2.

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