HEWLETT PACKARD

HP 85420E
HP 85460A
EMI Receiver Series

Service Guide

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What You'll Find in This Manual...

Chapter 1	• Introduction and descriptions
Chapter 2	• Making adjustments, manual and automated
Chapter 3	• Troubleshooting the RF Filter and diagnostics
Chapter 4	• Replacing major assemblies, removal and replacement procedures
Chapter 5	• Customer support, what to do if you have a problem
Chapter 6	• Assembly descriptions with reference designators
Chapter 7	• Major assembly and cable locations
Chapter 8	• Replaceable Parts
Chapter 9	• Service equipment and tools

Warranty

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Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For assistance, call your local Hewlett-Packard Sales and Service Office (refer to "Service and Support" on page vi).

Service and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local HP Service Center. You can find a list of HP Service Centers on the web at `http://www.hp.com/go/tmdir`.

If you do not have access to the Internet, one of these HP centers can direct you to your nearest HP representative:

United States:	Hewlett-Packard Company Test and Measurement Call Center PO Box 4026 Englewood, CO 80155-4026 (800) 452 4844 (toll-free in US)
Canada:	Hewlett-Packard Canada Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 (905) 206 4725
Europe:	Hewlett-Packard European Marketing Centre Postbox 999 1180 AZ Amstelveen The Netherlands (31 20) 547 9900
Japan:	Hewlett-Packard Ltd. Measurement Assistance Center 9-1, Takakura-Cho, Hachioji-Shi Tokyo 192, Japan (81) 426 56 7832 (81) 426 56 7840 (FAX)
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Safety and Regulatory Information

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument. This product has been designed and tested in accordance with international standards.

WARNING

The WARNING notice denotes a hazard. It calls attention to a procedure, practice, or the like, that, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

The **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

Instrument Markings

⚠	When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.
⚡	This symbol indicates hazardous voltages.
	The laser radiation symbol is marked on products that have a laser output.
~	This symbol indicates that the instrument requires alternating current (ac) input.
CE	The CE mark is a registered trademark of the European Community. If it is accompanied by a year, it indicates the year the design was proven.
	The CSA mark is a registered trademark of the Canadian Standards Association.
1SM1-A	This text indicates that the instrument is an Industrial Scientific and Medical Group 1 Class A product (CISPER 11, Clause 4).
I	This symbol indicates that the power line switch is ON.
⏻	This symbol indicates that the power line switch is OFF or in STANDBY position.

Safety Earth Ground ⏚

This is a Safety Class I product (provided with a protective earthing terminal). An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set. Whenever it is likely that the protection has been impaired, the product must be made inoperative and secured against any unintended operation.

Before Applying Power

Verify that the product is configured to match the available main power source as described in the input power configuration instructions in this manual. If this product is to be powered by autotransformer, make sure the common terminal is connected to the neutral (grounded) side of the ac power supply.

Typeface Conventions

Italics

- Used to emphasize important information:
  Use this software *only* with the HP xxxxxX system.
- Used for the title of a publication:
  Refer to the *HP xxxxxX System-Level User's Guide*.
- Used to indicate a variable:
  Type `LOAD BIN` *filename*.

`Instrument Display`

- Used to show on-screen prompts and messages that you will see on the display of an instrument:
  The HP xxxxxX will display the message **`CAL1 SAVED`**.

[Keycap]

- Used for labeled keys on the front panel of an instrument or on a computer keyboard:
  Press **[Return]**.

{Softkey}

- Used for simulated keys that appear on an instrument display:
  Press ***{Prior Menu}***.

`User Entry`

- Used to indicate text that you will enter using the computer keyboard; text shown in this typeface must be typed *exactly* as printed:
  Type `LOAD PARMFILE`
- Used for examples of programming code:
  `#endif // ifndef NO_CLASS`

`Path Name`

- Used for a subdirectory name or file path:
  Edit the file *`usr/local/bin/sample.txt`*

Computer Display

- Used to show messages, prompts, and window labels that appear on a computer monitor:
  The **Edit Parameters** window will appear on the screen.
- Used for menus, lists, dialog boxes, and button boxes on a computer monitor from which you make selections using the mouse or keyboard:
  Double-click **EXIT** to quit the program.

Typeface Conventions

Contents

9. Service Equipment and Tools

1 Introduction

The *HP 85420E/HP 85460A RF Filter Section Service Guide* provides the information needed to adjust and repair the HP 8542E/HP 8546A EMI receiver and HP 85420E/HP 85460A RF filter section to the assembly level.

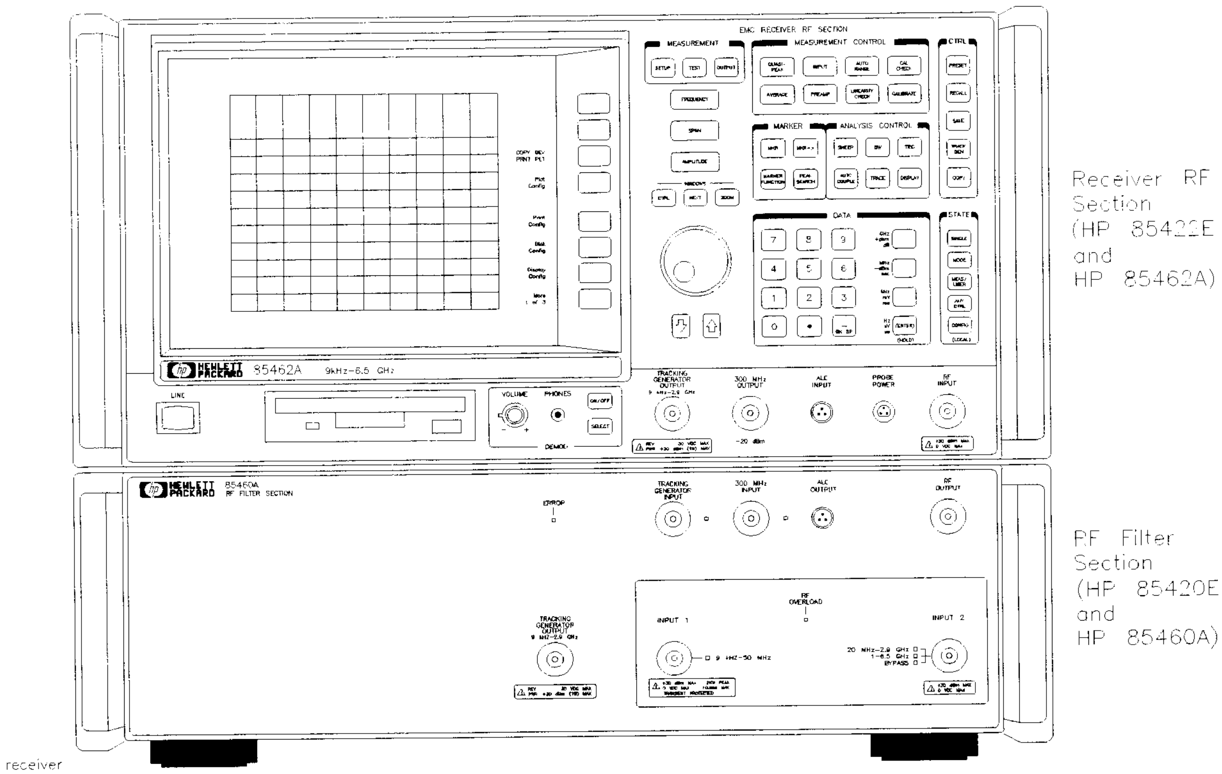


Figure 1-1 ***HP 8542E/HP 8546 EMI Receiver***
HP 85420E/HP 85460A RF Filter Section

Description

The HP 8542E/HP8546A EMI receiver provides measurement capabilities over the RF and Microwave frequency ranges.

The frequency ranges of the instruments are described below.

Table 1-1 ***HP 8542E/HP 8546A EMI Receiver***
HP 85420E/HP 85460A RF Filter Section Frequency Ranges

Instrument Model	Filter Section	Frequency Range
HP 8542E	HP 85420E	9 kHz to 2.9 GHz
HP 8546A	HP 85460A	9 kHz to 6.5 GHz

Further information about the EMI receiver and RF filter section, and additional features, is provided in the *HP 85462A/HP 85422E Receiver RF Section User's Guide.*

Firmware

Revision Date

When the instrument is first turned on, a display appears that contains the copyright date and firmware revision date. The first line of the display indicates if the instrument I/O is HP-IB or RS-232. Refer to the example below.

The version of firmware installed in the instrument is identified by the day, month, and year in the following format:

```
HP-IB ADRS: nn                          or RS232: nnnn
© Copyright HP 1986, 1989,1994
Rev 85462: yy.mm.dd 85640: yy.mm.dd   (if HP 8546A receiver)
                                        or
Rev 85433: yy.mm.dd 85420: yy.mm.dd   (if HP 8542E receiver)
```

Whenever you contact Hewlett-Packard about your instrument, be sure to provide the firmware date along with the complete serial number and option designation. This will ensure that you obtain accurate service information.

Firmware Upgrade Kit Ordering Information

There are occasions when the factory revises the instrument firmware to correct defects or make performance improvements. When a firmware revision is needed a service note is distributed by the factory to all Hewlett-Packard service centers. The service note identifies, by serial-number prefix, the instruments that require the latest firmware upgrade kit.

If your instrument requires a firmware upgrade kit, it can be obtained by contacting the nearest Hewlett-Packard Sales and Service office. Refer to the front matter for a list of Hewlett-Packard Sales and Service offices.

Safety Considerations

Before servicing the instrument, familiarize yourself with the safety markings on the instrument and the safety instructions in this manual. This instrument has been manufactured and tested according to international safety standards. To ensure safe operation of the instrument and the personal safety of the user and service personnel, the cautions and warnings in this manual must be heeded.

Refer to the summary of safety considerations at the front of this guide. Individual chapters also contain detailed safety notation.

WARNING

Failure to ground the instrument properly can result in personal injury, as well as instrument damage.

Before turning on the instrument, connect a three-wire power cable with a standard IEC 320-C13 (CEE 22-V) inlet plug to the instrument power receptacle. The power cable outlet plug must be inserted into a power-line outlet socket that has a protective earth-contact.*DO NOT* defeat the earth-grounding protection by using an extension cable, power cable, or autotransformer without a protective ground conductor.

If you are using an autotransformer, make sure its common terminal is connected to the protective ground conductor of its power-source outlet socket.

Reliability Considerations

Instrument Input Protection

The input circuitry can be damaged by power levels that exceed the maximum safe input-level specifications. Table 1-2 on page 1-5 provides the input specifications. To prevent input damage, these specified levels for your instrument must not be exceeded.

The input can also be damaged by large transients. If it is likely that your instrument will be exposed to potentially damaging transients, take whatever precautions are necessary to protect its input circuitry. The HP 85420E/HP 85460A RF filter section input can easily be protected by disconnecting it from the signal source whenever it is likely that large transients will be present.

CAUTION

Transients are often produced during electromagnetic interference (EMI) conducted emissions testing. One type of device, the line impedance stabilization network (LISN), can produce large transients when its switch position or voltage input is changed.

INPUT 1 of the HP 85420E/HP 85460A RF filter section is protected by the A3 RF Attenuator Board Assembly, which provides 0 to 54 dB of attenuation to the low frequency path. The A3 RF Attenuator Board Assembly, has a spark-gap limiter to absorb the energy of transients that exceed 90 volts. It also has a 90 MHz low-pass filter. This circuitry help to protect the RF filter section from damage.

INPUT 2 of the RF filter section is protected by the C1 DC BLOCK and the A2 50 dB Attenuator. C1 DC BLOCK is a blocking capacitor that protects INPUT 2 path from low-frequency dc current. A2 is a 0 to 50 dB attenuator that attenuates signals that pass through C1. Refer to the "RF filter section block diagram in Chapter 6" for additional information.

Table 1-2 Maximum Safe Input Levels for HP 85420E/HP 85460A RF Filter Section

Input	HP 85420E/HP 85460A Input 1	HP 85420E/HP 85460A Input 2
Average Continuous Power	+ 30 dBm	+ 30 dBm
Peak Pulse Power	2000 W Peak for 10 μs > 20 dB input attenuation	100 W for < 10 μs pulse width <1% duty cycle and > 30 dB input attenuation
dc (Volts)	0V	0V

Protection from Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. Figure 1-2 shows an example of a static-safe work station using two types of ESD protection:

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 M Ω of isolation from ground. Refer to Chapter 9 for information on ordering static-safe accessories.

WARNING **These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.**

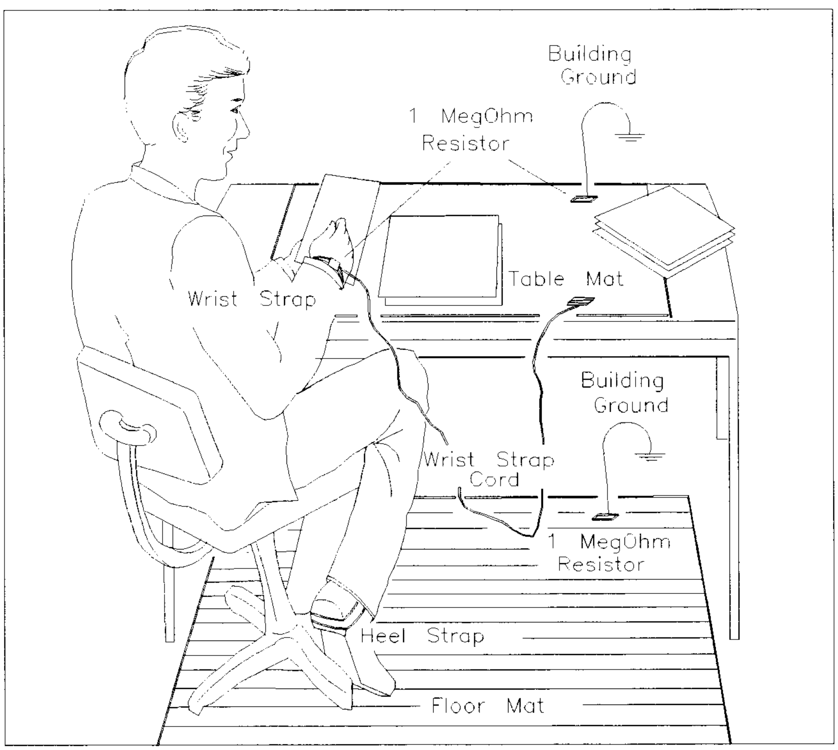


Figure 1-2 Example of a Static-Safe Work Station

Handling of Electronic Components and ESD

The possibility of unseen damage caused by ESD, is present whenever components are transported, stored, or used. The risk of ESD damage can be greatly reduced by close attention to how all components are handled.

- Perform work on all components at a static-safe work station.
- Keep static-generating materials at least one meter away from all components.
- Store or transport components in static-shielding containers.

CAUTION Always handle printed circuit board assemblies by the edges. This will reduce the possibility of ESD damage to components and prevent contamination of exposed plating.

Test Equipment Usage and ESD

- Before connecting any coaxial cable to an instrument connector for the first time each day, momentarily short the center and outer conductors of the cable together.
- Personnel should be grounded with a 1 M Ω resistor-isolated wrist-strap before touching any instrument connector and before removing any assembly from the instrument.
- Be sure that all instruments are properly earth-grounded to prevent build-up of static charge.

For Additional Information about ESD

For more information about preventing ESD damage, contact the Electrical Overstress/Electrostatic Discharge (EOS/ESD) Association, Inc. The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

2 Making Adjustments

Some adjustments require access to the interior of the instrument.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

NOTE

The service bus is used for troubleshooting, all adjustments, and some performance tests. It is not used during normal operation of the RF filter section.

Commands within parenthesis after a softkey, for example (ON), are used throughout this chapter to indicate the part of a softkey that should be underlined when the key is pressed.

Although most of the RF filter section adjustments are automated, there is one manual adjustment. Refer to Table 2-1 on page 2-2 for a list of adjustments and an indication as to whether the adjustment is automated or manual. Each of these adjustments are described later in this chapter.

Table 2-1 Table of Manual and Automated Adjustment Procedures

Name of Adjustment Procedure	Manual Procedure	Automated Procedure
Initial Setup		✔
Tracking A/D Gain Adjustment	✔	
Low Frequency Alignment, Input 1		✔
High Frequency Alignment, Input 2		✔
Very Low Frequency Alignment, Input 1		✔
RF Overload Calibration, Input 1		✔
RF Overload Calibration, Input2		✔
Low Frequency Calibration, Input 1		✔
High Frequency Calibration, Input 2		✔
Very High Frequency Calibration, Input 2		✔
Test Utilities		✔

Safety

Familiarize yourself with the safety symbols marked on the instrument and read the symbol definitions given in the front of this guide *before* you begin the procedures in this chapter. Refer to "General Safety Considerations" at the front of this manual for general *WARNINGS* and *CAUTIONS* related to safety considerations. *WARNINGS* and *CAUTIONS* related to specific procedures are included with the procedure.

Before You Start

There are three things you should do before starting an adjustment procedure:

- Check that you are familiar with the safety symbols marked on the instrument, and read the general safety instructions and the symbol definitions given in the front of this manual.
- Check that the instrument has been turned on and allowed to warm up for at least 45 minutes at room temperature before making any adjustments. The instrument *must* be allowed to stand at room temperature at least 2 hours prior to the 45 minute warm-up.
- Read the rest of this section.

Test Equipment You Will Need

Refer to "Chapter 9" for a list of recommended equipment for the instrument adjustments. Any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

If There Are Abnormal Indications During Adjustment

If the indications received during an adjustment do not agree with the normal conditions given in the adjustment procedures, a fault exists in your instrument. The fault should be repaired *before* proceeding with any further adjustments. Refer to the troubleshooting and repair information in "Chapter 3" of this guide.

Periodically Verifying Calibration

The instrument requires periodic verification of operation. Under most conditions of use, you should test the instrument at least once a year with the complete set of performance verification tests.

When test results show proper operation and calibration, no adjustments are necessary. However, if test results indicate that the instrument does not meet specifications, the cause should be determined and rectified. Refer to the troubleshooting information in "Chapter 3" before attempting recalibration.

Standard-value Replacement Components

Part numbers for standard-value replacement components used in the adjustment procedures are located in "Chapter 8"of this service guide.

If You Replace Or Repair An Assembly

If one or more assemblies has been replaced or repaired, related adjustment procedures should be done prior to verifying operation. Refer to Table 2-2 on page 2-9 to determine which adjustment to perform after replacing or repairing an assembly. Find the assembly that has been repaired or replaced in the left-hand column. Then perform the adjustments marked across the adjustment column for that assembly. It is important that adjustments are performed in the order indicated to ensure that the instrument meets all of its specifications.

Tracking A/D Gain Adjustment

NOTE

This is a manual adjustment.

The RF filter section tracking must be performed before performing any filter adjustments or running any troubleshooting diagnostic. The Tracking A/D Gain adjustment ensures that the filter adjustments or the troubleshooting diagnostic results are correct.

NOTE

The tracking and gain voltages are also used as reference voltages for the HP 85420E/HP 85460A RF filter section troubleshooting diagnostics.

Allow 45 minutes warm-up time for the HP 85420E/HP 85460A RF filter section before beginning the adjustment procedure.

Equipment Required

- Digital voltmeter (DVM)
- DVM test leads

Procedure

1. Remove the power cord.
2. Remove the instrument cover from the RF filter section.
3. Set the address switches on the rear panel to the test position. Refer to Figure 4.
4. Plug in the power cord. Push the square service power switch in.

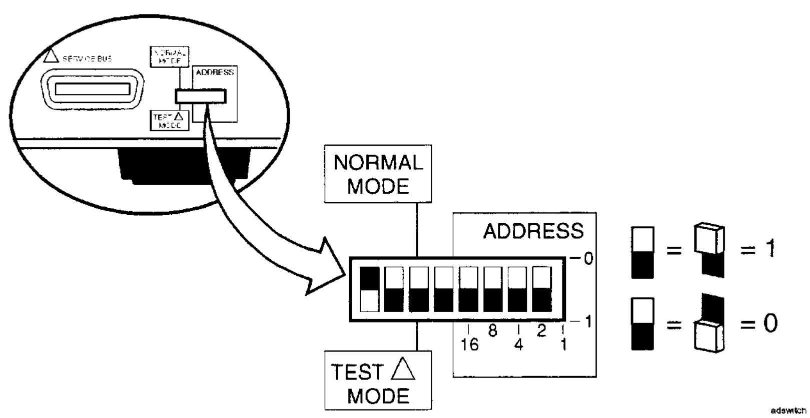


Figure 2-1 Service Power Switch

5. Connect the DVM as listed below. Refer to Figure 2-2.

- Positive (+) test lead to A12TP8
- Negative (–) test lead to TP1 or to chassis ground

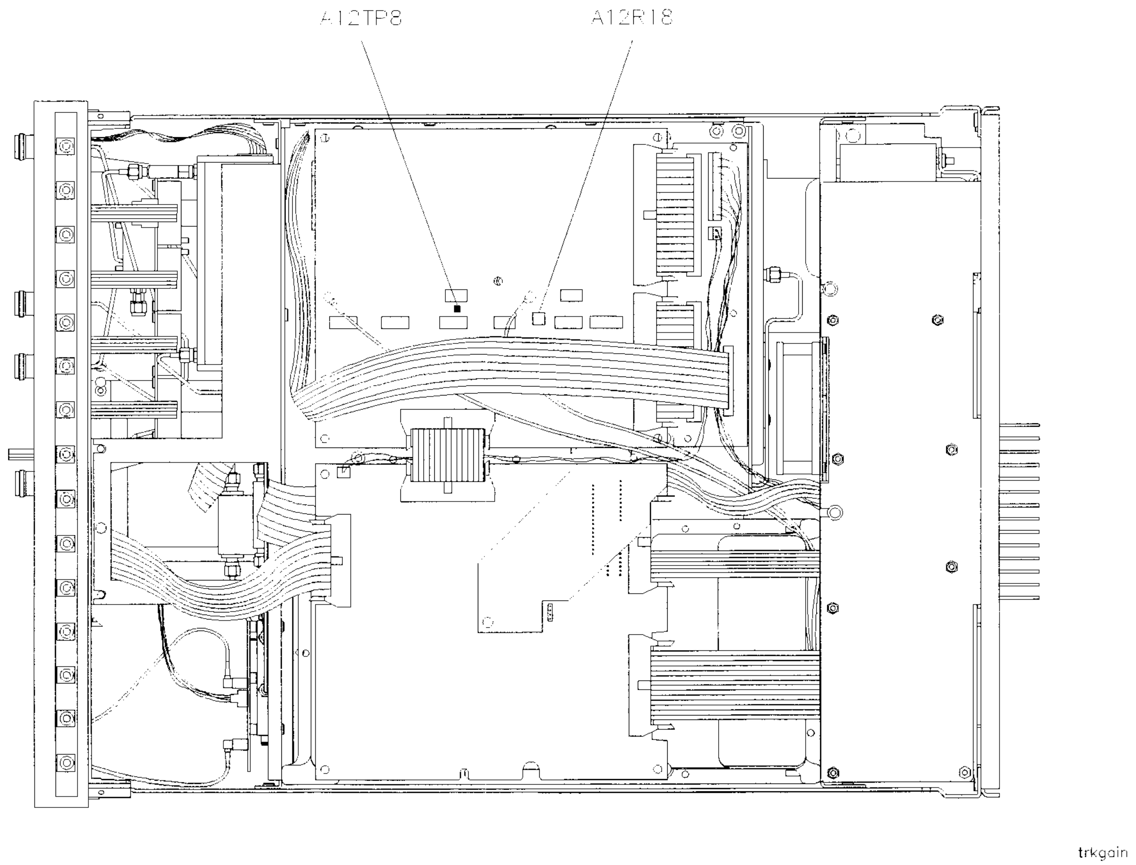


Figure 2-2 Tracking A/D Gain Adjustment Setup

6. Adjust A12R18 for +11.353 V.

7. Remove the DVM leads.

Preparing for Automated Tests

Setting Up the RF Filter Section

You must set up the RF filter section prior to performing the adjustments. The following items should be checked on the RF filter section before starting the adjustment procedure:

- Set the EEROM jumpers to the write-enable position.
- Set the HP-IB address to 19.
- Connect HP-IB cables between the RF filter section, the receiver RF section, the computer, and the test equipment.

Set the EEROM "write-enable, write-protect" jumpers.

Before performing any of the filter adjustments, verify that the "write-enable, write-protect" jumpers are in the write-enable position. Setting the jumpers on the A11 to their foremost position allows new data, generated by the filter adjustments, to be stored in EEROM.

To Set the Jumpers To Write-enable Position

1. Set both jumpers on the A11 processor board to their foremost position (refer to Figure 2-3 on page 2-7).
2. Replace the cover and perform the filter adjustments.

NOTE

After all computer controlled adjustments in this procedure are completed, set the jumpers back to the write-protect position; refer to Figure 2-3.

CAUTION

To prevent instrument damage: when connecting the receiver and filter sections to each other it is important that both the receiver and filter sections have their power off, and that the square Service Power Switch on the rear panel of the filter sections is not pushed in.

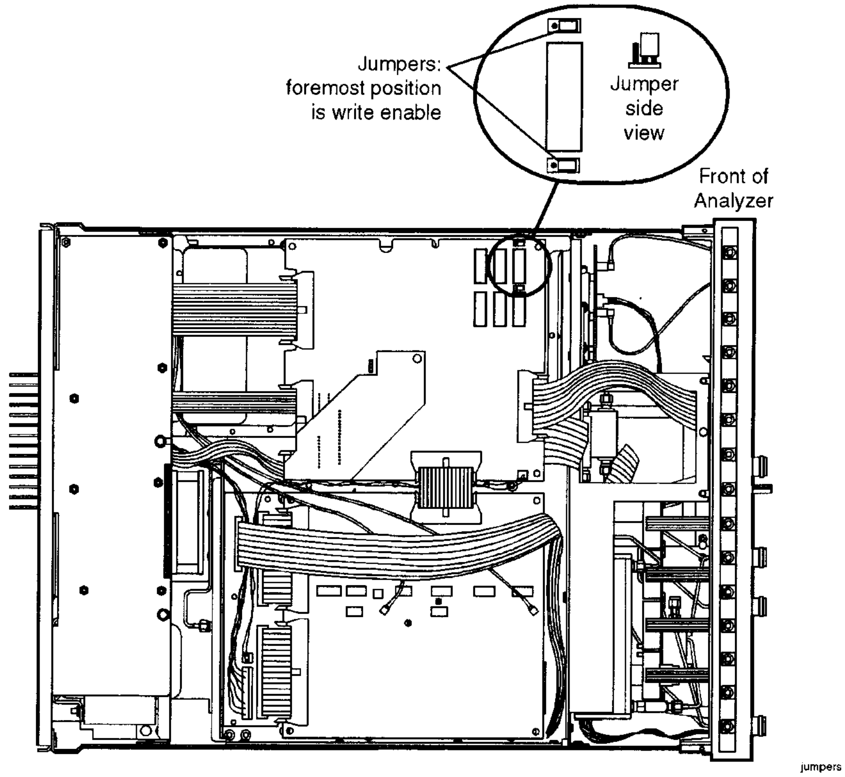


Figure 2-3 RF Filter Section EEROM Jumpers

Set the RF Filter Section To an HP-IB Address

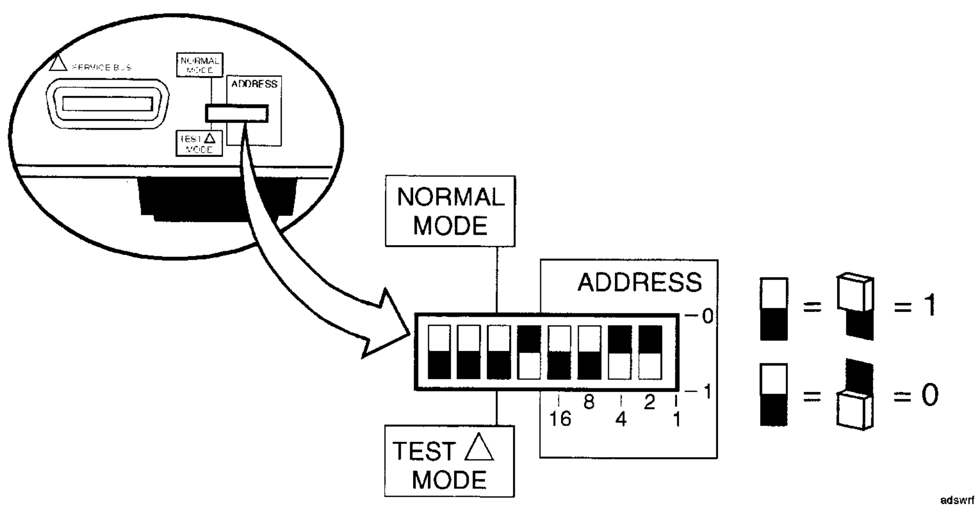


Figure 2-4 Address Switch Settings for RF Filter Section In the Normal Operating Mode (Address Switch Set to 19)

Connect HP-IB CAbles Between the RF Filter Section and Other Equipment

After the RF filter section has been set to address 19, an HP-IB cable must be connected to the SERVICE BUS connection on the RF filter section. Prior to performing automated adjustments, connect additional HP-IB cables as follows:

- The RF filter section SERVICE BUS connection
- The receiver RF section
- The computer
- All test equipment

See Figure 2-5 for more information.

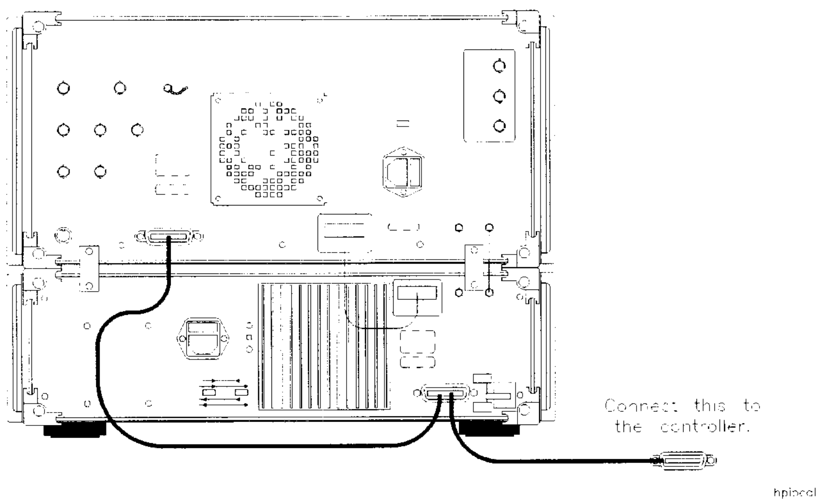


Figure 2-5 RF Filter Section HP-IB Cabling

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A1 Front Panel Assembly	High Frequency Alignment, Input2 Very High Frequency Calibration, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2
A1A1 Interconnect Board Assembly	Tracking A/D Gain Adjustment Very Low Frequency Alignment, Input Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
1A2 6 dB Power Splitterr	Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1
A1A3 Detector	Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2	Absolute Amplitude Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1
A2 Attenuator, 50 dB	High Frequency Alignment, Input 2 Very High Frequency Calibration, Input 2	Input VSWR: Input 2 (0 dB) Input VSWR: Input 2 (10 dB) Swept Attenuator Accuracy 20 MHz-200 MHz Swept Attenuator Accuracy 200 MHz-2.9 GHz Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Residual Responses Input 2 Displayed Average Noise Input 2
A3 RF Attenuator Board Assembly	Low Frequency Alignment, Input 1 Very Low Frequency Alignment, Input 1	VSWR: Input 1 (0 dB) VSWR: Input 1 (10 dB) Swept Attenuator Accuracy 9 kHz-500 kHz Swept Attenuator Accuracy 500 kHz-50 MHz Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies (Continued)

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A4 Fixed Bandpass Filter Board Assembly	Low Frequency Alignment, Input 1 Very Low Frequency Alignment, Input 1	Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1
A5 LF Filter / Amplifier	Low Frequency Alignment, Input 1 Very Low Frequency Alignment, Input 1	Absolute Amplitude at Cal Points Input 1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1
A6 RF Amplifier Board Assembly	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A7 LF Motherboard Assembly	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies (Continued)

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A8 Low Frequency Tunable Filters Assembly	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A9 High Frequency Filters Board Assembly	High Frequency Alignment, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Residual Responses Input 2 Displayed Average Noise Input 2
A10 Main Motherboard Assembly	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Calibration, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A11 Processor Board Assembly	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Serial/Model number (Test Utilities) Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2 Calibration Date (Test Utilities)
A11A1 9-pin Bus Board Assembly		RF Overload Power Input 1 RF Overload Power Input 2

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies (Continued)

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A12 DAC Board Assembly	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A13 Rear Panel Assembly	High Frequency Alignment, Input 2 Very Low Frequency Calibration, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 RF Overload Power Input 2
A13A1 Power Supply Board Assembly	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A13T1 Transformer	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies (Continued)

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A13FL1 Line Module	Tracking A/D Gain Adjustment Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A14 Amplifier Variable (AmpVar) Assembly	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A14A1	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 1 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2 RF Overload, Input 1 RF Overload, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A15 YIG-Tuned Filter (YTF)	High Frequency Alignment, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Residual Responses Input 2 Displayed Average Noise Input 2

Table 2-2 Adjustments and Tests for Replaced or Repaired Assemblies (Continued)

Replaced or Repaired Assembly	Related Adjustments and Adjustment Routines	Related Performance Verification Tests
A16 Filter, High Pass	High Frequency Alignment, Input 2 Very High Frequency Calibration, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Residual Responses Input 2 Displayed Average Noise Input 2
A19 Coax Switch	Low Frequency Alignment, Input 1 High Frequency Alignment, Input 2 Very Low Frequency Alignment, Input 1 Low Frequency Calibration, Input 2 High Frequency Calibration, Input 2 Very High Frequency Calibration, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 RF Overload Power Input 1 RF Overload Power Input 2 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2
A23 SPT2 11 dB dc 4.2 GHz	Low Frequency Calibration, Input 2 High Frequency Calibration, Input 2	Absolute Amplitude at Cal Points Input 2 Absolute Amplitude using TG Input 2 Absolute Amplitude Input 2 Absolute Amplitude at Cal Points Input1 Absolute Amplitude using TG Input 1 Absolute Amplitude Input 1 Displayed Average Noise LF Input 1 Displayed Average Noise Input 1 Residual Responses LF Input 1 Residual Responses Input 1 Residual Responses Input 2 Displayed Average Noise Input 2

Automated Adjustments

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in each test's setup illustration.
- The HP-IB cables must be connected.
- The test equipment must be powered on.
- The "Initial Setup" test must be run prior to running any other test independently.

Each of the automated tests has several screens with the choices listed and defined in the following table.

PROCEED	Returns to the alignment procedure.
TROUBLESHOOT	Allows the user local control of the RF filter section to troubleshoot specific problems. (see note below.)
ABORT	Aborts the test and returns to the test list and updates the status of the test to "ABORT".

NOTE

Before selecting **PROCEED**, after having selected **TROUBLESHOOT**, return the settings to the state that they were in before you selected **TROUBLESHOOT**.

Filter Adjustment Theory

The filter adjustments consist of the following three adjustments:

- Low Frequency Alignment, Input 1
- High Frequency Alignment, Input 2
- Very Low Frequency Alignment, Input 1

NOTE

Some or all three filter adjustment procedures should be performed when any assemblies that require filter adjustments being performed have been removed or replaced. Refer to Table 2-2 on page 2-9 for a list of assemblies and the adjustments and performance tests required for each.

The filter adjustment procedures tune the bandpass filters of the RF filter section automatically and store the resultant Digital-to-Analog Converter (DAC) data in the Electrically Erasable Read-Only Memory (EEROM).

Filter Paths

The RF filter section contains 25 separate filter paths. Each filter path is adjusted at a set number of data points as shown in Table 2-3 on page 2-17. Of the 25 separate filter paths:

- 11 paths are varactor-tuned (paths 8, 9, 11, 12, 14, 15, 17, 18, 20, 21, and 22).
- 6 paths are fixed-tuned (paths 1 through 6).
- 6 paths are through-paths (paths 7, 10, 13, 16, 19, 23).
- 1 path is YIG-tuned (path 24).
- 1 path is high-pass fix-tuned (path 25).
- Refer to Table 2-3 for a detailed listing of all 25 paths.

DAC 1, DAC 2, and DAC 3, are used to align each pole of the varactor-tuned filters. DAC 4 is used to adjust the gain of the amplifier for a particular filter point and DAC 5 is used to adjust the gain of a corresponding through-path data point. In the YIG-tuned filter path (path 24) and the high-pass fixed-tuned filter path (path 25), DAC 1,DAC 2, and DAC 5 are used to offset the gain between the points.

Nominal Gain Through the RF Filter Section Is:

- 15 dB with the preamplifier turned off.
- 27 dB with the pre-amplifier turned on and the attenuation set to 0 dB.

Pre-amplifier off and on settings share the same DAC 1, DAC 2, and DAC 3 for the varactor-tuned filters. In the YIG-tuned path (path 24), the pre-amplifier off and on settings share DAC 3.

Table 2-3 RF Filter Section Filter Paths

Path Number	Start Frequency (MHz)	Stop Frequency (MHz)	Data Points	Frequency Stepping
1	0.0090	0.0745	0 to 1	2^{16}
2	0.0180	0.0835	2 to 3	2^{16}
3	0.074	0.2051	4 to 6	2^{16}
4	0.1975	0.5252	7 to 12	2^{16}
5	0.525	1.0493	13 to 17	2^{17}
6	1.025	2.0736	18 to 22	2^{18}
7	0	2.0736	0 to 22	see[1]
8	1.96	5.8922	23 to 38	2^{18}
9	5.83	17.3643	39 to 50	2^{20}
10	1.96	17.3643	23 to 50	see[1]
11	17.33	28.8643	51 to 62	2^{20}
12	28.73	51.7987	63 to 74	2^{21}
13	17.33	51.7987	51 to 74	see[1]
14	17.33	28.8643	75 to 86	2^{20}
15	28.73	51.7987	87 to 98	2^{21}
16	17.33	51.7987	75 to 98	see[1]
17	51.73	97.8673	99 to 110	2^{22}
18	97.83	125.356	111 to 124	2^{22}
19	51.73	152.356	99 to 124	see[1]
20	152.33	219.4389	125 to 133	2^{23}
21	216.33	333.7705	134 to 148	2^{23}
22	332.23	500.0022	149 to 169	2^{23}
23	152.33	500.0022	125 to 169	see[1]
24	500.0	1003.3165	170 to 185	2^{25}
25	1003.3	2949.4735	186 to 215	2^{26}

1. The through-path frequency stepping is determined by the frequency stepping of the corresponding filter path for which the through-path covers.

Low Frequency Alignment, Input 1

NOTE This is an automated adjustment.

This adjustment adjusts the varactor-tuned filters gain and bandpass response (paths 8, 9, 11, and 12) as well as the through-path gains (paths 10 and 13). The adjustment consists of selecting the values for Tune-DAC 1, Tune-DAC 2 and Tune-DAC 3, to set the bandpass shape and selecting the values for Gain-DAC 4, and through-path Gain-DAC 5 to set the preselector gain at 67 reference frequency points. Gain-DAC 4 and Gain-DAC 5 are set for both Preamp Off and Preamp On settings.

First, amplitude reference values are obtained using the network analyzer at the predetermined reference frequency points for Input 1. Next, the RF filter section is inserted in the signal path and the filters are adjusted at each reference frequency point. The three Tune-DAC values for proper bandpass shape and centering at each reference frequency are determined. Finally, the Gain-DAC values are determined for15 dB for Preamp Off and 27 dB for Preamp On with 0 dB attenuation in the filter-paths and through-paths at each frequency reference point.

The data is stored in the preselector EEROM after each path has been adjusted. The data is stored on the data disk after all the paths for Input 1 have been adjusted.

Equipment Required

- Network analyzer
- S-parameter test set
- Open, short, and 50 Ω load
- Adapter, Type N (m) to APC-3.5 (f) (*two required*)
- RF cable (*two required*)
- 10-dB attenuator pad

Approximate test time: 1 hour 45 minutes.

NOTE

The HP 85422E/HP 85462A should be turned off and the line service switch on the rear panel of the RF filter section should be depressed for power on conditions.

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-6 on page 2-21.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select the Low Frequency Alignment, Input 1 from the test list.
2. If the network analyzer has been calibrated by software before the test was started, a prompt to recalibrate or skip calibration is displayed. Choose **RE-CAL** and follow the network analyzer calibration steps beginning in step 3. If you do not want to perform the calibration, choose **SKIP CAL** and proceed to the Low Frequency Alignment steps beginning in step 8.

Network Analyzer Calibration

3. When the following screen is displayed, make the connections described and choose: **PROCEED.**

> **Low Frequency Alignment, Input 1 NORMALIZATION: Two type-N cables + 10 dB pad.**
>
> **Connect a type-N cable to PORT 1 of the HP 85047A.**
>
> **Connect a10 dB pad to Channel B of the HP 8753B.**
>
> **Connect a second type-N cable to the 10 dB pad connected to the HP 8753B. Using a type-N barrel, connect the end of this cable to the unconnected end of the cable attached to PORT 1 of the HP 85047A.**

4. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 1 S11 CALIBRATION: OPEN**
>
> **Remove the Type-N barrel connecting the tow Type-N cables.**
>
> **Connect the Calibration Kit Type-N OPEN to the unconnected end of the Type-N cable that is attached to the HP 85047A.**

5. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 1 S11 CALIBRATION: SHORT**
>
> **Disconnect the OPEN from the Type-N cable.**
>
> **Connect the Calibration Kit Type-N SHORT to the unconnected end of the Type-N cable that is attached to the HP 85047A.**

6. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 1 S11 CALIBRATION: LOAD**
>
> **Disconnect the SHORT from the Type-N cable.**
>
> **Connect the Calibration Kit 50-ohm LOAD to the unconnected end of the Type-N cable that is attached to the HP 85047A.**

7. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 1 S11 CALIBRATION: END**
>
> **Remove the Calibration Kit 50-ohm LOAD from the Type-N cable that is attached to the HP 85047A.**

8. When the following screen is displayed, make the connections described and choose: **PROCEED**

Figure 2-6 on page 2-21 shows the adjustment setup.

> **Low Frequency Alignment, Input 1**
>
> **Connect the Type-N cable attached to PORT 1 of the HP 85047A to INPUT 1 of the HP 85460A.**
>
> **Connect the cable attached to the 10 dB pad connected to Channel B of the HP 8753B to the RF OUT port of the HP 85460A.**

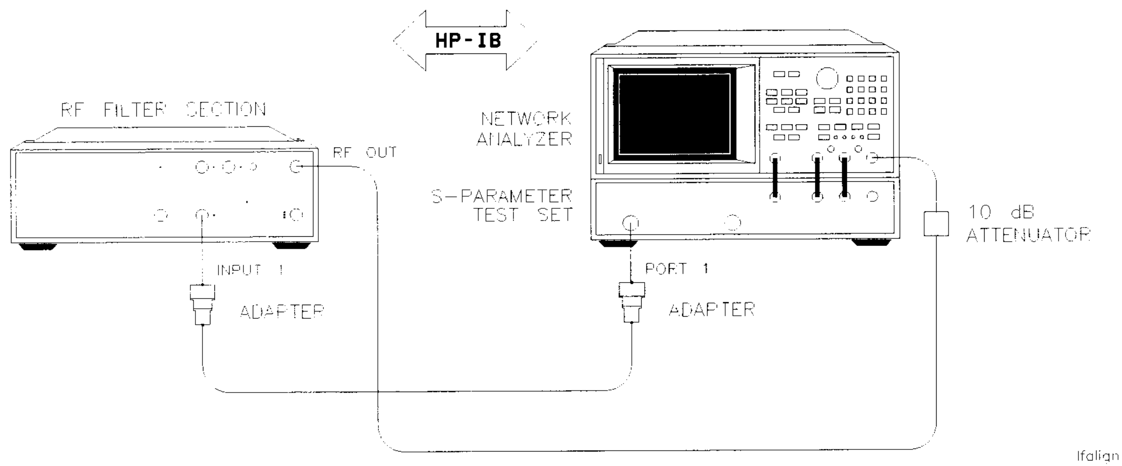


Figure 2-6 Low Frequency Alignment, Input 1 Setup

An example of the display for each path is shown below.

```
Frequency: 1.96 MHz
# of times thru adjust: 6
Data point = 23, 3 dB BW = 388 kHz
DACs= 398 433 348 1831
Return Loss = 4.69 Center Ratio = 1.12 Center Shift = 0
Elapsed time (minutes) = 6.31
```

NOTE During this test it is normal to see the overload light flicker as the gain DAC values are being adjusted.

High Frequency Alignment, Input 2

NOTE This is an automated adjustment.

The High Frequency Alignment, Input 2 adjusts the varactor-tuned filters, gain, and bandpass response (paths 14, 15, 17, 18, 20, 21, and 22), the through-path gains (paths 16, 19, and 23), and the YIG filter (path 24) gain and tuning, and the highpass filter (path 25) gain.

For the varactor-tuned filters, the adjustment consists of selecting the values for Tune-DAC 1,Tune-DAC 2, and Tune-DAC 3 to set the bandpass shape and selecting the values for Gain-DAC 4 and through-path Gain-DAC 5 to set the preselector gain at 95 reference frequency points. Gain-DAC and Gain-DAC 5 are set for both preamp off and preamp on settings.

First amplitude reference values are obtained using an HP 8753A/B/C network analyzer at the predetermined reference frequency points for Input 2. Next the RF filter section is inserted in the signal path and the filters are adjusted at each reference frequency point. At each reference frequency, the three Tune-DAC values for proper bandpass shape and centering are determined, and the Gain-DAC 4 values are determined for 0 dB gain. In the through-paths, only Gain-DAC 5 values for 0 dB gain is determined at each frequency reference point. Gain with 0 dB attenuation needs to be 15 dB for preamp off and 27 dB for preamp on.

In the YIG filter path, the bandpass shape is not adjustable and there is no corresponding through-path. Tune-DAC 3 tunes the center frequency of the filter and Gain-DAC 4 sets the gain at the reference frequency points. In the highpass filter path (path 25), there is no bandpass tuning and there is no corresponding through-path. Gain-DAC 4 sets the gain at the reference frequency points. Tune-DAC 3 is not used. The flatness of the YIG filter path (path 24) and the highpass filter path (path 25) are enhanced by adding an additional three gain offset points between each of the reference frequency points. These offset DAC values are stored in the Tune-DAC 1, Tune-DAC 2, and Gain-DAC 5 positions. Refer to Table 2-4 on page 2-23.

Table 2-4 Example of Gain-Offset Points

Point	Tune-DAC 1	Tune-DAC 2	Tune-DAC 3	Gain-DAC 4	Gain-DAC 5
170	−10	−2	870	1024	+5
171	−2	+4	890	1040	−3
.	.	.	.		
.	.	.	.		
	.	.	.		
185	+6	−3	2800	1080	21331
186	+2	+3	Not Used	2155	+2
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
215	+5	+7	Not Used	3100	21331

During normal operation, the actual gain-DAC value at these intermediate points is determined by adding the gain offset DAC value to the Gain-DAC 4 value.

For example using Table 2-4, to determine the first intermediate gain-DAC value between frequency point numbers 170 and 171, add the value stored in the Tune-DAC 1 position to the point 170 Gain-DAC 4 value. In this example, add 1024 to −10 (1024 + (−10) = 1014). The second intermediate gain-DAC value is determined by adding the point 170 Tune-DAC 2 value to the point 170 Gain-DAC 4 value (1024 + (−2) = 1022). The third intermediate gain offset DAC value is determined by adding the Gain-DAC 5 value to the next points Gain-DAC 4 value. So in this case, point 170 Gain-DAC 5 is added to point 171 Gain-DAC 4 to determine the third intermediate gain offset DAC value (1040 + 5 = 1045).

In normal operation, as the RF filter section sweeps, the RF filter section firmware interpolates between the stored reference Tune-DAC and Gain-DAC values to set the Tune-DACs and Gain-DAC. The reference Gain-DAC values used by the firmware to calculate the Gain-DAC settings as the filter tunes from point 170 through 171 in the example in Table 2-4 are:

Point	Gain-DAC
170	1024 1014 1022 1045
171	1040 1038 1044 .
172	. .

To determine the Tune-DAC and Gain-DAC values for the YIG filter (path 24), first amplitude reference values are obtained using a network analyzer at the predetermined reference frequency points for path 24 (including the intermediate gain offset points). Next, the RF filter section is inserted in the signal path and the YIG filter is tuned to each reference frequency point. At each of the 45 main reference frequency points, the Tune-DAC value required to center the YIG filter and the Gain-DAC value required for 0 dB gain are determined and stored. At the intermediate gain offset points, only the Gain-DAC offset value is determined and stored.

To determine the Gain-DAC values for the highpass filter (path 25), first amplitude reference values are obtained using a network analyzer at the predetermined reference frequency points for path 25 (including the intermediate gain offset points). Next, the RF filter section is inserted in the signal path and the YIG filter is tuned to each reference frequency point. At each of the main reference frequency points, the Gain-DAC value required for 0 dB gain are determined and stored. At the intermediate gain offset points, only the Gain-DAC offset value is determined and stored.

The data is stored in the preselector EEROM after each path has been adjusted. The data is stored on the data disk after all the paths for Input 2 have been adjusted.

Equipment Required

- Network analyzer
- S-parameter test set
- Open, short, and 50 Ω load
- Adapter, Type N (m) to APC-3.5 (f) (two required)
- RF cable (two required)
- 10-dB attenuator pad

Approximate test time: 3 hours 40 minutes.

NOTE

The receiver RF section should be turned off and the line service switch on the rear panel of the RF filter section should be depressed for power on conditions.

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-7 on page 2-27.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select the High Frequency Alignment, Input 2 from the test list.
2. If the network analyzer calibration was performed prior to beginning this test, a prompt to recalibrate or skip calibration is displayed. Choose **RE-CAL** and follow the Network Analyzer Calibration steps beginning in step 3. If you do not need to perform the calibration, choose **SKIP CAL** and proceed to the High Frequency Alignment steps beginning in step 8.

Network Analyzer Calibration

3. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 2 NORMALIZATION: Two Type-N cables + 10 dB Pad**
>
> **Connect a Type-N cable to PORT 1 of the HP 85047A.**
>
> **Connect a 10 dB pad to Channel B of the HP 8753B.**
>
> **Connect a second Type-N cable to the 10 dB pad connected to the HP 8753B. Using a Type-N barrel, connect the end of this cable to the unconnected end of the cable attached to PORT 1 of the HP 85047A.**

4. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 2 S11 CALIBRATION: OPEN**
>
> **Remove the Type-N barrel connecting the two Type-N cables.**
>
> **Connect the Calibration Kit Type-N OPEN to the unconnected end to the Type-N cable attached to the HP 85047A**

5. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 2 S11 CALIBRATION: SHORT**
>
> **Disconnect the OPEN from the Type-N cable.**
>
> **Connect the Calibration Kit Type-N SHORT to the unconnected end to the Type-N cable attached to the HP 85047A.**

6. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 2 S11 CALIBRATION: LOAD**
>
> **Disconnect the SHORT from the Type-N cable.**
>
> **Connect the Calibration Kit 50 W LOAD to the unconnected end to the Type-N cable attached to the HP 85047A.**

7. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Low Frequency Alignment, Input 2 S11 CALIBRATION: END**
>
> **Remove the Calibration Kit 50-ohm LOAD from the Type-N cable attached to the HP 85047A.**

8. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **High Frequency Alignment, Input 2**
>
> **Connect the Type-N cable attached to PORT 1 of the HP 85047A to INPUT 2 of the HP 85460A.**
>
> **Connect the cable attached to the 10 dB pad connected to Channel B of the HP 8753B to the RF OUT port of the HP 85460A.**

Figure 2-7 on page 2-27 shows the adjustment setup.

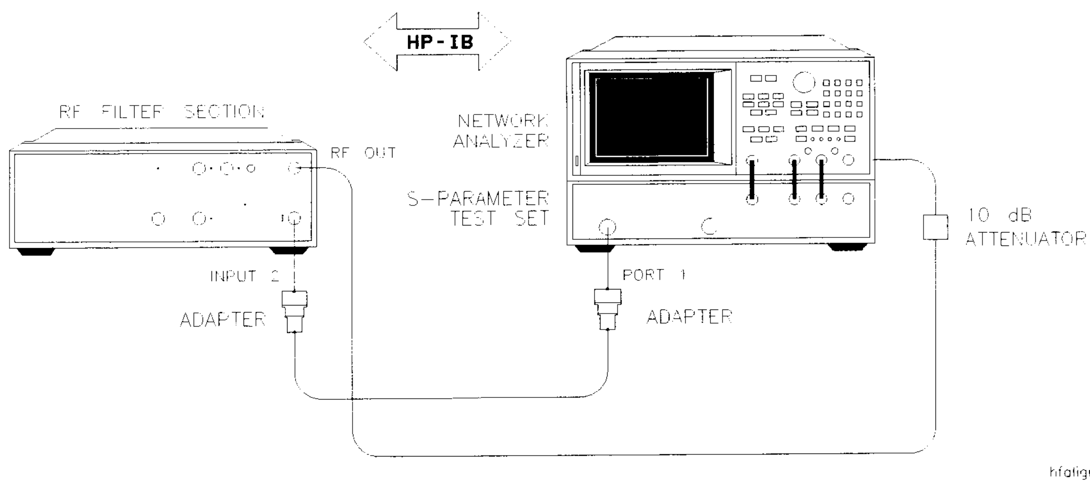


Figure 2-7 High Frequency Alignment, Input 2 Setup

An example of the display for each path is shown below.

`Frequency: 1.96 MHz`

`# of times thru adjust: 6`

`Data point = 23, 3 dB BW = 388 kHz`

`DACs= 398 433 348 1617`

`PREAMP DACE = 398 348 1831`

`Return Loss = 4.69 Center Ratio = 1.12 Center Shift = 0`

`Elapsed time (minutes) = 6.31`

NOTE During this test it is normal to see the overload light flicker as the gain DAC values are being adjusted.

Very Low Frequency Alignment, Input 1

NOTE This is an automated adjustment.

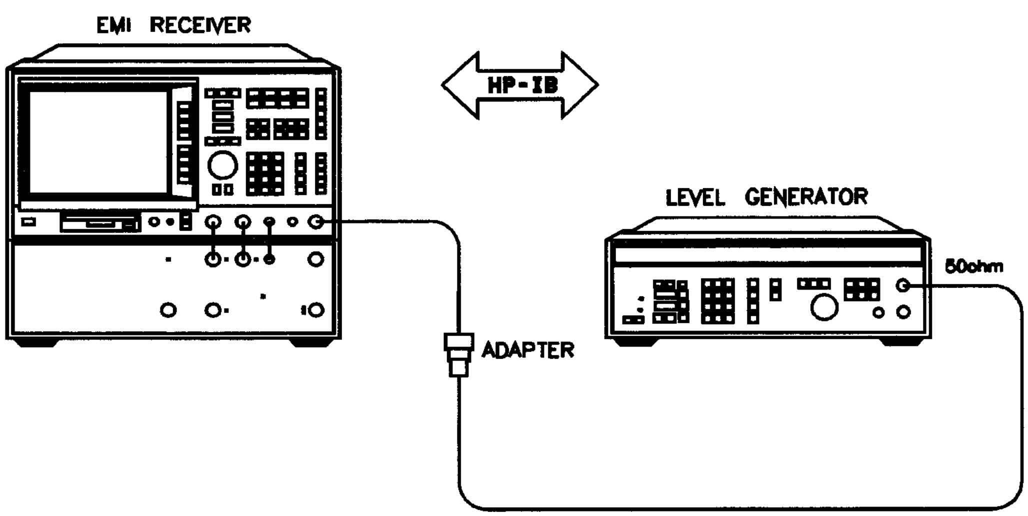
This test adjusts the gains for the fixed bandpass filters from 9 kHz to 2.074 MHz. The gains are adjusted with Gain-DAC 4 in the RF filter section.

To properly adjust Gain-DAC 4, in the RF filter section, the program first obtains reference points. Reference points are obtained by injecting the level generator into the RF filter section and storing the amplitude readings at 22 points as listed in Table 2-3 on page 2-17. The output of the level generator is then injected into the RF filter section using the same cables and connectors. The program measures the same 22 points again. Using the previously stored amplitude readings, Gain-DAC 4, in the RF filter section, is 15 dB of gain with the preamplifier off and 27 dB of gain with the preamplifier on when the attenuation is set to 0 dB.

Equipment Required

- Level generator
- Adapter Type N (m) to BNC (f)
- BNC cable

Approximate Test Time: 1 hour 45 minutes.



falign

Figure 2-8 Very Low Frequency Alignment, Input 1 Reference Setup

NOTE

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-8 on page 2-28.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select Very Low Frequency Alignment, Input 1 from the test list.
2. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Very Low Frequency Alignment, Input 1**
>
> **Connect the cable from the HP 3335A OUTPUT to the cable connected to the RF INPUT of the HP 8546A, using a BNC-BNC through.**

When **PROCEED** is selected the program begins to make reference measurements.

3. When the following screen is displayed, select: **1**
   This will tune all of the paths.

> **0 - Tune single paths**
>
> **1 - Tune all paths**
>
> **2 - Tune single paths with hand tune after every point**
>
> **3 - Adjust gains of all paths**
>
> **4 - Adjust gains of single paths**
>
> **0**
> **1**
> **2**
> **3**
> **4**

NOTE

The Following Is For Informational Purposes Only

Each choice is described in the following table. The default choice is 1. Once a selection is made, the program requires data from the RF filter section which it obtains from EEROM.

0	Aligns the first filter and adjusts the gain. When finished aligning the first filter, the program stops and prompts the user to **Proceed** or exit the test.
1	Aligns the first filter, adjusts the gain, and continues to the next filter without user interaction until all filters have been aligned; this is the standard selection.
2	Aligns one filter point. The RF filter section is made up of 215 filter points. When finished aligning the one filter point, the program prompts the user to proceed or exit the test. This selection is normally used for troubleshooting.
3	Adjusts the first filter's gain and continues to the next filter without user interaction until all filters have been adjusted. Filter adjustment is not performed, only gain is adjusted.
4	Adjusts the gain of the first filter. When finished adjusting the gain of the first filter, the program stops and prompts the user to proceed or exit the test. Filter adjustment is not performed, only gain is adjusted.

When the following screen is displayed, make the connections described and choose: **PROCEED**

Very Low Frequency, Input 1 (Rev X.XX)

Connect the cable from the HP 3335A OUTPUT to the cable connected to the INPUT 1 of the HP 85460A.

Connect a cable between the HP 85460A RF output and the RF INPUT of the HP 85462A.

Refer to Figure 2-9 on page 2-31 for an illustration of the equipment setup.

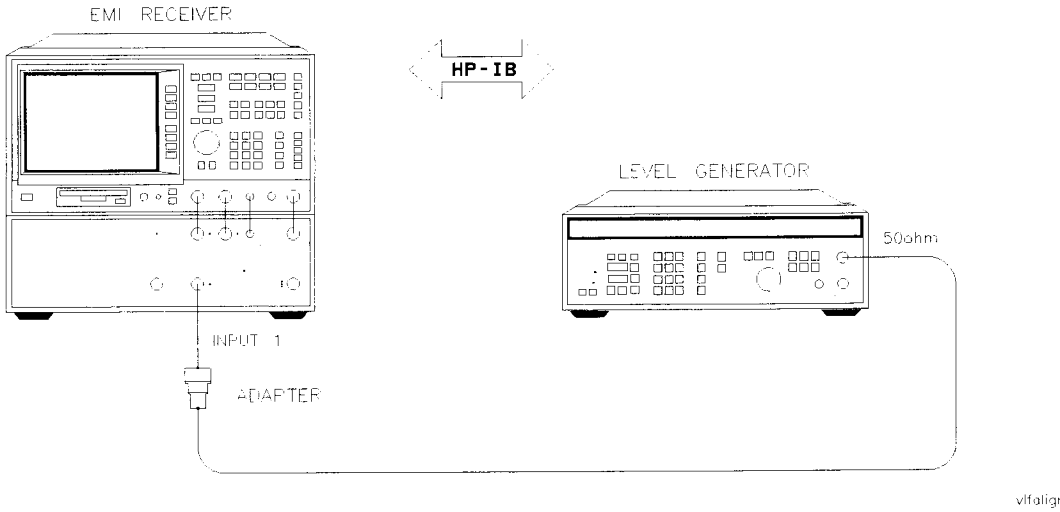


Figure 2-9 Very Low Frequency Alignment, Input 1 Setup

When the following screen is displayed, choose: **PROCEED**

```
Very Low Frequency, Input 1 (Rev X.XX)

This box had the lowband last tuned by:
on: (date), using a: (equipment list), firmware revision:
(revision)

Press a softkey
                                        Choices
                                        Proceed
```

4. When the following screen is displayed and when the RF filter section is warmed up, choose: **Yes**

Yes Continues the program and begins alignment of the RF filter section.

No Starts a 45 minute delay before beginning the alignment. This 45 minute delay allows the RF filter section to complete its required 45 minute warm up period.

```
Very Low Frequency, Input 1 (Rev X.XX)
     Is this instrument warmed up?


     Press a softkey
                              Choices
                              Yes
                              No
```

Once the warm-up is completed and Yes is selected, test system insertion loss is measured. After the test system insertion loss is measured, a screen similar to the following is displayed.

```
Very Low Frequency, Input 1 (Rev X.XX)
         Path 2, 0.018-.083536MHz, Points 2-3, Step= 2^16
Freq=  0.018 MHz  Point= 2   Gain DAC=  1261   PREAMP DAC=
1399

Freq=  0.018 MHz  Point= 1   Gain DAC=  931   PREAMP DAC=
1180


Freq=  0.009 MHz  Point= 0   Gain DAC=  1459   PREAMP DAC=
1584
Freq=  0.018 MHz Point= 1  Gain DAC=  0     PREAMP DAC= 0
```

After all selected paths or filters have been tuned and the gain DAC has been adjusted, the program stores the alignment data to EEROM's.

300 MHz Calibration

NOTE

This is an automated adjustment.

NOTE

This test must be run before the Low Frequency Calibration or High Frequency Calibration tests are performed. If it is not run, the calibration will become invalid.

This test assures that the 300 MHz is at the correct amplitude and frequency setting to optimally align the filters during the Low Frequency and High Frequency Calibration.

Equipment Required

- Synthesized Sweeper
- Power Splitter
- Power Sensor, Low Power
- Power Meter
- Adapter Type-N (m) to APC 3.5 (m)
- Adapter Type-N (f) to APC 3.5 (m)
- Adapter APC 3.5 (f) to APC 3.5 (f)
- RF Cable

Approximate test time: 15 minutes

1. After 300MHz CALIBRATION TEST is selected, the following screen is displayed:

```
HP 436A Power Meter HPIB address 713
              Input the calibration number of Power Sensor
              Examples are:    1
                              215
                             999999
```

Type the four-digit report number of the power sensor in use, then press **enter**.

2. Follow the instructions of the following prompts.

Type the four-digit report number of the power sensor in use, then press enter.

Connect the HP 8481D Power Sensor (Calibration report #.....) to the HP 436A at HP-IB address 713.

Connect the 8481D Power Sensor to the matching HP 11708A Reference Attenuator.

Connect the 11708A Reference Attenuator to the HP 436A Reference.

Set Cal Factor to 100%.

Press the Power Reference ON button on the HP 436A (then tweak Cal Adjust) until the Meter reading is -30.00 0.01 on the HP 436A.

After the calibration of the Power Sensor is done, press: **Enter.**

3. Follow the instructions of the following prompts.

Connect the Power Splitter input to the HP 8340A (HP-IB address 729) output.

Connect one of the Power Splitter Connect the other Power Splitter output to the HP 85046A, input 2.
Connect the HP 85460A output to the HP 85462A RF input.

Connect the TG, 300 MHz, and ALC cables between the HP 85460A and the HP 85462A.

See Figure 2-10 on page 2-35 for hook-up information. When hook-up is completed select: **PROCEED**

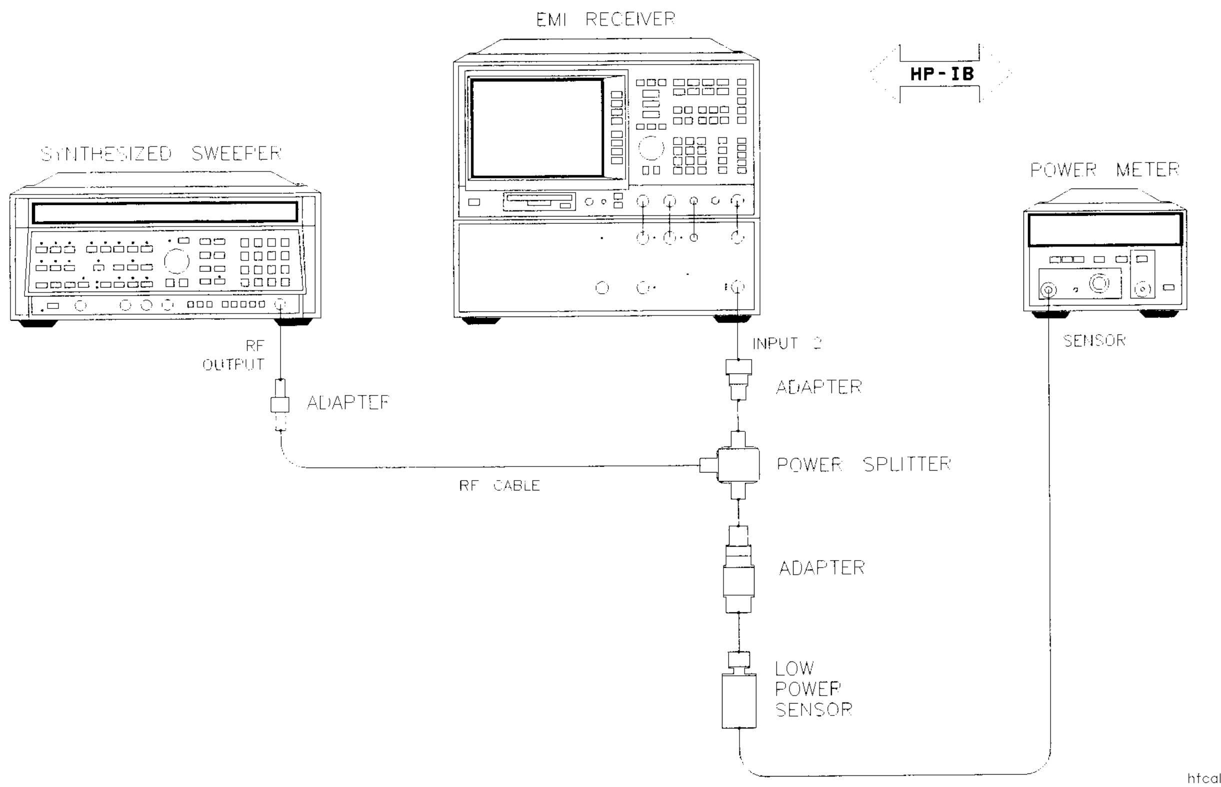


Figure 2-10 300 MHz Calibration Test

Low Frequency Calibration, Input 1

NOTE This is an automated adjustment.

This adjustment measures the insertion loss of the RF filter section calibration paths and stores the resultant data in Electrically Erasable Read-Only Memory (EEROM) to be used during system self calibration (CAL ALL).

The fundamental basis for the amplitude accuracy is the 300 MHz calibrator of the receiver RF section. During CAL ALL, this calibrator signal is injected into the 300 MHz Input of the RF filter section. The system measures the 300 MHz signal and adjusts the gain in the RF filter section until the receiver measures –20 dBm with 300 MHz offset. The 300 MHz offset transfers the accuracy of the 300 MHz calibrator to Input 2. The 300 MHz offset is the sum of the estimated cable loss (stored in EECOR 226) and the insertion loss difference between the 300 MHz Input path and the Input 2 path (stored in EECOR 225). The difference should be about 6 dB.

The RF filter section contains 25 separate filter paths. During CAL ALL, paths 3 through 25 are calibrated using the tracking generator of the receiver RF section externally leveled by the detector in the RF filter section. The tracking generator is set to the power of the 300 MHz Calibrator signal. During CAL ALL each filter path is adjusted at a set number of data points. The gain in the RF filter section is adjusted at each point to the sum of the 300 MHz power level and the tracking generator offset. The offset represents the difference in the input connector flatness and the tracking generator path flatness. These offsets are stored in EECOR 0 to 215.

First, the Low Frequency Calibration measures the 300 MHz offset. Then, the receiver switches to the 300 MHz input and measures the 300 MHz calibrator. Then, the receiver switches to Input 2. The amplitude of the source is adjusted until the receiver reads the same amplitude as the 300 MHz Calibrator signal. The amplitude of the source is read and assigned to Cal_ref. 100 * (–20 dBm –Cal Ref) is stored in EECOR 225. Because the 300 MHz input cable is used in this measurement and included in EECOR 225, 0 is stored in EECOR 226.

The receiver switches to the Tracking Generator Input and adjusts the externally-leveled tracking generator until the receiver reads the same amplitude as the 300 MHz Calibrator signal. At each calibration point for paths 3 to 13, see Table 2-3 on page 2-17, the receiver measures the tracking generator. The receiver then switches to Input 1. The amplitude of the source is adjusted until the receiver reads the same amplitude as the tracking generator signal at that frequency. The amplitude of the source is read and assigned to IL_data. 100 * (Il_data-Cal_Ref) is stored in EECOR for each point of paths 3 through 13.

Equipment Required

- Level generator
- Synthesized sweeper
- Power meter
- Power sensor, low power
- Power splitter
- Adapter Type N (m) to APC-3.5(m)
- Adapter Type N (f) to APC-3.5(m)
- Adapter BNC (m) to SMA (f)
- Adapter APC-3.5 (f) TO APC-3.5 (f)
- RF cable
- BNC cable

Approximate Test Time: 10 minutes.

NOTE

Important: This test will not be valid if the Low Frequency Alignment, Input1 and Very Low Frequency Alignment, Input 1 tests have not been previously done.

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-11 on page 2-39.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select Low Frequency Calibration, Input 1 from the test list.
2. Enter the power sensor calibration factors, if necessary.
3. Zero and calibrate the low power sensor to the power meter.

4. When the following screen is displayed, make the connections described and choose: **PROCEED**

> **Equipment setup for Low Frequency Calibration, Input 1**
>
> **Connect the cable from the HP 3335A (HP-IB Address 704) OUTPUT to the LOW FREQ INPUT of the HP 85460A.**
>
> **Connect the Power Splitter input to the HP 8340B (HP-IB Address 729) output.**
>
> **Connect one of the Power Splitter outputs to the Low Power Sensor connected to the HP 436A (HP-IB Address 713).**
>
> **Connect the other Power Splitter output to the HP 85460A HF input.**
>
> **Connect the HP 85460A output to the HP 85462A input.**
>
> **Connect the TG, 300MHz and ALC cables between the HP 85460A and HP 85462A.**

Refer to Figure 2-11 on page 2-39 for an illustration of the equipment setup.

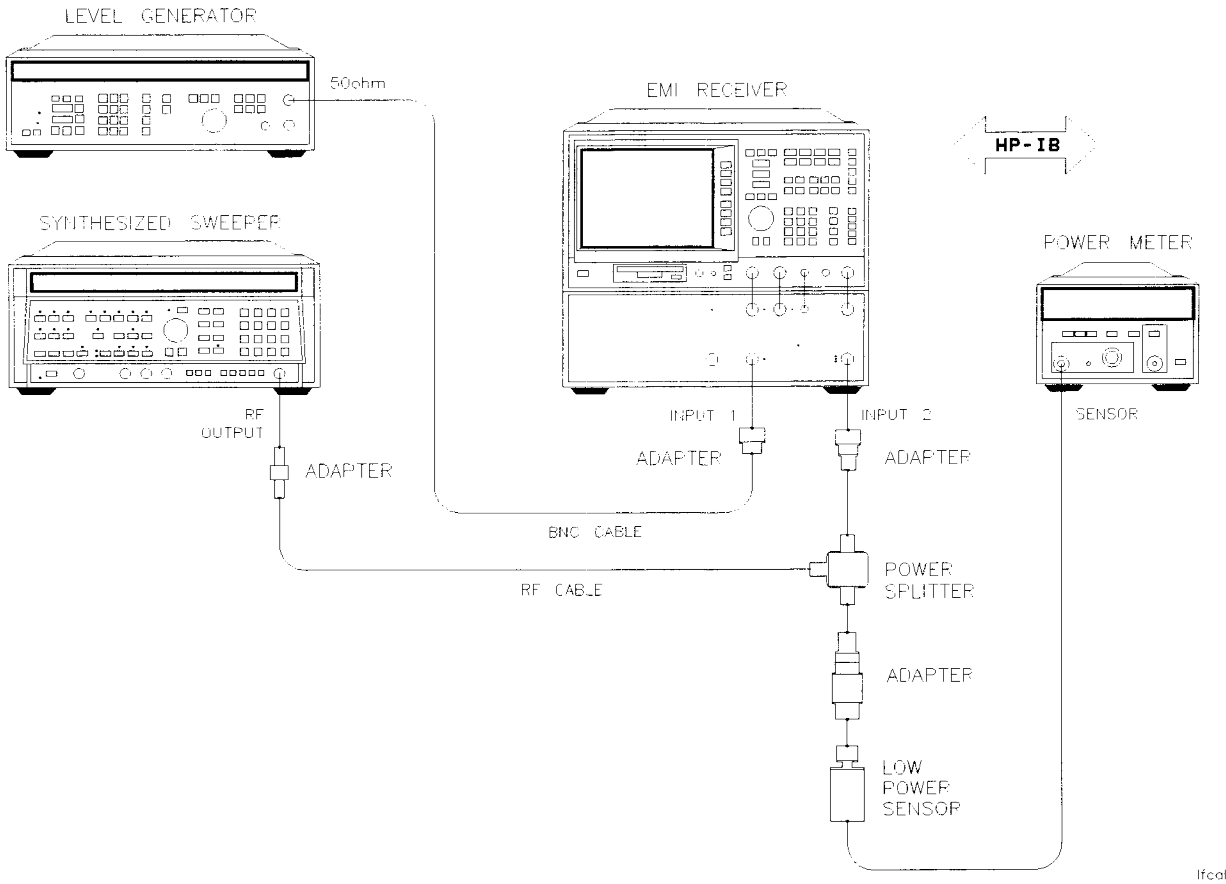


Figure 2-11 Low Frequency Calibration, Input 1 Setup

Once the reference measurement begins, the following messages are displayed in succession:

`Measuring 300 MHz Reference...`

`zeroing. EECOR data in DUT eerom...`

`Calibrating Zeroed Input...`

`Calibrating Filter N (where N is the Filter 3 through Filter 13)`

5. When the measurement is finished, return to the test list.

The controller displays **`storing EECOR data in DUT eerom...`** when the measurement is finished.

High Frequency Calibration, Input 2

NOTE This is an automated adjustment.

This adjustment measures the insertion loss of the RF filter section calibration paths and stores the resultant data in Electrically Erasable Read-Only Memory (EEROM) to be used during system self calibration (CAL ALL).

The fundamental basis for the amplitude accuracy is the 300 MHz calibrator of the receiver RF section. During CAL ALL, this calibrator signal is injected into the 300 MHz Input of the RF filter section. The system measures the 300 MHz signal and adjusts the gain in the RF filter section until the receiver measures −20 dBm with 300 MHz offset. The 300 MHz offset transfers the accuracy of the 300 MHz calibrator to Input 2. The 300 MHz offset is the sum of the estimated cable loss (stored in EECOR 226) and the insertion loss difference between the 300 MHz Input path and the Input 2 path (stored in EECOR 225). The difference should be about 6 dB.

The RF filter section contains 25 separate filter paths. During CAL ALL, paths 3 through 25 are calibrated using the tracking generator of the receiver RF section externally leveled by the detector in the RF filter section. The tracking generator is set to the power of the 300 MHz Calibrator signal. During CAL ALL each filter path is adjusted at a set number of data points. The gain in the RF filter section is adjusted at each point to the sum of the 300 MHz power level and the tracking generator offset. The offset represents the difference in the input connector flatness and the tracking generator path flatness. These offsets are stored in EECOR 0 to 215.

First, the High Frequency Calibration measures the 300 MHz offset. The receiver switches to the 300 MHz input and measures the 300 MHz Calibrator. The receiver switches to Input 2. The amplitude of the source is adjusted until the receiver reads the same amplitude as the 300 MHz Calibrator signal. The amplitude of the source is read and assigned to Cal_ref. 100 * (−20 dBm − Cal_Ref) is stored in EECOR 225. Because the 300 MHZ input cable is used in this measurement and included in EECOR 225, 0 is stored in EECOR 226.

The receiver switches to the Tracking Generator Input and adjusts the externally-leveled tracking generator until the receiver reads the same amplitude as the 300 MHz Calibrator signal. At each calibration point for paths 14 to 25, see Table 2-3 on page 2-17, the receiver measures the tracking generator. Then, the receiver switches to Input 1. The amplitude of the source is adjusted until the receiver reads the same amplitude as the tracking generator signal at that frequency. The amplitude of the source is read and assigned to IL_data. 100 * (Il_data-Cal_Ref) is stored in EECOR for each point of paths 14 to 25.

Equipment Required

- Synthesized sweeper
- Power meter
- Power sensor, low power
- Power splitter
- Adapter Type N (m) to Type N (m)
- Adapter Type N (m) to APC-3.5(f)
- RF cable

Approximate Test Time: 25 minutes.

NOTE

Important: This test will not be valid if the High Frequency Alignment, Input 2 and Low Frequency Alignment, Input 1 tests have not been previously done.

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-12 on page 2-42.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select Very High Frequency Calibration, Input 2 from the test list.
2. Enter the power sensor calibration factors, if necessary.
3. Zero and calibrate the low power sensor to the power meter.
4. Connect the equipment when the following is displayed. Refer to Figure 2-12 on page 2-42.

Equipment setup for High Frequency Calibration, Input 2

Connect the Power Splitter Input to the HP 8340B (HP-IB Address 729) output.

Connect one of the Power Splitter outputs to the Low Power Sensor connected to the HP 436A (HP-IB Address 713).

Connect the other Power Splitter output to the HP 85460A HF input.

Connect the HP 85460A output to the HP 85462A input.

Connect the TG, 300MHz and ALC cables between the HP 85460A and HP 85462A.

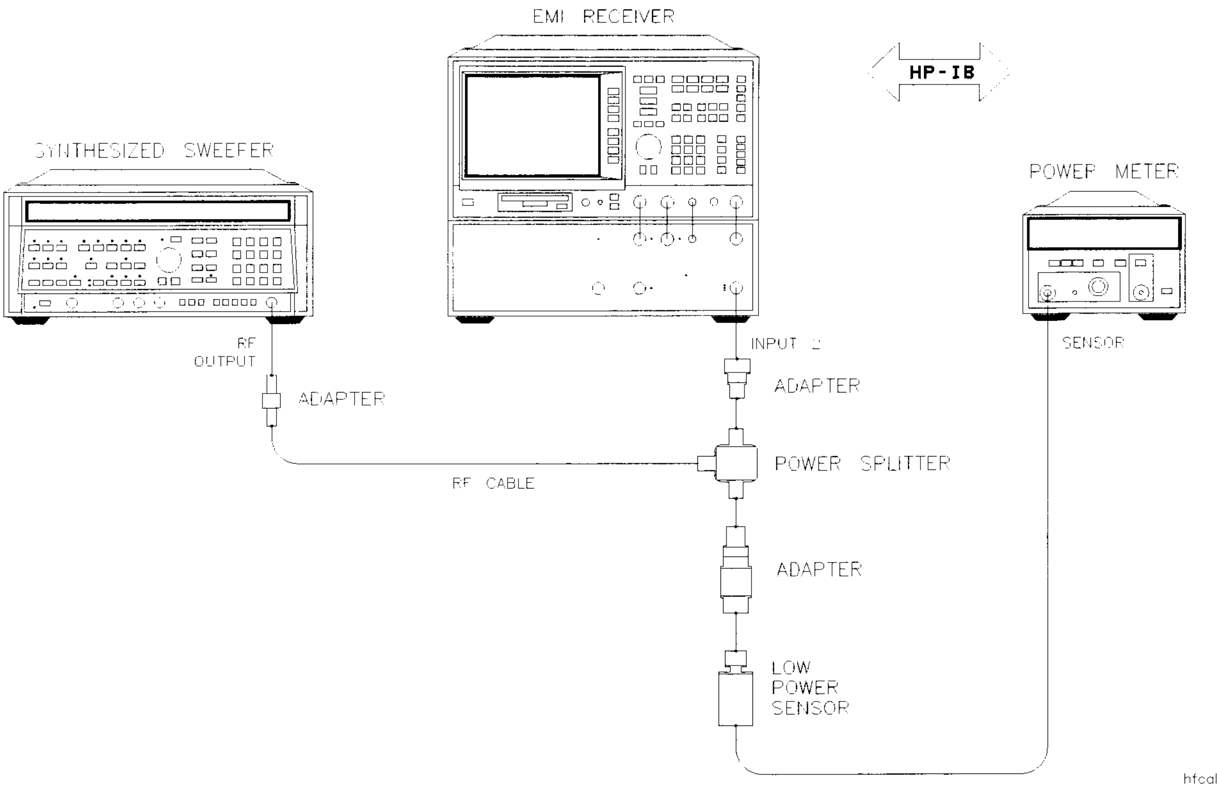


Figure 2-12 High Frequency Calibration, Input 2 Setup

5. Select **PROCEED** to begin the reference measurement.
   The following messages are displayed in succession:

   `Measuring 300 MHz Reference...`
   `Zeroing. EECOR data in DUT eerom...`
   `Calibrating Zeroed Input...`
   `Calibrating Filter N` (where N is the Filter 14 through Filter 25)

6. When the measurement is finished, return to the test list.

   `The controller displays storing EECOR data in DUT eerom` `...` when the measurement is finished.

Very High Frequency Calibration, Input 2

NOTE

This is an automated adjustment.
Perform this adjustment on an HP 8546A / HP 85462A *only,*

For the 1 to 6.5 GHz path, the correction frequencies of the RF filter section line up with the correction frequencies of the receiver RF section.

Table 2-5 ***Band Correction Frequencies***

Band		
Band 0	Correction Points	41
	First Point	12.0 MHz
	Last Point	2.892 GHz
	Frequency Step per Point	72 MHz
Band 1	Correction Points	17
	First Point	2.750 GHz
	Last Point	6.5084 GHz
	Frequency Step per Point	234.9 MHz

The correction data is stored in units of 1/100 dB. Therefore, −260 is equivalent to −2.60 dB of correction. The first correction point is stored in the RF filter section in the EECOR ROM at element 227.

The firmware in the receiver RF section will add the filter sections correction data to its own correction data before trace data is corrected when the 1 to 6.5 GHz path is in use.

Very High Frequency Calibration, Input 2 measures the values to be stored in EECOR. Reference data is obtained by injecting a source into the receiver RF section at the points listed inTable 2-5. The amplitude of the source is stored as the reference power for the point. The source is then connected to Input 2 of the RF filter section. The output of the RF filter section is connected to the input of the receiver RF section. At each point, the source is adjusted until the receiver RF section reads the same as the reference. Then the source power is read. The difference between the power of the source and the reference power of the source is multiplied by 100 and stored in EECOR beginning with EECOR 227.

Equipment Required

- Computer
- Synthesized sweeper
- Power meter
- Power sensor, low power
- Power splitter
- Adapter Type N (m) to APC-3.5 (f)
- RF cable
- HP-IB cable (three required)

Approximate Test Time: 25 minutes

NOTE

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-13 on page 2-45.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select Very High Frequency Calibration, Input 2 from the test list.
2. Enter the power sensor calibration factors, if necessary.
3. Zero and calibrate the low power sensor to the power meter.
4. The following is displayed on the controller.

> **Equipment Setup for Very High Low Frequency Calibration, Input 2**
>
> **Connect the Power Splitter input to the HP 8340B (HP-IB Address 729) output.**
>
> **Connect one of the Power Splitter outputs to the Low Power Sensor connected to the HP 436A (HP-IB Address 713).**
>
> **Connect the other Power Splitter output to the HP 85462A RF input cable.**
>
> **Select PROCEED to begin the reference measurement.**

5. The message `Measuring REF amplitude @ XXXXMHz...` is displayed as the program steps through each specific center frequency.

6. When the program has completed the REF measurements, connect the equipment as shown in Figure 2-13. The following is displayed on the controller.

Equipment Setup for Very High Frequency Calibration, Input 2

Connect the Power Splitter input to the HP 8340B (HP-IB Address 729) output.

Connect one of the Power Splitter outputs to the Low Power Sensor connected to the HP 436A (HP-IB Address 713).

Connect the other Power Splitter output to the HP 85460A HF input.

Connect the HP 85460A RF output to the HP 85462A RF input.

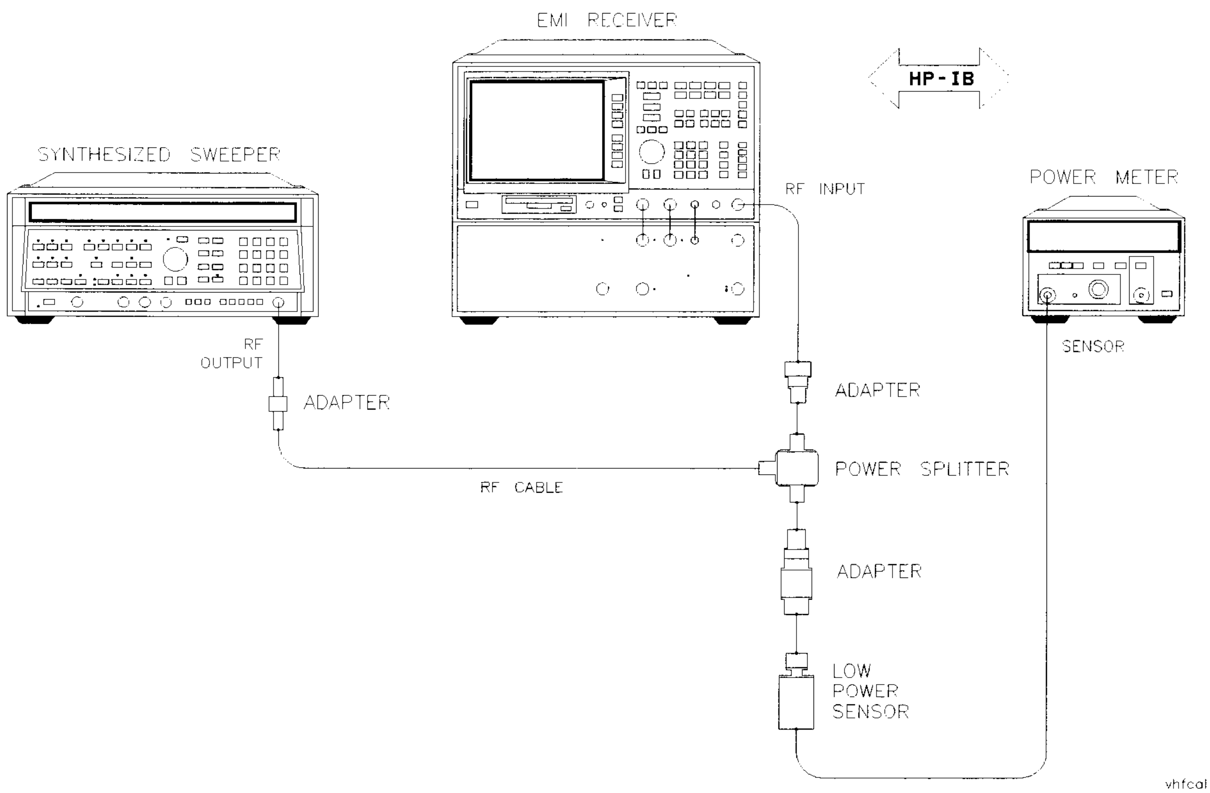


Figure 2-13 Very High Frequency Calibration, Input 2 Setup

7. Select **PROCEED** to begin the insertion loss measurement. The message `Measuring DUT insertion loss @ XXXXMHz...` as the program steps through each center frequency.

8. When the measurement is finished, the controller displays `storing EECOR data in DUT EEROM...` and return to the test list when finished.

RF Overload Calibration, Input 1

NOTE

This is an automated adjustment.

The RF Overload Calibration, Input 1 checks if the amplifier in the RF Filter Section or the mixer in the Receiver RF Section is in gain compression. The detector voltage (from the detector at the output of the RF filter section) is compared to a reference DAC-controlled voltage. The DAC number is stored in EEOVRLV for each of the 13 paths (paths 1 through 13). The DAC values of the EEOVRLV range from 0 to 256.

The RF Overload Calibration, Input 1 sets the values of EEOVRLV for each of the 13 paths. A source is connected to the input of the RF filter section and a power sensor is connected to the RF filter section output. The source and the RF filter section are tuned to a nominal mid frequency for each path. The source is adjusted until the power sensor measures –5 dBm. The overload DAC is adjusted until the detector is triggering on the signal. The DAC value for each path is displayed and then stored in EEOVRLV.The following is an example of the display showing the frequency and DAC value for each path.

```
RF Overload Calibration, Input 1 (Rev 1.12)

FREQ            .10MHz          OVLD DAC   62
FREQ            .10MHz          OVLD DAC   62
FREQ            .15MHz          OVLD DAC   62
FREQ            .35MHz          OVLD DAC   61
FREQ            .75MHz          OVLD DAC   60
FREQ            1.50MHz         OVLD DAC   62
FREQ            1.00MHz         OVLD DAC   62
FREQ            4.10MHz         OVLD DAC   61
FREQ            11.00MHz        OVLD DAC   67
FREQ            9.00MHz         OVLD DAC   61
FREQ            23.00MHz        OVLD DAC   66
FREQ            40.00MHz        OVLD DAC   65
FREQ            30.00MHz        OVLD DAC   69
```

Equipment Required

- Computer
- Level generator
- Power meter
- Power sensor
- Adapter BNC (f) to Type N (m)
- BNC cable
- HP-IB cable (three required)

Approximate Test Time: 20 minutes

NOTE

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-14.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select RF Overload Calibration, Input 1 from the test list.
2. Enter the power sensor calibration factors, if necessary.
3. Zero and calibrate the power sensor to the power meter.

NOTE

If the equipment is already set up, the program skips steps 4 and 5 and starts the calibration.

4. When the following is displayed, connect the equipment as described. See Figure 2-14 for more information.

Equipment Setup for RF Overload Calibration, Input 1

Insure all test equipment is connected to HP-IB bus.

Connect the HP 3335A 50 ohm output to the HP 85460A Input 1.

Connect the HP 85460A output to the HP 436A at 713 8482A sensor.

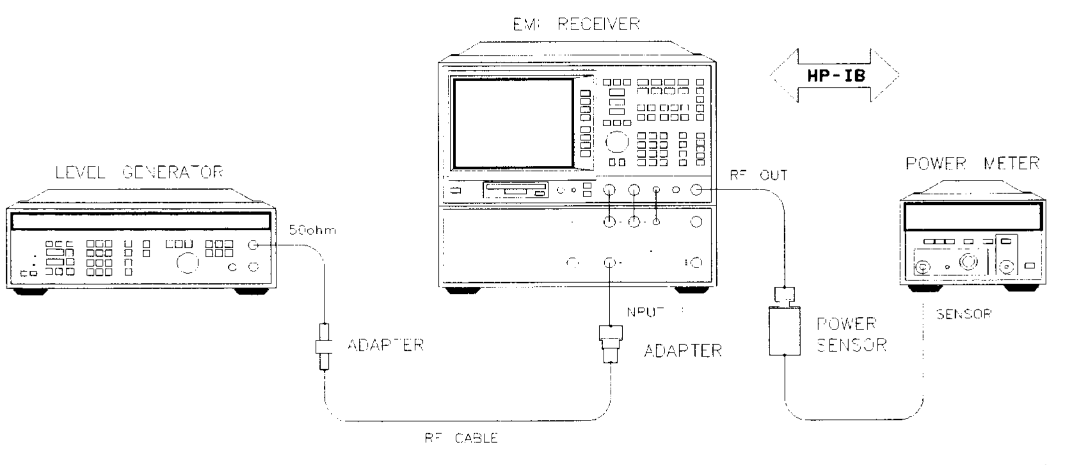


Figure 2-14 RF Overload Calibration, Input 1 Setup

5. Choose **PROCEED** to start the calibration.
6. When the measurement is finished, return to the test list.

The controller stores the values to the *RESULTS* directory and to the EEROM of the RF filter section.

RF Overload Calibration, Input 2

NOTE

This is an automated adjustment.

The RF Overload Calibration, Input 2 checks if the amplifier in the RF filter section or the mixer in the receiver RF section is in gain compression. The detector voltage (from the detector at the output of the RF filter section) is compared to a reference DAC-controlled voltage. The DAC number is stored in EEOVRLV for each of the 12 paths (paths 14 through 25). The DAC values of the EEOVRLV range from 0 to 256.

The RF Overload Calibration, Input 2 sets the values of EEOVRLV for each of the 12 paths. A source is connected to the input of the RF filter section and a power sensor is connected to the RF filter section output. The source and the RF filter section are tuned to a nominal mid frequency for each path. The source is adjusted until the power sensor measures –5 dBm. The overload DAC is adjusted until the detector is triggering on the signal. The DAC value for each path is displayed and then stored in EEOVRLV. The following is an example of the display showing the frequency and DAC value for each path.

```
RF Overload Calibration, Input 2 (Rev 1.12)

FREQ          .23.0MHz      OVLD DAC  68
FREQ          40.0MHz       OVLD DAC  72
FREQ          30.0MHz       OVLD DAC  68
FREQ          74.0MHz       OVLD DAC  91
FREQ          135.0MHz      OVLD DAC  92
FREQ          102.0MHz      OVLD DAC  92
FREQ          196.0MHz      OVLD DAC  129
FREQ          268.0MHz      OVLD DAC  129
FREQ          416.0MHz      OVLD DAC  137
FREQ          325.0MHz      OVLD DAC  134
FREQ          750.0MHz      OVLD DAC  137
FREQ          2000.0MHz     OVLD DAC  165
```

Equipment Required

- Computer
- Synthesized sweeper
- Power meter
- Power sensor
- Adapter Type N (m) to APC-3.5 (f)
- RF cable
- HP-IB cable (three required)

Approximate Test Time: 25 minutes

NOTE

This program has no equipment setup checks. To perform the adjustment:

- The test equipment must be connected as shown in Figure 2-15 on page 2-49.
- The HP-IB cables must be connected.
- The test equipment must be powered on.

Procedure

1. Select RF Overload Calibration, Input 2 from the test list.
2. Enter the power sensor calibration factors, if necessary.
3. Zero and calibrate the power sensor to the power meter.

NOTE

If the equipment is already set up, the program skips steps 4 and 5 and start the calibration.

4. When the following is displayed, connect the equipment as described. Refer to Figure 2-15 for more information.

Equipment Setup for RF Overload Calibration, Input 2

Insure all test equipment is connected to HP-IB bus.

Connect the HP 8340B 50 ohm output to the HP 85460A Input 2.

Connect the HP 85460A output to the HP 436A at 713 8482A

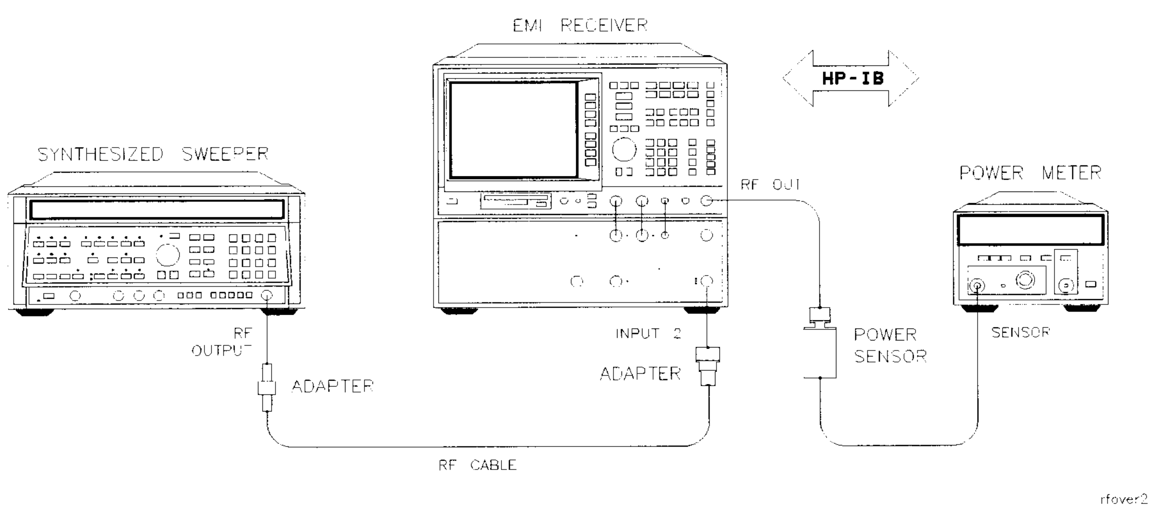


Figure 2-15 RF Overload Calibration, Input 2 Setup

5. Choose **PROCEED** to start the calibration.
6. When the measurement is finished, return to the test list.
7. The controller stores the values to the *RESULTS* directory and to the EEROM of the RF filter section.

System Tracking Verification Test

NOTE This is an automated adjustment.

NOTE This test does not require any external test equipment connections.

When the system is set to wide spans, occasionally some HP 85420E/HP 85460A's will not track properly with some HP 85422E/HP 85462A's. This test checks to verify that the Preselector is tracking properly with the RF Receiver. If this test fails it indicates that the Tracking A/D Gain Adjustment needs to be performed again.

Equipment Required

- No external test equipment is required.

Approximate Test Time: 10 minutes

Procedure

1. Select the System Tracking Verification Test from the test list.
2. When the following prompt is displayed connect the equipment as described then press **ENTER**.

System Tracking Verification

Verify that the following cables are connected between the HP 85420E/HP 85460A and the HP 85422E/HP 85462A.

Front:Tracking generator cable, 300 MHz cable, ALC Cable, RF Input Cable.

Rear: 9-Pin BUS, HIGH SWEEP cable, SWEEP RAMP cable.

CAUTION: Make sure the power to the HP 85420E/HP 85460A and the HP 85422E/HP 85462A is OFF before connecting or disconnecting the 9-Pin Bus Cable.

Test Utilities

The Test Utilities provide a method to enter the Calibration Date after the instrument has been calibrated at the service center. In addition the Test Utilities provide a method to enter the instruments serial number and model number into memory when the A11 processor board has been replaced.

Updating

Calibration Date

After the instrument has been calibrated a new calibration date should be entered into the instruments memory. To update the calibration date:

- From the test list select **Test Utilities**, then select **CALIBRATION DATE**, then follow the prompts.

Instrument Serial/Model Number

After the instruments A11 processor board has been replaced, the instruments serial number and model number will need to be entered into memory. To update the serial or model number:

- From the test list select **Test Utilities**, then select **SERIAL/MODEL #**, then follow the prompts.

At Test Completion

After the tests have been completed place the EEROM jumpers back into the "write-protect" position (refer to Figure 2-3 on page 2-7).

3 Troubleshooting the RF Filter

WARNING

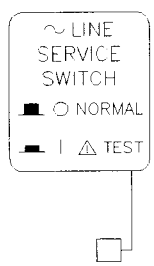
These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

Line Service Switch

The line service switch on the rear panel of the instrument allows AC power to be applied to the RF filter section without the Auxiliary Interface Bus Cable attached.



linsersw

Figure 3-1 Line Service Switch

CAUTION

The line service switch must be returned to the normal position when the diagnostic tests are completed. Refer to Figure 3-1.

Diagnostics

The diagnostic mode can be selected by setting the most significant bit (MSB) of the rear-panel ADDRESS switch to TEST MODE (logic=1). The other bits of the address switch determine which diagnostic test is selected. Refer to Figure 3-2 on page 3-3.

NOTE

Set the ADDRESS switch to the appropriate mode for normal operation or testing. This switch must be set to the correct mode and address for proper operation.

Some diagnostic tests use the internal front-panel LEDs, DIP switches, and the RESET button. The instrument cover must be removed to access this interface. Refer to Figure 3-2 on page 3-3 for the corresponding switches used in these diagnostic tests.

To execute a diagnostic test, the instrument power must be cycled (turned off and on), or the RESET button inside the instrument may be pressed. Once the diagnostic test is executed, all front-panel LEDs flash three times, indicating that a diagnostic test has begun. Unless otherwise indicated in the individual test descriptions, the ERROR LED remains on while the test is in progress and flashes when the test is complete. Refer to Table 3-1 on page 3-4 to determine the switch settings for each diagnostic test.

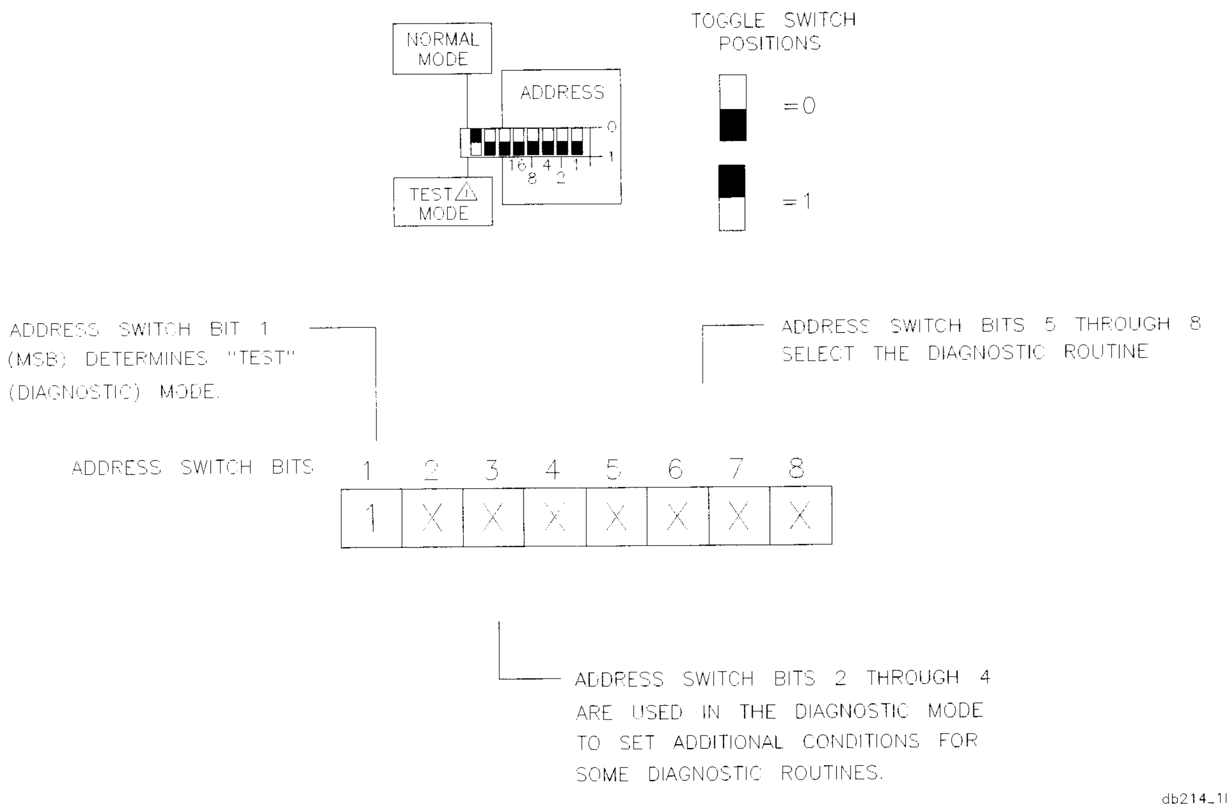


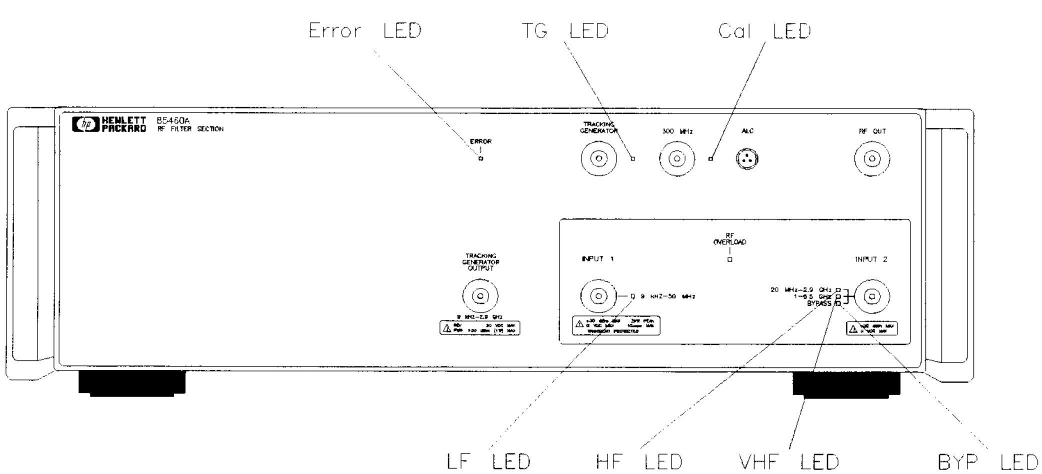
Figure 3-2 Diagnostic Switch-Bit Settings

The following diagnostic test descriptions are for troubleshooting purposes only. Refer to Figure 3-3 for corresponding LEDs used in these diagnostic tests.

Table 3-1 Diagnostic Tests and Switch-Bit Settings

	Diagnostic	Address Switch Bits							
		1	2	3	4	5	6	7	8
1.	Primary Control Check	1	0	0	see[1]	0	0	0	0
2.	Control Amplifier Check[2]	1	see[1]	see[1]	see[1]	0	0	0	1
3.	ROM Checksum	1	0	0	0	0	0	1	1
4.	EEROM Memory Check	1	0	0	0	0	1	0	0
5.	Cycle Check	1	0	0	0	0	1	0	1
6.	CPU Wait State Generation[2]	1	0	0	0	0	1	1	0
7.	LED Check	1	0	0	0	0	1	1	1
8.	Keyboard Check[2]	1	0	0	0	0	0	0	0
9.	Timer Check	1	see[1]	see[1]	see[1]	1	0	0	1
10.	Attenuator Check[2]	1	0	0	see[1]	1	0	1	0
11.	Group A Latched Data Check[2]	1	0	0	0	1	0	1	1
12.	Auxiliary Interface Bus Check	1	0	0	see[1]	1	1	0	0
13.	Group B Latched Data Check[2]	1	0	0	0	1	1	0	1
14.	Service Bus	1	0	see[1]	see[1]	1	1	1	0

1. Address switch bits are used to select additional test conditions. Refer to the specific test description.
2. This diagnostic test requires that the instrument cover be removed.



frnlleds

Figure 3-3 Front-Panel LEDs

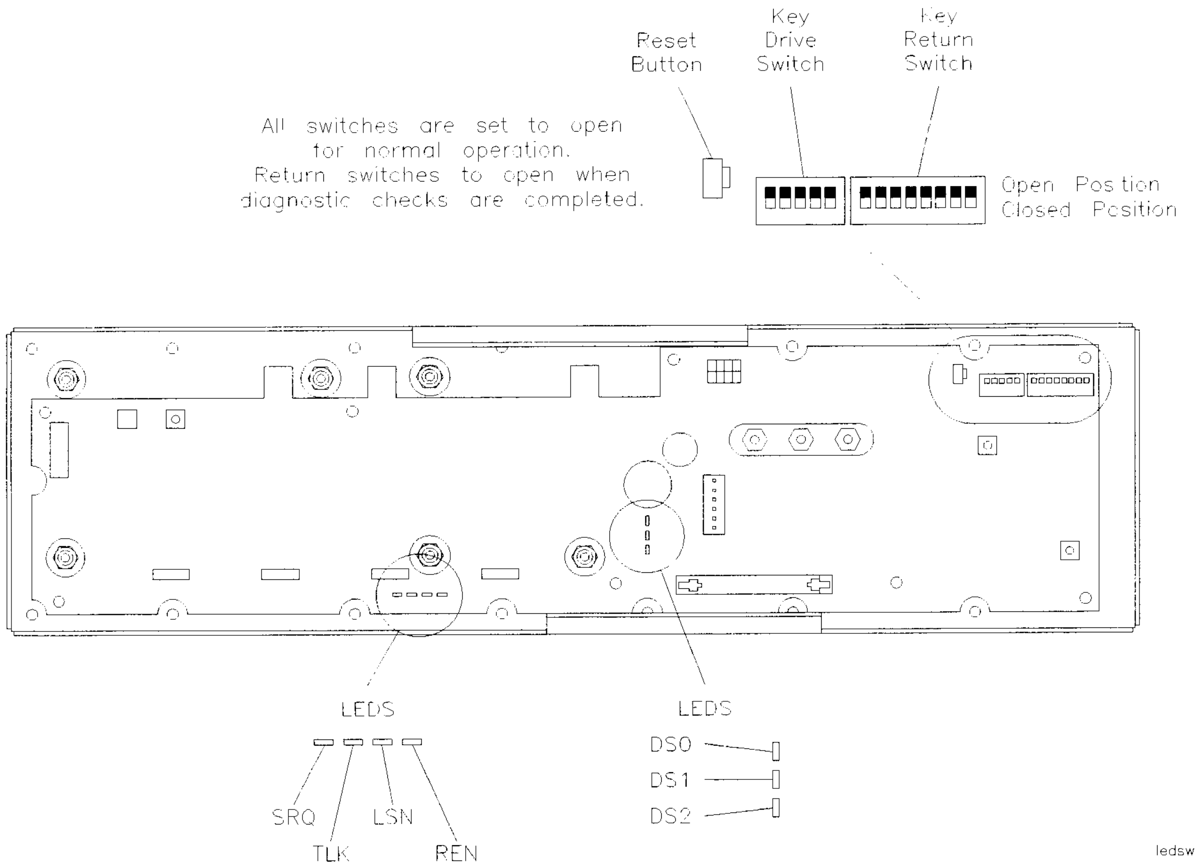


Figure 3-4 Internal Front-Panel LEDs and Switches

Primary Control Check

The Primary Control Check is the main diagnostic routine for the A11 processor board assembly and the A12 DAC board assembly. This test verifies gain, linearity, and offset characteristics of the ten DAC control amplifiers. In performing this diagnostic routine, 80% of the control hardware on both assemblies is verified. The output test voltage of each control amplifier is compared to TRAC DAC U15 by the internal tracking A/D comparators. Failures are indicated by lit LEDs on the front panel. Address switch bit 4 (refer to Figure 3-2 on page 3-3) is used to select which group of DACs are tested. Refer to Table 3-2 on page 3-6 for a cross reference of control amplifiers and corresponding LEDs.

Table 3-2 Control Amplifiers

Address Switch Bits								Control Amplifier	Corresponding LED	Expected Voltages
1	2	3	4	5	6	7	8			
1	0	0	0	0	0	0	1	50 V Tune 0	LF	9.214 V ± 275 mV
1	0	0	0	0	0	0	1	50 V Tune 1	HF	9.214 V ± 275 mV
1	0	0	0	0	0	0	1	50 V Tune 2	VHF	9.214 V ± 275 mV
1	0	0	0	0	0	0	1	30 V Tune 0	BYP	8.449 V ± 254 mV
1	0	0	0	0	0	0	1	30 V Tune 1	TG	8.449 V ± 254 mV
1	0	0	0	0	0	0	1	30 V Tune 2	CAL	8.449 V ± 254 mV
1	0	0	1	0	0	0	1	Low VCA	LF	9.524 V ± 286 mV
1	0	0	1	0	0	0	1	Mid VCA	HF	9.524 V ± 286 mV
1	0	0	1	0	0	0	1	Hi VCA	VHF	9.524 V ± 286 mV
1	0	0	1	0	0	0	1	YIG	BYP	9.516 V ± 286 mV

The gain of each control amplifier is checked by a full-scale test to verify that the output level is within three percent of the specified voltage. The linearity is checked by a half-scale test to verify that each control amplifier is operating linearly from half to full scale. A zero level test verifies that each control amplifier has an acceptable offset.

After the Primary Control Check has been completed (indicated by the ERROR LED flashing), the voltage of TRAC DAC U15 can be verified. TRAC DAC U15 is set at the factory to full scale, +11.4 V, and can be verified or adjusted at this time by monitoring A12TP8.

The voltage of TRAC DAC U15 can only be verified after performing the Primary Control Check or Control Amplifier Check diagnostic routines.

Control Amplifier Check

The Control Amplifier Check selects any of the 10 DAC control amplifiers or the TRAC DAC amplifier for individual diagnosis. The key return and key drive switches are used to select one of the 11 control amplifiers to be ramped or set to a dc level. The lit LED indicates the control amplifier to be tested, beginning with TRAC DAC U15. This is the only test in which the operation of TRAC DAC U15 can be viewed. Refer to Table 3-3 on page 3-7 for a cross reference of control amplifiers, TRAC DAC U15, switches, and LEDs.

Table 3-3 TRAC DAC U15 and Control Amplifier

Key Return Bits								Key Drive Bits					Control Amplifier	Corresponding LED
7	6	5	4	3	2	1	0	0	1	2	3	4		
0	0	0	0	0	0	0	1	1	0	0	0	0	TRAC DAC U15	All LEDs OFF (Except ERROR)
0	0	0	0	0	0	1	0	1	0	0	0	0	50 V Tune 0	LF
0	0	0	0	0	1	0	0	1	0	0	0	0	50 V Tune 1	HF
0	0	0	0	1	0	0	0	1	0	0	0	0	50 V Tune 2	VHF
0	0	0	1	0	0	0	0	1	0	0	0	0	30 V Tune 0	BYP
0	0	1	0	0	0	0	0	1	0	0	0	0	30 V Tune 1	TG
0	1	0	0	0	0	0	0	1	0	0	0	0	30 V Tune 2	CAL
1	0	0	0	0	0	0	0	1	0	0	0	0	Low VCA	SRQ
0	0	0	0	0	0	0	1	0	0	1	0	0	Mid VCA	TLK
0	0	0	0	0	0	1	0	0	0	1	0	0	Hi VCA	LSN
0	0	0	0	0	1	0	0	0	1	0	0	0	YIG	REN

The digital value output to any selected DAC control amplifier can be changed by using bits 3 and 4 of the address switch as follows:

Table 3-4 DAC Control Amplifier

Value	Address Switch Bit							
	8	7	6	5	4	3	2	1
4095 (full-scale)	1	0	0	0	0	0	0	1
2048 (mid-scale)	1	0	0	1	0	0	0	1
0 (zero-scale)	1	0	1	0	0	0	0	1
Ramp Continuously	1	0	1	1	0	0	0	1

By manipulating the switches above, the bits of a selected DAC control amplifier can be evaluated.

ROM Checksum

The ROM Checksum routine performs four checksums of the EPROM memory and two checksums of the EEROM memory, one for each integrated circuit. All ROM memory is located on the A11 processor board assembly. The checksum routines are used to verify the four sub-sections of the ROM memory and the low and high bytes of the EEROM memory. Front-panel LEDs are used to indicate faulty ROM and EEROM integrated circuits. Table 3-5 on page 3-8 lists the integrated circuit and the corresponding LED.

Table 3-5 ROM Checksum

Memory	Corresponding LED
U35 EPROM	BYP
U34 EPROM	VHF
U37 EPROM	HF
U36 EPROM	LF
U43 EEROM	TG
U42 EEROM	CAL

EEROM Memory Check

The EEROM Memory Check verifies the EEROM memory on the A11 processor board assembly.

CAUTION

This test is destructive to the contents of EEROM calibration data and is for service use only.

Cycle Check

The Cycle Check routine continuously cycles the CPU and RAM on the A11 processor board assembly. The ERROR LED remains on while the test is in progress, and the LF LED flashes for valid checks. As errors occur, the other five front-panel LEDs (HF, VHF, BYP, CAL, and TG) serve as counters in noting the number of errors that occur while the test is in process. If no errors are detected, the other five front-panel LEDs remain off and the routine continuously cycles until another diagnostic routine is activated or the diagnostic mode is terminated.

CPU Wait State Generation

The CPU Wait State Generation Check is a routine that verifies the microprocessor timing hardware on the A11 processor board assembly. This check performs continuous reads at different addresses to allow observation of wait-state generations.

NOTE

This diagnostic test is for service use only.

LED Check

The LED Check is a routine that toggles all front-panel LEDs simultaneously to verify operation. The LEDs flash on and off continuously until another diagnostic routine is activated or the diagnostic mode is terminated.

Keyboard Check

The Keyboard Check reads the internal front-panel dip switches and loads the front-panel shift register with all "ones" except the bit corresponding to the dip switch selected, which is loaded with "zero".

Table 3-6 Keyboard Check States

Key Value	Key Return Switch Pattern	Key Drive Switch Pattern	msb Shift Register Load lsb	Function
	7 6 5 4 3 2 1 0	0 1 2 3 4	15 8 7 0	
0	0 0 0 0 0 0 0 1	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0	LF LED on
1	0 0 0 0 0 0 1 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1	HP LED on
1	0 0 0 0 0 1 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1	VHF LED on
3	0 0 0 0 1 0 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1	BYP LED on
4	0 0 0 1 0 0 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1	CAL LED on
5	0 0 1 0 0 0 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1	TG LED on
6	0 1 0 0 0 0 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1	ERROR LED on
7	1 0 0 0 0 1 0 0	1 0 0 0 0	1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1	Ext ALC low filter off
8	0 0 0 0 0 0 0 1	0 1 0 0 0	1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 0
9	0 0 0 0 0 0 1 0	0 1 0 0 0	1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit1
10	0 0 0 0 0 1 0 0	0 1 0 0 0	1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 2
11	0 0 0 0 1 0 0 0	0 1 0 0 0	1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 3
12	0 0 0 1 0 0 0 0	0 1 0 0 0	1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 4
13	0 0 1 0 0 0 0 0	0 1 0 0 0	1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 5
14	0 1 0 0 0 0 0 0	0 1 0 0 0	1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 6
15	1 0 0 0 0 0 0 0	0 1 0 0 0	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	EXT ALC Attenuator DAC data bit 7

Timer Check

The Timer Check routine verifies that timer chip A11U15 is generating the correct time delays. The test uses timer interrupts to toggle the front-panel LEDs at a variable rate. When each interrupt occurs, the LEDs toggle. The period in which the interrupts occur can be adjusted up to 1 s and down to 4 ms. The address switch bits 2, 3, and 4 are used to adjust the interrupt period.

Table 3-7 Timer Check States

Address Switch Bit								Timer Value
7	6	5	4	3	2	1	0	
1	0	0	0	1	0	0	1	512
1	0	0	1	1	0	0	1	1023
1	0	1	0	1	0	0	1	896
1	0	1	1	1	0	0	1	763
1	1	0	0	1	0	0	1	256
1	1	0	1	1	0	0	1	128
1	1	1	0	1	0	0	1	64
1	1	1	1	1	0	0	1	4

Attenuator Check

The Attenuator Check routine selectively toggles one of the attenuator sections so that an audio check can verify the operation. The user selects an attenuator to toggle with the internal front-panel DIP switches. The internal front panel reset button is used to start the test after the selection is set.

Table 3-8 Attenuator Check States

Attenuator	LED Lit When active	Key Return								Key Drive				
		7	6	5	4	3	2	1	0	0	1	2	3	4
HF ATTEN_4[1]	SRG	0	0	0	1	0	0	0	0	1	0	0	0	0
HF ATTEN_10[1]	TLK	0	0	1	0	0	0	0	0	1	0	0	0	0
HF ATTEN_20B[1]	LSN	0	1	0	0	0	0	0	0	1	0	0	0	0
HF ATTEN_20A[1]	REN	1	0	0	0	0	0	0	0	1	0	0	0	0
LF ATT_4[2]	SRQ	0	0	0	0	0	0	0	1	0	1	0	0	0
LF ATT_10[2]	TLK	0	0	0	0	0	0	1	0	0	1	0	0	0
LF ATT_20B[2]	LSN	0	0	0	0	0	1	0	0	0	1	0	0	0
LF ATT_20A[2]	REN	0	0	0	0	1	0	0	0	0	1	0	0	0

1. Low frequency attenuator relays are located on A3 RF Attenuator Board Assembly.
2. High frequency attenuator relays are located on A2 50 dB Attenuators.

The attenuator control level is set with the rear-panel address switch.

Table 3-9 Rear Panel Address Switch States

Attenuator Control State	Rear Panel Address Switch							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Inactive	1	0	0	0	1	0	1	0
Active	1	0	0	1	1	0	1	0
Toggles	1	0	1	0	1	0	1	0

Group A Latched Data Check

The Group A Latched Data Check toggles all of the latched data used by the RF filter section hardware.

NOTE This check is for service use only.

Auxiliary Interface Bus Check

The auxiliary interface bus check verifies the operation of the 9-pin auxiliary bus. It requires a means to control the input levels on the external bus connector.

Bit 4 of the rear-panel address switch is used to select the method of unloading the input FIFO. If bit 4 is 0, the FIFO is unloaded in an interrupt routine which verifies the operation of the interrupt hardware. If bit 4 is 1, the FIFO is unloaded without using interrupts. The address switch is read-only at the beginning of the test so the reset must be activated to change the above interrupt mode. Reset may be done by cycling power, by pressing the internal front-panel reset button, or from the 9-pin auxiliary bus by momentarily setting 7 (refer to Table 3-10 on page 3-12).

Table 3-10 9-Pin Bus States

Control Input				LED Indicator							
D	C	B	A	TG	CAL	LF	BYP	VHF	HF	State	Function
see[1]	0	0	0	0	0	0	0	0	0	0	Idle, data or byte in/out clock low
see[2]	0	0	1	0	0	0	0	0	0	1	Clock data out of send shift register.
0	0	1	0	1	0	see[3]	see[3]	see[3]	see[3]	2	Byte in clock/FIFO not empty TG LED on i indicates FIFO not empty.
				0	0	0	0	1	0	2	Byte in clock/FIFO empty.
0	0	1	1	0	0	0	0	1	1	3	Status request state muxed on control I
see[1]	1	0	0	0	0	0	1	0	0	4	Clock data into receive shift register.
X	1	0	1	0	1	0	1	0	1	5	Byte out clock/status request active. CAL LED on indicates byte out has been loaded. Output shift register loaded with all 1's for this test.
0	1	1	0	0	0	0	1	1	0	6	FIFO full state muxed on control I
0	1	1	1	X	X	X	X	X	X	7	Reset

1. Indicates that data bit is clocked in on transition to state 4.
2. Indicates that data bit is muxed out on control 1.
3. Displays most significant nybble of input shift register for one second; then displays the least significant nybble for one second.

To Load Input Shift Register With The Data Pattern 1010 0101:

Table 3-11 Input Shift Register with 10 10 0 10 10 Data Pattern

Control Input				State	Description
D	C	B	A		
1	0	0	0	0	Idle state, data = 1
1	1	0	0	4	Clock data in, data = 1 MSB first
1	0	0	0	0	Idle state, single bit transition to idle, data = 1
0	0	0	0	0	Idle state, data = 0
0	1	0	0	4	Clock data in, data = 0
1	0	0	0	0	Idle state, data = 1
1	1	0	0	4	Clock data in, data = 1
1	0	0	0	0	Idle state, single bit transition to idle, data = 1
0	0	0	0	0	Idle state, data = 0
0	1	0	0	4	Clock data in, data = 0
0	0	0	0	0	Idle state, data = 0
0	1	0	0	4	Clock data in, data = 0
1	0	0	0	0	Idle state, data = 1
1	1	0	0	4	Clock data in, data = 1
1	0	0	0	0	Idle state, single bit transition to idle, data = 1
0	0	0	0	0	Idle state, data = 0
0	1	0	0	4	Clock data in, data = 0
1	0	0	0	0	Idle state, data = 1
1	1	0	0	4	Clock data in, data = 1 LSB Last

To Clock the Byte Into the FIFO and Set the FIFO-not-empty Bit:

The test program reads the FIFO when the not-empty bit is active (low) and display the data on the LEDs. When the TG LED is on, it indicates that the FIFO is not empty. The FIFO not-empty bit is set inactive (high) when the FIFO is read.

Table 3-12 FIFO Bit States

Control Input D	C	B	A	State	Description
1	0	0	0	0	Idle state, single bit transition to idle, data = 1
0	0	0	0	0	Idle state, single bit transition to idle, data = 0
0	0	1	0	2	Clock byte in, FIFO not empty bit goes active

Once the clock byte in and FIFO not empty bit goes active (refer to Table 3-13, the following sequence of LED states occurs:

Table 3-13 LED Display Sequence

TG	CAL	LF	BYP	VHF	HF	Description
1	0	1	0	1	0	Most significant nybble for 1 second
1	0	0	1	0	1	Least significant nybble for 1 second
0	0	0	0	1	0	FIFO is empty[1]

1. If Control B is toggled at a rate greater than once every two seconds (for example, clock byte in. idle, clock byte in, idle, and so forth), the FIFO continues to fill. The FIFO unload rate is one byte every two seconds because of the LED display delay time.

To Load the Output Shift Register Repetitively With 1111 1111:

The test program continues to load the output shift register as long as the status-request bit remains active (low). When the CAL LED is on, it indicates that byte out has been loaded.

Table 3-14 Output Shift Register With 1111 1111 Data Pattern

I	D	C	B	A	State	Description
X	0	0	0	0	0	Idle state, single bit transition to idle.
X	0	1	0	0	4	Clock data in, dummy state for single bit transition.
1	0	1	0	1	5	Status request.

Table 3-15 LED Display With Bit 7 of Output Shift Register ON

LED	State
TG	0
CAL	1
LF	0
BYP	1
VHF	0
HF	1

To Clock Out the Data On the Control I Pin:

Table 3-16 Pin States of Control I Pins

Bit	1	D	C	B	A	State	Description
7	1	0	1	0	0	4	Clock data in, dummy state for single bit transition. Bit 7 of output byte on control I pin.
7	1	0	0	0	0	0	Idle state, single bit transition to idle.
6	1	0	0	0	1	1	Data out clock high, bit 6 of output byte on I.
6	1	0	0	0	0	0	Idle state, data out clock low.
5	1	0	0	0	1	1	Data out clock high, bit 5 of output byte on I.
5	1	0	0	0	0	0	Idle state, data out clock low.
4	1	0	0	0	1	1	Data out clock high, bit 4 of output byte on I.
4	1	0	0	0	0	0	Idle state, data out clock low.
3	1	0	0	0	1	1	Data out clock high, bit 3 of output byte on I.
3	1	0	0	0	0	0	Idle state, data out clock low.
2	1	0	0	0	1	1	Data out clock high, bit 2 of output byte on I.
2	1	0	0	0	0	0	Idle state, data out clock low.
1	1	0	0	0	1	1	Data out clock high, bit 1 of output byte on I.
1	1	0	0	0	0	0	Idle state, data out clock low.
0	1	0	0	0	1	1	Data out clock high, bit 0 of output byte on I.
0	1	0	0	0	0	0	Idle state, data out clock low.
X	0	0	0	0	1	1	Data out clock high, shift register empty control I pin = 0

Group B Latched Data Check

The Group B Latched Data Check toggles the bits that drive the attenuator and main switch relays. This routine is used to test the A12 DAC board assembly.

This routine toggles the bits which drive the attenuator and main switch relays.

NOTE

This test is for service use only.

Service Bus Check

The service bus check consists of three tests:

- Data Test
- Control Test
- Interrupt Test

NOTE

The service bus is used for troubleshooting, all adjustments, and some performance tests. It is not used during normal operation of the RF filter section.

To begin a test, set the address switch pattern for the test desired and cycle power to start.

All LEDs flash three times and the ERROR LED remains on.

Data Test

The data test is selected using address switch pattern: 1000 1110

The HF LED is lit to indicate the data test is running. The LF LED toggles at the data toggle rate. This test sets up A11U8 (the HP-IB Interface IC) as a controller and transmits the following alternating data bit patterns over the rear-panel service bus:

- 0101 0101
- 1010 1010

NOTE

Remove all other HP-IB devices from the service bus before starting this test. An HP 59401A Bus System Analyzer may be connected to the service bus with REN off, LISTEN on, FAST on. Data pattern alternate from U 125 to U 252.

Control Test

The control test is selected using address switch pattern:1001 1110

The VHF LED is lit to indicate the control test is running. The LF LED toggles at the control toggle rate. This test sets up A11U8 (the HP-IB Interface IC) to alternately toggle the following control signals between high and low: SRQ, EOI, ATN, IFC, REN, DAV, NRFD, NDAC. Data alternates from 1111 1111 to 0000 1000.

NOTE

Remove all other HP-IB devices from the service bus before starting this test. An HP 59401A bus system analyzer may be connected to the service bus with REN off, LISTEN on, FAST on. The SRQ, EOI, ATN, IFC and REN LEDs cycle between on and off with some overlap of IFC and ATN, and EOI and ATN. DAV and NRFD alternates with NDAC. The data alternates from 377 to 010.

Interrupt Test

The interrupt test is selected using address switch pattern: 1010 1110

The BYP LED is lit to indicate interrupt test is running. The LF LED toggles at the interrupt toggle rate. This test sets up A11U8 (the HP-IB Interface IC) as a controller and transmits incrementing data bit patterns over the rear-panel service bus. A11U8 (the HP-IB Interface IC) is setup to generate an interrupt signal to test the service bus interrupt circuitry.

NOTE

This test requires the “ready for data” and “data accepted” handshake from a listening device. An HP 59401A Bus System Analyzer is recommended.

Remove all other HP-IB devices from the service bus before starting this test. An HP 59401A Bus System Analyzer must be connected to the service bus with REN off, LISTEN on, FAST on. Data pattern increments.

4 Replacing Major Assemblies

Introduction

The procedures in this chapter describe the removal and replacement of major assemblies.

The words "right" and "left" are used throughout these procedures to indicate the sides of the instrument as normally viewed from the front of the instrument. Numbers in parentheses, for example (1), indicate numerical callouts on the figures.

Before You Start

There are four things you should do before starting to troubleshoot an instrument failure:

- ❑ Check that you are familiar with the safety symbols marked on the instrument, and read the general safety instructions and the symbol definitions given in the front of the Service Guide.
- ❑ The instrument contains static sensitive components. Read the section entitled "Protection From Electrostatic Discharge" in Chapter 1.
- ❑ Become familiar with the organization of the troubleshooting information in this service guide.
- ❑ Read the rest of this section.

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

Needed Service Equipment

Refer to “Chapter 9” for a list of the recommended test equipment needed to troubleshoot and repair the instrument. Although Hewlett-Packard equipment is recommended, any equipment that meets the critical specifications given in the table can be substituted for the recommended model.

Chapter 9 also includes a list of required service and hand tools needed to troubleshoot and repair the instrument.

After a Repair

If one or more assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to “Chapter 2” for a table of Adjustments and Tests for Replaced or Repaired Assemblies, for the related adjustments and performance verification tests required for each assembly.

Removal and Replacement Procedures in this Chapter

- Instrument Cover
- Front Panel Assembly
- Front-Panel Coax Switch Assembly
- Front-Panel A1A1 Interconnect Board Assembly
- A14 and A14A1 AmpVar Assemblies
- A11A1 9-Pin Bus Board Assembly
- A11 Processor Board Assembly
- A12 DAC Board Assembly
- A17 High-Pass Filter
- Rear-Panel Assembly
- T1 Transformer Assembly
- A13 Power Supply Board Assembly
- B1 Fan Assembly
- A8 LF Tuneable Filters
- A15 YIG
- A9 HF Filters
- A2 Attenuator

Instrument Cover

WARNING

These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.

The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

CAUTION

To prevent damage to the front-frame, use a soft cloth or towel between the work surface and the front-frame.

Removal

1. Disconnect the instrument from ac power.
2. Place the instrument on the work surface with its front panel down.
3. Remove the four rear-feet screws using a Torx screwdriver.
4. Pull the cover off towards the rear.

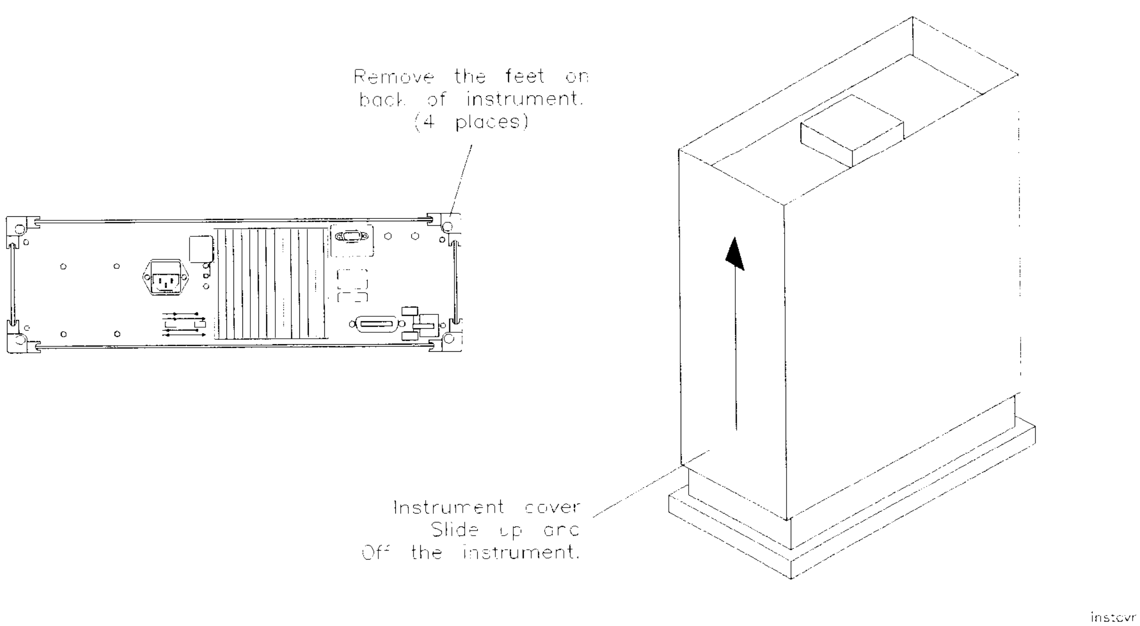


Figure 4-1 Instrument Cover Replacement

Replacement

CAUTION

To prevent damage when replacing the instrument cover, remember the following:

Place a soft cloth or towel between the work surface and the front-frame.

Ensure that cables do not bind between the instrument cover and its internal assemblies.

1. Disconnect the instrument from ac power.
2. Place the instrument on the work surface with its front panel down.
3. Replace the instrument cover assembly by matching the seam on the cover with the bottom of the instrument.
4. Fit the leading edge of the cover completely into the slot on the back of the front-frame assembly. The cover should fit snugly against the EMI gasket in the slot.
5. Replace and tighten the four rear-feet screws using a Torx screwdriver.

Front-Panel Assembly

CAUTION

Use ESD procedures when performing this replacement procedure.

Removal

1. Remove the instrument cover assembly. Refer to the "Instrument Cover removal procedure.
2. Place the instrument with the top facing up on the work surface.
3. To access the components underneath the top lid, remove eight screws on the front (1). Refer to Figure 4-2 on page 4-7.
4. Lift up the top lid and disconnect the brown cable, W23, from the LF RF input on the A10 motherboard (2). Refer to Figure 4-3 on page 4-8.
5. Push the top lid back into place.
6. Disconnect the ribbon cable that goes to the J5 connector on the front strut (3). Refer to Figure 4-2 on page 4-7.
7. Disconnect four cable assemblies (J1, J2, J8, J9) and two semi-rigid cables (J12, J13) from the front-panel motherboard (4). Refer to Figure 4-4 on page 4-9.
8. Disconnect the semi-rigid cable (W13) that goes from the front-panel switch assembly to the A18 AmpVar assembly at the switch assembly (5). Refer to Figure 4-2 on page 4-7.
9. Remove the two screws from the front strut (6).
10. Carefully turn the instrument over and remove the two screws from the front strut (7). Refer to Figure 4-4 on page 4-9.
11. Disconnect the two semi-rigid cables from the A3 attenuator (8).
12. Remove four screws each from each side frame of the instrument (9).
13. Carefully slide the front-panel assembly out of the instrument.

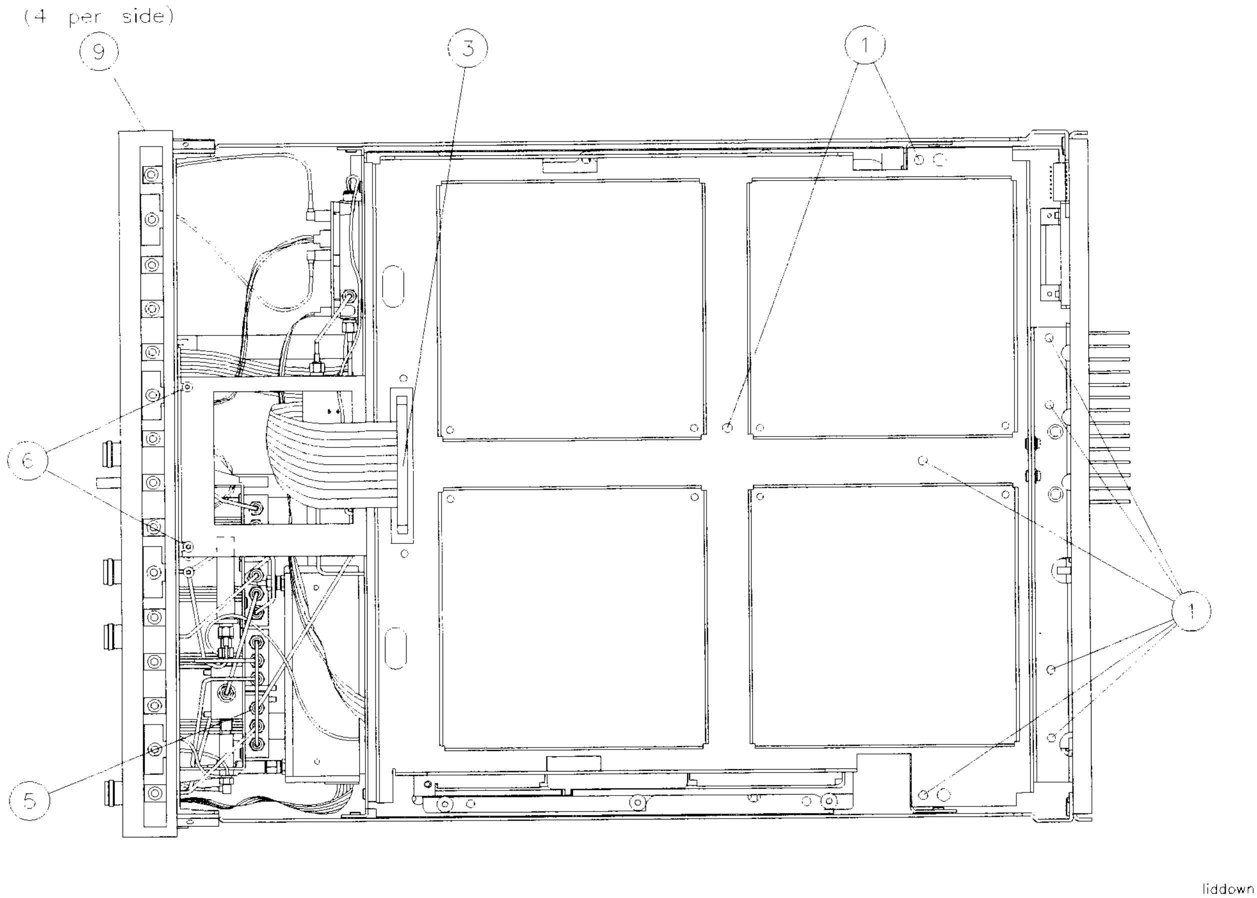


Figure 4-2 Top View, Lid Down

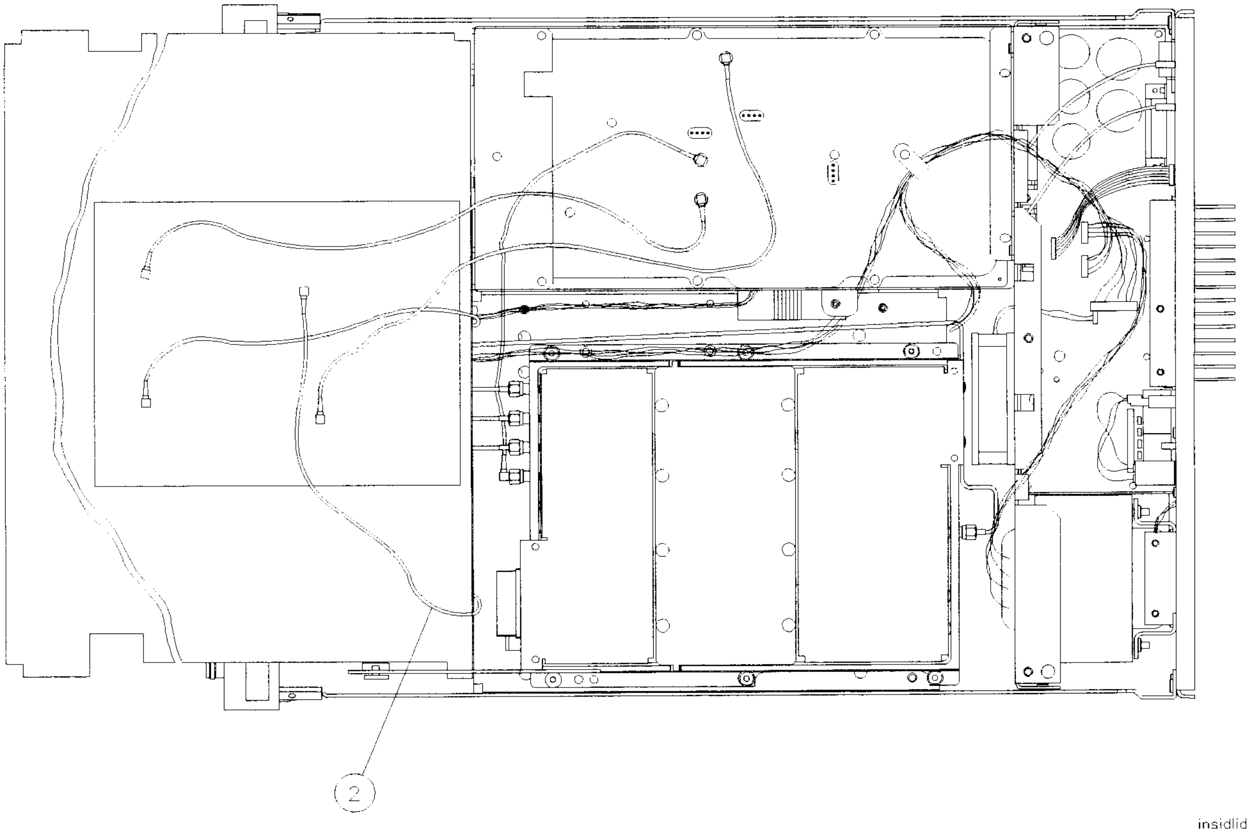


Figure 4-3 Inside Lid

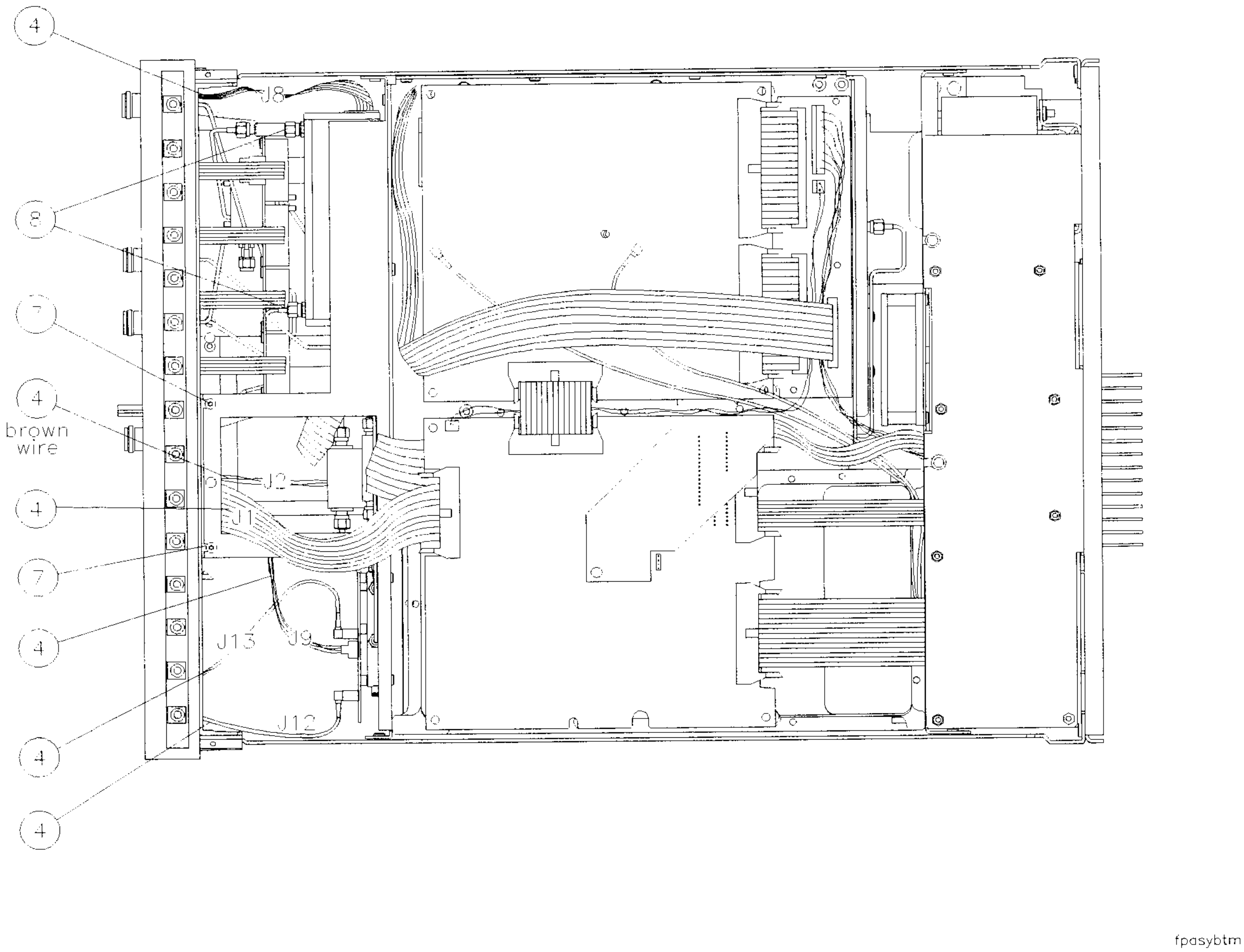


Figure 4-4 Front-Panel Assembly, Bottom View

Replacement

1. Carefully slide the front-panel assembly into the front of the instrument.
2. Replace four screws each to each side frame of the instrument (9. Refer to Figure 4-4 on page 4-9.
3. Connect the two semi-rigid cables that attach to the attenuator (8).
4. Replace the two screws on the front strut (7).
5. Carefully turn the instrument over and replace the two screws on the front strut (6). Refer to Figure 4-2 on page 4-7.
6. Connect the semi-rigid cable (W13) that goes from the front-panel switch assembly to the A18 AmpVar assembly to the switch assembly (5).
7. Connect four cable assemblies (J1, J2, J8, J9) and two semi-rigid cables (J12, J13) to the front-panel motherboard (4). Refer to Figure 4-4 on page 4-9.
8. Connect the ribbon cable that goes to the J5 connector on the front strut (3). Refer to Figure 4-2 on page 4-7.
9. Lift up the top lid and reconnect the brown cable (W23) to the LF RF input on the A10 motherboard (2). Refer to Figure 4-3 on page 4-8.
10. Push the top lid back into place.
11. Replace eight screws on the front (1). Refer to Figure 4-2 on page 4-7.
12. Replace the instrument cover assembly. Refer to the “Instrument Cover” replacement procedure for more information.

Front-Panel Coax Switch Assembly

Removal

NOTE

There are four coax switches connected on the front-panel switch assembly. The following procedure will apply to the removal of any one of the switches.

1. Remove the front-panel assembly. Refer to the "Front Panel Assembly" removal procedure.
2. Disconnect the ribbon cable assembly from that goes from the coax switch to the front-panel A1A1 interconnect board (1). Refer to Figure 4-5.
3. Loosen both ends of all three coax cable connections that go from the switch and the front-panel interconnect board (2). When both ends of each coax cable has been loosened, remove them from the instrument.
4. Remove the two screws that attach the switch to the switch assembly (3) and remove the switch from the instrument.

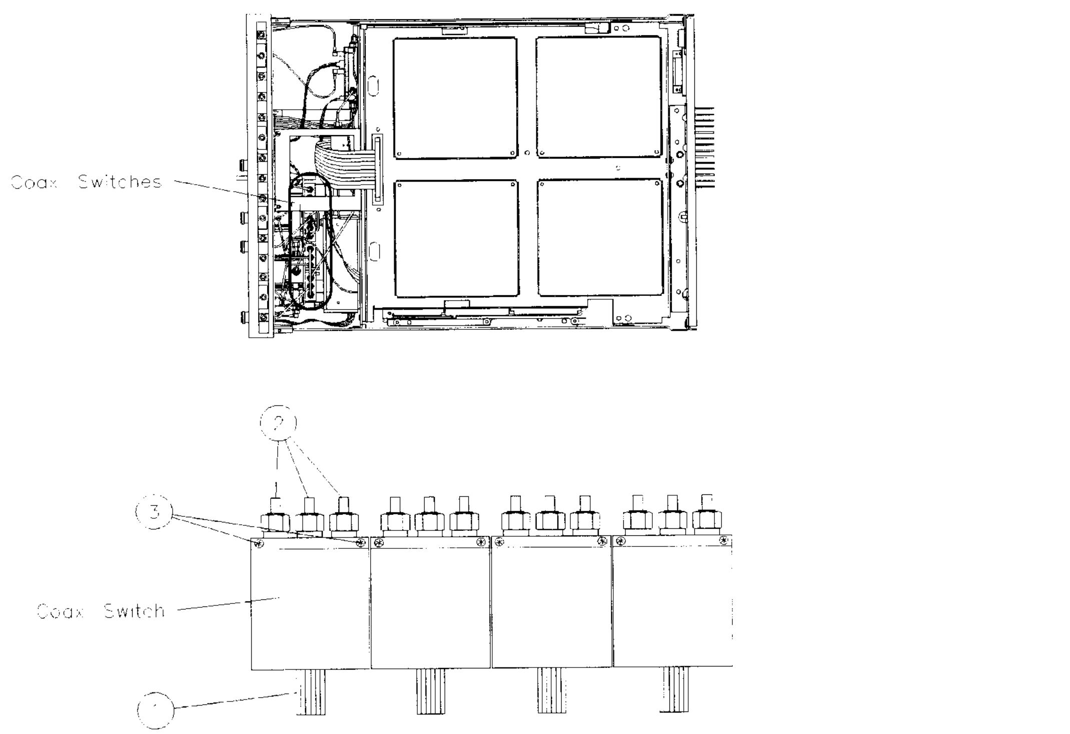


Figure 4-5 Front-Panel Coax Switch Replacement

Replacement

1. Place the switch onto the switch assembly.
2. Replace the two screws that attach the coax switch to the switch assembly (3). Refer to Figure 4-5 on page 4-11.
3. Connect the three coax cable connections between the switch and the front-panel A1A1 interconnect board (2).
4. Connect the cable assembly to the switch (1).
5. Replace the front-panel assembly. Refer to the “Front Panel Assembly” replacement procedure.

Front-Panel A1A1 Interconnect Board Assembly

Removal

1. Remove the front-panel assembly. Refer to the "Front Panel Assembly" removal procedure.
2. Disconnect the four ribbon cable assemblies that go from the front-panel switch assembly to the front-panel A1A1 interconnect board (1). Refer to Figure 4-6.
3. Disconnect the six semi-rigid cables (three on each side) that attach the front-panel switch assembly to the front-panel interconnect board (2).
4. Remove the four screws, one at each corner, that secure the front-panel switch assembly to the front-panel interconnect board (3).
5. Remove the front-panel switch assembly.
6. Remove the three extended hex nuts from the front-panel interconnect board using a 6 mm nut driver (4).
7. Remove the eight screws, that secure the front-panel interconnect board to the front-panel assembly (5).
8. Remove the front-panel interconnect board.

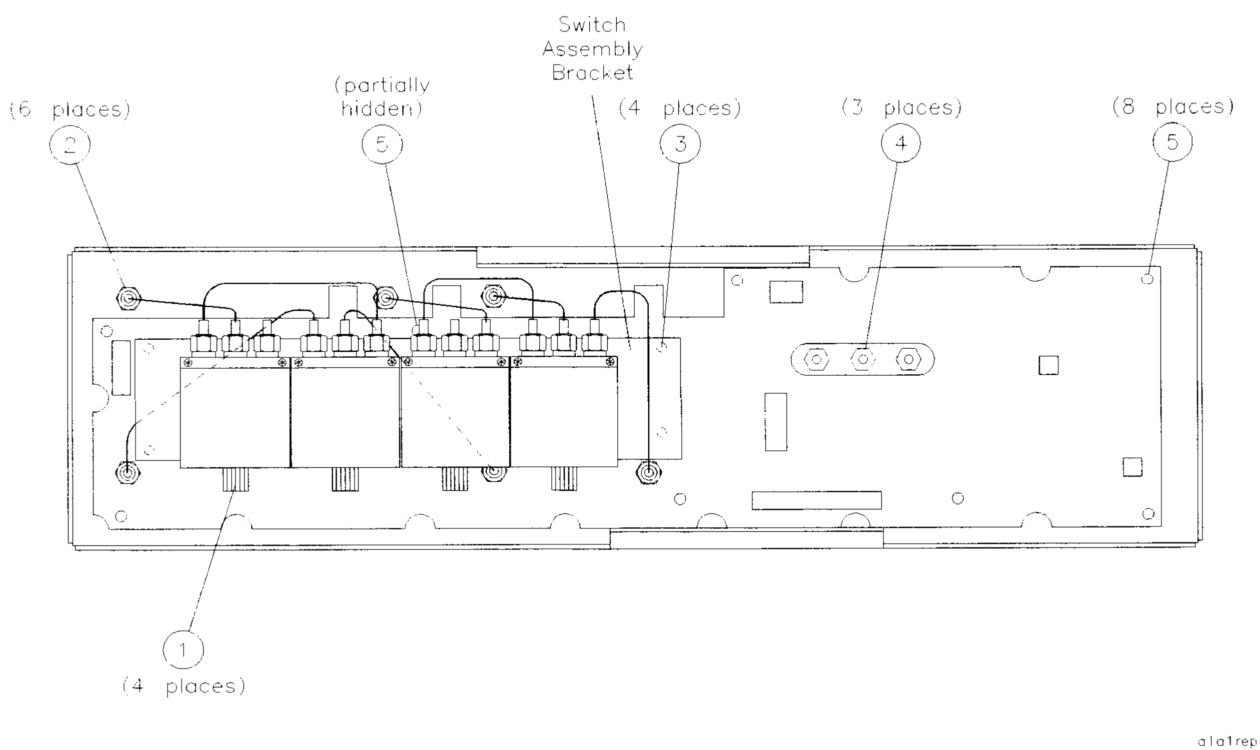


Figure 4-6 A1A1 Interconnect Board Replacement

Replacement

1. Place the front-panel A1A1 interconnect board onto the front-panel assembly.
2. Replace the eight screws, that secure the front-panel interconnect board to the front-panel assembly (5). Refer to Figure 4-5 on page 4-11.
3. Replace the three extended hex nuts to the front-panel interconnect board using a 6 mm nut driver (4).
4. Place the front-panel switch assembly onto the front-panel interconnect board.
5. Replace the four screws, one at each corner, that secure the front-panel switch assembly to the front-panel interconnect (3).
6. Connect the six semi-rigid cables that attach the front-panel switch assembly to the front-panel motherboard (2).
7. Connect the four ribbon cable assemblies from the front-panel switch assembly to the front-panel interconnect board (1).
8. Replace the front-panel assembly. Refer to the “Front Panel Assembly” replacement procedure.

A14 and A14A1 AmpVar Assemblies

Removal

1. Remove the instrument cover assembly. Refer to "Instrument Cover" removal procedure.
2. Remove the ribbon cable from J1, the cable assembly from J2, and two coax cables from J3 and J4 on the A14A1 AmpVar board (1). Refer to Figure 4-7.
3. Disconnect the four semi-rigid cables from the A14 AmpVar assembly (2).
4. Remove the four screws located in the corners of the AmpVar assembly (3).
5. Carefully remove the AmpVar assembly.

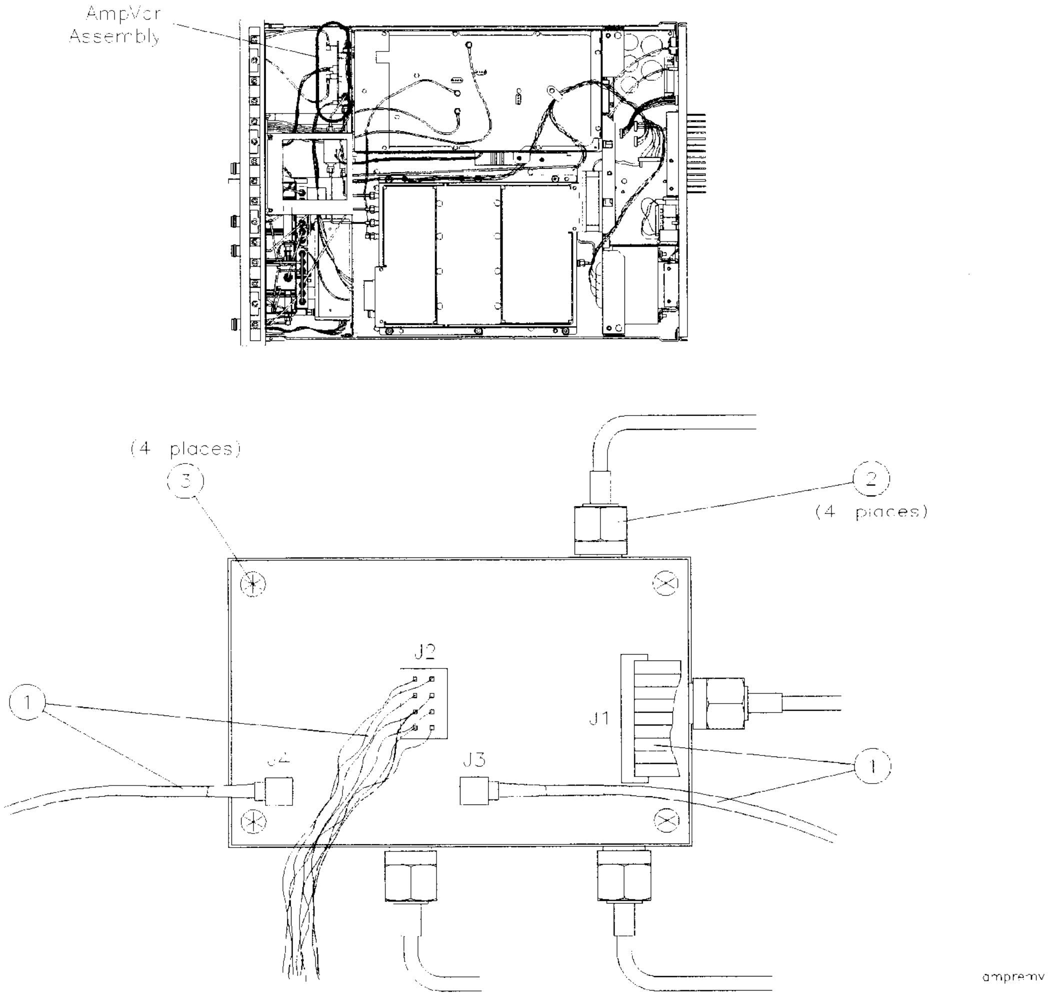


Figure 4-7 A14 and A14A1 AmpVar Assemblies Replacement

Replacement

1. Carefully place the A14 AmpVar assembly into the instrument.
2. Replace the four screws located at the corners of the AmpVar assembly (3). Refer to Figure 4-7 on page 4-15.
3. Connect the four semi-rigid cables to the AmpVar assembly (2).
4. Connect the ribbon cable to J1, the cable assembly to J2, and two coax cables to J3 and J4 on the A14A1 AmpVar board (1).
5. Replace the instrument cover assembly. Refer to the "Instrument Cover" replacement procedure.

A11A1 9-Pin Bus Board Assembly

CAUTION Use ESD precautions when performing this replacement procedure.

Removal

Remove the instrument cover assembly. Refer to "Instrument Cover" removal procedure.

Remove two screws from the A11A1 9-pin bus board (1). Refer to Figure 4-8.

Remove the 9-pin bus board from the A11 processor board.

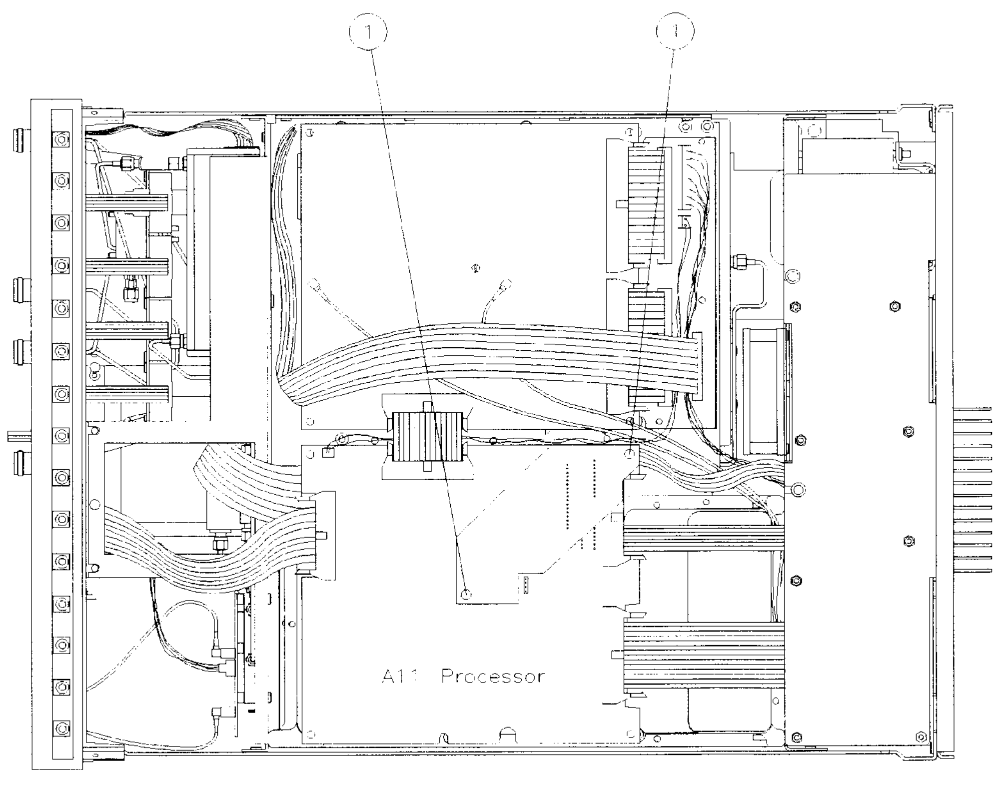


Figure 4-8 9-Pin Bus Board Replacement

Replacement

1. Place the A11A1 9-pin bus board onto the A11 processor board.
2. Replace the two screws on the 9-pin bus board (1). Refer to Figure 4-8 on page 4-17.
3. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

A11 Processor Board Assembly

CAUTION

Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the A11A1 9-pin bus board. Refer to “A11A1 9-Pin Bus Board Assembly” removal procedure.
2. Disconnect the five cables (located at J1 thru J5) from the A11 processor board (1). Refer to Figure 4-9.
3. Remove two hex nuts from the processor board (2).
4. Remove four screws from the processor board (3).
5. Remove the processor board.

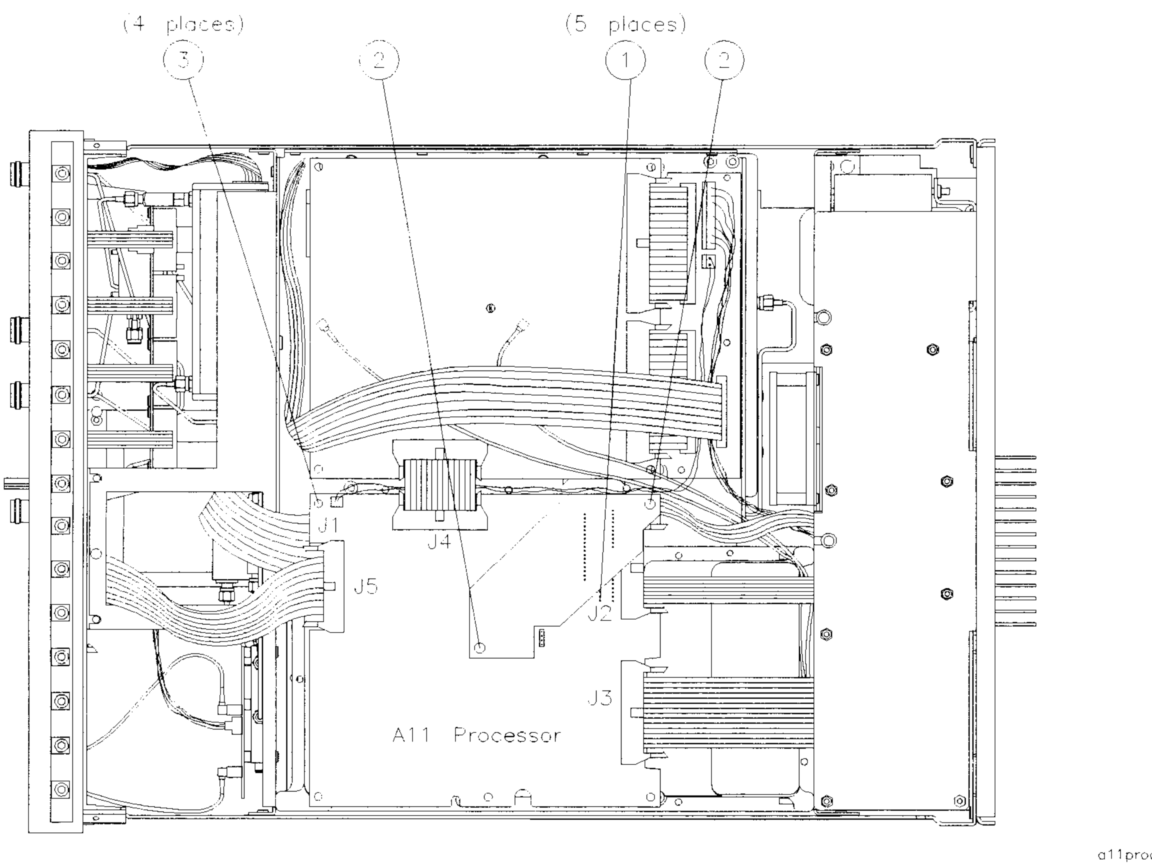


Figure 4-9 A11 Processor Board Replacement

Replacement

1. Place the A11 processor board into the instrument.
2. Replace four screws to the processor board (3). Refer to Figure 4-9 on page 4-19.
3. Replace the two hex nuts to the processor board (2).
4. Connect the ribbon cables (located at J1 thru J5) from the processor board (1).
5. Replace the A11A1 9-pin bus board. Refer to “A11A1 9-Pin Bus Board Assembly” replacement procedure.

NOTE

After replacing the processor board make sure to re-enter the serial number and model number using the Test Utilities in the software.

A12 DAC Board Assembly

Removal

CAUTION Use ESD precautions when performing this replacement procedure.

1. Remove the instrument cover assembly. Refer to “Instrument Cover” removal procedure.
2. Place the instrument with the bottom side facing up on the work surface.
3. Disconnect the two cables (J4 and J5) from the A12 DAC board (1). Refer to Figure 4-10 on page 4-22.
4. Disconnect the three ribbon cables (J1, J2, and J3) from the DAC board (2).
5. Disconnect the ribbon cable (J14) from the A10 motherboard (3).
6. Remove the five screws from the corners and center of the DAC board (4).
7. Carefully remove the DAC board from the instrument.

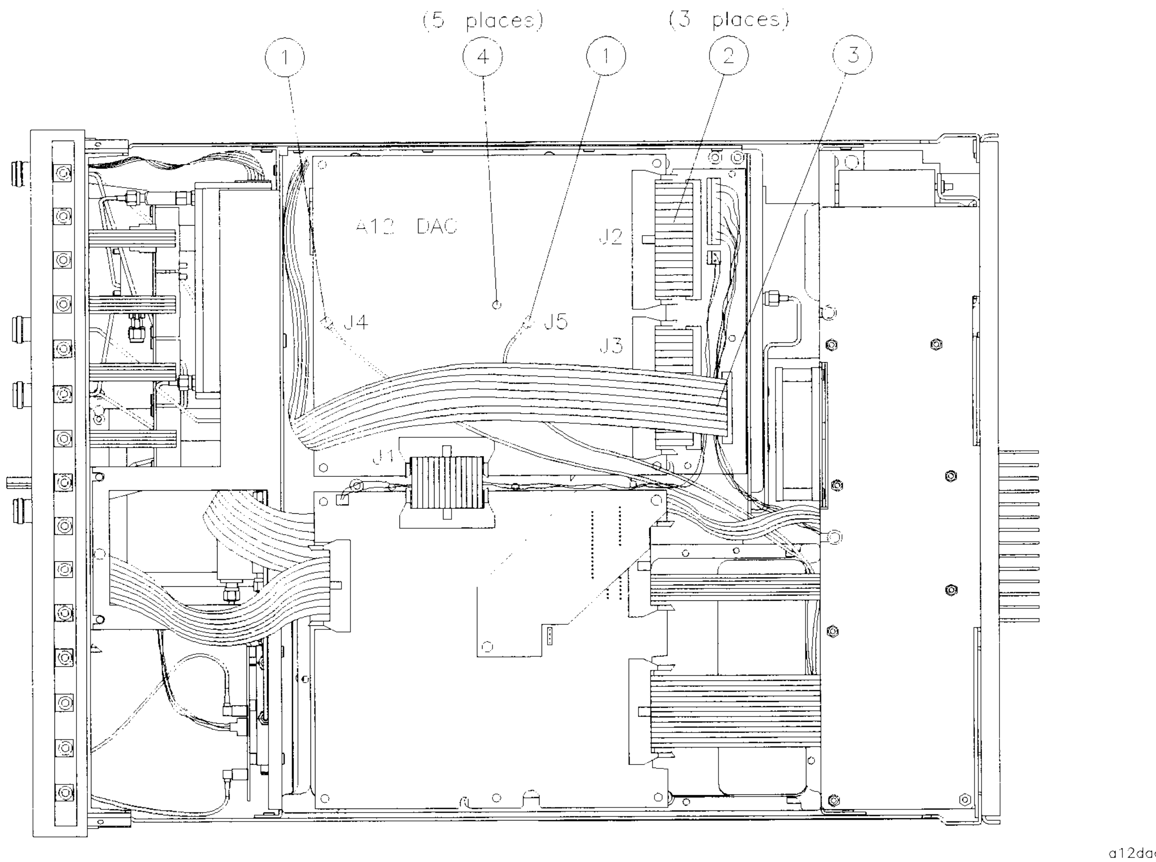


Figure 4-10 A12 DAC Board Replacement

Replacement

1. Place the instrument with the bottom side facing up on the work surface.
2. Place the A12 DAC board into the instrument.
3. Replace the five screws on the corners and in the center of the DAC board (4). Refer to Figure 4-10.
4. Connect the ribbon cable (J14) to the A10 motherboard (3).
5. Connect the two cables (J4 and J5) to the DAC board (2).
6. Connect three ribbon cables (J1, J2, and J3) to the DAC board (1).
7. Replace the instrument cover assembly. Refer to “Instrument Cover” replacement procedure.

A17 High-Pass Filter

CAUTION Use ESD precautions when performing this replacement procedure.

Removal

1. Disconnect the two ribbon cables from the A11 processor board (1). Refer to Figure 4-11.
2. Disconnect the two semi-rigid cables from the A17 high-pass filter (2).
3. Remove the two screws that secure the high-pass filter to the chassis (3).
4. Remove the high-pass filter.

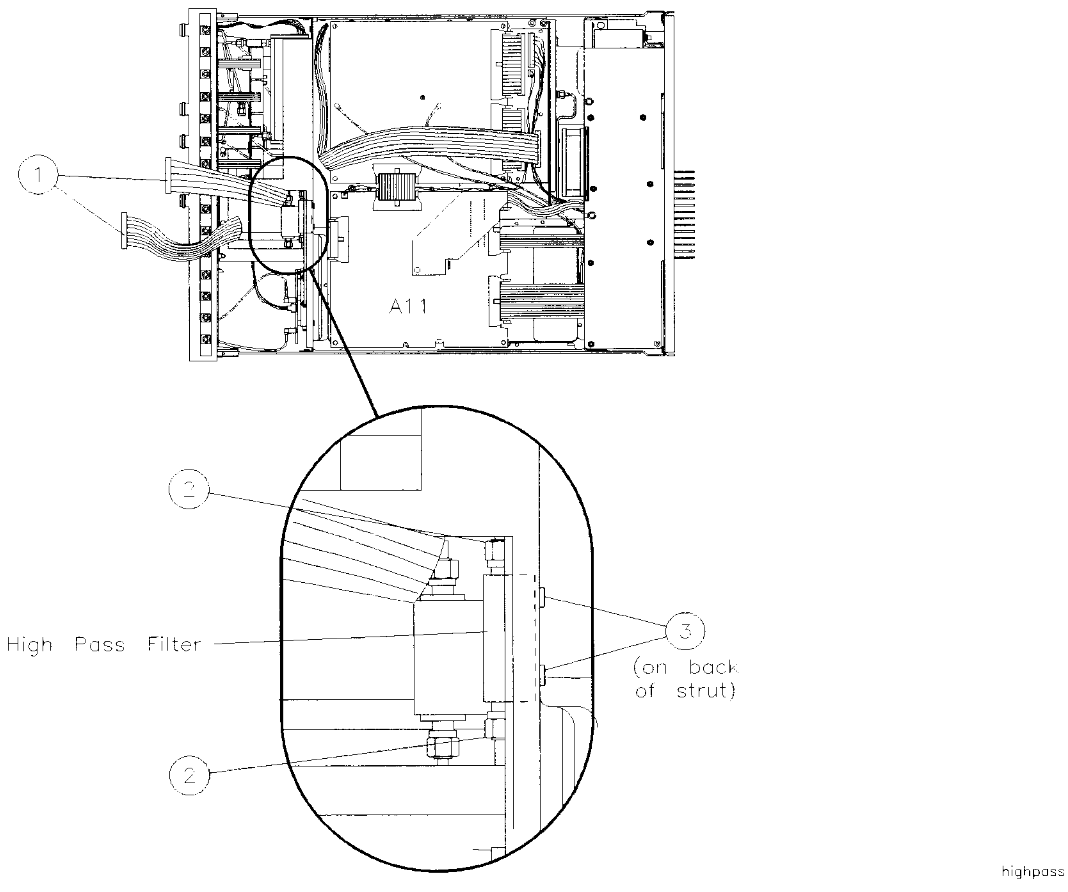


Figure 4-11 A17 High-Pass Filter Replacement

Replacement

1. Place the A17 high-pass filter into the instrument.
2. Replace the two screws that secure the high-pass filter to the chassis (2). Refer to Figure 4-11 on page 4-23.
3. Connect the two semi-rigid cables to the high-pass filter (3).
4. Connect the two ribbon cables to the A11 processor board (1).

Rear-Panel Assembly

Removal

CAUTION Use ESD precautions when performing this replacement procedure.

1. Cut the tie wrap that secures the two cables to the extended hex nut on the A11 processor board (1). Refer to Figure 4-12 on page 4-26.
2. Remove the two screws from the bottom plate of the rear panel (2).
3. Place the instrument with the top facing up on the work surface.
4. Remove the eight screws on the lid (3), to access the components underneath the top lid. Refer to Figure 4-13 on page 4-26.
5. Disconnect the three ribbon cables and the four cable harness assemblies from the rear panel (4). Refer to Figure 4-14 on page 4-27.
6. Slip the two cables that were released from the tie wrap in step 3 through to the top side of the instrument.
7. Remove the four screws from the corners located on the outside of the rear panel assembly (5).
8. Carefully slide the rear-panel assembly from the instrument.

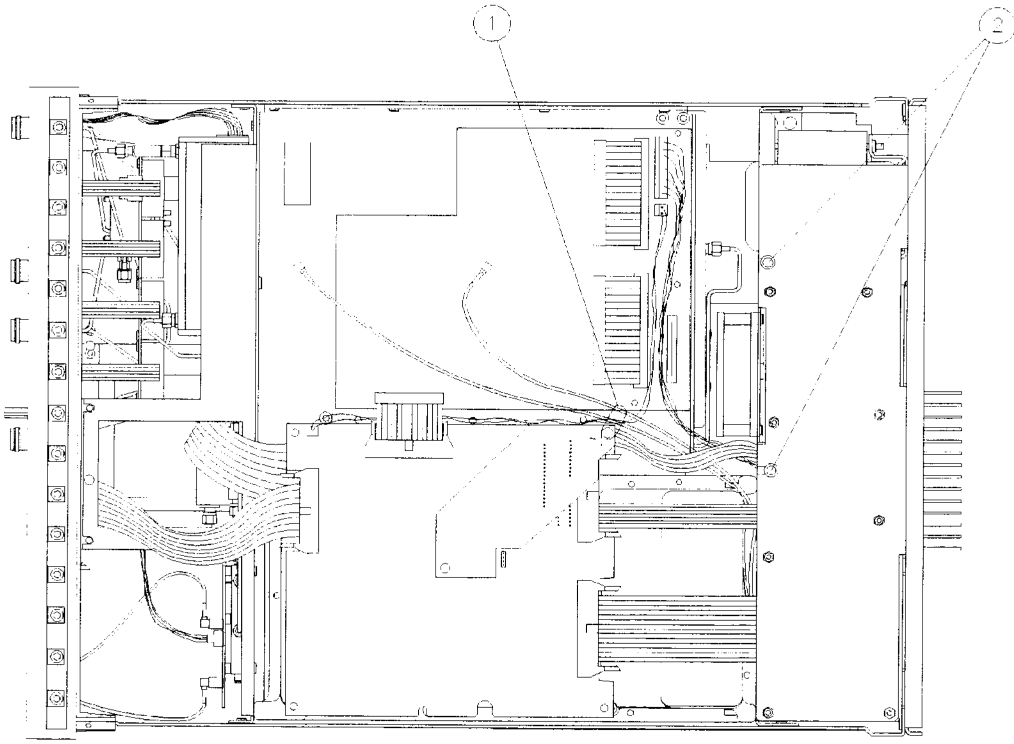


Figure 4-12 Rear-Panel Assembly Replacement

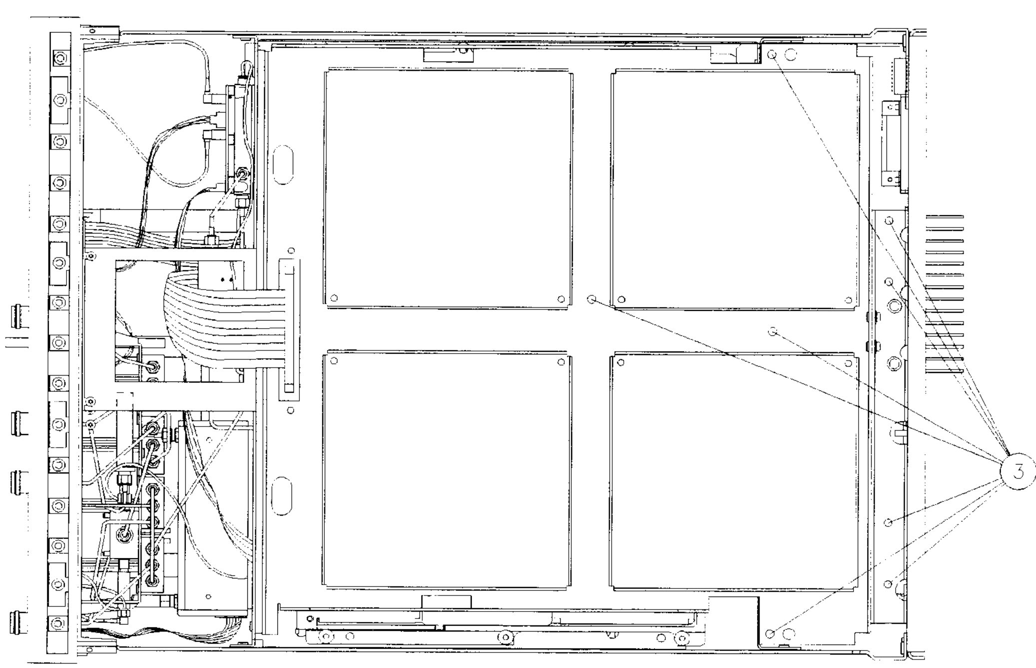


Figure 4-13 Rear-Panel Assembly Replacement, Removing Lid Screws

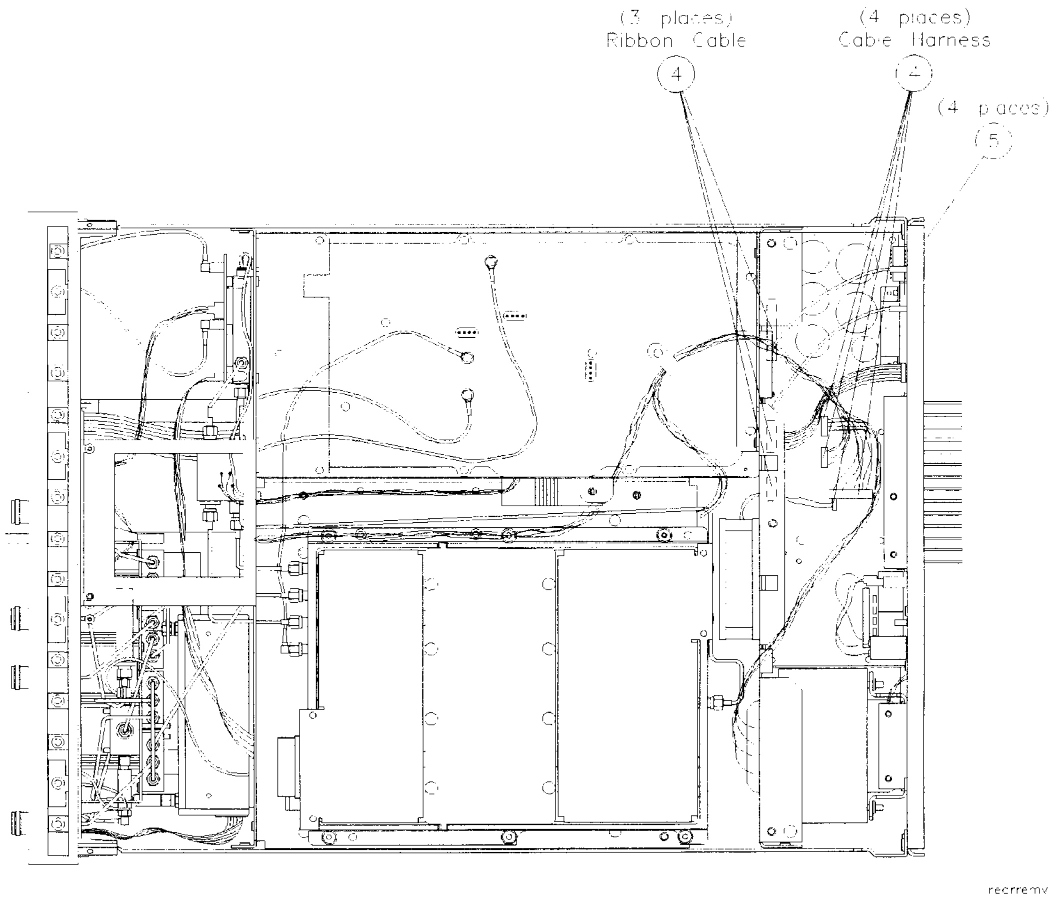


Figure 4-14 Rear-Panel Assembly Replacement, Rear Panel Removal

Replacement

1. Carefully slide the rear-panel assembly onto the instrument.
2. Replace the four screws on the corners located on the outside of the rear-panel assembly (5). Refer to Figure 4-14 on page 4-27.
3. Connect the three ribbon cables and the four cable harness assemblies to the rear panel (4).
4. Replace the eight screws on the lid (3). Refer to Figure 4-13 on page 4-26.
5. Place the instrument with the top facing up on the work surface.
6. Replace the two screws on the bottom plate of the rear panel (2). Refer to Figure 4-12 on page 4-26.
7. Place the instrument with the bottom side facing up on the work surface.
8. Replace the tie wrap that secures these two cables to the extended hex nut on the A11 processor board (1). Refer to Figure 4-12 on page 4-26.

T1 Transformer Assembly

Removal

1. Remove the rear-panel assembly. Refer to the 'Rear Panel Assembly" removal procedure.
2. Disconnect the cables going to J1 and J9 (1).
3. Remove the four screws securing the transformer to the rear panel chassis (2).
4. Carefully remove the transformer from the rear-panel assembly.

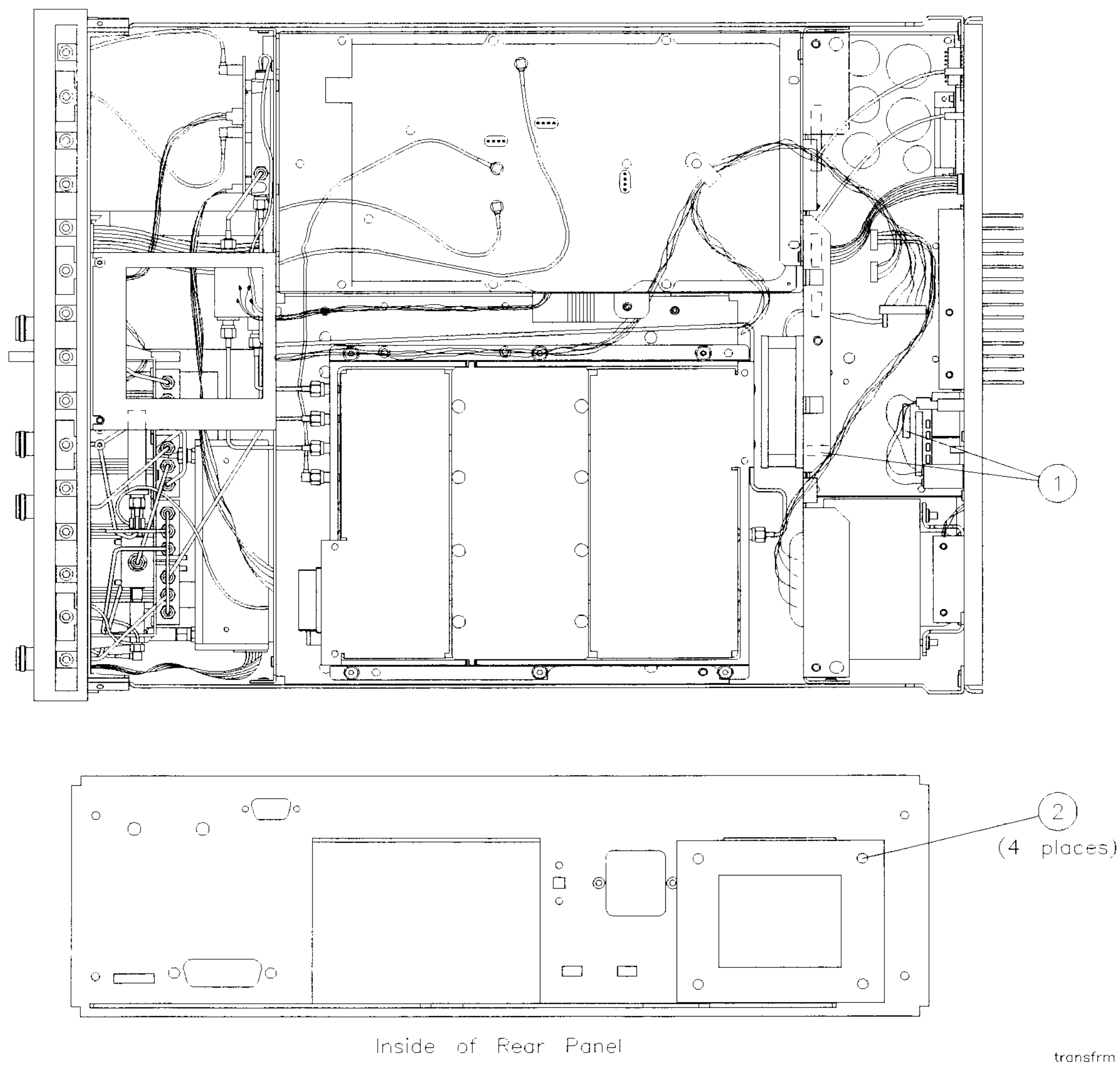


Figure 4-15 T1 Transformer Assembly Replacement

Replacement

1. Place the transformer into the rear-panel assembly.
2. Replace the four screws securing the transformer to the rear panel chassis (2). Refer to Figure 4-15 on page 4-29.
3. Connect the cables to J1 and J9 (1).
4. Replace the rear-panel assembly. Refer to the "Rear Panel Assembly" replacement procedure.

A13 Power Supply Board Assembly

Removal

1. Remove the rear-panel assembly. Refer to the "Rear Panel Assembly" removal procedure.
2. Disconnect the cables going to A13 Power Supply board connectors J1, J8, and J9 (1). Refer to Figure 4-16 on page 4-32.
3. Remove the two screws on the line module located on the outside of the rear panel and remove the line module (2).
4. Remove the two screws on the line-service switch located on the outside of the rear panel and remove the line service switch (3).
5. Remove the two hex nuts that secure the service-bus connector to the rear-panel chassis (4).
6. Remove the seven screws that secure the regulators to the rear-panel chassis (5). *Take care not to damage insulator.*
7. Remove the eight screws that secure the power supply board to the rear-panel chassis (6).
8. Remove the power supply board from the rear panel chassis.

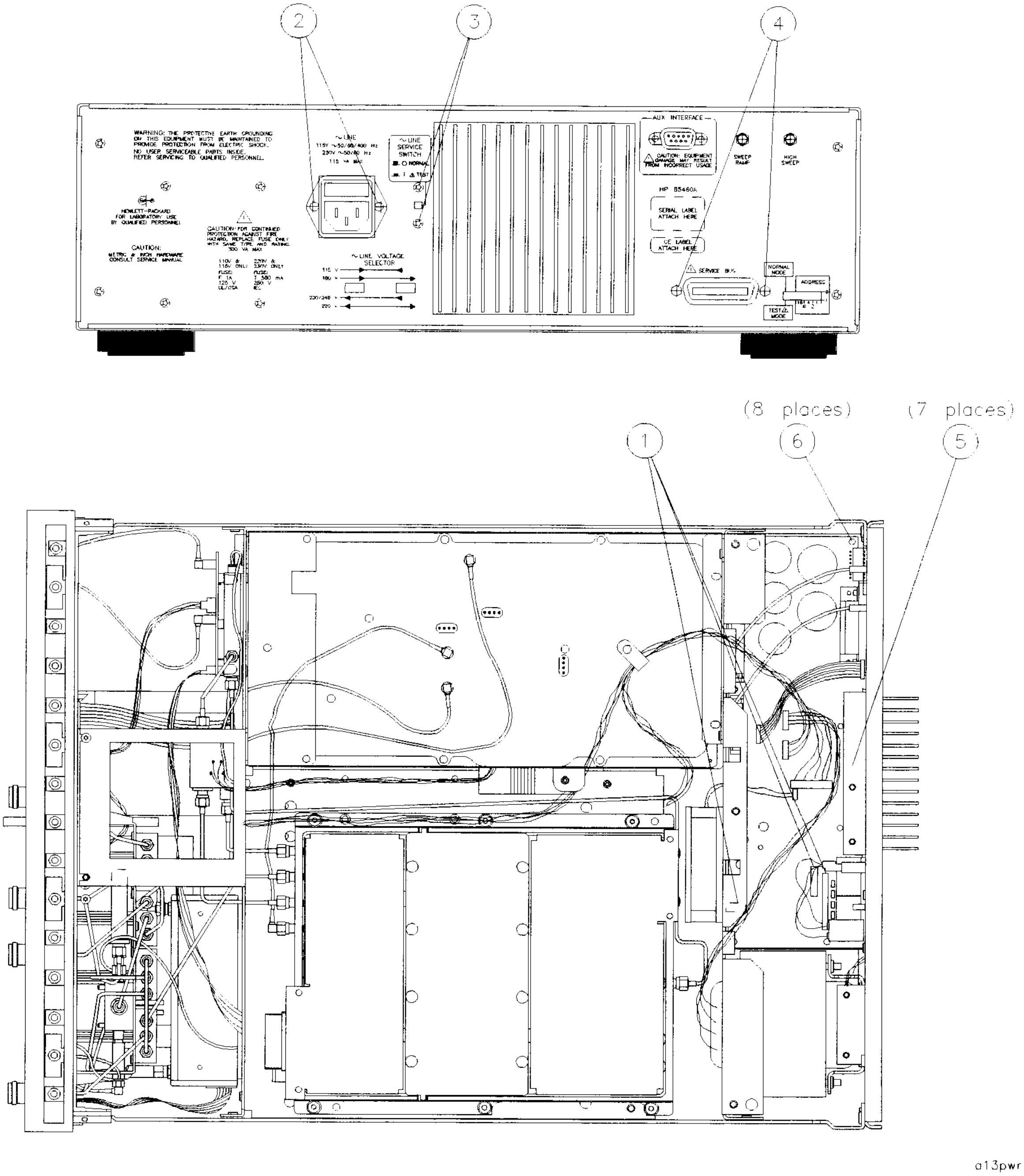


Figure 4-16 A13 Power Supply Board Replacement

Replacement

1. Place the A13 Power Supply board onto the rear-panel chassis.
2. Replace the eight screws that secure the power supply board to the rear-panel chassis (6). Refer to Figure 4-16 on page 4-32.
3. Replace the seven screws that secure the regulators to the rear-panel chassis (5). *Take care not to damage insulator.*
4. Replace the two hex nuts that secure the service-bus connector to the rear-panel chassis (4).
5. Replace the line-service switch.
6. Replace the two screws on the line service switch located on the outside of the rear panel (3).
7. Replace the line module.
8. Replace the two screws on the line module located on the outside of the rear panel (2).
9. Connect the cables going to J1, J8, and J9 (1).
10. Replace the rear-panel assembly. Refer to the "Rear Panel Assembly" replacement procedure.

B1 Fan Assembly

Removal

1. Remove the instrument cover assembly. Refer to “Instrument Cover” removal procedure.
2. Place the instrument with the top facing up on the work surface.
3. Disconnect the black and red B1 fan assembly cable from J5 on the rear panel (1). Refer Figure 4-17.
4. Remove the four screws securing the fan to the rear-panel chassis (2).
5. Remove the fan.

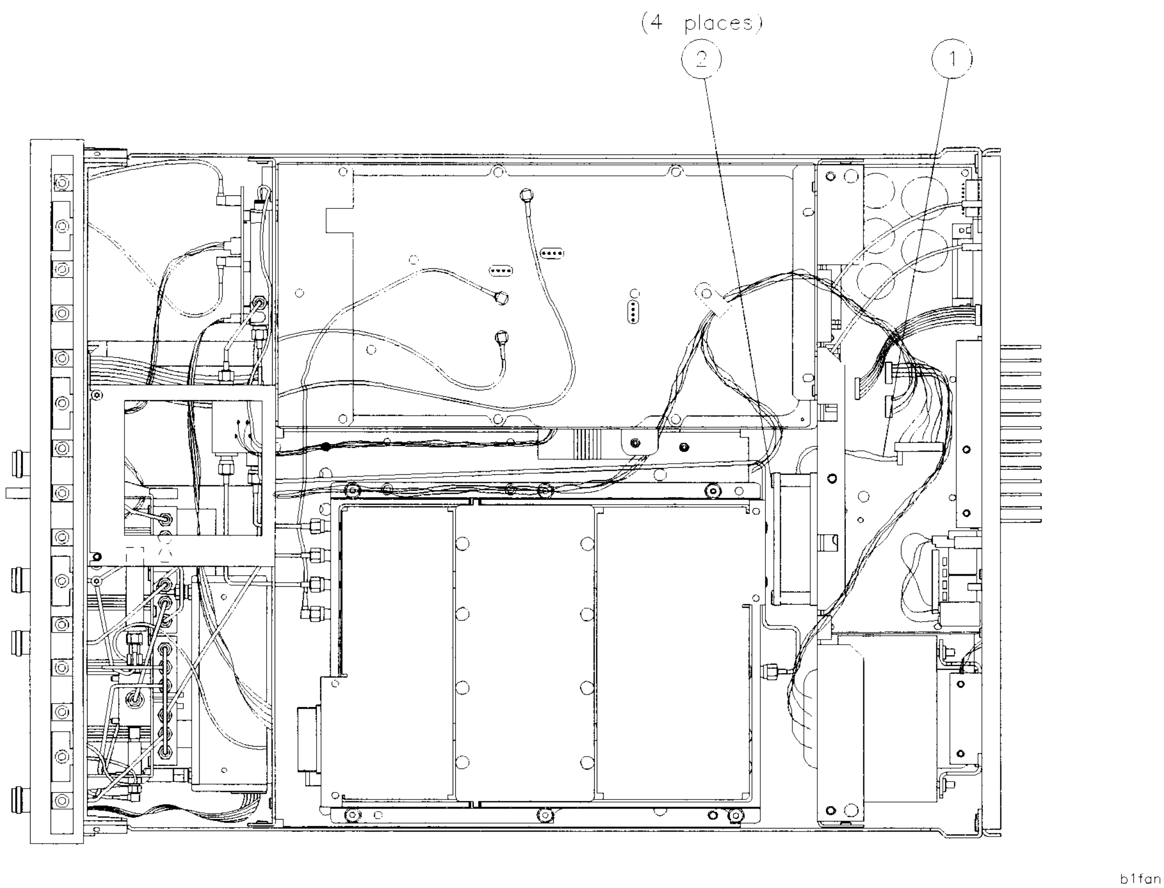


Figure 4-17 B1 Fan Assembly Replacement

Replacement

1. Place the instrument with the top facing up on the work surface.
2. Place the B1 fan in the instrument.
3. Replace the four screws securing the fan to the rear panel chassis (2). Refer to Figure 4-17 on page 4-34.
4. Connect the black and red fan assembly cable from J5 on the rear panel (1).
5. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

A8 LF Tuneable Filters

Removal

1. Remove the instrument cover assembly. Refer to “Instrument Cover” removal procedure.
2. Place the instrument with the top facing up on the work surface.
3. Remove the four screws from the clips that secure the cables to the cover plate (1). Refer to Figure 4-18.
4. Disconnect the three cables J2, J3, and J4 from the cover plate (2).
5. Remove the five screws, three from one end plate and two from the other end plate (3).
6. Remove the two screws from the rear-panel assembly (4).
7. Remove the two screws from the front strut (5).
8. Remove the eight screws from the cover plate and remove the cover plate (6).
9. Lift the A8 LF tuneable filter board from the cavity.

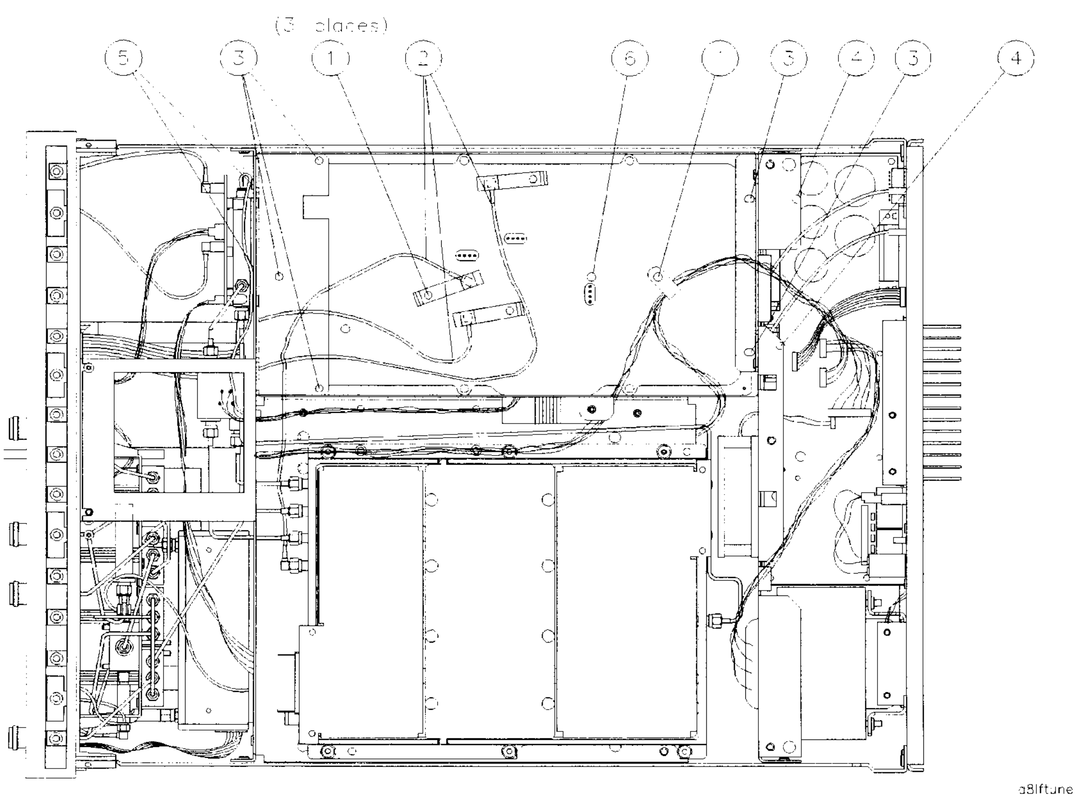


Figure 4-18 A8 LF Tuneable Filters Replacement

Replacement

1. Carefully place the A8 LF tuneable filter board into the cavity.
2. Replace the cover plate.
3. Replace the eight screws on the cover plate (6). Refer to Figure 4-18 on page 4-36.
4. Replace the two screws from the front strut (5).
5. Replace the two screws from the rear-panel assembly (4).
6. Replace the five screws on the end plates, three on one end plate and two on the other end plate (3).
7. Connect the three cables J2, J3, and J4 on the cover plate (2).
8. Replace the four screws on the clips that secure the cables to the cover plate (1).
9. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

A15 YIG

Removal

1. Remove the instrument cover assembly. Refer to "Instrument Cover" removal procedure.
2. Place the instrument with the top facing up on the work surface.
3. Disconnect the ribbon cable from the J5 connector on the front strut (1). Refer to Figure 4-19 on page 4-39.
4. Remove eight screws on the front to access the components beneath the top lid (2).
5. Disconnect the two semi-rigid cables from both sides of the A15 YIG (3).
6. Place the instrument with the bottom facing up on the work surface.
7. Disconnect the cable that goes to J5 on the A11 processor board (4).
8. Disconnect the YIG cable assembly from J9 on the top deck motherboard (5).
9. Place the instrument with the top facing up on the work surface.
10. Lift the lid and slide the YIG cable assembly through the hole underneath the processor board.
11. Remove the screw that secures the YIG to the chassis (6).
12. Carefully remove the YIG from the instrument.

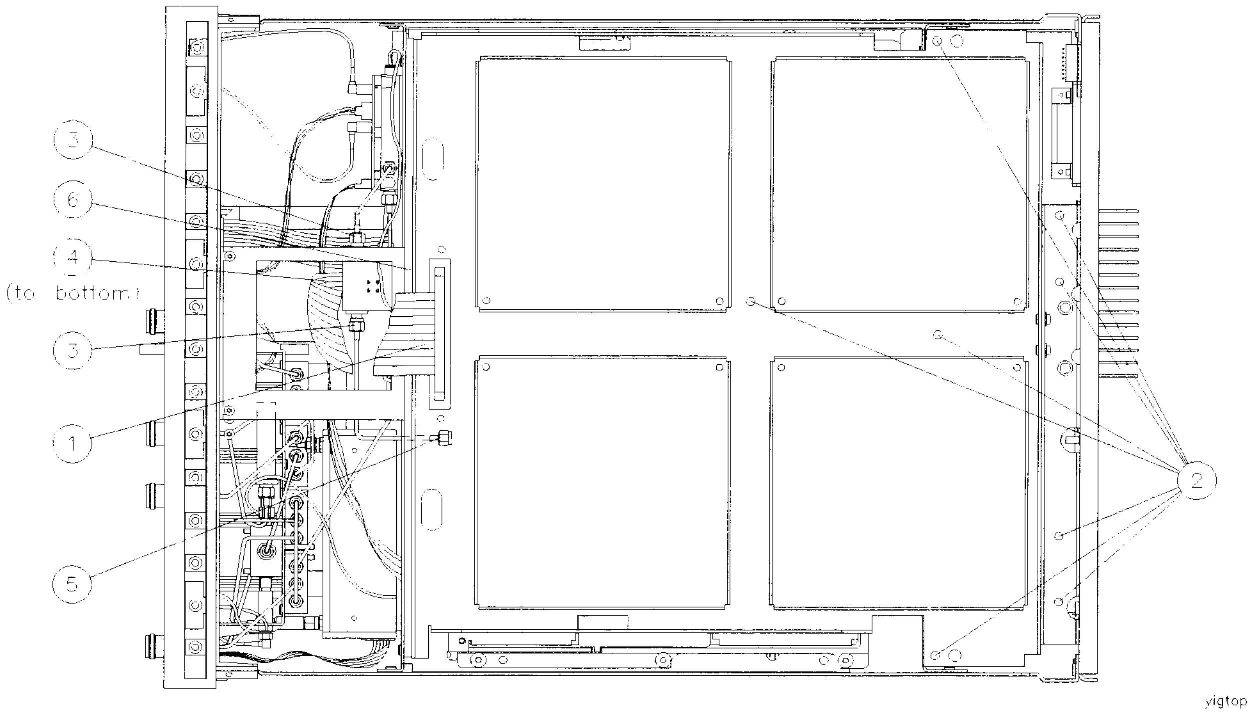


Figure 4-19 A15 YIG Replacement, Top View

Replacement

1. Place the instrument with the bottom facing up on the work surface.
2. Carefully place the A15 YIG assembly in the instrument.
3. Replace the screw that secures the YIG to the chassis (6). Refer to Figure 4-19.
4. Lift the lid and slide the YIG cable assembly through the hole underneath the A11 processor board.
5. Place the instrument with the top facing up on the work surface.
6. Connect the YIG cable assembly from J9 on the top deck motherboard (5).
7. Place the instrument with the bottom facing up on the work surface.
8. Connect the cable that goes to J5 on the A11 processor board (4).
9. Connect the two semi-rigid cables on either side of the YIG (3).
10. Replace the eight screws on the front (2).
11. Connect the ribbon cable to the J5 connector on the front strut (1).
12. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

A9 HF Filters

Removal

1. Remove the instrument cover assembly. Refer to "Instrument Cover" removal procedure.
2. Place the instrument with the top facing up on the work surface.
3. Remove eight screws on the front to access the components underneath the top lid (1). Refer to Figure 4-20 on page 4-41.
4. Disconnect the five cables that go to the A9 HF Filter assembly (2). Refer to Figure 4-20 on page 4-41.
5. Disconnect the ribbon cable (3) from the HF filter assembly.
6. Remove the six screws that attach the HF filter housing to the front strut (4).
7. Lift the housing out of the instrument.
8. Remove the 12 screws that attach the covers to the HF filter housing and remove the covers (5).
9. Remove the two jack-screws on the end of the HF filter housing.
10. Remove the two screws that secure the HF filter board to the HF filter housing and remove the board.

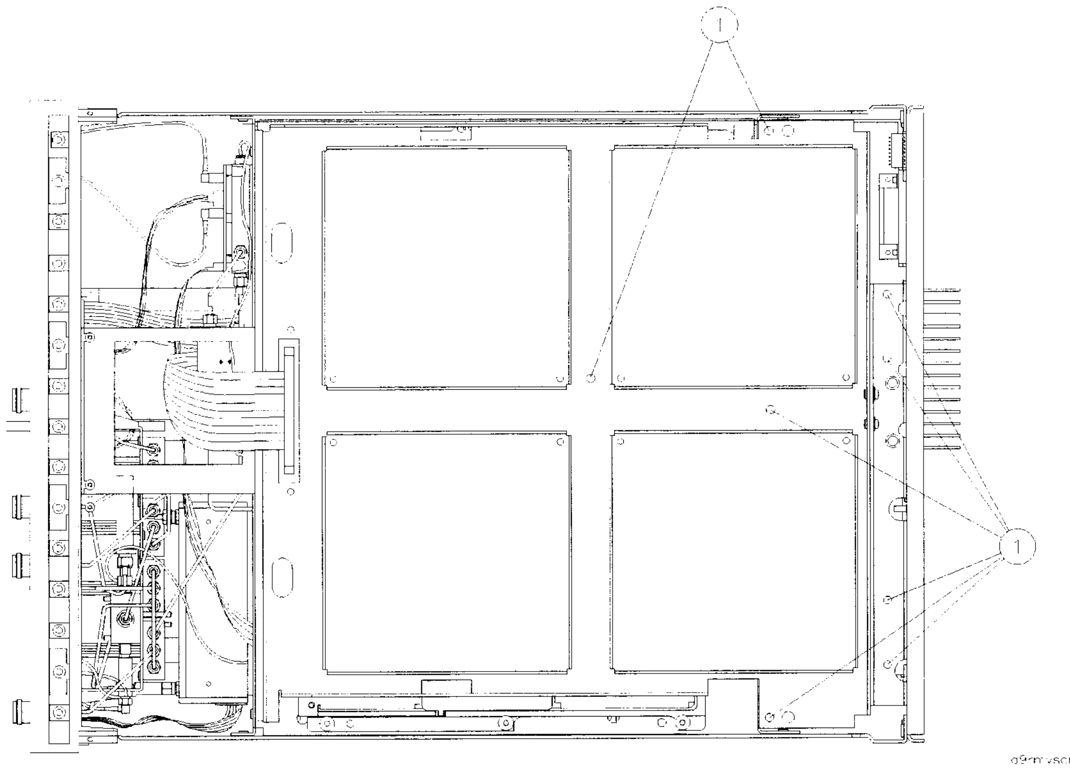


Figure 4-20 A9 HF Filters Replacement, Removing Lid Screws

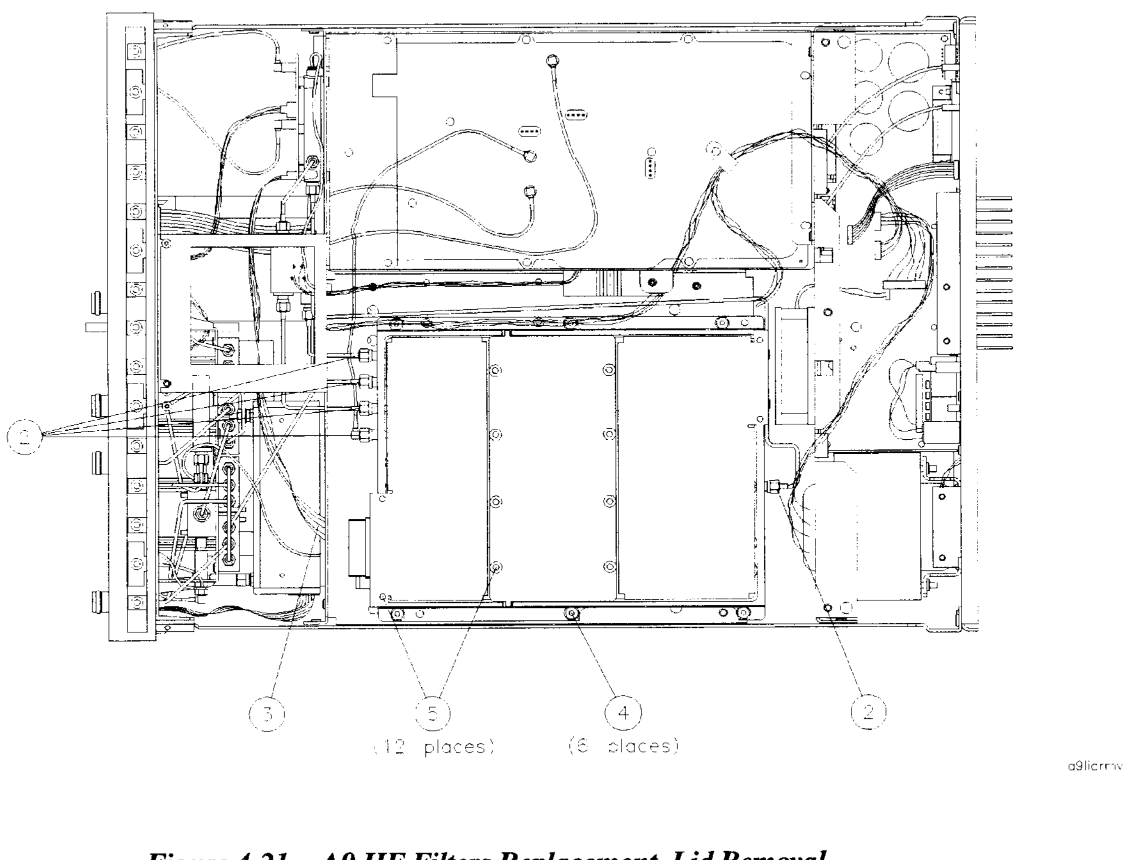


Figure 4-21 A9 HF Filters Replacement, Lid Removal

Replacement

1. Place the A9 HF filter board assembly into the instrument.
2. Replace the two screws that secure the board to the A9 HF Filter assembly housing.
3. Replace the two jack-screws on the end of the HF filter housing.
4. Replace the HF housing covers.
5. Replace the 12 screws that attach the covers to the HF filter housing (5). Refer to Figure 4-20 on page 4-41.
6. Place the housing in the instrument.
7. Connect the ribbon cable (3) to the HF filter.
8. Replace the six screws that attach the HF filter housing to the front strut (4).
9. Connect the five cables that go to the HF filter assembly (2).
10. Replace the eight screws on the front (1). Refer to Figure 4-20 on page 4-41.
11. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

A2 Attenuator

Removal

1. Remove the instrument cover assembly. Refer to "Instrument Cover" removal procedure.
2. Place the instrument with the bottom facing up on the work surface.
3. Disconnect the two semi-rigid cables that connect to the A2 attenuator (1). Refer to Figure 4-22.
4. Disconnect the ribbon cable from the attenuator (2).
5. Remove the two screws that attach the attenuator to the front strut (3).
6. Remove the attenuator from the instrument.

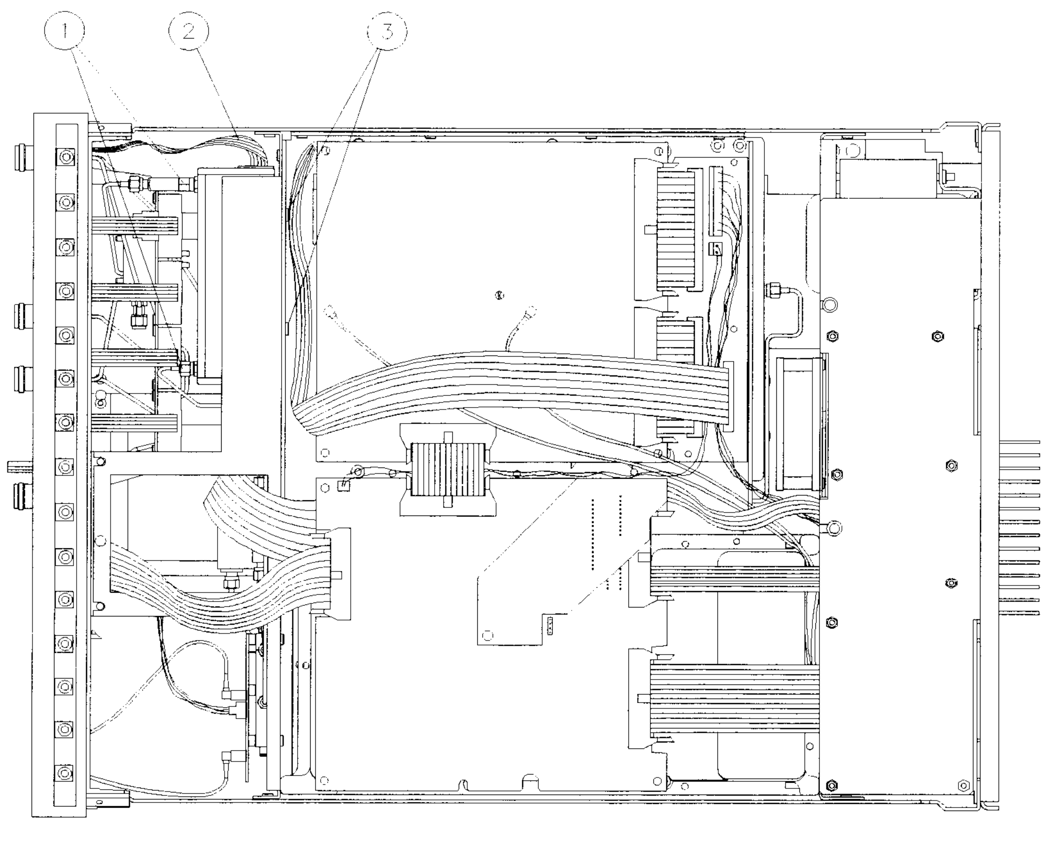


Figure 4-22 A2 Attenuator Assembly Replacement

Replacement

1. Place the A2 attenuator into the instrument.
2. Replace the two screws that attach the attenuator to the front strut (3). Refer to Figure 4-22 on page 4-43.
3. Connect the ribbon cable to the attenuator (2).
4. Connect the two semi-rigid cables that connect to the attenuator (1).
5. Replace the instrument cover assembly. Refer to "Instrument Cover" replacement procedure.

5 Customer Support

Your EMI receiver is built to provide dependable service. It is unlikely that you will experience a problem. However, Hewlett-Packard's worldwide sales and service organization is ready to provide the support you need.

If You Have a Problem

Before calling Hewlett-Packard or returning the EMI receiver for service, please make the checks listed in “Check the Basics.” If you still have a problem, please read the warranty printed at the front of this manual. If your EMI receiver is covered by a separate maintenance agreement, please be familiar with its terms.

Hewlett-Packard offers several maintenance plans to service your EMI receiver after warranty expiration. Call your HP Sales and Service Office for full details.

If you want to service the EMI receiver yourself after warranty expiration, contact your HP Sales and Service Office to obtain the most current test and maintenance information.

Calling HP Sales and Service Offices

Sales and service offices are located around the world to provide complete support for your EMI receiver. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service office listed in Table 5-1 on page 5-8. In any correspondence or telephone conversations, refer to the EMI receiver by its model number and full serial number. With this information, the HP representative can quickly determine whether your unit is still within its warranty period.

Check the Basics

In general, a problem can be caused by a hardware failure, a software error, or a user error. Often problems may be solved by repeating what was being done when the problem occurred. A few minutes spent in performing these simple checks may eliminate time spent waiting for instrument repair.

If Your EMI Receiver Does Not Turn On

- ❑ Check that the EMI receiver is plugged into the proper ac power source.
- ❑ Check that the line socket has power.
- ❑ Check that the rear-panel voltage selector switches are set correctly.
- ❑ Check that the line fuses are good.
- ❑ Check that the EMI receiver is turned on.

If the RF Filter Section Does Not Seem To Be Working

- ❑ Check the ac power to the EMI receiver as described above.
- ❑ Verify that the rear-panel auxiliary interface cable is properly connected.
- ❑ Verify that the rear-panel sweep ramp and high sweep cables are properly connected.
- ❑ Verify that the DIP switch near the service bus connector is set to the normal mode.

If the EMI Receiver Cannot Communicate Via HP-IB

- ❑ Verify that the proper HP-IB address has been set.
- ❑ Verify that there are no equipment address conflicts.
- ❑ Check that the other equipment and cables are connected properly and operating correctly.
- ❑ Verify that the HP-IB cable is connected to the RF section and not the RF filter section.

Verification of Proper Operation

- ❑ Check that the test being performed and the expected results are within the specifications and capabilities of the EMI receiver.
- ❑ Check operation by performing the operation verification procedures in Chapter 2 of the *EMI Series Installation and Verification Manual.* Record all results in the operation verification test record.

If the RF Filter Section Does Not Power Off

- ❑ Verify that the service power switch on the RF filter section is set to normal mode.

Error Messages

- ❑ Check the EMI receiver display for error messages. Refer to Chapter 4 of the *EMI Series Installation and Verification Manual.*

Additional Support Services

CompuServe

CompuServe, the worldwide electronic information utility, provides technical information and support for EMC instrumentation and communication with other EMI users.

With a CompuServe account and a modem-equipped computer, simply type GO HPSYS and select the EMC system section to get information on documentation, application notes, product notes, service notes, software, firmware revision listings, data sheets, and more.

If you are not a member of CompuServe and would like to join, call CompuServe and take advantage of the Free Introductory Membership. The membership includes the following:

- An introductory usage credit to CompuServe
- A private User ID and Password
- A complimentary subscription to CompuServe's monthly computing publication, *CompuServe Magazine*

To take advantage of the CompuServe Free Introductory Membership offer, call one of the telephone numbers below and ask for Representative Number 999.

Country	Toll Free	Direct
Argentina	—	(+54) 01-372-7883
Australia	008-023-158	(+61) 2-410-4555
Canada	—	(+1) 614-457-8650
Chile	—	(+56) 2-696-8807
Germany	0130-86-4643	(+49) (+89) 66-55-0-222
Hong Kong	—	(+852) 867-0102
Israel	—	(+972) 3-290466
Japan	0120-22-1200	(+81) 3-5471-5806
Korea	080-022-7400	(+82) 2-569-5400
New Zealand	0800-441-082	—
South Africa	—	(+27) 12-841-2530
Switzerland	155-31-79	—
Taiwan	—	(+886) 2-515-7035
United Kingdom	0800-289458	(+44) (+272) 255111
United States	800-848-8990	(+1) 614-457-8650
Venezuela	—	(+58) 2-793-2984
Elsewhere	—	(+1) 614-457-8650

FAX Support Line

A fax sheet is provided at the end of this chapter as a method in which to directly contact the HP EMC support team in the event of a problem. The fax cover sheet provides the EMC support team with information about your company, the product, and a detailed description about the problem.

NOTE

All items on the fax cover sheet *must* be completed in order to expedite your response. Any incomplete item may delay your response.

Simply copy the fax cover sheet, fill out the requested information, include any additional information sheets, and fax the sheet(s) to HP EMC Support at (707) 577-4200. Depending on the complexity of the problem, you should receive a response back within a few days.

Returning the EMI Receiver for Service

Use the information in this section if it is necessary to return the EMI receiver to Hewlett-Packard.

NOTE

If you are returning an EMI receiver, you must return both the RF section and RF filter section to the service center for repair and calibration. Also, you must package the units individually to avoid damage.

Package the EMI Receiver For Shipment

Use the following steps to package the EMI receiver for shipment to Hewlett-Packard for service:

1. Fill in a service tag (available at the end of this chapter) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:

- Any error messages that appeared on the EMI receiver display.
- A completed operation verification test record located at the end of Chapter 2 in the *EMI Series Installation and Verification Manual.*
- Any other specific data on the performance of the EMI receiver.

CAUTION

Damage to the EMI receiver 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 instrument or prevent it from shifting in the carton. Styrene pellets cause equipment damage by generating static electricity and by lodging in the fan.

2. Use the original packaging materials, if possible. You may also use strong shipping containers that are made of double-walled, corrugated cardboard with 159 kg (350 lb) bursting strength. The cartons must be both large enough and strong enough and allow at least 3 to 4 inches on all sides of the instrument for packing material. Containers and materials for factory shipments are also available through any Hewlett-Packard sales or service office.
3. Protect the front panel with cardboard.
4. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Hayward, CA 94545). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink

Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent 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. Retain copies of all shipping papers.

Table 5-1 Hewlett-Packard Sales and Service Offices

US Field Operations		
Customer Information Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014 USA (800) 752-0900	California, Northern Hewlett-Packard Company 301 E. Evelyn|gw421 South Manhattan Ave Mountain View, CA 94041 (415) 694-2000	California, Southern Hewlett-Packard Company Fullerton, CA 92631 (714) 999-6700
Colorado Hewlett-Packard Company 24 Inverness Place, East Englewood, CO 80112 (303) 649-5000	Georgia Hewlett-Packard Company 2000 South Park Place Atlanta, GA 30339 (404) 955-1500	Illinois Hewlett-Packard Company 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 255-9800
New Jersey Hewlett-Packard Company 120 W. Century Road Paramus, NJ 07653 (201) 599-5000	Texas Hewlett-Packard Company 930 E. Campbell Road Richardson, TX 75081 (214) 231-6101	
European Field Operations		
Headquarters Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2/Geneva Switzerland (42 22) 780 8111	France Hewlett-Packard France 1 Avenue Du Canada Zone D'Activite De Courtaboeuf F-91947 Les Ulis Cedex France (33 1) 69 82 60 60	Germany Hewlett-Packard GmbH Berner Strasse 117 6000 Frankfurt 56 West Germany (49 69) 500006-0
Great Britain Hewlett-Packard Ltd Eskdale Road, Winnersh Triangle Wokingham, Berkshire RF11 5DZ England (44 734) 696622		
Intercon Field Operations		
Headquarters Hewlett-Packard Company 3495 Deer Creek Roadl Palo Alto, CA 94304-1316 (415) 857-5027	Australia Hewlett-Packard Australia Ltd. 31-41 Joseph Street Blackburn, Victoria 3130 (61 3) 895-2895	Canada Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
China Hewlett-Packard Company China 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888	Japan Yokogawa-Hewlett-Packard Ltd. 1-27-15 Yabe, Sagamihara Kanagawa 229, Japan (81 427) 59-1311	Singapore Hewlett-Packard Singapore (Pte.) Ltd. 1150 Depot Road Singapore 0410 (65) 273-7388
Taiwan Hewlett-Packard Taiwan 8th floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404		

HEWLETT PACKARD

Fax Cover Sheet

To: HP EMC Support **FAX Number: (707) 577-4200** **Page ____ of _____**

Date Transmitted: ________________________ **Time Transmitted:** ______________________

From:

Company: ____

Last Name: ____________________________ First Name: __________________________

Address: ____

City: ____ State: __________________________

Country: _______________________ Postal Code: ____________ Mail Stop: __________

Telephone Number **(include Country Code)**: _______________________________________

Fax Number **(required)**: ____

Product:

☐ HP 8542E ☐ HP 85422E Option(s): ________________________________

☐ HP 8546A ☐ HP 85462A Option(s): ________________________________

Serial Number(s):	Receiver RF Section		RF Filter Section	
HP 8542E EMI Receiver:	HP 85422E	_________________	HP 85420E	_________________
HP 8546A EMI Receiver:	HP 85462A	_________________	HP 85460A	_________________
Firmware Revision:	HP 85422E	_________________	HP 85420E	_________________
	HP 85462A	_________________	HP 85460A	_________________

Is the problem reproducible? ☐ **Yes** ☐ **No**

Detailed Problem Description: (include all setup information and any additional pages)

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6 Assembly Descriptions

This chapter describes the operation of the HP 85420E/HP 85460A RF filter section that is useful when first troubleshooting a failure.

The HP 85420E/HP 85460A RF filter section are RF filter instruments covering the following frequency ranges. The overall description briefly describes each of the major instrument assemblies.

Table 6-1 ***HP 85420E/HP 85460A RF Filter Section Frequency Ranges***

Instrument Model	Frequency Range
HP 85420E	9 kHz to 2.9 GHz
HP 85460A	9 kHz to 6.5 GHz

A1A1 Interconnect Board Assembly

The A1A1 interconnect board assembly performs many different control and signal processing functions.These functions are coax switch drivers, input step attenuator driver, front-panel LED drivers, tracking generator external ALC loop signal conditioning, and overload signal processing.

The following coax switch drivers are located on this board: cal source switch, tracking generator switch, both bypass pass switches, and RF input switch. The switch drivers provide the required current and voltage to activate the appropriate electromechanical switch on command from the microprocessor.

The step attenuator driver circuitry provides the required current and voltage to activate the appropriate section of the input step attenuator on command from the microprocessor.

The front-panel LED drivers provide the current required to drive the front-panel LEDs and internal diagnostic LEDs on command from the microprocessor. The RF Overload LED is driven by digital logic which is triggered by the overload control circuitry.

The tracking generator ALC loop signal conditioning circuitry is composed of two parts. The first part, the tracking generator external detector amplifier amplifies the external detector video signal and inserts an active low-pass filter if the RF frequency is less than 70 kHz. The low-pass filter prevents the RF signal from modulating the video signal used for driving the tracking generator input attenuator. If the RF frequency is greater than 70 kHz, the low-pass filter is bypassed. The video signal from the detector amplifier/low-pass filter is then attenuated by an active, dual DAC programmable attenuator. The programmable attenuator is used to set the power level of the tracking generator while it is in external detector mode.

The overload signal processing consists of video amplifiers, video filters, ECL comparators and latches, and associated control circuitry. The video amplifiers amplify and split the dc video detector signal from the AmpVar detector circuit into two channels. The 25 MHz bandwidth channel is used at RF frequencies greater than 150 MHz, and the 7 MHz channel is used at RF frequencies between 50 MHz and 150 MHz. Each channel uses a five-section, Gaussian low-pass filter which defines the channel bandwidth. The filtered output of each channel is connected to a high speed ECL comparator. The ac detector signal from the AmpVar detector circuit is fed directly into a third ECL comparator. This direct detection channel is used when the RF signal is between 9 kHz and 50 MHz. The ECL comparators drive ECL latches which enables the circuit to capture pulsed signals. The overload control circuitry provides an interface between the microprocessor and the overload detection circuitry, which enables the microprocessor to select which channel is active and reset the latches.

A1A2 6 dB Power Splitter

The A1A2 6 dB power splitter is a two-resistor, 6 dB power splitter. One output of the splitter is connected to the various filter paths in the instrument, the other output is connected to the detector. This detector is used as the external detector of the tracking generator's external ALC loop. The magnitude of the detected video is used to adjust the amplitude of the tracking generator during system calibration. Once adjusted, the output amplitude tracking of the splitter and flatness of the detector is depended on to calibrate the system amplitude flatness from 70 kHz to 2.9 GHz.

A1A3 Detector

The A1A3 detector is a coaxial device attached to one output of the two-resistor, 6 dB power splitter. This detector is used as the external detector of the tracking generator's external ALC loop. The video output of this detector is sent to the front-panel interconnect board where some signal processing is accomplished before it is sent to the tracking generator bias control board. The magnitude of the detected video signal is adjusted on the front-panel interconnect board to adjust the amplitude of the tracking generator during system calibration. Once adjusted, the flatness of the detector and power splitter is depended on to calibrate the system amplitude flatness from 70 kHz to 2.9 GHz.

A3 RF Attenuator Board Assembly

The A3 RF attenuator board assembly provides 0 dB to 54 dB of attenuation to signals input to the low frequency path of the preselector. Relays (single-pole non-latching RF switches) are used to switch in either the 10/20 dB attenuator pads or the 4 dB linearity check pad. Relay drivers select either the pad or the through-path for each attenuator section. A 3-pole 90 MHz low-pass filter rejects out-of-band signals at the input.

The A3 RF attenuator board assembly provides amplitude limiting to prevent damage to the rest of the preselector. It has spark-gap limiter that absorbs the energy of relatively long transients that exceed 90 volts. It also has a transient limiter to protect the preselector from "fast" transients until the spark gap limiter starts to conduct. This limiter will handle 1 kV input spikes for the 2 μs to 10 μs required for the spark gap to fire.

The A3 RF attenuator board assembly also has an output switch which directs the output to one of three different filter paths. Diode and FET switches are used to select the appropriate output path for the selected frequency range.

A4 Fixed Bandpass Filter Board Assembly

The A4 fixed bandpass filter board assembly contains four signal paths that are selected with four different TTL-level input lines. Three of the signal paths contain bandpass filters, which segment the frequency range of 198 kHz to 2 MHz into these passbands: 198 kHz to 525 kHz, 525 kHz to 1 MHz, and 1 MHz to 2 MHz. The fourth path is the through-path, passing *all* frequencies ≤ 2 MHz, which can be selected when an individual frequency band is too small for accurate preselection.

The input RF signals come in on pins 19 and 20 of J1, go through a blocking capacitor, and then into a small biasing network which biases up the dc level of the path at approximately 3 to 4 V. Biasing up this path keeps the signal at the source of the MOSFETs above ground so that the ground signal at the gate will keep the switch off. This is necessary so that when the gate is pulled to ground to turn the path off, the RF signals coming in are not negative enough to turn the path back on.

There are four switch drivers, one that controls each path, that are selected by the logic signals from the A12 DAC board assembly. Individual paths are selected by pulling its drive circuit low, while keeping the other three paths at high levels.

The 198 kHz to 525 kHz bandpass filter consists of a 200 kHz high-pass filter cascaded with a 500 kHz low-pass filter. The biasing and the shorting networks are the same, but the capacitive and inductive values are larger than in the 1 MHz high-pass filter. All the inductors used in this bandpass filter are litz wire on ferrite pot cores to prevent skin effect.

The 525 kHz to 1 MHz bandpass filter consists of a 500 kHz high-pass filter cascaded with a 1 MHz low-pass filter. The 500 kHz high-pass filter is a five-pole Tchebychev filter with the same biasing and shorting networks as in the 1 MHz high-pass filter. Axial lead inductors (small inductors) are used with small series resistance to produce a sharp filter corner. The 1 MHz low-pass filter of this bandpass is also a five-pole filter, but its inductors use litz wire on ferrite pot cores to minimize the skin effect. The litz wire on ferrite pot cores is necessary to achieve a sharp filter corner at 1 MHz.

The 1 MHz to 2 MHz bandpass filter consists of a 1 MHz high-pass filter cascaded with a 2 MHz low-pass filter. The 1 MHz high-pass is a five-pole, high-pass, Tchebychev filter. The two axial lead inductors used in the filter have a small series resistance and are used at this frequency range to produce a good filter corner. The switching network is the same as in the through-path. The shorting network (one at the input and one at the output) and the switching network is the same networks used in the through-path. The 2 MHz low-pass filter is also common to both the through-path. It provides the filter corner for the 2 MHz end in both output paths. This five-pole low-pass filter produces a good filter corner at this frequency.

The through-path passes all frequencies up through 2 MHz by biasing on MOSFETs on both ends of the signal path. A pullup-resistor back-biases the drain to source, up to +15 V, to minimize "off" capacitance by increasing depletion regions. The drive provided to the gate on the switch toggles between +15 V (on) and 0 V (off). When these enhancement-mode MOSFETs are on, they have a very low series "on-resistance". When the path is off, a shorting network maintains that any signal coming in is immediately shorted to ground. This is necessary because a small amount of signal still couples across the switches and the signal could possibly resonate and get into the output. This could add to or subtract from the signal which is coming through another path and cause the passband to distort. The same 2 MHz low-pass filter used in the 1 MHz to 2 MHz bandpass filter is used in the through-path.

A5 LF Filter/Amplifier

The A5 low frequency filter/amplifier provides the preselection filters and preamplification for frequencies from 9 kHz to 200 kHz.

The filter portion of the board has a fifth order 0.01 dB-ripple Chebyshev low-pass filter for all frequencies below 10 kHz. This filter is not used in the HP 85460A RF filter section. The filter portion also contains 9 kHz to 74 kHz and 74 kHz to 198 kHz bandpass filters made up of 5-pole high-pass filters followed by 5-pole low-pass filters. Each of these filters is a 0.01 dB ripple Chebyshev polynomial filter. Each filter path has an input and an output MOSFET to switch the path in or out.

The preamplifier portion of the board contains the 10 dB low-noise preamplifier.

A6 RF Amplifier Board Assembly

The A6 RF amplifier board assembly provides most of the gain for the preselector in the 9 kHz to 50 MHz range. It has three inputs that may be selected; two 10 dB preamplifiers, a variable gain amplifier, and a 12 dB step-gain amplifier. Each of these inputs use a common 50 Ω output.

The preamplifier input section has the two 10 dB preamplifiers. The first preamplifier is used in the 200 kHz to 2 MHz frequency range. This preamplifier provides an excellent 50 Ω input match (required by the filters on the A4 fixed bandpass filter board assembly) and good noise figure. The second preamplifier section is used in the 2 MHz to 50 MHz frequency range. This high frequency preamplifier is a single-stage, common-base, transformer-feedback amplifier. This configuration gives a good input match and excellent noise figure. Preamplification for 9 kHz to 200 kHz is on the A5 low frequency filter/amplifier;.

The variable gain amplifier section contains a continuously-variable-gain amplifier which corrects the overall gain for filter loss and instrument flatness. Its gain is variable from 0 dB to 14 dB. This amplifier is a two-stage amplifier similar to the low frequency preamplifier. The gain is controlled by the analog voltage on LO GCV line (refer to Figure 6-3 on page 6-13). Correction data is generated during the alignment procedure and is stored in EEROM.

The step gain amplifier section contains two amplifiers. The first amplifier is a step gain amplifier which provides either 0 dB or 12 dB of gain (depending on the TTL level of the STEP GAIN control line). The second amplifier is a buffer that provides the 50 Ω output impedance. The gain of this stage is only about 2 dB, but it provides good TOI at the output. There is a 3-pole high-pass filter that rejects noise and line harmonics below 3 kHz.

A8 Low Frequency Tuneable Filters Assembly

The A8 low frequency tuneable filters assembly consists of four varactor-tuned bandpass filters. These bandpass filters have the following frequency ranges: 2 MHz to 6 MHz, 6 MHz to 17 MHz, 17 MHz to 28 MHz, and 28 MHz to 52 MHz. Each of these filters has three poles, which are tuned to resonate at the center frequency. The DAC logic used comes from data points that are stored in the EEROM memory of the AA11 processor board assembly. However, the 2DACs on the AA12 DAC board assembly control the filter lines.

The bandpass filters are selected by series pin-switch diodes. The driver for the pin-switch diodes are three IC pin-diode drivers, each having four buffers for turning the pin-switch diodes on and off. The inputs to the drivers are directly TTL-compatible, controlled by the AA11 processor board assembly. The outputs directly drive the pin-switch diode.

There are fixed low-pass filters on the input and output of each varactor-tuned bandpass filter to ensure good out-of-band rejection. The low-pass filters on the input also minimize the power into the bandpass filters. A 24 MHz low-pass filter is used for the 2 MHz to 17 MHz frequency range and a 90 MHz low-pass filter is for the 17 MHz to 52 MHz frequency range.

A9 High Frequency Filters Board Assembly

The A9 high frequency filters board assembly provides all the path switching in the preselector for frequencies above 20 MHz. In addition, the A9 high frequency filters board assembly provides the preselection filtering for input frequencies from 50 MHz to 500 MHz. It also selects the through-path (bypass) for the 50 MHz to 500 MHz frequency range. The HF filters board also switches the input signal between the 1 GHz to 3 GHz bandpass filter, the A15 YTF, and the A5 low frequency filter/amplifier.

The input signal can be switched to any of the filters, to the through-path, to the 1 GHz to 3 GHz bandpass filter, to the 500 MHz to 1 GHz YTF, or to the A5 low frequency filter/amplifier. The switch network is optimized for minimum insertion loss while maintaining as much off path isolation as possible.

The 40 MHz to 700 MHz filter contains a cascaded, 3-pole low-pass and a 3-pole high-pass filter forming a 40 MHz to 700 MHz bandpass filter. The filter is nominally a 0.01 dB-ripple Chebyshev design.

The bandpass filters consist of 3-pole, varactor-tuned, bandpass filters. The filters consist of 3 magnetically-coupled resonators with a loaded Q of about 20, yielding 5% bandwidths from 50 MHz to 500 MHz. The frequency range is set by using progressively lower-valued varactors and lower-valued inductors at higher frequencies. Matching the 50Ω input line to the high impedance resonator is accomplished by tapping into the input and output resonator inductors. This determines both the input/output impedance and the loaded Q of all three resonators. In some cases, matching inductors have been added to optimize for best input/output match, bandwidth, and filter loss. Some filter sections are also followed by low pass filters to improve the out-of-band rejection. These filters are nominally 0.01 dB Chebyshev design. A PIN diode switch network selects the appropriate filter or through-path when the 50 MHz to 500 MHz frequency range is selected.

A tuning voltages filtering circuit contains the filtering for the varactor tune lines that control the filter center frequencies. Each resonator is tuned independently by a DAC on the A12 DAC board assembly. The tune line filters prevent noise (from outside the A9 high frequency filters board assembly) from modulating the filters, and also prevent input signal frequencies on the A9 high frequency filters board assembly from escaping into the rest of the instrument.

A11 Processor Board Assembly

The A11 processor board assembly serves as the central processing unit (CPU) for the RF filter section. The A11 processor board assembly's major function blocks are:

- 68000 microprocessor.
- Read-only memory (ROM) for firmware.
- Random access memory (RAM) for microprocessor operations and system calibration data.
- Electronically-erasable read-only memory (EEROM) for non-volatile RF filter section calibration data.

The A11 processor board assembly has the following I/O interfaces:

- I/O interface to A11A1 9-pin bus board for system communication with the receiver RF section.
- I/O interface to A12 DAC board assembly to control path switching, filter tuning, and gain calibration.
- I/O interface to the A1A1 interconnect board assembly to control input switching, RF overload level, TG external level detector gain, RF attenuator, LEDs, and diagnostic switches.
- Service bus I/O for RF filter section service, filter alignment, and calibration.

A11A1 9-pin Bus Board Assembly

The A11A1 9-pin bus board assembly provides the hardware logic for the bus interface between the RF filter section CPU and the receiver RF section CPU. The receiver RF section serves as system master and controls all bus data transfer clocks and states. The A11A1 9-pin bus board assembly's major function blocks are:

- State decode of the four input lines.
- Serial-to-parallel input data conversion.
- Input data FIFO buffering.
- Parallel-to-serial output data conversion.

A12 DAC Board Assembly

The A12 DAC board assembly is the primary hardware control for path switching, filter tuning, and gain calibration for the RF filter section. The 0 to 10 volt sweep ramp from receiver RF section; provides the frequency tracking input. The high sweep output is used to stop the system sweep for switch and filter settling time during path changes. Sweep ramp tracking hardware on the A12 DAC board assembly is monitored by the CPU. Corresponding digital levels are sent from the CPU to the A12 DAC board assembly A12 DAC board assembly path switch drivers and to the digital-to-analog converters (DACs) to generate the filter tuning and gain control voltages. The A12 DAC board assembly's major function blocks are:

- I/O buffers with CPU board.
- Sweep ramp tracking.
- High sweep control driver.
- Path switching drivers.
- Filter tuning DACs.
- Gain control DACs.

A13A1 Power Supply Board Assembly

The A13A1 power supply board assembly is a multiple-output, linear power supply. The A13A1 power supply board assembly outputs are:

Requlated outputs:	± 5 Vdc
	+12 Vdc
	± 15 Vdc
	+ 29 Vdc
	+ 57 Vdc
Unregulated outputs:	± 7 Vdc + 22 Vac

The A13A1 power supply board assembly's major function blocks are:

- Line range switching for the power transformer primary.
- Remote relay line switch that is controlled by a 15 Vdc input supplied from the receiver RF section via the 9-pin bus.
- Transformer secondary voltage rectification and filtering.
- Multiple linear output regulators.
- Interconnection path from the rear-panel service bus connector to the CPU cable.
- Interconnection path from the 9-pin bus rear-panel cable to the CPU cable.

A13T1 Transformer

The A13T1 transformer is a step-down transformer from a 100, 115, 220, or 230 Vac primary to 8 Vrms, 20 Vrms, 22 Vac, 37 Vrms, and 65 Vrms secondaries. Line range primary tap switches are on the A13A1 power supply board assembly. The secondary voltages provide the input for the

A14 Amplifier Variable (AmpVar) Assembly

The A14 amplifier variable (AmpVar) assembly is a high-dynamic-range, variable gain amplifier and a wide-band (9 kHz to 2.9 GHz), high speed, RF overload detector. There are three inputs to the amplifier portion; Input 1 for 50 MHz to 500 MHz, Input 2 for 500 MHz to 1 GHz, and Input 3 for 1 GHz to 2.9 GHz. During operation, one of the three inputs is selected using a pin switch which connects it to the input of the variable gain amplifier. The output of the variable gain amplifier is connected to one selectable leg of a FET switch. The other selectable leg of the FET switch is connected to the low frequency input (9 kHz to 52 MHz). The FET switch connects either the output of the variable gain amplifier or the low frequency input to the input of the overload detector.

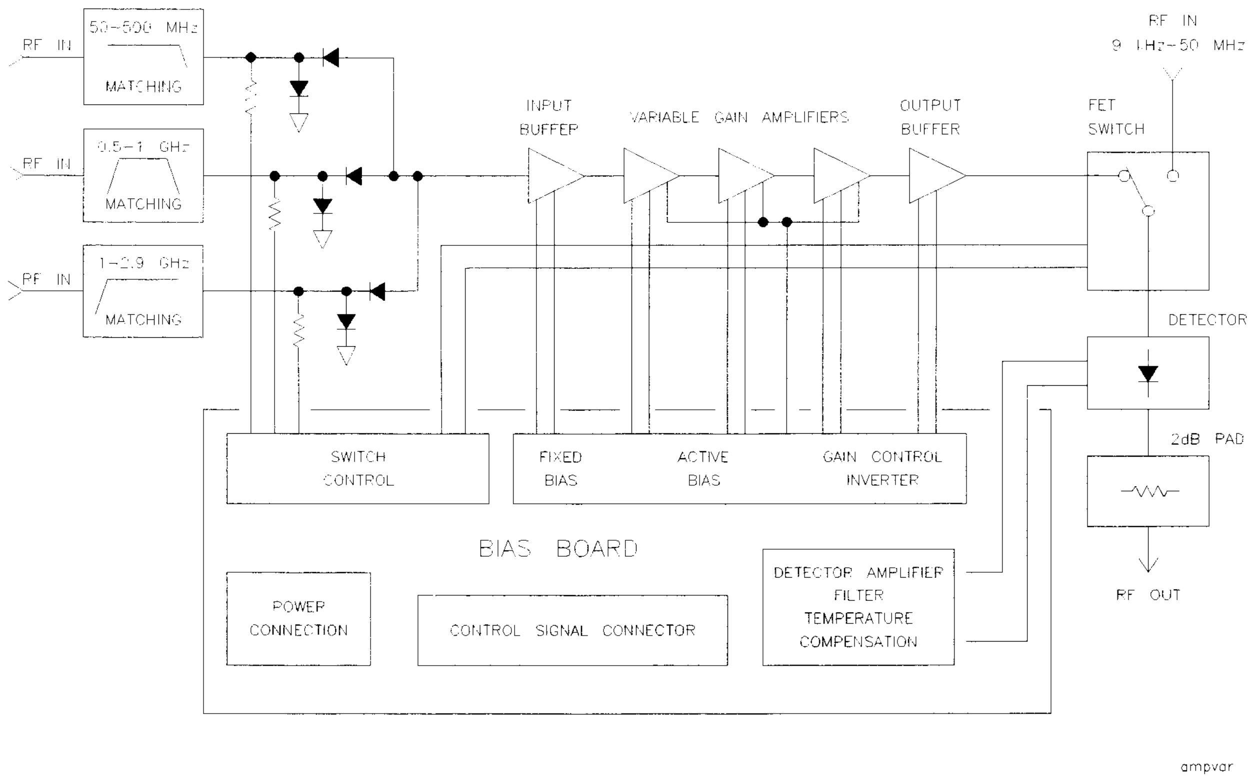


Figure 6-1 A14 Amplifier Variable (AmpVar) Assembly Block Diagram

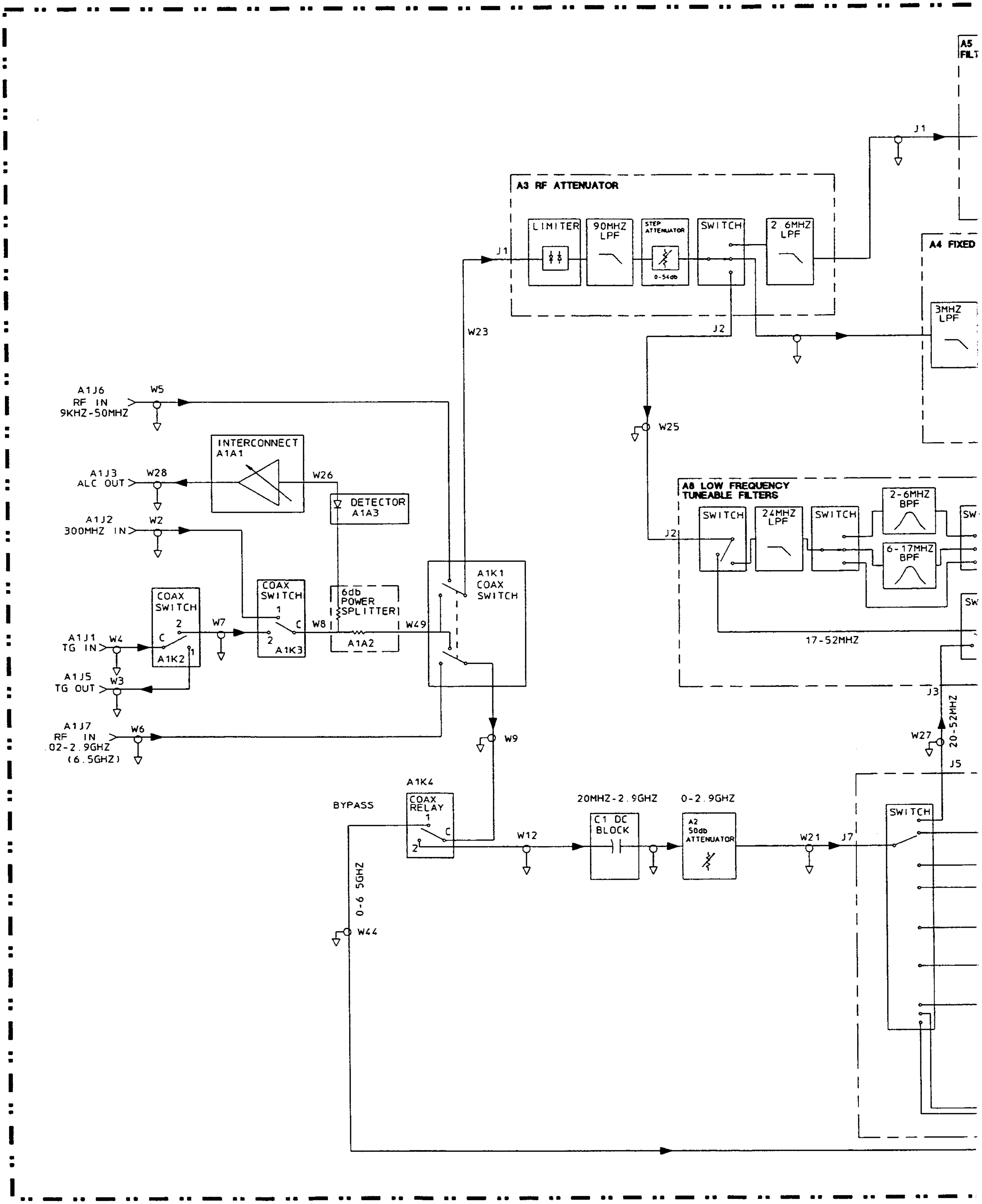
The amplifier is connected to a bias board which actively biases the various FET stages, provides switch decoding and drivers for the pin and FET switches, and performs video processing on the RF overload detector signals. There are two RF overload signals. The detected ac signal is the 9 kHz to 50 MHz RF signal which is amplified and buffered on the bias board. The detected video signal is the 50 MHz to 2.9 GHz RF signal which is amplified and temperature-compensated.

A15 YTF

The A15 YTF is a two-sphere, tunable bandpass, filter covering the frequency range from 500 MHz to 1 GHz. It is used as a filter path during normal operation of the preselector when it is tuned between 500 MHz and 1 GHz. The center frequency of the YTF is controlled with current supplied by the YTF current driver on the AA12 DAC board assembly. This YTF drive current tracks the sweep ramp which enables the YTF center frequency to track the center frequency of the instrument.

A16 High Pass Filter

The A16 high pass filter is used as a filter path from 1 GHz to 2.9 GHz. It is a static, high-pass filter with a corner frequency of 1 GHz.


A5
FILT
J1
A3 RF ATTENUATOR
LIMITER
90MHZ LPF
STEP ATTENUATOR
0-54db
SWITCH
2.6MHZ LPF
A4 FIXED
3MHZ LPF
J2
W23
A1J6 RF IN 9KHZ-50MHZ
W5
W25
INTERCONNECT A1A1
A1J3 ALC OUT
W28
W26
DETECTOR A1A3
A8 LOW FREQUENCY TUNEABLE FILTERS
SWITCH
24MHZ LPF
SWITCH
2-6MHZ BPF
6-17MHZ BPF
A1J2 300MHZ IN
W2
COAX SWITCH
COAX SWITCH
6db POWER SPLITTER
A1K1 COAX SWITCH
W7
W8
W49
A1J1 TG IN
W4
A1K2
A1K3
A1A2
17-52MHZ
A1J5 TG OUT
W3
J3
20-52MHZ
A1J7 RF IN .02-2.9GHZ (6.5GHZ)
W6
W9
W27
J5
A1K4
BYPASS
COAX RELAY
20MHZ-2.9GHZ
0-2.9GHZ
C1 DC BLOCK
A2 50db ATTENUATOR
W12
W21
J7
SWITCH
0-6.5GHZ
W44

RF FILTER SECTION BLOCK DIAGRAM

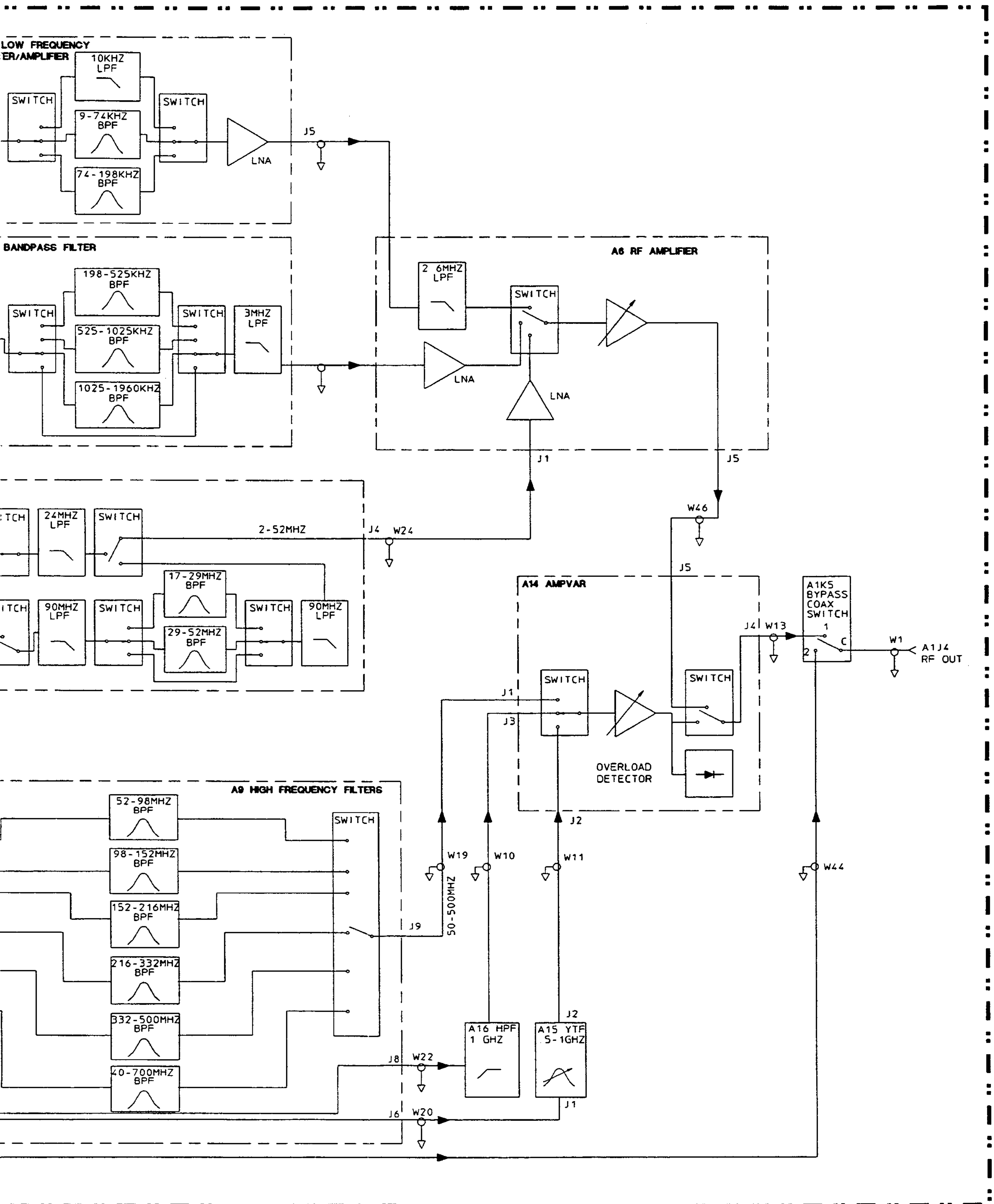


Figure 6-2. RF Filter Section Block Diagram

7

Major Assembly and Cable Locations

The various assemblies and cables of the HP 85460A RF filter section are illustrated in this chapter. Refer to Chapter 8, "Replaceable Parts" for part numbers, assembly descriptions, and ordering information.

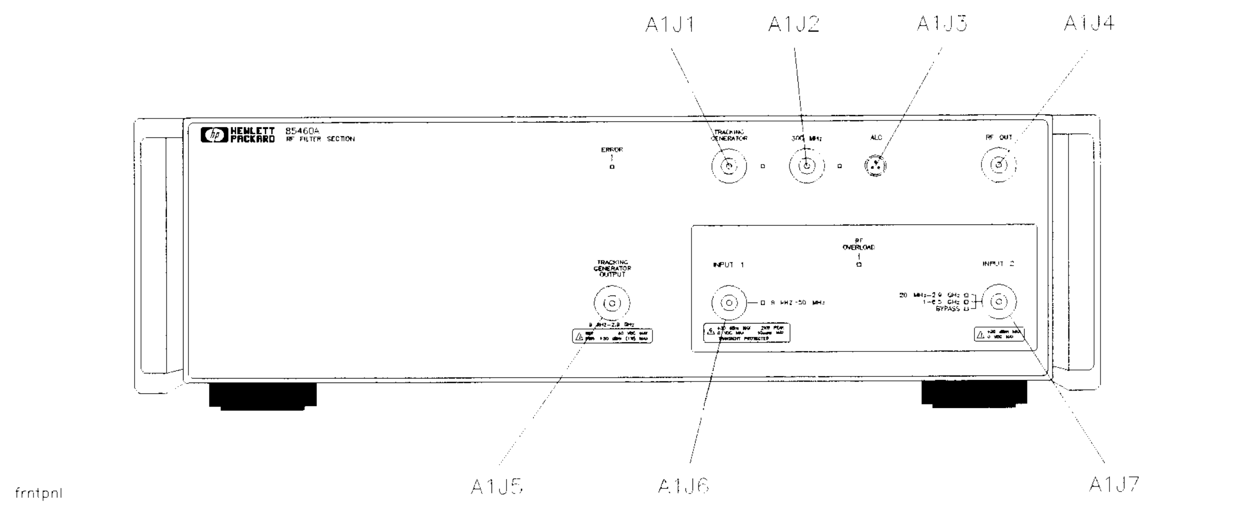


Figure 7-1 Front Panel

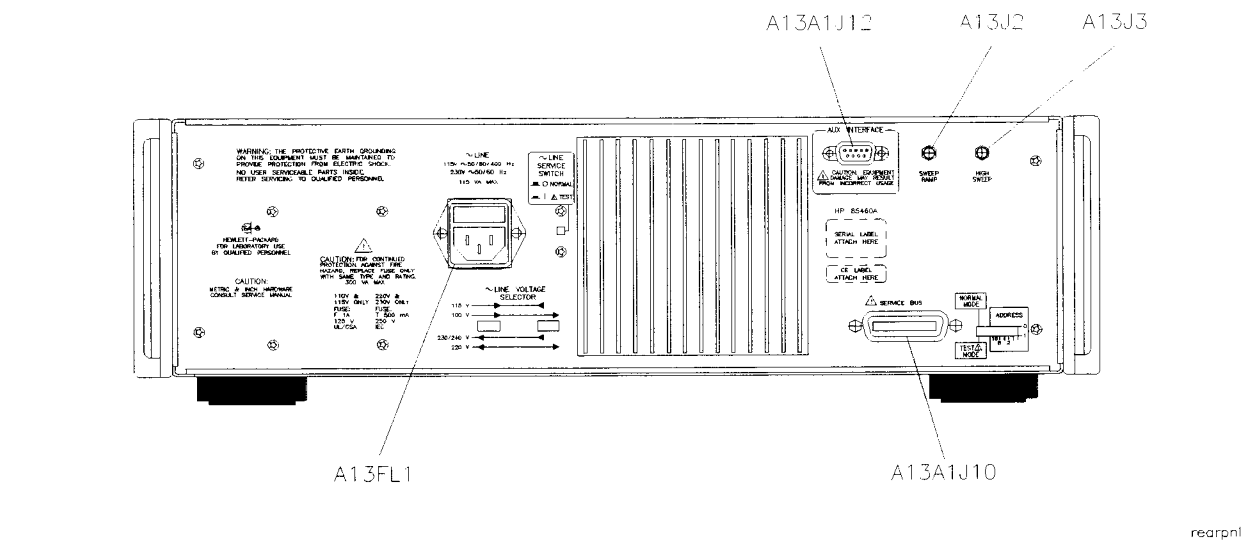


Figure 7-2 Rear Panel

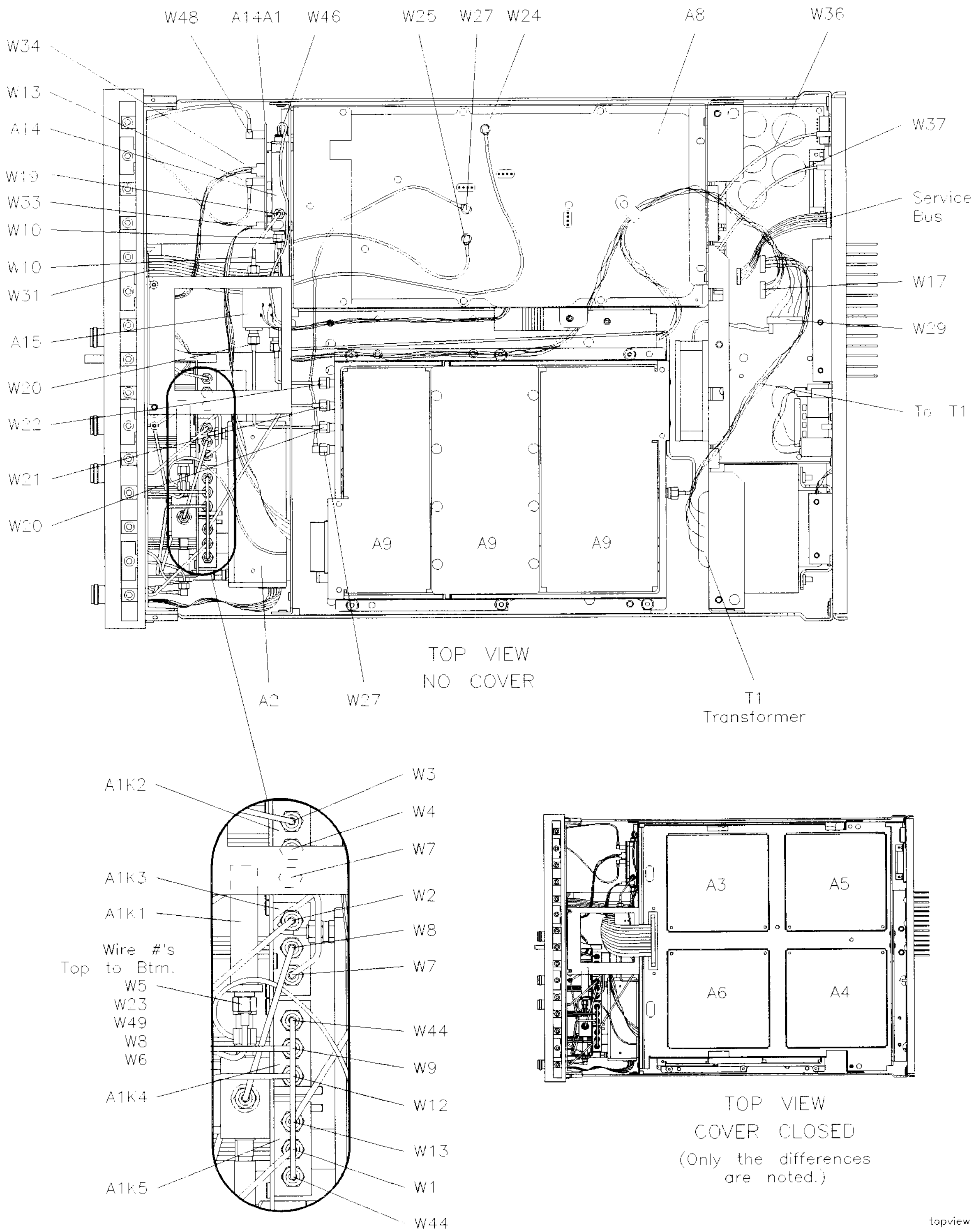


Figure 7-3 Top View

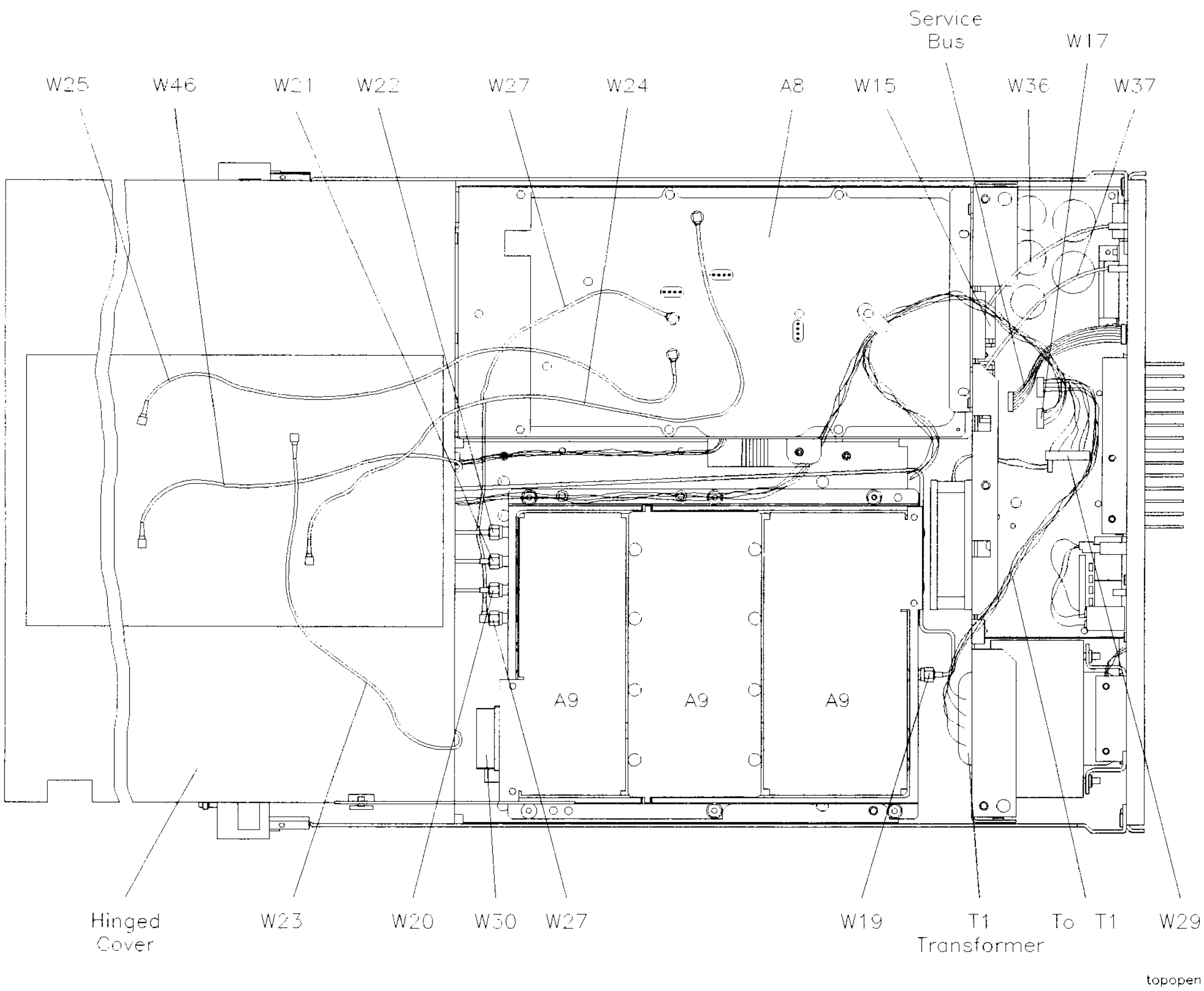


Figure 7-4 Top View, Lid Open

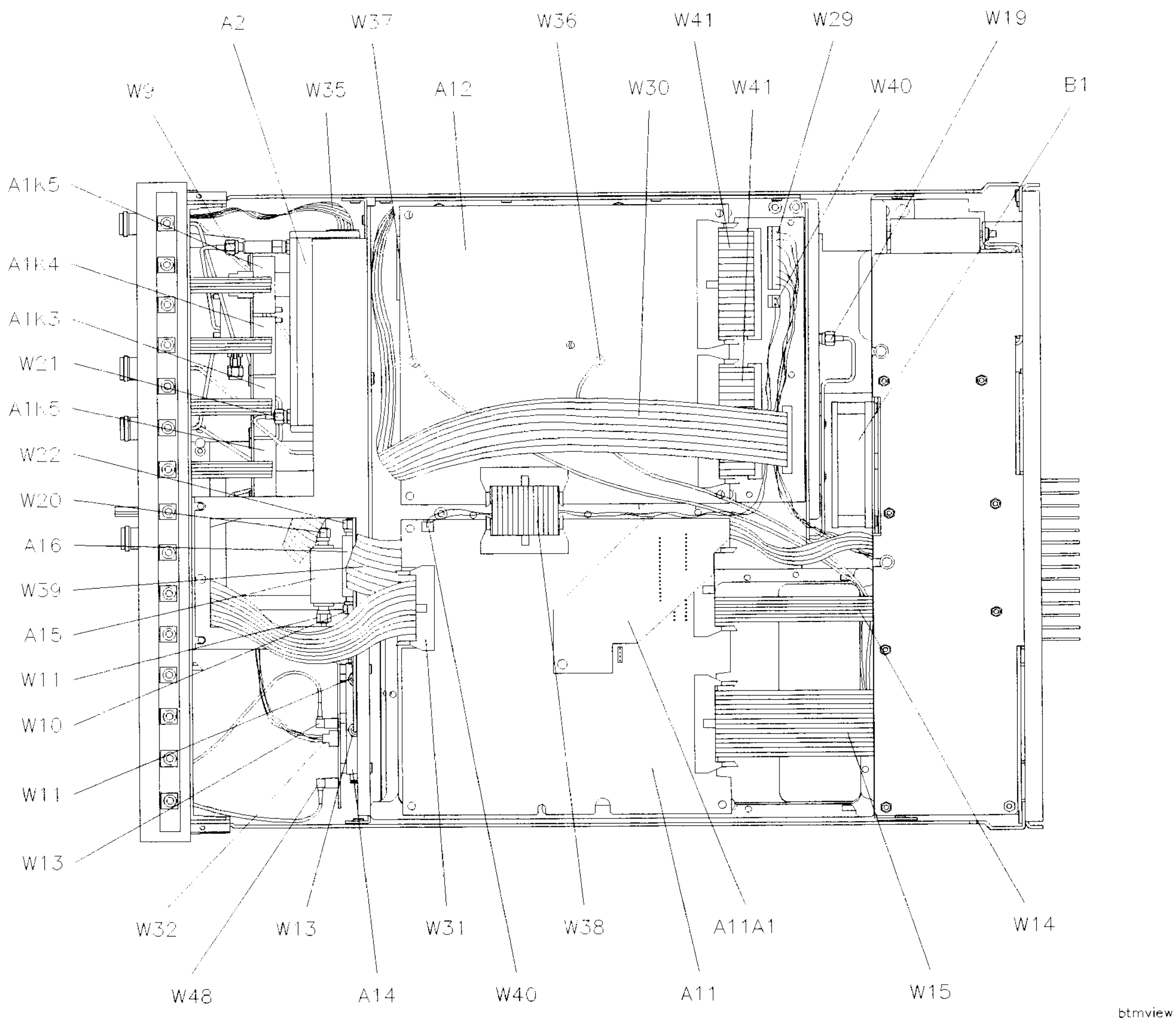


Figure 7-5 Bottom View

8 Replaceable Parts

This chapter contains information for identifying and ordering replacement assemblies for the HP 85460A RF filter section.

Major assembly and cable location information is given in Chapter 7.

The following tables and figures are also included in this chapter:

- Table 8-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.
- Table 8-2 lists standard value replacement capacitors.
- Table 8-3 lists standard value replacement resistors, 0.125 W.
- Table 8-4 lists standard value replacement resistors, 0.5 W.
- Table 8-5 lists all major assemblies.
- Table 8-6 lists the cable assemblies.

Ordering Information

To order an assembly or mechanical part listed in this chapter, quote the Hewlett-Packard part number and the check digit, and indicate the quantity required. The check digit is used to verify the correct part number. The check digit will ensure accurate processing of your order.

To order a part that is *not* listed, include the following information with the order:

- Instrument model number.
- Instrument serial number.
- Description of where the part is located, what it looks like, and its function (if known).
- Quantity needed.

Parts can be ordered by addressing the order to the nearest Hewlett-Packard office. Customers within the USA can also use either the direct mail-order system, or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

Direct Mail-Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail-order system. Advantages of using the system are as follows:

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

To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information are available through your local HP office.

Direct Phone-Order System

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

Regular Orders

The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 am to 5 pm (Pacific time). Regular orders have a four-day delivery time.

Hotline Orders

Hotline service is available 24 hours a day, 365 days a year, for emergency parts ordering. The toll-free phone number, (800) 227-8164, is available Monday through Friday, 6 am to 5 pm (Pacific time). After-hours and on holidays, call (415) 968-2347.

To cover the cost of freight and special handing, there is an additional hotline charge on each order (three line items maximum per order). Hotline orders are normally delivered the next business day after they are ordered.

Table 8-1 Reference Designations

Reference Designations					
A	Assembly	F	Fuse	RT	Thermistor
AT	Attenuator Isolator Limiter Termination	FL	Filter	S	Switch
B	Fan Motor	HY	Circulator	T	Transformer
BT	Battery	J	Electrical Connector (Stationary Portion) Jack	TB	Terminal Board
C	Capacitor	K	Relay	TC	Thermocouple
CP	Coupler	L	Coil Inductor	TP	Test Point
CR	Diode Diode Thyristor Step Recovery Diode Varactor	M	Meter	U	Integrated Circuit Microcircuit
DC	Direct Coupler	MP	Miscellaneous Mechanical Part	V	Electron Tube
DL	Delay Line	P	Electrical Connector (Movable Portion) Plug	VR	Breakdown Diode (Zener) Voltage Regulator
DS	Annunciator Lamp Light Emitting Diode (LED) Signaling Device (Visible)	Q	Silicon Controlled Rectifier (SCR) Transistor Triode Thyristor	W	Cable Wire Jumper
E	Miscellaneous Electrical Part	R	Resistor	X	Socket
				Y	Crystal Unit (Piezoelectric Quartz)
				Z	Tuned Cavity Tuned Circuit

Table 8-2 Abbreviations

Abbreviations					
A	Across Flats Acrylic Air (Dry Method) Ampere	C	Capacitance Capacitor Center Tapped Cermet Cold Compression	D	Deep Depletion Depth Diameter Direct Current
ADJ	Adjust Adjustment	CCP	Carbon Composition Plastic	DA	Darlington
ANSI	American National Standards Institute (formerly USASI-ASA)	CD	Cadmium Card Cord	DAP-GL	Diallyl Phthalate Glass
ASSY	Assembly	CER	Ceramic	DBL	Double
AWG	American Wire Gage	CHAM	Chamfer	DCDR	Decoder
BCD	Binary Coded Decimal	CHAR	Character Characteristic Charcoal	DEG	Degree
BD	Board Bundle	CMOS	Complementary Metal Oxide Semiconductor	D-HOLE	D-Shaped Hole
BE-CU	Beryllium Copper	CNDCT	Conducting Conductive Conductivity Conductor	DIA	Diameter
BNC	Type of Connector	CONT	Contact Continuous Control Controller	DIP	Dual In-Line Package
BRG	Bearing Boring	CONV	Converter	D-HOLE	D-Shaped Hole
BRS	Brass	CPRSN	Compression	DIA	Diameter
BSC	Basic	CUP-PT	Cup Point	DIP	Dual In-Line Package
BSC	Button	CW	Clockwise Continuous Wave	DIP-SLDR	Dip Solder

Table 8-2 Abbreviations (Continued)

Abbreviations					
D-MODE	Depletion Mode	FL	Flat Flash Fluid	HP	Hewlett-Packard Company High Pass
DO	Package Type Designation	FLAT-PT	Flat Point	IC	Collector Current Integrated Circuit
DP	Deep Depth Diametric Pitch Dip	FR	Front	ID	Identification Inside Diameter
DP3T	Double Pole Three Throw	FREQ	Frequency	IF	Forward Current Intermediate Frequency
DPDT	Double Pole Double Throw	FT	Current Gain Bandwidth Product (Transition Frequency) Feet Foot	IN	Inch
DWL	Dowel	FXD	Fixed	INCL	Including
E-R	E-Ring	GEN	**General** Generator	INT	Integral Intensity Internal
EXT	Extended Extension External Extinguish	GND	Ground	J-FET	Junction Field Effect Transistor
F	Fahrenheit Farad Female Film (Resistor) Fixed Flange Frequency	GP	General Purpose Group	JFET	Junction Field Effect Transistor
FC	Carbon Film/Composition Edge of Cutoff Frequency Face	H	Henry HIgh	K	Kelvin Key Kilo Potassium
FDTHRU	Feedthrough	HDW	Hardware	KNRLD	Knurled
FEM	Female	HEX	Hexadecimal Hexagon Hexagonal	KVDC	Kilovolts Direct Current
FIL-HD	Fillister Head	HLCL	Helical	LED	Light Emitting diode
LG	Length Long	MTG	Mounting	PAN-HD	Pan Head

Table 8-2 Abbreviations (Continued)

Abbreviations					
LIN	Linear Linearity	MTLC	Metallic	PAR	Parallel Parity
LK	Link Lock	MW	Milliwatt	PB	Lead (Metal) Push-button
LKG	Leakage Locking	N	Nano None	PC	Printed Circuit
LUM	Luminous	N-CHAN	N-Channel	PCB	Printed Circuit Board
M	Male Maximum Mega Mil Milli Mode	NH	Nanohenry	P-CHAN	P-Channel
MA	Milliampere	NO	Nanometer Nonmetallic	PD	Pad Power Dissipation
MACH	Machined	NOM	Nominal	PF	Picofarad Power Factor
MAX	Maximum	NPN	Negative Positive Negative (Transistor)	PKG	Package
MC	Molded Carbon Composition	NS	Nanosecond Non-Shorting Nose	PLSTC	Plastic
MET	Metal Metallized	NUM	Numeric	PNL	Panel
MHZ	Megahertz	NYL	Nylon (Polyamide)	PNP	Positive Negative Positive (Transistor)
MINTR	Miiniature	OA	Over-All	POLYC	Polycarbonate
MIT	Miter	OD	Outside Diameter	POLYE	Polyester
MLD	Mold Molded	OP AMP	Operational Amplifier	POT	Potentiometer
MM	Magnetized Material Millimeter	OPT	Optical Option Optional	POZI	Pozidriv Recess
MOM	Momentary	PA	Picoampere Power Amplifier	PREC	Precision

Table 8-2 Abbreviations (Continued)

Abbreviations					
PRP	Purple Purpose	SGL	Single	T	Teeth Temperature Thickness Time Timed Tooth typical
PSTN	Piston	SI	Silicon Square Inch	TA	Ambient Temperature Tantalum
PT	Part Point Pulse Time	SL	Slide Show	TC	Temperature Coefficient
PW	Pulse Width	SLT	Slot Slotted	THD	Thread Threaded
Q	Figure of Merit	SMA	Subminiature A Type (Threaded Connector)	THK	Thick
R	Range Red Resistance Resistor Right Ring	SMB	Subminiature B Type (Slip-on Connector)	TO	Package Type Designation
REF	Reference	SMC	Subminiature C-Type (Threaded Connector)	TPG	Tapping
RES	Resistance Resistor	SPCG	Spacing	TR-HD	Truss Head
RF	Radio Frequency	SPDT	Single Pole Double Throw	TRMR	Trimmer
RGD	Rigid	SPST	Single Pole Single Throw	TRN	Turn Turns
RND	Round	SQ	Square	TRSN	Torsion
RR	Rear	SST	Stainless Steel	UCD	Microcandela
RVT	Rivet Riveted	STL	Steel	UF	Microfarad
SAWR	Surface Acoustic Wave Resonator	SUBMIN	Subminiature	UH	Microhenry
SEG	Segment	SZ	Size	UL	Microliter Underwriters' Laboratories, Inc.
UNHDND	Unhardened				

Table 8-2 Abbreviations (Continued)

Abbreviations					
V	Variable Violet Volt Voltage	W	Watt Wattage White Wide Width	X	By (Used with Dimensions) Reactance
VAC	Vacuum Volts—Alternating Current	W/SW	With Switch	YIG	Yttrium-Iron_Garnet
VAR	Variable	WW	Wire Wound	ZNR	Zener
VDC	Volts—Direct Current				

Table 8-3 Multipliers

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	1^{-18}

Standard-Value Replacement Components

Table 8-4 Standard Value Replacement Capacitors

Type:Tubular Range: 1 to 24 pF Tolerance: 1 to 9.1 pF = 0.25 pF 10 to 24 pF = 5%			Type:Tubular Range: 27 to 470 pF Tolerance: 5%		
Value (pF)	HP Part Number	CD	Value (pF)	HP Part Number	CD
1.0	0160-2236	8	27	0160-2306	3
1.2	0160-2237	9	30	0160-2199	2
1.5	0150-0091	8	33	0160-2150	5
1.8	0160-2239	1	36	0160-2308	5
2.0	0160-2240	4	39	0140-0190	7
2.2	0160-2241	5	43	0160-2200	6
2.4	0160-2242	6	47	0160-2307	4
2.7	0160-2243	7	51	0160-2201	7
3.0	0160-2244	8	56	0140-0191	6
3.3	0150-0059	8	62	0140-0205	5
3.6	0160-2246	0	68	0140-0192	9
3.9	0160-2247	1	75	0160-2202	8
4.3	0160-2248	2	82	0140-0193	0
4.7	0160-2249	3	91	0160-2203	9
5.1	0160-2250	6	100	0160-2204	0
5.6	0160-2251	7	110	0140-0194	1
6.2	0160-2252	8	120	0160-2205	1
6.8	0160-2253	9	130	0140-0195	2
7.5	0160-2254	0	150	0140-0196	3
8.2	0160-2255	1	160	0160-2206	2
9.1	0160-2256	2	180	0140-0197	4
10.0	0160-2257	3	200	0140-0198	5
11.0	0160-2258	4	220	0160-0134	1
12.0	0160-2259	5	240	0140-0199	6
13.0	0160-2260	8	270	0140-0210	2
15.0	0160-2261	9	300	0160-2207	3
16.0	0160-2262	0	330	0160-2208	4
18.0	0160-2263	1	360	0160-2209	5
20.0	0160-2264	2	390	0140-0200	0
22.0	0160-2265	3	430	0160-0939	4
24.0	0160-2266	4	470	0160-3533	0

Table 8-5 Standard Value Replacement Resistors, 0.125 W

Type: Fixed-Film
Range: 10 Ω to 464 K Ω
Wattage: 0.125 at 125 °C
Tolerance: ± 1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0346	2	422	0698-3447	4
11.0	0757-0378	0	464	0698-0082	7
12.1	0757-0379	1	511	0757-0416	7
13.3	0698-3427	0	562	0757-0417	8
14.7	0698-3428	1	619	0757-0418	9
16.2	0757-0382	6	681	0757-0419	0
17.8	0757-0294	9	750	0757-0420	3
19.6	0698-3429	2	825	0757-0421	4
21.5	0698-3430	5	909	0757-0422	5
23.7	0698-3431	6	1.0 K	0757-0424	3
26.1	0698-3432	7	1.1 K	0757-0474	7
28.7	0698-3433	8	1.21 K	0757-0274	5
31.6	0757-0180	2	1.33 K	0757-0317	7
34.8	0698-3434	9	1.47 K	0757-1094	9
38.3	0698-3435	0	1.62 K	0757-0428	1
42.2	0757-0316	6	1.78 K	0757-0278	9
46.4	0698-4037	0	1.96 K	0698-0083	8
51.1	0757-0394	0	2.15 K	0698-0084	9
56.2	0757-0395	1	2.37 K	0698-3150	6
61.9	0757-0276	7	2.61 K	0698-0085	0
68.1	0757-0397	3	2.87 K	0698-3151	7
75.0	0757-0398	4	3.16 K	0757-0279	0
82.5	0757-0399	5	3.48 K	0698-3152	8
90.9	0757-0400	9	3.83 K	0698-3153	9
100	0757-0401	0	4.22 K	0698-3154	0
110	0757-0402	1	4.64 K	0698-3155	1
121	0757-0403	2	5.11 K	0757-0438	3
133	0698-3437	2	5.62 K	0757-0200	7
147	0698-3438	3	6.19 K	0757-0290	5
162	0757-0405	4	6.81 K	0757-0439	4
178	0698-3439	4	7.50 K	0757-0440	7
196	0698-3440	7	8.25 K	0757-0441	8
215	0698-3441	8	9.09 K	0757-0288	1
237	0698-3442	9	10.0 K	0757-0442	9
261	0698-3132	4	11.0 K	0757-0443	0

Type: Fixed-Film
Range: 10 Ω to 464 K Ω
Wattage: 0.125 at 125 °C
Tolerance: ± 1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
287	0698-3443	0	12.1 K	0757-0444	1
316	0698-3444	1	13.3 K	0757-0289	2
348	0698-3445	2	14.7 K	0698-3156	2
383	0698-3446	3	16.2 K	0757-0447	4
17.8 K	0698-3136	8	100 K	0757-0465	6
19.6 K	0698-3157	3	110 K	0757-0466	7
21.5 K	0757-0199	3	121 K	0757-0467	8
23.7 K	0698-3158	4	133 K	0698-3451	0
26.1 K	0698-3159	5	147 K	0698- 3452	1
28.7 K	0698-3449	6	162 K	0757-0470	3
31.6 K	0698-3160	8	178 K	0698- 3243	8
34.8 K	0757-0123	3	196 K	0698- 3453	2
38.3 K	0698-3161	9	215 K	0698- 3454	3
42.2 K	0698-3450	9	237 K	0698- 3266	5
46.4 K	0698-3162	0	261 K	0698- 3455	4
51.1 K	0757-0458	7	287 K	0698- 3456	5
56.2 K	0757-0459	8	316 K	0698- 3457	6
61.9 K	0757-0460	1	348 K	0698- 3458	7
68.1 K	0757-0461	2	383 K	0698- 3459	8
75 0 K	0757-0462	3	422 K	0698- 3460	1
82 5 K	0757-0463	4	464 K	0698- 3260	9
90.9 K	0757-0464	5			

Table 8-6 Standard Value Replacement Resistors, 0.5 W

Type: Fixed-Film
Range: 10 Ω to 1.47 MΩ
Wattage: 0.5 at 125 °C
Tolerance: ± 1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
10.0	0757-0984	4	383	0698-3404	3
11.0	0757-0985	5	422	0698-3405	4
12.1	0757-0986	6	464	0698-0090	7
13.3	0757-0001	6	511	0757-0814	9
14.7	0698-3388	2	562	0757-0815	0
16.2	0757-0989	9	619	0757-0158	4
17.8	0698-3389	3	681	0757-0816	1
19.6	0698-3390	6	750	0757-0817	2
21.5	0698-3391	7	825	0757-0818	3
23.7	0698-3392	8	909	0757-0819	4
26.1	0757-0003	8	1.0 0K	0757-0159	5
28.7	0698-3393	9	1.1 0K	0757-0820	7
31.6	0698-3394	0	1.21 K	0757-0821	8
34.8	0698-3395	1	1.33 K	0698-3406	5
38.3	0698-3396	2	1.47 K	0757-1078	9
42.2	0698-3397	3	1.62 K	0757-0873	0
46.4	0698-3398	4	1.78 K	0698-0089	4
51.1	0757-1000	7	1.96 K	0698-3407	6
56.2	0757-1001	8	2.15 K	0698-3408	7
61.9	0757-1002	9	2.37 K	0698-3409	8
68.1	0757-0794	4	2.61 K	0698-0024	7
75.0	0757-0795	5	2.87 K	0698-3101	7
82.5	0757-0796	6	3.16 K	0698-3410	1
90.9	0757-0797	7	3.48 K	0698-3411	2
100	0757-0198	2	3.83 K	0698-3412	3
110	0757-0798	8	4.22 K	0698-3346	2
121	0757-0799	9	4.64 K	0698-3348	4
133	0698-3399	5	5.11 K	0757-0833	2
147	0698-3400	9	5.62 K	0757-0834	3
162	0757-0802	5	6.19 K	0757-0196	0
178	0698-3334	8	6.81 K	0757-0835	4
196	0757-1060	9	7.50 K	0757-0836	5
215	0698-4301	0	8.25 K	0757-0837	6
237	0698-3102	8	9.09 K	0757-0838	7

Table 8-6 Standard Value Replacement Resistors, 0.5 W (Continued)

Type: Fixed-Film
Range: 10 Ω to 1.47 MΩ
Wattage: 0.5 at 125 °C
Tolerance: ± 1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Part Number	CD
261	0757-1090	5	10.0 K	0757-0839	8
287	0757-1092	7	12.1 K	0757-0841	2
316	0698-3402	1	13.3 K	0698-3413	4
348	0698-3403	2	14.7 K	0698-3414	5
16.2 K	0757-0844	5	162 K	0757-0130	2
17.8 K	0698-0025	8	178 K	0757-0129	9
19.6 K	0698-3415	6	196 K	0757-0063	0
21.5 K	0698-3416	7	215 K	0757-0127	7
23.7 K	0698-3417	8	237 K	0698-3434	7
26.1 K	0698-3418	9	261 K	0757-0064	1
28.7 K	0698-3103	9	287 K	0757-0154	0
31.6 K	0698-3419	0	316 K	0698-3425	8
34.8 K	0698-3420	3	348 K	0757-0195	9
38.3 K	0698-3421	4	383 K	0757-0133	5
42.2 K	0698-3422	5	422 K	0757-0134	6
46.4 K	0698-3423	6	464 K	0698-3426	9
51.1 K	0757-0853	6	511 K	0757-0135	7
56.2 K	0757-0854	7	562 K	0757-0868	3
61.9 K	0757-0309	7	519 K	0757-0136	8
68.1 K	0757-0855	8	581 K	0757-0869	4
75 0 K	0757-0856	9	750 K	0757-0137	9
82.5 K	0757-0857	0	825 K	0757-0870	7
90.9 K	0757-0858	1	909 K	0757-0138	0
100 K	0757-0367	7	1 M	0757-0059	4
110 K	0757-0859	2	1.1 M	0757-0139	1
121 K	0757-0860	5	1.21 M	0757-0871	8
133 K	0757-0310	0	1.33 M	0757-0194	8
147 K	0698-3175	5	1.47 M	0698-3463	5

Assembly-Level Replaceable Parts and Cables

Table 8-7 Assembly-Level Replaceable Parts

Reference Designator	Description	HP Part Number
A1	Front Panel Assembly	N/A
A1A1	Interconnect Board	85460-60001
A1A2	6 dB Power Splitter	0955-0606
A1A3	Detector	HP 33331EZ
A1K1	18 GHz Coax Switch	HP 33313B
A1K2	Switch Assembly	33314-60014
A1K3	Switch Assembly	33314-60014
A1K4	Switch Assembly	33314-60014
A1K5	Switch Assembly	33314-60014
A2	50 dB Attenuator	HP 33321RZ
A3	RF Attenuator Board	85460-60113
A4	Fixed Bandpass Filter Board	85685-60097
A5	LF Filter/Amplifier	85460-60035
A6	RF Amplifier Board	85460-60004
A7	LF Motherboard	85685-60126
A8	LF Tuneable Filters Assembly	85685-60003
	Rebuilt	85685-60073
A9	HF Filters Board	85460-60002
A10	Main Motherboard	85685-60111
A11	Processor Board	85460-60005
A11A1	9-Pin Bus Board	85460-60007
A12	DAC Board	85685-60110
A13	Rear Panel Assembly	N/A
A13A1	Power Supply Board	85460-60008
A13T1	Transformer	9100-5087
A13FL1	Line Module	8120-6222
A14	Amplifier Variable (AmpVar) Assembly	5086-7890
	Exchange AmpVar Assembly (Rebuilt)	5086-6890
A14A1	AmpVar Bias Board	Part of A14
A15	YIG-Tuned Filter (YTF)	0955-0611

Table 8-7 Assembly-Level Replaceable Parts

Reference Designator	Description	HP Part Number
A16	High-Pass Filter	0955-0607
B1	Fan	5063-0620
C1	dc Block	0955-0256

Table 8-8 Replaceable Cables

Reference Designator	Description	HP Part Number
W1	Semi-Rigid Cable, Output, A1K5 Switch to A1J4	85460-20014
W2	Semi-Rigid Cable, 300 MHz. A1J2 to A1K3 Switch	85460-20015
W3	Semi-Rigid Cable, TG Out, A1K2 Switch to A1J5	85460-20016
W4	Semi-Rigid Cable, TG, A1J1 to A1K2 Switch	85460-20017
W5	Semi-Rigid Cable, Input 1, RF IN (9 kHz to 50 MHz), A1J6 to A1K1 Switch	85460-20018
W6	Semi-Rigid Cable, Input 2, RF IN (20 MHz to 2.9/6.5 GHz), A1J7 to A1K1 Switch	85460-20019
W7	Semi-Rigid Cable, A1K2 Switch to A1K3 Switch	85460-20020
W8	Semi-Rigid Cable, A1A2 Power Splitter J2 to A1K3 Switch	85460-20021
W9	Semi-Rigid Cable, A1K1 Switch to A1K4 Switch	85460-20023
W10	Semi-Rigid Cable, A16 High Pass Filter to AmpVar Assembly J3	85460-20025
W11	Semi-Rigid Cable, A15 YTF J2 to A14 AmpVar Assembly J2	85460-20026
W12	Semi-Rigid Cable, A1K4 Switch to C1 DC Block	85460-20022
W13	Semi-Rigid Cable, A14 AmpVar Assembly J4 to A1K5 Switch	85460-20024
W14	Ribbon Cable, A13A1 Power Supply Board Assembly J13 to A11 Processor J2	8120-6211
W15	Ribbon Cable, Internal HP-IB, A13A1 Power Supply Board Assembly J11 to A11 Processor J3	8120-6210
W16	Ribbon Cable, 57V/29V, A13A1 Power Supply Board Assembly J4 to A10 Main Motherboard Assembly J11	8120-6209
W17	Wire Cable, Front Panel Power, A13A1 Power Supply Board Assembly J6 to A1A1 Interconnect Board Assembly J2	8120-6208
W18	Ribbon Cable, 9-Pin Aux Bus, A13 Rear Panel Assembly to A13A1 Power Supply Board Assembly J12	8120-6207
W19	Semi-Rigid Cable, 50 to 100 MHz, A9 HF Filters Board J9 to A14 AmpVar Assembly J1	85460-20027
W20	Semi-Rigid Cable, 500 MHz to 1 GHz, A9 HF Filters Board J6 to A15 YTF J1	85460-20028
W21	Semi-Rigid Cable, RF IN, A2 Attenuator to A9 HF Filters Board j7	85460-20029
W22	Semi-Rigid Cable, High Pass Filter, A9 HF Filters Board J8 to A16 High Pass filter	85460-20030
W23	Shielded Soft Cable, A1K1 Switch to A3 RF Attenuator Board Assembly J1	8120-6223
W24	Shielded Soft Cable, A8 LF Tuneable Filters Assembly J4 to A6 RF Amplifier Board Assembly J1	8120-5023
W25	Shielded Soft Cable, RF Attenuator Board Assembly J2 to A8 LF Tuneable Filters Assembly J2	8120-5025
W26	Shielded Soft Cable, ALC Detector In, A1A3 Detector To A1A1	8120-6120
W27	Shielded Soft Cable, LF Tuneable Out, A9 HF Filters Board J5 to A8 LF Tuneable Filters Assembly J3	8120-5105
W28	Shielded Soft Cable, Ext ALC, A1A1 Interconnect Board Assembly J11 to A1J3	8120-6220
W29	Wire Cable, Main Power supply, A13A1 Power Supply Board Assembly J7 to A10 Main Motherboard Assembly J3	85460-60015
W30	Ribbon Cable, HF Filter Control, A10 Main Motherboard Assembly J14 to A9 HF Filters Board	8120-6214

Table 8-8 Replaceable Cables (Continued)

Reference Designator	Description	HP Part Number
W31	Ribbon Cable, Interconnect Bus, A11 Processor J5 to A1A1 Interconnect Board Assembly J1	8120-6215
W32	Wire Cable, YTF Control, A10 Main Motherboard Assembly J9 to A15 YTF	85460-60014
W33	Ribbon Cable, AmpVar Control, A10 Main Motherboard Assembly J1 to A14A1 AmpVar Bias Board Assembly J2	8120-6217
W34	Wire Cable Assembly, AmpVar Power, A1A1 Interconnect Board Assembly J9 to A14A1 AmpVar Bias Board Assembly J1	8120-6218
W35	Ribbon Cable, Attenuator Control, A1A1 Interconnect Board Assembly J8 to A2 Attenuator	8120-6219
W36	Shielded Soft Cable, HIGH SWEEP, A13 Rear Panel Assembly J3 to A12 DAC Board Assembly J5	8120-6169
W37	Shielded Soft Cable, HIGH RAMP, A13 Rear Panel Assembly J2 to A12 DAC Board Assembly J4	8120-6169
W38	Ribbon Cable, A11 Processor J4 to A12 DAC Board Assembly J1	85685-60050
W39	Ribbon Cable, A10 Main Motherboard Assembly J12 to A7 LF Motherboard	8120-6213
W40	Wire Cable, +5 V, A10 Main Motherboard Assembly J4 to A11 Processor J1	85685-60067
W41	Ribbon Cable, A12 DAC Board Assembly to A10 Main Motherboard Assembly	85685-60051
W42	Ribbon Cable, A10 Main Motherboard Assembly J13 to A8 LF Tuneable Filters Assembly	85685-60052
W43	Wire Cable, BYP Control, A1A1 Interconnect Board Assembly J3 to A1K1 Switch	8120-6221
W44	Cable Assembly, A1K4 Switch to A1K5 Switch	85460-20031
W45	Wire Cable Assembly, A13FL1 Line Module and Wiring, A13 Rear Panel Assembly to A13A1 Power Supply Board Assembly	8120-6222
W46	Shielded Soft Cable, A6 Output, A6 RF Amplifier Board Assembly J5 to A14 AmpVar Assembly J5	8120-5106
W47	Shielded Soft Cable, dc Video Overload, A14A1 AmpVar Bias Board Assembly J4 to A1A1 Interconnect Board Assembly J13	8120-5016
W48	Shielded Soft Cable, AC Overload, A14A! AmpVar Bias Board Assembly J3 to A1A1 Interconnect Board Assembly J12	8120-5016
W49	Adapter, A1A2 Power Splitter to A1K1 Switch	1250-1788

9 Service Equipment and Tools

This chapter contains information about service equipment and tools needed to perform calibration, adjustments, and troubleshooting.

Satic-Safe Accessories

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.

Table 9-1 on page 9-2 provides information on ordering static-safe accessories and shows an example of a static-safe work station using two types of ESD protection:

- Conductive table-mat and wrist-strap combination.
- Conductive floor-mat and heel-strap combination.

The two types must be used together to ensure adequate ESD protection.

WARNING **These techniques for a static-safe work station should not be used when working on circuitry that has a voltage potential greater than 500 volts.**

For more information about preventing ESD damage, contact the Electrical Overstress/Electrostatic Discharge (EOS/ESD) Association, Inc. The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

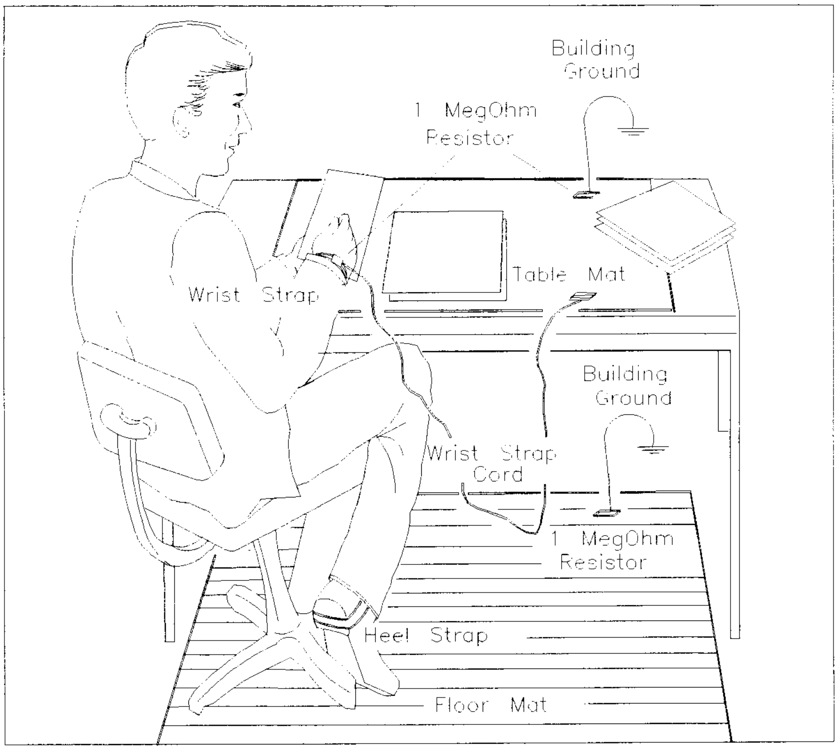


Figure 9-1 Example of Static-Safe Work Area

Table 9-1 Static-Safe Accessories

Description	HP Part NUmber
Set includes:[1] 3M static control mat 0.6 m X 1.2 m (2 ft X 4 ft) Ground Wire 4.6 m (15 ft)	9300-0797
Wrist Strap Cord 1.5 m (5 ft)	9300-0980
Wrist strap, color black, stainless steel, without cord has four adjustable links and a 7 mm post-type connection.	9300-1383
ESD heel strap (reusable 6 to 12 months)	9300-1169

1. The wrist strap and wrist strap cord are not included. They must be ordered separately.

Recommended Test Equipment

The tables in this section list the recommended test equipment required to perform the performance test, adjustments, and troubleshooting.

Table 9-2 Recommended Test Equipment

Equipment	Critical Specifications for Equipment Substitution	Recommended Models
Computer	RAM: 4 Megabytes Disk Drive: 3 1/2 inch Floppy HP Basic 6.2	HP 362 HP 382
Network Analyzer	Frequency Range: 300 kHz to 3 GHz Power Range: –5 dBm to +20 dBm	HP 8753C HP 8753B
S-parameter Test Set	Impedance: 50 Ω Frequency Range: 300 kHz to 3 GHz Effective Source Match: 300 kHz to 1.3 GHz: 14 dB 1.3 GHz to 3.0 GHz: 16 dB	HP 85044A HP 85047A HP 85046A
Level Generator	Frequency Range: 500 Hz to 80 MHz Amplitude Range: +12 to –85 dBm Flatness: ± 0.15 δB Attenuator Accuracy: ± 0.09 dB	HP 3335A
Digital Voltmeter	Vdc Resolution: 5 digits	HP 3458A HP 3456A HP 3455A
Power Meter	Power Range: Calibrated in dBm and dB relative to reference power –70 dBm to + 44 dBm, sensor dependent	HP 438A
Power Sensor, RF	Frequency Range: 100 kHz to 3.6 GHz Power Range: –30 dBm to +20 dBm	HP 8482A
Power Sensor (low power)	Frequency Range: 10 MHz to 6.5 GHz Power Range: –70 dBm to +20 dBm	HP 8481D
Synthesized Sweeper	Frequency Range: 10 MHz to 6.5 GHz Frequency Accuracy (CW): ± 0.02% Leveling Modes: Internal and External Modulation Modes: AM Power Level Range: –35 to +16 dBm	HP 8340A/B HP 83630A
Calibration Kit	Type-N Calibration Kit Contains: 50 Ω load, opens, shorts, and Type-N connectors.	HP 85032B

Table 9-3 Recommended Accessories

Equipment	Critical Specifications for Accessory Substitution	Recommended Model HP Part Number
Adapter	APC3.5 (m) to Type-N (m)	1250-1743
Adapter	APC 3.5 (f) to Type-N (m) (two required)	1250-1744
Adapter	Type-N (m) to BNC (f)	1250-1476
Adapter	APC 3.5 (f) to APC 3.5 (f)	1250-1749
Adapter	Type-N (f) to APC 3.5 (m)	1250-1750
Adapter	BNC (m) to SMA (f)	1250-2015
50 Ω Load	Type-N (m) Frequency Range dc to 3 GHz (For use on the Tracking Generator Output)	HP 908A HP 909A Option 012
50 Ω Load	Type-N (m) Frequency Range dc to 6.5 GHz (For use on the RF Inputs)	HP 909A Option 012
Power Splitter	Frequency Range 50 kHz to 6.5 GHz Insertion Loss: 6 dB (nominal) Output Tracking: < 0.25 dB Equivalent Output SWR: < 1.22:1	HP 11667B HP 11667A

Table 9-4 Recommended Cables

Equipment	Critical Specifications for Cable Substitution	Recommended Model
RF Cable	APC 3.5 (m) both ends	HP 11500E
BNC Cable	Frequency Range: dc to 1 GHz Length: ≥ 91 cm (36 in) Connectors: BNC (m) both ends	HP 10503A
HP-IB Cable	≥ 1 m (five required)	HP 10833A

Recommended Service Tools

Table 9-5 provides a list of hand tools that are also recommended for repairing the HP 85420E/HP 85460A RF filter section.

Refer to "Ordering Information" in Chapter 8 when ordering equipment, tools, and accessories.

Table 9-5 Required Hand Tools

Description	HP Part Number	Use[1]
Nut Driver (5 mm)	8710-1219	R
Nut Driver (6 mm)	8710-1221	R
Nut Driver (7 mm)	8710-1217	R
Nut Driver (3/8 inch)	8720-0005	R
Nut Driver (5/16 inch)	8720-0003	R
Pozidriv Screwdriver (large no. 2)	8710-0900	A, R
Pozidriv Screwdriver (small no.1)	8710-0899	A. R
Long-nose Pliers	8710-0003	R
Wire Cutters	8710-0012	R
Wire Strippers	7810-0058	R
Torx Hand Driver (T8)	8710-1614	R
Torx Hand Driver (T10)	8710-1623	R
Torx Hand Driver (T15)	8710-1622	R
Torque Wrench: Break-away 10 inch-pounds 5/16 inch Open-end	40-60271[2]	R
Torque Wrench: Break-away 9 inch-pounds 7/16 inch Bent shaft Open-end	40-60271-716S[2]	R

1. A = Adjustment, R = Replacement Procedure
2. The part number provided is a non-HP part number. This tool can be ordered from:

Assembly Systems Inc.
16595 Englewood Avenue
Los Gatos, CA 95032
(408) 395-5313

NOTE

If you ordered a similar tool from your local supplier, it is important that the outside dimensions be no wider than.518 inches. This allows the wrench to be used on semi-rigid cable connectors in confined areas.

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