Service Guide

HP 70908A

RF Section

HEWLETT PACKARD

HP Part No. 70908-90193
Printed in USA April 1997

Edition A.0.0

Notice

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Restricted Rights Legend.

Use, duplication, or disclosure by the U.S. Government is subject to restrictions as set forth in subparagraph (c) (1) (ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 for DOD agencies, and subparagraphs (c) (1) and (c) (2) of the Commercial Computer Software Restricted Rights clause at FAR 52.227-19 for other agencies.

1400 Fountaingrove Parkway, Santa Rosa, CA 95403-1799, USA

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard. Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Exclusive Remedies

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

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

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Symbols

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

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

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

DANGER **The *DANGER* sign denotes an imminent hazard to people. It warns the reader of a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *DANGER* sign until the indicated conditions are fully understood and met.**

General Safety Considerations

WARNING

- **The instructions in this document 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 five seconds after disconnecting the plug from its power supply.**
- **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.**
- **For continued protection against fire hazard, replace fuse only with same type and ratings, (type nA/nV). The use of other fuses or materials is prohibited.**

WARNING

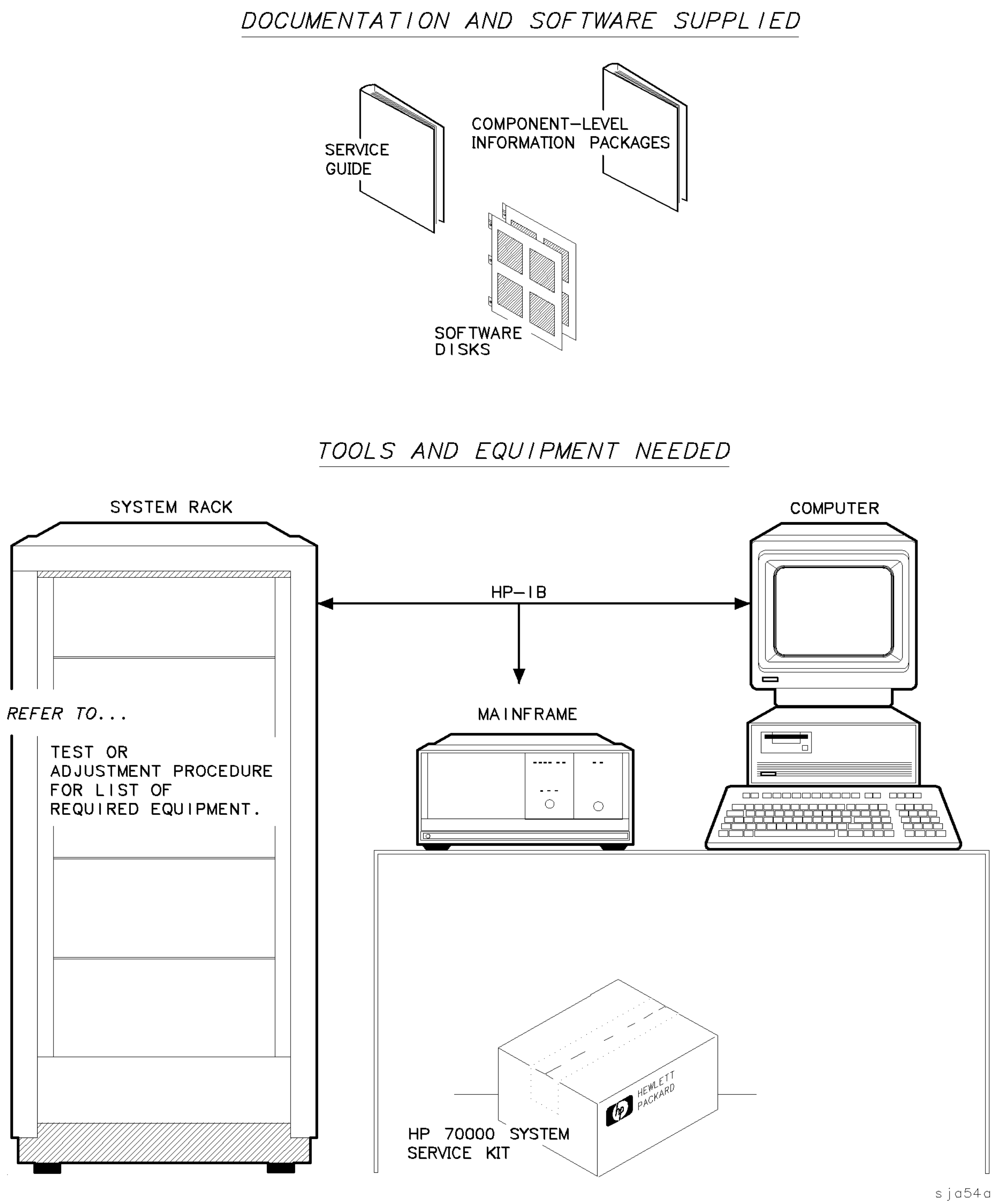
- **Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

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

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

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

Servicing at a Glance



The RF section is a module that is used in HP 70000 Series modular measurement systems. A standard modular spectrum analyzer system includes a mainframe with an RF section, IF section, local oscillator, an optional display, and an optional precision frequency reference.

Software and documentation supplied

This service guide is part of an Option OB3 package which includes:

- *HP 70908A Service Guide*
- *HP 70908A Component Level Information Packages*
- Module verification software disks.

Tools needed

Before servicing, refer to Chapter 5 for a list of the tools and accessories that may be needed during servicing.

Antistatic precautions

Electrical components are easily damaged by small amounts of static electricity. If possible, work at a static-safe work station. For further information, refer to "Preparing a Static-Safe Work Station" in Chapter 4.

In This Book

This book describes all of the service procedures necessary to test, adjust, troubleshoot, and repair your RF section.

Each MMS module has its own service guide. For further information related to the servicing of additional and alternate modules that can be used in this system, refer to that module's service guide.

This service guide is part of an Option OB3 package which consists of two manuals.

Manual 1

Chapter 1 provides information to help get you started so that your RF section is serviced properly.

Chapter 2 contains information needed to use module verification software while servicing your RF section.

Chapter 3 contains information to help identify and resolve some common problems that may occur with your RF section before extensive servicing.

Chapter 4 contains information about troubleshooting your RF section. It presents information on preparing a static-safe work station and includes a set of troubleshooting procedures that can be used to optimize repair time.

Chapter 5 contains tables with a complete listing of all equipment that may be required for servicing.

Chapter 6 contains the setups for all equipment calibration procedures that must be performed in order to optimize module performance when assemblies are changed, repaired, or adjusted.

Chapter 7 contains the setups for all adjustment procedures that are used to optimize module performance when assemblies are changed, repaired, or adjusted.

Chapter 8 contains the setups for all module verification tests that are used to optimize module performance when assemblies are changed, repaired, or adjusted.

Chapter 9 contains procedures for removal and replacement of major assemblies in your RF section. It also contains information needed to order mechanical parts for your RF section.

Chapter 10 contains information on all overall parts identification drawings that should be used when performing the troubleshooting procedures descibed in this service guide.

An index is added at the end of this service guide to aid the user in finding key items of interest.

Manual 2

Manual 2 is a separate volume that contains packets of component-level repair information for each RF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. Manual 2 also contains a table that can be used to cross reference different board assemblies that have different serial prefix breaks.

Before you begin servicing, you must become familiar with module verification software. For information on how to use this module verification software, refer to Chapter 2.

Contents

Figures

Tables

1

Getting Started

This chapter provides information to help get you started so that your RF section is serviced properly.

This chapter answers the questions "What Is Servicing?" and "When Is Servicing Needed?". It then describes the procedures used to return your RF section to Hewlett-Packard for servicing.

What Is Servicing?

Servicing includes testing, adjusting, troubleshooting, and repairing.

There are different categories of testing available. These categories are module verification tests, system verification of operation tests, and system performance tests.

Module Verification Tests Module verification tests are used to test modules so that when assembled into a system, the system meets the system's specifications. These sets of tests are used during servicing.

System Verification of Operation Tests System verification of operation tests are used to verify the proper operation of an instrument and to verify that the instrument meets approximately 80% of its measurement related specifications. These sets of tests are subsets of system performance tests.

System Performance Tests System performance tests are used to verify the proper operation of a complete modular measurement system (MMS) to full system specifications.

This service guide provides information related to testing, adjusting, troubleshooting, and repairing your RF section; it also provides information on module verification tests. These sets of tests are used during servicing.

For information related to system verification of operation tests, refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual*, and for information related to system performance tests, refer to the documentation for HP 11990A system performance test software.

When Is Servicing Needed?

Servicing is needed:

- if error messages are displayed on your HP 70000 Series display
- if an ERROR LED or FAULT LED is on
- to perform repairs or adjustments or both
- to verify the correct operation of your RF section
- or, if applicable, when upgrading firmware

If you determine that your RF section needs servicing, you can perform the servicing yourself using the information in this manual. If your RF section is still in warranty, or if you do not wish to perform the servicing yourself, return your RF section to a Hewlett-Packard service center.

If You Want Hewlett-Packard to Service Your RF Section

Before calling Hewlett-Packard or returning your RF section for service, please read your warranty information. Warranty information is printed at the front of this service guide.

In any correspondence or telephone conversations, refer to the RF section by its full model number and full serial number. With this information, the Hewlett-Packard representative can determine whether your unit is still within its warranty period.

Determining the Serial Number of Your RF Section

When a module is manufactured by Hewlett-Packard, it is given a unique serial number. This serial number is attached to a label on the front frame or front panel of the module. A serial number label is in two parts. (Refer to Figure 1-1.) The first part makes up the serial number prefix and consists of four digits and a letter. The second part makes up the serial number suffix and consists of the last five digits on the serial number label. The serial number prefix is the same for all identical modules; it only changes when a change in the electrical or physical functionality is made. The serial number suffix, however, changes sequentially and is different for each module.

Figure 1-1. Typical Serial Number Label

Table 1-1. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS HEADQUARTERS Hewlett-Packard Company 19320 Pruneridge Avenue Cupertino, CA 95014, USA (800) 752-0900	**EUROPEAN OPERATIONS HEADQUARTERS** Hewlett-Packard S.A. 150, Route du Nant-d'Avril 1217 Meyrin 2 Geneva Switzerland (41 22) 780.8111	**INTERCON OPERATIONS HEADQUARTERS** Hewlett-Packard Company 3495 Deer Creek Rd. Palo Alto, California 94304-1316 (415) 857-5027
California Hewlett-Packard Co. 1421 South Manhattan Ave. Fullerton, CA 92631 (714) 999-6700	**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	**Australia** Hewlett-Packard Australia Ltd. 31-41 Joseph Street (P.O. Box 221) Blackburn, Victoria 3130 (61 3) 895-2895
Hewlett-Packard Co. 301 E. Evelyn Ave. Mountain View, CA 94041 (415) 694-2000	**Germany** Hewlett-Packard GmbH Hewlett-Packard-Strasse 61352 Bad Homburg Germany (+49 6172) 16-0	**Canada** Hewlett-Packard (Canada) Ltd. 17500 South Service Road Trans-Canada Highway Kirkland, Quebec H9J 2X8 Canada (514) 697-4232
Colorado Hewlett-Packard Co. 24 Inverness Place East Englewood, CO 80112 (303) 649-5000	**Great Britain** Hewlett-Packard Ltd. Eskdale Road, Winnersh Triangle Wokingham, Berkshire RG11 5DZ England (44 734) 696622	**Japan** Yokogawa-Hewlett-Packard Ltd. 1-27-15 Yabe, Sagamihara Kanagawa 229, Japan (81 427) 59-1311
Georgia Hewlett-Packard Co. 2124 Barrett Park Drive Kennesaw, GA 30144 (404) 955-1500		**China** China Hewlett-Packard, Co. 38 Bei San Huan X1 Road Shuang Yu Shu Hai Dian District Beijing, China (86 1) 256-6888
Illinois Hewlett-Packard Co. 5201 Tollview Drive Rolling Meadows, IL 60008 (708) 342-2000		**Singapore** Hewlett-Packard Singapore Pte. Ltd. Alexandra P.O. Box 87 Singapore 9115 (65) 271-9444
New Jersey Hewlett-Packard Co. 150 Green Pond Road Rockaway, NJ 07866 (201) 586-5400		**Taiwan** Hewlett-Packard Taiwan 8th Floor, H-P Building 337 Fu Hsing North Road Taipei, Taiwan (886 2) 712-0404
Texas Hewlett-Packard Co. 930 E. Campbell Rd. Richardson, TX 75081 (214) 231-6101		

Returning Your RF Section for Service

Hewlett-Packard has sales and service offices around the world to provide complete support for your RF section. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard sales and service office listed in Table 1-1.

Use the following procedure to return your RF section to Hewlett-Packard for service:

1. Fill out a service tag (available at the end of this service guide) 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 HP 70000 Series display
   - a completed Performance Test record
   - any other specific data on the performance of the RF section

---

CAUTION Damage can result if the original packaging materials are not used. Packaging materials should be anti-static and should cushion the RF section on all sides.

Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the instrument or prevent it from moving in the shipping container. Styrene pellets can also cause equipment damage by generating static electricity or by lodging in fan motors.

---

2. Place the RF section in its original packaging materials.

   If the original packaging materials are not available, you can contact a Hewlett-Packard sales and service office to obtain information on packaging materials or you may use an alternative packing material referred to as “bubble-pack”. One of the companies that makes bubble-pack is Sealed Air Corporation of Hayward, California, 94545.
3. Surround the RF section with at least 3 to 4 inches of its original packing material or bubble-pack to prevent the RF section from moving in its shipping container.
4. Place the RF section, after wrapping it with packing material, in its original shipping container or a strong shipping container that is made of double-walled corrugated cardboard with 159 kg (350 lb) bursting strength.

   The shipping container must be both large enough and strong enough to accommodate your RF section and allow at least 3 to 4 inches on all sides for packing material.
5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to help ensure careful handling.
7. Retain copies of all shipping papers.

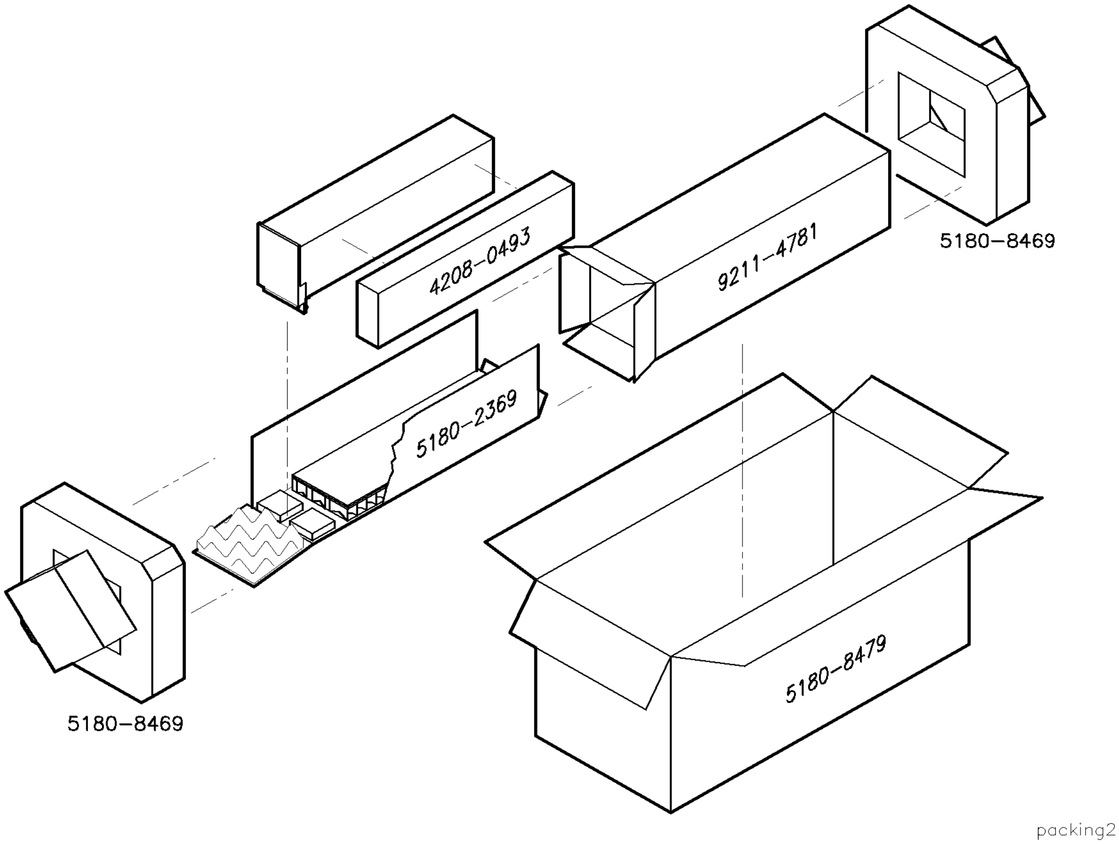


Table 1-2. Packaging for a 2/8 Module (RF Section)

Item	Description	HP Part Number	Qty
1	Carton-outer	5180-8479	1
2	Carton-inner	9211-4781	1
3	Carton-sliders	5180-2369	1
4	Foam inserts	4208-0493	1
5	Foam pads	5180-8469	2

2

Module Verification Software

Module Verification Software is a program that is designed to automate module verification tests and adjustment procedures. Included in this chapter is a step-by-step procedure to load the software and get the verification tests or adjustment procedures underway. For more detailed information, refer to the sections regarding individual menus.

This documentation supports Module Verification Software, Revision A.02.00 or greater.
Use this software with slave modules that have an HP 70900A/B local oscillator source as a master. This software is controlled by a softkey-driven menu and user-interface screens. The disks included with this module provide programs that test whether the module meets its characteristics for system operation.

The *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* contains configuration information for predefined models of HP 70000 Series modular spectrum analyzer systems. The software automatically reads your system configuration data from the Hewlett-Packard Modular System Interface Bus (HP-MSIB) to determine which system or modules you are using.

Computer Compatibility

Module Verification Software is written in HP BASIC 4.0 and can run on the following HP 9000 Series 200/300 controllers. Minimum RAM requirement is 2.5 megabytes.

HP 9816	HP 9920 (with HP 35721A monitor)
HP 9836	HP 9000 Series 300 controller

When using an HP 9000 Series 300 controller, a medium-resolution monitor and either an HP 98203C or an HP 46020A keyboard are required. A high-resolution monitor will preclude printing graphical test results. Due to the various keyboards supported, some minor text differences appear in the menus and softkeys displayed on-screen. (Refer to "Alternate Key Labels" for an explanation of keyboard differences.)

Alternate Key Labels

For simplicity in this document, we assume that you are using an HP 9000 Series 200 controller keyboard. Refer to the list below if your keyboard key labels do not match the ones used in text.

Keyboard Key Labels	**Alternate Key Labels**
(EXECUTE)	(RETURN)
(ENTER)	(RETURN)
(RUN)	press (SYSTEM), then RUN
(CONTINUE)	press (SYSTEM), then CONTINUE

Computer Language Compatibility

Module Verification Software runs on HP BASIC 4.0, or later, with the BIN files in RAM that are listed below. A procedure for loading HP BASIC is provided in "Installing Module Verification Software".

CLOCK	ERR	HPIB	MAT
CS80*	GRAPH	IO	MS
DISK†	GRAPHX	KBD	PDEV‡

*Optional – supports Winchester disk drives.
†Optional – supports microfloppies and older Winchester disk drives.
‡Optional – provides debugging features for program development.

In a shared resource management (SRM) environment, the following BIN files are also required:

DCOMM
SRM

Note If you have set up some RAM memory for specific usage, be aware that this program uses RAM memory Volume ":MEMORY, 0, 15". Move any information stored at this Volume to another location before running Module Verification Software.

Printer Compatibility

Module Verification Software supports any HP-IB printer; however, many of the printed test results require a graphics printer. Graphical test results are not output to a non-graphics printer.

Configuring the Hardware

1. Connect the HP 70000 Series modular spectrum analyzer system to the computer port determined by the following criteria:
   - For computers with an HP 98624A HP-IB interface, connect your spectrum analyzer to the port labeled HP-IB SELECT CODE 8. Check that the address switch on the HP 98624A HP-IB interface board assembly matches the HP-IB controller device address. If needed, refer to the *HP 9000 Series 200/300 controller Peripheral Installation Guide, Volume 1.*
   - For computers without an HP 98624A HP-IB interface, connect the HP 70000 Series modular spectrum analyzer system to the port labeled HP-IB SELECT CODE 7.
2. Connect the HP-IB cables from the test equipment to the computer's HP-IB SELECT CODE 7 port.
3. Use a HP 10833D 0.5 meter HP-IB cable, or similar cable to connect the external disk drive's HP-IB to the HP-IB SELECT CODE 7 port.

Note Occasionally disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If you find this occurring, connect the disk drive to a separate HP-IB interface.

4. Set the external test equipment and the HP 70000 Series modular spectrum analyzer system line switches to ON. Allow the equipment to warm up as specified for the verification tests or adjustment procedures.
5. Turn the disk drive (if used) and computer ON.

Installing Module Verification Software

Use the following steps to get the program loaded and running. Later sections of this chapter contain more specific program-operation information.

Note If you get an error message while installing this software, follow the directions in the message and refer to "Error and Status Messages" for troubleshooting instructions.

Two assumptions are made with the Module Verification Software: 1) you are using standard HP-IB addresses for the active devices of the microwave test station, and 2) all passive devices for the microwave test station are available. If either of these assumptions is inaccurate, you are prompted for data during program execution.

1. Load HP BASIC 4.0 or later, with the appropriate binaries, into an HP 9000 Series 200/300 controller. If necessary, refer to an HP BASIC reference manual.

CAUTION Make backup copies of all write-protected disks. If the program data on an individual disk should become altered, it cannot be ordered separately. The entire set of disks must be ordered to replace any single disk.

2. Assign the MSI (mass storage is) to the drive you will use as the default drive. As an example, you can assign the MSI to a disk drive with the following: `MSI ":,700,0"`
3. Insert the Executive Disk into the assigned default drive.
4. Type the following command line: `LOAD "MOD_VERF",1` and press (EXECUTE) (or (Return)).

   The software version number appears in the upper right-hand side of the initial display. Specific numbers vary, but the software version number looks similar to the following: `Rev. B.02.01`

   Depending on the version of HP BASIC that you are running, you may encounter an error such as `ERROR 84 in 3072 Record not found`. If an error such as this occurs, edit the number of records that are declared in your Module Verification Software's `Init_ram_memory` subroutine so that it runs properly with the version of HP BASIC you are using.

   To edit the `Init_ram_memory` subroutine:

   a. If your system encounters an error with the `Init_ram_memory` subroutine, it will stop and display the error and a line number at the bottom of the display.
   b. Type `EDIT` and push the ↓ key.
   c. Edit the line containing `0,15",10` to read `0,15",256` and press (EXECUTE) (or (Return)).
   d. Press (System).
   e. Press (Run).

   Because this software is being run from floppy disk, this entire process must be repeated each time that Module Verification Software is run.

5. Press `PROCEED` and follow the on-screen prompts to create a mass storage data file.

   If you are using your module's software for the first time, a message appears stating that mass storage data is needed. Once mass storage data is stored, this message does not appear. A similar message may also appear later for the parameter and equipment menus. Press `PROCEED` and follow the on-screen prompts to create the menus.

6. Load the Operating Disk as directed. The Operating Disk probably needs to remain in the drive specified as the MSI default drive.
   - Loading the Operating Disk may require up to two minutes.
   - An error message may be displayed at this point. If the device under test (DUT) does not match the module listed in the HP-MSIB Address Map, or if the software you are using belongs to another module of your system, refer to "Error Messages" at the end of this chapter to determine a course of action.
7. Insert the Driver Disks into the drive specified on-screen and press PROCEED.

Note Be sure that the Driver Disk you load is the disk that belongs with the module you are testing.

This process may require up to six minutes. If the date and time prompt appears, enter the date and time in the specified format. (This message appears only if date and time are not current.)

- If you have not entered serial numbers for passive devices that require calibration data for test purposes, on-screen prompts request the data now. Enter the data via the Calibration Data screen.

  For a detailed explanation of entering calibration data, refer to "Edit Calibration Data" under "Menus" in this chapter. Enter the serial number for each device specified, or bypass the device to continue if it is not used now. After entering and storing data for passive devices, this prompt screen will not reappear.

Note In the future, you can access calibration data stored on the Operating Disk, rather than enter the data for passive devices of a given serial number each time you begin testing. The program displays any additional passive devices requiring serial numbers and calibration data. Serial numbers are only required for passive devices that need their calibration data stored on the Operating Disk. You are prompted to enter serial numbers for these devices only.

- After all drivers have loaded and all required calibration data have been entered, a menu with the following options is displayed:
  - Select FINAL TEST to perform procedures for which the required test equipment is present, automatically.
  - Press equipment menu and return to the Equipment Menu. From here you can modify the status of the equipment in the menu (make it unavailable, readdress it, change the private bus, and so on). Refer to "Equipment Menu" under "Menus" in this chapter.
  - Press test menu to choose between verification tests or adjustment procedures.

    If you have already entered either the verification test or adjustment menus, be aware that changing menus purges status information for any tests you have already run. You determine individual tests or individual adjustments to perform via the menu you select.
  - Press MAIN MENU to customize your test process via any other menu.

    If you wish to change to the other menu, select MORE KEYS; if MORE KEYS is not available, use the (PREV) or (NEXT) keys on your keyboard. Once one of these keys have been selected, a key to change to the other menu becomes available.

Module Verification Software Overview

Testing Multiple Modules

Module Verification Software tests only one module at a time. If you have more than one module to test in your system, test them separately. If you have tested a module and want to change the module being tested without turning off the controller, follow the steps below.

1. Return to the Main Menu, then press `equipment menu`.
2. In the Equipment Menu edit screen, move the item indicator to the Device Model number column next to the DUT.
3. Press `SELECT`, modify the model number, and press (ENTER).
4. Press `DONE`, then `main menu`.
5. From the Main Menu, press `test menu`. If `ERROR MESSAGE: Selected instrument under test is ____; but the software supports the ____ module` appears, press either `RELOAD` and follow the on-screen prompts to load test software, or `CHANGE DUT` to gain access to the Equipment Menu or HP-MSIB Address Menu. From the Equipment Menu, you can select the module under test's model number and modify it to the module number of the software now loaded. From the HP-MSIB Address Menu, select the module to test that matches the software you already have loaded. Otherwise, press `ABORT`.

Error Messages or Warnings Defined

There are three kinds of error messages or warnings generated by the program.

- One appears briefly at the bottom of the CRT display. The program then goes automatically to a menu that asks you for corrections or modifications.
- Another type of error message begins with `ERROR MESSAGE` and provides special softkeys. These errors are user-correctable and anticipated by the program. There is usually a `Possible Fix` message displayed to help you clear the problem.
- The final type begins with `ERROR` and provides no special softkeys. The message informs you of an unanticipated error. There is no suggested fix displayed. If you cannot recover from one of these errors, please contact your Hewlett-Packard Sales and Service Office.

Final Tests Defined

Tests defined as Final Tests are a subset of all available verification tests for a given module. After *any* module-level adjustment or repair, run Final Tests. Once a module has passed the Final Tests, install it into any mainframe and expect performance within its specified characteristics. Perform tests classified as Additional Tests after troubleshooting or adjustments to be sure of the proper operation of specific assemblies. The `FINAL TEST` softkey has no defined purpose while performing adjustments.

Single Tests Defined

You may select individual tests with this program. Refer to "Test Menu" under "Menus" in this chapter for a description of selecting individual tests. As explained in "Final Tests," specific assembly performance is checked by running assembly-associated performance tests.

Printing Test Results

The program shows whether each procedure passed or failed. You may configure the computer operations to format and print test results via the Parameter Menu. If an HP-IB printer is on the bus and an address is provided in the Equipment Menu, and you configured the Parameter Menu to print test results, the program automatically prints the test results. The printout includes a title and summary page.

The title page lists the following data:

- Module software used and the test date.
- Serial number of the module tested.
- Firmware version of the module tested.
- Power line frequency.
- Test person's identification.
- Test equipment model numbers and names, addresses, and ID or serial number.

The Summary Page lists total test time beside the titles of tests performed. The Summary Page also includes test results beneath one of the following categories:

- `Not all Final Tests have been completed ... and so forth`
- `The following Final Tests need to be completed:`
- `The following tests showed insufficient performance:`
- `The following tests met the appropriate requirements:`
- `The following additional tests were not completed:`

Menus

Menu Structure

The first menu presented allows you to go to the Main Menu, to begin Final Tests, or to return to the Equipment Menu. From the Main Menu, access any of the following menus:

Main Menu
Mass Storage Menu
Parameter Menu
Equipment Menu
Edit Calibration Data
HP-MSIB Address Menu
Test Menu

Except for the Test Menu, these menus are configuration menus through which you initialize the software for program operation. Via these menus, you enter information about disk drives, environment conditions, test equipment, the module under test, and so on. Refer to the information following the menu name in this chapter for details.

In the Test Menu, you select and execute module-related procedures. The Test Menu provides some testing options. Refer to "Test Menu" in this chapter for details.

The Mass Storage Menu, the Parameter Menu, and the Equipment Menu have two menu screens. One is the edit screen, the other is the command screen. (The previously mentioned menus use only the command screen.)

- In edit screens, you can edit displayed data or input data to the screen.
- In command screens, you may perform various menu-specific functions, which include storing edited data, selecting test mode, accessing the help screen, accessing the Main Menu, and so on.

Edit and Command Screen Menus

The following softkeys are present for menus that appear in Figure 2-1 through Figure 2-4. Not all of the menus have edit screens, but all have command screens. When softkey labels are written in lowercase letters, a sub-level softkey menu exists for that particular softkey. Softkey labels written in uppercase letters indicate that no further sub-level softkey menus exist for that softkey.

Edit Screen Menus

The following softkeys are present for edit menus that appear in Figure 2-1 through Figure 2-4.

`SELECT OR SELECT/TOGGLE` either one of these keys appears in the Edit Menu. `SELECT` activates the column item where the cursor is located, while `SELECT/TOGGLE` activates predefined choices in the menu.

`DONE` exits the edit screen, then displays the menu's command screen.

Command Screen Menus

The following softkeys are present for the command menus pictured in Figure 2-1 through Figure 2-4. An additional softkey, `edit cal data`, appears only in the Equipment Menu command screen. Refer to "Equipment Menu Command Screen" for information about this softkey.

main menu returns you to the "Main Menu." Refer to "Main Menu" in this chapter for details.

EDIT appears if there is an edit screen in the menu you are working in. Pressing this key returns you to the menu's edit screen.

STORE appears if you have data that needs to be stored on the Operating Disk. The HP-MSIB Address Menu does not require this softkey, therefore it does not appear in that command menu.

- **CREATE** appears if you tried to store data without an existing file available. CREATE activates the store function and creates a file on the Operating Disk.
- **REPEAT** appears if the correct Operating Disk containing calibration data is not in the disk drive. This key allows you to insert the Operating Disk into the disk drive and try again.
- **ABORT** displays the Main Menu screen. ABORT is available in various special task screens but never in a menu screen. In general, pressing this key a time or two will display the Main Menu, which has a quit softkey.

  If the Main Menu has not appeared for the first time, pressing ABORT produces a message asking you to press (RUN), which returns you to where you were when you pressed ABORT.

HELP accesses menu and softkey descriptions. Listed below are softkey selections and functions available via this softkey.

- **NEXT PAGE** takes you to the top of the next available menu page.
- **PREVIOUS PAGE** returns you to the top of the preceding menu page.
- **PRINT HELP** generates a printout of help-screen information.
- **DONE** returns you to the command or edit screen of the menu you were previously in.

quit displays the quit screen. This softkey is available only from menu command screens. After you press quit, you are asked if you really want to return to BASIC operating system. The following two softkey selections are available via the quit softkey.

- **YES** stops the program, retains any data files you stored before pressing quit, and returns you to BASIC operating system. (You can press (RUN) to restart the program and return to the Main Menu. The program retains all previously entered and stored data.)
- **NO** displays the edit screen of the previous menu, or the command screen if there is no edit screen.

Cursor Keys and Menu Selections

When a cursor is present, use either the cursor arrow-keys or the RPG (rotary pulse generator) knob to position the cursor at the column item you wish to edit.

Note In most cases, there are more selections available than are displayed on-screen. Be sure to move the cursor to the right and down as far as you can. NEXT PAGE and PREVIOUS PAGE keys are provided to speed your vertical searches.

Main Menu

From the Main Menu screen you can access all other menus. There is no edit screen for this menu. Figure 2-1 illustrates the Main Menu softkey organization.

Aside from the common softkeys, there are two special softkeys presented in the Main Menu. One is FINAL TESTS, which begins the final test sequence for a module. The second is the RESTART softkey. Press RESTART to reconfigure the program and retest a module, or to test a different module. Pressing this key affects the test status column of both the Test Menu edit screen and HP-MSIB address screen. The remaining Main Menu softkeys include mass storage, parameter menu, and equipment menu. Each of these menus is explained in detail in their sections of this chapter.

If you have stored calibration data on another HP 70000 Software Product Operating Disk, replace your current Operating Disk with that one and access the data. Be sure to return the Operating Disk belonging with your module under test to the default drive.

Mass Storage Menu

The BASIC operating system can use a number of mass storage devices. These include internal disk drives, external disk drives, and SRM systems. You are prompted to assign the areas where the program stores system and operation data. You do this by assigning Volume Labels to an **msus** (mass storage unit specifier). An msus is a string expression that points to a mass storage location. A mass storage Volume is composed of one or more files. Files are data items or subprograms. A Volume might consist entirely of files on a floppy disk, or some number of files on a small portion of a hard disk. The Mass Storage Menu lists Volume Labels that show the location of certain types of program information. These Volume Labels are explained below.

- DATA is where the test results are temporarily stored.
- ERROR LOG is where unanticipated errors are recorded for possible future use.
- OPERATING is where all the program data is stored.

The program retrieves specific information from the following Volume Labels:

- SYSTEM contains the Driver Disk 3 program code. There must be an msus assigned to this Volume Label.
- OPERATING contains the menu configuration files and calibration data.
- DRIVER DISK contains the driver instrument control program code. There must be an msus assigned to this Volume Label.
- TEST DISK contains the module performance tests programs.
- ADJUST DISK contains the module adjustment procedures.

Volume Labels each have a default msus. From the Mass Storage Menu, you can reassign the current msus or directory path designation to another designation. You cannot edit Volume Labels, but you may edit their msus designations and directory path data fields.

Mass Storage Menu Edit Screen

The Mass Storage Menu softkeys and their functions are described below.

SELECT activates the column item where the cursor is located.

DONE exits the edit screen, then displays the Mass Storage Menu command screen.

1. Use either the keyboard arrow keys or the RPG knob to position the cursor next to the column item you wish to edit. The annotations <=more and more=> indicate that you must scroll the screen left or right to view off-screen column items.
2. Press SELECT. Key in the new location (msus or Directory Path). Press ENTER when data entry for the selected item is complete.

Note Leave the Directory Path field blank unless you are using an SRM system, or HP BASIC 5.0 (or later version) that uses directory path hierarchy.

3. Repeat steps 1 and 2 until you have finished editing. Press DONE to display the Mass Storage Menu command screen.

The Data Volume is predefined to use RAM DISK ":MEMORY,0,0". If this RAM disk is not initialized to at least 1040 records, or contains additional files not required by module verification, BASIC error 64 may occur. Either reinitialize the RAM disk or use the Mass Storage Menu edit screen to select another medium.

Mass Storage Menu Command Screen

From the command screen, you can press STORE to save the edited data. Saving Mass Storage Menu data for the first time causes an error message prompting you to create a file. Do this simply by pressing CREATE.

Next, press main menu to return to the Main Menu screen, or press EDIT and return to the Mass Storage Menu edit screen.

Parameter Menu

You may determine some operating conditions of the software program in the Parameter Menu. You can select the printer and its output parameters, decide whether you want the program beep feature on or off, include a message on the test-results output, and so on. Use the SELECT/TOGGLE softkey to select the parameter item and enter data, or toggle to a predefined state. The parameter items and their appropriate selections are defined below.

Parameter Menu Edit Screen

Results sent to: Your choices are Screen or Printer. Press SELECT/TOGGLE. When Screen is displayed, the test results appear on the CRT. When Printer is displayed, test results are displayed on-screen and printed out.

Output Format: Your choices are Graph or Table. Press SELECT/TOGGLE. When Graph is displayed, test results are generated in a graph format if appropriate for the particular test results (a graphics printer is required if Printer and Graph are both selected). When Table is displayed, the test results are output in a table format.

Printer Lines: Lines allowed are from 50 to 70. Press SELECT/TOGGLE. Enter a number from 50 to 70 to set the number of lines per printed page.

Line Frequency: Valid frequency selections are 50 Hz, 60 Hz, and 400 Hz. Press SELECT/TOGGLE until the power line frequency for your system is displayed. The line frequency value affects some test results.

Beeper to be activated: Your choices are Yes or No. Press SELECT/TOGGLE. When Yes is displayed, the warning and time-lapse reminder beeps are activated. When No is displayed, the program's beep feature is disabled.

Verify equipment on HP-IB: Your choices are Yes or No. Press SELECT/TOGGLE to indicate your choice. Yes causes the program to verify the presence of each instrument on HP-IB at the address shown in the Equipment Menu. Select No to bypass this feature.

Test person's ID: Press SELECT/TOGGLE, then enter your name or ID number to include it on the output report.

Number lines added: Lets you include a printed message with the test results. Depending on the program, you can enter up to 30 lines, with no more than 30 characters per line. Enter the message you wish to have printed in this screen by selecting User Line.

User Line:

1. Position the cursor to the left-hand side of a User Line in the menu. Press SELECT/TOGGLE.
2. The prompt, Enter additional information, appears. Type in your message (up to 30 characters per line), then press ENTER.
3. After you have entered your message, reposition the cursor at Number lines added:. Enter the number of user lines your message occupies, then press ENTER.

Parameter Menu Command Screen

Press DONE when you are finished with the Parameter Menu edit screen. The next screen displayed is the command screen. Press STORE to save any edited Parameter Menu data, EDIT to return to the edit screen, or main menu to return to the Main Menu screen.

Saving Parameter Menu data for the first time causes an error message. The message prompts you to create a file. Do this simply by pressing CREATE.

Equipment Menu

The Equipment Menu edit screen displays a list of all the equipment required to test your DUT completely. Next to each DEVICE TYPE in the equipment list is a column labeled DEVICE MODEL for the model number, ADDRESS for the HP-IB address, SERIAL or ID NO. (for example, calibration lab number), and PRIVATE BUS for private bus designation (as for HP 8757C scalar network analyzers, and so on).

Chapter 4 contains a table of required test equipment. Using preferred models of test equipment assures the most complete verification and adjustment testing. Refer to Chapter 8 and Chapter 7 for individual test descriptions and test setups.

Equipment Menu Edit Screen

From the Equipment Menu edit screen you can enter data about your test equipment. You cannot edit the DEVICE TYPE column.

You may use either the cursor arrow keys or the RPG knob to position the cursor at the column item you wish to edit.

1. Edit a DEVICE MODEL item by locating the cursor beside the model number you wish to edit. Press SELECT, type the model number, then press (ENTER).
2. Edit an ADDRESS by locating the cursor beside the address you want to edit. Press SELECT, edit the address, then press (ENTER). If the DEVICE MODEL has no address in the ADDRESS column, `Missing ETE` is included in the Status column next to the tests that required the device. Tests tagged with `Missing ETE` are not performed.
   Valid active device addresses are restricted to the following ranges:
   - 700 to 730 and 800 to 830 for an HP 70000 Modular Spectrum Analyzer master module.
   - 700 to 730 for any other device type.

   These three-digit HP-IB address include the HP-IB select code and the actual HP-IB address. For example, an HP 70000 Series modular spectrum analyzer system HP-IB select code of 8 and an HP-IB address of 21 yields an address of 821. The addresses of DUTs that function as slaves should match their master device's address.

   Address passive devices (non-programmable devices such as sensors, directional bridges, and detectors) as either `Available` or `Not Available`. For some of the passive devices, entering `Available` in the address column requires entering calibration data and a serial number for the device. The calibration data for a passive device is stored on the Operating Disk.

   Passive devices tagged `Not Available` in the address column cause `Missing ETE` to be printed next to the test names on the test results that are output for any procedure that required the missing device. Tests tagged with `Missing ETE` are not performed.
3. Edit a SERIAL NUMBER by locating the cursor beside the serial number. Press SELECT, enter the new serial number (10 digits or less), then press (ENTER). Some passive devices that have `Available` displayed in the address column must also have a serial-number entry.
4. Enter 19 in the PRIVATE BUS column if you are to use a Microwave or Full Microwave source with a network analyzer. Configure these instruments by connecting the source's HP-IB cable to the network analyzer's SYSTEM INTERFACE connection.
   a. Move the cursor through the DEVICE TYPE column until you reach the Full Microwave or Microwave source, then move horizontally to the PRIVATE BUS column.
   b. Enter `19` and press (ENTER). The program enters the ADDRESS column data for the selected source when 19 appears in the PRIVATE BUS column. Nineteen is the only allowable address for sources on a private bus. Refer to the network analyzer's manual for addressing information.

Equipment Menu Command Screen

After you have finished editing the Equipment Menu, press DONE to enter the Equipment Menu command screen. Press STORE to save the edited data.

Saving Equipment Menu data for the first time generates an error message prompting you to create a file. Do this simply by pressing CREATE.

This command screen displays the following additional softkeys:

`edit cal data` displays the Select Passive Device screen. From this screen, move the cursor to the passive device that needs its calibration data edited. Press `SELECT`, then enter the required data. Refer to "Edit Calibration Data" in this chapter for more information.

`NO ADDRESS` appears only if the program cannot find an instrument at a specified HP-IB address. To check which instruments are not responding, follow the steps below.

1. Access the Equipment Menu edit screen.
2. Scroll the ADDRESS column for flashing addresses, then be sure that the instrument is on.
3. `SELECT` the flashing address and either correct the address or press `NO ADDRESS` to delete all fault-addresses from the edit menu.

Note Either exiting the Equipment Menu or entering the Test Menu causes the program to search the addresses in the Equipment Menu for instruments assigned to HP-IB, if this feature is selected in the Parameter Menu.

---

4. Press `main menu` to return to the Main Menu, or `edit cal data` to enter calibration data for passive devices. Pressing `edit cal data` displays the Select Passive Device screen. Refer to the following section for more information.

Edit Calibration Data

The Select Passive Device screen displays all passive devices needing calibration data entered. Press `edit cal data` to enter the Select Passive Device screen. The program requires calibration data for some of the passive devices listed in the Equipment Menu edit screen.

Note Selecting a passive device needing a serial number generates a prompt requesting that you enter the number via the Equipment Menu. If you have formerly entered calibration data for a passive device of a given serial number and you would rather not reenter the data, replace your current Operating Disk with one containing data for passive devices from previous testing. Press `REPEAT` to access the calibration data from that disk. If you only need to enter the passive device's calibration data, press `CREATE` to enter the Edit Calibration Data screen, then begin at step 4.

---

1. Locate the cursor beside the device and press `SELECT`. The next screen displayed allows you to delete or edit data related to the passive device.

Note Not all frequencies are listed on the screen at once. Be sure to enter calibration data for frequencies listed on the next pages of the display.

---

2. If you edit the factory default FREQUENCY or CAL FACTORS values, enter valid calibration factors for each frequency edited.

Note For power sensors, you must enter a frequency and calibration factor for 10 MHz and 300 MHz, even if the device has no factor listed at 10 MHz or 300 MHz. Enter the values from the list of valid factors, below. Other frequencies outside the normal range of the device may also be required. Prior to using your device, you may need to calibrate it at these frequencies to ensure accurate measurement results.

Passive Device	Calibration Factors
Mixers	16 to 24 dB
Directional Couplers	8 to 11 dB
Noise Sources	12 to 16 dB
Sensors	0.3 to 1.6 (stored as a percentage by the program)

Edit Calibration Data Edit Screen

1. Move the cursor to a column item and press SELECT. Enter the new frequency or calibration factor, then press (ENTER). (It is not necessary to enter new frequency values in numeric order. The program sorts them before storing them on the Operating Disk.)
2. To delete an item, move the cursor to the column item. Press SELECT, clear the line, then move to another item. Repeat the above process as needed to edit frequency values or calibration data for any passive devices.

Edit Calibration Data Command Screen

1. After you have entered the necessary data, press DONE. The Equipment Menu command screen is displayed.
2. From the command screen, you can press main menu when you are ready to continue with the program.

HP-MSIB Address Menu

The HP-MSIB Address Menu lists the names and HP-MSIB addresses of the modules in the HP 70000 Series modular spectrum analyzer system that you may select to test. The HP-MSIB address of the master and the system are the same. In other words, the address of the master module determines the address of the system. For information on configuring the software to test a specific module, refer to "Equipment Menu" in this chapter.

There is no edit screen for this menu. The command screen has a SELECT MODULE softkey but requires no STORE softkey. Locate the cursor next to the module you wish to test. Press SELECT MODULE. Be sure the module selected here matches the `Device Under Test` listed in the Equipment Menu.

Test Menu

Pressing test menu from the Main Menu screen accesses the Test or Adjust selection screen. If `ERROR MESSAGE: The ____ is listed as the DUT in the Equipment Menu, but the ____ is selected in the HP-MSIB Address Menu` appears, the possible fix information suggests you select either MODIFY MODULE to enter new ROM data or CHANGE DUT to select the module you wish to test.

If you press MODIFY MODULE, on-screen commands help you change the model and serial number to the module you want to test. If you press CHANGE DUT, go either to the Equipment

Menu to change the model number or to the HP-MSIB Address Map to select the module number you want to test.

To begin the testing process, select TEST to run verification tests or ADJUST to perform adjustments procedures. Press main menu to return to the Main Menu.

If you have pressed FINAL TEST, and wish to get to the adjustment procedures, press main menu, RESTART, TEST MENU, then ADJUST. If you are in the adjustment procedures and want to get to the verification tests, press main menu, RESTART, TEST MENU, then TEST.

CAUTION Pressing either RESTART or equipment menu any time after testing begins purges Test Menu Status column information. Selecting a new module to test in the HP-MSIB Map Screen Menu also deletes the Status column data. The assumption is that verification-test status will most likely be modified if you are moving between modules, ETE model numbers, or to the adjustment procedures.

After selecting Tests, the names of the verification tests are displayed. Review the Status column for tests performed.

Additional test equipment is required to perform tests beside which Missing ETE is listed. To review which additional test equipment is required, locate the cursor beside the test name, then press SINGLE TEST. The Missing ETE screen displays the missing test equipment for that test.

A message stating that calibration data for passive devices is missing may also appear. If the correct Operating Disk is in the default drive, store the calibration data there. Press CREATE to build the data file. After the problem is cleared, the Test Menu is displayed.

Test Menu Command Screen

The Test Menu only has a command screen. It deviates from the command screen formats previously described. The following list defines the softkeys available in this menu.

FINAL TEST
: begins a sequence of final tests, which are a subset of verification tests. A full calibration requires all verification tests. Review the Test Menu Test Name list for all available tests. During the final test sequence, the keys listed below are also available.

  END SEQUENCE
  : interrupts the test sequence at the end of the test in progress. The Test Menu is displayed with an additional softkey labeled RESUME TESTING. Press this key to resume the test sequence where the program left off.

  ABORT
  : ends the testing process and displays the Test Menu. From there you may choose some other action.

RESUME TESTING
: allows you to continue the final test sequence after you have pressed FINAL TEST followed by END SEQUENCE.

SINGLE TEST
: lets you select an individual test to run. If Missing ETE is listed in the Status column, you can review which test equipment is missing. Locate the cursor beside that test name, then press SINGLE TEST. The Missing ETE screen is displayed. If you choose to return to the Test Equipment Menu via the Test Menu to install the missing test equipment, you lose

the status of any tests that have run. To run a single test that has the necessary ETE, locate the cursor beside the test name and press SINGLE TEST.

multiple test — softkey lets you organize a group of tests sequentially. Locate the cursor beside the test you want to run. Press SELECT to assign the first number of the series to that test. Continue to locate the cursor and press SELECT until you have organized the tests you want to run. Press END LIST when you are ready to begin testing. During testing, the following softkeys are also available.

- END SEQUENCE — interrupts the test sequence at the end of the test in progress, then displays the Test Menu.
- ABORT — ends the testing process and displays the Test Menu. From there you may choose some other action.

repeat mult. — softkey allows you to select a test sequence (you determine the quantity and order). The tests loop through this sequence until you decide to stop them. Locate the cursor beside the test you want to run, press SELECT, move the cursor to the next test, press SELECT, and so on. Continue selecting tests until you are ready to begin testing. It is acceptable to select the same test for repeated testing. Press END LIST to start the test sequence. During testing, the following softkeys are also available.

- END SEQUENCE — interrupts the test sequence at the end of the test in progress, then displays the Test Menu. \ABORT\ ends the testing process and displays the Test Menu. From there you may choose some other action.

more keys — toggles between SUMMARY, select output, and PURGE CAL DATA and the previously explained Test Menu command screen softkeys.

- SUMMARY — gives you a printout of the current tests run.
- select output — chooses an output device. You can print test results by pressing PRINTER, or you can print the current display by pressing SCREEN. Press RETURN to return to the previous set of softkeys in the Test Menu command screen.
- PURGE CAL DATA — Pressing this softkey deletes stored calibration data for the spectrum analyzer and any other calibration routines used for testing. Before module verification tests can be run again, equipment calibration routines have to be redone.

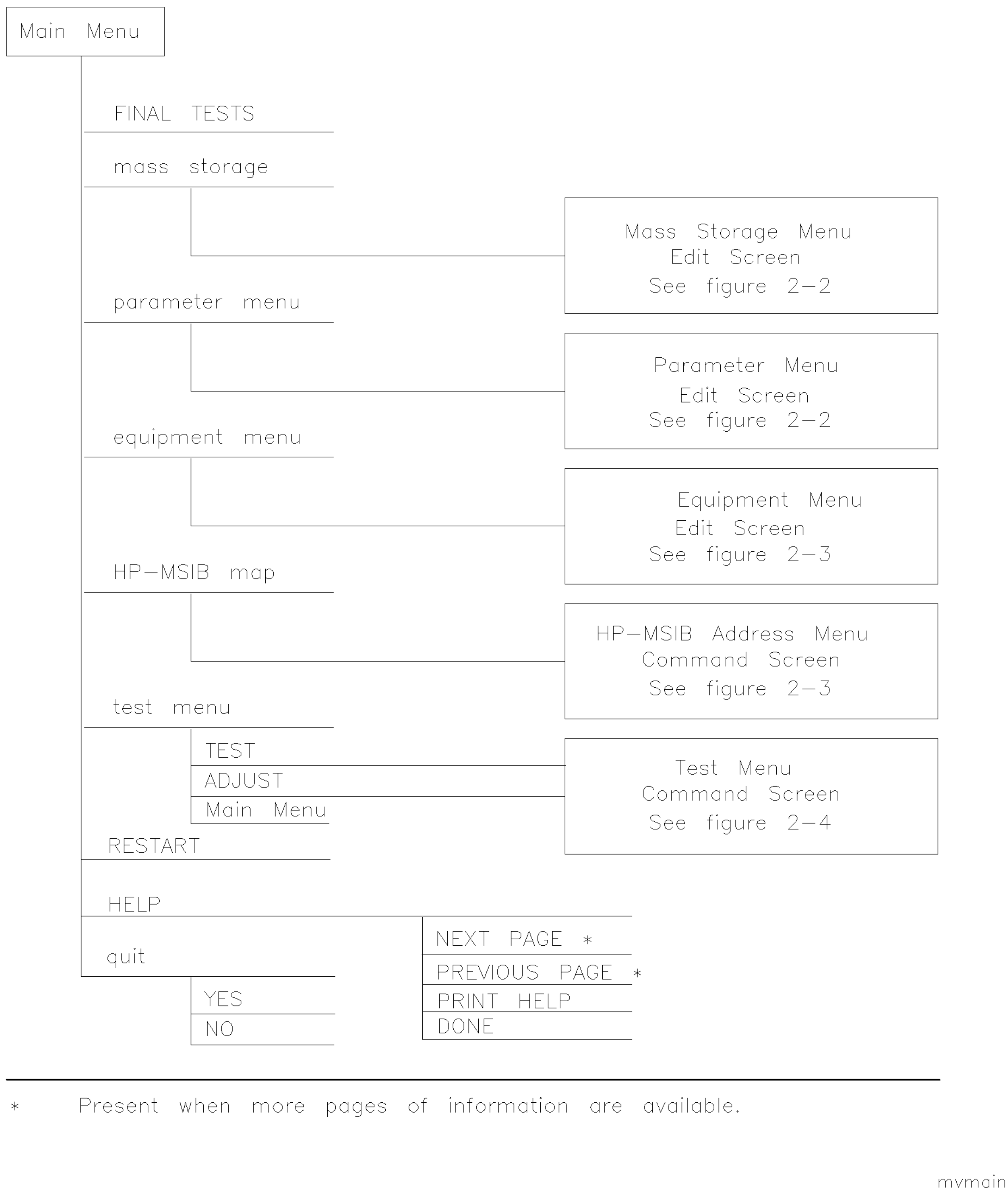
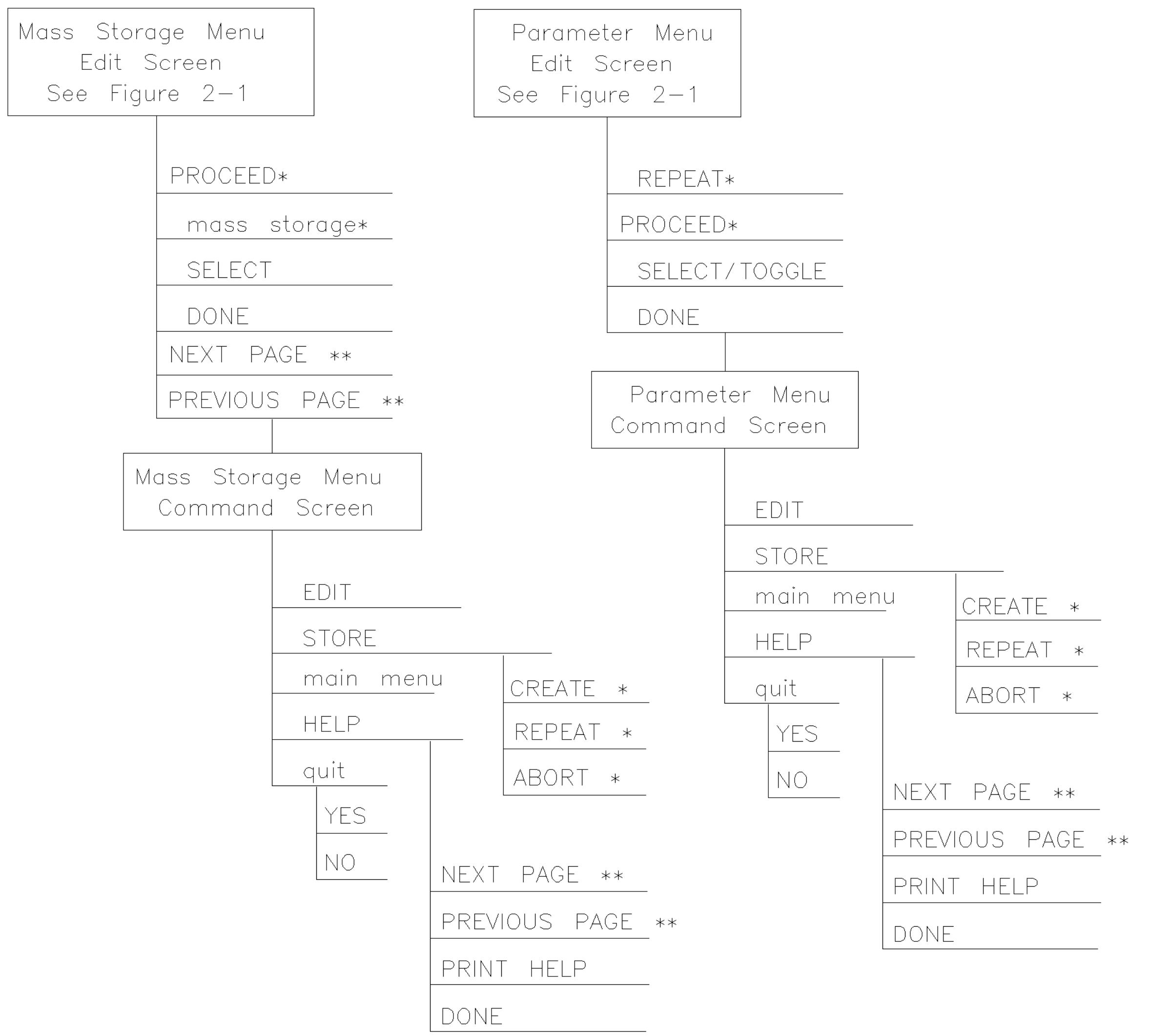


Figure 2-1. Main Menu Softkeys



* Present when the program does not find a file on the Operating Disc.

** Present when more pages of information are available.

mvmass

Figure 2-2. Mass Storage Menu and Parameter Menu Softkeys

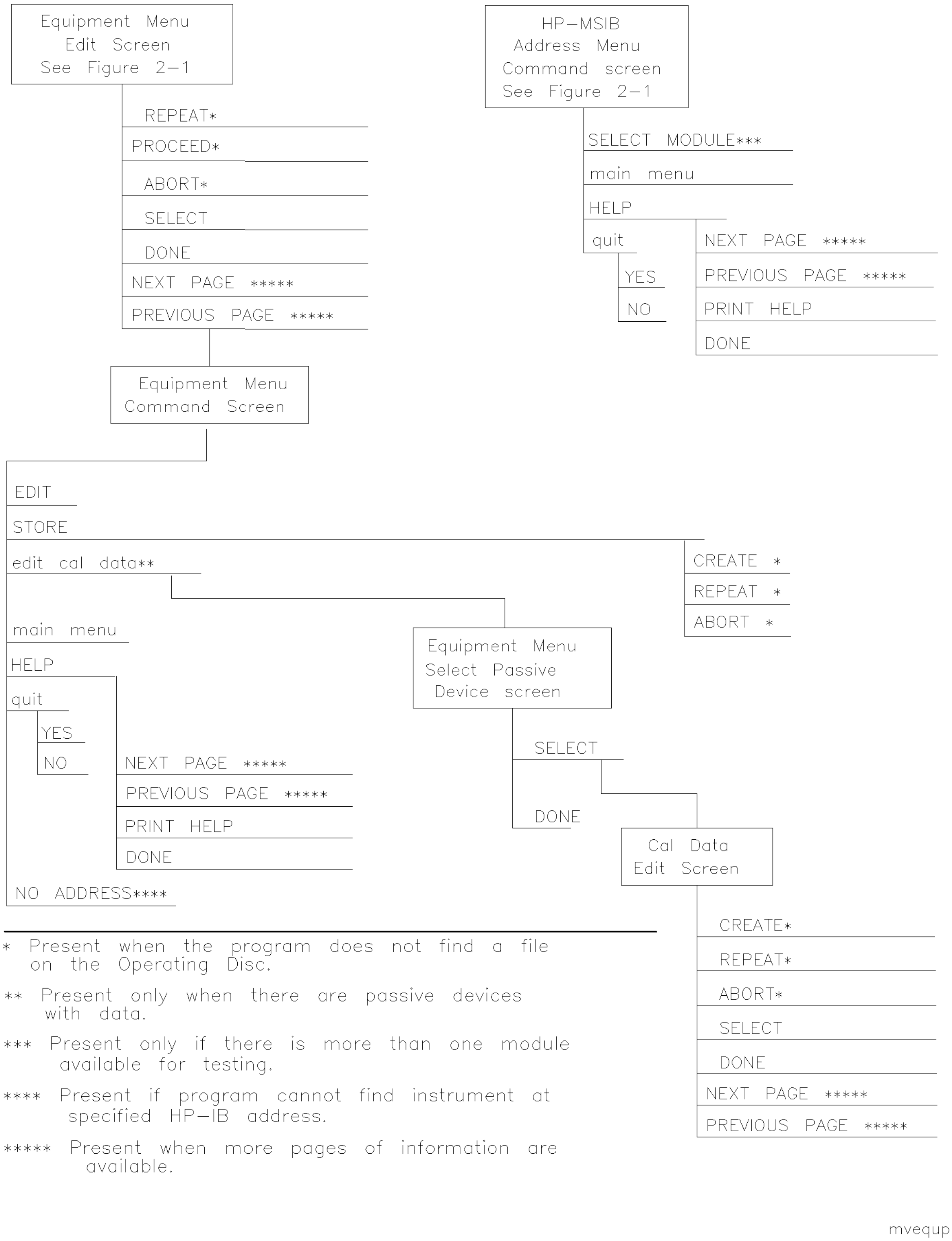
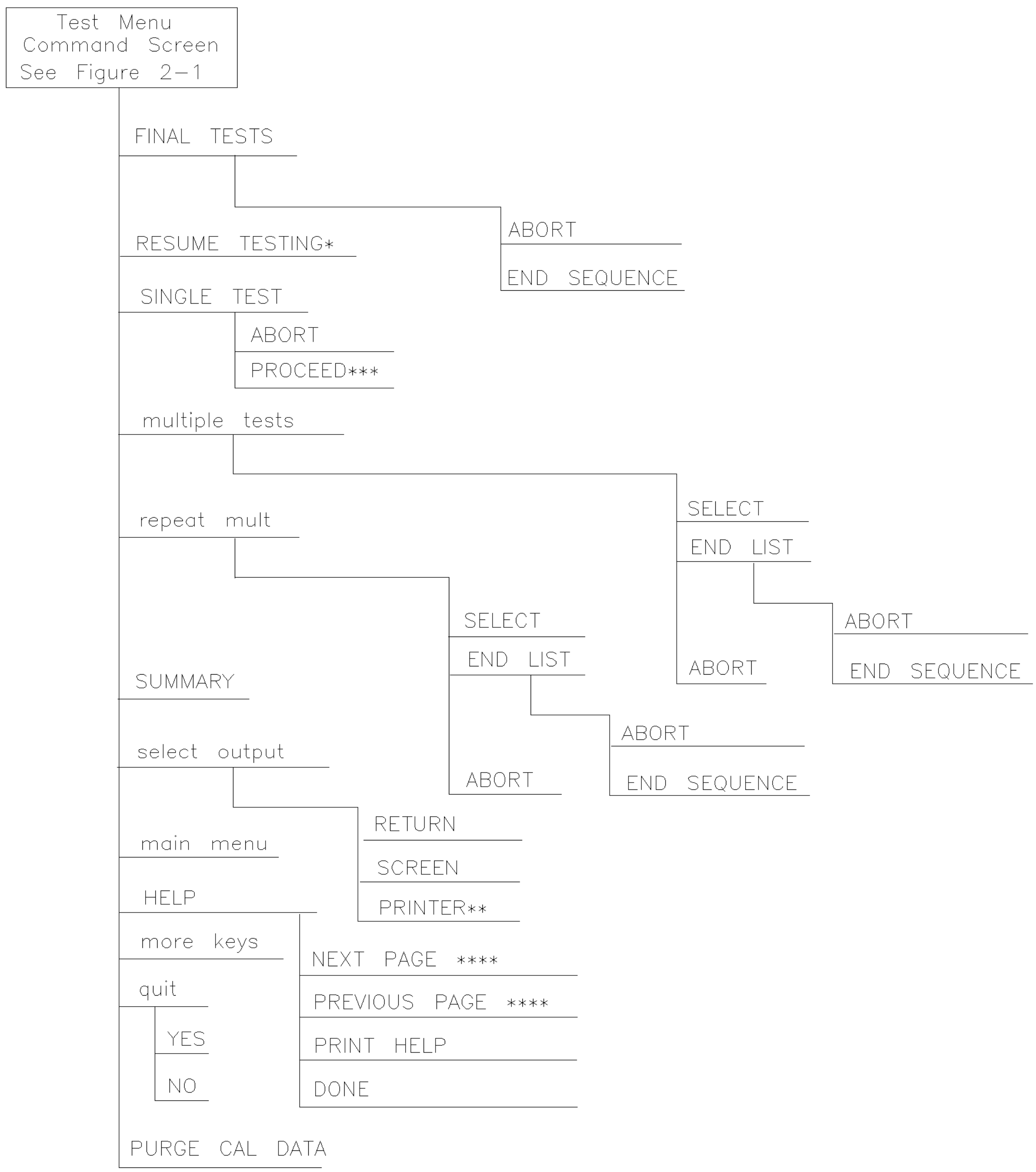


Figure 2-3. Equipment Menu and HP-MSIB Map Screen Menu Softkeys



* Present only if END SEQUENCE was previously selected for FINAL TESTS.

** Present only if a printer address is available in Equipment Menu.

*** Present when you've selected SINGLE TEST for a test having missing ETE in the status column.

**** Present when more pages of information are available.

mvtest

Figure 2-4. Test Menu Softkeys

Error and Status Messages

User interface messages used with HP 70000 Series software products are alphabetized in this section. The messages are designed to provide information about test results, operator errors, and system conditions. Refer to your *HP BASIC Language Reference* for system error information.

`Aborted`

You aborted the test indicated.

`EEPROM for ____ is defective.`

The EEPROM needs to be replaced.

`Failed`

The module under test needs adjustment or repair to pass the test number indicated.

`CAUTION: Passthru address is incorrect. (See Edit Screen).`

The address of the microwave source is not set to 19, or the address specified in the Equipment Menu does not match the address of the synthesized source. Return to the edit screen of the Equipment Menu to modify addresses in either the address column or the private bus column.

`CAUTION: Some Model #'s are not supported. (See Edit Screen).`

You have model numbers in the Equipment Menu that are not supported by the software. Ignore this caution if you are sure program memory contains a driver for these models. A driver that is required but missing causes the error message `Undefined function or subprogram` to appear on-screen. You are returned to the Test Menu.

`Equipment list is not acceptable.`

You attempted to enter the Test Menu, but the program could not locate all the instruments for which you have specified HP-IB addresses. Verify that the indicated equipment is turned on, then return to the Equipment Menu edit screen to verify accuracy of addresses that are flashing in either the address column or the private bus column.

`Equipment list shows no analyzer to test.`

The DUT has no assigned HP-IB address. Return to the Equipment Menu and edit the Address column.

`ERROR: Address matches system disk drive.`

You entered an HP-IB address matching that of the computer's external disk drive. HP-IB protocol allows only one instrument per address.

`Address not in acceptable range.`

You entered an HP-IB address outside the range 700 to 730, inclusive.

`ERROR: Duplicate HP-IB address.`

You attempted to exit the Equipment Menu after assigning the same HP-IB address to different model numbers. HP-IB protocol allows only one instrument per address. (It is acceptable to assign the same address to identical model numbers, implying multiple use of the same instrument.)

`ERROR: Non-responding HP-IB address.`

You attempted to exit the Equipment Menu after assigning an HP-IB address to an instrument not responding on HP-IB.

ERROR: Search for ____ unsuccessful.

The program tried to find the disk identified but could not. Either assign a drive to the disk and press REPEAT or insert the required disk into its appropriate drive. Press REPEAT.

ERROR: Some devices listed as Available require serial numbers.

You pressed View Cal Data, then selected a device to which you have not assigned a required serial number. Display the Equipment Menu edit screen and assign the serial number.

ERROR MESSAGE: Address is HP-IB controller address.

You entered an HP-IB address matching the computer's address. HP-IB protocol allows only one instrument per address.

ERROR MESSAGE: Attempt to close file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

- Press REPEAT to try again.
- Press CREATE to create a new file.
- Press ABORT to return to the Main Menu.

ERROR MESSAGE: Attempt to create file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

- Press REPEAT to try again.
- Press CREATE to create a new file.
- Press ABORT to return to the Main Menu.

ERROR MESSAGE: Attempt to Edit Mass Storage failed.

Your edits to the Mass Storage Menu were not valid. Return to this menu and correct the errors.

ERROR MESSAGE: Attempt to store Mass Storage failed.

You pressed ABORT after pressing STORE mass storage. The Mass Storage Menu failed.

Press ABORT to return to the Main Menu.

ERROR MESSAGE: Bad instrument address in equipment list. Address matches controller.

You entered an HP-IB address matching that of the controller. HP-IB protocol allows only one instrument per address and only one controller per HP-IB system. (The factory preset controller address is 21.)

ERROR MESSAGE: Calibration data frequency exceed acceptable limits.

Return to the Calibration Data edit screen and correct the data entries that are flashing.

ERROR MESSAGE: Calibration data frequency is less than minimum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data frequency is greater than maximum range of ____.

The frequency entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid frequencies for the values that are flashing.

ERROR MESSAGE: Calibration data for ____ is blank for some frequencies listed.

Return to the Calibration Data edit screen to enter the calibration data for frequencies indicated with flashing markers.

ERROR MESSAGE: Calibration data for ____ is less than minimum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data for ____ is greater than maximum range of ____.

The factor entered next to the device in the Cal Data edit screen is out of the device's operating range. The return to this screen is automatic. Enter valid values for the ones that are flashing.

ERROR MESSAGE: Calibration data file not found for ____ with serial number ____.

The data file cannot be found or there is a problem with the data file on the Operating Disk. Correct the problem, then either press REPEAT to try again or press (CONTINUE).

ERROR MESSAGE: DUT does not have an address.

You attempted to leave the Test Equipment Menu, but the program cannot verify the DUT at the specified HP-IB address. First check the address. If the address is correct, cycle the main power of the system under test.

ERROR MESSAGE: DUT was not at address in the equipment list. DUT was expected at address ____.

The DUT is not at the specified address, or HP-IB is at fault, or main power is off on the DUT. Press ABORT, then return to the Equipment Menu to verify the address.

ERROR MESSAGE: DUT was not found at address in equipment list.

The address specified for the DUT is not valid. Press ABORT, then return to the Equipment Menu to verify the address.

ERROR MESSAGE: Equipment address matches external disk drive.

You entered an equipment address matching that of the external disk drive. HP-IB protocol allows only one instrument per address.

ERROR MESSAGE: Equipment Menu data not found on ____.

The program could not find the Equipment Menu data file on the Operating Disk. Possible Fix instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk accessed by the program is not the one containing the Equipment Menu file. Insert the correct Operating Disk, then press REPEAT or (CONTINUE).

ERROR MESSAGE: Equipment does not have an address.

There is no address assigned to the DUT. Return to the Equipment Menu edit screen and verify or enter an address in the Address column.

ERROR MESSAGE: ERROR XXX in XXXXX ____ .

An unanticipated occurrence in the program caused a program failure. For clarification, call your Hewlett-Packard Sales and Service Office.

ERROR MESSAGE: File ____ not found while assigning I/O path.

You attempted to STORE a list (equipment, mass storage, or parameter) for the first time on the current Operating Disk. Possible Fix instructions appear with the on-screen error message. Follow the on-screen instructions or return to the Mass Storage Menu to change the location of the Operating Disk.

ERROR MESSAGE: Incorrect Volume found. ____ required.

The wrong disk is in the required storage medium. Either correct the fault and press REPEAT to retry, or select mass storage to return to the Mass Storage Menu. From here you can indicate a different mass storage drive.

ERROR MESSAGE: Parameter Menu data not found on ____.

The program could not find Parameter Menu data file on the Operating Disk. Possible Fix instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk accessed by the program is not the one containing the Parameter Menu data file. Insert the correct Operating Disk, then press REPEAT or (CONTINUE).

ERROR MESSAGE: Read ____ data from file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then either press REPEAT to try again or (CONTINUE) to use default values.

ERROR MESSAGE: Selected instrument under test is ____; but the software supports the ____.

The module entered in the HP-MSIB map is not currently supported by software. Either load the correct software or select a different module in the Equipment Menu or HP-MSIB Map Menu.

ERROR MESSAGE: Sensor model # ____ not supported.

Software does not support the sensor model number entered for the Signal Sensor in the Equipment Menu. Return to the Equipment Menu and select a sensor with a model number that is supported. (Refer to Chapter 5 for a list of supported equipment.)

ERROR MESSAGE: Test Parameter data file not found on ____.

The program could not find parameter-list data file on the Operating Disk. Possible Fix instructions appear with the on-screen error message. If the data file is available in a location other than the one currently specified in the Mass Storage Menu, return to that menu and change the msus and/or the directory path of the Operating Disk. It may also be that the Operating Disk being accessed by the program is not the one containing the parameter-list data file. Insert the correct Operating Disk, then press REPEAT or (CONTINUE).

ERROR MESSAGE: The ____ is listed as the DUT in the Equipment Menu, but the ____ is selected in the HP-MSIB Address Menu.

The DUT and the model selected in the HP-MSIB Address Map do not agree. You are given suggested fix instructions either to modify the module or change the DUT.

ERROR MESSAGE: The Operating Disk is write protected.

Make a working copy of the Operating Disk and store the original in a safe place, or remove the write-protect.

ERROR MESSAGE: Too many Cal Data frequencies were eliminated. There must be at least two frequencies.

Only one Cal Frequency remains in the Cal Data edit screen. Return to that screen and enter more frequencies in the Frequency column.

ERROR MESSAGE: Write ____ data to file ____ failed.

There is a problem with the data file on the Operating Disk. Correct the problem, then do one of the following:

- Press REPEAT to try again.
- Press CREATE to create a new file.
- Press ABORT to return to the Main Menu.

ERROR MESSAGE: Wrong device at specified address. DUT was expected at address ____.

The address specified for the DUT is actually that of a test instrument. Possible Fix instructions appear with the on-screen error message. If necessary, return to the Equipment Menu.

ERROR MESSAGE: ____ Volume was not located.

The program cannot access the listed Volume. If the Volume is correct, press REPEAT to retry. If the Volume is incorrect, press mass storage to return to the Mass Storage Menu. From here you can indicate a different mass storage medium for the Volume in question.

FORMAT ERROR: Observe date format and character position.

You entered the date/time in an unacceptable format. Enter date/time in the format dd mmm yyyy and hh:mm, then press (ENTER).

Hdw Broken

Actual test results far exceed the expected results. This is often an indication of a hardware failure (hardware broken) or incorrect connections.

Logging errors to ERRORLOG failed. Operating Disk is write protected.

The program tried to store error data onto the Operating Disk and could not because of the write-protect. Make a working copy of the Operating Disk and store the original in a safe place, or remove the write-protect.

KEYBOARD SYSTEM CRASH WITH KEYBOARD: ____.

The software program does not support the current keyboard. Install a keyboard having one of the part numbers listed at the beginning of this chapter, then restart the program.

Passed

The module meets the tested characteristics. PAUSED. PRESS CONTINUE.

You pressed (PAUSE) on the computer keyboard. Press (CONTINUE) to resume program execution.

PRGM ERROR

The program detected an error within itself. For clarification contact Hewlett-Packard *Santa Rosa Systems Division.*

`Reading errors from ERRORLOG failed. Check disk at ____.`

The program tried to read error data from the Operating Disk. Check that the Operating Disk is installed in the drive specified in the error message.

`Return to Equipment Menu to enter serial number for ____.`

You must return to the Equipment Menu edit screen and enter a SERIAL or ID NO. for the passive device selected before you can edit the device's calibration data.

`Setup Error`

The program aborted the test after attempting to verify the test setup. Ensure that all required ETE is present, has been turned on, and is properly connected.

`SORRY, but your SERIAL NUMBER must end in a NUMERIC -- This is ____.`

Contact Hewlett-Packard *Santa Rosa Systems Division* for assistance.

`Test can not be done.`

Required ETE is missing. Return to the Equipment Menu and enter all ETE listed as required for the current test.

`TEST_LIST is not compatible.`

A bad test list exists. Contact Hewlett-Packard *Santa Rosa Systems Division* for assistance.

`The controller does not have sufficient memory. This software cannot load. See the computer hardware system documentation for information on adding additional memory.`

Either refer to the appropriate manual to extend the memory capability of your system, or off-load some data to make room for the program.

`The ____ at address ____ was not found on HP-IB.`

When Verify HP-IB is set to ON in the Parameter Menu, this error message displays the ETE with the address that is either missing or not set to ON.

`The 436A is in lowest range, waiting 10 seconds.`

The current power measurement requires the lowest power-meter range. Program execution will resume in 10 seconds.

`The 8902A needs repair (Error 6).`

There is a problem related to the HP 8902A measuring receiver. Correct the fault or return to the Equipment Menu where you can enter a different model number.

`The DUT must have an HP-IB address.`

You attempted to leave the Equipment Menu, but the program cannot find the HP 70000 system at the assigned HP-IB address.

`THIS COLUMN CAN NOT BE EDITED.`

You pressed `SELECT` with the cursor positioned in the first column of the Mass Storage edit screen or the Equipment Menu edit screen. This column cannot be edited.

`THIS IS ____ AND FOUND DUPLICATE FILES: ____.`

Contact Hewlett-Packard *Santa Rosa Systems Division* for assistance.

`This test can not be selected because of missing ETE.`

You were in either Multiple Tests or Repeat Multiple, then tried to select a test that has missing ETE. This is not allowed. Check the Status column of the Test Menu to verify a `Missing ETE` tag next to the test name you attempted to select.

`Timed Out`

The program aborted the test.

`WARNING: Duplicate Address`

You entered a duplicate HP-IB address to an item in the Equipment Menu. (You may have to scroll through the menu to find the duplication.)

`WARNING: Duplication may exclude specific tests.`

You assigned two generic device functions to one ETE. (For example, the TOI test will not be run if you assign a single HP 3335A synthesizer/level generator as both the required level generator and the required general source.)

`WARNING: String is too long. It has been truncated.`

You entered too many characters in a user's line of the Parameter Menu edit screen. Select the line and enter 30 or fewer characters.

`Write protected.`

You attempted to store data on a write-protected disk. After correcting the fault, press (CONTINUE).

3

Before Extensive Servicing

This chapter contains information to help identify and resolve some common problems that may occur with your RF section before extensive servicing.

Symptoms of various problems are listed at the top of each page. Most symptoms have a brief description or explanation to help provide more insight into their cause. A possible cause for the symptom and a checklist of possible solutions are then presented. Use this checklist as an aid to correct the problem.

If you determine that your RF section needs further servicing and your RF section is not experiencing any of the symptoms presented in this chapter, refer to "Performing Related Adjustments and Verification Tests" in Chapter 4 to determine which adjustments and verification tests must be performed and also Table 5-1 for a list of recommended test equipment to use when assemblies are changed, repaired, or adjusted.

Note

- If your RF section is still in warranty, or if you do not wish to perform the servicing yourself, return your RF section to a Hewlett-Packard service center. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)
- If you decide to perform the servicing yourself, prepare a static-safe work station before you begin any servicing procedures. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

If the System's Power-On Self Test Fails

Each time the HP 70000 Series modular spectrum analyzer system is turned on, the system runs through an initializing routine (power-on self test) during which the front panel STATUS LEDs on each module flash on momentarily and then turn off.

If the system passes the power-on self test, the MEASURE LED on the HP 70900B local oscillator source begins blinking on and off (triggered by the system sweep), and the ACT LED on front panel of each active module is turned on.

If any module fails the self test, it will not establish a link with the display. If the front panel LEDs on the HP 70900B local oscillator source flash on and off, it means the instrument has failed the power-on self test.

To solve this problem:

- □ Check that the HP 70900B local oscillator source is powered on.
- □ Check that the HP 70000 Series modular spectrum analyzer system display and mainframe are plugged into the proper ac line voltage.
- □ Check that the line socket has ac line voltage.
- □ Check that the line voltage selector switch is set to the correct voltage for the ac line voltage being used. The line voltage selector switch is located on the left side of the HP 70004A color display, on the bottom of the HP 70001A mainframe, or on the rear panel of the HP 70206A system graphics display.

Figure 3-1. Line Voltage Selector

- □ Check the line fuse on the display or the mainframe to ensure that it is not damaged. The line fuse is located inside the power-cord receptacle housing on the rear of the display and mainframe. Also included in this housing is a spare fuse. The fuse is a 5 by 20 mm fuse rated at 6.3 A, 250 V (HP part number 2110-0703). This line fuse can be used with both 120 V and 230 V line voltage.

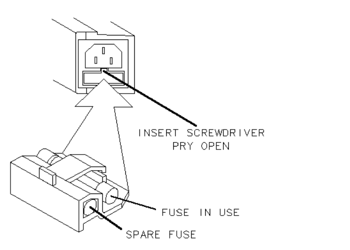


Figure 3-2. Line Fuse Removal and Replacement

- ☐ Check the address map. (Refer to Table 3-1.)
- ☐ Check the system interconnections.
- ☐ Check the A10 power supply/driver by removing the module from the mainframe and installing it on an extender cable (HP part number 70001-60013). Remove the outer cover of the module. Confirm that the yellow and green LEDs on the top of the A10 power supply/driver are lit. If any of these LEDs is not lit, the A10 power supply/driver may need servicing.
- ☐ If necessary, obtain service from Hewlett-Packard. Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.

Table 3-1. Default HP-MSIB Address Map

	Column 18	**Column 19**	**Column 20**
Row 7	blank	HP 70310	blank
Row 6	RF sections[1]	HP 70300	HP 70620 or HP 70621[2]
Row 5	HP 70907	HP 70301	blank
Row 4	HP 70903	blank	HP 70810 Option 850
Row 3	HP 70911	HP 70620 or HP 70621[3]	HP 70810
Row 2	HP 70700	HP 70600 or HP 70601	blank
Row 1	HP 70902	blank	blank
Row 0	HP 70900	blank	blank

1 This includes: HP 70904A RF section, HP 70905A/B RF section, HP 70906A/B RF section, HP 70908A RF section, HP 70909A or HP 70910A RF section.

2 When preamplifying the lightwave section's input signal.

3 When preamplifying the preselector's or RF section's input signal.

For more information about addressing criteria, refer to *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual.*

If Your HP 70908A RF Section is Powered On But Not Responding Correctly

If the HP 70908A RF section does not complete its power-up sequence, or if it causes the bus to hang up, the following procedure may be used to help troubleshoot the problem.

To solve this problem:

- □ Set the mainframe line switch to OFF. Remove the RF section from the mainframe, and then remove the left-hand side cover from the module to gain access to the A12 controller.
- □ Install the module service extender (HP part number 70001-60013) and connect the RF section to the extender cable.
- □ Set the mainframe line switch to ON.
- □ Measure the +5 V supply at A12U17 pin 3.
  - □ If +5 V is present, there is a problem with the A12 controller.
  - □ If +5 V is not present, remove the ribbon cable to the A14 front panel board.
- □ Remeasure the voltage at A12U17 pin 3.
  - □ If +5 V is present, the A14 front panel board is loading down the +5 V.
  - □ If +5 V is not present, check A12U17 pin 1 for +8 V (unregulated).
- □ If the voltage on the A12U17 pin 1 measures +8 V, there is a problem on the A12 controller.
- □ If pin 1 does not measure +8 V, refer to "Troubleshooting the A10 Power Supply/Driver" in Chapter 4.
- □ If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If One or More Modules' Error Indicator is Flashing

The HP 70908A RF section communicates with the HP 70000 Series modular spectrum analyzer system over the HP-MSIB. When the STATUS ERR indicator LED on a particular module flashes at a 1 Hz rate, the module cannot communicate over the HP-MSIB.

To solve this problem:

- □ Try turning off the power to the system and then turning it on again.
- □ If front panel keys are still responding, check the address map to see that all modules are located in their designated coordinates.
- □ If front panel keys are not responding and the address map cannot be checked, power-down the system, pull out each module, and check its address setting by looking at its address switches.

  All modules should conform to the required coordinates on the address map. (Refer to Table 3-1.)
- □ If your system contains more than one mainframe, check that the HP-MSIB cables are connected such that two cable connections are made to each mainframe. If these cable connections look correct, you may try replacing the HP-MSIB cables with new ones.
- □ If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

4

Troubleshooting

This chapter contains information about troubleshooting your RF section. It presents information on preparing a static-safe work station and then it presents a set of troubleshooting procedures that can be used to optimize repair time.

Adjustment and verification tests that must be performed, when assemblies are changed, repaired, or adjusted are presented at the end of the chapter.

Preparing a Static-Safe Work Station

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-safe work station.

Figure 4-1 shows an example of a static-safe work station. Two types of ESD protection are shown:

- a conductive table mat and wrist strap combination
- a conductive floor mat and heel strap combination

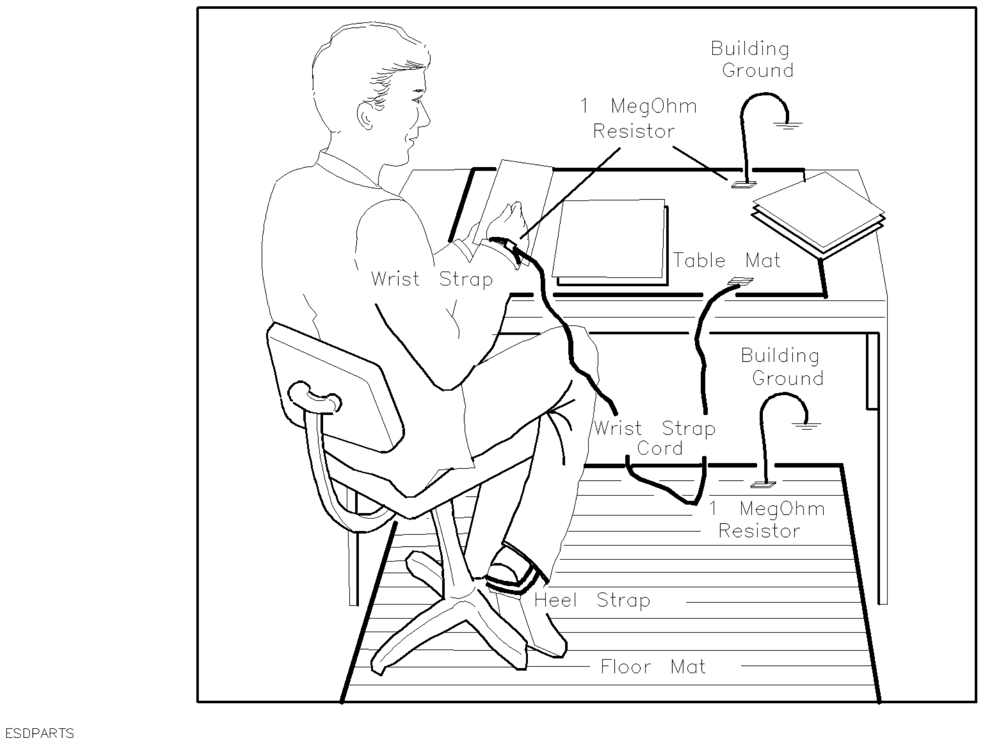


Figure 4-1. Static-Safe Work Station

These two types of ESD protection must be used together. Refer to Table 4-1 for a list of static-safe accessories and their HP part numbers.

CAUTION

- Do not touch the edge-connector contacts or trace surfaces with bare hands. Always handle board assemblies by the edges.
- Do not use erasers to clean the edge-connector contacts. Erasers generate static electricity and degrade the electrical quality of the contacts by removing the thin gold plating.
- Do not use paper of any kind to clean the edge-connector contacts. Paper or lint particles left on the contact surface can cause intermittent electrical connections.

Reducing ESD Damage

To help reduce the amount of ESD damage that occurs during testing and servicing use the following guidelines:

- Be sure that all instruments are properly earth-grounded to prevent buildup of static charge.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and before removing any assembly from a piece of equipment.

  Use a resistor-isolated wrist strap that is connected to the HP 70000 Series modular spectrum analyzer system mainframe's chassis. If you do not have a resistor-isolated wrist strap, touch the chassis frequently to equalize any static charge.
- 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.
- Handle all PC board assemblies and electronic components only at static-safe work stations.
- Store or transport PC board assemblies and electronic components in static-shielding containers.
- PC board assembly edge-connector contacts may be cleaned by using a lintfree cloth with a solution of 80% electronics-grade isopropyl alcohol and 20% deionized water. This procedure should be performed at a static-safe work station.

Static-Safe ESD Accessories

Table 4-1. Static-Safe ESD Accessories

HP Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft × 4 ft) and 4.6 m (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0865	Ground wire, 4.6 m (15 ft)
9300-0980	Wrist-strap cord 1.5 m (5 ft)
9300-1367	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1308	ESD heel-strap (reusable 6 to 12 months).
Order the above by calling HP DIRECT at (800) 538-8787 or through any Hewlett-Packard Sales and Service Office.	

If Operating Errors Messages (2000–2999) Occur

Operating errors are generated when a module in the HP 70000 Series modular spectrum analyzer system is not used properly. These errors can occur at any time, but are most common during remote operation. Operating errors range from 2000–2999 and are reported by the HP 70900B local oscillator source.

The A12 controller received a command it did not recognize and caused the HP 70000 Series modular spectrum analyzer system to display one or more of the following operating errors:

Operating error messages (2000–2999) are reported by the HP 70900B local oscillator source.

2001 **Illegal cmd**

2002 **Illegal parameter**

The remote command sent over the bus or executed as part of a DLP was not a legal remote command.

To solve this problem:

1. Use the "DEBUG ON OFF" key to turn on debug mode and determine exactly which command is generating the error.
2. Check for missing terminators and the proper number of parameters.
3. Verify that delimited strings are properly ended.
4. Refer to the programming manual for proper syntax.

2006 **Param out of range**

A change was made to an instrument setting that was beyond the capabilities of the hardware. This could be remote, DLP, or front panel changes.

To solve this problem:

1. For remote applications use "DEBUG ON OFF" key, to verify which setting caused the error.
2. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for descriptions of hardware capability.

2009 **Protocol error**

This is an internal error due to illegal communication caused by hardware failure.

To solve this problem:

1. Document all details possible that preceded the error.
2. Obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Hardware Error Messages (7000–7999) Occur

Hardware errors are generated when a module in the HP 70000 Series modular spectrum analyzer system is not working properly. These errors can occur at any time. Hardware errors range from 7000–7999. Troubleshoot these errors in the order reported by the HP 70900B local oscillator source.

One or more of the following hardware error messages may appear on your system display:

7000 **ROM check error**

This hardware error occurs when there is a difference between the programmed checksum and the computed checksum for the lower half of the addresses of A12U7.

To solve this problem:

1. Replace A12U7.
2. If problem remains, troubleshoot the A12 controller. (Refer to "Troubleshooting the A12 Controller".)
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7002 **1st LO unleveled**

This hardware error indicates an unleveled 1st LO signal. It occurs when the voltage at A13U4 pin 1 on the A13 ALC/bias goes positive. If that point goes slightly positive, it will cause the output of A13U4 to swing all the way to its positive rail. This voltage is sent to the A12 controller where it is monitored by A12U19 (TTL low = error condition).

To solve this problem:

1. Check that the LO IN signal is actually getting power to the RF section. This normally comes from the HP 70900B local oscillator source LO. The power level should be between +4 and +12 dBm.
2. Check that the power into the A1 leveling amplifier is between +4 and +12 dBm.
3. If correct, troubleshoot the A1 leveling amplifier. (Refer to "Troubleshooting the A1 Leveling Amplifier".)
4. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7003 **2nd LO unlocked**

This hardware error occurs when the voltage at A9TP1 (A9 2nd converter PLL) exceeds a −8.8 V to +8.6 V range. This voltage is sent to A12TP2-1 (A12 controller) where it is sensed, translated to TTL, and read by the controller. A TTL low measured at A12TP2-1 indicates a locked condition.

To solve this problem:

1. Perform the 2nd converter alignment adjustments.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Hardware Error Messages (7000–7999) Occur

7004 **300 MHz error**

This hardware error occurs when the detected level of 300 MHz at A11J2 falls below the reference voltage set by A11CR5 (about 0.3 V). Capacitor A11C46 charges up to a voltage proportional to the 300 MHz input power, and that voltage is sensed at A11U4A. The output of A11U4A is sent to the A12 controller where the error condition (TTL low) is reported to the master module of the spectrum analyzer.

To solve this problem:

1. Verify that the 300 MHz signal is actually getting to the RF section. This normally comes from the HP 70900B local oscillator source LO. The power level should be 0 ±2 dBm.
2. Troubleshoot the A11 last converter. (Refer to "Troubleshooting the A11 Last Converter".)
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7009 **ROM #2 check error**

This hardware error occurs when there is a difference between the computed checksum and programmed checksum of the upper half of the addresses of A12U7.

To solve this problem:

1. Replace A12U7.
2. If problem remains, troubleshoot the A12 controller. (Refer to "Troubleshooting the A12 Controller".)
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7033 **Power supply fault**

This hardware error occurs when any of the power supply sense lines to A10U191 or U192 fall below +2.5 V. This happens when a supply is loaded down.

To solve this problem:

1. Troubleshoot the A10 power supply/driver. (Refer to "Troubleshooting the A10 Power Supply/Driver".)
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7074 **Discriminator unlock**

This hardware error occurs when the power level supplied from the multiplier to the discriminator (difference between the LO and preselector frequencies) is greater than the discriminator loop lock range. The A10 power supply/driver reports the error when the voltage at A10TP1-5 exceeds the −10.4 V to +10.4 V range.

To solve this problem:

1. Isolate the problem to the HP 70900B local oscillator source or the HP 70908A RF section.

   Since the HP 70900B local oscillator source could cause frequency error, it is the first place to start troubleshooting.

   Checking for HP 70900B local oscillator source failures:

   - □ Run the HP 70900B Tune + Span offset adjustment procedure for the A8 frequency control assembly.
     - □ Note the voltage displayed on the DVM and subtract it from 4.5 V before making any adjustment (keep track of the sign of the difference).
     - □ Make the first adjustment. When finished, press DONE to get to the other adjustment.
     - □ Again, note the voltage displayed on the DVM before making any adjustment.
     - □ Add the difference from the previous calculation to the DVM reading, and then subtract it from 4.5 V.
     - □ If either of the differences is greater than 11 mV, there is a problem with the HP 70900B local oscillator source. Refer to the adjustment procedure failures section in the *HP 70900B Service Guide*.
   - □ If there is no problem found using the HP 70900B Tune + Span offset adjustment procedure, run the YTO linearity verification test in the *HP 70900B Service Guide*.
     - □ If the YTO linearity test fails, refer to the HP 70900B frequency control reference voltage adjustments and the YTO frequency endpoints adjustment. Then rerun the YTO linearity test.
     - □ If it still fails, refer to the YTO linearity adjustment troubleshooting section of the *HP 70900B Service Guide*.

   Checking for HP 70908A RF section failures:

   - □ If both of the above procedures pass, the problem is caused by the HP 70908A RF section. Refer to "Troubleshooting the A3 SYTFMD" and "Troubleshooting the A10 Power Supply/Driver".
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7076 **Multiplier unleveled**

This hardware error occurs when a low output is detected from the A10 power supply/driver. The error is reported when the voltage at A13U1 pin14 (A13 ALC/bias) is less than +0.65 V. This voltage is sent to the A10 power supply/driver where it is translated to TTL (TTL low = unleveled). The TTL information is sent to the A12 controller where the error condition is reported to the system controller.

To solve this problem:

1. Troubleshoot the A2 LO multiplier. (Refer to "Troubleshooting the A2 LO Multiplier".)
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

7078 **Tune + Span**

This hardware error occurs when the voltage at A10U17 pin 11 (A10 power supply/driver) drops below +2.48 V. When this occurs, A10U11 pin 13 goes to a positive rail of about +11 V. This is sent to the A12 controller where the error condition is reported.

To solve this problem:

1. Verify that the Tune + Span signal is actually getting to the RF section.
2. If correct, check the output of A10U17 pin 13.
3. If the output is a negative voltage, there is a problem on the A12 controller. (Refer to "Troubleshooting the A12 Controller".)
4. If it is not a negative voltage, troubleshoot the A10 power supply/driver. (Refer to "Troubleshooting the A10 Power Supply/Driver".)

If You Have Adjustment Procedure Failures

The following troubleshooting instructions are grouped according to module adjustment procedures. If the RF section fails an adjustment, look up the procedure in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment.

If Adjustment 01. LOLA Gate Bias Fails

The gate bias voltage for the A1 leveling amplifier comes from the A13 ALC/bias.

To solve this problem:

1. Troubleshoot function block G. (Refer to the A13 ALC/bias schematic diagram.)
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 02. Multiplier Gate Bias Fails

The gate bias voltage for the A2 LO multiplier comes from the A13 ALC/bias.

To solve this problem:

1. Troubleshoot function block B. Refer to the A13 ALC/bias schematic diagram.)
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 03. Reference Voltage Fails

If the reference voltage cannot be adjusted within test limits, the failure is most likely the A10 power supply/driver.

To solve this problem:

1. Troubleshoot the A10 power supply/driver.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 04. LOLA Power Out Fails

If the voltage printed on the A1 leveling amplifier cover cannot be obtained with an input signal of 3 GHz at 8 dBm, the failure is most likely the A1 leveling amplifier or A13 ALC/bias.

To solve this problem:

1. Troubleshoot the A1 leveling amplifier.
2. Troubleshoot the A13 ALC/bias.
3. Troubleshoot function block F. (Refer to the A13 ALC/bias schematic diagram.)
4. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 05. LOLA Tuned Filter Fails

If Adjustment 05. LOLA Tuned Filter fails, the failure is most likely the A1 leveling amplifier. Performing Adjustment 01. LOLA Gate Bias and Adjustment 04. LOLA Power Out verify that the A1 leveling amplifier stays leveled over an LO input frequency range of 3 GHz to 6.6 GHz at power levels of +5, +8, and +12 dBm.

To solve this problem:

1. Perform Adjustment 04. LOLA Power Out.
2. If procedure still fails, troubleshoot the A1 leveling amplifier.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 06. SYTFMD Offset Coil Fails

If the offset coil current for the A3 SYTFMD cannot be adjusted within test limits, the problem is most likely the A10 power supply/driver.

To solve this problem:

1. Remove A10J203. Measure the resistance between pin 8 and pin 9. A measurement between 6 to 8 ohms indicates a good A3 offset coil.
2. Replace the A3 SYTFMD if needed.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 07. SYTFMD Main Coil Preset or Adjustment 09. SYTFMD Main Coil Alignment Fails

If either adjustment fails, analyze the failure to determine the location of the malfunction.

To solve this problem:

1. Perform Adjustment 06. SYTFMD Offset Coil.
2. If Adjustment 07. SYTFMD Main Coil Preset still fails, refer to troubleshooting the main coil drive in the A10 power supply/driver.
3. If the main coil drive is not the problem, troubleshoot the A3 SYTFMD.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 08. Multiplier Power Leveling Fails

If Adjustment 08. Multiplier Power Leveling fails, analyze the failure to determine the location of the malfunction.

To solve this problem:

1. Verify that the input power to the A2 LO multiplier is 15 dBm.
2. If the power is not 15 dBm, troubleshoot the A1 leveling amplifier.
3. If the power is 15 dBm and the adjustment cannot be made, troubleshoot the A2 LO multiplier.
4. If the failed assembly is not located, the problem is either on the A13 ALC/bias or A2 LO multiplier.
5. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If 2nd Converter Fails

If any 2nd converter adjustment fails, use the following procedures to determine the cause of the malfunction.

CAUTION The 2nd converter contains extremely static-sensitive components. Before proceeding, refer to “Preparing a Static-Safe Work Station”.

Note If the cover of the 2nd converter is removed to make an adjustment, replace it with an HP 5022-1150 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

If Adjustment 10. VCO Tune-Line Voltage Fails

To solve this problem:

1. If A9R7 cannot be adjusted for −5 V, troubleshoot the A9 2nd converter PLL.
2. Verify that the A5 VCO sampler is not loading down the tune line.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Adjustment 11. VCO 2nd LO Frequency/Amplitude Fails

To solve this problem:

LO Frequency

1. If the VCO will not oscillate, check for an open electrical connection between the A9 2nd converter PLL and the A5 VCO sampler. The connection is made using spring contacts underneath the A9 2nd converter PLL. If the electrical connection is good, the voltage at A9J4 pin 2 (Vcc) will measure about +10.7 V and the voltage at A9J4 pin 3 (Vee) will measure about −2.7 V. The assembly must be disassembled to verify the contacts for A9J4 pin 1 and A9J2 pin 3.
2. If the VCO oscillates but cannot reach 3.3 GHz from the low side, loosen all of the screws holding the cavity block. Push the whole cavity block towards the front and bottom of the module, and tighten the screws while holding it in that position. The positioning of the LO cavity to the antenna probe inside the cavity is critical. Loosening the A5 VCO sampler, rotating it CCW, and re-tightening it may fix this problem.
3. If the VCO oscillates and then jumps to some other unadjustable frequency at a lower amplitude, center the LO adjust slug and cycle the power. This problem usually occurs when the VCO is being adjusted away from 3.3 GHz. It is possible to have the bandpass filter adjustment slugs in so far that they short out against the bottom of the casting.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

LO Amplitude

1. If there are two or fewer threads showing on the SMA (2ND LO OUT) connector, replace the A5 VCO sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Adjustment 12. 2nd Converter LO Feedthrough Fails

To solve this problem:

1. Refer to the Adjustment 22. 2nd Converter Bandpass Filter Tune. If the 3.3 GHz feedthrough cannot be adjusted within specification, the failure is most likely either C2 feedthrough cap, A8 321.4 MHz matching network, or A7 2nd mixer.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 13. Sampler IF Out DC Fails

To solve this problem:

1. Replace the A5 VCO sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 14. Sampler IF Out AC Fails

To solve this problem:

1. Replace the A5 VCO sampler.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 15. Search Oscillator Duty Cycle and Period Fails

To solve this problem:

1. If the search oscillator does not work, the problem is most likely A9U1.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 16. Search Oscillator Square Wave Min/Max Fails

To solve this problem:

1. Perform Adjustment 15. Search Oscillator Duty Cycle and Period.
2. If this test still fails after adjusting the search oscillator, the problem is probably on the A9 2nd converter PLL, or there is too much ac and/or dc coming out of the A5 VCO sampler. (Refer to the sampler ac and dc tests.)
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 17. Search Oscillator Tune Line Peak Fails

To solve this problem:

1. If A2R6 cannot be adjusted to stop the search oscillator, there is probably a problem with the phase-lock loop. Perform the phase lock check in the following adjustment.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 18. Phase Lock Check Fails

To solve this problem:

1. Remove the 300 MHz cable at A9J1.
2. Set the spectrum analyzer to a center frequency of 300 MHz and a span of 1 MHz. The 3.3 GHz oscillator will now be enabled.
3. Connect an oscilloscope to A9TP1. There should be a pulse with a 35% to 70% duty cycle with the peaks about ±9.5 V.
   - □ If the pulse is missing, troubleshoot the search oscillator and perform Adjustment 15. Search Oscillator Duty Cycle and Period.
   - □ If the pulse is present, phase-lock amplifier A9U1 is operating correctly.
4. Measure the voltage at A9J4 pin 3. It should read about −2.7 V.
   - □ If it is near 0 V, check A9J2 pin 4 (VCO Control) for a TTL high. A TTL high indicates that the oscillator is enabled.
   - □ If the voltage on pin 4 is not a TTL high, the VCO control signal is not correct. Troubleshoot the A12 controller.
5. Verify that there is a 300 MHz, 3 dBm signal going into A9J1. If the signal is low or not present, refer to troubleshooting the A11 last converter.
6. Connect a spectrum analyzer with a 1:1 probe to A9J4 pin 4 and look for a 300 MHz, −10 dBm signal. The power level will depend upon the type of probe used.
   - □ If there is no 300 MHz signal present, troubleshoot the A9 2nd converter PLL.
   - □ If the 300 MHz signal is present, the A5 VCO sampler is probably at fault or the spring contacts are open. To verify that the spring contacts are making a good connection, refer to the procedure in Adjustment 11. VCO 2nd LO Frequency/Amplitude.
   - □ If no failure is found, perform Adjustment 11. VCO 2nd LO Frequency/Amplitude.
7. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 19. VCO Tune Range Preliminary Check Fails

To solve this problem:

1. If the VCO cannot be adjusted to remain locked at the extremes, and if Adjustment 16. Search Oscillator Square Wave Min/Max passes, there is a problem on the A5 VCO sampler.
2. If Adjustment 16. Search Oscillator Square Wave Min/Max fails, there is a problem with the A9 2nd converter PLL.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 20. Lock Range Measurement Fails

To solve this problem:

1. Perform Adjustment 19. VCO Tune Range Preliminary Check.
2. If the adjustment cannot be performed, refer to the preceding VCO tune range preliminary adjustment failure information and "Troubleshooting and Alignment of the A5, A7, A8, A9".
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 21. Mixer Bias Fails

To solve this problem:

1. Perform Adjustment 11. VCO 2nd LO Frequency/Amplitude.
2. If Adjustment 11. VCO 2nd LO Frequency/Amplitude passes, the problem is probably either feedthrough capacitor C1 or the A7 2nd mixer diode. The A8 321.4 MHz matching network can also cause this to fail.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 22. 2nd Converter Bandpass Filter Tune Fails

To solve this problem:

1. If the bandpass response is greatly over-coupled or under-coupled and cannot be adjusted flat, the IF input SMA connector may be screwed in too far or not far enough.

   Feedthrough capacitor C1 (from the mixing diode to the matching network) can affect the bandpass shape. It is usually manifest by a skewing of the bandpass to one side or another, and higher-than-normal conversion loss.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 23. VCO Tune Range Final Fails

To solve this problem:

1. If the VCO cannot be adjusted so that it remains locked at the extremes, and if Adjustment 16. Search Oscillator Square Wave Min/Max passes, the problem is probably on the A5 VCO sampler.
2. If the Adjustment 16. Search Oscillator Square Wave Min/Max fails, then the problem is on the A9 2nd converter PLL.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If You Have Adjustments Procedure Failures

If Adjustment 24. Last Converter Bandpass Filter Fails

After *any* repair or replacement of the last converter, run this test to help adjust and verify last converter alignment.

To solve this problem:

1. Verify that the 2nd converter bandpass filter is adjusted properly.
2. Troubleshoot the A11 last converter. Refer to "Troubleshooting the A11 Last Converter".
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 25. Noise Figure Last Converter Fails

After *any* repair or replacement of the last converter, run this test to verify the noise figure of the last converter.

To solve this problem:

1. Verify that the 2nd converter bandpass filter is adjusted properly.
2. Troubleshoot the A11 last converter. Refer to "Troubleshooting the A11 Last Converter".
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 26. Noise Figure 2nd Converter Fails

To solve this problem:

1. Unless the Adjustment 11. VCO 2nd LO Frequency/Amplitude also fails, the problem is usually the A7 2nd mixer diode.
2. A poorly-tuned bandpass filter can also cause this test to fail.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Adjustment 27. 21.4 MHz IF Frequency Response Fails

This test verifies correct alignment of the 2nd converter, SYTFMD, and last converter at 300 MHz in 1H− band and at 2.7 GHz in 1L− band.

To solve this problem:

1. If the test fails, troubleshoot the A11 last converter. Refer to "Troubleshooting the A11 Last Converter".
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If You Have Verification Test Failures

The following troubleshooting instructions are grouped according to module verification tests. If the RF section fails a verification test, look up the test in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment.

If Test 01. Flatness or Test 02. Low Frequency Flatness < 10 MHz Fails

If any flatness calibration and verification routines fail, analyze the failure to determine the location of the malfunction.

To solve this problem:

1. If the failure occurs in band 1H− (100 Hz to 2.9 GHz), anything between the RF input connector and the A11 last converter can cause the problem. Verify that there is a 15 dBm LO output signal going into the A15 RF 1st converter LO input jack at the failing center frequency. If the LO signal is missing, troubleshoot the A1 leveling amplifier. Also check the A9 2nd converter PLL. (Refer to "Troubleshooting the A1 Leveling Amplifier" and "Troubleshooting and Alignment of the A5, A7, A8, A9".
2. If the failure is not frequency-dependent but exists across the entire band, check the A4 input attenuator and IF paths for high conversion or insertion loss.
3. If the failure occurs in bands 1L−, 2L−, or 4L− (2.7 to 22 GHz), verify that the LO input signal from the multiplier to the A3 SYTFMD is 14 dBm (+12.5 dBm in 4L− band). If it is not, troubleshoot the A2 LO multiplier. (Refer to "Troubleshooting the A2 LO Multiplier".) Anything between the RF input connector and the A3 SYTFMD can cause a failure in these bands.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 03. Attenuator Accuracy Fails

If any attenuator accuracy routines fail, the failure must be analyzed to determine the location of the malfunction.

To solve this problem:

1. If the failure is greater than 8 dB, troubleshoot the A12 controller circuitry (A12U8, U9, U20).
2. If the failure is less than 8 dB or if the A12 controller is not at fault, troubleshoot the A4 input attenuator.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 04. Front Panel LEDs Fails

If any front panel LED routines fail, the failure is most likely on the A12 controller.

To solve this problem:

1. Check that A14 front panel board is receiving signals from the A12 controller (A12J7).
2. Check that transistors A12Q1 and Q2 have +0.7 V at the emitter when the LEDs are on.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 05. 10.7 MHz Rejection Fails

If any 10.7 MHz rejection routines fail, the problem is most likely the A11 last converter 321.4 MHz bandpass filter or 10.7 MHz trap (A11C28, A11L10).

To solve this problem:

1. Troubleshoot the A11 last converter.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 06. Feedthrough Out 21.4 MHz Port Fails

If any 21.4 MHz output feedthrough routines fail, the failure is most likely the filters in the IF path.

To solve this problem:

1. Check the stop-band response of all the filters in the IF path.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 07. Harmonics Out 21.4 MHz Port Fails

This test checks the overall filter response of the HP 70908A RF section IF output.

If any 21.4 MHz output harmonics routines fail, the failure is most likely caused by A11 last converter.

To solve this problem:

1. Check that no RFI gaskets are missing from covers and underneath printed circuit boards.
2. If test falls within the test limits of the 21.4 MHz output port, troubleshoot the A11 last converter. (Refer to “Troubleshooting the A11 Last Converter”.)
3. If test does not fall within the test limits, check the IF path until the faulty assembly is found.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 08. Residual Emissions Out 21.4 MHz Port Fails

This test checks for N x 300 MHz and LO feedthrough emissions from the rear panel 21.4 MHz output.

If any 21.4 MHz output residual emissions response routines fail, analyze the failure to determine the location of the malfunction.

To solve this problem:

1. If the N x 300 MHz emissions test fails, troubleshoot the A11 last converter (either the diplexer circuit out of the mixer or the 21.4 MHz output bandpass filter). Ensure that the polyiron gasket is installed in the A11 last converter casting.
2. If the LO feedthrough test fails, verify that the LO signal is 15 dBm at the input of A15 RF 1st converter.
3. If the power level is correct, replace the A15 RF 1st converter.
4. If the power is too high, perform Adjustment 04. LOLA Power Out.
5. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 09. Image Rejection Fails

If any image rejection routines fail, the failure is most likely poor stopband response in one of the filters in the signal path.

To solve this problem:

1. Check for cracked solder joints on cables, loose connectors, and bad grounds (radiated).
2. Check the stop-band response of all the filters in the signal path.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 10. IF Rejection Fails

To solve this problem:

1. Check signal rejection in the IF path until the faulty assembly is found.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 11. 2nd Converter Startup Fails

To solve this problem:

1. If any 2nd converter startup verification routines fail, perform Adjustment 22. 2nd Converter Bandpass Filter Tune.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 12. IF Sub-Harmonics Fails

To solve this problem:

1. Troubleshoot the A11 last converter 10.7 MHz trap (A11L10, A11C28) and 321.4 MHz bandpass filter.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 13. Residual Responses Fails

If any residual responses routines fail, the failure is most likely caused by a harmonic of the 1st LO mixing with a harmonic of the 3.3 GHz oscillator to produce a signal at an IF frequency.

To solve this problem:

1. Check modules for cracked solder joints on cables, loose connectors, and loose screws attaching printed-circuit boards and covers.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 14. Miscellaneous Residual Responses Fails

This verification test checks for specific known residuals.

If any miscellaneous residual responses routines fail, the failure must be analyzed to determine the location of the malfunction.

To solve this problem:

1. Remove the A4 input attenuator ribbon cable from the A12 controller. If the residual disappears, replace the A4 input attenuator.
2. For N x 300 MHz residuals, verify that the “D” shaped chromerics and the RFI gasket, located in the grooves of the A9 2nd converter PLL cover, have no discontinuities. Ensure that the polyiron gasket is installed in the A11 last converter casting.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 15. 321.4 MHz IF Out Frequency Response Fails

The usual cause of test failure in 1H− band is 2nd-converter bandpass-filter alignment. Failures in the 1L− band may be caused by YTF tracking of the A3 SYTFMD.

If any 321.4 MHz output frequency response routines fail, the failure must be analyzed to determine the location of the malfunction.

To solve this problem:

1. If 1H− band fails, perform Adjustment 22. 2nd Converter Bandpass Filter Tune.
2. If 1L− band fails, perform Adjustment 06. SYTFMD Offset Coil and Adjustment 09. SYTFMD Main Coil Alignment.
3. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 16. 21.4 MHz IF Frequency Response Fails

This test checks the overall filter response of the RF section IF output. At 300 MHz in 1H− band and at 6.0 GHz in 1L− band, the test verifies correct alignment of the A3 SYTFMD, A9 2nd converter PLL, and A11 last converter.

The response is normally a function of the 321.4 MHz bandpass filter on the A11 last converter. However, if any filters before the A11 last converter are not correct, this test can fail.

If any 21.4 MHz output frequency response routines fail, analyze the failure to determine the location of the malfunction.

To solve this problem:

1. Check that the RFI gaskets are not missing from covers or underneath printed circuit boards.
2. Check the output response of the 321.4 MHz at the rear panel jack.
3. If the response falls within the test limits of the 21.4 MHz output port, troubleshoot the A11 last converter.
4. If the response does not fall within the test limits of the 21.4 MHz output port, check the IF path until the faulty assembly is found.
5. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 17. Step Gain Fails

If any step gain routines fail, the failure is most likely caused by A11 last converter.

To solve this problem:

1. Perform Adjustment 24. Last Converter Bandpass Filter.
2. If the test still fails, troubleshoot the A11 last converter. (Refer to "Troubleshooting the A11 Last Converter").
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 18. Gain Compression Fails

If any gain compression routines fail, the failure is most likely caused by A11 last converter.

To solve this problem:

1. Check the IF output at the rear panel 321.4 MHz output port. (The 321.4 MHz output must be enabled.)
2. If gain compression cannot be seen at that port, troubleshoot the A11 last converter.
3. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 19. Aux LO Power and Harmonics Fails

If any LO output power and harmonics routines fail, the failure is most likely caused by A1 leveling amplifier.

To solve this problem:

1. Perform Adjustment 01. LOLA Gate Bias, Adjustment 04. LOLA Power Out, and Adjustment 05. LOLA Tuned Filter.
2. If the test still fails its limits, troubleshoot the A1 leveling amplifier.
3. If A1J3 or A1J4 are heavily loaded down, this test may also fail.
4. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

If Test 20. Diagnostics Fails

In order to run this test, all loops must be able to lock and all error bits must show no errors. In general, this test causes conditions that toggle each error-reporting bit from a "no error" to "error" state. The power supply fault bit is not tested.

Use the following information when troubleshooting this failure.

LO unleveled

This test verifies that the LO leveling loop is leveled with a 5 dBm LO input power to the HP 70908A RF section and that it is unleveled with a power less than 5 dBm.

To solve this problem:

1. Troubleshoot a 7002 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

Multiplier unleveled

This test verifies that the multiplier leveling loop is leveled with a 5 dBm LO input power to the HP 70908A RF section and that it is unleveled with a power less than 5 dBm.

To solve this problem:

1. Troubleshoot a 7076 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

21.4 MHz detector

This test verifies the operation of the 21.4 MHz detector on the A11 last converter. It also tests the error-reporting circuits on the A10 power supply/driver and the A12 controller. Both 321.4 MHz inputs to the A11 last converter are tested.

To solve this problem:

1. Troubleshoot the A11 last converter. (Refer to “Troubleshooting the A11 Last Converter”.)
2. Troubleshoot the A10 power supply/driver. (Refer to “Troubleshooting the A10 Power Supply/Driver”.)
3. Troubleshoot the A12 controller. (Refer to “Troubleshooting the A12 Controller”.)
4. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

300 MHz present

This test verifies the operation of the 300 MHz detector on the A11 last converter. It also tests the error-reporting circuits on the A10 power supply/driver and the A12 controller.

To solve this problem:

1. Troubleshoot a 7004 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

Discriminator unlock

This test verifies the operation of the discriminator lock loop and the error-reporting circuits on the A10 power supply/driver and the A12 controller.

To solve this problem:

1. Troubleshoot a 7074 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

Tune + Span present

This test verifies the operation of the Tune + Span detector. Tune + Span is a +4.5 V to +9.9 V signal from the HP 70900A/B local oscillator source. The signal is proportional to the 3 to 6.6 GHz LO output frequency (1.5 V/GHz).

To solve this problem:

1. Troubleshoot a 7078 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

2nd LO unlocked

This test verifies the operation of the A9 2nd converter PLL unlock detector and the unlock reporting circuits on the A10 power supply/driver and A12 controller.

To solve this problem:

1. Troubleshoot a 7003 error code.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 21. LO Input Amplitude Range Fails

If any LO input amplitude range routines fail, the failure is most likely caused by A1 leveling amplifier.

To solve this problem:

1. Perform Adjustment 01. LOLA Gate Bias, Adjustment 04. LOLA Power Out, and Adjustment 05. LOLA Tuned Filter.
2. If LO input amplitude range routines still fail, refer to troubleshooting the A1 leveling amplifier.
3. The test may also fail if either A1J3 or A1J4 are heavily loaded down.
4. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 22. RF Input Emissions Fails

This test measures the LO emissions at the front panel RF INPUT. If any RF input emissions routines fail, the failure must be analyzed to determine the location of the malfunction.

To solve this problem:

1. If the failure occurs in band 1H−, troubleshoot the A15 RF 1st converter. (Refer to “Troubleshooting the A15 RF 1st Converter”.)
2. If the failure occurs in bands 1L−, 2L−, and 4L−, troubleshoot the A3 SYTFMD. (Refer to “Troubleshooting the A3 SYTFMD”.)
3. If test results are degraded by 10 dB, troubleshoot the A4 input attenuator. (Refer to “Troubleshooting the A4 Input Attenuator”.)
4. Check the LO to RF isolation of the A15 RF 1st converter.
5. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 23. RF Input Return Loss Fails

If any RF input return loss routines fail, the failure must be analyzed to determine the location of the malfunction.

To solve this problem:

1. Troubleshoot the A4 input attenuator. (Refer to “Troubleshooting the A4 Input Attenuator”.)
2. If failures are from .0000001 to 2.9 GHz, check everything between and including the RF input connector and the A15 RF 1st converter.
3. If failures are from 2.9 to 22 GHz, check everything between and including the RF input connector and the A3 SYTFMD.
4. Use the block diagram to determine which troubleshooting procedures to perform.
5. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 24. LO Output Return Loss Fails

If any LO output return loss routines fail, the failure can be anything between and including A1 leveling amplifier AUX jack and the rear panel LO input.

To solve this problem:

1. Use the block diagram to determine which troubleshooting procedures to perform.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 25. LO Input Return Loss Fails

If any LO input return loss routines fail, the failure can be anything between and including the A1 leveling amplifier and the rear panel LO input.

To solve this problem:

1. Use the block diagram to determine which troubleshooting procedures to perform.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 26. Reference Return Loss Fails

If any 300 MHz reference input return loss routines fail, the failure is most likely the A11 last converter

To solve this problem:

1. Troubleshoot the A11 last converter. (Refer to “Troubleshooting the A11 Last Converter”.)
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 27. Wide IF Output Return Loss Fails

If any LO input return loss routines fail, the failure can be anything between and including the A11 last converter and the rear panel 321.4 MHz output.

To solve this problem:

1. Use the block diagram to determine which troubleshooting procedures to perform.
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 28. Narrow IF Output Return Loss Fails

If any 21.4 MHz output return loss routines fail, the failure is most likely the A11 last converter.

To solve this problem:

1. Troubleshoot the A11 last converter. (Refer to “Troubleshooting the A11 Last Converter”.)
2. If necessary, obtain service from Hewlett-Packard. (Refer to “If You Want Hewlett-Packard to Service Your RF Section” in Chapter 1.)

If Test 29. Noise Figure Fails

Noise figure failures can be traced to two causes: high conversion/insertion loss, or excess noise addition in the signal path.

To solve this problem:

1. Verify that the cables are not causing the problem.
2. To isolate the problem, run Adjustment 26. Noise Figure 2nd Converter.
3. If this adjustment test fails, perform Adjustment 25. Noise Figure Last Converter.
4. If Adjustment 25. Noise Figure Last Converter passes, the problem is probably the A15 RF 1st Converter. (Refer to "Troubleshooting the A15 RF 1st Converter".)
5. High insertion loss of either the 321.4 MHz bandpass filter or the 1st IF lowpass filter may also be causing the failure.
6. If necessary, obtain service from Hewlett-Packard. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)

Troubleshooting the A1 Leveling Amplifier

The A1 leveling amplifier amplifies the 3 to 6.6 GHz, +4 to 12 dBm LO signal from the HP 70900A/B local oscillator source and levels the output at 15 dBm. A tunable 6 to 8 GHz notch filter removes the 3 to 4 GHz LO 2nd harmonic. Two internal switches direct the LO signal to either the A2 LO multiplier or A15 RF 1st converter.

This section contains the following troubleshooting information:

- Power Supply/Bias
- Voltage Reference
- Internal Switches
- Power Detector
- LO Harmonics
- Filter Drive Waveform

CAUTION The A1 leveling amplifier is extremely static-sensitive. Before proceeding, refer to "Preparing a Static-Safe Work Station".

Power Supply/Bias

The A1 leveling amplifier uses +7 V for Vdd. The gate bias (G1, G2, G3) comes from the A13 ALC/bias. Perform Adjustment 01. LOLA Gate Bias, Adjustment 04. LOLA Power Out, and Adjustment 05. LOLA Tuned Filter. If the power out of the A1 leveling amplifier is not 15 dBm, or if the LOLA still goes unleveled, there is a problem with the A1 leveling amplifier.

Voltage Reference

The voltage reference out of the A1 leveling amplifier should be a nominal −0.3 V. The purpose of this reference is to track the temperature coefficient of the detector diode of the leveling amplifier. Its absolute accuracy is not important.

Internal Switches

The voltage that controls the internal switches comes from the A13 ALC/bias. Refer to Table 4-2 for switch control voltages. Measure the voltages on the top of the assembly.

Table 4-2. A1 Switch Control Voltages

Band	Frequency Range (GHz)	Switch 1 (SW1)	Switch 2 (SW2)	Signal Out
1H−	.0000001 to 2.9	−11 V	+11 V	A1J3
1L−	2.7 to 6.2	+11 V	−11 V	A1J4
2L−	6.0 to 12.8	+11 V	−11 V	A1J4
4L−	12.6 to 22	+11 V	−11 V	A1J4

Troubleshooting the A1 Leveling Amplifier

Power Detector

The power-sensing detector has positive detection with negative bias for increased sensitivity. To verify the operation of the detector, monitor the A1 DET pin with a DVM (digital voltmeter). Remove the LO input cable from the rear panel of the module while observing the voltage. The voltage should go more negative when the LO power is removed.

The detected power out is sent to the A13 ALC/bias, where the difference between the reference and the detected output is integrated. The integrated output is sent back to the A1 leveling amplifier ATTEN input. As LO input power to the A1 increases, pin 2 drive linearly decreases until A13Q9 is biased off. This leaves a constant current that is proportional to maximum attenuation through PIN diode 2. PIN diode 1 responds to the smaller input power changes. Refer to A13 ALC/bias troubleshooting for verifying the leveling loop-drive circuitry.

LO Harmonics

The A1 leveling amplifier also provides the rear panel 3 to 6.6 GHz LO output that is unleveled at +5 to 10 dBm. Harmonics of the LO signal to the A3 SYTFMD or to the A15 RF 1st converter should be less than −25 dBc. Harmonics of the rear panel 3 to 6.6 GHz LO signal should be less than −20 dBc.

Filter Drive Waveform

The filter drive comes from the A10 power supply/driver. To observe the filter drive waveform, place the module on an HP 70001-60013 extender module and make all connections needed for spectrum analyzer operation. Perform the following steps:

1. On the HP 70000 Series modular spectrum analyzer system, initiate an instrument preset and set the controls as follows:
   - Span .... 0 Hz (press `SPAN`, 0 `Hz`)
   - Pathlock .... ON (press (MENU), `config`, `PATHLOK ON`)
   - LO START .... 3 GHz (press (MENU), `Freq`, `START`, 3 `GHz`)
   - LO STOP .... 6.6 GHz (press `STOP`, 6.6 `GHz`)
   - Sweep time .... 5 s (press (MENU), `BW,Swp`, `SWPTIME`, 5 `s`)
2. Set an oscilloscope to the following settings:
   - Display .... A vs B mode
   - Channel A .... 0.5 V/Div (with 10:1 Probe)
   - Channel B .... 0.1 V/Div (with 10:1 Probe)
3. Connect channel A on the oscilloscope to the VTF pin on the A1 leveling amplifier. Connect channel B to the rear panel SWP jack of the HP 70900A/B local oscillator source. Adjust the horizontal position of the the oscilloscope to place the start of the trace at the left-most graticule. Adjust the position of channel so that 0 V is one division above the bottom of the CRT.
4. The filter drive waveform should look like Figure 4-2, with the horizontal axis corresponding to the LO frequency and the vertical axis to waveform amplitude. For an HP 70900A/B local oscillator source sweep of 3.0214 to 6.5214 GHz the waveform should have a squared response approximately +6 V to +26 V, remaining at +26 V for the remainder of the sweep. If there is a problem with the filter drive, refer to A10 power supply/driver troubleshooting.

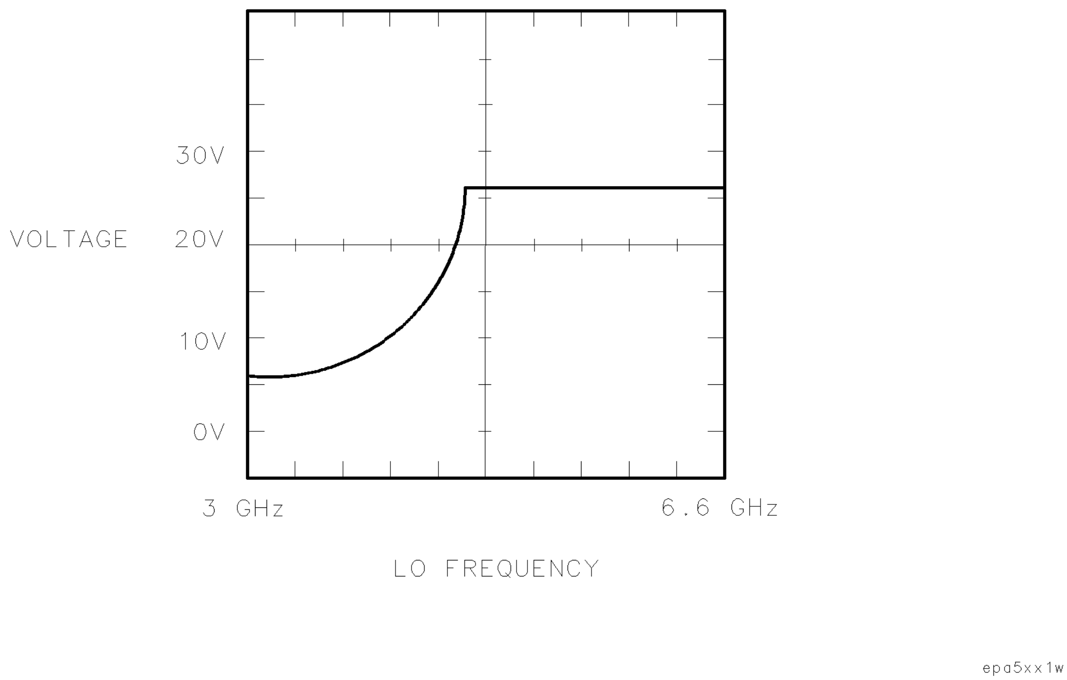


Figure 4-2. Notch-Filter Waveform

Troubleshooting the A2 LO Multiplier

The purpose of the A2 LO multiplier is to provide a leveled 3.0214 to 22.3214 GHz fundamental LO signal to mix RF input signals down to the IF frequency. The output is a nominal 14 dBm for an LO input signal of 15 dBm, 3 to 6.6 GHz. The A2 LO multiplier contains doublers, filters, and amplifier stages that are switched in as needed to produce the desired LO frequency.

For band 1L− (2.7 to 6.2 GHz) a 4 GHz lowpass filter is switched in the LO signal path when the A2 output signal is between 3 GHz to 4 GHz. The filter is switched out for output frequencies greater than 4 GHz.

For band 2L− (6.0 to 12.8 GHz) an 8 GHz lowpass filter is switched in after the first frequency doubler. It is switched out for A2 output frequencies greater than 8 GHz.

For band 4L− (12.6 to 22 GHz) a 6.4 to 11.2 GHz bandpass filter, a doubler, and a 12.8 to 22.3 GHz bandpass filter are added to the signal path.

CAUTION The A2 LO multiplier is extremely static-sensitive. Before proceeding, refer to "Preparing a Static-Safe Work Station".

Switch Control

Refer to Table 4-3 for control voltages for the internal switches of the A2 LO multiplier. If the output power is incorrect, but the switch voltages are correct, refer to Adjustment 08. Multiplier Power Leveling. If the switch voltages are incorrect, refer to A13 ALC/bias troubleshooting.

Table 4-3. A2 Switch Logic

Band	Frequency Range (GHz)	Switch 1 (S1, pin 5)	Switch 2 (S2, pin 9)	Switch 3 (S3, pin 11)
1H−	.0000001 to 2.9	0 V	0 V	0 V
1L−	2.7 to 6.2	+12 V	0 V	0 V
2L−	6.0 to 12.8	0 V	+12 V	0 V
4L−	12.6 to 22	0 V	0 V	+12 V

Power Supply/Bias

The A2 LO multiplier uses +4 V (four places), +5 V, +7 V (two places), and +8 V to power the amplifiers, filters, and doublers. The gate bias comes from the A13 ALC/bias. These voltages can be verified by running the Adjustment 02. Multiplier Gate Bias. The voltage reference should be a nominal +0.2 V when the 2 to 22 GHz path is selected. The purpose of this reference is to track the temperature coefficient of the detector diode. Its absolute accuracy is not important.

Power Detector/Leveling

The power-sensing detector uses negative detection with a slight positive bias for increased sensitivity. To verify detector operation, monitor the A2 DET pin with a DVM. Observe the DVM while removing the LO input cable from the rear panel of the module. The voltage should move more positive when the LO signal is removed.

The leveling drive circuitry is on the A13 ALC/bias. Refer to A13 ALC/bias troubleshooting for drive circuitry verification.

Pin Attenuator

To verify the operation of the A2 pin attenuator, connect a jumper from the A2 REF pin to ground and connect a power meter to A2J2. The jumper causes maximum power output from A2J2. Removing the jumper should cause the power to decrease.

Bandpass-Filter Drive

The bandpass filter is a voltage-tuned filter whose drive voltage comes from the A10 power supply/driver. To observe the drive waveform of the filter, perform the following steps:

1. On the HP 70000 Series modular spectrum analyzer system, initiate an (Instrument Preset), and set its controls as follows:
   - Span .... 0 Hz (press SPAN, 0 Hz)
   - Pathlock .... ON (press (MENU), config, PATHLOK ON)
   - LO START .... 3 GHz (press (MENU), Freq, START, 3 GHz)
   - LO STOP .... 6.6 GHz (press STOP, 6.6 GHz)
   - Sweep time .... 5 s (press (MENU), BW,Swp, SWPTIME, 5 s)
2. Set an oscilloscope to the following settings:
   - Display .... A vs B mode
   - Channel A .... 0.5 V/Div (with 10:1 Probe)
   - Channel B .... 0.1 V/Div (with 10:1 Probe)
3. Connect channel A of the oscilloscope to the A2 FLTR pin. Connect channel B to the SWP jack on the HP 70900A/B local oscillator source rear panel. Adjust the horizontal position on the oscilloscope to place the start of the trace at the leftmost graticule.
4. The drive waveform should look like Figure 4-3, with the horizontal axis corresponding to LO frequency and the vertical axis to the waveform amplitude. The voltage to the filter should be about +9 V at the beginning of each band, quickly sweep to +12 V, and then drop to 0 V for the remainder of the sweep. Refer to A10 power supply/driver troubleshooting for circuit verification.

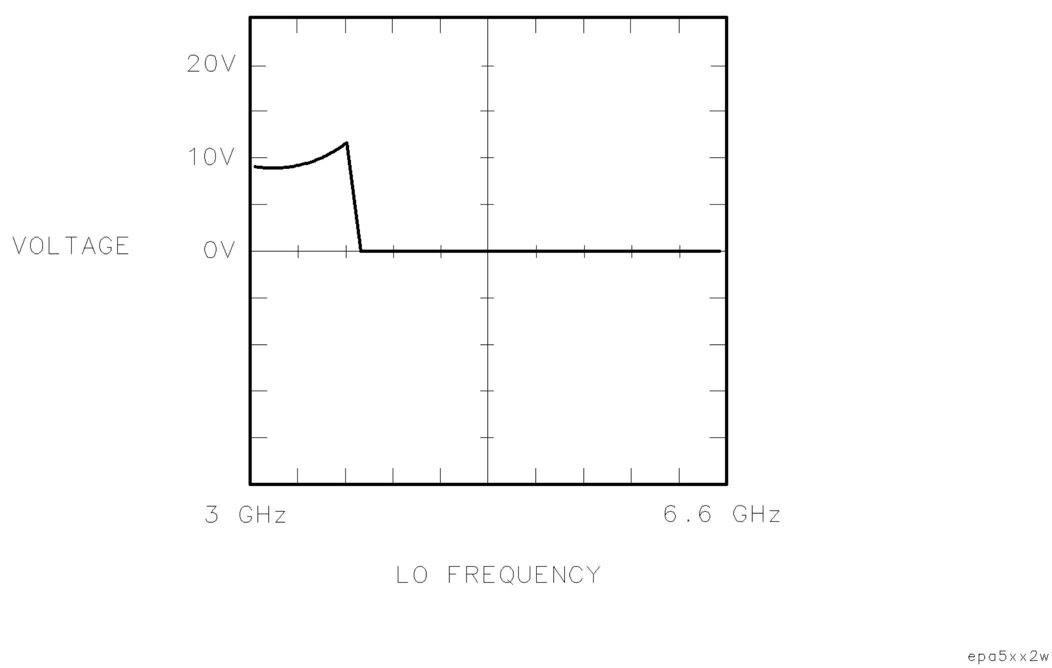


Figure 4-3. Bandpass-Filter Drive Waveform

Troubleshooting the A3 SYTFMD

The A3 SYTFMD provides RF preselection for input signals of 2.7 to 22 GHz. The A3 SYTFMD also down-converts 2.7 to 22 GHz input signals, resulting in a 1st IF of 321.4 MHz.

RF preselection is accomplished using a tunable RF bandpass filter and a tunable LO bandpass filter. Refer to the overall block diagram. The LO bandpass filter is used to keep the RF bandpass filter tuned to the input frequency of the analyzer. A feedback circuit, partially on the A10 power supply/driver, ensures that the LO bandpass filter tracks the LO frequency. Because the RF bandpass filter is tuned by the same tune line as the LO bandpass filter, any frequency change in the LO bandpass filter will be tracked by the RF bandpass filter. An additional tune current is applied to the LO bandpass filter to compensate for the 321.4 MHz offset between the LO and RF input frequencies.

The feedback circuit of the LO bandpass filter works by tuning the center frequency of the filter to maintain a constant 90 degrees of phase shift. (The phase shift caused by a filter will change as a signal is swept through its bandpass.) The LO signal gates the phase-shifted LO signal through a diode pair. The resulting tune signal leaves the A3 SYTFMD at A3J11 and is amplified and integrated by the A10 power supply/driver. It then leaves the A10 power supply/driver at J203 and is applied to the LO bandpass filter tune line. Because the tune line changes the center frequency of the filter to maintain a 90-degree phase shift, the center frequency will always track the LO frequency.

Information on the following topics is included in this section:

- Mixer Conversion Loss/BW
- PIN Switch Voltage
- Discriminator Output Amplitude
- Discriminator Output Waveform

CAUTION The A3 SYTFMD is extremely static-sensitive. Before proceeding, refer to "Preparing a Static-Safe Work Station".

Mixer Conversion Loss/BW

Table 4-4 lists preselected-mixer conversion and insertion loss values for the A3 SYTFMD. In band 1H−, 100 Hz to 2.9 GHz, the signal passes unconverted through the assembly. The insertion loss should not exceed the value given in the table. In bands 1L−, 2L−, and 4L−, 2.7 GHz to 22 GHz, the signal is converted with the typical loss values listed in the table. The 3 dB bandwidth of the filter should typically be 17 to 50 MHz.

Table 4-4. Typical Conversion/Insertion Loss Values

Band	Frequency Range (GHz)	Input Signal Level (dBm)	Conversion Loss (dB)	Insertion Loss (dB)
1H−	.0000001 to 2.9	−8	—	2
1L−	2.7 to 6.2	−20	17	—
2L−	6.0 to 12.8	−20	17	—
4L−	12.6 to 22	−20	16	—

Pin Switch Voltage

The pin switch voltage should typically be −4.5 V when an IF output of 321.4 MHz is directed out A3J10. The voltage should be about +12 V when an output of 100 MHz to 2.9 GHz is directed out A3J9. If the voltages are incorrect, perform the following steps:

1. On the HP 70000 Series modular spectrum analyzer system press (MENU), State, MORE 1 of 3, MORE 2 of 3, MORE 3 of 3, and POWERON LAST. Turn off the power on the analyzer.
2. Remove the A3 SYTFMD control cable from A10J203 and turn the power back on.
3. Check A10J203 pin 4 for about −11.4 V (bands 1L−, 2L−, 4L−) and +12 V (band 1H−). If these voltages are not correct, refer to A10 power supply/driver troubleshooting. If they are correct, there is a problem with the A3 SYTFMD. Turn the spectrum analyzer off before replacing the connector to A10J203.

Discriminator Output Amplitude

Before troubleshooting, perform Adjustment 06. SYTFMD Offset Coil and Adjustment 07. SYTFMD Main Coil Preset.

CAUTION The discriminator is extremely static-sensitive. Before proceeding, refer to "Preparing a Static-Safe Work Station".

Perform the following procedure to verify that the output of the discriminator is greater than 0.2 V peak to peak into a 10k ohm load when swept through its range:

1. On the HP 70000 Series modular spectrum analyzer system, initiate an (Instrument Preset), and set its controls as follows:

   Start frequency .... 2.9 GHz (press (MENU)], Freq, START, 2.9 GHz)

   Sweep time .... 30 s (press (MENU), BW,Swp, SWPTIME, 30 s)

2. Set an oscilloscope to the following settings:

   Display .... A vs B mode
   Channel A .... 0.01 V/Div (with 10:1 Probe)
   Channel B .... 0.1 V/Div (with 10:1 Probe)
   Channel B Gain .... Adj. for full screen trace

3. Construct a test connector using the Hewlett-Packard parts listed below. Snap the RF adapter and RF connector together as illustrated in Figure 4-4. Solder the 10k ohm resistor across the outer- and center-conductor posts of the RF connector.

   RF adapter .... HP 1250-1391 50Ω SMB tee(m) (f) (m)
   RF connector: .... HP 1250-0543 SMB(m)
   Resistor: 10k ohm, 0.1%, .125W .... HP 0698-6360

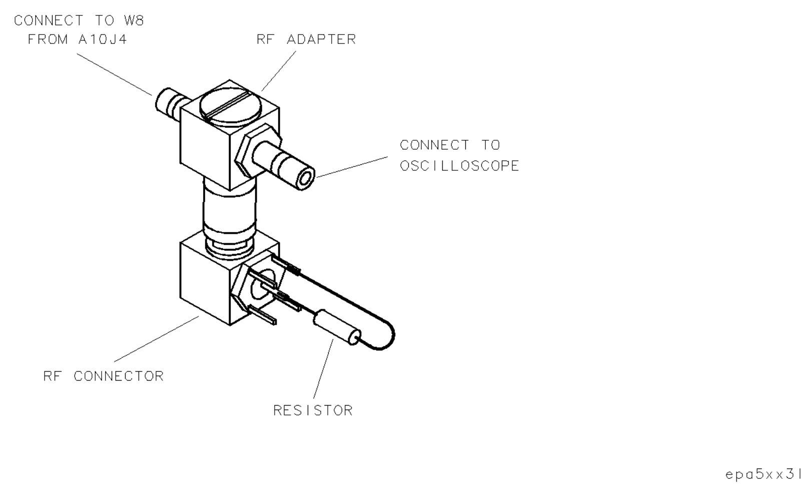


Figure 4-4. Test Connector Construction

4. Connect channel B of the oscilloscope to A10TP1-5. Remove the discriminator output cable, W8, from A10J4 and connect it to one side of the test connector. Use an SMB to BNC cable to connect the other side of the test connector to channel A on the oscilloscope.
5. The amplitude of the oscilloscope trace should be greater than 0.2 V peak to peak. See Figure 4-5 for illustrations of possible waveforms. If there are any problems with the amplitude of the discriminator output, perform Adjustment 08. Multiplier Power Leveling. If the module passes the procedure, but there is still a problem with the waveform, tune to the offending frequency and verify that the power out of the A2 LO multiplier is greater than or equal to +12.5 dBm with a power meter. If it is not, replace the A2 LO multiplier. If the power out of the A2 meets or exceeds +12.5 dBm, replace the A3 SYTFMD for low discriminator output.

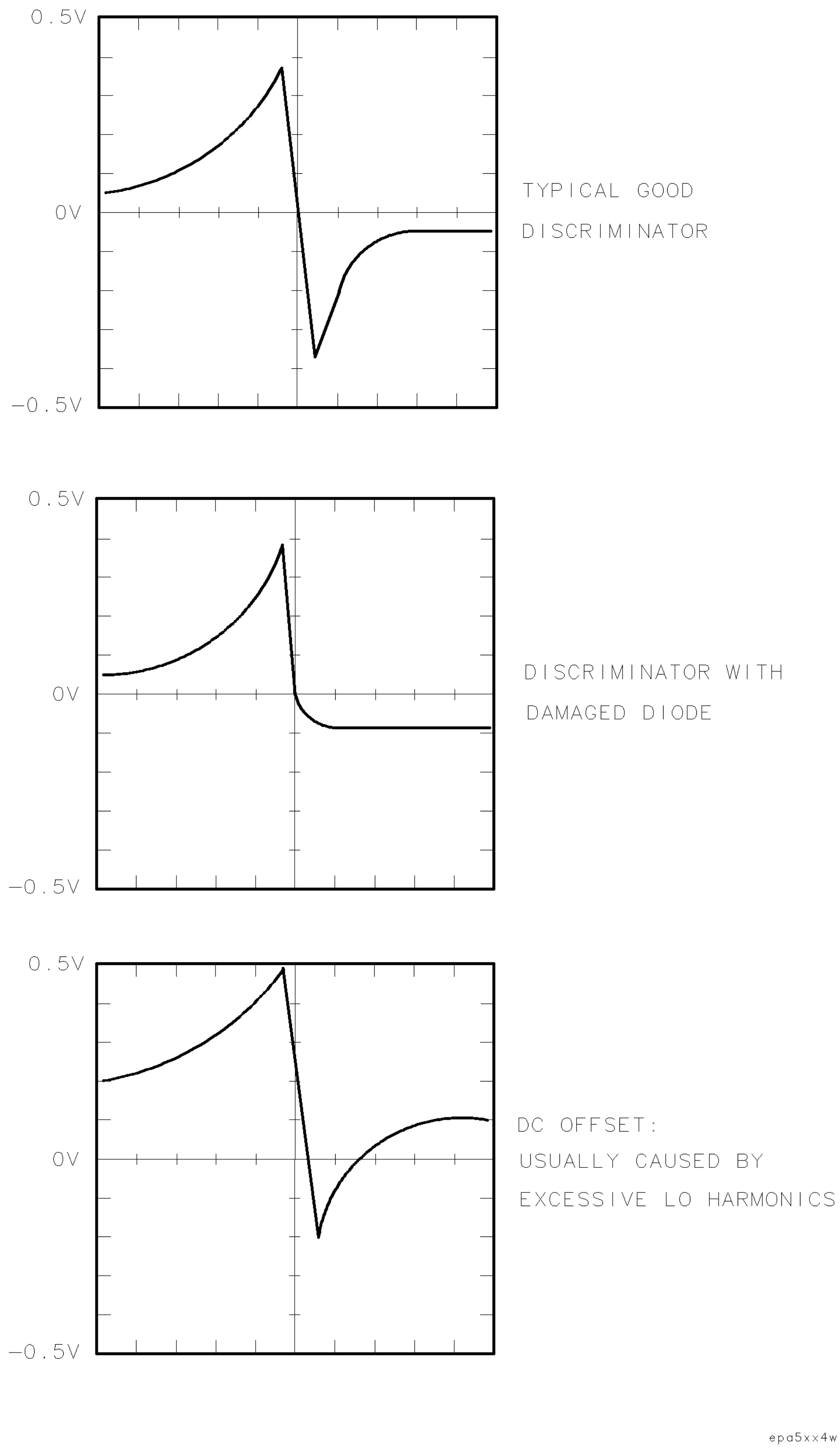


Figure 4-5. Discriminator Output Waveform

Troubleshooting the A4 Input Attenuator

The A4 input attenuator is a four-section attenuator with one 10 dB and three 20 dB sections. The switching drive comes from the A12 controller. Refer to function block E of the A12 controller schematic.

Each attenuator section is controlled by two lines. For example, when 40 dB of attenuation is used, attenuator sections two and four will be enabled. To switch in section two, control line SECT 2-20 will be +0.5 V and control line SECT 2-0 will be +25 V. The control line voltages will be reversed on sections that are not enabled. With 40 dB of attenuation, SECT 1-10 will measure +25 V and SECT 1-0 will measure 0.5 V.

1. If the switching logic is correct, but the signal attenuation is not, replace the A4 input attenuator.
2. If the switching logic is incorrect, replace the A12 controller.

Troubleshooting and Alignment of the A5, A7, A8, A9

The five parts that make up the 2nd converter are the A5 VCO sampler, A7 2nd mixer, A8 321.4 MHz matching network, A9 2nd converter PLL, and 3.6 GHz cavity bandpass filter and oscillator.

The A5 VCO sampler provides two functions: (1) varactor tuning for the 3.3 GHz local oscillator, and (2) sampler-phase detector for the 3.3 GHz oscillator.

The A8 321.4 MHz matching network provides the necessary loads to the output of the 2nd converter and the input of A11 last converter.

The A9 2nd converter PLL provides two functions: (1) 300 MHz amplification for use as the sampling signal, and (2) 3.3 GHz oscillator frequency correction voltage.

Refer to the Adjustment 22. 2nd Converter Bandpass Filter Tune for additional help.

CAUTION The A5 VCO sampler, A7 2nd mixer, A8 321.4 MHz matching network, and A9 2nd converter PLL are extremely static-sensitive. Before proceeding, refer to “Preparing a Static-Safe Work Station”.

Note If the cover of the 2nd converter is removed to make an adjustment, replace it with an HP 5022-1150 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

VCO Adjust

1. Turn on mainframe power.
2. Turn A9R6 (sampler offset adjustment) fully CW (clockwise).
3. Adjust A9R7 (tuning range adjustment) for −5.0 V at A5J4-1 (VCO tune line).
4. Connect the HP 8566B spectrum analyzer RF INPUT to A8 321.4 IF OUT.
5. Adjust LO ADJ (VCO cavity tuning screw) for an IF output frequency of 3300 MHz ±1 MHz.
6. If the oscillator will not adjust for an output frequency of 3300 MHz, perform the following steps.
   - □ Measure the VCO bias voltages at J4-2 and J4-3. They should be +10.4 V and −2.7 V, respectively. If J4-2 measures +12 V or if J4-3 measures −12 V, there may be no contact between the spring clips on the A5 and feedthroughs on the VCO feedthrough cover (HP 5086-1626).
   - □ Positioning of the bandpass filter relative to the antenna-probe screw can be critical. Typically, the casting should be as far as possible from the wall of the centerbody casting. To re-position the filter, loosen all screws in the bandpass casting. While holding the casting down and away from the top of the module, tighten all screws in a criss-cross pattern.
   - □ Positioning of the VCO/sampler board is also critical. To reposition, loosen the SMA connector nut and the two grounding screws. Typically the board is positioned toward the left corner and rotated CCW.
   - □ Verify that none of the bandpass filter tuning screws are screwed all the way in.
7. Connect the power meter to the 2nd LO auxiliary output SMA connector on the VCO cavity. Set the output power to −7.75 dBm by turning the SMA connector in or out of the cavity housing. (This power level directly affects the SAMPLER AC IF OUTPUT.)

   This power level should be close to correct with two threads showing on the aux out coupling connector. If not, the failure is most likely a faulty oscillator transistor (TC131) or incorrect supply voltages at the oscillator circuit.
8. Tighten the SMA connector locknut; then tighten the set screw.

Troubleshooting and Alignment of the A5, A7, A8, A9

Sampler DC IF Output

1. Connect the semi-rigid cable between the 2nd LO AUX OUT and the SAMPLER input.
2. Connect the synthesizer RF output (300 MHz, 0 dBm) to the 300 MHz reference input on the DUT rear panel.
3. Connect the DVM between TP-2 and J4-4 to measure the sampler IF OUTPUT. The voltage should be no greater than ±50 mVdc with the cable connected from the aux out.
4. Disconnect the DVM.

Sampler AC IF Output

1. Connect the semi-rigid cable between the 2nd LO AUX OUT and the SAMPLER input.
2. Connect the oscilloscope (or DVM) between J4-4 and ground.
3. Peak the response on the oscilloscope by tuning the synthesizer from 299.9 MHz to 300.1 MHz. The AC IF OUTPUT should be ≥ 196 mV peak to peak. Check the power level at the 300 MHz Aux port (+2 to 8 dBm) and at the SRD driver amp (15 dBm). If these power levels are correct, the failure is most likely either a defective sampler or feedthrough J4-4.

Search Oscillator Adjust

1. Connect the oscilloscope between A9TP1 and ground.
2. Set the reference frequency to 302 MHz.
3. Adjust R6 (sampler offset pot) for a 50% duty-cycle square wave at A9TP1. The square wave should switch between greater than +9.5 V and less than −9.5 volts.
4. Set the reference frequency to 298 MHz and check the duty cycle of the A9TP1 waveform. If the duty cycle is not 50%, repeat steps 2 through 4. If the search oscillator is not working, the failure is most likely A9U1 (phase-lock-loop amplifier).

Search Oscillator Peak

1. Connect the oscilloscope between A9J4-1 and ground.
2. Adjust R7 (tune range pot) for a square wave peak between 0 and −2 Vdc.

Phase Lock

1. Set the reference frequency to 300 MHz, and then verify 2nd LO phase lock.
2. Verify a stable −4 to −5 V at J4-1.

VCO Tuning Range Preliminary

1. Connect the DVM between A9TP1 and ground.
2. Set the reference frequency to 300.6 MHz.
3. Adjust the VCO cavity adjustment screw (usually CCW) until the 2nd LO phase locks. The following are phase lock indicators: the green 2nd LO LOCKED LED on A10 power supply/driver, a stable negative voltage (approximately −10 to −8 V) at A2TP1, a stable oscillator signal as viewed on the spectrum analyzer.
4. Set the reference frequency to 299.35 MHz.
5. Adjust R7 (usually CW) for 2nd LO phase lock. The DVM will indicate a positive voltage (6 to 9 V).
6. Repeat steps 2 through 5 until the 2nd LO remains locked at both reference frequencies without further adjustment of R7.

Mixer Bias Check

1. Connect the DVM between A8TP1 and ground.
2. The mixer bias should be in the range of +0.6 to +1.3 V. If mixer bias is higher than +1.3 V, check the value of the 100 ohm resistor on A8. If the bias is lower than +.6 V, the failure is most likely a bad mixer or poor 2nd LO coupling to the mixer. If the bias is −0.6 to −1.3 V, the mixer diode is backwards, but this will not affect operation.

Bandpass Filter Adjustment

1. The program provided for 2nd converter BPF alignment requires an HP 8756A scalar network analyzer or HP 8757A scalar network analyzer. Run the program found under the adjustment tests menu for 2nd BPF alignment.
2. In wide span (100 MHz) the bandpass filter center frequency will be to the right of center screen on the network analyzer.
3. Turn A8L1 all the way out.
4. Tune IF ADJ 3 for a peak at center frequency.
5. Tune IF ADJ 2 for a dip at center frequency. Peaks on either side of the dip should be nearly the same amplitude.
6. Tune IF ADJ 1 for a peak and an overall well-shaped bandpass.
7. Adjust A8L1 for overall bandpass flatness and symmetry.
8. If the 3 dB bandwidth limits and flatness cannot be met, adjust the input coupling connector for more or less coupling. This will necessitate readjustment of IF ADJ 1, 2, and 3.

VCO Tuning Range Final

Repeat the adjustment steps found under Adjustment 19. VCO Tune Range Preliminary Check.

2nd Converter Conversion Loss and Noise Figure

Run Adjustment 26. Noise Figure 2nd Converter.

Troubleshooting the A10 Power Supply/Driver

The A10 power supply/driver contains the power supplies and driver circuits for the various assemblies of the module. Troubleshooting procedures are provided for both circuits. Circuit descriptions for the driver circuit are also provided.

Power Supply Troubleshooting

The following power supplies are provided by A10 power supply/driver:

+4 V (unregulated)
+5 V
+8 V
+8 V (unregulated)
+11 V (unregulated)
+12 V
+25 V
+35 V (unregulated)
−12 V

To troubleshoot power supply problems, turn off the power on the HP 70000 Series modular measurement system, remove the rear panel LO INPUT cable, and remove the cables attached to the following A10 power supply/driver jacks:

Jack	Provides Power To
A10J201	A9 2nd converter PLL
A10J201	A11 last converter
A10J201	A12 controller
A10J201	A14 front panel board
A10J203	A3 SYTFMD
A10J301	A1 leveling amplifier
A10J301	A2 LO multiplier
A10J301	A13 ALC/bias

If the fuse is blown, replace it. Turn on the power of the HP 70000 Series modular measurement system. If the supply voltages are incorrect or if the fuse still blows, the problem is on the A10 power supply/driver. If these problems do not occur, turn off the power of the HP 70000 Series modular measurement system, replace one cable, and then turn the power back on. Continue to replace one cable at a time until the problem shows, and then troubleshoot the faulty assembly serviced by the cable.

Driver Circuit Descriptions

In the following descriptions, the term block refers to the function blocks on the A10 power supply/driver schematic diagram.

BLOCK C receives the Tune + Span signal from the HP 70900A/B local oscillator source. This is 1.5 V/GHz of LO output frequency. This signal is used as a reference for the frequency-dependent break points, frequency-dependent filter drives, and frequency-dependent loop gain.

BLOCKS D and E attenuate the Tune + Span signal so the output of A10U2 is a voltage ramp proportional to the center frequency of the A3 SYTFMD. The proportional relationship varies with the band setting.

BLOCK L provides frequency-dependent linearity compensation for approximating linear YTF tuning in the A3 SYTFMD.

BLOCK G sums the output of block D with correction information from the following sources: (1) hysteresis from block F and the discriminator, (2) linearity breakpoint information from block L, and (3) dc offset information from block M.

BLOCK F responds only to the fast change in voltage of the Tune + Span signal during retrace. The faster the rate of change the deeper into saturation U5A and U5B go, causing the duty cycle of the output pulse to change. U6C and U6D change the gain of U5A depending on which frequency band the A3 SYTFMD is tuned to.

BLOCK M provides a dc offset proportional to 321.4 MHz to the A3 SYTFMD. This causes the YTF to track 321.4 MHz below the LO input frequency.

BLOCK R provides an offset-coil summing node which adds together a squared offset error correction from block L and a slope correction to provide linearization of the offset coil response. This is added to a dc offset proportional to 321.4 MHz (the difference in frequency between the LO input of the A3 SYTFMD and YTF).

BLOCK S uses the signal from block R to drive current in the discriminator offset coil of the A3 SYTFMD.

BLOCKS K and N buffer the output from the A3 SYTFMD and provide frequency-dependent closed-loop gain.

BLOCK V controls the A3 SYTFMD temperature by reacting to temperature-sensing information and changing its heater current.

BLOCKS O and A shorten lock-acquisition time. The search oscillator is enabled when the discriminator loop is unlocked.

BLOCK P integrates the discriminator frequency-error information. The output is applied to the YTF main coil to force a 321.4 MHz frequency difference between the LO input of the A3 SYTFMD and YTF.

BLOCKS A, I, and X provide the A12 controller with the following status information:

Circuit	Conditions Reported
A1 LO Leveling Amplifier	leveled/unleveled
A2 LO Multiplier	leveled/unleveled
Discriminator Lock Loop	locked/unlocked
Tune + Span Signal	present/not present

BLOCK T drives the filter switch of the A2 LO multiplier. The filter is on for HP 70900A/B local oscillator source frequencies from 3 to 4.0 GHz.

BLOCK U drives the filter of the A1 leveling amplifier. The circuit uses the Tune + Span signal to reference the filter drive. The filter reduces in-band harmonics when the HP 70900A/B local oscillator source is tuned between 3 to 3.3 GHz.

Driver Troubleshooting

The following seven procedures are provided for troubleshooting driver circuits:

- Main Coil Drive
- Loop Gain versus Frequency
- Hysteresis and Delay
- Linearity Compensation
- A1 LOLA Filter Drive
- Multiplier Voltage-Tuned Filter Drive
- Interface Block

Troubleshooting the A10 Power Supply/Driver

Main Coil Drive

The main coil drive may be tested by the following procedure:

1. On the HP 70000 Series modular measurement system, initiate (Instrument Preset) and press (MENU), Freq, START, and 2.9 GHz. Press (MENU), State, MORE 3 of 4, poweron menu, and POWERON LAST.
2. Set an oscilloscope to the following settings:
   Channel A .... 0.2 V/Div (with a 10:1 probe)
   Sweep time .... 0.2 s/Div
   Trigger .... normal
3. Connect the oscilloscope to the source of A10Q1. (It may be easier to connect the probe to the side of R9 connected to Q1.) Verify that the trace on the oscilloscope is similar to Figure 4-6.

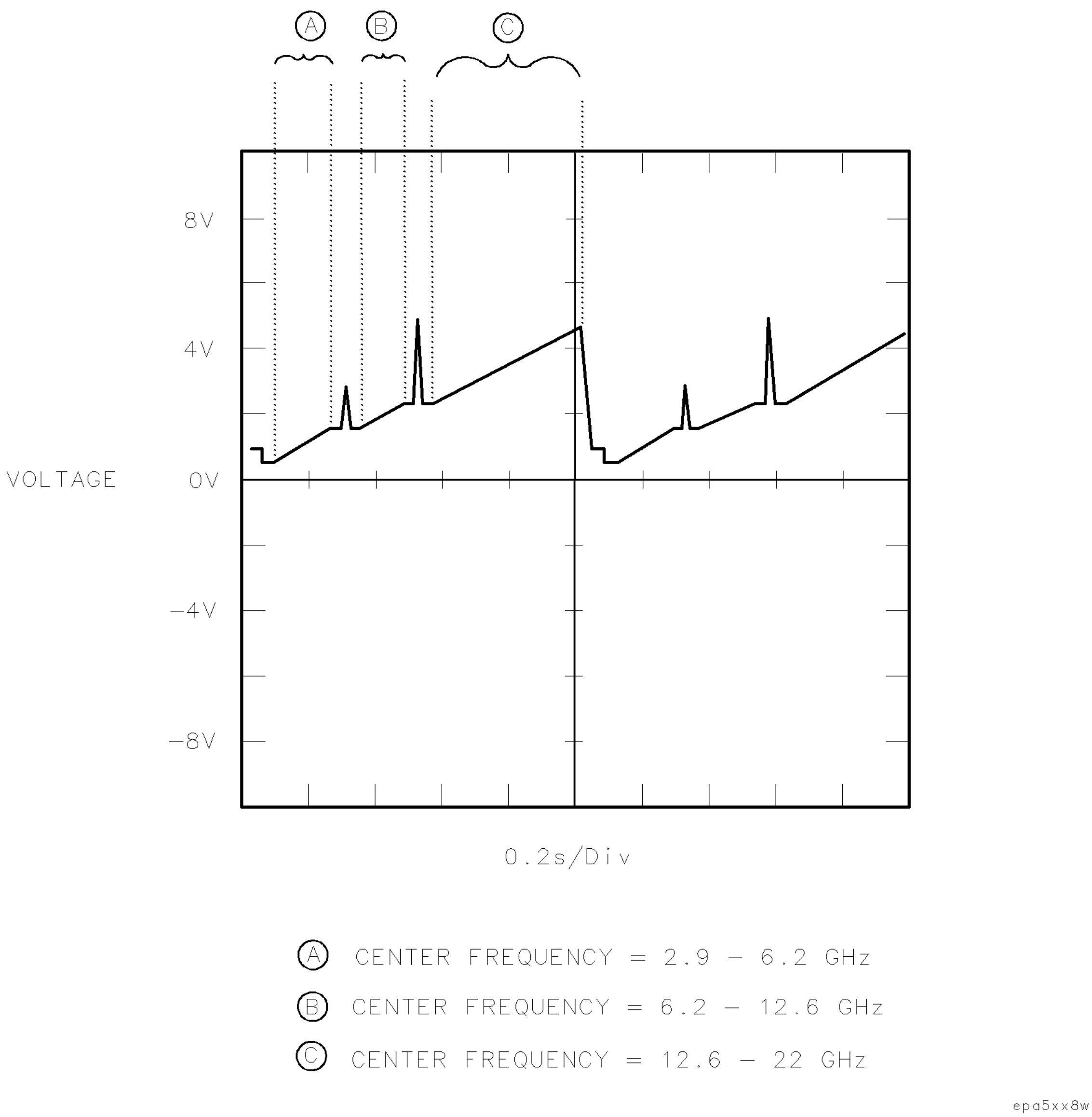


Figure 4-6. Signal at A10Q1

4. If the trace does not look like Figure 4-6, turn the mainframe power off and remove the cable to A10J203. This cable supplies the drive and power supplies to A3 SYTFMD.
5. Connect a jumper wire across A10CR4 and CR5. Turn the mainframe power back on.
6. If the waveform resembles Figure 4-6, turn the power off and replace the A3 SYTFMD. Remove the jumper, and reconnect the cable to A10J203. Turn on the mainframe power and run Adjustment 09. SYTFMD Main Coil Alignment.
7. If the discriminator still unlocks after realigning the A3 SYTFMD drive, refer to the discriminator section of "Troubleshooting the A3 SYTFMD". If the discriminator output has no problem, there is a problem on the A10 power supply/driver.

Loop Gain Versus Frequency

CAUTION The discriminator output is extremely static-sensitive. Before proceeding, refer to "Preparing a Static-Safe Work Station".

Perform the following steps to test loop gain versus frequency:

1. Turn off the power on the HP 70000 Series modular measurement system. Remove the cable from A10J4 (input of the A10 discriminator).
2. Set a function generator to the following settings:
   Function .... sine wave
   Frequency .... 500 Hz
   Amplitude .... 1 Vp-p
   Offset .... No dc offset
3. Connect a BNC tee (HP 1250-0781) to the output of the function generator. Connect a 50 ohm BNC load (HP 11593A) to one side of the BNC tee. Connect a BNC to SMB cable from the other side of the BNC tee to A10J4. Connect a jumper wire from A10TP1-3 to ground (this disables the search oscillator).
4. Set an oscilloscope to the following settings:
   Display .... A + B Mode
   Channel B .... 200 mV/Div (Inverted)
   Channel A .... 200 mV/Div
   Sweep time .... 1 ms/Div
5. Connect the oscilloscope probes across A10R68. Turn on the power of the spectrum analyzer.
6. Initiate an (Instrument Preset) on the spectrum analyzer, and set the controls as follows:
   Start frequency .... 2.9 GHz (press (MENU), Freq , START)
   Sweep time .... 30 s (press (MENU), BW,Swp , SWPTIME)
7. Check the oscilloscope for a relatively constant sine wave of about 60 to 100 mVp-p when the spectrum analyzer is sweeping from 2.9 to 12.5 GHz. Verify that the sine wave is decreasing in amplitude from about 12.5 to 22 GHz. If it is not, there is a problem on the A10 power supply/driver.

Troubleshooting the A10 Power Supply/Driver

Hysteresis and Delay

The following procedure tests hysteresis and delay.

1. Set a function generator to the following settings:
   Function .... sine wave
   Frequency .... 500 Hz
   Amplitude .... 500 mVp-p
2. Connect a BNC tee to the output of the function generator. Connect a 50 ohm BNC load to one side of the BNC tee. Connect a BNC to SMB cable from the other side of the BNC tee to the HP 70908A RF section rear panel Tune + Span input.
3. Set an oscilloscope to the following settings:
   Sweep time .... 1 ms/Div
   Channel A .... 1 V/Div
4. Initiate an (Instrument Preset) on the spectrum analyzer, and set the controls as follows:
   Start frequency .... 2.9 GHz (press (MENU), Freq , START)
   Sweep time .... 30 s (press (MENU), BW,SWP , SWPTIME)
5. Connect the oscilloscope to A10U5 pin 7. Verify that there is a distorted sine wave with the values listed in Table 4-5.

Table 4-5. Sine Wave Values at A10U5 Pin 7

HP 70000 Frequency	Positive Peak	Negative Peak
2.7 to 6.2	0.5 to 0.8 V	−0.6 to −1 V
6.0 to 12.8	0.9 to 1.5 V	−1.5 to −2.5 V
12.6 to 22	2 to 3 V	−4 to −5 V

The gain of the sine wave is a function of two parameters: (1) attenuation provided by the A10U2A MUX selection, and (2) the select gain of A10U5A.

Refer to Table 4-6 for correct waveforms at A10U2A and Table 4-7 for the correct waveforms at A10U5A. These signals originate on the A12 controller. If there is a problem with the waveforms, troubleshoot the A10 power supply/driver or A12 controller.

Table 4-6. Waveforms at A10U2A

Band	Frequency Range (GHz)	Waveform at U2A pin 1 (A0)	Waveform at U2A pin 16 (A1)
hold		TTL low	TTL low
1L−	2.7 to 6.2	TTL high	TTL low
2L−	6.0 to 12.8	TTL low	TTL high
4L−	12.6 to 22	TTL high	TTL high

Table 4-7. Waveforms at A10U5A

Band	Frequency Range (GHz)	Waveform at U5 pin 9	Waveform at U5 pin 16
1L−	2.7 to 6.2	TTL low	TTL low
2L−	6.0 to 12.8	TTL low	TTL high
4L−	12.6 to 22	TTL high	TTL high

Linearity Compensation

1. On the HP 70000 Series modular measurement system, initiate an (Instrument Preset), and set the controls as follows:
   Start frequency .... 2.9 GHz (press (MENU), Freq, START)
   Sweep time .... 30 s (press (MENU), BW,SWP, SWPTIME)
2. Set an oscilloscope to the following settings:
   Channel A .... 0.2 V/Div (with a 10:1 probe)
   Sweep time .... 2 s/Div
3. Connect the oscilloscope to A10TP1-1 (linearity compensation). The waveform should look like Figure 4-7. Verify that there is 0 V for swept frequencies from 2.9 to 12.6 GHz, and then a voltage proportional to the square of the Tune + Span voltage from about 12.5 to 22 GHz. The voltage should rise to about +7 V at 22 GHz. The break points vary from module to module. If the squared response is not present, there is a problem on the A10 power supply/driver.

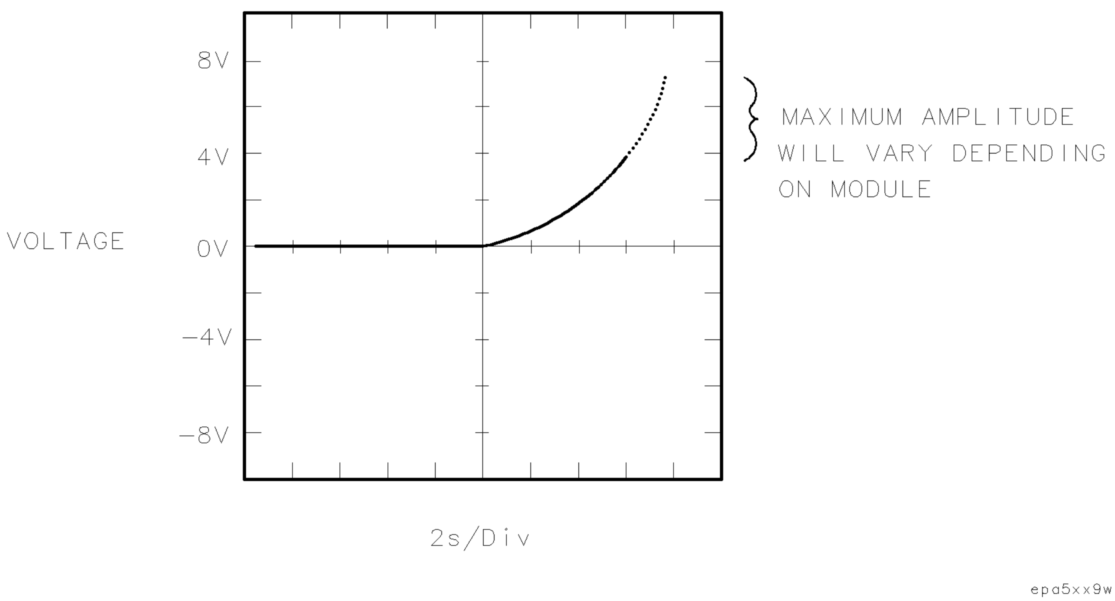


Figure 4-7. Linearity Compensation Waveform

A1 LOLA Filter Drive

To observe the filter-drive waveform, place the module on an HP 70001-60013 extender module and make all connections needed for spectrum analyzer operation. Perform the following steps:

1. On the HP 70000 Series modular measurement system, initiate an (Instrument Preset), and set the controls as follows:
   Span .... 0 Hz (press Freq, SPAN, 0 Hz)
   Pathlock .... (press (MENU), State, MORE 3 of 4, PATHLOK ON)
   LO START .... 3 GHz (press (MENU), Freq, START, 3 GHz)
   LO STOP .... 6.6 GHz (press STOP, 6.6 GHz)
   Sweep time .... 5 s (press (MENU), BW,SWP, SWPTIME, 5 s)

2. Set an oscilloscope to the following settings:
   - Display .... A versus B mode
   - Channel A .... 0.5 V/Div (with 10:1 Probe)
   - Channel B .... 0.1 V/Div (with 10:1 Probe)
3. Connect Channel A on the oscilloscope to the VTF pin on the A1 leveling amplifier. Connect Channel B to the rear panel SWP jack of the HP 70900A/B local oscillator source. Adjust the horizontal position of the oscilloscope to place the start of the trace at the leftmost graticule. Adjust the position of Channel A so that 0 V is one division above the bottom of the CRT.

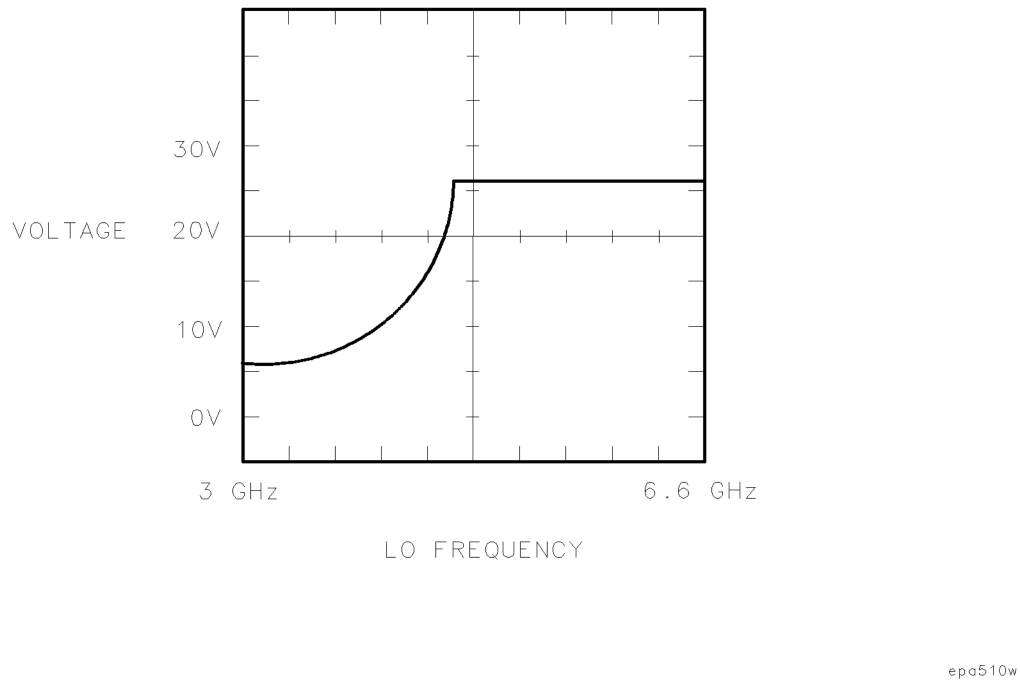


Figure 4-8. Notch Filter Waveform

4. The filter-drive waveform should look like Figure 4-8, with the horizontal axis corresponding to the LO frequency and the vertical axis to waveform amplitude. For an HP 70900A/B local oscillator source sweep of 3.0214 to 6.5214 GHz, the waveform should have a squared response approximately +6 V to +26 V and then remain at +26 V for the remainder of the sweep. If the waveform is not present, check for the trace at the collector of A10Q402. If it is not present at A10Q402, continue with step 5.
5. On the HP 70000 Series modular measurement system, press (MENU), State, MORE 3 of 4, poweron menu, POWERON LAST, and then turn the power off. Remove the ribbon cable to A10J301 and the rear panel LO INPUT cable. Connect a 1000 pF capacitor from the collector of A10Q402 to ground.
6. Turn the spectrum analyzer's power on. If the trace now appears at the collector of A10Q402, troubleshoot the filter drive signal path. The signal comes from the A10 power supply/driver, through the A13 ALC/bias, to the A1 leveling amplifier.

Multiplier Voltage-Tuned Filter Drive

1. Perform steps 1 through 4 of the bandpass-filter drive troubleshooting procedure for the A2 LO multiplier.
2. If there is no trace on the FLTR pin, or if it is incorrect, check the collector of A10Q403. If it is present at A10Q403, trace the signal through the A10 power supply/driver, A13 ALC/bias, and A2 LO multiplier to find out where it stops. If there is no trace at A10Q403, continue with step 3.
3. On the HP 70000 Series modular measurement system, press (MENU), State, MORE 3 of 4, poweron menu, POWERON LAST, and then turn the power off. Remove the LO INPUT cable from the rear panel of the HP 70908A RF section, and the cable from A10J301.
4. Turn on the power of the spectrum analyzer and check for the trace again at A10Q403. If the trace is now present, follow the path as stated above to find out what is loading it down. If there is an incorrect trace at the collector of A10Q403 when the cable is removed from A10J301, there is a problem on the A10 power supply/driver. Turn the power back off before returning any cables to their original positions.

Interface Block

Run Test 20. Diagnostics.

Troubleshooting the A11 Last Converter

The A11 last converter down-converts the 321.4 MHz IF signal to a 21.4 MHz IF signal that will be processed by the IF modules. It recombines the two IF paths from the A15 RF 1st converter and the A3 SYTFMD, and it compensates for IF path losses with the only analog gain adjustment in the signal path. The A11 can also provide 10 dB gain at 21.4 MHz IF step gain and the accuracy of the step gain can be affected by adjustment of the analog gain.

The A11 last converter contains a 300 MHz buffer amplifier which supplies the LO for mixer A11U5. The LO signal is also sent to the 2nd converter A11J3 for use in phase-locking the 3.3 GHz oscillator.

The signal path for the 321.4 MHz rear panel IF output is determined by the output select bit from the A12 controller.

The A11 last converter has two signal-present detectors: one detects the presence of 300 MHz; another detects a signal in the 21.4 MHz IF path. The 21.4 MHz detector is not used as part of HP 70908A RF section normal operation; it is utilized in system diagnostics. The detected outputs are compared to a reference voltage of about +0.3 V. Their output information (signal present/not present) is sent to the A12 controller.

To verify A11 last converter alignment, run Adjustment 24. Last Converter Bandpass Filter.

Troubleshooting the A12 Controller

Only the +5 V supply has to be present in order for the A12 controller to operate. This supply is generated on the A12 from +8 V unregulated supply (A10TP101-1) of the A10 power supply/driver. If the +8 V unregulated is not present, refer to the power supply section of A10 power supply/driver troubleshooting.

The A12 uses the +25 V supply for attenuator switching drive.

The +5 V supply is used for attenuator switching. When the spectrum analyzer is turned off, this supply sets the input attenuator to 70 dB. This protects the RF input of the module from any high-power signals applied while the spectrum analyzer is off. The supply is also used to disable the output from the ROM A12U7 during power down.

The A12 controller receives information from the HP-MSIB master module and acts upon it accordingly. The controller is responsible for the following functions under the control of the master element:

- Attenuator settings
- Last converter step gain on/off
- 2nd converter VCO on/off
- RF input path switching
- IF input selection to last converter
- 321.4 MHz IF output selection on last converter
- Track and hold
- Band information (A0, A1)
- Servicing of status detectors

Except for the servicing of status detectors (error reporting), the controller does not respond to any stimulus from the module itself.

Troubleshooting the A13 ALC/Bias

The A13 ALC/bias provides the drive signals for the A1 leveling amplifier and the A2 LO multiplier. The A2 LO multiplier gate bias is a voltage divider adjustment. The A2 LO multiplier block takes the detected output information from the A2 LO multiplier and compares it with a A2 LO multiplier voltage reference. This information is integrated and sent back to the A2 LO multiplier attenuator. Multiplier band switching takes decoded band information from A10 power supply/driver (BC1,BC2,BC4) and enables the appropriate paths inside the A2 LO multiplier to achieve the LO frequency necessary for fundamental mixing inside the A3 SYTFMD. Refer to A2 LO multiplier troubleshooting for switching logic per band.

LOLA Output Switch/Leveling

The LOLA output switch takes band information from the A10 power supply/driver (BC0) and sends the pin switch biasing to the A1 leveling amplifier for switching the LO output to either the A15 RF 1st converter (.0000001 to 2.9 GHz) or the A3 SYTFMD (2.9 to 22 GHz Input).

The LOLA leveling circuitry takes the detected output from the A1 leveling amplifier and compares it to a reference voltage from A1. This information is integrated and sent to the A1 leveling. When the LO input power to the A1 is low, PIN diodes 1 and 2 are at minimum attenuation. As the input power increases, A13Q9 gradually biases PIN diode 2 to maximum attenuation, leaving PIN diode 1 to respond to small changes in power. LO gate bias is a voltage divider bias adjustment scheme.

Multiplier Leveling Circuit

Tune the HP 70000 Series modular measurement system to a center frequency of 8 GHz with a span of 100 MHz. Connect a DVM to the ATTEN pin of the A2 LO multiplier. Connect one side of a jumper wire to ground. Touch the other side of the jumper wire to the REF pin of the A2. The voltage at the ATTEN pin should be less than +1.5 V. Remove the jumper from the REF pin and connect it to the DET pin of the A2. The voltage at ATTEN should be greater than +11 V. If either of the voltages is incorrect, troubleshoot the A13 ALC/bias.

LO Leveling Amplifier Leveling Circuit

Tune the HP 70000 Series modular measurement system to a center frequency of 8 GHz with a span of 100 MHz. Connect one side of a jumper wire to ground. Connect the other side of the jumper to the REF pin of the A1 leveling amplifier. The voltage at A1 PIN 1 should be +10.5 V, and PIN 2 +1.3 V. Remove the jumper from the REF pin and connect it to the DET pin of the A1 leveling amplifier. The voltage at PIN 1 should be 3.5 V and the voltage at PIN 2 should be 1.75 V. If any voltages are incorrect, troubleshoot the A13 ALC/bias.

Troubleshooting the A15 RF 1st Converter

The RF 1st converter should have the following conversion loss.

Frequency Range	Typical Conversion Loss
100 Hz to 2.5 GHz	less than 9 dB
2.5 to 2.9 GHz	less than 12 dB

The Troubleshooting Tool Program

This program allows communications from the controller keyboard to the HP 70908A RF section. The user can configure the HP 70908A RF section for specific test setups that utilize the external test equipment in the LOCAL mode. The following selections appear on the display.

1. PRESET
2. SELECT BAND
3. LOCK DISC
4. DIAGNOSTICS
5. 321.4 IF
6. 21.4 IF
7. STEP GAIN ON
8. STEP GAIN OFF
9. CAPABILITY STRING
10. SET ATTENUATOR
11. SERIAL NUMBER
12. FIRMWARE DATE CODE STRING
13. CONFIGURATION STRING

PRESET must precede *any* other tool command. It opens a communication link from the system controller to the HP 70908A RF section.

SELECT BAND configures the HP 70908A RF section to one of the four bands: 1H−, 1L−, 2L−, or 4L. LOCK DISC *must* follow selection of band 1L−, 2L−, or 4L−.

DIAGNOSTICS lists (on controller display) errors currently being generated by the HP 70908A RF section.

321.4 IF selects the 321.4 IF output path from the last converter.

21.4 IF selects the 21.4 IF output path from the last converter.

STEP GAIN ON enables the step gain circuit in the last converter 21.4 MHz amplifier.

STEP GAIN OFF disables the step gain circuit.

CAPABILITY STRING reads information (such as flatness correction) from the EEROM.

SET ATTENUATOR sets the RF attenuator to any setting from 0 to 70 dB attenuation.

SERIAL NUMBER reads and displays the serial number stored in EEROM.

FIRMWARE DATE CODE STRING reads and displays the date code stored in EEROM.

CONFIGURATION STRING reads and displays the current configuration.

Performing Related Adjustments and Verification Tests

After an assembly has been repaired, replaced, or adjusted, there are a set of related adjustments and verification tests that must be performed to ensure proper operation.

If an assembly has been repaired, changed, or adjusted, perform the related verification tests listed after each assembly name. Refer to Chapter 8 for a list of final tests.

Note

- If your RF section is still in warranty, or if you do not wish to perform the servicing yourself, return your RF section to a Hewlett-Packard service center. (Refer to "If You Want Hewlett-Packard to Service Your RF Section" in Chapter 1.)
- If you decide to perform the servicing yourself, prepare a static-safe work station before you begin any servicing procedures. (Refer to "Preparing a Static-Safe Work Station".)
- If the cover of the 2nd converter is removed to make an adjustment, replace it with an HP 5022-1150 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

A1 Leveling Amplifier

Perform the following related adjustment procedures:
Adjustment 01. LOLA Gate Bias
Adjustment 04. LOLA Power Out
Adjustment 05. LOLA Tuned Filter
Perform the following related verification tests:
All final tests
Test 19. Aux LO Power and Harmonics
Test 21. LO Input Amplitude Range
Test 25. LO Input Return Loss
Test 26. Reference Return Loss

A2 LO Multiplier

Perform the following related adjustment procedures:
Adjustment 02. Multiplier Gate Bias
Adjustment 08. Multiplier Power Leveling
Perform the following related verification tests:
All final tests

A3 SYTFMD

Perform the following related adjustment procedures:
Adjustment 06. SYTFMD Offset Coil
Adjustment 08. Multiplier Power Leveling
Adjustment 09. SYTFMD Main Coil Alignment
Flatness Calibration
Adjustment 27. 21.4 MHz IF Frequency Response
Perform the following related verification tests:
All final tests
Test 17. Step Gain
Test 23. RF Input Return Loss

Performing Related Adjustments and Verification Tests

A4 Input Attenuator

Perform the following related verification tests:
- All final tests
- Test 23. RF Input Return Loss

A5 VCO Sampler

Perform the following related adjustment procedures:
- Adjustment 10. VCO Tune-Line Voltage
- Adjustment 11. VCO 2nd LO Frequency/Amplitude
- Adjustment 12. 2nd Converter LO Feedthrough
- Adjustment 13. Sampler IF Out DC
- Adjustment 14. Sampler IF Out AC
- Adjustment 15. Search Oscillator Duty Cycle and Period
- Adjustment 16. Search Oscillator Square Wave Min/Max
- Adjustment 17. Search Oscillator Tune Line Peak
- Adjustment 18. Phase Lock Check
- Adjustment 19. VCO Tune Range Preliminary Check
- Adjustment 20. Lock Range Measurement
- Adjustment 21. Mixer Bias
- Adjustment 22. 2nd Converter Bandpass Filter Tune
- Adjustment 23. VCO Tune Range Final

Perform the following related verification tests:
- All final tests
- Test 11. 2nd Converter Startup

A6 Isolator

Perform the following related verification tests:
- All final tests

A7 2nd Mixer

Perform the following related adjustment procedures:
- Adjustment 10. VCO Tune-Line Voltage
- Adjustment 11. VCO 2nd LO Frequency/Amplitude
- Adjustment 12. 2nd Converter LO Feedthrough
- Adjustment 13. Sampler IF Out DC
- Adjustment 14. Sampler IF Out AC
- Adjustment 15. Search Oscillator Duty Cycle and Period
- Adjustment 16. Search Oscillator Square Wave Min/Max
- Adjustment 17. Search Oscillator Tune Line Peak
- Adjustment 18. Phase Lock Check
- Adjustment 19. VCO Tune Range Preliminary Check
- Adjustment 20. Lock Range Measurement
- Adjustment 21. Mixer Bias
- Adjustment 22. 2nd Converter Bandpass Filter Tune
- Adjustment 23. VCO Tune Range Final
- Adjustment 26. Noise Figure 2nd Converter

Perform the following related verification tests:
- All final tests
- Test 11. 2nd Converter Startup

A8 321.4 MHz Matching Network

Perform the following related adjustment procedures:
- Adjustment 10. VCO Tune-Line Voltage
- Adjustment 11. VCO 2nd LO Frequency/Amplitude
- Adjustment 12. 2nd Converter LO Feedthrough
- Adjustment 13. Sampler IF Out DC
- Adjustment 14. Sampler IF Out AC
- Adjustment 15. Search Oscillator Duty Cycle and Period
- Adjustment 16. Search Oscillator Square Wave Min/Max
- Adjustment 17. Search Oscillator Tune Line Peak
- Adjustment 18. Phase Lock Check
- Adjustment 19. VCO Tune Range Preliminary Check
- Adjustment 20. Lock Range Measurement
- Adjustment 21. Mixer Bias
- Adjustment 22. 2nd Converter Bandpass Filter Tune
- Adjustment 23. VCO Tune Range Final

Perform the following related verification tests:
- All final tests
- Test 11. 2nd Converter Startup

A9 2nd Converter PLL

Perform the following related adjustment procedures:
- Adjustment 10. VCO Tune-Line Voltage
- Adjustment 11. VCO 2nd LO Frequency/Amplitude
- Adjustment 12. 2nd Converter LO Feedthrough
- Adjustment 13. Sampler IF Out DC
- Adjustment 14. Sampler IF Out AC
- Adjustment 15. Search Oscillator Duty Cycle and Period
- Adjustment 16. Search Oscillator Square Wave Min/Max
- Adjustment 17. Search Oscillator Tune Line Peak
- Adjustment 18. Phase Lock Check
- Adjustment 19. VCO Tune Range Preliminary Check
- Adjustment 20. Lock Range Measurement
- Adjustment 21. Mixer Bias
- Adjustment 22. 2nd Converter Bandpass Filter Tune
- Adjustment 23. VCO Tune Range Final

Perform the following related verification tests:
- All final tests
- Test 11. 2nd Converter Startup

A10 Power Supply/Driver

Perform the following related adjustment procedures:
- All adjustments

Perform the following related verification tests:
- All final tests

Performing Related Adjustments and Verification Tests

A11 Last Converter

Perform the following related adjustment procedures:
- Adjustment 24. Last Converter Bandpass Filter
- Adjustment 25. Noise Figure Last Converter
- Adjustment 27. 21.4 MHz IF Frequency Response

Perform the following related verification tests:
- All final tests
- Test 05. 10.7 MHz Rejection
- Test 07. Harmonics Out 21.4 MHz Port
- Test 11. 2nd Converter Startup
- Test 15. 321.4 MHz IF Out Frequency Response
- Test 17. Step Gain
- Test 26. Reference Return Loss
- Test 27. Wide IF Output Return Loss
- Test 28. Narrow IF Output Return Loss

A12 Controller

Perform the following related verification tests:
- All final tests
- Test 11. 2nd Converter Startup
- Test 15. 321.4 MHz IF Out Frequency Response

A13 ALC/Bias

Perform the following related adjustment procedures:
- Adjustment 01. LOLA Gate Bias
- Adjustment 02. Multiplier Gate Bias
- Adjustment 05. LOLA Tuned Filter
- Adjustment 04. LOLA Power Out
- Adjustment 08. Multiplier Power Leveling

Perform the following related verification tests:
- All final tests
- Test 19. Aux LO Power and Harmonics
- Test 21. LO Input Amplitude Range

A14 Front Panel Board

Perform the following related verification tests:
- All final tests
- Test 23. RF Input Return Loss

A15 RF 1st Converter

Perform the following related verification tests:
- All final tests
- Test 19. Aux LO Power and Harmonics
- Test 23. RF Input Return Loss

A16 Low Pass Filter

Perform the following related verification tests:
- All final tests

A17 Low Pass Filter

Perform the following related verification tests:
- All final tests
- Test 23. RF Input Return Loss

Overall Block Diagram of RF Section

Front page for Foldout Goes Here (This is just a place holder.)

Figure 4-9. Overall Block Diagram of RF Section

Overall Block Diagram of RF Section

Back page for Foldout Goes Here. (This is just a place holder.)

5

Recommended Test Equipment Tables

The *HP Module Verification Software* contains drivers only for the equipment shown in the table below. The equipment is listed in order of preferred model number. The user must write drivers to support substitute test equipment which must satisfy the listed critical specifications.

In all cases, the specified aging rate requirement is 10^{-9} ms/day. The microwave source, synthesized source, and calibrated spectrum analyzer listed in Table 5-1 have internal time bases that meet the aging rate requirement.

Table 5-1. Recommended Test Equipment

Equipment	Recommended Model
Controllers	
Controller	HP 9000 Series 300 controller
Signal Sources	
Full microwave source	HP 8340A synthesized sweeper
	(frequency response: 10 MHz–26.5 GHz)
Synthesized source	HP 8663A synthesized signal generator, or
	HP 8662A synthesized signal generator
Level generator	HP 3335A synthesizer/level generator
Analyzers	
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
	(upgraded with firmware version 16.7.85 or later)
Scalar network analyzer	HP 8757A scalar network analyzer
Detector (2 required)	HP 11664E detector
Meters	
Excess noise source	HP 346C broadband noise source
Noise figure meter	HP 8970B noise figure meter
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Precision DVM	HP 3458A digital multimeter, or
	HP 3456A digital multimeter
Multimeter	HP 3478A digital multimeter
Amplifiers	
RF amplifier (optional)	HP 8447A RF amplifier
HP 70000 Components	
Mainframe	HP 70001A mainframe
Local oscillator source	HP 70900A/B local oscillator source
Extender module	HP 70001-60013 extender module
External reference	Refer to “External Frequency Reference” in Chapter 6.

Recommended Test Equipment (continued)

Specialized Test Equipment
Tune + Span ET.
Offset-Coil-Current ET.
Standard Equipment
HP 11667B power splitter
HP 0955-0204 microwave isolator
HP 85027B directional bridge
HP 85027-60004 calibrated open/short
HP 8493C Option 006 coaxial fixed attenuator
HP 908A 50Ω N(m) termination
HP 5022-1150 2nd converter test cover
Accessory Equipment
HP 54503A digitizing oscilloscope
HP 87421A power supply
Cables
HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m) (2 required)
HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m) (4 required)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) (2 required)
HP 5021-5450 260 mm SMA(m) to SMA(m)
HP 5061-9038 520 mm SMA(m) to SMA(m)
HP 5061-5458 1.0 meter SMA(m) to SMA(m)
HP 8120-5014 100 mm SMB(f) to SMB(f)
HP 8120-5016 160 mm SMB(f) to SMB(f) (2 required)
HP 10833D 0.5 meter HP-IB cable
Adapters
HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f) (2 required)
HP 85027-60002 50Ω APC 3.5(f) to APC 3.5(m) (2 required)
HP 1250-1744 50Ω APC-3.5(f) to N(m) (2 required)
HP 1250-1743 50Ω APC-3.5(m) to N(m)
HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m) (2 required)
HP 1250-1292 50Ω BNC(f) to alligator clips
HP 1251-2277 50Ω BNC(f) to dual banana plug
HP 1250-0780 50Ω N(m) to BNC(f) (2 required)
HP 1250-1250 50Ω N(m) to SMA(f)
HP 1250-1158 50Ω SMA(f) to SMA(f)
HP 1250-1200 50Ω SMA(m) to BNC(f)
HP 1250-1159 50Ω SMA(m) to SMA(m) (2 required)
HP 1250-1397 50Ω right angle SMA(m) to SMA(m)
HP 1250-1236 50Ω SMB(f) to BNC(f) (2 required)
HP 1250-0672 50Ω SMB(f) to SMB(f) (2 required)
HP 1250-0674 50Ω SMB(m) to SMA(f) (2 required)
HP 70000 system service kit HP 71000-60002[1]
HP 70001-60013 extender module
HP 70001-00038 right modified mainframe cover
HP 70001-00039 left modified mainframe cover
HP 5021-6773 cable puller
HP 8710-1651 short 8 mm hex-ball driver
HP 8710-1728 bandpass filter tuning tool
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) (three)
HP 5061-9021 390 mm SMB(f) to SMB(f) (seven)
HP 8160-0495 chromeric gasket (two feet)
HP 5021-7445 connector pin straightener
Accessory Service Tools
HP 8710-0033 nonmetallic tuning tool
HP 8710-1791 ceramic adjustment tool
HP 08555-20097 5/16 inch modified box wrench

1 This kit includes servicing tools used to repair all HP 70000 Series modular measurement system modules and a modification procedure for the HP 70001A mainframe which allows access to modules during bench testing and repair.

Specialized Test Equipment ET

Application of the Tune + Span ET

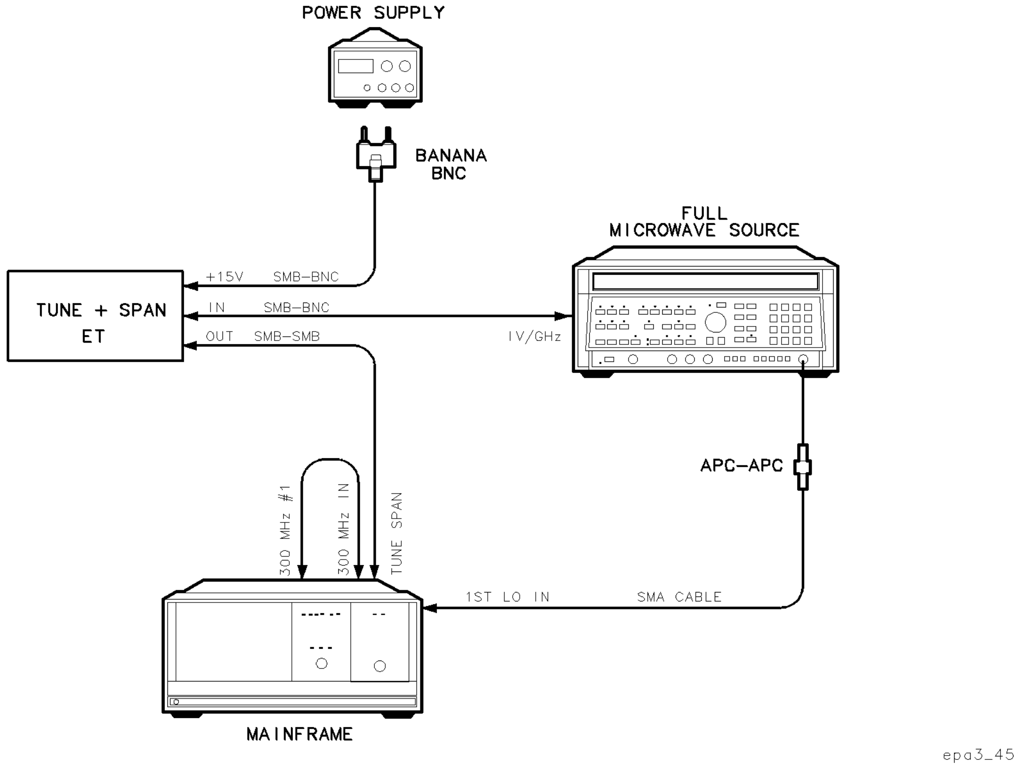


Figure 5-1. Typical Microwave Source Adjustment Setup Using Tune + Span ET

In a typical spectrum analyzer configuration, the HP 70900B local oscillator source Tune + Span ramp voltage (1.5 V/GHz) connects to the RF section rear panel Tune Span connector. The ramp tracks the 1ST LO IN signal and tunes the RF section SYTFMD. However, some RF section adjustments require that a microwave source substitute for the HP 70900B local oscillator source signal at the 1ST LO IN. The microwave source provides a tune voltage of either 0.5 V/GHz or 1.0 V/GHz. The Tune + Span ET converts the microwave source tune voltage to one compatible with the RF section Tune Span requirements.

Connections to the Tune + Span ET

1. Connect the “15 V” SMB jack to a +15 Vdc power supply.
2. Connect the “IN” SMB jack to the 1 V/GHz output of the microwave source.
3. Connect the third SMB jack labeled “OUT” to the RF section Tune Span.

Tune + Span ET

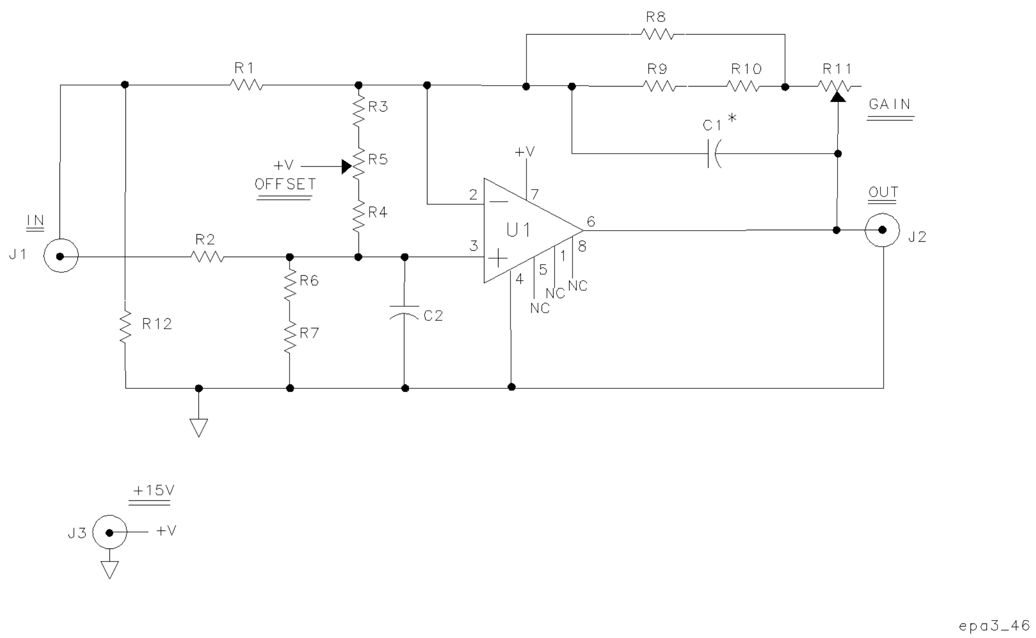


Figure 5-2. Tune + Span ET Schematic

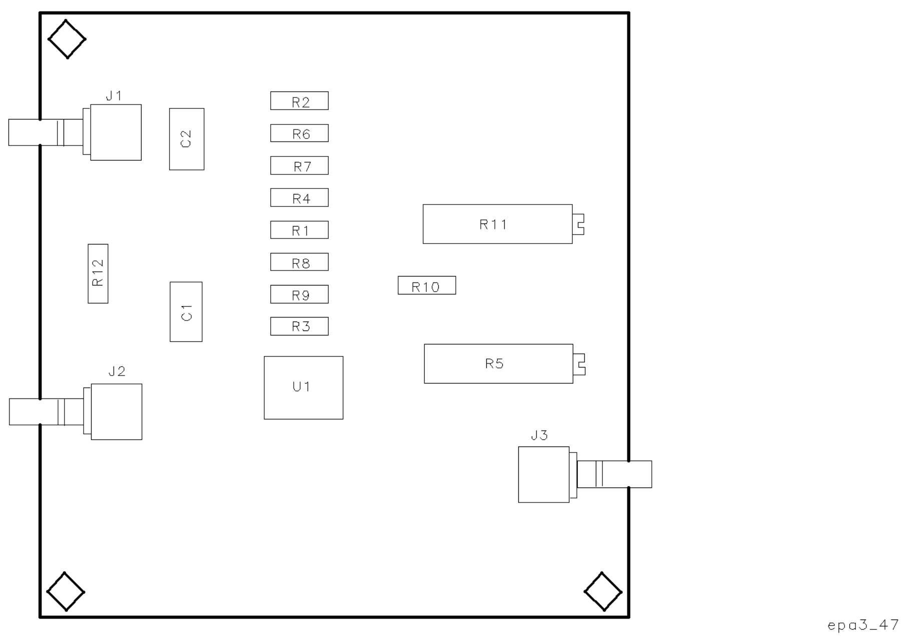


Figure 5-3. Tune + Span ET Component Locations

The non-inverting amplifier has a gain adjustment R11 and an offset adjustment R5. The two adjustments exhibit considerable interaction. Resistor R12 provides isolation between the input and output grounds. The HP 70908A RF section application does not require capacitors C1 and C2, but the holes are present to facilitate other applications. (Refer to Figure 5-3.)

Table 5-2. Tune + Span ET Parts Listing (1.5 V/GHz)

Ref.	HP Part No.	Description
	70908-20008	Board - Tune + Span
J1	1250-0543	Connector, SMB(m)
J2	1250-0543	Connector, SMB(m)
J3	1250-0543	Connector, SMB(m)
R1	0698-6322	Resistor, 4K 0.1% 1/8W
R2	0698-6322	Resistor, 4K 0.1% 1/8W
R3	0698-3260	Resistor, 464K 0.1% 1/8W
R4	0698-3260	Resistor, 464K 0.1% 1/8W
R5	2100-3165	Resistor, Var, 2M, 1 turn
R6	0698-6322	Resistor, 4K 0.1% 1/8W
R7	0698-6624	Resistor, 2K 0.1% 1/8W
R8	0698-3451	Resistor, 133K 1% 1/8W
R9	0698-6322	Resistor, 4K 0.1% 1/8W
R10	0698-6624	Resistor, 2K 0.1% 1/8W
R11	2100-3123	Resistor, Var, 500 ohms, 17 turns
R12	0757-0346	Resistor, 10 ohms 1% 1/8W
C1	not assigned	
C2	not assigned	
U1	1826-1049	Operational Amplifier

The printed-circuit board has part reference designators etched on the board surface. The assembly procedure consists of matching reference designators and parts descriptions, inserting the parts in the board, and then soldering. All parts are available from the Hewlett-Packard Support Materials Organization.

Tune + Span ET Ramp Converter Adjustment

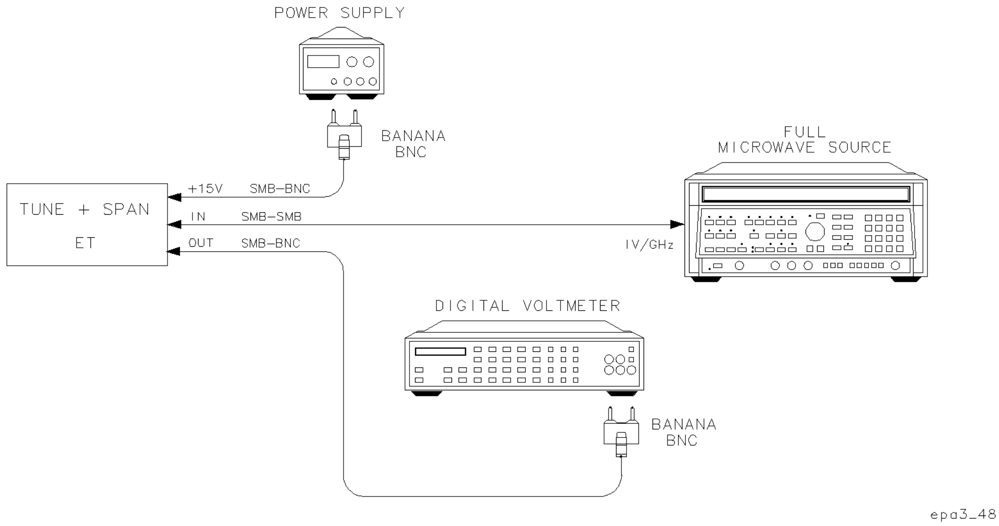


Figure 5-4. Tune + Span ET Ramp Converter Adjustment Setup

Adjusting the RF Section Tune + Span Ramp Converter

1. Connect the test setup shown in Figure 5-4.
2. Set the test equipment main-power switches to ON.
3. Set the power supply output to +15 Vdc.
4. Set the microwave source to 3 GHz, CW.
5. Adjust ET potentiometer R5, OFFSET, for 4.5 ±.3 mV as indicated by the DVM.
6. Set the microwave source to 6.6 GHz, CW.
7. Adjust ET potentiometer R11, GAIN, for 9.9 V ±0.3 mV as indicated by the DVM.
8. Repeat steps 3, 4, 5, and 6 until adjustment of R11 is not required.

Offset-Coil-Current ET

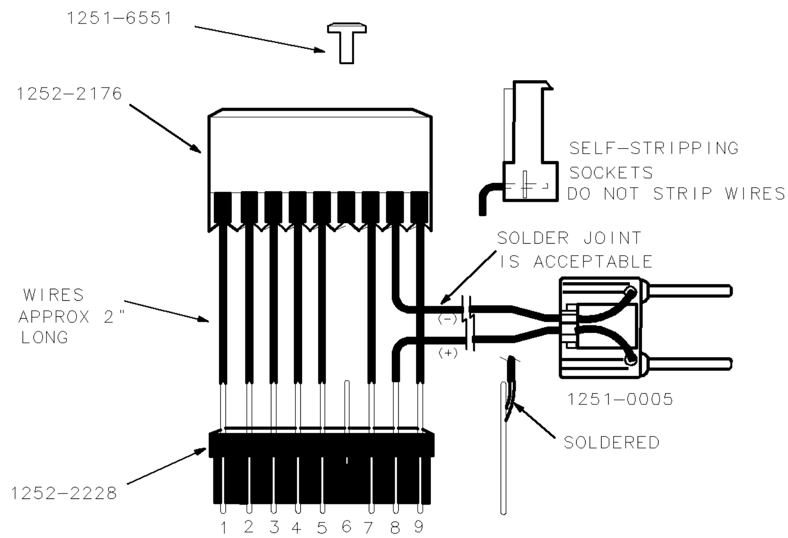


Figure 5-5. Equipment Setup for Offset-Coil-Current ET

Assembly Instructions

1. All connections should be soldered except for the press-in connections; there should be no clip-on connectors.
2. The connectors and the banana adapter are available from Hewlett-Packard; refer to Table 1-1.

Connections to the Offset-Coil-Current ET

1. On the A10 power supply/driver, remove the wire assembly connector from J203 and insert the Offset-Coil-Current ET.
2. Plug the wire assembly connector into the ET and the banana connector into a digital multimeter.

Current through the SYTFMD offset coil sets up a magnetic field that offsets the LO frequency for the 1L−, 2L−, and 4L− bands. An offset coil current adjustment assures an offset exactly 321.4 MHz above the RF frequency. The ET described here allows insertion of an ammeter in series with the coil while permitting normal SYTFMD operation. Leaving the SYTFMD fully in-circuit avoids warmup time before another adjustment.

6

System Calibration

This chapter contains preferred external frequency connections and the setups for all system calibration procedures that must be performed in order to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated. These automated setups require a controller and are run with software that is described in Chapter 2.

The information in this chapter is given in the following order:

External Frequency Reference

Most module verification tests and adjustment setups for the HP 70908A RF section require an external frequency reference. When running these tests, the HP 70900A/B local oscillator source module and instruments such as sources and analyzers must be connected to the same frequency standard.

In all cases, the specified aging rate requirement is 10^{-9}/day. The microwave source, synthesized source, and calibrated spectrum analyzer each have an internal time base that meets the aging rate requirement.

Figure 6-1 shows the preferred method of connecting a test system to a 10 MHz standard.

In (a), a frequency counter is connected to a house standard to ensure absolute frequency accuracy.

In (b), the 10 MHz internal frequency reference of an HP 8663A synthesized signal generator is used as the system reference. This method minimizes phase noise associated with chaining the same reference signal through several devices; it ensures that the last instruments in the chain receive reference signals of sufficient amplitude. The HP 8721A directional bridge splits the reference signal and ensures good isolation between the two reference signal paths.

Note The rear panel 10 MHz OUTPUT of the HP 3335A synthesizer/level generator lacks the spectral purity required for most applications as a frequency reference, and should not be connected to other test equipment.

The HP 8902A measuring receiver does not have a standard rear panel 10 MHz OUTPUT.

100 MHz Generation

The local oscillator requires a 100 MHz external reference. Most other instruments that need a reference require 10 MHz.

There are three equipment configurations used to generate the 100 MHz signal for the local oscillator:

- **HP 70310A Precision Frequency Reference and 10 MHz House Standard**

  In Figure 6-2 the 10 MHz frequency standard derives from the house standard (for example, the HP 5061B cesium beam standard). The house standard drives the HP 70310A precision frequency reference, which then generates the 10 MHz and 100 MHz signals.

- **HP 70310A Precision Frequency Reference**

  In Figure 6-3 the reference oscillator of the HP 70310A precision frequency reference provides a 100 MHz frequency standard output for the HP 70900A/B local oscillator source and a 10 MHz reference for most other electronic test equipment.

- **HP 8566B Spectrum Analyzer and 10 MHz House Standard**

  In Figure 6-4 the 100 MHz signal required by the HP 70900A/B local oscillator source comes from the HP 8566B spectrum analyzer 100 MHz calibrator output. The 6 or 10 dB pad prevents RF amplifier saturation. The RF amplifier must have a gain of at least 20 dB at 100 MHz.

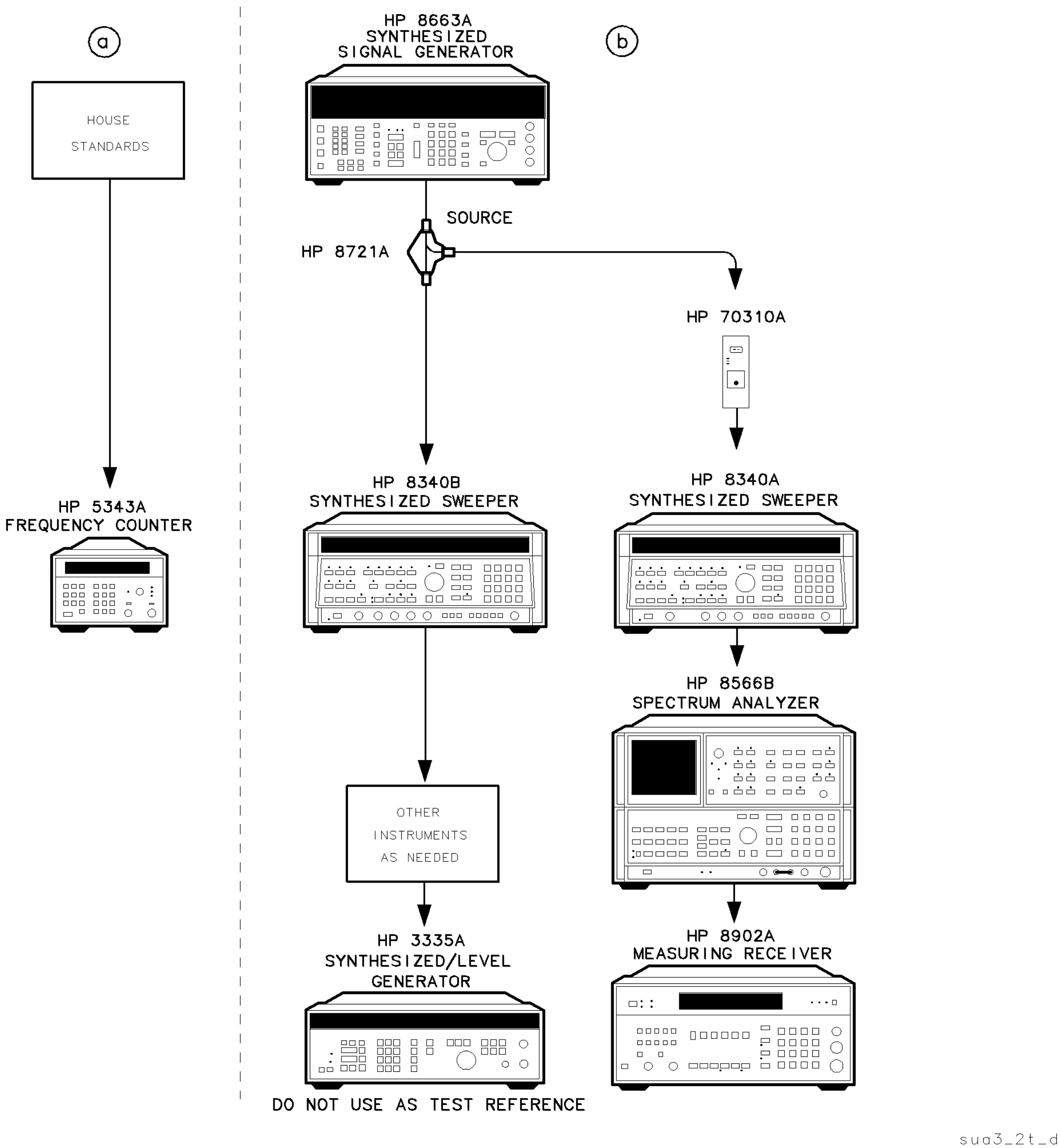


Figure 6-1. Preferred Frequency Reference Connections

External Frequency Reference

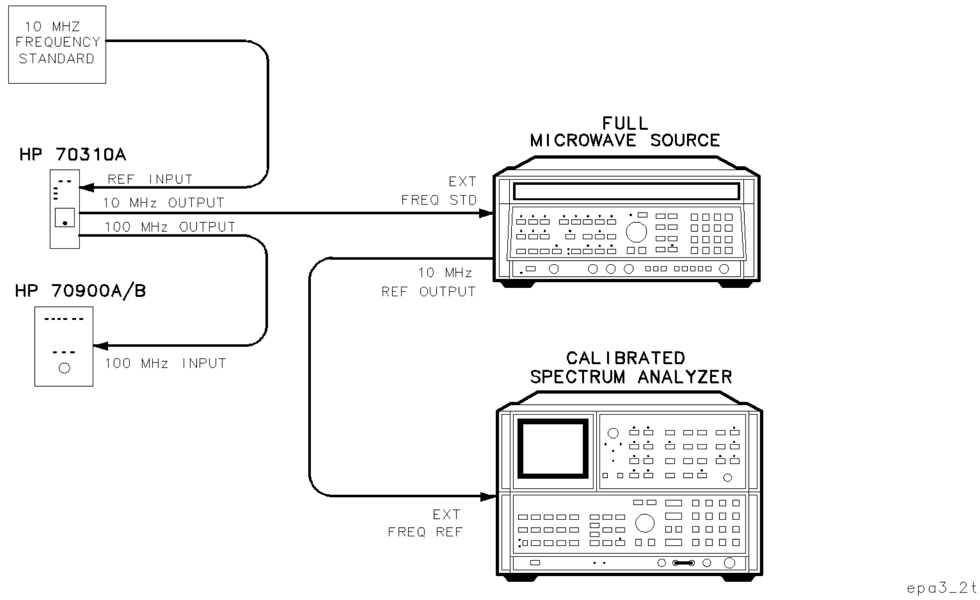


Figure 6-2. Using an HP 70310A Precision Frequency Reference and a House Standard

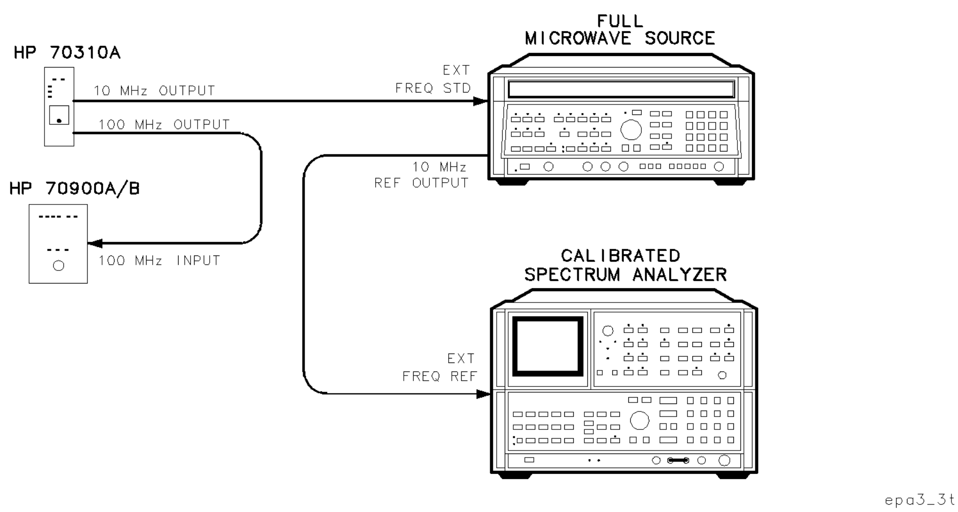


Figure 6-3. Using an HP 70310A Precision Frequency Reference

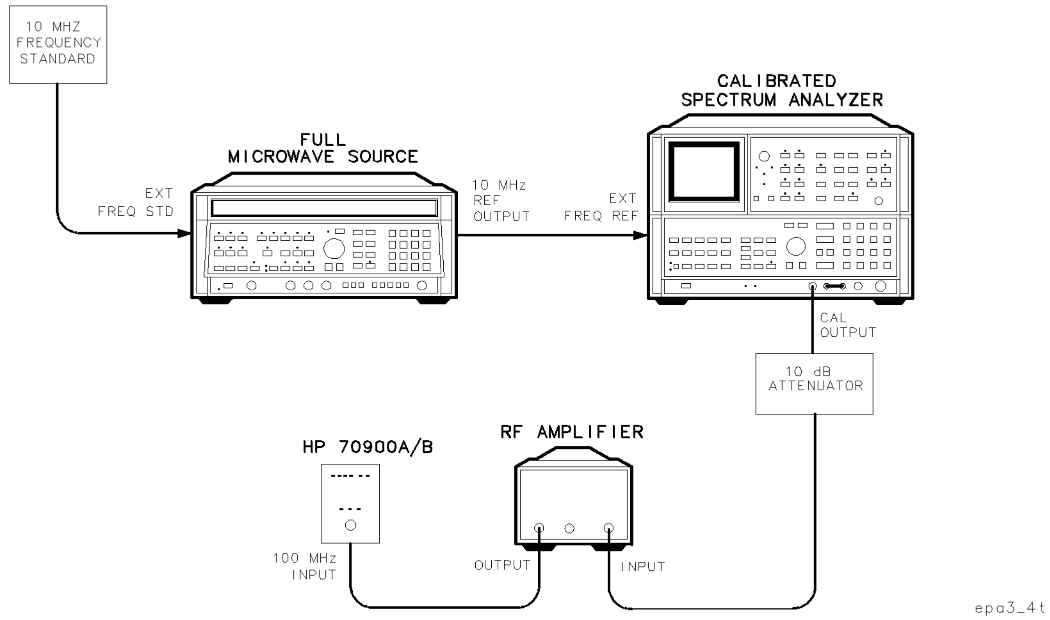


Figure 6-4. Using an HP 8566B Spectrum Analyzer and a House Standard

Test System Calibration

The verification tests require characterization of the sources, calibrated spectrum analyzer, scalar network analyzer, and noise figure meter. These calibrations store characterization data for verification tests measurement-correction in controller common memory.

The RF Section Module Verification Software automatically initiates and executes the ETE (Electronic Test Equipment) calibration routines and verifies the presence of calibration factors for the required test equipment. When the user moves to a different test group (tests that use common instruments), a new calibration screen shows any instruments that need characterization.

The controller treats aborted tests the same as pressing (Reset), which restarts the test. In sequence-mode the calibration screens are transparent, but in single mode the user can move from test to test. Pressing Exit Cal allows loading of a previously selected test.

Synthesized Source Calibration

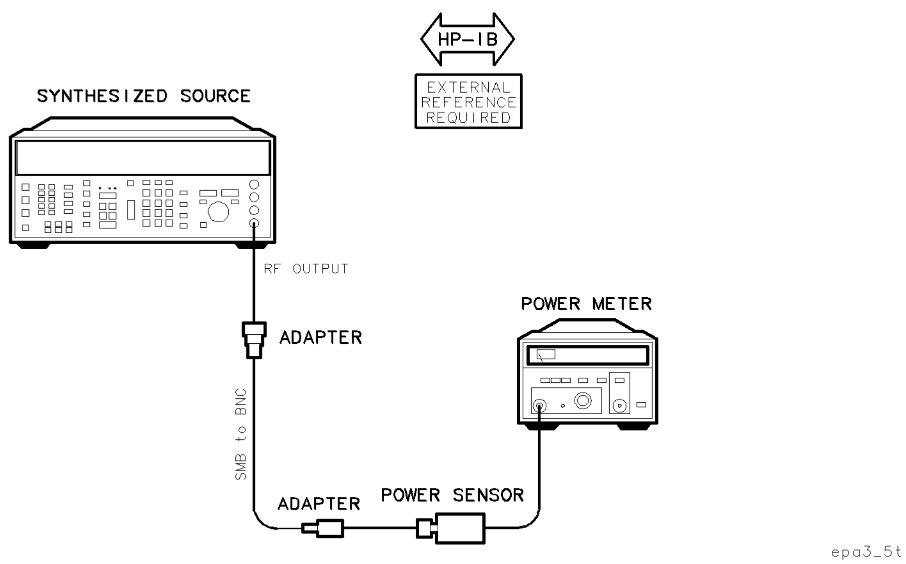


Figure 6-5. Synthesized Source Calibration Test Setup

Test Equipment	Preferred Model Numbers
Synthesized source	HP 8663A synthesized signal generator
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Power meter	HP 436A power meter
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)

The purpose of this procedure is to calibrate the amplitude settings for the synthesized source, which drives the 300 MHz IN of the DUT. This procedure also calibrates the amplitude degradation due to the BNC to SMB cable assembly. (Refer to Figure 6-5.)

The power sensor connects to the RF output of the synthesized source, which increments in amplitude from −5 to 5 dBm. Each amplitude adjusts to achieve the correct power output. The routine stores final amplitude settings in controller common memory.

Microwave Source Calibration

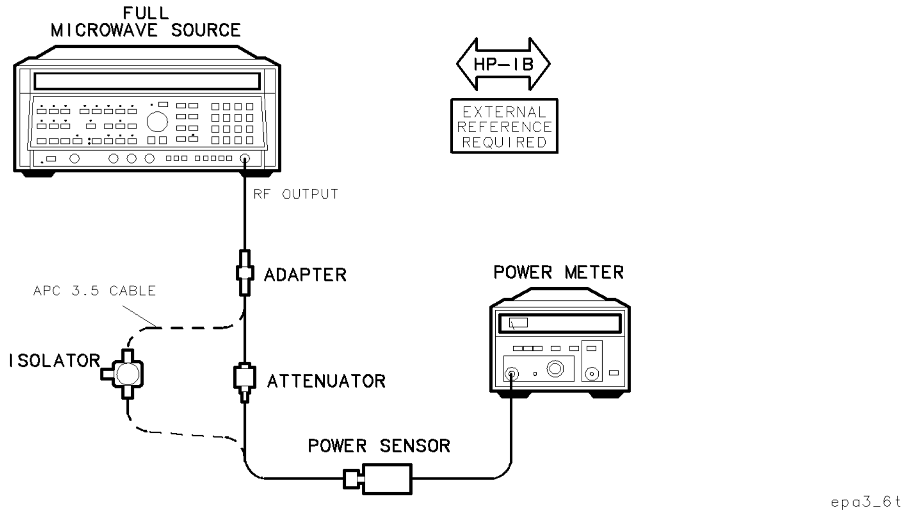


Figure 6-6. Microwave Source Calibration Test Setup

Test Equipment	Preferred Model Numbers
Full microwave source	HP 8340A synthesized sweeper
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Power meter	HP 436A power meter
Isolator	HP 0955-0204 microwave isolator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The purpose of this procedure is to calibrate the frequency response of the microwave source, the 6 dB fixed attenuator, and the cable assembly.

The full microwave source steps in discrete CW frequencies from 10 MHz to 22 GHz. At each frequency, the amplitude of the full microwave source adjusts until the power meter reads either −10 or +0.5 dBm, depending on the step frequency. The routine stores the full microwave source amplitudes in controller common memory.

When an isolator replaces the 6 dB fixed attenuator, this procedure calibrates the microwave source when it is used as a 1st LO source with adjustable amplitude, replacing the local oscillator at the DUT 1st LO IN. The procedure includes compensation for frequency response of the cable.

The microwave source increments in discrete 20 MHz CW steps, 3 to 6.6 GHz. At each frequency step the amplitude of the microwave source adjusts until the power meter reads 0.2 dBm. Controller common memory stores the microwave source amplitudes.

HP 8566B Spectrum Analyzer Calibration

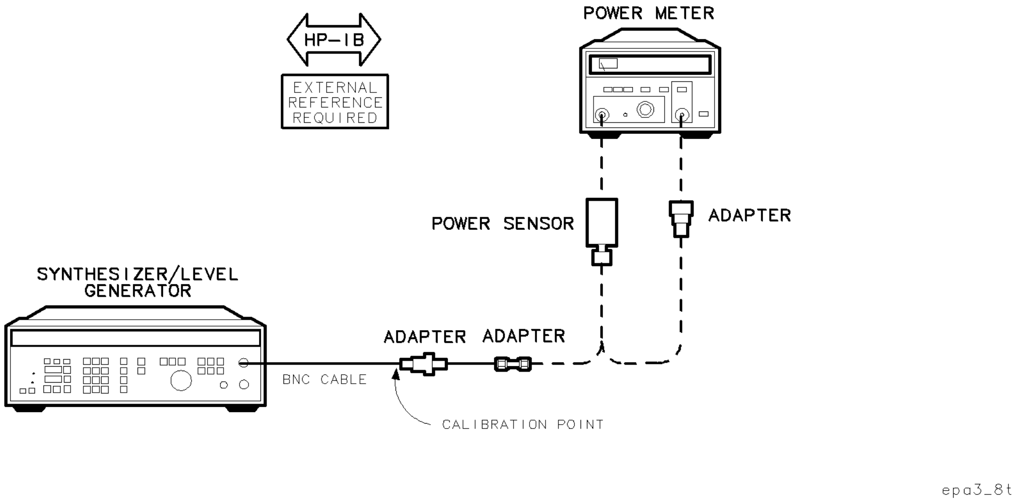


Figure 6-7. Spectrum Analyzer Reference Calibration Test Setup

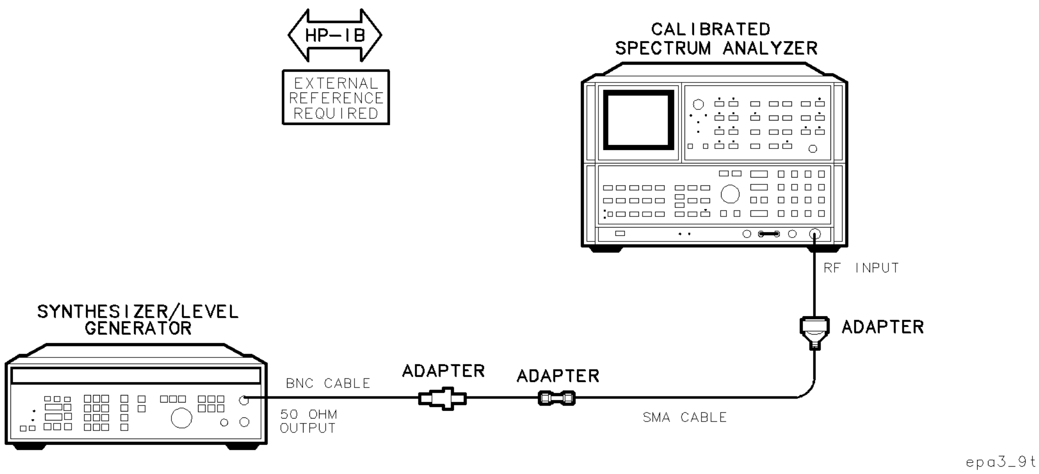


Figure 6-8. Spectrum Analyzer IF Calibration Test Setup

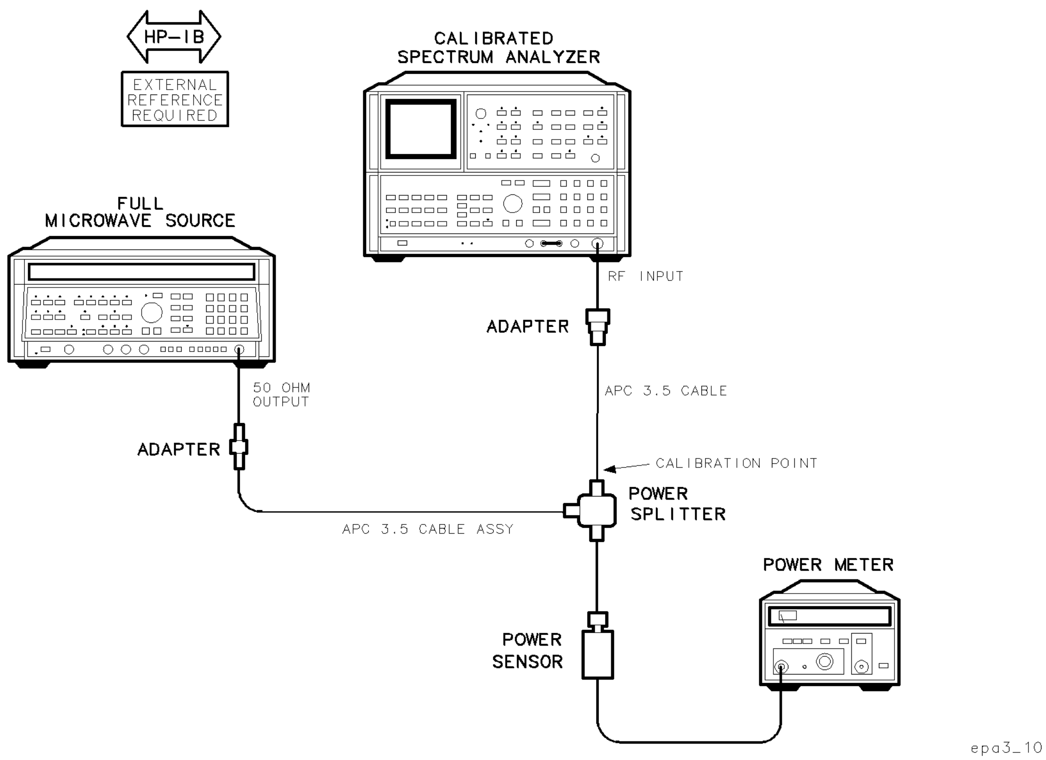


Figure 6-9. Spectrum Analyzer RF Calibration Test Setup

Test Equipment	Preferred Model Numbers
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
Level generator	HP 3335A synthesizer/level generator
Microwave source	HP 8340A synthesized sweeper
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Power meter	HP 436A power meter
Power splitter	HP 11667B power splitter
External reference	Refer to "External Frequency Reference".
Cable (2 required)	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 5061-9038 520 mm SMA(m) to SMA(m)
Adapter	HP 1250-1200 50Ω SMA(m) to BNC(f)
Adapter	HP 1250-1158 50Ω SMA(f) to SMA(f)
Adapter	HP 1250-1250 50Ω N(m) to SMA(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)

Note Reference to the HP 8566B spectrum analyzer implies use of the same RF cable used during calibration of the analyzer; they are a matched set. If a test requires the calibrated analyzer, always connect to the cable rather than directly to the analyzer input.

The purpose of this procedure is to characterize the calibrated spectrum analyzer IF and RF paths. The routine stores the characterization data as measurement amplitude corrections in the controller common memory.

Test System Calibration

Calibration consists of the following three procedures:

Reference calibration measures a reference signal and uses the signal to characterize the 10 kHz bandwidth and log fidelity of the spectrum analyzer. The power meter measures level generator output, which is set at 20 MHz, −10 dBm at the end of the cable. Figure 6-7 shows the required calibration setup.

IF calibration characterizes spectrum analyzer error in step gain, resolution-bandwidth filter-switching amplitude, and log fidelity. All measurements are normalized to a 10 kHz resolution bandwidth setting. The user connects the level generator output to the calibrated spectrum analyzer RF input cable and adjusts the calibrated spectrum analyzer FREQ ZERO and AMPTD CAL. Figure 6-8 shows the required calibration setup.

RF calibration measures the frequency response of the calibrated spectrum analyzer and the APC 3.5 cable. Figure 6-9 shows the required calibration setup.

Flatness Calibration

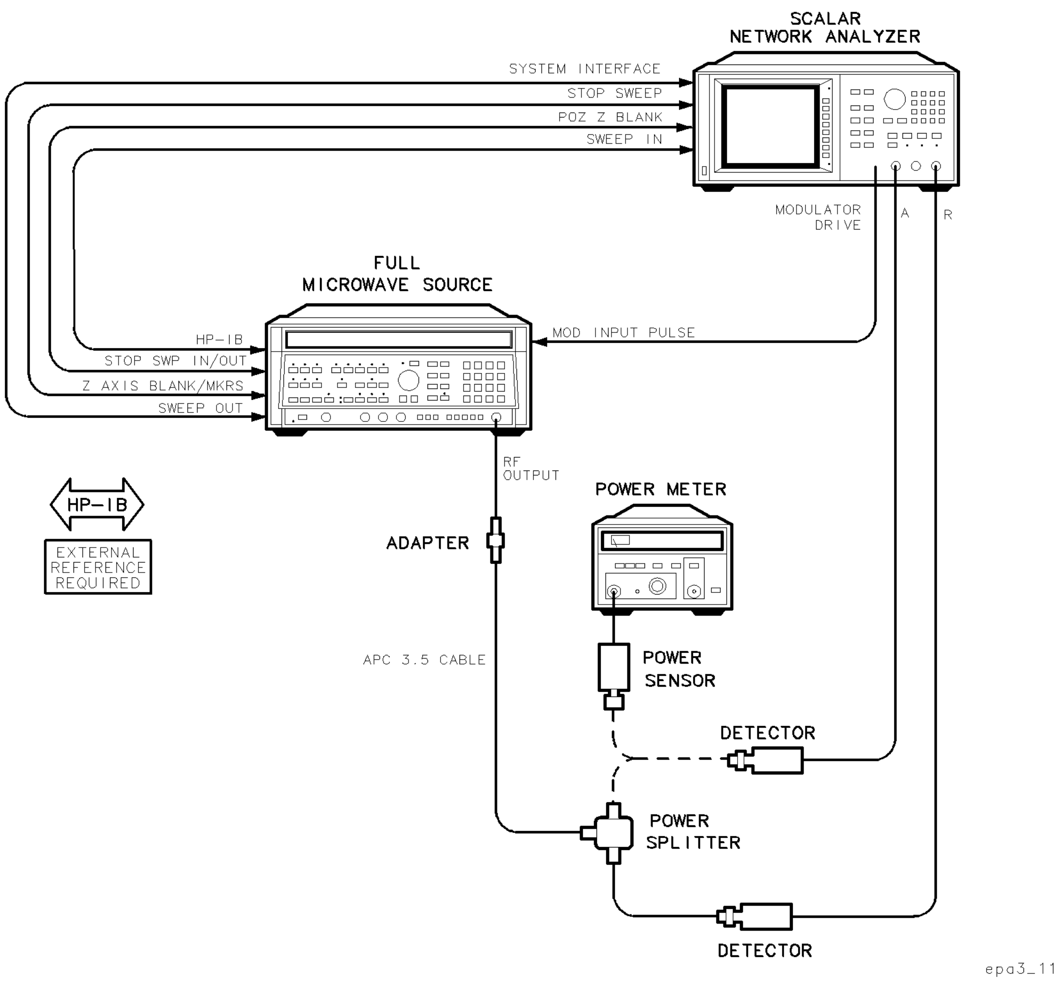


Figure 6-10. Flatness Calibration and Verification Test Setup

Test Equipment	Preferred Model Numbers
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to “External Frequency Reference”.
Power meter	HP 436A power meter
Power splitter	HP 11667B power splitter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Detector (2 required)	HP 11664E detector
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)

The purpose of this procedure is to calibrate out the detectors and power splitter and store the calibration factors in controller common memory.

The full microwave source increments in discrete steps from 10 MHz to 22 GHz. At each step, full microwave source amplitude adjusts until the power meter reading is −8 dBm. This calibrates out the approximately 6 dB loss through the power splitter. The procedure stores full microwave source amplitude in controller common memory.

The scalar network analyzer measures the absolute R channel power. The correction factor is the scalar network analyzer measurement minus the power meter measurement. This calibrates out the R channel detector.

The user removes the power sensor from the power splitter and attaches the network analyzer channel A detector to the power splitter. The full microwave source tunes to 21.4 MHz, and then the scalar network analyzer measures the A/R ratio and stores this ratio in the controller common memory.

Return Loss Test Block Calibration

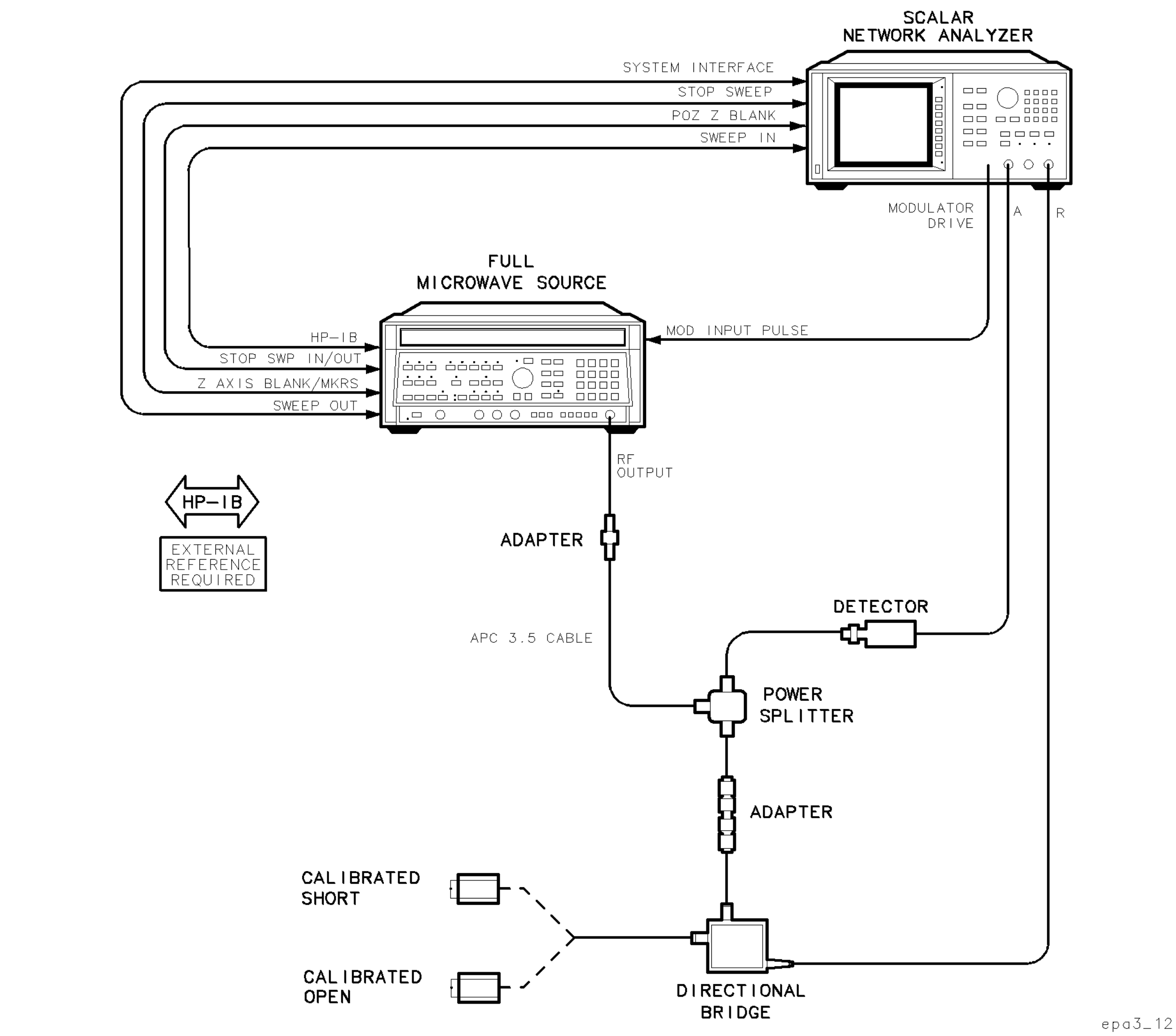


Figure 6-11. Return Loss Test Block Calibration Setup

Test Equipment	**Preferred Model Numbers**
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to “External Frequency Reference”.
Power splitter	HP 11667B power splitter
Directional bridge	HP 85027B directional bridge
Detector	HP 11664E detector
Calibrated open/short	HP 85027-60004 calibrated open/short
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The purpose of this procedure is to provide open/short calibration of the detectors and the scalar network analyzer used in return loss verification tests. The particular return loss test determines the calibration frequency ranges. The calibration data is stored in controller common memory.

The scalar network analyzer is in A/R ratio mode for all return loss measurements. The full microwave source provides the incident signal.

The user connects the calibrated short to the directional bridge test port and then chooses to calibrate either an individual port or all test ports. The full microwave-source/network analyzer combination sweeps over a port-dependent frequency range given in the test descriptions. The user then connects the calibrated open to the test port. The routine saves the responses from the two setups.

The routine converts the short/open data from logarithmic to linear, averages the converted data, and then converts it back to logarithmic data. The averaged logarithmic data is stored in controller common memory.

Noise Figure Meter Calibration

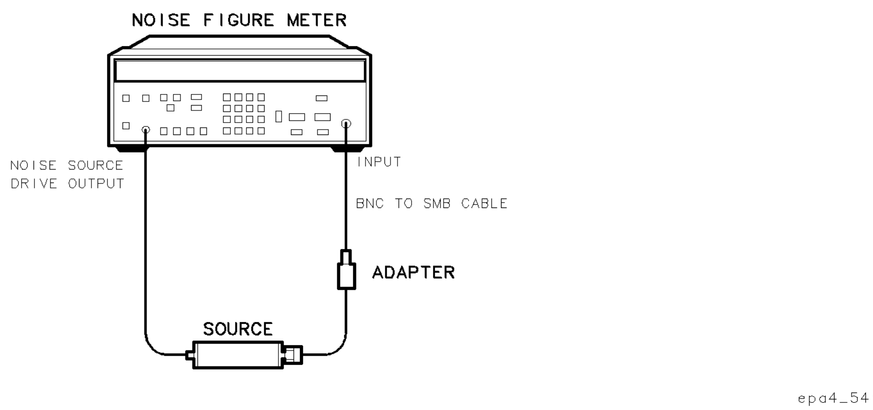


Figure 6-12. Noise Figure Meter Calibration Test Setup

Test Equipment	**Preferred Model Numbers**
Noise figure meter	HP 8970B noise figure meter
Excess noise source	HP 346C broadband noise source
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)

The purpose of this routine is to calibrate the noise figure meter and the input cable with the noise source.

1. Connect the noise figure meter noise-source-drive-output to the 28 Vdc bias input of the excess noise source.
2. Connect the output of the noise source to the input of the noise figure meter.

7

Adjustment Procedures

This chapter contains the setups for all adjustment procedures that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated. These automated setups require a controller and are run with software that is described in Chapter 2.

A procedure is considered an adjustment when the cover plate of a module must be removed to perform a repair or an adjustment. A procedure is also considered an adjustment when a module is replaced.

Additionally, a procedure is considered a test when checks are performed on a module and cover plates and modules are not removed from a system.

The information in this chapter is given in the following order:

Before You Make Adjustments

Recommended Test Equipment

Refer to Chapter 5 for a list of test equipment, accessories, and related critical specifications. Refer to "Preparing a Static-Safe Work Station" in Chapter 4 for a list of ESD accessories.

The only recommended nonmetallic tuning tool is the HP part number 8170-0033 fiber tuning tool. Never force an adjustable component, especially slug-tuned inductors or variable capacitors.

If the cover of the 2nd converter is removed to make an adjustment, replace it with an HP 5022-1150 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

Overall Adjustment Setup

The basic overall setup in Figure 7-1 is applicable to most RF section adjustment tests. Adjustments require that the HP 70908A RF section, often referred to as the DUT (device-under-test), be connected to an extender cable. The adjustment setups do not generally show the LO and the Tune Span connections.

Setups that utilize the tune-span ET (electronic tool) have alternate connections to the TUNE SPAN and 1st LO IN connectors. In all setups that receive inputs from the LO module rear panel, the LO module must meet its specifications for the particular output.

CAUTION To avoid connector damage, a blown mainframe line fuse, or a blown module fuse, the mainframe main power switch must be set to OFF before connecting or disconnecting the extender module cable.

1. With the mainframe line switch OFF, remove the HP 70908A RF section from the mainframe.
2. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
3. Connect the equipment as illustrated in the appropriate test setup, and then set the mainframe line switch to ON.

Note The test equipment must be allowed to warm up for 30 minutes before proceeding with a test.

4. Load and run the appropriate adjustment routine. Refer to Chapter 2 for information about running the software.

External Frequency Reference

The external reference symbol on an a adjustment setup diagram indicates that the HP 70000 Series modular spectrum analyzer system and equipment such as sources, analyzers, and frequency counters must connect to the same frequency standard. (Refer to "External Frequency Reference" in Chapter 6.)

HP-IB Symbol

The Hewlett-Packard Interface Bus (HP-IB) symbol that appears on the adjustment procedure setups indicates that the controller and test equipment need to be linked together with HP-IB cables.

Overall Adjustment Equipment Setup

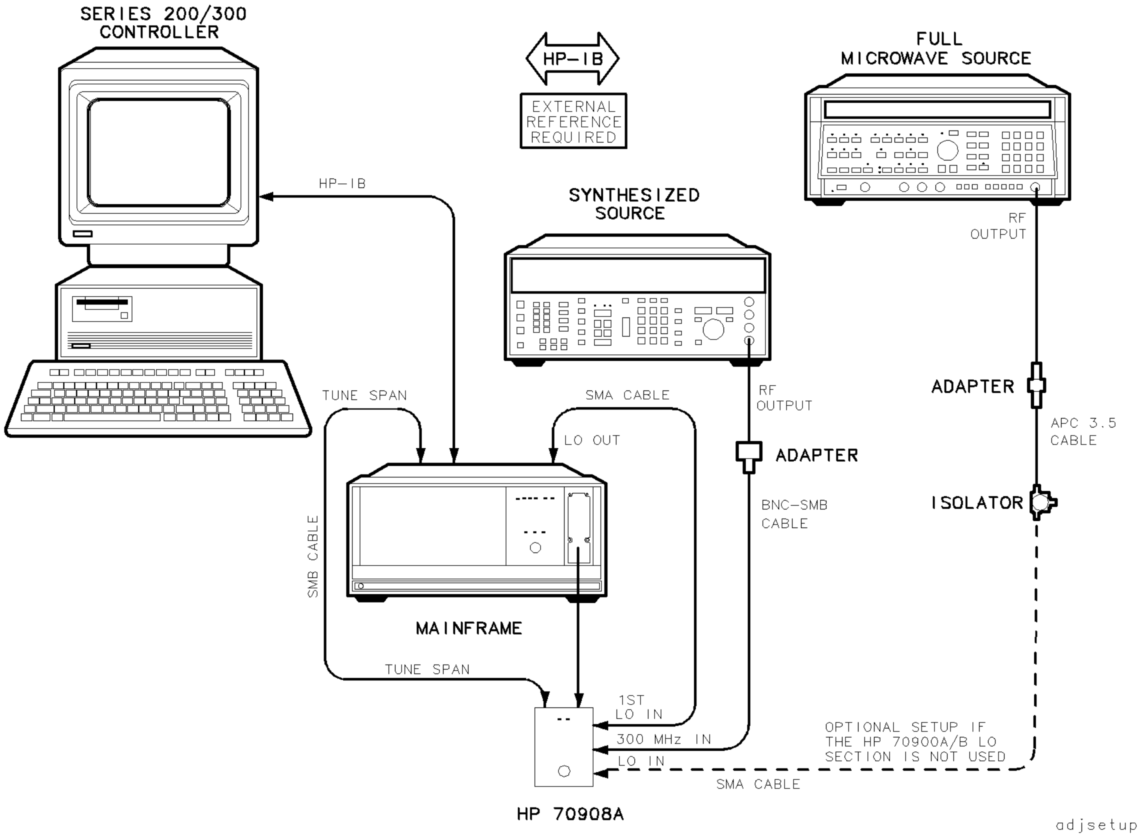


Figure 7-1. Overall Adjustment Equipment Setup

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator source	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to "External Frequency Reference" in Chapter 6.
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Cable	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 5061-9038 520 mm SMA(m) to SMA(m)
For optional LO setup	
Isolator	HP 0955-0204 microwave isolator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 5061-9038 520 mm SMA(m) to SMA(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

Adjustment 01. LOLA Gate Bias

CAUTION

- To prevent LOLA FET damage, the DVM 100 V range provides lower input resistance which allows drain off of the probe-cable capacitance.
- To prevent adjustment errors, do not connect the HP 70900A/B local oscillator source output to the HP 70908A RF section.

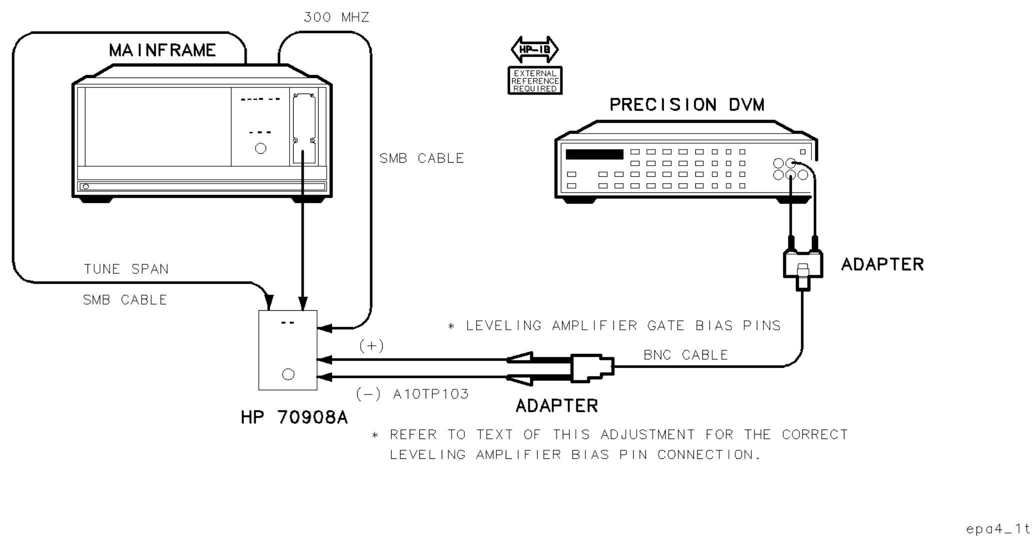


Figure 7-2. Equipment Setup for Adjustment 01. LOLA Gate Bias

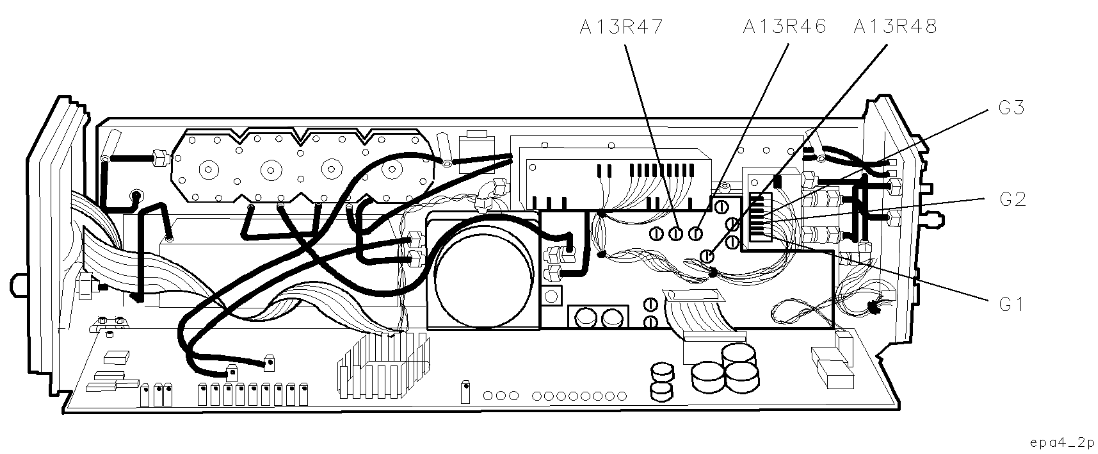


Figure 7-3. Locations for Adjustment 01. LOLA Gate Bias

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the three LO leveling amplifier (LOLA) gate-bias voltages to values listed on the multiplier assembly.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-2.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 01. LOLA Gate Bias. Refer to Chapter 2 for information about running the software.

The DVM connects to an A1 leveling amplifier bias pin. The user enters the gate bias voltage listed on the A1 leveling amplifier and adjusts the gate bias voltage ±5 mV. The procedure repeats for all three bias pins.

Adjustment 02. Multiplier Gate Bias

CAUTION

- To prevent multiplier FET damage, the DVM 100 V range provides lower input resistance which allows drain off of the probe-cable capacitance.
- To prevent adjustment errors, do not connect the HP 70900A/B local oscillator source output to the HP 70908A RF section.

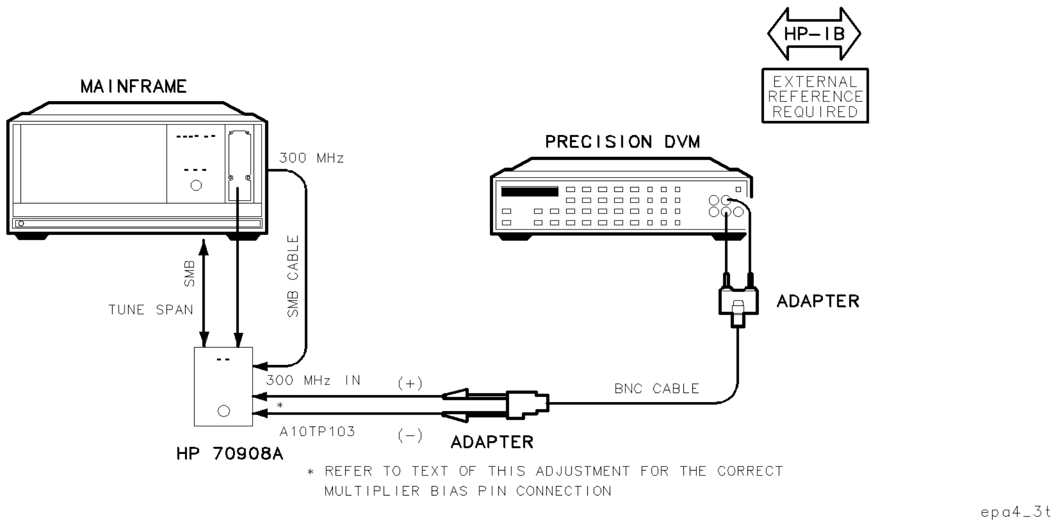


Figure 7-4. Equipment Setup for Adjustment 02. Multiplier Gate Bias

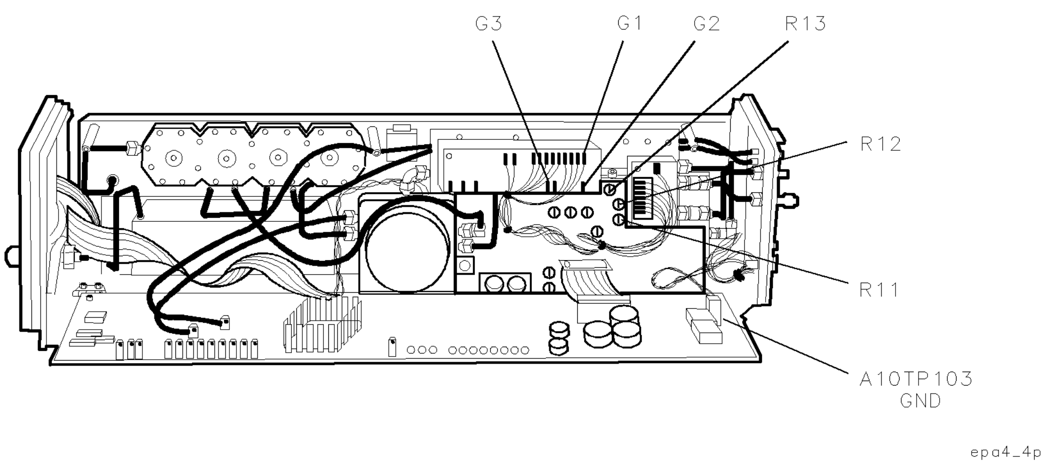


Figure 7-5. Locations for Adjustment 02. Multiplier Gate Bias

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the three multiplier gate-bias voltages to the values listed on the multiplier assembly.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-4.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 02. Multiplier Gate Bias. Refer to Chapter 2 for information about running the software.

The DVM connects to a multiplier bias pin. The user enters the gate bias voltage listed on the multiplier assembly and adjusts the gate bias voltage ±5 mV. The procedure repeats for all three bias pins.

Adjustment 03. Reference Voltage

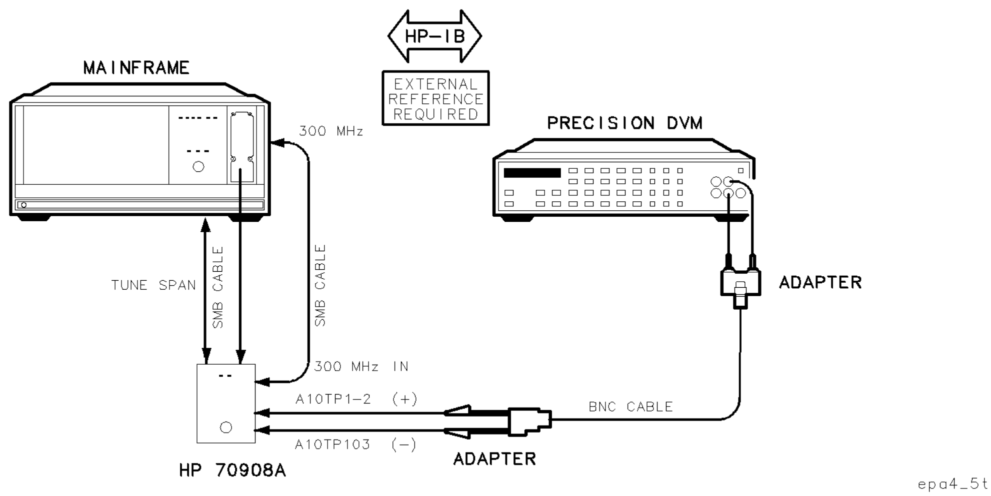


Figure 7-6. Equipment Setup for Adjustment 03. Reference Voltage

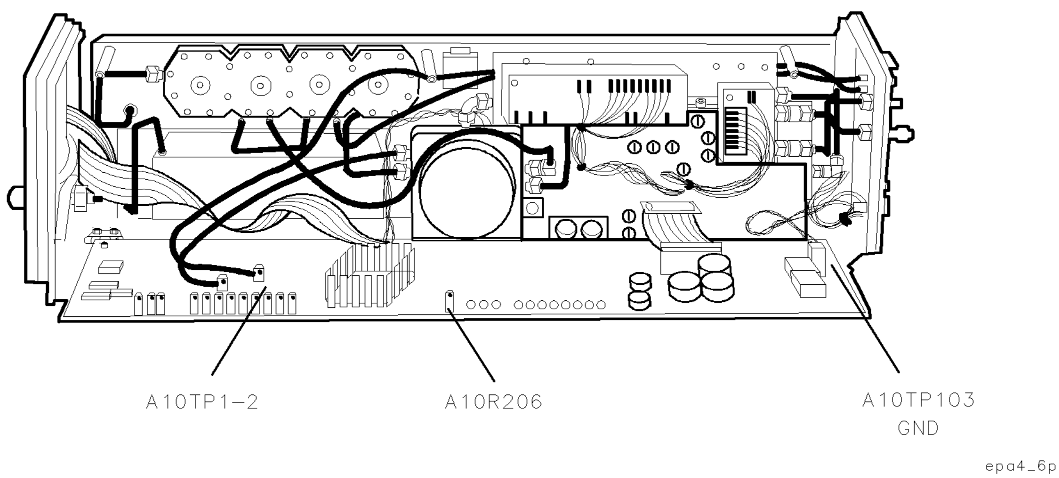


Figure 7-7. Locations for Adjustment 03. Reference Voltage

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Precision DVM	HP 3458A digital multimeter
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the switched, YIG-tuned filter, mixer, discriminator (SYTFMD) reference voltage.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-6.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 03. Reference Voltage. Refer to Chapter 2 for information about running the software.

The DVM connects to TP1-2 on the A10 power supply/driver. The user adjusts the reference voltage to 9 V ±5 mV.

Adjustment 04. LOLA Power Out

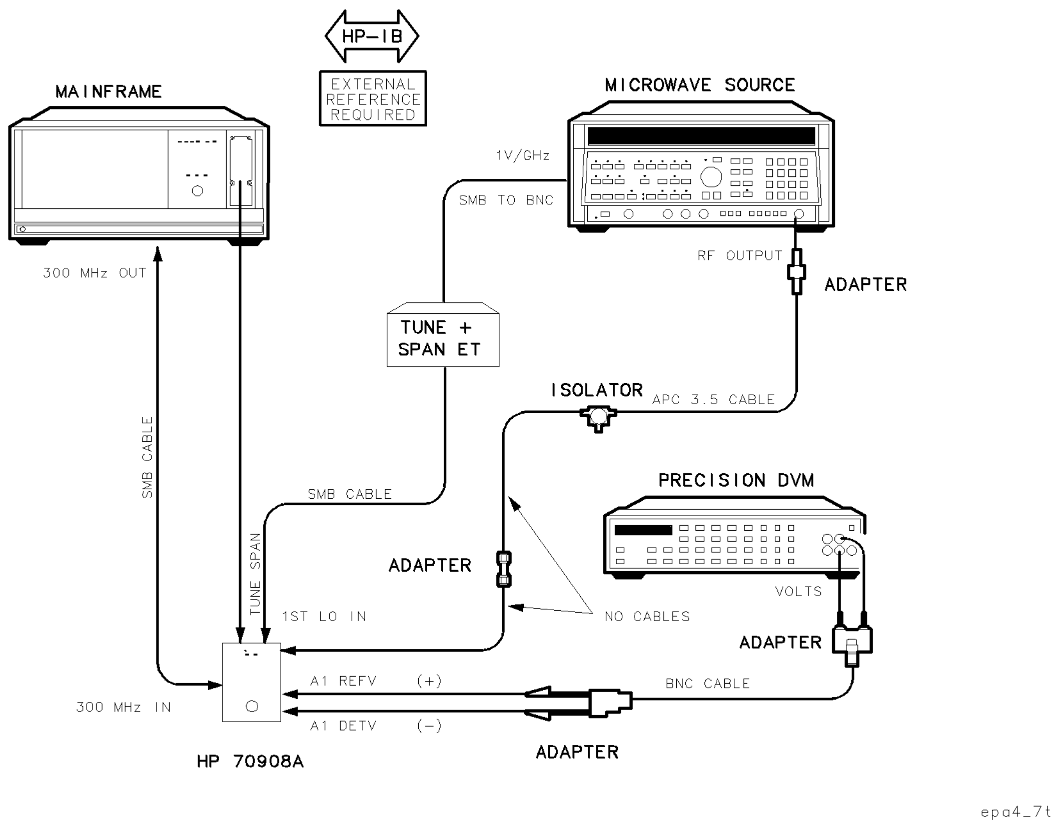


Figure 7-8. Equipment Setup for Adjustment 04. LOLA Power Out

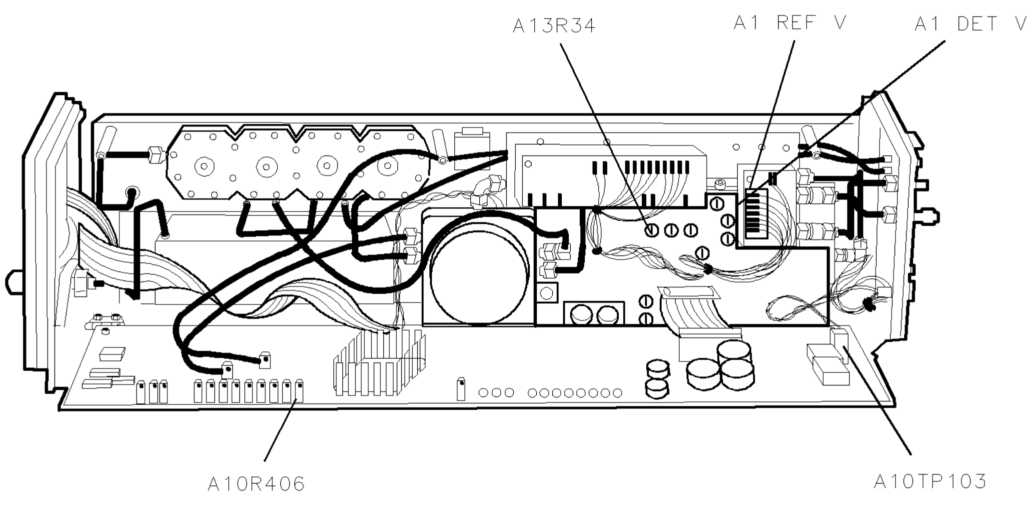


Figure 7-9. Locations for Adjustment 04. LOLA Power Out

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to "Specialized Test Equipment ET" in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the LO leveling amplifier power output by measuring and adjusting a detector voltage proportional to the power out. The proper voltage is listed on a label affixed on the A1 leveling amplifier.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-8.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 04. LOLA Power Out. Refer to Chapter 2 for information about running the software.

The microwave source provides 3 GHz, 8 dBm, at the DUT 1ST LO IN. The DVM(+) lead connects to the leveling amp REF V, and the DVM(−) lead connects to the leveling amp DET V. The DUT frequency band is 1L−. The user enters the A1 leveling amplifier detector voltage and adjusts to that voltage ±5mV as indicated on the DVM.

Adjustment 05. LOLA Tuned Filter

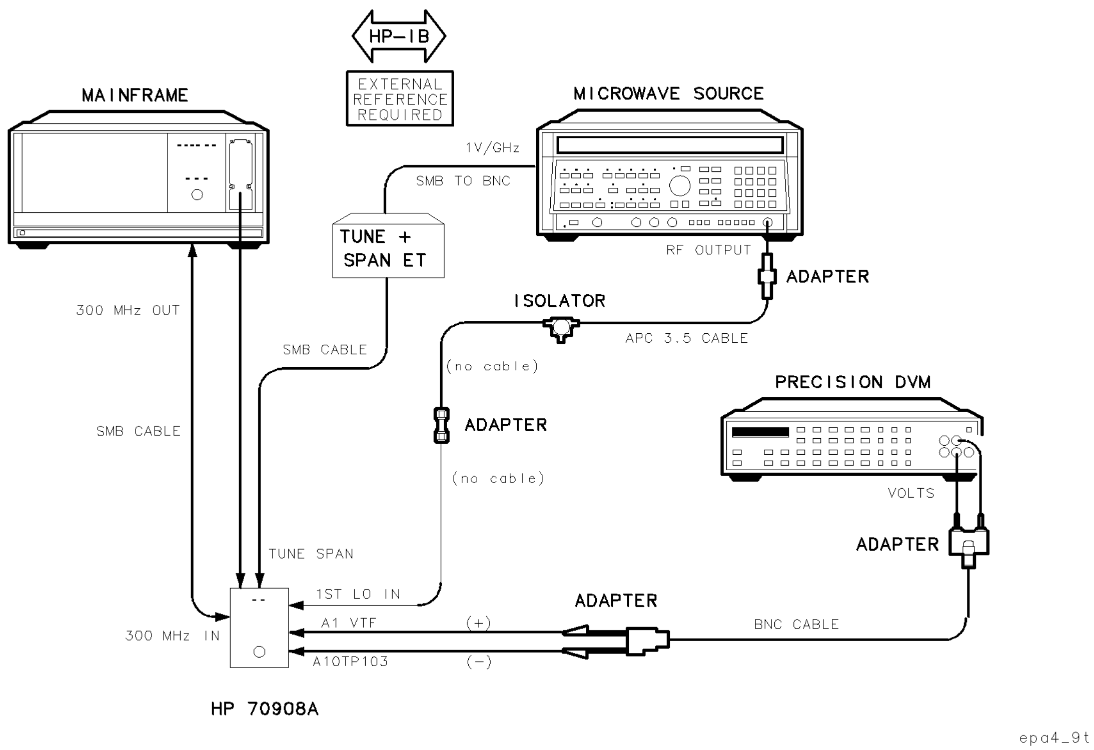


Figure 7-10. Equipment Setup for Adjustment 05. LOLA Tuned Filter

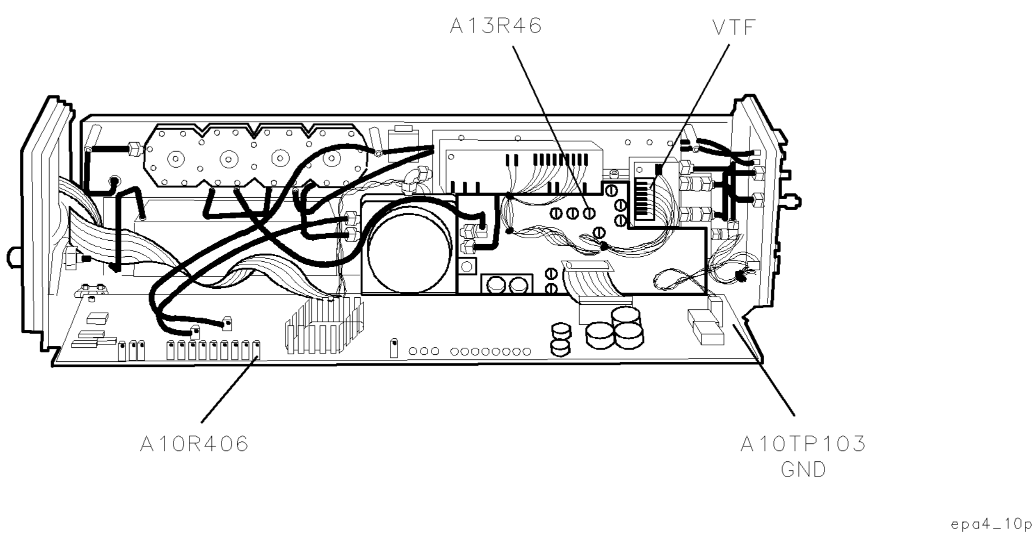


Figure 7-11. Locations for Adjustment 05. LOLA Tuned Filter

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the LO leveling amplifier tuned filter. The proper voltage is listed on a label affixed on the A1 leveling amplifier.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-10.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 05. LOLA Tuned Filter. Refer to Chapter 2 for information about running the software.

The DUT frequency band is 1L−. The microwave source provides 3 GHz connected through an isolator to the DUT 1ST LO IN.

The user enters the detected voltage listed on the A1 leveling amplifier, and then adjusts to that voltage (VTF @ 3 GHz), ±5 mV. The microwave source steps 36 frequencies from 3 to 6.5 GHz, at 5, 8, and 12 dBm. At every combination, a routine reads module diagnostics and compares them with test limits.

Adjustment 06. SYTFMD Offset Coil

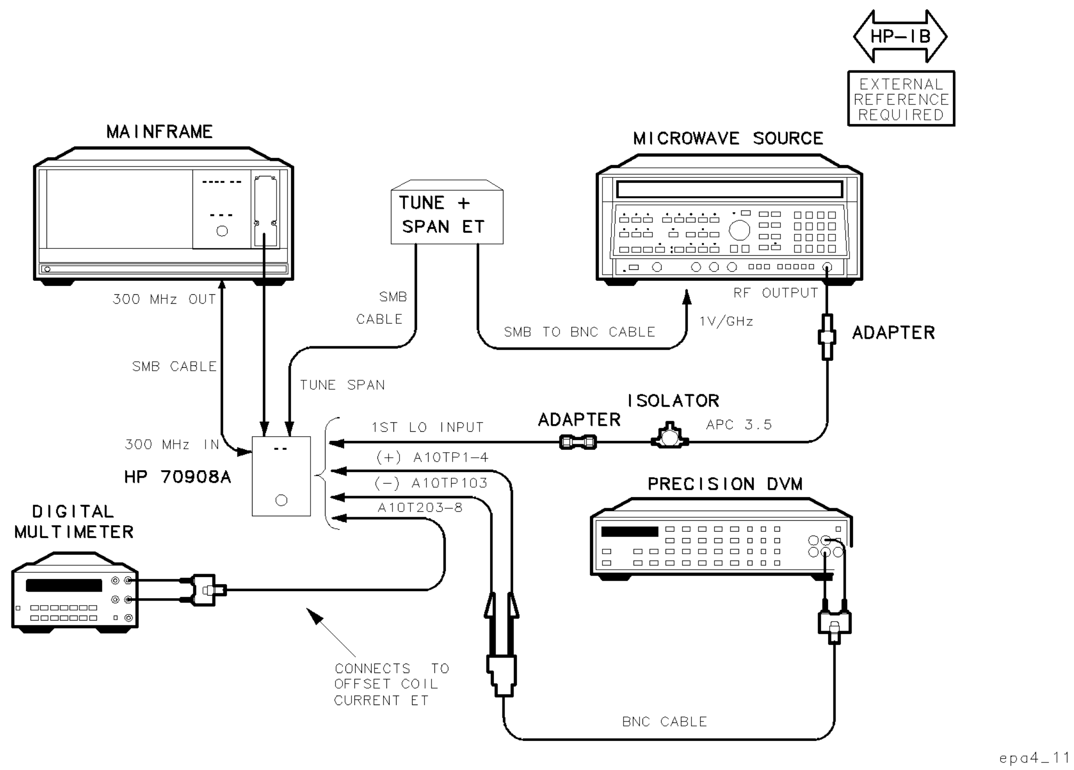


Figure 7-12. Equipment Setup for Adjustment 06. SYTFMD Offset Coil

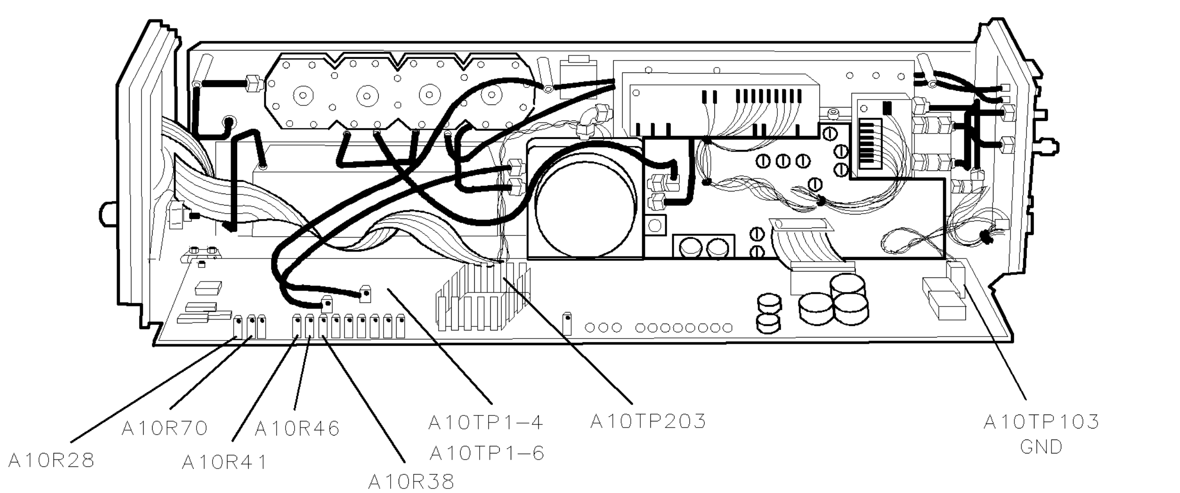


Figure 7-13. Locations for Adjustment 06. SYTFMD Offset Coil

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to "External Frequency Reference" in Chapter 6.
Digital multimeter	HP 3478A digital multimeter
Precision DVM	HP 3458A digital multimeter
Isolator	HP 0955-0204 microwave isolator
Offset-Coil-Current ET	Refer to "Specialized Test Equipment ET" in Chapter 5.
Tune + Span ET	Refer to "Specialized Test Equipment ET" in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the switched, Yig-tuned filter, mixer, discriminator (SYTFMD) offset coil driver.

Compensation to the Tune + Span ramp voltage corrects for offset, slope, and square law errors. The compensated voltage drives current through the offset coil, and this tunes the discriminator sphere 321.4MHz above the RF frequency in the 1L−, 2L−, and 4L− bands.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-12.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 06. SYTFMD Offset Coil. Refer to Chapter 2 for information about running the software.

The microwave source connects to the DUT 1ST LO IN. The synthesized source provides 300 MHz, 0 dBm, at the DUT 300 MHz IN. The Tune + Span ET output connects to the DUT TUNE SPAN. The DVM measures dc volts at A10TP1-4. The DMM measures dc current through A10TP203-8 using the Offset-Coil-Current ET.

The user enters offset, slope, and square law data from the SYTFMD label, and the test then calculates required current values.

The DUT band is 1L−, and the microwave source provides 4441 MHz. The user adjusts A10R38 for the calculated offset current. The DUT is set to band 2L−, and the microwave source tunes to 10 GHz. The user then adjusts A10R41 for the calculated slope current. These adjustments repeat as required for results within test limits.

Adjustment 06. SYTFMD Offset Coil

The DUT and microwave source tune to allow the user to adjust A10R70 to a calculated breakpoint voltage as indicated on the DVM. The DUT and microwave source then tune to allow the user to adjust A10R28 to a square law breakpoint voltage, and A10R46 for maximum squared offset voltage at 22 GHz.

The microwave source steps incrementally from 3021.4 to 6521.4 MHz, 3160.7 to 6560.7 MHz, and 3230.35 to 5580.35 MHz, in bands 1L−, 2L−, and 4L−, respectively. The DUT tunes at each step to center the RF INPUT signal. The test calculates current errors by subtracting the actual offset-coil currents from the calculated current values.

Adjustment 07. SYTFMD Main Coil Preset

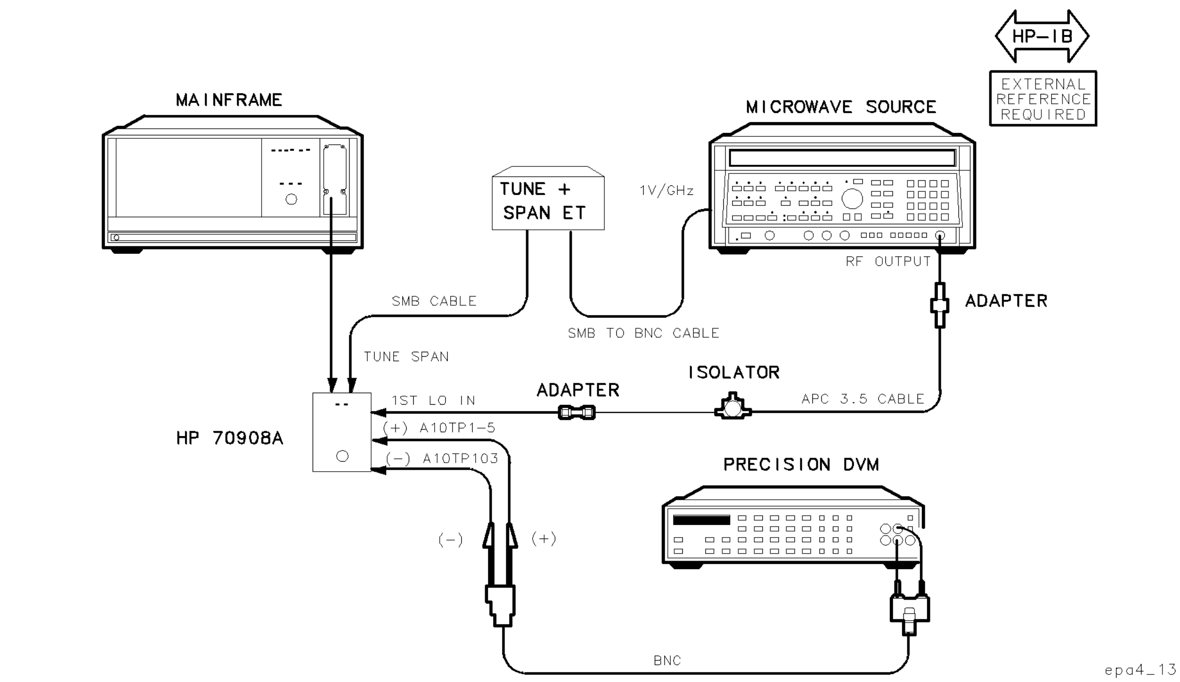


Figure 7-14. Equipment Setup for Adjustment 07. SYTFMD Main Coil Preset

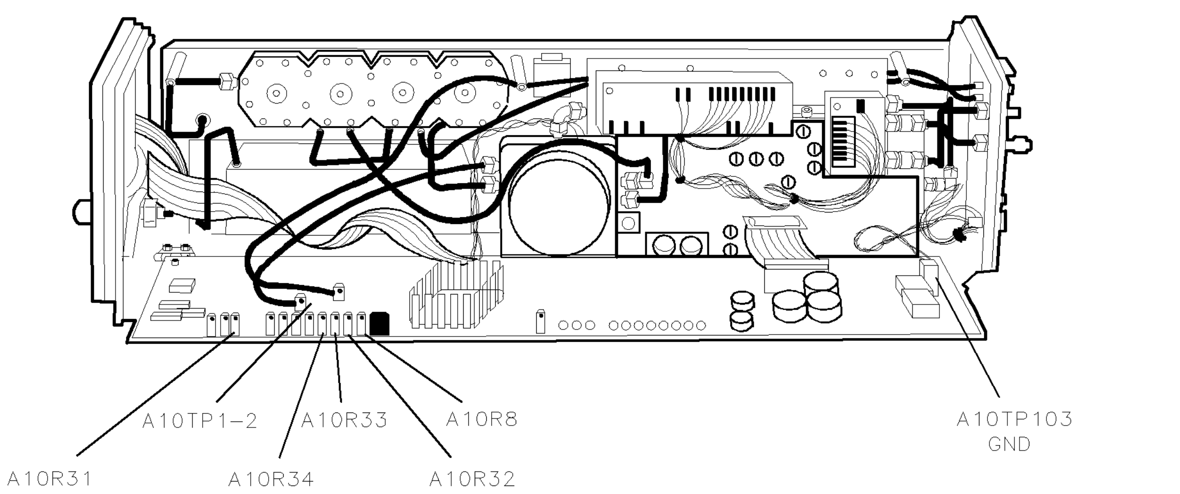


Figure 7-15. Locations for Adjustment 07. SYTFMD Main Coil Preset

Adjustment 07. SYTFMD Main Coil Preset

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5.
Power supply	HP 87421A power supply
Cable	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the the SYTFMD (switched, Yig-tuned, filter, mixer, discriminator) main coil current to a preliminary value. It adjusts the sensitivity of the main coil driver and also the 321.4 MHz offset for each band. (The Tune + Span ramp voltage drives the main coil driver, which provides main coil current.)

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-14.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment. initial warmup before starting the adjustment.
6. Load and run Adjustment 07. SYTFMD Main Coil Preset. Refer to Chapter 2 for information about running the software.
7. Center A13R19, A13R21, and A13R23.
8. Connect A3J11 to A10J4.

Note Inadequate power from the multiplier leveling amp may result in an inability to adjust A10R8 for a locked discriminator loop. If this occurs, adjust A13R19 fully CCW and A13R21 and R22 fully CW, and repeat the procedure.

The microwave source connects through an isolator to the DUT LO IN. The synthesized source provides 300 MHz, 0 dBm, at the DUT 300 MHz IN. The Tune + Span ET output connects to the DUT TUNE SPAN. The DVM connects to A10TP1-5, main-coil tuning-error voltage.

The initial setup is DUT frequency band 2L− and microwave source output of 4.9 GHz, 8 dBm. To minimize drift, the test returns to this setup if any adjustment requires more than one minute,; pressing `continue` returns to the adjustment.

Note To ensure accurate repeatable measurements, a hysteresis correction routine executes after any change in LO frequency. The routine eliminates residual magnetic effects.

DUT frequency band is 2L−. The microwave source frequency is 3160.7 MHz. Hysteresis correction executes. The user adjusts A10R8 for 0 V as indicated by the DVM.

Adjustment 08. Multiplier Power Leveling

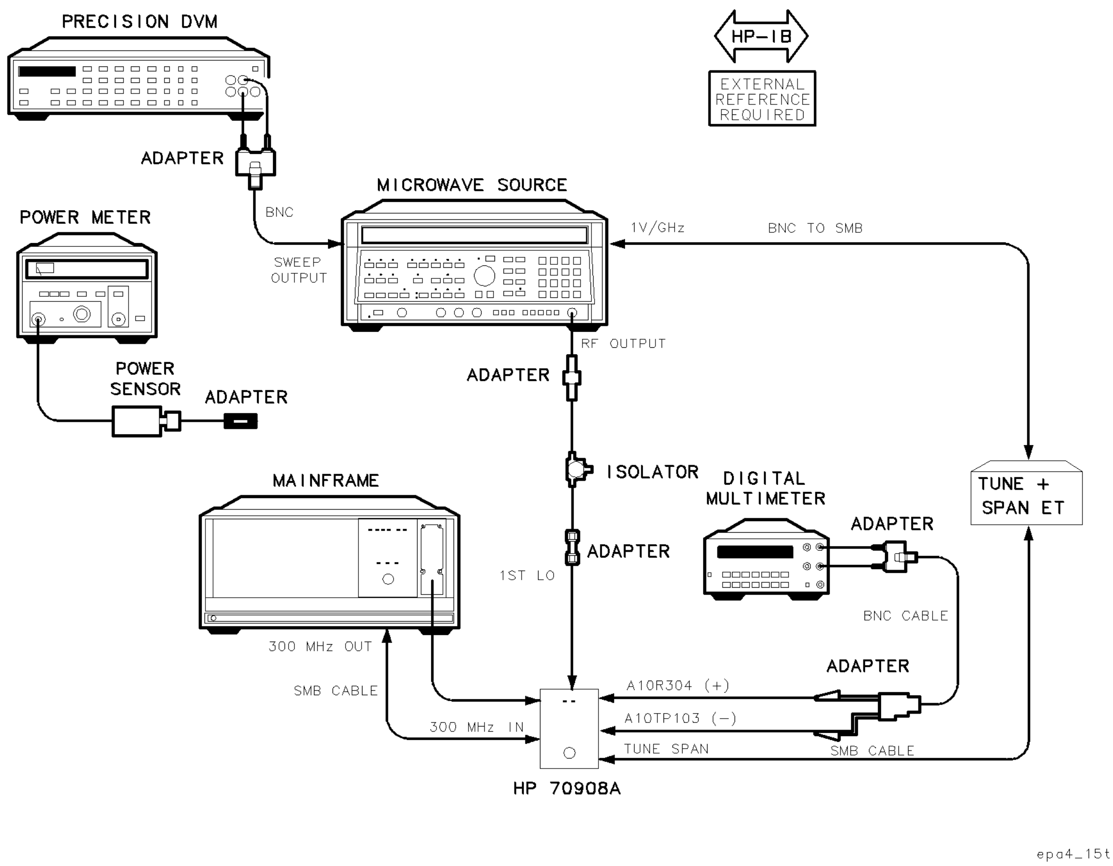


Figure 7-16. Equipment Setup for Adjustment 08. Multiplier Power Leveling

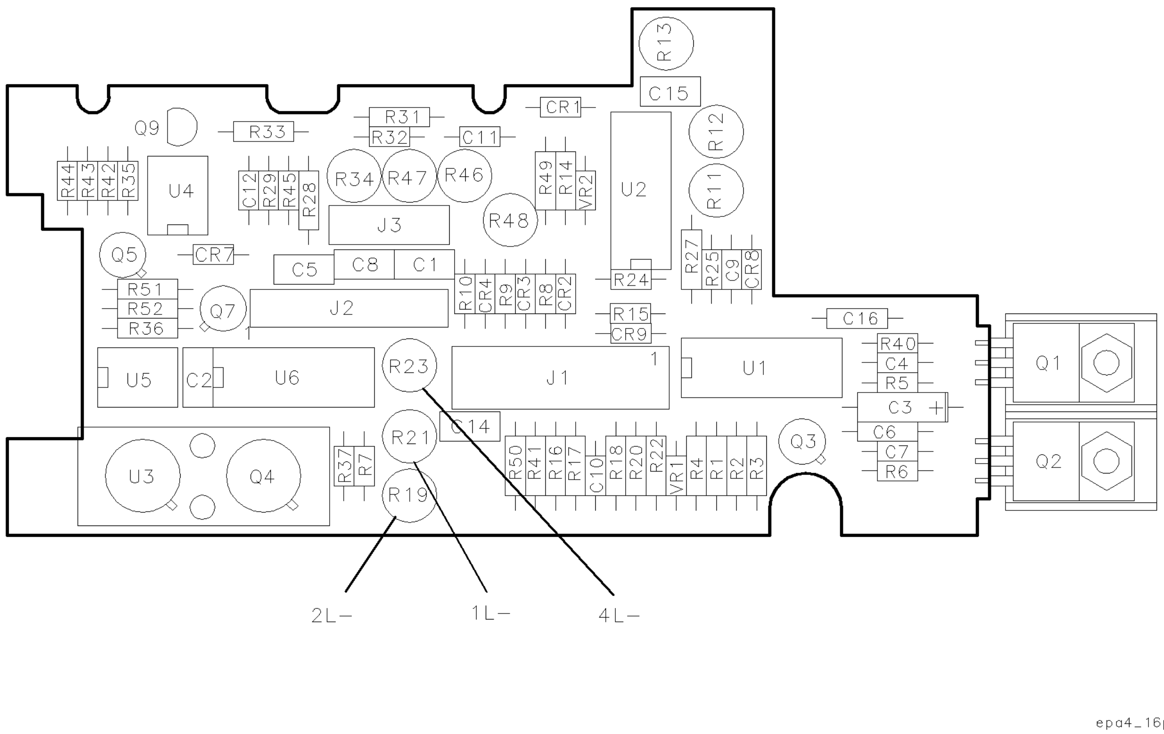


Figure 7-17. Locations for Adjustment 08. Multiplier Power Leveling

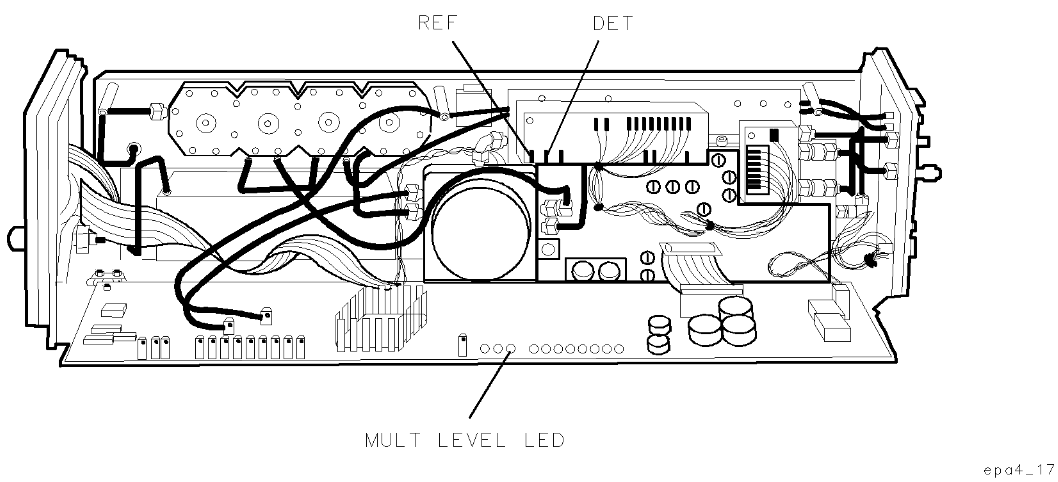


Figure 7-18.
Locations of MUT LEVEL LED and
Connect Points for Adjustment 08. Multiplier Power Leveling

Adjustment 08. Multiplier Power Leveling

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Digital multimeter	HP 3478A digital multimeter
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (2 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	&cbbncm2smbf123cm;
Adapter	HP 1250-1158 50Ω SMA(f) to SMA(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the multiplier detector-bias compensation to assure leveled multiplier output power through a specified temperature range.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-16.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 08. Multiplier Power Leveling. Refer to Chapter 2 for information about running the software.

When performing this adjustment, a microwave source provides the LO signal that would normally come from the LO module. (The multiplier microcircuit passes the signal or doubles it or quadruples it to provide fundamental mixing for bands 1L−, 2L−, and 4L−, respectively.) The Tune + Span ET (electronic tool) output connects to the DUT TUNE SPAN. A precision DVM monitors the microwave source SWEEP OUTPUT voltage as an indication of microwave source frequency. A voltmeter connects between A10R304 (end closest to user, same as A10J201-2) and A10TP103 (ground), as an indication of unleveled multiplier output power.

Initially, the microwave source provides 4000 MHz, 8 dBm, at the DUT LO IN. To assure unleveled multiplier output at some point in each of the three bands, the user sets A13R19 fully counterclockwise, A13R21 and A13R23 fully clockwise. A routine monitors the voltmeter in each band to verify unleveled power.

The user enters the multiplier serial number and the three power-delta numbers, which appear on the multiplier label. If the serial number is less than 250, and if the power-delta data on the multiplier label is hand-printed, the program adds 1.1 dBm temperature degradation to each of the three power delta numbers.

The adjustments and tests in this procedure require that the microwave source sweep through the following LO ranges from low to high limits:

1L− 3021.4 MHz to 6521.4 MHz

2L− 3160.7 MHz to 6560.7 MHz

4L− 3230.35 MHz to 5580.35 MHz

The adjustment band sequence is 2L−, 1L−, 4L−, because 4L− requires the most accuracy and because the 2L− detector bias adjustment affects the other two adjustments.

The following sections provide descriptions of the three part multiplier power leveling procedure.

Maximum Leveled Power with SYTFMD Connected

The multiplier output connects to the essentially unknown impedance of the SYTMFD LO input. The intent in this part of the procedure is to achieve maximum leveled power in each band by finding and then leveling unleveled power points. (The second part of this procedure applies temperature compensation at the last unleveled frequency in each band.)

Note In the following procedure, the initial adjustments result in a coarse adjustment of the three interactive detector-bias potentiometers. Therefore, if the 1L− and/or the 4L− potentiometers do not have enough range, readjustment of 2L− is acceptable. To allow adjustment of the 1L− or 4L− potentiometers, back off on 2L−, and then proceed with the 1L− or 4L− adjustment.

Adjustment 08. Multiplier Power Leveling

The microwave source sweeps a band from low to high limits. If the voltmeter indicates an unleveled condition at any frequency, the precision DVM returns the corresponding sweep voltage. A routine then calculates the approximate unleveled frequency and sets the microwave source to that CW frequency. If the calculated point is leveled, the CW frequency increments lower in 0.5 MHz steps until the unleveled condition occurs. The user then adjusts detector bias for the particular band until the point is level (MULT LEVEL LED turns off). (The MULT LEVEL LED is on the upper edge of the A10 power supply/driver.) Sweeping starts again from a frequency 5 MHz below the unleveled point. After the initial leveling in a band, the procedure repeats at a slower but more accurate sweep speed.

In the 2L− and 1L− bands, the procedure saves the detector voltages corresponding to maximum leveled powers. To save these reference voltages, the user connects the precision DVM positive lead to the multiplier REF terminal pin (beneath the multiplier), the DVM negative lead to the multiplier DET terminal pin. The user then reconnects the precision DVM to SWEEP OUTPUT of the microwave source.

Back Off Power

A power meter sensor replaces the SYTFMD at the multiplier output, thus providing the multiplier with a 50 ohm load. The precision DVM positive lead connects to the multiplier REF terminal pin (beneath the multiplier), the DVM negative lead to the multiplier DET terminal pin.

In 4L− band, both the DUT and the microwave source tune to the low band limit, 3230.35 MHz. If the voltmeter indicates an unleveled condition because of the impedance change at the multiplier output, the user adjusts the 4L− potentiometer until the voltmeter indicates a leveled condition. The user then adjusts detector bias to decrease the power meter reading by delta P. The program saves the precision DVM reading as an indication of the leveled frequency.

In 2L− band, both the DUT and the microwave source tune to the low band limit, 3160.7 MHz. The user adjusts detector bias for a precision DVM reading equal to the reference saved in the first part of the procedure. If the voltmeter indicates leveled power, the user adjusts detector bias to decrease the power meter reading by delta P. The program saves the precision DVM reading as an indication of the leveled frequency.

In 1L− band, both the DUT and the microwave source tune to the low band limit, 3021.4 MHz. The user adjusts detector bias for a precision DVM reading equal to the reference saved in the first part of the procedure. If the voltmeter indicates leveled power, the user adjusts detector bias to decrease the power meter reading by delta P. (If range is not adequate, adjustment of the 2L− detector bias is permissible.) The program saves the precision DVM reading as an indication of the unleveled frequency.

Both the DUT and the microwave source tune to the low band limit in each band in sequence. In each band the user adjusts detector bias for a precision DVM reading equal to the reading saved after the corresponding adjustment in the above three paragraphs.

Test

In each band, both the DUT and the microwave source tune from low to high limit. If the power meter reading exceeds the maximum power limit, the user adjusts the corresponding detector bias voltage for a power meter reading equal to the nominal power limit for each band: 14 dBm for 1L− band, 14 dBm for 2L− band, and + 13.25 dBm for 4L− band.

Adjustment 09. SYTFMD Main Coil Alignment

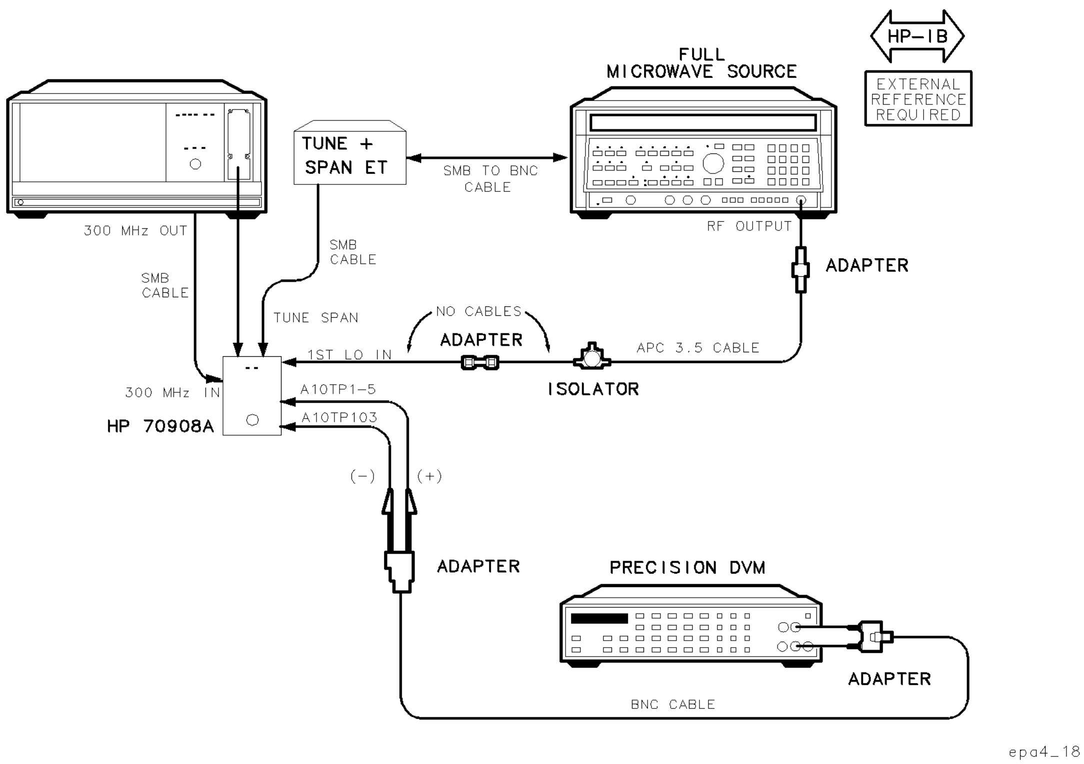


Figure 7-19. Equipment Setup for Adjustment 09. SYTFMD Main Coil Alignment

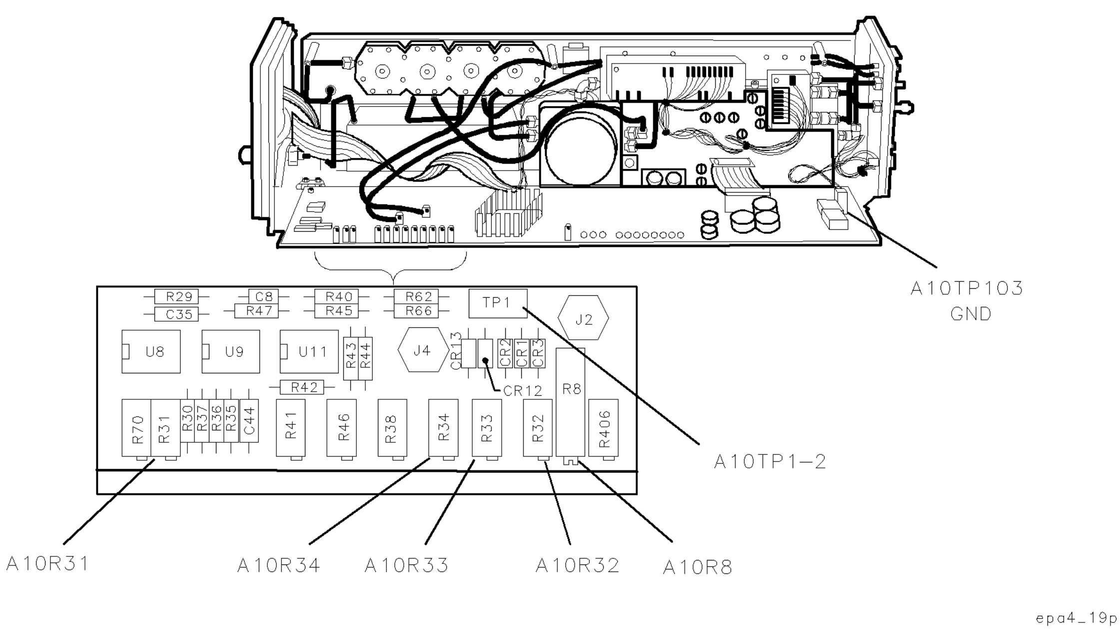


Figure 7-20. Locations for Adjustment 09. SYTFMD Main Coil Alignment

Adjustment 09. SYTFMD Main Coil Alignment

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the SYTFMD (switched, Yig-tuned, filter, mixer, discriminator) main-coil driver sensitivity and the 321.4 MHz offset for each band. (The LO Tune + Span ramp voltage drives the main-coil driver circuitry.)

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-19.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 09. SYTFMD Main Coil Alignment. Refer to Chapter 2 for information about running the software.

The microwave source connects to the DUT 1ST LO IN. The synthesized source provides 300 MHz, 0 dBm at the DUT 300 MHz IN. The Tune + Span ET connects to the DUT TUNE SPAN. The DVM connects to A10TP1-5, main-coil tuning-error voltage.

Note There is a fifteen minute warmup after the initial setup that follows.

The initial setup is DUT frequency band 2L− and a microwave source frequency of 4.9 GHz at 8 dBm. To minimize drift, the test returns to this setup if any adjustment requires more than one minute; pressing `continue` returns to the adjustment.

Note To ensure accurate repeatable measurements, a hysteresis correction routine executes after any change in LO frequency. The routine eliminates residual magnetic effects.

2L– Band Slope and Offset

Frequency band is 2L–, microwave source frequency is 3610.7 MHz. Hysteresis correction executes. The user adjusts A10R8, main coil sensitivity, for 0 V on the DVM.

Frequency band is 2L–, microwave source frequency is 6560.7 MHz. Hysteresis correction executes. The DVM measures the error voltage and a point slope equation calculates a new error voltage. The user readjusts A10R8 for a DVM voltage equal to the new error voltage.

Frequency band is 2L–, microwave source frequency is 3160.7 MHz. Hysteresis correction executes. The user adjusts A10R33, band 2 offset, for 0 V ±0.2 V.

The 2L– band slope and offset adjustment repeats until the band 2 offset is within its limits.

4L– Offset Preset and Final

Frequency band is 4L–. Microwave source frequency is 3230.35 MHz. Hysteresis correction executes. The user adjusts A10R32, band 4 offset, for 0 V on the DVM.

Frequency band is 4L–. Microwave source frequency is 5580.35 MHz. Hysteresis correction executes. The user adjusts A10R31, main coil linearity, for 0 V on the DVM.

Frequency band is 4L–. The microwave source steps 48 frequencies from 3230.35 MHz to 5580.35 MHz. At each step, the DVM measures the error voltage, which stores in an array that provides data for final offset calculations. The array is sorted for maximum and minimum values and frequency. At the 5580.35 MHz step, hysteresis correction execute, and the user then readjusts A10R31 for 0 V ±0.2 V.

The data in the array and the data stored by the offset coil adjustment allow calculation of a new maximum value. Then the full microwave source sets to 3230.35 MHz. Hysteresis correction executes. The DVM measures the A10TP-5 error voltage. A routine averages the new maximum value and the minimum value, and then subtracts the result from the TP1-5 error. The user adjusts A10R32 to this difference (final 4L– offset) as indicated by the DVM.

1L– Band Offset

Frequency band is 1L–, full microwave source frequency is 3021.4 MHz. Hysteresis correction executes. The user adjusts A10R34, band 1 offset, for 0 V ±0.2 V.

Test Main Coil

Frequency bands are 1L–, 2L–, 4L– in sequence. In each band, the microwave source steps through from low frequency limit to high. At every step, a routine corrects for hysteresis, measures the error voltage, and compares the voltage with limits.

Adjustment 10. VCO Tune-Line Voltage

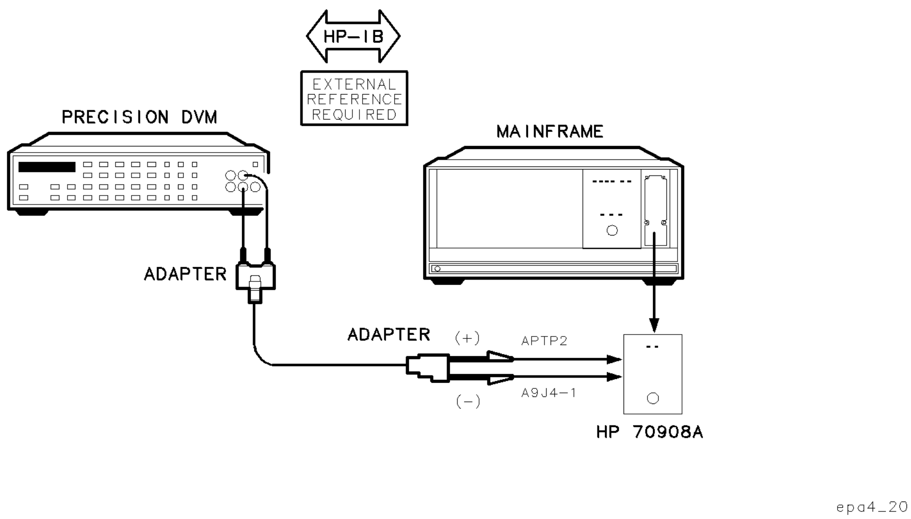


Figure 7-21. Equipment Setup for Adjustment 10. VCO Tune-Line Voltage

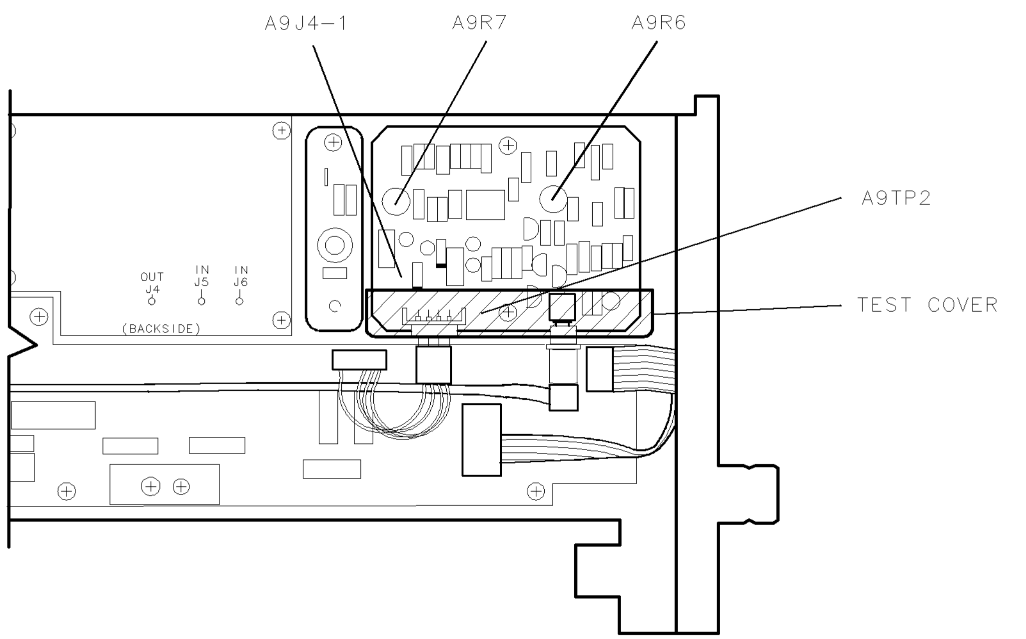


Figure 7-22. Locations for Adjustment 10. VCO Tune-Line Voltage

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the VCO tune line voltage. It sets the open loop, varactor-diode bias to a known level, thus allowing other 2nd LO adjustments.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-21.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 10. VCO Tune-Line Voltage. Refer to Chapter 2 for information about running the software.

The DVM connects to A9J4-1, VCO tune line. (The DVM 100 V range provides lower input resistance, which quickly drains probe cable capacitance.)

The user first adjusts A9R6 fully clockwise, and then adjusts A9R7 for a value between −4.524 V and 5.476 V.

Adjustment 11. VCO 2nd LO Frequency/Amplitude

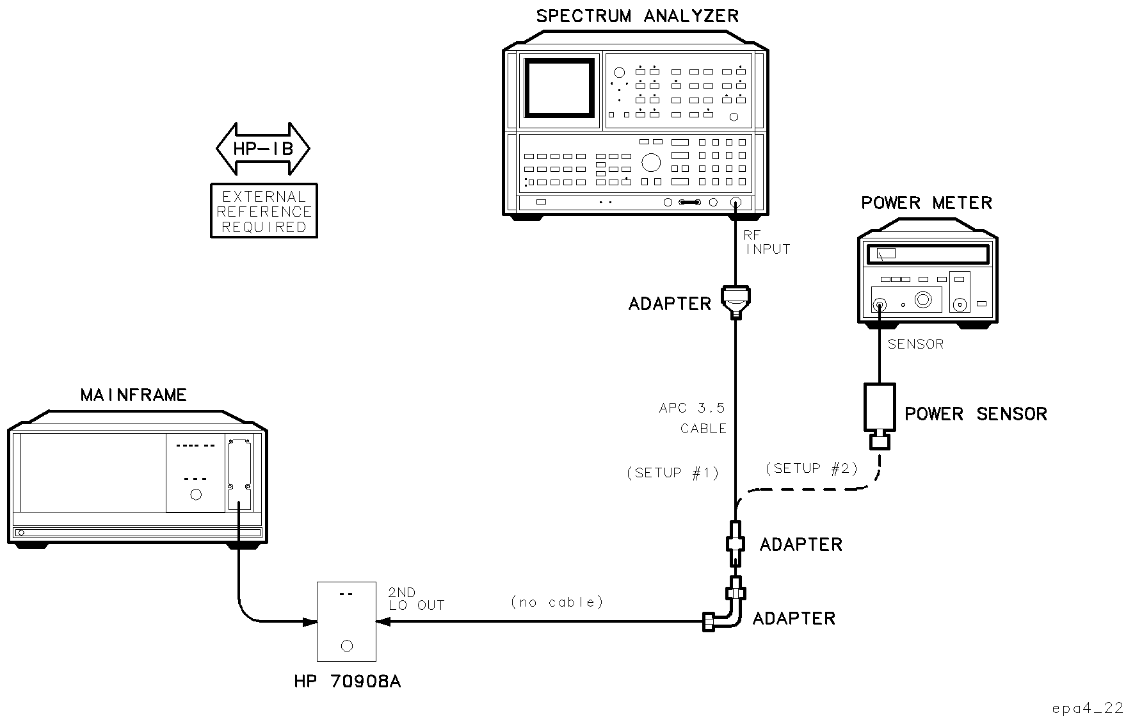


Figure 7-23. Equipment Setup for Adjustment 11. VCO 2nd LO Frequency/Amplitude

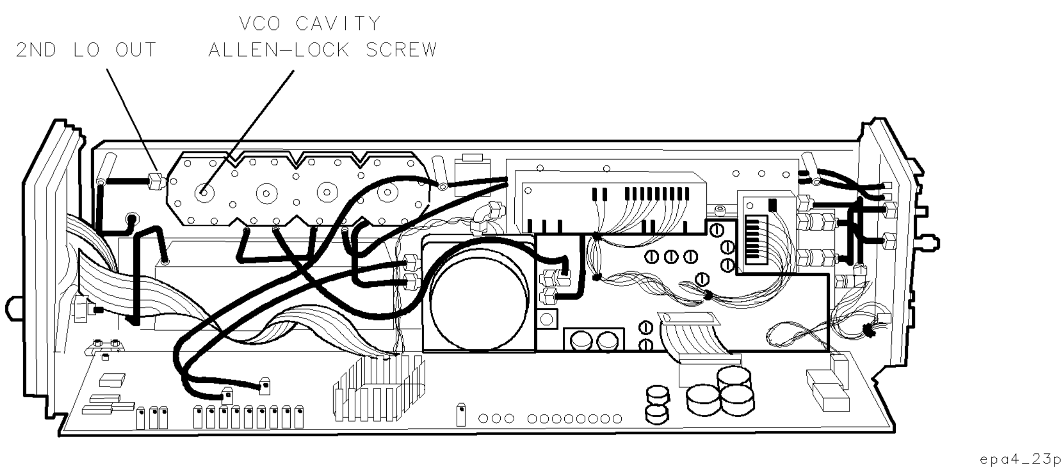


Figure 7-24. Locations for Adjustment 11. VCO 2nd LO Frequency/Amplitude

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 1250-1397 50Ω right angle SMA(m) to SMA(m)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to provide a first-pass adjustment of the 3.3 GHz VCO 2nd LO frequency and amplitude. (The VCO tune voltage is mid-range.)

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-23.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 11. VCO 2nd LO Frequency/Amplitude. Refer to Chapter 2 for information about running the software.

Initially in setup 1, the calibrated spectrum analyzer connects to the 2ND LO OUT of the VCO 2nd LO cavity. The user loosens the VCO 2nd LO cavity screw lock-nut and then adjusts LO ADJ for a frequency between 3299 and 3301 MHz, as indicated on the calibrated spectrum analyzer.

A power meter then replaces the calibrated spectrum analyzer at the 2ND LO OUT (setup 2). The user adjusts the VCO 2nd LO cavity SMA connector (2ND LO OUT) for a 2ND LO OUT of between −7.0 and −8.5 dBm.

Adjustment 12. 2nd Converter LO Feedthrough

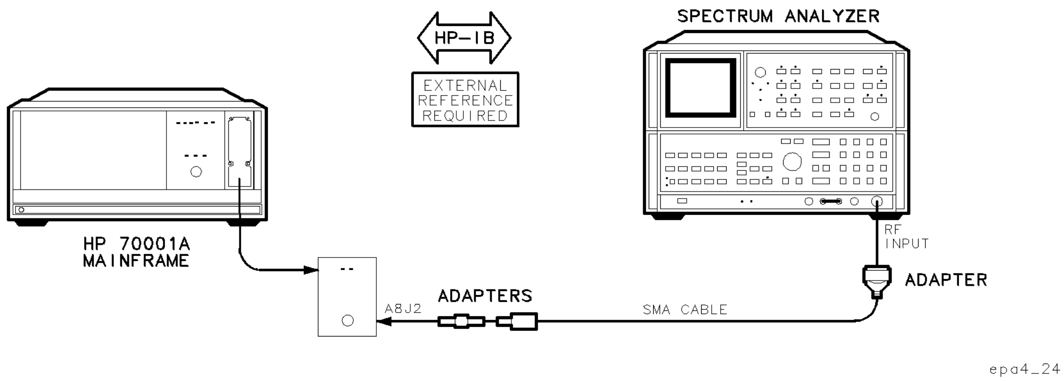


Figure 7-25. Equipment Setup for Adjustment 12. 2nd Converter LO Feedthrough

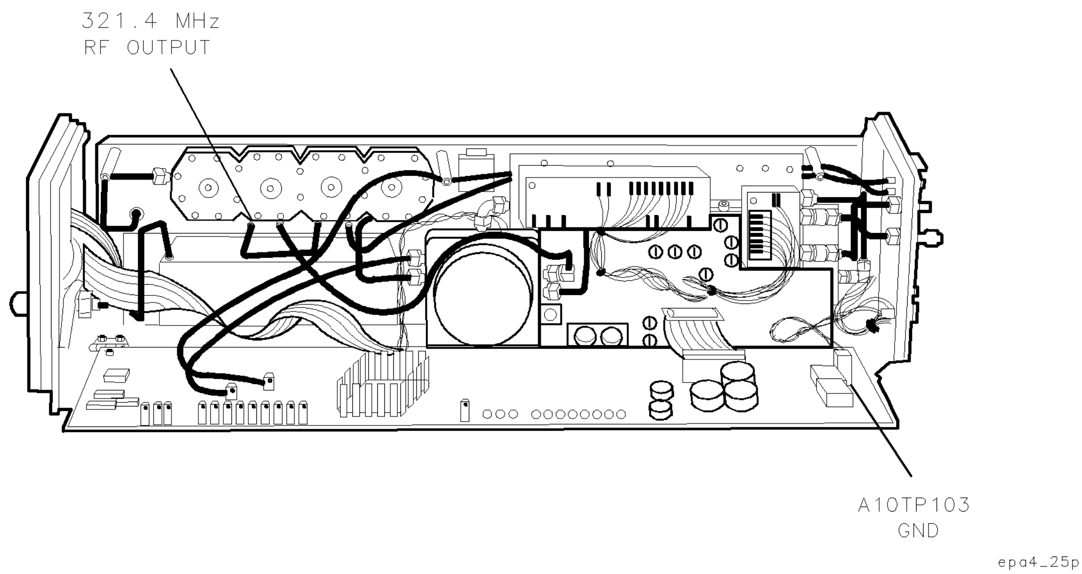


Figure 7-26. Locations for Adjustment 12. 2nd Converter LO Feedthrough

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Cable	HP 5061-5458 1.0 meter SMA(m) to SMA(m)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-1250 50Ω N(m) to SMA(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the 3.3 GHz 2nd LO feedthrough power at the 2nd converter 321.4 MHz IF OUTPUT.

Note Before performing this adjustment, verify completion of the following:

Adjustment 11. VCO 2nd LO Frequency/Amplitude

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-25.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 12. 2nd Converter LO Feedthrough. Refer to Chapter 2 for information about running the software.

The calibrated spectrum analyzer connects to the 2nd converter A8J2, 321.4 MHz IF OUT. (Refer to the A9 2nd converter PLL replacement procedure.) The HP 70900A/B local oscillator source provides the 300 MHz reference.

The calibrated spectrum analyzer setup is 3.3 GHz center frequency, 10 MHz span. The spectrum analyzer measures 2nd LO feedthrough which can range between limits of −29.0 dBm and −65.0 dBm.

Adjustment 13. Sampler IF Out DC

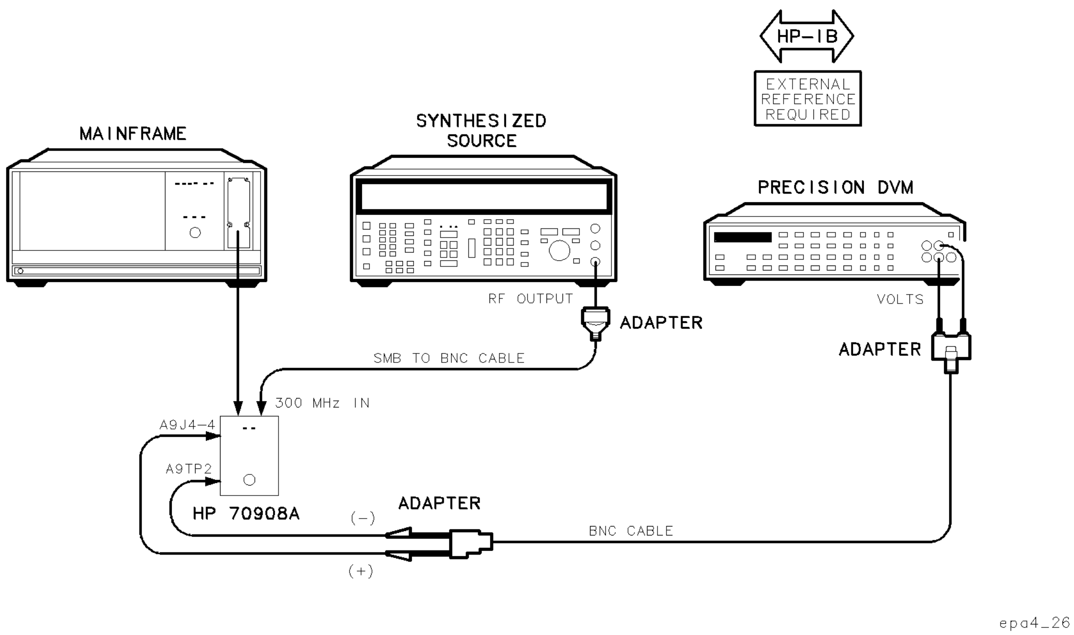


Figure 7-27. Equipment Setup for Adjustment 13. Sampler IF Out DC

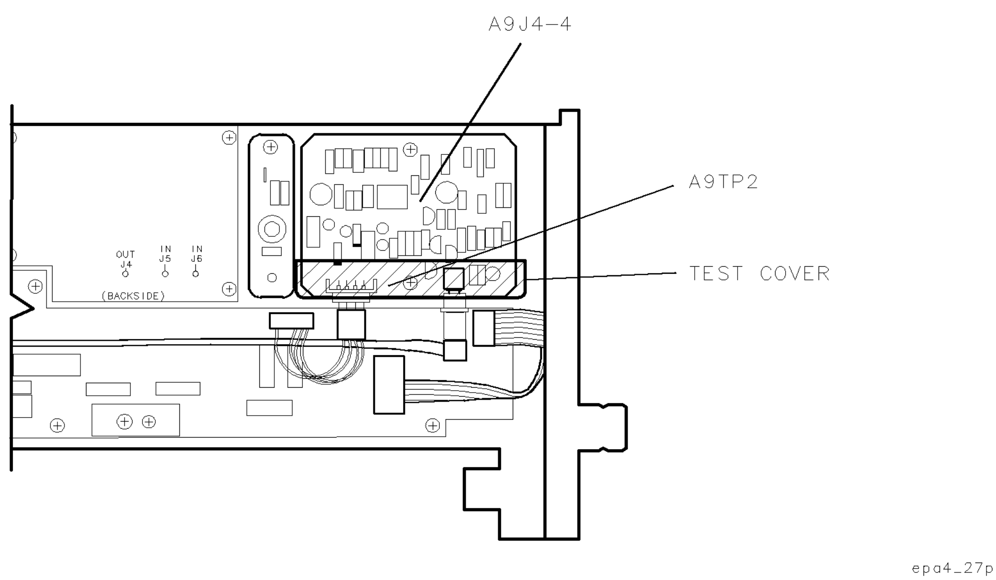


Figure 7-28. Locations for Adjustment 13. Sampler IF Out DC

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the dc offset voltage of the RF section VCO sampler IF output. (The offset voltage provides error correction. It is proportional to the phase difference between the 3.3 MHz 2nd LO input signal and the 11th harmonic of the 300 MHz reference.)

Note Before performing this adjustment, verify completion of the following:

Adjustment 11. VCO 2nd LO Frequency/Amplitude

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-27.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 13. Sampler IF Out DC. Refer to Chapter 2 for information about running the software.

The synthesized signal generator provides 300 MHz at the DUT 300 MHz IN. The DVM connects to the sampler IF output at A9J4-4. (The DVM 100 V range provides lower input resistance, which allows probe cable capacitance to quickly drain.) The DVM verifies a A9J4-4 value between −0.0985 V and +0.0985 V.

Adjustment 14. Sampler IF Out AC

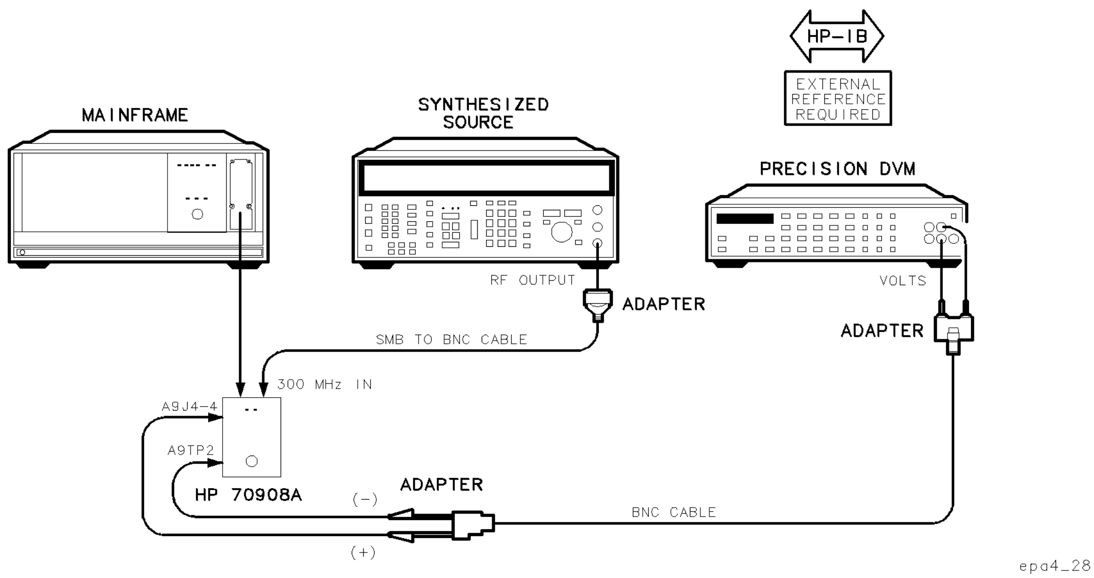


Figure 7-29. Equipment Setup for Adjustment 14. Sampler IF Out AC

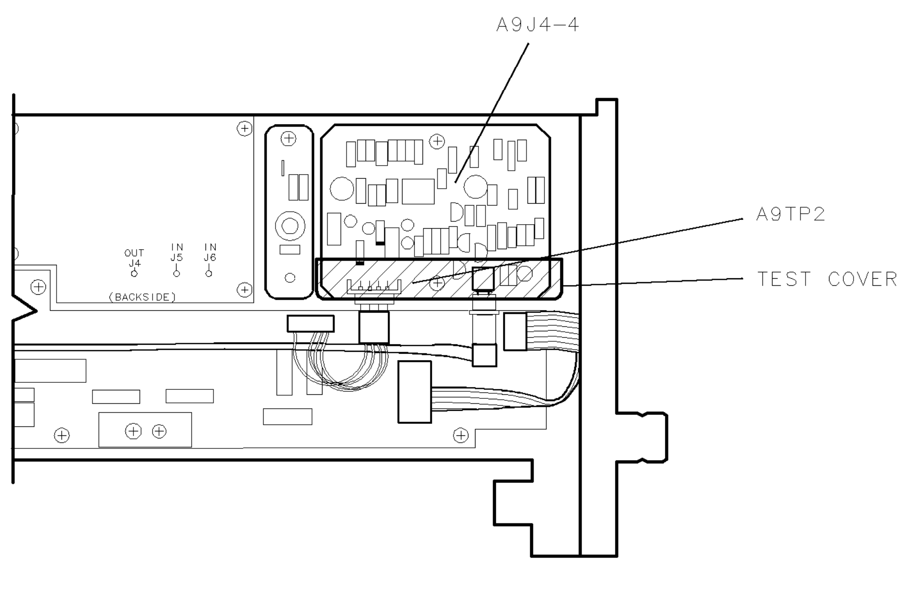


Figure 7-30. Locations for Adjustment 14. Sampler IF Out AC

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the ac voltage at the RF section VCO Sampler IF Output.

Note Before performing this adjustment, verify completion of the following:

Adjustment 11. VCO 2nd LO Frequency/Amplitude

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-30.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 14. Sampler IF Out AC. Refer to Chapter 2 for information about running the software.

The synthesized signal generator connects to the DUT 300 MHz IN. The DVM connects to the sampler IF output at A9J4-4.

Initially the synthesized signal generator provides 299.9 MHz, 0 dBm, and then searches in 0.001 MHz and 0.0001 MHz steps between 299.9 MHz and 300.1 MHz. A routine verifies that the maximum peak-to-peak voltage as indicated by the DVM is between 0.07 Vrms and 0.124 Vrms.

Adjustment 15. Search Oscillator Duty Cycle and Period

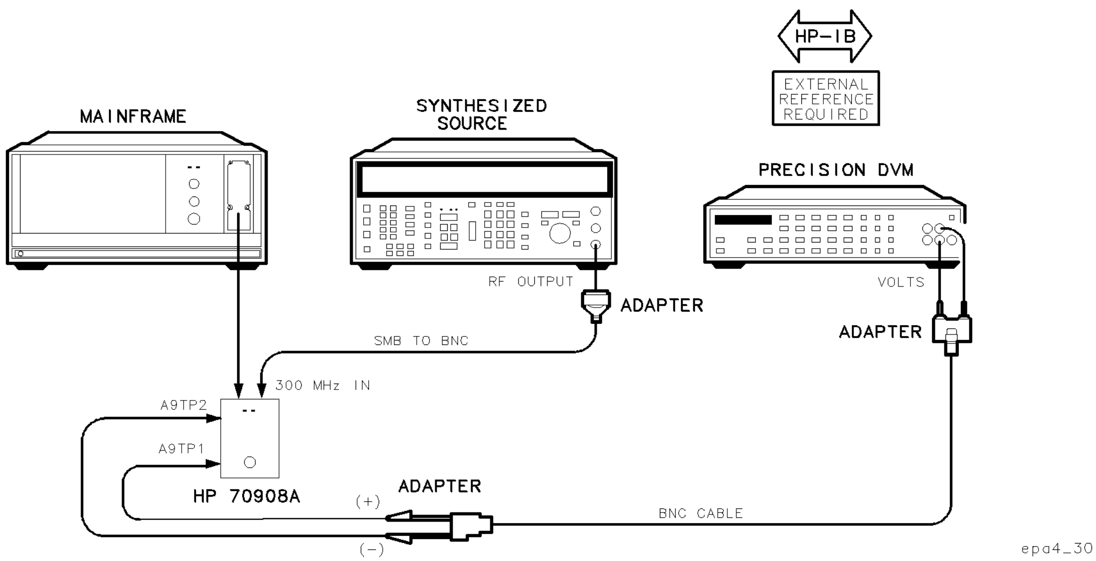


Figure 7-31.
Equipment Setup for Adjustment 15. Search Oscillator Duty Cycle and Period

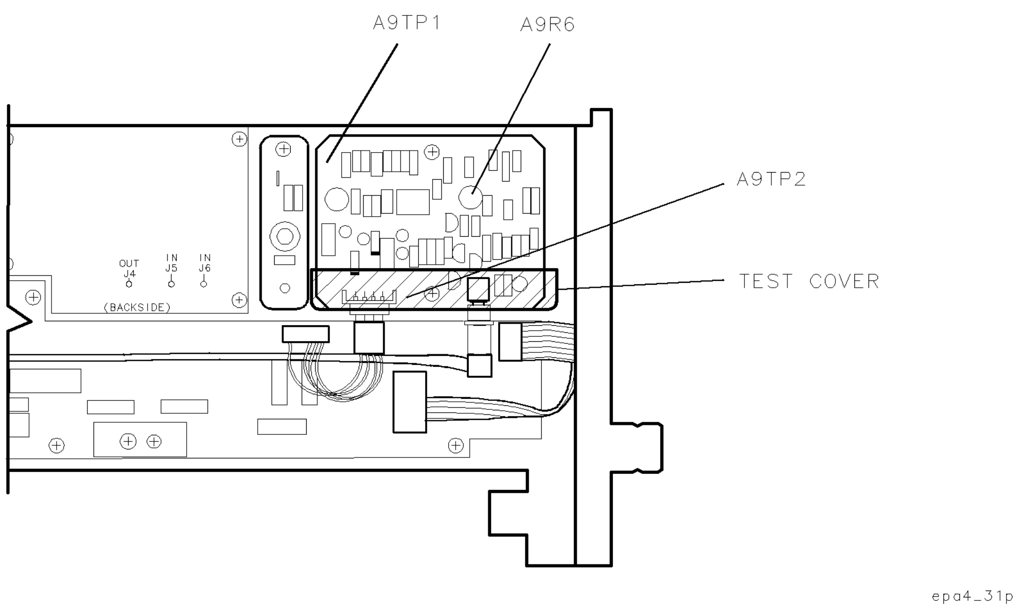


Figure 7-32. Locations for Adjustment 15. Search Oscillator Duty Cycle and Period

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Extender module	HP 70001-60013 extender module
Test cover	HP 5022-1150 2nd converter test cover

The purpose of this procedure is to adjust the duty cycle and the period of the 2nd converter PLL search oscillator. (The 300 MHz IN reference frequency varies to activate the oscillator, and then a manual adjustment sets duty cycle.)

Note Before performing this adjustment, verify completion of the following:

Adjustment 11. VCO 2nd LO Frequency/Amplitude

---

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-31.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 15. Search Oscillator Duty Cycle and Period. Refer to Chapter 2 for information about running the software.

The DVM connects to the PLL amplifier output at A9TP1. The synthesized signal generator provides 302 MHz, 0 dBm, at the 300 MHz IN. The user adjusts duty cycle by means of A9R6. A routine compares test limits to square-wave period and duty cycle. The test repeats with the synthesized signal generator providing 298 MHz.

Adjustment 16. Search Oscillator Square Wave Min/Max

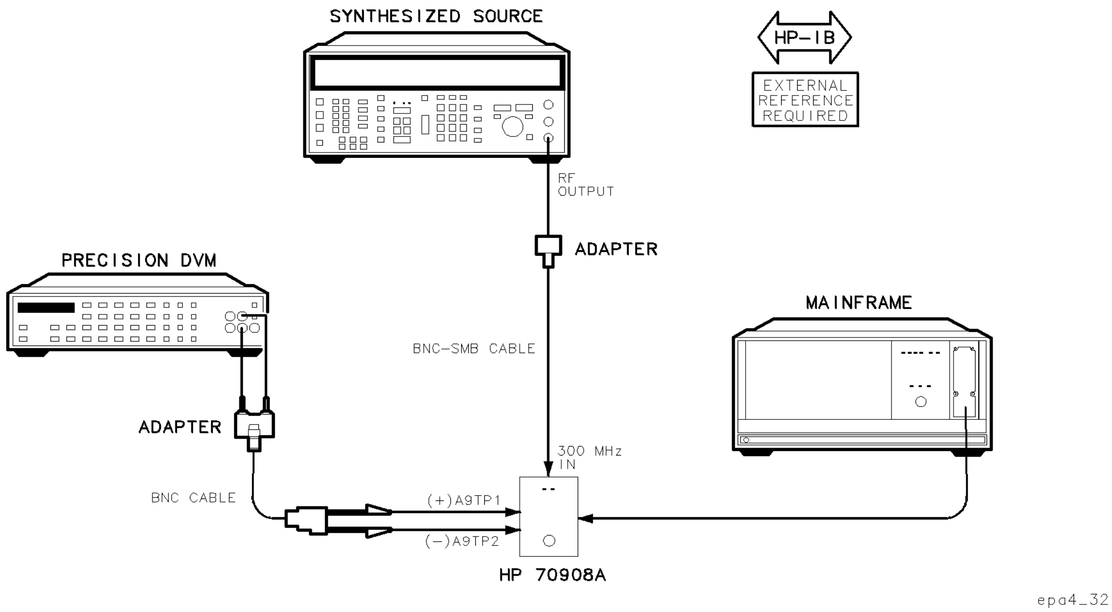


Figure 7-33.
Equipment Setup for Adjustment 16. Search Oscillator Square Wave Min/Max

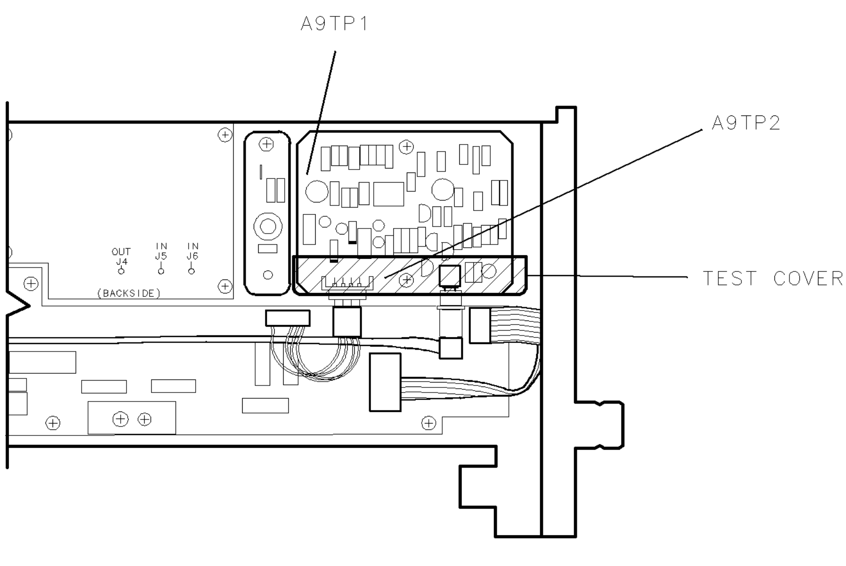


Figure 7-34. Locations for Adjustment 16. Search Oscillator Square Wave Min/Max

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to verify the minimum and maximum of the 2nd converter PLL search oscillator square wave. (The 300 MHz IN reference frequency varies to activate the oscillator.)

Note Before performing this adjustment, verify completion of the following:

Adjustment 15. Search Oscillator Duty Cycle and Period

---

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-33.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 16. Search Oscillator Square Wave Min/Max. Refer to Chapter 2 for information about running the software.

The DVM connects to the PLL amplifier output at A9TP1. The synthesized signal generator provides 302 MHz, 0 dBm, at the 300 MHz IN. The test makes multiple DVM measurements. A routine then verifies minimums between −9.53 V and −12.57 V and maximums between +9.53 V and +12.5 V. The test repeats with the synthesized signal generator providing 298 MHz.

Adjustment 17. Search Oscillator Tune Line Peak

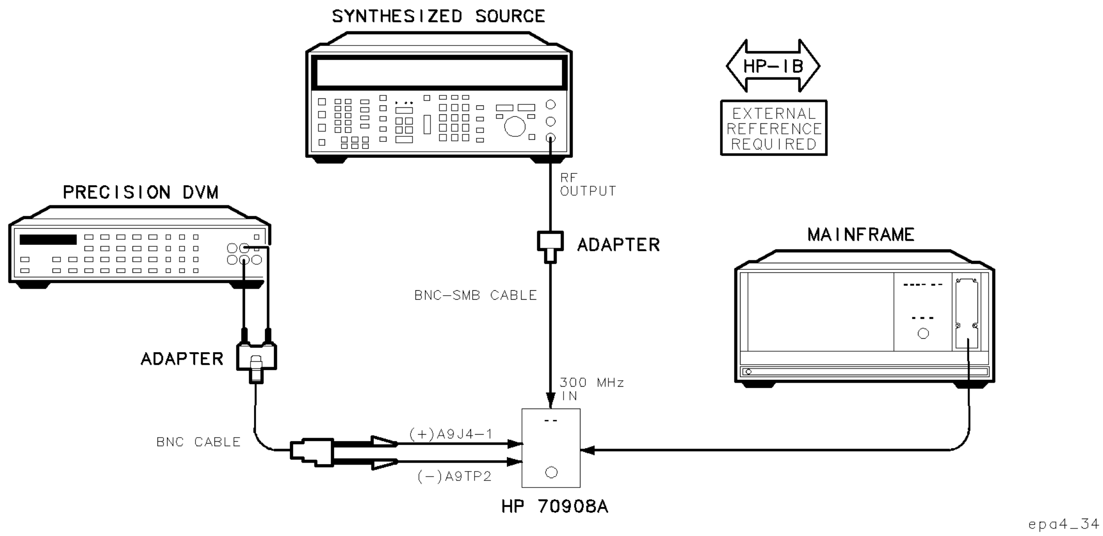


Figure 7-35. Equipment Setup for Adjustment 17. Search Oscillator Tune Line Peak

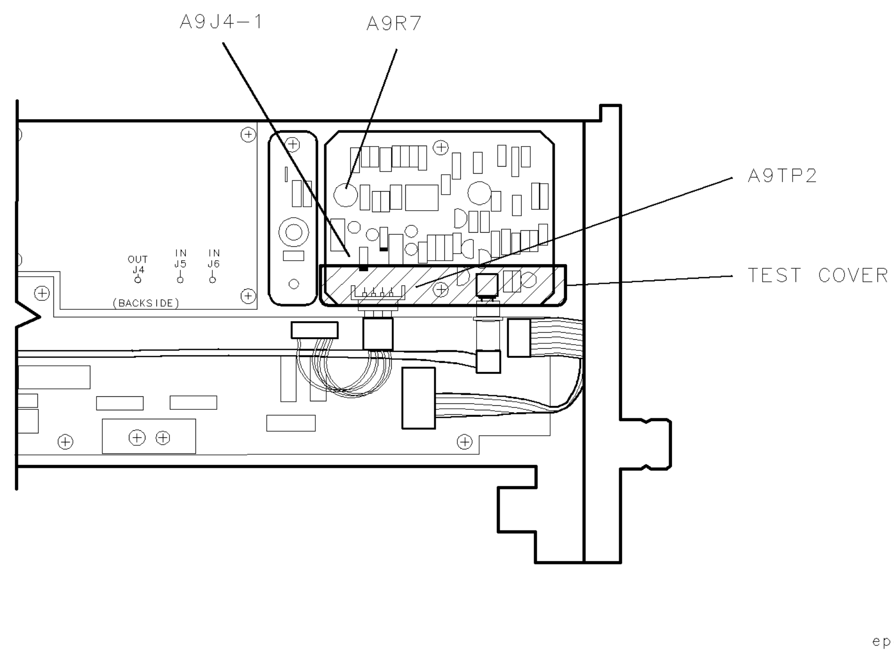


Figure 7-36. Locations for Adjustment 17. Search Oscillator Tune Line Peak

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8662A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this procedure is to adjust the search oscillator for a peak on the RF section VCO tune line.

Note Before performing this adjustment, verify completion of the following:

Adjustment 15. Search Oscillator Duty Cycle and Period

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-35.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 17. Search Oscillator Tune Line Peak. Refer to Chapter 2 for information about running the software.

The DVM connects to A9J4-1, VCO tune line.

The user adjusts A9R7 while watching for a “pass” on the controller display.

Adjustment 18. Phase Lock Check

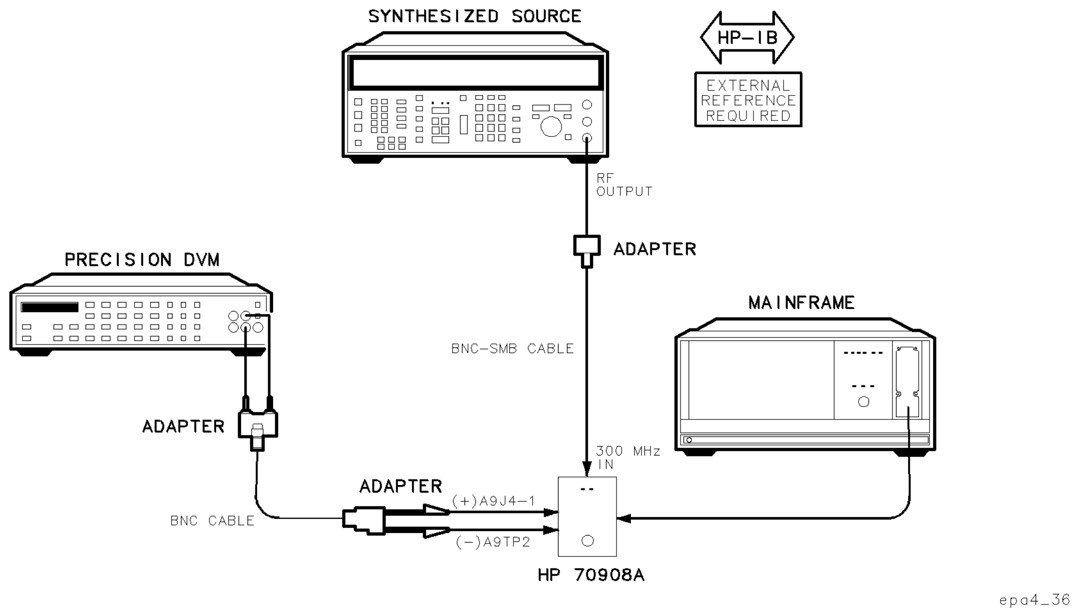


Figure 7-37. Equipment Setup for Adjustment 18. Phase Lock Check

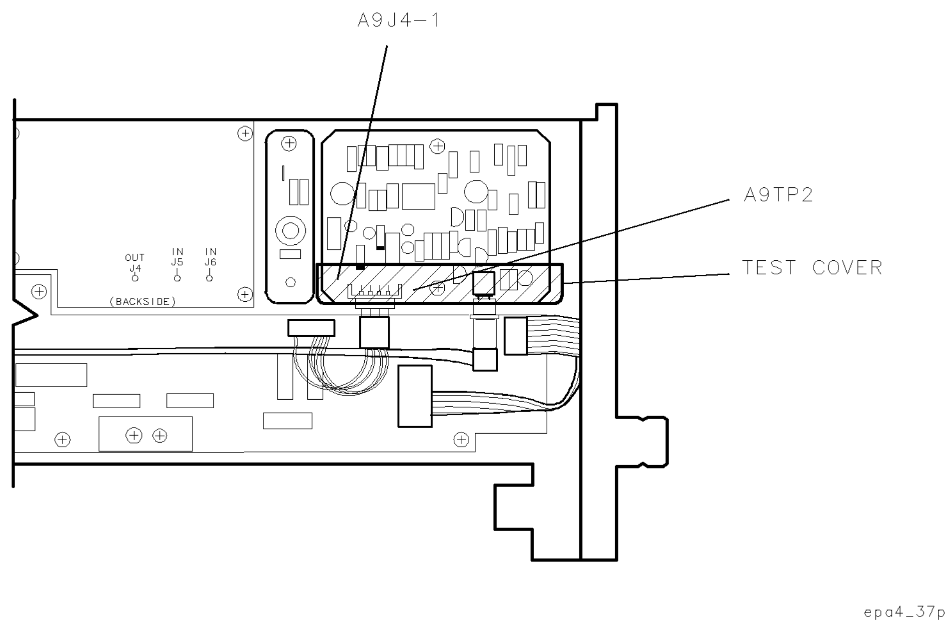


Figure 7-38. Locations for Adjustment 18. Phase Lock Check

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to check the 2nd converter phase-lock.

Note Before performing this adjustment, verify completion of the following:

all VCO related adjustments from Adjustment 10. VCO Tune-Line Voltage to this check.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-37.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 18. Phase Lock Check. Refer to Chapter 2 for information about running the software.

The DVM connects to A9J4-1, VCO Tune Line.

The test checks the RF section for phase lock of the 2nd converter PLL. An unlock condition causes a fail message. A locked condition results in a comparison of test limits and a DVM measurement of the VCO tune line.

Adjustment 19. VCO Tune Range Preliminary Check

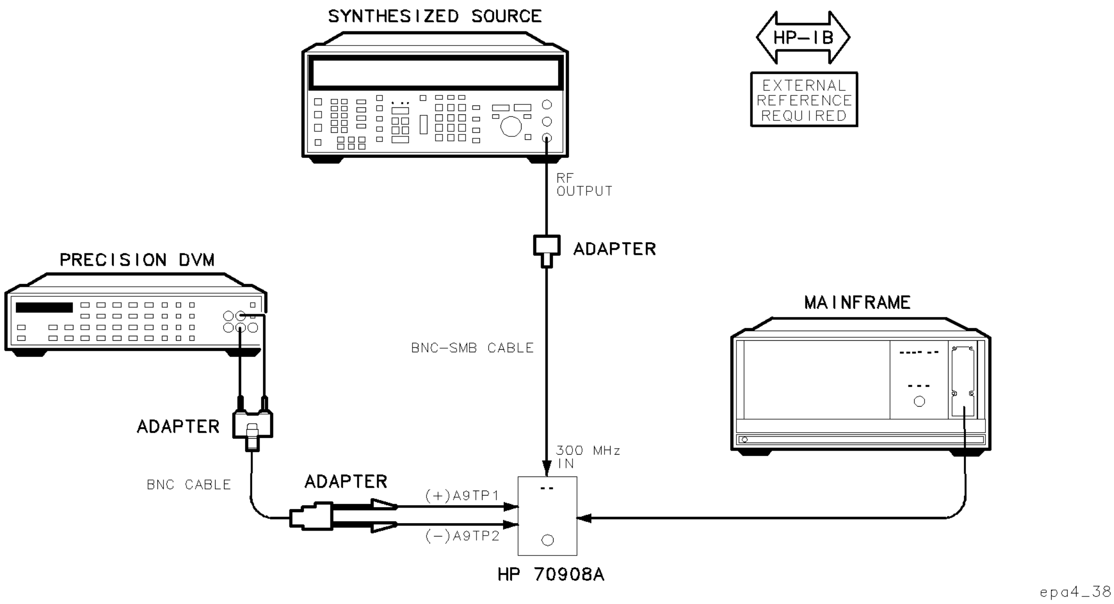


Figure 7-39. Equipment Setup for Adjustment 19. VCO Tune Range Preliminary Check

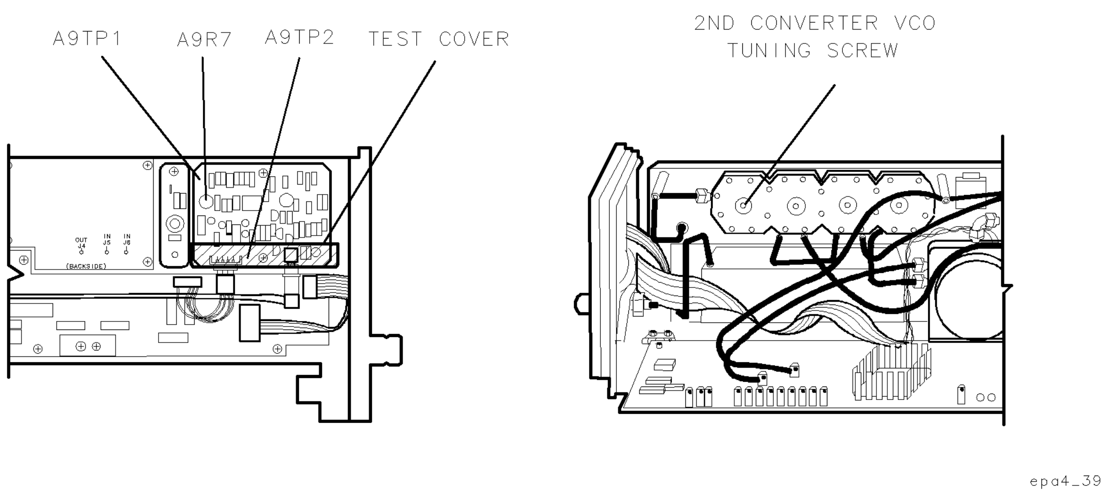


Figure 7-40. Locations for Adjustment 19. VCO Tune Range Preliminary Check

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to perform a first-pass adjustment of the RF section 2nd converter VCO tuning range.

Note Before performing this adjustment, verify completion of the following:

Adjustment 15. Search Oscillator Duty Cycle and Period
Adjustment 16. Search Oscillator Square Wave Min/Max
Adjustment 17. Search Oscillator Tune Line Peak

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-39.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 19. VCO Tune Range Preliminary Check. Refer to Chapter 2 for information about running the software.

The DVM connects to A9TP1, the phase-lock-loop amplifier output.

The user adjusts the 2nd LO cavity screw (located on the 2nd converter bandpass filter and LO housing) for a value between −7.97 V and 7.53 V as indicated on the DVM. (An unlock condition causes an UNLOCK warning on the controller display. Typically a very slight CCW rotation of the LO cavity screw will lock up the VCO.) The test compares two DVM measurements, and then displays a SEARCHING message if the results are too far apart.

The synthesized signal generator frequency is 299.35 MHz. The user adjusts A9R7 for a DVM reading between +7.53 V and +7.97 V. An unlock condition or measurements too far apart cause the respective message on the controller display.

The adjustment repeats until the VCO tune range is within test limits.

Adjustment 20. Lock Range Measurement

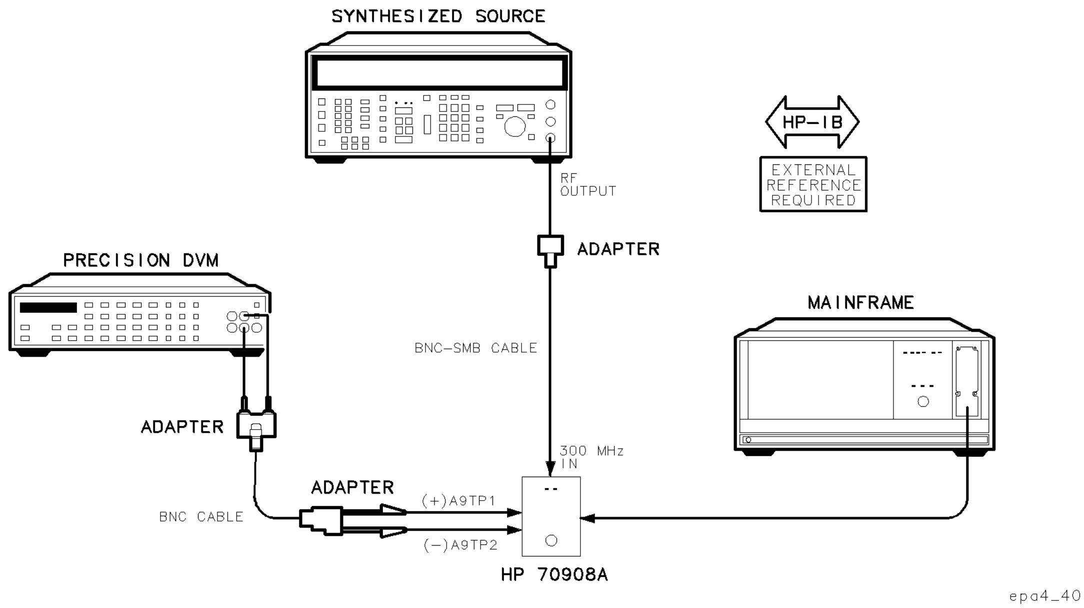


Figure 7-41. Equipment Setup for Adjustment 20. Lock Range Measurement

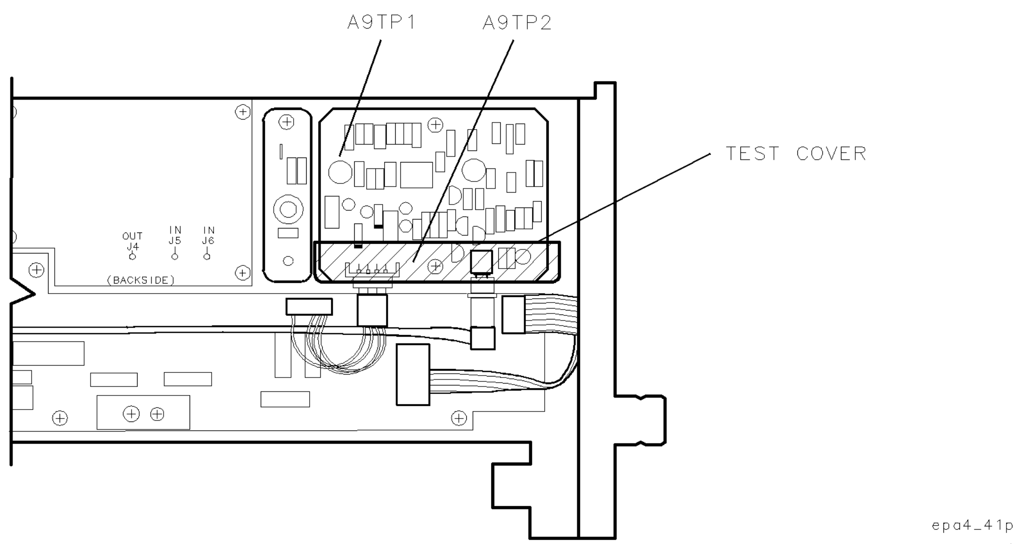


Figure 7-42. Locations for Adjustment 20. Lock Range Measurement

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source (optional)	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to check the RF section 2nd converter lock range.

Note Before performing this adjustment, verify completion of the following:

Adjustment 15. Search Oscillator Duty Cycle and Period
Adjustment 16. Search Oscillator Square Wave Min/Max
Adjustment 17. Search Oscillator Tune Line Peak

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-41.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 20. Lock Range Measurement. Refer to Chapter 2 for information about running the software.

The synthesized signal generator initially provides 299.35 MHz at the DUT 300 MHz IN. The DVM connects to A9TP1, 2nd converter PLL amplifier output.

The signal generator frequency decrements in 0.01 MHz steps until the PLL unlocks; the frequency then increments in 0.01 MHz steps until the PLL locks. The test compares the lock frequency with the test limit. If the lower lock frequency meets the test limit, a routine stores the associated DVM measurement.

To determine the upper lock frequency and voltage, the test repeats with a synthesized signal generator set to 300.6 MHz.

Adjustment 21. Mixer Bias

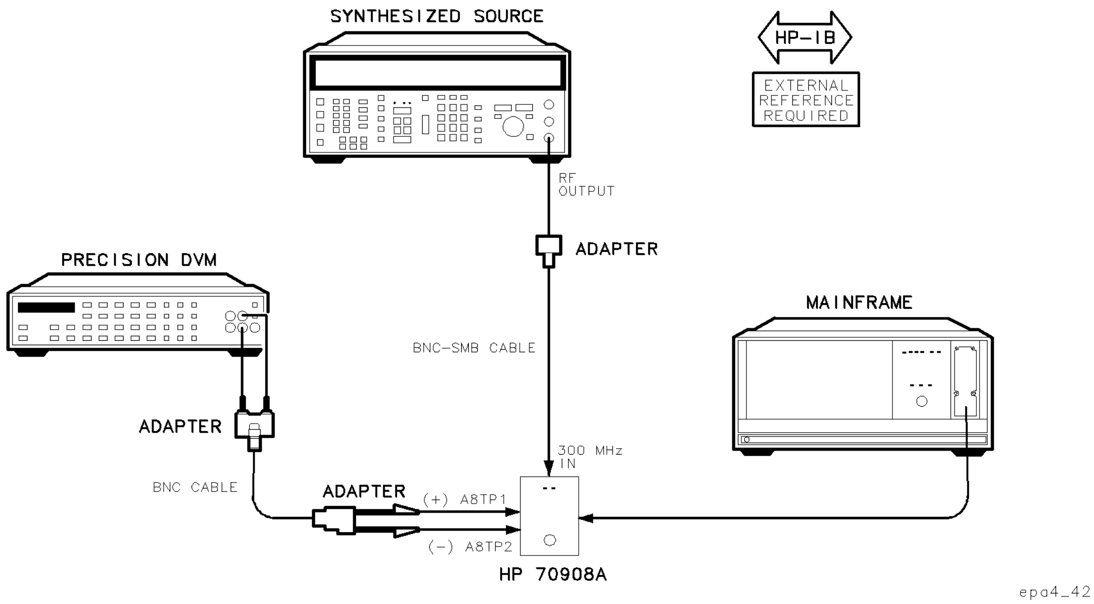


Figure 7-43. Equipment Setup for Adjustment 21. Mixer Bias

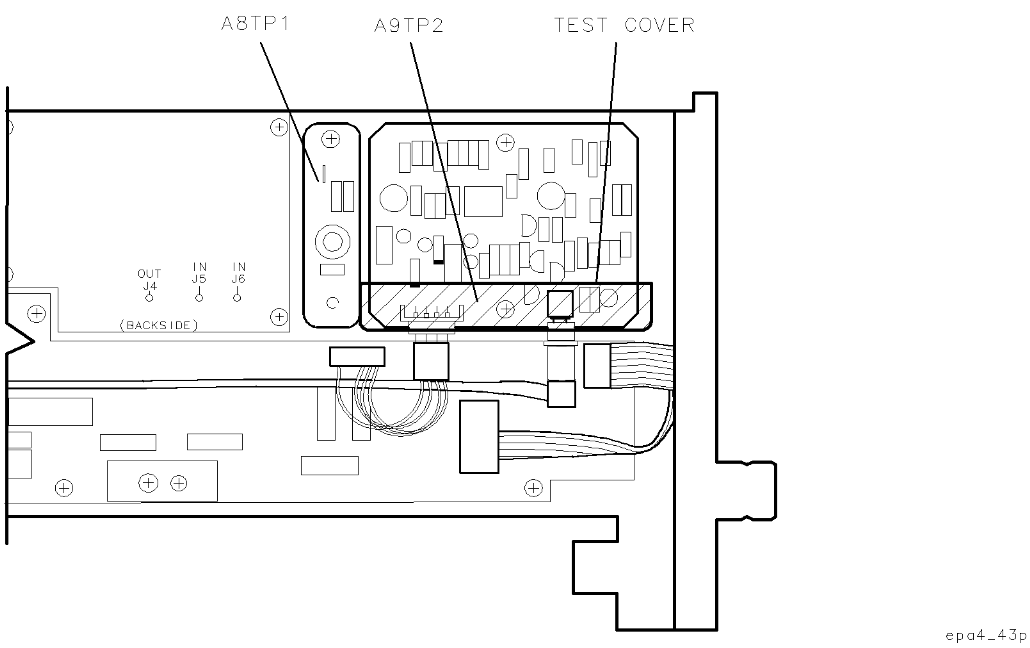


Figure 7-44. Locations for Adjustment 21. Mixer Bias

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the RF section 2nd mixer bias.

Note Before performing this adjustment, verify completion of the following:

Adjustment 20. Lock Range Measurement

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-43.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 21. Mixer Bias. Refer to Chapter 2 for information about running the software.

The synthesized signal generator provides 300 MHz at the DUT 300 MHz IN. The DVM connects to A8TP1. (The DVM 100 V range provides lower input resistance, which allows probe cable capacitance to quickly drain.) The test verifies a DVM measurement between 0.624 V and 1.276 V.

Adjustment 22. 2nd Converter Bandpass Filter Tune

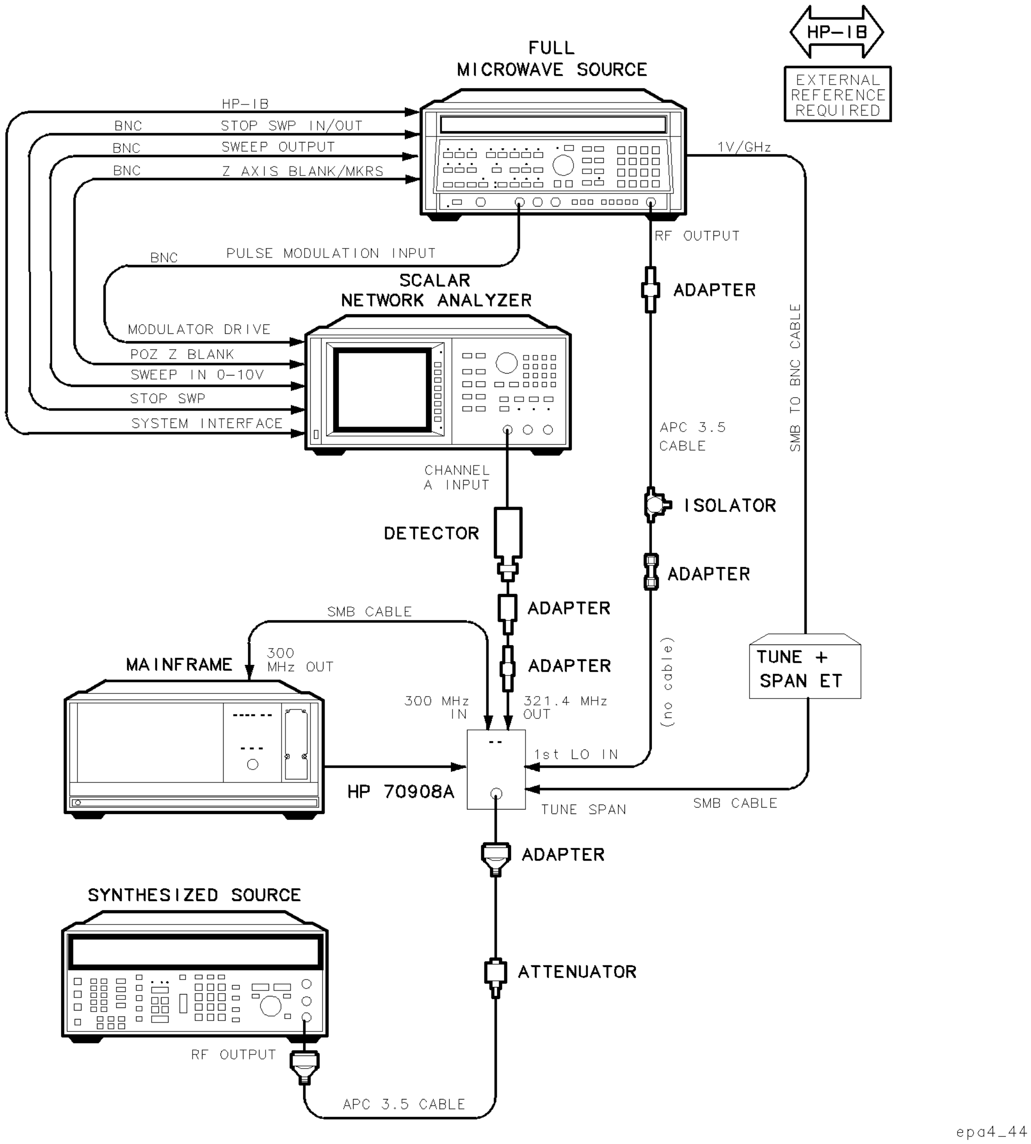


Figure 7-45. Equipment Setup for Adjustment 22. 2nd Converter Bandpass Filter Tune

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Network analyzer	HP 8757A scalar network analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Detector	HP 11664A detector
Microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Isolator	HP 0955-0204 microwave isolator
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5.
Power supply	HP 87421A power supply
Cable (2 required)	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable (2 required)	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1159 50Ω SMA(m) to SMA(m)
Adapter (2 required)	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

Note

Before performing this adjustment, verify completion of all VCO related adjustments.

If the cover of the 2nd converter is removed to make an adjustment, replace it with an HP 5022-1150 2nd converter test cover during testing to assure consistent ground connection and proper converter alignment.

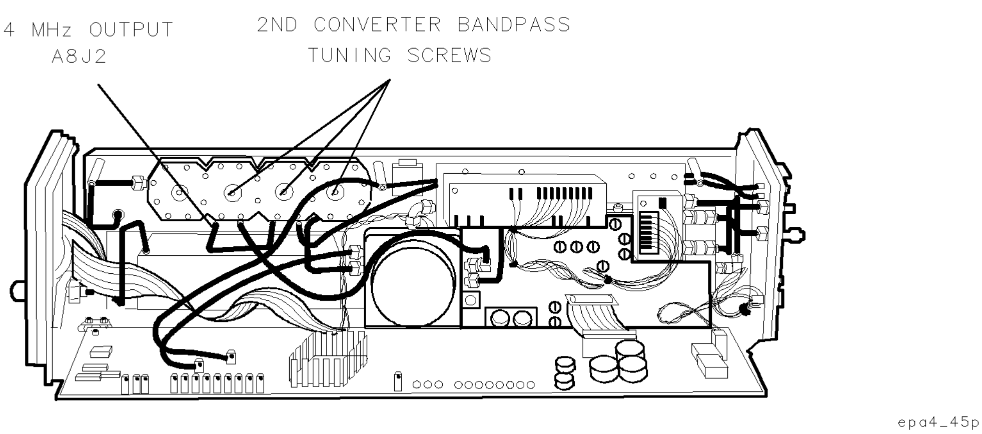


Figure 7-46. Locations for Adjustment 22. 2nd Converter Bandpass Filter Tune

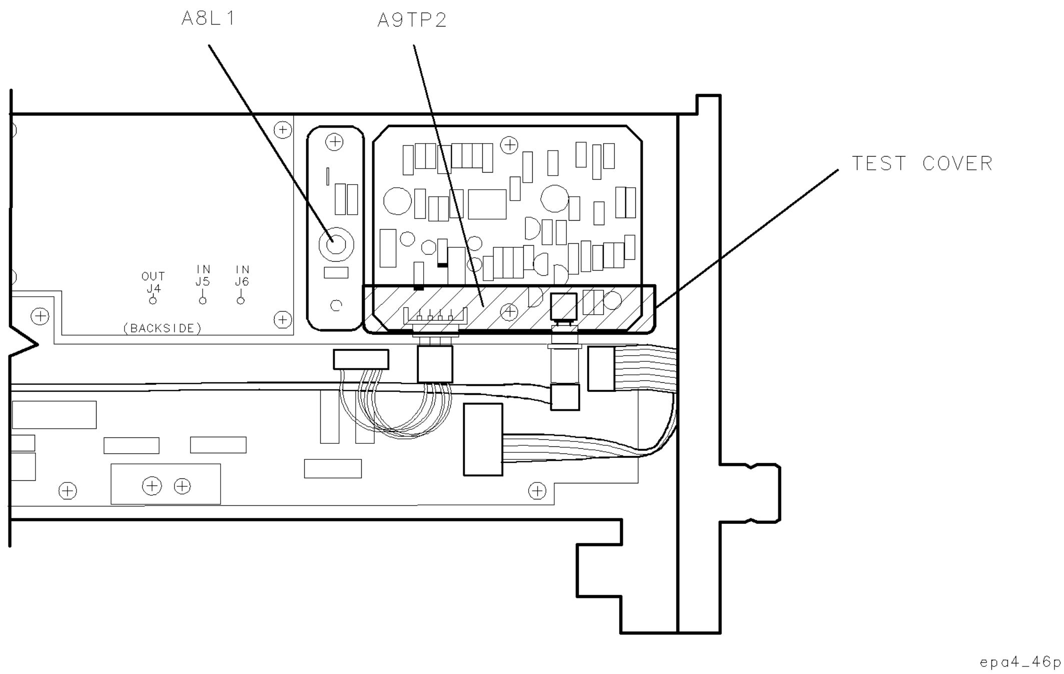


Figure 7-47. Locations for Adjustment 22. 2nd Converter Bandpass Filter Tune

The purpose of this adjustment procedure is to align the RF section 2nd-converter 3621.4 MHz bandpass-filter shape. (The user adjusts amplitude, flatness, and 3 dB bandwidth.) The test also measures 42.8 MHz image rejection.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-45.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 22. 2nd Converter Bandpass Filter Tune. Refer to Chapter 2 for information about running the software.

The synthesized signal generator provides 300 MHz, 0 dBm, at the DUT INPUT. The full microwave source through an isolator provides 3921.4 MHz, 8 dBm, at the DUT LO input. The network analyzer channel-A detector connects to the DUT 321.4 MHz OUT. The user views the network analyzer response while adjusting the three 2nd converter bandpass-filter tuning screws and also the matching inductor on the A8 321.4 MHz matching network. The adjusted parameters are maximum amplitude, flatness, 3 dB bandwidth, and 42.8 MHz image rejection.

The response must satisfy the following limits: amplitude, −35 to 2 dBm; flatness, 0.5 to 0.2 dB relative to amplitude at 3621.4 MHz, 15 MHz on either side of center (a slight adjustment of the 2nd converter bandpass filter input coupling connector is acceptable to improve flatness); 3 dB bandwidth, 25 to 30 MHz; image rejection, equal to or greater than 23 dB relative to the 3621.4 MHz center frequency.

Adjustment 23. VCO Tune Range Final

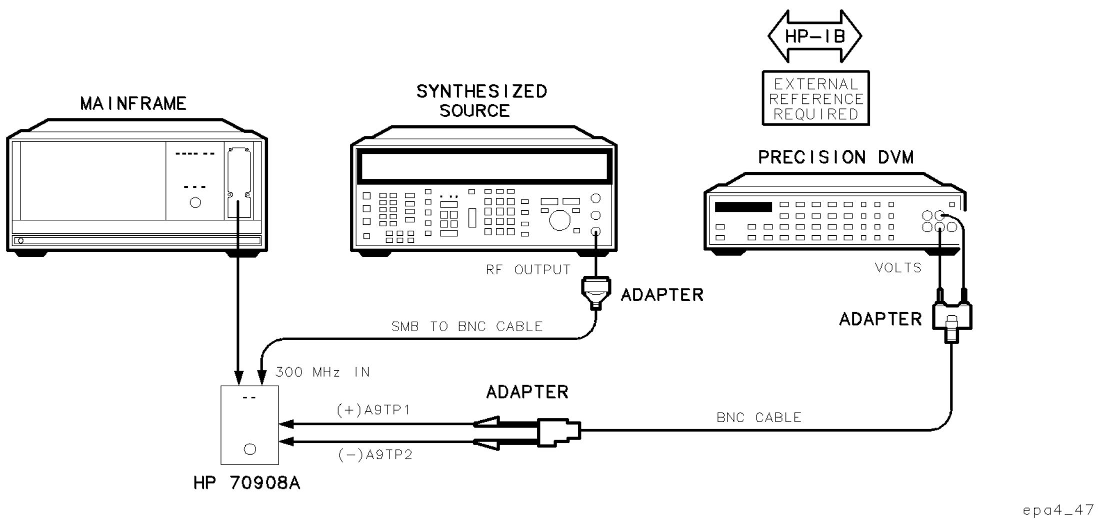


Figure 7-48. Equipment Setup for Adjustment 23. VCO Tune Range Final

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Precision DVM	HP 3458A digital multimeter
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1251-2277 50Ω BNC(f) to dual banana plug
Adapter	HP 1250-1292 50Ω BNC(f) to alligator clips
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Test cover	HP 5022-1150 2nd converter test cover
Extender module	HP 70001-60013 extender module

Adjustment 23. VCO Tune Range Final

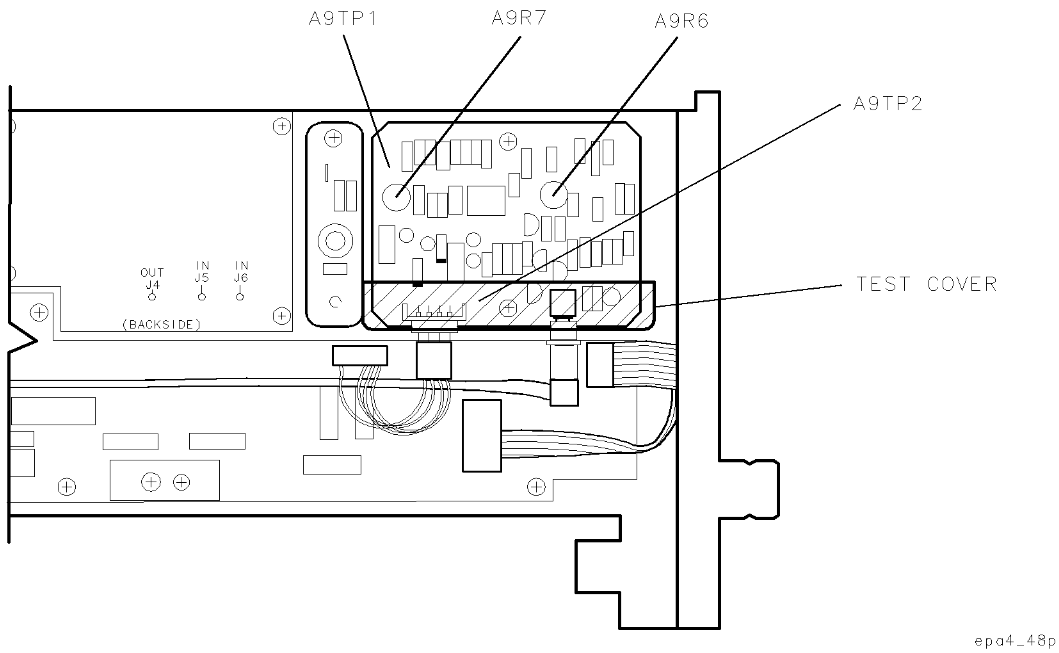


Figure 7-49. Locations for Adjustment 23. VCO Tune Range Final

The purpose of this procedure is to adjust the RF section 2nd converter VCO tuning range.

Note Before performing this adjustment, verify completion of the following:

Adjustment 15. Search Oscillator Duty Cycle and Period
Adjustment 16. Search Oscillator Square Wave Min/Max
Adjustment 17. Search Oscillator Tune Line Peak

---

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-48.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 23. VCO Tune Range Final. Refer to Chapter 2 for information about running the software.

The DVM connects to A9TP1, phase-lock-loop amplifier output. The user adjusts the 2nd LO cavity screw (located on 2nd converter bandpass filter and LO housing) for an A9TP1 voltage between −7.97 V and −7.53 V. (An unlock condition causes an UNLOCK warning on the controller display.) The test compares two DVM measurements, and then displays a SEARCHING message if the results are too far apart.

The synthesized signal generator frequency is 299.35 MHz. The user adjusts A9R7 for a DVM reading between +7.53 V and +7.97 V. An unlock condition or measurements too far apart cause the respective message on the controller display.

The user adjusts the LO cavity screw until the VCO tune range is within test limits.

Adjustment 24. Last Converter Bandpass Filter

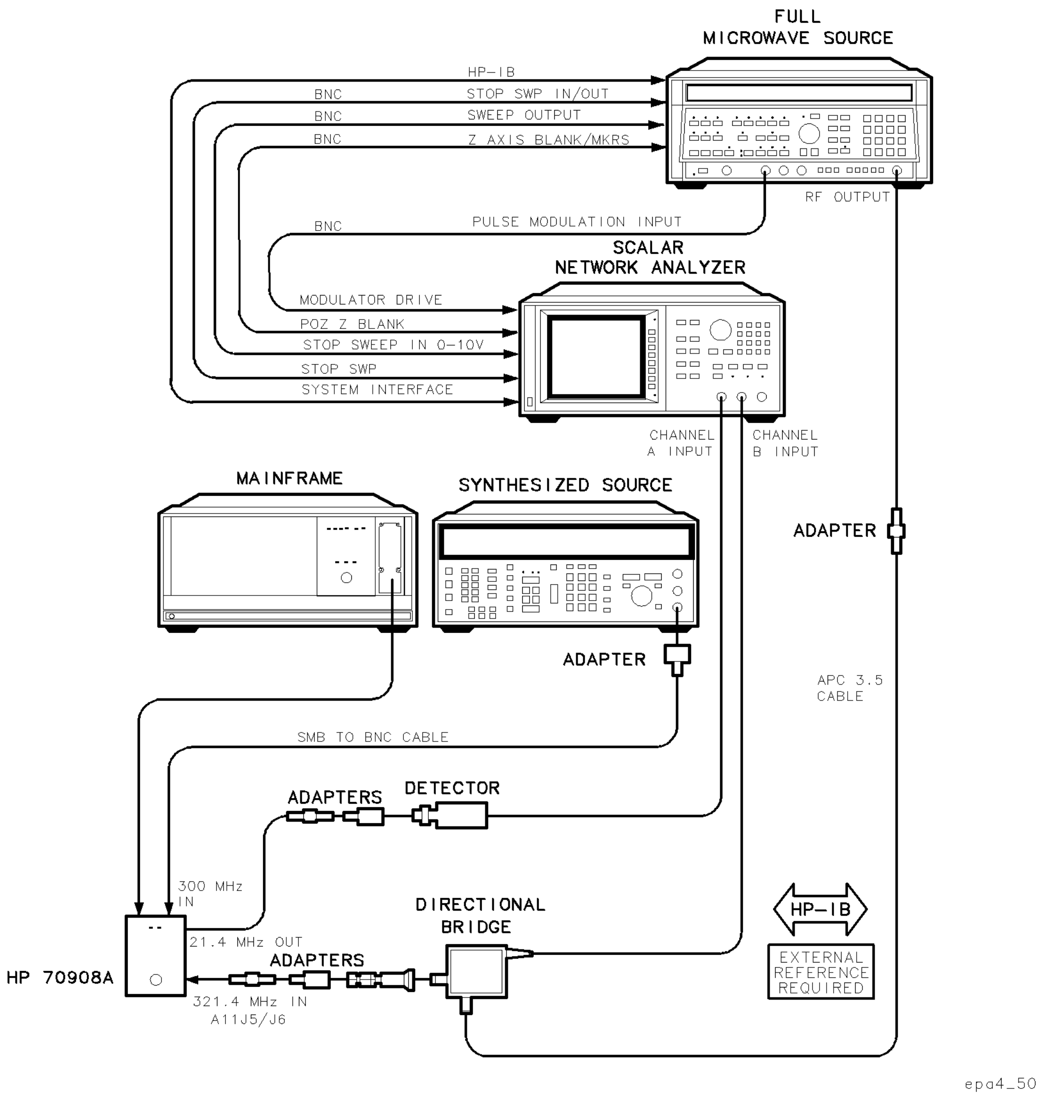


Figure 7-50. Equipment Setup for Adjustment 24. Last Converter Bandpass Filter

Adjustment 24. Last Converter Bandpass Filter

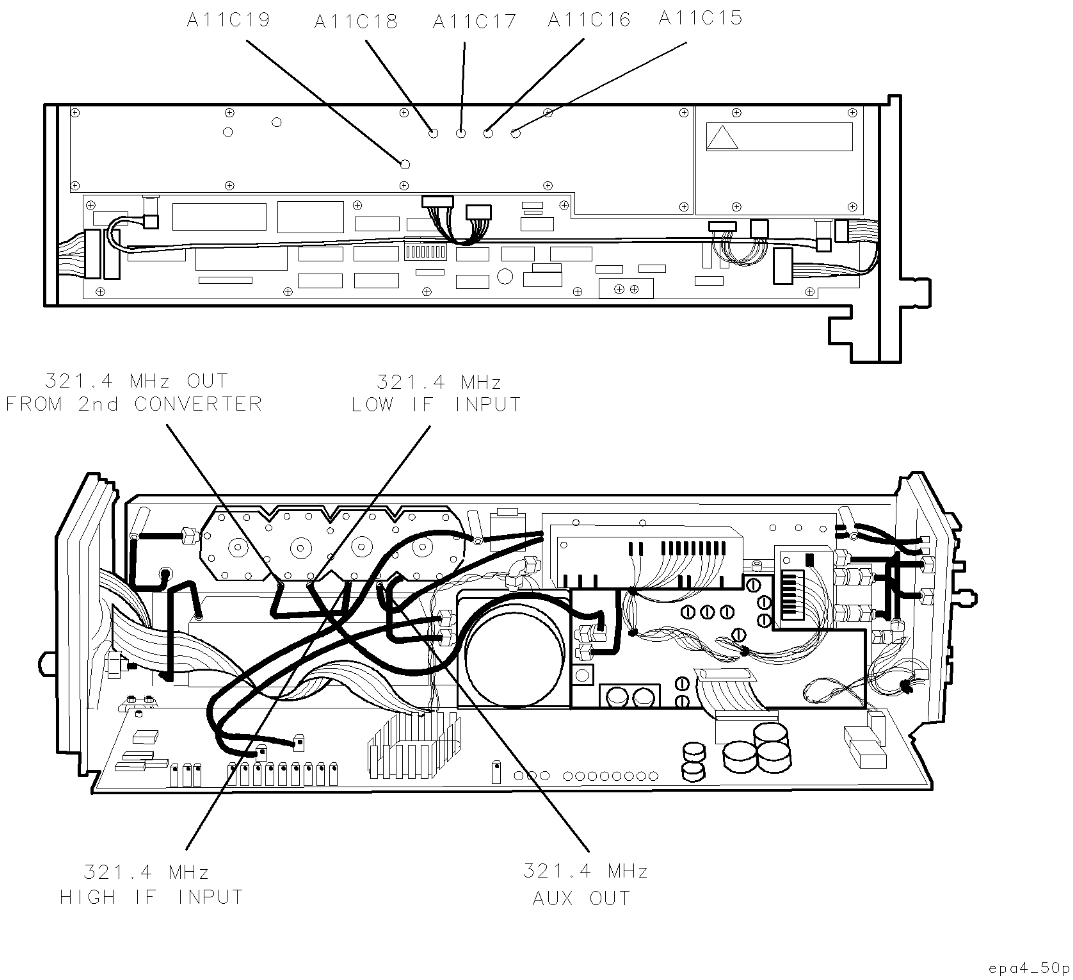


Figure 7-51. Locations for Adjustment 24. Last Converter Bandpass Filter

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Network analyzer	HP 8757A scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Detector	HP 11664E detector
Microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Directional bridge	HP 85027B directional bridge
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter (2 required)	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to verify or adjust the 321.4 MHz bandpass filter response of the A11 last converter.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-50.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 24. Last Converter Bandpass Filter. Refer to Chapter 2 for information about running the software.

A pulse-modulated carrier passes through the directional bridge to the A11 last-converter 321.4 MHz HIGH IF INPUT. The bridge and the A11 last converter output provide the inputs to channels B and A of the network analyzer. The resulting analyzer display is the A11 bandpass filter response.

A prompt instructs the user to adjust C15, C16, C17, C18, and C19 for maximum bandpass filter response at 278.6 MHz. (This initial adjustment maximizes the following notch filter adjustment.) The user next adjusts C19 at 278.6 MHz for minimum power. C15, C16, C17, and C18 are adjusted for best overall bandpass filter response at 321.4 MHz. The test verifies the resulting bandpass.

Adjustment 25. Noise Figure Last Converter

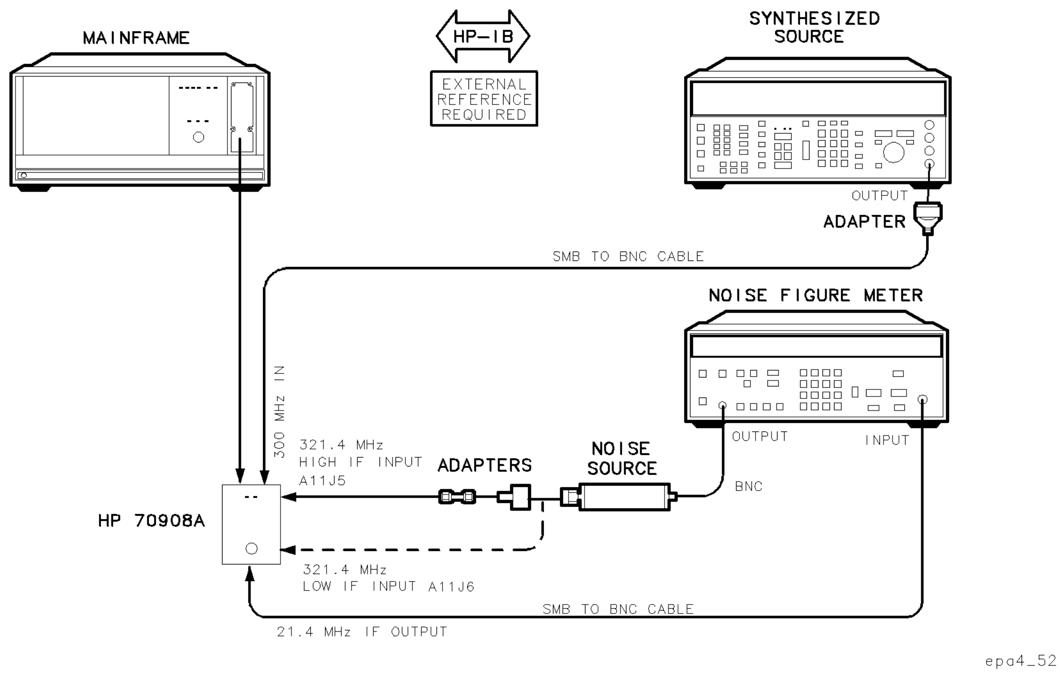


Figure 7-52. Equipment Setup for Adjustment 25. Noise Figure Last Converter

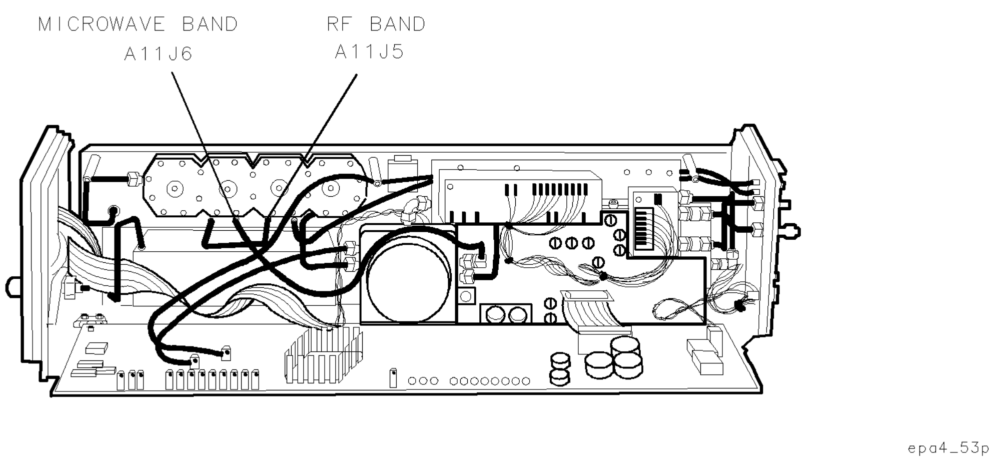


Figure 7-53. Locations for Adjustment 25. Noise Figure Last Converter

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
External reference	Refer to "External Frequency Reference" in Chapter 6.
Noise source	HP 346C broadband noise source
Noise figure meter	HP 8970B noise figure meter
Synthesized source	HP 8663A synthesized signal generator
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the last converter gain and noise figure.

Note Before performing this adjustment, verify completion of Adjustment 24. Last Converter Bandpass Filter.

This adjustment procedure requires an initial calibration of the noise figure meter. (Refer to Figure 6-12.)

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-52.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 25. Noise Figure Last Converter. Refer to Chapter 2 for information about running the software.

The test runs with the DUT step gain on. The synthesized signal source provides 300 MHz, 0 dBm, at the DUT 300 MHz IN. The RF noise source provides 321 MHz at A11J5, DUT high-RF 321.4 MHz IF input. The input of the noise figure meter measures 21 MHz at the DUT 21.4 OUT. The test executes; then the user connects the noise source to A11J6, low-μW 321.4 MHz IF input, and the test repeats. Step gain turns off and the sequence repeats.

Adjustment 26. Noise Figure 2nd Converter

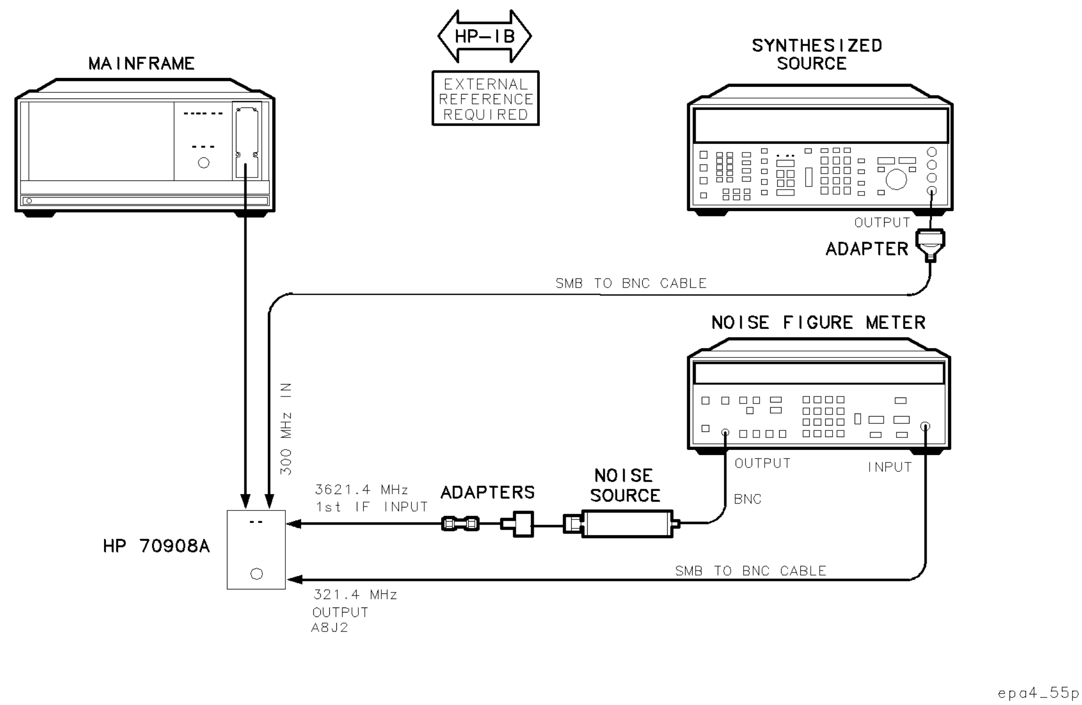


Figure 7-54. Equipment Setup for Adjustment 26. Noise Figure 2nd Converter

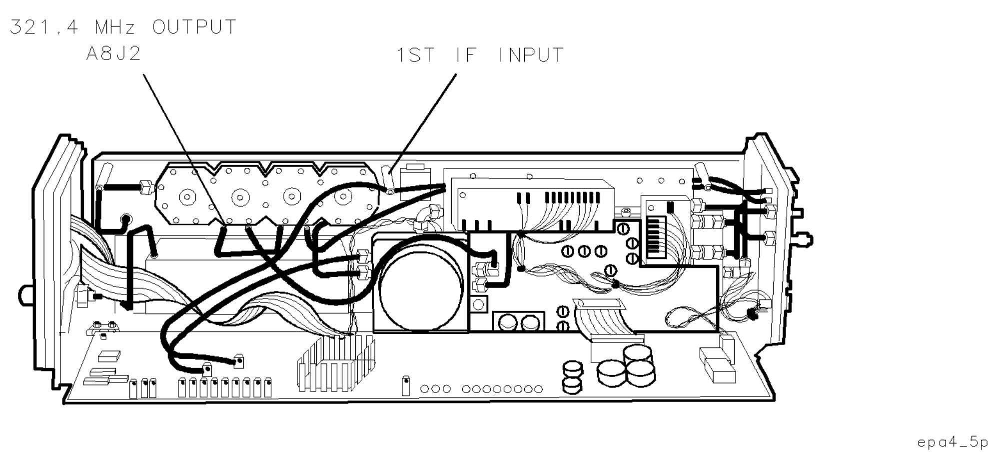


Figure 7-55. Locations for Adjustment 26. Noise Figure 2nd Converter

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
External reference	Refer to "External Frequency Reference" in Chapter 6.
Noise source	HP 346C broadband noise source
Noise figure meter	HP 8970B noise figure meter
Synthesized source	HP 8663A synthesized signal generator
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the 2nd converter conversion loss and noise figure. Noise figure indicate excess noise added by the 2nd converter. This test is a troubleshooting tool.

Note This adjustment procedure requires an initial calibration of the noise figure meter. (Refer to Figure 6-12.)

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-54.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 26. Noise Figure 2nd Converter. Refer to Chapter 2 for information about running the software.

The synthesized signal source provides 300 MHz, 0 dBm, at the DUT 300 MHz IN. The noise source provides 3621 MHz at the 1st IF INPUT. The noise figure meter input measures 321 MHz at A8J2, 2nd converter 321.4 MHz output. The test collects data and derives conversion loss and noise figure.

Adjustment 27. 21.4 MHz IF Frequency Response

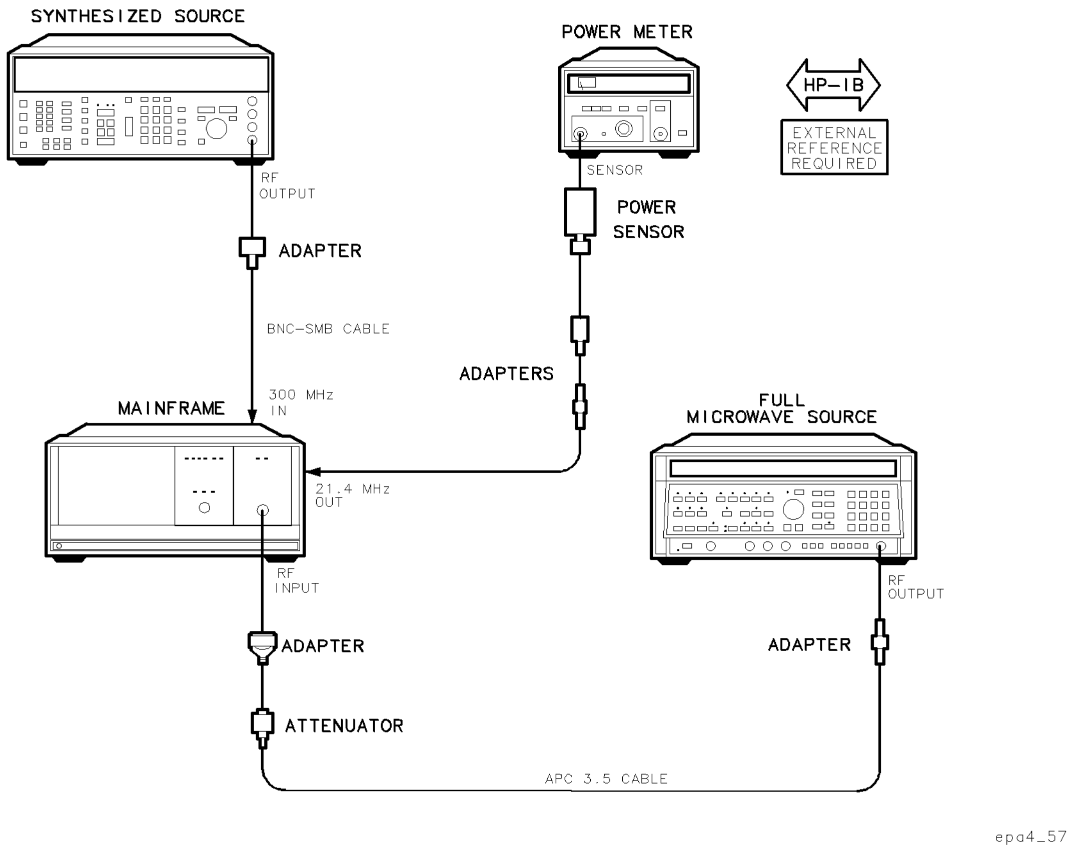


Figure 7-56. Equipment Setup for Adjustment 27. 21.4 MHz IF Frequency Response

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 200/300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Extender module	HP 70001-60013 extender module

The purpose of this adjustment procedure is to measure the 3 dB bandwidth and the passband frequency response of the 21.4 MHz OUT amplitude.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Connect the equipment as shown in Figure 7-56.
5. Set the mainframe line switch to ON and allow at least 30 minutes initial warmup before starting the adjustment.
6. Load and run Adjustment 27. 21.4 MHz IF Frequency Response. Refer to Chapter 2 for information about running the software.

When performing this adjustment, the measurement is made in the 1H− and the 1L− bands with the full microwave source providing RF INPUT amplitudes of 300 MHz and 2.7 GHz, respectively.

The local oscillator source frequency increments in 200 kHz steps, thus producing 15.4 to 27.6 MHz signals at the 21.4 MHz OUT. A power meter measures each step. The test determines 3 dB bandwidth by comparing power at 21.4 MHz with power at the step frequencies. With the same power data, the test determines passband amplitude response from 18.9 MHz to 23.9 MHz.

8

Module Verification Tests

This chapter contains the setups for all module verification tests that are used to optimize module performance when assemblies are changed, repaired, or adjusted. All of the setups described in this chapter are automated. These automated setups require a controller and are run with software that is described in Chapter 2.

Note

- Final tests are given in **bold** typeface; they are used to verify the operation of the module.
- The tests in normal typeface are not required for verifying the operation of the module, but may be needed after specific repairs or adjustments.

The information in this chapter is given in the following order:

Before You Begin Testing

Recommended Test Equipment

Refer to Chapter 5 for a list of test equipment, accessories, and related critical specifications. Refer to “Preparing a Static-Safe Work Station” in Chapter 4 for a list of ESD accessories.

The RF section, often referred to as the DUT (device-under-test), has four frequency bands: 1H−, 1L−, 2L−, and 4L−. Band selection affects configuration in the following ways.

- In the 1H− band, the switch in the SYTFMD (switched, Yig-tuned filter, mixer, discriminator) routes the input signal through the RF 1st converter. The IF chain is as follows:

  First LO .... 3.6214 to 6.5214 GHz
  First IF .... 3.6214 GHz
  Second LO .... 3.3 GHz
  Second IF .... 321.4 MHz
  Last LO .... 300 MHz
  Last IF .... 21.4 MHz

- In the 1L−, 2L−, and 4L− bands, the switch routes the input signal through the SYTFMD. The IF chain is as follows:

  First LO .... 3.0214 to 22.3214 GHz
  First IF .... 321.4 MHz
  Last LO .... 300 MHz
  Last IF .... 21.4 MHz

- Depending on the band setting, the LO multiplier multiplies the 1st LO frequency. The LO multiplier output frequency routed to the 1st mixer is as follows:

  1L− Band .... 3.0214 to 6.5214 GHz
  2L− Band .... 6.3214 to 13.1214 GHz
  4L− Band .... 12.9214 to 22.3214 GHz

Note In the 1H− band, the LO signal (3.6214 to 6.5214 GHz) is routed directly to the RF 1st converter, bypassing the LO multiplier.

- The 321.4 MHz switch in the last converter selects either the 321.4 MHz IF from the RF-band path (1H− band) or the 321.4 MHz IF from the μW-bands path (1L−, 2L−, and 4L− bands).
- The output switch in the A1 leveling amplifier routes the 3 to 6.6 GHz LO signal to either the A15 RF 1st converter (1H− band) or to the A2 LO multiplier (1L−, 2L−, and 4L− bands).

HP-IB Symbol

The Hewlett-Packard Interface Bus (HP-IB) symbol on verification test setup diagrams indicate that the controller and other instruments need to link together by means of HP-IB.

External Frequency Reference

The external reference symbol on a test setup diagram indicates that the HP 70000 Series modular spectrum analyzer system and equipment such as sources, analyzers, and frequency counters must connect to the same frequency standard. (Refer to “External Frequency Reference” in Chapter 6.)

Overall Test Setup

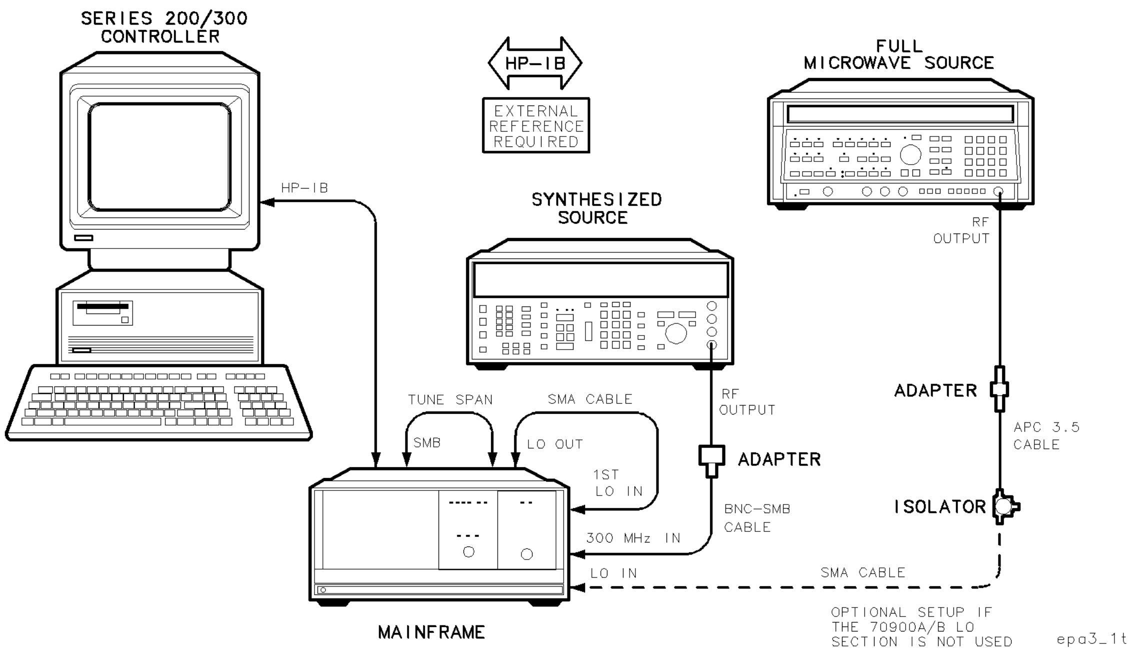


Figure 8-1. Overall RF Section Verification Test Setup

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Cable	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 5021-5450 260 mm SMA(m) to SMA(m)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
For optional LO setup	
Isolator	HP 0955-0204 microwave isolator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 5061-9038 520 mm SMA(m) to SMA(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The basic overall RF section setup in Figure 8-1 is applicable to all RF section verification tests except flatness, diagnostics, and LO input amplitude range.

Setups that utilize the Tune + Span ET (electronic tool) have alternate connections to the TUNE SPAN and 1st LO IN connectors. In all setups that receive inputs from the LO module rear panel, the LO module must meet its specifications for the particular output.

Test 01. Flatness

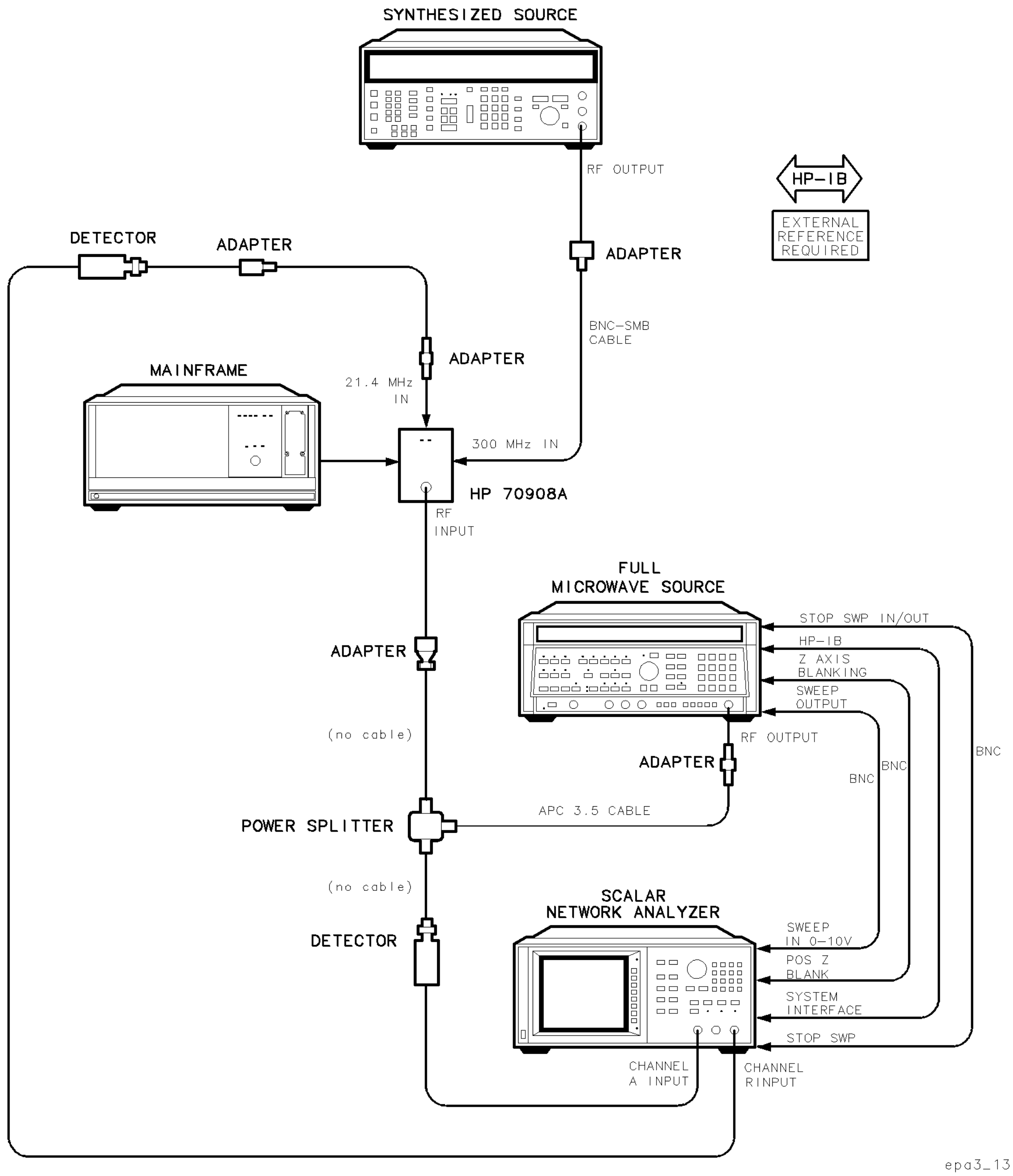


Figure 8-2. Equipment Setup for Test 01. Flatness

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Power splitter	HP 11667B power splitter
Detector (2 required)	HP 11664E detector
Cable (3 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter	HP 1250-1743 50Ω APC-3.5(m) to N(m)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Extender module	HP 70001-60013 extender module

The purpose of this verification test is to calculate and store the RF section flatness correction factors. Manual adjustments set gain in both the RF and μW bands.

This is a final test.

1. Set the mainframe line switch to OFF.
2. Remove the HP 70908A RF section from the mainframe.
3. Install the extender module in the mainframe and connect the HP 70908A RF section to the extender cable.
4. Set the mainframe line switch to ON.
5. Load and run Test 01. Flatness. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1H−. The network analyzer channel A detector connects to the DUT 21.4 MHz OUT. The full microwave source connects through a power splitter to channel R and to the DUT RF INPUT. A 300 MHz signal from the full microwave source produces −8 dBm at the DUT RF INPUT. The local oscillator tunes to center the RF INPUT frequency. A manual adjustment of A11R35 sets RF-band module gain. In the same manner in the 1L− band with a 2.7 GHz signal, A11R34 sets μW-band module gain.

The network analyzer measures the DUT input-to-output amplitude ratio, as the full microwave source steps from 10 MHz to 22 GHz. A software calibration routine subtracts detector flatness from the ratio. The result is flatness data for each DUT band.

To normalize flatness data to the DUT 300 MHz gain, a routine first subtracts the flatness data at 300 MHz from each data point, and then compares the difference to a test limit.

If the data meets the test limits, a linear regression algorithm processes the data to produce calibration factors for each DUT band. The software stores these factors in the DUT EEROM.

Test 02. Low Frequency Flatness < 10 MHz

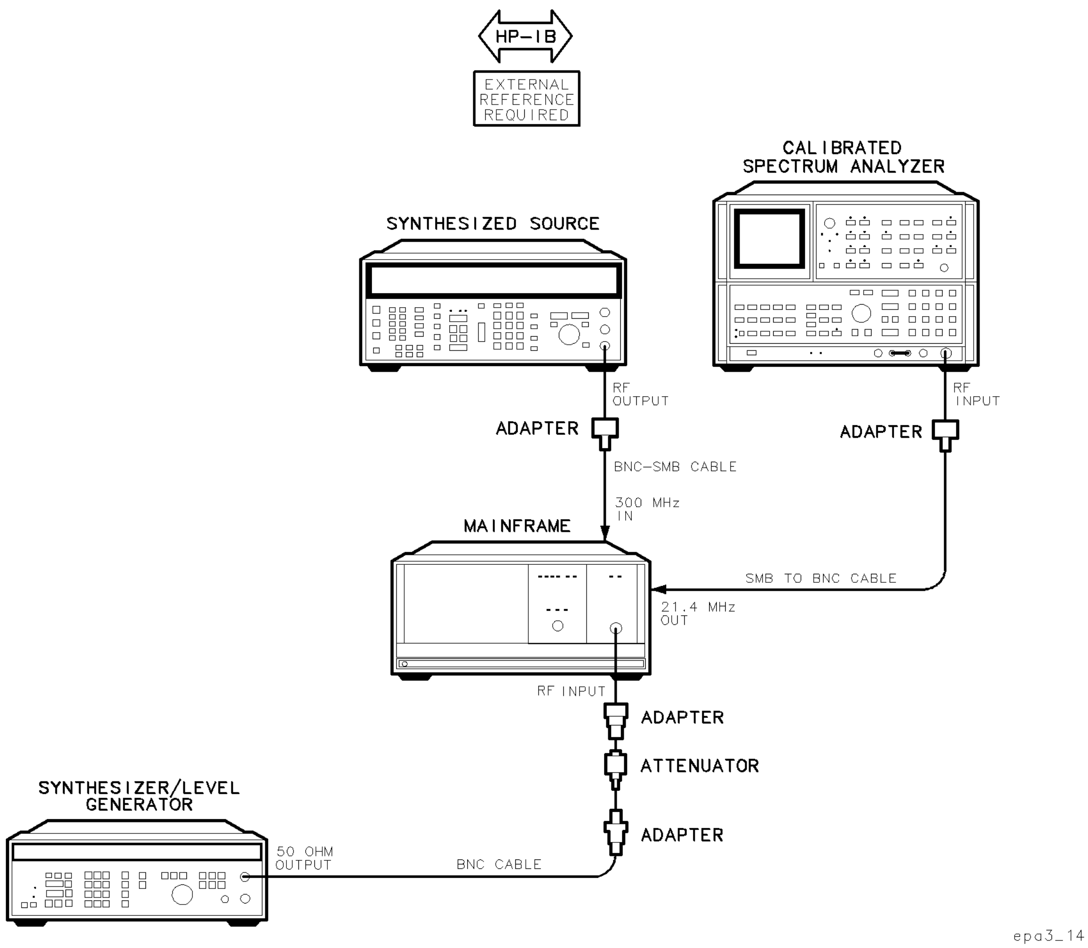


Figure 8-3. Equipment Setup for Test 02. Low Frequency Flatness < 10 MHz

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Level generator	HP 3335A synthesizer/level generator
Spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 1250-1200 50Ω SMA(m) to BNC(f)

Test 02. Low Frequency Flatness < 10 MHz

The purpose of this test is to measure the DUT frequency response for input signals from 200 Hz to 10 MHz. It complements Test 01. Flatness. It is only a verification and does not calculate and store flatness correction data in the DUT EEROM.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 02. Low Frequency Flatness < 10 MHz. Refer to Chapter 2 for information about running the software.

When performing this verification test, the level generator steps 10 MHz to 200 Hz at the DUT RF INPUT. At each frequency step, the local oscillator source tunes to produce a response at the DUT 21.4 MHz OUT. The calibrated spectrum analyzer measures the 21.4 MHz OUT amplitude. The measured amplitude at each frequency is normalized to the amplitude at 10 MHz input by subtracting the amplitude measured at 10 MHz from each amplitude reading. A routine compares test limits with flatness relative to the 10 MHz amplitude and then to peak-to-peak flatness found by subtracting the lowest amplitude reading from the highest amplitude reading.

Test 03. Attenuator Accuracy

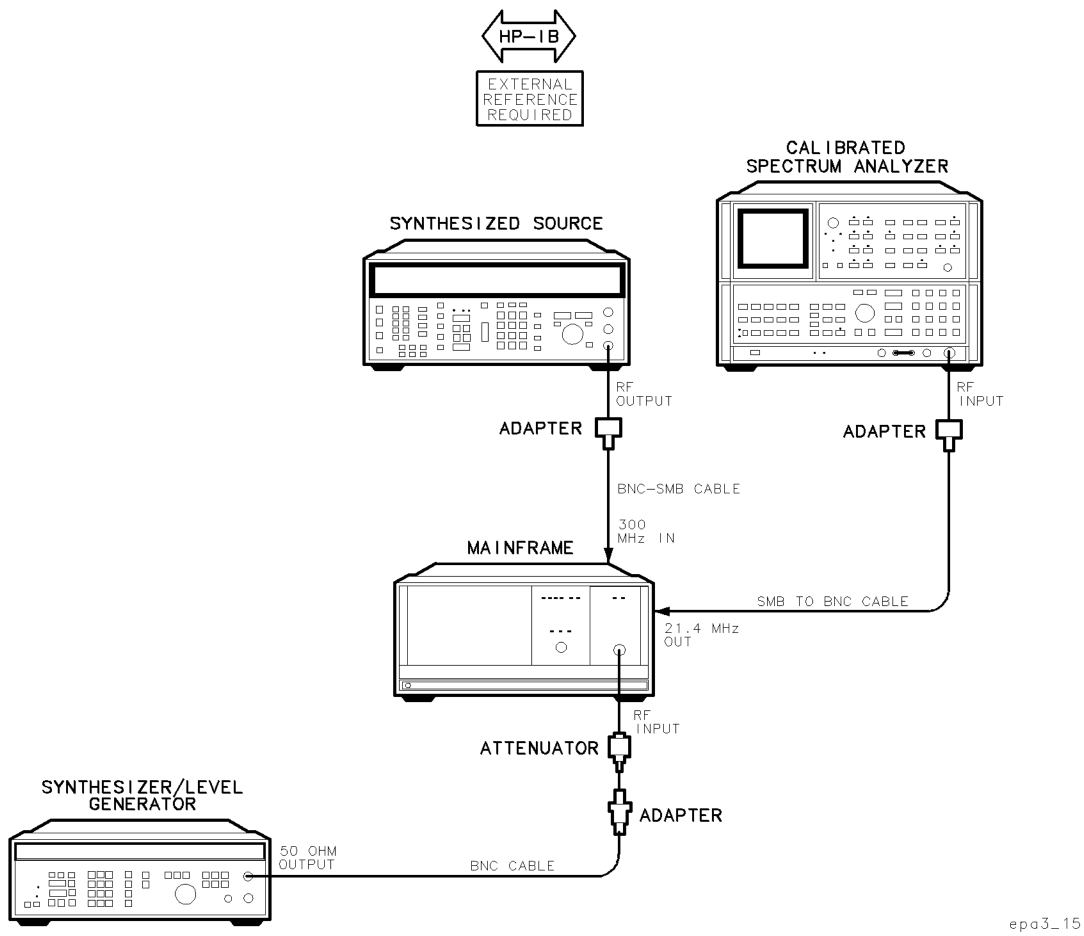


Figure 8-4. Equipment Setup for Test 03. Attenuator Accuracy

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Level generator	HP 3335A synthesizer/level generator
Spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-1200 50Ω SMA(m) to BNC(f)

The purpose of this verification test is to measure the DUT input attenuator switching error, referenced to the 10 dB input attenuator setting.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 03. Attenuator Accuracy. Refer to Chapter 2 for information about running the software.

When performing this verification test, the level generator provides 21.4 MHz, −50 dBm, at the DUT RF INPUT. The calibrated spectrum analyzer connects to the DUT 21.4 MHz OUT. The local oscillator source tunes to center the RF INPUT signal. The DUT input attenuation is 10 dB, and the frequency band is 1H−. The calibrated spectrum analyzer measures the 21.4 MHz OUT as a reference, and then the attenuator steps from 0 to 70 dB in 10 dB steps. At each step the level generator power level increases 10 dB to maintain a constant amplitude at the 21.4 MHz OUT. The calibrated spectrum analyzer measures each step amplitude , and then subtracts the reference measurement. The test compares the difference with amplitude accuracy test limits.

Test 04. Front Panel LEDs

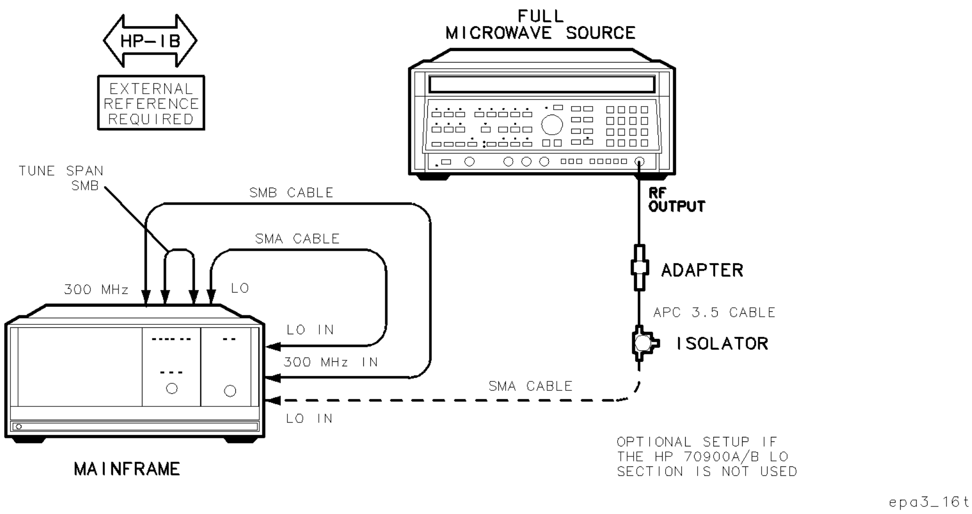


Figure 8-5. Equipment Setup for Test 04. Front Panel LEDs

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to "External Frequency Reference" in Chapter 6.
Cable	HP 8120-5014 100 mm SMB(f) to SMB(f)
Cable	HP 5061-9021 390 mm SMB(f) to SMB(f)
Cable	HP 5061-9038 520 mm SMA(m) to SMA(m)
For optional LO setup	
Isolator	HP 0955-0204 microwave isolator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 5021-5450 260 mm SMA(m) to SMA(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The purpose of test is to visually verify that the front panel LEDs are functioning properly and that the controller can operate the LEDs. The error/diagnostics-sensing capability is not tested. All module-related adjustments and calibrations must be completed prior to beginning this test.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 04. Front Panel LEDs. Refer to Chapter 2 for information about running the software.

When performing this verification test, the RF section can be configured in the system or connected to an extender module. Either the HP 70900B local oscillator source or a full microwave source can provide the LO input signal.

The test prompts the user to select a softkey that agrees with the state of the LEDs at the beginning of the test. The ACT (active) LED turns off, and the ERR (error) LED turns on. The user again selects a softkey that indicates LED state.

Test 05. 10.7 MHz Rejection

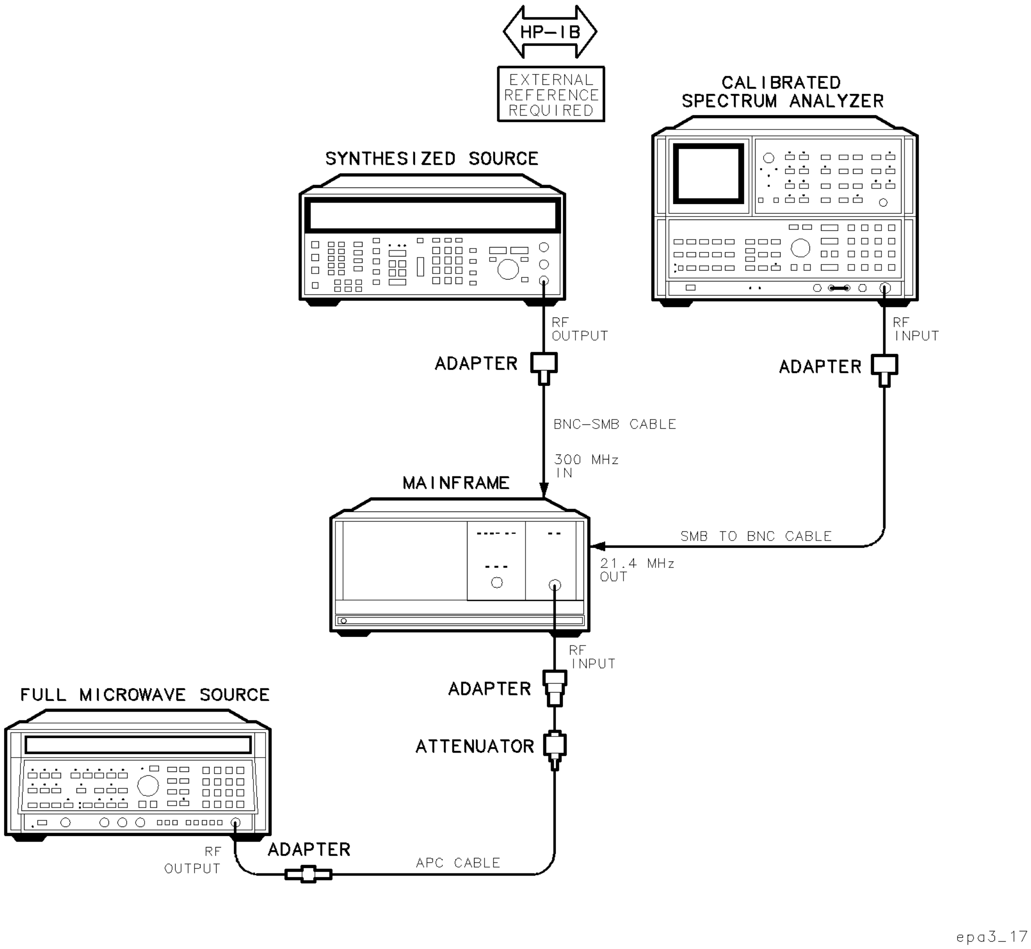


Figure 8-6. Equipment Setup for Test 05. 10.7 MHz Rejection

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

The purpose of this verification test is to measure the amplitude of 10.7 MHz signals at the 21.4 MHz OUT.

This test is dependent upon the repair, replacement, and/or the adjustment of the A11 last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 05. 10.7 MHz Rejection . Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1H−. The full microwave source provides 300 MHz, −10 dBm, at the DUT RF INPUT. The local oscillator source tunes to center the RF INPUT signal. The calibrated spectrum analyzer measures the 21.4 MHz OUT signal amplitude. The local oscillator source tunes to a 10.7 MHz offset, which results in a 10.7 MHz signal at the 21.4 MHz OUT. The spectrum analyzer subtracts the 10.7 MHz signal amplitude from the 21.4 MHz signal amplitude. The test compares the difference with test limits.

The procedure repeats in the 1L− band with 2.7 GHz at the RF INPUT.

Test 06. Feedthrough Out 21.4 MHz Port

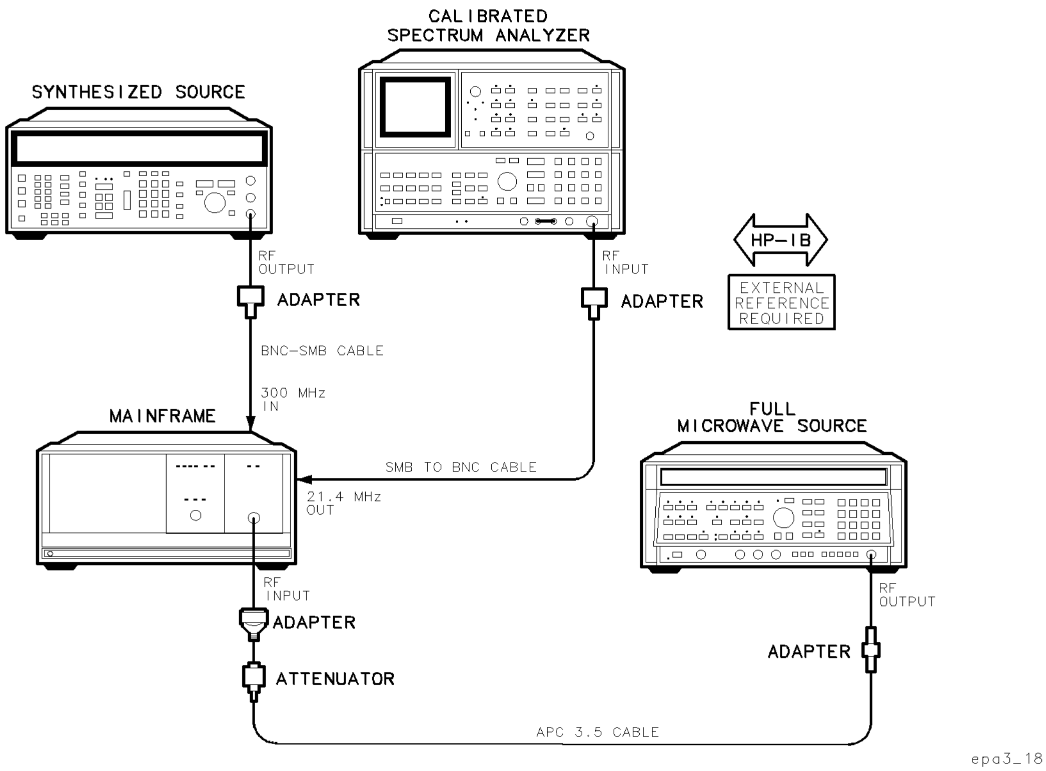


Figure 8-7. Equipment Setup for Test 06. Feedthrough Out 21.4 MHz Port

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the signal feedthrough out of the 21.4 MHz OUT. (The measured quantities result from 1st and 2nd IF feedthrough and 621.4 MHz mixing products.)

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 06. Feedthrough Out 21.4 MHz Port. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz at the DUT RF INPUT. DUT input attenuation is 10 dB and the frequency band is 1H−. The local oscillator source tunes to center the RF INPUT signal. The calibrated spectrum analyzer compares test limits with signal amplitudes at 321.4 MHz, 621.4 MHz, 300 MHz, and 3621.4 MHz. The procedure repeats in the 1L− band with 4 GHz at the RF INPUT.

Test 07. Harmonics Out 21.4 MHz Port

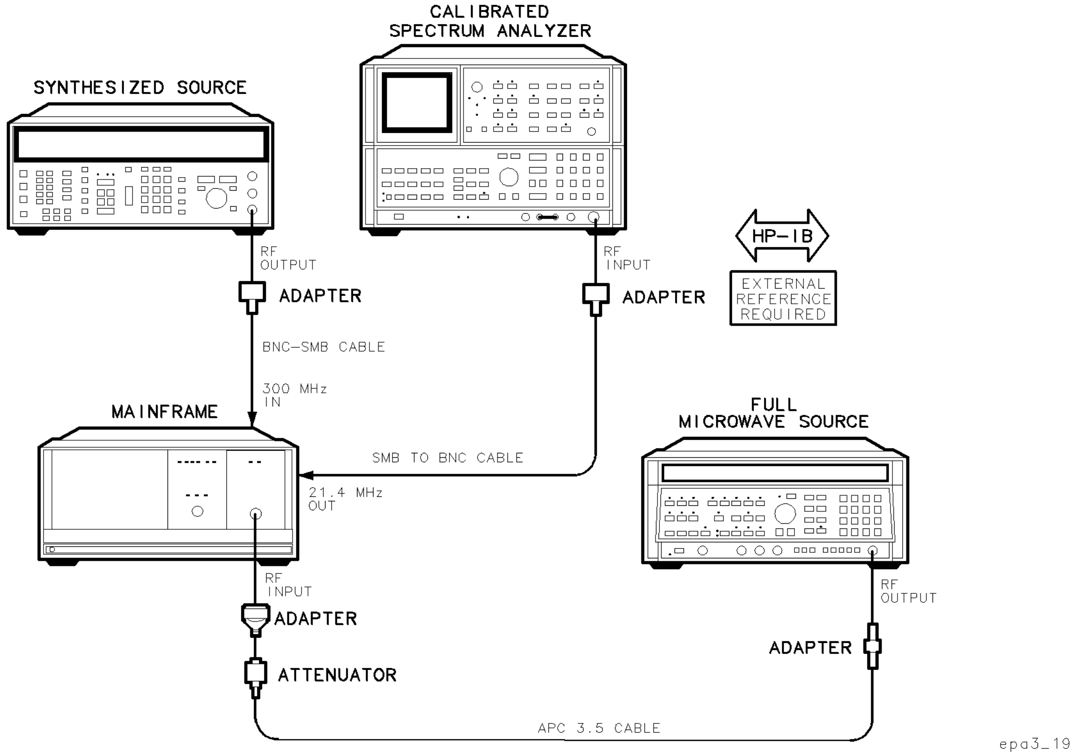


Figure 8-8. Equipment Setup for Test 07. Harmonics Out 21.4 MHz Port

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure and compare amplitudes of fundamental and harmonic frequencies at the 21.4 MHz OUT.

This test is dependent upon the repair, replacement, and/or adjustment of the A11 last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 07. Harmonics Out 21.4 MHz Port. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz, 0 dBm, at the DUT RF INPUT. The DUT frequency band is 1H−. The synthesized source provides 300 MHz, 2 dBm, at the DUT 300 MHz IN. The local oscillator source tunes to center the RF INPUT signal. The calibrated spectrum analyzer measures the amplitude of the fundamental and the first three harmonics of the 21.4 MHz signal. A routine subtracts the amplitude of each harmonic from the amplitude of the fundamental , and then compares the difference with a test limit.

The procedure repeats in the 1H− band with 300 MHz, 2 dBm at the RF INPUT, and then again in the 1L− bandwidth 4 GHz at the RF INPUT.

Test 08. Residual Emissions Out 21.4 MHz Port

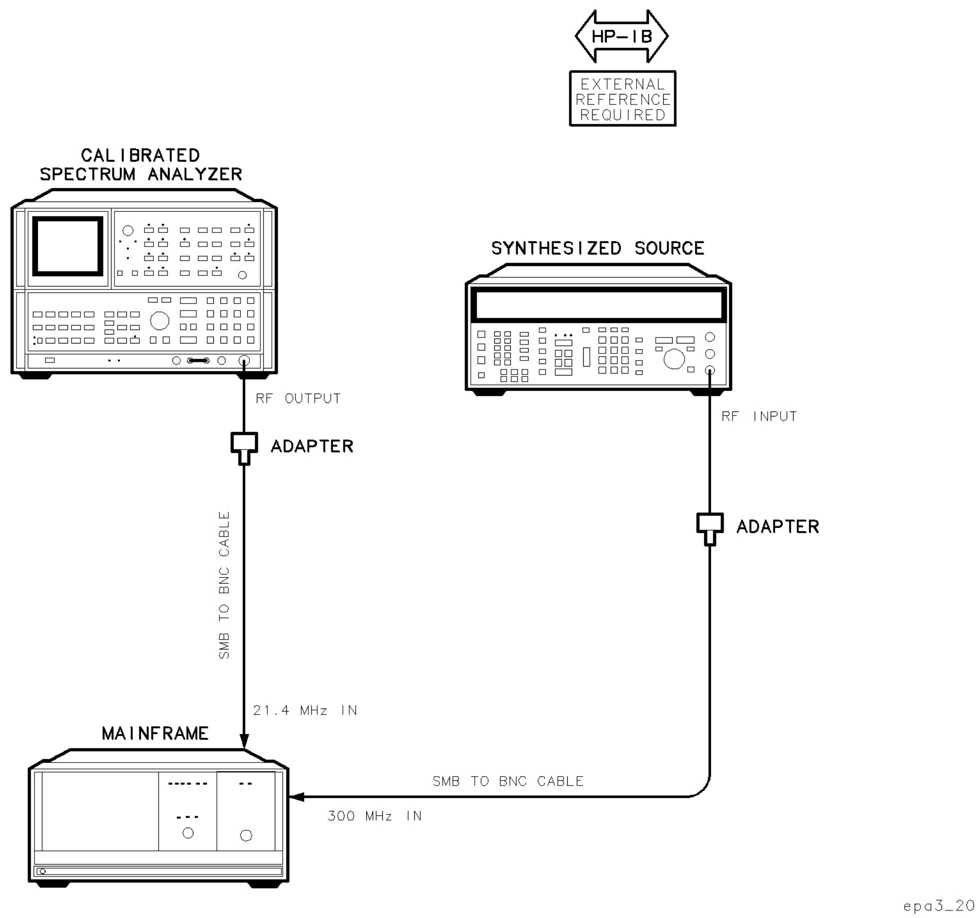


Figure 8-9. Equipment Setup for Test 08. Residual Emissions Out 21.4 MHz Port

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

Test 08. Residual Emissions Out 21.4 MHz Port

The purpose of this verification test is to measure last-LO residual emissions present at the 21.4 MHz OUT. It then measures 1st LO feedthrough at the 21.4 MHz OUT.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 08. Residual Emissions Out 21.4 MHz Port. Refer to Chapter 2 for information about running the software.

When performing this verification test, the synthesized source provides 300 MHz, 0 dBm, at the DUT 300 MHz IN. The calibrated spectrum analyzer connects to the DUT 21.4 MHz OUT and measures the DUT 300 MHz last-LO fundamental (300 MHz) and its second and third harmonics (600 and 900 MHz). The test then compares these 1 kHz bandwidth measurements with test limits.

The test next measures 1H− band 1st LO feedthrough. The local oscillator source tunes to the 1st IF frequency, 3.6214 GHz. The calibrated spectrum analyzer then measures the 21.4 MHz OUT signal. The test compares the measurement to the test limit.

Test 09. Image Rejection

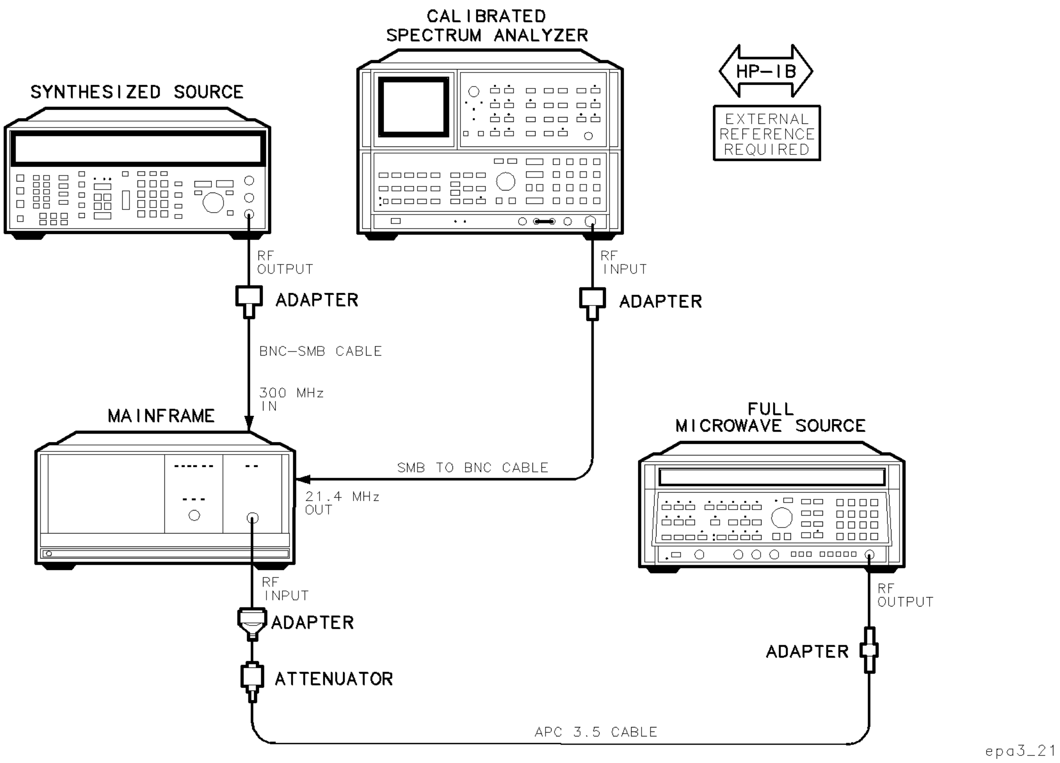


Figure 8-10. Equipment Setup for Test 09. Image Rejection

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the image responses of the first and last IFs in the μW bands and the second and last IFs in 1H− band. (Image responses are a pair of frequencies separated by twice the IF frequency of the analyzer.)

This is a final test.

Note If this test fails in 1H− band, repeat using a different HP 8340A synthesized sweeper. (Some HP 8340A synthesized sweepers may have output spurious levels that mix with the LO to produce a −642.8 MHz response in the 1st IF.)

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 09. Image Rejection. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source connects to the DUT RF INPUT, and then steps through the image frequencies. At each step frequency the local oscillator source tunes to center the signal. The calibrated spectrum analyzer measures the amplitude of the 21.4 MHz OUT signal. The local oscillator source frequency is then offset by −642.8 MHz to cause the input signal from the full microwave source to appear as an image response of the DUT 321.4 MHz IF. The calibrated spectrum analyzer measures the amplitude of this image response. Subtracting image response from the measured real response results in a relative measurement, which a routine compares with test limits.

The test repeats in the 1H−, 1L−, 2L−, and 4L− bands, and at the 1H−band last IF image response (local oscillator source offset −42.8 MHz).

Test 10. IF Rejection

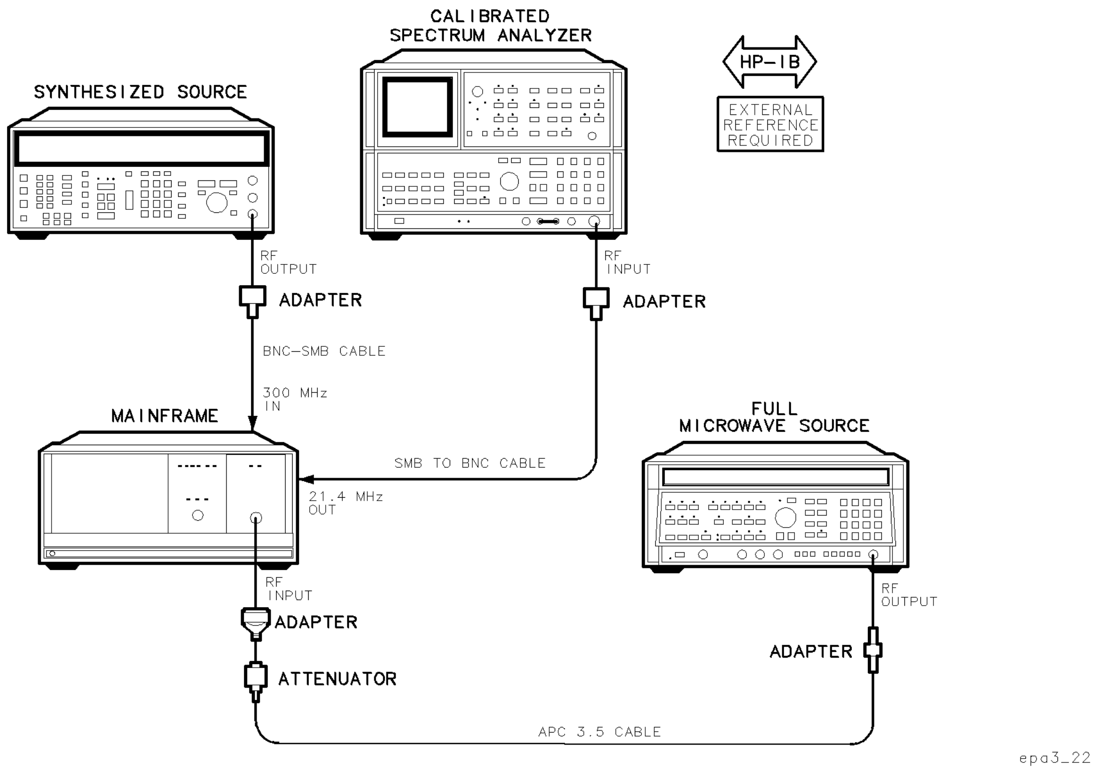


Figure 8-11. Equipment Setup of Test 10. IF Rejection

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the DUT 21.4 MHz OUT response corresponding to RF INPUT frequencies equal to the DUT internal IF and IF image frequencies. (Inadequate IF rejection results in base line lift of the system.)

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 10. IF Rejection. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz, +0.5 dBm, at the RF INPUT. The local oscillator source tunes to center the RF INPUT signal, and the calibrated spectrum analyzer stores the 21.4 MHz OUT response amplitude as a reference.

The full microwave source tunes in sequence to the following frequencies:

21.4 MHz (last IF)
278.6 MHz (image of second IF)
321.4 MHz (second IF)
2978.6 MHz (image of first IF)
3621.4 MHz (first IF)

Measurements at the above frequencies are independent of the DUT 1st LO because the LO frequency does not change. The calibrated spectrum analyzer provides a relative measurement by subtracting the 21.4 MHz OUT response at each frequency from the reference response. A routine compares the relative measurement to test limits. These measurements are performed in bands 1H−, 1L−, 2L−, and 4L−.

Test 11. 2nd Converter Startup

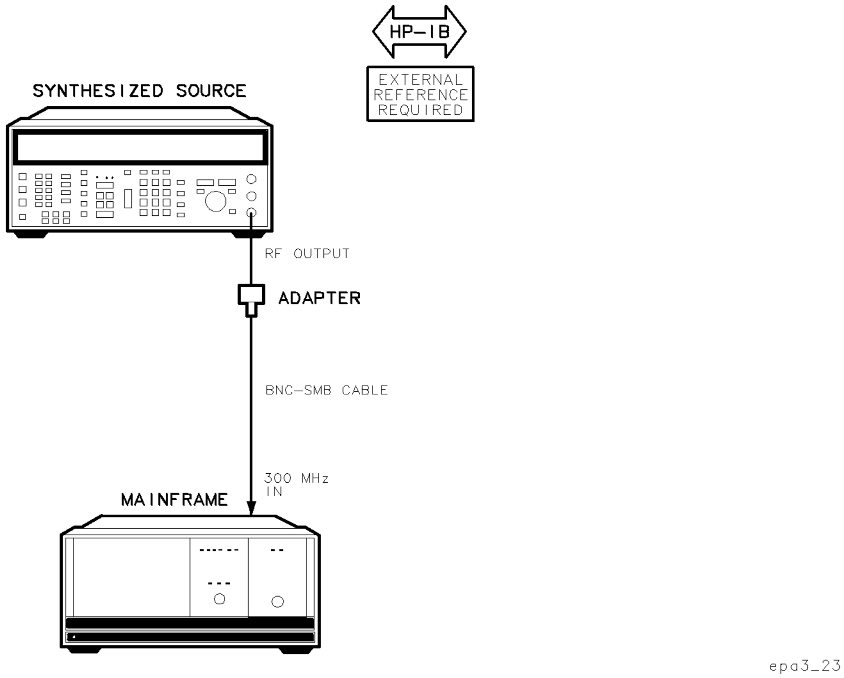


Figure 8-12. Equipment Setup for Test 11. 2nd Converter Startup

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to "External Frequency Reference" in Chapter 6.
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this test is to verify that the 2nd converter LO turns on when the DUT is switched into band 1H−.

This test is dependent upon the repair, replacement, and/or the adjustment of the A9 2nd converter PLL, A5 VCO sampler, A7 2nd mixer, or A8 321.4 MHz matching network.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 11. 2nd Converter Startup. Refer to Chapter 2 for information about running the software.

When performing this verification test, in DUT band 1H−, the local oscillator source tunes to 4 GHz. The synthesized source connects to the 300 MHz IN, and then steps through five power levels (−5 to 5 dBm) at each of five frequencies (299.4 to 300.55 MHz). At each power level the DUT switches to 1L− band and then to 1H− band to turn the 2nd LO off and then on.

The DUT 2nd LO unlock diagnostic detector verifies 2nd LO turn-on and lock. This on/off cycle repeats five times.

Test 12. IF Sub-Harmonics

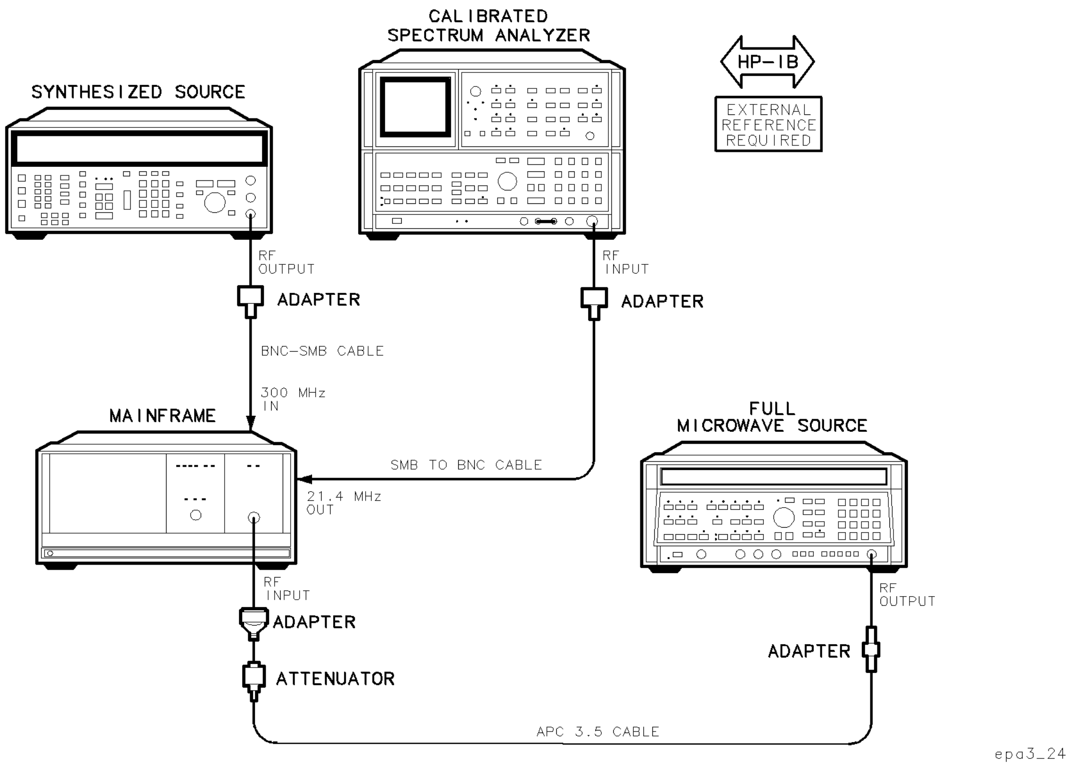


Figure 8-13. Equipment Setup for Test 12. IF Sub-Harmonics

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

Test 12. IF Sub-Harmonics

The purpose of this verification test is to measure the DUT 21.4 MHz OUT response due to subharmonics of the DUT IF. (A subharmonic is an input signal offset from the DUT center frequency by 1/2 the DUT internal IF frequencies.)

In the 1H− band the subharmonics are one-half the first IF (3621.4 MHz/2= 1810.7 MHz) and one-half the last IF (21.4 MHz/2 = 10.7 MHz). For the 1L−, 2L−, and 4L− bands the sub-harmonics are one-half the first IF (321.4 MHz/2 = 160.7 MHz) and one-half the last IF (21.4 MHz/2 = 10.7MHz)|.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 12. IF Sub-Harmonics. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source connects to the RF INPUT. The synthesized source provides the DUT with a 300 MHz, −2 dBm, 300 MHz IN reference signal, which ensures worst-case sub-harmonic response in the DUT. The calibrated spectrum analyzer connects to the 21.4 MHz OUT. The following procedure repeats twice in each band (once for each subharmonic of interest).

The local oscillator source tunes to center the RF INPUT. The calibrated spectrum analyzer stores the amplitude of the 21.4 MHz OUT, along with a flatness correction, as the measurement reference, thus ensuring results that are independent of module gain.

To simulate a subharmonic response, the RF INPUT signal frequency remains constant, while the local oscillator source retunes an offset amount equal to the separation between the input signal and the subharmonic. This causes the 1st IF to differ from normal by the offset amount, thus causing the 21.4 MHz OUT frequency to differ from 21.4 MHz by the offset amount. The calibrated spectrum analyzer subtracts this offset output amplitude from the previously stored 21.4 MHz reference. A routine compares the difference with test limits.

Test 13. Residual Responses

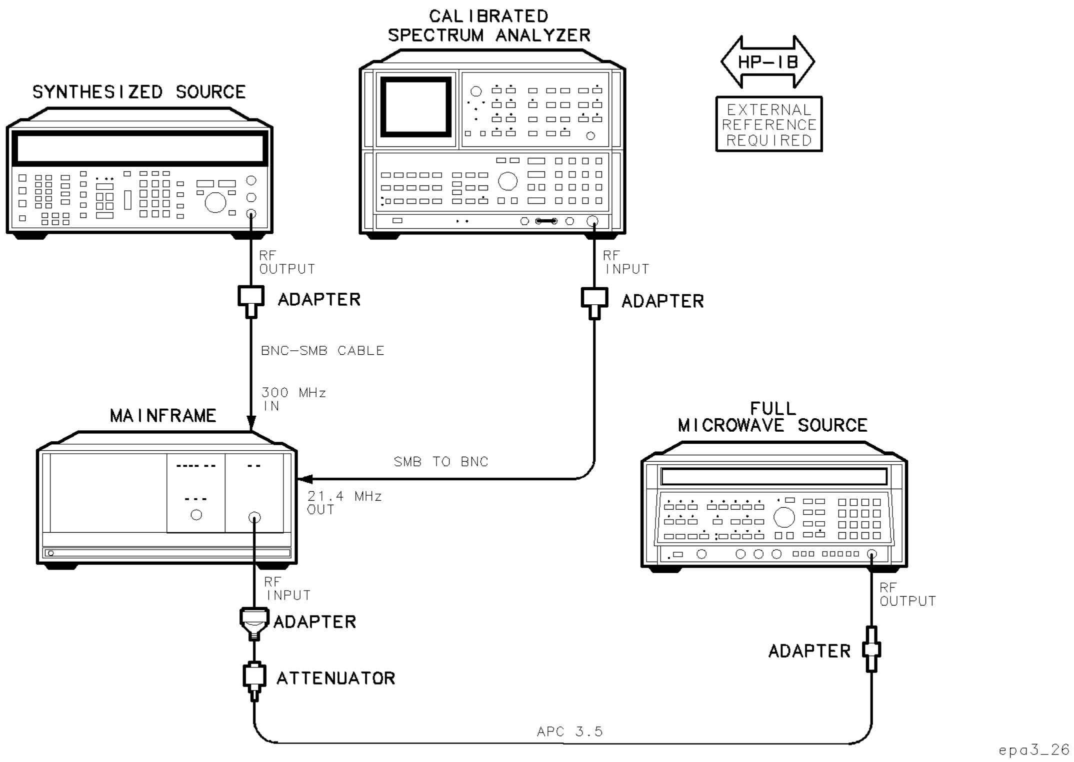


Figure 8-14. Equipment Setup for Test 13. Residual Responses

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

Test 13. Residual Responses

The purpose of this verification test is to measure residual responses generated by the DUT with no signal at the DUT RF INPUT. (The residual responses measured by this test are mixing products of the DUT second and last LOs and the second and last IFs.)

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 14. Miscellaneous Residual Responses. Refer to Chapter 2 for information about running the software.

When performing this verification test, before measuring residual responses, the test characterizes DUT gain, DUT input attenuator, and the calibrated spectrum analyzer input attenuator. The characterization data later corrects the measured residual responses.

Characterizing the DUT Gain

The full microwave source provides a 300 MHz, −10 dBm, signal at the DUT RF INPUT. DUT input attenuation is −10 dB. The local oscillator source tunes to center the response. The calibrated spectrum analyzer stores the 21.4 MHz OUT amplitude, which is then corrected for DUT flatness. The test then calculates DUT gain: corrected 21.4 MHz amplitude minus 10 dBm RF INPUT.

Characterizing the DUT Input Attenuator

With the DUT input attenuator set to 10 dB attenuation, the calibrated spectrum analyzer measures the 21.4 MHz OUT amplitude. The measurement repeats with 0 dB input attenuation. The DUT attenuator correction factor equals the second measurement minus the first. Only the 0 to 10dB DUT input attenuator setting is of interest.

Characterizing the Calibrated Spectrum Analyzer Input Attenuator

With the calibrated spectrum analyzer input attenuator set to 10 dB, the analyzer measures the DUT 21.4 MHz OUT amplitude. The measurement repeats with 0 dB attenuation. The calibrated spectrum analyzer attenuation correction factor equals the second measurement minus the first.

Measuring Residuals

The full microwave source RF output is off. The DUT input attenuation is 0 dB. In each of the four bands the local oscillator source tunes to known residual frequencies, and the calibrated spectrum analyzer measures responses at the 21.4 MHz OUT. The test corrects the measurement for DUT gain, DUT attenuation error, calibrated spectrum analyzer error, and DUT flatness, and then compares the result with test limits.

Test 14. Miscellaneous Residual Responses

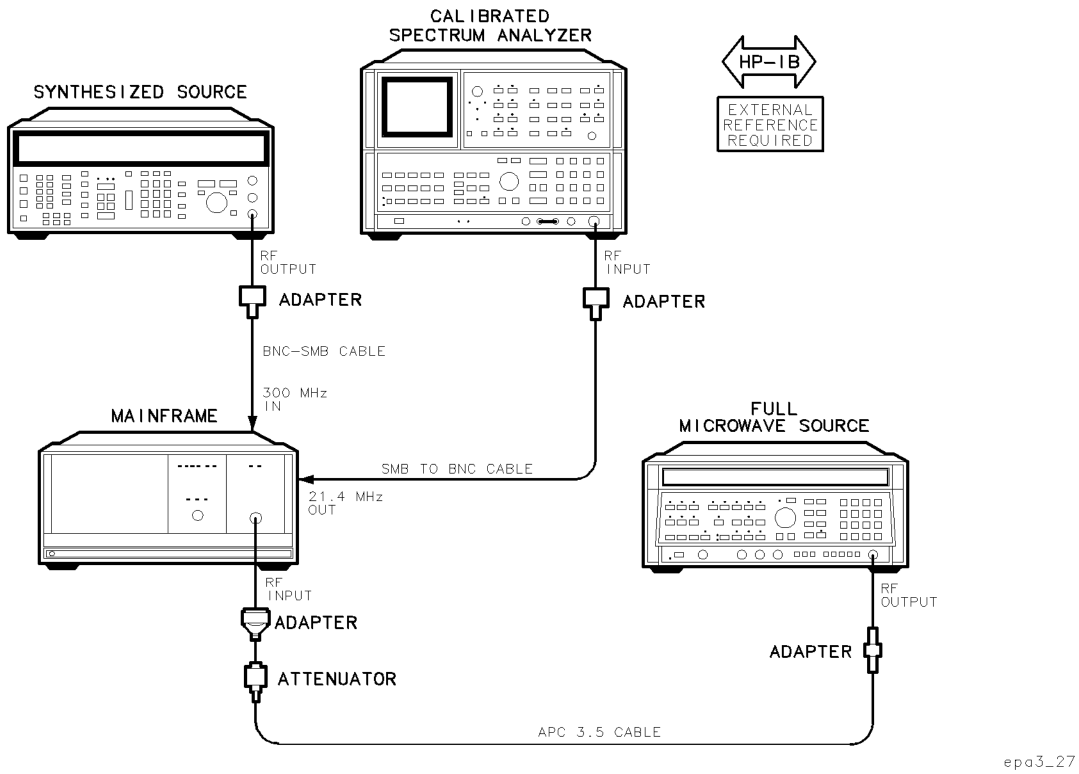


Figure 8-15. Equipment Setup for Test 14. Miscellaneous Residual Responses

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

Test 14. Miscellaneous Residual Responses

The purpose of this verification test is to measure residual responses generated by the DUT with no signal applied to the DUT RF INPUT. (The residual responses measured are harmonics of the 300 MHz reference input.)

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 14. Miscellaneous Residual Responses. Refer to Chapter 2 for information about running the software.

When performing this verification test, before measuring residual responses, the test characterizes DUT gain, DUT input attenuator, and the calibrated spectrum analyzer input attenuator. The characterization data later corrects the measured residual responses.

Characterizing the DUT Gain

The full microwave source provides a 300 MHz, −10 dBm, signal at the DUT RF INPUT. DUT input attenuation is 10 dB. The local oscillator source tunes to center the response. The calibrated spectrum analyzer stores the 21.4 MHz OUT amplitude and corrects it for DUT flatness. The test then calculates DUT gain, the corrected 21.4 MHz amplitude minus 10 dBm RF INPUT.

Characterizing the DUT Input Attenuator

With the DUT input attenuator set to 10 dB attenuation, the calibrated spectrum analyzer measures the 21.4 MHz OUT amplitude. The measurement repeats with 0 dB input attenuation. The DUT attenuator correction factor equals the second measurement minus the first. Only the 0 and 10 dB DUT input attenuator settings are of interest.

Characterizing the Calibrated Spectrum Analyzer Input Attenuator

With the calibrated spectrum analyzer input attenuator set to 10 dB, the calibrated spectrum analyzer measures 21.4 MHz OUT amplitude of the DUT. The measurement repeats with 0 dB attenuation. The calibrated spectrum analyzer attenuation correction factor equals the second measurement minus the first.

Measuring Residuals

The full microwave source RF output is off. The calibrated spectrum analyzer settings are −50 dBm reference level, 100 Hz span, 30 Hz resolution bandwidth. The DUT input attenuation is 0 dB. In 1H− band only, the local oscillator source tunes in sequence to the fundamental and the first eight harmonics of 300 MHz, and the calibrated spectrum analyzer measures responses at the 21.4 MHz OUT. The test corrects the measurements for DUT gain, DUT attenuation error, calibrated spectrum analyzer error, and DUT flatness, and then compares the results with test limits.

Test 15. 321.4 MHz IF Out Frequency Response

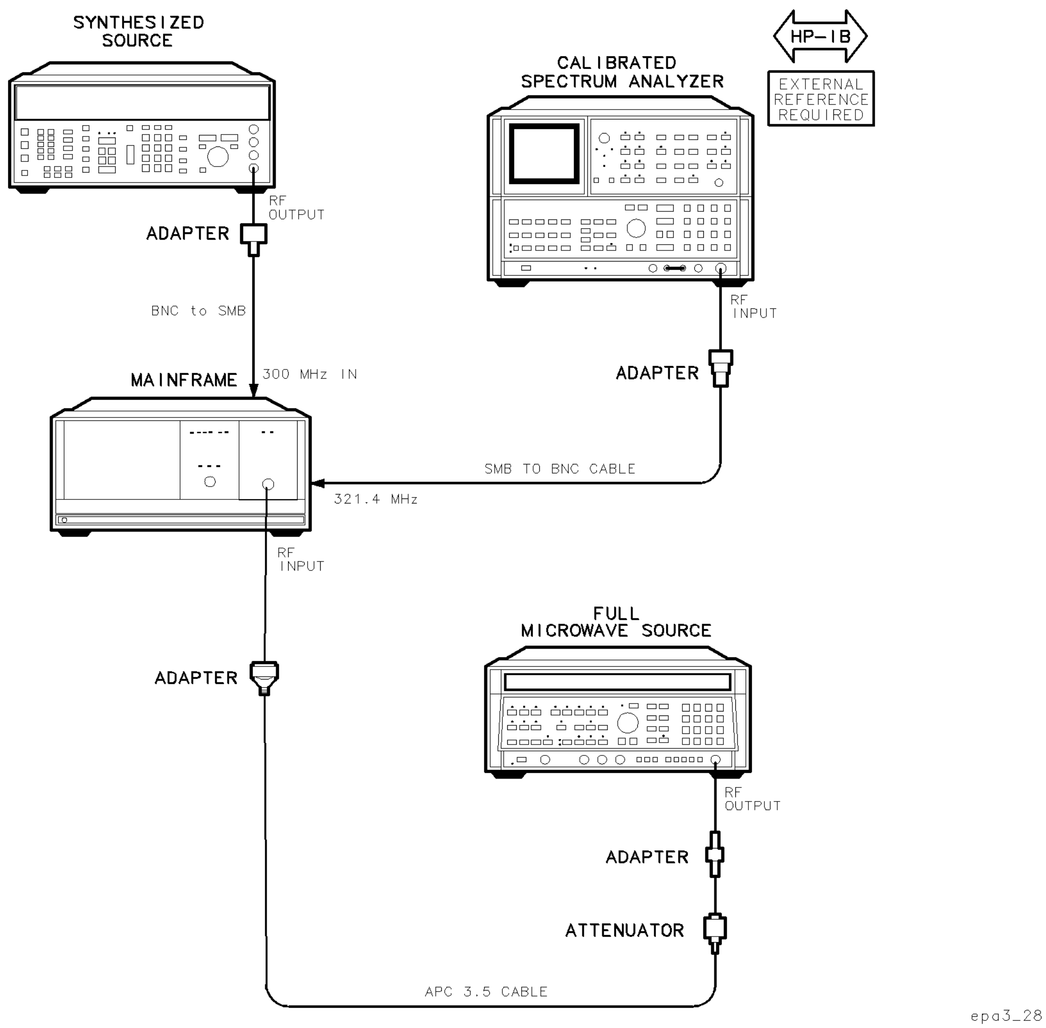


Figure 8-16. Equipment Setup for Test 15. 321.4 MHz IF Out Frequency Response

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

Test 15. 321.4 MHz IF Out Frequency Response

The purpose of this verification test is to measure the output amplitude and 3 dB bandwidth at the 321.4 MHz OUT. (The 321.4 MHz signal is the 2nd IF in band 1H−, and the 1st IF in bands 1L−, 2L−, and 4L−.)

This test is dependent on the repair, replacement, or adjustment of the A11 last converter or the A12 controller.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 15. 321.4 MHz IF Out Frequency Response. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz, −10 dBm, at the DUT RF INPUT. The DUT input attenuation is 0 dB and the frequency band is 1H−. The 321.4 MHz switch on A11 last converter routes the 321.4 MHz to the rear panel 321.4 MHz OUT. The calibrated spectrum analyzer stores the amplitude of the 321.4 MHz signal as a reference.

The local oscillator source increments in 20 kHz steps, thus causing the signal at the 321.4 MHz OUT to vary in 20 kHz steps from the normal 321.4 MHz. At each frequency, the calibrated spectrum analyzer measures the amplitude of the signal at the 321.4 MHz OUT. Comparisons between the 321.4 MHz reference and the signal at each step allow the test to determine the 3 dB bandwidth. The test utilizes the same data to determine amplitude level throughout the range of 321.4 MHz ±4 MHz. The procedure repeats in band 1L− at 2700 MHz.

Test 16. 21.4 MHz IF Frequency Response

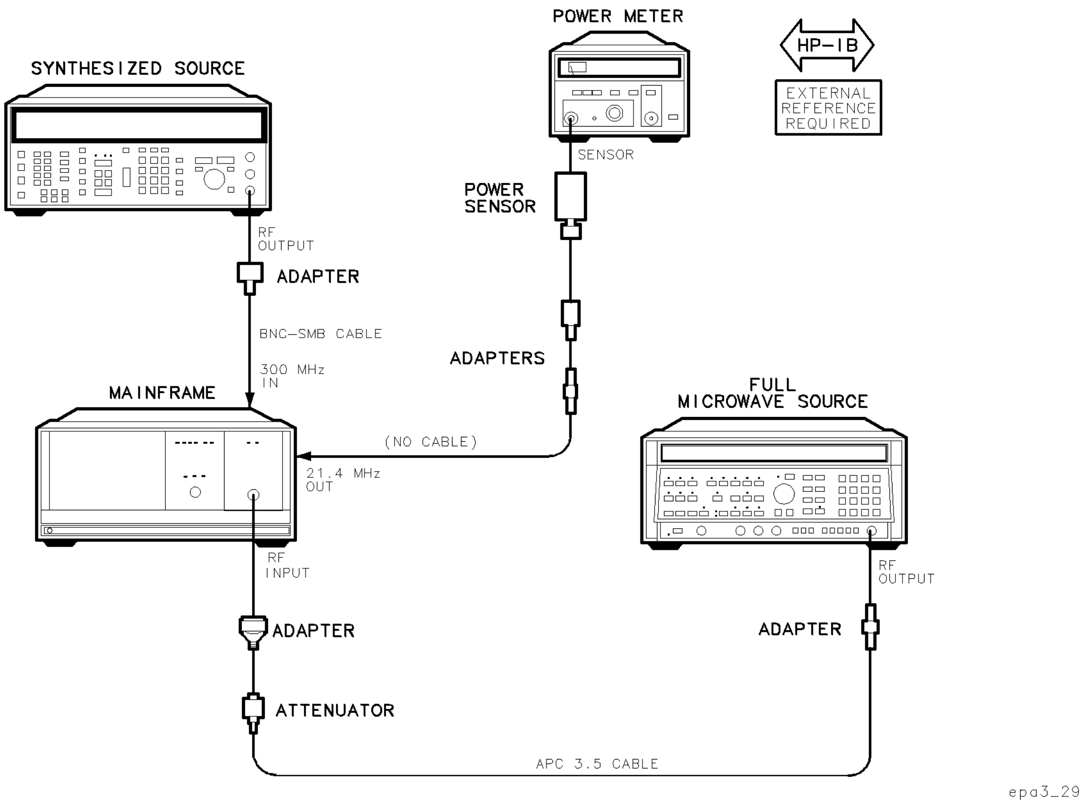


Figure 8-17. Equipment Setup for Test 16. 21.4 MHz IF Frequency Response

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

Test 16. 21.4 MHz IF Frequency Response

The purpose of this verification test is to measure the 3 dB bandwidth and the passband frequency response of the 21.4 MHz OUT amplitude.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 16. 21.4 MHz IF Frequency Response. Refer to Chapter 2 for information about running the software.

When performing this verification test, the measurement is made in the 1H− and the 1L− bands with the full microwave source providing RF INPUT amplitudes of 300 MHz and 6 GHz, respectively.

The local oscillator source frequency increments in 200 kHz steps, thus producing 15.4 MHz to 27.6 MHz signals at the 21.4 MHz OUT. A power meter measures each step. The test determines 3 dB bandwidth by comparing power at 21.4 MHz with power at the step frequencies. With the same power data, the test determines passband amplitude response from 18.9 MHz to 23.9 MHz.

Test 17. Step Gain

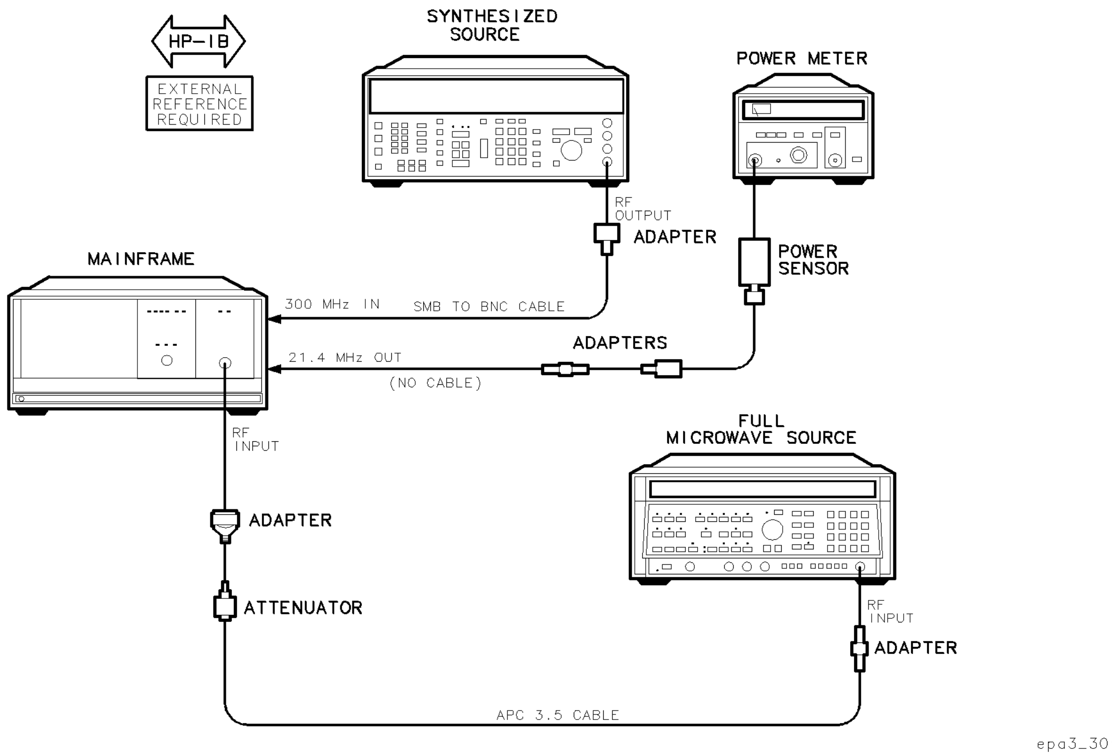


Figure 8-18. Equipment Setup for Test 17. Step Gain

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

Test 17. Step Gain

The purpose of this verification test is to measure the DUT step gain at the 21.4 MHz OUT, and then store the difference between step gain in baseband and μW bands in EEROM.

(DUT gain and step gain are interactive; therefore, DUT gain must be set before this test.)

This test is dependent on the repair, replacement, or adjustment of the last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 17. Step Gain. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz, 10 dBm, at the DUT RF INPUT. The power meter connects to the DUT 21.4 MHz OUT port.

The test measures 21.4 MHz OUT power with the step gain turned off, and then turned on. The test repeats the measurement at a frequency in 1H− band and a frequency in 1L− band, and then stores the on/off power differences as the step gain values.

Test 18. Gain Compression

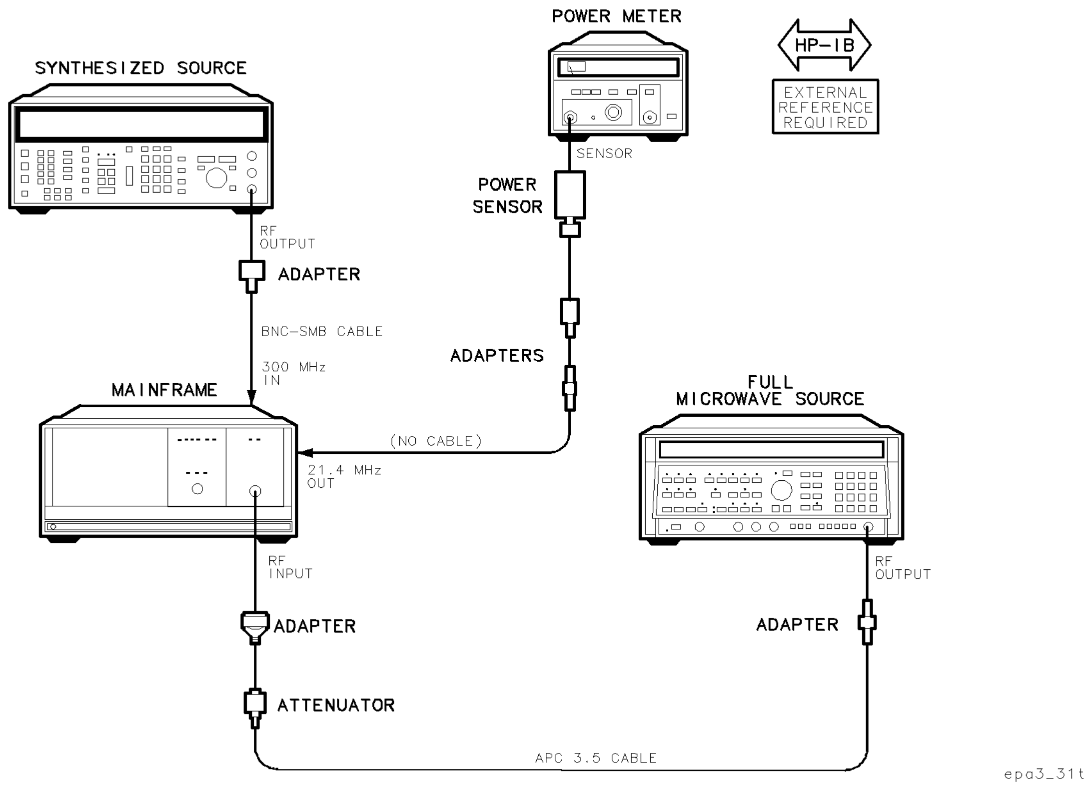


Figure 8-19. Equipment Setup for Test 18. Gain Compression

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0674 50Ω SMB(m) to SMA(f)
Adapter	HP 1250-0672 50Ω SMB(f) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

Test 18. Gain Compression

The purpose of this verification test is to measure DUT gain compression.

This test is dependent upon the repair, replacement or adjustment of the A11 last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 18. Gain Compression. Refer to Chapter 2 for information about running the software.

When performing this verification test, the full microwave source provides 300 MHz, −10 dBm, at the DUT RF INPUT. The DUT input attenuation is 10 dB, and the frequency band is 1H−. The local oscillator source tunes to center the signal. The power meter measures the amplitude of the 21.4 MHz OUT signal. The measurement repeats with 0 dBm at the DUT RF INPUT.

Module gain compression at 10 dBm refers to the gain with 10 dBm at the input to the mixer minus the gain with 0 dBm at the input. The test compares this difference with test limits. The procedure repeats in the 1L− band with the full microwave source set to 2.7 GHz.

Test 19. Aux LO Power and Harmonics

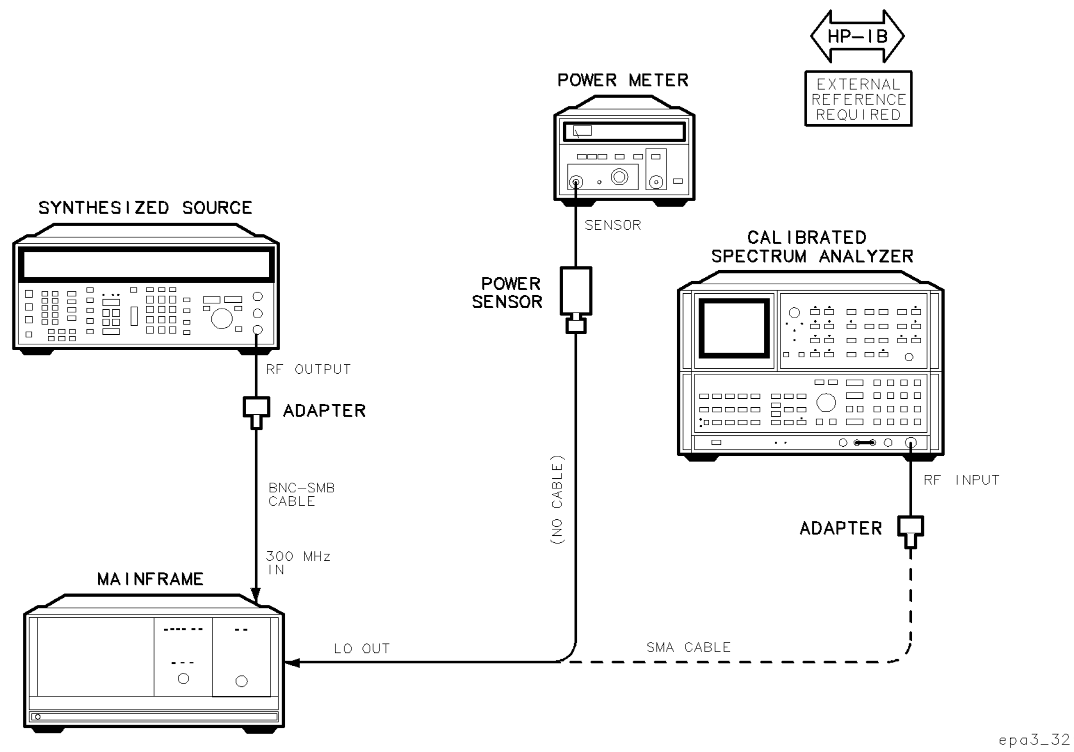


Figure 8-20. Equipment Setup for Test 19. Aux LO Power and Harmonics

Test Equipment	**Preferred Model Numbers**
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Power meter	HP 436A power meter
Power sensor	HP 8485A APC-3.5 mm(m) power sensor
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 5021-5450 260 mm SMA(m) to SMA(m)
Adapter	HP 1250-1250 50Ω N(m) to SMA(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

Test 19. Aux LO Power and Harmonics

The purpose of this verification test is to measure the 1st LO fundamental and 2nd harmonic power levels in 1H− band and 1L− bands over a LO range of 3 to 6.6 GHz.

This test is dependent upon the repair, replacement or adjustment of the A1 leveling amplifier and/or the A13 ALC/bias.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 19. Aux LO Power and Harmonics. Refer to Chapter 2 for information about running the software.

When performing this verification test, the calibrated spectrum analyzer connects to the DUT 1st LO OUT. The DUT input attenuation is 70 dB, and the frequency band is 1H−. The HP 70900B local oscillator source provides the LO input signal. The LO source tunes in 40 MHz steps from 3 GHz to 6.6 GHz. At each step, the calibrated spectrum analyzer measures the amplitude of the 1st LO and of the 1st LO second harmonic. The test calculates relative measurements equal to the fundamentals minus second harmonics, and then compares fundamental and relative measurements to test limits.

Test 20. Diagnostics

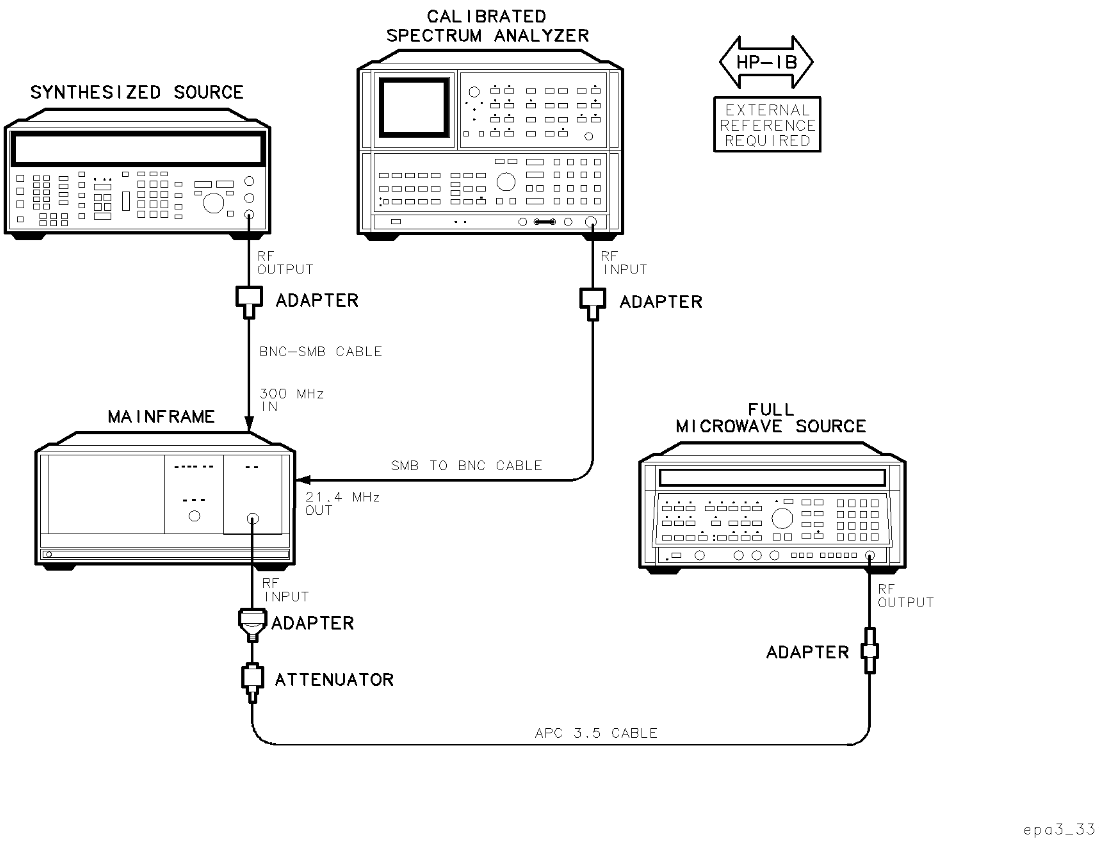


Figure 8-21. Equipment Setup for Test 20. Diagnostics (1 of 2)

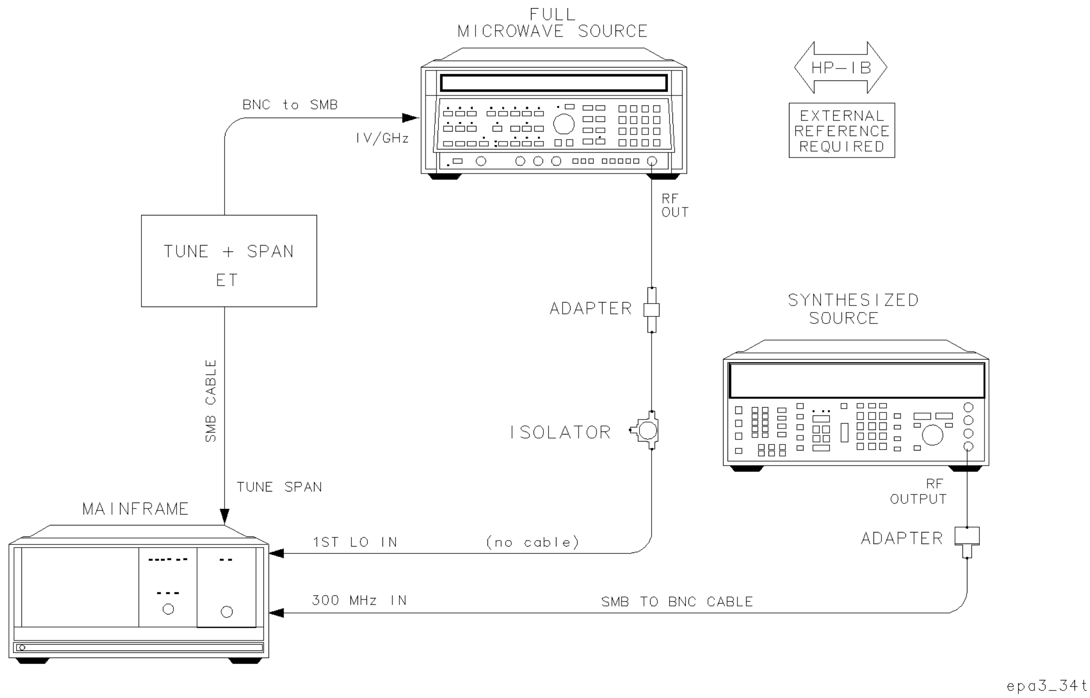


Figure 8-22. Equipment Setup for Test 20. Diagnostics (2 of 2)

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Microwave source	HP 8340A synthesized sweeper
Synthesized source	HP 8663A synthesized signal generator
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Isolator	HP 0955-0204 microwave isolator
Attenuator	HP 8493C Option 006 coaxial fixed attenuator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5
Power supply	HP 87421A power supply
Cable	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to verify proper operation of the internal diagnostic detectors that trigger the following RF section error codes:

7002 1st LO unleveled

7003 2nd LO unlocked

7004 300 MHz error

7078 Tune Span error

7074 Discriminator unlock

7076 Multiplier unleveled

0043 Problem/Ampl low (reported during the running of system diagnostics)

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 20. Diagnostics. Refer to Chapter 2 for information about running the software.

When performing this verification test, the diagnostic detectors are checked in the following order:

7002 **1st LO unleveled**

7076 **Multiplier unleveled**

The 1st LO unleveled detector monitors the LO leveling amplifier drive circuitry. The multiplier unleveled detector monitors the LO multiplier drive circuit.

These tests use setup #1 (Refer to Figure 8-21), with the microwave source providing 5 dBm at the 1st LO IN. The test first verifies that the detectors are not reporting errors; the microwave source power then steps down until the detectors do report unleveled errors. The test fails if the LO unleveled detector does not report before the multiplier unleveled detector reports.

0043 **Problem/Ampl low?**

The 0043 error occurs when DUT 21.4 MHz OUT power is too low.

This test prompts for setup #2 connections (Refer to Figure 8-22. Either the full microwave source or the synthesized source power provides 300 MHz, −10 dBm, at the DUT RF INPUT. The DUT setup is band 1H−, 10 dB input attenuation. The calibrated spectrum analyzer measures the DUT 21.4 MHz OUT. The full microwave source power first steps down until the detector triggers; the power then steps up until the detector resets. The acceptable power levels are −12.5 dBm and 7.5 dBm, respectively, as measured by the calibrated spectrum analyzer.

7004 **300 MHz error**

The 7004 error occurs when 300 MHz IN power is low or missing.

The synthesized source connects to 300 MHz IN. It first provides 300 MHz, −8 dBm, and then 300 MHz, 0 dBm. The detector must first indicate 300 MHz missing and then 300 MHz present.

Test 20. Diagnostics

7074 **Discriminator unlocked**

The DUT setup is 1L− band, 4 GHz center frequency. The DUT first switches from the 1L− band to the 1H− band and then from 1H− band to the 1L− band. The detector must first indicate discriminator loop unlock and then discriminator loop lock.

7078 **Tune Span error**

The 7078 error occurs when TUNE SPAN voltage is low or missing.

The Tune Span cable from the LO module is first connected and then disconnected. The detector must first indicate that the Tune + Span voltage is present and then missing.

7003 **2nd LO unlocked**

The 7003 error occurs when 300 MHz IN signal to the 2nd converter PLL is low or missing. This causes 2nd LO loop unlock.

The synthesized source connects to 300 MHz IN and first provides 300 MHz, 0 dBm, and then 300 MHz, −50 dBm. The detector must first indicate 2nd LO loop lock and then 2nd LO loop unlocked.

Test 21. LO Input Amplitude Range

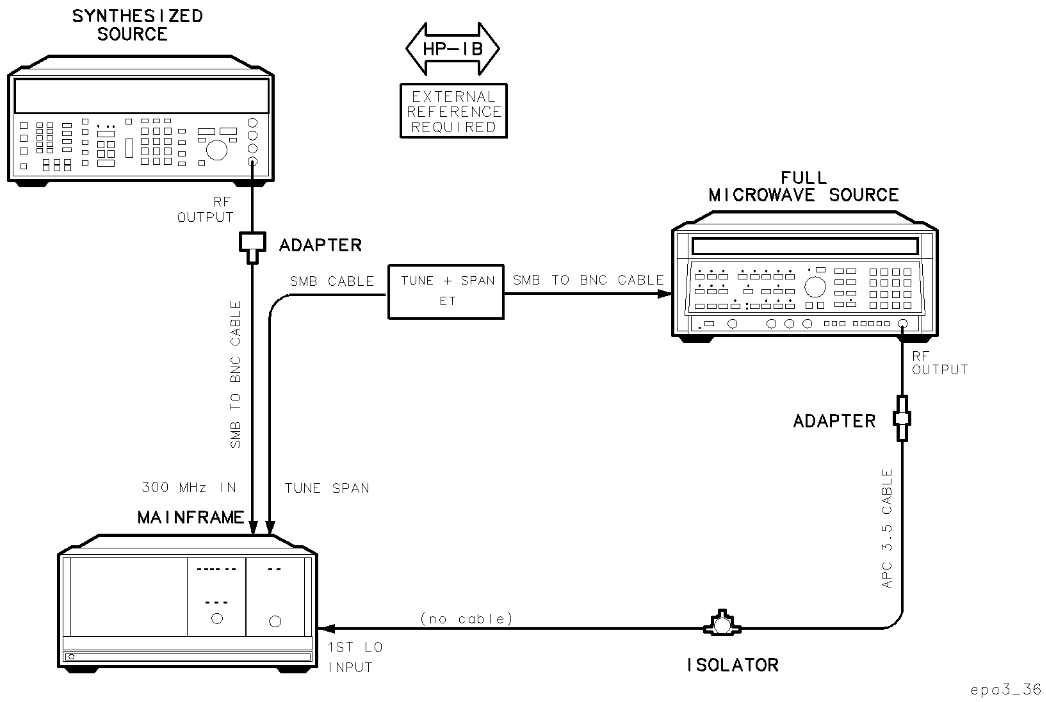


Figure 8-23. Equipment Setup for Test 21. LO Input Amplitude Range

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Microwave source	HP 8340A synthesized sweeper
External reference	Refer to “External Frequency Reference” in Chapter 6.
Isolator	HP 0955-0204 microwave isolator
Tune + Span ET	Refer to “Specialized Test Equipment ET” in Chapter 5
Power supply	HP 87421A power supply
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 8120-5016 160 mm SMB(f) to SMB(f)
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)

Test 21. LO Input Amplitude Range

The purpose of this test is to verify the ability of the DUT to maintain leveled 1st LO power with minimum power at 1st LO IN over an LO frequency range of 3 to 6.6 GHz.

This test is dependent upon the repair, replacement, or adjustment of the A1 leveling amplifier, A2 LO multiplier, and/or the A13 ALC/bias.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 21. LO Input Amplitude Range. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency is band 2L−. The microwave source first provides the DUT 1st LO IN with 3 GHz, 8 dBm, and then 3 GHz, −110 dBm. The 1st LO unleveled detector must first indicate leveled power, and then unleveled power.

After verification of the unleveled detector, the microwave source steps the 1st LO IN from 3 GHz to 6.6 GHz at 20 MHz steps at a power level 1.2 dBm. The test verifies leveled power at each step.

Test 22. RF Input Emissions

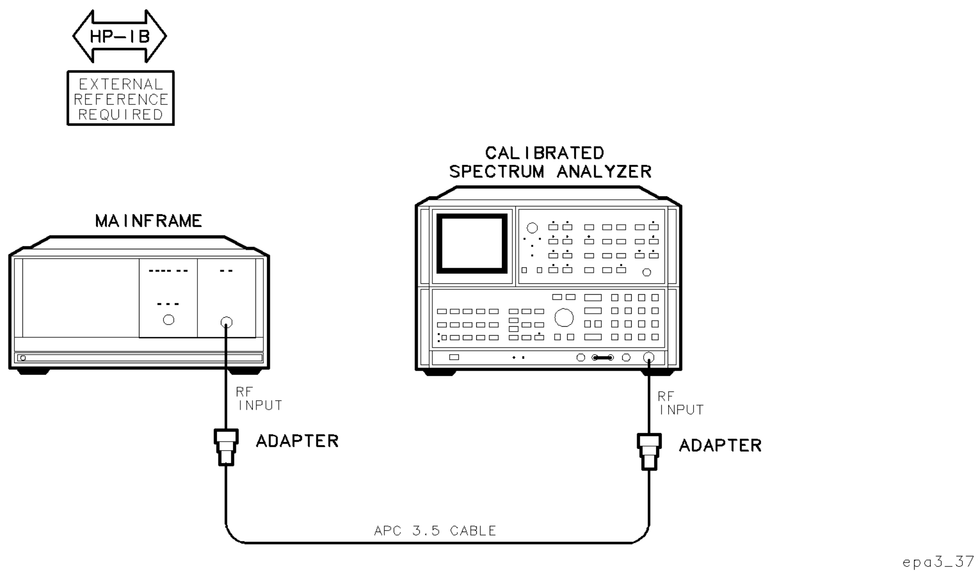


Figure 8-24. Equipment Setup for Test 22. RF Input Emissions

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Calibrated spectrum analyzer	HP 8566B spectrum analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Adapter (2 required)	HP 1250-1744 50Ω APC-3.5(f) to N(m)

The purpose of this verification test is to measure the 1st LO feedthrough emissions out of the RF INPUT.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 22. RF Input Emissions. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT input attenuation is 10 dB. The calibrated spectrum analyzer connects to the DUT RF INPUT. In each of the four frequency bands, the local oscillator source steps through a range of frequencies. At each step, the calibrated spectrum analyzer tunes to measure the LO feedthrough amplitude, which the test compares with test limits.

Test 23. RF Input Return Loss

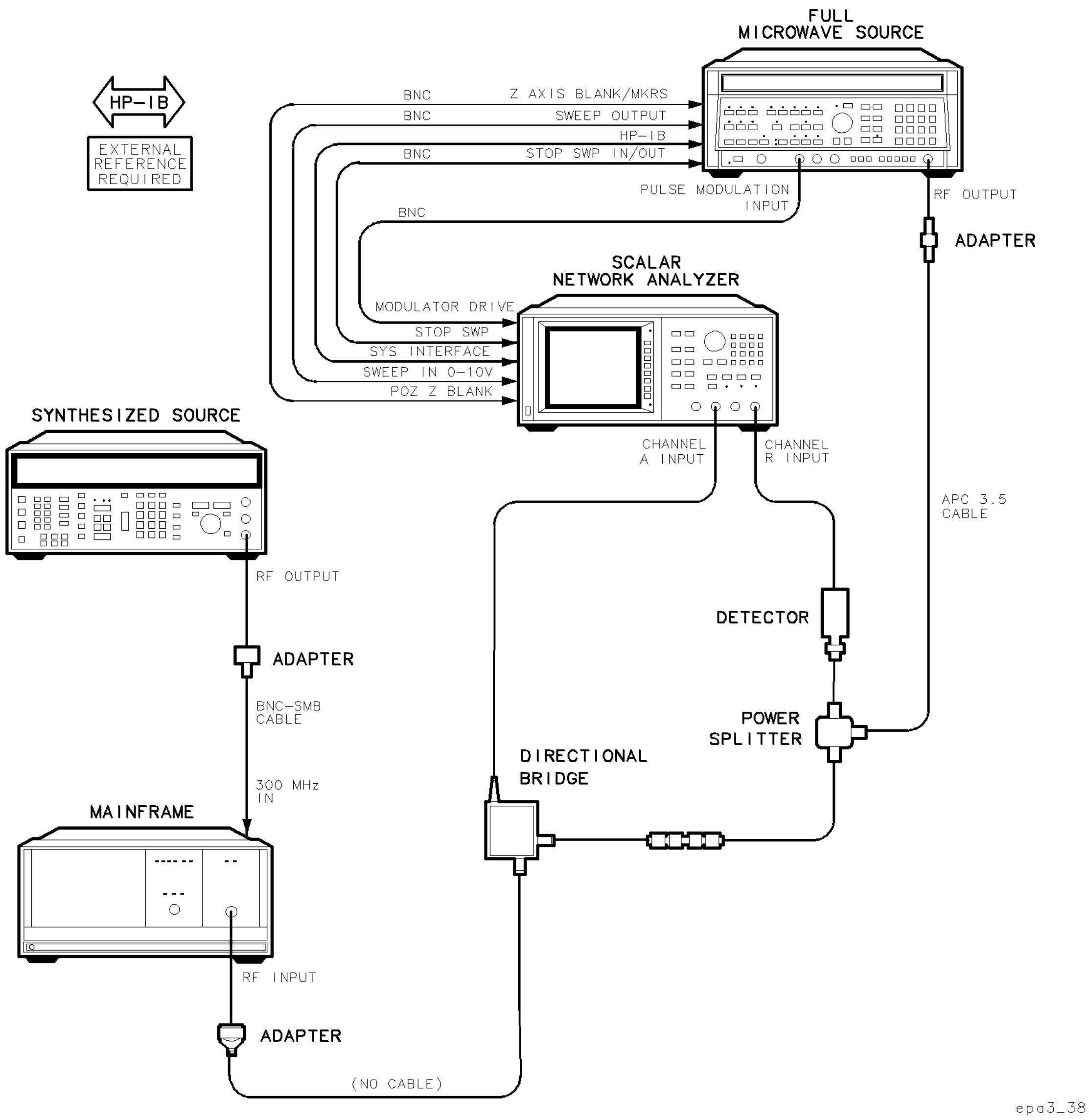


Figure 8-25. Equipment Setup for Test 23. RF Input Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 10833D 0.5 meter HP-IB cable
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the return loss of the DUT RF INPUT.

This test is dependent upon the repair, replacement, or adjustment of the input connector, A4 input attenuator, A3 SYTFMD, or A15 RF 1st converter.

This is a final test.

Note Open/short calibration must be performed prior to this test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 23. RF Input Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the test runs initially in band 1H−. It then repeats in bands 1L−, 2L−, and 4L−. The scalar network analyzer mode is A/R ratio, incident signal input is channel R and reflected signal input is channel A. The DUT input attenuation is 10 dB. The full microwave source connects through accessories to both the network analyzer and the DUT RF INPUT; it then sweeps from 10 to 2900 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

Test 24. LO Output Return Loss

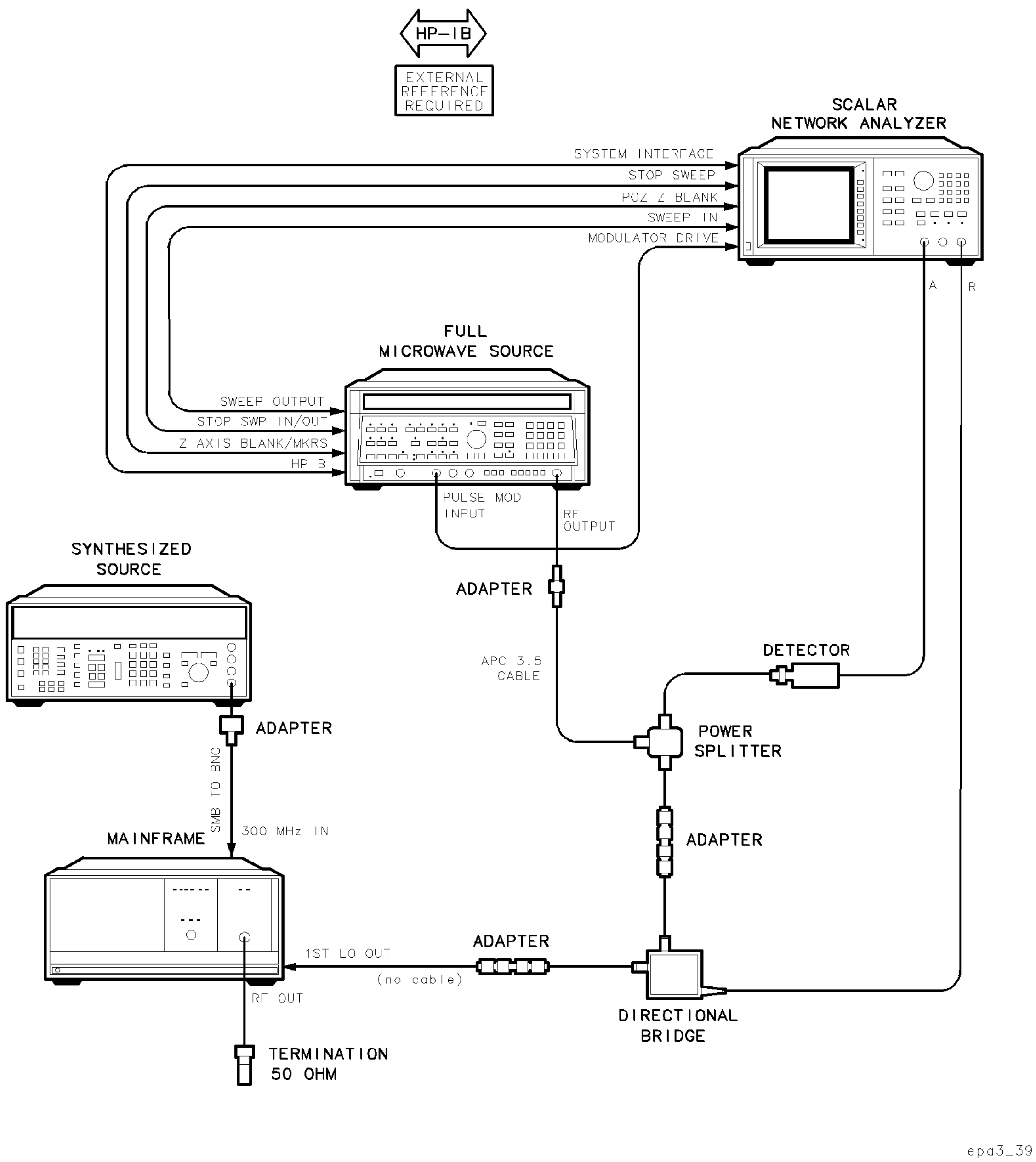


Figure 8-26. Equipment Setup for Test 24. LO Output Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Termination	HP 908A 50Ω N(m) termination
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 10833D 0.5 meter HP-IB cable
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Adapter (2 required)	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the return loss of the DUT 1st LO OUT.

This test is dependent upon the repair, replacement, and/or the adjustment of the A1 leveling amplifier or W20 RF LO aux cable.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 24. LO Output Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1H− and input attenuation is 70 dB. The scalar network analyzer mode is A/R ratio, incident signal input is channel R, and reflected signal input is channel A. The full microwave source connects through accessories to both the network analyzer and the DUT 1st LO OUT; it then sweeps from 3 to 6.6 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

Test 25. LO Input Return Loss

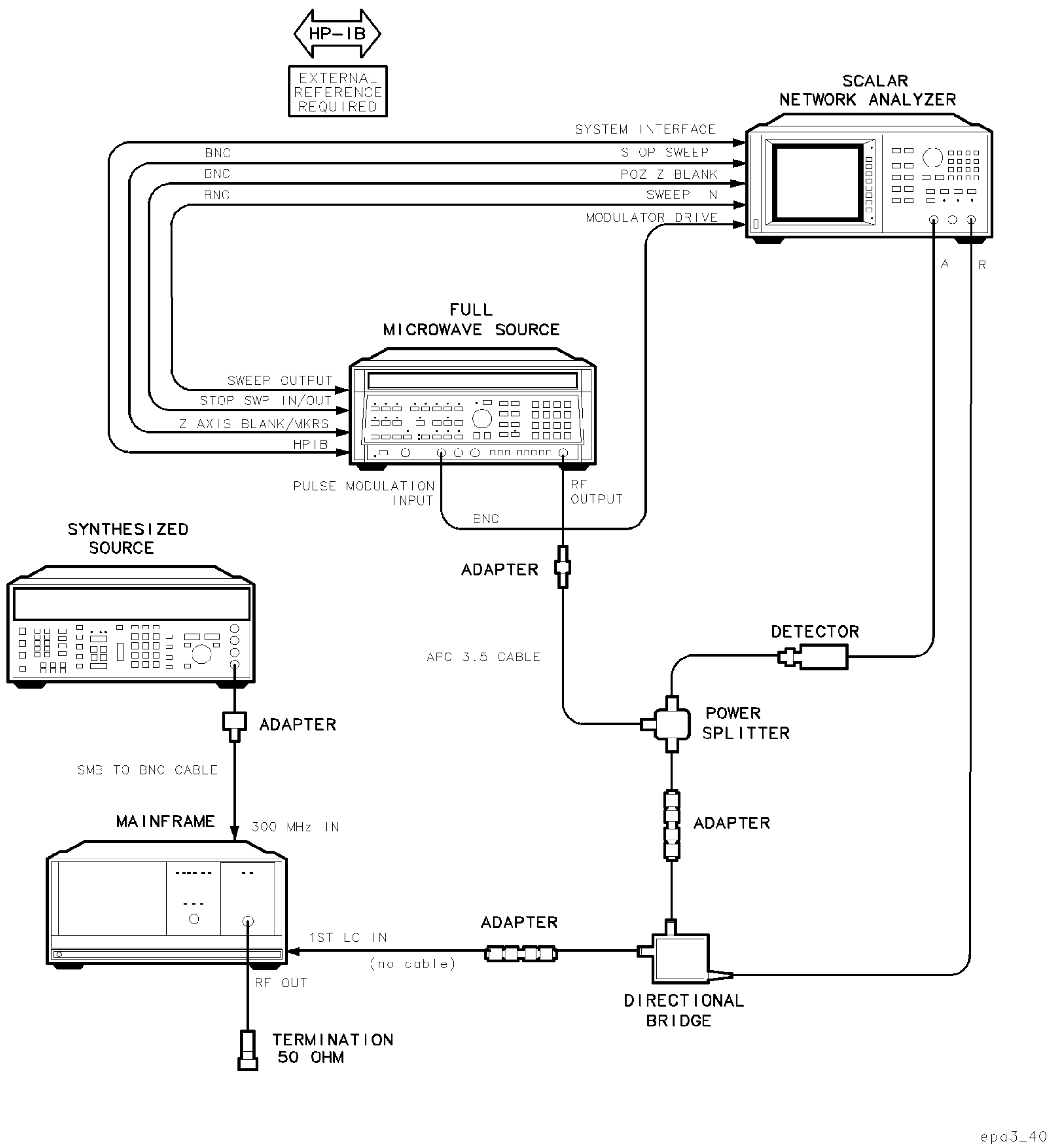


Figure 8-27. Equipment Setup for Test 25. LO Input Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Termination	HP 908A 50Ω N(m) termination
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10833D 0.5 meter HP-IB cable
Adapter (2 required)	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure 1st LO input port return loss of the DUT.

This test is dependent upon the repair, replacement, and/or the adjustment of the A1 leveling amplifier or W21 RF LO input cable.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 25. LO Input Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 2L− and input attenuation is 70 dB. The scalar network analyzer mode is A/R ratio, incident signal input is channel R, and reflected signal input is channel A. The full microwave source connects through accessories to both the network analyzer and the DUT 1st LO IN; it then sweeps from 3 to 6.6 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

Test 26. Reference Return Loss

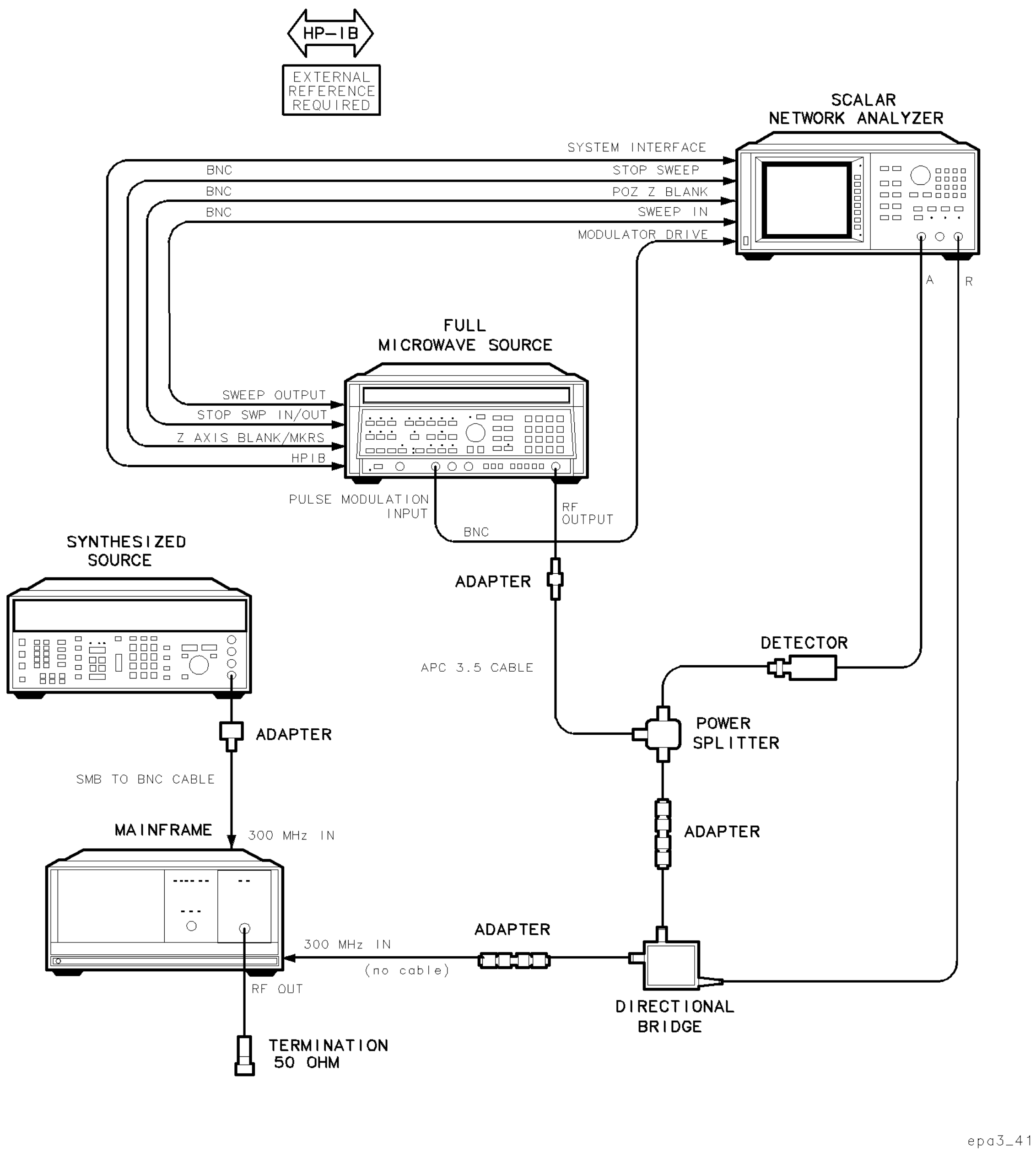


Figure 8-28. Equipment Setup for Test 26. Reference Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Termination	HP 908A 50Ω N(m) termination
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10833D 0.5 meter HP-IB cable
Adapter (2 required)	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure 300 MHz input port return loss of the DUT.

This test is dependent upon the repair, replacement, and/or the adjustment of the A11 last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 26. Reference Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1H− and input attenuation is 70 dB. The scalar network analyzer mode is A/R ratio, incident signal input is channel R, and reflected signal input is channel A. The full microwave source connects through accessories to both the network analyzer and the DUT 300 MHz IN; it then sweeps from 299.97 MHz to 300.03 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

The DUT is set to 1H− band. The test port of the directional bridge is connected to the DUT 300 MHz IN. The scalar network analyzer mode is A/R ratio, incident signal is channel R, reflected signal is channel A. The full microwave source sweeps from 299.97 to 300.03 MHz. The network analyzer measures the response, and then subtracts the calibration factors that were calculated in the return loss calibration. A routine compares the corrected data to test limits.

Test 27. Wide IF Output Return Loss

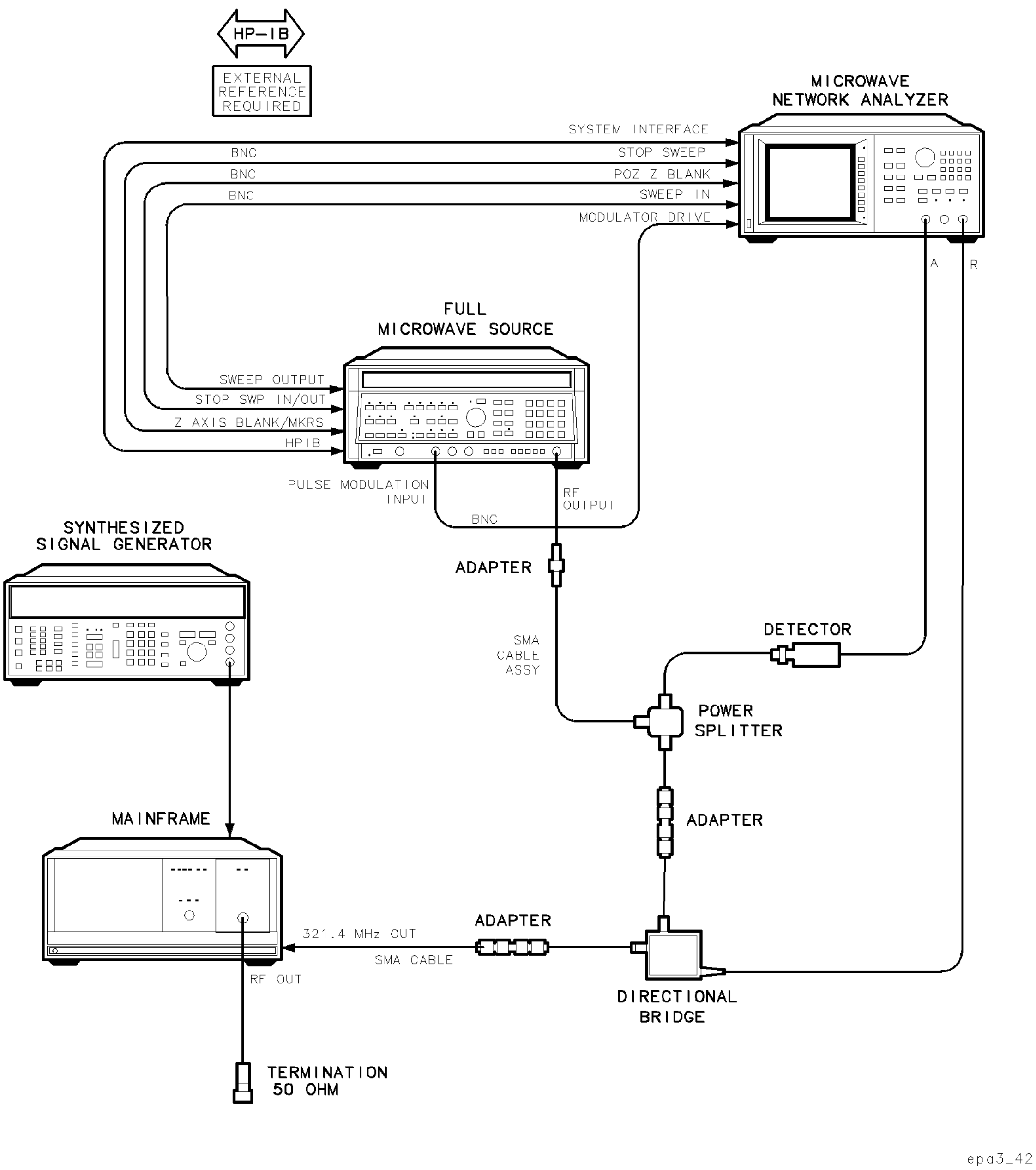


Figure 8-29. Equipment Setup for Test 27. Wide IF Output Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to “External Frequency Reference” in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Termination	HP 908A 50Ω N(m) termination
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10833D 0.5 meter HP-IB cable
Adapter (2 required)	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure 321.4 MHz IF output port return loss of the DUT.

This test is dependent upon the repair, replacement, and/or the adjustment of the A11 last converter or W10 321.4 MHz cable.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 27. Wide IF Output Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1L− and input attenuation is 70 dB. The scalar network analyzer mode is A/R ratio, incident signal input is channel R, and reflected signal input is channel A. The local oscillator source tunes to 3121.4 MHz. The full microwave source connects through accessories to both the network analyzer and the DUT 321.4 MHz OUT; it then sweeps from 306.4 to 336.4 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

Test 28. Narrow IF Output Return Loss

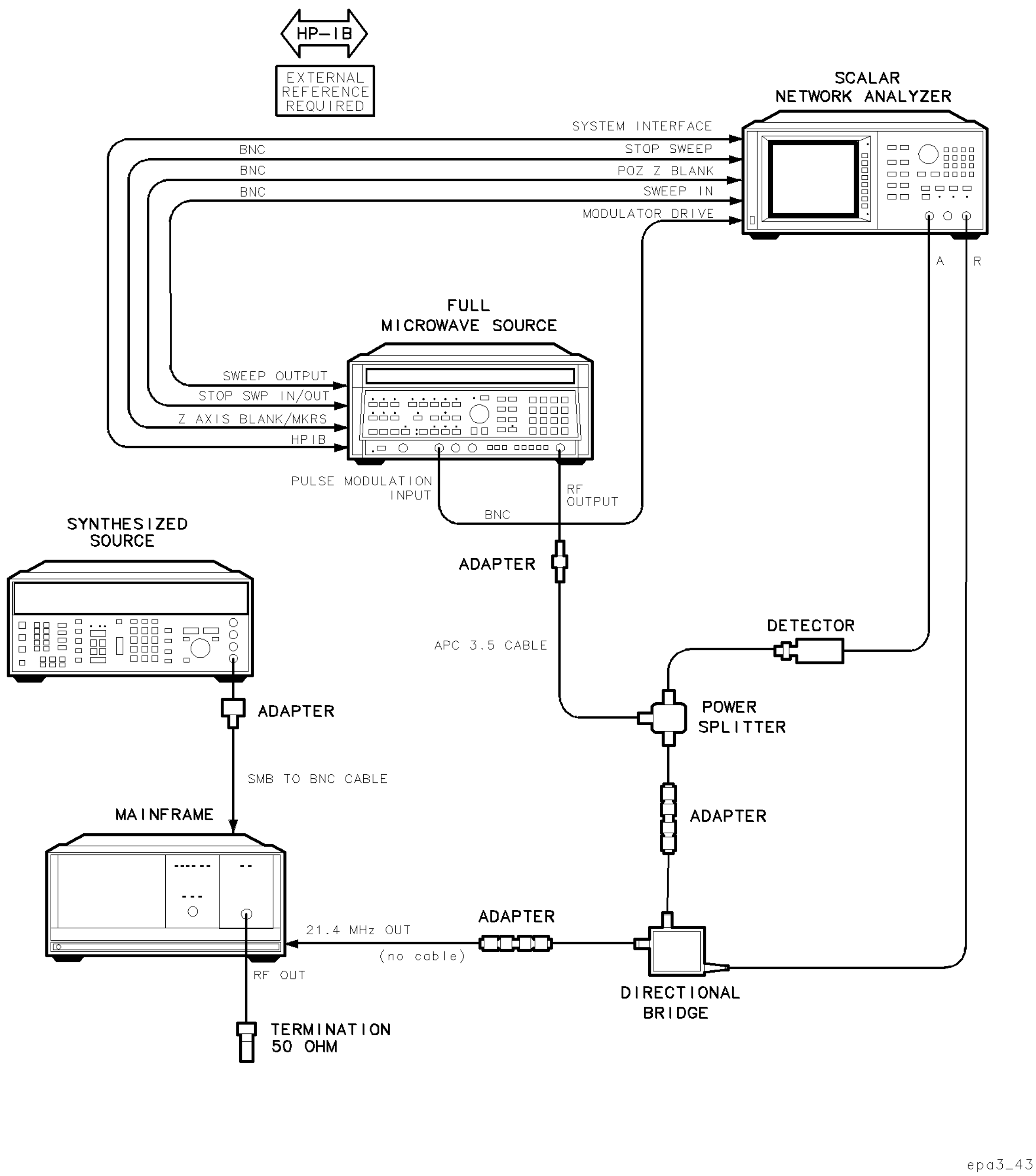


Figure 8-30. Equipment Setup for Test 28. Narrow IF Output Return Loss

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
Full microwave source	HP 8340A synthesized sweeper
Network analyzer	HP 8757C scalar network analyzer
External reference	Refer to "External Frequency Reference" in Chapter 6.
Directional bridge	HP 85027B directional bridge
Power splitter	HP 11667B power splitter
Detector	HP 11664E detector
Termination	HP 908A 50Ω N(m) termination
Cable	HP 8120-4921 91 cm 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
Cable (4 required)	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Cable	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10833D 0.5 meter HP-IB cable
Adapter (2 required)	HP 1250-1748 50Ω APC-3.5(m) to APC-3.5(m)
Adapter	HP 5061-5311 50Ω APC-3.5(f) to APC-3.5(f)
Adapter	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure the DUT 21.4 MHz OUT return loss.

This test is dependent upon the repair, replacement, and/or the adjustment of the A11 last converter.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 28. Narrow IF Output Return Loss. Refer to Chapter 2 for information about running the software.

When performing this verification test, the DUT frequency band is 1H− and input attenuation is 70 dB. The scalar network analyzer mode is A/R ratio, incident signal input is channel R, and reflected signal input is channel A. The full microwave source connects through accessories to both the network analyzer and the DUT 21.4 MHz OUT; it then sweeps from 16.4 to 26.4 MHz.

The network analyzer measures the reflected-signal to incident-signal ratio, and then subtracts the return loss open/short calibration factor. The test compares measured return loss with test limits.

Test 29. Noise Figure

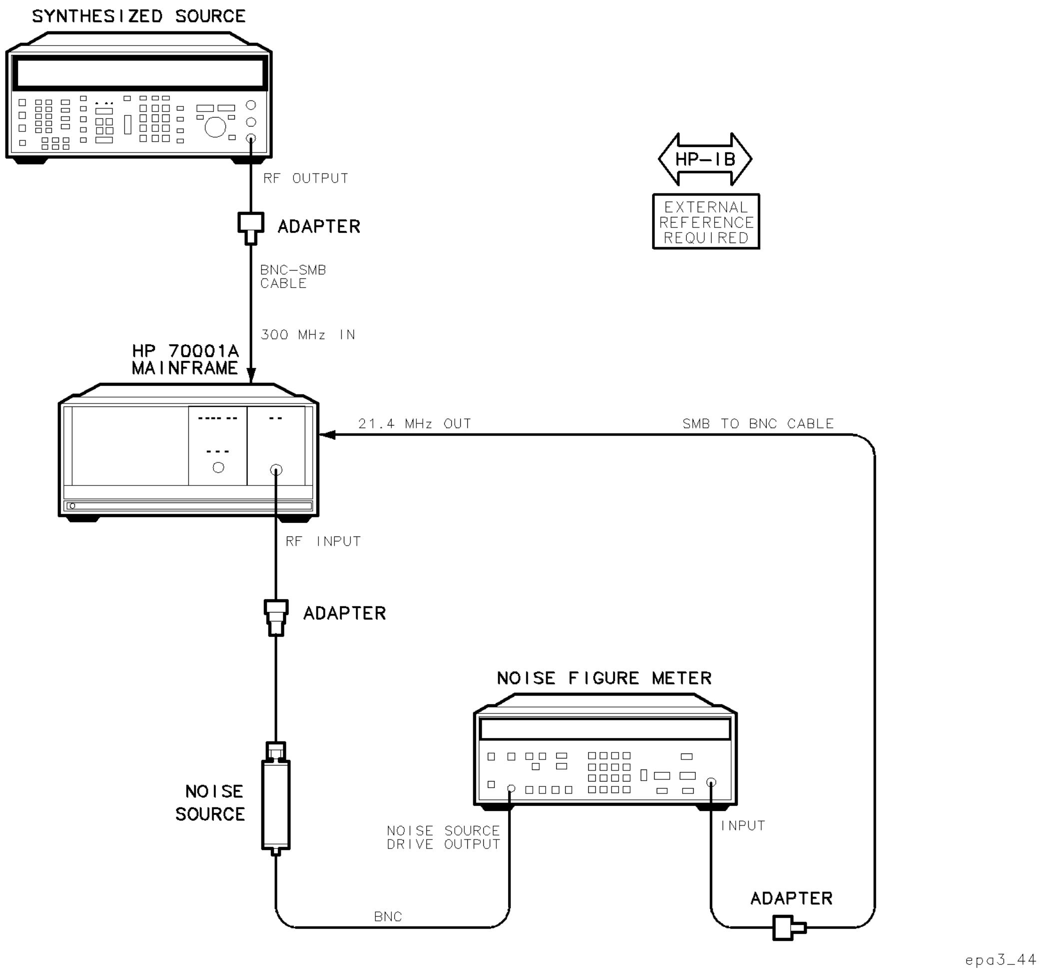


Figure 8-31. Equipment Setup for Test 29. Noise Figure

Test Equipment	Preferred Model Numbers
Controller	HP 9000 Series 300 controller
Mainframe	HP 70001A mainframe
Local oscillator	HP 70900A/B local oscillator source
Synthesized source	HP 8663A synthesized signal generator
External reference	Refer to “External Frequency Reference” in Chapter 6.
Excess noise source	HP 346C broadband noise source
Noise figure meter	HP 8970B noise figure meter
Cable (2 required)	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)
Cable	HP 10503A 122 cm (48 in) 50Ω coax UG-88C/U BNC(m) to BNC(m)
Adapter	HP 1250-1744 50Ω APC-3.5(f) to N(m)
Adapter (2 required)	HP 1250-0780 50Ω N(m) to BNC(f)

The purpose of this verification test is to measure DUT gain and noise as a function of frequency. Noise figure is a function of DUT noise and DUT gain at a particular frequency. A noise figure within a specified limit ensures acceptable DUT noise contribution to system displayed average noise level.

This is a final test.

1. Connect the equipment as shown in the test setup illustration for this procedure.
2. Set the mainframe line switch to ON.
3. Load and run Test 29. Noise Figure. Refer to Chapter 2 for information about running the software.

When performing this verification test, the local oscillator source connects to the DUT 1st LO IN. The synthesized source provides 300 MHz, 0 dBm, at the 300 MHz IN. The 21.4 MHz OUT of the DUT connects to the input of the noise figure meter. The output of the noise source connects to the RF INPUT of the DUT. DUT input attenuation is 0 dB.

The local oscillator source tunes to 1st LO frequencies corresponding to RF INPUT test frequencies. At the test frequencies and at the reference frequency, the test collects DUT gain and noise figure data. The DUT gain at the reference frequency is required for determination of displayed average noise level.

9

Replacing Major Assemblies

This chapter contains procedures for removal and replacement of major assemblies in your RF section. Instructions are given for the following assemblies:

- Module Cover
- Front Panel
- Rear Panel
- Bandpass Filter
- A1 Leveling Amplifier
- A2 LO Multiplier
- A3 SYTFMD
- A4 Input Attenuator
- A5 VCO Sampler
- A6 Isolator
- A7 2nd Mixer
- A8 321.4 MHz Matching Network
- A9 2nd Converter PLL
- A10 Power Supply/Driver
- A11 Last Converter
- A12 Controller
- A13 ALC/Bias
- A14 Front Panel Board
- A15 RF 1st Converter
- A16 Low Pass Filter
- A17 Low Pass Filter

This service guide is part of an Option OB3 package which consists of two manuals. To obtain a list of all versions of all assemblies available for your RF section, refer to Manual 2.

Module Cover

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the Module Cover

1. Remove the four side screws (1).
2. Remove the four top screws (2).
3. Remove the module cover.

To Replace the Module Cover

1. Replace the module cover.
2. Replace the four top screws (2).
3. Replace the four side screws (1).

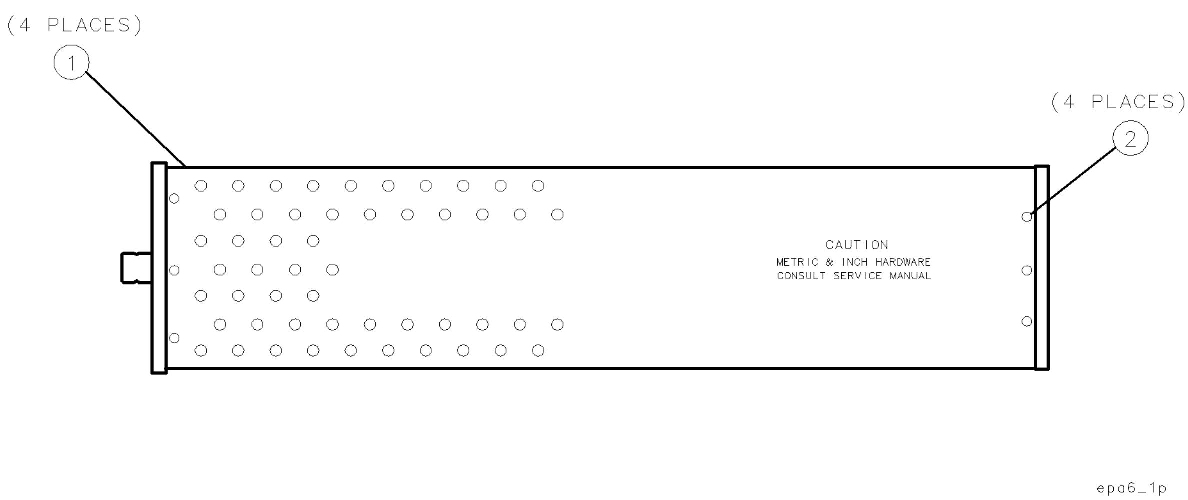


Figure 9-1. Module Cover Removal/Replacement

Front Panel

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the Front Panel

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect W3 (2) from the front panel. Do not bend the cable or damage its center connector.
4. Disconnect W1 (3) from A12J7.
5. Remove the two hex-screws (4) that hold the front panel to the base of the module. Use a 3.0 mm hex wrench (HP part number 8710-1392).
6. Pull the front panel (5) forward.

To Replace the Front Panel

1. Position the front panel against the module base.
2. Line up the front panel RF INPUT connector (6) and W3 (2), and loosely reconnect them. Do not bend the cable when moving the module.
3. Use a 3.0 mm hex-wrench to replace the two hex-screws (4) that hold the front panel to the base of the module and torque them to 20 inch-pounds.
4. Torque W3 (2) to 10 inch-pounds.
5. Reconnect W1 (3) to A12J7.
6. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
7. Replace the module cover. (Refer to the “Module Cover” procedure.)

Front Panel

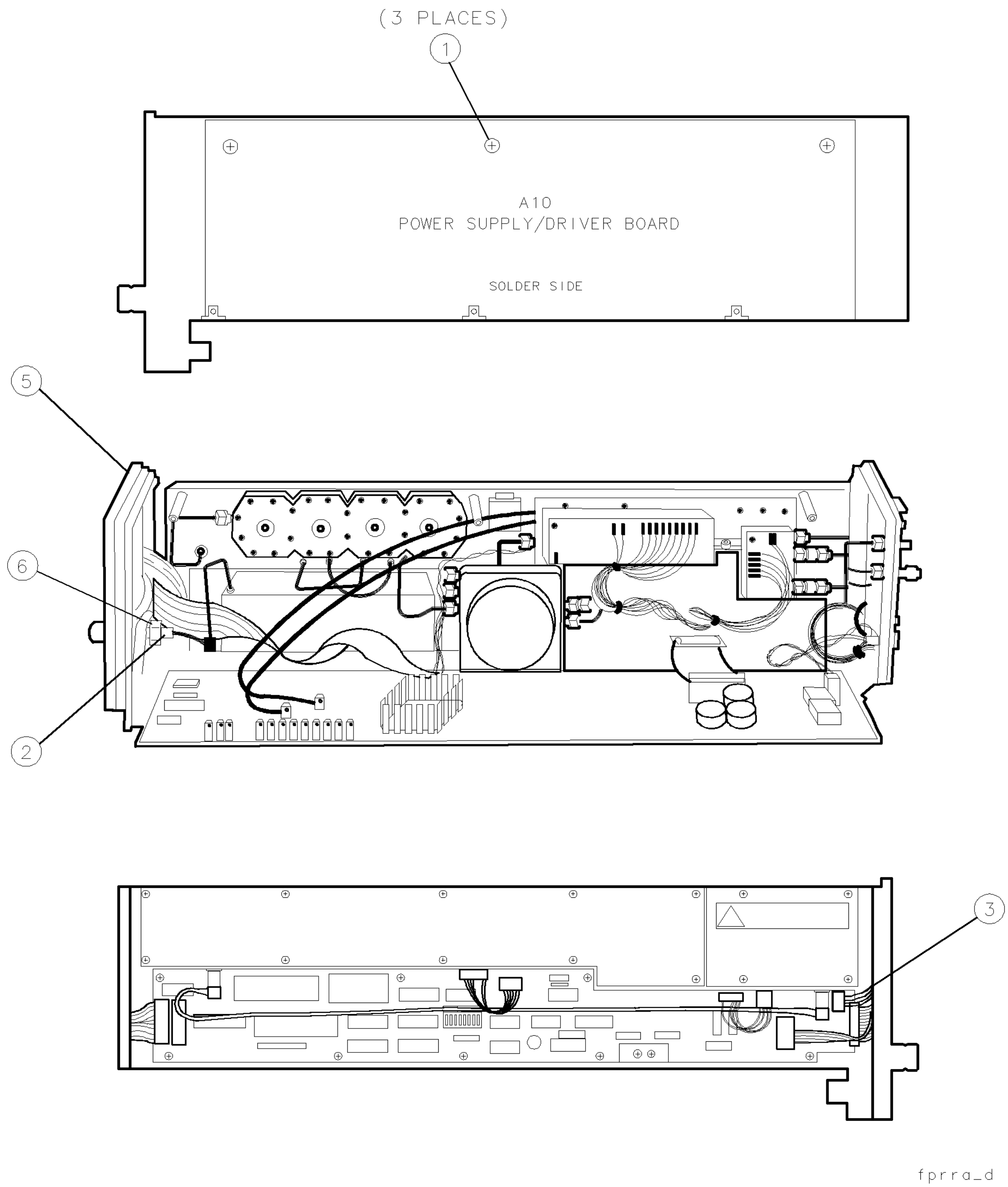


Figure 9-2. Front Panel Removal/Replacement (1 of 2)

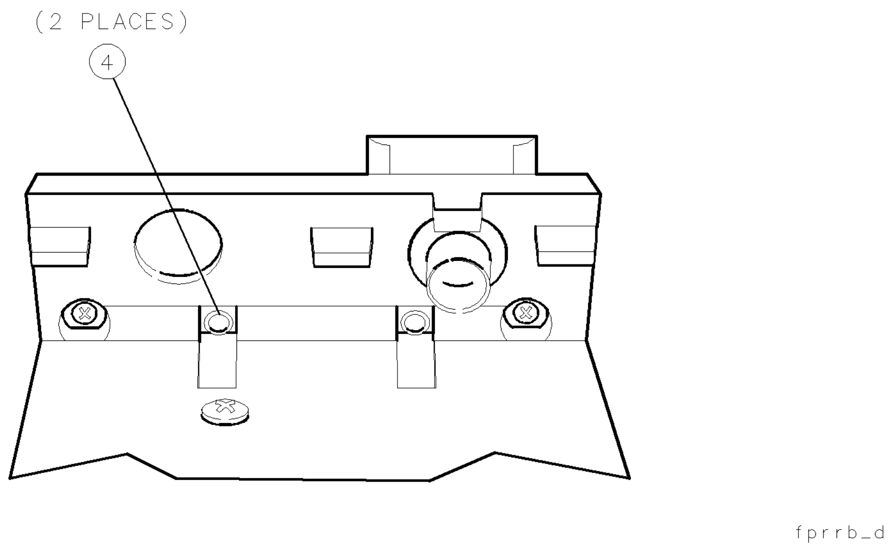


Figure 9-3. Front Panel Removal/Replacement (2 of 2)

Rear Panel

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the Rear Panel

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Remove the one screw (2) that holds the rear-panel to the module center casting.
4. Remove the three screws (3) that hold the rear-panel to the module base.
5. Disconnect W20 (4) and W21 (5) from the rear panel. Do not distort or damage the cables.
6. Disconnect W22J2 (6) from A10J101.
7. Disconnect W22J1 (7) from A12J1.
8. Remove the hex-nut and washers from W11 (8) and W10 (9), and remove the rear panel (10).

To Replace the Rear Panel

1. Reinsert W11 (8) and W10 (9) in the rear panel (10), replacing the hex-nuts and washers. Torque the connectors to 6 inch-pounds.
2. Reconnect W22J1 (7) to A12J1.
3. Reconnect W22J2 (6) to A10J101.
4. Position the rear-panel against the module, being careful not to damage the rear-panel ground spring (11).
5. Reconnect W20 (4) and W21 (5) to the rear panel and torque the connectors to 10 inch-pounds. Do not distort or damage the cables.
6. Replace the three screws (3) that hold the rear-panel to the module base. Torque the three base screws to 20 inch-pounds.
7. Replace the one screw (2) that holds the rear-panel to the module center casting. Torque the one center casting screw to 6 inch-pounds.
8. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
9. Replace the module cover. (Refer to the “Module Cover” procedure.)

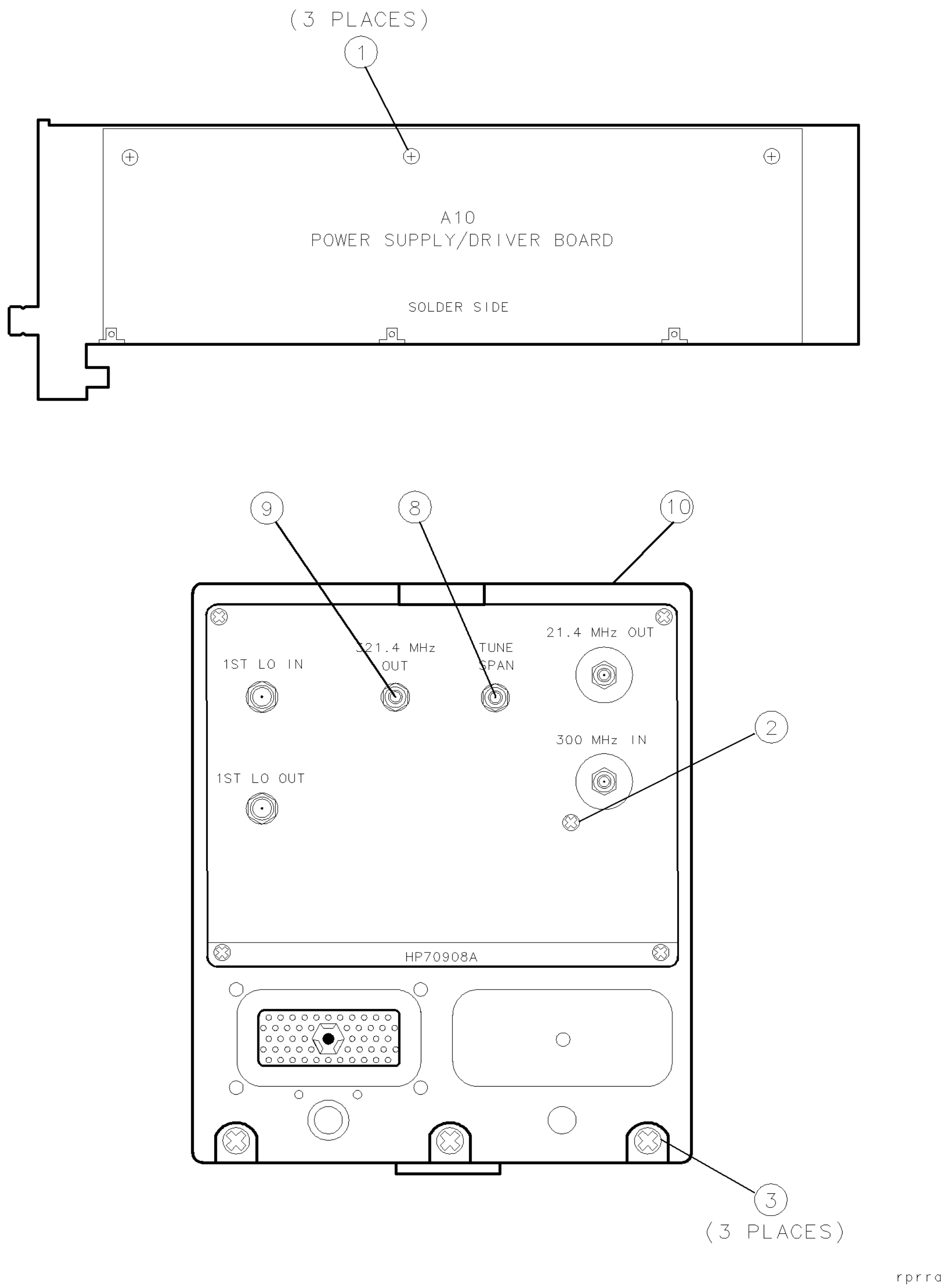


Figure 9-4. Rear Panel Removal/Replacement (1 or 2)

Rear Panel

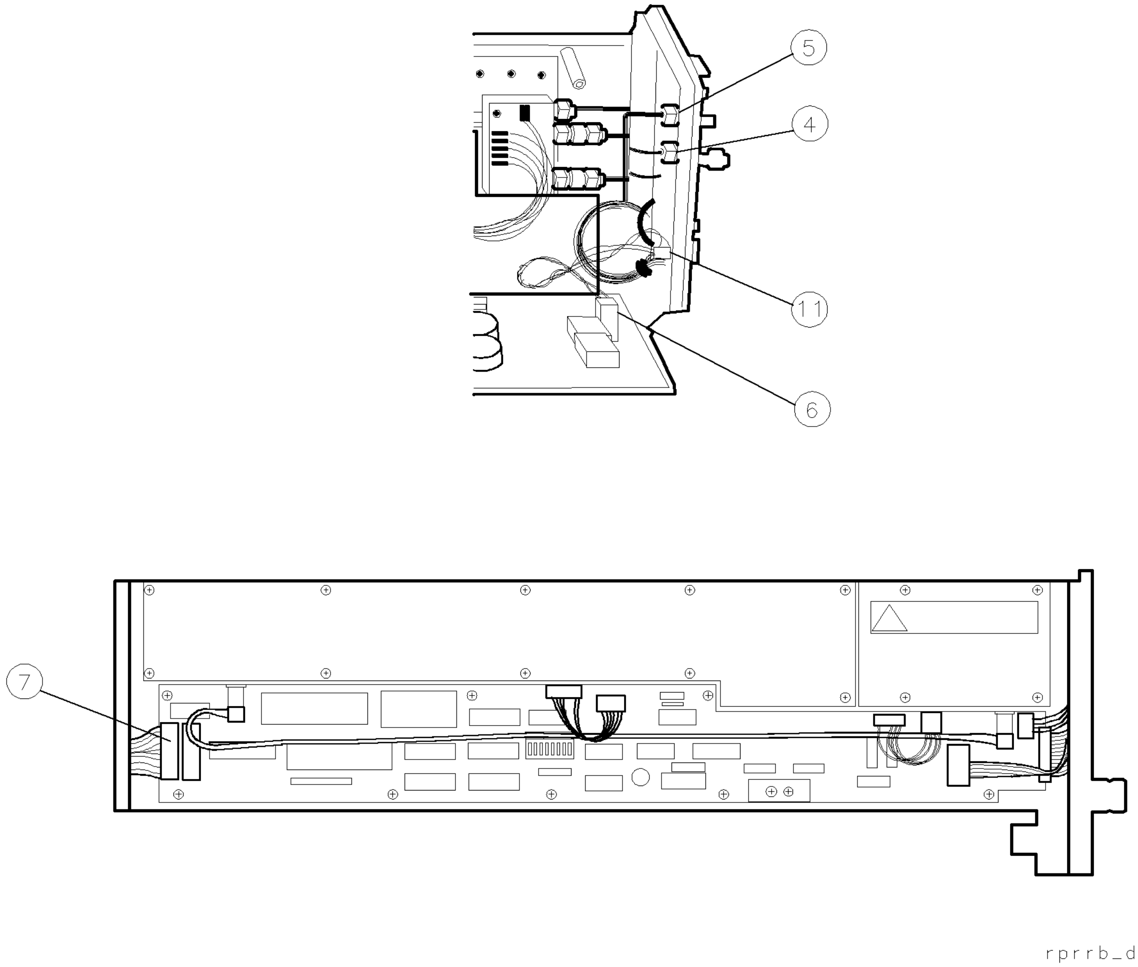


Figure 9-5. Rear Panel Removal/Replacement (2 or 2)

Bandpass Filter

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the Bandpass Filter

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect W4 (2).
4. Remove the 26 bandpass-filter screws (3) in the order given in Figure 9-7.
5. Disconnect the bandpass filter 1ST IF IN connection from the A6 isolator (4), while gently lifting the bandpass filter (5) slightly and sliding it out of the module. Do not damage the A7 2nd mixer.

To Replace the Bandpass Filter

1. Replace the bandpass filter (5), positioning it over the A7 2nd mixer on the casting while lining up the bandpass-filter 1ST IF IN connection with the A6 isolator (4). Do not damage the A7 2nd mixer.
2. With the bandpass filter flat against the casting, tighten the bandpass-filter 1ST IF IN connection to the A6 isolator.
3. Loosely replace the 26 bandpass-filter screws (3), position the bandpass-filter cavity toward the front end and bottom of the module, and then tighten the screws in the order given in Figure 9-7.
4. Reconnect W4 (2).
5. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
6. Replace the module cover. (Refer to the "Module Cover" procedure.)

Bandpass Filter

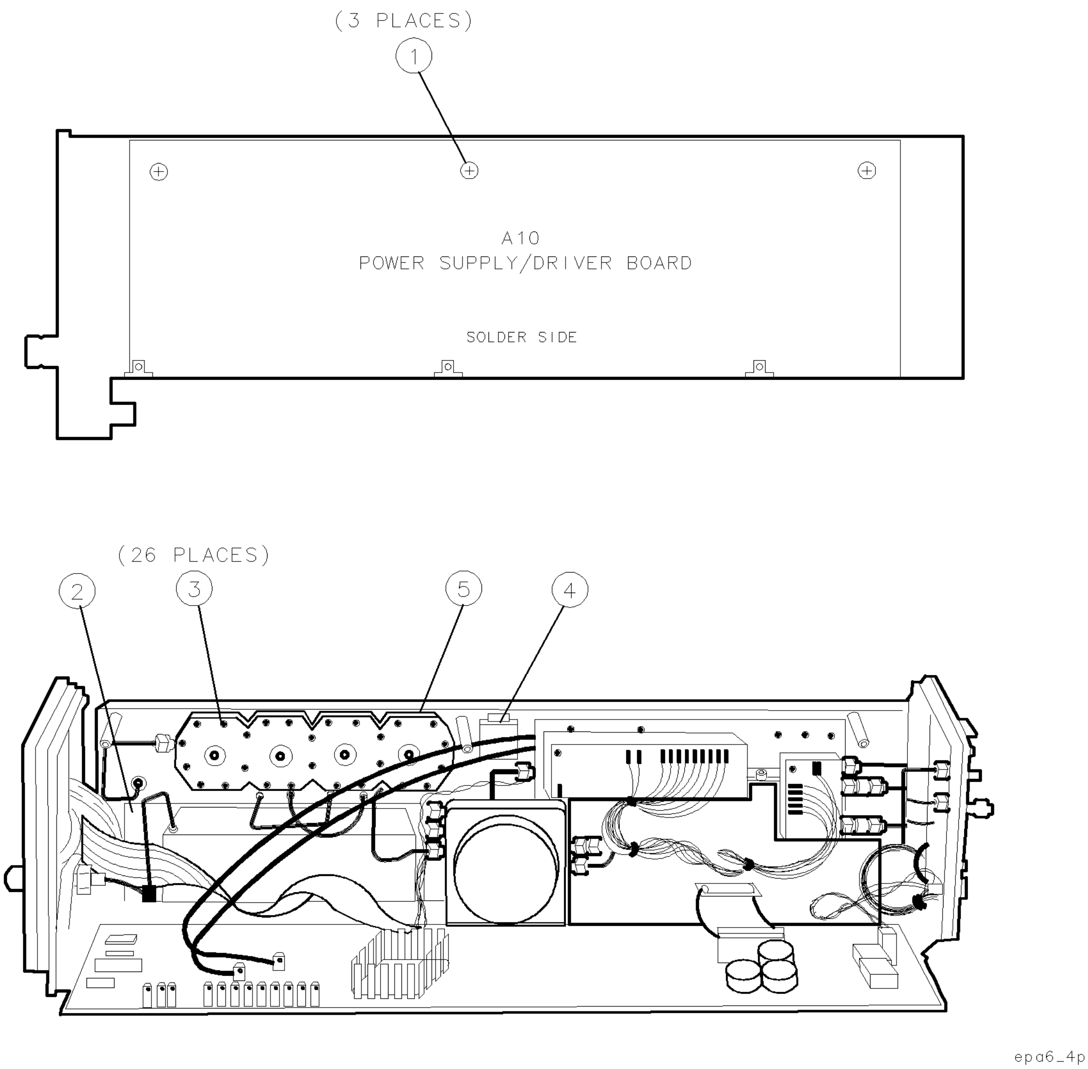


Figure 9-6. Bandpass Filter Removal/Replacement (1 or 2)

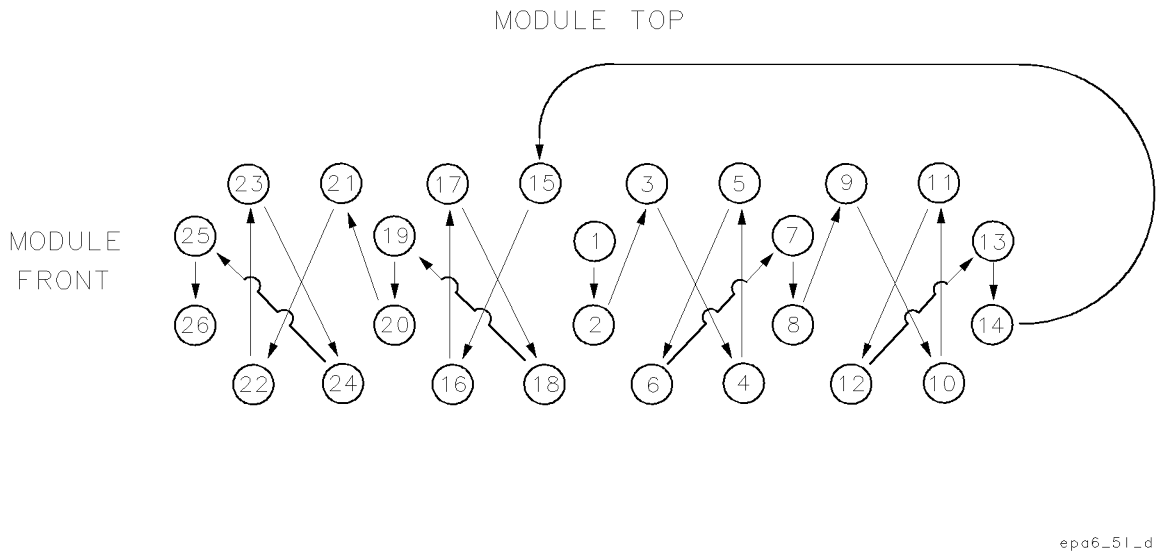


Figure 9-7. Bandpass Filter Removal/Replacement (2 or 2)

A1 Leveling Amplifier

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A1 Leveling Amplifier

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Remove the one screw (2) that holds the rear-panel to the module center casting.
4. Remove the three screws (3) that hold the rear-panel to the module base.
5. Disconnect the 2 dB attenuator (4), the 3 dB attenuator (5), and W19 (6) from the A1 leveling amplifier (7). Do not damage the attenuators, the cables, or any pins on the A1 leveling amplifier.
6. Disconnect W17 (8) from the A13 ALC/bias (9).
7. Remove the four screws (10) that connect the A1 leveling amplifier to the center casting.
8. Disconnect the connector (11) between the A1 leveling amplifier and the A2 LO multiplier, and lift out the A1 leveling amplifier.

To Replace the A1 Leveling Amplifier

1. Position the A1 leveling amplifier (7) on the center casting, and loosely reconnect the connector (11) between the A1 leveling amplifier and the A2 LO multiplier.
2. Loosely replace the four screws (10) that hold the A1 leveling amplifier to the center casting; these screws will be tightened in step 4.
3. Finish tightening the connector (11) between A1 leveling amplifier and A2 LO multiplier.
4. Tighten the four screws (10) that hold the A1 leveling amplifier to the center casting.
5. Reconnect the 2 dB attenuator (4), the 3 dB attenuator (5), and W19 (6) to the A1 leveling amplifier (7). Do not damage the attenuators, the cables, or any pins on the A1 leveling amplifier.
6. Reconnect W17 (8) to the A13 ALC/bias.
7. Replace the three screws (3) that hold the rear-panel to the module base. Torque the three base screws to 20 inch-pounds.
8. Replace one screw (2) that holds the rear-panel to the module center casting. Torque the one center casting screw to 6 inch-pounds.
9. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
10. Replace the module cover. (Refer to the "Module Cover" procedure.)

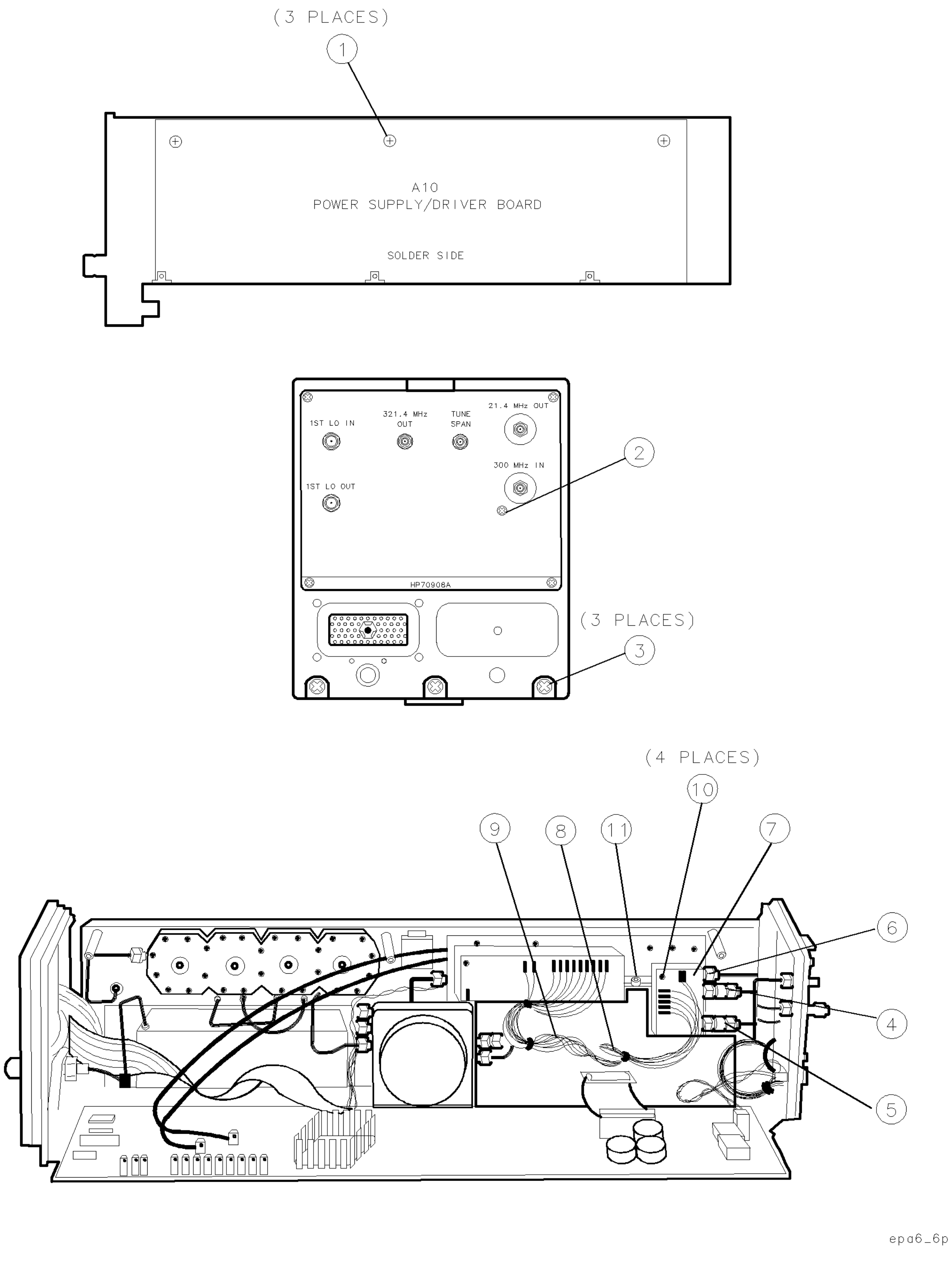


Figure 9-8. A1 Leveling Amplifier Removal/Replacement

A2 LO Multiplier

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A2 LO Multiplier

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Remove the two screws (8) from the A3 SYTFMD (7).
4. Loosen the four screws (3) two turns that hold the A2 LO multiplier (4) onto the center casting.
5. Loosen the connector (6) from the INPUT connector on the A2 LO multiplier (4).
6. Loosen the elbow connector (2) at both ends by one turn.

Note Do not put stress on the elbow as it can damage the A2 LO multiplier, A3 SYTFMD, or the elbow itself.

7. Finish removing the four screws (3) that hold the A2 LO multiplier (4) onto the center casting.
8. Disconnect W16 (5) from the A13 ALC/bias.
9. Carefully finish disconnecting the elbow connector (2) from the A3 SYTFMD J7 (7) and then from the A2 LO multiplier (4).
10. Carefully finish disconnecting the connector (6) at the INPUT of the A2 LO multiplier (4) and slide the A2 LO multiplier forward to remove it.

To Replace the A2 LO Multiplier

1. Reconnect the elbow connector (2) to the A2 LO multiplier OUTPUT. Do not tighten at this time.
2. Slide the A2 LO multiplier back into the module and begin to reconnect the connector (6) to the INPUT connector on the A2 LO multiplier (4). Line up the elbow connector (6) with the A3 SYTFMD J7 (7)
3. Begin the reconnection of the elbow (2) to the A3 SYTFMD J7 (7).
4. Finish reconnecting the connector (6) to the INPUT connector on the A2 LO multiplier (4).
5. Finish reconnecting both ends of the elbow connector to the A2 LO multiplier OUTPUT (4) and the A3 SYTFMD J7 (7).
6. Replace the four screws (3) that hold the A2 LO multiplier (4) to the center casting.
7. Replace the two screws (8) that hold the A3 SYTFMD (7) to the module casting.
8. Reconnect W16 (5) to the A13 ALC/bias.
9. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
10. Replace the module cover. (Refer to the “Module Cover” procedure.)

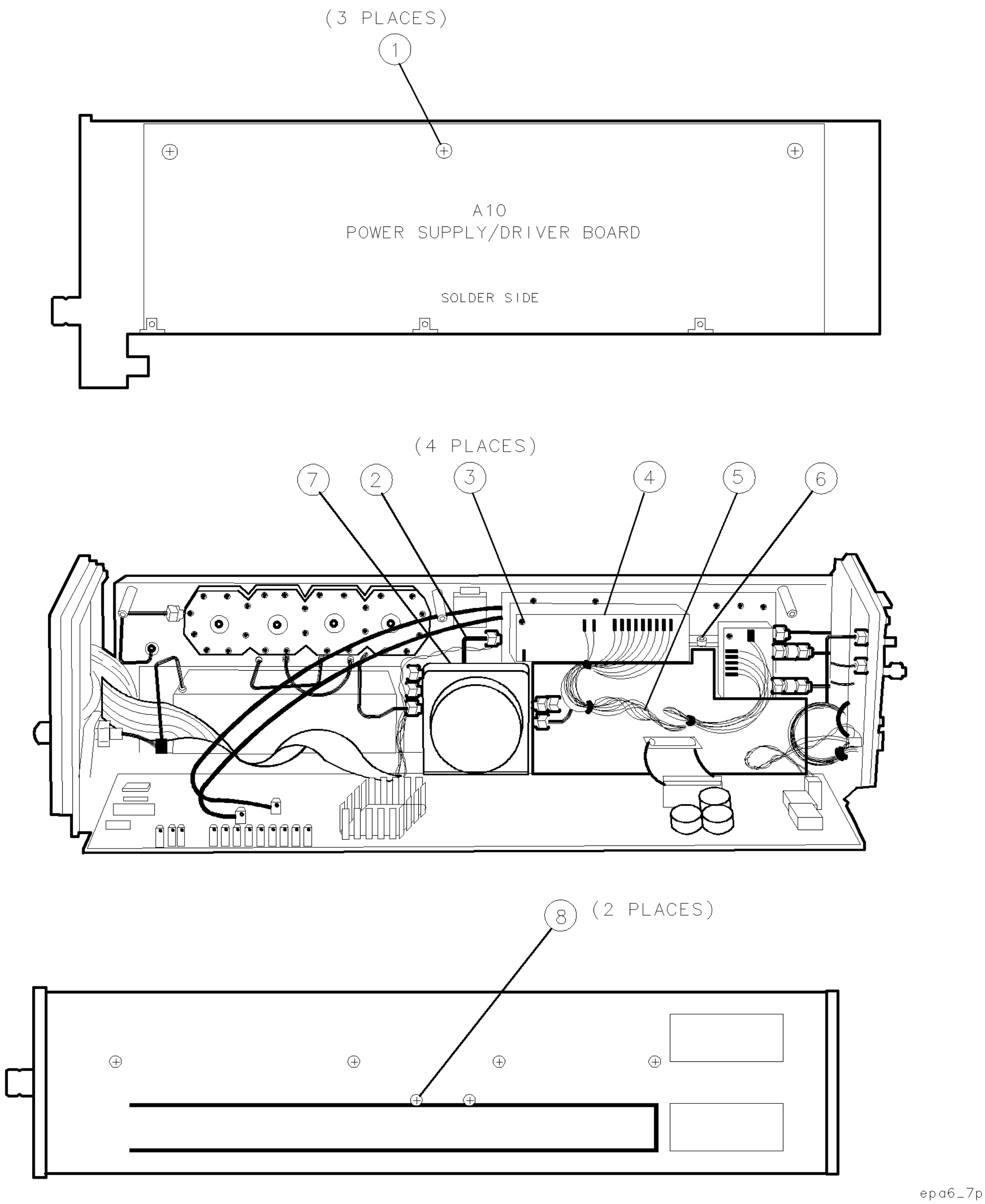


Figure 9-9. A2 LO Multiplier Removal/Replacement

A3 SYTFMD

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A3 SYTFMD

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the 3 screws holding the A10 power supply/driver in place and fold it down.
3. Loosen the elbow connector (1) one turn. Take care not to crack the connector or damage the wires near it.

Note Do not put stress on the elbow as it can damage the A2 LO multiplier, A3 SYTFMD, or the elbow itself.

4. Remove the four screws that hold the A2 LO multiplier to the center casting (9).
5. Remove the two module-base screws (2) that hold the A3 SYTFMD in place.
6. Disconnect W8 (4) from A3J11.
7. Disconnect W12 (3) from both A3J8 and the A4 input attenuator.
8. Disconnect W9 (5) from A3J10.
9. Disconnect W15 (6) from A3J9.
10. While carefully sliding A3 SYTFMD (7) out of the module, finish disconnecting the elbow connector (1) from the OUTPUT connector of the A2 LO multiplier.

To Replace the A3 SYTFMD

1. Replace the A3 SYTFMD (7). Line up the elbow connector (1) with the OUTPUT connector on the A2 LO multiplier; line up A3J9 with W15 (6).
2. Loosely reconnect the elbow connector (1) to the OUTPUT connector on A2 LO multiplier. Do not tighten the elbow connector all of the way yet; it will be fully tightened in step 8.
3. Reconnect W15 (6) to A3J9.
4. Reconnect W12 (3) to both A3J8 and the A4 input attenuator. W23 (8) should be routed behind W12.
5. Reconnect W9 (5) to A3J10. Route W9 across the top of the A3 SYTFMD.
6. Reconnect W8 (4) to A3J11.
7. Loosely replace the two module-base screws (2).
8. Torque the elbow connector (1) to 10 inch-pounds.
9. Hold the A3 SYTFMD (7) in place and tighten the two module-base screws (2). Torque the screws to 20 inch-pounds.
10. Install the four screws that hold the A2 LO multiplier to the center casting (9).
11. Fold up the A10 power supply/driver and replace three screws that hold it in place. Torque the screws to 20 inch-pounds.
12. Replace the module cover. (Refer to the “Module Cover” procedure.)

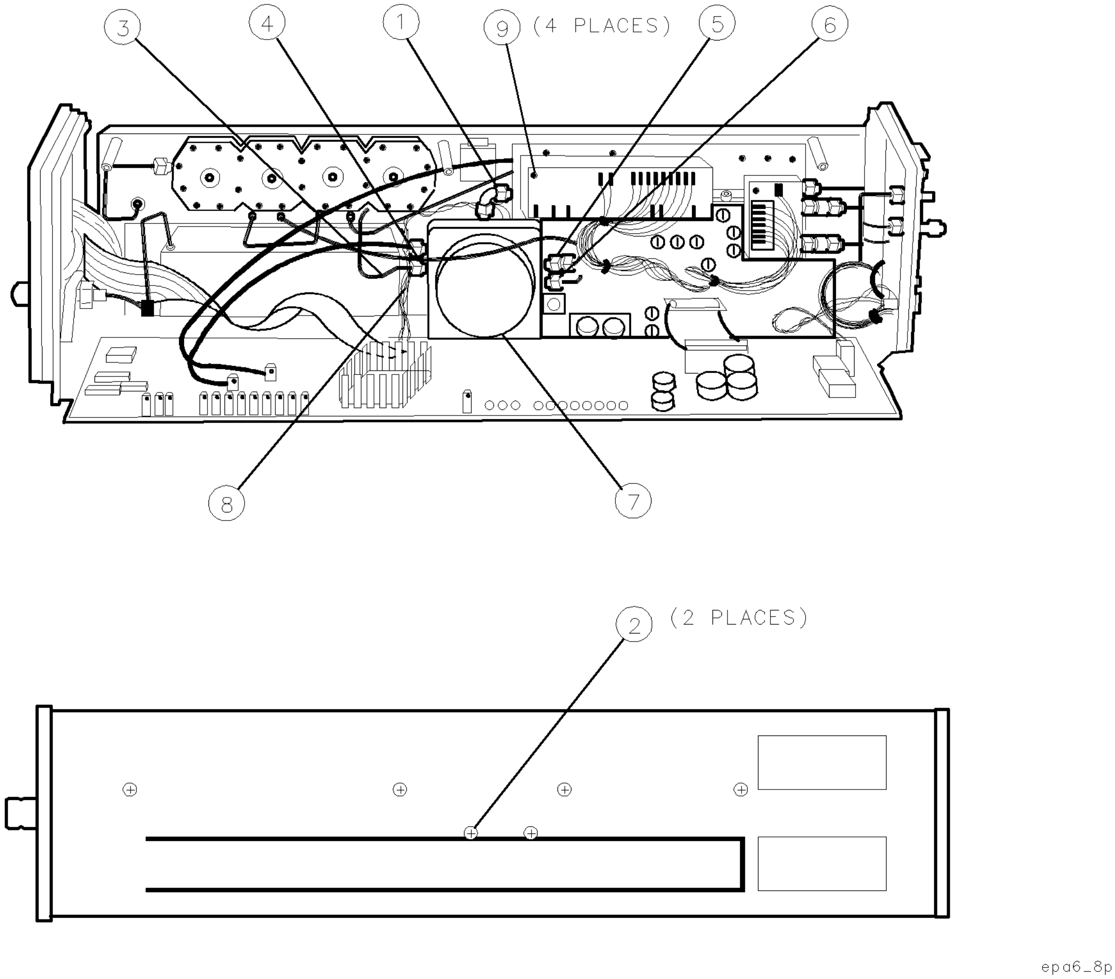


Figure 9-10. A3 SYTFMD Removal/Replacement

A4 Input Attenuator

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A4 Input Attenuator

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect W3 (2) from both A4 input attenuator and the front panel RF INPUT connector.
4. Disconnect W12 (3) from both A4 input attenuator and A3J8.
5. Disconnect W2 (4) from A10J201 and move it out of the way.
6. Remove the four screws (5) that hold the attenuator bracket to the center casting. Do not damage the cables or wires.
7. Disconnect W1 (7); this is done to allow the attenuator ribbon cable to be moved.
8. Disconnect the attenuator ribbon cable (6) from A12J9.
9. Lift out the attenuator/attenuator bracket assembly (8); be careful not to damage the wires on the surrounding assemblies when lifting out this assembly.
10. Remove the two screws (9) that hold the A4 input attenuator to the attenuator bracket.

To Replace the A4 Input Attenuator

1. Replace the two screws (9) that hold the A4 input attenuator to the attenuator bracket. The edges of the attenuator bracket should line up with the edge of the attenuator.
2. Replace the attenuator/attenuator bracket assembly (8) into the module. Do not pinch any wires between the attenuator bracket and the center casting.
3. Loosely replace the four screws (5) that hold the attenuator bracket in place (the screws will be fully tightened in step 5).
4. Reconnect W12 (3) to both A4 input attenuator and A3J8. W23 (10) should be routed behind W12.
5. Finish tightening the four screws (5) that hold the attenuator bracket in place.
6. Reconnect the attenuator ribbon-cable (6) to A12J9.
7. Reconnect W1 (7).
8. Reconnect W2 (4) to A10J201.
9. Reconnect W3 (2) to both the A4 input attenuator and the front-panel RF INPUT connector.
10. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
11. Replace the module cover. (Refer to the “Module Cover” procedure.)

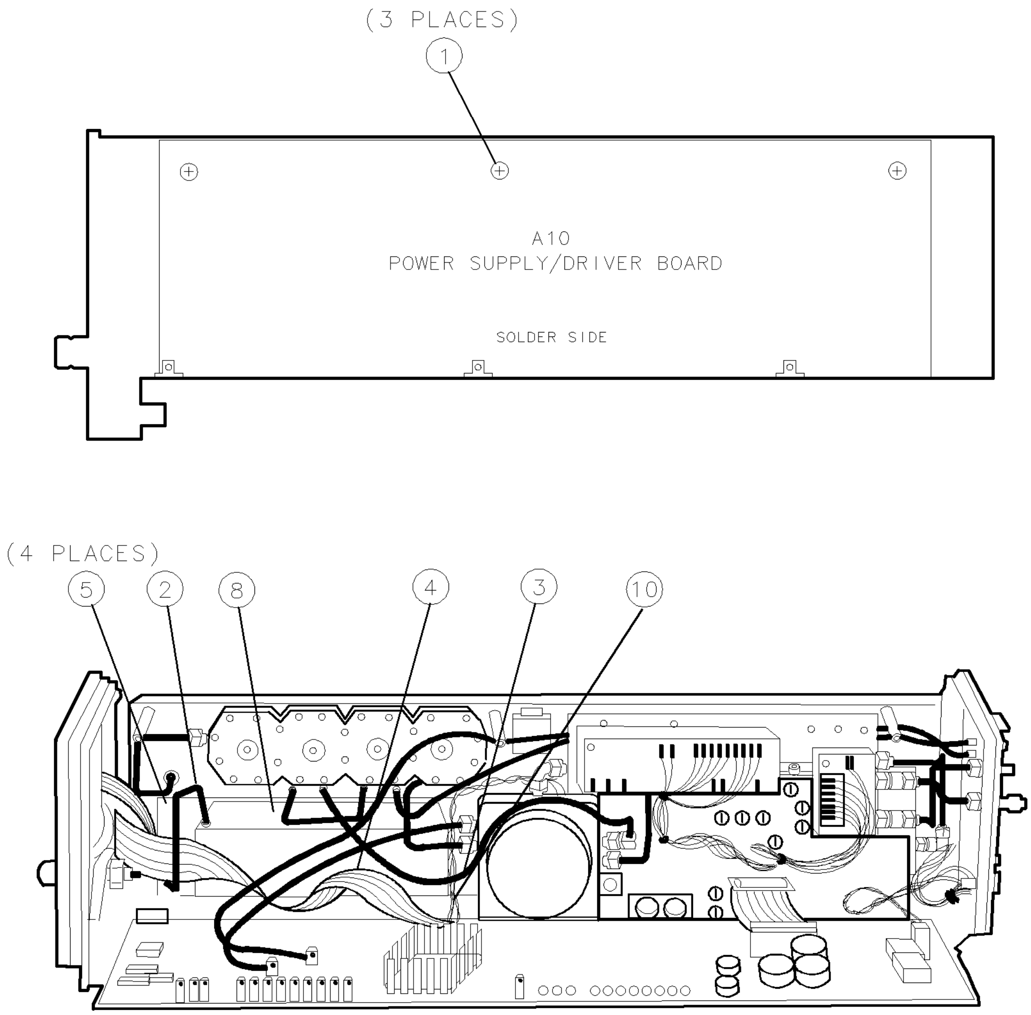


Figure 9-11. A4 Input Attenuator Removal/Replacement (1 of 2)

A4 Input Attenuator

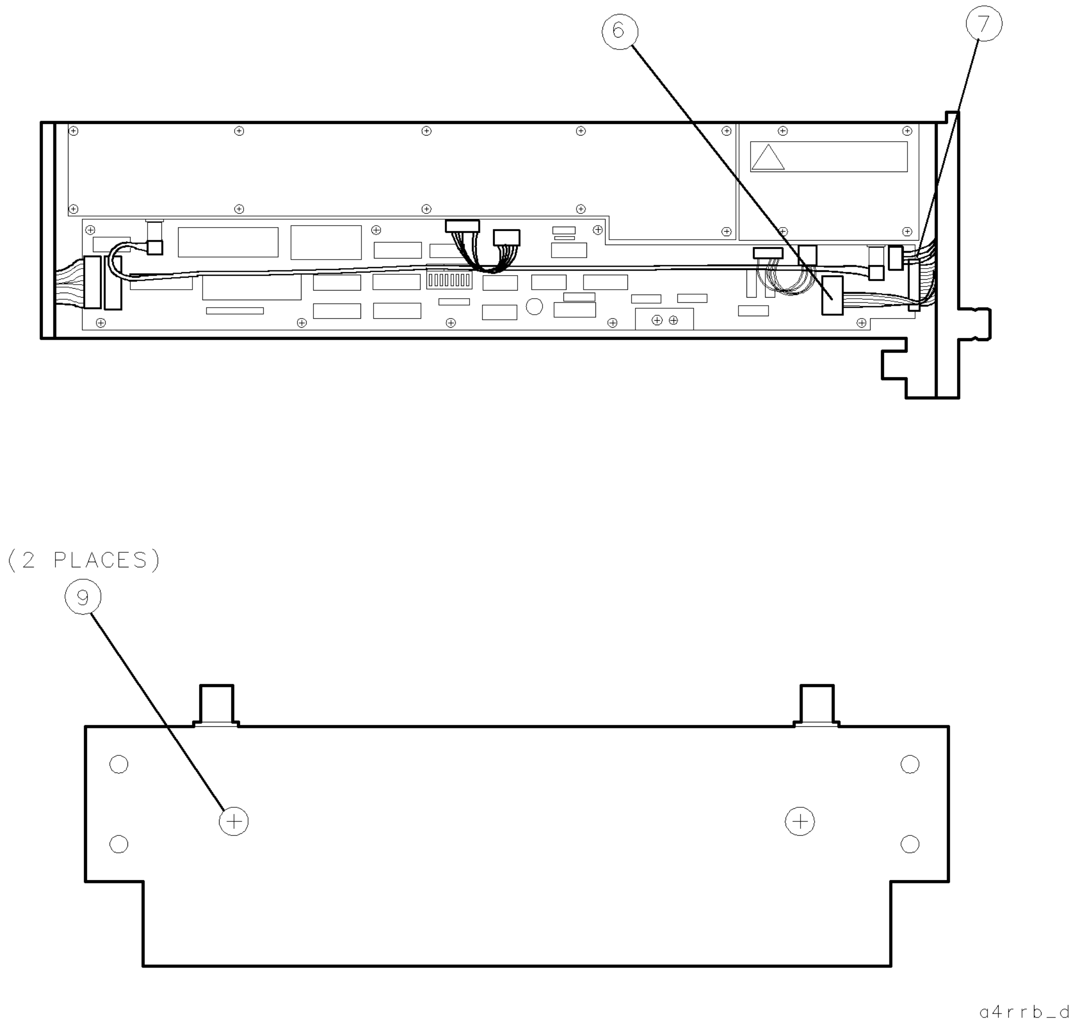


Figure 9-12. A4 Input Attenuator Removal/Replacement (2 of 2)

A5 VCO Sampler

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A5 VCO Sampler

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect W4 (2) from the A5 VCO sampler RF IN connector (3); remove the hex-nut and lock-washer from the connector.
4. On the other side of the module, disconnect W6 (4) from A9J2.
5. Disconnect W5 (5) from A9J1.
6. Remove the four screws (6) and lift off the 2nd converter cover.
7. Remove the two screws (7) and lift up the A9 2nd converter PLL cover assembly (8).
8. Remove the one slot-head screw (9), the two hex-screws and washers (10), and remove the A5 VCO sampler (11) from the casting.

To Replace the A5 VCO Sampler

1. Replace the A5 VCO sampler (11) into the casting, and replace the two hex-screws and washers (10), and the one slot-head screw (9). Torque the screws to 3 inch-pounds.
2. On the other side of the module, replace the hex-nut and lockwasher on the A5 VCO sampler RF IN connector (3).
3. Reconnect W4 (2) to the A5 VCO sampler RF IN connector (3).
4. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
5. Check that the VCO cover has RFI gasket strips (12) in its bottom slots.
6. Check that the D-shaped RFI gasket on A9J1 (13) is flat-side up.
7. Position the A9 2nd converter PLL cover assembly (8) in the module and replace the two screws (7).
8. The 2nd converter cover should have RFI gasket strips (14) in all of its bottom slots.
9. Position the 2nd converter cover over the A9 2nd converter PLL and replace the four screws (6).
10. Reconnect W5 (5) to A9J1, and W6 (4) to A9J2. Be sure to orient W6 so that it matches the sequence of wire colors silkscreened on the 2nd converter cover.
11. Replace the module cover. (Refer to the “Module Cover” procedure.)

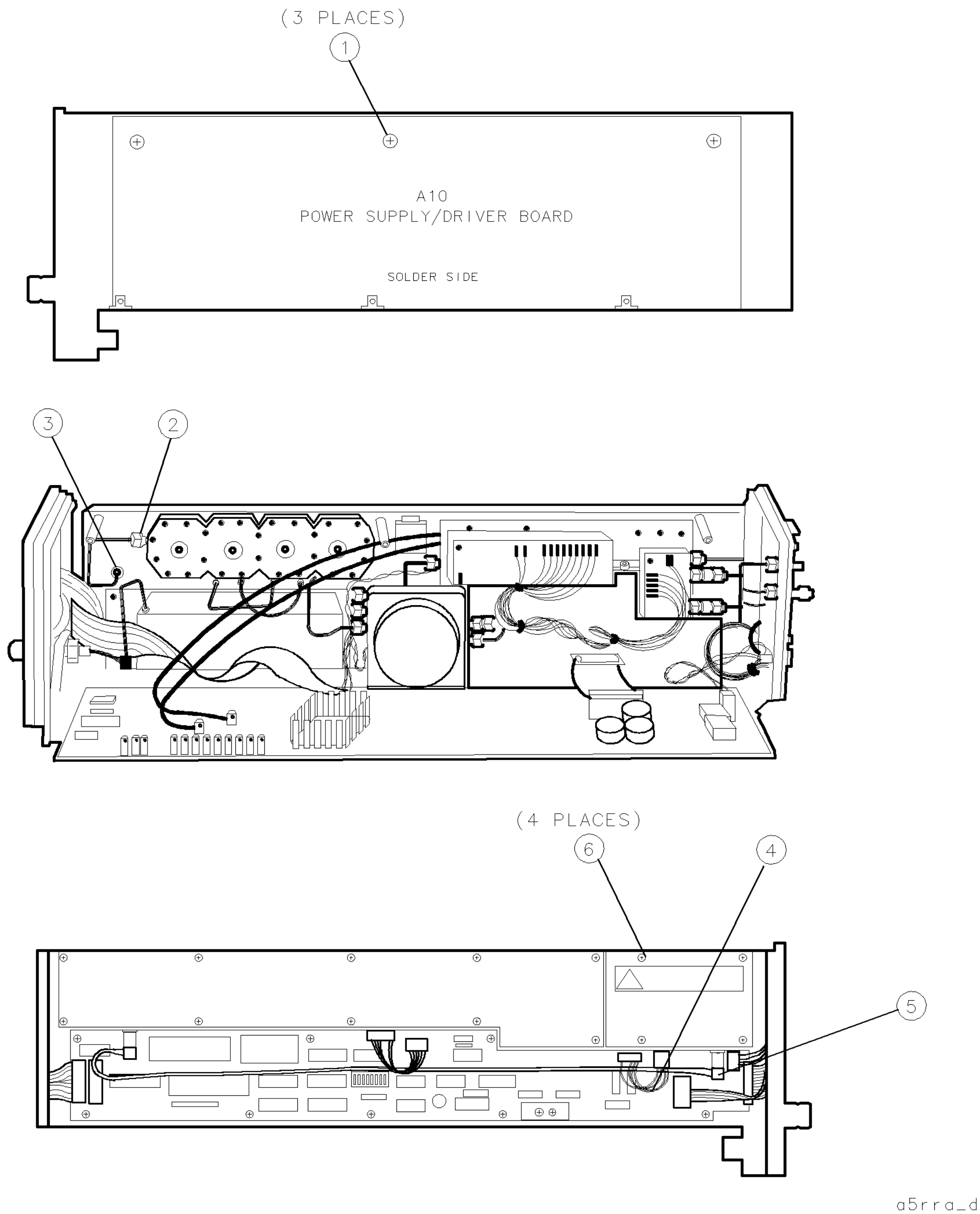


Figure 9-13. A5 VCO Sampler Removal/Replacement (1 of 3)

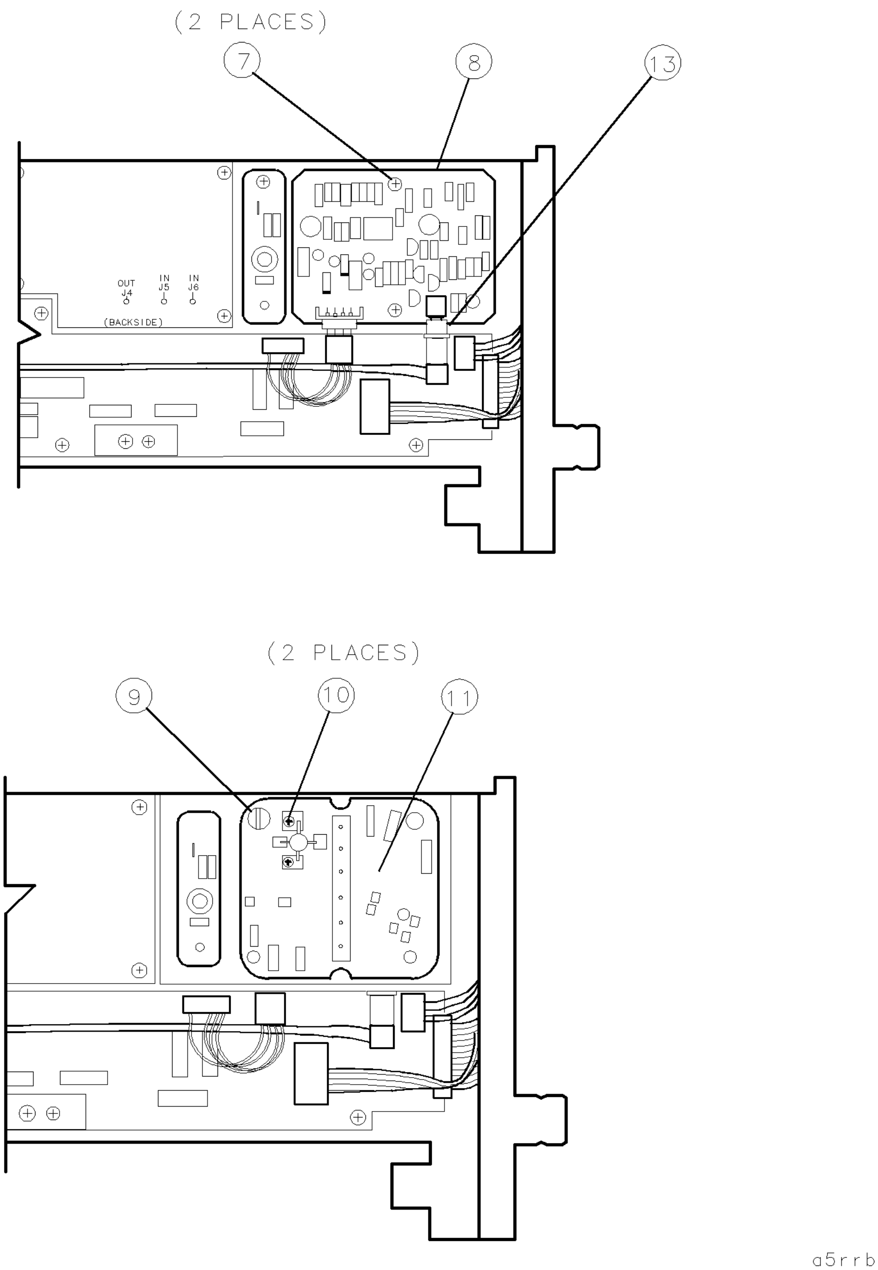


Figure 9-14. A5 VCO Sampler Removal/Replacement (2 of 3)

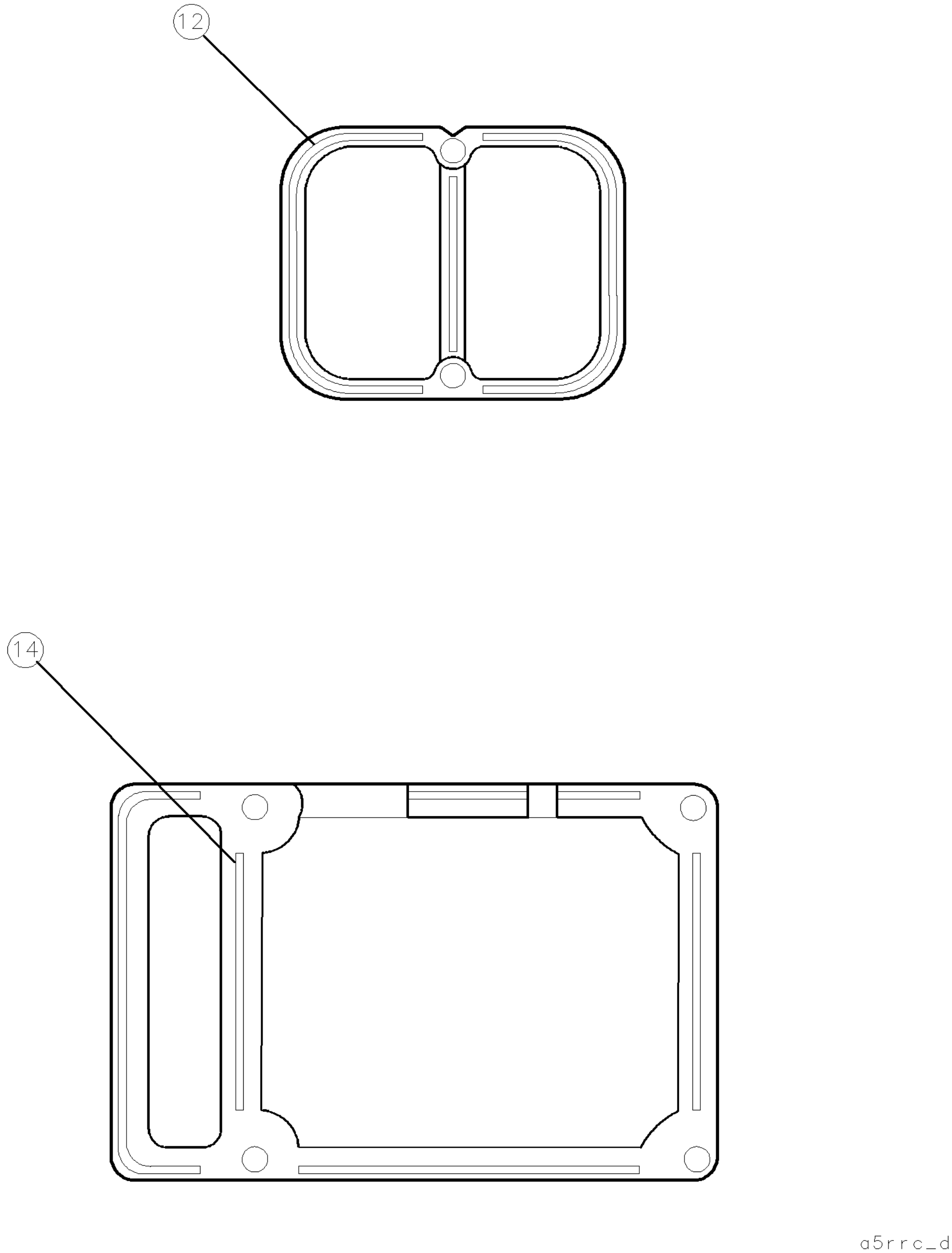


Figure 9-15. A5 VCO Sampler Removal/Replacement (3 of 3)

A6 Isolator

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A6 Isolator

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the three screws holding the A10 power supply/driver in place and fold it down.
3. Remove the A10 power supply/driver center standoff (3).
4. Disconnect the A6 isolator (1) from the bandpass filter (2). Note the orientation of the A6 isolator.
5. Disconnect the cable from the A16 low pass filter to the isolator IN (4).

To Replace the A6 Isolator

1. Reconnect the A6 isolator (1) to the bandpass filter (2). Note the orientation of the A6 isolator.
2. Reconnect the cable from A16 low pass filter to isolator IN (4)
3. Replace the A10 power supply/driver center standoff (3).
4. Fold up the A10 power supply/driver and replace three screws that hold it in place. Torque the screws to 20 inch-pounds.
5. Replace the module cover. (Refer to the "Module Cover" procedure.)

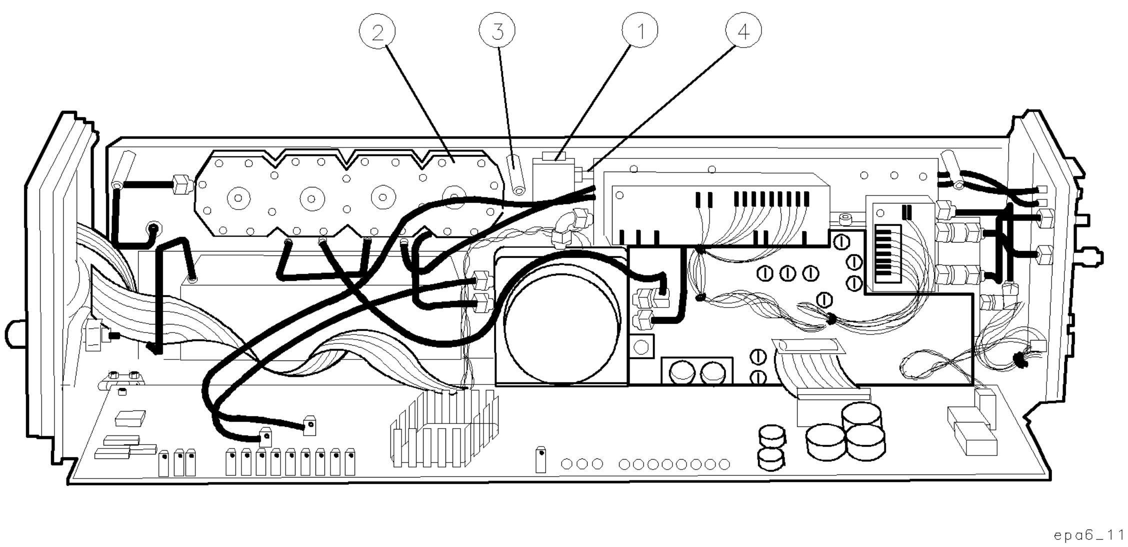


Figure 9-16. A6 Isolator Removal/Replacement

A7 2nd Mixer

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A7 2nd Mixer

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Remove the bandpass filter. (Refer to the “Bandpass Filter” procedure.)
4. Remove the A7 2nd mixer (2).

Note If the 2nd mixer ground pin (4) needs replacement, unscrew the old ground pin and carefully screw in a new ground pin. Torque the screw to 1.5 inch-pounds. Do not cross-thread the new ground pin.

To Replace the A7 2nd Mixer

1. Short the capacitor pin (5) to the module casting; then carefully replace the A7 2nd mixer diode board (2). The notched long-edge (6) of the A7 2nd mixer should be next to the casting, and the component side should be facing the center of the module.
2. Replace the bandpass filter. (Refer to the “Bandpass Filter” procedure.)
3. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
4. Replace the module cover. (Refer to the “Module Cover” procedure.)

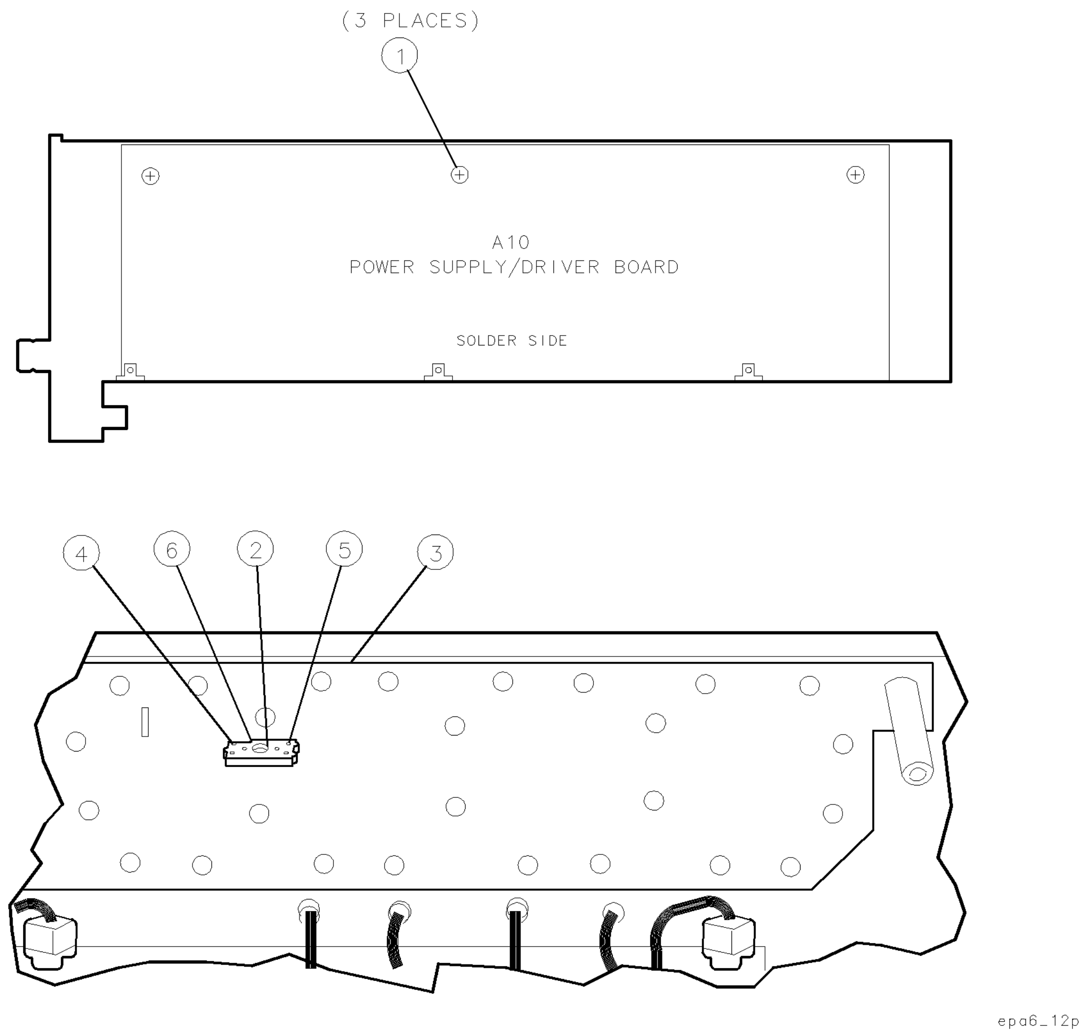


Figure 9-17. A7 2nd Mixer Removal/Replacement

A8 321.4 MHz Matching Network

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A8 321.4 MHz Matching Network

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the four screws (1) that hold the 2nd converter cover to the center casting.
3. Remove the one screw (2), and carefully lift up the A8 321.4 MHz matching network (3).

To Replace the A8 321.4 MHz Matching Network

1. Position the A8 321.4 MHz matching network (3) with the pin-feedthrough hole over the capacitor pin, and press into place.
2. Replace the one screw (2).
3. Check that the 2nd converter cover has RFI gasket strips (4) in all slots.
4. Replace the 2nd converter cover.
5. Replace the four screws (1).
6. Replace the module cover. (Refer to the “Module Cover” procedure.)

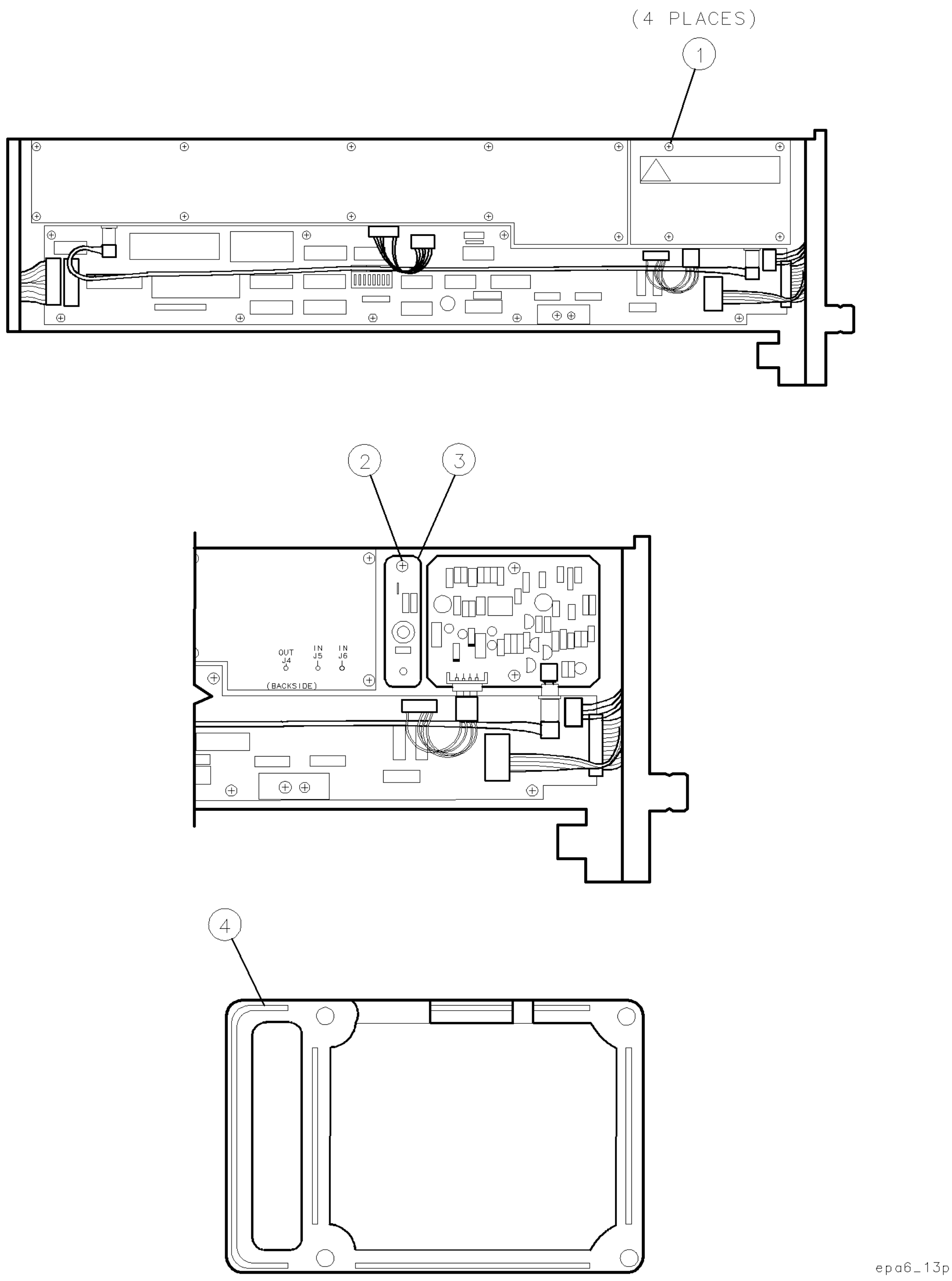


Figure 9-18. A8 321.4 MHz Matching Network Removal/Replacement

A9 2nd Converter PLL

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A9 2nd Converter PLL

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Disconnect W6 (1) from A9J2.
3. Disconnect W5 (2) from A9J1.
4. Remove the four screws (3) and remove the 2nd converter cover.
5. Remove the two screws (4) and lift up the A9 2nd converter PLL (5).
6. Remove the cover (6) from the back of A9 2nd converter PLL.

To Replace the A9 2nd Converter PLL

1. Position the A9 2nd converter PLL over the VCO cover (6) with the notch (7) in the VCO cover lined up with the notch in A9 2nd converter PLL.
2. Line up the feedthrough pins with the holes in A9 2nd converter PLL and press A9 2nd converter PLL into place on the VCO cover.
3. Check that the VCO cover has RFI gasket strips (8) in its bottom slots.
4. Check that the D-shaped RFI gasket (9) on A9J1 is flat-side up.
5. Position the A9 2nd converter PLL/VCO cover in the module and replace the two screws (4).
6. Check that the 2nd converter cover has RFI gasket strips (10) in all of its bottom slots.
7. Position the 2nd converter cover over the A9 2nd converter PLL and replace the four screws (3).
8. Reconnect W5 (2) to A9J1.
9. Reconnect W6 (1) to A9J2 so wire colors match silkscreen on the cover.
10. Replace the module cover. (Refer to the "Module Cover" procedure.)

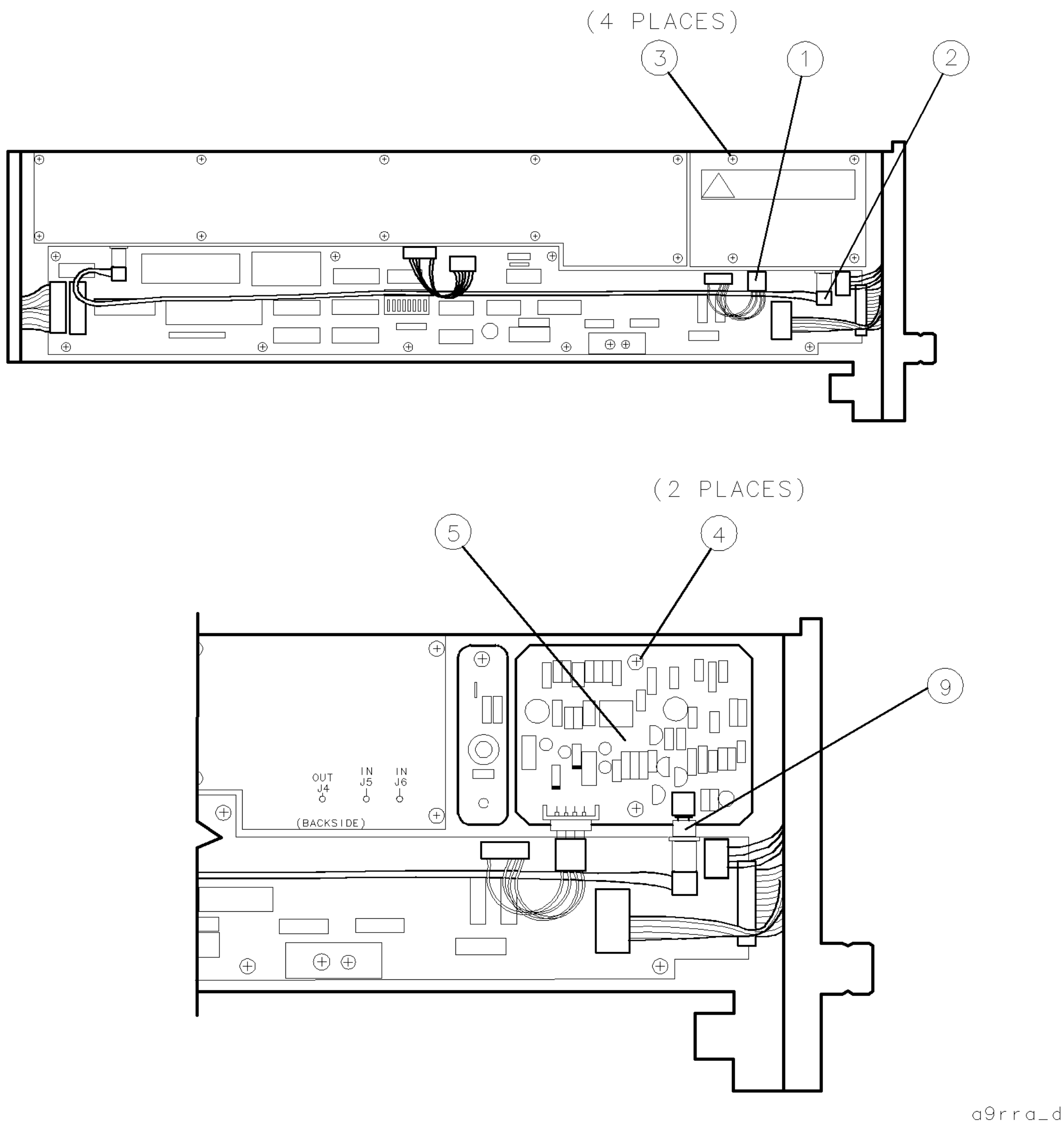


Figure 9-19. A9 2nd Converter PLL Removal/Replacement (1 of 2)

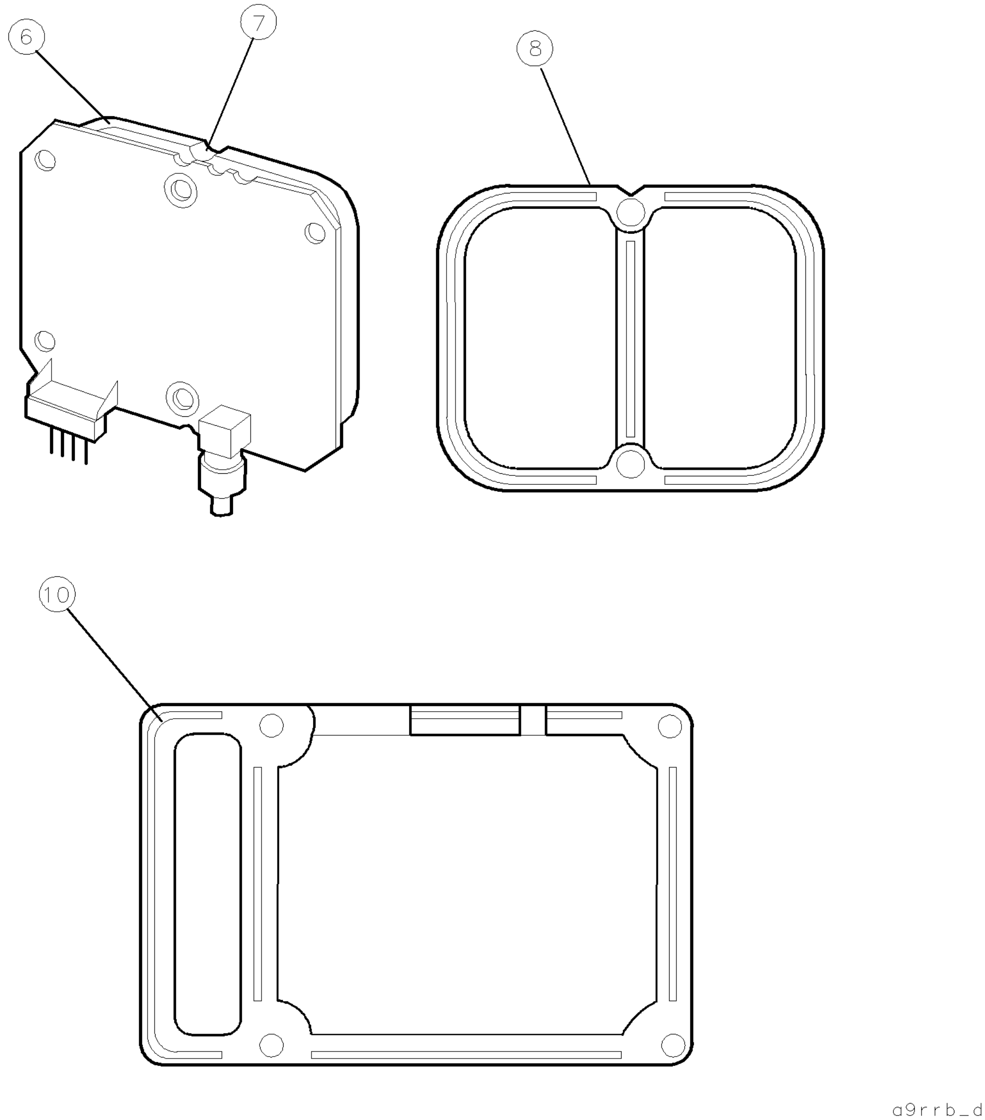


Figure 9-20. A9 2nd Converter PLL Removal/Replacement (2 of 2)

A10 Power Supply/Driver

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A10 Power Supply/Driver

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect the following cables:
   W2 (2) from A10J201
   W23 (3) from A10J203
   W11 (4) from A10J2
   W8 (5) from A10J4
   W18 (6) from A10J301
   W22J2 (7) from A10J101
4. Remove the three screws (8) from the hinges (9); then remove A10 power supply/driver.

To Replace the A10 Power Supply/Driver

1. Position the A10 power supply/driver on the hinges (9).
2. Replace the three screws (8). Torque the screws to 9 inch-pounds.
3. Reconnect the following cables:
   W22J2 (7) to A10J101
   W18 (6) to A10J301
   W8 (5) to A10J4
   W11 (4) to A10J2
   W23 (3) to A10J203
   W2 (2) to A10J201
4. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
5. Replace the module cover. (Refer to the “Module Cover” procedure.)

A10 Power Supply/Driver

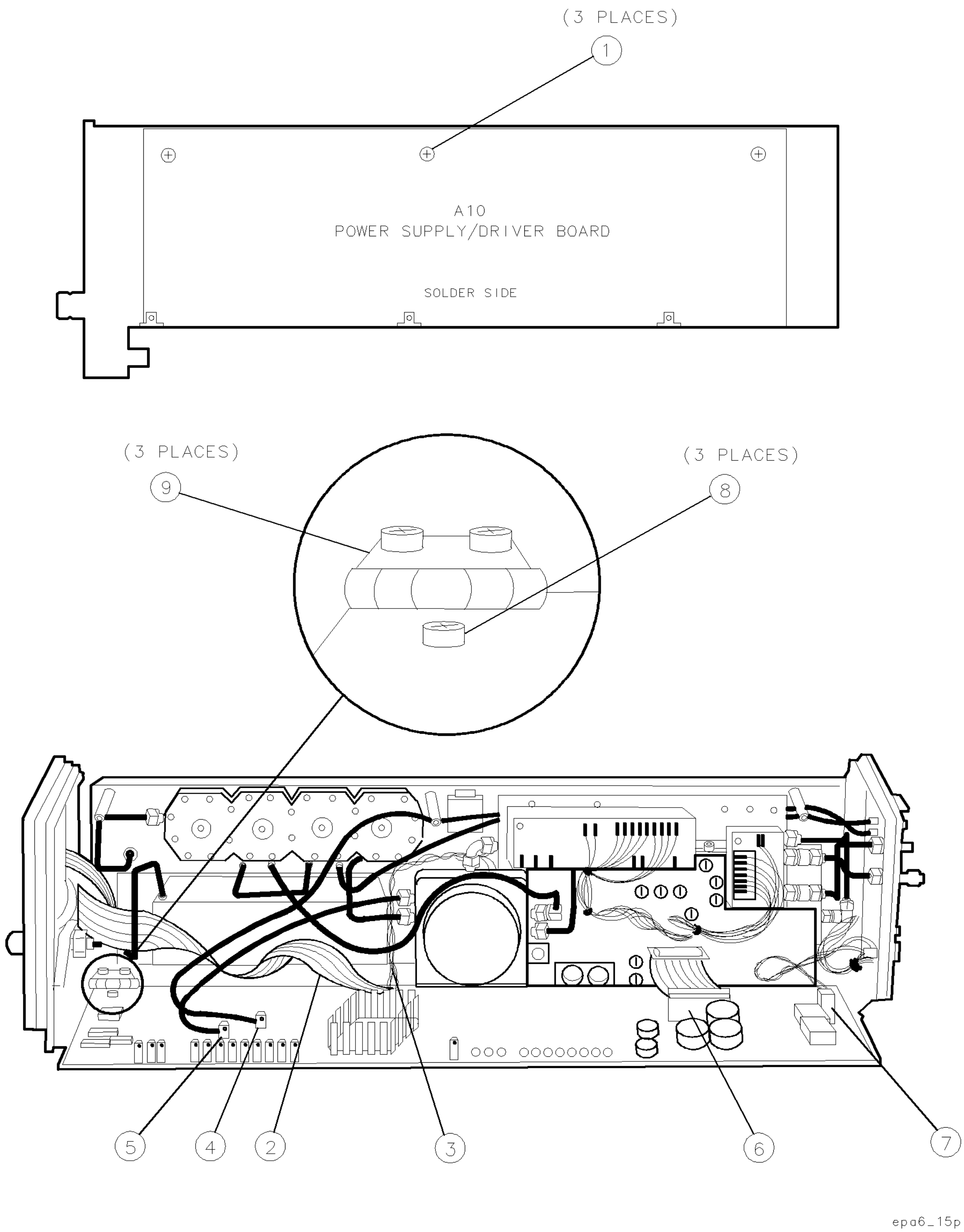


Figure 9-21. A10 Power Supply/Driver Removal/Replacement

A11 Last Converter

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A11 Last Converter

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the three screws (1) holding the A10 power supply/driver in place and fold it down.
3. Disconnect the following cables:
   W10 (2) from A11J4 (3)
   W7 (4) from A11J5 (5)
   W9 (6) from A11J6 (7)
4. Remove the hex-nuts and lockwashers from the three feedthrough connectors: A11J4 (3), A11J5 (5), and A11J6 (7).
5. From the other side of the module, disconnect the following cables:
   W5 (8) from A11J3
   W13 (9) from A11J7
6. Remove the ten screws (10) and lift off the A11 last converter cover.
7. From the rear of the module, remove the hex-nuts and lockwashers from the 300 MHz IN connector (11) and the 21.4 MHz OUT connector (12).
8. Slightly lift the A11 last converter (13) and slide it out of the module.

To Replace the A11 Last Converter

1. Slide the A11 last converter (13) into the module.
2. From the rear of the module, replace the hex-nuts and lockwashers on the 300 MHz IN connector (11) and the 21.4 MHz OUT connector (12).
3. Replace the hex-nuts and lockwashers on the three feedthrough connectors: A11J4 (3), A11J5 (5), and A11J6 (7).
4. Reconnect the following cables:
   W10 (2) to A11J4 (3)
   W7 (4) to A11J5 (5)
   W9 (6) to A11J6 (7)
5. Check that the A11 last converter cover has RFI gasket strips (14) in all slots.
6. Check that the D-shaped RFI gasket (15) on A11J3 is flat-side up.
7. Slide the A11 last converter cover into place and replace the ten screws (10).
8. Reconnect W5 (8) to A11J3.
9. Reconnect W13 (9) to A11J7 so wire colors match silkscreen on the cover.
10. Fold up the A10 power supply/driver and replace the three screws (1) that hold it in place. Torque the screws to 20 inch-pounds.
11. Replace the module cover. (Refer to the "Module Cover" procedure.)

A11 Last Converter

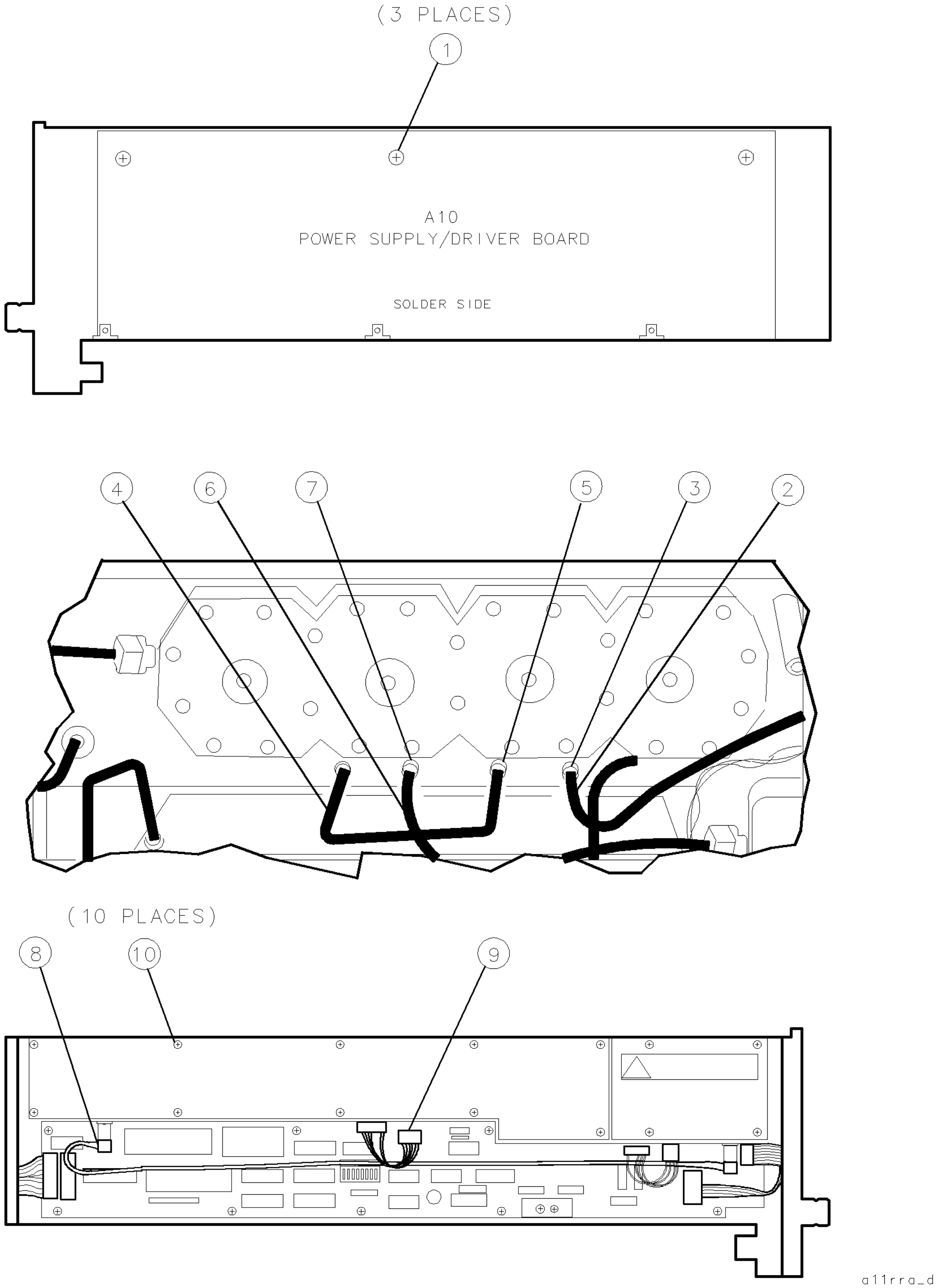


Figure 9-22. A11 Last Converter Removal/Replacement (1 of 2)

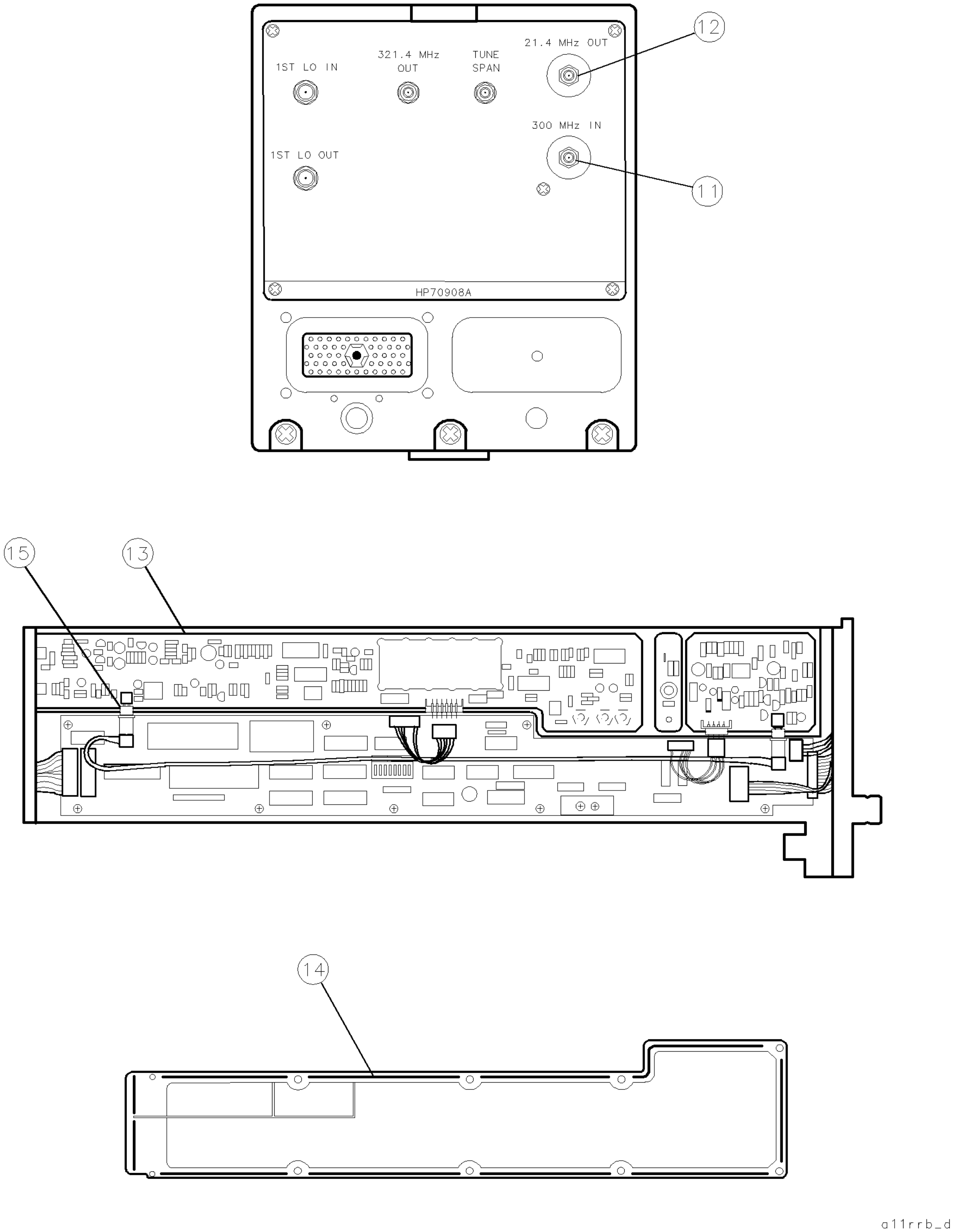


Figure 9-23. A11 Last Converter Removal/Replacement (2 of 2)

A12 Controller

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A12 Controller

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Disconnect the following cables:
   W1 (1) from A12J7
   A14 front panel board ribbon-cable (2) from A12J6
   W2 (3) from A12J2
   W6 (4) from both A9J2 and A12J3
   W13 (5) from A12J4 and A11J7
   W5 (6) from both A9J1 and A11J3
   W22J1 (7) from A12J1
3. Remove the eleven screws (8) and carefully slide the A12 controller (9) out of the module. Do not damage any of the feedthroughs on the A9 2nd converter PLL or A11 last converter.

To Replace the A12 Controller

1. Slide the A12 controller (9) into the module. Do not damage any of the feedthroughs on the A9 2nd converter PLL or A11 last converter.
2. Reconnect the following cables:
   W22J1 (7) to A12J1
   W5 (6) to both A9J1 and A11J3
   W13 (5) to A12J4 and A11J7
   W6 (4) to both A9J2 and A12J3
   W2 (3) to A12J2
   A14 front panel board ribbon-cable (2) to A12J6
   W1 (1) to A12J7
3. Replace the module cover. (Refer to the "Module Cover" procedure.)

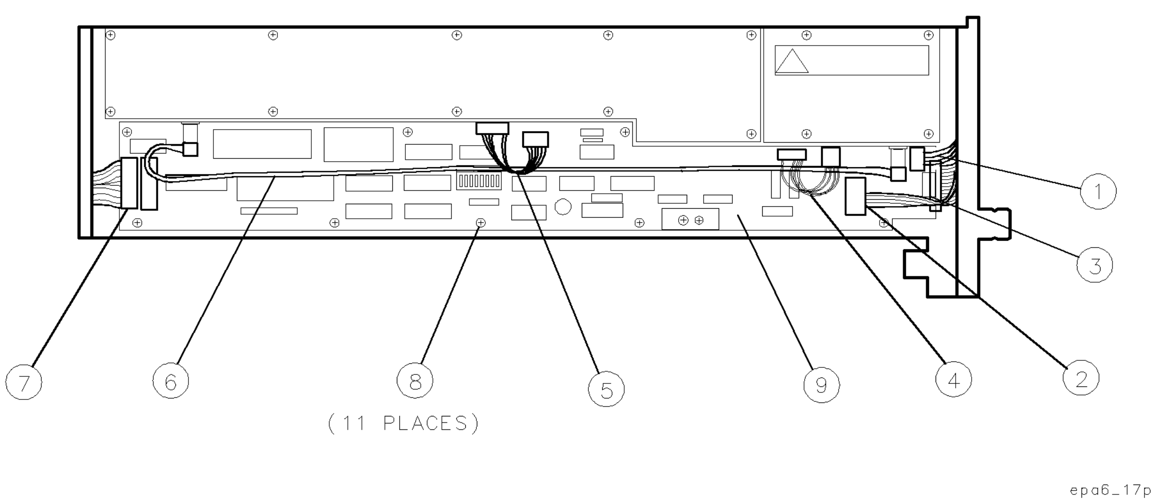


Figure 9-24. A12 Controller Removal/Replacement

A13 ALC/Bias

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A13 ALC/Bias

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the A10 power supply/driver. (Refer to the "A10 Power Supply/Driver" procedure.)
3. Disconnect W17 (1), W16 (2), W18 (3) from the A13 ALC/bias (4).
4. Remove the two screws (5) that hold the transistors to the heat sink.
5. Remove the five screws (6) that hold A13 ALC/bias in place.
6. Slide out the A13 ALC/bias, making sure not to lose the insulators (7).

To Replace the A13 ALC/Bias

1. Slide the A13 ALC/bias (4) into the module; the insulators (7) should be in place between the heatsink and the transistors.
2. Replace the five screws (6) that hold A13 ALC/bias in place.
3. Replace the two screws (5) that hold the transistors to the heat sink.
4. Reconnect W18 (3), W16 (2), and W17 (1) to the A13 ALC/bias (4).
5. Replace the A10 power supply/driver. (Refer to the "A10 Power Supply/Driver" procedure.)
6. Replace the module cover. (Refer to the "Module Cover" procedure.)

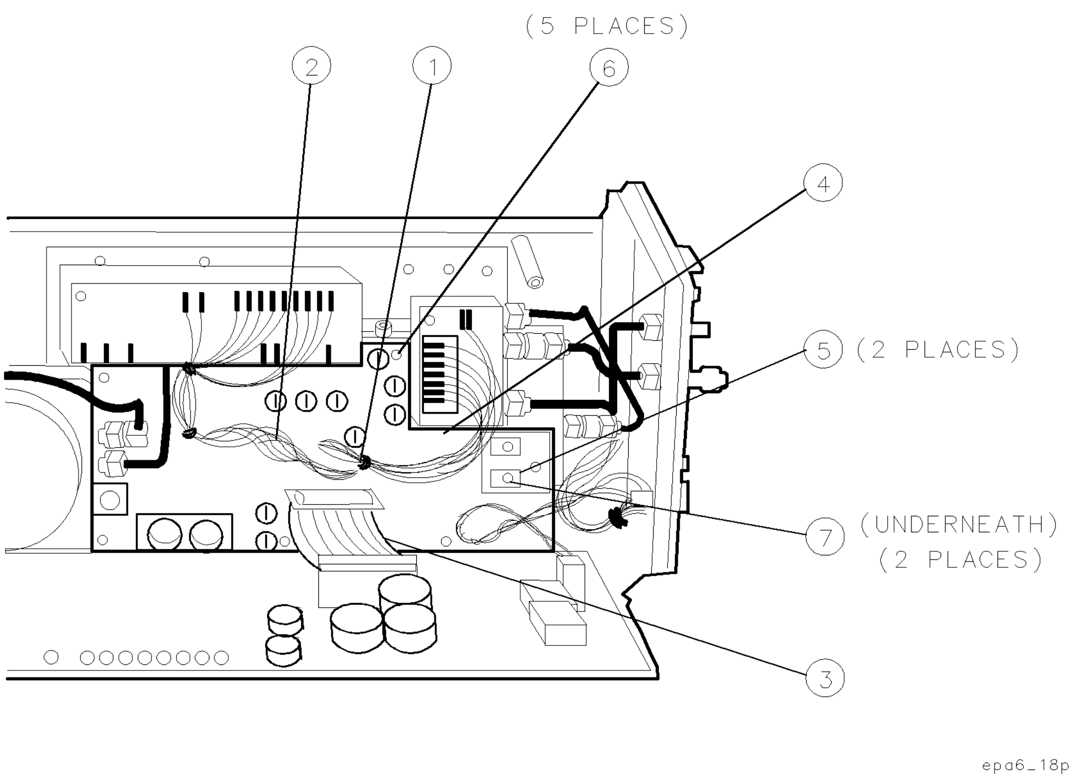


Figure 9-25. A13 ALC/Bias Removal/Replacement

A14 Front Panel Board

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to "Preparing a Static-Safe Work Station" in Chapter 4.)

To Remove the A14 Front Panel Board

1. Remove the module cover. (Refer to the "Module Cover" procedure.)
2. Remove the front panel. (Refer to the "Front Panel" procedure.)
3. Remove the four screws (1) that hold the A14 front panel board (2) in place.

To Replace the A14 Front Panel Board

1. Replace the A14 front panel board (2) on the front panel.
2. Replace the four screws (1) that hold the A14 front panel board (2) in place.
3. Replace the front panel. (Refer to the "Front Panel" procedure.)
4. Replace the module cover. (Refer to the "Module Cover" procedure.)

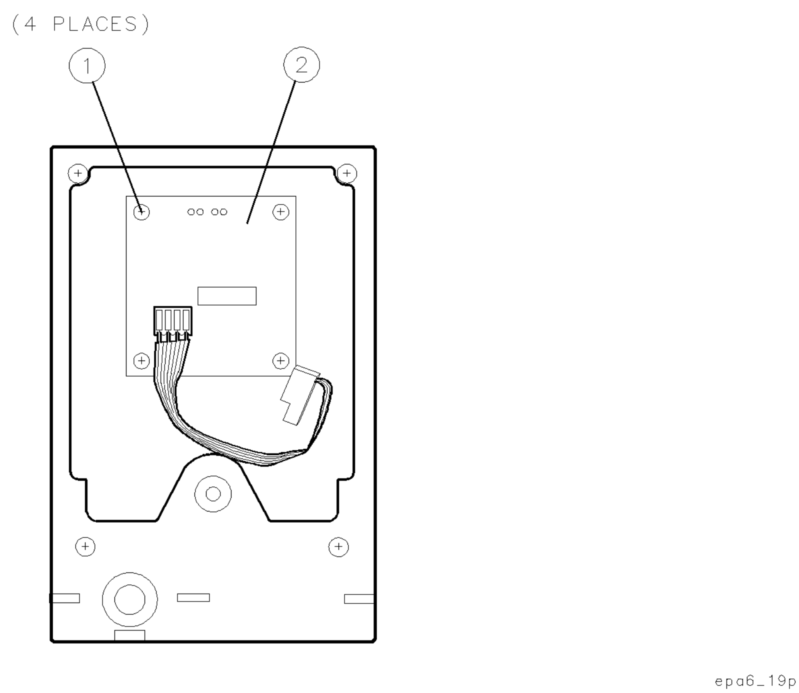


Figure 9-26. A14 Front Panel Board Removal/Replacement

A15 RF 1st Converter

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A15 RF 1st Converter

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
3. Remove the one screw (1) that holds the rear-panel to the module center casting, and the three screws (2) that hold the rear-panel to the module base.
4. Disconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
5. Swing the rear-panel out of the way. Do not distort or damage the cables.
6. Disconnect W19 (6) from the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
7. Loosen the elbow connector (8) one turn at the A2 LO multiplier. (If the elbow connector is loosened more or fewer turns it may crack during the rest of the removal process.) Do not crack the connector, or damage the wires near it.
8. Remove the ten screws (9) that hold the microcircuit assembly (10) on the center casting.
9. Finish disconnecting the elbow connector (8) while sliding out the microcircuit assembly.
10. Loosen W25 (11) at A16 low pass filter (13).
11. Loosen W24 (12) at A17 low pass filter (14).
12. Disconnect W25 (11) and W24 (12) from the A15 RF 1st converter (7).
13. Remove four screws (15).
14. Remove the A15 RF 1st converter (7).
15. Remove W19 (6) from the A15 RF 1st converter.

To Replace the A15 RF 1st Converter

1. Connect W19 (6) to the A15 RF 1st converter (7).
2. Position the A15 RF 1st converter (7) in the module.
3. Replace the four screws (15).
4. Connect W25 (11) and W24 (12) to the A15 RF 1st converter (7) IF and RF connectors.
5. Tighten all connectors on cables W25 (11) and W24 (12).
6. Slide the microcircuit assembly (10) back into the module, lining up the elbow connector (8) and the A2 LO multiplier OUTPUT connection; tighten the elbow connector only one turn.
7. With the microcircuit assembly flat against the casting, replace the ten screws (9) that hold it in place. The screws should be two turns short of being tight (for example, fasten the screw down, and then loosen it two turns).
8. Torque the elbow connector (8) to 10 inch-pounds.
9. Torque the ten screws (9) to 9 inch-pounds.
10. Reconnect W19 (6) to both the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
11. Position the rear panel against the module; do not damage the rear-panel ground spring (15).
12. Reconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
13. Replace the three screws (2) that hold the rear-panel to the module base. Torque the screws to 20 inch-pounds.
14. Replace the one screw (1) that holds the rear-panel to the module center casting. Torque the screw to 6 inch-pounds.
15. Replace the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
16. Replace the module cover. (Refer to the “Module Cover” procedure.)

A15 RF 1st Converter

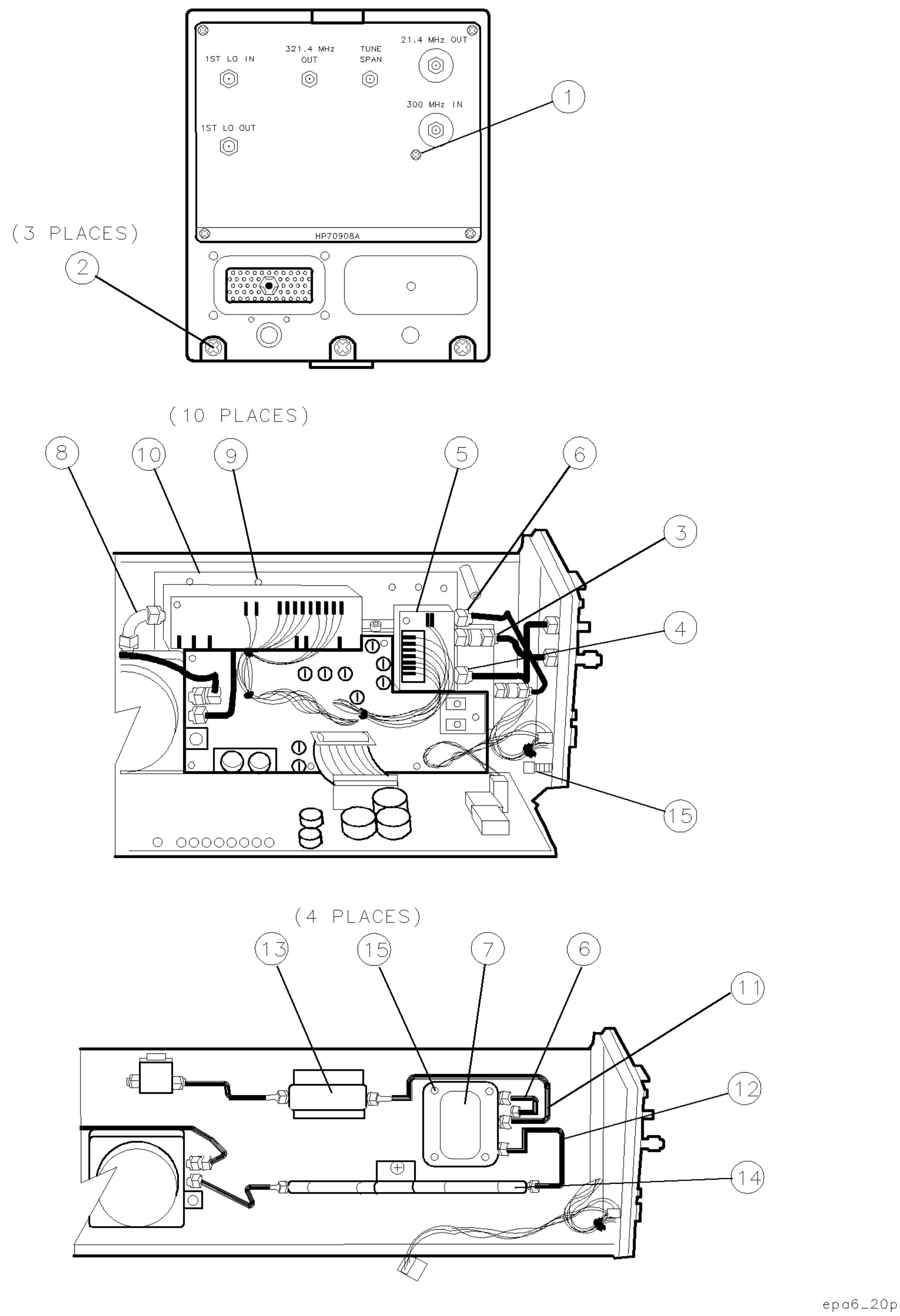


Figure 9-27. A15 RF 1st Converter Removal/Replacement

A16 Low Pass Filter

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A16 Low Pass Filter

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
3. Remove the one screw (1) that holds the rear-panel to the module center casting, and the three screws (2) that hold the rear-panel to the module base.
4. Disconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
5. Swing the rear-panel out of the way. Do not distort or damage the cables.
6. Disconnect W19 (6) from the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
7. Loosen the elbow connector (8) one turn at the A2 LO multiplier. Do not crack the connector, or damage the wires near it.

Note Do not put stress on the elbow as it can damage the A2 LO multiplier, A3 SYTFMD, or the elbow itself.

8. Remove the ten screws (9) that hold the microcircuit assembly (10) on the center casting.
9. Finish disconnecting the elbow connector (8) while sliding out the microcircuit assembly.
10. Remove cable W25 (11) and disconnect W26 (13) from the A16 low pass filter (12).
11. Remove A16 low pass filter (12).

To Replace the A16 Low Pass Filter

1. Connect the A16 low pass filter (12) to W26 (13).
2. Connect cable W25 (11) between A16 low pass filter (12) and the A15 RF 1st converter (14).
3. Slide the microcircuit assembly (10) back into the module, lining up the elbow connector (8) and the A2 LO multiplier OUTPUT connection; tighten the elbow connector only one turn.
4. With the microcircuit assembly flat against the casting, replace the ten screws (9) that hold it in place. The screws should be two turns short of being tight (for example, fasten the screw down, and then loosen it two turns).
5. Torque the elbow connector (8) to 10 inch-pounds.
6. Torque the ten screws (9) to 9 inch-pounds.
7. Reconnect W19 (6) to both the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
8. Position the rear panel against the module being careful not to damage the rear-panel ground spring (15).
9. Reconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
10. Replace the three screws (2) that hold the rear-panel to the module base. Torque the screws to 20 inch-pounds.
11. Replace the one screw (1) that holds the rear-panel to the module center casting. Torque the screw to 6 inch-pounds.
12. Replace the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
13. Replace the module cover. (Refer to the “Module Cover” procedure.)

A16 Low Pass Filter

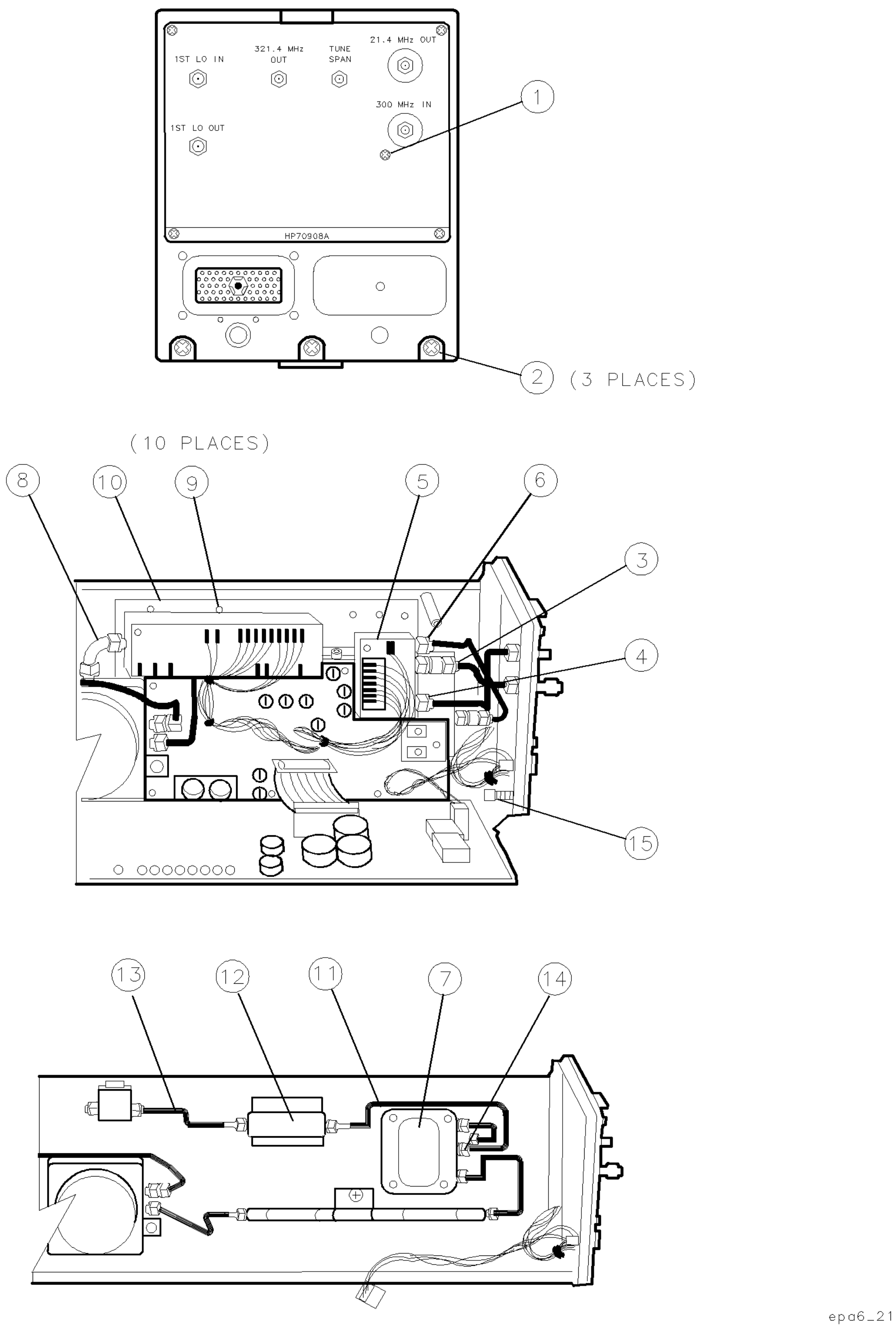


Figure 9-28. A16 Low Pass Filter Removal/Replacement

A17 Low Pass Filter

CAUTION This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced at a static-safe workstation. (Refer to “Preparing a Static-Safe Work Station” in Chapter 4.)

To Remove the A17 Low Pass Filter

1. Remove the module cover. (Refer to the “Module Cover” procedure.)
2. Remove the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
3. Remove the one screw (1) that holds the rear-panel to the module center casting, and the three screws (2) that hold the rear-panel to the module base.
4. Disconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
5. Swing the rear-panel out of the way. Do not distort or damage the cables.
6. Disconnect W19 (6) from the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
7. Loosen the elbow connector (8) one turn at the A2 LO multiplier. Do not crack the connector, or damage the wires near it.

Note Do not put stress on the elbow as it can damage the A2 LO multiplier, A3 SYTFMD, or the elbow itself.

8. Remove the ten screws (9) that hold the microcircuit assembly (10) on the center casting.
9. Finish disconnecting the elbow connector (8) while sliding out the microcircuit assembly.
10. Remove cable W24 (11).
11. Disconnect W15 (13) from the A17 low pass filter (12).
12. Remove the clamp screw (14).
13. Remove the A17 low pass filter (12).

To Replace the A17 Low Pass Filter

1. Position the A17 low pass filter (12); secure it with the clamp screw (14).
2. Connect W15 (13) to the A17 low pass filter (12).
3. Connect cable W24 (11) between A17 low pass filter (12) and the A15 RF 1st converter (7).
4. Slide the microcircuit assembly (10) back into the module, lining up the elbow connector (8) and the A2 LO multiplier OUTPUT connection; tighten the elbow connector only one turn.
5. With the microcircuit assembly flat against the casting, replace the ten screws (9) that hold it in place. The screws should be two turns short of being tight (for example, fasten the screw down, and then loosen it two turns).
6. Torque the elbow connector (8) to 10 inch-pounds.
7. Torque the ten screws (9) to 9 inch-pounds.
8. Reconnect W19 (6) to both the A1 leveling amplifier (5) and the A15 RF 1st converter (7).
9. Position the rear panel against the module being careful not to damage the rear-panel ground spring (15).
10. Reconnect W20 (3) and W21 (4) from the attenuators on the A1 leveling amplifier (5).
11. Replace the three screws (2) that hold the rear-panel to the module base. Torque the screws to 20 inch-pounds.
12. Replace the one screw (1) that holds the rear-panel to the module center casting. Torque the screw to 6 inch-pounds.
13. Replace the A10 power supply/driver. (Refer to the “A10 Power Supply/Driver” procedure.)
14. Replace the module cover. (Refer to the “Module Cover” procedure.)

A17 Low Pass Filter

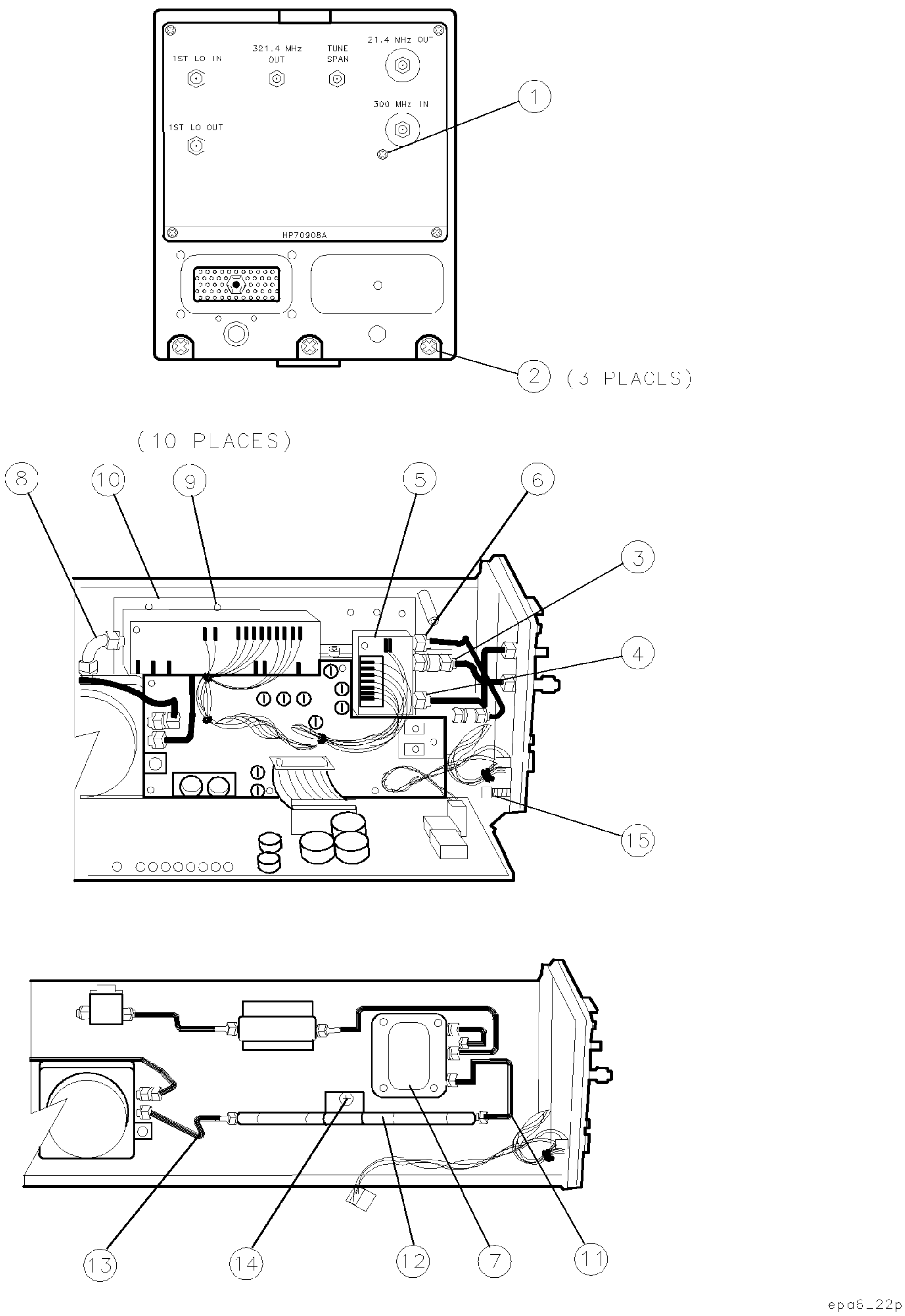


Figure 9-29. A17 Low Pass Filter Removal/Replacement

10

Overall Parts Identification Drawings

This chapter contains information on all overall parts identification drawings that should be used when performing the troubleshooting procedures described in this service guide. This chapter contains the following sections:

- "Major Cables"
- "Front View Identification"
- "Rear View Identification"
- "Bottom View Identification"
- "Left Side Cover Removed Identification"
- "Right Side Cover Removed Identification"
- "Side View Identification"

Because this service guide is part of an Option OB3 package which consists of two manuals, refer to Manual 2 of this option set for information on part listings and schematics.

Manual 2

Manual 2 is a separate volume that contains packets of component-level repair information for each RF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. This manual also contains a table that can be used to cross reference different board assemblies that have different serial prefix breaks.

Major Cables

Table 10-1. HP 70908A RF Section Cables

Cable Reference Designator[1]	HP Part Number
W1 front panel cable	70908-60032
W2 controller cable	70908-60033
W3 RF input cable	70908-20025
W4 BPF sampler cable	70908-20035
W5 300 MHz cable	70908-60025
W6 2nd converter wiring harness	5061-5493
W7 2nd converter cable	70908-60029
W8 DISC cable	70908-60031
W9 IF cable	70908-60030
W10 321.4 MHz cable	70908-60026
W11 tune span cable	70908-60027
W12 RF attenuator filter cable	70908-20026
W13 3rd converter cable	70908-60035
W15 1st RF filter cable	70908-20039
W16 LO multiplier wiring harness	70908-60038
W17 LOLA wiring harness	70908-60037
W18 bias microcircuit cable	70908-60036
W19 1st converter LO cable	70908-20041
W20 RF LO aux cable	70908-20045
W21 RF LO input cable	70908-20031
W22 RP connector w/W22J1 & W22J2	70300-60042
W23 4-baller to drive cable	5062-0786
W24 RF 1st converter cable	70908-20040
W25 IF 1st converter cable	70908-20042
W26 isolator input cable	70908-20043
W27 controller to attenuator cable	5062-0701

1 For information related to assemblies, refer to manual two of this option set.

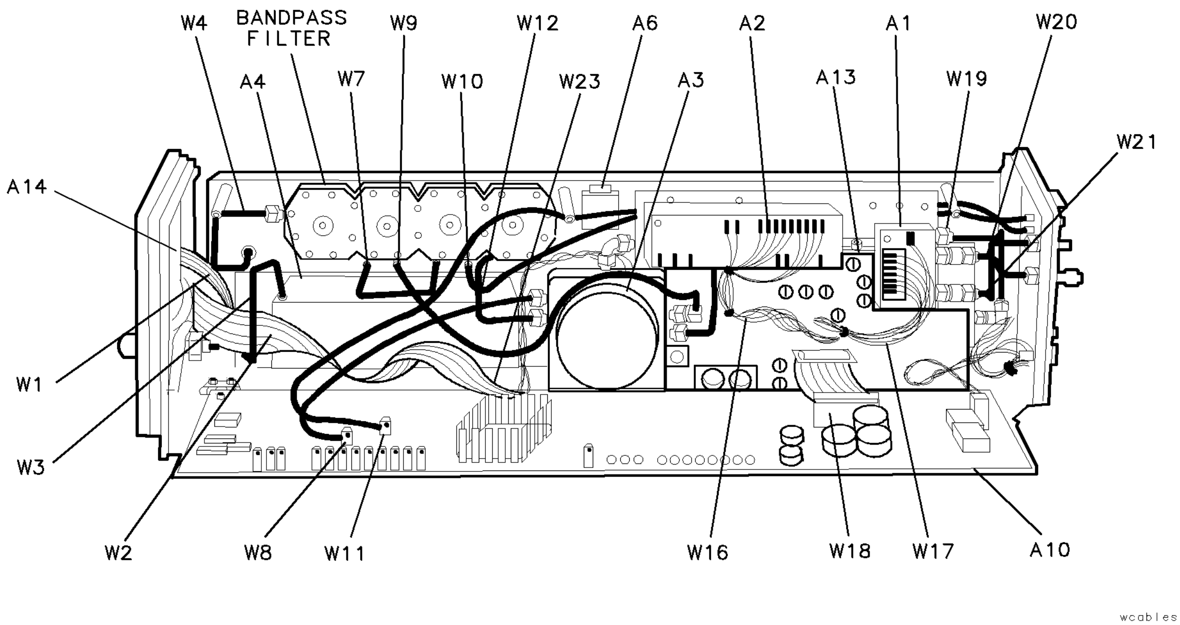


Figure 10-1. Overall Parts Identification Drawing, Major Cables (1 of 3)

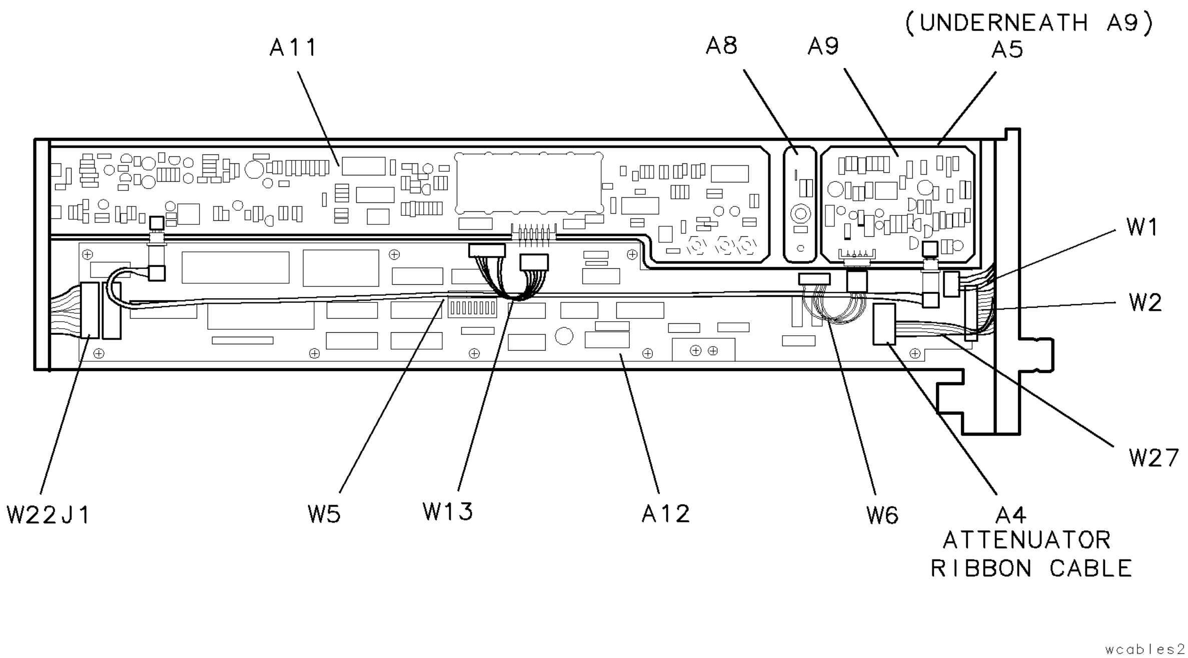


Figure 10-2. Overall Parts Identification Drawing, Major Cables (2 of 3)

Major Cables

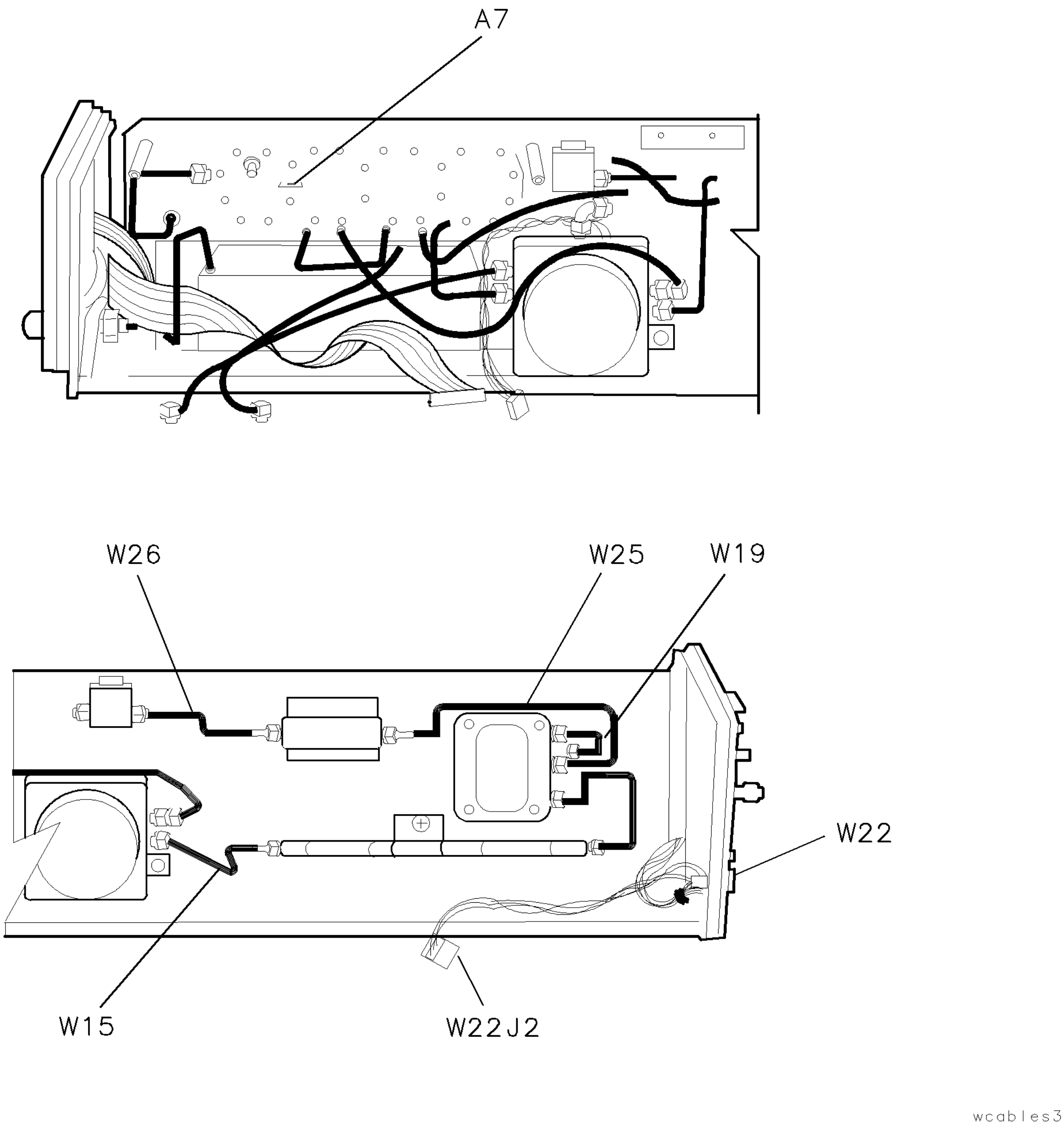


Figure 10-3. Overall Parts Identification Drawing, Major Cables (3 of 3)

Front View Identification

Table 10-2. Overall Parts Identification Listing, Front View

Item	HP Part Number	Description
1	70908-00001	Panel, Front
2	70300-20060	Frame, Front
3	86290-60005	Connector, Type-N
4	0900-0012	O-ring, .364 IN-ID
5	5022-0051	Latch, Module
6	0510-1244	Retainer, push-on
7	2190-0681	Washer, LK 7/16 IN-ID
8	2950-0214	Nut, Hex 7/16 X 28 IN
9	3050-0891	Washer, FL M3.0 MM-ID
10	0515-1950	Screw, SMM3.0 8 CWPNTX
11	0515-0680	Screw, SMM3.0 6 PNTX

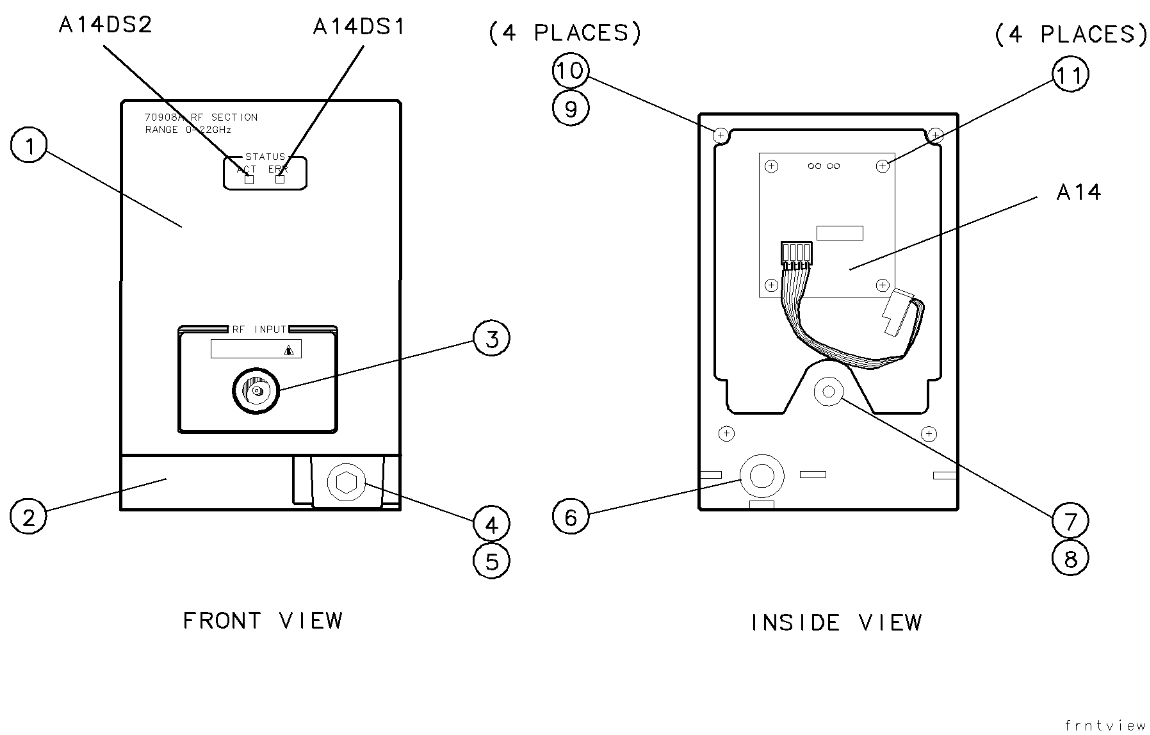


Figure 10-4. Overall Parts Identification Drawing, Front View

Rear View Identification

Table 10-3. Overall Parts Identification Listing, Rear View

Item	HP Part Number	Description
1	0515-2113	Screw, SMM4.0 8 PCPNTX
2	0515-0680	Screw, SMM3.0 6 PNTX
3	70908-20014	Frame, Rear
4	70908-00002	Panel, Rear
5	0515-0680	Screw, SMM3.0 6 PNTX
6	3050-1205	Washer, Nylon 0.190 IN-ID
7	2190-0124	Washer, Lock 0.195 IN-ID
8	2950-0078	Nut, Hex 10-32
9	1250-1957	Adapter, SMA(f) to SMA(f) w/nut & washer
10	1810-0118	Termination, SMA(m) 50 ohms
11	0515-0366	Screw, SMM2.5 6 PNTX
12	5001-5840	Spring, Grounding
13	5001-5835	Connector, Bar
14	1460-2095	Spring, CPR 5.49 MM-OD
15	0535-0042	Nut, Plastic Lock M3 X 0.5

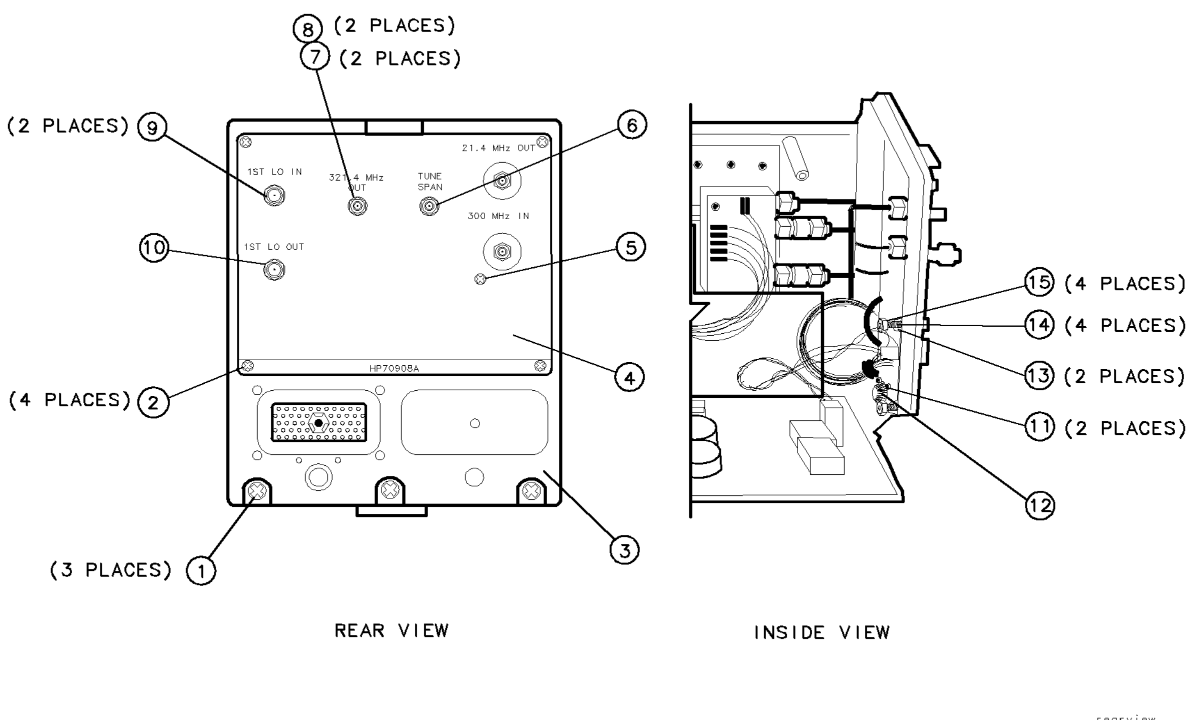


Figure 10-5. Overall Parts Identification Drawing, Rear View

Top View Identification

Table 10-4. Overall Parts Identification Listing, Top View

Item	HP Part Number	Description
1	70908-00005	Cover, Module
2	0515-1946	Screw, SMM3.0 6 PCFLTX
3	0515-2332	Screw, SMM3.0 6 PCPNTX
4	70908-20016	Casting, Center
5	70908-20019	Post, PC Support
6	70908-00024	Insulator, Cover

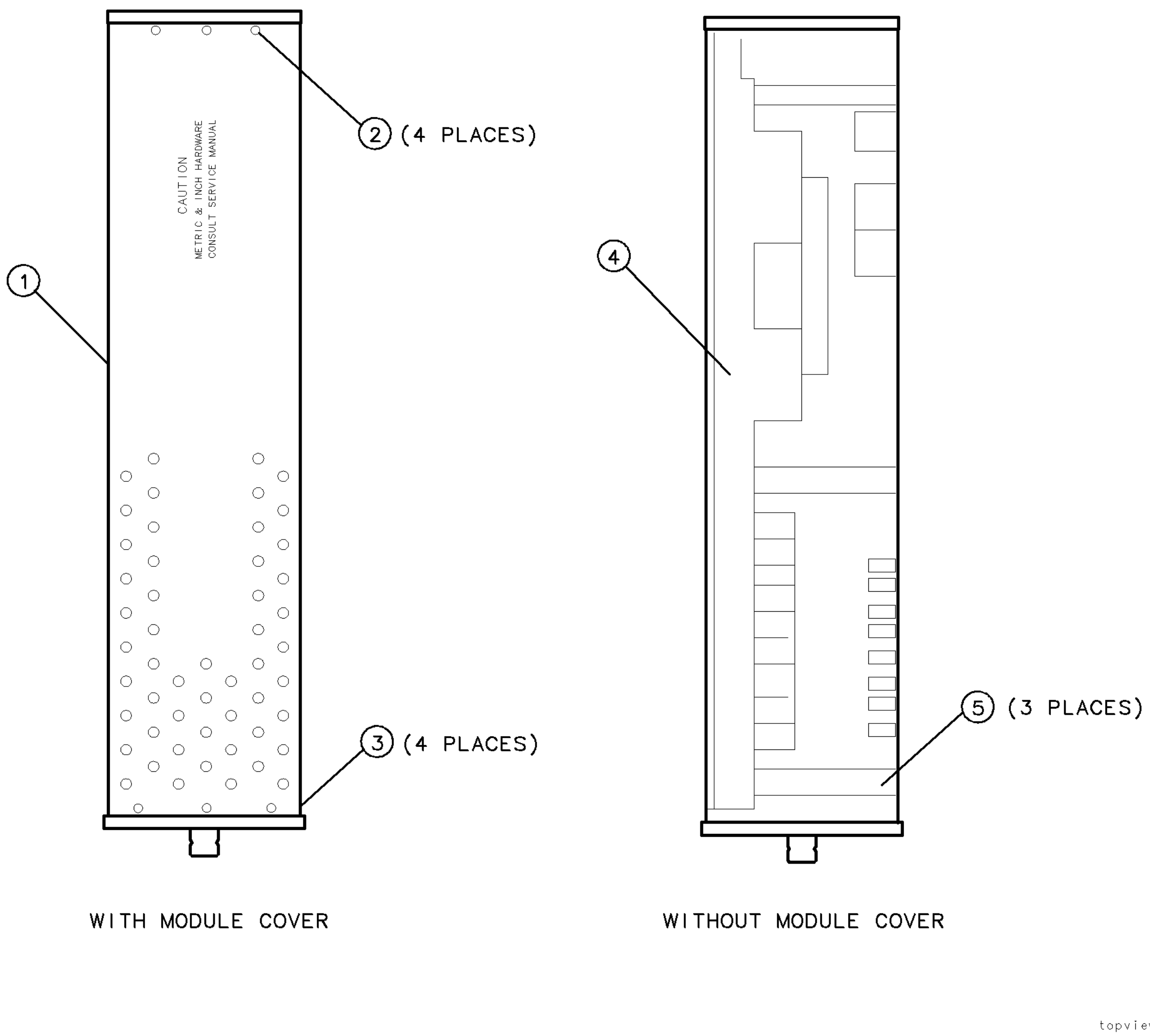


Figure 10-6. Overall Parts Identification Drawing, Top View

Bottom View Identification

Table 10-5. Overall Parts Identification Listing, Bottom View

Item	HP Part Number	Description
1	0515-2113	Screw, SMM4.0 8 PCPNTX
2	0515-2143	Screw, SMM3.0 6 PNTX
3	70908-20011	Base, Mounting
4	0515-1498	Screw, SMM4.0 8 PCSHHX

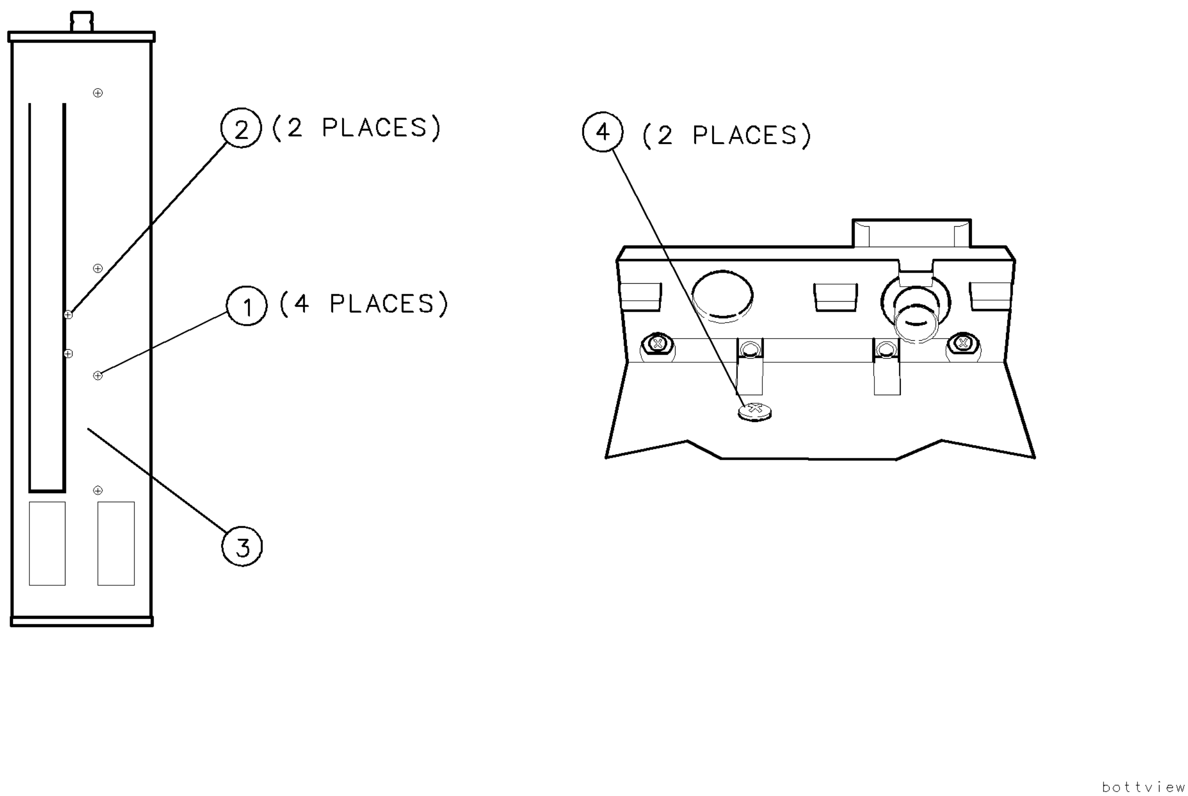


Figure 10-7. Overall Parts Identification Drawing, Bottom View

Side View Identification

Table 10-6. Overall Parts Identification Listing, Side View

Item	HP Part Number	Description
1	0515-1590	Screw, SMM3.0 45 PCFLPD
2	70908-20012	Cover, Last Converter
3	70908-20021	Cover, 2nd Converter
4	0515-0680	Screw, SMM3.0 6 PNTX
5	0515-2113	Screw, Mach M4 X 0.70 8MMLG PHPD
6	70908-20013	Pivot, C-STG
7	70908-00004	Clamp, Pivot Pin

Side View Identification

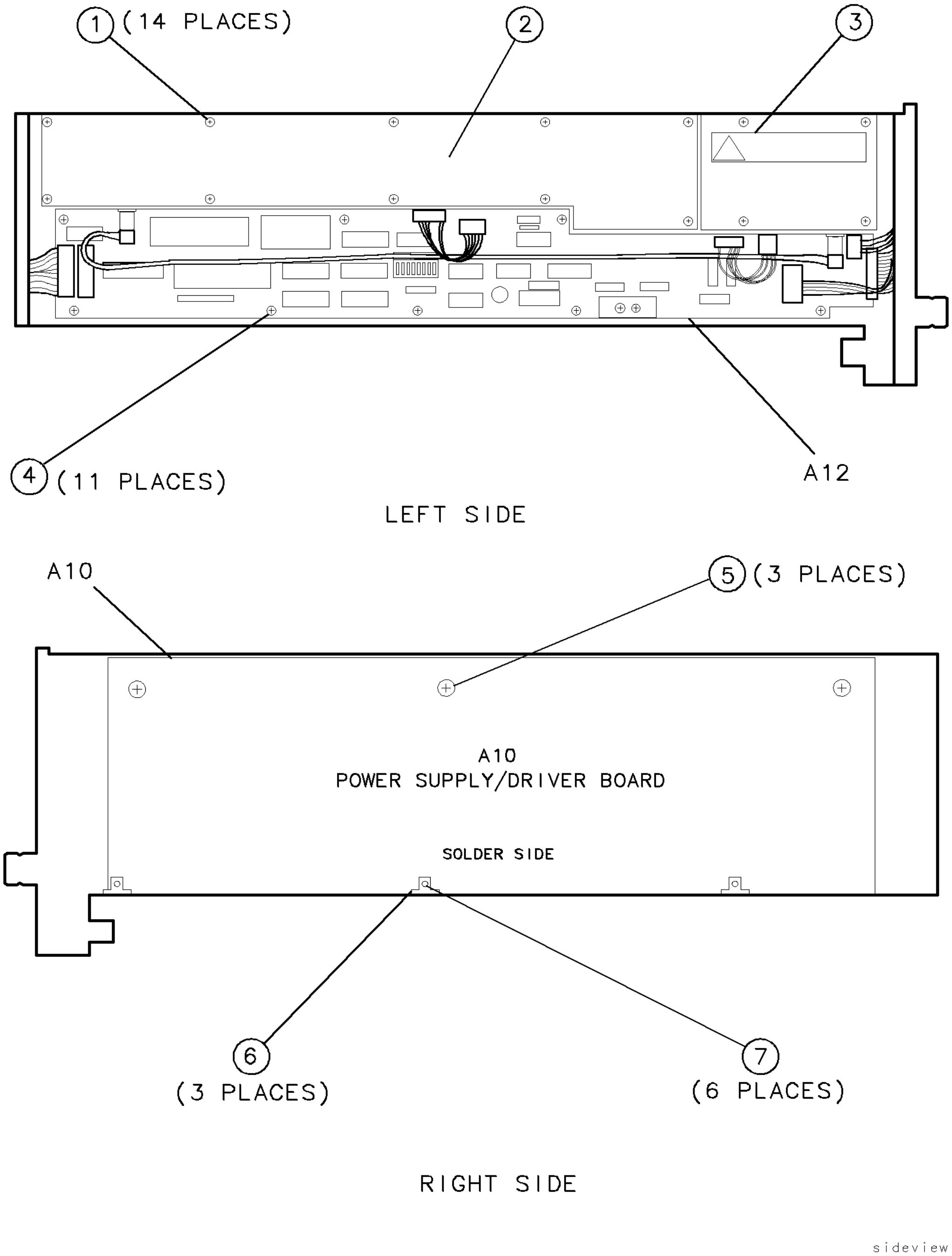


Figure 10-8. Overall Parts Identification Drawing, Side View

Left Side Cover Removed Identification

Table 10-7.
Overall Parts Identification Listing, Left Side View, and Cover Removed

Item	HP Part Number	Description
1	2190-0124	Washer, Lock 0.195IN-ID
2	2950-0078	Nut, Hex 10-32
3	0515-1950	Screw, SMM3.0 8 CWPNTX
4	0515-0680	Screw, SMM3.0 6 PNTX
5	5086-1626	Cover, VCO
6	8160-0494	Gasket, RFI D-strip hollow
7	70904-20026	Screw, Osc Feed
8	0515-0677	Screw, SMM2.0 6 PNTX
9	0515-0658	Screw, SMM2.0 6 CWPNTX
10	5062-1925	Pin Cap Assy
11	5062-1924	Filter Connector Assy
12	8160-0495	Gasket, RFI 2.54 X 1.57 MM

Left Side Cover Removed Identification

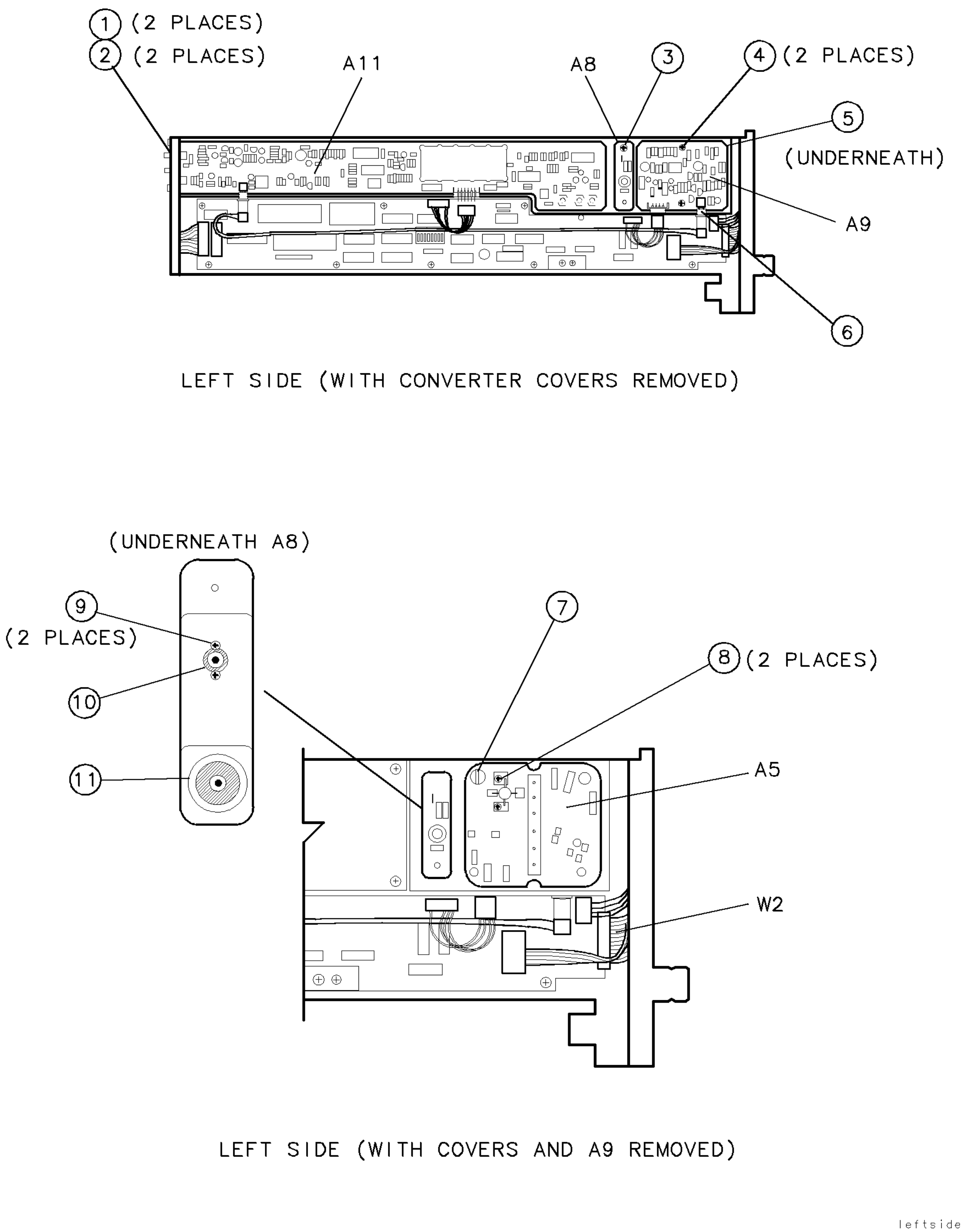


Figure 10-9.
Overall Parts Identification Drawing, Left Side View, and Cover Removed (1 of 2)

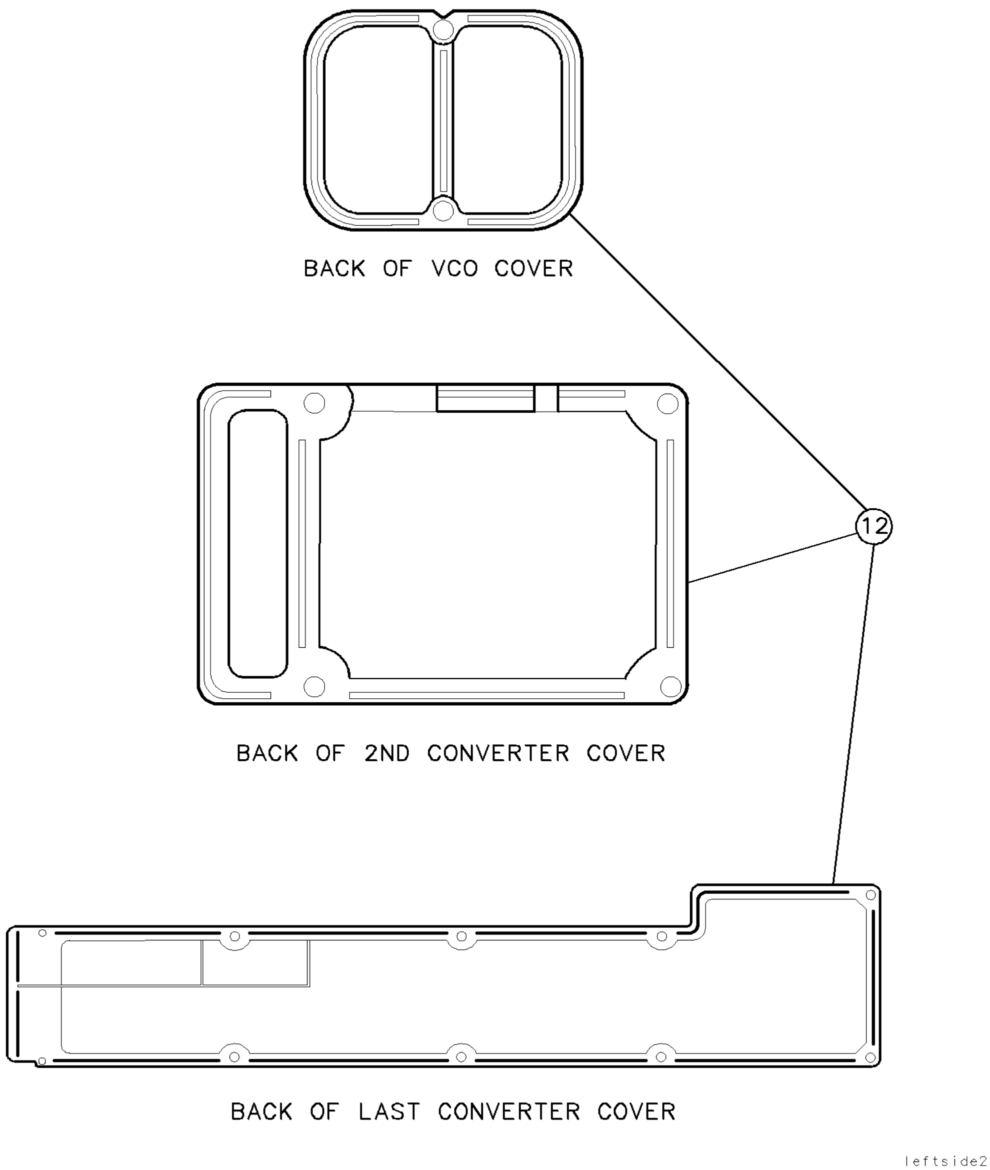


Figure 10-10.
Overall Parts Identification Drawing, Left Side View, and Cover Removed (2 of 2)

Right Side Cover Removed Identification

Table 10-8. Overall Parts Identification Listing, Right Side View, A10 Power Supply/Driver Facing Down, and Cover Removed

Item	HP Part Number	Description
1	2200-0103	Screw, SM 440 .250PNPD
2	70908-00007	Bracket, Attenuator
3	0515-1950	Screw, SMM3.0 8 CWPNTX
4	2190-0124	Washer, Lock 0.195IN-ID
5	2950-0078	Nut, Hex 10-32
6	2950-0216	Nut, Hex 1/4-36
7	0515-0366	Screw, SMM2.5 6 PNTX
8	2950-0216	Nut, Hex 1/4-36
9	1250-1157	Connector, RF SMA(f)
10	0515-0666	Screw, SMM3.0 18 CWPNTX
11	0515-1046	Screw, SMM2.0 8 SHHX
12	0535-0018	Nut, Hex M2 X 0.4
13	70904-20019	Bandpass Filter
14	2950-0216	Nut, Hex 1/4-36
15	5062-1926	Connector Probe Assembly
16	1250-1397	Adapter, Right Angle SMA(m) to SMA(m)
17	0515-0680	Screw, SMM3.0 6 PNTX
18	5021-7441	Insulator, 6-hole
19	5021-7441	Insulator, 12-hole
20	0515-2286	Screw, Mach M2.5 X 0.45 12MMLG PHPD
21	1250-1788	Adapter, SMA(m) to SMA(m)
22	0515-2080	Screw, SMM2.5 14 PNTX
23	70908-00006	Heatsink, Microcircuit
24	0955-0114	Attenuator, 2 dB Fixed
25	1250-1957	Adapter, SMA(f) to SMA(f)

Table 10-8.
Overall Parts Identification Listing, Right Side View,
A10 Power Supply/Driver Facing Down, and Cover Removed (continued)

Item	HP Part Number	Description
26	0955-0114	Attenuator, 3 dB Fixed
27	0340-0949	Insulator
28	0515-1950	Screw, SMM3.0 8 CWPNTX
29	0515-0680	Screw, SMM3.0 6 PNTX
30	70908-20020	Heatsink Block
31	0340-0949	Insulator
32	0515-0680	Screw, SMM3.0 6 PNTX
	Not shown (A7 2nd Mixer is behind BPF)	
	70904-20025	Pin, Ground, 2nd Mixer
	0515-0666	Screw, SMM3.0 18 CWPNTX
	0515-0382	Clamp, Filter

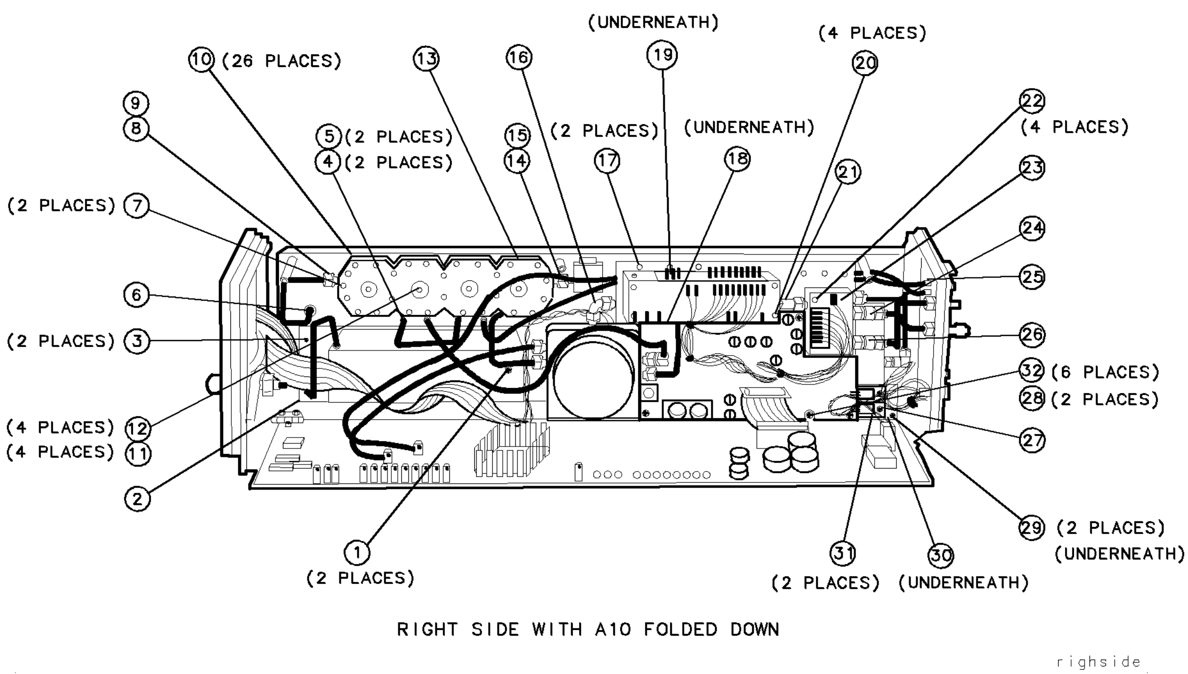


Figure 10-11.
Overall Parts Identification Listing, Right Side View,
A10 Power Supply/Driver Facing Down, and Cover Removed

Index

F

H

I

M

V