HP 70000 Modular Measurement System Documentation Outline

Instruments and modules of the HP 70000 Modular Measurement System are documented to varying levels of detail. Modules that serve as masters of an instrument require operation information in addition to installation and verification instructions. Modules that function as slaves in a system require only a subset of installation and verification information.

Manuals Supplied with Module

Installation and Verification Manual

Topics covered by this manual include installation, specifications, verification of module operation, and some troubleshooting techniques. Manuals for modules that serve as instrument masters will supply information in all these areas; manuals for slave modules will contain only information needed for slave module installation and verification. Master module documentation may also include some system-level information.

Operation Manual

Operation Manuals usually pertain to multiple- and single-module instrument systems. Topics include preparation for module use, module functions, and softkey definitions.

Programming Manual

Programming Manuals also pertain to multiple- and single-module instrument systems. Programming Manual topics include programming fundamentals and definitions for remote programming commands.

Service Manual, Available Separately

This manual provides service information for a module, including module verification tests, adjustments, troubleshooting, replaceable parts lists, and replacement procedures. For ordering information, contact a Hewlett-Packard Sales and Service Office. This manual is not always immediately available for new products.

Note Some earlier service manuals are titled *Technical Reference.*

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General Information

Introduction

This is the service manual for the HP 70904A RF Section. This manual contains information needed to test, adjust, and service the instrument to the component level.

Manual Organization

This manual is divided into the following eight chapters:

Chapter 1, "General Information," contains lists of service kit contents, recommended test equipment, and sales and service offices. Also included are instructions for returning an instrument for service, and information about electrostatic discharge (ESD).

Chapter 2, "Verification Software," contains information needed to use the HP 70904A Module Verification software.

Chapter 3, "Verification Tests," contains information on the tests used to verify the electrical operation of the module.

Chapter 4, "Adjustment Procedures," contains module adjustment procedures.

Chapter 5, Troubleshooting, contains troubleshooting procedures, module error-code definitions, and an explanation of troubleshooting tool program selections.

Chapter 6, "Replacement Procedures," contains removal and replacement information for the major assemblies.

Chapter 7, "Replaceable Parts," contains the information needed to order mechanical parts and replacement assemblies for the module.

Chapter 8, "Major Assembly and Cable Locations," contains figures identifying all major assemblies and cables.

Manual Conventions

The following text conventions are used throughout this manual:

Keys physically located on an instrument are represented in this way: (KEY)
Softkeys, keys defined by software or firmware, are represented in this way: `softkey`
Text that appears on the CRT is represented in this way: `screen text`

Safety Considerations

Before servicing this module, read the safety markings on the instrument and the safety instructions in the manual. Refer to the summary of safety information in the front of the manual.

The instrument is manufactured and tested to international safety standards. However, to prevent instrument damage and ensure your personal safety, all cautions and warnings must be heeded.

Modules/Assemblies Covered by This Manual

The contents of this manual apply to HP 70904A RF Sections with the serial-number prefix(es) listed under "Serial Numbers" on the manual title page.

Serial-Number Label

Attached to the front frame of the module is a serial-number label. The serial number is in two parts. The first four digits and letter are the prefix; the last five digits are the suffix. The prefix changes only when a major change is made to the module. The suffix is assigned sequentially and is different for each module.

Manual Updating

A module manufactured after this manual was printed may have a serial-number prefix other than that listed under "Serial Numbers" on the manual title page. This unlisted serial prefix means that major changes have been made to the module since the manual was printed.

These changes are documented in the Manual Updating Supplement for this manual. The Manual Updating Supplement may also contain information for correcting errors in the manual. To keep the manual as current and accurate as possible, periodically request the latest Manual Updating Supplement for this manual from your nearest Hewlett-Packard Sales and Service office. Refer to Table 1-4.

Module Options

The HP 70904A RF Section has the following module options available.

Option W30 This option adds 2 years to the standard 1 year factory-service warranty.

Option 910 This option adds another set of the manuals that normally ship with the module.

Option 915 This option adds the module service documentation and module verification software.

Firmware Compatibility

The HP 70904A will function properly in an HP 70000 Modular Measurement System with any firmware version installed in the HP 70900A/B Local Oscillator.

Module Verification Software

The HP 70904A Module Verification Software documented in this manual is available through Hewlett-Packard Sales and Service Offices. The HP 70904A Module Verification Software contains the verification tests and adjustments used to service the HP 70904A RF Section.

Directions for using the HP 70904A Module Verification Software are in Chapter 2. Verification test information is in Chapter 3; adjustment information is in Chapter 4.

Service Kits

HP 71000 System Service Kit (71000-60002)

The HP 71000 System Service Kit (HP part number 71000-60002) is the general service kit for HP 70000 Modular Measurement System modules. This kit includes servicing tools used to repair all HP 70000 Modular Measurement System modules, and a modification procedure for the HP 70001A Mainframe. The modification allows access to HP 70000 Modular Measurement System modules during bench testing and repair. Refer to the latest version of Service Note 70001A-1 for a full listing of the HP 71000 System Service Kit contents. Refer to Table 1-1 for parts included in the kit.

HP 70900A LO Service Kit (70900-60102)

This service kit supplies specific service tools required to service the HP 70900A Local Oscillator module. However, some of the same service tools are required to service the HP 70904A RF Section module. These tools are not supplied in the HP 71000 System Service Kit. Refer to Table 1-2 for a list of parts included in the kit.

Recommended Test Equipment

Table 1-5 lists standard test equipment for testing or adjusting the HP 70904A RF Section.

Note

Only equipment listed in Table 1-5 may be used during the HP 70904A verification tests and adjustments. If equipment other than the recommended models is used, Hewlett-Packard will not be responsible for the accuracy of the tests or adjustments.

Table 1-1. HP 71000 System Service Kit Parts

Description	Qty	HP Part Number
Fuse 1.5 A, 125 V	10	2110-0695
Fuse 1.0 A, 250 V	10	2110-0700
Fuse 1.6 A, 250 V	10	2110-0701
Fuse 6.3 A, 250 V	10	2110-0703
Fuse 2.0 A, 250 V	10	2110-0710
Cable Puller	1	5021-6773
Connector Pin Straightener	1	5021-7445
Cable Assembly—SMB (f) to SMB (f), 390mm	7	5061-9021
Modified Mainframe Cover—Right	1	70001-00038
Modified Mainframe Cover—Left	1	70001-00039
Module Service Extender	1	70001-60013
Service Note	1	70001A-1A
RFI Gasket 0.094 in. diameter	2 ft	8160-0035
RFI Gasket 0.125 in. diameter	10 ft	8160-0484
Chromeric Gasket	2 ft	8160-0495
Chromeric Gasket	2 ft	8160-0496
Cable Assembly - BNC (m) to SMB (f)	3	85680-60093
Hex-Ball Driver, 8 mm	1	8710-1651
Bandpass Filter Tuning Tool	1	8710-1728

Table 1-2. HP 70900A LO Service Kit Parts

Description	Qty	HP Part Number
Test Clip-IC	1	1400-0734
Fuse 2.0A, 125V	20	2110-0517
Flex PDT Wiring	1	5062-1933
Pin Grabber IC	1	5959-0288
LO Cover, modified	1	70900-00012
Ribbon Cable Assy, Power Supply	1	70900-60057
Extender Cable, Controller Board	2	70900-60058
Extender Cable, 50-pin	3	70900-60059
Extender Cable, Frequency Cont. to YTO	1	70900-60060
Extender Cable, 7-pin	2	70900-60061
Extender Cable, 6-pin	1	70900-60062
Extender Cable, 9-pin	1	70900-60063
Extender Cable, 10-pin	1	70900-60064
Extender Cable, 14-pin	1	70900-60065
Extender Cable, 5-pin	2	70900-60067
Parts List Ser Kit	1	70900-90144
Backplane Interconnect Cable	1	70900-60021

Electrostatic Discharge Information

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 1-1 shows an example of a static-safe work station. Two types of ESD protection are shown: (a) conductive table mat and wrist strap combination, and (b) conductive floor mat and heel strap combination. The two types *must* be used together to ensure adequate ESD protection. Refer to Table 1-3 for a list of static-safe accessories and their part numbers.

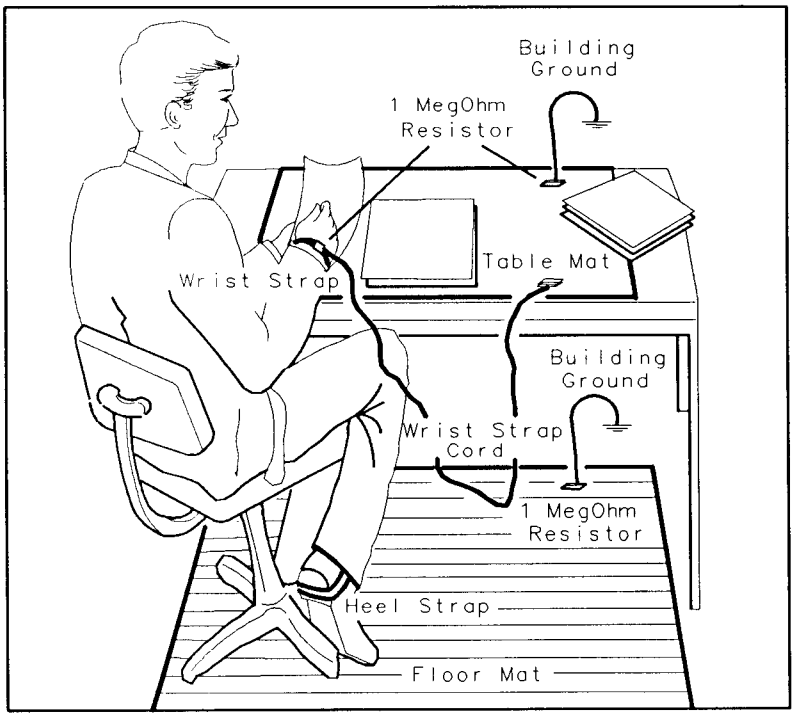


Figure 1-1. Static-Safe Work Station

Reducing ESD Damage

Below are suggestions that may help reduce the amount of ESD damage that occurs during testing and servicing instruments.

PC Board Assemblies and Electronic Components

- Handle these items at a static-safe work station.
- Store or transport these items in static-shielding containers.

Caution

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.

Do not touch the edge-connector contacts or trace surfaces with bare hands. Always handle board assemblies by the edges.

PC board assembly edge-connector contacts may be cleaned by using a lint-free 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.

Test Equipment

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

Table 1-3. Static-Safe Accessories

Accessory	Description	HP Part Number
Static-control mat and ground wire	Set includes: 3M static-control mat, 0.6 m × 1.2 m (2 ft × 4 ft) ground wire, 4.6 m (15 ft) (The wrist strap and wrist-strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist-strap cord	1.5 m (5 ft)	9300-0980
Wrist strap	Black, stainless steel with four adjustable links and 7-mm post-type connector (The wrist-strap cord is *not* included.)	9300-1383
ESD heel strap	Reusable 6 to 12 months	9300-1169
Hard-surface static-control mat*	Large, black, 1.2 m × 1.5 m (4 ft × 5 ft) Small, black, 0.9 m × 1.2 m (3 ft × 4 ft)	92175A 92175C
Soft-surface static-control mat*	Brown, 1.2 m × 2.4 m (4 ft × 8 ft)	92175B
Tabletop static-control mat*	58 cm × 76 cm (23 in × 30 in)	92175T
Antistatic carpet*	Small, 1.2 m × 1.8 m (4 ft × 6 ft) natural color russet color Large, 1.2 m × 2.4 m (4 ft × 8 ft) natural color russet color	 92176A 92176C 92176B 92176D

* These accessories can be ordered either through a Hewlett-Packard Sales Office or through HP DIRECT Phone Order Service. In the USA, the HP DIRECT phone number is (800) 538-8787. Contact your nearest Hewlett-Packard Sales Office for more information about HP DIRECT availability in other countries.

Sales and Service Offices

Hewlett-Packard has sales and service offices around the world providing complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 1-4.

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

Note

Within the USA, a toll-free phone number is available for ordering replacement parts. Refer to "Ordering Information" in Chapter 7 for the phone number and more information.

Table 1-4. Hewlett-Packard Sales and Service Offices

IN THE UNITED STATES

California
Hewlett-Packard Co.
1421 South Manhattan Ave.
P.O. Box 4230
Fullerton, CA 92631
(714) 999-6700

Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94039
(415) 694-2000

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5000

Georgia
Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(312) 255-9800

New Jersey
Hewlett-Packard Co.
120 W. Century Road
Paramus, NJ 07653
(201) 265-5000

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

IN AUSTRALIA
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
895-2895

IN CANADA
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
(514) 697-4232

IN FRANCE
Hewlett-Packard France
F-91947 Les Ulis Cedex
Orsay
(6) 907-78-25

IN GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 Frankfurt 56
(0611) 50-04-1

IN GREAT BRITAIN
Hewlett-Packard Ltd.
King Street Lane
Winnersh, Wokingham
Berkshire RG11 5AR
0734 784774

IN OTHER EUROPEAN COUNTRIES
Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 Widen (Zurich)
(0041) 57 31 21 11

IN JAPAN
Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku Tokyo 168
(03) 331-6111

IN PEOPLE'S REPUBLIC OF CHINA
China Hewlett-Packard, Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory
Main Bldg.
Shuang Yu Shu, Bei San Huan Rd.
Beijing, PRC
256-6888

IN SINGAPORE
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
273 7388
Telex HPSGSO RS34209
Fax (65) 2788990

IN TAIWAN
Hewlett-Packard Taiwan
8th Floor, Hewlett-Packard
Building
337 Fu Hsing North Road
Taipei
(02) 712-0404

IN ALL OTHER LOCATIONS
Hewlett-Packard Inter-Americas
3495 Deer Creek Rd.
Palo Alto, California 94304

Returning Instruments for Service

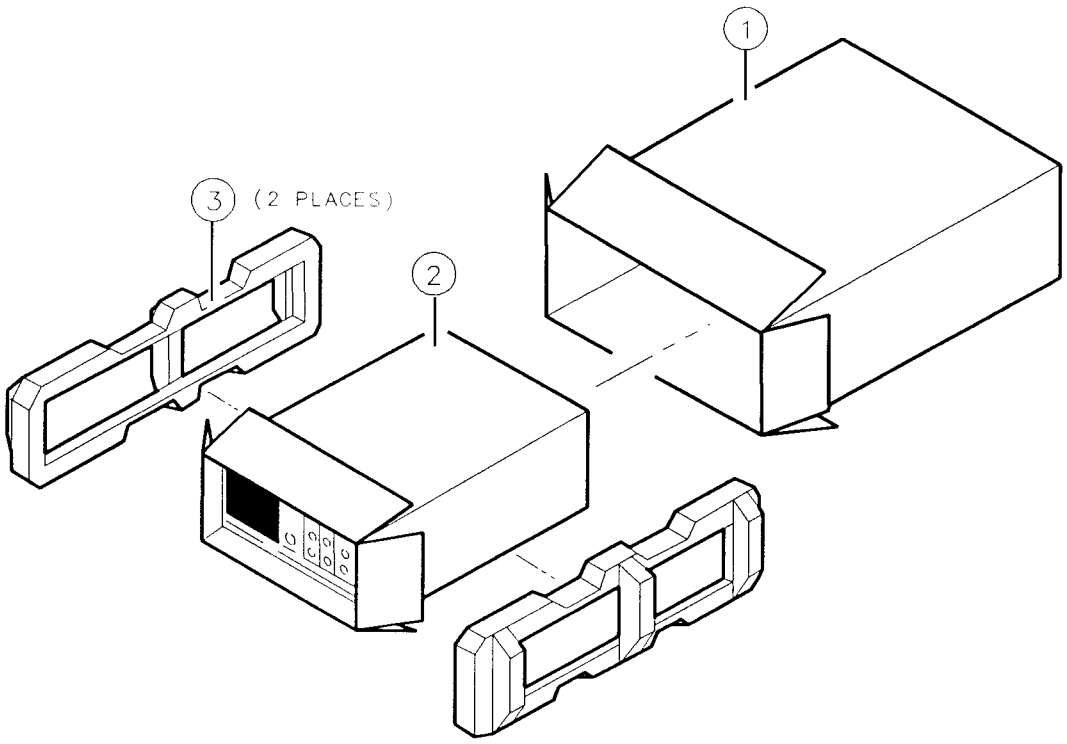
The original shipping containers and materials, or the equivalent, must be used when repackaging the mainframe with modules, or modules alone. Packaging materials identical to the original factory packaging can be purchased through any Hewlett-Packard office. However, if these shipping materials are not available, instruments can be repackaged for shipment using the information below.

Caution

Instrument damage can result from using packaging materials other than the original shipping materials or equivalent. Never use styrene pellets as packaging materials. They do not adequately cushion the instrument or prevent it from shifting in the carton. They cause instrument damage by generating static electricity.

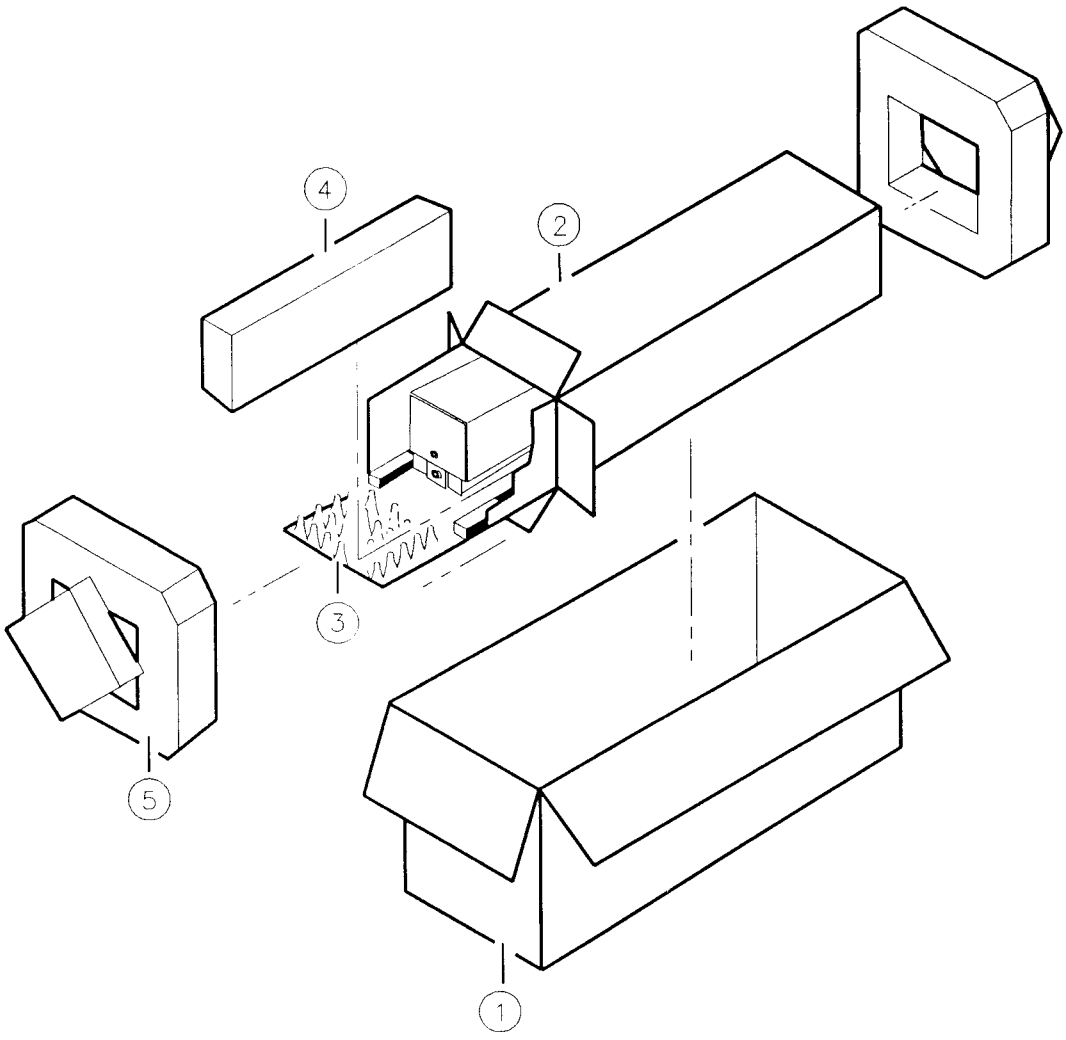
Use the following procedure to prepare the instrument for shipment:

1. Fill out a blue repair card (located at the end of this chapter) and attach it to the instrument. Also send copies of any error messages and performance data recorded for the instrument. If a blue repair card is not available, send the following information with the returned instrument:
   a. Type of service required.
   b. Description of the problem; state if the problem is constant or intermittent.
   c. Name and phone number of technical contact person.
   d. Return address.
   e. Model number of returned instrument.
   f. Full serial number of returned instrument.
   g. List of any accessories returned with instrument.
2. Pack the instrument in the original shipping materials (or the equivalent). However, if these are not available, instruments can be repackaged for shipment using the following instructions.
   a. Wrap the instrument in anti-static plastic to reduce the possibility of ESD-caused damage.
   b. For instruments that weigh less than 54 kg (120 lb), use a double-walled, corrugated cardboard carton of 159 kg (350 lb) test strength. The carton must be large enough and strong enough to accommodate the instrument. Allow at least 3 to 4 inches on all sides of the instrument for packing material.
   c. Surround the equipment with 3 to 4 inches of packing material to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Commerce, California 90001). Air Cap is a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink (antistatic) Air Cap to reduce static electricity. Wrapping the instrument several times in this material should both protect the instrument and prevent it from moving in the carton.
3. Seal the carton with strong nylon adhesive tape.
4. Mark the carton "FRAGILE, HANDLE WITH CARE."
5. Retain copies of all shipping papers.



Item	Qty	HP Part Number	Description
1	1	9211-4487	Carton-outer
2	1	5180-2321	Carton-inner
3	2	5180-2319	Foam Pads

Figure 1-2. Mainframe Packaging Material



Item	Qty	HP Part Number	Description
1	1	9211-5118	Carton-outer
2	1	9211-5119	Carton-inner
3	1	5180-2369	Carton-slider
4	2	4208-0493	Foam Insert
5	2	5180-2370	Foam Pads

Figure 1-3. Module Packaging Material

Table 1-5. Recommended Test Equipment

Equipment	Recommended HP Model or Part Number	Verif. Test	Adj. Proc.
Signal Sources			
Full Microwave Source	HP 8340A/B	√	√
Microwave Source	HP 8340A/B	√	√
Synthesized Source	HP 8662A, HP 8563A, HP 8340A/B	√	√
Level Generator	HP 3335A	√	
Analyzers			
Calibrated Spectrum Analyzer	HP 8566B (16.7.85 or later firmware)		√
Spectrum Analyzer	HP 8566B (16.7.85 or later firmware)	√	√
Microwave Network Analyzer	HP 8757A	√	√
Meters			
Power Meter	HP436A HP 8902A, Opt. 002	√	√
Power Sensor	HP 8485A	√	√
Precision DVM	HP 3456A		√
Noise Figure Meter	HP8970A/B	√	√
HP 70000 Components			
Mainframe	HP 70001A	√	√
Local Oscillator	HP 70900A	√	√
Extender Module	HP Part Number 70001-60013	√	√
Required to configure HP 71200A			
IF Section	HP 70902A	√	√
Graphics Display	HP 70205A, HP 70206A	√	
Accessories			
External Reference	HP 5061A with HP 70310A	√	√
Directional Bridge	HP 85027B	√	
Noise Source	HP 346C	√	√
Detector	HP 11664E	√	√
Power Splitter	HP 11667B	√	
Modulator	HP 11665B		√
Attenuator	HP 8493C, Option 006	√	√
Isolator	0955-0204	√	√

Table 1-5. Recommended Test Equipment (continued)

Equipment	Recommended HP Model or Part Number	Verif. Test	Adj. Proc.
Cables			
RF Cable Assembly, APC 3.5 (m) to APC 3.5 (m)	8120-4921	√	√
Cable Assembly, SMA (m) to SMA (m)	5061-5458 or 5061-9038	√	√
Cable Assembly, SMB (f) to BNC (m)	85680-60093	√	√
Cable Assembly, BNC (m) to BNC (m)	HP 10503A	√	√
Adapters			
Type N (f) to BNC (m)	1250-0077	√	
Type N (m) to BNC (f)	1250-0780	√	√
Type N (m) to APC 3.5 (f)	1250-0744	√	√
Type N (f) to SMA (f)	1250-1772		√
BNC (f) to SMA (m)	1250-1200	√	√
BNC (f) to SMB (f)	1250-1236	√	
APC 3.5 (m) to APC 3.5 (m)	1250-1748	√	√
APC 3.5 (f) to APC 3.5 (f)	1250-1749	√	√
SMA (m) to SMA (f) right angle	1250-1249		√
SMA (f) to SMB (m)	1250-0674	√	√
SMB (f) to SMB (f)	1250-0672	√	√
BNC (f) to dual banana plug	1251-2277		√
BNC (f) to dual alligator clips	8120-1292		√
SMA (m) to SMA (m)	1250-1159	√	√
Type N (m) to SMA (f)	1250-1250		√
Service Kits			
LO Module Service Kit	70900-60102	√	
HP 71000 Service Kit	71000-60002	√	

External Frequency Reference

The system test equipment used for all verification tests and adjustments must use the same frequency reference, to ensure that frequency measurements are correct. The preferred method for connecting a test system to the master frequency reference is shown in Figure 1-4. This method minimizes phase noise associated with chaining the same reference signal through several devices, and ensures that the last instruments in the chain receive reference signals of sufficient amplitude.

A frequency counter is connected to ensure its absolute frequency accuracy and traceability (to the National Institute of Standards and Technology). The HP 8721A Directional Bridge is used to split the reference signal and ensure good isolation between the two reference signal paths.

If the HP 70310A Precision Frequency Reference module is not available to provide the 100 MHz reference signal to the local oscillator module used by the module under test, the 100 MHz signal of the Cal Output on the HP 8566B may be used instead. The HP 8566B Cal Output signal must be attenuated before being fed to the input of an HP 8446 RF Amplifier, to ensure that clipping does not occur in the amplifier. The amount of attenuation necessary will vary with the model of the HP 8447 RF Amplifier. The amplitude level of the 100 MHz signal that the local oscillator requires is +4 dBm.

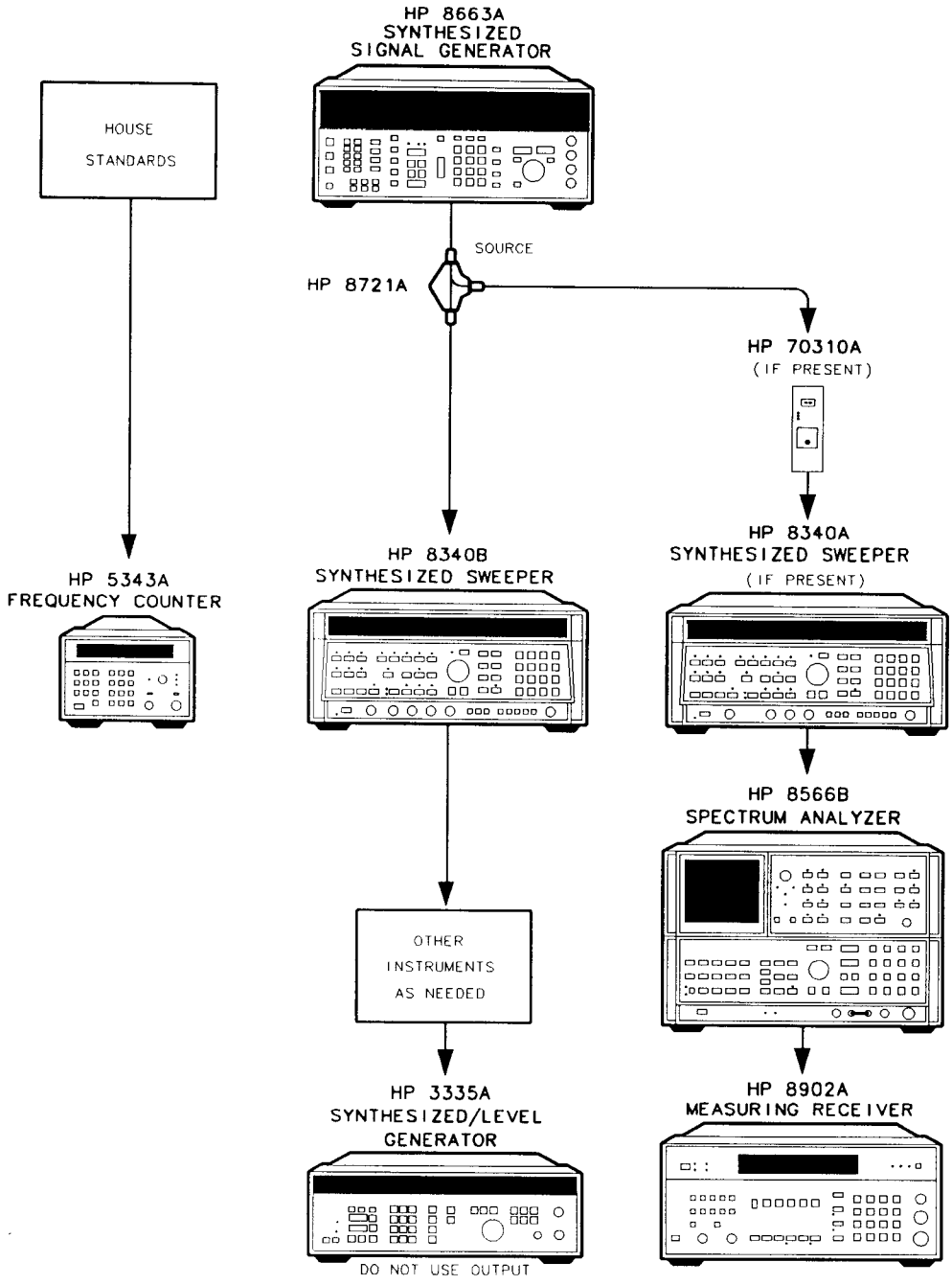


Figure 1-4. Preferred Frequency Reference Connections

2

Verification Software

Introduction

Verification Software is the program designed to automate the module's 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. Listed below are the major divisions of this chapter.

General Information

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

The *Installation and Verification Manual* for the HP 70900 local oscillator contains configuration information for predefined models of HP 70000 Modular Spectrum Analyzers. The software automatically reads your system configuration data from the HP-MSIB (Hewlett-Packard Modular System Interface Bus) to determine which system or modules you are using.

Refer to "Verification Tests" in Chapter 3 and "Adjustment Procedures" in Chapter 4 for individual test setups and test descriptions. Chapter 1 contains a list of recommended test equipment.

Computer Compatibility

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

HP 9816	HP 9920 (with HP 35721A Monitor)
HP 9836	HP 9000 Series 300 computer

When using an HP 9000 Series 300 computer, 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," below.

Computer Language Compatibility

The software program 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 Verification Software" later in this chapter.

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 an SRM (shared resource management) 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 the Verification Software program.

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.

Alternate Key Labels

For simplicity in this document, we assume that you are using an HP 9000 Series 200 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

Configuring the Hardware

Procedure

1. Connect the HP 70000 Modular Spectrum Analyzer to the computer port determined by the following criteria:
   a. For computers with an HP 98624A HP-IB Interface, connect your 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 Peripheral Installation Guide, Volume 1.*
   b. For computers without an HP 98624A HP-IB Interface, connect the HP 70000 Modular Spectrum Analyzer 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 0.5 meter HP-IB cable (HP 10833D, 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 Modular Spectrum Analyzer 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 Verification Software

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

Two assumptions are made with the Module Verification Software. One is that you are using standard HP-IB addresses for the active devices of the microwave test station. The second is that 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.

Software Version

View the version number of the software program after loading the first program disk. Look in the right-hand side of the initial display. Specific numbers vary, but the version number looks like this: `Rev. A.02.00`

Locate the program part number printed on the disk labels.

Procedure

1. Load BASIC 4.0 or later, with the appropriate binaries, into an HP 9000 Series 200/300 Computer. 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 one.

---

2. Assign the MSI (mass storage is) to the drive you will use as the default drive. As an example, assigning the MSI to a disk drive looks like this: `MSI ":,700,0"`
3. Insert Executive Disk 1 into the assigned default drive. Type the following command line: `LOAD "MOD_VERF",1`
4. Press (EXECUTE). The software version number appears in the screen that is next displayed.
5. Follow the on-screen prompts and load Executive Disk 2. Press (CONTINUE). Loading Executive Disk 2 may require up to two minutes.

Note 

Be sure the Executive Disk 3 you load is the disk that belongs with the module you wish to test.

---

6. Replace Executive Disk 2 with Executive Disk 3, then press PROCEED. 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.)
7. If you are using your module's software for the first time, a message appears stating that mass storage data is needed. Press PROCEED and follow the on-screen prompts to create a mass storage data file. Once mass storage data is stored, this message will not reappear.
8. An error message may be displayed at this point. If the DUT (device under test) 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.
9. Load the Operating Disk as directed. The Operating Disk probably needs to remain in the drive specified as the MSI default drive. Load the Driver Disks into the drive specified on-screen.
10. Load all Driver Disks. Insert each Driver Disk and press PROCEED. This process may require up to six minutes.
11. 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. Press CREATE to access this 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 Operating Disks, 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.

12. You may perform any of the items listed below after satisfying the above conditions:

- 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, the screen allowing you to choose one or the other does not reappear. To retrieve the Test or Adjust selection screen, select `main menu` from the Test Menu softkeys. In the Main Menu, press `RESTART`. Be aware that pressing `RESTART` 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.

Module Verification Software Overview

Testing Multiple Modules

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. Get 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 Module Under Test.
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. Refer to Chapter 5, "Troubleshooting," for a cross-reference of tests to perform versus assembly adjusted, repaired, or changed.

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 ... etc.`
- `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:

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 Figures 2-1 through 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 there no further sub-level softkey menus exist for that softkey.

Edit Screen Menus

The following softkeys are present for edit menus that appear in Figures 2-1 through 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 Figures 2-1 through 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 VOLUME. 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 VOLUME.
- **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.

Main Menu Softkeys

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 Executive 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.

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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, 60, 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 8757A Network Analyzers, and so on).

Chapter 1 contains a table of required test equipment. Using preferred models of test equipment assures the most complete verification and adjustment testing. Refer to "Verification Tests" in Chapter 3 and "Adjustment Procedures" in Chapter 4 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 Modular Spectrum Analyzer 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 Operating Disks.

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 Modular Spectrum Analyzer 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 `Module 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.

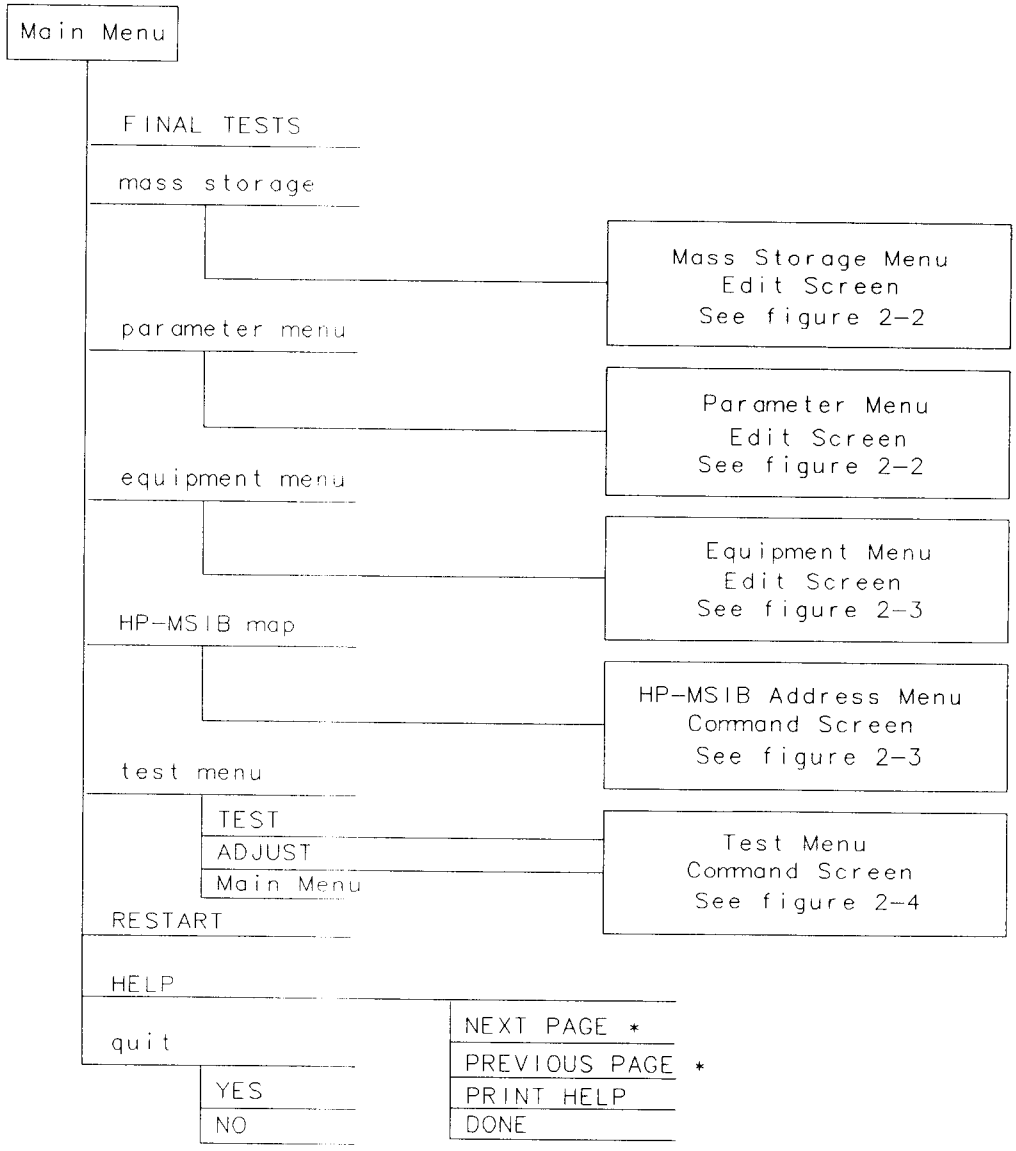
more keys toggles between **SUMMARY**, **select output**, and **PURGE CAL DATA** and the previously explained Test Menu command screen softkeys.

SUMMARY gives you a printout of the current test(s) 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

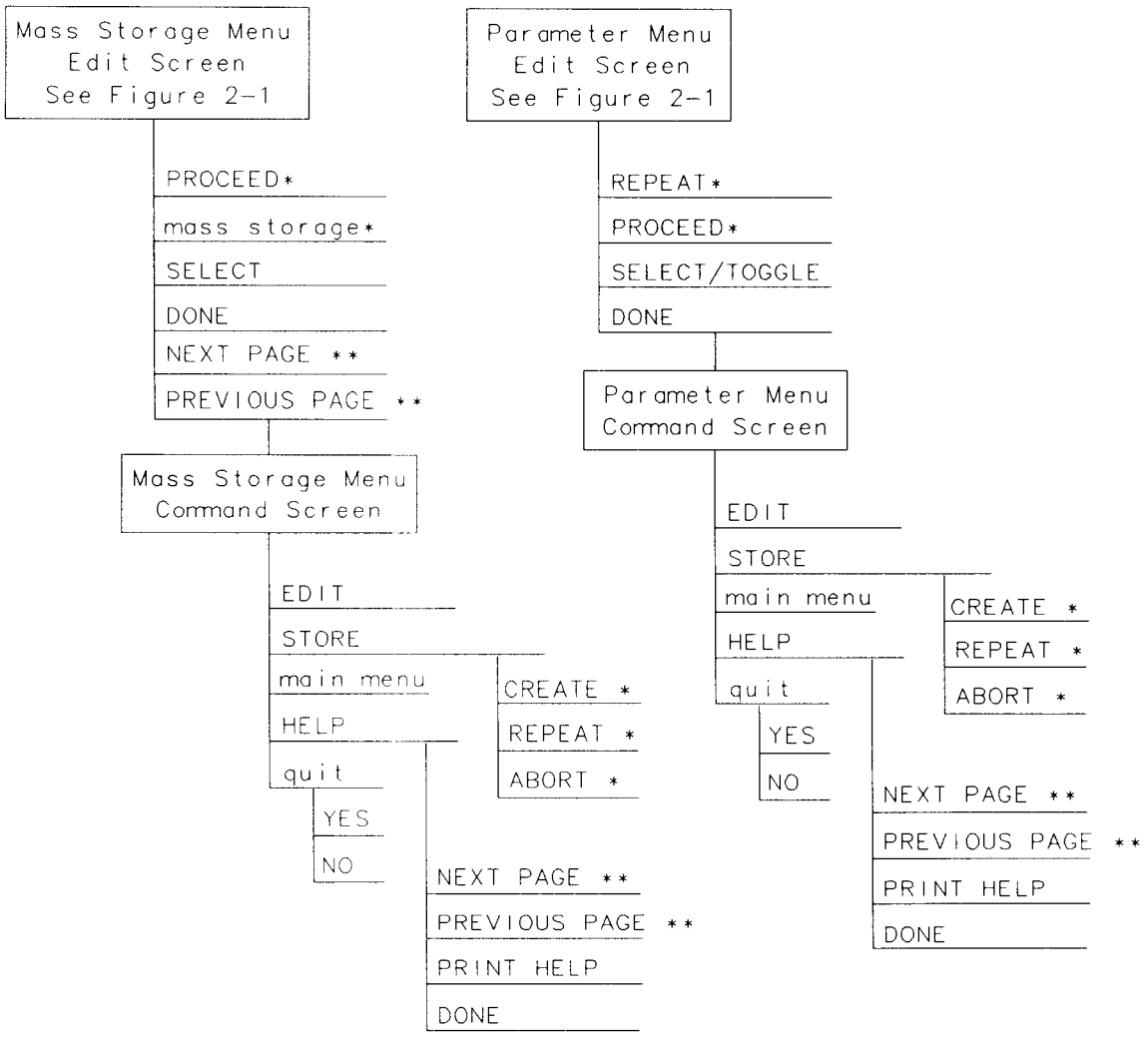
to the previous set of softkeys in the Test Menu command screen.

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.



* Present when more pages of information are available.

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.

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

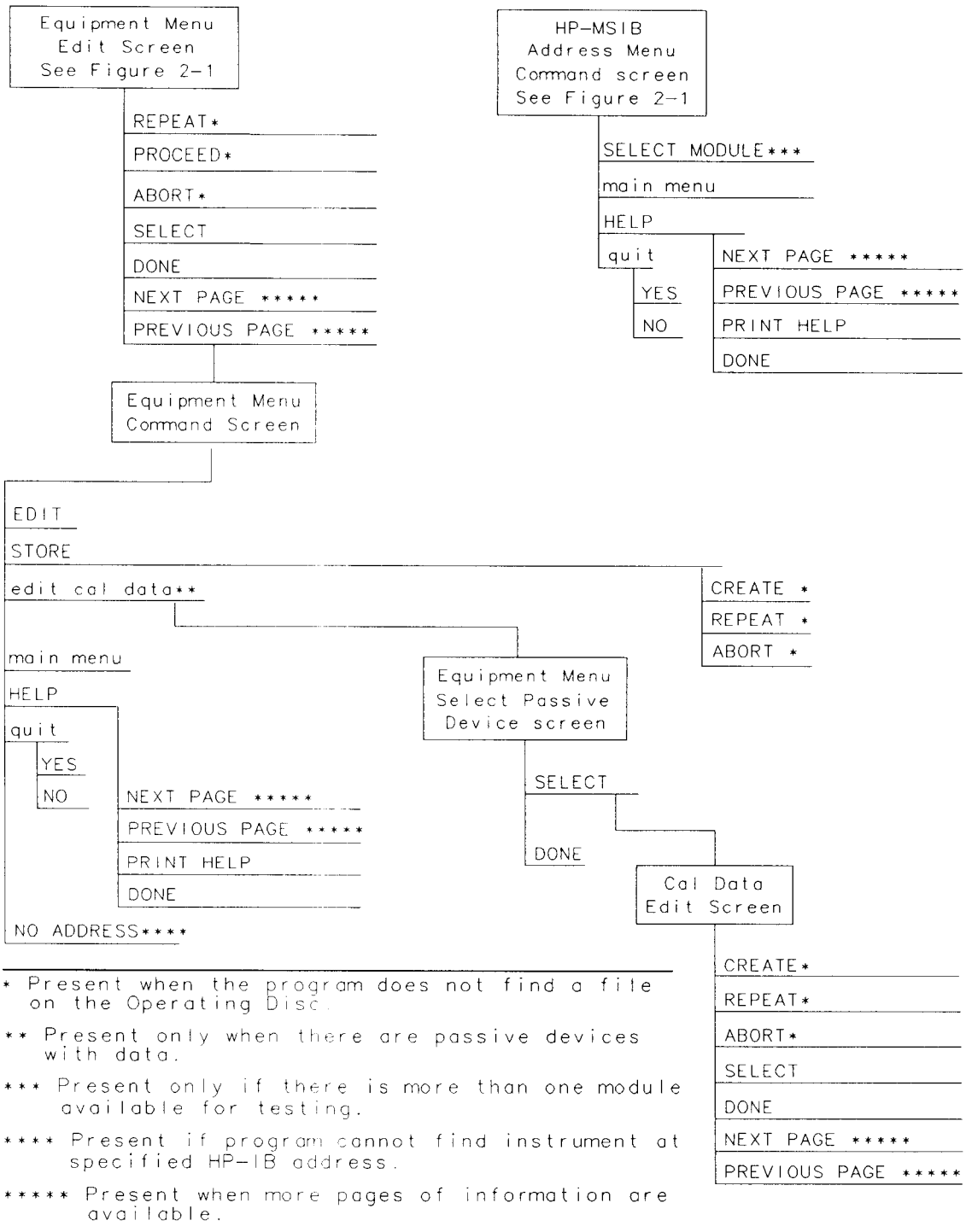
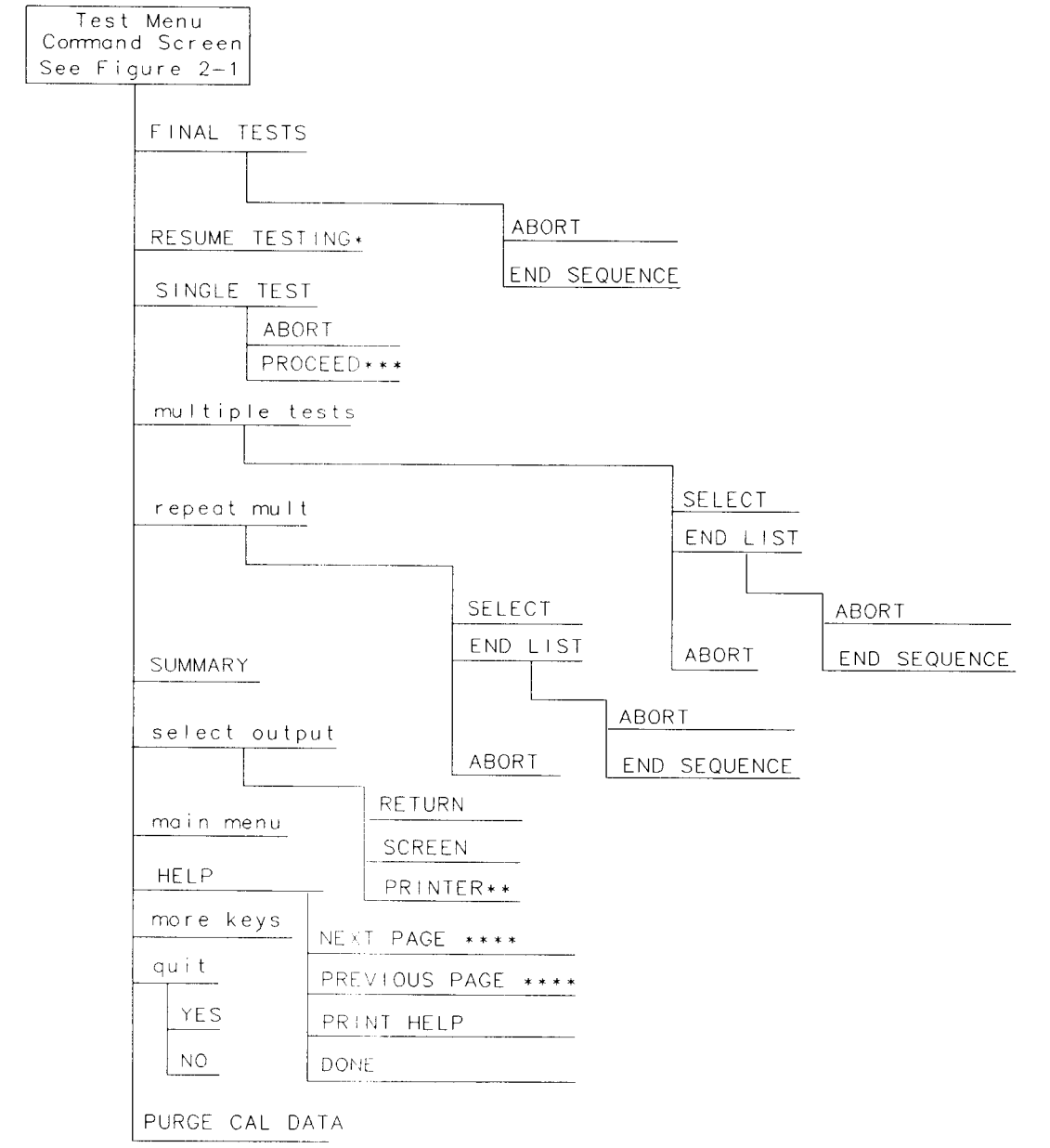


Figure 2-3. Equipment Menu and HP-MSIB Map Screen Menu Softkeys



* 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.

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, system conditions, and so on. 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 1 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 Signal Analysis 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 Signal Analysis 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 Signal Analysis 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. 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 Signal Analysis 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 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

Verification Tests

The HP 70904A RF Section Verification Software is used to run the verification tests on the HP 70904A RF Section. The tests verify that module performance is accurate. Chapter 2, "Verification Software," contains information on running this software.

Final tests, listed with an asterisk below, verify the basic operation of the module. Run all final tests to verify module operation after any repair or adjustment. The remaining verification tests are not required for verifying the module's operation, but may be required after specific repairs. Chapter 5, "Troubleshooting," contains a list of required tests for each assembly changed, repaired, or adjusted.

Overall Test Setup

The RF section is tested as configured in the mainframe for most of the verification tests. Only one test requires that the module be removed from the mainframe and connected to the module service extender. Figure 3-1 shows the overall test setup to use throughout the verification test series. Some test setups will illustrate setup changes. The HP 9000 Series 200/300 controller is not illustrated in each test setup, but it is required for each test.

The required test equipment calibration routines are at the end of this chapter. Refer to "External Frequency Reference" in Chapter 1 for more information related to the preferred frequency reference connections.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A
Synthesized Source *(300 MHz Reference Input)*	HP 8662A/HP 8663A
Microwave Source *(alternative to the LO module)*	HP 8340A/B
Accessories	
Isolator *(for use with the Microwave Source)*	0955-0204
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f) *(for optional LO setup)*	1250-1749
SMA (m) to SMA (m) *(for optional LO setup)*	1250-1159
Cables	
BNC (m) to SMB (f)	85680-60093
SMA (m) to SMA (m) *(for use with HP 70900 LO module)*	5061-9038
SMA (m) to SMA (m) *(for optional LO setup)*	5061-5458

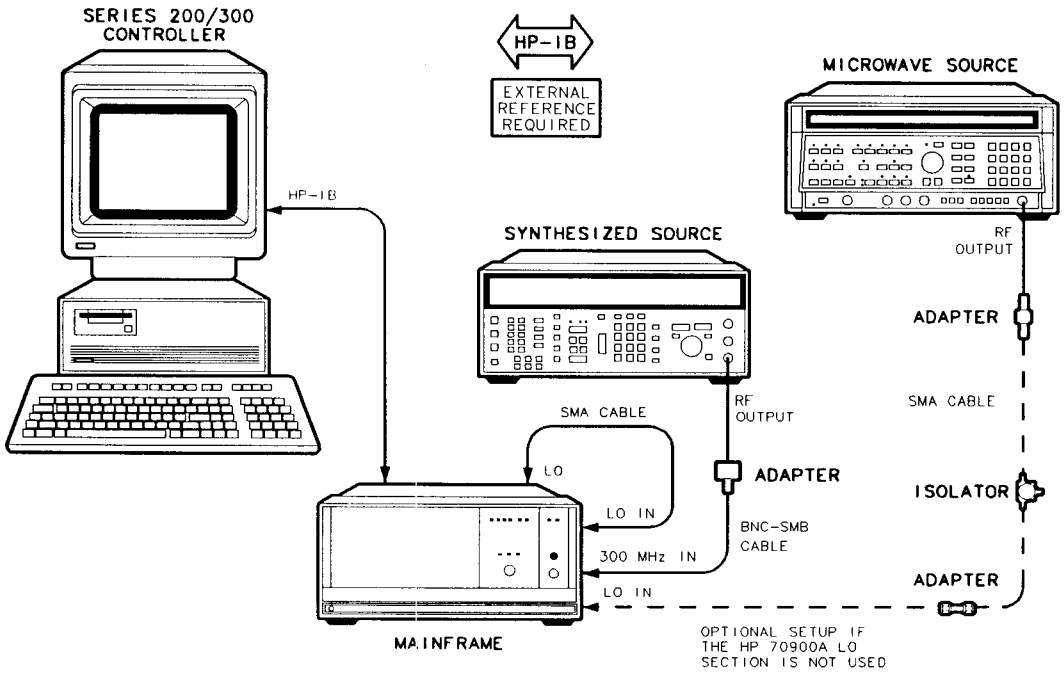


Figure 3-1. Overall Test Setup

1. RF Flatness Calibration

Purpose

This test adjusts the HP 70904A module gain at 300 MHz, as well as measures and calculates the flatness calibration data for the RF section. The flatness calibration data is written into ROM.

This is a final test.

Description

The test equipment is verified for correct setup, then the module attenuator is cycled from 0 to 10 dB attenuation. The RF frequency is set to 300 MHz and the operator is prompted to adjust A3R6, IF GAIN, for −5 dBm ±0.05 dB. The A/R measurement of the 300 MHz reference is compared with the remaining measurements.

The RF frequency is set to the appropriate level and the power level is set as per the calibration information. A point-by-point reading is made beginning with the start frequency and continued through the stop frequency of the RF section. The final A/R readings are saved. With the calibration factors, the conversion response is calculated using the following formula:

response = final A/R + 21.4 MHz A/R + frequency response correction

The 21.4 MHz A/R factor is derived from the calibration routine that replaces the RF section with a through-line. The frequency response correction factor is of the R detector.

With the conversion gain data gathered, the final corrected flatness is calculated. This corrected flatness is normalized to the 300 MHz A/R measurement. The normalized flatness and the un-normalized data are compared with test limits. The test results are stored.

There are two overlapping bands from 20 MHz to 2900 MHz in the HP 70904A RF Section. The difference occurs between the ac-coupled readings and the dc-coupled readings.

All calibration data points are calculated (twelve total, or six for each coupled state). These are written into ROM at completion, then read and verified.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663B
Full Microwave Source	HP 8340A/B
Scalar Network Analyzer	HP 8757A
Detector *(2 required)*	HP 11664E
Power Splitter	HP 11667B
Accessories	
Module Service Extender	70001-60013

Adapters

Type N (m) to BNC (f) 1250-0780
Type N (m) to APC 3.5 (f) 1250-1744
APC 3.5 (f) to APC 3.5 (f) 5061-1749
APC 3.5 (m) to APC 3.5 (m) 1250-1748
SMA (f) to SMB (m) 1250-0674
SMA (f) to SMB (f) 1250-0672

Cables

BNC (m) to BNC (m)*(4 required)* ..... HP 10503A
BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m) 8120-4921

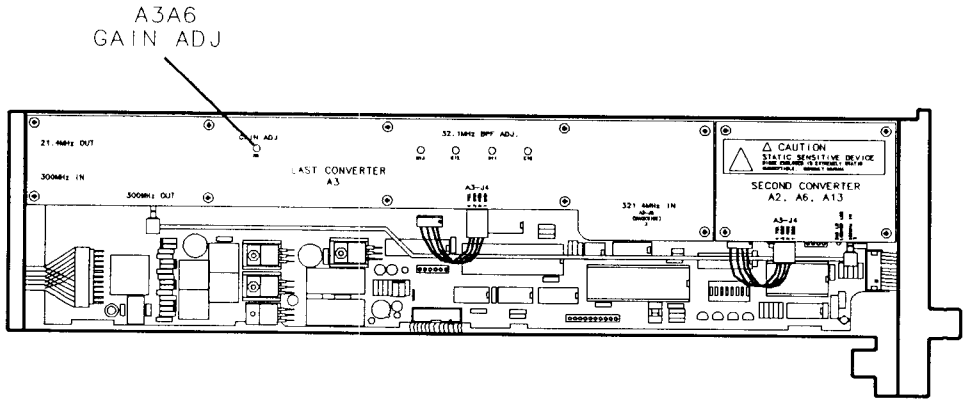


Figure 3-2. RF Flatness Gain Adjustment Location

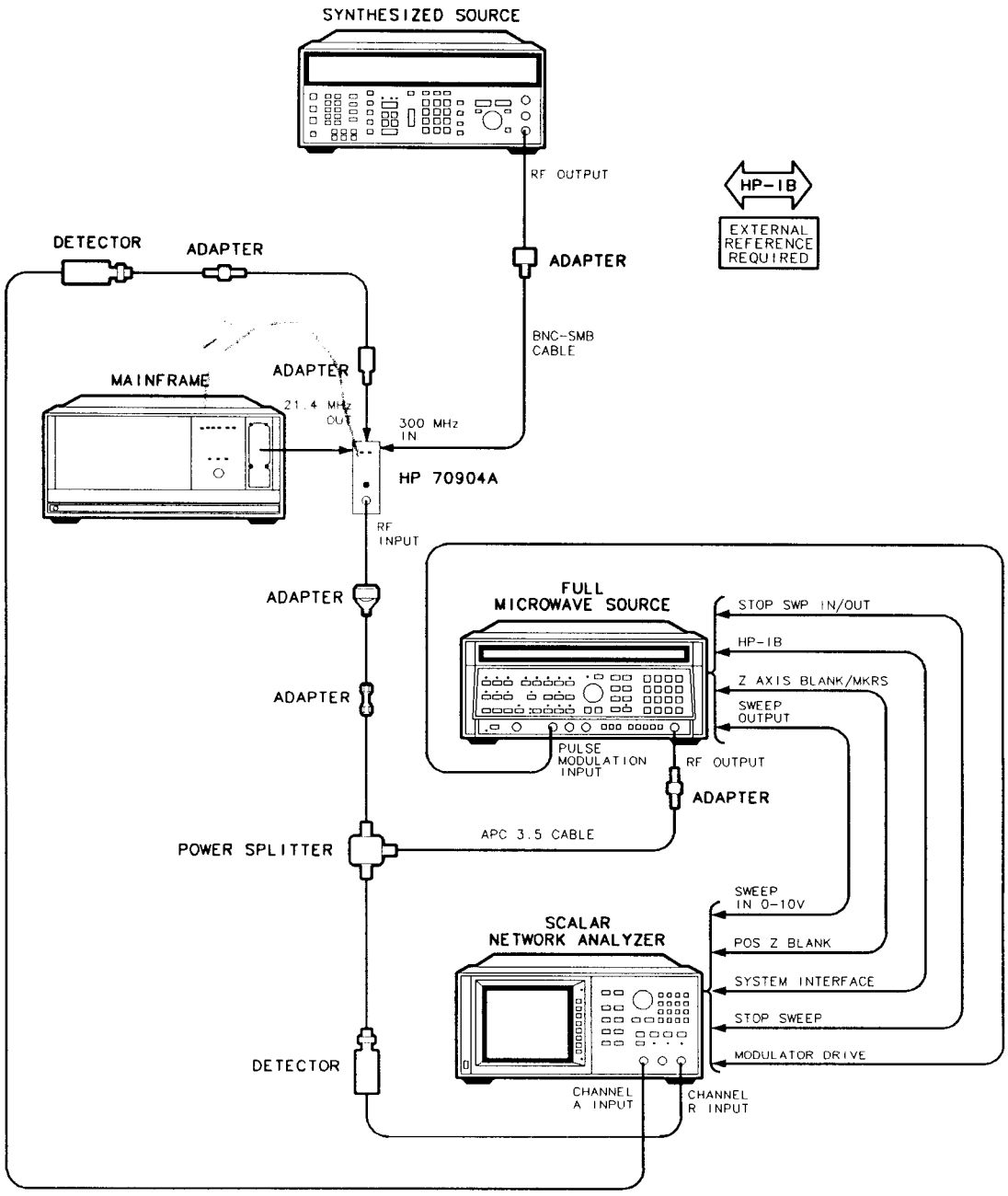


Figure 3-3. RF Flatness Calibration Setup

Procedure

1. With the mainframe line switch set to OFF, remove the RF section and install the module service extender into the mainframe.
2. Remove the left-side cover from the module to gain access to A3R6. See Figure 3-2.
3. Connect the RF section to the module service extender cable.
4. Connect the equipment as shown in Figure 3-3.
5. Set the mainframe line switch to ON.

2. Low Frequency Flatness Verification

Purpose

This test verifies that the flatness below 10 MHz on the RF section is within test limits.

All module-related adjustments and the RF Flatness Calibration must be completed prior to beginning this test.

This is only a verification test. Flatness correction data are not calculated or stored in the DUT EEPROM.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-4 for the test setup.

The flatness calibration test provides information needed in this procedure. Relative flatness data is stored during the flatness calibration and combined with the data taken in this test. The net results are compared with test limits to ensure that module flatness is within test limits across the RF section frequency range.

The RF input signal is set to begin at 20 MHz, then logarithmically decreased to the minimum frequency of the RF section. All frequency-response data is relative to the first data point, plus the offset acquired from the stored flatness information. The corrected data is compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
Local Oscillator Source	HP 70900A/B
HP 70000 Series Mainframe	HP 70001A
Synthesized Source	HP 8662A/HP 8663A
Synthesizer/Level-Generator	HP 3335A
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
BNC (f) to SMA (m)	1250-1200
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to BNC (m)	HP 10503A
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921

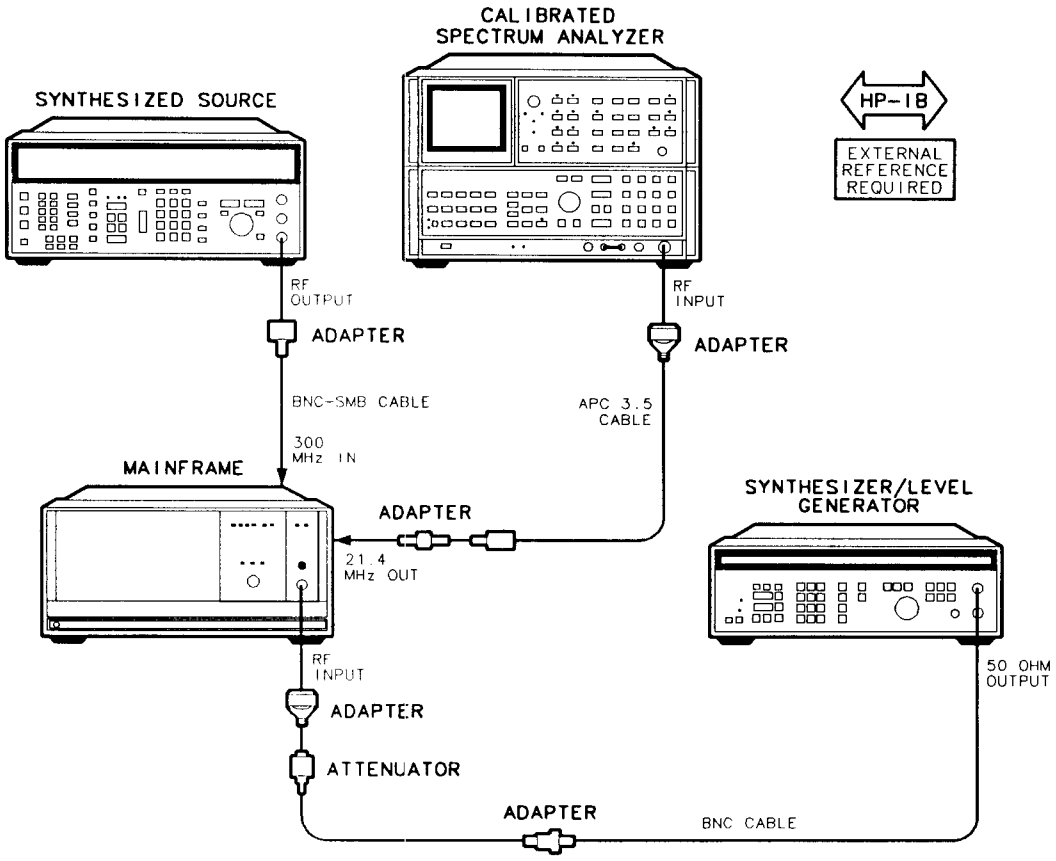


Figure 3-4. Low Frequency Flatness Verification Setup

3. Attenuator Accuracy

Purpose

This test checks the absolute amplitude accuracy of the input attenuator in the RF section.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-5 for the test setup.

The input attenuator is initially set to 10 dB and the synthesizer/level-generator is set to −49 dBm. The spectrum analyzer reads the 21.4 MHz output power level and sets this value as the reference level.

The input attenuator is set to 0 dB and the synthesizer/level-generator is decreased −59 dBm. The spectrum analyzer reads the 21.4 MHz output again. This measurement is subtracted from the reference level reading to obtain the attenuator accuracy value.

The input attenuator is then set to 20 dB, the synthesizer/level-generator is set to −39 dBm, and another 21.4 MHz output power measurement is made with the spectrum analyzer. This reading is subtracted from the reference level value. (For every 10 dB increase in attenuation, a subsequent synthesizer/level-generator increase is made so that the output signal remains on the spectrum analyzer display.)

The preceding process is repeated for the 30, 40, 50, 60, and 70 dB attenuation levels of the RF section. The calculations are compared with test limits to measure attenuation accuracy.

Equipment

Test Equipment	**Preferred HP Model or Part Number**
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Synthesizer/Level-Generator	HP 3335A
Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
BNC (f) to SMA (m)	1250-1200
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672

Cables

BNC (m) to BNC (m) ..... HP 10503A
BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m) 8120-4921

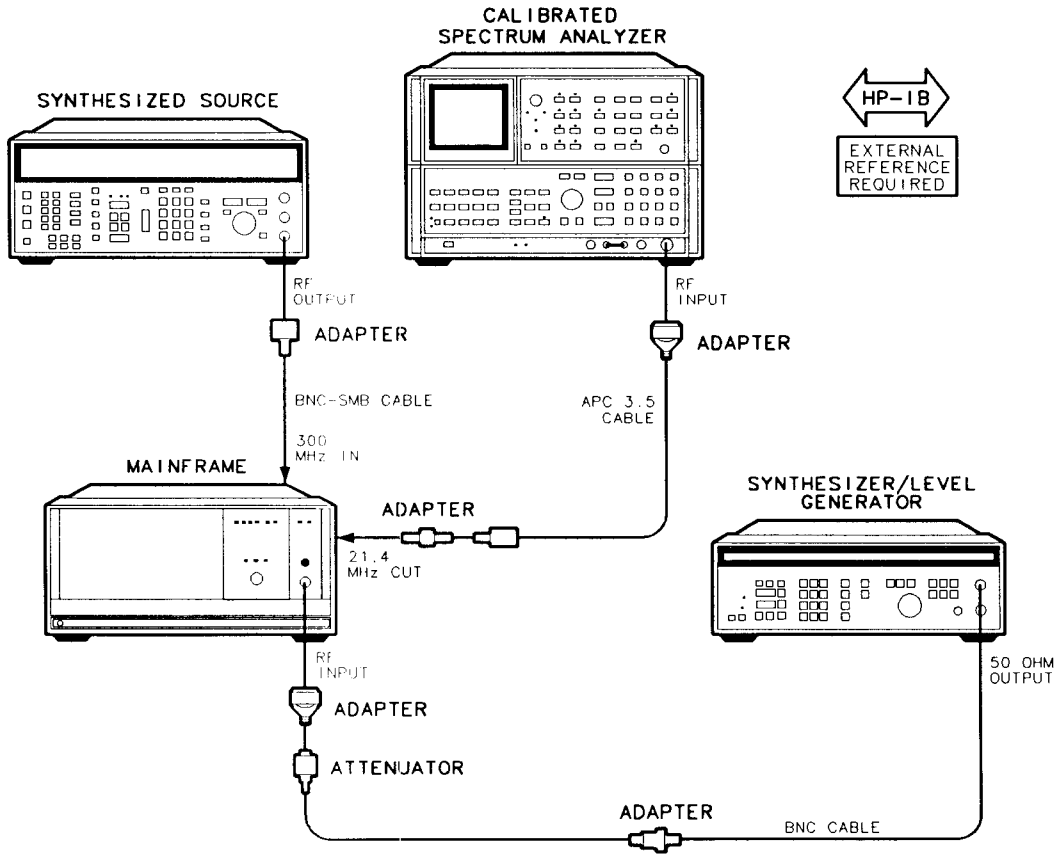


Figure 3-5. Attenuator Accuracy Test Setup

4. Front-Panel LEDs

Purpose

This test visually verifies that the front-panel LEDs are functioning properly. The ability of the internal controller to operate the LEDs is tested as well. The error- and diagnostics-sensing capability is not tested in this procedure.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-6 for the test setup.

The operator is prompted to make a softkey selection that agrees with the state of the LEDs at the beginning of the test. The ACT (active) LED is turned off and the ERR (error) LED is turned on. The operator is again prompted to input the state of the LEDs via the softkey selection.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Display	HP 70205A/HP 70206A
IF Section	HP 70902A/HP 70903A

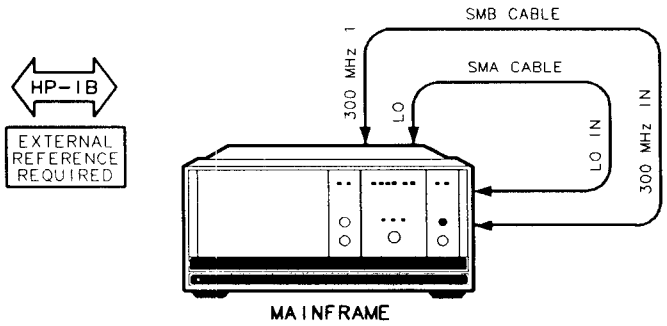


Figure 3-6. Front-Panel LEDs Test Setup

5. 10.7 MHz Rejection

Purpose

This test measures the 10.7 MHz subharmonic response relative to the 21.4 MHz IF output.

All module-related adjustments and calibrations must be completed prior to beginning this test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-7 for the test setup.

The full microwave source with the 6 dB attenuator connected is calibrated to provide −10 dB to the RF INPUT on the RF section. The spectrum analyzer RF amplitude calibration is performed at 10.7 MHz.

A 300 MHz signal is applied to the RF INPUT of the RF section. The 1st LO source is set to 300 MHz plus 3621.4 MHz for the 1H− band. The calibrated spectrum analyzer measures the 21.4 MHz OUT response. The LO frequency is offset by −10.7 MHz and the calibrated spectrum analyzer again measures the 21.4 MHz OUT. The response at 10.7 MHz relative to the 21.4 MHz OUT response is determined by the difference between these two measurements.

Equipment

Test Equipment	**Preferred HP Model or Part Number**
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

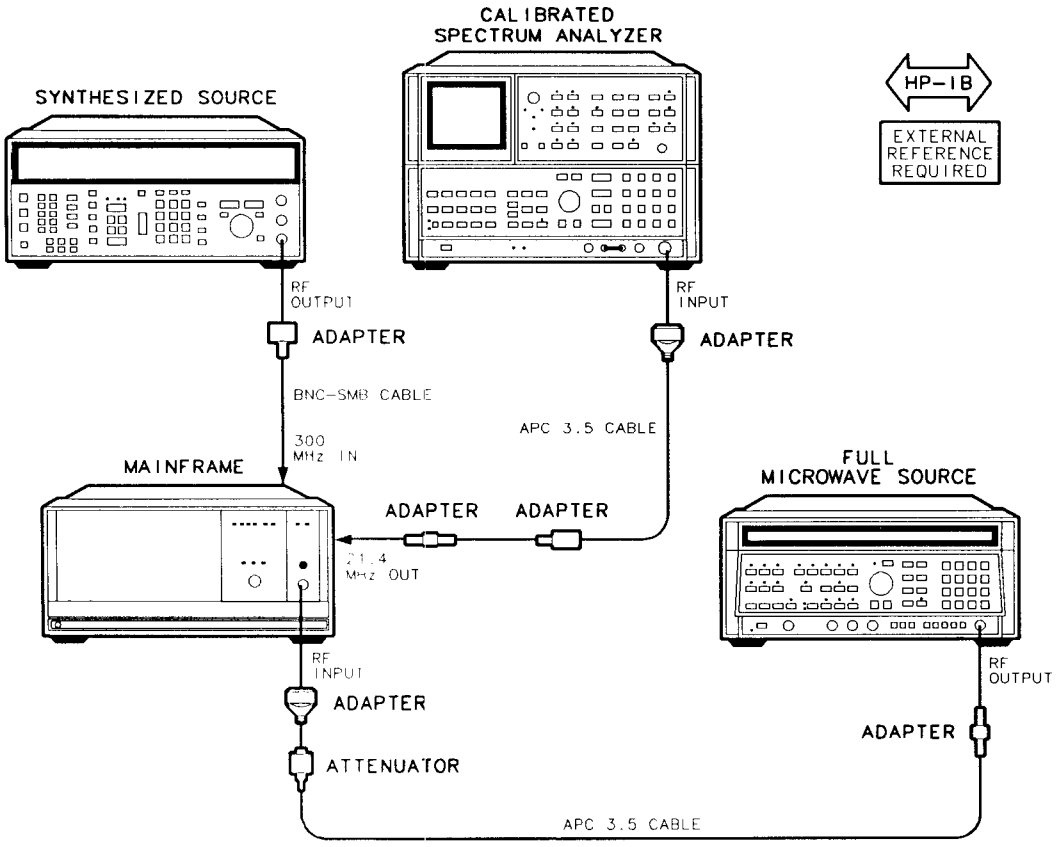


Figure 3-7. 10.7 MHz Rejection Test Setup

6. 21.4 MHz IF Output Converted Feedthrough

Purpose

This test measures the converted feedthrough from the 21.4 MHz OUT of the RF section. Converter feedthrough emissions result from the internal frequency conversion of signals applied to the RF INPUT of the RF section. These emissions reflect post-mixer selectivity in the last converter as well as undesired coupling.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO signal to the RF section. Refer to Figure 3-8 for the test setup.

The setup is initially checked by measuring the RF section output power to determine that it is greater than −15 dBm. The full microwave source is set to 300 MHz. The LO frequency is calculated from the 300 MHz input frequency and the RF section is set to the 1H− band. The synthesized source is set to 0 dBm. The spectrum analyzer measures the IF output for converted feedthrough. This procedure is repeated for synthesized signal generator power levels of −2.2 dBm and +2.2 dBm.

Equipment

Test Equipment	**Preferred HP Model or Part Number**
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

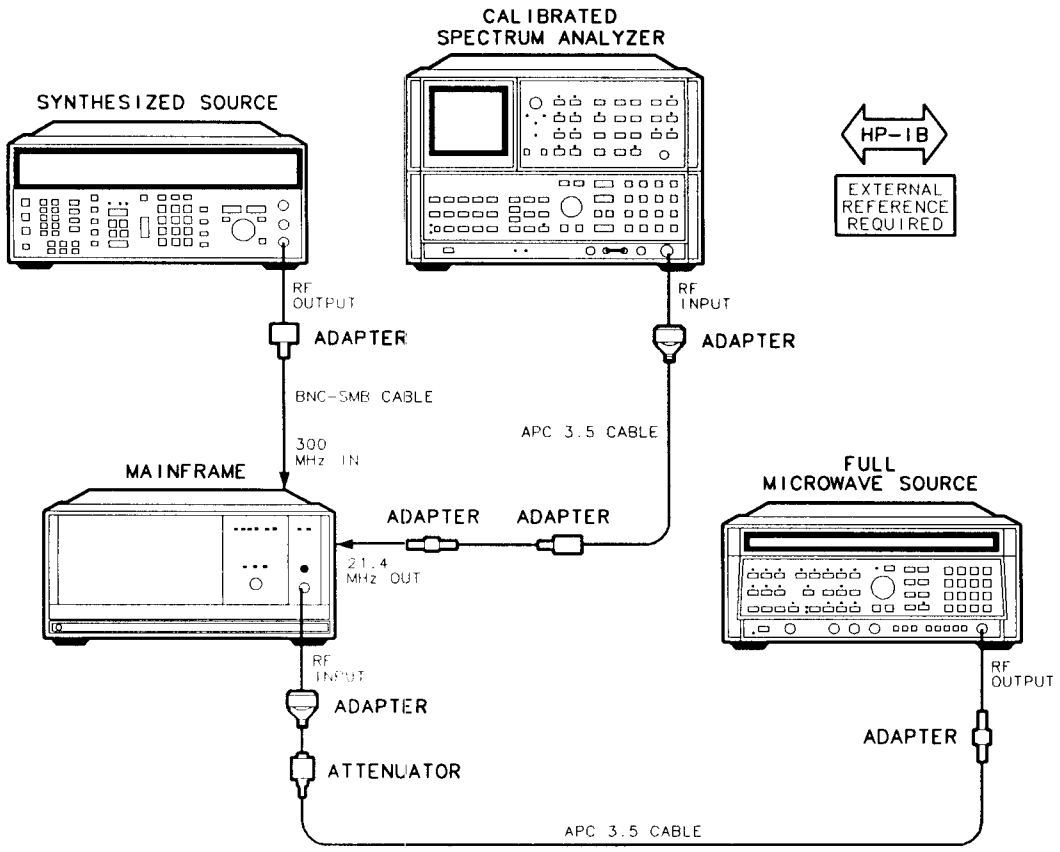


Figure 3-8. 21.4 MHz IF Output Converted Feedthrough Test Setup

7. 21.4 MHz IF Output Harmonics

Purpose

This test measures the relative harmonic amplitude of the RF section 21.4 MHz IF output.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-9 for the test setup.

Initially, the test setup is checked by measuring the 21.4 MHz OUT for a power level of at least −10 dBm. The full-microwave-source frequency is set to 300 MHz. The synthesized signal generator is set to an amplitude of 2 dBm. At each input frequency, two harmonics are measured with the calibrated spectrum analyzer. The results are compared with test limits.

The above process is repeated for specified amplitude and frequency combinations.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

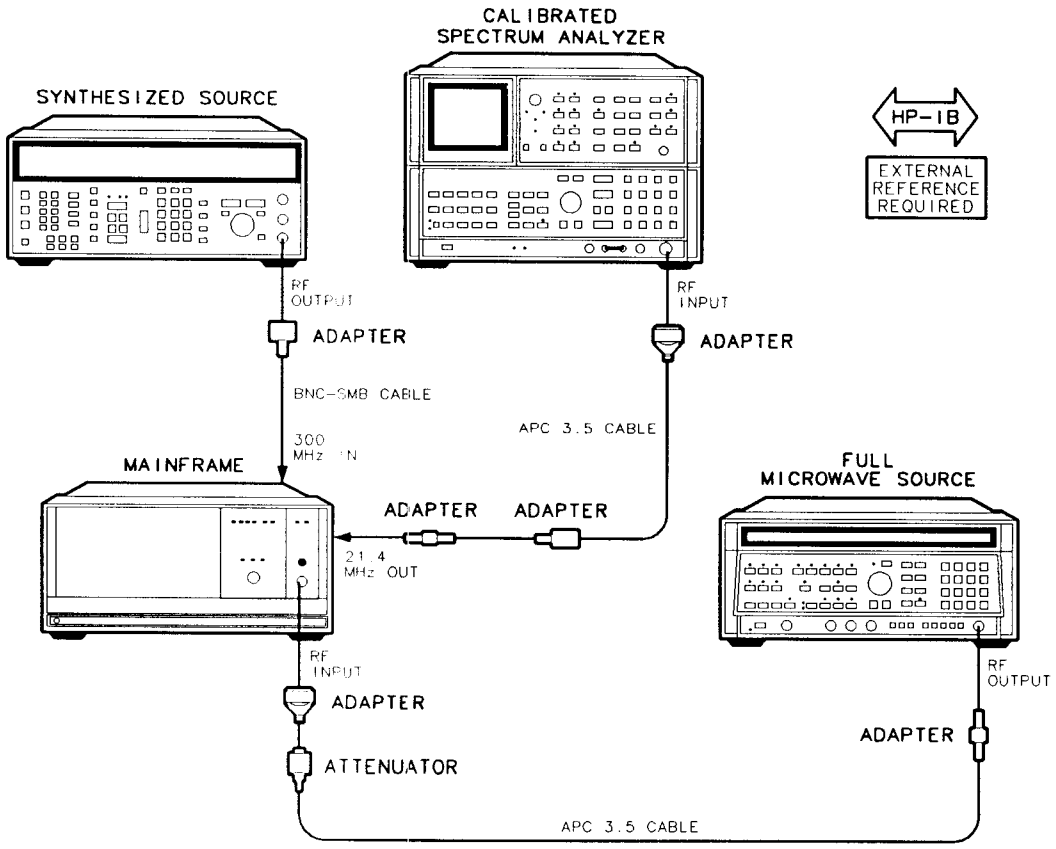


Figure 3-9. 21.4 MHz IF Output Harmonics Test Setup

8. 21.4 MHz IF Output Residual Emissions

Purpose

This test measures the residual emissions from the 21.4 MHz OUT connector. These residual emissions may appear as baseline lift in a system that contains a susceptible IF module. This test also measures first LO feedthrough at the 21.4 MHz OUT.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-10 for the test setup.

Last LO Emissions

Initially, the test setup is verified by checking the 21.4 MHz IF output for a signal greater than −50 dBm in amplitude. The calibrated spectrum analyzer center frequency is set to the frequency of the harmonic to be measured. Emissions at harmonics of 300 MHz are measured.

First LO Feedthrough

The spectrum analyzer is set to a center frequency of 21.4 MHz at a 20 dBm reference level. The LO feedthrough is measured and checked to ensure that it is less than −3.0 dBm.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Calibrated Spectrum Analyzer	HP 8566B
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f)	1250-0780
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921

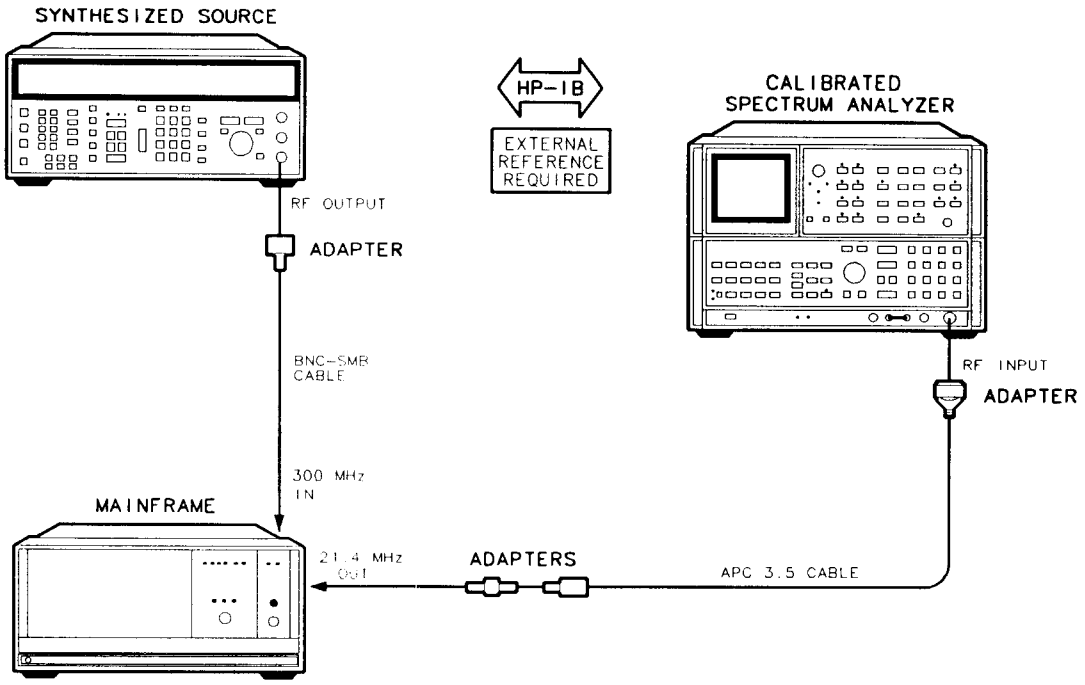


Figure 3-10. 21.4 MHz IF Output Residual Emissions Test Setup

9. Image Rejection

Purpose

This test measures image responses. Inadequate image rejection causes false responses to occur at 42.8 MHz and 642.8 MHz from the applied signal frequency. False responses are due to image frequencies of the last and second converters, respectively. The 42.8 MHz response is a function of first and second IF selectivity, and the last mixer. The 642.8 MHz response is a function of the first IF selectivity and the second mixer. The image response is linear.

The LO frequency is above the RF signal frequency, and the second and third LO signals are below the preceding IF frequency. As a result, the false responses appear below the frequency of the incoming signal.

The test limit is in dB, relative to the amplitude at the 21.4 MHz OUT when a normal RF input signal is applied.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-11 for the test setup.

The RF section 1H– band is activated, the LO source is set to 300 MHz, and the calibrated spectrum analyzer reference level is set to 0 dBm. The full microwave source connected to the RF INPUT is set to 1 GHz and the amplitude required to provide 0.5 dBm at the RF INPUT on the RF section. The calibrated spectrum analyzer uses the amplitude measured at the 21.4 MHz OUT as the reference value.

The calibrated spectrum analyzer reference level is set to −50 dBm, and the LO source is set to the LO frequency required to tune the RF section to the image frequency. The spectrum analyzer measures the 21.4 MHz OUT amplitude. The image response is this measured value subtracted from the reference value. The result is compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f)*(2 required)* 1250-1744
Type N (m) to BNC (f) 1250-0780
APC 3.5 (f) to APC 3.5 (f) 1250-1749
SMA (f) to SMB (m) 1250-0674
SMB (f) to SMB (f) 1250-0672

Cables

BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m)*(2 required)* 8120-4921

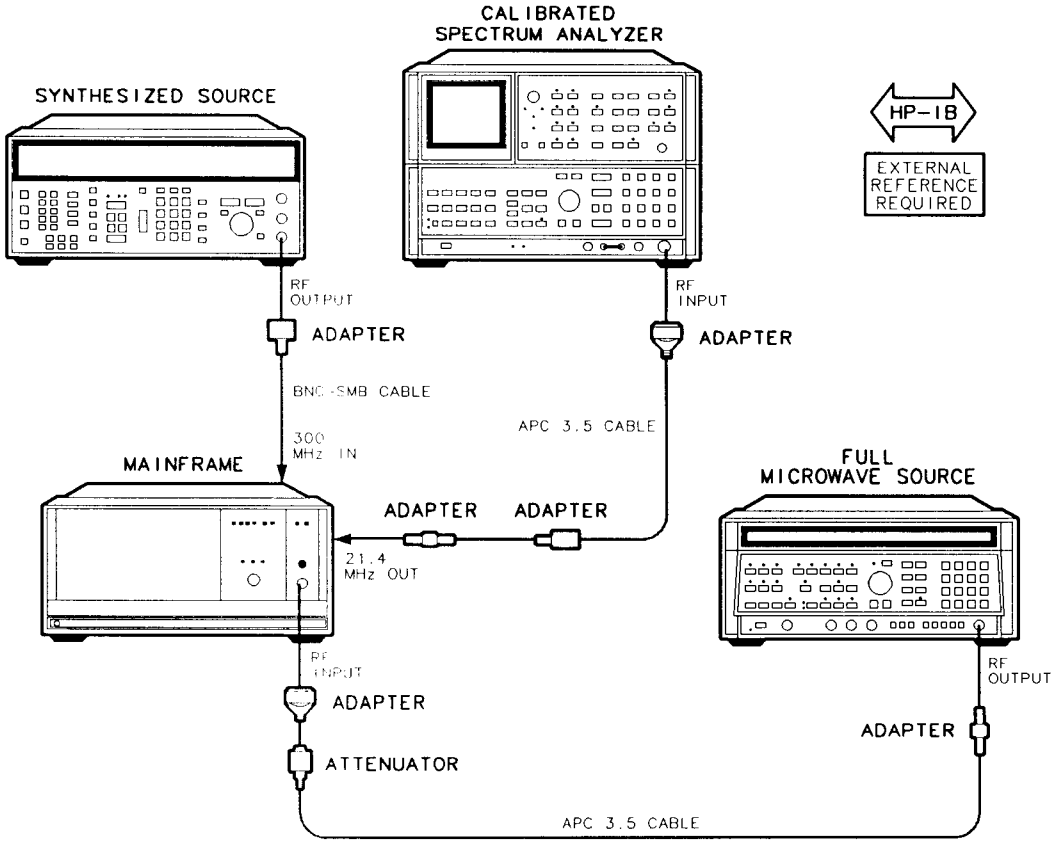


Figure 3-11. Image Rejection Test Setup

10. IF Rejection

Purpose

This test measures the ability of the RF section to reject RF input signals that are at frequencies equal to internal IF frequencies as well as the images of those frequencies. Inadequate IF rejection results in baseline lift, which appears as an increase in wideband noise floor. Baseline lift occurs when subject signals that have sufficient amplitude are present in the applied signal spectrum. Notice that this condition is a linear response.

The test limits are expressed in dB, relative to the IF output amplitude when an RF input reference signal is applied to the RF section.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-12 for the test setup.

With a 300 MHz signal applied to the RF INPUT, the LO is tuned to select 300 MHz and the amplitude at the 21.4 MHz OUT is measured with the calibrated spectrum analyzer. This measurement is used to establish a reference so that test results are not directly dependent on the RF section gain. The measurement made at the 21.4 MHz OUT is corrected with the residual RF input amplitude error from the 300 MHz full microwave source input.

The spectrum analyzer reference level is set to −50 dBm. The HP 70900A/B Local Oscillator is offset 1 MHz to avoid last mixer dc offset for 21.4 MHz and 321.4 MHz response measurements. The band to be tested is activated. The full microwave source is set to 21.4 MHz and to an amplitude that yields 0.5 dBm at the RF INPUT. The calibrated spectrum analyzer measures the 21.4 MHz OUT, then corrects this value with the residual RF input amplitude error measured at 0.5 dBm. The reference value is subtracted from this calculation to yield the IF response at 21.4 MHz.

The above procedure is repeated for all IF offsets.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f) *(2 required)* 1250-1744
Type N (m) to BNC (f) 1250-0780
APC 3.5 (f) to APC 3.5 (f) 1250-1749
SMA (f) to SMB (m) 1250-0674
SMB (f) to SMB (f) 1250-0672

Cables

BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)* 8120-4921

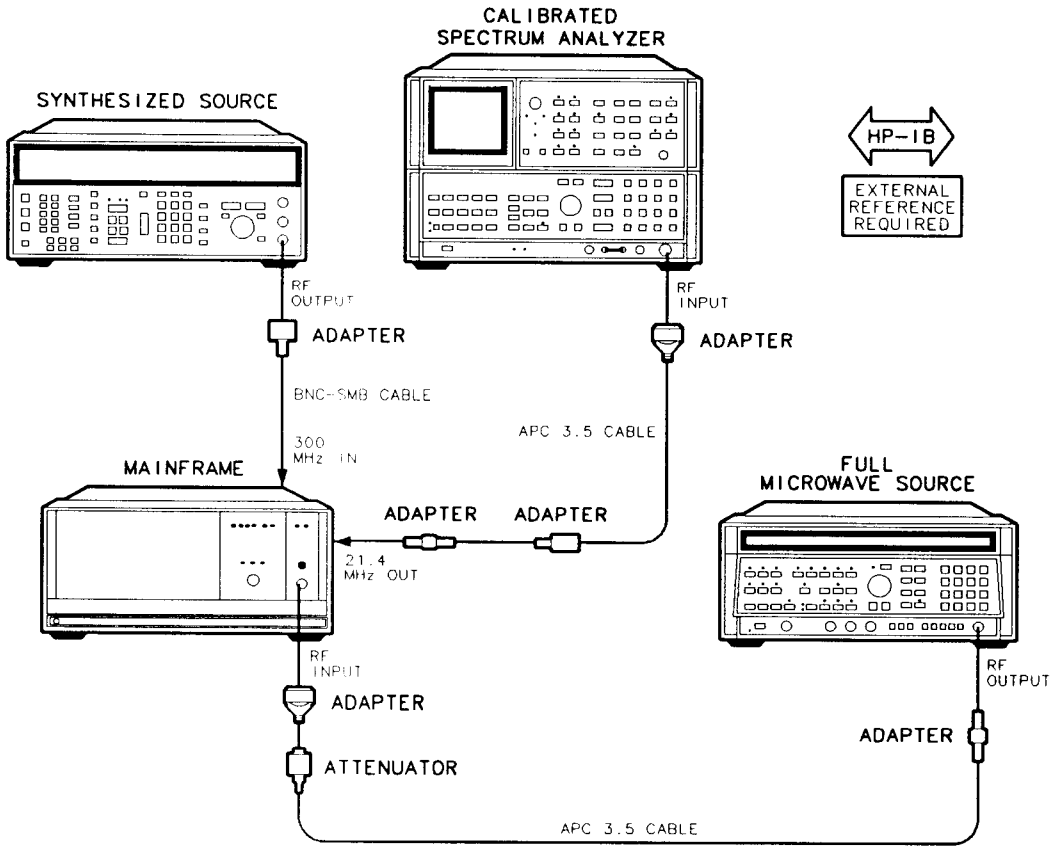


Figure 3-12. IF Rejection Test Setup

11. Out of Band Rejection

Purpose

This test measures the image rejection of the RF section to ensure that out-of-band inputs to the mixer do not appear in the IF signal.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If the HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-13 for the test setup.

The LO frequency is stepped from 3.65 GHz to 6.50 GHz, in 50 MHz increments. The RF source is tuned to all frequencies that will generate a 3.6214 GHz IF response when mixed with the LO or the harmonics of the LO. Either four or five RF frequencies are checked at each LO frequency, depending on the number of tuning lines crossed. The image conversion gain is calculated as the corrected IF response power (dBm), minus the RF input signal power (dBm). The result is a negative gain. The result is compared to test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

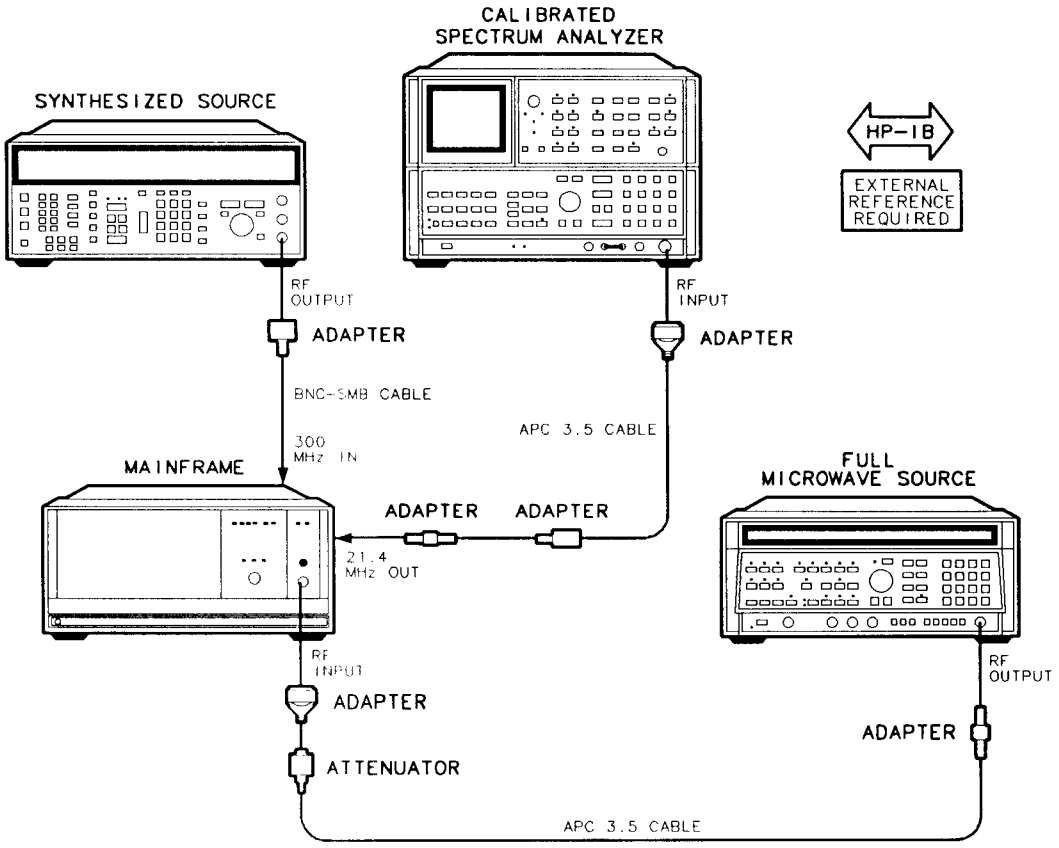


Figure 3-13. Out of Band Rejection Test Setup

12. Reference Input Frequency and Amplitude Range

Purpose

This test verifies the reference input frequency and amplitude range over which the second converter phase-lock loop acquires locked condition at turn-on. Proper operation of the phase-lock loop is verified in this test as well.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-14 for the test setup.

The 300 MHz reference input signal is set. Module diagnostics are cleared and a 0.2 second wait is initiated. Diagnostics are checked after the wait, then checked four more times. If a second converter unlock is indicated at any time, the test registers the failure and keeps track of total failures. The total failure figure is compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Adapter	
Type N (m) to BNC (f)	1250-0780
Cable	
BNC (m) to SMB (f)	85680-60093

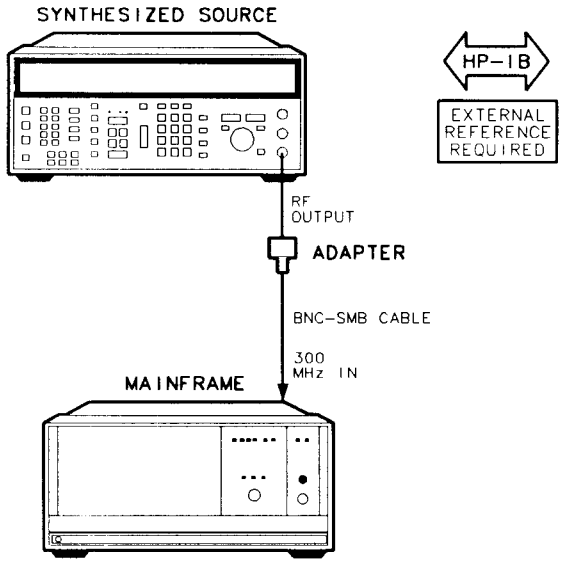


Figure 3-14. Reference Input Frequency and Amplitude Range Test Setup

13. IF Subharmonics

Purpose

This test measures the IF subharmonic responses. IF subharmonic responses manifest themselves as false responses at multiples of internal IF frequencies. The first LO frequency is above the RF input signal frequency and the second and third LO frequencies are below the preceding IF frequency. As a result, the false subharmonic responses appear below the frequency of the incoming signal.

The IF second subharmonic of the last converter occurs 10.7 MHz away from 21.4 MHz. For this condition, the signal driving the last converter is at 310.7 MHz rather than 321.4 MHz. Distortion in the mixer causes a product at 2 × the RF input signal minus 2 × the LO signal, or 621.4 MHz minus 600 MHz = 21.4 MHz. The result is a function of the mixer and the distortion which is influenced by drive levels, load impedances, and so on. The amplitude of the 310.7 MHz signal is influenced by preceding selectivity, and since this is a nonlinear response, the gain distribution in the system influences the results. The doubling of the 10.7 MHz signal in subsequent 21.4 MHz amplifiers contributes to the amplitude of the 310.7 MHz signal. The modular measurement system IF section also contributes to subharmonic amplitude. The IF section is influenced by any post-mixer selectivity.

For a given input signal, the IF subharmonic response is measured with respect to a typical response and is expressed in dBc.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-15 for the test setup.

The spectrum analyzer reference level is set to 0 dBm. The RF section is set to the 1H− band and the LO source frequency is set to a level required to tune the RF section to 20.8 MHz. The full microwave source output is set to 20.8 MHz and an amplitude to yield 0.5 dBm at the RF INPUT. The calibrated spectrum analyzer measures the amplitude at the 21.4 MHz OUT. This measurement is corrected with the RF section flatness correction to yield the IF output reference.

The LO is set to the frequencies needed to tune the RF section to a frequency of 20.8 MHz plus −10.7 MHz. The spectrum analyzer is set to a −50 dBm reference level then used to measure the amplitude at the 21.4 MHz OUT.

The above measurements are made for all appropriate RF input frequencies. The measurements are made to establish IF output references so that test results are not dependent on module gain and are less dependent on the absolute accuracy of the RF input signal amplitude.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672

Cables

BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

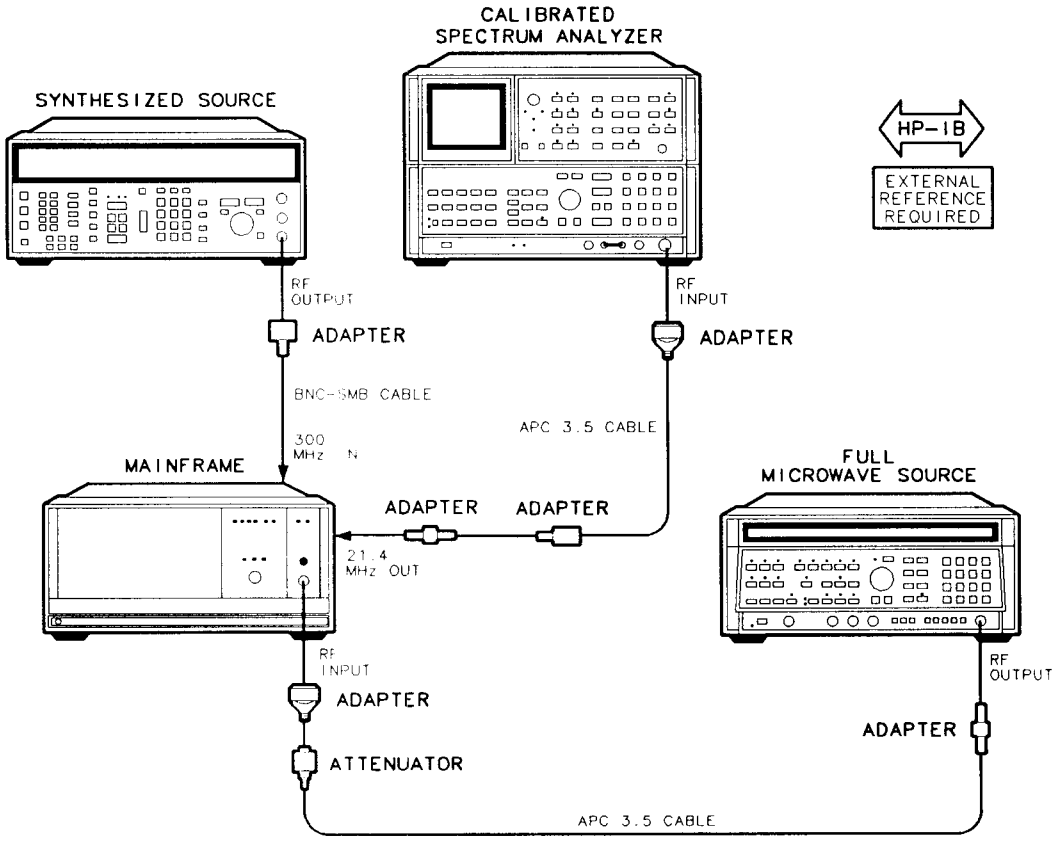


Figure 3-15. IF Subharmonics Test Setup

14. Close-In Sidebands

Purpose

This test checks power-supply and other RF-section-related sidebands. These sidebands are discrete responses that are added to the input signal by the RF section at offset frequencies that are harmonics of power-supply switching.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. A microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-16 for the test setup.

The RF section is set to 300 MHz and the microwave source is tuned to 3921.4 MHz. The 21.4 MHz OUT power is measured, then checked that it is between −3.5 and −6.0 dBm. The center frequency of the calibrated spectrum analyzer is set to measure the 40 kHz or 80 kHz sideband, then the power is measured. If the relative measurement exceeds the test limit by more than 4.0 dB, the spectrum analyzer is set to a lower resolution bandwidth and video bandwidth. A five-sweep video average is initiated and the sideband power is measured again. If the power is too high, the test fails. If the first sideband tested is within test limits, the second sideband is not tested.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
Isolator	0955-0204
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f) *(3 required)* 1250-1744
APC 3.5 (f) to APC 3.5 (f) 1250-1749
SMA (m) to SMA (m) 1250-1159
SMA (f) to SMB (f) 1250-0674
SMB (f) to SMB (f) 1250-0672

Cables

APC 3.5 (m) to APC 3.5 (m) *(2 required)* 8120-4921
SMA (m) to SMA (m) 5061-5458

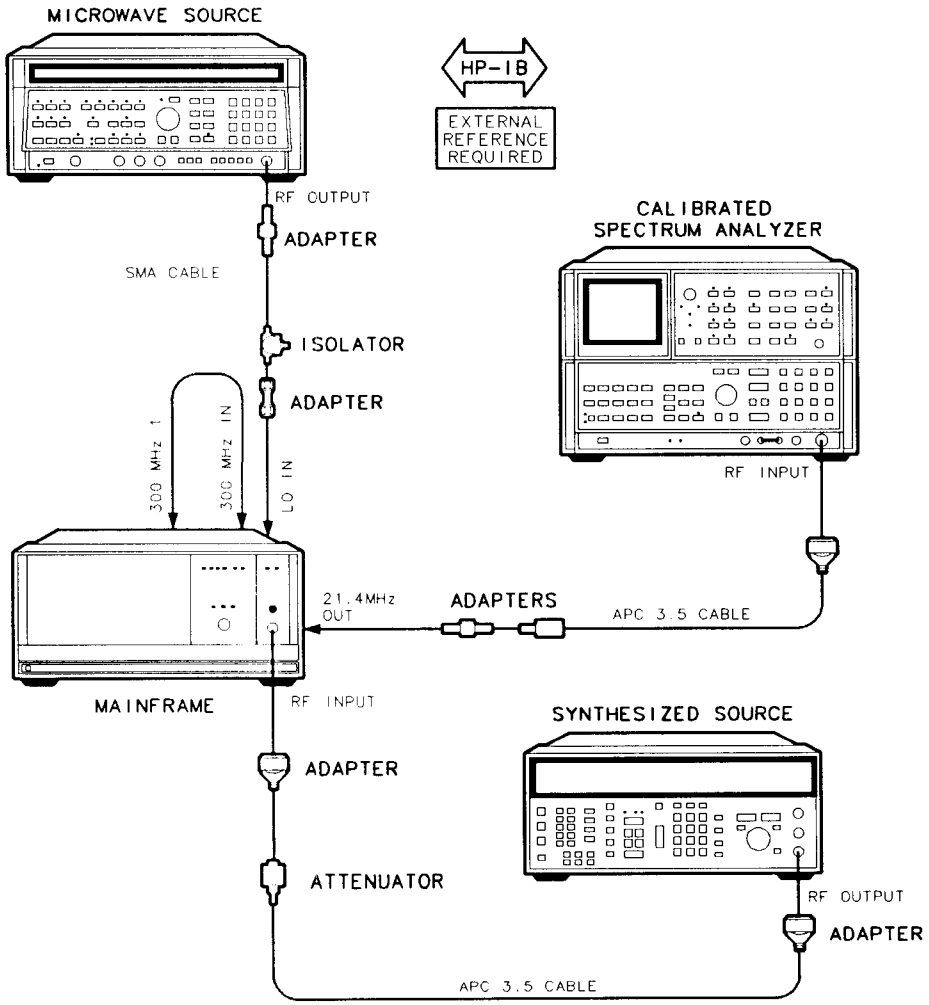


Figure 3-16. Close-In Sidebands Test Setup

15. Residual Responses

Purpose

This test measures the RF section residual responses. Customer specifications do not include residual response limits at center frequencies below 10 MHz, since spurious signals from the HP 70900A/B Local Oscillator make it difficult to predict and control residual response behavior in this range. The RF section verification tests include measurements down to 1 MHz, and tests residuals in that range that are not caused by the LO. Test limits are based on 0 dB attenuation and are expressed in dBm. This test is designed to measure potential residuals which are derived from calculations based on harmonics of the first and second LO, or the first and last LO. Residuals due to spurious feedthrough from the LO via the LO input or the reference input connectors are not tested.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-17 for the test setup.

The LO is set to the frequency needed to tune the RF section to the center frequency. The calibrated spectrum analyzer measures the amplitude at the 21.4 MHz OUT of the RF section. The attenuation correction factor of the calibrated spectrum analyzer is subtracted from this measurement. The resulting value is then corrected by subtracting the RF section flatness correction factor, the attenuation correction factor, and the module gain to yield the residual response. The result is compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672

Cables

BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m)*(2 required)* 8120-4921

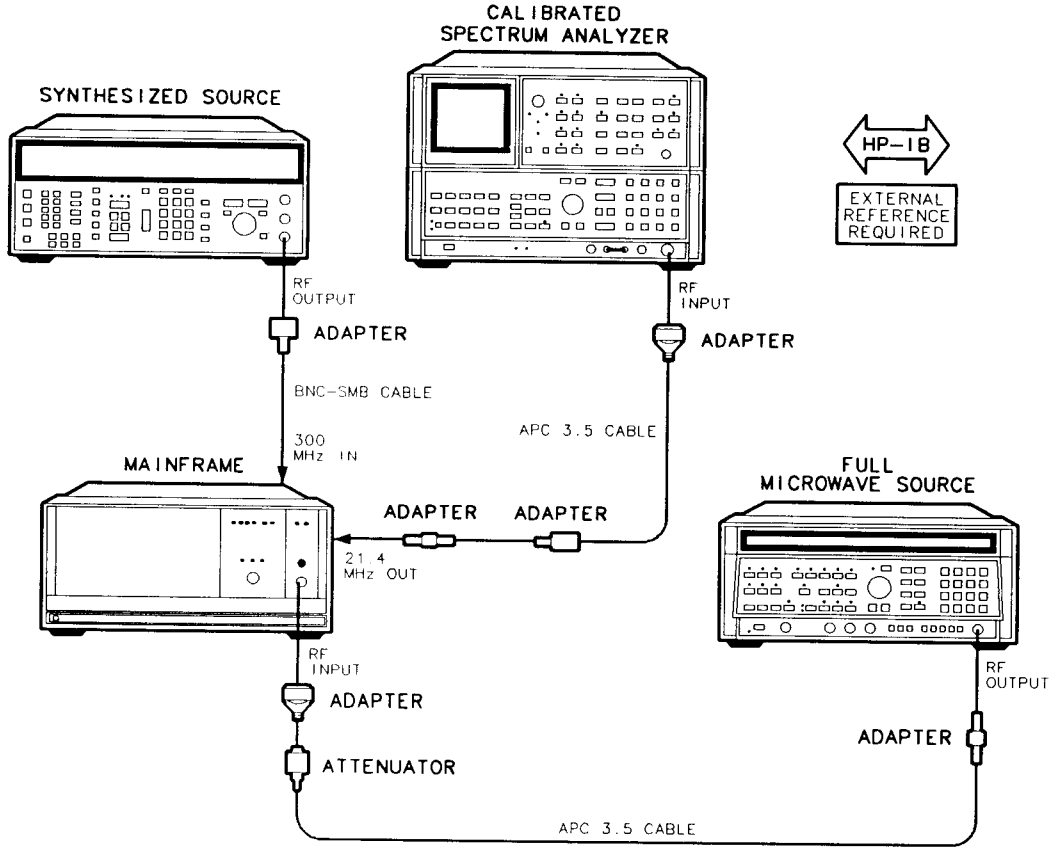


Figure 3-17. Residual Responses Test Setup

16. Miscellaneous Residual Responses

Purpose

This test measures RF section residual responses that are not mixing products. These residuals appear in a system as false signals when no input signal is applied. This test is designed to measure potential residuals that are derived from calculations based on harmonics at the 300 MHz IN connector.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. The HP 70900A/B LO is not used as the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-18 for the test setup.

Gain Compression Correction Factor

The 21.4 MHz OUT amplitude is measured using the calibrated spectrum analyzer. This measurement establishes a reference and avoids having the test results be totally dependent on RF section gain or absolute accuracy of the IF output measurements. The reference value is corrected with the residual RF input amplitude error and the RF section flatness correction. The RF input amplitude of −10 dBm is subtracted from the results to obtain module gain.

RF Section Attenuation Correction Factor

The calibrated spectrum analyzer reference level is set to 0 dBm to prevent gain compression. The amplitude at the 21.4 MHz OUT connector is measured with the calibrated spectrum analyzer. The attenuation of the RF section is set to 0 dB and the amplitude is measured again. The first measurement is subtracted from the second to obtain the attenuator correction factor.

Spectrum Analyzer Attenuation Correction Factor

The RF section attenuator is set to 20 dB and the calibrated spectrum analyzer is set for a −20 dB reference level. The 21.4 MHz OUT is measured and the calibrated spectrum analyzer is set to 0 dB attenuation. The 21.4 MHz OUT amplitude is measured again. The first measurement is subtracted from the second to derive the calibrated spectrum analyzer attenuator correction factor. Since the residuals are measured at 0 dB attenuation, this process is required to keep the noise floor at a minimum. The program driver for the calibrated spectrum analyzer correction factor is not valid for 0 dB attenuation.

The full microwave source connected to the RF INPUT is turned off and the RF section attenuator is set to 0 dB. (The 0 dB attenuation is used because signals can get into the first section of the attenuator through the switching lines.) The reference level of the calibrated spectrum analyzer is set to −50 dBm.

The HP 70900A/B Local Oscillator is set to a frequency that will tune the RF section to the center frequency to be measured. The calibrated spectrum analyzer is used to measure the amplitude at the 21.4 MHz OUT. The attenuation correction factor of the calibrated spectrum analyzer is subtracted from this measurement. The result is corrected with the RF section flatness correction factor, the attenuator correction factor, and the module gain to yield the

residual response. This measurement is repeated for all miscellaneous residual frequencies of the RF section.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006

Adapters

Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672

Cables

BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

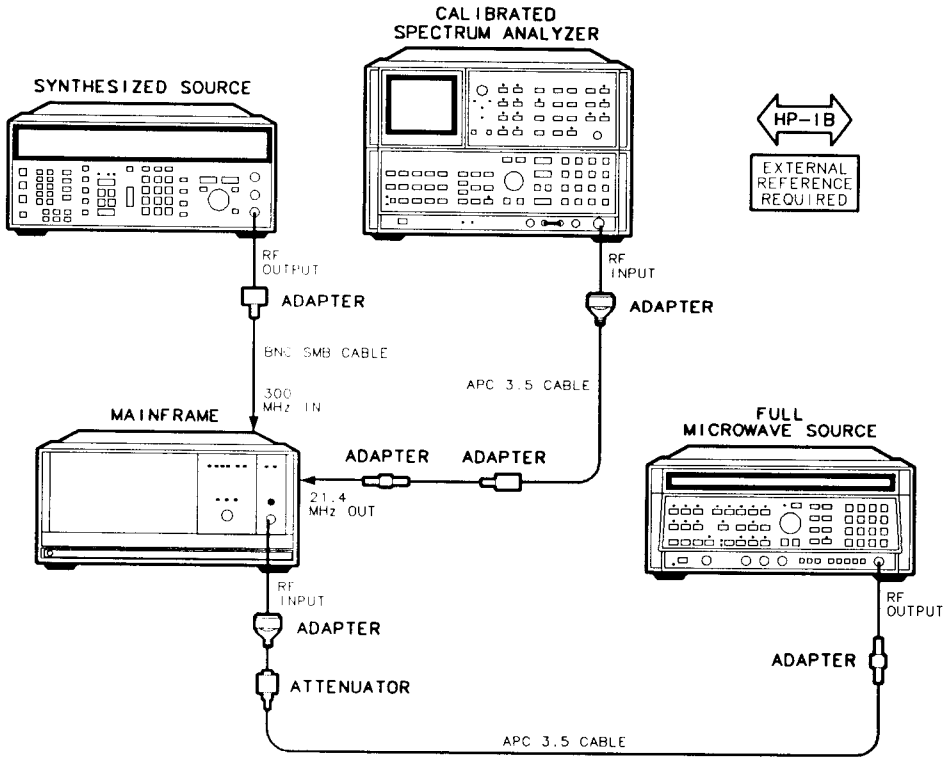


Figure 3-18. Miscellaneous Residual Responses Test Setup

17. 21.4 MHz IF Output Frequency Response

Purpose

This test measures the 21.4 MHz IF output passband response and verifies the RF section ±2.5 MHz flatness, with respect to the 21.4 MHz gain and the −3 dB bandwidth.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-19 for the test setup.

The full microwave source with the 6 dB attenuator connected is calibrated to provide −10 dBm at the RF input of the RF section.

As the RF input is maintained at a constant power and frequency, the LO input signal is stepped through a specified offset range. The 21.4 MHz IF output is measured at each increment with a power meter to determine the IF output response.

The 21.4 MHz IF output gain is determined by subtracting the measured RF input power level from the measured IF output power level. The frequency response of the 21.4 MHz IF output is relative to the 21.4 MHz gain. The gain is determined by subtracting the 21.4 MHz output measurement from the offset measurements. There is a stepped test limit for flatness with ±800 kHz flatness at ±0.15 dB, and ±2.5 MHz flatness at +0.4 and −0.5 dB.

The −3 dB bandwidth is determined by calculating the difference between the frequencies at the upper and lower −3 dB points.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A
Power Meter	HP 436A
Power Sensor	HP 8485A
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
Type N (f) to BNC (m)	1250-0077
APC 3.5 (f) to APC 3.5 (f)	5061-1749
BNC (f) to SMB (f)	1250-1236

Cables

BNC (m) to SMB (f) 85680-60093
APC 3.5 (m) to APC 3.5 (m) 8120-4921

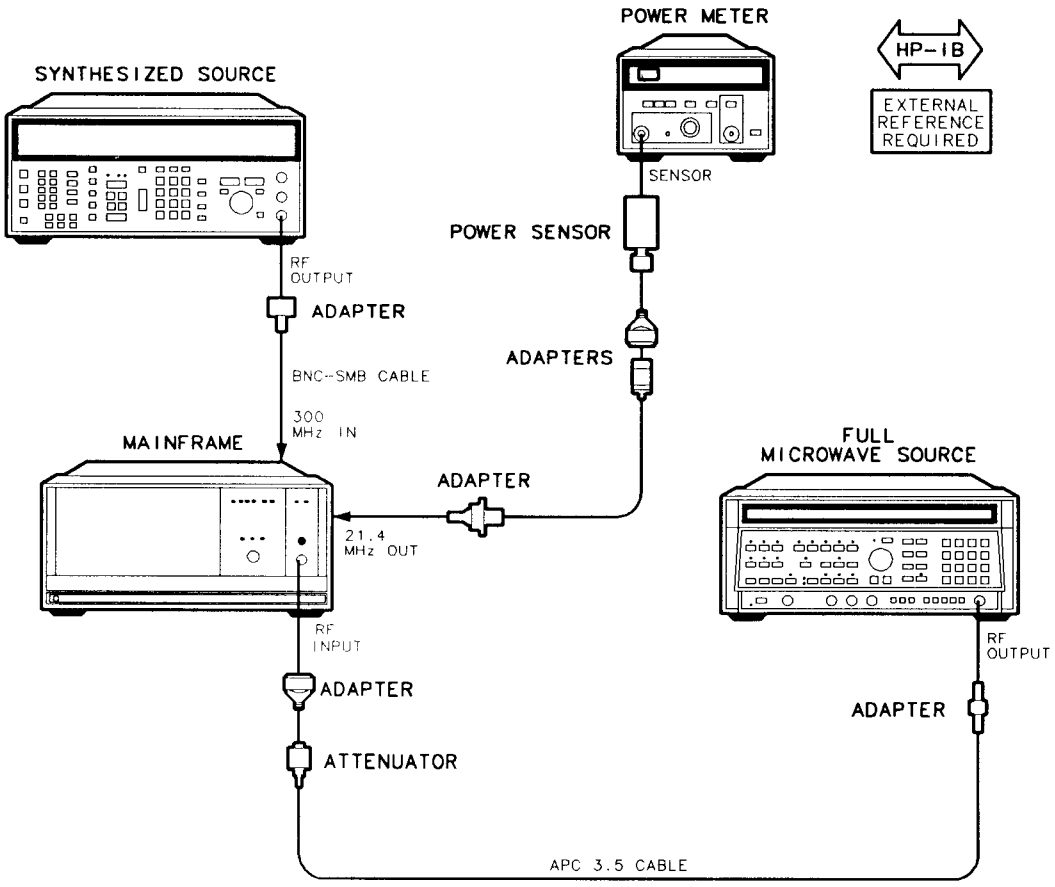


Figure 3-19. 21.4 MHz IF Output Frequency Response Test Setup

18. Gain Compression

Purpose

This test checks the gain compression of the RF section at a specified RF input power and frequency. This test does not fully characterize the gain compression of the module; it is only intended to verify that the module meets HP 70000 Module Measurement System specifications.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. Refer to Figure 3-20 for the test setup.

The output power of the RF section is initially checked to determine whether the system is working properly. Gain compression is tested at each measured point with the HP 70900A/B Local Oscillator or the microwave source set to the appropriate frequency for the corresponding RF input frequency. The full microwave source is set to the desired frequency at a −10 dBm power level. This input provides a calibrated RF input to the RF section at the nominal input level of the mixer. The IF output power is measured to determine the nominal gain of the RF section. The microwave source is set to 0 dBm and the IF output power is again measured. The gain compression is the difference between these two measurements adjusted by 10 dB of step attenuation. This measured difference is compared to test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A
Power Meter	HP 436A
Power Sensor	HP 8485A
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
Type N (f) to BNC (m)	1250-0077
APC 3.5 (f) to APC 3.5 (f)	5061-1749
BNC (f) to SMB (f)	1250-1236
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921

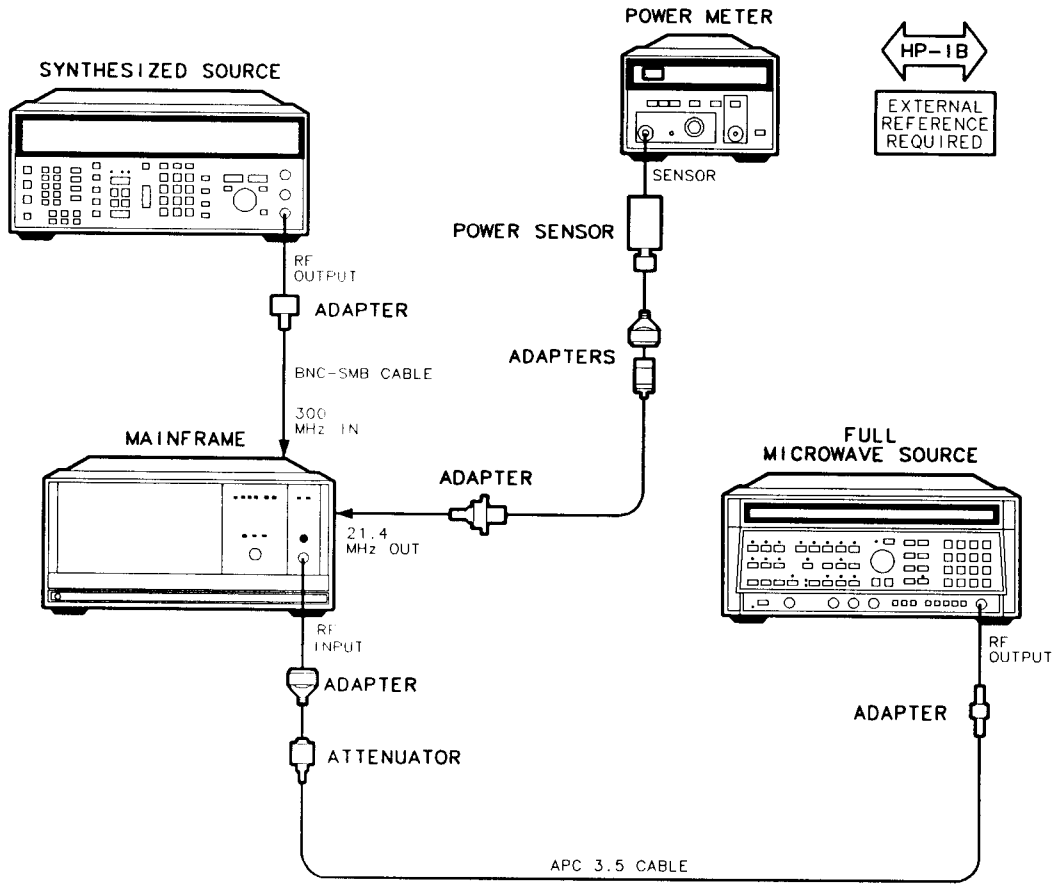


Figure 3-20. Gain Compression Test Setup

19. LO Input Amplitude Range

Purpose

This test measures the LO input amplitude range of the RF section. The LO leveling loop and the LO unleveled detector are exercised as well.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. A microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-21 for the test setup.

The LO input amplitude and frequency are set and the LO unleveled detector is monitored for several LO frequencies. (Since the leveling amplifier gain rolls off with frequency and periodic characteristics in frequency response due to standing waves caused by first converter mismatch, the amplitude and frequency must be reset as the LO unleveled detector is monitored.) The maximum LO input amplitude is not measured since this input level is typically beyond the range of most microwave sources.

The LO leveled status of the RF section is initially checked without an LO input. If the LO is unleveled, the test continues. The synthesized source is set to input a +8 dBm power level and the RF section is checked for an unleveled state. If the LO is leveled, the test continues.

The RF input from the synthesized source is turned off; then, at each LO frequency, it is set to an amplitude level of −0.6 dBm plus the CAL FACTOR of the synthesized source. The RF input is turned on and the RF section is checked for an unleveled condition. If a leveled condition exists, the test passes.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Microwave Source	HP 8340A/B
Isolator	0955-0204
Adapters	
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (m) to SMA (m)	1250-1159
Cables	
BNC (m) to SMB (f)	85680-60093
SMA (m) to SMA (m)	5061-5458

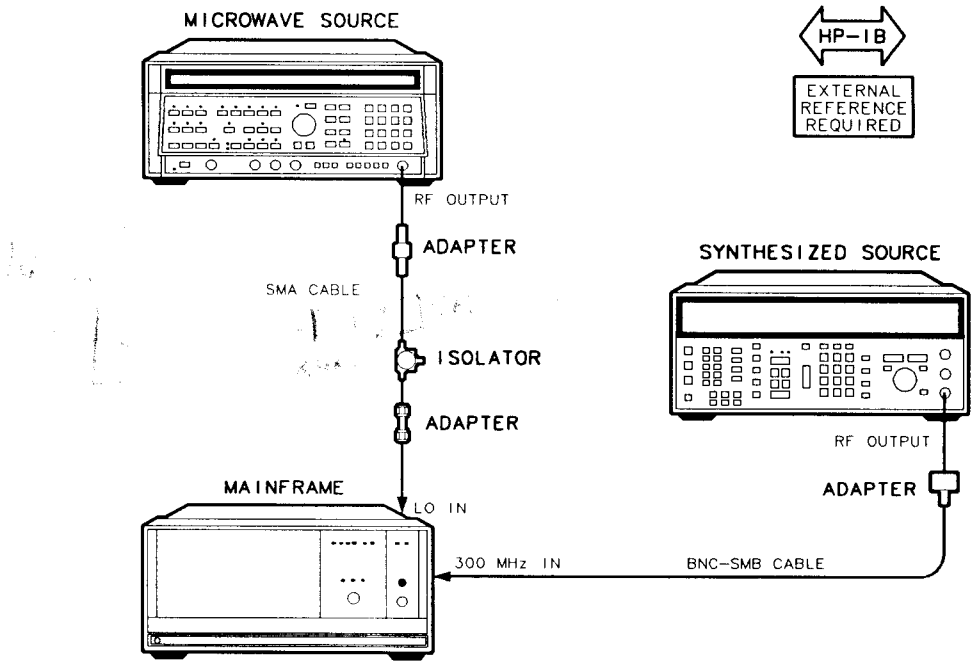


Figure 3-21. LO Input Amplitude Range Test Setup

20. Auxiliary LO Output Amplitude and Harmonics

Purpose

This test measures the fundamental absolute amplitude and second harmonic relative amplitude of the auxiliary LO output on the RF section. This measurement ensures that the leveling loop is adjusted and operating properly.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. The microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-22 for the equipment setup.

The fundamental amplitude is measured using the power meter and power sensor. The calibrated spectrum analyzer is then connected to the LO output and the power of the second harmonic is measured. The results are compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
Power Meter	HP 436A
Power Sensor	HP 8485A
Isolator	0955-0204
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (m) to APC 3.5 (m)	1250-1748
APC 3.5 (f) to APC 3.5 (f) *(2 required)*	1250-1749
SMA (m) to SMA (m)	1250-1159
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921
SMA (m) to SMA (m)	5061-5458

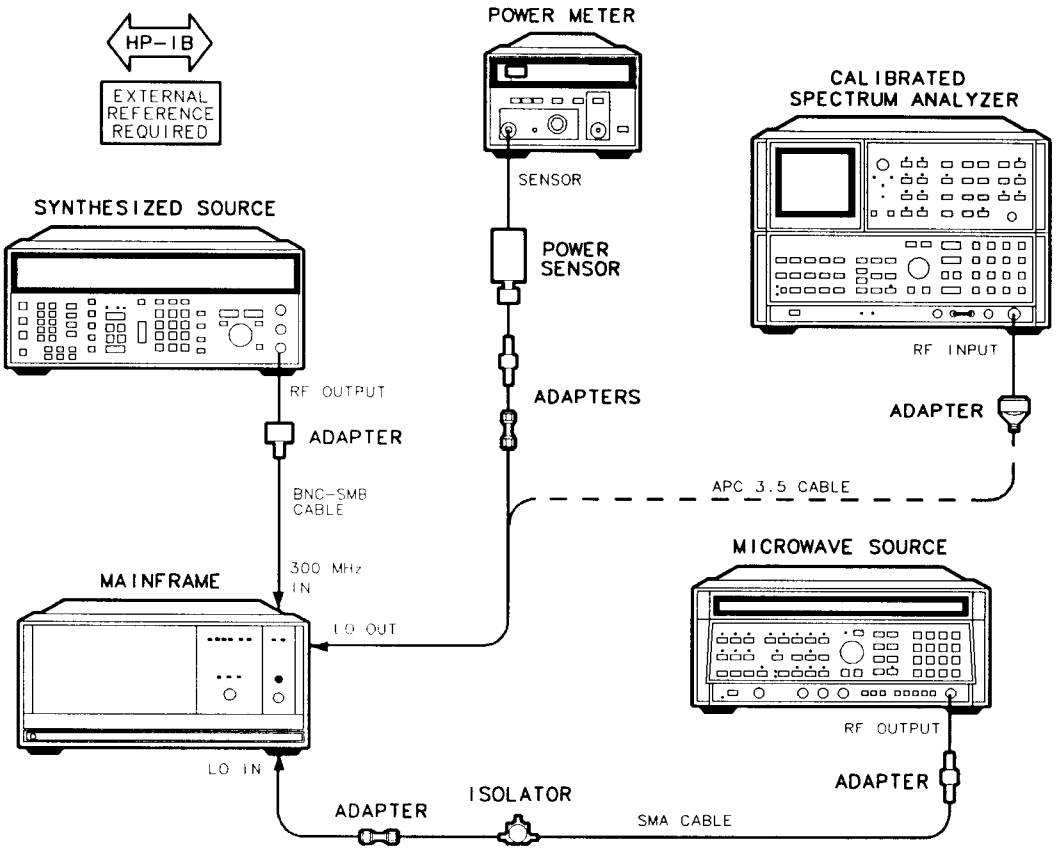


Figure 3-22. Auxiliary LO Output Amplitude and Harmonics Test Setup

21. Diagnostics

Purpose

This test exercises the *1st LO unleveled, 2nd converter unlocked,* and *IF level detector* diagnostic functions to determine the proper operation of their associated detector circuits and microprocessor. The trigger level of the 21.4 MHz detector is determined as well.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-23 for the test setup.

Specific states are set up to determine whether the RF section diagnostic detectors are functioning properly. This is accomplished by checking the diagnostic detector byte status in the various states that are listed below.

State 1: Use no LO input, no reference input, and no RF input to check the detectors of the *1st LO unleveled, 2nd converter unlocked,* and the *IF level for no signal.*

State 2: Use no LO and no RF input. Set the synthesized source to 300 MHz at 0 dBm and connect it to the RF section 300 MHz IN. The detectors of the *1st LO unleveled,* the *2nd converter unlocked,* and the *IF level detector no-signal* state are checked.

State 3: Use no RF and no 300 MHz reference inputs. The detectors of the *1st LO unleveled, 2nd converter unlocked,* and the *IF level detector no-signal* state are checked.

State 4: Use no RF input signal. The LO signal remains connected, the synthesized source frequency is set to 300 MHz at 0 dBm and connected to the 300 MHz IN on the RF section. The detectors of the *1st LO unleveled, 2nd converter unlocked,* and *IF level detector no-signal* state are checked.

State 5: The LO input source and the 300 MHz reference input are both left connected. The full microwave source is set to 300 MHz at −4 dBm and connected to the RF INPUT of the RF section. The detectors of the *1st LO unleveled, 2nd converter unlocked,* and *IF level detector no-signal* state are checked.

IF Level Detector Threshold

The RF input signal amplitude from the full microwave source is set to −12.5 dBm. As the diagnostic detector of the IF level bit is monitored, the RF input amplitude is increased until the detector bit goes low. The low state indicates that the IF level is within test limits. The 21.4 MHz OUT amplitude is measured with the calibrated spectrum analyzer to determine whether the IF level detector trigger is less than −7.6 dBm.

The full microwave source RF input signal is increased 3.5 dB above the RF input amplitude that caused the IF level bit to go low. As the diagnostic detector of the IF level bit is monitored, the RF input amplitude is decreased until the IF level detector bit goes high. The high state indicates that the IF level is beyond test limits. The 21.4 MHz OUT amplitude is

measured with the calibrated spectrum analyzer to determine whether the IF level detector trigger is greater than −12.4 dBm.

The IF Level Detector threshold has been refined with a change to A3Q1, A3R53, and A3R49. Some instruments with serial prefixes 2818A and below may have different components for these parts.

The IF Level Detector threshold can be set by changing factory-select resistor A3R49. A 20% change in the value of A3R49 causes a change in the threshold of approximately 1.1 dB. Increasing the value of A3R49 will move the threshold to a lower power. An input of −10 dBm should be the nominal power level.

Equipment

Test Equipment	**Preferred HP Model or Part Number**
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Calibrated Spectrum Analyzer	HP 8566B
6 dB Attenuator	HP 8493C, Option 006
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921

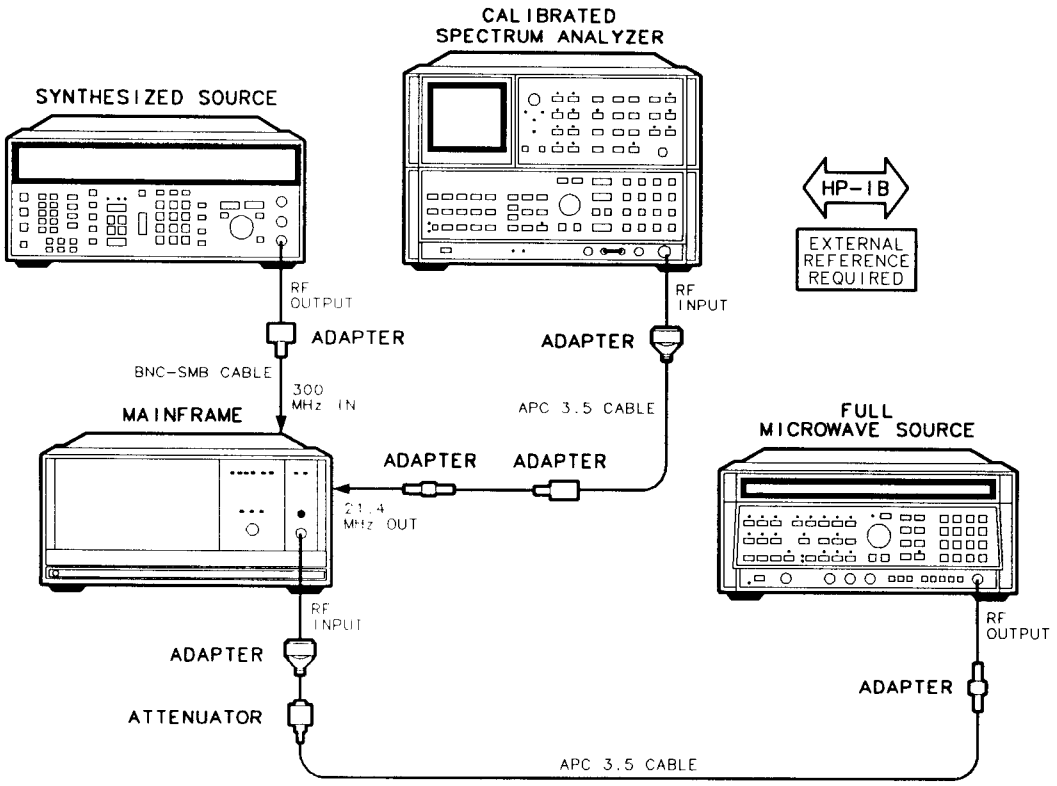


Figure 3-23. Diagnostics Test Setup

22. RF Input Emissions

Purpose

This test measures the LO emissions from the RF Input connector.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, full microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-24 for the test setup.

The RF section band is selected and the LO input power level is set to +8 dBm. The power level is then stepped from 3600 MHz to 6560 MHz. At each of the LO input frequencies, one harmonic is measured with the calibrated spectrum analyzer. The resulting emissions are compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Calibrated Spectrum Analyzer	HP 8566B
Adapters	
Type N (m) to APC 3.5 (f) *(2 required)*	1250-1744
Type N (m) to BNC (f)	1250-0780
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921

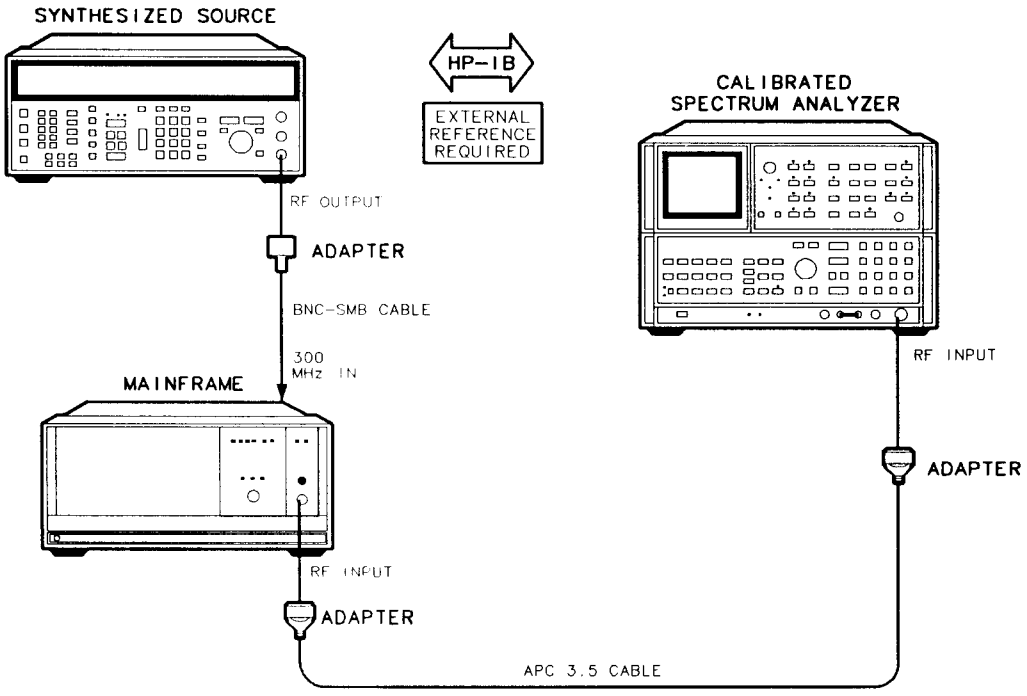


Figure 3-24. RF Input Emissions Test Setup

23. RF Input Return Loss

Purpose

This test measures the return loss of the RF INPUT. All adjustments and calibrations must be completed prior to running this test. The network analyzer calibration must also be current.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-25 for the test setup.

The frequency of the full microwave source is stepped in 60 increments from 10 MHz to 2900 MHz at a power level of 6 dBm. The network analyzer measures the B/R amplitude and return loss is calculated by subtracting calibration data related to the 60 amplitude measurements from the measured data.

The above process is repeated with the RF section attenuation at 10 dB. The test results at both attenuation settings are compared with test limits.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Full Microwave Source	HP 8340A/B
Scalar Network Analyzer	HP 8757A
Detector	HP 11664E
Microwave Directional Bridge	HP 85027B
Power Splitter	HP 11667B
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f)	1250-0780
APC 3.5 (m) to APC 3.5 (m)	1250-1748
APC 3.5 (f) to APC 3.5 (f)	1250-1749
APC 3.5 (m) to APC 3.5 (f)	85027-60003
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921
BNC (m) to BNC (m) *(4 required)*	10503A

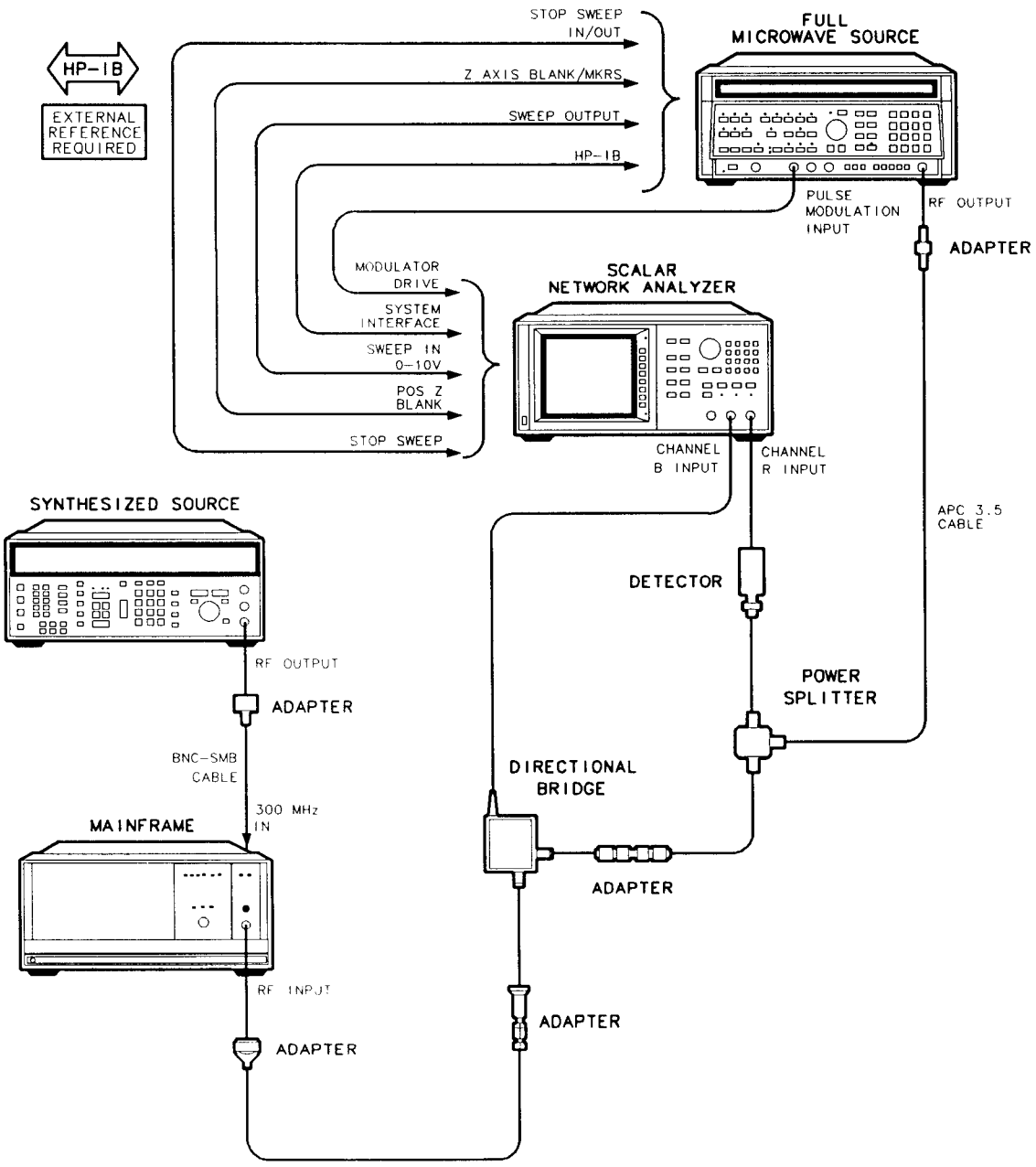


Figure 3-25. RF Input Return Loss Test Setup

24. RF Noise Figure

Purpose

This test measures the RF section noise figure. The noise figure is an indicator of the excess noise and the noise gain produced by the RF section at a particular RF frequency. This noise figure relates directly to the overall displayed average noise level of the HP 70000 Modular Measurement System. The minimum level of displayed noise for the system is determined by the combined effect of noise due to RF section and IF section operation, plus digital correction terms for gain.

LO feedthrough and spectral impurities at frequencies <10 MHz can cause the minimum displayed noise level to increase. This figure must be combined with the noise level of the module to determine system specifications. LO feedthrough and spectral impurities are not measured in this test or included in the RF section noise figure limit.

The test setup is verified with an initial check. This check determines if the insertion gain and noise figure are roughly within limits, and whether the system calibration is current.

This is a final test.

Description

The RF section may be tested as it is configured in the system, or removed from the mainframe and connected to the module service extender. If an HP 70900A/B LO is not used for the local oscillator signal, the microwave source must be connected to provide the LO input signal to the RF section. See Figure 3-26 for the test setup.

This test measures the noise figure of the RF section as a function of frequency. The measurement is compared with test limits to ensure that the RF section noise level is not excessive.

Equipment

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Noise Figure Meter	HP 8970A/B
Noise Source	HP 346A/B/C
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f) *(2 required)*	1250-0780
Cables	
BNC (m) to BNC (m)	10503A
BNC (m) to SMB (f) *(2 required)*	85680-60093

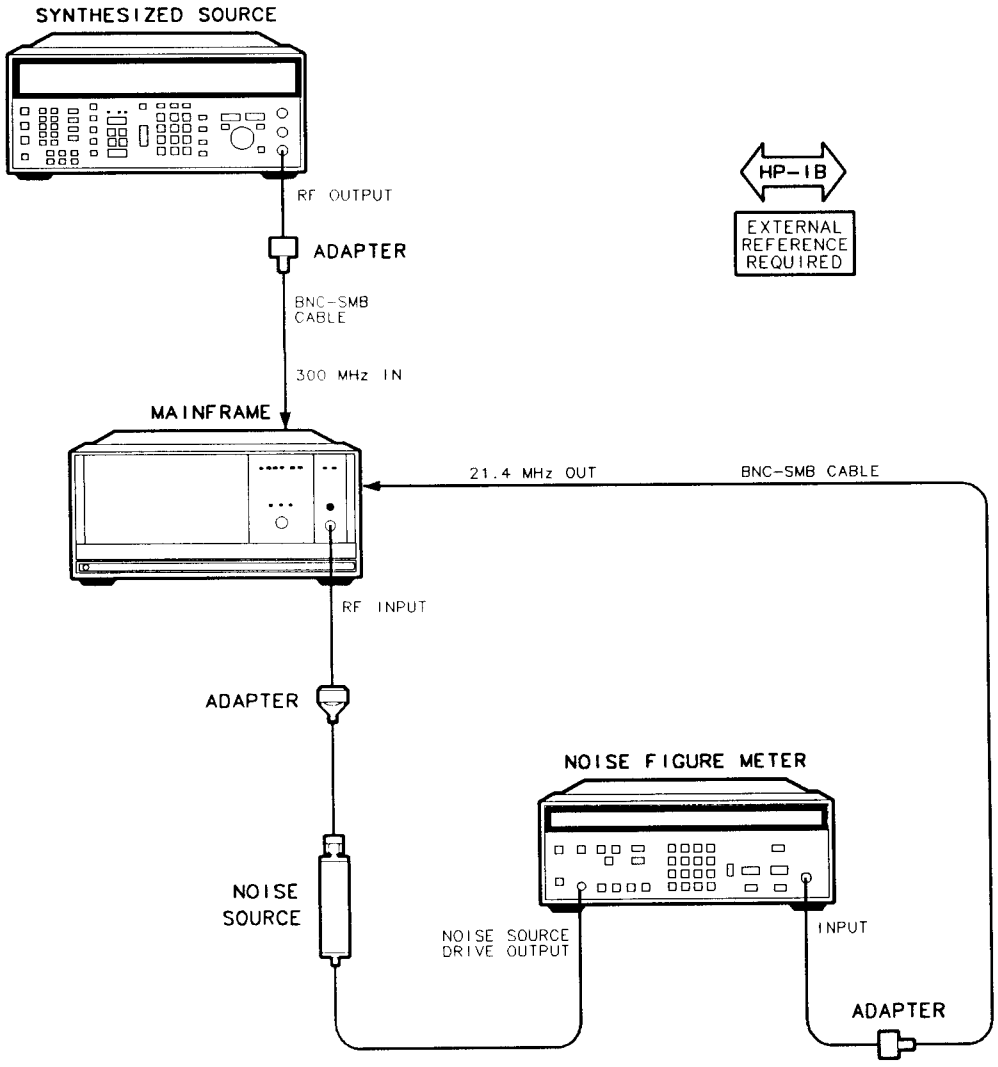


Figure 3-26. RF Noise Figure Test Setup

Calibration Routines

The following routines are used to calibrate test equipment required for verification tests.

- Spectrum Analyzer Calibration
- Flatness $\geq$10 MHz Calibration
- Noise Figure Calibration
- RF SYN Calibration
- LO SYN or LO SRC Calibration
- IF SYN Calibration

Spectrum Analyzer Calibration

This routine calibrates the IF and RF sections of the spectrum analyzer for corrected measurements. The level generator and power meter establish an amplitude reference. The level generator's attenuators and ALC loop are used over their dynamic ranges. Bandwidth, logging, and gain errors are measured, stored, and used as correction factors during verification test measurements. The RF frequency response from 10 MHz to 22.4 GHz is measured with a power meter in steps of approximately 40 MHz. The data is stored on the Operating Volume disk and is valid for eight days. Repeat the calibration routines after eight days.

Equipment

Test Equipment	Preferred HP Model or Part Number
Full Microwave Source	HP 8340A/B
Spectrum Analyzer	HP 8566B
Power Meter	HP 436A
Power Sensor	HP 8485A
Synthesizer/Level Generator	HP 3335A
Power Splitter	HP 11667B
Adapters	
APC 3.5 (f) to APC 3.5 (f)	1250-1749
APC 3.5 (f) to Type N (m)	1250-1744
SMA (m) to BNC (m)	1250-1200
Cables	
APC 3.5 (m) to APC 3.5 (m) *(2 required)*	8120-4921
BNC (m) to BNC (m)	HP 10503A

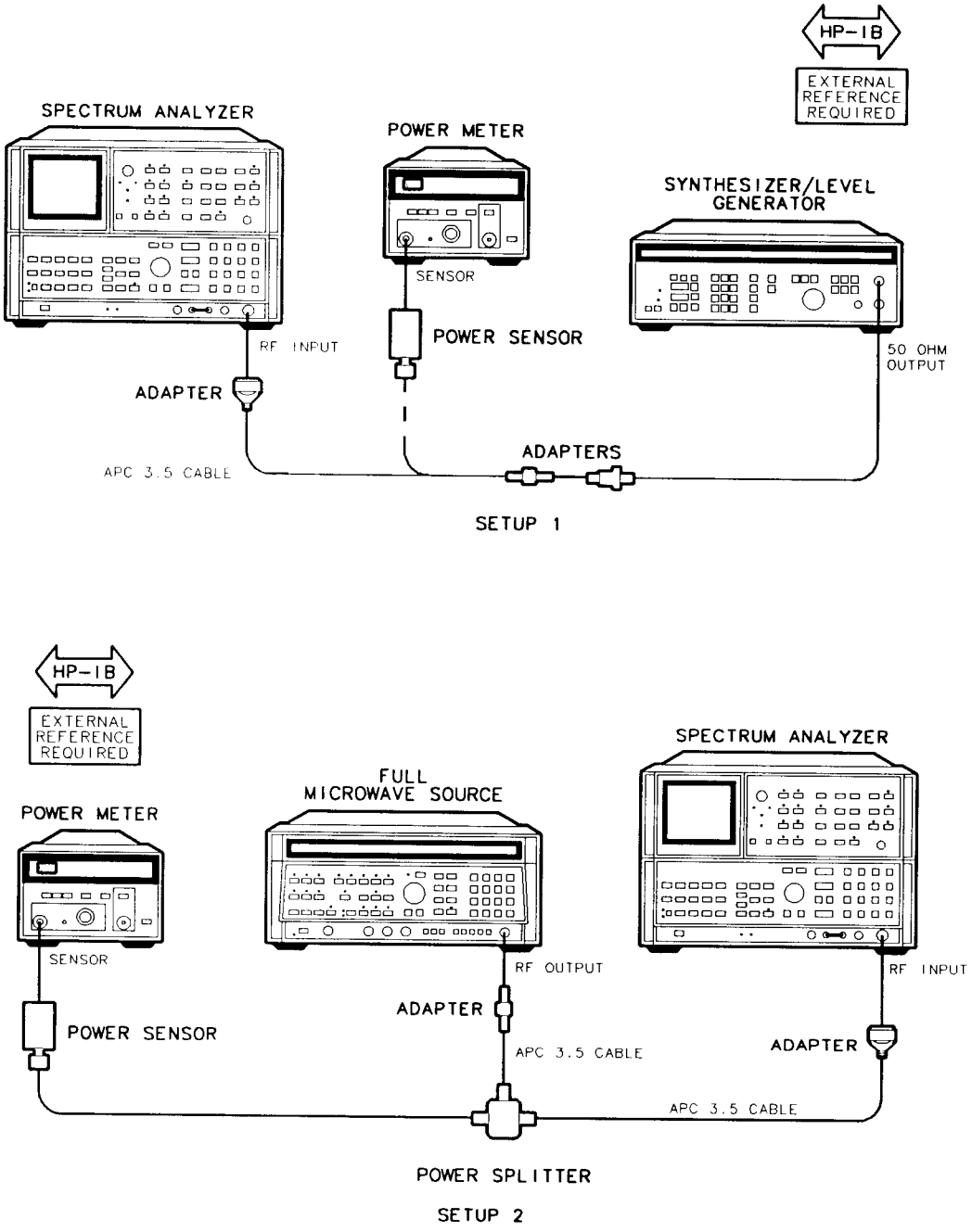


Figure 3-27. Spectrum Analyzer Calibration Setup

Flatness ≥10 MHz Calibration

This routine calibrates the microwave network analyzer for corrected frequency response measurements. It is required to run the flatness tests.

Equipment

Test Equipment	Preferred HP Model or Part Number
Scalar Network Analyzer	HP 8757A
Power Meter	HP 436A
Power Sensor	HP 8485A
Full Microwave Source	HP 8340A/B
Detector *(2 required)*	HP 11664E
Power Splitter	HP 11667B

Adapter

APC 3.5 (f) to APC 3.5 (f)	1250-1749

Cables

APC 3.5 (m) to APC 3.5 (m)	8120-4921
BNC (m) to BNC (m) *(4 required)*	HP 10503A

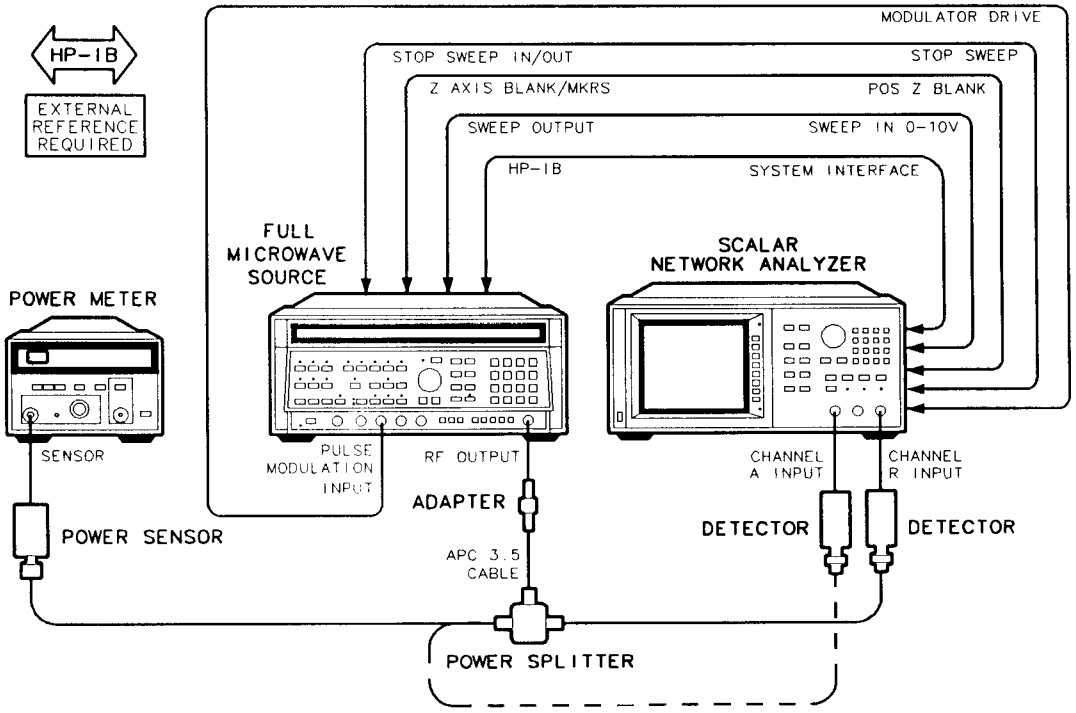


Figure 3-28. Flatness ≥10 MHz Calibration Setup

Noise Figure Calibration

This routine calibrates the noise figure meter and the input cable with the Noise Source. This calibration is required for the RF Noise Figure test.

The noise figure meter noise-source drive output connects to the 28 V dc bias input of the excess noise source. The output of the noise source connects to the input of the noise figure meter.

Equipment

Test Equipment	Preferred HP Model or Part Number
Noise Figure Meter	HP 8970A/B
Noise Source	HP 346A/B/C
Adapters	
Type N (m) to BNC (f)	1250-0780
SMA (f) to SMB (m)	1250-0674
Cables	
BNC (m) to BNC (m)	HP 10503A
BNC (m) to SMB (f)	85680-60093

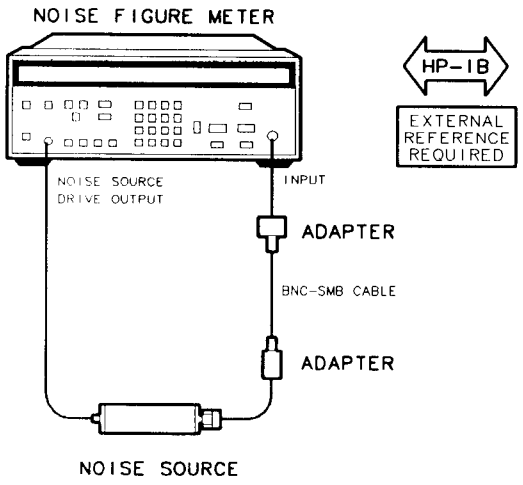


Figure 3-29. Noise Figure Calibration Setup

RF SYN Calibration

This routine amplitude-calibrates the full microwave source, cable assembly, and 6 dB attenuator for use as the microwave input signal. The calibration is from 10 MHz to 22 GHz for −5 dBm at the power sensor.

Equipment

Test Equipment	Preferred HP Model or Part Number
Power Meter	HP 436A
Power Sensor	HP 8485A
Full Microwave Source	HP 8340A/B
6 dB Attenuator	HP 8493C, Option 006
Adapter	
APC 3.5 (f) to APC 3.5 (f) *(2 required)*	1250-1749
Cable	
APC 3.5 (m) to APC 3.5 (m)	8120-4921

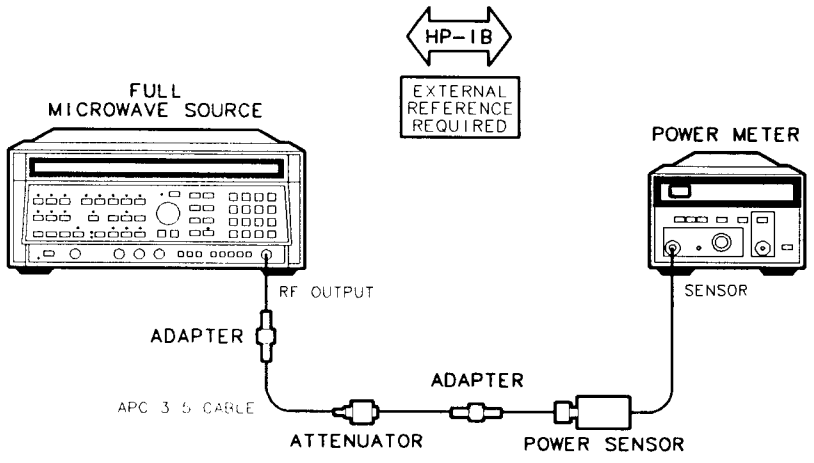


Figure 3-30. RF SYN Calibration Setup

LO SYN or LO SRC Calibration

This routine is used to amplitude-calibrate the microwave source for use as a local oscillator substitute. The calibration range is from 3 to 6.6 GHz at about +8 dBm. The HP 70900A/B Local Oscillator must be included in the overall test setup. It is used to provide HP-MSIB communication for the RF section under test. This calibration is required for LO leveling amplifier tests.

Equipment

Test Equipment	Preferred HP Model or Part Number
Microwave Source	HP 8340A/B
Power Meter	HP 436A
Power Sensor	HP 8485A
Isolator	0955-0204
Adapter	
APC 3.5 (f) to APC 3.5 (f)	1250-1749
Cable	
SMA (m) to SMA (m)	5061-5458

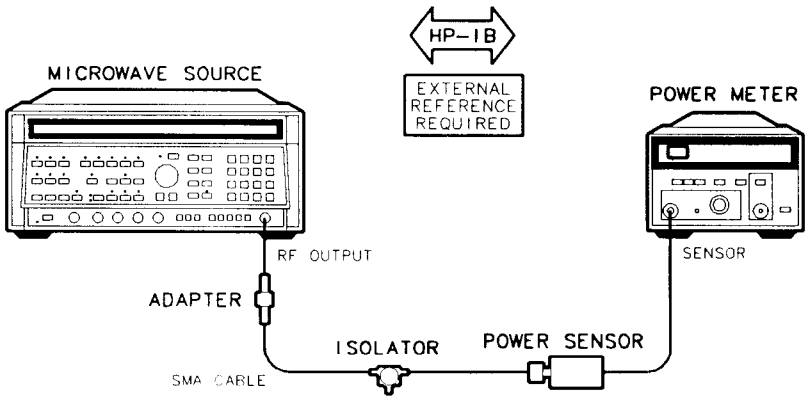


Figure 3-31. LO SYN or LO SRC Calibration Setup

IF SYN Calibration

This routine is for amplitude calibration of the synthesized source. It calibrates the 300 MHz output between ±5 dBm. It is required for all test setups.

Equipment

Test Equipment	Preferred HP Model or Part Number
Power Meter	HP 436A
Power Sensor	HP 8485A
Synthesized Source	HP 8662A/8663A
Adapters	
Type N (f) to BNC (f)	1250-0780
SMA (f) to SMB (m)	1250-0674
Cable	
BNC (m) to SMB (f)	85680-60093

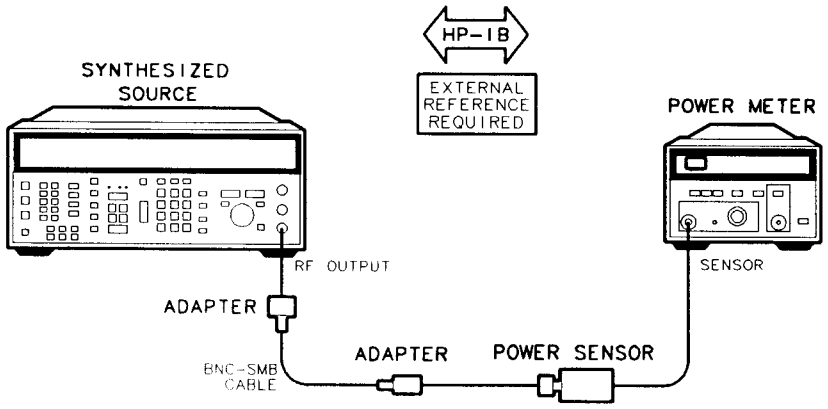


Figure 3-32. IF SYN Calibration Setup

4

Adjustment Procedures

Introduction

The adjustment procedures are used to optimize performance after any repairs have been made to the module. The adjustment software programs prompt the user to make appropriate adjustments. Refer to Chapter 2, "Verification Software," for information about running the software.

Contents

The adjustments with their corresponding page numbers are listed below.

Related Adjustments

Note Before performing any adjustments, allow the module to warm up for at least 30 minutes.

Table 5-1, Related Adjustments and Performance Tests, lists the adjustment procedures and performance tests that need to be performed whenever an assembly is changed or repaired. Perform these adjustments to ensure proper module operation.

Adjustable Components

Adjustable components are listed in Table 4-1 by reference designator and name. The adjustment procedure number and name is also included.

Recommended Test Equipment

Table 1-4, Recommended Test Equipment, lists test equipment and accessories required to perform the adjustment procedures. Any equipment that satisfies the critical specifications given in the table may be substituted for the preferred test equipment. Module Verification Software contains only the drivers for equipment listed in the table. Additional drivers have to be written by the user to support substituted test equipment.

Refer to Figure 3-1, Overall Test Setup, for the standard test setup. The HP 9000 Series 200/300 controller for the standard test setup is illustrated in the Overall Test Setup. The HP 9000 Series 200/300 controller is illustrated in the Overall Test Setup, but is not shown in each adjustment and check illustration.

Adjustment Equipment

Service accessories and electrostatic discharge (ESD) accessories are listed in Chapter 1. For adjustments that require a nonmetallic tuning tool, use the fiber tuning tool, HP part number 8170-0033. Never try to force an adjustable component in the module. This is especially critical when tuning slug-tuned inductors or variable capacitors.

Caution

To avoid blowing the mainframe line fuse or any module fuse, the mainframe line power must be off before connecting or disconnecting the module service extender cable.

Preparing for Adjustments

1. With the mainframe line switch OFF, remove the HP 70904A RF Section.
2. Install the module service extender and connect the extender cable to the RF section.
3. Connect the equipment as illustrates in the appropriate test setup, then set the mainframe line switch to ON.

Note

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

4. Load and run the appropriate adjustment routine. Refer to Chapter 2, "Verification Software," for information about related to loading the software or getting the adjustment routines underway.

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.

External Frequency Reference

Some adjustment procedures require an external frequency reference. This is indicated by the external reference symbol on the test setup drawing. Equipment such as sources, analyzers, and frequency counters must be connected to the same frequency standard. The device under test (DUT) must also be connected to this frequency standard.

Refer to "External Frequency Reference" in Chapter 1 for more information. Figure 1-7 illustrates the preferred frequency reference connections. In all cases, the specified aging rate requirement is $<10^{-9}$/day. The microwave source, synthesized source, and calibrated spectrum analyzer listed in Table 1-4 have internal time bases that meet the aging rate requirement.

Table 4-1. Adjustable Components

Adjustment	Adjustment Name	Adjustment Test
A1R15	LO Sense	3. LO Leveling Amplifier
A1R24	Gate Bias	3. LO Leveling Amplifier
A2R6	Sampler Offset	4. VCO Tune-Line Voltage
		9. Search Oscillator Duty Cycle and Period
A2R7	Tune Range	4. VCO Tune-Line Voltage
		11. Search Oscillator Tune-Line Peak
		13,17. VCO Tune Range
A3C10	Last Converter Tuning	18. Last Converter Bandpass Filter Tune
A3C11	Last Converter Tuning	18. Last Converter Bandpass Filter Tune
A3C12	Last Converter Tuning	18. Last Converter Bandpass Filter Tune
A3C13	Last Converter Tuning	18. Last Converter Bandpass Filter Tune
A6L1	2nd Converter Tuning	16. Second Converter Bandpass Filter Tune
IF ADJ1	2nd Converter Tuning	16. Second Converter Bandpass Filter Tune
IF ADJ2	2nd Converter Tuning	16. Second Converter Bandpass Filter Tune
IF ADJ3	2nd Converter Tuning	16. Second Converter Bandpass Filter Tune
LO ADJ	LO Adjust Tuning	5. VCO Frequency and Amplitude Adjust
		13,17. VCO Tune Range Adjustment
2ND LO OUT SMA	LO Output Power	5. VCO Frequency and Amplitude Adjust

1. Power Supply/Controller Check

Purpose

This routine measures the voltages of the A4 Power Supply/Controller board assembly.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The digital voltmeter (DVM) is connected to A4TP1-1 through A4TP1-6 and ground on A4TP2-10. The measured voltages are compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A
Precision DVM	HP 3456A
Accessories	
Module Service Extender	70001-60013
Adapters	
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to BNC (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as illustrated in Figure 4-1. Load and run the Power Supply/Controller Check routine. Make the checks as defined by the computer. Figure 4-2 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

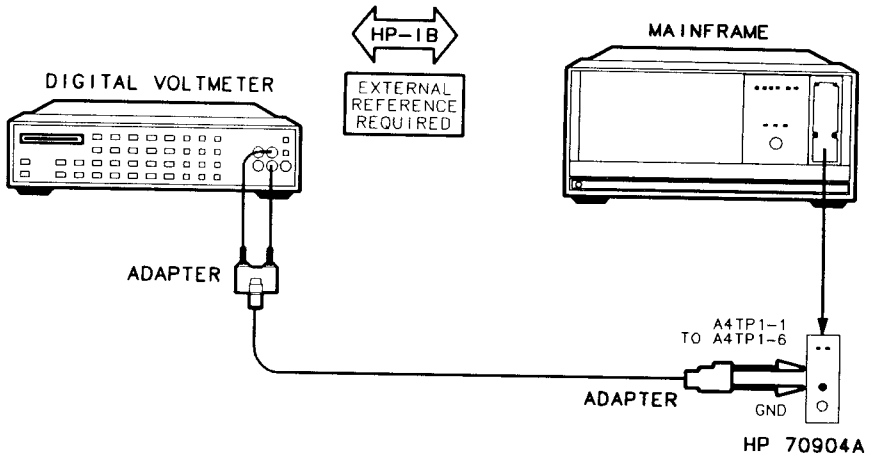


Figure 4-1. Power Supply/Controller Check Test Setup

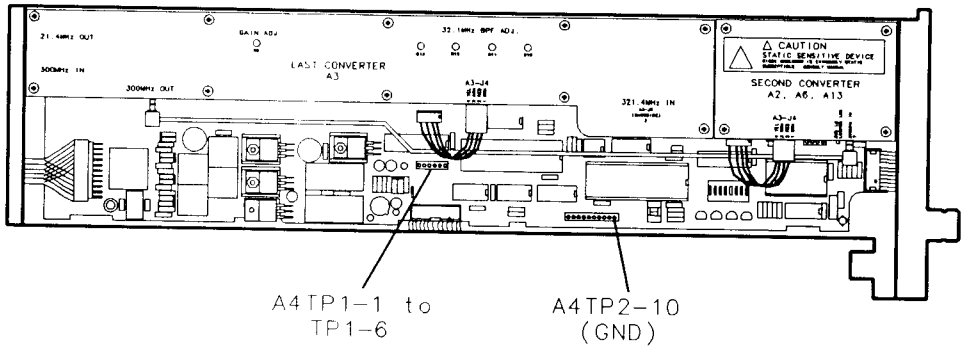


Figure 4-2. Power Supply/Controller Check

2. Miscellaneous Bias Voltage Check

Purpose

This routine measures the dc voltages at A1TP1 on the A1 Miscellaneous Bias board assembly. The gate bias and LO sense voltages are not measured.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to each of the following test points, one at a time: `A1TP1-1`, `A1TP1-2`, `A1TP1-4`, `A1TP1-6`. Use the RF module center body for chassis ground. At each test point, a DVM reading is taken and the results are compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Accessories	
Module Service Extender	70001-60013
Adapters	
BNC (f) to Dual Banana	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to BNC (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-3. Load and run the Miscellaneous Bias Voltage Check routine. Make the checks as defined by the computer. Figure 4-4 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

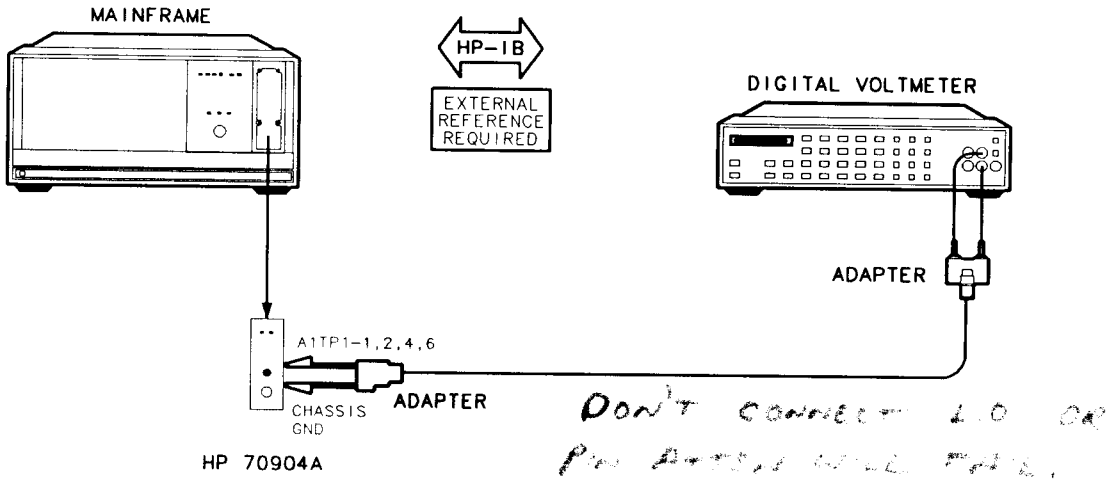


Figure 4-3. Miscellaneous Bias Voltage Check Test Setup

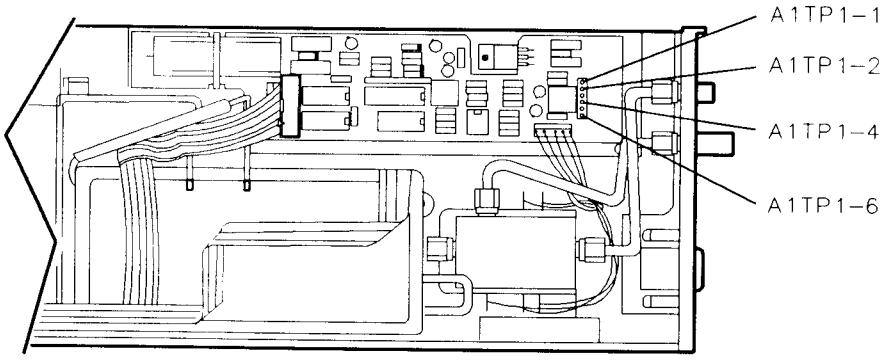


Figure 4-4. Miscellaneous Bias Voltage Check Locations

3. LO Leveling Amplifier Adjustment

Purpose

This routine allows adjustment of the gate bias voltage and LO sense error voltage to values equal to those stamped onto the A12 Leveling Amplifier label.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

With the DVM connected to A1TP1-3, the gate bias is adjusted using A1R24 for a voltage level within ±0.0044 V of the GATE BIAS voltage stamped on the A12 Leveling Amplifier label. (The DVM is set to the 100 V range to provide lower input resistance, which allows probe cable capacitance to drain off quickly.) Use the RF module center body for chassis ground.

The microwave source is set to 5 GHz at +8 dBm, the DVM is connected to LO sense at A1TP1-5. The LO sense offset voltage is adjusted using A1R15 for a value within ±0.0044 V of the voltage labeled LO SENSE on the A12 Leveling Amplifier label.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Microwave Source	HP 8340A/B
Accessories	
Isolator	0955-0204
Module Service Extender	70001-60013
Adapters	
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (m) to SMA (m)	1250-1159
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to BNC (m)	HP 10503A
SMA (m) to SMA (m)	5061-5458

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-5. Load and run the LO Leveling Amplifier Adjustment routine. Make the adjustments as defined by the computer. Figure 4-6 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

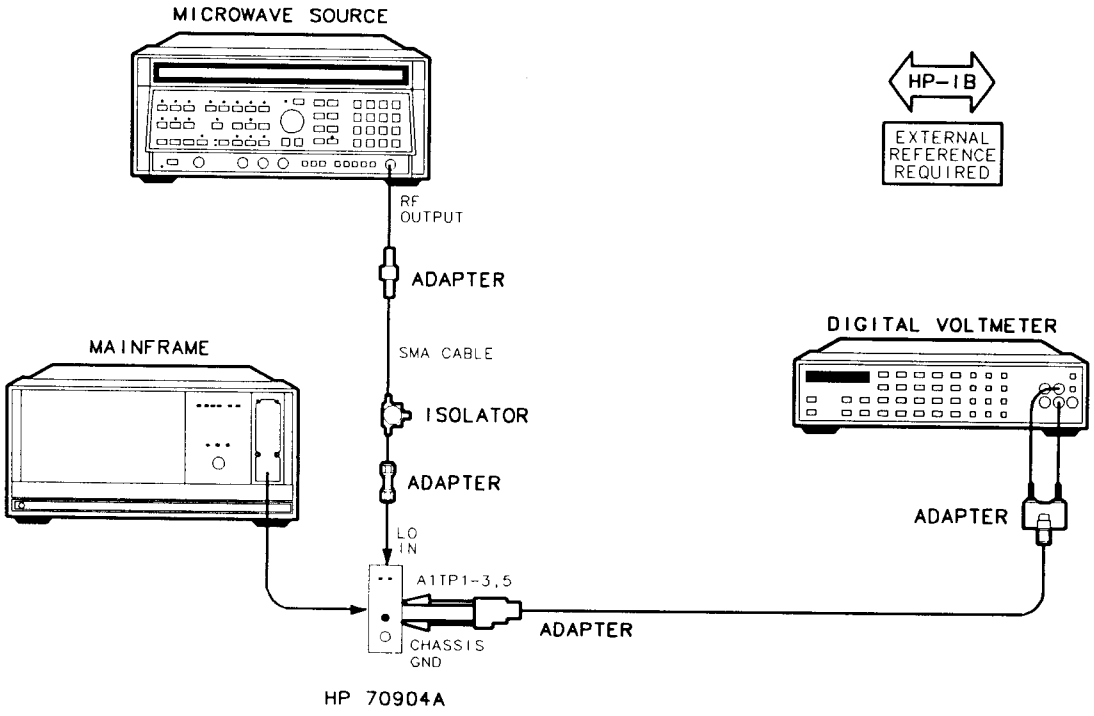


Figure 4-5. LO Leveling Amplifier Adjustment Test Setup

3. LO Leveling Amplifier Adjustment

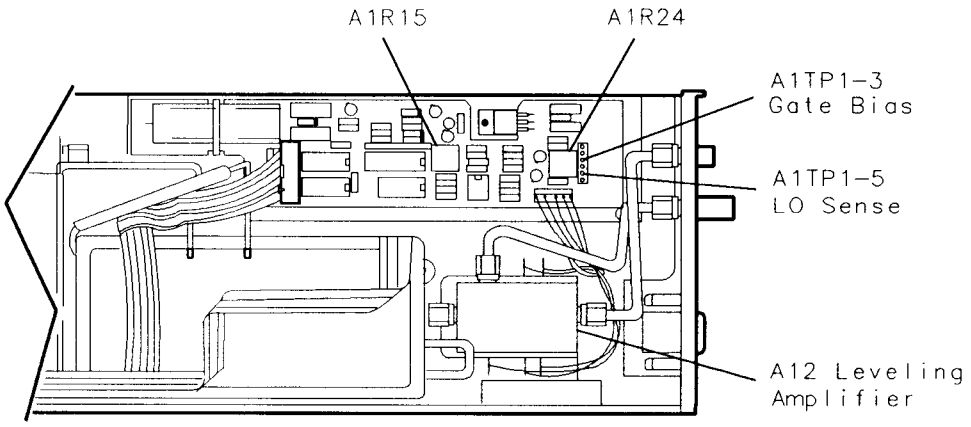


Figure 4-6. LO Leveling Amplifier Adjustment Locations

4. VCO Tune-Line Voltage Adjustment

Purpose

This routine permits the adjustment of the VCO tune-line voltage in the RF section. This adjustment sets the open loop, varactor-diode bias to a known level so that the remaining second LO adjustments can be made.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the VCO TUNE-Line at A2J4-1. (The DVM is set to the 100 V range to provide lower input resistance, which allows probe cable capacitance to drain off quickly.)

The operator is prompted to adjust A2R6 Sampler Offset fully clockwise, then A2R7 Tune Range is adjusted for a value between −4.524 V and −5.476 V.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Accessories	
Module Service Extender	70001-60013
Adapters	
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to BNC (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-7. Load and run the VCO Tune-Line Voltage Adjustment routine. Make the adjustments as defined by the computer. Figure 4-8 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

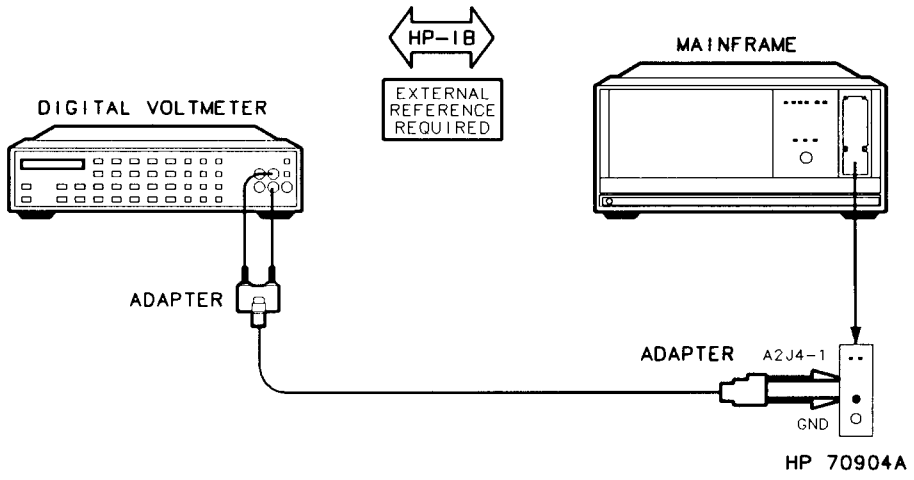


Figure 4-7. VCO Tune-Line Voltage Adjustment Test Setup

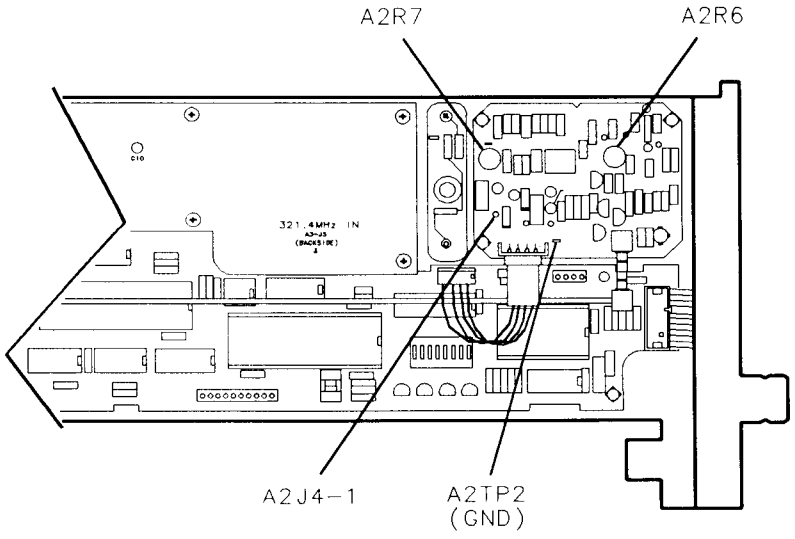


Figure 4-8. VCO Tune-Line Voltage Adjustment Locations

5. VCO Frequency and Amplitude Adjustment

Purpose

This routine permits the adjustment of the VCO second LO frequency and amplitude. Adjustment 4, "VCO Tune-Line Voltage Adjustment," must be completed prior to making these adjustments.

Description

The spectrum analyzer is connected to the 2ND LO OUT connector of the Second Converter Bandpass Filter and LO Cavity (setup 1). The operator is instructed to loosen the locknut, then adjust the LO ADJ tuning screw to obtain a frequency 3300 MHz ±1 MHz on the spectrum analyzer. Once the frequency is adjusted, the LO ADJ locknut is tightened.

The spectrum analyzer is removed from the 2ND LO OUT connector and replaced with the power sensor from the power meter (setup 2). The lock screw and locknut to the 2ND LO OUT SMA connector of the cavity are loosened. The 2ND LO OUT SMA connector is then adjusted in or out to obtain an amplitude between −8.5 dBm and −7.0 dBm. Once the amplitude is set, the lock screw and locknut are tightened.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Spectrum Analyzer	HP 8566B
Synthesized Source	HP 8662A/HP8663A
Power Meter	HP 436A
Power Sensor	HP 8485A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to BNC (f)	1250-0780
SMA (m) to SMA (f)*right angle*	1250-1249
Cables	
APC 3.5 (m) to APC 3.5 (m)	8120-4921
BNC (m) to SMB (f)	85680-60093

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-9. Load and run the VCO Frequency and Amplitude Adjustment routine. Make the adjustments as defined by the computer. Figure 4-10 illustrates the adjustment location. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

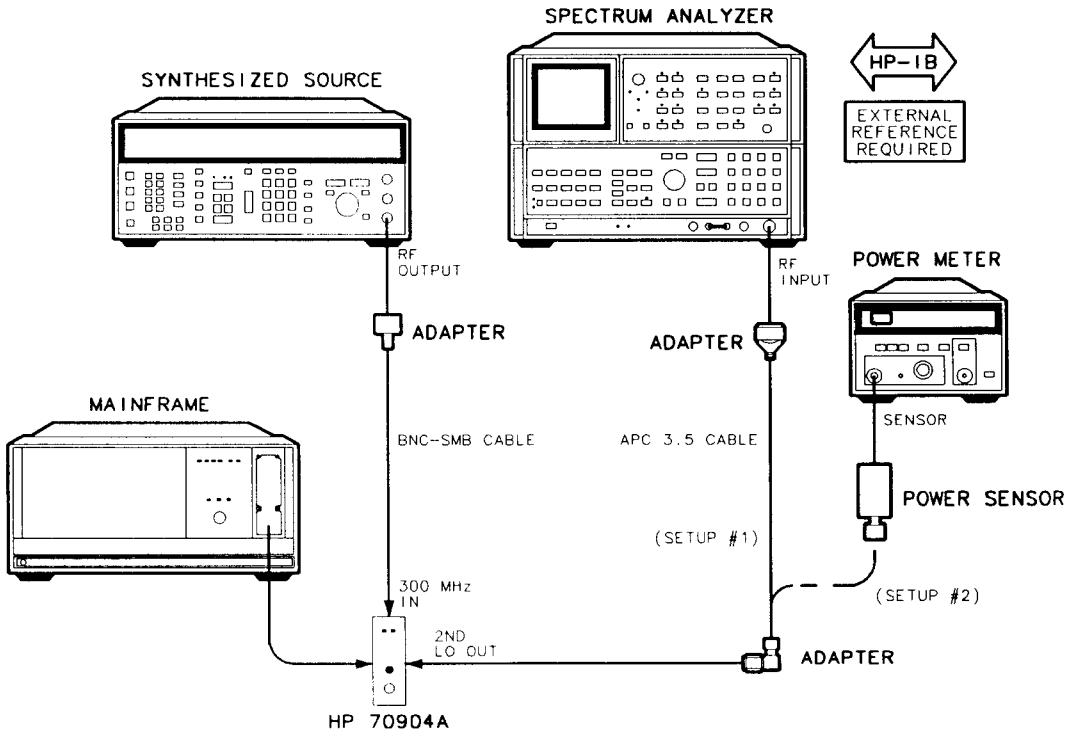


Figure 4-9. VCO Frequency and Amplitude Adjustment Setup

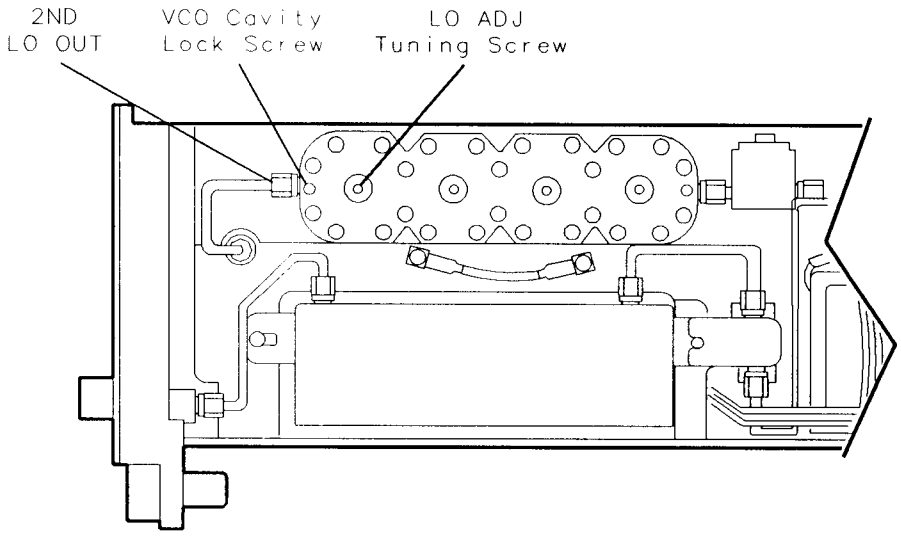


Figure 4-10. VCO Frequency and Amplitude Adjustment Locations

6. Second Converter LO Feedthrough Check

Purpose

This routine measures the power of the second LO feedthrough from the second converter 321.4 MHz IF OUTPUT.

Description

The spectrum analyzer is connected to the RF Section second converter 321.4 MHz IF output at A6J2. Refer to A6 "Second Converter Replacement Procedure" in Chapter 6.

The spectrum analyzer is set to a center frequency of 3300 MHz and a span of 10 MHz. The second converter LO feedthrough power is measured. The maximum power should be no greater than −29.0 dBm and the minimum power should be no less than −65.0 dBm.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Spectrum Analyzer	HP 8566B
Synthesized Source	HP 8662A/HP8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to APC (f)	1250-1744
Type N (m) to BNC (f)	1250-0780
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)	85680-60093
APC 3.5 (m) to APC 3.5 (m)	8120-4921

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-11. Load and run the Second Converter LO Feedthrough Check routine. Make the checks as defined by the computer. Figure 4-12 illustrates the check location. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

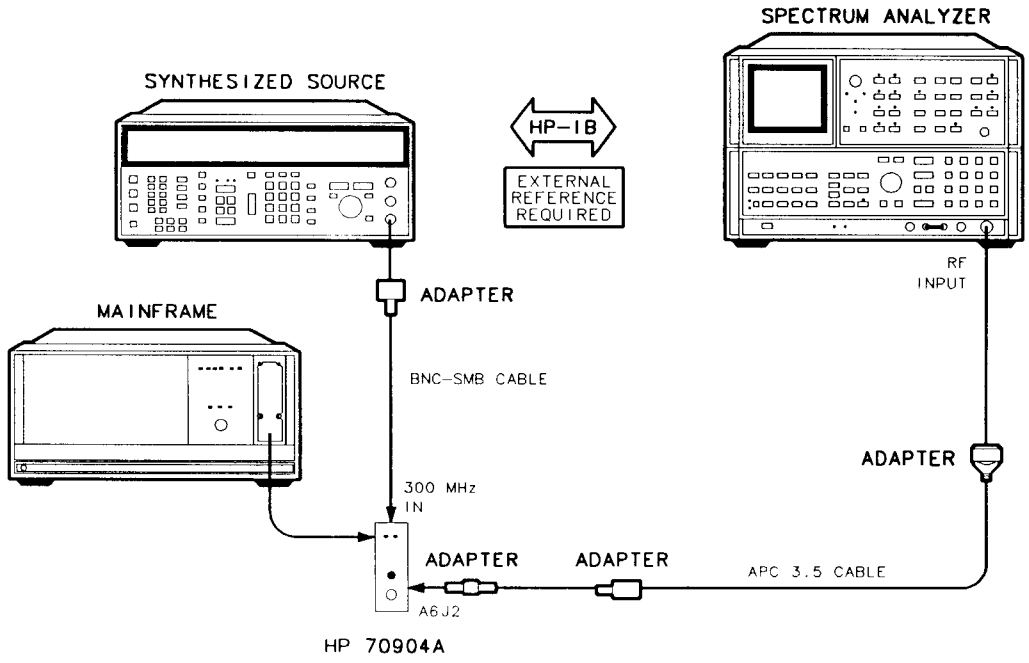


Figure 4-11. Second Converter LO Feedthrough Check Test Setup

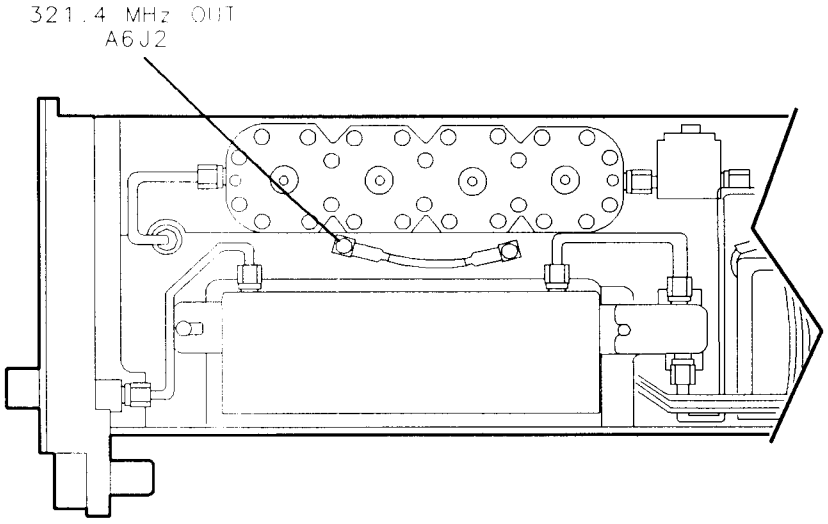


Figure 4-12. Second Converter LO Feedthrough Check Location

7. Sampler DC IF Output Check

Purpose

This routine measures the dc offset voltage of the VCO sampler IF output in the RF section. Adjustment 5, "VCO Frequency and Amplitude Adjustment," must be completed before performing this adjustment.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the sampler IF output at A2J4-4. (The DVM is set to the 100 V range to provide lower input resistance, which allows probe cable capacitance to drain off quickly.)

The voltage at A2J4-4 is checked with the DVM for a value between −0.0985 V and +0.0985 V.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-13. Load and run the Sampler DC IF Output Check routine. Make the checks as defined by the computer. Figure 4-14 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

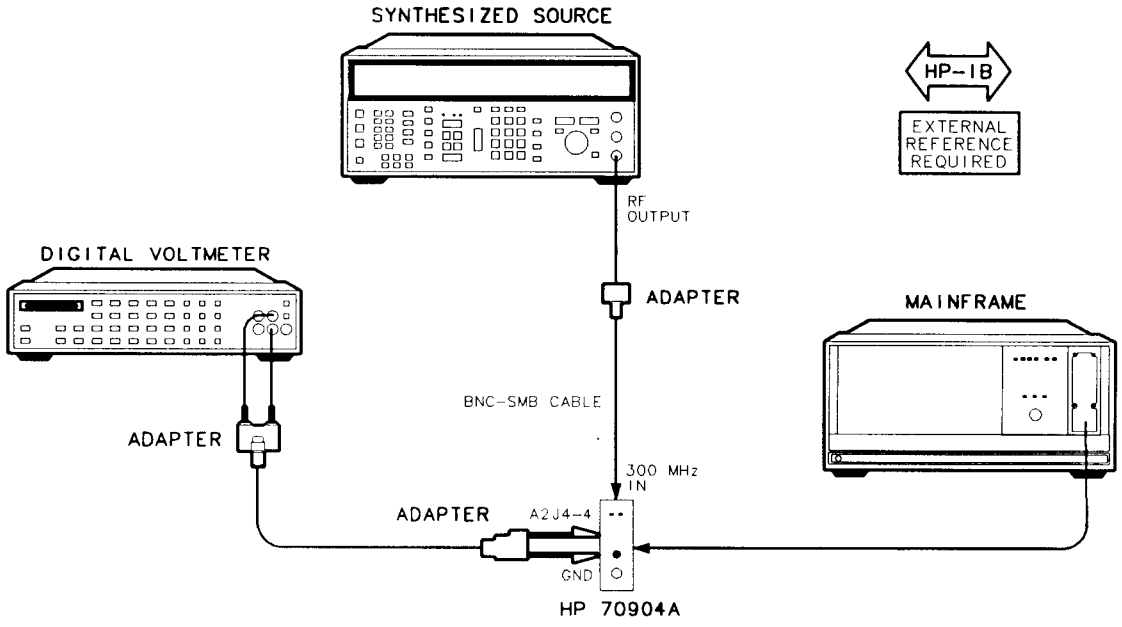


Figure 4-13. Sampler DC IF Output Check Setup

7. Sampler DC IF Output Check

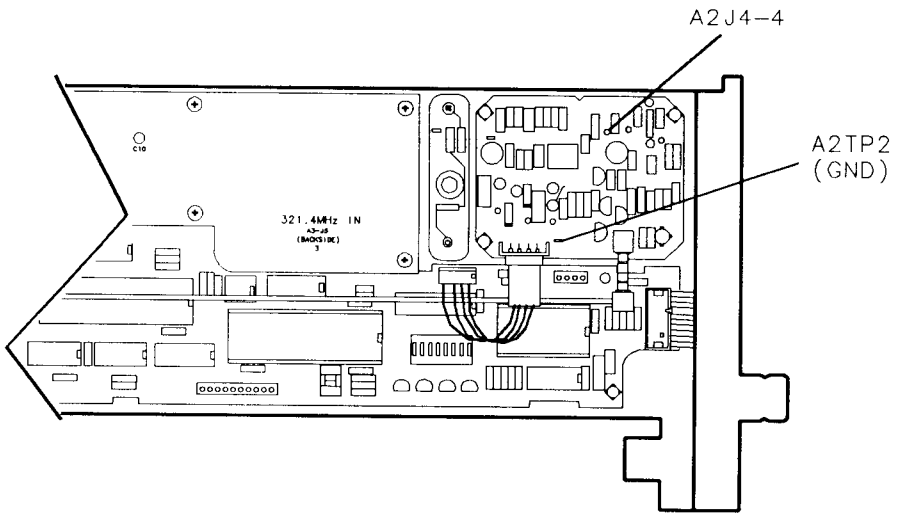


Figure 4-14. Sampler DC IF Output Check Location

8. Sampler AC IF Output Check

Purpose

This routine measures the ac voltage of the VCO sampler IF output in the RF section. Adjustment 5, "VCO Frequency and Amplitude Adjustment," must be completed before performing this adjustment.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The synthesized source is connected to the 300 MHz reference input of the RF section and the DVM is connected to the sampler IF output at A2J4-4.

The synthesized source is initially set to 299.9 MHz at 0 dBm. The frequency is increased in 0.001 MHz and 0.0001 MHz steps, up to 300.1 MHz, until the DVM measures the highest peak-to-peak voltage. The minimum ac voltage must be at least 0.07 V rms and the maximum not more than 0.124 V rms. The output readings are compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-15. Load and run the Sampler AC IF Output Check routine. Make the checks as defined by the computer. Figure 4-16 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

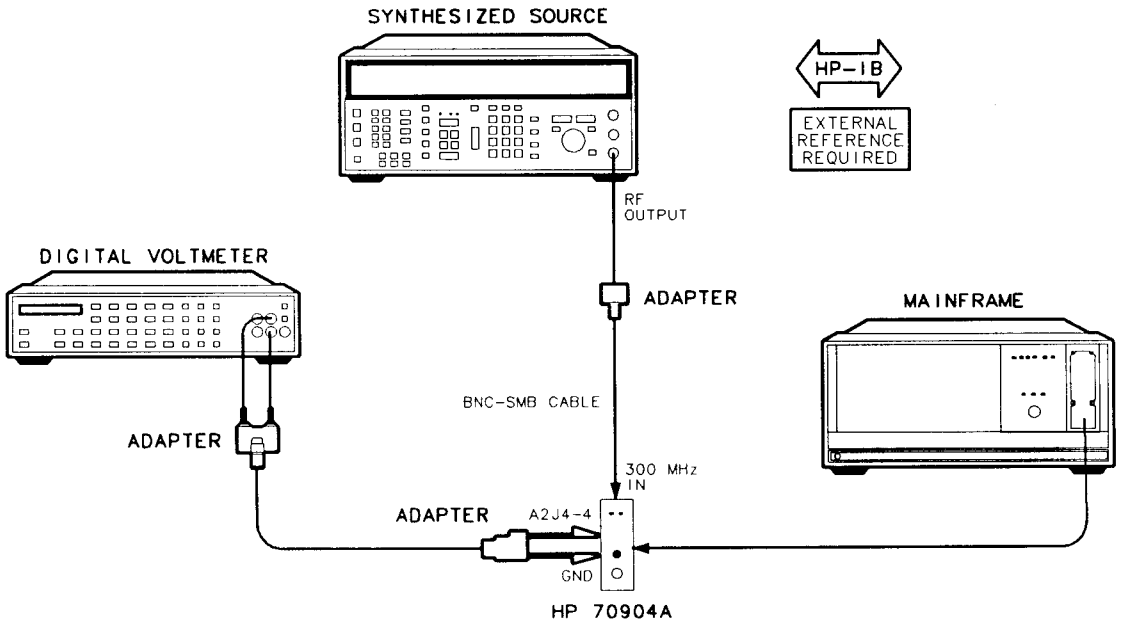


Figure 4-15. Sampler AC IF Output Check Setup

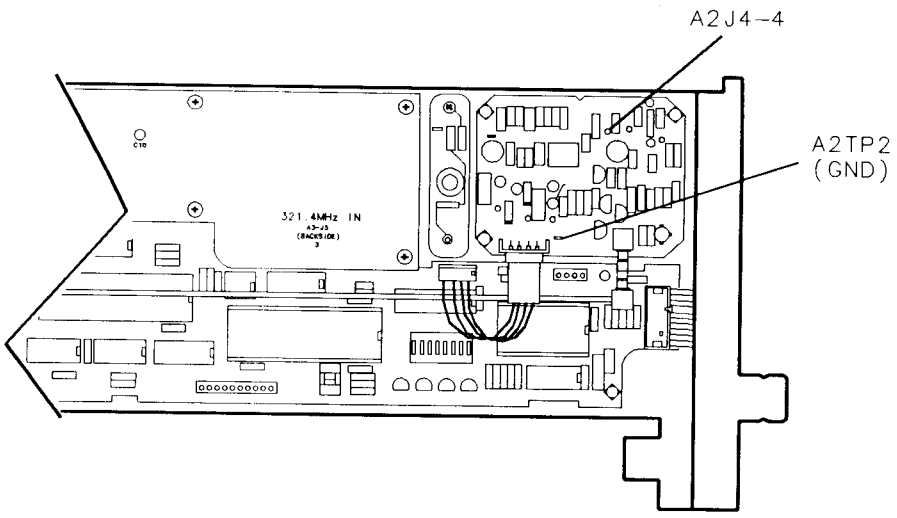


Figure 4-16. Sampler AC IF Output Check Location

9. Search Oscillator Duty Cycle and Period Adjustment

Purpose

This routine permits adjustment of the duty cycle and period of the second converter search oscillator.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the phase-lock-loop amplifier output at A2TP1. The synthesized source is set to a reference frequency of 302 MHz at 0 dBm. The operator is prompted to adjust A2R6. The square-wave period is compared with test limits. The duty cycle is measured 40 times, and the readings are compared with test limits.

The synthesized source is set to a reference frequency of 298 MHz. The above measurements are repeated, then compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-17. load and run the Search Oscillator Duty Cycle and Period Adjustment routine. Make the adjustments as defined by the computer. Figure 4-18 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

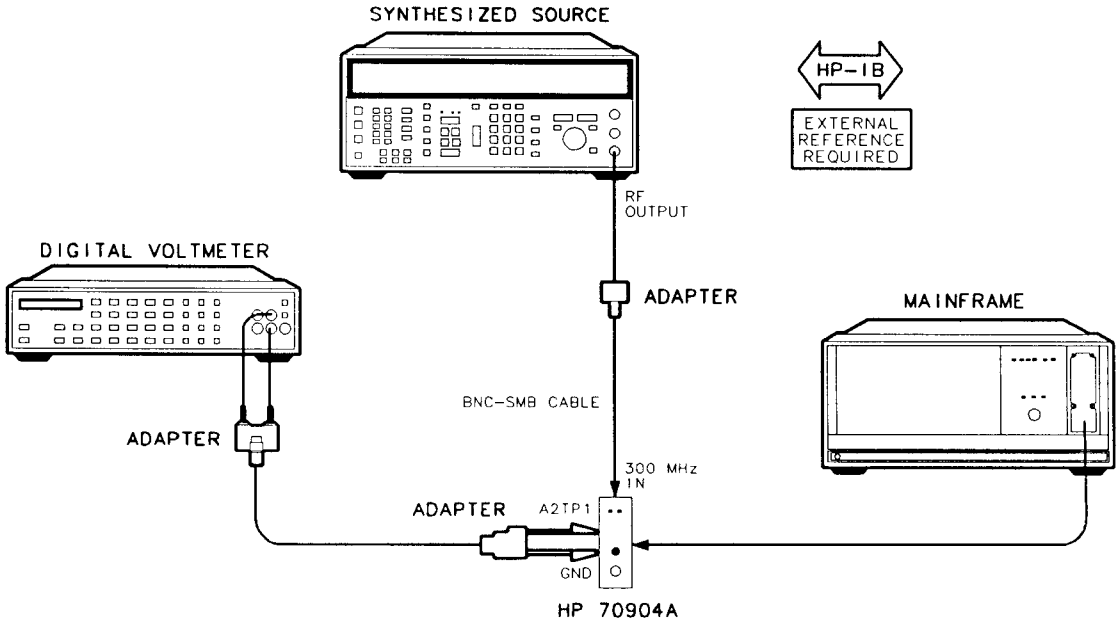


Figure 4-17. Search Oscillator Duty Cycle and Period Adjustment Setup

9. Search Oscillator Duty Cycle and Period Adjustment

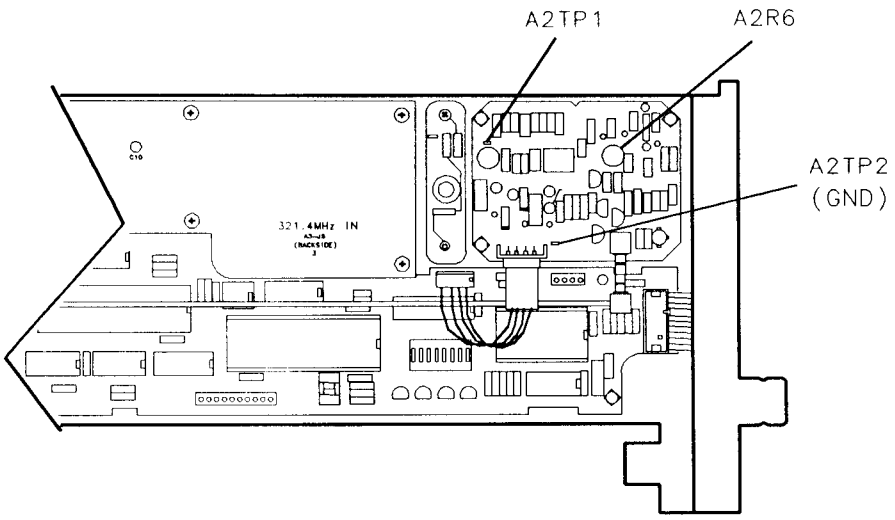


Figure 4-18. Search Oscillator Duty Cycle and Period Adjustment Locations

10. Search Oscillator Square Wave Min and Max Check

Purpose

This routine measures the second-converter search-oscillator square-wave minimum and maximum points. Adjustment 9, "Search Oscillator Duty Cycle and Period Adjustment," must be completed before running this routine.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the phase-lock-loop amplifier output at A2TP1. The synthesized source output frequency is set to 302 MHz, and the DVM takes six readings. The minimum reading must be between −9.53 V and −12.57 V. The maximum DVM reading must be between +9.53 V and +12.57 V.

The synthesized source frequency is decreased to 298 MHz, and the DVM readings repeated. The results are compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-19. Load and run the Search Oscillator Square Wave Min and Max Check routine. Make the checks as defined by the computer. Figure 4-20 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

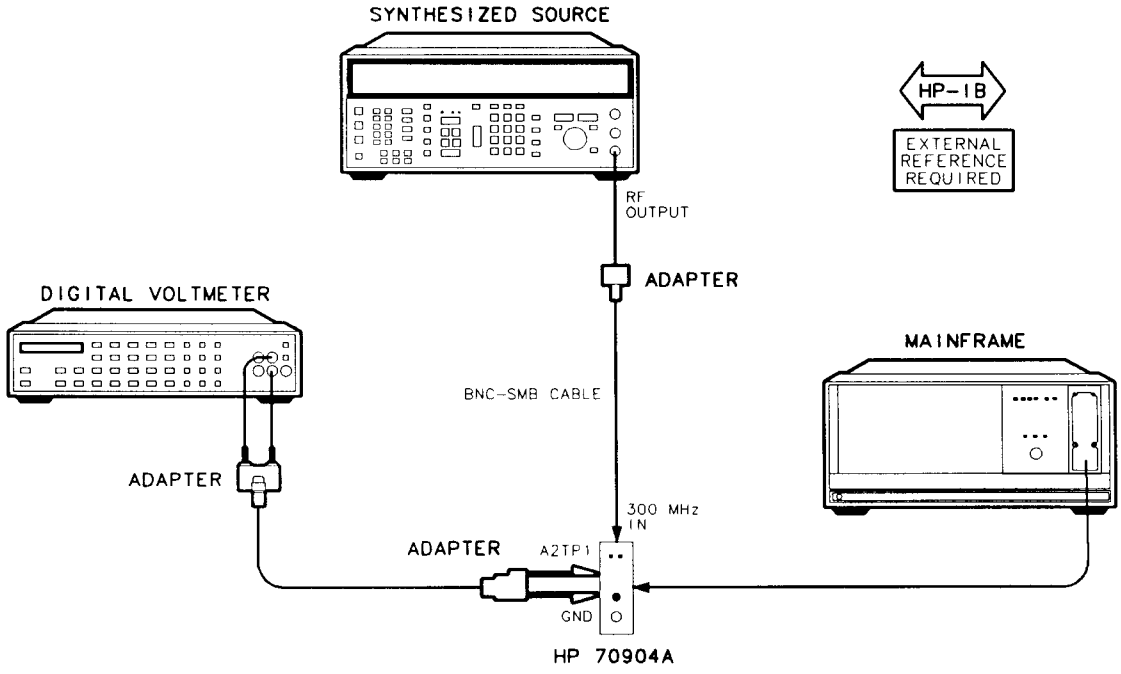


Figure 4-19. Search Oscillator Square Wave Min and Max Check Setup

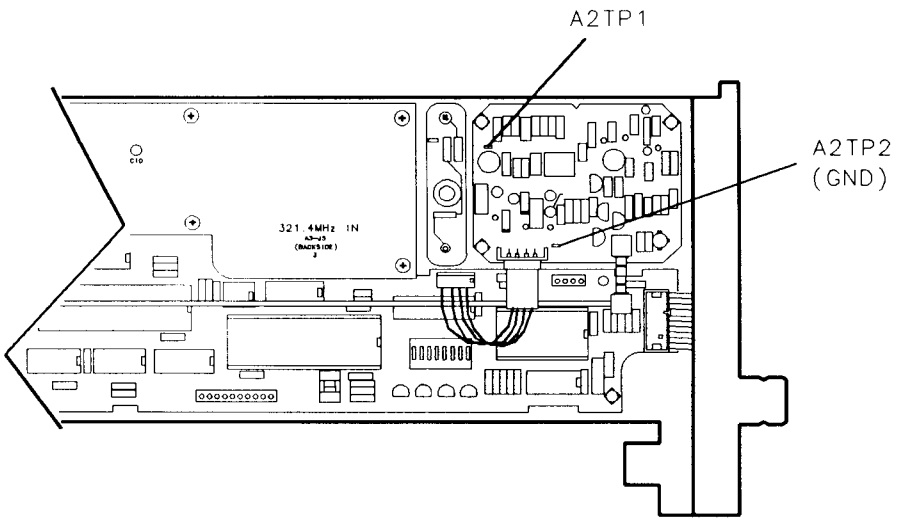


Figure 4-20. Search Oscillator Square Wave Min and Max Check Location

11. Search Oscillator Tune-Line Peak Adjustment

Purpose

This routine permits adjustment of the search oscillator for a peak on the VCO tune line of the RF section. Adjustment 10, "Search Oscillator Square Wave Min and Max," must be completed prior to making these adjustments.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the VCO TUNE line at A2J4-1. The operator is prompted by the software to adjust A2R7 until a pass condition is displayed.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-21. Load and run the Search Oscillator Tune-Line Peak Adjustment routine. Make the adjustments as defined by the computer. Figure 4-22 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

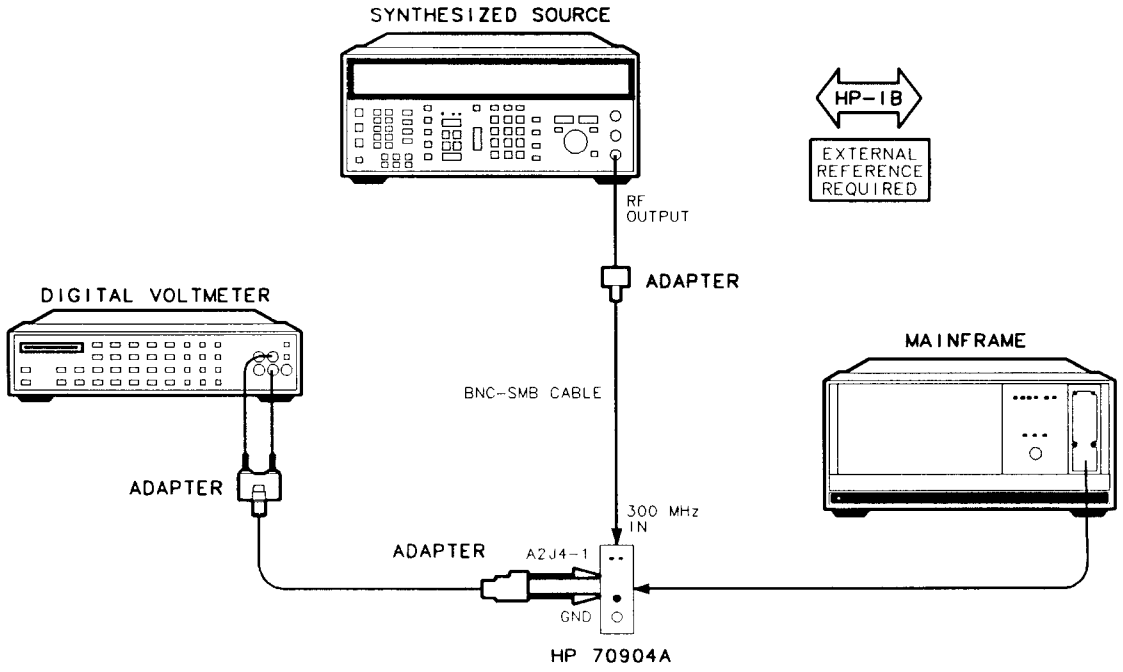


Figure 4-21. Search Oscillator Tune-Line Peak Adjustment Setup

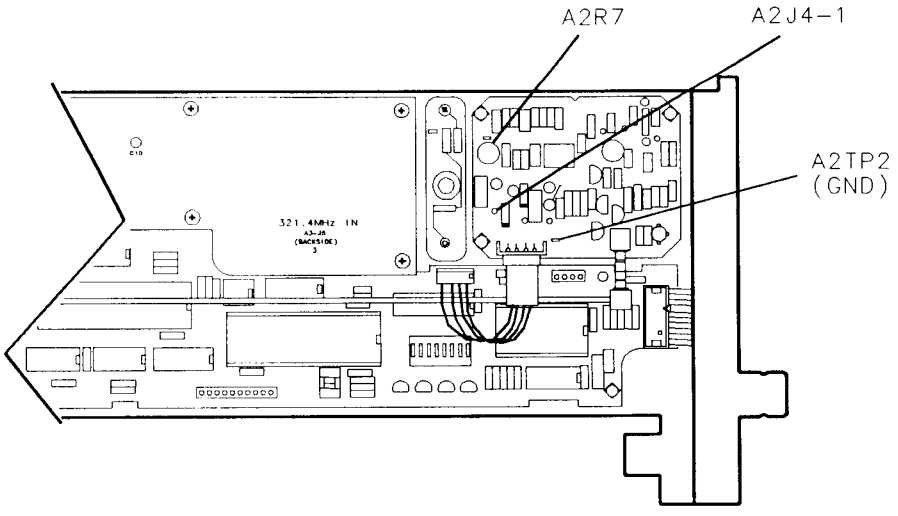


Figure 4-22. Search Oscillator Tune-Line Peak Adjustment Locations

12. Phase Lock Check

Purpose

This routine measures the phase lock of the second converter in the RF section.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the VCO tune line at A2J4-1. The RF section is checked for a locked condition. If it is locked, a DVM reading is taken and the tune line voltage is compared with test limits. If the second converter indicates an unlock condition, the test fails.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-23. Load and run the Phase Lock Check routine. Make the checks as defined by the computer. Figure 4-24 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note

Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

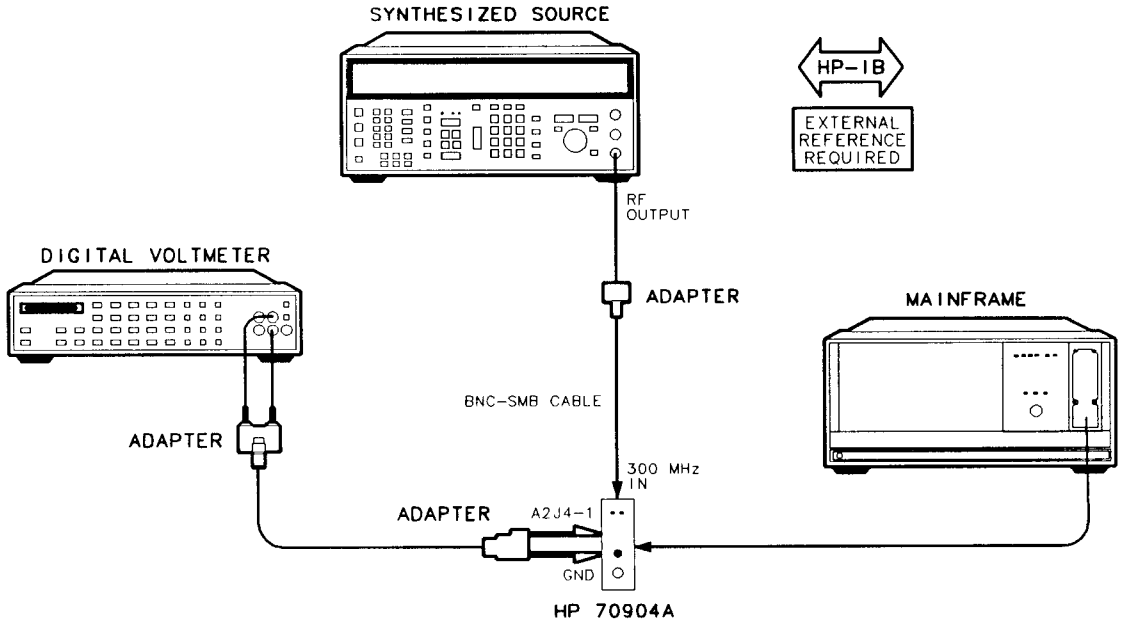


Figure 4-23. Phase Lock Check Setup

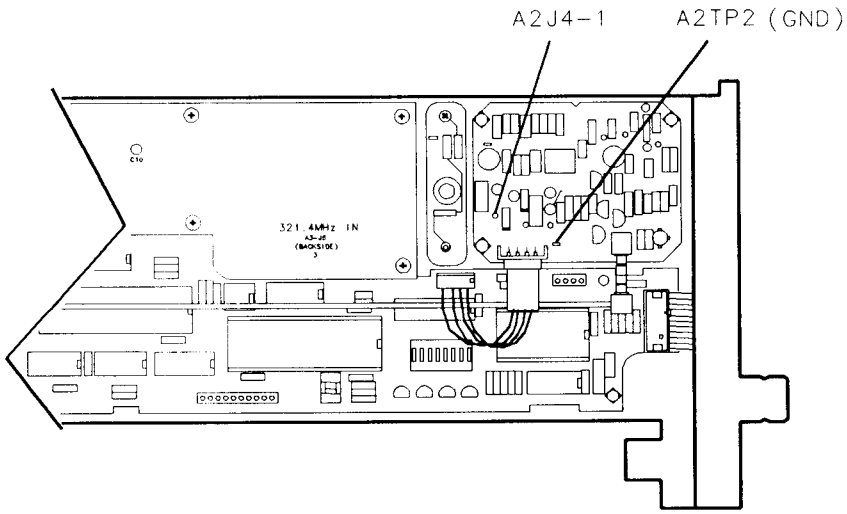


Figure 4-24. Phase Lock Check Location

13. VCO Tune Range Preliminary Adjustment

Purpose

This routine permits adjustment of the second converter VCO tuning range. Adjustment 12, "Phase Lock," must be completed prior to making these adjustments.

Description

Caution

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the phase-lock-loop amplifier output at A2TP1. The synthesized source is set to a frequency of 300.6 MHz. The operator is prompted to adjust the second LO ADJ cavity screw located on A2 Second Converter Bandpass Filter and LO Housing for a value between −7.97 V and −7.53 V. If an unlock condition is detected, an `UNLOCK` warning is displayed. Two measurements are made with the DVM. If these measurements are too far apart in value, the operator is notified with a `SEARCHING` indication.

The synthesized source is set to a frequency of 299.35 MHz. The operator is prompted to adjust A2R7 for a DVM reading between +7.53 V and +7.97 V. If an unlock condition is detected or the readings are too far apart, the appropriate information is again displayed. The LO ADJ cavity screw is repeatedly adjusted until the VCO tune range is within test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-25. Load and run the VCO Tune Range Preliminary Adjustment routine. Make the adjustments as defined by the computer. Figure 4-26 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

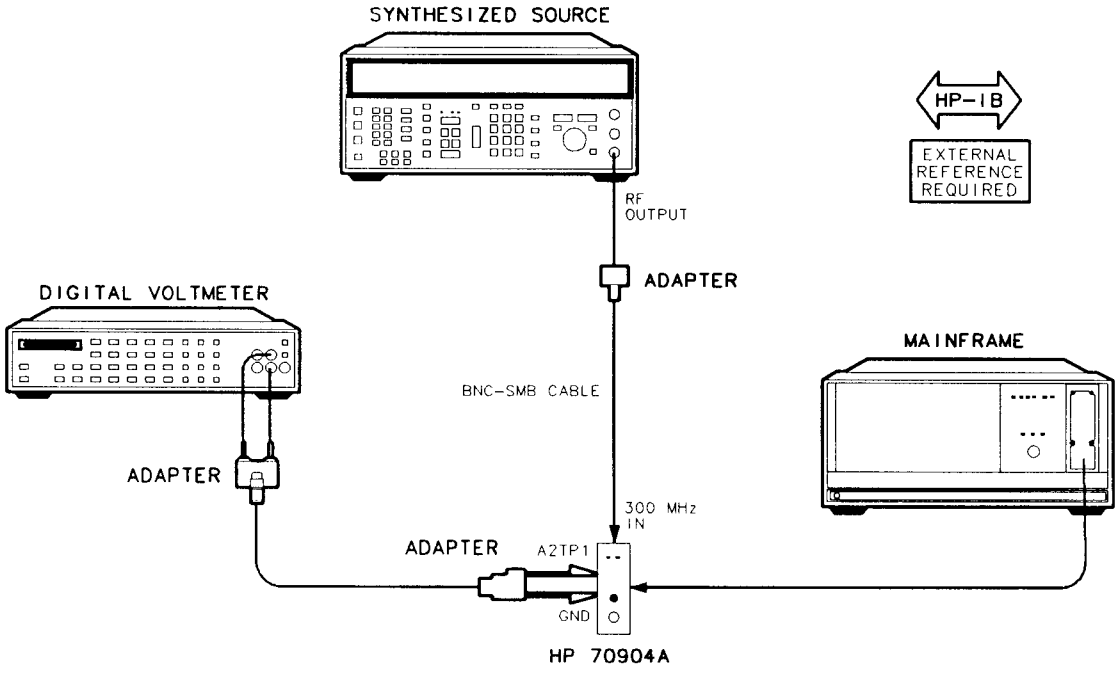


Figure 4-25. VCO Tune Range Preliminary Adjustment Setup

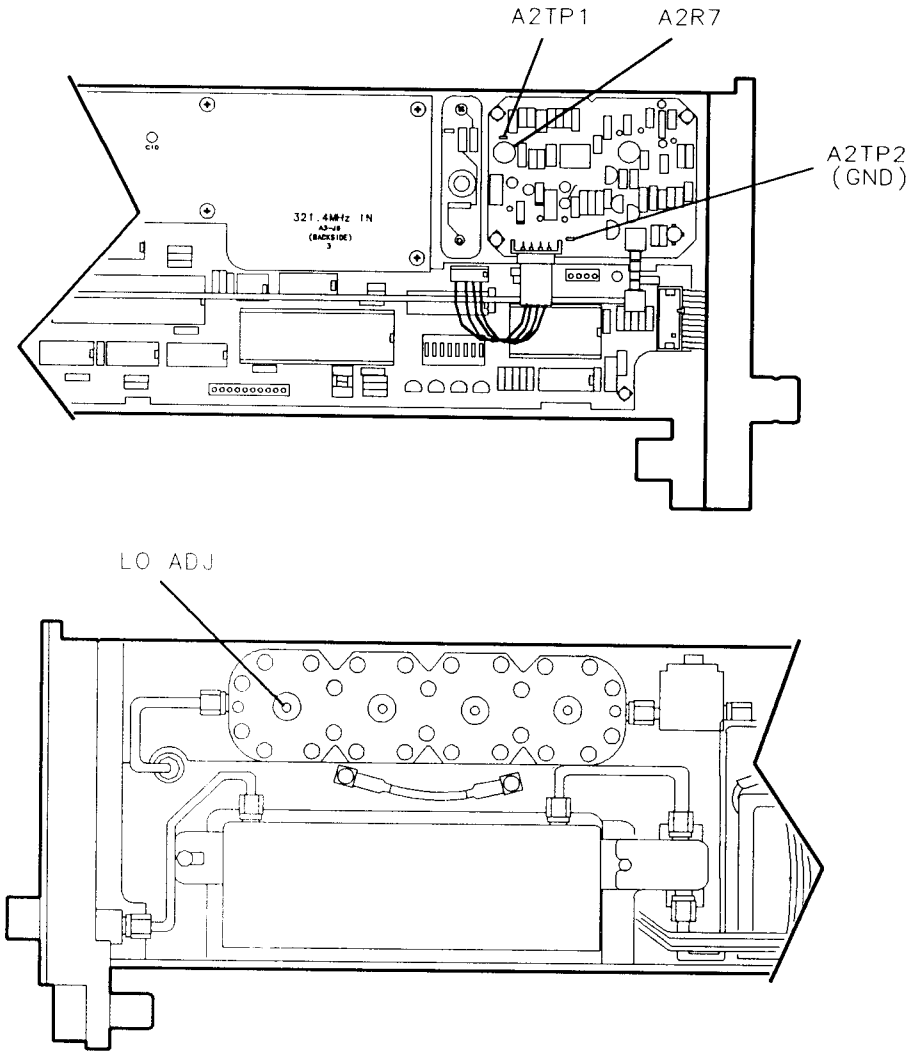


Figure 4-26. VCO Tune Range Preliminary Adjustment Locations

14. Lock Range Check

Purpose

This routine measures the second converter lock range of the RF section.

Description

Caution 

Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to the PLL amplifier output at A2TP1. The synthesized source frequency is set to 299 MHz, then decreased in 0.01 MHz steps while the second converter output is checked. When the second converter indicates an unlock, the frequency is incremented in 0.01 MHz steps until the second converter relocks. The lock frequency is compared with test limits. If the frequency is within test limits, the DVM measures the output voltage of the PLL amplifier.

The synthesized source frequency is set to 300 MHz. The above process is repeated, incrementing and decrementing the frequency of the synthesized source to determine upper lock frequency and voltage.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A

Accessories

Module Service Extender	70001-60013

Adapters

Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292

Cables

BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-27. Load and run the Lock Range Check routine. Make the checks as defined by the computer. Figure 4-28 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

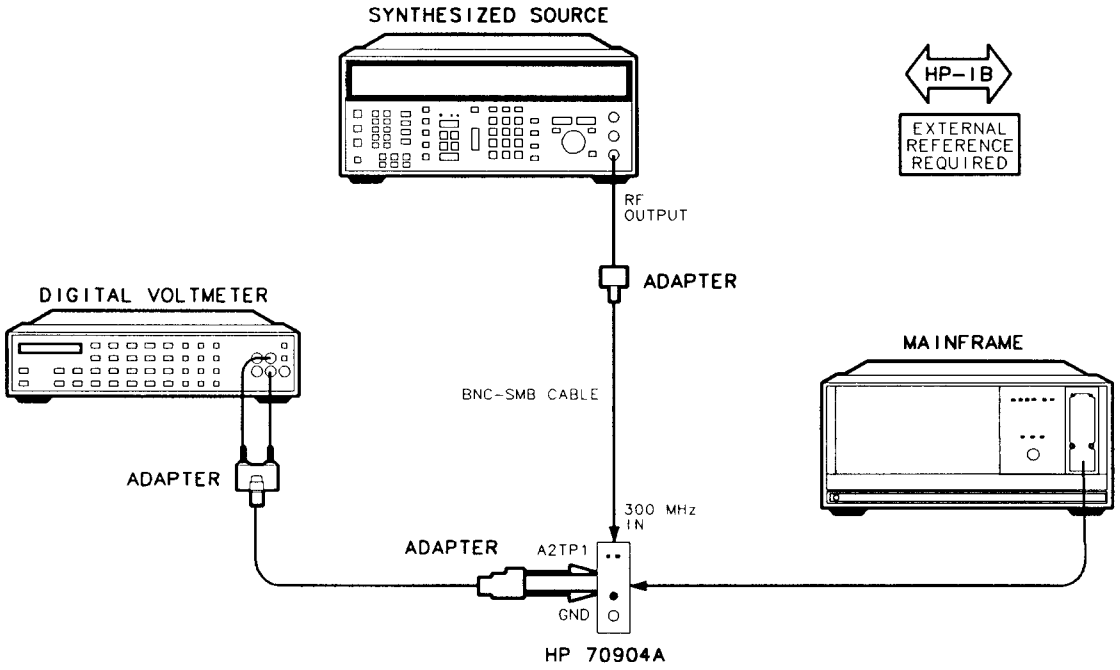


Figure 4-27. Lock Range Check Setup

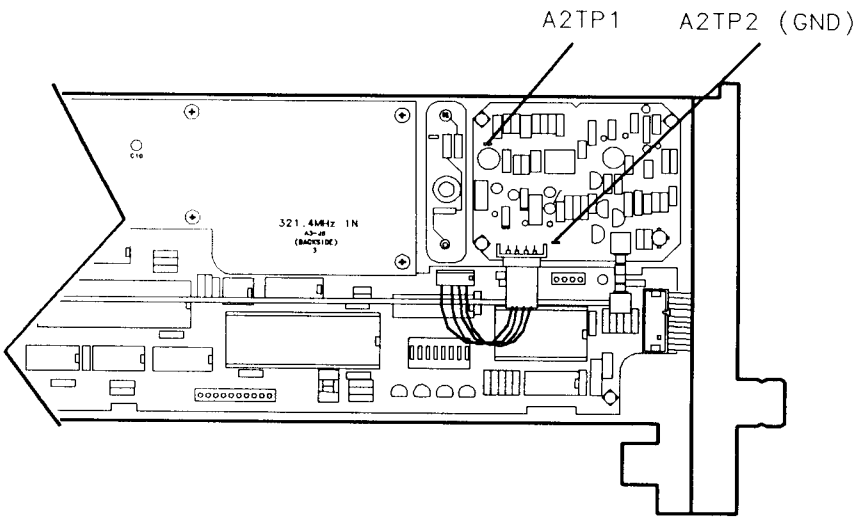


Figure 4-28. Lock Range Check Location

15. Mixer Bias Check

Purpose

This routine measures the second mixer bias of the RF section. Adjustment 12, "Phase Lock," must be completed prior to running this routine.

Description

Caution Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse A4F1 on the A4 Power Supply/Controller board to blow, or could cause damage to other components.

The DVM is connected to A6TP1. (The DVM is set to the 100 V range to provide lower input resistance, which allows probe cable capacitance to drain off quickly.) The DVM reading is checked for a value between 0.624 V and 1.276 V.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-29. Load and run the Mixer Bias Check routine. Make the checks as defined by the computer. Figure 4-30 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

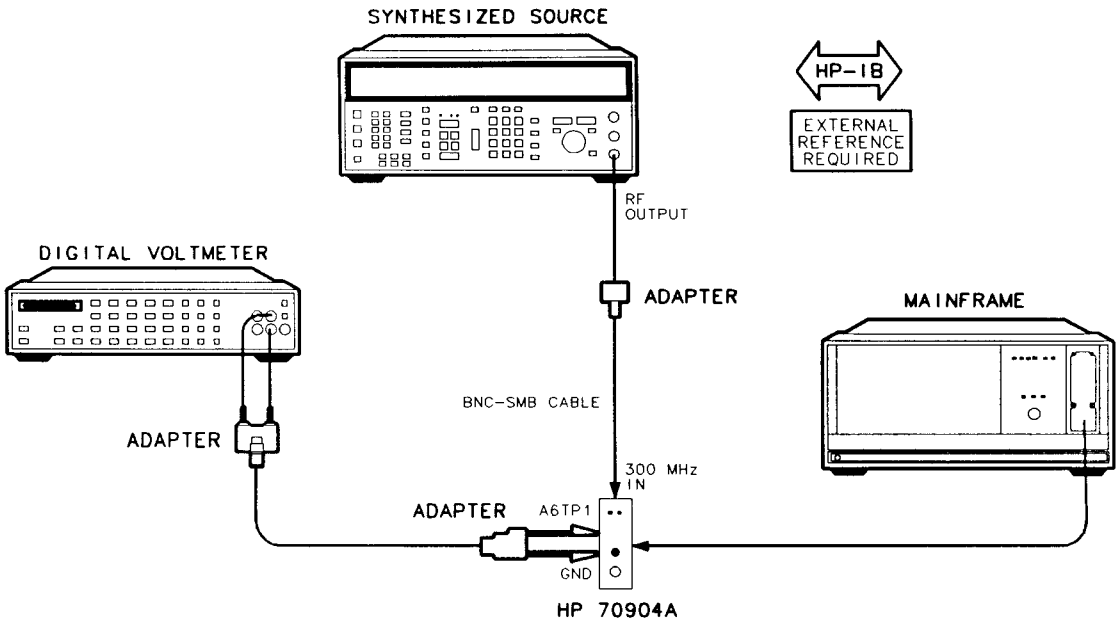


Figure 4-29. Mixer Bias Check Setup

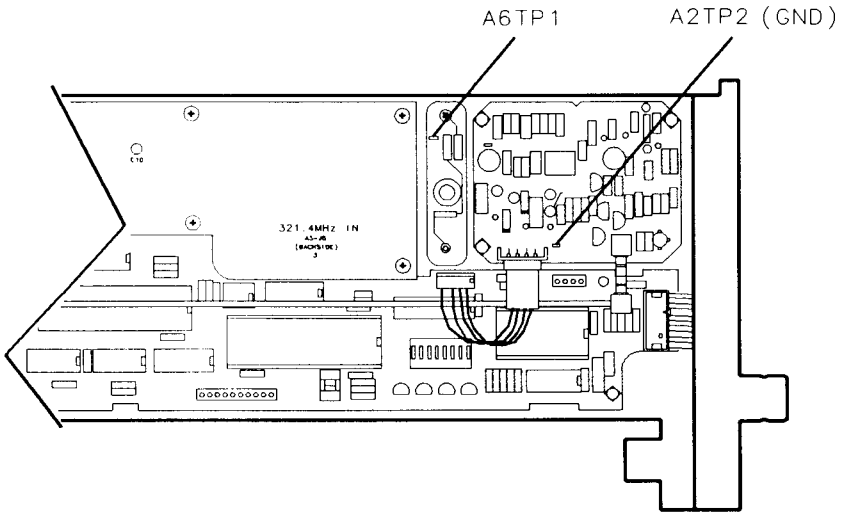


Figure 4-30. Mixer Bias Check Location

16. Second Converter Bandpass Filter Tune

Purpose

This routine permits adjustment of the second converter 3621.4 MHz bandpass filter shape. The bandpass filter is adjusted for amplitude, flatness, and 3 dB bandwidth. Adjustment 12, "Phase Lock," must be completed prior to making these adjustments.

Description

The RF input source is set to 300 MHz at 0 dBm, and the LO input source frequency is set to 3921.4 MHz at 8 dBm with a delta frequency of 35 MHz. The network analyzer scale is set to 0.5 dB per division.

The operator is prompted to adjust the three second-converter bandpass-filter tuning screws and A6L1 matching inductor on A6 321.4 MHz Matching Network board for maximum amplitude, flatness, 3 dB bandwidth, and 42.8 MHz image rejection. Flatness must be between −0.5 dB and +0.2 dB. The amplitude and flatness are relative to the amplitude of a 3621.4 MHz signal at a bandwidth of 15 MHz.

The 3 dB bandwidth must be between 25 MHz and 30 MHz. The 42.8 MHz image rejection is measured relative to the 3621.4 MHz center. The image rejection must be at least 23 dB from the 42.8 MHz signal.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Scalar Network Analyzer	HP 8757A
Detector	HP 11664E
Synthesized Source	HP 8662A/HP 8663A
Microwave Source	HP 8340A/B
6 dB Attenuator	HP 8493C, Option 006

Accessories

Isolator	0955-0204
Module Service Extender	70001-60013

8710-1728

Adapters

Type N (m) to APC (f) *(2 required)*	1250-1744
APC 3.5 (f) to APC 3.5 (f)	1250-1749
SMA (m) to SMA (m)	1250-1159
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672

Cables

BNC (m) to BNC (m)	HP 10503A
APC 3.5 (m) to APC 3.5 (m)	8120-4921
SMA (m) TO SMA (m)	5061-5458

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-31. Load and run the Second Converter Bandpass Filter Tune routine. Make the adjustments as defined by the computer. Figure 4-32 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

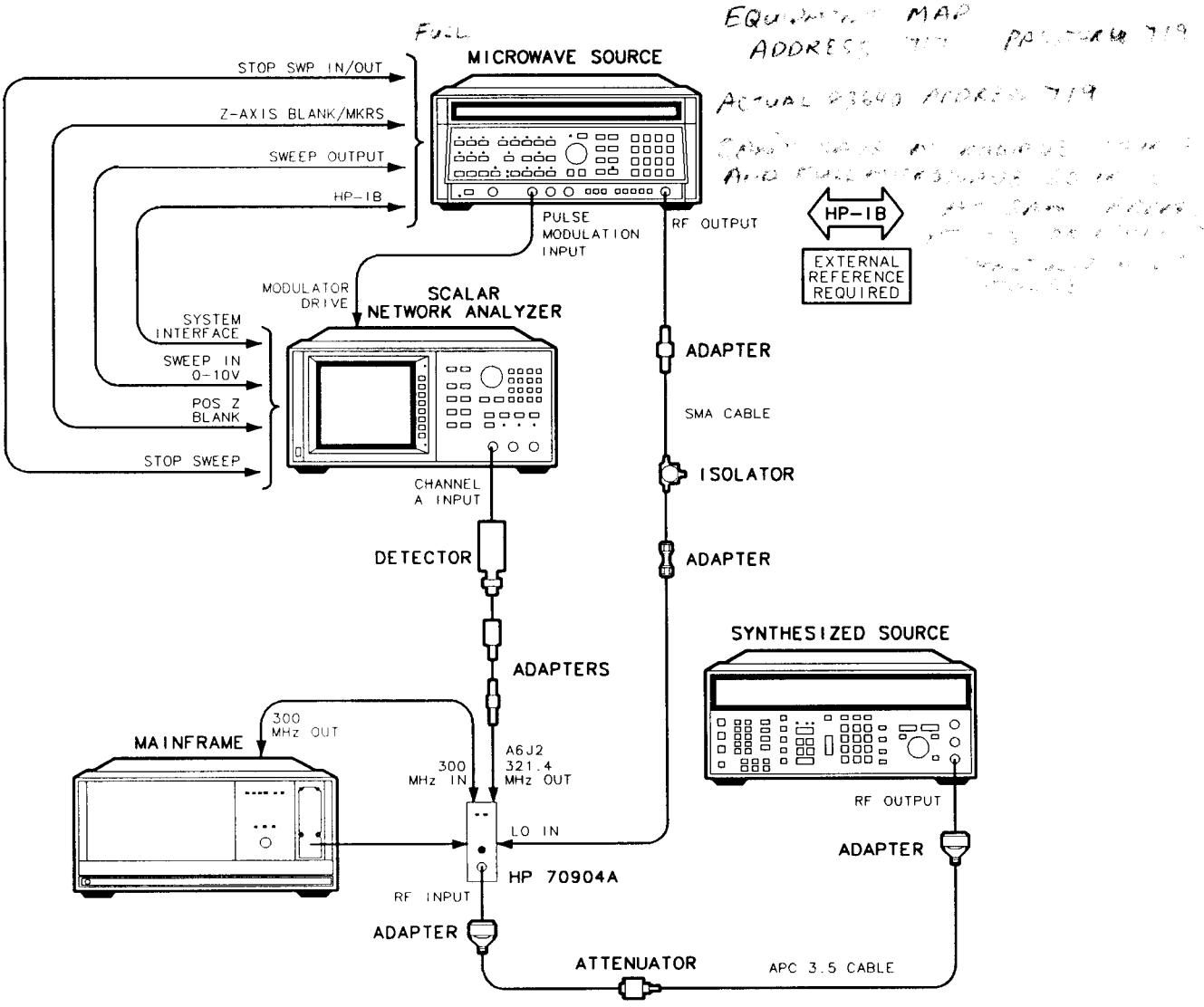


Figure 4-31. Second Converter Bandpass Filter Tune Setup

16. Second Converter Bandpass Filter Tune

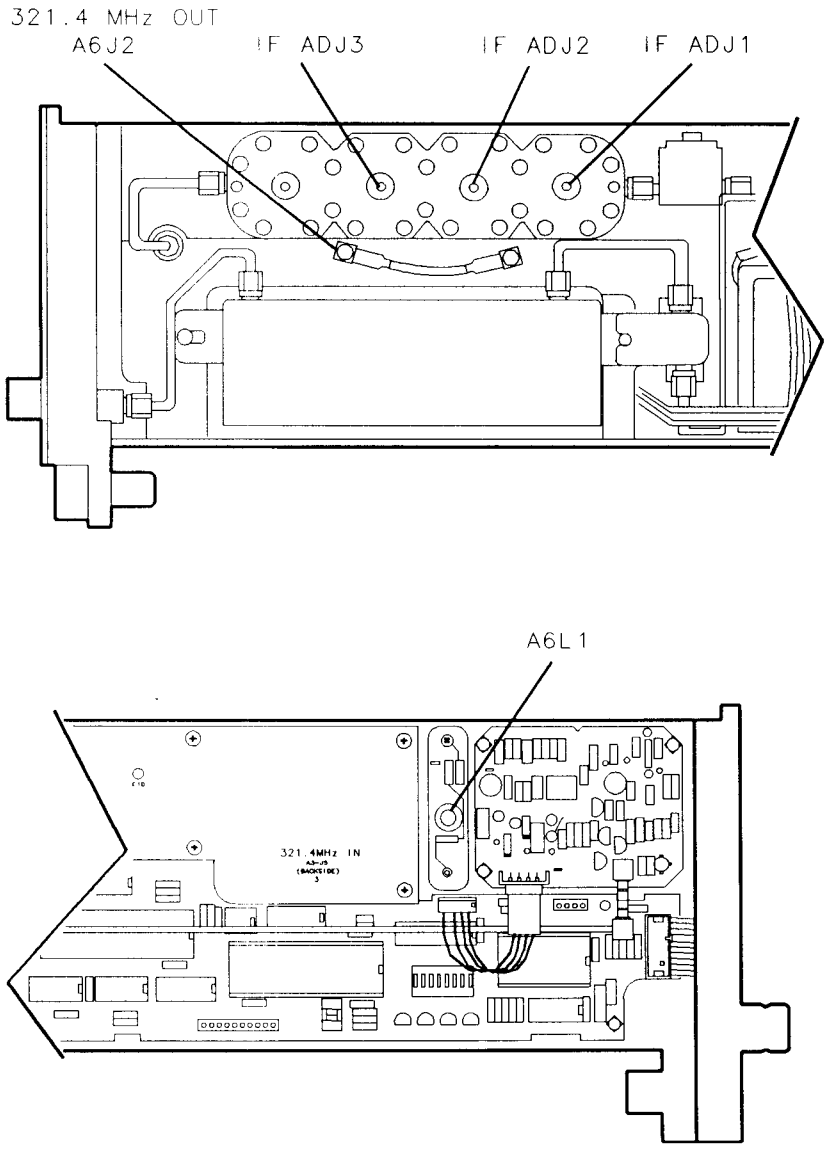


Figure 4-32. Second Converter Bandpass Filter Tune Locations

17. VCO Tune Range Final Adjustment

Purpose

This routine permits adjustment of the second converter VCO tuning range.

Caution This test must be executed and passed if the second converter bandpass filter has been adjusted.

Description

Caution Do not allow the two alligator clips to short together or to adjacent test points. Shorting could cause fuse, A4F1, on A4 Power Supply/Controller board to blow or could cause damage to other components.

The DVM is connected to the phase-lock-loop amplifier output at A2TP1. The synthesized source is set to a frequency of 300.6 MHz. The operator is prompted to adjust the second LO ADJ cavity screw located on the A2 Second Converter Bandpass Filter and LO Housing for a value between −7.97 V and −7.53 V. If an unlock condition is detected, an `UNLOCK` warning is displayed. Two measurements are made with the DVM. If these measurements are too far apart in value, the operator is notified with a `SEARCHING` indication.

The synthesized source is set to a frequency of 299.35 MHz. The operator is prompted to adjust A2R7 for a DVM reading between +7.53 V and +7.97 V. If an unlock condition is detected or the readings are too far apart, the appropriate information is again displayed. The LO ADJ cavity screw is repeatedly adjusted until the VCO tune range is within test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Precision DVM	HP 3456A
Synthesized Source	HP 8662A/HP 8663A
Accessories	
Module Service Extender	70001-60013
[illegible]	8710-1728
Adapters	
Type N (m) to BNC (f)	1250-0780
BNC (f) to Dual Banana Plug	1251-2277
BNC (f) to Dual Alligator Clips	8120-1292
Cables	
BNC (m) to SMB (f)	85680-60093
BNC (m) to SMB (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-33. Load and run the VCO Tune Range Final routine. Make the adjustments as defined by the computer. Figure 4-34 illustrates the adjustment locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

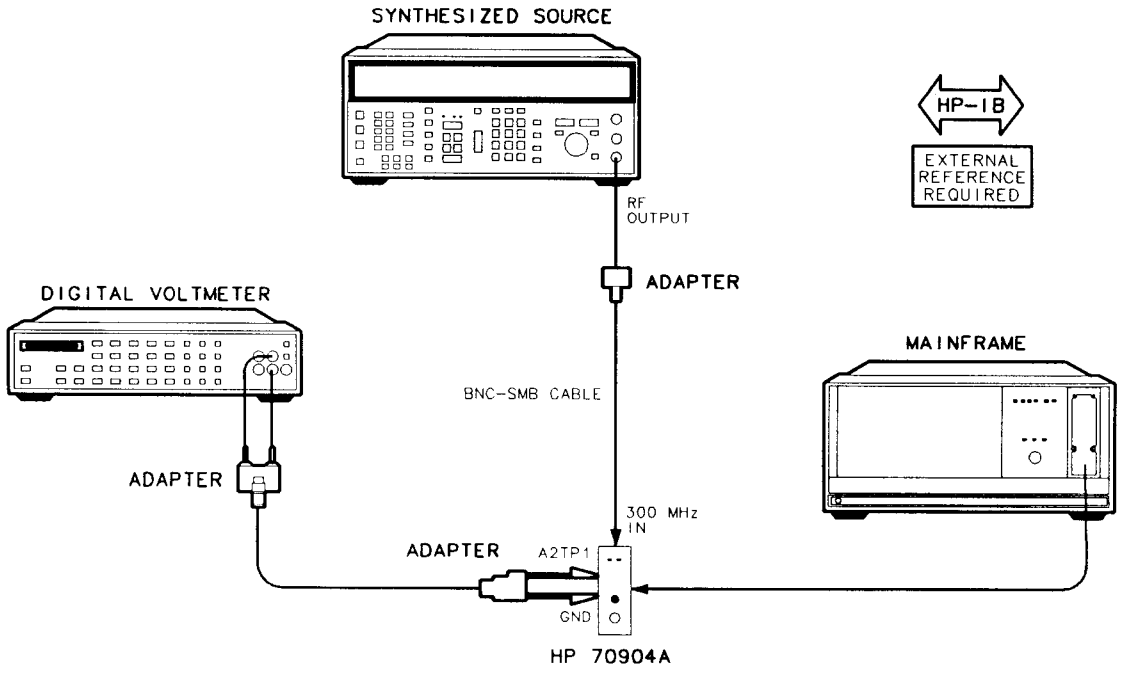


Figure 4-33. VCO Tune Range Final Adjustment Setup

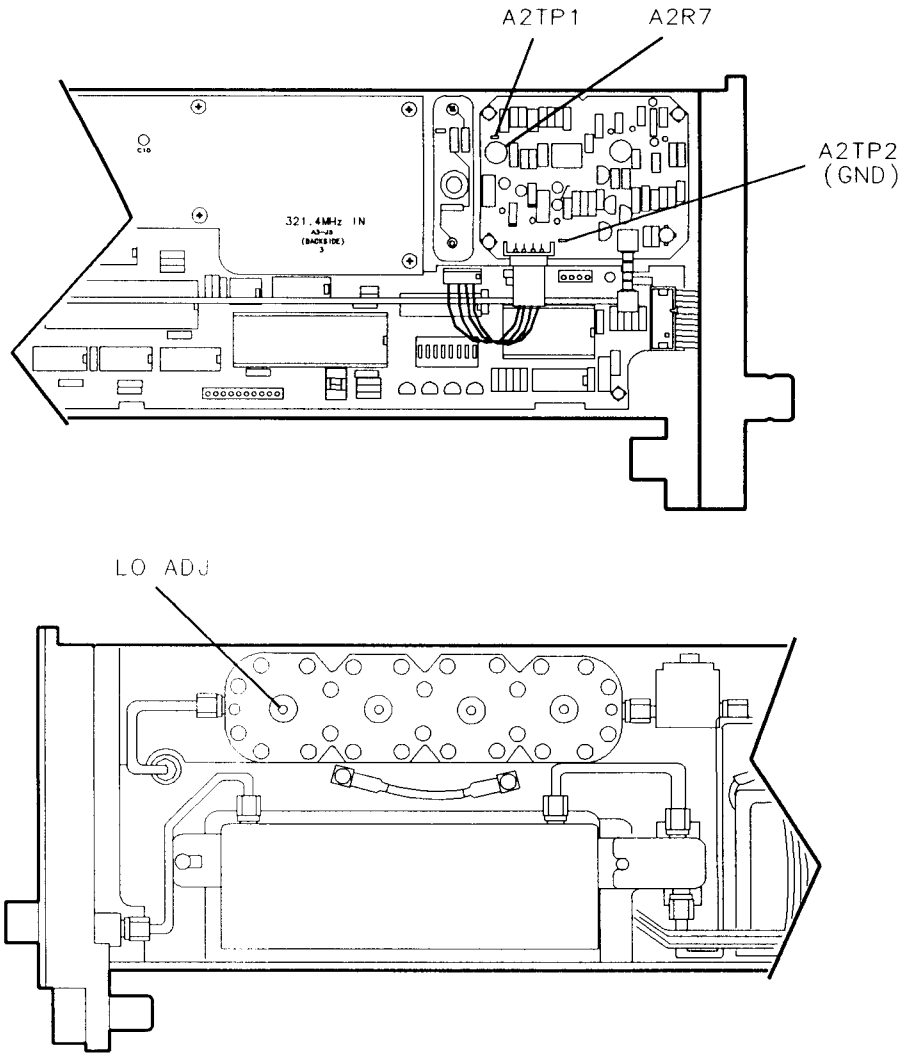


Figure 4-34. VCO Tune Range Final Adjustment Locations

18. Last Converter Bandpass Filter Tune

Purpose

This manual test is provided to allow adjustment of the 321.4 MHz bandpass filter response of the RF section A3 Last Converter.

Description

A continuous wave signal is applied to the RF INPUT of the HP 70904A RF Section. The local oscillator signal is swept as a scalar network analyzer is used to adjust the bandpass filter at the 21.4 MHz IF output of the RF section. The A3 Last Converter bandpass filter response is adjusted for a 3 dB bandwidth that is greater than 9 MHz, and a passband response at 21.4 MHz ±2.5 MHz, ≥+0.2 dB and ≤−0.5 dB.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
IF Section	HP 70902A/HP 70903A
Full Microwave Source	HP 8340A/B
Scalar Network Analyzer	HP 8757A
Detector	HP 11664E
Modulator	HP 11665B
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to APC 3.5 (f)	1250-1744
Type N (m) to SMA (f)	1250-1250
Type N (f) to SMA (f)	1250-1772
APC 3.5 (f) to APC 3.5 (f)	1250-1749
BNC (f) to SMA (m)	1250-1200
SMA (f) to SMB (m) *(2 required)*	1250-0674
SMB (f) to SMB (f) *(2 required)*	1250-0672
Cables	
BNC (m) to BNC (m) *(3 required)*	HP 10503A
APC 3.5 (m) to APC 3.5 (m)	8120-4921
SMA (m) to SMA (m) *(2 required)*	5061-5458
BNC (m) to SMB (f) *(2 required)*	85680-60093

Procedure

Caution To avoid blowing the mainframe line fuse or damaging the interface bus connectors, be sure to set the mainframe line switch to OFF before connecting or disconnecting the module extender cable.

1. With the mainframe line switch set to OFF, remove the HP 70904A RF Section.
2. Install the module service extender and connect the extender cable to the RF section.
3. Remove the side-cover on the left-hand side of the RF section, then connect the equipment as shown in Figure 4-35. Do not connect the interface bus of the network analyzer to the full microwave source. Figure 4-36 illustrates the adjustment locations
4. Set the mainframe line switch to ON.

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

5. Key in the following HP 70000 Modular Spectrum Analyzer settings:

   I-P
   SPAN ..... 5.5 MHz
   CENT FREQ ..... 300 MHz

6. Key in the following network analyzer settings:

   PRESET
   CHAN 2 ..... OFF
   SYSTEM
   MORE
   SWEEP MODE
   SYSINTF ..... OFF
   REF ..... −15 dBm

7. Key in the following microwave source settings:

   CW ..... 300 MHz
   POWER LEVEL ..... 0 dBm

8. Use a nonmetallic alignment tool to adjust A3C11, A3C12, and A3C13 (in that order) on the A3 Last Converter board assembly for maximum amplitude and best shape, relative to the horizontal center of the network analyzer display. Adjust A3C10 for signal flatness.
9. Set the network analyzer SCALE to 1 dBm.
10. Repeat the adjustment sequence in step 8 for maximum amplitude and flatness.
11. Set the network analyzer SCALE to 0.2 dB. Press (REF), then set the signal so that it is at the reference level on the network analyzer.
12. Repeat the adjustment sequence in step 8 for maximum amplitude and gain. Skew the bandpass response slightly so that the roll-off is steeper on the low frequency side as illustrated in Figure 4-38. Verify that the passband response meets the following conditions: $\leq +0.2$ dB and ≥ -0.4 dB at ± 2.5 MHz from the center of the network

analyzer display. Adjust C10 for best flatness. Figure 4-39 illustrates a properly-adjusted last converter bandpass response.

13. Set the HP 70000 Modular Spectrum Analyzer SPAN to 10 MHz and set the network analyzer SCALE to 1 dB.

14. Verify that the bandwidth meets the following condition: 3 dB bandwidth $\geq$9 MHz (full sweep on the network analyzer display = 10 MHz).

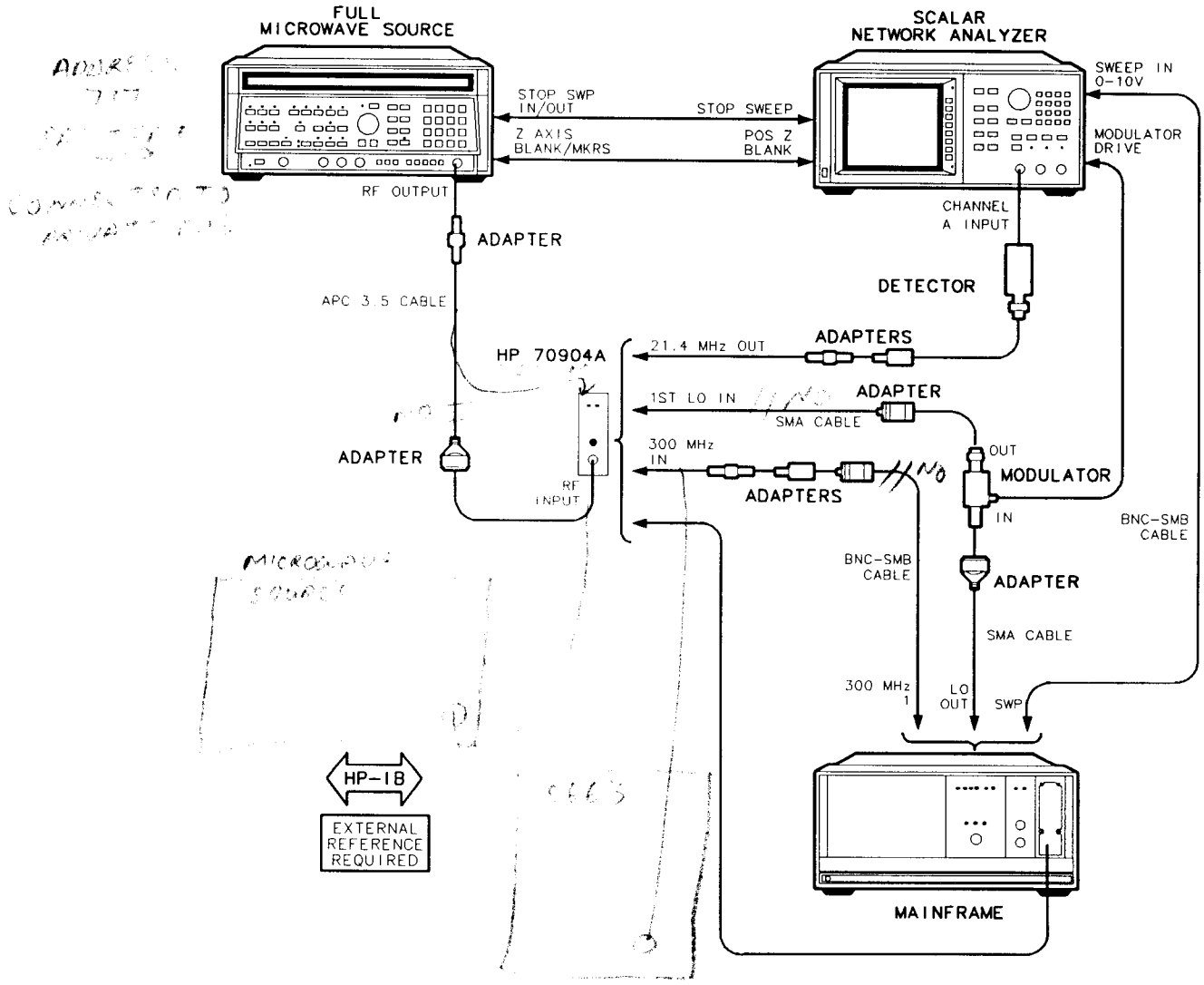


Figure 4-35. Last Converter Bandpass Filter Tune Setup

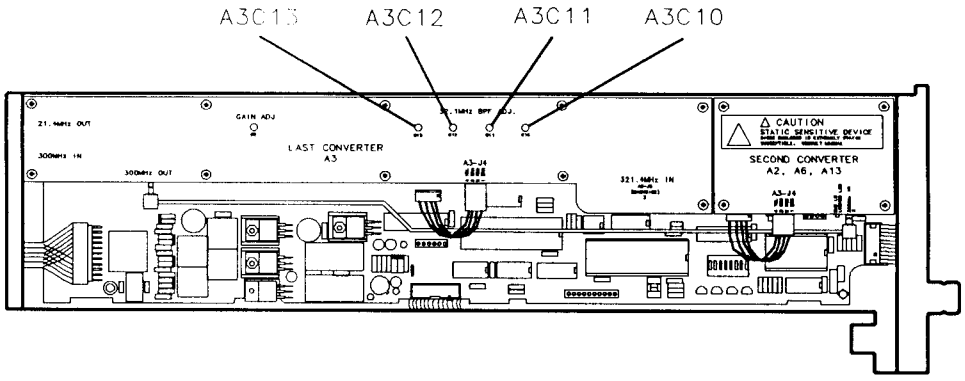


Figure 4-36. Last Converter Bandpass Filter Tune Locations

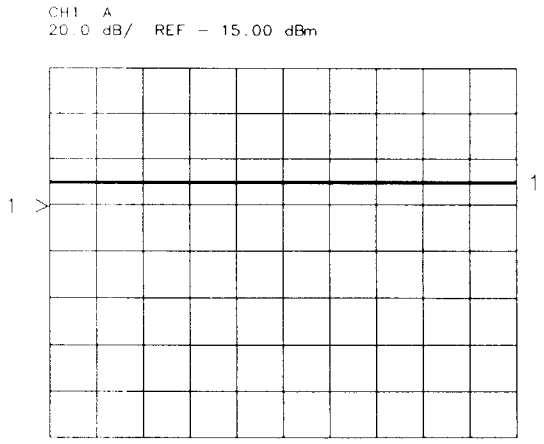


Figure 4-37. Last Converter Passband Response at 20 dB, Reference −15 dBm

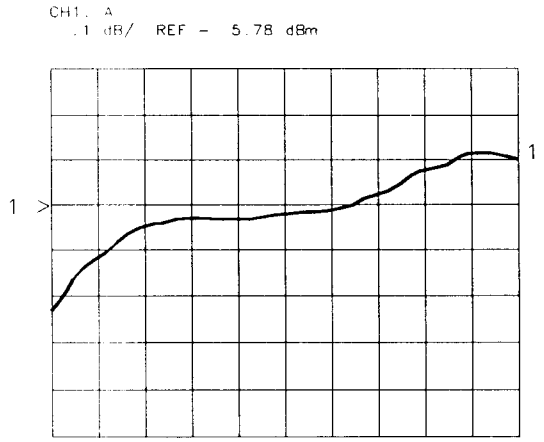


Figure 4-38.
Last Converter Passband Response at 0.1 dB, Reference −5.78 dBm

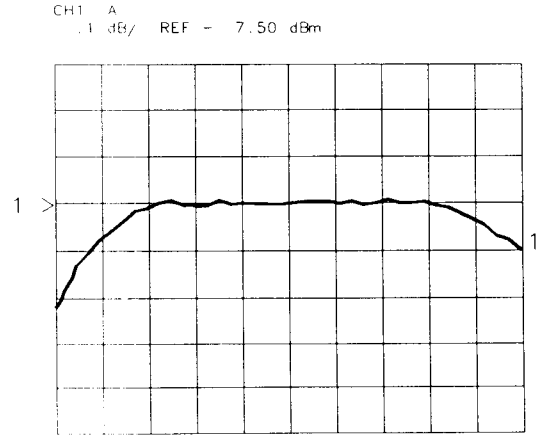


Figure 4-39.
Last Converter Passband Response at 0.1 dB, Reference −7.50 dBm

19. Last Converter Noise Figure Check

Purpose

This routine measures the noise figure of the last converter. This test is a troubleshooting tool that helps determine whether the noise figure is within test limits.

Description

The noise figure meter must be calibrated at the beginning of this adjustment. It is calibrated at 21 MHz with an input of 321 MHz. The synthesized source is set to 300 MHz at 0 dBm. The RF section noise figure is measured at 21 MHz with an input of 321 MHz. This measurement is compared with test limits.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Noise Figure Meter	HP 8970A/B
Noise Source	HP 346C
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to BNC (f) *(2 required)*	1250-0780
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
BNC (m) to SMB (f)*(2 required)*	85680-60093
BNC (m) TO BNC (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-40. Load and run the Last Converter Noise Figure routine. Make the checks as defined by the computer. Figure 4-41 illustrates the check location. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

19. Last Converter Noise Figure Check

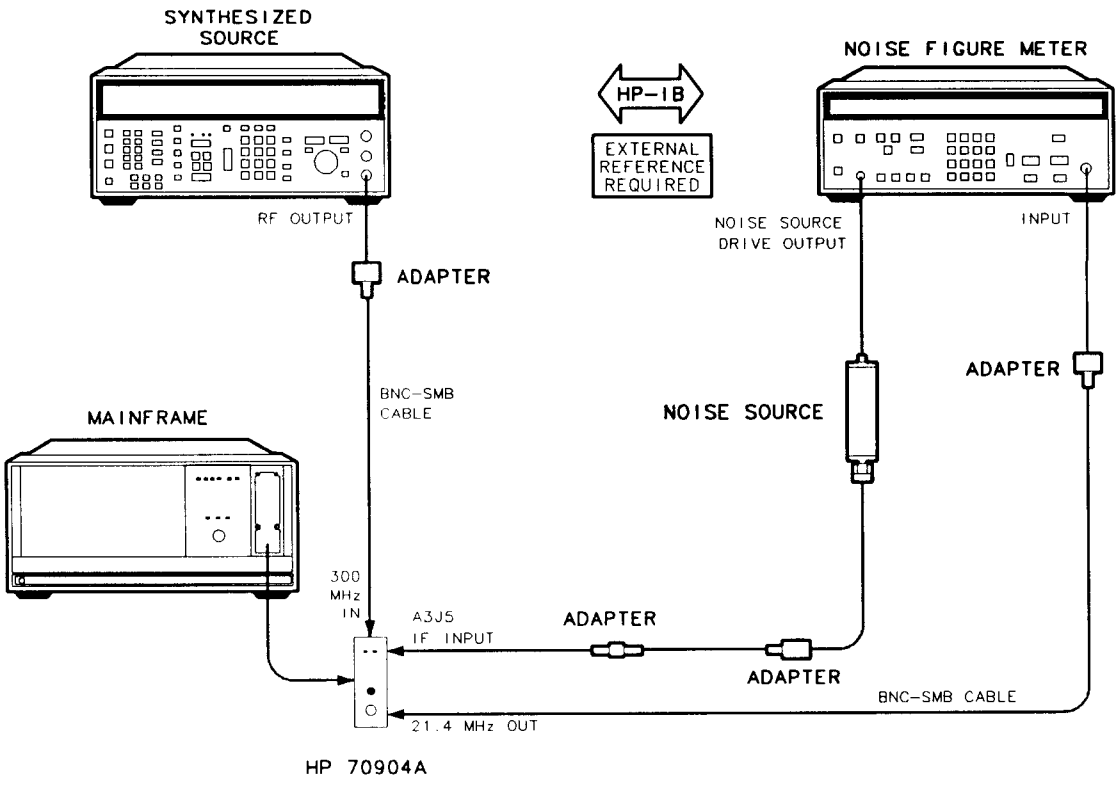


Figure 4-40. Last Converter Noise Figure Check Setup

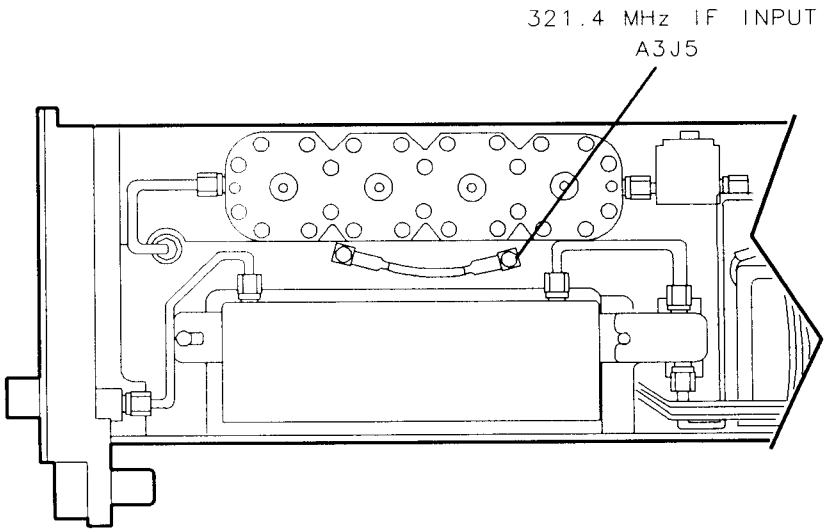


Figure 4-41. Last Converter Noise Figure Check Location

20. Second Converter Noise Figure Check

Purpose

This routine measures the conversion loss and the noise of the second converter in the RF section. The excess noise due to the second converter is indicated by the noise figure measurement. A periodic system calibration must be performed prior to beginning this test to ensure measurement integrity. Adjustment 16, "Second Converter Bandpass Filter Adjustment," and adjustment 17, "VCO Tune Range Final Adjustment," need to be completed before running this routine.

Description

The input of the noise figure meter is connected to the 321.4 MHz output, with the excess noise source connected to the first IF input on the A2 Second Converter Bandpass Filter and LO Housing.

The noise figure and the insertion gain is read from the noise figure meter. The program checks that the noise figure is between 3.0 and 12.0 dB and that the insertion loss is between 3.0 and 6.5 dB. Typical insertion loss is approximately 4 to 4.5 dB.

External Equipment Required

Test Equipment	Preferred HP Model or Part Number
Controller	HP 9000 Series 200/300
HP 70000 Series Mainframe	HP 70001A
Local Oscillator Source	HP 70900A/B
Synthesized Source	HP 8662A/HP 8663A
Noise Figure Meter	HP 8970A/B
Noise Source	HP 346C
Accessories	
Module Service Extender	70001-60013
Adapters	
Type N (m) to APC (f)	1250-1744
Type N (m) to BNC (f)	1250-1780
SMA (m) to SMA (f) *right angle*	1250-1249
SMA (f) to SMB (m)	1250-0674
SMB (f) to SMB (f)	1250-0672
Cables	
SMA (m) to SMA (m)	5061-5458
BNC (m) to SMB (f)	85680-60093
BNC (m) TO BNC (m)	HP 10503A

Procedure

Refer to "Preparing for Adjustments" in this chapter, then connect the equipment as shown in Figure 4-42. Load and run the Second Converter Noise Figure Check routine. Make the checks as defined by the computer. Figure 4-43 illustrates the check locations. Refer to Chapter 2, "Verification Software," for detailed information about loading and running the software.

Note Allow the test equipment to warm up for 30 minutes before proceeding with this adjustment.

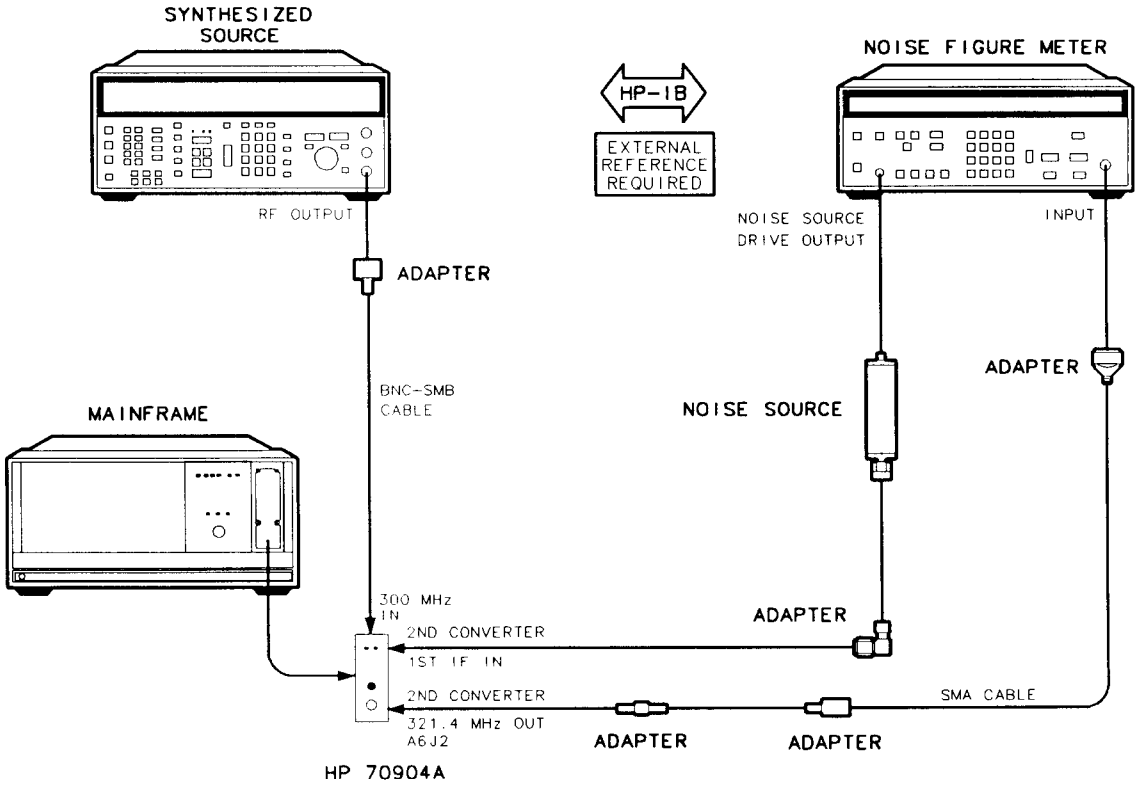


Figure 4-42. Second Converter Noise Figure Check Setup

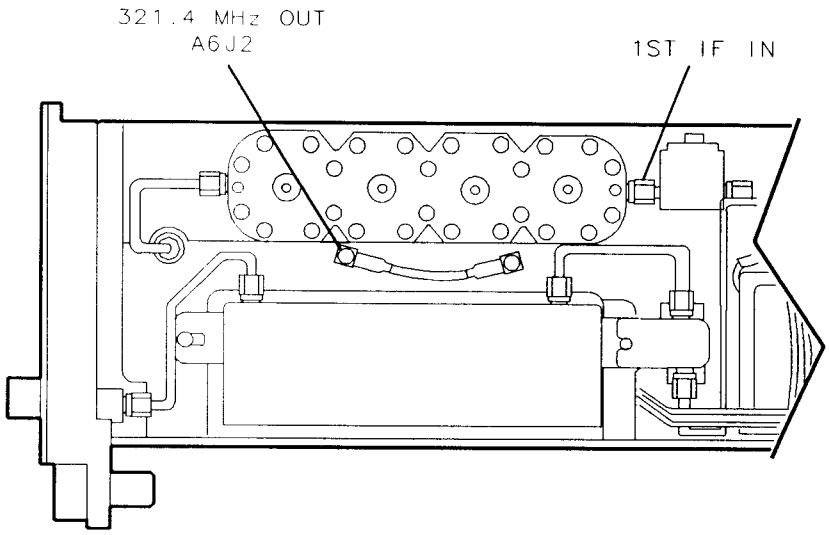


Figure 4-43. Second Converter Noise Figure Check Location

5

Troubleshooting

Introduction

This chapter contains information that can help troubleshoot to the assembly level. When necessary, refer to the block and interconnect diagrams located at the end of this book and the schematics located in the *HP 70904A Component-Level Information* binder. The troubleshooting information covered in this chapter is listed below.

Preparing the Module

Unless otherwise stated, install the HP 70904A on an extender module (HP part number 70001-60013), remove the cover, and make connections necessary for normal HP 71000 Modular Spectrum Analyzer operation. The procedures assume that correct power-supply voltages are supplied to the individual assemblies. If the voltages are not correct, refer to "A4 Power Supply/Controller" in this chapter.

Related Tests

If an assembly has been repaired or replaced, refer to Table 5-1. The table lists the adjustments and performance tests that should be performed to ensure proper module operation. These adjustments and tests should be performed in addition to the final verification tests listed in Chapter 3, "Verification Tests."

Block Diagram

The module's block and interconnect diagrams are located at the end of this book.

Table 5-1. Related Adjustments and Performance Tests

Assembly Changed, Repaired, or Adjusted	Perform the Following Related Adjustments and Checks	Perform the Following Related Performance Tests
A1 Miscellaneous Bias	Miscellaneous Bias Voltage LO Leveling Amplifier	All Final Tests
A2 Second LO PLL	VCO Tune-Line Voltage Adj VCO Freq and Amp Adj Sampler DC IF Output Check Sampler AC IF Output Check Search Oscillator Duty Cycle and Period Adj Search Oscillator Min and Max Check Search Oscillator Tune-Line Peak Adj Phase Lock Check VCO Tune Range Preliminary Adj Lock Range Check Mixer Bias Check Second Converter Bandpass Filter Tune VCO Tune Range Final Adj	All Final Tests Reference Input Freq and Range
A3 Last Converter	Last Converter Bandpass Filter Tune	All Final Tests Reference Input Freq and Amp Range 10 MHz Rejection
A4 Power Supply/Controller	Power Supply and Controller Miscellaneous Bias Voltage	All Final Tests

Table 5-1. Related Adjustments and Performance Tests (continued)

Assembly Changed, Repaired, or Adjusted	Perform the Following Related Adjustments and Checks	Perform the Following Related Performance Tests
A5 Second Mixer	VCO Tune-Line Voltage VCO Freq and Amp Adj Sampler DC IF Output Check Sampler AC IF Output Check Search Oscillator Duty Cycle and Period Adj Search Oscillator Min and Max Check Search Oscillator Tune-Line Peak Adj Phase Lock Check VCO Tune Range Preliminary Adj Lock Range Check Mixer Bias Check Second Converter Bandpass Filter Tune VCO Tune Range Final Adj Second Converter Noise Figure Check	All Final Tests Reference Input Freq and Range
A6 321.4 Matching Network	Phase Lock Check VCO Tune Range Preliminary Adj Lock Range Check Mixer Bias Check Second Converter Bandpass Filter Tune VCO Tune Range Final Adj	All Final Tests Reference Input Freq and Amp Range

Table 5-1. Related Adjustments and Performance Tests (continued)

Assembly Changed, Repaired, or Adjusted	Perform the Following Related Adjustments and Checks	Perform the Following Related Performance Tests
A7A1 Front Panel	No Adjustments	All Final Tests
A8 Input Attenuator	No Adjustments	All Final Tests
A9 Limiter	No Adjustments	All Final Tests
A10 Isolator	No Adjustments	All Final Tests
A11 First Converter	No Adjustments	All Final Tests
A12 Leveling Amplifier	LO Leveling Amplifier	All Final Tests Aux LO Out Amp and Harmonics LO Input Amplitude Range
A13 VCO Sampler	VCO Tune-Line Voltage VCO Freq and Amp Adj Sampler DC IF Output Check Sampler AC IF Output Check Search Oscillator Duty Cycle and and Period Adj Search Oscillator Min and Max Check Search Oscillator Tune-Line Peak Adj Phase Lock Check VCO Tune Range Preliminary Adj Lock Range Check Mixer Bias Check Second Converter Bandpass Filter Tune VCO Tune Range Final Adj Second Converter Noise Figure Check	All Final Tests Reference Input Freq and Range

Table 5-1. Related Adjustments and Performance Tests (continued)

Assembly Changed, Repaired, or Adjusted	Perform the Following Related Adjustments and Checks	Perform the Following Related Performance Tests
A14 Low Pass Filter	No Adjustments	All Final Tests
A15 2.9 GHz Low Pass Filter	No Adjustments	All Final Tests

Power-Up Failure

A power-up sequence is automatically executed. If the module cannot complete its power-up sequence, the module may prevent the master module from establishing a link with the display. An indication of this would be a partial or blank display, or a flashing front-panel ERROR LED on the HP 70904A.

If the HP 70904A fails to complete its power-up sequence, perform the following procedure:

1. Remove the module from the mainframe and install it on an extender module (HP part number 70001-60013). Remove the left-side module outer cover, then locate the A4 Power Supply/Controller assembly.
2. Measure the +5 V supply at A4TP1. If +5 V is present, there is a problem with the A4 Power Supply/Controller assembly. If +5 V is not present, check the fuse located at the bottom near the rear of the A4 board assembly. Replace the fuse if it is blown. Next, disconnect the following connectors to remove power from various assemblies of the module.

Connector	Assembly Supplied
A4J2	A1 Miscellaneous Bias power supplies
A4J3	A3 Last Converter power supplies
A4J4	A2 Second Converter PLL power supplies
A4J5	A7A1 Front Panel power supplies

3. Power up the module with these connectors removed. If the power-supply voltages are still incorrect, there is a problem with the A4 Power Supply/Controller board. If the supplies are correct when power is applied, replace A4J2 through A4J5 one at a time until the loading problem is isolated. When the faulty assembly is located, refer to the appropriate schematic.
4. If the voltages are correct but the module still cannot complete the power-up sequence, then there is a problem on the A4 Power Supply/Controller.

Error Message Troubleshooting

Error Codes

If an error message caused by the HP 70904A RF Section is reported, use the following information to begin troubleshooting. It is assumed that the power-supply voltages are operating correctly. If the power supplies are incorrect, refer to the A4 Power Supply/Controller assembly troubleshooting information.

These error code definitions apply when the HP 70904A causes the errors. A single problem can cause multiple errors messages; in that case, first investigate the following errors:

- 2000 series errors
- 7000 ROM Check Error
- 7004 300 MHz Error
- 7009 ROM #2 Check Error
- 7033 Power Supply Fault

2001 (ILLEGAL CMD)

This error occurs when the processor on the A4 Power Supply/Controller assembly finds an unrecognizable command. Check for and open or short in the interconnect cable that connects the rear panel to the A4 Power Supply/Controller assembly (refer to the HP 70904A Block Diagram). If the cable is not at fault, troubleshoot the A4 Power Supply/Controller assembly.

2002 (ILLEGAL PARAMETER)

Refer to the error 2001 description.

2006 (PARAMETER OUT OF RANGE)

Refer to the error 2001 description.

2009 (PROTOCOL ERROR)

Refer to the error 2001 description.

7000 (ROM CHECK ERROR)

This error occurs when there is a difference between the programmed checksum and the computed checksum for the lower half of the addresses of A4U9 EEROM. The serial number and flatness data will have to be reloaded into the new ROM. If replacing A4U9 does not solve this problem, troubleshoot the A4 Power Supply/Controller assembly.

7002 (FIRST LO UNLEVELED)

This error indicates an unleveled 1st LO signal. It occurs when the voltage at A1U6A pin 3 is more positive than that at A1U6A pin 2. Check that the gate bias and LO sense voltages to the A12 Leveling Amplifier are the same as the voltages printed on the leveling amplifier label. If the voltages are not the same, perform the LO Leveling Amplifier Gate Bias and LO Sense adjustment procedures. If the voltages match but the error remains, tune the HP 70000 Modular Spectrum Analyzer system to the settings where the failure occurs. Verify that the power into A12J1 is greater than 0 dBm. If it is not, troubleshoot the source of the low LO power. Verify that the output power from A12J2 is about +14 dBm. If it is not, replace the A12 Leveling Amplifier. If it is, the problem is either in the A12 Leveling Amplifier or on the A1 Miscellaneous Bias board.

7003 (SECOND LO UNLOCKED)

This error will be reported when the voltage at A2TP1 (VCO Tune) exceeds the +8.6 V to −8.8 V range. This voltage is sent from the A2 Second LO PLL board via the VCO monitor line to the A4 Power Supply/Controller board. The A4 assembly senses the voltage level, translates it to TTL (low = locked), and reports any error condition. A TTL low measured at A4TP3-4 indicates a locked condition.

If an unlocked or error condition exists, perform the following adjustments defined in Chapter 4, "Adjustment Procedures."

- "Second Converter Bandpass Filter Tune"
- "Lock Range Check"
- "Phase Lock Check"

Performance Test Failures

The following troubleshooting instructions are grouped according to module performance test. If an HP 70904A fails a performance test, look up the test in the list and follow the instructions. Performance test numbers are shown in parenthesis. This troubleshooting information assumes that the power-supply voltages are correct and that the test failures are not due to faulty test equipment.

RF Flatness Calibration and Verification (1, 2)

The A11 First Converter usually causes these tests to fail. Too much or too little LO power into the A11 First Converter, or any incorrect condition preceding the A11 First Converter, can cause flatness problems. If overall gain is the only problem, excessive loss located anywhere in the IF path(s) can be the cause. Refer to the A11 First Converter troubleshooting information.

- If the failure is a frequency-dependent problem, it may be caused by anything between the J1 RF INPUT connector and the A11 First Converter. Verify that the LO signal into the A11 First Converter is greater than +13 dBm. If it is not, look for the cause of the LO power inadequacy.
- If the failure is not frequency-dependent, the problem may be LO gain in the A3 Last Converter or high conversion/insertion loss in the IF signal path. The A8 Input Attenuator may also cause the power to appear low across the band.
- Flatness <10 MHz: Any problem between the input connector and the A11 First Converter may cause this problem. Typically, the A11 First Converter is the cause.

Attenuator Accuracy (3)

If the test results are greater then 8 dB, then the problem could be the A8 Input Attenuator or the attenuator drive circuitry. Connect the HP 71000 Modular Spectrum Analyzer CALIBRATOR output to the HP 70904A RF INPUT. Step the attenuator through its positions (0 to 70 dB in 10 dB increments) as you watch the peak of the signal on the CRT display. If the signal peak is intermittent in amplitude and the test still fails, the problem is likely to be the A8 Input Attenuator. Refer to the A1 Miscellaneous Bias board (attenuator logic), or the A4 Power Supply/Controller (attenuator logic) troubleshooting information.

Front Panel LEDs (4)

Check test points A4TP2-7 (active) and A4TP2-8 (error). If the logic is high, the LED should be on. If the voltages are correct on the A4 Power Supply/Controller board, then the problem is on the A7A1 Front Panel board.

10.7 MHz Rejection (5)

Check the 10.7 MHz trap, A3L20 and A3C50, on the A3 Last Converter board assembly.

21.4 MHz OUT Feedthrough (6)

This is usually due to a problem with the stopband of the 321.4 MHz bandpass filter and 50 MHz lowpass filter on the A3 Last Converter board.

21.4 IF Output Harmonics (7)

If this test fails, the most common cause is the A3 Last Converter. Refer to "A3 Last Converter" troubleshooting in this chapter.

21.4 MHz Residual Emissions (8)

Two parameters are tested:

1. 300 MHz emissions from the A3 Last Converter. Usually the stopband of the 50 MHz lowpass filter is bad. However, the output of the mixer or the 21.4 MHz OUT bandpass filter should also be checked.
2. First LO feedthrough. If this test fails there is usually a problem with the A11 First Converter. Check that the LO signal is +14 dBm at the input of A11 First Converter before replacing it. If the power is too high, perform the A12 "Leveling Amplifier Adjustment" procedure defined in Chapter 4, "Adjustment Procedures."

Image Rejection (9)

- If the failing image is 42.8 MHz, then the second converter 3621.4 MHz bandpass filter or the 321.4 MHz bandpass filter is allowing IF frequencies of 3578.6 MHz and 278.6 MHz, respectively, to get through.
- If the failing image is 642.8 MHz, then the 3621.4 MHz filter stopband probably has a problem. The A11 First Converter, or poor A14 Lowpass Filter rejection, can cause this test to fail.
- Cracked solder joints on semirigid cables, loose connections, and bad grounds can also cause these failures.

IF Rejection (10)

This test measures the 21.4 MHz OUT response corresponding to the RF INPUT frequencies equal to the internal and IF image frequencies. Inadequate IF rejection results in baseline lift of the system. If this test fails, troubleshoot the IF path until the faulty assembly is found.

Out of Band Rejection (11)

This test measures the image rejection of the RF section to ensure that out-of-band inputs to the mixer do not appear in the IF signal. Problems can be caused by the A11 First Converter, poor A14 Lowpass Filter rejection, or poor A15 low-pass filter rejection.

Reference Frequency and Amplitude Range (12)

This test checks the locking ability of the second converter at ranges from −5 to +5 dBm, and 299.6 to 300.4 MHz input to the rear-panel 300 MHz IN.

If this test fails, the 300 MHz amplifier on the A3 Last Converter board assembly, the 300 MHz amplifier on the A2 Second LO PLL board, or the A13 VCO/Sampler can cause the failure. The cause may also be due to low 300 MHz gain in the A3 Last Converter or in the A2 Second LO PLL. It may also fail due to the second converter VCO/sampler, or the second-converter lock-loop capture range in general. If the A3 Last Converter 300 MHz amplifier is operating correctly, refer to the "Second Converter Adjustment" procedure defined in Chapter 4, "Adjustment Procedures."

IF Sub-Harmonics (13)

There is IF signal-path distortion occurring somewhere in the IF path when this test fails. Trace the IF signal path until the source of distortion is located. Poor grounding of the A13 VCO/Sampler board assembly cover, located beneath the A2 Second Converter board assembly, is often the cause. If the failure is the 10.7 or 310.7 MHz offset, refer to the A3 "Last Converter Bandpass Filter Adjustment" procedure defined in Chapter 4, "Adjustment Procedures."

Close-In Sidebands (14)

If this test fails, verify the presence of a ferrite core on W18 (flex cable assembly from J4 to A4). This ferrite core is necessary to suppress sideband energy.

Loose grounding screws, loose connectors, and cracked solder connections on semirigid cables can cause radiation and susceptibility problems. Make sure all ground connection contacts are good.

The most common causes are as follows:

- Missing ferrite core on W18 that suppresses the 40 kHz and 80 kHz energy.
- Broken heatsink solder joints that hold the heatsink of the series-pass element to the A4 Power Supply/Controller board assembly.
- Loose mounting screws on the A1 Miscellaneous Bias or A4 Power Supply/Controller boards.

To isolate the problem, substitute the IF frequencies with a synthesizer beginning with 321.4 MHz into the A3 Last Converter. If the RF input frequency = 300 MHz, then the 321.4 MHz signal goes into A3J6. If RF input frequency = 2700 MHz, then the 321.4 MHz signal goes into A3J5. Observe the sideband level on the 21.4 MHz signal with a spectrum analyzer. If it improves by using the synthesizer input, the problem exists on the signal path before the A3 Last Converter. Repeat the synthesized source substitution technique on the other IF frequencies until the cause of the failure is isolated.

If the above steps do not isolate the sidebands, 40 kHz or 80 kHz susceptibility of the A3 Last Converter or the A4 Power Supply/Controller board assembly can also contribute to this problem.

Residual Responses (15)

- Mixing of the first and second LO harmonics results in a product that is the second IF frequency.
- Check for loose connectors first, then for cracked solder joints on the semirigid cables (replace any of these), and finally for loose screws holding any board assemblies or castings to the center frame of the module.
- For N × 300 MHz residuals, check the RFI gasketing located in the grooves of the A2 Second LO PLL cover. Occasionally N × 300 MHz products enter via the RF signal path to the A11 First Converter and become abnormal mixing signals for the first and second LO. Determine whether this is the cause of residuals by removing the RF input cable to the A11 First Converter after the test setup check is completed, and replace this cable with a 50Ω load.
- Continue residual testing to determine if this is the cause of the problem. If it is, the A8 Input Attenuator is most likely causing the conduction of the N × 300 MHz residual.

Miscellaneous Residual Responses (16)

This test specifically checks for N × 300 MHz residuals. Refer to the above "Residual Responses" troubleshooting information.

21.4 MHz IF Output Frequency Response (17)

This test checks the overall filter response of the HP 70904A IF output. The response is normally a function of the 321.4 MHz bandpass filter on the A3 Last Converter. However, if any of the filters before the A3 assembly are not correct, this test can fail. RFI gaskets missing from covers and underneath printed circuit boards can also cause this test to fail.

Three parameters are tested:

1. Module gain at 300 MHz. If this check fails, perform the "Flatness Calibration Test" defined in Chapter 3, "Verification Tests."
2. Passband response. If this check fails, any of the filters in the signal path may be causing the problem. Verify proper alignment of both the Second Converter and Last Converter bandpass filters by performing the "Second Converter Bandpass Filter Tune" and "Last Converter Bandpass Filter Tune" routines defined in Chapter 4, "Adjustment Procedures."
3. 3 dB Bandwidth. Refer to the A3 "Last Converter Bandpass Tune" defined in Chapter 4, "Adjustment Procedures." The 42.8 MHz rejection of the second converter should also be checked.

If the problem is not found in the A3 Last Converter, check the IF path until the faulty assembly is found.

Gain Compression (18)

The A11 First Converter is usually the cause of gain compression; however, any of the amplifiers or mixers in the IF path can cause gain compression. If replacing the A11 First Converter does not eliminate the problem, trace the IF signal path until the offending component is found.

LO Input Amplitude Range (19)

If this test fails, there is usually a problem with the A12 Leveling Amplifier. Verify that the LO signal is +14 dBm at the input of A11 before replacing the A12 Leveling Amplifier. If the power is too high, refer to the A12 "Leveling Amplifier Adjustment" procedure defined in Chapter 4, "Adjustment Procedures." If the power is too low, replace the A12 Leveling Amplifier.

Aux LO Output Amplitude and Harmonics (20)

Refer to the LO Leveling Amplifier Adjustments. If the test still fails, the A12 Leveling Amplifier is faulty, or the A11 First Converter is presenting a poor VSWR to the A12 Leveling Amplifier.

Diagnostics (21)

This test checks the service detectors of the RF module:

- 1st LO unleveled detector
- Second LO unlocked detector
- 21.4 MHz level detector

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 an "error" state. The Power Supply Fault bit is not tested.

- The 1st LO unleveled line comes from the A1 Miscellaneous Bias board. The LO sense voltage is monitored. As the voltage at A1U11 pin 14 goes positive, A1J1-9 sends a TTL high to the A4 Power Supply/Controller. This indicates that an unleveled condition exists.
- The second LO unlocked condition originates on the A2 Second LO PLL board. The tune voltage to the 3.3 GHz oscillator is sent to the A4 Power Supply/Controller board where it is monitored. Whenever the voltage at A4J4-3 is greater than +10.3 V or less than +1.7 V, an unlocked condition results.
- The 21.4 MHz level detector is located on the A3 Last Converter board. When the voltage out of the detector is less than +0.1 V, an error state is reported to the CRT display. If this part of the test fails and the voltage is found on the A4 board, check for the +0.1 V reference voltage at A4U17 pin 9. Check that there is about 20 dB of gain from A3J5 to A3J1 on the A3 Last Converter. If the gain is about 20 dB, then there is probably high conversion loss somewhere along the 1H– signal path. If the gain is unacceptable, then there is a problem with the A3 Last Converter.

RF INPUT Emissions (22)

This test measures LO emissions at the front-panel RF INPUT. The A11 First Converter or A15 2.9 GHz Low Pass Filter can cause this test to fail.

RF Input Return Loss (23)

Failures may be caused by anything between and including the RF INPUT connector and the A11 First Converter.

Noise Figure (24)

Noise figure failures can be traced to two causes: high conversion/insertion loss, or excess noise addition in the signal path. If the failure is in the HP 70904A, then run the Second Converter Noise Figure test. If the test passes, continue on. If the test fails, then run the Last Converter Noise Figure test. If this test passes, then the problem is probably the First Converter; however, high insertion loss of either the 321.4 MHz bandpass filter or of the first IF lowpass filter, or bad cables, may also be causing this failure.

Adjustment Failures

If the HP 70904A RF Section cannot be adjusted to specification, use the information in this chapter to begin troubleshooting. The following troubleshooting instructions are grouped according to the module adjustment procedures. Adjustment procedure numbers are shown in parenthesis ( ). The information provided here assumes that a problem is not caused by power supplies that are out of tolerance, or external test equipment problems.

Power Supply/Controller (1)

Refer to the A4 Power Supply/Controller troubleshooting information.

Miscellaneous Bias Voltage (2)

Refer to the A1 Miscellaneous Bias troubleshooting information.

LO Leveling Amplifier Troubleshooting (3)

Gate Bias: This voltage is from a resistive divider on the A1 Miscellaneous Bias board assembly and can be measured at A1TP7. The voltage level is stamped onto the A11 Leveling Amplifier label.

LO Sense: The detected power information (LO Sense) is sent from the A11 Leveling Amplifier to the A1 Miscellaneous Bias board assembly , where it is compared with a reference voltage. The integrated result of this comparison is returned to the A11 Leveling Amplifier as the pin diode modulation drive.

VCO Tune-Line Voltage Adjustment (4)

If A2R7 cannot be adjusted to −5 V, then the problem is probably on the A2 Second LO PLL board assembly; however, this problem may also be caused by the A13 VCO/Sampler loading down the tune line.

VCO Frequency and Amplitude Adjustment (5)

If the VCO will not oscillate, check for open contacts. Electrical connection between the A2 Second LO PLL board assembly and the A13 VCO/Sampler is made with spring contacts beneath the A2 board assembly. Refer to the A2 "Second LO PLL Replacement Procedure" in Chapter 6 to access these contacts. Electrical contact may be verified by measuring VCO V_{cc} at A2J3-2. It should be about +10.7 V if contact is good. If contact is poor, the voltage should measure +12 V. VCO V_{ee} at A2J3-3 should be about −2.7 V if contact is good, and −12 V if contact is poor. Verification of electrical contact may also be made at A2J3-1 and A2J2-3; however, verifying contact at these test points requires that the A2 Second LO PLL board assembly be removed.

If the VCO oscillates but does not reach 3.3 GHz from the low side, loosen all of the screws holding the Second Converter BPF (bandpass filter) and LO Housing assembly. Push the second converter BPF and LO Housing assembly towards the front and bottom of the module. Tighten the screws while holding it in that position. The positioning of the LO housing cavity relative to the antenna probe within the cavity is critical. The problem may also be eliminated by loosening the screws holding the A13 VCO/Sampler board assembly and

rotating the assembly counter-clockwise as far as the screws will allow, then tightening it in that position.

If the VCO oscillates, then jumps to some other unadjustable frequency at a lower amplitude, center the LO ADJUST slug on the Second Converter BPF and LO Housing and cycle power. This problem usually occurs when the VCO is being adjusted away from 3.3 GHz.

It is also possible to position the bandpass filter adjustment slugs in so far that they short out to the bottom of the Second Converter BPF and LO Housing assembly. This problem is typically one that occurs after the instrument is powered up for the first time and usually does not recur after the bandpass filter has been adjusted.

Amplitude: Check the SMA connector threads on the 2nd LO OUT connector. If there are two or fewer threads showing, then there is probably a problem with the A13 VCO/Sampler and it should be replaced.

Second Converter LO Feedthrough Check (6)

Caution 

Many components on the A2 Second LO PLL board assembly are extremely susceptible to electrostatic discharge (ESD) damage. It is essential to perform troubleshooting at a designated static-safe workstation.

Refer to the A6 321.4 MHz Matching Network adjustment in the "Second Converter Bandpass Filter Tune" troubleshooting information. C2, a 22 pF feedthrough capacitor can cause this test to fail by providing poor rejection of the 3.3 GHz LO signal.

Sampler DC IF Output Check (7)

Refer to the A13 VCO Sampler Troubleshooting section.

Sampler AC IF Output Check (8)

Refer to the A13 VCO Sampler Troubleshooting section.

Search Oscillator Duty Cycle and Period Adjustment (9)

If the search oscillator fails to work, A2U1 is probably bad and should be replaced. Refer to the A13 VCO Sampler Troubleshooting section.

Search Oscillator Square Wave Min and Max Check (10)

Refer to the Search Oscillator adjustment procedure. If this test continues to fail after adjusting the search oscillator, the problem is probably on the A2 Second LO PLL board assembly. Also, there may be too much ac or dc voltage coming from the A13 VCO/Sampler. Refer to the "Sampler AC and DC IF Output Checks" defined in Chapter 4, "Adjustment Procedures." If the search oscillator square-wave signal is present, but the minimum and maximum voltages are low, then replace A2U1.

Search Oscillator Tune-Line Peak Adjustment (11)

If this test fails and A2R7 cannot be adjusted to stop the search oscillator, then there is probably a problem with the phase-lock loop. Refer to the Phase Lock Check troubleshooting information.

Phase Lock Check (12)

Any problem in the phase-lock loop may cause this test to fail.

- Remove the 300 MHz cable from A2J1. Tune the HP 71000 Modular Spectrum Analyzer to 300 MHz center frequency and 1 MHz span (this span enables the 3.3 GHz oscillator).
- Connect an oscilloscope to A2TP1. There should be a pulse with a 35 to 70% duty cycle and peaks of about ±9.5 V. If there is not, there is a problem with the search oscillator. Refer to the Search Oscillator adjustment and check procedures defined in Chapter 4, "Adjustment Procedures." If the pulse is present after performing the adjustment procedure, then A2U1 phase-lock amplifier is operating correctly.
- Verify that there is a 300 MHz signal of about +3 dBm going into A2J1. If the signal is low or not present, refer to A3 Last Converter troubleshooting information.
- Use a 1:1 probe and a spectrum analyzer to observe the signal at A2J3-5. If no 300 MHz signal is present (10 dBm, depending on the probe used), then the A2 Second LO PLL board has a problem.
- If a 300 MHz signal is present, the A13 VCO/Sampler is probably bad or the spring contacts are faulty. Refer to the troubleshooting information for VCO Frequency and Amplitude for information about the spring contacts.
- If everything appears to be intact, rerun the VCO Frequency and Power Adjustment test.

VCO Tune Range Preliminary Adjustment (13)

- If the VCO cannot be adjusted so that it remains locked at the extremes, and if the Search Oscillator Min and Max test passes, the problem is probably on the A13 VCO/Sampler board assembly.
- If the Search Oscillator Min and Max test fails, then the problem is on the A2 Second LO PLL board assembly.

Lock Range Check (14)

Refer to the VCO Tune Range Preliminary Adjustment test procedure.

Mixer Bias Check (15)

If the VCO Frequency and Amplitude adjustment procedure passes, then the problem is the A5 Second Mixer diode. The magnitude of the power of the VCO available at the A5 Second Mixer diode will contribute to the mixer bias level. A reduction in available power at the second LO output port will increase the available power at the mixer, thus increasing the mixer bias level.

Second Converter Bandpass Filter Tune (16)

- If the bandpass shape appears to have a gross over coupled (too narrow) or under coupled (too wide) response that cannot be flattened, then the second converter IF INPUT SMA connector may either be screwed in too far or not far enough, respectively. Once this connector is initially adjusted, this response problem is not typical.
- The C1 feedthrough capacitor from the mixing diode to the matching network can affect the bandpass shape. It is usually manifested by a skewing of the bandpass shape to one side or the other, and a higher-than-normal conversion loss.

VCO Tune Range Final Adjustment (17)

- If the VCO cannot be adjusted so that it remains locked at the extremes, and if the Search Oscillator Min and Max test passes, the problem is probably on the A13 VCO/Sampler board assembly.
- If the Search Oscillator Min and Max test fails, then the problem is on the A2 Second LO PLL board assembly.

Last Converter Bandpass Filter Tune (18)

Verify that the second converter bandpass filter is adjusted properly. If the last converter bandpass response cannot be adjusted flat, adjustment of A6L1 may be necessary. A6L1, C1, and C2 can affect the impedence match between the second and last converter, and thus the bandpass shape of the last converter.

Last Converter Noise Figure Check (19)

See A3 Last Converter troubleshooting procedure

Second Converter Noise Figure Check (20)

Unless the VCO Frequency and Amplitude Adjustment Procedure also fails, the problem is usually the A5 Second Mixer diode. A poorly tuned bandpass filter can also cause this test to fail.

Caution

Many components on the A2 Second LO PLL board assembly are extremely susceptible to electrostatic discharge damage. It is essential to perform troubleshooting at a designated static-safe workstation.

Troubleshooting HP 70904A RF Section Assemblies

The following information may be used to aid in troubleshooting the various assemblies of the RF module. It is organized to follow the signal flow through the module. When necessary, refer to the block diagram at the end of this book or to the schematic diagrams in the *HP 70904A Component-Level Information* binder.

Troubleshooting Procedures

A8 Input Attenuator

This assembly is a three-section attenuator that has 10, 20, and 40 dB sections. There also is a programmable dc-blocking capacitor for input signals. The switching drive comes from the A1 Miscellaneous Bias, which drives the switching signals from the A4 Power Supply/Controller. Each attenuator section is controlled by two lines. For example, when 40 dB of attenuation is used, attenuator section 3 will be enabled. To switch in section 3, A1J1-9 (40 dB IN) will be +13 V and A1J1-3 (40 dB OUT) will be −13 V. The voltages on these pins will be reversed on sections that are not enabled. With 30 dB of attenuation, A1J1-2 and A1J1-5 will measure +13 V and A1J1-11 and A1J1-13 will measure −13 V.

If the switching logic is correct, but the signal attenuation is not, replace the A8 assembly. If the switching logic is incorrect replace the A1 Miscellaneous Bias Assembly or the A4 Power Supply/Controller assembly.

A9 Limiter

With input power levels up to 0 dB and frequencies from 0.0 to 2.9 GHz, the limiter should have an insertion loss (S21) of less than 0.5 dB. The A9 Limiter can be damaged by excessive power.

A11 First Converter

The RF First Converter should have the following conversion loss relative to 300 MHz:

Frequency Range	Typical Conversion Loss
100 Hz to 2.5 GHz	<6 dB
2.5 to 2.9 GHz	<9 dB

A2, A5, A13 A6, Second Converter

Caution

Many components on the A2 Second LO PLL board assembly are extremely susceptible to electrostatic discharge damage. It is essential to perform troubleshooting at a designated static-safe workstation.

The five parts that make up the second converter are A13 VCO/Sampler, A2 Second LO PLL, A5 Second Mixer, 3.6 GHz Second Converter Bandpass Filter and LO Housing, and A6 321.4 MHz Matching Network.

The A13 VCO/Sampler provides these two functions:

- Varactor tuning for the 3.3 GHz local oscillator.
- Sampler/phase detector for the 3.3 GHz local oscillator.

The A2 Second LO PLL provides these two functions:

- 300 MHz amplification for use as the sampling signal.
- 3.3 GHz local oscillator frequency correction voltage.

The A6 321.4 MHz Matching Network provides the necessary loads to the output of the second converter and the input to A3 Last Converter. Refer to the A2 Second LO PLL Adjustment procedure if you have any problems.

A3 Last Converter

The last converter provides the gain adjustment for the HP 70904A RF Section. The gain range should be from +13 to +20 dB. The last converter also down-converts the 321.4 MHz IF signal to a 21.4 MHz IF signal that is processed by the IF modules, and it provides amplification of the 300 MHz signal. This signal becomes the LO for the mixer. The LO signal to the mixer is sent to the second converter for use in phase-locking the 3.3 GHz oscillator. The A3 Last Converter has a signal present in the 21.4 MHz IF path. This detector is not used as part of the HP 70904A normal operation. It is used in System Diagnostics.

A1 Miscellaneous Bias

The miscellaneous bias provides gate-bias and feedback voltages to the A12 Leveling amplifier. It also provides voltage for the attenuator/dc-block drive circuitry. There is a +5 Vs supply from the A4 Power Supply/Controller that is derived from the +15 Vs on the miscellaneous bias board assembly. The purpose of this supply is to maintain a voltage level a few seconds after power is turned off, allowing the attenuator to be set to 70 dB attenuation and to engage the dc-blocking capacitor. This function protects the RF module while power is off.

A12 Leveling Amplifier

This amplifier receives the 3.0 to 6.6 GHz LO signal, amplifies it, and levels it. It is also the rear-panel LO output of the module.

A4 Power Supply/Controller

The +5 V supply must be present in order for the controller to operate. Use a voltmeter to measure the test point voltages in Table 5-2.

Table 5-2. Power Supply Voltages

Test Point	Voltage	Tolerance
A4TP1-1	+5 V	±0.2 V
A4TP1-2	+8 V	±0.4 V
A4TP1-3	+11 V	±0.5V
A4TP1-4	−12 V	± 0.6 V
A4TP1-5	+12 V	±0.6 V
—	+15 V	+14 V
—	−15 V	<−14 V
—	+7.5 V	+7 V

If none of the voltages are present, check the fuse located near the bottom to the rear of the A4 board assembly. Replace the fuse if it is blown.

Next, disconnect the following connectors to remove power from various assemblies of the module.

Connector	Assembly Supplied
A4J2	A1 Miscellaneous Bias power supplies
A4J3	A3 Last Converter power supplies
A4J4	A2 Second Converter PLL power supplies
A4J5	A7A1 Front Panel power supplies

Recheck the test point voltages. If the power supply voltages remain incorrect, the problem is on the A4 Power Supply/Controller. If the supplies are correct when power is applied, reconnect A4J2 through A4J5, one at a time, to isolate the location of the loading problem. Refer to the appropriate troubleshooting information when the faulty assembly is isolated.

The +5 Vs supply is derived from the +15 Vs on the A1 Miscellaneous Bias board assembly. The purpose of this supply is to maintain voltage level a few seconds after power is turned off, allowing the attenuator to be set to 70 dB attenuation and to engage the dc-blocking capacitor. A4U7 latches the attenuator/dc-block information and sends it to the A1 Miscellaneous Bias board assembly. This function protects the RF module while power is off.

The A4 Power Supply/Controller receives status information from the second converter VCO (locked/unlocked), the 21.4 MHz detector (used only in System Diagnostics with the system in 0 Hz span: signal present equals 0 V), and the A12 Leveling Amplifier (leveled/unleveled). This information is read by the controller, which reports the error state only. Run Diagnostics from the module Performance Verification Tests to check its operation.

The controller board assembly receives information via the HP-MSIB master element and acts upon it accordingly. The controller board assembly is responsible for setting the attenuator and the ac/dc coupling, as controlled by the program from the master element. Except for error reporting, the controller board assembly does not respond to any stimulus from the module itself.

The Troubleshooting Tool Program

This program allows communications from the controller keyboard to the HP 70904A RF Section. The user can configure the HP 70904A 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 (use only for HP 70905 and HP 70906)
3. DIAGNOSTICS
4. CAPABILITY STRING
5. SET ATTENUATOR
6. SERIAL NUMBER
7. FIRMWARE DATE CODE STRING
8. CONFIGURATION STRING

PRESET must precede *any* other tool command. It opens a communication link from the system controller to the HP 70904A.

SELECT BAND configures the HP 70905 or HP 70906 to one of the four bands: 1H−, 1L−, 2L−, or 4L.

DIAGNOSTICS lists (on the controller display) errors currently being generated by the HP 70904A.

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.

6

Replacement Procedures

Introduction

The procedures in this chapter describe the removal and replacement of the major assemblies in the HP 70904A RF Section. Numbers enclosed in parentheses are used throughout these procedures as reference to the numerical callouts on the figures. Refer to Table 6-1 for a complete listing of all tools and materials required in the procedures.

Caution 

This module has static-sensitive components. Read the "Electrostatic Discharge" (ESD) section in Chapter 1 before proceeding.

The following replacement procedures are included in this chapter:

Table 6-1. Tools and Materials Required

Description	HP Part Number	CD
Phillips Screwdriver #0	8710-0978	6
Pozi-Drive Screwdriver (small)	8710-0899	0
Pozi-Drive Screwdriver (large)	8710-0900	4
3 mm Hex (Allen) Wrench	8710-1366	8
5/16-inch Open-end Wrench	8720-0015	3
1/14-inch Nut Driver	8720-0002	8
9/16-inch Nut Driver (drilled out, end covered with heat-shrink tubing)	8720-0008	4
Long-Nosed Pliers	8710-0030	1
Wire Cutters	8710-0012	9

HP 70904A RF Section

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Set the mainframe line switch to OFF.
2. Remove the following rear-panel cables before removing the module from the mainframe. See Figure 6-1.
   - 21.4 MHz IF cable from A3 Last Converter J1 **(1)**
   - 300 MHz cable from A3 Last Converter J2 **(2)**
   - 1st LO IN cable from rear-panel J2 **(3)**
3. Open the mainframe front-panel door **(4)** and loosen the hex-nut latch **(5)** to free the module.
4. Carefully push against the rear panel of the module and pull it out of the mainframe.

Replacement

5. Verify that the address switch is at the correct setting, then slide the HP 70904A RF Section into the mainframe.
6. Press against the module front panel and tighten the hex-nut latch **(5)**.
7. Reconnect the following rear-panel cables to the module.
   - 21.4 MHZ IF cable to A3 Last Converter J1 **(1)**
   - 300 MHz cable to A3 Last Converter J2 **(2)**
   - 1st LO IN cable to rear-panel J2 **(3)**
8. Close the mainframe front-panel door **(4)** and set the mainframe line switch to ON.

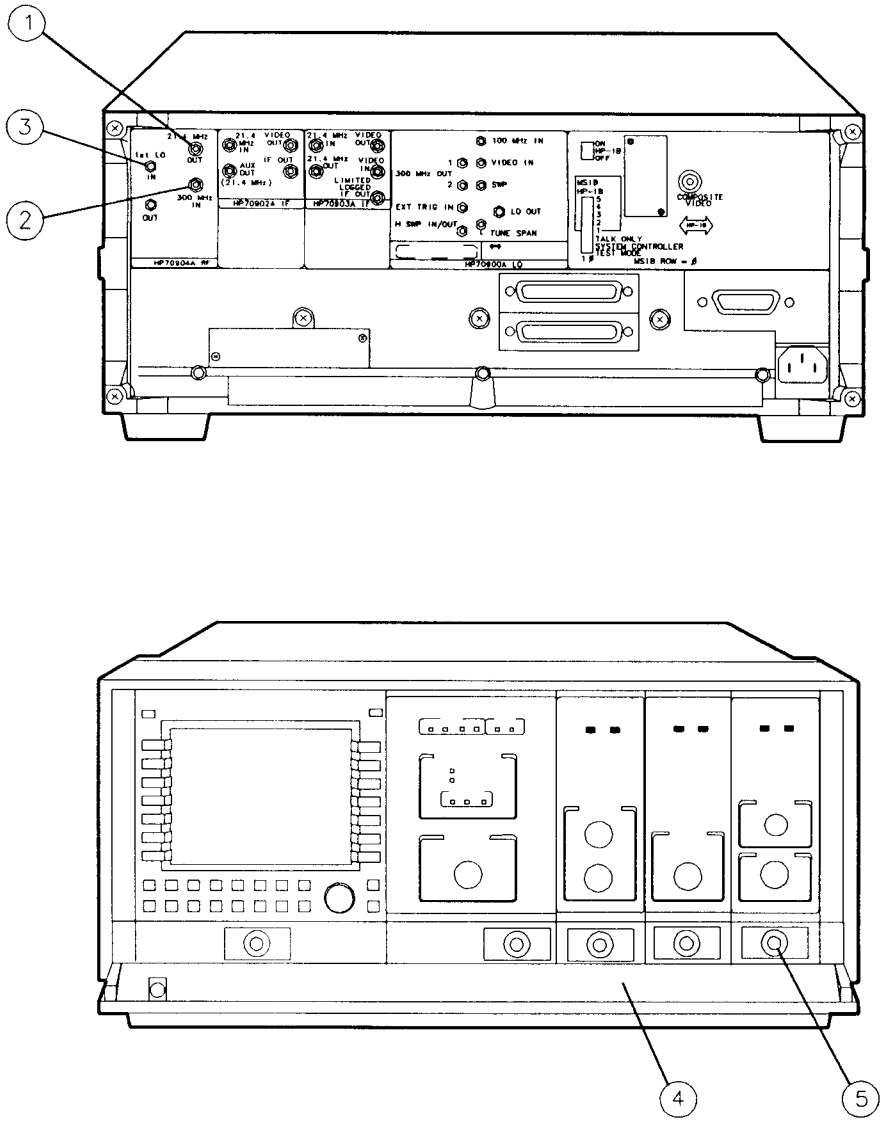


Figure 6-1. HP 70904A RF Section Replacement

A1 Miscellaneous Bias

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the right-side cover from the RF section.
3. Remove the W8 semirigid cable from rear-panel J3 and from A12 Leveling Amplifier LO IN **(2)**. See Figure 6-2.
4. Remove the W7 semirigid cable from rear-panel J2 and from A12 1st LO AUX OUT port **(2)**.
5. Disconnect the W15 ribbon cable from A1J3 **(3)**.
6. Disconnect the A12 Leveling Amplifier W1 cable assembly from A1J2 **(4)**.
7. Disconnect the A8 Attenuator W1 cable assembly from A1J1 **(7)**.
8. Remove the five board-assembly screws **(5)**.
9. Remove the A1U1 Voltage Regulator screw **(6)**.
10. Lift the top edge of the board assembly up and carefully slide it out of the casting past the remaining cables.

Replacement

11. Slide the bottom of the A1 Miscellaneous Bias Board assembly into the casting.
12. Replace the five screws **(5)** and alternately torque them to 6 inch-pounds to ensure that the board is flat.
13. Replace the A1U1 Voltage Regulator Screw **(6)**. Torque to 6 inch-pounds.
14. Reconnect the A12 Leveling Amplifier W1 cable assembly to A1J2 **(4)**.
15. Reconnect the A8 Attenuator W1 cable assembly to A1J1 **(7)**.
16. Reconnect the W15 ribbon cable to A1J3 **(3)**.
17. Reconnect the W7 semirigid cable to rear-panel J2 and to A12 1st LO AUX OUT port **(2)**.
18. Reconnect the W8 semirigid cable to rear-panel J3 and to A12 Leveling Amplifier LO IN **(2)**. Torque both ends to 10 inch-pounds.
19. Install and latch the right-side cover to the module.
20. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

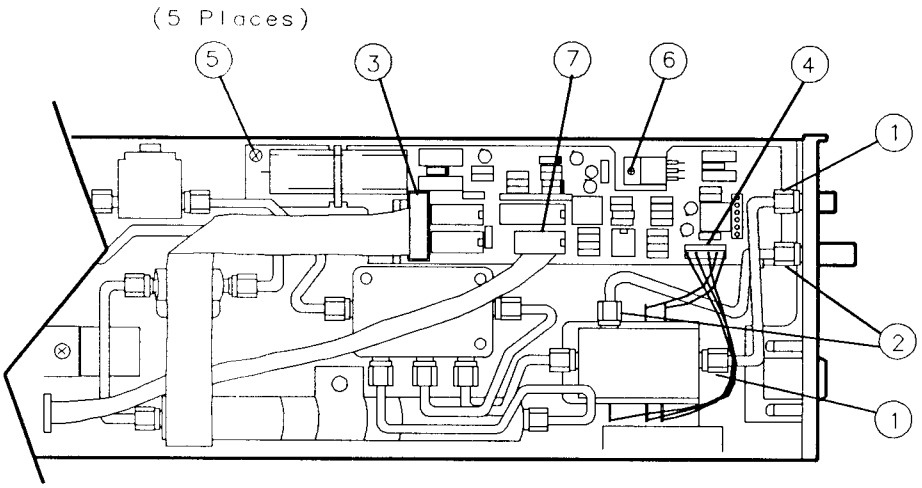


Figure 6-2. A1 Miscellaneous Bias Replacement

A2 Second Converter PLL (Phase Lock Loop)

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the left-side cover lock and remove the cover from the RF section.
3. Remove the four screws (1) to A2, A6, A13 Second Converter cover and lift it off. See Figure 6-3.
4. Remove the W11 cable assembly connector from A2J2 (2) and W9 coaxial cable from A2J1 (3).
5. Remove the two screws (4) to A2 Second Converter board assembly and carefully lift it out.
6. Separate the A2 Second Converter Board from the metal VCO/sampler cover attached to the back.

Replacement

7. Reconnect the A2 Second Converter board to the metal VCO/sampler cover. Ensure the numbered feedthrough pins on the VCO/sampler cover are inserted into the corresponding feedthrough holes on the second converter board.
8. Replace the A2 Second Converter board assembly into the casting.
9. Replace the two screws and alternately tighten both to 6 inch-pounds (4).
10. Replace the A2, A6, A13 Second Converter cover and alternately tighten the four screws to 6 inch-pounds (1).

Note Ensure that RF gaskets are properly seated when replacing cover.

11. Reconnect the W11 cable assembly to A2J2 (2) and the W9 coaxial cable to A2J1 (3).
12. Install and latch the left-side cover to the module.
13. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

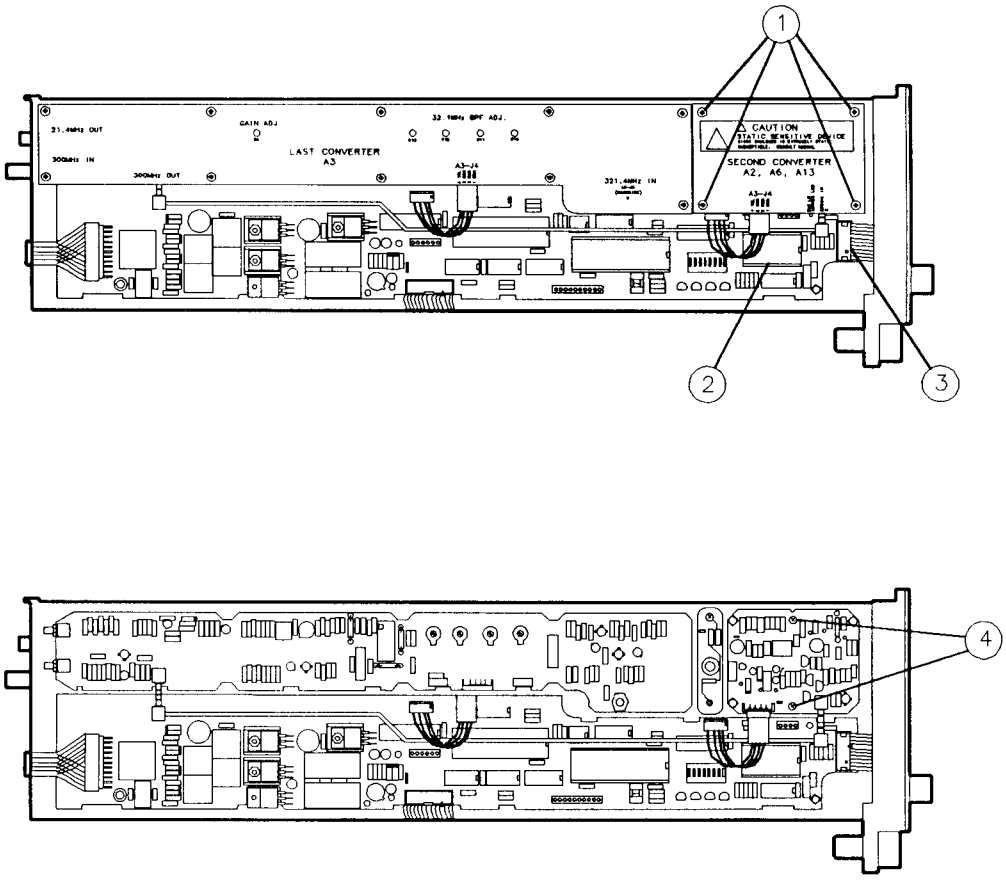


Figure 6-3. A2 Second Converter PLL Replacement

A3 Last Converter

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove both right- and left-side covers from the HP 70904A RF Section.
3. Disconnect the W3 coaxial cable on the right side of the module from A3J5 **(1)**. Remove the SMA lock-nut and the star washer from A3J5. See Figure 6-4.
4. On the left side of the module, remove the W9 coaxial cable from A3J3 **(2)** and the W10 cable from A3J4 **(3)**.
5. Remove the SMA lock-nuts from rear-panel A3J1 and A3J2 **(4)**.
6. Remove the 10 screws **(5)** from A3 Last Converter cover.
7. Lift the board assembly up and slide it out of the casting.

Caution The adjustable air-dielectric capacitors on the Last Converter board damage easily. They should not be used as a handle to pickup or move the board.

Replacement

8. Place the A3 Last Converter board assembly into the casting.
9. Replace the SMA lock-nuts to rear-panel A3J1 and A3J2 **(4)**. Torque the lock-nuts to 6 inch-pounds.
10. Reconnect the W9 cable to A3J3 **(2)** and the W10 cable to A3J4 **(3)**.
11. Replace the SMA lock-nut and star washer on A3J5 **(1)**. Torque to 6 inch-pounds.
12. Reconnect the W3 coaxial cable to A3J5 **(1)**.
13. Replace the A3 Last Converter cover and alternately tighten the 10 screws **(5)** to 6 inch-pounds.
14. Install and latch the side covers to the module.
15. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

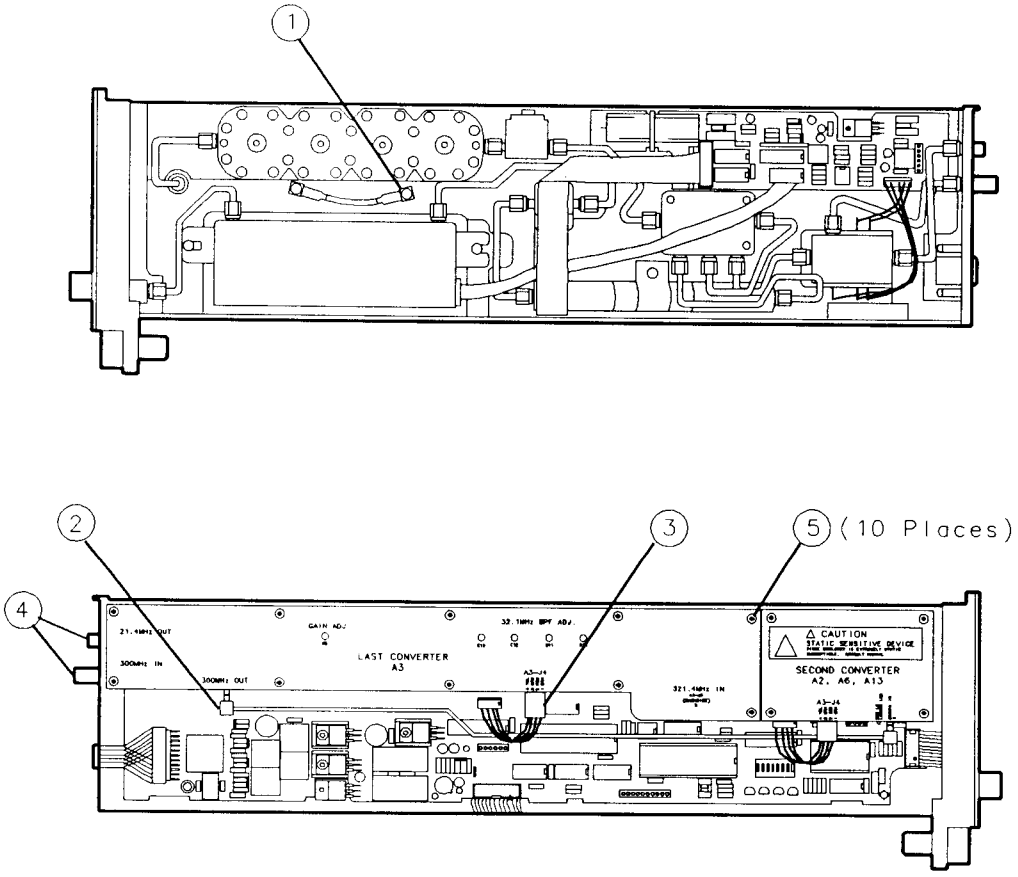


Figure 6-4. A3 Last Converter Replacement

A4 Power Supply/Controller

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the left-side cover lock and remove the cover from the RF section.
3. Disconnect the W12 ribbon cable from A4J5 **(1)** and the W15 ribbon cable from A4J2 **(2)**. See Figure 6-5.
4. Remove the W10 cable assembly from A3 Last Converter J4 **(3)** and the W11 cable assembly from A2 Second Converter J2 **(4)**.
5. Remove the W9 coaxial cable **(5)** from the A3 Last Converter J3 and from the A2 Second Converter J1.
6. Carefully remove the W18 mylar ribbon cable from A4J1 **(6)**.
7. Remove the seven board-assembly screws **(7)** and the one screw from the U11 Voltage Regulator **(8)**.
8. Lift the bottom edge of the board assembly up and slide it out while clearing the connector pins on the adjacent assemblies.

Replacement

9. Slide the A4 Power Supply/Controller board assembly under the connector pins on the adjacent assemblies and into the casting.
10. Replace the seven board-assembly screws **(7)** and the one screw to the U11 Voltage Regulator **(8)**.
11. Alternately tighten each screw to ensure that the board is flat. Tighten screws to 6 inch-pounds.
12. Reconnect the W9 coaxial cable **(5)** to the A3 Last Converter J3 and to the A2 Second Converter J1.
13. Reconnect the W11 cable assembly to the A2 Second Converter J2 **(4)**, and the W10 cable assembly to the A3 Last Converter J4 **(3)**.
14. Reconnect the W12 ribbon cable to A4J5 **(1)** and the W15 ribbon cable to A4J2 **(2)**.
15. Reconnect the W18 Mylar ribbon cables to A4J1 **(6)**.
16. Install and latch the left-side cover to the module.
17. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

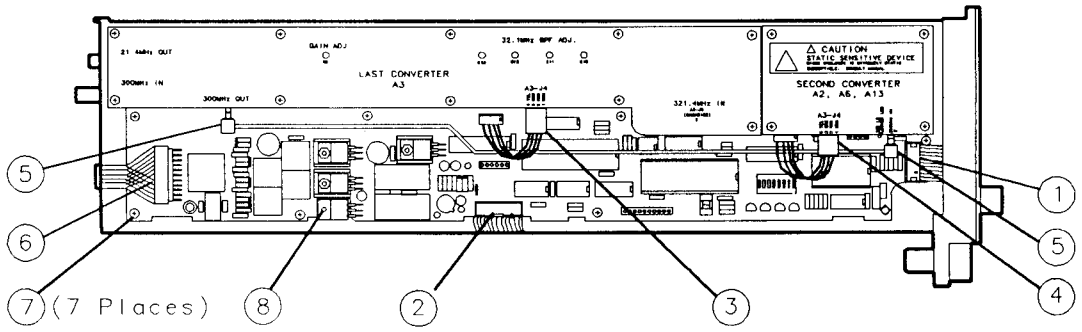


Figure 6-5. A4 Power Supply/Controller Replacement

A5 Second Mixer

Caution Use ESD precautions when working on this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the right-side cover from the RF section.
3. Remove the Second Converter Bandpass and LO Housing. Refer to the Second Converter Bandpass and LO Housing removal procedure.
4. Carefully lift the A5 Second Mixer board assembly connectors (A and B) from the two connector pins extending from the module chassis. See Figure 6-6.

Replacement

Note Make sure the A5 Second Mixer board assembly is oriented correctly. See Figure 6-6.

5. Reinstall the board assembly to the connector pins as shown in Figure 6-6.
6. Replace the Second Converter Bandpass and LO Housing to the HP 70904A RF Section. Refer to the Second Converter Bandpass and LO Housing replacement procedure.
7. Install and latch the right-side cover to the module.
8. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

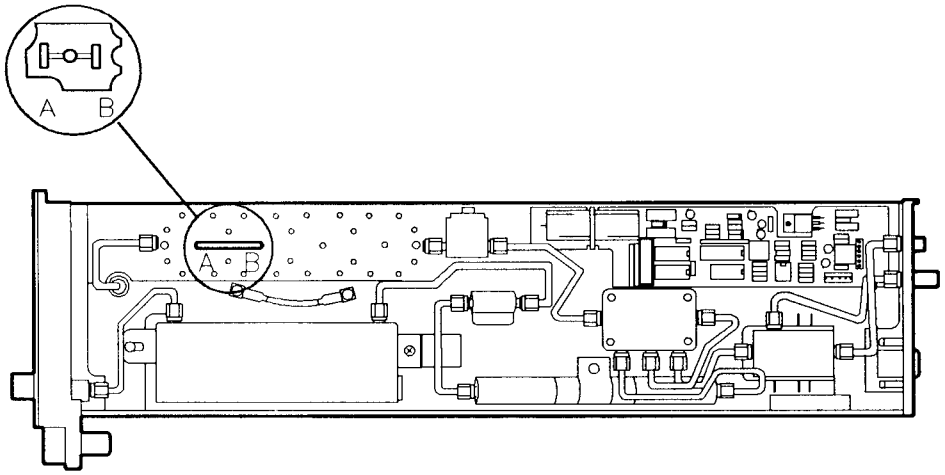


Figure 6-6. A5 Second Mixer Replacement

A6 321.4 MHz Matching Network

Caution Use ESD precautions when working on this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the left-side cover lock and remove the cover from the RF section.
3. Remove the four screws (1) on the A2, A6, A13 Second Converter cover and lift it off. See Figure 6-6.
4. Remove the screw (2) from the A6 321.4 MHz Matching Network board assembly and ease it off of the dc feedthrough (3).

Replacement

5. Replace the A6 321.4 MHz Matching Network board assembly into the module.
6. Replace the board-assembly screw (2) and torque it to 6 inch-pounds.
7. Replace the A2, A6, A13 Second Converter cover and alternately tighten the four screws (1) to ensure that the cover seats flat making a good ground.

Note Ensure that the RF gaskets are properly seated when replacing the cover.

8. Install and latch the left-side cover to the module.
9. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

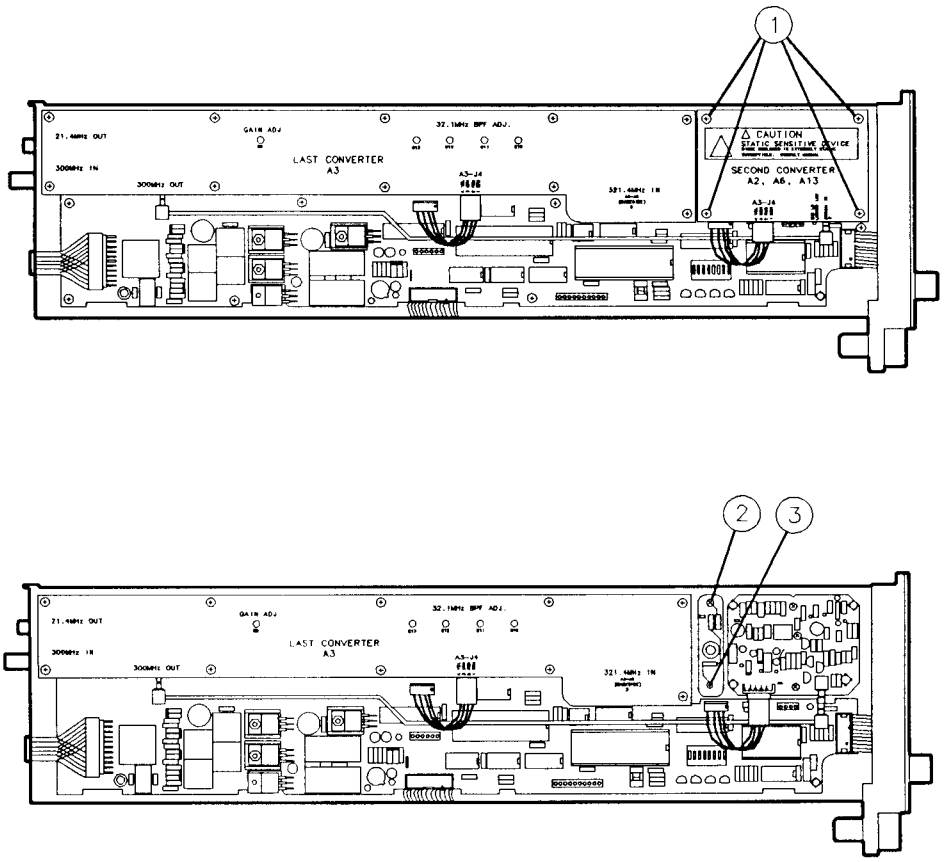


Figure 6-6. A6 321.4 MHz Matching Network Replacement

A7 Front Panel

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the locks to both side covers and remove the covers from the RF section.
3. Disconnect the W1 semirigid cable from the chassis J1 **(1)**. See Figure 6-7.
4. Remove the two top and the two bottom screws securing the front panel to the module frame **(2)**.
5. Remove the W12 ribbon cable from A7J1 **(3)**.

Replacement

6. Reconnect the W12 ribbon cable to A7J1 **(3)**.
7. Carefully guide the center pin of the W1 semirigid cable into chassis J1 **(1)**.
8. Replace the two top and two bottom screws to secure the front panel to the module frame **(2)**. Alternately tighten each screw to 6 inch-pounds.
9. Reconnect the SMA connector of the W1 semirigid cable to chassis J1 **(1)** and tighten to 10 inch-pounds.
10. Install and latch the side covers to the module.
11. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

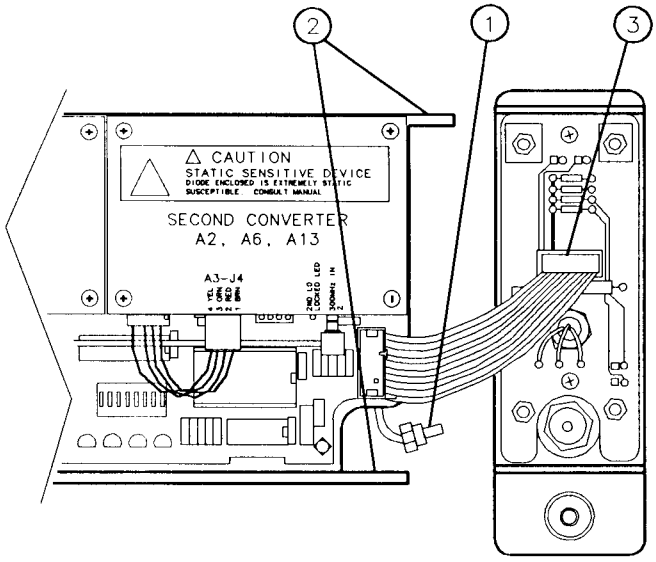


Figure 6-7. A7 Front Panel Replacement

A8 Input Attenuator

Caution Use ESD precautions when working on this replacement procedure.

Note Certain older attenuators are obsolete. When replacing an obsolete attenuator with a new design a retrofit kit should be ordered. The replacement instructions are provided in the retrofit kit.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the lock and remove the right-side cover from the RF section.
3. Disconnect the A8W1 ribbon cable from the A8 Attenuator **(1)**. See Figure 6-8.
4. Remove the W1 semirigid cable from the A7 Front Panel J1 and from the A8 Input Attenuator INPUT **(2)**.
5. Disconnect the W4 semirigid cable from the A8 Input Attenuator OUTPUT **(3)**.
6. Remove the front **(4)** and rear **(5)** attenuator mounting bracket screws. Lift the A8 Input Attenuator out of the module.
7. Remove the attenuator mounting brackets from the original attenuator and install onto the new attenuator.

Note Attenuators are not shipped with end brackets. End brackets need to be removed from the original attenuator and installed on the new attenuator. Install the longer of the two attenuator brackets onto the attenuator end toward the front of the module (input).

Replacement

8. Replace the A8 Input Attenuator with mounting brackets installed into the HP 70904A RF Section.
9. Replace the front (**4**) and rear (**5**) attenuator mounting bracket screws. Start the threads but do not tighten them at this time.
10. Connect the W4 semirigid cable to the A8 Input Attenuator output connector (**3**). Torque to 10-inch pounds.
11. Connect W1 semirigid cable to A8 Input Attenuator and to A7 Front Panel J1 (**2**). Torque to 10 inch-pounds. Tighten the two attenuator-bracket screws to 6 inch-pounds.
12. Connect the A8W1 ribbon cable to A8 Attenuator (**1**).
13. Install and latch the right-side cover to the module.
14. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

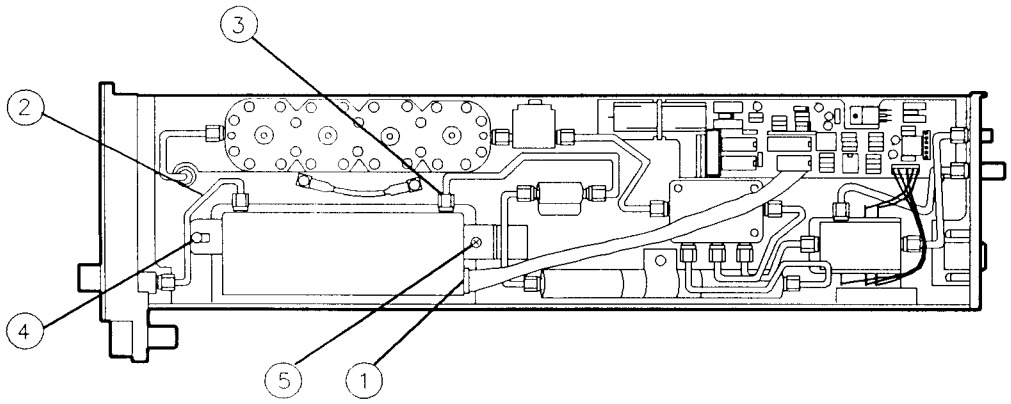


Figure 6-8. A8 Input Attenuator Replacement

A9 Limiter

Caution Use ESD precautions when performing this replacement procedure.

Note The location of the A9 Limiter has been changed in later module versions. Refer to Chapter 8, "Major Assembly and Cable Locations," for more information.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Release the lock and remove the right-side cover from the RF section.

Caution Avoid bending the semirigid cables during the A9 Limiter removal and replacement.

3. Remove the W4 semirigid cable from the A8 Input Attenuator and from the A9 Limiter **(1)**. See Figure 6-9.
4. Disconnect the W5 semirigid cable from the A9 Limiter output **(2)**.
5. Remove the A9 Limiter clamp by removing the screw **(3)**.
6. Remove the A9 Limiter from the module.

Replacement

7. Place the A9 Limiter into the clamp.
8. Start tightening the SMA connector of the W5 semirigid cable onto the A9 Limiter output connector **(2)**.
9. Replace the W4 semirigid cable to the A8 Input Attenuator and to A9 Limiter input. Start the SMA connectors **(1)**, but do not tighten.
10. Replace the screw to the A9 Limiter clamp **(3)** and torque it to 6 inch-pounds.
11. Torque the SMA connectors on cables W4 and W5 to 10 inch-pounds.
12. Install and latch the right-side cover to the RF section.
13. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

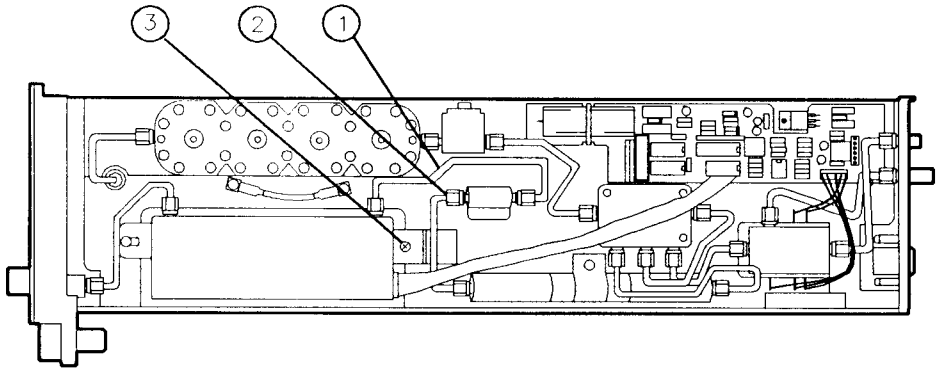


Figure 6-9. A9 Limiter Replacement

A11 First Converter

Caution Use ESD precautions when performing this replacement procedure.

Note Do not bend or stress the semirigid cables during the replacement of the A11 First Converter.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section Removal procedure.
2. Remove the right-side cover from the RF section.
3. Disconnect the A8W1 cable assembly (not shown) from J1 of the A1 Miscellaneous Bias board assembly (**1**). See Figure 6-10.
4. Loosen the SMA connector of W16 one turn from the LO OUT port of the A12 Leveling Amplifier (**2**).
5. Remove semirigid cables W17 (**3**), W6 (**4**), and W16 (**5**) from the A11 First Converter.
6. Remove the four first converter screws (**6**).
7. Remove the A11 First Converter from the RF section.

Replacement

8. Place the A11 First Converter into the RF section.
9. Replace the four screws (**6**) and torque them to 6 inch-pounds.
10. Replace the W16 semirigid cable on the LO port of the A11 First Converter (**5**), and torque the SMA connectors on both ends to 10 inch-pounds.
11. Replace the W6 semirigid cable on the IF port of the A11 First Converter (**4**), and torque the SMA connector to 10 inch-pounds.
12. Replace the W17 semirigid cable on the RF port of the A11 First Converter (**3**), and torque the SMA connector to 10 inch-pounds.
13. Reconnect the A8W1 cable assembly to J1 of the A1 Miscellaneous Bias board (**1**).
14. Install and latch the right-side cover to the RF section.
15. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

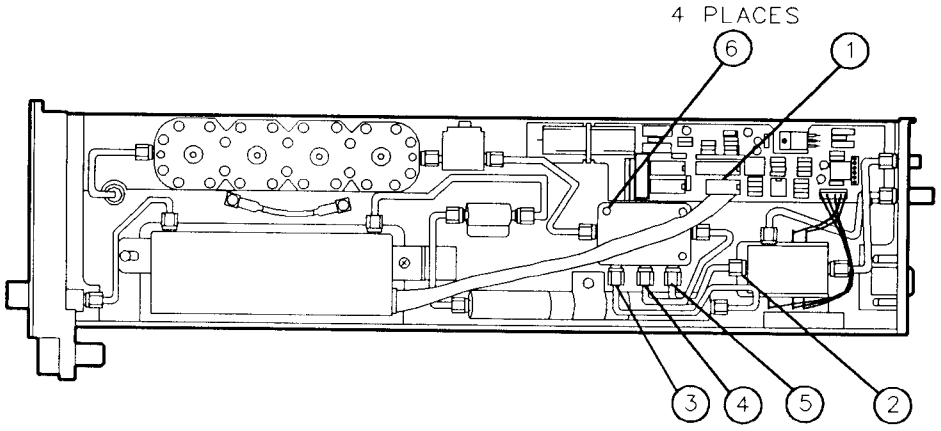


Figure 6-10. A11 First Converter Replacement

A12 Leveling Amplifier

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the right-side cover from the RF section.
3. Disconnect the W1 cable assembly of the A12 Leveling Amplifier from the A1 Miscellaneous Bias J2 (**1**). See Figure 6-11.
4. Loosen semirigid cables W7 and W8 at the rear panel. Disconnect the remaining end of both the W7 cable (**2**) and the W8 cable (**3**) from the A12 Leveling Amplifier.
5. Disconnect the SMA connector between the A12 Leveling Amplifier LO OUT (**4**) and the LO input of the A11 First Converter.

Note Semirigid cable W16 has been added in later versions of the HP 70904A RF Section. W16 connects the A12 Leveling Amplifier LO OUT port and the LO input port of the A11 First Converter (described in step 5). Refer to Chapter 8, "Major Assembly and Cable Locations," for further information regarding cable W16.

6. Remove the A12 Leveling Amplifier from the RF section by removing the four screws (**5**).

Replacement

7. Replace the A12 Leveling Amplifier into the RF section and secure the assembly with the four screws (**5**). Torque them to 3 inch-pounds.
8. Reconnect the W7 semirigid cable to the A12 Leveling Amplifier AUX LO OUT (**2**). Torque both ends to 10 inch-pounds.
9. Reconnect the W8 semirigid cable to the A12 Leveling Amplifier LO IN (**3**). Torque both ends to 10 inch-pounds.
10. Connect the W1 cable assembly of the A12 Leveling Amplifier to J2 of the A1 Miscellaneous Bias Board (**1**).
11. Install and latch the right-side cover to the RF section.
12. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

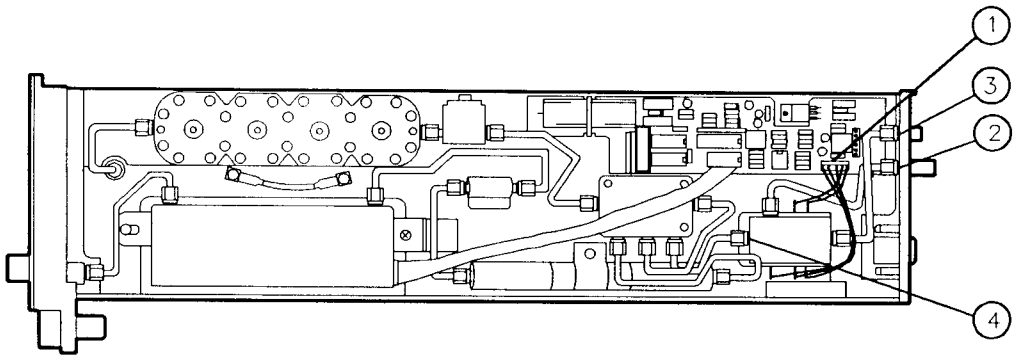


Figure 6-11. A12 Leveling Amplifier Replacement

A13 VCO/Sampler

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove both side covers from the RF section.
3. Remove the A2, A6, A13 Second Converter cover from the PLL board assembly. Refer to the A2 Second Converter PLL (Phase Lock Loop) removal procedure for removing the A2 Second Converter board assembly and A13 VCO /Sampler cover.
4. Disconnect the W2 semirigid cable located on the right side of the RF section **(1)**. See Figure 6-12.
5. Remove the SMA connector nut and lock washer from the A13 VCO/Sampler board assembly connector **(2)**.
6. Remove the two allen screws and flat washers **(3)** from the board assembly.
7. Remove the probe screw (4) and lift the A13 VCO/Sampler board assembly out of the casting.

Replacement

8. Replace the A13 VCO/Sampler board assembly into the casting.
9. Replace the probe screw into the board assembly **(4)** but do not tighten at this time.
10. Replace the two allen screws and flat washers to the board assembly **(3)** and lightly tighten.
11. Press the upper-left corner of the A13 VCO/Sampler board assembly lightly toward the bottom of the RF section. Alternately torque the probe screw and two allen screws to 3 inch-pounds.
12. Replace the lock washer and nut on the SMA connector **(2)**. Torque to 6 inch-pounds.
13. Refer to the A2 Second Converter PLL (Phase Lock Loop) replacement procedure for final steps of the A13 VCO/Sampler board assembly and A2 board assembly replacement.
14. Reconnect the W2 semirigid cable to the A13 board assembly connector located on the right side of the RF section (1) and torque to 6 inch-pounds. Torque the other end of W2 to 10 inch-pounds.
15. Install and latch the side covers to the RF section.
16. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

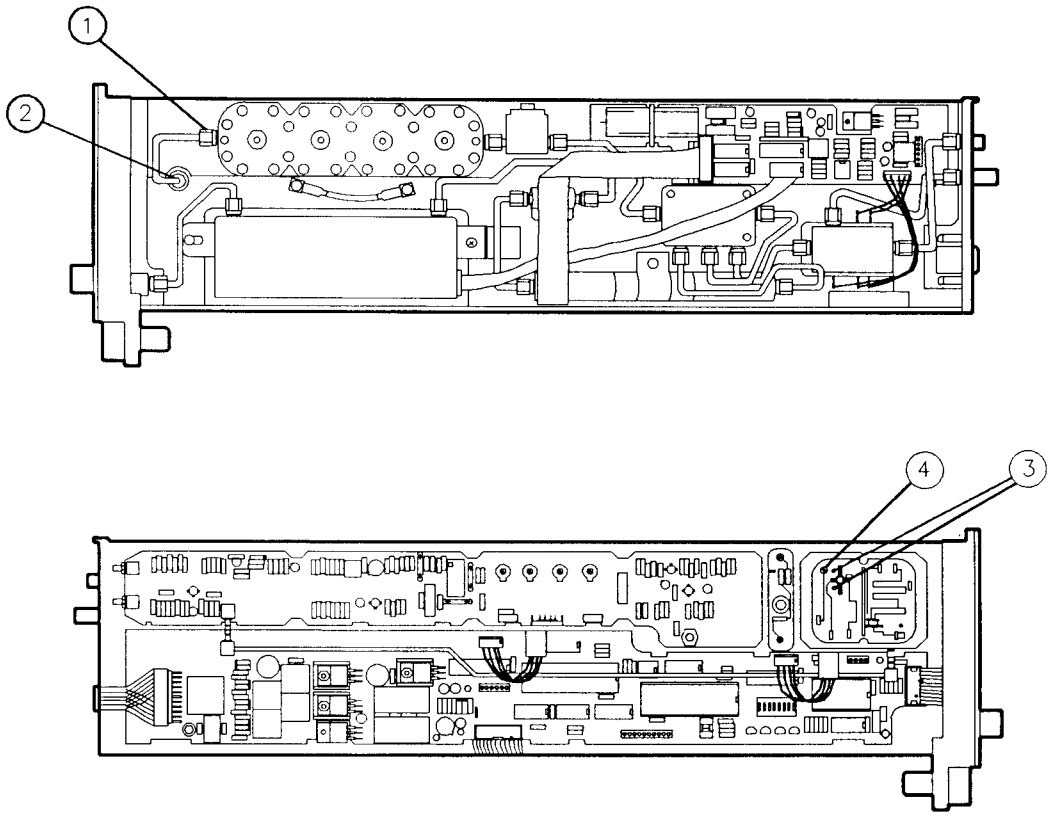


Figure 6-12. A13 VCO/Sampler Replacement

A14 4.4 GHz Low Pass Filter

Caution Use ESD precautions when performing this replacement procedure.

Note Do not bend or stress the semirigid cables during the replacement of the A11 First Converter.

Removal

1. Remove the HP 70904 RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the right-side cover from the RF section.
3. Disconnect the A8W1 cable assembly from J1 of the A1 Miscellaneous Bias board **(1)**. See Figure 6-13.
4. Remove the A11 First Converter. Refer to the A11 First Converter removal procedure.
5. Remove the W6 semirigid cable from the A14 4.4 GHz Low Pass Filter **(2)**.
6. Remove the W14 semirigid cable from the A14 4.4 GHz Low Pass Filter **(3)**.
7. Remove the A14 4.4 GHz Low Pass Filter from the RF section.

Replacement

8. Place the A14 4.4 GHz Low Pass Filter into the RF section.
9. Replace the W14 semirigid cable on the A14 4.4 GHz Low Pass Filter **(3)**.
10. Replace the W6 semirigid cable on the A14 4.4 GHz Low Pass Filter **(2)**.
11. Replace the A11 First Converter. Refer to the A11 First Converter replacement procedure.
12. Torque the SMA connectors on both ends of the A14 4.4 GHz Low Pass Filter to 10 inch-pounds **(2)(3)**.
13. Reconnect the A8W1 cable assembly to J1 of the A1 Miscellaneous Bias board **(1)**.
14. Install and latch the right-side cover to the RF section.
15. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

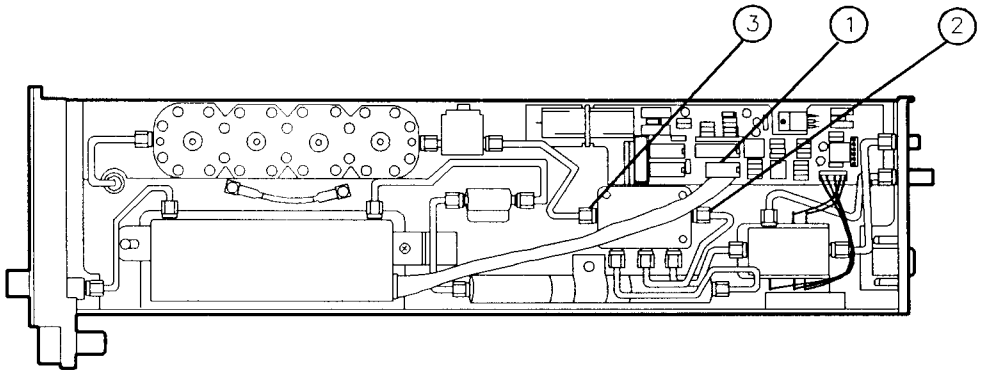


Figure 6-13. A14 4.4 GHz Low Pass Filter Replacement

A15 2.9 GHz Low Pass Filter

Caution Use ESD precautions when performing this replacement procedure.

Note Do not bend or stress the semirigid cables during the replacement of the A11 First Converter.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section Removal procedure.
2. Remove the right-side cover from the RF section.
3. Disconnect the A8W1 cable assembly (not shown) from J1 of the A1 Miscellaneous Bias board **(1)**. See Figure 6-14.
4. Disconnect the W15 cable assembly from J3 of the A1 Miscellaneous Bias board **(2)**.
5. Remove the W5 semirigid cable from the A9 Limiter and the A15 2.9 GHz Low Pass Filter **(3)**.
6. Remove the W17 semirigid cable from the RF port **(4)** of the A11 First Converter.
7. Remove the W6 semirigid cable from the IF IN port **(7)** of the A11 First Converter.
8. Remove the W16 semirigid cable from the 1st LO IN port of the A11 First Converter.
9. Remove the screw and bracket from the body of the A15 2.9 GHz Low Pass Filter **(5)**.
10. Remove the A15 2.9 GHz Low Pass Filter, with W17 still attached, by sliding it toward the front of the RF section.
11. Remove the W17 semirigid cable from the A15 2.9 GHz Low Pass Filter **(6)**.

Replacement

12. Replace the W17 semirigid cable on the output port of the A15 2.9 GHz Low Pass Filter **(6)**, leaving the SMA connector loose.
13. Slide the A15 2.9 GHz Low Pass Filter toward the rear of the RF section, under semirigid cables W6 **(7)** and W16 **(8)**.
14. Replace the W17 semirigid cable on the RF port **(4)** of the A11 First Converter.
15. Replace the W6 semirigid cable on the IF IN port **(7)** of the A11 First Converter.
16. Replace the W16 semirigid cable on the 1st LO IN port of the A11 First Converter.
17. Replace the screw and bracket **(5)** over the body of the A15 2.9 GHz Low Pass Filter. Torque the screw to 9 inch-pounds.
18. Replace the W5 semirigid cable on the A9 Limiter and the A15 2.9 GHz Low Pass Filter **(3)**.
19. Torque all SMA connectors to 10 inch-pounds **(3)(4)(6)**.
20. Replace the W15 cable assembly on J3 **(2)** of the A1 Miscellaneous Bias board.
21. Reconnect the A8W1 cable assembly to J1 **(1)** of the A1 Miscellaneous Bias board.
22. Install and latch the right-side cover to the RF section.
23. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

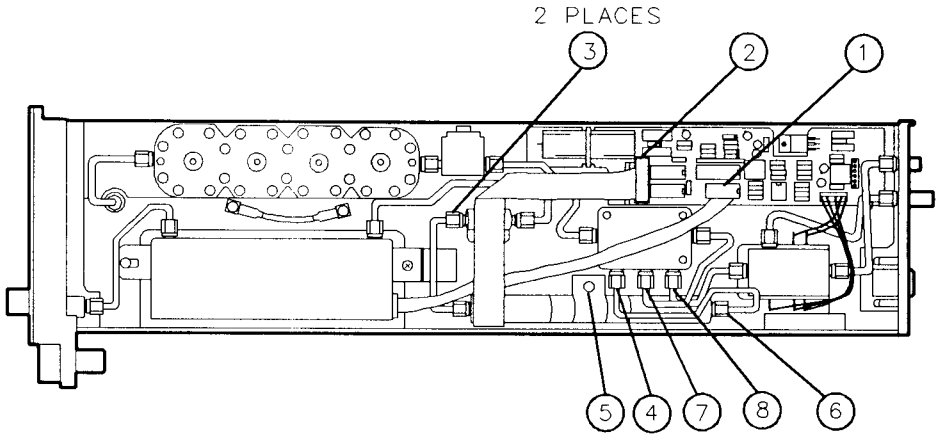


Figure 6-14. A15 2.9 GHz Low Pass Filter Replacement

Second Converter Bandpass Filter and LO Housing

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the right-side cover from the RF section.
3. Disconnect the W2 semirigid cable **(1)**. See Figure 6-15.
4. Remove the SMA connector between A10 Isolator and the 1st IF IN connector on the Second Converter Bandpass Filter and LO Housing **(2)**.
5. Remove the 26 screws from the housing **(3)**. Lift the housing straight up for removal.

Replacement

6. Replace the Second Converter Bandpass Filter and LO Housing into the RF section.
7. Replace the 26 screws to the housing **(3)**, but do not tighten at this time.
8. Beginning with the two center screws, follow the numbered sequence in Figure 6-15 to hand-tighten each screw.
9. Torque each screw in the assigned sequential order to 6 inch-pounds.
10. Reconnect the W2 semirigid cable **(1)**. Torque the W2 SMA connector at the A13 VCO/Sampler to 6 inch-pounds. Torque the W2 SMA connector on the Second Converter Bandpass Filter and LO Housing to 10 inch-pounds.
11. Replace the SMA connector between the 1st IF IN and the A10 Isolator **(2)** and torque it to 10 inch-pounds.
12. Install and latch the right-side cover to the RF section.
13. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

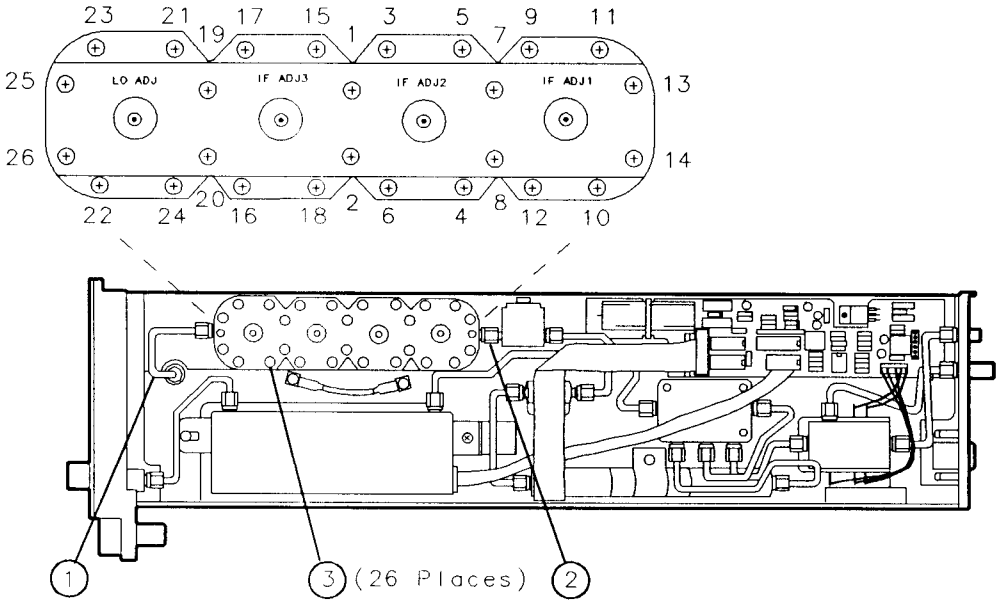


Figure 6-15. Second Converter Bandpass Filter and LO Housing Replacement

Rear Panel

Caution Use ESD precautions when performing this replacement procedure.

Removal

1. Remove the HP 70904A RF Section from the mainframe. Refer to the HP 70904A RF Section removal procedure.
2. Remove the 1st LO OUT 50Ω termination from rear-panel J3 **(1)**. See Figure 6-16.
3. Remove the SMA lock-nuts from rear-panel J2 1st LO IN and J3 1st LO OUT **(2)**.

Note Handle the Mylar ribbon cables carefully.

4. Remove both of the side covers and disconnect the W18 mylar ribbon cable from the A4 Power Supply/Controller J1 **(3)**.
5. Remove the three screws securing the rear panel to the RF section frame **(4)**.
6. Press rear-panel J2 and J3 SMA connectors out of their sockets and remove the rear panel from the RF section.

Replacement

7. Lay the shorter end of the W18 mylar ribbon cable over the longer end, and fold them both toward the inside-left side of the rear panel. This puts them in the proper position for use in later steps.
8. Fit the SMA connectors to rear-panel J2 and J3 into the sockets **(2)**. Replace the rear panel to the RF section frame and secure it with the three screws **(4)**.
9. Torque the two lower rear-panel screws to 6 inch-pounds and torque the upper rear-panel screw to 20 inch-pounds (4). Replace the washers and lock-nuts on each connector and torque each lock-nut to 10 inch-pounds **(2)**.
10. Replace the 1st LO OUT 50Ω termination to rear-panel J3 **(1)**.
11. Reconnect the W18 mylar ribbon cable to the A4 Power Supply/Controller J1 **(3)**.
12. Install and latch the right-side cover to the RF section.
13. Install the RF section in the mainframe. Refer to the HP 70904A RF Section replacement procedure.

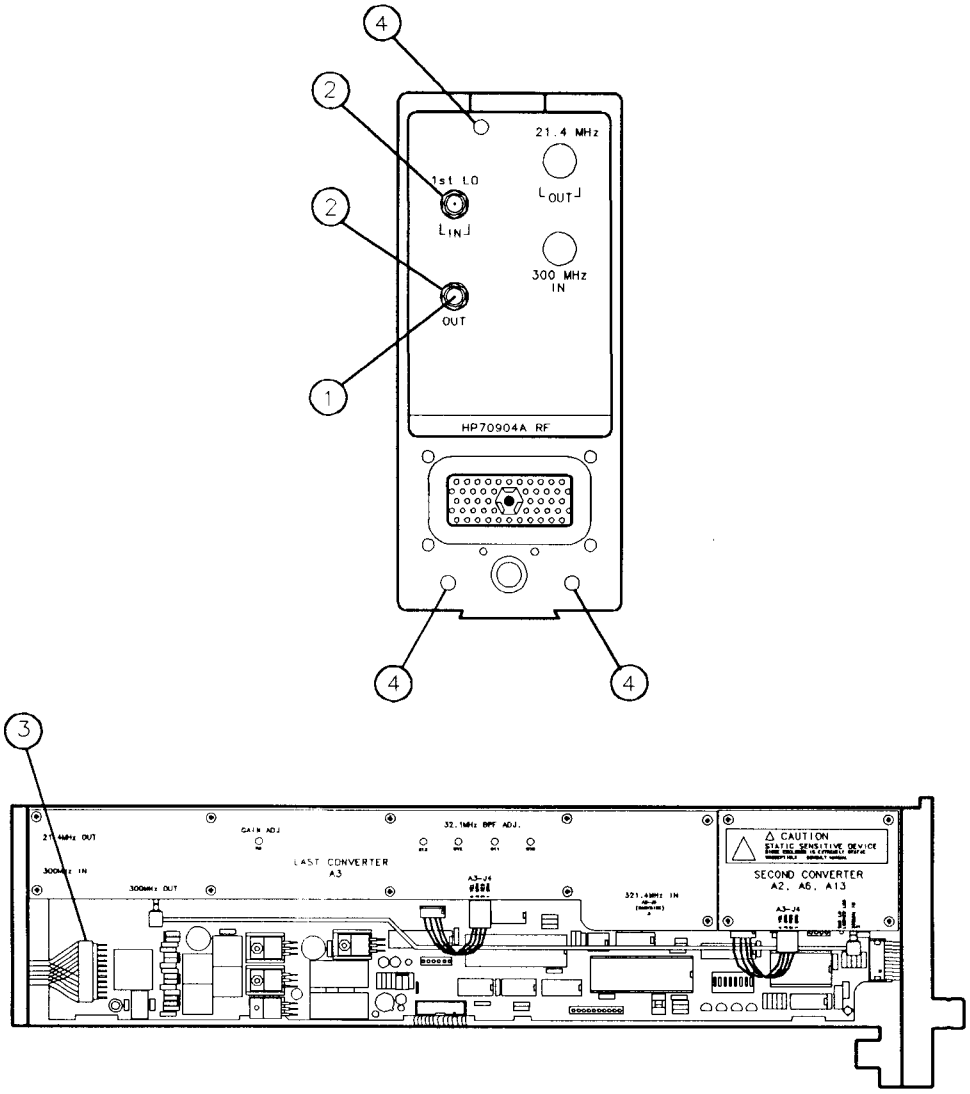


Figure 6-16. Rear Panel Replacement

7

Replaceable Parts

Introduction

This chapter contains information on ordering all replaceable parts and assemblies. The parts list documents all assembly versions produced up to the date this manual was printed.

Table 7-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.

Figures 7-1 through 7-5 illustrate the locations of module assemblies and hardware. Hardware part numbers are listed in a table in each figure. Assemblies and cables are denoted with an asterisk (*). These parts are listed in Table 7-2.

Table 7-2 lists all major assemblies, chassis electrical, and chassis mechanical parts.

Component-level parts lists for all versions of board assemblies are located in the *HP 70904A Component-Level Information* binder along with component locations and schematics.

New Assemblies

Although this manual documents all assembly versions produced up to the date that this manual was printed, some versions listed are not available as new assemblies. Only those assembly versions listed under "Major Assemblies" in Table 7-2 may be ordered as new assemblies.

Exchange Assemblies

Table 7-2 includes the part numbers for rebuilt assemblies that may be replaced on an exchange basis. Exchange assemblies (factory repaired and tested) are available only on a trade-in basis; therefore, the defective asemblies must be returned for credit. For this reason, assemblies required for spare parts in the user stock must be ordered by the new assembly part number.

Replaceable Parts List Format

The following information is listed for each part:

1. The Hewlett-Packard part number.
2. The part number check digit (CD).
3. The total quantity (Qty) in the assembly (this number is stated once and only at the first mention of the part).
4. The description of the part.
5. A five-digit code indicating a typical manufacturer of the part.
6. The manufacturer part number.

Ordering Information

To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, include the check digit, and indicate the quantity required. Address and mail the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the model number of the module, the function and description of the part, and the number of parts required. Address and mail the order to the HP Sales and Service office nearest you.

Direct Mail-Order System

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

a. Direct ordering and shipment from the HP Parts Center in Mountain View, California.

b. No maximum or minimum quantity requirement on any mail order. (There is a minimum order quantity imposed on orders made through the HP Sales and Service Offices when the orders require billing and invoicing.)

c. Prepaid transportation. (There is a handling charge added to each order.)

d. No invoices.

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

Table 7-1. Reference Designations, Abbreviations and Multipliers (1 of 4)

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

ABBREVIATIONS					
A		BSC	Basic	CNDCT	Conducting, Conductive, Conductivity, Conductor
A	Across Flats, Acrylic, Air (Dry Method), Ampere	BTN	Button		
ADJ	Adjust, Adjustment	**C**		CONT	Contact, Continuous, Control, Controller
ANSI	American National Standards Institute (formerly USASI-ASA)	C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression	CONV	Converter
ASSY	Assembly	CCP	Carbon Composition Plastic	CPRSN	Co mpression
AWG	American Wire Gage	CD	Cadmium, Card, Cord	CUP-PT	Cup Point
B		CER	Ceramic	CW	Clockwise, Continuous Wave
BCD	Binary Coded Decimal	CHAM	Chamfer		
BD	Board, Bundle	CHAR	Character, Characteristic, Charcoal	**D**	
BE-CU	Beryllium Copper	CMOS	Complementary Metal Oxide Semiconductor	D	Deep, Depletion, Depth, Diameter, Direct Current
BNC	Type of Connector			DA	Darlington
BRG	Bearing, Boring				
BRS	Brass				

Table 7-1. Reference Designations, Abbreviations, and Multipliers (2 of 4)

ABBREVIATIONS					
DAP-GL	Diallyl Phthalate Glass	FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot	JFET	Junction Field Effect Transistor
DBL	Double				
DCDR	Decoder				**K**
DEG	Degree				
D-HOLE	D-Shaped Hole	FXD	Fixed	K	Kelvin, Key, Kilo, Potassium
DIA	Diameter				
DIP	Dual In-Line Package		**G**	KNRLD	Knurled
DIP-SLDR	Dip Solder			KVDC	Kilovolts
D-MODE	Depletion Mode	GEN	General, Generator		Direct Current
DO	Package Type Designation	GND	Ground		
		GP	General Purpose, Group		**L**
DP	Deep, Depth, Diametric Pitch, Dip			LED	Light Emitting Diode
DP3T	Double Pole Three Throw		**H**		
				LG	Length, Long
DPDT	Double Pole Double Throw	H	Henry, High	LIN	Linear, Linearity
		HDW	Hardware	LK	Link, Lock
DWL	Dowell	HEX	Hexadecimal, Hexagon, Hexagonal	LKG	Leakage, Locking
				LUM	Luminous
	E				
		HLCL	Helical		
E-R	E-Ring	HP	Hewlett-Packard Company, High Pass		**M**
EXT	Extended, Extension, External, Extinguish				
				M	Male, Maximum, Mega, Mil, Milli, Mode
			I		
	F				
		IC	Collector Current, Integrated Circuit	MA	Milliampere
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency			MACH	Machined
		ID	Identification, Inside Diameter	MAX	Maximum
				MC	Molded Carbon Composition
		IF	Forward Current, Intermediate Frequency		
FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face			MET	Metal, Metallized
				MHZ	Megahertz
		IN	Inch	MINTR	Miniature
		INCL	Including	MIT	Miter
FDTHRU	Feedthrough	INT	Integral, Intensity, Internal	MLD	Mold, Molded
FEM	Female			MM	Magnetized Material, Millimeter
FIL-HD	Fillister Head				
FL	Flash, Flat, Fluid		**J**	MOM	Momentary
FLAT-PT	Flat Point			MTG	Mounting
FR	Front	J-FET	Junction Field Effect Transistor	MTLC	Metallic
FREQ	Frequency			MW	Milliwatt

Table 7-1. Reference Designations, Abbreviations, and Multipliers (3 of 4)

ABBREVIATIONS					
	N	PLSTC	Plastic	SMA	Subminiature,
		PNL	Panel		A Type (Threaded
N	Nano, None	PNP	Positive Negative		Connector)
N-CHAN	N-Channel		Positive (Transistor)	SMB	Subminiature,
NH	Nanohenry	POLYC	Polycarbonate		B Type (Slip-on
NM	Nanometer,	POLYE	Polyester		Connector)
	Nonmetallic	POT	Potentiometer	SMC	Submi niature,
NO	Normally Open,	POZI	Pozidriv Recess		C-Type (Threaded
	Number	PREC	Precision		Connector)
NOM	Nominal	PRP	Purple, Purpose	SPCG	Spacing
NPN	Negative Positive	PSTN	Piston	SPDT	Single Pole
	Negative (Transistor)	PT	Part, Point,		Double Throw
NS	Nanosecond,		Pulse Time	SPST	Single Pole
	Non-Shorting, Nose	PW	Pulse Width		Single Throw
NUM	Numeric			SQ	Square
NYL	Nylon (Polyamide)			SST	Stainless Steel
			Q	STL	Steel
	O			SUBMIN	Subminiature
		Q	Figure of Merit	SZ	Size
OA	Over-All				
OD	Outside Diameter		**R**		
OP AMP	Operational				
	Amplifier	R	Range, Red,		**T**
OPT	Optical, Option,		Resistance, Resistor,		
	Optional		Right, Ring	T	Teeth,
		REF	Reference		Temperatu re,
	P	RES	Resistance, Resistor		Thickness, Time,
		RF	Radio Frequency		Timed, Tooth,
PA	Picoampere, Power	RGD	Rigid		Typical
	Amplifier	RND	Round	TA	Ambient
PAN-HD	Pan Head	RR	Rear		Temperature,
PAR	Parallel, Parity	RVT	Rivet, Riveted		Tantalum
PB	Lead (Metal),			TC	Temperature
	Pushbutton		**S**		Coeffi cient
PC	Printed Circuit			THD	Thread, Threaded
PCB	Printed Circuit	SAWR	Surface Acoustic	THK	Thick
	Board		Wave Resonator	TO	Package Type
P-CHAN	P-Channel	SEG	Segment		Designation
PD	Pad, Power	SGL	Single	TPG	Tapping
	Dissipation	SI	Silicon,	TR-HD	Truss Head
PF	Picofarad, Power		Square Inch	TRMR	Trimmer
	Factor	SL	Slide, Slow	TRN	Turn, Turns
PKG	Package	SLT	Slot, Slotted	TRSN	Torsion

Table 7-1. Reference Designations, Abbreviations, and Multipliers (4 of 4)

ABBREVIATIONS					
	U	VAR	Variable		**Y**
		VDC	Volts—Direct Current		
UCD	Microcandela			YIG	Yttrium-Iron-Garnet
UF	Microfarad				
UH	Microhenry		**W**		
UL	Microliter, Underwriters' Laboratories, Inc.	W	Watt, Wattage, White, Wide, Width		**Z**
UNHDND	Unhardened	W/SW	With Switch	ZNR	Zener
		WW	Wire Wound		
	V				
			X		
V	Variable, Violet, Volt, Voltage	X	By (Used with Dimensions), Reactance		
VAC	Vacuum, Volts—Alternating Current				

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

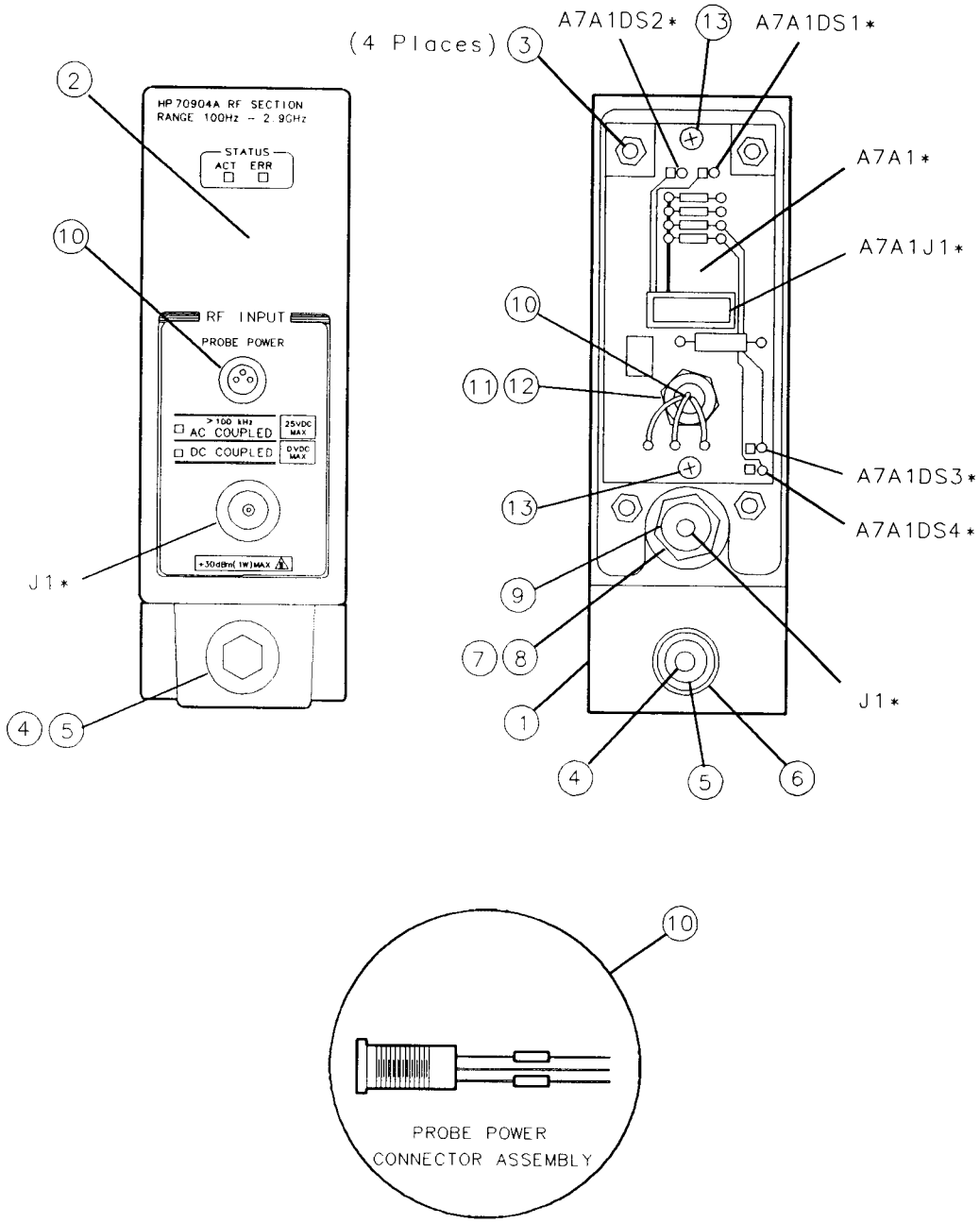


Figure 7-1. Overall Module Parts Identification, Front Panel (1 of 2)

Item	HP Part Number	CD	Description
1	70904-20029	1	FRAME, FRONT
2	70904-00003	9	PANEL, FRONT
3	0535-0088	9	NUT-HEX PRVLG-TRQ M4 X 0.7 2.9 MM-THK
4	~~5021-3290~~ 5022-0051	7	MODULE HEX LATCH
5	0900-0012	4	0-RING 0.364-IN-ID 0.07-IN-XSECT-DIA NTRL
6	0510-1244	9	RETAINER-PUSH ON CIRCULAR-EXT
7	2950-0214	5	NUT-HEX NO CHAM 7/16-28-THD 0.218-IN-THK
8	2190-0681	8	WASHER-LK EXT T
9	2190-0458	7	WASHER-FL MTLC 3/8-IN 0.438-IN-ID
10	70904-60042	2	PROBE POWER CONNECTOR ASSEMBLY INCLUDES THE FOLLOWING PARTS: 5086-0467; CD 0 QTY 1; CONNECTOR 2110-0669; CD 4 QTY 2; FUSE .25 A 8150-0447; CD 6; QTY 1; WIRE
11	2950-0001	8	NUT-HEX-DBL-CHAM 3/8-32 THD 0.094-IN- THK
12	2190-0016	3	WASHER-LK INTL T 3/8-IN 0.377-IN-ID
13	0515-0886	3	SCREW-MACH M3 x 0.56MM-LG PAN-HD

Figure 7-1. Overall Module Parts Identification, Front Panel (2 of 2)

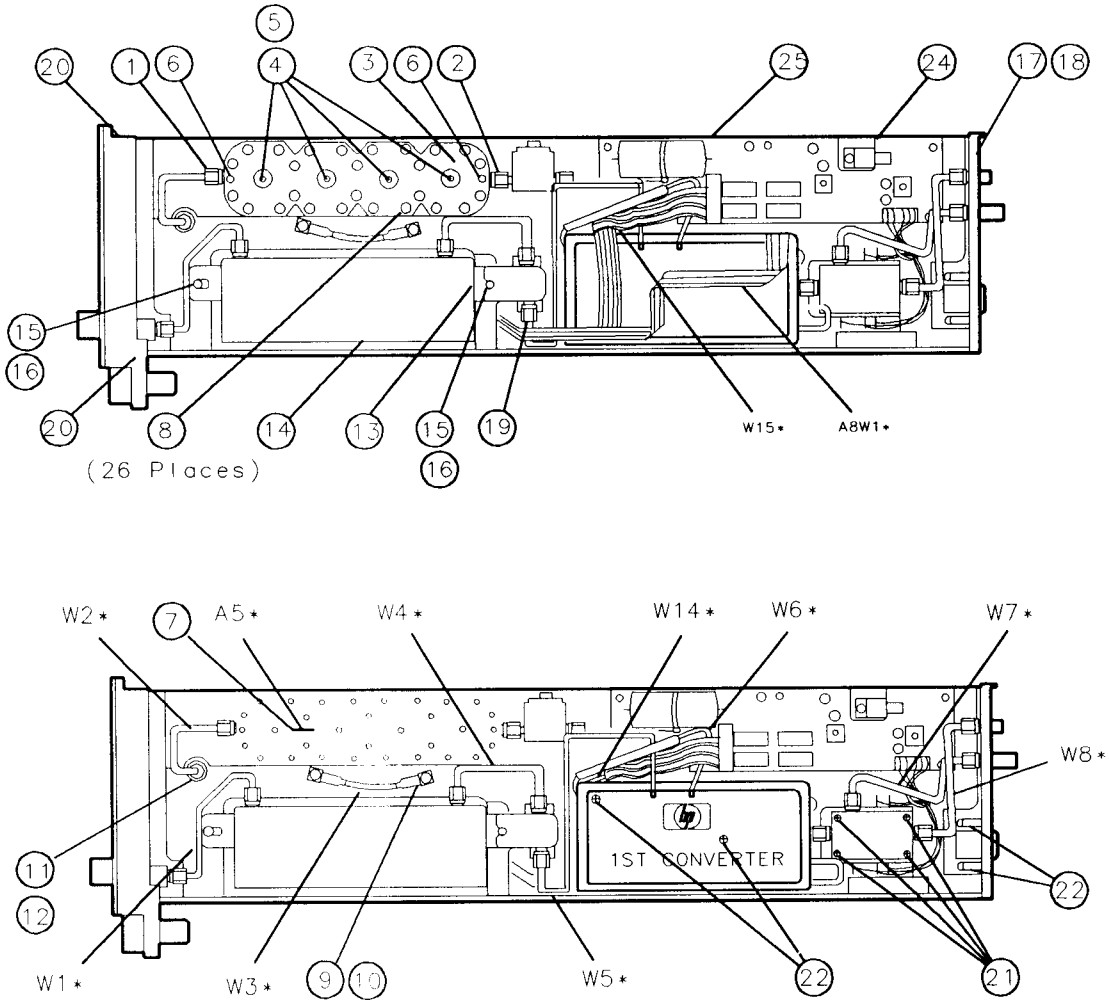


Figure 7-2.
Overall Module Parts Identification, Right- Side View,
Serial Prefixes 2807A and Below (1 of 2)

Item Text	HP Part Number	CD	Description
1	1250-1157	2	CONNECTOR-RF SMA FEM THD-HOLE 50-OHM
2	5062-1926	8	FIRST IF IN CONNECTOR/PROBE ASSEMBLY
3	70904-20019	9	2ND CONVERTER BANDPASS & LO HOUSING
4	0515-1046	9	SCREW-SKT-HD-CAP M2 X 0.4 SMM-LG
5	0535-0018	5	NUT-HEX DBL-CHAM M2 X 0.4 1.6 MM-THK
6	0515-0894	3	SCREW-SET M2.5X 0.45 6 MM-LG PAN-HD
7	70904-20025	7	SECOND MIXER GROUNDING PIN
8	0515-1462	3	SCREW-MACH M3 X 0.5 20MM-LG PAN-HD
9	2950-0078	9	NUT-HEX-DBL-CHAM 10-32-THD 0.067-IN-THK
10	2190-0124	4	WASHER-LK INTL T NO.10.0.195-IN-ID
11	1250-0569	8	NUT-RF CONNECTOR
12	1250-1142	5	WASHER-LK INTL T 1/2-IN 0.26-IN-ID
13	5021-3297	4	ATTENUATOR BRACKET-FRONT
14	5021-9372	8	ATTENUATOR BRACKET-REAR
15	0515-1583	9	SCREW-MACH M4 X 0.7 12 MM-LG PAN-HD
16	3050-0893	9	WASHER-FL MTLC 4.0 MM 4.4-MM-ID
17	0515-1483	9	SCREW-MACH M4 X 0.7 12 MM-LG PAN-HD
18	3050-0893	9	WASHER-FL MTLC 4.0 MM 4.4-MM-ID
19	70904-00006	2	LIMITER CLAMP
20	0515-1430	5	SCREW-MACH M3 X 0.58MM-LG 90-DEG-FLH-HD
21	0515-1364	4	SCREW-MACH M2 X 0.5 16 MM-LG
22	0515-1280	3	SCREW-MACH M3 X 0.5 14MM-LG PAN-HD
23	0515-0886	3	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD
24	70904-00005	1	INSULATOR-A1 MISCELLANEOUS BIAS
25	70904-20028	0	CENTER FRAME ASSEMBLY

Figure 7-2.
Overall Module Parts Identification, Right-Side View,
Serial Prefixes 2807A and Below (2 of 2)

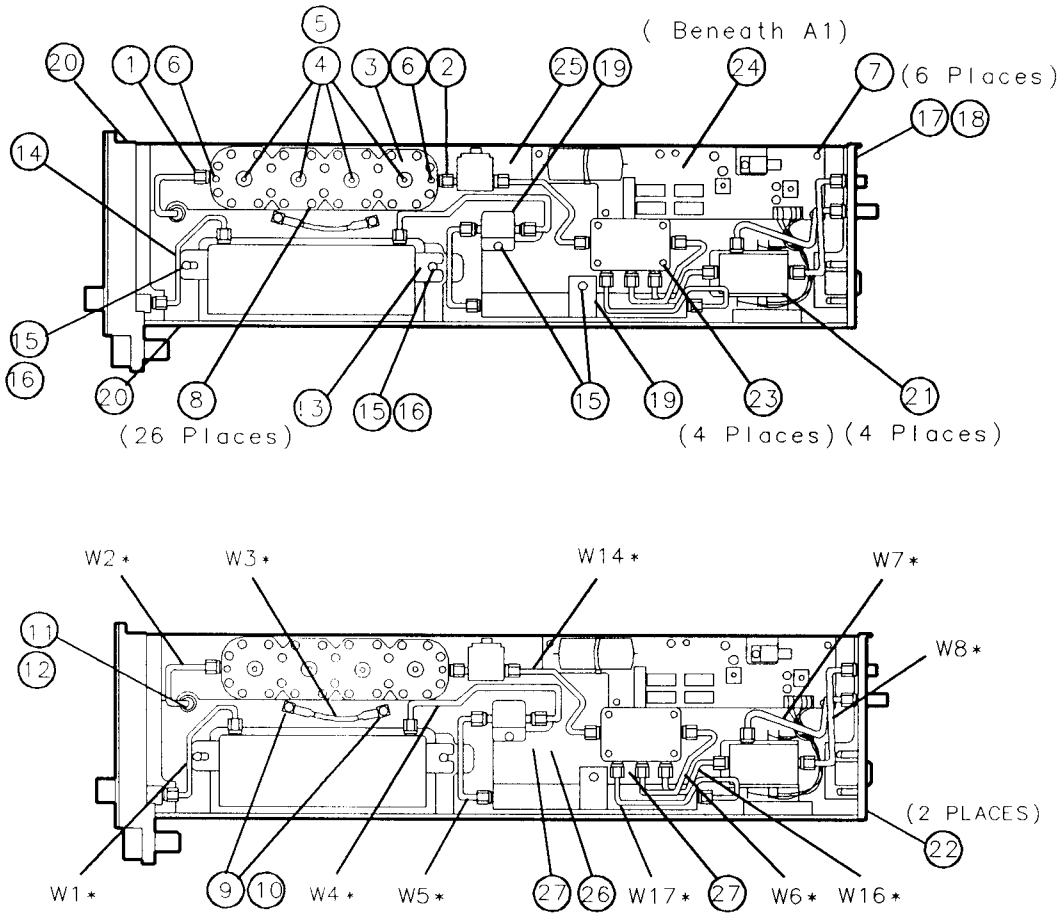


Figure 7-3.
Overall Module Parts Identification, Right-Side View,
Serial Prefixes 2818A and Above (1 of 2)

Item	HP Part Number	CD	Description
1	1250-1157	2	CONNECTOR-RFSMA FEM THD-HOLE 50-OHM
2	5062-1926	8	FIRST IF IN CONNECTOR/PROBE ASSEMBLY
3	~~7094-20019~~	9	2ND CONVERTER BANDPASS & LO HOUSING
4	0515-1046	9	SCREW-SKT-HD-CAP M2 X 0.48 MM-LG
5	0535-0018	5	NUT-HEX DBL-CHAM M2 X 0.4 1.6 MM-THK
6	0515-0894	3	SCREW-SET M2.5 X 0.45 6 MM-LG PAN-HD
7	0515-0886	3	SCREW-MACH M3 X 0.5 6 MM-LG PAN-HD
8	0515-1462	3	SCREW-MACH X3 X 0.520 MM-LG PAN-HD
9	2950-0078	9	NUT-HEX-DBL-CHAM 10-32-THD 0.067-IN-THK
10	2190-0124	4	WASHER-LK INTL T NO.10 0.1905-IN-ID
11	1250-0569	8	NUT-RF CONNECTOR
12	1250-1142	5	WASHER-LK INTL T 1/2-IN 0.26-IN-ID
13	5021-3296	3	ATTENUATOR BRACKET-REAR
14	5021-3297	4	ATTENUATOR BRACKET-FRONT
15	0515-1583	9	SCREW-MACH M4 X 0.7 12 mm-LG PAN-HD
16	3050-0893	9	WASHER-FL MTLC 4.0 MM 4.4-MM-ID
17	0515-1583	9	SCREW-MACH M4 X 0.7 12MM-LG PAN-HD
18	3050-0893	9	WASHER-FL MTLC 4.0 MM 4.4-MM-ID
19	70904-00006	2	LIMITER CLAMP
20	0515-1430	5	SCREW-MACH M3 X 0.58 MM-LG 90-DEG-FLH-HD
21	0515-1364	4	SCREW-MACH M2 X 0.5 16 MM-LG
22	0515-1280	3	SCREW-MACH M3 X 0.5 14 MM-LG PAN-HD
23	0515-1453	2	SCREW-MACH M3 X 0.5 12 MM-LG
24	70904-00005	1	INSULATOR-A1 MISCELLANEOUS BIAS
25	70904-20028	0	CENTER FRAME ASSEMBLY
26	70904-20050	8	FIRST CONVERTER MOUNTING PLATE
27	0515-0866	3	SCREW-MACH M3 X 0.56 MM-LG PAN-HD

Figure 7-3.
Overall Module Parts Identification, Right-Side View,
Serial Prefixes 2818A and Above (2 of 2)

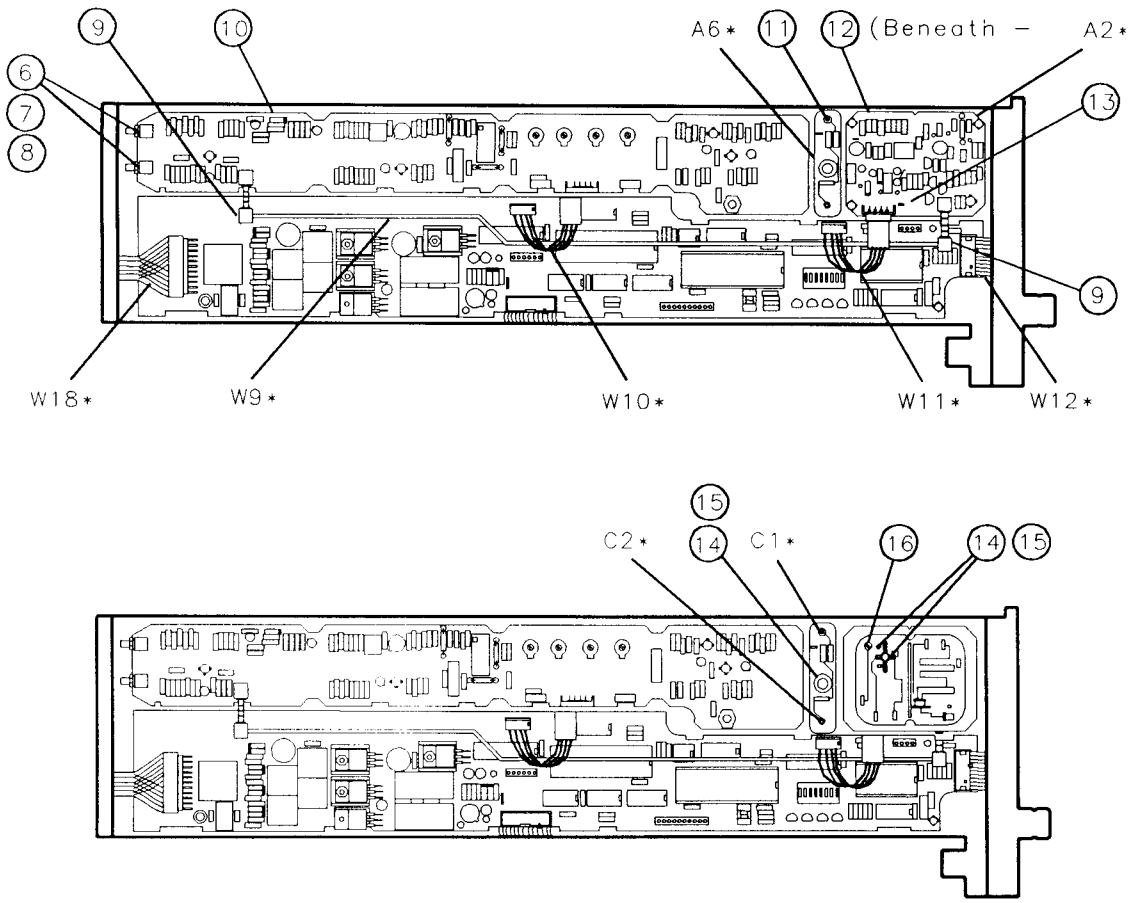
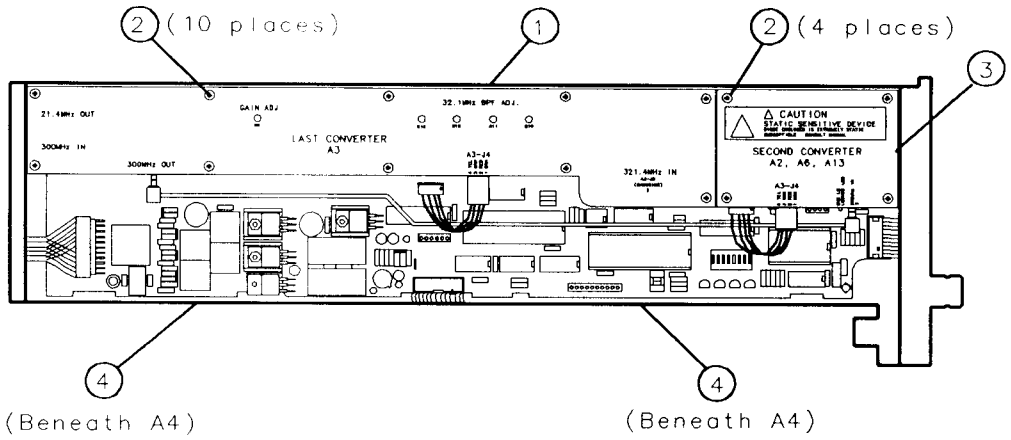


Figure 7-4. Overall Module Parts Identification, Left-Side View (1 of 2)



Item	HP Part Number	CD	Description
1	70904-20022	4	LAST CONVERTER COVER
2	0515-0897	6	SCREW-MACH M3 X 0.58MM-LG PAN-HD
3	70904-20021	3	SECOND CONVERTER COVER
4	5001-5875	4	INSULATOR-A4 POWER SUPPLY/CONTROLLER
5			Not Used
6	2950-0028	9	NUT-HEX-DBL-CHAM 1/4-32-THD 0.125-IN-THK
7	2190-0124	4	WASHER-LK INTL T NO.10 0.194-IN-ID
8	2950-0078	9	NUT-HEX-DBL-CHAM 10-32 THD 0.067-IN-THK
9	8160-0494	4	RFI "D" STRIP CNDCT-ELSTMR
10	70904-20028	0	CENTER FRAME ASSEMBLY
11	0515-0886	3	SCREW-MACH M3 X 0.56MM-LG PAN-HD
12	5086-1626	5	VCO/SAMPLER COVER
13	0515-1280	3	SCREW-MACH M3 X 0.514MM—LG PAN-HD
14	0515-1046	9	SCREW-SKT-HD-CAP M2 X 0.48MM-LG
15	3050-1066	0	WASHER-FL MTLC 2MM 2.28-MM-ID
16	70904-20026	8	VCO PROBE

Figure 7-4. Overall Module Parts Identification, Left-Side View (2 of 2)

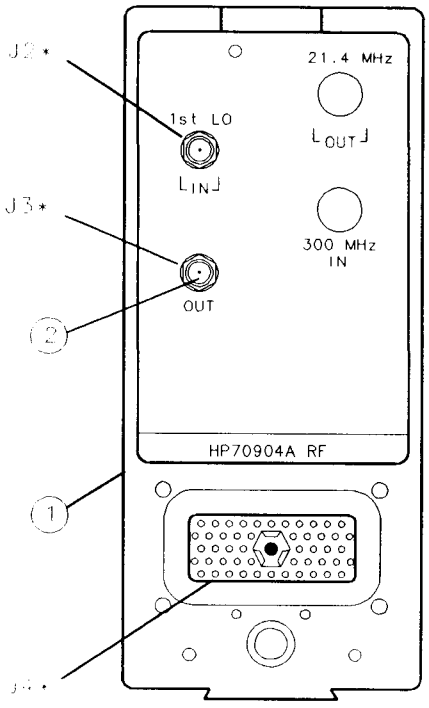
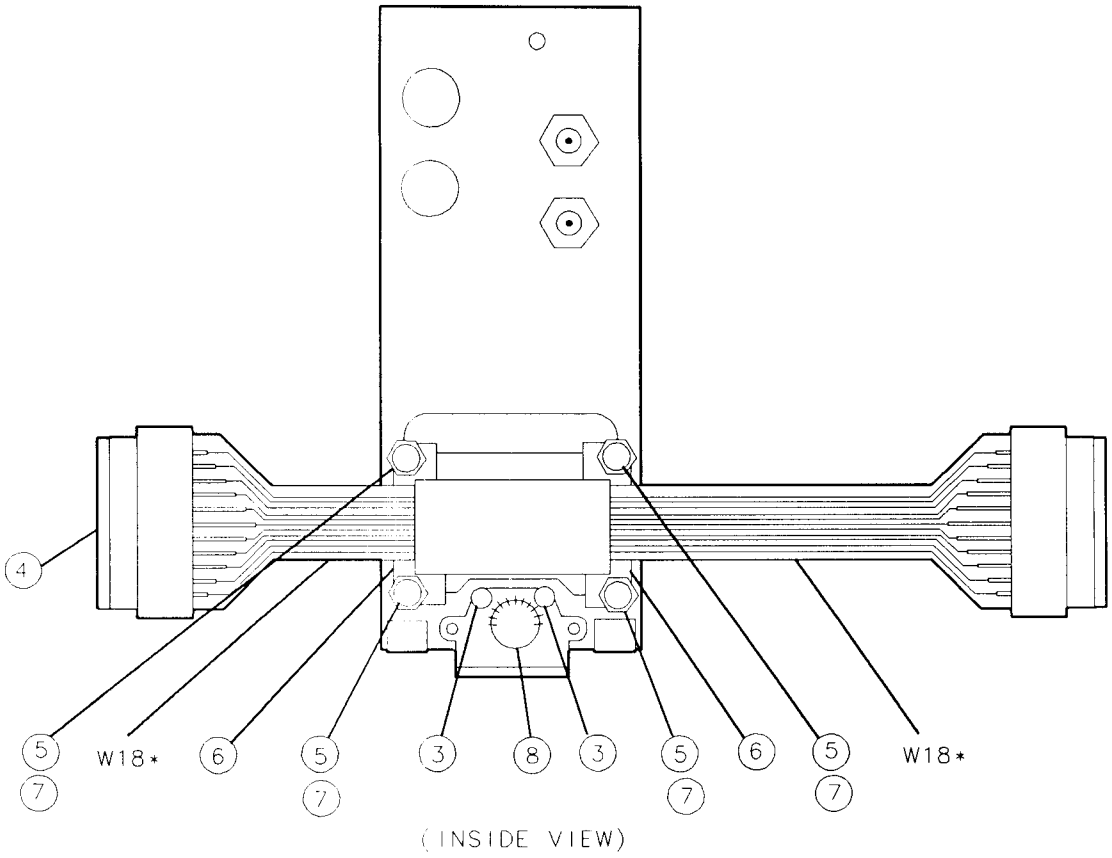


Figure 7-5. Overall Module Parts Identification, Rear Panel (1 of 2)



Item	HP Part Number	CD	Description
1	70904-60033	1	FRAME-REAR
2	0960-0053	9	TERMINATION SMA (m) 50 OHMS
3	0515-0894	3	SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD
4	70904-60040	0	HP-MSIB CABLE ASSEMBLY
5	0535-0042	5	NUT-HEX PLSTC-LKG M3 X 0.5.4MM-THK
6	5001-5835	8	CONNECTOR BAR
7	1460-2095	4	SPRING-CPRSN 5.49-MM-0D 16.8 MM-0A-LG
8	5001-5840	5	GROUNDING SPRING

70904-60002 REAR PANEL LABEL

Figure 7-5. Overall Module Parts Identification, Rear Panel (2 of 2)

Table 7-2. HP 70904A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	70904-60001	3	1	BOARD ASSEMBLY, MISCELLANEOUS BIAS	28480	70904-60001
	70904-69001	1		(RESTORED 70904-60001. EXCHANGE REQURIED)	28480	70904-69001
A2	70904-60002	4		BOARD ASSEMBLY, 2ND LO PHASE LOCK LOOP USED IN SERIAL PREFIX 2830A AND BELOW (OBSOLETE. ORDER 70905-60002.)	28480	70904-60002
	70905-60002	5	1	BOARD ASSEMBLY, 2ND LO PHASE LOCK LOOP USED IN SERIAL PREFIX 2840 AND ABOVE	28480	70905-60002
A3	70904-60003	5	1	BOARD ASSEMBLY, LAST CONVERTER USED IN SERIAL PREFIX 2941A AND BELOW (OBSOLETE. ORDER 70904-60039)	28480	70904-60003
	70904-69003	3		(RESTORED 70904-60003, EXCHANGE REQUIRED) (OBSOLETE. ORDER 70904-69039)	28480	70904-69003
	70904-60039	7	1	BOARD ASSEMBLY, LAST CONVERTER USED IN SERIAL PREFIX 2950A AND ABOVE	28480	70904-60039
	70904-69039	5		RESTORED 70904-60039, EXCHANGE REQUIRED	28480	70904-69039
A4	70904-60004	6		BOARD ASSEMBLY, POWER SUPPLY/CONTROLLER USED IN SERIAL PREFIX 2818A AND BELOW (OBSOLETE. ORDER 70904-60046.)	28480	70904-60004
	70904-69004	4		RESTORED 70904-60004 (OBSOLETE. ORDER 70904-60046.)	28480	70904-69004
	70904-60045	5		BOARD ASSEMBLY, POWER SUPPLY/CONTROLLER USED IN SERIAL PREFIX 2830A TO 2840A	28480	70904-60045
	70904-69045	3		RESTORED 70904-60045 (OBSOLETE. ORDER 70904-60046)	28480	70904-69045
	70904-60046	6		REPLACEMENT KIT, POWER SUPPLY/CONTROLLER (RESTORED 70904-60049. EXCHANGE REQUIRED)	28480	70904-60046
	70904-60049	9	1	BOARD ASSEMBLY, POWER SUPPLY/CONTROLLER USED IN SERIAL PREFIX 2924A AND ABOVE	28480	70904-60049
	70904-69049	7		RESTORED 70904-60049, EXCHANGE REQUIRED ORDER 70904-60046	28480	70904-69049
A5	70904-60005	7	1	BOARD ASSEMBLY, SECOND MIXER USED IN SERIAL PREFIX 2924A AND BELOW	28480	70904-60005
A6	70904-60006	8	1	BOARD ASSEMBLY, 321 MHz MATCHING NETWORK USED IN SERIAL PREFIX 2924A AND BELOW	28480	70904-60006

Table 7-2. HP 70904A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A7A1	70904-60007	9		BOARD ASSEMBLY, FRONT PANEL USED IN SERIAL PREFIX 2725A AND BELOW (OBSOLETE. ORDER 70904-60041.)	28480	70904-60007
	70904-60041	1	1	BOARD ASSEMBLY, FRONT PANEL USED IN SERIAL PREFIX 2727A AND ABOVE	28480	70904-60041
A8	5086-7724	6	1	INPUT ATTENUATOR USED IN SERIAL PREFIX 2924A AND BELOW (OBSOLETE. ORDER KIT 5062-6419)	28480	33321YG
	5086-6724	4		(RESTORED 5086-7724 OBSOLETE ORDER KIT 5062-6419)	28480	5086-6724
	5086-7843	0	1	INPUT ATTENUATOR USED IN SERIAL PREFIX 2941A AND ABOVE	28480	33321UG
	5086-6843	8		(RESTORED 5086-7843, EXCHANGE REQUIRED)	28480	5086-6724
	5062-6419			ATTENUATOR RETROFIT KIT (USED TO REPLACE 5086-7724)	28480	5062-6419
A9	5086-7746	2	1	LIMITER 0-3GHZ	28480	5086-7746
	5086-6746	0		RESTORED 5086-7746 LIMITER	28480	5086-6746
A10	0955-0214	3	1	ISOLATOR	28480	0955-0214
A11	5086-7737	1		FIRST CONVERTER USED IN SERIAL PREFIX 2807A AND BELOW (OBSOLETE. ORDER 70904-60050)	28480	5086-7737
	5086-7798	4	1	FIRST CONVERTER USED IN SERIAL PREFIX 2818A AND ABOVE	28480	5086-7798
	70904-60050	9		FIRST CONVERTER RETROFIT KIT	28480	70904-60050
A12	0955-0332	6	1	LEVELING AMPLIFIER 3-6.6 GHZ USED IN SERIAL 2807A00943 AND ABOVE	28480	0955-0332
	5086-7703	1		LEVELING AMPLIFIER (ALTERNATE FOR 0955-0332) ORDER 5062-1993 LEV AMP REPLACEMENT KIT	28480	5086-7703
	5062-1993	9		LEVELING AMPLIFIER REPLACEMENT KIT (USED TO REPLACE 5086-7703)	28480	5062-1993
	5086-6703	9		(RESTORED 5086-7703, EXCHANGE REQUIRED)	28480	5086-6703
A13	5086-7736	0		BOARD ASSEMBLY, VCO/SAMPLER USED IN SERIAL PREFIX 2953A AND BELOW (OBSOLETE. ORDER 5086-7794.)	28480	5086-7736
	5086-7794	0	1	BOARD ASSEMBLY, VCO/SAMPLER USED IN SERIAL PREFIX 2807A AND ABOVE	28480	5086-7794

Table 7-2. HP 70904A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14	0955-0448	5	1	LOW PASS FILTER, 4.4 GHZ (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	0955-0448
	9135-0040	4		LOW PASS FILTER, 6.2 GHZ (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7737.)	28480	9135-0040
A15	0955-0447	4	1	LOW PASS FILTER 2.9 GHZ (FOR USE WITH A11 FIRST CONVERTER (PART NUMBER 5086-7798.)	28480	0955-0447
				CHASSIS ELECTRICAL PARTS		
C1	5062-1924	6	1	C1 REPLACEMENT ASSEMBLY (6.2pf)	28480	5062-1924
C2	5062-1925	7	1	C2 REPLACEMENT ASSEMBLY (22pf)	28480	5062-1925
J1	86290-60005	7	1	RF CONNECTOR ASSEMBLY, TYPE N	28480	86290-60005
J2	1250-1957	0	1	ADAPTER - COAX STR F-SMA F-SMA	28480	1250-1957
J3	1250-1957	0	1	ADAPTER - COAX STR F-SMA F-SMA	28480	1250-1957
J4				PART OF W18, NOT SEPERATELY REPLACEABLE		
W1	5021-7442	9	1	CABLE ASSEMBLY, SEMI-RIGID, FRONT PANEL J1 TO A8 INPUT ATTENUATOR	28480	5021-7442
W2	70904-20013	3	1	CABLE ASSEMBLY, SEMI-RIGID, SECOND LO TO A13 VCO/SAMPLER	28480	70904-20013
W3	70904-60015	9	1	CABLE ASSEMBLY, COAX 3, A6321 MHZ MATCHING NETWORK TO A3 LAST CONVERTER	28480	70904-60015
W4	70904-20049	5	1	CABLE ASSEMBLY, SEMI-RIGID, A8 INPUT ATTENUATOR TO A9 LIMITER (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20049
	70904-20031	5		CABLE ASSEMBLY, SEMI-RIGID, A8 INPUT ATTENUATOR TO A9 LIMITER (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7737.)	28480	70904-20031
W5	70904-20044	0	1	CABLE ASSEMBLY, SEMI-RIGID, A9 LIMITER TO A15 2.9 GHZ LPF (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20044
	70904-20032	6		CABLE ASSEMBLY, SEMI-RIGID, A9 LIMITER TO A11 FIRST CONVERTER (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7737.)	28480	70904-20032

Table 7-2. HP 70904A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W6	70904-20047	3	1	CABLE ASSEMBLY, SEMI-RIGID, A11 FIRST CONVERTER TO A14 4.4 GHZ LPF (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20047
	70904-20042	8		CABLE ASSEMBLY, SEMI-RIGID, A11 FIRST CONVERTER TO A14 6.2 GHZ LPF (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7737.)	28480	70904-20042
W7	70904-20030	4	1	CABLE ASSEMBLY, SEMI-RIGID, A12 LEVELING AMP TO REAR PANEL J3	28480	70904-20030
W8	70904-20012	2	1	CABLE ASSEMBLY, SEMI-RIGID, REAR PANEL J2 TO A12 LEVELING AMPLIFIER	28480	70904-20012
W9	70904-60009	1	1	CABLE ASSEMBLY, COAX 2, A3 LAST CONVERTER TO A2 SECOND LO PLL	28480	70904-60009
W10	5061-5493	0	1	CABLE ASSEMBLY, RIBBON, A4 POWER SUPPLY/ CONTROLLER TO A3 LAST CONVERTER	28480	5061-5493
W11	5061-5493	0	1	CABLE ASSEMBLY, RIBBON, A4 POWER SUPPLY/ CONTROLLER TO A2 SECOND LO PLL	28480	5061-5493
W12	70904-60017	1	1	CABLE ASSEMBLY, RIBBON, A4 POWER SUPPLY/ CONTROLLER TO A7 FRONT PANEL	28480	70904-60017
W13				NOT ASSIGNED		
W14	70904-20048	4	1	CABLE ASSEMBLY, SEMI-RIGID, A14 4.4 GHZ LPF TO A10 ISOLATOR (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20048
	70904-20043	9		CABLE ASSEMBLY, SEMI-RIGID, A14 6.2 GHZ LPF TO A10 ISOLATOR (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7737.)	28480	70904-20043
W15	70904-60016	0	1	CABLE ASSEMBLY, RIBBON, A4 POWER SUPPLY/ CONTROLLER TO A1 MISCELLANEOUS BIAS	28480	70904-60016
W16	70904-20046	2	1	CABLE ASSEMBLY, SEMI-RIGID, A12 LEVELING AMP TO A11 FIRST CONVERTER (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20046
W17	70904-20045	1	1	CABLE ASSEMBLY, SEMI-RIGID, A15 2.9 GHZ LPF TO A11 FIRST CONVERTER (FOR USE WITH A11 FIRST CONVERTER PART NUMBER 5086-7798.)	28480	70904-20045

Table 7-2. HP 70904A Major Assemblies

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W18	70904-60040	0	1	CABLE ASSEMBLY, FLEX, REAR PANEL J4 MSIB CONNECTOR TO A4 POWER SUPPLY/CONTROLLER (USED WITH A4 PART NUMBER 70904-60045)	28480	70904-60040
	70904-60013	7		CABLE ASSEMBLY, FLEX, REAR PANEL J4 MSIB CONNECTOR TO A4 POWER SUPPLY/CONTROLLER (USED WITH A4 PART NUMBER 70904-60004)	28480	70904-60013
				MISCELLANEOUS PARTS		
	70904-60042	2	1	PROBE POWER CONNECTOR ASSEMBLY. INCLUDES THE FOLLOWING PARTS: 5086-0467; CD 0; QTY 1; CONNECTOR 2110-0669; CD 4; QTY 2; FUSE .25A 8150-0447; CD 6; QTY 1; WIRE	28480	70904-60042
F1	2110-0669	4	1	FUSE .25A	28480	2110-0669
F2	2110-0669	4	1	FUSE .25A	28480	2110-0669
	5061-5494	1	1	WIRE HARNESS, 5 WIRE, A12 LEVELING	28480	5061-5494

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Major Assembly and Cable Locations

Introduction

The various assemblies and cables of the RF Section are illustrated and identified in this chapter. Refer to the Chapter 7, "Replaceable Parts," for part numbers and ordering information.

Contents

List of Assemblies, Cables, and Connectors

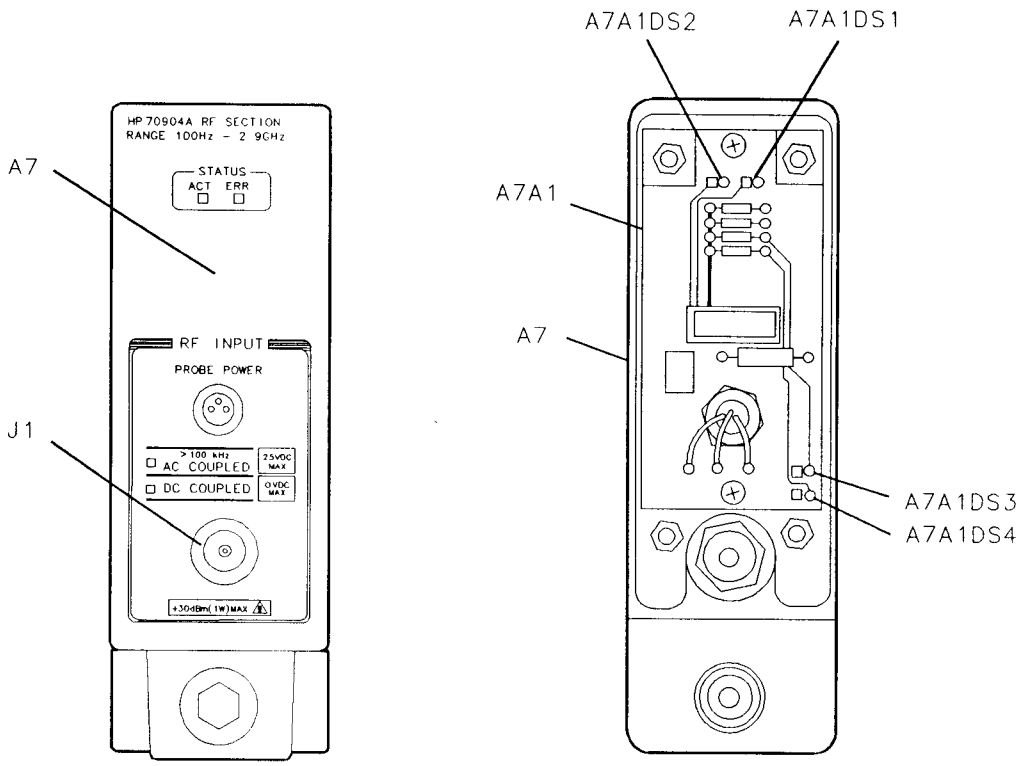

Figure 8-1. Front-Panel View, Connector and Component Designations

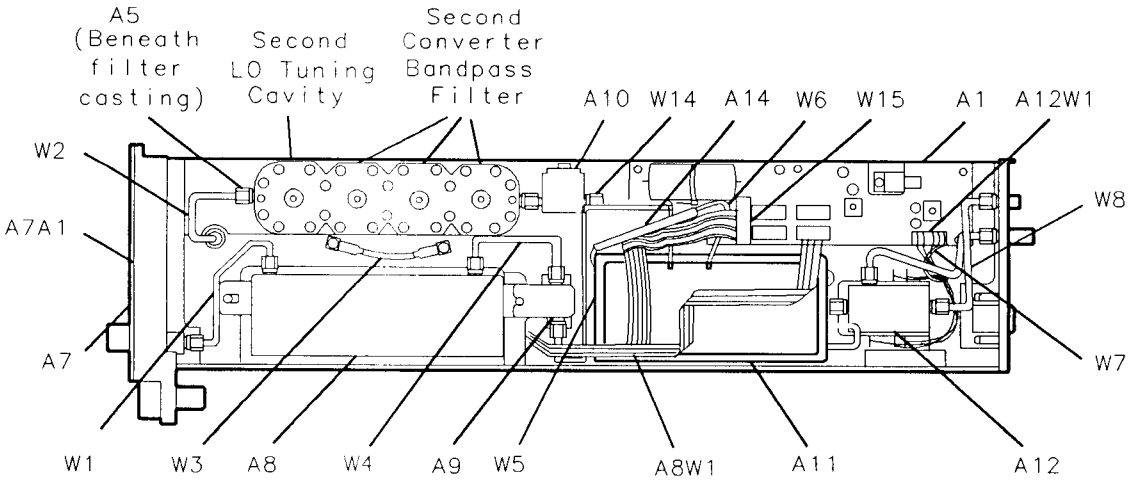

Figure 8-2.
Right-side View, Major Assembly and Cable Designations
Serial Prefix 2807A and Below

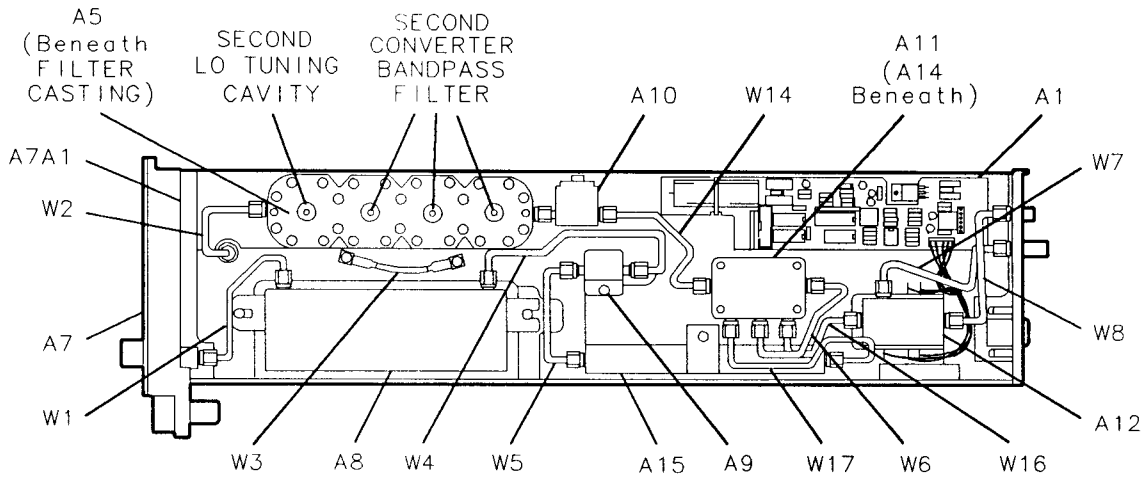

Figure 8-3.
Right-side View, Major Assembly and Cable Designations
Serial Prefix 2818A and Above

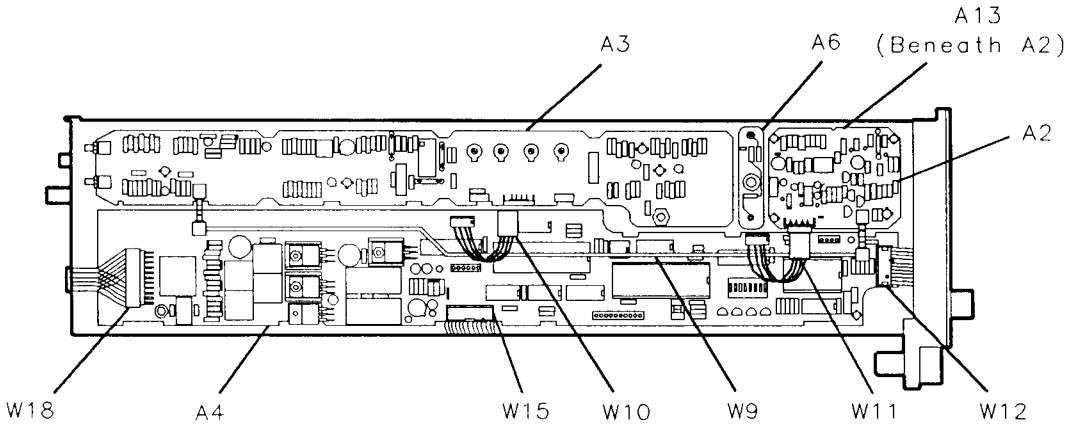

Figure 8-4. Left-Side View, Major Assembly and Cable Designations

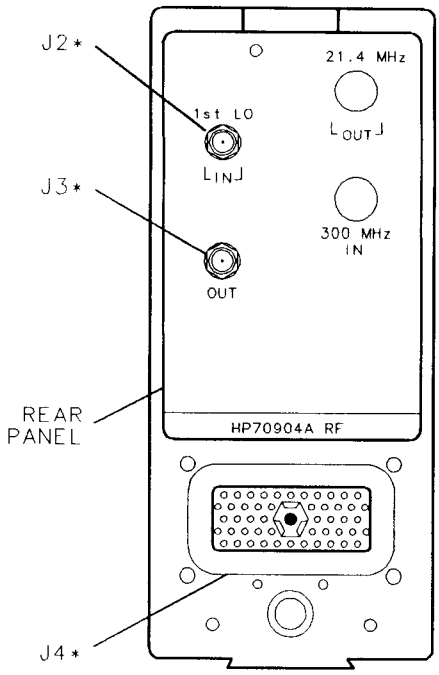

Figure 8-5. Rear-Panel Outside View, Connector Designations

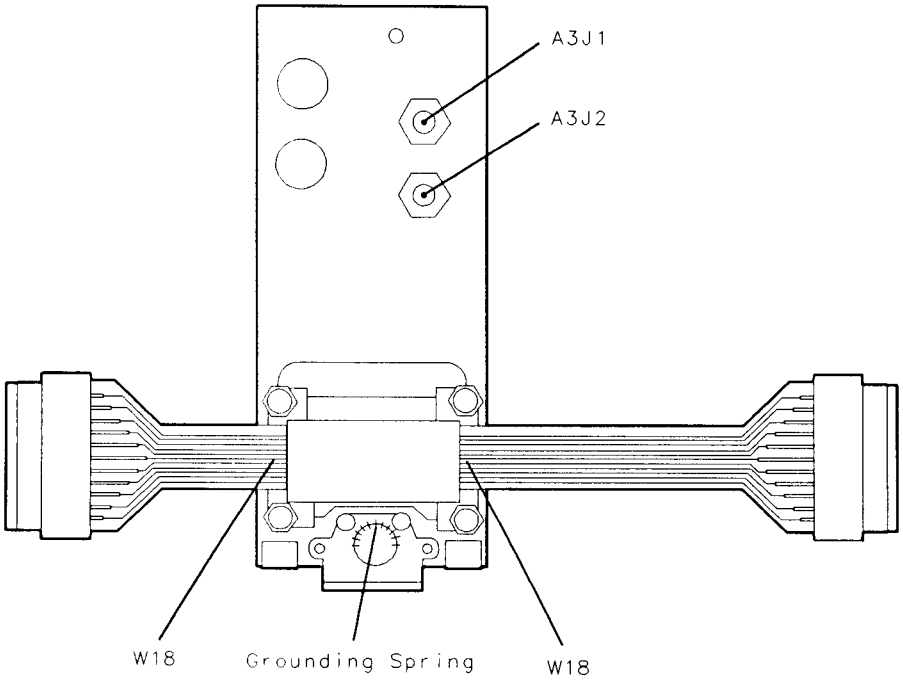

Figure 8-6. Rear-Panel Inside View, Connector and Cable Designations

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Component-Level Information Packets

Component-level information is available for selected instrument assemblies. The information for each repairable assembly is provided in the form of Component-Level Information Packets (CLIPs). Each CLIP contains a parts list, component-location diagram, and schematic diagram. Each CLIP has an HP part number which is changed whenever the HP part number for its related instrument assembly is changed.

Updated or replacement CLIPs may be ordered through your local Hewlett-Packard Sales or Service office using the CLIP part number provided in Table A-1.

A complete set of CLIPs can be obtained by ordering the *HP 70904A Component-Level Information* binder, HP part number 70904-90047. The current set of CLIPs contains CLIPs that support any version of HP 70904A RF section assemblies.

CLIPs are packaged in protective plastic envelopes. To use and store your CLIPs effectively, the following accessories are available:

2-1/2 inch CLIP binder (for 25 to 30 packets)	HP part number 9282-1134
2 inch CLIP binder (for 15 to 25 packets)	HP part number 9282-1133
1-1/2 inch CLIP binder (for fewer than 15 packets)	HP part number 9282-1132

Note CLIPs may not be available for recently introduced assemblies.

Table A-1.
Board Assembly, Serial Number, and CLIP Part Number Cross-Reference

Assembly	Instrument Serial Prefix Number	Board Assembly Part Number	CLIP Part Number
A1 Miscellaneous Bias	2924A and below	70904-60001	70904-90048
A2 Second Converter PLL	2830A and below	70904-60002*	70904-90049
	2840A and above—except 2429A00672, and 2429A00801 through 2429A00804	70905-60002	70905-90035
A3 Last Converter	2941A and below	70904-60003†	70904-90051
	2950A and above—except module serial numbers 2840A01174, 2840A01175 and 2840A01176	70904-60039	70904-90052
A4 Power Supply/Controller	2818A and below	70904-60004‡	70904-90053
	2830A to 2840A	70904-60045‡	70904-90054
	2924A and above	70904-60049	70904-90055
A5 Second Mixer	2924A and below	70905-60005	70904-90056
A6 321.4 MHz Matching Network	2924A and below	70904-60006	70904-90057
A7A1 Front Panel	2725A and below	70904-60007§	70904-90058
	2727A and above	70904-60041	70904-90059

*This board is obsolete. If replacement is required order 70905-60002.
†This board is obsolete. If replacement is required order 70904-60039.
‡This board is obsolete. If replacement is required order 70904-60049.
§This board is obsolete. If replacement is required order 70904-60041.

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