Service Guide

HP 70902A

IF Section

HP Part No. 70902-90079
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Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

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

Safety Notes

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

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

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

Instruction Manual

The **instruction manual** symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the manual.

General Safety Considerations

Warning

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

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

Warning

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

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

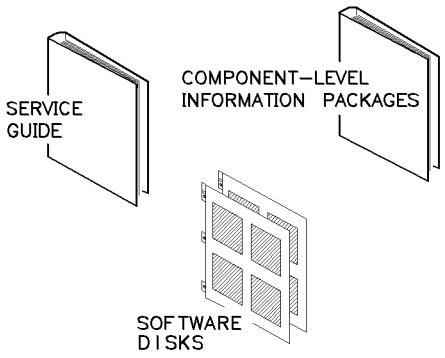
Caution

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

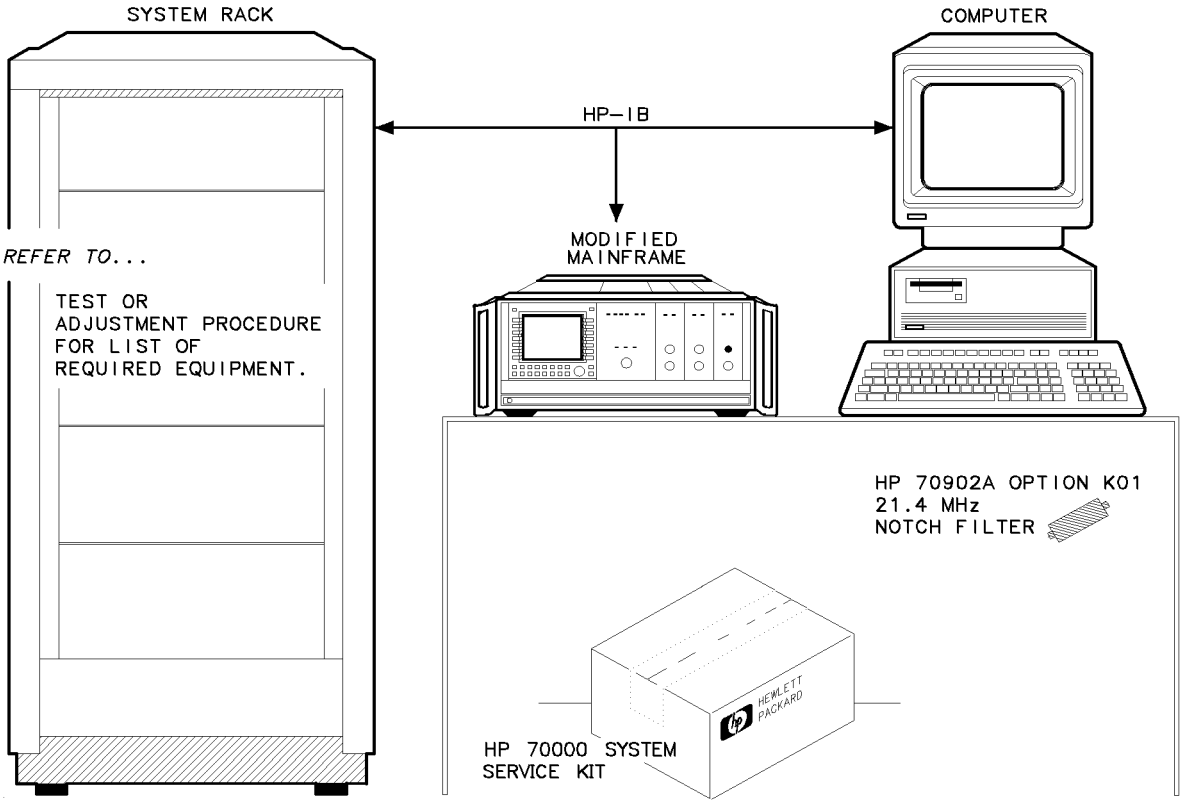
Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

Servicing at a Glance

DOCUMENTATION AND SOFTWARE SUPPLIED



TOOLS AND EQUIPMENT NEEDED



The HP 70902A IF section is an IF module that is used in HP 70000 Series modular spectrum analyzer systems. A standard modular spectrum analyzer system includes a mainframe with an RF section, IF section, local oscillator, an optional display, and an optional precision frequency reference.

Documentation and software supplied

This service guide is part of an Option 915 package which includes:

- *HP 70902A Service Guide*
- *HP 70902A Component Level Information Packages*
- Five disks containing module verification software.

Tools and equipment needed

Before servicing, refer to Chapter 2 for a list of the tools and equipment that may be needed during servicing.

Antistatic precautions

Electrical components are easily damaged by small amounts of static electricity. If possible, work at a static-safe work station. For further information, refer to "Electrostatic Discharge Information" in Chapter 2.

In This Book

This book is part of an Option 915 documentation package which consists of a service guide, a component-level information packages manual, and software disks that contain module verification software.

It describes all of the service procedures necessary to test, adjust, troubleshoot, and repair an HP 70902A IF section in an HP 70000 Series modular spectrum analyzer system. Each module in the HP 70000 Series modular spectrum analyzer system has its own service guide.

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

Service Guide

Chapter 1 answers the questions "What is service?" and "When is service needed?" It then describes the procedures used to return your HP 70902A IF section to Hewlett-Packard for servicing.

Chapter 2 contains a list of recommended test equipment, a listing of a general service kit for HP 70000 modular measurement system modules, documentation on the HP 70902A Option K01 IF section, and information on electrostatic discharge (ESD).

Chapter 3 contains information needed to use module verification software.

Chapter 4 contains information on the tests used to verify module operation.

Chapter 5 contains information about the procedures needed to adjust the module after a repair.

Chapter 6 contains module-level troubleshooting procedures, error-code definitions, and block diagrams.

Chapter 7 contains instructions for removal and replacement of all major assemblies.

Chapter 8 contains information needed to order mechanical parts and replacement board or cable assemblies for the module.

Chapter 9 contains figures identifying all major assemblies and cables.

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

Component-Level Information Packages

The component-level information packages manual contains packets of component-level repair information for each HP 70902A IF section board assembly that has field-replaceable parts. Each packet includes the parts list, component-location drawing, and schematics for a specific board-assembly part number. This chapter also contains a table cross-referencing board-assembly version and module serial prefix.

Before you begin servicing, you must become familiar with module verification software. For information on how to use module verification software, refer to Chapter 3.

Contents

6. Troubleshooting

Figures

Tables

1

Getting Started

This chapter provides information to help get you started so that your HP 70902A IF section is serviced properly.

This chapter answers the questions “What is servicing?” and “When is servicing needed?”. It then describes the procedures used to return your HP 70902A IF section to Hewlett-Packard for servicing if you choose not to perform the servicing yourself.

What is servicing?

Servicing includes:

- adjusting
- troubleshooting
- repairing
- testing

All areas of servicing are explained in this service guide. This service guide is used to:

- describe all adjustment procedures
- illustrate module-level block diagrams and interconnect diagrams
- illustrate the procedures for removal and replacement of major assemblies
- explain module verification testing

In this service guide, when we refer to testing, we are referring to module verification tests. Module verification tests should not be confused with verification of operation tests or performance tests.

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

Verification of Operation Tests Verification of operation tests are used to verify the proper operation of an instrument and to verify that the instrument meets approximately 80% of its measurement related specifications.

For information related to verification of operation tests, refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual*.

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

For information related to performance tests, refer to the documentation for the HP 11990A performance test software.

When is servicing needed?

Servicing is needed:

- if error messages are displayed on your HP 70000 Series display
- to perform repairs or adjustments or both
- to verify the correct operation of your HP 70902A IF section
- or, if applicable, when upgrading firmware

If you determine that your HP 70902A IF section needs servicing, you can perform the servicing yourself or, you can return your HP 70902A IF section to a Hewlett-Packard service center.

If you want Hewlett-Packard to service your HP 70902A IF section

Before calling Hewlett-Packard or returning your HP 70902A IF section for service, please read your warranty information. Warranty information is printed at the front of this service guide.

In any correspondence or telephone conversations, refer to the HP 70902A IF section by its full model number and full serial number. With this information, the Hewlett-Packard representative can determine whether your unit is still within its warranty period.

Determining your HP 70902A IF section's serial number

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

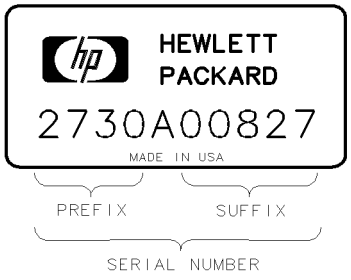


Figure 1-1. Typical Serial Number Label

Returning your HP 70902A IF section for service

Hewlett-Packard has sales and service offices around the world to provide complete support for your HP 70902A IF section. To obtain servicing information or to order replacement parts, contact the nearest Hewlett-Packard sales and service office listed in Table 1-2.

Use the following procedure to return your HP 70902A IF section to Hewlett-Packard for service:

1. Fill out a service tag (available at the end of this service guide) and attach it to the instrument. Please be as specific as possible about the nature of the problem. Send a copy of any or all of the following information:
   - any error messages that appeared on the HP 70000 Series display
   - a completed Performance Test Record
   - any other specific data on the performance of the HP 70902A IF section

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Caution Damage can result if the original packaging materials are not used. Packaging materials should be anti-static and should cushion the HP 70902A IF section on all sides.

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

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2. Place the HP 70902A IF section in its original packaging materials (see Table 1-1).

   If the original packaging materials are not available, you can contact a Hewlett-Packard sales and service office to obtain information on packaging materials or you may use an alternative packing material referred to as "bubble-pack". One of the companies that makes bubble-pack is Sealed Air Corporation of Commerce, California, 90001.

3. Surround the HP 70902A IF section with at least 3 to 4 inches of its original packing material or bubble-pack to prevent the HP 70902A IF section from moving in its shipping container.

4. Place the HP 70902A IF section, after wrapping it with packing material, in its original shipping container or a strong shipping container that is made of double-walled corrugated cardboard with 159 kg (350 lb) bursting strength.

   The shipping container must be both large enough and strong enough to accommodate an HP 70902A IF section and allow at least 3 to 4 inches on all sides for packing material.

5. Seal the shipping container securely with strong nylon adhesive tape.

6. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to help ensure careful handling.

7. Retain copies of all shipping papers.

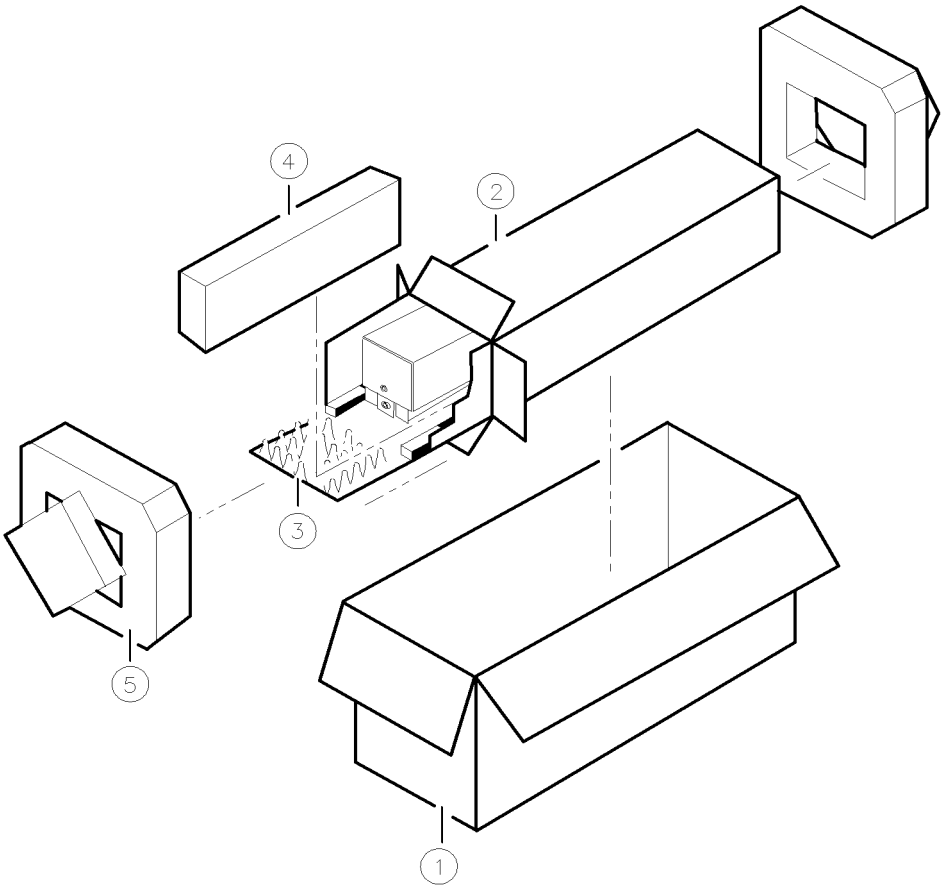


Table 1-1. Packaging and Contents

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

Table 1-2. Hewlett-Packard Sales and Service Offices

US FIELD OPERATIONS HEADQUARTERS
Hewlett-Packard Company
19320 Pruneridge Avenue
Cupertino, CA 95014, USA
(800) 752-0900

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

Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94041
(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
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(708) 255-9800

New Jersey
Hewlett-Packard Co.
120 W. Century Road
Paramus, NJ 07653
(201) 599-5000

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

EUROPEAN OPERATIONS HEADQUARTERS
Hewlett-Packard S.A.
150, Route du Nant-d'Avril
1217 Meyrin 2/Geneva
Switzerland
(41 22) 780.8111

France
Hewlett-Packard France
1 Avenue Du Canada
Zone D'Activite De Courtaboeuf
F-91947 Les Ulis Cedex
France
(33 1) 69 82 60 60

Germany
Hewlett-Packard GmbH
Berner Strasse 117
6000 Frankfurt 56
West Germany
(49 69) 500006-0

Great Britain
Hewlett-Packard Ltd.
Eskdale Road, Winnersh Triangle
Wokingham, Berkshire RG11 5DZ
England
(44 734) 696622

INTERCON OPERATIONS HEADQUARTERS
Hewlett-Packard Company
3495 Deer Creek Rd.
Palo Alto, California 94304-1316
(415) 857-5027

Australia
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
(61 3) 895-2895

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

Japan
Yokogawa-Hewlett-Packard Ltd.
1-27-15 Yabe, Sagamihara
Kanagawa 229, Japan
(81 427) 59-1311

China
China Hewlett-Packard, Co.
38 Bei San Huan X1 Road
Shuang Yu Shu
Hai Dian District
Beijing, China
(86 1) 256-6888

Singapore
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
(65) 273 7388

Taiwan
Hewlett-Packard Taiwan
8th Floor, H-P Building
337 Fu Hsing North Road
Taipei, Taiwan
(886 2) 712-0404

2

Recommended Test Equipment

This chapter contains a list of recommended test equipment, a listing of a general service kit for HP 70000 modular measurement system modules, and information on electrostatic discharge (ESD).

The following tables list the recommended models of equipment that may be used. If a piece of equipment has any critical specifications, they are defined under the list of recommended models for that equipment. The following tables also list any specialized test equipment needed during the tests and adjustments; for more information, refer to Chapter 4 and Chapter 5.

Table 2-1. Recommended Test Equipment

Equipment	Recommended Model	Verif. Test	Adj. Proc.
HP 70000 system components:			
Display	HP 70205A graphics display	√	
	or HP 70206A system graphics display	√	
	or HP 70004A color display	√	
Mainframe	HP 70001A mainframe, modified[1]	√	√
Local oscillator source	HP 70900A local oscillator source	√	√
	or HP 70900B local oscillator source	√	√
IF section	HP 70903A IF section		√
RF section	HP 70904A RF section	√	
	or HP 70905A RF section	√	
	or HP 70906A RF section	√	
	or HP 70908A RF section	√	
	or HP 70909A RF section	√	
	or HP 70910A RF section	√	
Specialized test equipment:			
21.4 MHz Notch Filter	HP 70902A Option K01 IF section[2]	√	

1 Mainframe must be modified. Refer to "Service Kit".

2 Refer to Chapter 4 for more details on building this specialized test equipment.

Table 2-1. Recommended Test Equipment (2 of 4)

Equipment	Recommended Model	Verif. Test	Adj. Proc.
Attenuator/Switch driver	HP 11713A attenuator/switch driver[1]	√	√
Controller	HP 9000 Series 200/300 controller[2] Series 200 and 300	√	√
Frequency counter	HP 5316B universal counter **Critical Specifications:** Frequency range: 3 to 25 MHz Resolution: 1 Hz This equipment must have adjustable gate time to 2 seconds.	√	√
Interface card	HP 98624A HP-IB interface		
Level generator	HP 3335A synthesizer/level generator **Critical Specifications:** Frequency: Range: 3 to 25 MHz Resolution: 0.001 Hz Amplitude: Range: +10 to −86 dBm Resolution: 0.01 dB Accuracy: ±0.09 dB Spurious: < −75 dBc	√	√
Network analyzer	HP 8757C scalar network analyzer or HP 8757A scalar network analyzer or HP 8756A scalar network analyzer		√ √ √

1 For use with a programmable step attenuator. It must be HP-IB programmable and compatible with the step attenuator.

2 See also Interface card.

Table 2-1. Recommended Test Equipment (3 of 4)

Equipment	Recommended Model	Verif. Test	Adj. Proc.
Power meter	HP 8902A measuring receiver **Critical Specifications:** Range: +10 to −20 dBm Accuracy: ±0.02 dB ±0.02 dB/range change	√	√
Power sensor	HP 11722A sensor module **Critical Specifications:** Range: +10 to −20 dBm Accuracy: +2% to −4% Input SWR: < 1.15	√	√
Precision DVM	HP 3456A digital multimeter	√	√
Receiver	HP 8902A measuring receiver	√	√
RF source	HP 8340A synthesized sweeper[1] or HP 8340B synthesized sweeper[1] or HP 83640A synthesized sweeper[1] **Critical Specifications:** Frequency: 21.4 MHz ±5 MHz Amplitude: +10 to −21 dBm		√ √ √
RF amplifier	HP 8447A RF amplifier **Critical Specifications:** Gain: 20 ±1 dB Noise Figure: < 8 dB		√

1 This equipment must work with an HP 8757C scalar network analyzer.

Table 2-1. Recommended Test Equipment (4 of 4)

Equipment	Recommended Model	Verif. Test	Adj. Proc.
Spectrum analyzer	HP 71200A modular spectrum analyzer	√	
	or HP 8566B spectrum analyzer	√	
	(upgraded with firmware version 16.7.85 or later)		
	Critical Specifications:		
	Frequency:		
	Range: 100 Hz to 25 MHz		
	Resolution: 1 Hz		
	Amplitude:		
	Range: 0 to −25 dBm		
	Resolution: 0.01 dB		
	Log Fidelity: ≤ 0.1 dB		
Synthesized source	HP 8662A synthesized signal generator	√	√
	or HP 8663A synthesized signal generator	√	√
	Critical Specifications:		
	Frequency:		
	Range: 18.3 to 25 MHz		
	Resolution: 1 Hz		
	Amplitude:		
	+10 to −20 dBm		
	Resolution: 0.1 dB		
	Spurious: <−75 dBc		

Table 2-2. Recommended Test Accessories

Accessories	Recommended Model	Verif. Test	Adj. Proc.
Adjustment tool	HP 8710-1781 alignment tool		√
	HP 8710-1010 alignment tool		√
Detector	HP 11664A detector		√
	HP 11664E detector		√
	Critical Specifications:		
	Frequency: 21.4 MHz ±5 MHz		
	AC detection mode must work with an HP 8757C scalar network analyzer		
Directional bridge	HP 8721A directional bridge	√	
	Critical Specifications:		
	Nominal impedance: 50Ω		
	Frequency range: 21.4 ±2 MHz		
	Directivity: > 40 dB		
	Transmission/coupling loss: 6 dB *(nominal)*		
Feedthrough terminator	HP 10100C 50Ω BNC feedthrough		√
	Critical Specifications:		
	Nominal impedance: 50Ω		
Power splitter	HP 11667A power splitter	√	√
	or HP 11667B power splitter	√	√
	Critical Specifications:		
	Nominal impedance: 50Ω		
	Tracking: ≤ 0.15 dB		
Probe (resistive divider)	HP 10020A resistive divider probe kit		√
	Critical Specifications:		
	1:1 Division Ratio		

Table 2-2. Recommended Test Accessories (2 of 3)

Accessories	Recommended Model	Verif. Test	Adj. Proc.
RF mixer	HP 10514A double-balanced and harmonic mixer		√
	HP 10534A double-balanced and harmonic mixer		√
	Critical Specifications: Frequency: 21.4 MHz ±5 MHz		
Step attenuator[1]	HP 8496G Option 001 coaxial step attenuator	√	√
	Critical Specifications: Frequency: 21.4 MHz; Range: 0 to 110 dB in 10 dB steps; Nominal impedance: 50Ω		
Terminator	HP 1250-0676 precision 50Ω SMB(f) termination	√	√
	Critical Specifications: Frequency: 21.4 MHz; VSWR: < 1.05		

1 A programmable attenuator is recommended.

Table 2-3. Recommended Test Accessories (3 of 3)

Cables and Adapters — Recommended Model	Verif. Test	Adj. Proc.
Cables		
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)	√	√
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)	√	√
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)	√	√
Adapters		
HP 1250-1745 50Ω APC-3.5(f) to N(f)	√	√
HP 1251-2277 50Ω BNC(f) to dual banana plug	√	√
HP 1250-1474 precision 50Ω N(f) to BNC(f)	√	√
HP 1250-1477 precision 50Ω N(f) to BNC(m)	√	√
HP 1250-1476 precision 50Ω N(m) to BNC(f)	√	√
HP 1250-1473 precision 50Ω N(m) to BNC(m)	√	
HP 1250-1236 50Ω SMB(f) to BNC(f)	√	√
HP 1250-0672 50Ω SMB(f) to SMB(f)	√	
HP 1250-0896 50Ω SMB(m) to BNC(m)	√	
HP 1250-1237 50Ω SMB(m) to BNC(f)	√	
HP 1250-0674 50Ω SMB(m) to SMA(f)	√	
HP 1250-0669 50Ω SMB(m) to SMB(m)	√	
HP 1250-0671 50Ω SMB(m) to N(m)	√	√
HP 1250-1391 50Ω SMB tee(f) (m) (m)	√	√

Service Kit

The HP 71000 system service kit is the general service kit for HP 70000 modular measurement system (MMS) modules. This kit includes servicing tools required to repair all MMS modules, and a modification procedure for the HP 70001A mainframe. The modification allows access to MMS modules during bench testing and repair.

Table 2-4.
Contents of the HP 71000 system service kit (HP part number 71000-60002)

Quantity	Recommended Model
10	HP 2110-0695 1.5A, 125V fuse
10	HP 2110-0700 1.0A, 250V fuse
10	HP 2110-0701 1.6A, 250V fuse
10	HP 2110-0703 6.3A, 250V fuse
10	HP 2110-0710 2.0A, 250V fuse
1	HP 5002-0685 cable puller
1	HP 5021-6773 cable puller
1	HP 5021-7445 pin straightener
7	HP 5061-9021 309 mm (12.2 in) SMB(f) to SMB(f) cable
3	HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) cable
1	HP 70001-00038 modified mainframe cover, right
1	HP 70001-00039 modified mainframe cover, left
1	HP 70001-60013 extender module
1	HP 71000-90015 installation note
2 feet	HP 8160-0035 RFI RND STR.0940
10 feet	HP 8160-0484 RFI RND BEC.125D
2 feet	HP 8160-0495 2.54 x 1.57mm chromeric gasket
1	HP 8710-1651 short 8 mm hex-ball driver[1]
1	HP 8710-1728 bandpass filter tuning tool
1	HP 9211-0065 20.5L x 6.5W container
2	HP 9222-0316 bag BR 6.0 x 20.0D
1	HP 9222-0320 bag BR 10.0 x 20.0D
7	HP 9222-1364 bag shield zip 6 x 8
6	HP 9222-1417 bag shield zip 4 x 4
2	HP 9222-1675 bag shield zip AY12

1 An HP 8710-1307 long 8 mm hex-ball driver is also available separately.

21.4 MHz Notch-Filter Documentation

The 21.4 MHz notch filter (HP 70902A Option K01 IF section) can be ordered from Hewlett-Packard. If you would prefer to build a filter, the following information includes a schematic diagram, a list of required parts for building the filter, and a figure showing the typical filter stopband for testing the filter.

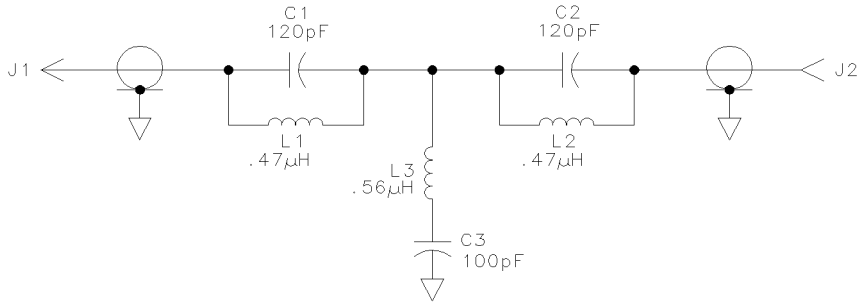


Figure 2-1. 21.4 MHz Notch Filter, Schematic Diagram

Table 2-5. 21.4 MHz Notch Filter, Required Parts

Reference Designation	HP Part Number	CD	Qty	Description
C1	0160-4800	6	2	Capacitor-Fixed 120 pF 100 V CER
C2	0160-4800	6		Capacitor-Fixed 120 pF 100 V CER
C3	0160-4801	7	1	Capacitor-Fixed 100 pF 100 V CER
J1	1250-0045	5	1	Connector-RF BNC Male
J2	1250-0212	8	1	Connector-RF BNC Female
L1	9100-3548	0	2	Inductor-Fixed 0.47 μH $\pm$5%
L2	9100-3548	0		Inductor-Fixed 0.47 μH $\pm$5%
L3	9140-0395	3	1	Inductor-Fixed 0.56 μH $\pm$5%
	7100-1040	1	1	Can-Rectangular 1.18 $\times$ 3.1
	7100-1048	9	1	Cover-Rectangular 1.12 $\times$ 3.1
	2190-0016	3	4	Washer-Lock 0.377ID
	2950-0001	8	2	Nut-Hex 3/8-32

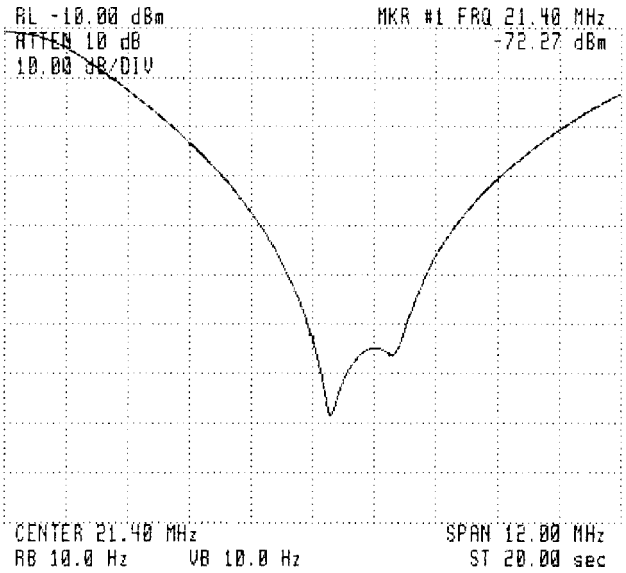


Figure 2-2. Typical Filter Stopband

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 workstation.

Figure 2-3 shows an example of a static-safe workstation. 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 2-6 for a list of static-safe accessories and their part numbers.

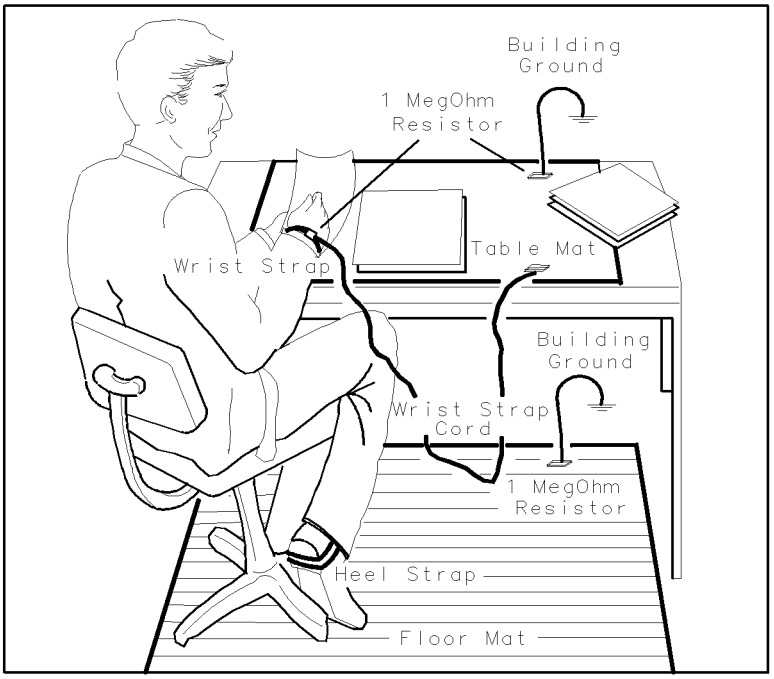


Figure 2-3. Static-Safe Workstation

Reducing ESD Damage

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

PC Board Assemblies and Electronic Components

- Handle these items at a static-safe workstation.
- 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 workstation.

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.

Static-Safe Accessories

Table 2-6. 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.

3

Module Verification Software

Module 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
- Computer Compatibility
- Typographic Conventions
- Configuring the Hardware
- Installing Verification Software
- Module Verification Software Overview
- Menus
- Error and Status Messages

General Information

This documentation supports module verification software Revision B.03.00 or greater. Use this software with slave modules that have an HP 70900A/B local oscillator source 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 *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* contains configuration information for predefined models of HP 70000 Series modular spectrum analyzer systems. The software automatically reads your system configuration data from the Hewlett-Packard Modular System Interface Bus (HP-MSIB) to determine which system or modules you are using.

Refer to Chapter 4 and Chapter 5 for individual test setups and test descriptions. Chapter 2 contains a list of recommended test equipment.

Computer Compatibility

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

When using an HP 9000 Series 200/300 controller, a medium-resolution monitor and either an HP 98203C, HP 46020A, or an HP 46021A keyboard is required. Due to the various keyboards supported, some minor text differences appear in the menus and softkeys displayed on-screen. (Refer to "Typographic Conventions").

Computer Language Compatibility

The software program runs on HP BASIC 4.0, or later, with the BIN files in RAM that are listed below:

CLOCK	HPIB
CS80 (optional—supports newer	IO
Winchester disk drives)	KBD
DISC (optional—supports microfloppies	MAT
and older Winchester disk drives)	MS
ERR	PDEV (optional—provides
GRAPH	debugging features for
GRAPHX	program development)

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

DCOMM
SRM

A procedure for loading HP BASIC is provided in "Installing Module Verification Software".

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

Printer Compatibility

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

Typographic Conventions

This manual uses the following typographic conventions to represent key labels for both keyboard keys and softkeys: text shown in the form, (KEYBOARD KEYS) represents keyboard keys; text shown in a shaded area in the form, `SOFTKEY` represents softkeys. Text shown in the form, `special typeface` represents messages displayed on the CRT, or text that the user enters via the keyboard.

For simplicity in this document, we assume that you are using an HP 9000 Series 200/300 controller keyboard. Refer to the list below if your keyboard key labels do not match the ones used in text.

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

Configuring the Hardware

Procedure

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

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

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 Module Verification Software

Use the following steps to get the module verification software 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. B.01.00
```

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 controller. If necessary, refer to an HP BASIC reference manual.

Caution Make backup copies of all write-protected disks. If the program data on an individual disk should become altered, it cannot be ordered separately. The entire set of disks must be ordered to replace any 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 Disc 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. 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.
6. Load the Operating Disc as directed. The Operating Disc probably needs to remain in the drive specified as the MSI default drive. Load the Driver Discs into the drive specified on-screen.

   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.

7. Load the Driver Disc as directed. Insert the Driver Disc and press PROCEED.
8. 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 on entering calibration data, refer to "Edit Calibration Data" 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 Discs, 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 Disc. You are prompted to enter serial numbers for these devices only.

---

9. 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, etc.). Refer to "Equipment Menu" under "Menu" 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. Completing these tests verifies a module's electrical performance. 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 6, "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:

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

Except for the Test Menu, these menus are configuration menus through which you initialize the software for program operation. Via these menus, you enter information about disk drives, environment conditions, test equipment, the module under test, etc. 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, etc.

Edit and Command Screen Menus

The following softkeys are present for menus that appear in Figure 2-1 through Figure 2-4. Not all of the menus have edit screens, but all have command screens. When softkey labels are written in lowercase letters, a sub-level softkey menu exists for that particular softkey. Softkey labels written in uppercase letters indicate 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 Figure 2-1 through Figure 2-4.

`SELECT`	either one of these keys appears in the Edit Menu. or `SELECT` activates the column item where the cursor is located,
`SELECT TOGGLE`	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" 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-IB 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 Disc containing calibration data is not in the disk drive. This key allows you to insert the Operating Disc into the disk drive and try again.
`ABORT`	displays the Main Menu screen. The `ABORT` softkey is available for some special task screens, but not in the Main Menu screen. Pressing `ABORT` a time or two returns you to the Main Menu screen. From the Main Menu, you may press `quit` to return to BASIC command. If you happen to press `ABORT` before the Main Menu is displayed at all, you are prompted to press the RUN key. Press RUN to return to where you were when you pressed `ABORT`. If you press `ABORT` or `ABORT TEST` during a performance test, the Test Menu appears and offers the selections `quit` or `main menu`.
`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 command. 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 command. (If the Operating Disc has not been removed, 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 Disc, replace your current Operating Disc with that one and access the data. Be sure to return the Operating Disc 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 Disc 3 program code. There must be an msus assigned to this Volume Label.
- OPERATING contains the menu files and calibration data.
- DRIVER DISC contains the Driver Disc program code. There must be an msus assigned to this Volume Label.
- TEST DISC contains the module performance test or adjustment procedures programs.
- ADJUST DISC contains the module adjustment tests or any applicable 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 locate the cursor next to the column item you wish to edit. (Be sure to check column items to the right- or left-hand side of the CRT, shown by `more`.)
2. Press `SELECT`. Key in the new location (msus or Directory Path). Press ENTER when data entry for the selected item is complete.

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

---

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

The Data Volume is predefined to use RAM DISC `: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, etc. 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 the HP 8756A scalar network analyzer, HP 8757A scalar network analyzer, and HP 8757C scalar network analyzer, etc.).

Using preferred models of test equipment, described in Chapter 2, assures the most complete verification and adjustment testing. Refer to the verification tests and adjustment procedures in this manual 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 Discs.

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` 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 the fault-address 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 Disc 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 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 Disc.)

2. To delete an item, move the cursor to the column item. Press SELECT, clear the line, then move to another item. Repeat the above process as needed to edit frequency values or calibration data for any passive devices.

Edit Calibration Data Command Screen

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

HP-MSIB Address Menu

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

There is no edit screen for this menu. The command screen has a SELECT MODULE softkey but requires no STORE softkey. Locate the cursor next to the module you wish to test. Press SELECT MODULE. Be sure the module selected here matches the 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 Disc 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 the final test sequence. Final tests are the ones required to verify module operation. There are additional tests that can be selected as well. (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`, etc. 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.

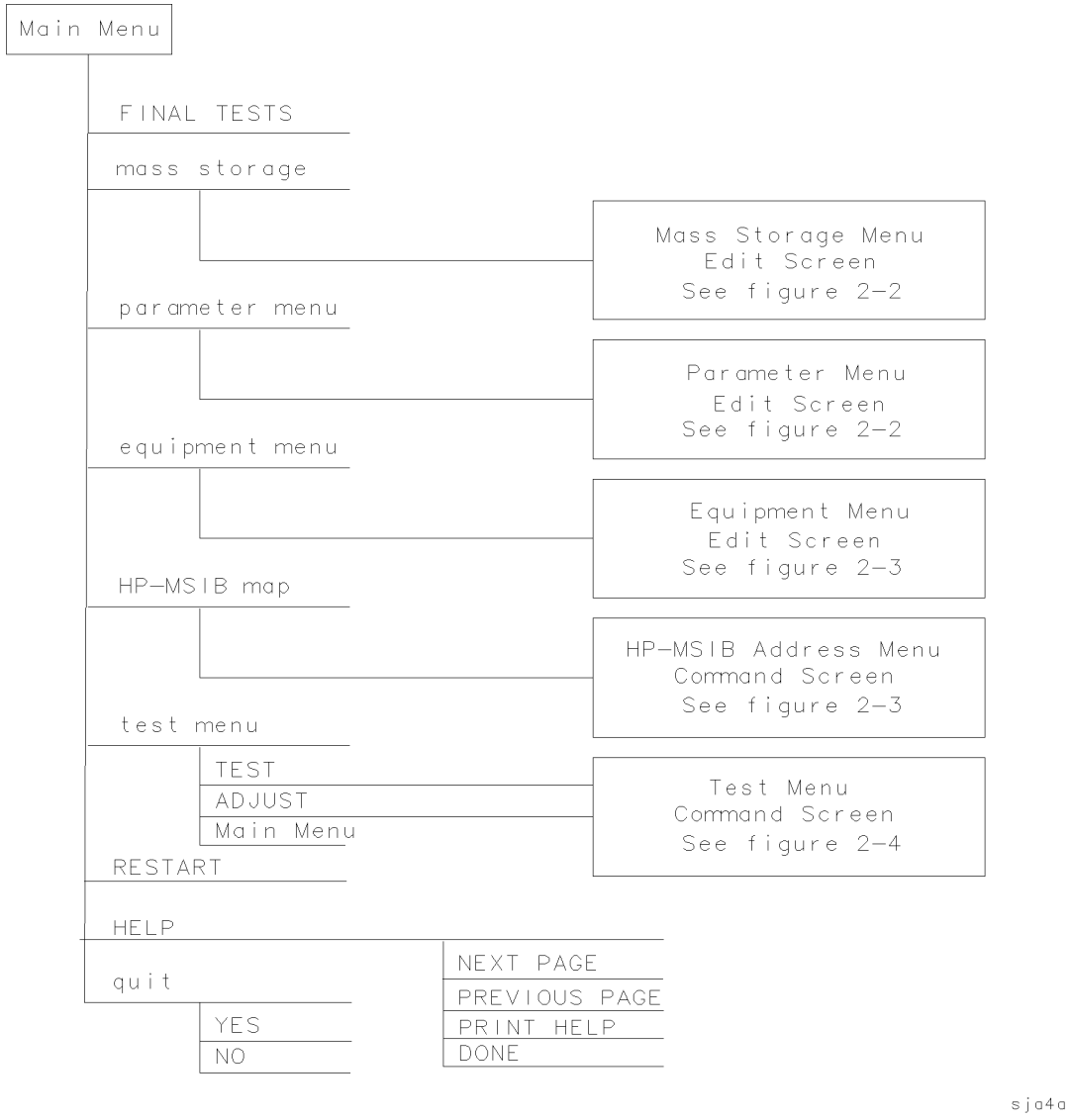


Figure 3-1. Main Menu Softkeys

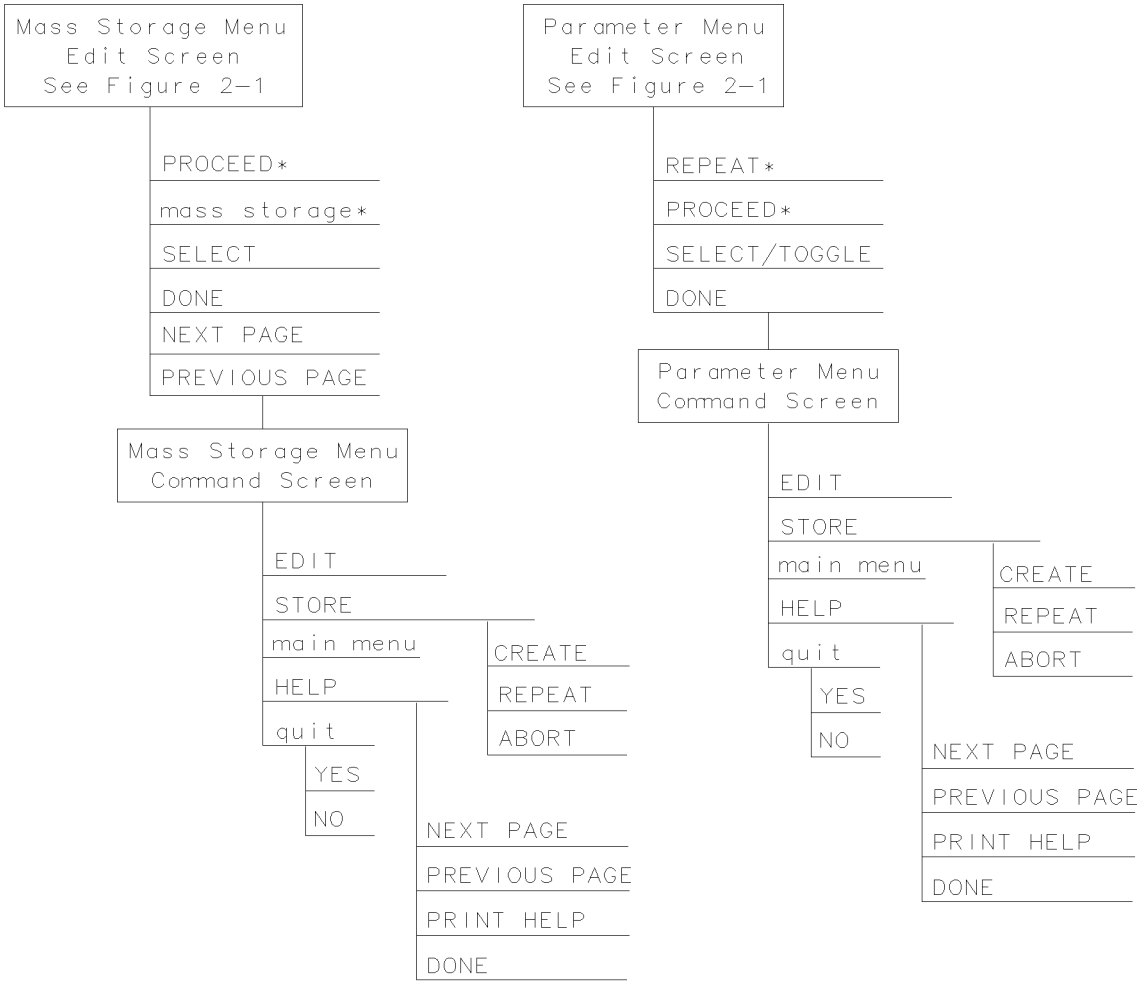


Figure 3-2. Mass Storage Menu and Parameter Menu Softkeys

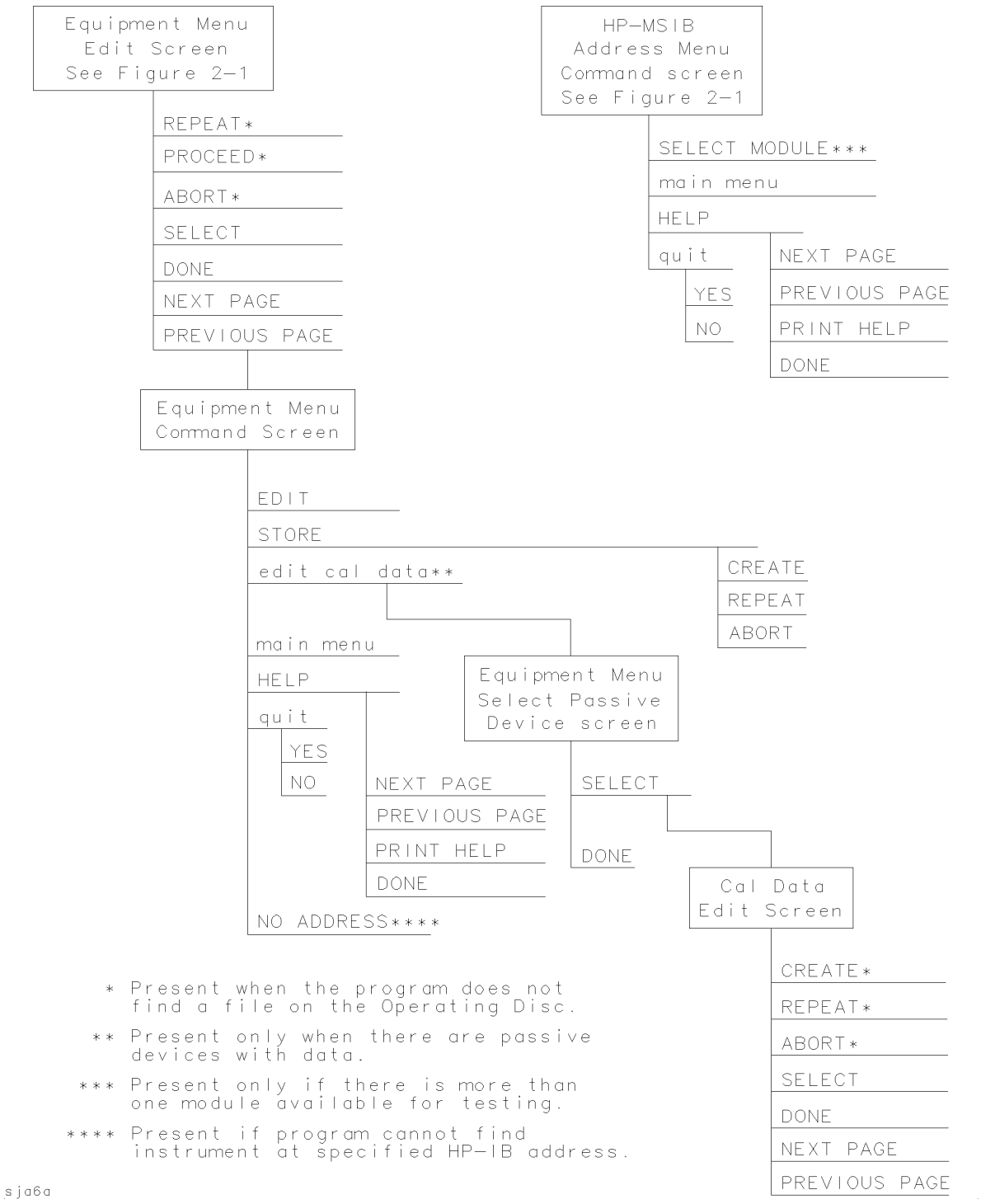
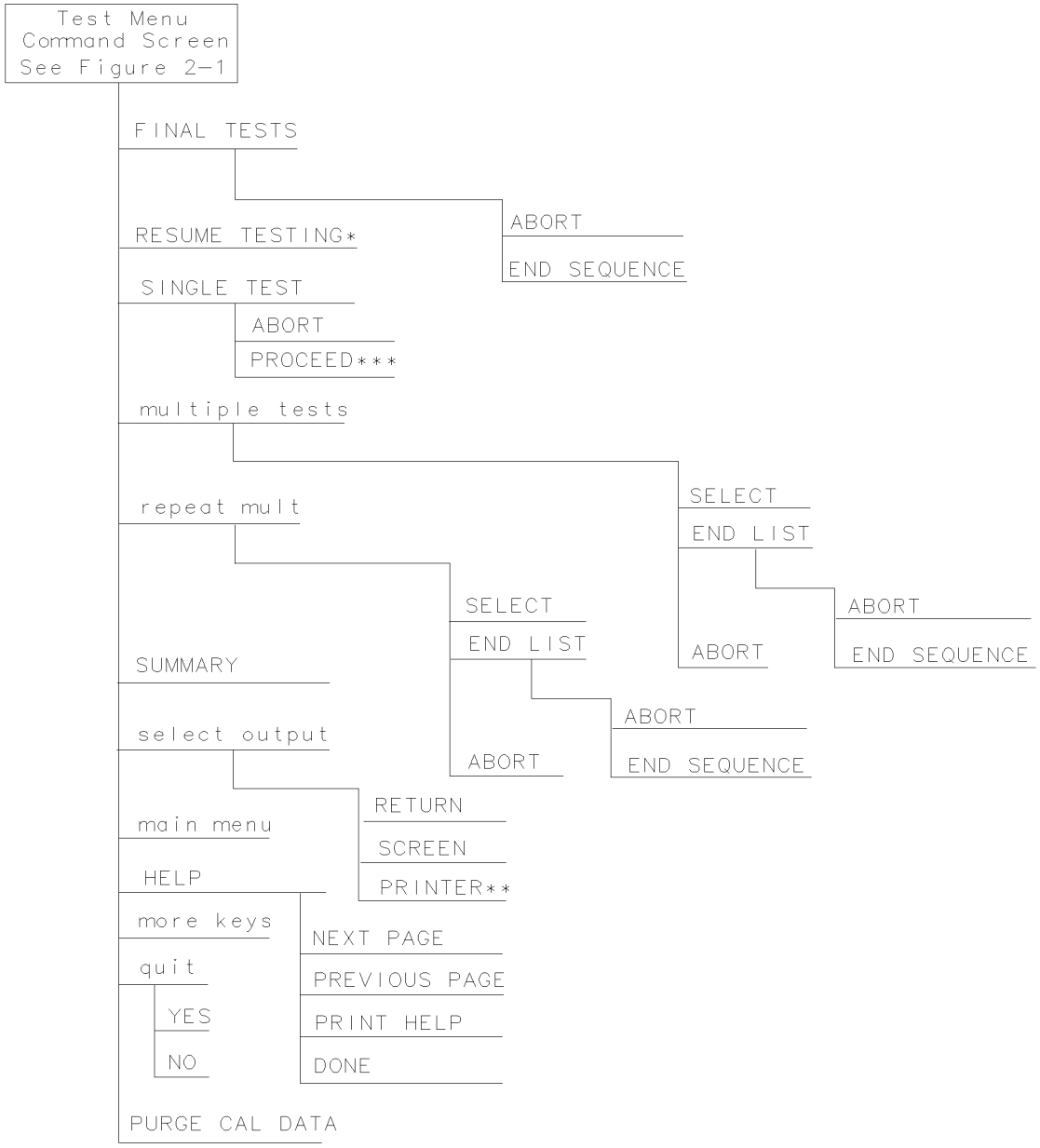


Figure 3-3. Equipment Menu and HP-MSIB Map Screen Menu Softkeys



*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.

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Figure 3-4. 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, etc. 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 disc 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.

`ERROR: 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.)

`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 Disc. 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 Disc. 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 Disc. 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 disc 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 Disc. 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 Disc. It may also be that the Operating Disc accessed by the program is not the one containing the Equipment Menu file. Insert the correct Operating Disc, 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 Disc. 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 Disc.

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 Disc. 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 Disc. It may also be that the Operating Disc accessed by the program is not the one containing the Parameter Menu data file. Insert the correct Operating Disc, then press REPEAT or CONTINUE.

ERROR MESSAGE: Read _____ data from file _____failed.

There is a problem with the data file on the Operating Disc. 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 2 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 Disc. 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 Disc. It may also be that the Operating Disc being accessed by the program is not the one containing the parameter-list data file. Insert the correct Operating Disc, 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 Disc is write protected.

Make a working copy of the Operating Disc 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 Disc. Correct the problem, press REPEAT, 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 Disc is write protected.`

The program tried to store error data onto the Operating Disc and could not because of the write-protect. Make a working copy of the Operating Disc 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 a Hewlett-Packard Sales and Service Office.

`Reading errors from ERRORLOG failed. Check disc at _____.`

The program tried to read error data from the Operating Disc. Check that the Operating Disc 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 I.D. 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 your Hewlett-Packard Sales and Service Office personnel.

`Test can not be done.`

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

`TEST_LIST is not compatible.`

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

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

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

`The _____at address _____was not found on HP-IB.`

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

The HP 436A power meter 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 HP 8902A measuring receiver needs repair (Error 6).

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

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

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

`THIS COLUMN CAN NOT BE EDITED.`

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

`THIS IS _____AND FOUND DUPLICATE FILES: _____.`

Contact your HP Sales and Service Office personnel.

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

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

`Timed Out`

The program aborted the test.

`WARNING: Duplicate Address`

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

`WARNING: Duplication may exclude specific tests.`

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

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

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

`Write protected.`

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

4

Module Verification Tests

This chapter lists the module verification tests for the HP 70902A IF section and gives information for making any specialized test equipment that is required. All of the tests are automated. Chapter 3 tells what computer equipment is needed and gives instructions for running the Module Verification Software.

Final Tests

3. 18.4 MHz Oscillator Stability Test
4. DUT Calibration
5. Average Noise Test
6. Corrected Sensitivity Test
7. Third-Order Intercept Test
8. Spurious Responses Test
9. Resolution Bandwidths Test
10. Video Bandwidths Test
11. Module Gain Test
12. Calibration Attenuator Test
13. Corrected Module Fidelity Test

After Repair Tests

The following list of tests are run after repair to verify operation of specific functional areas.

1. Front Panel LED Check
2. Diagnostic Detectors Check
14. Crystal Spurs Test
15. Rear-Panel Auxiliary Port Test
16. Front-Panel Auxiliary Port Test
17. Auxiliary Video Test
18. Limited IF Output Check

Caution Use 5 to 8 inch-pounds of torque when connecting SMA or APC-3.5 cables. More torque may cause damage to the cables or connectors.

Make sure covers are secure and module is warmed up for at least one hour prior to running tests.

Note Install the HP 70902A IF section in an HP 70000 Series mainframe that has been modified to allow access to the top of the module. Make sure that the HP 70902A IF section's HP-MSIB address is correct. For information about the parts required for the mainframe modification, refer to "Service Kit" in Chapter 2. For information about the correct address for an HP 70902A IF section, refer to the system-configuration information in the *Installation and Verification Manual* for the system master (for example, HP 70900B local oscillator source).

Preferred Frequency-Reference Connections

Figure 4-1 shows the preferred order for connecting equipment when a frequency reference is required. For tests that require an exact frequency reference, a house standard connected to an HP 5343A microwave frequency counter is suggested, as shown in part (a) of Figure 4-1. For tests that require equipment to be synchronized with each other, part (b) of Figure 4-1 shows the order in which the equipment should be connected.

Note Do not use the output from the HP 3335A synthesizer/level generator as the input to any other instrument. The HP 3335A synthesizer/level generator output is not stable enough to be used as a frequency reference.

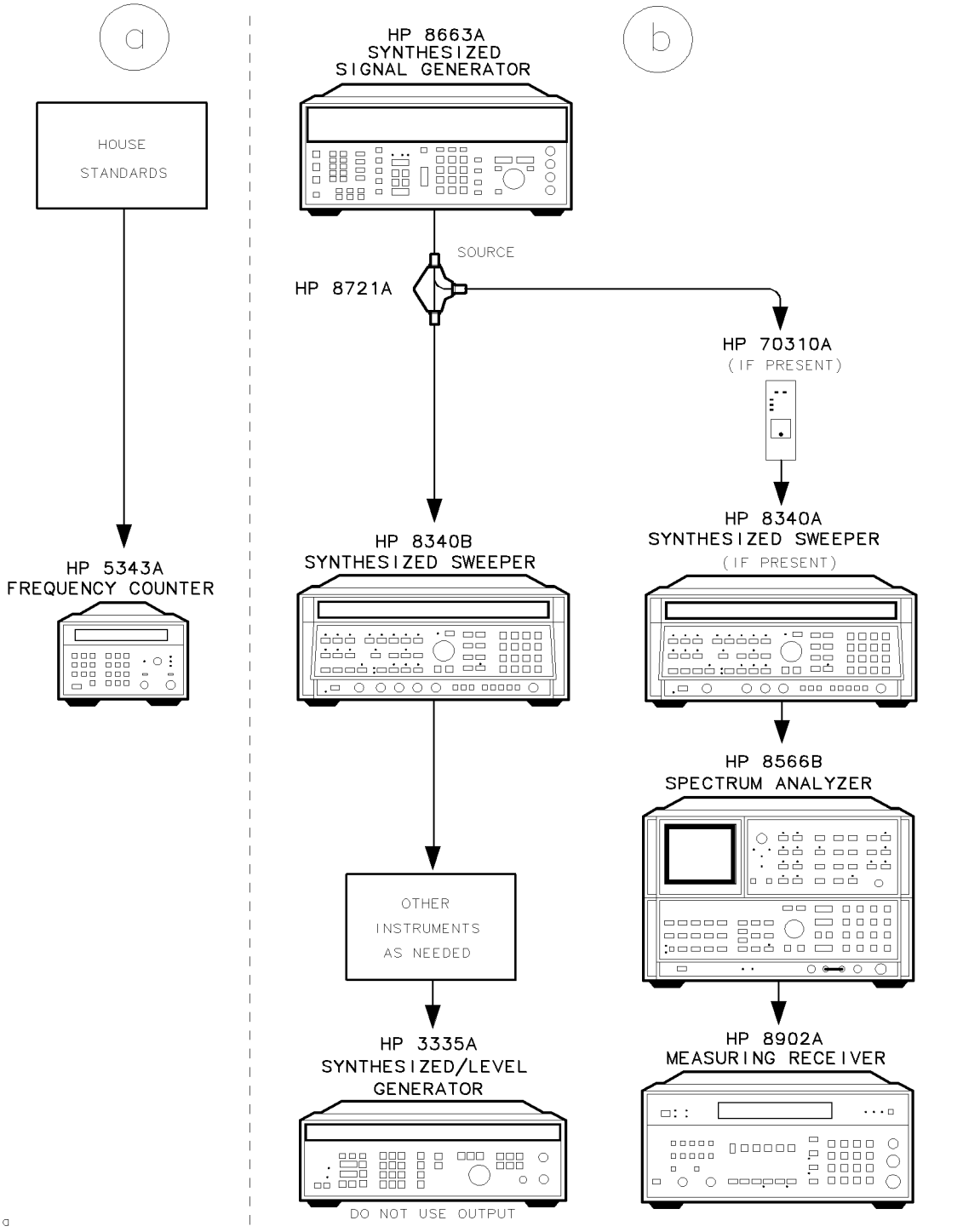

Figure 4-1. Preferred Frequency-Reference Connections

1. Front Panel LED Check

Purpose

This procedure tests the functionality of the HP 70902A IF section ACTive and ERRor status LEDs and associated control circuitry. In order to light the ACTive LED and test its related circuitry, a display must be configured into the system.

Description

The software prompts the operator with questions requiring "yes" or "no" answers. Softkeys are activated to allow the operator to respond. The HP 70902A IF section passes this test if the response to every question is "yes." No data is displayed. This is a final test.

Equipment

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source
Display	HP 70205A graphics display

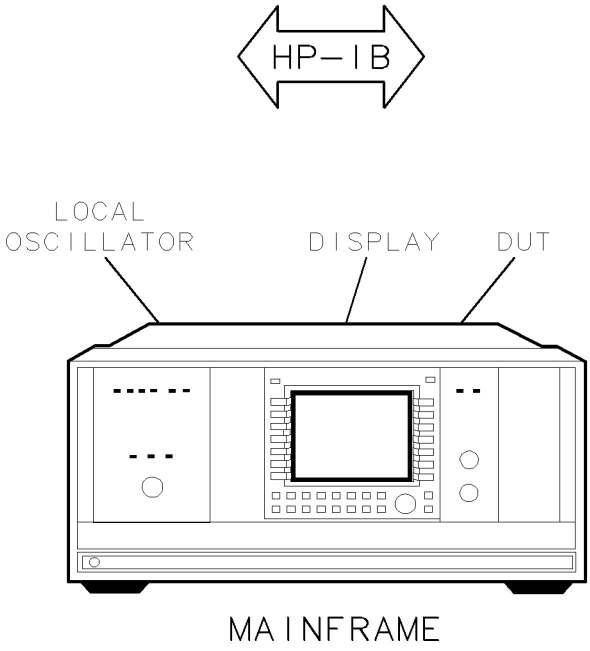

Figure 4-2. LED Check Setup

2. Diagnostic Detectors Check

Purpose

This test checks that the HP 70902A IF section diagnostic detectors are functional, and measures the signal levels at which the detectors become active. These detectors report to the local oscillator module if an insufficient signal level is present inside the HP 70902A IF section during the system-calibration routine, or during system diagnostics testing.

There are two detectors inside the module. Detector 1 detects the level of the 21.4 MHz input signal. Detector 2 detects the video-output voltage level.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of −6 dBm to the DUT 21.4 MHz input.

The level generator is then set to provide a −23 dBm signal at the 21.4 MHz input. If any detector is on (active) at this level, the test reports an error.

The level generator output is then increased in amplitude by 1 dB steps while the HP-MSIB is monitored for detector turn-on. When a detector turns on, the level generator amplitude value that caused the detector to turn on is stored in a variable. If the level generator reaches 13 dBm before all detectors turn on, the test reports an error.

After all detectors turn on, the level generator is returned to 10 dB below the first detector turn-on level and waits for the detector to turn off. After the detector turns off, the level generator is set to 1.5 dB below the previously measured turn-on level. Then the level generator amplitude level is increased by 0.1 dB steps until the detector turns on again. This amplitude level is measured by the power meter and becomes the recorded turn-on level for that detector. This process is repeated for each detector.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Power meter .....HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

2. Diagnostic Detectors Check

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

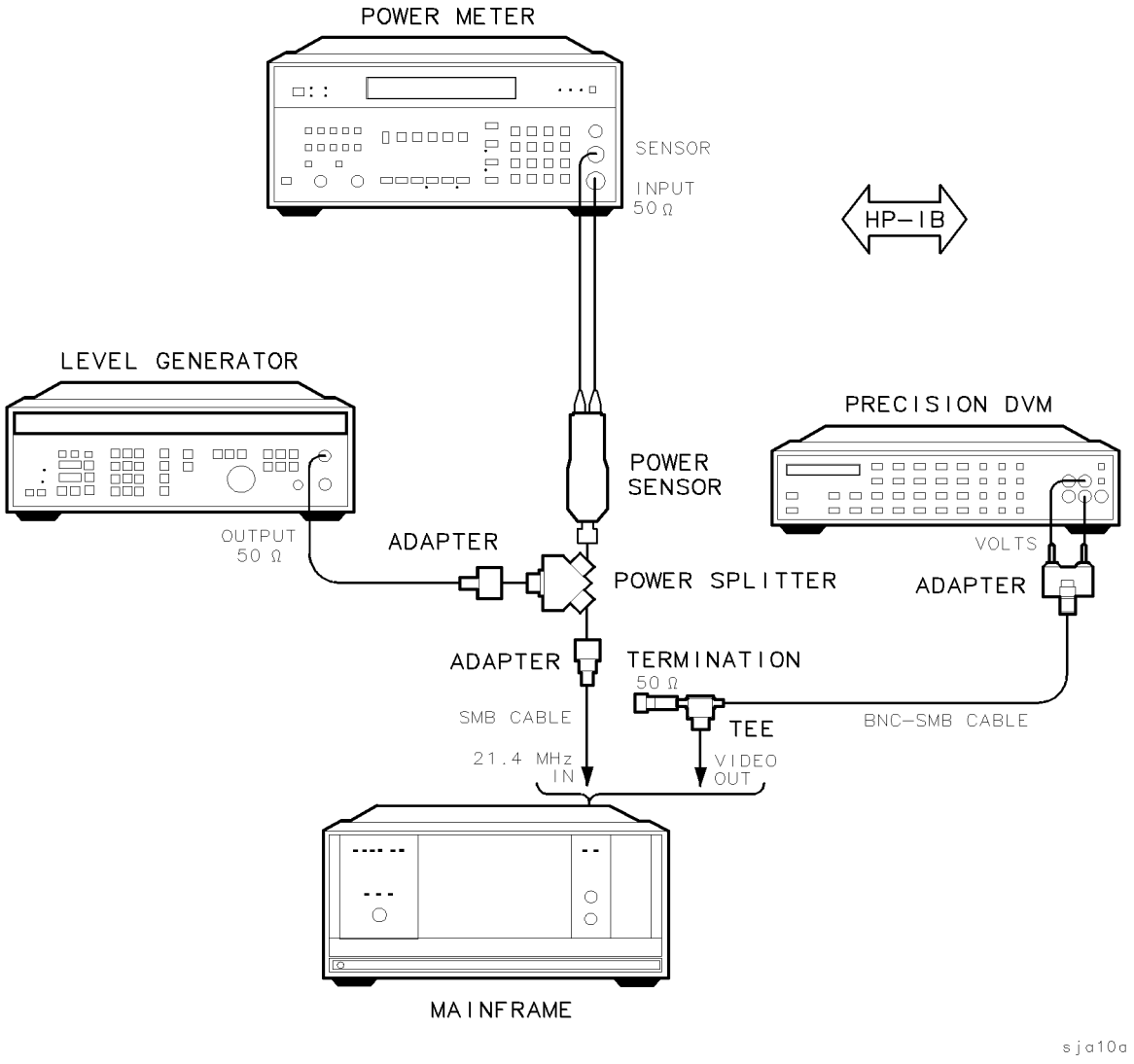

Figure 4-3. Diagnostic Detectors Check Setup

3. 18.4 MHz Oscillator Stability Test

Purpose

This test measures the stability of the HP 70902A IF section 18.4 MHz oscillator over a five-minute time span.

This is not a final test, but it should be run if a problem is suspected, or if repairs related to the oscillator have been made.

Description

A frequency counter is connected to the 18.4 MHz output, and samples are taken over five minutes. If the oscillator drifts more than ±5 Hz in five minutes, the test fails. The results are displayed in a graph.

Equipment

Frequency counter ..... HP 5316B universal counter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Adapters
HP 1250-0669 50Ω SMB(m) to SMB(m)
HP 1250-0672 50Ω SMB(f) to SMB(f)

Cables
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

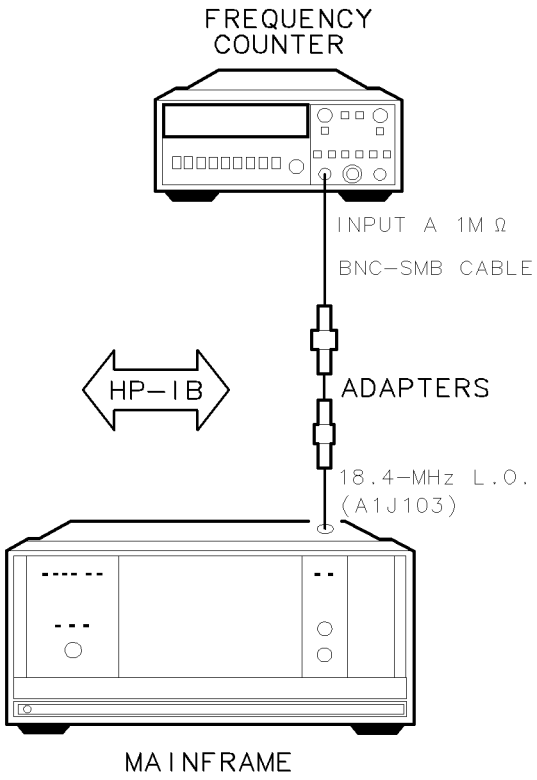

Figure 4-4. 18.4 MHz Oscillator Stability Test Setup

4. DUT Calibration

Purpose

This test simulates the routines of the HP 70000 Series system calibration that pertain to the HP 70902A IF sections. The purpose of this test is to establish log fidelity, absolute gain, and resolution bandwidth correction factors. The correction factors will be used to make corrected measurements in the following tests:

- Corrected Module Fidelity
- Corrected Sensitivity
- Third-Order Intercept
- Spurious Responses

DUT Calibration must be run before performing any of the tests listed above.

Make sure covers are secure and module is warmed up for at least one hour prior to running tests.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. With the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. (A −5 dBm input should result in 2 Vdc being present at the DUT video output. Refer to "Absolute-Gain Error Correction".) The precision DVM is connected to the DUT video output across a 50Ω termination.

Log-Fidelity Error Correction

As the calibration attenuator in the DUT HP 70902A IF section is stepped from 0 dB to −11 dB, the DUT video-output voltage is read for each step. After the −11 dB reading, the DUT calibration attenuator is reset to 0 dB, the RF attenuator in the level generator is stepped down 10 dB, and the DUT video-output voltage is read again.

This reading is compared to the previous −10 dB reading, and any difference is attributed to RF-attenuator error. An offset, calculated to correct for this error, is applied to the next 0 dB to −11 dB decade as the measuring sequence is continued. In this fashion, log fidelity is measured down to the HP 70902A IF section noise floor.

The correction factors are stored in a COMMON array for use by other tests.

Absolute-Gain Error Correction

Theoretically, a −5 dBm input signal applied to the DUT 21.4 MHz input should result in 2 Vdc being present at the DUT video output. The absolute gain error is the difference between the theoretical input power of −5 dBm and the actual input power required to obtain 2 Vdc at the DUT video output. The correction factor is the opposite of this error.

Bandwidth-Switching Error Correction

The level generator is tuned to the center of the DUT reference bandwidth, and then the DUT video-output voltage is measured. This is the reference voltage.

The level generator is then tuned to the center of each bandwidth, and the resulting video-output voltage is measured. The bandwidth-switching error is the difference between this voltage and the reference voltage. The correction factor is the opposite of the bandwidth switching error.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Power meter .....HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

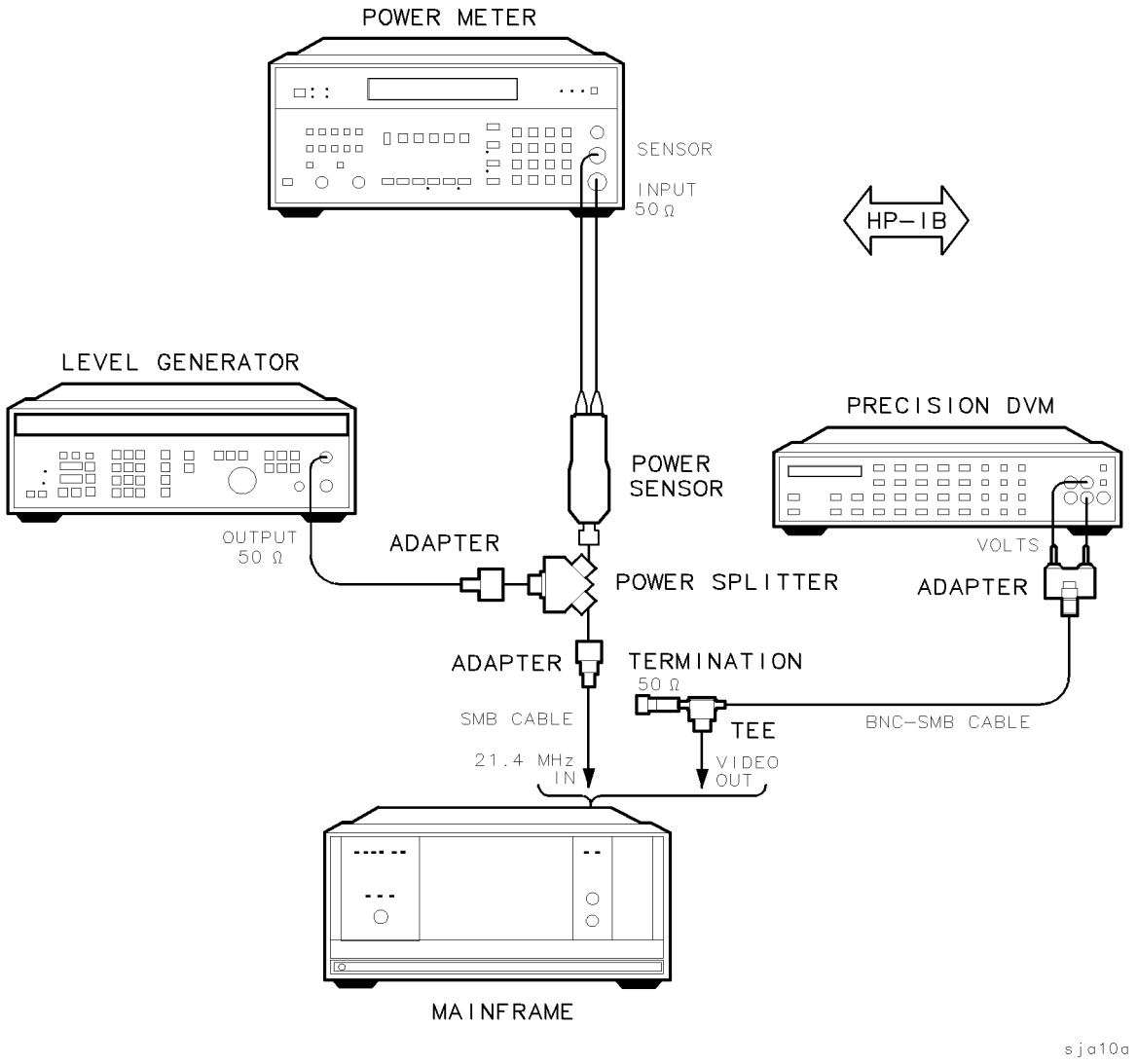

Figure 4-5. DUT Calibration Setup

5. Average Noise Test

Purpose

This test measures the noise floor of the HP 70902A IF section at each resolution bandwidth. This test ensures the HP 70902A IF section is not contributing more than its share towards the system displayed-average-noise specification.

Description

The HP 70902A IF section 21.4 MHz input is terminated in 50Ω. A precision DVM is connected to the video output across a 50Ω termination. The precision DVM uses a voltage-averaging routine to measure the average noise level accurately at each resolution bandwidth setting in combination with several step gain settings. The results are converted to dBm and displayed in a graph.

Equipment

Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination *(2 required)*

Adapters
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

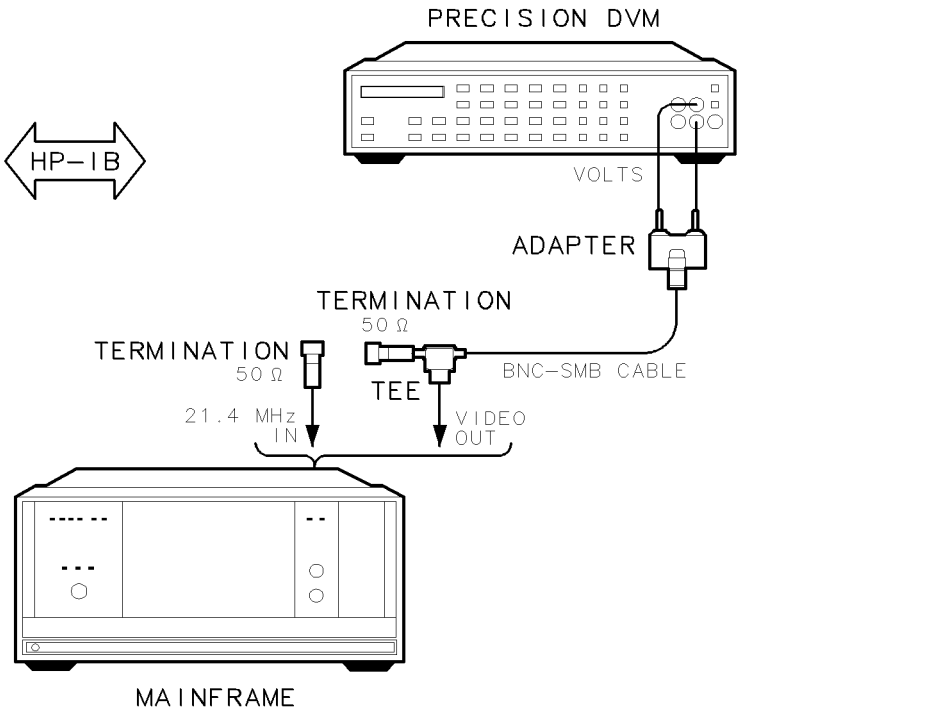

Figure 4-6. Average Noise Test Setup

6. Corrected Sensitivity Test

Purpose

This test applies the correction factors generated by the DUT calibration routine, and then measures the maximum sensitivity of the HP 70902A IF section. This assures that the HP 70902A IF section will have adequate dynamic range to satisfy the system specification.

Description

The HP 70902A IF section 21.4 MHz input is terminated in 50Ω. A precision DVM is connected to the video output across a 50Ω termination. The HP 70902A IF section is set to a 10 Hz bandwidth. Then, the precision DVM uses a voltage-averaging routine to measure the noise floor of the HP 70902A IF section accurately. The correction factors are applied to this measurement and reported in dBm.

Equipment

Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination *(2 required)*

Adapters
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

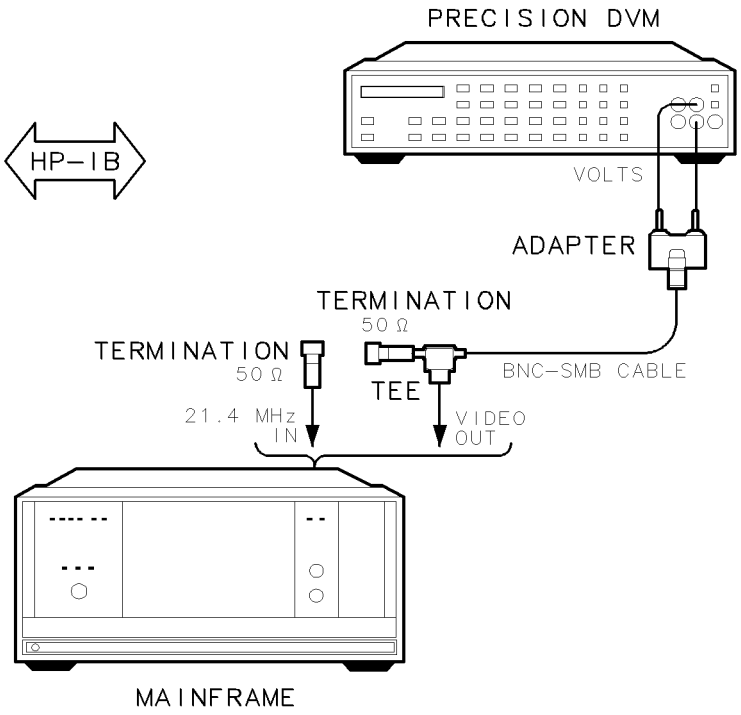

Figure 4-7. Corrected Sensitivity Test Setup

7. Third-Order Intercept Test

Purpose

This test measures the third-order intercept (TOI) of the distortion products that are generated by the HP 70902A IF section. Compliance with this test ensures that the HP 70902A IF section will not contribute significantly to system TOI performance.

Description

Note In addition to the connections mentioned, this test also requires external frequency-reference connections. For information, refer to "Preferred Frequency-Reference Connections".

A level generator and a synthesized source both function as synthesizers in this test. The two synthesizers are connected to a directional bridge. The bridge output is connected to a power splitter input. One output of the power splitter is connected to a power sensor, the other output is connected to the HP 70902A IF section 21.4 MHz input. A precision DVM is connected to the HP 70902A IF section video output across a 50Ω termination.

Several routines are run that set each synthesizer to provide a −5 dBm signal to the HP 70902A IF section 21.4 MHz input while the other synthesizer is set at minimum amplitude. During one of these routines, the HP 70902A IF section video voltage is measured and then corrected for log fidelity errors, gain errors, and bandwidth-switching errors, using the correction factors that were generated by the DUT calibration routine. The corrected video voltage becomes the reference amplitude for the TOI measurements.

The two synthesizers are then set so that the third-order product generated by the HP 70902A IF section will appear in the center of the 21.4 MHz bandpass. The precision DVM measures the video voltage, the error-correction factors are added in, and then the third-order intercept is calculated. This routine is repeated for each resolution bandwidth filter, and a variety of tone spacings.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Synthesized source ..... HP 8663A synthesized signal generator
Precision DVM ..... HP 3456A digital multimeter
Power meter ..... HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter ..... HP 11667A power splitter
Directional bridge ..... HP 8721A directional bridge

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-1473 precision 50Ω N(m) to BNC(m)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

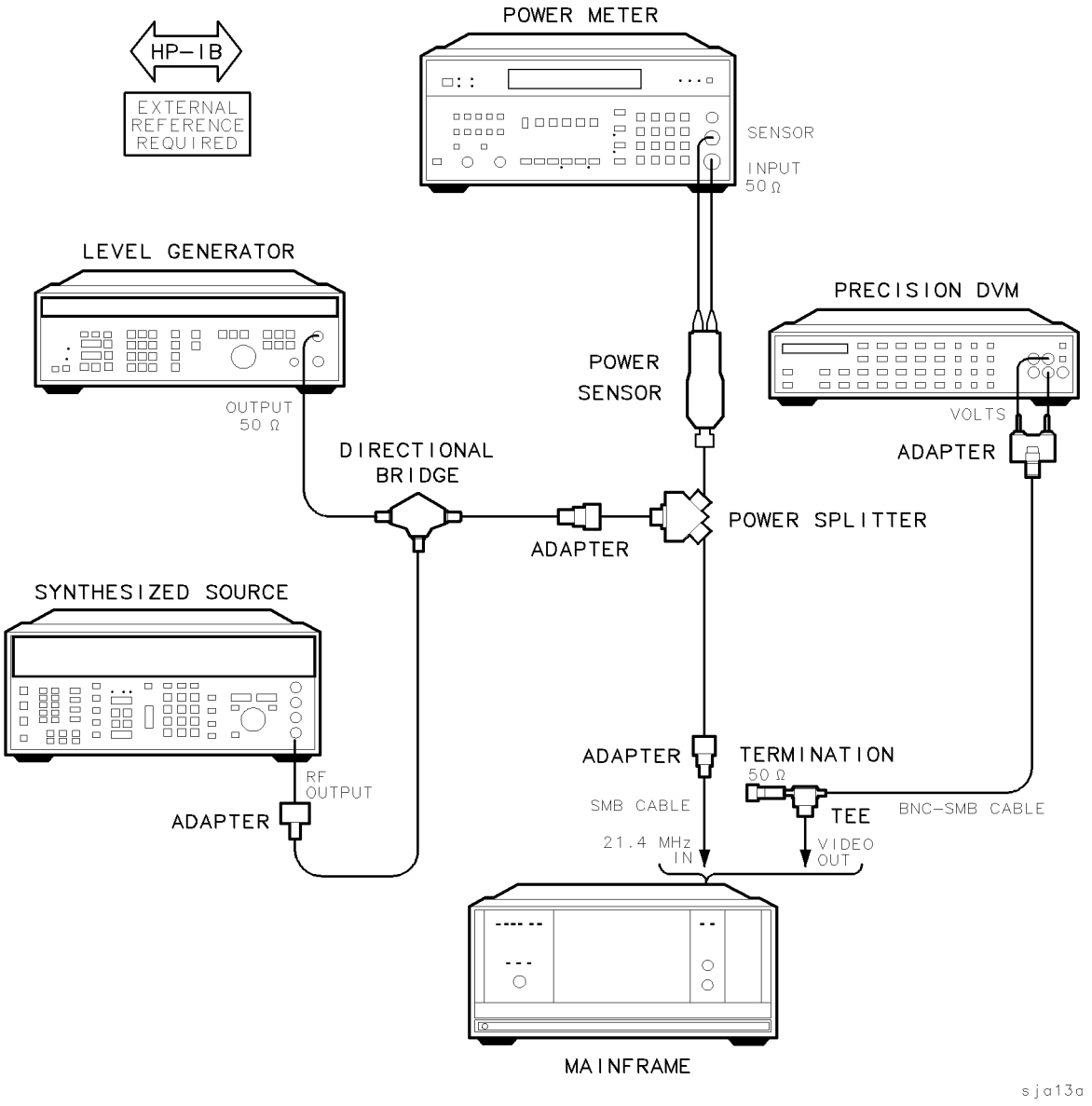

Figure 4-8. Third-Order Intercept Test Setup

8. Spurious Responses Test

Purpose

This test measures the relative amplitudes of several responses created in the HP 70902A IF section. These responses include harmonics generated in the 21.4 MHz input filter, and mixing products of the 21.4 MHz input signal and the 18.4 MHz oscillator. All responses are measured relative to the amplitude of the 21.4 MHz input signal.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. A precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution bandwidth filter, and then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The DUT video-output voltage that results from the −5 dBm input is measured and used as the reference voltage. The operator is then prompted to insert the 21.4 MHz notch filter between the level generator and the power splitter. The level generator is tuned to several frequencies that could cause unwanted responses within the HP 70902A IF section.

These test frequencies include 7.1333 MHz (21.4 MHz divided by three), and 10.7 MHz (21.4 MHz divided by two). Either of these test frequencies may generate a 21.4 MHz product inside the DUT 21.4 MHz input filter.

Frequencies of 3 MHz and 15.4 MHz are also tested. These test frequencies may generate unwanted responses as a result of mixing with the 18.4 MHz oscillator. The 21.4 MHz notch filter is used to attenuate the 21.4 MHz product generated by the level generator when it is tuned to 15.4 MHz. Otherwise, this product would interfere with the response under investigation.

The precision DVM measures the DUT video-output voltage resulting from each response, and then the corresponding dBc value relative to the 21.4 MHz input signal is calculated.

Equipment

Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter
Precision DVM	HP 3456A digital multimeter

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination
21.4 MHz Notch Filter* ..... HP 70902A Option K01 IF section

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

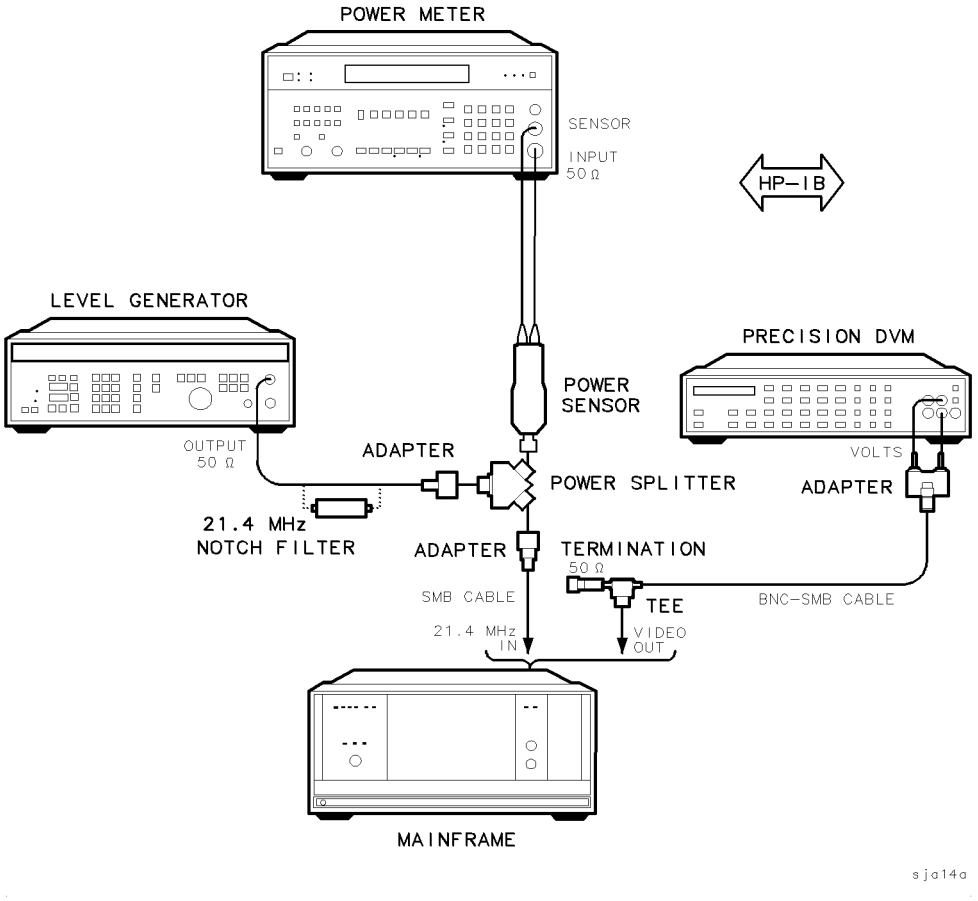

Figure 4-9. Spurious Responses Test Setup

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* For information on building a 21.4 MHz notch filter, refer to "21.4 MHz Notch-Filter Documentation" in Chapter 2.

9. Resolution Bandwidths Test

Purpose

This test measures the 3 dB bandwidth, center frequency, amplitude shift, and shape factor (60 dB/3 dB ratio) of each HP 70902A IF section bandwidth filter. It tests only the 1 and 3 sequence of filters, not the 10 percent increments between filter stages.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination.

The synthesized source is connected, through a cable and adapter, to the 18.4 MHz oscillator test point (A1J103). The frequency counter is connected to the limited IF output on the DUT rear panel. The frequency counter measures the output signal, and the actual frequency of the DUT 18.4 MHz oscillator is calculated.

The synthesized source is set to the calculated frequency at 8 dBm to "injection-lock" the 18.4 MHz oscillator. This prevents drift in this oscillator from adding measurement error for the duration of the test.

First, the reference bandwidth (100 Hz) is measured for center frequency, 3 dB bandwidth, amplitude, and shape factor. Then each of the other bandwidths is measured for center frequency, 3 dB bandwidth, and shape factor. Bandwidth amplitude-switching error is measured relative to the reference bandwidth.

Equipment

Synthesized source	HP 8663A synthesized signal generator
Frequency counter	HP 5316A universal counter
Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter
Precision DVM	HP 3456A digital multimeter

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source

Accessories

HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

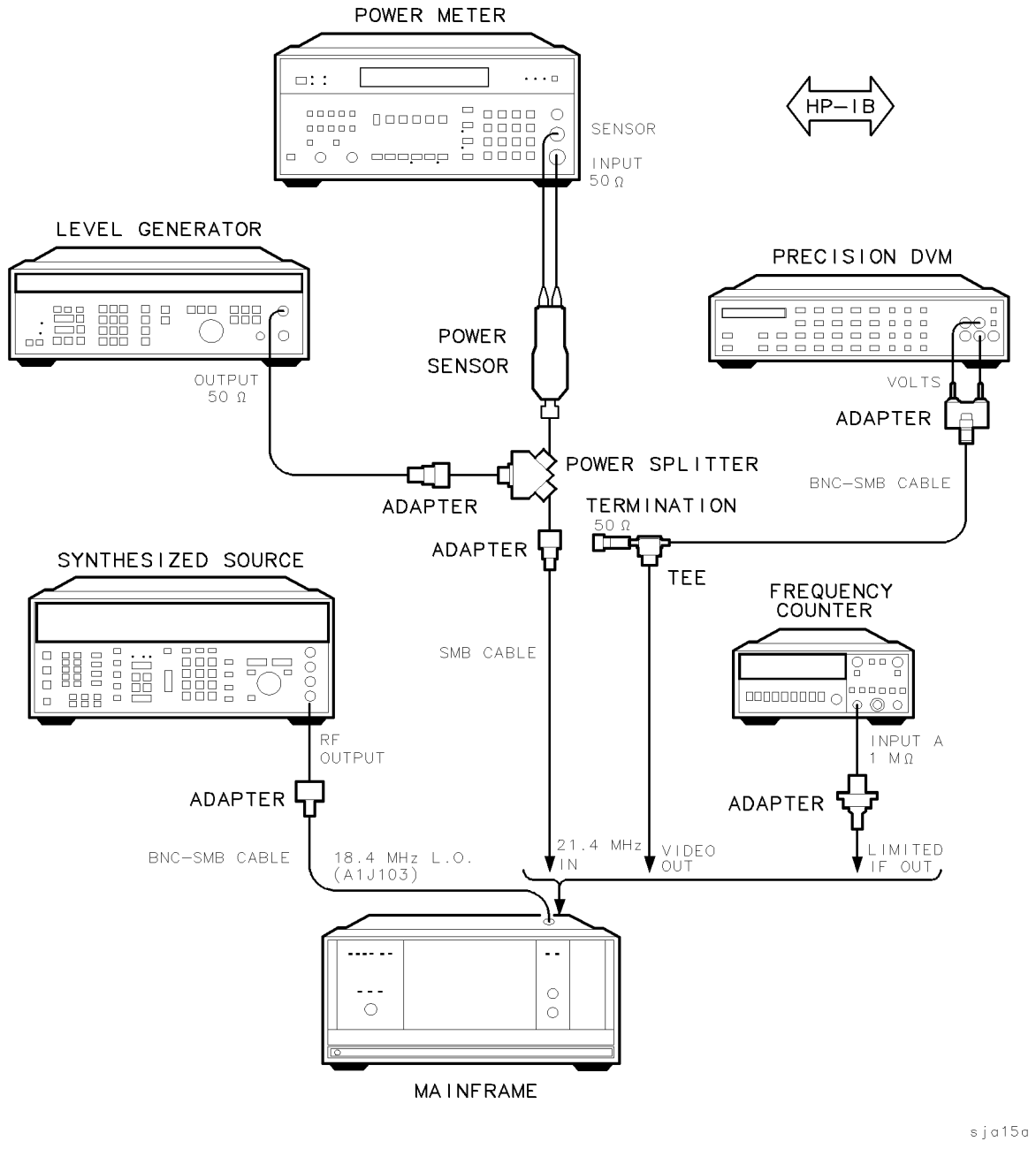

Figure 4-10. Resolution Bandwidths Test Setup

10. Video Bandwidths Test

Purpose

This test measures the dc error of the HP 70902A IF section video filters. The dc error is defined as the shift in DUT video-output voltage measured as each video bandwidth is selected. The shift is measured relative to the DUT video-output voltage present at the reference video bandwidth (300 kHz).

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. With the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input.

To measure the reference voltage, the level generator is set to provide 2 Vdc at the DUT video output. To measure the dc error, each video bandwidth is selected and the DUT video-output voltage for that bandwidth is measured. The differences between these voltages and the reference bandwidth voltage are reported as dc error.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Power meter .....HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

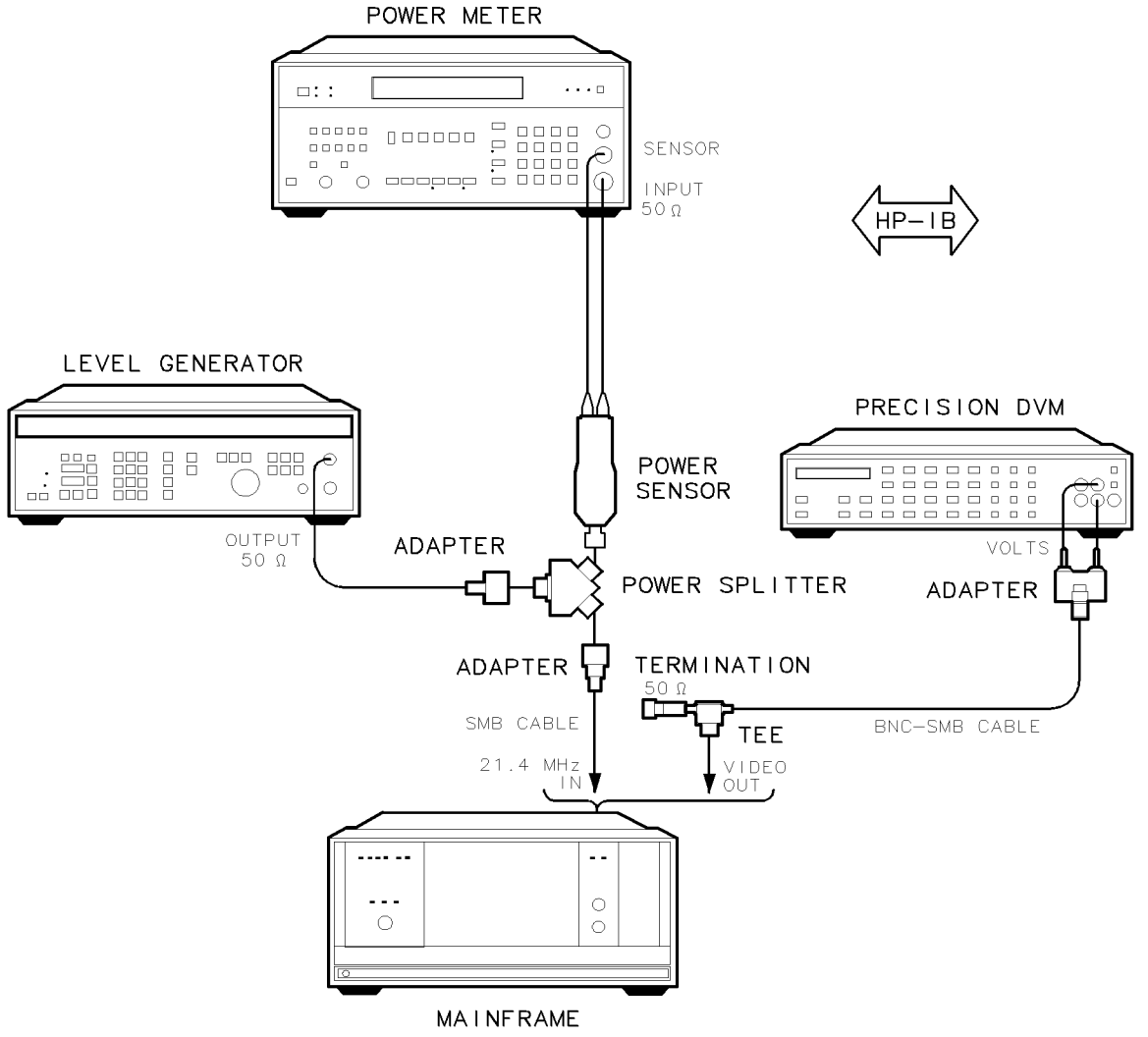

Figure 4-11. Video Bandwidths Test Setup

11. Module Gain Test

Purpose

This test measures the difference between −5 dBm and the level of 21.4 MHz input signal required to produce exactly 2 Vdc at the HP 70902A IF section video-output port.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination.

The level generator is tuned to the center of the selected resolution bandwidth filter. The level generator amplitude is adjusted to provide exactly 2 Vdc (as measured by the DVM) at the DUT video output. The power meter takes a number of samples and averages them to determine the signal level at the 21.4 MHz input accurately. This averaged value is compared to −5 dBm, and the difference is reported.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Power meter .....HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

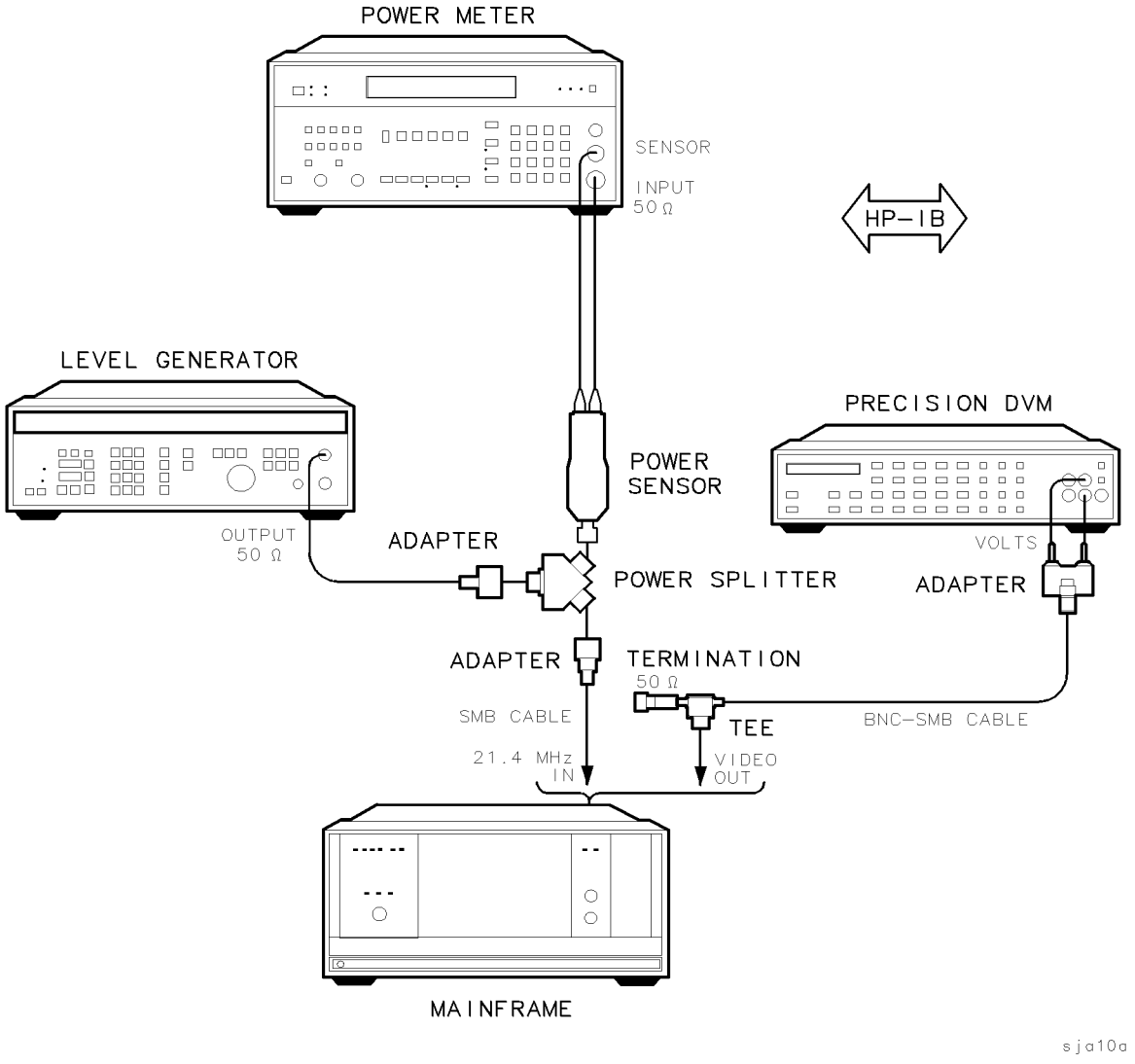

Figure 4-12. Module Gain Test Setup

12. Calibration Attenuator Test

Purpose

This test verifies the accuracy of the HP 70902A IF section calibration attenuator. This accuracy is critical to achieving specified system performance. The calibration attenuator is used by the system to calibrate system log fidelity during the system-calibration routine. It is also used by the system to adjust the HP 70902A IF section gain in some combinations of step gain, bandwidth, and reference level.

Description

The calibration attenuator is a precise PIN-diode attenuator circuit consisting of 1 dB, 2 dB, 4 dB, 8 dB, and 30 dB stages. It may be set from 0 dB to 15 dB, and 30 dB to 45 dB with 1 dB resolution. At ambient room temperature, the calibration attenuator 1 dB, 2 dB, 4 dB, and 8 dB stages are specified to ±0.03 dB, and the 30 dB stage is specified to ±0.05 dB.

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the signal sensor, to the measuring receiver. A precision DVM is connected to the DUT video output across a 50Ω termination. The TUNED RF calibration of the measuring receiver is first checked, and then performed if necessary.

The level generator is set to provide −16 dBm at the DUT 21.4 MHz input, and the DUT video-output voltage is measured and used as the reference voltage. With the aid of the measuring receiver, the level generator output is reduced in amplitude by exactly the value of the calibration-attenuator step being measured. Then, the DUT video-output voltage is measured. Next, the level generator is reset to the original amplitude of −16 dBm, the calibration-attenuator step is activated, and the video voltage is again measured. The error between this measurement and the previous voltage measurement is the attenuator error. This measuring sequence is repeated for each stage of the calibration attenuator.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Measuring receiver ..... HP 8902A measuring receiver
Signal sensor ..... HP 11722A sensor module
Power splitter ..... HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

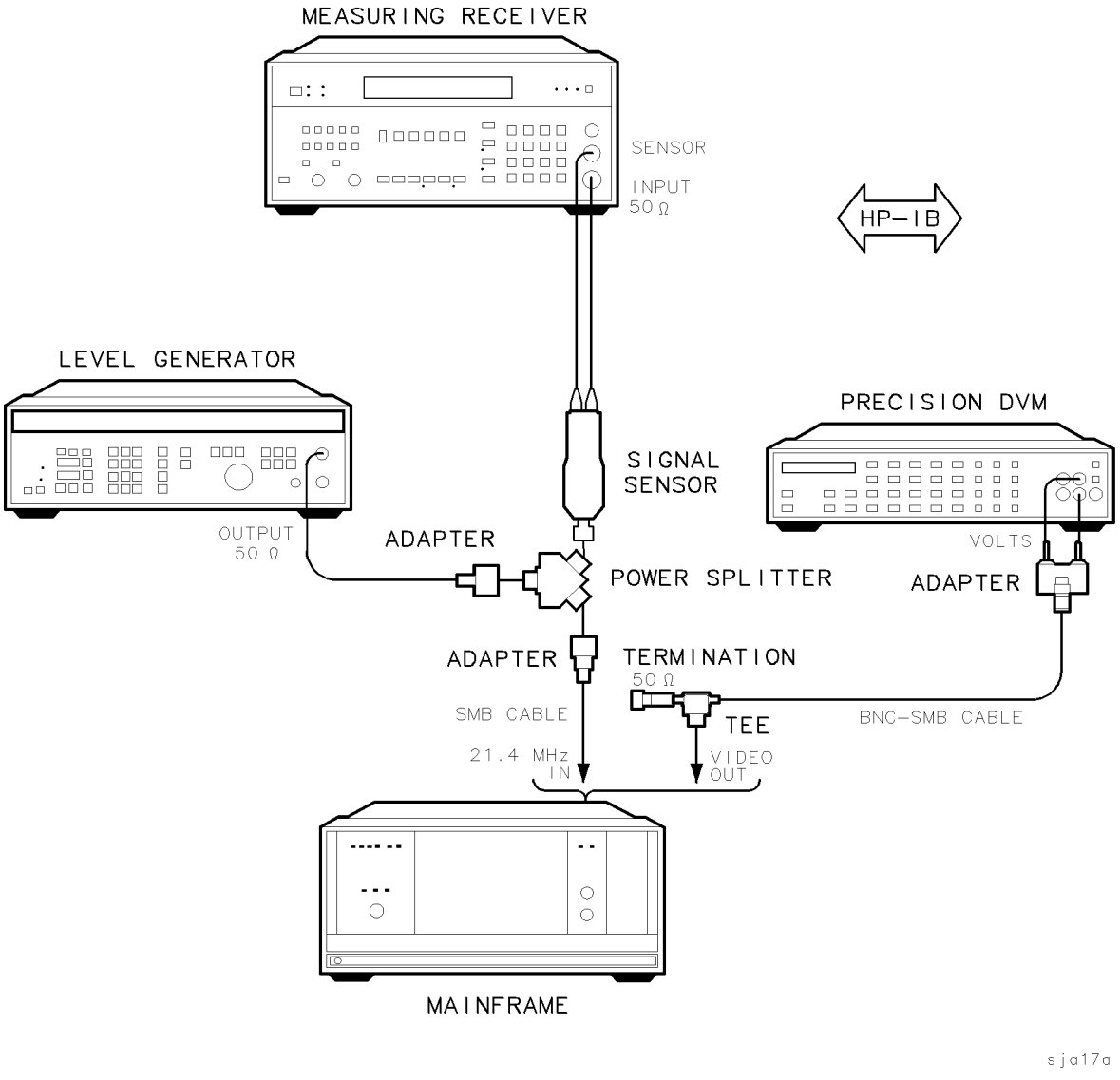

Figure 4-13. Calibration Attenuator Test Setup

13. Corrected Module Fidelity Test

Purpose

This test measures the corrected fidelity of the HP 70902A IF section. Corrected fidelity consists of the combinations of log fidelity performance, step gain accuracy, and sensitivity at various resolution bandwidths. This fidelity is essential for achieving specified system performance.

Description

The level generator is connected, through a 10 dB step attenuator, to the power splitter input. (The 10 dB step attenuator is used to increase the dynamic range of the level generator to cover the range of −5 dBm to −1.5 dBm.)

Note Because this test take approximately 20 minutes, a programmable 10 dB step attenuator and accompanying attenuator driver are recommended. If these are not available, a manual 10 dB step attenuator may be used.

One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the signal sensor, to the measuring receiver. This provides highly accurate RF level measurements at 21.4 MHz, and is used to establish reference amplitudes and calibrate the step attenuator. The precision DVM is connected to the DUT video output across a 50Ω termination. The DVM is used to measure the detected video-output voltage of the HP 70902A IF section accurately. A −5 dBm input results in approximately 2 Vdc being present at the DUT video output.

The level generator is tuned to the center of the chosen resolution bandwidth filter. The desired step gain is programmed. The generator and step attenuator are switched to maximum attenuation to allow the precision DVM to sample the video output and determine the noise floor. The step attenuator is set to the same value as the chosen step gain. The generator is then stepped from 10 dB above the reference level (at 2 Vdc) to the noise floor. At high levels, one voltage reading is taken. As the noise floor is approached, a voltage-averaging routine is used to remove the noise component statistically from the video signal. (Fidelity measurements are not made within 10 dB of the noise floor, since the uncertainties of these measurements render the data meaningless.)

Several combinations of resolution bandwidth and step gain are tested.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Measuring receiver .....HP 8902A measuring receiver
Signal sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter
10 dB Step attenuator ..... HP 8496G Option 001 coaxial step attenuator
Attenuator driver ..... HP 11713A attenuator/switch driver

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f) *(3 required)*
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

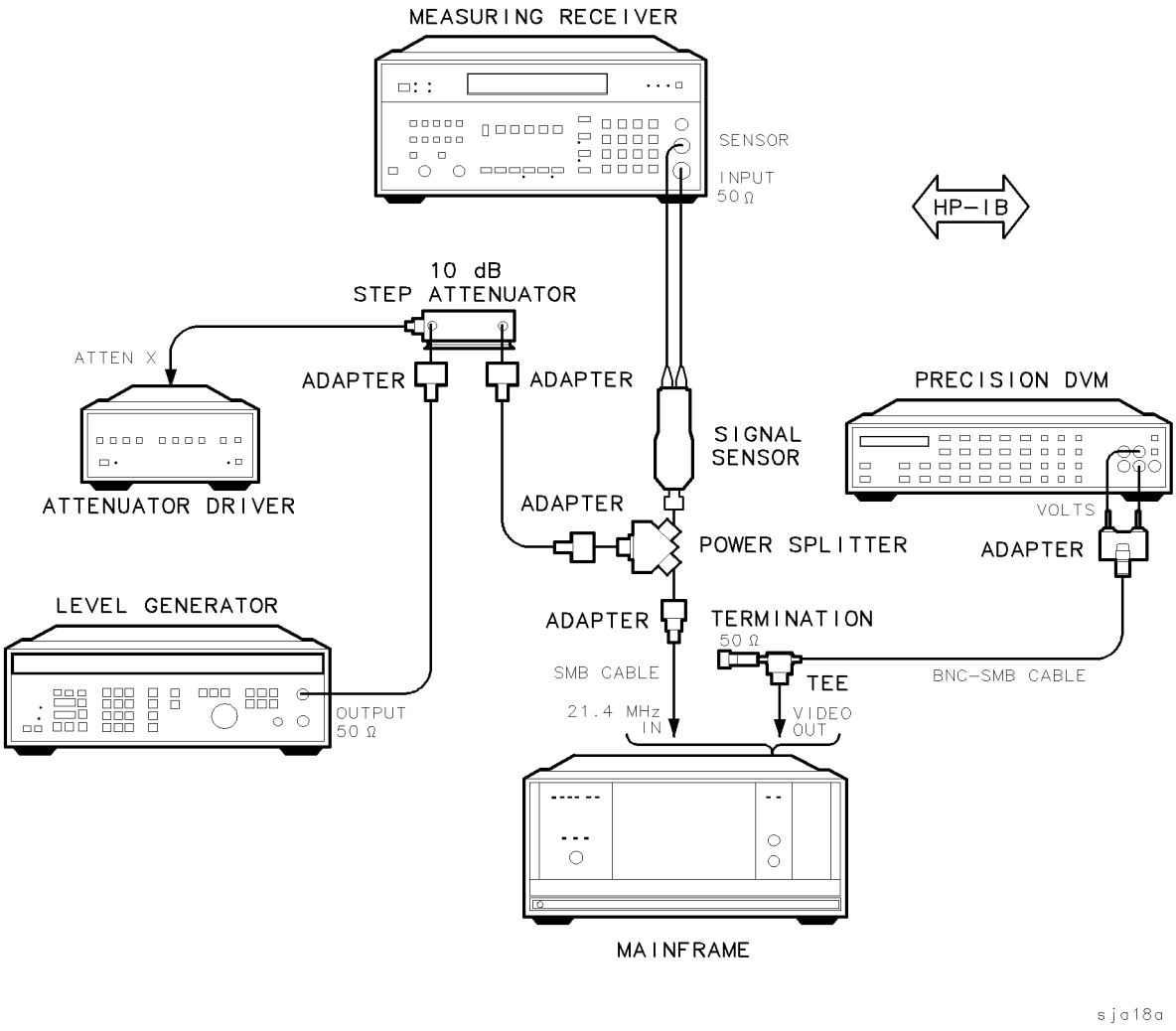

Figure 4-14. Corrected Module Fidelity Test Setup

14. Crystal Spurs Test

Purpose

This test looks for spurious responses caused by parasitic oscillations of the resolution bandwidth filter crystals. The spurious responses occur on the skirts of displayed signals, or, in cases of very narrow resolution bandwidths, adjacent to displayed signals.

Description

The HP 70902A IF section is configured into an HP 70000 Series modular spectrum analyzer system system. The system-calibration routine is performed. Then the HP 70902A IF section is tested for crystal spurs. If any spurs are found, they are reported.

Equipment

HP 70000 Series Components:

Mainframe ..... HP 70001A mainframe
Local oscillator ..... HP 70900A/B local oscillator source
Display ..... HP 70205A graphics display
IF section ..... HP 70903A IF section
RF section ..... HP 70904A RF section

Note In addition to the cables listed below, additional cables will be needed to configure the HP 70902A IF section under test into an HP 70000 Series modular spectrum analyzer system. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for more information about the required cables.

Adapters

HP 1250-0780 50Ω N(m) to BNC(f)

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

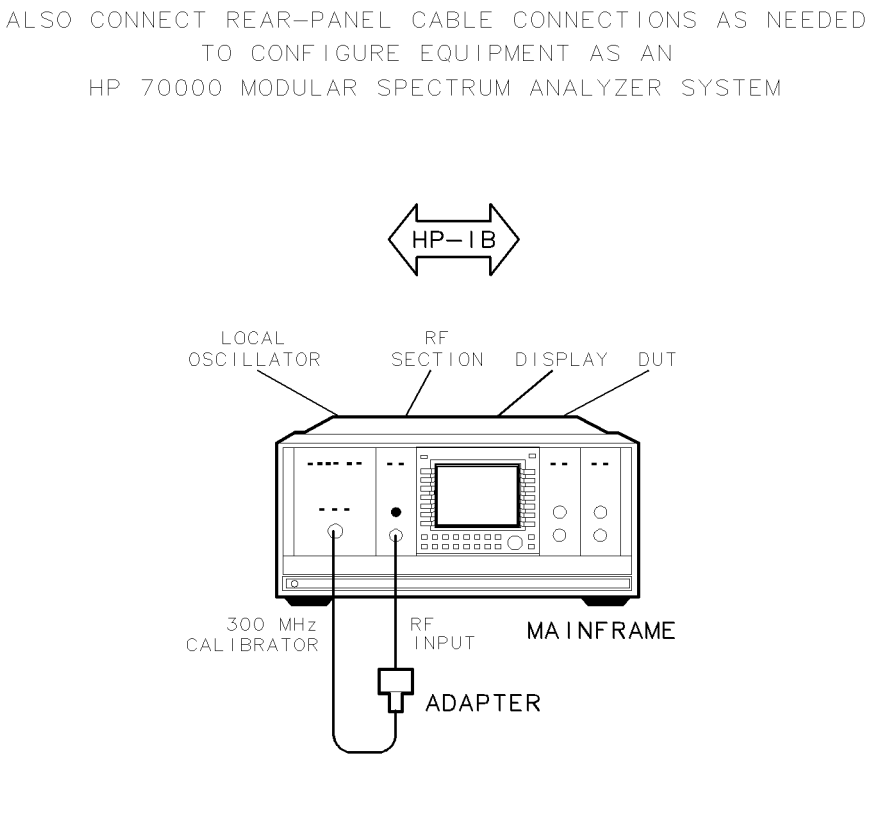

Figure 4-15. Crystal Spurs Test Setup

15. Rear-Panel Auxiliary Port Test

Purpose

This test measures the gain and passband response of the HP 70902A IF section rear panel auxiliary 21.4 MHz output port.

Description

Calibration

Note This part of the procedure calibrates the spectrum analyzer. The same cables that are used during calibration must be used during the measurements.

The level generator is connected to the power splitter input. One power splitter output is connected, through the power sensor, to the power meter. The other power splitter output has an adapter and a short SMB cable connected to it. A spectrum analyzer is connected, through a BNC cable and the necessary adapters, to the end of the short SMB cable.

The level generator is set to 21.4 MHz at −9 dBm. The power meter is used to set the level generator to provide a −15 dBm ±0.6 dBm at the power splitter output. The spectrum analyzer measures the signal, and the difference between the power-meter measurement and the spectrum analyzer measurement is stored as the spectrum analyzer amplitude error.

Measurement

The short SMB cable is disconnected from the spectrum analyzer cable and then connected to the 21.4 MHz input of the device under test (DUT). The spectrum analyzer is then connected, through the cable that was used for calibration, to the DUT rear panel auxiliary 21.4 MHz output. The level generator is set to provide −5 dBm ±0.5 dBm at the power splitter output. The spectrum analyzer then measures the gain at the DUT rear panel auxiliary 21.4 MHz output. The gain is expected to be −10 dB ±0.85 dB.

The level generator is then set to five different frequencies between 16.4 MHz and 26.4 MHz. The spectrum analyzer measures the DUT auxiliary-port gain at each frequency. The expected flatness variation is <2.28 dB.

Equipment

Spectrum analyzer	HP 8566B spectrum analyzer
Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-0669 50Ω SMB(m) to SMB(m)
HP 1250-1236 50Ω SMB(f) to BNC(f)

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

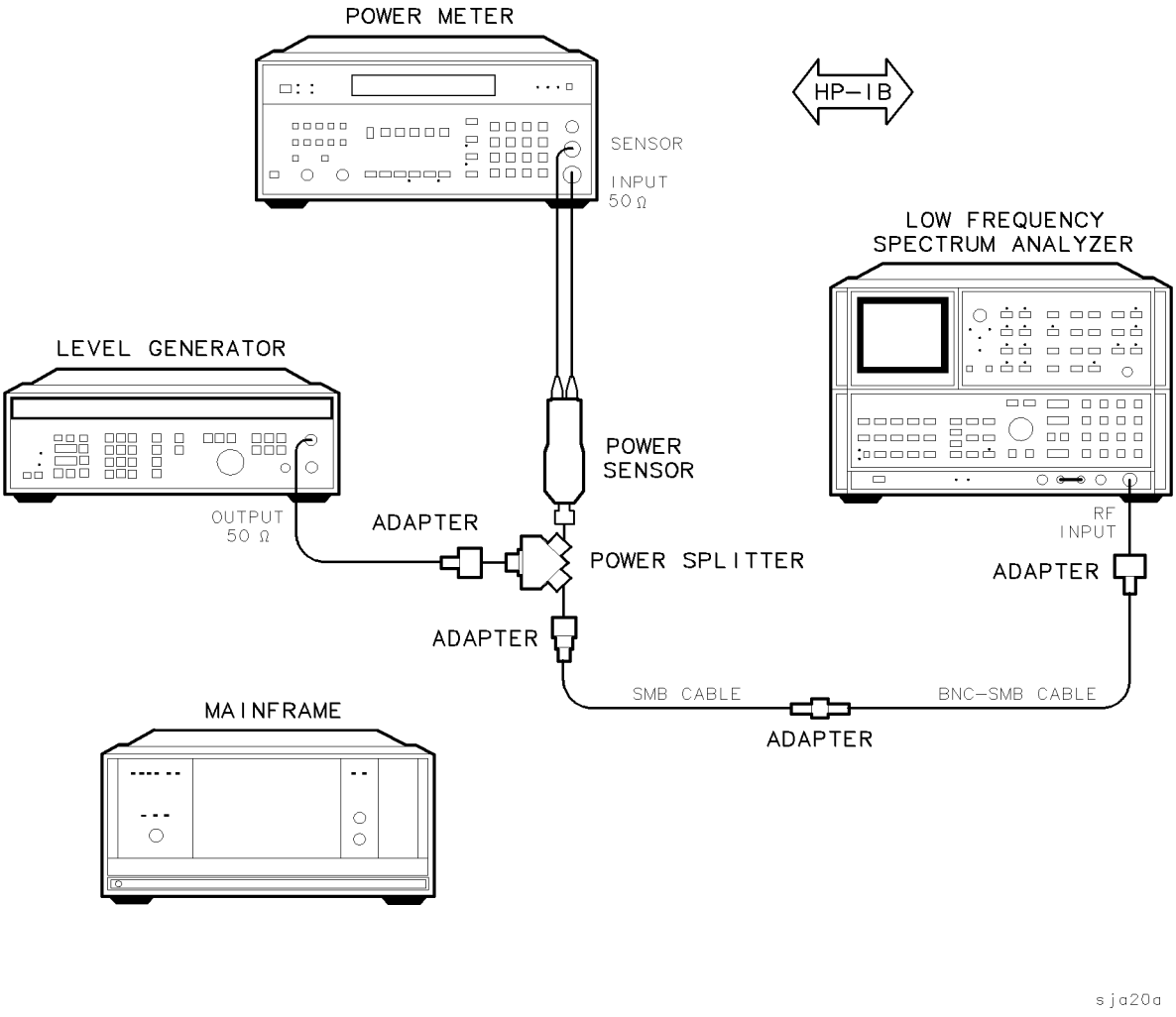

Figure 4-16. Rear-Panel Auxiliary Port Test, Calibration Setup

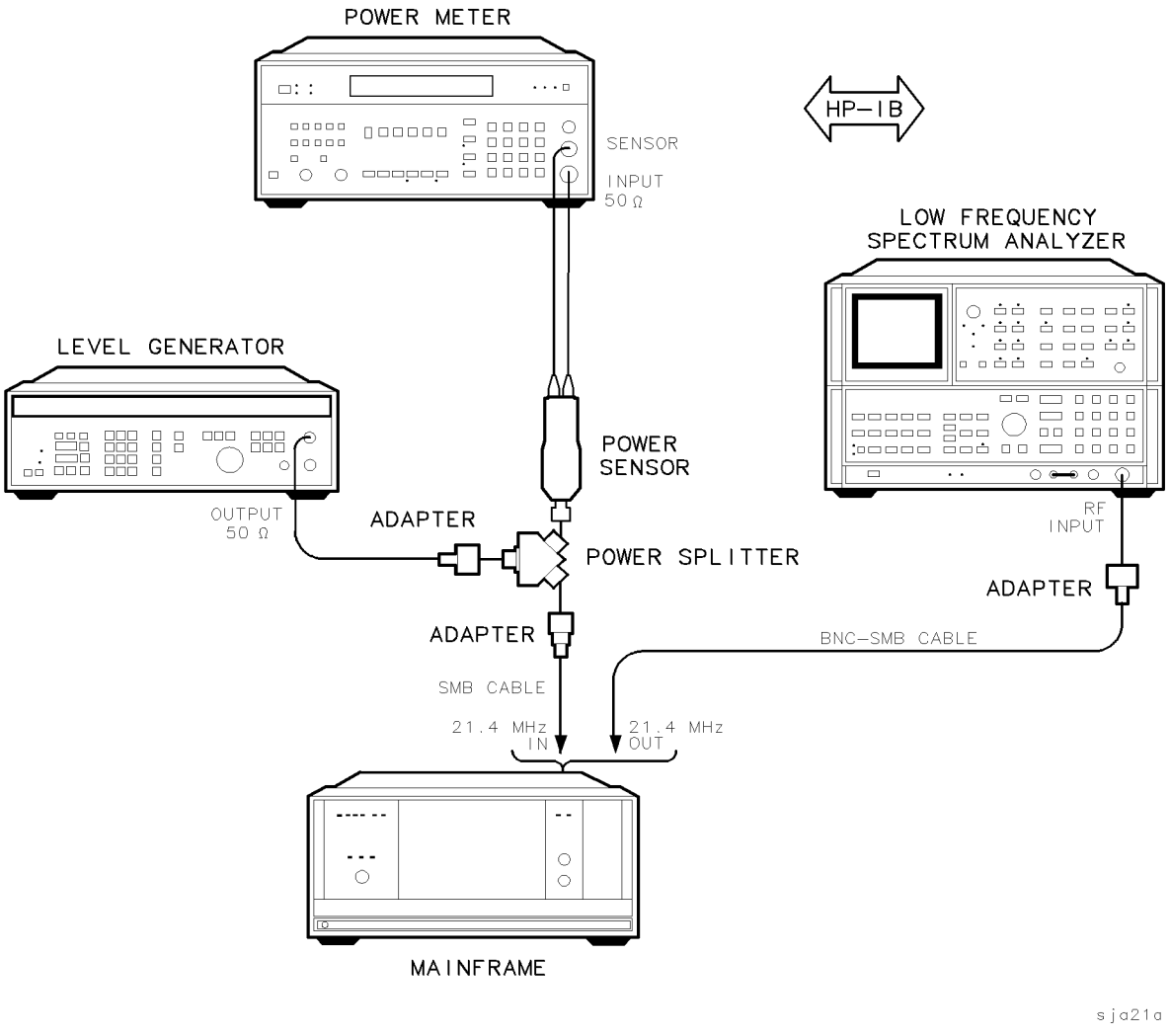

Figure 4-17. Rear-Panel Auxiliary Port Test, Measurement Setup

16. Front-Panel Auxiliary Port Test

Purpose

This test measures the gain of the HP 70902A IF section front panel auxiliary 3 MHz output port.

Description

Calibration

Note This part of the procedure calibrates the spectrum analyzer. The same cables that are used during calibration must be used during the measurements.

The level generator is connected to the power splitter input. One power splitter output is connected, through the power sensor, to the power meter. The other power splitter output has an adapter and a short SMB cable connected to it. A spectrum analyzer is connected, through a BNC cable and the necessary adapters, to the end of the short SMB cable.

The level generator is set to 3 MHz at −9 dBm.

The power meter is used to set the level generator to provide a −15 dBm ±0.6 dBm at the power splitter output. The spectrum analyzer measures the signal, and the difference between the power-meter measurement and the spectrum analyzer measurement is stored as the spectrum analyzer amplitude error.

Measurement

The short SMB cable is disconnected from the spectrum analyzer cable and then connected to the 21.4 MHz input of the device under test (DUT). The spectrum analyzer is then connected, through the cable that was used for calibration, to the DUT front panel auxiliary 3 MHz output. The level generator is set to provide a 21.4 MHz, −5 dBm ±0.5 dBm signal at the power splitter output. The spectrum analyzer then measures the gain at the DUT front panel auxiliary 3 MHz output. The gain is expected to be −10 dB ±0.85 dB.

Equipment

Spectrum analyzer ..... HP 8566B spectrum analyzer
Level generator ..... HP 3335A synthesizer/level generator
Power meter ..... HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter ..... HP 11667A power splitter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-0669 50Ω SMB(m) to SMB(m)
HP 1250-0896 50Ω SMB(m) to BNC(m)

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

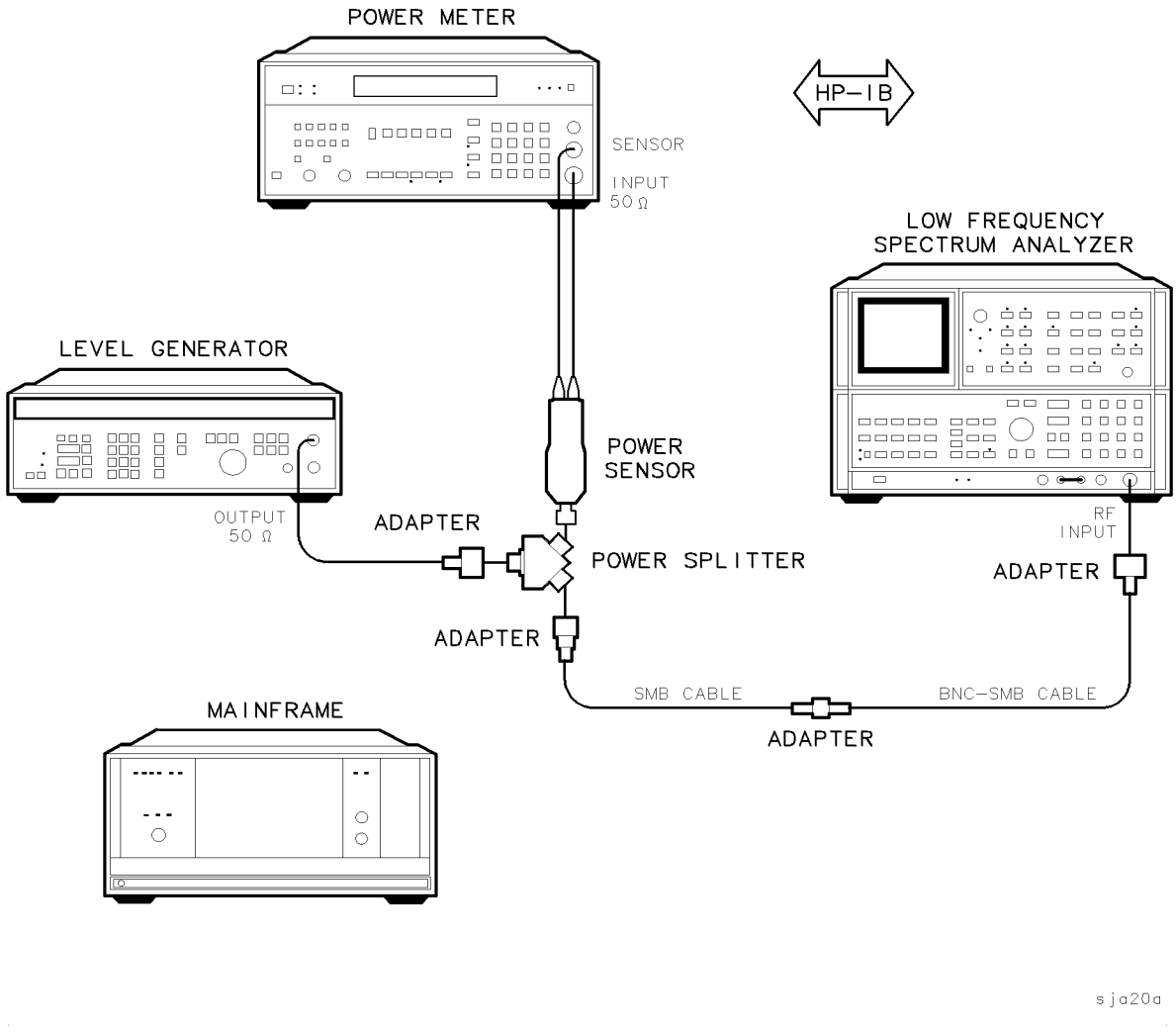

Figure 4-18. Front-Panel Auxiliary Port Test, Calibration Setup

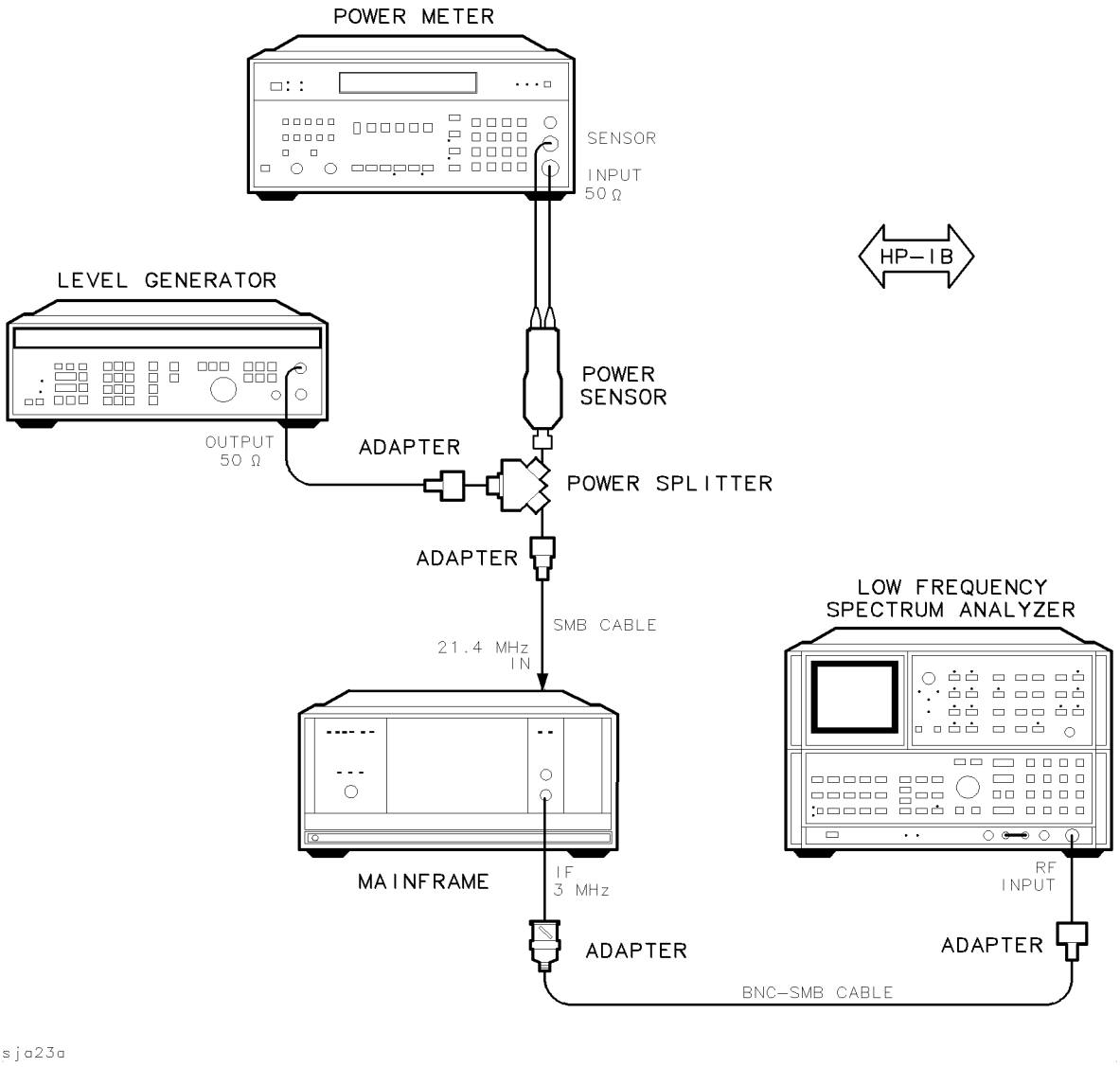

Figure 4-19. Front-Panel Auxiliary Port Test, Measurement Setup

17. Auxiliary Video Test

Purpose

This test measures the output voltage of the front panel auxiliary video-output port on the HP 70902A IF section. The front panel auxiliary video-output voltage is nominally 50 percent of the value of the rear panel video-output voltage.

Description

Calibration

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT rear panel video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The precision DVM measures the DUT rear panel video-output voltage. (The voltage is expected to be 2 Vdc.)

Measurement

Leave the SMB tee and 50Ω termination connected to the DUT rear panel video output. Disconnect the cable that goes to the precision DVM from the SMB tee. Then connect that cable to the front panel auxiliary video output.

Note The SMB tee and 50Ω load must remain on the DUT video-output port or the resulting impedance change will alter the gain of the module.

The precision DVM measures the DUT front panel video-output voltage. The voltage measured should be 50 percent ±0.5 percent of the DUT rear panel video-output voltage that was measured in the calibration procedure.

Equipment

Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter
Precision DVM	HP 3456A digital multimeter

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1250-0896 50Ω SMB(m) to BNC(m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

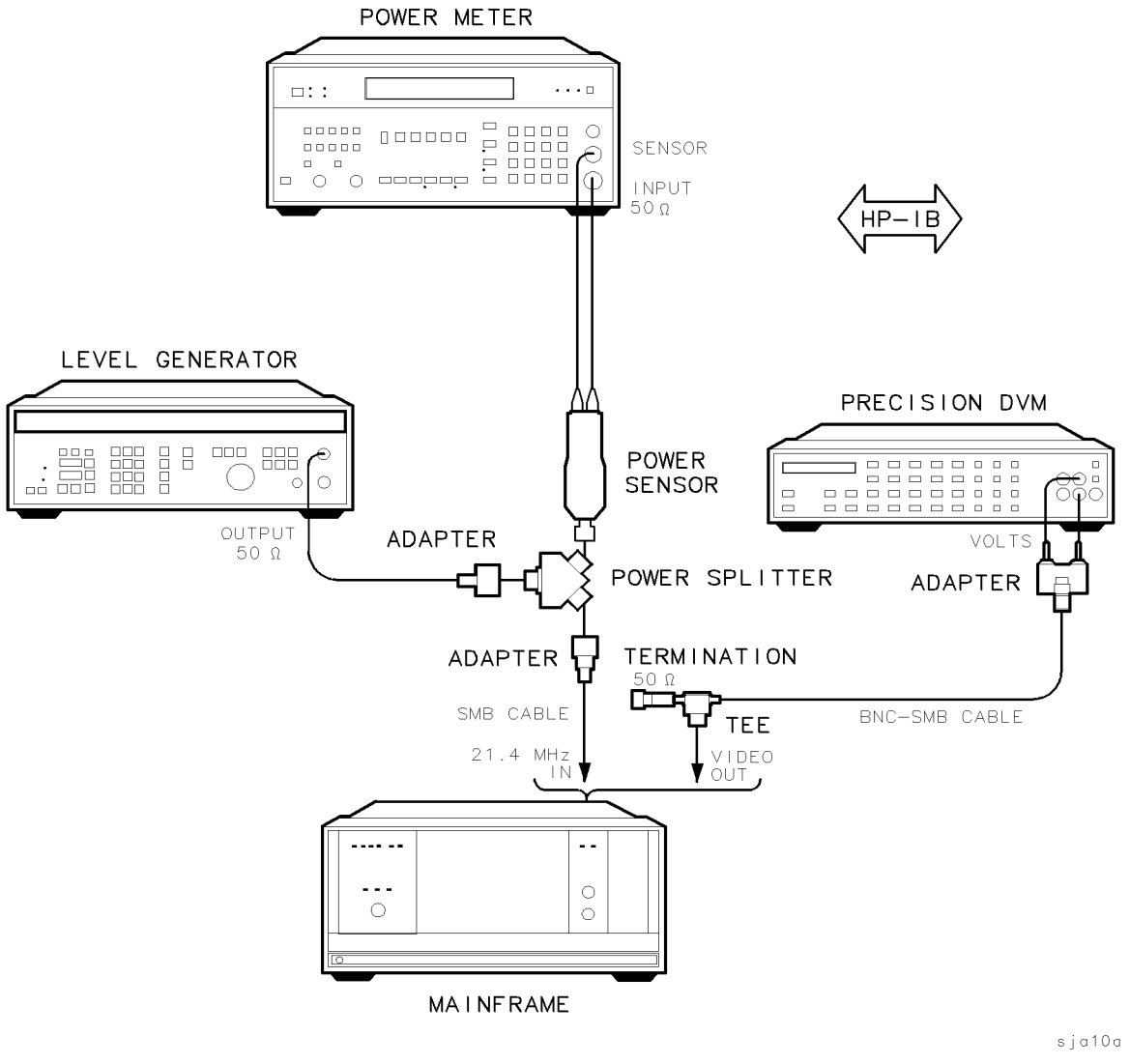

Figure 4-20. Auxiliary Video Test, Calibration Setup

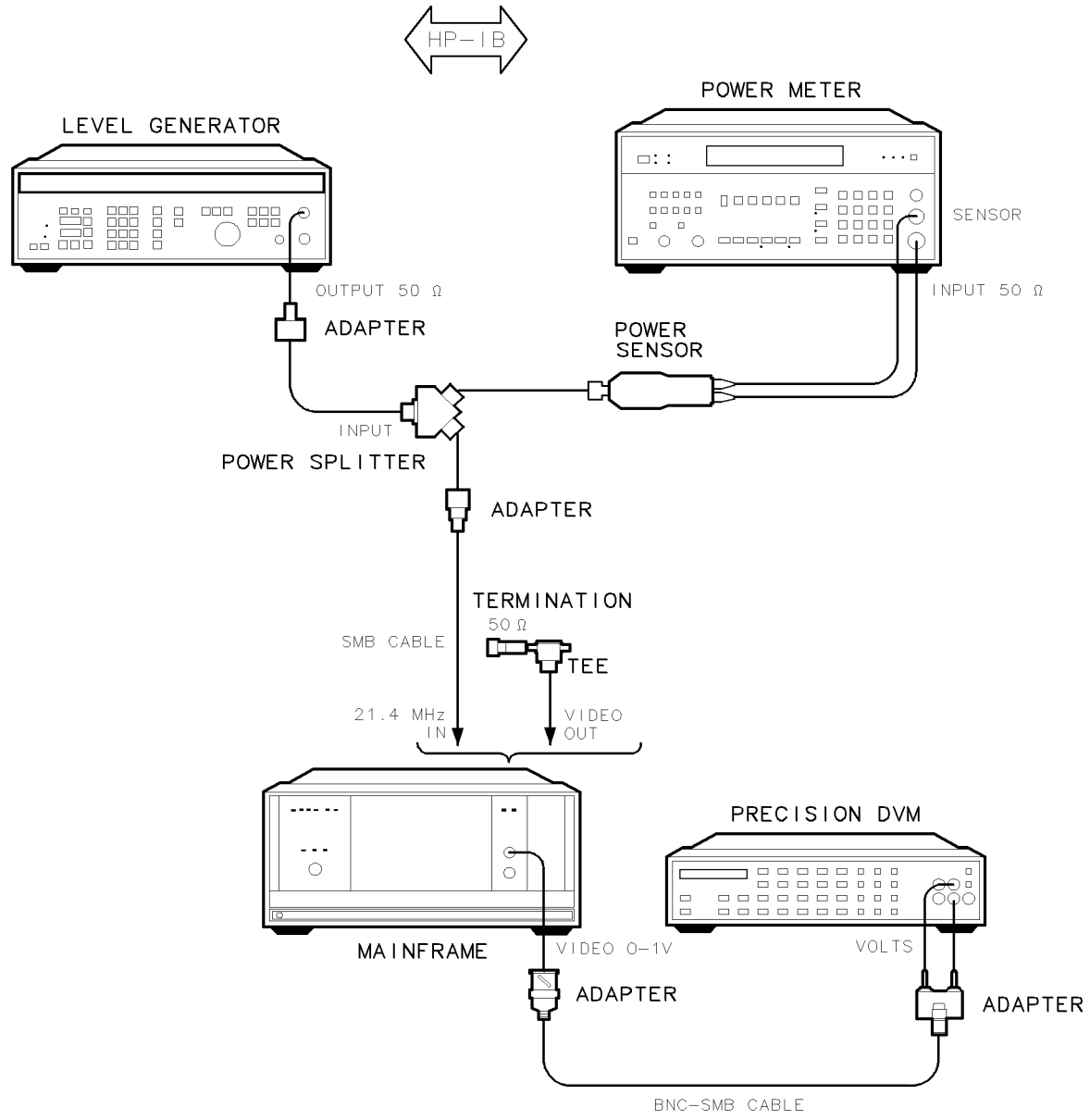

Figure 4-21. Auxiliary Video Test, Measurement Setup

18. Limited IF Output Check

Purpose

This procedure tests the functionality of the HP 70902A IF section rear panel limited IF output. The output of this port is nominally a 3 MHz ±1 V sawtooth riding on a 7 Vdc offset, which represents the post-bandwidth IF frequency. The sawtooth and the 7 Vdc offset is generated in the log amplifier circuitry and should be of sufficient level to trigger a frequency counter.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The precision DVM is connected to the DUT video output across a 50Ω termination. The frequency counter is connected to the limited IF output.

The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The frequency counter then checks for a signal in the 2 to 10 MHz range. If a signal is detected, the test passes.

The level generator is then set to −70 dBm, the lowest input amplitude expected to trigger the counter. The counter trigger level is set to 0.3 volts. If the counter detects a signal, the test passes.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Power meter .....HP 8902A measuring receiver
Power sensor ..... HP 11722A sensor module
Power splitter .....HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter
Frequency counter ..... HP 5316A universal counter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0780 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

18. Limited IF Output Check

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

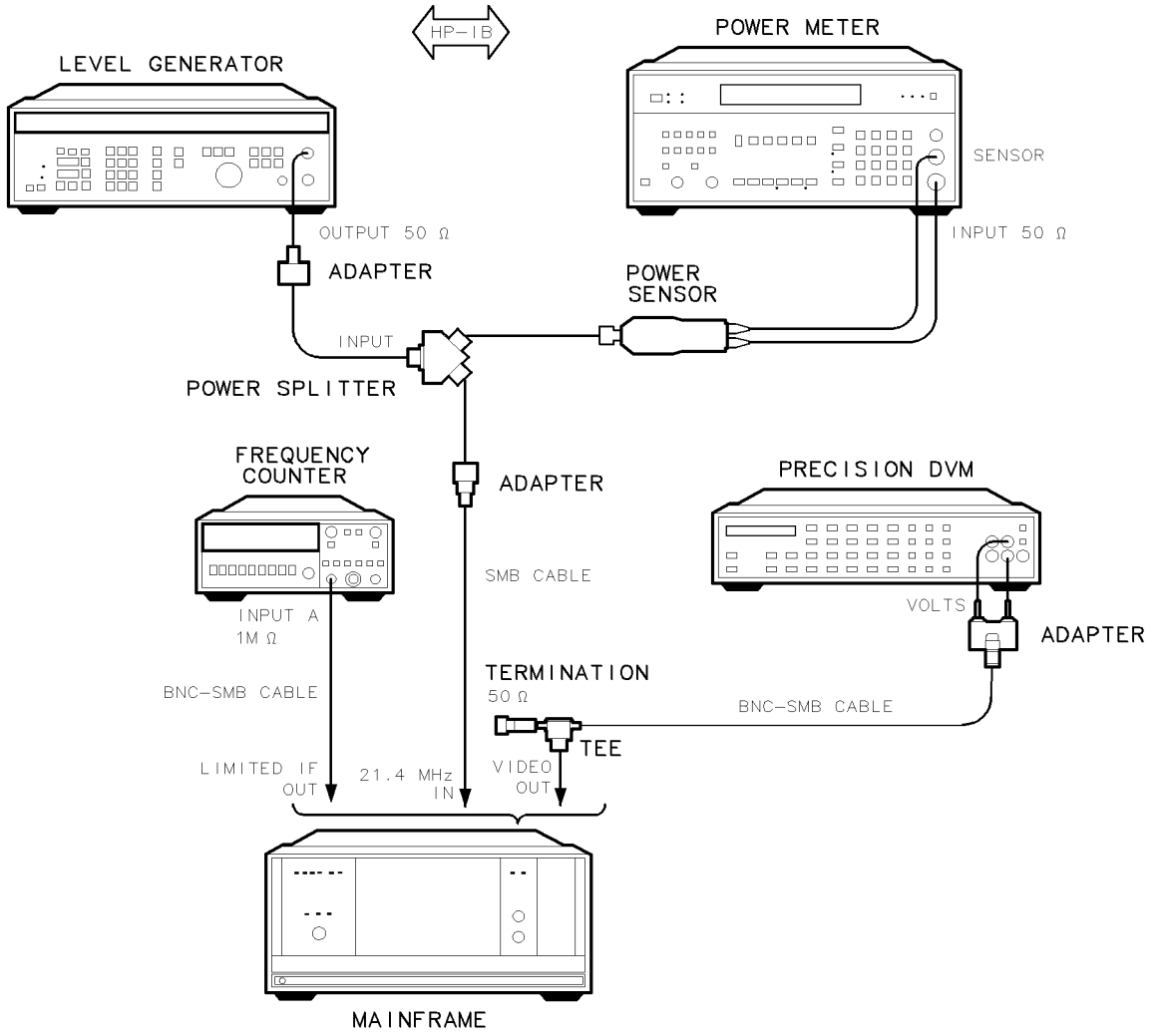

Figure 4-22. Limited IF Output Check Setup

5

Adjustment Procedures

This chapter contains descriptions of each adjustment procedure for the HP 70902A IF section. All of the adjustments are automated; instructions for running the Module Verification Software are given in Chapter 3.

1. 21.4 MHz Input Bandpass Filter Adjustment
2. LC Bandwidth Filter Adjustment
3. Crystal Bandwidth Filter Adjustment
4. Bandwidth Filter Amplitude Adjustment
5. Step Gain/Calibration Attenuator Adjustment
6. Log Amplifier Adjustment
7. Module Gain Adjustment
8. Bandwidth Filter Final Adjustment
9. Bandwidth Filter DAC Optimization

Caution Use 5 to 8 inch-pounds of torque when connecting SMA or APC-3.5 cables. More torque may cause damage to the cables. Use only the correct adjustment tools to adjust the components during these procedures or damage to the components will result. Refer to Table 2-2 for adjustment tool part numbers.

Note The adjustments require an HP 70000 modular measurement system display, and an HP 70000 modular measurement system mainframe that has been modified to allow access to the top of the module. Install the HP 70902A IF section in the modified mainframe so that both sides of the module are accessible. For information about the parts required for the mainframe modification, refer to "Service Kit" in Chapter 2.

1. 21.4 MHz Input Bandpass Filter Adjustment

Purpose

This procedure is used to adjust the HP 70902A IF section 21.4 MHz input filter for correct gain and filter passband.

Description

Calibration

The detector is connected to the scalar network analyzer. Then the probe is connected to the detector. A cable is connected to the output of the scalar network analyzer source, then a 50Ω feedthrough is connected to the end of the cable. The probe is connected to the end of this feedthrough, and the probe insertion loss is measured. Probe insertion loss is approximately 15 dB.

Note Be sure to remove the feedthrough before connecting the source cable to the HP 70902A IF section. For this adjustment, use the same cables that were used during calibration.

Adjustment

The scalar network analyzer source is connected, through the cable used during calibration, to the HP 70902A IF section 21.4 MHz input. The probe is inserted in the filter test point to measure the output response of the filter.

The software then continues with the adjustment. The operator uses the scalar network analyzer display to adjust the filter gain and passband as instructed by the software. Limit lines are drawn to assist the operator in making this adjustment.

Equipment

Network analyzer ..... HP 8757C scalar network analyzer
Source .....HP 8340B synthesized sweeper

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
50Ω feedthrough ..... HP 10100C 50Ω BNC feedthrough
Detector .....HP 11664A detector
1:1 Probe ..... HP 10020A resistive divider probe kit

Adapters
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-1474 precision 50Ω N(f) to BNC(f)
HP 1250-1745 50Ω APC-3.5(f) to N(f)
HP 1250-1236 50Ω SMB(f) to BNC(f)

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

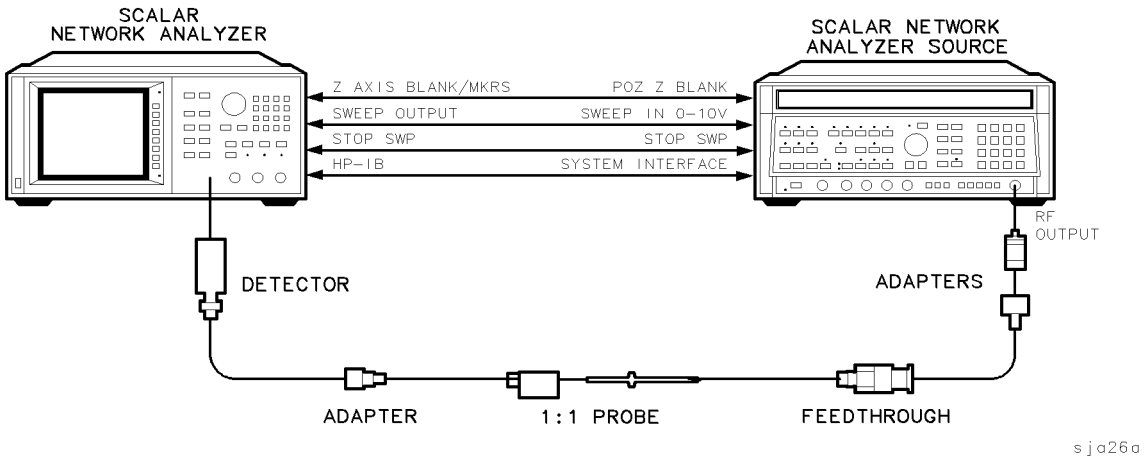

Figure 5-1. 21.4 MHz Input Bandpass Filter, Calibration Setup

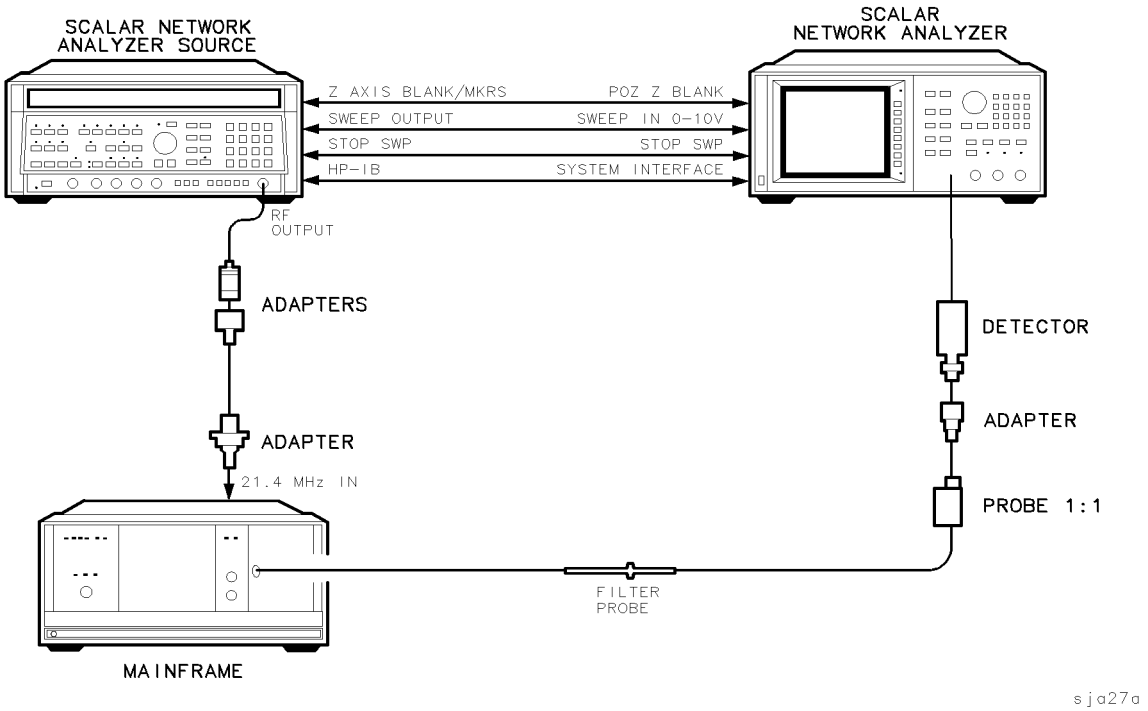

Figure 5-2. 21.4 MHz Input Bandpass Filter, Adjustment Setup

2. LC Bandwidth Filter Adjustment

Purpose

This procedure is used to adjust the center frequency, amplitude, and 3 dB bandwidth of each LC filter stage.

Description

The 300 MHz calibration output from the local oscillator module is connected to the RF section input. The 21.4 MHz output of the RF section is connected to the 21.4 MHz input port of the device under test (DUT). The DUT front panel 3 MHz output is connected to the RF port of the mixer. The DUT 18.4 MHz L.O. is connected, through an RF amplifier, to the LO port of the mixer. The mixer IF is connected to the 21.4 MHz input of an HP 70903A IF section that has been configured into an HP 70000 Series modular spectrum analyzer system.

The 21.4 MHz LC filters in the HP 70902A IF section under test are adjusted. The computer screen is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is placed within the box drawn on the computer screen.

Equipment

RF amplifier ..... HP 8447A RF amplifier

HP 70000 Series Components:

Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source
IF section ..... HP 70903A IF section
RF section ..... HP 70904A RF section

Accessories

RF mixer ..... HP 10514A double-balanced and harmonic mixer

Adapters

HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-1236 50Ω SMB(f) to BNC(f)

Note In addition to the cables listed below, additional cables will be needed to configure the HP 70902A IF section under test into an HP 70000 Series modular spectrum analyzer system. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for more information about the required cables.

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

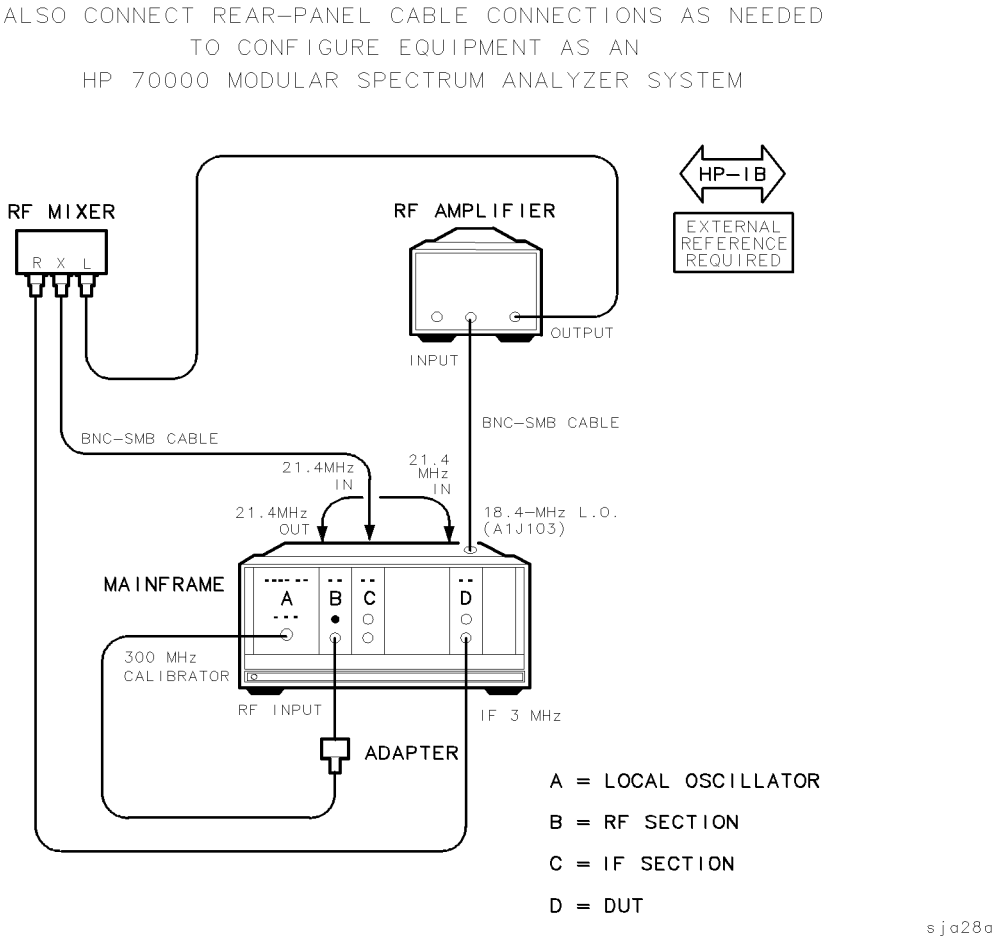

Figure 5-3. LC Bandwidth Filter Adjustment Setup

3. Crystal Bandwidth Filter Adjustment

Purpose

This procedure is used to adjust the center frequency, symmetry, amplitude, and 3 dB bandwidth of each crystal-filter stage. In addition, the shorting diodes of each stage are tested. This is a diagnostic aid.

Description

The 300 MHz calibration output from the local oscillator module is connected to the RF section input. The 21.4 MHz output of the RF section is connected to the 21.4 MHz input port of the device under test (DUT). The DUT front panel 3 MHz output is connected to the RF port of the mixer. The DUT 18.4 MHz L.O. port is connected, through an RF amplifier, to the LO port of the mixer. The mixer IF is connected to the 21.4 MHz input of an HP 70903A IF section that has been configured into an HP 70000 Series modular spectrum analyzer system.

The 3 MHz crystal filters in the HP 70902A IF section under test are adjusted. The computer screen is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is placed within the box drawn on the computer screen.

Equipment

RF amplifier ..... HP 8447A RF amplifier

HP 70000 Series Components:

Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source
IF section ..... HP 70903A IF section
RF section ..... HP 70904A RF section

Accessories

RF mixer ..... HP 10514A double-balanced and harmonic mixer

Adapters

HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-1236 50Ω SMB(f) to BNC(f)

Note In addition to the cables listed below, additional cables will be needed to configure the HP 70902A IF section under test into an HP 70000 Series modular spectrum analyzer system. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for more information about the required cables.

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

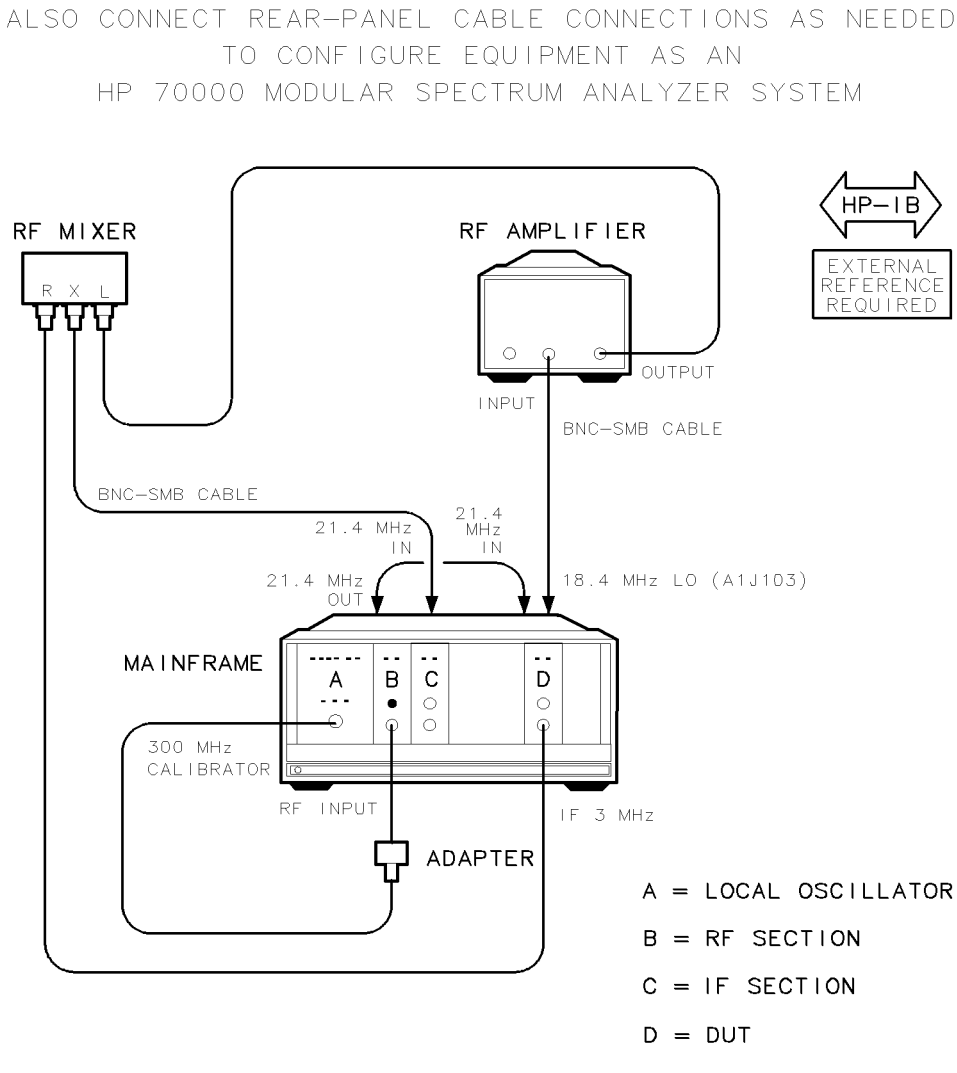

Figure 5-4. Crystal Bandwidth Filter Adjustment Setup

4. Bandwidth Filter Amplitude Adjustment

Purpose

This procedure is used to adjust the amplitude shift between the LC filter and crystal filter stages, and to adjust the amplitude shift between the 10 Hz and 3 kHz crystal filters.

Description

The 300 MHz calibration output from the local oscillator module is connected to the RF section input. The 21.4 MHz output of the RF section is connected to the 21.4 MHz input port of the device under test (DUT). The DUT front panel 3 MHz output is connected to the RF port of the mixer. The DUT 18.4 MHz L.O. port is connected, through an RF amplifier, to the LO port of the mixer. The mixer IF is connected to the 21.4 MHz input of an HP 70903A IF section that has been configured into an HP 70000 Series modular spectrum analyzer system.

The gain difference between the LC and crystal filters in the IF section under test are adjusted. The computer screen is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is placed within the box drawn on the computer screen.

Equipment

RF amplifier ..... HP 8447A RF amplifier

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source
IF section ..... HP 70903A IF section
RF section ..... HP 70904A RF section

Accessories
RF mixer ..... HP 10514A double-balanced and harmonic mixer

Adapters
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-1236 50Ω SMB(f) to BNC(f)

Note In addition to the cables listed below, additional cables will be needed to configure the HP 70902A IF section under test into an HP 70000 Series modular spectrum analyzer system. Refer to the *HP 70000 Modular Spectrum Analyzer Installation and Verification Manual* for more information about the required cables.

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

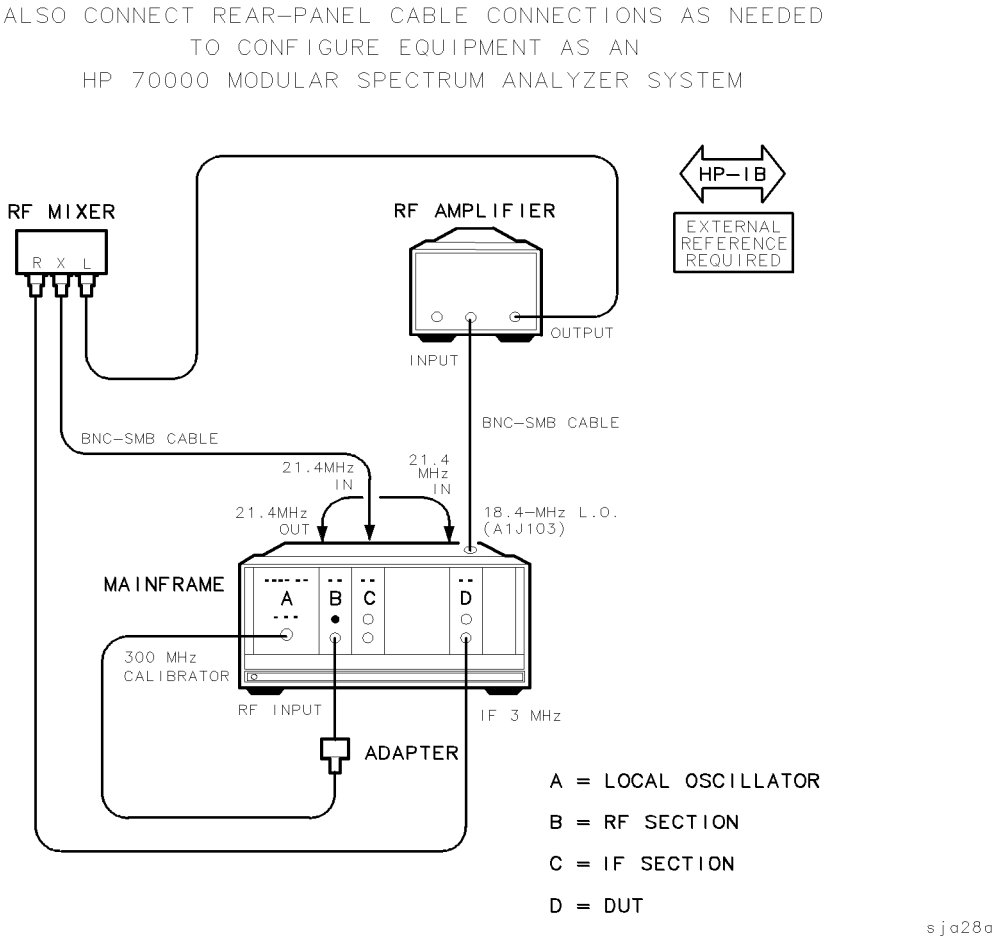

Figure 5-5. Bandwidth Filter Amplitude Adjustment Setup

5. Step Gain/Calibration Attenuator Adjustment

Purpose

This procedure is used to adjust the 1 dB, 2 dB, 4 dB, 8 dB, and 30 dB calibration attenuators and the 10 dB, 20 dB, and 40 dB step gain amplifiers.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the signal sensor, to the measuring receiver. The precision DVM is connected to the DUT video output across a 50Ω termination. The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the measuring receiver, the level generator is set to provide a power level of −16 dBm to the DUT 21.4 MHz input. This level is chosen to minimize the number of range changes the measuring receiver must make during the course of the adjustment.

The measuring receiver is used to measure the amplitude changes of the level generator accurately. The precision DVM measures the video-voltage changes that result from switching either calibration attenuators or step gain amplifiers into the signal path.

To return the video voltage to the reference level during calibration-attenuator adjustments, the level generator amplitude is increased by the amount of the calibration attenuator. To return the video voltage to the reference level during step gain adjustments, the level generator amplitude is decreased by the amount of the step gain amplifier.

The computer display is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Measuring receiver ..... HP 8902A measuring receiver
Signal sensor ..... HP 11722A sensor module
Power splitter ..... HP 11667A power splitter
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

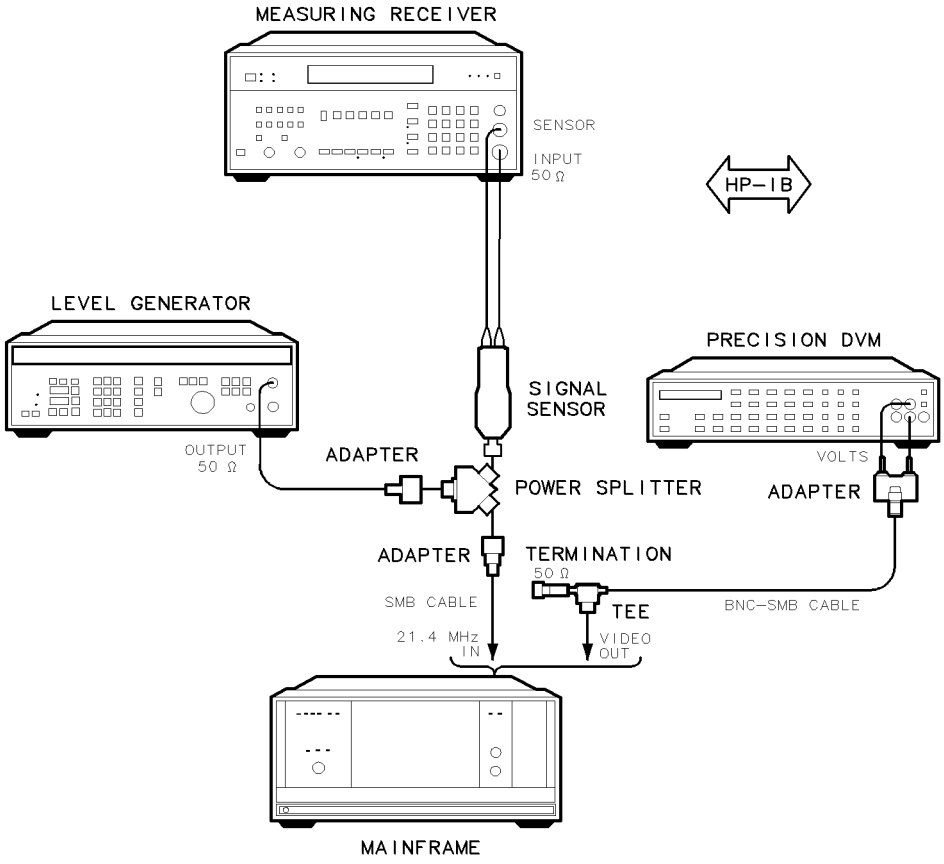

Figure 5-6. Step Gain/Calibration Attenuator Adjustment Setup

6. Log Amplifier Adjustment

Purpose

This procedure is used to adjust the log-align, log-offset, and log-slope of the HP 70902A IF section.

Description

The level generator is connected, through a 10 dB step attenuator, to the rear panel 21.4 MHz input of the device under test (DUT). The step attenuator is used to increase the dynamic range of the level generator to greater than 100 dB below 0 dBm. The precision DVM is connected to the DUT video output across a 50Ω termination.

The log amplifiers are characterized before adjustments are made. The log-amplifier characteristics are shown in a graph on the computer screen. If adjustment is required, a linear-regression algorithm is used to estimate where the log-align, log-offset, and log-slope adjustments should be set. After adjusting these components, the log amplifiers are recharacterized and the results are displayed.

The computer display is used as a "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

A troubleshooting routine which directly displays the results of the characterization measurements is included. The routine helps to isolate the defective log-amplifier microcircuit by finding "holes" in the log-amplifier response.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Precision DVM ..... HP 3456A digital multimeter
10 dB Step attenuator ..... HP 8496G Option 001 coaxial step attenuator
Attenuator driver ..... HP 11713A attenuator/switch driver

HP 70000 Series Components:
Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-1476 precision 50Ω N(m) to BNC(f)
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

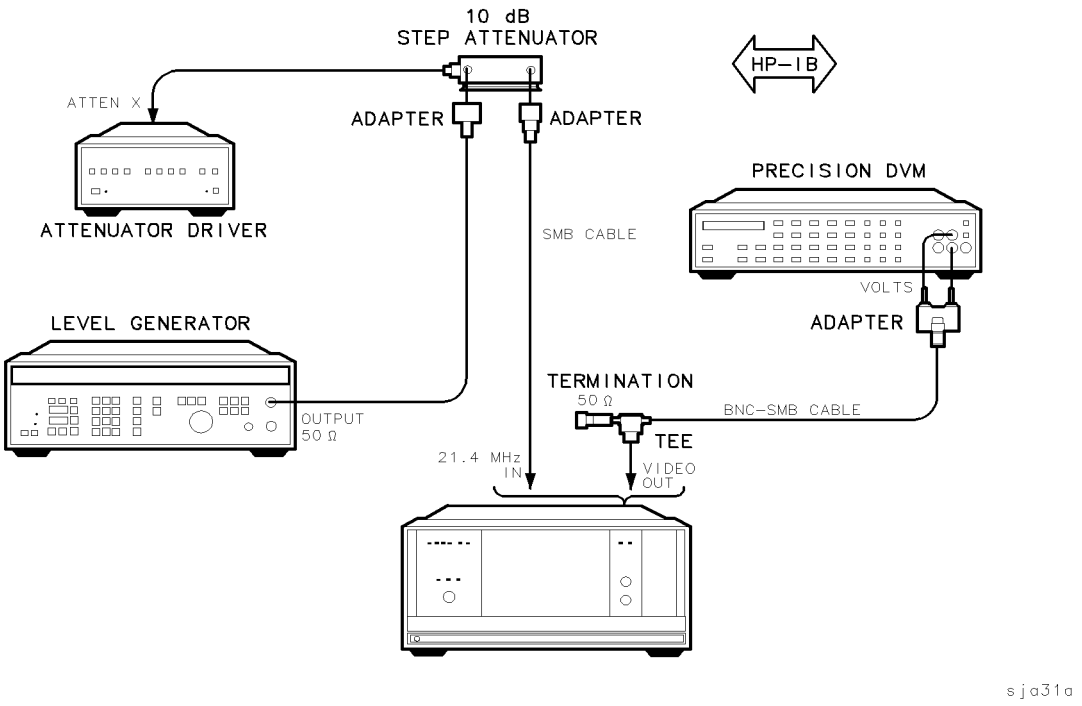

Figure 5-7. Log Amplifier Adjustment Setup

7. Module Gain Adjustment

Purpose

This procedure is used to adjust the overall gain of the IF section.

Description

The adjustment is done in two stages. The first stage sets the gain through all bandwidth filter stages. The gain is set by having the level generator provide a −5 dBm signal to the DUT rear panel 21.4 MHz input, while the measuring receiver measures −15 dBm at the DUT front panel auxiliary IF output.

To minimize the screen error, the second stage of the adjustment uses the precision DVM to measure the dc component of the DUT video output while the log offset is adjusted.

Each adjustment uses the computer on-screen "meter" to provide feedback to the operator. Each adjustment is completed when the on-screen cursor is within the box drawn on the computer display.

Equipment

Level generator ..... HP 3335A synthesizer/level generator
Measuring receiver .....HP 8902A measuring receiver
Signal sensor ..... HP 11722A sensor module
Precision DVM ..... HP 3456A digital multimeter

HP 70000 Series Components:
Mainframe .....HP 70001A mainframe, modified
Local oscillator .....HP 70900A/B local oscillator source

Accessories
HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-0077 50Ω N(f) to BNC(m)
HP 1250-1237 50Ω SMB(m) to BNC(f)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f)

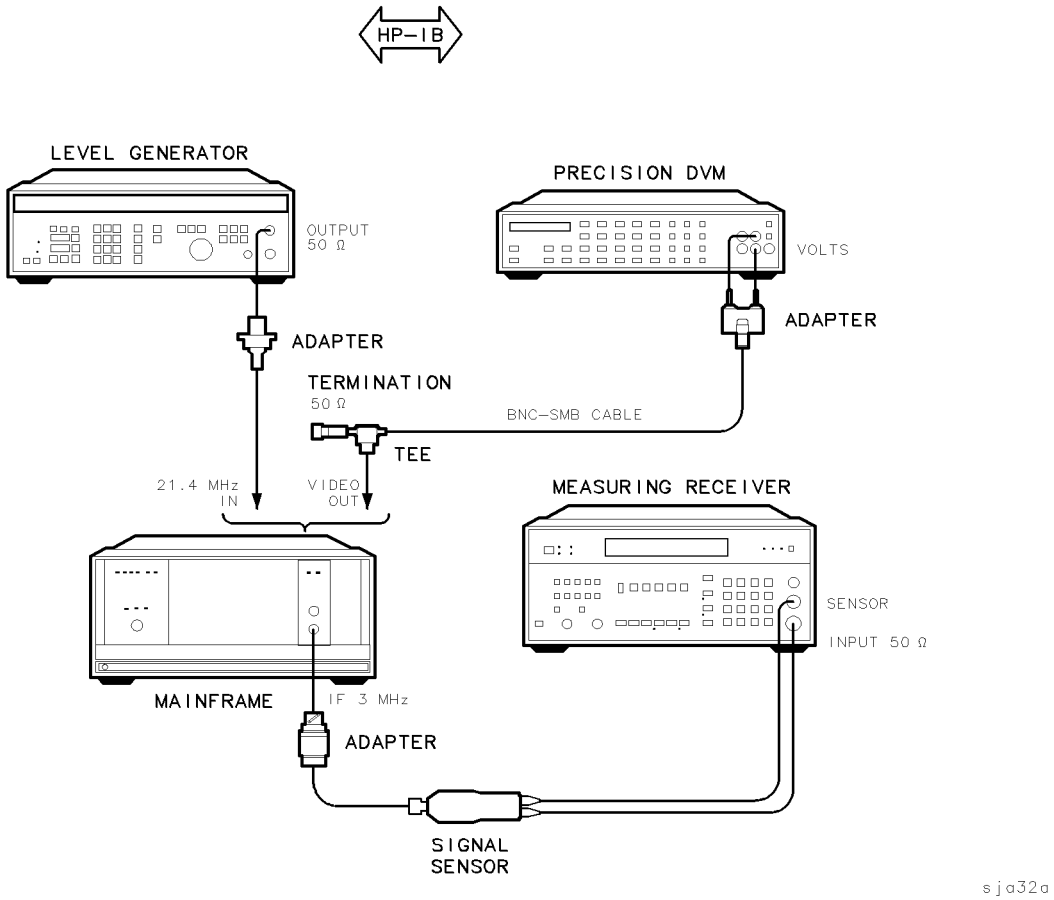

Figure 5-8. Module Gain Adjustment Setup

8. Bandwidth Filter Final Adjustment

Purpose

This procedure is used to adjust the scaling of the bandwidth DAC circuitry on the A3 MSIB Control board assembly. Manual adjustments at maximum and minimum bandwidths are necessary since the bandwidth DAC cannot compensate for these bandwidths.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. The level generator is tuned to the center of the selected resolution bandwidth filter. Then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination and used to monitor the video-output voltage.

The synthesized source is connected, through a cable and adapter, to the 18.4 MHz oscillator test point (A1J103). The frequency counter is connected to the limited IF output on the DUT rear panel. The frequency counter measures the output signal, and the actual frequency of the DUT 18.4 MHz oscillator is calculated. The frequency counter and synthesized source are used to "injection-lock" the 18.4 MHz oscillator to prevent its drift from adding an error term to the measurement during the adjustment.

As the level generator frequency is varied above and below the center of the filter, the precision DVM measures the DUT video-output voltage, and the −3 dB points are determined. The computer display is used to provide adjustment feedback to the operator. The adjustment is accomplished when the on-screen cursor is within the box drawn on the computer display.

This adjustment is made prior to performing adjustment "9. Bandwidth Filter DAC Optimization", which determines the proper DAC settings for achieving all other 3 dB bandwidths.

Equipment

Synthesized source	HP 8663A synthesized signal generator
Frequency counter	HP 5316A universal counter
Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter
Precision DVM	HP 3456A digital multimeter

HP 70000 Series Components:

Mainframe	HP 70001A mainframe, modified
Local oscillator	HP 70900A/B local oscillator source

Accessories

HP 1250-0676 precision 50Ω SMB(f) termination

Adapters
HP 1250-1476 precision 50Ω N(m) to BNC(f) *(2 required)*
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables
HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

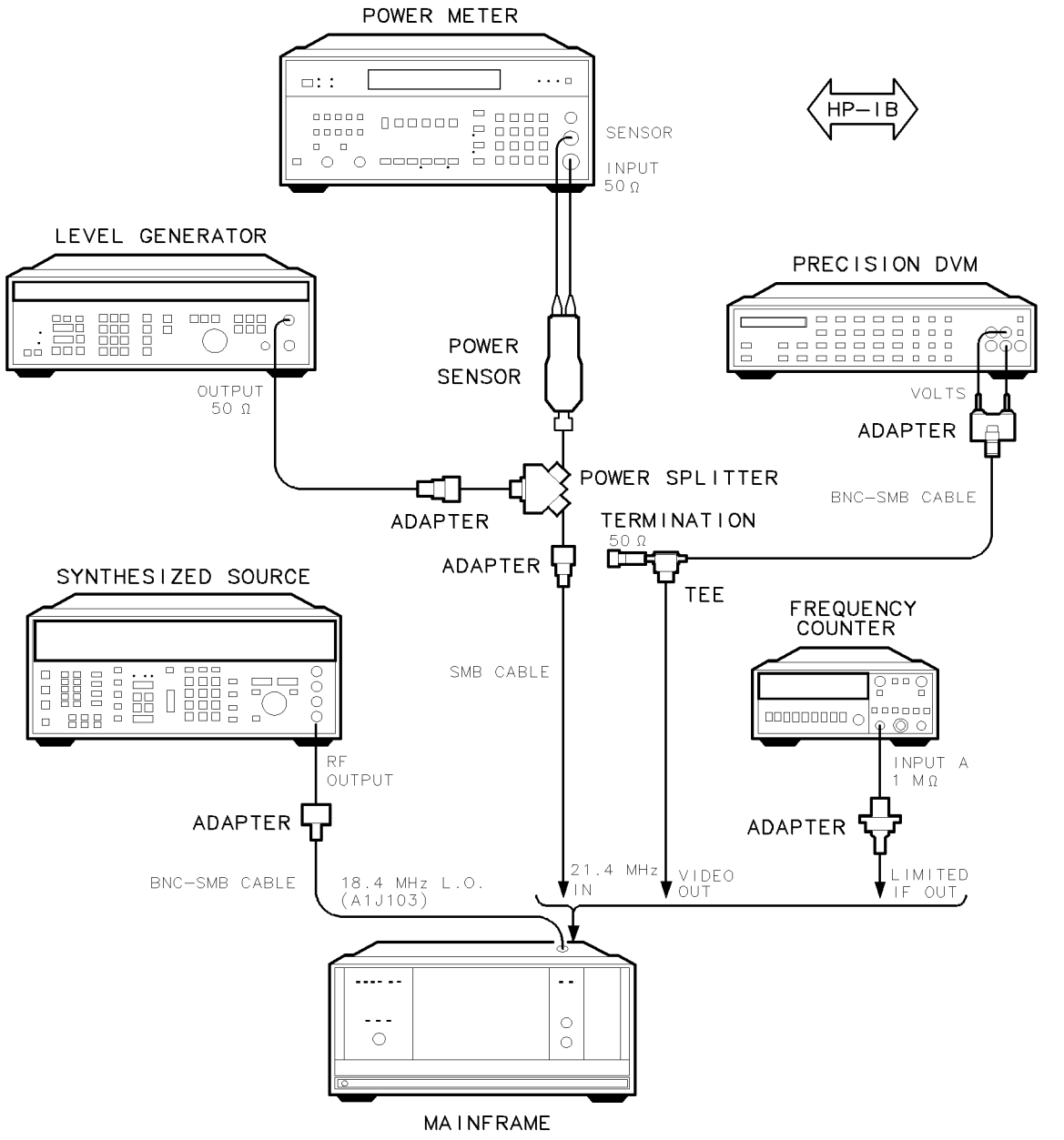

Figure 5-9. Bandwidth Filter Final Adjustment Setup

9. Bandwidth Filter DAC Optimization

Purpose

This procedure is used to determine the correct bandwidth-filter DAC settings required to achieve specified 3 dB bandwidths. The bandwidth DAC is an 8-bit DAC, which allows the necessary resolution to provide bandwidths in 10% increments.

Note Some older HP 70902A IF sections have only 7 bits available for DAC settings. These units still have 10% bandwidth increments, but were determined with less resolution. Because the HP 70902A IF section has both crystal and LC bandwidth filters, no 10% increments are available between the 3 kHz and 10 kHz bandwidths. This is the transition between the two filter types.

Description

The level generator is connected to the power splitter input. One power splitter output is connected to the 21.4 MHz input of the device under test (DUT). The other power splitter output is connected, through the power sensor, to the power meter. Then, with the aid of the power meter, the level generator is set to provide a power level of −5 dBm to the DUT 21.4 MHz input. The precision DVM is connected to the DUT video output across a 50Ω termination.

The synthesized source is connected, through a cable, to the 18.4 MHz oscillator test point (A1J103). The frequency counter is connected to the limited IF output on the DUT rear panel. The frequency counter measures the output signal, and the actual frequency of the DUT 18.4 MHz oscillator is calculated. The frequency counter and synthesized source are used to "injection-lock" the 18.4 MHz oscillator to prevent its drift from adding an error term to the measurement during the adjustment.

The bandwidth for the DAC number is measured sequentially. During each step of the routine, the level generator is centered in the bandwidth. Then the level generator frequency is varied up and down while the precision DVM measures the DUT video-output voltage. In this way, the 3 dB bandwidth for each DAC number is calculated for both LC and crystal bandwidths.

After these measurements are taken, the computer calculates the desired 10% increments and matches them with the DAC number most closely providing the desired bandwidth. If all is in order, these DAC numbers are entered into non-volatile memory inside the IF section, where they are available for use by the spectrum analyzer system as required.

Equipment

Synthesized source	HP 8663A synthesized signal generator
Frequency counter	HP 5316A universal counter
Level generator	HP 3335A synthesizer/level generator
Power meter	HP 8902A measuring receiver
Power sensor	HP 11722A sensor module
Power splitter	HP 11667A power splitter
Precision DVM	HP 3456A digital multimeter

HP 70000 Series Components:

Mainframe ..... HP 70001A mainframe, modified
Local oscillator ..... HP 70900A/B local oscillator source

Accessories

HP 1250-0676 precision 50Ω SMB(f) termination

Adapters

HP 1250-1476 precision 50Ω N(m) to BNC(f) *(2 required)*
HP 1250-0671 50Ω SMB(m) to N(m)
HP 1250-1391 50Ω SMB tee(f) (m) (m)
HP 1251-2277 50Ω BNC(f) to dual banana plug

Cables

HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
HP 8120-5016 160 mm (6.3 in) SMB(f) to SMB(f)
HP 85680-60093 123 cm (48.4 in) 50Ω BNC(m) to SMB(f) *(2 required)*

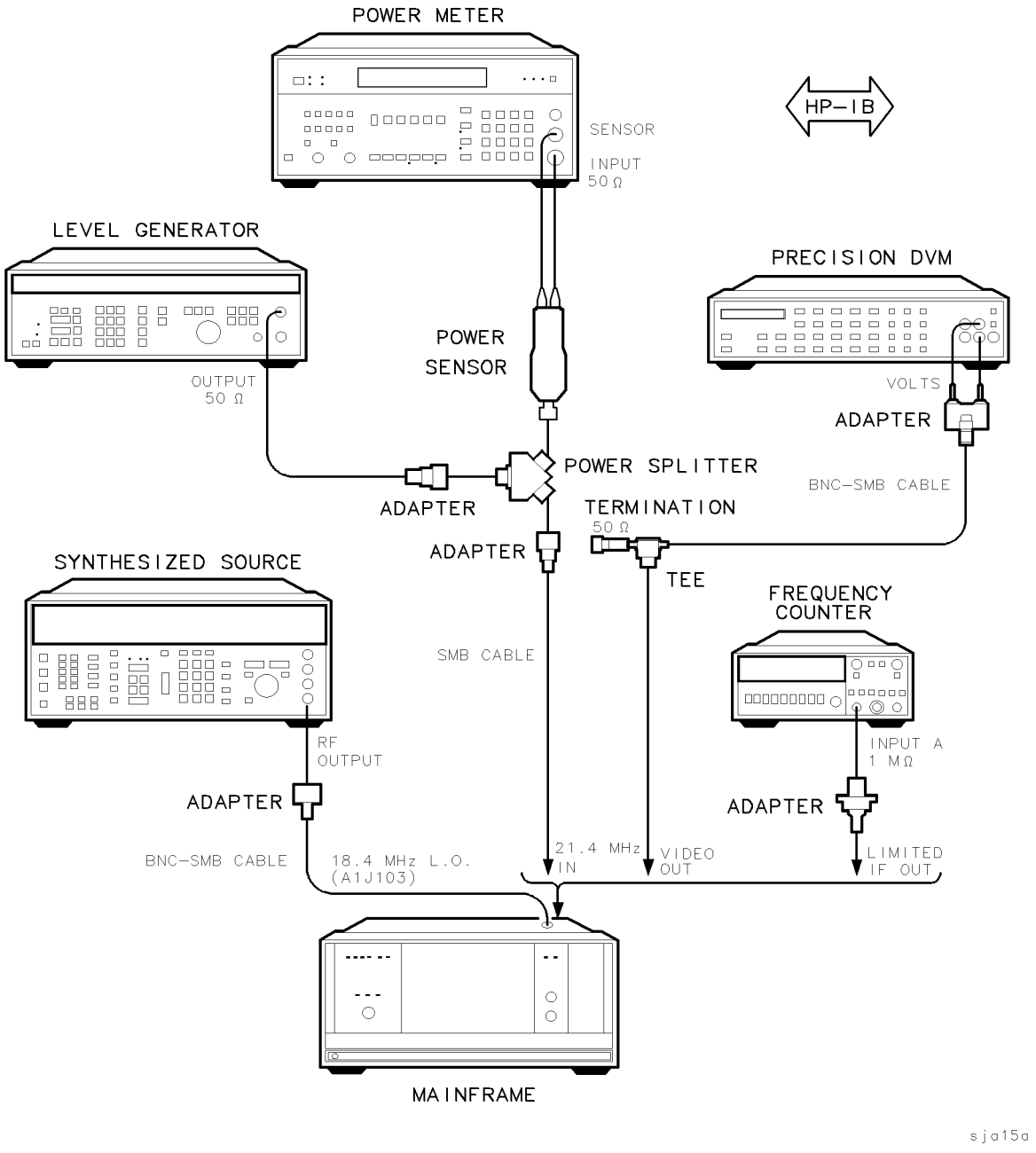

Figure 5-10. Bandwidth Filter DAC Optimization

6

Troubleshooting

Note If either of the HP 70902A IF section's side covers are removed, or if the screws in the covers are loosened, the full adjustment sequence for the HP 70902A IF section must be performed.

This chapter contains troubleshooting information for the HP 70902A IF section. This information includes the module-level block diagram and interconnect diagram.

- Adjustment Reference-Designation Information
- Power-Up Problems
- Error Codes
- Circuit Descriptions
- Troubleshooting the Board Assemblies
- Troubleshooting Verification Test Problems
- Troubleshooting Adjustment Problems

Note While troubleshooting, refer to the following illustrations: the overall block diagram located in this chapter, the major assembly and cable locations figure located in Chapter 9, and the board assembly schematic diagrams located in the *HP 70902A Component Level Information Packages*. The power levels, voltages, and so forth given in this chapter are for troubleshooting purposes only. Unless otherwise noted, the directions "left" and "right" in the instructions are given for an observer facing the instrument front panel.

Adjustment Reference-Designation Information

Refer to Table 6-1 for information about adjustment reference designations, and a cross-reference of adjustment cover and schematic names.

Table 6-1. Cross Reference of Adjustment Names

Board Assembly	Adjustment Name	Schematic Function Block	Schematic Reference Designation	
	On the Cover	In the Schematic		
A1	CA 1 dB	1 dB	Y	R338
Downconverter	CA 2 dB	2 dB	W	R328
	CA 4 dB	4 dB	V	R318
	CA 8 dB	8 dB	U	R308
	CA 30 dB	30 dB	Z	R350
	FILTER PROBE	(Not Named)	Between C and D	TP101
	INPUT FILTER 1	INPUT FILTER 1	B	L102
	INPUT FILTER 2	INPUT FILTER 2	B	L103
	INPUT FILTER 3	INPUT FILTER 3	B	L104
	INPUT FILTER 4	INPUT FILTER 4	B	L105
	LC1 AMPL	AMP1	N	R221
	LC1 BW	BW1	N	R223
	LC1 CTR	CF1	N	T201
	LC2 AMPL	AMP2	0	R222
	LC2 BW	BW2	N	R224
	LC2 CTR	CF2	0	T202
	MOD GAIN	IF GAIN	AA	R362
	XTAL GAIN	XTAL GAIN	AA	R356
	10 dB GAIN	10 dB	T	R286
	20 dB GAIN	20 dB	S	R285
	40 dB GAIN	20 dB GAIN	M	R148
	18.4 LO	LO FREQ	L	C150
	10 Hz AMPL	AMP1	P	R261

Table 6-1. Cross Reference of Adjustment Names (continued)

Board Assembly	Adjustment Name	Schematic Function Block	Schematic Reference Designation	
	On the Cover	**In the Schematic**		
	XTAL1BW	RBW1	P	R287
	XTAL1DIP	DIP1	P	C248
	XTAL1SYM	SYM1	P	C251
	XTAL2BW	RBW2	Q	R288
	XTAL2CTR	CF2	Q	C254
	XTAL2DIP	DIP2	Q	C249
	XTAL2SYM	SYM2	Q	C252
	XTAL3BW	BW3	R	R289
	XTAL3CTR	CF3	R	C255
	XTAL3DIP	DIP3	R	C250
	XTAL3SYM	SYM3	R	C253
A2	LC3 AMPL	LC3 AMPL	C	R161
Log Amplifier/	LC3 BW	LC3 BW	C	R159
Power Supply	LC3 CTR	LC3 BW	C	T103
	LC4 AMPL	LC4 AMPL	C	R162
	LC4 BW	LC4 BW	C	R160
	LC4 CTR	LC4 CTR	C	T104
	LOG ALIGN	LOG ALIGN	D	R220
	LOG OFFSET	LOG OFFSET	F	R302
	LOG SLOPE	LOG SLOPE	F	R313
	XTAL4 BW	X4 BW	A	R157
	XTAL4 CTR	X4 CTR	A	C139
	XTAL4 DIP	X4 DIP	A	C141
	XTAL4 SYM	X4 SYM	A	C137
	XTAL5 BW	X5 BW	B	R158
	XTAL5 CTR	X5 CTR	B	C140
	XTAL5 DIP	X5 DIP	B	C142
	XTAL5 SYM	X5 SYM	B	C138
A3	LC RB	(Not Named)	I	R112
MSIB Control	XTAL RB	(Not Named)	H	R111
The A4 Front Panel board assembly has no adjustable parts.				

Power-Up Problems

Use the following procedure if the HP 70902A IF section will not complete its power-up sequence, or if it causes the HP 70000 modular measurement system to hang up when the system is turned on. While troubleshooting, refer to the schematics and component location diagrams given in the *HP 70902A Component Level Information Packages*.

1. Turn off the mainframe power.
2. Disconnect any rear panel cabling and remove the HP 70902A IF section from the mainframe.
3. Remove the left-side module cover and the bottom module cover.
4. Install the extender module into the mainframe. (Refer to "Service Kit" in Chapter 2 for the extender module part number.)
5. Connect the HP 70902A IF section to the extender module.
6. Turn on the mainframe.
7. Skip to the next step if the yellow LED (A2DS403) near the bottom of the A2 board assembly is lit. If A2DS403 is not lit, refer to the A2 board assembly troubleshooting information later in this chapter. (This problem can also be caused by a short on another board assembly pulling down the +5 V power supply.)
8. Verify that approximately +5 V is present at A3J2 pin 1. If the voltage is not present, skip to the next step. If the voltage is present, the problem is caused by either a faulty rear panel cable (W9) or by a faulty A3 MSIB Control board assembly. Refer to the A3 board assembly troubleshooting information later in this chapter.
9. Verify that approximately +5 V is present at A2J102 pin 20. If the voltage is present, the cable from A2J102 pin 20 to A3J2 pin 1 is faulty. If the voltage is not present, refer to the A2 board assembly troubleshooting information later in this chapter.

Error Codes

The error codes generated by the HP 70902A IF section are listed below in numerical order.

Error Types	**Error Numbers**
Usage/Operating	2000 to 2999
Hardware Warning	6000 to 6999
Hardware Broken	7000 to 7999

Usage/Operating Errors

These errors occur when the instrument is used incorrectly.

2001 illegal CMD This error occurs when the processor on the A3 MSIB Control board assembly encounters a command that it does not recognize. This problem can be caused by the system master's sending an illegal command. However, if the error follows the HP 70902A IF section (moves with the module when it is moved to a different mainframe/system-master combination), the HP 70902A IF section is faulty. An open or shorted W9 cable assembly (from the rear panel to A3), or a faulty A3 MSIB Control board assembly, can also cause this error to occur.

2002 illegal parameter This error has the same causes as "2001 illegal CMD."

2006 parameter out of range This error has the same causes as "2001 illegal CMD."

2009 protocol error This error has the same causes as "2001 illegal CMD."

Hardware Warning Errors

These error codes report the status of the HP 70902A IF section hardware, or indicate that some of the hardware may be broken. These error codes indicate that measurement accuracy may be impaired.

6000 EAROM unprotected This error can be caused by the write-protect switch (on the left side of the module) being in the ENABLE (write) position. Use a non-metallic tool to set the switch to the PROTECT position. The switch is in the PROTECT position when the switch slide bar is closest to the PROTECT silk-screening on the side-cover, or, if the board is out of the module, when the switch slide bar is closest to the dot on the switch. If the error occurs when the write-protect switch is already in the PROTECT position, the A3 MSIB Control board assembly has a problem.

Hardware Broken Errors

The following error codes are generated by hardware or firmware failures within the module.

7000 ROM check error This error occurs when the A3 MSIB Control board assembly has a faulty ROM (A3U8) or a problem with circuitry related to A3U8.

Circuit Descriptions

Signal Path Description

A1 Board Assembly Signal Path

The 21.4 MHz input signal enters the module at A1J101. The 21.4 MHz signal passes through a 21.4 MHz bandpass filter that attenuates the unwanted mixing products present in the input signal. The signal is then mixed with an 18.4 MHz local oscillator signal to produce a 3 MHz IF signal. The 3 MHz signal then goes through a 6 MHz low-pass filter that attenuates unwanted mixing products.

The 3 MHz signal is sent through the first step gain amplifier, which provides 0 to 20 dB of gain, and then through the A1 board assembly's filters. The signal then goes through two more step gain amplifiers, which provide 20 and 10 dB of gain, respectively. The three step gain amplifiers are switched on in different combinations to provide up to 50 dB of gain in 10 dB steps. (Refer to the step gain amplifier information under "Troubleshooting the Board Assemblies.")

The 3 MHz IF signal then goes through a set of calibration attenuators (8, 4, 2, 1, and 30 dB). The calibration attenuators can be set from 0 to 15 dB and from 30 to 45 dB in 1 dB steps. The output from the 30 dB calibration attenuator goes into a variable-gain amplifier.

The variable-gain amplifier compensates for the difference in gain between the LC bandwidths (10 kHz to 300 kHz) and the crystal bandwidths (10 Hz to 3 kHz). (Refer to "LC and Crystal Filter Description.") The output from the variable-gain amplifier goes to the A2 board assembly through the W3 cable assembly.

A2 Board Assembly Signal Path

The 3 MHz signal comes onto the A2 board assembly at A2J101. It then passes through the A2 board assembly's filters, where the signal splits off to the front panel auxiliary IF 3 MHz output (A2J103). The main signal path continues from the filters to the log amplifier.

The log amplifier converts the linear 3 MHz signal into a detected logarithmic video signal. The signal for the rear panel limited IF output (A2J203) is split off here. The main signal path continues through to the video filter.

Part of the video filter's output is split off to the front panel auxiliary video output. The main video-output signal is sent to the rear panel video output.

A3 and A4 Board Assemblies

The A3 MSIB Control board assembly and the A4 Front-Panel board assembly are not in the signal path.

LC and Crystal Filter Description

There are a total of four LC filters and five crystal filters in the HP 70902A IF section IF signal path. Table 6-2 below indicates which board assembly each filter is located on.

Table 6-2. HP 70902A IF section LC and Crystal Filter Locations

Board Assembly	LC Filter	Crystal Filter
A1 Down Converter	LC Filter 1	Crystal Filter—Stage 1
	LC Filter 2	Crystal Filter—Stage 2
		Crystal Filter—Stage 3
A2 Log Amplifier/Power Supply	LC Filter 3	Crystal Filter 4
	LC Filter 4	Crystal Filter 5

For resolution bandwidths of 10 kHz to 300 kHz the crystal filters are "shorted"* out and the LC filters are left on. For resolution bandwidths of 10 Hz to 3 kHz, both the LC filters and the crystal filters are left on. Each filter stage has an LED that will turn on when the stage is shorted.

Varying the resistance of the PIN diodes in the LC- and crystal-filter circuits changes the "Q" of the filter and determines the filter bandwidth. The resistance is varied by using two DACs (digital-to-analog converters) on the A3 MSIB Control board assembly to change the current through the PIN diodes. One DAC, A3U101, controls the current through the PIN diodes in the LC filters; another DAC, A3U102, controls the current through the PIN diodes in the crystal filters.

The filter stages can be shorted out to allow the module to be adjusted. All stages except the one being adjusted are shorted. The CRYSTAL SHORT (XTAL1 through XTAL5) and LC SHORT (LC1 SHORT through LC4 SHORT) lines are set high by A3 in a sequence that leaves only one filter stage in the signal path at a time. The CRYSTAL SHORT and LC SHORT lines are not enabled during normal operation.

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* The term "shorted" used in relation to LC filters refers to "hard" forward-biasing the PIN diodes to make the filter bandwidth wide enough to be of no concern during adjustment. The term "shorted" used in relation to crystal filters refers to forward-biasing the switching diodes that (1) short out the crystal and the LC resonance, and (2) reverse-bias the PIN diodes to remove the bandwidth-adjust circuitry from the signal path.

Troubleshooting the Board Assemblies

A1 Downconverter Board Assembly

The function blocks referred to in this section are located in the A1 schematic diagram given in the *HP 70902A Component Level Information Packages*.

Input Buffer

The input buffer (function block **(A)**) provides a 50Ω input impedance for the HP 70902A IF section.

Common-base amplifier A1Q101 has its voltage gain determined by the ratio of the series emitter resistance to the collector load. Resistors A1R101 and A1R102 provide both the series emitter resistance and the module's 50Ω input impedance. The collector load consists of the combined impedance of A1R106 and the 21.4 MHz bandpass filter.

21.4 MHz Level Detector

The 21.4 MHz level detector (function block **(K)**) is a diagnostic tool and is not used during normal system operation. The level detector verifies that the signal in the IF path is at the correct power level.

High-gain common-emitter amplifier A1Q104 has a varying input impedance due to A1CR101 switching with each cycle of the IF signal. Resistor A1R123 decouples the base of A1Q104 from the emitter of A1Q102. This keeps the varying impedance from distorting the IF signal to the mixer.

The detector circuitry consists of A1L106, A1CR101, A1R124, and A1C125. Schottky diode A1CR101 only conducts on the positive half of the IF waveform. When A1CR101 conducts, A1C125 charges to the average value of the rectified 21.4 MHz IF signal. Resistor A1R124 determines how fast the detector can respond to changes in the input signal level.

18.4 MHz Local Oscillator

The 18.4 MHz local oscillator (function block **(L)**) is a crystal-controlled Colpitts oscillator. The oscillator is tuned to approximately 18.4 MHz by the parallel-resonant LC circuit consisting of parallel inductors A1L112 and A1L113, and series capacitors A1C147, A1C145, and A1C146. Crystal A1Y101, in the oscillator feedback, improves the "Q" and stability of the oscillator by controlling the oscillations.

Tuning-capacitor A1C150 is used to tune the 18.4 MHz oscillator that mixes with the 21.4 MHz to produce the 3 MHz mixer output frequency (function block **(D)**) until it is centered on the bandpass of the crystal filters (function blocks **(P)**, **(Q)**, and **(R)**).

Filters

There are two LC filters and three crystal filters on the A1 Downconverter board assembly. The filter bandwidths are determined by altering the "Q" of the filter. This is done by changing the resistance of the PIN diodes, thereby varying the current through them.

Table 6-3 below identifies each filter's function block and PIN-diode reference designations.

Table 6-3. A1 LC and Crystal Filter PIN Diodes

Filter Name	Function Block	PIN-Diode Reference Designations
LC Filter 1	(N)	A1CR201, A1CR202, A1CR203, and A1CR204
LC Filter 2	(0)	A1CR205, A1CR206, A1CR207, and A1CR208
Crystal Filter—Stage 1	(P)	A1CR212 and A1CR213
Crystal Filter—Stage 2	(Q)	A1CR215 and A1CR216
Crystal Filter—Stage 3	(R)	A1CR219 and A1CR220

An individual filter stage can be shorted by enabling the LC (LC SHORT) or XTAL (CRYSTAL SHORT) control line for the filter stage. LC filters are shorted by turning their PIN diodes all the way on. Crystal filters are shorted by turning on a set of diodes that shorts across the filter.

Table 6-4 below lists each filter's function block, short control line, and shorting diode reference designations. For more information about filters, refer to "LC and Crystal Filter Description," above.

Table 6-4. A1 Filter-Shorting Control Lines and Diodes

Filter Name	Function Block	Control Line	Shorting-Diode Reference Designations
LC Filter	(P)	LC1 SHORT	Refer to Table 6-3 above for the
LC Filter	(P)	LC2 SHORT	PIN diode reference designations.
Crystal Filter—Stage 1	(P)	XTAL1	A1CR221, A1CR222, A1CR232
Crystal Filter—Stage 2	(Q)	XTAL2	A1CR223, A1CR224, and A1CR233
Crystal Filter—Stage 3	(R)	XTAL3	A1CR225, A1CR226, and A1CR 234

Step-gain Amplifiers

The three switchable step gain amplifiers, one before and two after the filter stages, can be selected to provide improved measurement sensitivity for the HP 70000 Series modular spectrum analyzer system. The step gain amplifiers are shown in function blocks **(H)**,**(S)**, and **(T)**.

The 0 to 20 dB step gain (function block **(H)** provides either 0 or 20 dB of gain depending on whether the step gain control (function block **(M)**) turns A1Q107 off or on. When A1Q107 is turned off, A1Q109 has 0 dB of gain because its collector and emitter resistances are both 316Ω. When A1Q107 is turned on, A1Q107 and A1Q109 act as one transistor, with A1R144

and A1R150 in parallel, and the amplifier has approximately 20 dB of gain. The gain is adjusted using A1R148 (function block **(M)**).

The 20 dB step gain (function block **(S)**) is turned on when A1Q213 is turned on by A1U207. When A1Q213 is off, A1Q212 has 0 dB of gain because its collector and emitter resistances are both 316Ω. When A1Q213 is turned on, A1Q212 and A1Q213 act as one transistor, the emitter resistance drops, and the amplifier has approximately 20 dB of gain. The gain is adjusted using A1R285.

The 10 dB step gain (function block **(T)**) is turned on when A1Q215 is turned on by A1U207 (function block **(S)**). When A1Q215 is off, A1Q214 has 0 dB of gain because its collector and emitter resistances are both 316Ω. When A1Q215 is turned on, A1Q214 and A1Q215 act as one transistor, the emitter resistance drops, and the amplifier has approximately 10 dB of gain. The gain is adjusted using A1R286.

Table 6-5 below lists each step gain amplifier's function block and control line.

Table 6-5. Step-Gain Control Lines

Step Gain Name	Function Block	Control Line
0 to 20 dB Step Gain	(H)	SG1
20 dB Step Gain	(S)	SG2
10 dB Step Gain	(T)	SG3

Different step gain selections are enabled for different spectrum analyzer reference levels and attenuator settings.

Note The settings given in Table 6-6 can only be obtained if all system-calibration correction is turned off.

Table 6-6 has the spectrum analyzer reference-level settings on one axis and the spectrum analyzer attenuator settings on the other axis. To use the table, skim down the left side of the table until you find the appropriate reference-level listing, then go across the row until you reach the column headed by the appropriate attenuator setting. For example, a reference level of 0 dBm and an attenuator level of 40 dB result in a step gain of 20 dB.

Table 6-6. Step-Gain Amplifier Settings

Spectrum Analyzer Reference Level	Spectrum Analyzer Attenuator Setting							
	0 dB	10 dB	20 dB	+ 30 dB	**40 dB**	**50 dB**	**60 dB**	**70 dB**
0 dBm	0 dB	0 dB	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
−10 dBm	0 dB	0 dB	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB
− 20 dBm	10 dB	10 dB	10 dB	20 dB	30 dB	40 dB	50 dB	50 dB
−30 dBm	20 dB	20 dB	20 dB	30 dB	40 dB	50 dB	50 dB	50 dB
−40 dBm	30 dB	30 dB	30 dB	40 dB	50 dB	50 dB	50 dB	50 dB
−50 dBm	40 dB	40 dB	40 dB	50 dB	50 dB	50 dB	50 dB	50 dB
−60 dBm	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB
<−60 dBm	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB	50 dB

1 dB, 2 dB, 4 dB, 8 dB, and

30 dB Attenuators The 1 dB, 2 dB, 4 dB, 8 dB, and 30 dB calibration attenuators (function blocks **(Y)**,**(W)**, **(V)**, **(U)**, and **(Z)**) are used as the calibration standard for characterizing log-amplifier error during system calibration. These attenuators are set to 0 dB during normal spectrum analyzer use.

The 1 dB attenuator (function block **(Y)**) is switched on when A1CR304 is forward-biased by a low signal from the Attenuator Control (function block **(X)**). The unity-gain amplifier A1Q307 and buffer-amplifier A1Q308 act as buffers to isolate the circuit. Series-resistor A1R336 and shunt-resistors A1R337 and A1R338 provide approximately 1 dB of attenuation. The 1 dB attenuator is adjusted using A1R338.

The 2 dB attenuator (function block **(W)**) is switched on when A1CR303 is forward-biased by a low signal from the Attenuator Control (function block **(X)**). The unity-gain amplifier A1Q305 and buffer-amplifier A1Q306 act as buffers to isolate the circuit. Series-resistor A1R326 and shunt-resistors A1R327 and A1R328 provide approximately 2 dB of attenuation. The 2 dB attenuator is adjusted using A1R328.

The 4 dB attenuator (function block **(V)**) is switched on when A1CR302 is forward-biased by a low signal from the Attenuator Control (function block **(X)**). The unity-gain amplifier A1Q303 and buffer-amplifier A1Q304 act as buffers to isolate the circuit. Series-resistor A1R316 and shunt-resistors A1R317 and A1R318 provide approximately 4 dB of attenuation. The 4 dB attenuator is adjusted using A1R318.

The 8 dB attenuator (function block **(U)**) is switched on when A1CR301 is forward-biased by a low signal from the Attenuator Control (function block **(X)**). The unity-gain amplifier A1Q301 and buffer-amplifier A1Q302 act as buffers to isolate the circuit. Series-resistor A1R306 and shunt-resistors A1R307 and A1R308 provide approximately 8 dB of attenuation. The 8 dB attenuator is adjusted using A1R308.

The 30 dB attenuator (function block **(Z)**) is switched on when A1CR305 is forward-biased by a low signal from the Attenuator Control (function block **(X)**). The unity-gain amplifier A1Q309 and buffer-amplifier A1Q310 act as buffers to isolate the circuit. Series-resistors A1R346, A1R348, and A1R350, and shunt-resistors A1R347 and A1R349, provide approximately 30 dB of attenuation.

The 30 dB attenuator is adjusted using A1R350.

Attenuator Control

The A3 MSIB Control board assembly uses the attenuator control (function block **(X)**) to turn on the 1 dB, 2 dB, 4 dB, 8 dB, and 30 dB calibration attenuators (function blocks **(Y)**, **(W)**, **(V)**, **(U)** and **(Z)**). Table 6-7 below lists each attenuator's function block and control line.

Table 6-7. Calibration Attenuator Control Lines

Attenuator Name	Function Block	Control Line
1 dB Attenuator	(Y)	1 dB
2 dB Attenuator	(W)	2 dB
4 dB Attenuator	(V)	4 dB
8 dB Attenuator	(U)	8 dB
30 dB Attenuator	(Z)	30 dB

Variable-Gain Amplifier

The variable-gain amplifier (function block **(AA)**) is adjusted to compensate for the difference in gain between the LC bandwidths and the crystal bandwidths. The output of the variable-gain amplifier goes to the A2 board assembly.

A2 Log Amplifier/Power Supply Board Assembly

The function blocks referred to in this section are located in the A2 schematic diagram given in the *HP 70902A Component Level Information Packages*.

Filters

There are two LC filters and two crystal filters on the A2 Log Amplifier/Power Supply board assembly. The filter bandwidths are determined by altering the "Q" of the filter. This is done using by changing the resistance of the PIN diodes by varying the current through them.

Table 6-8 below identifies each filter's function block and PIN-diode reference designations.

Table 6-8. A2 LC and Crystal Filter PIN Diodes

Filter Name	Function Block	PIN-Diode Reference Designations
LC Filter 3	(C)	A2CR109,110,111, and 112
LC Filter 4	(C)	A2CR113, 114, 115, and 116
Crystal Filter 4	(A)	A2CR101 and 104
Crystal Filter 5	(B)	A2CR105 and 108

An individual filter stage can be shorted by enabling the LC (LC SHORT) or XTAL (CRYSTAL SHORT) control line for the filter stage. LC filters are shorted by turning their PIN diodes all the way on. Crystal filters are shorted by turning on a set of diodes that shorts across the filter.

Table 6-9 below lists each filter's function block, filter-shorting control line, and filter-shorting diodes. For more information about the filters, refer to "LC and Crystal Filter Description" on the previous pages.

Table 6-9. A2 Filter-Shorting Control Lines and Diodes

Filter Name	Function Block	Control Line	Shorting-Diode Reference Designations
LC Filter 3	(C)	LC3 SHORT	Refer to Table 6-7 above for the
LC Filter 4	(C)	LC4 SHORT	PIN diode reference designations.
Crystal Filter 4	(A)	XTAL4	A2CR117, A2CR118, and A2CR121
Crystal Filter 5	(B)	XTAL5	A2CR119, A2CR120, and A2CR122

Log Amplifier/Detection

The log amplifier and detection functions are performed by log-amplifier thick-film hybrid circuits A2U201 and A2U202 (function block **(D)**). Each log-amplifier circuit contains four separate log-amplifier stages that have a gain of approximately 12.5 dB each. The output of each log-amplifier stage has a detector circuit that adds a positive dc offset, equal to the peak of the signal, to the 3 MHz IF signal. The 3 MHz signal, with the dc offset, then goes into a low-pass filter that removes the 3 MHz component from the signal path. The dc output of each individual stage is summed with the outputs from the other stages. This leaves, as the output of the log-amplifier (function block **(D)**), a logged dc level proportional to the amplitude of the 3 MHz signal into A2U201 and A2U202.

Limited IF Output

The log-amplifier circuit A2U202 (function block **(D)**) also provides a 3 MHz square wave that goes to the limited IF output on the module's rear panel.

Video Filter

The dc level from the log amplifier goes into a fixed 500 kHz video filter (function block **(F)**), and then to the programmable video filter (function block **(G)**). The video filter can be selected in a 1, 3, 10 sequence with a 3 to 300 kHz video-bandwidth range. The A3 MSIB

Control board assembly uses the VBR1, VBR2, and VBC1 through VBC6 control lines to set the video bandwidth. Three ICs, A2U303 through A2U305 (function block **(G)**), use the control-line information to switch to the selected video bandwidth. Table 6-10 below lists the video-bandwidth selection control lines, and identifies the IC reference designation and pin number for each control line.

Table 6-10. Video-Bandwidth Selection Control Lines

Control Line	VBR1	VBR2	VBC1	VBC2	VBC3	VBC4	VBC5	VBC6
IC Reference Designation	A2U303	A2U303	A2U304	A2U304	A2U305	A2U304	A2U305	A2U304
IC Pin Number	14	1	10	8	10	6	8	4

There are two different sets of video-bandwidth control-line logic settings. HP 70902A IF section firmware versions earlier than 850912 have settings for the 100-kHz bandwidth that are different from the settings for firmware versions 850912 and later. Table 6-11 and Table 6-12 below show the logic settings for both firmware versions.

Use one of the following procedures to find out which HP 70902A IF section firmware version you have. (The HP 70902A IF section must be configured in a system with an HP 70900A/B local oscillator source as the system master for this procedure to work.)

HP 70900A local oscillator source firmware version of 870501 or earlier:

1. Press MENU
2. Press `instr disp`
3. Press `SHOW CONFIG`

   The firmware version of all the modules in the system should now be shown. The firmware version of the modules can be listed in the YYMMDD format (in other words, 850912) or as a date format (in other words, 09/12/85).

HP 70900A local oscillator source firmware version of 880314:

1. Press MENU
2. Press `Misc`
3. Press `catalog`
4. Press `CONFIG`

   The firmware version of all the modules in the system should now be shown. The firmware version of the modules can be listed in the YYMMDD format (for example, 880314) or as a date format (for example, 03/14/88).

HP 70900A/B local oscillator source firmware version of 911021 or later:

1. Press MENU
2. Press `STATE`
3. Press `MORE`
4. Press `MORE`

5. Press SHOW STATES

6. Press CONFIG

The firmware version of all the modules in the system should now be shown. The firmware version of the modules can be listed in the YYMMDD format (for example, 911021) or as a date format (for example, 10/21/91).

Table 6-11.
Video-Bandwidth Control-Line Logic Settings
(Firmware Versions Earlier than 850912)

Video Bandwidth Selection	Control Lines							
	VBR1	**VBR2**	**VBC1**	**VBC2**	**VBC3**	**VBC4**	**VBC5**	**VBC6**
300 kHz	Low	High	High	High	High	High	High	High
100 kHz	Low	High	High	High	High	Low	High	High
30 kHz	High	Low	High	High	High	High	Low	High
10 kHz	High	Low	High	High	High	Low	High	High
3 kHz	High	Low	High	High	Low	High	High	High
1 kHz	High	Low	High	Low	High	High	High	High
300 Hz	High	High	High	High	High	High	Low	High
100 Hz	High	High	High	High	High	Low	High	High
30 Hz	High	High	High	High	Low	High	High	High
10 Hz	High	High	High	Low	High	High	High	High
3 Hz	High	High	Low	High	High	High	High	High

Table 6-12.
Video-Bandwidth Control-Line Logic Settings
(Firmware Versions 50912 and Later)

Video Bandwidth Selection	Control Lines							
	VBR1	VBR2	VBC1	VBC2	VBC3	VBC4	VBC5	VBC6
300 kHz	Low	High	High	High	High	High	High	High
100 kHz	Low	High	High	High	High	High	Low	High
30 kHz	High	Low	High	High	High	High	Low	High
10 kHz	High	Low	High	High	High	Low	High	High
3 kHz	High	Low	High	High	Low	High	High	High
1 kHz	High	Low	High	Low	High	High	High	High
300 Hz	High	High	High	High	High	High	Low	High
100 Hz	High	High	High	High	High	Low	High	High
30 Hz	High	High	High	High	Low	High	High	High
10 Hz	High	High	High	Low	High	High	High	High
3 Hz	High	High	Low	High	High	High	High	High

Power Supplies

The A2 board assembly provides the ±12 V and the +5 V power supplies for the HP 70902A IF section. Remove jumper wires A2J401 through J403 to isolate the A2 power-supply section from the signal-processing section and allow easier troubleshooting. The jumper wires are located near the three yellow LEDs (A2DS401, A2DS402, and A2DS403).

Use the following procedure to troubleshoot the A2 power supplies. Refer to the removal and replacement procedures in Chapter 7, and the schematics and component location diagrams in the *HP 70902A Component Level Information Packages*.

1. Turn off the mainframe power.
2. Disconnect the rear panel cabling and remove the HP 70902A IF section from the mainframe.
3. Install the extender module into the mainframe. Refer to "Service Kit" in Chapter 2 for the part number of the extender module.
4. Remove the bottom cover from the HP 70902A IF section to allow access to the A3 board assembly.
5. Connect the HP 70902A IF section to the extender module.
6. Turn the mainframe power back on.
7. Measure the voltages at A3J2 pins 1, 19, and 20. The voltage at pin 1 should be +5 V, at pin 19 it should be −12 V, and at pin 20 it should be +12 V. If all of these voltages are present, the A2 power supplies are working properly. If only some, but not all, of the

voltages are present, skip to step 13 below. If none of the voltages are present, continue with step 8 below.

8. Check the module fuse using the procedure below:
   a. Turn the mainframe power off.
   b. Remove the cover on the left side of the module to allow access to the A2 board assembly.
   c. Remove the screws that hold the A2 board assembly in place.
   d. Remove the A2 board assembly from the module.
   e. Replace the fuse if it is blown. (The fuse is located at the bottom rear of the A2 assembly near A2T401.)
9. Replace the A2 board assembly in the module and replace the screws that hold the board in place.
10. Turn on the mainframe power.
11. Verify that there is a 40 kHz sine wave of approximately 36 V peak-to-peak at the fuse. If the sine wave is present and there are still no power supplies present at A3J2 pins 1, 19, and 20, then there is a problem on the A2 board assembly. If the sine wave is not present, continue with step 12 below.
12. Check A2J404 pins 1 and 2 for the presence of the 40 kHz sine wave. If the sine wave is not present, there is a problem with W9, the rear panel interconnect cable. Refer to Chapter 7 and Chapter 8 for information needed to identify and replace W9.
13. If some, but not all, of the power supplies are present at A3J2 pins 1, 19, and 20, turn the mainframe power off.
14. Remove the screws that hold the A3 board assembly in the module.
15. Remove A3 from the module.
16. Disconnect W7 and W8 from A3J2.
17. Turn the mainframe power back on.
18. Check the voltages at A2J102 pins 1, 2, and 20 (or the equivalent pins on W7 or W8). The voltage at A2J102 pin 1 should be +12 V, at pin 2 it should be −12 V, and at pin 20 it should be +5 V. If these voltages are not present, there is a problem with the A2 board assembly. If the voltages are present, continue with step 19 below.
19. Reconnect W7 and W8 to A3J2.
20. Disconnect W5 and W6 from A3J1.
21. Check the voltages at A3J2 pins 1, 19, and 20. The voltage at A3J2 pin 1 should be +5 V, at pin 19 it should be −12 V, and at pin 20 it should be +12 V. If the voltages are present, there is a problem with the A1 Downconverter board assembly. If the voltages are not present, continue with step 22 below.
22. Remove W4 from A3J4.
23. Check the voltages at A3J2 pins 1, 19, and 20. The voltage at A3J2 pin 1 should be +5 V, at pin 19 it should be −12 V, and at pin 20 it should be +12 V. If the voltages are present, there is a problem with the A4 Front-Panel board assembly. If the voltages are not present, there is a problem on the A3 MSIB Control board assembly.

A3 MSIB Control Board Assembly

The function blocks referred to in this section are located in the A3 schematic diagram given in the *HP 70902A Component Level Information Packages*.

HP-MSIB Interface

The system master sends information over HP-MSIB through W9 to the HP-MSIB interface (function block **(A)**). Integrated circuit A3U6 functions as a buffer for HP-MSIB.

Interface IC A3U7 allows communication between HP-MSIB and the CPU (function block **(C)**). Table 6-13 below lists the A3U7 inputs and outputs.

Table 6-13. A3U7 Inputs and Outputs

Signal Name	Signal Description
M0 through M8	Bidirectional HP-MSIB (input or output signals)
MDRV	HP-MSIB data direction control
MCLK, RTS, CTS, ACK, BSY	HP-MSIB handshake lines (HP-MSIB CLocK, Ready To Send, Clear To Send, ACKnowledge, BuSY)
IREQ	Interrupt request line to the CPU
RESET	Reset line from the system master
CS, RD, WR	Control inputs for the CPU (Chip Select, ReaD, and WRite)
A0 through A2	Address lines
D0 through D7	Bidirectional CPU data bus

When A3U7 receives data from HP-MSIB, it reformats the data and then interrupts the CPU by setting IREQ low. When IREQ is set low, the CPU does the following things that affect A3U7:

- Addresses lines A0 through A2
- Sets the CS line low
- Puts an active-low strobe pulse on the RD line
- Reads the data from lines D0 through D7

The control signals for step gain selection, filter settings, and programmable attenuators are sent through W5 and W6 to A1J301.

Diagnostics Interface

The diagnostics interface (function block **(B)**) consists of a comparator IC (A3U11) and a buffer IC (A3U2). The comparators sense the signal level at the detectors on the A1 and A2 board assemblies. If the signal level is too low, the comparators toggle to a logical low. When the CPU requests the detector information, the buffer IC passes the information to the data bus for the CPU to read.

Central Processing Unit (CPU)

The processor IC A3U12 (function block **(C)**) contains basic module-operation algorithms that are common to all HP 70000 modular measurement system modules. The program ROM A3U8 contains information specific to the HP 70902A IF section (for example, IO routines, bandwidth values, and firmware revision date).

The processor clock is a nominal 5 MHz, and is controlled by the π network at A3U12 pins 2 and 3.

When the IREQ line at A3U12 pin 6 is set to a logical low, the processor stops its current routine and addresses A3U7 for data. When the processor is finished reading and processing the data from A3U7, the CPU continues with the routine at the place it left off.

When the RESET line at A3U12 pin 4 is set to a logical low, any active interrupt is disabled and the processor's memory pointer is sent to the beginning of its internal ROM for new instructions.

At module power-up, A3U12 pin 36 is set to a logical high. This causes the module address, as set by S1, to be present at A3U12 pins 27 to 34. The processor then transmits this address information to A3U7 (function block **(A)**).

The signals at A3U12 pins 37 and 38 drive the front panel ERRor and ACTive indicators.

The processor A3U12 uses its output pins to control its reading and writing operations. The A3U12 output pins are WRite (pin 10), ReaD (pin 8), Program Store ENable (pin 9), P2-2 (pin 23), and P2-3 (pin 24). The A3U1 and A3U10 gates determine which operations can occur at the same time.

The address latch A3U9 receives address information from the processor on lines D0 through D7 (A3U9 pins 3, 4, 7, 8, 13, 14, 17, and 18). The falling edge of the waveform on the Address Latch Enable line (A3U12 pin 11) latches the address information into A3U9. The address that is seen on the address bus is the output of A3U9 on lines A0 through A7 (A3U9 pins 2, 5, 6, 9, 12, 15, 16, and 19).

The program ROM A3U8 requires an 11-bit address. Eight of those bits are received from A3U9 lines A0 through A7 as mentioned above. The processor A3U12 provides the other three address bits, A8 (A3U8 pin 23), A9 (A3U8 pin 22), and A10 (A3U8 pin 19). After A3U8 receives the address information, the data bus clears. Then, A3U12 puts a low pulse on the Program Store ENable line (A3U12 pin 9) to enable it, and A3U8 places an 8-bit instruction onto the data bus. The processor A3U12 then performs the action dictated by this instruction.

Calibration Attenuator Controls

The calibration attenuators are on the A1 board assembly. The CPU uses the CA 30 dB line (A3U5 pin 9 in function block **(D)**) to control the 30 dB calibration attenuator, and the CA 1 dB, CA 2 dB, CA 4 dB, and CA 8 dB (A3U3 pins 3, 4, 5, and 6 in function block **(E)**) to control the other four calibration attenuators.

If both the A1 and A6 lines (A3U3 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U3 pin 7) will put the state of data input lines D4 through D7 (A3U3 pins 14, 13, 12, and 11) onto the CA DB output lines (A3U3 pins 3 through 6).

Filter Controls

The CPU uses latch A3U4 (function block **(F)**) to control LC1 SHORT through LC4 SHORT lines. (In the A1 schematic, the LC SHORT lines are called LC1 SHORT through LC4 SHORT.) If both the A0 and A6 lines (A3U4 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U4 pin 7) will put the state of data input lines D0 through D3 (A3U4 pins 14, 13, 12, and 11) onto the output lines (A3U4 pins 3 through 6).

Latches A3U18 and A3U19 (function block **(G)**) are used to set the video bandwidth on the A2 board assembly. If both the A2 and A6 lines (A3U18 and A3U19 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U18 and A3U19 pin 7) will put the state of data input lines D0 through D3 (A3U18 and A3U19 pins 14, 13, 12, and 11) onto the output lines (A3U18 and A3U19 pins 3 through 6).

Latches A3U13 and A3U14, and DAC A3U102 (function block **(H)**), are used to control the bandwidth of the crystal filters. If both the A2 and A7 lines (A3U13 and A3U14 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U13 and A3U14 pin 7) will put the state of data input lines D4 through D7 (A3U13 and A3U14 pins 14, 13, 12, and 11) onto the A3U13 and A3U14 output lines (A3U13 and A3U14 pins 3 through 6). DAC A3U102 converts the inputs from A3U13 and A3U14 to a dc current that is proportional to the numerical value of the input. The filter bandwidth is adjusted using A3R111 to change the amount of the DAC's output current.

Latches A3U15 and A3U16, and DAC A3U101, (function block **(I)**) are used to control the bandwidth of the LC filters. If both the A1 and A7 lines (A3U15 and A3U16 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U15 and A3U16 pin 7) will put the state of data input lines D4 through D7 (A3U15 and A3U16 pins 14, 13, 12, and 11) onto the A3U15 and A3U16 output lines (A3U15 and A3U16 pins 3 through 6). DAC A3U101 converts the inputs from A3U15 and A3U16 to a dc current that is proportional to the numerical value of the input. The filter bandwidth is adjusted using A3R101 to change the amount of the DAC's output current.

Operational amplifier A3U103 (function block **(J)**) converts the output currents from the DACs in function blocks **(H)** and **(I)** to a voltage. This voltage drives the bandwidth-adjustment circuits on the A1 and A2 board assemblies.

Latch A3U17 (function block **(L)**) is used to control the XTAL 1 SHORT through XTAL4 SHORT lines. The latch used to control the XTAL5 SHORT line is in function block **(D)**. (In the A1 schematic, the XTAL SHORT lines are called XTAL1 through XTAL5.) If both the A0 and A7 lines (A3U17 pins 10 and 9) are low, the rising edge of a pulse on the WRite line (A3U17 pin 7) will put the state of data input lines D0 through D3 (A3U17 pins 14, 13, 12, and 11) onto the output lines (A3U17 pins 3 through 6).

Refer to "LC and Crystal Filter Description" on the previous pages for more information about the filters.

A4 Front-Panel Board Assembly

The +5 V power supply and the signals that drive the ERRor and ACTive LEDs come over W4 from the A3 board assembly to the A4 board assembly. If one or both of the LEDs do not function properly, make sure that the LED drive signals and the +5 V power supply are present at A4J1. If they are present, there is a problem on the A4 board assembly.

Troubleshooting Verification Test Problems

Use the following information to troubleshoot an HP 70902A IF section that has failed one or more of its module verification tests. The information in this section is listed in the same order as the module verification tests given in chapter 3. The module verification tests that are more general are run first, then the tests that check specific functional areas of the module are run. Be sure to run the entire sequence of tests.

Note These tests must be made while the HP 70902A IF section's operating temperature and airflow is stabilized. To allow the HP 70902A IF section to stabilize, install it in a modified mainframe and apply power to the mainframe for at least half an hour before attempting any tests. For information on modifying the mainframe, refer to "Service Kit" in Chapter 2.

A setup check is run by the software before the test is begun. If the prompt `Setup Check Fails` appears near the bottom of the screen when the test program begins, recheck the setup. The prompt may also appear if the module is faulty or far out of alignment, but, usually, the prompt is the result of an incorrect setup. The setup check failure will also list the value that was measured and what it expected to measure. Because the setup-check limits are quite wide (to allow broken modules to be tested), the setup check may not catch every incorrect setup configuration.

Test 1. Front-Panel LED Check

This test verifies the operation of the HP 70902A IF section front panel ACTive and ERRor LEDs. The +5 V power supply, and the signals that drive the ERRor and ACTive LEDs, come from the A3 board assembly over W4. If this test fails when the LED drive signals and the +5 V power supply are present at A4J1, there is a problem on the A4 board assembly. Make sure that W4 is properly connected to the front panel board assembly.

Test 2. DUT Calibration

This routine characterizes the module's linearity error, resolution bandwidth switching error, and gain error. This information is stored for use when testing the module. If this test fails, run the adjustment procedures.

Test 3. Average Noise Test

This test measures the module's displayed average noise. If this test fails, use the crystal filter adjustments to find a filter stage that contributes more noise than the other stages.

Test 4. Corrected Sensitivity Test

This test measures the corrected sensitivity of the HP 70902A IF section. The results of this test are tied to the results of the average noise test.

Test 5. Third Order Intercept Test

This test measures the third-order intermodulation of the HP 70902A IF section. If this test fails, use an active probe to trace the IF signal path until the faulty stage is found.

Test 6. Spurious Responses Test

This test measures the spurious and image responses of the HP 70902A IF section. If this test fails, there may be a faulty filter, or poor isolation.

Test 7. Resolution Bandwidths Test

This test measures the bandwidth, center frequency, amplitude, and shape factor of the HP 70902A IF section. If this test fails there are one or more bad filter poles. Run the adjustment procedures.

Test 8. Video Bandwidths Test

This test verifies the operation of the video-bandwidth filters, and the dc error of the video filters. If this test fails, verify the video-bandwidth switching logic. Refer to the video-bandwidth information in the A2 troubleshooting section on the previous pages.

Test 9. Diagnostic Detector Check

This test checks the module's two fault detectors to verify that they will turn on when the module input level is within a certain power range.

Level Detector 1

The test fails when the input signal level is between −13 dBm and −8 dBm, and the voltage at A3U11 pin 5 is less than +0.1 V. This voltage originates from function block **(K)** of the A1 Downconverter board assembly.

Level Detector 2

The test fails when the input signal level is between −20 dBm and −8 dBm, and the voltage at A3U11 pin 8 is less than +0.1 V. This voltage originates from function block **(G)** of the A2 Log Amplifier/Power Supply board assembly.

Test 10. Module Gain Test

This test measures the IF gain error of the HP 70902A IF section. If this test fails, run the adjustment procedures.

Test 11. Calibration Attenuator Test

This test measures the accuracy of the calibration attenuators in the HP 70902A IF section. If this test fails, run the adjustment procedures.

Test 12. Corrected Module Fidelity Test

This test measures the corrected log fidelity of the module. If this test fails, there could be a problem with the log-amplifier ICs A2U201 and A2U202, or related circuitry. Make sure that the covers, top clamp, and module casting are clean and making good contact. Refer to Chapter 7, "Replacement Procedures" for information about the critical contact areas.

Test 13. Crystal Spurs Test

This test measures the amplitude of any spurious response generated by the 3 MHz crystals used in the module's resolution bandwidth filters. The most likely cause for this test's failing is a faulty 3 MHz crystal. If one of the crystals is faulty, the entire set of five crystals (A1Y1A, A1Y1B, A1Y1C, A2Y1D, and A2Y1E) must be replaced.

Test 14. Rear-Panel Auxiliary Port Test

This test measures the gain from the 21.4 MHz input port to the 21.4 MHz output port, and the flatness of the 21.4 MHz output. If this test fails, the problem is most likely to be found in the A1 Downconverter board assembly's function block **(J)**.

Test 15. Front-Panel Auxiliary Port Test

This test measures the gain from the 21.4 MHz input port to the 3 MHz output port. If this test fails, perform the module adjustments, specifically the input filter, calibration attenuator, and filter adjustments. If the adjustments pass, there is a problem in function block **(AA)** of the A1 board assembly.

Test 16. Auxiliary Video Test

After the video-output signal has been set to a specific output level, this test verifies that the front panel auxiliary video output is at the correct voltage level. If this test fails, there is a problem in function block **(G)** of the A2 board assembly.

Test 17. Limited IF Output Check

This test verifies that the rear panel limited IF output is correct. If only this test fails, there may be a broken connection between A2U202 and the rear panel limited if output.

Test 18. 18.4 MHz Oscillator Stability Test

This test measures the stability of the module's 18.4 MHz local oscillator. If this test fails, make sure that the module is properly installed in the mainframe. If the module is properly installed, the failure indicates either a faulty 18.4 MHz crystal, or a problem in the related tank circuitry.

Troubleshooting Adjustment Problems

Use the following information to troubleshoot the HP 70902A IF section if it cannot be adjusted within the module adjustment limits. The troubleshooting information in this section is given in the same order as the adjustment procedures given in chapter 4. The adjustments are organized in the software menu such that a given adjustment will generally be dependent on the ones before it.

Note These adjustments must be made while the HP 70902A IF section's operating temperature and airflow is stabilized. To allow the HP 70902A IF section to stabilize, install it in a modified mainframe and apply power to the mainframe for at least half an hour before attempting any tests. For information on modifying the mainframe, refer to "Service Kit" in Chapter 2.

A setup check is run by the software before the adjustment procedure is begun. If the prompt `Setup Check Fails` appears near the bottom of the screen when the adjustment program begins, recheck the setup. The prompt may also appear if the module is faulty or far out of alignment, but, usually, the prompt is the result of an incorrect setup. The setup check failure will also list the value that was measured and what it expected to measure. Because the setup-check limits are quite wide (to allow broken modules to be tested), the setup check may not catch every incorrect setup configuration.

Adjustment 1. 21.4 MHz Input Bandpass Filter Adjustment

This routine is used to adjust the module's input filter for symmetry and gain. If the 21.4 MHz input filter on the A1 board assembly cannot be adjusted to pass its limits, use an active probe to find the point where the problem is. The problem is most likely to be found in function blocks **(A), (B), (C), (D), (E), (J),** or **(K)** of the A1 board assembly.

Adjustment 2. LC Resolution Bandwidth Filter Adjustment

This routine is used to adjust the center frequency, gain, and bandwidth of the four LC filters relative to the 10 kHz filter.

LC Center Frequency

If the center frequency of an LC filter stage cannot be adjusted within limits, the most probable cause is faulty inductors and/or capacitors in that specific stage. Make sure that the filter-shorting circuit for that filter stage has been disabled, and that all of the other filter stages have been shorted. (Refer to the filter information under the "Circuit Description" and "Troubleshooting the Board Assemblies" sections in the previous pages.) If another filter stage is enabled and out of adjustment, it can prevent the center frequency of the filter you are trying to adjust from adjusting properly.

If all of the filter stages, except for one, appear to have problems, suspect the stage that adjusts properly of having a problem with its shorting circuit.

LC Amplitude

Everything that can affect the filter's center frequency (see above) can also affect the filter's amplitude. Additionally, the resistors that are in series with the primary of the filter inductor, the PIN diodes used to bypass the filter inductor, and the amplifier, can cause problems with this adjustment.

LC Bandwidth

Everything that can affect the filter's center frequency and amplitude (see above) can affect the filter's bandwidth.

Adjustment 3. Crystal Resolution Bandwidth Filter Adjustment

This routine is used to adjust the module's five crystal filters for symmetry and dip, bandwidth, center frequency, and amplitude. This routine also checks the shorting diodes for noise.

Note If one of the crystals is faulty, the entire set of five crystals (A1Y1A, A1Y1B, A1Y1C, A2Y1D, and A2Y1E) must be replaced. Refer to the *HP 70902A Component Level Information Packages* for the crystal-set part number.

Crystal Symmetry and Dip

The following example tells how to adjust the symmetry of Crystal Filter 4 (A2 function block **(A)**); however, the information can also be applied to the other filter stages. Adjust A2C137 until the parallel resonance of the crystal A2Y1D is nulled out.

If none of the crystal filter stages can be adjusted, apply a 21.4 MHz input signal to the HP 70902A IF section and use an active probe to find where in the IF signal path the problem first occurs.

If only one of the stages will adjust, suspect that stage of having a problem with its signal-bypass circuit.

If more than one, but not all, of the stages will adjust, swap the crystal in a good stage with the crystal in a stage that cannot be adjusted and try to adjust the failing stage again. If the failing stage now passes and the good stage has degraded performance after realignment, then the crystal is bad.

If swapping the crystals made little or no difference, return the crystals to their original locations and suspect passive components in the circuit. For example, in Crystal Filter 4 suspect the passive components between A2Q101 and A2Q107.

Noise Check

If the noise check fails, the most probable cause is that one or more of the shorting diodes in the crystal filter stages is noisy. The shorting-diode reference designations are listed below:

Crystal Filter—Stage 1 shorting diodes are A1CR221, A1CR222, and A1CR232.
Crystal Filter—Stage 2 shorting diodes are A1CR223, A1CR224, and A1CR233.
Crystal Filter—Stage 3 shorting diodes are A1CR225, A1CR226, and A1CR234.
Crystal Filter 4 shorting diodes are A2CR117, A2CR118, and A2CR121.
Crystal Filter 5 shorting diodes are A2CR119, A2CR120, and A2CR122.

Crystal Bandwidth

Note Make sure that the crystal resolution bandwidth pot XTAL RB is centered before attempting bandwidth adjustment.

If the bandwidth of a filter stage cannot be properly adjusted, swap the crystal in a good stage with the crystal in the stage that cannot be adjusted and try to adjust the failing stage again. If the failing stage now passes and the previously good stage exhibits degraded performance after realignment, then the crystal is bad.

If swapping the crystals made little or no difference, return the crystals to their original locations. The problem could be caused by any of the reactive components in the failing stage, the PIN diodes, or the PIN-diode drive circuitry. Compare voltage levels from a good stage with those of the suspect stage to find the cause of the problem.

18.4 MHz Local Oscillator Frequency and Crystal Center

Frequency When Crystal Filter—Stage 1 is enabled, A1C150 is used to adjust the 18.4 MHz Local Oscillator (A1 function block **(L)**) so that it tracks the frequency of Crystal Filter—Stage 1.

When any of the other crystal filters are enabled, the crystal-centering pot for the specific crystal-filter stage is adjusted. For example, Crystal Filter—Stage 2 center frequency is adjusted with A1C254 (A1 function block **(Q)**).

If the center frequency of a filter stage cannot be properly adjusted, swap the crystal in a good stage with the crystal in the stage that cannot be adjusted and try to adjust the failing stage again. If the failing stage now passes and the previously good stage exhibits degraded performance after realignment, then the crystal is bad.

If swapping the crystals made little or no difference, return the crystals to their original locations. The problem could be caused by any of the reactive components in the failing stage.

Adjustment 4. Bandwidth Filter Amplitude Adjustment. This routine is used to adjust the amplitude of the 10 Hz resolution bandwidth to match the amplitude of the 3 kHz resolution bandwidth. The routine also is used to adjust the gain of the crystal filters in a 3 kHz resolution bandwidth to match the gain of the LC filters in a 10 kHz resolution bandwidth.

10 Hz Amplitude

The 10 Hz AMPL pot (A1R261 in A1 function block **(P)**) is adjusted to match the amplitude of the 10 Hz bandwidth to the amplitude measured for the 3 kHz bandwidth. If this adjustment fails, use an active probe to check each crystal filter stage for similar amplitude in both the 3 kHz and 10 Hz resolution bandwidths.

Crystal to LC Filter Gain

The XTAL GAIN pot (A1R356 in A1 function block **(AA)**) is adjusted to match the gain of the crystal filters in a 3 kHz resolution bandwidth to the gain of the LC filters in a 10 kHz resolution bandwidth. If this adjustment fails, use an active probe to check the gain of the filter stages in the appropriate bandwidths.

Adjustment 5. Step Gain/Calibration Attenuator Adjustment

This routine is used to adjust the module's step gain amplifiers and calibration attenuators.

Step-Gain Amplifiers

If one of the step gain stages will not adjust within limits, verify that all of the other step gain stages are turned off and that the stage being adjusted is turned on. The instructions to turn the step gain stages on or off come from the A3 board assembly. A step gain stage is off if its control line is at a TTL low and on when its control line is at a TTL high. If the step gain stage being adjusted does not have a TTL high on its control line, the problem is either a faulty cable between A1 and A3, or a faulty A3 board assembly. (Refer to Table 6-5 for a listing of the step gain control lines.)

Refer to "Step Gain Amplifiers" in the A1 board assembly troubleshooting for information about how the step gain circuits work. There should be no current flowing from the emitters of the switched transistor stages when they are turned off. To find leaky switches, look for a dc voltage drop across the emitter resistor when the stage is turned off.

Calibration Attenuators

If a calibration attenuator cannot be adjusted within limits, verify that all of the other calibration attenuator stages are off and that the calibration attenuator stage being adjusted is on. Refer to the A1 board assembly troubleshooting section for more information about the calibration attenuators.

Adjustment 6. Log Amplifier Adjustment

This routine is used to adjust the module's log-amplifier stages for alignment, slope, and offset. Resistor A2R220 (A2 function block **(D)**) is used to adjust the log-amplifier alignment. Resistor A2R313 (A2 function block **(F)**) is used to adjust the log-amplifier slope. Resistor A2R302 (A2 function block **(F)**) is used to adjust the log-amplifier offset. If this adjustment cannot be accomplished, either one of the log amplifiers (A2U201 and A2U202) is faulty, or there is a faulty passive component in the circuitry related to the log amplifiers.

Adjustment 7. Module Gain Adjustment

This routine is used to adjust the absolute IF gain and to adjust the total module gain.

Absolute IF Gain

Resistor A1R362 (A1 function block **(AA)**) is used to adjust the IF gain from the rear panel 21.4 MHz input to the front panel 3 MHz output.

Total Module Gain

Resistor A2R313 (A2 function block **(F)**) is used to adjust the module gain from the rear panel 21.4 MHz input to the rear panel video output.

Adjustment 8. Bandwidth Filter Final Adjustment

This routine is used to adjust the LC filters at a resolution bandwidth of 300 kHz, and the crystal filters at a resolution bandwidth of 10 Hz.

Resistor A3R112 (A3 function block **(I)**) is used to adjust the LC filters at a resolution bandwidth of 300 kHz. Resistor A3R111 (A3 function block **(H)**) is used to adjust the crystal filters at a resolution bandwidth of 10 Hz. The tunable resistors are used to adjust the filters because, at these bandwidths, the DACs that are used to control the other bandwidth adjustments are set full on (127 or 255 counts, depending on the firmware version), leaving no room for error minimization.

Adjustment 9. Bandwidth Filter DAC Optimization

This routine is used to correct all of the HP 70902A IF section resolution bandwidths except 10 Hz and 300 kHz. The routine also checks the 10% step bandwidth selection function.

DAC A3U102 (A3 function block **(H)**) is used to control the crystal-filter bandwidths; DAC A3U101 (A3 function block **(I)**) is used to control the LC filter bandwidths. For all resolution bandwidths except 10 Hz and 300 kHz, the resolution bandwidth error is minimized by using a custom DAC number for each setting. The custom DAC numbers are stored in the module's ROM.

7

Replacement Procedures

This chapter contains procedures for removal and replacement of the following major assemblies in the HP 70902A IF section:

- Module Right-Side Cover
- Module Left-Side Cover
- Front Panel
- Rear Panel
- A1 Downconverter
- A2 Log Amplifier/Power Supply
- A3 MSIB Control
- A4 Front Panel

Caution This module contains components that can be damaged or destroyed by electrostatic discharge. It should be serviced only at a static-safe work station. Refer to "Electrostatic Discharge Information" in Chapter 2.

Unless otherwise stated, the screws in this module should be torqued to 6 inch-pounds.

The HP 70902A IF section contains both metric and inch hardware. Instrument damage can occur if incorrect hardware is used. Refer to Chapter 8 for identification of hardware types.

Note Unless otherwise noted, the directions "left" and "right" in the instructions are given for an observer facing the instrument front panel.

Module Right-Side Cover

The shaded areas in Figure 7-1 show the areas of the module casting, covers, and top clamp (if present) that must make good electrical contact. See Figure 7-2 for identification of the parts called out in this procedure.

Module Version without Top Clamp

HP 70902A IF sections with serial numbers 2419A00155 and below, 2419A00156, -00189, -00206, -00208, -00209, -00211, -00214, -00216, -00217, and -00218 were built without a top clamp. Use the procedure below to remove and replace this version's right-side cover:

Removal

1. Remove the 10 screws (1).
2. Remove the right-side cover (2).

Replacement

Note The module may fail the corrected module fidelity test if the side covers or the module casting are not clean, or if the side covers are replaced incorrectly. See Figure 7-1 for identification of the areas that must make good contact. When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws. The side covers and module casting may be cleaned with isopropyl alcohol and a lint-free wipe. The module may also fail the corrected module fidelity test because there is no top clamp. The top clamp was added in later versions of the module to reduce this type of failure. Refer to Chapter 8, "Replaceable Parts" for information about the preferred-replacement parts needed to retrofit the module.

3. Replace the right-side cover (2).
4. Squeeze the cover into place against the module casting, and replace the 10 screws (1), inserting the screws (3) and (4) first so that the holes in the cover correctly line up with the holes in the board.

Module Versions with Top Clamp

HP 70902A IF sections with serial numbers 2419A00144, -00145, -00147, -00159, -00166, -00181, -00193, -00195, -00198, -00200, -00204, -00207, -00210, -00212, -00213, -00215, -00219, -00221, -00222, and 2532A and above were built with a top clamp. Use the procedure below to remove and replace this version's right-side cover:

Removal

1. Loosen the 11 screws (5) on the top clamp (6). Do not remove the top clamp.
2. Remove the 10 screws (1).
3. Remove the right-side cover (2).

Replacement

Note The module may fail the corrected module fidelity test if the top clamp, side covers, or the module casting are not clean. The test may also fail if the side covers are replaced incorrectly. See Figure 7-1 for identification of the areas that must make good contact. When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws. While tightening the top-clamp screws, squeeze the side covers together to insure good ground connections between the top clamp, covers, and module casting. The top clamp, side covers, and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

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4. Replace the right-side cover (2).
5. Squeeze the cover into place against the module casting, and replace the 10 screws (1), inserting the screws (3) and (4) first so that the holes in the cover correctly line up with the holes in the board.
6. Tighten the 11 screws (5) on the top clamp (6). Tighten the screws from the rear of the module forward.

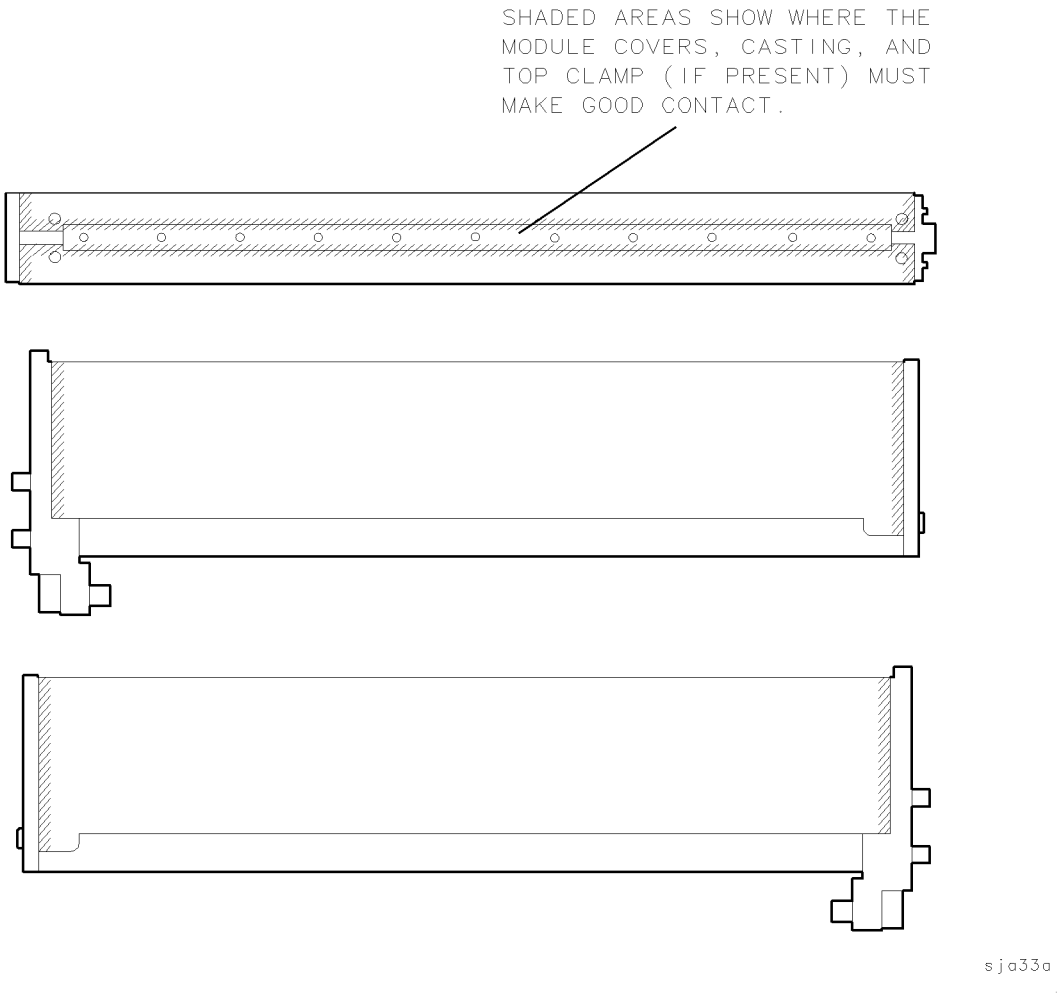

Figure 7-1. Module Casting, Cover, and Top-Clamp Areas That Must Make Good Contact

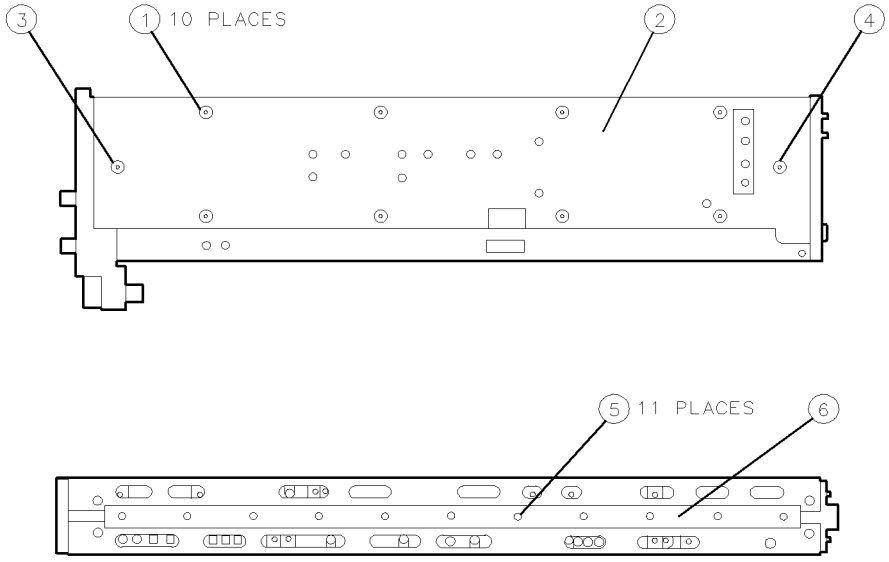

Figure 7-2. Module Right-Side Cover Removal/Replacement

Module Left-Side Cover

The shaded areas in Figure 7-1 show the areas of the module casting, covers, and top clamp (if present) that must make good electrical contact. See Figure 7-3 for identification of the parts called out in this procedure.

Module Version without Top Clamp

HP 70902A IF sections with serial numbers 2419A00155 and below, 2419A00156, -00189, -00206, -00208, -00209, -00211, -00214, -00216, -00217, and -00218 were built without a top clamp. Use the procedure below to remove and replace this version's left-side cover:

Removal

1. Remove the nine screws (1).
2. Remove the left-side cover (2).

Replacement

Note The module may fail the corrected module fidelity test if the side covers or the module casting are not clean, or if the side covers are replaced incorrectly. See Figure 7-1 for identification of the areas that must make good contact. When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws. The side covers and module casting may be cleaned with isopropyl alcohol and a lint-free wipe. The module may also fail the corrected module fidelity test because there is no top clamp. The top clamp was added in later versions of the module to reduce this type of failure. Refer to Chapter 8, "Replaceable Parts" for information about the preferred-replacement parts needed to retrofit the module.

3. Replace the left-side cover (2).
4. Squeeze the cover into place against the module casting, and replace the nine screws (1), inserting the screws (3) and (4) first so that the holes in the cover correctly line up with the holes in the board.

Module Versions with Top Clamp

HP 70902A IF sections with serial numbers 2419A00144, -00145, -00147, -00159, -00166, -00181, -00193, -00195, -00198, -00200, -00204, -00207, -00210, -00212, -00213, -00215, -00219, -00221, -00222, and 2532A and above were built with a top clamp. Use the procedure below to remove and replace this version's left-side cover:

Removal

1. Loosen the 11 screws (5) on the top clamp (6). Do not remove the top clamp.
2. Remove the nine screws (1).
3. Remove the left-side cover (2).

Note The module may fail the corrected module fidelity test if the top clamp, side covers, or the module casting are not clean. The test may also fail if the side covers are replaced incorrectly. See Figure 7-1 for identification of the areas that must make good contact. When replacing the side covers, make sure that the top corners of the side covers are flush with the front and rear frames. To insure a good ground connection between the cover top and the module casting, hold the top of the side cover firmly down against the module casting while tightening the side-cover screws. While tightening the top-clamp screws, squeeze the side covers together to insure good ground connections between the top clamp, covers, and module casting. The top clamp, side covers, and module casting may be cleaned with isopropyl alcohol and a lint-free wipe.

4. Replace the left-side cover (2).
5. Squeeze the cover into place against the module casting, and replace the nine screws (1), inserting the screws (3) and (4) first so that the holes in the cover correctly line up with the holes in the board.
6. Tighten the 11 screws (5) on the top clamp (6). Tighten the screws from the rear of the module forward.

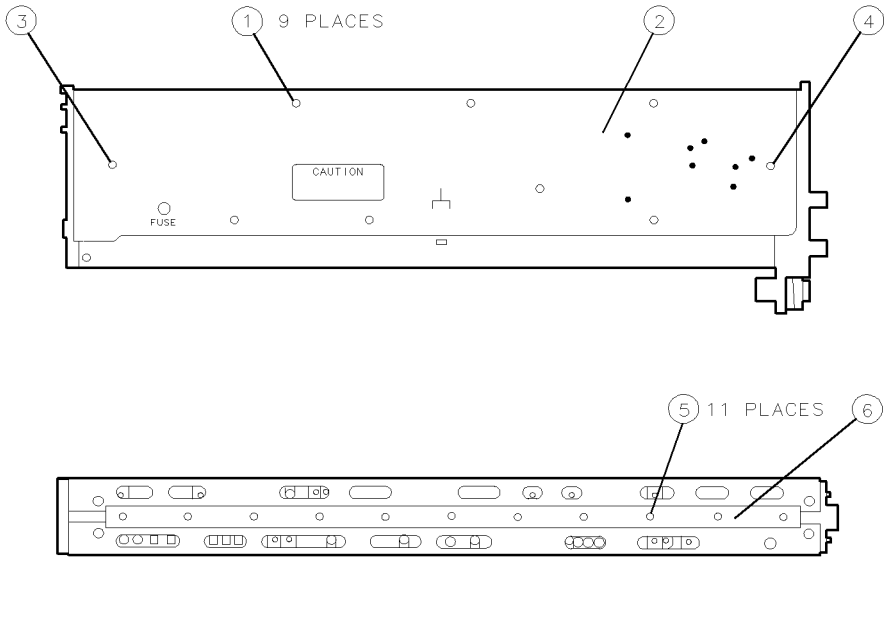

Figure 7-3. Module Left-Side Cover Removal/Replacement

Front Panel

See Figure 7-4 for identification of the parts called out in this procedure.

Removal

1. Remove the two screws (1) on the top and the two screws (2) on the bottom that hold the front panel to the module casting, and gently pull the front panel away from the module.
2. Disconnect W4 (3) from A4J1.
3. Remove the nuts (4) from the two BNC connectors (5) on the front panel and detach the front panel from the module.

Replacement

4. Replace the two BNC connectors (5) in the front panel. The black cable (W2) goes to VIDEO 0-1V, the light-blue cable (W1) goes to IF 3 MHz.
5. Replace the nuts (4) on the two BNC connectors. Tighten the nuts to 20 inch-pounds torque.
6. Reconnect W4 (3) to A4J1.
7. Slide the front panel back against the module, making sure not to catch any cables between the front panel and the module.
8. Replace the two screws (1) on the top and the two screws (2) on the bottom that hold the front panel to the module casting.

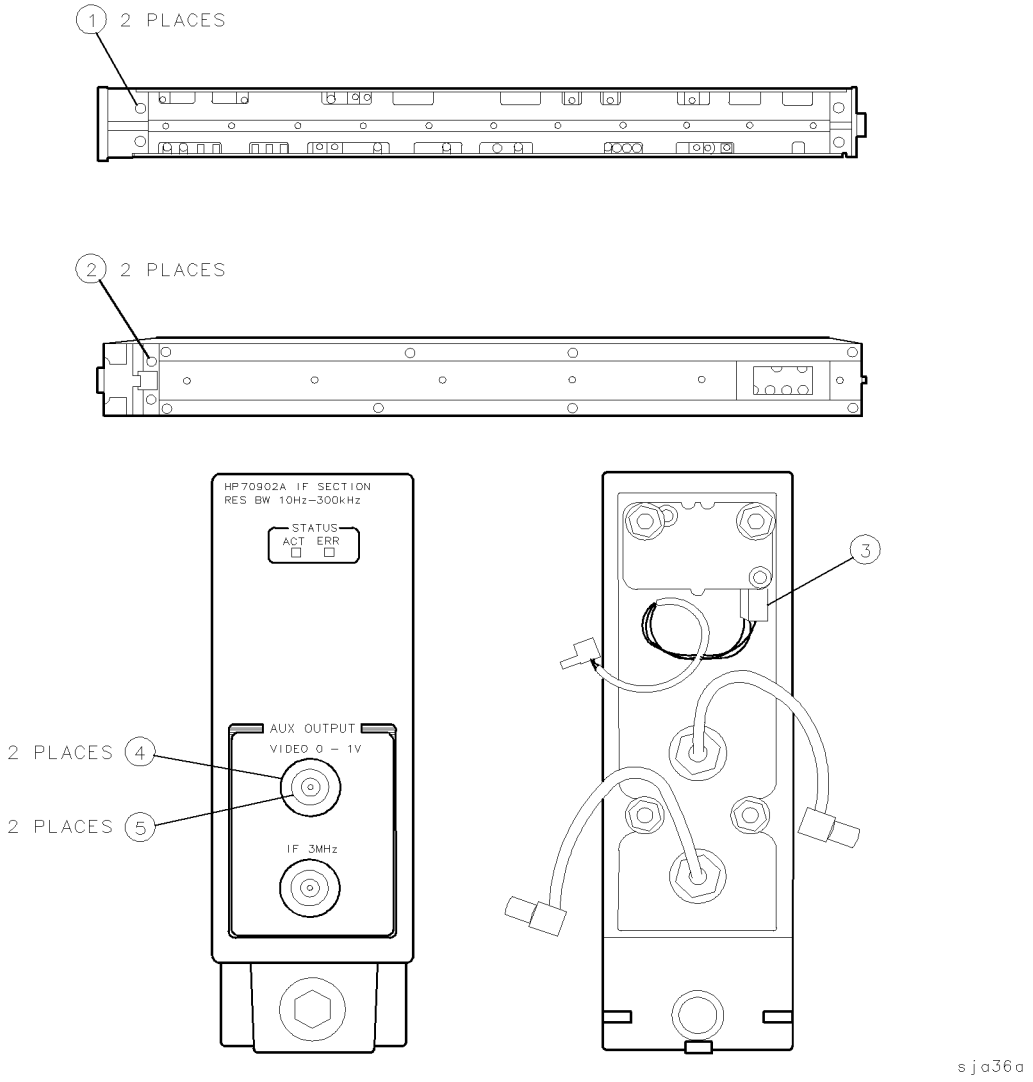

Figure 7-4. Front Panel Removal/Replacement

Rear Panel

See Figure 7-5 for identification of the parts called out in this procedure.

Removal

1. Remove the left-side cover. Refer to the removal procedure for the module left-side cover.
2. Remove the two screws (1) on top of the rear panel, the two screws (2) on the bottom of the rear panel, and the two screws (3) on the side of the rear panel.
3. Remove the A2 board assembly. Refer to the removal procedure for the A2 board assembly.
4. Remove the nuts and washers (4) from A1J101 and A1J102.
5. Slide the rear panel (5) away from the module and disconnect W9 (6) from A3J3 (7).

Replacement

6. Reconnect W9 (6) to A3J3 (7).
7. Replace the A2 board assembly. Refer to the replacement procedure for the A2 board assembly.
8. Line up the holes in the rear panel with the connectors on the board assemblies and slide the rear panel back into place against the module.
9. Replace the two screws (1) on top of the rear panel, the two screws (2) on the bottom of the rear panel, and the two screws (3) on the side of the rear panel.
10. Replace the nuts and washers (4) on A1J101 and A1J102, and the nuts and washers (8) on A2J301 and A2J203.
11. Replace the left-side cover. Refer to the replacement procedure for the module left-side cover.

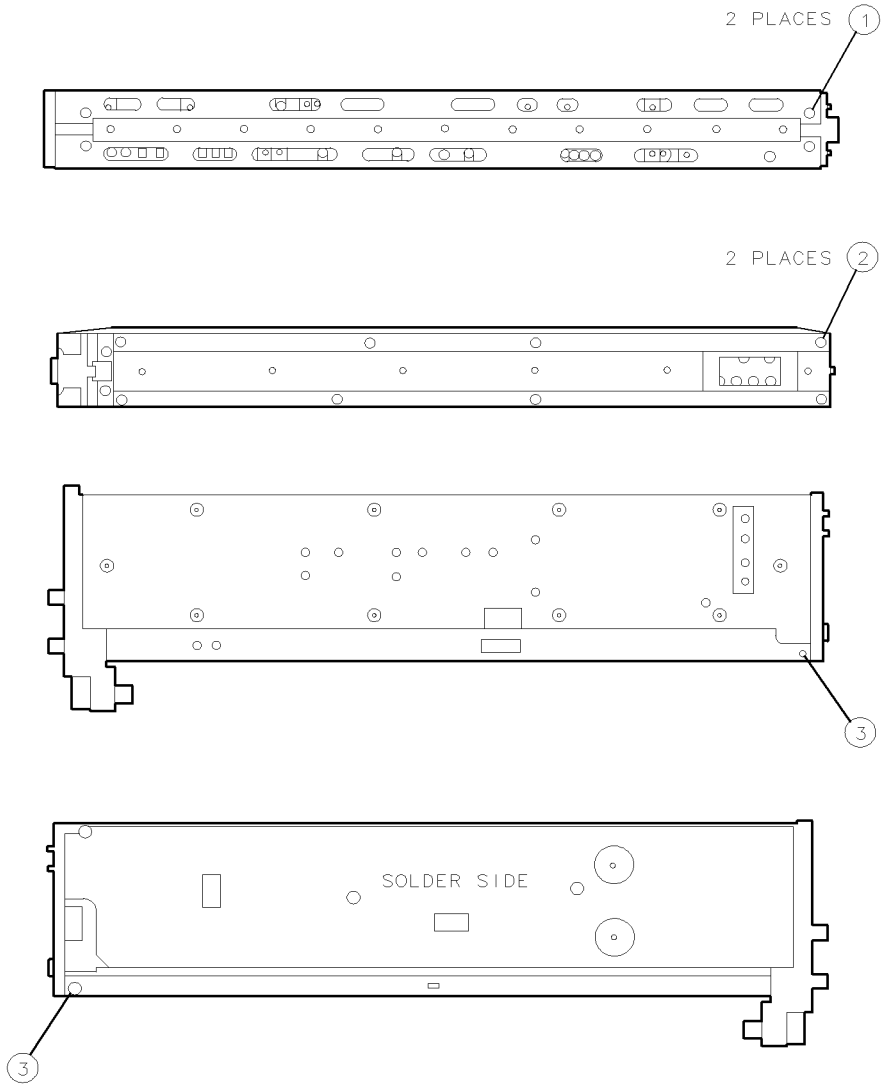

Figure 7-5. Rear Panel Removal/Replacement (1 of 2)

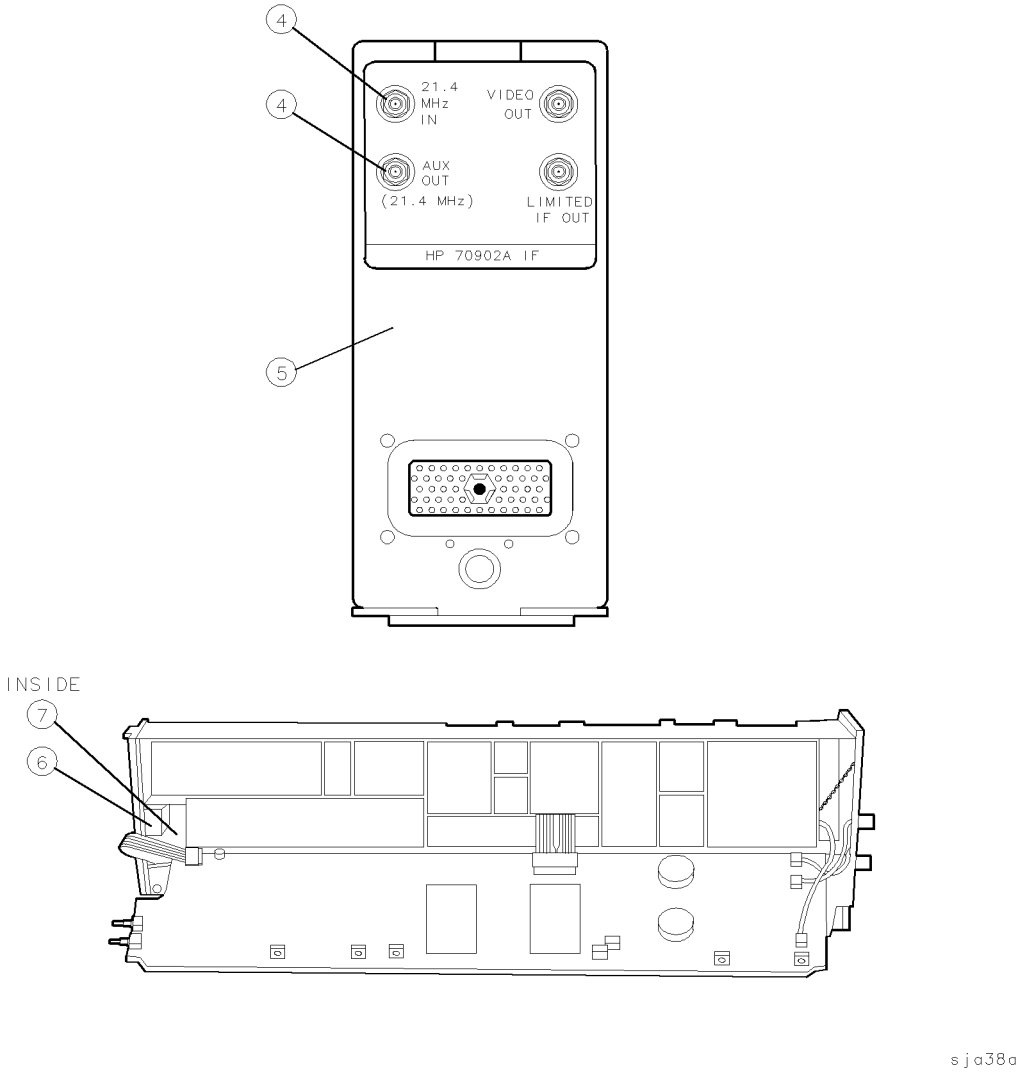

Figure 7-5. Rear Panel Removal/Replacement (2 of 2)

A1 Downconverter

See Figure 7-6 for identification of the parts called out in this procedure.

Removal

1. Remove the right-side cover. Refer to the removal procedure for the module right-side cover.
2. Remove the nuts and washers (1) from A1J101 and A1J102.
3. Remove the four screws (2) that hold A1 (3) in place.
4. Carefully lift up the front of A1 and slide it out, pulling toward the front of the module.
5. Disconnect W3 (4) from A1J302 (5).
6. Disconnect W5 and W6 (6) from A1J301 (7).

Replacement

7. Reconnect W5 and W6 (6) to A1J301 (7).
8. Reconnect W3 (4) to A1J302 (5).
9. Carefully slide A1 (3) back into the module, inserting the two connectors (A1J101 and A1J102) through the holes in the rear panel. Make sure that the cables are not caught between A1 and the module casting.
10. To allow easy insertion of the side-cover screws later, make sure that the holes in the module casting and the holes in the board assembly are properly aligned. Then, replace the four screws (2) that hold A1 in place.
11. Replace the nuts and washers (1) on A1J101 and A1J102.
12. Replace the right-side cover. Refer to the replacement procedure for the module right-side cover.

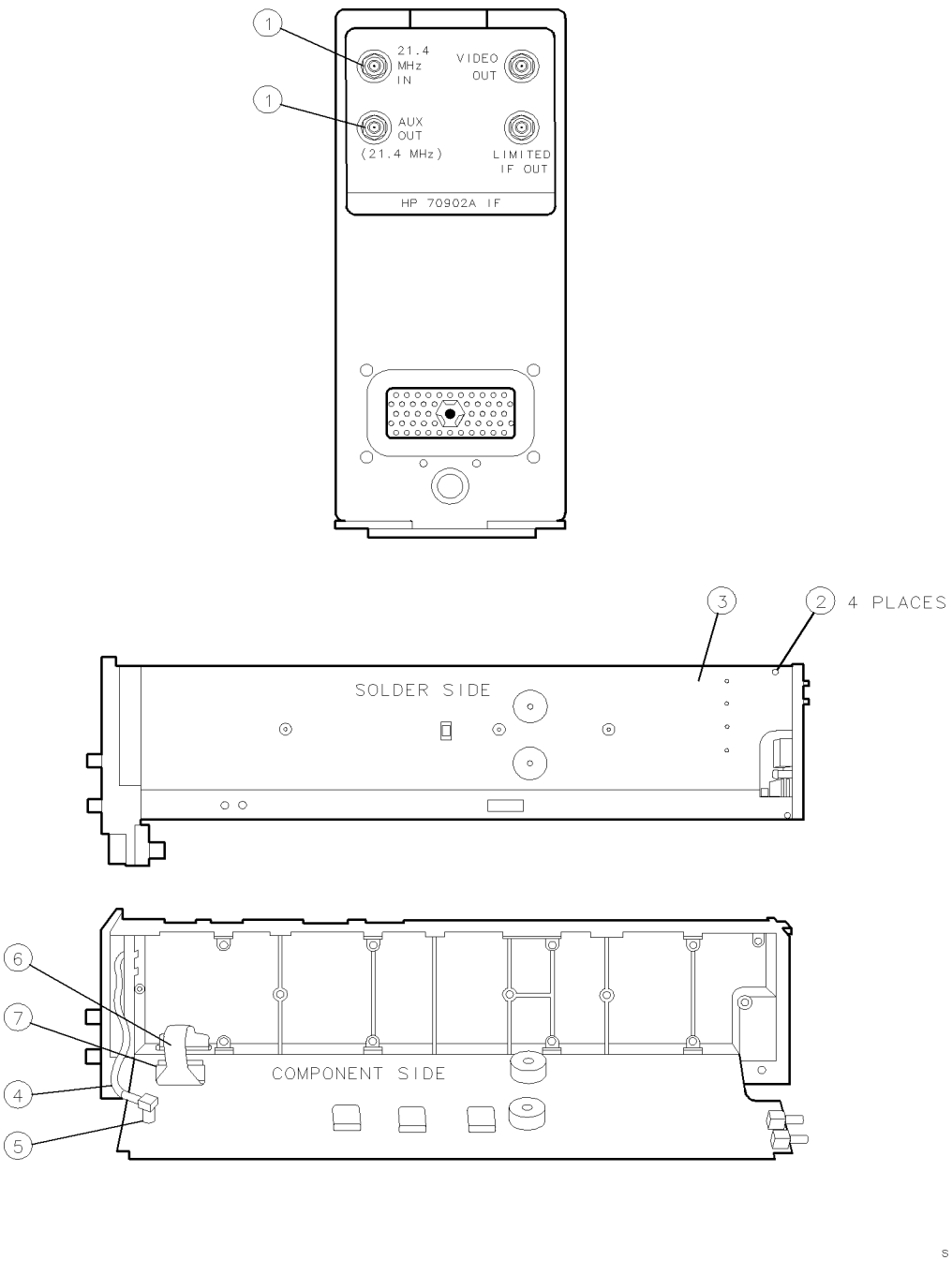

Figure 7-6. A1 Removal/Replacement

A2 Log Amplifier/Power Supply

See Figure 7-7 for identification of the parts called out in this procedure.

Removal

1. Remove left-side cover. Refer to the removal procedure for the module left-side cover.
2. Remove the nuts and washers (1) from A2J301 and A2J203.
3. Remove the three screws (2) that hold A2 (3) in place.
4. Carefully lift up the front of A2 and slide it out, pulling toward the front of the module.
5. Disconnect the following cables:

   W3 (4) from A2J101 (5)
   W2 (6) from A2J302 (7)
   W1 (8) from A2J103 (9)
   W7 and W8 (10) from A2J102 (11)
   W9 (12) from A2J404 (13)

Replacement

6. Reconnect the following cables:

   W9 (12) to A2J404 (13)
   W7 and W8 (10) to A2J102 (11)
   W1 (8) to A2J103 (9)
   W2 (6) to A2J302 (7)
   W3 (4) to A2J101 (5)

7. Carefully slide A2 (3) back into the module, inserting the two connectors (A2J301 and A2J203) through the holes in the rear panel. Make sure that the cables are not caught between A2 and the module casting.
8. To allow easy insertion of the side-cover screws later, make sure that the holes in the module casting and the holes in the board assembly are properly aligned. Then, replace the three screws (2) that hold A2 in place.
9. Replace the nuts and washers (1) on A2J301 and A2J203.
10. Replace the left-side cover. Refer to the replacement procedure for the module left-side cover.

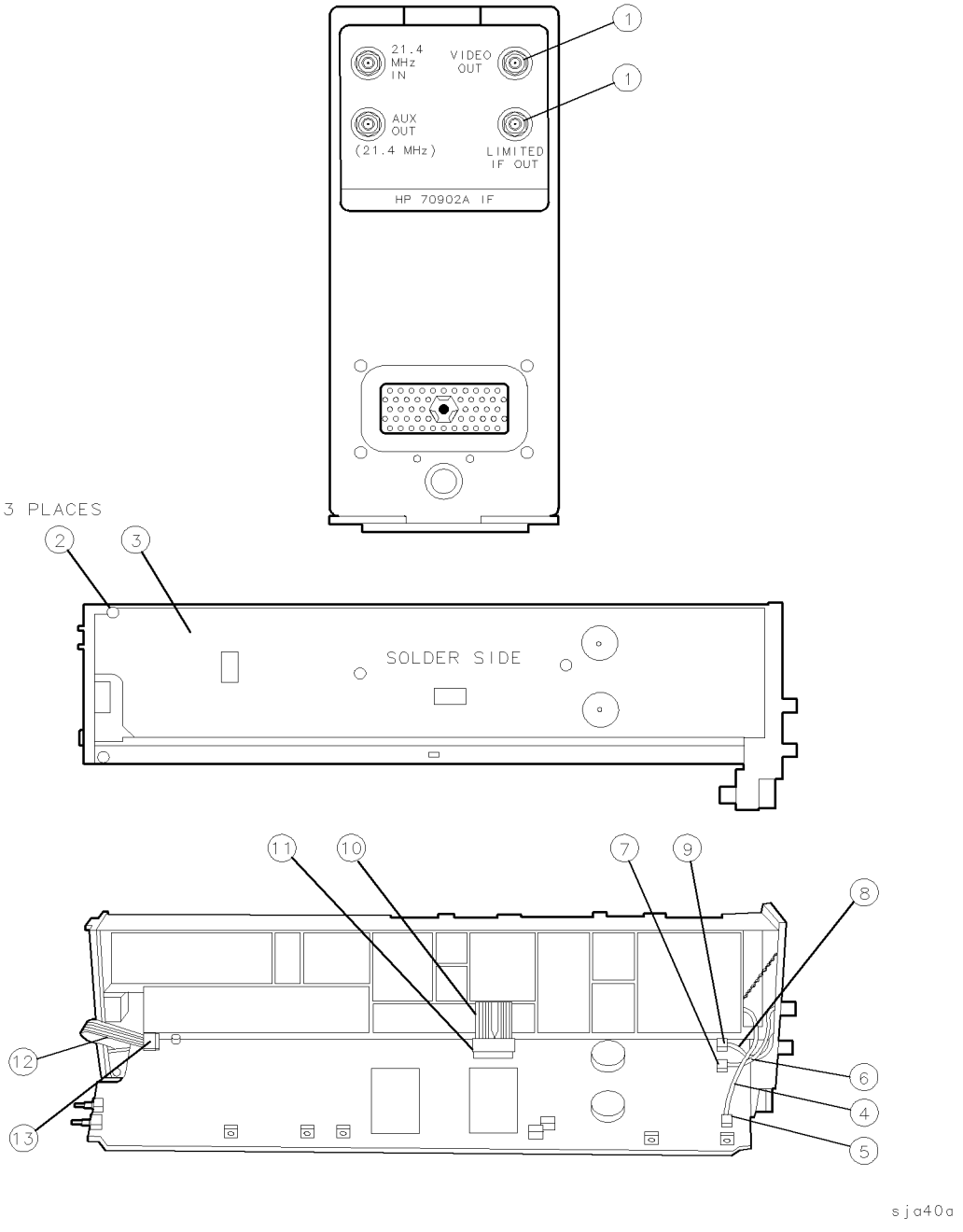

Figure 7-7. A2 Removal/Replacement

A3 MSIB Control

See Figure 7-8 and Figure 7-8 for identification of the parts called out in this procedure.

Removal

Note The module may need re-alignment if the side covers are removed. Older versions of the module may not require either the side covers or the rear panel to be removed, and so may not need to follow the full procedure below. Newer versions of the module have a shorter W9 cable (rear panel to A3J3). The shorter cable length can make it difficult or impossible to reconnect W9 to A3J3 without removing the covers and rear panel. Remove and replace A3 with the least amount of disassembly needed for your module.

1. Remove both side covers. Refer to the removal procedures for the module left-side cover and module right-side cover.
2. Remove the eight screws (1) holding the bottom cover (2) in place, and lift off the bottom cover.
3. Remove the nine screws (3) that hold A3 (4) in place.
4. Remove the rear panel from the module. Refer to the removal procedure for the rear panel.
5. Remove the four screws (5) that hold A1 (6) in place, and fold A1 down.
6. Carefully lift A3 part way from the module, then disconnect the following cables:

   W5 and W6 (7) from A3J1 (8)
   W7 and W8 (9) from A3J2 (10)
   W4 (11) from A3J4 (12)
   W9 (13) from A3J3 (14)

Replacement

7. Reconnect the following cables:

   W5 and W6 (7) to A3J1 (8)
   W7 and W8 (9) to A3J2 (10)
   W4 (11) to A3J4 (12)
   W9 (13) to A3J3 (14)

8. Replace A3 (4) in the module. Make sure that no cables are caught between A3 and the module casting.
9. Replace the nine screws (3) that hold A3 in place.
10. Replace the bottom cover (2), and replace the eight screws (1) that hold the bottom cover in place.
11. Replace A1 (6) in the module, and replace the four screws (5) that hold A1 in place.
12. Replace the rear panel. Refer to the replacement procedure for the rear panel.
13. Replace both side covers. Refer to the replacement procedures for the module left-side cover and module right-side cover.

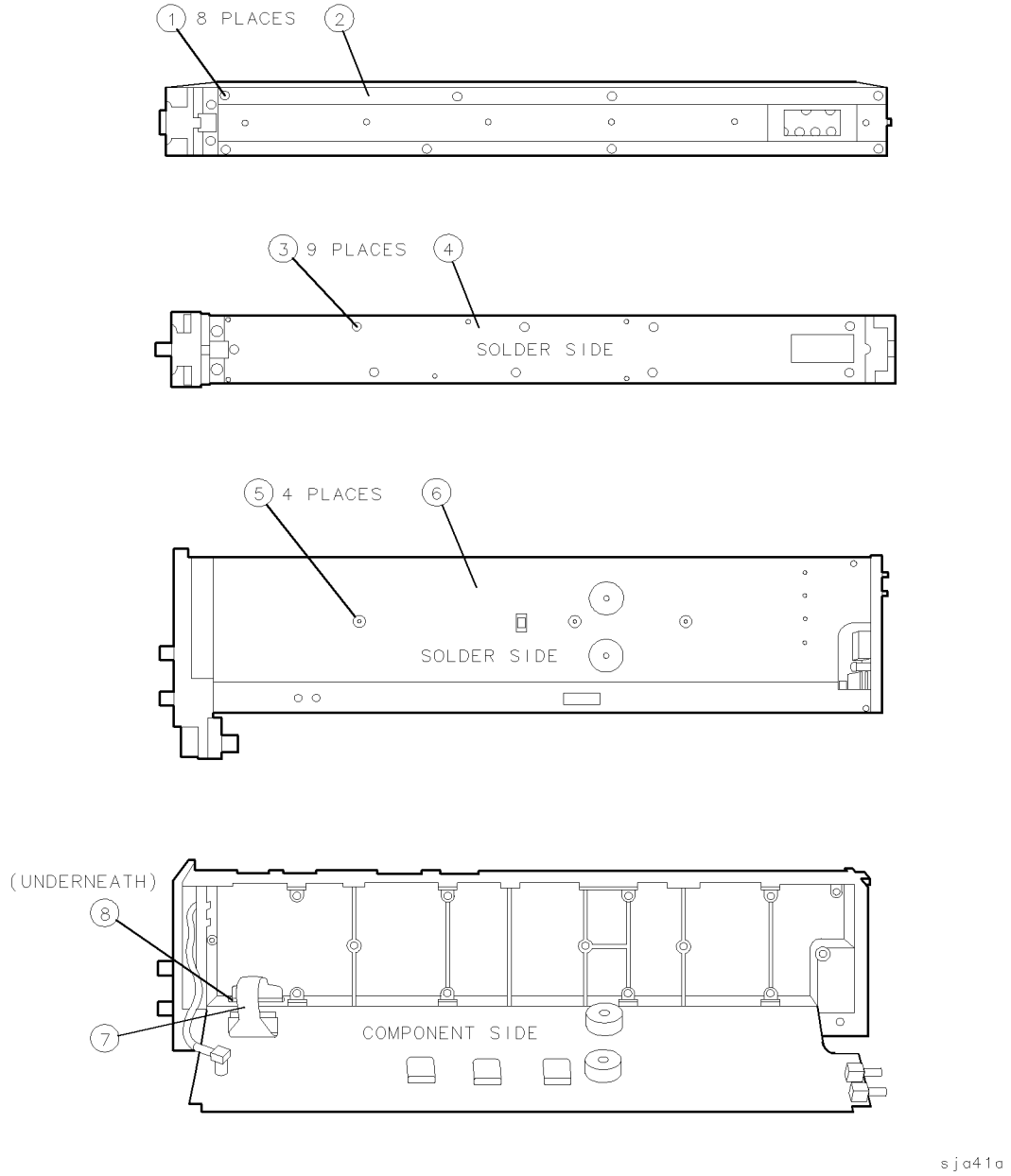

Figure 7-8. A3 Removal/Replacement (1 of 2)

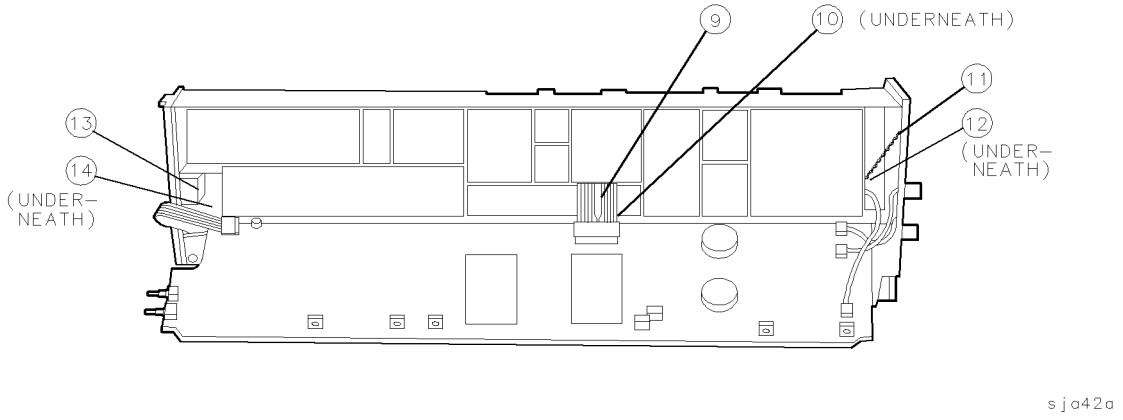

Figure 7-8. A3 Removal/Replacement (2 of 2)

A4 Front Panel

See Figure 7-9 for identification of the parts called out in this procedure.

Removal

1. Remove the two screws (1) on the top and the two screws (2) on the bottom that hold the front panel (3) to the module casting. Then slide the front panel slightly away from the module.
2. Disconnect W4 (4) from A4J1 (5).
3. Remove the two nuts (6) that hold A4 (7) in place, and lift A4 from the front panel.

Replacement

4. Reconnect W4 (4) to A4J1 (5) with the red wire toward the outside of the board.
5. Replace A4 (7) in the front panel (3), then replace the two nuts (6).
6. Slide the front panel back against the module, making sure not to catch any cables between the front panel and the module. Then replace the two screws (1) on the top and the two screws on the bottom (2) that hold the front panel (3) to the module casting.

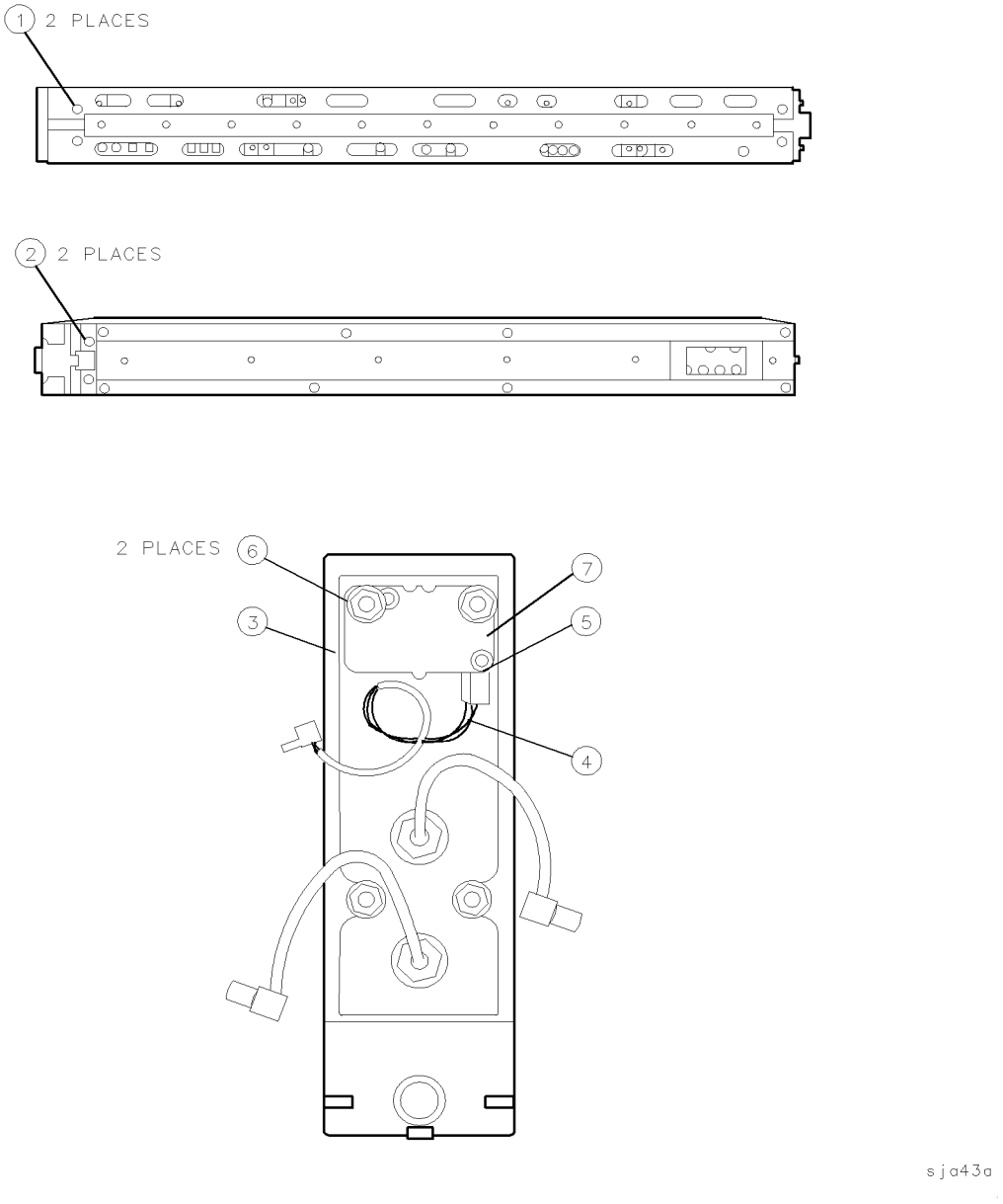

Figure 7-9. A4 Removal/Replacement

8

Replaceable Parts

This chapter contains information for identifying chassis mechanical parts, and ordering replacement assemblies for the HP 70902A IF section HP 70902A IF section. Refer to Chapter 9 for major assembly and cable location information, and to the *HP 70902A Component Level Information Packages* for board-assembly parts lists.

- Overall Module Parts Identification Format
- Replaceable Parts List Format
- Ordering Information
- Board-Assembly Compatibility
- Module Body/Cover/Top-Clamp Versions

This chapter also includes the following tables and figures:

- Table 8-1 lists reference designations, abbreviations, and value multipliers used in the parts lists.
- Table 8-1 lists the names and addresses that correspond to the manufacturer code numbers in the parts lists.
- Figures 7-1 through 7-6 give the overall module parts identification information (chassis mechanical parts).
- Table 8-1 reference designations, abbreviations, and multipliers.

Note *HP 70902A Component Level Information Packages* gives board-assembly compatibility information needed when replacing A1, A2, or A3.

Overall Module Parts Identification Format

Figures 7-1 through 7-6 contain illustrations of the module with a listing of the chassis mechanical parts identified for each figure. The listing includes the following information for each part:

1. Item number of part as shown in the figure.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (Qty) in the assembly.
5. Description of the part.
6. Five-digit code indicating a typical manufacturer of the part. (Table 8-1 gives information for each manufacturer code.)
7. Manufacturer part number.

Replaceable Parts List Format

The parts list includes the following information for each part:

1. Reference designation of the part.
2. Hewlett-Packard part number.
3. Part number check digit (CD).
4. Total quantity (Qty) in the assembly. (This quantity appears only at the first appearance of the part in the list.)
5. Description of the part.
6. Five-digit code indicating a typical manufacturer of the part. (Table 8-1 gives information for each manufacturer code.)
7. Manufacturer part number.

Ordering Information

To order a part listed in the overall module parts identification figures or the replaceable parts tables, quote the Hewlett-Packard part number and the check digit, and indicate the quantity required. The check digit will ensure accurate and timely processing of your order.

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

- Module model number.
- Module serial number.
- Board assembly number (if the part is a component of a board assembly).
- Description of the part's location, what it looks like, and its function (if known).
- Quantity needed.

Address parts orders to the nearest Hewlett-Packard office. Customers within the USA can also use either the direct mail-order system, or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

Direct Mail-Order System

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

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

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

Direct Phone-Order System

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

Regular Orders

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

Hotline Orders

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

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

Module Body/Cover/Top-Clamp Versions

The HP 70902A IF section has three different versions of module body/cover/top-clamp combinations. These different versions are neither backward- nor forward-compatible. The following information is given for each version:

- Serial numbers for version identification.
- Related parts.
- Retrofit information.

Version 1

Serial Numbers

2419A00155 and below, 2419A00156, -00189, -00206, -00208, -00209, -00211, -00214, -00216, -00217, and -00218.

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the equivalent part in the present module. This version does not have a top clamp.

Module Body	Figure 8-5, item 4
Cover-Right	Figure 8-5, item 1
Cover-Left	Figure 8-5, item 2
Front Frame	Figure 8-1, item 5
Rear Frame	Figure 8-2, item 4

Retrofit Information

If any of the parts listed above require replacement, the module should be retrofitted with the related parts listed under "Version 3 (Preferred Replacement)" below. Refer to the overall module parts identification figures for the part numbers.

Version 2

Serial Numbers

2419A00144, -00145, -00147, -00159, -00166, -00181, -00193, -00195, -00198, -00200, -00204, -00207, -00210, -00212, -00213, -00215, -00219, -00221, -00222, 2532A00223 through 2621A00792, and 2621A00799 through -00878

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the equivalent part in the present module.

- Module Body ..... Figure 8-5, item 4
- Cover-Right ..... Figure 8-5, item 1
- Cover-Left ..... Figure 8-5, item 2
- Top Clamp ..... Figure 8-3, item 3
- Screws (for top clamp) ..... Figure 8-3, item 2
- Front Frame ..... Figure 8-1, item 5
- Rear Frame ..... Figure 8-2, item 4

Retrofit Information

If the module body, the right or left side cover, or the top clamp need replacement, the module should be retrofitted with the preferred replacement versions of *all* the following parts:

- Module Body
- Cover-Right
- Cover-Left
- Top Clamp
- Screws (for top clamp)

Refer to the appropriate overall module parts identification figures for part number information.

Version 3 (Preferred Replacement)

Serial Numbers

2621A00793 through -00798, and 2626A and above

Related Parts

Listed for each related part is the overall module parts identification figure and item number of the part.

Module Body ..... Figure 8-5, item 4
Cover-Right ..... Figure 8-5, item 1
Cover-Left ..... Figure 8-5, item 2
Top Clamp ..... Figure 8-3, item 3
Screws (for top clamp) ..... Figure 8-3, item 2
Front Frame ..... Figure 8-1, item 5
Rear Frame ..... Figure 8-2, item 4

Retrofit Information

Any of the related parts listed for this version can be replaced independently. Refer to the overall module parts identification figures for part number information.

Table 8-1. Reference Designations, Abbreviations and Multipliers (1 of 5)

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

Table 8-1. Reference Designations, Abbreviations and Multipliers (2 of 5)

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

Table 8-1. Reference Designations, Abbreviations, and Multipliers (3 of 5)

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 8-1. Reference Designations, Abbreviations, and Multipliers (4 of 5)

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	Subminiature,
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		Temperature,
	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 8-1. Reference Designations, Abbreviations, and Multipliers (5 of 5)

ABBREVIATIONS					
	U	VAR	Variable		**Y**
		VDC	Volts—Direct Current		
UCD	Microcandela			YIG	Yittrium-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}			

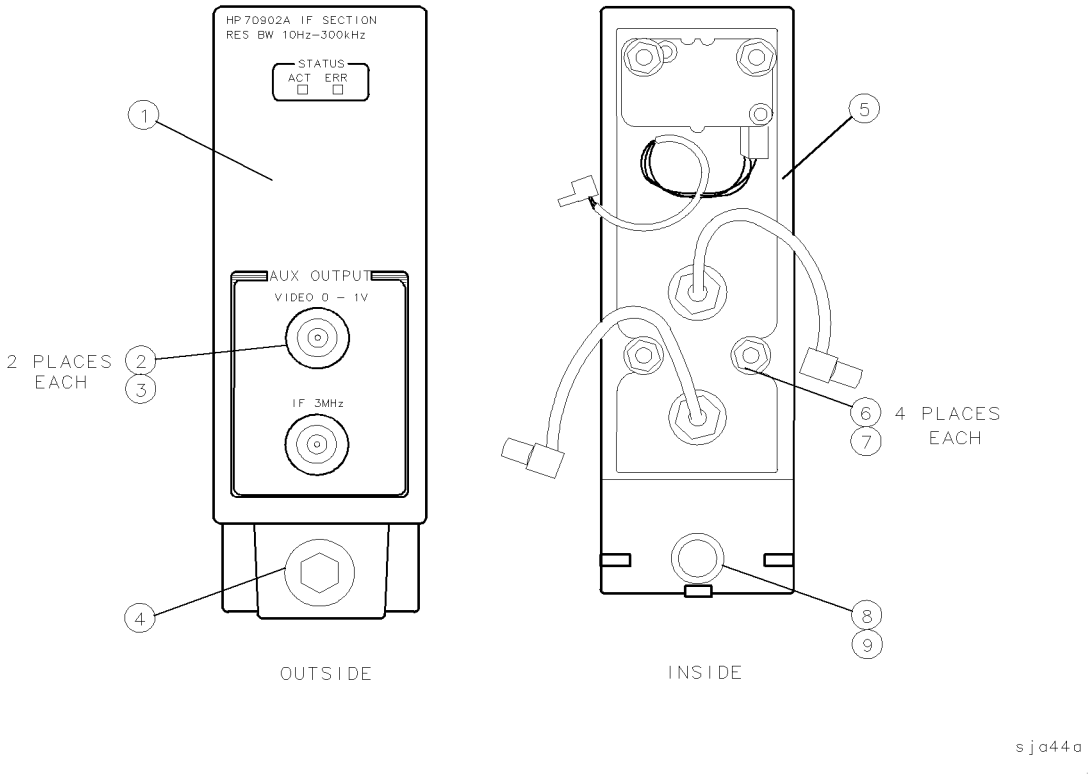

Figure 8-1. Overall Module Parts Identification, Front Panel

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70902-00003	7	1	PANEL-FRONT	28480	70902-00003
2	2190-0104	0	2	WASHER-LK INTL T 7/16 IN 439-IN-ID	78189	1922-04
3	0590-1251	6	2	NUT-SPCLY 15/32-32-THD		
				.1-IN-THK .562-WD	00000	ORDER BY DESCR.
4	5021-3290	7	1	LATCH-MOD TH REC	28480	5021- 3290
5	70902-20020*	0	1	FRONT FRAME MACH	28480	70902-20020
6	3050-0893	9	4	WASHER-FL MTLC 4.0 MM 4.4-MM-ID	28480	3050-0893
7	0535-0023	2	4	NUT-HEX DBL-CHAM M4 × 0.7 3.2MM-THK	00000	ORDER BY DESCR.
8	0510-1244	9	1	RETAINER-PUSH ON CIRCULAR-EXT	79136	11-410-0120-100
9	0900-0012	4	1	O-RING .364-IN-ID		
				.07-IN-XSECT- DIA NTRL	51633	AS568-012 A-700

* If the serial prefix of the module is earlier than 2626A, refer to "Module Body/Cover/Top-Clamp Versions" for information about any related parts that must be replaced if this part is replaced.

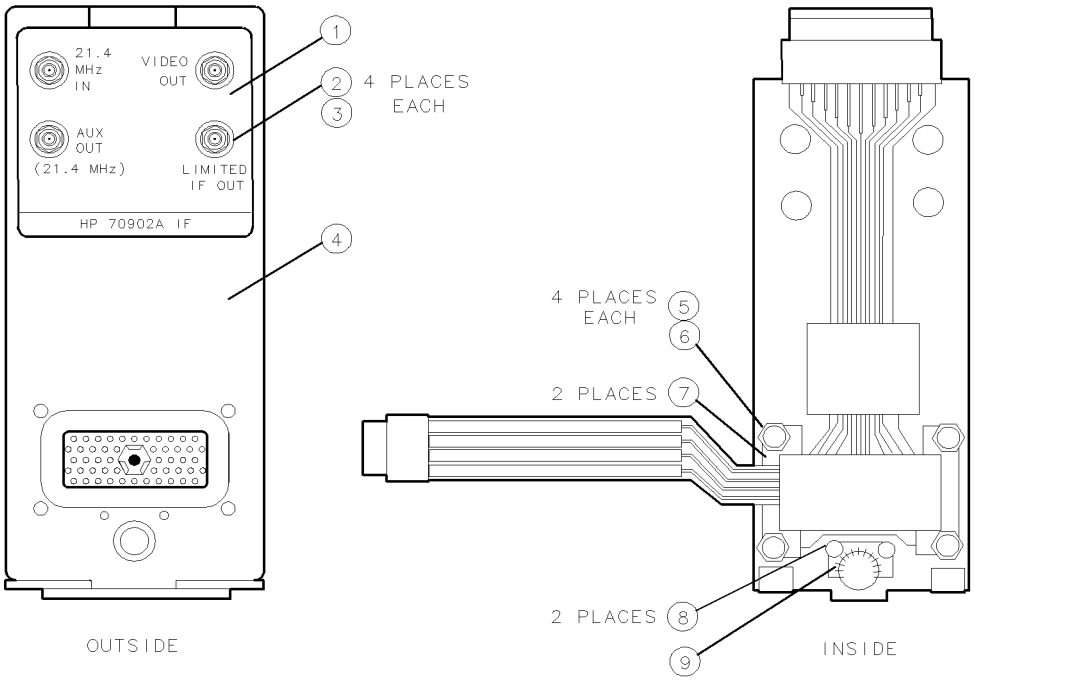

Figure 8-2. Overall Module Parts Identification, Rear Panel

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70902-80002	4	1	LABEL-REAR PANEL	28480	70902- 80002
2	2190-0124	4	4	WASHER-LK INTL T NO. 10 .195-IN-ID	16179	500222
3	2950-0078	9	4	NUT-HEX-DBL-CHAM 10-32-THD		
				.067-IN-THK .562-WD	28480	2950-0078
4	5021-5417*	4	1	REAR FRAME	28480	70902-20019
5	1460-2095	4	4	SPRING-CPRSN 5.49-MM-OD		
				16.8-MM-OA-LG	28480	1460-2095
6	0535-0042	5	4	NUT-HEX PLSTC-LKG M3 × 0.5 4MM-TK	00000	ORDER BY DESCR.
7	5001-5835	8	2	BAR-CONNECTOR	28480	5001-5835
8	0515-1717	1	2	SCREW-MACHINE ASSEMBLY M2.5 × 0.45	28480	0515-1717
9	5001-5840	5	1	SPRING-GROUNDING	28480	5001- 5840

* If the serial prefix of the module is earlier than 2626A, refer to "Module Body/Cover/Top-Clamp Versions" for information about any related parts that must be replaced if this part is replaced.

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1121	1	4	SCREW-MACH M2.5 × 0.45 6MM-LG	28480	0515-1121
2	0515-1351*	9	11	SCREW-MACH M2.5 × 0.45 8MM- LG	28480	0515-1351
3	5021-6769*	1	1	TOP CLAMP	28480	5021-6769
* If the serial prefix of the module is earlier than 2626A, refer to "Module Body/Cover/Top-Clamp Versions" for information about any related parts that must be replaced if this part is replaced.						

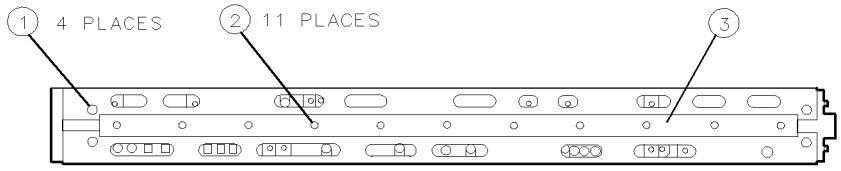

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Figure 8-3. Overall Module Parts Identification, Top View

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1121	1	10	SCREW-MACH M2.5 × 0.45 6MM-LG	28480	0515-1121
2	5001-5864	3	1	COVER-BOTTOM	28480	5001-5864
3	0515-0905	7	9	SCREW-MACH M2.5 × 0.45 6MM-LG PAN-HD	28480	0515-0905

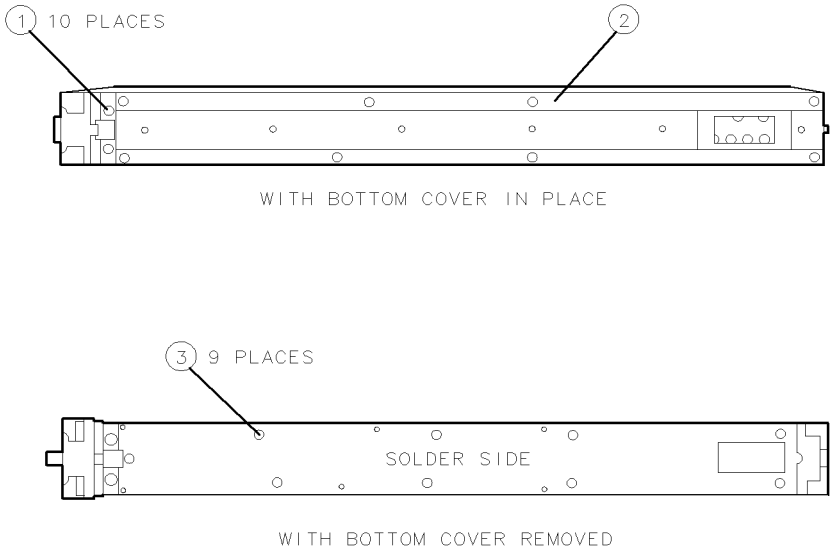

Figure 8-4. Overall Module Parts Identification, Bottom View

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	70902-00007	1	1	COVER RIGHT	28480	70902-00007
2	70902-00008*	2	1	COVER LEFT	28480	70902-00008
3	0515-1548	6	19	SCREW-MACH ASSEMBLY M2.5 × 0.45	28480	0515-1548
4	70902-20024*	4	1	MODULE BODY	28480	70902- 20024
* If the serial prefix of the module is earlier than 2626A, refer to "Module Body/Cover/Top-Clamp Versions" for information about any related parts that must be replaced if this part is replaced.						

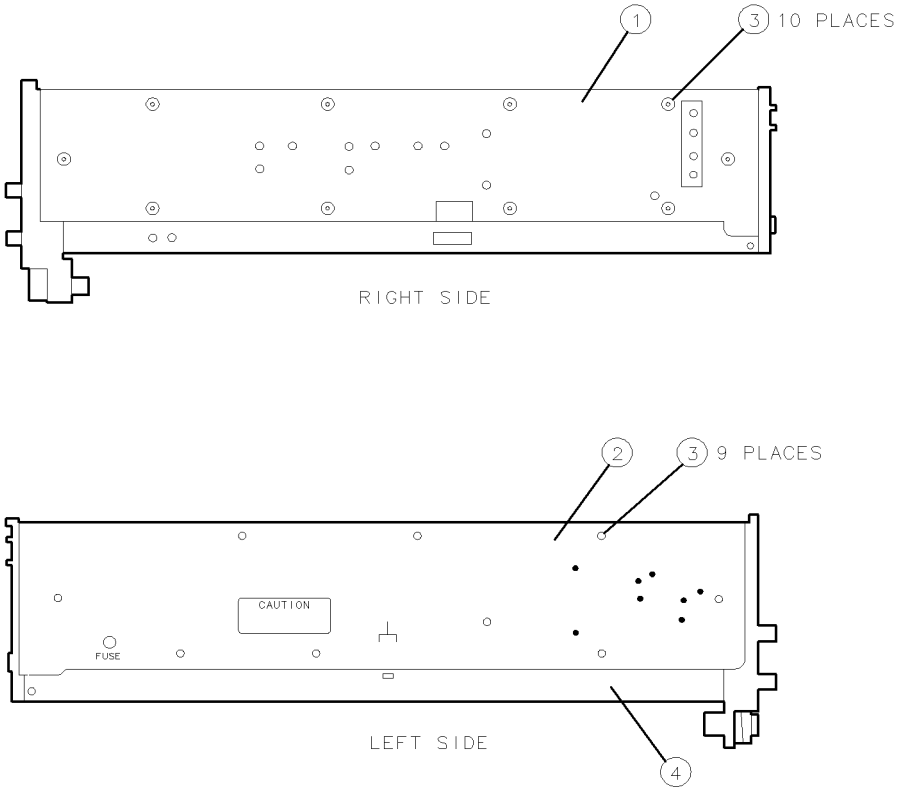

Figure 8-5. Overall Module Parts Identification, Side Views with Covers

Item No.	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-0905	7	7	SCREW-MACH M2.5 × 0.45 6MM-LG PAN-HD	28480	0515-0905
2	0515-1121	1	2	SCREW-MACH M2.5 × 0.45 6MM- LG	28480	0515-1121

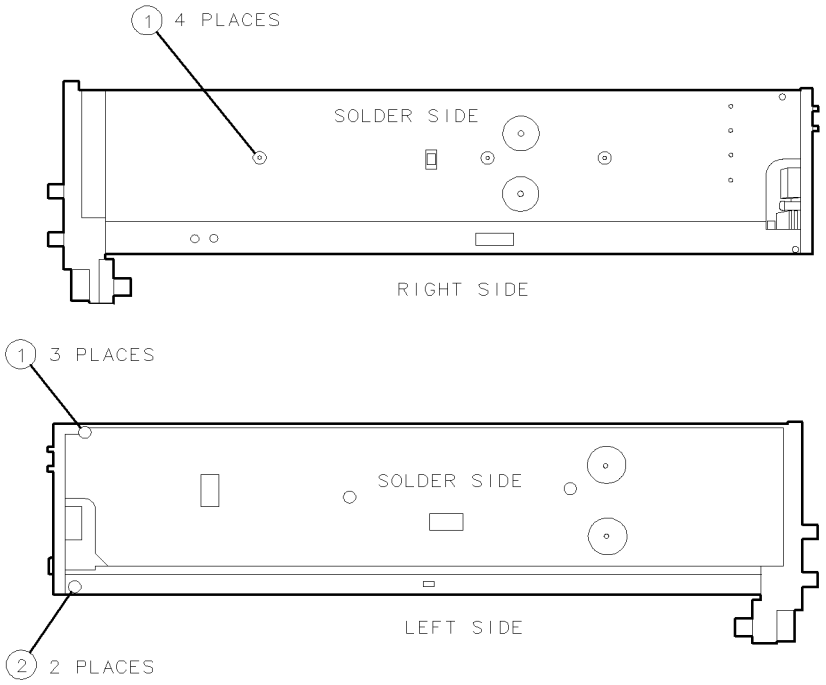

Figure 8-6. Overall Module Parts Identification, Side Views without Covers

9

Major Assembly and Cable Locations

The locations of the board assemblies and cables of the HP 70902A IF section are shown in Figure 9-1. Each assembly and cable is listed below by reference designation. Figure 9-2 shows the rear panel "J" designations as referred to on the overall block diagram and schematics.

Board Assemblies

A1 and A2 Matched Set 70902-60035
A1 Downconverter 70902-60042
A2 Log Amplifier/Power Supply 70902-60047
A3 MSIB Control Board 70902-60039
A4 Front Panel 70902-60027

Cable Assemblies

W1 Upper Coax Assembly 70902-60007
W2 Lower Coax Assembly 70902-60008
W3 Signal Path Coax Assembly 70902-60009
W4 Cable Assembly 5061-5492
W5 Flexible Circuit Assembly—Down 70902-60011
W6 Flexible Circuit Assembly—Down 70902-60011
W7 Flexible Circuit Assembly—Log 70902-60010
W8 Flexible Circuit Assembly—Log 70902-60010
W9 Flexible Assembly—Rear 70902-60023

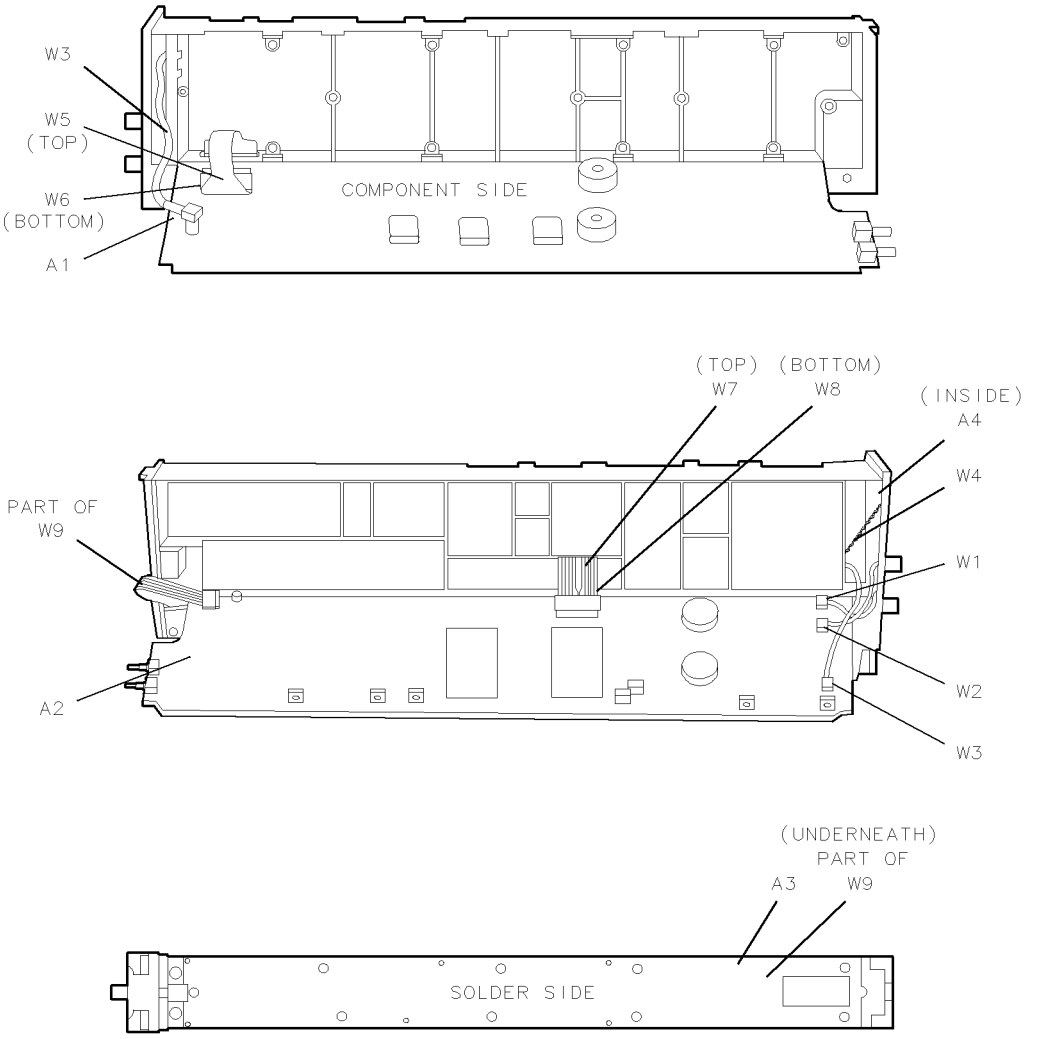

Figure 9-1. Major Assemblies

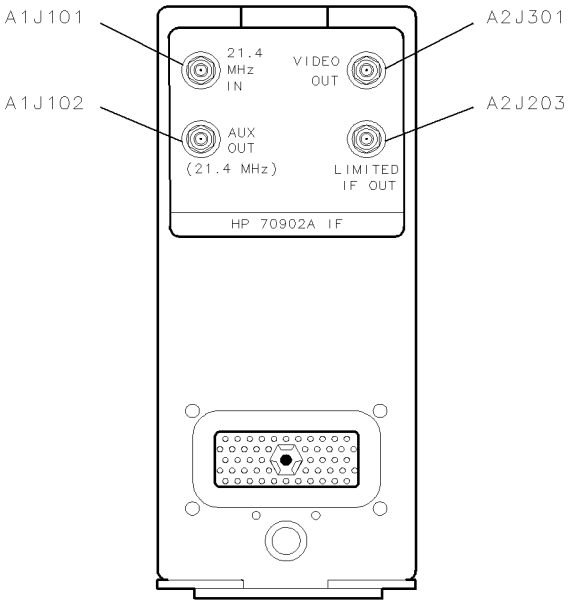

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Figure 9-2. Rear-Panel Connector "J" Designations

Index

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