HEWLETT PACKARD

# SERVICE MANUAL
## Volume 1

# HP 70900A
# LOCAL OSCILLATOR

### SERIAL NUMBERS

This manual applies directly to HP 70900A LO modules with serial numbers prefixed 2842A and below.



Manual Part Number: 70900-90116
Microfiche Part Number: 70900-90117
Printed: December 1988

## CERTIFICATION

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

## WARRANTY

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

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

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

*LIMITATION OF WARRANTY*

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

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

*EXCLUSIVE REMEDIES*

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

## ASSISTANCE

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

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

## SAFETY SYMBOLS

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

⚠ Instruction manual symbol. The instrument will be marked with this symbol when it is necessary for the user to refer to the instruction manual in order to protect the instrument against damage. Location of pertinent information within the manual is indicated by use of this symbol in the table of contents.

ϟ Indicates dangerous voltages are present. Be extremely careful.

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

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

## 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 voltages at 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.**

# HP 70000 MODULAR MEASUREMENT SYSTEM DOCUMENTATION OUTLINE

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

## Manuals Supplied with Module

### INSTALLATION AND VERIFICATION MANUAL

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

### OPERATION MANUAL

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

### PROGRAMMING MANUAL

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

## Service Manual, Available Separately

When available, this manual provides service information for a module, including module verification tests, adjustments, troubleshooting, replaceable parts lists, and replacement procedures. For ordering information, contact an HP Sales and Service Office. (NOTE: Some versions of this manual are titled *Technical Reference*.)

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# Chapter 1

# General Information

## Introduction

The HP 70900A Service Manual contains information required for testing, adjusting, and servicing the HP 70900A Local Oscillator module to the component level. The manual is a three volume set that includes the following chapters:

**Chapter 1, General Information,** contains information on module versions, service kits, and recommended test equipment.

**Chapter 2, Verification Software,** explains how to use the module's verification software. This software runs the performance tests and adjustment procedures.

**Chapter 3, Verification Tests,** contains descriptions on each test used to verify the electrical operation of the module.

**Chapter 4, Adjustment Procedures,** contains descriptions of the procedures used to adjust the module after a repair.

**Chapter 5, Troubleshooting,** contains troubleshooting procedures.

**Chapter 6, Replacement Procedures,** contains instructions for replacing all major assemblies.

**Chapter 7, Replaceable Parts,** contains the information necessary to order parts and/or assemblies for the module.

**Chapter 8, Major Assembly and Cable Locations,** contains figures identifying all major assemblies and components.

**Chapter 9, Component-Level Information,** contains all module block diagrams and component level parts lists and diagrams.

# Safety Considerations

Before servicing this module, you should familiarize yourself with the safety markings on the module and the safety instructions in this manual. This module has been manufactured and tested according to international safety standards. However, to ensure safe operation of the module and personal safety of the user and service personnel, the cautions and warnings in this manual must be followed. Refer to the summary of safety considerations at the front of this manual. Refer also to individual sections of this manual for detailed safety notation concerning the use of the module as described in those individual sections.

# Manual Conventions

The following conventions are used throughout this manual:

Keys located physically on an instrument are represented with bold capitalized print.

Key . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **[MENU]**

Softkeys, keys defined by software or firmware, are represented by print enclosed in braces { }.

Softkey . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . {CENTER FREQ}

# Modules Covered by Manual

## Serial Numbers

Attached to the front frame of your module is a mylar serial number label. The serial number is in two parts. The first four digits and letter are the serial number prefix; the last five digits are the suffix (see Figure 1-1). The prefix is the same for all identical modules; it changes only when a change is made to the module. The suffix, however, is assigned sequentially and is different for each module. The contents of this manual apply to modules with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.


*Figure 1-1. Typical Serial Number Label*

## Manual Updating Supplement

A module manufactured after the printing of this manual might have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates that the module is different from those described in this manual. The manual for this newer module is accompanied by a Manual Updating Supplement. This supplement contains change information that explains how to adapt the manual to the newer module.

In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Updating Supplement. Copies of the supplement are available from Hewlett-Packard offices listed at the end of this chapter.

# Assembly Versions

**NOTE**

**Early modules used an A1 Controller Assembly. This assembly was obsoleted in later modules and replaced with a combination A1A1 Processor and A1A2 RAM/ROM assembly.**

Module serial numbers do not always accurately indicate the assembly versions used in the module. Always check an assembly's version (e.g., part number) before servicing an assembly. Refer to Table 9-1 in Chapter 9 for a complete list of assembly versions documented in this manual.

The version of a board assembly is identified by the part number printed on the circuit board. The part number is a ten digit number consisting of a five digit prefix and five digit suffix. (Microcircuit part numbers are an eight digit number.) The suffix varies for each board type and version produced. Later versions of an assembly will always have a suffix with a higher numerical value than the first version. For example, the first version of the A2 Video Processor assembly has a 70900-60004 part number. The number for the second version of this assembly is 70900-60094.

**NOTE**

**Be sure that you are using the correct schematic or component location diagram for the assembly being worked on. Match the assembly part number printed on the circuit board with the part number printed on the diagrams.**

# Module Verification Software

The HP 70900A Module Verification Software documented in Chapter 2 is available from the HP Sales and Service Offices listed in Table 1-5. The software contains the verification tests and adjustment procedures required to service this module. Refer to the Chapter 2 of this manual for information on using the software. Refer to the Chapter 3 for descriptions of each test. Refer to the Chapter 4 for information on adjusting the module.

# Service Kits

The following two kits aid the user in servicing the HP 70900A Local Oscillator module. Use the ten-digit numbers listed when ordering the kits from Hewlett-Packard.

## HP 71000 System Service Kit (71000-60002)

This service kit is the general service kit for HP 70000 series modules. The kit includes servicing tools required to repair all HP 70000 series modules and a modification procedure for the HP 70001A Mainframe. The modification allows access to modules during bench testing and repairing. Refer to Table 1-1 for a list of parts included in the kit.

## HP 70900A LO Service Kit (70900-60102)

This service kit supplies the specific service tools required to service the HP 70900A LO module. These tools are not supplied in the HP 71000 System Service Kit. Refer to Table 1-2 for a list of tools included in the kit.

*Table 1-1. HP 71000 System Service Kit*

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

*Table 1-2. HP 70900A LO Service Kit Tools*

| Description | Quantity | HP Part Number |
|---|---|---|
| Fuse 2.0A, 125V | 20 | 2110-0517 |
| Extender Cable, 5 pin | 2 | 70900-60067 |
| Extender Cable, 6 pin | 1 | 70900-60062 |
| Extender Cable, 7 pin | 2 | 70900-60061 |
| Extender Cable, 9 pin | 1 | 70900-60063 |
| Extender Cable, 10 pin | 1 | 70900-60064 |
| Extender Cable, 14pin | 1 | 70900-60065 |
| Extender Cable, 50 pin | 3 | 70900-60059 |
| Extender Cable, A1A1 Host/Processor Assembly | 2 | 70900-60058 |
| Extender Cable, A8 Freq/ Cont. to A6A5 YTO | 1 | 70900-60060 |
| Ribbon Cable, A3 Power Supply | 1 | 70900-60057 |
| Backplane Interconnect Flexprint Cable | 1 | 5062-1933 |
| LO Cover, modifier | 1 | 70900-00012 |
| DIP Clip, 16-pin IC | 1 | 5959-0288 |
| Mini-grabber clip | 1 | 1400-0734 |

# Recommended Test Equipment

Equipment required for the verification tests and adjustment procedures are listed in Table 1-6. Any equipment that satisfies the critical specifications given in the table may be substituted for the preferred test equipment. However, the HP 70900A Module Verification software only contains instrument drivers for the equipment listed in Table 1-6. Any additional drivers will have to be written by the user.

# Specialized Test Equipment

Some of the verification tests, adjustment procedures, and troubleshooting procedures require specialized test equipment constructed by the user. This equipment must be constructed using the procedures provided in this manual. Most of the parts used can be ordered from Hewlett-Packard. Refer to Table 1-3 for a list of constructed test equipment used in the manual.

*Table 1-3. Constructed Test Equipment*

| Constructed Test Equipment | Used In | Location of Construction Procedure |
|---|---|---|
| 300 MHz to 6 GHz Upconverter | Verification Tests<br>Troubleshooting Procedures | Chapter 3 |
| Sniffer Loop | Verification Tests | Chapter 3 |
| 20:1 Resistive Divider | Adjustment Procedures | Chapter 4 |
| Modified IC Clip | Adjustment Procedures | Chapter 4: Adjustment 8, step 2 |

# Electrostatic Discharge Information

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

Figure 1-2 shows an example of a static-safe work station. Two types of ESD protection are shown: a) conductive table mat and wrist strap combination, and b) conductive floor mat and heel strap combination. The two types *must* be used together to ensure adequate ESD protection. Refer to Table 1-4 for a list of static-safe accessories and their part numbers.

## Reducing ESD Damage

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

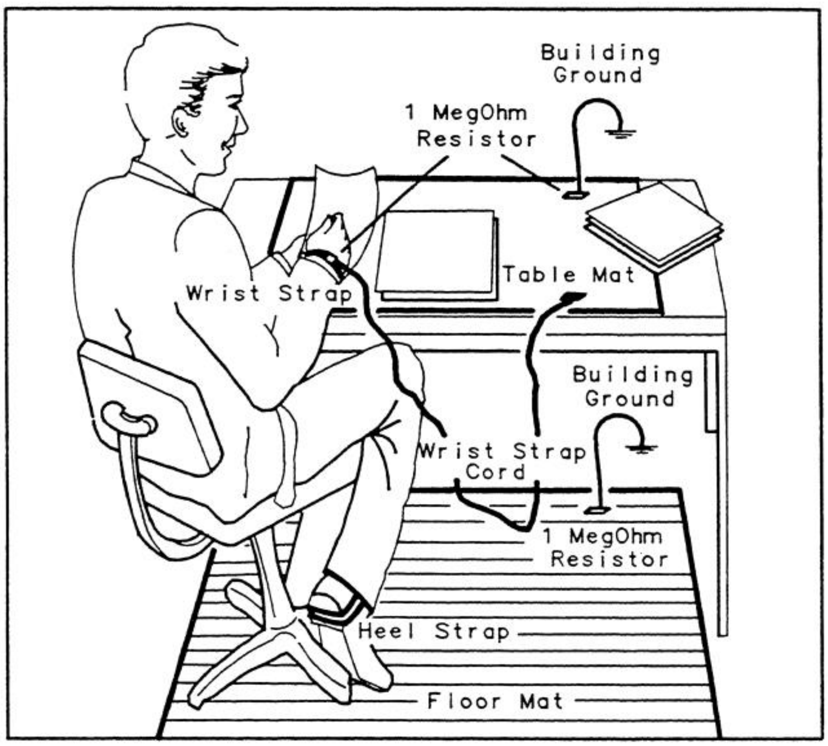



*Figure 1-2. Static-Safe Work Station*

## PC Board Assemblies and Electronic Components

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

CAUTION

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

## Test Equipment

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

*Table 1-4. Static-Safe Accessories*

| Accessory | Description | HP Part Number |
|---|---|---|
| Static-control mat and ground wire[1] | Set includes:<br>3M static control mat 0.6m × 1.2m<br>(2 ft. × 4 ft.) and 4.6m (15 ft.) ground wire<br>(The wrist strap and wrist strap cord are *not* included. They must be ordered separately.) | 9300-0797 |
| Wrist strap cord[1] | 1.5m (5 ft.) | 9300-0980 |
| Wrist strap[1] | Large<br>Small | 9300-0985<br>9300-0986 |
| ESD heel strap[1] | Reusable 6 to 12 months | 9300-1169 |
| Shoe ground strap[1] | One-time use only | 9300-0793 |
| Hard-surface static-control mat[2] | Large, black, 1.2m × 1.5m (4 ft. × 5 ft.)<br>Small, black, 0.9m × 1.2m (3 ft. × 4 ft.) | 92175A<br>92175C |
| Soft-surface static-control mat[2] | Brown, 1.2m × 2.4m (4 ft. × 8ft.) | 92175B |
| Tabletop static control mat[2] | 58 cm × 76 cm (23 in. × 30 in.) | 92175T |
| Anti-static carpet[2] | Small, 1.2m × 1.8m (4 ft. × 6 ft.)<br>natural color<br>russet color<br>Large, 1.2m × 2.4m (4 ft. × 8 ft.)<br>natural color<br>russet color | <br>92176A<br>92176C<br><br>92176B<br>92176D |

[1] Ordered from any Hewlett-Packard Sales and Service Office

[2] These accessories can be ordered from
Hewlett-Packard Company
Computer Supplies Operations
1320 Kifer Road
Sunnyvale, California 94086
Phone: (408) 738-8858

# Sales and Service Offices

Hewlett-Packard has sales and service offices around the world providing complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 1-5.

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

**NOTE**

**Within the U.S.A., a toll-free phone number is available for ordering replacement parts. Refer to "Ordering Information" in Chapter 4, "Replaceable Parts", for the phone number and more information.**

# Returning Instruments for Service

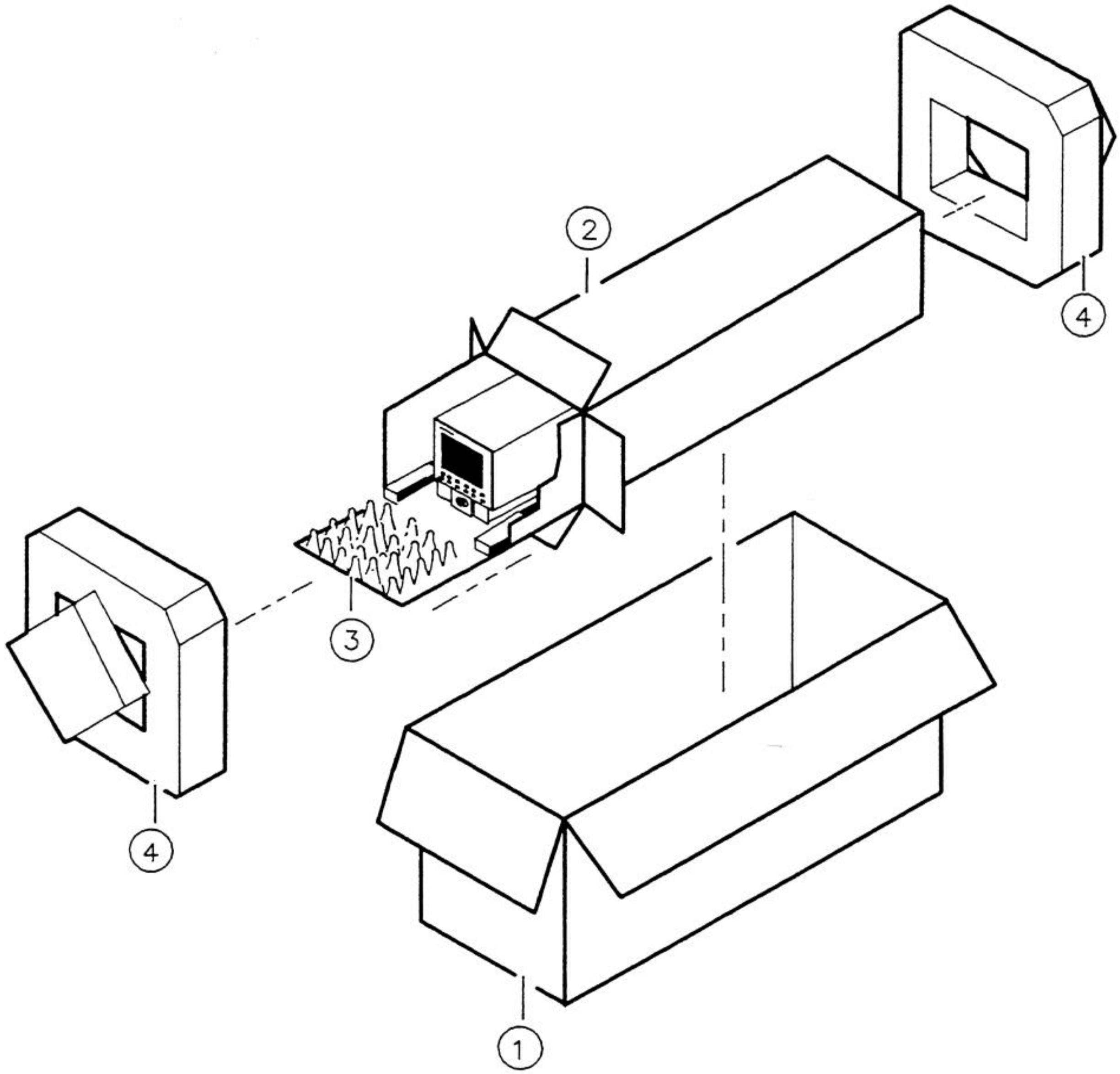
## Service Tag

If you are returning the instrument to Hewlett-Packard for servicing, fill in and attach a blue service tag. (Service tags are supplied at the end of this chapter.

Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen or have any other specific data on the performance of the analyzer, please send a copy of this information with the unit.

## Original Packaging

Befor shipping, pack the unit in the original factory packaging materials if they are available (see Figure 1-3). Original materials are available through any Hewlett-Packard office.




| ITEM | QTY | HP PART NO. | DESCRIPTION |
|---|---|---|---|
| 1 | 1 | 9211-5118 | CARTON-OUTER |
| 2 | 1 | 9211-5119 | CARTON-INNER |
| 3 | 1 | 5180-2369 | CARTON-SLIDER |
| 4 | 2 | 5180-2370 | FOAM PADS |

*Figure 1-3. Factory-Packaging Materials*

## Other Packaging

**CAUTION**

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

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. Install the front-panel cover on the instrument.
3. Wrap the instrument in anti-static plastic to reduce the possibility of damage caused by electrostatic discharge.
4. Use a strong shipping container. A double-walled, corrugated cardboard carton of 159-kg (350-lb) bursting strength is adequate. The carton must be large enough and strong enough to accommodate the instrument. Allow at least three to four inches on all sides of the instrument for packing material.
5. Surround the instrument with three to four inches of packing material, to protect the instrument and prevent it from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap from Sealed Air Corporation (Commerce, California 90001). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink (antistatic) Air Cap to reduce static electricity. Wrapping the instrument several times in this material should both protect the instrument and prevent it from moving in the carton.
6. Seal the carton with strong nylon adhesive tape.
7. Mark the carton “FRAGILE, HANDLE WITH CARE”.
8. Retain copies of all shipping papers.

*Table 1-5. Hewlett-Packard Sales and Service Offices*

**IN THE UNITED STATES**

**California**

Hewlett-Packard Co.
P.O. Box 4230
1421 South Manhattan Ave.
Fullerton, CA 92631
(714) 999-6700
Hewlett-Packard Co.
301 E. Evelyn Ave.
Mountain View, CA 94039
(415) 694-2000

**Colorado**

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

**Georgia**

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

**Illinois**

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

**New Jersey**

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

**Texas**

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

**IN AUSTRALIA**

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

**IN CANADA**

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

**IN FRANCE**

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

**IN GERMAN FEDERAL REPUBLIC**

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

**IN GREAT BRITAIN**

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

**IN OTHER EUROPEAN COUNTRIES**

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

**IN JAPAN**

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

**IN PEOPLE'S REPUBLIC OF CHINA**

China Hewlett-Packard, Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory
Main Bldg.
Shuang Yu Shu, Bei San Huan
Rd.
Beijing
28-0567

**IN SINGAPORE**

Hewlett-Packard Singapore
Pte. Ltd.
#08-00 Inchcape House
450-2 Alexandra Road
Alexandra P.O. Box 58
Singapore, 9115
4731788

**IN TAIWAN**

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

**IN ALL OTHER LOCATIONS**

Hewlett-Packard Inter-Americas
3200 Hillview Avenue
Palo Alto, California 94304

*Table 1-6. Recommended Test Equipment (1 of 3)*

| Equipment | Critical Specifications | Recommended Model | Verif. Test | Adj. Proc. |
|---|---|---|---|---|
| **HP 70000 COMPONENTS** | | | | |
| Mainframe | HP 71000 System Mainframe | HP 70001A | √ | √ |
| Test System | Modules required to configure the HP 70900A Local Oscillator under test into a functioning spectrum analyzer. | HP 70902A, HP 70903A, HP 70905A/6A, HP 70908A | √ | |
| Frequency Standard | Aging: $<10^{-9}$/day<br>Output: 10 MHz, 100 MHz | HP 70310A | √ | √ |
| Extender Module | HP Series 71000 Extender Module | HP 70001–60013 | | √ |
| Display | HP 71000 System Display | HP 70205A/6A | √ | |
| **SIGNAL SOURCES** | | | | |
| Full Microwave Source | Frequency Range: 2.7 – 26 GHz<br>Output Power: −30 to +5 dBm (leveled)<br>Aging Rate: $<10^{-9}$/day | HP 8340A/B | √ | |
| Microwave Source | Frequency Range: 30 MHz to 12.8 GHz<br>Output Power: −30 to +5 dBm (leveled)<br>Aging Rate: $<10^{-9}$/day | HP 8340A/B | √ | √ |
| Synthesized Source | Frequency Range: 100 MHz to 500 MHz<br>Output Power: −30 to +5 dBm (leveled)<br>Aging Rate: $<10^{-9}$/day | HP 8662A<br>HP 8663A<br>HP 8340A/B | √ | √ |
| Level Generator | Frequency Range: 20 MHz<br>Amplitude Range: +12 to −85 dBm<br>Amplitude Accuracy: <0.1 dB | HP 3335A | √ | |
| Function Generator | Output: Sine, Square, Triangle Wave; 1.5Vp–p<br>DC Offset: 0 – 2 Vdc<br>Freq. Range: 100 – 5 MHz | HP 3325A | √ | |
| **ANALYZERS** | | | | |
| Calibrated Spectrum Analyzer | Frequency Range: 30 MHz – 19.6 GHz<br>Preselected: >2 GHz<br>Dynamic Range: >85 dB<br>Minimum Resolution BW: 10 Hz<br>Log Fidelity error: < ±1 dB<br>(Must have external freq. reference input and digital video averaging capability) (Requires Calibration: refer to Chapter 3) | HP 8566B (Upgraded with 16.785 or later firmware) | √ | √ |
| Spectrum Analyzer | Frequency Range: 3.0 – 6.6 GHz<br>Log Fidelity Error: < ±0.1 dB<br>(Must have external freq. reference input) | HP 71200A, HP 8566B (Upgraded with 16.7.85 or later firmware) | √ | √ |

*Table 1-6. Recommended Test Equipment (2 of 3)*

| Equipment | Critical Specifications | Recommended Model | Verif. Test | Adj. Proc. |
|---|---|---|---|---|
| **METERS** | | | | |
| Power Meter | Power Range: −20 dBm to +10 dBm<br>Accuracy: ±0.02 dB | HP 436A,<br>HP 8902A Opt. 002 | √ | √ |
| Power Sensor | Frequency Range: 30 MHz – 20 GHz<br>Power Range −20 to +10 dBm | HP 8485A | √ | √ |
| Precision DVM | Range: 0 – 10V<br>Accuracy: 10 μV<br>Digit Readout: >5 1/2 digits | HP 3456A | √ | √ |
| Voltmeter | Range: 0 – 10V<br>Accuracy: 10 μV | HP 3456A | √ | |
| **OSCILLOSCOPE** | | | | |
| Oscilloscope | BW: dc to 100 MHz<br>Sensitivity: <5 mV/div<br>General: Dual Channel | HP 54111D | √ | √ |
| Oscilloscope Probe | 10:1 Division Ratio | HP 10080A | √ | √ |
| **MISCELLANEOUS DEVICES** | | | | |
| External Reference | Output: 10 MHz<br>Aging Rate: $<10^{-9}$/day | HP 5061B,<br>HP 70310A | √ | √ |
| Directional Coupler | Directivity: >30 dB at 300 MHz | HP 778D | √ | |
| Power Splitter | 10 MHz to 22 GHz | HP 11667B | √ | |
| Power Supply | General Perpose: 0 - 40V | HP 6205C | | √ |
| Attenuator | Attenuation: 20 dB | HP 8491A Option 20 | √ | |
| Calibrated Open/Short | APC 3.5 (m) | HP 85037–60001 | √ | |
| Termination | Type N (m), 50Ω Impedance | HP 908A | √ | |
| **CONSTRUCTED TEST EQUIPMENT** | | | | |
| Resistive Divider | Refer to the Chapter 4. | | | √ |
| Sniffer Loop | Refer to the Chapter 3. | | √ | |
| 300 MHz Upconverter | Refer to the Chapter 3. | | √ | |

*Table 1-6. Recommended Test Equipment (3 of 3)*

| Equipment | Critical Specifications | Recommended Model | Verif. Test | Adj. Proc. |
|---|---|---|---|---|
| **SERVICE KIT** | | | | |
| HP 71000 System Service Kit | N/A | HP 70900–60002 | | √ |
| LO Module Service Kit | N/A | HP 70900–60102 | | √ |
| **CABLES** | | | | |
| Cable Assembly | APC 3.5 (m) (m) *(3 required)*<br>Frequency Range: 100 MHz – 26 GHz<br>VSWR: < 1.25<br>Length: 1 meter | HP 8120–4921 | √ | √ |
| Cable Assembly | BNC (m) to SMB (f) *(3 required)* | HP 85680–60093 | √ | √ |
| Cable Assembly | BNC (m) to BNC (m) | HP 10503A | √ | √ |
| **ADAPTERS** | | | | |
| Adapter | APC 3.5 (f) to APC 3.5 (f) | HP 5061–5311 | √ | √ |
| Adapter | Type N (f) to APC 3.5 (m) | HP 1250-1750 | √ | |
| Adapter | Type N (f) to APC 3.5 (f) *(2 required)* | HP 1250-1745 | √ | |
| Adapter | Type N (m) to APC 3.5 (f) *(3 required)* | HP 1250–1744 | √ | √ |
| Adapter | Type N (f) to BNC (m) | HP 1250–0077 | √ | |
| Adapter | Type N (m) to BNC (f) | HP 1250–1476 | √ | √ |
| Adapter | SMA (f) to SMB (m) *(2 required)* | HP 1250–0674 | √ | √ |
| Adapter | SMB (f) to SMB (f) *(2 required)* | HP 1250–0672 | √ | √ |
| Adapter | SMB Tee (m) (f) (m) | HP 1250–1391 | √ | √ |
| Adapter | BNC (f) to SMA (m) | HP 1250-1200 | √ | √ |
| Adapter | BNC (m) to SMA (f) | HP 1250–1700 | √ | √ |
| Adapter | BNC (m) to BNC (m) | HP 1250-0216 | √ | √ |
| Adapter | BNC (f) to dual banana plug *(2 required)* | HP 1251–2277 | √ | √ |
| Adapter | BNC Tee (f) (m) (f) | HP 1250–0781 | | √ |
| Adapter | BNC (f) to Alligator Clips | HP 1250–1292 | | √ |

# Chapter 2

# VERIFICATION SOFTWARE

Verification Software is the program designed to automate the module's verification tests and adjustment procedures. Included in this chapter is a step-by-step procedure to load the software and get the verification tests or adjustment procedures underway. For more detailed information, refer to the sections regarding individual menus. Listed below are the major divisions of this chapter.

# General Information

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

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

Refer to verification tests and adjustment procedures in this manual for individual test setups and test descriptions. Chapter 1 contains a list of recommended test equipment.

# Computer Compatibility

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

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

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

## COMPUTER LANGUAGE COMPATIBILITY

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

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

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

DCOMM
SRM

**NOTE**

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

## PRINTER COMPATIBILITY

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

# Typographic Conventions

This manual uses the following typographic conventions to represent key labels for both keyboard keys and softkeys: text enclosed in [BRACKETS] represents keyboard keys; text enclosed in {braces} represents softkeys. `Text in this special typeface` represents messages displayed on 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 keyboard. Refer to the list below if your keyboard key labels do not match the ones used in text.

| Keyboard Key Labels | Alternate Key Labels |
|---|---|
| [EXECUTE] | [RETURN] |
| [ENTER] | [RETURN] |
| [RUN] | press [SYSTEM], then {RUN} |
| [CONTINUE] | press [SYSTEM], then {CONTINUE} |

# Configuring the Hardware

## PROCEDURE

1. Connect the HP 70000 Modular Spectrum Analyzer to the computer port determined by the following criteria:

   a. For computers with an HP 98624A HP-IB Interface, connect your analyzer to the port labeled HP-IB SELECT CODE 8. Check that the address switch on the HP 98624A HP-IB Interface board assembly matches the HP-IB controller device address. If needed, refer to the *HP 9000 Series 200/300 Peripheral Installation Guide, Volume 1.*

   b. For computers without an HP 98624A HP-IB Interface, connect the HP 70000 Modular Spectrum Analyzer to the port labeled HP-IB SELECT CODE 7.

2. Connect the HP-IB cables from the test equipment to the computer's HP-IB SELECT CODE 7 port.

3. Use a 0.5 metre HP-IB cable (HP 10833D, or similar cable) to connect the external disk drive's HP-IB to the HP-IB SELECT CODE 7 port.

**NOTE**

**Occasionally disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If you find this occurring, 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 Verification Software

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

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

## SOFTWARE VERSION

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

```
Rev. A.02.00
```

Locate the program part number printed on the disk labels.

### Procedure

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

CAUTION

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

2. Assign the MSI (mass storage is) to the drive you will use as the default drive. As an example, assigning the MSI to a disk drive looks like this:

```
MSI ":,700,0"
```

3. Insert Executive Disc 1 into the assigned default drive. Type the following command line:

```
LOAD "MOD_VERF",1
```

4. Press [EXECUTE]. The software version number appears in the screen that is next displayed.

5. Follow the on-screen prompts and load Executive Disc 2. Press [CONTINUE]. Loading Executive Disc 2 may require up to two minutes.

**NOTE**

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

6. Replace Executive Disc 2 with Executive Disc 3, then press {PROCEED}. If the date and time prompt appears, enter the date and time in the specified format. (This message appears only if date and time are not current.)

7. If you are using your module's software for the first time, a message appears stating that mass storage data is needed. Press {PROCEED} and follow the on-screen prompts to create a mass storage data file. Once mass storage data is stored, this message will not reappear.

8. An error message may be displayed at this point. If the DUT (device under test) does not match the module listed in the HP-MSIB Address Map, or if the software you are using belongs to another module of your system, refer to "Error Messages" at the end of this chapter to determine a course of action.

9. Load the Operating 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.

10. Load all Driver Discs. Insert each Driver Disc and press {PROCEED}. This process may require up to six minutes.

11. If you have not entered serial numbers for passive devices that require calibration data for test purposes, on-screen prompts request the data now. Enter the data via the Calibration Data screen. Press {CREATE} to access this screen. For a detailed explanation 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.**

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

- Select {FINAL TEST} to perform procedures for which the required test equipment is present, automatically.

- Press {equipment menu} and return to the Equipment Menu. From here you can modify the status of the equipment in the menu (make it unavailable, readdress it, change the private bus, 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 5, "Troubleshooting," for a cross-reference of tests to perform versus assembly adjusted, repaired, or changed.

## PRINTING TEST RESULTS

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

The title page lists the following data:

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

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

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

# Menus

## MENU STRUCTURE

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



Except for the Test Menu, these menus are configuration menus through which you initialize the software for program operation. Via these menus, you enter information about disk drives, environment conditions, test equipment, the module under test, 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 Figures 2-1 through 2-4. Not all of the menus have edit screens, but all have command screens. When softkey labels are written in lowercase letters, a sub-level softkey menu exists for that particular softkey. Softkey labels written in uppercase letters indicate there no further sub-level softkey menus exist for that softkey.

### Edit Screen Menus

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

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

**{DONE}** exits the edit screen, then displays the menu's command screen.

## Command Screen Menus

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

**{main menu}** returns you to the Main Menu. Refer to "Main Menu" 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 HP 8756/7A Network Analyzers, etc.).

Chapter 1 contains a table of required test equipment. Using preferred models of test equipment assures the most complete verification and adjustment testing. Refer to 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 Modular Spectrum Analyzer that you may select to test. The HP-MSIB address of the master and the system are the same. In other words, the address of the master module determines the address of the system. For information on configuring the software to test a specific module, refer to "Equipment Menu" in this chapter.

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

## TEST MENU

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

If you press {MODIFY MODULE}, on-screen commands help you change the model and serial number to the module you want to test. If you press {CHANGE DUT}, go either to the Equipment Menu to change the model number or to the HP-MSIB Address Map to select the module number you want to test.

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

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

**CAUTION**

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

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

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

A message stating that calibration data for passive devices is missing may also appear. If the correct Operating 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.

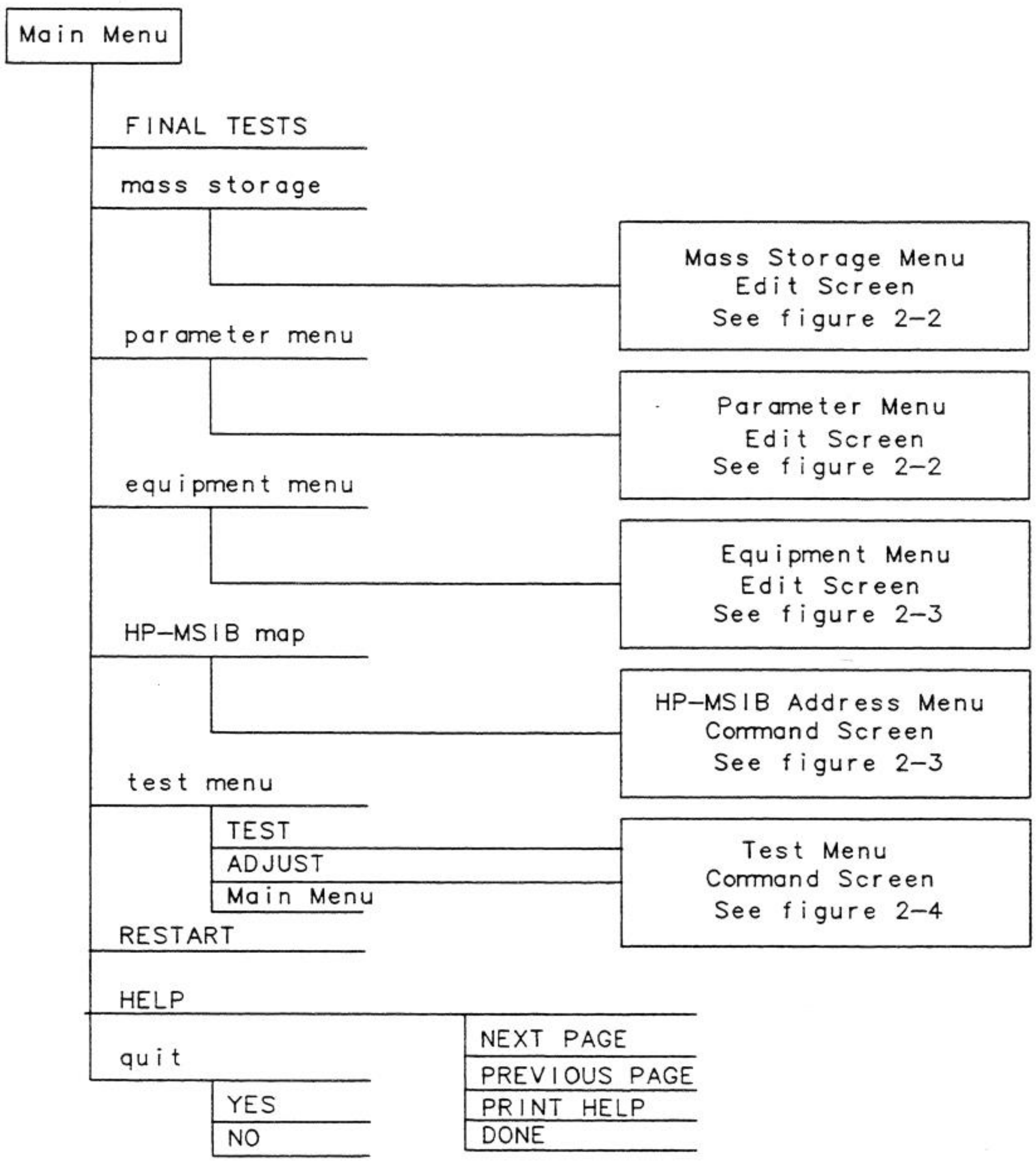



*Figure 2-1. Main Menu Softkeys*

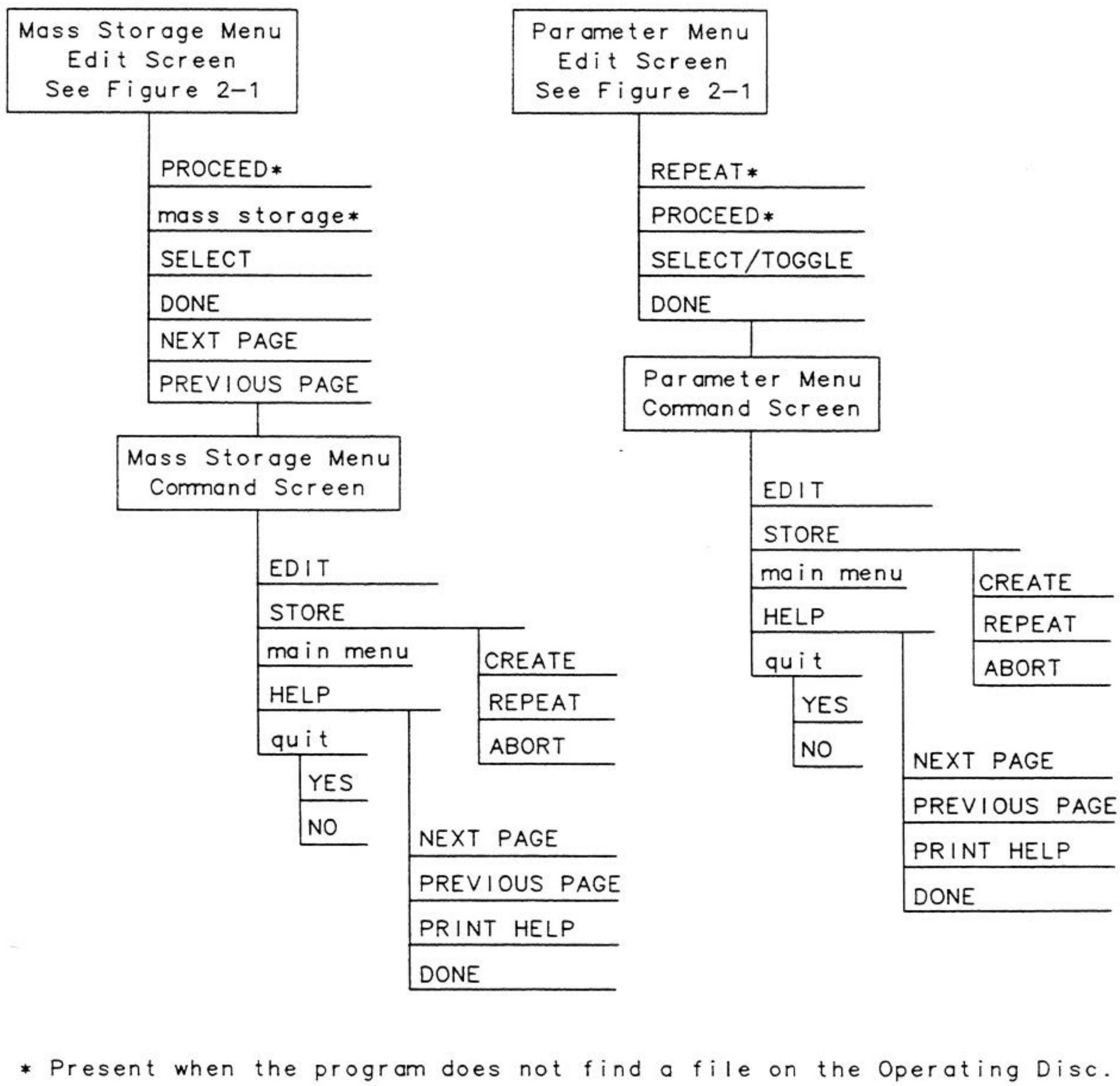



*Figure 2-2. Mass Storage Menu and Parameter Menu Softkeys*

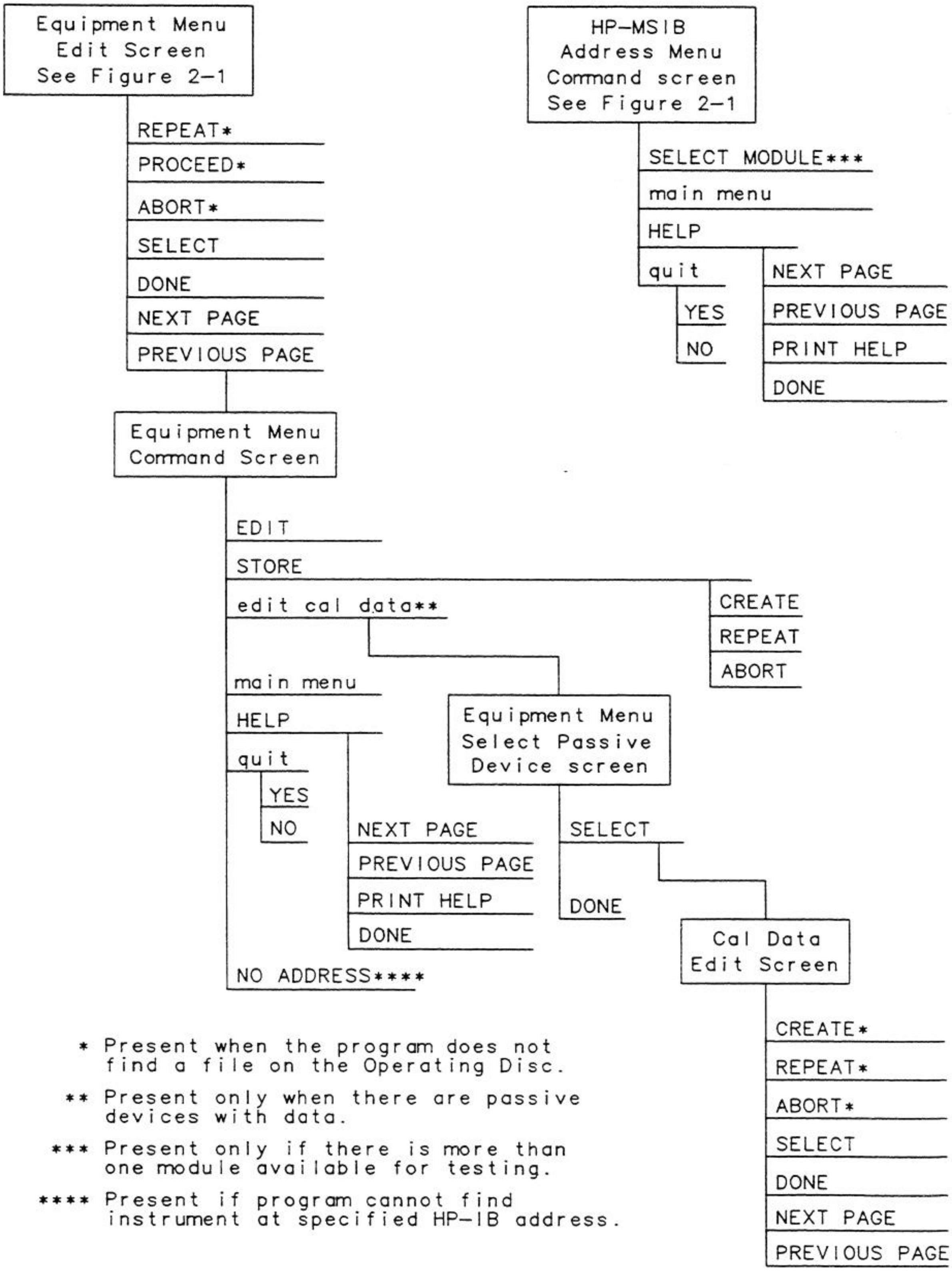
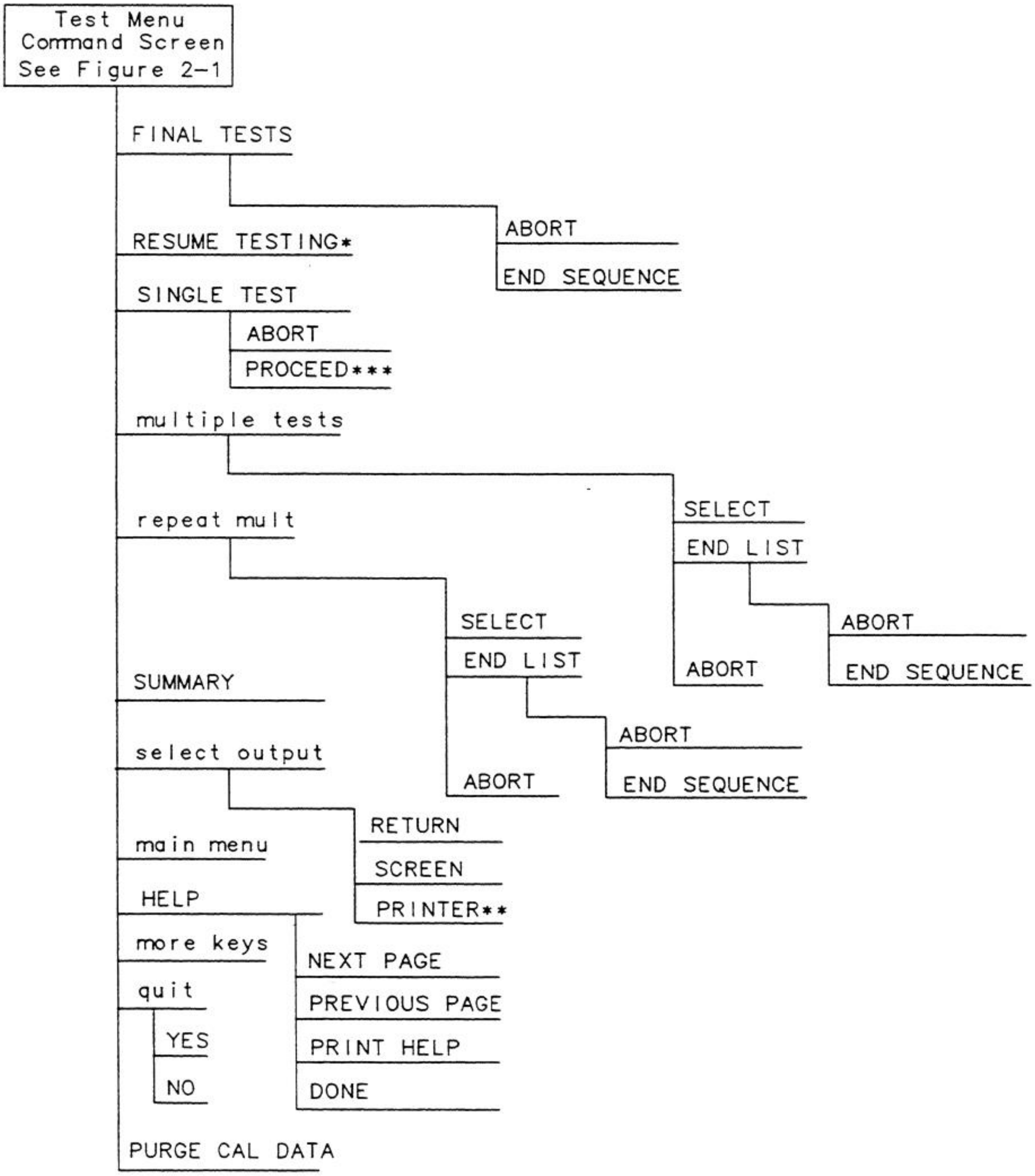



*Figure 2-3. Equipment Menu and HP-MSIB Map Screen Menu Softkeys*




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

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

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

*Figure 2-4. Test Menu Softkeys*

# ERROR AND STATUS MESSAGES

User interface messages used with HP 70000 Series software products are alphabetized in this section. The messages are designed to provide information about test results, operator errors, system conditions, 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 1 for a list of supported equipment.)

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

The program could not find parameter-list data file on the Operating 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 Signal Analysis Division for assistance.

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

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

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

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

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

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

The 8902A needs repair (Error 6).

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

The DUT must have an HP-IB address.

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

THIS COLUMN CAN NOT BE EDITED.

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

THIS IS ____ AND FOUND DUPLICATE FILES: ____.

Contact 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 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].

# Chapter 3

# Verification Tests

## Introduction

This chapter contains descriptions of each HP 70900A verification test. The tests are run from the HP 70900A Module Verification software.

Page

The verification tests check the module's electrical performance. Since there are no specifications on this module outside of the HP 70000 Modular Measurement System, the tests verify module operation in a manner similar to factory production tests. If the module passes the tests, its operation in the HP 70000 Modular Measurement System is assured. All tests can be performed without access to the interior of the module. For information on verifying HP 70000 Modular Spectrum Analyzer specifications, refer to the HP 70900A Installation and Verification Manual.

Throughout this chapter, the word DUT (Device Under Test) refers to the HP 70900A module being tested.

## Verification Software

The verification tests are performed using the HP 70900A Module Verification Software. For information on using the software, refer to Chapter 2, Verification Software.

## Which Tests Should be Run?

To decide which verification tests to run, refer to Table 5-1, Related Adjustments and Verification Tests, in Chapter 5. Table 5-1 lists the tests that should be performed when an assembly is repaired or changed. If the module passes the tests, its operation in the HP 70000 Modular Measurement System is assured.

## Final Tests

The first 21 verification tests are known as Final Tests. These tests are used to verify the operation of the module. Run the Final Tests whenever module operation needs to be verified or after any repair or adjustment. Final tests may be run from both the main and test menus. The remaining verification tests are not required for verifying the module's operation, but may be required after specific repairs or adjustments.

### Manual Tests

Test 21 is a manual step-by-step procedure. The test appears on the software's test menu so that the test's name and results will appear on the test record. The software prompts the user to refer to the manual's test description in this chapter. Once the test is completed, the program will prompt the user to enter the results into the controller. That enables the results to be included in the pass/fail record.

## Test Equipment

Table 3-2 lists the equipment types used in each verification test and the spectrum analyzer\RF-cable calibration. Table 1-7 lists recommended equipment for each equipment type. Any equipment that satisfies the critical specifications given in Table 1-7 may be substituted for the preferred test equipment. However, the HP 70900A Module Verification software only contains instrument drivers for the equipment listed in Table 1-7. Any additional drivers will have to be written by the user.

### Common Connections/Equipment

Many of the tests require an RF and IF module configured in the mainframe as a spectrum analyzer. Figure 3-1 shows the rear-panel connections required for proper operation.

**NOTE**

**Graphics, IF, and RF modules can be left in the mainframe during tests that require only the HP 70900A module. However, the test will not run if these modules cause errors or unlocks.**

The equipment listed below is common to all test setups. Therefore, this equipment will not be included in each tests equipment list.

Controller . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 9836A/B/C
HP 70000 Mainframe . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70001A

### HP-IB Connections

When the Hewlett-Packard Interface Bus (HP-IB) symbol appears on a verification test set-up diagram, the controller and instruments such as sources, analyzers, and counters need to be linked together by HP-IB.

## Test Equipment Construction

Some of the verification tests require a 300 MHz Upconverter and a Sniffer Loop. Procedures for the construction of this equipment will be found at the end of this chapter. Refer to Table 3-2 for a list of tests requiring this equipment.

*Table 3-1. Final and Manual Tests*

| Verification Test | Final Tests | Manual Tests |
|---|---|---|
| 1. 300 MHz Reference Output Power and Harmonics | √ | |
| 2. LO OutputPower and Harmonics | √ | |
| 3. Residual FM (Span > 10 MHz) | √ | |
| 4. LO Output Spurious-Response | √ | |
| 5. LO 24 kHz Sidebands | √ | |
| 6. LO 40 kHz Sidebands | √ | |
| 7. Reference Oscillator Accuracy | √ | |
| 8. CalibratorAmplitude Accuracy | √ | |
| 9. 300 MHz Reference Amplitude Accuracy | √ | |
| 10. Video Detector Tracking | √ | |
| 11. External Triggering | √ | |
| 12. Video Processor Noise | √ | |
| 13. LO Span Accuracy (Span > 10MHz) | √ | |
| 14. LO Span Accuracy (Span ≤ 10 MHz) | √ | |
| 15. LO Frequency Accuracy (Span > 10 MHz) | √ | |
| 16. LO Frequency Accuracy (Span ≤ 10 MHz) | √ | |
| 17. LO Frequency Error vs Sweep Time | √ | |
| 18. Tune + Span Output Accuracy | √ | |
| 19. SWP Output Accuracy | √ | |
| 20. HSWP Output Voltage | √ | |
| 21. Line Triggering | √ | √ |
| 22. LED Check | | |
| 23. Video Bandwidth | | |
| 24. 300 MHz 40 kHz Sidebands | | |
| 25. Calibrator Harmonics | | |
| 26. Calibrator Output Impedance | | |
| 27. 300 MHz Reference Isolation | | |
| 28. External Reference | | |
| 29. Reference Oscillator Stability | | |
| 30. Reference Oscillator Shot Noise | | |
| 31. YTO Linearity | | |

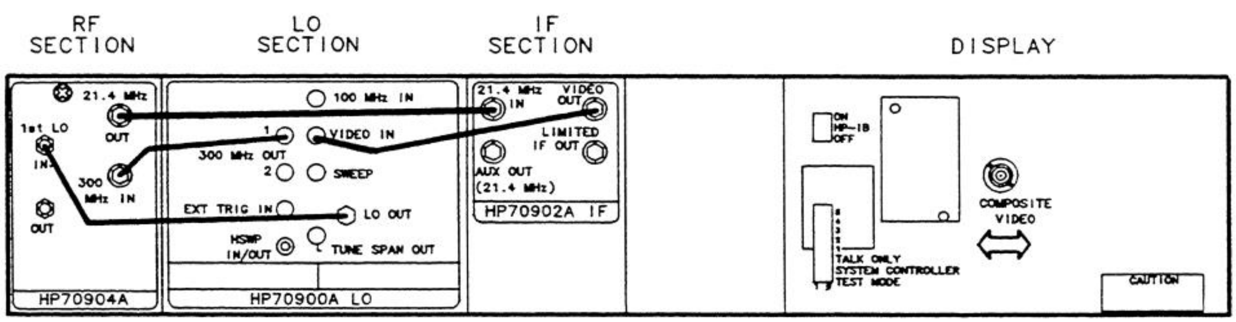



*Figure 3-1. System Rear-Panel Connections*

*Table 3-2. Equipment Required for Tests (1 of 2)*

| Verification Tests | Calibrated Spectrum Analyzer, HP 8566B | Directional Coupler, HP 778D | External Reference, HP 70310A | Full Microwave Source, HP 8340A/B | Function Generator, HP 3325A | Graphics Display, HP 70205A | IF Module, 70902A | IF Module , 70903A | Level Generator, HP 3335A | Microwave Source, HP 8340A/B | Open/Short, 85037-60001 | Oscilloscope, HP 54111D | Power Meter, HP 436A | Power Sensor, HP 8485A | Power Splitter, HP 11667B | Precision DVM, HP 3456A | RF Module, HP 70905A/6A/8A | Sniffer Loop | Spectrum Analyzer, HP 8566B | Syn. Source, HP 8340A/B | Voltmeter, HP 3456A | Upconverter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spectrum Analyzer Calibration | | | | | | | | | ● | ● | | | ● | ● | ● | | | | ● | | | |
| 1 | ● | | | | | | | | | | | | | | | | | | | | | |
| 2 | ● | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | ● | | | | | | | | | | | | | | | | ● | | | |
| 4 | ● | | ● | | | | | | | | | | | | | | | | | | | |
| 5 | ● | | ● | | | ● | | | | | | | | | | | | ● | | | | |
| 6 | ● | | ● | | | | | | | | | | | | | | | ● | | | | |
| 7 | ● | | ● | | | | | | | | | | | | | | | | | ● | | |
| 8 | | | | | | | | | | | | | ● | ● | | | | | | | | |
| 9 | | | | | | | | | | | | | ● | ● | | | | | | | | |
| 10 | | | | | ● | | | | | | | | | | | | | | | | | |
| 11 | | | | | ● | | | | | | | | | | | | | | | | ● | |
| 12 | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | ● | ● | | | ● | | | | | | | | | | ● | | | | | |
| 14 | | | ● | | | | ● | | | ● | | | | | | | ● | | | | | |

*Table 3-2. Equipment Required for Tests (2 of 2)*

| Verification Tests | Calibrated Spectrum Analyzer, HP 8566B | Directional Coupler, HP 778D | External Reference, HP 70310A | Full Microwave Source, HP 8340A/B | Function Generator, HP 3325A | Graphics Display, HP 70205A | IF Module, HP 70902A | IF Module, HP 70903A | Level Generator , HP 3335A | Microwave Source, HP 8340A/B | Open/Short, 85037-60001 | Oscilloscope, HP 54111D | Power Meter, HP 436A | Power Sensor, HP 8485A | Power Splitter, HP11667B | Precision DVM, HP 3456A | RF Module, HP 70905A/6A/8A | Sniffer Loop | Spectrum Analyzer, HP 8566B | Syn. Source, HP 8340A/B | Voltmeter, HP 3456A | Upconverter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | | | • | • | | | | • | | | | | | | | | • | | | | | |
| 16 | | | • | | | | • | | | | | | | | | | • | | | • | | |
| 17 | | | • | | | | • | | | | | | | | | | • | | | • | | |
| 18 | | | | | | | | | | | | | | | | • | | | | | | |
| 19 | | | | | | | | | | | | | | | | • | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | • | |
| 21 | | | | | | • | | | | | | • | | | | | | | | | | |
| 22 | | | | | | | | | | | | | | | | | | | | | | |
| 23 | | | | | • | | | | | | | | | | | | | | | | | |
| 24 | • | | • | | | | | | | | | | | | | | | • | | | | • |
| 25 | • | | • | | | | | | | | | | | | | | | | | | | |
| 26 | • | • | • | | | | | | | | • | | | | | | | | | • | | |
| 27 | • | | • | | | | | | | • | | | | | | | | | | | | |
| 28 | • | | • | | | | | | | | | | | | | | | | | • | | |
| 29 | | | • | | | | • | | | • | | | | | | | • | | | | | |
| 30 | | | • | | | | • | | | • | | | | | | | • | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | |

# External Frequency Reference

Table 3-2 lists the verification tests requiring an external frequency reference. When running these tests, equipment such as sources, analyzers, counters, and the DUT must to be connected to the same frequency standard. Figure 3-2 illustrates the preferred order of connecting text equipment to a 10 MHz standard. The HP 70900A requires a 100 MHz standard. To generate the standard, refer to "100 MHz Reference Generation".

The standard's specified aging rate requirement is $<10^{-9}$/day. The microwave source, synthesized source, and calibrated spectrum analyzer's internal time bases meet the aging rate requirement. It is important that all test equipment be connected to the same frequency standard.

## 100 MHz Reference Generation

Most of the test equipment requires a 10 MHz external reference. However, the DUT requires a 100 MHz reference. There are three ways to generate the 100 MHz signal for the DUT:

1. Using an HP 70310A Precision Frequency Reference
2. Using an HP 70310A and 10 MHz House Standard
3. Using an HP 8566B Spectrum Analyzer and 10 MHz House Standard

**Using an HP 70310A Precision Frequency Reference:** The HP 70310A has a 100 MHz output for the HP 70900A and a 10 MHz reference for most other test equipment. Connect the equipment as illustrated in Figure 3-3.

**Using an HP 70310A and 10 MHz House Standard:** The HP 70310A's 100 MHz reference can be derived from the house standard (for example, the HP 5061B Cesium Beam Standard). See Figure 3-4 for the equipment connections.

**Using an HP 8566B and 10 MHz House Standard:** The HP 8566B Spectrum Analyzer's 100 MHz calibrator output can be used for the reference. See Figure 3-5 for the equipment connections. A 10 dB pad is needed so as not to drive the RF amplifier into saturation. The RF amplifier must have a gain of at least 20 dB at 100 MHz.

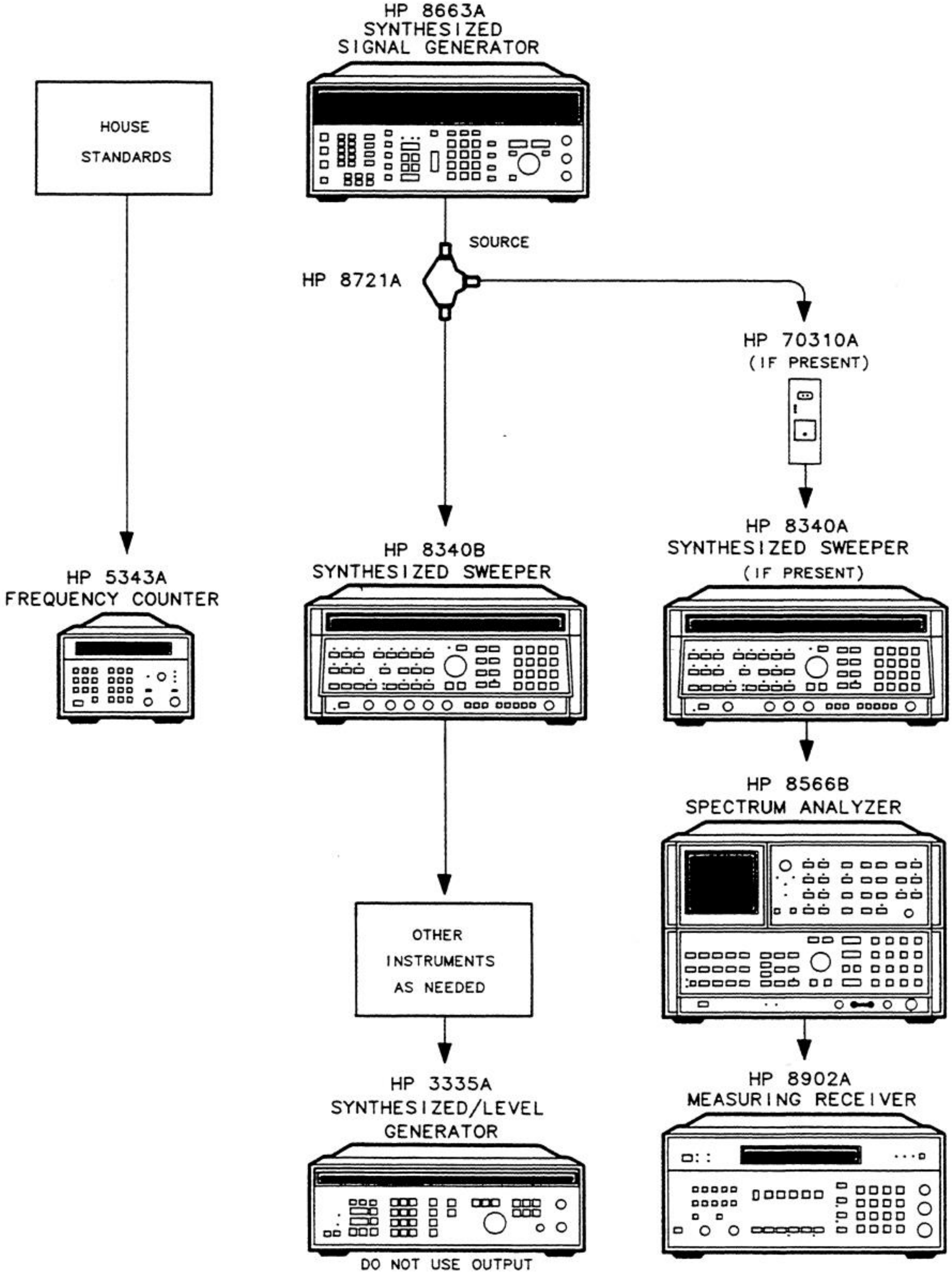



*Figure 3-2. Preferred Frequency Reference Connections*

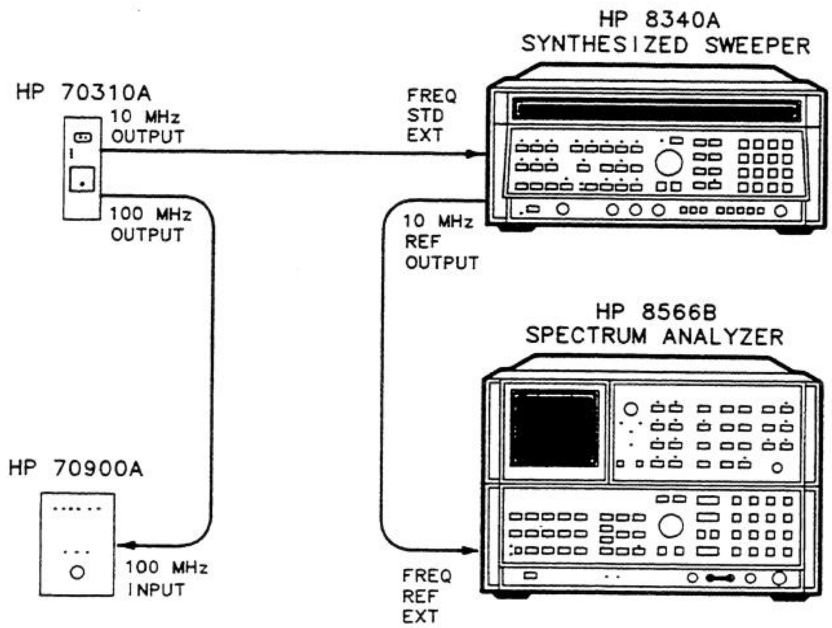



*Figure 3-3. Using an HP 70310A*

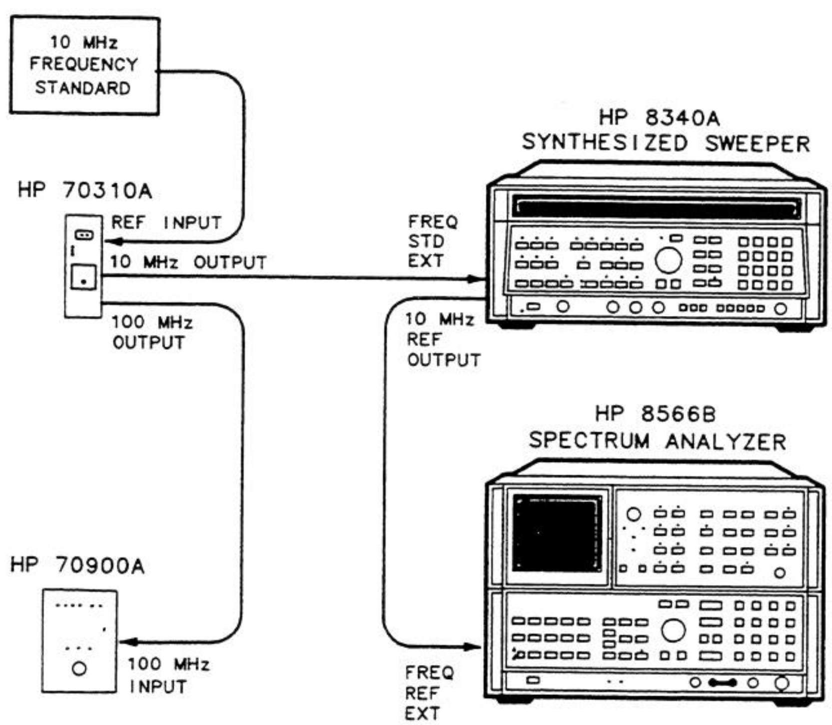



*Figure 3-4. Using an HP 70310A and a House Standard*

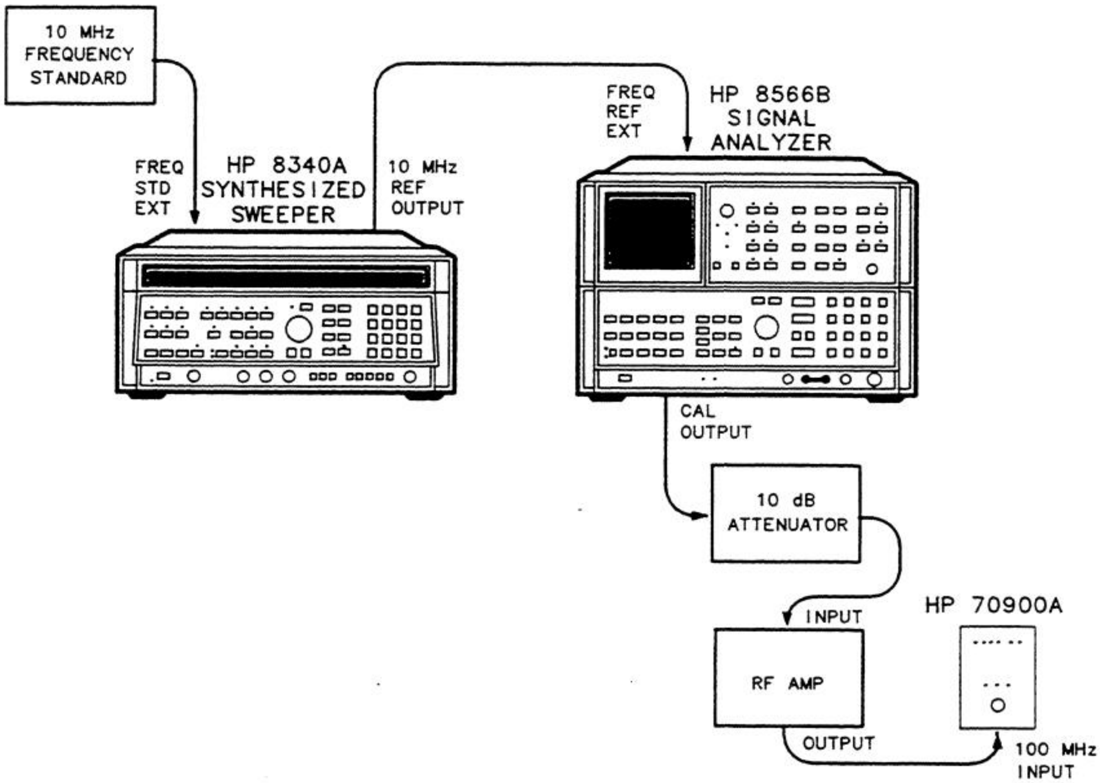



*Figure 3-5. Using an HP 8566B and a House Standard*

# Spectrum-Analyzer/RF-Cable Calibration

## Purpose

Many of the verification tests require accurate amplitude measurements. This procedure ensures accurate measurements by calibrating an HP 8566B Spectrum Analyzer/RF-cable combination. Refer to Table 3-2 for a list of tests requiring spectrum analyzer calibration.

## Description

This procedure automatically runs whenever a test requiring spectrum analyzer calibration is chosen and more than 8 days have elapsed since the last calibration. Although this procedure may begin after a test is selected, the software will return to the selected test after the procedure is completed. The calibration is performed by the following three procedures:

**NOTE**

**Since the HP 8566B Spectrum Analyzer and RF cable are both calibrated at the same time, use both throughout the performance tests.**

**1. Reference Calibration:** measures a reference signal and uses this signal to characterize the spectrum analyzers 10 kHz bandwidth and log fidelity. Figure 3-6 shows the required test setup.

**2. IF Calibration:** characterizes the spectrum analyzer's step gain and log fidelity errors and resolution bandwidth filter switching amplitude and frequency errors. All measurements are normalized to a 10 kHz resolution bandwidth setting. Figure 3-7 shows the required test setup.

**3. RF Calibration:** measures the frequency response of the spectrum analyzer. Figure 3-8 shows the required test setup.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Level Generator | HP 3335A |
| Microwave Source | HP 8340A |
| Power Meter | HP 436A |
| Power Sensor | HP 8485A |
| Power Splitter | HP 11667B |

**Adapters:**

Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
Type N (f) to APC 3.5 (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1750
Type N (m) to BNC (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1476
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**

APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921
BNC (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 10503A

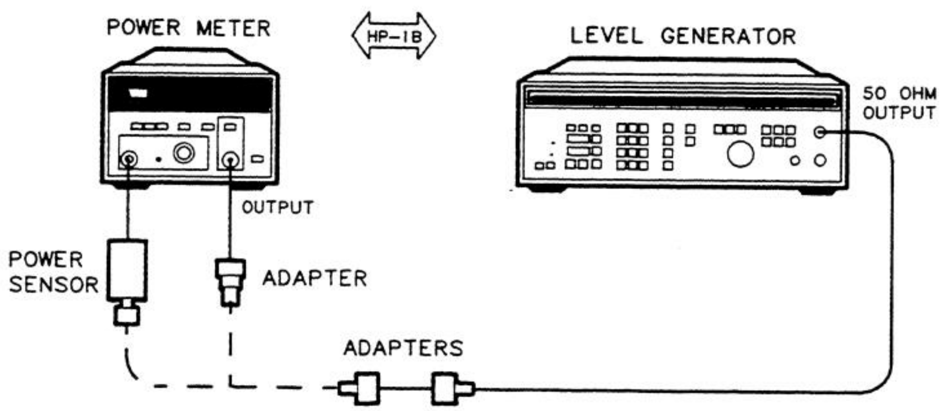



*Figure 3-6. Reference Calibration Test Setup*

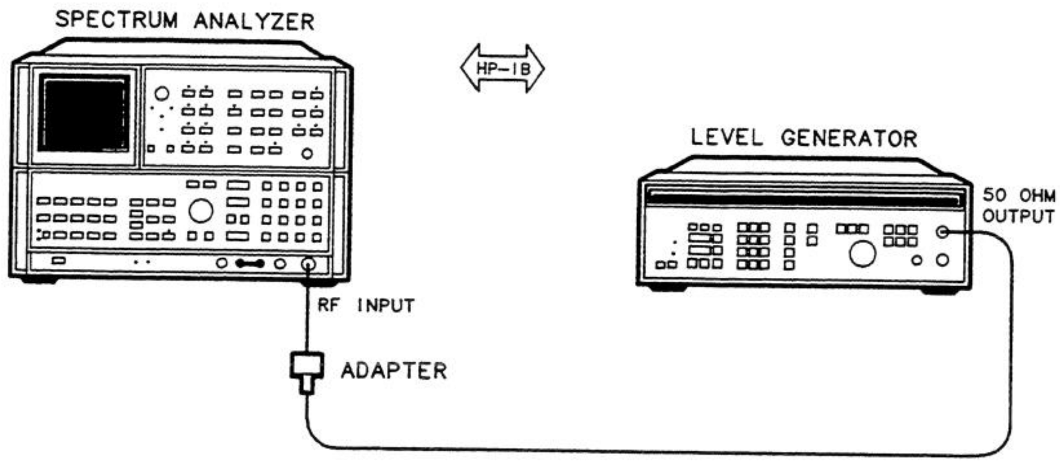



*Figure 3-7. IF Calibration Test Setup*

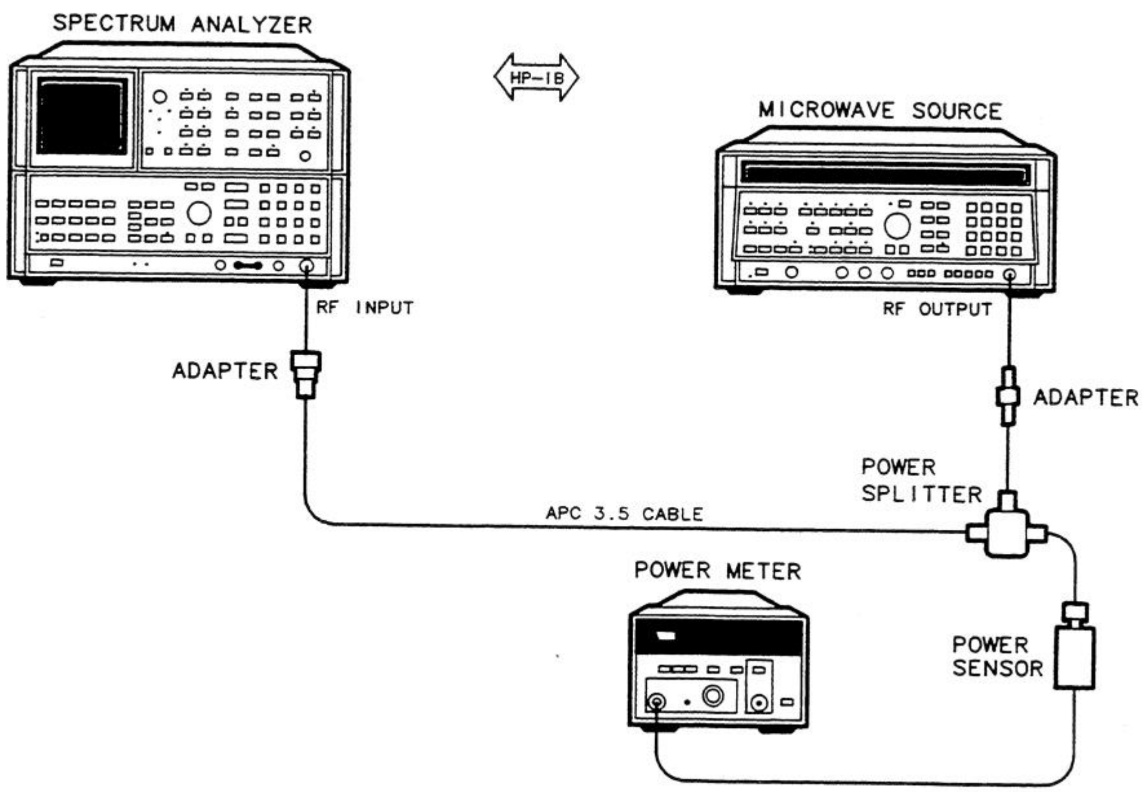



*Figure 3-8. RF Calibration Test Setup*

# Test 1.
# 300 MHz Reference Output Power and Harmonics Test

**NOTE**

**Use the 300 MHz Reference Accuracy Test for a more accurate 300 MHz output power measurement.**

## Purpose

This test measures both the fundumental output power level and the 10 worst harmonic power levels at the two 300 MHz rear-panel outputs (1 and 2).

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment to the DUT's rear-panel 300 MHz 1 jack as illustrated in Figure 3-9. The calibrated spectrum analyzer measures the power level of the fundamental and its first ten harmonics. The power level of the fundamental and the power levels of the harmonics, relative to the fundamental, are then compared to test limits.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
SMA (f) to SMB (m) . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0674
SMB (f) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0672

**Cables:**

APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

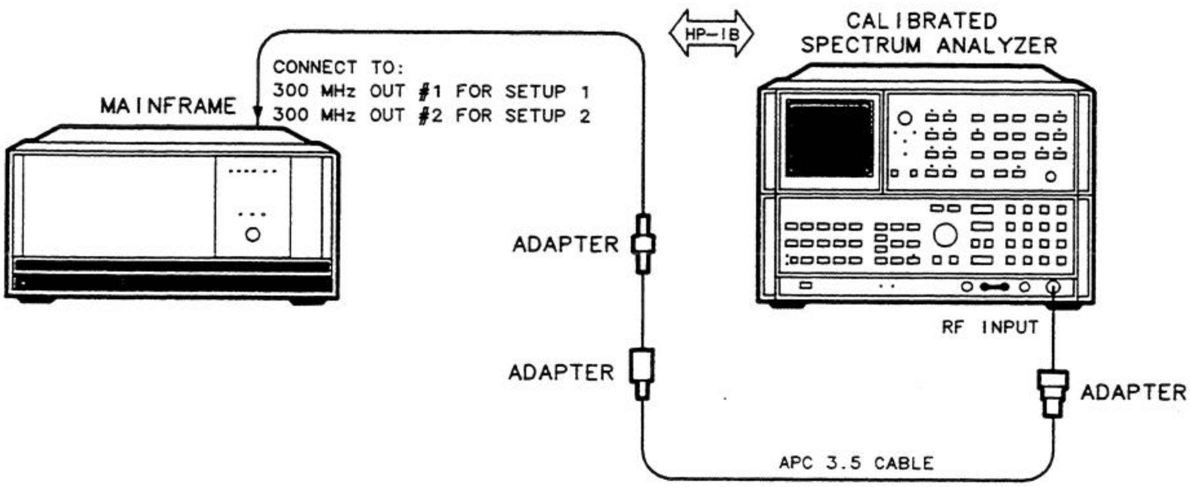



*Figure 3-9. Test Setup for Test 1*

# Test 2.
# LO Output Power and Harmonics Test

## Purpose

This test measures the local oscillator's output power and first three harmonics.

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment to the DUT's rear-panel LO jack as illustrated in Figure 3-10. The DUT tunes to discrete CW frequencies from 3 to 6.6 GHz in 100 MHz steps. At each step the calibrated spectrum analyzer measures the fundamental power level and the power level of the fundamental's first three harmonics in dBc. Spectrum analyzer measurements are made in a 100 kHz span and a 1 kHz resolution bandwidth. Measurements are compared to test limits and displayed graphically.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

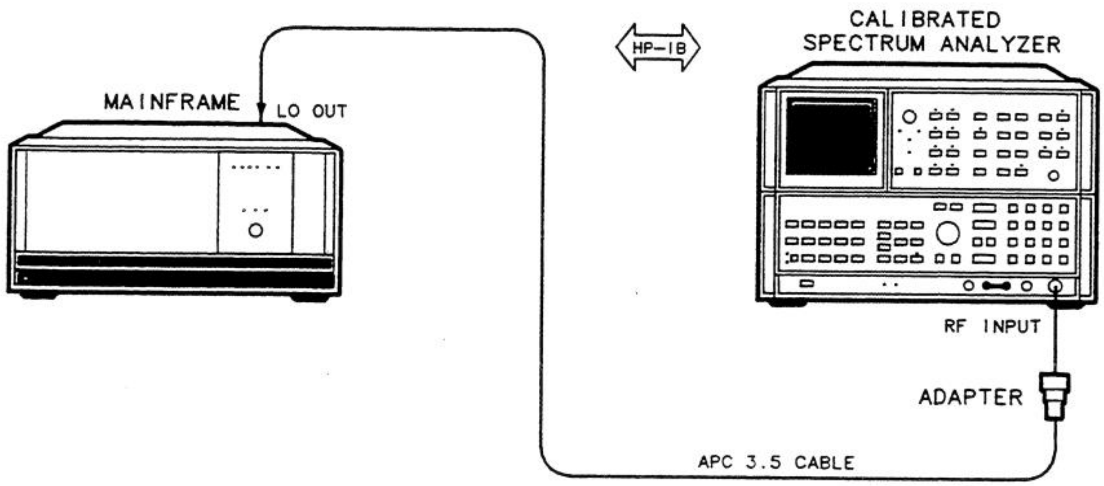



*Figure 3-10. Test Setup for Test 2*

# Test 3.
# Residual FM (Span > 10 MHz) Test

## Purpose

This test measures the rear-panel LO output's residual FM in spans >10 MHz. The DUT's is not phase locked in spans greater than 10 MHz.

This test is run as part of Final Test.

## Description

Connect the equipment to the DUT's rear-panel LO jack as illustrated in Figure 3-11. The spectrum analyzer measures residual FM using its 30 kHz resolution bandwidth filter's slope. The spectrum analyzer places delta markers 30 dB apart on the spectrum analyzer LO feedthrough signal and calculates the slope. The slope is the ratio of the frequency difference to the amplitude difference between the two markers.

The program sets the DUT span to 10.01 MHz and initiates a single sweep. The spectrum analyzer places the DUT's LO signal half-way down the analyzer's 30 kHz resolution bandwidth filter skirt. The spectrum analyzer then switches to a 0 Hz span and a 1s sweep time. A single sweep is initiated and the spectrum analyzer records 1000 trace data points. The program calculates the residual FM as the trace amplitude deviation (in dB) multiplied by the measured filter slope (in kHz/dB). If residual FM fails the test limits, the 1000 data points are divided into 10 segments of 100 data points each. The residual FM is then recalculated in each of the 10 segments and compared to the test limits. Recalculating residual FM in the 10% segments removes errors generated by LO frequency drift (stability).

## Equipment

Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

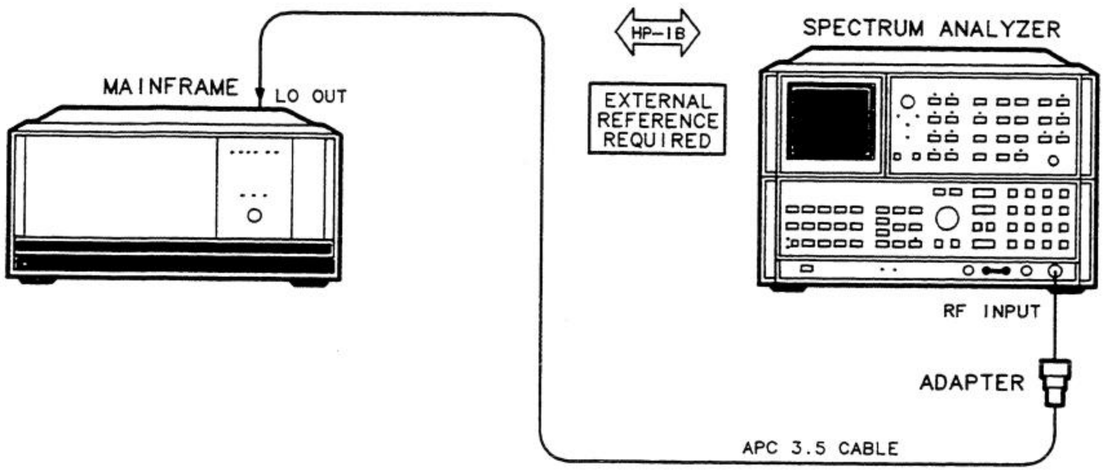



*Figure 3-11. Test Setup for Test 3*

# Test 4.
# LO Output Spurious Response Test

## Purpose

This test measures phase-lock-related spurious responses on the rear-panel LO jack port.

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment to the DUT's rear-panel LO jack as illustrated in Figure 3-12. The spectrum analyzer measures each synthesis-related spurious signal with the following method. The program sets the analyzer to a 0 Hz span, 30 Hz resolution bandwidth, and 500 ms sweep time. The analyzer tunes to the spurious signal and performs an average of the trace amplitude. If the average value fails the test limit, the analyzer performs trace average again at an increased sweep time of 3 seconds. If the value still fails the test limits, the analyzer performs five video averages at a decreased resolution bandwidth of 10 Hz and an decreased span of 100 Hz. If the value again fails the test limit, the test fails.

**NOTE**

**If the HP 70900A's LO output amplitude falls below -3 dBm on the Calibrated Spectrum Analyzer, the message "The CAL'D SPEC ANALYZER found carrier power <-3 dBm" results. The test will not proceed until the power is greater than -3 dBm.**

The program checks two different sources of spurious signals:

1) The YTO Lock Loop generates YTO Lock spurs. To locate these signals, the program increases the LO frequency from 3 to 6.6 GHz in 12.5 MHz increments. At each frequency, the program tunes the LO frequency to create a sideband 10 kHz away from the LO signal. The spectrum analyzer measures each spurious response relative to the carrier. Even though the 10 kHz sidebands were purposely created, the sideband should pass the test.

2) The idler lock circuitry creates idler spurs. The program tunes the LO to predetermined frequencies from 3 to 6.6 GHz. These frequencies cause 10 kHz sidebands on the idler signal which translate directly to the LO signal.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

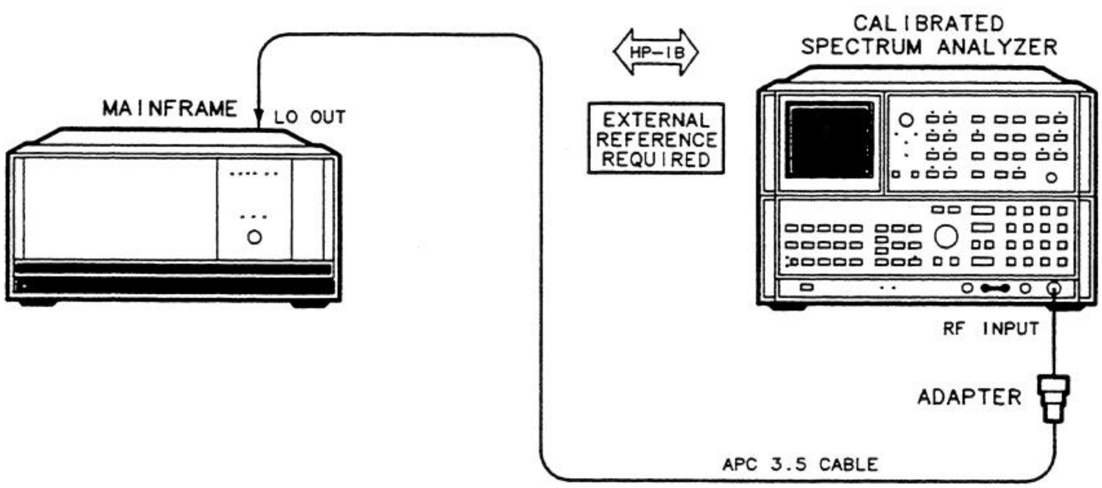



*Figure 3-12. Test Setup for Test 4*

# Test 5.
# LO 24 kHz Sidebands Test

## Purpose

This test measures sidebands on the LO signal caused by radiated emissions from the HP 70205A Graphics Display's. These display emissions come from the display's 24 kHz horizontal oscillator.

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment as illustrated in Figure 3-13. Place the sniffer loop behind the graphics display. The test uses the sniffer loop to measure the frequency of 24 kHz emissions.

**NOTE**

**For the emmissions to be measured, the emissions must be greater than -85 dBm.**

The program tunes the DUT's LO to CW frequencies of 3.1, 4.5, and 6.5 GHz. The spectrum analyzer sets to a span of 1 kHz and a resolution bandwidth of 10 Hz. At each LO frequency, the spectrum analyzer measures the power of the first six upper and six lower 24 kHz sidebands in dBc. The program uses video averaging for sidebands that excede the test limits. In order to decrease test time, the analyzer tunes each sideband within and only sweeps the first three display divisions.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| External Reference | Refer to "External Frequency Reference" |
| Sniffer Loop | Refer to "Sniffer Loop Construction Procedure" |

**HP 70000 Modules:**

| | |
|---|---|
| Graphics Display | HP 70205A |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Type N (m) to BNC (f) | HP 1250-1476 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |

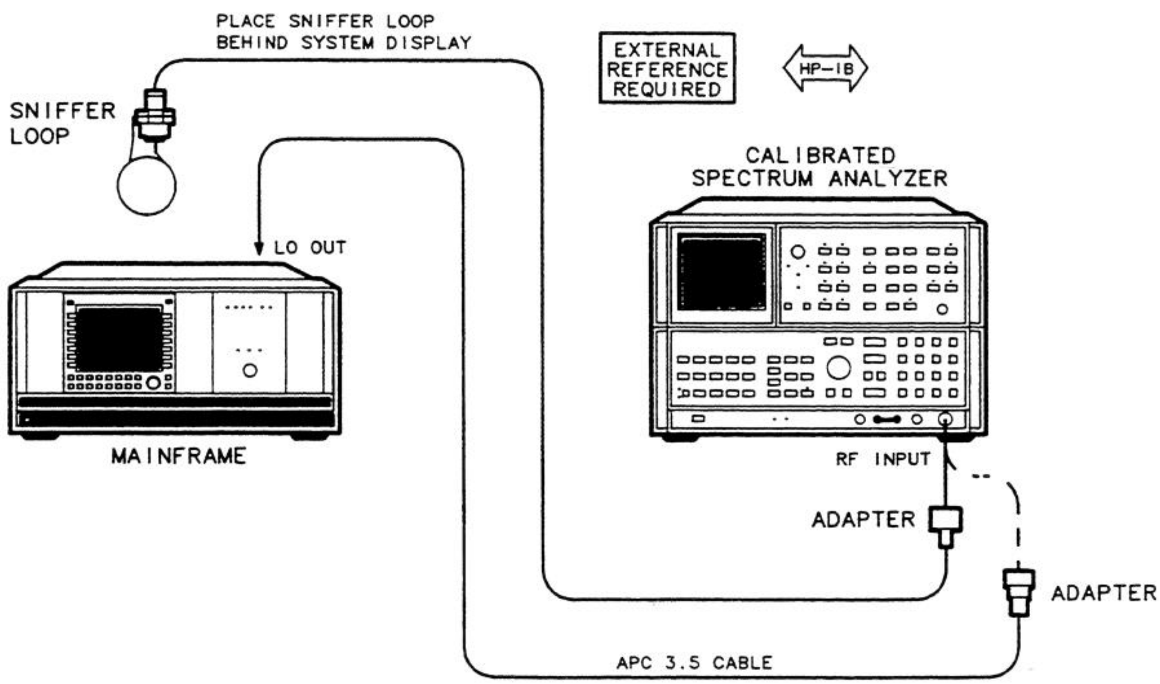



*Figure 3-13. Test Setup for Test 5*

# Test 6.
# LO 40 kHz Sidebands Test

## Purpose

This test measures sidebands on the LO signal that are caused by radiated by emissions from the HP 70001A Mainframe's 40 kHz switching power supply.

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment as illustrated in Figure 3-14. Place the sniffer loop near the rear of the mainframe. The test uses the sniffer loop to measure the frequency of 40 kHz emissions.

**NOTE**

**For the emmissions to be measured, the emissions must be greater than -85 dBm.**

The program tunes the DUT's LO to CW frequencies of 3.1, 4.5, and 6.5 GHz. The spectrum analyzer is set to a span of 1 kHz and a resolution bandwidth of 10 Hz. At each LO frequency, the spectrum analyzer measures the power of the first six upper and six lower 40 kHz sidebands in dBc. The program uses video averaging for sidebands that excede the test limits. In order to decrease test time, the analyzer tunes each sideband within and only sweeps the first three display divisions.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"
Sniffer Loop . . . . . . . . . . . . . . . Refer to "Sniffer Loop Construction Procedure"

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
Type N (m) to BNC (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1476

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921
BNC (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 10503A

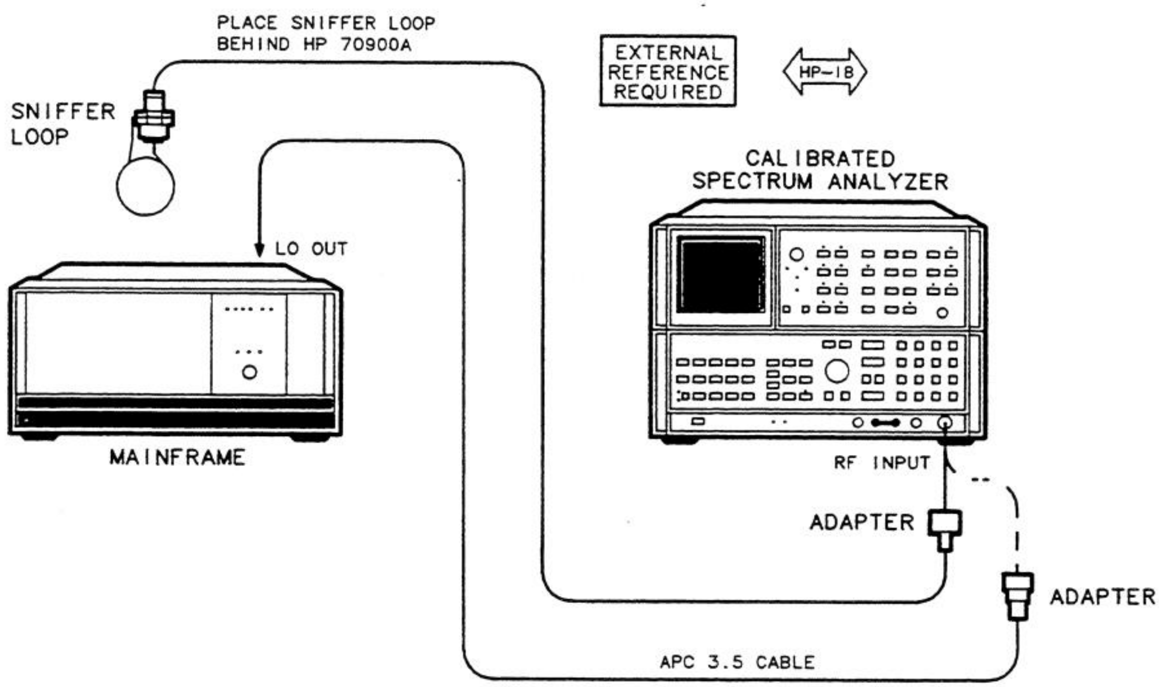



*Figure 3-14. Test Setup for Test 6*

# Test 7.
# Reference Oscillator Accuracy Test

## Purpose

This test measures the frequency accuracy of the 300 MHz calibrator. It is also an indirect frequency measurement of the DUT's internal 100 MHz oscillator.

This test is run as part of Final Test.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

**NOTE**

**disconnect the external 100 MHz reference from the HP 70900A.**

Connect the synthesized source to the spectrum analyzer as illustrated in Figure 3-15. Do not connect the DUT to the external frequency reference. Connect the synthesized source and spectrum analyzer to the external frequency reference.

The program uses the output from the synthesized source to measure the spectrum analyzer's frequency readout error. Since the frequency error of the synthesized source is negligible, any frequency error is due to the analyzer. After measuring the frequency error, the spectrum analyzer measures the 300 MHz calibrator's frequency.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"
Synthesized Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311
BNC (m) to SMA (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1700

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

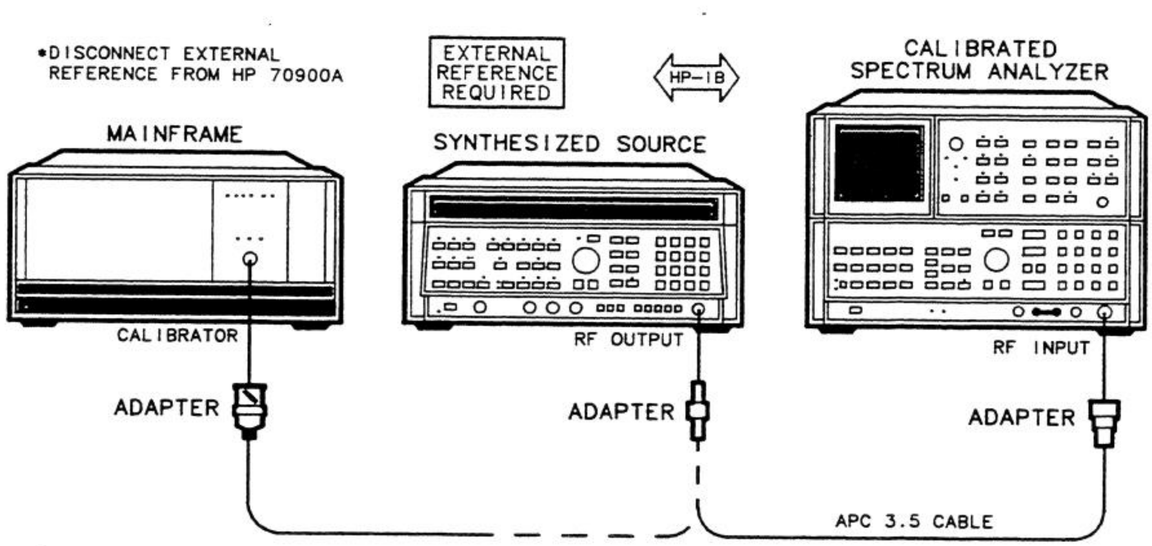



*Figure 3-15. Test Setup for Test 7*

# Test 8.
# Calibrator Amplitude Accuracy Test

## Purpose

This test measures the 300 MHz calibrator's output amplitude.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-16.

## Equipment

Power Meter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 436A
Power Sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8485A

**Adapters:**
BNC (m) to BNC (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0216
BNC (f) to SMA (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1200
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

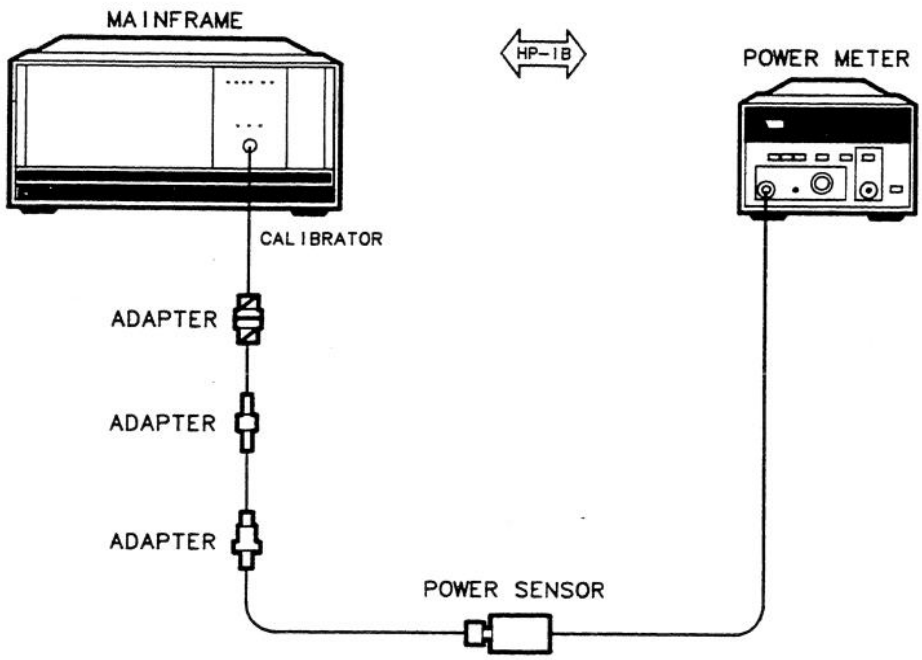



*Figure 3-16. Test Setup for Test 8*

# Test 9.
# 300 MHz Reference Amplitude Accuracy Test

## Purpose

This test measures the output power of the two rear-panel 300 MHz 1 and 2 references.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-17.

## Equipment

Power Meter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 436A
Power Sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8485A

**Adapters:**
SMA (f) to SMB (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0674
SMB (f) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0672

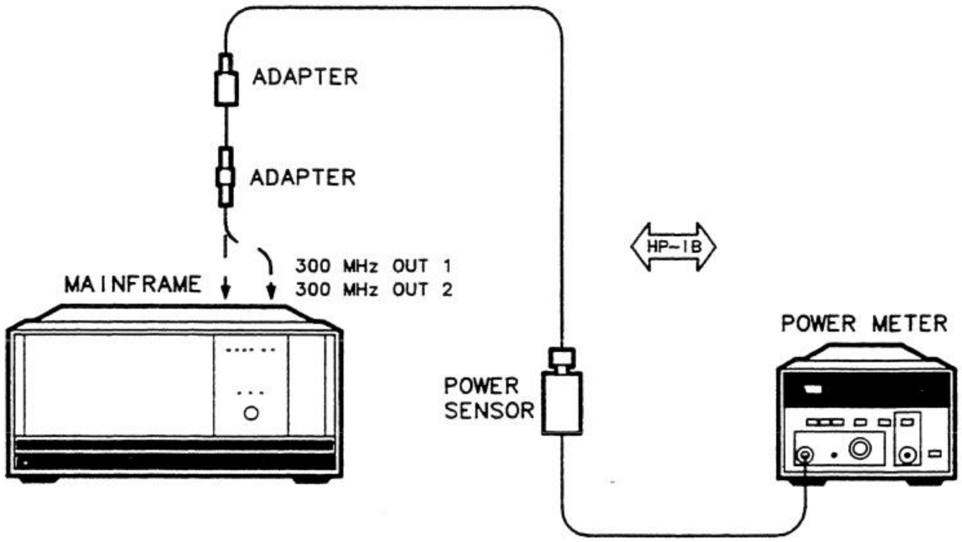



*Figure 3-17. Test Setup for Test 9*

# Test 10.
# Video Detector Tracking Test

## Purpose

Video detector operation is verified and the voltage variation between different types of video detection tested. The different types of video detection tested are Sample, Pos. Peak, Neg. Peak, and Rose n Fell. Rose'n'Fell is the "Normal" or default detection scheme used by the DUT.

This test is run as part of Final Test.

## Description

Connect the function generator to the DUT's rear-panel VIDEO jack as illustrated in Figure 3-18. The program uses a function generator, set to 1V Vdc, as a known video signal. The video detector response variation is tested between Sample, Pos. Peak, Neg. Peak, and Rose'n'Fell detection. The program averages each detector voltage over 10 sweeps.

## Equipment

Function Generator . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3325A

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

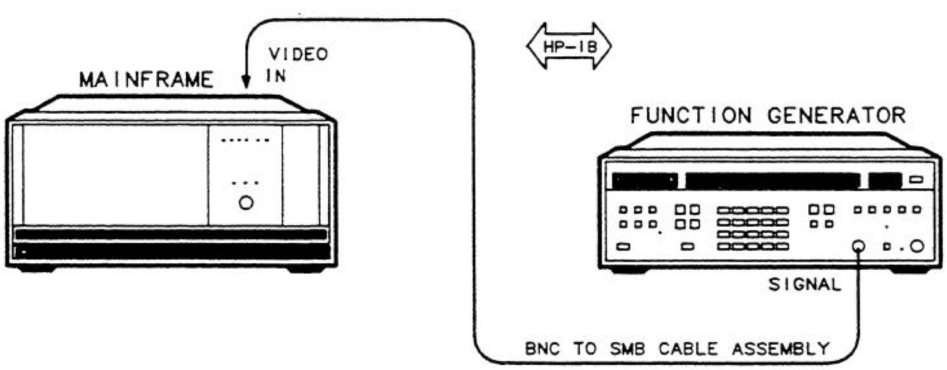



*Figure 3-18. Test Setup for Test 10*

# Test 11. External Triggering Test

## Purpose

This test checks the external triggering circuit.

This test is run as part of final Test.

## Description

Connect the test equipment as illustrated in Figure 3-19. The program sets the DUT to external triggering mode and places a 100 Hz square wave from the function generator at the DUT's EXT TRIG jack. The voltmeter monitors the HSWP voltage to verify that the DUT is sweeping.

## Equipment

Function Generator . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3325A
Voltmeter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A

**Adapters:**
BNC (f) to dual banana plug . . . . . . . . . . . . . . . . . . . . . . . . HP 1251-2277

**Cables:**
BNC (m) to SMB (f) *(2 required)* . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

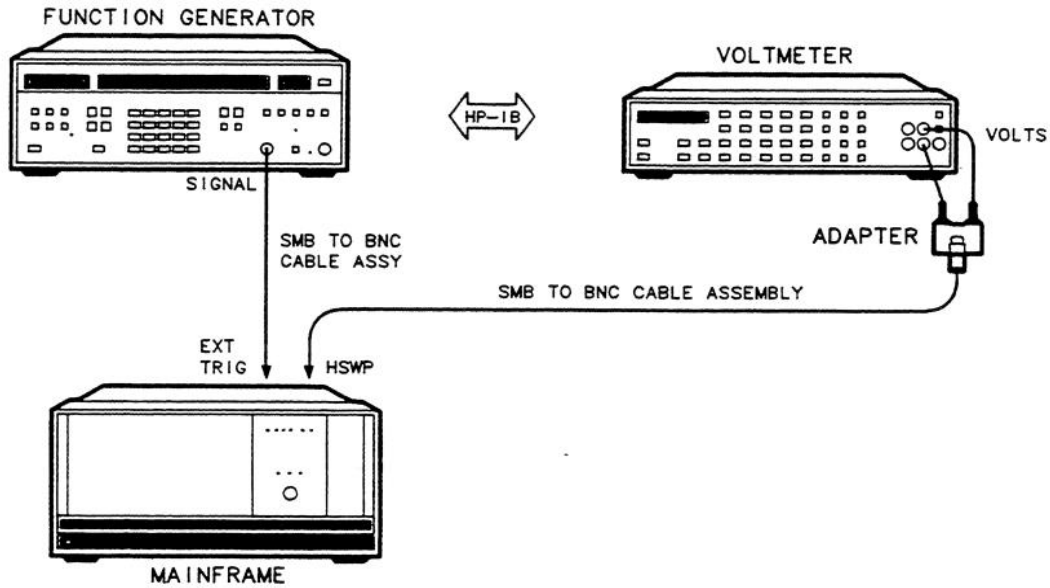



*Figure 3-19. Test Setup for Test 11*

# Test 12. Video Processor Noise Test

## Purpose

This test measures noise generated by the video processor assembly. Video processor noise is a contributing factor to amplitude accuracy and trace measurement repeatability.

This test is run as part of Final Test.

## Description

Insert the DUT into the HP 70001A mainframe. Disconnect any input to the DUT's rear-panel VIDEO jack. The program sets the DUT to a 300 MHz center frequency, 0 Hz span, and normal (Rose'n'Fell) video detection. A single sweep is initiated and 800 trace data points recorded. The between the minimum and maximum trace amplitude variations is compared to the test limit.

# Test 13.
# LO Span Accuracy (Span > 10 MHz) Test

## Purpose

This test measures span accuracy for spans greater than 10 MHz. Spans greater than 10 MHz use non-synthesized, "lock 'n' roll", tuning.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-20. Refer to Figure 3-1 for system rear-panel connections. The program tunes the DUT to four frequencies from 500 MHz to 12.6 GHz. At each frequency three spans are tested: 11 MHz, 110 MHz, and 1.1 GHz

For each span setting, the microwave source tunes a signal across the DUT's span in 10 percent increments. The DUT records the each frequency and compares the frequency with the frequency of the microwave source. This gives the frequency error of each signal. Percent span error is calculated as the difference of the worst case frequency errors in a span divided by the DUT span setting.

## Equipment

Full Microwave Source . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B
External Reference . . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . . . . HP 70905A, 70906A, or 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A or 70903A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

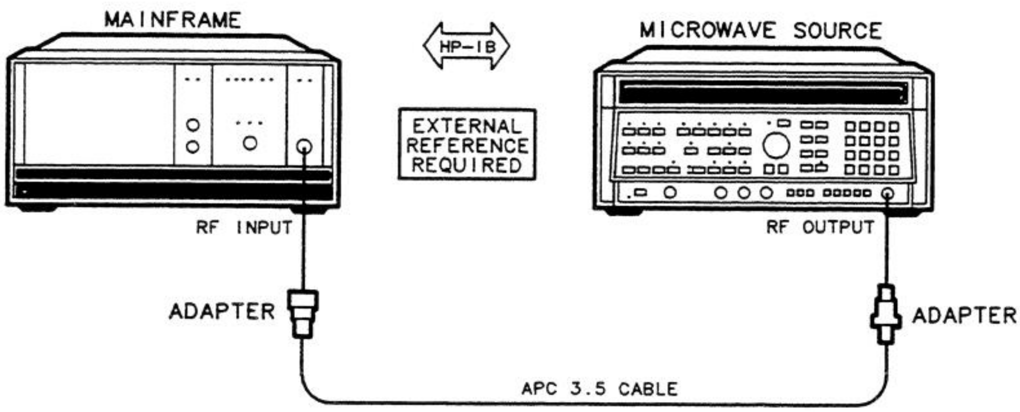



*Figure 3-20. Test Setup for Test 13*

# Test 14.
# LO Span Accuracy (Span ≤10 MHz) Test

## Purpose

This test measures span accuracy for spans less than or equal to 10 MHz. The spans are phase-locked by the DUT fractional frequency synthesizer circuit.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-21. Refer to Figure 3-1 for system rear-panel connections.

The program tunes the DUT to 4 GHz and sets its spans consecutively to 8.88 kHz, 44.4 kHz, 3.33 kHz, 2.22 kHz, 5.55 kHz, 6.66 kHz, 7.77 kHz, and 10.0 kHz. For each span setting, the microwave source tunes a signal across the DUT's span at 30, 50, and 70 percent of span increments. If a graphics display is present, the signal will appear at the third, fifth, and sventh major divisions. The DUT records the each frequency and compares the frequency with the frequency of the microwave source. This gives the frequency error of each signal. Span accuracy is calculated three times in each span: from division 3 to division 5, division 3 to division 7, and division 5 to division 7

## Equipment

Microwave Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . . . HP 70905A, 70906A, or 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

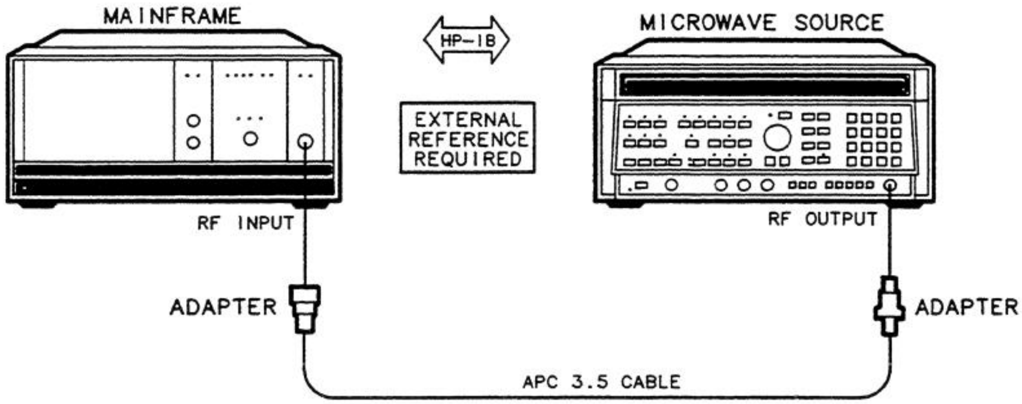



*Figure 3-21. Test Setup for Test 14*

# Test 15.
# LO Frequency Accuracy (Span > 10 MHz) Test

## Purpose

This test measures the center-frequency readout accuracy for spans greater than 10 MHz. In these spans, the DUT is phase-locked between sweeps.

This test is run as part of Final Test.

## Description

Connect the test equipment as illustrated in Figure 3-22. Refer to Figure 3-1 for system rear-panel connections.

The microwave source provides a signal with a precise frequency for testing. The program tunes the microwave source and the HP 70000 Spectrum Analyzer to 10 discrete frequencies from 2.7 to 26 GHz. At each frequency, the DUT measures the frequency of the signalat several different span settings. Below 8 GHz, spans are set to 0.1, 1, and 10 GHz. Above 8 GHz, the span is set to 1 GHz. The frequency difference between the DUT's readout and the signal gives the frequency readout error. Ratios between the frequency readout errors and spans are calculated, expressed as a percentage, and compared to test limits.

## Equipment

Full Microwave Source . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70905A, 70906A, 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70903A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

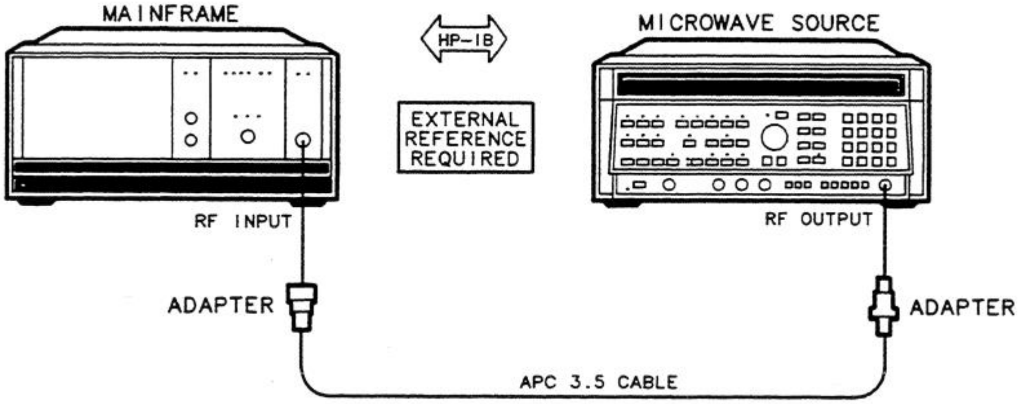



*Figure 3-22. Test Setup for Test 15*

# Test 16.
# LO Frequency Accuracy (Span ≤ 10 MHz) Test

## Purpose

This test measures the center-frequency readout accuracy for spans less than or equal to 10 MHz. In these spans, the DUT uses synthesized sweeps.

This test is run as part of Final Test.

## Description

Connect the test equipment as illustrated in Figure 3-23. Refer to Figure 3-1 for system rear-panel connections.

The microwave source provides a signal with a precise frequency for testing. The program tunes the microwave source and the HP 70000 Spectrum Analyzer to 300 MHz. To ensure a more accurate measurement, the test measures IF module frequency errors and subtracts these errors from the test results.

For the LO frequency accuracy measurement, the DUT measures the frequency of the input signal in five spans between 1 kHz and 10 MHz. The frequency difference between the DUT's readout and the signal, minus the errors caused by the IF, gives the frequency readout error. Ratios between the frequency readout errors and the spans are calculated, expressed as a percentage, and compared to the test limits.

## Equipment

Synthesized Source . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . HP 70904A, 70905A, 70906A, or 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A or 70903A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

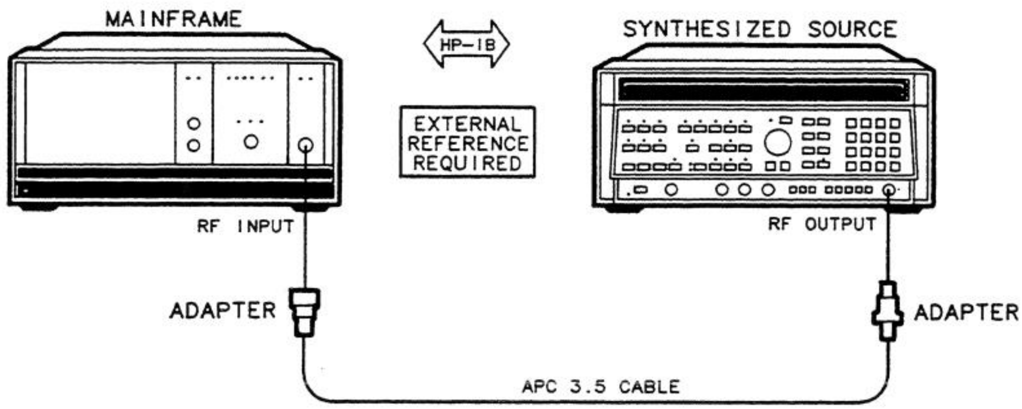



*Figure 3-23. Test Setup for Test 16*

# Test 17.
# LO Frequency Error vs Sweeptime Test

## Purpose

This test verifies that the sweep circuitry does not effect span and frequency accuracy.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-24. Refer to Figure 3-1 for system rear-panel connections.

The program places the DUT to a 500 MHz center frequency, 300 MHz span, and 50 ms, 500 ms, 5s, 50s, and 1000s consecutive sweeptimes. Span and frequency accuracy errors at each sweeptime are computed and compared to the errors at 500 ms. By normalizing out errors at 500 ms, the resulting errors are caused by the sweeptime circuitry.

## Equipment

Synthesized Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . . HP 70904A, 70905A, 70906A, or 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A or 70903A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

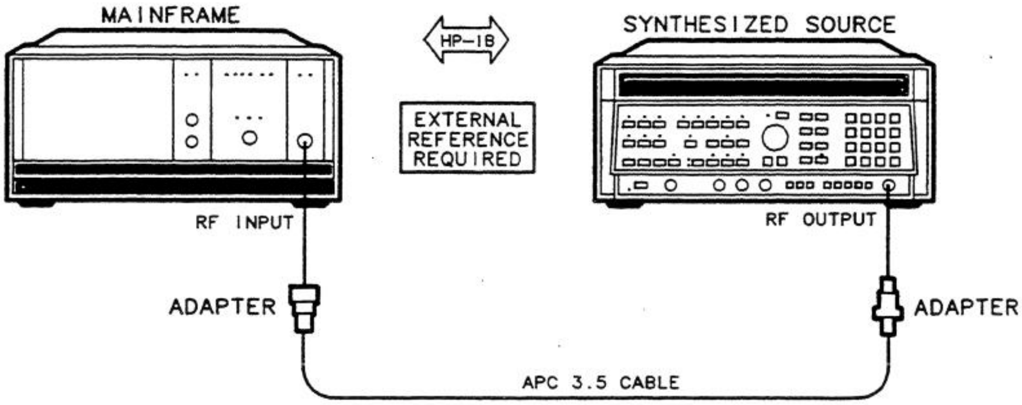



*Figure 3-24. Test Setup for Test 17*

# Test 18.
# Tune + Span Output Accuracy Test

## Purpose

This test measures the rear-panel TUNE SPAN voltage.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-25. The DUT's LO signal tunes in 150 MHz steps from 3 to 6.45 GHz. At each frequency the voltmeter measures the TUNE SPAN voltage. The theoretical TUNE SPAN voltage is calculated as the DUT's LO frequency multiplied by 1.5V/GHz. The difference between the measured and theoretical values are compared to test limits.

## Equipment

Precision Digital Voltmeter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A

**Adapters:**
BNC (f) to dual banana plug . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1251-2277

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

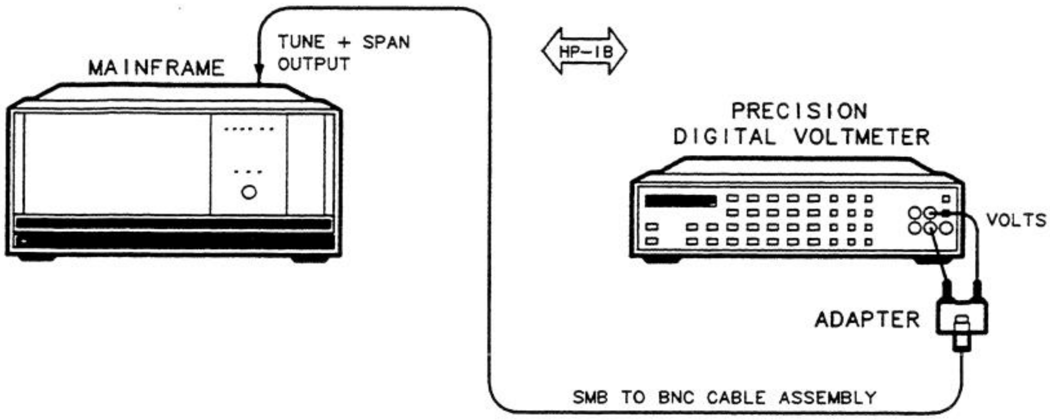



*Figure 3-25. Test Setup for Test 18*

# Test 19.
# SWP Output Accuracy Test

## Purpose

The rear-panel SWP voltage is measured.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-26. The DUT tunes its LO to 3 GHz in a 0 Hz span. The program initiates a ten second sweep producing a zero to ten volt SWP ramp. Every 500 ms, the voltmeter records the rear-panel SWP voltage and calculates the slope ($\Delta V/\Delta T$) from the last measurement. The difference between the measured and theoretical slopes is expressed as a percentage and compared to test limits. The sweep ramp offset error is determined by comparing the voltage at the end of the sweep to ten volts.

## Equipment

Precision Digital Voltmeter . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A

**Adapters:**
BNC (f) to dual banana plug . . . . . . . . . . . . . . . . . . . . . . . . . HP 1251-2277

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

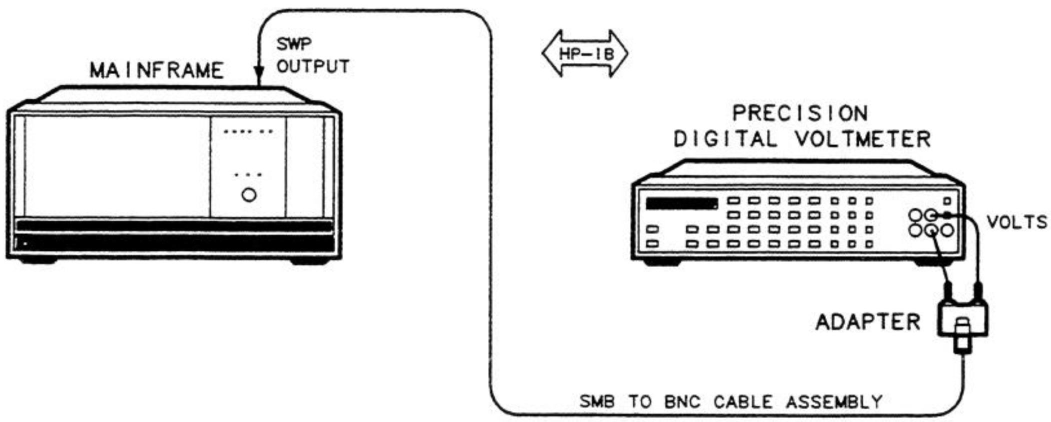



*Figure 3-26. Test Setup for Test 19*

# Test 20.
# HSWP Output Voltage Test

## Purpose

The TTL-levels at the rear-panel HSWP jack are measured. The H SWP voltage is low between sweeps and high during sweeps.

This test is run as part of Final Test.

## Description

Connect the equipment as illustrated in Figure 3-27. The voltmeter measures the HSWP TTL-levels while the program controls the DUT's sweep.

## Equipment

Voltmeter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A

**Adapters:**
BNC (f) to dual banana plug . . . . . . . . . . . . . . . . . . . . . . . . HP 1251-2277

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

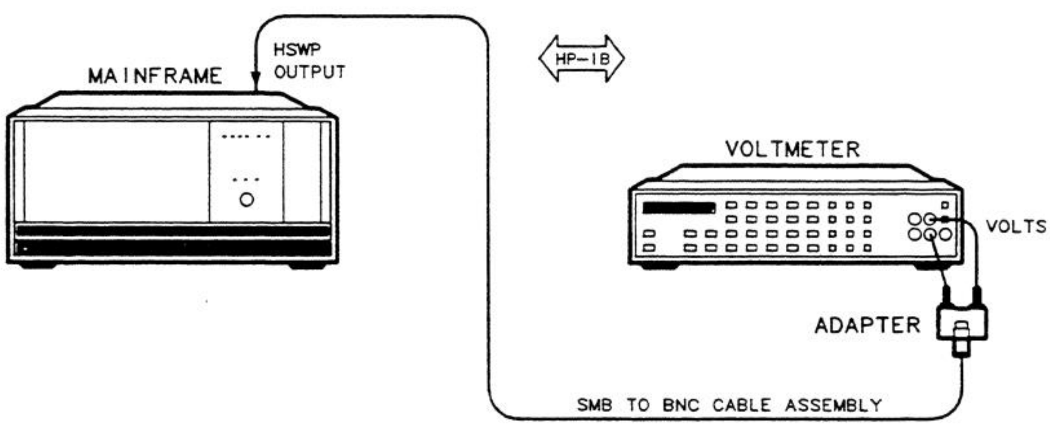



*Figure 3-27. Test Setup for Test 20*

# Test 21.
# Line Triggering Test

## Purpose

This manual test verifies line triggering operation.

This test is run as part of Final Test.

## Description

**NOTE**

**This is a manual test. The performance test program prompts the user to refer to this test description.**

An oscilloscope is used to monitor the rear-panel HSWP waveform during line triggering. If functioning correctly, the signal will be stable.

## Equipment

Oscilloscope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 54111D

**HP 70000 Modules:**
Graphics Display . . . . . . . . . . . . . . . . . . . . . . . . . HP 70205A or 70206A

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

## Procedure

1. Connect the equipment as illustrated in Figure 3-28.
2. Set the graphics display's controls as follows:

Span . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 Hz
Trace Length A . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50
Sweeptime . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 8 ms
Trigger . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Line

3. Set the oscilloscope's controls as follows:

   Volts/Div . . . . . . . . . . 2
   Sec/Div . . . . . . . . . . 8 ms
   Trigger . . . . . . . . . . Line
   Channel 1 . . . . . . . . . . On, DC Coupled

4. Connect the DUT's rear-panel H SWP jack to channel 1 on the oscilloscope. The oscilloscope will display a 50 ms square wave with 8 ms, 5V, positive peaks.

5. Adjust the oscilloscope triggering level and sweeptime for a stable display.

6. On the graphics display module, press {TRIGGER FREE}. Verify that the oscilloscope waveform drifts. On the graphics display press {TRIGGER LINE}. If the displayed waveform is stable, the DUT passes the test.

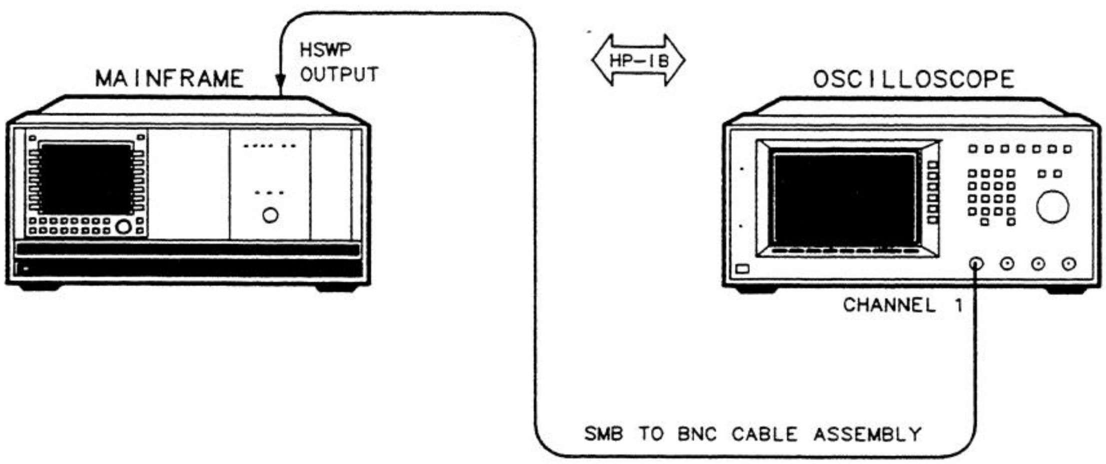



*Figure 3-28. Test Setup for Test 21*

# Test 22.
# LED Check Test

## Purpose

This test verifies the proper front panel LED operation.

## Description

This test sends commands to turn front-panel LEDs on and off. A total of 28 LED patterns are displayed on the DUT. The user is prompted to watch and verify the correct LED patterns. Install the DUT into the HP 70000 series mainframe.

# Test 23.
# Video Bandwidth Test

## Purpose

The bandwidths of the positive and negative peak detectors are measured.

## Description

Connect the equipment as illustrated in Figure 3-29. The program sets the function generator for a 1.8V peak-to-peak, 1 kHz, sine wave with a 1V dc offset. The DUT is set to 0 Hz span, 50 ms sweeptime, and positive peak detection.

The test records eight hundred trace data points, averages the data, and subtracts the average from each data point. This mathematically removes the dc offset. The maximum data point is considered the reference trace value. The test remeasures the data points with the function generator increased to 5 MHz and mathematically removes the dc offset. The frequency response of the positive-peak detector circuitry is detemined by comparing the maximum trace point to the maximum reference trace value.

The program repeats the procedure at 4 MHz using negative-peak detection.

## Equipment

Function Generator . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3325A

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

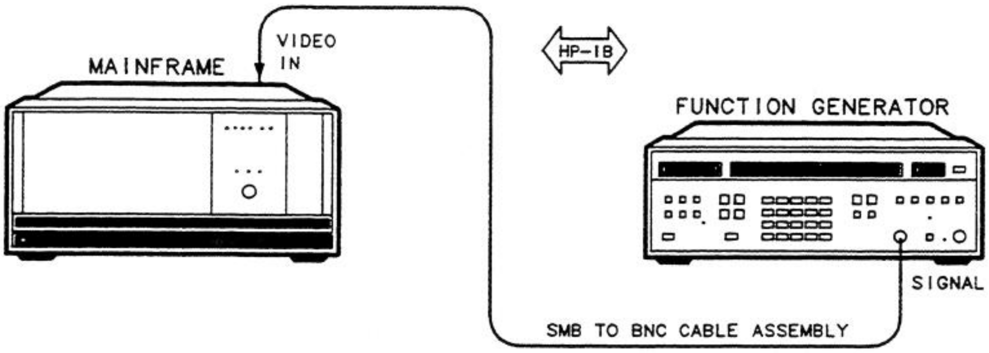



*Figure 3-29. Test Setup for Test 23*

# Test 24.
# 300 MHz 40 kHz Sidebands Test

## Purpose

This test measures sidebands on the rear-panel 300 MHz 1 and 2 jacks. These sidebands are generated by radiated emissions from the HP 70001A Mainframe's 40 kHz switching power supply.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment as illustrated in Figure 3-30. Place the sniffer loop near the rear of the mainframe. The test uses the sniffer loop to measure the frequency of the 40 kHz emissions. To be measured, the emissions must be greater than -85 dBm. The 300 MHz Upconverter multiplies the 300 MHz signal and sidebands by 20. This multiplication increases the sideband power levels within the measurement range of the spectrum analyzer. Refer to the following formula:

$$\text{Sideband Increase (dB)} = 20 \text{ Log } (6 \text{ GHz}/300 \text{ MHz})$$

$$= 26 \text{ dB}$$

The spectrum analyzer measures the power of the first six upper and lower 40 kHz sidebands. Each measurement is made relative to the 6 GHz signal. The program remeasures sidebands that excede the test limits using video averaging.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| External Reference | Refer to "External Frequency Reference" |
| Sniffer Loop | Refer to "Sniffer Loop Construction Procedure" |
| 300 MHz Upconverter | Refer to "300 MHz Upconverter Construction Procedure" |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Type N (m) to BNC (f) | HP 1250-1476 |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1250-0672 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) *(2 required)* | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |

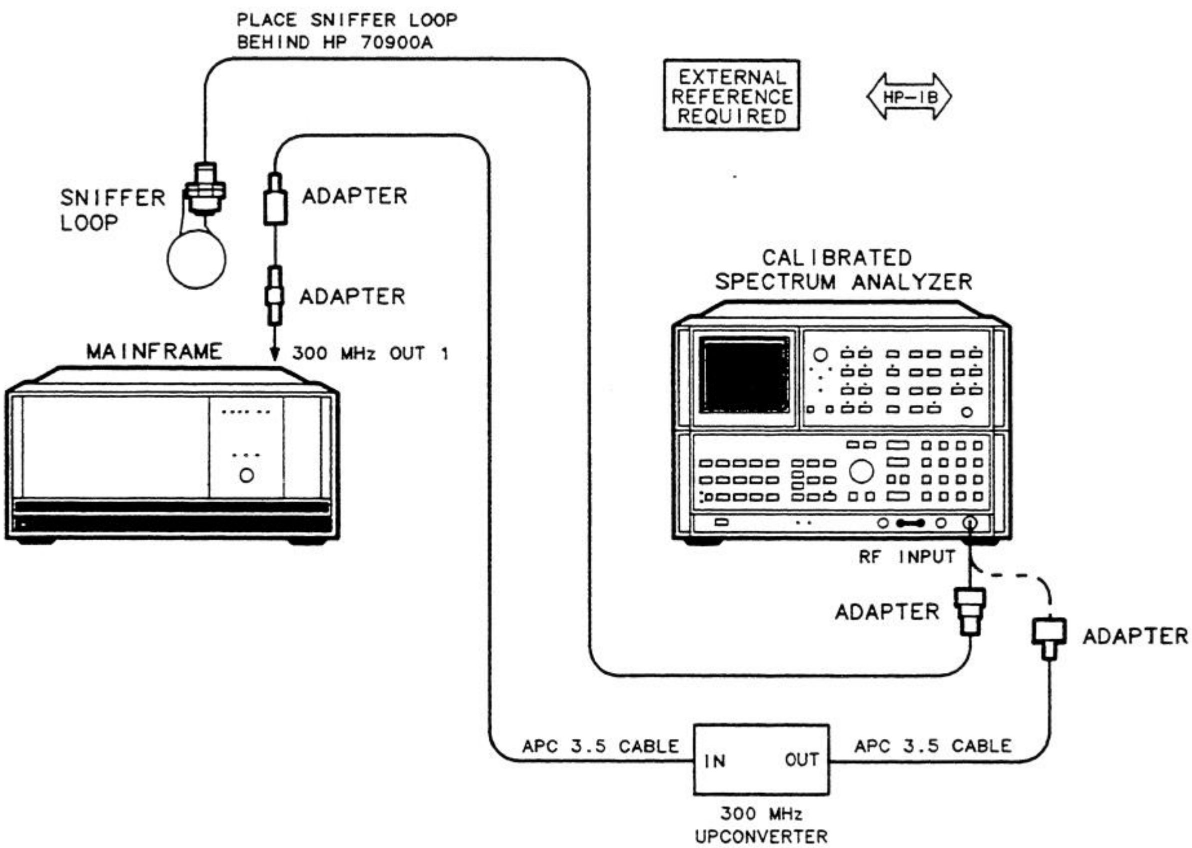



*Figure 3-30. Test Setup for Test 24*

# Test 25.
# Calibrator Harmonics Test

## Purpose

This test measures the 300 MHz calibrator's harmonic power levels.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment as illustrated in Figure 3-31. The spectrum analyzer measures the power levels, in dBc, of the first 10 harmonics of the 300 MHz signal.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
BNC (m) to SMA (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1700

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

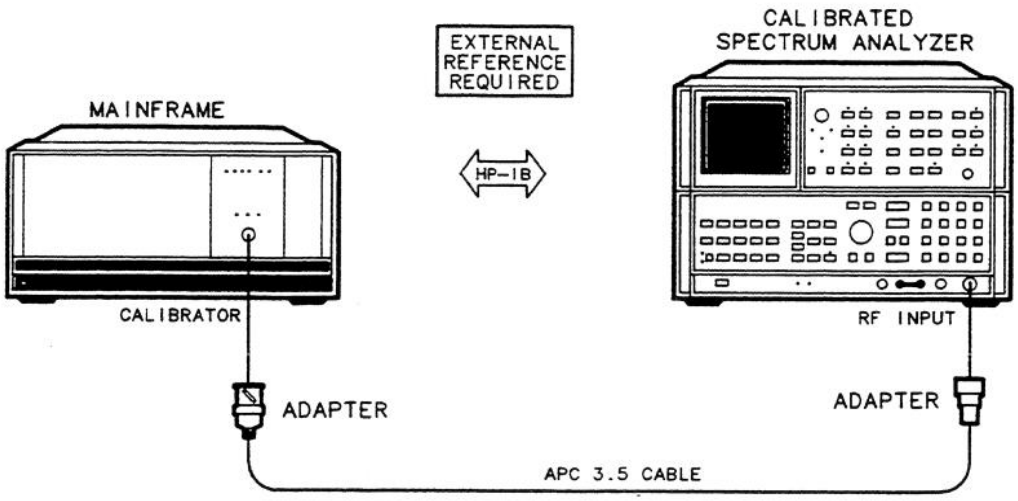



*Figure 3-31. Test Setup for Test 25*

# Test 26.
# Calibrator Output Impedance Test

## Purpose

This test measures the output return loss of the module's front-panel calibrator jack. From the return loss measured, the calibrator source impedance can be measured.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

Connect the equipment as illustrated in Figure 3-32. The calibrator output impedance measurement is made with the module powered up. To eliminate interference with the calibrator signal, the return measurement is made at a 50 kHz offset from 300 MHz.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| External Reference | Refer to "External Frequency Reference" |
| Synthesized Source | HP 8663A |
| Directional Coupler | HP 778D |
| Open/Short | HP 85037-60001 |
| 20 dB Attenuator | HP 8491A Option 20 |
| 50Ω Type N (m) Termination | HP 908A |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) *(3 required)* | HP 1250-1744 |
| Type N (f) to APC 3.5 (f) *(2 required)* | HP 1250-1745 |
| BNC (m) to SMA (f) | 1250-1700 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) *(3 required)* | HP 8120-4921 |

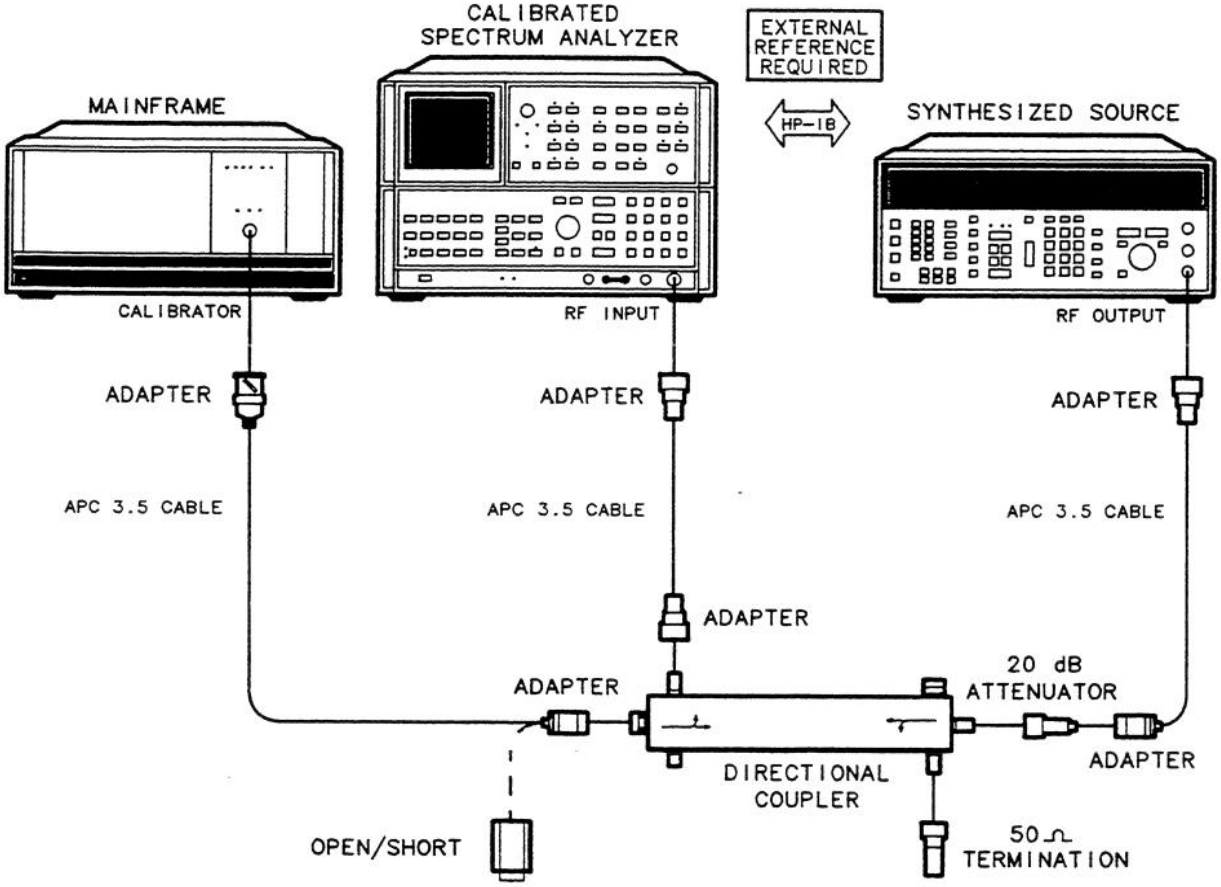



*Figure 3-32. Test Setup for Test 26*

# Test 27. 300 MHz Reference Isolation Test

## Purpose

This test measures the isolation between the module's three 300 MHz output ports. These ports include the front-panel CALIBRATOR jack, the rear-panel 300 MHz 1 jack, and the rear-panel 300 MHz 2 jack. Isolation is checked at frequencies that simulate coupling from the RF module's second IF.

## Description

The program prompts you to connect six variations of the test setup illustrated in Figure 3-33. In each test, the microwave source simulates coupling from the RF module's low and high band IFs. To simulate low band coupling, the microwave source tunes from 278.6 to 321.4 MHz in 1 MHz steps. To simulate the high band coupling, the microwave source tunes from 3 to 6.6 GHz in 100 MHz steps. The spectrum analyzer measures the amount of coupling. The six test variations are as follows:

**Setup 1:**
Microwave Source to rear-panel 300 MHz 1
Calibrated Spectrum Analyzer to rear-panel 300 MHz 2

**Setup 2:**
Microwave Source to rear-panel 300 MHz 1
Calibrated Spectrum Analyzer to front-panel CALIBRATOR

**Setup 3:**
Microwave Source to rear-panel 300 MHz 2
Calibrated Spectrum Analyzer to rear-panel 300 MHz 1

**Setup 4:**
Microwave Source to rear-panel 300 MHz 2
Calibrated Spectrum Analyzer to front-panel CALIBRATOR

**Setup 5:**
Microwave Source to front-panel CALIBRATOR
Calibrated Spectrum Analyzer to rear-panel 300 MHz 1

**Setup 6:**
Microwave Source to front-panel CALIBRATOR
Calibrated Spectrum Analyzer to rear-panel 300 MHz 2

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| External Reference | Refer to "External Frequency Reference" |
| Microwave Source | HP 8340A/B |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| SMA (f) to BNC (m) | HP 1250-1700 |
| SMA (f) to SMB (m) *(2 required)* | HP 1250-0674 |
| SMB (f) to SMB (f) *(2 required)* | HP 1250-0672 |
| APC 3.5 (f) to APC 3.5 (f) | HP 5061-5311 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) *(2 required)* | HP 8120-4921 |

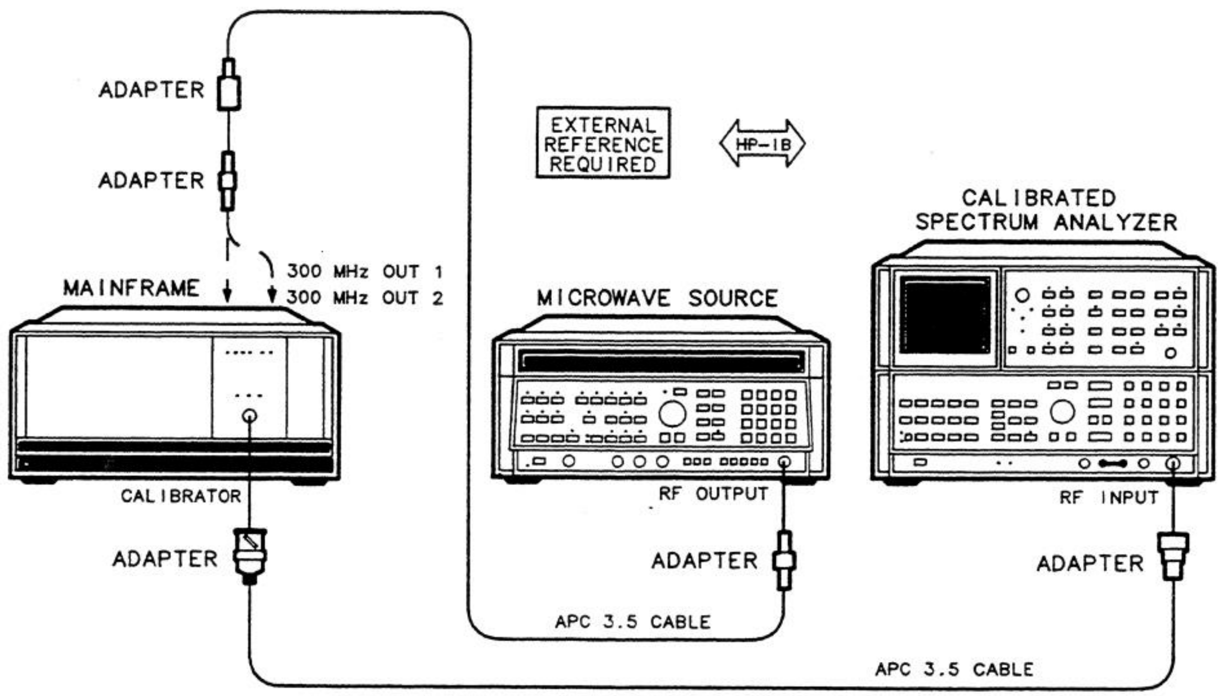



*Figure 3-33. Test Setup for Test 27*

# Test 28. External Reference Test

## Purpose

This test verifies the DUT's abiltiy to lock on an external frequency-reference even with variations in reference power and frequency.

## Description

**NOTE**

**This test requires a calibrated HP 8566B Spectrum Analyzer. If the HP 8566B is not calibrated when the test is entered, the verification software will start a calibration procedure. Refer to Spectrum-Analyzer/RF-Cable Calibration in this chapter. After the calibration is completed, the software will return to this test procedure.**

**NOTE**

**Disconnect the 100 MHz reference from the HP 70900A.**

Connect the equipment as illustrated in Figure 3-34. The sythesized source provides the 100 MHz external reference signal to the DUT. The calibrated spectrum analyzer monitors the calibrator signal to detect problems in the 100 MHz and the 300 MHz assemblies.

Test 1 verifies the DUT's ability to lock onto an external reference. The controller checks for any unlock status errors with a 100 MHz, +4 dBm reference. Test 2 verifies that the DUT stays locked when the external reference's frequency is varied. Test 3 verifies if the 300 MHz CALIBRATOR stays level with variations of external reference power level. Test 4 verifies the operation of the DUT internal/external reference switch. The DUT normally uses its internal 100 MHz oscillator. When the DUT senses an external reference signal, the internal/external switch is automatically set to external. In this portion of the test, the synthesized source power level is decremented until the switch goes from external to internal.

## Equipment

Calibrated Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"
Synthesized Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8663A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
SMA (f) to SMB (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0674
SMB (f) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0672
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) *(2 required)* . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921
BNC (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 10503A

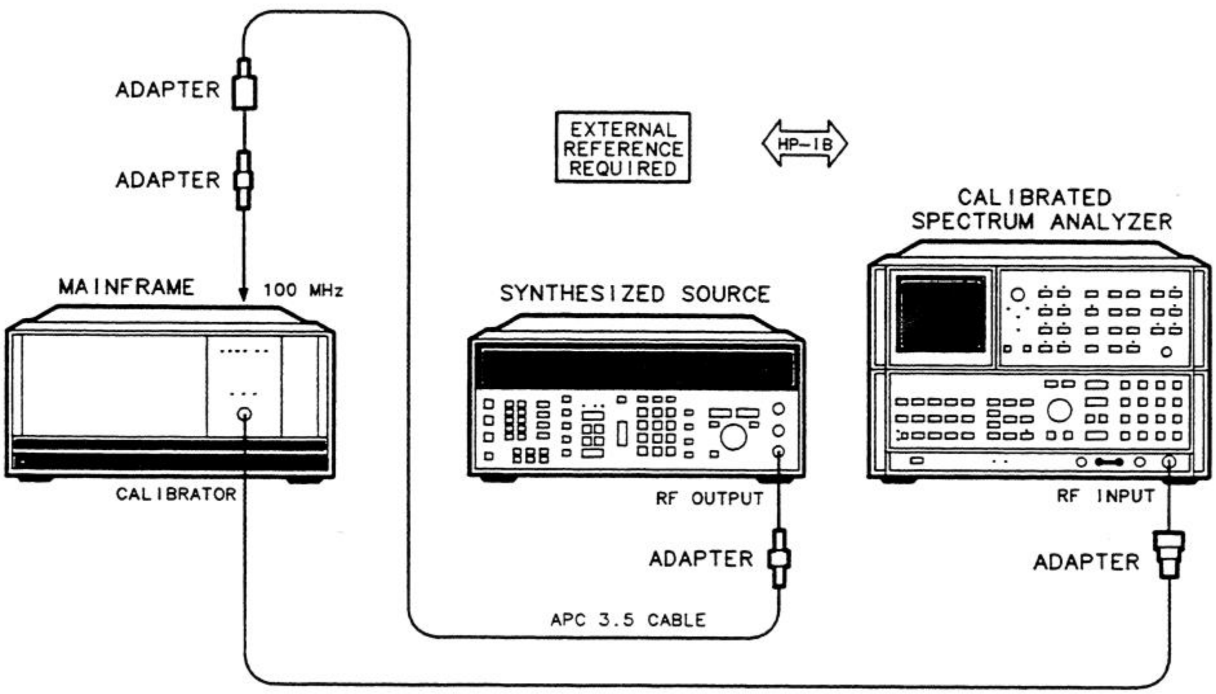



*Figure 3-34. Test Setup for Test 28*

# Test 29.
# Reference Oscillator Stability Test

## Purpose

This test measures the short term stability of the 100 MHz reference oscillator.

## Description

**NOTE**

**Disconnect the 100 MHz reference from the HP 70900A. If an external 100 MHz reference was connected, allow 30 minutes for internal reference to stabilize.**

Connect the test equipment as illustrated in Figure 3-35. The test programs the DUT to make two frequency measurements, 20 seconds apart, on a stable signal. Any difference between the two measurements is caused by the reference oscillator's frequency drifting.

## Equipment

External Reference . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"
Microwave Source . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . . . . . . HP 70905A, 70906A, or 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

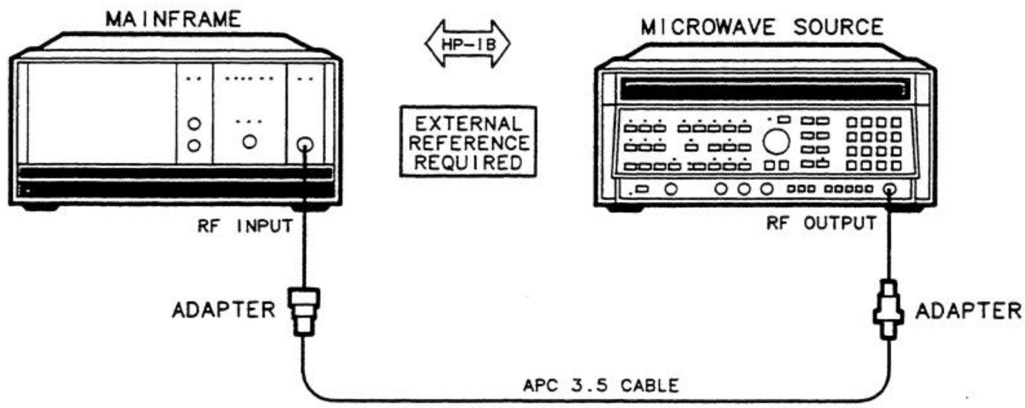



*Figure 3-35. Test Setup for Test 29*

# Test 30.
# Reference Oscillator Shot Noise Test

## Purpose

This measures the shot noise generated by the 100 MHz reference oscillator crystal.

## Description

**NOTE**

**Disconnect the 100 MHz reference from the HP 70900A. If an external 100 MHz reference was connected, allow 30 minutes for internal reference to stabilize.**

Connect the equipment as illustrated in Figure 3-36. To measure the shot noise, the program performs a residual FM test. The slope of the IF module's 30 Hz resolution-bandwidth filter is measured using the LO feedthrough signal. After calculating the filter's slope, the test places the microwave source's 5 GHz signal in the middle of the filter's slope and measures the residual FM. (The residual FM equals the signal's amplitude variation times the slope of the filter.) Since the residual FM generated by the DUT's 100 MHz oscillator is typically greater than the FM generated by the microwave source, the residual FM measured is due to the DUT 100 MHz oscillator.

## Equipment

External Reference . . . . . . . . . . . . . . . . . Refer to "External Frequency Reference"
Microwave Source . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A/B

**HP 70000 Modules:**
RF Module . . . . . . . . . . . . . . . . . . . . HP 70905A, HP 70906A, or HP 70908A
IF Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70902A

**Adapters:**
Type N (m) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . HP 1250-1744
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . HP 5061-5311

**Cables:**
APC 3.5 (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . HP 8120-4921

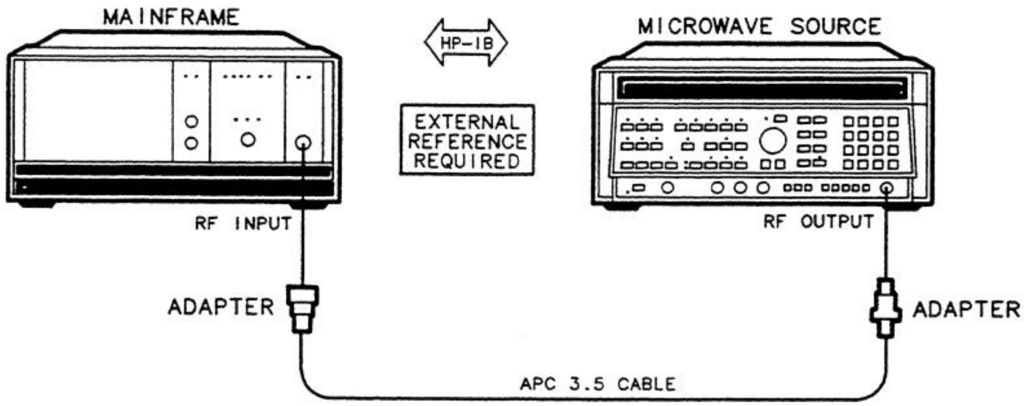



*Figure 3-36. Test Setup for Test 30*

# Test 31. YTO Linearity Test

## Purpose

This test measures the YTO (YIG tuned oscillator) frequency linearity over the frequency range of 3 to 6.6 GHz.

## Description

~~The~~ test determines the YTO linearity by reading the module's tune correction DAC. The YTO is tuned in 100 MHz steps from 3 to 6.6 GHz. At each frequency, the tune correction DAC value is measured, converted to a frequency value, and plotted graphically. Install the DUT into the HP 70001A mainframe.

# 300 MHz Upconverter Construction Procedure

## Theory of Operation

The 300 MHz Upconverter converts a 300 MHz input signal to 6 GHz. Refer to Table 3-2 for a list of performance tests that require the upconverter.

Figure 3-37 illustrates the block diagram for the Upconverter. The 300 MHz, 0 dBm, input signal is first attenuated by 3 dB to improve matching. Next, the 300 MHz, -3 dBm, signal is amplified 40 dB by the extremely low noise amplifier (noise figure is approximately 3.5 dB). The step recovery diode (SRD) generates frequency harmonics. The 20th harmonic of the 300 MHz signal (6 GHz) is bandpass filtered resulting in a 6 GHz output. The isolator suppresses the signals reflecting off the input of the bandpass filter. Without the isolator these reflected signals could mix in the SRD and potentially cause spurious signals to be passed through to the output.

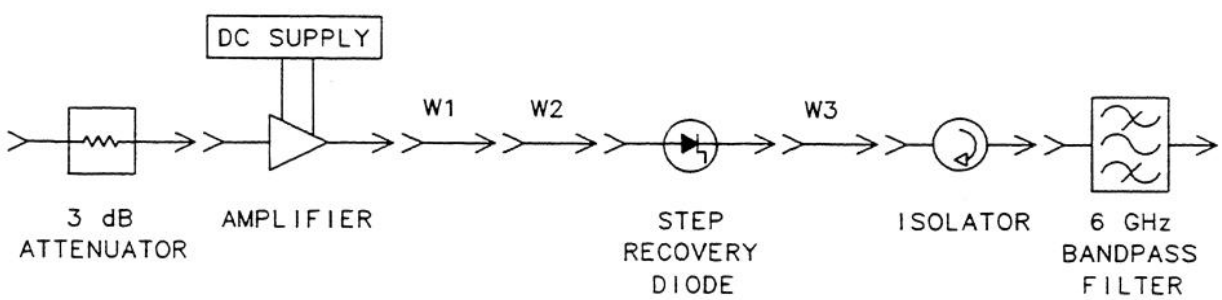



*Figure 3-37. 300 MHz Upconverter Block Diagram*

## Specifications

| | |
|---|---|
| Input Frequency: | 300 MHz ±10.5 MHz |
| Input Power: | 0 dBm ±1 dB |
| Output Frequency: | 20 × Input Frequency, normally 6 GHz |
| Conversion Loss: | 7 dB Maximum |
| Power Supply Requirements: | +24V ±5% @ 550 mA |

# Component Specifications

## 3 dB Attenuator

| | |
|---|---|
| Operating Frequency: | 300 MHz ±10 MHz |

## Amplifier

| | |
|---|---|
| Operating Frequency: | 300 MHz ±10 MHz |
| Gain: | 40 to 43 dB |
| Noise Figure: | <4 dB |
| 1 dB Gain Compression: | 33 dBm |

## Step Recovery Diode

| | |
|---|---|
| Operating Frequency: | 300 MHz ±10 MHz |
| Output Comb Frequency: | >6 GHz |
| Power Capability: | >1 Watt |

## Isolator

| | |
|---|---|
| Frequency: | 6 GHz ±200 MHz |
| Insertion Loss: | <1 dB |
| Reverse Isolation: | >15 dB |
| Power Capability: | >0.5 Watts |

## Bandpass Filter

| | |
|---|---|
| Center Frequency: | 6 GHz |
| Stop Band Attenuation: | >70 dB |

## Power Supply

| | |
|---|---|
| Voltage: | +24V |
| Current: | 550 mA |

## 300 MHz Upconverter Assembly

Table 3-3 lists the components used in the upconverter. Assemble the components as shown in Figure 3-38. Connect the positive lead of the power supply to the feedthrough filter on the amplifier. Connect the ground lead to the standoff on the amplifier. Set the power supply to +24 Vdc. Refer to Table 3-3 for assembly parts.

The linear amplifier, Q-Bit Corporation part number QB-442, is available from the following company:

Allis Associates
P.O. Box 1256
Cupertino, CA 95015
408-252-2883

The bandpass filter, Lark Engineering part number 3B-6000-180-6BA, is available from the following company:

Stout Associates
175 South San Antonio Road
Suite 114
Los Altos, CA 94022
408-746-0470

*Table 3-3. 300 MHz Upconverter Parts List*

| Part Description | Quantity | Model/Part Number |
|---|---|---|
| 3 dB Fixed Attenuator | 1 | HP 8493A Option 003 |
| 10 MHz to 400 MHz Linear Amplifier | 1 | *(See "300 MHz Upconverter Assembly")* |
| Step Recovery Diode | 1 | HP 33003A |
| Isolator | 1 | HP P/N 0955-0204 |
| 6 GHz Bandpass Filter | 1 | *(See "300 MHz Upconverter Assembly")* |
| DC Power Supply (+24V, 550 mA) | 1 | HP 6277B, HP 6206B, HP 6200B, HP 6114A, HP 6289A, HP 6255A, HP 6291A, HP 6115A, or HP 6228B |
| Semi-Rigid Coaxial Cable (W1) | 1 | HP P/N 85660-20073 |
| SMA (m) to SMA (m)Adapter (W2) | 1 | HP P/N 1250-1159 |
| SMA (f) to SMA (f) Adapter (W3) | 1 | HP P/N 1250-1158 |

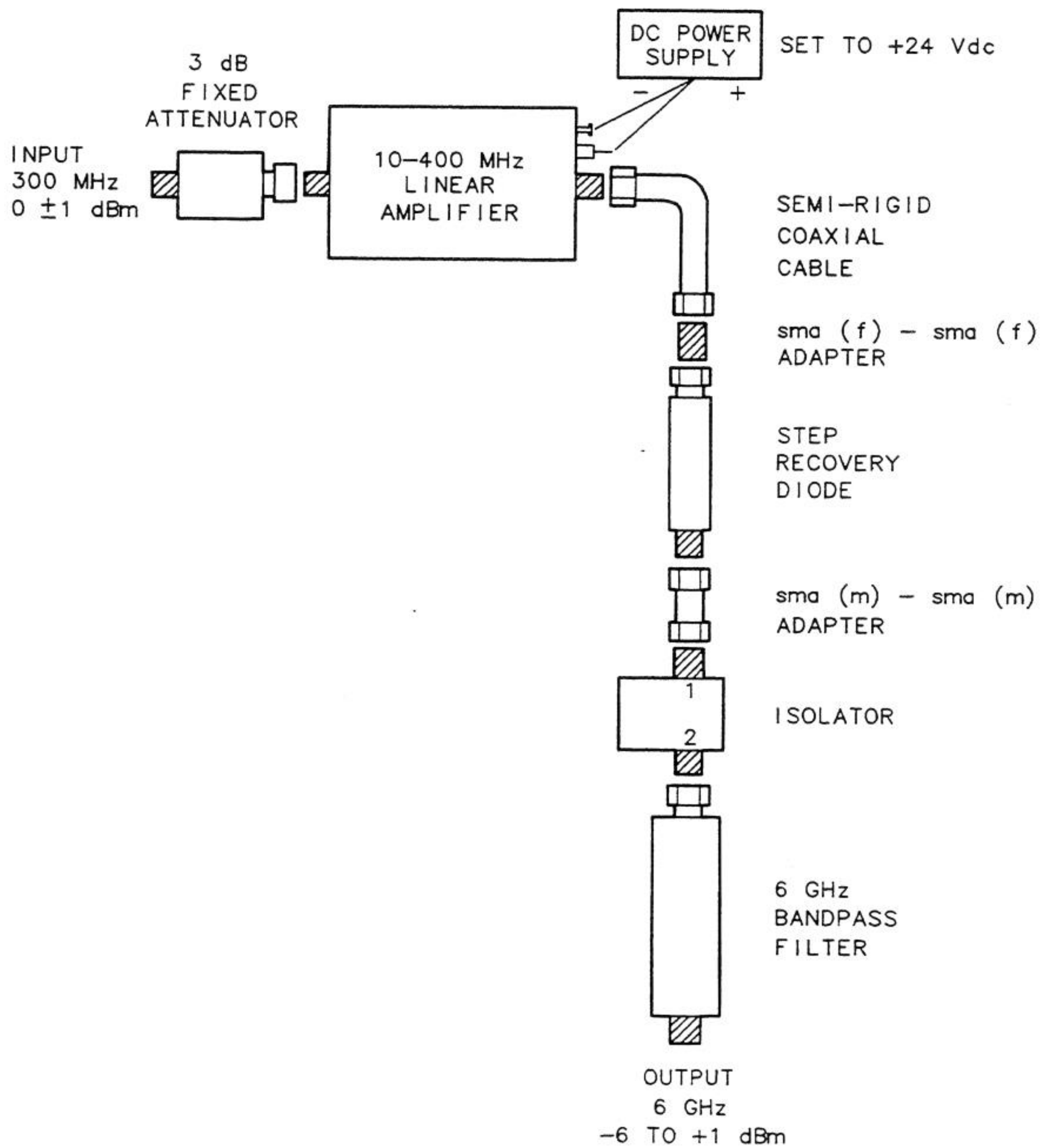



*Figure 3-38. 300 MHz Upconverter Assembly Diagram*

## Upconverter Performance Verification

The critical parameters for this electronic tool are Conversion Loss and Noise Floor. See Figure 3-39 for the power levels through the RF chain.

## Conversion Loss Verification

1. Connect an HP 8662A or HP 8663A to the input.

2. Set the HP 8662A or HP 8663A controls as follows:

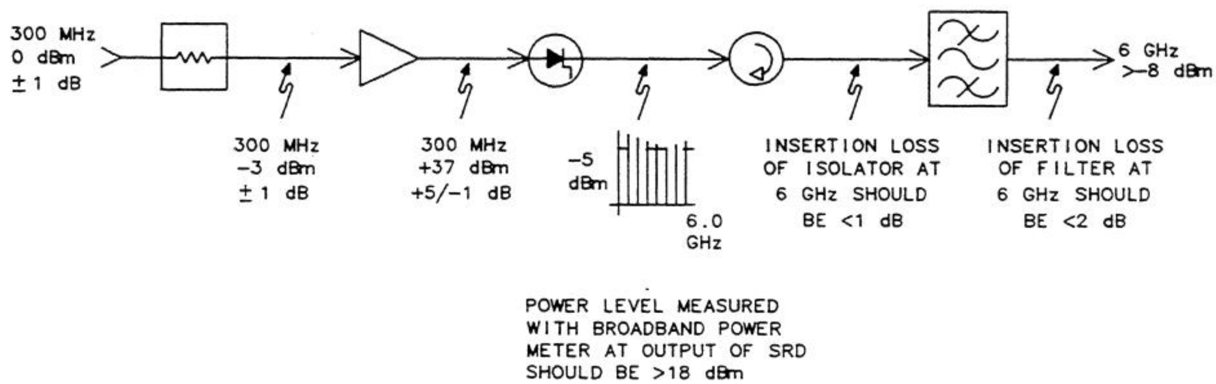



*Figure 3-39. Power Levels Through RF Chain*

Frequency . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 300 MHz
Power . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 dBm

3. Connect an HP 8566A to the upcoverter output.

4. Set the HP 8566A controls as follows:

Frequency . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6 GHz
Span . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 MHz
Reference Level . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +10 dBm

5. Use the marker peak function, the marker peak should read >-7 dBm.

## Noise Floor Verification

For the 300 MHz Phase Noise test, the critical test limit is the 10 kHz offset which must be -135 dBc. When the 300 MHz signal is multiplied up to 6 GHz (20X) the phase noise increases by +26 dB. Accounting for this +26 dB change and the 2 dB guard band in the 300 MHz phase noise test, the noise floor at 6 GHz +200 kHz must be 111 dBm normalized to a 1 Hz BW.

1. To measure the noise floor at 200 kHz offset from 6 GHz connect the HP 8662A or 8663A to the input.

2. Set the HP 8662A or 8663A controls as follows:

Frequency . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 300 MHz
Span . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 dBm

3. Connect the HP 8566A to the upconverter output.

4. Set the HP 8566A controls as follows:

   Frequency . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6 GHz
   Span . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 450 kHz
   Reference Level . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 20 dBm
   Video Bandwidth . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 300 Hz
   Marker . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 200 kHz from the 6 GHz signal

5. Enable the Noise Measurement routine by selecting [Shift], [M]. This will give the marker amplitude reading normalized to a 1 Hz Bandwidth. The reading should be <-111 dBm.

# Sniffer Loop Construction Procedure

## Theory of Operation

The Sniffer Loop is used to measure the 24 kHz radiated signal generated by the HP 70205A Graphics Display, HP 70900A LO Modules, and 40 kHz radiated signal generated by the HP 70001A Mainframe power supply.

## Sniffer Loop Assembly

Table 3-4 lists the components used in the Sniffer Loop Assembly. Wrap the wire in a 2 inch diameter circle, solder the wire to the J1 BNC connector and attach the lockwasher and hexnut. Refer to the assembly diagram in Figure 3-40.

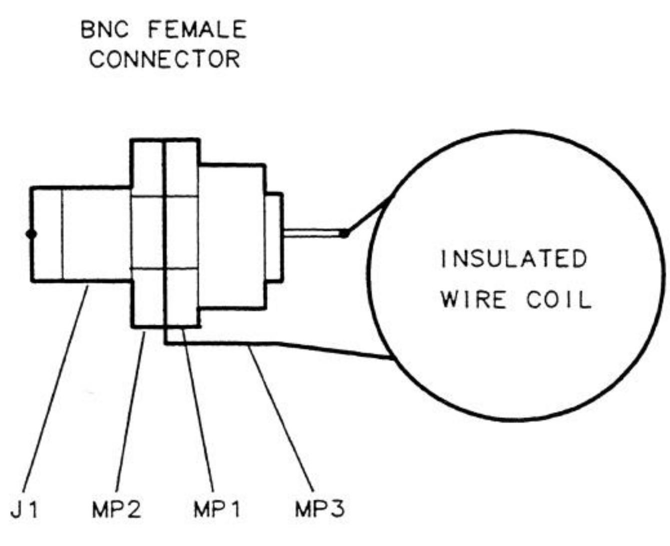



*Figure 3-40. Sniffer Loop Assembly Diagram*

*Table 3-4. Sniffer Loop Assembly Parts List*

| Part Description | Quantity | Model/Part Number |
|---|---|---|
| 22 Gauge Wire | 3 ft. | 8150-0005 |
| J1, BNC (f) | 1 | 1250-0212 |
| MP1, Hexnut | 1 | 2950-0001 |
| MP2, Lockwasher | 1 | 2190-0016 |
| MP3, Solderlug | 1 | 0360-1190 |

# Chapter 4

# Adjustment Procedures

## Introduction

Adjustment procedures optimize module performance after a repair. This chapter contains descriptions of each HP 70900A adjustment procedure. The adjustments are run from the HP 70900A Module Verification software. Refer to Chapter 8, Major Assembly and Cable Locations for the location of module assemblies.

**Page**

**NOTE**

**Before performing any adjustments, allow the module to warmup for 30 minutes.**

## Verification Software

The adjustment procedures are performed using the HP 70900A Module Verification Software. The software controls the test equipment and prompts the user to manually adjust the appropriate components. For information on using the software, refer to Chapter 2, Verification Software.

## Which Tests Should be Run?

To decide which adjustment procedure to run, refer to the Table 5-1, Related Adjustments and Verifications Tests. The table lists the adjustments and verification tests that should be performed when an assembly is repaired or changed.

## Adjustable Components

Table 4-1 lists all adjustable components in the HP 70900A. For each component, the table lists the associated adjustment procedure and adjustment description.

# Test Equipment and Tools

Table 4-2 lists the equipment types used in each adjustment procedure. Table 1-6 lists recommended equipment for each equipment type. Any equipment that satisfies the critical specifications given in the Table 1-6 may be substituted for the preferred test equipment. However, The Module Verification Software only contains instrument drivers for the equipment listed in the Table 1-6. Any additional drivers will have to be written by the user.

Many of the tests require either a spectrum analyzer or a calibrated spectrum analyzer. Although the calibrated spectrum analyzer may be used as a spectrum analyzer, the analyzer's HP-IB address can only be listed once in the software's equipment menu. For example, if the next test performed requires a spectrum analyzer instead of a calibrated spectrum analyzer, go to the software's equipment menu and delete the HP-IB address entry for the calibrated spectrum analyzer and enter the address next to the spectrum analyzer entry.

## Test Equipment Construction

Some of the adjustment procedures require a 20:1 Resistive Divider. The procedure for the construction of this divider is found at the end of this chapter. Refer to Table 4-2 for a list of tests requiring this equipment.

## Adjustment Tools

For adjustments requiring a non-metallic tuning tool, use fiber tuning tool, HP Part Number 8170-0033. Never try to force an adjustment control in the module. This is especially critical when tuning slug-tuned inductor and variable capacitors.

## Extender Cable Installation

CAUTION

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

## HP-IB Connections

When the Hewlett-Packard Interface Bus (HP-IB) symbol appears on an adjustment set-up diagram, the controller and instruments such as sources, analyzers, and counters need to be linked together by HP-IB.

## External Frequency Reference

Table 4-2 lists the adjustment procedures that require an external frequency reference. During these procedures, instruments such as sources, analyzers, counters, and the DUT need to be connected to the same frequency standard. Refer to the External Frequency Reference paragraph of Chapter 3 for information on external reference requirements and generation.

## HP 8566B Spectrum Analyzer Calibration

A calibration procedure for the HP 8566B Spectrum Analyzer is run by the verification software whenever a test is run that requires calibration. Refer to Table 4-2 for a list of procedures requiring calibration. Refer to "Spectrum Analyzer/RF-Cable Calibration" in Chapter 3 for an explanation of the calibration procedure. After calibration, the software will return to the adjustment procedure selected.

**NOTE**

**Since the RF cable and HP 8566B Calibrated Spectrum Analyzer are both calibrated at the same time, use both throughout the adjustment procedures.**

*Table 4-1. Adjustable Components*

| Reference Designator | Adjustment Name | Adjustment Number | Description |
|---|---|---|---|
| A2R8 | POS PEAK | 1 | Ajusts positive peak detector offset voltage |
| A2R26 | NEG PEAK | 1 | Adjusts negative peak detector offset voltage |
| A2R52 | REFERENCE ADJ | 1 | Adjusts a reference voltage for the A2 ADC |
| A2R56 | GAIN | 1 | Adjusts gain of the A2 ADC |
| A2R58 | OFFSET | 1 | Adjusts the A2 ADC offset voltage |
| A4A1C2 | | 3 | Adjusts 300 MHz bandpass filter |
| A4A1C3 | | 3 | Adjusts 300 MHz bandpass filter |
| A4A1C4 | | 3 | Adjusts 300 MHz bandpass filter |
| A4A1C5 | | 3 | Adjusts 300 MHz bandpass filter |
| A4A1C36 | | 6 | Adjusts rear-panel 300 MHz Ref. 2 amplitude |
| A4A1C41 | | 6 | Adjusts rear-panel 300 MHz Ref. 1 amplitude |
| A4A1R40 | OUTPUT 1 LVL SET | 6 | Adjusts rear-panel 300 MHz Ref. 2 amplitude |
| A4A1R53 | OUTPUT 2 LVL SET | 6 | Adjusts rear-panel 300 MHz Ref. 1 amplitude |
| A4A1R84 | CAL LEVEL ADJUST | 5 | Adjusts calibrator amplitude |
| A4A2R16 | LOW IDLER ADJ | 15 | Adjusts power of low idler freq. relative to high idler freq. |
| A6A1C5 | | 2 | Adjusts 300 MHz bandpass filter |
| A6A1C6 | | 2 | Adjusts 300 MHz bandpass filter |
| A6A1C7 | | 2 | Adjusts 300 MHz bandpass filter |
| A6A1C9 | REF FREQ ADJUST | 2, 4 | Adjusts 100 MHz reference oscillator's frequency |
| A6A1C19 | | 2 | Adjusts 300 MHz bandpass filter |
| A6A1C20 | | 2 | Adjusts 100 MHz oscillator's power level |
| A6A2R9 | IBUF | 22 | Adjusts bias voltage to the A4A3 Idler microcircuit |
| A7A1L7 | VCO | 7 | Adjusts the FFS VCO frequency range |
| A7A2C36 | | 9 | Nulls out the 125/124.844 kHz reference feedthrough |
| A7A2R22 | TUNE COMP | 8, 13 | Nulls A7 spurious responses |
| A7A2R23 | API 1 | 10 | Nulls A7 spurious responses |
| A7A2R25 | API 2 | 11 | Nulls A7 spurious responses |
| A7A2R27 | API 3 | 12 | Nulls A7 spurious responses |
| A8R100 | FINE TUNE GAIN | 17 | Adjusts positive dc reference voltage |
| A8R101 | SPAN GAIN | 17 | Adjusts negative dc reference voltage |
| A8R102 | FM GAIN | 19 | Adjusts FM coil current |
| A8R104 | 3 GHz FINE | 18 | Adjusts YTO start frequency |
| A8R105 | LPF | 20 | Adjusts the sweep-ramp overshoot |
| A8R106 | TUNE/SPAN OFFSET | 21 | Adjusts the tune-span dc offset voltage |
| A8R107 | 6 GHz CALIB | 18 | Adjusts YTO stop frequency |
| A8R108 | | 16 | Adjust s the sweep ramp offset voltage |

*Table 4-2. Equipment Required for Adjustments*

| Adjustment Procedures | | Calibrated Spectrum Analyzer, HP 8566B | Extender Cables, HP 70900A Service Kit | Extender Module, HP 71000 Service Kit | External Reference, HP 70310A | Microwave Source, HP 8340A | Modified Covers, HP 71000/70900A Service Kits | Oscilloscope, HP 54111D | Power Meter, HP 436A | Power Sensor, HP 8485A | Power Supply, HP 6205C | Precision DVM, HP 3456A | Spectrum Analyzer, HP 8566B | Synthesized Source, HP 8663A | 20:1 Resistive Divider | DIP Clip - 16 pin | Mini-Grabber |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Video Processor Adjustment | 1 | | | | | | • | | | | • | • | | | • | | |
| Reference Adjustments | 2 | • | • | • | • | • | | • | | | | • | | | | | |
| | 3 | • | • | • | | | | | | | | | | • | | | |
| | 4 | | | • | • | | | | | | | | • | • | | | |
| | 5 | | | • | | | | | • | • | | | | | | | |
| | 6 | • | • | • | | | | | | | | | | | | | |
| FFS Adjustments | 7 | | • | • | • | | | | | | | • | • | | | | • |
| | 8 | | | • | | | | | | | | • | | | | • | |
| | 9 | | | • | • | | | | | | | | • | | | | |
| | 10 | | • | • | • | | | | | | | • | • | | | | • |
| | 11 | | • | • | • | | | | | | | • | • | | | | • |
| | 12 | | • | • | • | | | | | | | • | • | | | | • |
| | 13 | • | • | • | | | | | | | | • | | | | | • |
| | 14 | • | • | • | | | | | | | | • | | | | | • |
| Idler Adjustment | 15 | | | • | • | | | | | | | | | • | | | |
| Freq. Control Adjustments | 16 | | | • | | | | | | | | • | | | | | |
| | 17 | | | • | | | | | | | | • | | | | | |
| | 18 | | | • | • | | | | | | | | • | | | | |
| | 19 | | | • | | | | | | | | | • | | | | |
| | 20 | | | • | | | | • | | | | | | | | | |
| | 21 | | | • | | | | | | | | • | • | | | | |
| YTO Lock Loop Adjustment | 22 | • | | • | • | • | | | | | | • | | | | | |

# Video Processor Adjustment

## Reference

A2 Video Processor Board Assembly

## Description

The power supply and 20:1 resistive divider provide a 2 Vdc level with high sensitivity to the HP 70900A rear-panel VIDEO jack The DVM (digital voltmeter) monitors the voltage into the VIDEO jack. First the offset and gain of the A to D converter circuitry on the A2 Video Processor Board Assembly are adjusted. Next, the offsets of both the positive peak detector and negative peak detector circuits are adjusted. Finally, the +2V reference used to calibrate the A to D converter is adjusted to a tolerance of 500 μV.

The adjustment consists of the following semi-automated adjustment performed using the HP 70900A Module Verification software:

1. Video Processor Adjustment

# Adjustment 1. Video Processor Adjustment

## Equipment

| | |
|---|---|
| Precision DVM | HP 3456A |
| Power Supply (General Purpose 0-40V) | HP 6205C |
| Modified Mainframe Cover | HP 70001-00039 or 70001-00038 |
| Modified LO Module Cover | HP 70900-00012 |
| 20:1 Resistive Divider | Refer to "Resistive Divider Construction Procedure" |

**Adapters:**

| | |
|---|---|
| SMA Short (m) | HP 0960-0055 |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| SMB Tee (m) (f) (m) | HP 1250-1391 |
| Banana Plug to BNC (f) *(2 required)* | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| BNC (m) to SMB (f) *(2 required)* | HP 85680-60093 |

## Procedure

**NOTE**

**The Video Processor Adjustments are very heat-sensitive. The modified LO module cover allows access to the A2 Video Processor Board Assembly adjustments while keeping the heat flow stable throughout the instrument.**

During the test, the technician is prompted to adjust a potentiometer to a *number of counts* value. This value is displayed on the computer display. The *number of counts* is the value of the decimal bit from the A to D converter on the A2 Video Processor Board Assembly. The program converts this value to a voltage level with the following equation:

$$V = (\text{Counts}/1850)\ (0.0216)$$

Where:

40 counts corresponds to 0V
3740 counts corresponds to +2V

1. Install the modified LO module cover on the HP 70900A module. Place the module into the HP 70001A Mainframe that has the modified mainframe cover attached.

**NOTE**

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

2. Connect the power supply to the 20:1 resistive divider as illustrated in Figure 4-1. Connect the other end of the divider to the SMB Tee adapter. Connect the precision DVM to one end of the adapter and the other end of the adapter to the HP 70900A rear-panel VIDEO jack. Turn on the power supply and the mainframe. Do not allow the power supply to exceed 40V.

3. After the 30 minute warm-up time, run the Video Processor Adjustment test from the LO Module Verification program.

4. Set the power supply for a DVM reading of 1.99975V. Follow the prompts provided by the program to make setup changes and potentiometer adjustments.

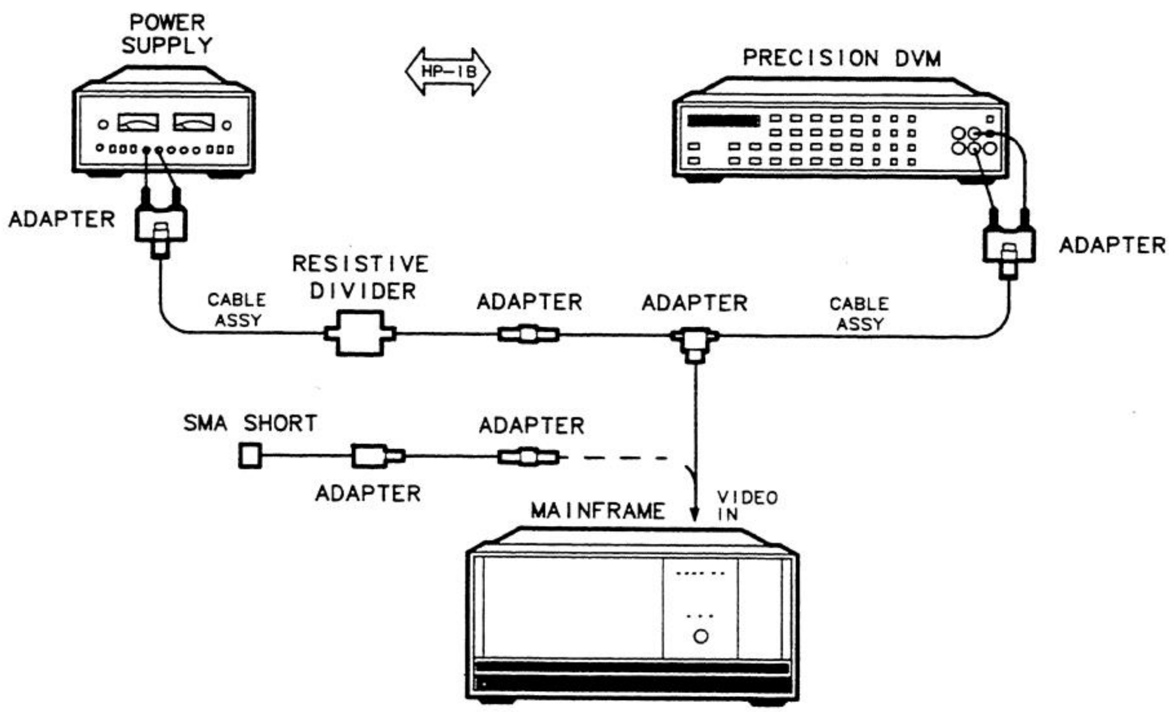



*Figure 4-1. Equipment Setup for Adjustment 1*

5. Refer to Figure 4-2 for the location of the adjustments. The adjustments are made in the following order:

   a. Adjust A2R58 OFFSET ADJUSTMENT with 0V at the rear-panel VIDEO jack.

   b. Adjust A2R56 GAIN ADJUSTMENT with 1.99975V at the rear-panel VIDEO jack.

   c. Perform steps 5a and 5b until measurements are in tolerance.

   d. Adjust A2R8 POS PEAK with 1.99975V at the rear-panel VIDEO jack.

   e. Remove A1W14 and adjust A2R26 NEG PEAK with 1.99975V at the rear-panel VIDEO jack.

   f. Adjust A2R52 REFERENCE ADJUSTMENT.

6. The program measures the adjustment of A2R8 POS PEAK and A2R26 NEG PEAK with both 0 and 1.99975V at the rear-panel VIDEO jack. The adjustment of R52 and R58 are also checked. The program prompts the technician to make any needed adjustments.

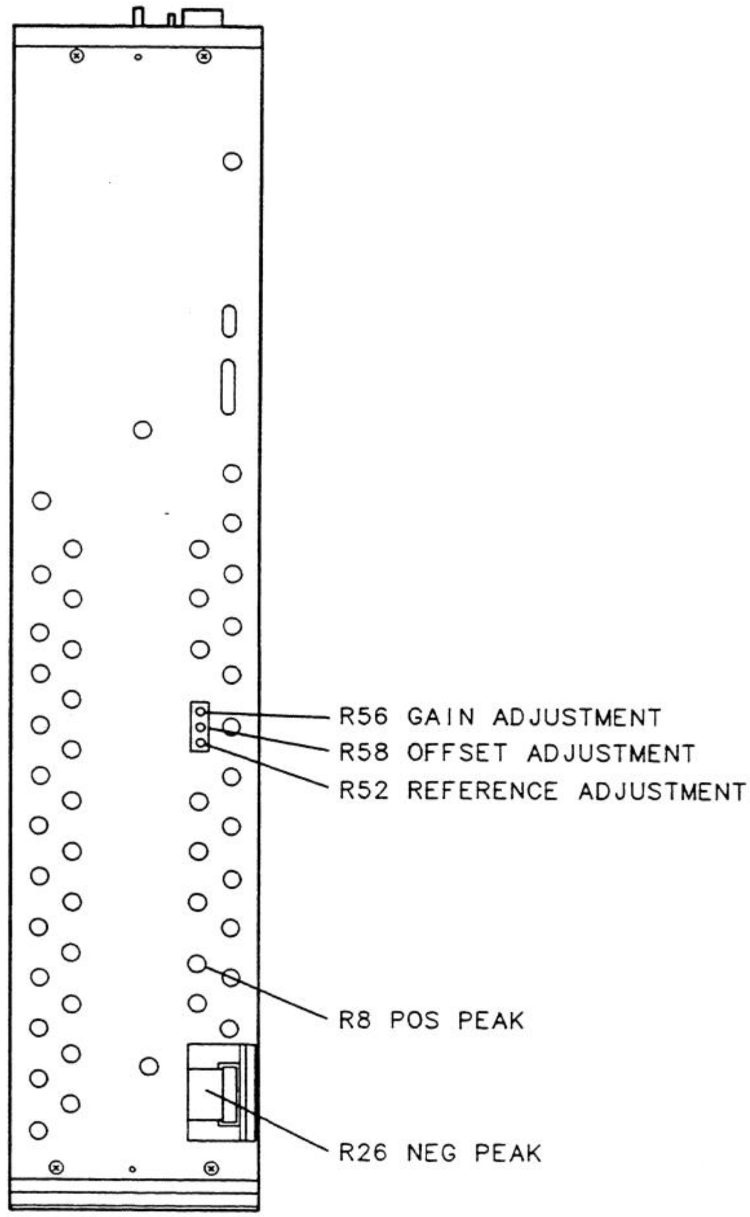



*Figure 4-2. Component Locations for Adjustment 1*

# Reference Adjustments

## Reference

A4A1 300 MHz Board Assembly

A6A1 100 MHz Board Assembly

## Description

Five semi-automated adjustments adjust the following reference functions the 100 MHz internal oscillator, the 300 MHz bandpass filters, and the 300 MHz signal's amplitude. The adjustments are performed in the following order:

2. 100 MHz Reference Assembly/300 MHz Bandpass Filter Adjustment
3. 300 MHz Bandpass Filter Adjustment
4. Calibrator Output Frequency Adjustment
5. Calibrator Output Amplitude Adjustment
6. 300 MHz Reference Output Amplitude Adjustment

# Adjustment 2.
# 100 MHz Reference/300 MHz Bandpass Filter Adjustment

## Purpose

This procedure adjusts the bandwidth of the A6A1 100 MHz assembly's 300 MHz Bandpass Filter. The power level and frequency of the 100 MHz oscillator are also adjusted.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Microwave Source | HP 8340A |
| Oscilloscope | HP 54111D |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| APC 3.5 (f) to APC 3.5 (f) | HP 5061-5311 |
| SMA (f) to SMB (m) *(2 required)* | HP 1250-0674 |
| SMB (f) to SMB (f) *(2 required)* | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| Oscilloscope Probe | HP 10080A |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) *(2 required)* | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |
| Extender Cable - 9 pin | HP 70900-60063 |
| Extender Cable - 10 pin | HP 70900-60064 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A3 Power Supply | HP 70900-60057 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

## Procedure

### Accessing the Adjustments

The adjustments for this procedure are located just behind the A3 Power Supply assembly. Both the A1A1 Host/Processor Assembly and the A3 Power Supply assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

**NOTE**

**Older modules contain an A1 Controller assembly instead of a combination A1A1 Host/Processor and A1A2 RAM/ROM assembly. When working on an older module, substitute the words "A1 Controller" for the words "A1A1 Host/Processor" in the following steps.**

1. Set the mainframe line switch to OFF.

2. Remove the A1A1 Host/Processor and A3 Power Supply assemblies (refer to the A1A1 Host/Processor and A3 Power Supply Assembly Replacement Procedures). Cables from the HP 70900A LO Service Kit will be used to electrically connect these assemblies to the module. See Figure 4-3.

3. Connect the 50-pin Back-Plane Interconnect cable to J4 on the A1A1 Host/Processor Assembly.

4. Connect the two A1A1 assembly extender cables (HP Part Number 70900-60058), from the A10 Motherboard to the two 50-pin connectors, J6 and J7, located on the bottom of the A1A1 Host/Processor Assembly.

5. Connect the 14-pin extender cable (HP Part Number 70900-60065) from A7A2J5 on the A7A2 FFS Analog Assembly to J5 located on the A1A1 Host/Processor Assembly.

**NOTE**

**It is not necessary to connect the 4-wire cable assembly to J3 located on the A1A1 Host/Processor Assembly.**

6. Lay the A1A1 Host/Processor Assembly flat. The side with the components should face up.

7. Connect the power supply ribbon cable assembly (HP Part Number 70900-60057) from the A10 Motherboard to the A3J4 connector located on the bottom of the A3 Power Supply Assembly.

8. Connect the 10-pin extender cable (HP Part Number 70900-60064) from the 10-pin connector on W21 to A3J1. Connect the 9-pin extender cable (HP Part Number 70900-60063) from the 9-pin connector on W21 to A3J2.

CAUTION

**The 9-and 10-pin extender cables are not keyed. Use the black wires on these cables to determine correct cable connection.**

9. Connect the 4-pin cable assembly to A3J3. This cable supplies power to the A3 assembly. If an extender cable is needed, use a 5-pin extender cable. Make sure the cable connects together the proper pins.

**CAUTION**

**Before turning the mainframe power on, make sure that no components of the A1A1 Host/Processor or A3 Power Supply Assemblies come into contact with anything conductive.**

10. Set the mainframe line switch to ON.

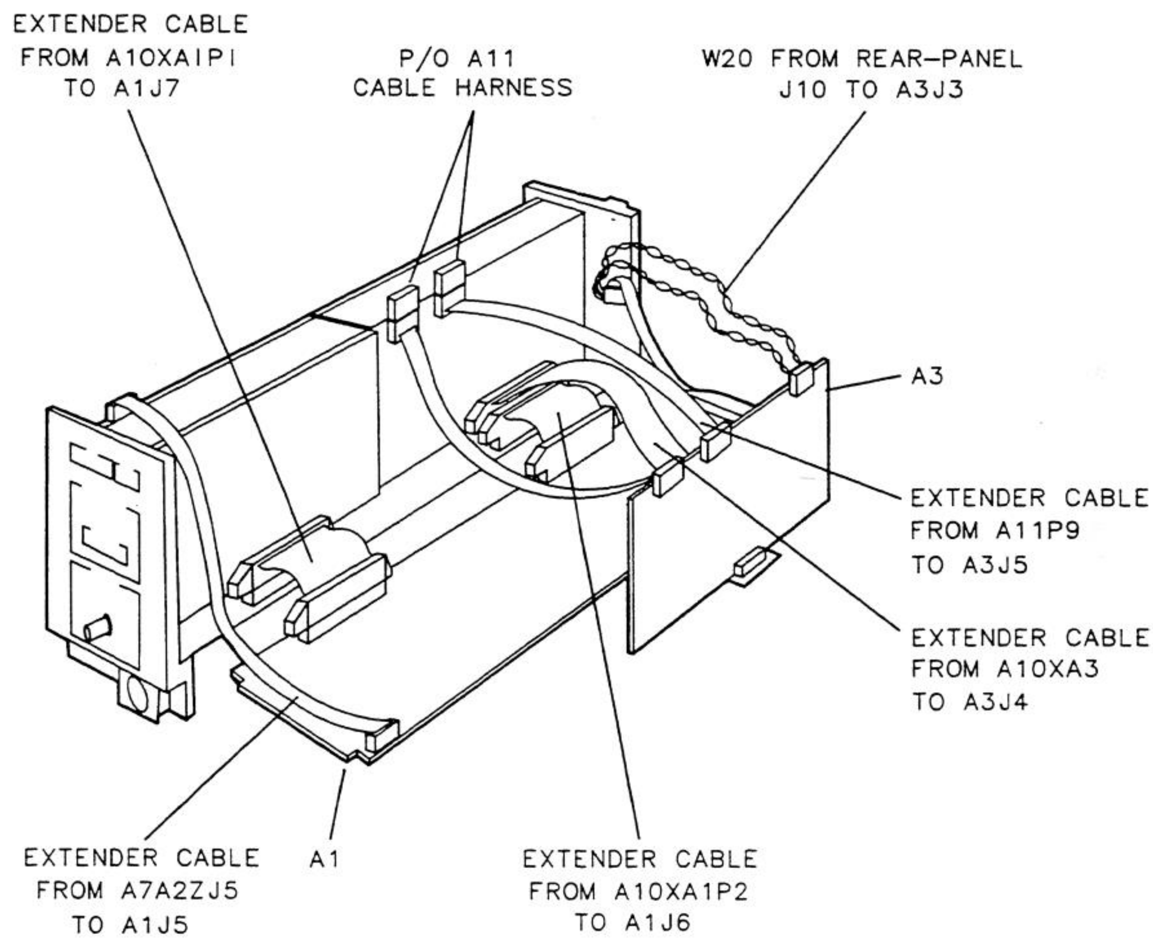



*Figure 4-3. Placing A1A1 and A3 on Extender Cables*

## Performing the Procedure

1. Connect the test equipment as shown in Figure 4-4. Figure 4-5 illustrates the test points and adjustment locations on the A6A1 assembly. Connect the spectrum analyzer to A6A1J1. Connect the positive DVM lead to A6A1J3-2 and the negative lead to the chassis. Connect the oscilloscope probe to A6A1J3-3 and the probe's ground lead to the chassis. Connect the synthesized source to the module's rear-panel 100 MHz jack (this jack is electrically connected to A6A1J2 by W9).

**NOTE**

**The assembly's test points are grouped on common connectors (e.g. A6A1J3 pins 2 and 3). Test point one is orientated towards the front of the module.**

2. Run the 100 MHz Reference Assembly/300 MHz Bandpass Filter Adjustment from the HP 70900A Module Verification software.

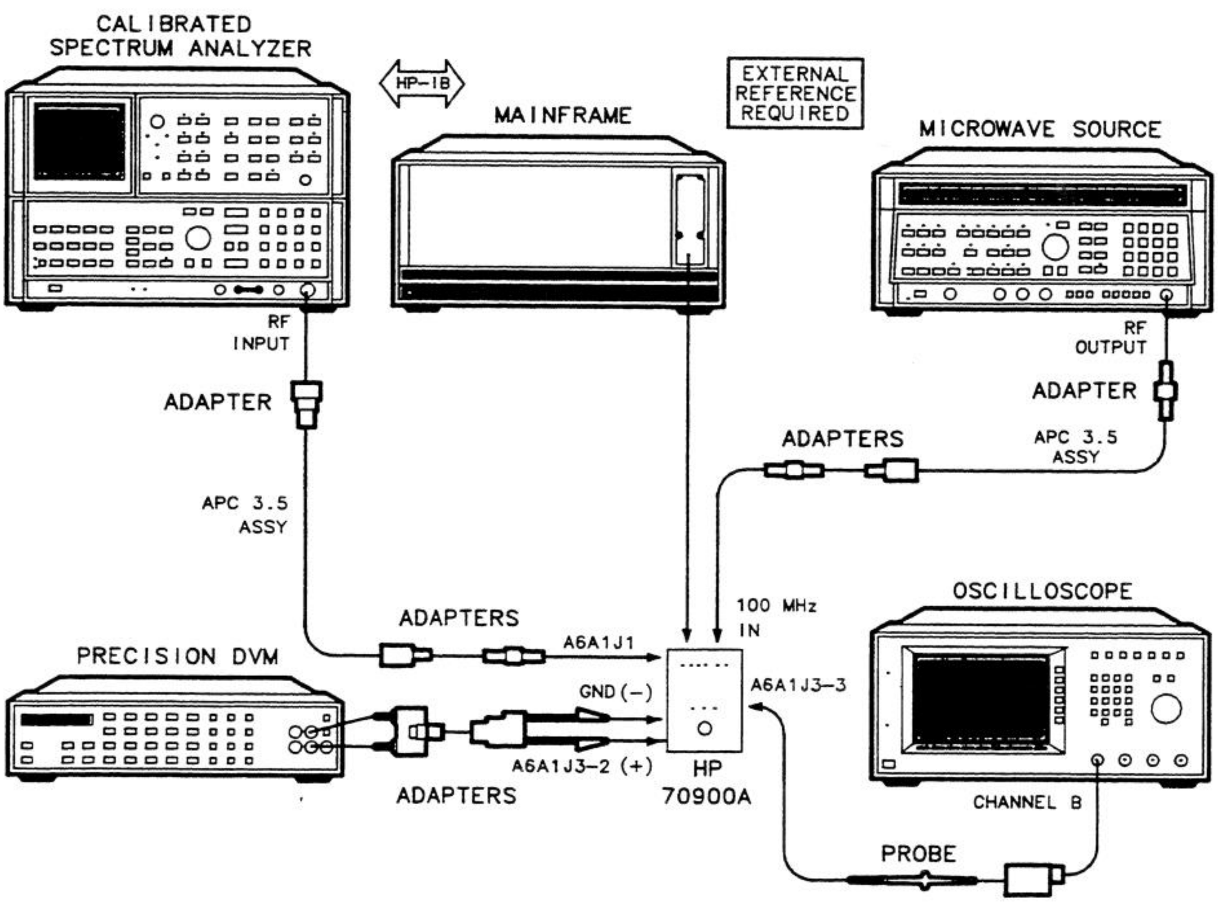



*Figure 4-4. Equipment Setup for Adjustment 2*

3. The precision DVM monitors the detected external reference oscillator's power level. The oscilloscope monitors the detected power level of the 100 MHz internal reference oscillator. The calibrated spectrum analyzer monitors the 300 MHz output from the A6A1 100 MHz assembly.

4. A6A1C20 is adjusted to peak the oscilloscope display for maximum 100 MHz internal oscillator power. Set the oscilloscope to the following settings:

| Oscilloscope Function | Setting |
|---|---|
| Volts/Div (displayed sensitivity) | 200 mV |
| Second/Div | 2.00μs |
| Trigger | Internal |
| Coupling | DC |

5. The calibrated spectrum analyzer displays the output from the 300 MHz Bandpass Filter. With the HP 70900A set to external reference, A6A1C6, C7, C5, and C19 are adjusted to peak the displayed power.

6. The 100 MHz internal oscillator's frequency must be within 1 kHz of the external oscillators frequency (microwave source). If this limit is not met, A6A1C9 is adjusted to correct the internal oscillators frequency.

7. With the HP 70900A set to external reference, the microwave source sweeps from 96 to 104 MHz as the spectrum analyzer measures the A6A1 assembly's 300 MHz output. The 3 dB points of the 300 MHz bandpass filter are determined and compared to test limits.

8. With the HP 70900A set to internal reference, the assembly's output is measured and compared to test limits.

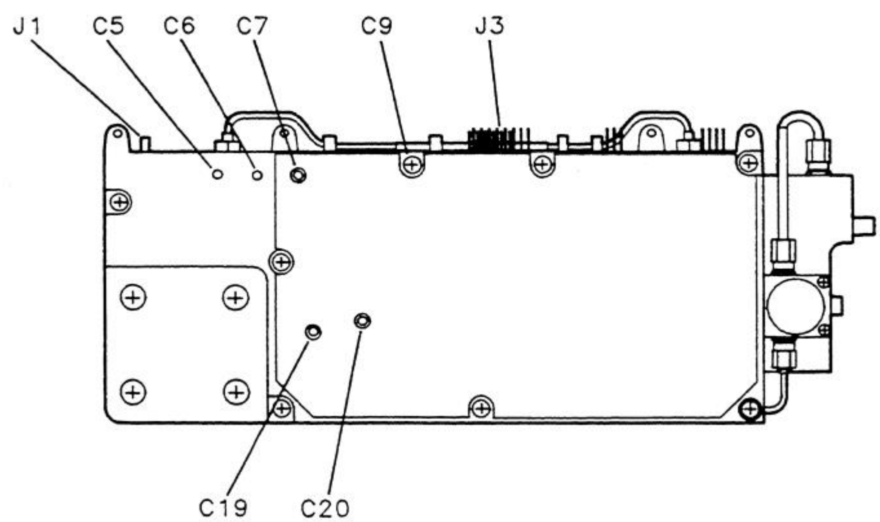



*Figure 4-5. Adjustment Locations on A6A1*

# Adjustment 3. 300 MHz Bandpass Filter Adjustment

## Purpose

The 300 MHz Bandpass Filter on the A4A1 300 MHz Assembly is adjusted with this procedure.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Synthesized Source | HP 8663A |
| Extender Module | HP 70001-60013 |

**Adapters:**

| | |
|---|---|
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Type N (m) to BNC (f) | HP 1250-1476 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) | HP 8120-4921 |
| BNC (m) to SMB (f) | HP 85680-60093 |
| Extender Cable - 7 pin | HP 70900-60061 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - 50 pin | HP 70900-60059 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

## Procedure

### Accessing the Adjustments

The A4A1 assembly's adjustments are located just behind the A2 Video Processor Assembly. Both the A1A1 Host/Processor and A2 Video Processor Assemblies must be removed, and then electrically reconnected to the HP 70900A using extender cables from the HP 70900A LO Service Kit.

1. Set the mainframe line switch to OFF.

**NOTE**

**Older modules contain an A1 Controller assembly instead of a combination A1A1 Host/Processor and A1A2 RAM/ROM assembly. When working on an older module, substitute the words "A1 Controller" for the words "A1A1 Host/Processor" in the following steps.**

2. Remove the A1A1 Host/Processor and A2 Video Processor Assemblies (refer to the Chapter 6 in this manual). The assemblies must be electrically reconnected to the module as illustrated in Figure 4-6.

3. Connect two cables (HP Part Number 70900-60058) from the A10 Mother Board to the two 50-pin connectors, J6 and J7, located on the bottom of the A1A1 Host/Processor Assembly.

4. Connect the 14-pin extender cable (HP Part Number 70900-60065) from A7A2J5, located on the A7A2 FFS Analog Assembly, to A1J5. It is not necessary to connect the 4-wire cable assembly to A1J3.

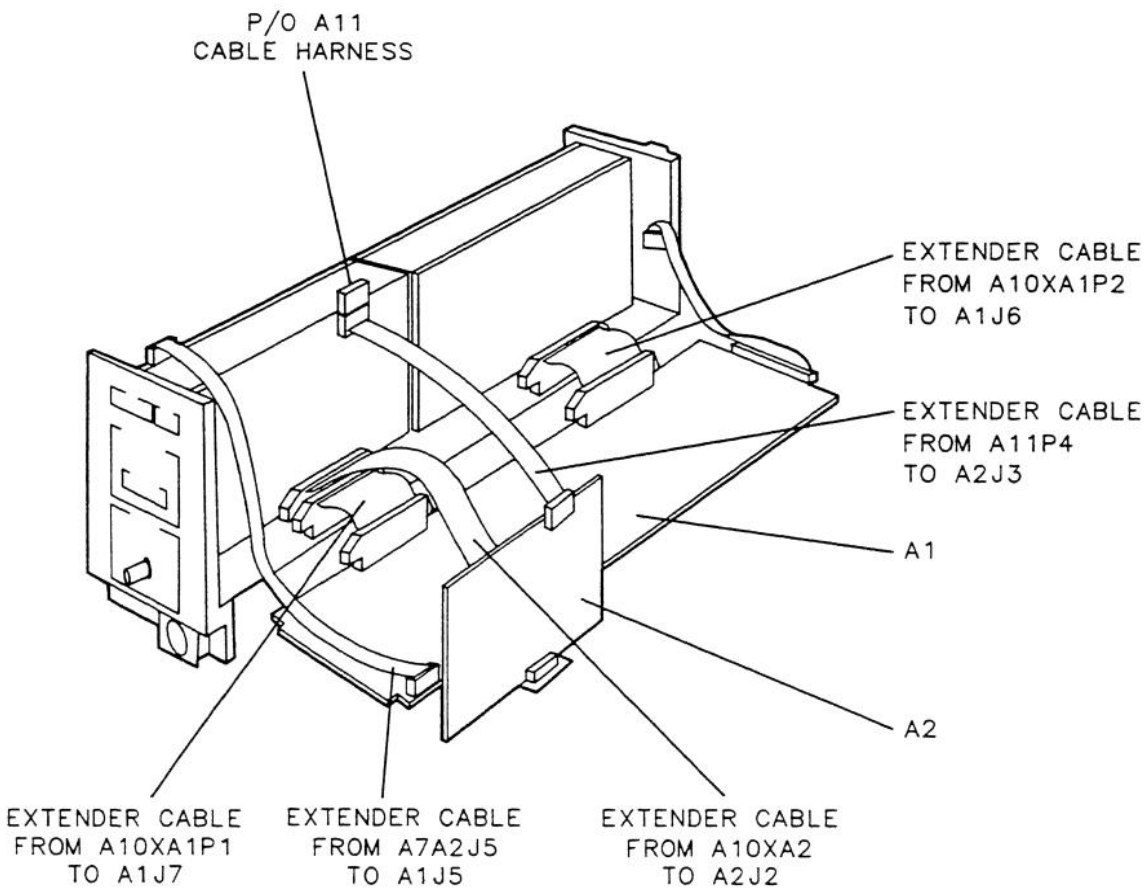



*Figure 4-6. Placing A1A1 and A2 on Extender Cables*

5. Connect the 50-pin extender cable (HP Part Number 70900-60059) from A2J4, located on the bottom of the A2 Video Processor Assembly to the A10 Motherboard. Connect the 7-pin extender cable (HP Part Number 70900-60061) from W21 to A2J3. It is not necessary to connect W6, coax 92, to A2J1.

CAUTION

**The 9-and 10-pin extender cables are not keyed. Use the black wires on these cable assemblies to determine correct cable connection.**

CAUTION

**Before turning the mainframe power on make sure no components of the A1A1 Host/Processor or A2 Video Processor Assemblies come into contact with anything conductive.**

6. Set the mainframe line switch to ON.

## Performing the Procedure

1. Connect the equipment as shown in Figure 4-7. Refer to Figure 4-8 for the location of A4A1J1 and J3.
2. Run the 300 MHz Bandpass Filter Adjustment from the HP 70900A Module Verification Software.
3. Components A4A1C3, C4, C2, and C5 are adjusted for maximum output power as displayed on the spectrum analyzer. The adjustments are made at spectrum analyzer settings of 10 dB/div and 5 dB/div.

NOTE

**Adjustment 20 requires the A1A1 and A2 assemblies be placed on the same extender cables that are used in this test. If adjustment 20 is to be performed, leave A1A1 and A2 on the extender cables during Adjustments 18 and 19.**

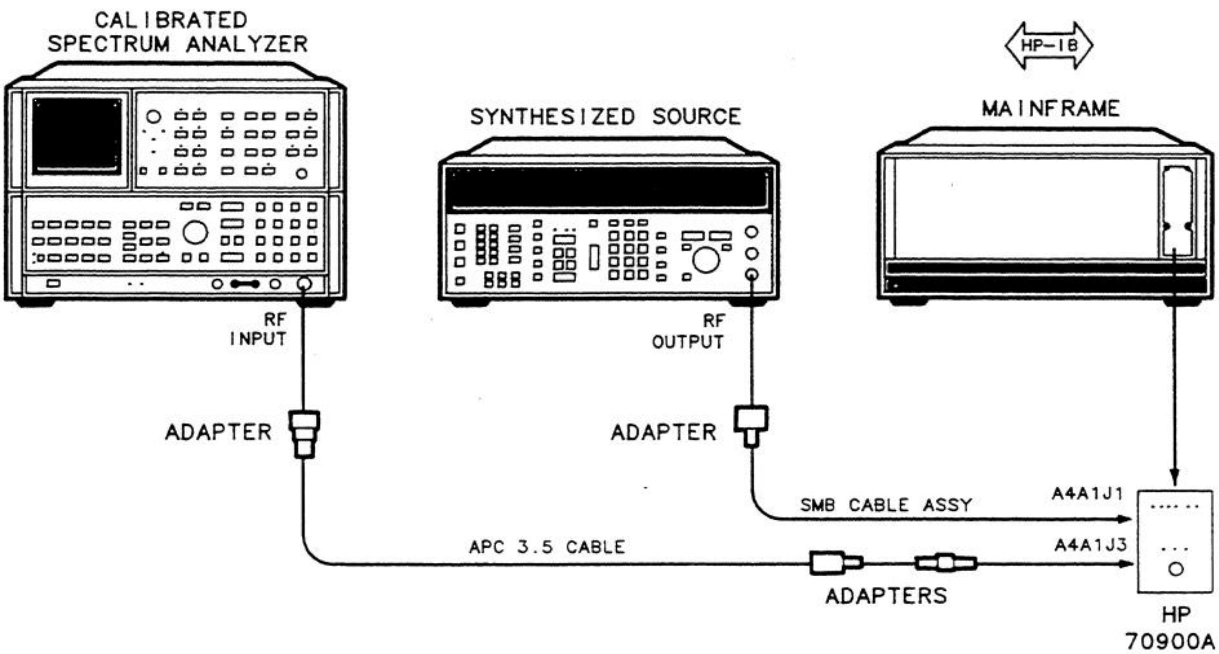



*Figure 4-7. Equipment Setup for Adjustment 3*

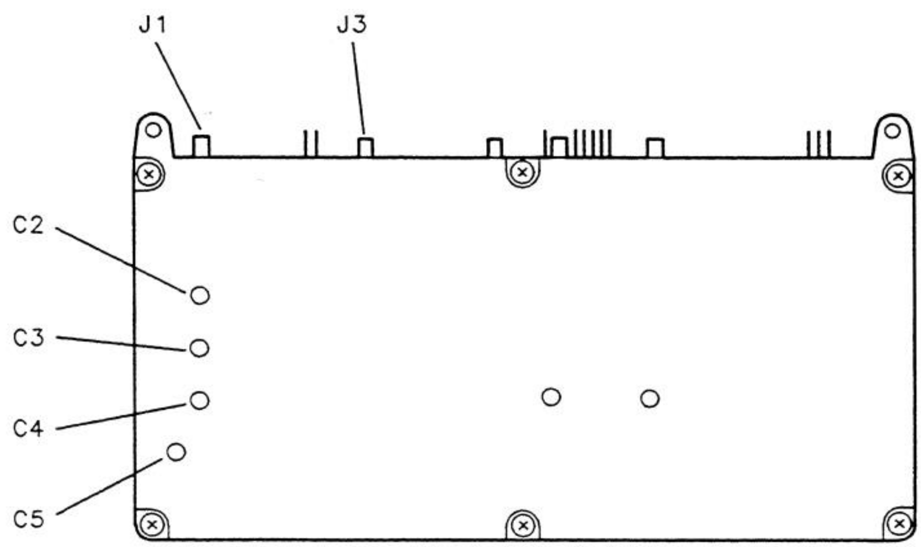



*Figure 4-8. A4A1 Component Locations*

# Adjustment 4. Calibrator Output Frequency Adjustment

## Purpose

The 100 MHz Internal Reference Oscillator's frequency is adjusted in this procedure.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Synthesized Source | HP 8663A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| SMA (f) to BNC (m) | HP 1250-1700 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) | HP 8120-4921 |

## Procedure

1. Place the HP 70900A on a module extender and connect the equipment as illustrated in Figure 4-9. Connect the synthesized source to the spectrum analyzer. DO NOT connect the external reference to the HP 70900A.

2. Run the Calibrator Output Frequency Adjustment from the HP 70900A Module Verification Software. The program calculates the spectrum analyzer's frequency readout error before performing any frequency measurements.

3. After connecting the spectrum analyzer to the HP 70900A's front-panel CALIBRATOR jack, A6A1C9 (REF FREQ ADJ) is adjusted to change the calibrator's frequency. Access the adjustment through the hole in the module's top cover labeled REF FREQ ADJUST. This adjustment is made in five decreasing spectrum-analyzer spans from 100 kHz to 200 Hz.

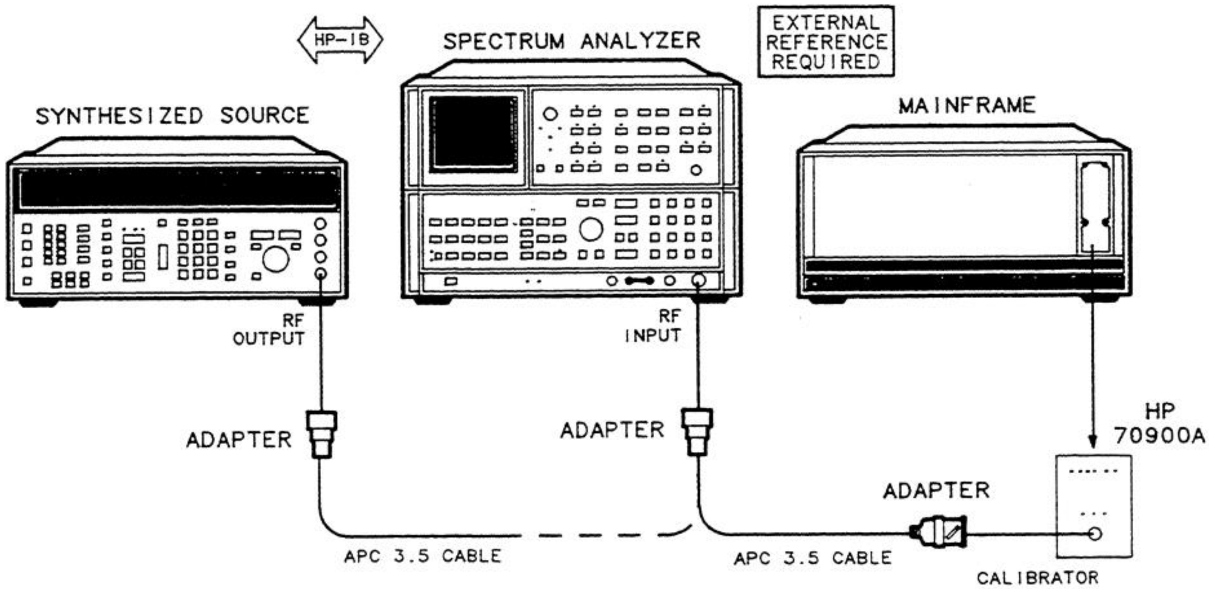



*Figure 4-9. Equipment Setup for Adjustment 4*

# Adjustment 5.
# Calibrator Output Amplitude Adjustment

## Purpose

The output amplitude of the DUT 300 MHz Calibrator signal is adjusted in this procedure.

## Equipment

Power Meter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 436A
Power Sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8485A
Extender Module . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70001-60013

**Adapters:**
APC 3.5 (f) to APC 3.5 (f) . . . . . . . . . . . . . . . . . . . . . . . HP 5061-5311
SMA (m) to BNC (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1200
BNC (m) to BNC (m) . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-0216

## Procedure

1. Place the HP 70900A on a module extender and connect the equipment as illustrated in Figure 4-10.
2. Run the Calibrator Output Amplitude Adjustment from the HP 70900A Module Verification Program.
3. Component A4A1R84 (CAL LEVEL ADJ) is adjusted to change the calibrator's amplitude. Access the adjustment through the hole in the module's top cover labeled CAL LEVEL ADJ.

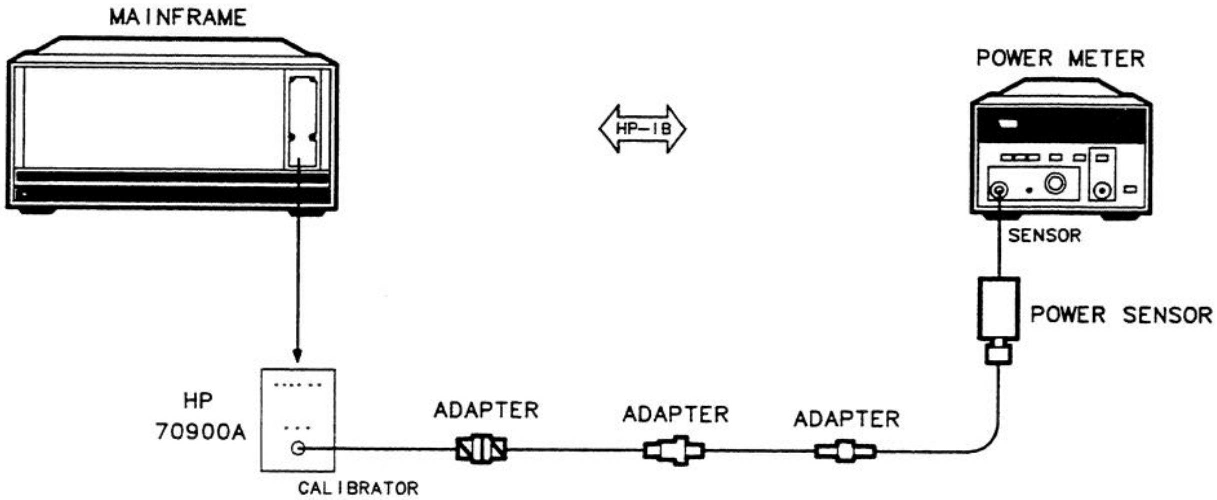



*Figure 4-10. Equipment Setup for Adjustment 5*

# Adjustment 6.
# 300 MHz Reference Output Amplitude Adjustment

## Purpose

The two 300 MHz Reference Output Signals of the HP 70900A LO Module are adjusted for output power in this procedure.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| **Cables:** | |
| APC 3.5 (m) (m) | HP 8120-4921 |
| Extender Cable - 7 pin | HP 70900-60061 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - 50 pin | HP 70900-60059 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

## Procedure

### Accessing the Adjustments

The A4A1 assembly's adjustments are located just behind the A2 Video Processor Assembly. Both the A1A1 Host/Processor and A2 Video Processor Assemblies must be removed, and then electrically reconnected to the HP 70900A using extender cables from the HP 70900A LO Service Kit.

Refer to Accessing the Adjustments in Adjustment 3 for instructions on placing these assemblies on extender cables.

## Performing the Adjustment

1. Place the HP 70900A on an extender module, and connect the equipment as illustrated in Figure 4-11.
2. Run the 300 MHz Output Amplitude Adjustment from the HP 70900A Module Verification Software.
3. The output circuit is peaked for maximum output signal at 300 MHz. A4A1C41 tunes the 300 MHz 1 output circuit and A4A1C36 tunes the 300 MHz 2 output circuit.
4. The power out of each of the two rear-panel 300 MHz jacks is set to 0 dBm ±0.1 dB. A4A1R53 adjusts the power out of the 300 MHz 1 jack. A4A1R40 adjusts the power out of the 300 MHz 2 jack. See Figure 4-12.

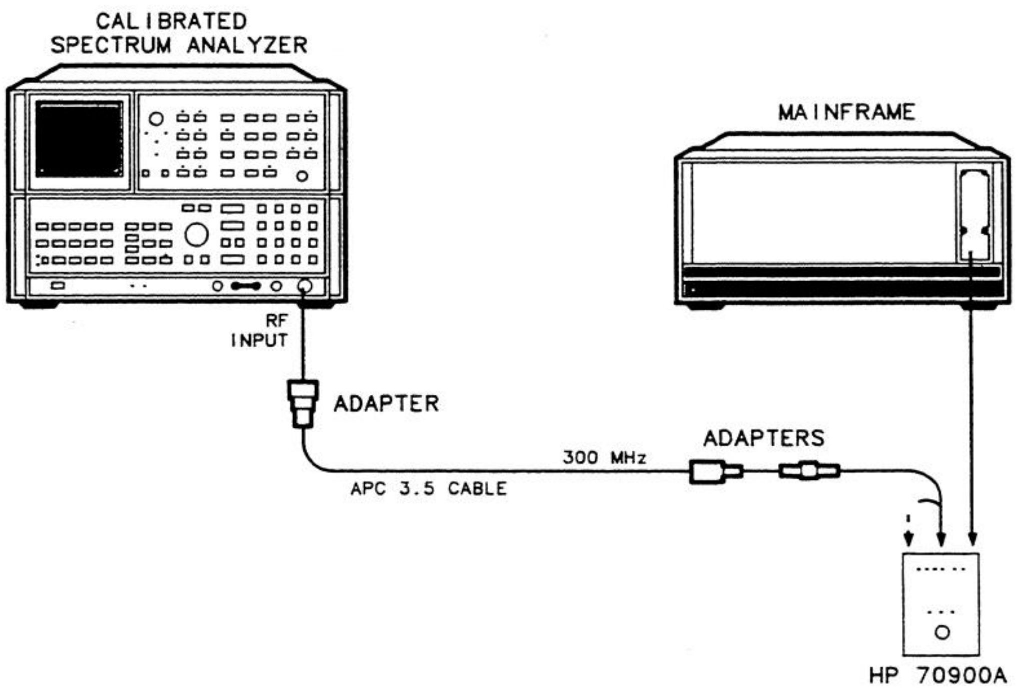



*Figure 4-11. Equipment Setup for Adjustment 6*

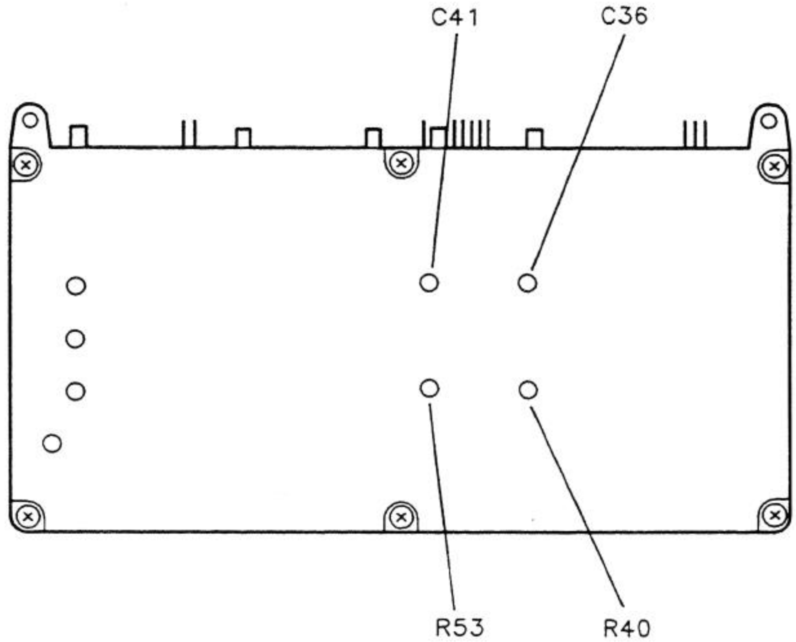



*Figure 4-12. Location of A4A1C36, C41, R40, and R53*

# Fractional Frequency Synthesizer Adjustments

## Reference

A7A1 FFS VCO Board Assembly

A7A2 FFS Analog Board Assembly

## Description

The FFS (Fractional Frequency Synthesizer) consists of the six adjustments procedures listed below. If just the A7A1 assembly is replaced or repaired, perform only adjustments 8, 9, and 14. If the A7A2 assembly is replaced or repaired, perform all the adjustments.

7. FFS VCO Adjustment
8. FFS Tune/Comp Coarse Adjustment
9. FFS Reference Null Adjustment
10. FFS API 1 Adjustment
11. FFS API 2 Adjustment
12. FFS API 3 Adjustment
13. FFS Tune/Comp Fine Tune Adjustment
14. FFS Spurious Responses Adjustment

**NOTE**

**Adjustment 9 cannot be performed on A7A2 assemblies with HP Part Number 70900-60012. This version of the assembly does not have the component adjusted in the procedure. Refer to Adjustment 9, Reference Null Adjustment, for information on determining the vintage of your A7A2 FFS Analog Board Assembly.**

# Adjustment 7. FFS VCO Adjustment

## Purpose

This procedure adjusts the tuning range of the FFS VCO (voltage-controlled oscillator).

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| Type N (m) to BNC (f) | HP 1250-1476 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| BNC (m) (m) | HP 10503A |
| BNC (m) to SMB (f) | HP 85680-60093 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure required access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

**NOTE**

**Older modules contain an A1 Controller assembly instead of a combination A1A1 Host/Processor and A1A2 RAM/ROM assembly. When working on an older module, substitute the words "A1 Controller" for the words "A1A1 Host/Processor" in the following steps.**

1. Set the mainframe line switch to OFF.

2. Place the HP 70900A on its side, and remove the three screws securing the A7A1/A7A2 FFS Assembly to the chassis frame. Without removing any cables from the FFS assembly, rotate the FFS assembly forward and up so that the single adjustment hole in the A7A1 FFS Assembly Cover may be accessed. See Figure 4-13.

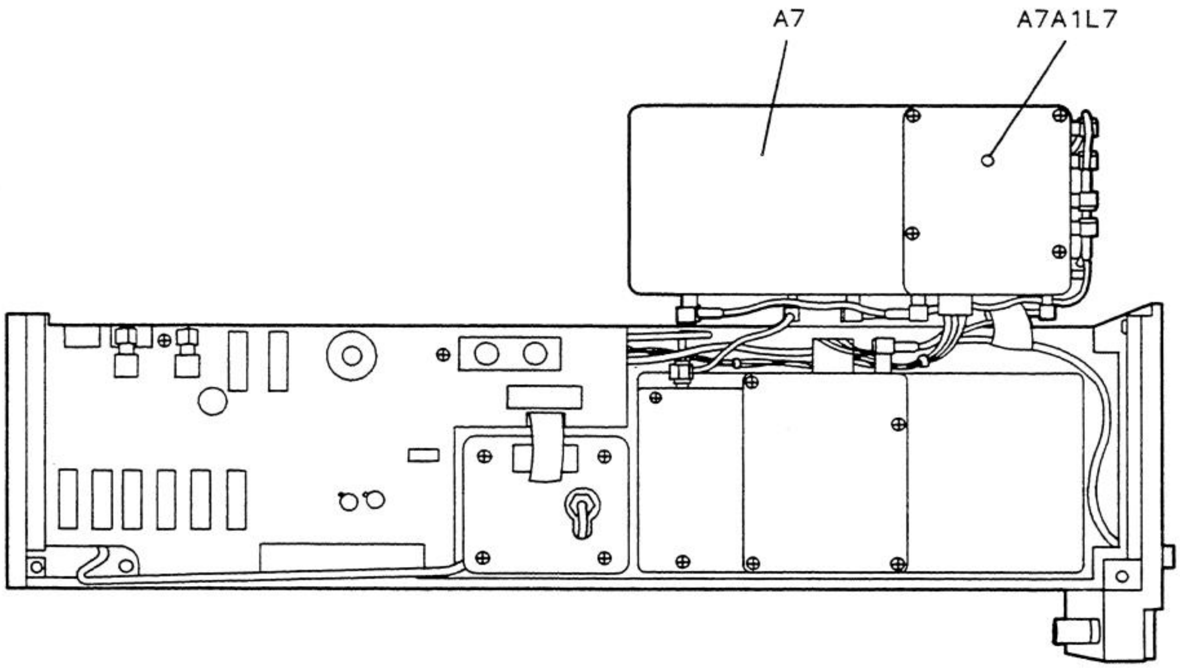



*Figure 4-13. Preparing A7A1 for Adjusting*

3. Remove the A1A1 Host/Processor and A1A2 RAM/ROM assemblies. Do not remove the A1A2 assembly from the A1A1 assembly. (Refer to the A1 Controller Assembly Replacement Procedure.) Cables from the HP 70900A LO Service Kit will be used to electrically connect these assemblies to the module. See Figure 4-14.

4. Connect the 50-pin Back-Plane Interconnect cable to J4 on the A1A1 Host/Processor Assembly.

5. Connect the two controller board extender cables (HP Part Number 70900-60058), from the A10 Motherboard to the two 50-pin connectors, J6 and J7, located on the bottom of the A1A1 Host/Processor Assembly.

6. Connect the 14-pin extender cable (HP Part Number 70900-60065) from A7A2J5 on the A7A2 FFS Analog Assembly to J5 located on the A1A1 Host/Processor Assembly.

**NOTE**

**It is not necessary to connect the 4-wire cable assembly to J3 located on the A1A1 Host/Processor Assembly.**

7. Lay the A1A1 Host/Processor Assembly flat. The side with the components should face up.

CAUTION

**Before turning the mainframe power on, ensure that no components of the A1A1 Host/Processor Assembly come into contact with anything conductive.**

8. Set the mainframe line switch to ON.

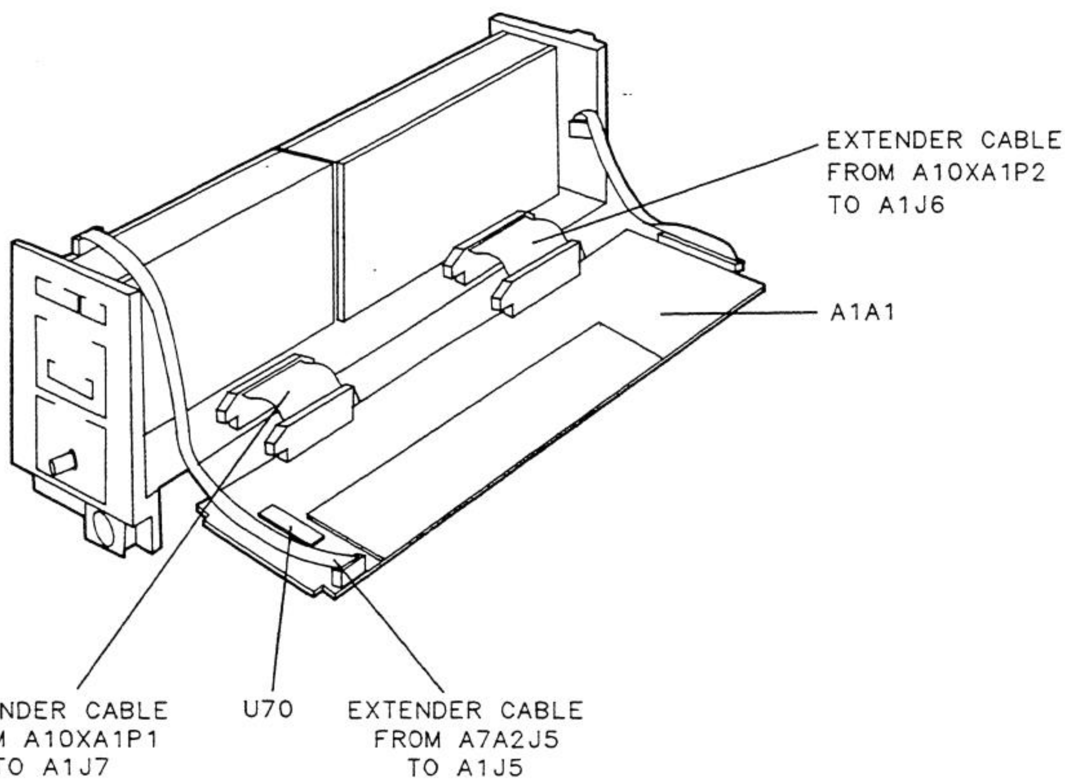



*Figure 4-14. Placing A1A1 on Extender Cables*

## Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-15. Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 for the location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*

2. Remove W1 cable assembly from A7A1 (refer to the Major Assembly and Component Locations Chapter for the location of W1). Connect an SMB cable from the spectrum analyzer's RF INPUT to A7A1J1.

3. Run the FFS VCO Adjustment from the HP 70900A Module Verification Program.

4. The DVM monitors the FFS phase-lock loop unlock signal to detect unlock conditions. The spectrum analyzer monitors the FFS VCO output.

5. The program confirms an FFS VCO output at 52 MHz is greater than 10 dBm. The FFS VCO then tunes to 32 MHz. If the phase-lock loop is locked, the technician is prompted to adjust A7A1L7 VCO until the loop unlocks. Once the loop unlocks, the A7A1L7 is adjusted until the loop just achieves lock condition. The minimum FFS frequency is now defined.

6. The program tunes the FFS VCO to 73 MHz. The frequency is varied until the loop unlocks. This point is the maximum FFS frequency. The minimum FFS frequency must be less than 31.5 MHz and the maximum FFS frequency must be greater than 73 MHz.

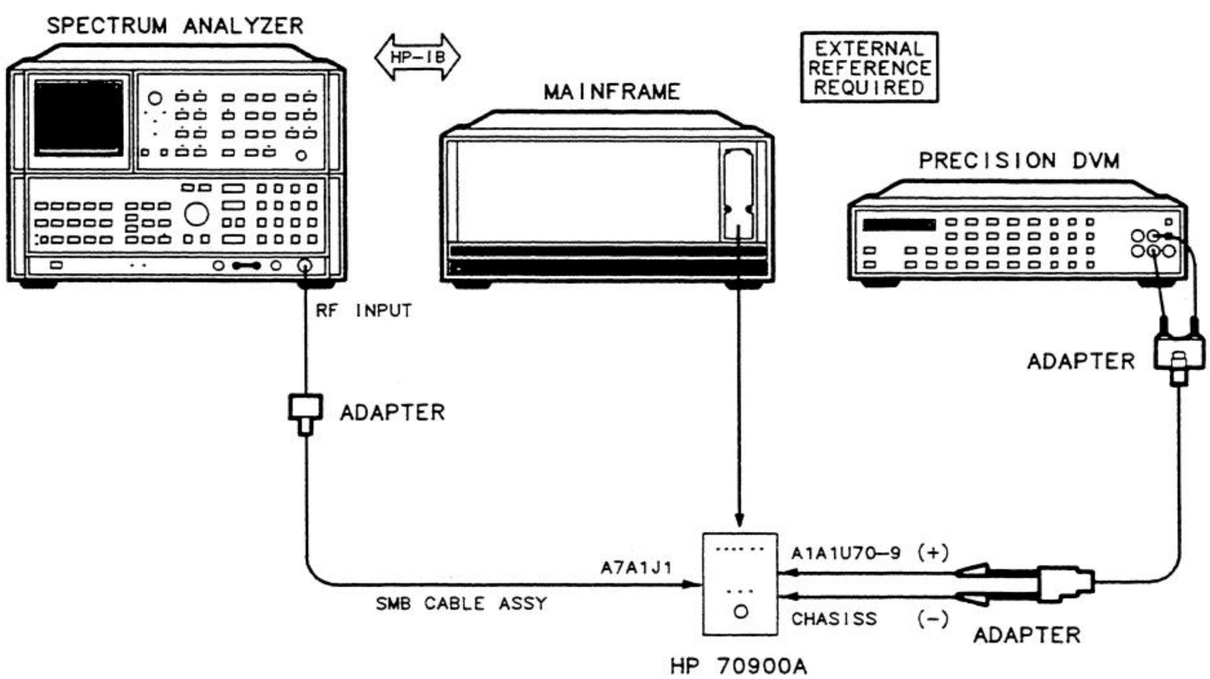



*Figure 4-15. Equipment Setup for Adjustment 7*

# Adjustment 8.
# FFS Tune/Comp Coarse Adjustment

## Purpose

This test sets up the API (analog phase interpolator) DACs on the A7A2 FFS Analog Board Assembly. This must be done before further adjustments on the A7A2 assembly can be performed. The FFS Tune/Comp Fine Adjustment test must be performed after all the other A7A2 adjustments have been completed.

## Equipment

Precision DVM . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A
Extender Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70001-60013

**Adapters:**
Alligator Clips to BNC (f) . . . . . . . . . . . . . . . . . . . . . . HP 1250-1292
Banana Plug to BNC (f) . . . . . . . . . . . . . . . . . . . . . . . HP 1251-2277

**Cables:**
BNC (m) (m) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 10503A

## Procedure

1. Remove the HP 70900A's cover and place the module on an extender cable. Remove the A7A2 assembly's cover.
2. A voltmeter is used to measure voltage potentials on A7A2U36 as illustrated in Figure 4-16. To provide access for the voltmeter probes, a modified IC clip must be placed on U36. To modify the IC clip, cut off the two end pins of a standard 16 pin IC clip (HP Part Number 1400-0734) making it a 14 pin clip. Trim the clip's plastic body exposing about 3 mm of each pin.
3. Connect the voltmeter's positive lead to A7A2U38 pin 4 and its negative lead to A7A2U38 pin 11. See Figure 4-17.
4. Run the FFS Tune/Comp Coarse Adjustment from the HP 70900A Module Verification Program.
5. The program tunes the FFS phase-lock loop to 35 MHz. This places the API DACs to a known state. The precision DVM measures the voltage across A7A2R22, Tune/Comp potentiometer. Potentiometer A7A2R22 Tune/Comp is adjusted for 0V $\pm 10\ \mu$V.

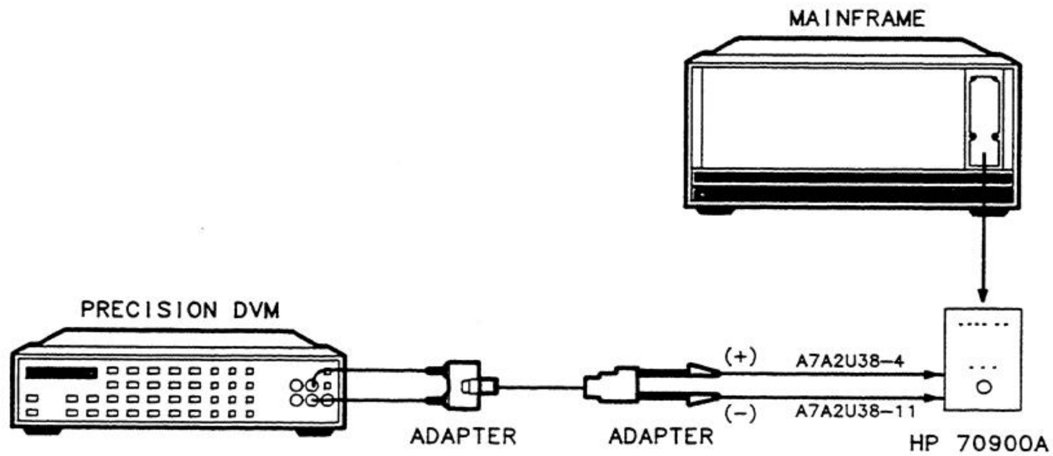



*Figure 4-16. Equipment Setup for Adjustment 8*

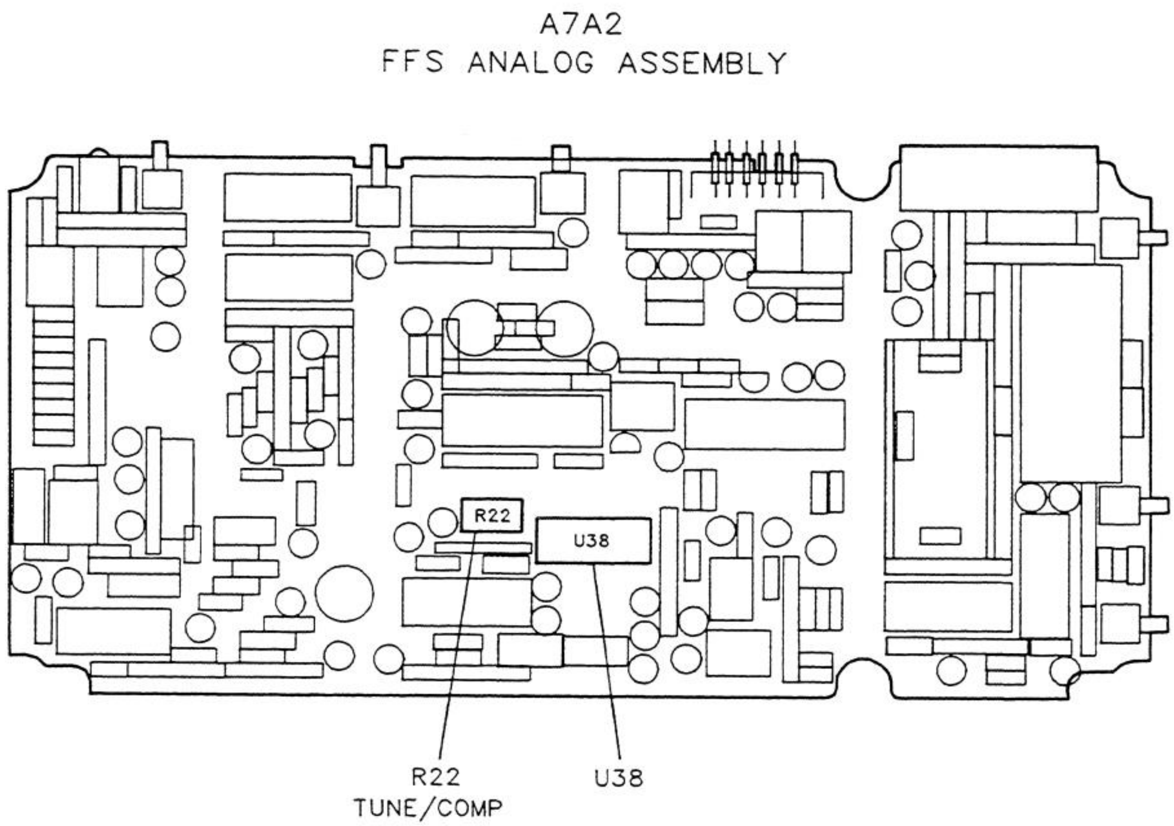



*Figure 4-17. Location of A7A2U38 and A7A2R22*

# Adjustment 9.
# FFS Reference Null Adjustment

## Purpose

This adjustment nulls the 125/124.844 kHz FFS Reference signal feedthrough that appears as a sideband on the FFS VCO OUT signal.

**NOTE**

**If the A7A2 assembly is version 70900-60012, the adjustment cannot be made. This board version does not have adjustment component C36.**

**To identify if the A7A2 assembly is adjustable, remove the A7A2 cover and look for variable capacitor A7A2C36. See Figure 4-19. If C36 is on the board, the adjustment can be performed.**

## Equipment

Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
Extender Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70001-60013
External Reference . . . . . . . . . Refer to "External Frequency Reference" in Chapter 3

**Adapters:**
Type N (m) to BNC (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 1250-1476

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093

## Procedure

1. Remove the HP 70900A's cover and place the module on an extender cable. Connect the equipment as illustrated in Figure 4-18. Connect the spectrum analyzer to A7A1J1, which is usually connected to cable assembly W1. Refer to the Major Assembly and Component Locations section of this manual for the location of A7A1J1.

2. Remove the cover from the A7A2 FFS VCO Analog Board Assembly.

3. Run the FFS Reference Null Adjustment from the HP 70900A Module Verification Program.

4. The program tunes the modules's FFS phase-lock loop to 35 MHz and the loop's reference input to 125 kHz. The spectrum analyzer searches for the 125 kHz sideband on the FFS output. A7A2C36 is adjusted to minimize the sideband. See Figure 4-19.

5. After the adjustment, the program tests the 125 kHz sidebands at eleven FFS frequencies between 35 and 70 MHz. Each sideband must be greater than 80 dBc.

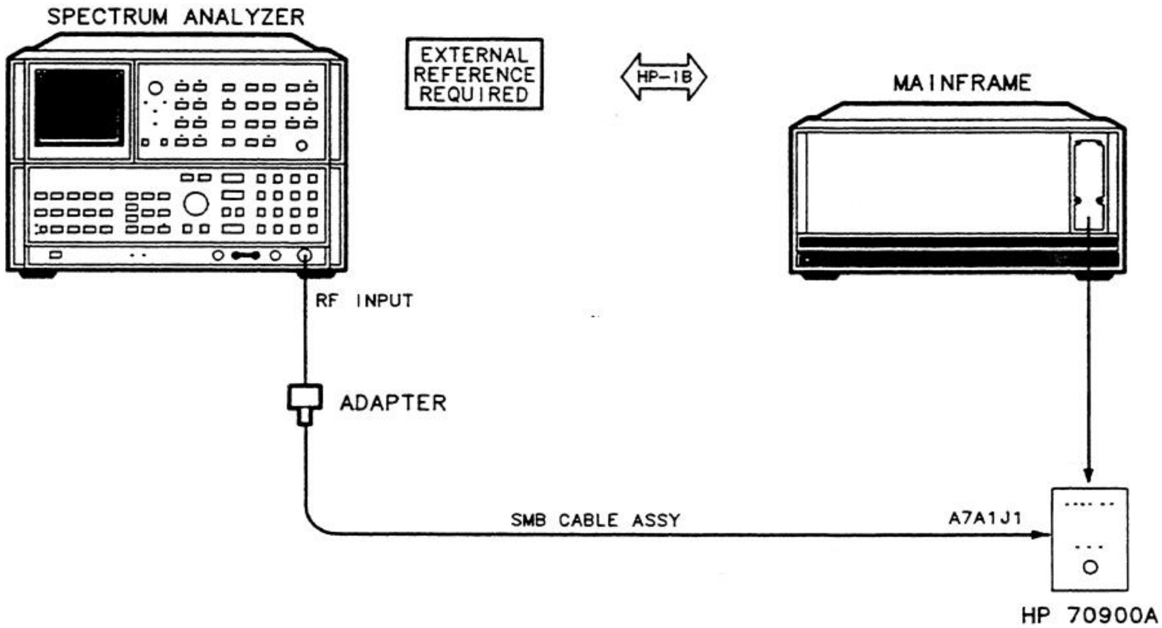



*Figure 4-18. Equipment Setup for Adjustment 9*

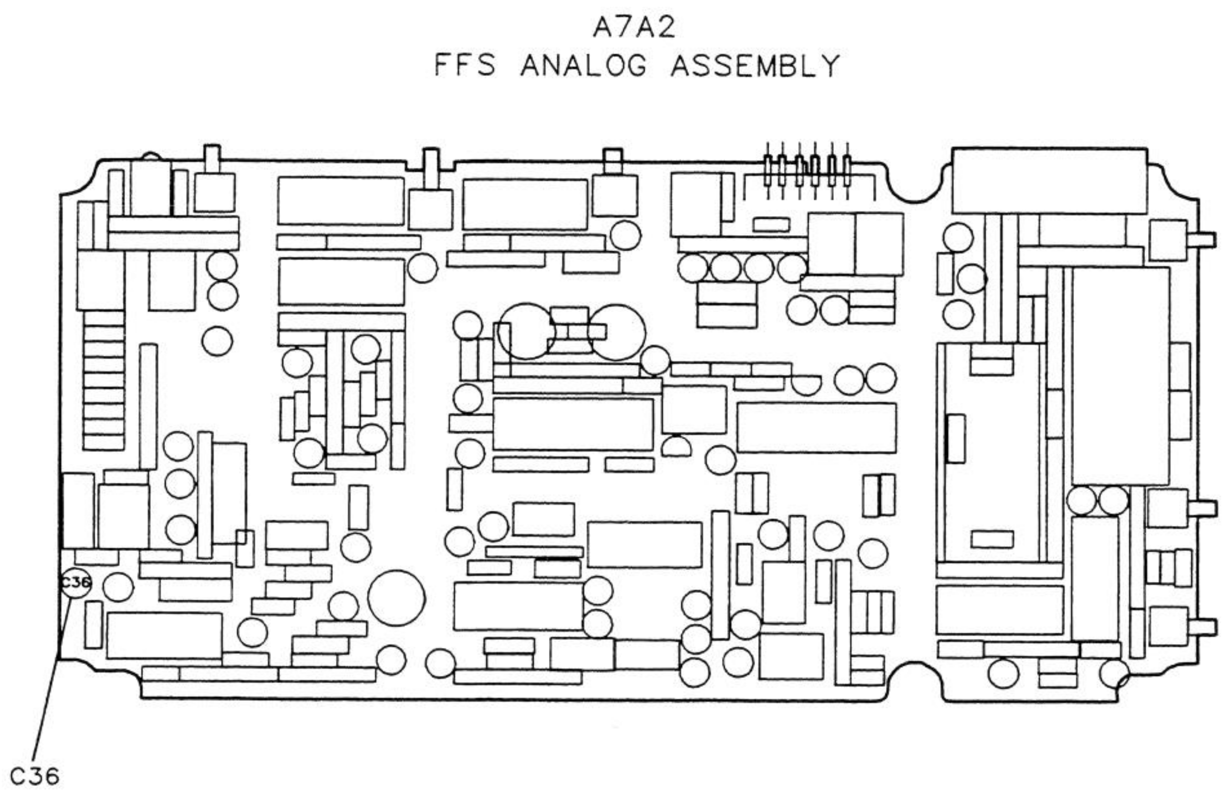



*Figure 4-19. Location of A7A2C36*

# Adjustment 10.
# FFS API 1 Adjustment

## Purpose

There are three API (analog phase interpolator) DACs on the A7A2 FFS Analog assembly; API 1, API 2, and API 3. The adjustment of the current source for these DACs affects spurious responses on the FFS phase-lock loop. This procedure adjusts the current source while measuring a spur affected by the API 1 DAC. The current source is adjusted for API 2 and 3 by FFS API 2 and FFS API 3 Adjustment procedures.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| Type N (m) to BNC (f) | HP 1250-1476 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| BNC (m) (m) | HP 10503A |
| BNC (m) to SMB (f) | HP 85680-60093 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure requires access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

**NOTE**

**Older modules contain an A1 Controller assembly instead of a combination A1A1 Host/Processor and A1A2 RAM/ROM assembly. When working on an older module, substitute the words "A1 Controller" for the words "A1A1 Host/Processor" in the following steps.**

1. Set the mainframe line switch to OFF.
2. Remove the A1A1 Host/Processor and A1A2 RAM/ROM assemblies. Do not remove the A1A2 assembly from the A1A1 assembly. (Refer to the A1A1 Host/Processor Assembly replacement procedure in Chapter 6.) Cables from the HP 70900A LO Service Kit will be used to electrically connect these assemblies to the module. See Figure 4-14 located in Adjustment 7.
3. Connect the 50-pin Back-Plane Interconnect cable to J4 on the A1A1 Host/Processor Assembly.
4. Connect the two controller board extender cables (HP Part Number 70900-60058), from the A10 Motherboard to the two 50-pin connectors, J6 and J7, located on the bottom of the A1A1 Host/Processor Assembly.
5. Connect the 14-pin extender cable (HP Part Number 70900-60065) from A7A2J5 on the A7A2 FFS Analog Assembly to J5 located on the A1A1 Host/Processor Assembly.

**NOTE**

**It is not necessary to connect the 4-wire cable assembly to J3 located on the A1A1 Host/Processor Assembly.**

6. Lay the A1A1 Host/Processor Assembly flat. The side with the components should face up.

**CAUTION**

**Before turning the mainframe power on, ensure that no components of the A1A1 Host/Processor Assembly come into contact with anything conductive.**

7. Set the mainframe line switch to ON.

## Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-20. Connect the spectrum analyzer to A7A1J1 (refer to Chapter 8 for the location of A7A1J1). Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 for the location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*
2. Run the FFS API 1 Adjustment from the HP 70900A Module Verification Program. The spectrum analyzer monitors the FFS VCO frequency as the precision DVM monitors the FFS lock/unlock indicator signal.
3. The program tunes the FFS phase-lock loop to 72.126250 MHz and measures a known spurious response at 72.125 MHz. If the spur is greater than 82 dBc, potentiometer A7A2R23 is adjusted to null the spur. See Figure 4-21 for the location of A7A2R23. The figure also shows the locations of components adjusted in the API 2 and API 3 Adjustment Procedures. If the spur is within test limits, no adjustment is necessary.

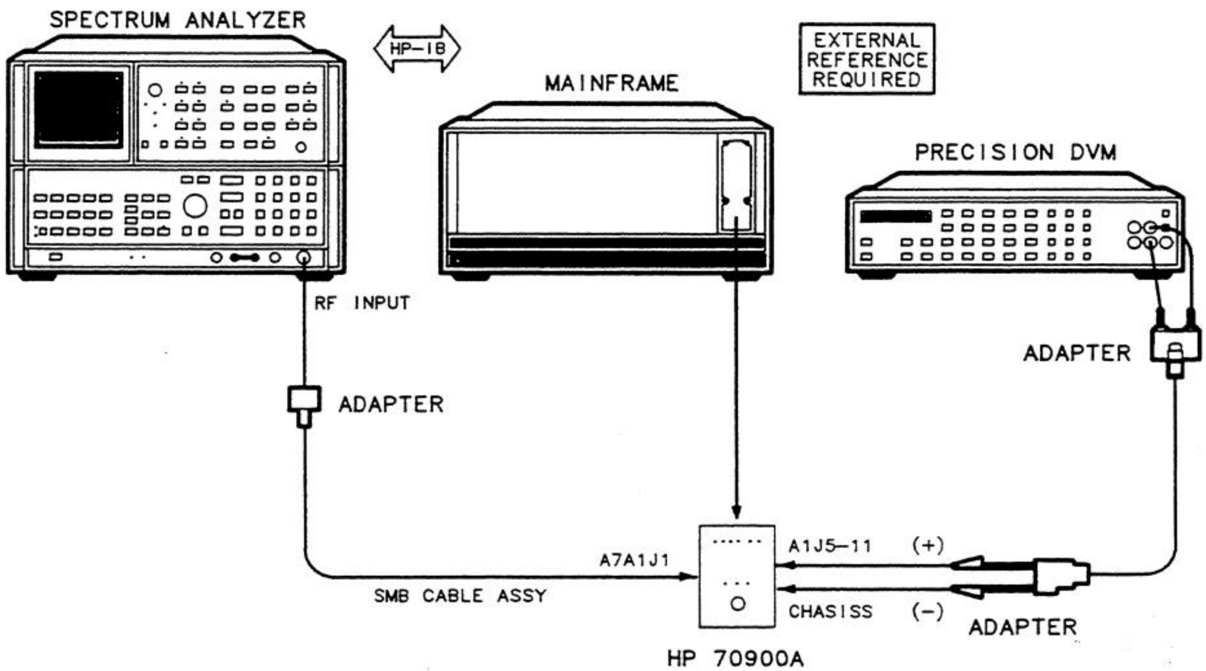



*Figure 4-20. Equipment Setup for Adjustment 10*

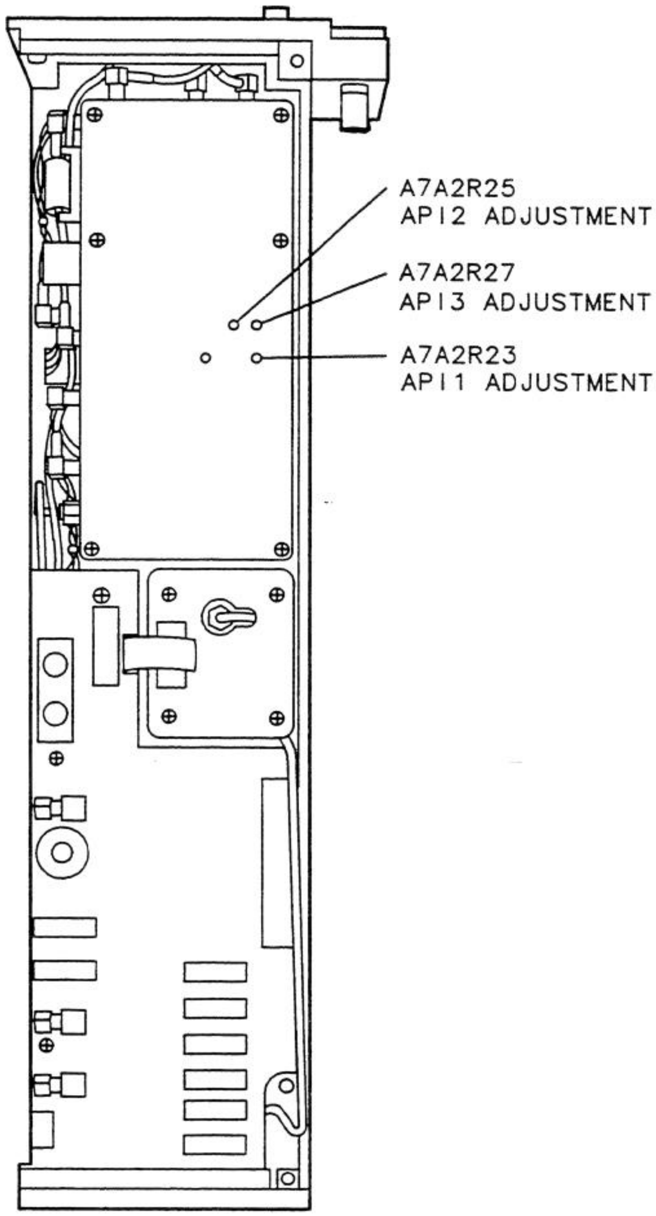



*Figure 4-21. Location of FFS API Adjustments*

# Adjustment 11. FFS API 2 Adjustment

## Purpose

There are three API (analog phase interpolator) DACs on the A7A2 FFS Analog assembly; API 1, API 2, and API 3. The adjustment of the current source for these DACs affects spurious responses on the FFS phase-lock loop. This procedure adjusts the current source while measuring a spur affected by the API 2 DAC. The current source is adjusted for API 2 and 3 by FFS API 2 and FFS API 3 Adjustment procedures.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |
| **Adapters:** | |
| Type N (m) to BNC (f) | HP 1250-1476 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| BNC (m) (m) | HP 10503A |
| BNC (m) to SMB (f) | HP 85680-60093 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure requires access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

Perform the steps in "Accessing the Adjustments" in Adjustment 10.

### Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-20 of Adjustment 10. Connect the spectrum analyzer to A7A1J1 (refer to Chapter 8 for the location of A7A1J1). Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 in Adjustment 7 for the

location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*

2. Run the FFS API 2 Adjustment from the HP 70900A Module Verification Program. The spectrum analyzer monitors the FFS VCO frequency as the precision DVM monitors the FFS lock/unlock indicator signal.

3. The program tunes the FFS phase-lock loop to 72.125125 MHz and measures a known spurious response at 70.123875 MHz. If the spur is greater than 82 dBc, potentiometer A7A2R25 is adjusted to null the spur. See Figure 4-21 in Adjustment 10. If the spur is within test limits, no adjustment is necessary.

# Adjustment 12.
# FFS API 3 Adjustment

## Purpose

There are three API (analog phase interpolator) DACs on the A7A2 FFS Analog assembly; API 1, API 2, and API 3. The adjustment of the current source for these DACs affects spurious responses on the FFS phase-lock loop. This procedure adjusts the current source while measuring a spur affected by the API 3 DAC. The current source is adjusted for API 1 and 2 by FFS API 1 and FFS API 2 Adjustment procedures.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| Type N (m) to BNC (f) | HP 1250-1476 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| BNC (m) (m) | HP 10503A |
| BNC (m) to SMB (f) | HP 85680-60093 |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure requires access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

Perform the steps in "Accessing the Adjustments" in Adjustment 10.

### Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-20 of Adjustment 10. Connect the spectrum analyzer to A7A1J1 (refer to Chapter 8 for the location of A7A1J1). Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 in Adjustment 7 for the

location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*

2. Run the FFS API 3 Adjustment from the HP 70900A Module Verification Program. The spectrum analyzer monitors the FFS VCO frequency as the precision DVM monitors the FFS lock/unlock indicator signal.

**NOTE**

**The DVMs positive lead must be touching A1J5 pin 11 during testing.**

3. The program tunes the FFS phase-lock loop to 70.1250125 MHz measures a known spurious response at 70.12376 MHz. If the spur is greater than 82 dBc, potentiometer A7A2R27 is adjusted to null the spur. See Figure 4-21 in Adjustment 7. If the spur is within test limits, no adjustment is necessary.

# Adjustment 13.
# FFS Tune/Comp Fine Adjustment

## Purpose

The FFS API DAC Tune/Comp potentiometer is adjusted for minimum spurious response from the fractional frequency synthesizer.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| APC 3.5 (m) (m) | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure requires access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

Perform the steps in "Accessing the Adjustments" in Adjustment 10.

### Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-22. Connect the spectrum analyzer to A7A1J1 (refer to Chapter 8 for the location of A7A1J1). Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 in Adjustment 7 for the location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*

2. Run the FFS Tune/Comp Fine Adjustment from the HP 70900A Module Verification Program. The spectrum analyzer monitors the FFS VCO frequency as the precision DVM monitors the FFS lock/unlock indicator signal.

3. The spectrum analyzer looks for known spurs that exist 1.25 kHz below FFS phase-lock loop frequencies of 35.126250 and 52.626250 MHz. If the spur level is greater than 85 dBc, A7A2R22 is adjusted for minimum spur level at each FFS frequency. This adjustment is an iterative process between the two FFS frequencies

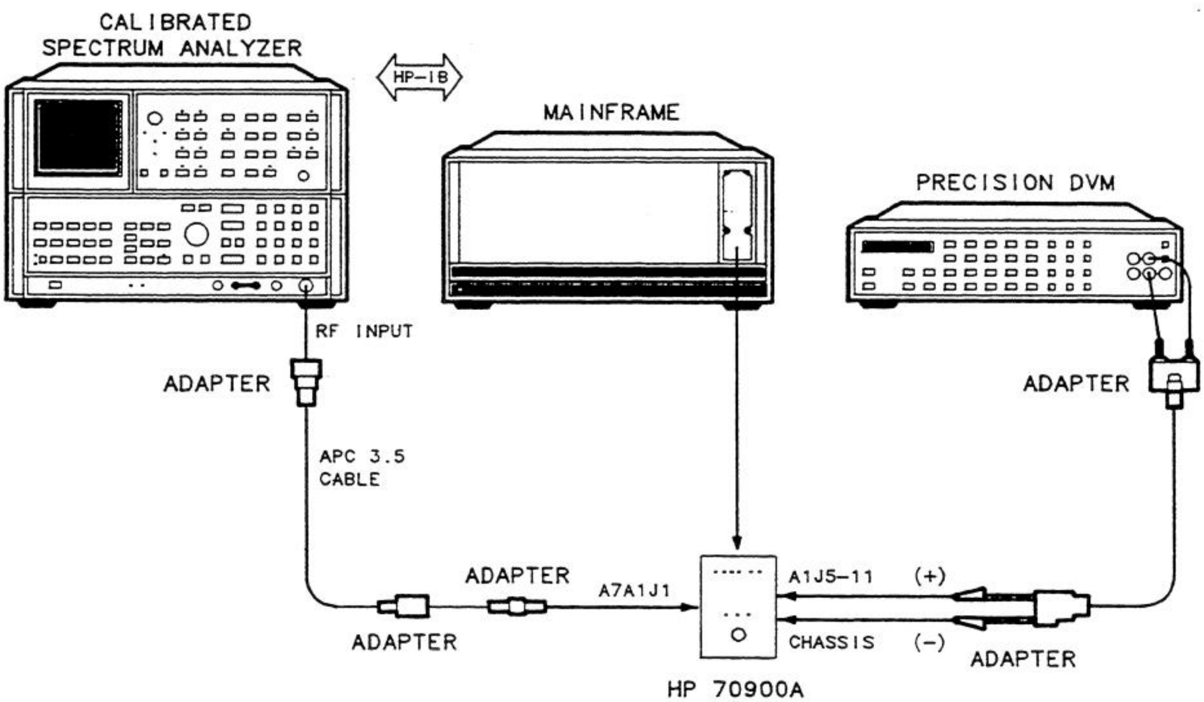



*Figure 4-22. Equipment Setup for Adjustment 13*

# Adjustment 14.
# FFS Spurious Responses Adjustment

## Purpose

This procedure verifies that the FFS Tune/Comp and FFS API Adjustments are correct; no adjustments are done. This test should be run after all other FFS-related adjustments are completed.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| APC 3.5 (m) (m) | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |
| Extender Cable - 14 pin | HP 70900-60065 |
| Extender Cable - A1A1 Host/Processor | HP 70900-60058 |

### Accessing the Adjustments

This procedure requires access to an IC on the A1A1 Host/Processor Assembly. The assembly must be removed, then electrically reconnected to the LO module using extender cables from the HP 70900A LO Service Kit.

Perform the steps in "Accessing the Adjustments" in Adjustment 10.

### Performing the Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-23. Connect the spectrum analyzer to A7A1J1 (refer to Chapter 8 for the location of A7A1J1). Connect the DVM's positive lead to A1A1U70 pin 9. Use the LO Service Kit's mini-grabber clip to connect the DVM's lead to the IC's pin. See Figure 4-14 in Adjustment 7 for the location of U70. Connect the DVM's negative lead to chassis ground. *On older modules having an A1 Controller Assembly, connect the DVM's positive lead to A1U24 pin 9.*

2. Run the FFS Spurious Responses Adjustment from the HP 70900A Module Verification Program. The spectrum analyzer monitors the FFS VCO frequency as the precision DVM monitors the FFS lock/unlock indicator signal.

3. The LO module tunes FFS loop to 18 frequencies from 35 to 70 MHz. At each frequency settings, the spectrum analyzer looks at frequencies where known spurious responses exist. The spectrum analyzer measures the spurious responses in 0 Hz span, 10 Hz resolution bandwidth. The spurious response must be 75 dBc.

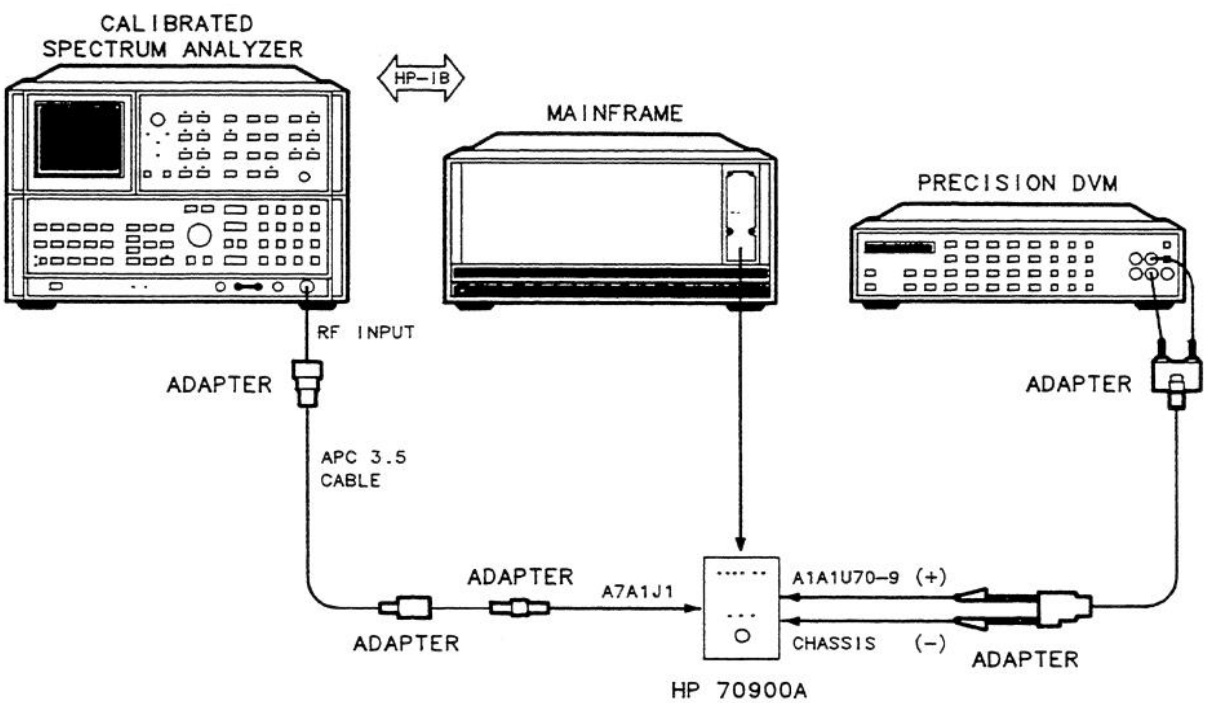



*Figure 4-23. Equipment Setup for Adjustment 14*

# Idler Assembly Adjustment

## Reference

A4A2 Idler Lock Board Assembly

## Description

The Idler phase-lock loop produces the following two signals: 3.6 GHz and 5.4 GHz. The Low Idler Adjustments sets the overall and-relative power levels of these two signals.

15. Low Idler Adjustment

# Adjustment 15.
# Low Idler Adjustment

## Purpose

The power level of the low idler frequency (3.6 GHz) relative to the power level of the high idler frequency (5.4 GHz) is adjusted in this procedure. (The low idler frequency is 3.6 GHz minus the FFS frequency. The high idler frequency is 5.4 GHz minus the FFS frequency.)

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Synthesized Source | HP 8663A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to BNC (f) | HP 1250-1476 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |

**Cables:**

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

### Accessing the Adjustments

The A7 assembly must be removed from the module to access the low idler adjustments. Complete the following steps to remove the assembly:

**NOTE**

**The adjustment on modules serial prefixed 2842A and above can be accessed through a hole in the A4 assembly casting. (These modules contain A4A2 assembly version HP 70900-60108.) The A7 assembly does not need to be removed and steps 1 through 6 of "Accessing the Adjustments" do not need to be performed.**

1. Set the mainframe line switch to OFF.

2. Remove the HP 70900A from the mainframe and place it on an extender module. Remove the module's cover.

3. Remove the three screws that secure the A7 assembly to the bottom of the LO module. Refer to A7 FFS Phase Lock Loop in Chapter 6 for the location of these screws.

4. Without disconnecting any cables, rotate the A7 FFS Assembly up and set it on top of the LO module. Place an insulating material between the A7 assembly and the module. See Figure 4-24.

5. Remove the A4A2 YTO Lock Assembly cover by removing the four screws that secure the cover to the YTO Lock Assembly.

6. Set the mainframe line switch to ON.

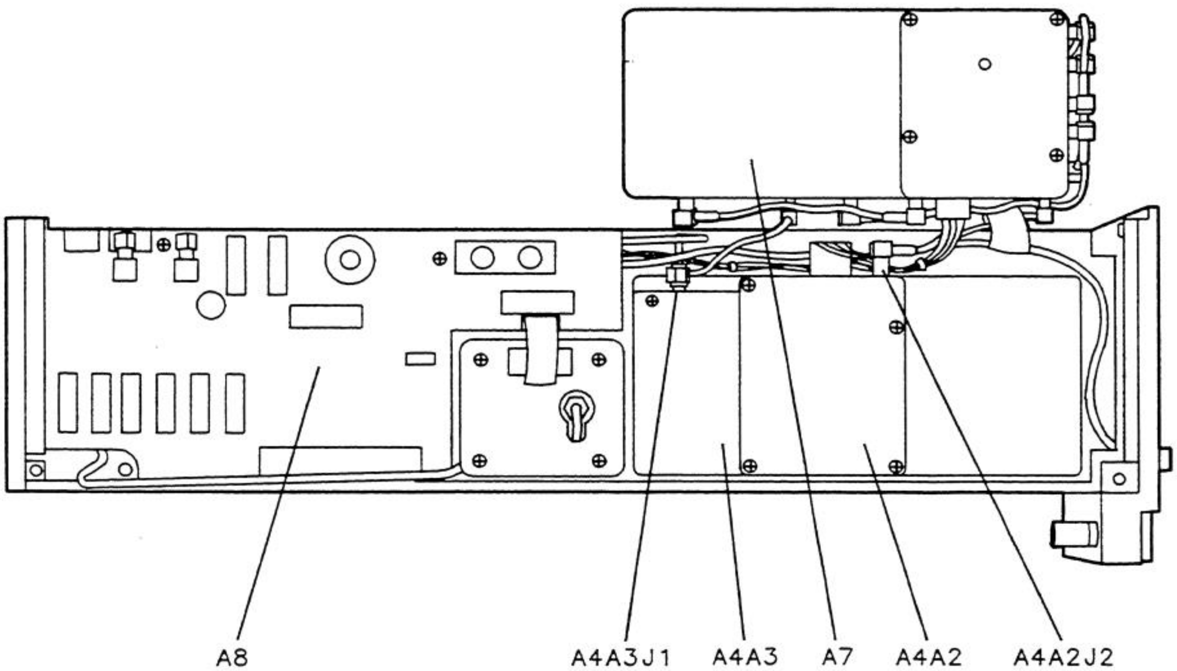



*Figure 4-24. Accessing the Low Idler Adjustments*

## Performing the Procedure

1. Connect the equipment as illustrated in Figure 4-25. See Figure 4-24 for the location of A4A2J2 and A4A3J1.

2. Run the Low Idler Adjustment from the HP 70900A Module Verification Software.

3. The program uses the spectrum analyzer to measure both the high and low idler output power levels. Component A4A2R16 is adjusted to set the low-idler power level 4 dB lower than the high-idler power level. See Figure 4-26. (On A4A2 assemblies with HP Part Number 70900-60014, a potentiometer is loosely soldered in the place of R16. The potentiometer's reference designation is R100.)

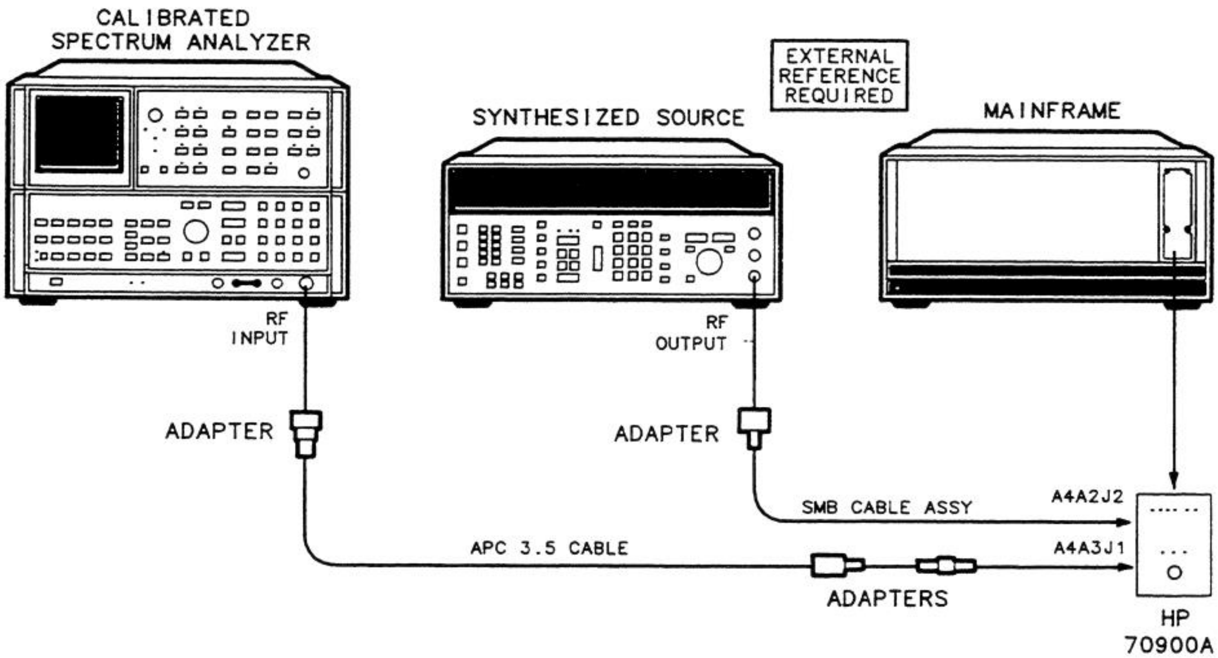



*Figure 4-25. Equipment Setup for Adjustment 15*

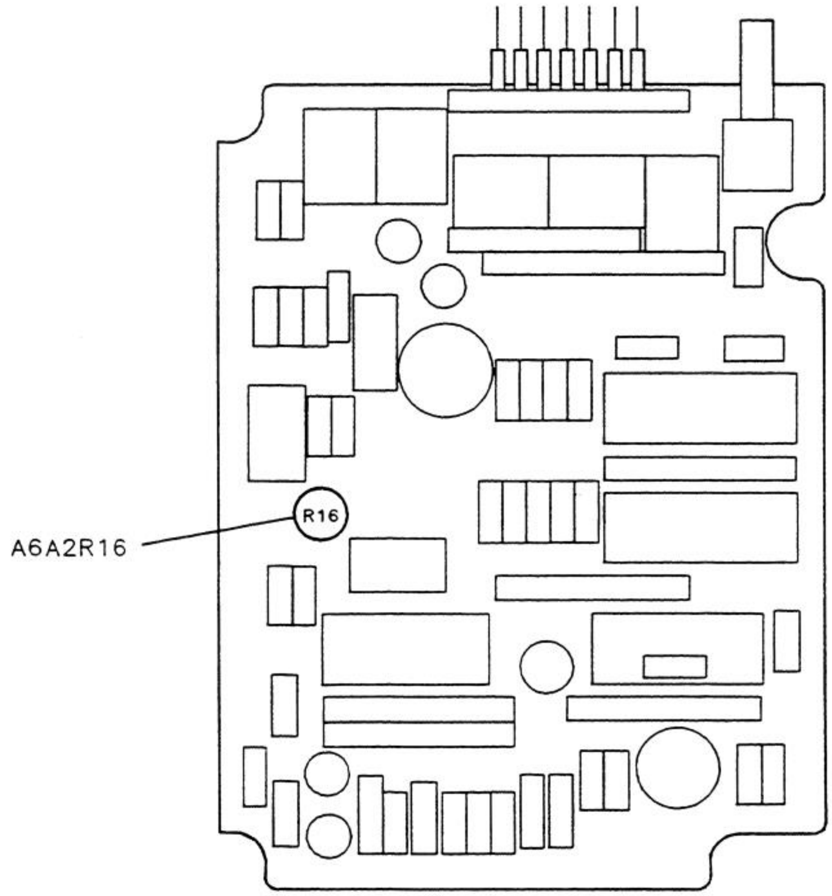



*Figure 4-26. Location of A4A2R16*

# Frequency Control Adjustments

## Reference

A8 Frequency Control Board Assembly

## Description

This adjustment consists of six semi-automated adjustments that are performed using the HP 70900A Module Verification Software. The adjustments must be run in the following order:

16. Sweep Offset Adjustment
17. Frequency Control Voltage Reference Adjustment
18. YTO Frequency Endpoints Adjustment
19. FM Gain Adjustment
20. Sweep Overshoot Adjustment
21. Tune Span Offset Adjustment

# Adjustment 16. Sweep Offset Adjustment

## Purpose

This adjustment nulls the A8U13 Amplifier offset current in the sweep-ramp integrator circuit.

## Equipment

| | |
|---|---|
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| BNC (m) (m) | HP 10503A |

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-27. Connect the DVM ground lead to A8TP4-1 and the positive lead to A8TP2-1. Place a jumper wire across A8R30. See Figure 4-28.

CAUTION

**When shorting out R30, be careful not to ground the case of U29. Grounding U29's case destroys the device.**

NOTE

**Some of the assemblies test points are grouped on a common connector (e.g. A8TP4). On these common connectors, test point one is always orientated towards the top or the front of the module.**

2. Run the Sweep Offset Adjustment from the HP 70900A Module Verification Program.

3. The adjustment program runs as follows: The integrator, which is used to smooth out the staircase sweep-ramp that is generated by the sweep DAC, has its input junction grounded by the jumper wire across A8R30. A 1000-second sweep is initiated in the local oscillator. After a 10-second pause, the user is prompted to adjust A8R108. The DVM measures the integrator output once each second. The difference between readings is calculated, then output graphically. This adjustment minimizes the difference between DVM readings, nulls the offset current, and thereby minimizes integrator drift.

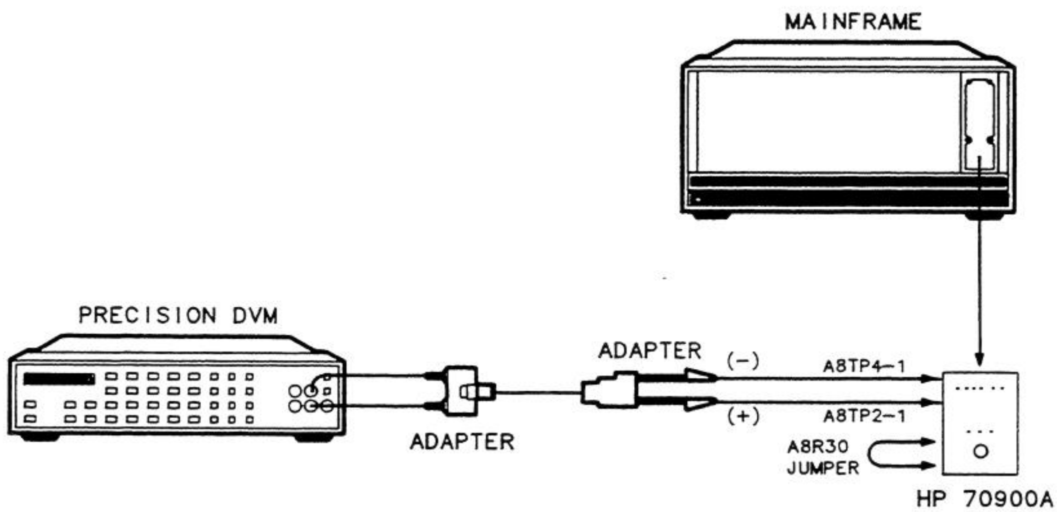



*Figure 4-27. Equipment Setup for Adjustment 16*

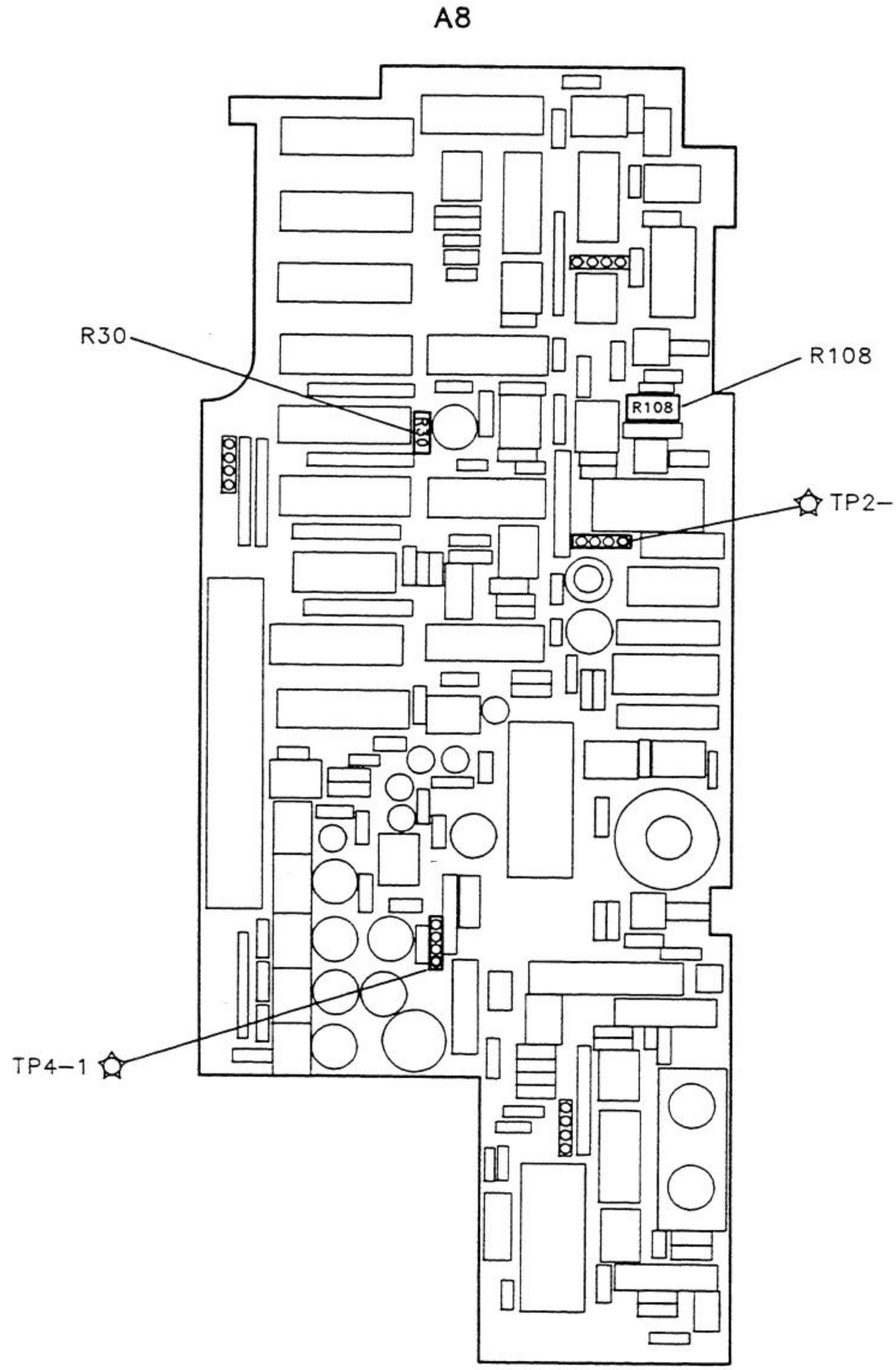



*Figure 4-28. Component Locations for Adjustment 16*

# Adjustment 17.
# Frequency Control Voltage References Adjustment

## Purpose

Voltage references on the A8 Frequency Control Assembly are adjusted to a 100 $\mu$V accuracy.

## Equipment

| | |
|---|---|
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| BNC (m) (m) | HP 10503A |

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-29. Connect the DVM positive lead to A8TP1-2 and the negative lead to the grounded side of A8C2. See Figure 4-30.

**NOTE**

**Some of the assemblies test points are grouped on a common connector (e.g. A8TP1). On these common connectors, test point one is always orientated towards the top or the front of the module.**

2. Run the Frequency Control Voltage Reference Adjustment from the HP 70900A Module Verification Program.

3. The DVM is connected to the span circuitry output. The program varies the tune DAC to ensure that the tune circuitry is isolated from the span circuitry.

4. The program prompts the technician to adjust A8R100 FINE TUNE GAIN. This adjusts the positive voltage reference. The DVM monitors the span circuitry output for a reading of -10.2375V ±0.0001V.

5. After the positive voltage reference is set, the negative voltage reference is adjusted. The technician is prompted to connect the DVM positive lead to A8TP1-3, the tune circuitry output. A8R101 SPAN GAIN is adjusted for a DVM reading of -10.2350V ±0.001V.

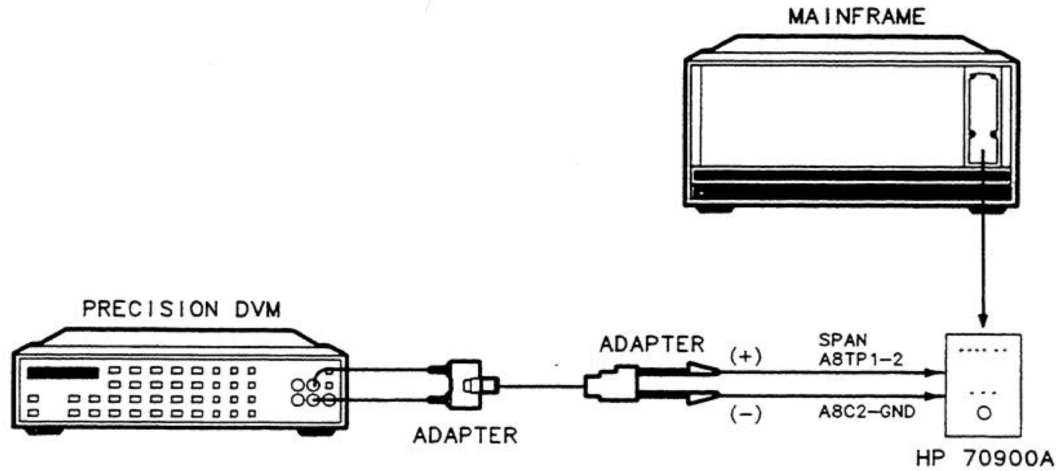



*Figure 4-29. Equipment Setup for Adjustment 17*

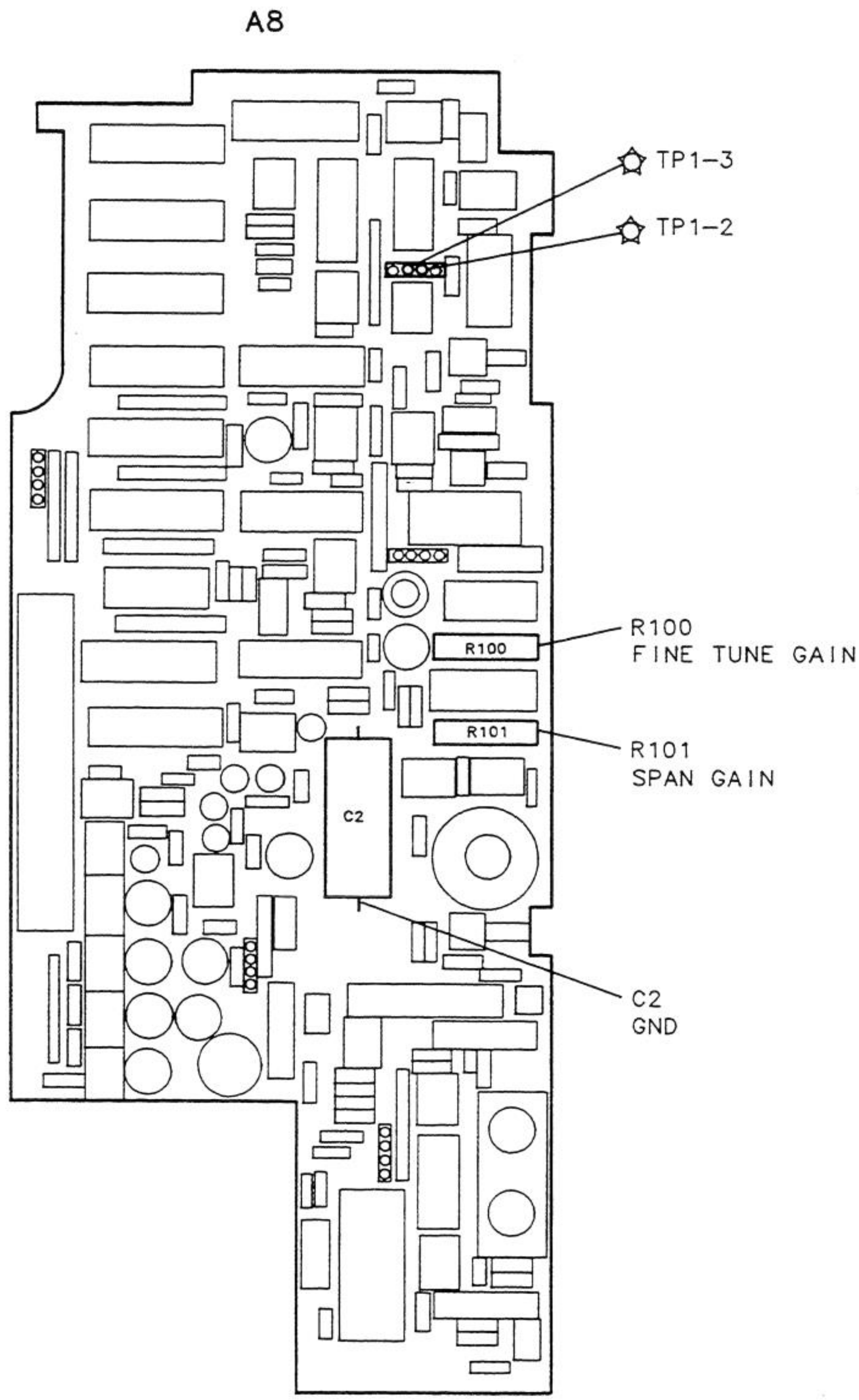



*Figure 4-30. Component Locations for Adjustment 17*

# Adjustment 18.
# YTO Frequency Endpoints Adjustment

## Purpose

The fixed current sources are adjusted to set the 3.0 and 6.6 GHz YTO bias points.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) | HP 8120-4921 |

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-31.
2. Run the YTO Frequency Endpoints Adjustment from the HP 70900A Module Verification Program.

**NOTE**

**During this test, the technician is instructed to position jumpers on connectors J9 and J10. These connectors each have six pins which allow three jumper positions. The jumpers should be placed between two vertically adjacent pins as illustrated in Figure 4-32. See Figure 4-33 for the location of the connectors on the assembly. Jumpers can be ordered by HP part number 1258-0225.**

3. The program prompts the user to remove the 3 GHz COARSE SEL and 6 GHz COARSE SEL jumpers. Potentiometers A8R104 3.0 GHz FINE and A8R107 6.0 GHz CALIB are then centered in their range.

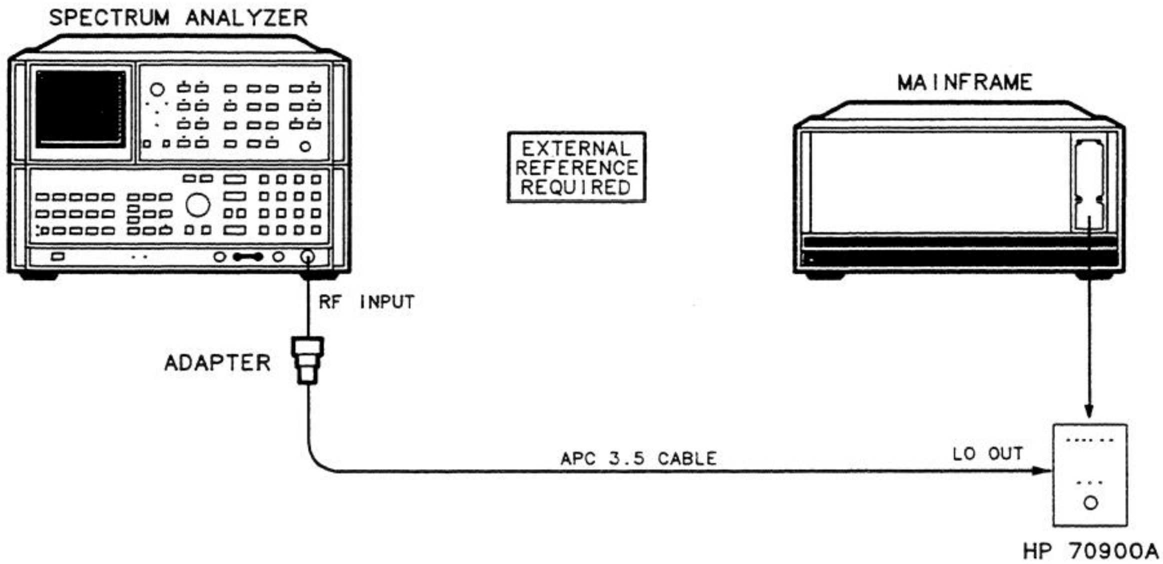



*Figure 4-31. Equipment Setup for Adjustment 18*

4. The program sets the HP 70900A's frequency control DACs for a 3.0 GHz LO output signal and opens the YTO lock loop. The spectrum analyzer tunes to the 3.0 GHz LO output signal. The computer display instructs the technician to center the signal on the spectrum analyzer by positioning the coarse-tune jumper on A8J9. Place the jumper in the position that best centers the signal. (The best centering may be accomplished with the jumper removed.)

5. The program tunes the HP 70900A LO and the spectrum analyzer to 6.6 GHz. Center the signal on the spectrum analyzer display by positioning the coarse-tune jumper A8J10. (The best centering may be accomplished with the jumper removed.)

6. A YTO frequency endpoints adjustment is made to set the local oscillator's tuning range to 3.6 GHz. A8R107 6.0 GHz CALIB is adjusted to set the 6.6 GHz endpoint frequency 3.6 GHz higher than the 3.0 endpoint frequency.

7. The YTO frequency endpoints are centered using A8R104 3.0 GHz FINE. Fine-tuning is done at successive spectrum analyzer spans of 1.0 GHz, 50 MHz, and 10 MHz. The program may iterate between steps 6 and 7 until proper adjustment is reached.

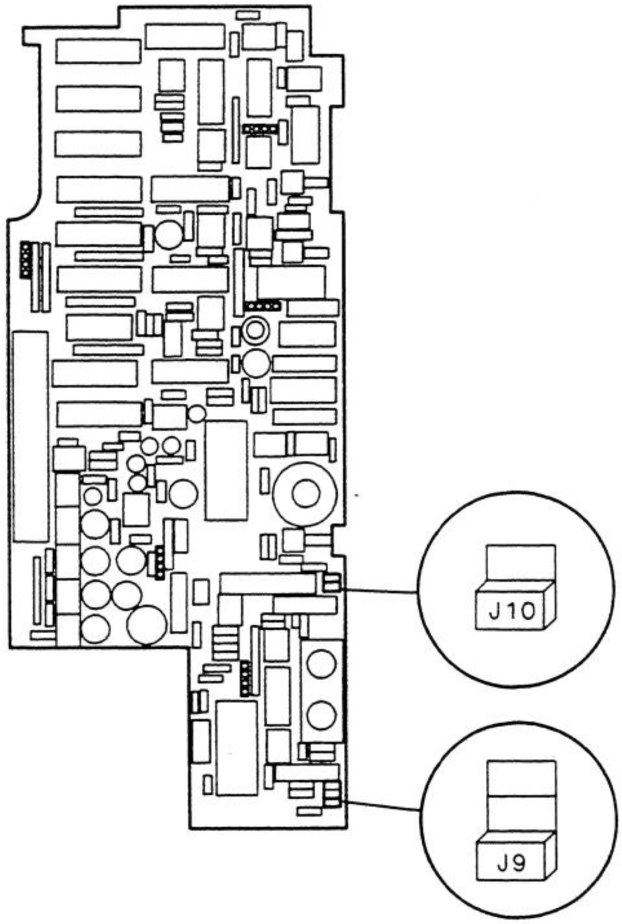



*Figure 4-32. J9 and J10 Jumper Positions*

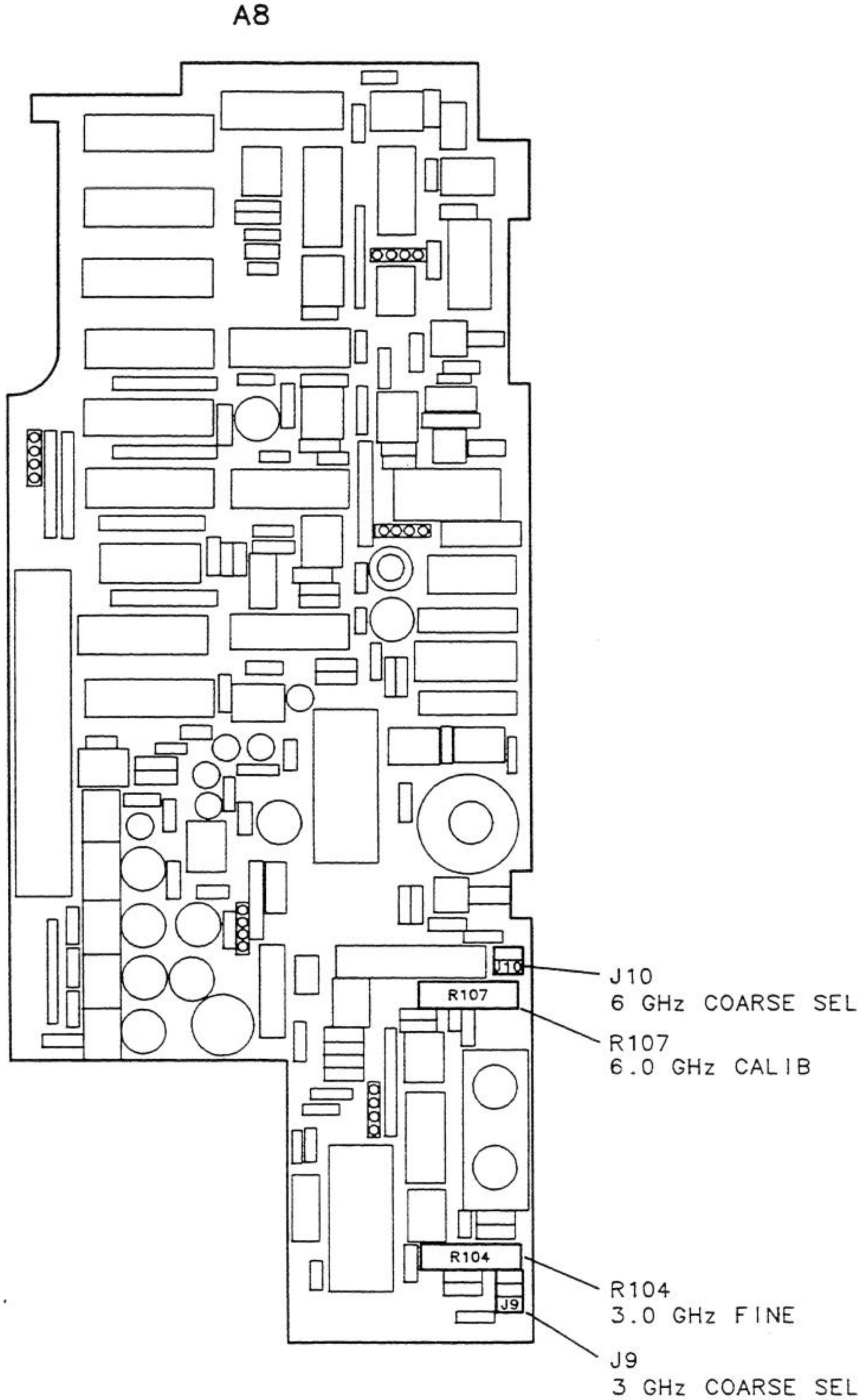



*Figure 4-33. Component Locations for Adjustment 18*

# Adjustment 19.
# FM Gain Adjustment

## Purpose

This adjustment sets the range of the YTO FM coil driver.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) | HP 8120-4921 |

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-34.
2. Run the FM Gain Adjustment from the HP 70900A Module Verification Program.
3. The program sets the HP 70900A's start frequency correction DAC to switch the YTO between its maximum and minimum frequency deviations. The program prompts the technician to adjust A8R102 for a YTO output frequency deviation of less than 100 kHz. The adjustment is made in three successive spectrum analyzer spans, 200 MHz, 20 MHz, and 1 MHz. See Figure 4-35 for the location of A8R102.

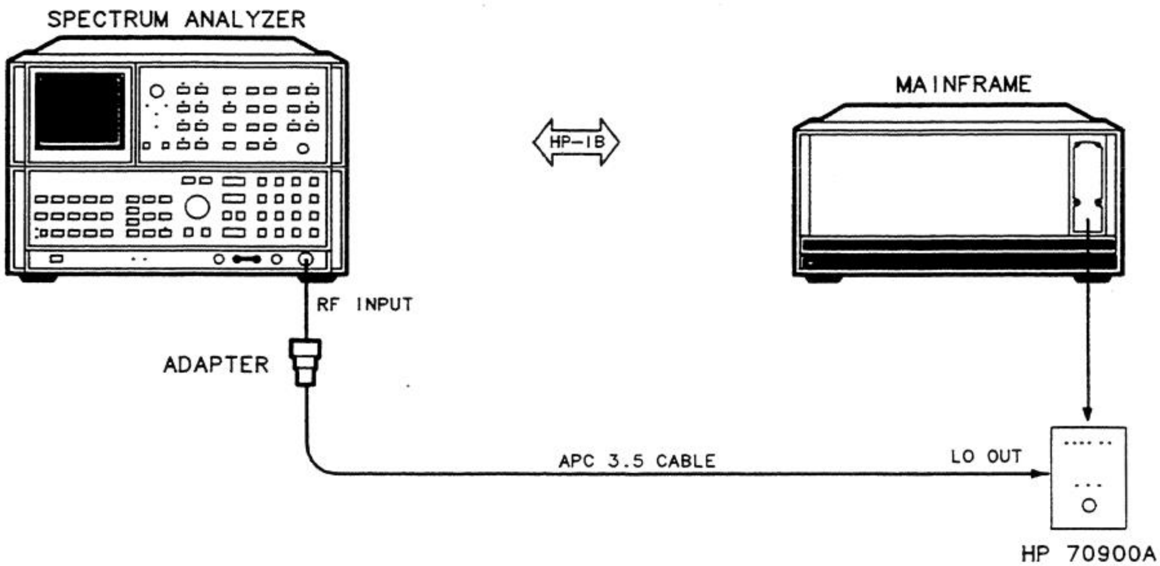



*Figure 4-34. Equipment Setup for Adjustment 19*

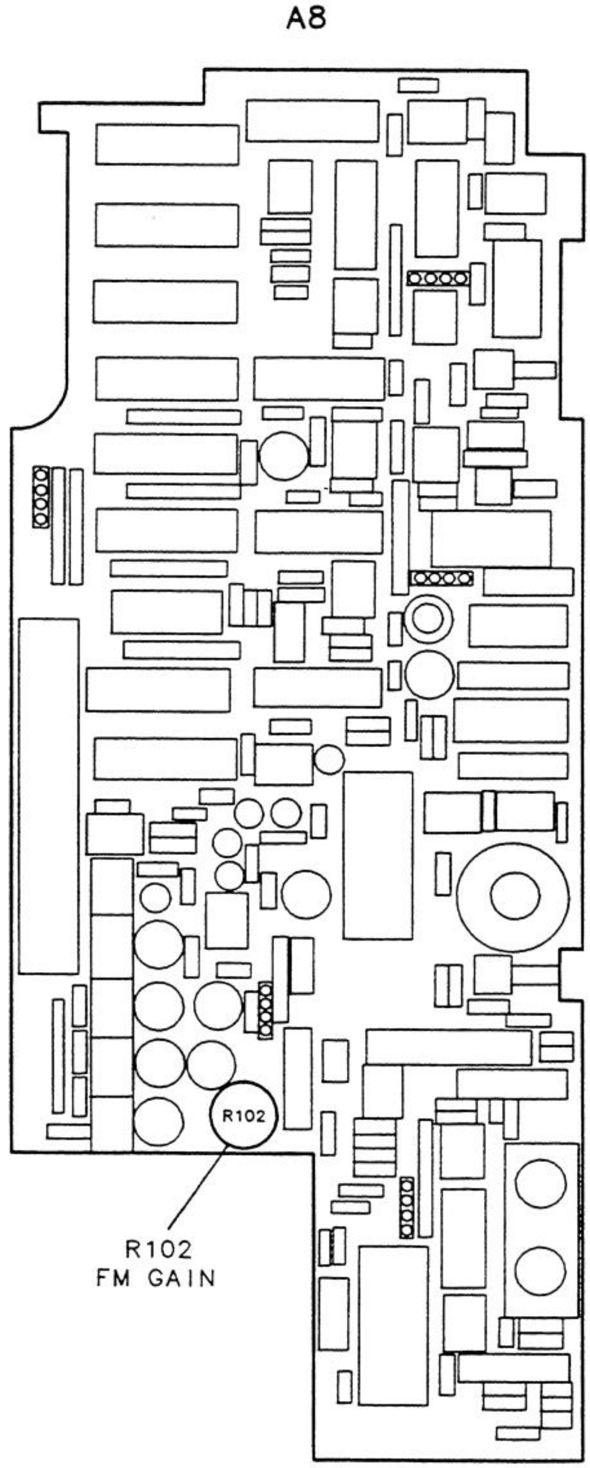



*Figure 4-35. Location of A8R102*

# Adjustment 20.
# Sweep Overshoot Adjustment

## Purpose

The gain of the sweep-ramp generating circuit is adjusted.

## Equipment

Oscilloscope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 54111D
Extender Module . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 70001-60013

**Cables:**
BNC (m) to SMB (f) . . . . . . . . . . . . . . . . . . . . . . . . . HP 85680-60093
Oscilloscope Probe . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 10080A

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-36. Connect the oscilloscope probe to A8TP2-4. See Figure 4-37 for the location of the test point. The oscilloscope monitors the HP 70900A's sweep DAC output while being triggered by the module's rear-panel H SWP signal.

**NOTE**

**Some of the assemblies test points are grouped on a common connector (e.g. A8TP2). On these common connectors, test point one is always orientated towards the top or the front of the module.**

2. Run the Sweep Overshoot Adjustment from the HP 70900A Module Verification Program.
3. The program sets the oscilloscope to the following settings:

   Channel 1 (external trigger) . . . . . . . . . . . . . . . . . . . . . . . . 2V/div
   Channel 2 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2V/div
   Sweep time . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 200 μs/div

4. The HP 70900A's sweep DAC is programmed to output a voltage ramp at 50 ms sweeps. The sweep DAC output rises from a minimum (0V) to a maximum of 8V to 10V. The resulting response, displayed on the oscilloscope, is adjusted with A8R105 LPF for minimum overshoot voltage.

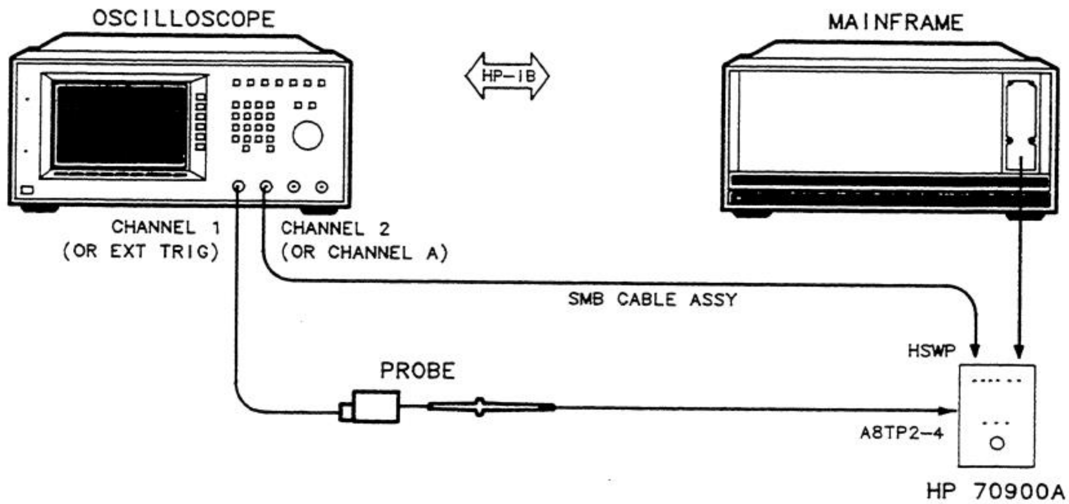



*Figure 4-36. Equipment Setup for Adjustment 20*

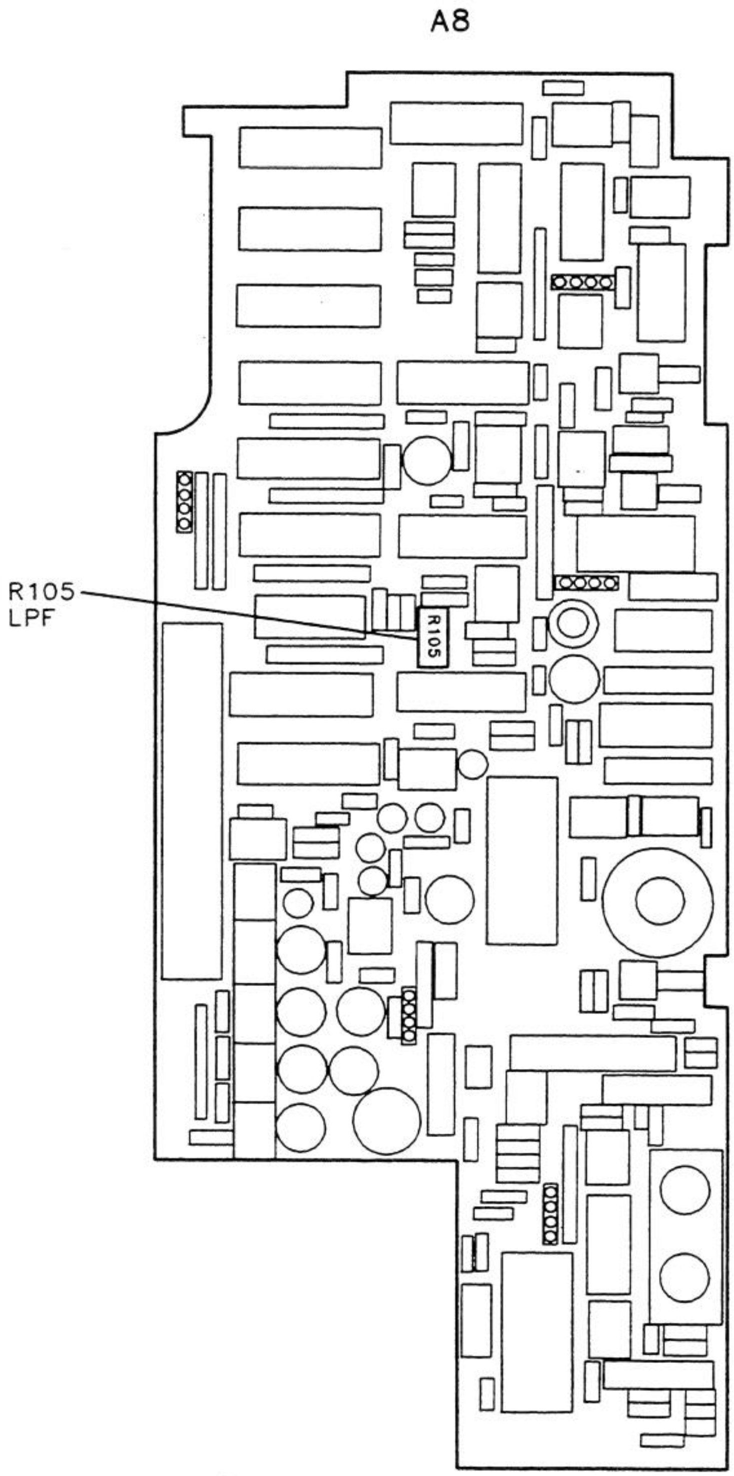



*Figure 4-37. Component Locations for Adjustment 20*

# Adjustment 21.
# Tune + Span Offset Adjustment

## Purpose

The tune span output voltage is adjusted for minimum offset.

## Equipment

| | |
|---|---|
| Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Extender Module | HP 70001-60013 |
| **Adapters:** | |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |
| **Cables:** | |
| APC 3.5 (m) (m) | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |

## Procedure

1. Remove the HP 70900A's cover and connect the equipment as illustrated in Figure 4-38. The DVM ground lead connects to grounded side of A8C2 and the positive lead to A8TP1-1. See Figure 4-39.

**NOTE**

**Some of the assembly's test points are grouped on a common connector (e.g. A8TP1). On these common connectors, test point one is always orientated towards the top or the front of the module.**

2. Run the Tune Span Offset Adjustment from the HP 70900A Module Verification Program.

3. The program sets the sweep and span DACs for a 0V output and the tune DAC to produce a full output. The DVM monitors the rear-panel TUNE SPAN voltage. The computer display prompts the technician to adjust A8R106 TUNE SPAN OFFSET for 10.3425 ±0.0005 Vdc.

4. The program sets the tune DAC for a 0V output and the sweep and span DACs to produce a full output. The computer display prompts the technician to adjust A8R106 TUNE SPAN OFFSET for 10.3425 ±0.0005 Vdc. The tune and span offsets adjustments are an iterative process.

5. To re-check the tune offset, press {ADJUST TUNE}.

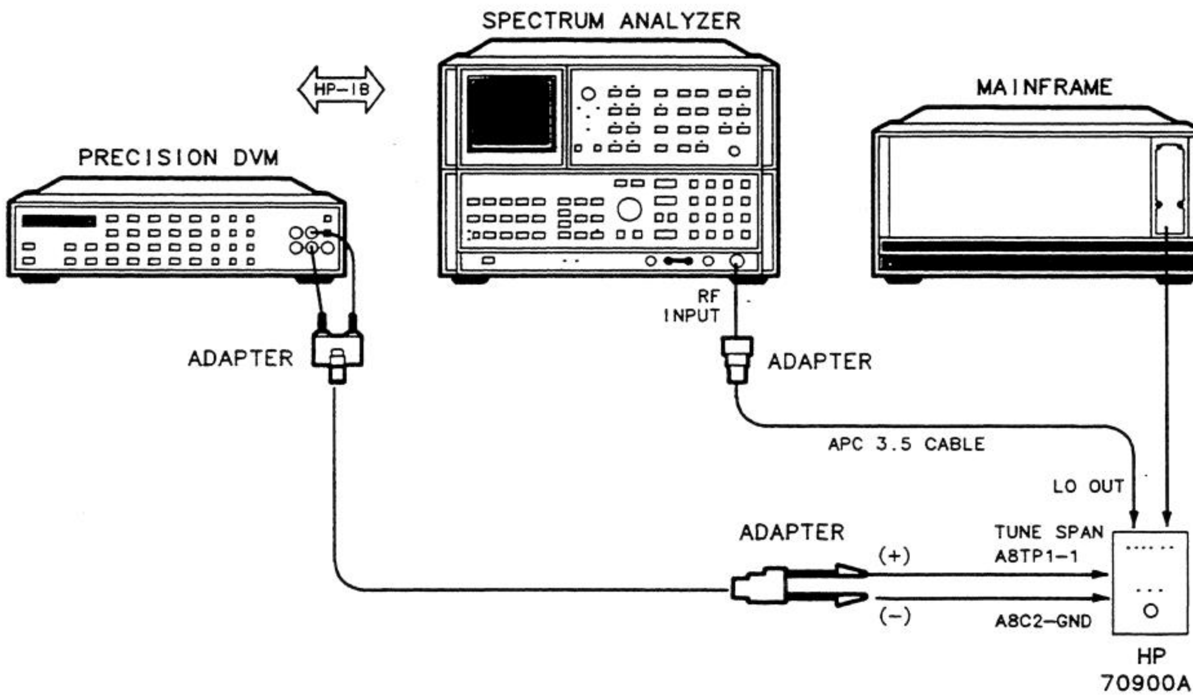



*Figure 4-38. Equipment Setup for Adjustment 21*

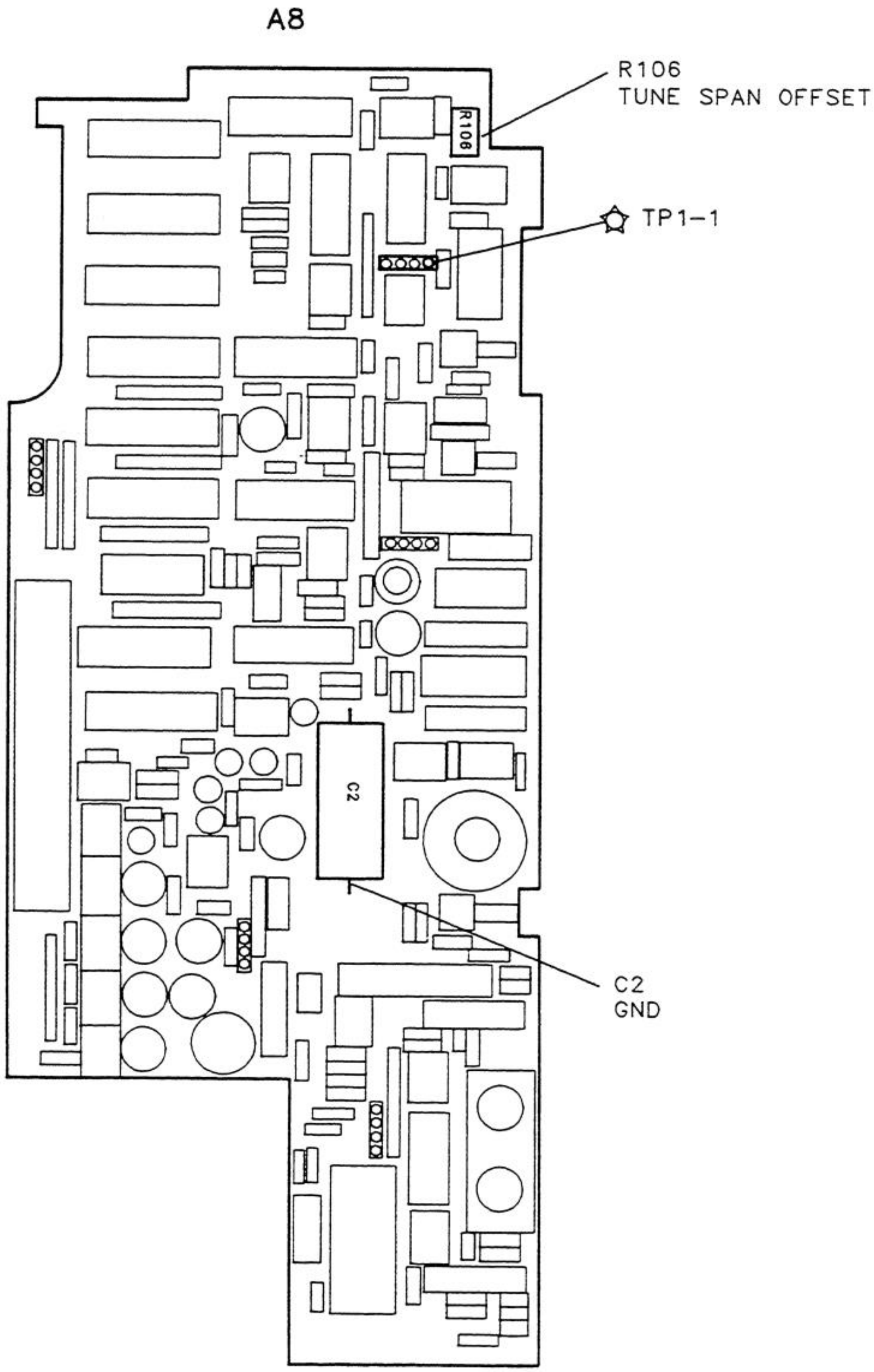



*Figure 4-39. Component Locations for Adjustment 21*

# YTO Lock Loop Adjustment

## Reference

A4A2 Idler Lock Board Assembly
A6A2 YTO Lock Board Assembly

## Description

The Idler Buffer Adjustments sets the gain of the A4A3 idler Buffer Microcircuit.

22. Idler Buffer Adjustment

# Adjustment 22.
# Idler Buffer Adjustment

## Purpose

The gain of the A4A3 Idler Buffer Microcircuit is adjusted by setting the A4A3's bias voltage. This in turn effects spurs on the LO signal. The bias voltage is set for minimum spur levels. The bias adjustment is located on the A6A2 YTO Lock Assembly.

## Equipment

| | |
|---|---|
| Calibrated Spectrum Analyzer | HP 8566B |
| Precision DVM | HP 3456A |
| Microwave Source | HP 8340A |
| Extender Module | HP 70001-60013 |
| External Reference | Refer to "External Frequency Reference" in Chapter 3 |

**Adapters:**

| | |
|---|---|
| APC 3.5 (f) to APC 3.5 (f) | HP 5061-5311 |
| SMA (f) to SMB (m) | HP 1250-0674 |
| SMB (f) to SMB (f) | HP 1251-0672 |
| Type N (m) to APC 3.5 (f) | HP 1250-1744 |
| Alligator Clips to BNC (f) | HP 1250-1292 |
| Banana Plug to BNC (f) | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| APC 3.5 (m) (m) *(2 required)* | HP 8120-4921 |
| BNC (m) (m) | HP 10503A |

## Procedure

1. Set the mainframe line switch to OFF.

2. Remove the HP 70900A from the mainframe and place it on an extender module. Remove the module's cover. Connect the equipment as illustrated in Figure 4-40. Do not connect the microwave source or DVM at this time. Refer to Figure 4-41 for the location of A6A3J1.

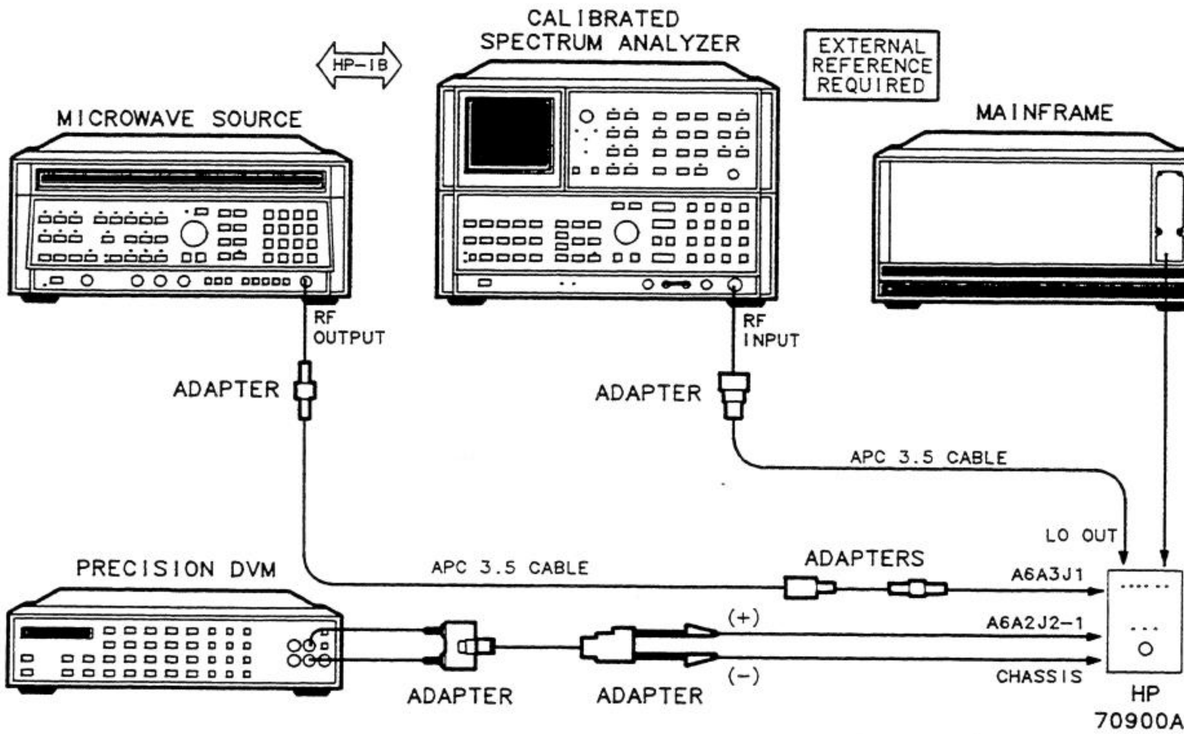



*Figure 4-40. Equipment Setup for Adjustment 22*

3. Run the Idler Buffer Adjustment from the LO Module Verification Software. At the start of the procedure, two testing methods are provided. The two testing methods allow a choice of A4A3 Idler Buffer inputs: 1) the HP 70900A's normal circuitry, {DUT IDL}, or 2) the microwave source, {SYN IDL}. Choose {DUT IDL} for normal testing; {SYN IDL} is used for troubleshooting because it isolates the Idler Buffer from the FFS Phase-Lock Loop. During testing, the spectrum analyzer measures a spur that occurs 10 kHz higher in frequency than the HP 70900A's LO signal. Measurement are repeated for ten LO frequencies. The bias voltage is adjusted for minimum spur level.

4. The computer screen displays a set of softkeys used to select the desired ten predetermined spur frequencies for testing. For normal adjusting, choose {TOP 10}. The remaining softkeys are primarily used for troubleshooting.

   Softkey Selections:

   {XOVER 10}
   {LOEND 10}
   {HIEND 10}
   {TOP 10} (use for normal adjusting)
   {INIT 10}

5. After selecting {TOP 10}, the program will continuously check the spurs between 3 and 6.6 GHz with the results displayed on the computer's display. Adjust A6A2R9 to lower the level of the displayed spurs. See Figure 4-41.

## NOTE

**During the adjustment, as high frequency spur levels increase, low frequency spur levels decrease. Conversely, as high frequency spurs decrease, low frequency spurs increase. Therefore, this adjustment is used to minimize ALL spur levels; it is an iterative process.**

6. When all the spurs measure below the test-limit line, use the DVM to measure the voltage at A6A2J2-1. (Pin 1 of A6A2J2 connects to a grey wire and is located towards the front of the module.)

7. Press {ADJ DONE}. The program makes an exhaustive check of the spurs over the 3.0 to 6.6 GHz LO signal range in 12.5 MHz steps, which takes approximately 12 minutes.

8. After the 12-minute test, the computer screen displays the set of softkeys listed below. If all spurs are below the test-limit line, press {ADJ DONE} to determine if the adjustment passed or failed. If any spurs are above the test-limit line, press one of the remaining softkeys.

   Softkey Selections:

   {ADJ DONE} press if test passed
   {MAX RNGE} initiates exhaustive spur search over 3 to 6.6 GHz LO range
   {LOW RNGE} initiates exhaustive spur search over 3 to 4.43 GHz low idler frequency range
   {HI RNGE} initiates exhaustive spur search over 4.43 to 6.6 GHz high idler frequency range
   {NEW 10}
   {CAN'T ADJ} exits adjustment procedure

9. If the spurs cannot be adjusted within test limits, use the microwave source to isolate the source of the spurs. Exit the program, press {RE-TEST}, and when prompted for the idler source, press {SYN IDL}. The microwave source provides a clean idler signal to the YTO lock-loop circuitry. If the spurs are reduced, the source of the spurs is either the Idler or FFS circuitry.

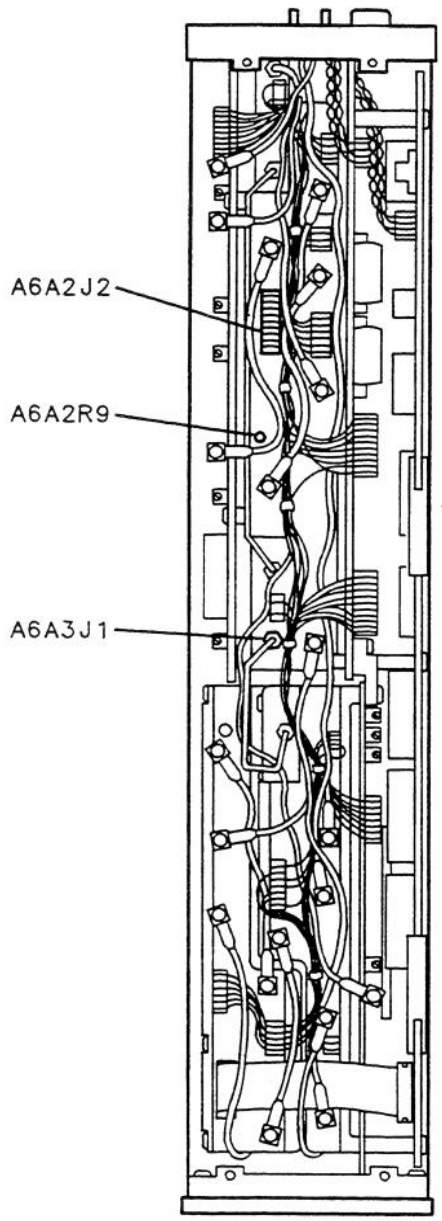



*Figure 4-41. Component Locations for Adjustment 22*

# Resistive Divider Construction Procedure

## Theory of Operation

The Resistive Divider is used to attenuate 40 Vdc down to 2 Vdc. The video processor adjustments require a 0-2V input with the sensitivity of the 40 Vdc power supply. See Figure 4-42 for the 20:1 Resistive Divider schematic diagram.

## Resistive Divider Assembly

Solder J1 and J2 Connectors together, back to back. Solder the capacitors and resistors to the connectors. See to Figure 4-43, Resistive Divider Assembly Diagram.

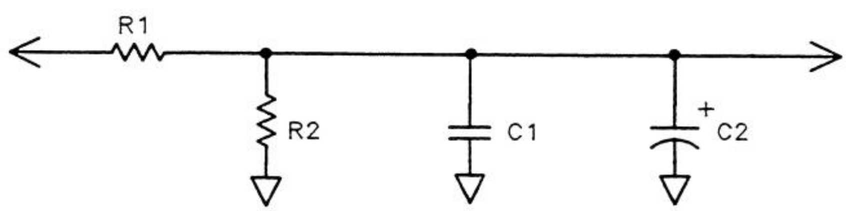



*Figure 4-42. Resistive Divider Schematic Diagram*

*Table 4-3. Resistive Divider Parts List*

| Description | Qty | HP Part Number |
|---|---|---|
| J1, J2 Connectors | 2 | 1250-0543 |
| C1, 0.1 μf Capacitor | 1 | 0160-4554 |
| C2, 6.8 μf Capacitor | 1 | 0180-0116 |
| R1, 680 Ω 3W Resistor | 1 | 0811-1088 |
| R2 147 Ω 0.5W Resistor | 1 | 0698-3400 |

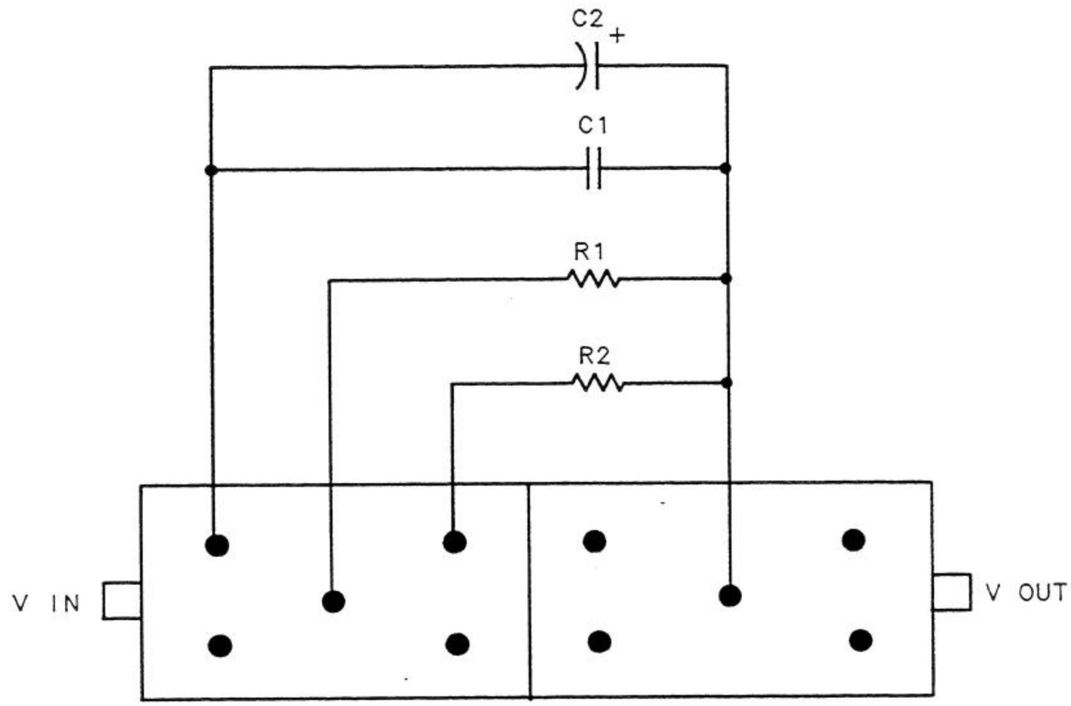



*Figure 4-43. Resistive Divider Assembly Diagram*

# Chapter 5

# Troubleshooting

## Introduction

Chapter 5 provides fault isolation to the assembly level. The chapter contains the following information:

## Getting Started

Begin troubleshooting by reading the following directions:

1. If an error code is displayed, refer to "Error Codes".
2. If the module failed its power-up sequence, refer to "Power-Up Failure".
3. Fill in the State Worksheet located in "State Worksheet".
4. If a verification test failed, refer to "Verification Test Failures".
5. If an adjustment procedure failed, refer to "Adjustment Procedure Failures".
6. For step-by-step troubleshooting, refer to "Troubleshooting Flow Chart".

## Which Tests Should be Run?

Refer to Table 5-1 whenever an assembly has been repaired or changed. Table 5-1 lists the related Adjustments and Verification Tests that should be performed to ensure proper module operation.

## Block Diagram

The block and Interconnect diagrams for the module are located in Chapter 9 (volume 2).

*Table 5-1. Related Adjustments and Perf. Tests (1 of 2)*

| Assembly Changed or Repaired | Perform the Following Related Adjustments | Perform the Following Related Verification Tests |
|---|---|---|
| A1A1 Host/Processor | No related adjustment | All Final Tests<br>22. LED Check |
| A1A2 RAM/ROM | No related adjustment | All Final Tests<br>22. LED Check |
| A2 Video Processor | 1. Video Processor | All Final Tests<br>23. Video Bandwidth |
| A3 Power Supply | No related adjustments | All Final Tests<br>24. 300 MHz Reference 40 kHz Sidebands |
| A4A1 300 MHz | 3. 300 MHz Bandpass Filter<br>5. Calibrator Output Amplitude<br>6. 300 MHz Reference Output Amplitude | All Final Tests<br>24. 300 MHz Reference 40 kHz Sidebands<br>25. Calibrator Harmonics<br>26. Calibrator Output Impedance<br>27. 300 MHz Reference Isolation<br>28. External Reference |
| A4A2 Idler Lock | 15. Low Idler<br>22. Idler Buffer | All Final Tests |
| A4A3 Idler Microcircuit | 15. Low Idler<br>22. Idler Buffer | All Final Tests |
| A6A1 100 MHz | 2. 100 MHz Ref./300 MHz Bandpass Filter<br>4. Calibrator Output Frequency | All Final Tests<br>28. External Reference<br>29. Reference Oscillator Stability<br>30. Reference Oscillator Shot Noise |
| A6A2 YTO Lock | 22. Idler Buffer | All Final Tests |
| A6A3 Idler Buffer | 22. Idler Buffer | All Final Tests |
| A6A4 YTO Lock Microcircuit | 22. Idler Buffer | All Final Tests |
| A6A5 YTO | 18. YTO Frequecy Endpoints<br>19. FM Gain | All Final Tests<br>31. YTO Linearity |
| A7A1 FFS VCO | 7. FFS VCO<br>13. FFS TUNE/COMP Fine | All Final Tests |

*Table 5-1. Related Adjustments and Perf. Tests (2 of 2)*

| Assembly Changed or Repaired | Perform the Following Related Adjustments | Perform the Following Related Verification Tests |
|---|---|---|
| A7A2 FFS Analog | 8. FFS TUNE/COMP Coarse<br>9. FFS Reference Null<br>10. FFS API 1<br>11. FFS API 2<br>12. FFS API 3<br>13. FFS TUNE/COMP Fine<br>14. FFS Spurious Response | All Final Tests |
| A8 Frequency Control | 16. Sweep Offset<br>17. Frequency Control Voltage References<br>18. YTO Frequency Endpoints<br>19. FM Gain<br>20. Sweep Overshoot<br>21. Tune + Span Offset | All Final Tests<br>31. YTO Linearity |
| A9 Front Panel | No related Adjustments | All Final Tests<br>22. LED Check<br>26. Calibrator Output Impedance |
| A10 Motherboard | No related Adjustments | All Final Tests |
| A11 Wiring Harness | No related Adjustments | All Final Tests<br>24. 300 MHz Reference 40 kHz Sidebands |
| W20 MSIB (Hughes Connector/flex cable) | No related Adjustments | All Final Tests |

# Error Codes

## Series 2000 Errors

Confirm that the error is caused by the HP 70900A. Also, make sure the error is not caused by a user error, user defined function, or any other user-input command or program. If an error code other than 2011 or 2034 appears, replace the A1A1 Host/Processor or A1A2 RAM/ROM assemblies.

**2011 (Memory Overflow)** When this error code appears, execute a "DISPOSE ALL" command (refer to HP 71000 Language Reference) and set N STATES to 0. This will erase all user input programs. If the problem still exists, then change the A1A1 Host/Processor or A1A2 RAM/ROM assembly.

**2034 (Test Switch is On)** Set A1A1S2 switch 1 to the "1" position (open) when this error code appears. If the switch is already in the "1" position, replace the A1A1 Host/Processor assembly.

## Series 8000 Errors

Confirm that the error is caused by the HP 70900A. Also, make sure the error is not caused by a user error, user defined function, or any other user-input command or program. These errors can be caused by problems in down-loaded code. If a down-loaded code is not the source of the error, replace the A1A1 Host/Processor or the A1A2 RAM/ROM assembly.

## Series 9000 Errors

Confirm that the error is caused by the HP 70900A. Also, make sure the error is not caused by a user error, user defined function, or any other user-input command or program.

These errors can be caused by bad information sent from other modules to the HP 70900A. Make certain that the error is caused by the HP 70900A before replacing the A1A1 Host/Processor or A1A2 RAM/ROM assembly.

## Series 7000 Errors

The following error codes may be reported by the HP 70000 Spectrum Analyzer during the Power-Up sequence or when the Analyzer Test softkey is pressed. The following definitions apply when the codes are produced by the HP 70900A. Due to dependencies, a single problem can cause multiple errors. Troubleshoot these errors in the order of which they are reported. Refer also to Troubleshooting Flow Chart located in this chapter.

**7000 (ROM check)** A checksum is computed on the ROM at power-up. Replace the A1A1 Host/Processor or A1A2 RAM/ROM assembly.

**7001, 7002 (1st LO unleveled)** These codes are sent from slave modules indicating the LO signal is unleveled. Check the LO power at A6A4J3,the rear-panel LO jack. Refer to the YTO Unlock paragraph in A6/A8 YTO PLL Troubleshooting.

**7003, 7004 (2nd LO unlocked)** These codes are sent from slave modules indicating an unlocked second LO. Check rear-panel 300 MHz Outputs. Refer to the A4A1 300 MHz Assembly paragraph in A4 Idler PLL Troubleshooting.

**7008, (FFS Handshake)** The A1A1 Host/Processor originates these errors when it cannot communicate with the A7A2 Fractional Frequency Synthesizer (FFS) through the W14 ribbon cable. Refer to A7 FFS PLL Troubleshooting.

**7010 (FFS is Unlocked)** This code is sent by the A7A2 assembly to the A1A1 Host/Processor assembly indicating the A7 Fractional Frequency Synthesizer (FFS) is unlocked. It is sent from A7A2J5 pin 11 through ribbon cable W14 when the tune voltage to the A7A1 FFS VCO exceeds limits. Refer to A7 FFS PLL Troubleshooting

**7011 (125 kHz to FFS)** This error is reported when the A6A1 assembly fails to detect the 125 kHz signal during the Power-Up sequence or Analyzer Test. A detected voltage is sent from A6A1J7 pin 2 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the ADC (Analog to Digital Converter). The error occurs when the detected voltage falls outside of the +0.65V to +0.85V range. Measure the voltage at A6A1J7 pin 2. If it is out of this voltage range, the A6A1 100 MHz assembly is bad. If the voltage is correct, measure the voltage at A2J3 pin 7. If the voltage is out of the range, A11 is bad. If the voltage is correct, then the problem is a faulty A2 Video assembly.

**7012 (Cannot lock YTO)** This error occurs when the A6/A8 YTO PLL fails to phase lock. The A1A1 Host/Processor attempts to lock the YTO at the beginning of a sweep by moving the error voltage at A6A2J3 off of the maximum or minimum rail value. The controller attempts to move the error voltage by changing the start-frequency tune DAC on the A8 assembly. Refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

**7013 (Cannot finetune YTO)** This error results when the A6/A8 YTO PLL cannot be finetuned. The A1A1 Host/Processor locks the YTO at the start of a sweep and tries to move the error voltage at A6A2J3 to 0V by changing the start-frequency correction DAC on the A8 assembly. Refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

**7014 (12.5 MHz to YTO lock Bd.)** This is reported only during a Power-Up sequence or Analyzer Test and occurs when A6A1 assembly fails to detect the 12.5 MHz signal. A detected voltage is sent from A6A1J5 pin 1 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the ADC (Analog to Digital Converter). This error occurs when the detected voltage falls outside the +0.65V to +0.85V range. Measure the voltage at A6A1J5 pin 1. If it is out of the voltage range, the A6A1 100 MHz assembly is bad. If the voltage is correct, measure the voltage at A2J3 pin 6. If the voltage at pin 6 is out of the voltage range, replace wire harness A11. If the voltage is correct, the problem is a faulty A2 Video assembly.

**7015 (YTO is Unleveled)**

This error is reported when the A6A5 YTO output fails to level. The signal (HYOLVL) is sent from the A6A5 YTO through W15 pin 7 to the A8 assembly where it is read by the A1A1 Host/Processor. This error usually occurs at an LO frequency of 3 GHz and is normally caused by the YTO. Refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

**7016 (YTO is Unlocked)**

This error indicates an unlocked YTO PLL. The error occurs when the error voltage at A6A2J3 exceeds a -9V to +9V range. The signal is sent from A6A2J5 to the A1A1 Host/Processor through the A8 assembly. Refer to the YTO Unlock paragraph of A6A8 YTO PLL Troubleshooting.

**7018 (50 MHz to Sampler)**

This error is reported only during a Power-Up sequence or Analyzer Test and occurs when A6A1 assembly fails to detect the 50 MHz signal. A detected voltage is sent from A6A1J7 pin 3 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the ADC (Analoge to Digital Converter). This error occurs when the detected voltage falls below 0.5V. Measure the voltage at A6A1J7 pin 3. If it is between 0.35V and 0.5V, replace the A6A1 100 MHz assembly. If the voltage level is less than 0.35V, the A6A1 or A6A4 assemblies are probably faulty. If voltage at A6A1J7 pin 3 is correct, measure the voltage at A2J3 pin 1. If it is out of the voltage range, change wire harness A11. If the voltage is correct, the problem is a faulty A2 Video assembly.

**7019 (300 MHz Post filter det.)**

This error is reported only during a Power-Up sequence or Analyzer Test and occurs when A4A1 assembly fails to detect the 300 MHz signal. A detected voltage is sent from A4A1J2 pin 1 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the A2 assembly's ADC (Analog to Digital Converter). This error occurs when the voltage falls below +0.2V. Measure the voltage at A4A1J2 pin 1. If it is less than +0.2V, the A4A1 300 MHz assembly is bad. If the voltage is correct, measure the voltage at A2J3 pin 5. If it is out of the voltage range, change wire harness A11. If the voltage is correct, the problem is a faulty A2 Video assembly.

**7020 (300 MHz AGC)**

This error is reported only during a Power-Up sequence or Analyzer Test and occurs when an incorrect value of the 300 MHz leveling loop's AGC voltage is present on the A4A1 assembly. The AGC voltage is sent from A4A1J2 pin 2 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the A2 assembly's ADC (Analog to Digital Converter). The error occurs when the voltage exceeds a +0.2V to +1.5V range. Measure the voltage at A4A1J2 pin 2. If it is out of the voltage range, the A4A1 300 MHz assembly is bad. If it is correct, measure the voltage at A2J3 pin 3. If it is out of the voltage range, change wire harness A11. If it is correct, the problem is a faulty A2 Video assembly.

**7021 (600 MHz to Idler)**

This error is reported only during a Power-Up sequence or Analyzer Test. It occurs when the A4A1 assembly fails to detect the 600 MHz signal which is the output of an A4A1 doubler circuit. The 600 MHz is used on the A4A3 Idler microcircuit. A detected voltage is sent from A4A1J6 pin 3 through A11 Wiring Harness to the A2 Video assembly. There it is read by the A1A1 Host/Processor through the A2 assembly's ADC (Analog to Digital Converter). An error is reported when the detected voltage falls below 1.1V. Measure the voltage at A4A1J6 pin 3. If it is less than 1.1V, the A4A1 300 MHz assembly is bad. If it is correct, measure the voltage at A2J3 pin 4. If it is out of the voltage range, change wire Harness A11. If it is correct, the problem is a faulty A2 Video assembly.

**7022 (Low Idler Range)**

This error is reported from a Power-Up sequence or Analyzer Test and occurs when the A4A2 Idler Lock assembly detects an unlocked Idler PLL loop. The tests tune the Idler oscillator to its extremes in the Low Idler function (3.530 to 3.565 GHz) and checks for an unlock condition. Refer to the Idler Unlock paragraph of A4 Idler PLL Troubleshooting.

**7023 (High Idler Range)**

This error is reported from a Power-Up sequence or Analyzer Test and occurs when the A4A2 Idler Lock assembly detects an unlocked Idler PLL loop. The tests tune the Idler oscillator to its extremes in the High Idler function (5.330 to 5.365 GHz) and checks for an unlock condition. Refer to the Idler Unlock paragraph of A4 Idler PLL Troubleshooting.

**7024 (Tune DAC)**

This error is only reported from Analyzer Test and indicates an unlinear A8 Start Frequency Tune DAC. The Sweep DAC and Binary Span Attenuator DAC are set to 0 counts on the A8 assembly. The Start Frequency Tune DAC is then checked for linearity through the Tune Span line. This signal leaves the A8 assembly through A8J5 pin 1, goes through the A10 Motherboard assembly to the A2 Video assembly. There the A1A1 Host/Processor monitors it through the digital to analog converter. The problem is usually caused by the A8 Frequency Control assembly, but it can be caused by the A2 Video assembly if the wrong multiplexer channel is enabled or the A2 assembly is out of adjustment.

**7025 (Decade Span)**

This error is only reported from Analyzer Test and indicates a faulty Decade Span Attenuator on the A8 Frequency Control assembly. The Sweep DAC and Binary Span Attenuator DAC on the A8 Frequency Control assembly are set to 4095 counts (full on) and the Start Frequency Tune DAC is set to 0 counts. The Decade Span Attenuator is stepped through its positions, and the resultant output is sent through the Tune Span line through A8J5 pin 1. This signal goes through the A10 Motherboard assembly to the A2 Video assembly, where the A1A1 Host/Processor monitors it through the analog to digital converter. The problem is usually caused by the A8 Frequency Control assembly. The problem may also be caused if the wrong multiplexer channel is enabled on the A2 assembly or if the assembly is out of adjustment.

**7026 (Binary Attenuator)**

This error is only reported from Analyzer Test and indicates a faulty Binary Span Attenuator DAC on the A8 Frequency Control assembly. The A8 assembly's Sweep DAC is set to 4095 counts (full on), the Decade Span Attenuator is set for zero attenuation, and the Start Frequency Tune DAC is set to 0 counts. The Binary Span Attenuator DAC is then checked for linearity through the Tune + Span line. This signal leaves the A8 assembly through A8J5 pin 1, passes through the A10 Motherboard assembly, to the A2 Video assembly. There the A1A1 Host/Processor monitors it through the analog to digital converter. The problem is usually caused by the A8 Frequency Control assembly. The problem may also be caused if the wrong multiplexer channel is enabled on the A2 assembly or the assembly is out of adjusment.

**7027 (Sweep DAC)**

This error is only reported from Analyzer Test and indicates a fauly Sweep DAC on the A8 Frequency Control assembly. The A8 assembly's Binary Span Attenuator DAC and Decade Span Attenuator are set to zero attenuation and the Start Frequency Tune DAC is set to 0 counts. The linearity of the Sweep DAC is then checked through the Tune + Span line. This signal leaves the A8 assembly through A8J5 pin 1, goes through the A10 Motherboard assembly to the A2 Video assembly. There the A1A1 Host/Processor monitors it through the analog to digital converter. The problem is usually caused by the A8 Frequency Control assembly. The problem may also be caused if the wrong multiplexer channel is enabled on the A2 assembly or the assembly is out of adjustment.

**7028 (Correction DAC)**

This error is only reported from Analyzer Test and indicates the Start Frequency Correction DAC on the A8 Frequency Control assembly is nonlinear. The test requires that the A6/A8 YTO PLL be able to lock in order to run. The Start Frequency Correction DAC is checked for linearity via the Lock-N-Roll offset line. This signal leaves the A8 assembly though A8J5 pin 50, passes through the A10 Motherboard assembly to the A2 Video assembly, where it is monitored by the A1A1 Host/Processor through the analog to digital converter. If the HP 70900A phase locks at 3 GHz CW frequency and 6.6 GHz CW frequency, the A8 Frequency Control assembly is bad. If not, refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

**7029 (Video Proc: 0 volt)**

This error is only reported during a Power-Up sequence or Analyzer Test. The error indicates the ADC (Analog to Digital Converter) on the A2 Video assembly is not calibrated a 0V input. The A1A1 Host/Processor assembly checks ADC calibration by selecting the grounded multiplexer input, A2U3 pin 8, and reading its value through the ADC. Refer to the Video Processor Adjustment in Chapter 4.

**7030 (Video Proc: 2 volt)**

This error is only reported during a Power-Up sequence or Analyzer Test. The error indicates the ADC (Analog to Digital Converter) on the A2 Video assembly is not calibrated with a 2V input. The A1A1 Host/Processor assembly checks ADC calibration by selecting the 2V input of the multiplexer, A2U3 pin 7, and reading its value through the ADC. Refer to the Video Processor Adjustment in Chapter 4.

**7031 (Idler is Unlocked)**

This error is reported from the A4A2 Idler Lock assembly and occurs when the tune voltage to the idler exceeds its limits. The signal is sent from A4A2J1 pin 1 through the wire harness A11 to the A8 Frequency Control assembly where it is monitored by the A1A1 Host/Processor. If an error 7019, 7020, or 7021 is also reported from Analyzer Test, troubleshoot it first. Refer to the Idler Unlock paragraph of A4 Idler PLL Troubleshooting.

**7041 (FFS won't tune low)**

This error is reported during a Power-Up sequence or Analyzer Test. It occurs when the A7 FFS (Fractional Frequency Synthesizer) becomes onlocked when tuned to 35 MHz. Refer to A7 FFS PLL Troubleshooting.

**7042 (FFS won't tune high)**

This error is reported during a Power-Up sequence or Analyzer Test. It occurs when the A7 FFS (Fractional Frequency Synthesizer) becomes unlocked when tuned to 70 MHz. Refer to A7 FFS PLL Troubleshooting.

**7043 (FREQ. Assembly Adjust)**

Reported from analyzer test only. The sweep and binary span DACs (Digital to Analog Converter) are turned off and the zero tune DAC is set to 200 counts (-0.5V at A8TP1-2 and 4.5V at A8TP1-1). This signal leaves the A8 assembly through A8J5-1 and goes through the A10 Motherboard to A2J2 pin 25, on the A2 Video Assembly. The A1A1 Host/Processor reads the signal through the A2 ADC (Analog to Digital Converter). This error occurs when the voltage at A8TP1-1 is greater than ±50 mV from 4.5V. Refer to the Frequency Control Voltage Reference, the Tune Span Offset adjustments and Video Processor adjustments in chapter 4. If the error persists, replace the A8 Frequency Control or A2 Video assembly.

**7044 (YTO tuning range)**

This error is reported during a Power-Up sequence or Analyzer Test. It indicates the A6/A8 YTO PLL has become unlocked at either 3 GHz or 6.6 GHz (CW frequencies). Refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

**7047 (RAM failure)**

This failure indicates a RAM failure. Replace the A1A1 Host/Processor assembly or A1A2 RAM/ROM assembly.

**7048 (FFS Won't Unlock)**

This error occurs when the A1A1 Host/Processor assembly slews the A7 FFS (Fractional Frequency Synthesizer) from one rail to another very quickly. It monitors the FFS unlock indicator while it slews, looking for the proper unlock condition. This error is usually caused by the A7A2 FFS Analog assembly.

# State Worksheet

The State Worksheet speeds up troubleshooting by providing the status of module oscillators, switches, and settings. When returning a module or assembly for service, include a copy of the State Worksheet.

## State Worksheet

**(sheet 1 of 2)**

1. Tune the spectrum analyzer to the frequency(s) that exhibits the problem.
2. On the system display press the [MENU] key, {Misc}, {MORE}, {catalog}, and {STATE}. Record the LOSTART and LOSTOP frequencies on the following lines. *(Some analyzers require the following alternate keystrokes: press the [MNU] key, {inst disp}, and {SHOW STATE}).*

   LOSTART . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________ Hz

   LOSTOP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________ Hz

3. Press {EXTEND STATE} and record the values listed in the following lines:

   LOCK POLARITY . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________

   FREQ REFERENCE . . . . . . . . . . . . . . . . . . . . . . . . . . . ________

   DIVIDE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________

   IDLER STATE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________

   FFS START . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________ MHz

4. Subract the LOSTART frequency from the LOSTOP frequency and record the result below.

   (LOSTOP - LOSTART) . . . . . . . . . . . . . . . . . . . . . . . . ________ MHz

5. If the frequency recorded in step 4 is greater than 10 MHz, the analyzer is in lock-and-roll spans. Calculate the FFS STOP frequency according to the following formula:

   FFS STOP = FFS START

   FFS STOP (lock-and-roll spans) . . . . . . . . . . . . . . . . . . . . ________ MHz

## State Worksheet

**(sheet 2 of 2)**

6. If the frequency recorded in step 4 is less than or equal to 10 MHz, the analyzer is in phase-locked spans. Calculate the FFS STOP frequency according to the following formula:

FFS STOP = FFS START – (LOSTOP – LOSTART)

FFS STOP (phase-locked spans) . . . . . . . . . . . . . . . . . . . . . . . ________ MHz

7. If the IDLER STATE recorded in step 3 is low, calculate the IDLER START frequency according to the following formula:

IDLER START = 3600 MHz – FFS START

IDLER START (low Idler State) . . . . . . . . . . . . . . . . . . . . . . . ________ MHz

8. If the IDLER STATE recorded in step 3 is high, calculate the IDLER START frequency according to the following formula:

IDLER START = 5400 MHz – FFS START

IDLER START (high Idler State) . . . . . . . . . . . . . . . . . . . . . . ________ MHz

9. Calcuate the IDLER STOP frequency using the following formula:

IDLER STOP = (IDLER START + FFS STOP – FFS START)

IDLER STOP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ________ MHz

# Troubleshooting Flow Chart

The Troubleshooting Flow Chart, Figure 5-1, is designed to help you troubleshoot the HP 70900A module. Follow the instructions on the flow chart: it will direct you to troubleshooting procedures contained in this chapter. Information on each major decision block in the flow chart is provided below.

### Does the Module Complete Power-UP?

The Power-Up sequence is performed automatically by the module each time the power is applied. If the module cannot complete its Power-Up sequence, it will not be able to establish a link with the display. (An indication of this would be all the HP 70900A front-panel LEDs flashing on and off.) Refer to Power-Up Failure.

### Any Errors from Analyzer Test?

To perform the Analyzer Test sequence, press the [MNU] key, {MISC}, {MORE}, {SERVICE}, and {ANALYZER TEST} on the system display. (Always wait at least 30 seconds after power up before performing the test.) Analyzer Test checks the presence of key reference signals, the ability of the three phase-lock loops to lock at their maximum and minimum points, the linearity of all DACs (Digital to Analog Converter) and the ADC (Analog to Digital Converter). If any errors are reported, refer to Error Codes.

### Can Symptom be Observed on LO Output?

At this point in troubleshooting, the module's three PLLs (Phase Lock Loops) can lock. The PLLs are the A4 Idler PLL, A6/A8 YTO (Yig Tuned Oscillator) PLL, and A7 FFS (Fractional Frequency Synthesizer) PLL. Any remaining problems could be noise/sidebands, frequency-dependant unlocks, intermittant unlocks, bad rear-panel outputs, and video detector failures. Can noise/sideband or unlock be observed on the module's rear-panel LO signal? The rear-panel jack is A6A4J3.

### Can Symptom be Observed on Idler Output?

Place the module on an HP 70001-60013 extender cable. Remove the module cover. Can the noise/sideband or unlock be observed on the Idler signal at A4A3J1. If the symptom cannot be observed, the problem is in the YTO lock loop. If it can be observed at A4A3J1, look at the signal at A7A1J1? If the symptom can be observed at A7A1J1, refer to A7 FFS PLL Troubleshooting. If the problem cannot be observed at A7A1J1, refer to A4 Idler PLL Troubleshooting.

### Can Symptom be Observed on Rear-Panel 300 MHz Output?

Can the symptoms be observed on the two rear-panel 300 MHz outputs? If they can, refer to the A4A1 Troubleshooting paragraph in A4 Idler PLL Troubleshooting. Measure the power of the 300 MHz front-panel calibrator signal. The power should be -10 dBm ±0.3 dB. If the power level is incorrect, refer to the A4A1 Troubleshooting paragraph in A4 Idler PLL Troubleshooting.

## Is the A2 Video Assembly OK?

Perform the following steps to test the A2 assembly:

1. Set an HP 3325A Function Generator to the following settings:

| | |
|---|---|
| FREQ | 20 Hz |
| AMPTD | 2V |
| DC OFFSET | 1V |
| FUNCTION | triangle wave |

2. Set the HP 70900A to the following settings:

| | |
|---|---|
| SPAN | 0 Hz |
| SWEEPTIME | 60 ms |
| SWEEP | CONTINUOUS |
| Cal Corrections | ALL OFF |
| EXTERNAL TRIGGER | ON |

3. Connect the front-panel SYNC OUT of the HP 3325A to the HP 70900A's rear-panel EXT TRIG. Connect the HP 3325A SIGNAL output to the HP 70900A's rear-panel VIDEO jack.

4. Verify that the triangle wave on the spectrum analyzer's display has no nonlinearities in it. Check out all of the bits of the analog to digital converter. If necessary, use the dB/DIV and reference level to expand the scale to look at the LSB (Least Significant Bit). (1 LSB $\approx$ 0.27 dB $\approx$ 500 $\mu$V.) If there is any nonlinearity displayed on the CRT, either the A2 Video assembly or the A1A1 Host/Processor assembly is bad.

5. Check out the detectors on the A2 Video assembly. With a signal on the screen, and a span less than 10 MHz, press the [MNU] key, {TRACE}, then {DETECTOR}. verify that POS PK, NEG PK, SAMPLE, and NORMAL detectors all give similar amplitude readings in the uncorrected mode ($\pm$1 dB referenced to SAMPLE detector). If there are any problems, run the Video Processor Adjustment procedure. If the assembly cannot be adjusted, change the A2 Video assembly.

## Are the A9 Front-Panel Indicators OK?

Run the LED Check verification test. If the test passes, run the HP 70900A Verification Tests.

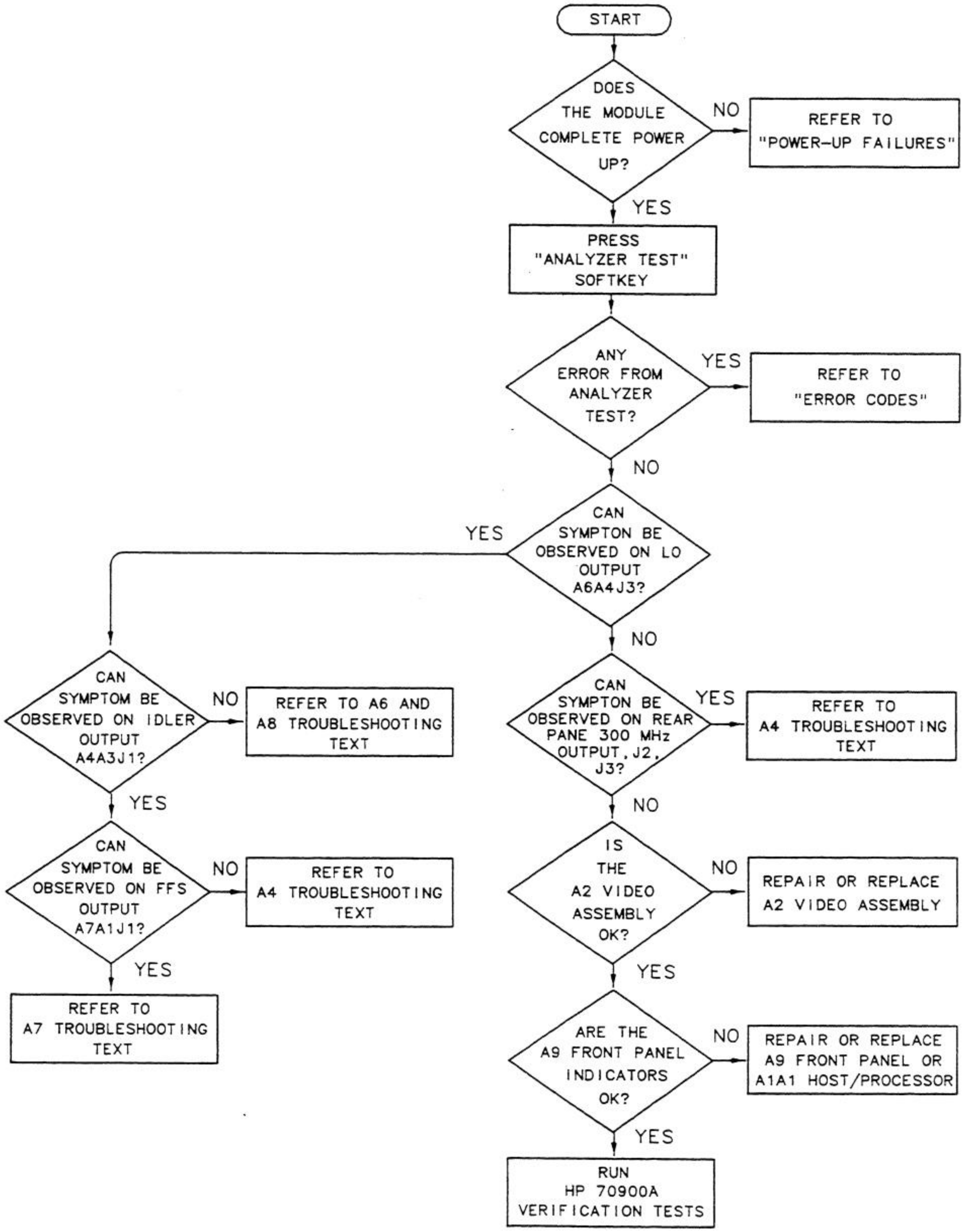



*Figure 5-1. Troubleshooting Flow Chart*

# Power-Up Failure

The Power-Up sequence is performed automatically by the module each time the power is applied. If the module cannot complete its Power-Up sequence, it will not be able to establish a link with the display. (An indication of this would be all the HP 70900A front-panel LEDs flashing on and off.)

If the module fails its Power-Up sequence, check the power supplies by removing the module from the mainframe and installing it on an 70001-60013 extender cable. With the power turned off, remove the module's outer cover. Verify that all of the yellow and green LEDs on the top of the A3 Power Supply assembly are on. If not, refer to A3 Power Supply Troubleshooting. If the LEDs are all on, check for +5.2V ±0.1V on A1A1J6 pin 48 and for +13.5V at A1A1J6 pin 49 (measure these pins on the back side of the A1A1 Host/Processor). If either of these voltages are incorrect, refer to A3 Power Supply Troubleshooting. If the voltages are correct, refer to "A1 Controller Troubleshooting".

# Verification Test Failures

The following troubleshooting instructions are grouped according to module verification test. If an HP 70900A fails a verification test, look up the test in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment.

### Test 1. 300 MHz Output Power and Harmonics Test

If this test fails for power only, run the Calibrator Output Amplitude Adjustment and then the 300 MHz Reference Output Amplitude Adjustment. If the test still fails, refer to the A4A1 300 MHz Assembly paragraph of A4 Idler PLL Troubleshooting. If the test fails for harmonics, verify that A4A1R48 and A4A1R61 are 316 ohms and that A4A1R39 and A4A1R52 are 100 ohms as per Service Note 70900A-9. If the modification is already installed, refer to the A4A1 Troubleshooting section.

### Test 2. LO Output Power and Harmonics Test

If the harmonics fail, replace the A6A5 YTO. If the power out fails, refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting.

### Test 3. Residual FM (Spans >10 MHz) Test

This test checks the residual FM of the A6A5 YTO and the tuning control of the A8 Frequency Control assembly in a non-phase locked condition. The usual cause of failure is the A6A5 YTO, however, the voltage reference on the A8 Frequency Control assembly can also cause this test to fail.

### Test 4. LO Output Spurious Response Test

Perform the Idler Buffer Adjustment in Chapter 4, Adjustment Procedures.

### Test 5. LO 24 kHz Sidebands Test

If this test fails replace the A6A5 YTO.

### Test 6. LO 40 kHz Sidebands Test

If this test fails, remove the A1A1 Host/Processor Assembly and install it on board extender cables. Remove the screws that fasten the A3 Assembly to the A6 housing. Install the module on the 70001-60013 module extender. Tune the 70900A to the frequency that failed and monitor the sideband with a spectrum analyzer. Gently pull the A3 assembly away from the A6 housing. If the sideband amplitude changes more than 2 dB, replace the A3 assembly. If the sideband doesn't change by more than 2 dB, troubleshoot the A6A5 YTO or A8 Frequency Controller.

### Test 7. Reference Oscillator Accuracy Test

Run the Calibrator Output Frequency Adjustment and re-test. If the verification test fails again, troubleshoot or replace the A6A1 100 MHz assembly.

### Test 8. Calibrator Amplitude Accuracy Test

Run the Calibrator Output Amplitude Adjustment. If the verification test still fails, refer to the A4A1 300 MHz Assembly paragraph of A4 Idler PLL Troubleshooting.

### Test 9. 300 MHz Ref Amplitude Accuracy Test

If this test fails for power only, run the Calibrator Output Amplitude Adjustment and then the 300 MHz Reference Output Amplitude Adjustment. If the test still fails, or if the test fails for harmonics, refer to the A4A1 300 MHz Assembly paragraph of A4 Idler PLL Troubleshooting.

### Test 10. Video Detector Tracking Test

If the A2 Video Processor is adjusted properly, troubleshoot or replace the A2 Video assembly.

### Test 11. External Triggering Test

If the A1A1 Host/Processor assembly's number is 70900-60078, make sure that A1R7 and A1R12 are 51.1Ω resistors. If the resistors are 51.1Ω, or if the module has an A1A2 RAM/ROM assembly, the problem is usually A1A1 assembly related.

### Test 12. Video Processor Noise Test

Troubleshoot the A2 Video assembly.

### Test 13. LO Span Accuracy (Span >10 MHz) Test

Run Analyzer Test. If no errors are reported, run the Frequency Control Voltage References Adjustment then the YTO Frequency Endpoints Adjustment. Run the verification test again. If the test still fails, the A6A5 YTO is the most probable cause, with the A8 Frequency Control assembly being the next most probable cause.

### Test 14. LO Span Accuracy (Span ≤10 MHz) Test

If no unlocks are reported, refer to A7 FFS PLL Troubleshooting. If unlocks are reported, refer to Error Codes troubleshooting.

### Test 15. LO Frequency Accuracy (Span >10 MHz) Test

Run Analyzer Test. If no errors are reported, run the Frequency Control Voltage References Adjustment then the YTO Frequency Endpoints Adjustment. Run the verification test again. If the test still fails, the A6A5 YTO is the most probable cause, with the A8 Frequency Control assembly being the next most probable cause.

### Test 16. LO Frequency Accuracy (Span ≤10 MHz) Test

Refer to A7 FFS PLL Troubleshooting.

### Test 17. LO Frequency Error vs Sweep Time Test

Perform the Sweep Offset Adjustment and re-run the verification test. If the test still fails, replace the A8 Frequency Control assembly.

### Test 18. Tune + Span Output Accuracy Test

Troubleshoot the A8 Frequency Control assembly.

### Test 19. SWP Output Accuracy Test

This failure is probably caused by a faulty A8 Frequency Control assembly.

### Test 20. HSWP Output Voltage Test

The HSWP signal originates on the A1A1 Host/Processor assembly or A1A2 RAM/ROM assembly. Verify that the J connector is properly installed and then troubleshoot the A1 or A1A1 assemblies.

### Test 21. Line Triggering Test

If there is a one-piece controller assembly (70900-60078 or 70900-69078), check to see if the lower-right corner of the assembly has two crisscrossed resistors attached to stand-off posts. If these resistors are not present, verify that the external trigger and high sweep cables are properly connected to the A1 assembly. If the cables are correctly installed replace the A1 assembly. If these resistors are present, or if the module has an A1A2 RAM/ROM assembly, the problem is usually caused by a faulty A1 assembly.

### Test 22. LED Check Test

The A1A1 Host/Processor assembly (or A1A2 RAM/ROM assembly), provides the power and control of the LED's through J7 pins 1 thru 7 and pins 44 thru 50. A TTL high to the front-panel assembly turns the LEDs off.

## Test 23. Video Bandwidth Test

If this test fails check the POS PEAK detector on the A2 Video assembly.

## Test 24. 300 MHz Reference 40 kHz Sidebands Test

The 40 kHz sidebands on the rear-panel 300 MHz outputs is effected by the routing of the 300 MHz cables. Cables routed by the A3 Power Supply assembly near the fuses are especially susceptible to sidebands. Route the cables around A6A1J6 and A6A1J7 so that they are routed away from the power supply assembly.

## Test 25. Calibrator Harmonics Test

If this test fails, install the module on an HP 70001-60013 Module Extender and remove the module's cover. Check the 300 MHz signal at A6A1J1 for >0 dBm power with harmonics <-30 dBc. If the power or harmonics levels are incorrect, the problem is on the A6A1 100 MHz assembly. If the power and harmonics are correct, the problem is a faulty A4A1 300 MHz assembly.

## Test 26. Calibrator Output Impedance Test

If this test fails, install the module on an HP 70001-60013 Module Extender and remove the module's cover. Connect the verification test equipment directly to A4A1J3 bypassing the cable to the front-panel CALIBRATOR jack. Replace the cable if the return loss improves by greater than 2 dB. If there is no improvement, the problem is a faulty A4A1 300 MHz assembly.

## Test 27. 300 MHz Reference Isolation Test

If this test fails, remove the A4A1 300 MHz assembly from the A4 casting. Verify that the conductive gasket is present in all the casting and cover grooves. If the gasket is present, reassemble and run the test again. If the test still fails, the problem is a faulty A4A1 300 MHz assembly.

## Test 28. External Reference Test

If this test fails, refer to the A6A1 100 MHz Assembly paragraph of the A6/A8 YTO PLL Troubleshooting section. If everything mentioned looks correct, the reference line is probably being toggled. A faulty A6A1 100 MHz assembly is the probable cause.

## Test 29. Reference Oscillator Stability Test

If the module has not been properly warmed-up for at least one hour, the reference could still be unstable. If the module is warmed-up, check the 100 MHz crystal on the A6A1 100 MHz assembly.

## Test 30. Reference Oscillator Shot Noise Test

If the module has not been properly warmed-up for at least one hour, the reference could still be unstable. If the module is warmed-up, check the 100 MHz crystal on the A6A1 100 MHz assembly.

## Test 31. YTO Linearity Test

If this test fails, the most probable cause is the A6A5 YTO, the next most probable cause is the A8 Frequency Control assembly.

# Adjustment Procedure Failures

The following troubleshooting instructions are grouped according to module adjustment procedure. If an HP 70900A fails an adjustment, look up the procedure in the list and follow the instructions. Before troubleshooting, always check to ensure that the failure is not caused by the test equipment or associated cables. If a previous repair involved removal of assemblies, check to ensure that connector pins were not bent during replacement.

### Adj. 1. Video Processor Adjustment

If the A2 Video assembly cannot be adjusted, the problem is usually on the A2 assembly. However, the interface with the A1A1 Host/Processor assembly may also cause this adjustment to fail.

### Adj. 2. 100 MHz Ref/300 MHz Bandpass Filter Adjustment

If this adjustment fails, refer to the A6A1 100 MHz Assembly paragraph in A6/A8 YTO PLL Troubleshooting.

### Adj. 3. 300 MHz Bandpass Filter Adjustment

If this adjustment fails, refer to the A4A1 300 MHz Assembly paragraph in A4 Idler PLL Troubleshooting.

### Adj. 4. Calibrator Output Frequency Adjustment

Troubleshoot the A6A1 100 MHz assembly. The failure is usually caused by one of the inductors in the assembly's oscillator circuit. The oscillator's crystal may also contribute to the problem.

### Adj. 5. Calibrator Output Amplitude Adjustment

If this adjustment fails, check to see that A4A1R84 is a 2000Ω resistor and A4A1R85 is a 1300Ω resistor as per service note 70900A-10. If these changes have already been made refer to the A4A1 300 MHz Assembly paragraph in A4 Idler PLL Troubleshooting.

### Adj. 6. 300 MHz Reference Output Amplitude Adjustment

This adjustment is dependent upon the previously performed 300 MHz Calibrator Amplitude Adjustment. If that test has been done and the power will not adjust, refer to the A4A1 300 MHz Assembly paragraph in A4 Idler PLL Troubleshooting.

### Adj. 7. FFS VCO Adjustment

If this adjustment fails, refer to the FFS Unlock paragraph in A7 FFS PLL Troubleshooting.

### Adj. 8. FFS TUNE/COMP Coarse Adjustment

The A7A2 FFS Analog assembly is the most probable causes of the failure of the tune-compensation potentiometer to adjust for a 0V difference.

### Adj. 9. FFS Reference Null Adjustment

The A7A2 FFS Analog assembly is almost always the cause of this adjustment failing. However, the reference feedthrough is also a function of the tune voltage sent to the A7A1 FFS VCO.

### Adj. 10, 11, and 12. FFS API 1,2,3 Adjustment

If these adjustments fail, replace the A7A2 FFS Analog assembly.

### Adj. 13. FFS TUNE/COMP Fine Adjustment

The A7A2 FFS Analog assembly is the usual cause for not being able to null the spurs. The A7A1 FFS VCO may also cause this if there are gross non-linearities in the tuning curve.

### Adj. 14. FFS Spurious Responses Adjustment

This test checks the API and Tune Compensation adjustments at various points across the frequency range of the FFS. Troubleshoot the A7A2 FFS Analog Assembly.

### Adj. 15. Low Idler Adjustment

If this adjustment fails, refer to the Idler Unlock paragraph in A4 Idler PLL Troubleshooting.

### Adj. 16. Sweep Offset Adjustment

A failure is usually due to the integrator on the A8 Frequency Control assembly. Make certain the jumper used to short-out the resistor during the adjustment is a good short.

CAUTION

**When shorting out R30, be careful not to ground the case of U29. Grounding U29's case destroys the device.**

### Adj. 17. Frequency Control Voltage References Adjustment

An adjustment failure is usually caused by the A8 Frequency Control assembly. If the A1 or A8 assemblies have been removed and re-installed, check to see if one of the pins on the A5 Motherboard connector is bent.

## Adj. 18. YTO Frequency Endpoints Adjustments

If this adjustment fails, troubleshoot the A8 Frequency Control assembly. Check the signals from the A1A1 Host/Processor to the A8 assembly. If the A1 or A8 assemblies have been removed and re-installed, check to see if one of the pins on the A5 Motherboard connector is bent. The A6A5 YTO may also be a cause of failure.

## Adj. 19. FM Gain Adjustment

If this adjustment fails, and the FM coil on the YTO is not open, the problem is probably on the A8 Frequency Control assembly.

## Adj. 20. Sweep Overshoot Adjustment

If this adjustment fails, troubleshoot the sweep-ramp generating loop on the A8 Frequency Control assembly.

## Adj. 21. Tune + Span Offset Adjustment

If this adjustment fails, troubleshoot the A8 Frequency Control assembly.

## Adj. 22. Idler Buffer Adjustment

If the spur power cannot be adjusted lower than -72 dBc, tune the module to 4635 MHz. Connect an HP 8566B Spectrum Analyzer to A6A3J2 (Idler Buffer Output). If the power of the spur at 5400 MHz is less than -77 dBc replace the A6A4 Converter assembly. If the spurs power is greater than or equal to -77 dBc, replace the A4A3 Idler microcircuit.

High phase noise from the A6A5 YTO can cause the spur adjustment program to fail. To insure that you are actually working on a spur, tune the HP 8566B to the spur and increase the span of the HP 8566B to 100 Hz. Verify that there is indeed a spur present. If none is present, the most probable cause of the noise is the A6A5 YTO. If not, refer to the Noise paragraph of A6/A8 YTO PLL Troubleshooting.

If the program shows spurs with power levels greater than -40 dBc between 5100 MHz to 5600 MHz, A6A2R9 will have to be adjusted. Adjust A6A2R9 to decrease the voltage at A6A4J2 pin 1 by 0.5V and rerun the program. Repeat until the spurs disappear. If the spur limit cannot be met, replace the A6A4 assembly.

# A1A1 Host/Processor and A1A2 RAM/ROM Troubleshooting

Make certain that no two modules have the same HP-MSIB address. Duplicate addresses cause the HP-IB bus to lock up. Install the HP 70900A on the HP 70001-60013 Extender Module and remove the cover.

## Power-Up Sequence Failure

The HP 70900A has failed its power-up sequence when any of the following conditions exist:

a. No analyzer display after pressing the **[DISP]** key, then {SELECT INST}
b. All front-panel LEDs stay on
c. No front-panel LEDs are on
d. LEDs other than MEASURE are blinking

If any of the above conditions exist, check the power supplies for the A1A1 Host/Processor assembly at the following points:

A1J6 pin 48 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +5.2V ±0.1V
A1J6 pin 49 . . . . . . . . . . . . . . . . . . . . . . . . . . . . +13.5V ±0.2V

If these voltages are incorrect, refer to A3 Power Supply Troubleshooting. If the voltages are correct, MSIB cable W20 must be checked. To check the cable, substitute the Backplane Interconnect Cable (HP Part Number 5062-1933) from the HP 70900A LO Service Kit. Connect one end of the cable to A1J4 and the other end to the extender module. Connect the interconnect cable's power supply jack to A3J4. Power up the module. If the module completes its Power Up sequence, replace W20.

## Front-Panel Self Test LED

If the HP 70900A firmware date is 860203 or earlier, refer to the paragraph titled Normal/Test Switch in this section. If the SELF TEST LED on the front panel of the HP 70900A is on or flashing after power up, it is indicating one of the errors listed below. If the module cannot complete the power-up sequence, replace the A1A2 RAM/ROM assembly as the most probable cause. If the problem still occurs, replace the A1A1 Host/Processor assembly.

**SELF TEST and IDL LEDs on:** The ROM checksum test has failed. The ACT LED will also be on if more than one error has been detected. Replace the A1A2 RAM/ROM assembly if any of the following conditions are met:

a. No other LEDs are on
b. SRQ on
c. TLK on
d. TLK and SRQ on
e. LSN on
f. LSN and SRQ on

g. LSN and TLK on
h. LSN,TLK, and SRQ on

**SELF TEST, IDL, and FFS LEDs on:** The RAM checksum test has failed. The ACT LED will also be on if more than one error has been detected. Replace the A1A2 RAM/ROM assembly if any of the following conditions exist:

a. No other LEDs on
b. SRQ on
c. TLK on
d. TLK and SRQ on

**SELF TEST, IDL, FFS, and YTO LEDs on:** The interrupt checksum test has failed. The ACT LED will also be on if more than one error has been detected. Replace the A1 Host assembly if any of the following conditions exist:

a. SRQ on
b. TLK on
c. TLK and SRQ on
d. LSN on
e. LSN and SRQ on
f. LSN and TLK on
g. LSN, TLK, and SRQ on

## HP-IB Troubleshooting

Verify the HP-IB address by pressing the **[DISP]** key, then {ADDRESS MAP}. Rotate the RPG until the HP 70900A shows up on the map (the ACT LED should light when the address-map cursor encloses the LO module address). Verify that the HP-IB address in the box is the desired address. If not, change the address, cycle power, and try again.

If the HP-IB address is correct, check A1S1 (HP-IB Enable Switch). Verify that it is in the "ON" position. If it is not, set it to "ON" and try again.

Substitute W20 back-plane interconnect by using the 5062-1933 interconnect from the HP 70900A Service Kit. Plug the 50 pin interconnect into A1J4, then reinstall the A1 assembly into the HP 70900A. Connect the interconnect to the extender module, and the power supply connection to A3J4. Power up the module. If it now functions normally over HP-IB, replace W20 back-plane interconnect. If there is still a problem, replace the A1A1 Host/Processor assembly.

## Normal/Test Switch

CAUTION

**Setting NORMAL/TEST switch A1A1S2 to the TEST position and then cycling power will cause all downloaded programs, user-defined keys, contents of the recall registers, and all memory functions in the HP 70900A to be erased.**

If the HP 70900A will not complete its Power-Up sequence, and all of the above methods of isolating the problem have been exhausted, set the A1A1S2 NORMAL/TEST switch to the TEST position, and cycle the module's power. If the module still fails the Power-Up sequence, replace A1A1 Host/Processor or A1A2 RAM/ROM assemblies.

If the module passes the sequence, set the switch to the NORMAL position and cycle the power. If the module cannot complete the Power Up sequence, replace the A1A1 Host/Processor or A1A2 RAM/ROM assemblies.

# A3 Power Supply Troubleshooting

Check the two banks of LEDs on the top of the A3 assembly. The supplies with the green LEDs (DS2) are fused by F1 (closest to the back of the module). The supplies with the yellow LEDs (DS1) are fused by F2. Both fuses are 2A. All power supplies are distributed to the board assemblies through the A11 Wire Harness except those listed below. These supplies are distributed through the A10 Motherboard assembly. The supply for the A9 Front-Panel comes from the A1 assembly through the A10 assembly.

A1A1 Host/Processor: +5.2V, +13.5V

A2 Video Processor: +15V, +13.5V, +5.2V, -5.3V, -13.5V

A8 Frequency Control: +15V, +13.5V, +5.0V, -13.5V

## Blown Fuses

The quickest way to troubleshoot a blown fuse is to remove the connectors going to A3J1 and J2 (wire harness connectors on the top of the A3 assembly), replace the blown fuse, then power-up the HP 70900A. If the fuse does not blow, replace J1.

If the fuse blows, remove all of the A11 Wire Harness connectors on top of the A4 Idler PLL and A7 FFS PLL assemblies and replace the fuse. Replace the wire-harness connectors one at a time until the fuse blows indicating the faulty assembly.

**CAUTION**

**Improperly connecting the wire-harness connectors may cause damage to the module. Do not offset the wire-harness connectors when connecting them to an assembly.**

If the fuse did not blow when A3J1 was replaced, remove all of the wire-harness connectors to the A6 YTO PLL assembly and follow the procedure above for A3J2.

If the fuse blows again after removing the A3J1 and J2 connectors, remove the A1 assembly, then the A2 assembly, then the A8 assembly, and power the HP 70900A up each time an assembly is removed. If the fuse continues to blow after removing these assemblies, replace A3 Power Supply.

## Loaded Down Supplies

Use the procedure for blown fuses to troubleshoot individual supply problems. Valid power supply measurements are listed in Table 5-2. If the power supplies are close to their ranges, it does not necessarily mean that the A3 assembly is bad. More likely, a supply is being loaded down by another assembly.

*Table 5-2. A3 Power Supply Measurements*

| Supply | Measurement Point | Valid Range |
|---|---|---|
| –3.25V | A3J1 pin 1 | –3.15V to –3.35V |
| –5.0V | A3J1 pin 6 | –4.93V to –5.07V |
| –5.3V | A3J1 pin 2 | –5.22V to –5.36V |
| –13.5V | A3J1 pin 3 | –13.38V to –13.65V |
| –10V | A3J1 pin 4 | –9.45V to –10.45V |
| –25V | A3J1 pin 5 | –23.49V to –26.43V |
| +5.0V | A3J1 pin 7 | +4.95V to +5.08V |
| +5.2V | A3J4 pin 11 | +5.1V to 5.3V |
| +13.5V | A3J1 pin 9 | +13.30V to +13.65V |
| +15V | A3J1 pin 10 | +14.25V to +15.75V |

# A4 Idler PLL Troubleshooting

## Idler Unlock

If an FFS Unlock is reported with the Idler Unlock, repair the FFS Unlock before performing this procedure.

1. Connect an HP 8566B Spectrum Analyzer to A6A3J3 (Idler Buffer Out). Verify the power output under the following conditions (from the State Worksheet):

| Condition | Power |
|---|---|
| IDLER is low | -18 to -32 dBm |
| IDLER is high | -12 to -26 dBm |

2. If the power measured in step 1 is incorrect, connect an HP 8566B to A4A3J1 (A4 Idler PLL output). Verify the power output under the following conditions:

| Condition | Power |
|---|---|
| IDLER is low | -4 to -14 dBm (Harmonics <-11 dBc) |
| IDLER is high | 0 to -10 dBm (Harmonics <-9 dBm) |

3. If the power or harmonics measured in step 2 is incorrect, refer to the A4A2 Idler Lock Assembly paragraph. If the power and harmonics levels are correct, check the power supplies going to A6A3J2 at A11P7. A11P7 is the wire harness jack that connects to A6A3J2.

| A11 Wire Harness | Power Supply |
|---|---|
| A11P7 pin 1 (8 wire from A6A2) | -5 to -12V |
| A11P7 pin 4 (91 wire from A3) | +5V ±0.2V |

4. If the voltages measured in step 3 are correct, replace the A6A3 assembly. If the procedure reveals no problems on the A4A2 assembly, replace A4A3 Idler micro-circuit.

## Frequency Error

1. Connect an HP 8566B Spectrum Analyzer to A7A1J1 (FFS VCO output). Verify that the FFS START and FFS STOP frequencies are correct (from State Worksheet) and measure the output power. If the power is greater than zero dBm, refer to A7 FFS PLL Troubleshooting. If the frequencies and power at A7A1J1 are correct, refer to the A4A2 Idler Lock Assembly paragraph.

2. If the A4A2 assembly is working properly, connect an HP 8566B Spectrum Analyzer to A4A3J1 and a DVM to A4A2J3. Remove the cable to A4A2J2. The voltage should measure more negative than

-23V. If the voltage is incorrect, replace the A4A2 assembly. The signal on the HP 8566B should measure within the following frequency ranges:

| Condition | Frequency |
|---|---|
| IDLER is low | >3585 MHz |
| IDLER is high | >5385 MHz |

3. Reconnect the cable to A4A2J2 and then remove the RF cable to A4A1J1. The voltage at A4A2J3 should measure more positive than -2V. If the voltage is incorrect, replace the A4A2 assembly. The signal on the HP 8566B should be within the following frequency ranges:

| Condition | Frequency |
|---|---|
| IDLER is low | <3510 MHz |
| IDLER is high | <5310 MHz |

4. If the frequencies measured in steps two and three are incorrect, replace the A4A3 assembly. If the frequencies are correct, reconnect the RF cable to A4A1J1.
5. Have the analyzer take a sweep.
6. If the voltage at A4A2TP2 is between -3V and -21V and the HP 70900A front panel IDL LED is on, measure the voltage at A4A2J1 pin 1 (LIDLK). If the voltage is a TTL high, troubleshoot the A4A2 assembly. If the voltage measures a TTL low measure the voltage at A1J6 pin 41 on the A1A1 Host/Processor assembly. If the voltage is a TTL low, the A1A1 Host/Processor assembly or A1A2 RAM/ROM assembly is bad. If the voltage is a TTL high, follow the LIDLK line through the A10 Motherboard assembly to the A8 Frequency Control assembly to see where the LIDLK changes state.
7. Connect an HP 8566B to A4A2TP1 using a 1:1 probe and a dc blocking capacitor. Check for a signal between 5 MHz and 130 MHz with an amplitude greater than -55 dBm. If the signal meets these specs, the A4A2 assembly is bad. If the signal falls out of the frequency range or has low amplitude, change the A4A3 assembly.

## A4A1 300 MHz Assembly

1. Connect an HP 436A Power Meter with an HP 8482A Power Sensor to A6A1J1 (300 MHz out). Verify that the power is greater than 0 dBm. Connect an HP 8566B Spectrum Analyzer to A6A1J1. If the harmonics are -25 dBc or greater in power, refer to the A6A1 100 MHz Assembly paragraph of A6/A8 YTO PLL Troubleshooting.
2. If the harmonics at A6A1J1 are less than -25 dBc, reconnect the cable to A6A1J1. Connect the power meter to the module's front-panel CALIBRATOR. Verify that the power is -10 dBm, ±0.3dB. If the power is incorrect, adjust or replace the A4A1 assembly.
3. Connect the power meter to the module's rear-panel 300 MHz 1 jack. Verify that the power is 0 dBm, ± 1 dB. If the power out is incorrect, run the Calibrator Output Amplitude Adjustment and then the 300 MHz Reference Output Amplitude Adjustment. Connect the spectrum analyzer to the jack and measure the harmonics. If the harmonics are -30 dBc or greater in power, replace the A4A1 assembly. Repeat this procedure for the rear-panel 300 MHz 2 jack.

4. Measure the voltage at A4A1J2 pin 1 (300 MHz post-filter detector). If the voltage is less than or equal to +0.2V, replace the A4A1 assembly.

5. Measure the voltage at A4A1J2 pin 2 (AGC voltage). If the voltage is greater than or equal to +1.2V, replace the A4A1 assembly.

6. Measure the voltage at A4A1J6 pin 3 (600 MHz detector). If the voltage is less than or equal to +1.1V, replace the A4A1 assembly.

## A4A2 Idler Lock Assembly

1. Remove the A7 FFS PLL assembly and install it on extender cables. Remove the A4A2 assembly's cover.

2. Refer to the "State Worksheet" in this chapter to determine if the IDLER STATE is high or low.

3. Measure the voltage at A4A2J1 pin 3. If the IDLER STATE is low, the voltage should be a TTL high. If the IDLER STATE is high, the voltage should be a TTL low.

4. Measure the voltage at A4A2J4. If the IDLER STATE is low, the voltage should be -3.5V to -9V. If the IDLER STATE is high, the voltage should be -0.5V to +0.5V. If the voltage is incorrect, troubleshoot the A4A2 assembly.

5. Measure the voltage at A4A2J5. For ambient temperatures (20 to 30 C), the voltage should be +12.0V ±0.6V. If the voltage is incorrect, troubleshoot the A4A2 assembly.

6. Measure the voltage at A4A2J6. If the IDLER STATE is low, the voltage should be -0.5V to +0.5V. If the IDLER STATE is high, the voltage should be -7.5V to -9V. If the voltage is incorrect, troubleshoot the A4A2 assembly.

7. Measure the voltage at A4A2J8. The voltage should be +4V to +5.1V. If the voltage is incorrect, troubleshoot the A4A2 assembly.

8. Measure the voltage at A4A2J9. The voltage should be -9.0V to -10.1V. If the voltage is incorrect, troubleshoot the A4A2 assembly.

## Spurious/Sideband/Noise

In the following text, it is assumed that the frequency and power at the rear-panel 300 MHz outputs and at A4A3J1 (A4 Idler PLL output) are correct. If the rear-panel 300 MHz signals are incorrect, refer to the A4A1 300 MHz Assembly paragraph in A4 Idler PLL Troubleshooting. If the A4 Idler PLL output is incorrect, refer to the Idler Unlock and Frequency Error paragraphs in A4 Idler PLL Troubleshooting.

Use this procedure to troubleshoot spurious signals, sidebands, or noise; the procedure is the same for all three conditions. This section applies if either of the following conditions exist:

- Spurious, sidebands, or high noise conditions are found on the rear-panel LO output and at A4A3J1 (A4 Idler PLL output) but not at A7A1J1 (A7 FFS PLL output).

- Spurious, sidebands, or noise conditions are found on the rear-panel 300 MHz outputs A4A1J4-J5 but not at A6A1J1 (A6A1 300 MHz output).

1. If spurious, sidebands, or noise are on the A4 Idler PLL output, perform steps 1a and 1b.

   a. Connect an HP 8566B Spectrum Analyzer to A4A3J1 (A4 Idler PLL output). Spurious signals should be less than -71 dBc for offsets below 15 kHz. Spurs beyond the 15 kHz offset fall outside the YTO Lock Loop's bandwidth and should be less than -60 dBc. If the spurs do not meet these specifications, connect the spectrum analyzer to A7A1J1 (A7 FFS PLL output). If the spurs are on the FFS signal, refer to A7 FFS PLL Troubleshooting.

   b. The phase noise at A4A3J1 should be less than -91 dBc at a 1 kHz offset (measured in a 1 Hz resolution bandwidth). If the phase-noise is not within the this limit, connect the spectrum analyzer to the output of the A7A1J1 (A7 FFS PLL). The phase noise should be less than -94 dBc at 1 kHz offset (measured in a 1 Hz resolution bandwidth). If the phase noise is not within the limit, refer to A7 FFS PLL Troubleshooting.

**NOTE**

**The ability to make phase noise measurements on an HP 8566B Spectrum Analyzer is based on the typical noise performance rather than the specified noise performance.**

2. If spurious, sidebands, or noise are on the rear-panel 300 MHz outputs and A4 Idler PLL output (but not on the A7 FFS PLL output), perform steps 2a and 2b.

   a. Connect an HP 8566B Spectrum Analyzer's RF input, through a 300 MHz Upconverter to A4A1J5. (Refer to the end of Chapter 3, Verification Tests, for information on constructing the upconverter.)

   b. Measure the phase noise at A4A1J5. The spurs should be less than -69 dBc, and phase noise less than -91 dBc (1 Hz) at 1 kHz offset. If the phase noise and spurs measure within these limits continue with step 5. If the limits are not met, connect A6A1J1 (300 MHz out) to the upconverter. If the spur and noise performance still does not meet the limits, replace the A6A1 assembly. If the specifications are met, change or troubleshoot the following assemblies in the order listed: A4A3 Idler Microcircuit, A4A2 Idler Lock assembly, and A4A1 300 MHz assembly.

### NOTE

**The -69 dBc spur limit out of the 300 MHz Upconverter is not an HP 70900A performance specification; it is an indication of performance. A spur at this level would produce a spur on the high idler (worst case) at about -71 dBc.**

3. The Idler PLL produces an output in two frequency ranges. The previous steps have confirmed spurs in the Idler PLL's low or high frequency range. The (following) remaining steps changes the output of the Idler PLL to the remaining frequency range and checks for spurs. If the spurs are not on the other frequency range, replace the A4A3 Idler Microcircuit.

4. Connect an HP 8566B Spectrum Analyzer to A4A3J1 and confirm the spurs on the Idler PLL output. (The HP 70000 Spectrum Analyzer must be in zero span.)

5 Press the following keys on the HP 70000 Spectrum Analyzer: **[MNU]**, {Misc}, {MORE}, {catalog}, and {STATE}. Write down the LOSTART frequency. (LOSTART should equal LOSTOP.) The Idler PLL output changes its frequency range when the LO frequency passes through 4.4375 GHz:

| **LO Frequency** | **Idler Freq. Range** |
|---|---|
| ≤4.4375 GHz | low (3.530 to 3.565 GHz) |
| 4.4375 GHz | high (5.330 to 5.365 GHz) |

6. A change in the analyzer's center frequency will cause an equal change in the analyzer's LO and Idler PLL frequencies. To change the Idler PLL frequency range, press {freq} and {center freq}, and change the center frequency of the analyzer according to the following rules:

   a. Change the center frequency by the amount needed to change the LO frequency through the 4.4375 GHz point. For example, if the LO frequency is 5.0 GHz, decrease the analyzer's center frequency more than 625 MHz. (5.0 GHz 4.375 GHz = 0.625 MHz)

   b. The change in center frequency must be a multiple of 25 MHz. This will ensure that the A7 FFS PLL output frequency will not change. In the example in step a, the analyzer frequency could be decreased by 650 MHz.

7. Locate the Idler PLL output signal on the HP 8566B Spectrum Analyzer. If no spurs are present, change the A4A3 Idler Microcircuit. If the spurs are present in both the low and high frequency ranges, the most likely cause is the A4A2 then the A4A3 assemblies.

# A6/A8 YTO PLL Troubleshooting

## YTO Unlock

The following measurement criteria are for functional values and are not intended as test limits. Test limits are verified by HP 70900A Module Verification Tests.

**NOTE**

**Any Idler Unlock or FFS Unlock should be repaired before troubleshooting the A6/A8 YTO PLL.**

Make sure Analyzer Test has been run before starting this procedure. To perform Analyzer Test, press the [MENU] key, {misc}, {MORE}, {SERVICE}, and {ANALYZER TEST} on the system display. (Always wait at least 30 seconds after power up before performing the test.) Analyzer Test checks the presence of key reference signals, the ability of the three phase-lock loops to lock at their maximum and minimum points, the linearity of all DACs (Digital to Analog Converter), and the ADC (Analog to Digital Converter). If any errors other than YTO Unlocks 7012, 7013, or 7016 are reported, refer to Error Codes in this chapter.

1. Confirm the proper power supply levels to A6A1, A6A2, A6A3, and A6A4 on W21 harness connectors.

2. The voltage at A6A1J5 pin 1 should measure 0.65V to 0.85V. This is the 12.5 MHz detector voltage (the 12.5 MHz signal is the YTO PLL's reference).

3. The voltage at A6A1J7 pin 2 should measure 0.65V to 0.85V. This is the 125 kHz detector voltage (the 125 kHz signal is the FFS PLL's reference).

4. The voltage at A6A1J7 pin 3 should measure 0.5V to 2.1V. This is the 50 MHz detector voltage (the 50 MHz signal is the sampler bias level).

5. Tune the analyzer to the settings that cause YTO PLL unlock and fill in the State Worksheet located at the beginning of this section.

6. Measure the A6/A8 YTO PLL output power at the rear-panel LO jack (A6A4J3). The power should be greater or equal to +5 dBm and less than +12 dBm. If the power is not within this limit, measure the power out of the A6A5 YTO assembly. The power should be +11 dBm, ±3 dB. If the power is incorrect, replace the A6A5 assembly. If the power is correct, run the YTO Frequency Endpoints Adjustment.

7. If the unlock condition still exists, measure the power and frequency of the Idler PLL signal supplied to A6A4J1. (Disconnect W18 at A6A4J1 and measure the signal out of W18.) The correct Idler frequency is on the State Worksheet filled out at the start of this procedure. The power should be within the limits below. If the power and/or frequency are not correct, refer to A4 Idler PLL Troubleshooting.

| Idler state | Idler PLL Output Power to A6A4J1 |
|---|---|
| low | -18 to -28 dBm |
| high | -14 to -24 dBm |

8. Reconnect W18. Monitor A6A2TP1 with an oscilloscope and a 10:1 probe. When the YTO is locked, there should be a 12.5 MHz rectangular waveform about 0.8 Vp-p (ECL levels through a capacitor). When the YTO is unlocked, this frequency will be in the 0 to 25 MHz range.

9. If the waveform at A6A2TP1 has rounded edges, write down the spectrum analyzer's span and sweeptime settings. Set the spectrum analyzer to a 1 GHz span with a sweeptime to 20 seconds. Have the spectrum analyzer take another sweep.

10. After the sweep is initiated, the waveform at A6A2TP1 should be rectangular sweeping from 0 to 25 MHz. If the waveform is still rounded or missing, place the A8 assembly on extender cables and remove the A6A2 assembly casting cover. This may be done without removing the entire A6 assembly.

11. Return the spectrum analyzer to the settings recorded in step 5. Use an HP 8566B Spectrum Analyzer and a 1:1 probe with a dc blocking capacitor to check A6A2J7 and J8 for a signal >-55dBm from 0 to 25 MHz. If the signal is missing or low, check the voltages supplied to the A6A4 assembly. If these measure correctly replace A6A4. If the signal at A6A2J7 and J8 is >-55 dBm, and the waveform is still rounded replace the A6A2 assembly.

12. Connect an oscilloscope with a 10:1 probe to A6A2U3 pin 11. Check that there is a 12.5 MHz ECL rectangular wave. If there is no signal, refer to the A6A1 100 MHz Assembly Troubleshooting section (J4).

13. Set the HP 71000 Spectrum Analyzer to a 100 Hz span. Use a SMB snap-on tee to connect a DVM between A6A2J3 and W4. Connect an oscilloscope to A6A2J2 pin 8. Look up the Lock Polarity value in the State Worksheet.

14. Find the values of A6A2J2 pin 8 and the Lock Polarity in Table 5-3 and follow the instructions contained in the corresponding "Action/Status" column.

*Table 5-3. YTO PLL State*

| TTL Logic at A6A2J2 pin 8 | Lock Polarity | Action/Status |
|---|---|---|
| TTL High | POS | Functioning Properly |
| TTL Low | NEG | Functioning Properly |
| TTL Low | POS | Replace A8 |
| TTL High | NEG | Replace A8 |

15. Remove the cable to A6A2J1. Find the values of A6A2J2 pin 8, A6A2J3, and the Lock Polarity in Table 5-4 and then follow the instructions listed in the corresponding "Action/Status" column.

*Table 5-4. YTO PLL State (W19 Removed)*

| TTL Logic at A6A2J2 pin 8 | Lock Polarity | Voltage at A6A2J3* | Action/Status |
|---|---|---|---|
| TTL High | NEG or POS | +9V | Functioning Properly |
| TTL High | POS | < +9V | Replace A6A2 |
| TTL Low | NEG or POS | <-9V | Functioning Properly |
| TTL Low | NEG | >-9V | Replace A6A2 |

*< indicates "more negative than"
> indicates "more positive than"

16. Replace the cable to A6A2J1. Remove the power supply connector on top of A6A4. Find the values of A6A2J2 pin 8, A6A2J3, and the Lock Polarity in Table 5-5 and then follow the instructions listed in the corresponding "Action/Status" column.

*Table 5-5. YTO PLL State (Power Removed)*

| TTL Logic at A6A2J2 pin 8 | Lock Polarity | Voltage at A6A2J3* | Action/Status |
|---|---|---|---|
| TTL High | NEG or POS | <-9V | Functioning Properly |
| TTL High | POS | >-9V | Replace A6A2 |
| TTL Low | NEG or POS | > +9V | Functioning Properly |
| TTL Low | NEG | < +9V | Replace A6A2 |

*< indicates "more negative than"
> indicates "more positive than"

17. Replace the power supply connector on top of A6A4. Install the connector with the red wire towards the rear panel. Have the analyzer take a sweep. If the voltage at A6A2J3 is between -8V and +8V and the message YTO IS UNLOCKED is still displayed, check A6A2J2 pin 6 for a TTL low. If A6A2J2 pin 6 is not TTL low, replace the A6A2 assembly.

18. Connect an HP 3325A Function Generator to A8J1. Set the function generator to a -9V to +9V sine wave of 1 kHz.

19. Connect an HP 8566B Spectrum Analyzer to the rear-panel LO jack (A6A4J3). If the signal excursion is between 30 to 45 MHz, the A6/A8 YTO PLL is probably functioning properly. If the signal excursion at A6A4J3 is incorrect, connect an oscilloscope to A8TP4-4.

20. The signal at A8TP4-4 should be a -9V to +9V, ±0.5V sine wave. If the sine wave is not there, replace A8. If it is there, but the signal excursion is incorrect, change the A6A5 assembly.

21. Change the function generator to 20 Hz. If the signal excursion on the HP 8566B is not between 30 to 45 MHz, change the A8 assembly.

## A6A1 100 MHz Assembly

Fill out the State Worksheet and run Analyzer Test before starting this procedure. To run Analyzer Test, press the **[MENU]** key, {MORE}, {service}, and {ANALYZER TEST} on the system display. (Always wait at least 30 seconds after power up before performing the test.) Analyzer Test checks the presence of key reference signals, the ability of the three phase-lock loops to lock at their maximum and minimum points, the linearity of all DACs (Digital to Analog Converter), and the ADC (Analog to Digital Converter).

1. Set an HP 8566B Spectrum Analyzer to the following settings:

| | |
|---|---|
| Center Frequency | 100 MHz |
| Span | 1 MHz |
| Resolution BW | 10 kHz |

2. Connect the HP 8566B Spectrum Analyzer to A6A1J1. If the signal is less than -2 dBm, perform the 300 MHz Bandpass Filter Adjustment in Chapter 4. After performing the 300 MHz Bandpass Filter Adjustment, the signal at A6A1J1 should be greater than -2 dBm. If the power is still low, check the State Worksheet for the value of REF. If REF is INTERNAL, perform step 2a. If REF is EXTERNAL, and there is no external reference applied, perform step 2b.

   a. Connect a DVM to A6A1J3 pin 5. If A6A1J3 pin 5 is a TTL high, replace the A6A1 assembly. If A6A1J3 pin 5 is not a TTL high, change the A8 assembly.

   b. Check A6A1J3 pin 2 with a DVM. If the voltage is greater than +25 mV, replace the A6A1 assembly. If it is less than or equal to 25 mV, replace the A2 Video Processor assembly.

3. Connect an HP 8662A Synthesized Signal Generator to A6A1J2. Set the generator to 100 MHz at 0 dBm.

4. Set the HP 70000 Spectrum Analyzer to continuous sweep. If the analyzer's Extended State shows internal reference, measure A6A1J3 pin 2 with a DVM. If pin 2 is ≥ +50 mV, replace the A2 Video assembly. If A6A1J3 pin 3 is less than +50 mV, replace the A6A1 assembly.

5. Check the output of A6A1J4 with an oscilloscope and a 10:1 probe. Check for an ECL signal at 12.5 MHz. If it is not present, change the A6A1 assembly.

6. Tune the HP 70000 Spectrum Analyzer to a center frequency of 300 MHz with a 1 MHz span.

7. Use an HP 5316A Universal Counter to verify that there is a 125.00 kHz pulse at A6A1J6. If there is no pulse, check A6A1J7 pin 4 with a DVM. If it measures -5V, change the A6A1 assembly. If it measures 0V, change the A8 assembly.

8. Tune the spectrum analyzer to a center frequency of 300 MHz with a 100 Hz span.

9. Use the universal counter to verify that there is a 124.84 kHz signal at A6A1J6. If there is no signal, check A6A1J7 pin 4 with a DVM. If the DVM reads 0V, change the A6A1 assembly. If it is -5V, change the A8 assembly.

10. Place the A1, A3, and A8 assemblies on extenders. Remove semi-rigid cable W17 (A4A3J1 to A6A3J1). Unsnap semi-rigid cable W16 (A6A5 to AT1) from the clips on the A10 Motherboard assembly. Remove the four screws securing the A6 assembly to the module's frame. Remove the A6A1 cover.

11. Connect at oscilloscope with a 10:1 probe to A6A1J8. If a 50 MHz waveform is not present, change the A6A1 assembly.

## Spurious/Sideband

All spurious and sidebands are referred to as spurs in this procedure. The troubleshooting procedure is the same for both. Fill in the State Worksheet to determine key frequencies and switch positions at the settings where the spurs occur. This procedure applies to HP 70900A modules that have spurs on A6A1J1 (300 MHz output) or spurs on the rear-panel LO output but not on A6A3J2 (Idler Buffer output).

1. If the power or frequency of the rear-panel LO output jack is incorrect, refer to the YTO Unlock paragraph of A6/A8 YTO PLL Troubleshooting. If the power or frequency of the front-panel CALIBRATOR jack or rear-panel 300 MHz jacks is incorrect, refer to the A6A1 100 MHz assembly paragraph.

2. Connect an HP 8566B Spectrum Analyzer to the module's rear-panel LO output jack (A6A4J3). Lock the module's reference to the HP 8566B by connecting the HP 8566B's 100 MHz Calibrator output, through an HP 8447A Amplifier, to the module's rear-panel 100 MHz jack.

3. Have the HP 70000A Spectrum Analyzer take a sweep to enable the external reference. If the spurs disappear, the internal reference is bad. Replace the A6A1 100 MHz assembly. Leave the external reference connected.

4. If the spurs are not caused by the internal reference and occur in offsets less than 1 kHz, place the HP 70900A on the HP 70001-60013 Module Extender. If no spurs are present or if they are greatly reduced in amplitude, replace the A8 Frequency Control assembly.

5. Perform the LO Output Spurious Response verification test in Chapter 3. If the test fails, perform the FFS Spurious Responses Adjustment in Chapter 4.

6. If the spurs at A6A4J3 are 24 kHz sidebands, replace the A6A5 YTO or A8 Frequency Control assembly. If the spurs are 40 kHz sidebands, connect the HP 8566B Spectrum Analyzer to the Idler output (A4A3J1). If the 40 kHz spurs can be seen here with similar amplitude, replace the A3 Power Supply assembly. If not, replace the A6A5 YTO.

7. All spurs should be less than -71 dBc at room temperature. If the spurs are ≥-71 dBc, connect an HP 8566B Spectrum Analyzer to A6A3J2 (Idler buffer output). If the spurs at A6A3J2 are seen here refer to "Spurious/Sideband/Noise" in "A4 Idler PLL Troubleshooting."

8. If there are no spurs at A6A3J2, connect the HP 8566B Spectrum Analyzer to A6A1J4 (12.5 MHz Reference output) through a dc blocking capacitor.

9. If the spurs are at A6A1J4, replace the A6A1 assembly. If not, connect A6A1J1 (300 MHz Reference output) to the input of 300 MHz Upconverter. Connect the output of the upconverter to the input of the HP 8566B Spectrum Analyzer. Instructions for assembling the 300 MHz Upconverter are included in Chapter 3 of this manual. If the spurs of interest are greater than -69 dBc, change the A6A1 assembly.

10. If no failed assembly has been found, the most probable cause of the spurs is the A6A5 YTO, and the second most probable cause is the A8 Frequency Control assembly.

# A7 FFS PLL Troubleshooting

## FFS Unlock

Make sure that Analyzer Test is completed and all resulting errors checked in their reported order. Tune the HP 70000 Analyzer to the settings where any A7 unlock occurs. Fill out the State Worksheet and troubleshoot the unlock conditions with the following procedure.

1. Connect an HP 5316A Universal Counter to A6A1J6. If no signal is present, refer to the A6A1 100 MHz Assembly paragraph of A6/A8 YTO PLL Troubleshooting.

2. Connect a DVM to A6A1J7 pin 4. Measure the frequency at A6A1J6 with the universal counter. The signal should be at ECL levels (high = -0.6V, low = -1.5V). Table 5-6 shows the correct voltage and frequency values for the Divide number listed on the State Worksheet. If the voltage is incorrect, change the A8 Frequency Control assembly. If the voltage is correct but the frequency is not, change A6A1 100 MHz Reference assembly.

*Table 5-6. Measurements at A6A1J6 and A6A1J7 pin 4*

| Divide Number | A6A1J7 pin 4 | A6A1J6 |
|---|---|---|
| ÷800 | -5V | 125kHz |
| ÷801 | 0V | 124.84 kHz |

3. Connect an HP 8566B Spectrum Analyzer to A7A1J1 (A7 FFS VCO output). Connect +10V from a dc power supply to A7A1J3 (FFS VCO tune). The signal frequency should be less than 33.5 MHz with a power greater than zero dBm. Connect -7V from a dc power supply to A7A1J3. The signal frequency should be greater than 70 MHz with a power greater than zero dBm. If the power is low or the frequency extremes cannot be met, change the A7A1 FFS VCO assembly.

4. Lay the HP 70900A on its side so the A1A1 Host/Processor assembly is at the bottom. Remove the three screws securing the A7 assembly to the bottom of the module. Slide the assembly upward about one-half inch, and pull the end with the LED outward. Rotate the assembly 180 degrees so the top of the assembly is against the top cabling of the rest of the module.

5. Connect an HP 3325A Function Generator to the input of a high impedance oscilloscope. Set the function generator to a 10 MHz square wave at ECL levels (high = -0.6V, low = -1.5V). Connect the function generator to A7A1J5. Connect a cable from A6A1J6 to A7A1J6 (125 kHz). Connect an ocilloscope to A7A1J4. Verify that there is a pulse at ECL levels. If not, replace the A7A1 assembly. If it is there, replace the cables to the A7A1 assembly.

6. Remove the cable going to A7A1J3 and place a 50Ω load on the jack. Connect an ocilloscope to A7A1J7. Verify that there is a signal greater than 50 mVp-p. If not, replace the A7A1 assembly. If the signal looks good, replace the A7A2 assembly.

## Spurious/Noise

1. The A7A2 FFS Analog Assembly is almost always the source of spurs caused by the A7 assembly.

2. If noise is the problem, connect a spectrum analyzer, through a dc blocking capacitor, to A6A1J7. If the spur/noise is present on the 124.84/125 kHz signal, replace the A6A1 assembly. If not check to see if the noise increases when the FFS PLL output frequency is around 70 MHz as opposed to around 45 MHz. For every 1 Hz increase in LO frequency, the FFS PLL output decreases 1 Hz. This process repeats every 25 MHz. Find out what the FFS frequency is from the State Worksheet, then tune the LO accordingly.

3. If the noise does increase, replace the A7A1 FFS VCO assembly. If the noise occurs in offsets greater than 3 kHz, then the most probable cause is the A7A1 FFS VCO assembly.

4. If the noise occurs in offsets less than 3 kHz, connect an HP 8663A Synthesized Signal Generator to the HP 70900A rear-panel 100 MHz input. Set the signal generator to 100 MHz at 0 dBm. Have the HP 70900A take a sweep to enable the external reference. If the noise goes away, then replace the A6A1 100 MHz assembly. If it does not, replace the A7A2 FFS Analog assembly.

# Chapter 6

# Replacement Procedures

The procedures in this chapter describe the removal and replacement of all major assemblies. Throughout the procedures, numbers in parenthesis indicate numerical callouts on figures. Refer to Table 6-1 for a complete listing of all required tools and materials.

CAUTION

**The module contains static sensitive components. Refer to "Electrostatic Discharge Information" in Chapter 1 before proceeding.**

The following replacement procedures are included in this chapter:

*Table 6-1. Required Tools*

| Description | HP Part Number |
|---|---|
| 5/16-inch open-end wrench | 8720-0015 |
| 3mm hex (Allen) wrench | 8710-1366 |
| 1/4-inch nut driver | 8720-0002 |
| 9/16-inch nut driver (drilled out, end covered with heatshrink tubing) | 8720-0008 |
| small #1 Posi-drive screwdriver | 8710-0899 |
| large #2 Posi-drive screwdriver | 8710-0900 |
| #0 Phillips screwdriver | 8710-0978 |
| long-nose pliers | 8710-0030 |
| wire cutters | 8710-0012 |

CAUTION

**Many gaskets used in the module conduct electrical current. These gasket are located under assembly covers and around assembly connectors and feed-throughs. Do not misplace these gaskets in the assembly. When removing assembly covers, avoid loosing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

**NOTE**

**All SMA rigid-cable connections should be torqued to 10 IN-LBs.**

# Procedure 1.
# A1 Controller, A1A1 Host/Processor

The controller assembly's reference designator depends upon the module's vintage. Early module versions use the A1 Controller; newer modules use the A1A1 Host/Processor and A1A2 RAM/ROM combination. The following procedure applies to each of these controller assemblies.

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Removing the A1A2 RAM/ROM Assembly from the A1A1 Host/Processor Assembly results in the loss of data stored in RAM. A battery on the A1A1 assembly powers the RAM.**

## Removal

1. Remove the module's cover by removing the eight screws (**1**) (four on top, two on each side) illustrated in Figure 6-1.
2. Remove three screws (**2**), (**3**), and (**4**) and their spacers from the controller assembly (A1 or A1A1).
3. Disconnect wire W11 from the controller assembly's connector (**5**).
4. Carefully work the controller assembly out of its two motherboard connectors. When it is just out of the connectors, but still within the frame, disconnect W14 (**6**).

CAUTION

**The controller assembly can be damaged if it contacts a conductive surface. This possibility exists because of the board-mounted battery.**

4. Carefully move the controller assembly away from the frame, taking care not to damage the W20 HP-MSIB flex-print cable (**7**). Disconnect the flex-print cable and put the assembly on a nonconductive, static protection surface.

## Replacement

5. Reconnect the W20 HP-MSIB flex cable to the controller assembly.
6. Insert the assembly into its motherboard connectors taking care that pins and connectors line up properly before seating the assembly into the connectors.
7. Reconnect W11 cable harness **(5)**.
8. Secure the assembly using the red **(2)**, green **(3)**, and yellow **(4)** spacers and their screws. *(On A1A1 Host Processor Assemblies, place a flat washer on the screw securing the green center spacer.)* Torque screws to 6 IN-LBs.
9. Reconnect W14 cable harness **(6)**.
10. Replace the module's cover. Replace eight screws **(1)**. Torque screws to 6 IN-LBs.

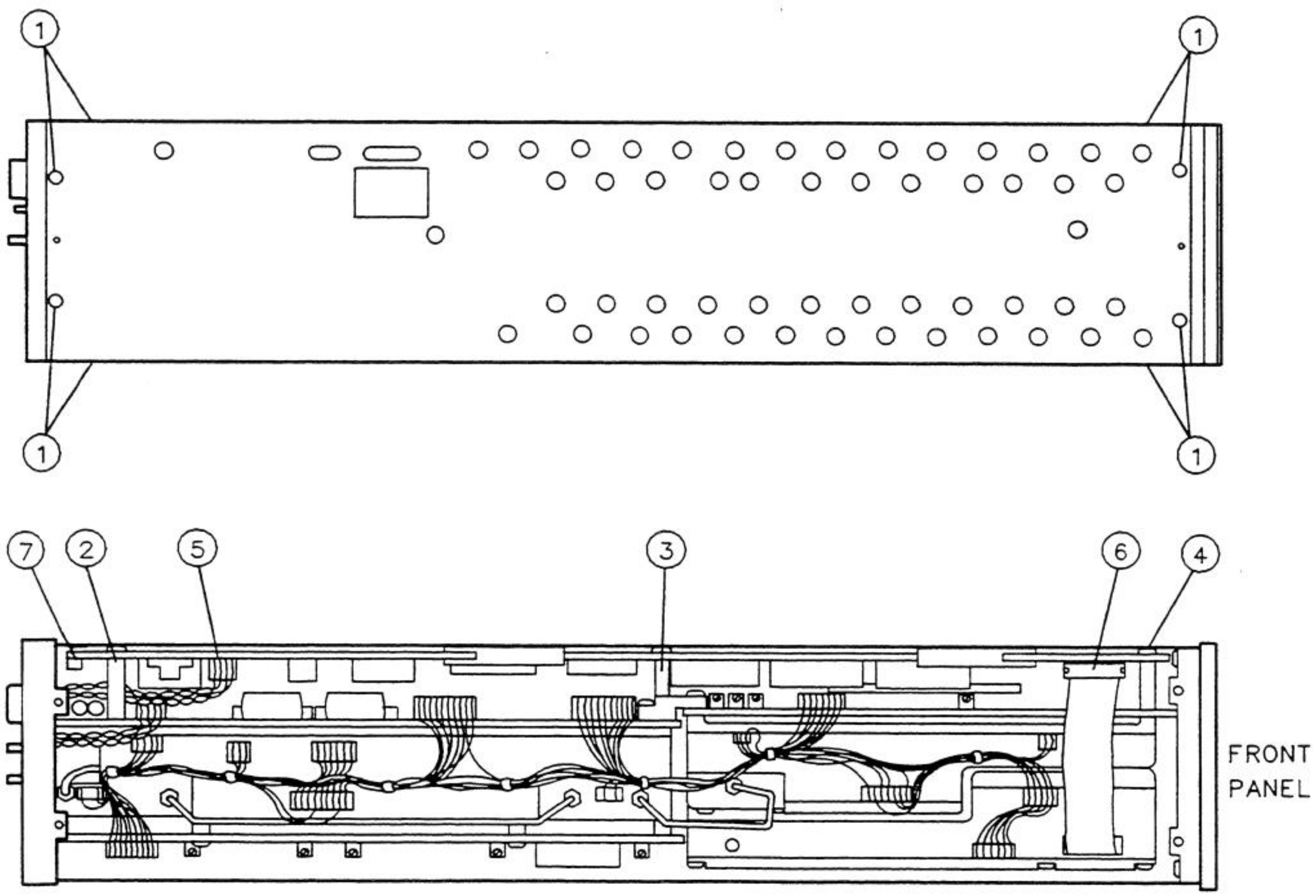



*Figure 6-1. A1 (A1A1) Replacement*

# Procedure 2.
# A1A2 RAM/ROM Assembly

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Removing the A1A2 RAM/ROM Assembly from the A1A1 Host/Processor Assembly results in the loss of data stored in RAM. A battery on the A1A1 assembly powers the RAM.**

## Removal

1. Remove the module's cover by removing eight screws (**1**) (four on top, two on each side) illustrated in Figure 6-1.
2. Remove one screw (**3**) with a star washer, a flat washer, and green spacer from the center top of the A1A2 assembly.
3. Raise the extractors on either end of the A1A2 Assembly. This will withdraw the A1A2 from the connectors on the A1A1 assembly.
4. Remove the A1A2 RAM/ROM Assembly, and place on a non-conductive static-protective surface.

## Replacement

5. Carefully slide the A1A2 into the guides on the A1A1 assembly, seating the connectors firmly until the extractors can be depressed to allow the cover to fit.
6. Replace the green spacer, flat washer, and screw with a star washer (**3**). Torque screw to 6 IN-LBs.

# Procedure 3.
# A2 Video Processor

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Refer to procedure 1 to remove the A1 (A1A1) assembly.
2. Disconnect A11 Wiring Harness (**1**) from the A2 Video Processor Assembly. See Figure 6-2.
3. Remove the bracket and screws (**2**) from the assembly. Carefully work the assembly out of its motherboard connector. When it is just out of the connector, carefully disconnect W6 (**3**).
4. Remove the A2 Video Processor Assembly.

## Replacement

5. Insert the A2 Video Processor Assembly into its motherboard connector.
6. Replace the bracket and screws (**2**) in the assembly. Torque screws to 6 IN-LBs.
7. Reconnect A11 (**1**) and W6 (red) (**3**).
8. Refer to procedure 1 to replace the A1 (A1A1) assembly.

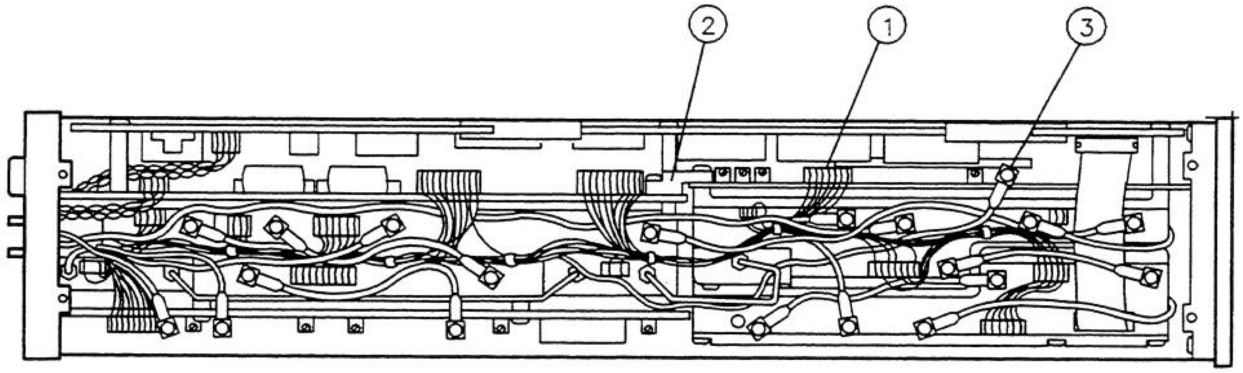



*Figure 6-2. A2 Video Processor Replacement*

# Procedure 4.
# A3 Power Supply

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Refer to procedure 1 to remove the A1 (A1A1) assembly.
2. Disconnect the A11 Wiring Harness from the two connectors (**1**) on the A3 Power Supply Assembly. See Figure 6-3.
3. Remove the screws (**2**) from the assembly.
4. Carefully work the assembly out of its motherboard connector. When it is just out of the connector, disconnect W20 (**3**).
5. Remove the A3 Power Supply Assembly.

## Replacement

6. Insert the A3 Power Supply Assembly into its motherboard connector, taking care not to bend any pins.
7. Replace the screws (**2**) in the assembly. Torque screws to 6 IN-LBs.
8. Reconnect the two A11 connectors (**1**) and W20 (**3**). W20 is a brown/orange/red/yellow twisted-wire pair. W20 has a 5 pin connector that plugs into a 4 pin jack. W20 should be offset one pin to the left as illustrated in Figure 6-3. W20's clear wire should not be connected to a pin. (The clear wire is an unused ground and if W20 is plugged in wrong, over current conditions will be indicated on the mainframe.)
9. Refer to procedure 1 to replace the A1 (A1A1) assembly.

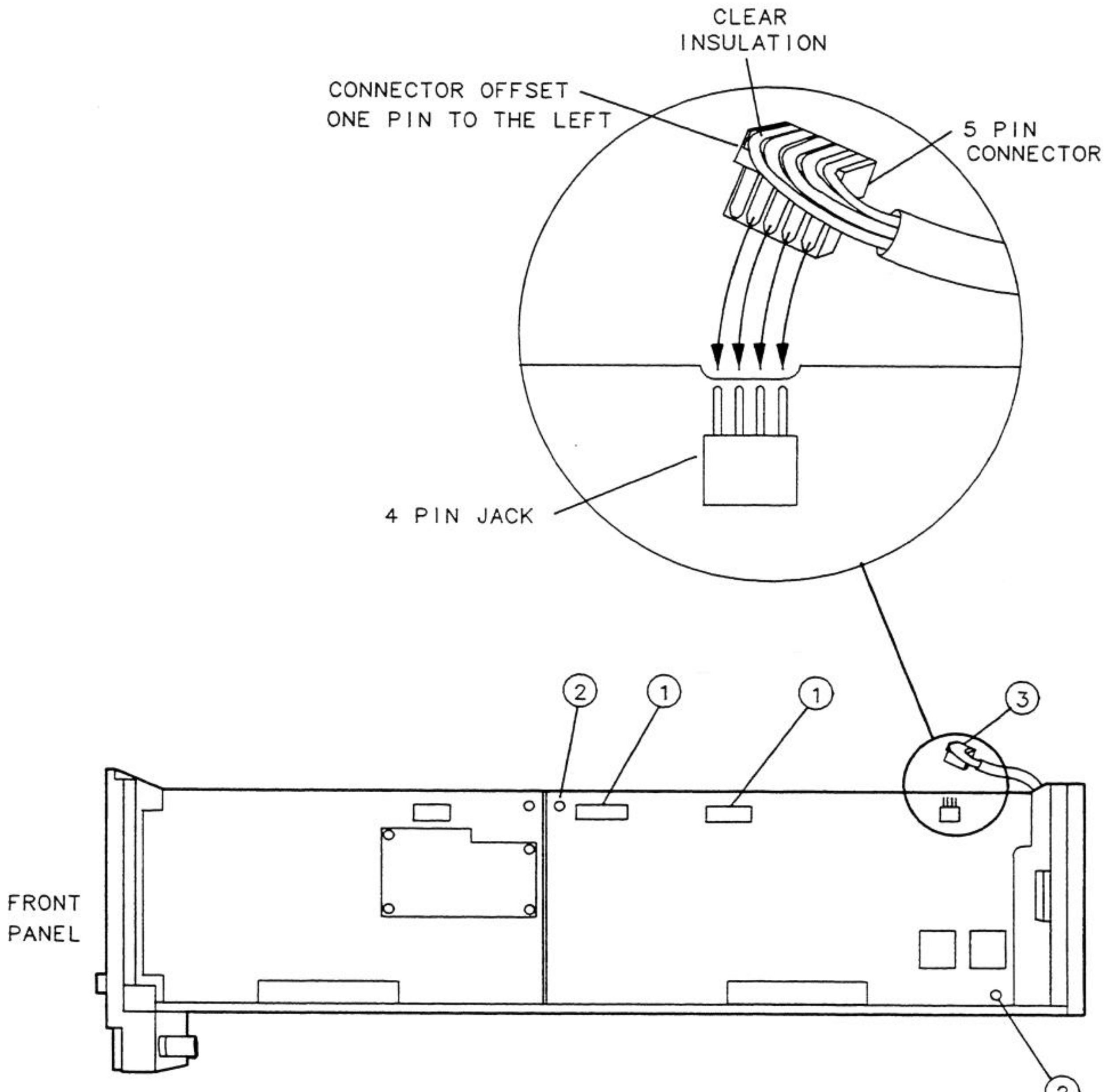



*Figure 6-3. A3 Power Supply Replacement*

# Procedure 5.
# A4 Idler Phase Lock Loop

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Refer to procedure 1 to remove the A1 (A1A1) assembly.
2. Remove three screws (**1**) while the local oscillator (LO) module rests on its left side. See Figure 6-4.
3. Disconnect W2 (**2**), W13 (**3**), W7 (**4**), W3 (**5**), W1 (**6**), and W8 (**7**) from the A4 Idler PLL Assembly. Disconnect W6 (**8**) from the A2 Video Processor.
4. Disconnect the three A11 Wire Harness connectors (**9**).
5. Remove semi-rigid cable W17 (**10**).
6. Remove the front screw from A2/A3 bracket (**11**). Loosen the bracket's back screw.
7. Remove the A4 Idler PLL Assembly.

## Replacement

NOTE

**When replacing screws in an assembly or part, first start all screws, then tighten them evenly.**

8. Place the A4 Idler PLL Assembly into the module.
9. Replace semi-rigid cable W17 (**10**). Torque connector to 10 IN-LBs.
10. Reconnect the four A11 connectors (**9**).
11. Reconnect W1 (brown) (**6**), W3 (orange) (**5**), W8 (orange) (**7**), W13 (blue) (**3**), W2 (red) (**2**), W7 (white/orange) (**4**), and W6 (white/red) (**8**).

12. Reconnect the A11 Wire Harness in four places (**9**).
13. Replace the three screws (**1**) while the LO module rests on its left side. Torque screws to 20 IN-LBs.
14. Refer to procedure 1 to replace the A1 (A1A1) assembly.

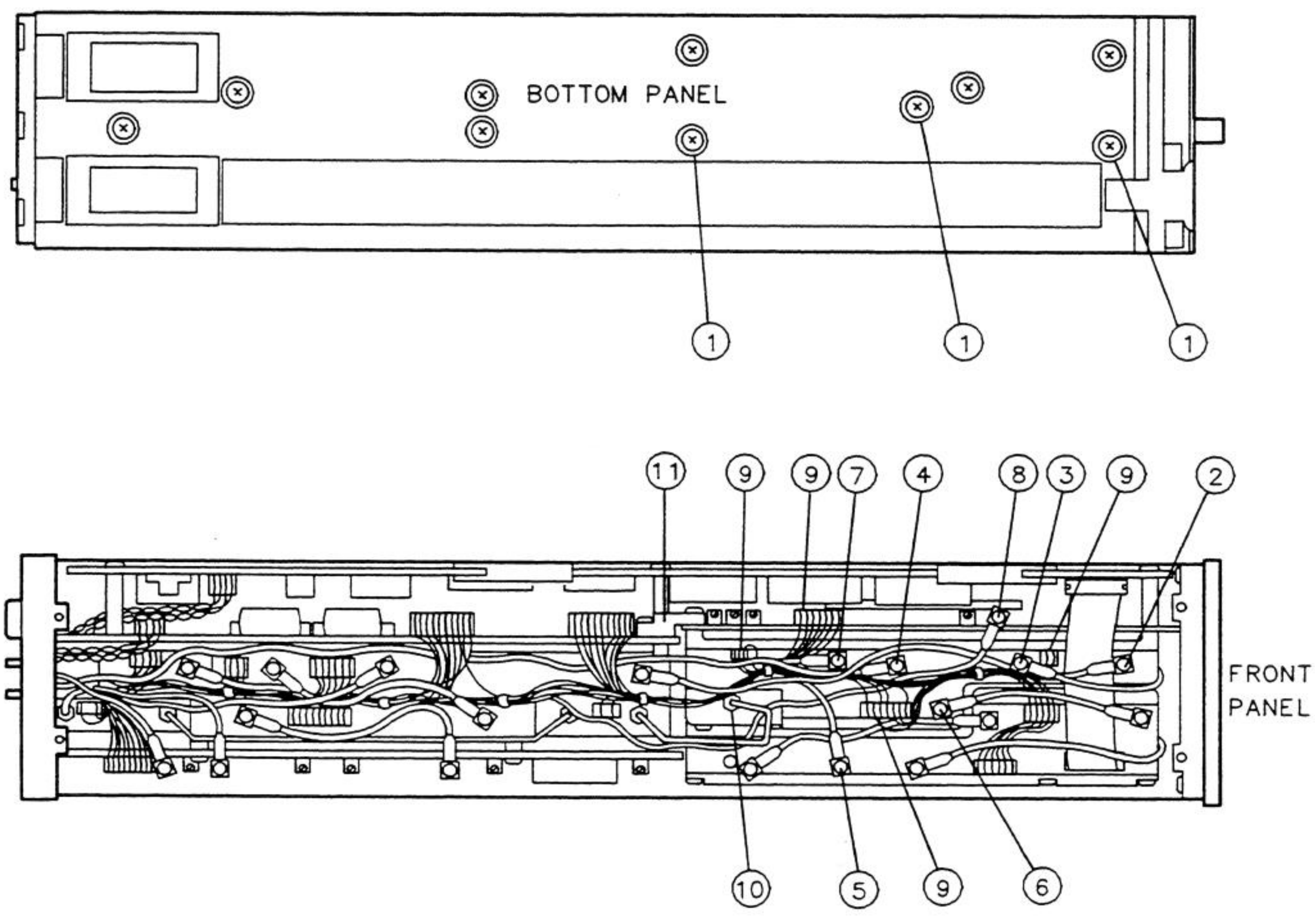



*Figure 6-4. A4 Idler PLL Replacement*

# Procedure 6.
# A4A1 300 MHz Amplifier

**CAUTION**

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

**CAUTION**

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedure 5 to remove the A4 assembly.
2. Remove the six screws (1) from the A4A1 Idler PLL Assembly and remove the cover. When removing this cover, hold the assembly with the cover down and lift the assembly off the cover. This allows the gaskets to remain in their associated channels. See Figure 6-5. Do not lose any RFI gasket material.
3. Remove the screw (2) securing the assembly and lift the assembly straight up. Do not bend the feed-through pin (3) which is inserted into a socket on the back of the board assembly.

## Replacement

**CAUTION**

**When replacing screws in an assembly or part, first start all screws, then tighten them evenly.**

4. If the feed-through pin (3) has been bent, carefully straighten it.

5. Position the A4A1 300MHz Amplifier Assembly in the casting with the socket over the feed-through pin. Press the assembly gently into place, and secure it with a screw. Torque screws to 6 IN-LBs.

6. To install the cover, ensure all gaskets are in their respective cover channels, hold the cover with the gaskets up, and lay the assembly onto the cover. This prevents the gaskets from falling out. Replace the six screws (**1**). Torque screws to 9 IN-LBs.

7. Refer to procedure 5 to replace the A4 assembly.

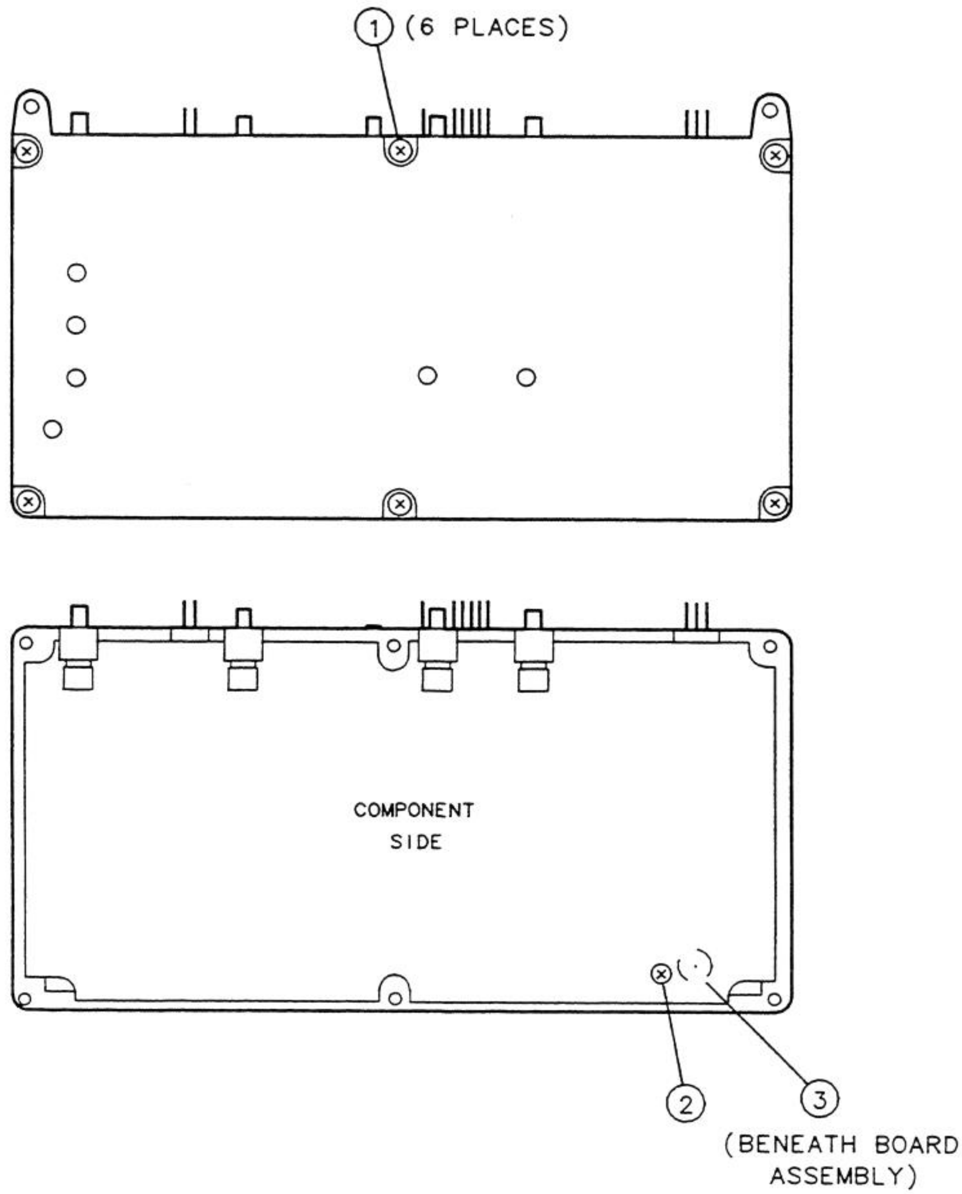



*Figure 6-5. A4A1 300 MHz Amplifier Replacement*

# Procedure 7.
# A4A2 Idler Lock and A4A3 Idler Microcircuit (VCO)

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedure 5 to remove the A4 assembly. The A4A2 Idler Lock Assembly and the A4A3 VCO Microcircuit are removed as an assembly and then separated.
2. Remove four cover screws (1). See Figure 6-6. Remove the cover.
3. Remove the screw (2) from the A4A2 Idler Lock Assembly and the two screws (3) from the A4A3 Idler Microcircuit.
4. Carefully remove the A4A2/A4A3 assembly by lifting straight up. Do not bend the feed-through pin (5) on the bottom of the A4A3 Idler Microcircuit.
5. Use solder wick to unsolder the seven pins (4), and then separate the A4A2 Idler Lock Assembly and the A4A3 Idler Microcircuit.

## Replacement

6. Position the A4A2 Idler Lock Assembly in the casting, and replace the screw (2). Torque screws to 6 IN-LBs.
7. If the feed-through pin (5) on the A4A3 Idler Microcircuit has been bent, straighten it.
8. Carefully position the A4A3 Idler Microcircuit, press it into place, and replace the two screws (3). Torque screws to 6 IN-LBs.

9. Carefully resolder the seven pins (**4**).

10. To install the cover, ensure all gaskets are in their respective cover channels, hold the cover with the gaskets up and lay the assembly onto the cover. This avoids gaskets falling out when the cover is turned over.

11. Replace the A4A3 cover and replace the four screws (**1**). Torque screws to 9 IN-LBs.

12. Refer to procedure 5 to replace the A4 assembly.

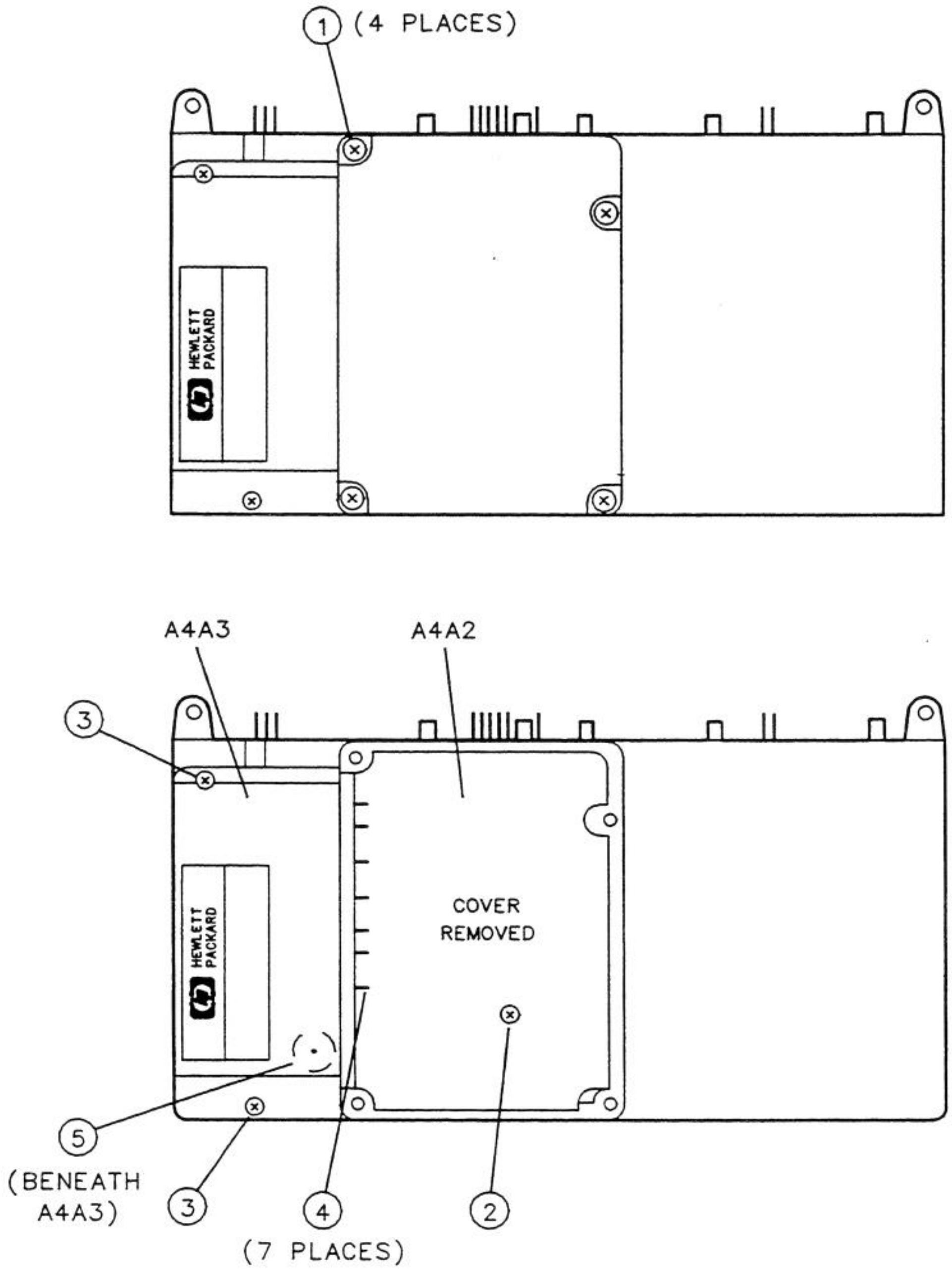



*Figure 6-6. A4A2 and A4A3 Replacement*

# Procedure 8.
# A6 YTO Phase Lock Loop

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Refer to procedures 17 and 1 to remove the A8 and A1 (A1A1) assemblies.
2. Remove the screw (**1**) from the A3 Power Supply Assembly. See Figure 6-7.
3. Remove semi-rigid cable W17 (**2**).
4. Disconnect coaxial cables W6 (**3**), W2 (**4**), W9 (**5**), W19 (**6**), W3 (**7**), and W4 (**8**) from the A2 and A6 assemblies.
5. Remove three screws (**9**) to free the rear panel from the frame.
6. Remove four screws (**10**) to free the A6 assembly from the frame.
7. Remove six A11 Wiring Harness connectors (**12**) from the A6 assembly.
8. Carefully remove W16 from the two motherboard clips (**11**) and lift the A6 assembly high enough to clear the A8 connector (**13**). Remove the A6 YTO Phase Lock Loop Assembly.

## Replacement

NOTE

**All SMA rigid-cable connections should be torqued to 10 IN-LBs.**

NOTE

**If A6AT1 Isolator was removed, secure with two screws torqued to 3 IN-LBs.**

9. Position the A6 YTO Phase Lock Loop Assembly.

10. Press W16 into the two motherboard clips (**11**).

11. Replace four screws (**10**) to secure the A6 assembly to the frame. Torque screws to 20 IN-LBs.

12. Replace three screws (**9**) to secure the rear panel to the frame. Torque screws to 20 IN-LBs.

13. Reconnect six A11 connectors (**12**). There should be no flexible cables under the A11 Wiring Harness.

14. Reconnect coaxial cables W2 (red) (**4**), W9 (green) (**5**), W19 (green) (**6**), W3 (orange) (**7**), W4 (yellow) (**8**).

15. Reconnect W6 (white/red) (**3**) on the A2 Video Processor Assembly.

16. Replace semi-rigid cable W17 (**2**). Torque connector to 10 IN-LBs.

17. Replace the screw (**1**) in the A3 Power Supply Assembly. Torque screw to 6 IN-LBs.

18. Refer to procedures 17 and 1 to replace the A8 and A1 (A1A1) assemblies.

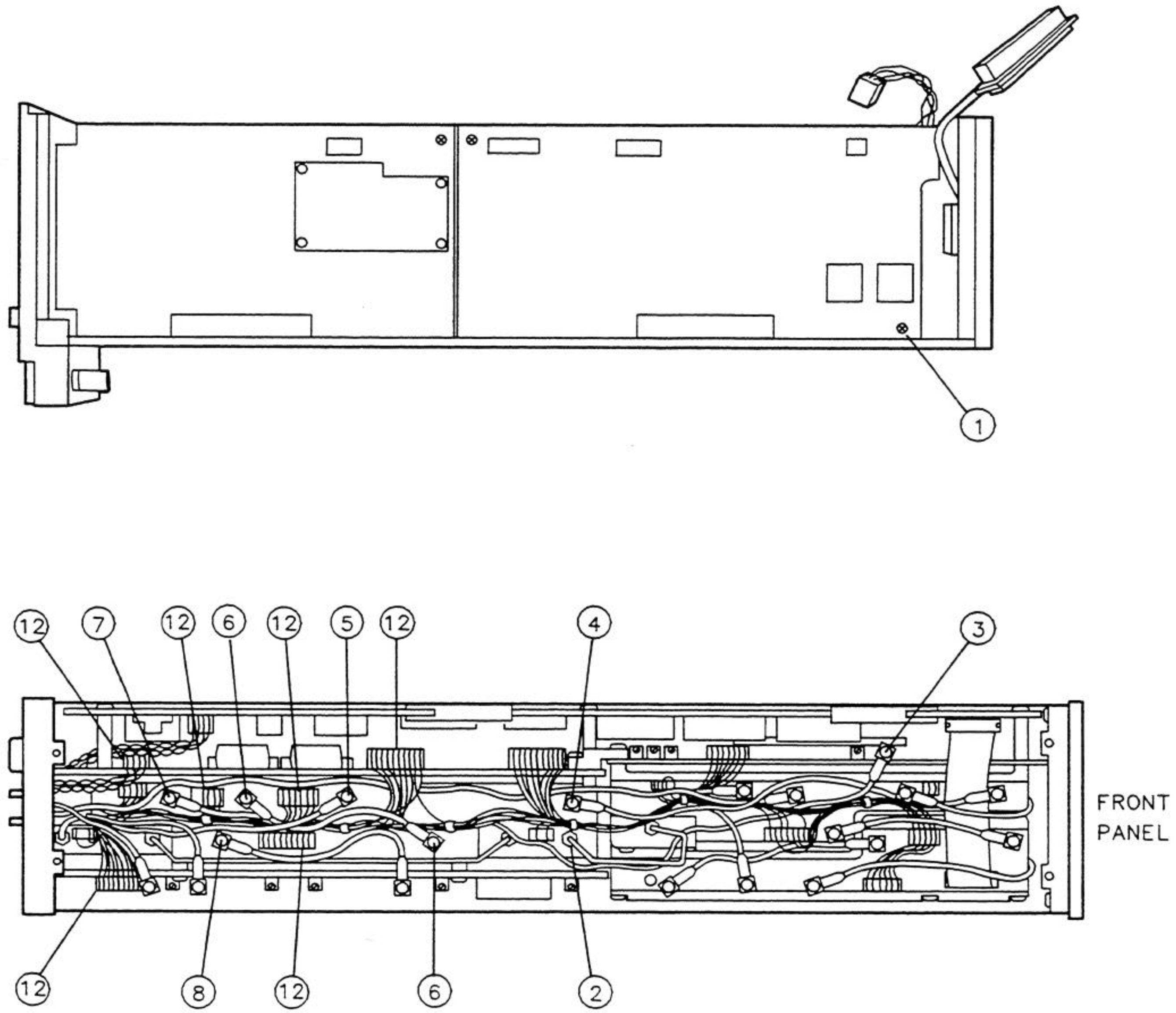



*Figure 6-7. A6 YTO PLL Replacement (1 of 2)*

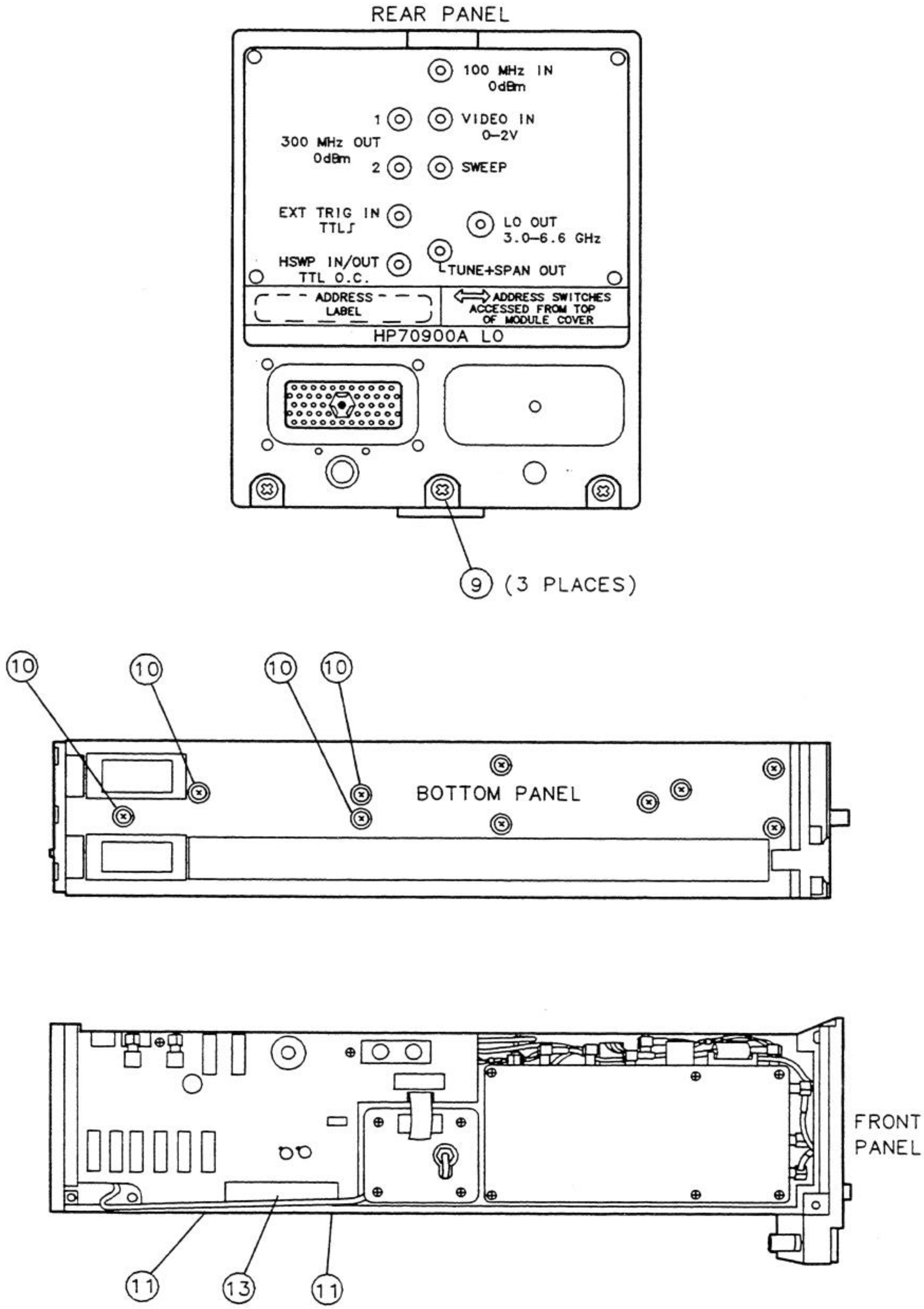



*Figure 6-7. A6 YTO PLL Replacement (2 of 2)*

# Procedure 9.
# A6A1 100 MHz Reference

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedures 17 and 8 to remove the A8 and A6 assemblies.
2. Remove seven screws (**1**) to remove the cover from the A6A1 100 MHz Reference Assembly. See Figure 6-8.
3. Remove three screws (**2**) to free the assembly.
4. Carefully work the board straight up and out of the casting. Do not bend the feed-through (**3**) inserted into the back of the assembly. Do not lose any RFI gasket material that may stick to the back of the assembly.

## Replacement

5. Replace any RFI gasket material missing from the casting grooves.
6. Carefully position the A6A1 100 MHz Reference Assembly and press it into place. Do not bend the feed-through which inserts into the back of the assembly.
7. Replace the three screws (**2**) to secure the assembly. Torque screws to 6 IN-LBs.
8. Position the A6A1 100 MHz Reference Assembly cover and replace the seven screws (**1**). Torque screws to 9 IN-LBs.

9. Refer to procedures 17 and 8 to replace the A8 and A6 assemblies.

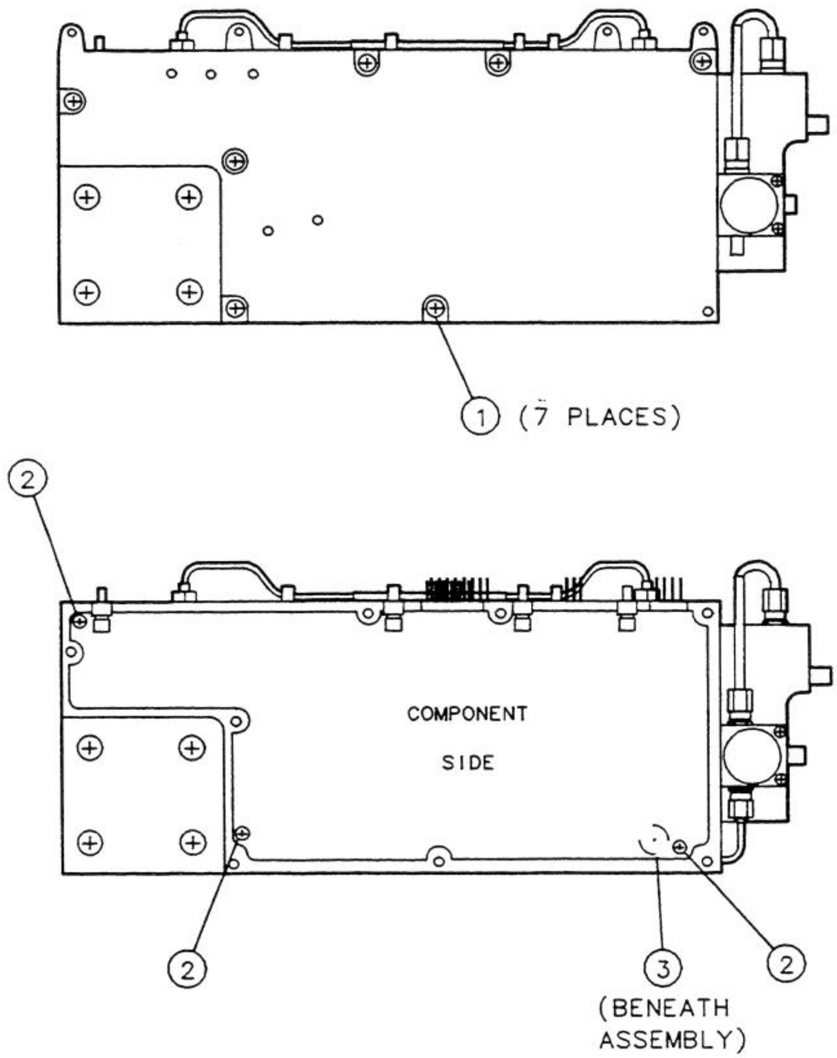



*Figure 6-8. A6A1 100 MHz Reference Replacement*

# Procedure 10.
# A6A2 YTO Lock

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedures 17 and 8 to remove the A8 and A6 assemblies.

2. Remove the four screws (**1**) securing the A6A5 YTO cover and remove the cover. See Figure 6-9.

3. Remove semi-rigid cables W16 (**2**) and W18 (**3**) from the A6 assembly.

4. Remove four screws (**4**) and with the cover side down, remove the A6A2 YTO Lock Assembly from the cover.

5. Disconnect the six slip-on wire connectors (**5**) that electrically connect the A6A2 and A6A4 assemblies.

6. Remove the screw (**6**) from the assembly and remove the A6A2 YTO Lock Assembly from the casting.

## Replacement

7. Position the A6A2 YTO Lock Assembly, press it into place, and replace the screw (**6**) and six slip-on connectors (**5**). Ensure that no wires pass directly over the screw, as they will be damaged when the cover is tightened. Torque screws to 6 IN-LBs.

8. With the cover side down, position the A6A2 YTO Lock Assembly onto the cover and replace the four screws (**4**). Torque screws to 9 IN-LBs.

9. Replace semi-rigid cables W16 (**2**) and W18 (**3**) and replace the A6A5 YTO cover with four screws (**1**). Torque cable connectors to 10 IN-LBs. Torque screws to 6 IN-LBs.

10. Refer to procedures 17 and 8 to replace the A8 and A6 assemblies.

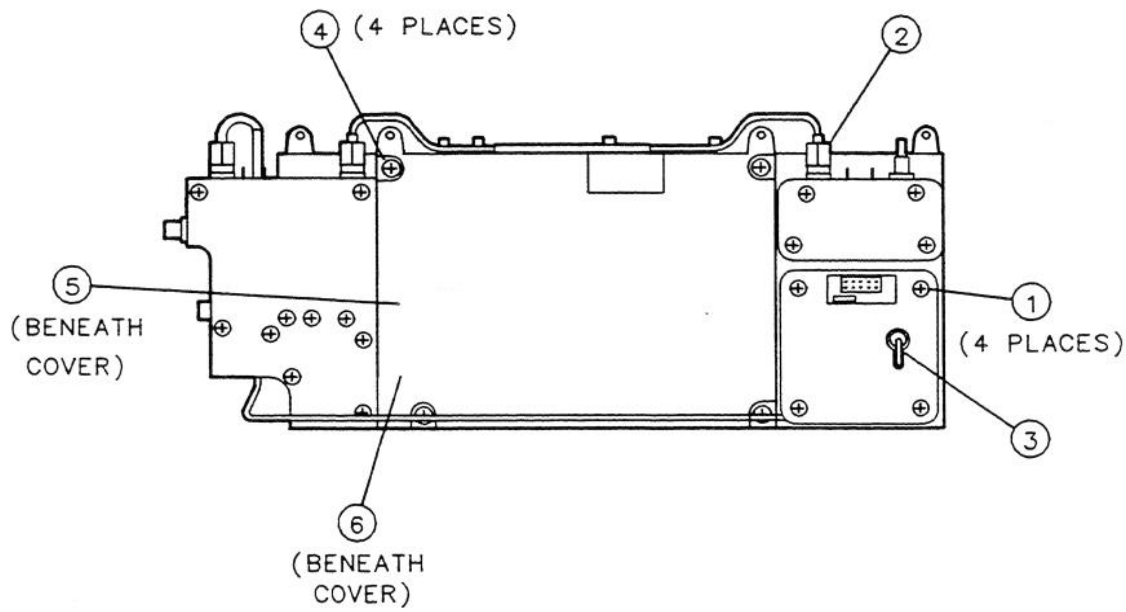



*Figure 6-9. A6A2 YTO Lock Replacement*

# Procedure 11.
# A6A3 Idler Buffer

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedures 17 and 8 to remove the A8 and A6 assemblies.
2. Remove semi-rigid cable W18 (**1**) from the A6 YTO Phase Lock Loop Assembly. See Figure 6-10.
3. Remove four screws (**2**), and remove the cover from the A6A3 Idler Buffer Microcircuit.
4. Remove the two larger screws (**3**) securing A6A3 to the microcircuit casting. Do not try to remove the circuit board from the casting.

## Replacement

5. Position the A6A3 Idler Buffer Microcircuit, and replace two screws (**3**). Torque screws to 9 IN-LBs.
6. Position the microcircuit cover, and replace four screws (**2**). Torque screws to 6 IN-LBs.
7. Replace semi-rigid cable W18 (**1**) on the A6 YTO Phase Lock Loop Assembly. Torque connectors to 10 IN-LBs.
8. Refer to procedures 17 and 8 to replace the A8 and A6 assemblies.

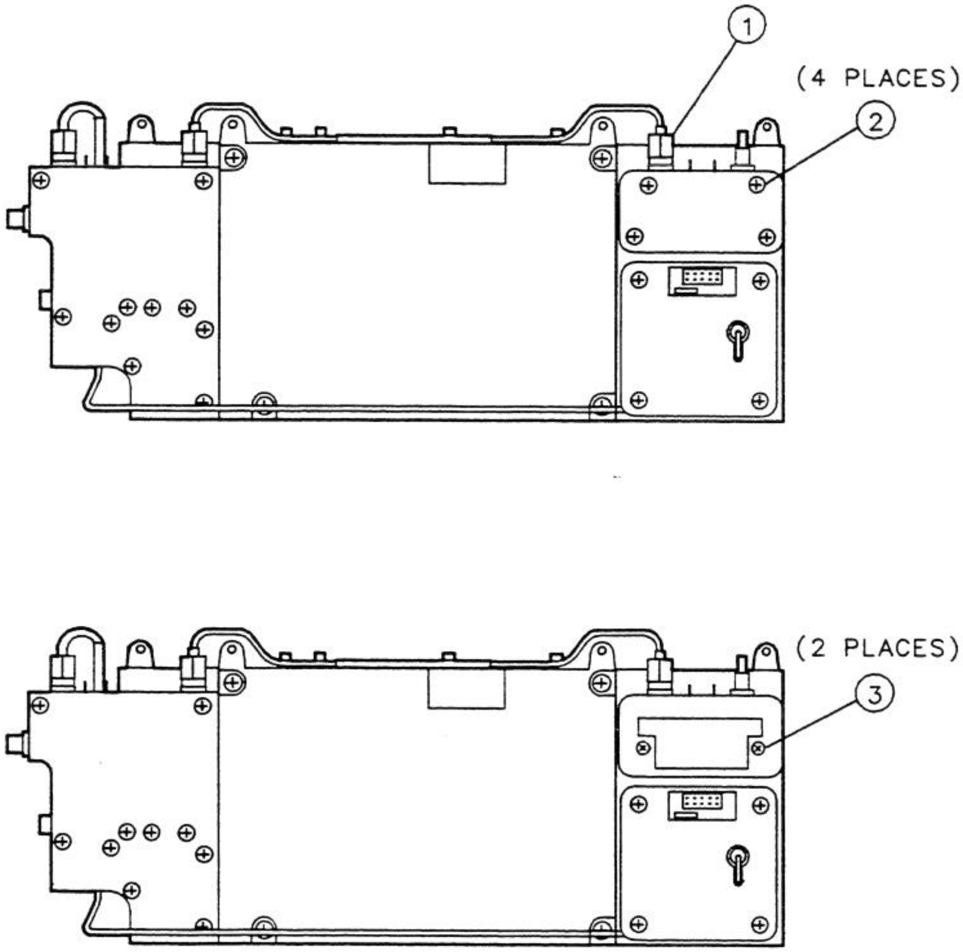



*Figure 6-10. A6A3 Idler Buffer Replacement*

# Procedure 12.
# A6A4 YTO Lock Microcircuit

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedures 17 and 8 to remove the A8 and A6 assemblies.
2. Remove the two screws (1) from the A6AT1 Isolator. See Figure 6-11.
3. Disconnect semi-rigid cables A6W1 (3) and W18 (2) the from A6A4 YTO Lock Microcircuit.
4. Remove four screws (4) from the A6A2 YTO Lock Assembly's cover. With the cover side down, remove the assembly from the cover.
5. Disconnect six slip-on connectors (5) securing the A6A2 wires to the A6A4 assembly.
6. Remove three screws (6) securing the A6A4 assembly. (Two of the screws are under the A6A2 cover that was removed in step 4.)
7. Lift the A6A4 assembly straight up to remove it. Do not bend the feed-through pin located under the assembly.

## Replacement

8. If the feed-through pin has been bent, carefully straighten it.
9. Position the A6A4 assembly and press straight down.

10. Replace three screws (**6**) securing the assembly. Torque screws to 6 IN-LBs.

11. Reconnect six slip-on connectors (**5**) securing the A6A2 wires to the A6A4 assembly.

12. With the cover side down, and gaskets in place, position the A6A2 YTO Lock Assembly onto the cover and replace the four screws (**4**). Torque screws to 9 IN-LBs.

13. Reconnect semi-rigid cables A6W1 (**3**) and W18 (**2**) to the A6A4 YTO Lock Microcircuit. Torque connectors to 10 IN-LBs.

14. Replace the two screws in the A6AT1 Isolator (**1**). Torque screws to 3 IN-LBs.

15. Refer to procedures 17 and 8 to replace the A8 and A6 assemblies.

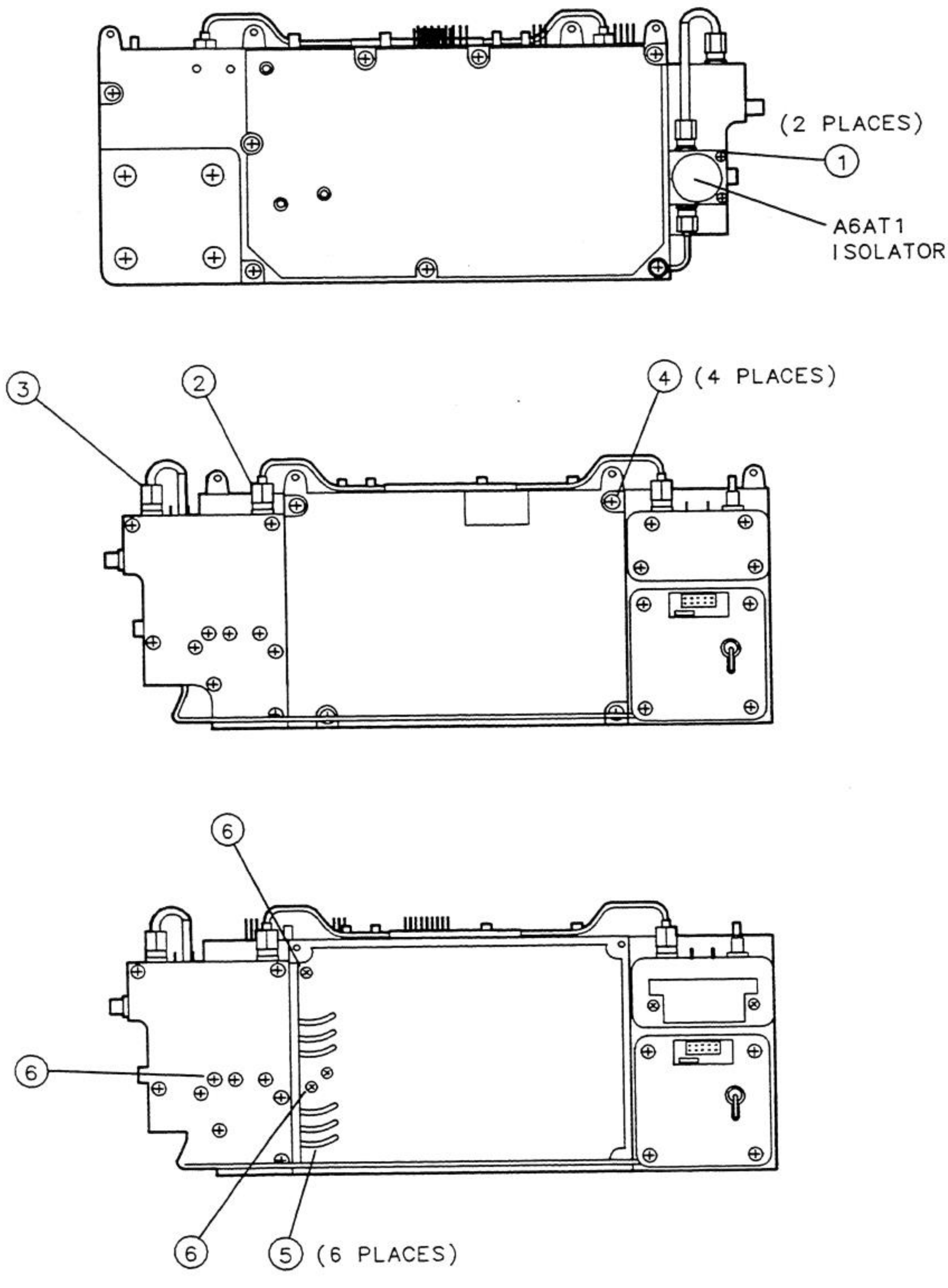



*Figure 6-11. A6A4 YTO Lock Microcircuit Replacement*

# Procedure 13.
# A6A5 YIG Tuned Oscillator (YTO)

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Refer to procedures 1 and 4 to remove the A8 and A6 assemblies.
2. Remove ribbon-cable W15 (**1**) as illustrated in Figure 6-12. Remove the four screws (**2**) securing the A6A5 cover and remove the cover.
3. Disconnect W16 (**3**) at the A6A5 YTO Assembly and free the cable from the two motherboard clips (**4**). Gently swing the cable down and away from the A6A5 assembly.

CAUTION

**When moving W16, avoid placing any permanent bends in the cable. Damage to the cable could result in RF discontinuities.**

4. Remove the four screws and nylon washers (**5**), (**6**), (**7**), and (**8**) securing the A6A5 YTO Assembly to the casting. The screws are located on the back side of the A6 assembly.
5. Carefully remove the YTO and its enclosure can from the A6 assembly casting. Do not loose the nylon insulator located behind the A6A5 assembly.

CAUTION

**The A6A5 YTO Assembly is not secured to its enclosure can. Use one of the screws removed in step 4 to secure the YTO to its can.**

## Replacement

6. Ensure that the nylon insulator is located in the A6 casting. The screws securing the A6A5 assembly to the casting will pass through the A6 casting, through the insulator, and into the A6A5 assembly.

7. Remove the screw securing the A6A5 YTO Assembly to its enclosure can. The screw is located in one of four holes on the back of the can.

8. Insert the A6A5 YTO Assembly into the A6 assembly casting. Orientate the assembly as shown in Figure 6-12. The RF SMA connector should be located towards the front of the module and the ribbon-cable connector torwards the top of the module.

9. From the back side of the A6 casting, use two small-blade screwdrivers to align the holes in the A6 casting, insulator, and A6A5 assembly.

10. Use two screws **(5)**, **(6)**, **(7)**, or **(8)** and nylon washers to secure the A6A5 assembly to the casting. Remove the two alignment screwdrivers and screw the remaining two screws and nylon washers. Do not tighten the four screws.

11. To seat the A6A5 assembly in the casting, turn the module so that the A6A5 assembly hangs from its four securing screws. Tighten the four securing screws in the following order: **(5)**, **(7)**, **(6)**, and **(8)**. Torque screws to 9 IN-LBs.

12. Reconnect W16 **(3)** to the A6A5 YTO Assembly. Secure the cable to the two motherboard clips **(4)**. Torque connector to 10 IN-LBs.

13. Replace the A6A5 cover with four screws **(2)**. Torque screws to 6 IN-LBs.

14. Replace ribbon-cable W15 **(1)**. Only one end of the cable is properly keyed to connect to the A6A5 assembly.

15. Refer to procedures 1 and 4 to replace the A1 (A1A1) and A3 assemblies.

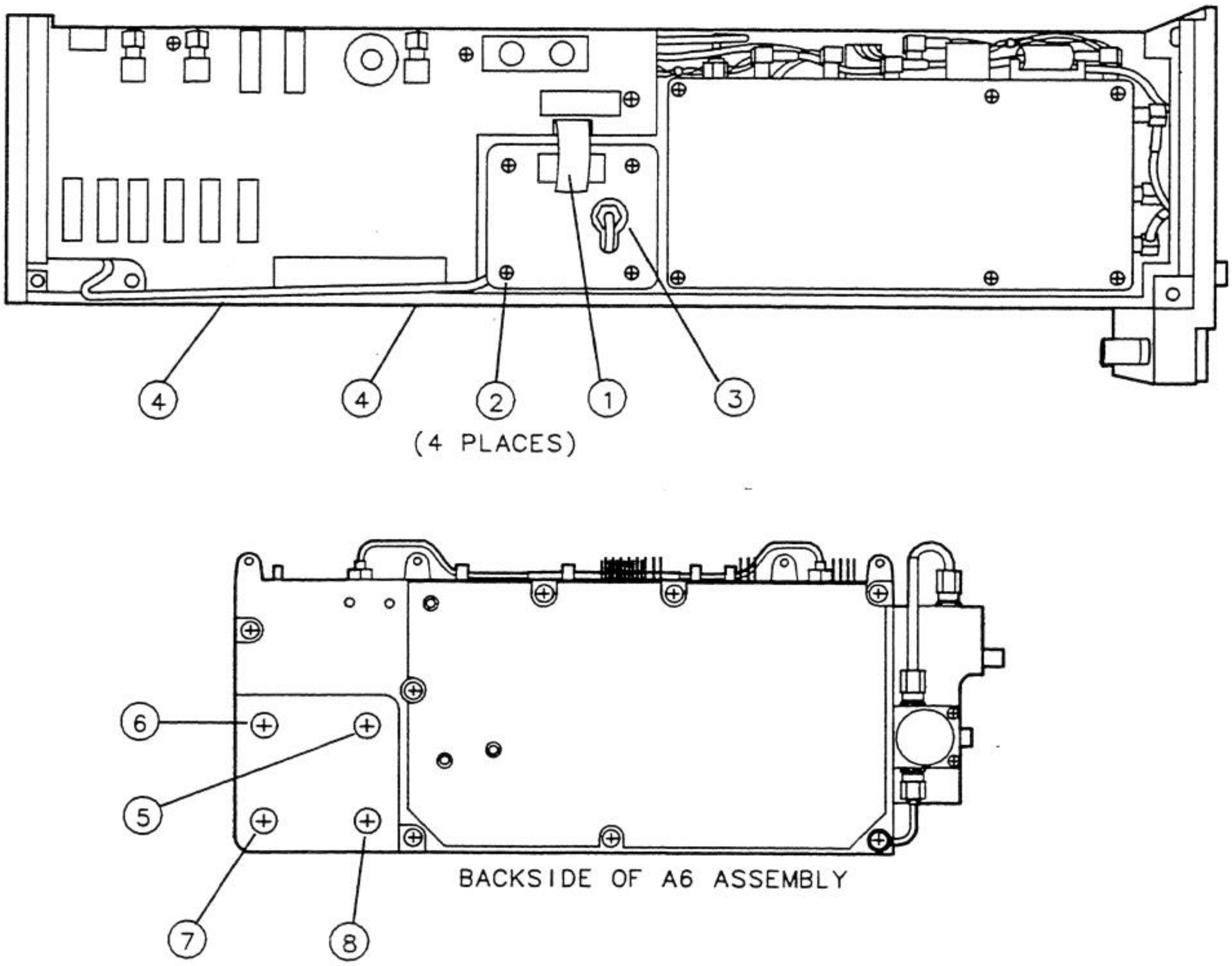



*Figure 6-12. A6A5 YIG Tuned Oscillator Replacement*

# Procedure 14.
# A7 FFS Phase Lock Loop

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Remove three screws (**1**) while the HP 70900A LO Module rests on its right side. See Figure 6-13.
2. Disconnect W3 (**2**) and W1 (**3**) from the A7 FFS Phase Lock Loop (PLL) Assembly.
3. Disconnect the two A11 Wiring Harness connectors (**5**) and the W14 ribbon cable (**4**).
4. Lift the A7 assembly about one centimeter and carefully rotate the center end out of the frame. The A7 assembly fits tightly but removal does not require force or removal of the front panel.

## Replacement

5. Insert the front end of the A7 FFS PLL Assembly into the frame. Lift the assembly about one centimeter and rotate the center end of the assembly into place.
6. Reconnect the W14 ribbon cable (**4**) and the two A11 connectors (**5**).
7. Reconnect W1 (brown) (**3**) and W3 (orange) (**2**) to the A7 assembly.
8. Replace three screws (**1**) while the HP 70900A LO Module rests on its right side. Torque screws to 20 IN-LBs.

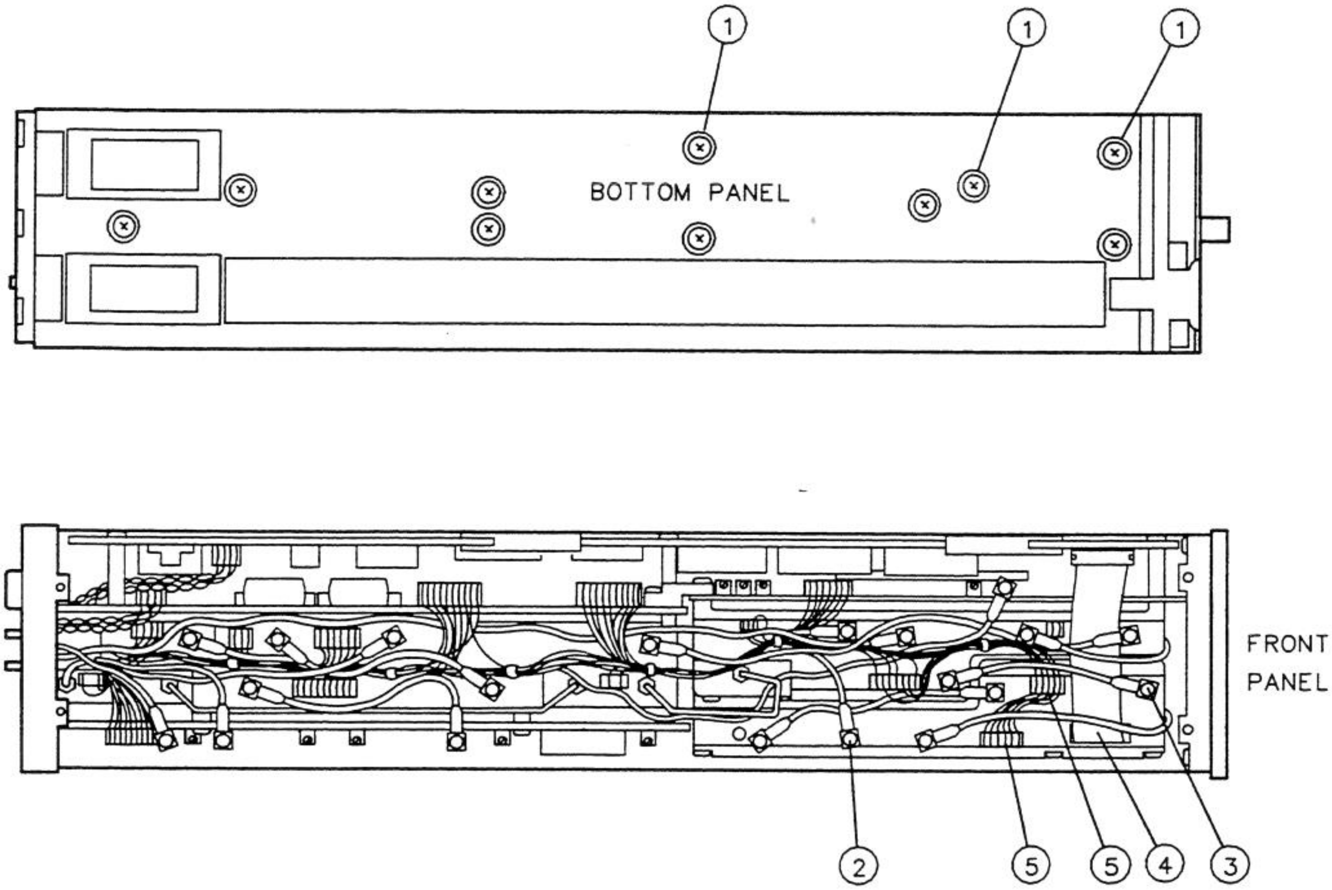



*Figure 6-13. A7 FFS PLL Replacement*

# Procedure 15.
# A7A1 FFS VCO

**CAUTION**

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

**CAUTION**

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedure 14 to remove the A7 assembly.
2. Disconnect cables **(1)**, **(2)**, **(3)**, and **(4)** from the A7A1 VCO Assembly. See Figure 6-14.
3. Disconnect cable A7W5 from the assembly jack **(5)**.
4. Remove the four screws **(6)** and with the cover side down remove the assembly from the cover.
5. Remove the one screw **(7)** from the assembly and remove the A7A1 VCO Assembly.

## Replacement

6. Position the A7A1 VCO Assembly in the casting and replace the one screw **(7)**. Torque screws to 6 IN-LBs.
7. With the cover side down, position the assembly onto the cover. (Use the adjustment hole as a guide.) Replace the four screws **(6)**. Torque screws to 9 IN-LBs.
8. Reconnect A7W5 (green) to the assembly jack **(5)**.
9. Reconnect A7W4 (yellow) **(1)**, A7W1 (white/violet) **(2)**, A7W3 (white/orange) **(3)**, A7W2 (white/red) **(4)**.

10. Refer to procedure 14 to replace the A7 assembly.

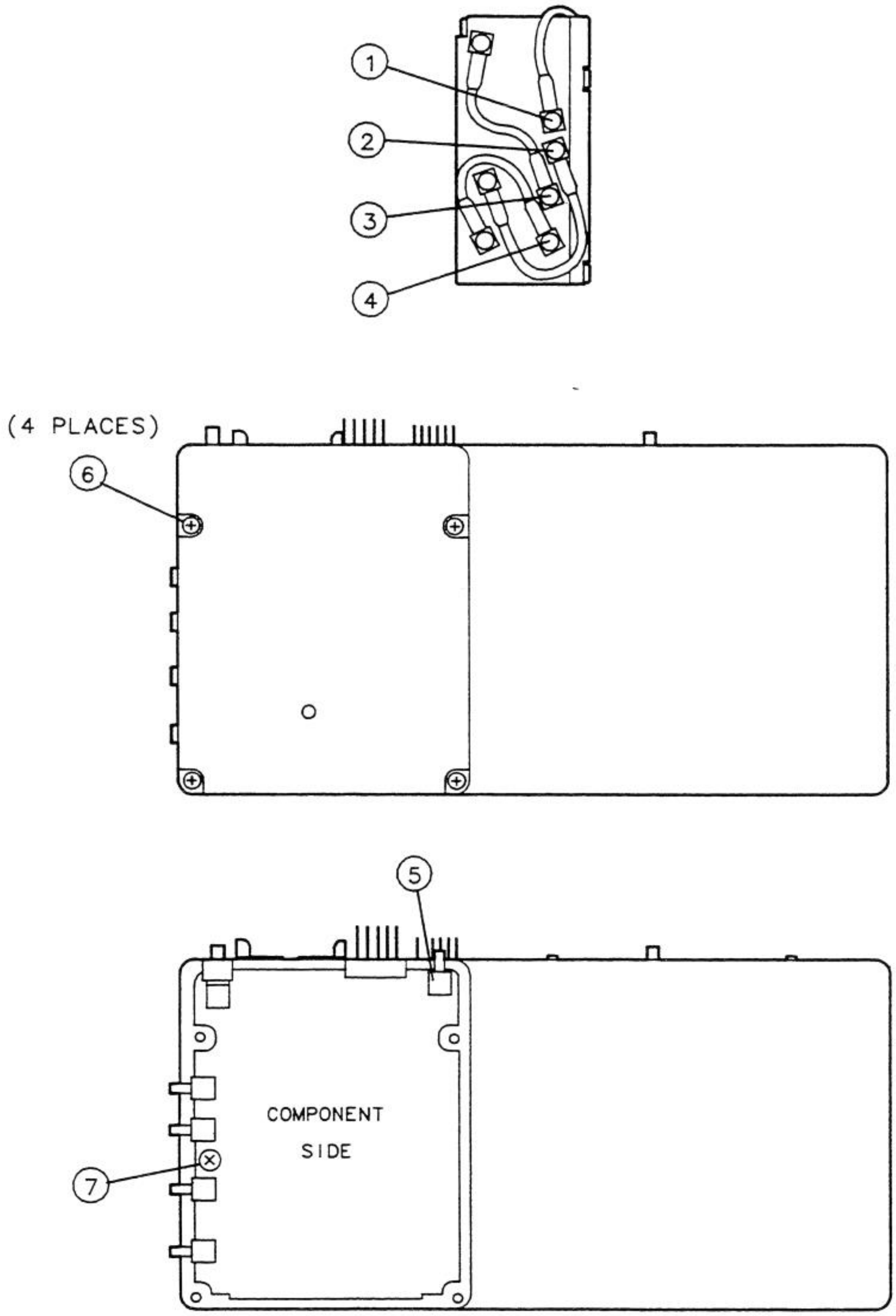



*Figure 6-14. A7A1 VCO Replacement*

# Procedure 16.
# A7A2 FFS Analog

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

CAUTION

**Gaskets used in this assembly conduct electrical current. Misplaced gaskets may cause electrical shorts. The gaskets are located under the assembly covers and around connectors and feed-throughs. When removing assembly covers, avoid losing gaskets by orientating the assembly with the cover down and then lifting the assembly off the cover.**

## Removal

1. Refer to procedure 14 to remove the A7 assembly.
2. Disconnect cables labeled (**1**), (**2**), and (**3**) in Figure 6-15 from the A7A2 Analog Assembly.
3. Disconnect A7W5 and A7W4 from the assemblies jacks (**4**) (**5**).
4. Remove the six screws (**6**), and with the cover side down, remove the assembly from the cover.
5. Remove the one screw (**7**) from the assembly, and remove the A7A2 Analog Assembly.

## Replacement

6. If more heat sink compound is needed, apply a small amount to the two IC heat sink posts.
7. Position the A7A2 Analog Assembly in the casting and replace the one screw (**7**). Torque screws to 6 IN-LBs.
8. With the cover side down, position the assembly onto the cover. (Use the adjustment holes as a guide.) Replace the six screws (**6**). Torque screws to 9 IN-LBs.
9. Reconnect A7W4 (yellow) (**5**) and A7W5 (green) (**4**).
10. Reconnect A7W2 (white/red) (**3**), A7W1 (white/violet) (**2**), and A7W3 (white/orange) (**1**) to the A7A2 Analog Assembly.

11. Refer to procedure 14 to replace the A7 assembly.

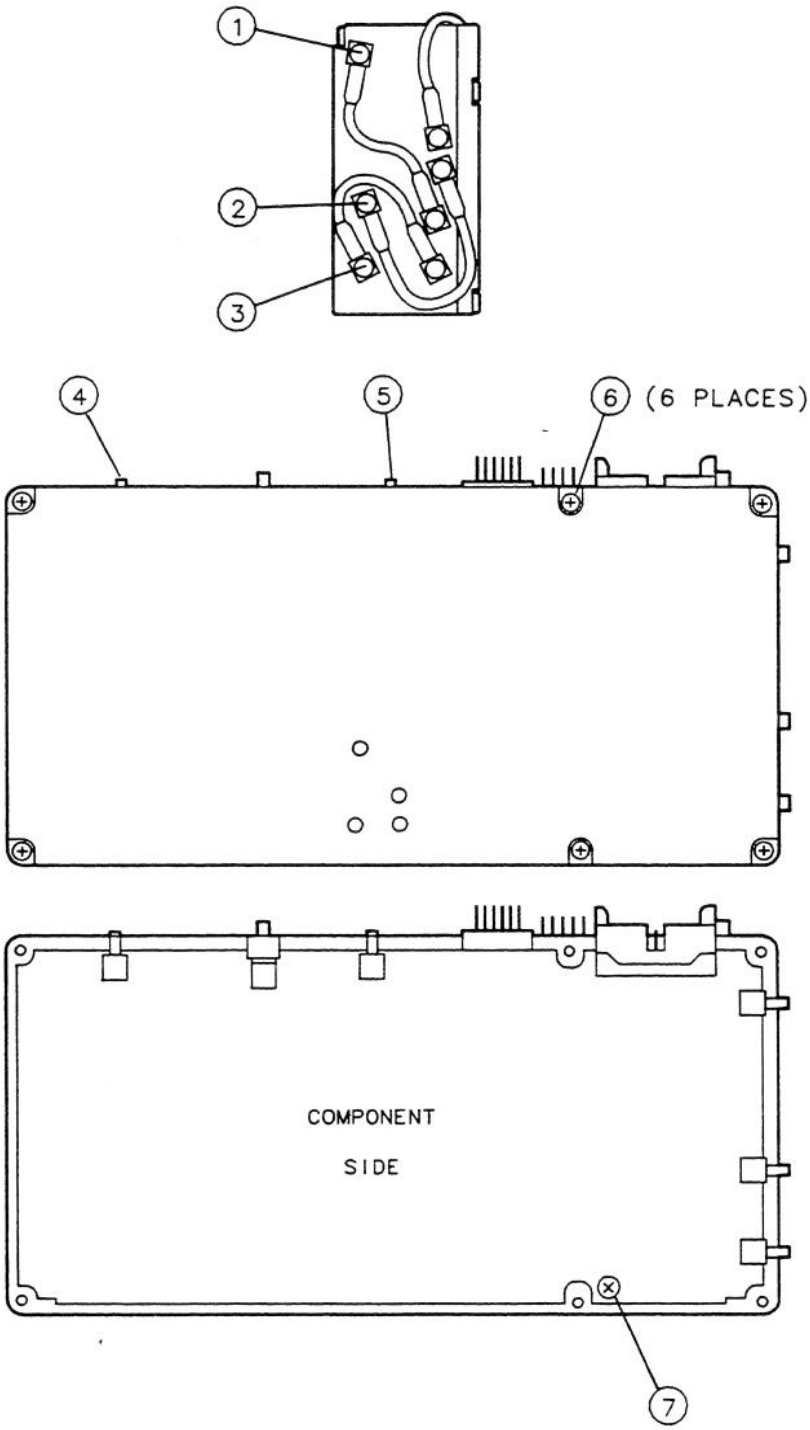



*Figure 6-15. A7A2 Analog Replacement*

# Procedure 17.
# A8 Frequency Control

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Disconnect A11 Wiring Harness (1) and ribbon cable W15 (2). See Figure 6-16.
2. Disconnect coaxial cables W10 (3), W12 (4), and W4 (5) from the A8 Frequency Control Assembly.
3. Remove the two screws (6) from the assembly. Remove the nylon screw and washer (7).
4. Carefully work the A8 Frequency Control Assembly out of its motherboard connector.

## Replacement

5. Insert the A8 Frequency Control Assembly into its motherboard connector, taking care that pins match the connector.
6. Replace the two screws (6) and nylon screw and washer (7). Torque the screws (6) to 6 IN-LBs. Torque nylon screw (7) to 11 IN-OZs.
7. Reconnect coaxial cables W4 (yellow) (5), W12 (brown) (4), and W10 (white/blue) (3).
8. Reconnect A11 Wiring Harness (1) and ribbon cable W15 (2) on the A8 Frequency Control Assembly.

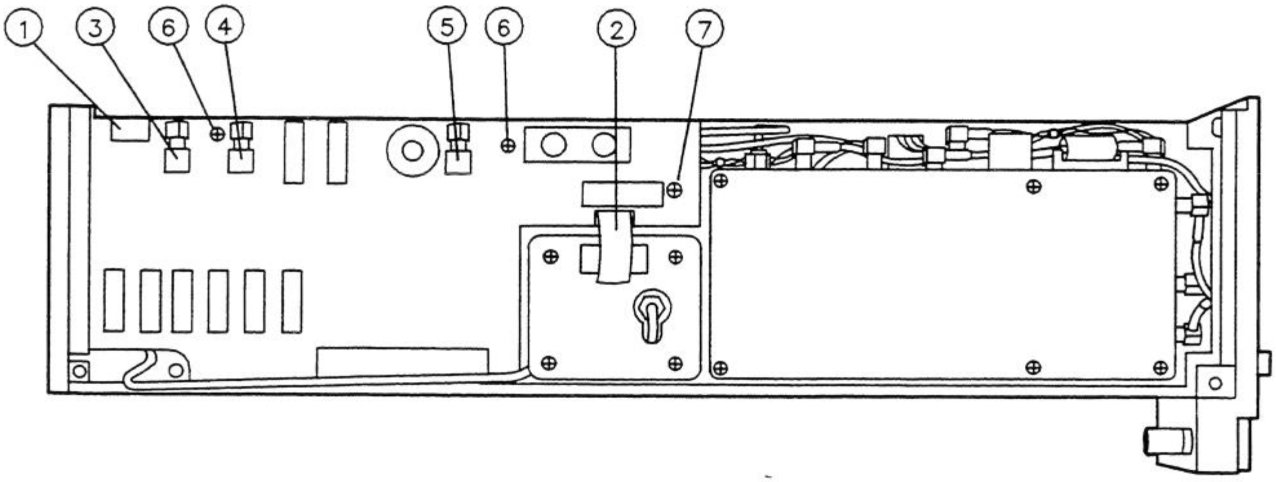



*Figure 6-16. A8 Frequency Control Replacement*

# Procedure 18.
# A9 Front Panel

CAUTION

**Use electrostatic discharge (ESD) precautions when working on this assembly. Refer to "Electrostatic Discharge Information" in Chapter 1.**

## Removal

1. Use a 9/16-inch nut driver to remove the nut securing the front-panel calibrator jack. Be careful not to scratch the front panel.
2. Remove two 4 mm cap-screws (**1**) securing the front frame and A9 assembly to the module. See Figure 6-17.
3. Remove the four screws and flat washers securing the A9 Front Panel Assembly to the faceplate.

## Replacement

4. Position the A9 Front Panel Assembly on the faceplate, and secure with four screws and flat washers. Torque screws to 6 IN-LBs.
5. Secure the front frame using two 4 mm cap-screws (**1**). Torque cap-screws to 20 IN-LBs.
6. Use a 9/16-inch nut driver to tighten the nut securing the calibrator jack to the front panel. Torque nut to 20 IN-LBs.

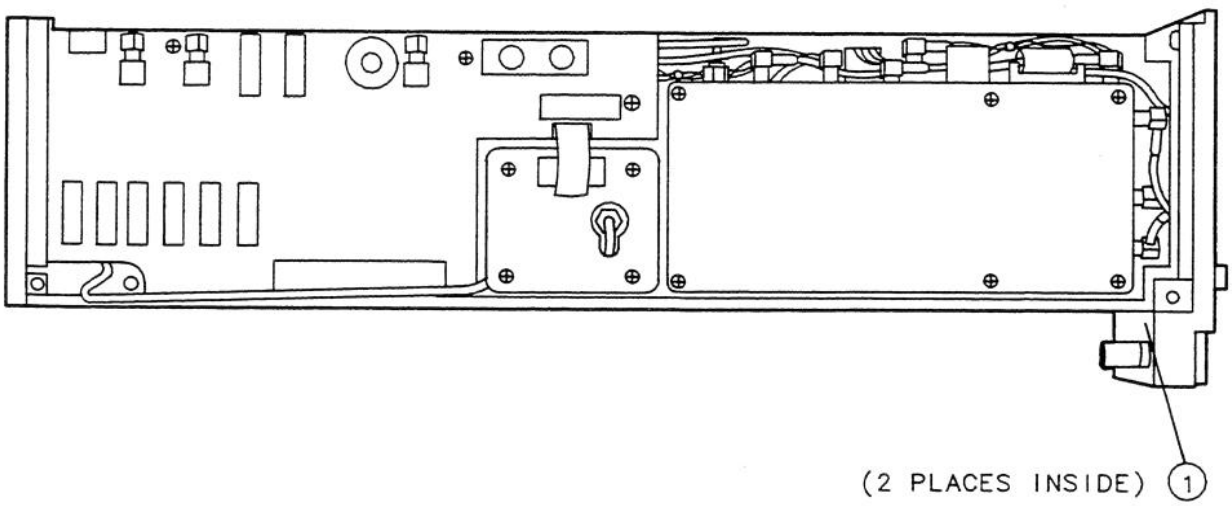



*Figure 6-17. A9 Front-Panel Replacement*

# Chapter 7

# Replaceable Parts

Chapter 7 provides ordering information, assembly-level part numbers, and chassis part numbers. Part numbers for components mounted on each board assembly are located in Chapter 9. To locate a part number, refer to the following tables and figures:



## Ordering Information

To order a part or assembly, quote the Hewlett-Packard part number (with check digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard office. The check digit will ensure accurate and timely processing of your order.

To order a part that is not listed in the replaceable parts table, include the instrument model number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

### New Assemblies

Although this manual documents all assembly versions produced up to the time of the manual's print date, only those assemblies versions listed in Table 7-3 may be ordered.

## Exchange Assemblies

Table 7-3 includes the part numbers for rebuilt assemblies that may be replaced on an exchange basis. Exchange assemblies (factory repaired and tested) are available only on a trade-in bases: the defective assembly must be returned for credit.

## 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 the HP Parts Center in Mountain View, California.
- 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 ar money order must accompany each order. Mail order forms and specific ordering information is 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 6 AM to 5 PM, Pacific time, Monday through Friday. Regular orders have a four-day delivery time.

**Hotline Orders:** Hotline service for ordering emergency parts is available 24 hours a day, 365 days a year. There is an additional hotline charge to cover the cost of freight and special handling.

The toll-free phone number is (800) 227-8164, is available 6 AM to 5 PM, Pacific time, Monday through Friday and (415) 968-2347 for after-hours, weekends, and holidays. Hotline orders are normally delivered the following business day.

# Firmware Dependent Part Numbers

Table 7-4 and Table 7-5 lists the part numbers for ROMs contained on the A1 and A1A2 assemblies. The ROM part numbers are dependent on the firmware date-code used in the analyzer. To determine the firmware date code, press [PRESET] and look in the display's active-function area for firmware revision information.

# Parts List Format

The following information is listed for each part:

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

*Table 7-1. Reference Designations and Abbreviations (1 of 3)*

## REFERENCE DESIGNATIONS

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

## ABBREVIATIONS

### A

| | |
|---|---|
| A | Across Flats, Acrylic, Air (Dry Method), Ampere |
| ADJ | Adjust, Adjustment |
| ANSI | American National Standards Institute (formerly USASI-ASA) |
| ASSY | Assembly |
| AWG | American Wire Gage |

### B

| | |
|---|---|
| BCD | Binary Coded Decimal |
| BD | Board, Bundle |
| BE-CU | Beryllium Copper |
| BNC | Type of Connector |
| BRG | Bearing, Boring |
| BRS | Brass |
| BSC | Basic |
| BTN | Button |

### C

| | |
|---|---|
| C | Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression |
| CCP | Carbon Composition Plastic |
| CD | Cadmium, Card, Cord |
| CER | Ceramic |
| CHAM | Chamfer |
| CHAR | Character, Characteristic, Charcoal |
| CMOS | Complementary Metal Oxide Semiconductor |
| CNDCT | Conducting, Conductive, Conductivity, Conductor |
| CONT | Contact, Continuous, Control, Controller |
| CONV | Converter |
| CPRSN | Compression |
| CUP-PT | Cup Point |
| CW | Clockwise, Continuous Wave |

### D

| | |
|---|---|
| D | Deep, Depletion, Depth, Diameter, Direct Current |
| DA | Darlington |
| DAP-GL | Diallyl Phthalate Glass |
| DBL | Double |
| DCDR | Decoder |
| DEG | Degree |
| D-HOLE | D-Shaped Hole |
| DIA | Diameter |
| DIP | Dual In-Line Package |
| DIP-SLDR | Dip Solder |
| D-MODE | Depletion Mode |
| DO | Package Type Designation |
| DP | Deep, Depth, Diametric Pitch, Dip |
| DP3T | Double Pole Three Throw |
| DPDT | Double Pole Double Throw |
| DWL | Dowel |

### E

| | |
|---|---|
| E-R | E-Ring |
| EXT | Extended, Extension, External, Extinguish |

### F

| | |
|---|---|
| F | Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency |
| FC | Carbon Film/Composition, Edge of Cutoff Frequency, Face |
| FDTHRU | Feed Through |
| FEM | Female |
| FIL-HD | Fillister Head |
| FL | Flash, Flat, Fluid |
| FLAT-PT | Flat Point |
| FR | Front |
| FREQ | Frequency |
| FT | Current Gain Bandwidth Product (Transition Frequency), Feet, Foot |
| FXD | Fixed |

### G

| | |
|---|---|
| GEN | General, Generator |
| GND | Ground |
| GP | General Purpose, Group |

### H

| | |
|---|---|
| H | Henry, High |
| HDW | Hardware |
| HEX | Hexadecimal, Hexagon, Hexagonal |
| HLCL | Helical |
| HP | Hewlett-Packard Company, High Pass |

### I

| | |
|---|---|
| IC | Collector Current, Integrated Circuit |
| ID | Identification, Inside Diameter |
| IF | Forward Current, Intermediate Frequency |
| IN | Inch |
| INCL | Including |
| INT | Integral, Intensity, Internal |

*Table 7-1. Reference Designations and Abbreviations (2 of 3)*

**J**

J-FET ........... Junction Field Effect Transistor
JFET ............ Junction Field Effect Transistor

**K**

K ......... Kelvin, Key, Kilo, Potassium
KNRLD .................... Knurled
KVDC ........ Kilovolts Direct Current

**L**

LED ............ Light Emitting Diode
LG .................... Length, Long
LIN ................ Linear, Linearity
LK ....................... Link, Lock
LKG ............... Leakage, Locking
LUM ...................... Luminous

**M**

M ............ Male, Maximum, Mega, Mil, Milli, Mode
MA ..................... Milliampere
MACH ................... Machined
MAX .................... Maximum
MC ................... Molded Carbon Composition
MET ............... Metal, Metallized
MHZ .................... Megahertz
MINTR ................... Miniature
MIT .......................... Miter
MLD ................. Mold, Molded
MM ............ Magnetized Material, Millimeter
MOM ................... Momentary
MTG ..................... Mounting
MTLC ..................... Metallic
MW ...................... Milliwatt

**N**

N ...................... Nano, None
N-CHAN ................ N-Channel
NH ..................... Nanohenry
NM .......... Nanometer, Nonmetallic
NO .......... Normally Open, Number
NOM ...................... Nominal
NPN ............... Negative Positive Negative (Transistor)
NS ........ Nanosecond, Non-Shorting, Nose
NUM ...................... Numeric
NYL .............. Nylon (Polyamide)

**O**

OA ........................ Over-All
OD ................ Outside Diameter
OP AMP ....... Operational Amplifier
OPT ........ Optical, Option, Optional

**P**

PA ............... Picoampere, Power Amplifier
PAN-HD .................. Pan Head
PAR ................. Parallel, Parity
PB .......... Lead (Metal), Pushbutton
PC ................... Printed Circuit
PCB ............ Printed Circuit Board
P-CHAN ................. P-Channel
PD ........... Pad, Power Dissipation
PF ........... Picofarad, Power Factor
PKG ....................... Package
PLSTC ...................... Plastic
PNL .......................... Panel
PNP ........ Positive Negative Positive (Transistor)
POLYC ............... Polycarbonate
POLYE ...................... Polyester
POT .................. Potentiometer
POZI ................ Pozidriv Recess
PREC ...................... Precision
PRP ................ Purple, Purpose
PSTN ........................ Piston
PT ........... Part, Point, Pulse Time
PW .................... Pulse Width

**Q**

Q .................... Figure of Merit

**R**

R ............ Range, Red, Resistance, Resistor, Right, Ring
REF ...................... Reference
RES .............. Resistance, Resistor
RF ................. Radio Frequency
RGD .......................... Rigid
RND ......................... Round
RR ............................ Rear
RVT .................. Rivet, Riveted

**S**

SAWR ......... Surface Acoustic Wave Resonator
SEG ....................... Segment
SGL .......................... Single
SI ............... Silicon, Square Inch
SL ...................... Slide, Slow
SLT .................... Slot, Slotted
SMA ........... Subminiature, A Type (Threaded Connector)
SMB ........... Subminiature, B Type (Slip-On Connector
SMC ........... Subminiature, C Type (Threaded Connector)
SPCG ...................... Spacing
SPDT ....... Single Pole Double Throw
SPST ........ Single Pole Single Throw
SQ ......................... Square
SST ................... Stainless Steel
STL ........................... Steel
SUBMIN ............... Subminiature
SZ ............................. Size

**T**

T ................ Teeth, Temperature, Thickness, Time, Timed, Tooth, Typical
TA ............ Ambient Temperature, Tantalum
TC ........... Temperature Coefficient
THD .............. Thread, Threaded
THK .......................... Thick
TO ......... Package Type Designation
TPG ........................ Tapping
TR-HD ................... Truss Head
TRMR ...................... Trimmer
TRN ..................... Turn, Turns
TRSN ....................... Torsion

**U**

UCD ................... Microcandela
UF ...................... Microfarad
UH ...................... Microhenry
UL .......... Microliter, Underwriters' Laboratories, Inc.
UNHDND .............. Unhardened

**V**

V .............. Variable, Violet, Volt, Voltage
VAC ....... Vacuum, Volts, Alternating Current
VAR ........................ Variable
VDC ............ Volts, Direct Current

**W**

W ............. Watt, Wattage, White, Wide, Width
W/SW ................... With Switch
WW .................... Wire Wound

**X**

X ......... By (Used With Dimensions), Reactance

**Y**

YIG ............. Yttrium-Iron-Garnet

**Z**

ZNR .......................... Zener

*Table 7-1. Reference Designations and Abbreviations (3 of 3)*

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

*Table 7-2. Manufacturers Code List (1 of 3)*

| Mfr. Code | Manufacterer Name | Address | | Zip Code |
|---|---|---|---|---|
| C0633 | RIFA AB | STOCKHOLM | SW | S-163 |
| C1433 | AB ELEKTRONIK GMBH | SALZBURG | AU | A-501 |
| D8350 | GROSS A | STUTTGART | GM | 7000 |
| D8439 | ROEDERSTEIN/RESISTA GMBH | LANDSHUT | GM | 8300 |
| K7253 | STC/STANTEL | DEVON | EG | |
| K8479 | HOLSWORTHY ELECTRONICS LTD | HOLSWORTHY | EG | |
| S0562 | TOSHIBA CORP | TOKYO | JP | |
| 00000 | ANY SATISFACTORY SUPPLIER | | | |
| 00471 | DOW-KEY CO INC | BROOMFIELD | WY | 80020 |
| 00494 | ADDRESSOGRAPH FARRINGTON | TREVOSE | PA | 44117 |
| 00779 | AMP INC | HARRISBURG | PA US | 17111 |
| 00815 | NEL FREQUENCY CONTROLS INC | BURLINGTON | WI US | 53105 |
| 00853 | SANGAMO WESTON INC | NORCROSS | GA US | 30071 |
| 01121 | ALLEN-BRADLEY CO INC | EL PASO | TX US | 79935 |
| 01295 | TEXAS INSTRUMENTS INC | DALLAS | TX US | 75265 |
| 01561 | CHASSIS TRAK DIV GENERAL DEVICES CO | INDIANAPOLIS | IN | 46219 |
| 01686 | RCL ELECTRONICS INC | NORTHBROOK | IL US | 60062 |
| 01766 | INTL CRYSTAL MFG CO INC | OKLAHOMA CITY | OK | 73102 |
| 02114 | FERROXCUBE CORP | SAUGERTIES | NY US | 12477 |
| 04222 | AVX CORP | GREAT NECK | NY US | 11021 |
| 04713 | MOTOROLA INC | ROSELLE | IL US | 60195 |
| 05347 | ULTRONIX INC | GRAND JUNCTION | CO | 81501 |
| 06001 | MEPCO/ELECTRA INC | MORRISTOWN | NJ US | 07960 |
| 06132 | COMPUTER TERMINAL CORP | SAN ANTONIO | TX | 78784 |
| 06156 | BAUM W A CO INC | COPIAGUE | NY | 11726 |
| 06341 | PRODUCTS/TECHNIQUES INC | LOS ANGELES | CA | 90059 |
| 06383 | PANDUIT CORP | TINLEY PARK | IL US | 60477 |
| 06394 | HOOVER UNIVERSAL INC BALL & RLR DIV | SALINE | MI | 68310 |
| 06424 | SPERRY U-WAVE ELEK DIV SPERRY RAND | CLEARWATER | FL | 33518 |
| 06560 | JEFFERS ELECTRONICS INC | NOGALES | AZ US | 85621 |
| 06665 | PRECISION MONOLITHICS INC | SANTA CLARA | CA US | 95054 |
| 07047 | MILTON ROSS CO | SOUTHHAMPTON | PA | 18966 |
| 07263 | FAIRCHILD SEMICONDUCTOR CORP | CUPERTINO | CA US | 95014 |
| 07933 | RAYTHEON CO SEMICONDUCTOR DIV HQ | MOUNTAIN VIEW | CA | 94040 |
| 08111 | MFELECTRONICS CORP | NEW YORK | NY | 10010 |
| 08182 | ALPINE ELECTRONIC COMPONENTS INC | WOLCOTT | CT | 06716 |
| 08810 | ANGELL MFG CO | DAYTON | OH | 45404 |
| 09464 | DRYCO MFG CO INC | CHICAGO | IL | 60612 |
| 09535 | JOHNSON MATTHEY AND MALLORY LTD | TORONTO | CN | |
| 09969 | DALE ELECTRONICS INC | YANKTON | SD US | 57078 |
| 1B546 | VARO INC | GARLAND | TX US | 75046 |
| 10183 | GRAHAM MAGNETICS INC | FT WORTH | TX US | 76118 |
| 10411 | TI-TAL INC | SANTA MONICA | CA | 90405 |
| 10899 | EASTERN AIR DEVICES INC | GREAT NECK | NY | 11021 |
| 10960 | T D R ELECTRONICS INC | BRISTOL | RI | 02809 |
| 11214 | HARDIGG IND INC | S DEERFIELD | MA | 01373 |
| 11236 | CTS CORP | ELKHART | IN US | 46514 |
| 11244 | DYMO INDUSTRIES INC | BERKELEY | CA | 94701 |
| 11502 | IRC INC | BOONE | NC US | 28607 |
| 11591 | STUART RADIATOR CO | SAN FRANCISCO | CA | 94107 |
| 12014 | CHICAGO RIVET & MACHINE CO | NAPERVILLE | IL US | 60540 |
| 12344 | TALLY CORP | KENT | WA | 98031 |
| 12360 | ALBANY PROD CO DIV OF PHEUMO DYN | NORWALK | CT | 06850 |
| 12474 | BEL-RAY CO INC | FARMINGDALE | NJ | 07727 |
| 12498 | CRYSTALONICS, DIV TELEDYNE | CAMBRIDGE | MA | 02140 |
| 12403 | CANFIELD H O CO OF INDIANA INC THE | SEYMOUR | IN | 47274 |
| 12855 | TRAK MICROWAVE CORP | TAMPA | FL US | 33614 |

*Table 7-2. Manufacturers Code List (2 of 3)*

| Mfr. Code | Manufacterer Name | Address | Zip Code |
|---|---|---|---|
| 13103 | THERMALLOY INC | DALLAS TX US | 75234 |
| 14936 | GENERAL INSTRUMENT CORP (DIODE) | HICKSVILLE NY US | 11802 |
| 15003 | VALOR ELECTRONICS INC | SANTA ANA CA | 92705 |
| 15542 | MINI-CIRCUITS LAB | BROOKLYN NY US | 11235 |
| 15818 | TELEDYNE SEMICONDUCTOR | MOUNTAIN VIEW CA | 94043 |
| 16179 | M/A-COM INC | BURLINGTON MA US | 01803 |
| 16299 | CORNING ELECTRONICS | RALEIGH NC US | 27604 |
| 16428 | COOPER INDUSTRIES INC | HOUSTON TX US | 77210 |
| 17856 | SILICONIX INC | SANTA CLARA CA US | 95054 |
| 18324 | SIGNETICS CORP | SUNNYVALE CA US | 94086 |
| 18565 | CHOMERICS INC | WOBURN MA | 01801 |
| 18612 | VISHAY INTERTECHNOLOGY INC | MALVERN PA US | 19355 |
| 18873 | DUPONT E I DE NEMOURS & CO | WILMINGTON DE US | 19801 |
| 19701 | MEPCO/CENTRALAB INC | WEST PALM BEACH FL US | 33407 |
| 2M627 | ROHM CORP | IRVINE CA US | 92713 |
| 24022 | TELEDYNE INC | LOST ANGELES CA US | 90067 |
| 24226 | GOWANDA ELECTRONICS CORP | GOWANDA NY US | 14070 |
| 24355 | ANALOG DEVICES INC | NORWOOD MA US | 02062 |
| 24931 | SPECIALTY CONNECTOR CO | FRANKLIN IN US | 46131 |
| 25403 | NV PHILIPS ELCOMA | EINDHOVEN NE | 02876 |
| 24539 | AVANTEK INC | SANTA CLARA CA US | 95054 |
| 25403 | NV PHILIPS ELCOMA | EINDHOVEN NE | 02876 |
| 27264 | MOLEX INC | LISLE IL US | 60532 |
| 27014 | NATIONAL SEMICONDUCTOR CORP | SANTA CLARA CA US | 95052 |
| 28480 | HEWLETT-PACKARD CO CORPORATE HQ | PALO ALTO CA | 94304 |
| 3L585 | RCA CORP | NEW YORK NY US | 10112 |
| 30161 | AAVID ENGINEERING INC | LACONIA NH US | 03247 |
| 32159 | WEST-CAP ARIZONA | SAN FERNANDO CA US | 91340 |
| 32293 | INTERSIL INC | CUPERTINO CA CA | 95014 |
| 32997 | BOURNS INC | RIVERSIDE CA US | 92507 |
| 33399 | TELE-TECH CORP | BOZEMAN MT US | 59771 |
| 34333 | SILICON GENERAL INC | SAN JOSE CA US | 95134 |
| 34335 | ADVANCED MICRO DEVICES INC | SUNNYVALE CA US | 94086 |
| 34371 | HARRIS CORP | MELBOURNE FL US | 32901 |
| 34649 | INTEL CORP | SANTA CLARA CA US | 95054 |
| 50157 | MIDWEST COMPONENTS | MUSKEGON MI | 49443 |
| 50364 | MONOLITHIC MEMORIES INC | SANTA CLARA CA US | 95054 |
| 52063 | EXAR INTEGRATED SYSTEMS INC | SUNNYVALE CA | 94086 |
| 52763 | STETTNER & CO | LAUF GM | D-856 |
| 54186 | MICRO POWER SYSTEMS | SANTA CLARA CA | 95050 |
| 55719 | SNAP-ON TOOLS CORP | KENOSHA WI US | 53140 |
| 55210 | GETTIG ENGRG & MFG CO INC | SPRING MILLS PA | 16875 |
| 55680 | NICHICON (AMERICA) CORP | SCHAUMBERG IL US | 60195 |
| 56289 | SPRAGUE ELECTRIC CO | LEXINGTON MA US | 02173 |
| 6E259 | AMETEK INC | PAOLI PA US | 19301 |
| 71124 | BRAND REX CO | WILLIMANTIC CT | 06226 |
| 71744 | GENERAL INSTRUMENT CORP | CLIFTON NJ US | 07012 |
| 71984 | DOW CORNING CORP | MIDLAND MI | 48641 |
| 72799 | GENERAL ELECTRIC CO | FAIRFIELD CT US | 06430 |
| 72962 | ELASTIC STOP NUT DIVOF HARVARD | UNION NJ US | 07083 |
| 73138 | BECKMAN INDUSTRIAL CORP | FULLERTON CA US | 92635 |
| 75915 | LITTELFUSE INC | DES PLAINES IL US | 60016 |
| 78189 | ILLINOIS TOOL WORKS INC SHAKEPROOF | ELGIN IL | 60126 |
| 78488 | STACKPOLE CARBON CO | ST MARYS PA | 15857 |
| 76381 | 3M CO | ST PAUL MN US | 55144 |
| 78553 | TINNERMAN PRODUCTS INC | CLEVELAND OH | 44101 |
| 81073 | GRAYHILL INC | LA GRANGE IL US | 60525 |
| 83701 | ELECTRONIC DEVICES INC | YONKERS NY | 10710 |

*Table 7-2. Manufacturers Code List (3 of 3)*

| Mfr. Code | Manufacterer Name | Address | | Zip Code |
|---|---|---|---|---|
| 84411 | AMERICAN SHIZUKI CORP | CANOGA PARK | CA US | 91304 |
| 88245 | LITTON PRECISION PROD INC | VAN NUYS | CA | 91409 |
| 9M011 | INTL RECTIFIER CORP | LOS ANGELES | CA US | 90069 |
| 9N171 | UNITRODE CORP | LEXINGTON | MA US | 02173 |
| 91637 | DALE ELECTRONICS INC | COLUMBUS | NE US | 68601 |
| 91833 | KEYSTONE ELECTRONICS CORP | NEW YORK | NY | 10012 |
| 92895 | AMERICAN OIL & SUPPLY CO | NEWARK | NJ | 07105 |
| 98291 | SEALECTRO CORP | TRUMBULL | CT US | 06611 |
| 99800 | AMER PRCN IND INC DELEVAN DIV | AURORA | NY | 14052 |
| 98978 | INTL ELECTRONIC RESEARCH CORP | BURBANK | CA US | 91502 |

*Table 7-3. Assembly-Level Replaceable Parts*

| Reference Designation | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| | | | | MAJOR ASSEMBLIES | | |
| A1 | 70900-60078 | 0 | 1 | BOARD ASSEMBLY, CONTROLLER | 28480 | 70900-60078 |
| | 70900-69078 | 8 | 1 | RESTORED 70900-60078, EXCHANGE REQUIRED (The 70900-60078 is not designed for use with an A1A2 RAM/ROM assembly.) | 28480 | 70900-69078 |
| A1A1 | 70900-60111 | 2 | 1 | BOARD ASSEMBLY, HOST/PROCESSOR | 28480 | 70900-60111 |
| | 70900-69111 | 0 | 1 | RESTORED 70900-60111, EXCHANGE REQUIRED (Does not include A1A2.) | 28480 | 70900-69111 |
| A1A2 | 70900-60083 | 7 | 1 | BOARD ASSEMBLY, RAM/ROM | 28480 | 70900-60083 |
| | 70900-69083 | 5 | 1 | RESTORED 70900-60083, EXCHANGE REQUIRED | 28480 | 70900-69083 |
| | 70900-60109 | 8 | 1 | BOARD ASSEMBLY, RAM/ROM | 28480 | 70900-60109 |
| | 70900-69109 | 6 | 1 | RESTORED 70900-60109, EXCHANGE REQUIRED | 28480 | 70900-69109 |
| | 70900-60114 | 8 | 1 | BOARD ASSEMBLY, RAM/ROM | 28480 | 70900-60114 |
| | 70900-69114 | 6 | 1 | RESTORED 70900-60114, EXCHANGE REQUIRED | 28480 | 70900-69114 |
| | 70900-60126 | 9 | 1 | BOARD ASSEMBLY, RAM/ROM | 28480 | 70900-60126 |
| | 70900-69126 | 7 | 1 | RESTORED 70900-60126, EXCHANGE REQUIRED | 28480 | 70900-69126 |
| A2 | 70900-60094 | 0 | 1 | BOARD ASSEMBLY, VIDEO PROCESSOR | 28480 | 70900-60094 |
| | 70900-69094 | 8 | 1 | RESTORED 70900-60094, EXCHANGE REQUIRED | 28480 | 70900-69094 |
| A3 | 70900-60003 | 1 | 1 | BOARD ASSEMBLY, POWER SUPPLY | 28480 | 70900-60003 |
| | 70900-69003 | 9 | 1 | RESTORED 70900-60003, EXCHANGE REQUIRED | 28480 | 70900-69003 |
| A4 | - - | | | IDLER LOCK LOOP (Includes A4A1, A4A2, A4A3, and the following parts.) | | |
| | 70900-20029 | 7 | 1 | HOUSING-300 MHZ-IDLER | 28480 | 70900-20029 |
| | 70900-20028 | 6 | 1 | COVER - 300 MHZ | 28480 | 70900-20028 |
| | 70900-20033 | 3 | 1 | COV-IDLR DRVR-PC | 28480 | 70900-20033 |
| | 8160-0495 | 5 | | RFI "D" STRIP CNDCT-ELSTMR 2.54-MM-WD | 28480 | 8160-0495 |
| | 8160-0490 | 0 | | RFI GASKET CNDCT-ELSTMR 1.6-MM-WD | 28480 | 8160-0490 |
| | 0515-0886 | 3 | 42 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| | 0515-0897 | 6 | 26 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| | 0515-1112 | 0 | 2 | SCREW-MACH M3 X 0.5 20MM-LG PAN-HD | 28480 | 0515-1112 |
| | 70900-20018 | 4 | 2 | INSUL BUSHING | 28480 | 70900-20018 |
| | 8160-0494 | 4 | 13 | RFI "D" STRIP CNDCT-ELSTMR | 28480 | 8160-0494 |
| A4A1 | 70900-60017 | 7 | 1 | BOARD ASSEMBLY, 300 MHz | 28480 | 70900-60017 |
| | 70900-69017 | 5 | 1 | RESTORED 70900-60017, EXCHANGE REQUIRED | 28480 | 70900-69017 |
| | 70900-60117 | 8 | 1 | BOARD ASSEMBLY, 300 MHz | 28480 | 70900-60117 |
| | 70900-69117 | 6 | 1 | RESTORED 70900-60117, EXCHANGE REQUIRED | 28480 | 70900-69117 |
| A4A2 | 70900-60069 | 7 | 1 | BOARD ASSEMBLY, IDLER LOCK | 28480 | 70900-60069 |
| | 70900-69069 | 5 | 1 | RESTORED 70900-60069, EXCHANGE REQUIRED | 28480 | 70900-69069 |
| | 70900-60108 | 9 | 1 | BOARD ASSEMBLY, IDLER LOCK | 28480 | 70900-60108 |
| | 70900-69108 | 7 | 1 | RESTORED 70900-60108, EXCHANGE REQUIRED | 28480 | 70900-69108 |

*Table 7-3. Assembly-Level Replaceable Parts*

| Reference Designation | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| A4A3 | 5086-7706 | - | 1 | IDLER MICROCIRCUIT (Not supported: order 70900-60119 Upgrade Kit) | | |
| | 5086-7789 | 3 | 1 | IDLER MICROCIRCUIT | 28480 | 5086-7789 |
| | 5086-6789 | 1 | 1 | RESTORED 5086-7789, EXCHANGE REQUIRED | 28480 | 5086-6789 |
| A5 | - - | | | NOT ASSIGNED | | |
| A6 | 70900-60101 | 0 | 1 | YTO LOCK LOOP (Includes A6AT1, A6A1 through A6A5, and the following parts.) | | |
| | 70900-20027 | 5 | 1 | YTO PLL HOUSING | 28480 | 70900-20027 |
| | 70900-20026 | 4 | 1 | COVER A6A1 ASSEMBLY | 28480 | 70900-20026 |
| | 70900-20025 | 3 | 1 | COVER A6A2 ASSEMBLY | 28480 | 70900-20025 |
| | 0515-0974 | 0 | 2 | SCREW-MACH M2 X 0.4 16MM-LG PAN-HD | 28480 | 0515-0974 |
| | 0515-0897 | 6 | 10 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| | 0515-1114 | 2 | 11 | SCREW-MACH M4 X 0.7 10MM-LG PAN-HD | 28480 | 0515-1114 |
| | 0515-0886 | 3 | 1 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| | 0515-1105 | 1 | 2 | SCREW-MACH M3 X 0.5 10MM-LG PAN-HD | 28480 | 0515-1105 |
| | 3050-0239 | 7 | 4 | WASHER-FL NM NO. 8 .17-IN-ID .375-IN-OD | 28480 | 3050-0239 |
| | 3050-1189 | 8 | 4 | WASHER-SHLDR NO. 8 .171-IN-ID .375-IN-OD | 28480 | 3050-1189 |
| | 70900-20018 | 4 | | NYLON BUSHING | 28480 | 70900-20018 |
| | 8160-0494 | 4 | | RFI "D" STRIP CNDCT-ELSTMR | 28480 | 8160-0494 |
| A6AT1 | 0955-0204 | 1 | 1 | ISOLATOR-FERRITE 3.0 TO 6.8 GHz | 28480 | 0955-0204 |
| A6A1 | 70900-60016 | 6 | 1 | BOARD ASSEMBLY, 100 MHz | 28480 | 70900-60016 |
| | 70900-69016 | 4 | 1 | RESTORED 70900-60016, EXCHANGE REQUIRED | 28480 | 70900-69016 |
| A6A2 | 70900-60015 | 5 | 1 | BOARD ASSEMBLY, YTO LOCK | 28480 | 70900-60015 |
| | 70900-69015 | 3 | 1 | RESTORED 70900-60015, EXCHANGE REQUIRED | 28480 | 70900-69015 |
| A6A3 | 70900-60008 | 6 | 1 | IDLER BUFFER ASSEMBLY | 28480 | 70900-60008 |
| | 70900-69008 | 4 | 1 | RESTORED 70900-60008, EXCHANGE REQUIRED | 28480 | 70900-69008 |
| A6A4 | 70900-60006 | 4 | 1 | YTO LOCK MICROCIRCUIT | 28480 | 70900-60006 |
| | 70900-69006 | 2 | 1 | RESTORED 70900-60006, EXCHANGE REQUIRED | 28480 | 70900-69006 |
| A6A5 | 5086-7747 | 3 | 1 | YTO (YIG TUNED OSCILLATOR) | 28480 | 5086-7747 |
| | 5086-6747 | 1 | 1 | RESTORED 5086-7747, EXCHANGE REQUIRED | 28480 | 5086-6747 |
| A7 | - - | | | FFS LOCK LOOP (Includes A7A1, A7A2, and the following parts.) | | |
| | 70900-20024 | 2 | 1 | HOUSING-FFS | 28480 | 70900-20024 |
| | 70900-20023 | 1 | 1 | COVER-VCO F-N | 28480 | 70900-20023 |
| | 70900-20022 | 0 | 1 | COVER-ANALOG F-N | 28480 | 70900-20022 |
| | 8160-0495 | 5 | | RFI "D" STRIP CNDCT-ELSTMR 2.54-MM-WD | 28480 | 8160-0495 |
| | 0515-0886 | 3 | 2 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| | 0515-0897 | 6 | 4 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| | 8160-0494 | 4 | | RFI "D" STRIP CNDCT-ELSTMR | 28480 | 8160-0494 |
| A7A1 | 70900-60013 | 3 | 1 | BOARD ASSEMBLY, FFS VCO | 28480 | 70900-60013 |
| | 70900-69013 | 1 | 1 | RESTORED 70900-60013, EXCHANGE REQUIRED | 28480 | 70900-69013 |

*Table 7-3. Assembly-Level Replaceable Parts*

| Reference Designation | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| A7A2 | 70900-60085 | 9 | 1 | BOARD ASSEMBLY, FFS ANALOG | 28480 | 70900-60085 |
| | 70900-69085 | 7 | 1 | RESTORED 70900-60085, EXCHANGE REQUIRED | 28480 | 70900-69085 |
| | 70900-60125 | 9 | 1 | BOARD ASSEMBLY, FFS ANALOG | 28480 | 70900-60125 |
| | 70900-69125 | 7 | 1 | RESTORED 70900-60125, EXCHANGE REQUIRED | 28480 | 70900-69125 |
| A8 | 70900-60087 | 1 | 1 | BOARD ASSEMBLY, FREQUENCY CONTROL | 28480 | 70900-60087 |
| | 70900-69087 | 9 | 1 | RESTORED 70900-60087, EXCHANGE REQUIRED | 28480 | 70900-69087 |
| A9 | 70900-60100 | 9 | 1 | BOARD ASSEMBLY, FRONT PANEL | 28480 | 70900-60100 |
| A10 | 70900-60005 | 3 | 1 | BOARD ASSEMBLY, MOTHERBOARD | 28480 | 70900-60005 |
| A11 | 70900-60030 | 4 | 1 | WIRING HARNESS | 28480 | 70900-60030 |
| | | | | CHASSIS MECHANICAL PARTS | | |
| | | | | (See Figures 7-1 through 7-8 for a complete listing of mechanical chassis parts.) | | |
| | | | | CABLE ASSEMBLIES | | |
| W1 | 70900-60007 | 5 | 1 | CABLE ASSEMBLY, COAX 1, A7A1J1 to A4A2J2 | 28480 | 70900-60007 |
| W2 | 70900-60023 | 5 | 1 | CABLE ASSEMBLY, COAX 2, A6A1J1 to A4A1J1 | 28480 | 70900-60023 |
| W3 | 70900-60024 | 6 | 1 | CABLE ASSEMBLY, COAX 3, A6A1J6 to A7A2J2 | 28480 | 70900-60024 |
| W4 | 70900-60025 | 7 | 1 | CABLE ASSEMBLY, COAX 4, A6A2J3 to A8J1 | 28480 | 70900-60025 |
| W5 | | | | NOT ASSIGNED | | |
| W6 | 70900-60032 | 6 | 1 | CABLE ASSEMBLY, COAX 92, A2J1 from REAR PANEL J7 (VIDEO) | 28480 | 70900-60032 |
| W7 | 70900-60033 | 7 | 1 | CABLE ASSEMBLY, COAX 93, A4A1J4 to REAR PANEL J2 (300 MHZ 1) | 28480 | 70900-60033 |
| W8 | 70900-60034 | 8 | 1 | CABLE ASSEMBLY, COAX 4, A4A1J5 to REAR PANEL J3 (300 MHZ 2) | 28480 | 70900-60034 |
| W9 | 70900-60035 | 9 | 1 | CABLE ASSEMBLY, COAX 5, A6A1J2 to REAR PANEL J6 (100 MHZ) | 28480 | 70900-60035 |
| W10 | 70900-60036 | 0 | 1 | CABLE ASSEMBLY, COAX 96, A8J3 to REAR PANEL J9 (TUNE SPAN) | 28480 | 70900-60036 |

*Table 7-3. Assembly-Level Replaceable Parts*

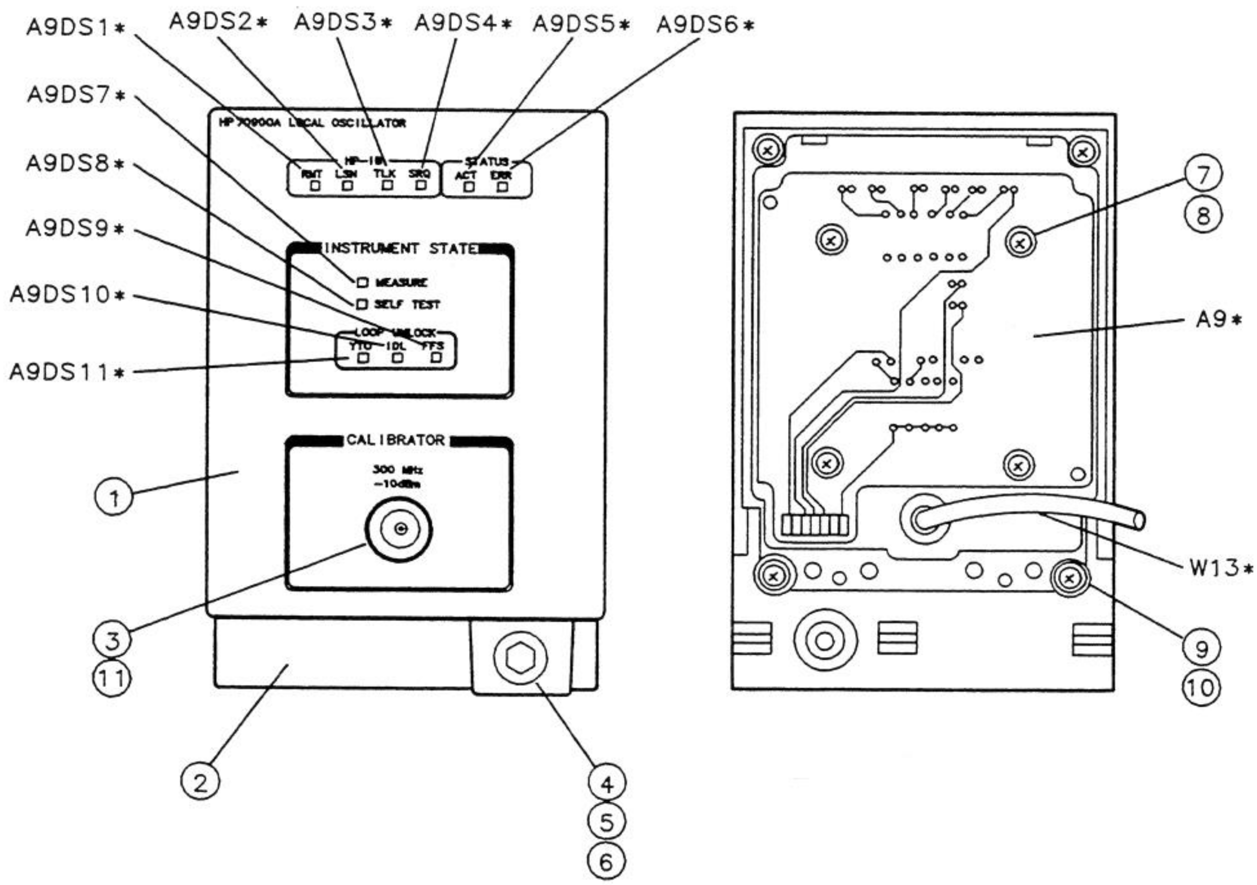
| Reference Designation | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| W11 | 70900-60037 | 1 | 1 | CABLE ASSEMBLY, TWIN BRAID, A1J3 to REAR PANEL J4 (EXT TRIG) and Rear Panel J5 (H SWP) | 28480 | 70900-60037 |
| W12 | 70900-60039 | 3 | 1 | CABLE ASSEMBLY, COAX 1, A8J2 to REAR PANEL J8 (SWP) | 28480 | 70900-60039 |
| W13 | 70900-60040 | 6 | 1 | CABLE ASSEMBLY, COAX 6, A4A1J3 to FRONT PANEL J1 (300 MHZ CAL) | 28480 | 70900-60040 |
| W14 | 70900-60046 | 2 | 1 | CABLE ASSEMBLY, RIBBON, A1J5 to A7A2J5 | 28480 | 70900-60046 |
| W15 | 70900-60047 | 3 | 1 | CABLE ASSEMBLY, RIBBON, A8J6 to A6A5J2 | 28480 | 70900-60047 |
| W17 | 70900-20038 | 8 | 1 | CABLE ASSEMBLY, SEMI-RIGID, A4A3J1 to A6A3J1 | 28480 | 70900-20038 |
| W18 | 9135-0257 | 5 | 1 | CABLE ASSEMBLY, SEMI-RIGID, A6A3J3 to A6A4J1 | 28480 | 9135-0257 |
| W19 | 70900-60026 | 8 | 1 | CABLE ASSEMBLY, COAX 5, A6A1J4 to A6A2J1 | 28480 | 70900-60026 |
| W20 | 5062-1933 | 7 | 1 | CABLE ASSEMBLY, MSIB, A1J4 and A3J3 to Rear Panel J10 | 28480 | 70900-60021 |
| W21 | | | | NOT ASSIGNED | | |
| W22 | 9135-0253 | 1 | 1 | CABLE ASSEMBLY, SEMI-RIGID, A6AT1J2 to A6A4J2 | 28480 | 9135-0253 |
| A4W5 | 70900-60026 | 8 | 2 | CABLE AY 12.5 MHZ | 28480 | 70900-60026 |
| A6W1 | 9135-0253 | 1 | 1 | 6.2 GHz LPF | 28480 | 9135-0253 |
| A6W16 | 70900-20036 | 6 | 1 | CABLE ASSEMBLY, SEMI-RIGID, A6A5J1 to A6AT1J1 | 28480 | 70900-20036 |
| A7W1 | 70900-60041 | 7 | 1 | CBL AY, COAX 97, A7A1J5 to A7A2J7 | 28480 | 70900-60041 |
| A7W2 | 70900-60042 | 8 | 1 | CBL AY, COAX 92, A7A1J7 to A7A2J8 | 28480 | 70900-60042 |
| A7W3 | 70900-60043 | 9 | 1 | CBL AY, COAX 93, A7A1J6 to A7A2J6 | 28480 | 70900-60043 |
| A7W4 | 70900-60044 | 0 | 1 | CBL AY, COAX 4, A7A1J4 to A4A2J3 | 28480 | 70900-60044 |
| A7W5 | 70900-60045 | 1 | 1 | CBL AY, COAX 5, A7A1J3 to A7A2J1 | 28480 | 70900-60045 |

*Table 7-4. Firmware Dependent Part Numbers for A1 Controller*

| Firmware Date Code | A1U11 | A1U12 | A1U13 | A1U29 | A1U30 | A1U31 |
|---|---|---|---|---|---|---|
| 850730 | 70900-80019 | 70900-80020 | 70900-80021 | 70900-80022 | 70900-80023 | 70900-80024 |
| 860203 | 70900-80031 | 70900-80032 | 70900-80033 | 70900-80034 | 70900-80035 | 70900-80036 |

*Table 7-5. Firmware Dependent Part Numbers for A1A2 RAM/ROM*

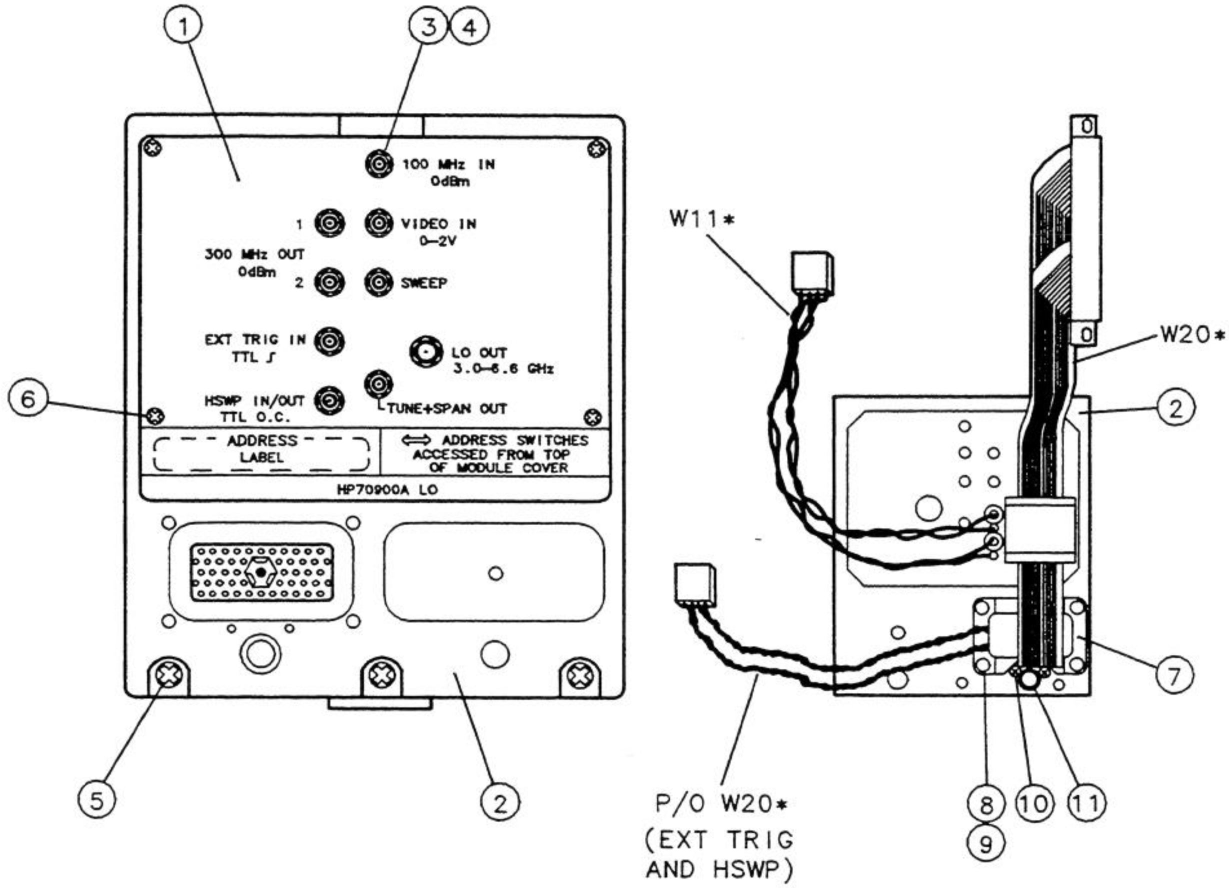
| Firmware Date Code | A1A2U5 | A1A2U6 | A1A2U7 | A1A2U8 | A1A2U9 | A1A2U10 | A1A2U11 | A1A2U12 |
|---|---|---|---|---|---|---|---|---|
| 861015 | 70900-80043 | 70900-80044 | 70900-80045 | 70900-80046 | 70900-80047 | 70900-80048 | 70900-80049 | 70900-80050 |
| 870501 | 70900-80097 | 70900-80098 | 70900-80099 | 70900-80100 | 70900-80101 | 70900-80102 | 70900-80103 | 70900-80104 |
| 880314 | 70900-80166 | 70900-80167 | 70900-80168 | 70900-80169 | 70900-80170 | 70900-80171 | 70900-80172 | 70900-80173 |
| 880901 | 70900-80204 | 70900-80205 | 70900-80206 | 70900-80207 | 70900-80208 | 70900-80209 | 70900-80210 | 70900-80211 |




* Refer to Replaceable Parts List for part numbers

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-00003 | 5 | 1 | FACEPLATE, FRONT | 28480 | 70900-00003 |
| 2 | - - | | 1 | FRAME, FRONT (Order by Description) | 28480 | 70900-20097 |
| 3 | 0590-1251 | 6 | 1 | NUT-SPCLY 15/32-THD .1-IN-THK .562-WD | 28480 | 0590-1251 |
| 4 | 5021-3290 | 7 | 1 | LATCH SCREW | 28480 | 5021-3290 |
| 5 | 0900-0012 | 4 | 1 | O-RING .364-IN-ID .07-IN-XSECT-DIA NTRL | 28480 | 0900-0012 |
| 6 | 0510-1244 | 9 | 1 | RETAINER-PUSH ON CIRCULAR-EXT | 28480 | 0510-1244 |
| 7 | 0515-0886 | 3 | 4 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0510-0886 |
| 8 | 3050-0891 | 7 | 4 | WASHER-FLMTLC 3.0MM 3.3-MM-ID | 28480 | 3050-0891 |
| 9 | 0515-1079 | 8 | 4 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-1079 |
| 10 | 3050-0105 | 6 | 4 | WASHER-FL MTLC NO.4 .125-IN-ID | 28480 | 3050-0105 |
| 11 | 2190-0104 | 0 | 1 | WASHER-LK T 1/2IN .505-IN-ID | 28480 | 2190-0104 |

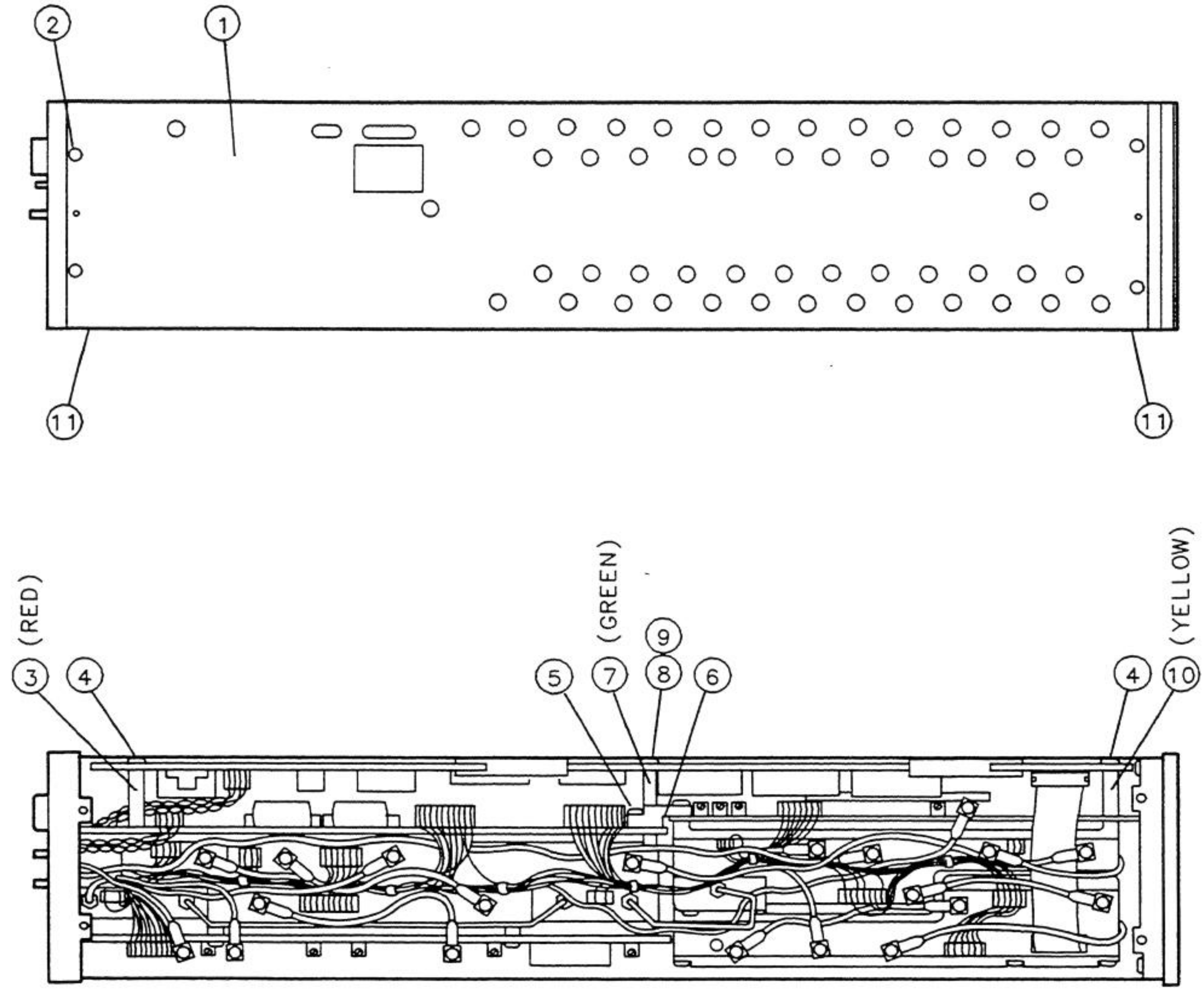
*Figure 7-1. Parts Identification, A1 Front-Frame Assembly*




* Refer to Replaceable Parts List for part numbers

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-00001 | 3 | 1 | FACEPLATE, REAR | 28480 | 70900-00001 |
| 2 | 70900-20030 | 0 | 1 | FRAME, REAR | 28480 | 70900-20030 |
| 3 | 2950-0078 | 9 | 8 | NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK | 28480 | 2950-0078 |
| 4 | 2190-0124 | 4 | 8 | WASHER-LK INTL T NO.10 .195-IN-ID | 28480 | 2190-0124 |
| 5 | 0515-1114 | 2 | 3 | SCREW-MACH M4 X 0.7 10MM-LG PAN-HD | 28480 | 0515-1114 |
| 6 | 0515-0886 | 3 | 4 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| 7 | 5001-5835 | 8 | 2 | BAR-CONNECTOR | 28480 | 5001-5835 |
| 8 | 1460-2095 | 4 | 4 | SPRING-CPRSN 5.49-MM-OD 16.8-MM-OA-LG | 28480 | 1460-2095 |
| 9 | 0535-0042 | 5 | 4 | NUT-HEX PLSTC-LKG M3 X 0.5 4MM-THK | 28480 | 0535-0042 |
| 10 | 0515-0894 | 3 | 4 | SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD | 28480 | 0515-0894 |
| 11 | 5001-5840 | 5 | 1 | SPRING-GROUNDING | 28480 | 5001-5840 |

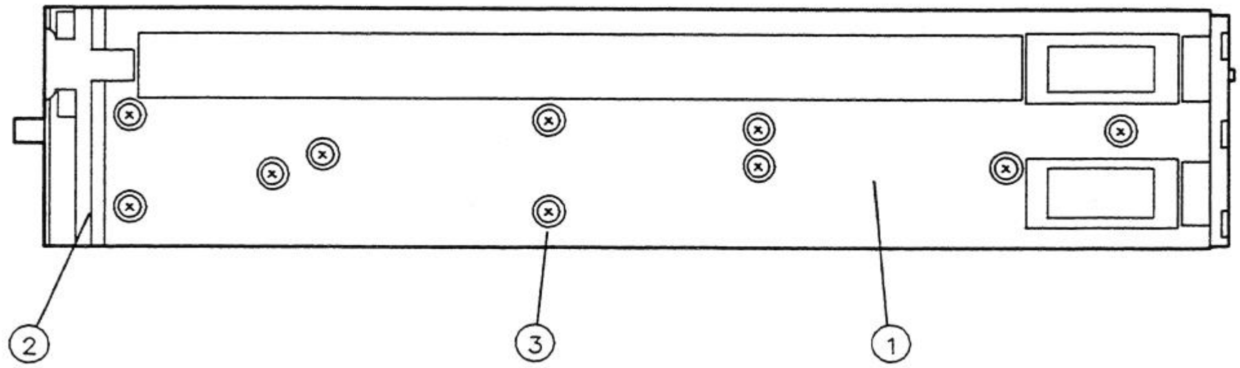
*Figure 7-2. Parts Identification, Rear-Frame Assembly*



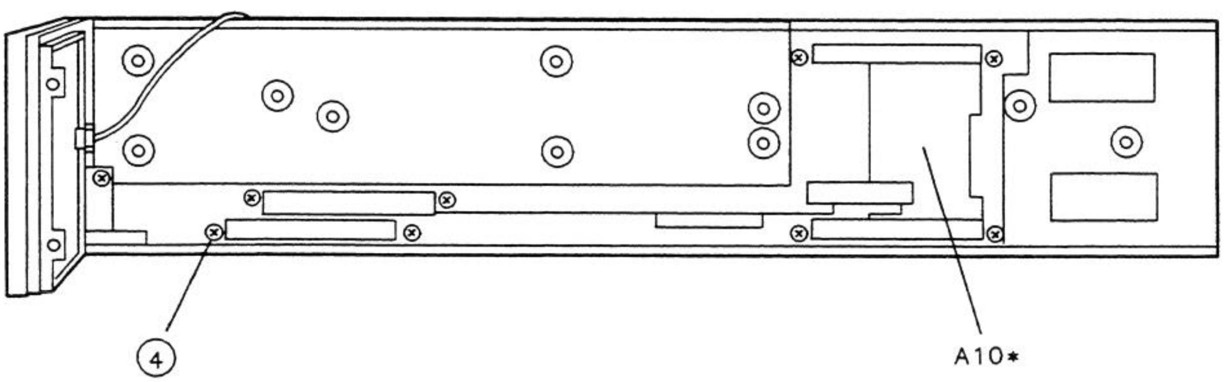

* Refer to Replaceable Parts List for part numbers

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-00006 | 8 | 1 | COVER, MODULE | 28480 | 70900-00006 |
| 2 | 0515-0890 | 9 | 4 | SCREW-MACH M3 X 0.5 6MM-LG 90-DEG-FLH-HD | 28480 | 0515-0890 |
| 3 | 0380-1908 | 5 | 1 | SPACER-RVT-ON 31-MM-LG 3.8-MM-ID 6-MM-OD | 28480 | 0380-1908 |
| 4 | 0515-1323 | 5 | 1 | SCREW-MACH M3 X 0.5 30MM-LG PAN-HD | 28480 | 0515-1323 |
| 5 | 0515-0911 | 5 | 1 | SCREW-MACH M3 X 0.5 12MM-LG PAN-HD | 28480 | 0515-0911 |
| 6 | 70900-20095 | 7 | 1 | SUPPORT BRACKET | 28480 | 70900-20095 |
| 7 | 0380-1905 | 2 | 1 | SPACER-RND 16-MM-LG 3.4-MM-ID 6.4-MM-OD | 28480 | 0380-1905 |
| 8 | 3050-0891 | 7 | 1 | WASHER-FL MTLC 3.0MM 3.3-MM-ID | 28480 | 3050-0891 |
| 9 | 0515-1825 | 2 | 1 | SCREW-MACHINE ASSEMBLY M3 X 0.5 23MM-LG | 28480 | 0515-1825 |
| 10 | 0380-1707 | 2 | 1 | SPACER-RND-20MM-LG PLST | 28480 | 0308-1707 |
| 11 | 0515-0886 | 3 | 4 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |

*Figure 7-3. Parts Identification, Top View*




BOTTOM FRAME, BOTTOM VIEW

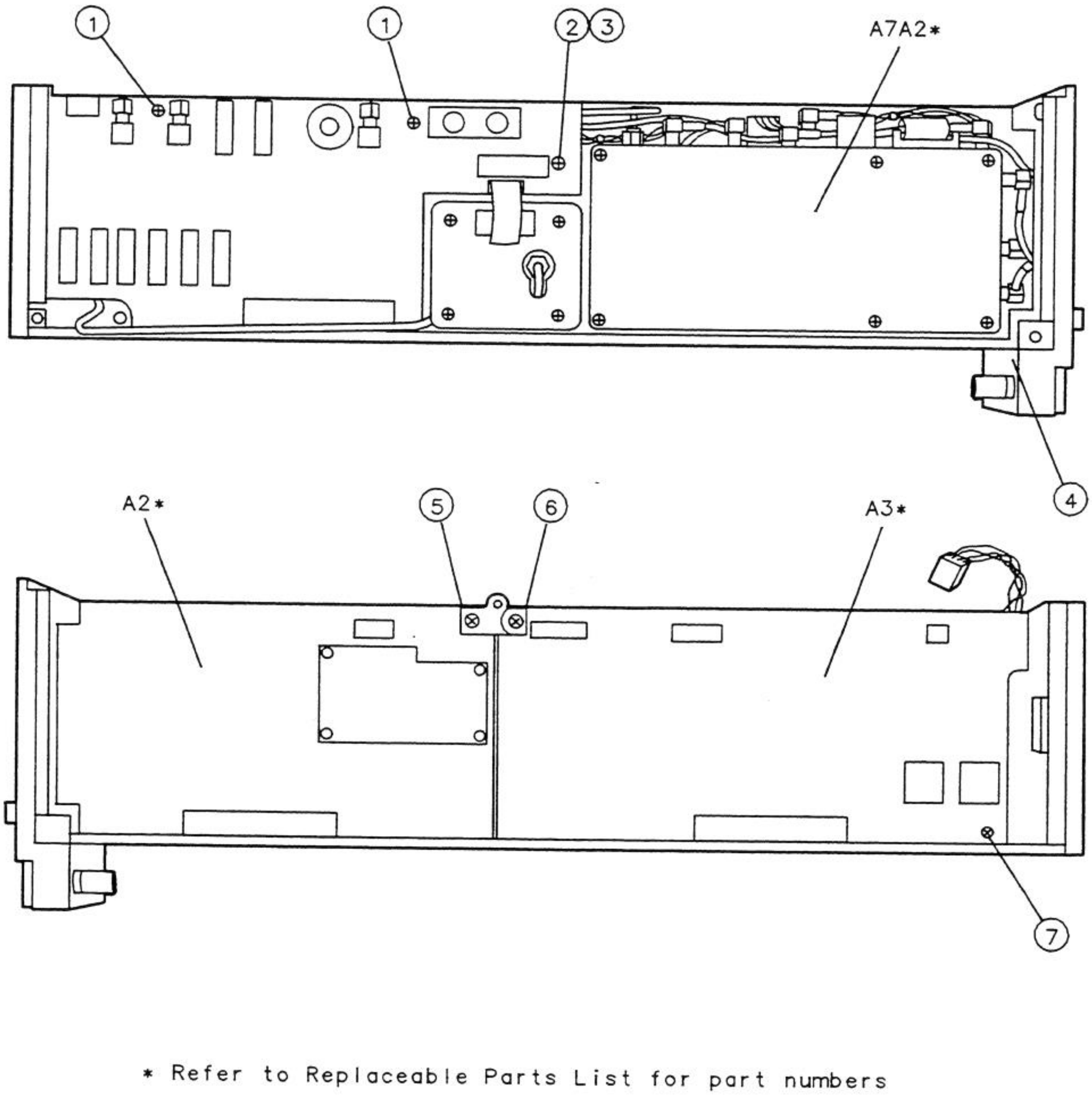



BOTTOM FRAME, TOP VIEW

* Refer to Replaceable Parts List for part numbers

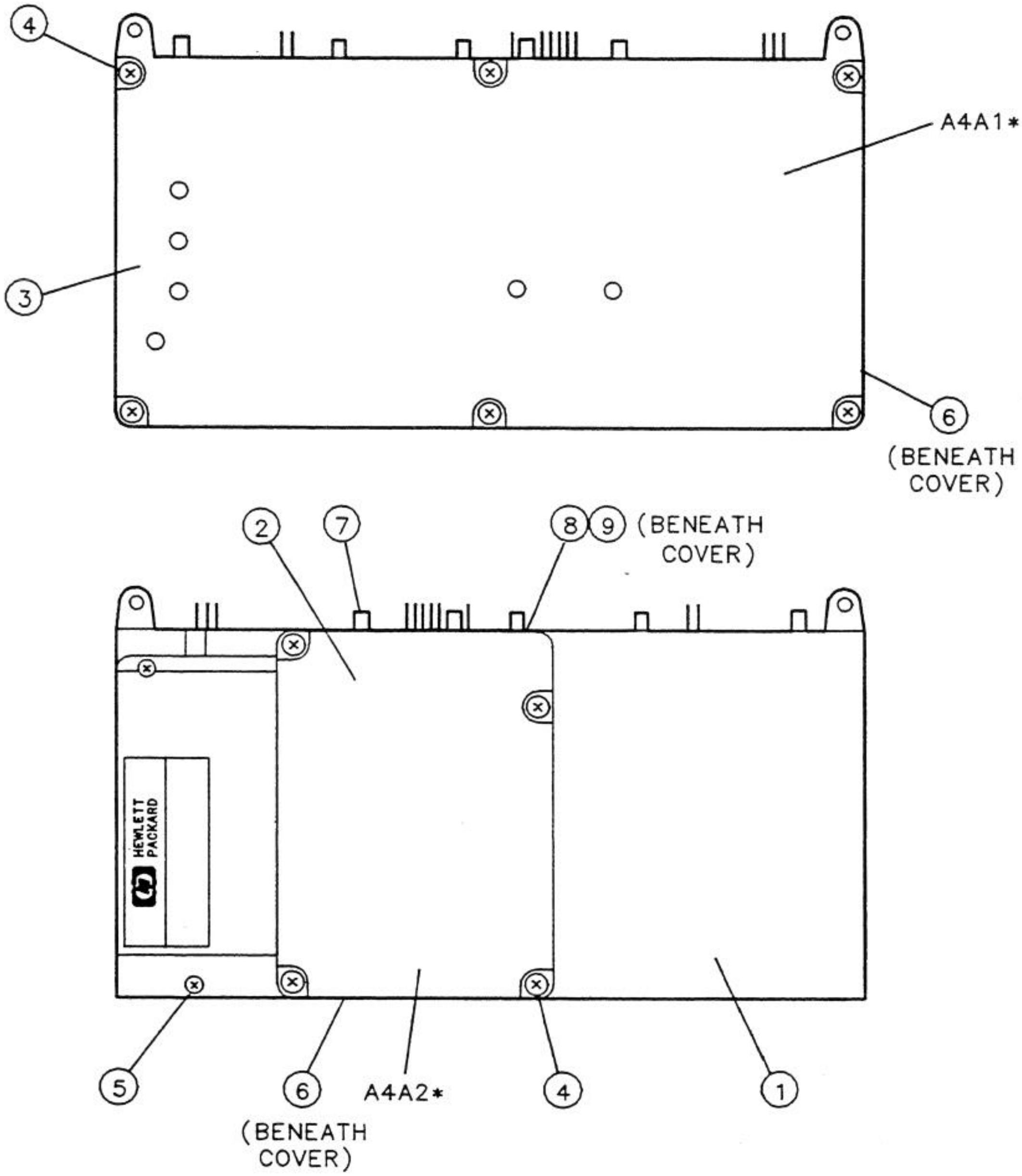
| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-20032 | 2 | 1 | FRAME, BOTTOM | 28480 | 70900-20032 |
| 2 | 0515-1498 | 5 | 2 | SCREW-SKT-HD-CAP M4 X 0.7 8MM-LG | 28480 | 0515-1498 |
| 3 | 0515-0885 | 2 | 10 | SCREW-MACH M4 X 0.7 8MM-LG PAN-HD | 28480 | 0515-0885 |
| 4 | 0515-0886 | 3 | 9 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |

*Figure 7-4. Parts Identification, Bottom View*




| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 0515-0886 | 3 | 2 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| 2 | 0515-1348 | 4 | 1 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-1348 |
| 3 | 3050-1207 | 1 | 1 | WASHER-FL NM 3.0MM 3-MM-ID 7.8-MM-OD | 28480 | 3050-1207 |
| 4 | 0515-1498 | 5 | 2 | SCREW-SKT-HD-CAP M4 X 0.7 8MM-LG | 28480 | 0515-1498 |
| 5 | 70900-20095 | 7 | 1 | SUPPORT BRACKET | 28480 | 70900-20095 |
| 6 | 0515-0911 | 5 | 2 | SCREW-MACH M3 X 0.5 12MM-LG PAN-HD | 28480 | 0515-0911 |
| 7 | 0515-1111 | 9 | 1 | SCREW-MACH M3 X 0.5 16MM-LG PAN-HD | 28480 | 0515-1111 |

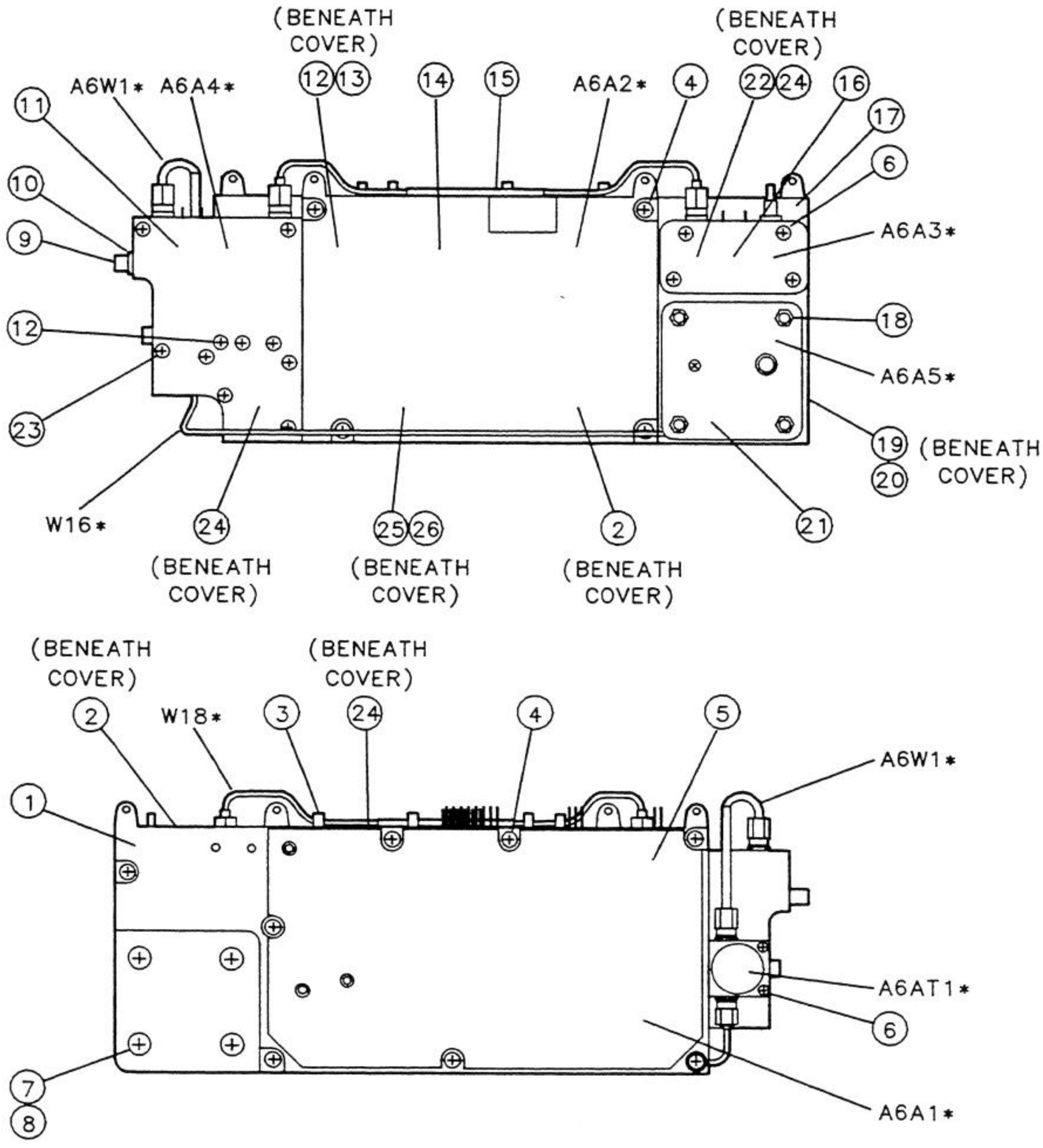
*Figure 7-5. Parts Identification, Side View*




* Refer to Replaceable Parts List for part numbers

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-20029 | 7 | 1 | HSG-300 MHZ-IDLER | 28480 | 70900-20029 |
| 2 | 70900-20033 | 3 | 1 | COV-IDLR DRVR-PC | 28480 | 70900-20033 |
| 3 | 70900-20028 | 6 | 1 | COVER-300 MHZ | 28480 | 70900-20028 |
| 4 | 0515-0897 | 6 | 10 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| 5 | 0515-1112 | 0 | 2 | SCREW-MACH M3 X 0.5 20MM-LG PAN-HD | 28480 | 0515-1112 |
| 6 | 0515-0886 | 3 | 1 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| 7 | 8160-0494 | 4 | 5 | RFI GSKT SURROUNDING JACK | 28480 | 8160-0494 |
| 8 | 8160-0490 | 0 | 1 | RFI STRIP GSKT 1.07MM X 1.6MM | 28480 | 8160-0490 |
| 9 | 8160-0495 | 5 | 1 | RFI STRIP GSKT 2.54MM X 1.57MM | 28480 | 8160-0495 |

*Figure 7-6. Parts Identification, A4 Assembly*

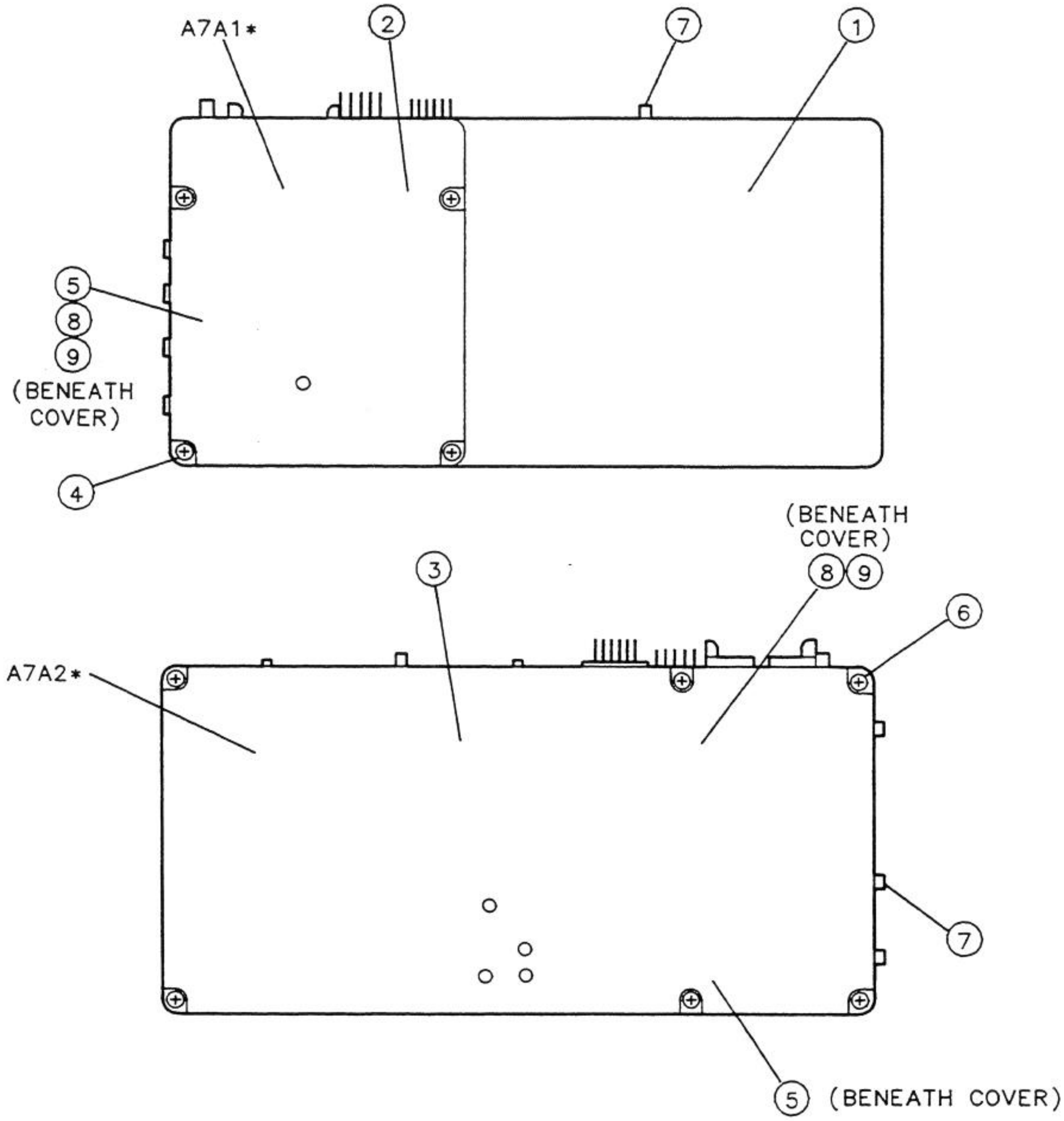



* Refer to Replaceable Parts List for part numbers

*Figure 7-7. Parts Identification, A6 Assembly (1 of 2)*

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-20026 | 4 | 1 | COVER A6A1 ASSEMBLY | 28480 | 70900-20026 |
| 2 | 8160-0495 | 5 | 1 | RFI "D" STRIP CNDCT-ELSTMR 2.54-MM-WD | 28480 | 8160-0495 |
| 3 | 8160-0494 | 4 | 5 | RFI "D" STRIP CNDCT-ELSTMR 7.92-MM-WD | 28480 | 8160-0494 |
| 4 | 0515-0897 | 6 | 7 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| 5 | 70900-00007 | 9 | 1 | INSULATOR 87 X 162MM | 28480 | 70900-00007 |
| 6 | 0515-0894 | 3 | 2 | SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD | 28480 | 0515-0894 |
| 7 | 0515-1367 | 7 | 4 | SCREW-MACH M4 X 0.7 8MM-LG 90-DEG-FLH-HD | 28480 | 0515-1367 |
| 8 | 70900-20098 | 0 | 2 | WASHER INSL 90DEG-M4 | 28480 | 70900-20098 |
| 9 | 1250-1938 | 7 | 1 | CONNECTOR-RF SMA FEM THD-HOLE 50-OHM | 28480 | 1250-1938 |
| 10 | 1250-1142 | 5 | 1 | WASHER-LK INTL T 1/2 IN .26-IN-ID | 28480 | 1250-1142 |
| 11 | 70900-20021 | 9 | 1 | COVER A6A4 ASSEMBLY | 28480 | 70900-20021 |
| 12 | 0515-0897 | 6 | 3 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| 13 | 0515-0886 | 3 | 1 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| 14 | 70900-20025 | 3 | 1 | COVER A6A2 ASSEMBLY | 28480 | 70900-20025 |
| 15 | 0340-1130 | 1 | 1 | INSULATION-RBR-SIL 4.76-MM-THK 10-MM-WD | 28480 | 0340-1130 |
| 16 | 70900-20019 | 5 | 1 | COVER A6A3 ASSEMBLY | 28480 | 70900-20019 |
| 17 | 70900-20101 | 6 | 1 | YTO PLL HOUSING | 28480 | 70900-20101 |
| 18 | 2360-0333 | 8 | 4 | SCREW-MACH 6-32 .32-IN-LG 100 DEG | 28480 | 2360-0333 |
| 19 | 7100-1309 | 5 | 1 | CAN-SQ H875-IN-DP-OUT 2.234-IN-WD-OUT | 28480 | 7100-1309 |
| 20 | 70900-00011 | 5 | 1 | INSULATOR-MYL 54.5MM SQ | 28480 | 70900-00011 |
| 21 | 7100-1308 | 4 | 1 | COVER-SQ .25-IN-DP-OUT 2.183-IN-WD-OUT | 28480 | 7100-1308 |
| 22 | 0515-1105 | 1 | 2 | SCREW-MACH M3 X 0.5 10MM-LG PAN-HD | 28480 | 0515-1105 |
| 23 | 0515-0894 | 3 | 9 | SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD | 28480 | 0515-0894 |
| 24 | 8160-0490 | 0 | 1 | RFI STRIP GSKT 1.07MM X 1.6MM | 28480 | 8160-0490 |
| 25 | 8160-0491 | 1 | 1 | RFI STRIP GSKT 1.57MM X 3.18MM X 2.36MM | 28480 | 8160-0490 |
| 26 | 8160-0493 | 1 | 1 | RFI STRIP GSKT 1.07MM X 1.6MM X 1.78MM | 28480 | 8160-0495 |

*Figure 7-7. Parts Identification, A6 Assembly (2 of 2)*




* Refer to Repl aceable Parts List for part numbers

| Item | HP Part Number | C D | Qty | Description | Mfr Code | Mfr Part Number |
|---|---|---|---|---|---|---|
| 1 | 70900-20024 | 2 | 1 | HOUSING-FFS | 28480 | 70900-20024 |
| 2 | 70900-20023 | 1 | 1 | COVER-FFS-VCO | 28480 | 70900-20023 |
| 3 | 70900-20022 | 0 | 1 | COVER-FFS-ANALOG | 28480 | 70900-20022 |
| 4 | 0515-0897 | 6 | 4 | SCREW-MACH M3 X 0.5 8MM-LG PAN-HD | 28480 | 0515-0897 |
| 5 | 0515-0886 | 3 | 2 | SCREW-MACH M3 X 0.5 6MM-LG PAN-HD | 28480 | 0515-0886 |
| 6 | 0515-1105 | 1 | 6 | SCREW-MACH M3 X 0.5 10MM-LG PAN-HD | 28480 | 0515-1105 |
| 7 | 8160-0494 | 4 | 6 | RFI GSKT SURROUNDING JACK | 28480 | 8160-0494 |
| 8 | 8160-0490 | 0 | 1 | RFI STRIP GSKT 1.07MM X 1.6MM | 28480 | 8160-0490 |
| 9 | 8160-0495 | 5 | 1 | RFI STRIP GSKT 2.54MM X 1.57MM | 28480 | 8160-0495 |

*Figure 7-8. Parts Identification, A7 Assembly*

# Chapter 8

# Major Assembly and Cable Locations

This chapter identifies the module's assemblies and cables and contains the figures listed below.



| Assemblies | See Figure |
|---|---|
| A1 Controller | 8-1, 6 |
| A1A1 Host Processor | 8-1, 6 |
| A1A2 RAM/ROM | 8-1 |
| A2 Video Processor | 8-1, 6 |
| A3 Power Supply | 8-1 |
| A4A1 300 MHz Amplifier | 8-1, 6 |
| A4A2 Idler lock | 8-1 |
| A4A3 Idler VCO | 8-1 |
| A6A1 100MHz Reference | 8-1 |
| A6A2 YTO Lock | 8-1 |
| A6A3 Idler Buffer | 8-1 |
| A6A4 YTO Lock Microcircuit | 8-1 |
| A6A5 YTO | 8-1 |
| A7 FFS Phase Lock Loop | 8-1, 6 |
| A7A1 FFS VCO | 8-1, 6 |
| A7A2 FFS Analog | 8-1, 6 |
| A8 Frequency Control | 8-1, 4 |
| A9 Front-Panel Assembly | 8-1, 5, 6 |
| A10 Motherboard | 8-6 |
| A11 Wiring harness | 8-1 |

| Cables | See Figure |
|---|---|
| A6W1 | 8-2 |
| W1 | 8-2 |
| W2 | 8-2 |
| W3 | 8-2 |
| A7W4 | 8-2, 6 |
| W4 | 8-2 |
| A7W1 | 8-6 |
| A7W2 | 8-6 |
| A7W3 | 8-6 |
| A7W5 | 8-2 |
| W6 | 5-4 |
| W7 | 5-3 |
| W8 | 5-4 |
| W9 | 5-4 |
| W10 | 5-6 |
| W11 | 5-6 |
| W12 | 8-2 |
| W13 | 8-2, 6 |
| W14 | 8-2 |
| W15 | 8-4 |
| W16 | 8-4 |
| W17 | 8-2 |
| W18 | 8-2 |
| W19 | 8-2 |
| W20 | 8-2 |

| Jacks | See Figure |
|---|---|
| J1 | 8-5 |
| J2 | 8-7 |
| J3 | 8-7 |
| J4 | 8-7 |
| J5 | 8-7 |
| J6 | 8-7 |
| J7 | 8-7 |
| J8 | 8-7 |
| J9 | 8-7 |
| J10 | 8-7 |
| A1A1J1 | 8-3 |
| A1A1J5 | 8-3 |
| A2J1 | 8-3 |
| A2J3 | 8-3 |
| A3J1 | 8-3 |
| A3J2 | 8-3 |
| A3J3 | 8-3 |
| A4A1J1 | 8-3 |
| A4A1J2 | 8-3 |
| A4A1J3 | 8-3 |
| A4A1J4 | 8-3 |
| A4A1J5 | 8-3 |
| A4A1J6 | 8-3 |
| A4A2J1 | 8-3 |

**Jacks** *(cont.)* **See Figure**

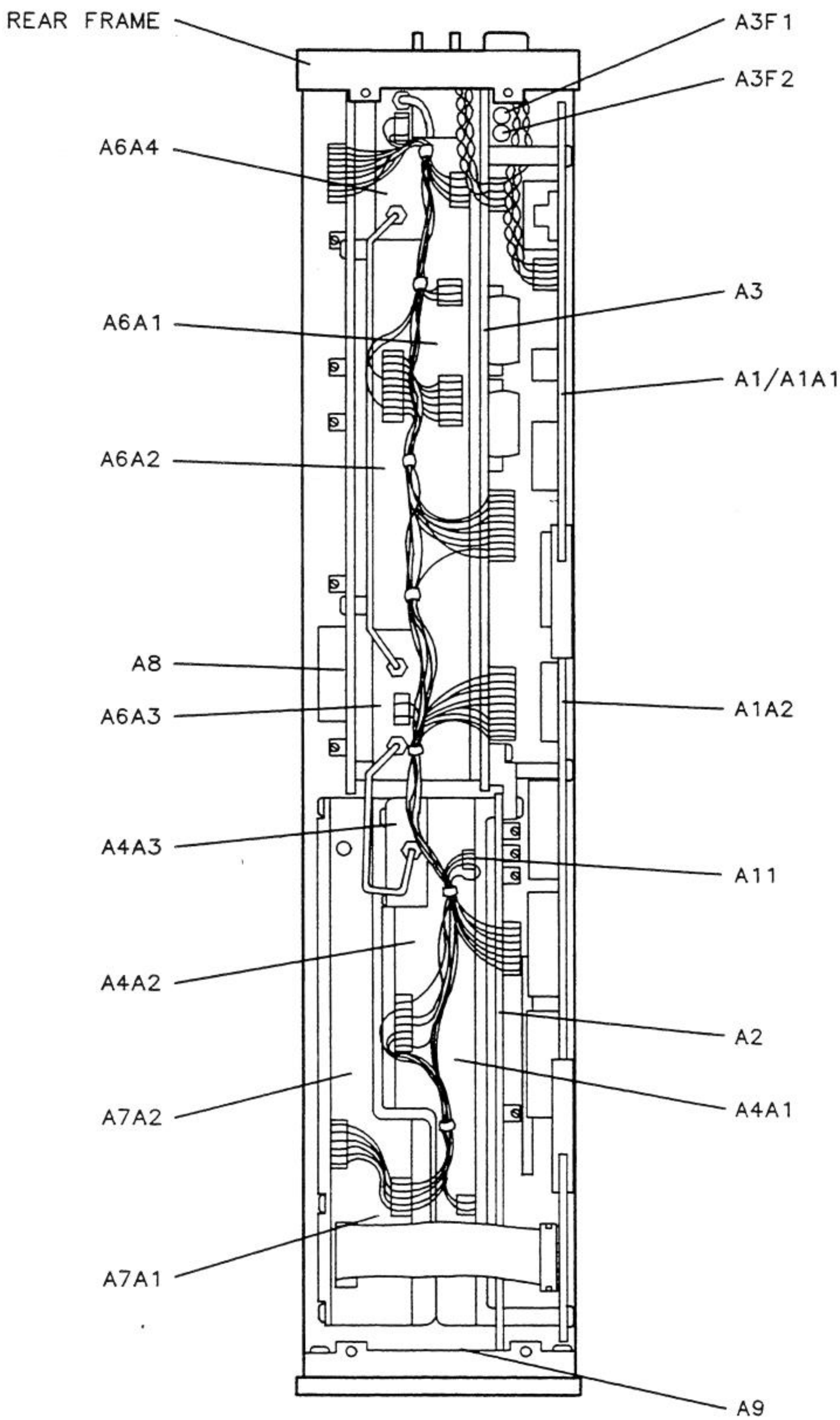



*Figure 8-1. Top View, Assembly Locations*

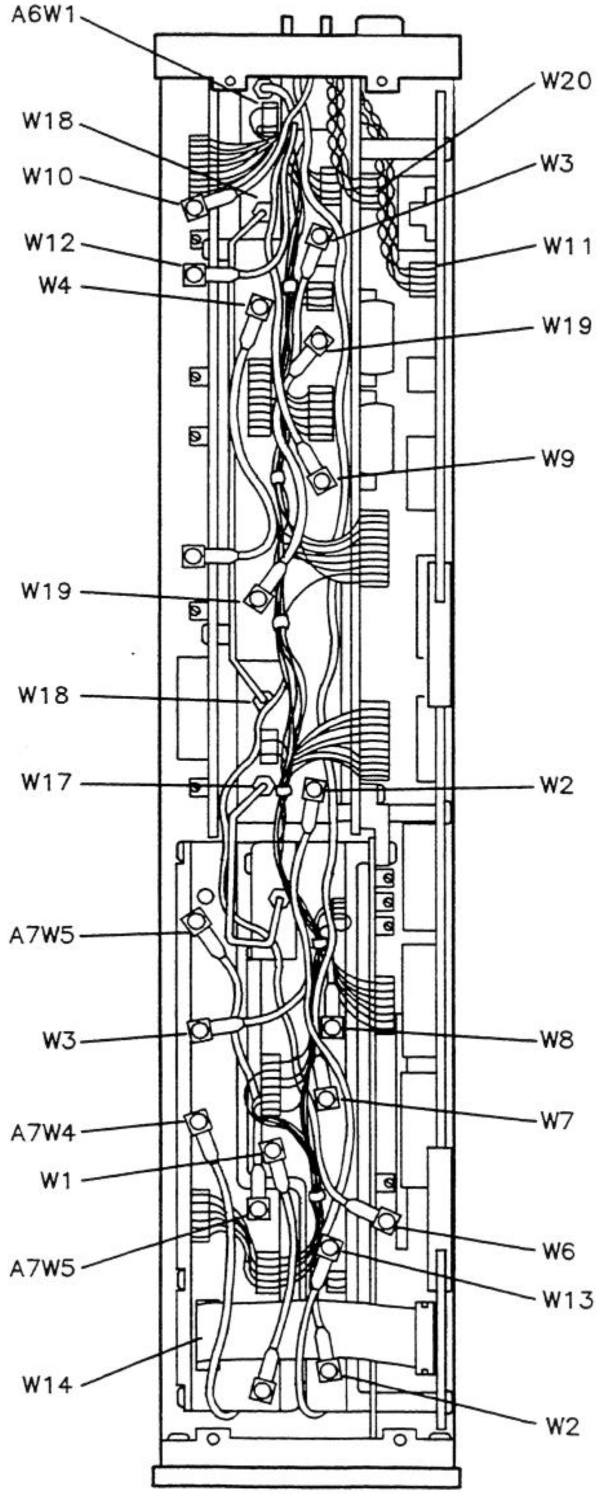



*Figure 8-2. Top View, Cable Locations*

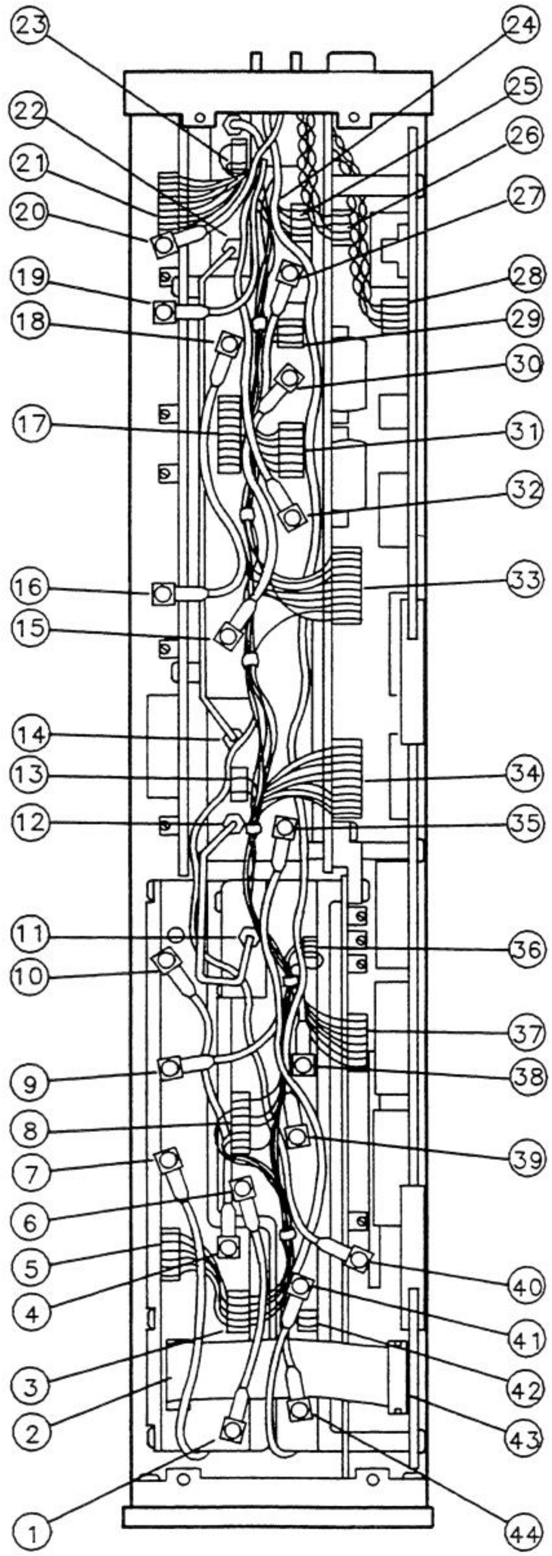



*Figure 8-3. Top View, Jack Locations (1 of 2)*

| Jacks | Item Number |
|---|---|
| A1A1J1 | 28 |
| A1A1J5 | 43 |
| A2J1 | 40 |
| A2J3 | 37 |
| A3J1 | 34 |
| A3J2 | 33 |
| A3J3 | 26 |
| A4A1J1 | 44 |
| A4A1J2 | 42 |
| A4A1J3 | 41 |
| A4A1J4 | 39 |
| A4A1J5 | 38 |
| A4A1J6 | 36 |
| A4A2J1 | 8 |
| A4A2J2 | 6 |
| A4A3J1 | 11 |
| A6A1J1 | 35 |
| A6A1J2 | 32 |
| A6A1J3 | 31 |
| A6A1J4 | 30 |
| A6A1J5 | 29 |
| A6A1J6 | 27 |
| A6A1J7 | 25 |
| A6A2J1 | 15 |
| A6A2J2 | 17 |
| A6A2J3 | 18 |
| A6A3J1 | 12 |
| A6A3J2 | 13 |
| A6A3J3 | 14 |
| A6A4J1 | 22 |
| A6A4J2 | 23 |
| A6AT1J1 | 24 |
| A7A1J1 | 1 |
| A7A1J2 | 3 |
| A7A1J3 | 4 |
| A7A2J1 | 10 |
| A7A2J2 | 9 |
| A7A2J3 | 7 |
| A7A2J4 | 5 |
| A7A2L5 | 2 |
| A8J1 | 16 |
| A8J2 | 19 |
| A8J3 | 20 |
| A8J7 | 21 |

*Figure 8-3. Top View, Jack Locations (2 of 2)*

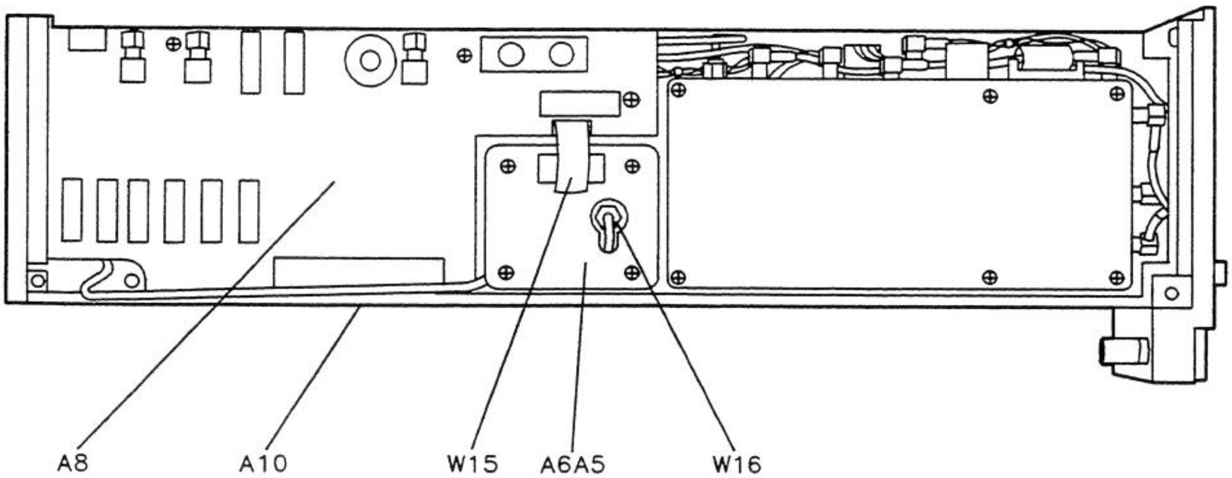



*Figure 8-4. Left-Side View*

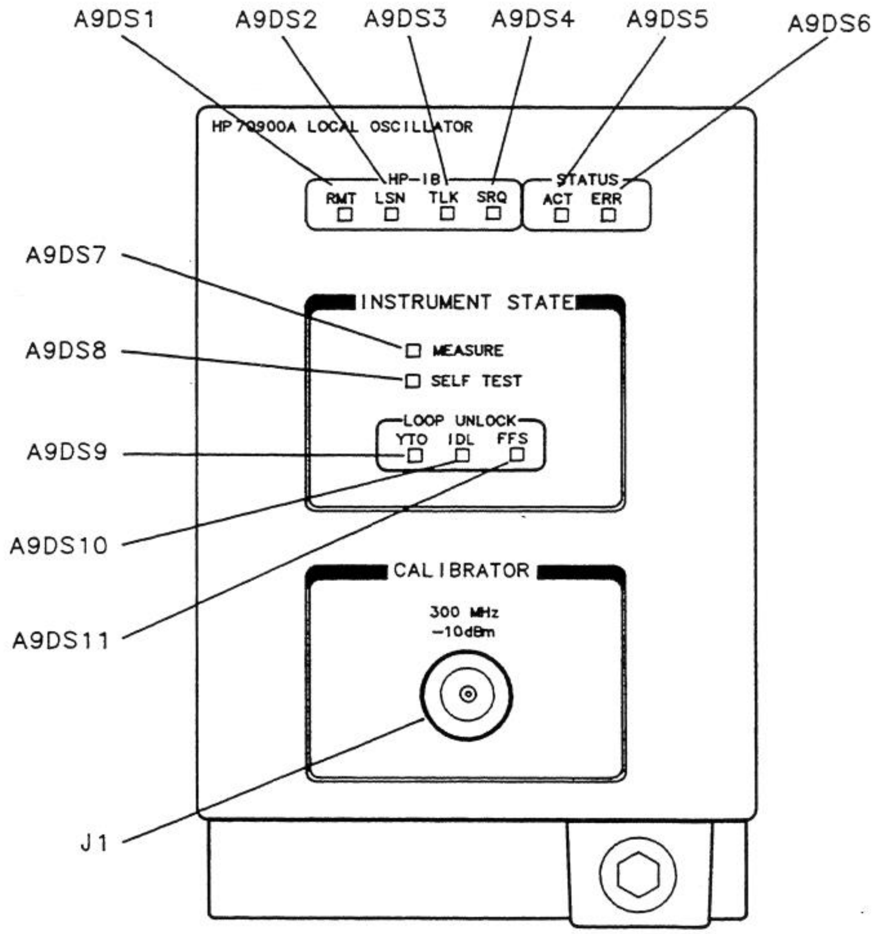



*Figure 8-5. Front View*

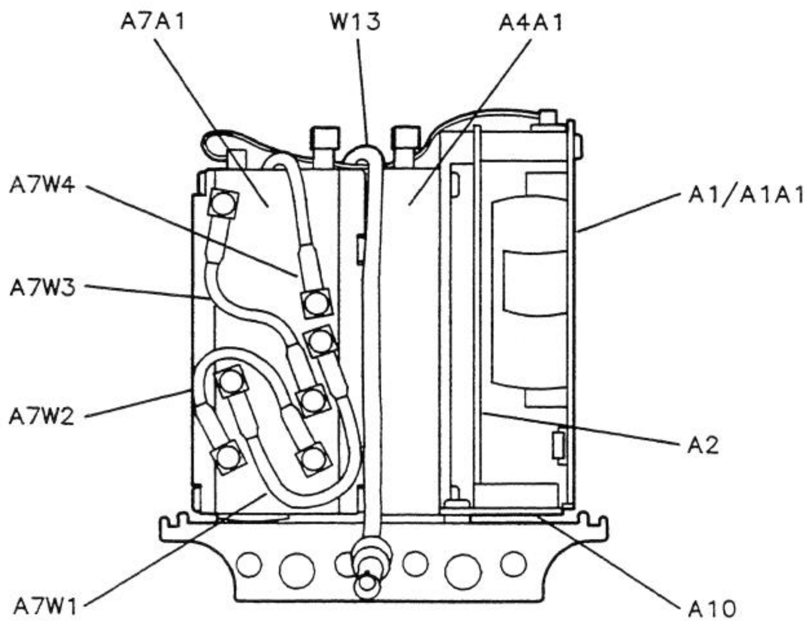



*Figure 8-6. Front View, Panel Removed*

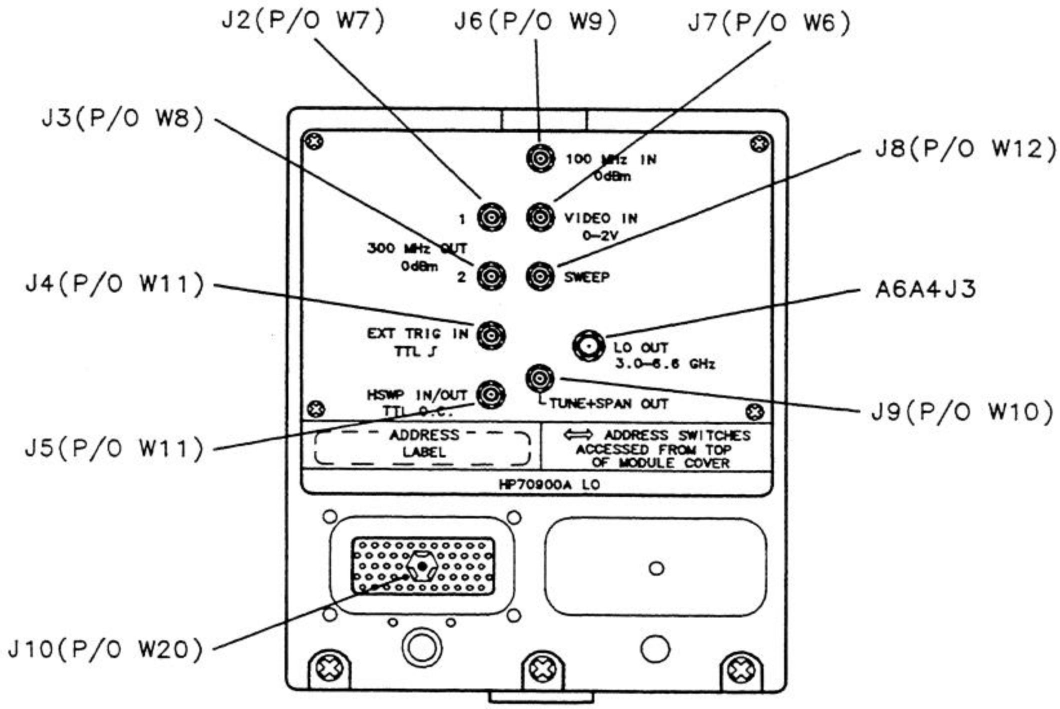



*Figure 8-7. Rear View*

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