Keysight Technologies 8511B Frequency Converter Test Set

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KEYSIGHT TECHNOLOGIES

Operating & Service Manual

Notices

Manual Part Number

08511-90067

Edition

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Published by:

Keysight Technologies, Inc.
1400 Fountaingrove Pkwy.
Santa Rosa, CA 95403 USA

Safety Notices

CAUTION

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

WARNING

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

Operating and Service Manual

HP 8511B
Frequency Converter Test Set

HP part number: 08511-90067
Printed in USA April 1996

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Hewlett-Packard Company
Santa Rosa Systems Division
1400 Fountaingrove Parkway
Santa Rosa, CA 95403-1799, U.S.A.

Serial Numbers

This manual applies directly to HP 8511B Frequency Converter Test Sets with serial number prefix 3047A and higher.

For additional information about serial numbers, refer to "Instruments Covered By Manual" in the General Information section of this manual.

What You'll Find in This Manual

Section I: HP 8511B Test Set Information

- General information
- Installation
- Operation
- Specifications and characteristics

Section II: HP 8511B Troubleshooting Information

- Test set troubleshooting
- Test set assembly replacement procedures
- Replaceable parts and accessories
- Performance tests
- Miscellaneous, including:
  - Adjustments
  - Instrument History

Warranty

Certification

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

Warranty

This Hewlett-Packard system product is warranted against defects in materials and workmanship for a period corresponding to the individual warranty periods of its component products. Instruments are warranted for a period of one year. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products that prove to be defective.

Warranty service for products installed by HP and certain other products designated by HP will be performed at Buyer's facility at no charge within HP service travel areas. Outside HP service travel areas, warranty service will be performed at Buyer's facility only upon HP's prior agreement and Buyer shall pay HP's round trip travel expenses. In all other areas, products must be returned to a service facility designated by HP.

For products returned to HP for warranty service, 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.

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Assistance

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

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

Support and Service

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. contact your local HP sales and service office.

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8th Floor
337 Fu Hsing North Road
Taipei
Taiwan
(866 2) 712-0404

Safety Considerations

General

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

Safety Symbols

WARNING

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

CAUTION

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

When you see this symbol on your instrument, you should refer to the instrument's instruction manual for important information.

Indicates hazardous voltages.

Indicates an earth (ground) terminal.

Safety Earth Ground

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

Before Applying Power

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

Typeface Conventions

Italics	• Used to emphasize important information. • Used for the title of a publication. • Used to indicate a variable: Type `LOAD BIN` *filename*.
`Instrument Display`	• Used to show on-screen prompts and messages that you will see on the display of an instrument: The HP 8511B will display the message **`CAL1 SAVED`**.
[Keycap]	• Used for labeled keys on the front panel of an instrument or on a computer keyboard: Press **[Return]**.
{Softkey}	• Used for simulated keys that appear on an instrument display: Press ***{Prior Menu}***.
`User Entry`	• Used to indicate text that you will enter using the computer keyboard; text shown in this typeface must be typed *exactly* as printed: Type `LOAD PARMFILE` • Used for examples of programming code: `#endif // ifndef NO_CLASS`
`Path Name`	• Used for a subdirectory name or file path: Edit the file *`usr/local/bin/sample.txt`*
Computer Display	• Used to show messages, prompts, and window labels that appear on a computer monitor: The **EDIT PARAMETERS** window will appear on the screen. • Used for menus, lists, dialog boxes, and button boxes on a computer monitor from which you make selections using the mouse or keyboard: Double-click **EXIT** to quit the program.

Declaration of Conformity

DECLARATION OF CONFORMITY
according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	Hewlett-Packard Co.
Manufacturer's Address:	1400 Fountaingrove Parkway Santa Rosa, California 95403 U.S.A.

Declares that the product:

Product Name:	S-Parameter Test Set
Model Numbers:	HP 8514B
Product Options:	This declaration covers all options of the above product(s).

Conforms to the following product specifications:

Safety:	IEC 348:1978/HD 401:1980 CAN/CSA-22.2 No. 231 Series M89
EMC:	CISPR 11:1990 /EN 55011:1991, Group 1 Class A IEC 801-2:1991 /EN 50082-1:1992, 4 kV CD, 8 kV AD IEC 801-3:1984 /EN 50082-1:1992, 3 V/m, 27–500 MHz IEC 801-4:1988 /EN 50082-1:1992, 500 V signal, 1000 V AC

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

The HP 8514B was qualified as part of a product family which includes the HP 8510C, HP 8530A, HP 8511A, HP 8511B, HP 8515A, HP 8516A, HP 8517A, HP 85105A, HP 85110A, and HP 85309A.

Santa Rosa, California — **Location**

May 7, 1993 — **Date**

Dixon Browder / Quality Manager

European Contact:
Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ/Standards Europe, Herrenberger Straße 130, D-7030 Böblingen (FAX: +49-7031-143143)

Notice for Germany: Noise Declaration LpA < 70 dB
am Arbeitsplatz (operator position)
normaler Betrieb (normal position)
nach DIN 45635 T. 19 (per ISO 7779)

Contents

6. Replacement Procedures

7. Replaceable Parts

8. Performance Tests

1

General Information

How To Get Started

This is the Operating and Service Manual for the HP 8511B frequency converter test set. This manual, in conjunction with the HP 8510 network analyzer manual set, provides all the information needed to properly configure your system and make measurements.

First. Place this manual behind the tab titled "Test Sets" in the *HP 8510 Test Sets and Accessories Manual*. Read the chapters titled "General Information" and "Installation." These chapters include information on site preparation, unpacking and inspecting your instrument for damage, safety considerations, and configuring your test set to the HP 8510.

Second. Read the chapters of the *Microwave Connector Care Manual*, supplied with the HP 8510 manual set, that pertain to the care, cleaning, gauging, and connection of precision 2.4 mm devices. This information will help you make good connections and care for your precision devices. To maintain the performance of your test set and network analyzer system, it is important to pay strict attention to the information provided in the *Microwave Connector Care Manual.*

Third. Read the chapter titled "Operation." This chapter will acquaint you with the front and rear panel features of your test set. Also included is information on controlling multiple test sets, using the anti-rotation clamps, and connecting devices to the test set.

The rest of the manual may be used as needed. The remaining chapters provide information on specifications, troubleshooting, replacement procedures, and parts.

Verifying the Frequency Converter Test Set

The test set has been designed to operate specifically with the HP 8510 network analyzer.

- To check the proper operation of the test set, perform the Operator's Check in the "Operation" chapter of this manual.
- The specifications for the test set may be verified by running the performance test software as described in the "Performance Tests" chapter in this manual.
- To troubleshoot the test set, refer to the troubleshooting information in the *HP 8510 Service Manual* to determine if the test set is at fault. Then refer to the troubleshooting information in this manual to determine the faulty assembly.

Measurement Accuracy

Any precision measurement is no better than the calibration of the network analyzer. As a general rule, the shorter the time between a calibration and the measurement of a device under test (DUT), the more precise the measurement will be, within the limitations of your system. For this reason Hewlett-Packard recommends that for precision measurements you recalibrate your system every few hours, or at a minimum, reverify your system calibration.

The frequency of your required calibration will depend on the temperature stability of the location of the network analyzer.

Instruments Covered By This Manual

You will find a two-part serial number on the rear panel of the instrument. The first four digits and the letter are the serial number prefix. The last five digits are the sequential suffix which is unique to each test set. The contents of this manual apply directly to test sets with the same serial number prefix as the one(s) in the front section of this manual.

If the serial prefix of your test set is not listed, your instrument differs from those documented in this manual. The differences are documented in the "Instrument History" section of this manual.

Instrument Compatibility

The test set is compatible with all HP 8510 network analyzers, HP 8340 or 8341 synthesized sweepers, and HP 8350 sweep oscillators.
HP 836XX-series sources must have a frequency range that extends to 50 GHz to take full advantage of the frequency range of the HP 8511B. If your network analyzer and/or source do not fulfill the required conditions, it will be necessary to upgrade your system. Please consult your Hewlett-Packard representative for more information. It is possible to use the HP 8511B test set with an HP 834x or an HP 8350 source, to their upper frequency limit.

Description and Characteristics of the Instrument

The HP 8511B four channel frequency converter test set is designed to operate with all HP 8510 network analyzers. The test set provides a convenient means of customizing a test configuration for a variety of applications within the frequency range of 45 MHz to 50 GHz. In addition to configurations for measuring reflection and transmission parameters of one-port or two-port devices, you can build configurations to characterize antenna parameters, radar cross sections and frequency translation devices. Figure 1-1 shows one possible measurement set-up.

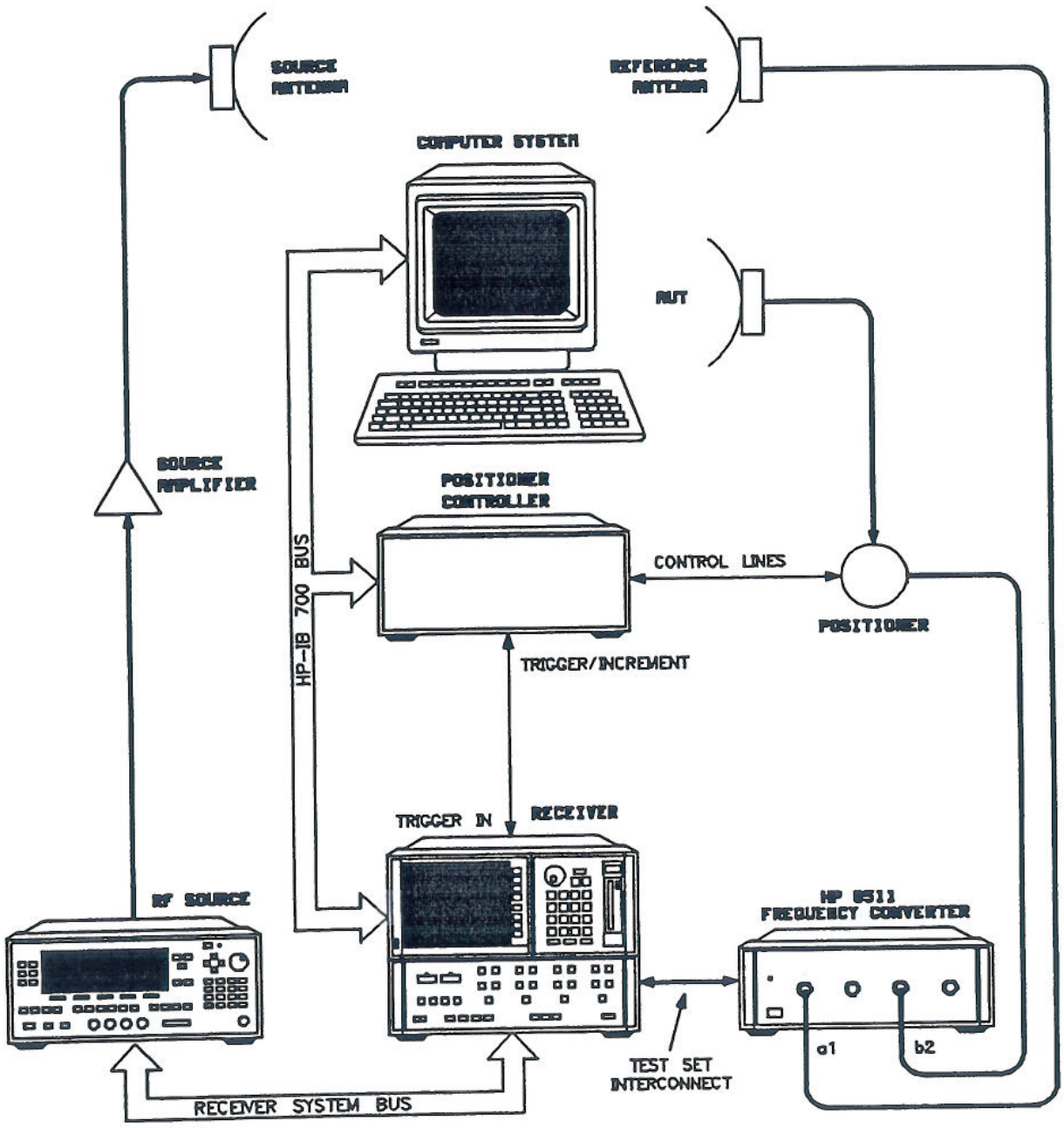

Figure 1-1 Measurement Setup

Options

Option 001

This option adds IF switching capability to allow up to four test sets to be connected to the HP 8510 at the same time. The test set in use is selected from the network analyzer. The 20 MHz IF signal is transmitted from the standard test set through the option 001 test set(s) to the network analyzer. IF switching is performed automatically by the option 001 test set(s), without reconnections. For more information, refer to "Controlling Multiple Test Sets" in the "Operation" chapter of this manual.

Option 908

This option supplies the parts required to rack mount the test set with handles removed. Refer to the "Installation" chapter of this manual for additional information.

Option 910

This option provides a duplicate manual.

Option 913

This option supplies the parts required to rack mount the test set with handles attached. Refer to the "Installation" chapter of this manual for additional information.

Service and Support Products

A variety of service and support products are available. These products cover repair, calibration, and verification. Consult your local Hewlett-Packard customer engineer for details.

The instrument includes a one year on-site service warranty. In the event of failure, Hewlett-Packard will provide service for the system. Note that system installation is not included.

Option W30

This option supplies a three year customer return repair coverage, which adds to the product warranty to provide a total of three years of customer return to Hewlett-Packard repair service.

Option W31

This option supplies a three year on-site repair coverage, which adds to the product warranty to provide a total of three years of next day on-site repair service.

Option 1BN

This option adds a MIL-STD 45662A Certificate of Calibration to the instrument. This option must be ordered when the instrument is ordered.

Option 1BP

This option adds a MIL-STD 45662A Certificate of Calibration and the corresponding calibration data to the instrument. This option must be ordered when the instrument is ordered.

Accessories

Accessories Supplied

The accessories supplied with the test set, including part numbers, are listed in the "Installation" and "Replaceable Parts" chapters of this manual.

Accessories Available

NOTE Additional HP 8510 system accessory information is located in the HP 8510 manual set.

Calibration and Verification Kits

Hewlett-Packard offers several calibration and verification kits. Suitable for use with 2.4 mm interfaces, they are listed below.

HP 85056A 2.4 mm Calibration Kit

Contains open and short circuits, fixed and sliding loads (2), 2.4 mm to 2.4 mm adapters, 2.4 mm connector tools and gauges.

HP 85057S 2.4 mm Verification Kit

Contains precision airline, mismatched airline, 20 and 40 dB attenuators with NIST (National Institute of Standards and Technology) traceable data and uncertainties.

Operating and Safety Precautions

Electrostatic Discharge Information

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe work station. Figure 1-2 on page 1-7 shows an example of a static-safe work station using two types of ESD protection:

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

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone.

To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground. Refer to Table 1-1 on page 1-8 for information on ordering static-safe accessories.

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

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

Reducing ESD Damage

The following suggestions may help reduce ESD damage that occurs during testing and servicing operations.

- Before connecting any coaxial cable to an instrument connector for the first time each day, momentarily ground the center and outer conductors of the cable.

- 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 unit.
- Be sure that all instruments are properly earth-grounded to prevent a buildup of static charge.

Table 1-1 lists static-safe accessories that can be obtained from Hewlett-Packard using the HP part numbers shown.

Table 1-1 Static-Safe Accessories

HP Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m X 1.2 m (2 ft X 4 ft) and 4.6 cm (15 ft) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft).
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1169	ESD heel-strap (reusable 6 to 12 months).

Operating Power Level

Do **not** exceed the front panel operating level power input as noted:

Table 1-2 Maximum Operating Power Level

Maximum Operating Power Level	Test Port
+13 dBm	a_1, a_2, b_1, b_2

- Do **not** exceed +15 dBm source RF input level into the test set and under no circumstances ever apply a DC level to the source RF input of the test set.
- Do **not** torque anything to the test port connector with greater than 90 N-cm (8 in.-lb.) of torque. The wrench supplied with your accessory kit is calibrated to 90 N-cm (8 in.-lb.).
- Do **not** torque anything to the source RF input on the back of your test set, with greater than 90 N-cm. (8 in.-lb.) of torque.

Service

The voltages in this test set warrant normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel. Service strategy, troubleshooting procedures, replaceable parts and similar information for the HP 8511B test set is in this manual or the *HP 8510B Service Manual.*

- 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 unit.
- Be sure that all instruments are properly earth-grounded to prevent a buildup of static charge.

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The voltages in this test set warrant normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel. Service strategy, troubleshooting procedures, replaceable parts and similar information for the HP 8511B test set is in this manual or the *HP 8510B Service Manual.*

Specifications

The specifications of the test set with an HP 8510 network analyzer are listed in the "Specifications" chapter of this manual.

Characteristics

The performance parameters listed in the "Specifications" chapter as characteristics are typical or nominal, but non-warranted characteristics of the HP 8510/8511B system.

Recommended Equipment

Additional equipment and accessories required for use with the test set are listed in tables in the "Specifications" and "Performance Tests" chapters of this manual. The tables note which items are required to verify the performance of the test set and which are required to operate it. Other equipment may be substituted if its specifications meet or exceed the specifications listed in the critical specifications column.

2

Installation

Introduction

This section explains how to install the test set. The topics covered include initial inspection, environmental considerations, positioning and connecting the test set for use, and packaging the instrument. Refer to the "Installation" chapter of the HP 8510 manual for more complete system connection and turn-on instructions.

Initial Inspection

Inspect the shipping container (including cushioning material) for damage. If it is damaged, keep it until you have checked the contents for completeness. The accessories supplied with the test set are illustrated in Figure 2-1.

NOTE

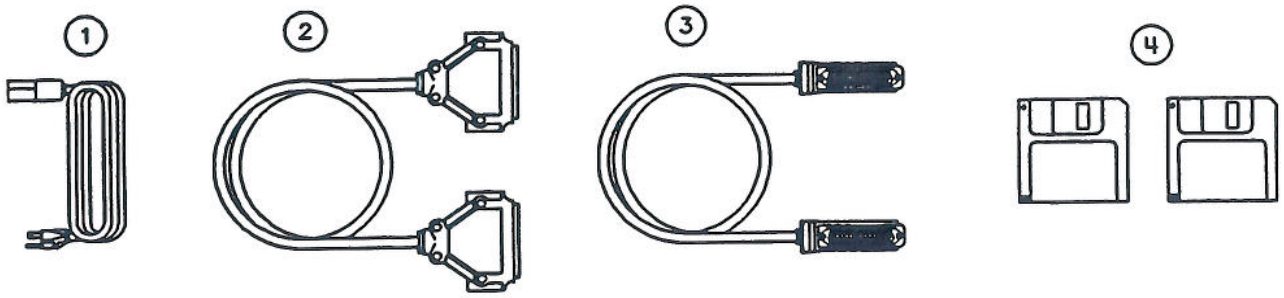
If the shipping container is damaged, perform the performance tests. If the test set fails the performance tests, or is damaged or defective, keep the shipping materials and notify both the carrier and the nearest Hewlett-Packard office. The HP office will arrange for repair or replacement of the test set without waiting for settlement of the claim. If any of the following accessories are not received with the test set, notify your nearest HP office and the missing parts will be sent to you.

Environmental Considerations

Operation and Storage

To perform within specifications, the test sets should be operated in temperatures between 0°C and +55°C with relative humidity less than 95% (at 40°C dry bulb temperature, maximum). They may be operated at altitudes up to 4,500 meters (15,000 feet).

The test sets may be stored in temperatures from –40°C to +75°C, with relative humidity up to 90% at +65° (maximum dry bulb temperature) and at altitudes up to 15,240 meters (50,000 feet).



1. Power Cord U.S.A. only 2. Test Set Interconnect Cable 3. HP-IB Cable 4. Performance Test Software

Figure 2-1 Accessories Supplied with the Test Set

CAUTION

Assemblies in the test set are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

Always use an anti-static wrist strap when calibrating or verifying the test set or using the test set to measure devices. Never touch the test port center conductors. For more information on ESD, refer to "Operating and Safety Precautions" on page 1-6.

Installing the Test Set in a System Rack

The recommended system rack is the HP 85043A. Instructions for rack-mounting the test set in a system configuration with the HP 8510 are provided in the "Installation" chapter of the HP 8510 on-site service manual and in the HP 85043A system rack manual.

To install the flanges to rack mount the instrument (with or without handles) in a standard 19 inch rack, refer to Figure 2-2.

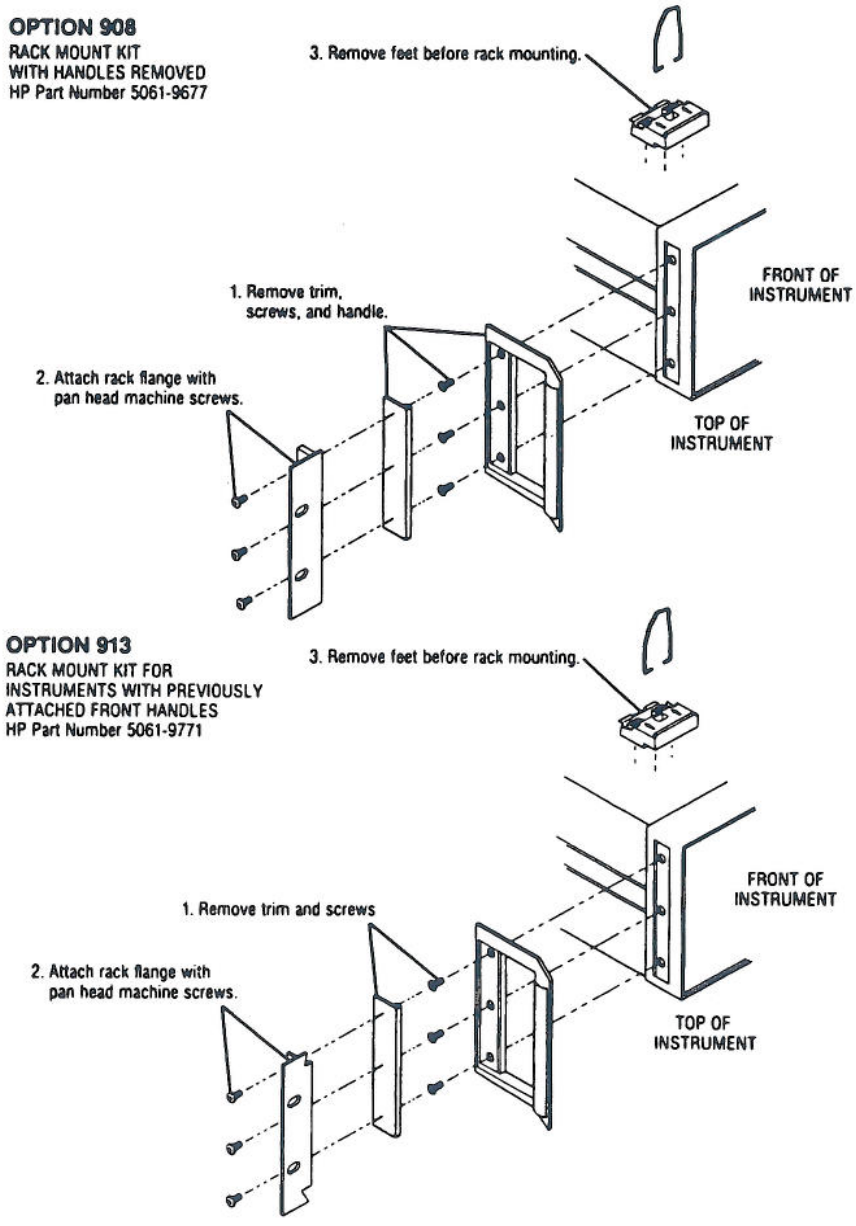


Figure 2-2 Attaching Rack-Mounting Hardware

Installing the Test Set on a Bench

When installing the test set for use on a bench, place it on a grounded anti-static work surface to lessen the chance of ESD damage. The antistatic surface should extend far enough in front of the test set to provide effective protection for the test ports and cable ends. Refer to "Operating and Safety Precautions" on page 1-6. A grounding receptacle is provided on the test set as an alternate grounding point for your anti-static wrist-strap.

Connecting the Test Set in a System Configuration

The cable connections in a system configuration are illustrated in Figure 2-3. Follow the instructions in the following paragraphs.

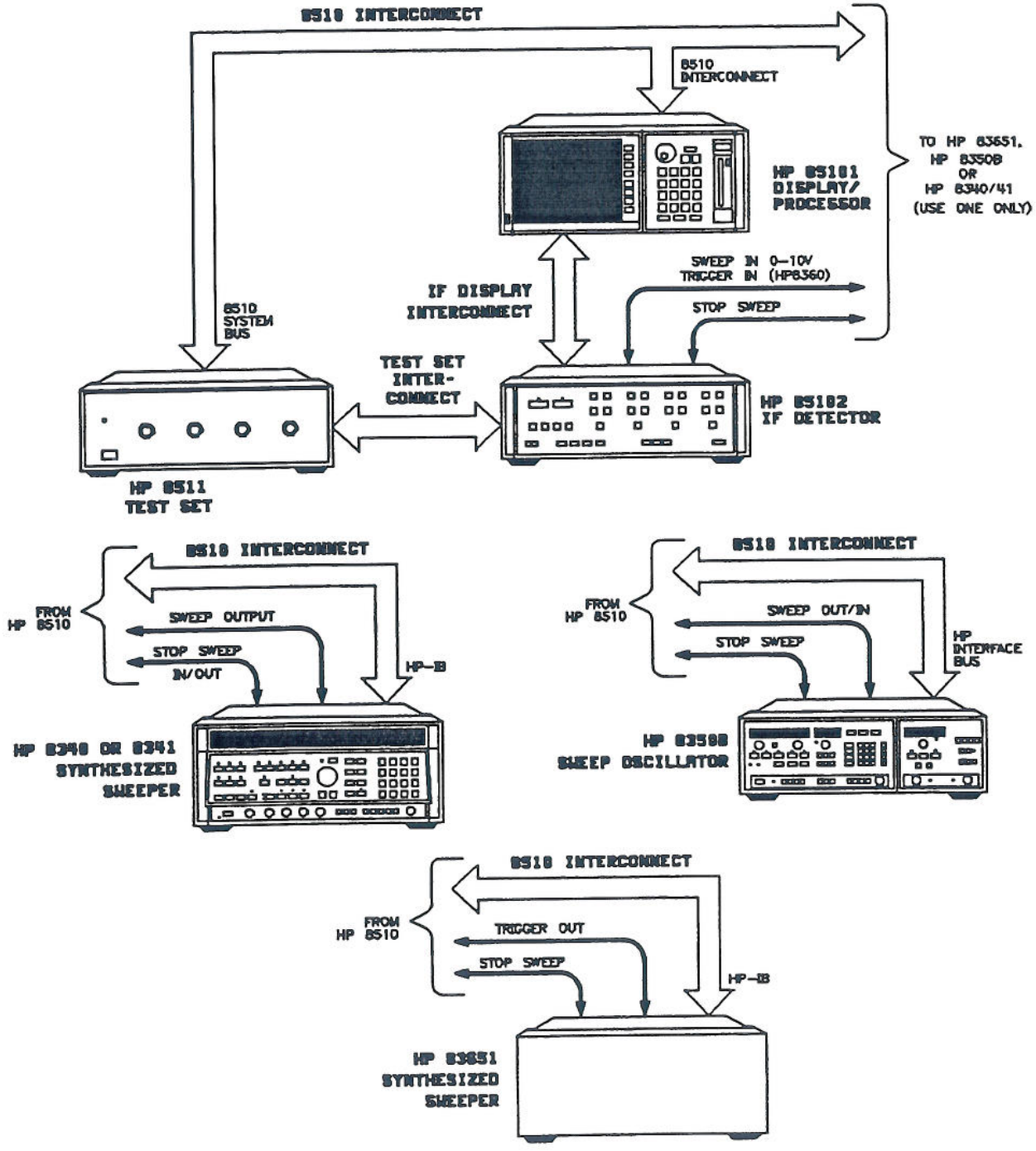


Figure 2-3 System Connections

Power and Control Connections

Make sure the line module is set to the correct voltage. For information on changing the voltage selection or replacing the line fuse, refer to the "Troubleshooting" chapter of this manual. Connect the test set power cord to an electrical outlet.

Connect the test set IF interconnect cable from the J11 TEST SET INTERCONNECT connector on the rear panel of the test set to the J1 TEST SET INTERCONNECT connector on the rear panel of the HP 85102 IF detector.

Connect the system bus cable from the test set J12 HP 8510 SYSTEM BUS connector to the HP 8510 INTERCONNECT connector of the HP 85101 display/processor. The test set IF interconnect cable and the system bus cable transmit control signals between the test set and the network analyzer.

Signal Path Connections

The IF signals from the test set are transmitted to the HP 85102 IF detector by the test set IF interconnect cable (see above).

Test Port Connectors

Ports a_1, a_2, b_1, and b_2 are precision 2.4 mm female connectors and mate with 2.4 mm male connectors.

Packaging

If reshipping is required, the test set should be repackaged in the original factory package. Containers and materials identical to those used by the factory are available through Hewlett-Packard offices.

Alternatively, comparable packaging materials may be used. Wrap the test set in heavy paper or anti-static plastic. If shipping to an HP office or service center, complete and attach a service tag (in the HP 8510 manual set). Use sufficient shock absorbing material on all sides of the test set to provide a thick, firm cushion and prevent movement. Seal the shipping container securely and mark it FRAGILE.

In any correspondence with HP, refer to the test set by full model and serial number.

3

Operation

Introduction

This section illustrates the features and functions of the front and rear panels of the test set, and describes the multiple test set option (option 001). It explains the setup and use of one or more test sets in a system.

Front Panel Features

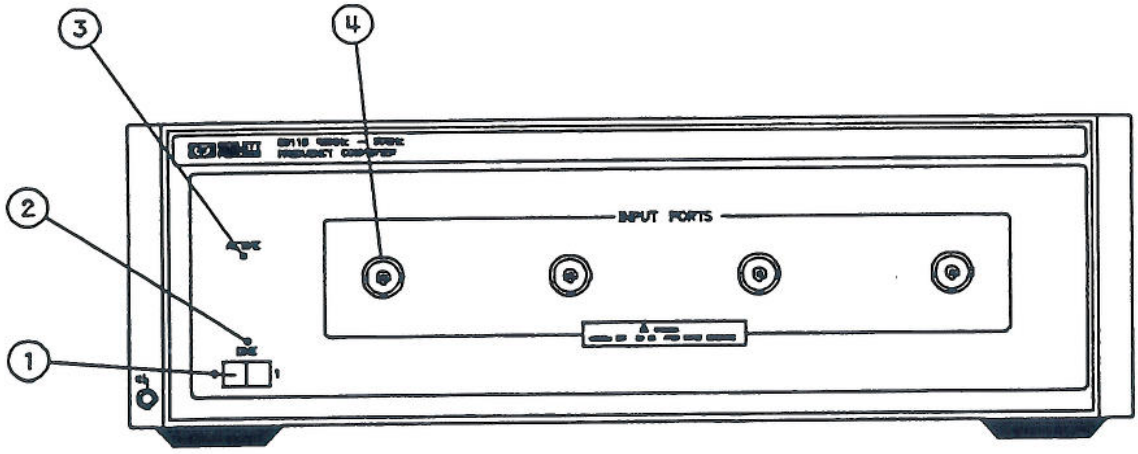


Figure 3-1 Front Panel Features of the Test Set

1. Line Switch

This switch turns the test set on and off. When the side of the switch labeled O is depressed, the test set is off; | is on.

2. Line LED

This LED goes on and off with the test set line switch.

3. Active LED

This LED lights about two seconds after power is turned on, following the successful conclusion of self-test, If the test set is used with other test sets (option 001) and is not addressed by the HP 8510, then this light remains off.

4. Input ports b_1, a_1, a_2, and b_2

These input ports transmit RF energy to the samplers within the instrument. Port a_1 or a_2 must be used for system phaselock. These ports are precision 2.4 mm connectors and all connections must be torqued no more than 90 N-cm (8 in-lb).

Rear Panel Features

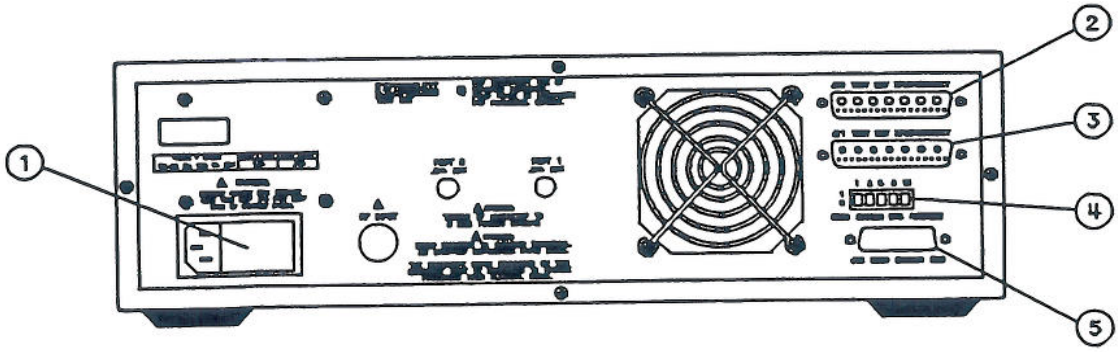


Figure 3-2 Rear Panel Features of the Test Set

1. Line Module

This assembly houses the line cord connector, line fuse and line voltage selector. Pull out the right side of the line module cover to replace or change the fuse or to change the voltage selection. The voltage selector drum must be removed to rotate it to a different voltage setting. Recommended fuse values are printed on the rear panel.

2. J10 Test Set Interconnect

This connector is used only in test sets with option 001. It allows connecting another test set to the option 001 test set. Up to four test sets can be serially connected to the analyzer. The HP 8510 system automatically selects the IF output from the chosen test set for processing and display. Refer to "Controlling Multiple Test Sets" in this chapter for more information.

3. J11 Test Set Interconnect

This connector transmits the IF signal from the test set to the HP 85102 IF detector. It also transmits control signals bidirectionally.

4. HP 8510 System Bus Address Switch

This five-pole binary-weighted switch sets the system bus address of the test set. The binary weight of each pole is indicated on the rear panel, as are the on and off positions. Decimal twenty (off-off-on-off-on, from left to right) is the default setting.

5. J12 8510 System Bus Connector

This connector is used for HP-IB communications with the HP 85101 display/processor.

Operator's Check

The purpose of this check is to confirm that the HP 8511B functions properly as part of an HP 8510 system. The performance tests are documented in the "Performance Tests" section of this manual.

NOTE This procedure must be performed with a properly configured and operational HP 8510 system.

Equipment

Network analyzer system	HP 8510A/B/C
Semi-rigid cables (2)	08511-20025[1]
Power splitter	HP 11667C[1]

1. Supplied with HP 8511B service kit (part number 08511-60016).

Procedure

Plug in and turn on the frequency converter. The line LED should light immediately and the active LED should light in about two seconds. Those indications mean that the instrument has passed its self-test. In case of difficulty, refer to "Troubleshooting" in this manual or contact your local HP Service office.

Turn on the source and then the HP 8510.

1. Press **[RECALL]**, **[MORE]**, **[FACTORY PRESET]** on the HP 85102 to preset the HP 8510C, or **[PRESET]** on the HP 8510A/B.
   a. HP 8340/41 and 83651 systems: press STIMULUS, **[MENU]**, **[STEP]** on the HP 85102 to put the source in step mode.
   b. HP 8350B systems: press STIMULUS, **[MENU]**, **[SWEEP TIME]** and then use the entry keys to set the sweep time to 200 ms. In narrow band systems, the power level in the frequency band generated should match the level shown in Figure 3-5 on page 3-8 for a given frequency.
2. Reduce the source power by pressing STIMULUS, **[MENU]**, POWER, **[MENU]**, **[POWER SOURCE 1]**, **[-10]**, **[x1]**.

NOTE All of the observed traces should decrease from –15 ±5 dB at 45 MHz to –35 ±5 dB at 50.0 GHz. Refer to Figure 3-4 on page 3-6.

a1 and b1 Test

3. Loosely connect the RF source cable to the power splitter as shown in Figure 3-3 below. Connect the other end of the RF source cable to the output of the source. Rotate the semi-rigid cables to the required position for connection to ports a1 and b1. Tighten all connections.

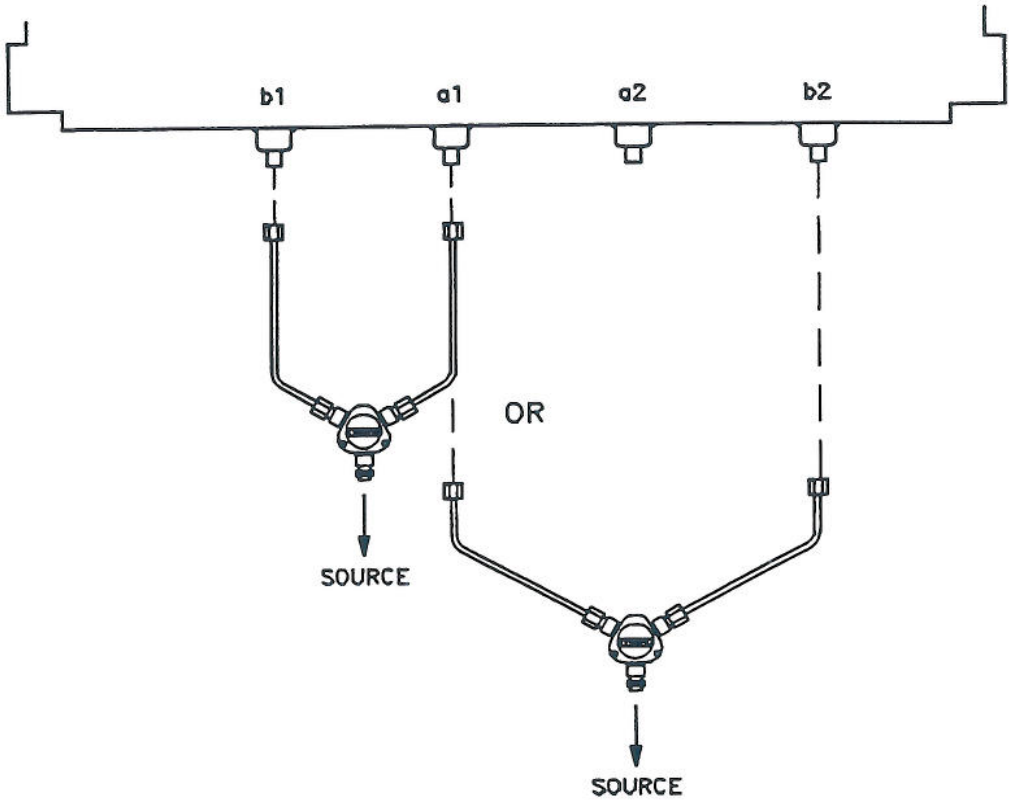


Figure 3-3 Hardware Configuration for Operator's Check

4. Press PARAMETER, **[MENU], [User 1 a1]** to observe the a1 power level trace.

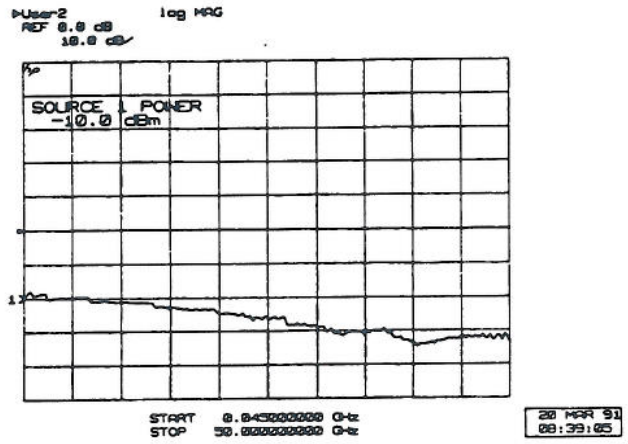


Figure 3-4 Typical Operator's Check CRT Trace

5. Press [User 4 b1] to observe the b1 power level trace.

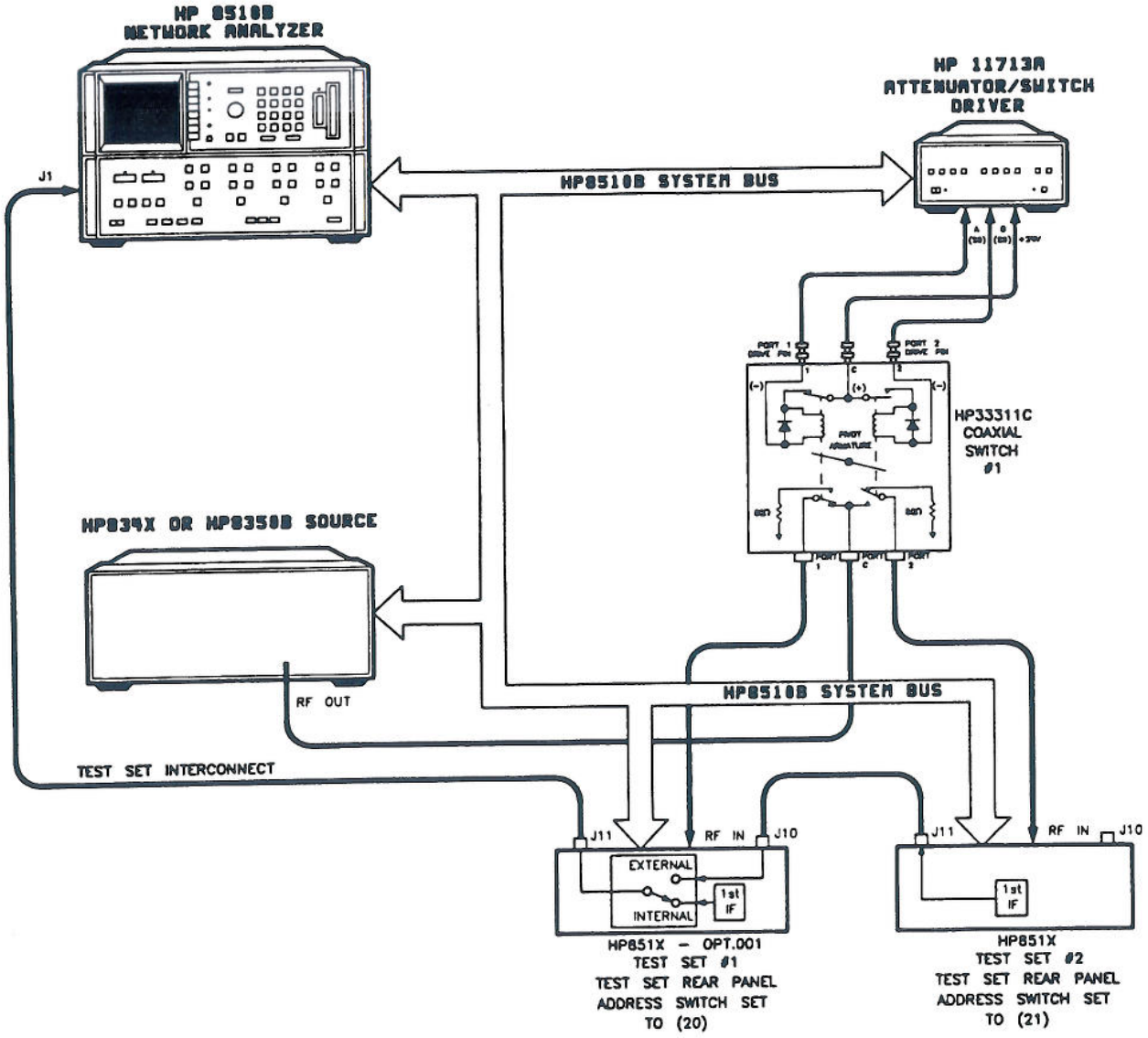
a2 and b2 Test

6. Reconnect the semi-rigid cables (as in step 2) to ports a2 and b2. Disregard the running error message **"Caution: NO IF FOUND"**.
7. Press **[User 3 a2], [REDEFINE PARAMETER], [PHASE LOCK], [a2], [REDEFINE DONE]** to observe the a2 power level trace.
8. Press **[User 2 b2], [REDEFINE PARAMETER], [PHASE LOCK], [a2], [REDEFINE DONE]** to see the b2 trace.
9. If any of the traces are not within the limits noted above, check all of the connections and repeat the above procedure.

Controlling Multiple Test Sets

Option 001 for the HP 851X-series test sets allows an HP 8510 to alternately control up to four test sets. While a measurement is proceeding on test set number 1, which is equipped with option 001, a test device can be connected to test set number 2, which does not need to be equipped with option 001. When the measurement on test set number 1 is complete, the HP 8510 can control test set number 2.

In a standard test set, the 20 MHz IF and control signals are applied directly to J11 TEST SET INTERCONNECT, which connects to the HP 8510. Option 001 adds a set of IF switches, control switches, and the J10 TEST SET INTERCONNECT connector. This allows the selection of 20 MHz test set IF signals. As shown in Figure 3-6, test set number 1 can apply its IF to the HP 8510 or it can switch to pass the IF from test set number 2 through the J10 TEST SET INTERCONNECT to the HP 8510.



NOTE: 1. Not all system connections are shown.
2. In dual source configurations, the second can be multiplexed in a similar manner. If only one dual source test set is used, the second source can be directly connected to the appropriate test set.

Figure 3-5 RF and IF Switching with Two Test Sets

HP 33311C Coaxial Switch Positions with Two Test Sets		
New ADDRESS of Test Set	Test Set Selected	HP 33311C Coaxial Switch Port Selected
20	1	Port 1
21	2	Port 2

Test Set Connections

Set each test set rear panel address switch to the address listed in Figure 3-5 for a dual test set configuration, or Figure 3-6 if configuring more than two test sets. Use the supplied test set interconnect cable to connect test set number 1 J11 to the analyzer. Use the supplied test set interconnect cable to connect test set number 2 J11 to test set number 1 J10. You may continue to connect in series up to four test sets if the total length of all test set interconnect cables does not exceed 13 meters (about 40 feet). The last test set in the chain does not require option 001.

If the RF coaxial switch is not incorporated into the system, the RF input to the test set must be manually switched to the active test set.

Initialization at Power-Up

Upon power-up, the IF switches must be configured so that only one system test set is active. The following procedure shows how to make one test set active:

1. Check the active lights of all system test sets.
2. Check the analyzer's expected test set address by pressing **[LOCAL]**, **[TEST SET]**. The display should match the address of the desired test set. If not, change the address on the analyzer.
3. If unselected test sets are active (active light on), deactivate the test set by temporarily addressing it. Then return to the desired address.

Selecting a Test Set

Test Set IF Switching

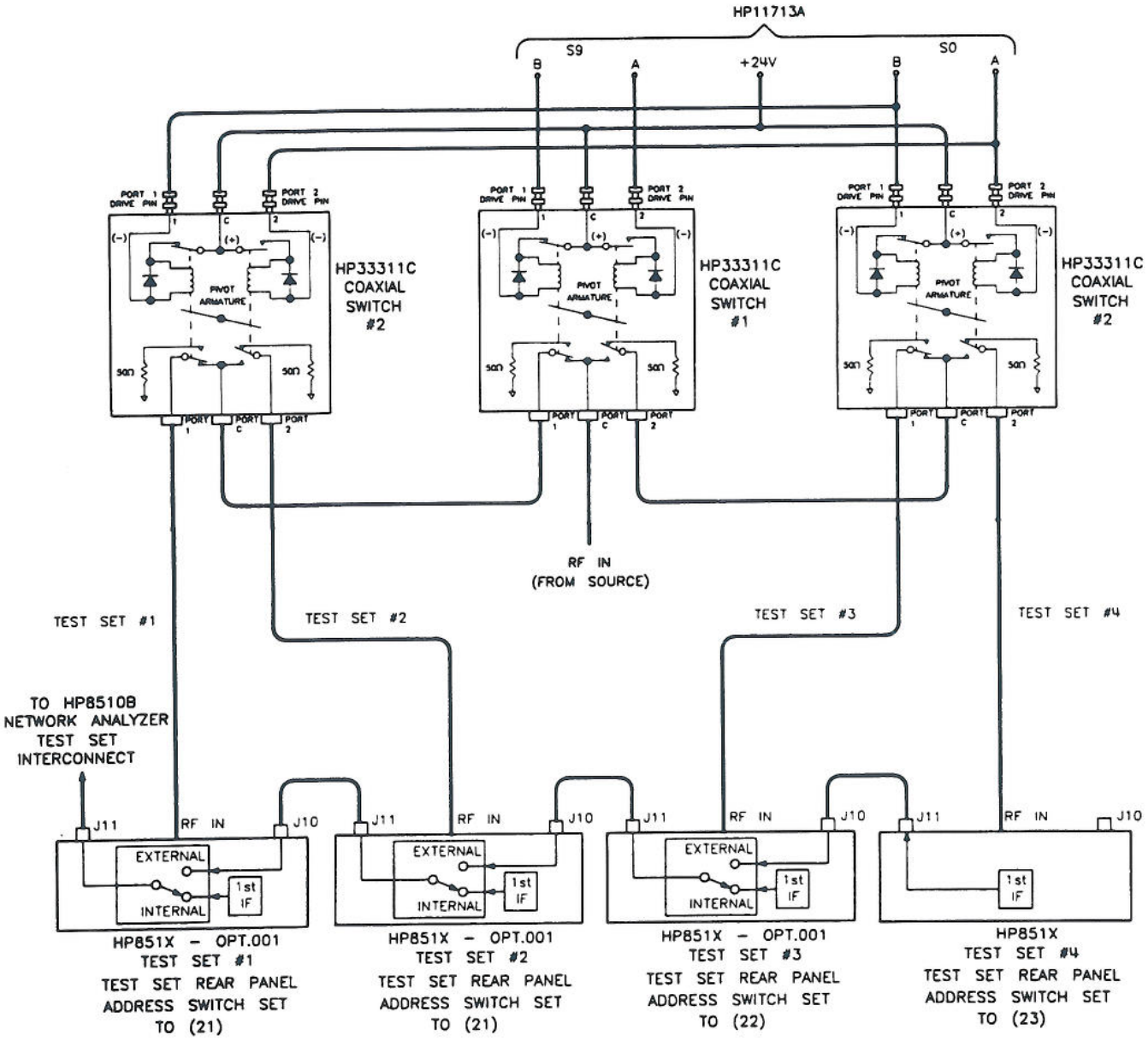
The active test set is selected by the built-in capability of the analyzer to generate an addressed command to the test set. Each time the HP 8510 **[ADDRESS of TEST SET]** function is changed (see **[LOCAL]** Menu), the analyzer switches the previously addressed test set IF to external and the newly addressed test set IF to internal. The test set front panel **ACTIVE** indicator shows the test set status. When the test set is active, the IF signals from the test set are applied directly to J11 TEST SET INTERCONNECT. When the test set is inactive, the IF signals appearing at J10 are passed through to J11 and on to the next test set or the analyzer.

Test Set Address

The address of the active test set can be changed manually from the analyzer front panel by selecting the **[ADDRESS of TEST SET]** function, then entering the address of the test set and pressing **[x1]**; or it can be changed under program control using the analyzer's HP-IB **ADDRESS;** command. The HP-IB address of a particular test set is set by address switches on the test set rear panel.

RF Switch Driver Commands

A related feature of the analyzer is that when the HP 8510 **[ADDRESS of TEST SET]** function is changed, a code sequence is automatically issued over the HP 8510 system bus to the device at the **[ADDRESS of RF SWITCH]**. In the recommended configuration, this device is an HP 11713A attenuator/switch driver which in turn controls one or more coaxial switches. As shown in Figure 3-5 and Figure 3-6, these switches are used to select which of the test sets receives the RF output of the network analyzer source. The exact command issued depends upon the new value of the **[ADDRESS of TEST SET]** function, also shown in Figure 3-5 and Figure 3-6.



NOTE: 1. Not all system connections are shown.
2. In dual source configurations, the second can be multiplexed in a similar manner. If only one dual source test set is used, the second source can be directly connected to the appropriate test set.

Figure 3-6 RF and IF Switching with Four Test Sets

HP 33311C Coaxial Switch Positions with Four Test Sets			
New ADDRESS of Test Set	Test Set Selected	HP 33311C Coaxial Switch Port Selected	
		Switch #1	Switch #2
20	1	Port 1	Port 1
21	2	Port 1	Port 2
22	3	Port 2	Port 1
23	4	Port 2	Port 2

Measurement Calibration

After selecting the active test set, perform the system calibration procedure as usual. When you select a different test set, make sure that you recall the cal set that applies to that test set.

NOTE

Since the cal set limited instrument state does not include the number of the active test set, a cal set which does not apply to the current test set can be turned on without any HP 8510 caution messages appearing. This will cause errors in the displayed data because incorrect error coefficients are applied to the measured data.

It may be convenient to store a hardware state file and an instrument state file for each combination of test set and cal set. You may also store your hardware state file on a tape or disk for future use. To change the configuration, simply recall the appropriate hardware state file, which sets the address of test set and issues the RF switch command, and then the appropriate instrument state file which recalls the cal set.

Operational Checks

To check operation of a multiple test set configuration, first connect a device with a known response at test set number 1, then press HP 8510 **[LOCAL]**, **[TEST SET]**, **[ADDRESS of TEST SET]**, enter the address of test set number 1 (this would be 20), then press **[x1]**. The test set number 1 measurement should appear. Press **[DISPLAY]**, **[DATAÆMEMORY]**, **[DISPLAY: DATA and MEMORY]** to store the trace for later comparison. Now use **[ADDRESS of TEST SET]** to select test set number 2, then switch back to test set number 1. Observe any difference in the response between the stored trace and the result after switching back and forth between the test sets. Repeat for each of the test sets. Any difference in the data believed due to the option 001 IF switch or RF switching must be investigated. Refer to the "Troubleshooting" chapter for more information.

Performance Verification

Standard system performance verification procedures are used to verify the operation of the option 001 test set as test set number 1. To verify the performance of a test set other than an HP 8511 in the chain, select it as the active test set and proceed as usual. Refer to the *HP 8510 On-Site Service Manual* for the performance verification procedure.

4

Specifications

Introduction

Specifications and characteristics differ as defined in the following table. Both are based on certain operating conditions. Those conditions are defined in the paragraph titled Specification Assumptions, which follows. **Specifications** describe the warranted performance of the instrument. To verify the specifications, refer to "Performance Tests" chapter of this manual.

Characteristics provide information useful in applying the instrument by giving typical but non-warranted performance parameters.

Table 4-1 HP 8510/8511B Specifications

Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Frequency Response Tracking Magnitude (ripple)[1] Phase (ripple) Magnitude slope[2]	 ±1.5 dB ±75 degrees ±0.055 dB/GHz	 ±1.5 dB ±75 degrees ±0.055 dB/GHz	 ±1.5 dB ±75 degrees ±0.055 dB/GHz	 ±1.5 dB ±75 degrees ±0.055 dB/GHz
Crosstalk[3]	–85 dB	–85 dB	–75 dB	–70 dB
High Level Noise[4] Magnitude (ratio) Phase (ratio)	 0.006 dB rms 0.08 degrees rms	 0.009 dB rms 0.145 degrees rms	 0.040 dB rms 0.245 degrees rms	 0.060 dB rms 0.400 degrees rms
Low Level Noise[5]	–100 dBm	–102 dBm	–102 dBm	–102 dBm
Conversion Gain[6]	–4 dB to 1 dB	–6 dB to –1 dB	–13 dB to –3 dB	–15 dB to –5 dB
Compression (0.1 dB point)[7]	–10 dBm	–10 dBm	–15 dBm	–20 dBm
Input Port[8] Impedance Match (return loss) (all 4 ports)	 ≥17 dB	 ≥15 dB	 ≥9 dB	 ≥7 dB

1. Deviation from a least-squares-straight-line fit, excluding noise and slope. Ratio measurement of any two ports.
2. Slope of least-squares-straight-line fit over full frequency range.
3. Uncorrected port to port crosstalk with averaging factor of 1024.
4. Trace noise, sweep to sweep variation.
5. Low level noise measured with 50 ohm load at port, and calculated as the mean value of a 101 point trace with IF averaging set at one. Low level noise varies with averaging factory: 10 log (average factor).
6. See example below.
7. Do not exceed –5 dBm input to sampler for proper phase lock operation.
8. Tested with sampler in non-conducing state. When diodes are turned on by the LO pulse, they present a short circuit across the sampler input port. This may affect the measured data.

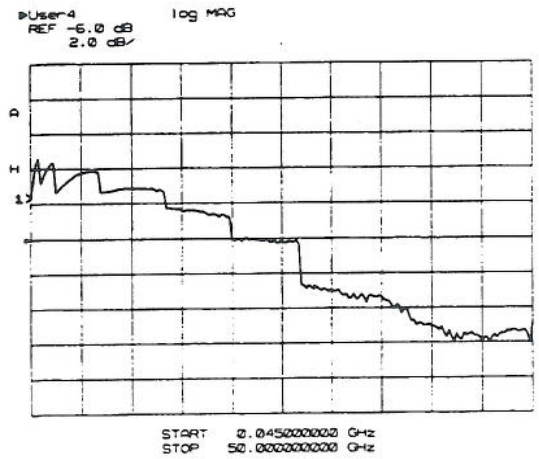


Table 4-2 HP 8510/8511B Characteristics

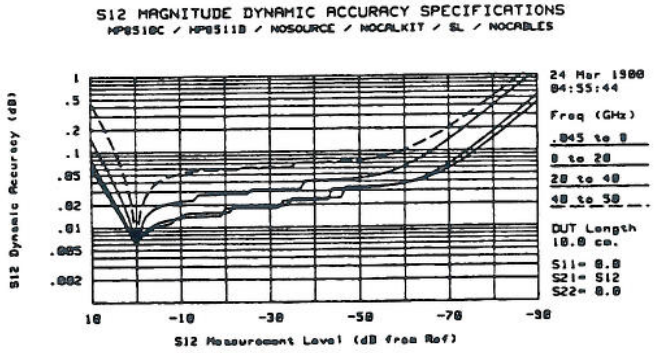
Parameter	0.045 to 8 GHz	8 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Dynamic Range[1] all inputs	110 dB (–10 to –120 dBm)	112 dB (–10 to –122 dBm)	107 dB (–15 to –122 dBm)	102 dB (–20 to –122 dBm)
Accuracy Enhanced Crosstalk[2] –115 dB	–115 dB	–113 dB	–110 dB	–105 dB
Typical Drift (typical)	Magnitude 0.001 X V °C, linear Phase (0.01 + 0.01 f(GHz) X V °C, degrees			

Input Ports

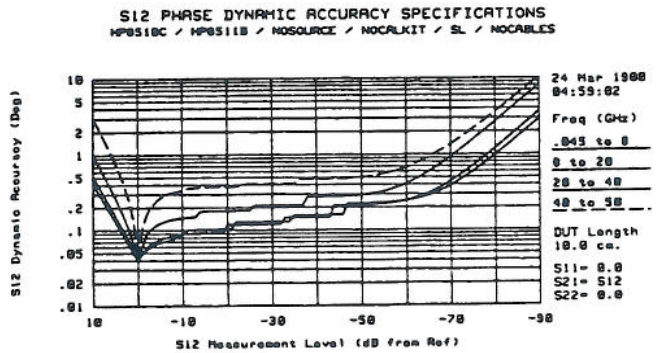
Connector type: precision 2.4 mm female
Impedance: 50 ohms nominal
Damage level: +13 dBm (20 mW) CWRF input[3]
Port input power for phase lock:

Frequency	Minimum	Maximum
0.045 to 8 GHz	–41 dBm	–5 dBm
8 to 20 GHz	–39 dBm	–5 dBm
20 to 26.5 GHz	-32 dBm	–5 dBm
40 to 50 GHz	–30 dBm	–5 dBm

Dynamic Accuracy: The following plots illustrate worst case magnitude and phase uncertainty due to IF residuals and detector inaccuracies.



Magnitude



Phase[5]

1. Determined by 0.1 dB compression level and system low level peak noise. Low level peak noise measured with 50 ohm load at port and 1024 averaging factor. Noise floor varies with averaging factor. (10 log averaging factor.) Low level noise is calculated from low level noise +10.4 dB.
2. Effective crosstalk with isolation, calibration, excludes noise.
3. Do not exceed –5 dBm input to sampler for proper phase lock operation.

Table 4-2. HP 8510/HP 8511B Characteristics (Continued)

Source of System Dynamic Accuracy Errors: The factors affecting dynamic accuracy listed below are primarily a function of the IF/detector. Compression though, is primarily a function of the sampler/mixer circuitry. In order to measure these values, some of the system cables must be disconnected to gain access to the individual instruments.

IF Amplifier Gain Accuracy	IF Amplifier Power Range (dBm)[1]	Maximum Gain Error (dB)
	–10 to –34	0
	–34 to –46	±0.005
	–46 to –58	±0.010
	–58 to –70	±0.015
	≤ 70	±0.025

Detector Circularity Error: ±0.003 dB peak
IF Residuals: –140 dBm[1]
IF Linearity: ±0.003 dB
Incremental Phase Accuracy (Phase versus Phase) at Measurement Reference: ±0.001 degrees/degree, not to exceed 0.02 degrees peak.

Operating Temperature: 0°C to 55°C
Power: 110, 120, 220 or 240 ±10% Vac; 47 to 66 Hz line frequency
Dimensions: 460 mm x 133 mm x 609 mm (18.1 x 5.25 x 24 inches)
Weight: 13 kg (29 lb) net; 17 kg (38 lb) shipping

1. Measured at the IF input to the HP 8510, not at the test set test ports.

Specification Assumptions

The specifications of the HP 8511B require that the following operating conditions are met:

- All system instruments have reached stable operating temperature.
- RF source: HP 83651A. Other sources recommended in the HP 8511B Performance Test procedures may be used for verification within the frequency limits of those sources. When used with another recommended source, the performance specifications may differ from those for the HP 8510/8511/83651A configuration. The performance test software will display and print the limits for the chosen configuration.
- Performance verification temperature: 23 ±3°C.
- RF source power levels as follows:

Test	Power at Input Level (dBm)		
	0.045 to 20 GHz	20 to 40 GHz	40 to 50 GHz
Compression, Crosstalk	–10	–15	–20
Conversion Gain, Tracking, High Level Noise	–15	–20	–25

Recommended Test Equipment

The following test equipment is required when troubleshooting, operating, and performance testing the HP 8511B.

Table 4-3 Recommended Test Equipment

Item	Critical Specifications	Recommended Model (or Part Number)	Use[1]
Network analyzer	no substitute	HP 8510A/B	O,P,T
Controller	no substitute	HP 9000 series 200/300 (with 1 Mbyte memory)	P
Disk drive	compatible with controller		P
Multimeter	range: 0 to 50 V	HP 3456A	T
Oscilloscope	50 MHz bandwidth	HP 1740A	T
Semi-rigid cables			T,P
Power splitter	45 MHz to 50 GHz	HP 11667C	P,T
Power meter		HP 436A, 437A, 438A	P
Power sensor	no substitute	HP 8487A	P
2.4 mm coax cables (2)	no substitute	08511-20031	P,T
2.4 mm (f) to 2.4 mm (m) adapter	no substitute	1250-2186	P
20 dB fixed attenuator	no substitute	HP 33340D opt. 020[2]	P
RF cable	2.4 (m) semi-rigid 2-in long	08511-20031A	P,T
6 dB fixed attenuator (2)	no substitute	HP 33340D opt. 006	P
2.4 mm 50 ohm load (m)	no substitute	HP 85148A	P
2.4 mm 50 ohm load (f)	no substitute	HP 85138B	P

1. O = Operation; P = Performance test; T = Troubleshooting
2. Supplied in the HP 8511B Service Kit (HP part number 08511-60016)

5

Test Set Troubleshooting

Introduction

The troubleshooting strategy for the HP 8511B frequency converter test set is a systematic sequence of procedures. This troubleshooting information is used after system-level troubleshooting has pin-pointed the test set as the problem instrument. Use the troubleshooting flowchart (Figure 5-2) to identify the faulty assembly. The troubleshooting flowchart is keyed to numbered, individual troubleshooting procedures. As you progress through the flowchart, perform the numbered procedure associated with each block. Block diagrams are provided at the end of this section to assist in understanding the operation of the test set.

Theory of Operation

The RF section of a HP 8511B frequency converter test set consists of a voltage tuned oscillator (VTO), a four-way power splitter and four samplers. The frequency converter operates within the frequency range of 45 MHz to 50 GHz. Two reference (a1 and a2), and two test (b1 and b2) channels accept RF input via front panel bulkhead connectors.

The VTO/driver produces a harmonic that is 20 MHz away from the RF source frequency. The samplers use either the fundamental or a harmonic of the LO with the reference and test RF signals to develop a 20 MHz IF. The IF signals are then routed to the HP 85102 via a rear panel connector on the test set.

The LO, generated by the VTO/driver, is phase locked to the source. The phase lock loop includes the following portions of; the A3 VTO summing amplifier board, A14 VTO/driver, A12 a1 reference sampler assembly, A13 a2 reference sampler assembly and the HP 8510 network analyzer.

A microprocessor on the A4 HP-IB board controls the samplers, which may be switched either on or off, depending on the parameter being measured. The default condition is for all four samplers to be on. This insures that the test set will be usable in the event of a failure of the A4 HP-IB board or a failure in the communication between the test set and the HP 8510 display/processor.

The HP 85102 IF detector controls the VTO/driver via the VTO summing amplifier board. A control voltage is input to the VTO to tune to the correct LO frequency.

The VTO summing amplifier board has an output called LENDRA (Low = END of RAnge) that is sent to the HP 85102 IF detector over the test set interconnect cable. This indicates to the HP 85101 display processor whether or not the VTO is outside of its normal operating frequency range. Should the VTO exceed its normal operating range, the network analyzer will respond by displaying the running error message, **VTO OVER-RANGE**. This message will not be seen in the HP 8510C. It has been replaced by **PRETUNE FAILED**.

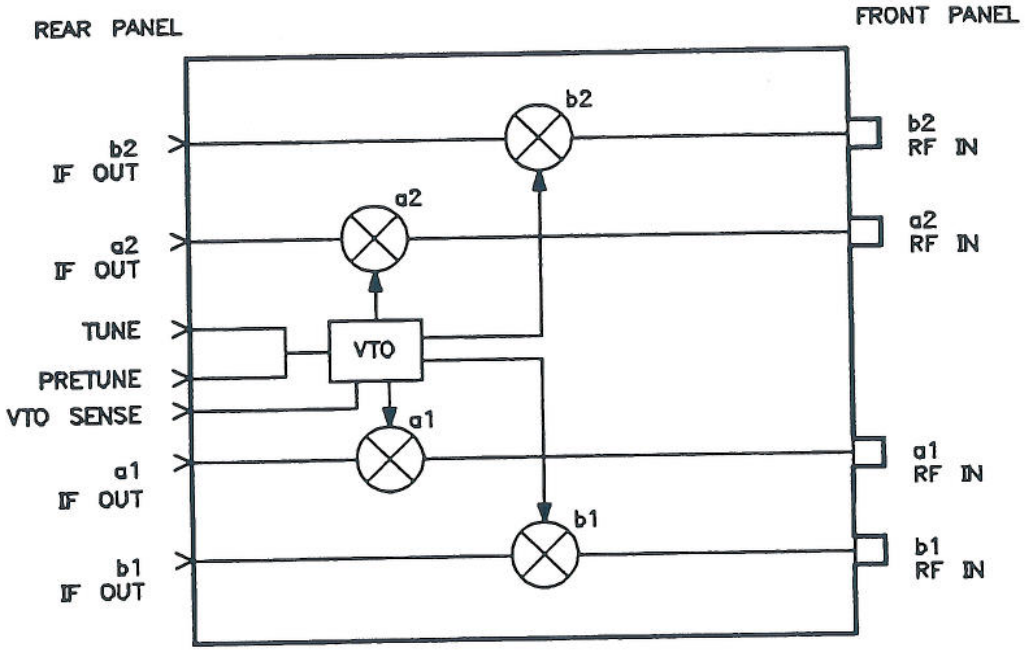


Figure 5-1 Simplified RF Block Diagram

CAUTION

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Refer to "Operating and Safety Precautions" on page 1-6 for more information on preventing ESD.

The assemblies handled in this procedure are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. In any case, an electrostatic discharge will impair the reliability of these assemblies. Always perform the steps in order.

Equipment Needed But Not Supplied

The following equipment is needed to troubleshoot your instrument. It is not supplied with the instrument.

1 point pozidriv screwdriver	8710-0899
2 point pozidriv screwdriver	8710-0900
Service adapter	85105-60210
5/16 in. torque wrench	8710-1655
Oscilloscope	HP 1740A

Troubleshooting Sequence

Use this flowchart and the following procedures to determine the faulty assembly.

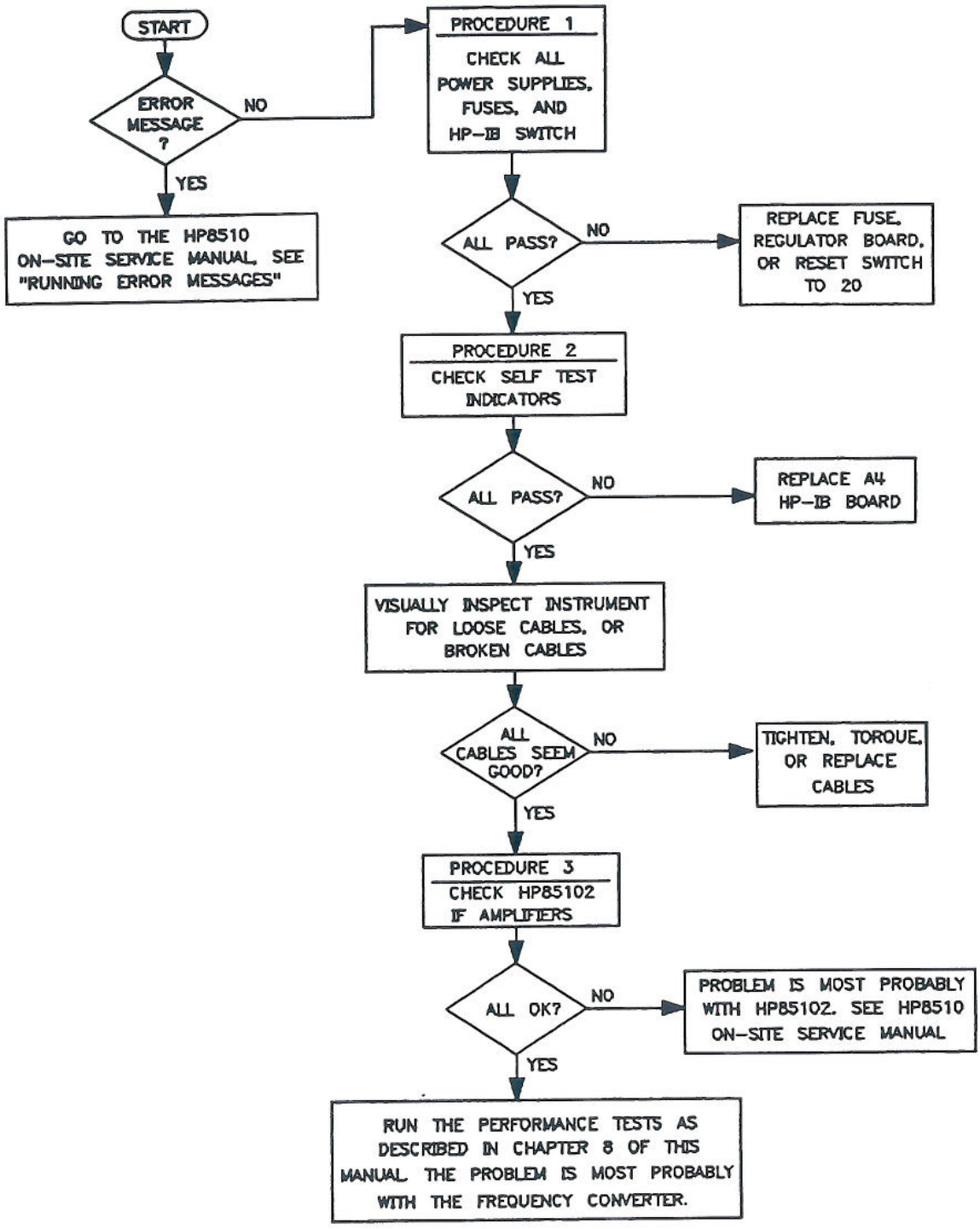


Figure 5-2 Troubleshooting Flowchart

Troubleshooting Procedures

Procedure 1. A15 Regulator
HP-IB Address Switches
Fuse Locations

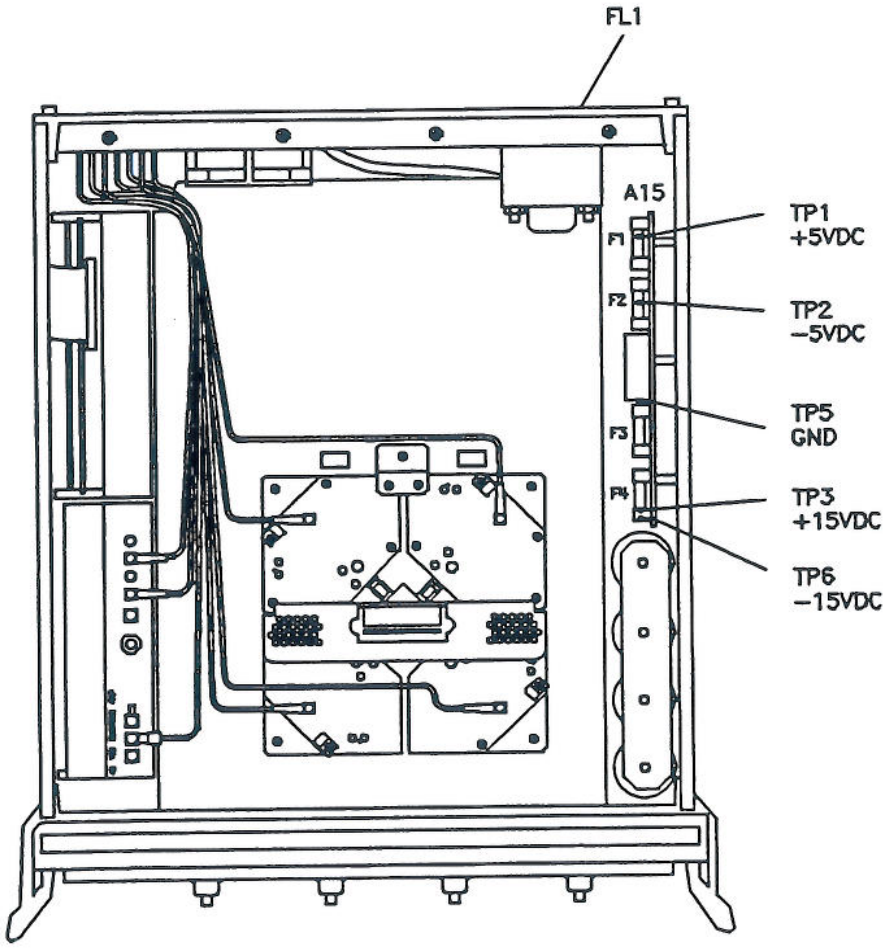


Figure 5-3 Power Supply Fuses and Test Points

A15 Primary Regulator Board Assembly

Use a digital voltmeter to check the voltages and an oscilloscope to check the ripple in Table 5-1.

Table 5-1 Power Supply Voltages

Nominal Voltage	Test Point	Voltage Range	Maximum Ripple
+5.05 Vdc	A15TP1	+4.75 to +5.25	2 mV
–5.20 Vdc	A15TP2	–4.90 to –5.50	2 mV
+14.85 Vdc	A15TP3	+14.10 to +15.60	2 mV
–14.85 Vdc	A15TP6	–14.10 to –15.60	2 mV

HP-IB Address Switch

Set the switch as indicated in Figure 5-4 (the dark side of the switch is depressed). The HP-IB address switch is on the instrument rear panel. It is easy to access but need not be changed unless the error message **SYSTEM BUS ADDRESS ERROR** is displayed on the HP 8510 screen. Decimal twenty, binary 00101 (off, off, on, off, on) is the default setting.

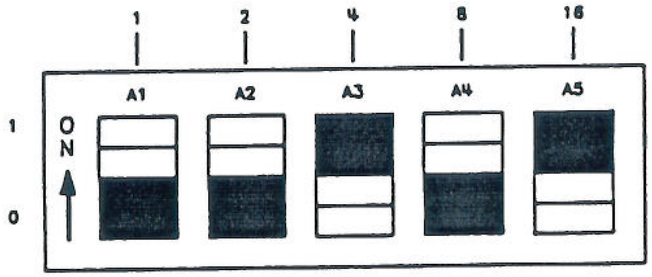


Figure 5-4 Instrument HP-IB Switch Setting

Fuses

The locations of the fuses used in the test set are illustrated in Figure 5-3. The values of these fuses and their part numbers may be found in the "Replaceable Parts" chapter.

Refer to Figure 5-5 for information on how to set the voltage selector cam and replace the line fuse.

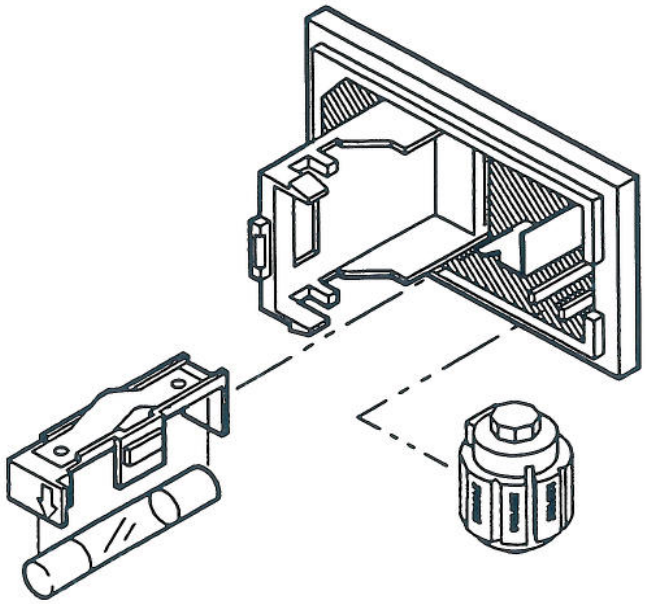


Figure 5-5 Power Line Module

CAUTION Do not attempt to rotate the voltage selector cam while it is installed in the line module or non-repairable damage will result. The cam must be completely removed from the line module, rotated to the proper position, and reinstalled. Refer to the instructions below.

Replacement of Fuse

1. Pry open line module cover door.
2. Pull out fuse carrier.
3. Insert fuse of proper rating.
4. Place carrier back into line module.

Selection of Operating Voltage

1. Pry open line module cover door.
2. REMOVE CAM FROM THE LINE MODULE.
3. Rotate the cam to the desired voltage. (When the line module cover is closed, the selected voltage will be visible through a small window.)
4. Insert the cam back into the line module.
5. Close the line module cover door.

Procedure 2. Self-Test Indicators

If the ACTIVE LED on the front panel of the instrument fails to light within five seconds of power on or lights immediately, the instrument has not passed its self-test. To determine what part of the self-test has failed, note which LEDs on the A4 board are lit (Figure 5-6), as shown below:

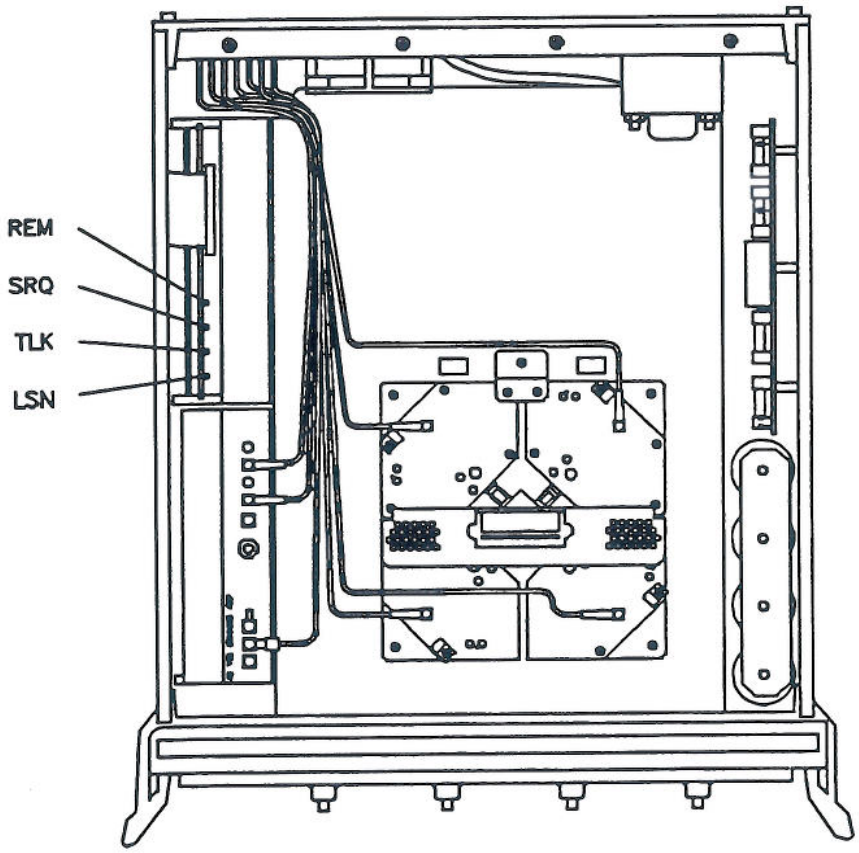


Figure 5-6 Location of Self-Test Indicators

Table 5-2 Self-Test Failure Indications

Self-Test Indication	A4 HP-IB LEDs				Time (after turn-on)
	LSN	TLK	SRQ	REM	
PWON	ON	ON	ON	ON	0 to 0.5 seconds on briefly
Fail ROM Test	OFF	ON	ON	ON	
Pass ROM Test	OFF	OFF	ON	ON	0.5 to 2.0 seconds
Pass RAM Test	OFF	OFF	OFF	ON	
Pass RAM Test	OFF	OFF	OFF	OFF	after 2 seconds

If the Self-Test Fails to Run

If the portion of memory which contains the self-test programming is faulty, the self-test will not run properly. The following conditions indicate that the HP-IB board is most probably faulty.

- all LEDs flash briefly and go off
- all LEDs flash briefly and stay on
- ACTIVE LED goes on too soon
- ACTIVE LED does not go on

Procedure 3. HP 85102 IF Amplifier Test

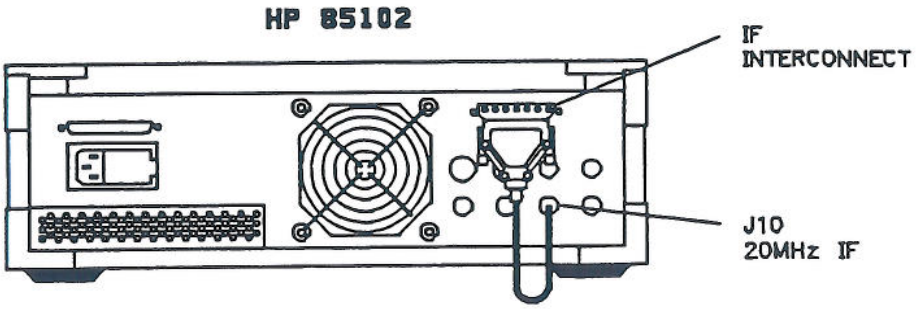


Figure 5-7 *Service Adapter Connections*

Using the Service Adapter

The service adapter (part number 85102-60210) substitutes for a test set, by connecting the 20 MHz IF signal from the HP 85102 back into the amplifier of the HP 85102. This is done to determine if a fault is in the test set or the HP 85102.

1. Connect the service adapter as shown in Figure 5-7.
2. Press **[RECALL]**, **[MORE]**, **[FACTORY PRESET]**, **[MARKER]**, STIMULUS, **[MENU]**, **[STEP]**, PARAMETER, **[MENU]**. Examine each User parameter by pressing the corresponding softkey to observe the unratioed power level of the User1 through User4 channels. The traces should be flat lines, quite close to each other, as indicated by the marker value (typically about –28 ±5 dB).

Service Adapter Conclusions

If all the channels look good. The HP 85102 is working properly. The problem is most probably with the source or the test set. Refer to the "Performance Tests" portion of this manual.

If one or more channels look bad. The problem is most probably with the HP 85102. Refer to the *HP 8510 On-Site Service Manual* for information on troubleshooting the HP 85102.

Figure 5-8 HP 8511B RF Block Diagram

Figure 5-9 HP 8511B Control Block Diagram

Table 5-3 HP 8511B Motherboard Wiring List (1 of 2)

Table 5-4 HP 8511B Motherboard Wiring List (2 of 2)

6

Replacement Procedures

Introduction

This chapter consists of the following replacement procedures:

(1) Frequency converter

(2) Regulator board assembly

(3) Filter capacitors

(4) 2.4 mm RF connectors

(5) B1 Fan

(6) T1 Power transformer

Equipment Needed But Not Supplied

Table 6-1 lists all the equipment needed to replace the assemblies documented in the following procedures. Use Figure 6-1 to locate the assemblies in the test set.

Table 6-1 Equipment Needed to Replace Test Set Major Assemblies

Tools	Used For	HP Part Number
2 point Pozidriv screwdriver	all components	8710-0900
1 point Pozidriv screwdriver38	all components	8710-0899
5/16 inch torque wrench, 90 N-cm (8 in-lb)	all components	8710-1765
2.4 mm gauge kit	port connectors	in 85056A cal kit
anti-static mat	all components	9300-0797
wrist strap	all components	9300-1257
clip lead	C1-C4 capacitors	any supplier
wire cutters	B1 fan	any supplier
T-10 Torx screwdriver	all components	8710-1623
T-15 Torx screwdriver	8710-1622	
9/16 inch nut driver	connector repair	8720-0008
1/2 inch torque wrench, 280 N-cm (25 in-lb)	connector repair	8710-1581
100 ohm 20 watt resistor	C1-C4 capacitor removal	0819-0019
5/16 inch open end wrench	fan replacement	any supplier
1/2 inch open-end wrench	RF input connector	any supplier

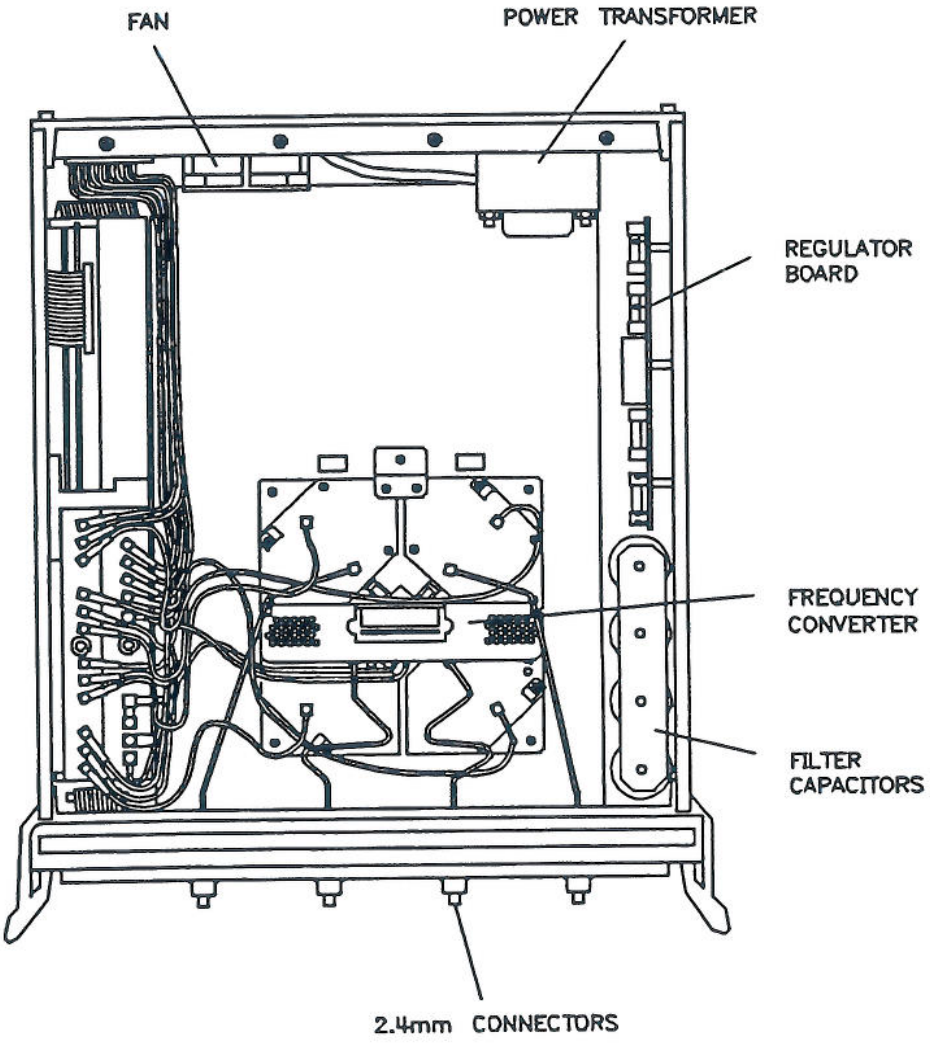


Figure 6-1 Assembly Location Diagram

Assembly Replacement Procedures

Preliminary Precautions

CAUTION Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Refer to "Operating and Safety Precautions" on page 1-6 for more information on preventing ESD.

The assemblies handled in this procedure are very sensitive to damage by static electricity. They may or may not continue to function if subjected to an electrostatic discharge. Their reliability will, however, be impaired.

1. To prevent electrostatic damage, ground the work area and yourself.
2. Turn the test set off.
3. Disconnect the power cord.
4. Remove the top and side covers, trim strips, and handles.
5. Torque 2.4 mm connections to 90 N-cm (8 in-lb).
6. Exercise caution when handling semi-rigid coax cables. They are easily bent.
7. To install a part, reverse the appropriate procedure.

(1) Frequency Converter

The frequency converter consists of a VTO (voltage-tuned oscillator) assembly and four samplers.

1. Remove the semi-rigid cable attached to each of the four samplers.
2. Remove the two in-line attenuators from the samplers.
3. Remove the six flexible cables from the frequency converter by gently pulling on the gold connector.
4. Remove the four frequency converter mounting plate screws and the bracket screw that fastens the frequency converter to the chassis.
5. Unplug the ribbon cable near the front panel.
6. Unplug the four harnessed (multi-colored) wire and socket assemblies.
7. Lift the frequency converter out of the test set.
8. Remove the frequency converter bracket by removing the two pozidriv screws.

(2) Regulator Board Assembly

1. Unplug the transformer socket from the regulator board.
2. Remove the three mounting screws from the top edge of the regulator board.
3. Remove the regulator board. (You may have to partially back out one of the transformer mounting screws for clearance.)

(3) Filter Capacitors

1. Set the test set upright and pull the metal and plastic cover off the capacitors.
2. Turn the test set over and remove the bottom cover.
3. To discharge the capacitors attach one end of an insulated clip lead to the chassis of the instrument and the other end of the clip lead to a 100Ω 20 watt resistor. Use the resistor to discharge each capacitor terminal (large pozidriv screw on the bottom side of the test set). Each capacitor has two terminals. Discharge all capacitor terminals. It takes approximately six seconds to discharge each capacitor.

4. To remove a capacitor, remove the corresponding pair of screws and pull the capacitor out of the test set.

(4) 2.4 mm RF Connector Repair

Refer to Figure 6-2 and the following text to repair a 2.4 mm connector. Refer to the "Replaceable Parts" section of this manual for replacement part numbers.

Disassembly

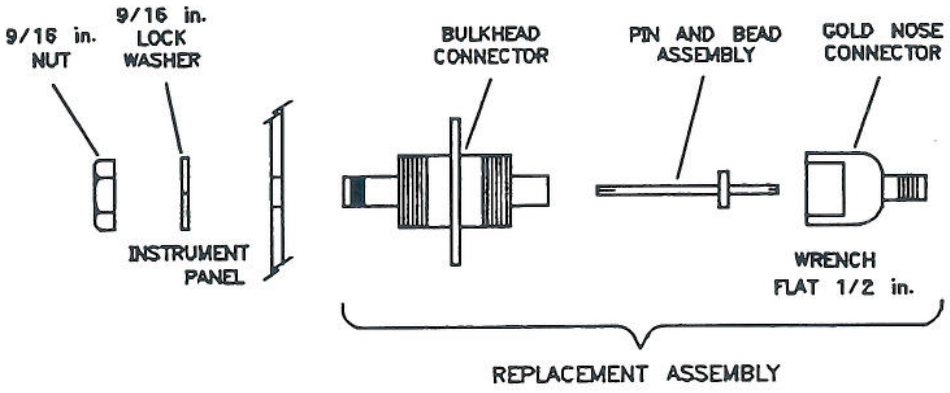


Figure 6-2 Exploded Diagram of 2.4 mm Connector

1. Remove any attached cables from the connector to be replaced.
2. From inside the test set, use a 9/16 inch nut driver to loosen the nut and remove the connector.

Assembly

3. Assemble the bulkhead connector, lock washer and nut.
4. Using the 9/16 inch nut driver, tighten the nut to 506 N-cm (45 in-lb).
5. Attach the assembly to the bulkhead connector. Torque to 281 N-cm (25 in-lb).
6. Clean the mating surfaces with alcohol and lint-free swabs.
7. Check the pin depth of the gold nose connector. The pin depth specification is 0.0000 to +0.0030 inch.
8. Reconnect the cables disconnected in step 1.

(5) B1 Fan

WARNING **Turn the test set OFF and disconnect the power cord from the mains. Electrocution can result if power is not removed from the test set prior to this procedure.**

To replace the fan B1 , you must remove the transformer (T1) so that the ends of the fan wires can be unsoldered from the line module FL1. Refer to the "Replaceable Parts" chapter of this manual for a detailed view of the fan and transformer hardware.

1. Turn the test set on its right side.
2. Unplug the transformer connector at J2 on the A15 regulator board.
3. Using a large pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
4. Using a large pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
5. Carefully remove the transformer from the test set and put it on the bench close to the test set.
6. Strip the heat shrink tubing off the two fan wires and unsolder the wires from the line module. Cut any cable ties holding the fan wires to nearby cables.
7. Using a small pozidriv screwdriver, remove the screw and lockwasher that secure the green/yellow fan ground wire to the top of the rear panel frame.
8. Using a small pozidriv screwdriver, remove the four screws that hold the fan to the rear panel; remove the fan.

(6) T1 Power Transformer

WARNING **Turn the test set OFF and disconnect the power cord from the mains. Electrocution can result if power is not removed from the test set prior to this procedure.**

1. Turn the test set on its right side.
2. Unplug the transformer connector at J2 on the A15 regulator board.
3. Using a large pozidriv screwdriver, remove the four screws and washers that hold the transformer onto the rear panel.
4. Using a large pozidriv screwdriver, remove the screw that holds the transformer angle bracket to the main deck. The transformer wires soldered to the line module are short, so do not pull the transformer out too far.
5. Carefully remove the transformer from the test set and put it on the bench close to the test set.
6. Strip the heat shrink tubing off the transformer wires soldered to the line module, and unsolder the wires.
7. Unsolder the transformer ground wire connected to the chassis side rail.
8. Remove the transformer.
9. When you replace the transformer, refer to Figure 6-3 for the location of the wires connected to the line module.

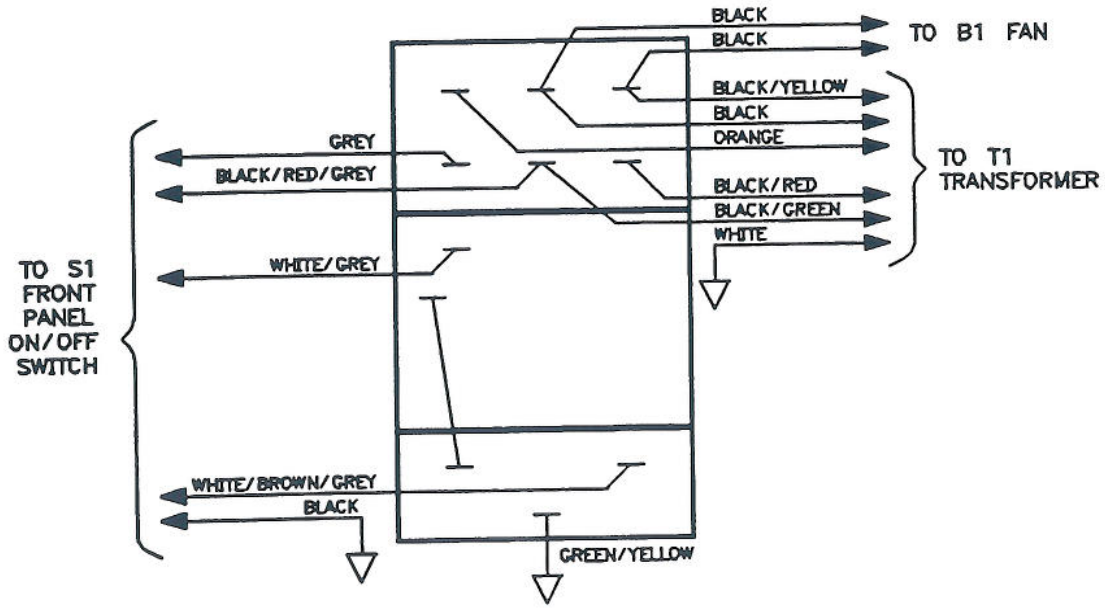


Figure 6-3 Wire Connections to Line Module FL1

7

Replaceable Parts

Introduction

This section contains information for ordering replaceable parts for the instrument. The replaceable parts include major assemblies, and chassis hardware, but not parts of major assemblies.

R-E (Rebuilt-Exchange) Assemblies Cost Less

Lower cost assemblies are available through the rebuilt-exchange program. Factory rebuilt (repaired and tested) assemblies meet all factory specifications required of a new assembly. They are offered on an exchange (trade-in) basis only. The defective assembly must be returned for credit. Figure 7-2 illustrates the rebuilt-exchange procedure. If you have any questions, contact your HP customer engineer.

Replaceable Parts List

The following figures assist in locating and identifying all replaceable parts, and include corresponding lists that provide the following information:

1. Hewlett-Packard part number.
2. Reference designation.
3. Part quantity. There may be more of the same part located elsewhere in the instrument.
4. Part description.

Ordering Information

To order a listed part, quote the HP part number, quantity required, and send the order to the nearest Hewlett-Packard office.

To order a part that is not listed, include the instrument model number, complete serial number, description and function of the part, and quantity required. Send the order to the nearest Hewlett-Packard office.

To Order Parts .... Fast!

(800) 227-8164

Monday through Friday, 6 am to 5 pm (Pacific Standard Time)

The parts specialists have on-line access to replacement parts. There is a charge for hotline one day delivery, but four day delivery time is standard. After hours and holidays, call (415) 968-2347. This service applies to the United States only. Outside the United States, contact your nearest HP office.

Reference Designations			
A	assembly	J	electrical connector, jack
AT	attenuator	MP	miscellaneous part
B	fan	R	resistor
C	capacitor	T	transformer
E	miscellaneous electrical part	W	cable, wire
F	fuse	X	socket
FL	filter		
More comprehensive tables of reference designators and abbreviations are behind the Replacement Parts tab of the *HP 8510B Service Manual.*			

PLUG TYPE **	CABLE HP PART NUMBER	PLUG DESCRIPTION	CABLE LENGTH CM (INCHES)	CABLE COLOR	FOR USE IN COUNTRY
250V 	8120-1351 8120-1703	Straight* BS1363A 90□	229 (90) 229 (90)	Mint Gray Mint Gray	Great Britain, Cyprus, Nigeria, Singapore, Zimbabwe
250V 	8120-1369 8120-0696	Straight* NZSS198/ ASC112 90□	201 (79) 221 (87)	Gray Gray	Argentina, Australia, New Zealand, Mainland China
250V 	8120-1689 8120-1692	Straight* CEE7-Y11 90□	201 (79) 201 (79)	Mint Gray Mint Gray	East and West Europe, Central African Republic, United Arab Republic (unpolarized in many nations)
125V 	8120-1348 8120-1538	Straight* NEMA5-15P 90□	203 (80) 203 (80)	Black Black	United States, Canada, Japan (100V or 200V), Brazil, Colombia, Mexico, Philippines, Saudia Arabia, Taiwan
	8120-1378 8120-4753 8120-1521 8120-4754	Straight* NEMA5-15P Straight 90□ 90□	203 (80) 230 (90) 203 (80) 230 (90)	Jade Gray Jade Gray Jade Gray Jade Gray	
250V 	8120-5182 8120-5181	Straight* NEMA5-15P 90□	200 (78) 200 (78)	Jade Gray Jade Gray Jade Gray Jade Gray	Israel

* Part number for plug is industry identifier for plug only. Number shown for cable is HP Part Number for complete cable, including plug.

** E = Earth Ground: L = Line: N = Neutral.

Figure 7-1 Power Cable and Plug Part Numbers

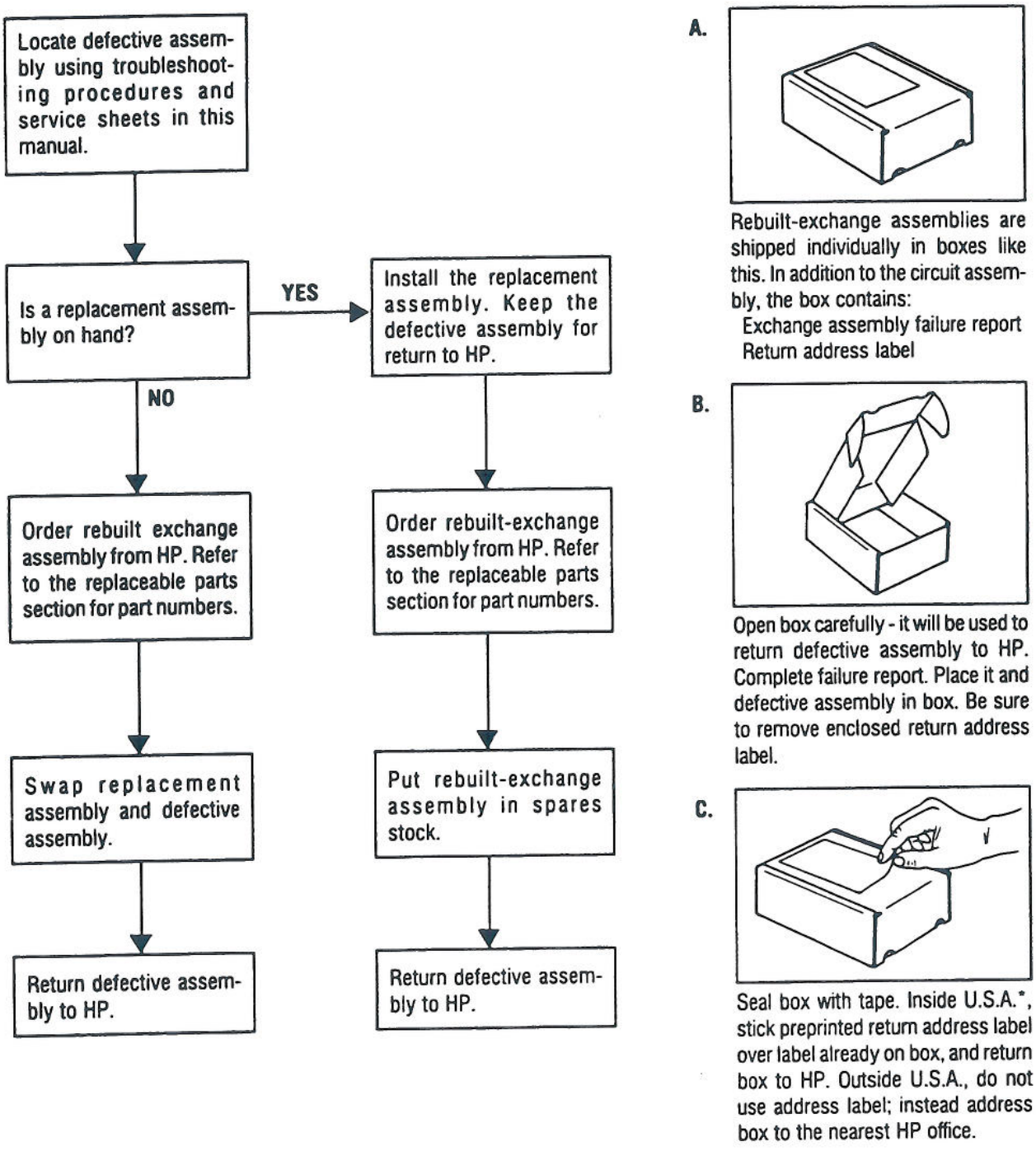


Figure 7-2 The Low Cost Rebuilt-Exchange Procedure

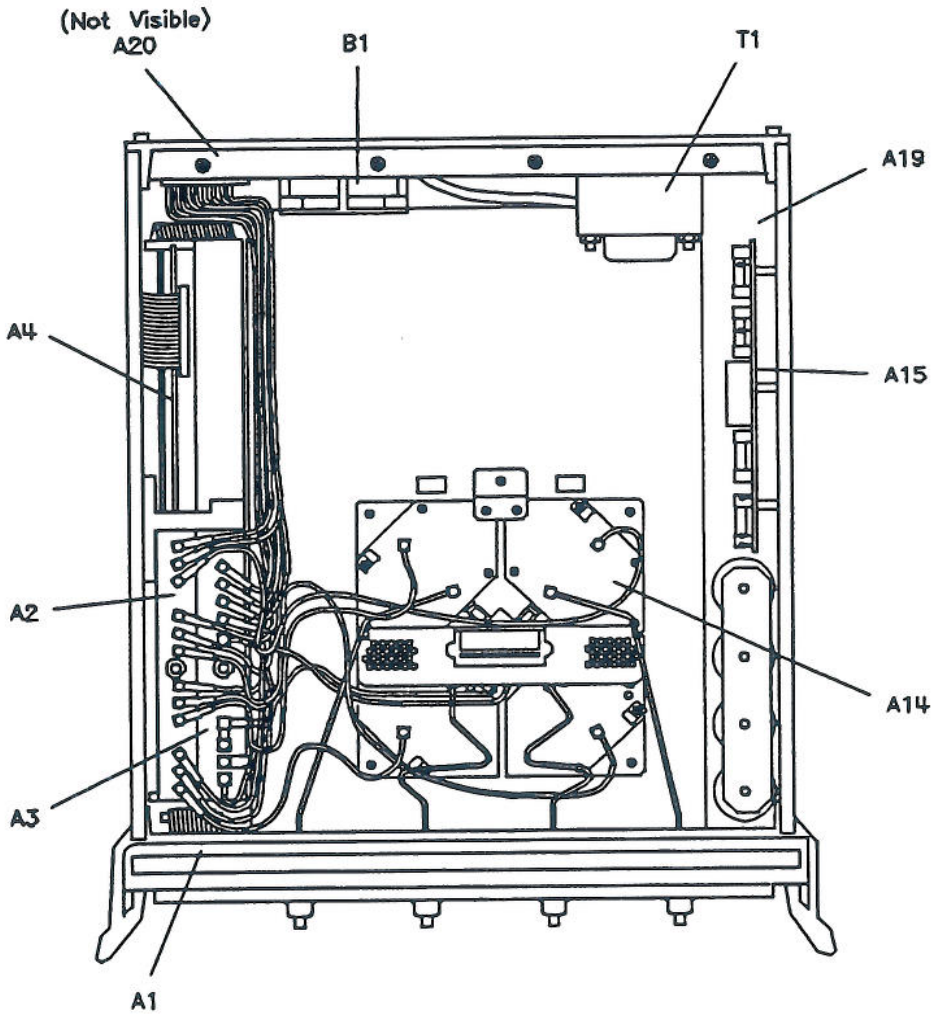


Figure 7-3 Major Assemblies

Reference Designation	HP Part Number	Qty	Description
A1	08513-60005	1	FRONT PANEL INTERFACE BOARD ASSEMBLY
A2			USED FOR OPTION 001 SEE Figure 7-11
A3	08517-60002	1	VTO SUMMING AMPLIFIER BOARD ASSEMBLY (NEW)
	08517-69002		VTO SUMMING AMPLIFIER BOARD ASSEMBLY (R-E)
A4	08516-60029	1	HP-IB BD ASSEMBLY (NEW)
	08516-69029		HP-IB BOARD ASSEMBLY (R-E)
A14	5086-7501	1	FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (NEW)
	5086-6501		FREQ. CONV. 50 GHZ (SAMPLERS & VTO) (R-E)
A15	08513-60007	1	REGULATOR BOARD ASSEMBLY
A19	08513-60001	1	MOTHERBOARD
A20	08513-60006	1	HP-IB INTERFACE BOARD ASSEMBLY
B1	08513-20031	1	FAN-TBAX 34-CFM 115V 50/60 HZ 1.5KV DIEL
T1	9100-4723	1	POWER TRANSFORMER

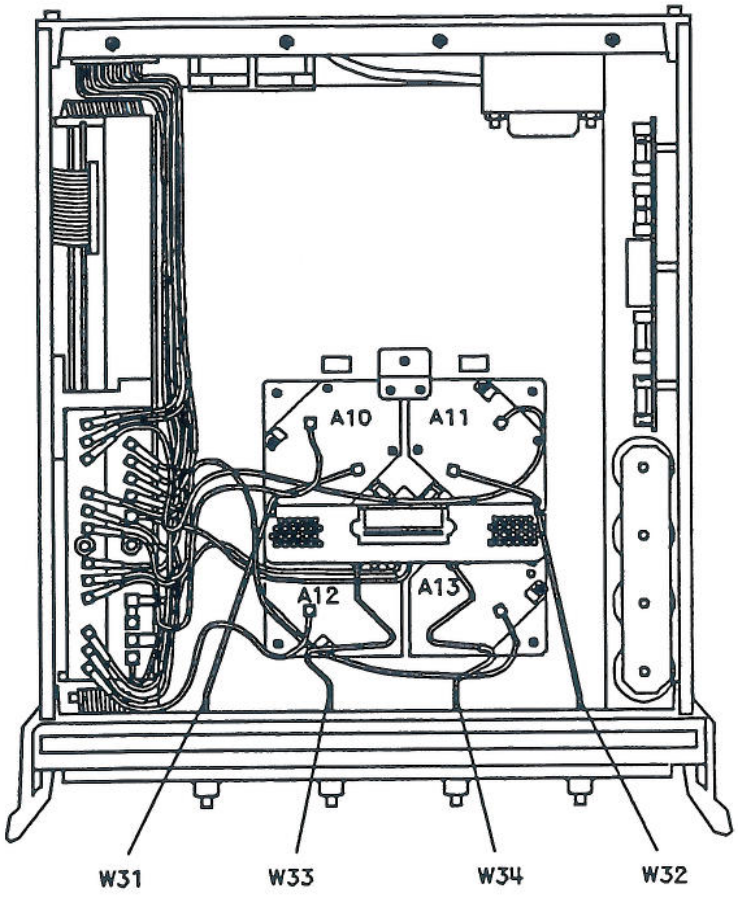


Figure 7-4 Semi-Rigid Cables

Reference Designation	HP Part Number	Qty	Description
W31	08511-20021	1	CABLE ASSEMBLY A10 TO FRONT PANEL
W32	08511-20024	1	CABLE ASSEMBLY A11 TO FRONT PANEL
W33	08511-20022	1	CABLE ASSEMBLY A12 TO FRONT PANEL
W34	08511-20023	1	CABLE ASSEMBLY A13 TO FRONT PANEL

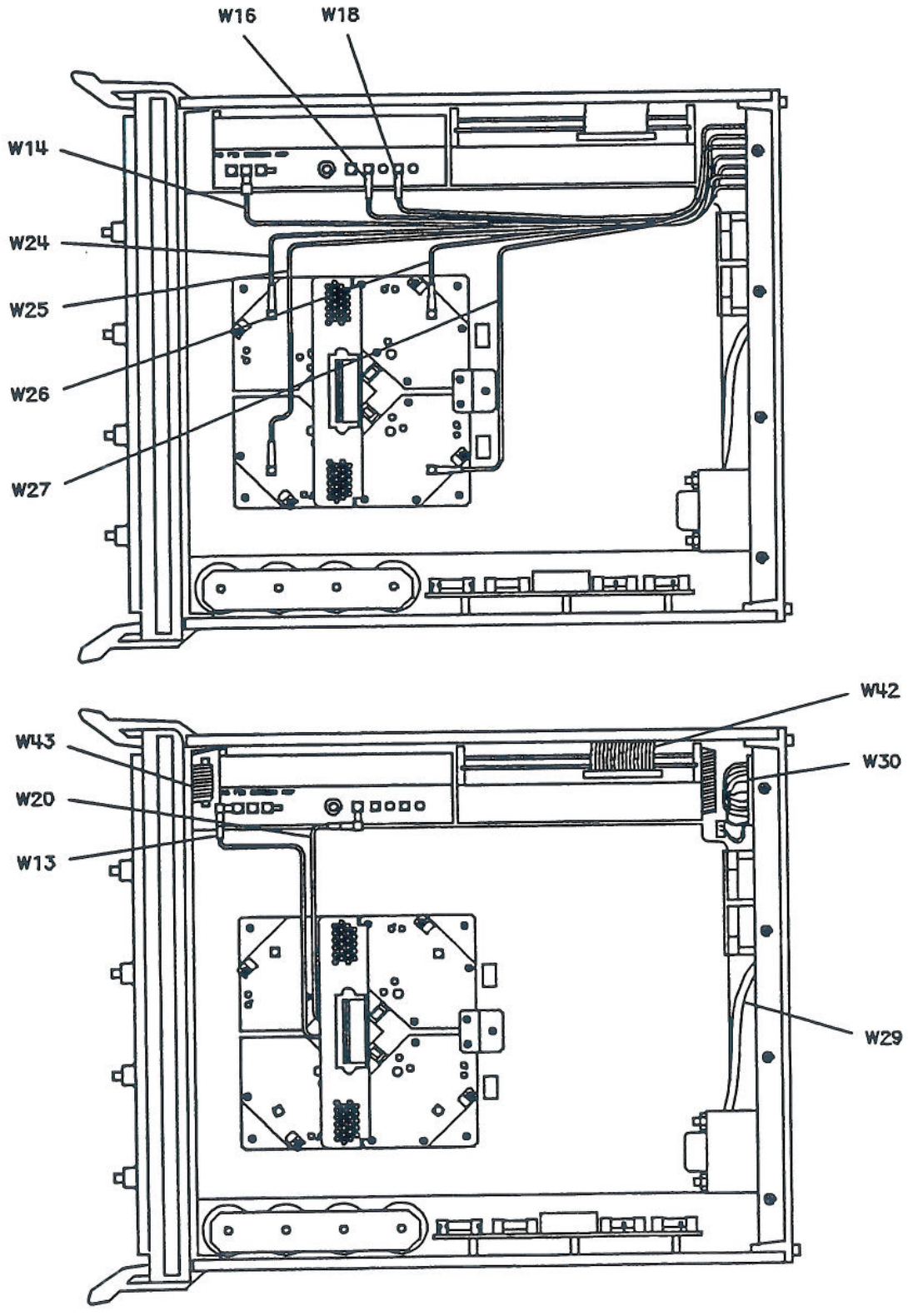


Figure 7-5 Flexible RF Cables

Reference Designation	HP Part Number	Qty	Description
W13	08513-60133	1	CABLE ASSEMBLY A3J1 TO A14J1
W14	08513-60134	1	CABLE ASSEMBLY A3J2 TO J11A7
W16	08513-60136	1	CABLE ASSEMBLY A3J5 TO J11A5
W18	08513-60138	1	CABLE ASSEMBLY A3J7 TO J11A6
W20	08513-60140	1	CABLE ASSEMBLY A3J4 TO A14J2
W24	08513-60144	1	CABLE ASSEMBLY A12J3 TO J11A1
W25	08513-60145	1	CABLE ASSEMBLY A13J3 TO J11A4
W26	08513-60146	1	CABLE ASSEMBLY A10J3 TO J11A2
W27	08513-60147	1	CABLE ASSEMBLY A11J3 TO J11A3
W29	85102-60226	1	CABLE ASSEMBLY LINE SWITCH
W30	08513-60014	1	CABLE ASSEMBLY J10 TO J11
W42	08513-60036	1	CABLE ASSEMBLY A4 TO A20
W43	08513-60013	1	CABLE ASSEMBLY A1 TO A19

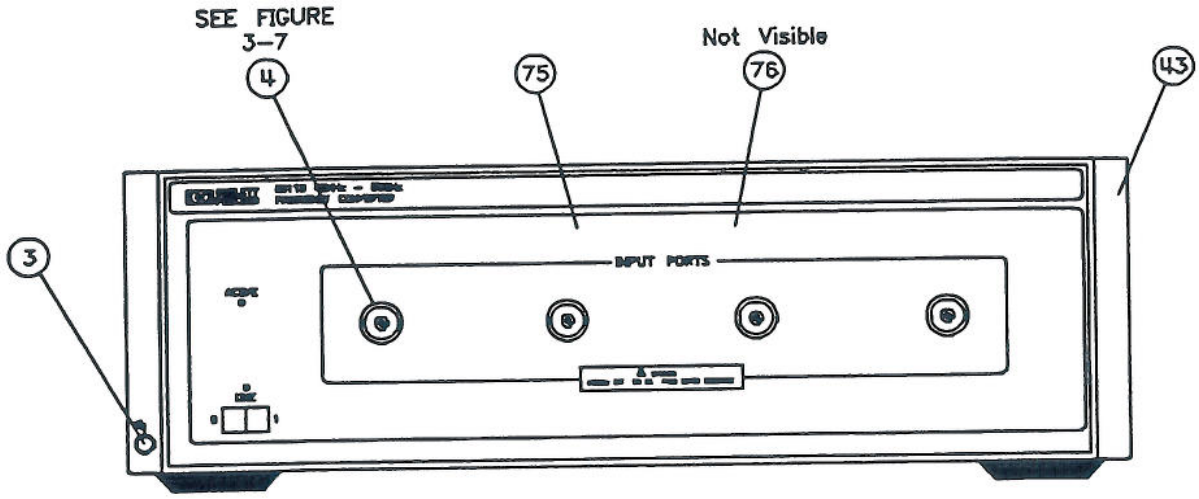


Figure 7-6 Miscellaneous Parts, Front Panel

Reference Designation	HP Part Number	Qty	Description
3	1510-0038	1	BINDER POST ASSEMBLY
4	5062-7243	4	PORT CONNECTOR ASSEMBLY
43	5021-8747	1	FRONT BEZEL
75	08511-00015	1	FRONT DRESS PANEL
76	08517-00002	1	FRONT SUB PANEL

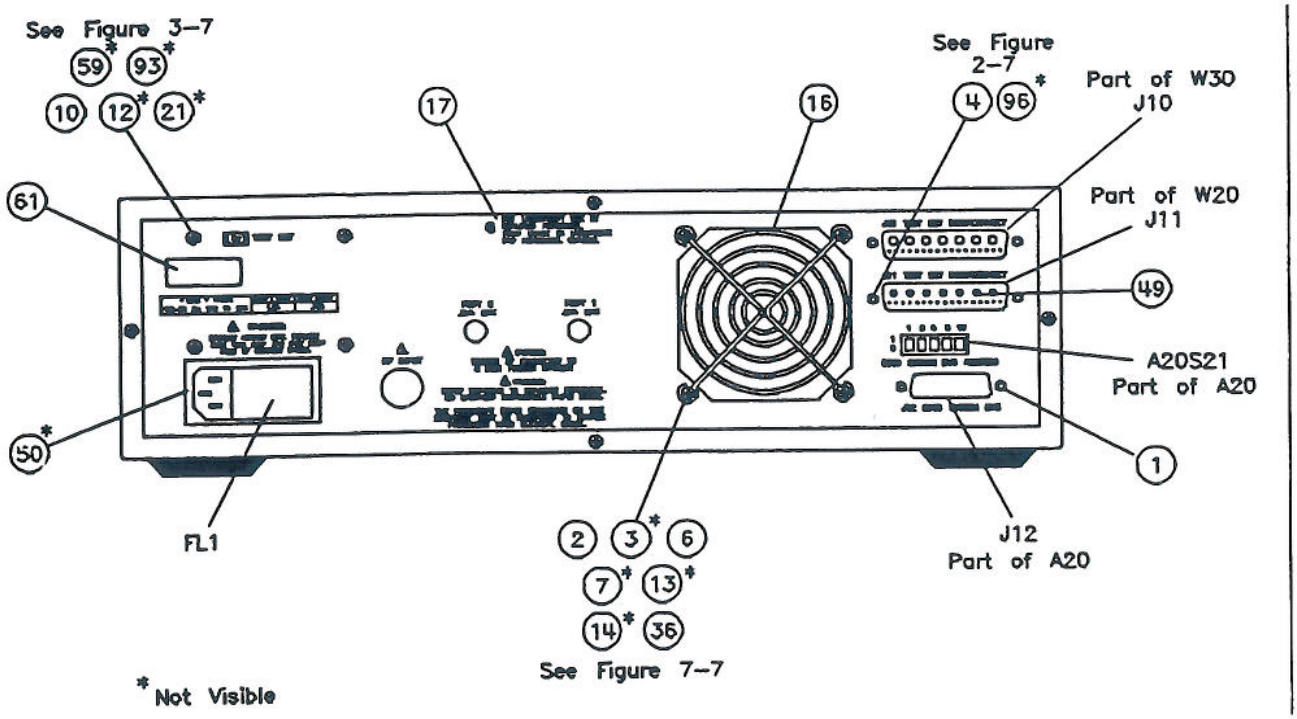


Figure 7-7 Miscellaneous Parts, Rear Panel

Reference Designation	HP Part Number	Qty	Description
FL1	9135-0217	1	LINE MODULE-FILTERED
J10	1251-2197	1	CONNECTOR R&P 24F
J11	1251-2204	1	CONNECTOR R&P 24M
1	0380-0643	2	STANDOFF-HEX .255-IN-LG 6-32 THD
2	0400-0010	4	GROMMET-RND .188-IN-ID .312-IN-GRV-OD
3	0380-0926	4	THREADED INSERT-STDF 6-32 .188-IN-LG SST
4	1251-7812	6	CONNECTOR JACKSCREW
6	0380-0002	4	SCREW-MACH 6-32 .625-IN-LG PAN-HD-POZI
7	2510-0322	4	NUT-HEX-W/LKWR 6-32-THD .109-IN-THK
10	2510-0270	4	SCREW-MACH 8-32 3.25-IN-LG PAN-HD-POZI
12	3050-0139	12	WASHER-FL MTLC NO.8 .172-IN-ID
13	3050-0152	4	WASHER-SHLDR NO.8 .172-IN-ID .438-IN-OD
14	3050-0227	4	WASHER-FL MTLC NO.6 .149-IN-ID
16	3160-0309	1	FINGER GUARD
17	08517-00001	1	REAR PANEL
21	2190-0017	4	WASHER-LK INTL NO.10 .195-IN-ID
36	08513-00002	1	TRANSFORMER BRACKET
49	5021-0906	14	TEFLON CABLE SLEEVE
50	5001-3907	2	LINE MODULE RETAINER CLIPS
61	7121-2380	1	LABEL-SERIAL NUMBER
93	08513-20032	2	TRANSFORMER SUPPORT BRACKET
96	0590-0663	6	NUT-HEX 4/40

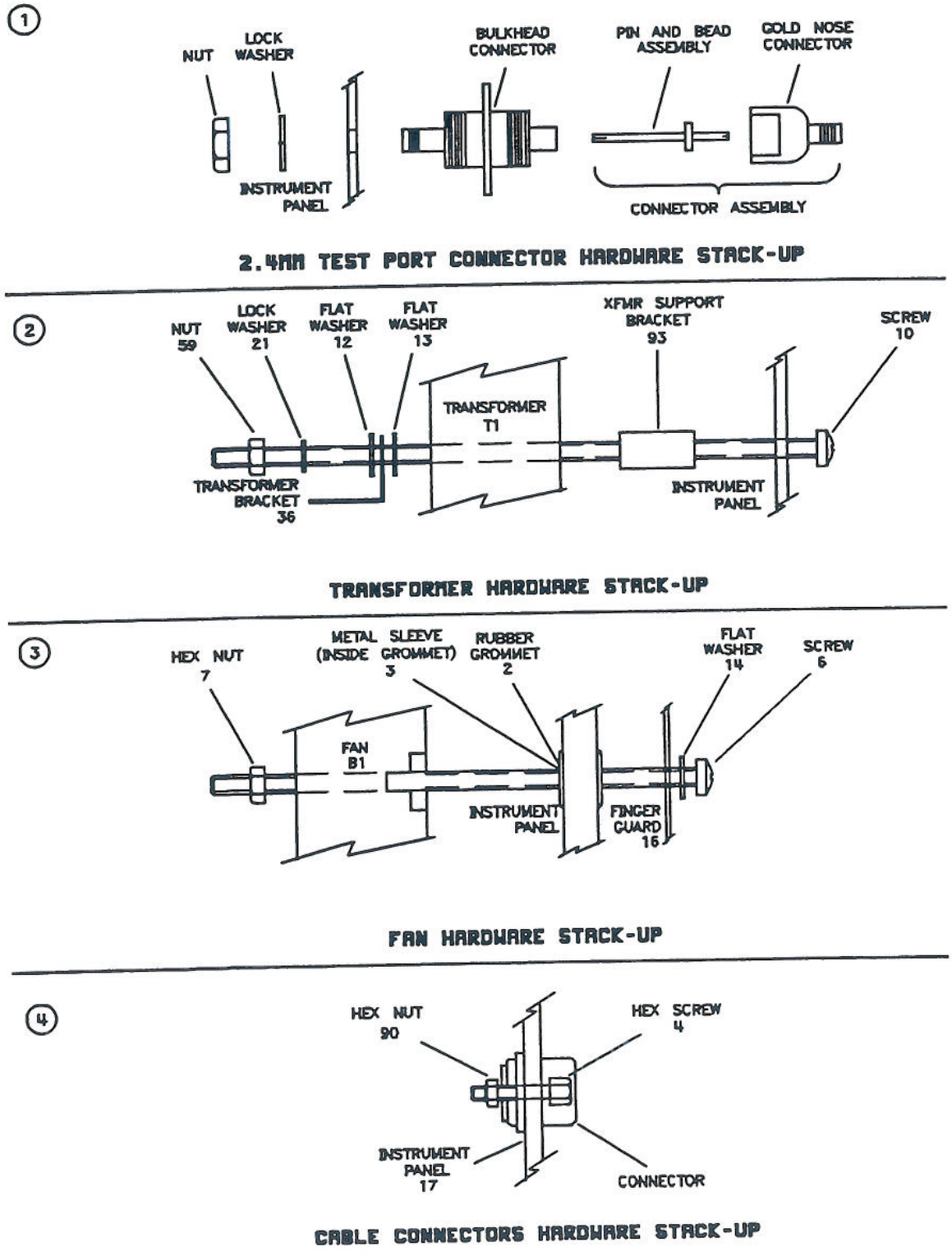


Figure 7-8 Rear Panel Miscellaneous Parts, Detailed Views

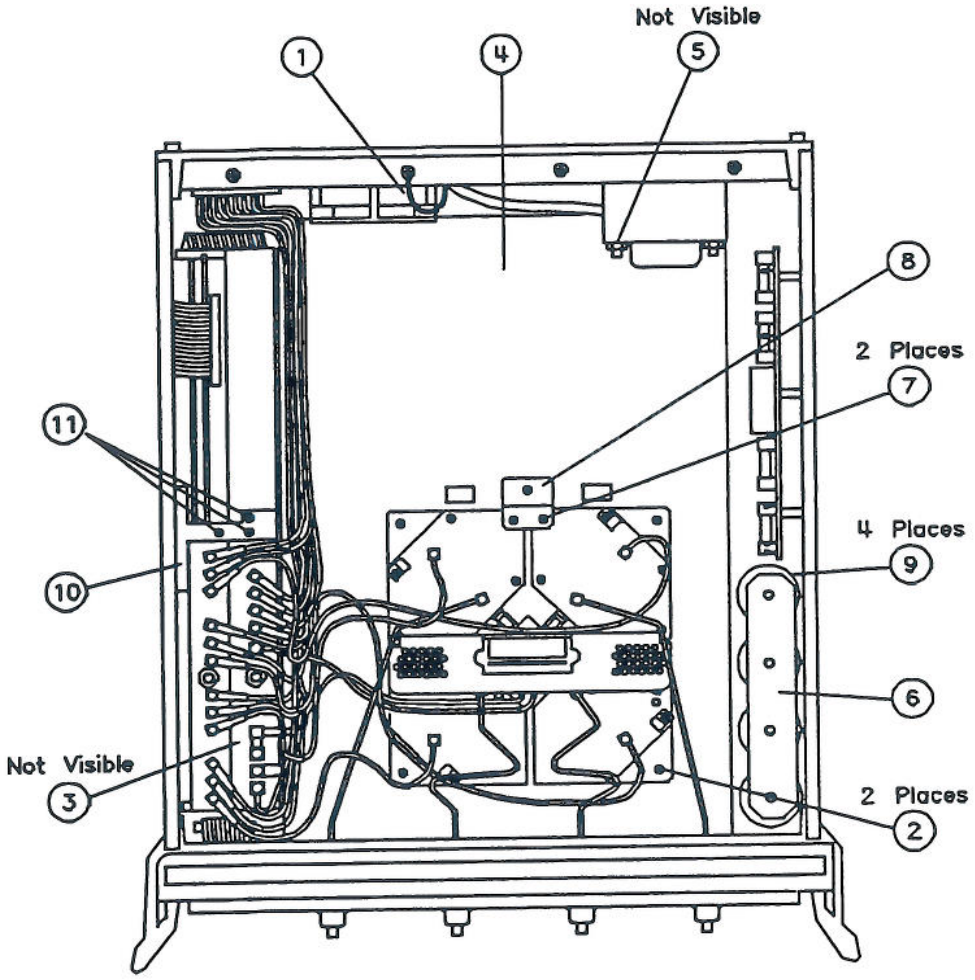


Figure 7-9 Miscellaneous Parts, Top Internal

Reference Designation	HP Part Number	Qty	Description
1	0360-0031	1	TERMINAL CRIMP
2	2360-0115	5	MACHINE SCREW
3	08512-20005	1	RFI GASKET
4	08513-00001	1	TOP DECK
5	08513-00002	1	TRANSFORMER BRACKET
6	08513-00015	1	CAPACITOR PLATE
7	2200-0109	2	MACHINE SCREW
8	08514-00007	1	MOUNTING PLATE
9			SEE Figure 7-12
10	0513-00037	1	ENCLOSURE BRACKET
11	2200-0107	3	MACHINE SCREWS

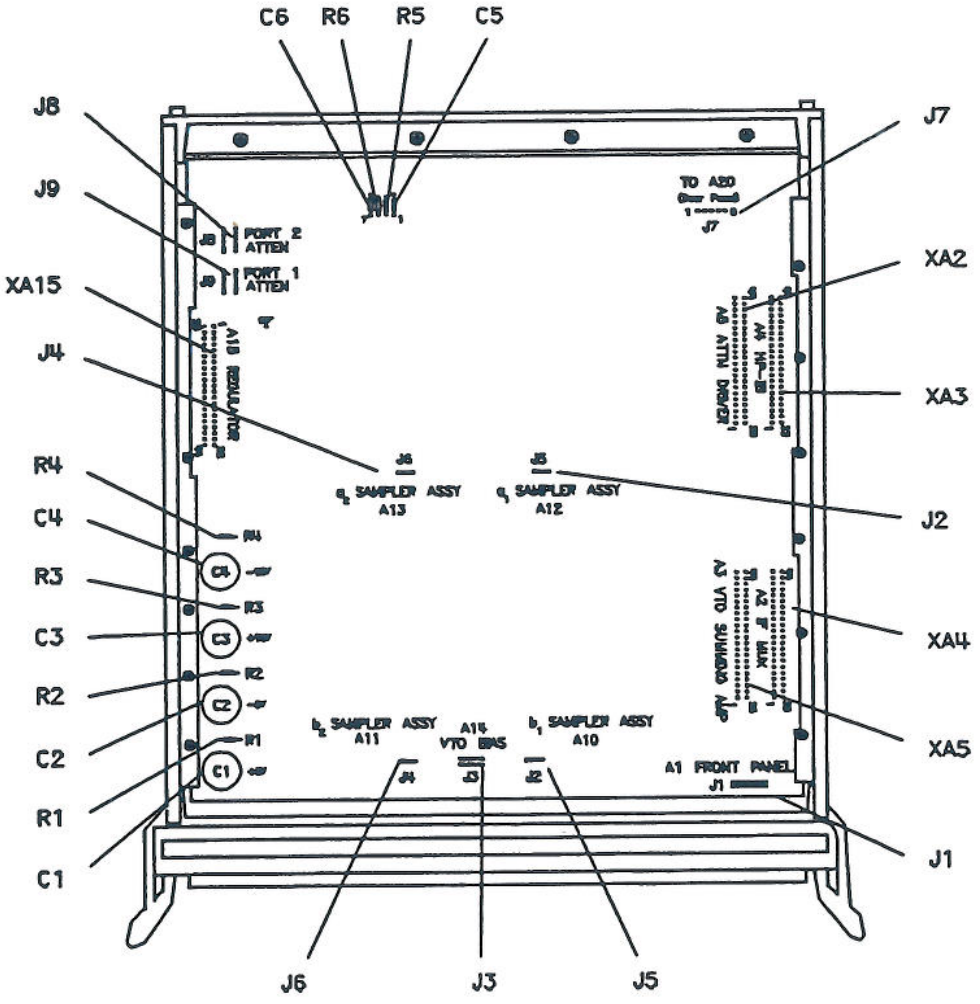


Figure 7-10 Miscellaneous Parts, Motherboard

Reference Designation	HP Part Number	Qty.	Description
C1	0180-2671	4	CAPACITOR-FXD .012F +75-10% 30 VDC AL
C2	0180-2671		CAPACITOR-FXD .012F +75-10% 30 VDC AL
C3	0180-2671		CAPACITOR-FXD .012F +75-10% 30 VDC AL
C4	0180-2671		CAPACITOR-FXD .012F +75-10% 30 VDC AL
C5-C6	0160-4834	2	CAPACITOR-FXD .047UF ±10% 100 VDC CER
J1	1251-5745		CONNECTOR 20-PIN M POST TYPE (A19J1 DOES NOT INCLUDE A19MP1 & A19MP2)
J2	1251-6868	4	CONNECTOR 5-PIN POST TYPE
J3	1251-7939	1	CONN-POST TYPE .100-PIN-SPCG 14-CONT (A19J3 DOES NOT INCLUDE A19MP3)
J4	1251-6868		CONNECTOR 5-PIN M POST TYPE
J5	1251-6868		CONNECTOR 5-PIN M POST TYPE
J6	1251-6868		CONNECTOR 5-PIN M POST TYPE
J7	1251-3825	1	CONNECTOR 5-PIN M POST TYPE
J8	1200-0508	2	SOCKET-IC 14-CONT DIP-SLDR
J9	1200-0508		SOCKET-IC-14-CONT DIP-SLDR
R1	0764-0015	2	RESISTOR 560 5% 2W MO TC=0 ±200
R2	0764-0015		RESISTOR 560 5% 2W MO TC=0 ±200
R3	0764-0016	2	RESISTOR 1K 5% 2W MO TC=0 ±200
R4	0764-0016	2	RESISTOR 1K 5% 2W MO TC=0 ±200
R5	0757-0394		RESISTOR 51.1 1% .125W F TC=0 ±100
R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0 ±100
XA2	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS
XA3	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS
XA4	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS
XA5	1251-7882	5	CONNECTOR-PC EDGE 2-ROWS
XA6-XA14			NOT ASSIGNED
XA15	1251-7882		CONNECTOR-PC EDGE 2-ROWS

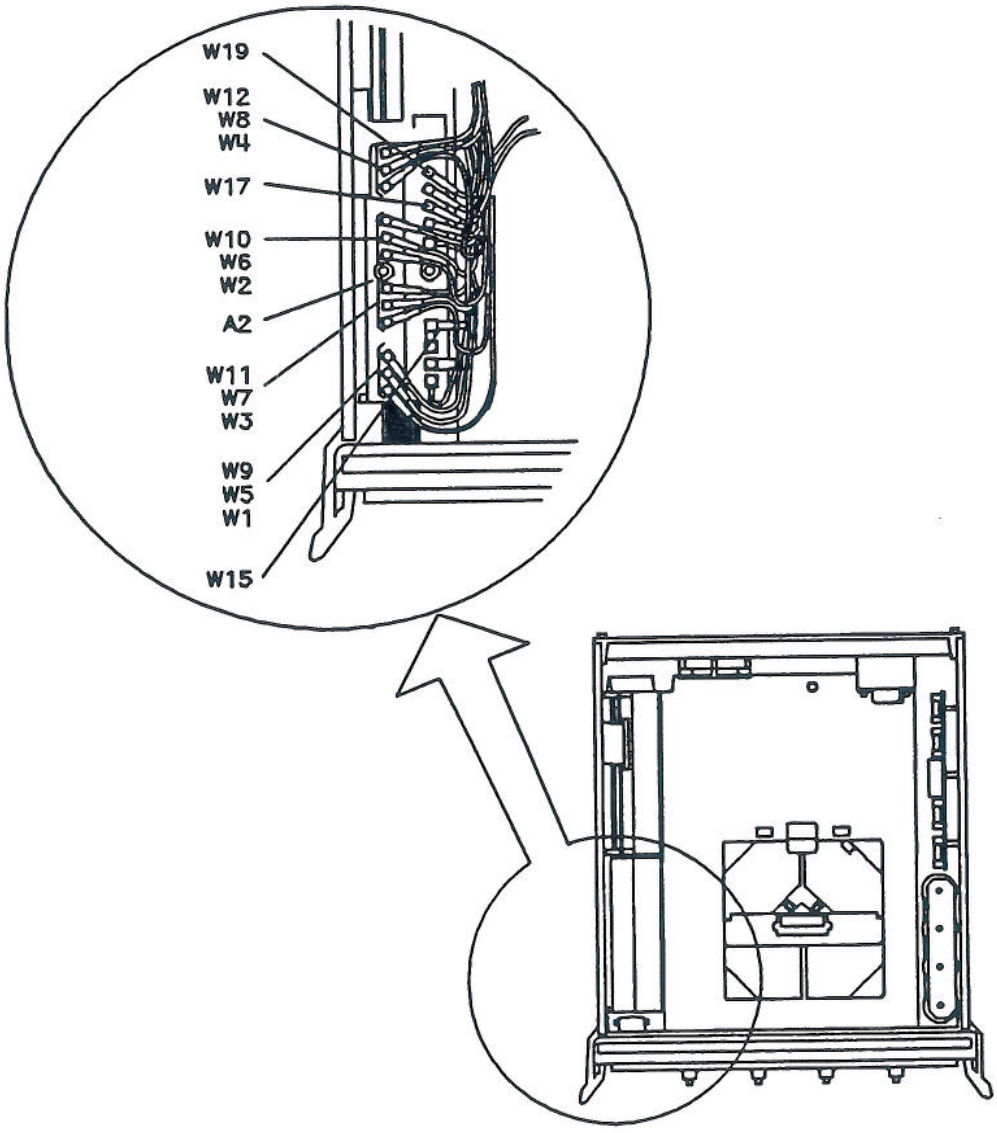


Figure 7-11 Parts Unique to Option 001

Reference Designation	HP Part Number	Qty	Description
A2	08513-60004	1	BOARD ASSEMBLY, IF MULTIPLEXER (NEW)
A2	08513-69004	1	BOARD ASSEMBLY, IF MULTIPLEXER (REBUILT)
W1	08513-60121	1	CABLE ASSEMBLY A12J3 TO A2J1
W2	08513-60122	1	CABLE ASSEMBLY A13J3 TO A2J7
W3	08513-60123	1	CABLE ASSEMBLY A10J3 TO A2J4
W4	08513-60124	1	CABLE ASSEMBLY A11J3 TO A2J10
W5	08513-60125	1	CABLE ASSEMBLY A2J2 TO J11A1
W6	08513-60126	1	CABLE ASSEMBLY A2J8 TO J11A4
W7	08513-60127	1	CABLE ASSEMBLY A2J5 TO J11A2
W8	08513-60128	1	CABLE ASSEMBLY A2J11 TO J11A3
W9	08513-60129	1	CABLE ASSEMBLY A2J3 TO J10A1
W10	08513-60130	1	CABLE ASSEMBLY A2J9 TO J10A4
W11	08513-60131	1	CABLE ASSEMBLY A2J6 TO J10A2
W12	08513-60132	1	CABLE ASSEMBLY A2J12 TO J10A3
W13-W14			NOT UNIQUE TO OPTION 001
W15	08513-60135	1	CABLE ASSEMBLY A3J3 TO J10A7
W16			NOT UNIQUE TO OPTION 001
W17	08513-60137	1	CABLE ASSEMBLY A3J6 TO J10A5
W18			NOT UNIQUE TO OPTION 001
W19	08513-60139	1	CABLE ASSEMBLY A3J8 TO J10A6
W45	08517-20017	1	CABLE ASSEMBLY A8 TO A18
W46	08517-20018	1	CABLE ASSEMBLY A6 TO A18

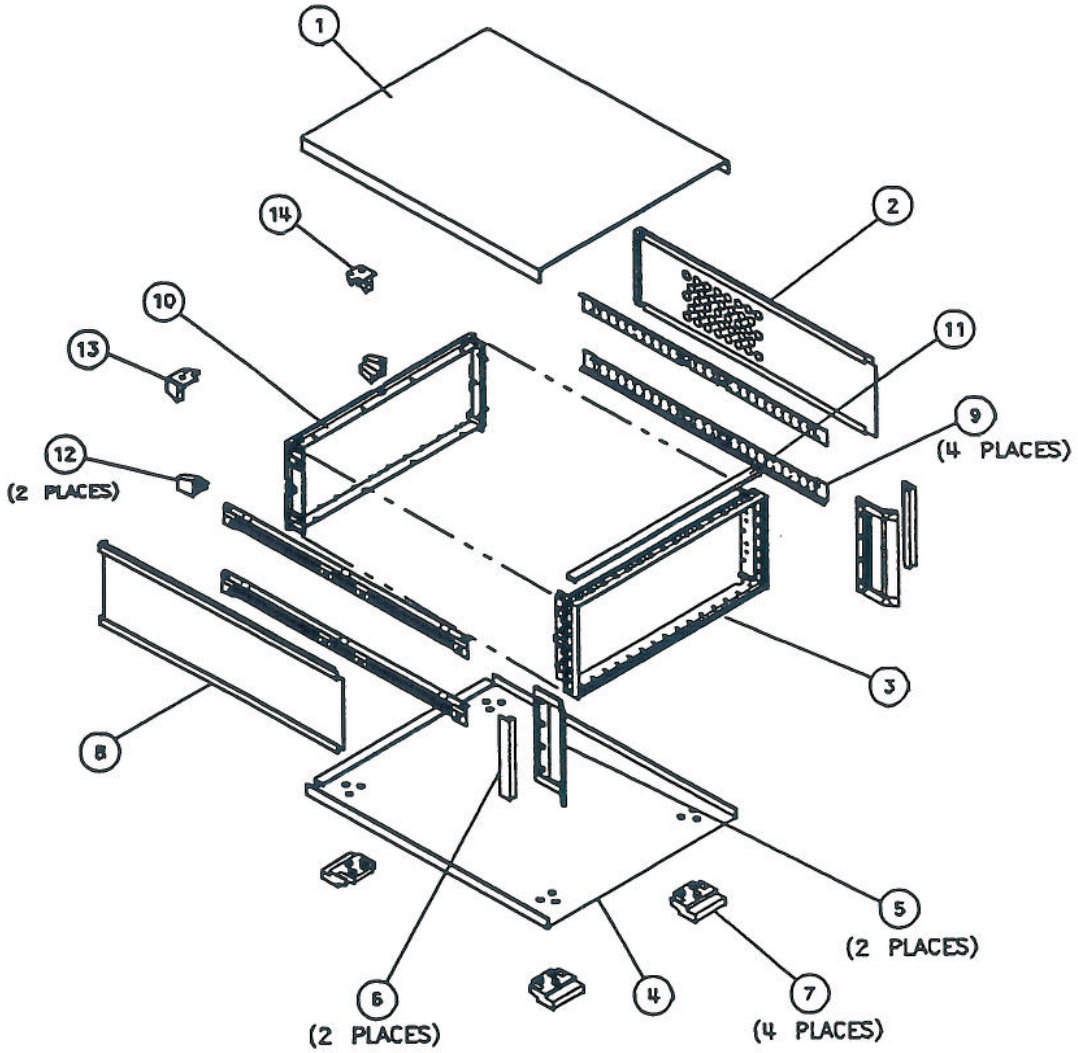


Figure 7-12 Cabinet Parts

Reference Designation	HP Part Number	Qty	Description
1	08513-00040	1	TOP COVER
2	08513-00041	1	SIDE COVER PERFORATED
3	5021-8403	1	FRONT FRAME
4	5062-3747	1	BOTTOM COVER
5	5062-3799	1	HANDLE ASSEMBLY
6	5021-8496	1	TRIM FRONT HANDLE
7	5041-8821	4	BOTTOM FOOT
8	5062-3757	1	SIDE COVER
9	5021-5837	1	18" CORNER STRUT
10	5021-5804	1	REAR FRAME
11	5041-8802	1	TRIM STRIP
12	5041-8821	2	BACK PANEL FOOT
13	5021-8538	1	LOCK FOOT
14	5021-8540	1	LOCK FOOT

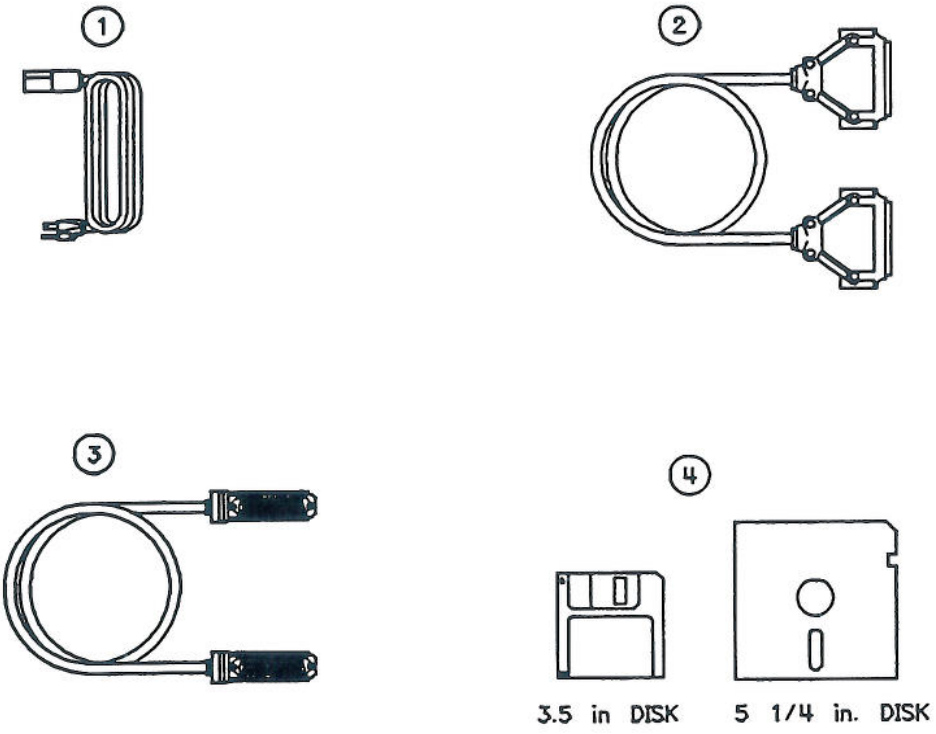


Figure 7-13 Accessories Supplied with the Test Set

Reference Designation	HP Part Number	Qty	Description
1	8120-1348	1	POWER CORD U.S.A.
2	08510-60106	1	INTERFACE CABLE
3	8120-3445	1	HP-IB CABLE
4	08510-10035	2	PERFORMANCE TEST SOFTWARE

8

Performance Tests

Introduction

The semi-automated HP 8511B Performance Verification procedure is the method for performance testing an HP 8511B as part of an HP 8510 system. These sources may be used:

- HP 8360-series sources
- HP 8340A or 8340B
- HP 8341A or 8341B
- HP 8350B (with one of the following plug-ins):
  - HP 83522A, 83525A, 83525B, 83540A, 83540B, 83545A, 83570A, 83590A, 83592A, 83592B, 83592C, 83594A, 83595A, 83596A, 83597A, 83599A

Verifying Your HP 8511B

1. Have all the right equipment before beginning. Refer to Table 8-1 on page 8-2.
2. Be sure that your HP 200 or 300-series controller is properly loaded with the correct BASIC operating system and the necessary drivers and language extensions. Use the following section, "Controllers and BASIC," if you need help.
3. Refer to the Configuration diagram and the Splitter/Cables diagram to make the proper connections.
4. Power up the HP 8510 system and run the program as follows:
   a. Insert the performance verification disk in the drive and type `LOAD "PERF8511B"`
   b. Press **[RETURN]**, **[EXECUTE]**, or **[ENTER]**.
   c. When the program is loaded, run it by pressing **[RUN]** on your controller or by typing `RUN` and then pressing **[RETURN]**, **[EXECUTE]** or **[ENTER]**.

Typically if an error is displayed now, it means that a driver or language extension (or combination) has not been loaded (see Step 2 above).

5. When the system is correctly configured and the program is running, the program title banner will appear on the controller CRT. Refer to "HP 8511B Performance Verification Procedure" for details on the program menu selections.

Required Equipment

The equipment listed in the following tables is required to test the performance of the HP 8511B.

Table 8-1 Instruments

Instrument	Critical Specification	Model Number
Network Analyzer	No substitute	HP 8510
Controller	No substitute	HP 900-series 200/300
Power Meter	Range: –70 to +44 dBm	HP 436A, 437A or 438A
Power Sensor	Frequency range: 50 MHz to 50 GHz	HP 8487A
S-parameter test set (optional)	No substitute	HP 8517A

Table 8-2 HP 8511B Service Kit (HP part number 08511-60016)

Equipment	Critical Specification	Model Number
Power Splitter	DC to 50 GHz	HP 11667C
Adapter	2.4 mm (f) to 2.4 mm (f)	HP 11900B
6 dB Attenuators (2)	2.4 mm 50 MHz to 50 GHz	HP 33340D opt 006
20 dB Attenuator	2.4 mm 50 MHz to 50 GHz	HP 33340D opt 020
50 Ohm Fixed Load	2.4 mm (m) DC to 50 GHz	HP 85138A
50 Ohm Fixed Load	2.4 mm (f) DC to 50 GHz	HP 85138B
Coax Test Cables (2)	2.4 mm (m) Semi-rigid	08511-20025
RF Cable	2.4 mm (m) Semi-rigid 2 ft. long	08511-20031

Controllers and BASIC

The software can be run on most HP-series 200 or 300 controllers with a BASIC 3.0 operating system or higher and the BIN (binary) drivers and language extensions specified below. Follow the instructions below to load BASIC 3.0 or higher and BIN files. Refer to your BASIC manual set for detailed instructions about your system.

Loading BASIC and BIN Files

1. With the controller OFF, insert the BASIC system disk into the default drive and turn the controller ON. For 200-series HP 9836A controllers, the right hand drive is usually the default drive. For other 200 and 300-series controllers, the left hand drive is usually the default drive. When BASIC has finished loading, remove the disk.
2. Load the first driver by inserting the drivers disk and typing, `LOAD BIN "DISC"`.
3. When the binary file named disk has finished loading, press **[RETURN]** or **[EXECUTE]**.
4. Load the second driver by typing, `LOAD BIN "HPIB"`.
5. When it has finished loading, press **[RETURN]** or **[EXECUTE]**. Remove the drivers disk.
6. Insert the extensions disk and load the following extensions in similar fashion. Type `LOAD BIN "EXTENSION FILENAME"` and press **[RETURN]** or **[EXECUTE]** for each extension file. The extension file names are:

   CLOCK

   GRAPH

   ERR

   IO

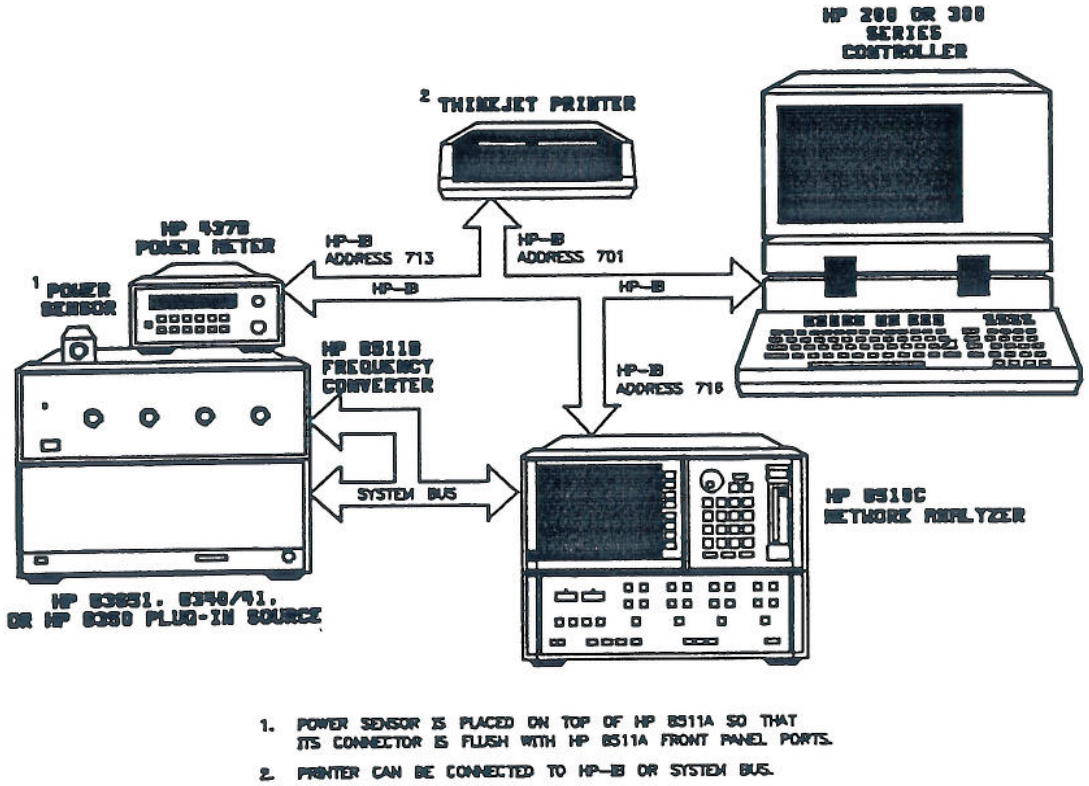
   KBD

   MAT

   MS

If you have any of the following system configurations, you must load additional drivers or extensions, or both, as shown below.

Configuration	Driver	Extension
SRM	DCOMM	SRM
HP 9885 drive	HP9885	
CS80 disk drives (such as HP 9122, 9133D, 9134D, 7908, 7911)	CS80	



1. POWER SENSOR IS PLACED ON TOP OF HP 8511A SO THAT ITS CONNECTOR IS FLUSH WITH HP 8511A FRONT PANEL PORTS.
2. PRINTER CAN BE CONNECTED TO HP-IB OR SYSTEM BUS.

Figure 8-1 Configuration Diagram

NOTE This is a suggested bench configuration for verification purposes only. If an HP 8350B source is used, raise the rear of the HP 8511B to provide adequate ventilation of the source. The HP 8350B is not as deep as the test set and will not normally support the test set by its rear feet.

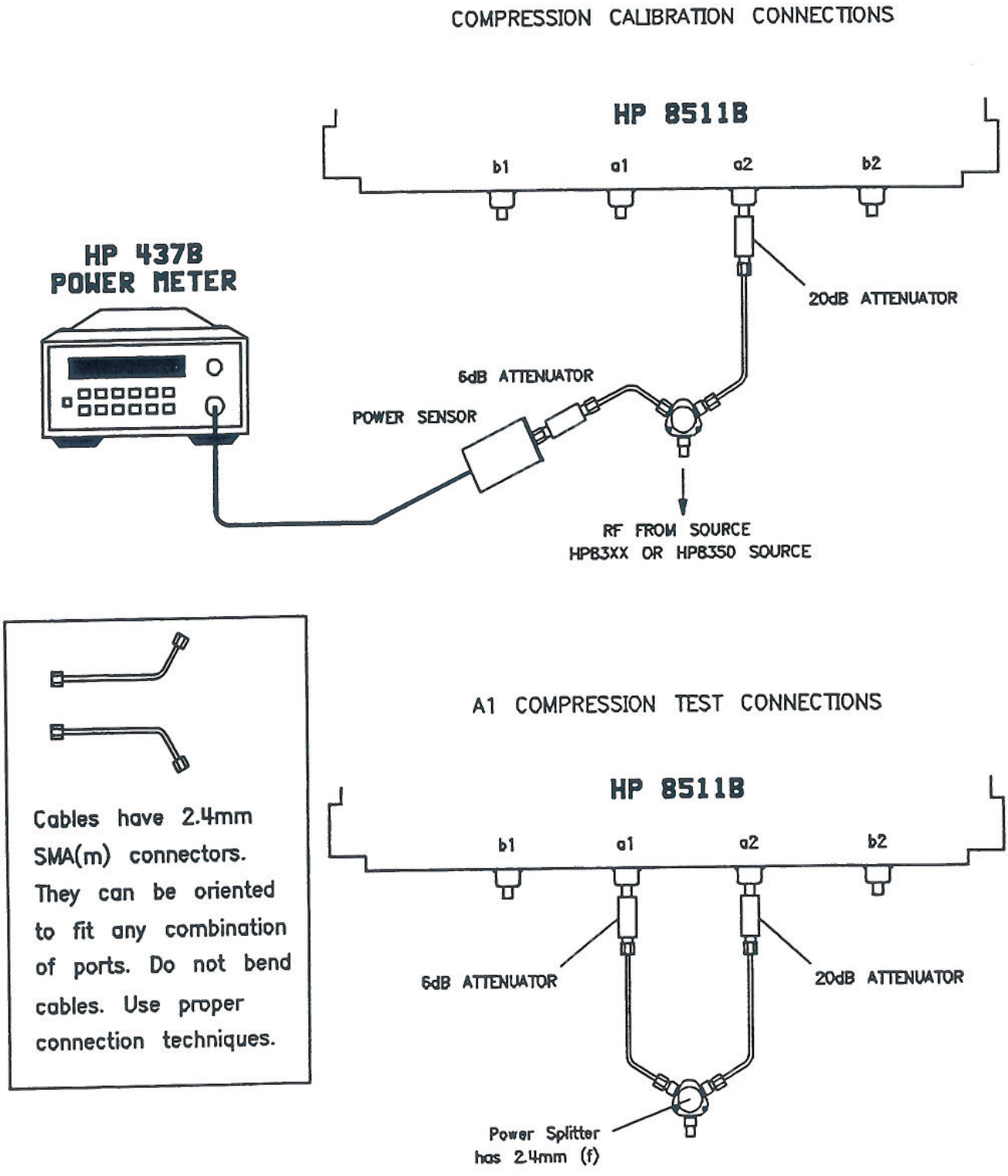


Figure 8-2 Splitter/Cables Diagram

HP 8511B Performance Verification Procedure

This procedure includes a brief description of the tests which constitute the performance verification, a summary of the softkey functions and the procedure itself.

Brief Description of the Tests

The following paragraphs briefly describe the individual tests of the performance verification procedure. Refer to "Detailed Description of the Tests" at the end of this section for additional information.

Compression

This test measures the error in a ratio measurement due to compression of the sampler output at high input power levels.

Crosstalk

This test measures signal leakage between ports.

Conversion Gain

This test measures the maximum and minimum signal gain (or loss) of the RF to IF down conversion.

Low-Level Noise

This test measures the rms noise level of the trace data when the port is terminated with a 50 ohm load.

Tracking

This test indicates how closely the output of two samplers track (match) given identical input signals.

High-Level Noise

This test measures the rms noise magnitude and phase ripple on the trace data.

Port Return Loss

This optional test measures the return loss (S11) of each of the four test ports of the test set.

Softkey Summary

[HELP]

Press this key for instructions or further information about the current test or menu. This key appears throughout the test menus and does not disrupt the test sequence.

[ABORT]

Press this key to stop the current test or menu and return to the last menu or the test menu. (it will take effect at the end of a sweep but not when the program is executing a sweep.)

[RESTART]

Press this key to view the current connection diagram and restart a single test without returning to the test menu. This softkey will appear after a test has been made.

[RECALIB]

Press this key when a test fails due to a faulty or suspect calibration. This function erases the results of the current test.

[REMEAS]

Press this key to repeat a measurement with the same setup and calibration (without viewing the current connection diagram or returning to the test menu. This softkey appears following tests and calibrations.

[I/O MENU]

This softkey displays a menu with the following softkeys and program features:

Print - prints to printer on HP-IB or System Bus.

File - saves data to or loads data from disk.

Equip - displays equipment list.

Sys Info - records system serial numbers.

MAINmenu - returns to main menu.

END_prog - exits the program.

Data Storage

Use the **[FILE]** key in the I/O menu to save data on a separate data disk. This feature enables you to return to an incomplete test and continue the test where it left off.

You can exit the program any time by pressing **[END_prog]** (in the I/O menu). However, **[END_prog]** erases calibration data from the program disk unless it has been previously saved.

Running the Software Program

The appearance of the program title banner on the controller CRT indicates that the hardware is properly configured and the software is running properly.

The program title banner looks similar to this:

HP 8510/HP 8511B PERFORMANCE VERIFICATION

HP part number and copyright notice.

Accompanying text with a list of compatible

HP 8350 source plug-ins and synthesizers.

If this screen is not now visible, check these items:

Configuration okay? (see Configuration Diagram)

BASIC and extensions loaded okay? (see Controllers and BASIC)

Individual instruments okay? (run self-tests, refer to troubleshooting information in the *HP 8510 On-Site Service Manual*)

During these procedures, either disregard the HP 8510 beeper sound and accompanying error message or turn off the beeper. To turn off the beeper on a HP 8510 system, press **[SYSTEM]**, **[BEEPER OFF]**.

Use the controller softkeys as defined by the program when making program selections. For example, when prompted to press **[CONTINUE]**, press the softkey ***{f5}*** or ***{k5}***, not the keyboard `"Continue"` key.

With the title banner displayed, press the program key **[CONTINUE]**. At the prompt, if you want to see the equipment list, press **[YES]**; if not, press **[NO]**. Use the **[More]** key to view (and **[Again]** to review) the equipment list. When you are finished, press ***[Done]*** to see the softkey definition menu. Then press **[Confg]** to see the System Configuration menu shown below:

System Configuration

Display/Processor: HP 85101x

IF/Detector: HP 85102x

Source: HP 83xxx

Plug-in: HP 835xx

Power meter: HP 43xx

Return loss test set (optional): HP 851xx

Printer connected to: xxxx

Toggle each softkey until the information displayed represents your system. Note that the identification of the source (or plug-in, if applicable) determines the frequency range of the performance verification. Press **[Done]** when all of the displayed information is correct.

The system information menu, shown below, will appear. Use the **[NEXT]** and **[PREVIOUS]** keys to move the cursor and the controller keyboard to enter as much information as you want for your records. This information can be printed using the I/O menu of this program. System information is saved to the data disk when the measurement data is saved. When saved, this information can also be printed after verification. Otherwise, it will be erased as soon as another program is run or the controller is turned off.

HP 8510/8511B Performance Tests

System information:	Date
Temperature	C:
Humidity	%:
HP 85101	S/N:
HP 85102	S/N:
HP 8511B	S/N:
Power Meter	S/N:
Power Splitter	S/N:
HP Source	S/N:
HP Plug-in	S/N:
NOTE:	

To reenter this menu, press **[Sys_Info]** anytime the I/O menu is displayed. To leave this menu, press **[DONE]** after you have entered as much of the above information as you need.

The program will ask you to calibrate the power meter. Turn on the power meter line switch (no other front panel set up is necessary because it is under HP-IB control). Calibrate the power meter and power sensor by using the power meter POWER REF OUTPUT, as explained in the power meter manual.

The Main menu will appear on the CRT. This menu, as shown below, enables you to select and perform any of the six tests, display additional

instructions with the [HELP] key or access the I/O menu. Press [MAINmenu] to access this menu as needed.

HP 8510/8511B PERFORMANCE VERIFICATION
Source: HP 83xx, etc.

Compress:	Compression & Crosstalk tests
ConvGain:	Conversion Gain tests
Tracking:	Tracking tests
High-Lev:	High-Level Noise tests
Low-Lev	Low-Level Noise tests
Port RL:	Port Return Loss tests (optional)
Help:	Testing instructions
I/O menu:	Print to printer or save to disk a summary of test data.

Press a program softkey to choose the test you wish to perform. You can perform the tests in any order, but may find it more efficient to perform them in the order listed. The first five tests are standard. The sixth, Port Return Loss, is optional and requires an HP 8517A test set.

Performing the Verification Procedure

Introduction

The instructions which follow augment the screen prompts of the program. They are step-by-step instructions intended for novice operators. The screen prompts are sufficient for technicians familiar with the HP 8510 system. Refer to this supplemental information, or not, as appropriate.

With the Main menu displayed on the controller CRT, read the instructions for each test below and follow the steps carefully. If an error message repeatedly appears during any part of the procedure, or if the program will not continue as the instructions indicate, you may have to rerun the program from the beginning. But this should only be done if no other program softkey can provide a solution.

SAVE/LOAD NOTE: To stop the verification at any time and save the tests you have completed, or to recall those same tests later, refer to the Save/Load Instructions immediately following the last test described in this section.

Compression and Crosstalk Test Procedure

1. Press **[Compress]** to display the Compression and Crosstalk menu. It defaults to the b_1 port compression and crosstalk tests, but that setting can be changed. Press **[Port]**. The port selected changes the combination of crosstalk tests listed below it. Press **[Port]** until it returns to b_1.
2. Press **[b1 compr]** to begin. The program will search through the controller memory for compression calibration data. It data which matches the current hardware setup is found, the program will load that data and set up for the compression test (see step 3).

Otherwise the program will display the following:

A Compression calibration is required.

CAL: Perform Compression calibration

LOAD: Load Compression calibration from disk

Select a softkey.

Press **[CAL]** and continue with step 3 to perform the calibration.

Press **[LOAD]** to display the following menu and load calibration data from disk.

Default data drive is:

Press RETURN or ENTER if okay.

If not okay, then enter

the MASS STORAGE UNIT SPECIFIER

of the disk drive used for data storage.

The default data drive will be the drive from which the program was loaded. It you want to load the calibration data from another drive, enter the MSIS of that drive. Otherwise, press **[RETURN]** or **[ENTER]** on the controller keyboard.

NOTE Error messages may result from using the wrong or no disk, not having a calibration on the disk, or specifying the wrong drive.

The source (and plug-in) and test frequency range of the current hardware must match the hardware which was used for the calibration stored on disk. If so, continue with step 3. If not, this menu will appear:

Test conditions changed by the Compression calibration

	FROM	TO
Source:	HP 83xx	HP 83yy
Plug-in:	HP 83zz	HP 83ww

Test frequency range: nn-mm GHz
Is this okay? (NO = undo)

In the example above, the controller loaded a compression calibration from the disk. Then it compared the current hardware (listed under FROM) to the record of the hardware used previously (TO column). The information did not match. But for the calibration to aid the performance test, it must match. So the answer to the question, "Is this okay?", is NO.

The solution is to match the two columns before continuing. Current setup data (FROM column) is entered by using the System Configuration menu or by loading data from a disk with the I/O menu. First make sure the FROM information represents your hardware setup. Then either match the TO data to the FROM data or perform a calibration. The TO data can be corrected by loading the appropriate calibration data, if available, from (another) disk.

3. The program will require power sensor cal factors. Enter the factors listed on the side of the power sensor.

   The power meter sensor should not be connected to RF power at this time. Unless the program prompts **Power meter doesn't respond**, assume the power meter's address is correctly set to 13 (see power meter manual) and the instrument is on the HP-IB bus (refer to the HP 8510 installation information).

4. Press **[Continue]** to automatically zero the power meter. This automatically prompts you to enter in Cal factors.

   If the meter does not zero, confirm that the power sensor is not connected to RF power. Press the **[TRY AGAIN]** key. If necessary, start over by loading and running the program from the beginning.

5. When the meter is zeroed, the program will display the same setup, except that now the power meter sensor is connected to the pad/cable/splitter. Connect the Compression CAL setup as shown on the CRT and in the Compress Calibration Connections diagram (part of the Splitter/Cables Diagram).

   Press **[CONTINUE]** to set reference levels for each frequency data point. The program will take approximately 5-6 minutes to do this. The information will be displayed on the controller CRT.

   After the last frequency point, the program will query whether you want to save the data on disk. This is the only time that the calibration can be saved. You should save a calibration only if you intend to use it within 24 hours. Place a blank initialized disk in the drive and press **[YES]**. The

program will automatically load and name the file after you have identified the drive you are going to use. Otherwise, press **[NO]**.

6. When the CRT displays the b1 Compression setup, connect the hardware exactly as shown. Remember that the program performs the following tests using the results of the calibration for accuracy enhancement, but the calibration will be degraded by excess connections and disconnections. As much as possible, disconnect the set-ups at the test port/attenuator interface; do not disconnect the attenuators or switch the semi-rigid cables unless unavoidable.

7. Press **[CONTINUE]** for the program to perform the b1 Compression test. The measured compression (dB) at each frequency point will be displayed on the controller CRT. When the test is finished, the results will be displayed similar to this:

Table 8-3 B1 Compression

Parameter	Limit		Units	Meas.	Pass/Fail
	Min.	Max.			
Compr. @–10 dBm @.045-20 GHz	0	0.1	dB	0.12	Pass
Compr. @–15 dBm @20-40 GHz	0	0.1	dB	.027	Pass
Compr. @–20 dBm @40-50 GHz	0	0.1	dB	.019	Pass

Here, the PASS/FAIL column indicates that the HP 8511B has passed the b1 compression test in the three frequency ranges required for the source used in this example. In tests with sources which do not exceed 20 GHz, only one frequency range will be displayed.

8. If the test result was PASS, go to step 9. If the test result was FAIL, press one of the other keys. Press **[REMEAS]** to repeat the measurement. If it fails again, press **[RESTART]** to return to the setup display and check all connections, addresses, and so forth before restarting the b1 compression test, or press **[RECALIB]** to erase the current calibration and prepare to perform another measurement if the test still fails.

9. Press **[CONTINUE]** to begin the b1 crosstalk tests by displaying the b1 Compression/Crosstalk test menu. The word PASS, in the Pass/Fail column, indicates that the b1 Compression test has passed.

Press **[b1 x a1]** (and choose an averaging factor if using an HP 8350 source). Press **[Done]** and the b1 x a1 crosstalk setup will be displayed. Connect the hardware exactly as shown. Notice that you will need to use the two 50 ohm terminations.

10. Press **[CONTINUE]** to perform the b1 x a1 crosstalk measurement. The number of sweeps the program will take for the measurement varies: for

HP 8350B-based systems the number is averaging-factor-plus-one sweeps; for synthesizers, one sweep.

11. When the b1 x a1 Crosstalk test is complete, the results will be displayed on a menu similar to this:

Table 8-4 a1 → b1 Crosstalk

Parameter	Limit		Units	Meas.	Pass/Fail
	Min.	Max.			
Compr. @.045-8 GHz	–130	–85	dB	–90.09	Pass
Averaging = xx					

The measurement result displayed is the worst case measurement, -90.09 in the example above. The measurement passed.

If your instrument did not pass, press the appropriate softkey to remeasure, restart, or recalibrate.

12. Press **[CONTINUE]** to display the a1 Compression/Crosstalk menu and the status of the test. As indicated by the CRT, only two tests remain undone: b1 x a2 and b1 x b2.

13. Complete the two remaining crosstalk tests in the same manner that you completed the b1 x a1 test. Refer to the preceding paragraphs if the procedure remains unclear.

14. When the test set has passed all of the b1 Compression/Crosstalk tests, test the next port, a1. Press **[PORT]** until the Compression/Crosstalk test menu shows that Port is set to : **a1**. Then press **[a1 Compr]** and complete that test in the same manner that you completed the b1 Compression test.

15. When the test set has passed the a1 Compression test, select the Crosstalk tests for a1 by pressing the appropriate softkeys.

16. Complete the a1 Crosstalk tests in the same manner that you completed the b1 Crosstalk tests. If necessary, refer to the steps above and substitute a1 for b1 as you proceed.

17. Perform the Compression/Crosstalk tests for both of the untested ports: a2 and b2. The end result should be a Pass indication on each Compression/Crosstalk menu (Ports: a1, a2, b1, b2). When the test set has passed all of the Compression/Crosstalk tests, press **[MAINmenu]** to access the main test menu. You should see a **Pass** message on the main test menu.

Conversion Gain Test Procedure

NOTE The following instructions are less detailed than those of the Compression/Crosstalk test. If you desire greater guidance, use the **[HELP]** key and refer to the preceding documentation. Additional information is in the detailed description of the tests at the end of this section.

1. Press **[ConvGain]** to begin this test. You must calibrate specifically for this test, so press **[CAL]**. If you have performed this calibration within the last 24 hours and have saved it on a data disk, you may load it from the disk rather than repeating the calibration. Go to step 6 if you do not need to perform a calibration.
2. Make the connections as shown in the CRT test setup. Be sure to identify one cable as #1 and #2. They must be connected as shown.
3. Press **[Continue]** to enable the HP 8510 to take several sweeps.
4. When the CRT displays another test setup for a1 power level, make the connections exactly as shown.
5. Press **[Continue]** to perform the calibration. It will take several minutes because data must be taken at each frequency point. When completed, save it on the data disk by pressing **[YES]** or continue without saving it by pressing **[NO]**.
6. The program will now display the b1 conversion gain setup. Make the connections exactly as shown. You will probably have to loosen all of the connections to adjust the orientation of the two semi-rigid cables. Retorque all loosened connections.
7. Press **[Continue]** to perform the test. If the test passes, press **[Continue]**. Perform the remaining conversion gain tests as prompted. The result should be that all tests have passed as indicated on the menu display.

   If the test fails, recalibrate and/or remeasure, after checking all connections.

Tracking Test Procedure

1. Select **[Tracking]** from the Main menu. Since the program uses data taken in the conversion gain tests, no connections are necessary.
2. Press **[Continue]** to test the b1/a1 tracking. The test will be completed quickly and the results will be displayed.
3. Complete the remaining Tracking tests in the same manner.

High-Level Noise Test Procedure

NOTE Perform these tests in the order presented.

1. Select **[High-Lev]** from the Main menu for the program to initialize the HP 8510 and display a test setup. Make the connections exactly as shown and press **[Continue]**. The tests are ratios between port pairs: b1/a1, b2/a1, a2/a1, b1/a2, b2/a2.
2. Perform the tests as prompted.

Low-Level Noise Test Procedure

1. Select **[Low-Lev]** from the Main menu for the program to initialize the HP 8510 and display a prompt to normalize the a1 power level.
2. Make all connections exactly as shown, then press **[Continue]**.
3. When these tests are complete and have passed, the HP 8511B Frequency Converter can be considered verified. The sixth test, port reflection, is optional. It requires an HP 8517A test set as part of the system. If you have one of those test sets, perform the Port Return Loss test by selecting it from the Main menu.

After the Test is Over

When you are done with the testing, decide whether you want a printed or disk copy of the results and the system information. If you do, access the I/O menu and press **[PRINT]** or **[FILE]** as desired. Make sure that the printer is properly connected, turned on and loaded with paper. The disk drive must be correctly specified, with a data (not the program) disk inserted.

To exit the program, simply remove the disk and turn off the power to the instruments, or press **[END_prog]** in the I/O menu.

Port Return Loss Test Procedure (optional)

NOTE An HP 8517A test set is required for this test.

1. Disconnect the HP 8511B from the HP-IB, Test Set IF Interconnect, and RF source signal. Leave it connected to line power.
2. Place the HP 8517A test set on top of the HP 8511B. Connect the HP 8517A test set in the system by connecting the HP-IB, Test Set IF Interconnect, RF source power and line power to it.
3. Turn on the HP 8511B and treat it like a device under test. You will use the HP 8517A test set to make S11 measurements of each port on the HP 8511B.
4. Press **[Port RL]** in the Main menu to perform the Port Return Loss test.
5. Follow the instructions and the test setup drawings exactly as shown. The program will prompt you to perform a calibration using devices in the 2.4 mm calibration kit with the HP 8517A test set in the system. Perform the calibration at the end of the cable and take care to avoid overly sharp cable bends (defined in cable manual). Then measure the return loss of each port on the HP 8511B.

Save/Load Instructions

NOTE

Calibrations and normalizations are not automatically saved by the various performance test procedures. They must be saved on a data disk immediately after they are performed. When the program queries about saving calibration data, follow the display prompts to do so.

However, as long as the controller stays ON or until another program is run, calibrations, normalizations, system information and test results will remain in the controller memory.

Use the following procedures to save and load both test results and the current system information.

How To Save Test Results

1. Insert an initialized blank (data) disk in the drive.
2. While in the Main menu, press **[I/O Menu]**, **[File]** to begin the save process.
3. Enter the mass storage unit specifier (MSUS) of the data disk drive and press the keyboard RETURN or ENTER key to enter the File menu.
4. Press the **[Save]** key, type in a name for the file and press the keyboard RETURN or ENTER key. The controller will save the test results and system information onto disk.
5. Remove the disk and properly store it.

How To Load Test Results to Continue Testing or Print-Out Data

NOTE The file must have been saved (copied) by the procedure above.

1. Insert the data disk in the drive.
2. Access the Main menu and press **[I/O Menu]**, **[File]** to begin the load process.
3. Enter the mass storage unit specifier of the data disk drive and press the keyboard RETURN or ENTER key to enter the File menu.
4. Press **[LOAD]**, type in a name for the file and press RETURN or ENTER. The program will load the test results and system information into the controller from the data disk.
5. Press **[DONE]** to return to the I/O menu.
6. To print out a copy of the data just loaded, press **[PRINT]**. Only the printer, disk and controller need be connected and turned on to make a print-out.
7. To continue testing an instrument, press **[MAINmenu]** to reenter the test selection menu. Select one of the tests with a softkey. Connect the devices as shown in the configuration diagram and prompts and proceed with the test.

Other File Menu Functions

In addition to save and load capabilities, the File menu can catalog and purge files. The File menu is shown below.

HP 8510/8511B PERFORMANCE VERIFICATION
Source: HP 83xx
Select the desired disk functions:

CAT	:	CATALOG of files
LOAD	:	LOAD from a data file
SAVE	:	SAVE to a data file
PURGE	:	PURGE to a data file
DONE	:	Return to I/O menu

Detailed Description of the Tests

Compression

This test measures the error in a ratio measurement due to compression of the sampler output at high input power levels. Each port is tested over the test frequency range. Data is taken at 25 frequency points for two sampler input power levels. For example, at a given frequency under 20 GHz, –15 dBm sampler input power is applied. The test sampler output is ratioed to the reference sampler output and the trace data is put into memory. Then the divide function is used to normalize the trace data to 1. That is, it is divided by itself to provide a flat trace. Next, the input level is increased to –10 dBm and the test port is again ratioed to the reference port. At this point, the data taken at –10 dBm is compared (using the math divide function) to the –15 dBm ratio that is in memory. This comparison should result in no more than a 0.1 dB change for any of the 25 measured frequency points. The program will display the greatest amount (or worst case) of measured compression and it will also indicate pass or fail for each port tested.

Crosstalk

This test measures the signal leakage from one port to another port where one port (sampler) has a high level input signal and the other port is terminated with a 50 ohm load. Either the a1 or a2 sampler is used to phase lock the system. With –15 dBm input, the reference sampler is measured and that data is sent to memory. Then the test sampler is terminated with a 50 ohm load and measured while power is applied to the reference sampler. The test sampler data is then compared to the reference data in memory to determine its relative level. Each sampler is tested in combination with the other three - a total of 12 tests. 200 data points are taken over the test frequency range. The program will display the results (worst case) for each combination of ports. It will also indicate pass or fail for each combination tested.

Conversion Gain

Each port is tested for both maximum and minimum conversion gain. Because there is amplification in the signal path, there can be either loss or gain after the RF is down-converted by the network analyzer. Input power is monitored with the power meter to determine the input level prior to sampling. The sampled RF signal is then compared to the monitored input level and displayed by the HP 8510 after all of the down conversion processes. The result is a relative signal level that may have some loss or gain. Two hundred data points are taken over the range of the source and the results (worst case) are displayed with a pass or fail indication.

Low-Level Noise

Low-level noise is the rms noise level of the trace data when the port is terminated with a 50 ohm load. Each port (sampler) is tested at up to four different frequencies to determine the rms noise level. Test port sampler power is measured by the HP 8510 with a fixed 50 ohm load attached to the specific port. The noise floor is measured by taking the log equivalent of the averaged standard deviations of the real and imaginary parts. The worst case results are displayed in dBm along with the minimum and maximum limits and the pass or fail indication.

Tracking

Tracking measures how well the output of one sampler tracks with the output of another sampler when they have identical input signals. Six pairs are measured at 200 frequencies over the test frequency range. For each pair of ports, there are three tests:

- Magnitude Slope (dB/GHz)
- Ripple p-p magnitude (in dB p-p)
- Ripple p-p phase (in degree p-p).

The three measured delta values (difference between port pairs) are displayed (worst case) along with the minimum and maximum limits and the pass or fail indication.

High-Level Noise

High level noise measures the rms noise magnitude and phase ripple on the trace data. The trace data is the ratio of two ports driven by a high power level. Five port pairs are measured at up to three frequency points to determine the phase and magnitude ratios between the two ports. The minimum and maximum limits, along with the worst case measurement, are displayed for each of the frequency points. A pass or fail indication is also displayed.

Port Return Loss

This optional test uses an HP 8517A test set to measure the return loss (S11) of each port on the HP 8511B. The HP 8511B has line power applied, but no RF, HP-IB, or any other connections. The HP 8517A test set is calibrated using the prompts in the program: 1-port cal using a short, open, fixed load, and sliding load, or broadband load. After calibration, the HP 8511B ports are measured and the S11 data (plotted) is displayed. A pass or fail indication for each port is also displayed.

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Miscellaneous

Adjustments

The HP 8511B has no adjustments. Specifically, no attempt should be made to adjust the samplers.

Instrument History

This manual applies directly to instruments as designated in the front of this manual.

If your instrument had a lower serial number prefix and needed additional documentation, it would be located in this section. For additional information, refer to "Instruments Covered By This Manual" on page 1-2 of this manual.