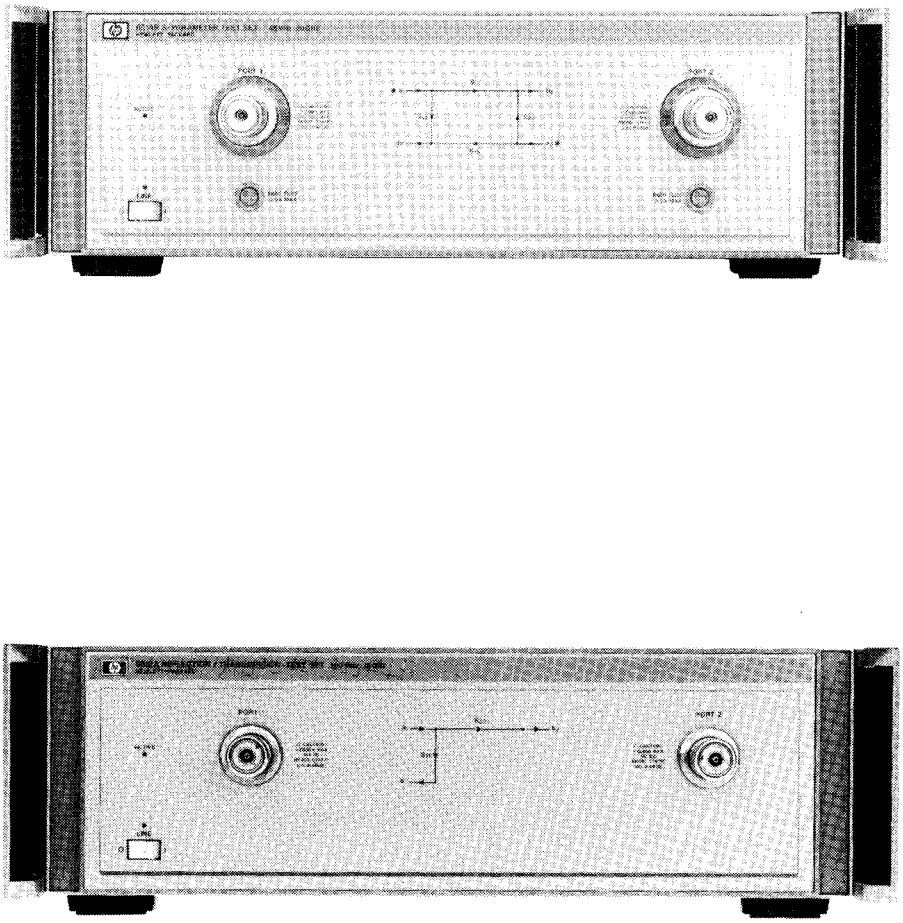

*Figure 1. HP 8514B (upper) and HP 8512A Test Sets*

# General Information

## INTRODUCTION

The purpose of this manual is to enable you to use your HP 8514B S-parameter or HP 8512A reflection/transmission test set effectively and confidently. These test sets are integral components of the HP 8510 measurement system. For that reason, this manual has been divided into two major portions (Operating and Service) to be an integral part of the HP 8510 documentation.

To begin using your test set, first place the Operating portion of this manual (with its *HP 8514B/8512A Test Sets* tab) in the TEST SETS section of the HP 8510B Test Set and Accessories Manual. Or put it in the front of volume 3 of the HP 8510A manual set. The Operating part consists of:

- General Information
- Installation
- Operation
- Performance Tests
- Adjustments
- Backdating

Place the Service portion of this manual (with the *HP 8514B or 8512A TROUBLESHOOTING* tab) behind the TEST SET TROUBLESHOOTING information in the HP 8510B Service Manual. If you do not have the HP 8510B Service manual, put the Service portion behind the Operating portion. The Service part consists of:

- Replaceable Parts
- Service

The major topics of this section, GENERAL INFORMATION, are:

- how to use the test set
- what the test set is
- operating, safety and warranty considerations
- test set specifications

## VERIFYING THE TEST SET

The HP 8514B and HP 8512A have been designed to operate specifically with the HP 8510 network analyzer.

- To install the instrument, turn to the INSTALLATION section of this manual.
- To check the proper operation of the test set, see the *Operator's Check* in the OPERATION section of this manual.
- To see the specifications of the test set refer to SPECIFICATIONS in the HP 8510B System Manual or GENERAL INFORMATION in volume 1 of the HP 8510A manual set.

- To verify that the instrument meets its published specifications, turn to the PERFORMANCE TESTS section in the HP 8510B System Manual or Volume 2 of the HP 8510A Operating and Service Manual. Note that the HP 8514B can be performance tested only to 18 GHz with the HP 8510A software.

- To troubleshoot the test set, refer to the SERVICE OVERVIEW section and the TEST SET TROUBLESHOOTING section of the HP 8510B Service Manual. Or refer to the SERVICE section in Volume 4 of the HP 8510A Operating and Service manual. Otherwise call your local Hewlett-Packard office.

## INSTRUMENTS COVERED BY 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) on the title page under the heading SERIAL NUMBERS.

If the serial prefix of your test set is not listed on the title page, your instrument differs from those documented in this manual. The differences are documented in the yellow manual changes supplement supplied with the manual.

To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest manual changes supplement, as it may contain replacement information as well as change information. The supplement for this manual is keyed to the manual's print date and part number (on the title page) and is available on request from Hewlett-Packard.

You can order this manual in microfiche form (the part number appears on the title page). With the manual (in 4 x 6 inch microfilm transparency format) you will also receive the latest manual changes supplement.

## DESCRIPTION AND OPERATING CHARACTERISTICS OF THE INSTRUMENT

The combination of the HP 8514B test set with the HP 8510 network analyzer and source provides a system for making S-parameter measurements over the frequency range of 45 MHz to 20 GHz. This system is suited for making measurements on two port devices when it is inconvenient or inexpedient to physically reverse the DUT (device under test) to measure all four S-parameters.

The HP 8514B uses two couplers for signal separation. For measurements of active devices, the standard HP 8514B includes:

four RF to IF converters to measure all four S-parameters without reconnecting the DUT,
two 90 dB programmable step attenuators for changing (in 10 dB steps) the incident power level at both ports,
two bias tees for applying external dc bias to both test port center conductors.

The HP 8512A reflection/transmission test set uses one coupler for signal separation. The standard HP 8512A has:

three RF to IF converters, for making reflection (S11) and transmission (S21)measurements,
no step attenuators to internally change the incident power level,
no bias tees to apply external DC bias to the test port center conductors.

Tables 1 and 1B list additional characteristics of the HP 8514B and 8512A, respectively. Figure 2 shows the HP 8514B in a typical measurement set-up.

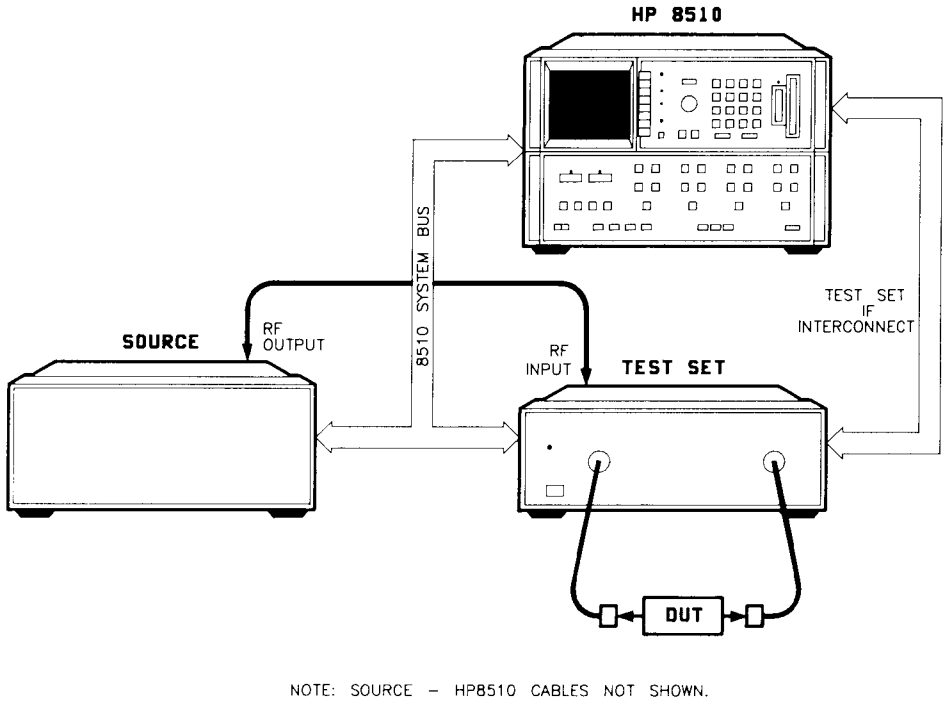


*Figure 2. Typical HP 8514B Measurement Set-up*

## OPTIONS

### Option 001

This option adds IF switching capability to allow up to four test sets to be connected to the HP 8510B at the same time. The test set in use is selected from the HP 8510B front panel. 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.

### Option 002 (HP 8514B only)

This option deletes the 90 dB programmable step attenuators and the dc bias tees. Note that bias can be applied externally, using the HP 11612A bias tee, if bias is required but attenuation not.

### Option 908

This option supplies the test set with the parts required to rack mount it with handles removed. Refer to the INSTALLATION section of this manual for additional information.

## Option 910

This option provides a duplicate test set manual.

## Option 913

This option supplies the test set with the parts required to rack mount it with handles. Refer to the INSTALLATION section of this manual for additional information.

## Option W03, Warranty Conversion

Option W03 converts the standard one year return to Hewlett-Packard warranty to a 90 day on-site warranty. W03 can only be ordered at the time of instrument purchase. Instruments ordered with option W03 are identified on the serial number label, or on a special identification label supplied with the instrument.

## Option W30, Extended Service

Option W30 adds two additional years of return-to-HP service, to follow the first year of warranty. Option W30 can be ordered only at the time of purchase. Instruments ordered with option W30 are identified on the serial number label, or on a special identification label supplied with the instrument.

**NOTE:** additional system warranty information is included in the HP 8510 manual set.

# ACCESSORIES

## Accessories Supplied

Figure 3 shows the accessories supplied with the HP 8514B and 8512A test sets (except as noted in Table 3). The accessories, with part numbers, are listed in the INSTALLATION section for both test sets.

## Accessories Available

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

**Calibration, Verification and Adapter Kits.** Hewlett-Packard offers several calibration kits suitable for calibrating an HP 8510/8514B or 8512A when making error corrected measurements. Each calibration kit noted below includes a set of precision standards to calibrate an HP 8510 system in the indicated interface. Additional information is located in the SYSTEM AND DOCUMENTATION OVERVIEW section of the HP 8510B System Manual and volume 1 of the HP 8510A manual set.

| Connector Type | Calibration Kit | Verification Kit | Adapter Kit |
|---|---|---|---|
| 3.5 mm<br>7 mm<br>Type-N 50Ω<br>3.5 to 7 mm | HP 85052B/E<br>HP 85050B/C/D<br>HP 85054B | HP 85053B<br>HP 85051B<br>HP 85055A | <br><br><br>HP 85130A/B[1] |

1 These adapters attach directly to the 3.5 mm test ports.

**RF Cables.** The HP 85131D 3.5 mm Test Port Return Cable Set is a pair of 21 inch long cables specified from DC to 26.5 GHz. Typically it is used with the HP 8514B. One of the cables has 3.5 mm (f) connectors, the other cable has one 3.5 mm (f) and one 3.5 mm(m) connector.

The HP 85132C 7 mm Test Port Return Cable is a single, 36 inch cable for measurements where the device is connected directly to one test port. It is typically used with the HP 8512A. The cable has two 7 mm connectors. Its frequency range is DC to 18 GHz.

**Transistor Test Fixture Kit.** The HP 85041A Transistor Test Fixture Kit (TTF) is a comprehensive measurement system for testing and characterizing stripline packaged microwave transistors. Although it has 7 mm connectors and a frequency range limited to 18 GHz, the TTF may be easily adapted for use with the HP 8514B. Please consult with your local HP Systems Engineer for specific recommendations.

## OPERATING AND SAFETY PRECAUTIONS

### Operating

Beware of electro-static damage (ESD). The input connectors (test ports or cables or adapters connected to the test ports) are very sensitive to ESD. Use a grounded wrist strap when attaching devices to the input connectors.

Otherwise, you need observe only normal precautions in handling and operating the test set. Do not exceed the front panel operating level power input as noted:

| Maximum Operating Power Level | Test Port |
|---|---|
| +10 dBm | HP 8514B Port 1 and 2 |
| +10 dBm | HP 8512A Port 1 |
| −10 dBm | HP 8512A Port 2 |

### 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 8514B and 8512A test sets is in the HP 8510 B Service Manual.

## ADDITIONAL EQUIPMENT REQUIRED

Table 2 lists additional equipment and accessories required for use with the HP 8514B and 8512A test sets. The table notes which items are required to verify the performance of the test sets and which are required to operate them. Other equipment may be substituted if its specifications meet or exceed the specifications listed in the critical specifications column.

# Specifications

The specifications of the HP 8514B and HP 8512A test sets with an HP 8510B network analyzer are defined in the SPECIFICATIONS section of the HP 8510B System Manual. Specifications for HP 8510A/8512A systems are also defined in GENERAL INFORMATION, volume 1 of the HP 8510A manual set.

## CHARACTERISTICS

The performance parameters listed in Table 1 are typical or nominal characteristics of the HP 8510B/8514B.

*Table 1. HP 8510B/8514B Characteristics*

**Test Ports (Front Panel)**

Connector type: precision 3.5 mm male
Impedance: 50 ohms nominal
DC bias: 500 mA, 40 VDC, maximum
Incident signal attenuation range: 0 to 90 dB in 10 dB steps
Damage input level: $>+20$ dBm CW RF[1]
Nominal operating power level:[2]

| Frequency | Operating Level |
|---|---|
| 0.045 to 8 GHz | +3 dBm |
| 8 to 20 GHz | 0 dBm |

**RF Input Connector (Rear Panel)**

Connector type: precision 3.5 mm female
Damage input level: $>+23$ dBm
Source power levels for reference channel phase lock:
Minimum: 0 dBm
Maximum: +14 dBm

1. Do not exceed +10 dBm input for proper operation.
2. Available power in PRESET condition.

The performance parameters listed in Table 1B are typical or nominal characteristics of the HP 8510B/8512A.

*Table 1B. HP 8510B/8512A Characteristics*

**Test Ports (Front Panel)**

Connector type: 7 mm
Impedance: 50 ohms nominal
Damage input level:[1]
Port 1: > +23 dBm Port 2: > +13 dBm
Nominal operating power level:

| Frequency | Nominal Operating |
|---|---|
| 0.045 to 8 GHz | +4 dBm |
| 8 to 18 GHz | +2 dBm |

**RF Input Connector (Rear Panel)**

Connector type: precision 3.5 mm female
Damage input level: +23 dBm
Source power levels for reference channel phase lock:
Minimum: −2 dBm
Maximum: +12 dBm

1. Do not exceed +10 dBm input to Port 1 or −10 dBm input to Port 2 for proper operation.

*Table 1C. HP 8514B and 8512A Power Requirements and Physical Characteristics*

**Operating Temperature:** 0°C to 55°C

**Power:** 110, 120, 220 or 240 ±10% Vac; 47 to 66 Hz line frequency

**Dimensions:** 460 mm × 133 mm × 609 mm (18.1 × 5.25 × 24 inches)

**Weight:** HP 8514B: 17 kg (38 lb) net
HP 8512A: 15 kg (33 lb) net

*Table 2. Recommended Equipment*

| Item | Critical Specifications | Recommended Model | Use[1] |
|---|---|---|---|
| Network analyzer | no substitute | HP 8510A/B | O, P, T |
| Source[2] | | | O, P, T |
| Controller[3] | no substitute | HP 9000 series 200 or 300 with 1 Mbyte memory | P |
| Disc drive[3] | compatible with controller | | P |
| Multimeter | range: 0 to 50V | HP 3456A | T |
| Oscilloscope | 50 MHz bandwidth | HP 1740A | T |

1. O = operation P = performance test T = troubleshooting
2. HP 8340 or 8341 or 8350 with plug-in. Refer to HP 8510 INSTALLATION manual for additional information.
3. Not required for manual performance tests with HP 8510A.