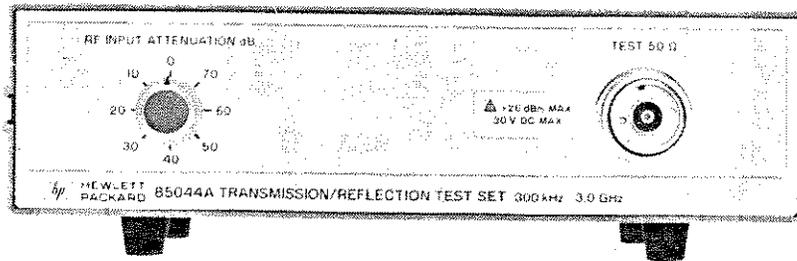


# OPERATING AND SERVICE MANUAL

## HP 85044A/B TRANSMISSION/ REFLECTION TEST SET



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

# TABLE OF CONTENTS

## Section 1 General Information

Introduction .....	1
Using the HP 85044A/B .....	1
Instruments Covered by Manual .....	1
Description and Operating Characteristics of the Instrument .....	2
Options .....	2
Accessories Supplied .....	2
Accessories Available .....	3
Calibration and Accessory Kits .....	3
Cable Sets .....	3
Operating and Safety Precautions Service .....	3
Recommended Test Equipment .....	4
Specifications .....	4

## Section 2 Installation

Introduction .....	1
Initial Inspection .....	1
Environmental Considerations .....	1
Operation and Storage .....	1
Preparation for Use .....	2
Positioning the Test Set .....	2
Connecting the Test Set .....	2
Mating Connectors .....	2
Power and Control Connections .....	2
Signal Path Connections .....	2
Bias Connection .....	2
Packaging .....	2

## Section 3 Operation

Introduction .....	1
Operator's Check .....	3
Equipment .....	4
Procedure .....	4

## Section 4 Performance Tests

Introduction .....	1
Performance Test Record .....	1
DIRECTIVITY .....	2
PORT MATCH .....	5
EFFECTIVE SOURCE MATCH .....	9

## Section 5 Adjustments

## Section 6 Replaceable Parts

Introduction .....	1
Exchange Assemblies Available .....	1
Replaceable Parts Lists .....	1

## Section 7 Manual Backdating Changes

Introduction .....	1
Application .....	1

## Section 8 Service

Introduction .....	1
Troubleshooting .....	1
Opening the Instrument Case .....	1
Servicing the Directional Bridge .....	1
RF Troubleshooting Procedure .....	2

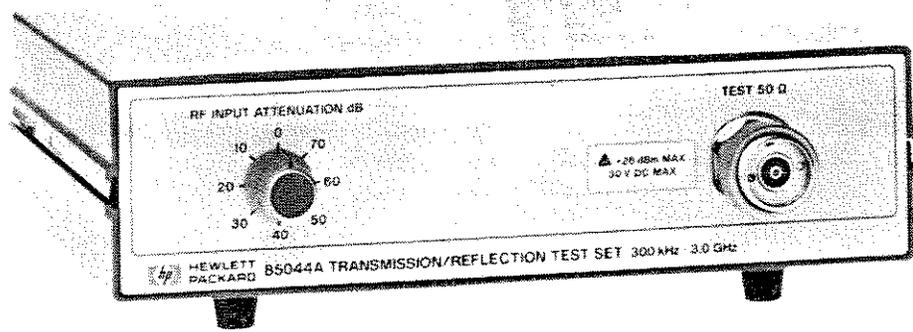


Figure 1-1. HP 85044A Transmission/Reflection Test Set

# Section 1. General Information

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## INTRODUCTION

The purpose of this manual is to enable you to use your HP 85044A or HP 85044B transmission/reflection test set efficiently and confidently. This manual contains both general and specific information. When information applies to both the HP 85044A and the HP 85044B, the name HP 85044A/B will be used. To use the HP 85044A/B to perform a specific function (without reading the entire manual), follow the directions in "Using the HP 85044A/B".

This section (1) outlines how to begin using the HP 85044A/B as quickly as possible, (2) describes what instruments are covered by this manual, (3) describes the test set itself, (4) mentions operating precautions, safety considerations and warranty restrictions, (5) lists the additional equipment required, and (6) defines and lists the instrument's specifications.

## USING THE HP 85044A/B

The HP 85044A/B has been designed to operate specifically with the HP 8753A network analyzer.

- To install the instrument, turn to Section 2, Installation.
- To check the proper operation of the HP 85044A/B, see the Operator's Check in Section 3, Operation.
- To verify that the instrument meets its published specifications, turn to Section 4, Performance Tests.
- To troubleshoot the HP 85044A/B, turn to Section 8, Service.

## INSTRUMENTS COVERED BY MANUAL

An identification label is affixed to the rear panel of the instrument. The instrument's serial number and options, if any, appear there. 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.

This manual is also available in microfiche form (the part number is 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 HP 85044A/B transmission/reflection test set has been designed to operate with the HP 8753A network analyzer. This test set provides a convenient means of simultaneously measuring the reflection and transmission characteristics of a 50 ohm or 75 ohm device in one direction. The frequency range of the HP 85044A is 300 kHz to 3 GHz. The frequency range of the HP 85044B is 300 kHz to 2 GHz. The test set includes a 0 to 70 dB step attenuator manually controllable in 10 dB steps, and the circuitry necessary for biasing active devices.

Table 1-1 lists the operating specifications and characteristics of the HP 85044A/B. The test set is illustrated on the cover of this manual and shown in a typical measurement setup in Figure 3-4.

### **OPTIONS**

#### **Option 910**

This option provides a duplicate test set manual.

#### **Option W03**

This option converts the standard one year warranty to a ninety day on-site warranty. The standard warranty appears on the inside front cover of this manual.

#### **Option W30**

This option adds two additional years of return-to-HP support to the standard one year warranty (for a total of three years).

### **ACCESSORIES SUPPLIED**

The HP 85044A includes a precision 7 mm to 50 $\Omega$  type-N (f) adapter.

The HP 85044B includes one HP 11852B 50 $\Omega$  to 75 $\Omega$  minimum loss pad.

## ACCESSORIES AVAILABLE

### Calibration and Accessory Kits

The calibration kits listed below contain the components required to characterize the systematic errors of measurement systems. The calibration kits also contain precision adapters.

The accessory kits listed contain the components generally required to measure devices with the types of connectors indicated. Additional information is included in the HP 8753A manual.

Connector Type	Calibration Kit	Accessory Kit
7 mm Type-N 50 $\Omega$ 3.5 mm (SMA) Type-N 75 $\Omega$ BNC 50 $\Omega$	HP 85031B HP 85032B HP 85033C HP 85036B HP 11854A*	HP 11853A* HP 85033A
*use with the HP 85032B type-N calibration kit		

### Cable Sets

Use the three phase-matched cables of the HP 11851B RF cable set to connect the test set to the HP 8753A. Use the fourth cable of the HP 11851B cable set to extend the test port of the HP 85044A/B. Additional information is included in the HP 8753A manual.

## OPERATING AND SAFETY PRECAUTIONS

### CAUTION

Electrostatic discharge (ESD) can damage the sensitive microcircuits in the HP 85044A/B test sets. ESD damage is most likely to occur as the bridges are connected or disconnected. Protect the test sets by wearing a grounding strap that provides a path to ground of no less than 1 Megohm and no more than 2.5 Megohms. Alternatively, ground yourself by touching the outer shell of any grounded instrument chassis before touching the test set connectors.

Never touch the center contacts of the connectors.

Use a work station equipped with an anti-static surface.

You need observe only normal precautions in handling and operating the HP 85044A/B. Do not exceed its operating level input of +26 dBm or 30 Vdc.

### Service

The voltages in this test set do not warrant more than normal caution for operator safety. Nevertheless, service should be performed only by qualified personnel.

## RECOMMENDED TEST EQUIPMENT

Table 1-2 lists equipment and accessories required for operating, testing and repairing the HP 85044A/B. The table notes 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.

## SPECIFICATIONS

### Definitions

The specifications listed in Table 1-1 range from those guaranteed by Hewlett-Packard to those typical of most HP 85044A/B instruments but not guaranteed. Codes in the far right column reference a specification definition listed below. These definitions are intended to clarify the extent to which Hewlett-Packard supports the specified performance of the HP 85044A/B.

**S-1:** This performance parameter is field verifiable using performance tests documented in the service manual.

**T:** Typical but non-warranted performance characteristics intended to provide information useful in applying the instrument. Typical characteristics are representative of most instruments, though not necessarily tested in each unit. Not field tested.

Table 1-1. HP 85044A/B Specifications

Parameter	HP 85044A	HP 85044B	Code
Frequency Range	300 kHz to 3 GHz	300 kHz to 2 GHz	S-1
Directivity <sup>1</sup> : TEST Port	≥ 35 dB to 1.3 GHz ≥ 30 dB to 3 GHz	≥ 35 dB to 1.3 GHz ≥ 30 dB to 2 GHz	S-1 S-1
Port Match <sup>1</sup> : INCIDENT and REFLECTED	≥ 18 dB to 1.3 GHz ≥ 13 dB to 3 GHz	≥ 18 dB to 1.3 GHz ≥ 13 dB to 2 GHz	S-1
RF INPUT	≥ 17 dB to 1.3 GHz ≥ 12 dB to 3 GHz	≥ 17 dB to 1.3 GHz ≥ 12 dB to 2 GHz	
Effective Source Match <sup>1</sup> : TEST Port	≥ 14 dB 300 kHz to 2 MHz ≥ 20 dB 2 MHz to 1.3 GHz ≥ 16 dB 1.3 GHz to 3 GHz	≥ 14 dB 300 kHz to 2 MHz ≥ 17 dB 2 MHz to 1.3 GHz ≥ 16 dB 1.3 GHz to 2 GHz	S-1
Typical Transmission Tracking <sup>1</sup> : Magnitude Phase <sup>3</sup>	± 1.5 dB <sup>2</sup> 300 kHz to 3.0 GHz ± 10 deg 300 kHz to 3.0 GHz	± 1.5 dB <sup>2</sup> 300 kHz to 2.0 GHz ± 10 deg 300 kHz to 2.0 GHz	T
Typical Reflection Tracking <sup>1</sup> : Magnitude Phase <sup>3</sup>	± 1.5 dB <sup>2</sup> 300 kHz to 3.0 GHz ± 25 deg 300 kHz to 2.0 MHz ± 10 deg 2.0 MHz to 3.0 GHz	± 1.5 dB <sup>2</sup> 300 kHz to 2.0 GHz ± 25 deg 300 kHz to 2.0 MHz ± 10 deg 2.0 MHz to 2.0 GHz	T

Table 1-1. HP 85044A/B Specifications

Parameter	HP 85044A	HP 85044B	Code
Nominal Insertion Loss:			
RF INPUT to TEST Port	12.5 dB +.5 dB/GHz	18 dB +.5 dB/GHz	
RF INPUT to INCIDENT	18 dB +1.5 dB/GHz	18 dB +1 dB/GHz	
RF INPUT to REFLECTION	19 dB +1.5 dB/GHz	30 dB +1.5 dB/GHz	
Impedance:			
TEST Port	50Ω	75Ω	nominal
RF INPUT, INCIDENT, REFLECTED	50Ω	50Ω	nominal
Connectors:			
TEST Port	7 mm	75Ω type-N (f)	
RF INPUT, INCIDENT, REFLECTED	50Ω type-N (f)	50Ω type-N (f)	
DC bias inputs:	BNC (f)	BNC (f)	
DC bias input range:	+30 Vdc, +200 mA (fused at 750 mA)(some degradation of RF specifications, 300kHz to 100 MHz)		
Damage level:	1 watt (+30 dBm) CW RF input		
Dimensions:	19 cm x 15 cm x 5 cm (7.5 x 6.0 x 2.0 inches)		
Weight:	1.7 kg (3.7 lb) net; 3.1 kg (7 lb) shipping		
<sup>1</sup> can be greatly improved with HP 8753A accuracy enhancement techniques <sup>2</sup> deviation from mean value <sup>3</sup> deviation from linear phase			

Table 1-2. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
Network analyzer	no substitute	HP 8753A	O, P, T
Multimeter	range: DC to 50V	HP 3456A	T
Cable set	50Ω type-N, three 24 inch phase-matched, one 34 inch	HP 11851B	P
*O=operation; P=performance test; T=troubleshooting			

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## Section 2. Installation

### INTRODUCTION

This section explains how to install the HP 85044A/B test set for use with the HP 8753A network analyzer. The topics covered include initial inspection, environmental considerations, positioning and connecting the test set for use, and packaging the instrument.

### 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 contents are listed in Table 2-1.

In addition, check the test set mechanically and electrically. If the test set and shipping container are undamaged, performing the Directivity performance test in Section 4 should suffice for incoming inspection. If the test set does not pass the performance test, refer to the troubleshooting procedures in Section 8.

If the shipping container is damaged, perform all four electrical performance tests in Section 4. If the test set fails the electrical tests, or is damaged, defective, or incomplete, 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.

Table 2-1. Components of HP 85044A/B Test Set.

	HP 85044A	HP 85044B
Operating and Service Manual	85044-90001	85044-90001
Accessory	85054-60001 adapter	HP 11852B minimum loss pad

### ENVIRONMENTAL CONSIDERATIONS

#### Operation and Storage

For best performance, the HP 85044A/B should be operated in temperatures between 0°C and +55°C, with relative humidity between 5% and 95% at +40°C (noncondensing). It may be operated at altitudes up to 4,500 metres (15,000 feet).

The HP 85044A/B may be stored in temperatures from -40°C to +75°C, with relative humidity up to 90% at +65°C (noncondensing), and at altitudes up to 15,240 metres (50,000 feet).

## PREPARATION FOR USE

### Positioning the Test Set

Typically the HP 85044A/B is placed in front of or next to the HP 8753A. Use an anti-static work surface to lessen the chance of ESD damage.

If the HP 8753A is rack-mounted in the HP 85043B rack, place the test set on the built-in work surface.

### Connecting the Test Set

**Mating Connectors:** The TEST port of the HP 85044A is a precision 7 mm connector and mates with precision 7 mm connectors. The TEST port of the HP 85044B is a precision 75 $\Omega$  type-N female connector and mates with precision 75 $\Omega$  type-N male connectors. Do not mate type-N 50 $\Omega$  connectors to type-N 75 $\Omega$  connectors or damage may result.

The RF INPUT, INCIDENT and REFLECTED ports of the HP 85044A/B are precision 50 $\Omega$  type-N female connectors which mate with the corresponding precision type-N male connectors whose dimensions conform to US specification MIL-C-39012.

The BIAS INPUT connector is a 50 $\Omega$  BNC female connector and mates with the corresponding male connectors (UG-88/U).

**Power and Control Connections:** Power is not required for the HP 85044A/B. Nor do the HP 85044A/B and 8753A need to communicate with each other as the only variable component in the test set is the manual attenuator.

**Signal Path Connections:** Place the test set near the network analyzer and connect its RF INPUT port to the network analyzer's RF OUT port, INCIDENT to R, and REFLECTED to B. Use the cables of the HP 11851B RF cable set.

**Bias Connection:** This connector supplies a bias voltage to the center conductor of the TEST port.

## PACKAGING

If it is necessary to reship the test set, repackage it in the original factory package. Containers and materials identical to those used by the factory are available through Hewlett-Packard offices.

Alternatively, use comparable packaging materials. 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 this manual). Use sufficient shock absorbing material on all sides of the HP 85044A/B to provide a thick, firm cushion and prevent movement. Seal the shipping container securely and mark it **FRAGILE**.

In any correspondence with Hewlett-Packard, refer to the HP 85044A/B by model number and full serial number.

## Section 3. Operation

### INTRODUCTION

This section illustrates the features and functions of the front and rear panels of the test set (Figures 3-1 and 3-2). Figure 3-3 shows the case bottom (which depicts the RF signal path through the test set). Figure 3-4 shows a typical test set measurement setup.

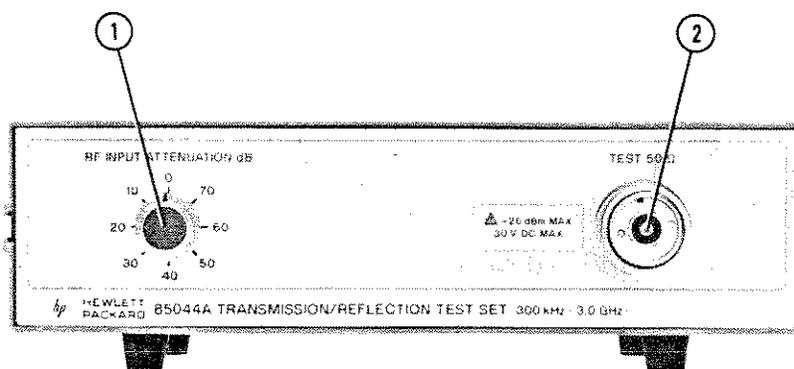


Figure 3-1. Front Panel Features.

1. **RF INPUT ATTENUATION dB.** This knob controls the attenuation in the test signal path in 10 dB steps.
2. **TEST.** The device under test is connected here. This connector provides the output signal to the DUT and receives the reflected signal from the DUT. The HP 85044A TEST connector is a 50Ω 7 mm connector. The HP 85044B TEST connector is a 75Ω type-N connector.



Do not input more than +26 dBm (1/2 watt) or 30 Vdc to the TEST connector.

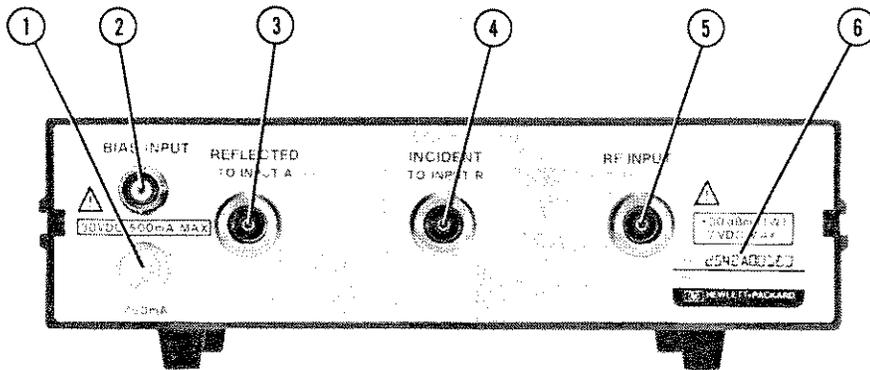


Figure 3-2. Rear Panel Features.

1. **BIAS INPUT FUSE.** This 0.75 amp 125V fuse protects the TEST port bias line.
2. **BIAS INPUT.** This connector biases devices connected to the TEST port when it is connected to an appropriate source.
3. **REFLECTED TO INPUT A.** This connector returns the reflected signal from the device under test to input A of the HP 8753A.
4. **INCIDENT TO INPUT R.** This connector routes a portion of the incident signal from the HP 8753A source to input R of the network analyzer. This signal is necessary for proper phase-locked operation of the HP 8753A and is used as the reference signal in ratio measurements.
5. **RF INPUT.** This connector receives the RF signal from the HP 8753A RFOUT and splits it between the TEST and INCIDENT ports.
6. **IDENTIFICATION LABEL.** This label identifies the test set with a serial number. The first four digits and single letter are the serial prefix. The last five numbers are the test set's unique number. Options, if any, are noted below the serial number.

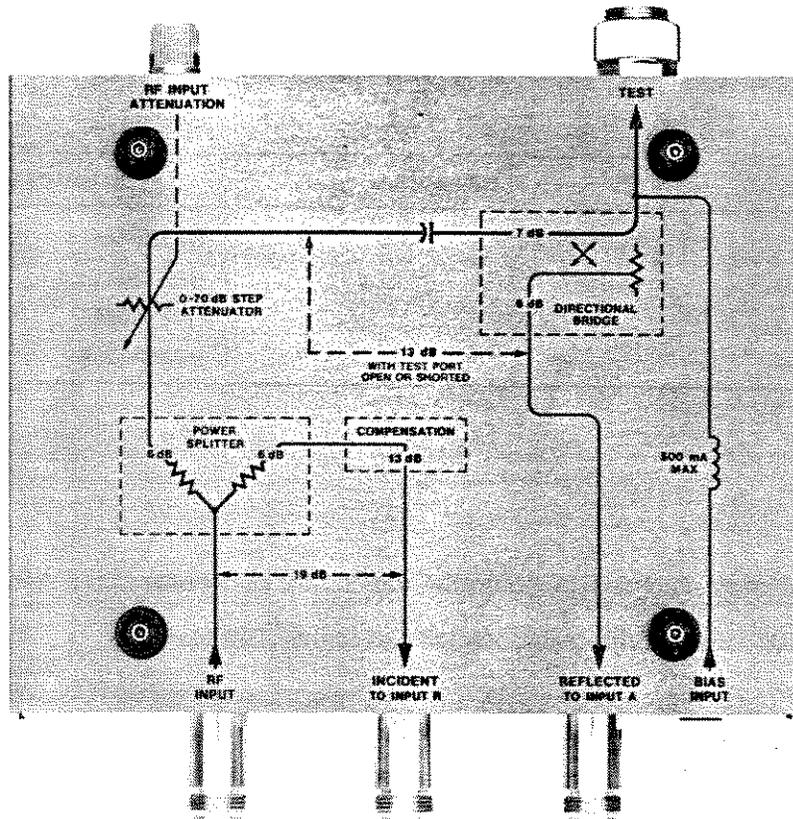


Figure 3-3. HP 85044A Case Bottom Showing RF Signal Path.

### OPERATOR'S CHECK

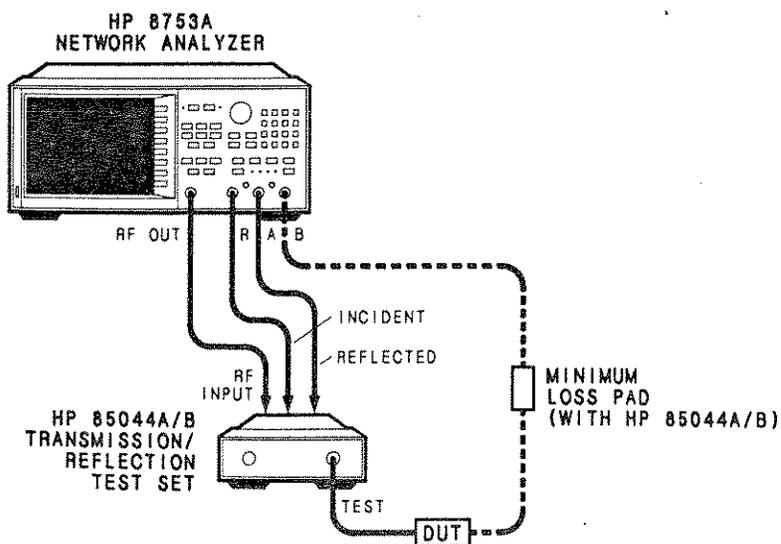


Figure 3-4. Typical Measurement Setup.

## EQUIPMENT

	HP 85044A	HP 85044B
Network analyzer	HP 8753A	HP 8753A
RF cable set	HP 11851B	HP 11851B
Calibration kit	HP 85031B	HP 85036B
Minimum loss pad		HP 11852B

## PROCEDURE

1. Connect the equipment as shown in Figure 3-4 but do not connect the DUT.
2. In place of the DUT, connect the calibration kit load to the TEST port.
3. Turn on the HP 8753A and press **[PRESET]**. If the test set is an HP 85044B, press **[STOP] [2] [G/n]** on the network analyzer to limit the frequency to 2 GHz.
4. Press **[SCALE REF] [REFERENCE POSITION] [9] [x1]** to position the reference line one division from the top.
5. Press **[MKR FCTN] [MKR SEARCH] [MAX]** to set the HP 8753A to identify the point of minimum directivity. It should be greater than about 30 dB.
6. Remove the load from the TEST port of the test set.
7. Rotate the attenuator knob counterclockwise one detent to increase the attenuation by 10 dB. The trace should drop 10 dB (1 division). Rotate the attenuator knob six more times. The trace should drop 10 dB each time.
8. This concludes the Operator's Check. In case of difficulty, refer to Section 8, Service.

## Section 4. Performance Tests

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### INTRODUCTION

The procedures in this section test the directivity, port match and effective source match of the HP 85044A/B test set using the specifications of Table 1-1 as the performance standards. Each test procedure lists the equipment required to test the HP 85044A and HP 85044B. You can substitute other equipment if the substitute equipment meets or exceeds the critical specifications of Table 1-2. All of the tests can be performed without access to the interior of the instrument.

### PERFORMANCE TEST RECORD

Tabulate the results of the performance tests in Table 4-1. The Performance Test Record provides space to list all of the tested specifications and their acceptable limits. Test results recorded during incoming inspection can be used for comparison with test results obtained after periodic maintenance, troubleshooting or repair.

# DIRECTIVITY

## SPECIFICATION

The directivity of the HP 85044A and 85044B from 300 kHz to 1.3 GHz is equal to or greater than 35 dB. The directivity of the HP 85044A from 1.3 GHz to 3 GHz is 30 dB. The directivity of the HP 85044B from 1.3 GHz to 2 GHz is 30 dB.

## DESCRIPTION

Directivity is a measure of the ability of a directive device (in this case the HP 85044A/B) to discriminate between incident and reflected signals. In this procedure directivity is tested by using the internal bridge to measure the reflection coefficient of a standard termination. Since the return loss of the termination is much greater than the directivity of the test set, the measurement made in this procedure is essentially the directivity of the HP 85044A/B. Use the highest quality termination available as that factor determines the accuracy of the procedure.

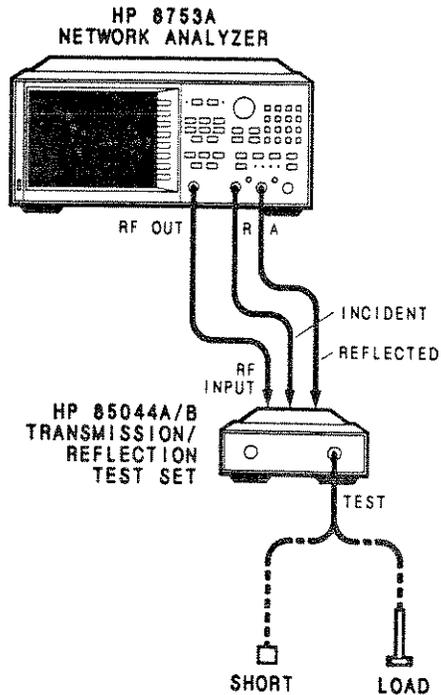


Figure 4-1. Directivity Test Setup.

## EQUIPMENT

	HP 85044A	HP 85044B
Network analyzer	HP 8753A	HP 8753A
RF cable set	HP 11851B	HP 11851B
Calibration kit	HP 85031B	HP 85036B

## PROCEDURE

**NOTE:** By convention, when the connector sex is indicated in parentheses for a calibration standard, it refers to the sex of the test port connector (not the actual standard). For example, short (f) indicates that the test port connector, not the short circuit connector, is female.

1. Connect the equipment as shown in Figure 4-1 and turn on the HP 8753A. Allow 30 minutes for warm-up.
2. On the HP 8753A press **[PRESET] [STOP] [1] [.] [3] [G/n]** to set the stop frequency to 1.3 GHz.
3. If the test set is an HP 85044B, press **[CAL] [CAL KIT] [N 75Ω]** to select the calibration kit and to set the system impedance to 75Ω.
4. Press **[CAL] [CALIBRATE MENU] [RESPONSE]** to enter the response calibration menu.

**NOTE:** The calibration standards must be correctly aligned and properly seated in the following steps. Mediocre connections will result in poor directivity measurements. Refer to the Microwave Connector Care manual for additional information.

5. Connect the short supplied with the calibration kit to the test set's TEST port when prompted.
6. On the HP 8753A press **[SHORT]** for the network analyzer to measure the calibration standard. If the test set is an HP 85044B, press **[SHORT (F)]**.
7. Press **[DONE: RESPONSE]** after the short has been measured. The status indicator "Cor" should appear at the left side of the display.
8. Connect the load supplied with the calibration kit to the HP 85044A/B TEST port.
9. On the HP 8753A press **[MKR FCTN] [MKR SEARCH] [MAX]** to identify the point of minimum directivity (the trace maximum). Enter on the Performance Test Record the marker value visible in the upper right corner of the display.

10. Press **[START] [1] [.] [3] [G/n] [STOP] [3]** (2 for the HP 85044B) **[G/n]** to reset the frequency range.
11. Repeat steps 4 through 9 to determine the performance for the second frequency range.
12. If the test set fails the directivity specification of Table 1-1 by 1 dB or less, perform a S11 1-port calibration. Set the HP 8753A to generate in CW mode the frequency of worst directivity. Connect a short and press **[DISP] [DATA→MEM] [DATA/MEM]**. Then connect an open and record the marker reading. Finally connect the load and record the marker reading.

The actual directivity of the test set is expressed in this formula:

$$(\text{open marker reading})/2 + \text{load marker reading} = \text{directivity.}$$

Calculate the directivity. If the test set still fails the directivity specifications of Table 1-1, refer to the Service section of this manual.

13. If the test set fails the directivity specifications of Table 1-1 by more than 1 dB, refer to the Service section of this manual.

# PORT MATCH

## SPECIFICATION

The port match of the INCIDENT and REFLECTED ports of the HP 85044A/B from 300 kHz to 1.3 GHz is 18 dB; from 1.3 GHz to 3 GHz (2 GHz for the 85044B), 13 dB.

The port match of the RF INPUT port of the HP 85044A/B from 300 kHz to 1.3 GHz is 17 dB; from 1.3 GHz to 3 GHz (2 GHz for the 85044B), 12 dB.

## DESCRIPTION

This procedure uses one HP 85044A to measure the port match of the RF INPUT, INCIDENT and REFLECTED ports of the HP 85044A/B under test.

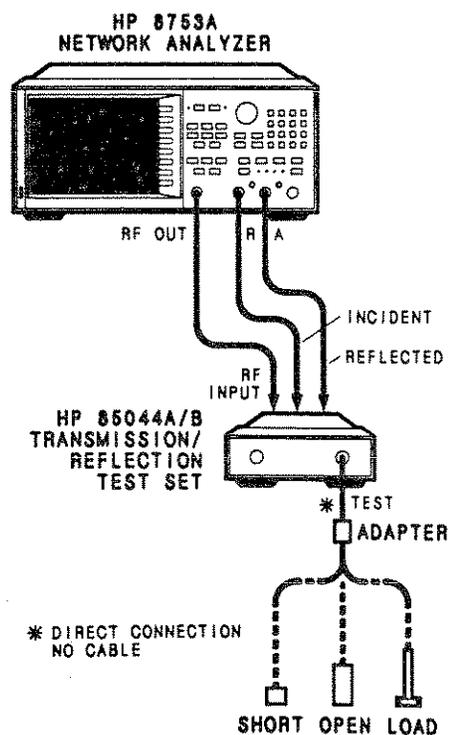


Figure 4-2. HP 85044A Calibration Setup.

## EQUIPMENT

	HP 85044A	HP 85044B
Network analyzer	HP 8753A	HP 8753A
Test set	HP 85044A	HP 85044A
RF cable set	HP 11851B	HP 11851B
Calibration kit	HP 85032B	HP 85032B
7 mm/type-N (m) adapter	p/o HP 85032B	p/o HP 85032B
Additional loads (2)	HP Part No. 85032-60004	HP Part No. 85032-60004

## PROCEDURE

1. Connect the HP85044A test equipment to the HP 8753A and connect the 7 mm/type-N (m) adapter as shown in Figure 4-2. Turn on the analyzer and press **[PRESET]**.
2. On the HP 8753A press **[MENU] [POWER] [1] [0] [x1]** to set the RF power output level to +10 dBm. Then press **[AVG] [IF BW] [1] [0] [0] [x1]** to set the IF bandwidth to 100 Hz.
3. Press **[STOP] [1] [.] [3] [G/n]** to limit the network analyzer to the first frequency range of interest.
4. Press **[CAL] [CAL KIT] [N 50Ω] [RETURN] [CALIBRATE MENU] [S11 1-PORT]** to enter the type-N S11 1-port calibration menu. Perform the following steps.

Connect an open to the adapter on the HP 85044A and press **[OPENS] [OPEN (M)] [DONE OPENS]**.

Connect a short to the adapter on the HP 85044A and press **[SHORTS] [SHORT (M)] [DONE SHORTS]**.

Connect a load to the adapter on the HP 85044A and press **[LOAD]**.

Press **[DONE 1-PORT CAL]** to conclude the calibration routine. The display should show "Cor" in the status indicator area.

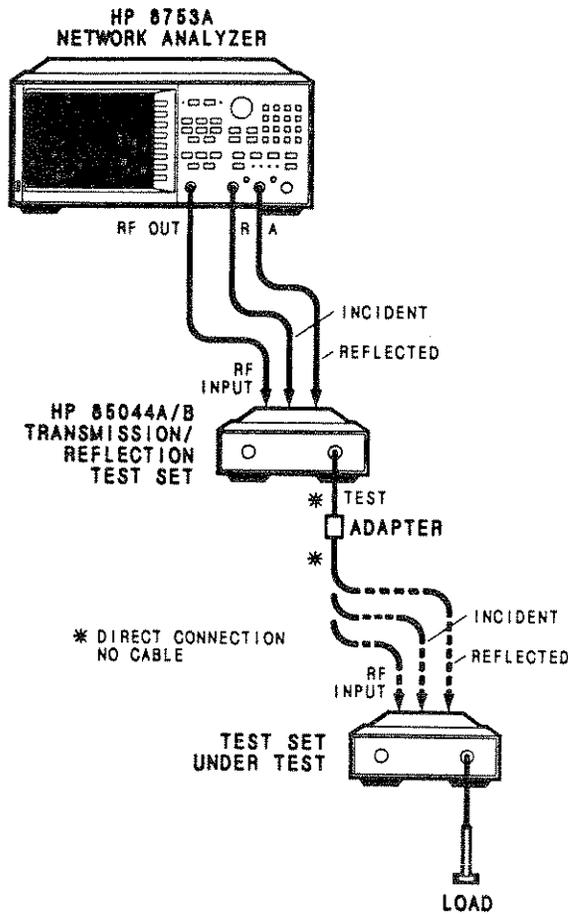


Figure 4-3. Port Match Test Setup.

5. Connect a  $50\Omega$  load on the RF INPUT and REFLECTED ports of the HP 85044A/B under test as shown in Figure 4-3. In addition, to test the port match of the
  - HP 85044A: connect a 7 mm  $50\Omega$  load to the TEST port.
  - HP 85044B: connect a type-N  $75\Omega$  load to the TEST port.
6. Connect the HP 85044A (through the adapter) to the HP 85044A/B INCIDENT port of the HP 85044A/B under test. Then press [MENU] [TRIGGER MENU] [SINGLE] on the HP 8753A to generate a single sweep.
7. Press [MKR FCTN] [MKR SEARCH] [MAX] to identify the point of minimum port match return loss (the trace maximum). Enter the value on the Performance Test Record.
8. To measure the port match return loss of the REFLECTED port, connect the HP 85044A to the REFLECTED port of the HP 85044A/B under test and connect a load to each of the other three ports.
9. Press [MENU] [TRIGGER MENU] [SINGLE] [MKR FCTN] [MKR SEARCH] [MAX] to generate another sweep and identify the point of minimum port match return loss (the trace maximum). Enter the value on the Performance Test Record.

10. To measure the port match return loss of the RF INPUT port, connect the HP 85044A to the RF INPUT port of the HP 85044A/B under test and connect a load to each of the other three ports.
11. Press [MENU] [TRIGGER MENU] [SINGLE] [MKR FCTN] [MKR SEARCH] [MAX] to generate another sweep and identify the point of minimum port match return loss (the trace maximum). Enter the value on the Performance Test Record.
12. Press [START] [1] [.] [3] [G/n] [STOP] [3] (2 for the HP 85044B) [G/n] to reset the frequency range.
13. Perform steps 4 through 13 to determine the performance of the test set for the second frequency range.
14. If the results of this test are not within specification, refer to the Service section of this manual.

# EFFECTIVE SOURCE MATCH

## SPECIFICATION

The effective source match of the HP 85044A/B from 300 kHz to 2 MHz is 15 dB. The effective source match of the HP 85044A is 20 dB from 2 MHz to 1.3 GHz and 16 dB from 1.3 GHz to 3 GHz. The effective source match of the HP 85044B is 17 dB from 2 MHz to 1.3 GHz and 16 dB from 1.3 GHz to 2 GHz.

## DESCRIPTION

This procedure determines the effective source match of port 1 and port 2 by examining the calibration coefficient arrays. These arrays are generated during measurement calibration. The arrays are the difference between the measured known calibration standards and ideal modeled data. Thus the calibration coefficient arrays are a direct indication of performance because they represent the systematic errors of the test set.

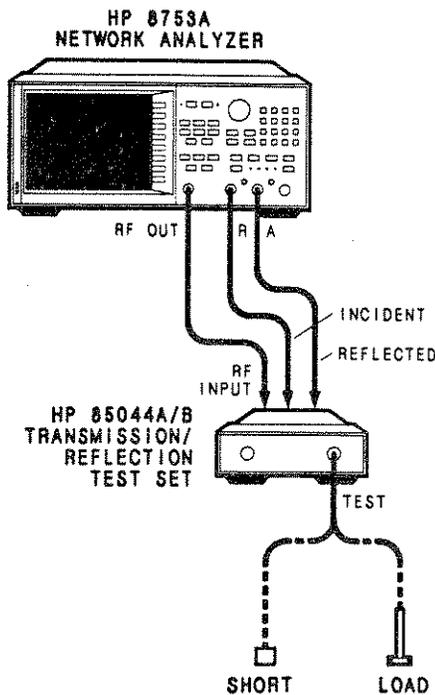


Figure 4-4. Source Match Test Setup.

## EQUIPMENT

	HP 85044A	HP 85044B
Network analyzer	HP 8753A	HP 8753A
RF cable set	HP 11851B	HP 11851B
Calibration kit	HP 85031B	HP 85036B

## PROCEDURE

1. Connect the test set to the network analyzer as shown in Figure 4-4, turn on the HP 8753A and press **[PRESET]**. Allow 30 minutes for warm-up.
2. On the HP 8753A press **[MENU] [POWER] [1] [0] [x1]** to set the network analyzer output power to +10 dBm. Then press **[AVG] [IF BW] [1] [0] [0] [x1]** to reduce the IF bandwidth to 100 Hz.
3. If the test set is an HP 85044B, press **[CAL] [CAL KIT] [N75Ω]** to set the system impedance to 75Ω. Then press **[STOP] [2] [M/u]** to limit the frequency range to 2 MHz.
4. Press **[CAL] [CALIBRATE MENU] [S11 1-PORT]** to enter the S11 1-port calibration menu. Connect, in turn, the three calibration standards (open, short and load) to the TEST port and press the softkeys as prompted. Then press **[DONE 1-PORT CAL]** to complete the calibration.
5. Press **[SYSTEM] [SERVICE MENU] [TESTS] [3] [3] [x1]** to select the calibration coefficient dumping routine. When the screen indicates "Cal Coef 2", press **[EXECUTE TEST]** to display the calibration coefficients.
6. Press **[MKR FCTN] [MKR SEARCH] [MAX]** to position the marker at the high point of the trace, the point of minimum source match return loss. Enter this value on the Performance Test Record.
7. Press **[START] [2] [M/u] [STOP] [1] [.] [3] [G/n]** to select the next frequency range of interest. Repeat steps 4 through 6.
8. Press **[START] [1] [.] [3] [G/n] [STOP] [3]** (2 for the HP 85044B) **[G/n]** to select the last frequency range of interest. Repeat steps 4 through 6.
9. If the test set does not meet its specifications, refer to Section 8, Service.

Table 4-1. HP 85044A Performance Test Record (1 of 2).

<p><b>HP 85044A</b></p> <p>Date _____ Tested By _____</p> <p>Temperature _____ Humidity _____</p>		
Parameter	Specification	Test Result
<p><b>Directivity</b></p> <p>TEST Port</p> <p>300 kHz to 1.3 GHz</p> <p>1.3 GHz to 3 GHz</p>	<p><math>\geq 35</math> dB</p> <p><math>\geq 30</math> dB</p>	<p>_____</p> <p>_____</p>
<p><b>Port Match</b></p> <p>INCIDENT</p> <p>300 kHz to 1.3 GHz</p> <p>1.3 GHz to 3 GHz</p> <p>REFLECTED</p> <p>300 kHz to 1.3 GHz</p> <p>1.3 GHz to 3 GHz</p> <p>RF INPUT</p> <p>300 kHz to 1.3 GHz</p> <p>1.3 GHz to 3 GHz</p>	<p><math>\geq 18</math> dB</p> <p><math>\geq 13</math> dB</p> <p><math>\geq 18</math> dB</p> <p><math>\geq 13</math> dB</p> <p><math>\geq 17</math> dB</p> <p><math>\geq 12</math> dB</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>
<p><b>Effective Source Match</b></p> <p>TEST Port</p> <p>300 kHz to 2 MHz</p> <p>2 MHz to 1.3 GHz</p> <p>1.3 GHz to 3 GHz</p>	<p><math>\geq 14</math> dB</p> <p><math>\geq 20</math> dB</p> <p><math>\geq 16</math> dB</p>	<p>_____</p> <p>_____</p> <p>_____</p>

Table 4-1. HP85044B Performance Test Record (2 of 2).

<b>HP 85044B</b> Date _____ Tested By _____ Temperature _____ Humidity _____		
Parameter	Specification	Test Result
<b>Directivity</b> TEST Port 300 kHz to 1.3 GHz 1.3 GHz to 2 GHz	$\geq 35$ dB $\geq 30$ dB	_____ _____
<b>Port Match</b> INCIDENT 300 kHz to 1.3 GHz 1.3 GHz to 2 GHz REFLECTED 300 kHz to 1.3 GHz 1.3 GHz to 2 GHz RF INPUT 300 kHz to 1.3 GHz 1.3 GHz to 2 GHz	$\geq 18$ dB $\geq 13$ dB $\geq 18$ dB $\geq 13$ dB $\geq 17$ dB $\geq 12$ dB	_____ _____ _____ _____ _____ _____
<b>Effective Source Match</b> TEST Port 300 kHz to 2 MHz 2 MHz to 1.3 GHz 1.3 GHz to 2 GHz	$\geq 14$ dB $\geq 17$ dB $\geq 16$ dB	_____ _____ _____

## Section 5. Adjustments

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The HP 85044A and 85044B transmission/reflection test sets have no adjustable components.

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## Section 6. Replaceable Parts

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### INTRODUCTION

This section contains information for ordering parts. Figure 6-1 identifies the cables and major assemblies of the instrument. Figure 6-2 identifies the miscellaneous parts, mostly attaching hardware, of the test set. Table 6-1 is a list of manufacturers arranged by code number.

### EXCHANGE ASSEMBLIES AVAILABLE

The power splitter/directional bridge assembly, A1 (see Figure 6-1) is not field-repairable. It is replaceable on a restored exchange basis at a considerable cost saving. The assembly includes the RF and DC bias connectors. Defective assemblies must be returned for credit to realize the cost savings. Thus, assemblies required for spare parts stock must be ordered by the new assembly part number which is included in the replaceable parts list in this section of the manual.

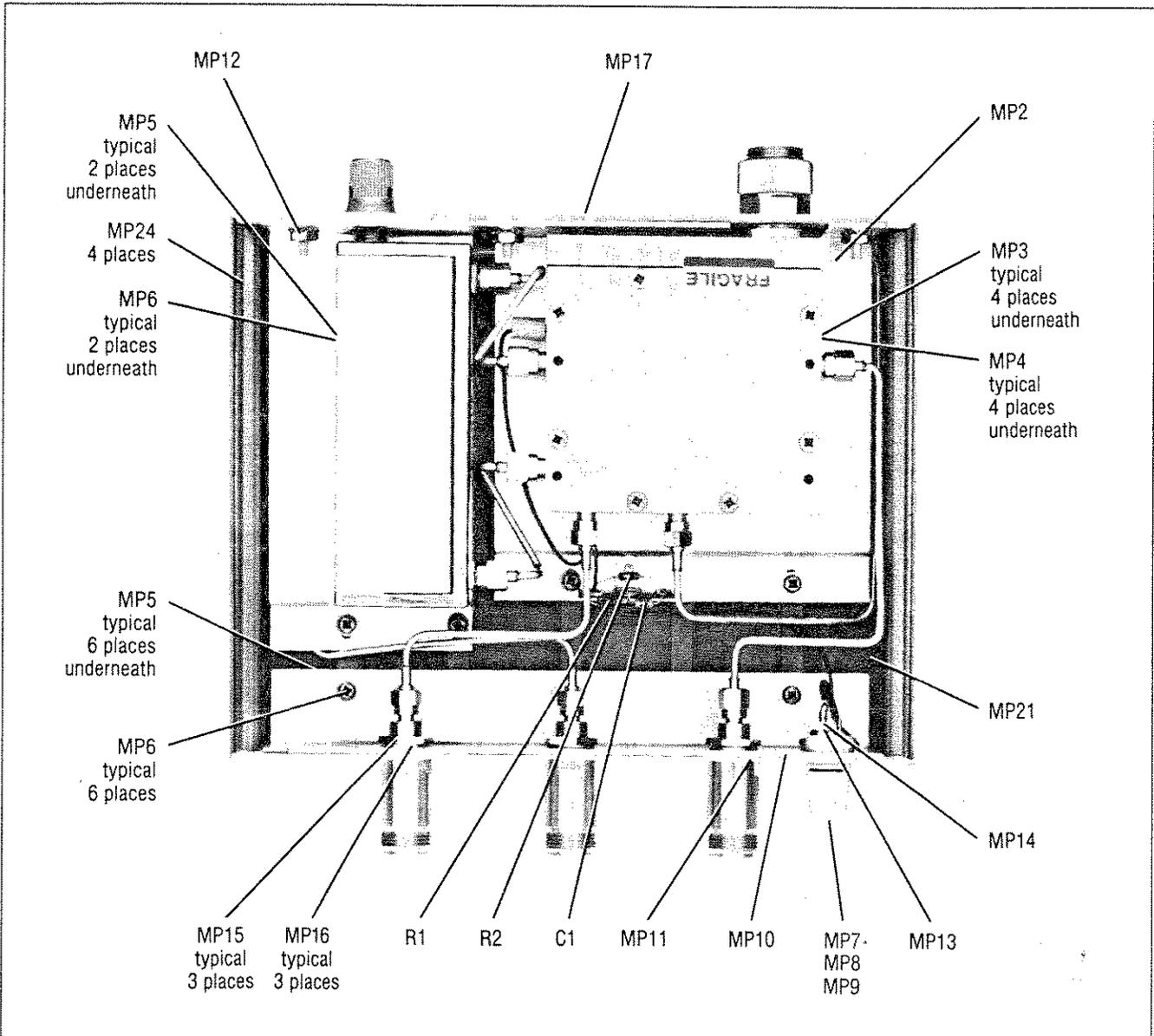
HP part number 5086-6446 is the factory restored (repaired and tested) exchange assembly for the HP 85044A power splitter/directional bridge.

HP part number 5086-6448 is the factory restored (repaired and tested) exchange assembly for the HP 85044B power splitter/directional bridge.

A two-year warranty applies to both the original power splitter/directional bridges and to replacements. The two-year warranty applies equally to replacements purchased new or restored through the support life of the instrument.

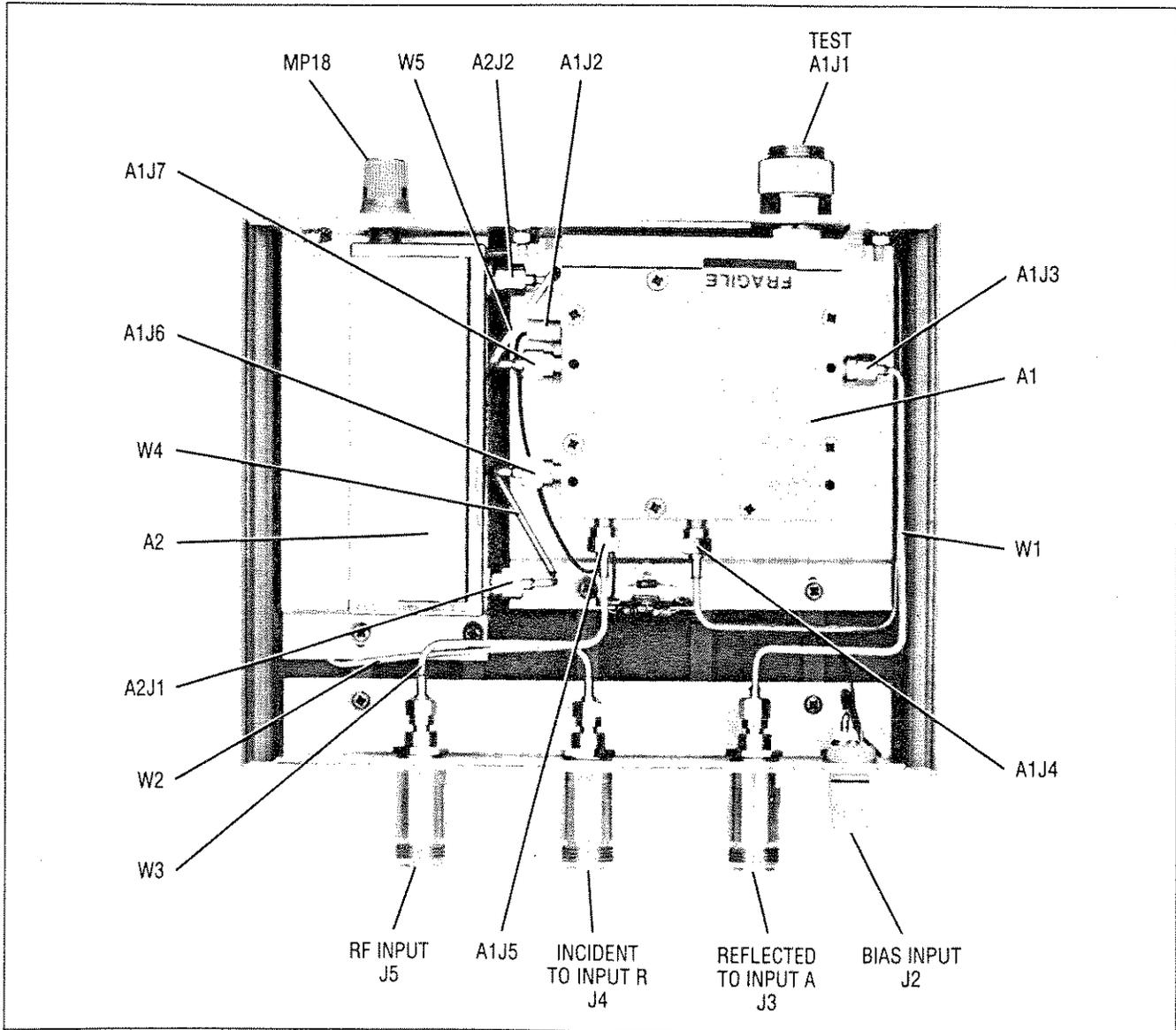
### REPLACEABLE PARTS LISTS

Accompanying each replaceable parts illustration is a replaceable parts list. Each list is arranged in alpha-numerical order by reference designator. The reference designator keys the part listed to the illustration. The first part number listed is HP's part number and may differ from the manufacturer's part number. The check digit serves as an error check of the part number and should be used when ordering a part. Quantity refers to the number of the part in the accompanying illustration. The description is a brief written description of the part and may be used for ordering purposes. Manufacturer's code is a five digit number assigned to each manufacturer (identified in Table 6-1). The manufacturer part number may or may not be the same as the HP part number.



RD	Part #	CD	Q	Description	Mfr #	Mfr p/n
A1	5086-7446	9	1	50 OHM BRIDGE-SPLITTER (HP 85044A)	28480	5086-7446
A1J1	5086-7448	1	1	75 OHM BRIDGE-SPLITTER (HP 85044B)	28480	5086-7448
A1J2	P/O A1			7 MM CONNECTOR (HP 85044A)		
A1J3	P/O A1			BIAS FEEDTHRU CONNECTOR		
A1J4	P/O A1			TYPE-N 75 OHM (F) CONNECTOR (HP 85044B)		
A1J5	P/O A1			SMB CONNECTOR		
A1J6	P/O A1			SMB CONNECTOR		
A1J7	P/O A1			SMB CONNECTOR		
A2	85044-60001	3	1	ATTENUATOR ASSEMBLY	28480	85044-60001
A2J1	P/O A2			SMB CONNECTOR		
A2J2	P/O A2			SMB CONNECTOR		
J2	1250-0083	1	1	BNC (F) CONNECTOR	28480	1250-0083
J3	5061-5386	0	1	TYPE-N 50 OHM (F) CONNECTOR	28480	5061-5386
J4	5061-5386	0	1	TYPE-N 50 OHM (F) CONNECTOR	28480	5061-5386
J5	5061-5386	0	1	TYPE-N 50 OHM (F) CONNECTOR	28480	5061-5386
MP18	0370-2874	5	1	KNOB POINTER	28480	0370-2874
W1	08502-20005	6	1	INPUT A-BRIDGE CABLE	28480	08502-20005
W2	08502-20004	5	1	INPUT R CABLE	28480	08502-20004
W3	08502-20003	4	1	RF INPUT CABLE	28480	08502-20003
W4	08502-20011	4	1	ATTENUATOR-BRIDGE CABLE	28480	08502-20011
W5	08502-20006	7	1	RF ATTENUATOR-BRIDGE CABLE	28480	08502-20006

Figure 6-1. Cables and Major Assemblies (bottom internal view).



RD	Part #	CD	Q	Description	Mfr #	Mfr p/n
C1	0160-4833	5	1	CERAMIC CAPACITOR .022UF 100V	00901	C124C223K1R5CA
MP2	08502-00018	9	1	MAIN DECK	28480	8502-00018
MP3	2190-0377	8	4	FLAT WASHER NO. 6 .145-IN-ID	04821	0BD
MP4	2360-0331	3	4	MACH SCREW 6-32 .25-IN-LG PAN-HEAD POZI	02053	0BD
MP5	3050-0105	6	6	FLAT WASHER MTLC NO. 4 .125-IN-ID	04821	0BD
MP6	2200-0105	4	8	MACH SCREW 4-40 .312-IN-LG PAN-HD-POZI	04771	0BD
MP7	1400-0110	4	1	FUSE HOLDER (BIPIN) AND NUT	04480	0BD
MP8	1400-0112	6	1	FUSE HOLDER CAP	04480	0BD
MP9	2110-0424	9	1	FUSE .75A 125V .25X.27	04480	GMW 3/4A
MP10	08502-00017	8	1	REAR SUB PANEL	28480	08502-00017
MP11	08502-00016	7	1	REAR PANEL	28480	08502-00016
MP12	2420-0001	5	3	HEX NUT W/LKWR 6-32-THD .109-IN-THK	04805	0BD
MP13	2190-0016	3	1	LOCK WASHER INTL T 3/8 IN .377-IN-ID	02440	2190-0016
MP14	2950-0001	8	1	HEX NUT 3/8-32	28480	2950-0001
MP15	2190-0104	0	3	LOCK WASHER INTL T 7/16 IN .439-IN-ID	04805	1922-04
MP16	2950-0132	6	3	HEX NUT DBL-CHAM 7/16-28-THD .094-IN-THK	04604	76500NP
MP17	85044-00001	7	1	FRONT PANEL (HP 85044A)	28480	85044-00001
	85044-00002	8	1	FRONT PANEL (HP 85044B)	28480	85044-00002
MP19	85054-60001	5	1	TYPE-N(F)/7MM ADAPTER (HP 85044A)	28480	85054-60001
MP20	HP 11852B	3	1	MINIMUM LOSS PAD (HP 85044B)	28480	HP 11852B
MP21	08502-20001	2	1	CASE-BOTTOM COVER (HP 85044A)	28480	08502-20001
	08502-20012	5	1	CASE-BOTTOM COVER (HP 85044B)	28480	08502-20012
MP24	08502-20010	3	4	SPRING CLIP	28480	08502-20010
R1	0757-0394	0	1	RESISTOR 51.1 OHM 1% .125W	00746	CRB14
R2	0698-8827	4	1	RESISTOR 1M 1% .125W	00746	CRB14

Figure 6-2. Miscellaneous Parts (bottom internal view) (1 of 2)

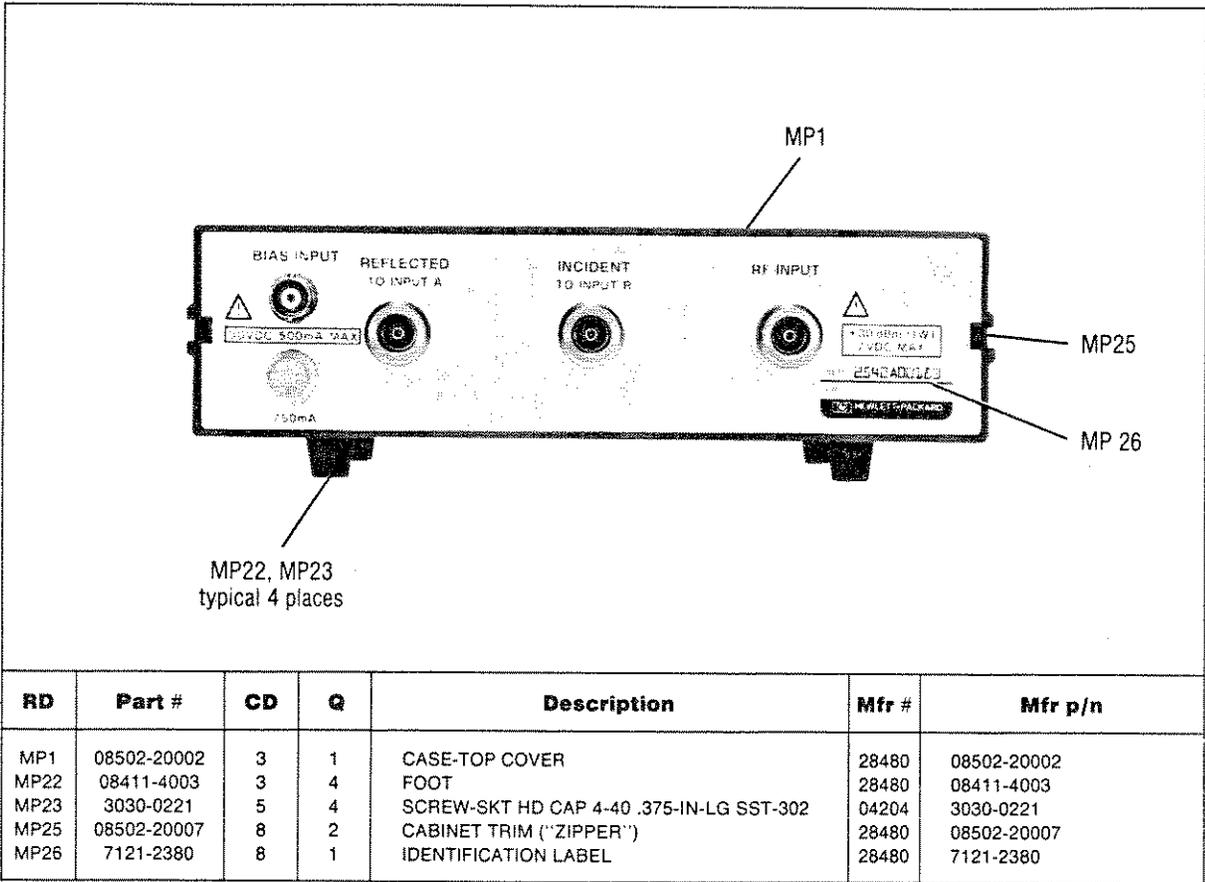


Figure 6-2. Miscellaneous Parts (rear panel view) (2 of 2)

Table 6-1. Manufacturers

Mfr #	Name	Location	Zip Code
00901	KEMET ELEK DIV UNION CARBIDE	GREENVILLE SC	
02053	NYLOK-DETROIT CORP	TROY MI	48084
02440	THOMSON BREMER DIV VARE	CHICAGO IL	60622
04480	BUSSMAN MFG DIV OF McGRAW-EDISON CO	ST LOUIS MO	63107
04604	FEDERAL SCREW PRODUCTS CO	CHICAGO IL	60618
04771	PHEOLL DFM DIV OF ALLIED PROD	CHICAGO IL	60650
04805	ILLINOIS TOOL WORKS INC	ELGIN IL	60126
04821	TILLEY MANUFACTURING COMPANY	MORGAN HILL CA	94070
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304



## Section 7. Manual Backdating Changes

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### INTRODUCTION

This section usually contains instructions to help you adapt this manual to an instrument with a serial number prefix lower than the one on the title page.

### APPLICATION

Since there are no earlier versions of this instrument (with lower serial number prefixes), this manual applies directly to instruments with the serial number prefix on the title page.

**NOTE:** To adapt this manual to a later version instrument (higher serial number prefix), refer to INSTRUMENTS COVERED BY THE MANUAL in Section 1.

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## Section 8. Service

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### **INTRODUCTION**

This section provides instructions for troubleshooting and repairing the HP 85044A and 85044B transmission/reflection test sets. It includes simplified diagrams and schematic diagrams of the test sets.

### **TROUBLESHOOTING**

The intent of this section is to enable technicians to isolate problems to the assembly level, identify the defective assembly and order the replacement part. The schematic diagrams and circuit descriptions may be used to aid in troubleshooting to the component level. Recommended test equipment is listed in Table 1-2.

### **OPENING THE INSTRUMENT CASE**

The two halves of the case of the HP 85044A/B are held together by two U-shaped strips of plastic (zippers). Remove the two strips to open the case.

Place the HP 85044A/B upside down on a flat surface. Squeeze the top and bottom of the case together by applying pressure to the side to be opened. Compressing the case reduces pressure on the zipper. With the pressure reduced, you can use a small screwdriver to slide the zipper toward the rear panel. When you have forced the zipper out as far as shown in Figure 8-1, grasp it firmly with your hand and pull it out completely. Repeat the procedure for the remaining zipper. Lift the case bottom from the instrument.

### **SERVICING THE DIRECTIONAL BRIDGE**

The power splitter/directional bridge assembly is not field-repairable but it is replaceable on an exchange basis at a considerable cost saving. See "Exchange Assemblies Available" in Section 6 for additional information.

## RF TROUBLESHOOTING PROCEDURE

To troubleshoot RF path failures, use a power meter to check the RF power levels indicated on Figure 8-2. Use the HP 8753A network analyzer to apply an RF signal of 1.5 GHz CW at 0 dBm to the RF INPUT port of the test set.

Perform the directivity performance test in Section 4 of this manual to check the directivity of the bridge. If the directivity is less than specified in Table 1-1, check the cables and connectors for damage and loose connections.

On the HP 85044A check the connector collet of the TEST port for possible damage. If replacement is indicated, replace it with a new 6-slot collet. The replacement procedure, parts and equipment are included in the Microwave Connector Care manual (HP part number 08510-90064). Repeat the directivity check. Replace the directional bridge/splitter if the directivity is still less than that specified in Table 1-1.

**NOTE:** The internal SMA connectors have a low torque specification: 7 to 10 in-lb (0.8 to 1.1 Nm). Damage to the assembly or connector may result if this specification is exceeded.

Disconnect the RF cables one at a time and check for power levels as indicated by Figure 8-2.

Measure the signal level into and out of the attenuator. Connect the power meter to the output connector of the attenuator. Use the HP 8753A to apply an RF signal of 1.5 GHz CW at +6 dBm to the RF INPUT port of the test set. The power meter should read about 0 dBm. Step the attenuator down to 70 dB in 10 dB increments. The power meter reading should decrease 10 dBm with each step.

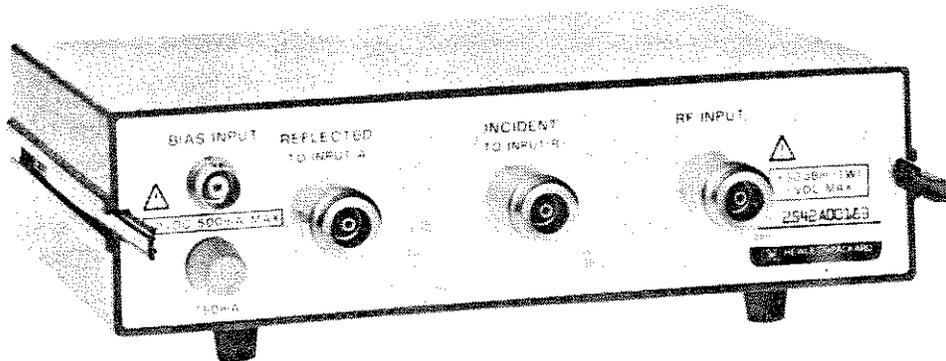


Figure 8-1. HP 85044A/B Case Disassembly

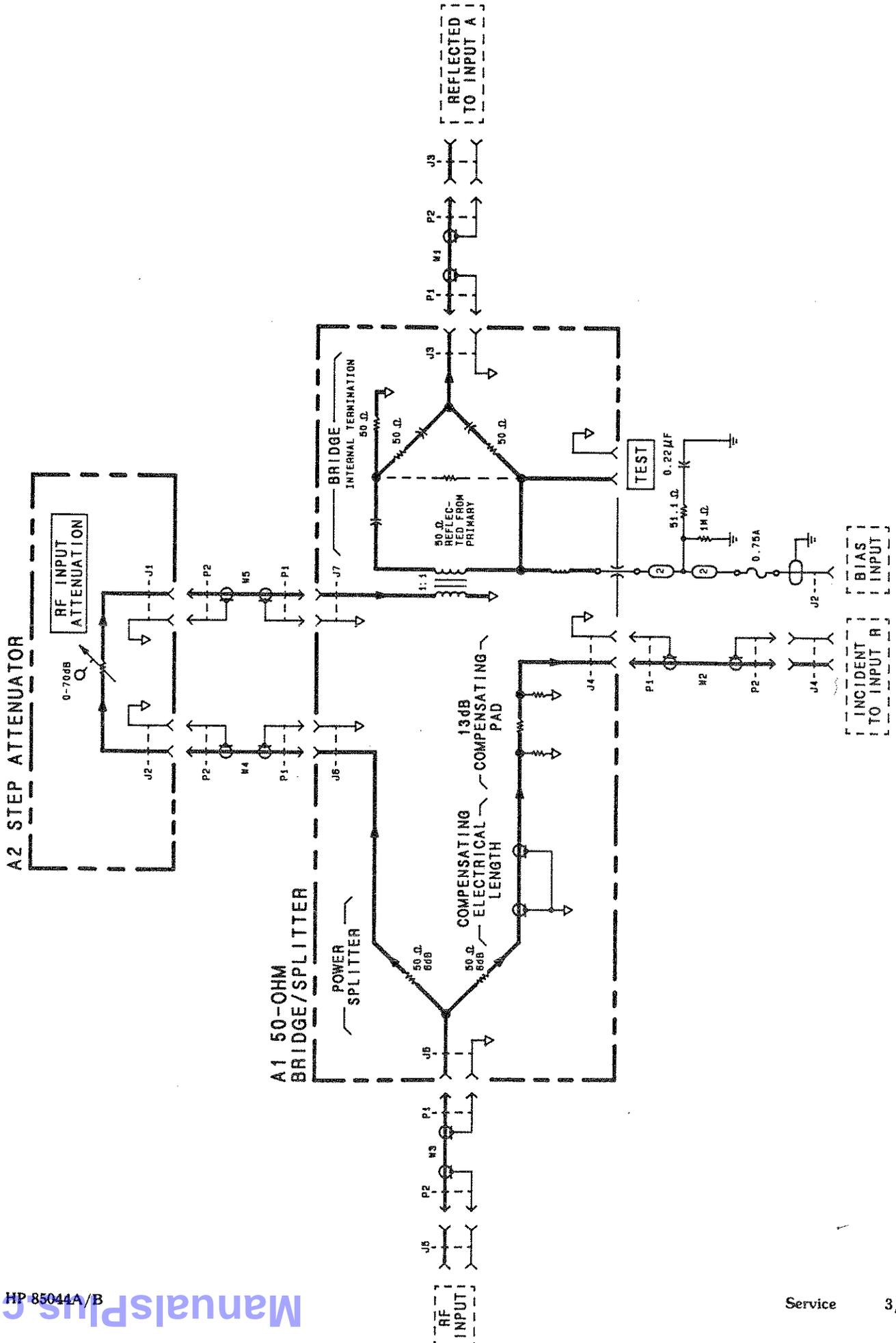


Figure 8-2. Front Panel and Logic Board Schematic Diagram

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Service  
Tag

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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February, 1986

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100