Operating Note

Agilent Technologies

11652A
75 Ohm
Transmission/Reflection Kit
Option 008

8721A
75 Ohm
Directional Bridge
Option 008

Manufacturing Part Number: 11652-90006

Printed in USA

Print Date: December 1983

Supersedes: 1971

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Hewlett-Packard to Agilent Technologies Transition

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11/16/04

OPERATING NOTE

11652A 75Ω TRANSMISSION/ REFLECTION KIT

Option 008

8721A 75Ω DIRECTIONAL BRIDGE

Option 008

HEWLETT PACKARD

ADDENDUM

MANUAL CHANGES

NOTE

This ADDENDUM contains important information of the kind normally contained in MANUAL CHANGES supplements. Use the ADDENDUM to correct your manual in the same way you would use the MANUAL CHANGES supplement.

MANUAL IDENTIFICATION

HP Model Number:
8721A opt. 008
Date Printed: December 1983
Part Number: 11652-90006

■ = NEW ITEM

	Serial Prefix or Number	Make Manual Changes
■	All	1

■ CHANGE 1

Page 4, Table 2:

Modify the directional bridge "Load Port VSWR" specification to read "**Load Port VSWR (Reflection Measurements):** <1.063 (30 dB return loss) 0.1 to 110 MHz."

Add this explanation: "Note: Load Port VSWR (Power Monitoring) is not specified."

Addendum Date: 13 October 1988

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INTRODUCTION

The HP Model 11652A Option 008 Transmission/ Reflection Kit (see Figure 1) is used when characterizing 75-ohm RF networks from 0.1 to 110 MHz. Swept measurements may be made when the HP 11652A Option 008 is used with the HP Model 8407A Option 008 Network Analyzer or the HP

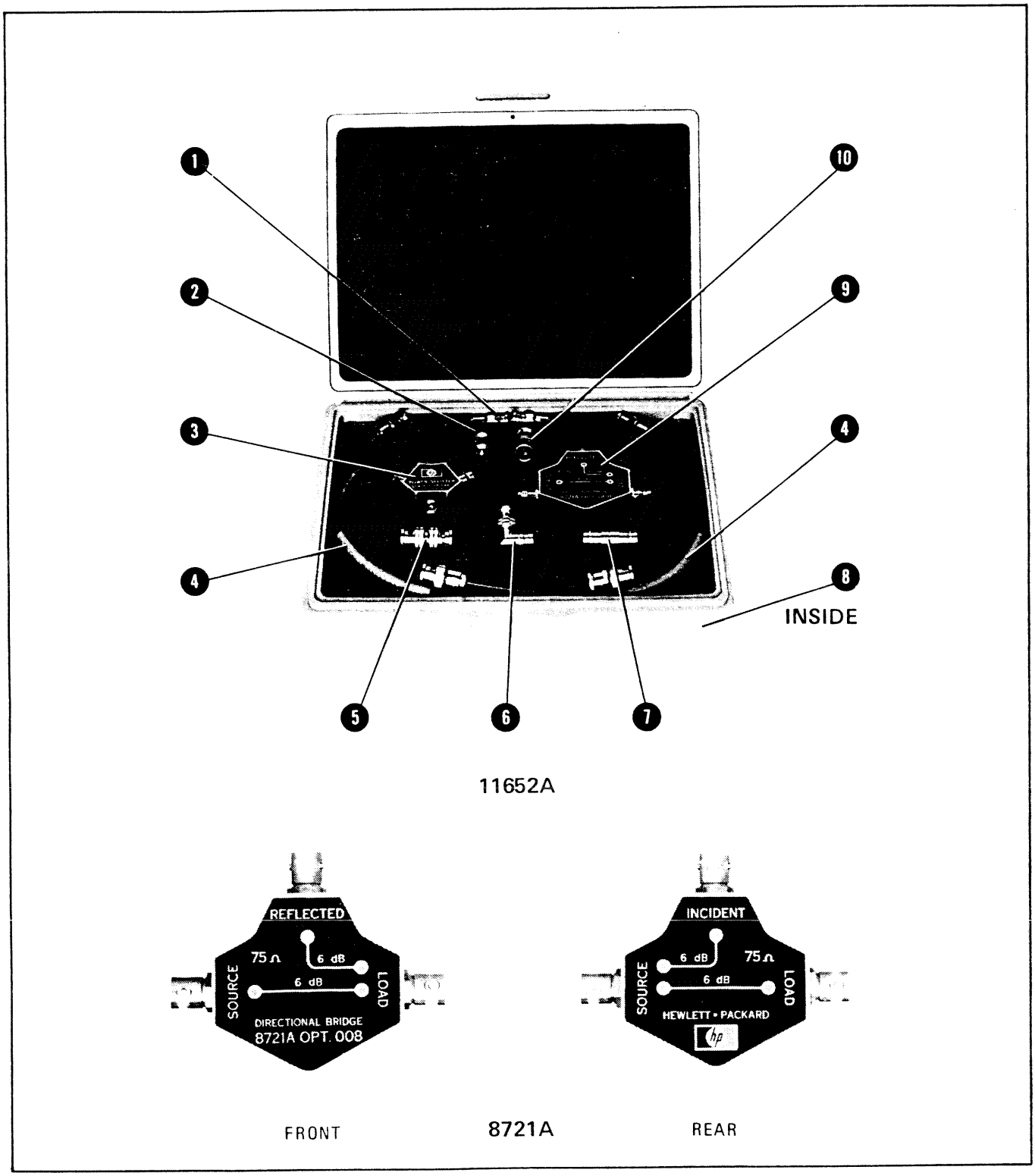


Figure 1. HP 11652A Option 008 Transmission Reflection Kit and HP 8721A Option 008 Directional Bridge

Table 1. Contents of HP 11652A Option 008 Transmission/Reflection Kit

Item Number	Quantity	HP Part No.	Description
1	1	11652-60013	Cable Assembly, 2 foot
2	1	1250-0929	Connector-BNC Short
3	1	11652-60019	Power Splitter
4	2	11652-60012	Cable Assembly, 1 foot
5	1	1250-1288	Connector-RF BNC
6	1	1250-1286	Connector Angle
7	1	1250-1287	Connector-RF Adapter
8	1	11652-60014	Cable Assembly, 3 ft 3 in. (inside case)
9	1	8721A Opt. 008	Directional Bridge
10	1	11652-60010	Precision Termination

8407A Network Analyzer with two 11658A 50 to 75 ohm matching resistors (see Figures 4 and 5).

The HP Model 8721A Option 008 Directional Bridge, which is available separately or as part of the HP Model 11652A Option 008 Transmission/ Reflection Kit, is principally used to make reflection measurements. The 8721A is also very useful for power monitoring and closed-loop leveling applications.

INITIAL INSPECTION

Mechanical Check

If damage to the shipping carton is evident, ask that the carrier's agent be present when the instrument is unpacked. Inspect the parts for mechanical damage, such as scratches or dents. Also, check the cushioning material for signs of severe stress.

Electrical Check

The electrical performance should be verified as soon as possible after receipt. Refer to the paragraph on MAINTENANCE.

Claims for Damage

If any unit is mechanically damaged or fails to meet specifications upon receipt, notify the carrier and your nearest HP office immedately (a list of regional offices is at the rear of this note). Retain the shipping carton and padding for the carrier's inspection. The HP office will arrange for repair or replacement without waiting for the claim against the carrier to be settled.

REPACKAGING FOR SHIPMENT

Using Original Packaging

The same containers and materials used in factory packaging can be obtained through the HP offices near you.

If the Model 11652A Option 008 or Model 8721A Option 008 is being returned to HP for servicing, attach a tag indicating the type of service required, return address, and model or part number. Also mark the container FRAGILE to assure careful handling.

Using Other Packaging

If it is desired to return a component without its case, the following general instructions should be used for repackaging with commercially-available materials:

a. Wrap the component in heavy paper or plastic. (If shipping to a HP office attach a tag indicating the type of service required, return address, and model or part number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use enough shock-absorbing material (three to four inch layer) around all sides of the fixture to provide a firm cushion and prevent movement.

d. Seal the shipping carton securely.

e. Mark the shipping carton FRAGILE to assure careful handling.

TRANSMISSION/REFLECTION KIT CONTENTS

Refer to Table 1 for a list of the components furnished in the HP Model 11652A Option 008 Transmission/Reflection Kit.

SPECIFICATIONS

Refer to Table 2 for the specifications and circuit representations of the components in the HP 11652A Option 008 Kit.

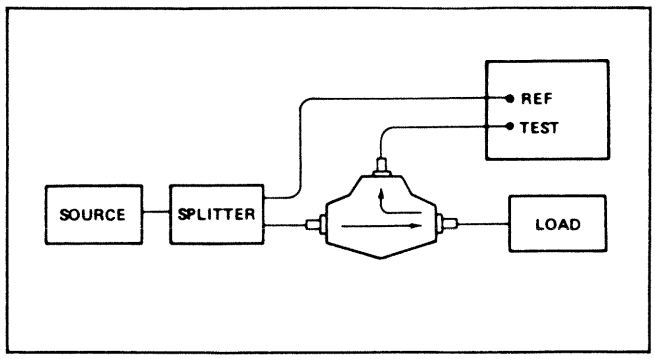


Figure 2. Reflection Measurements with the HP 8721A Option 008

OPERATION

Reflection Measurements with the HP 8721A Option 008

The HP Model 8721A Directional Bridge (functionally similar to a directional coupler) is a valuable device in reflection measurements and power monitoring.

By measuring the reflected voltage and comparing this to the voltage incident upon a device under test, you can characterize the test device for its complex reflection coefficient (EREFLECTED/EINCIDENT), complex impedance, VSWR, and return loss (—20 Log reflection coefficient).

To find the ratio of two voltages, measure the voltages present at a prescribed test channel and compare it to a reference voltage. To make a reflection measurement, use an instrument such as the HP 8405A Vector Voltmeter and connect the directional bridge as shown in Figure 2.

Power Monitoring with the HP 8721A Option 008

Power monitoring can also be accomplished by the 8721A. The 8721A can monitor the power being produced by a source while loaded and also monitor the power being delivered to a remote load. To use the directional bridge for this purpose, insert the bridge as shown in Figure 3. Since there is a 6 dB drop below the source power level in both arms of the bridge, the power meter measures the power delivered to the load.

HP 11652A Option 008 Kit Measurements with the HP 8407A

Transmission. (Refer also to AN 121-1 "Network Analysis with the HP 8407A 0.1 — 110 MHz").

a. The HP 11652A is used as shown in Figure 4 when making a transmission measurement.

b. Power entering the power splitter is divided into two channels, reference and test. The HP 8407A measures the ratio of the test channel to the reference channel and measures the phase difference between the two channels.

c. The cable lengths specified are necessary in order to ensure matched electrical lengths between channels.

d. The general procedure for making a transmission measurement is the following (refer also to AN 121-1).

1. Setup the equipment as shown in Figure 4.
2. Establish a 0 dB, zero-degree reference level on the HP 8407A.
3. Insert the unknown at box marked UNKNOWN and make the measurement.

Reflection. (Refer also to AN 121-1.)

a. The HP 11652A Option 008 is used as shown in Figure 5 when measuring complex impedance, reflection coefficient or return loss (VSWR).

b. Power from the sweeper is again divided into a reference and test channel. This time, however, the signal entering the test channel is the reflected voltage from the input to a network, not the transmitted voltage. The HP 8407A takes the ratio of EREFLECTED/EINCIDENT, which is defined as reflection coefficient.

c. The cable lengths specified are necessary to ensure proper phase matching of the two channels.

d. The general procedure for making a reflection measurement is the following (refer also to AN 121-1):

1. Setup the equipment as shown in Figure 5.
2. Place a short circuit (or open circuit) at the LOAD port of the directional bridge.

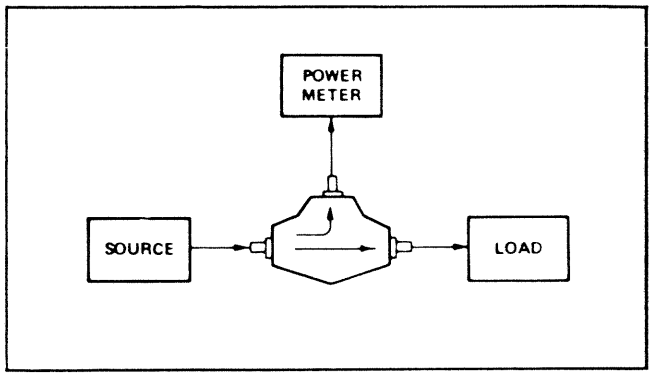


Figure 3. Power Monitoring with the HP 8721A Option 008

Table 2. Specifications

COMPLETE KIT:

Plastic Case Dimensions: 10 in. by 7.5 in. by 2.38 in.

Net Weight: 2 lb, 3 oz.

COMPONENTS:

Directional Bridge (HP 8721A Option 008)

Frequency Range: 0.1 to 110 MHz

Impedance: 75 ohm nominal

Load Port VSWR: <1.063 (30 dB return loss)

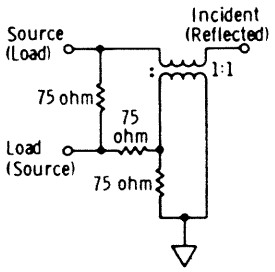
Directivity: >40 dB (>30 dB, 0.1 — 1.0 MHz)

Coupling: 6 dB nominal. ±0.6 dB frequency variation when used with HP 8407A Network Analyzer.

Transmission: 6 dB nominal insertion loss. ±0.1 dB frequency variation when used with HP 8407A Network Analyzer.

Maximum Input Power: +20 dBm

Connectors: BNC female



Circuit Equivalent of Directional Bridge

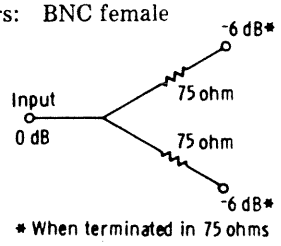
Power Splitter (11652-60019)

Impedance: 75 ohm nominal

Input VSWR: 1.02 (>40 dB return loss)

Output VSWR: 1.02 (>40 dB return loss) when used with the HP 8407A or HP 8405A

Connectors: BNC female



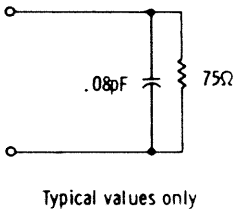
Circuit Equivalent of Power Splitter

Precision Termination (11652-60010)

Impedance: 75 ohm nominal

VSWR: 1.014 (>43 dB return loss)

Connector: BNC male



Circuit Equivalent of Precision Termination

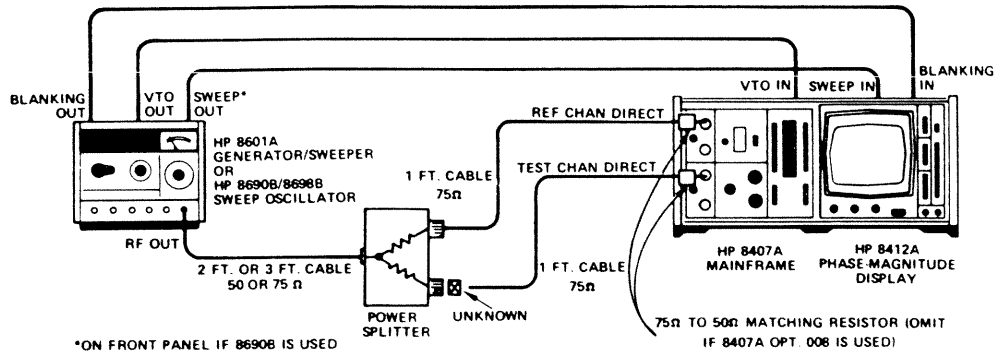


Figure 4. Setup for Making Transmission Measurements

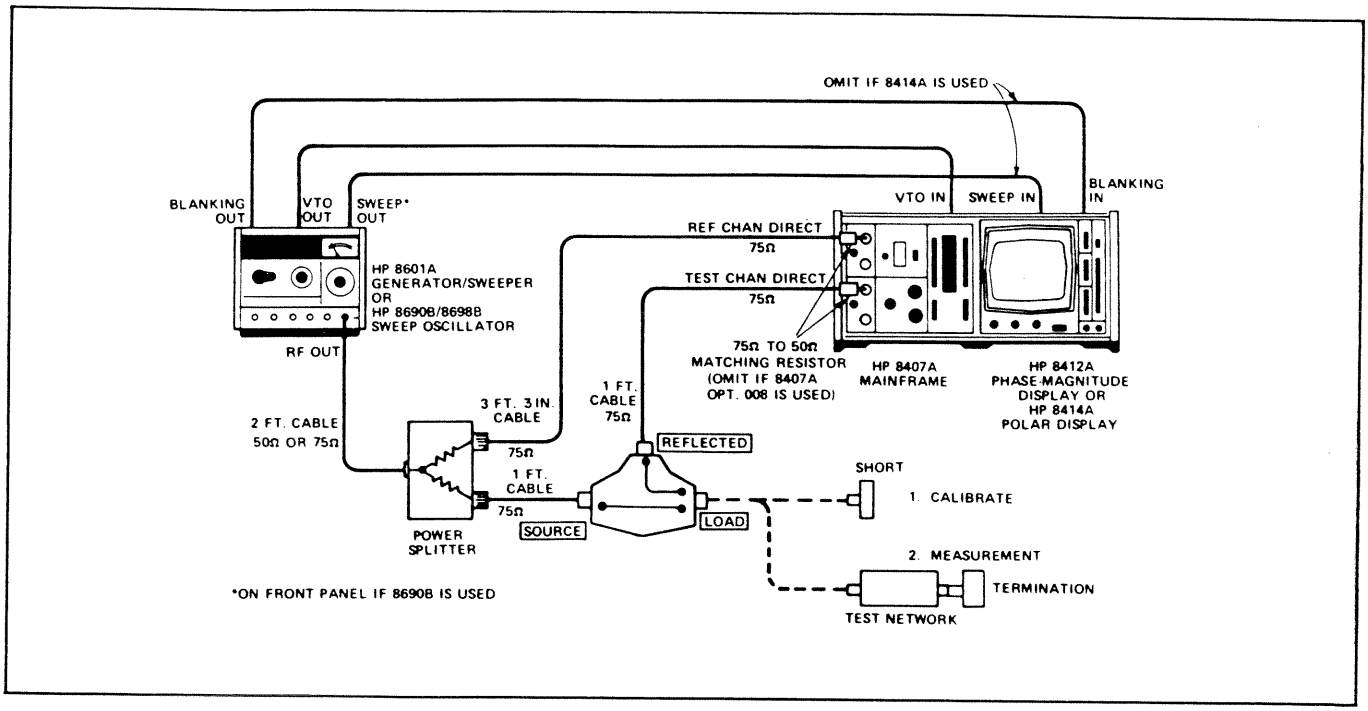


Figure 5. Basic Setup for Reflection Measurements

Establish a 0 dB, 180 degree (or 0 dB, zero degree) reference level on the HP 8407A Phase-Magnitude Display or the HP 8414A Polar Display.

3. Replace the short with the terminated network and make the measurement.

HP 11652A Kit Measurements with the HP 8405A Vector Voltmeter, 0.1 to 110 MHz

The HP 11652A Option 008 can be used with the HP 8405A Vector Voltmeter to make CW transmission and reflection measurements. The procedure is outlined below. (Refer also to the HP 8405A Operating and Service Manual.)

Transmission

a. Setup the equipment as shown in Figure 6.

b. Establish a 0 dB, zero degree reference level with the CHANNEL switch set to B. (Set the amplitude with the oscillator attenuator and the phase with the HP 8405A PHASE ZERO.)

c. Insert the unknown at box marked UNKNOWN in Figure 6 and make measurement.

Reflection

a. Setup the equipment as shown in Figure 7. Be sure to use the cable lengths specified (from the HP 11652A) in order to ensure proper phase matching between channels A and B.

b. Place a short circuit at the LOAD port of the directional bridge. Establish a 0 dB, 180 degree reference level with the CHANNEL switch set to B. (Use the oscillator output attenuator to set the amplitude and the HP 8405A PHASE ZERO to set the phase.)

c. Replace the short with the terminated network and read phase and magnitude of reflected signal.

PRECAUTIONS

Do not misplace the cables supplied with the kit. They have been carefully chosen for proper electrical length and are triple-shielded for isolation. Be sure to use proper lengths of cable during setup (refer to Figures 4 through 7).

Be sure the HP 8721A Option 008 Directional Bridge is being used as a reverse coupler, not as a forward coupler during a reflection measurement (see Figure 5). This ensures that only the reflected signal will enter the test channel ($E_{REFLECTED}$).

MAINTENANCE

Specifications for the Directional Bridge, Power Splitter and Precision Termination are given in Table 2. However, the individual specifications for these components are of such a tolerance that the ambiguities encountered in the directivity, port

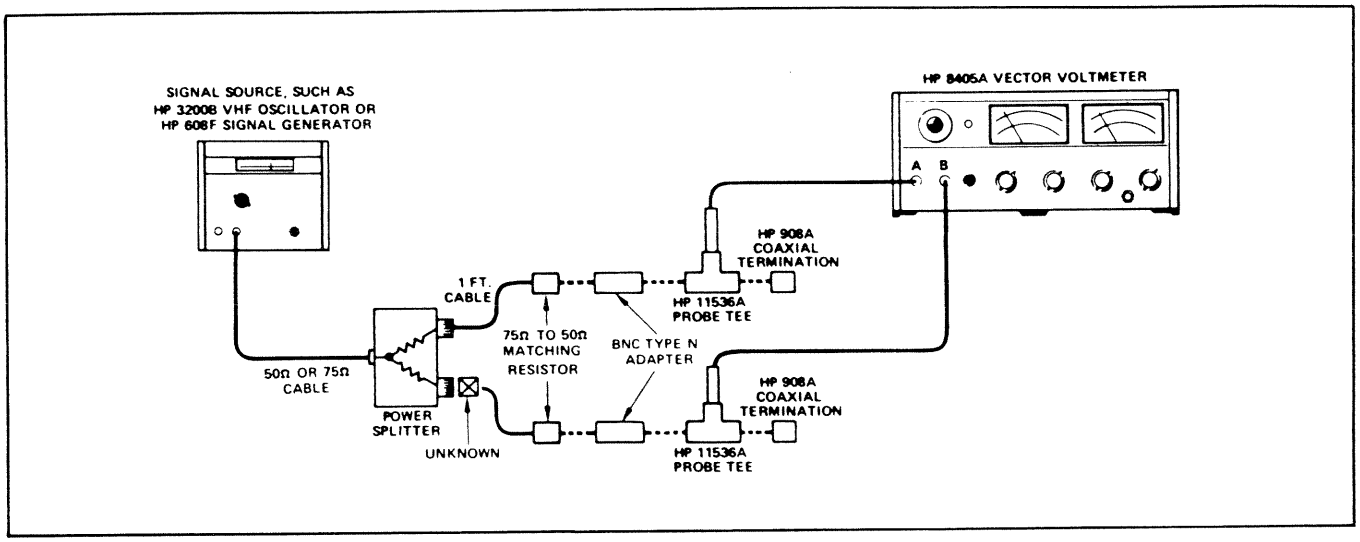


Figure 6. Setup for Making Transmission Measurements with HP 8405A

VSWR, and Input/Output VSWR measurement set-ups impair the checking of each of the component's specifications. Verification of the individual specifications can be accomplished by using a standards lab calibrated equivalent component, available through your local Hewlett-Packard sales and service offices.

REPLACEABLE PARTS

The HP 8721A Option 008 Directional Bridge, the Power Splitter and the Precision Termination are not field repairable. If any of them do not meet the specifications in Table 2, return the component to the HP Service Center nearest you.

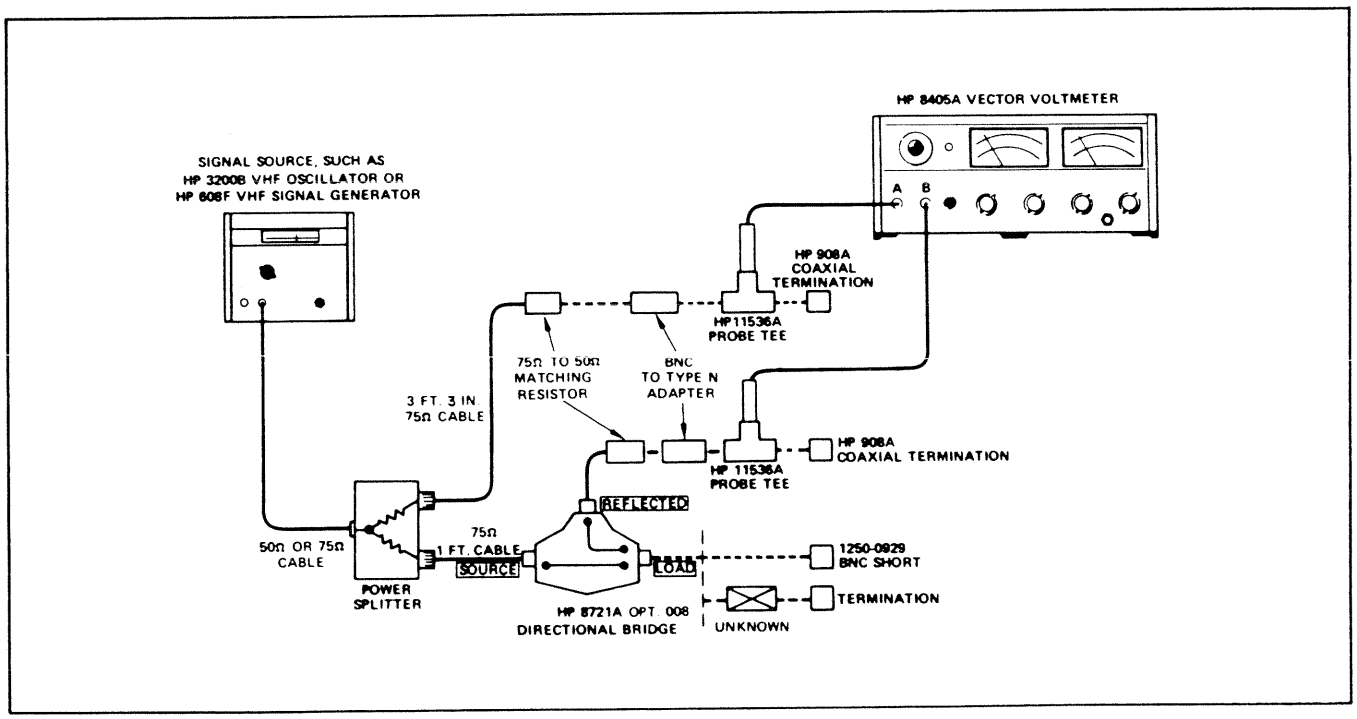


Figure 7. Setup for Making Reflection Measurements with HP 8405A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