MANUAL CHANGES

MANUAL IDENTIFICATION
Model Number: 11608A
Date Printed: September 1981
Part Number: 11608-90029

This supplement contains important information for correcting **manual errors and** for **adapting the manual** to instruments containing improvements made **after the** printing of the manual.

To use this supplement, make all ERRATA **corrections and all appropriate serial number related changes indicated in the tables below.**

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
2149A	1

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES

▶ NEW ITEM

ERRATA

▶ **Page** 4. **Figure 3:**
Option **003** includes a stripline board and ground **contact installed,** and separate throughline and short circuit calibrators. There **are** no KDisk transistor packages included with Option 003 **as** Figure 3 suggests.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies, quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

Printed in U.S.A.

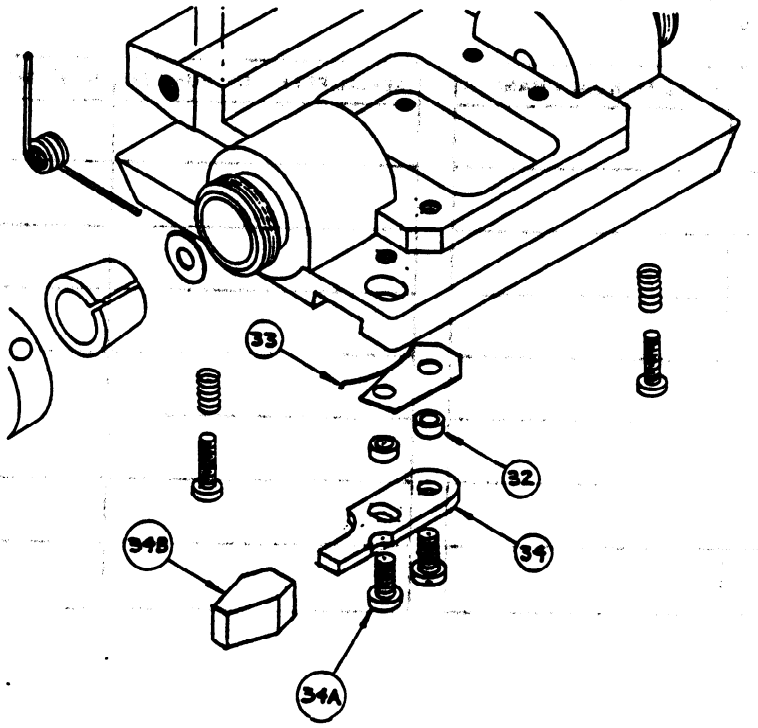
SEPTEMBER 30, 1986
2 pages

HEWLETT PACKARD

CHANGE 1

Page 19, Replaceable Parts:

Change Item 6 to HP Part No. 11608-20059.
Add Item 6A, Latch Pin, HP Part No. 11608-20060.
Delete Items 7 and 8.
Change the latch detail in Figure 9 as shown below:



P/O Figure 9

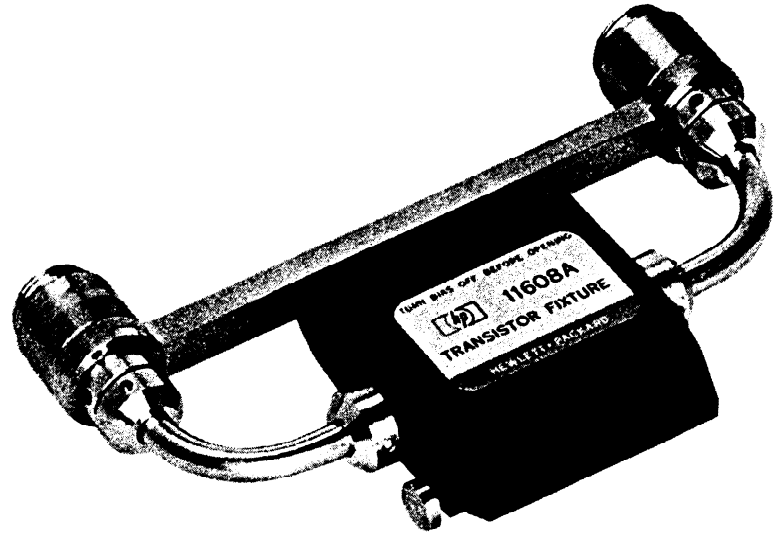
Page 20, Replaceable Parts:

Change Item 29 to HP Part No. **11608-20058.**
Change Item 32 to **Latch** Spacer, HP **Part** No. 11608-20062.
Change Item 33 to Latch **Spring, HP Part** No. 1160840004.
Change Item 34 to Latch, HP Part No. **11608-20061.**
Add Item 34A, Screw. Mach. SS 2–56X3/16 PAN HD, HP Part No. 0520-0127.
Add Item 34B, Lever Switch Knob, HP Part No. 0370-0929.

OPERATING NOTE

11608A TRANSISTOR FIXTURE

Serial Prefix: 2137A
For other serial prefixes see Appendix II



SEPTEMBER 1981

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CERTIFICATION

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

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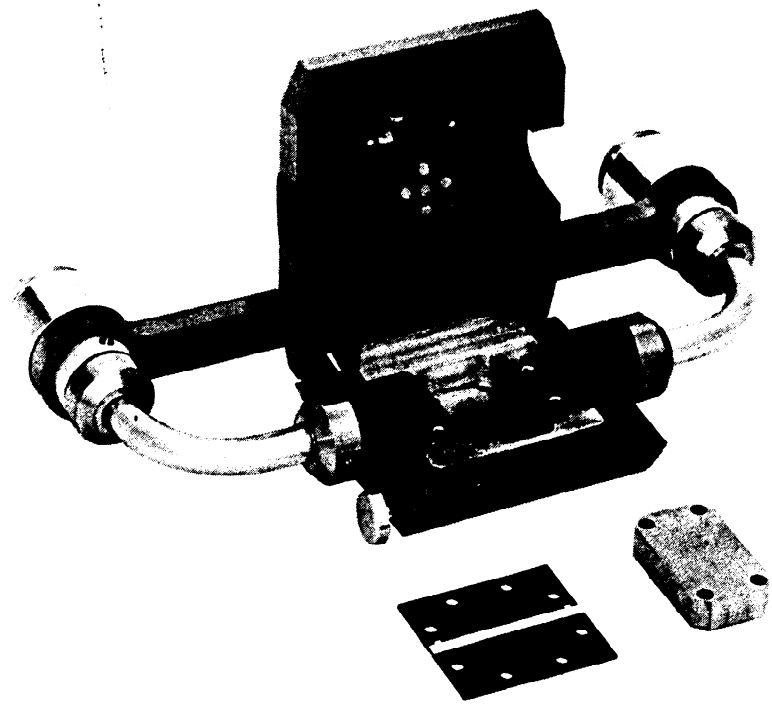
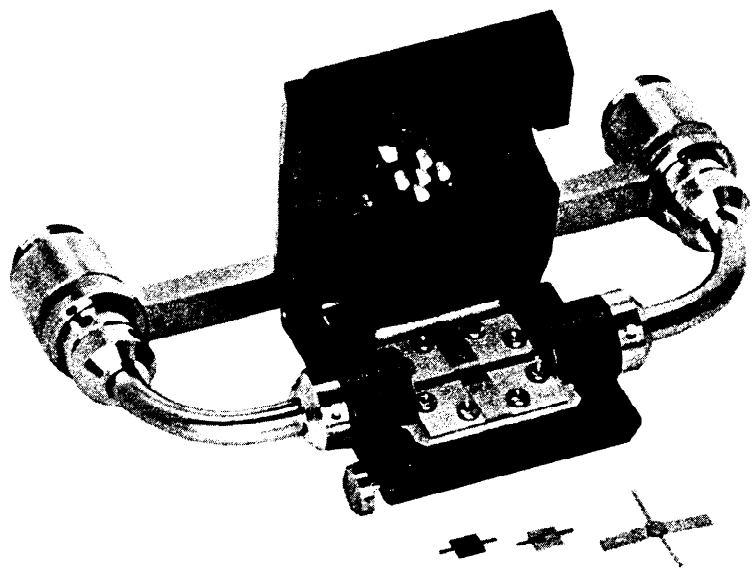


STANDARD



OPTION 003

Figure 1. Equipment Supplied

INTRODUCTION

This operating note covers the Hewlett-Packard Model 11608A Transistor Fixture. This operating note contains information for operating and servicing the Model **11608A.** Table 1 lists the specifications for the 11608A. Supplementary operating characteristics for the **11608A** are listed in Table 2. Supplementary operating characteristics are not specifications but are other typical characteristics included for the information of the user.

Table 1. Model 11608A Transistor Fixture Specifications

Frequency Range: DC to 12.4 **GHz.**

Package Styles

Standard: Through-line stripline microstrip and bolt-in grounding contact structure machinable by customer for special transistor package styles.

Option 003: **K-disc** (0.205 in. dia. x ,020 in. thick).

Characteristic Impedance: 50 ohms.

Insertion Loss: [1] 0.15 **dB** + **.04** (frequency in **GHz).**

Connectors: APC7 hybrid connectors. Mates with **8746B** S-Parameter Test Set. Spacing **4.810 ±0.003** inches.

Calibration Units: The Standard Instrument is supplied with a blank insulation board to machine into a short and thru calibration.

Each Option 003 instrument is supplied with two calibrators:

1. Short-circuit termination calibrator;
2. **50-ohm** through-line calibrator.

Maximum Power: **10W** nominal including RF sig nals (depends upon mounting and heat dissipation of the transistor under test).

Stripline Material: 0.031 in. thick **RT/duroid**[2] dielectric,
0.080 in. wide **50-ohm** stripline (microstrip).

Weight: Net, 13 **oz** (368 gm).

Dimensions: **5-5/8** inches (143 mm) long, **3-1/2** inches (89 mm) wide, 1 inch (25 mm) high.

[1] **Expressed as loss from one port to open end of stripline (one-half port-to-port insertion loss).**

[2] **RT/duroid ® microwave laminate is a registered trademark of Rogers Corporation, Chandler. AZ.**

INSTRUMENTS COVERED BY OPERATING NOTE

This instrument has a two-section serial number (OOOOAOOOOO). The first four digits are a prefix. The contents of this operating note apply directly to instruments having the same serial number prefix as listed after SERIALS PREFIXED on the cover page.

Important information for correcting errors, and for adapting the contents of this operating note to cover improvements that occur after the printing of the operating note, is provided in a yellow Manual Changes supplement inserted under the front cover of the operating note. These supplements are keyed to the operating note's print date and part number. (Print date appears on the front cover and part number appears on rear cover in lower left-hand corner). These supplements are revised as often as necessary to keep the operating note current and accurate. **Hewlett-**Packard recommends that you periodically request the latest Manual Changes supplement.

Table 2. Supplementary Operating Information

These values are not specifications but are included for the information of the user.

VSWR (Measured with a through-line calibrator installed and opposite end of fixture terminated with a **50-ohm** load):
<1.10, DC to 4 **GHz** (typically **<1.06);**
<1.15, 4 to 8 **GHz** (typically **<1.10);**
<1.30, 8 to 12.4 **GHz** (typically **<1.25).**
This data obtained with the through-line calibrator in good condition and measured data corrected for the characteristics of the load.

Through-Line Calibrator Offsetting Value
In calibrating for a transmission measurement, the reference plane is established at the center of the through-line calibrator. To move the reference plane to the edge of the transistor case decrease the reference channel Iength by the offsetting value.

Calibrator Overall Electrical Length
Standard = mechanical length ÷ 0.65',
Option 003 = 0.80 cm.

Equivalent Electrical Length (from either port to the center of the 11608A with through-line calibrator installed): 14.2 **±0.5** cm.

Temperature Range: **+10** to **+40°C** (operation), **−20** to **+65°C** (storage).

[1] **For calibrators with dielectric constant of 2.35 only.**

Complementary copies of these supplements are available from all Hewlett-Packard offices.

For information concerning serial number prefixes not listed on the cover page or in a Manual Changes supplement, contact the nearest Hewlett-Packard office.

DESCRIPTION

The Model 11608A Transistor Fixture (Figure 1) is designed to hold stripline transistors, or other stripline components, in a 50-ohm stripline fixture for testing S-parameters. Model 11608A gives optimal performance when used with the 8746B S-Parameter Test Set, but may also be used without the Model 8746B.

STANDARD AND OPTION 003 INSTRUMENTS

The model number *11608A* may have an option number given. The standard instrument and option number have the following meanings:

Standard: APC-7 hybrid connector with through-line kit (machinable).
Option 003: APC-7 hybrid connector with K-Disc Package.

The 11608A Transistor Fixture is currently available only with Options 003 to accommodate the K-Disc package. Dimensions for the K-Disc package styles is given in Figure 2.

To meet the present needs of those who do not use the K-Disc package, or have experimental components which require testing, the standard instrument is available. This configuration provides the basic external requirements of Option 003, but the internal structure has been left blank so that it may be machined and modified by the user to fit a particular device. (See Figure 3.) Two striplines and ground contacts (one stripline is installed) are furnished, together with a piece of plated dielectric which can be machined for making through-line calibrators. Low-temperature solder inserts are also furnished, together with ribbon contact strips for making calibrators. For further information concerning the standard instrument, refer to Appendix I.

ACCESSORIES SUPPLIED

Each 11608A Option 003 instrument comes with a stripline board and ground contact installed, and separate through-line and shorting calibrators. As shown in Figure 3, the standard instrument is supplied with un-machined stripline boards and ground contact structures for special applications.

EQUIPMENT REQUIRED BUT NOT SUPPLIED

S-Parameter Test Set

An HP Model 8746B S-Parameter Test Set is a combination of directional couplers and switches which can be used with the 11608A for testing the four s-parameters. With the 8746B, the power incident to the device under test can be adjusted in 10 dB steps. All of these functions are selected by means of front-panel pushbuttons. Also, an external bias supply may be connected through the 8746B to bias a transistor or other device being tested.

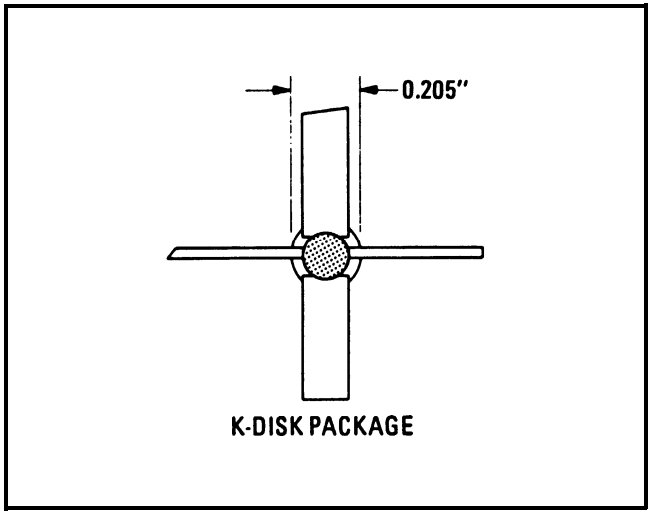


Figure 2. K-Disc Package Styles (option 003)

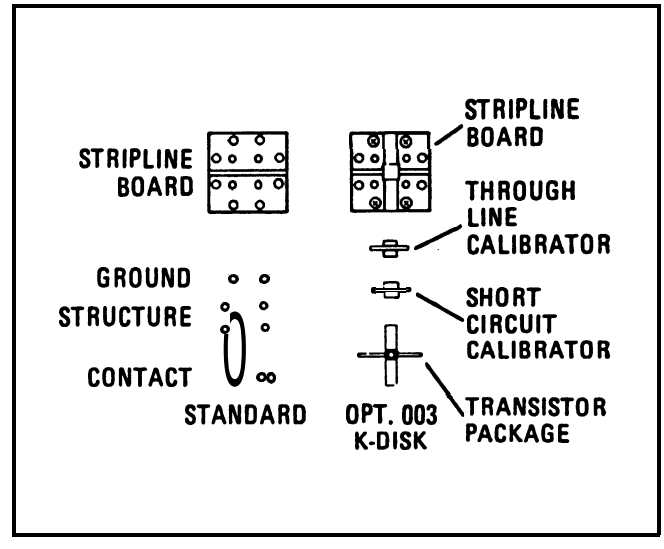


Figure 3. Model 11608A Standard and Option 003

Other S-Parameter Test Sets

An HP Model 8745A can also be used (with slight degradation of accuracy) with the 11608A by using a Model 11604A Universal Extension between the 8745A and the 11608A.

Using Equipment Other than S-Parameter Test sets

Equipment other than S-Parameter Test Sets may be used with the **11608A,** provided a means of separating the RF incident, reflected, and transmitted signals is used. This is usually done with directional couplers. In addition, some means must be provided to bias the transistor under test to its proper **dc-operating** conditions.

Network Analyzer

The Model 11608A must be used with a **phase-**amplitude ratio indicator, such as the HP Model 8410B Network Analyzer System or the Model 8405A Vector Voltmeter. The Model 8405A may be used for single-frequency measurements at and below 1 **GHz.**

For further information concerning the use of a Network Analyzer, consult Hewlett-Packard Application Note 117-2, "Stripline Component Measurement with the Model **8410B** Network **Ana**lyzer System", available free from the nearest Hewlett-Packard office.

Display Indicators

A display indicator is needed to display the result of the measurement of the **8410B/8411A** Network Analyzer. The display indicators are:

Model **8412A** Phase-Magnitude Display
Model **8413A** Phase-Gain Indicator
Model **8414A** Polar Display.

Model 8412A Phase-Magnitude Display. The Hewlett-Packard Model **8412A** displays either magnitude or phase or both on a rectangular cathode-ray screen.

Model 8413A Phase-Gain Indicator. The Hewlett-Packard Model 8413A contains a meter **which** indicates either single-frequency magnitude or phase at any one time. The Model 8413A has both magnitude and phase analog outputs so, if used with a dual-channel oscilloscope, **swept-**frequency indications of both magnitude and phase are possible.

Model 8414A Polar Display. The Hewlett-Packard Model 8414A displays both magnitude and phase simultaneously on a polar display.

Model 8405A Vector Voltmeter. If the Hewlett-Packard Model 8405A Vector Voltmeter is used, the meters on the 8405A may be used for display indicators but only for single-frequency measurements at and below a frequency of 1 **GHz.**

Bias Networks

The Hewlett-Packard Model 11589A and **11590A** Bias Networks are designed to provide a means of supplying dc bias to the center of a coaxial line and thus to a transistor under test, while blocking the dc bias from the input RF circuit. The Model 11589A is designed for test frequencies from 0.1 to 3.0 **GHz** and the Model **11590A** for frequencies from 1.0 to 12.4 **GHz.**

Line Stretcher

Hewlett-Packard can furnish a line stretcher separately for custom applications. Consult the nearest Hewlett-Packard office for further information.

Bias Supply

Transistors in the Model **11608A** may be biased with the Hewlett-Packard Model **8717B** Transistor Bias Supply or a dual dc power supply. The Model 8717B provides up to 30 volts with a maximum current of 500 **mA.** This voltage is continuously variable and current limitation is available. This supply is programmable for remote operation, if desired. If a Model 8746B S-Parameter Test Set is used with the **11608A,** a cable furnished with the **8717B** connects the bias supply to the 8746B. For further instructions, consult the operating and service manual for the 8746B.

INSTALLATION

Connecting the 11608A to 8746B Test Set

Before connecting the 11608A to an 8746B Test Set, be sure Port 2 on the test set "floats" or moves a bit to allow proper alignment of the two ports to the two matching connectors on the **11608A.** DO NOT bend the arms of the **11608A** to obtain connector alignment.

If 8746B Port 2 does not float, remove the bottom cover and loosen the two screws holding the **DC1** mounting plate to allow DC1 to float.

Using Standard Stripline Boards and Calibrators

Option 003 is completely assembled and requires no special installation instructions. A Standard 11608A Transistor Fixture has a removable 50-ohm through-line stripline board and ground contact. (See below.)

Adapting Fixture to Other Components

Using the Standard Instrument. The Standard 11608A permits machining stripline boards and ground contacts to configurations other than that of the Option 003 stripline boards and ground contacts. The device to be tested is not limited to transistors, but can be any stripline component (resistor, capacitor, inductor, integrated circuit, etc.) which will fit in the Model 11608A. See Appendix I for further details concerning the Standard 11608A.

Making Special Stripline Boards and Ground Contacts. Stripline boards and ground contacts may also be manufactured, if the standard instrument is not suitable, provided the requirements for testing in the 11608A are met. Examples where the stripline board may need to be manufactured are: (1) when the desired dielectric has a different dielectric constand from 2.35, or (2) if a wider conductor stripline is desired. (See Appendix I for further details.) Through-line and shorting calibrators must also be manufactured if special stripline boards are made. Modified empty transistor cases can be used as calibrators for low-precision measurements; however, precision calibrators are not difficult to construct.

OPERATING PRECAUTIONS

The transistor under test may be damaged if the following precautions are not observed.

Switching Transients

Microwave transistors may be damaged by switching transients while testing. These switching transients may be caused by changing the switches on the power supply while in operation or by turning the power supply on and off. ***Avoid switching transients while testing.*** Turn down input circuit bias voltages or currents before switching bias-supply meter functions. Also, turn down the input circuit control and then bring it up to operating conditions rather than merely switching the bias supply output off and on. If supplies are merely switched off and on, switching transients may damage sensitive transistors. If the power supplies are programmed, include a zero-voltage or current program step before changing the voltage or current setting.

Turn Off Bias Before Opening 11608A Lid

Always turn off the bias supply before opening the 11608A lid by turning down the bias supplies. The transistor is held in contact by the lid. If the lid is opened before turning down the bias supplies, the transistor may be damaged.

Straightening Ribbon Contact Strips

If the ribbon contact terminals of either transistors or calibrators get bent, straighten with a pair of tweezers so they make good contact.

Test Device Alignment

When installing either a transistor or a calibrator into the fixture, make sure that the device under test is properly aligned before closing the lid. Damage to the device under test may occur if the lid is closed when the device is improperly aligned.

Cleaning Stripline

CAUTION

Do not touch either stripline or calibrators with the fingers as performance will be degraded. Handle calibrators only with tweezers as instructed in paragraph titled calibrators. Clean calibrators and stripline only with alcohol.

Table 3. Calibrator Reference Indications

S-Parameter	Termination	Magnitude	Phase
S_{11}, S22	Open	1.0	Approximately 0”
S_{11}, S22	Short	1.0	180”
S_{21}, S12	Through line	1.0	0°

Preliminary Considerations. Before connecting any bias, the following steps should be performed:

a. Determine the maximum allowable voltages and currents for both input and output circuits of the transistor under test.

b. Draw a simplified schematic circuit of the transistor in the test fixture. Label input circuit "Port 1 circuit" and output circuit "Port 2 circuit", The common point between the two circuits will be grounded in the 11608A.

c. Determine the polarities of the input and output (bias voltages).

d. Determine order in which input and output voltages should be applied. With bipolar transistors the output voltage should be applied first. With FET's the order will depend upon the type (enhanced or non-enhanced gate). Consult the manufacturer's instructions for further details.

Connecting and Adjusting the Bias. The bias supplies can be connected with either the input or output circuit voltage connected to either port terminal. The input bias voltage is normally connected to Bias Tee No. 1 and the output bias voltage is normally connected to Bias Tee No. 2. This convention will make the normal (forward-gain) signal (S_{21}) flow from left to right in the 11608A.

CAUTION

The following instructions are for bipolar transistors (PNP or NPN). Some field-effect transistors may be damaged by applying bias in this order. Therefore, always read the manufacturer's biasing instructions before testing field-effect transistors. Great care should be taken when setting the bias levels to ensure that excess voltage, switching transients, or loose connections do not cause burnout of sensitive devices under test.

Capacitor Discharge

If the 11608A is used without an RF path-switching transducer, such as the Model 8746B S-Parameter Test Set, take care not to discharge auxiliary equipment, such as bias networks, through the transistor. When connecting auxiliary equipment to measure another s-parameter, any electrical charge on the auxiliary equipment may damage the transistor under test. Make sure auxiliary equipment has bleeder resistor to discharge residual charge.

Calibrators

Turn the bias supply voltages to zero before inserting the calibrators. If this is not done, the power supply may be damaged or a fuse in the 8746B S-Parameter Test Set may be blown. Handle calibrators with care. Measurement accuracy depends upon accurate calibration. If the calibrator is damaged, accuracy may be degraded. Perhaps the most practical method of handling calibrators is to use tweezers and handle only the body of the calibrators. If a shorting calibrator is unavailable, an open (no calibrator) can be used with slightly less precise calibration. Table 3 lists the reference indications of the calibrators.

Precautions when Using a Dual DC Power Supply

When using a dual dc power supply, additional circuitry to protect the transistor under test may be needed. Refer to the transistor manufacturer's biasing instructions for further details.

Seating the Device Under Test

Be sure the device under test (calibrators or transistors) is firmly seated in the well in the center of the stripline and the ribbon leads are flat and aligned over the conductors before closing the lid.

OPERATION

Biasing

Transistors in the 11608A can be biased with either the Hewlett-Packard Model 8717B Transistor Bias Supply or by a dual dc power supply. Observe the precautions listed under OPERATING PRECAUTIONS when operating any power supply. When using the Model 11608A with the 8746B, refer to the Model 8746B Operating and Service Manual for instructions concerning the use of either the Model 87178 or a dual dc power supply. For instructions using the 11608A without the 8746B, refer to the following.

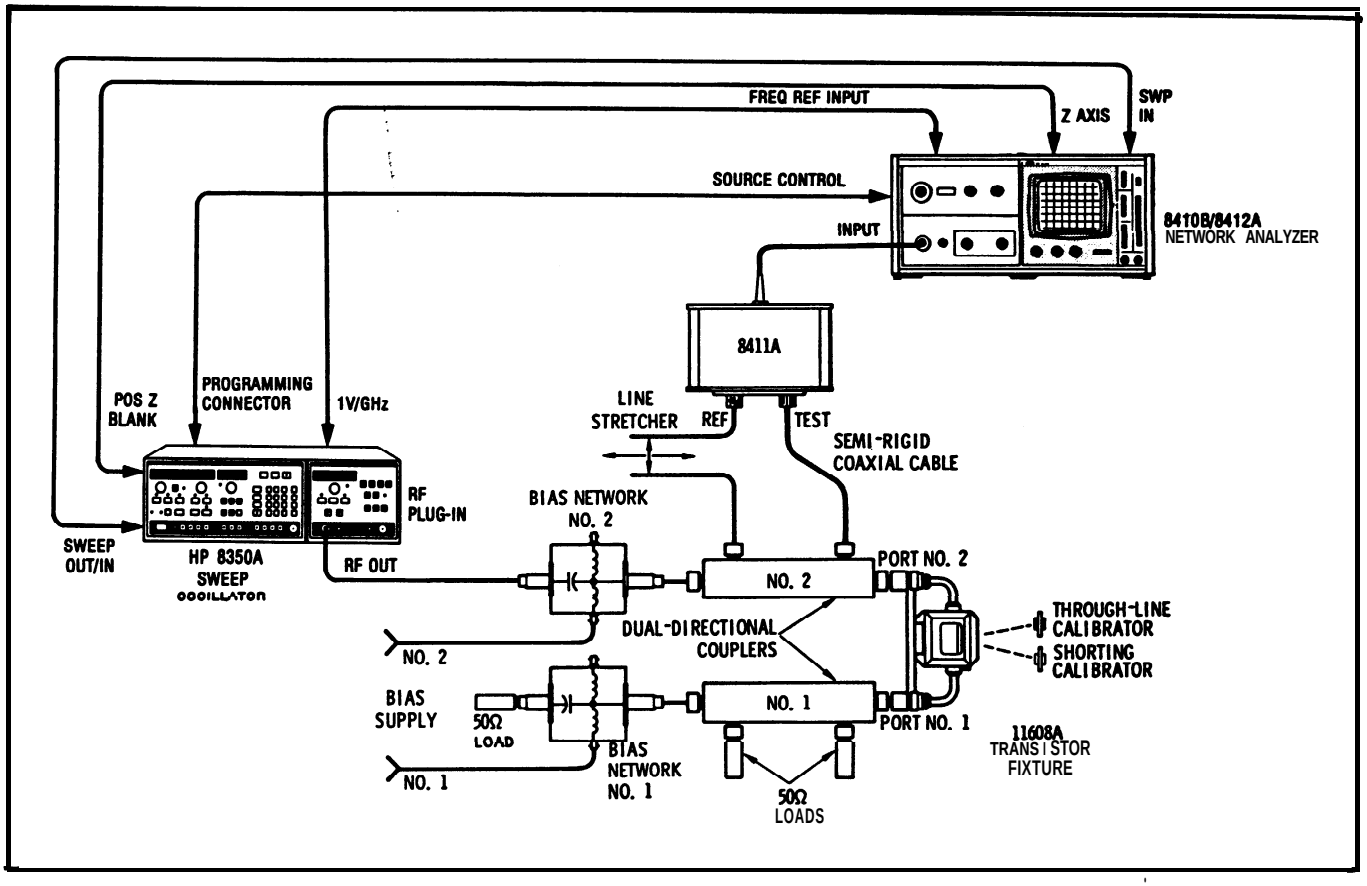


Figure 4. Block Diagram of Measurement Setup Using Model 841 OB Network Analyzer

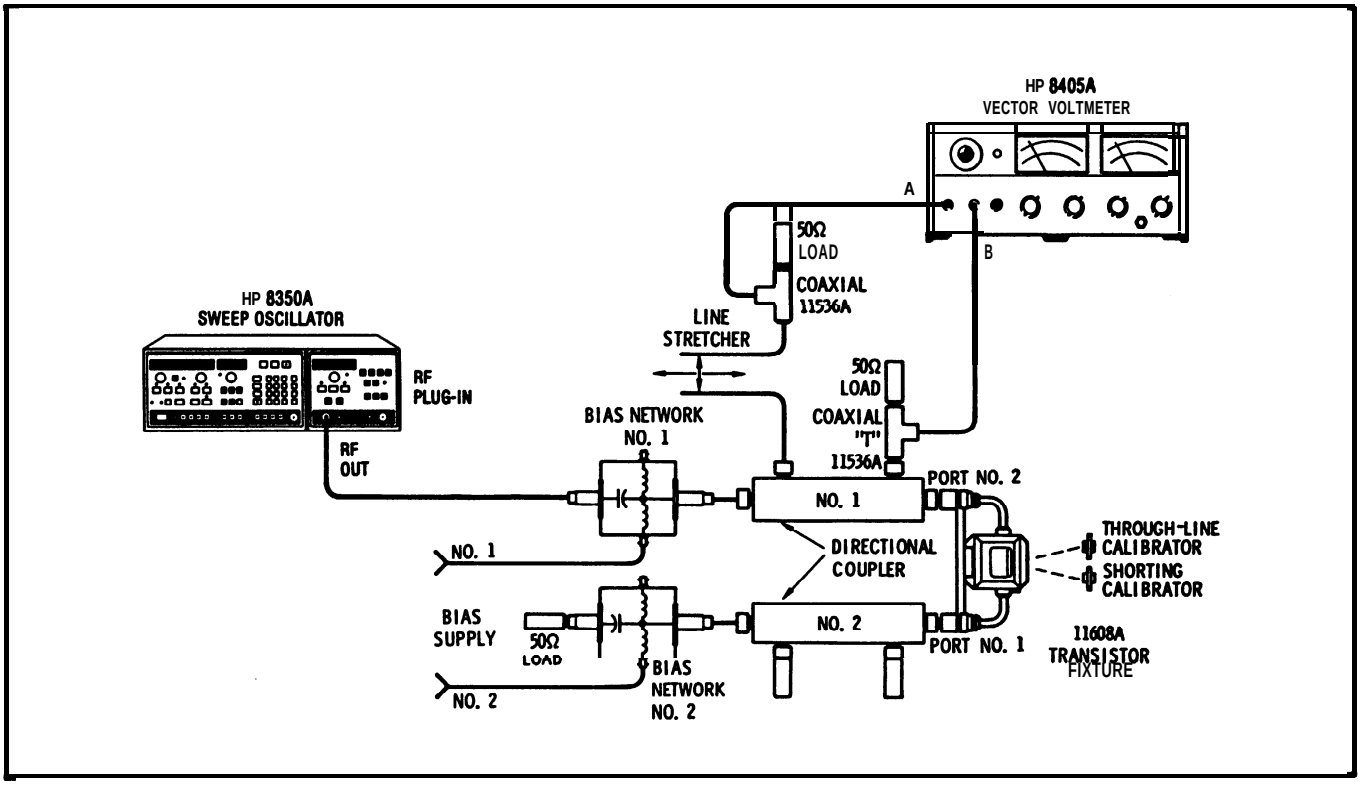


Figure 5. Block Diagram of Measurement Setup Using Model 8405A Vector Voltmeter

To connect bias to the transistor fixture, proceed as follows:

CAUTION

Biasing procedures must be selected and performed carefully. If this is not done, sensitive transistors may be damaged. Good practice is to try out biasing procedures on similar, but inexpensive, transistors first.

a. Connect the equipment as shown in Figure 4 when using a Model 8410B Network Analyzer System or in Figure 5 when using a Model 8405A Vector Voltmeter. Both figures show the S_{22} configuration. For other configurations the equipment must be rearranged as shown in Figure 6 or 7.

b. Determine the bias-voltage polarity for the device being tested and make connection to the bias supplies.

c. Set both power supplies to zero volt output and turn both supplies on.[1]

d. Place the device under test in the 11608A with input lead to the left and output lead to the right. Be sure ribbon leads are straight and contact the fixture.

e. Hold device under test firmly in contact with the stripline by closing the 11608A lid.

CAUTION

When applying bias, make sure operating limits are not exceeded either in a steady-state condition or by switching transients, such as occur when the power supply is turned on or off. If this is not done, delicate transistors may be damaged.

f. Turn off bias.

CAUTION

Always turn bias off before opening 11608A lid. If this is not done, delicate transistors may be damaged.

g. Open 11608A and remove transistor.

[1] **When using the Hewlett-Packard Model 8717A, turn base supply to zero volts output and then reduce the collector I_E AMPL supply to 0.1 to 0.3 volt. If the collector supply is turned to zero volt, the collector-base junction may become forward-biased and draw excessive current. If difficulty is encountered setting 0.1 to 0.3 volt, contact your nearest Hewlett-Packard office for further information.**

PERFORMANCE TESTS

The performance tests can be used for incoming inspection and periodic evaluation. Limits against which the transistor fixture is tested are given in Table 1, Specifications. Table 4 is a list of recommended test equipment. Other equipment may be substituted, provided their specifications meet or exceed the critical specifications listed in the table.

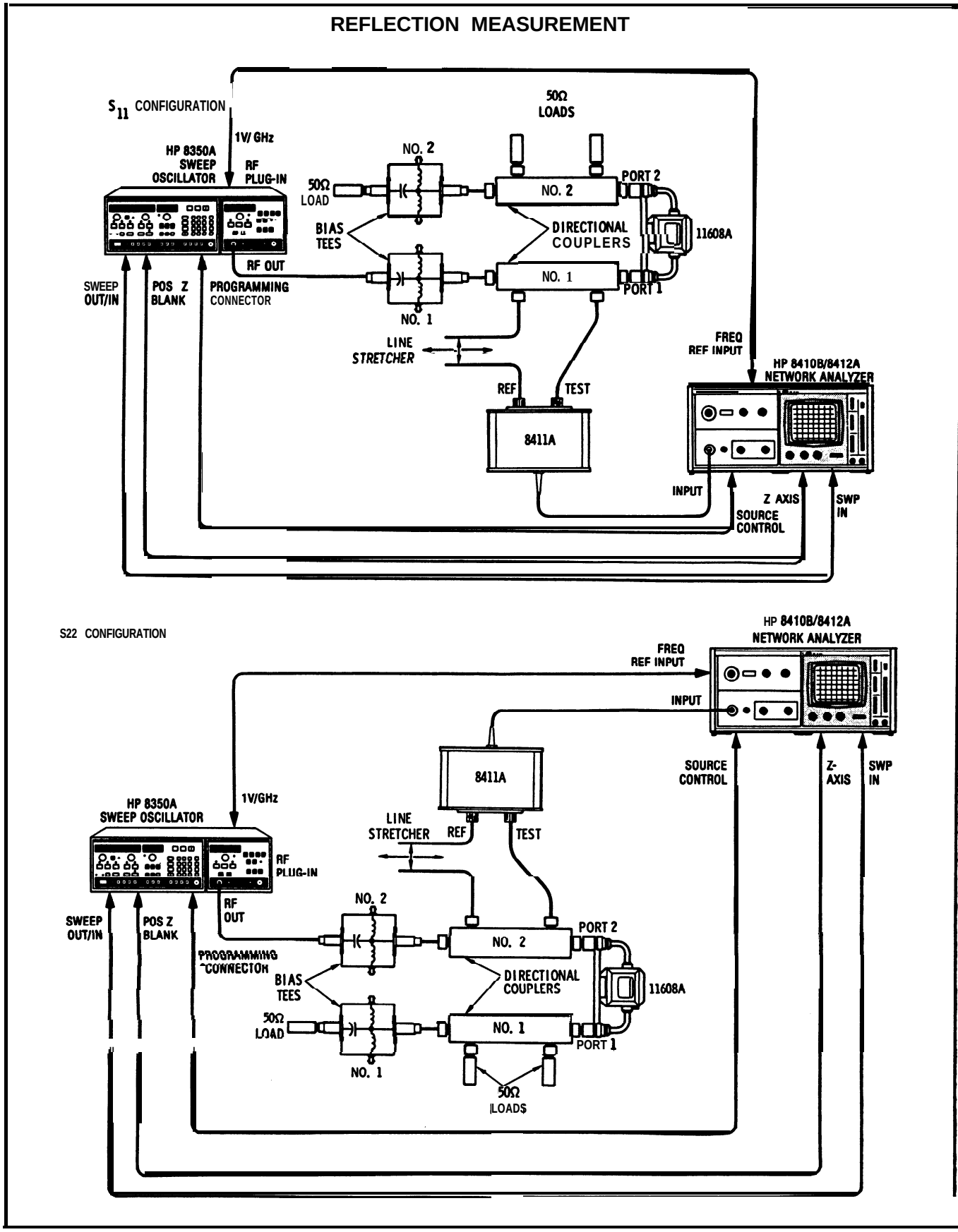


Figure 6. Reflection Measurement Procedure (Sheet 1 of 2)

REFLECTION MEASUREMENT

CALIBRATION

1. Connect equipment for S_{11} or S22 as shown in Figure 6.

2. Set up the bias power supplies as instructed in the paragraph CONNECTING AND ADJUSTING THE BIAS with the bias supply outputs turned down. Install the shorting calibrator in the 11608A. (The shorting calibrator is the calibrator made completely of metal.)

3. Set the Sweep Oscillator to sweep the frequency band of interest.

4. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band selected.

5. Adjust the Network Analyzer TEST CHANNEL GAIN and AMPLITUDE VERNIER controls for an amplitude reference on the display unit:

a. For **8412A,** adjust for a convenient amplitude reference (preferable 0 **dB).**

b. For **8414A,** adjust for a reflection coefficient of 1.0 (outer graticule circle).

6. Adjust line stretcher to obtain equal reference and test channel electrical lengths:

a. For **8412A,** adjust for horizontal phase trace.

b. For **8414A,** adjust for dot or smallest cluster.

7. Adjust Network Analyzer PHASE VERNIER control:

a. For **8412A,** adjust for a convenient reference. (Set DEGREES control to 180 degrees. Always return to 0 degrees before making a measurement.)

b. For **8414A,** adjust for calibrator reference of 180 degrees.

MEASUREMENT

1. Remove the calibrator from the Transistor Fixture and install transistor with output lead pointing to the right.

CAUTION

Observe **precautions in OPERATING PRECAUTIONS paragraph.**

2. Adjust transistor bias. (See CONNECTING AND ADJUSTING BIAS paragraph for instructions concerning bias-supply operation.)

3. Read magnitude and phase from the display indicator.

CAUTION

Always turn bias down before opening 11608A lid.

Figure 6. Reflection Measurement Procedure (Sheet 2 of 2)

TRANSMISSION MEASUREMENT

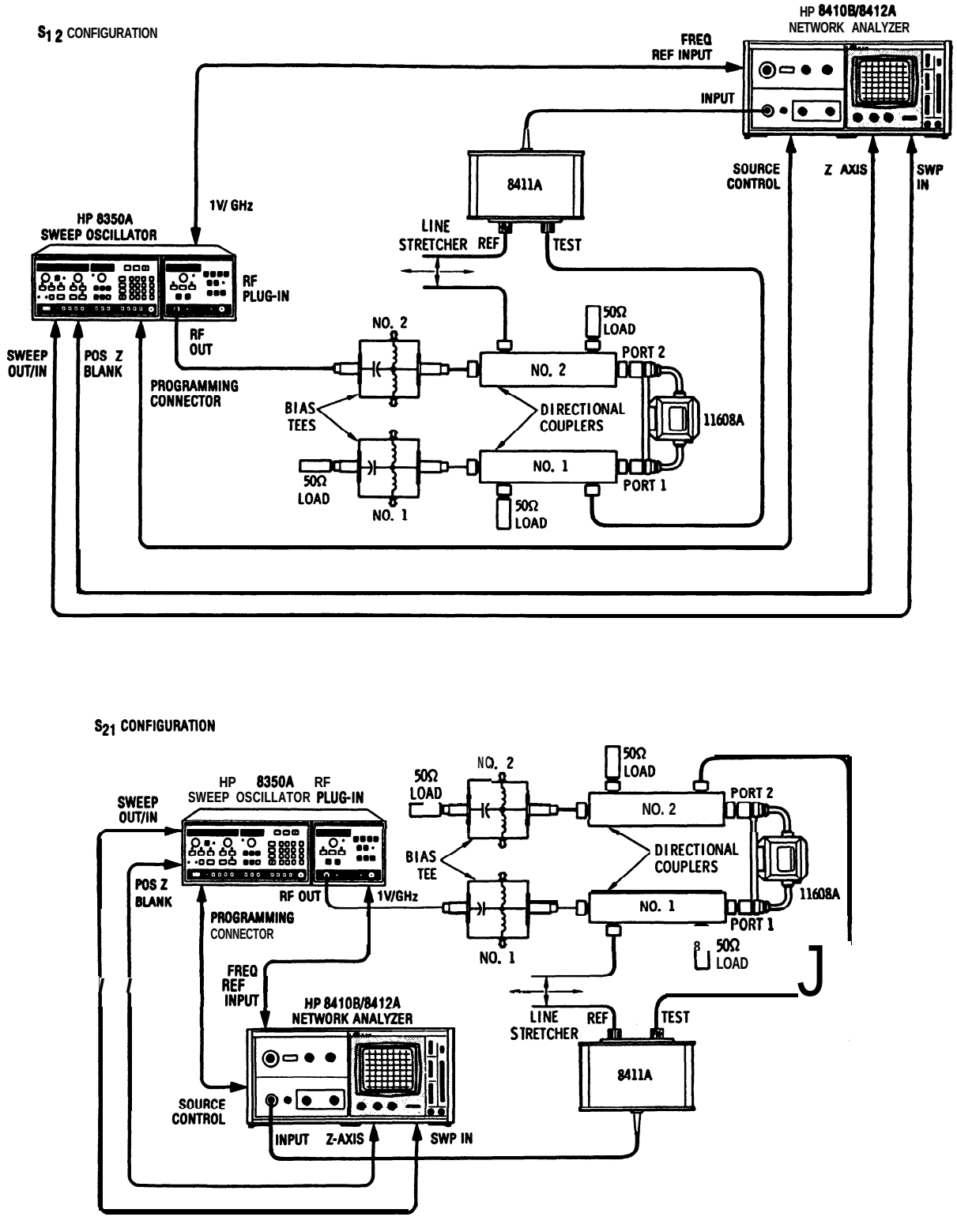


Figure 7. Transmission Measurement Procedure (Sheet 1 of 2)

TRANSMISSION MEASUREMENT

CALIBRATION

1. Connect the equipment for S_{21} or S_{12} as shown in Figure 7.

2. Set up the bias power supplies as instructed in the paragraph CONNECTING AND ADJUSTING THE BIAS with the bias supply outputs turned down. Install the through-line calibrator in the 11608A. (The through-line calibrator is the calibrator made partly of metal and partially of dielectric.)

3. Set the Sweep Oscillator to sweep the frequency band of interest.

4. Adjust the Sweep Oscillator and Network Analyzer controls to phase lock the Network Analyzer over the frequency band selected.

5. Adjust the Network Analyzer TEST CHANNEL GAIN and AMPLITUDE VERNIER controls for an amplitude reference on the display unit:

a. For 8412A, adjust for a convenient amplitude reference (preferable 0 dB).

b. For 8414A, adjust for a reflection coefficient of 1.0 (outer graticule circle).

6. Adjust line stretcher to obtain equal reference and test channel electrical lengths:

a. For 8412A, adjust for horizontal phase trace.

b. For 8414A, adjust for dot or smallest cluster.

7. Adjust Network Analyzer PHASE VERNIER control:

a. For 8412A, adjust for a convenient reference,

b. For 8414A, adjust for calibrator reference of 0 degree.

NOTE

Two transistor calibrators are used for calibration: a short for reflection, and a through-line for transmission. The through-line calibrator does not calibrate to the edge of the transistor case directly, as the short does. The transmission calibration reference plane is half-way between the two input ports.

8. For transmission calibration only (using the through-line calibrator) move the measurement plane to the edge of the transistor case by decreasing the reference channel length the amount of the offsetting calibration value. On HP line stretchers, this is accomplished by turning the extension adjustment crank counterclockwise the offsetting value. The through-line offsetting calibration value is given in Table 2. This value is the calibrator's overall electrical length. When using the Model 8746B S-Parameter Test Set, the change in reference channel line-length is twice the change in the REFERENCE PLANE EXTENSION counter indication. Therefore, the counter should be changed by an amount of one-half the calibrator overall length given in Table 2.

MEASUREMENT

1. Remove the calibrator from the Transistor Fixture and install transistor with output lead pointing to the right.

CAUTION

Observe precautions in OPERATING PRECAUTIONS paragraph.

2. Adjust transistor bias. (See CONNECTING AND ADJUSTING BIAS paragraph for instructions concerning bias-supply operation.)

3. Read magnitude and phase from the display indicator.

CAUTION

Always turn bias down before opening 11608A lid.

Figure 7. Transmission Measurement Procedure (Sheet 2 of 2)

PERFORMANCE TESTS

Insertion Loss

Specification:

0.15 dB + .04 (frequency in GHz)

Description:

The 11608A insertion loss is measured by calibrating the equipment for reflection coefficient, then measuring the return loss at one 11608A port with the other port terminated in' a coaxial short. The measured return loss is four times the 11608A insertion loss from one port to the center of the 11608A.

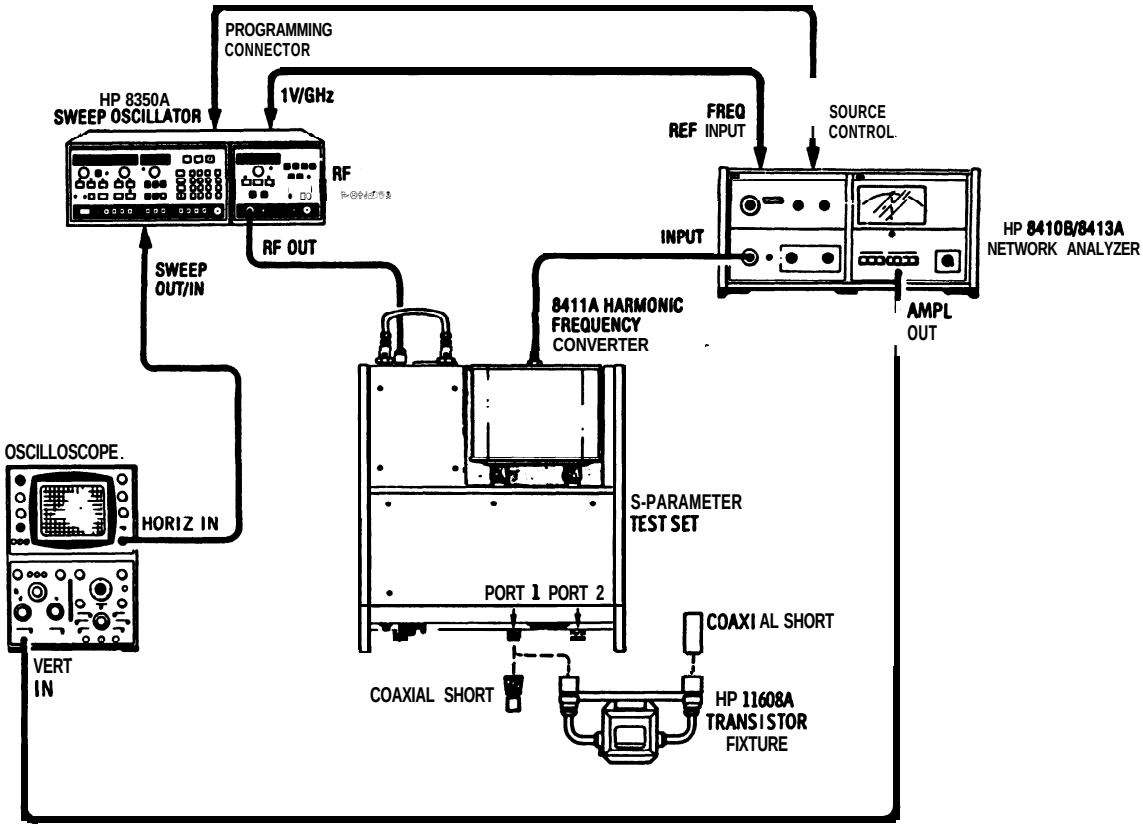


Figure 8. Insertion Loss Measurement Equipment Setup

Equipment:

Sweep Oscillator	HP Model 8350A with RF unit as required
Network Analyzer	HP Model 8410B with 8413A Phase-Gain Indicator
Harmonic Frequency Converter	HP Model 8411A
Oscilloscope	HP Model 180A
Coaxial Short	HP Model 11565A
S-Parameter Test Set	HP Model 8746B

PERFORMANCE TESTS

Procedure:

Calibration

a. Connect the equipment as shown in Figure 8 with the coaxial short connected to the 8746B measurement port.

b. Set the sweep oscillator for automatic sweep over the band of interest.

c. Select S_{11} when measuring at 8746B Port 1 or S_{22} when measuring at Port 2.

d. Adjust the Sweep Oscillator, Network Analyzer, and Oscilloscope controls to obtain a swept-amplitude display over the frequency band of interest.

e. Calibrate the oscilloscope vertical sensitivity for maximum resolution which will allow the trace to remain on the display. Do not adjust controls after this step.

f. Draw over the trace on the face of the oscilloscope CRT with a grease pencil.

g. Remove the coaxial short and draw over the trace of the open circuit on the face of the CRT with a grease pencil.

h. Draw an average trace half-way between the two traces. This is the calibration trace. Erase other two traces.

Measurement

i. Connect 11608A, with a through-line calibrator inserted, to the measurement port. Terminate the other 11608A port with the coaxial short.

j. Draw over the trace on the face of the CRT with a grease pencil.

k. Remove the coaxial short and draw over the trace on the face of. the CRT with a grease pencil.

l. Draw an average trace half-way between the two measurement traces. This is the measurement trace. Erase other two measurement traces.

m. The difference between the calibration trace and the average of the two measurement traces should be less than 0.6 dB + 0.16 (frequency in GHz), or four times the 11608A insertion loss from one port to the center of the 11608A.

For greater resolution at single frequencies, proceed as follows:

Calibration

a. Set the Sweep Oscillator for CW operation at the frequency in question.

b. Select S_{11} when measuring at 8746B Port 1 or S_{22} when measuring at Port 2.

c. Set the Model 8413A to read amplitude with 3 dB full-scale sensitivity.

d. Alternately connect and disconnect the coaxial short from the measurement port while observing the Model 8413A meter. Adjust the Network Analyzer controls so that the average reading is zero. Do not adjust controls after this step.

Measurement

e. Connect 11608A, with a through-line calibrator inserted, to the measurement port.

f. Alternately connect and disconnect the coaxial short from the 11608A while observing the Model 8413A meter. The average of the meter indications should be less than 0.6 dB + 0.16 (frequency in GHz) or four times the 11608A insertion loss from one port to the center of the 11608A.

Table 4. Recommended Test Equipment

Instrument	Critical Specifications	HP Model No.	Use[1]
Sweep Oscillator	Frequency: band of interest Power Output: >10 mW	Model 8350A with: Model 83522A (10 MHz to 2.4 GHz) Model 83525A (10 MHz to 8.4 GHz) Model 83592A (10 MHz to 20 GHz)	A, P
S-Parameter Test Set	Frequency: to 12.4 GHz Directivity: 30 dB, 0.5 to 4 GHz 26 dB, 4 to 12.4 GHz Works with 8410A/8411A	Model 8'746B	P
Network Analyzer	No substitute may be used	Model 8410B/8411A	P
Harmonic Frequency Converter	No substitute may be used	Model 8411A	P
Phase-Gain Indicator	No substitute may be used	Model 8413A	P
Oscilloscope	Frequency: 450 kHz Sensitivity: 10 mV/cm Sweep: external trigger	Model 180A with 1801A	P
Coaxial Short	Connector: APC-7	Model 11565A	P
Time-Domain Reflectometer	System Rise time: ≤35 picosec Accuracy: ±3% Input: 50Ω feedthrough	Model 180A with 1815A/1817A/1106A	A, T
Air Line (2 each)	Length: 20 cm Impedance: 50Ω VSWR: ≤1.05	Model 11567A	A, T
Coaxial Load	Impedance: 50Ω VSWR: ≤1.01, DC to 2 GHz ≤1.05, 2 to 12.4 GHz	Model H05-909A	A, T

[1] A = Adjustment, P = Performance Testing, and T = Troubleshooting

TROUBLESHOOTING

Troubleshoot the Model 11608A Transistor Fixture using a Time Domain Reflectometer (TDR). If the TDR display shows a discontinuity at the transition from coax to stripline, adjust the tuning screws as described in Appendix I under ADJUSTMENT.

REPAIR

APC-7 Type Connectors

Replacement inner conductor contacts are available from Hewlett-Packard (Part No. 12504907) and from Amphenol RFD Division, Danbury, Connecticut (Part No. 131.129).

Important precautions that apply to the replacement of inner conductor contacts are these:

a. Do not disassemble the connector.

b. Do not attempt to repair contacts.

c. Do not reuse contacts that have been removed from the connector.

A self-positioning, hypodermic-action, **contact-extractor tool** (HP Part No. **5060-0236)**[1] is available **for removing the inner conductor contact. No tool is required when installing a replacement contact. Insert the contact** gently by hand, applying **only enough inward pressure to snap it in** place. Then check for proper installation by inspecting the contact with a magnifying glass for even spacing of its four segments. Also, test for **normal spring-action by applying a light inward pressure against the end of** the contact with the **eraser on the end of a pencil.** As **the pressure is released the** contact's spring action should cause it to move outward. If not, the contact is defective and should be replaced.

FIXTURE DISASSEMBLY

To disassemble the transistor fixture, refer to Figure 9 **for parts** identification and proceed as follows:

a. Loosen ferrule nuts (24) on 'the cable connector (both sides), and the ferrule nuts connected to the 11608A body (26) if they are to **be removed.**

b. Remove the two screws (1) in the sup port bar (4).

c. Slide the support **bar** and connector assemblies off the two cables while holding the cables themselves rigid. Completely unscrew the ferrule nuts at the **Transistor Fixture body. The outer conductor of the cable will now be free but the inner conductor is still soldered to the strip line on the** stripline **board. Before the coaxial** cable can be completely removed, the inner con**ductor must be unsoldered from the stripline board.**

CAUTION

Do Not use a soldering iron with a temperature higher than 450° F. Test the soldering iron tip against the edge of the stripline board. If the soldering iron melts the edge of the board, the soldering iron is too hot.

[1]Part of APC-7 connector tool kit. 11591A.

d. Using a clean, well-tinned **low-**temperature soldering iron, unsolder the center conductor of the cable while gently pulling the cable outward from the stripline.

CAUTION

Do Not **at any time apply force to the center conductor tab, as it bends easily.**

e. Loosen the two tuning screws in the base of the 11608A to prevent damage to the bottom of the stripline when removing stripline.

f. Remove the screws holding the **stripline** and lift the stripline out.

g. Remove the ground contact.

FIXTURE ASSEMBLY

To assemble the transistor fixture refer to Figure 9 for parts identification and proceed as follows:

NOTE

This assembly procedure assumes the stripline board and ground contact are already in the fixture. If either the stripline or ground contact has been removed, refer to the paragraph marked INSTALLING THE GROUND CONTACT AND STRIPLINE in Appendix I.

a. Insert cables (25) with ferrule nuts **(26),** ferrules **(27),** and spring washers (28) into the fixture and tighten finger-tight.

b. Flatten a piece of **360° F** solder as thin as possible and trim to size of center conductor **or use a solder** insert. Place solder between strip line and tab. Apply a ***small*** amount of rosin flux to the tab.

c. While holding the tab down with a pair of tweezers or small screwdriver, apply heat with a low-temperature soldering iron. When cool, clean off any excess flux with soap or **detergent and water or** methanol.

d. Install connector assembly onto cables **by** first pushing the cable assembly into the center conductor receptacle and then tightening the ferrule nuts (24) finger-tight.

e. Install support bar (4) using two **posi-**drive screws **(1)** and tighten screws to provide support for cables.

f. Tighten ferrule nuts (26) and (24).

g Adjust the two tuning screws in the base of the 11608A. Refer to the paragraph TDR ADJUSTMENT PROCEDURE in Appendix I for the adjustment procedure.

Stripline Removal

To remove the stripline only, proceed as follows:

a. Apply low-temperature soldering iron to a center conductor tab.

CAUTION

Do *Not* use a soldering iron with a temperature higher than 450° F. Test the soldering iron tip against the edge of the stripline board. If the soldering iron melts the edge of the board, the soldering iron is too hot. If this precaution is not taken, the stripline or center conductor tabs may be damaged.

b. With a desoldering tool*, remove the solder underneath the tab.

c. Using a piece of fine copper wire, pull up gently on the tab to free it.

d. Loosen tuning screws in base of 11608A several turns.

e. Remove the screws holding the stripline.

f. Slide the board gently from beneath the tab.

Stripline Insertion

If only the stripline needs replacement, proceed as follows:

a. On a new stripline board, trim approximately 1/2 the width from the two trim tabs (Figure I-6) with a knife. (This adjusts for approximately *50* ohms at each end of the strip line.)

b. Slide the stripline in place under the center conductor table.

c. Insert screws and tighten to hold strip line in place.

d. Flatten a piece of 360°F solder as thin as possible and trim to size of center conductor tab or use solder insert. Place solder between stripline and tab. Apply a *small* amount of rosin flux to the tab.

e. While holding the tab down with a pair of tweezers or small screwdriver, apply heat with a low-temperature soldering iron. When cool, clean off any excess flux with soap or detergent and water or methanol.

f. Adjust the two tuning screws in the base of the 11608A. Refer to the paragraph TDR ADJUSTMENT PROCEDURE in Appendix I for the procedure.

REPLACEABLE PARTS

An exploded view parts list (Figure 9) for parts identification is included at the end of this operating note. The parts considered replaceable are identified there.

Parts Ordering Information

To obtain replacement parts, address order or inquiry to your local Hewlett-Packard office. Identify parts by their Hewlett-Packard part numbers. To obtain a part not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of part.

d. Function and location of part.

---

[1] Soldapullt Desoldering Tool, Manufactured by Edsyn Inc.. Pacoima, Ca.

Replaceable Parts (1 of 2)

Item numbers are keyed to the numbers in Figure *9*

Item	Description	HP Part No.
1	Machine Screw: FH SS 6-32 x .5	2360-0185
2	Nameplate	7120-2448
3	Connector: (Hybrid APC-7)	11608-20004
4	Support Bar	11608-20006
5	Screw: Machine FH Posi-Drive SS 2-56 x .312	0520-0165
6	Fixture Top	11608-20037
7	Latch	11608-20012
8	Screw: Machine 2-56 x 1/4 Pan Hd Posi-Drive w/Lock	0520-0174
9	Mode Suppressor	11608-40001
10	Transistor Clamp Assembly: Includes item 11	11608-60023

(cont overleaf)

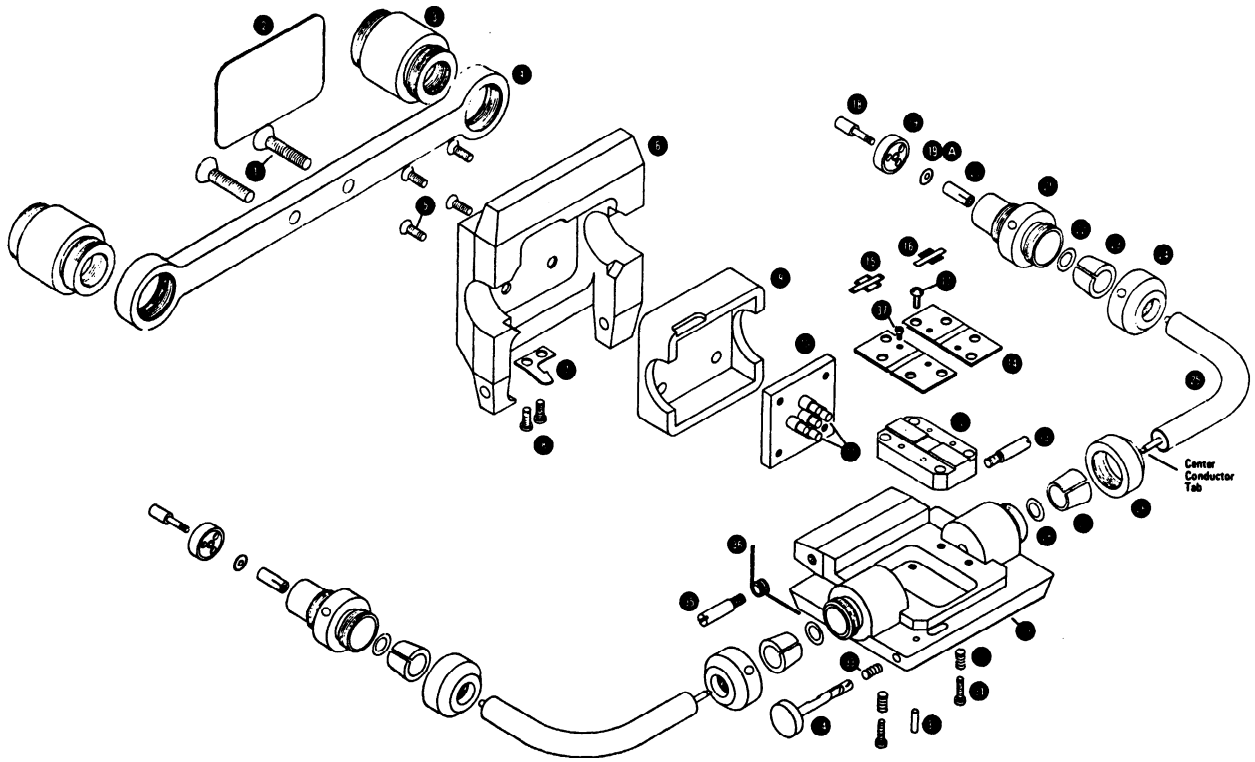


Figure 9. Replaceable Parts

Replaceable Parts (2 of 2)

Item	Description	HP Part No.
11	Clamp: Rubber	11608-20016
12	Ground Contact: Standard (unmachined)	11608-20028
	Option 003 (K-Disc)	11608-20034
13	Hinge Pin	11608-20014
14	Stripline Board: Standard (unmachined)	11608-20054
	Option 003 (K-Disc)	11608-20055*
15	Calibrator: Shorting Standard	Machined by user
	Option 003 (K-Disc)	11608-20032
16	Calibrator: Thru-Line Standard	Machined from 11608-20057
	Option 003 (K-Disc)	11608-60056
17	Screw: Machine SS Pan Head 2-56 x 0.375	0520-0130
18	Contact Assy: Center	1250-0816
19	Insulator: Bead	5040-0306
19A	Shim, 2 mil	08742-0005
20	Cable Terminator: 'Center Conductor	08741-2010
21	Cable Terminator: Outer Conductor	11608-20008
22	Washer: Spring	5000-8676
23	Ferrule	11608-20010
24	Nut: Ferrule	11608-20009
25	Bend: 90° Coaxial Cable	11608-20003
26	Nut: Ferrule	11608-20009
27	Ferrule	11608-20010
28	Washer: Spring	5000-8676
29	Body: Fixture	11608-20036
30	Spring: Compression	1460-1224
31	Screw: Machine 0-80 x 1/4	0516-0006
32	Pin: Spiral Drive 1/16 OD x 0.25 'long	1480-0073
33	Spring: Compression	1460-0298
34	Rod: Latch	11608-20011
35	Pin: Hinge	11608-20014
36	Spring: Torsion	1460-1237
37	Screw: Machine 2-56 x 3/16 Fillister Head Nylon	0520-0021
Not shown	Solder Insert (for soldering stripline). (Consists of a flat piece of solder the same width as the stripline)	8090-0047
Not shown	Solder (in roll form). (Specify 63% tin 37% lead eutectic solder)	Not sold by HP
Not shown	Spanner Wrench: Face Hybrid APC-7 Connector	5060-0237
Not shown	Spring: Compression	1460-0298

*These items must be replaced in pairs if going from earlier PPO or rexolite insulating materials to RT/duroid.

APPENDIX I
MACHINING STANDARD 11608A TRANSISTOR FIXTURE

NOTE

Repairs required as a result of customer modifications to the 11608A will not be covered under warranty.

INTRODUCTION

This appendix consists of information for machining the Standard Model 11608A Transistor Fixture (See Figure I-l). This configuration is designed to be machined by the customer to fit his particular needs when the standard commercially-available options are not suitable for his application. Refer to PRELIMINARY CONSIDERATIONS to determine if the Standard 11608A is suitable. If the Standard 11608A is suitable, read the entire Appendix I before commencing machine work.

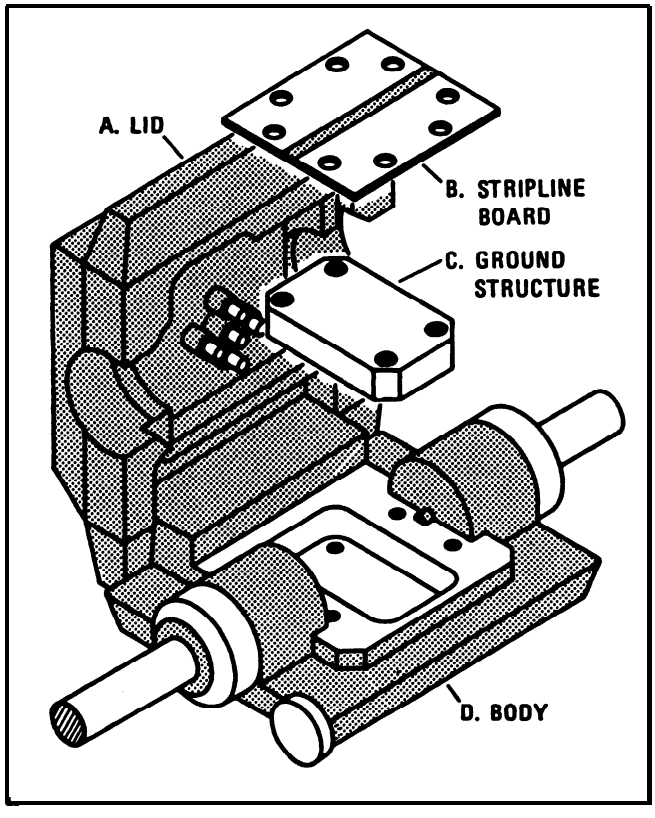


Figure ***I-l. Standard 11608A, Exploded View***

Exact instructions are not included but design considerations plus drawings for Option 003 have been included to show typical cases.

PRELIMINARY CONSIDERATIONS

Transistor configuration requirements for testing using the Standard 11608A are as follows:

a. Inputoutput leads must be in line. To fit the Standard **11608A,** the stripline leads for input and output must be in line.

b Lead width must be less than **.086** inch. Wider leads cannot be used with the Standard dielectric for **a 50-ohm** impedance.

c. Maximum lead length must fit in a **one-**inch square. Total overall length in both planar dimensions must be less than one inch.

d. Transistor package body diameter must be less than 0.45 inch. This restriction is necessary to use the clamp in the lid.

e. Transistor package body thickness must be less than 0.20 inch. This is the maximum thickness without machining the 11608A body. The 11608A body may be machined, for instance for stud-mounted transistors.

REQUIREMENTS FOR TESTING NON-STANDARD COMPONENTS

Certain requirements are necessary for any component to be tested in the Model **11608A.** First, it must fit the fixture physically. Secondly, the component under test must be able to be clamped in the 11608A and must make good contact on all leads including grounds. In addition, the electrical properties of a **50-ohm** transmission line must be maintained.

Physical Dimensions

Overall Dimensions. The overall dimensions of the component under test, including lead lengths, must not be over 1.00 inch in both planar dimensions. While the board is slightly wider than one

inch, the board must fit under the center-conductor tabs so the useful dimension is 1.00 inch in both directions.

Thickness Beneath Stripline Board. The removable ground-contact is machinable to a depth of 0.200 inch. Therefore, the maximum depth of the component under test below the stripline board is 0.234 inch (0.200 inch ground-contact cavity plus 0.034 inch thickness of the board with copper conductors). This cavity can be deeper if the 11608A body itself is machined, for example, for stud clearance.

Width of Leads. The width of the conductor on the Standard stripline board is .087 inch. Leads of devices under test must be narrower than this to maintain the 50-ohm transmission line impedance. If wider lead devices are used, a thicker stripline board could be made which has a wider conductor. Higher frequency performance (greater than 6 GHz) will be degraded somewhat as larger stripline geometries are used.

Lead Configuration

The leads of the component under test must be stripline and the input and output leads must be in line. Other leads or the case of the device under test must be grounded for testing purposes.

Clearance for Tuning Screws

Two screws, which fit into the bottom of the fixture, can be varied in position to adjust shunt capacitance on both ends of the stripline. These tuning screws primarily affect operation above 4 GHz. On the Standard 11608A, a small cutout in the plating and dielectric on the lower side of the stripline board allows adjustment of each screw without grounding. If you make your own stripline, it should have a similar pair of cutouts. See dimension drawing for the Standard 11608A.

Clamping the Component Under Test

Using Lid of 11608A. The component under test must be held in good electrical contact with a fixture. The usual method of doing this is with the lid of the 11608A. Silicone rubber clamps hold each of four possible stripline leads to the fixture. In addition, there is a rubber clamp to hold down the component under test. If the component under test is too thick or fragile, the center clamp may be removed with a pair of diagonal-cutting pliers. If clamp spacing other than that of the standard clamp is desired, a new holder can be machined to the desired spacing. In addition to holding the component under test in good contact with a fixture, another function of the lid is shielding. The lid has polyiron inserted in it to act as a mode suppressor for optimum high-frequency operation.

Using an External Clamp. If it is desired to use an external clamp (not in the lid of the 11608A) be sure that all of the above requirements are met. Also, while a majority of the field in a strip line is between the center line and the nearest ground (bottom coating of stripline board) some of the field goes to the lid and allowance for this must be made. The clamp adds capacitance, which must also be considered.

Electrical Requirements

Preserving Transmission-Line Characteristics. Any component-testing fixture for the HP network analyzer system must preserve the electrical properties of a 50-ohm coaxial transmission line. This means that any fiiture must not introduce any discontinuities into the transmission-line configuration either by an abrupt change in path or by varying from 50-ohms impedance.

Any change of conductor dimensions should be done gradually. If the transistor is to be clamped, as in the Hewlett-Packard available fixtures, the line should taper slightly towards the center to allow for the added shunt capacitance introduced by the clamp.

In addition to preserving a smooth electrical continuity in the conductors, the impedance of the line must be maintained. The impedance is determined by the surface of the center conductor (stripline) exposed, the proximity of the outer conductor (ground), and the dielectric constant of the material in between. The dielectric of the Standard stripline is RT/duroid having a dielectric constant of 2.35 ±.02. This dielectric board is .0310 ±.0007 inch thick. Use a milling cutter to work this board, since nicks and cuts in dielectric are also electrical discontinuities which will degrade performance.

Grounding. Good grounding of devices under test is essential for characterization of the devices. Thus, ground contact should be made as near as possible to the transistor itself to avoid

excess lead inductance. However, if it is desired to duplicate an actual operating condition, the test fixture should duplicate as nearly as possible the conditions under which the component will actually operate. Thus, if the ground for the component in actual use is some distance from the component, the ground on the test fixture can be made the same distance away. Also note that the stripline board is coated with copper on both sides. (The under side acts as a ground plane for the stripline.)

STANDARD 11608A

The Standard 11608A Transistor Fixture is supplied with the basic internal structure left blank. Figure I-l shows the individual components which make up the completed fixture.

The bonded stripline is 0.087 inch wide tapering to 0.083 inch in the center. The taper is designed to compensate for the added shunt capacitance of the clamp in the lid of the fixture. A copper ground plane is bonded to the reverse side and both surfaces are gold flashed.

The ground structure is 0.234 inch thick brass plate. This thickness allows the final machined ground plate to have a top surface flush with the top of the stripline board should the device under test require it. This means that the maximum depth clearance available is 0.20 inch unless the base of the fixture itself is machined.

MACHINING THE STRIPLINE

When machining the stripline board, use care not to strip the plating from the board on top side. The peel strength of this board is four pounds per inch. The plating on this board can be hand or dipped soldered (500°F for five seconds) without distortion or loss of bond. The board is capable of being exposed to temperatures from −270°F to +500°F without damage. Standard high-speed twist drills and cutting tools work well on this board. Cooling media recommended for drilling or cutting are water, air, or air-water spray mist. Use of a coolant will result in lower induced strain in the machined parts. Drilling speed of 1500 to 2000 rpm is recommended.

This board can be sawed with the type of saws commonly used for wood, metal, and other plastics. Special saw blades are not required, nor is speed critical; but for high-speed cutting, particularly on thick sections, it is recommended the teeth have a slight set to reduce friction and provide a smoother surface. Milling saws or bandsaw blades with 10 to 18 normal teeth per inch, with and without set, will satisfactorily cut this board at speeds between 1500 and 3000 feet per minute.

This board is resistant to all solvents and reagents, hot or cold normally used in etching printed circuits or in plating edges and holes.

For more information concerning the properties of this board, write Rogers Corporation, Micromat Division, Chandler, Arizona, and ask for data concerning RT/Duroid[1] boards.

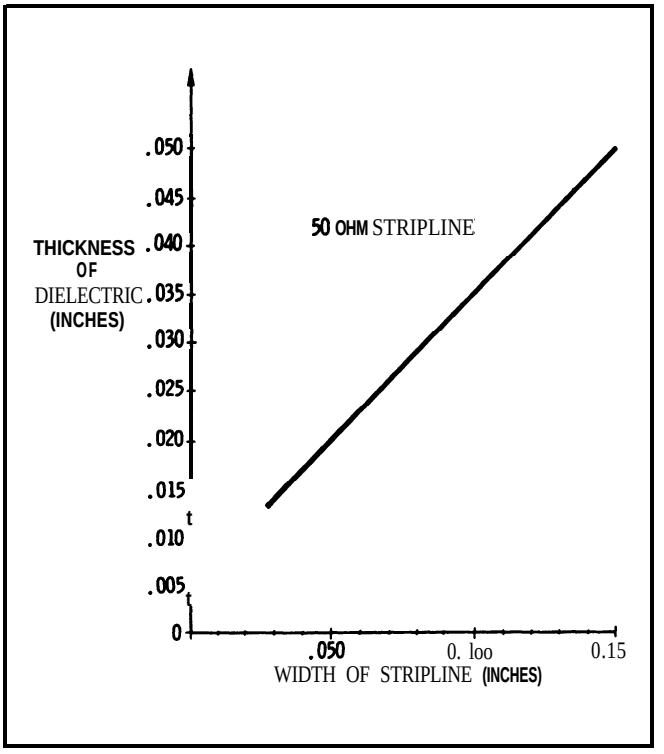


Figure I-2. Graph of Stripline Width vs. Dielectric Thickness for a 50-Ohm Impedance

[1] Trademark of Rogers Corporation.

USING OTHER THICKNESS STRIPLINE

If use of other thicknesses of stripline material besides that furnished in the Standard 11608A is desired, consult the graph in Figure I-2. As shown, when thickness of the dielectric is changed the width of the stripline must be adjusted to keep a 50-ohm impedance. In actual practice the center portion of the stripline must be tapered (width made smaller) to compensate for the added capacitance of a clamp.

MACHINING THE GROUND CONTACT

The contact material is brass. A square central cutout may be used to test round-button transistors. (See Figure I-3.) The shape of the cutout varies depending upon whether the ground contact central cutout is above or below the ground plane of the stripline. When machining the ground contact, take care to provide a good surface finish and accurate machined dimensions. The button of the transistor under test should fit snugly into the stripline gap so discontinuities are avoided. Gold flash plate all conductors after final machining.

MACHINING CALIBRATORS

Through-Line

A through-line calibrator provides a 50-ohm stripline between the input circuits and the output ports. (See Figure I-4). It may be constructed of a piece of circuit board the same width and depth as the cutout section with a 50-ohm stripline conductor on top and a ribbon lead soldered to the conductor to serve as input and output leads. To make a through-line calibrator proceed as follows:

a. Machine a piece of the plated board furnished with Standard 11608A to the same size conductor and dielectric as the cutout portion of the board.

NOTE

Be sure to remove all copper clading from bottom side when machining the board into a through-line.

b. Align the board with two pieces of dielectric of the same thickness as the board and hold flush to the two stripline edges by pressing all three pieces down on a piece of electrical tape. (See Figure I-5.)

c. Place a solder insert (furnished as part of the Standard 11608A) on top of the stripline on the stripline board. If a solder insert is not available, flatten a thin piece of 360°F solder and trim to size.

d. Place a strip of .002 inch thick gold-plated beryllium copper ribbon about ,010 inch narrower than the stripline width and long enough to make good contact over the solder insert.

e. Put a *small* amount of rosin flux over the solder insert.

f. Solder the ribbon to the stripline with a low-temperature soldering iron. Clean off any remaining flux with detergent and water.

An empty transistor case, with its input connected to its output, can be used as a through calibrator but only for low-precision work.

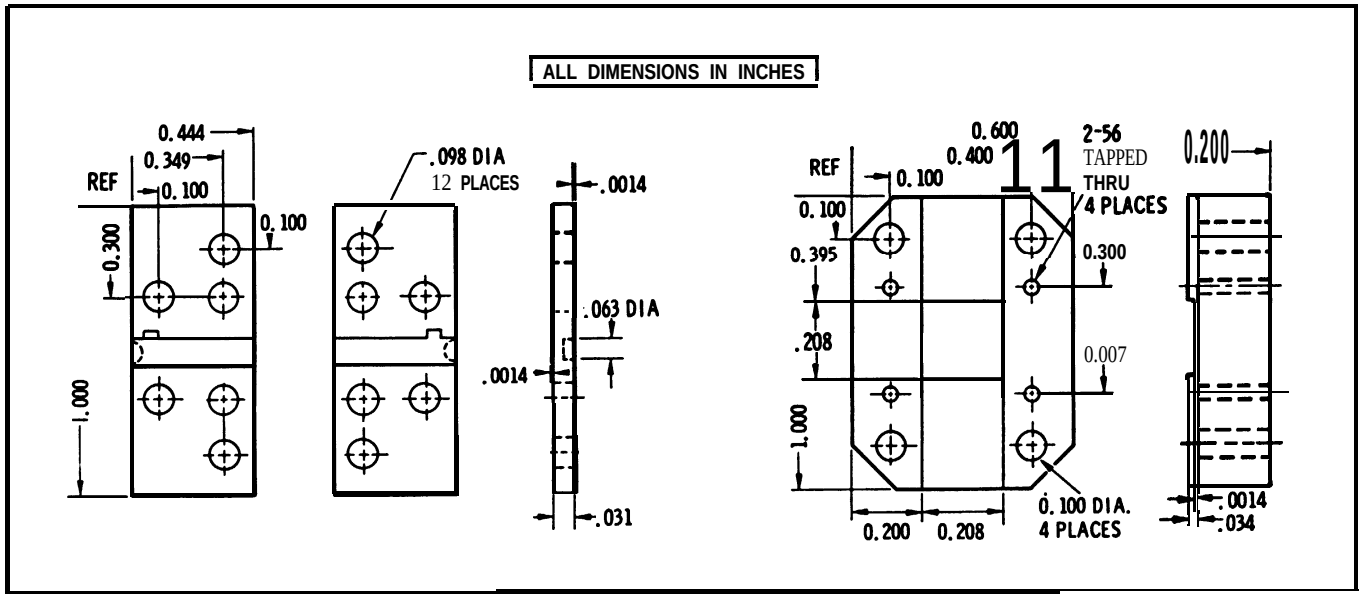


Figure I-3. Dimensions of Striplines and Ground Contacts for Option 003

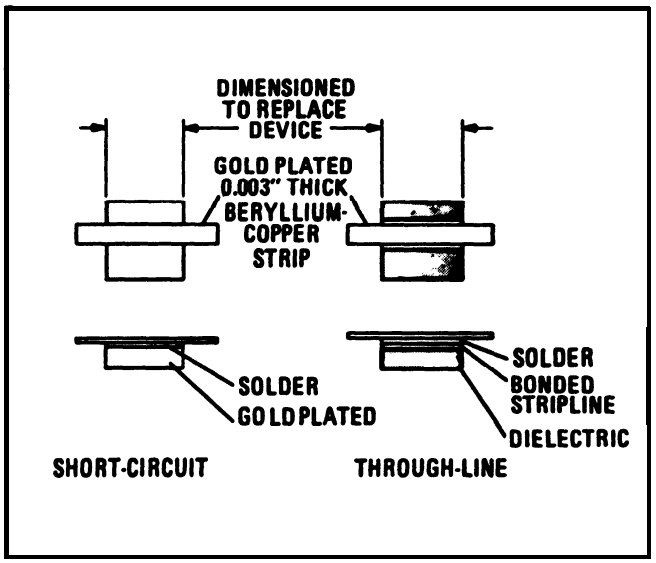


Figure I-4. Shorting and Through-Line Calibrators

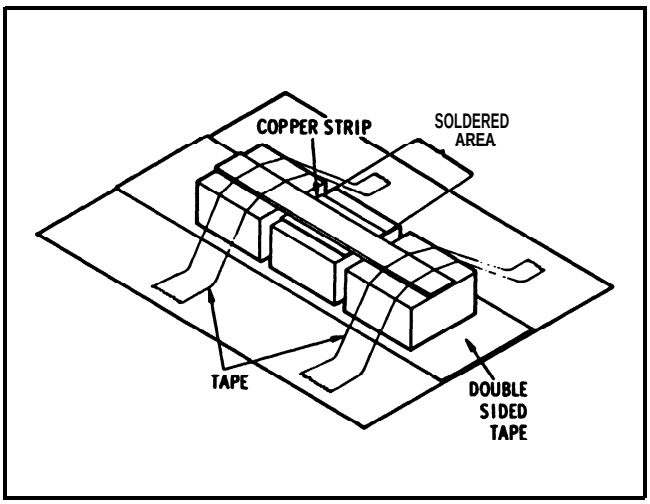


Figure I-5. Making Through-Line Calibrators

Shorting Calibrator

A shorting calibrator is desirable for the most precise measurement. An open circuit (no calibrator) can be used, but it provides lower-precision calibration. Be sure to make the brass central ground contact the same size as the body of the transistor under test and about 0.0015 inch thicker than the depth of the cavity so the ground contact will mate before the leads or else the leads will hold the short up slightly. Machine the shorting calibrator body from solid brass and gold plate. Solder the ribbon contacts on similar to the through-line calibrator.

INSTALLING THE GROUND CONTACT AND STRIPLINE

If the stripline has been removed or if the stripline is being installed for the first time, proceed as follows:

a. Place ground contact in 11608A body.

b. Using a low-temperature soldering iron and desoldering tool, clean excess solder from stripline and center conductor tab to which it is to be soldered.

c. Hold the stripline tight against the center ground contact and tighten down the mounting screws.

DIMENSIONAL DRAWINGS

Dimensional drawings for the Standard stripline board (Figure I-6) and ground contact (Figure I-7) have been included in this appendix. Additional screw holes may be desirable to put pressure on the stripline near the contacting surfaces as a slight bow in the stripline may hold the calibrators and transistors off the ground plane. Hold down with nylon screws in line with steel screws near the contacting surfaces but positioned so the screw head just clears the contact area.

TUNING THE COMPLETE FIXTURE

As the frequency of operation increases, the residual losses and the effect of small perturbations increase. To allow for adjustment of the final fixture, two tuning screws are provided, one at each end of the stripline, to give a variable shunt capacitance at the input and output.

The best way of adjusting the fixture is to use -a TDR (Time Domain Reflectometer) such as the HP 1815 system, which shows the response of the individual junctions within the fixture and allows the effect of tuning adjustments to be closely observed up to 12.4 GHz. Refer to the following paragraph, **TDR ADJUSTMENT PROCEDURE**, for further details.

TDR ADJUSTMENT PROCEDURE

This adjustment (Figure I-8) need be performed only for customer-machined fixtures to adjust the

input and output impedance at the coaxial-to-stripline transitions to 50-ohms impedance. This test is a Time Domain Reflectometer (TDR) measurement for adjusting the shunt capacitance by means of the adjusting screws on the input and output of the 11608A. Equipment necessary to make this adjustment is listed in Table 4, Recommended Test Equipment, marked "A". Other equipment may be substituted provided its specifications equal or exceed the specifications listed in the column marked "Critical Specifications".

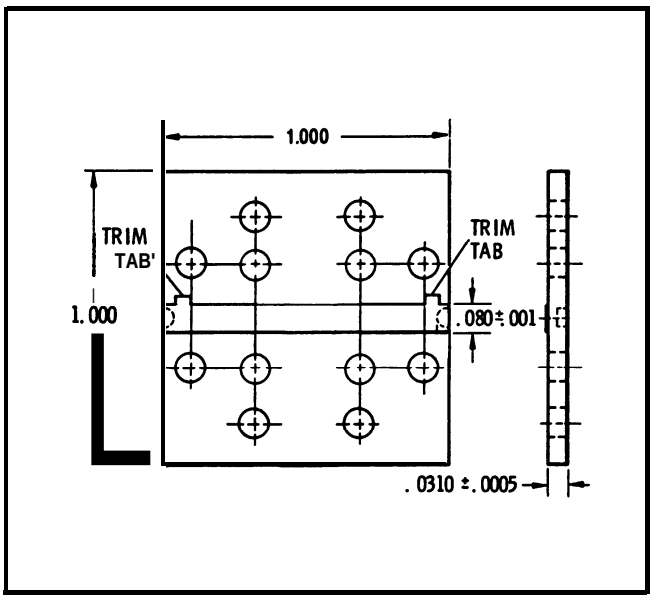


Figure I-6. Standard Stripline Board

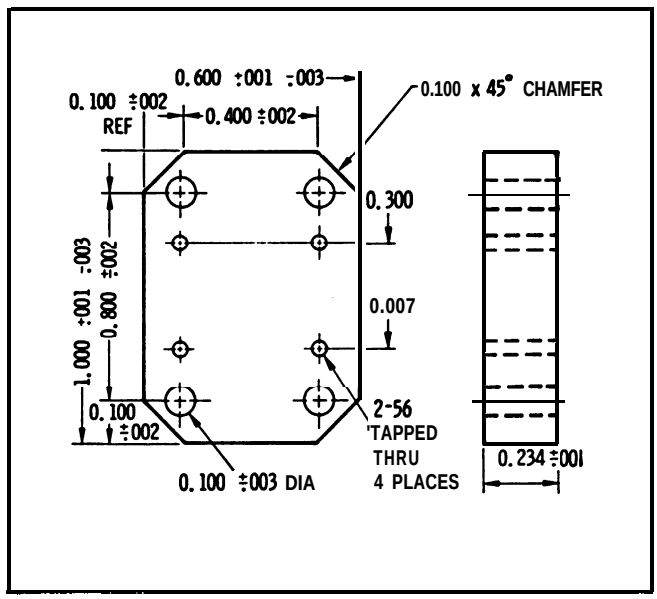


Figure I-7. Standard Ground Contact

ADJUSTMENTS

TDR Adjustment

Descrip tion:

This procedure allows adjustment of the tuning screws at the base of the 11608A. A TDR reflectometer is used to adjust the tuning screws to make both ports of the 11608A look like a 50-ohm impedance. An air line of at least 20 cm in length is used to move the measurement area outside the source-mismatch **reflection-noise area near the connectors of the Time Domain Reflectometer.**

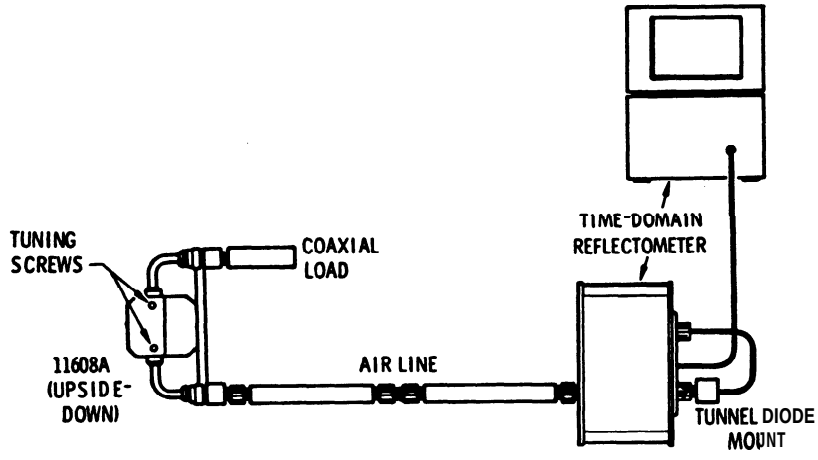


Figure I-8, TDR Adjustment Equipment Setup

Equipment:

Sweep **Oscillator** . . .. HP Model 8350A with 83592A plug-in
Time Domain Reflectometer ..... HP Model **1815A**
Air Line (2) ..... HP Model 11567A
Coaxial Load ..... HP Model **909A**

Procedure:

1. Connect the equipment as shown in Figure I-8. Use the best load available.

2. Set the Time Domain Reflectometer controls as follows:
   ρ/DIV . . . . . **.01** NORM-SIGNAL AVG . . . . . SIGNAL AVG
   NSEC/DIV . . . . . **.02**

3. Insert a through-line calibrator in the **11608A** and close lid to hold calibrator.

NOTE

When adjusting a new stripline, a good **50 ohm match is usually obtained by cutting the two trim tabs on the board to approximately 0.013 inch (1/2 the original length), then adjusting tuning screws for best match.**

4. Adjust tuning screw nearest the TDR, **first** to identify location on the trace, then for the least discontinuity. If necessary, cut small amount from the associated trim tab on stripline with **a** knife, then try to adjust tuning screw again.

5. Turn the 11608A end-for-end and repeat above measurement for the other tuning screw.

ADJUSTMENTS

If a TDR is not available, the same adjustment can be done less precisely with any sweep-frequency VSWR measuring setup. Proceed as follows:

1. Arrange setup to measure Sll as shown in Figure I-9.
2. Calibrate **8410B/8412A/8743B** System to a reference with the Coaxial Short.
3. Terminate **11608A** with best coaxial load available and connect opposite end to VSWR measuring setup.
4. Sweep 4 to 8 and 8 to 12.4 **GHz** bands or band of highest frequency at which the 11608A is to be used.

NOTE

When adjusting a new stripline, a good 50 ohm match is usually obtained by cutting the two trim tabs on the board to approximately 0.013 inch (1/2 the original length), then adjusting tuning screws for best match.

5. Connect the load to one 11608A port, connect other 11608A port to VSWR measuring setup, and tune the screw nearest the test port for minimum VSWR. If necessary, cut **small** amount from the associated trim tab on stripline with a knife, then try to adjust tuning screw again.
6. Connect load to the opposite **11608A** port, connect other **11608A** port to VSWR measuring setup, and tune screw nearest the test port for minimum VSWR. (Both sides have to be tuned individually since the adjustments interact.)

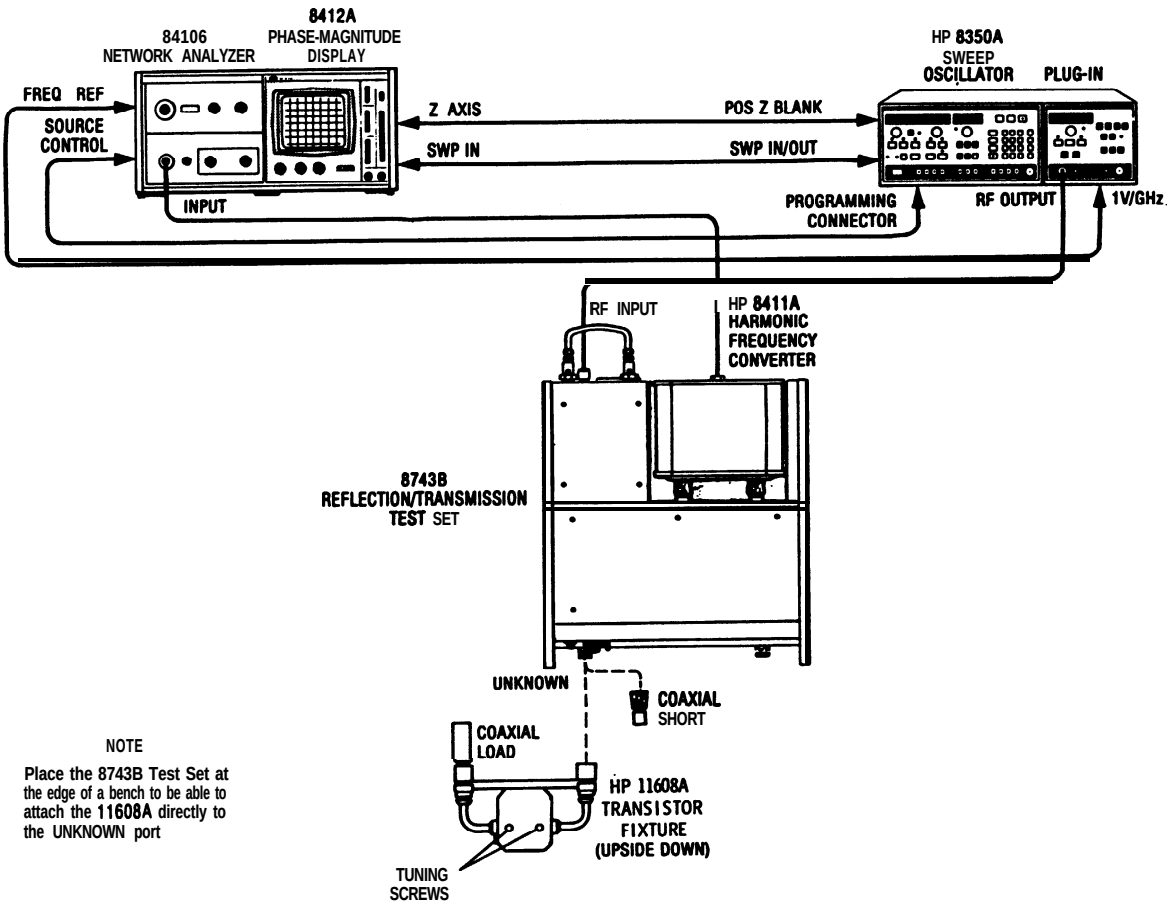


Figure I-9. VSWR Test Setup with 8410 System

APPENDIX II
MANUAL CHANGES

INTRODUCTION

This section contains information for adapting this operating note to instruments for which the content does not apply directly.

To adapt this operating note to your instrument, refer to Table II-1 and make all the manual changes listed opposite your instrument serial number. Perform these changes in the sequence listed.

If your instrument serial number is not listed on the front page of this operating note, or in Table II-l, the serial number may be documented in a yellow MANUAL CHANGES supplement. For additional important information concerning serial number coverage, refer to INSTRUMENTS COVERED BY MANUAL.

Table I I-1

Serial Prefix or Number	Make Manual Changes	Serial Prefix or Number	Make Manual Changes
1144A, 2119A	A		
1051A, 1124A	A, B		

CHANGE A

Throughout the manual, change **"RT/duroid"** to "Polypheylene Oxide". However, the recommended replacement for all stripline boards is RT/duroid material. See Table **II-2.**

Throughout the manual, the Standard **11608A** was previously Option 001.

Table II-2. Stripline Insulating Material (CHANGE A)

STRIPLINE CONFIGURATION	TRADE NAME & HP PART NUMBER		
	PPO Polypheylene Oxide (Light Tan)	Rexolite (Clear)	**RT/duroid** (Dark Brown)
Standard Stripline Board	11608-20029	11608-20045	11608-20054
Option 003 Stripline Board	11608-20035	11608-20048	**11608-20055**
Standard **Thru-Line**	11608-20019	11608-20019	11608-20057
Option 003 Thru-Line	11608-60031	11608-60031	**11608-60056**

NOTE

The only recommended replacement are the boards made of RT/duroid.

CHANGE B:

Page 3, Figure 3,
Delete four central holes from three microstrips and ground structure.

Page 19, Figure 9,
Delete Item 37 and four central holes in Item 14.

Page I-4, Figure I-3,
Delete four central holes from both striplines and both ground structures.

Page I-6, Figure I-6,
Delete four central holes.

Page I-7, Figure I-7,
Delete four central holes.

HEWLETT-PACKARD SALES AND SERVICE OFFICES

To obtain servicing information and order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office in HP Catalog, or contact the nearest regional **office** listed below.

THE UNITED STATES:

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3003 Scott Boulevard
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Atlanta 30348

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Rolling Meadows 60008

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Paramus 07652

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Hewlett-Packard (Canada) Ltd.
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Pointe Claire **H9R** IG7

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