

Keysight 86207A

75 Ohm Directional Bridge

Notices

Copyright Notice

© Keysight Technologies 1992 - 2019

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies as governed by United States and international copyright laws.

Manual Part Number

86207-90001

Edition

Edition 4, March 13, 2019

Printed in:

Printed in Malaysia

Published by:

Keysight Technologies
Bayan Lepas Free Industrial Zone,
11900 Penang, Malaysia

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to <http://www.keysight.com/go/conformity>. You can then search by product number to find the latest Declaration of Conformity.

U.S. Government Rights

The Software is "commercial computer software," as defined by Federal Acquisition Regulation ("FAR") 2.101. Pursuant to FAR 12.212 and 27.405-3 and Department of Defense FAR Supplement ("DFARS") 227.7202, the U.S. government acquires commercial computer software under the same terms by which the software is customarily provided to the public. Accordingly, Keysight provides the Software to U.S. government customers under its standard commercial license, which is embodied in its End User License Agreement (EULA), a copy of which can be found at <http://www.keysight.com/find/sweula>. The license set forth in the EULA represents the exclusive authority by which the U.S. government may use, modify, distribute, or disclose the Software. The EULA and the license set forth therein, does not require or permit, among other things, that Keysight: (1) Furnish technical information related to commercial computer software or commercial computer software documentation that is not customarily provided to the public; or (2) Relinquish to, or otherwise provide, the government rights in excess of these rights customarily provided to the public to use, modify, reproduce, release, perform, display, or disclose commercial computer software or commercial computer software documentation. No additional government requirements beyond those set forth in the EULA shall apply, except to the extent that those terms, rights, or licenses are explicitly required from all providers of commercial computer software pursuant to the FAR and the DFARS and are set forth specifically in writing elsewhere in the EULA. Keysight shall be under no obligation to update, revise or otherwise modify the Software. With respect to any technical data as defined by FAR 2.101, pursuant to FAR 12.211 and 27.404.2 and DFARS 227.7102, the U.S. government acquires no greater than Limited Rights as defined in FAR 27.401 or DFAR 227.7103-5 (c), as applicable in any technical data.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Safety Information

CAUTION

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

WARNING

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

Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/mta
(product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
(worldwide contact information for repair and service)

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.

Table of Contents

Waste Electrical and Electronic Equipment (WEEE) Directive	3
Product category:	3
Sales and Technical Support	3
List of Figures	7
List of Tables	9
1 General Information	
Manual Overview	12
Product description	12
Instruments covered by this manual	12
Specifications & Supplemental Characteristics	13
Initial Inspection	16
2 Operation	
Overview	18
Bridge Operation	19
Bridge Features	20
Operating Precautions	21
Measurement Configurations	22
Remote reflection measurement configuration	22
Vector impedance measurement configuration	23
External power leveling configuration	24
Reflection measurement configuration	27
3 Performance Tests	
Introduction	30
Performance test record	30
Function Test	31
Recommended equipment	31
In case of failure	33
Return Loss Test	34
Recommended equipment	34
Procedure	34
In case of failure	38
Directivity Test	39
Recommended equipment	39
Procedure	39
In case of failure	41
4 Maintenance	
Mating Connectors	46

Environment	47
-------------------	----

List of Figures

Figure 1-1	Example plot of 86207A directivity	14
Figure 1-2	Example plot of 86207A insertion loss	15
Figure 1-3	Example plot of 86207A coupling factor	15
Figure 2-1	86207A bridge ports and measurement paths	19
Figure 2-2	Location of threaded mounting holes	20
Figure 2-3	Remote directivity measurement setup	22
Figure 2-4	Vector impedance measurement setup	23
Figure 2-5	External power leveling configuration	25
Figure 2-6	Reflection measurement setup	27
Figure 3-1	Equipment setup for a thru measurement calibration	31
Figure 3-2	Equipment setup for insertion loss measurement	32
Figure 3-3	Equipment setup for coupling loss measurement	33
Figure 3-4	Equipment setup for a 522 1-port measurement calibration	35
Figure 3-5	Equipment setup for return loss measurement on port 1	36
Figure 3-6	Equipment setup for return loss measurement on port 3	37
Figure 3-7	Equipment setup for return loss measurement on port 2	37
Figure 3-8	Equipment setup for S22 1-port measurement calibration	40
Figure 3-9	86207A test record (1 of 3)	42
Figure 3-10	86207A test record (2 of 3)	43
Figure 3-11	86207A test record (3 of 3)	44

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.

List of Tables

Table 1-1	86207A specifications	13
Table 1-2	86207A supplemental characteristics	14
Table 2-1	Port orientation with corresponding application	19
Table 3-1	Recommended equipment for function test	31
Table 3-2	Recommended equipment for return loss test	34
Table 3-3	Recommended equipment for directivity test	39
Table 4-1	Environmental requirements	47

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.

1 General Information

Manual Overview	12
Specifications & Supplemental Characteristics	13
Initial Inspection	16

This manual contains information for operating, testing, and servicing 86207A bridge.

Manual Overview

Product description

86207A is a high performance 75 Ω directional bridge designed for high quality reflection measurements and external source leveling applications over an RF frequency range of 300 kHz to 6 GHz. The bridge achieves a low through loss of 1.5 dB and a high coupling factor of 16 dB. These characteristics make it useful in applications requiring directional couplers, such as power monitoring and closed-loop leveling applications.

Instruments covered by this manual

Each bridge has a unique serial number. The contents of this manual apply directly to bridges with serial numbers.

Specifications & Supplemental Characteristics

Table 1-1 lists bridge specifications, which are the performance standards or limits against which you can test the device.

Table 1-2 lists supplemental (typical, non-warranted) bridge characteristics.

Table 1-1 86207A specifications

Characteristic	Value
Connector	75 Ω precision type-N female
Frequency range	300kHz to 3 GHz
Directivity	
– >30 dB	300 kHz to 5 MHz
– >40 dB	5 MHz to 1.3 GHz
– >35 dB	1.3 GHz to 2 GHz
– >30 dB typical	2 to 3 GHz
Port match	
– >20 dB (1.22 SWR)	300kHz to 1.3 GHz
– >18 dB (1.29 SWR)	1.3 to 2 GHz
– > 18 dB typical (1.29 SWR)	2 to 3 GHz

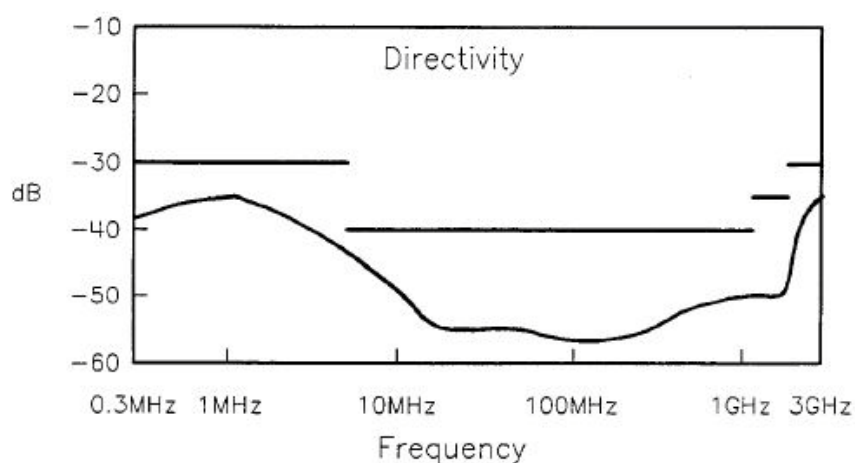
Table 1-2 86207A supplemental characteristics

Characteristic	Value
Nominal through loss	1.5 dB +0.1 dB/GHz
Through loss deviation	±0.2 dB from nominal
Nominal coupling factor	
– 0.3 MHz to 3 GHz	16 dB + 0.15 dB/GHz
Coupling factor deviation	
– 0.3 MHz to 3 GHz	±0.2 dB from nominal
– 3 GHz to 6 GHz	±0.4 dB from nominal
Max input power	+25 dBm
Max Input voltage	
– port 1 or port 2	30 VDC
– port 3	0 VDC
Max input current	1 amp DC ^[a]
Connector recession ^[b]	0.204 in to 0.207 in ^[c]
Weight	
– net	0.57 kg (1.3 lbs)
– shipping	1.80 kg (4.0 lbs)
Dimensions	160W x 93H x 23D (mm) 6.3W x 3.7H x 1D (in)

[a] Below 1 MHz, directivity and port match will be slightly degraded above 200 mA bias current.

[b] Recession refers to a female type-N connector center conductor dimension.

[c] Before you performance test an HP 86207A bridge, gage all the connectors and enter the results in the test record at the end of "Performance Tests."

**Figure 1-1** Example plot of 86207A directivity

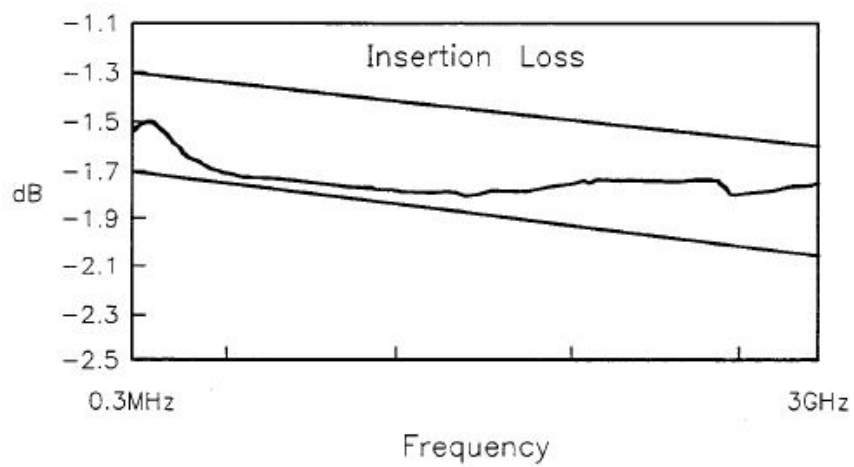


Figure 1-2 Example plot of 86207A insertion loss

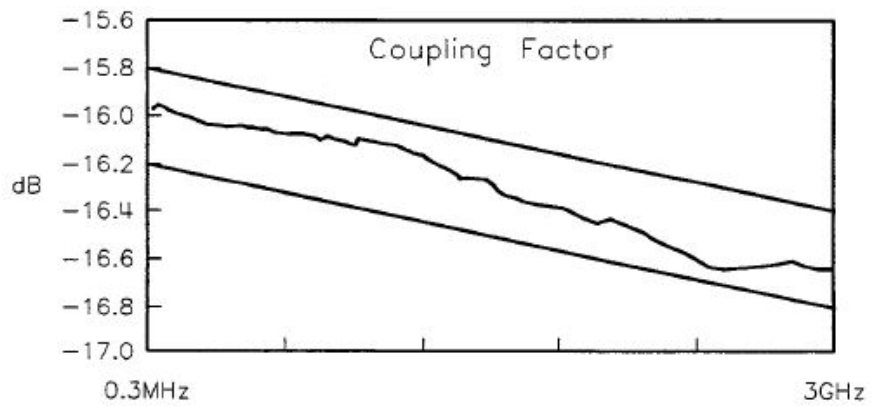


Figure 1-3 Example plot of 86207A coupling factor

Initial Inspection

- 1** Check the shipping container and packaging material for damage.
- 2** Check the shipment for completeness.
- 3** Check the connectors and bridge body for mechanical damage.
- 4** Check the bridge electrically.
Refer to the [Chapter 3, "Performance Tests"](#) for procedures that check the bridge electrically.

If any of the following conditions exist, notify your nearest Keysight office:

- incomplete shipment
- mechanical damage or defect
- failed electrical test

If you find damage or signs of stress to the shipping container or the cushioning material, keep them for the carrier's inspection. Keysight does not wait for a claim settlement before arranging for repair or replacement.

2 Operation

Overview	18
Bridge Operation	19
Bridge Features	20
Operating Precautions	21
Measurement Configurations	22

Overview

This chapter includes the following information on Keysight 86207A directional bridge:

- bridge operation
- bridge features
- operating precautions
- measurement configurations

Bridge Operation

Table 2-1 and Figure 2-1 illustrate the bridge operation. The table shows the port orientation in a reflection measurement and in a power monitoring or leveling configuration. The figure identifies the paths and ports of the bridge and shows the electrical characteristics of each path.

Table 2-1 Port orientation with corresponding application

Part number	Application	
	Reflection measurement	Power monitoring/leveling
1	Test port	Input
2	Input port	Output
3	Coupled	Coupled level

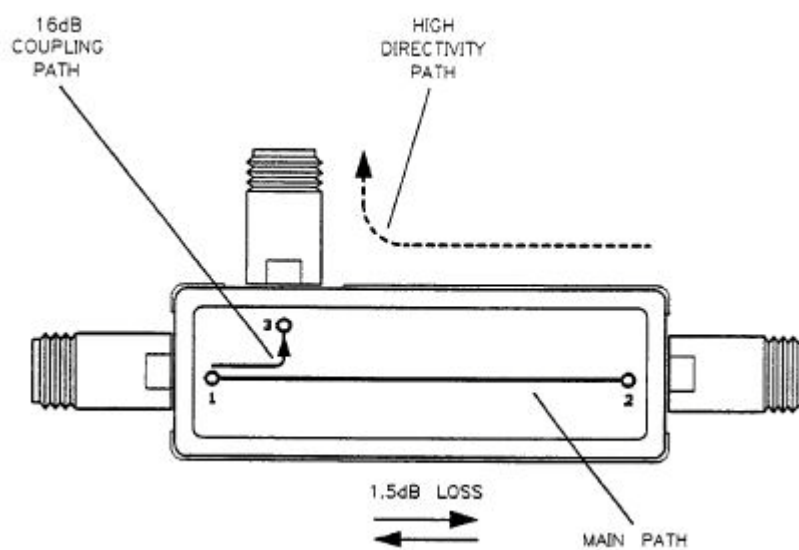


Figure 2-1 86207A bridge ports and measurement paths

Bridge Features

- Frequency range from 300kHz to 3 GHz
- High directivity
- Insertion loss of 1.5 dB (nominal)
- Coupled arm flatness of ± 0.2 dB from nominal

86207A operates over an RF frequency range of 300 kHz to 3 GHz and has excellent directivity for high quality reflection measurements. Additionally, the bridge has a very low insertion loss of 1.5 dB which means more power to the device under test; this is especially important in the measurement of high power solid state amplifiers and TWTs. The bridge also features a ± 0.2 dB flatness from the nominal 16 dB coupled arm. This capability is valuable in external leveling applications where a power meter or diode detector is used to level the power remotely from the source. Power variations are then minimized, which is important when measuring input-sensitive devices.

CAUTION

DC bias may be applied to a DUT through the main arm of the bridge. (**DO NOT** apply bias to the coupled port of the bridge.)

Threaded mounting holes (3.5 mm x 0.5 mm) are located under pre-punched holes in the model number label, as shown in [Figure 2-2](#). Since the bridge package is brass, appropriate caution must be taken to avoid damaging the threaded holes.

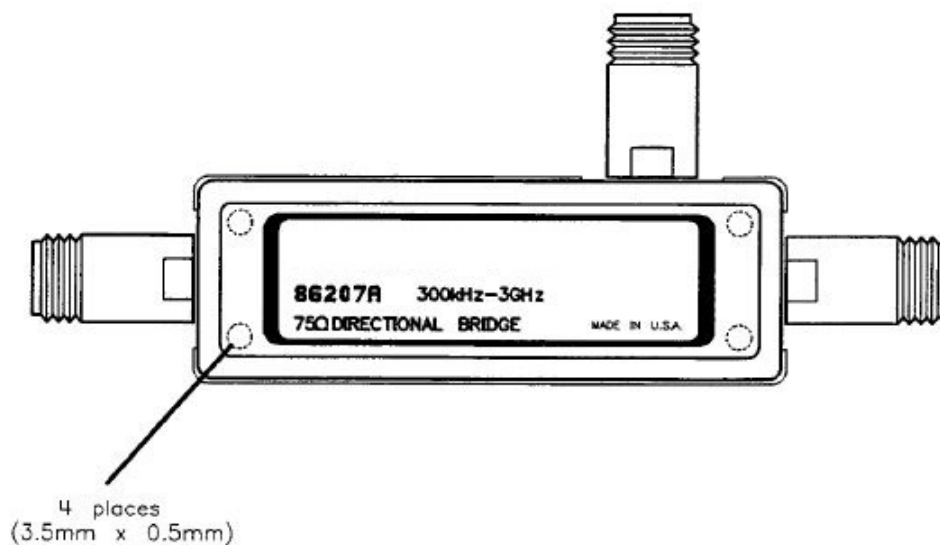


Figure 2-2 Location of threaded mounting holes

Operating Precautions

- Read and observe all cautions.
- Tighten the bridge connectors with fingers only.
- If you must use a wrench, use a torque wrench set at 9.2 cm-kp (12 lb-in).

CAUTION

Electrostatic discharge (ESD) can damage the highly sensitive microcircuits in this device; an ESD as low as 1000V can destroy your bridge.

ESD damage occurs most often as you connect or disconnect a device. Use the bridge at a static-safe workstation and wear a grounding strap. *Never* touch the input connector center contacts, or the contact pins of a connecting cable.

Do *not* apply > +25 dBm RF CW power, or > 1 amp DC or > 0 VDC to port 3 or > 30 VDC to port 1 or 2 of the bridge. Higher current/power/voltage can electrically damage the bridge.

Before you connect a cable to the bridge, always discharge the cable's center conductor static electricity to instrument-ground.

Severe damage to the bridge will result if you connect 50 Ω type-N connectors to 75 Ω ports.

Do not drop the bridge or subject it to mechanical shock.

Measurement Configurations

This section shows 86207A directional bridge in the following configurations:

- remote reflection measurement using 8711 network analyzer
- vector impedance measurement using two bridges and 8753 network analyzer
- external power leveling with or without a controller
- reflection measurement using a spectrum analyzer and tracking generator

Remote reflection measurement configuration

You can use remote sensing in applications where your DUT is not easily accessible. For example: when measuring the reflection coefficient of an antenna that is located on a tower.

To set up the measurement

- 1 Connect the equipment as shown in [Figure 2-3](#).

NOTE

The cable length from the analyzer source to the bridge does not affect directivity, but may affect source match. However, you may put an attenuator between the cable and bridge to improve source match.

Connect the DUT either directly to the bridge or as close as possible.

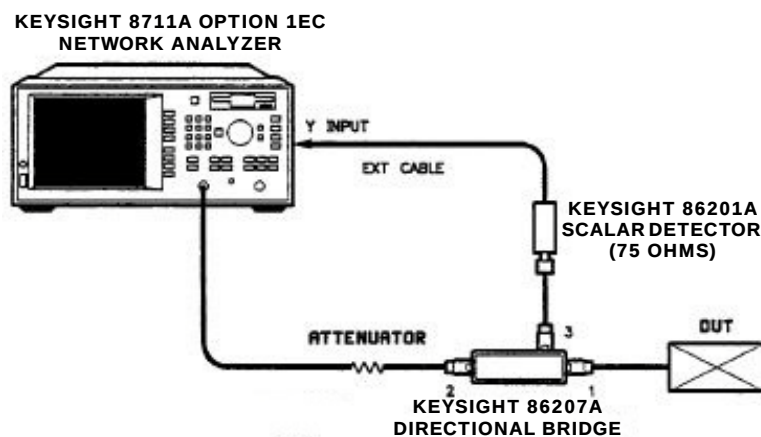


Figure 2-3 Remote directivity measurement setup

- 2 Set the parameters on the analyzer to measure with an external detector by pressing:
CHAN 1, Det Options, Broadband External, Y/R*
- 3 With nothing connected to the bridge, make a normalization of the measurement setup by pressing:
CAL, Normalize
- 4 Connect the DUT to the bridge and adjust the scale/division under the **SCALE** key.

Vector impedance measurement configuration

This configuration provides a low-cost custom test system when full 2-port measurements are not needed.

To set up the measurement

- 1 Connect the equipment as shown in Figure 2-4.

NOTE

You may connect the analyzer input signal to either the A or B input port. Use an A/R or B/R ratio measurement to improve the source match.

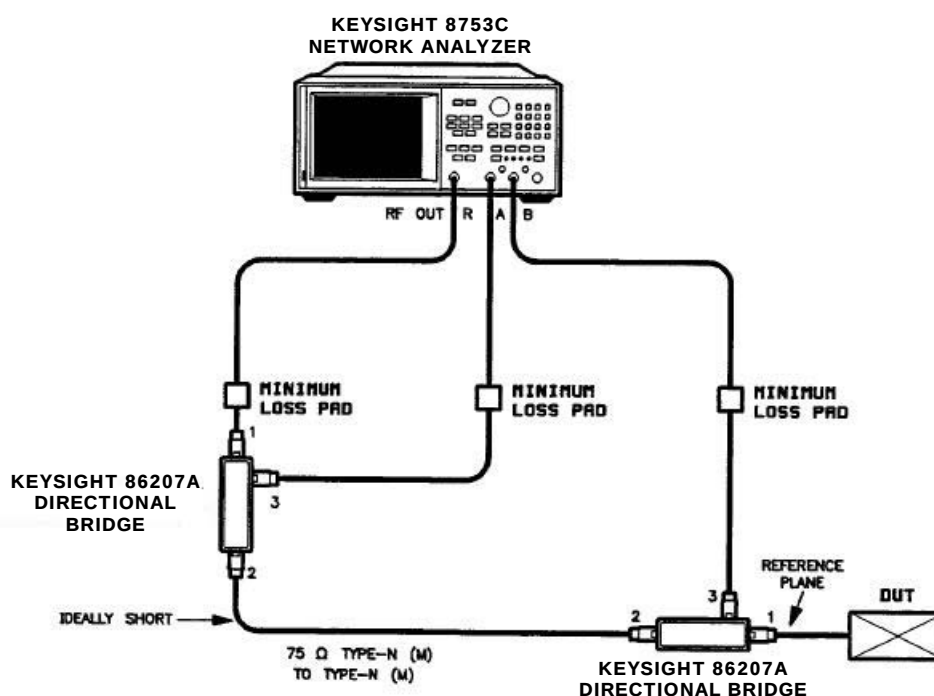


Figure 2-4 Vector impedance measurement setup

- 2 Choose the following parameters on the analyzer:
PRESET
MEAS, A/R (or **B/R** if you connected the analyzer input signal to the B input port)
MENU, POWER then enter the power value and press **x1**
NUMBER OF POINTS then enter the desired number
START then enter the start frequency and press **x1**
STOP then enter the stop frequency and press **x1**

- 3 Make a measurement calibration by pressing one of the following key sequences:

CAL

Cal Kit, N 75Ω, Modify 75Ω

Define Standard, 8, x1

Open CF, 33, x1, Std Done

Kit Done, Save User Kit

Return, Calibrate menu

RESPONSE, connect *either* an open or short calibration device to the reference plane and press the corresponding **OPEN (F)** or **SHORT (F)** key.

or

CAL, Cal Kit, N 75Ω, Modify 75Ω

Define Standard, 8, x1

Open CF, 33, x1, Std Done

Kit Done, Save User Kit

Return, Calibrate menu

(for A/R) **S11 1-PORT**

(for B/R) **S22 1-PORT**

Connect an open, short, and load calibration device to the reference plane while pressing the corresponding key for measurement.

- 4 Connect the DUT to the reference plane and adjust the scale/division under the **SCALE REF** key.

External power leveling configuration

The measurement configuration shown in [Figure 2-5](#) provides precision power levels to a remote DUT. With a power meter and bridge, the source power can be monitored and automatically adjusted.

8360A is used in the following example. Either 8753 or 8625 sources can also be used in this automated measurement configuration.

By substituting a frequency counter for the power meter, this configuration can be used for signal monitoring.

To set up the measurement

- 1 Connect the equipment as shown in [Figure 2-5](#).

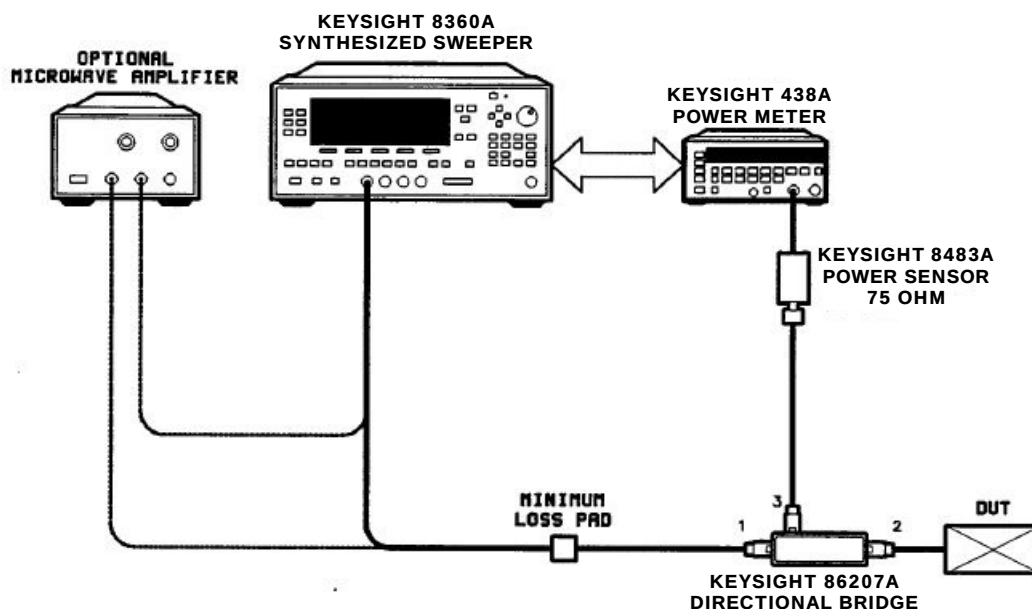


Figure 2-5 External power leveling configuration

- 2 Zero and calibrate the power meter/sensor.
- 3 Enter the appropriate power sensor calibration factors into the power meter (can only be done with 438A or 437B) or manually set the calibration factors for an 436A.
- 4 Enable the power meter/ sensor cal factor array. For operating information on the power meter refer to its operating manual.
- 5 Connect the power sensor to the bridge as shown in [Figure 2-5](#).
- 6 Set up the synthesizer parameters by pressing:
 - PRESET**
 - START** then enter the desired start frequency
 - STOP** then enter the desired stop frequency
- 7 Set up the user flatness correction by pressing:
 - MENU, Fltness Menu**
 - Delete Menu, Delete All**
 - PRIOR**
 - Auto Fill Start** and entered the desired start frequency value
 - Auto Fill Stop** and entered the desired stop frequency value
 - Auto Fill Incr** and entered the desired increment frequency value
- 8 Set the power meter under synthesizer control to perform the sequence of steps necessary to generate the correction information at each frequency point by pressing:
 - Mtr Meas Menu, Measure Corr All**

- 9** When a message is displayed, indicating the operation is complete, apply the flatness correction array to your measurement setup by pressing:

FLTNESS ON/OFF (the amber LED should be on)

The power produced at the point where the power meter/sensor was disconnected is now calibrated at the frequencies and power level specified above.

- 10** On 8360, press:

ALC, Leveling Point ExtDet

- 11** Set the coupling factor by pressing:

Coupling Factor, -14.5, dB(m)

NOTE

The 16 dB coupling factor is partially compensated by the through loss (1.5 dB) to give a 14.5 dB effective coupling factor (relative to the bridge output port).

The bridge coupling flatness has as good as 0.1 dB/GHz power level roll-off with ± 0.2 dB error.

Reflection measurement configuration

This configuration is for portable reflection measurement applications.

To set up the measurement

- 1 Connect the equipment as shown in Figure 2-6.

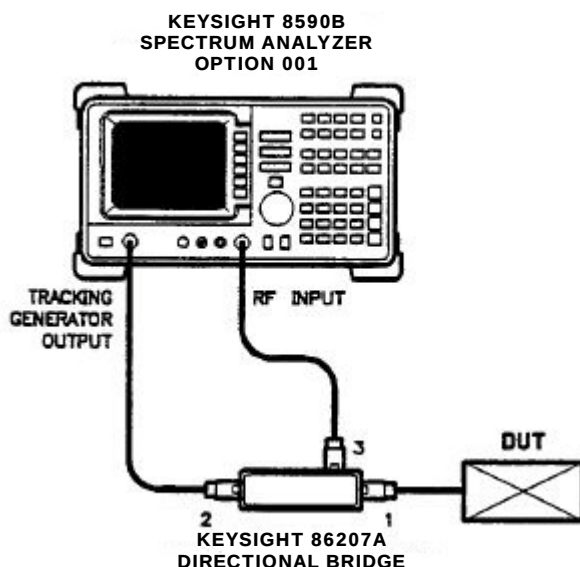


Figure 2-6 Reflection measurement setup

- 2 On the tracking generator, press:
AUX CTRL
TRACK GEN, SRC PWR ON
- 3 Set the desired center frequency and span to view the DUT.
- 4 Replace the DUT with a short circuit.
- 5 Normalize the trace by pressing:
TRACE
TRACE B, CLEAR WRITE B
BLANK B, MORE 1 OF 3, NORMALIZE ON
The normalized trace or flat line represents 0 dB return loss.
- 6 Measure the DUT by connecting it to port 1 of the bridge. Terminate the second port of a two-port DUT.
- 7 Press **MKR** and position the marker with the front panel knob to measure the return loss at the frequency of interest.

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.

3 Performance Tests

Introduction	30
Function Test	31
Return Loss Test	34
Directivity Test	39

Introduction

Use the procedures in this chapter to test the bridge's electrical performance. None of the tests require you to access the interior of the bridge. The procedures, and an explanation of what they check, are listed below.

- The functional test checks the bridge's typical operation.
- The return loss test verifies that the bridge operates within the return loss specification.
- The directivity test verifies that the bridge operates within the directivity specification.

Performance test record

Record the results of the performance tests on the test record that is located at the end of this chapter.

Tables are also provided for recording the results of the functional test and connector pin depth measurements.

Function Test

The functional test confirms your bridge is operating correctly. The procedure checks the nominal insertion loss and coupling of the bridge.

Recommended equipment

Table 3-1 Recommended equipment for function test

Equipment	Recommended model
Network analyzer	8753C (or 8753A with 85046A)
S-parameter test set	85046A or 85047A
75 Ω type-N (m) load	909E
75 Ω type-N cable (m)-(f)	part number 8120-2409
Adapters 7 mm to type-N (m) 2 each	11525A
Adaprer 75 Ω type-N (f)-(f)	p/n 1250-1529 or 85036-60014 (part of 85036B)
Minimum loss pad 2 each	11852B

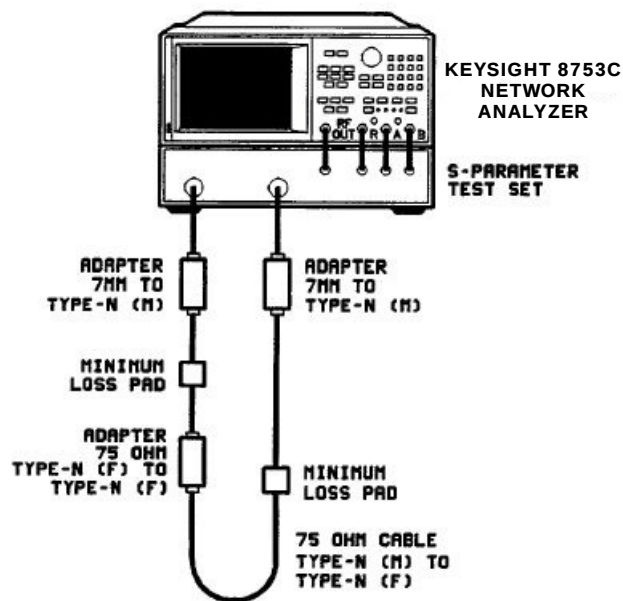


Figure 3-1 Equipment setup for a thru measurement calibration

- 1 Connect the equipment as shown in [Figure 3-1](#).

- 2 To perform a thru measurement calibration, press the following keys on 8753.

PRESET

MEAS, S21

CAL, CALIBRATE MENU

RESPONSE, THRU, DONE:RESPONSE

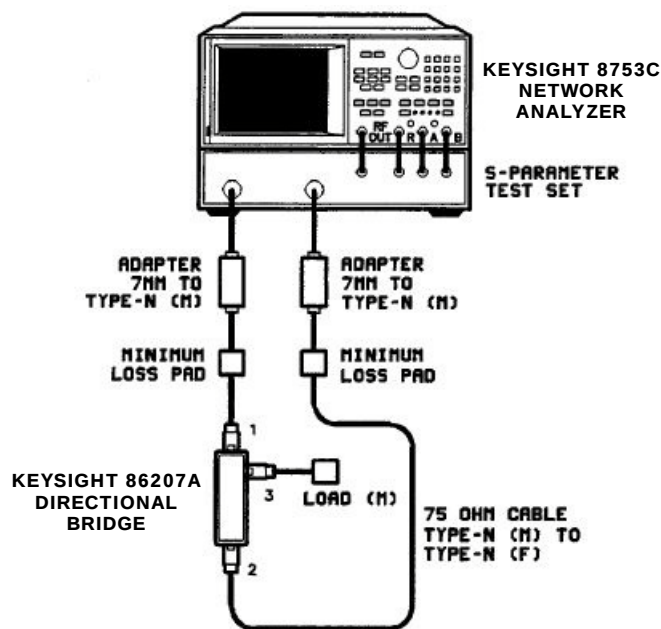


Figure 3-2 Equipment setup for insertion loss measurement

- 3 Connect the equipment as shown in [Figure 3-2](#).
- 4 To measure the insertion loss, press the following keys.

SCALE, 1, x1

MKR FCTN, MARKER SEARCH, MAX

The insertion loss shown on the display should be between 0 and 3 dB. Write the maximum insertion loss on the test record located at the end of this chapter.

- 5 Press **MIN** to find the minimum value and record it also.

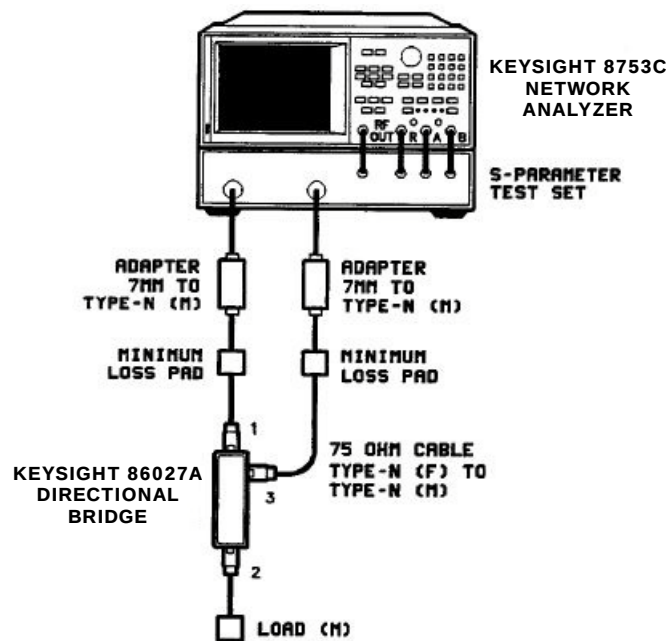


Figure 3-3 Equipment setup for coupling loss measurement

- 6** Connect the equipment as shown in [Figure 3-3](#).
- 7** To measure the coupling loss, press the following keys.

SCALE, 5, x1

MKR FCTN, MARKER SEARCH, MAX

The value should be between -14 dB and -18 dB. Write the maximum coupling loss on the test record located at the end of this chapter.

- 8** Press **MIN** to find the minimum value and record it also.

In case of failure

Check connectors for damage. Clean and gage connectors.

Verify that the calibration kit devices are within their tolerances. Check adapters and cables to make sure that they are not broken.

Return Loss Test

Recommended equipment

Table 3-2 Recommended equipment for return loss test

Equipment	Recommended model
Network analyzer	8753C (or 8753A with 85046A)
S-parameter test set	85046A or 85047A
75 Ω type-N calibration kit	85036B
75 Ω type-N (m) load	909E
Minimum loss pad	11852B
Adapters 7 mm to type-N (m)	11524A (p/o 85032B)

Procedure

- 1 Set the IF bandwidth to 100 Hz and select S22 as the measurement parameter, by pressing the following keys on 8753:
PRESET
MEAS, S22
AVG, IF BW, 100, x1
- 2 Set the stop frequency to 1.3 GHz and select a log frequency sweep, by pressing:
STOP, 1.3, G/n
MENU, TRIGGER MENU, SINGLE
MENU, SWEEP TYPE MENU, LOG FREQ
- 3 Set the power to 20 dBm, by pressing:
MENU
POWER, 20, x1
- 4 Perform a one-port calibration on port 2, by pressing:
CAL
CAL KIT, N 75 ohm
RETURN, CALIBRATE MENU, S22 1-PORT
- 5 When prompted, connect the standards as shown in [Figure 3-4](#).

NOTE

When measuring the open and short devices, select OPEN (m) and SHORT (m) on the analyzer. The selection must correspond to the test port, *not* the device being measured. When connecting the open, connect center conductor extender FIRST, then connect the outer conductor.

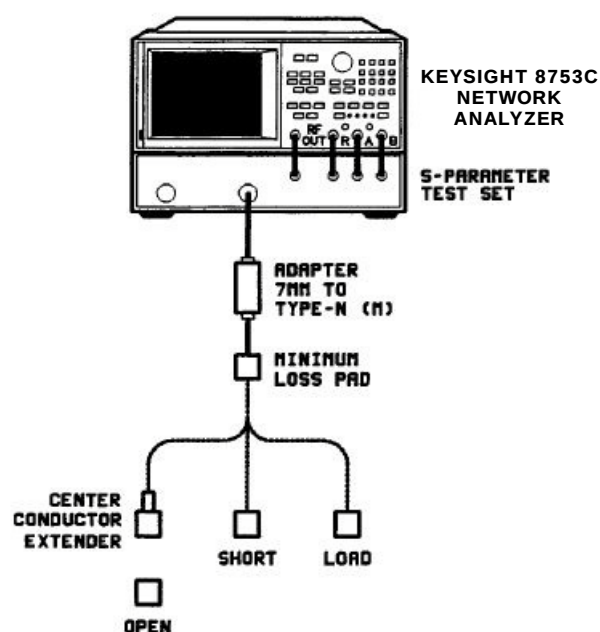


Figure 3-4 Equipment setup for a 522 1-port measurement calibration

- 6 Save the calibration in a register by pressing:
SAVE, REG 1
- 7 On channel 2, set a linear frequency sweep from 1.3 to 2 GHz, by pressing:
CH2
MEAS, S22
MENU, COUPLED CH OFF
SWEEP TYPE MENU, LIN FREQ
START, 2, G/n
STOP, 3, G/n
- 8 Repeat steps 4 and 5 to perform a one-port calibration on port 2.
- 9 Save the calibration in a register by pressing:
SAVE, REG 2

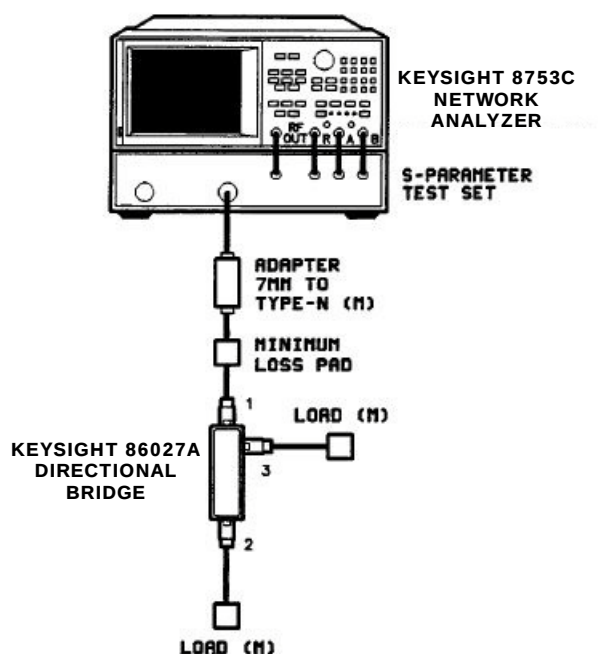


Figure 3-5 Equipment setup for return loss measurement on port 1

10 Connect the equipment as shown in [Figure 3-5](#) to measure the return loss.

NOTE

Do not use a female load with a type-N adapter, since an adapter has poor return loss and may affect the measurement.

11 Trigger a new sweep, by pressing:

CHI

MENU, MEASURE RESTART

12 Find the worst-case return loss from 300 kHz to 1.3 GHz, by pressing:

MKR FCTN

MARKER SEARCH, MAX

Write the value on the test record located at the end of this chapter.

13 Trigger a new sweep, by pressing:

CH2

MENU, MEASURE RESTART

14 Find the worst-case return loss from 1.3 to 2 GHz, by pressing:

MKR FCTN

MARKER SEARCH, MAX

Write the value on the test record located at the end of this chapter.

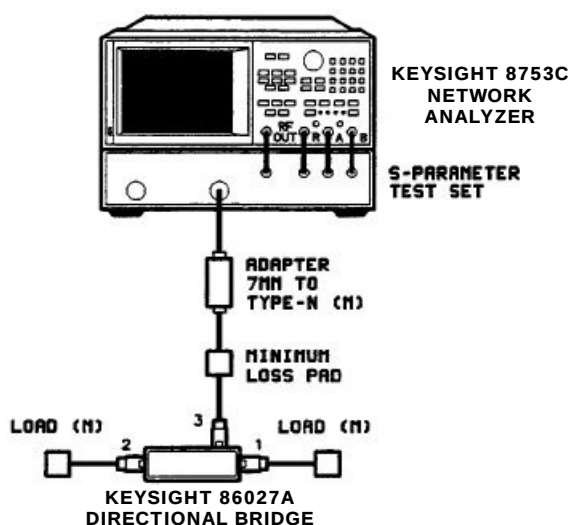


Figure 3-6 Equipment setup for return loss measurement on port 3

- 15** Connect the equipment as shown in [Figure 3-6](#) and repeat steps 11 through 14 to find the return loss on port 3.

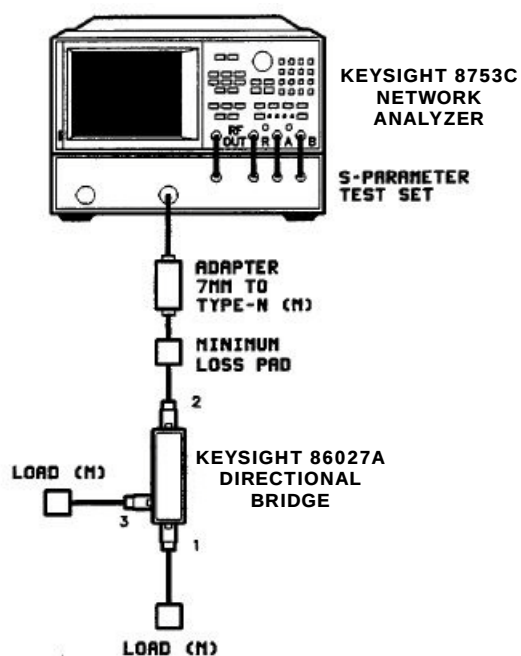


Figure 3-7 Equipment setup for return loss measurement on port 2

- 16** Connect the equipment as shown in [Figure 3-7](#) and repeat steps 11 through 14 to find the return loss on port 2.

In case of failure

Check connectors for damage. Clean and gage connectors.

Verify that the calibration kit devices are within their tolerances. Check adapters and cables to make sure that they are not broken.

Directivity Test

Recommended equipment

Table 3-3 Recommended equipment for directivity test

Equipment	Recommended model
Network analyzer	8753C (or 8753A with 85046A)
S-parameter test set	85046A or 85047A
75 Ω type-N calibration kit	85036B
75 Ω type-N (m) load	909E
Adapters 7 mm to type-N (m)	11524A (p/o 85032B)
Minimum loss pad 2 each	11852B
50 Ω type-N cable	p/n 8120-4781

Procedure

- Switch the RF output to port 2 on the test set to prevent the test set from switching the test port power during the calibration, by pressing:
PRESET
MEAS, S12
INPUT PORTS, A/R
- Set the IF bandwidth to 30 Hz and the analyzer power to 20 dBm, by pressing:
AVG
IF BW, 30, x1
MENU
POWER, 20, x1
- Put the analyzer into hold mode and move the reference line up so that the data trace can be seen, by pressing:
RETURN, TRIGGER MENU, HOLD
SCALE/REF
REFERENCE POSITION, 8, x1
- Set up a log frequency sweep from 300 kHz to 1.3 GHz, by pressing:
STOP, 5, G/n
MENU
SWEEP TYPE MENU, LOG FREQ

- 5 Make a S22 one-port calibration (to calibrate A/R, even though test port appears to be port 2), by pressing:

CAL

CAL KIT, N 75 ohm, Modify N 75Ω

DEFINE STANDATD, 8, x1

OPEN CΦ, 33, x1, STD DONE

RETURN, CALIBRATE MENU, S22 1-PORT

- 6 6. When prompted, connect the calibration devices to port 1 of the bridge as shown in ***<xref DIRECT>: undefined*** (measure the load last).

NOTE

When measuring the open and short devices, select OPEN (f) and SHORT (f) on the analyzer. The selection made must correspond to the test port *not* the device being measured.

Measure the open and short circuit devices; then measure the load.

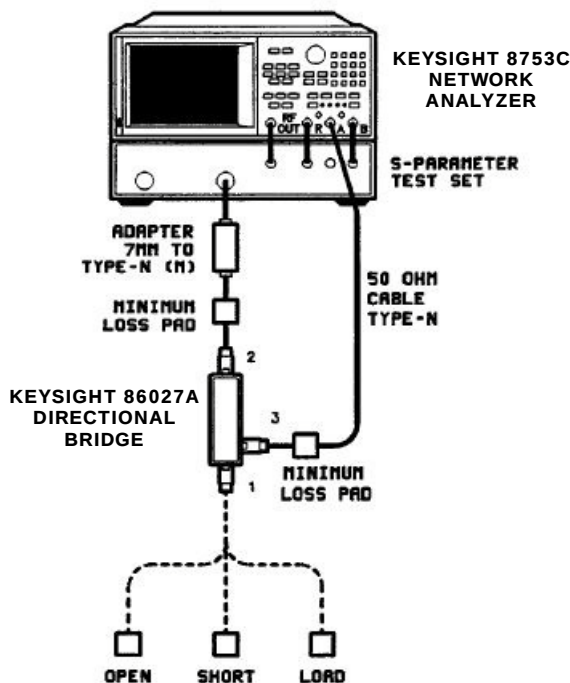


Figure 3-8 Equipment setup for S22 1-port measurement calibration

- 7 Load the frequency response error term into memory when the calibration is done, by pressing:

SYSTEM

SERVICE MENU, TESTS

34, x1, EXECUTE TEST

DISPLAY, DATA/MEM

CAL, CORRECTION OFF

The resulting display is the uncorrected load data (the last measurement taken during the calibration), normalized to the frequency response of the system.

- 8 Find the worst-case directivity value of the first two specified ranges (300kHz to 5 MHz and 5 MHz to 1.3 GHz), by pressing:

MKR FCTN

MARKER SEARCH, MAX

Identify which specified range the marker search found as worst case and write the directivity value in the test record located at the end of this chapter.

- 9 Use the front panel knob to measure the worst case directivity value in the other specified range. Write this value in the test record.
- 10 Set up a linear frequency sweep from 1.3 GHz to 2 GHz, by pressing:

START, 1.3, G/n

STOP, 2, G/n

MENU, SWEEP TYPE MENU, LIN FREQ

- 11 Repeat steps 5 through 8.

In case of failure

Check connectors for damage. Clean and gage connectors.

Verify that the calibration kit devices are within their specifications. Check adapters and cables to make sure that they are not broken.

Test Facility _____	Report Number _____
_____	Date _____
_____	Customer _____
_____	Tested by _____
Model _____	Ambient temperature _____ °C
Serial Number _____	Relative humidity _____ %
Options _____	Line frequency _____ Hz (nominal)
Functional Test Performed _____	
Special Notes	

Test Equipment Used	Model Number	Trace Number	Cal Due Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____
4. _____	_____	_____	_____
5. _____	_____	_____	_____
6. _____	_____	_____	_____
7. _____	_____	_____	_____
8. _____	_____	_____	_____

Figure 3-9 86207A test record (1 of 3)

Specifications			
Serial Number:	Report Number:		Date:
Test Description	Minimum Value	Measured Results	Measurement Uncertainty ¹
Return Loss			
300 kHz to 1.3 GHz			
Port 1	20 dB		±0.79 dB
Port 2	20 dB		±0.79 dB
Port 3	20 dB		±0.79 dB
1.3 GHz to 2 GHz			
Port 1	18 dB		±0.67 dB
Port 2	18 dB		±0.67 dB
Port 3	18 dB		±0.67 dB
Directivity			
300 kHz to 5 MHz	30 dB		±1.60 dB
5 MHz to 1.3 GHz	40 dB		±6.22 dB
1.3 GHz to 2 GHz	35 dB		±3.00 dB

Figure 3-10 86207A test record (2 of 3)

The measurement uncertainty is quoted for these performance tests using only the recommended models specified at the beginning of each test. The measurement uncertainty quoted represents limits of ± 3 times the equivalent standard deviation (3σ) and is intended to represent a 99% confidence level.

Serial Number _____	Report Number _____
_____	Date _____

**Functional Test (Typical Operation)
Data Record**

Characteristic	Nominal Values		Measured Values	
	Minimum	Maximum	Minimum	Maximum
Insertion Loss	0 dB	3 dB	_____	_____
Coupling Loss	-14 dB	-18 dB	_____	_____

**Typical Connector Pin Depths
Data Record**

Connector Pin Depth	Minimum Value	Measured Results	Maximum Value
Port 1	0.204 in	_____	0.207 in
Port 2	0.204 in	_____	0.207 in
Port 3	0.204 in	_____	0.207 in

Figure 3-11 86207A test record (3 of 3)

4 Maintenance

Mating Connectors	46
Environment	47

Mating Connectors

Table 1-2 lists connector mechanical tolerances. The *Microwave Connector Care Manual* (part number 08510-90064) provides information on the proper maintenance, inspection, and gaging of connectors.

CAUTION

When tightening a connector, do not apply more than 9.2 cm-kg (12 lb-in) of torque. Greater torque can deform the mating surfaces.

Environment

Operate the bridges only in environments within the limits listed. Storage and shipment environments must meet the conditions shown.

Table 4-1 Environmental requirements

Parameter	Required values/ranges
Temperature	
– Operating	0 to +55 °C
– Storage and shipment	-25 to +75 °C
Humidity	
– Operating	Up to 95%. Protect the bridge from temperature extremes, which can cause condensation.
– Storage and shipment	Up to 95%. Protect the bridge from temperature extremes, which can cause condensation.
Altitude	
– Operating	Up to 7,620m (25,000 feet)
– Storage and shipment	Up to 7,620m (25,000 feet)

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK.



This information is subject to change without notice. Always refer to the Keysight website for the latest revision.

© Keysight Technologies 1992 - 2019
Edition 4, March 13, 2019

Printed in Malaysia



86207-90001

www.keysight.com