

# Keysight 11667C Power Splitter

Operating and  
Service Manual

# Notices

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

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# 1 General Information

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This manual contains operating and service information for the Keysight 11667C power splitter. The microfiche part number of the power splitter is 11667-90045. Use this number to order microfilm transparencies of this manual. The microfiche package includes the latest manual changes supplement and relevant service notes.

## Specifications

**Table 1-1** lists performance specifications. The instrument is tested against these performance standards. **Table 1-2** provides supplemental (non-warranted) characteristics of the Keysight 11667C. These are also denoted as typical, nominal, or approximate.

**Table 1-1** General specifications

Description	Value
Frequency range	DC to 50 GHz
Maximum power	+27 dBm
Connectors	2.4 mm female on all ports

**Table 1-2** Electrical specifications

Description	Frequency			
	DC to 18 GHz	DC to 26.5 GHz	DC to 40 GHz	DC to 50 GHz
Input return loss (SWR)	20 dB (1.22)	16 dB (1.38)	14 dB (1.50)	12 dB (1.65)
Equivalent output SWR (leveling or ratio measurements)	1.29	1.29	1.50	1.65
Output tracking (between output arms)	0.30 dB	0.35 dB	0.40 dB	0.40 dB

**Table 1-3** Mechanical specifications

Description	Value
Pin depth	0.000 to 0.076 mm (0.000 to 0.003 in) <sup>[a]</sup>
Dimensions	35.2 mm H x 35.2 mm W x 10 mm D (1.4 x 1.4 x 0.4 in)
Weight	Net 0.06 kg (0.13 lb) Shipping 0.14 kg (0.3 lb)

[a] Allowable recession of the end of the female center pin behind the outer conductor mating plane.

**Table 1-4** Supplemental characteristics

Description	Frequency			
	DC to 18 GHz	DC to 26.5 GHz	DC to 40 GHz	DC to 50 GHz
Phase tracking (between output arms)	2.0°	2.5°	3.0°	3.0°
Insertion loss	6.0 dB	7.0 dB	8.0 dB	8.5 dB

## Instrument Covered by Manual

Each Keysight 11667C has a unique serial number. The content of this manual applies directly to power splitters with serial number 00101 and above.

An Keysight 11667C manufactured after the printing of this manual may be different from those documented in this manual. The manual for that instrument is supplied with a manual changes supplement that documents the differences.

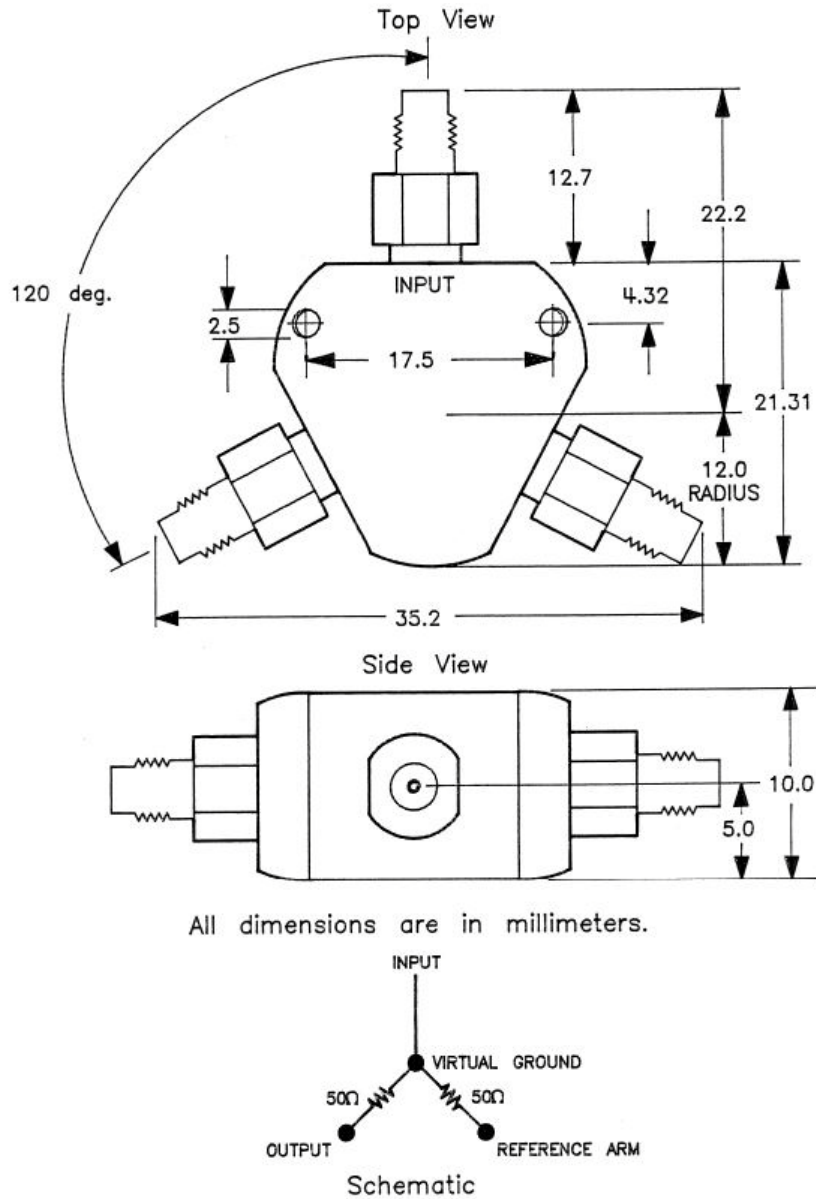
In addition to change information, the supplement may contain information that applies to all instruments, regardless of serial number. To keep this manual as current as possible, periodically request the latest manual changes supplement. The supplement for this manual is keyed to its print date and part number. Copies of the supplement are available from Keysight.

## Description

The Keysight 11667C is a two-resistor power splitter used in network analysis where one output arm is used for leveling or to supply a reference signal for ratio measurements.

In a network analyzer system, the node at the fork of the power splitter is held constant by the leveling action of the network analyzer reference channel (see Figure 1-1). Because a virtual ground is present at the node, the resistance in each output arm is 50 ohms, giving a 50 ohm matched output impedance.

The ratio between the two power splitter arms is not affected by source power level variation. Variations in power level appear in both arms equally and simultaneously.



**Figure 1-1** Keysight 11667C schematic and dimensions

## Equipment Available

The power splitter's 2.4 mm connectors are compatible with all other 2.4 mm connectors. Keysight also produces adapters from 2.4 mm to other coaxial connector types. Refer to *2.4 mm ADAPTERS and CALIBRATION ACCESSORIES*, part number 11900-90003, for a list of these products and their specifications.

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## 2 Installation

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## Initial Inspection

If the shipping container or cushioning material is damaged, do not discard them until the power splitter has been checked mechanically and electrically.

Inspect the power splitter for mechanical damage.

Electrically test the power splitter. Refer to Performance Tests.

Notify your nearest Keysight office if there is mechanical damage or defect, or if the power splitter does not pass electrical tests. Notify the carrier if the shipping container is damaged or the cushioning material shows signs of stress. Keep all shipping materials for the carrier's inspection. Keysight will arrange for repair or replacement without waiting for a claim settlement.

## Preparation for Use

### CAUTION

Maximum input power to the Keysight 11667C is +27 dBm. Exceeding this limit will damage the resistor network and void the warranty.

### Mating connectors

The accuracy and repeatability of each measurement depends on the proper care and use of the 2.4 mm connectors. Visually inspect and clean connectors before every connection. Measure mechanical tolerances (pin depth) with a precision gage prior to the connector's first use, and periodically thereafter. Torque connections to 8 in-lb (90 N-cm). Information concerning the proper maintenance, inspection, and gaging of connectors is provided in the Keysight *Microwave Connector Care manual*, part number 08510-90064.

### Environment

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

**Table 2-1** Environmental requirements

Parameter	Required values/ranges
<b>Temperature</b>	
- Operating	0 to +55 °C (+32 to +131 °F)
- Storage and shipment	-40 to +75 °C (-40 to +167 °F)
<b>Humidity</b>	
- Operating	Up to 95% relative
- Storage and shipment	Up to 95% relative
<b>Altitude</b>	
- Operating	Up to 4,572 metres (15,000 feet)
- Storage and shipment	Up to 7,620 metres (25,000 feet)

### Returning the power splitter for service

If you return the instrument to Keysight, follow the [Packaging](#) instructions. Attach a tag to the instrument indicating the model and serial number, type of service required, return address, and technical contact person with complete phone number.

## Packaging

Containers and materials identical to those used in factory packaging are available through Keysight offices. If you choose to package the instrument with commercially available materials, follow these instructions:

- 1** Place the power splitter completely inside an anti-static bag.
- 2** Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.
- 3** Use a 7 to 10 cm (3 to 4 in) layer of shock-absorbing material around all sides of the instrument to provide a firm cushion and prevent movement inside the container.
- 4** Seal the shipping container securely.
- 5** Mark the shipping container **FRAGILE**.

# 3 Operation

Operator's Check [22](#)

## Operator's Check

The operator's check is a quick evaluation of the power splitter 's operation. Perform this procedure to verify that the power splitter is functioning.

- 1** Visually inspect the input port and both output ports for defect or damage. Mating defective or unclean connectors will degrade the measurement and damage the mating connector.
- 2** Perform the *Output Tracking* test from 0.01 to 40 GHz (or over the frequency range you will be using.) Refer to [Chapter 4, "Performance Tests"](#) for this procedure.

If the power splitter fails either check, contact Keysight for repair or replacement.

## 4 Performance Tests

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## Input Return Loss

### Specifications

Refer to [Table 1-1](#). Specifications apply at  $25^\circ \pm 5^\circ\text{C}$ .

### Description

Input return loss is a measurement of the input port match of the power splitter. The reflected RF signal is measured at the input port with both output ports terminated in 50 ohms.

Two test setups are required to measure the input return loss of the Keysight 11667C. The test system for 0.01 to 40 GHz uses the Keysight 85027D directional bridge. The second, for 40 to 50 GHz, uses a waveguide system.

To ensure that the power splitter meets the input return loss specifications, the measured values must be greater than or equal to the specifications plus the measurement uncertainty. [Figure 4-5](#) lists the input return loss specifications and the approximate measurement uncertainty for the Keysight 11667C power splitter.

### Equipment

#### For 0.01 to 40 GHz

Scalar network analyzer	8757A
Sweep oscillator	8350B
RF plug-in	83597A
Directional bridge	85027D
Open PSC-2.4 (f)	85141B <sup>[a]</sup>
Short PSC-2.4 (f)	85140B <sup>[a]</sup>
Termination 50 ohm (m) (2 required)	85138A

[a] Included with the 85027D

#### Additional equipment required for 40 to 50 GHz

RF plug-in	83550A
Millimeter-wave source module	83555A
Directional coupler	Q752C
Detector	85025D
Adapter waveguide to 2.4 mm (f)	Q281A
Adapter waveguide to 2.4 mm (m)	Q281B



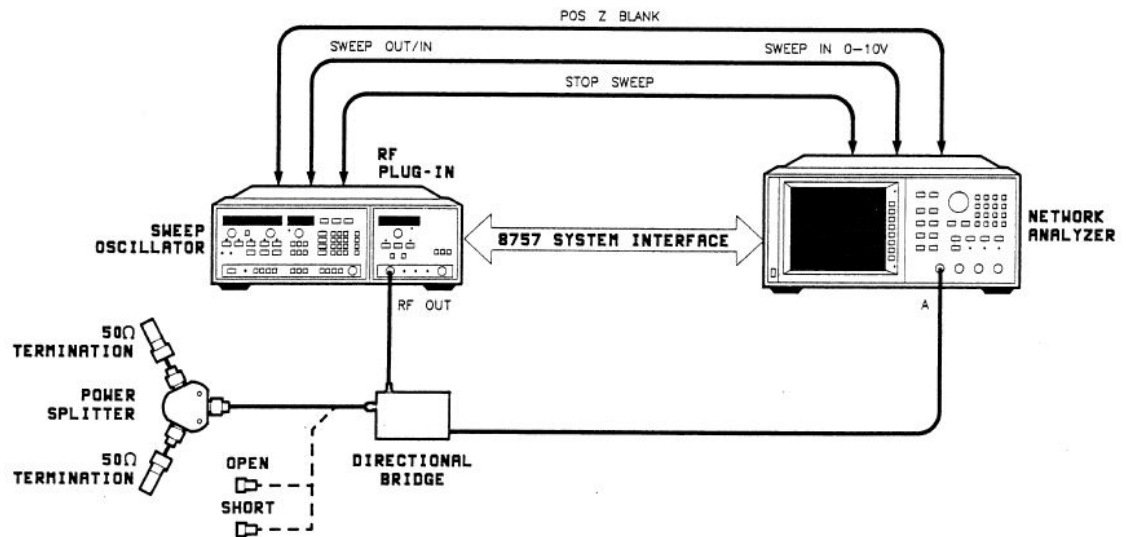
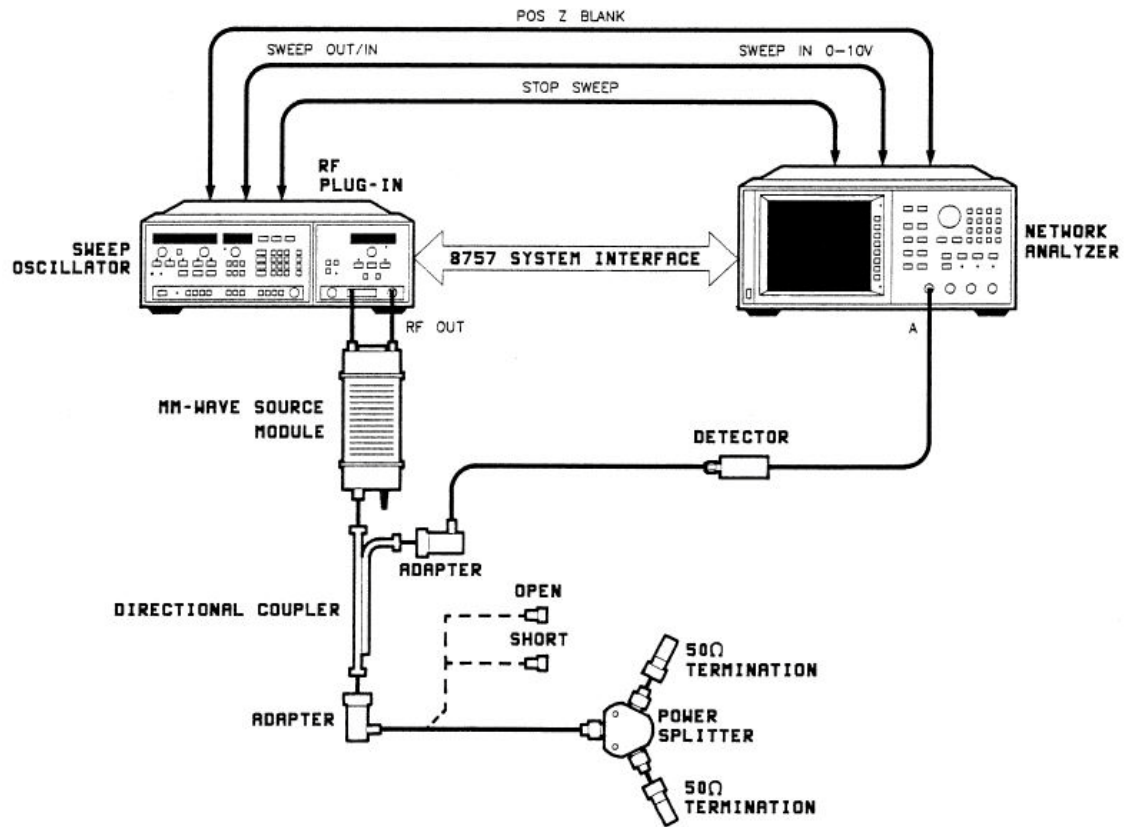


Figure 4-1 Input return loss test setup 0.01 to 40 GHz

#### Procedure - 0.01 to 40 GHz

- 1 Connect the equipment as shown in Figure 4-1, with no connection to the bridge test port. Allow 30 minutes warm-up.
- 2 On the analyzer, press **[PRESET]**. Both the source and analyzer will reset.
- 3 Set up the analyzer. Press **[CHAN 2 OFF]** **[REF]** **[REF POSN]**. Use the step keys to move the reference position to center screen.  
Press **[SCALE]** **[AUTO SCALE]**.
- 4 Calibrate the analyzer. Press **[CAL]** **[SHORT/OPEN]** and connect the short to the bridge test port.  
Press **[STORE SHORT]**. Remove the short and replace with the open .  
Press **[STORE OPEN]** and remove the open. The CRT will display:  
SHORT/OPEN CAL SAVED IN CH 1 MEM.  
Press **[DISPLAY]** **[MEAS-MEM]** to normalize the measurement.
- 5 Connect a 50 ohm termination to each of the power splitter output ports, then connect the power splitter to be tested to the test port of the bridge.
- 6 Press **[CURSOR]**. Turn the analyzer's front panel knob to read the worst case return loss (highest value) between each frequency range listed in the performance specifications.  
Enter the measured value on the *Performance Test Record* (Figure 4-5).



**Figure 4-2** Input Return Loss Test Setup 40 to 50 GHz

### Procedure - 40 to 50 GHz

- 1 Set up the equipment as shown in [Figure 4-2](#) with nothing connected to the adapted output of the coupler. Allow 30 minutes warm-up.
- 2 Set up the analyzer. Press **[PRESET]** **[CHAN 2 OFF]** **[REF]** **[REF POSN]**. Set the reference position to center screen if it is not already there.  
Press **[SCALE]** **[AUTO SCALE]**.
- 3 Calibrate the analyzer. Press **[CAL]** **[SHORT/OPEN]** and connect the short to the adapted output of the coupler.  
Press **[STORE SHORT]**. Remove the short and replace it with the open.  
Select **[STORE OPEN]** and remove the open. The CRT will display:  
SHORT/OPEN CAL SAVED IN CH 1 MEM.  
Press **[DISPLAY]** **[MEAS-MEM]**.
- 4 Connect a 50 ohm termination to each of the power splitter output ports, then connect the power splitter to be tested to the adapted output of the coupler.
- 5 Press **[CURSOR]**. Turn the analyzer's front panel knob to read the worst case return loss (highest value) between 40 and 50 GHz.  
Enter the measured value on the *Performance Test Record* ([Figure 4-5](#)).

## Output Tracking

### Specifications

Refer to [Table 1-1](#). Specifications apply at  $25^{\circ} \pm 5^{\circ}\text{C}$ .

### Description

Output tracking compares the frequency response of one output port to the other output port. A swept measurement is stored from the first output port and compared to the measurement of the other output port. Output tracking is measured as the maximum peak-to-peak variation.

Two tests are required to cover the frequency range of the power splitter. The first tests from 0.01 to 40 GHz. The second tests from 40 to 50 GHz.

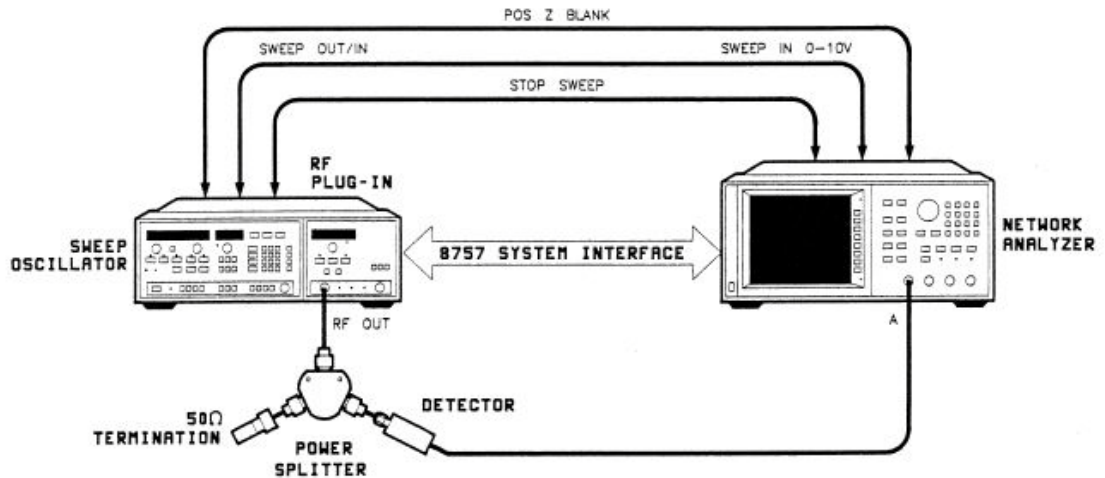
### Equipment

#### For 0.01 to 40 GHz

Scalar network analyzer	8757A
Sweep oscillator	8350B
RF plug-in	83597A
Detector	85025D
Termination 50 ohm (m) (2 required)	85138A

#### Additional equipment required for 40 to 50 GHz

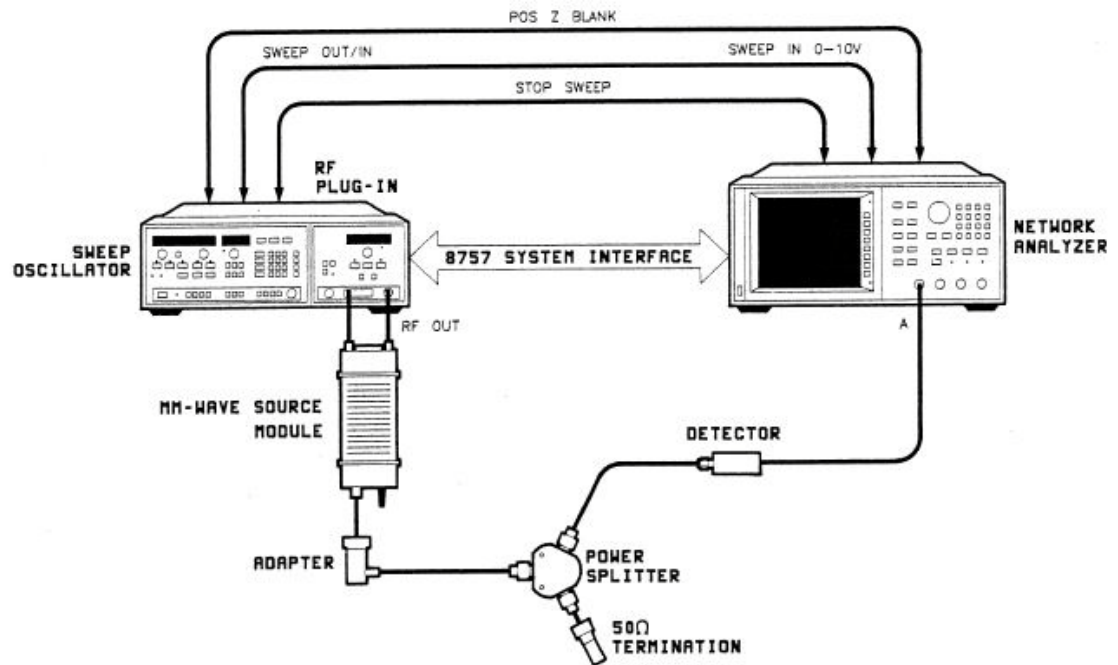
RF plug-in	83550A
Millimeter-wave source module	83555A
Adapter waveguide to 2.4 mm (m)	Q281B



**Figure 4-3** Output tracking test setup 0.01 to 40 GHz

#### Procedure - 0.01 to 40 GHz

- 1 Connect the equipment as shown in [Figure 4-3](#). Allow 30 minutes warm-up.
- 2 On the analyzer, press **[PRESET]**. Both the source and analyzer will reset.
- 3 Set up the analyzer. Press **[CHAN 2 OFF]** **[REF]** **[REF POSN]**. Use the step keys to set the reference at center screen, if it is not already there.  
Press **[SCALE]** **[AUTO SCALE]**.
- 4 Press **[DISPLAY]** **[MEAS-MEM]** **[MEAS-MEM]**. The displayed trace will be a flat line.
- 5 Reverse the connections to the output ports of the power splitter. Press **[CURSOR]**. Turn the analyzer's front panel knob to read the worst case output tracking (greatest deviation + or - from the reference line) between the frequency ranges specified.  
Enter the measured values on the *Performance Test Record* ([Figure 4-5](#)).



**Figure 4-4** Output tracking test setup 40 to 50 GHz

#### Procedure - 40 to 50 GHz

- 1 Set up equipment as shown in [Figure 4-4](#). Allow 30 minutes warm-up.
- 2 On the analyzer, press **[PRESET]**. Both the source and analyzer will reset.
- 3 On the source, press **[START] [4] [0] [GHZ]**.
- 4 Set up the analyzer. Press **[CHAN 2 OFF] [REF] [REF POSN]**. Set reference at center screen, if it is not already there.  
Press **[SCALE]** and select **[AUTO SCALE]**.
- 5 Press **[DISPLAY] [MEAS -MEM] [MEAS-MEM]**. The displayed trace will be flat.
- 6 Reverse the connections to the output ports of the power splitter. Press **[CURSOR]**. Turn the analyzer's front panel knob to read the worst case output tracking (greatest deviation + or - from the reference line) between 40 and 50 GHz.  
Enter the measured values on the *Performance Test Record* ([Figure 4-5](#)).

## Source Match (Equivalent Output SWR)

A performance test for source match is not included in this manual. Complex vector network analysis is required to accurately measure this characteristic. Source match specification is guaranteed by virtue of its simple design if the power splitter passes the other performance tests in this section, and the output port connectors are in good condition.

<b>11667C POWER SPLITTER PERFORMANCE TEST RECORD</b>			
Serial No. _____	Date _____	Tested By _____	
<b>INPUT RETURN LOSS</b>			
<b>Frequency Range</b>	<b>Minimum</b>	<b>Approximate Measurement Uncertainty</b>	<b>Actual</b>
DC to 18 GHz	20 dB	±2.5 dB	_____dB
DC to 26.5 GHz	18 dB	±2.5 dB	_____dB
DC to 40 GHz	16 dB	±2.5 dB	_____dB
DC to 50 GHz	14 dB	±2.5 dB	_____dB
<b>OUTPUT TRACKING</b>			
<b>Frequency Range</b>	<b>Specification</b>		<b>Actual</b>
DC to 18 GHz	0.30 dB		
DC to 26.5 GHz	0.35 dB		_____dB
DC to 40 GHz	0.40 dB		_____dB
DC to 50 GHz	0.40 dB		_____dB
<b>PIN DEPTH</b>			
<b>Connector Type</b>	<b>Minimum Recession</b>	<b>Maximum Recession</b>	<b>Measured Recession</b>
PSC-2.4	0.000 in 0.000 mm	0.003 in 0.076 mm	_____

Figure 4-5 Performance test record

# 5 Adjustments

Keysight 11667C has no electrical or mechanical adjustments.

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

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