

# **HP 85024A HIGH FREQUENCY PROBE**

## **SERIAL NUMBERS**

This manual applies directly to HP 85024A high frequency probe with the following serial prefix number:

Serial Prefix: 2801A

For additional information about serial numbers, refer to INSTRUMENTS COVERED BY THE MANUAL in the General Information.

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Figure 1. HP 85024A in Supplied Case



## General Information

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### SECTION CONTENTS

Product Description  
Accessories and Required Equipment  
Specifications and Supplemental Characteristics

### PRODUCT DESCRIPTION

The HP 85024A is an active probe that provides low input capacitance, high input impedance, and wide bandwidth. The probe may be used with a variety of network analyzers, spectrum analyzers, frequency counters, and oscilloscopes.

The probe allows the testing of high frequency RF circuits. High input impedance is maintained by a GaAs field effect transistor (FET) microcircuit.

The probe tip may be inserted into the supplied HP 11880A probe adapter, changing the probe input into a 50 Ohm Type-N male connector. The probe's output connector is a Type-N male.

The probe tip is protected when not in use by a retractable grounded metal sleeve. This sleeve helps prevent electrostatic discharge damage to the probe, and protects the tip from breaking if the probe is dropped.

In addition to the HP 11880A probe adapter, the following is also supplied with the probe:

- HP 11881A 10:1 voltage divider
- Slip-on tip with grounding spike
- Clip-on ground lead
- Extra Probe tips
- Probe tip nut driver
- 10229A Hook Tip Adapter

### PRODUCT VERSIONS COVERED BY THE MANUAL

A serial number label is attached to the side of the HP 85024A. The serial number is in two parts:

1. The first four digits followed by the letter "A", comprise the serial number prefix. This prefix differentiates between different product versions.
2. The last five digits of the serial number are unique to each probe.

The contents of this manual apply directly to HP 85024A high frequency probes having the same serial number prefix as those listed on the title page of this manual, under SERIAL NUMBERS.

## Manual Change Supplement

An HP 85024A manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. An unlisted serial prefix indicates that the product may be different from those documented in this manual. If this occurs, a manual change supplement is sent with the product, documenting the differences. To keep this manual as current as possible, periodically request the latest manual change supplement from your nearest Hewlett-Packard office.



The CAUTION sign in this manual identifies an operating procedure or practice which, if not correctly performed, could damage or destroy the product. Do not proceed beyond a CAUTION sign until you fully understand and meet the conditions indicated.

## ACCESSORIES

Description	HP Part Number
Connector Cleaning Kit .....	92193Z
Type-N Connector Gage Kit .....	HP 85054B
Adapter, Type-N female to Precision 7 mm .....	HP 11524A
(for use with HP 85046A S-parameter test set)	
Adapter, Type-N female to BNC male .....	1250-1477
(for use with HP 8590A spectrum analyzer)	

## COMPATIBLE INSTRUMENTS

Any one of the following instruments is required when using the HP 85024A. Unless otherwise noted, each of the following instruments may be controlled by a computer via HP-IB, and can directly output results to a printer or plotter. (HP-IB is Hewlett-Packard's hardware, software, documentation and support for IEEE-488 and IEC 625, worldwide standards for interfacing instruments).

### Network Analyzers

**HP 8753A Network Analyzer.** This is a high performance 300 kHz to 3 GHz vector network analyzer which is equipped with a built-in synthesized RF source. Option 010 provides time domain measurements.

**HP 3577A Network Analyzer.** Equipped with a built-in RF source, The HP 3577A may be used in audio, video, baseband and IF applications from 5 Hz to 200 MHz.

### Spectrum Analyzers

**HP 8590A Portable RF Spectrum Analyzer.** This compact, portable spectrum analyzer makes measurements from 10 kHz to 1.5 GHz over an amplitude range of  $-115$  to  $+30$  dBm. A BNC (m) to Type-N (f) adapter is required.

**HP 8562A/B Portable Spectrum Analyzer.** Environmentally rugged, the HP 8562A/B spectrum analyzers make synthesized measurements from 1 kHz to 22 GHz with an input range of  $-121$  to  $+30$  dBm.

**HP 8568B Spectrum Analyzer.** This spectrum analyzer operates over a 100 Hz to 1.5 GHz frequency range. The HP 8568B's 10 Hz resolution bandwidth yields sensitivities to  $-135$  dBm, providing a dynamic range greater than 85 dB.

**HP 71100A Modular Spectrum Analyzer.** The HP 71100A offers high performance in a modular system. Covering a frequency range of 100 Hz to 2.9 GHz, the HP 71100A makes measurements from audio to RF.

### **Combined Network/Spectrum Analyzer**

**HP 4195A Network/Spectrum Analyzer.** Provides vector-network and spectrum analysis from 10 Hz to 500 MHz with a dynamic range greater than 100 dB.

### **Other Equipment**

With the addition of an external power supply, the HP 85024A may be used with a variety of frequency counters and oscilloscopes, as well as non-HP network and spectrum analyzers.

## **EQUIPMENT AVAILABLE**

**HP 1122A External DC Power Supply.** Supplies power to as many as four probes when used with HP frequency counters oscilloscopes, or non-HP instruments.

Table 1. Specifications

Two types of performance parameters are provided in this table. The code letter provided in the right-hand column shows the appropriate category for each performance parameter. The code letter legend is shown below:

**S = Specification** (warranted)

**N = Nominal** (non-warranted)

Specifications apply at 25°C ±5°C except where noted.

Performance Parameter		Code
Input Capacitance at 500 MHz:	<0.7 pF	N
Input Resistance:	1M Ohm	N
Bandwidth:	300 kHz to 3 GHz (usable to 100 kHz)	N
Gain at 500 MHz:	0 dB ±1.25 dB	S
Frequency Response Relative to 500 MHz:		
300 kHz to 1 GHz:	±1.25 dB	S
1 GHz to 3 GHz:	+2/-3 dB	S
Average Noise Level: (10 Hz to 10 MHz)	<1 mV	S
Input Voltage for 1 dB Compression:	0.3V Peak	S
Noise Figure:		
<100 MHz:	<50 dB	N
100 MHz to 3 GHz:	<25 dB	N
Pulse Transition Time:	200 picoseconds	N
Distortion at 0.3V Input:	<-30 dBc	N
Maximum Safe Input Voltage		
Without 10:1 Divider:	±50V	N
With 10:1 Divider:	±200V	N
Probe Length	130 cm (51 inches)	N
Net Weight	0.3 kg (0.7 lb)	N
Shipping Weight	2.3 kg (5 lb)	N
<b>HP 11881A 10:1 DIVIDER CHARACTERISTICS</b>		
Input Capacitance:	<0.7 pF	N
Input Resistance:	1M Ohm	N
Input Voltage for 1 dB Compression:	3.0V	N
Maximum Safe Input Voltage:	±200V	N

#### RF CONNECTOR MECHANICAL TOLERANCES

When performance testing the HP 85024A, the user may wish to gage the output connector, even though the connector tolerances are not warranted specifications. Hewlett-Packard offices are required to gage the connector when performing a calibration. Enter the results in the Test Record at the end of the Performance Tests Section. The Hewlett-Packard *Microwave Connector Care* manual, HP Part Number 08510-90064, contains illustrations that define connector tolerances and describes how to gage them.

RF Connector: Type-N Male	Tolerance	Code
Recession of the center conductor shoulder from the outer conductor mating plane:	0.208 to 0.214 inches <sup>1</sup>	N

1. The Type-N gage calibration block zeros the gage at a 0.207 inch offset. Therefore the 0.208 to 0.214 inch recession is displayed as 0.001 to 0.007 inches on the gage. The gage is showing the actual recession from the outer conductor mating plane.

## Installation

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### SECTION CONTENTS

Initial Inspection  
Preparation for Use and Power Requirements  
Mating Connectors  
Environmental Requirements  
Returning the Product for Service

### INITIAL INSPECTION

If the shipping container or cushioning material is damaged, keep it until the contents of the shipment are checked for completeness, and the product is checked both mechanically and electrically. Procedures for checking electrical performance are given in the Performance Tests Section.

Notify your nearest Hewlett-Packard office if; the product does not pass performance tests, the shipping contents are incomplete, or if there is mechanical damage or defect. Notify the carrier if the shipping container is damaged or if the cushioning material shows signs of stress. Keep all shipping materials for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement without waiting for a claim settlement. Table 2 lists the contents of the HP 85024A. For part numbers of the accessories listed, refer to the Replaceable Parts Section.

*Table 2. Contents of HP 85024A High Frequency Probe*

HP 85024A High Frequency Probe
HP 11881A 10:1 Divider
HP 11880A Probe to Type-N Adapter
Replacement Probe Tips (5)
Probe Tip Nut Driver (3/32 inch)
Ground Clip (flexible)
Slip-on Spanner Ground Tip
HP 10229A Hook Tip Adapter

## PREPARATION FOR USE

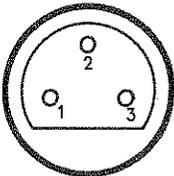


Electrostatic discharge (ESD) can damage the highly sensitive input amplifier microcircuit in the HP 85024A. Always hold the probe by the retracted metal sleeve. Always extend the sleeve when not making measurements. Never touch the probe tip. Use a work station equipped with an anti-static surface.

## Power Requirements

Power for the HP 85024A is supplied by any of the instruments mentioned in **COMPATIBLE EQUIPMENT**. If using the probe with an instrument that does not supply probe power, use a separate power supply which meets the requirements shown in Table 3. A male power connector is available for use with the probe, HP Part Number 5060-0467.

Table 3. Probe Power Supply Requirements and Connector Pin-outs\*

	Pin	Voltage	Current
		1	$-12.6V \pm 20\%$
	2	GND	
	3	$+15 \pm 20\%$	150 mA

\*as seen looking into the probe's power connector

## MATING CONNECTORS

Critical input and test port connector tolerances are provided in Table 1, Specifications. Periodically inspect, gage, and if necessary, clean the Type-N output connector. The HP 11880A probe adapter should be inspected at the same time, and cleaned if necessary. Refer to the Hewlett-Packard *Microwave Connector Care* manual, HP part number 08510-90064 for instructions.

## ENVIRONMENTAL REQUIREMENTS

**Humidity.** Protect this product from temperature extremes which can cause internal condensation.

	Operating	Storage
<b>Temperature:</b>	0°C to +55°C	-40°C to +70°C
<b>Altitude:</b>	Up to 4,600 metres (15,000 feet)	Up to 15,000 metres (50,000 feet)

## **RETURNING THE PRODUCT FOR SERVICE**

If you ship the probe to a Hewlett-Packard office or service center, please include a blue service tag (found at the end of this manual). Remember, when filling out the service tag, provide a valid mailing address. **Products can not be returned to a post office box.** Provide the name and phone number of a contact person within your organization, the complete model and serial number of the product, and a complete description of the problem.

Wrap the probe (with service tag) in heavy paper or anti-static material, and place in a strong shipping container such as a double-wall carton made of 350-pound test material. Pack at least 1 inch of loose fill packing material. Seal the shipping container securely and mark it **FRAGILE**.

When making inquiries, either by correspondence or by telephone, please refer to the probe by model and full serial number.



## SECTION CONTENTS

Operating Precautions  
Operating Instructions  
Operator's Check  
Typical Measurement Setups

## OPERATING PRECAUTIONS



Electrostatic discharge (ESD), excessive input signals or mechanical shock can dramatically degrade the performance of the HP 85024A.

- **NEVER TOUCH THE PROBE TIP!**
- always hold the probe by the retracted metal sleeve
- work at a workstation equipped with an anti-static mat
- extend the protective sleeve when not actually making measurements
- wear an anti-static wrist strap and avoid introducing static electricity into the DUT or test setup

### Discharging the Probe Between Measurements

Measuring a node having a DC voltage potential charges blocking capacitors inside the HP 85024A probe. Ground the probe tip after measuring such nodes to discharge probe capacitors. Failure to do this could result in damage to sensitive circuits in the DUT, especially if it is an active device.

## Grounding the Probe

Proper grounding is important when making measurements with any probe. The HP 85024A probe is supplied with two grounding devices, an alligator-type ground clip and a slip-on ground tip. Use the shortest ground path possible. The effects of improper grounding become greater as frequency increases. For optimum measurements in a factory environment, design your circuits with ground-plane feedthroughs next to every test point.

## Retracting and Extending the Protective Sleeve

Hold the probe wand in one hand, pointing the tip away from yourself. Grasp the probe sleeve in the other hand and turn it about 1/4 turn counter-clockwise. Now, pull the sleeve toward you while SLOWLY turning it counter-clockwise. The sleeve will now retract quickly with very little counter-clockwise rotation. Reverse this procedure to extend the sleeve.

### Probe Features

The figure below shows the main features of the probe.

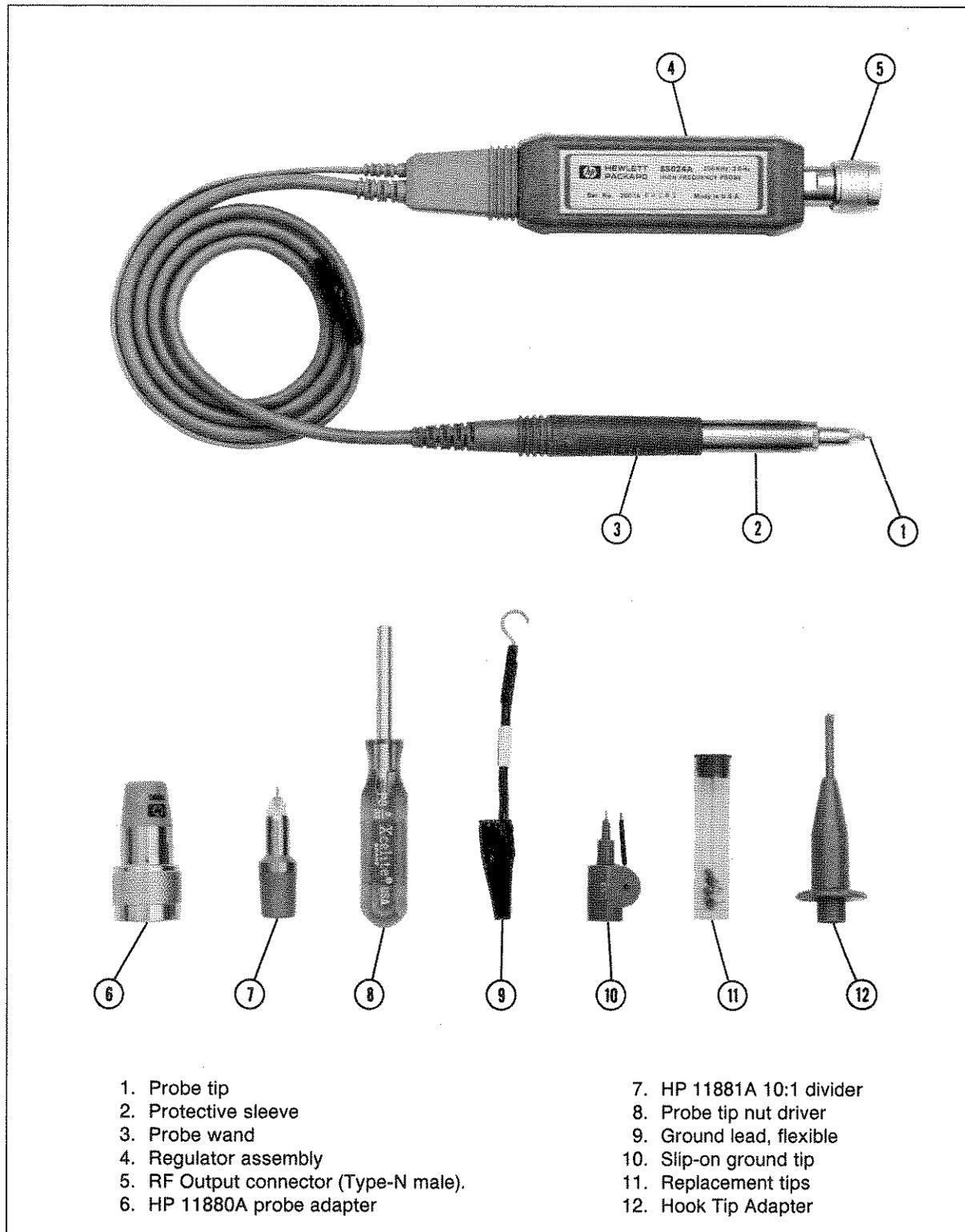


Figure 2. HP 85024A Features

## OPERATOR'S CHECK

Figures 3 and 4 illustrate two test setups for the operator's check procedure, one is for use with a network analyzer, the other for use with spectrum analyzer. Follow the desired procedure to check the probe. This test is only intended to ensure that the probe is *functioning*. If the probe fails the test, it must be repaired. Refer to the Service Section.

If the probe appears to be out of specification, verify the probe using the performance tests supplied in this manual. If the probe fails those tests, turn to the Service Section to isolate the problem.

### Operator's Check Using a Network Analyzer

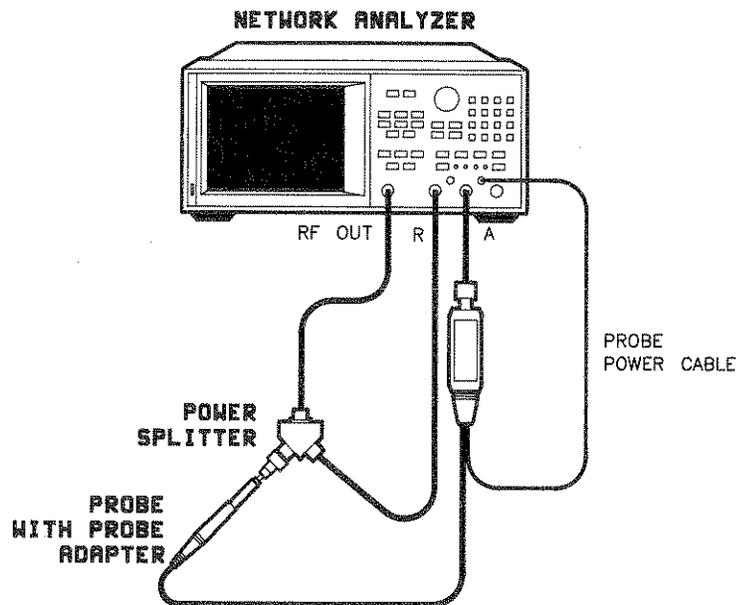


Figure 3. Operator's Check using a Network Analyzer

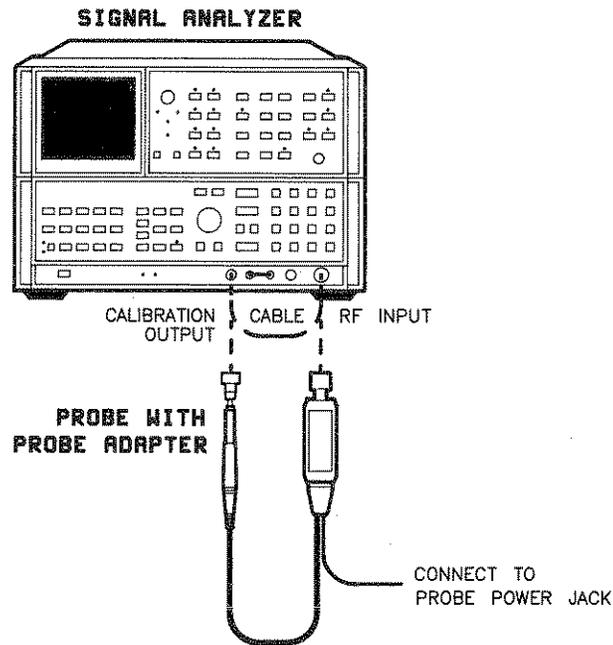
### Equipment

Network Analyzer .....	Any Compatible
Power Splitter .....	HP 11667
Probe Adapter .....	HP 11880A

### Procedure

1. Connect the equipment as shown in Figure 3. A test set should not be connected to the analyzer.
2. Set the network analyzer to A/R mode and activate a marker.
3. The signal loss caused by the probe should not exceed 5 dB. If the probe fails this test it must be repaired.

## Operator's Check Using a Spectrum Analyzer



NOTE: CONNECT CABLE IN STEPS 1 THROUGH 3  
CONNECT PROBE IN STEP 4

Figure 4. Operator's Check using a Spectrum Analyzer

### Equipment

Spectrum Analyzer .....	Any Compatible
Adapters .....	As Necessary
Probe Adapter .....	HP 11880A

### Procedure

1. Connect the spectrum analyzer's calibration output directly to its RF input. Turn on the spectrum analyzer.
2. Set the spectrum analyzer center frequency to the frequency of the calibration output. Set the frequency span to 10 MHz and activate a marker.
3. Place the marker on the peak of the displayed signal and note the value in dBm.
4. Connect the probe to the spectrum analyzer as shown in Figure 4. Place the marker on the peak of the displayed signal and compare the signal level in dBm to that measured in step 3. If the probe caused more than 5 dBm of signal loss it must be repaired.

## TYPICAL MEASUREMENT SETUPS

Figures 5 through 7 show typical measurement setups using the HP 85024A high frequency probe. Only network analyzers are shown in these examples. When using the probe with instruments such as spectrum analyzers, oscilloscopes, and frequency counters, simply connect the probe to the instrument's RF input connector.

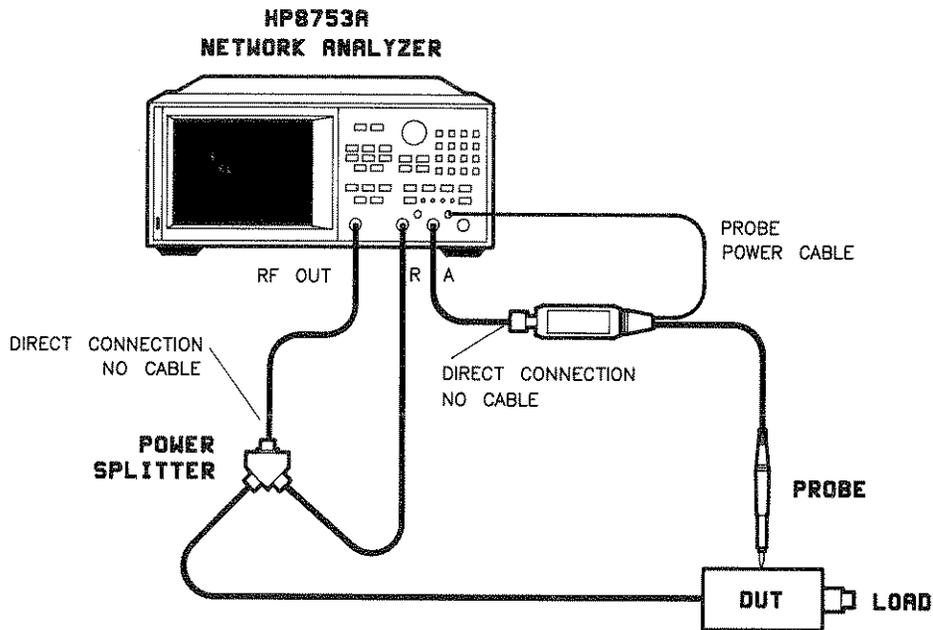


Figure 5. Typical Measurement Setup using a Network Analyzer

### Measurements using a Network Analyzer (without test set)

The RF output of the analyzer is sent to a power splitter. One arm of the splitter is connected to the reference input of the analyzer. The other is connected to the DUT. Terminate the DUT with a 50 Ohm load if necessary.

Connect the probe output to the A or B input and measure the DUT as close to its input connector as possible, and perform a thru calibration to normalize system errors. Make measurements as needed.

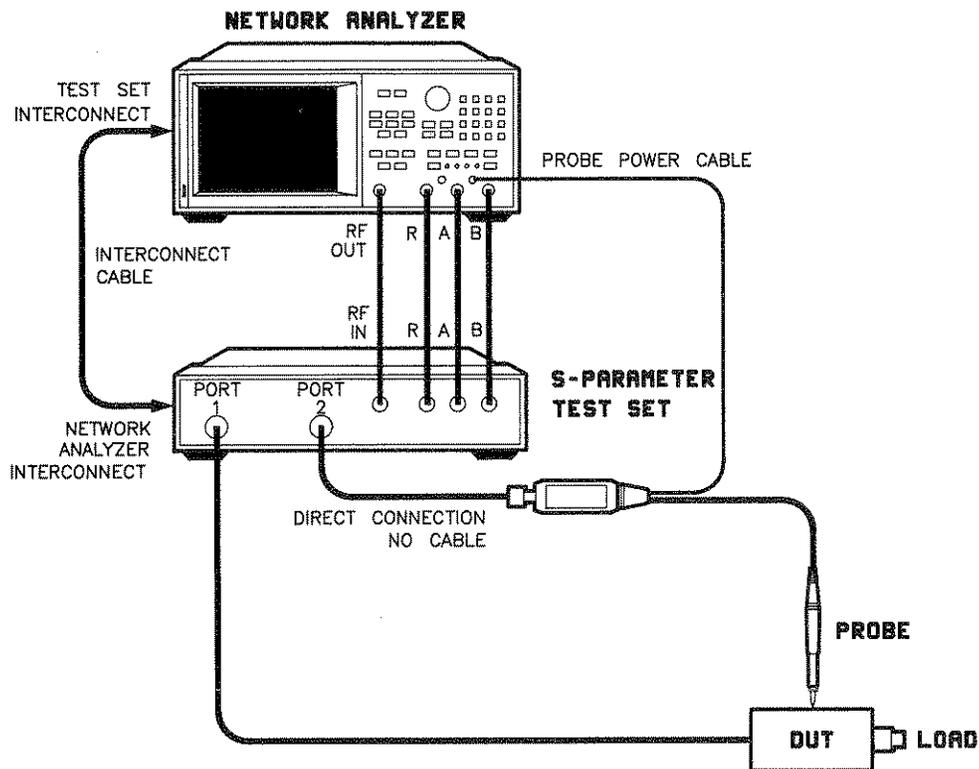


Figure 6. Typical Measurement Setup using a Network Analyzer and S-Parameter Test Set

### Measurements using a Network Analyzer and S-Parameter Test Set

Port 1 is connected to the input of the DUT. Terminate the DUT with a 50 Ohm load if necessary. Connect the probe output to port 2 and select an  $S_{21}$  measurement.

Measure the DUT as close to its input connector as possible and perform a thru calibration to normalize system errors. Make measurements as needed.

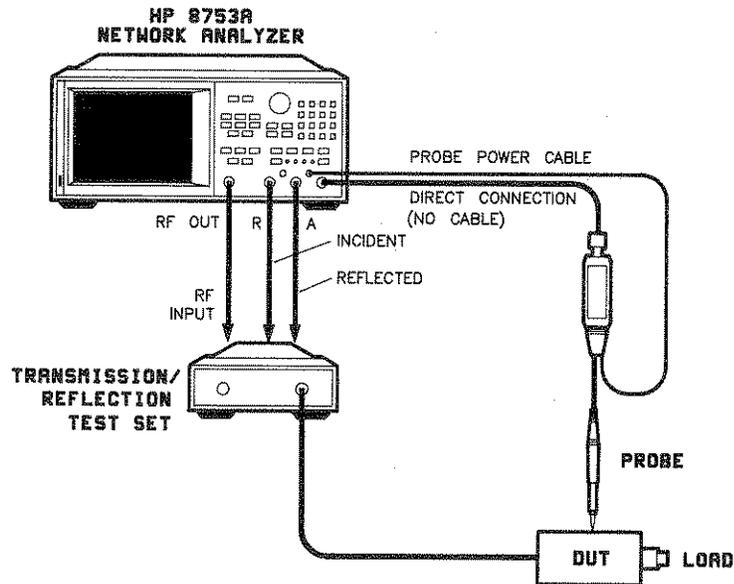


Figure 7. Typical Measurement Setup using a Network Analyzer and Transmission/Reflection Test Set

### Measurements using a Network Analyzer and Transmission/Reflection Test Set

Connect the A channel, R channel, and RF power cables between the network analyzer and the test set. Connect the test set's test port to the input of the DUT, terminate the DUT if necessary. Connect the probe output to the B input of the network analyzer. Select B/R.

Measure the DUT as close to its input connector as possible and perform a thru calibration to normalize system errors. Make measurements as needed.



