# User's and Service Guide

## Agilent Technologies
## 85025A/B/D/E
## Detectors

Agilent Technologies

**Manufacturing Part Number: 85025-90063**
**Supersedes 85025-90014 & 85025-90031**

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## Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product number/name was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP 85109C is now model number Agilent 85109C.

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**NOTE** In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine whether your product is still within its warranty period.

## Safety Notes

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

**Caution** Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

⚠ The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

## How to Use This Guide

### This guide uses the following conventions:

| | |
|---|---|
| (Front-Panel Key) | This represents a key physically located on the instrument. |
| `Softkey` | This indicates a "softkey," a key whose label is determined by the instrument's firmware. |
| `Screen Text` | This indicates text displayed on the instrument's screen. |

## Documentation Description

This manual contains information on operating, testing, and servicing the Agilent 85025A/B/D/E detectors.

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# General Information

This manual contains information on operating, testing, and servicing the Agilent 85025A/B/D/E detectors. Figure 1-1 shows the detectors.

## Product Description

The 85025A/B/D/E detectors are specifically designed for use with Agilent 8757 series scalar network analyzers.

**Table 1-1. 85025 Series Detector Descriptions**

| Detector | Connector Type | Frequency Range |
|---|---|---|
| 85025A | Type-N (m) | .01 to 18 GHz |
| 85025A Option 001 | precision 7 mm | .01 to 18 GHz |
| 85025B | precision 3.5 mm (m) | .01 to 26.5 GHz |
| 85025D | precision 2.4 mm (m) | .01 to 50 GHz |
| 85025E | precision 3.5 mm (m) | .01 to 26.5 GHz |

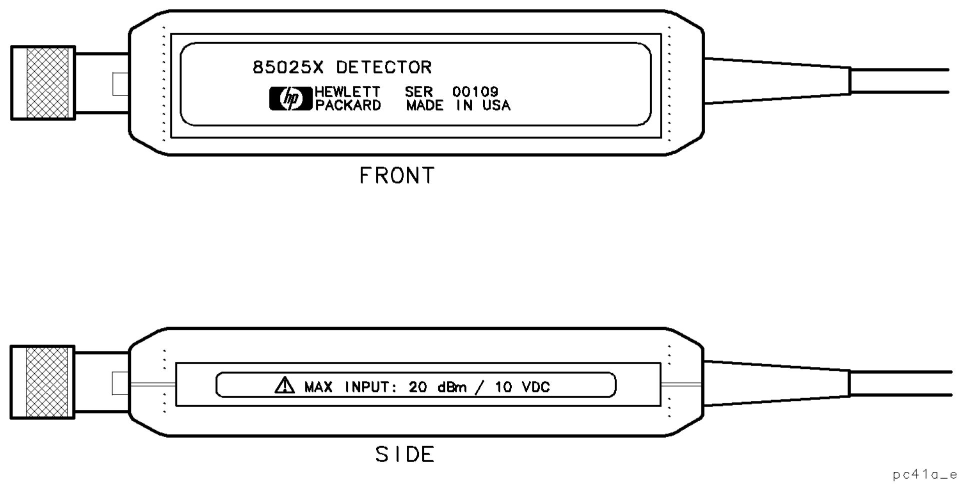



Figure 1-1. 85025A/B/D/E Detector

## Specifications and Supplemental Characteristics

Tables 1-2 through 1-6 list detector specifications when used with an 8757 series scalar network analyzer. These specifications represent the warranted performance standards or limits against which you can test the device.

Table 1-7 lists supplemental (typical, non-warranted) detector characteristics, when used with one of the above-mentioned analyzers.

**Note** Specifications describe the instrument's warranted performance over the temperature range of 25 °C, ±5 °C.

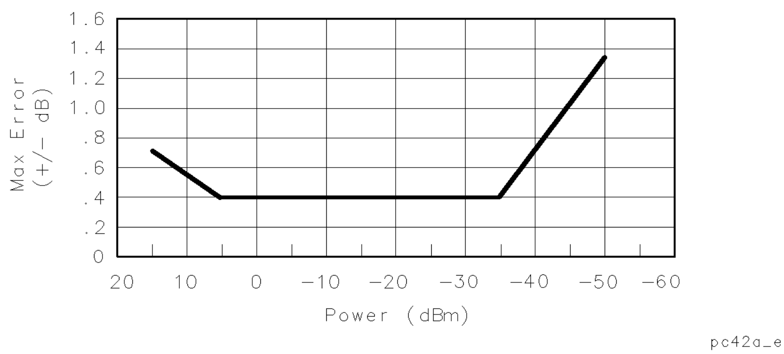
**Table 1-2. 85025A/B/D/E Detector General Specifications**

| | |
|---|---|
| **Dynamic Range** (on all 8757 Series analyzer's detector inputs): | |
| AC mode | +16 to −55 dBm |
| DC mode | +16 to −50 dBm |
| **Nominal Impedance** | 50Ω |
| **Maximum Input Power** | +20 dBm (100 mW), ±10 VDC |

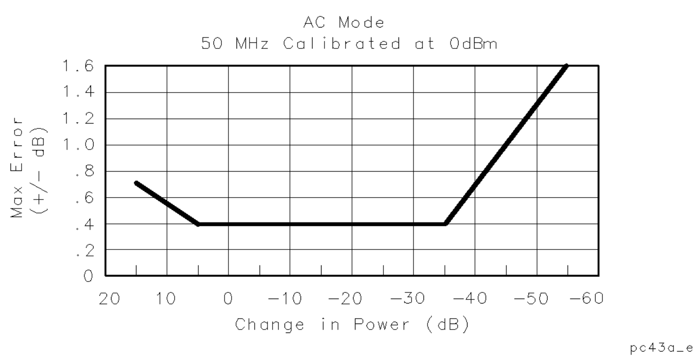
## Table 1-3. 85025A Detector Specifications (including Option 001)

| | |
|---|---|
| **Frequency Range** | 0.01 to 18 GHz |
| **Return Loss**: | |
| 10 MHz to 40 MHz | 10 dB |
| 40 MHz to 4 GHz | 20 dB |
| 4 GHz to 18 GHz | 17 dB |
| **Frequency Response** (in DC mode, input power −10 dBm): | |
| 10 MHz to 40 MHz | +0.25 dB/−0.75 dB |
| 40 MHz to 18 GHz | ±0.5 dB |

**Absolute Power Accuracy** (in DC mode, 50 MHz, calibrated at 0 dBm)



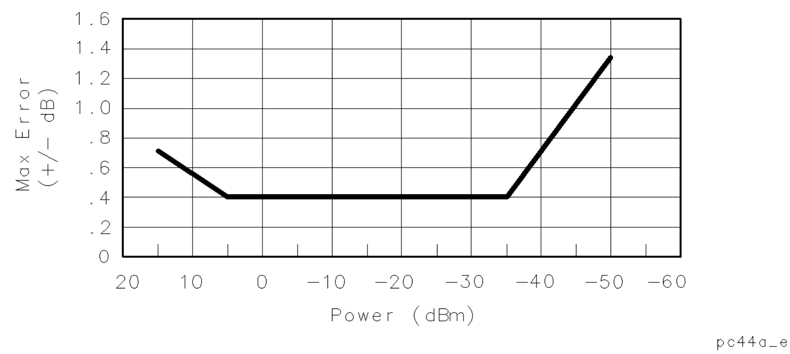

**Dynamic Power Accuracy**



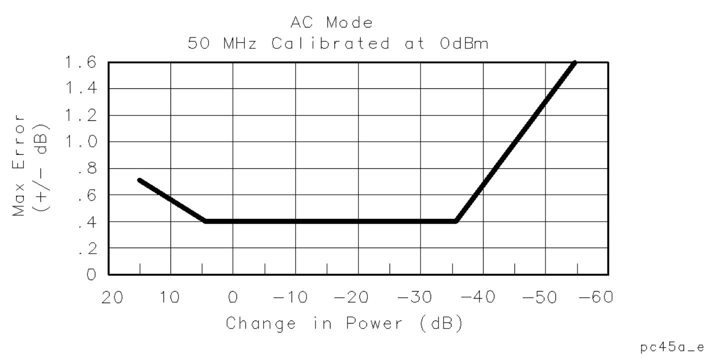
## Table 1-4. 85025B Detector Specifications

| | |
|---|---|
| **Frequency Range** | 0.01 to 26.5 GHz |
| **Return Loss**: | |
| 10 MHz to 40 MHz | 10 dB |
| 40 MHz to 4 GHz | 20 dB |
| 4 GHz to 18 GHz | 17 dB |
| 18 GHz to 26.5 GHz | 12 dB |
| **Frequency Response** (in DC mode, input power −10 dBm): | |
| 10 MHz to 40 MHz | +0.25 dB/−0.75 dB |
| 40 MHz to 18 GHz | ±0.5 dB |

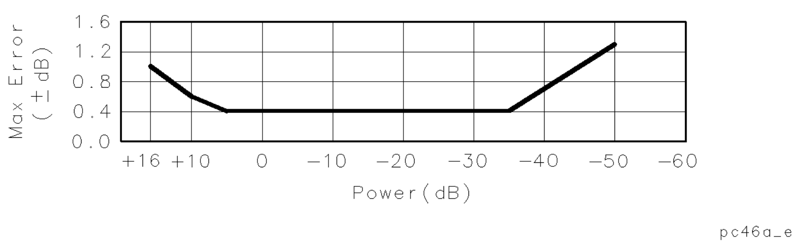
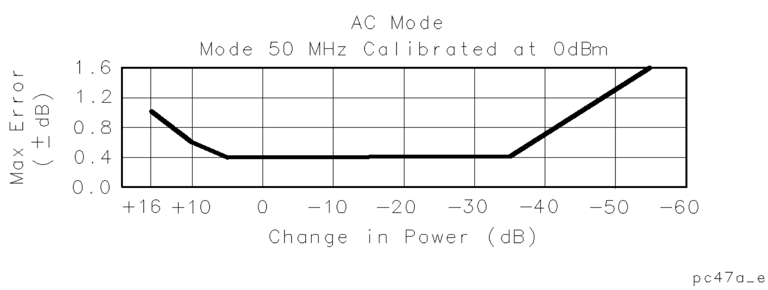
**Absolute Power Accuracy** (in DC mode, 50 MHz, calibrated at 0 dBm)




**Dynamic Power Accuracy**



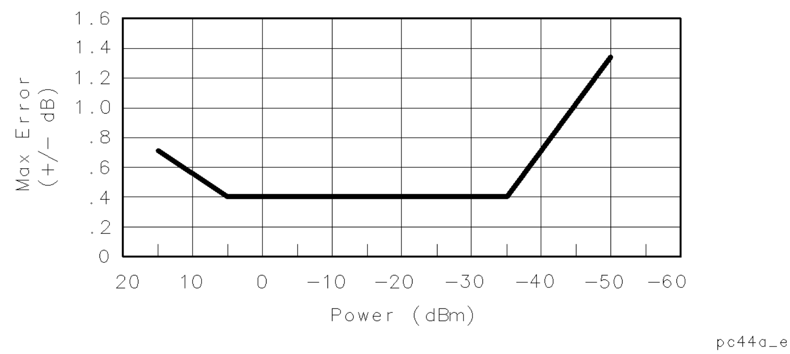
## Table 1-5. 85025D Detector Specifications

| | |
|---|---|
| **Frequency Range** | 0.01 to 50 GHz |
| **Return Loss**: | |
| 10 MHz to 40 MHz | 10 dB |
| 40 MHz to 100 MHz | 20 dB |
| 100 MHz to 14 GHz | 23 dB |
| 14 GHz to 34 GHz | 20 dB |
| 34 GHz to 40 GHz | 15 dB |
| 40 GHz to 50 GHz | 9 dB |
| **Frequency Response** (in DC mode, input power −10 dBm): | |
| 10 MHz to 40 MHz | +0.25 dB/−0.75 dB |
| 40 MHz to 20 GHz | ±0.5 dB |
| 20 GHz to 26.5 GHz | +1/−0.5 dB |
| 26.5 GHz to 40 GHz | +2.5/−0.5 dB |
| 40 GHz to 50 GHz | +3.0/−0.5 dB |
| **Absolute Power Accuracy** (in DC mode, 50 MHz, calibrated at 0 dBm) | |
|   | |
| **Dynamic Power Accuracy** | |
|   | |

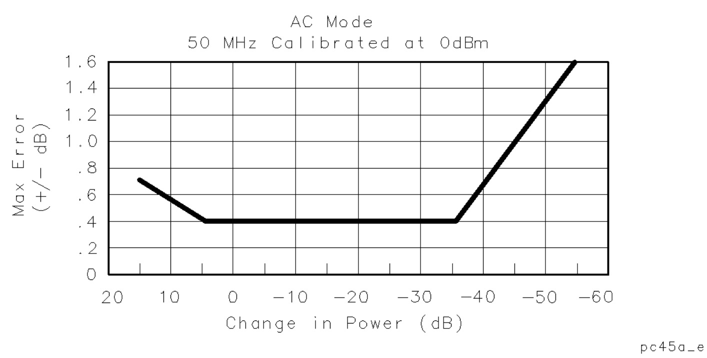
## Table 1-6. 85025E Detector Specifications

| | |
|---|---|
| **Frequency Range** | 0.01 to 26.5 GHz |
| **Return Loss**: | |
| 10 MHz to 40 MHz | 10 dB |
| 40 MHz to 100 MHz | 20 dB |
| 100 MHz to 25 GHz | 25 dB |
| 25 GHz to 26.5 GHz | 23 dB |
| **Frequency Response** (in DC mode, input power −10 dBm): | |
| 10 MHz to 40 MHz | +0.25 dB/−0.75 dB |
| 40 MHz to 18 GHz | ±0.5 dB |
| 18 GHz to 26.5 GHz | ±0.5 dB at 18 GHz to ±1.4 dB at 26.5 GHz |

**Absolute Power Accuracy** (in DC mode, 50 MHz, calibrated at 0 dBm)

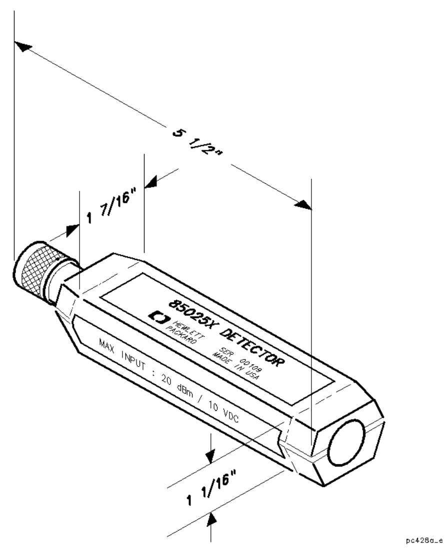



**Dynamic Power Accuracy**



## Table 1-7. 85025A/B/D/E Detector Supplemental Characteristics

| | |
|---|---|
| **RF Connector Mechanical Tolerances**: | |
| Recession of the male center conductor from reference plane: | |
| 85025A | 0.207 to 0.210 inches[1] |
| 85025A Option 001 | 0.000 to 0.003 inches |
| 85025B | 0.000 to 0.003 inches |
| 85025D | 0.000 to 0.002 inches |
| 85025E | 0.000 to 0.003 inches |
| **Cable Length** | 1.22 m (48 inches) |
| **Weight** (Including cable): | |
| Net: | 0.24 kg (0.5 lb) |
| Shipping: | 1.0 kg (2.2 lb) |
| **Dimensions**[2] (Including input connector, not including cable) | |




1 Because a type-N gage calibration block zeros the gage at a 0.207-inch offset, the gage displays a 0.207- to 0.210-inch offset as 0.000 to 0.003 inches.

2 The model used in this illustration is an 85025A. Because of varying input connector lengths, the overall length measurements for the other detector models covered by this manual are:
85025A Option 001: 5 3/16 inches
85205B: 5 1/8 inches
85025D: 5 1/4 inches
85025E: 5 7/16 inches

## Operating Environment

The detector will operate safely under the following conditions, but its performance is not necessarily warranted. See the specifications section for more information.

**Temperature**: 0° to +55 °C

**Humidity**: Up to 95%. Protect the detector from temperature extremes which can cause condensation.

**Altitude**: Up to 4,572 m (15,000 ft)

### Accessories

The detectors come with a 2-meter cable. A 25-foot and 200-foot cable can be ordered separately. Table 6-1 lists the accessories that are available for use with these detectors.

## Storage and Shipment

To keep your detector in proper working condition, keep the following suggestions in mind when storing or shipping it.

### Environment

Store or ship the detectors in environments within the following limits:

**Temperature**: −25° to +75 °C

**Humidity**: Up to 95%. Protect the detector from temperature extremes which can cause condensation.

**Altitude**: Up to 4,572 m (15,000 ft)

### Packaging

Use containers and materials identical or comparable to those used in factory packaging. If you ship the detector, follow these packaging instructions:

1. Wrap the detector in the original pouch and box. If they are not available, wrap the detector in heavy paper and use a strong shipping container.
2. Provide a firm cushion that prevents movement inside the container. Use a layer of shock-absorbing material around all sides of the detector.
3. Seal the shipping container securely.
4. Mark the shipping container *FRAGILE*.

---

## Returning a Detector for Service

When you make an inquiry, either by mail or by telephone, refer to the detector by both model number and full serial number.

If you ship the detector to an Agilent office or service center, fill out a blue service tag (provided at the back of this manual), and include the following information:

1. Company name and address.

   *Do not* use an address with a P.O. box number because products cannot be returned to a post office box.
2. The complete phone number of a technical contact person.
3. The complete model and serial number of the detector.
4. The type of service required (calibration, repair).
5. Any other information that could expedite service, such as failure condition or cause.

2

# Installation

Refer to the following information when using the detector. Do not drop the detector or subject it to excessive mechanical shock.

## Initial Inspection

1. Check the shipping container and packaging material for damage.
2. Check that the shipment is complete.
3. Check connector, cable, and detector body for mechanical damage.
4. Check the detector electrically:

   Either perform the operator's check in Chapter 3, "Operation," or make a measurement in Chapter 4, "Performance Tests."

If any of the following conditions exist, notify your nearest Agilent 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. Agilent does not wait for a claim settlement before arranging for repair or replacement.

# Electrostatic Discharge (ESD)

ESD can damage the highly sensitive circuits in this device; charges as low as 100 V can destroy a detector. ESD damage occurs most often as you connect or disconnect a device. Use this detector at a static-safe workstation and wear a grounding strap. *Never* touch the input connector center contacts or the cable contact pins.

## Static-Safe Work Station

Figure 2-1 illustrates a static-safe station using two types of ESD protection that you can use either together or separately:

- A conductive table mat and wrist-strap combination.
- A conductive floor mat and heel-strap combination.

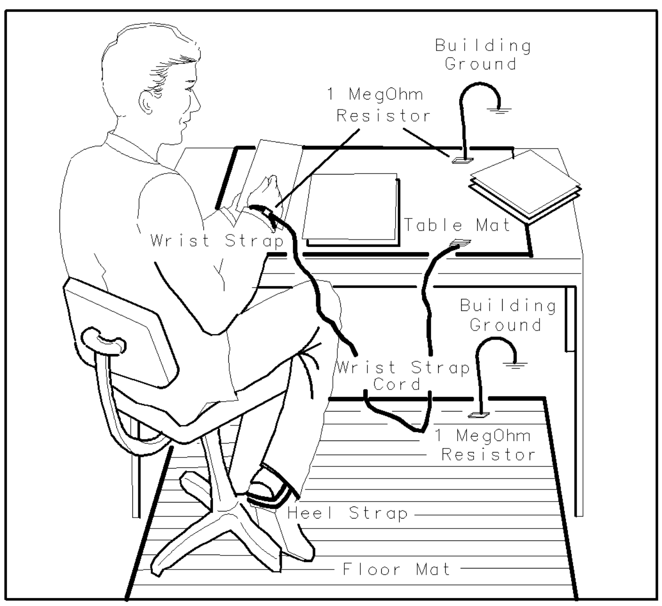



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**Figure 2-1. Example of a Static-Safe Work Station**

### Static-Safe Practices

- Before cleaning, inspecting, or making a connection to a static-sensitive device or test port, ground yourself as far as possible from the test port.
- Discharge static electricity from a device before connecting it. Touch the device briefly (through a resistor of at least 1 MΩ) to either the outer shell of the test port, or another exposed ground. This discharges static electricity and protects test equipment circuitry.

## Power Requirements

The scalar network analyzer supplies power for the detector.

## Mating Connectors

Table 1-7 lists connector mechanical tolerances. *Microwave Connector Care* (part number 08510-90064) provides information on the proper maintenance, inspection, and gaging of connectors.

## Connecting the Detector

1. The 85025A/B/D/E cables plug into the connectors on the front panel of the 8757 series scalar network analyzer. With the cable plug key downward, insert the multi-pin (DC) connector into the A input on the front panel of the analyzer.
2. To secure the DC connector in the analyzer, turn the *outer* shell clockwise.
3. Connect the RF input to the test device by turning the male connector's *outer* shell clockwise.

3

# Operation

**Caution**

- Electrostatic discharge (ESD) can damage the highly sensitive circuits in this device; charges as low as 100 V can destroy your detector.
- ESD damage occurs most often as you connect or disconnect a device. Use this detector at a static-safe workstation and wear a grounding strap. *Never* touch the input connector center contacts or the cable contact pins.
- Do *not* apply more than +20 dBm RF power or more than ±10 VDC to the detector. Higher power/voltage can electrically damage the detector.
- Before you connect a RF cable to the detector, always discharge the static electricity that may have accumulated on the cable's outer conductor to instrument ground. This is most important if the cable is very long or connected to a large antenna.
- Do not drop the detector or subject it to mechanical shock.

## Features

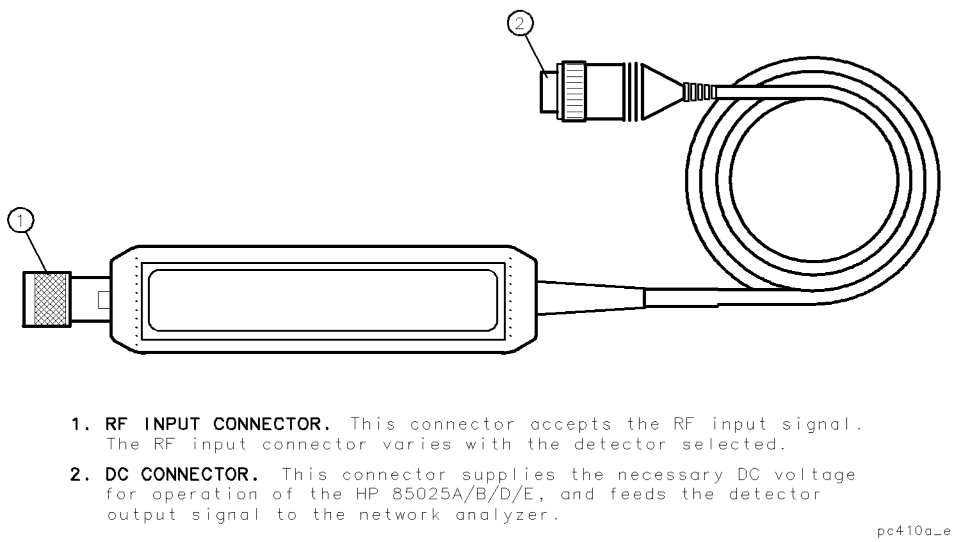


**Figure 3-1. Detector Features**

## Operating Theory

The 85025A/B/D/E can detect either unmodulated RF signals in DC mode or square wave amplitude modulated RF signals in AC mode. In either AC or DC detection mode, the detector provides a 27.778 MHz square wave signal for the analyzer to interpret and display.

In AC detection mode, and RF or microwave signal is amplitude modulated with a 27.778 MHz square wave. The detector demodulates (envelope detects) this signal to produce a 27.778 MHz signal with a peak-to-peak voltage that corresponds to the magnitude of the RF signal at the detector input.

In DC detection mode, no modulation is required. The detector diode in the 85025A/B/D/E converts the RF signal into an equivalent DC voltage. The detector chops the DC voltage at a 27.778 kHz rate, and this chopped signal is then amplified. The amplified signal simulates the signal produced by AC detection.

## Measurement System Configuration

With an 8757 series scalar network analyzer using an 85025A/B/D/E detector, system configuration requires special attention. AC mode is the default state of the analyzer system and there are no further requirements to initiate a measurement. However, to enable DC mode operation, a series of keystrokes is required.

### DC Detection mode

DC detection offers greater power measurement accuracy and the ability to characterize oscillators and modulation-sensitive devices. Figure 3-2 depicts a typical measurement setup for 0.01 to 50 GHz, using an Agilent 8350B sweep oscillator/RF plug-in as the source.

1. On the analyzer, press (PRESET). Connect the detector(s).
2. DC detection mode must be selected. On the analyzer, press (SYSTEM) and select MODE DC.

   When the MODE DC softkey is selected, the source's square wave modulation is automatically switched OFF.

## Accurate DC Measurements

### Zeroing the Detector

When you make DC detection measurements, it is important to perform this detector zeroing procedure to compensate for the effects of DC drift and temperature fluctuations. This zeroing procedure eliminates small DC voltages from the diode detector that would otherwise cause amplitude measurement errors at low ($\leq$40 dBm) power levels. Zeroing also establishes the displayed noise level with no RF signal applied (the system's noise floor).

#### Autozero

Pressing the autozero softkey AUTOZRO switches OFF the source RF signal output and automatically zeros the detector.

The repeat autozero function softkey (REPT AZ ON/OFF) periodically repeats the autozero. You must use a GPIB interfaced sweeper to take advantage of this function because the analyzer must be able to switch OFF the RF output of the sweeper to perform the autozeroing.

### Manual Zero

Manual zero, represented by the MANUAL softkey, is similar to zeroing a power meter.

1. Remove the RF signal from the detector's RF input.
2. On the analyzer, press MANUAL to perform the zeroing.

Refer to "Operation," in the *Agilent Technologies 8757C/E Scalar Network Analyzer Operating Manual* or *Agilent Technologies 8757D Scalar Network Analyzer Operating Manual* for detailed information on these and other softkeys.

In the DC mode, the 85025A/B/D/E is specified for absolute power level accuracy. In regard to these specifications, the following conditions apply:

- The equipment has had a 30 minute warmup period.
- The detector zeroing procedure has been performed.
- The offset has been adjusted with a calibrated 0 dBm, 50 MHz signal applied.
- Trace averaging is enabled on the analyzer at low power levels, as required.
- The source harmonics are below −40 dBc.
- The source SWR is 1.0.

To increase the accuracy of absolute power level measurements, select DET OFFSET to properly set the system response to a 0 dBm signal. After zeroing the detector, follow these steps to set the detector offset:

1. On the analyzer, press (CAL) DET OFFSET DET A (or the appropriate input port). Press (0) (dB). This ensures the 0 dB offset.
2. Connect the detector to the POWER REF output of a calibrated power meter, such as an Agilent 436A or 438A. Switch the POWER REF output ON.
3. Press (CURSOR) AUTOSCALE.
4. Press (CAL) MORE DET OFFSET.

5. Press DET A (or the appropriate input port) and use the entry keys to enter the value opposite in sign to the cursor reading being displayed. The display should now indicate a power reading of 0.00 dBm.

**Note** Pressing (PRESET) on the analyzer does not reset any DC OFFSET to zero, and the SAVE/RECALL registers do not save or recall the offset value(s).

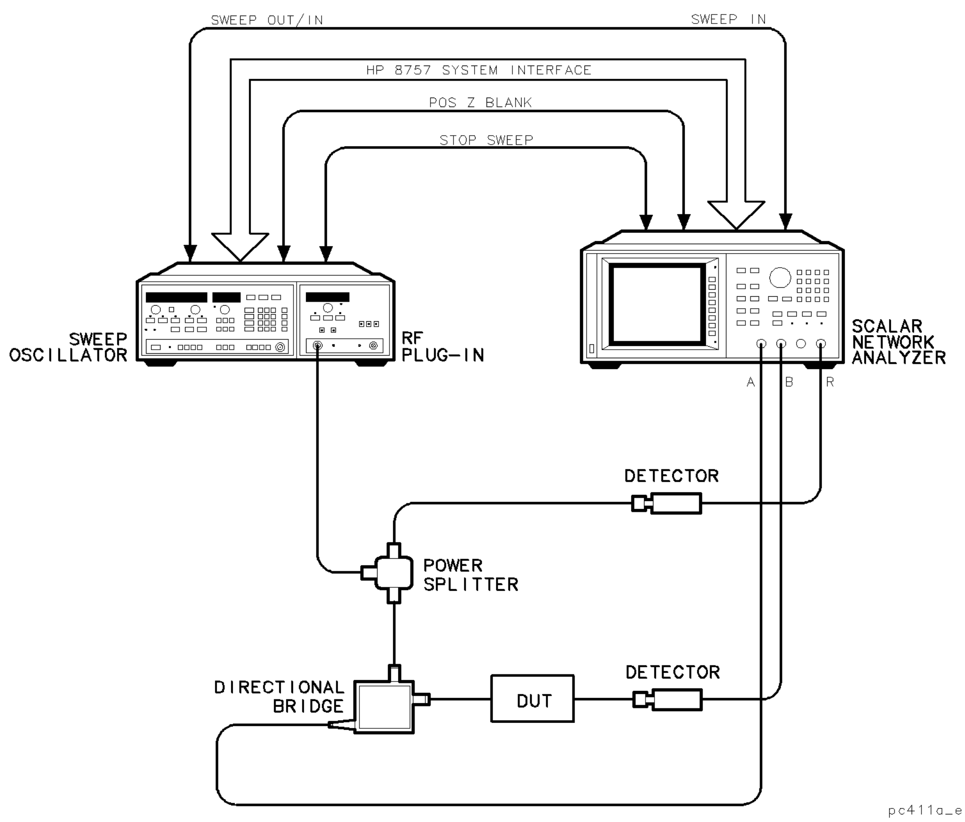


**Figure 3-2. Typical System Setup for 0.01 to 50 GHz Measurements**

## AC Detection Measurements

For the majority of measurements, AC detection is still the preferred method. AC detection offers greater sensitivity and immunity to noise and drift across time and temperature. AC detection amplitude measurements with this scalar network analyzer system require a modulation envelope. This envelope is provided through a 27.778 kHz square wave amplitude modulation of the RF test signal. Test set connections vary depending on the source. Figure 3-2 depicts a typical measurement setup. The 27.778 kHz modulation is supplied by the sweep oscillator.

## Operator's Check

The following procedure provides a quick operational check of the 85025A/B/D/E detector.

**Table 3-1. Equipment Required for Operator's Check**

| Description | Model/Part Number |
|---|---|
| Detector | 85025A/B/D/E |
| GPIB cable | 10833A/B/C/D |
| Bandpass filter | any within the frequency range of the sweeper |
| Sweep oscillator | any compatible with the 8757 series scalar network analyzer |
| BNC cables (3 required) | part number 8120-1839 |

## Procedure

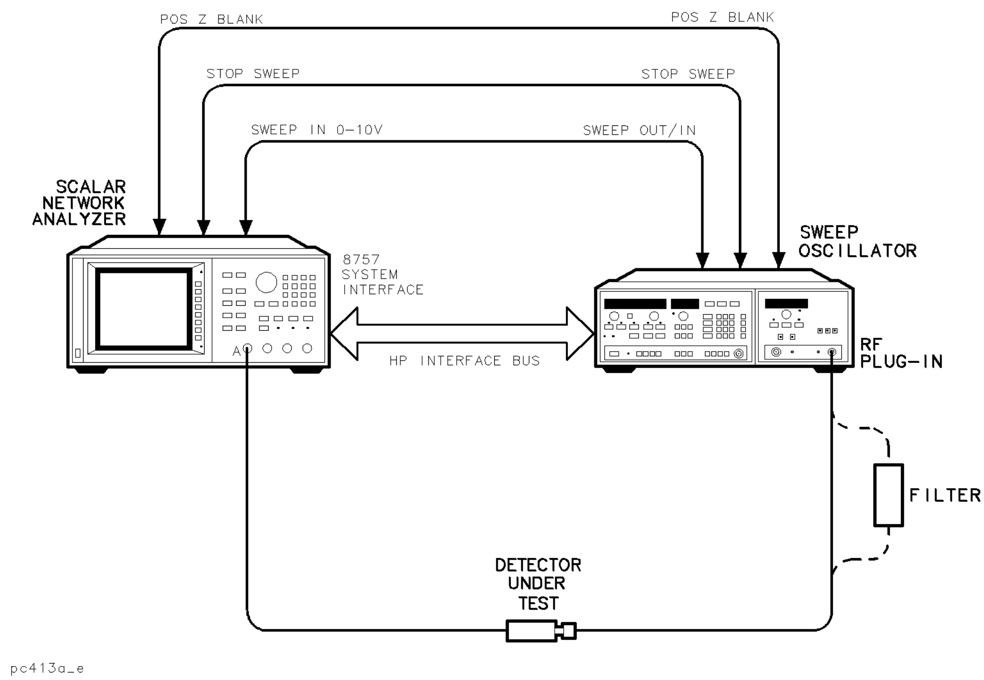


**Figure 3-3. Operator's Check Equipment Setup**

1. Connect the equipment as shown in Figure 3-3, with the detector connected to input A on the analyzer. Form a thru connection by connecting the detector's RF input to the RF output of the source. Switch all of the instruments' line powers ON and allow them to warm up.
2. If the 8757 series analyzer's system interface is not engaged (the analyzer's status line displays SYSINTF OFF), press (SYSTEM) MORE SWEEP MODE SYSINTF ON.
3. On the analyzer, press (PRESET). The analyzer's channel 1 should be active and measuring input A.
4. Adjust the STOP and START frequencies on the source to include the frequency range of the device under test (the bandpass filter).

5. Switch OFF the analyzer's channel 2 by pressing CHANNEL (2) twice.
6. On the analyzer, press (CURSOR) MAX to place the cursor at the maximum value of the trace. The CRSR value is displayed in the active entry area of the analyzer. Adjust the output power of the RF plug-in until the cursor value on the analyzer reads +16 dBm (this power level may not be attainable on all sources). This value is the upper limit of the dynamic range of the analyzer.
7. Press (DISPLAY) MEAS→MEM to store the trace in memory. The analyzer's message line displays CHAN 1 MEAS TO MEMORY.
8. Disconnect the detector from the RF OUTPUT of the source. Press (AVG) AVG ON to activate the averaging function. The averaging value will be 8. Wait a few seconds to allow the trace to settle.
9. Press (CURSOR) MAX. A cursor value of −55 dBm or lower should be displayed in the active entry area. This value represents the noise floor power level.
10. Insert the bandpass filter between the RF output of the source and the detector. Wait a few seconds to allow the trace to settle.
11. Press (CURSOR) MAX to find the trace maximum. The CRSR value displayed in the active entry area now represents the minimum insertion loss of your test device. Verify that the bandpass filter shape is as expected.
12. Press (SYSTEM) MODE AC/DC until the DC mode is activated. Allow the trace to settle. The trace should look similar to the trace observed in step 11, however the noise floor may be up to 5 dB higher. If the noise floor level has increased more than 5 dB, zero the detector.

## If the Operator's Check Fails

Since the detector is measuring the output of an external source, problems may be due to the source, rather than the detector. Verify that the source output as well as the bandpass filter waveform are accurate. Note that bandpass filters can vary considerably from unit to unit.

If the average noise floor is not below −50 dBm in DC mode, try zeroing the detector. The instructions for zeroing the detector can be found earlier in this chapter.

4

# Performance Tests

Use the procedures in this chapter to test the detector's electrical performance to the specifications listed in "General Information." None of these tests require access to the detector's interior.

To completely test each detector, three tests are required:

1. return loss
2. frequency response
3. absolute power/dynamic accuracy

**Note** For information on automating the Frequency Response Performance Test, see the chapter titled "Program Listing."

## Equipment Required

Preceding each test is a list that describes the equipment required to perform that particular test. You may substitute any equipment that meets the indicated critical specifications. See Table 4-1 for an overall list of required equipment.

**Note** Before you proceed with the performance tests, gage the input connector on the detector and enter the results in the *Performance Test Record* at the end of "Performance Tests." For instructions on gaging the detector's input connector, see "Detector Maintenance."

## Table 4-1. Recommended Equipment

| Description | Recommended Agilent Model |
| --- | --- |
| **Equipment Common to all 85025A/B/D/E Detectors** | |
| Scalar network analyzer | 8757C/D/E |
| Sweep oscillator | 8350B |
| Power meter | 436A, 437B, or 438A |
| **Equipment required for 85025A Detectors** | |
| RF plug-in | 83592C |
| Power sensor | 8481A |
| Directional bridge | 85027C |
| Shielded open | p/n 85032-20002 |
| Short | 11511A |
| Adapter type-N(m) to type-N(m) | p/n 1250-1475 |
| Attenuator | 8491B Option 010 |
| **Equipment required for 85025A Option 001 Detectors** | |
| RF plug-in | 83592C |
| Power sensor | 8481A Option 001 |
| Directional bridge | 85027A |
| Calibrated open/short | p/n 85021-60001 |
| Adapter type-N(m) to type-N(m) | p/n 1250-1475 |
| Attenuator | 8492A Option 010 |
| **Equipment required for 85025B Detectors** | |
| RF plug-in | 83595C |
| Power sensor | 8485B |
| Directional bridge | 85027B |
| Calibrated open/short | p/n 85037-60001 |
| Attenuator | 8493C Option 010 |
| **Equipment required for 85025D Detectors** | |
| Sweep oscillator | 8350B |
| RF plug-in | 83597B |
| Power sensor | 8487A |
| Directional bridge | 85027D |
| Open 2.4 mm(m) | 85141A |
| Short 2.4 mm(m) | 85140A |
| Adapter 2.4 mm(f) to 2.4 mm(f) | 11900B |
| Attenuator | 8490D Option 010 |

**Table 4-1. Recommended Equipment (continued)**

| Description | Recommended Model |
| --- | --- |
| **Equipment required for 85025E Detectors** | |
| RF plug-in | 83595C |
| Power sensor | 8485A |
| Directional bridge | 85027B |
| Calibrated open/short | p/n 85037-60001 |
| Attenuator | 8493C Option 010 |

# Return Loss Performance Test

This performance test uses an 8757C/D/E scalar network analyzer system to measure the return loss of the detector.

## 85025A/B/D/E Return Loss Performance Test Procedure

### Specifications

Specifications apply at a temperature range of 25 °C ±5 °C. For the detector's return loss specifications, refer to Tables 1-2 through 1-6.

### Description

The return loss of the 85025A/B/D/E can be measured using the test system described in this procedure. The test setup is calibrated using an open/short to minimize frequency response and phasing errors. The detector under test is then connected to the TEST PORT of the bridge, and its return loss is measured on the analyzer.

The return loss should be greater than the limits listed in Tables 1-2 through 1-6. There is a certain amount of measurement uncertainty in any scalar network analyzer system. The return loss uncertainty for each detector is given in Tables 4-2 through 4-4. Conformance to specification cannot be assured unless the return loss of the detector is equal to the specified return loss plus the measurement uncertainty. Failure to meet specification cannot be proven unless measured return loss equals the specified return loss minus the measurement uncertainty. The measurement uncertainty is based on the worst case specifications for the test devices in the measurement.

### Example A:

The specified return loss for an 85025A detector at 1 GHz is 20 dB. The measurement uncertainty is ±1.4 dB.

If the detector's measured return loss is 20 dB +1.4 dB (21.4 dB or higher), the detector is definitely within specification.

If the measured return loss is within the specified return loss plus-or-minus the measurement uncertainty, the detector may or may not be within specification. One way to reduce the measurement uncertainties is to measure the detector using a vector network analyzer.

### Example B:

If the 85025A in Example A measures 20 dB ±1.4 dB (i.e. from 18.6 to 21.4 dB), it cannot be determined if it is or is not within specification.

If the measured return loss is less than the specified return loss minus the measurement uncertainty, the detector is definitely out of specification.

### Example C:

If the 85025A in Example A and B measured less than 20 dB −1.4 dB (18.6 dB or less), the detector is definitely out of specification.

The three main sources of error in these measurements come from:

- Bridge directivity
- Source match of the bridge
- Dynamic accuracy of the analyzer

The first two vary with frequency while dynamic accuracy varies with the measured return loss amplitude.

Tables 4-2, 4-3, and 4-4 show measurement uncertainty for the 85025A/B, 85025D, and 85025E detectors, respectively. The tables assume you are using the corresponding connector-compatible Agilent directional bridges. For example, an 85027A bridge with an 85025A detector.

## Table 4-2.
## 85025A/B Return Loss with Measurement Uncertainty

| Model | Specified Return Loss and Measurement Uncertainty vs Frequency | | | |
|---|---|---|---|---|
| | 0.01 to 0.04 GHz | 0.04 to 4.0 GHz | 4.0 to 18 GHz | 18 to 26.5 GHz |
| 85025A | 10 ±0.6 dB | 20 ±1.4 dB | 17 ±1.1 dB | |
| 85025A Option 001 | 10 ±0.6 dB | 20 ±1.1 dB | 17 ±0.7 dB | |
| 85025B | 10 ±0.6 dB | 20 ±1.1 dB | 17 ±0.7 dB | 12 ±0.9 dB |

## Table 4-3.
## 85025D Return Loss with Measurement Uncertainty

| Specified Return Loss and Measurement Uncertainty vs Frequency | | | | | |
|---|---|---|---|---|---|
| 0.01 to 0.04 GHz | 0.04 to 0.1 GHz | 0.1 to 14 GHz | 14 to 34 GHz | 34 to 40 GHz | 40 to 50 GHz |
| 10 ±.5 dB | 20 −2, −1.5 dB | 23 +3, −2 dB | 20 +3, −2 dB | 15 +2, −1.5 dB | 9 +2, −1.5 dB |

## Table 4-4.
## 85025E Return Loss with Measurement Uncertainty

| Specified Return Loss and Measurement Uncertainty vs Frequency | | | |
|---|---|---|---|
| 0.01 to 0.04 GHz | 0.04 to 0.1 GHz | 0.1 to 25 GHz | 25 to 26.5 GHz |
| 10 ±0.5 dB | 20 ±1 dB | 25 ±2 dB | 23 ±1.8 dB |

**Note** An 85027A/B/C/D directional bridge (depending on the connector type) is used to measure the detector return loss.

## Return Loss Measurement

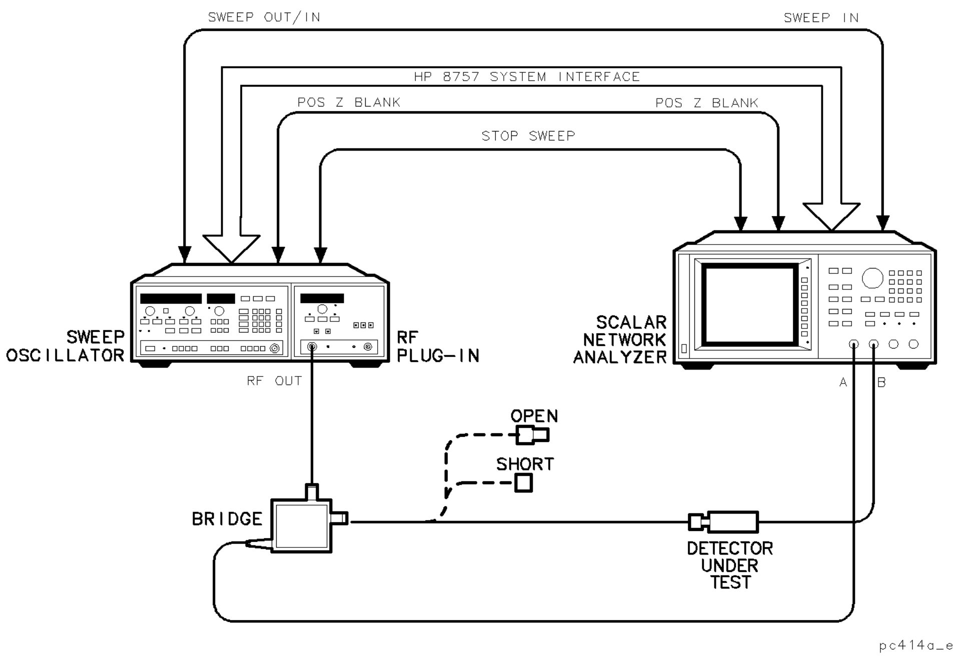


**Figure 4-1. Setup for 85025A/B/D/E Return Loss Test**

1. Connect the equipment as shown in Figure 4-1, leaving the directional bridge TEST PORT unconnected.
2. Press (PRESET) on the analyzer. This will reset both the network analyzer and the sweep oscillator (the source).

   Allow 30 minutes for warmup.
3. On the source, press (START) (10) (MHz) (STOP) (40) (MHz).
4. On the RF plug-in, press (POWER LEVEL) and adjust the output power with the power level knob for a −3 dBm power level indication.

5. On the analyzer, press CHAN 2 OFF to switch channel 2 OFF. Press FUNCTION (MEAS) A . Press FUNCTION (REF) REF POSN , then use the step keys or the knob to move REF POSN one line down from the top of the CRT graticule.

6. On the analyzer, press FUNCTION (SCALE) AUTO SCALE .

### Calibrating the Scalar Network Analyzer

7. On the analyzer, press FUNCTION (CAL) SHORT/OPEN . Follow the directions (prompts) appearing on the CRT:

   a. Connect the short to the TEST PORT of the directional bridge, then press STORE SHORT on the analyzer. Remove the short.

   b. Connect the open to the TEST PORT of the directional bridge, then press STORE OPEN on the analyzer. Remove the open.

   The CRT will display SHORT/OPEN CAL SAVED IN CH1 MEM.

8. Press FUNCTION (DISPLAY) MEAS-MEM .

9. Connect the detector to be tested to the TEST PORT of the directional bridge. On the analyzer, press FUNCTION (CURSOR) and turn the analyzer's front panel knob to read the highest value (worst case return loss).

Record the worst case value in the space provided on the *Performance Test Record*, located at the end of this chapter.

## Return Loss from 40 MHz to 18 GHz (to 26.5 GHz for 85025B/E only, to 50 GHz for 85025D only)

10. On the source, reset the START/STOP frequencies by pressing (START) (40) (MHz). Next, for an 85025A detector, press (STOP) (18) (GHz), for an 85025B/E detector, press (26.5) (GHz), or for an 85025D detector, press (50) (GHz).

11. On the analyzer, ensure FUNCTION MEAS POWER A is still active. Remove the detector.

12. It will be necessary to recalibrate the analyzer, since a new range of frequencies has been selected for measurement. Repeat the steps in the section titled "Calibrating the Measurement System."

Ensure that channel 1 display MEAS-MEM is active. MEAS-MEM is highlighted when active.

13. Connect the detector to the TEST PORT of the directional bridge.
14. On the analyzer, press FUNCTION (SCALE) (5) (dB). The CRT display should be somewhat similar to Figure 4-2.

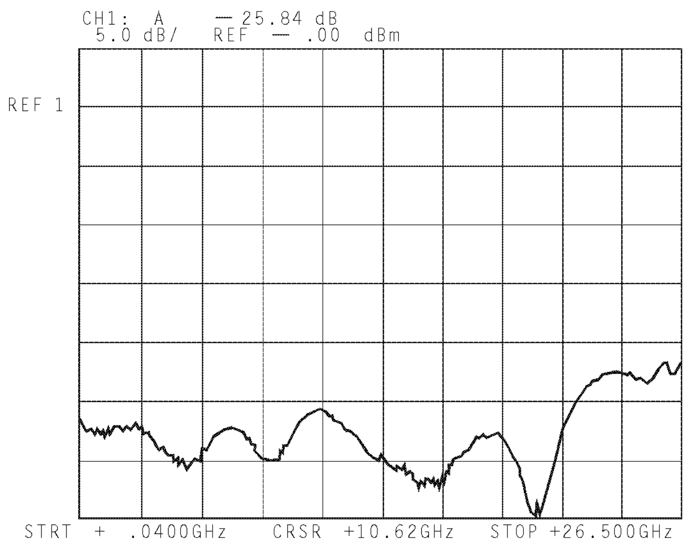


**Figure 4-2. 85025A/B/E Return Loss 0.04 GHz to Maximum Frequency**

15. On the analyzer, press (CURSOR). Use the cursor to find the highest trace value in each specification range.

**Note** A specification range is a range of frequencies which have the same return loss specification. For example, the 85025A specification from 0.4 to 4 GHz.

16. Record each value in the *Performance Test Record*.

This completes the 85025A/B/D/E return loss performance test procedure.

### If This Test Fails

Check the detector's input connector to make sure there is no damage. Open the detector's case and check the connection between the input connector and the PC board. Check that the detector is connected securely to the front panel of the analyzer. Replace the connector if necessary. If the detector still fails, refer to the "Service" chapter for more troubleshooting information.

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## Frequency Response Performance Test

### Description

The frequency response of the 85025A/B/D/E detector is specified as the maximum peak-to-peak deviation from a constant input signal level of −10 dBm, as measured over the specified frequency range. At Agilent Technologies, frequency response is measured with the use of an automated test station traceable to the U.S. National Institute of Standards and Technology (NIST).

The "frequency response" specification for the 85025 family of detectors may more properly be called "frequency response flatness." The test for frequency response does not check absolute gain of the detector across its operating frequency range. It checks the relative variations in gain across the operating frequencies (for example, flatness).

To simplify the measurement procedure, frequency response is measured with a nominal −10 dBm signal applied. First, the source is characterized for frequency response using a calibrated power meter/sensor combination. Next, the DUT is characterized. Finally, a point-by-point difference is computed, plotted and compared to the specification window. Differences in the values recorded due to the different measurement scheme should be negligible.

The manual test described in this procedure has an approximate root sum of the squares (RSS) uncertainty ranging from ±0.19 dB to ±0.37 dB for 85025A/B/E detectors and ±0.12 dB to ±0.76 dB for 85025D detectors. This implies that a "good" detector, well within the limits of its specifications, could measure out of specifications.

This measurement is only an indication of the detector's response within these limits. If greater measurement accuracy is desired, a test system that minimizes the sources of measurement uncertainty will be required. An error analysis of the sources of measurement uncertainty follows.

**Table 4-5.
Approximate Error Analysis at 18 GHz for 85025A/B/E Detectors**

| Uncertainty | 85025A Option 001 | 85025A | 85025B | 85025E |
|---|---|---|---|---|
| Power Sensor CAL Factor Uncertainties (RSS) | 1.5% | 1.5% | 1.5% | 1.5% |
| Mismatch between Attenuator and Power Sensor | 5.2% | 3.8% | 2.1% | 2.4% |
| Mismatch between Attenuator and Detector | 5.9% | 4.2% | 3.3% | 1.5% |
| Miscellaneous System Errors | 1.1% | 1.1% | 1.1% | 3.2% |
| RSS Calculation | 8.1% | 6.0% | 4.3% | 4.5% |
| Total RSS Uncertainties Expressed in dB | +0.34 to −0.37 | +0.25 to −0.27 | +0.18 to −0.19 | +0.19 to −0.20 |

**Table 4-6.
Approximate Error Analysis for the 85025D Detector**

| Uncertainty | 26.5 GHz | 40 GHz | 50 GHz |
|---|---|---|---|
| Power sensor CAL factor approximate uncertainties | 1.5% | 2% | 2.5% |
| Mismatch between attenuator and power Sensor | 1.3% | 3.8% | 7.4 |
| Mismatch between attenuator and detector | 1.4 | 4.2 | 14.3 |
| Miscellaneous system errors | 1.1% | 1.1% | 1.1% |
| RSS calculation | 2.7% | 6.1% | 16.3% |
| Total RSS uncertainties expressed in dB | +0.12 to −0.12 | +0.26 to −0.27 | +0.64 to −0.76 |

Uncertainties are smaller at lower frequencies. The error analysis is done assuming the power sensor, attenuator, and DUT all mate without the use of adapters. A standard 85025A is used with an 8481A and 8491B. An 85025A Option 001 detector is used with an 8481A Option 001 and 8492A. The 85025B/E is used with an 8485A and 8493C. The 85025D is used with an 8487A and 8490D.

## Equipment Required

### Equipment Common to 85025A/B/D/E

Sweep oscillator .......... 8350B

Scalar network analyzer .......... 8757C/D/E

Power meter .......... 436A

### Additional Test Equipment Required for 85025A

RF plug-in .......... 83592C

Power sensor .......... 8481A

10 dB attenuator .......... 8491B Option 010

### Additional Test Equipment Required for 85025A Option 001

RF plug-in .......... 83592C

Power sensor .......... 8481A

10 dB attenuator .......... 8492A Option 010

## Additional Test Equipment Required for 85025B

RF plug-in .......... 83592C

Power sensor .......... 8485A

10 dB attenuator .......... 8493C Option 010

Adapter, type-N(m) to 3.5 mm(f) .......... part number 1250-1744

### Additional Test Equipment Required for 85025D Only

RF plug-in .......... 83597B

Power Sensor .......... 8487A

10 dB attenuator .......... 8490D Option 010

Adapter, 2.4 mm(f) to 2.4 mm(f) .......... 11900B

## Additional Test Equipment Required for 85025E Only

RF plug-in ............................................................ 83595C

Power Sensor ............................................................ 8485A

10 dB attenuator ............................................ 8493C Option 010

Adapter, 3.5 mm(f) to 3.5 mm(f) ......................... part number 1250-1749

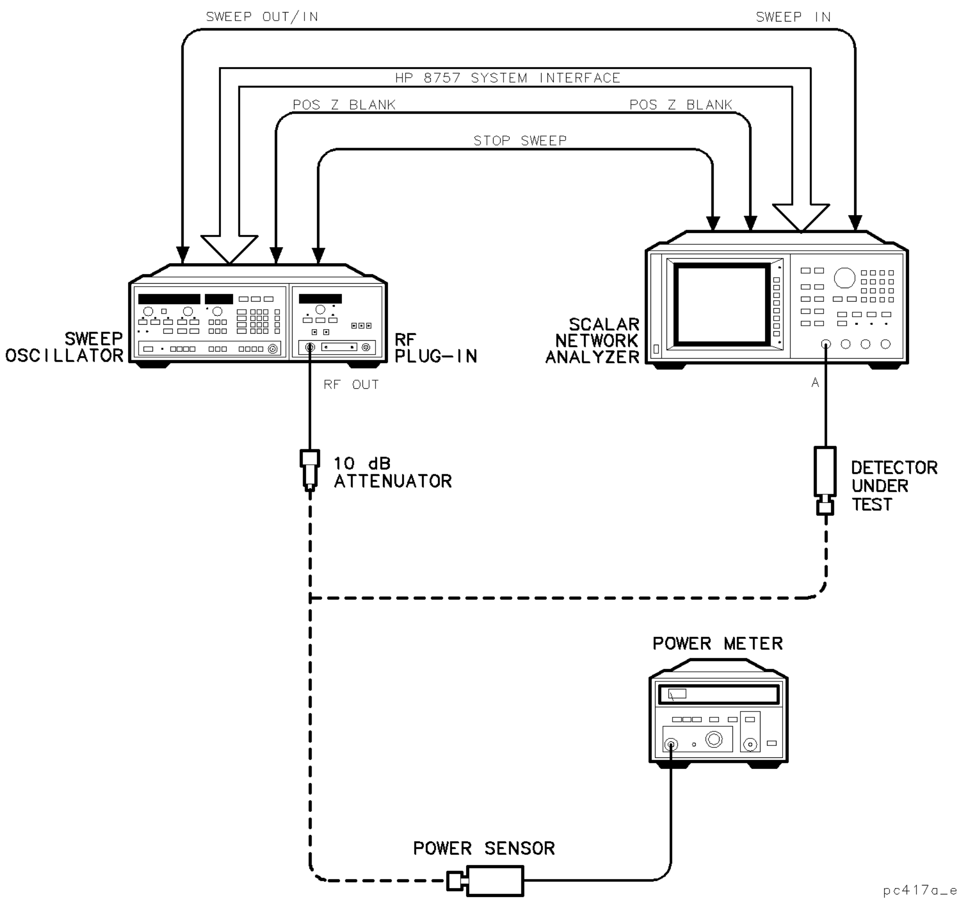


Figure 4-3. Frequency Response Measurement Setup

## Specifications

Specifications apply at a temperature range of 25 °C ±5 °C. For the detector's return loss specifications, refer to Tables 1-2 through 1-6.

## 85025A/B/D/E Frequency Response Performance Test Procedure

**Note** **For 85025D detectors:**

While the detector is specified down to 10 MHz, the power sensor used in this procedure is only calibrated down to 50 MHz. If data is required below 50 MHz, characterize the power sensor to 10 MHz, or use an additional power sensor which covers this frequency range, and correlate the results with the data above 50 MHz.

### Configuring the System

1. Connect the equipment as shown in Figure 4-3, with nothing connected to the attenuated output of the source. Switch ON all equipment and allow 30 minutes for warmup.
2. On the power meter, press (dBm) mode.

   Zero and calibrate the power meter. If you are unsure of how to do this, refer to the power meter's Operating and Service Manual.

   (RANGE HOLD) and (POWER REF) should remain out.

   Set the CAL FACTOR % dial on the power meter to the value indicated for 50 MHz on the power sensor CAL FACTOR chart.
3. On the analyzer, press (PRESET) (CHANNEL) CHAN 2 OFF INSTRUMENT STATE (SYSTEM) MODE DC.
4. On the analyzer, zero the detector by pressing DC DET ZERO MANUAL CONT.

   When the zero is complete, the display will indicate: MANUAL ZERO COMPLETE.
5. Connect the power meter/sensor to the attenuated RF output.
6. On the source/RF plug-in, press (CW) (5) (0) (MHz).

7. Adjust the power level for an indication of −10 dBm on the power meter.

   Do *not* readjust the power level for the remainder of this test.

### Characterizing the Source

8. On the source, press (CW) and enter the desired test frequency as indicated on the *Performance Test Record* located at the end of this chapter. For example: (CW) (0.01) (GHz).
9. Using the CAL FACTOR chart on the power sensor, set the CAL FACTOR % dial on the power meter to the value indicated for the test frequency as needed. Use the nearest frequency value.
10. Note the reading on the power meter.
11. Record this value and the test frequency in the *Performance Test Record*.
12. Repeat steps 9 and 10 until the source is characterized to your satisfaction.

### Characterizing the Detector

13. Disconnect the power meter/sensor.
14. On the analyzer, zero the detector by pressing `DC DET ZERO` `AUTOZRO`.

    When the zero is complete, the display will indicate: `AUTOZERO COMPLETED`.
15. Connect the detector between the attenuated output of the source and INPUT A of the analyzer.
16. On the analyzer, press `CHAN 2 OFF` to switch channel 2 OFF. Press FUNCTION (CURSOR) to switch the cursor ON.
17. On the source, press (CW) and enter the value of the first test frequency. Remember to use only the test frequencies used in steps 9 through 11.

    Note the value indicated by the analyzer's cursor display and record it in the *Performance Test Record*.

    Repeat this step until all of the same frequency points have been characterized.

### Computing the Maximum Error

18. Using the values recorded in steps 11 and 17, subtract the value in step 11 from the value in step 17 for each of the test frequencies. Record the difference in the space provided on the *Performance Test Record*.

Now use these values to plot a point-to-point variation curve on the graph provided in the *Performance Test Record*.

19. Read the “frequency response” limits from the appropriate specifications table in Chapter 1. Plot these limits onto the graph with the point-to-point variation curve.
20. The detector is considered to “pass ” this test if the variation curve is contained within the limits, OR if an offset can be applied to the variation curve so that it is contained within the limits. (In other words, can the variation curve be shifted up or down to make it fit within the limits?)

This completes the procedure for measuring frequency response.

## Power Accuracy Performance Test

### Specifications

Refer to Table 1-2 through Table 1-6. Specifications apply at 25 °C ±5 °C.

### Description

Power accuracy is measured with consideration given to the following conditions (the order is not important):

- Power accuracy is measured at 50 MHz.
- If in DC mode, autozero has been performed (not necessary for AC mode).
- All equipment has been allowed to warmup for 30 minutes.
- Source harmonics are below −40 dBc.
- This performance test includes mismatch effects. Specifications assume no mismatch.
- Trace averaging should be used on the analyzer as required.
- Offset active and adjusted with a calibrated 0 dBm, 50 MHz signal applied (DC mode only).

The recommended method for testing power accuracy is to use an Agilent 8116A pulse/function generator as the source. An 8116A provides the amplitude necessary to check the detector to its full specifications. Both AC and DC modes must be tested to verify the performance specifications of the detector.

Note that the DC mode test is an "absolute" measurement, requiring the use of a calibrated power meter to set a level of 0 dBm. Using the 436A as a calibrated 0 dBm, 50 MHz source introduces a maximum measurement uncertainty of ±0.07 dB.

AC power accuracy testing is done with the 8116A modulated by an 11665B.

An alternate procedure is provided using an 8350B with an RF plug-in as the source. This method does not test the detector to its full specifications (tests to +10 dBm) and should not be used when traceability to the National Institute of Standards and Technology (NIST) is required.

## Equipment Required

Pulse/function generator .......... 8116A

Scalar network analyzer .......... 8757C/D/E

50 MHz bandpass filter .......... part number 08757-80027

3 dB attenuator .......... 8491B

Calibrated 10 dB step attenuator .......... 355D Option 001/H88

Calibrated 1 dB step attenuator .......... 355C Option 001/H88

Modulator (AC mode only) .......... 11665B

Power meter (DC mode only) .......... 436A/438A

Adapters .......... as required

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**Note** Calibrated attenuation is used in the power accuracy calculations below. Calibrated step attenuators include a calibration report at 50 MHz to improve measurement accuracy. The report lists the actual attenuation of each step at one frequency of interest. The calibration report may be ordered as an option with the step attenuators when purchased or performed as a service afterwards.

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## Procedure

### Absolute Power Accuracy in DC Mode Performance Test

1. Connect the equipment as shown in Figure 4-4. Do not connect detector to attenuator output. Do not use the modulator for this test (AC mode only). Switch all the equipment ON and allow 30 minutes warmup time.

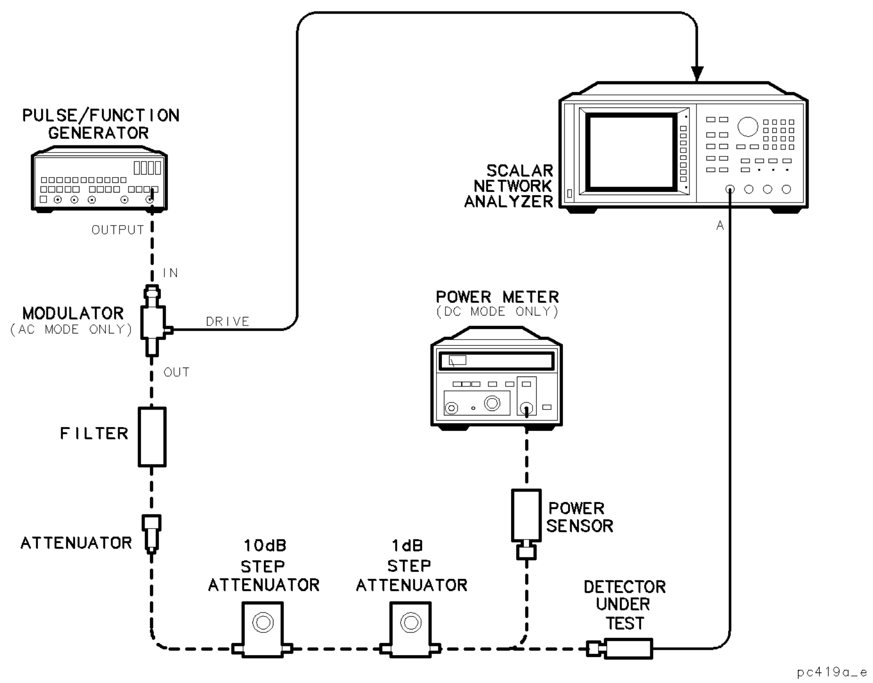


**Figure 4-4. Absolute Power Accuracy Test Setup**

2. For each of the power levels specified in columns 2 and 3 of the *Performance Test Record*, record the required calibration data of the step attenuators (10 dB step attenuator data in column 4 and 1 dB step attenuator data in column 5).

3. Calculate the calibrated power level for each power level and record this value in column 6 CAL PWR LVL. An example follows:

| 1. Nominal PWR LVL | 2. Nominal 10 dB STEP ATTEN | 3. Nominal 1 dB STEP ATTEN | 4. CAL ATTEN | 5. CAL ATTEN | 6. CAL PWR LVL |
|---|---|---|---|---|---|
| 0 | 10 | 6 | 10.02 | 6.01 | −0.03 |

*16 dBm −(column 4 + column 5) = CAL PWR LVL*

*16 dBm −(10.02 dB + 6.01 dB) = −0.03 dBm*

4. On the 8116A, set a frequency of 50 MHz by pressing Sine Function (P) Duty (DTY). Using the VERNIER rocker keys adjust for a 50% duty cycle display.

   Press Frequency (FRQ). Using the VERNIER and RANGE rocker keys adjust for a 50 MHz display.

   Select normal operation. LED NORMAL ON.

5. On the analyzer, press (PRESET) CHAN 2 OFF. Switch continuous wave ON and select DC mode for the detector by pressing INSTRUMENT STATE (SYSTEM) MORE SWEEP MODE CW ON, INSTRUMENT STATE (SYSTEM) MODE DC.

6. Configure the analyzer inputs and perform a manual DC zero.

   On the analyzer, press FUNCTION (CAL) CONFIG SYSTEM DC DET ZERO MANUAL CONT.

7. Perform the detector offset calibration.

   On the analyzer, press DET OFFSET A (0) (dB). This ensures 0 dB of offset.

8. Connect the detector to the power meter POWER REF output.

9. Switch POWER REF output ON.

10. On the analyzer, perform the following:

   a. Press FUNCTION (SCALE) AUTO SCALE FUNCTION (CURSOR). Note the reading for use in step b.

   b. Press FUNCTION (CAL) DET OFFSET A. Using the ENTRY keys, enter the value opposite in sign to the reading noted above.

      Example: CRSR = +.45 dBm

      Press (-) (.) (4) (5) (dB).

   c. Press FUNCTION (CURSOR). The display should indicate a power level of 0.00 dBm. If not, repeat the detector DC ZERO and OFFSET CALIBRATION (steps 6 and 7) until a 0.00 dBm power level is obtained.

11. On the step attenuators, set the attenuators for a total of 16 dB attenuation. Set the 355C to 6 dB and set the 355D to 10 dB.

12. Connect the DUT to the attenuated output.

13. On the 8116A enable the output by pressing (DISABLE). The DISABLE LED should deactivate.

    Refer to the *Performance Test Record* at the end of this chapter for the calibrated power level computed at nominal 0 dBm. Use the VERNIER rocker keys to adjust the output power to the CAL PWR LVL.

14. Note the cursor value displayed on the CRT. Record this value in the space provided in column 7 of the *Performance Test Record*.

15. Set both attenuators to 0 dB attenuation. Note and record the cursor value.

16. Set the attenuators for the next Nominal PWR LVL (dBm).

---

**Note** For nominal power levels of −16 dBm and below, use a combination of AVERAGING ON and SMOOTHING ON to reduce trace noise and obtain a stable reading. Refer to the *Performance Test Record* for the specified AVERAGING FACTOR. Allow for settling time after resetting the attenuator(s).

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17. When the cursor reading has stabilized, note and record the value in column 7.

18. Repeat steps 13 and 14 for each nominal power level listed on the *Performance Test Record*.

19. Calculate the Dynamic Accuracy Error as follows:

    *Dynamic Accuracy Error = MEAS PWR LVL − CAL PWR LVL*

    Include and preserve signs in this calculation. Enter this value in the Dynamic ACCY Error (dBm), column 8, of the *Performance Test Record*.

## Dynamic Accuracy in AC Mode Performance Test

20. Connect equipment as shown in Figure 4-4. Connect the modulator's DRIVE INPUT to the analyzer's rear panel MODULATOR OUTPUT. Connect the DUT to the attenuated output. Switch the equipment ON and allow 30 minutes for warmup.
21. Record and calculate the data as necessary into columns 4, 5, and 6 of the *Performance Test Record*. If the attenuators used in this test are the same as the ones used in steps 2 and 3, copy the data from the Absolute Power Accuracy in DC Mode *Performance Test Record* (columns 4, 5, and 6).
22. On the analyzer, press (PRESET) CHAN 2 OFF FUNCTION (CURSOR).
23. Set the 10 dB step attenuator to 10 dB and set the 1 dB step attenuator to 6 dB.
24. On the 8116A, set a frequency of 50 MHz by pressing Sine Function (P) Duty (DTY). Using the VERNIER rocker keys adjust for a 50% duty cycle display.

    Press Frequency (FRQ). Using the VERNIER and RANGE rocker keys adjust for a 50 MHz display.

    Select normal operation. LED NORMAL on.

    Refer to the *Performance Test Record* for the CAL PWR LVL computed at nominal 0 dBm. Use the VERNIER rocker keys to adjust the output power to the CAL PWR LVL as displayed by the CURSOR on the analyzer.
25. Note and record on the *Performance Test Record* the cursor value displayed.
26. Set both attenuators to 0 dB. Note and record the cursor value.
27. Set the attenuators for the next Nominal PWR LVL. Continue the procedure as outlined in steps 24 through 26 of the DC Mode Test for each of the Nominal PWR LVLs listed on the *Performance Test Record*.

    This completes the procedure for measuring dynamic accuracy.

# Power Accuracy, Alternate Procedure Using an 8350B (+10 dBm maximum)

## Alternate Equipment

| | |
|---|---|
| Sweep oscillator | 8350B |
| RF plug-in | 83592B |
| Scalar network analyzer | 8757C/D/E |
| 50 MHz bandpass filter | Part Number 08757-80027 |
| 3 dB attenuator | 8491B |
| Calibrated 10 dB step attenuator | 355D Option 001/H88 |
| Calibrated 1 dB step attenuator | 355C Option 001/H88 |
| Power meter (DC mode only) | 436A or 438A |
| Adapters | as required |

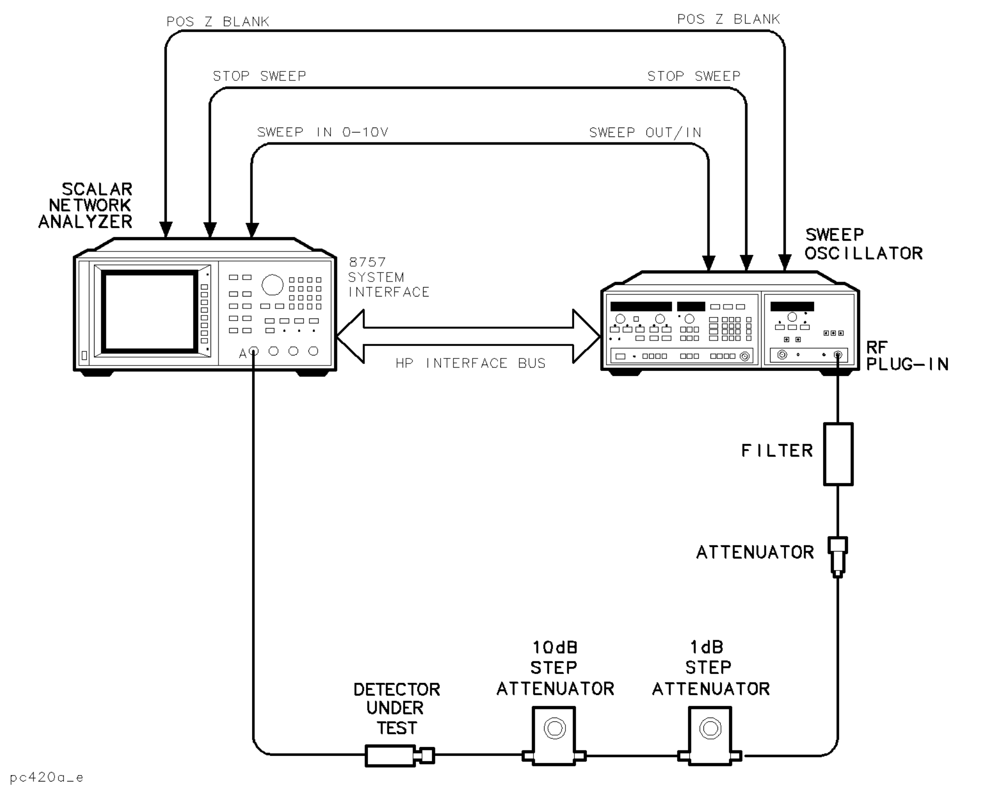



**Figure 4-5. Power Accuracy Alternate Test Setup**

## Procedure

1. Connect the equipment as shown in Figure 4-5. Allow 30 minutes warmup time.

2. For each of the nominal power levels specified in the *Performance Test Record* (Alternate Procedure), calculate the Calibrated Power Level. Refer to steps 2 and 3 in the Absolute Power Accuracy in DC Mode Performance Test for details. Change all +16 dBm references to +10 dBm.

## Absolute Power Accuracy in DC Mode, Alternate Procedure

3. Do not connect the detector to the attenuated output.
4. On the analyzer, press (PRESET) CHAN 2 OFF INSTRUMENT STATE (SYSTEM) (MODE DC). Next, press (CAL) CONFIG SYSTEM DC DET ZERO MANUAL CONT DET OFFSET A (0) (dB).
5. Connect the detector to the power meter POWER REF output.
6. Switch the POWER REF output ON.
7. On the analyzer, press (SCALE) AUTO SCALE (CURSOR). Note the reading.

   On the analyzer, press (CAL) DET OFFSET A. Using the ENTRY keys, enter the value opposite in sign to the reading noted above.
8. On the analyzer, press (CURSOR). The display should indicate a power level of 0.00 dBm. If not, repeat the detector zero and offset calibration until a 0.00 dBm power level is obtained (steps 4 through 7).
9. Set the 10 dB step attenuator to 10 dB.
10. Connect the DUT to the attenuated output.
11. On the source, switch square wave modulation OFF. Set a CW frequency of 50 MHz.
12. Refer to the *Performance Test Record* for the CAL PWR LVL computed at nominal 0 dBm. Adjust the output power to the CAL PWR LVL.
13. Note the cursor value displayed on the CRT. Record this value in column 7 of the *Performance Test Record*.
14. Set the attenuators for the next nominal PWR LVL. Continue the procedure as outlined in steps 9 through 13 of the Absolute Power Accuracy in DC Mode Performance Test for each of Nominal PWR LVLs listed on the *Performance Test Record* (Nominal −55 dBm is for AC Test only).

## Dynamic Accuracy in AC Mode, Alternate Procedure

15. Repeat steps 1 and 2 of Absolute Power Accuracy in DC Mode Performance Test, Alternate Procedure. Connect the DUT to the attenuated output.
16. Preset the analyzer. Switch OFF channel 2. Switch ON the cursor.
17. Set the 10 dB step attenuator to 10 dB.
18. On the source set CW to 50 MHz.
19. Refer to the *Performance Test Record* for the CAL PWR LVL computed at nominal 0 dBm. Adjust the output power to the CAL PWR LVL.
20. Note and record the displayed cursor value.
21. Set both attenuators to 0 dB. Note and record the cursor value.
22. Set the attenuators for the next nominal PWR LVL. Continue the procedure as outlined in steps 17 through 19 of the Absolute Power Accuracy in DC Mode Performance Test for each of the nominal PWR LVLs listed on the *Performance Test Record*.

This completes the power accuracy alternate procedure.

# Performance Test Record

**85025A/B/D/E Detector Performance Test Record (1 of 9)**

| | |
|---|---|
| Test Facility ______________________ | Report Number ______________________ |
| ______________________ | Date ______________________ |
| ______________________ | Customer ______________________ |
| ______________________ | Tested by ______________________ |
| Model ______________________ | Ambient temperature ____________ °C |
| Serial Number ______________________ | Relative humidity ____________ % |
| Options ______________________ | |
| Special Notes | |
| ______________________ | |
| ______________________ | |

## 85025A/B/D/E Detector Performance Test Record (2 of 9)

Model________________ Report Number ____________ Date ________

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

## 85025A/B/D/E Detector Performance Test Record (3 of 9)

| Test Description | Specification | Measured Results | Measurement Uncertainty[1] |
|---|---|---|---|
| **85025A/B Return Loss** | | | |
| 10 MHz to 40 MHz | ≥ 10 dB | ________ | ±1.4 dB |
| 0.04 GHz to 4.0 GHz | ≥ 20 dB | ________ | ±1.1 dB |
| 4 GHz to 18 GHz | ≥ 17 dB | ________ | ±1.4 dB |
| 18 GHz to 26.5 GHz[2] | ≥ 12 dB | ________ | ±1.1 dB |
| **85025D Return Loss** | | | |
| 10 MHz to 40 MHz | ≥ 10 dB | ________ | ±0.5 dB |
| 0.04 GHz to 0.10 GHz | ≥ 20 dB | ________ | +2, −5 dB |
| 0.10 GHz to 14 GHz | ≥ 23 dB | ________ | +3, −2 dB |
| 14 GHz to 34 GHz | ≥ 20 dB | ________ | +3, −2 dB |
| 34 GHz to 40 GHz | ≥ 15 dB | ________ | +2, −1.5 dB |
| 40 GHz to 50 GHz | ≥ 9 dB | ________ | +2, −1.5 dB |
| **85025E Return Loss** | | | |
| 10 MHz to 40 MHz | ≥ 10 dB | ________ | ±1.4 dB |
| 0.04 GHz to 0.1 GHz | ≥ 20 dB | ________ | ±1.1 dB |
| 0.1 GHz to 25 GHz | ≥ 25 dB | ________ | ±1.4 dB |
| 25 GHz to 26.5 GHz | ≥ 23 dB | ________ | ±1.1 dB |

1 Using the equipment and procedures documented in this manual.

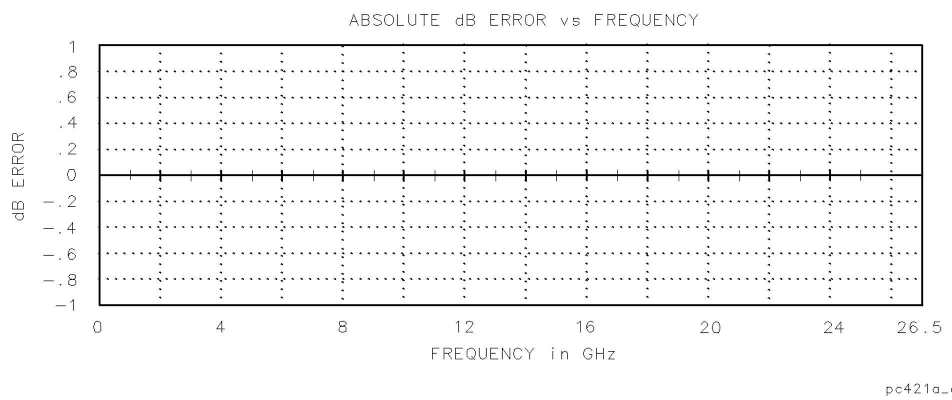
2 85025B only

## 85025A/B/D/E Detector Performance Test Record (4 of 9)

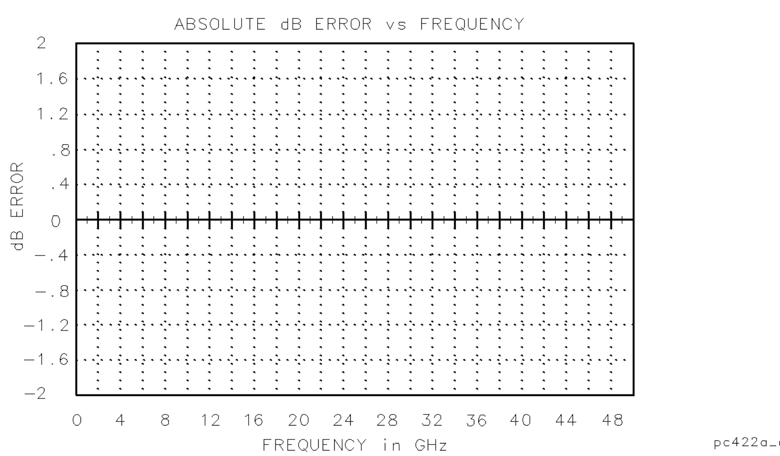
| Frequency Response | | | | |
|---|---|---|---|---|
| Test Frequency | | Source Step 11 | Detector Step 17 | Difference Step 18 |
| Recommended | Actual | | | |
| 0.01 GHz | | | | |
| 2.00 GHz | | | | |
| 4.00 GHz | | | | |
| 6.00 GHz | | | | |
| 8.00 GHz | | | | |
| 10.0 GHz | | | | |
| 12.0 GHz | | | | |
| 14.0 GHz | | | | |
| 16.0 GHz | | | | |
| 18.0 GHz | | | | |
| 20.0 GHz | | | | |
| 21.0 GHz | | | | |
| 22.0 GHz | | | | |
| 23.0 GHz | | | | |
| 24.0 GHz | | | | |
| 25.0 GHz | | | | |
| 26.0 GHz | | | | |
| 26.5 GHz | | | | |
| 28.0 GHz | | | | |
| 30.0 GHz | | | | |
| 32.0 GHz | | | | |
| 34.0 GHz | | | | |
| 36.0 GHz | | | | |
| 38.0 GHz | | | | |
| 40.0 GHz | | | | |
| 42.0 GHz | | | | |
| 44.0 GHz | | | | |
| 46.0 GHz | | | | |
| 48.0 GHz | | | | |
| 50.0 GHz | | | | |

## 85025A/B/D/E Detector Performance Test Record (5 of 9)

**85025A/B/E Absolute dB Error Versus Frequency**




**85025D Absolute dB Error Versus Frequency**



## 85025A/B/D/E Detector Performance Test Record (6 of 9)

| Absolute Power Accuracy in DC Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. Nominal PWR LVL (dBm) | 2. Nominal 120 dB ATTEN Setting (dB) | 3. Nominal 12 dB ATTEN Setting (dB) | 4. CAL ATTEN (120 dB ATTN) | 5. CAL ATTEN (12 dB ATTN) | 6. CAL PWR LVL (dBm) (16 dBm - CAL ATTN) | 7. MEAS PWR LVL (Cursor) (dBm) | 8. Dynamic ACCY Error (dBm) | 9. Upper Limit[1] ( 85025A/B/D/E unless noted otherwise) |
| 0 | 10 | 6 | | | | | REF | REF |
| 16 | 0 | 0 | | | | | | 0.70[2]<br>1.0[3] |
| 13 | 0 | 3 | | | | | | 0.61[2]<br>0.76[3] |
| 10 | 0 | 6 | | | | | | 0.52 |
| 6 | 10 | 0 | | | | | | 0.40 |
| 3 | 10 | 3 | | | | | | 0.40 |
| 0 | 10 | 6 | | | | | REF | REF |
| −3 | 10 | 9 | | | | | | 0.40 |
| −6 | 20 | 2 | | | | | | 0.40 |
| −10 | 20 | 6 | | | | | | 0.40 |
| −13 | 20 | 9 | | | | | | 0.40 |
| −16[4] | 30 | 2 | | | | | | 0.40 |
| −20[4] | 30 | 6 | | | | | | 0.40 |
| −25[4,5] | 40 | 1 | | | | | | 0.40 |
| −30[4,5] | 40 | 6 | | | | | | 0.40 |
| −35[4,6] | 50 | 1 | | | | | | 0.40 |
| −40[4,6] | 50 | 6 | | | | | | 0.70 |
| −45[4,7] | 60 | 1 | | | | | | 1.0 |
| −50[4,7] | 60 | 6 | | | | | | 1.3 |

1 Upper limit does not include measurement uncertainties.

2 85025A/B only

3 85025D/E only

4 Smoothing ON

5 Averaging ON, Averaging Factor = 4

6 Averaging ON, Averaging Factor = 8

7 Averaging ON, Averaging Factor = 8

## 85025A/B/D/E Detector Performance Test Record (7 of 9)

| Dynamic Accuracy in AC Mode | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1. Nominal PWR LVL (dBm) | 2. Nominal 120 dB ATTEN Setting (dB) | 3. Nominal 12 dB ATTEN Setting (dB) | 4. CAL ATTEN (120 dB ATTN) | 5. CAL ATTEN (12 dB ATTN) | 6. CAL PWR LVL (dBm) (16 dBm - CAL ATTN) | 7. MEAS PWR LVL (Cursor) (dBm) | 8. Dynamic ACCY Error (dBm) | 9. Upper Limit[1] ( 85025A/B/D/E unless noted otherwise) |
| 0 | 10 | 6 | | | | | REF | REF |
| 16 | 0 | 0 | | | | | | 0.70[2], 1.0[3] |
| 13 | 0 | 3 | | | | | | 0.61[2], 0.76[3] |
| 10 | 0 | 6 | | | | | | 0.52 |
| 6 | 10 | 0 | | | | | | 0.40 |
| 3 | 10 | 3 | | | | | | 0.40 |
| 0 | 10 | 6 | | | | | REF | REF |
| −3 | 10 | 9 | | | | | | 0.40 |
| −6 | 20 | 2 | | | | | | 0.40 |
| −10 | 20 | 6 | | | | | | 0.40 |
| −13 | 20 | 9 | | | | | | 0.40 |
| −16[4] | 30 | 2 | | | | | | 0.40 |
| −20[4] | 30 | 6 | | | | | | 0.40 |
| −25[4,5] | 40 | 1 | | | | | | 0.40 |
| −30[4,5] | 40 | 6 | | | | | | 0.40 |
| −35[4,6] | 50 | 1 | | | | | | 0.40 |
| −40[4,6] | 50 | 6 | | | | | | 0.70 |
| −45[4,7] | 60 | 1 | | | | | | 1.0 |
| −50[4,7] | 60 | 6 | | | | | | 1.3 |
| −55[4,8] | 70 | 1 | | | | | | 1.6 |

1 Upper limit does not include measurement uncertainties.

2 85025A/B only

3 85025D/E only

4 Smoothing ON

5 Averaging ON, Averaging Factor = 4

6 Averaging ON, Averaging Factor = 8

7 Averaging ON, Averaging Factor = 8

8 Averaging ON, Averaging Factor = 32

## 85025A/B/D/E Detector Performance Test Record (8 of 9)

| Alternate Tests | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1. Nominal PWR LVL (dBm)** | **2. Nominal 120 dB ATTEN Setting (dB)** | **3. Nominal 12 dB ATTEN Setting (dB)** | **4. CAL ATTEN (120 dB ATTN)** | **5. CAL ATTEN (12 dB ATTN)** | **6. CAL PWR LVL (dBm) (16 dBm - CAL ATTN)** | **7. MEAS PWR LVL (Cursor) (dBm)** | **8. Dynamic ACCY Error (dBm)** | **9. Upper Limit[1]** |
| 0 | 10 | 0 | | | | | REF | REF |
| 10 | 0 | 0 | | | | | | 0.52 |
| 6 | 0 | 4 | | | | | | 0.40 |
| 3 | 0 | 7 | | | | | | 0.40 |
| 0 | 10 | 0 | | | | | REF | REF |
| −3 | 10 | 3 | | | | | | 0.40 |
| −6 | 10 | 6 | | | | | | 0.40 |
| −10 | 20 | 0 | | | | | | 0.40 |
| −13 | 20 | 3 | | | | | | 0.40 |
| −16 | 20 | 6 | | | | | | 0.40 |
| −20 | 30 | 0 | | | | | | 0.40 |
| −25[2] | 30 | 5 | | | | | | 0.40 |
| −30[2] | 40 | 0 | | | | | | 0.40 |
| −35[2,3] | 40 | 5 | | | | | | 0.40 |
| −40[2,3] | 50 | 0 | | | | | | 0.70 |
| −45[2,4] | 50 | 5 | | | | | | 1.0 |
| −50[2,4] | 60 | 0 | | | | | | 1.3 |
| −55[2,5] | 60 | 5 | | | | | | 1.6 |
| −50[2,5] | 60 | 6 | | | | | | 1.3 |
| −55[2,6] | 70 | 1 | | | | | | 1.6 |

1 Upper limit does not include measurement uncertainties.

2 Smoothing ON

3 Averaging ON, Averaging Factor = 4

4 Averaging ON, Averaging Factor = 8

5 Averaging ON, Averaging Factor = 8

6 Averaging ON, Averaging Factor = 32

## 85025A/B/D/E Detector Performance Test Record (9 of 9)

| RF Input Connector Mechanical Tolerances | | | |
|---|---|---|---|
| **Connector** | **Minimum Recession (inches)**[1] | **Maximum Recession (inches)** | **Measured Recession (inches)** |
| 85025A<br>Type-N male | 0.207 | 0.210[2] | ___________ |
| 85025A Option 001<br>Precision 7 mm[3] | 0.000 | 0.003 | ___________ |
| Precision 7 mm<br>Collet Resilience | Collet must spring back out after being depressed. | | Pass ______<br>Fail ______ |
| 85025B/E<br>Precision 3.5 mm male | 0.000 | 0.003 | ___________ |
| 85025D<br>Precision 2.4 mm male | 0.000 | 0.002 | ___________ |

1 Minimum recession must NEVER be less than the minimum recession tolerance. If a connector fails this specification, immediately replace it. Such connectors will damage any connector mated to it.

2 The type-N gage calibration block zeros the gage at a 0.207 inch offset. Therefore, the 0.207 inch to 0.210 inch recession is displayed as 0.000 to 0.003 inches on the gage.

3 With collet removed.

5

# Adjustments

There are no adjustments which can be performed on the 85025A/B/D/E.

6

# Replaceable Parts

This chapter provides information on ordering replaceable parts. To order a part listed in Table 6-1:

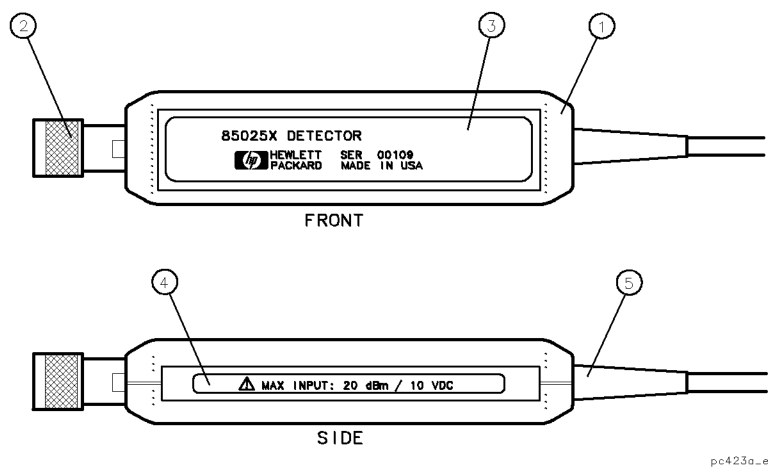
- Quote the Agilent part number.
- Indicate the quantity required.
- Address the order to your nearest Agilent office.

To request information on a part that is not listed in Table 6-1, include the instrument model number, a description of the part, and its function. Address the inquiry to the nearest Agilent office.

## How To Order Parts Fast

When you know which parts you need to repair the detector, contact Agilent Technologies. The parts specialists have direct online access to the replacement parts inventory corresponding to Table 6-1 in this guide.

## Table 6-1. 85025A/B/D/E Replaceable Parts and Accessories




| Item Number | Description | Agilent Part Number |
|---|---|---|
| 1 | Replacement 85025A Detector, Type-N | 85025-69018 |
| 1 | Replacement 85025A Option 001 Detector, 7 mm | 85025-69019 |
| 1 | Replacement 85025B Detector, 3.5 mm | 85025-69020 |
| 1 | Replacement 85025D Detector, 2.4 mm | 85025-69024 |
| 1 | Replacement 85025E Detector, 3.5 mm | 85025-69025 |
| 2 | 85025A Connector Repair Kit, Type-N | 85025-60021 |
| 2 | 85025A Option 001 Connector Repair Kit, 7 mm | 85025-60022 |
| 2 | 85025B Connector Repair Kit, 3.5 mm | 85025-60023 |
| 2 | 85025D Connector Repair Kit, 2.4 mm | 85025-60026 |
| 2 | 85025E Connector Repair Kit, 3.5 mm | 85025-60027 |
| 3 | Label, Serial Number | Not Available |
| 4 | Label, Warning Max Input | 85025-80001 |
| 5 | Cable Assembly (W1) | 85025-60003 |
| | Cover, Plastic Half Body | 85025-40001 |
| | Screw-Machine M2.5 × 0.45; 4 mm-LG | 0515-0061 |
| | Washer-Lock 2.5 mm | 2190-0583 |
| | Cable Marker Kit | 5061-1044 |
| | Cable, 25 foot | 11679A |
| | Cable, 200 foot | 11679B |

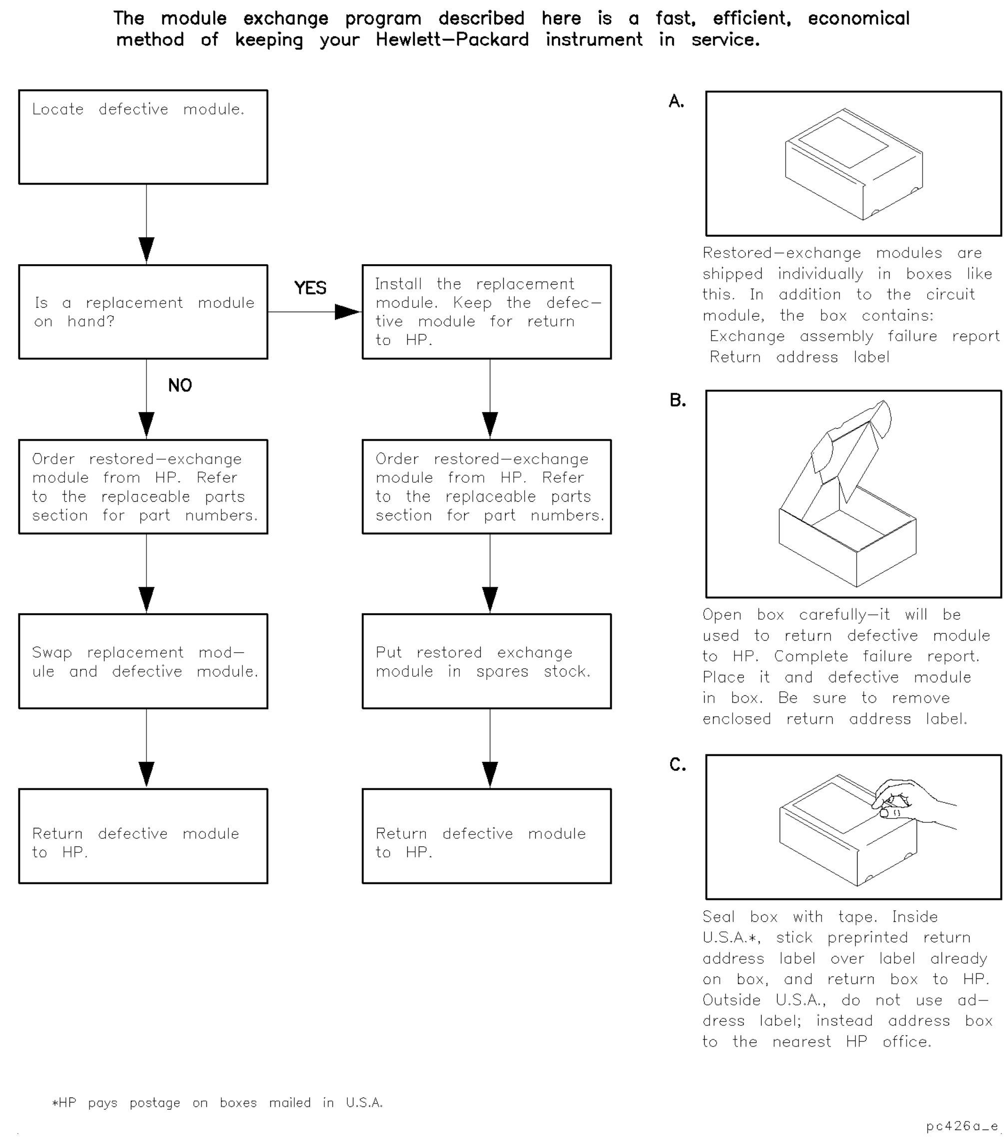



**Figure 6-1. Module Exchange Program**

# 7

# Service

**Caution** This product is susceptible to damage from electrostatic discharge (ESD). When you perform any of the following procedures, wear a grounded static-strap and work at a static-safe work station.

If the detector fails electrically, order a replacement detector. Do not order the detector using its model number (85025A/B/D/E). Instead, use the replacement part number given in Table 6-1 that is referenced to the model number.

These detectors have the following replaceable items:

- The input connector.
- The cable assembly.

# Repair

## Removing the Covers

A small flat-blade screwdriver with a blade width no greater than 3.5 mm (1/8 inch) is required to perform this procedure.

### Procedure

1. Place the detector so its narrow side is on a flat surface. Position it so that the RF connector is facing away from you. Refer to Figure 7-1.

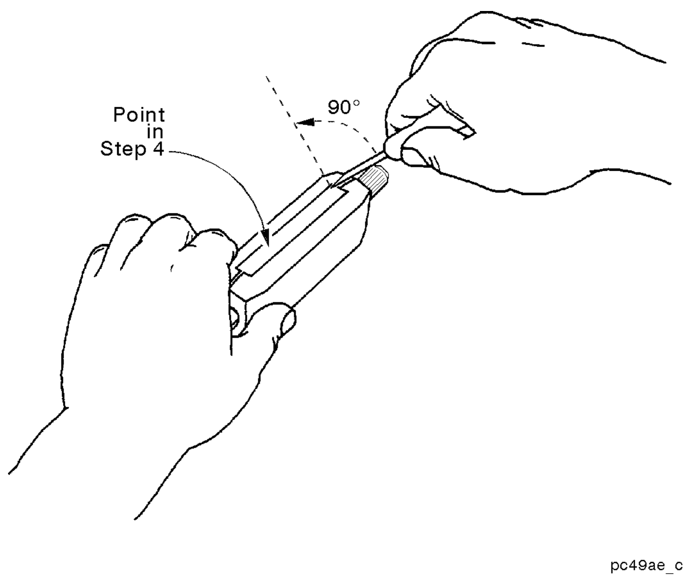



**Figure 7-1. Removing the Detector Covers**

2. Hold the sides of the detector near the cable-end. Insert the screwdriver at a 45 degree angle between the side label and the raised edge of the plastic cover as shown in Figure 7-1. Make sure the screwdriver is inserted as far forward as possible on the detector.
3. Rotate the screwdriver about 90 degrees as shown, until the cover snaps apart.
4. Repeat steps 2 and 3, inserting the screwdriver approximately 2/3 of the way toward the cable-end of the detector, at the point shown in Figure 7-1.
5. Separate the plastic shell halves. If the cover does not separate easily, repeat steps 2, 3, and 4 on the other side of the detector.
6. Attach the covers to the replacement detector by snapping the halves together.

## Replacing the Detector

1. Remove the plastic covers from the existing detector using the cover removal procedure.
2. Install the covers on the replacement detector.
3. Perform the operator's check described in "Operation."
4. If using a restored exchange replacement detector, return the defective detector using the packing material supplied. This should be done *immediately* in order to assure proper credit for the exchange.

---

**Note** If the existing plastic half cover is damaged or broken, replacement covers are available. The part number is provided in the replaceable parts list. Two are required for each detector.

---

## Replacing the Cable Assembly

1. Order the cable assembly (Item 5 in Table 6-1).
2. Remove the outer covers using the cover removal procedure indicated earlier in this section.
3. Remove the two pozi-drive screws located at the cable end of the metal housing.

4. Slide the metal housing away from the RF connector to expose the printed circuit (P.C.) assembly completely.
5. Carefully de-solder all cable wires from the P.C. assembly.
6. With the P.C. assembly facing up, secure the detector frame in a vice. Be careful to set the detector so the P.C. assembly is NOT gripped.

**Caution** Over-tightening the vice causes the frame to bend.

7. Use a 7/16-inch open-ended wrench to unscrew the cable hex nut.
8. Remove the old cable assembly and remove the metal housing from the cable.
9. Carefully slide the metal housing onto the new cable assembly. Be sure to place the metal housing so the adjustment potentiometers are accessible.
10. Screw the cable assembly onto the detector frame.
11. Solder the wires of the new cable to the P.C. assembly (refer to Figure 7-2 for proper placement).
12. Ensure that all cable wires are securely connected to the assembly.
13. Slide the metal housing over the P.C. assembly and secure to the frame using pozi-drive screws.
14. Snap the outer covers back on.

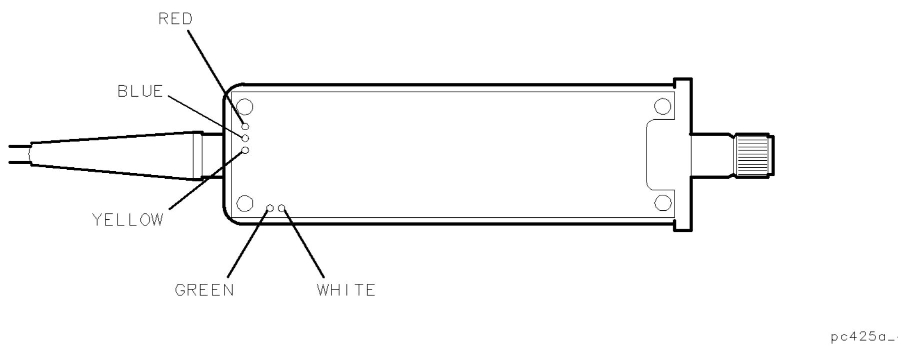



**Figure 7-2. Cable Connections**

## Replacing the Connectors

Order the appropriate Connector Repair Kit (see Table 6-1) for your detector. Follow the instructions provided in the kit to replace the connectors.

8

# Detector Maintenance

This chapter describes how to maintain your detector in proper working order. This includes:

- How to inspect the detector
- How to clean the input connector
- How to gage the input connector

## Mechanical Inspection

This section provides a brief introduction to the fundamentals of proper connector care, which is as important to making good measurements as proper instrument calibration and adjustment.

This is not intended to be a comprehensive discussion of this vital topic. For information on connector care, refer to the *Microwave Connector Care Quick Reference Card*, part number 08510-90360.

### Inspecting the Connectors

Visual and mechanical inspection of the connectors should be done periodically. If a bad connector is accidentally attached to a good connector, the good connector can be damaged. The time and expense involved in replacing detectors or other devices due to damaged connectors warrants caution.

A connector is bad if one of the following conditions exist:

- It fails the visual examination.
- It fails the mechanical examination.
- When attaching two connectors together, they do not mate smoothly.

### Visual Examination

A careful visual inspection should be performed often on all system connectors. Vigilance can save money and ensure accurate measurements with your equipment.

Examine the connectors for such obvious problems as deformed threads, contamination, or corrosion, concentrating especially on the contacting surfaces. Look for burrs, scratches, rounded shoulders and similar signs of wear or damage. Any problem you can see is sufficient to cause degraded performance, and the detector must be cleaned or replaced.

## Cleaning the Connectors

In harsh environments, the connectors might become dirty. To safely clean the connector, carefully brush or wipe dirt from the surface with a foam swab. It is safe to use trichlorotrifluoroethane (liquid Freon) sparingly as a cleaning solvent. However, it is not safe to use abrasives of any kind (such as pencil eraser) or any other solvent, because of damage to the thin metal plating or to the plastic dielectric supporting element.

### Connector Cleaning Kit

When cleaning an RF connector, Agilent recommends that you use the Connector Cleaning Kit, part number 92193Z.

## Gaging Connectors

Gaging connectors is necessary to ensure that they conform to mechanical tolerances. Out-of-tolerance connectors have poor electrical performance and could damage another connector mated to them. Refer to the *Microwave Connector Care Quick Reference Card*, part number 08510-90360.

Refer to Table 1-7, "Supplemental Characteristics," for 85025A/B/D/E connection tolerances.

## Gaging Connectors to be Mated with the 85025A/B/D/E

It is important to gage connectors which will be used with the 85025A/B/D/E. The specifications for attaching connectors may vary, depending on the connector used and the application. However, if the following guidelines are used, you can avoid connector damage due to tolerance problems.

### Type-N female

Gage any female device to be mated with the 85025A. When mated, a type-N connector pair must have separation between the tip of the female contact fingers and the shoulder of the male contact pin. Do not use female type-N connectors that have an inner rubber washer, they damage the male center conductor.

### Precision 7 mm

Gage with the center conductor collet removed, refer to the tolerances given in the device's manual. There should be no protrusion of the center conductor in front of the outer conductor mating plane. Check the collet for proper spring action. Collets should only be removed with a collet extraction tool. Refer to the *Microwave Connector Care Quick Reference Card* for information.

### Precision 3.5 mm female

Gage any female connector to be used with the 85025B/E. There should be no protrusion of the tip of the female contact fingers in front of the outer conductor mating plane.

9

# Automated Program Listing

The information in this section is provided as a convenience only. It is intended to provide a starting point for making automated measurements and does not contain full error detection or extra enhancements. This program is not warranted to be uninterrupted or error free.

## Automating the Frequency Response Test

The program listing at the end of this chapter allows you to automate the frequency response test of the detector. This test determines the frequency response at up to 401 points in just a few minutes. The program first measures the frequency response of the source (taking into account the frequency response of the power sensor), then measures the frequency response of the detector, and finally plots the difference between the two on the computer's CRT. This is identical to the manual version of the test and the results should be identical.

As written, this program will test detectors to 26.5 GHz. If you need results to 18 or 50 GHz, you must modify the START/STOP frequencies of the program.

The following equipment (.01 to 50 GHz) is recommended to run the program:

- HP 9000 series 200 or 300 computer with BASIC 2.0 or above
- A signal source: 83752A/B, 8360 Series, or 8350B with plug-in (depending on the operating frequency of the detector you are testing)

**Note** The 8360 Series and 83752A/B must first be placed in network analyzer language before running the program.

- 8757C/D/E scalar network analyzer
- 436A power meter with an appropriate power sensor

- 10 dB attenuator
- Printer: (optional) for printouts; the printer must be capable of performing a graphics dump.
- Three GPIB cables (4 required if a printer is used): 10833A/B/C/D

  GPIB is Agilent's hardware, software, documentation, and support for IEEE-488 and IEC-625 worldwide standards for interfacing instruments.

There are two separate program listings:

- Cal Factor Entry Program
- Detector Frequency Response Program

## Cal Factor Entry Program

The Cal (calibration) Factor Entry program allows you to input the calibration factors listed on the power sensor. These cal factors are stored on a disc under a file name that contains the power sensor serial number. This allows the storage of cal factors for more than one power sensor. At the beginning of the frequency response program, you are asked to input the serial number of the power sensor. Only data for that power sensor is loaded into memory. Up to 50 cal factors can be stored in each file although less are shown on the power sensors. A two-dimensional array is created containing combinations of a frequency and its associated cal factor. This program need only be run once to store the file on disc.

### Running the Cal Factor Entry Program

The following information will help you successfully run the Cal Factor Entry program.

- When prompted, enter the last few digits of the power sensor serial number (no more than 5 digits).
- Enter the frequency in GHz, *not* MHz.
- Enter both the frequency and the cal factor. For example, if the cal factor at 50 MHz is 99, enter .05,99 and press (ENTER).
- Each entered frequency must be greater than the preceding frequency.
- Fractional percentages are allowed (Example: 98.5).
- If you make a mistake, back up the program by entering a negative frequency. Each negative input backs up one entry and each entry must be input again.

- When all cal factors are entered, enter 0,0 to exit. The program displays all of the entered points. Verify the accuracy of each.
- When you press (CONTINUE), the controller will store the file on disc. Make sure the disc is not write protected.

## Detector Frequency Response Program

The Detector Frequency Response program performs the Frequency Response Performance Test using the cal factors previously stored on the disc. Any number of frequency points, up to 401, may be chosen, although 101 points is more than enough. The cal factor used is interpolated between the two closest frequency points. The cal factor used for frequencies measured below the lowest entered frequency point of the array defaults to the cal factor of the lowest entered frequency point. A similar method is used at the high end.

To reduce the time required to copy these programs, the code listings represent a minimum configuration to perform the measurement. There are no error checking or convenience features. Be careful when entering data and when following the displayed instructions.

### Running the Detector Frequency Response Program

The following information will help you successfully run the Detector Frequency Response program.

- If not testing from .01 to 26.5 GHz, change the START/STOP frequencies in lines 180/190 to the appropriate values.
- When prompted, enter the last few digits of the power sensor serial number (no more than 5 digits). Use the same power sensor serial number as in the Cal Factor Entry program.
- When prompted, enter the number of frequency points to be taken (no more than 401). The data points will be evenly spaced across the frequency range.
- When prompted, connect the calibrated power sensor to the attenuated output of the source. The program automatically zeros the meter.
- When prompted, remove the power sensor and connect the detector under test to the attenuated output of the source. Connect the input cable of the detector to the "A" input of the scalar network analyzer.
- The program will ask if the test should be performed in AC or DC mode. Normally DC mode is used for frequency response testing.

**Note** If using DC mode, zero the detector before measuring the DUT response.

A sample displayed output of the program is shown in Figure 9-1. If the displayed frequency response exceeds the limits of the graph, increase the value of "Scale" (variable controlling the scale size) in line 210.

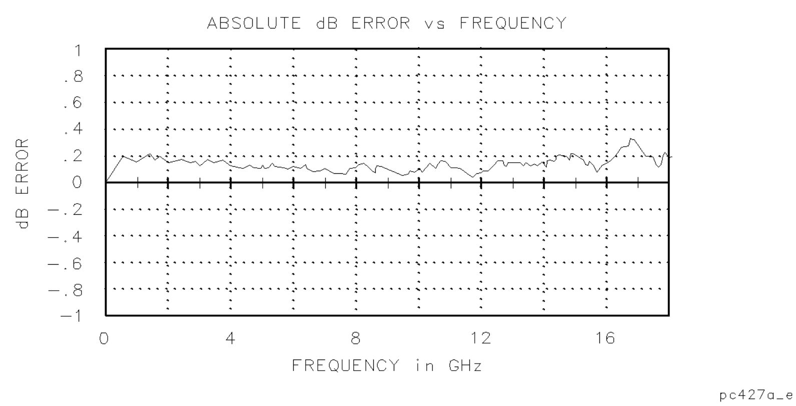



**Figure 9-1. Typical Program Output**

## Measurement Setup

Connect the equipment as shown in Figure 4-3. Connect the GPIB cables from the controller to the GPIB inputs of both the power meter and scalar network analyzer. Ensure that a system configuration and detector zero have been performed.

The GPIB addresses are as follows:

- Network analyzer: 716
- Source: 19 (connected to the analyzer's System Interface Bus, *not* the controller's GPIB)
- Power meter: 713

A printer may be connected to the GPIB at address 701 if a printout is required. The printer must be capable of performing a graphics dump.

## Example Programs

The following programs can be used to automate the power meter CAL factor entry and the Frequency Response Performance Test.

```
10    ! POWER METER CAL FACTOR ENTRY PROGRAM
20    ! Creates 2 dim array of freq (in MHz) vs cal factor
        (in percent)
30    ! Assigns a file name of "PM_xxxxx" (xxxxx is the pwr
        sensor serial #)
40    !
50    OPTION BASE 0
60    DIM Cal(1:50,1:2)
70    INTEGER I,Pm_points
80    !
90    GRAPHICS OFF
100   PRINTER IS 1
110   OFF KEY
120   OUTPUT 1;CHR$(12)
130   BEEP 300,.1
140   INPUT "ENTER THE POWER SENSOR SERIAL # (LAST 5
      DIGITS)",Serial
```

```
150   !
160   PRINT USING "3/,K,/";"ENTER BOTH FREQ AND CAL SEPARATED
      BY A COMMA."
170   PRINT "ENTERING A NEG FREQ WILL BACK UP."
180   PRINT USING "3/,K,/";" #      FREQ       CAL%"
190   !
200   FOR I=1 TO 50  ! 50 POINTS MAX
210 Entry:  !
220      BEEP 200,.02
230      DISP I;" Enter FREQ (in GHz) and CAL (in %). ""0,0
         EXITS""";
240      INPUT "",Freq,Pct
250      IF Freq=0 OR Pct=0 THEN GOTO Done
260      Freq=Freq*1000
270      IF Freq<0 THEN
280         I=I-1
290         BEEP 1000,.02
300         GOTO Entry
310      END IF
320      IF I>1 THEN
330         IF Freq<=Cal(I-1,1) THEN
340            DISP "FREQ MUST BE GREATER THAN LAST ENTRY... TRY
               AGAIN!"
350            BEEP 2000,.5
360            WAIT 2
370            GOTO Entry
380         END IF
390      END IF
400      Cal(I,1)=Freq
410      Cal(I,2)=Pct
420      PRINT USING "DD,3X,6D.D,5X,3D.D";I,Freq,Pct
430   NEXT I
440   !
450 Done:  !  DISPLAY ENTERED VALUES
460   Pm_points=I-1
470   OUTPUT 1;CHR$(12)
480   PRINT USING "K,/,K,/";"    ENTERED VALUES"," #      FREQ
      CAL%"
490   FOR I=1 TO Pm_points
500      PRINT USING "DD,3X,6D.D,5X,3D.D";I,Cal(I,1),Cal(I,2)
510   NEXT I
```

```
520   PRINT "Power Sensor serial number =";Serial
530   BEEP 400,.1
540   DISP "PRESS CONTINUE TO STORE DATA ON DISC."
550   PAUSE
560   !
570   DISP
580   ON ERROR GOSUB Error
590   ASSIGN @File TO "PM_"&VAL$(Serial)
600   OFF ERROR
610   OUTPUT @File;Pm_points,Cal(*)
620   ASSIGN @File TO *
630   BEEP 500,.02
640   DISP "CAL FACTORS HAVE BEEN STORED ON DISC."
650   CAT
660   STOP
670   !
680   ! **************************
690 Error:  ! ERROR ON ASSIGNMENT
700   !
710   IF ERRN=56 THEN   ! NO EXISTING FILE
720      CREATE BDAT "PM_"&VAL$(Serial),4  ! CREATE FILE
730      RETURN
740   END IF
750   DISP "ERROR # ";ERRN;"  FIX, THEN PRESS CONTINUE"
760   BEEP 2000,.3
770   PAUSE
780   DISP
790   RETURN
800   END
```

```
10    ! DETECTOR FLATNESS PROGRAM
20    ! Plots detector measurements vs power meter measurements.
30    !
40    OPTION BASE 0
50    COM INTEGER Cal_data_flg
60    COM /Cal_f/ Cal(1:50,1:2),INTEGER Pm_points
70    COM /Measure/
      Meas(1:401,1:3),Set_power,Start,Stop,Scale,INTEGER Points
80    COM /Hpib/ @Sna,@Source,@Pwr_mtr
90    !
100   GINIT
110   CALL Clear_screen
120   OFF KEY
130   ASSIGN @Sna TO 716      ! Scalar Network Analyzer address
140   ASSIGN @Source TO 717   ! Passthrough address to Source
150   ASSIGN @Pwr_mtr TO 713  ! Power Meter address
160   !
170   ! Change the below variables as needed for the detector under
        test.
180   Max_points=401
190   Start=10      ! Start frequency in MHz
200   Stop=26510    ! Stop  frequency in MHz
210   Set_power=2   ! Power level set point of source in dBm
220   Scale=2       ! dB  (+/- graph limits)
230   !
240   IF NOT Cal_data_flg THEN  ! get cal data on power sensor
250      DISP "ENTER THE POWER SENSOR SERIAL # (LAST 5 DIGITS)";
260      BEEP 700,.1
270      INPUT Serial
280      DISP "LOADING CAL FACTORS"
290      ASSIGN @File TO "PM_"&VAL$(Serial)
300      ENTER @File;Pm_points,Cal(*)  ! Load cal factors
310      ASSIGN @File TO *
320      Cal_data_flg=1
330      DISP
340   END IF
350   BEEP 500,.1
360   DISP "ENTER NUMBER OF POINTS TO BE MEASURED
      (";Max_points;"MAX)";
370   INPUT Points
380   Step_size=(Stop-Start)/(Points-1)
```

```
390   FOR I=1 TO Points
400      Meas(I,1)=Start+Step_size*(I-1)
410   NEXT I
420   REMOTE 7
430   OUTPUT @Sna;"IP PT19" ! preset system
440   CALL Set
450   LOOP
460      CALL Verify
470      BEEP 300,.1
480      DISP "        To repeat...press CONTINUE;  to re-cal...RUN"
490      PAUSE
500      !
510   END LOOP
520   END
530   !
540   ! **********  SUB PROGRAMS  *************
550   !
560   SUB Corr_pwr(Freq,Power) ! uses cal factor to find actual
      power read
570      COM /Cal_f/ Cal(*),INTEGER Pm_points
580      IF Freq<Cal(1,1) THEN  ! freq too low, use first
         value
590         Cal_factor=Cal(1,2)
600         GOTO Act_pwr
610      END IF
620      X=0
630      REPEAT
640         X=X+1
650         IF X>Pm_points THEN  ! freq too high, use last value
660            Cal_factor=Cal(Pm_points,2)
670            GOTO Act_pwr
680         END IF
690      UNTIL Freq<Cal(X,1)
700      Frac=(Freq-Cal(X-1,1))/(Cal(X,1)-Cal(X-1,1))
710      Cal_factor=Frac*(Cal(X,2)-Cal(X-1,2))+Cal(X-1,2) ! cal
         factor in %
720 Act_pwr:Power=Power-(10*LGT(Cal_factor/100))          ! actual
    power read
730   SUBEND
740   !
750   SUB Set ! finds freq response of source using pwr mtr as ref.
```

```
760       COM /Cal_f/ Cal(*),INTEGER Pm_points
770       COM /Measure/ Meas(*),Set_power,Start,Stop,Scale,INTEGER
          Points
780       COM /Hpib/ @Sna,@Source,@Pwr_mtr
790       Clear_screen
800       OUTPUT @Sna;"MD0"
810       OUTPUT @Source;"MD0 CW PL-60DB RF0" ! works for 8350 or
          8340/41
820       BEEP 400,.1
830       DISP "CONNECT POWER SENSOR TO ATTENUATORS"
840       PAUSE
850       !
860       CALL Zero_mtr
870       OUTPUT @Source;"PL";Set_power;"DB RF1 MD0 SV1 AM0 PM1" !
          for 8350/40/41
880       FOR I=1 TO Points
890          OUTPUT @Source;"CW";Meas(I,1);"MZ"
900          IF I=1 THEN WAIT 5
910          Read_pwr(Meas(I,2))
920          Corr_pwr(Meas(I,1),Meas(I,2))
930          DISP USING 940;"Freq =";Meas(I,1);"MHz     Power
             =";Meas(I,2);"dBm"
940          IMAGE   K,6D.D,K,3D.2D,K
950       NEXT I
960       DISP
970       Set_flg=1
980    SUBEND
990     !
1000   SUB Clear_screen  ! clears alpha and graphics screen
1010      GRAPHICS OFF
1020      OUTPUT 1;CHR$(12)
1030      DISP
1040   SUBEND
1050   !
1060   SUB Read_pwr(Power)  ! reads power from 436A power meter @
       100%
1070      COM /Hpib/ @Sna,@Source,@Pwr_mtr
1080      REPEAT
1090         WAIT .3
1100         OUTPUT @Pwr_mtr;"9D+T"
1110         ENTER @Pwr_mtr USING "B,B,X,K";Sts,Range,Power
```

```
1120     UNTIL Sts=80
1130  SUBEND
1140  !
1150  SUB Zero_mtr
1160     COM /Hpib/ @Sna,@Source,@Pwr_mtr
1170     DISP "STAND-BY... zeroing power meter"
1180     OUTPUT @Pwr_mtr;"A1+R"
1190     WAIT 7
1200     OUTPUT @Pwr_mtr;"Z1+R"
1210     OUTPUT @Pwr_mtr;"9D+V"
1220     WAIT 7
1230     DISP
1240  SUBEND
1250  !
1260  SUB Verify  ! measures detector response
1270     COM /Cal_f/ Cal(*),INTEGER Pm_points
1280     COM /Measure/ Meas(*),Set_power,Start,Stop,Scale,INTEGER
         Points
1290     COM /Hpib/ @Sna,@Source,@Pwr_mtr
1300     INTEGER I
1310     Clear_screen
1320     OUTPUT @Sna;"C2 C0 C1 IA ME FD0 MD1 SW0 AF1"
1330     BEEP 500,.1
1340     DISP "Select AC or DC mode. (A or D) Default = AC ";
1350     INPUT Answ$
1360     IF Answ$[1,1]="d" OR Answ$[1,1]="D" THEN
1370     OUTPUT @Sna;"DM0 MD0"
1380     ELSE
1390     OUTPUT @Sna;"DM1 MD1"
1400     END IF
1410     BEEP 400,.01
1420     DISP "CONNECT DETECTOR TO ATTEN AND TO INPUT ""A"" "
1430     PAUSE
1440     !
1450     ALPHA OFF
1460     Graticule
1470     GRAPHICS ON
1480     PEN 1
1490     OUTPUT @Source;"PL";Set_power;"DB RF1"
1500     FOR I=1 TO Points
1510        OUTPUT @Source;"CW";Meas(I,1);"MZ"
```

```
1520       WAIT .3
1530       OUTPUT @Sna;"OV"
1540       ENTER @Sna;Meas(I,3)
1550       Db_err=Meas(I,3)-Meas(I,2)
1560       IF I=1 THEN MOVE Meas(I,1),Db_err
1570       PLOT Meas(I,1),Db_err
1580    NEXT I
1590 SUBEND
1600 !
1610 SUB Graticule  ! generates  graphics graticule
1620    COM /Measure/ Meas(*),Set_power,Start,Stop,Scale,INTEGER
        Points
1630    GCLEAR
1640    DEG
1650    LDIR 0
1660    !
1670    ! ** GRATICULE **
1680    X=Stop-Start
1690    Xmin=-.15*X
1700    Xmax=1.02*X
1710    Ymax=1.2*Scale
1720    Ymin=-1.5*Scale
1730    WINDOW Xmin,Xmax,Ymin,Ymax
1740    CLIP 0,X,-Scale,Scale
1750    FRAME
1760    LINE TYPE 3
1770    GRID 2000,Scale/5,0,0
1780    LINE TYPE 1
1790    AXES 1000,Scale/10,0,0,2,2
1800    CLIP OFF
1810    !
1820    ! ** X-AXIS LABEL **
1830    CSIZE 4.3
1840    FOR I=INT(Start/1000) TO Stop STEP 4000
1850       LORG 6
1860       MOVE I,-Scale
1870       LABEL I/1000
1880    NEXT I
1890    !
1900    ! ** Y-AXIS LABEL **
1910    CSIZE 4.
```

```
1920     FOR I=-Scale TO Scale STEP Scale/5
1930        LORG 8
1940        MOVE 0,I
1950        LABEL (INT(I*100+.5))/100
1960     NEXT I
1970     !
1980     ! ** LABELS **
1990     CSIZE 5
2000     LORG 4
2010     MOVE (Stop-Start)/2,Scale
2020     LABEL "ABSOLUTE dB ERROR vs FREQ."
2030     LORG 6
2040     MOVE (Stop-Start)/2,-Scale*1.1
2050     LABEL "FREQUENCY in GHz."
2060     LDIR 90
2070     MOVE Xmin,0
2080     LABEL "dB ERROR"
2090  SUBEND
```

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