

HP 8757A SCALAR NETWORK ANALYZER OPERATING MANUAL

SERIAL NUMBERS AND FIRMWARE REVISIONS

This manual applies directly to any HP 8757A scalar network analyzer having:

a serial number prefixed 2439A through 2802A
and revision 2.0 or 2.1 firmware.

For additional information about serial numbers
and firmware revisions, refer to INSTRUMENTS
COVERED BY MANUAL in Section I.

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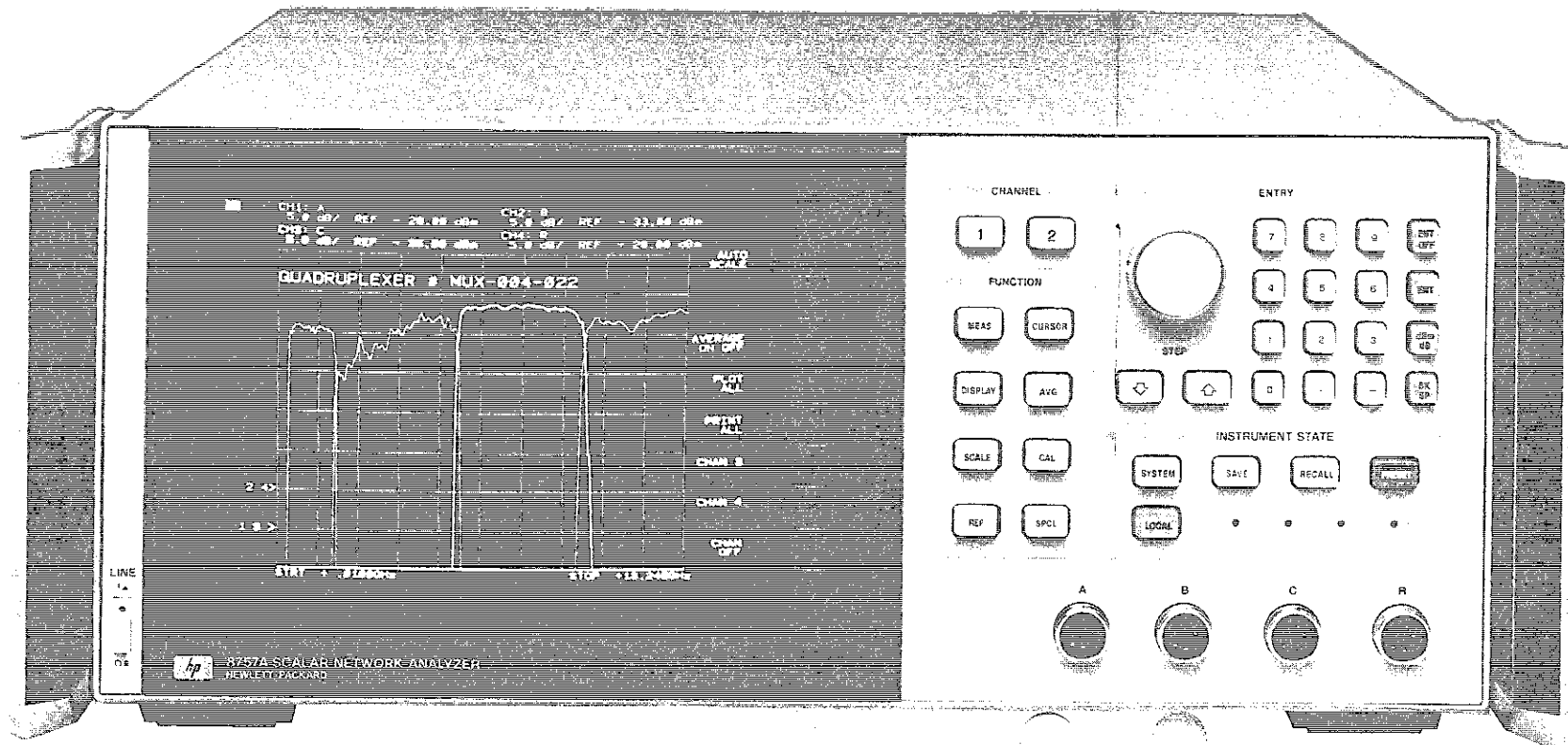
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HP 8757A Option 001

SECTION IV PERFORMANCE TESTS

INTRODUCTION

The procedures in this section test the electrical performance of the HP 8757A scalar network analyzer using the specifications of Table 1-1 as the performance standards. All tests can be performed without access to the interior of the instrument. A simpler operational test is included in Section III under Operator's Check. Measurement results depend on calibration constants stored within the instrument using the HP 11613A calibrator. The HP 11613A, used with an HP 9000 series 200 or 300 computer and HP BASIC language, calibrates the loggers independently of any detectors by injecting a 27.778 kHz square wave modulated signal at different power levels. The HP 11613A is supplied with a calibration constant program stored on a 3.5 inch disc and a 5.25 inch disc. For instructions on performing the calibration constant loading procedure, refer to the Operating and Service Manual for the HP 11613A calibrator.

The performance test procedures must be performed in the sequence given, since some procedures rely on satisfactory test results in foregoing steps. If a test measurement is slightly out of tolerance, go to Section V and perform

the adjustment procedures. If a function fails to operate, refer to the information titled "In Case of Difficulty" in Section III, or to the troubleshooting information in Section VIII.

EQUIPMENT REQUIRED

Equipment required for testing the HP 8757A, as well as for adjustments and troubleshooting, is listed in Table 4-1. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended models.

TEST RECORD

Results of the performance tests may be recorded in the Performance Test Record at the end of this section. The Performance Test Record lists all of the tested specifications and their acceptable limits, with columns for recording actual measurements before and after calibration. Test results recorded at incoming inspection can be used for comparison in periodic maintenance and troubleshooting and after adjustments or repairs.

Table 4-1. Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model	Use*
Sweep Oscillator	0-10V SWEEP OUT ramp Positive Z-axis blanking HP-IB programmable Interface to HP 8757A	HP 8350B or HP 8340A or HP 8341A	P,A,T
RF Plug-In (with HP 8350B)	Compatible with sweep oscillator Frequency range: includes 50 MHz Leveled power output: ≥13 dBm at 50 MHz	HP 83592B	P,A,T
Detector	No substitute**	HP 11664A/E	P,A,T
Calibrator	No substitute	HP 11613A	P,A,T
12 dB Step Attenuator	1 dB steps Type-N(f) connectors Calibration data at 50 MHz to 0.01 dB resolution	HP 355C Opt. 001 + Opt. H88	P,A,T
120 dB Step Attenuator	10 dB steps Type-N(f) connectors Calibration data at 50 MHz to 0.01 dB resolution	HP 355D Opt. 001 + Opt. H88	P,A,T
Oscilloscope	Dual channel Bandwidth: ≥100 MHz	HP 1740A	P,T
Oscilloscope Probes (3)	10:1 divider	HP 10041A	T
Universal Counter	Frequency range: ≥30 kHz Frequency resolution: ≤1 Hz Time Interval resolution: ≤100 ns	HP 5316A	P,T
Digital Voltmeter	Accuracy: ≤0.03 % Resolution: ≤0.1 mV Input impedance (dc): ≥10 MΩ	HP 3456A	A,T
Power Meter	HP-IB programmable	HP 436A	A,T
Power Sensor	Frequency range: includes 50 MHz Compatible with power meter	HP 8484A	A,T
50 MHz Bandpass Filter		HP P/N 08757-80027	P
Signature Multimeter	Signature analyzer clock frequency: ≥10 MHz	HP 5005A/B	T
Logic Probe	TTL compatible Data rate: ≥16 MHz	HP 545A or HP 10525T	T
Logic Pulser	TTL compatible	HP 546A or HP 10526T	T
Current Tracer	TTL compatible Compatible with logic pulser	HP 547A	T
Service Kit	No substitute	HP P/N 08757-60048	T

* P = performance tests, A = adjustments, T = troubleshooting

** Serial number 25000 or above for the HP 11664A

4-1. SELF TEST

SPECIFICATION

Digital circuitry within the HP 8757A functions properly.

DESCRIPTION

The HP 8757A is PRESET to initiate a built-in self test routine. The self test checks that major parts of the analog and digital circuitry are working properly. The self test results are displayed on the CRT.

PROCEDURE

1. Connect the HP 8757A to line power and turn the LINE switch on.
2. Press **[PRESET]** to run the self test. The self test takes approximately one second to run. If the test runs successfully and passes, the graticule and top-level soft key menu will appear on the display. If the self test fails, an error message will be displayed. Record the results (pass or error message) in the Performance Test Record.
3. If the self test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-2. DYNAMIC RANGE

SPECIFICATIONS

With HP 11664A/E detector: +16 to -60 dBm

With HP 11664D detector: +10 to -50 dBm

With HP 85025A/B detector (25°C ±5°C):

AC mode +16 to -55 dBm

DC mode +16 to -50 dBm

DESCRIPTION

A signal source is connected to the HP 8757A through an HP 11664A or 11664E detector. A signal square-wave modulated at 27.778 kHz is applied, to test the greatest response range and the noise floor of the HP 8757A with the detector.

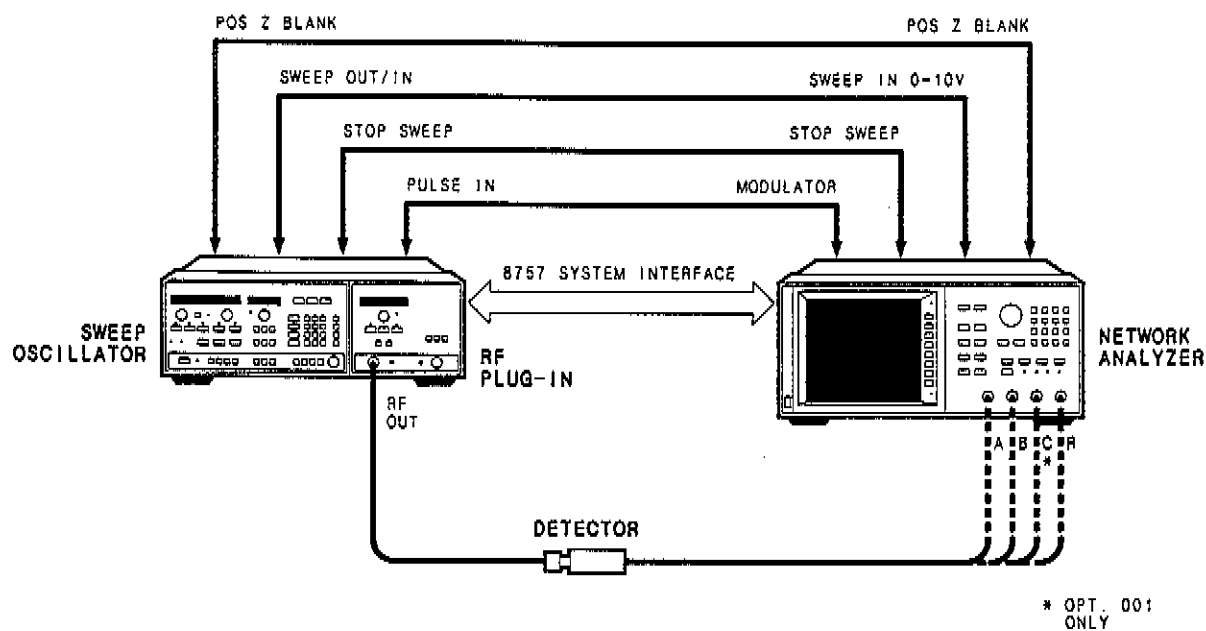


Figure 4-1. Dynamic Range Test Setup

EQUIPMENT

Sweep Oscillator Mainframe	HP 8350B
RF Plug-In	HP 83592B*
Detector	HP 11664A/E

* Any RF Plug-In with output power capabilities of +16 dBm at 50 MHz can be substituted.

PROCEDURE

1. Connect the equipment as shown in Figure 4-1, with the detector connected to the A input of the HP 8757A. On the HP 8757A, press **[PRESET]** to preset both the HP 8757A and 8350B. The HP 8757A is preset automatically to channel 1 and input A.

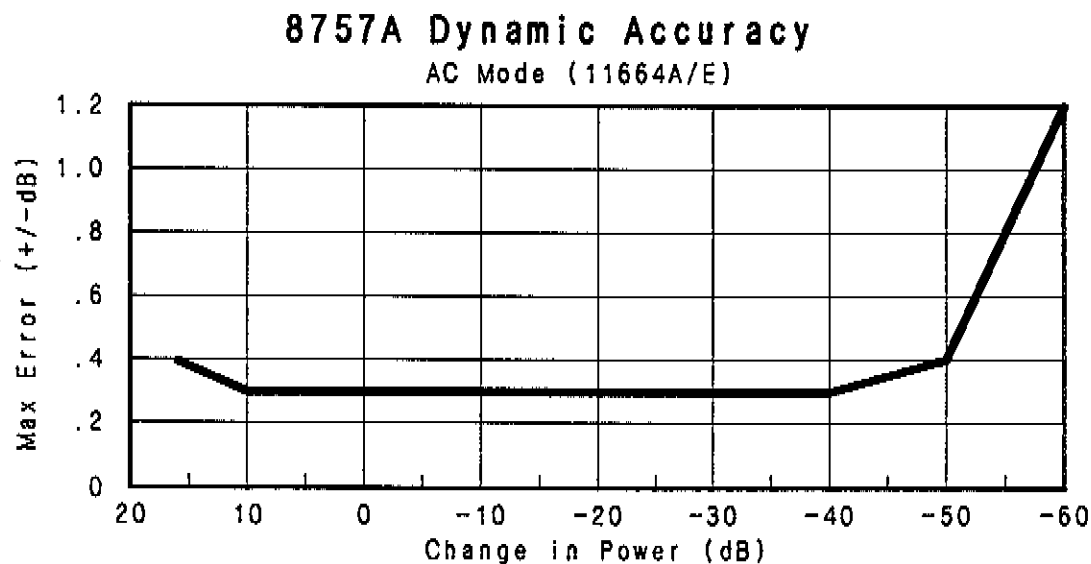
4-2. DYNAMIC RANGE (cont'd)

2. On the HP 8350B, press **[CW] [50] [MHz]**. Press **[] MOD** to turn off the internal square-wave modulation. On the HP 8757A press the **[AVG]** key, and verify that the default averaging factor of 8 is displayed on the CRT.
3. On the HP 8757A, press **[CURSOR]** and a cursor will appear at the center of the trace. Note the cursor value displayed on the CRT. Adjust the output power of the RF plug-in until the cursor value on the CRT reads +16 dBm or greater. (Some RF plug-ins may not be capable of outputting +16 dBm at 50 MHz. If necessary use an amplifier or perform the test at a different frequency.) Record the cursor value in the Performance Test Record, step 3.
4. Disconnect the detector input from the RF plug-in. Allow the trace to settle. Note the new cursor value displayed. This value should be -60 dBm or lower. Record the cursor value in the Performance Test Record, step 4.
5. Disconnect the detector from the A input and connect it to the B input. Reconnect the detector input to the RF plug-in. On the HP 8757A press the **[MEAS]** key and then the **[B]** soft key.
6. Allow the trace to settle. Note the cursor reading. If necessary, adjust the output power of the RF plug-in until the cursor value reads +16 dBm or greater. Record the cursor value in the Performance Test Record, step 6.
7. Disconnect the detector input from the RF plug-in and allow the trace to settle. Record the displayed cursor value in the Performance Test Record, step 7.
8. If the instrument is not an Option 001 proceed to step 10. If the instrument is an Option 001, disconnect the detector from input B and connect it to input C. Reconnect the detector input to the RF plug-in.
9. On the HP 8757A press the **[C]** soft key. Repeat steps 6 and 7 and record the high and low cursor values in the Performance Test Record, step 9.
10. Disconnect the detector and connect it to input R. Reconnect the detector input to the RF plug-in. On the HP 8757A press the **[R]** soft key. Repeat steps 6 and 7 and record the high and low cursor values in the Performance Test Record, step 10.
11. If any part of the dynamic range test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-3. DYNAMIC POWER ACCURACY

SPECIFICATION

The dynamic accuracy of the HP 8757A (with the specified HP 11664A/E detector) is graphed in Figure 4-2 below.



Note 1: Measured at 50 MHz, referenced at 0 dBm.

Note 2: For ≤ 20 dB change of power within +10 to -40 dBm the specification is $\pm(0.1 \text{ dB} + 0.01 \text{ dB/dB})$.

Figure 4-2. Dynamic Accuracy Specification

NOTE

Meeting AC dynamic accuracy specifications verifies DC absolute accuracy when the detectors are properly calibrated.

DESCRIPTION

The recommended method for checking dynamic amplitude accuracy is to use the HP 11613A calibrator. Alternatively, use calibrated step attenuators to check the dynamic amplitude accuracy of the HP 8757A at 50 MHz from +10 dBm to -60 dBm. For power levels from +10 dBm to +16 dBm, use an external amplifier capable of outputting at least +20 dBm or use the HP 11613A calibrator.

EQUIPMENT

Sweep Oscillator Mainframe	HP 8350A/B
RF Plug-In	HP 83592B*
Calibrated 12 dB Step Attenuator (1 dB steps)	HP 355C Option 001/H88
Calibrated 120 dB Step Attenuator (10 dB steps)	HP 355D Option 001/H88
50 MHz Bandpass Filter	HP P/N 08757-80027
3 dB Pad	HP 8491B
Detector	HP 11664A (S/N 25000 or above) or HP 11664E

*Serial prefix 2410 or higher

4-3. DYNAMIC POWER ACCURACY (cont'd)

NOTE

Calibrated attenuation is used in the dynamic 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 with the step attenuators when purchased or performed as a service afterwards.

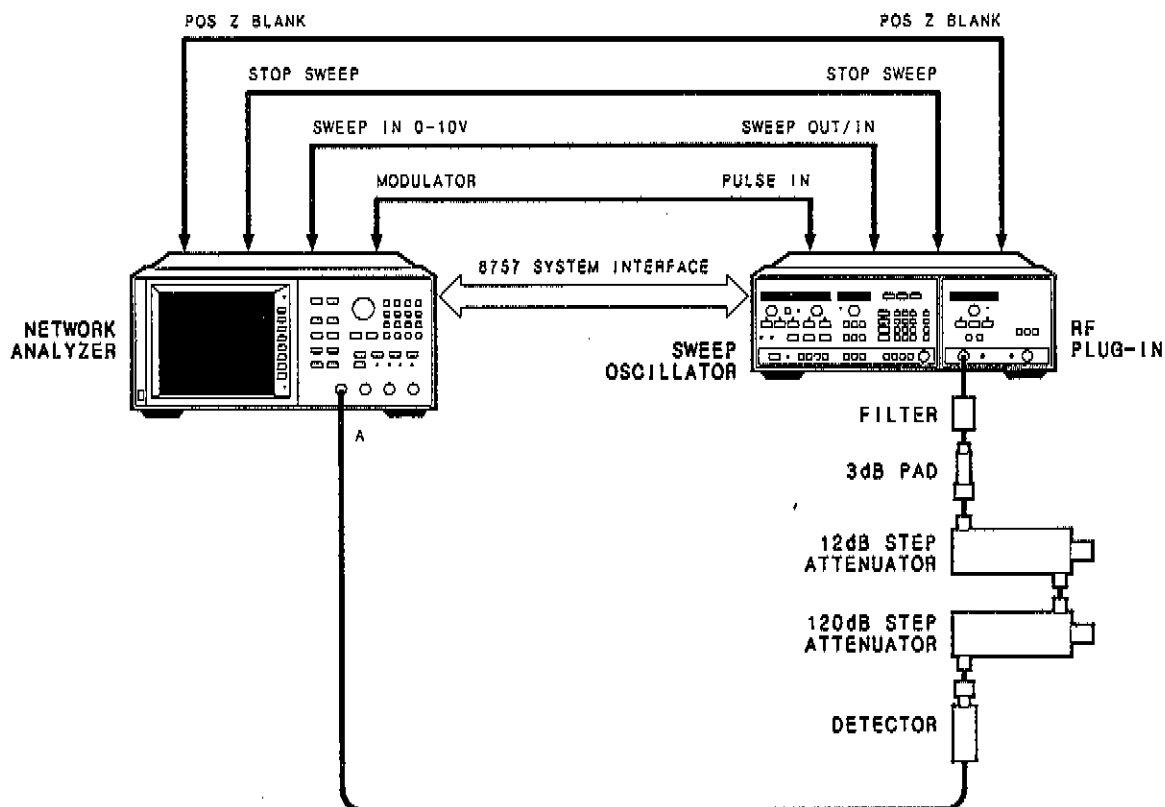


Figure 4-3. Dynamic Power Accuracy Test Setup

PROCEDURE

1. Set up the equipment, as shown in Figure 4-3, with the detector connected to input A. Allow 30 minutes warm-up time.
2. For each of the power levels specified in column 1 of the Performance Test Record, calculate the calibrated power level from the calibration report data as follows:

Calibrated power level = (+10 dBm) minus (120 dB step attenuator calibrated attenuation) minus (12 dB step attenuator calibrated attenuation).

Enter these values in the Calibrated Power Level column (#6) on the Performance Test Record

3. Set the 120 dB attenuator to 10 dB and set the 12 dB attenuator to 0 dB.
4. Set the HP 8350B to generate 50 MHz CW without internal modulation by pressing [INSTR PRESET] [CW] [5] [0] [MHz]. Press [] [MOD] to turn off internal modulation. External modulation is used to ensure accurate modulation characteristics.

4-3. DYNAMIC POWER ACCURACY (cont'd)

5. Activate the cursor of the HP 8757A by pressing **[CURSOR]**. Then rotate the POWER knob on the RF plug-in to set the cursor value (CRSR) to +10 dB minus (calibrated attenuation at 10 dB attenuation).

NOTE

The internal power level resolution of the RF plug-in is better than the 0.1 dB of displayed resolution. Make this adjustment slowly and carefully. Do not change this setting for the remainder of the procedure.

6. Note and record on the Performance Test Record the cursor value displayed on the CRT.
7. Set both attenuators to 0 dB attenuation.
8. Calculate the dynamic accuracy error as follows:

Dynamic accuracy error = (cursor value) minus (calibrated power level)

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

9. Set the attenuator(s) for the next Nominal PWR LVL (dBm).

NOTE

For power levels of -40 dBm and below use the averaging factor specified on the Performance Test Record to reduce trace noise. Set the attenuator(s) for the desired power level. Press **[AVG] [AVG FACTOR] [↑]** or **[↓]** as required for the appropriate averaging factor. Press **[AVERAGE ON OFF]** to turn on averaging. Press cursor, and when the trace settles, note in the MEAS PWR LVL column (#7) the CRSR value displayed on the CRT. Press **[AVG ON OFF]** to turn off the averaging factor before resetting the attenuator(s).

10. Repeat steps 6, 7, 8 and 9 for each power level listed on the Performance Test Record.
11. Set the 120 dB attenuator to 10 dB attenuation and the 12 dB attenuator to 0 dB attenuation. If the displayed cursor value is not within 0.02 dB of the value recorded in step 6, repeat steps 5 through 10.
12. Connect the detector to input B.
13. Measure input B by pressing **[MEAS] [B]**. Repeat steps 5 through 11.
14. If the instrument is an Option 001, connect the detector to input C, measure and record the data as above.
15. Connect the detector to input R, measure and record the data as above.
16. If the HP 8757A fails the dynamic accuracy test, refer to "In Case of Difficulty" in Section III or to Section VIII of the Service Manual.

4-4. MODULATOR DRIVE

SPECIFICATION

The modulator drive provides $\geq \pm 2.2V$ into 50 ohms. The frequency accuracy is 27.778 ± 0.012 kHz and symmetry is 50/50 $\pm 1\%$.

DESCRIPTION

The amplitude of the modulator drive (into 50 ohms) is checked with an oscilloscope. The frequency and symmetry of the modulator drive are measured with a universal counter.

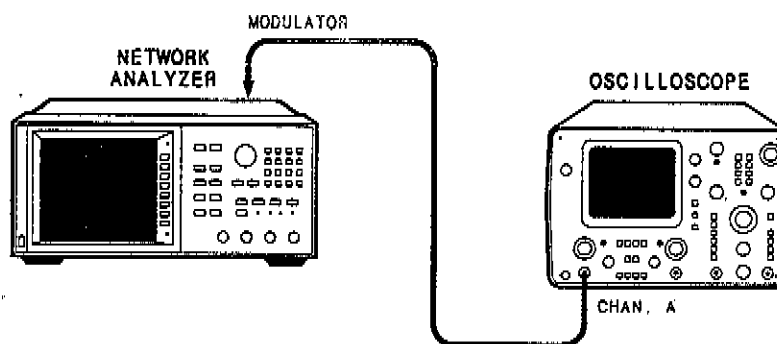


Figure 4-4. Modulator Drive Test Setup

EQUIPMENT

Oscilloscope*	HP 1740A
Universal Counter	HP 5316A
2 Adapters, BNC tee (m)(f)(f)	HP P/N 1250-0781
50 ohm Load	HP 11593A

* NOTE

The HP 1740A oscilloscope's 50 ohm input will dissipate 5 Vrms. If another oscilloscope is used, its 50 ohm input must be able to dissipate 3 Vrms or about 200 mW. If not, use the oscilloscope's high impedance input and externally terminate the input with a BNC tee and 50 ohm load.

Voltage Amplitude

1. Connect the HP 8757A to the oscilloscope as shown in Figure 4-4.
2. Press HP 8757A **[PRESET]** to turn on the modulation.
3. Set the oscilloscope functions as follows: DISPLAY A, TRIGGER A, CHAN A VOLTS/DIV set at 1, TIME/DIV set at $5\mu s$, TRIGGERING AUTO, HORIZONTAL DISPLAY MODE MAIN. Set all other buttons out.
4. Set oscilloscope input to GND, adjust POSN to vertically center the trace, then reset input to 50 OHM.
5. Adjust the oscilloscope TRIGGER LEVEL for a stable display.

6. Both positive and negative portions of the square wave should exceed 2.2V in absolute magnitude. Record the smaller value on the Performance Test Record, step 6.

Frequency Accuracy and Symmetry

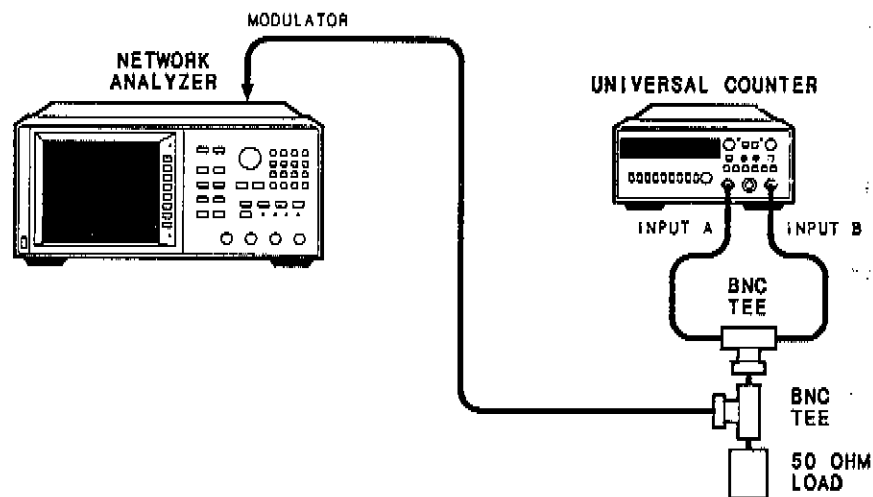


Figure 4-5. Frequency Accuracy and Symmetry Test Setup

7. Turn the universal counter ON. Set all other keys out.
8. With the universal counter inputs disconnected, rotate the channel A LEVEL/SENS knob CCW until the TRIGGER LEVEL LED lights. Rotate the knob CW until the LED just extinguishes. Repeat this procedure for channel B. This sets the trigger levels to 0.0V. Once set, do not readjust these two knobs.
9. Connect the equipment as shown in Figure 4-5.
10. Set channel A at RISING EDGE and channel B at FALLING EDGE. This sets channel A to trigger on the rising edge, B on the falling edge.
11. Press **FREQ A** to measure the modulation frequency. Record this frequency on the Performance Test Record, step 11.
12. Set the **FREQ/PERIOD** key (blue) to **PERIOD** and select **T1 AVG A to B** to measure the positive half cycle. Record this value on the Performance Test Record, step 12.
13. Reset channel A to trigger on the falling edge and B on the rising edge to measure the negative half cycle. Record this value on the Performance Test Record, step 13.
14. The symmetry specification is verified when the test limits of steps 12 and 13 are met.
15. If the HP 8757A fails one or more parts of the modulator drive test, refer to "In Case of Difficulty" in Section III or to Section VIII of the Service Manual.

4-5. HP INTERFACE BUS AND 8757 SYSTEM INTERFACE SPECIFICATION

NOTE

The following diagnostic test verifies the hardware associated with the HP interface bus and 8757 system interface. These have no electrical specifications or performance standards other than IEEE Standard 488-1978.

The HP interface bus (HP-IB) and 8757 system interface operate according to IEEE Standard 488-1978. They allow bi-directional communication with other instruments and/or controllers.

DESCRIPTION

The HP interface bus and 8757 system interface connectors are connected together with an HP-IB cable. Internal diagnostic routines check the ability of both ports to send and accept data. This procedure also serves as an operator's check of the remote mode.

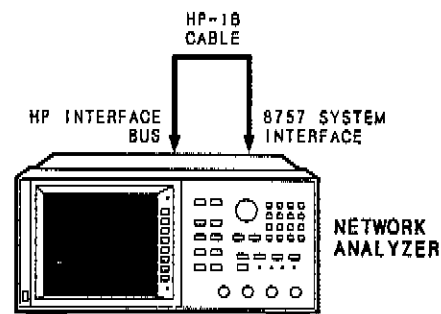


Figure 4-6. HP Interface Bus and 8757 System Interface Test Setup

EQUIPMENT

HP-IB Cable HP 10833A/B/C/D

PROCEDURE

1. Connect the HP-IB cable between the rear panel HP INTERFACE BUS and 8757 SYSTEM INTERFACE ports as shown in Figure 4-6.
2. Press **[PRESET]**.
3. Press **[SYSTEM]**, then soft keys **[MORE]** **[SERVICE]** **[A6 HPIB INSTBUS]** **[HPIB TESTS]**. Then press **[HPIB TALK]** to run the first diagnostic test. In this test, the HP interface bus sends test data to the 8757 system interface, acting as talker. If the test passes, the CRT displays "HPIB TALK PASS"; other messages indicate the test failed. Record the results on the Performance Test Record, step 3.

4. Press **[HPIB LISTEN]** to run the second diagnostic test. In this test, the HP interface bus port accepts test data from the 8757 system interface, acting as listener. If the test passes, the CRT displays "HPIB LISTEN PASS"; other messages indicate the test failed. Record the results on the Performance Test Record, step 4.
5. Press **[PRESET]** or **[EXIT SERVICE]** to exit the diagnostic test, and disconnect the HP-IB cable.
6. If either of the tests fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

4-6. DETECTOR CONTROL CIRCUITRY

SPECIFICATION

The HP 8757A has the capability to determine which type of detector is connected to each of the three inputs (four in Option 001). In addition, it can also determine some of the characteristics of each detector, as well as its temperature if the detector has this capability. This test verifies the operation of the detector control circuitry.

DESCRIPTION

Instrument **[PRESET]** verifies most of the detector control circuitry. To completely verify the control circuitry at each of the inputs, the sense resistor (1.0k ohms) must be measured. This is done by measuring the voltage drop across the resistor when an HP 11664 detector is connected to the input (1.0k ohms to ground).

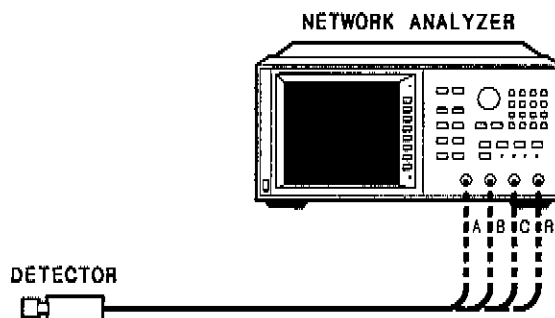


Figure 4-7. Detector Control Circuitry Test Setup

EQUIPMENT

Detector HP 11664A (S/N 25000 or above) or HP 11664E

PROCEDURE

1. On the HP 8757A, press **[PRESET]**. If the instrument passes **[PRESET]**, most of the detector control circuitry is verified, with the exception of the sense resistors for each input.
2. Press the **[SYSTEM]** key. Then press soft keys **[MORE]** and **[SERVICE]**.
3. Press soft keys **[A4 ADC]** and **[MORE]**.
4. Press soft keys **[CHANNEL VOLTS]**, **[CHANV DET DAC]**, **[MODE 1]** and **[DET DAC MAX]**. The CRT displays the DRIVE and SENSE voltages for each of the inputs.
5. Connect the detector to input A of the HP 8757A as illustrated in Figure 4-7.

4-6. DETECTOR CONTROL CIRCUITRY (cont'd)

6. Note the CHAN A SENSE and DRIVE voltages displayed. With the detector connected to the input, the SENSE voltage should drop to one half of the DRIVE voltage $\pm 3\%$. Record the results as pass or fail in the Performance Test Record, step 6.
7. Repeat steps 5 and 6 for the B, C (Option 001), and R inputs. Record the results as pass or fail in the Performance Test Record, step 7.
8. If the detector control circuitry test fails, refer to "In Case of Difficulty" in Section III, or to Section VIII of the Service Manual.

PERFORMANCE TEST RECORD (1 of 5)

Test	Lower Limit	Test Result (Before Cal)	Test Result (After Cal)	Upper Limit
4-1. Self Test				
2. Press [PRESET]	PASS	_____	_____	
4-2. Dynamic Range				
3. RF ON (A)	+16 dBm	_____	_____	—
4. RF OFF (A)	—	_____	_____	-60 dBm
6. RF ON (B)	+16 dBm	_____	_____	—
7. RF OFF (B)	—	_____	_____	-60 dBm
9. RF ON (C) (Opt 001)	+16 dBm	_____	_____	—
RF OFF (C) (Opt 001)	—	_____	_____	-60 dBm
10. RF ON (R)	+16 dBm	_____	_____	—
RF OFF (R)	—	_____	_____	-60 dBm
4-3. Dynamic Accuracy	See remaining pages of Performance Test Record.			
	Lower Limit	Test Result	Upper Limit	
4-4. Modulator Drive				
6. Absolute magnitude	2.2V	_____		—
11. Modulation frequency	27.766 kHz	_____		27.790 kHz
12. Positive half cycle	17.65 μ s	_____		18.35 μ s
13. Negative half cycle	17.65 μ s	_____		18.35 μ s
4-5. HP Interface Bus and 8757 System Interface				
3. HPIB TALK	PASS	_____		—
4. HPIB LISTEN	PASS	_____		—
4-6. Detector Control Circuitry	Test Result	Limit		
6. CHAN A SENSE	_____	1/2 CHAN A DRIVE V \pm 3%		
7. CHAN B SENSE	_____	1/2 CHAN B DRIVE V \pm 3%		
CHAN C SENSE (Opt 001)	_____	1/2 CHAN C DRIVE V \pm 3%		
CHAN R SENSE	_____	1/2 CHAN R DRIVE V \pm 3%		

PERFORMANCE TEST RECORD (2 of 5)

A Input		(Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)						
1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTN Setting (dB)	3. Nominal 12 dB ATTN Setting (dB)	4. CAL ATTN (120 dB ATTN)	5. CAL ATTN (12 dB ATTN)	6. CAL PWR LVL (dBm) (10 dBm - CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	*10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
-3	10	3						0.13
-6	10	6						0.16
-10	20	0						0.20
-13	20	3						0.23
-16	20	6						0.26
-20	30	0						0.30
-25	30	5						0.30
-30	40	0						0.30
-35	40	5						0.30
-40	50 (16)	0						0.30
-45	50 (32)	5						0.35
-50	60 (64)	0						0.40
-55	60 (64)	5						0.80
-60	70 (64)	0						1.20

*Record on B Input, C Input (if Option 001) and R Input Performance Test Record.

PERFORMANCE TEST RECORD (3 of 5)

Input								
(Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)								
1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTN Setting (dB)	3. Nominal 12 dB ATTN Setting (dB)	4. CAL ATTN (120 dB ATTN)	5. CAL ATTN (12 dB ATTN)	6. CAL PWR LVL (dBm) (10 dBm - CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	+10	0	1φ.φ7	φ.φ3	-φ.1φ		REF	REF
+10	0	0	φ.φ3	φ.φ3	9.94			0.20
+6	0	4	φ.φ3	4.φ9	5.88			0.16
+3	0	7	φ.φ3	7.φ6	2.91			0.13
0	10	0	1φ.φ7	φ.φ3	-φ.1φ		REF	REF
-3	10	3	1φ.φ7	3.φ5	-3.12			0.13
-6	10	6	1φ.φ7	6.φ7	-6.14			0.16
-10	20	0	19.88	φ.φ3	-9.91			0.20
-13	20	3	19.88	3.φ5	-12.93			0.23
-16	20	6	19.88	6.φ7	-15.95			0.26
-20	30	0	29.93	φ.φ3	-19.96			0.30
-25	30	5	29.93	5.φ3	-24.96			0.30
-30	40	0	39.61	φ.φ3	-29.64			0.30
-35	40	5	39.61	5.φ3	-34.64			0.30
-40	50 (16)	0	49.91	φ.φ3	-39.94			0.30
-45	50 (32)	5	49.91	5.φ3	-44.94			0.35
-50	60 (64)	0	59.7φ	φ.φ3	-49.73			0.40
-55	60 (64)	5	59.7φ	5.φ3	-54.73			0.80
-60	70 (64)	0	69.74	φ.φ3	-59.77			1.20

PERFORMANCE TEST RECORD (4 of 5)

C Input		(Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)						
1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTN Setting (dB)	3. Nominal 12 dB ATTN Setting (dB)	4. CAL ATTN (120 dB ATTN)	5. CAL ATTN (12 dB ATTN)	6. CAL PWR LVL (dBm) (10 dBm - CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit (Absolute Value)
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
-3	10	3						0.13
-6	10	6						0.16
-10	20	0						0.20
-13	20	3						0.23
-16	20	6						0.26
-20	30	0						0.30
-25	30	5						0.30
-30	40	0						0.30
-35	40	5						0.30
-40	50 (16)	0						0.30
-45	50 (32)	5						0.35
-50	60 (64)	0						0.40
-55	60 (64)	5						0.80
-60	70 (64)	0						1.20

PERFORMANCE TEST RECORD (5 of 5)

R Input (Perform last five measurements with Averaging ON. Averaging Factor is listed in column 2 and placed within parentheses.)								
1. Nominal PWR LVL (dBm)	2. Nominal 120 dB ATTN Setting (dB)	3. Nominal 12 dB ATTN Setting (dB)	4. CAL ATTN (120 dB ATTN)	5. CAL ATTN (12 dB ATTN)	6. CAL PWR LVL (dBm) (10 dBm - CAL ATTN)	7. MEAS PWR LVL (Cursor) (dBm)	8. Dynamic ACC Error (dBm)	9. Upper Limit
0	+10	0					REF	REF
+10	0	0						0.20
+6	0	4						0.16
+3	0	7						0.13
0	10	0					REF	REF
-3	10	3						0.13
-6	10	6						0.16
-10	20	0						0.20
-13	20	3						0.20
-16	20	6						0.20
-20	30	0						0.20
-25	30	5						0.20
-30	40	0						0.20
-35	40	5						0.20
-40	50 (16)	0						0.20
-45	50 (32)	5						0.30
-50	60 (64)	0						0.40
-55	60 (64)	5						0.80
-60	70 (64)	0						1.20

GENERAL INFORMATION

85025A(w) OPT 001
85025B

INTRODUCTION

This manual contains information required to operate, test, and service the Hewlett-Packard 85025A, 85025A Option 001, and 85025B detectors. The standard instrument and the supplied cable marker kit are shown in Figure 1.

Operating information is found under the major heading **OPERATION. PERFORMANCE TESTS** contains instructions for testing the HP 85025A/B to the published specifications. Included is a Performance Test Record for recording test results. Repair and adjustment information is found under the **SERVICE** heading.

An appendix and a supplement are found at the back of this manual. Appendix A contains information on mechanical inspection of precision 3.5 mm connectors and APC-7®* connectors. The use of pin depth gages is also discussed. Type-N connectors are discussed in general maintenance terms only.

The supplement contains a program listing of an automated Frequency Response measurement, with brief notes on how to use it and the equipment necessary to make the automated measurement.

DESCRIPTION

The HP 85025A/B detector is specifically designed for use with the HP 8757A scalar network analyzer. The detector enables the scalar analyzer to measure either modulated (AC) or unmodulated (DC) test signals. RF signal levels (dependent on the mode AC or DC) from -55 to +16 dBm in the frequency range of 10 MHz to 18 GHz (10 MHz to 26.5 GHz for the HP 85025B) can be detected. Three types of connectors are available:

- HP 85025A, Type-N
- HP 85025A Option 001, APC-7
- HP 85025B, precision 3.5mm

SPECIFICATIONS

Table 1 lists the performance specifications for the HP 85025A/B detector. These are the performance standards or limits against which the instrument can be tested.

ACCESSORIES

The following accessories for the HP 85025A/B are available:

- HP 11679A, 7.6 metre (25 foot) extension cable and
- HP 11679B, 61 metre (200 foot) extension cable

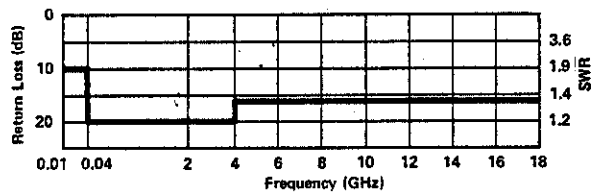
If you wish to order these accessories, please refer to the paragraph titled **ORDERING THE PARTS** under major heading **SERVICE**.

*APC-7® is a registered trademark of Bunker-Ramo Corporation.

Table 1. Specifications

HP 85025A Detector

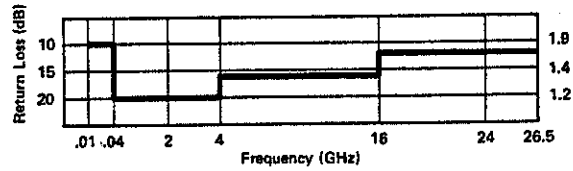
Frequency Range: 10 MHz to 18 GHz.
Return Loss (25° ± 5°C):
 10 MHz to 40 MHz: 10 dB.
 40 MHz to 4 GHz: 20 dB.
 4 GHz to 18 GHz: 17 dB.



Connector: Type-N Male (Option 001: APC-7)

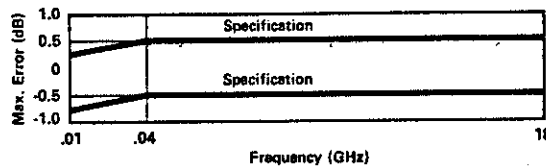
HP 85025B Detector

Frequency Range: 10 MHz to 26.5 GHz.
Return Loss (25° ± 5°C):
 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.

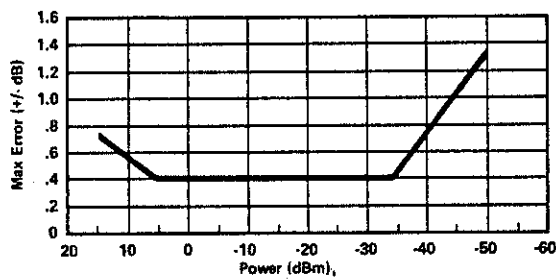


Connector: Precision 3.5mm Male

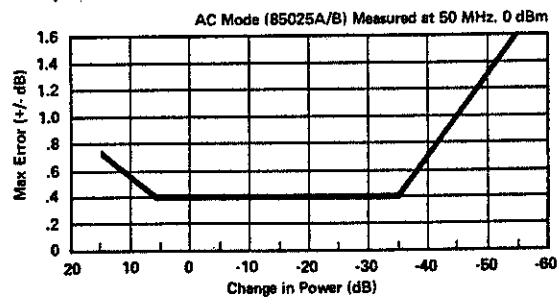
Detector Frequency Response (HP 85025A/B detectors in DC mode, -10 dBm 25° ± 5°C):
 10 MHz to 40 MHz: +0.25/-0.75 dB
 40 MHz to 18 GHz: ±0.5 dB.



Absolute Power Accuracy (HP 85025A/B detectors in DC mode, 50 MHz, calibrated at 0 dBm, 25° ± 5°C):



Dynamic Power Accuracy (25° ± 5°C):



GENERAL

Dynamic Range (on all HP 8757A detector inputs):

HP 85025A/B (25° ± 5°C):
 AC mode +16 to -55 dBm.
 DC mode +16 to -50 dBm.

Impedance: 50 ohms nominal.

Maximum Input Power: +20 dBm (100 mW), ±10 VDC.

Dimensions: Cable lengths is 1.22 m (48 in.).

Weight: Net 0.24 kg (0.5 lb) Shipping 1.0 kg (2.2 lb)

EQUIPMENT REQUIRED BUT NOT SUPPLIED

Reflection and transmission measurements require one or more HP 85025A/B detectors and an HP 8757A scalar network analyzer. Swept frequency measurements require a swept signal source. In addition, the RF source signal must be amplitude modulated by a 27.778 kHz squarewave signal for AC detection measurements.

To make reflection and transmission measurements you will need the following equipment:

1. one or more detectors.
2. a sweep oscillator or synthesized sweeper capable of 27.778 kHz squarewave amplitude modulation.
3. an external modulator (HP 11665B) that squarewave modulates the RF signal if the RF source cannot provide the modulation signal (needed for AC detection only).
4. an HP 8757A scalar network analyzer.
5. a dual directional coupler (or two single directional couplers) or a directional bridge.

RECOMMENDED TEST EQUIPMENT

Equipment required for testing the HP 85025A/B is listed in Table 2. Other equipment may be substituted if it meets or exceeds the critical specifications indicated in the table. You may also use this list as a reference for the equipment necessary to make reflection and transmission measurements.

INITIAL INSPECTION

If the shipping container or cushioning material is damaged, keep it until the contents of the shipment have been checked for completeness, and the instrument has been checked both mechanically and electrically.

First, check the package for completeness. Figure 1 depicts the items you should receive.

Second, check connectors, cable, and body for mechanical damage.

Third, test the detector electrically by either making measurements or testing to the specifications. Refer to **OPERATION** or **PERFORMANCE TESTS** in this manual.

Notify your nearest Hewlett-Packard office, if any of the following conditions exists:

- a. The instrument does not pass electrical tests.
- b. Shipping contents are incomplete.
- c. There is mechanical damage or defect.

Also, notify the carrier if the shipping container is damaged or the cushioning material shows signs of stress. Keep all shipping materials for the carrier's inspection. Hewlett-Packard will arrange for repair or replacement without waiting for a claim settlement.

PREPARATION FOR USE

CAUTION

SUSCEPTIBLE TO DAMAGE FROM STATIC DISCHARGE

Power Requirements

Power for the detector is supplied by the HP 8757A scalar network analyzer.

OPERATING ENVIRONMENT

Temperature: 0° to +55°C.

Humidity: Up to 95%. Provide protection from temperature extremes. Condensation may occur within the instrument if exposed to temperature extremes or higher humidity levels.

Altitude: Up to 7,620 metres (25,000 feet).

STORAGE AND SHIPMENT

Environment

The instrument may be stored or shipped in environments within the following limits:

Temperature: -25°C to +75°C.

Humidity: Up to 95%.

Altitude: Up to 7,620 metres (25,000 feet).

Provide protection from temperature extremes, which can cause condensation within the instrument.

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

1. Wrap the instrument in heavy paper.
2. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.
3. Use shock-absorbing material (3 to 4-inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside the container.
4. Seal the shipping container securely.
5. Mark the shipping container **FRAGILE**.

Returning for Service

If you are shipping the instrument to a Hewlett-Packard office or Service Center please including the following information:

1. Company name and address.
2. Technical contact person with complete phone number.
3. Complete model and serial number of the instrument.
4. Type of service required (calibration vs. repair).
5. Any other information that may expedite service.

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

Table 2. Recommended Test Equipment (1 of 2)

Instrument Type	Critical Specifications	Suggested Model
Pulse/Function Generator	Amplitude + 16 dBm at a frequency of 50 MHz.	HP 8116A
Scalar Network Analyzer	No substitute.	HP 8757A
50 MHz Bandpass Filter		HP P/N 08757-80027
3 dB Attenuator		HP 8491B
10 dB Step Attenuator	Calibration Data required.	HP 355D Opt 001 / H88
1 dB Step Attenuator	Calibration Data required.	HP 355C Opt 001 / H88
Modulator	Provides squarewave amplitude modulation at a 27.778 kHz rate.	HP 11665B
Power Meter		HP 436A or 438A
Sweep Oscillator Mainframe or Synthesized Sweeper	Capable of being modulated.	HP 8350B HP 8340A / 8341A
RF Plug-in	Compatible with Sweeper. Low harmonic distortion.	HP 83592C
RF Plug-in	Compatible with Sweeper. Frequency: 10 MHz - 26.5 GHz.	HP 83594A / 84595A
Directional Bridge	Compatible with HP 8757A.	HP 85021A / B / C (AC detection only) or HP 85027A / B / C (AC / DC detection)
10 dB Attenuator	Type-N connector. APC-7 connector. Precision 3.5 mm conn.	HP 8491B Opt. 010 HP 8492A Opt. 010 HP 8493C Opt. 010

Table 2. Recommended Test Equipment (2 of 2)

Instrument Type	Critical Specifications	Suggested Model						
Shielded Open	Type-N connector.	HP P/N 85032-20002						
Calibrated Short	Type-N connector.	HP 11512A						
Calibrated Short/Shielded Open	APC-7 connector.	HP P/N 85021-60001						
Calibrated Short/Shielded Open	Precision 3.5 mm connector.	HP P/N 85037-60001						
Calibrated Power Sensor	Type-N connector. APC-7 connector. Precision 3.5 mm conn.	HP 8481A HP 8481A Opt. 001 HP 8485A						
Adapters	N (f) to BNC (m) N (m) to N (m) 3.5mm (f) to 3.5mm (f)	HP P/N 1250-1534 HP P/N 1250-1475 HP P/N 1250-1865						
FOR ADJUSTMENTS ONLY Synthesizer / Level Generator	Low harmonic distortion at an* output of +6.00 dBm and fre- quency of 50 MHz.	HP 3335A						
<p>CONNECTOR MECHANICAL INSPECTION ONLY</p> <table border="0"> <tr> <td data-bbox="272 1350 892 1384">Type-N Inspection Gage</td> <td data-bbox="910 1350 1286 1384">Maury Microwave* Gage A 020A</td> </tr> <tr> <td data-bbox="272 1413 793 1447">APC-7 Inspection Gage and Calibration Block</td> <td data-bbox="910 1413 1256 1476">Maury Microwave Gage A 028 Maury Microwave Block 028-2</td> </tr> <tr> <td data-bbox="272 1509 831 1572">Precision 3.5mm Inspection Gage and Calibration Block</td> <td data-bbox="910 1509 1304 1572">Maury Microwave Gage A 034B-M Maury Microwave Block 027-3</td> </tr> </table>			Type-N Inspection Gage	Maury Microwave* Gage A 020A	APC-7 Inspection Gage and Calibration Block	Maury Microwave Gage A 028 Maury Microwave Block 028-2	Precision 3.5mm Inspection Gage and Calibration Block	Maury Microwave Gage A 034B-M Maury Microwave Block 027-3
Type-N Inspection Gage	Maury Microwave* Gage A 020A							
APC-7 Inspection Gage and Calibration Block	Maury Microwave Gage A 028 Maury Microwave Block 028-2							
Precision 3.5mm Inspection Gage and Calibration Block	Maury Microwave Gage A 034B-M Maury Microwave Block 027-3							

*To order a Maury part, list the description, Maury part number, and quantity desired. Send your order to Maury Microwave Corporation, 8610 Helms Avenue, Cucamonga, California 91730 (telephone 714-987-4715; TWX 910-581-3408).

PERFORMANCE TESTS

INTRODUCTION

The procedures in this section test the instrument's electrical performance to the specifications in Table 1. None of these tests requires access to the interior of the instrument.

In the instructions, the words "press" and "select" will be used to mean, "press key named . . .". The only difference is, "press" references a front panel labeled key, while "select" is used to reference softkeys.

At the back of this manual is a supplement containing additional information for automating the frequency response performance test. The example program listings are the bare essentials necessary for an automated measurement.

The supplement is intended to provide a starting point for making automated measurements and does not contain full error detection or additional features. Hewlett-Packard does not warrant that the use of this software will be uninterrupted or error free. It is provided as a convenience only.

RETURN LOSS AT A NOMINAL - 10 dBm

SPECIFICATIONS

Specifications apply at 25°C ± 5°C.

Frequency Range	HP 85025A HP 85025A Opt 001	HP 85025B
10 MHz to 40 MHz	>10 dB	>10 dB
40 MHz to 4 GHz	>20 dB	>20 dB
4 GHz to 18 GHz	>17 dB	>17 dB
18 GHz to 26.5 GHz	---	>12 dB

DESCRIPTION

The return loss of the HP 85025A/B 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. Then, the detector under test, DUT is connected to the **TEST PORT** of the bridge; its return loss is measured on the HP 8757A.

The return loss should be greater than the limits listed above plus allowable test limits. The three main sources of error in these measurements come from:

- A. Bridge directivity.
- B. Source match of the bridge.
- C. Dynamic accuracy of the HP 8757A.

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

An RSS (root-sum of the squares) calculation of these errors produces the following lower limits to the published specifications of return loss.

RETURN LOSS (dBm)

MODEL	FREQUENCY (GHz)			
	0.01 to 0.04	0.04 to 4.0	4.0 to 18	18 to 26.5
HP 85025A	10 (9.4)	20 (18.6)	17 (15.9)	---
HP 85025A Opt. 001	10 (9.4)	20 (18.9)	17 (16.3)	---
HP 85025B	10 (9.4)	20 (18.9)	17 (16.3)	12 (11.1)

NOTE

An HP 85021A, B or C directional bridge (depending on the connector type) is used to measure the detector return loss. The lower limit value is in parentheses.

PROCEDURE

Return Loss 10 to 40 MHz

1. Connect the equipment as shown in Figure 6, with nothing connected to the bridge TEST PORT.

Press [PRESET] on the HP 8757A; both the HP 8757A and the HP 8350B will reset.

Allow 30 minutes for warm-up.

On the source:

2. Press [L Γ MOD].
Press [START] [-] [1] [0] MHz.
Press [STOP] [4] [0] MHz.

On the RF plug-in:

3. Press [POWER LEVEL] and adjust the power with the RPG (Rotary Pulse Generator knob) for a -3 dBm power level indication.

On the HP 8757A:

4. Select [CHAN 2 OFF] to turn channel 2 off.
5. Press Function [MEAS].
Select [A].
6. Press Function [REF].
Select [REF POSN], then use the step keys or RPG to move REF POSN one line down from the top of the CRT graticule.
7. Press Function [SCALE].
Select [AUTO SCALE].

Notice a response dip similar to Figure 7. This dip is formed because the sweeper is a heterodyned source (in Band 0) sweeping through low frequencies where it is incapable of generating output power. The middle of this response dip is the "ZERO FREQUENCY" point.

On the RF plug-in front panel:

8. Use the **FREQ CAL** potentiometer to center the "ZERO FREQUENCY" point over the second graticule line from the left. Refer to Figure 8.

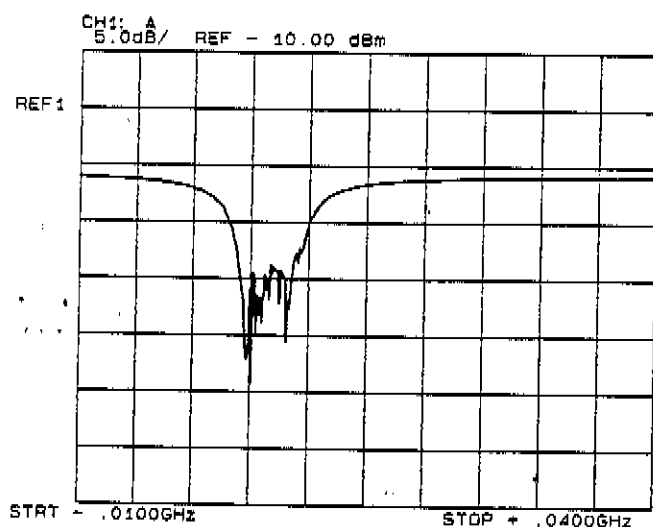


Figure 7. Trace Before Adjustment

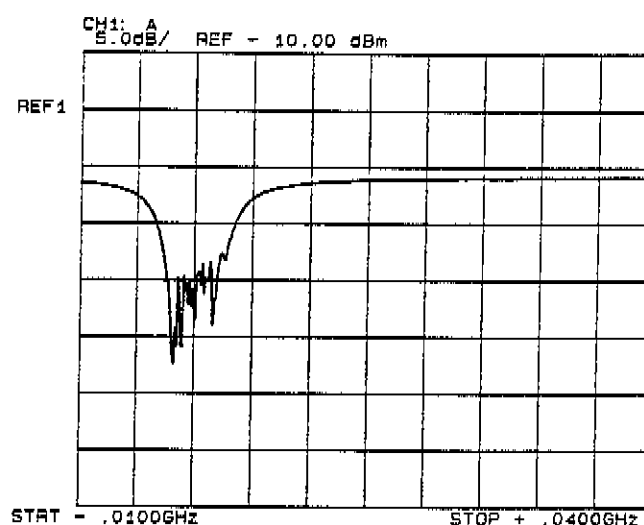


Figure 8. Properly Adjusted Trace

On the HP 8757A:

9. Calibrate the test setup.

Press Function **[CAL]**.

Select **[SHORT/OPEN]**. Follow the directions (prompts) appearing on the CRT:

First, connect the **SHORT** to the **TEST PORT** of the bridge, then select **[STORE SHORT]**.
Remove the **SHORT**.

Second, connect the **OPEN** to the **TEST PORT** of the bridge, then select **[STORE OPEN]**.
Remove the **OPEN**.

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

10. Press Function **[DISPLAY]**.

Select **[MEAS-MEM]**. The CRT display should be similar to Figure 9.

11. Connect the detector to be tested (DUT) to the **TEST PORT** of the bridge. Press Function **[CURSOR]** and rotate the **RPG** to read the highest value (worst case return loss) at or above 10 MHz.

Record the worst case value on the **PERFORMANCE TEST RECORD** in the space provided.

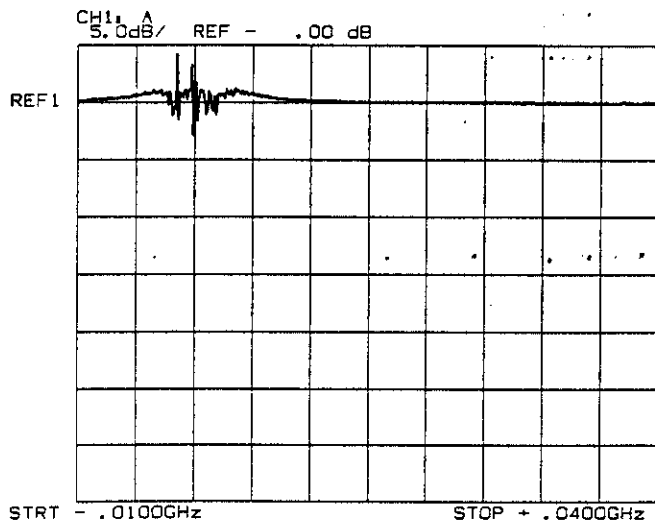


Figure 9. MEAS-MEM Display

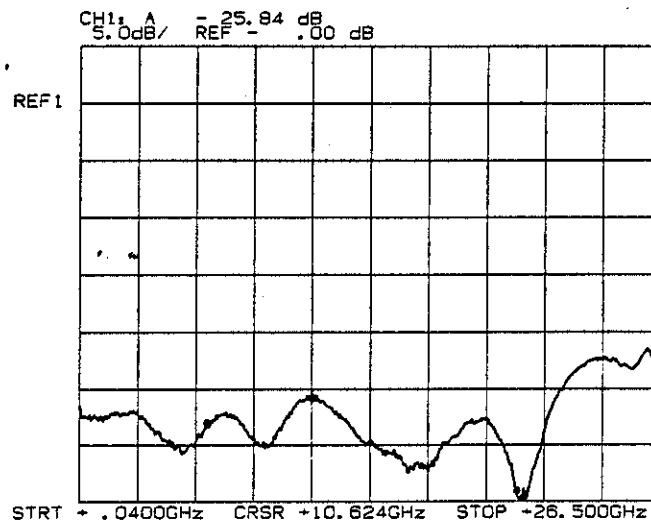


Figure 10. DUT Return Loss .04 to 26.5 GHz

Return Loss 40 MHz to 18 GHz (26.5 GHz for HP 85025B only)

On the source:

12. Reset the start/stop frequencies.

Press **[START][4][0][MHz]**.

Press **[STOP][1][8][GHz]** or **[2][6][.][5][GHz]** for the HP 85025B.

Press **[M1][4][GHz]**.

HP 85025B only: Press **[M2][1][8][GHz]**.

The scalar network analyzer will now display a response with the specification break point(s) identified by the marker(s).

On the HP 8757A:

13. Ensure Function **MEAS POWER A** is still active.

Remove the **DUT**.

14. It will be necessary to recalibrate the HP 8757A, since a new window of frequencies has been selected for measurement.

Repeat the procedure in Step 9 above.

Ensure that channel 1 DISPLAY MEAS-MEM is active. **[MEAS-MEM]** is highlighted when active.

15. Connect the DUT to the **TEST PORT** of the bridge.
Press Function **[SCALE][5][dB]**. The CRT display should be similar to Figure 10.
16. Press Figure **[CURSOR]**. Use the RPG to set the cursor to the highest trace value (lowest return loss value) between 40 MHz and **M1**.
Note and record this value on the Test Record.

Repeat the measurement between **M1** and 18 GHz.
Note and record the value.

Repeat the measurement between **M2** and 26.5 GHz, HP 85025B only.
Note and record the value.

This completes the procedure for measuring return loss.

FREQUENCY RESPONSE AT A NOMINAL -10 dBm

SPECIFICATIONS

Specifications apply at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

	10 MHz to 40 MHz	40 MHz to 18 GHz
HP 85025A, 85025A Opt. 001 and 85025B	At 10 MHz $+0.25/-0.75$ dB linearly changing to ± 0.5 dB.	± 0.5 dB

DESCRIPTION

The frequency response of the HP 85025A/B 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 Hewlett-Packard, frequency response is measured with the use of an automated test station traceable to the U.S. National Bureau of Standards (NBS). The uncertainty of this measurement is ± 0.15 dB from 10 MHz to 2 GHz and ± 0.1 dB above 2 GHz.

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. Second, 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 difference 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. 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.

ERROR ANALYSIS AT 18 GHz

MODEL	HP 85025A	HP 85025A Opt. 001	HP 85025B
POWER SENSOR CAL FACTOR UNCERTAINTIES (RSS)	1.5%	1.5%	1.5%
MISMATCH BETWEEN ATTEN. AND PWR SENSOR	5.2%	3.8%	2.1%
MISMATCH BETWEEN ATTEN. AND DETECTOR	5.9%	4.2%	3.3%
MISC. SYSTEM ERRORS	1.1%	1.1%	1.1%
RSS CALCULATION	8.1%	6.0%	4.3%
TOTAL RSS UNCERTAINTIES EXPRESSED IN dB	+0.34 -0.37	+0.25 -0.27	+0.18 -0.19

NOTE

Uncertainties are less at lower frequencies. The error analysis is done assuming the power sensor, attenuator and DUT all mate **without** the use of adapters. A standard HP 85025A is used with an HP 8481A and 8491B. An Opt. 001 detector is used with an HP 8481A Opt. 001 and 8492A. The HP 85025B is used with an HP 8485A and 8493C.

EQUIPMENT

Sweep Oscillator	HP 8350B
RF Plug-in	HP 83592C
Scalar Network Analyzer	HP 8757A
Power Meter	HP 436A
Power Sensor	HP 8481A*
Attenuator 10 dB	HP 8491B Opt. 010*

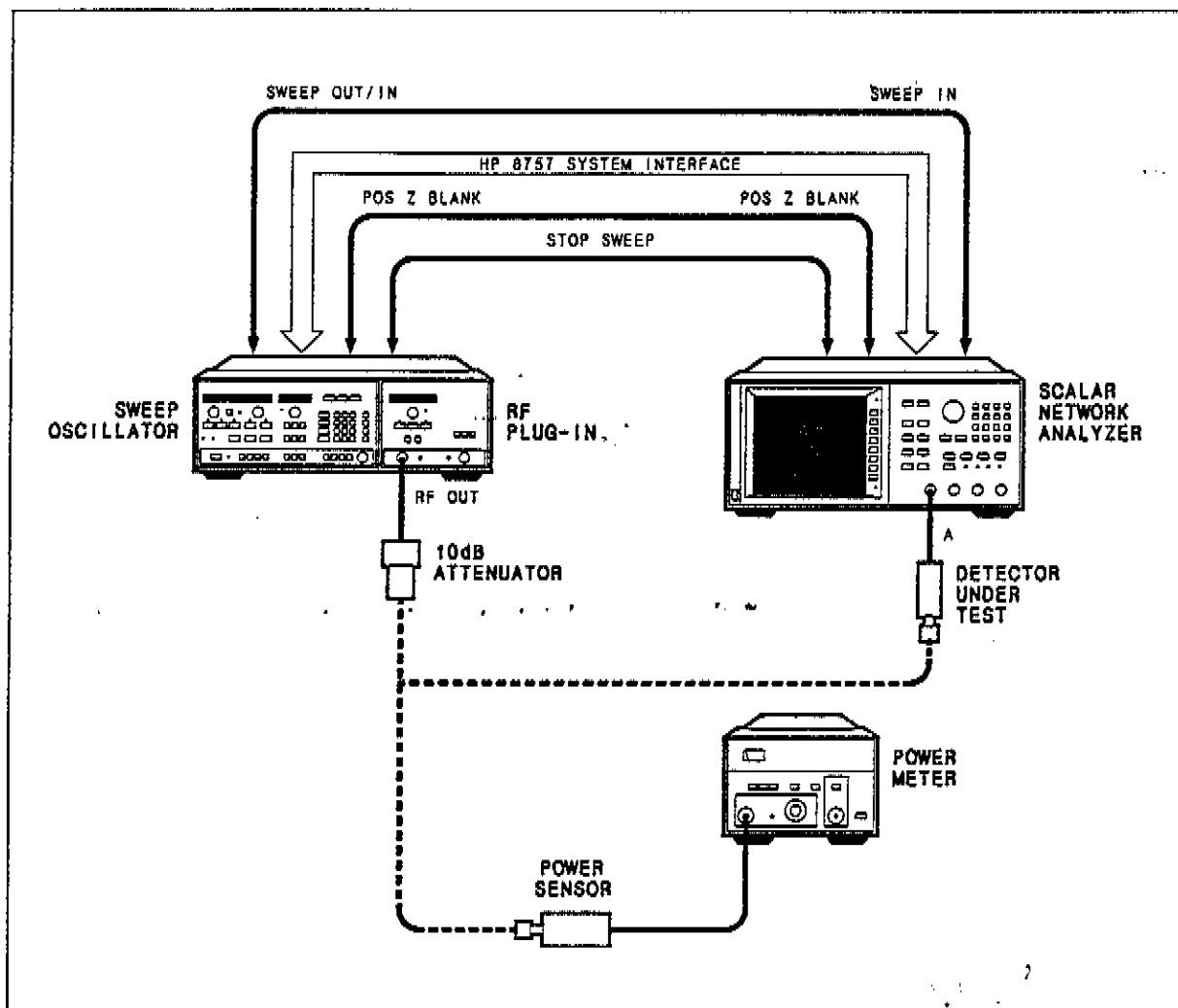


Figure 11. Frequency Response Test Setup

*Model that applies for testing an HP 85025A. The following are the models that apply for testing Opt. 001 and HP 85025B:

HP 85025A Opt. 001	
Power Sensor	HP 8481A Opt. 001
Attenuator 10 dB	HP 8492A Opt. 010
HP 85025B	
Power Sensor	HP 8485A
Attenuator 10 dB	HP 8493C Opt. 010

PROCEDURE**Configuring the System**

1. Connect the equipment as shown in Figure 11, with nothing connected to the attenuated output of the source.

Turn on all equipment and allow 30 minutes for warm-up.

On the power meter:

2. Press **[dBm]** mode.
Zero and calibrate the power meter. If you are unsure of how to do this, refer to the power meter 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**.

On the HP 8757A:

3. Reset the analyzer, turn channel 2 off and select the detector mode for DC:

Press **[PRESET]**.

Select **[CHAN 2 OFF]**.

Press Instrument State **[SYSTEM]**.

Select **[MODE DC]**.

4. Configure the analyzer inputs:

Press **[CAL]**.

Select **[CONFIG SYSTEM]**.

NOTE

During the configuration routine, the HP 8757A samples the A, B, C (Opt. 001 only), and R inputs to determine the detector type. Correction factors are generated and stored for each detector connected. The system must be configured each time a detector is connected to any input.

When the configuration is complete (assuming only one AC/DC detector is connected), the display indicates (the default detection mode is AC):

CONFIG SYSTEM

COMPLETED

A: AC/DC B: AC C: AC R: AC

5. Zero the detector:

Select **[DC DET ZERO]**.

Select **[MANUAL]**.

Select **[CONT]**. When the zero is complete, the display will indicate:

MANUAL ZERO COMPLETE.

6. Connect the power meter / sensor to the attenuated RF output.

On the source / RF plug-in:

7. Press **[CW] [5] [0] [MHz]**.

8. 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

On the source:

9. Press **[CW]** and enter the desired test frequency.
(example: **[CW][1][GHz]**).

Using the **CAL FACTOR CHART** on the power sensor:

10. Set the **CAL FACTOR %** dial on the power meter to the value indicated for the test frequency as needed. (Use the nearest frequency value.)

Note the reading on the power meter.

Record this value and the test frequency onto the Test Record.

11. Repeat Steps 9 and 10 until the source is characterized to your satisfaction. Hewlett-Packard recommends using the test frequencies noted on the Test Record.

Characterizing the Detector

12. Disconnect the power meter / sensor.
Connect the detector between the attenuated output of the source and Input A of the HP 8757A.

On the HP 8757A:

13. Press **[CHAN 2 OFF]** to turn channel 2 off.
14. Press Function **[CURSOR]** to turn cursor on.

On the source:

15. Press **[CW]** and the first test frequency. Remember to use only the test frequencies used in Steps 9 through 11.

Note and record the value indicated by the HP 8757A cursor display.

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

Computing the Maximum Error

16. Using the values recorded in Steps 9 and 15, subtract the value in Step 9 from the value in Step 15 for each of the test frequencies. Record the difference in the space provided on the Test Record.

Now use these values to plot a point to point variation curve on the graph provided. The peak-to-peak variations are what determine the frequency response of the detector.

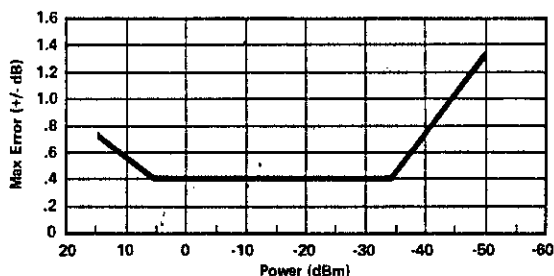
This completes the procedure for measuring frequency response.

POWER ACCURACY

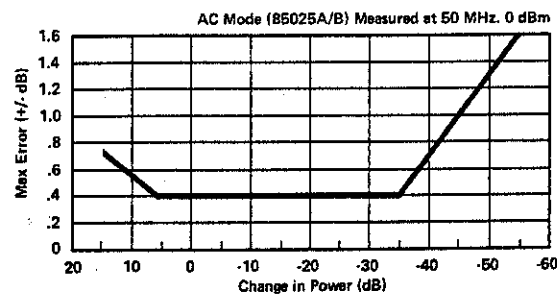
SPECIFICATIONS

Below are the power accuracy specifications of the HP 85025A/B presented graphically. Specifications apply at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$.

Absolute Power Accuracy (HP 85025A/B detectors in DC mode)



Dynamic Power Accuracy



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

Measured at 50 MHz.

If in DC mode, Autozero performed (not necessary for AC mode).

30 minute warm-up.

Offset active and adjusted with a calibrated 0 dBm, 50 MHz signal applied (DC mode only).

Harmonics of the source below -40 dBc.

Excludes mismatch effects.

Trace averaging used on the HP 8757A as required.

DESCRIPTION

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

Note that the DC mode test is an "absolute" measurement and requires the use of a calibrated power meter to set a level of 0 dBm. Using the HP 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 HP 8116A modulated by an HP 11665B.

An alternate procedure is provided using an HP 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 Bureau of Standards (NBS) is required.

EQUIPMENT

Pulse/Function Generator	HP 8116A
Scalar Network Analyzer	HP 8757A
50 MHz Bandpass Filter	HP P/N 08757-80027
3 dB Attenuator	HP 8491B
Calibrated 10 dB Step Attenuator	HP 355D Option 001/H88*
Calibrated 1 dB Step Attenuator	HP 355C Option 001/H88*
Modulator (AC Mode only)	HP 11665B
Power Meter (DC Mode only)	HP 436A/438A
Adapters	See Table 2, Recommended Test Equipment

***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.

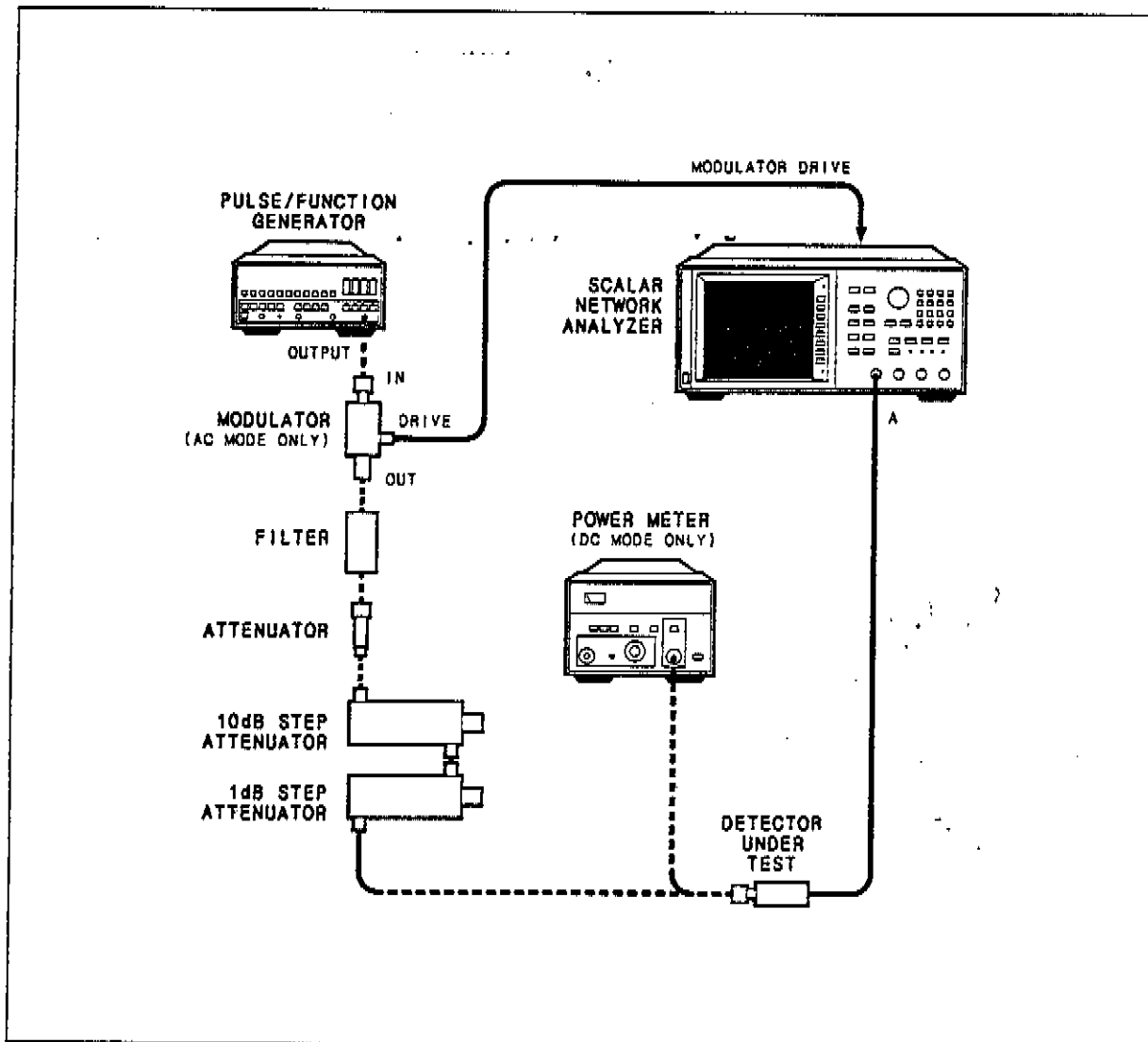


Figure 12. Power Accuracy Test Setup

PROCEDURE

Absolute Power Accuracy - DC Mode

1. Connect the equipment as shown in Figure 12. Do not connect detector to attenuator output. Do not use the modulator for this test (AC mode only). Turn all equipment on and allow 30 minutes warm-up time.
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 120 dB ATTEN	3. Nominal 12 dB ATTEN	4. CAL ATTEN	5. CAL ATTEN	6. CAL PWR LVL
0	10	6	10.02	6.01	<u>-0.03</u>

$$16 \text{ dBm} - (\text{column 4} + \text{column 5}) = \text{CAL PWR LVL}$$

$$16 \text{ dBm} - (10.02 \text{ dB} + 6.01 \text{ dB}) = \underline{-0.03 \text{ dBm}}$$

On the HP 8116A:

4. Set the frequency of 50 MHz:
Press Sine Function [\sim].
Press 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.

On the HP 8757A:

5. Reset the analyzer:
Press [PRESET].
6. Turn channel 2 off:
Select [CHAN 2 OFF].
7. Turn continuous wave on and select DC mode for the detector:
Press Instrument State [SYSTEM].
Select [MORE].
Select [SWEEP MODE].
Select [CW ON].
Press Instrument State [SYSTEM].
Select [MODE DC].
8. Configure the analyzer inputs and perform a manual DC ZERO:
Press Function [CAL].
Select [CONFIG SYSTEM].
Select [DC DET ZERO].
Select [MANUAL].
Select [CONT].

9. Perform the detector OFFSET CALIBRATION:

Select [DET OFFSET].

Select [A].

Press [0] [dB]. This ensures 0 dB of offset.

Connect the detector to the power meter POWER REF output.

Turn POWER REF output on.

On the HP 8757A:

10. Press Function [SCALE].

Select [AUTO SCALE].

Press Function [CURSOR]. Note the reading.

Press Function [CAL].

Select [DET OFFSET].

Select [A]. Using the ENTRY keys, enter the value opposite in sign to the reading noted above.

Example: CRSR = +.45 dBm

Example: Press [-][.][4][5][dB]

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 8 and 9) until a 0.00 dBm power level is obtained.

On the step attenuators:

11. Set the attenuators for a total of 16 dB attenuation.

Set the HP 355C to 6 dB.

Set the HP 355D to 10 dB.

12. Connect the DUT to the attenuated output.

On the HP 8116A:

13. Enable the output:

Press [DISABLE]. The DISABLE LED should go off.

Refer to the Performance Test Record, Table 4, 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).

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

18. Repeat steps 16 and 17 for each nominal power level listed on the Performance Test Record.

19. Calculate the Dynamic Accuracy Error as follows:

$$\text{Dynamic Accuracy Error} = \text{MEAS PWR LVL} - \text{CAL PWR LVL}$$

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

Dynamic Accuracy - AC Mode

20. Connect equipment as shown in Figure 12. Connect the modulator's DRIVE INPUT to the HP 8757A's rear panel MODULATOR output. Connect the DUT to the attenuated output. Turn equipment on and allow 30 minutes for warm-up.
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 above, copy the data from the DC Mode Absolute Power Accuracy Test (columns 4, 5 and 6).

On the HP 8757A:

22. Reset the analyzer; Turn channel 2 off:
Press [PRESET].
Select [CHAN 2 OFF].
23. Turn the cursor on:
Press Function [CURSOR].
24. Set the 10 dB step attenuator to 10 dB.
Set the 1 dB step attenuator to 6 dB.

On the HP 8116A:

25. Set a sine wave frequency of 50 MHz.
26. Enable the output.

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 HP 8757A.
27. Note and record on the Performance Test Record the cursor value displayed.
28. Set both attenuators to 0 dB. Note and record the cursor value.
29. Set the attenuators for the next Nominal PWR LVL. Continue the procedure as outlined in steps 17 through 19 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.

Alternate Equipment

Sweep Oscillator	HP 8350B
RF Plug-in	HP 83592B
Scalar Network Analyzer	HP 8757A
50 MHz Bandpass Filter	HP P/N 08757-80027
3 dB Attenuator	HP 8491B
Calibrated 10 dB Step Attenuator	HP 355D Opt. 001/H88
Calibrated 1 dB Step Attenuator	HP 355C Opt. 001/H88
Power Meter (DC Mode only)	HP 436A/438A
Adapters	See Table 2

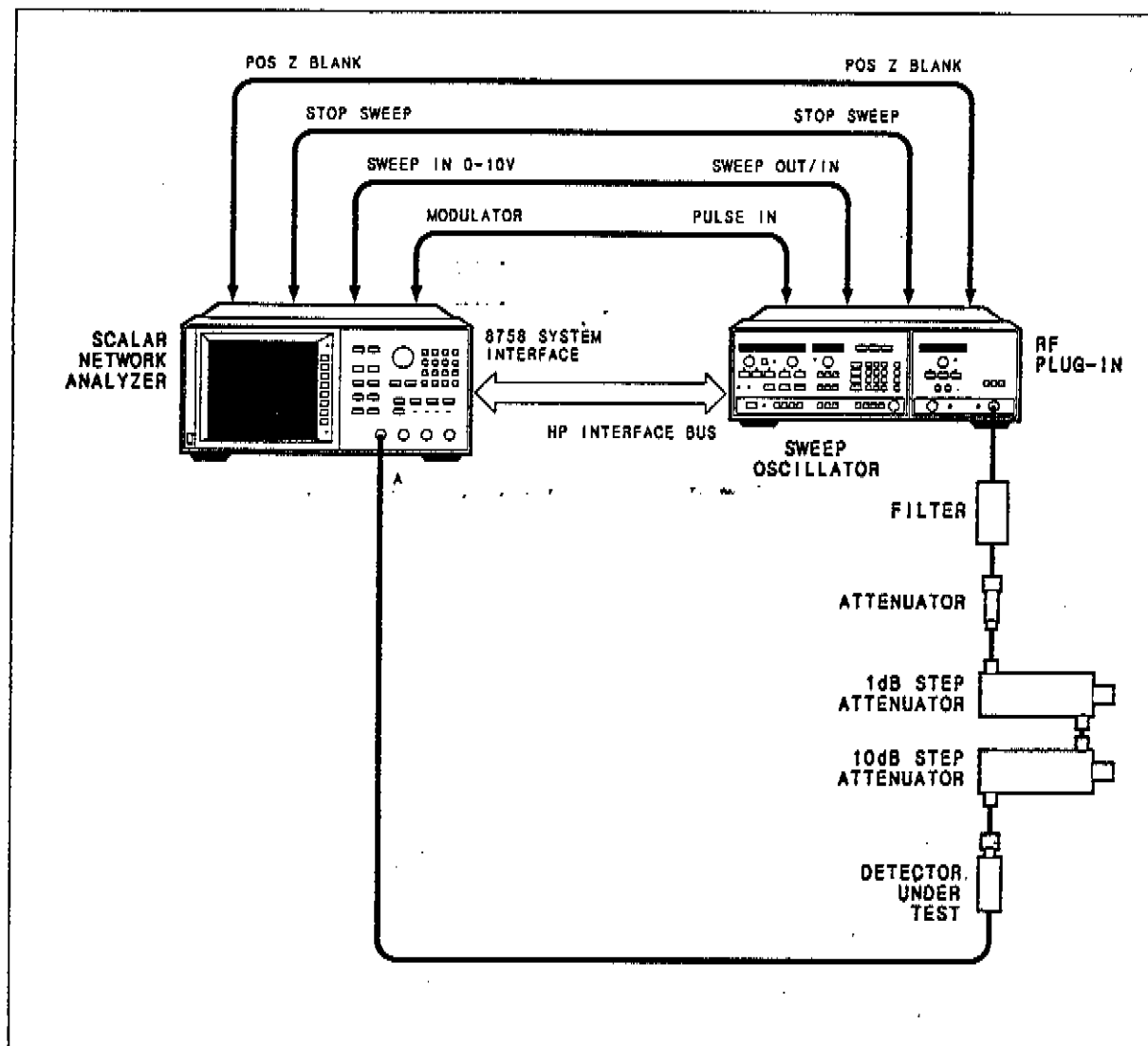


Figure 13. Power Accuracy Alternate Test Setup

Alternate Procedure Using an HP 8350B (+ 10 dBm maximum)

- A. Connect the equipment, as shown in Figure 13. Allow 30 minutes warm-up time.
- B. 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 DC Mode Test for details. Change all + 16 dBm references to + 10 dBm.

Alternate Procedure - DC

- C. Do not connect the detector to the attenuated output.

On the HP 8757A:

- D. Reset the analyzer; Turn channel 2 off:
Press [PRESET].
Select [CHAN 2 OFF].

- E. Press Instrument State [System].
Select [MODE DC].

- F. Press Function [CAL].
Select [CONFIG SYSTEM].
Select [DC DET ZERO].
Select [MANUAL].
Select [CONT].
Select [DET OFFSET].
Select [A].
Press [0] [dB].

- G. Connect the detector to the power meter POWER REF output.
Turn POWER REF output on.

On the HP 8757A:

- H. Press Function [SCALE].
Select [AUTO SCALE].
Press Function [CURSOR]. Note the reading.

Press Function [CAL].
Select [DET OFFSET].

Select [A]. Using the ENTRY keys, enter the value opposite in sign to the reading noted above.

Press Function [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 F through H).

- I. Set the 10 dB step attenuator to 10 dB.
J. Connect the DUT to the attenuated output.

On the source:

- K. Turn square wave modulation off. Set a CW frequency of 50 MHz.
L. 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.
M. Note the cursor value displayed on the CRT. Record this value in column 7 of the Test Record.
N. Set the attenuators for the next Nominal PWR LVL. Continue the procedure as outlined in steps 17 through 19 of the DC Mode Test for each of Nominal PWR LVLs listed on the Performance Test Record (Nominal - 55 dBm is for AC Test only).

Alternate Procedure - AC

- O. Repeat steps A and B of Alternate Procedure - DC. Connect the DUT to the attenuated output.

- P. Reset the analyzer.
Turn channel 2 off.
Turn the cursor on.

- Q. Set the 10 dB step attenuator to 10 dB.