

S E R V I C E N O T E

SUPERSEDES:

None

HP MODEL 8565A SPECTRUM ANALYZER

All Serials

IMPROVED FREQUENCY RESPONSE PERFORMANCE TEST

The following is the recommended procedure for frequency response testing of all HP Model 8565A Spectrum Analyzers. Replace test paragraph 4-20 in your Operation and Service Manual with the service note.

A synchronizer and sweep oscillator are connected to make a tracking generator for the 8565A. The sweep oscillator is phase locked across each FREQUENCY BAND, and frequency response tests are performed. The YTF is modulated with a 1 kHz sine wave to eliminate amplitude variations due to small errors in YTF Tracking.

BF/eg/WO

4/81-53

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PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST

SPECIFICATION:

Frequency Response (with 0 or 10 dB of Input Attenuation): Frequency response includes input attenuator, preselector and mixer response plus mixing mode gain variation (band to band).

Frequency Band (GHz)	Frequency Response (± dB MAX.)
0.01 to 1.8	1.2
1.7 to 4.1	1.7
3.8 to 8.5	2.5
5.8 to 12.9	2.5
8.5 to 18	3.0
10.5 to 22	4.5

DESCRIPTION:

Frequency response is checked in each internal mixing band. The spectrum analyzer is externally swept in FULL BAND mode and the RF input signal is swept across the entire FREQUENCY BAND selected. The resulting display will vary in height across the CRT. Since the RF source is leveled and held quite flat across each frequency band and the YTF is modulated, variations in amplitude on the display represent the frequency response of the spectrum analyzer. Since leveling within reasonable limits becomes difficult from 18 GHz to 22 GHz, the RF output at the power splitter is characterized and compensated for when making the measurement from 18 GHz to 22 GHz.

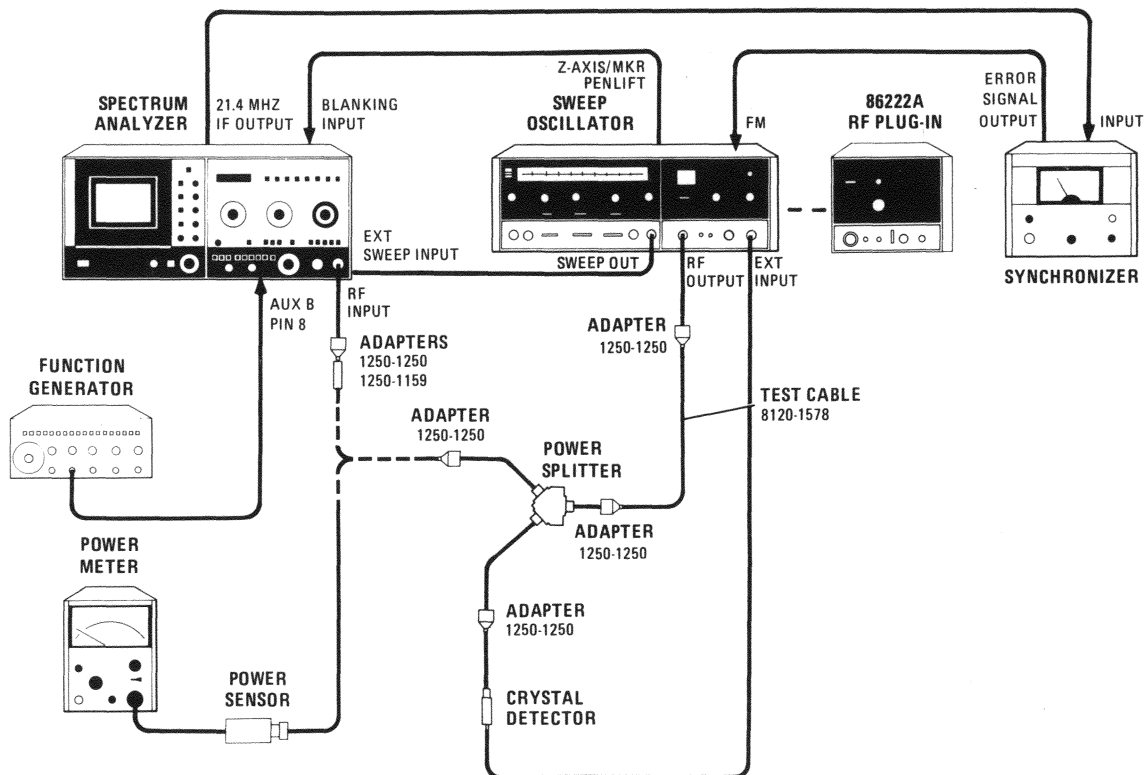


Figure 1. Frequency Response Test Setup

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8620C/86290B-H08
RF Plug-In	HP 86222A
Synchronizer	HP 8709-H10
Function Generator	HP 3312A
Power Meter	HP 435A
Power Splitter	HP 11667A
Power Sensor	HP 8485A
Crystal Detector	HP 33330C
10 dB Attenuator	HP 8492A
Test Cable SMA Female to BNC Male (part of Service Package, HP P/N 08565-60100)	HP 11592-60001
Adapter, N Plug/SMA Jack (5 required)	HP 1250-1250
Cable Assembly	HP 8120-1578
Adapter, SMA Male to SMA Male	HP 1250-1159

PROCEDURE:

- a. Set controls as follows:

Spectrum Analyzer:

Set all Normal Settings (controls marked with green)

FREQUENCY BAND GHz	.01–1.8
INPUT ATTEN	0 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0
RESOLUTION BW	3 MHz Uncoupled
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.100 GHz
AMPLITUDE SCALE	2 dB LOG/DIV

Sweep Oscillator (8620C/86290B-H08):

BAND	Band 4
MARKER SWEEP pushbutton	Depress
START MARKER pointer	Low frequency of selected spectrum analyzer FREQUENCY BAND
STOP MARKER pointer	High frequency of selected spectrum analyzer FREQUENCY BAND
SWEEP TIME - SECONDS	1 - .1
SWEEP TIME - SECONDS vernier	Fully clockwise
RF OFF-ON	ON
ALC switch	EXT
POWER LEVEL	Midrange
RF BLANKING/OFF (Rear Panel)	DISPLAY BLANKING
FM-NORM-PL (Rear Panel)	PL

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

Frequency Response .01 to 18 GHz Bands

- b. Using .01 to 2.4 GHz source, connect equipment as shown in Figure 1. Phase lock sweep oscillator and set output power level as follows:
1. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise, and select Marker Sweep function.
 2. Set sweep oscillator start marker to low frequency of selected spectrum analyzer FREQUENCY BAND and adjust start marker for synchronizer phase lock (minimum phase error). Phase lock error switch should be – for bands 1 through 4 and + for bands 5 and 6.
 3. Set sweep oscillator manual sweep control fully clockwise and stop marker to high frequency of selected spectrum analyzer FREQUENCY BAND. Adjust stop marker for synchronizer phase lock (minimum phase error).
 4. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display. If the system is breaking phase lock, repeat steps 1 through 3.
- c. Disconnect power splitter from 8565A INPUT 50 Ω and connect power meter to power splitter output. With RF power off, zero the power meter. Turn RF power on.
- d. Set sweep oscillator for 100 MHz and adjust power level for a power meter indication of –8 dBm. Connect output of power splitter and adapter directly (do not use cable) to INPUT 50 Ω of spectrum analyzer. Peak of signal should be at center horizontal graticule line \pm one minor division (± 0.3 dB). If not, recheck sweep oscillator output level making sure that power meter has been properly calibrated and zeroed before making the measurement.
- e. Adjust REF LEVEL CAL to place peak of 100 MHz signal at center horizontal graticule line.
- f. Set spectrum analyzer FREQUENCY SPAN MODE to FULL BAND and set TUNING control fully counterclockwise (lowest frequency). Set sweep oscillator to cover entire FREQUENCY BAND selected.
- g. Set spectrum analyzer PERSIST control fully clockwise. Set sweep oscillator for automatic internal sweep at slowest sweep time (100 seconds). Slowly adjust sweep oscillator sweep time vernier for display similar to that of Figure 2. Read greatest positive and greatest negative deviations from center horizontal graticule line. Frequency response (deviation from center horizontal graticule line) should not exceed ± 1.2 dB.

NOTE

If the frequency response appears to be out of specifications near a band edge, use a frequency counter to ensure the frequency in question is within the specified band. This may be necessary as the FULL BAND mode frequency span is slightly beyond the specified band edges.

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

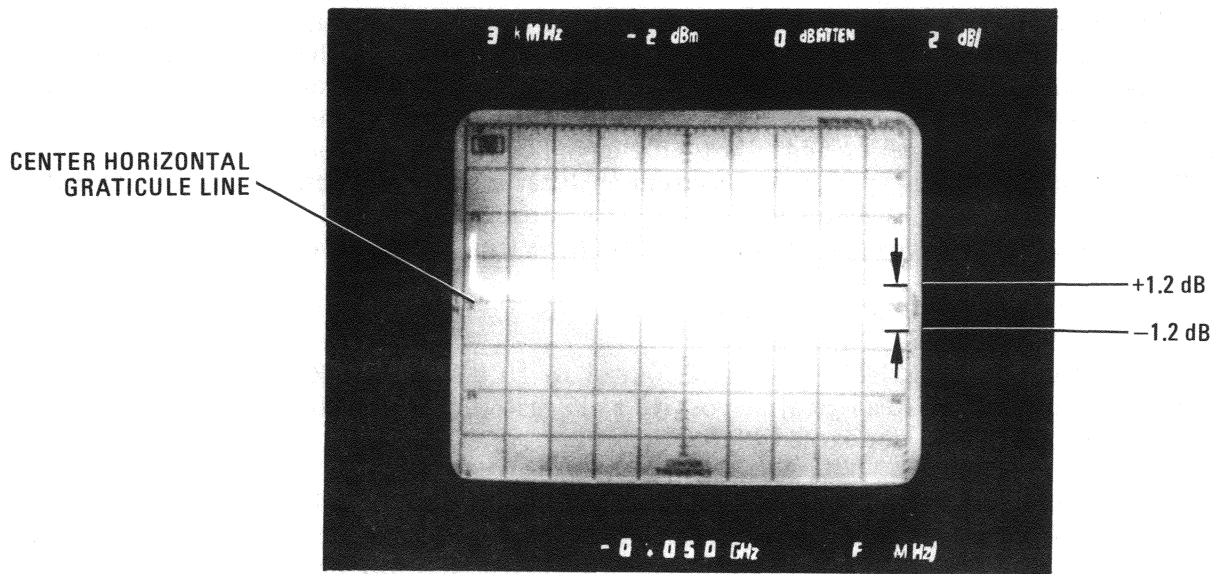


Figure 2. Typical Frequency Response, .01 to 1.8 GHz

h. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Record level with respect to center horizontal graticule line at 100 MHz. This level is the reference for frequency response measurements with 10 dB INPUT ATTENUATION. Read greatest positive and negative deviations from the 100 MHz reference. Frequency response should not exceed ± 1.2 dB.

100 MHz Reference ____ dB from center horizontal graticule line

i. Remove .01 to 2.4 GHz RF plug-in from mainframe and replace with 2 to 22 GHz RF plug-in. Remove 10 dB attenuator and connect power splitter directly to spectrum analyzer INPUT 50 Ω . Select band 4 (2.0–22 GHz) on 8620C sweep oscillator.

j. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 1.7–4.1. Set PERSIST control fully counterclockwise. Set sweep oscillator to CW mode and adjust CW control to center signal on center FREQUENCY line. Set sweep oscillator to $\Delta F \times 10$. Set mode switch to manual sweep and set manual sweep control fully counterclockwise. Adjust ΔF control until phase lock occurs. Set manual sweep control fully clockwise. Signal should be a right-hand edge of CRT display. If necessary, readjust ΔF and CW controls to phase lock FREQUENCY BAND (1.7–4.1 GHz).

k. Set PRESELECTOR PEAK control to center of green region. Apply a 1 kHz 10V peak-to-peak sine wave from a function generator to AUX B pin 8. This signal modulates the YTF (YIG tuned filter) and is equivalent to peaking the PRESELECTOR PEAK at all frequencies.

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

l. Disconnect power splitter from spectrum analyzer input and measure output at power splitter port with power meter. Slowly tune through the entire frequency band using the sweep oscillator manual sweep control. Note the maximum and minimum excursions and set manual sweep control for a power meter indication midway between the maximum and minimum excursions. Turn RF power off and zero the power meter. Turn RF power on and adjust RF plug-in power level control for a power meter indication of -8 dBm. Reconnect power splitter to spectrum analyzer input. Set spectrum analyzer PERSIST control fully clockwise. Set sweep oscillator mode switch to automatic sweep and press spectrum analyzer ERASE pushbutton. Read greatest positive and negative deviations from center horizontal graticule line.

m. Frequency response should not exceed ± 1.7 dB.

n. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Read greatest positive and negative deviations from 100 MHz reference (step h). Frequency response should not exceed ± 1.7 dB.

o. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 3.8–8.5. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual and set controls to cover entire FREQUENCY BAND selected (refer to step b). Repeat steps k through l. Frequency response should not exceed ± 2.2 dB.

p. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 5.8–12.9. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND selected (refer to step b). Repeat steps k through l. Frequency response should not exceed ± 2.5 dB.

q. Set spectrum analyzer INPUT ATTEN control to 0 dB, REF LEVEL control to 0 dBm, and FREQUENCY BAND GHz to 8.5–18. Set PERSIST control fully counterclockwise. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND selected (refer to step b). Repeat steps k through l. Frequency response should not exceed ± 3.0 dB. Set spectrum analyzer INPUT ATTEN control to 10 dB and set REF LEVEL control to 0 dBm. Press ERASE pushbutton. Read greatest positive and negative deviations from 100 MHz reference (step h). Frequency response should not exceed ± 3.0 dB.

Frequency Response 10.5 to 22 GHz Band

r. Disconnect power splitter from spectrum analyzer input and measure output at power splitter with power meter. Set sweep oscillator to 18 GHz. Switch to CW and adjust RF plug-in power level control for a power meter indication of -8 dBm. Slowly tune the CW source from 18 GHz to 22 GHz and note all of the peak deviations (positive and negative) from -8 dBm reference, and frequencies at which they occur. Record frequencies and peak deviations in Table 1 (see example).

s. Set AMPLITUDE SCALE to 10 dB (LOG/DIV). Set TUNING control to each frequency recorded in Table 1 and record CRT Horizontal Displacement of marker (number of divisions from far left graticule line) for each setting. (See example.) Disconnect power sensor from power splitter and connect measured port of power splitter to spectrum analyzer INPUT 50Ω .

t. Set AMPLITUDE SCALE to 2 dB (LOG/DIV). Set TUNING control for any frequency less than 18 GHz. Set sweep oscillator to manually triggered sweep function and adjust band edges to cover 18 GHz to 22 GHz. Set sweep time for slowest sweep (100 seconds).

PERFORMANCE TESTS

4-20. FREQUENCY RESPONSE TEST (Cont'd)

- u. Press spectrum analyzer ERASE pushbutton and set PERSIST control fully clockwise. Trigger the sweep oscillator. Store display and read greatest positive and negative deviations from center horizontal graticule line. (−8 dBm reference.)
- v. Read deviation from horizontal graticule line at each CRT Horizontal Displacement and record Actual Deviations in Table 1. Algebraically subtract Peak Deviation from CRT Actual Deviation for each setting in Table 1. Record results in Corrected Deviation column. (See example.)
- w. Set spectrum analyzer INPUT ATTEN Control to 0 dB, REF LEVEL Control to 0 dB, and FREQUENCY BAND GHz to 10.5–22. Set PERSIST Control fully counterclockwise. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND selected (refer to step b). Repeat steps k through l. Frequency response should not exceed ±4.5 dB. Set spectrum analyzer INPUT ATTEN control to 10 dB, REF LEVEL control to 0 dB. Press ERASE pushbutton. Read greatest positive and negative deviations. After corrections frequency response should not exceed ±4.5 dB.

Table 4-12. Correcting for Frequency Response of Signal Source

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Example:

Frequency (GHz)	Peak Deviation (dB)	CRT Horizontal Displacement (div)	Actual Deviation (dB)	Corrected Deviation (dB)
18.6	− 1.0	7	− 1.0	0
19.6	− 0.5	7.8	− 1.0	− 0.5
20.1	+ 1.0	8.3	0	− 1.0
20.6	− 1.5	8.7	− 2.0	− 0.5
21.2	+ 0.5	9.2	+ 1.5	+ 1.0
21.8	− 1.0	9.7	− 0.4	+ 0.6