HEWLETT PACKARD

OPERATION AND SERVICE MANUAL

8569B SPECTRUM ANALYZER

Includes Options 001 and 002

SERIAL NUMBERS

This manual applies directly to HP Model 8569B Spectrum Analyzers having serial prefix number 2244A.

For additional important information about serial numbers see INSTRUMENTS COVERED BY MANUAL in Section I.

volume 2 PERFORMANCE TESTS
ADJUSTMENTS

1424 FOUNTAIN GROVE PARKWAY, SANTA ROSA, CALIFORNIA, 95404, U.S.A.

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4-1. INTRODUCTION

4-2. The procedures in this section test the electrical performance of the instrument using the specifications in Section I as the performance standards. The performance tests included in this section are listed in Table 4-1. Most of the tests can be performed without access to the interior of the instrument.

Table 4-1. Performance Tests

Paragraph	Test
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4-3. If a test measurement is marginal, perform the appropriate adjustment procedures in Section V.

4-4. EQUIPMENT REQUIRED

4-5. The equipment required for the performance tests is listed under Recommended Test Equipment, Table 1-3, in Section I. Any equipment that satisfies the critical specifications given in the table may be substituted for the recommended model.

4-6. TEST RECORD

4-7. Results of the performance tests may be tabulated in Table 4-23, Performance Test Record, at the end of this section. The test record lists all the tested specifications and their acceptable limits.

4-8. CALIBRATION CYCLE

4-9. This instrument requires periodic verification of performance. It should be checked, using the performance tests, at least every six months.

PERFORMANCE TESTS

NOTE

Allow one hour warm-up time for the HP Model 8569B Spectrum Analyzer and perform the front-panel adjustments described on the pull-out card (located under the instrument) before beginning Performance Tests.

4-10. TUNING ACCURACY

SPECIFICATION:

Overall tuning accuracy of the digital frequency readout in any span mode:

± (5 MHz or 0.2% of center frequency, whichever is greater, plus 20% of frequency span per division)

DESCRIPTION:

A comb generator is used to check the tuning accuracy in the lower frequency bands (.01 GHz to 4.1 GHz, internal mixing). In the higher frequency bands (3.8 GHz to 22 GHz, internal mixing) a sweep oscillator is used and the frequencies are accurately tuned using a frequency counter. The signal, in each case, is tuned to the center graticule line of the spectrum analyzer using the TUNING control. The tuning accuracy is then indicated by the FREQUENCY readout.

In the four external mixing bands 12.4 to 26.5 GHz, 21 to 44 GHz, 31 to 71 GHz, and 53 to 115 GHz, the tuning accuracy is checked by measuring the frequency of the 1st LO output and calculating what the center frequency readout should be using the tuning equation F = nLO ± IF.

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

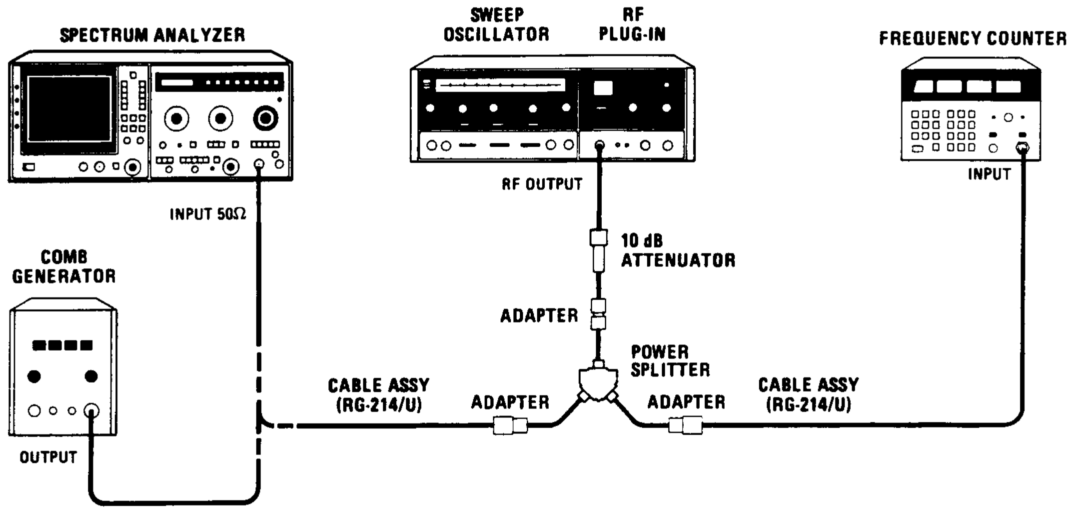
EQUIPMENT:

Sweep Oscillator/RF Plug-in .... HP 8620C/86290A-H08
Frequency Counter .... HP 5342A, Opt. 005
Comb Generator .... HP 8406A
Power Splitter .... HP 11667A, Opt. 002
10-dB Attenuator .... HP 8491B, Opt. 010
Cable Assembly .... HP 8120-1578
Cable Assembly, RG-214/U with Type N Connectors (2 required) .... HP 11500A
Adapter, APC-7 to Type N (f) (2 required) .... HP 11524A
Adapter, Type N (m) to Type N (m) .... HP 1250-0778
Adapter, Type N Plug to SMA Jack .... HP 1250-1250

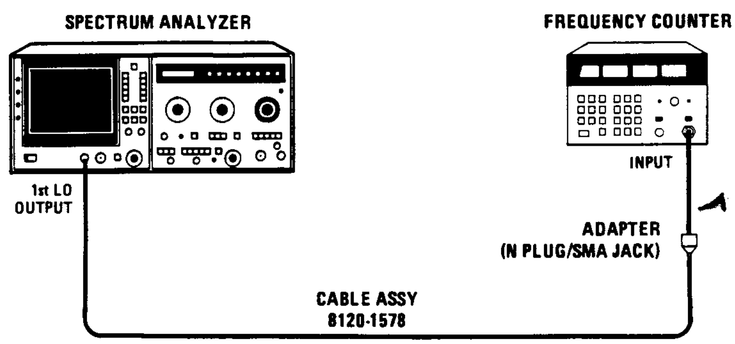
PERFORMANCE TESTS

4-10. TUNING ACCURACY (Cont'd)

CONFIGURATION A



CONFIGURATION B



INSERT 20 dB pad @ Counter Input

Figure 4-1. Tuning Accuracy Test Setup

PERFORMANCE TESTS

4-10. TUNING ACCURACY (Cont'd)

PROCEDURE:

.01 to 4.1 GHz (Internal Mixing)

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	– 10
REFERENCE LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	1 MHz
MIXING MODE	INT

2. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector of spectrum analyzer and center signal on CRT with TUNING control.
3. Adjust FREQ CAL screwdriver adjustment to indicate 0.100 GHz on FREQUENCY GHz readout.
4. Connect equipment as shown in Configuration A of Figure 4-1. Comb generator is connected to INPUT 50Ω connector of spectrum analyzer.
5. Set comb generator for 10 MHz comb output. Adjust TUNING control for an indication of 0.010 on FREQUENCY GHz readout.
6. Use TUNING control to set 10 MHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
0.005 GHz	________	0.015 GHz

7. Set comb generator for 100 MHz comb output. Adjust TUNING control for an indication of 1.000 on FREQUENCY GHz readout.
8. Use TUNING control to set 1.0 GHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
.0995 GHz	________	1.005 GHz

9. Adjust TUNING control for an indication of 1.800 on FREQUENCY GHz readout.
10. Set 1.8 GHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
1.795 GHz	________	1.805 GHz

PERFORMANCE TESTS

4-10. TUNING ACCURACY (Cont'd)

11. Set FREQUENCY BAND GHz to 1.7 – 4.1. Adjust TUNING control for an indication of 1.700 on FREQUENCY GHz readout. (Pull for rapid tuning.)

12. Use TUNING control to set 1.7 GHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
1.695 GHz	______	1.705 GHz

13. Adjust TUNING control for an indication of 3.000 on FREQUENCY GHz readout. Use TUNING control to set 3.0 GHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
2.294 GHz	______	3.006 GHz

14. Adjust TUNING control for an indication of 4.100 on FREQUENCY GHz readout. Use TUNING control to set 4.1 GHz comb tooth on center graticule line. FREQUENCY GHz readout should indicate:

Min.	Actual	Max.
4.092 GHz	______	4.108 GHz

3.8 to 22 GHz (Internal Mixing)

15. Disconnect comb generator from spectrum analyzer input. Connect sweep oscillator and frequency counter as shown in Configuration A of Figure 4-1.

16. Check tuning accuracy at frequencies listed in Table 4-2. Use the frequency counter to set each frequency. Adjust TUNING control to position signal on center graticule line. Indication on FREQUENCY GHz digital readout must be within the test limits given in Table 4-2.

Table 4-2. Tuning Accuracy Test Limits, 3.8 to 22 GHz Bands

Spectrum Analyzer		RF Source	FREQUENCY GHz Digital Readout Test Limits	
FREQUENCY BAND GHz	FREQUENCY SPAN/DIV (MHz)	FREQUENCY (GHz)*	Min.	Max.
3.8 – 8.5	1	3.800	3.792	3.808
3.8 – 8.5	1	6.000	5.988	6.012
3.8 – 8.5	1	8.500	8.483	8.517
5.8 – 12.9	1	5.800	5.788	5.812
5.8 – 12.9	1	8.000	7.984	8.016
5.8 – 12.9	1	12.900	12.874	12.926
8.5 – 18	1	8.500	8.483	8.517
8.5 – 18	1	12.500	12.475	12.525
8.5 – 18	1	18.000	17.964	18.036
10.5 – 22	1	10.500	10.479	10.521
10.5 – 22	1	16.500	16.467	16.533
10.5 – 22	1	22.000**	21.956	22.044

*Frequency set to within ±.05%.

**Use HP 8350A/83570A with appropriate adapters in place of 8620C/86290A, Configuration A of Figure 4-1.

PERFORMANCE TESTS

4-10. TUNING ACCURACY (Cont'd)

12.4 to 115 GHz (External Mixing)

17. Connect equipment as shown in Configuration B of Figure 4-1.
18. Set spectrum analyzer MIXING MODE to EXT and FREQUENCY BAND GHz to 12.4 – 26.5.
19. Adjust spectrum analyzer TUNING control for FREQUENCY GHz readout of 12.4.
20. Set FREQUENCY SPAN MODE to ZERO SPAN and set spectrum analyzer AUTO STABILIZER to ON.
21. Record frequency counter reading.

Min.	Actual	Max.
2.009 GHz	________	2.017 GHz

22. Set spectrum analyzer AUTO STABILIZER to OFF.
23. Adjust spectrum analyzer TUNING control for FREQUENCY GHz readout of 26.5.
24. Set spectrum analyzer AUTO STABILIZER to ON.
25. Record frequency counter reading.

Min.	Actual	Max.
4.354 GHz	________	4.372 GHz

26. Repeat the procedure of steps 19 through 25 for the FREQUENCY BAND GHz and FREQUENCY GHz readouts listed in Table 4-3. Record the results.

Table 4-3. Tuning Accuracy Test Limits, 12.4–115 GHz

FREQUENCY BAND GHz		FREQUENCY GHz Readout	LO Frequency	
Harmonic Number (N)	Frequency Range		Min.	Max.
6+	12.4–26.5	12.40	2.009	2.017
		26.50	4.354	4.372
10+	21.0–44.0	21.00	2.064	2.072
		44.00	4.359	4.377
16+	33.0–71.0	33.00	2.038	2.046
		71.00	4.408	4.426
26+	53.0–115.0	53.00	2.022	2.030
		115.0	4.402	4.420

PERFORMANCE TESTS

4-11. SPAN WIDTH ACCURACY

SPECIFICATION:

The frequency error for any two points on the display for spans from 500 MHz/division to 20 kHz/division (unstabilized) is less than ± 5% of the indicated separation; for stabilized spans 100 kHz/division and less, the error is less than ± 15%.

DESCRIPTION:

The 500 MHz per division and 200 MHz per division span widths are checked using a wide-band source and a frequency counter. The source is set to 7 GHz, and the spectrum analyzer is tuned to place the signal at the far left graticule line. The source is then tuned to 11 GHz, and the span error for 500 MHz per division is checked at the eighth graticule line. The 200 MHz per division span width accuracy is checked in the same manner.

The span width accuracy from 100 MHz per division down to 1 kHz per division is tested using a comb generator. Wide span widths (100 MHz to .5 MHz/division) are checked by using the 100 MHz, 10 MHz, and 1 MHz comb generator outputs. Narrow span widths (.2 MHz/division to 1 kHz/division) are checked by using the comb generator output modulated by a function generator. Since the comb generator produces frequency components separated by a precisely determined frequency interval, the resultant spectral lines displayed on the CRT are evenly spaced when no span error exists in the instrument. Thus, span error is the cumulative variance of distance among the spectral line intervals displayed across the CRT. The span error is determined by comparing the distance between the the eighth graticule line and the ninth spectral line.

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

EQUIPMENT:

Sweep Oscillator/RF Plug-in	HP 8620C/86290A-H08
Frequency Counter	HP 5342A, Opt. 005
Comb Generator	HP 8406A
Function Generator	HP 3312A
10-dB Attenuator	HP 8491A, Opt. 010

PROCEDURE:

500 MHz and 200 MHz Per Division

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	5.8 – 12.9
INPUT ATTEN	10 dB
REF LEVEL dBm	– 10
REFERENCE LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	500 MHz

4-11. SPAN WIDTH ACCURACY (Cont'd)

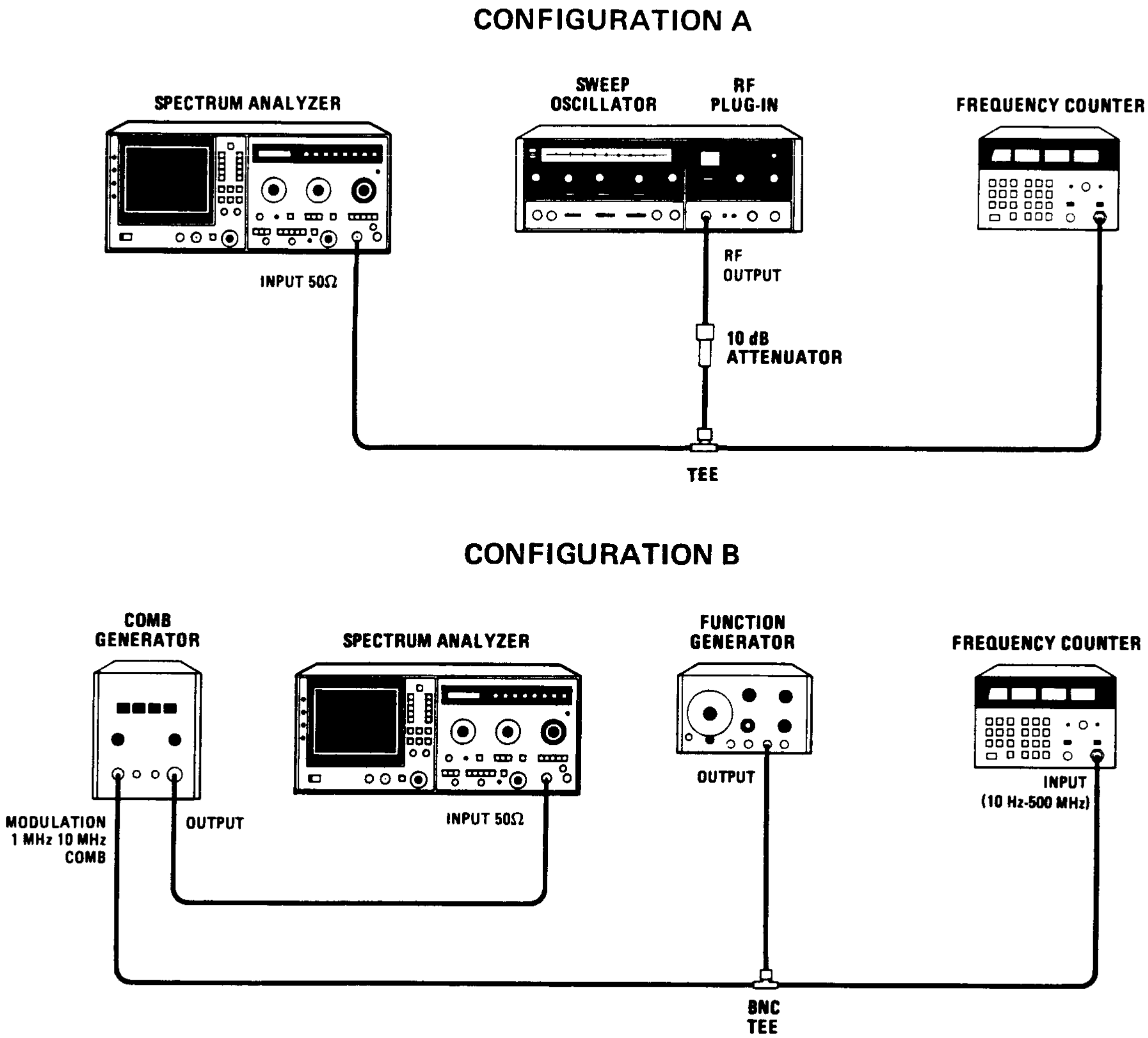


Figure 4-2. Span Width Accuracy Test Setup

2. Connect equipment as shown in Configuration A of Figure 4-2.

3. Set sweep oscillator for CW output, 6.0 to 12.4 GHz band, and tune for a frequency counter indication of 7.000 ±.005 GHz.

4. Adjust spectrum analyzer TUNING control to position signal at graticule reference line (far left) of display (about 9.5 on FREQUENCY GHz readout).

5. Tune sweep oscillator CW output for a frequency counter indication of 11.000 ±.005 GHz.

PERFORMANCE TESTS

4-11. SPAN WIDTH ACCURACY (Cont'd)

6. Measure error between signal peak and eighth graticule line. Error should not exceed ±0.4 division. (See Figure 4-3.)

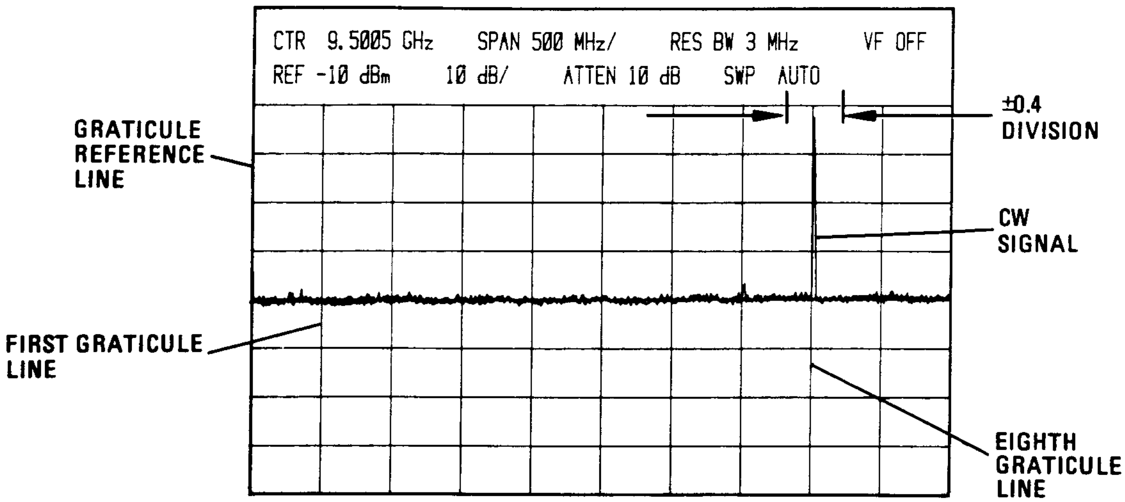


Figure 4-3. Span Width Accuracy Measurement, 500MHz and 200 MHz per Division

7. Set spectrum analyzer FREQUENCY SPAN/DIV control to 200 MHz. Set TUNING control for a FREQUENCY GHz readout of approximately 8 GHz.

8. Tune sweep oscillator CW output for a frequency counter indication of 7.000 ± .005 GHz. Adjust spectrum analyzer TUNING control to position signal at graticule reference line (far left) of display.

9. Tune sweep oscillator CW output for a frequency counter indication of 8.600 ± .005 GHz.

10. Measure error between signal peak and eighth graticule line. Error should not exceed ±0.4 division. (See Figure 4-3.)

11. Connect equipment as shown in Configuration B of Figure 4-2 without connecting function generator. Set comb generator for 100 MHz comb output.

12. Set spectrum analyzer FREQUENCY BAND GHz to .01 – 1.8, FREQUENCY SPAN/DIV control to 100 MHz. Set TUNING control for a FREQUENCY readout of 0.800 GHz.

13. Adjust spectrum analyzer TUNING control to position one spectral line (from comb generator) at graticule reference line (first graticule line at far left) of display. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division. (See Figure 4-4.)

14. Set FREQUENCY SPAN/DIV to 50 MHz. Adjust TUNING control to position one spectral line (from comb generator) at graticule reference line (first graticule line at far left) of display. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

15. Set comb generator for 10 MHz comb output. Set spectrum analyzer FREQUENCY SPAN/DIV to 20 MHz and RESOLUTION BW to OPTIMUM. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between seventeenth spectral line and eighth graticule line on display. Error should not exceed ±0.4 division.

4-11. SPAN WIDTH ACCURACY (Cont'd)

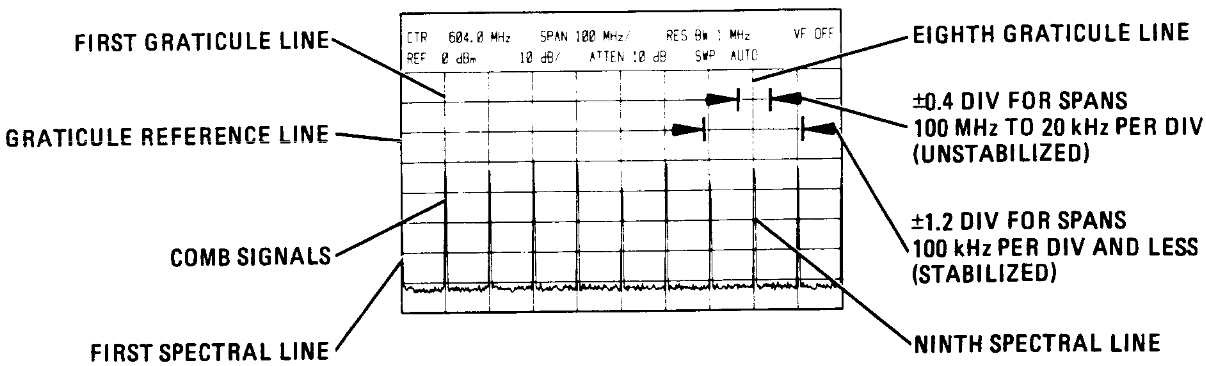


Figure 4-4. Span Width Accuracy Measurement, 100 MHz per Division and Less

16. Set FREQUENCY SPAN/DIV to 10 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

17. Set FREQUENCY SPAN/DIV to 5 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

18. Set comb generator for 1 MHz comb output. Set spectrum analyzer FREQUENCY SPAN/DIV to 2 MHz and VIDEO FILTER to .1. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between seventeenth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

19. Set FREQUENCY SPAN/DIV to 1 MHz. Adjust TUNING control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

20. Set FREQUENCY SPAN/DIV to .5 MHz. Adjust TUNING control to position one spectral line at the graticule reference line. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

21. Set comb generator for 10 MHz comb output. Connect function generator output to modulate the comb generator. Set function generator to 200 ±1 kHz and set output level control for a clean 200 kHz comb (approximately 1 volt) on the spectrum analyzer display.

NOTE

To accurately set the frequency of the function generator, disconnect the function generator output from the comb generator modulation input whenever the frequency counter is used.

22. Set spectrum analyzer FREQUENCY SPAN/DIV to .2 MHz. Adjust FINE tuning control to position one spectral line at graticule reference line. Measure error between ninth spectral line and eighth graticule line. Error should not exceed ±0.4 division.

4-11. SPAN WIDTH ACCURACY (Cont'd)

100 kHz to 5 kHz Per Division

23. Using procedure of steps 21 and 22, change spectrum analyzer FREQUENCY SPAN/DIV and function generator output frequency in accordance with Table 4-4. Adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Measure the span error between ninth spectral line and eighth graticule line.

NOTE

It might be necessary to temporarily disable the AUTO STABILIZER to tune the spectrum analyzer TUNING control for best comb presentation.

NOTE

It might be necessary to increase the function generator output to increase the number of comb teeth present.

Table 4-4. Narrow Span Width Error Measurements

Spectrum Analyzer		Function Generator Output Frequency*	Maximum Allowable Error (Division)	
FREQ SPAN/DIV	RESOLUTION BW		Unstabilized	Stabilized
100 kHz	OPTIMUM	100 kHz	±0.4	±1.2
50 kHz	OPTIMUM	50 kHz	±0.4	±1.2
20 kHz	OPTIMUM	20 kHz	±0.4	±1.2
10 kHz	OPTIMUM	10 kHz		±1.2
5 kHz	OPTIMUM	5 kHz		±1.2

*Check function generator output frequency using an electronic counter. Frequency readout should be within ±0.5% of desired audio frequency.

2 kHz and 1 kHz Per Division

24. Set spectrum analyzer AMPLITUDE SCALE to 5 dB, REF LEVEL dBm to −40, and FREQUENCY SPAN/DIV to 2 kHz.

25. Set function generator frequency to 4.00 ± .02 kHz. Adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Set VIDEO FILTER to .03. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ± 1.2 divisions. Set VIDEO FILTER to OFF.

26. Set spectrum analyzer FREQUENCY SPAN/DIV to 1 kHz. Set function generator frequency to 2.00 ± .02 kHz and adjust spectrum analyzer TUNING control to position one spectral line at graticule reference line. Set VIDEO FILTER to .03. Measure error between fifth spectral line and eighth graticule line. Error should not exceed ± 1.2 divisions.

PERFORMANCE TESTS

4-12. RESOLUTION BANDWIDTH ACCURACY

SPECIFICATION:

Individual resolution bandwidth 3-dB points: < ± 15%

DESCRIPTION:

Resolution bandwidth accuracy is measured in the linear mode to eliminate log amplifier errors. Since half power (− 3 dB below full-power level) is represented by a voltage ratio of 0.707:1, 5 horizontal divisions on the spectrum analyzer display represent half-power points for a bandwidth display of 7.1 vertical divisions.

$$.07 \text{ (voltage ratio)} = \frac{X \text{ div}}{7.1 \text{ div}}$$

$$X \text{ div} = (7.1 \text{ div})(0.707) = 5 \text{ div}$$

In the narrow bandwidths (10 kHz and below), a 321.4 MHz signal (first IF) is injected by connecting the output of the signal generator to the external mixer port of the spectrum analyzer. This IF injection method provides the high degree of stability required when measuring narrow resolution bandwidths.

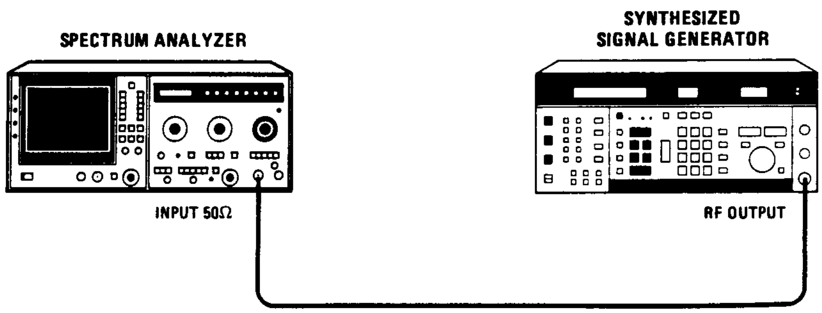


Figure 4-5. Resolution Bandwidth Accuracy Test Setup

EQUIPMENT:

Synthesized Signal Generator .... HP 8662A

PROCEDURE:

1. With normal setting (green), set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 − 1.8
INPUT ATTEN	20 dB
REF LEVEL dBm	− 10
REFERENCE LEVEL FINE	0
RESOLUTION BW	3 MHz, Uncoupled
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	LIN
AUTO STABILIZER	OFF

PERFORMANCE TESTS

4-12. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

2. Set signal generator for an unmodulated 100 MHz output at approximately − 10 dBm.
3. Adjust spectrum analyzer TUNING control to locate peak of 100 MHz signal on CRT. Reduce signal generator output if necessary.
4. Adjust signal generator output level to position trace at 7.1 divisions above graticule baseline.
5. Tune signal generator frequency until trace drops to 5 divisions above graticule baseline. Record frequency displayed on signal generator.

   ________ MHz

6. Tune signal generator frequency in direction opposite to that of step 5 until trace peaks (7.1 divisions) and then drops to 5 divisions above graticule baseline. Record frequency displayed on signal generator.

   ________ MHz

7. The difference between results of steps 5 and 6 is the measured resolution bandwidth at 3-dB points.

Min.	Actual	Max.
2.55 MHz	________	3.45 MHz

8. Set RESOLUTION BW to 1 MHz. Tune signal generator to 100 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
850 kHz	________	1.15 MHz

9. Set RESOLUTION BW to 300 kHz. Tune signal generator to 100 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
255 kHz	________	345 kHz

10. Set RESOLUTION BW to 100 kHz. Tune signal generator to 100 MHz and repeat steps 3 through 7.

Min.	Actual	Max.
85 kHz	________	115 kHz

11. Set RESOLUTION BW to 30 kHz. Tune signal generator to 100 MHz and increase frequency tuning resolution of signal generator to 100 Hz. Enable spectrum analyzer AUTO STABILIZER (push button out) and repeat steps 3 through 7.

Min.	Actual	Max.
25.5 kHz	________	34.5 kHz

4-12. RESOLUTION BANDWIDTH ACCURACY (Cont'd)

12. Set RESOLUTION BW to 10 kHz. Set EXT MIXING BIAS adjustment to zero.

13. Tune signal generator to 321.4 MHz. Connect signal generator output to spectrum analyzer EXT MIXING SMA connector. Press MIXING MODE EXT push button.

14. Tune signal generator to peak signal on CRT. Adjust output level to position trace at 7.1 divisions above graticule baseline.

15. Tune signal generator frequency until trace drops to 5 divisions above graticule baseline. Record frequency displayed on signal generator.

    ________ MHz

16. Tune signal generator frequency in direction opposite to that of step 15 until trace peaks (7.1 divisions) and then drops to 5 divisions above graticule baseline. Record frequency displayed on signal generator.

    ________ MHz

17. The difference between results of steps 15 and 16 is the measured resolution bandwidth at 3-dB points.

Min.	Actual	Max.
8.5 kHz	________	11.5 kHz

18. Set spectrum analyzer RESOLUTION BW to 3 kHz and repeat steps 14 through 17.

Min.	Actual	Max.
2.55 kHz	________	3.45 kHz

19. Set spectrum analyzer RESOLUTION BW to 1 kHz and repeat steps 14 through 17 with frequency tuning resolution on signal generator set to 10 Hz.

Min.	Actual	Max.
0.85 kHz	________	1.15 kHz

NOTE

The following steps do not apply to Option 002 instruments.

20. Set spectrum analyzer RESOLUTION BW to .3 kHz and repeat steps 14 through 17 with frequency tuning resolution of signal generator set to 1 Hz.

Min.	Actual	Max.
255 Hz	________	345 Hz

21. Set spectrum analyzer RESOLUTION BW to .1 kHz and repeat steps 14 through 17.

Min.	Actual	Max.
85 Hz	________	115 Hz

PERFORMANCE TESTS

4-13. RESOLUTION BANDWIDTH SELECTIVITY

SPECIFICATION:

60-dB/3-dB bandwidth ratio:

<15:1 for bandwidths 1 kHz to 3 MHz
<11:1 for bandwidths .1 kHz to 1 kHz

DESCRIPTION:

The 60-dB bandwidth is measured for all resolution bandwidth settings (.1 kHz to 3 MHz). The 60-dB to 3-dB resolution bandwidth ratio (shape factor) is then computed by dividing the 3-dB bandwidth values, obtained in the Resolution Bandwidth Accuracy performance test, into the 60-dB bandwidth values for each resolution bandwidth setting.

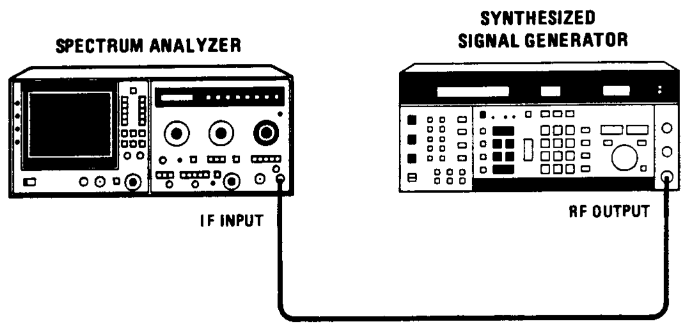


Figure 4-6. Resolution Bandwidth Selectivity Test Setup

EQUIPMENT:

Synthesized Signal Generator .... HP 8662A

NOTE

For Option 002 instruments, omit procedures for the .1 kHz and .3 kHz bandwidths.

PROCEDURE:

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
MIXING MODE	EXT
INPUT ATTEN	20 dB
REF LEVEL dBm	−10
REFERENCE LEVEL FINE	0
RESOLUTION BW	.1 kHz, Uncoupled
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	10 dB LOG/DIV
VIDEO FILTER	.03
EXT MIXING BIAS	0

PERFORMANCE TESTS

4-13. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

2. Connect equipment as shown in Figure 4-6. Tune signal generator to 321.4 MHz and set output level to approximately – 10 dBm.

3. Set frequency tuning resolution of signal generator to 1 Hz and tune signal generator to peak signal on CRT. Adjust output level to position trace at top graticule line.

4. Tune signal generator frequency until trace drops to two divisions above graticule baseline. Record frequency displayed on signal generator.

_________ MHz

5. Tune signal generator frequency in direction opposite to that of step 4 until trace peaks and then drops to two divisions above graticule baseline. Record frequency displayed on signal generator.

_________ MHz

6. Calculate measured bandwidth at 60-dB points by taking difference between results of steps 4 and 5.

7. Record measured bandwidth (difference between results of steps 4 and 5).

_________ Hz (.1 kHz BW)

8. Set RESOLUTION BW to .3 kHz and repeat steps 3 through 6.

_________ Hz (.3 kHz BW)

9. Set RESOLUTION BW to 1 kHz and repeat steps 3 through 6 with frequency tuning resolution of signal generator set to 10 Hz.

10. Record measured bandwidth (difference between results of steps 4 and 5).

_________ kHz (1 kHz BW)

11. Set RESOLUTION BW to 3 kHz and repeat steps 3 through 6.

_________ kHz (3 kHz BW)

12. Set RESOLUTION BW to 10 kHz and repeat steps 3 through 6 with frequency tuning resolution of signal generator set to 100 Hz.

_________ kHz (10 kHz BW)

13. Connect signal generator output to spectrum analyzer INPUT 50Ω connector. Tune signal generator to 100 MHz and set output level to approximately 0 dB.

PERFORMANCE TESTS

4-13. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

14. Set spectrum analyzer FREQUENCY BAND GHz to .01 – 1.8, INPUT ATTEN to 10 dB, REF LEVEL dBm to 0, RESOLUTION BW to 30 kHz, and TUNING for an indication of 0.100 on FREQUENCY GHz readout (disable AUTO STABILIZER while using coarse TUNING).

15. Tune signal generator frequency to peak signal on CRT. Adjust output level to position trace at top graticule line.

16. Tune signal generator frequency until trace drops to two divisions above graticule baseline. Record frequency displayed on signal generator.

_________ MHz

17. Tune signal generator frequency in direction opposite to that of step 16 until trace peaks and then drops to two divisions above graticule baseline. Record frequency displayed on signal generator.

_________ MHz

18. Calculate measured bandwidth at 60-dB points by taking difference between results of steps 16 and 17.

_________ MHz (30 kHz BW)

19. Set RESOLUTION BW to 100 kHz and repeat steps 15 through 18 with frequency tuning resolution of signal generator set to 1 kHz.

_________ MHz (100 kHz BW)

20. Set RESOLUTION BW to 300 kHz and repeat steps 15 through 18.

_________ MHz (300 kHz BW)

21. Set RESOLUTION BW to 1 MHz and repeat steps 15 through 18 with frequency tuning resolution of signal generator set to 10 kHz.

_________ MHz (1 MHz BW)

22. Set RESOLUTION BW to 3 MHz and repeat steps 15 through 18.

_________ MHz (3 MHz BW)

23. Record in Table 4-5 the measured 3-dB bandwidths from the Resolution Bandwidth Accuracy performance test.

PERFORMANCE TESTS

4-13. RESOLUTION BANDWIDTH SELECTIVITY (Cont'd)

24. Record in Table 4-5 the 60-dB bandwidths measured in this procedure.

25. Compute resolution bandwidth selectivity for each RESOLUTION BW setting, dividing the measured 60-dB bandwidth by the measured 3-dB bandwidth for each setting. Ratios should be less than 15:1 for RESOLUTION BW settings 3 MHz to 3 kHz and less than 11:1 for RESOLUTION BW settings 1 kHz to .1 kHz.

Table 4-5. Resolution Bandwidth Selectivity

RESOLUTION BW Setting	MEASURED 3 dB BW	MEASURED 60 dB BW	Resolution Bandwidth Selectivity (60 dB BW/3 dB BW)
3 MHz	________	________	________
1 MHz	________	________	________
300 kHz	________	________	________
100 kHz	________	________	________
30 kHz	________	________	________
10 kHz	________	________	________
3 kHz	________	________	________
1 kHz	________	________	________
.3 kHz*	________	________	________
.1 kHz*	________	________	________

*Does not apply to Option 002 instruments.

PERFORMANCE TESTS

4-14. RESIDUAL FM

SPECIFICATION:

Total residual FM:

Stabilized: <100 Hz p-p in 0.1 second, .01 to 8.5 GHz

Unstabilized: <10 kHz p-p in 0.1 second, .01 to 4.1 GHz (fundamental mixing)

DESCRIPTION:

A comb generator is used to supply a stable 1.8 GHz signal to the spectrum analyzer. The relationship between amplitude and frequency on the linear portion of the trace is determined for a given frequency span and resolution bandwidth. The residual FM is then slope detected by using the spectrum analyzer as a fixed-tuned receiver (ZERO SPAN). Using the determined relationship between amplitude and frequency, the test limits (in divisions) for the demodulated residual FM are determined.

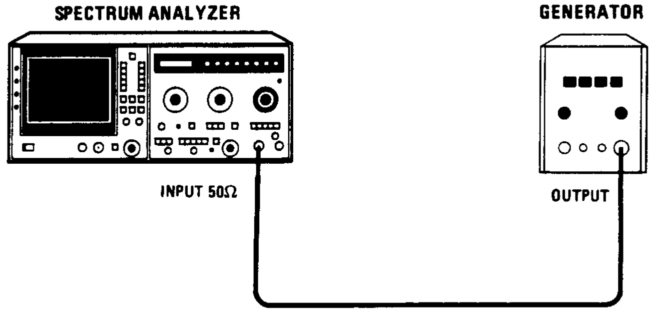


Figure 4-7. Residual FM Test Setup

EQUIPMENT:

Comb Generator .... HP 8406A

PROCEDURE:

Stabilized

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	0 dB
REF LEVEL	– 30 dBm
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	.2 MHz
AMPLITUDE SCALE	LIN
SWEEP TIME/DIV	.1 SEC
TUNING	1.800 GHz

4-14. RESIDUAL FM (Cont'd)

2. Connect comb generator output to spectrum analyzer INPUT as shown in Figure 4-7. Set comb generator for maximum output amplitude.

NOTE

With AUTO STABILIZER on (push button out), the coarse TUNING control (large knob) can be adjusted in very small increments to 'fine tune' the position of the signal displayed. If the signal disappears from the display, set FREQUENCY SPAN/DIV to .2 MHz to locate the signal.

3. Locate 1.8 GHz comb tooth and center it on CRT. Uncouple FREQUENCY SPAN/DIV and RESOLUTION BW controls and reduce FREQUENCY SPAN/DIV to 2 kHz keeping signal centered on CRT with FINE TUNING control. Reduce RESOLUTION BW to 1 kHz.

4. Adjust REFERENCE LEVEL FINE control to place signal peak at top graticule line. Carefully adjust TUNING control so upward slope of signal intersects the center vertical graticule line one division down from the top as shown in Figure 4-8.

5. Set TRACE A to STORE VIEW. Record the distance from the signal skirt at the horizontal center graticule line to the center vertical graticule line. (In Figure 4-8 the distance is 0.2 division.)

_________ Division

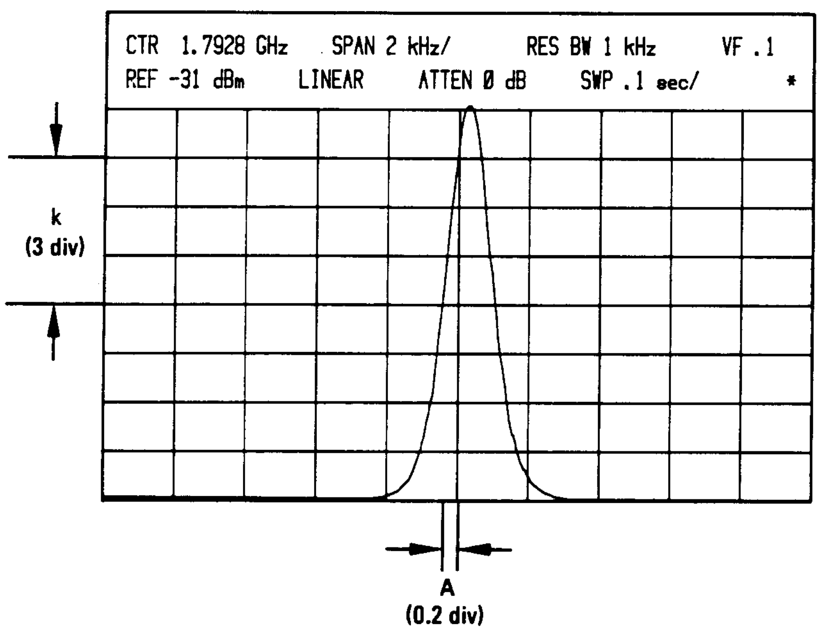


Figure 4-8. Residual FM to AM Conversion Display

4-14. RESIDUAL FM (Cont'd)

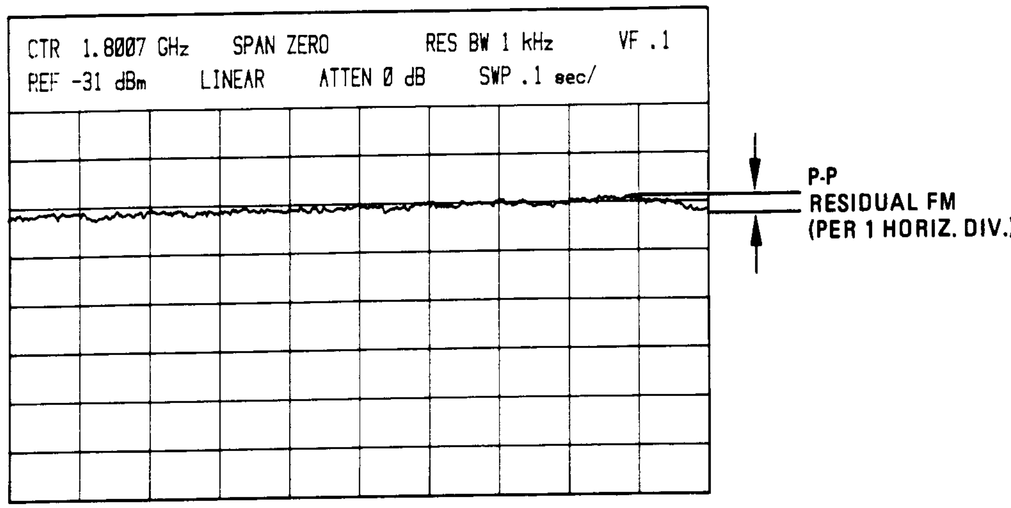


Figure 4-9. Residual FM Display

6. Calculate the test limit by using the following formula:

$$X = \frac{S}{\frac{A}{k} \times F}$$, where

X = Test limit (peak to peak) in vertical divisions per 1 horizontal division

S = Specification in Hz peak to peak

A = Distance from signal skirt at horizontal center graticule line to vertical center graticule line

k = A constant (3) representing linear portion of the trace in divisions

F = Frequency span per division

Test limit for a distance A of 0.2 division:

$$X = \frac{100^*}{\frac{0.2}{3} \times 2000}$$

$$= \frac{100}{0.067 \times 2000}$$

$$= 0.75$$

*Use 200 for Option 002 instrument

PERFORMANCE TESTS

4-14. RESIDUAL FM (Cont'd)

7. Set TRACE A to WRITE. Press ZERO SPAN push button and adjust FINE TUNING control to place trace between center horizontal graticule line and seventh horizontal graticule line (linear portion of signal).

8. Set SWEEP TRIGGER to SINGLE. Press START/RESET push button to display one sweep as shown in Figure 4-9. Set TRACE A to STORE VIEW. The maximum peak-to-peak variation should not exceed the test limit calculated in step 6 for each horizontal division (since SWEEP TIME/DIV is .1 SEC and residual FM is specified in a time interval of 0.1 second).

9. Repeat steps 1 through 8 with FREQUENCY BAND GHz set to 3.8 – 8.5 and TUNING to 8.500 GHz. In step 3, locate 8.5 GHz comb tooth.

Unstabilized

10. Set TRACE A to WRITE, FREQUENCY BAND GHz to 0.1 – 1.8, FREQUENCY SPAN MODE to PER DIV, FREQUENCY SPAN/DIV to 10 kHz, and RESOLUTION BW to 30 kHz. Set SWEEP TRIGGER to FREE RUN and AUTO STABILIZER to OFF (push button in).

11. Locate 1.8 GHz comb tooth and center it on CRT. Turn AUTO STABILIZER on (push button out) to return to stabilized mode.

12. Adjust REFERENCE LEVEL FINE control to place signal peak at top graticule line. Carefully adjust TUNING control so upward slope of signal intersects the center vertical graticule line one division down from the top as shown in Figure 4-8. Set TRACE A to STORE VIEW.

13. Record the distance from the signal skirt at the center horizontal graticule line to the center vertical graticule line (should be approximately 1.3 divisions).

    ________ Division

14. Calculate the test limit using formula given in step 6. Use unstabilized specification (10 kHz) and 10 kHz FREQUENCY SPAN/DIV.

15. Set TRACE A to WRITE and reposition signal, if necessary, as in step 12. Press AUTO STABILIZER to OFF (push button in for unstabilized mode). Press ZERO SPAN push button and adjust FINE TUNING control to place trace between center horizontal graticule line and seventh horizontal graticule line.

16. Set SWEEP TRIGGER to SINGLE. Press START/RESET pushbutton to display one sweep as shown in Figure 4-9. The maximum peak-to-peak variation should not exceed the test limit calculated in step 14.

17. Repeat steps 10 through 16 with FREQUENCY BAND GHz set to 1.7 – 4.1 and TUNING to 4.100 GHz. In step 12, locate 4.1 GHz comb tooth.

PERFORMANCE TESTS

4-15. NOISE SIDEBANDS

SPECIFICATION:

At least 75 dB down, greater than 30 kHz from center of CW signal when set to a 1 kHz RESOLUTION BANDWIDTH and 10 Hz (.01) VIDEO FILTER.

DESCRIPTION:

A comb generator is used to supply a stable 1.8 GHz signal to the spectrum analyzer. The analyzer RESOLUTION BW is set to 1 kHz and the VIDEO FILTER is set to .01. The peak of the 1.8 GHz signal is set at 20 dB above the REFERENCE LEVEL graticule line to allow greater readability of the noise sidebands. The noise-associated sidebands and unwanted responses measured close to the signal must be more than 75 dB down (below −50 graticule line), more than 30 khz from center of CW signal.

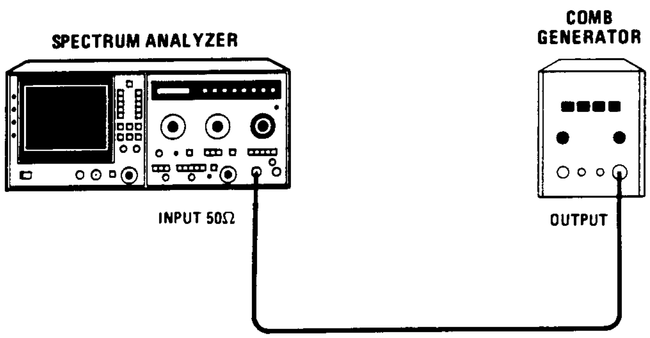


Figure 4-10. Noise Sidebands Test Setup

EQUIPMENT:

Comb Generator .... HP 8406A

PROCEDURE:

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 − 1.8
INPUT ATTEN	0 dB
REF LEVEL dBm	−30
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	.2 MHz
TUNING	1.800 GHz

2. Connect comb generator output to spectrum analyzer INPUT as shown in Figure 4-10. Set comb generator for 100 MHz comb and maximum output amplitude.

3. Locate 1.8 GHz comb tooth and center it on CRT. Reduce FREQUENCY SPAN/DIV to 10 kHz keeping signal centered on CRT with FINE TUNING control. Turn on AUTO STABILIZER.

4-15. NOISE SIDEBANDS (Cont'd)

4. Adjust REFERENCE LEVEL FINE control to place signal peak at top graticule line (REFERENCE LEVEL).

5. Set REF LEVEL dBm control to – 50 to place signal peak 20 dB above REFERENCE LEVEL.

6. Set SWEEP TRIGGER to SINGLE and VIDEO FILTER to .01. Press START/RESET push button to display a single sweep.

7. Observe noise level at three divisions (30 kHz) and more on either side of CW signal. Noise sidebands should be greater than 75 dB below CW signal level. (The – 50 graticule line is 70 dB down.)

NOTE

Disconnect the comb generator from the INPUT 50Ω connector to verify that residual responses (at 30-kHz offset) do not interfere with the noise sidebands measurement. If a residual response is present at the 30-kHz offset, adjust the TUNING control for a center frequency of 1.700 GHz and repeat steps 1 through 7 with the new center frequency.

4-16. RESIDUAL RESPONSES

SPECIFICATION:

Residual Responses (no signal present at input): With 0 dB input attenuation in fundamental mixing (0.01 to 4.1 GHz): <−90 dBm

DESCRIPTION:

Residual responses are signals present on the display with no input to the analyzer. A reference level is selected that will allow the operator to see signals less than −90 dBm. The two fundamental mixing bands (.01 − 1.8 GHz and 1.7 − 4.1 GHz) are slowly swept through their entire ranges in several incremental spans while the display is observed. Any residual responses that appear must be less than −90 dBm.

EQUIPMENT:

50Ω Termination .... HP 909A, Opt. 012

PROCEDURE:

1. Connect 50-ohm termination to INPUT 50Ω port.

2. With all normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 − 1.8
INPUT ATTEN	0 dB
REF LEVEL dBm	−60
REFERENCE LEVEL FINE	0
RESOLUTION BW	10 kHz, Uncoupled
FREQUENCY SPAN/DIV	10 MHz
VIDEO FILTER	.1
SWEEP TRIGGER	SINGLE
TUNING	0.060 GHz

3. Press START/RESET push button to display a single sweep. Any residual responses must be less than −90 dBm (below the −30 graticule line).

4. Adjust TUNING control for an indication of 0.150 on FREQUENCY GHz readout. Press START/RESET push button and check for residual responses.

5. Continue tuning spectrum analyzer in 100 MHz increments (0.250 GHz, 0.350 GHz, and so on) up to 1.750 GHz. Press START/RESET push button and check for residual responses at each frequency.

6. Set RESOLUTION BW to 3 kHz. Leave FREQUENCY SPAN/DIV set to 10 MHz. Set SWEEP TIME/DIV to 5 SEC and press 1.7 − 4.1 FREQUENCY BAND GHz push button. Adjust TUNING control for an indication of 1.750 on FREQUENCY GHz readout.

7. Press START/RESET push button and check for residual responses.

8. Tune spectrum analyzer in 100 MHz increments (1.850 GHz, 1.950 GHz, and so on) up to 4.050 GHz. Check for residual responses at each frequency.

PERFORMANCE TESTS

4-17. AVERAGE NOISE LEVEL

SPECIFICATION:

Maximum average noise level with 1 kHz resolution bandwidth, 0 dB input attenuation, and the video filter set to NOISE AVG position, is given in Table 4-6.

Table 4-6. Average Noise Level Specifications

FREQUENCY BAND GHz	First IF (MHz)	Harmonic Mode	Average Noise Level	
			dBm	dBμV
.01–1.8	2050	1–	–113	–6
1.7–4.1	321.4	1–	–110	–3
3.8–8.5	321.4	2–	–107	0
5.8–12.9	321.4	3–	–100	+7
8.5–18	321.4	4+	–95	+12
10.5–22	321.4	5+	–90	+17
12.4–26.5	321.4	6+	–104	+3
21–44	321.4	10+	–104	+3
33–71	321.4	16+	–104	+3
53–115	321.4	26+	–104	+3

DESCRIPTION:

Average noise level is checked in all frequency bands. The maximum noise level of each frequency band is located with FREQUENCY SPAN MODE set to FULL BAND. The maximum noise level is isolated, and maximum average noise is observed for each frequency band. In the external mixing bands, this test assumes that offset and gain adjustments have been adjusted for a 30-dB mixer conversion loss.

PROCEDURE:

1. With normal (green) settings, set spectrum analyzer controls as follows:

   TRACE A .... WRITE
   TRACE B .... STORE BLANK
   FREQUENCY BAND GHz .... .01 – 1.8
   INPUT ATTEN .... 0 dB
   REF LEVEL dBm .... – 60
   REFERENCE LEVEL FINE .... – 12
   RESOLUTION BW .... 1 kHz, Uncoupled
   FREQUENCY SPAN MODE .... FULL BAND

2. Observe sweep in FULL BAND. Using TUNING control, tune marker to point of highest noise level. (A typical trace is shown in Figure 4-11.)

NOTE

Do not tune marker beyond band edge.

4-17. AVERAGE NOISE LEVEL (Cont'd)

3. Set FREQUENCY SPAN MODE to ZERO SPAN and VIDEO FILTER to NOISE AVG. Set TRACE A to STORE VIEW and measure noise level. Record results in Table 4-7.

4. Set FREQUENCY BAND GHz to 1.7 – 4.1. Set TRACE A to WRITE, FREQUENCY SPAN MODE to FULL BAND, and REF LEVEL dBm to place noise peaks near top of display. Locate and measure maximum average noise level as in steps 1 and 2. Measure and record average noise level for each successive FREQUENCY BAND GHz setting.

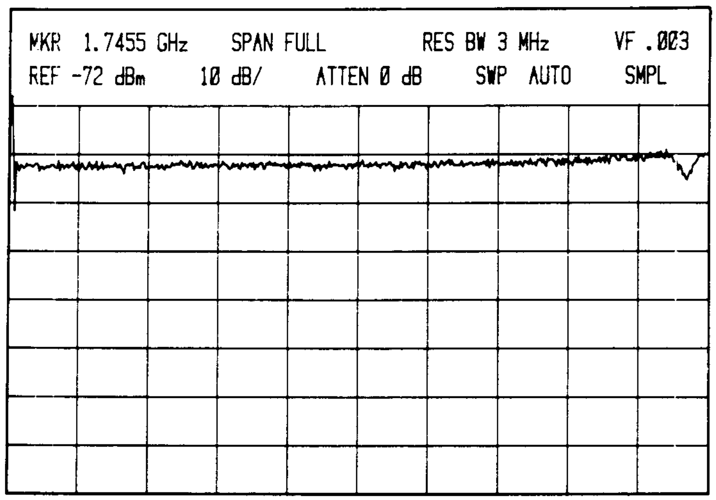


Figure 4-11. Average Noise Level Measurement, 3.8–8.5 GHz

Table 4-7. Average Noise Level

FREQUENCY BAND GHz	First IF (MHz)	Harmonic Mode	Average Noise Level		
			Maximum		Actual
			dBm	dBμV	
.01–1.8	2050	1–	–113	–6	________
1.7–4.1	321.4	1–	–110	–3	________
3.8–8.5	321.4	2–	–107	0	________
5.8–12.9	321.4	3–	–100	+7	________
8.5–18	321.4	4+	–95	+12	________
10.5–22	321.4	5+	–90	+17	________
12.4–26.5	321.4	6+	–104	+3	________
21–44	321.4	10+	–104	+3	________
33–71	321.4	16+	–104	+3	________
53–115	321.4	26+	–104	+3	________

PERFORMANCE TESTS

4-18. REFERENCE LEVEL VARIATION

SPECIFICATION:

Reference level variation (Input Attenuator at 0 dB):

10 dB steps, +20°C to +30°C:

- −10 to −70 dBm: <±0.5 dB
- −10 to −100 dBm: <±1.0 dB

Vernier (0 to −12 dB, continuous):

Maximum error <±0.5 dB, when read from Reference Level Fine control.

DESCRIPTION:

The reference level variation is tested by checking the IF gain steps in 1 dB per division log and in linear scale. Specially calibrated step attenuators (355 C/D, Option H80) are used to check the 10-dB steps and the vernier (REFERENCE LEVEL FINE control).

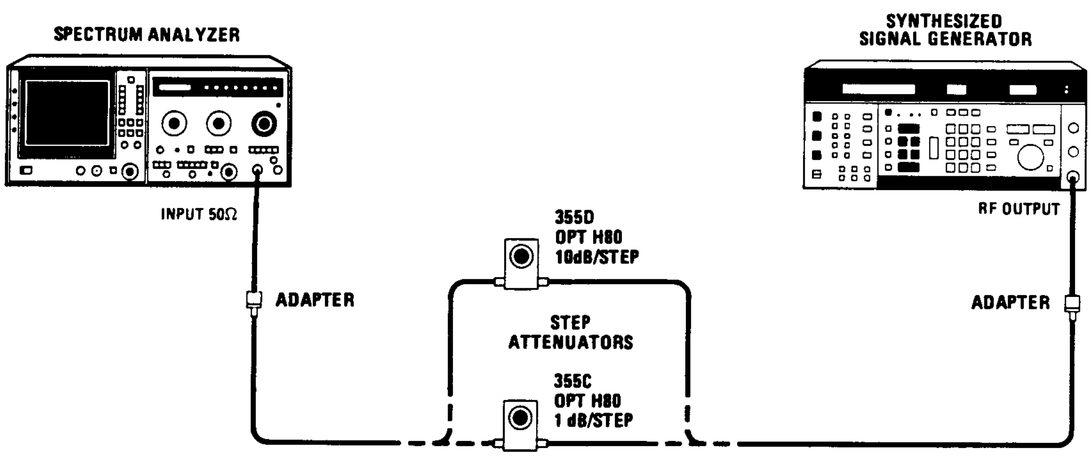


Figure 4-12. Reference Level Variation Test Setup

EQUIPMENT:

Synthesized Signal Generator	HP 8662A
Step Attenuator (1 dB/Step)	HP 355C, Opt. H80
Step Attenuator (10 dB/Step)	HP 355D, Opt. H80
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

4-18. REFERENCE LEVEL VARIATION (Cont'd)

PROCEDURE:

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	0 dB
REF LEVEL dBm	– 10
REFERENCE LEVEL FINE	0
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	1 MHz
TUNING	0.090 GHz
AUTO STABILIZER	On

2. Set signal generator for an unmodulated 90 MHz output at approximately – 10 dBm.

Reference Level Variation (10-dB Steps) in Log Mode

3. Connect equipment as shown in Figure 4-12 using 10-dB step attenuator. Set step attenuator at 0 dB and adjust spectrum analyzer TUNING control to center signal on CRT.

4. Adjust signal generator output level to place peak of trace at top graticule line. Set spectrum analyzer AMPLITUDE SCALE to 1 dB. Set FREQUENCY SPAN MODE to ZERO SPAN, RESOLUTION BW to 100 kHz, and VIDEO FILTER to NOISE AVG. Adjust TUNING control to peak signal on CRT.

5. Keeping signal peaked on CRT with FINE tuning control, reduce RESOLUTION BW to 1 kHz. Adjust signal generator output level until peak of trace is at sixth division (from bottom graticule line). Set REF LEVEL dBm control and step attenuator to settings indicated in Table 4-8. (Use FINE tuning control to keep signal peaked.) Record deviation from sixth division reference for each setting.

6. To compute corrected deviation, add step attenuator error to deviation from sixth division for each setting. Corrected deviation should not exceed +0.5 dB or –0.5 dB from – 10 to – 70 dBm, and should not exceed + 1.0 dB or – 1.0 dB from – 10 to – 100 dBm.

Reference Level Variation (10-dB Steps) in Linear Mode

7. Set spectrum analyzer AMPLITUDE SCALE to LIN. Set REF LEVEL dBm control to – 10 and set step attenuator to 0 dB.

8. Adjust signal generator output level and spectrum analyzer FINE tuning control until peak of trace is at sixth division. Set spectrum analyzer REF LEVEL dBm control and step attenuator to settings indicated in Table 4-9. (Use FINE tuning control to peak signal.) Record deviation from sixth division reference for each setting.

9. Using Table 4-10, convert deviation from sixth division in LIN to deviation from sixth division in dB for each setting. Record dB values in Table 4-8.

4-18. REFERENCE LEVEL VARIATION (Cont'd)

Table 4-8. Reference Level Variation (10 dB Steps) in Log Mode

REF LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)* (dB)	Corrected Deviation (dB)
−10	0	0 (Ref.)	Ref.	0 (Ref.)
−20	10	________	________	________
−30	20	________	________	________
−40	30	________	________	________
−50	40	________	________	________
−60	50	________	________	________
−70	60	________	________	________
−80	70	________	________	________
−90	80	________	________	________
−100	90	________	________	________

*Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (−). For example 9.99 dB calibration for a 10 dB attenuator setting represents an error of −0.01 dB.

Table 4-9. Reference Level Variation (10 dB Steps) in Linear Mode

REF LEVEL Setting (dBm)	Step Attenuator Setting (dB)	Deviation from 6th Division in Linear Mode (div.)	Deviation from 6th Division in dB*	Step Attenuator Error (Calibration)** (dB)	Corrected Deviation (dB)
−10	0	0 (Ref.)	0 (Ref.)	Ref.	0 (Ref.)
−20	10	________	________	________	________
−30	20	________	________	________	________
−40	30	________	________	________	________
−50	40	________	________	________	________
−60	50	________	________	________	________
−70	60	________	________	________	________
−80	70	________	________	________	________
−90	80	________	________	________	________
−100	90	________	________	________	________

*Use Table 4-9 to convert deviation in linear mode to deviation in dB.
**Attenuations > dial settings are positive (+). Attenuations < dial settings are negative(−).

PERFORMANCE TESTS

4-18. REFERENCE LEVEL VARIATION (Cont'd)

10. To compute corrected deviation, add step attenuator error to deviation from sixth division in dB. Corrected deviation should not exceed +0.5 dB or −0.5 dB from −10 to −70 dBm, and should not exceed +1.0 dB or −1.0 dB from −10 to −100 dBm.

Table 4-10. Conversions from Deviation in Linear Mode to Deviation in dB

POSITIVE DEVIATIONS (Above 6th division from graticule baseline)		NEGATIVE DEVIATIONS (Below 6th division from graticule baseline)	
Linear (divisions)	dB	Linear (divisions)	dB
0	0	0	0
+ .1	+0.14	− .1	−0.15
+ .2	+0.28	− .2	−0.29
+ .3	+0.42	− .3	−0.45
+ .4	+0.56	− .4	−0.60
+ .5	+0.70	− .5	−0.76
+ .6	+0.83	− .6	−0.92
+ .7	+0.96	− .7	−1.08
+ .8	+1.09	− .8	−1.24
+ .9	+1.21	− .9	−1.41
+1.0	+1.34	−1.0	−1.58
+1.1	+1.46	−1.1	−1.76
+1.2	+1.58	−1.2	−1.94
+1.3	+1.70		
+1.4	+1.82		
+1.5	+1.94		

Reference Level Fine (Vernier) Variation

11. Replace 10-dB step attenuator with 1-dB step attenuator. Set step attenuator to 0 dB. Set spectrum analyzer REF LEVEL dBm control to −10, REFERENCE LEVEL FINE to 0, AMPLITUDE SCALE to 1 dB, and RESOLUTION BW to 10 kHz.

PERFORMANCE TESTS

4-18. REFERENCE LEVEL VARIATION (Cont'd)

12. Adjust signal generator output level and spectrum analyzer FINE tuning control until peak of trace is at sixth division. Set step attenuator and REFERENCE LEVEL FINE control to settings indicated in Table 4-11. (Use FINE tuning control to peak signal.) Record deviation from sixth division for each setting.

13. To compute corrected deviation, add step attenuator error to deviation from sixth division for each setting. Corrected deviation should not exceed +0.5 dB or −0.5 dB.

Table 4-11. Reference Level Fine (Vernier) Variation

REF LEVEL FINE Setting	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)* (dB)	Corrected Deviation (dB)
0	0	0 (Ref.)	Ref.	0 (Ref.)
−1	1	________	________	________
−2	2	________	________	________
−3	3	________	________	________
−4	4	________	________	________
−5	5	________	________	________
−6	6	________	________	________
−7	7	________	________	________
−8	8	________	________	________
−9	9	________	________	________
−10	10	________	________	________
−11	11	________	________	________
−12	12	________	________	________

*Attenuations >dial settings are positive (+). Attenuations <dial settings are negative (−).

PERFORMANCE TESTS

4-19. GAIN COMPRESSION

SPECIFICATION:

<1 dB for – 7 dBm input level with 0 dB attenuation

DESCRIPTION:

Gain compression is checked by changing the input signal from 10 dB less than the maximum input setting to the level of the maximum input setting. The signal will compress (indicate less than a 10 dB change in signal level). The amount of compression must be less than 1 dB.

EQUIPMENT:

Signal Generator	HP 8640B, Opt. 001
Power Meter	HP 435B
Power Sensor	HP 8481A
Power Splitter	HP 11667A, Opt. 002

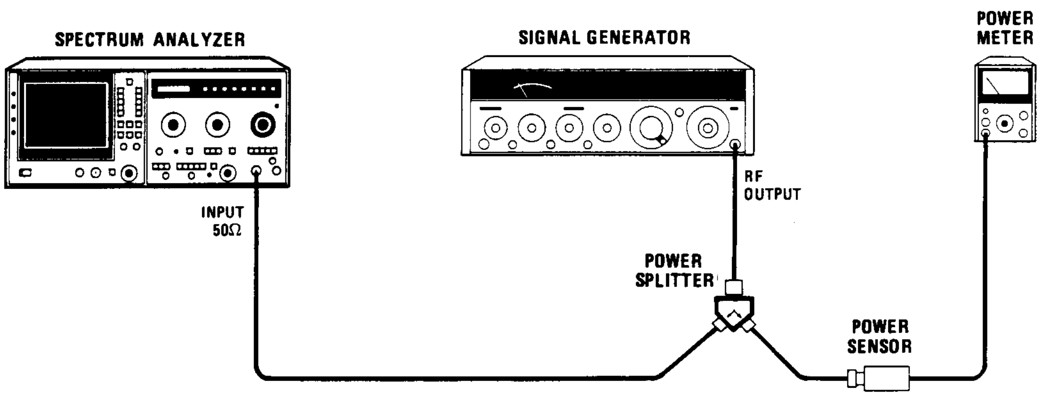


Figure 4-13. Gain Compression Test Setup

PROCEDURE:

1. Set normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	– 10
REFERENCE LEVEL FINE	– 10
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	.2 MHz
TUNING	0.100 GHz

PERFORMANCE TESTS

4-19. GAIN COMPRESSION (Cont'd)

2. Set signal generator for an unmodulated 100 MHz output of −17 dBm at spectrum analyzer input (and at power meter). Adjust spectrum analyzer TUNING control to center signal on CRT.
3. Set FREQUENCY SPAN/DIV to 100 kHz keeping signal centered with FINE TUNING control. Pull to uncouple and set RESOLUTION BW to 300 kHz.
4. Set AMPLITUDE SCALE to 2 dB. Center signal on CRT and adjust REFERENCE LEVEL FINE control to place peak of signal at convenient horizontal graticule line.
5. Set output of signal generator to −7 dBm at spectrum analyzer input. Set REF LEVEL dBm to 0. Record deviation from reference established in step 4. This is the step-gain error. (Values above the reference line are positive; values below are negative.)

   ____

6. Set signal generator output to −17 dBm as measured with power meter. Set spectrum analyzer INPUT ATTEN to 0 dB, REF LEVEL dBm to −20, and REFERENCE LEVEL FINE to 0. Adjust VERT POSN and REF LEVEL CAL to place peak of signal at a convenient horizontal graticule line.
7. Set signal generator output to −7 dBm at spectrum analyzer and REF LEVEL dBm to −10. Record deviation from reference set in step 6.

   ____

8. To calculate gain compression, algebraically subtract step-gain error (step 5) from deviation recorded in step 7. Gain compression should be less than 1 dB.
9. Re-calibrate REF LEVEL CAL screwdriver adjustment.

PERFORMANCE TESTS

4-20. INPUT ATTENUATOR ACCURACY

SPECIFICATION:

Input Attenuator (at preselector input, 70 dB range in 10 dB steps):

Step size variation (for steps from 0 to 60 dB):

0 to 60 dB, 0.01 to 18 GHz: < ± 1.0 dB
0 to 40 dB, 0.01 to 22 GHz: < ± 1.5 dB

Maximum cumulative error:

0 to 60 dB, 0.01 to 18 GHz: < ± 2.4 dB
0 to 40 dB, 0.01 to 22 GHz: < ± 2.5 dB

DESCRIPTION:

The input attenuator accuracy is tested at 100 MHz using RF substitution (external, calibrated attenuator). The accuracy is also checked at 18 GHz and 22 GHz using IF substitution. The IF gain reference level variation, previously recorded in Table 4-7, is taken into account when measuring attenuator accuracy at 18 GHz and 22 GHz.

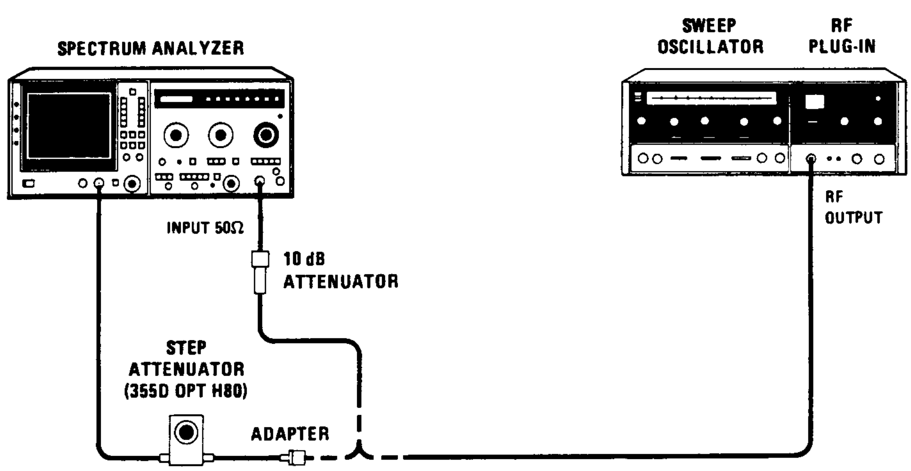


Figure 4-14. Input Attenuator Accuracy Test Setup

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

4-20. INPUT ATTENUATOR ACCURACY (Cont'd)

EQUIPMENT:

Sweep Oscillator/RF Plug-in	HP 8620C/86290A-H08
Step Attenuator (10 dB/step)	HP 355D, Opt. H80
10 dB Attenuator	HP 8491B, Opt. 010
Adapter, Type N (f) to BNC (m)	HP 1250-0077

PROCEDURE:

1. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	60 dB
REF LEVEL dBm	– 10
RESOLUTION BW	Coupled (pushed in)
FREQUENCY SPAN/DIV	.2 MHz
TUNING	0.100 GHz
AUTO STABILIZER	On (out)

2. Connect equipment as shown in Figure 4-14 using CAL OUTPUT signal through 10-dB attenuator and 10-dB step attenuator. Set step attenuator to 0 dB. Adjust spectrum analyzer TUNING control to center signal on CRT.

3. Pull to uncouple and set FREQUENCY SPAN/DIV to 10 kHz keeping signal centered with FINE TUNING control. Set RESOLUTION BW to 10 kHz.

4. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and set VIDEO FILTER to .01. Adjust REFERENCE LEVEL FINE control to place peak of signal at sixth division (from bottom graticule line).

5. Set both INPUT ATTEN of spectrum analyzer (push in to set) and 10-dB step attenuator to settings indicated in Table 4-12. Record deviation from sixth division for each setting.

NOTE

The reference level changes by 10 dB for every 10-dB change in INPUT ATTEN. Do not change the reference level back to the original setting after changing the INPUT ATTEN.

6. To compute the corrected deviation, add the step attenuator error to the deviation from 6th division for each setting. The corrected deviation should not exceed ± 1.0 dB between any two adjacent settings of the input attenuator.

7. Record the maximum positive and maximum negative corrected deviation values computed in Table 4-12. The difference between these two values (total deviation) should not exceed ± 2.4 dB.

_________ dB Max Positive Corrected Deviation
_________ dB Max Negative Corrected Deviation
_________ dB Maximum Cumulative Error (Total Deviation

PERFORMANCE TESTS

4-20. INPUT ATTENUATOR ACCURACY (Cont'd)

Table 4-12. Input Attenuator Accuracy, 100 MHz

INPUT ATTEN Setting (dB)	Step Attenuator Setting (dB)	Deviation from 6th Division (dB)	Step Attenuator Error (Calibration)*	INPUT ATTEN Corrected Deviation (dB)
60	0	0 (Ref.)	Ref.	0 (Ref.)
50	10	______	______	______
40	20	______	______	______
30	30	______	______	______
20	40	______	______	______
10	50	______	______	______
0	60	______	______	______

*Attenuations > dial settings are positive (+). Attenuations < dial settings are negative (−). For example, 9.9 dB calibration for a 10 dB attenuator setting represents an error of -0.01 dB.

8. Disconnect step attenuator from spectrum analyzer input and connect sweep oscillator output through 10 dB attenuator as shown in Figure 4-14.
9. Set spectrum analyzer to normal (green) settings (except for TRACE B, which remains in STORE BLANK throughout procedure). Set INPUT ATTEN to 0 dB and set REF LEVEL dBm to −10. Set FREQUENCY BAND GHz to 8.5−18. set FREQUENCY SPAN/DIV (uncoupled) to 2 MHz, RESOLUTION BW to 3 MHz, and adjust TUNING control for an indication of 18.000 on FREQUENCY GHz readout.
10. Set sweep oscillator for a 18.0 GHz CW signal with maximum internally leveled output power. Adjust CW and CW vernier controls of sweep oscillator to center signal on CRT display.
11. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and adjust REFERENCE LEVEL FINE control to place peak of signal at sixth division (from bottom graticule line). Reduce sweep oscillator power if necessary.
12. Press ZERO SPAN push button and set VIDEO FILTER to NOISE AVG. Adjust FINE TUNING control to peak trace on CRT display, and adjust REFERENCE LEVEL FINE control to place trace at sixth division.
13. Set INPUT ATTEN to 10 dB and return REF LEVEL dBm to −10. Do not adjust REFERENCE LEVEL FINE control.
14. Adjust FINE TUNING control to peak trace and record deviation from 6th division in Table 4-12.
15. Set INPUT ATTEN to 20 dB and return REF LEVEL dBm to −10. Do not adjust REFERENCE LEVEL FINE control. Repeat step 14.
16. Set INPUT ATTEN to 30 dB and return REF LEVEL dBm to −10. Do not adjust REFERENCE LEVEL FINE control. Repeat step 14.
17. Remove 10 dB attenuator and connect cable from sweep oscillator output directly to analyzer input. Set REF LEVEL dBm to 0. Adjust FINE TUNING control to peak trace and adjust REFERENCE LEVEL FINE control to place trace at deviation recorded for 30 dB INPUT ATTEN setting.

4-20. INPUT ATTENUATOR ACCURACY (Cont'd)

18. Set INPUT ATTEN to 40 dB and return REF LEVEL dBm to 0. Do not adjust REFERENCE LEVEL FINE control. Repeat step 14.

19. Set INPUT ATTEN to 50 dB and return REF LEVEL dBm to 0. Do not adjust REFERENCE LEVEL FINE control. Repeat step 14.

20. Set INPUT ATTEN to 60 dB and return REF LEVEL dBm to 0. Do not adjust REFERENCE LEVEL FINE control. Repeat step 14.

Table 4-13. Input Attenuator Accuracy, 18 GHz

INPUT ATTEN Setting (dB)	Deviation from 6th Division (dB)	REF LEVEL Corrected Deviation* (dB)		INPUT ATTEN Corrected Deviation (dB)
0	0 (Ref.)	0 (Ref.)	(−10)	0 (Ref.)
10	______	______	(−20)	______
20	______	______	(−30)	______
30	______	______	(−40)	______
40	______	______	(−40)	______
50	______	______	(−50)	______
60	______	______	(−60)	______

*From Table 4-7.

21. Record in Table 4-13 the REF LEVEL corrected deviation from Table 4-8. (Note that REF LEVEL corrected deviation for INPUT ATTEN settings of 30 dB and 40 dB are the same.)

22. To compute corrected deviation, subtract REF LEVEL corrected deviation from deviation from sixth division for each setting (see Table 4-14). Corrected deviation should not exceed ± 1.0 dB between any two adjacent settings of input attenuator.

Table 4-14. Input Attenuator Accuracy, 22 GHz

INPUT ATTEN Setting (dB)	Deviation from 6th Division (dB)	REF LEVEL Corrected Deviation* (dB)		INPUT ATTEN Corrected Deviation (dB)
0	0 (Ref.)	0 (Ref.)	(−10)	0 (Ref.)
10	______	______	(−20)	______
20	______	______	(−30)	______
30	______	______	(−40)	______
40	______	______	(−50)	______

*From Table 4-7.

PERFORMANCE TESTS

4-20. INPUT ATTENUATOR ACCURACY (Cont'd)

23. Record the maximum positive and maximum negative corrected deviation values computed in Table 4-13. The difference between these two values should not exceed ±2.4 dB.

_________ dB Max Pos. Corrected Deviation
_________ dB Max Neg. Corrected Deviation
_________ dB Max Cumulative Error (Total Deviation)

24. Set spectrum analyzer to normal (green) settings, except for TRACE B, which remains in STORE BLANK. Set INPUT ATTEN to 0 dB and REF LEVEL dBm to – 10. Set FREQUENCY BAND GHz to 10.5 – 22. Set FREQUENCY SPAN/DIV (coupled) to 2 MHz and adjust TUNING control for an indication of 22.000 on FREQUENCY GHz readout.

25. Set sweep oscillator for a 22.0 GHz CW signal with maximum internally leveled output power. Adjust CW and CW vernier controls of sweep oscillator to center signal on CRT display.

26. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and adjust REFERENCE LEVEL FINE control to place peak of signal at sixth division (from bottom graticule line). Reduce sweep oscillator power if necessary.

27. Press ZERO SPAN push button and set VIDEO FILTER to NOISE AVG. Adjust FINE TUNING control to peak trace on CRT display and adjust REFERENCE LEVEL FINE control to place trace at sixth division.

28. Set INPUT ATTEN to 10 dB and return REF LEVEL dBm to – 10. Do not adjust REFERENCE LEVEL FINE control.

29. Adjust FINE TUNING control to peak trace and record deviation from 6th division in Table 4-14.

Table 4-15. Computation of Corrected Deviation

INPUT ATTEN Setting (dB)	Deviation from 6th Division (dB)	REF LEVEL Corrected Deviation* (dB)		INPUT ATTEN Corrected Deviation (dB)
0	0 (Ref.)	0 (Ref.)	(–10)	0 (Ref.)
10	–0.1	–0.2	(–20)	+0.1
20	+0.3	–0.1	(–30)	+0.4
30	–0.2	+0.1	(–40)	–0.3
40	+0.2	+0.1	(–40)	+0.1
50	+0.3	+0.1	(–50)	+0.2
60	+0.4	+0.1	(–60)	+0.3

30. Set INPUT ATTEN to 20 dB and return REF LEVEL dBm to – 10. Do not adjust REFERENCE LEVEL FINE control. Repeat step 29.

4-20. INPUT ATTENUATOR ACCURACY (Cont'd)

31. Set INPUT ATTEN to 30 dB and return REF LEVEL dBm to – 10. Do not adjust REFERENCE LEVEL FINE control. Repeat step 29.

32. Set INPUT ATTEN to 40 dB and return REF LEVEL dBm to – 10. Do not adjust REFERENCE LEVEL FINE control. Repeat step 29.

33. Record in Table 4-14 REF LEVEL corrected deviation from Table 4-8.

34. To compute corrected deviation, subtract REF LEVEL corrected deviation from deviation from sixth division for each setting (see Table 4-14). Corrected deviation should not exceed ± 1.5 dB between any two adjacent settings of input attenuator.

35. Record maximum positive and maximum negative corrected deviation values computed in Table 4-14. Difference between these two values should not exceed ± 2.5 dB.

_________ dB Max Pos. Corrected Deviation
_________ dB Max Neg. Corrected Deviation
_________ dB Max Cumulative Error (Total Deviation)

PERFORMANCE TESTS

4-21. CALIBRATOR OUTPUT ACCURACY

SPECIFICATION:

Calibrator output:
- 10 dBm ±0.3 dB
100 MHz ± 10 kHz

DESCRIPTION:

The calibrator output level is measured with a power meter. The frequency of the calibrator output signal is measured using a frequency counter.

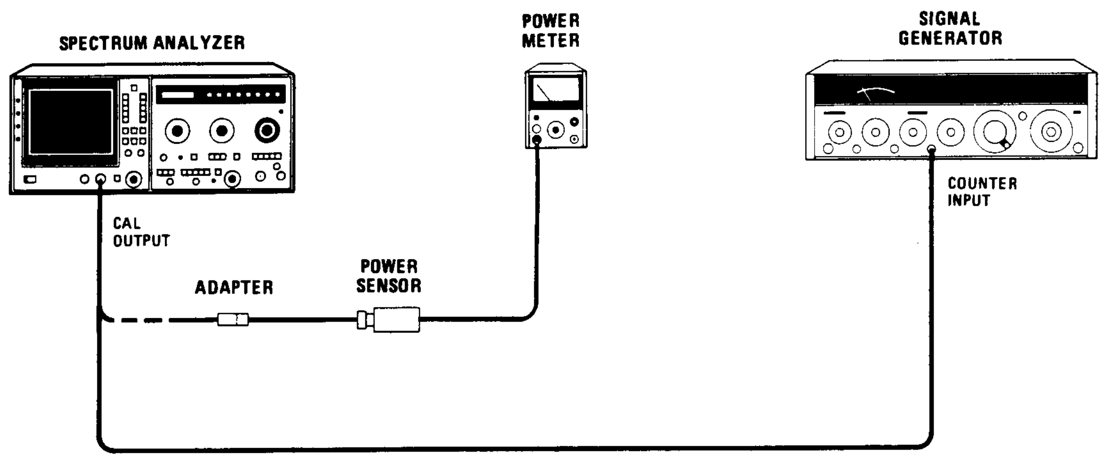


Figure 4-15. Calibrator Output Accuracy Test Setup

EQUIPMENT:

Power Meter	HP 435B
Power Sensor	HP 8485A
Frequency Counter	HP 5342A, Opt. 005
Adapter, Type N (f) to BNC (m)	HP 1250-0077

PROCEDURE:

1. Zero and calibrate the power meter. Connect power sensor, through adapter, directly to CAL OUTPUT port and measure power level. Calibrator output level should be - 10 dBm ±0.3 dB.

2. Disconnect power sensor and adapter and connect CAL OUTPUT to counter input (10 Hz to 500 MHz) of HP 5342A. Calibrator output frequency should be 100 MHz ± 10 kHz.

PERFORMANCE TESTS

4-22. FREQUENCY RESPONSE

SPECIFICATION:

Frequency Response (with 0 or 10 dB of Input Attenuation): Frequency response includes input attenuator, preselector and mixer frequency response plus mixing mode gain variation (band to band) and assumes preselector peaking. (Refer to Table 1-1.)

DESCRIPTION:

Frequency response is checked in each internal mixing band. The spectrum analyzer, in FULL BAND mode, is externally swept by the RF source across the entire FREQUENCY BAND GHz selected. Since the RF source is leveled and held quite flat across each frequency band, variations in amplitude on the display represent the frequency response of the spectrum analyzer. The preselector is modulated by a function generator to ensure that it tracks the spectrum analyzer tuning. 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.

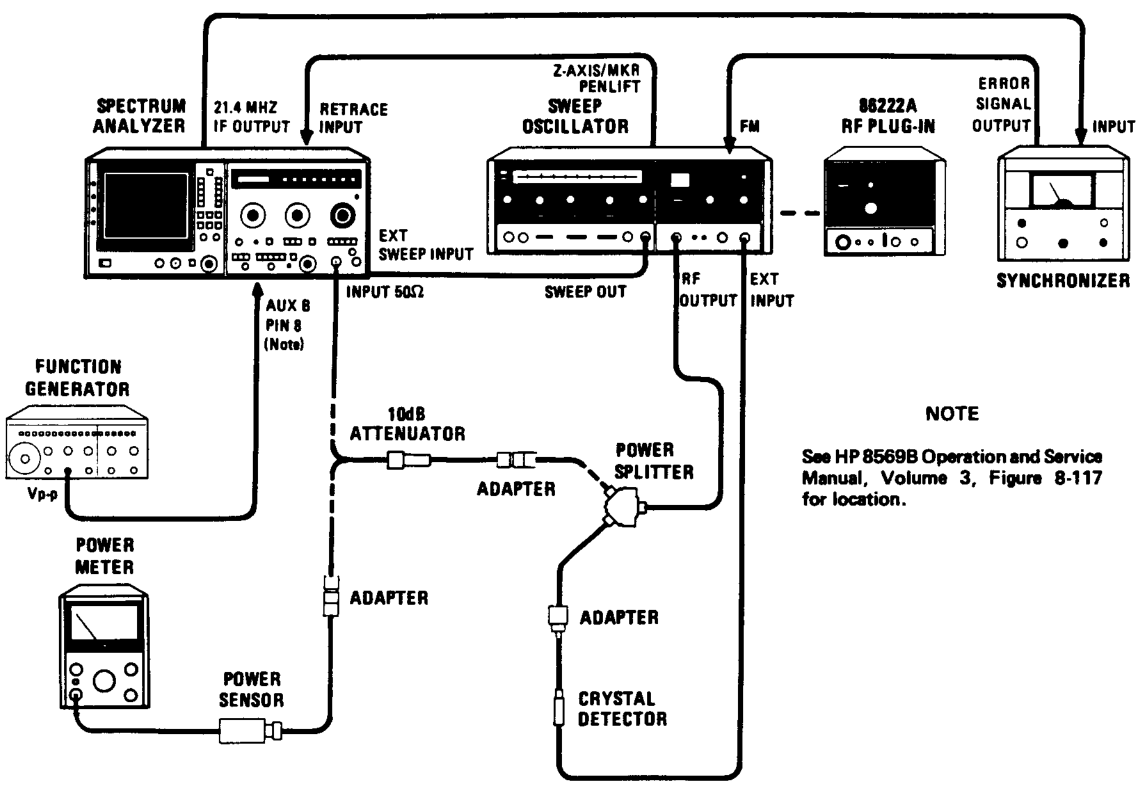


Figure 4-16. Frequency Response Test Setup

PERFORMANCE TESTS

4-22. FREQUENCY RESPONSE (Cont'd)

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

EQUIPMENT:

Sweep Oscillator	HP 8620C/86290C-H08
RF Plug-in	HP 86222A
Synchronizer	HP 8709A, Opt. H10
Function Generator	HP 3312A
Power Meter	HP 435B
Power Splitter	HP 11667A, Opt. 002
Power Sensor	HP8481A, Opt. C03
Power Sensor	HP 8485A
Crystal Detector	HP 33330C
Adapter, APC-7 to Type N (m)	HP 11525A
Adapter, APC-7 to SMA (f)	HP 11534A
Adapter, SMA (f) to Type N (f)	HP 86290-60005
Adapter, SMA (f) to Type N (m) (2 required)	HP 1250-1404
Attenuator, 10-dB	HP 8491B, Opt. 010
Test Cable, SMA (f) to BNC (m)	HP 11592-60001
Cable Assembly (SMA plug, both ends)	HP 8120-1578

PROCEDURE:

1. Set all normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	0 dB
REF LEVEL	– 10 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
TRACE A and TRACE B	STORE BLANK

Frequency Response, .01 to 1.8 GHz Band

2. Using .01 to 2.4 GHz source, connect equipment as shown in Figure 4-16. Connect output of power splitter, through 10-dB attenuator, to power sensor. With RF power off, zero the power meter. Turn RF power on.

4-22. FREQUENCY RESPONSE (Cont'd)

3. Set sweep oscillator to CW with frequency of 100 MHz and adjust RF power level for a power meter indication of − 18 dBm. Connect output of power splitter through 10-dB attenuator directly (do not use cable) to INPUT 50Ω connector of spectrum analyzer. Peak of signal should be at center horizontal graticule line ± one minor division (± 0.4 dB). If not, recheck sweep oscillator output level, making sure that power meter has been properly calibrated and zeroed before making the measurement. Also, recheck amplitude calibration of the spectrum analyzer.

4. Adjust REF LEVEL CAL screwdriver adjustment to place peak of 100 MHz signal at center horizontal graticule line. (If HP 8350A is used, connect rear-panel POZ Z BLANK to rear-panel RETRACE input on HP 8569B.)

5. Set spectrum analyzer FREQUENCY SPAN MODE to FULL BAND, SWEEP SOURCE to EXT and set TUNING control fully counterclockwise (lowest frequency). Set sweep oscillator to cover entire FREQUENCY BAND GHz selected. Turn on HP 8709A phase lock sweep oscillator and set output power level as follows:

   a. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

   b. Set sweep oscillator start frequency to low frequency of selected spectrum analyzer FREQUENCY BAND GHz and adjust start frequency for synchronizer phase lock (minimum phase error). Phase lock error switch should be set to negative (−) for bands 1 through 4 and to positive (+) for bands 5 and 6.

   c. Set sweep oscillator manual sweep control fully clockwise and stop frequency to high frequency of selected spectrum analyzer FREQUENCY BAND GHz. Adjust stop frequency for synchronizer phase lock (minimum phase error).

   d. Set sweep oscillator to AUTO (or TIME) sweep (≥ 10 seconds).

   e. Check spectrum analyzer CRT display for phase lock during sweep. If the system is breaking phase lock, adjust both start and stop frequencies during slow sweep (≥ 10 seconds) to obtain phase lock.

   f. Disconnect power splitter with 10-dB attenuator from INPUT 50Ω connector of spectrum analyzer and connect power meter to power splitter output.

   g. Set sweep oscillator to manual sweep.

   h. Slowly adjust sweep oscillator manual sweep control over its entire range, and adjust power level for an average power meter reading of − 18 dBm.

   i. Disconnect power meter and reconnect power splitter output with 10-dB attenuator to INPUT 50Ω connector of spectrum analyzer.

6. Set TRACE A (or TRACE B) to WRITE. Set sweep oscillator to single sweep mode at slowest sweep time (100 seconds). Trigger a sweep. 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.

4-22. FREQUENCY RESPONSE (Cont'd)

NOTE

If the frequency response appears to be out of specification 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.

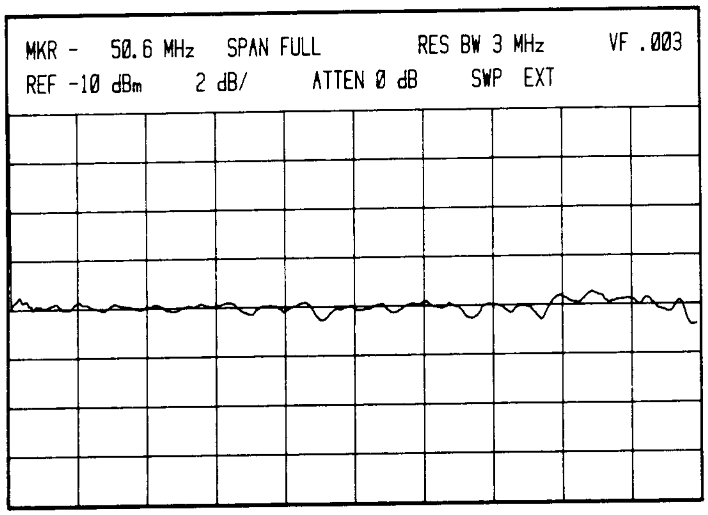


Figure 4-17. Typical Frequency Response, .01 to 1.8 GHz

7. Set spectrum analyzer INPUT ATTEN to 10 dB and REF LEVEL dBm to − 10. Trigger a sweep on sweep oscillator. Read greatest positive and negative deviations from the 100 MHz reference (center horizontal graticule line). Frequency response should not exceed ± 1.2 dB.

Frequency Response, 1.7 – 22 GHz Bands

8. Remove .01 to 2.4 GHz RF Plug-in from mainframe and replace with 2 to 22 GHz RF Plug-in. Select band 4 (2.0 – 22 GHz) on HP 8620C sweep oscillator.

9. Set spectrum analyzer INPUT ATTEN control to 0 dB, TRACE A and TRACE B to STORE BLANK, REF LEVEL dBm control to − 10, and FREQUENCY BAND GHz to 1.7 – 4.1. Set sweep oscillator to CW mode and adjust CW control to approximately 2.9 GHz. Set sweep oscillator to ΔF X10. (On HP 8350A, set CF control to 2.9 GHz and ΔF, initially, to 1 GHz.) Set mode switch to manual sweep and set manual sweep control fully counterclockwise. Adjust ΔF control until phase lock occurs (minimum phase error). Set manual control fully clockwise. Signal should be at right-hand edge of CRT display. If necessary, readjust ΔF and CW controls to obtain phase lock across entire frequency band. Set TRACE A and TRACE B to WRITE.

4-22. FREQUENCY RESPONSE (Cont'd)

10. Set PRESELECTOR PEAK control to center of green region. Apply a 1-kHz, 1.0-volt, peak-to-peak sine wave from a function generator to pin 8 of spectrum analyzer AUX B connector on rear panel. This signal modulates the YIG-tuned filter (YTF) and is equivalent to peaking the PRESELECTOR PEAK at all frequencies.

11. Disconnect power splitter with 10-dB attenuator from INPUT 50Ω connector of spectrum analyzer and use power meter to measure output at 10-dB attenuator port. 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 power meter. Adjust CAL FACTOR (%) to correct level. Turn RF power on and adjust RF Plug-in power level control for a power meter indication of – 18 dBm. Reconnect power splitter with 10-dB attenuator to INPUT 50Ω connector of spectrum analyzer. Set sweep oscillator to single sweep with sweep speed of 100 seconds. Trigger a sweep.

12. Read greatest positive and negative deviations from center horizontal graticule line. Frequency response should not exceed ± 1.5 dB.

13. Set spectrum analyzer INPUT ATTEN to 10 dB and REF LEVEL dBm to – 10. Trigger a sweep and read greatest positive and negative deviations from 100 MHz reference (center horizontal graticule line). Frequency response should not exceed ± 1.5 dB.

14. Set spectrum analyzer INPUT ATTEN to 0 dB, REF LEVEL dBm to – 10, and FREQUENCY BAND GHz to 3.8 – 8.5. Set both TRACE A and TRACE B to STORE BLANK. Set sweep oscillator mode switch to manual and set controls to cover entire FREQUENCY BAND GHz selected (steps 5 through 5e). Set both TRACE A and TRACE B to WRITE. Repeat procedure of steps 11 and 12. Frequency response should not exceed ± 2.5 dB.

15. Set spectrum analyzer INPUT ATTEN to 10 dB and REF LEVEL dBm to – 10. Trigger a sweep and read greatest positive and negative deviations from 100 MHz reference (center horizontal graticule line). Frequency response should not exceed ± 2.5 dB.

16. Set spectrum analyzer INPUT ATTEN to 0 dB, REF LEVEL dBm to – 10, and FREQUENCY BAND GHz to 5.8 – 12.9. Set both TRACE A and TRACE B to STORE BLANK. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND GHz selected (steps 5 through 5e). Set both TRACE A and TRACE B to WRITE. Repeat procedure in steps 11 and 12. Frequency response should not exceed ± 2.5 dB. Repeat step 15. Frequency response should not exceed ± 2.5 dB.

17. Set spectrum analyzer INPUT ATTEN to 0 dB, REF LEVEL dBm to – 10 dBm, and FREQUENCY BAND GHz to 8.5 – 18. Set phase lock switch on HP 8709A to '+'. Set both TRACE A and TRACE B to STORE BLANK. Set sweep oscillator mode switch to manual sweep and set controls to cover entire FREQUENCY BAND GHz selected (steps 5 through 5e). Set both TRACE A and TRACE B to WRITE. Repeat procedure in steps 11 and 12. Frequency response should not exceed ± 3.0 dB. Repeat step 15. Frequency response should not exceed ± 3.0 dB.

4-22. FREQUENCY RESPONSE (Cont'd)

18. Disconnect power splitter from spectrum analyzer input and measure output at power splitter with power meter. Set sweep oscillator to CW with a frequency of 18 GHz and adjust power level control of RF Plug-in for a power meter indication of −18 dBm. Slowly tune the CW source from 18 GHz to 22 GHz and note all peak deviations (positive and negative) from −18 dBm reference, with frequencies at which they occur. Record frequencies and peak deviations in Table 4-16. (Examples are shown in Table 4-17.)

19. Set spectrum analyzer AMPLITUDE SCALE to 10 dB, TRACE A and TRACE B to STORE BLANK, INPUT ATTEN to 0 dB, REF LEVEL dBm to −10, and FREQUENCY BAND GHz to 10.5−22. Set sweep oscillator to manual sweep mode and adjust band edges to cover the entire FREQUENCY BAND GHz. Set TUNING control to each frequency recorded in Table 4-15 and adjust manual sweep to the marker (lowest dip in amplitude) corresponding to tuning frequency as seen on CRT display. Record horizontal displacement of marker (number of divisions from far left graticule line) for each frequency recorded in step 18. (Examples are shown in Table 4-17.)

20. Disconnect power splitter from power meter and connect it to spectrum analyzer. Adjust sweep oscillator and spectrum analyzer controls according to procedure in steps 5 through 5e. Repeat step 11.

21. Set AMPLITUDE SCALE to 2 dB and trigger a sweep. Read deviation from center horizontal graticule line (−18 dBm) at each CRT Horizontal Displacement and record Displayed Deviations in Table 4-16. Algebraically subtract Peak Deviation from CRT Displayed Deviation for each setting in Table 4-16. Record results in Corrected Deviation column. (Examples are shown in Table 4-17.) Frequency response should not exceed ±4.5 dB, using corrected deviation from Table 4-16.

22. Repeat procedure of step 15. Frequency response, using corrected deviation from Table 4-16, should not exceed ±4.5 dB.

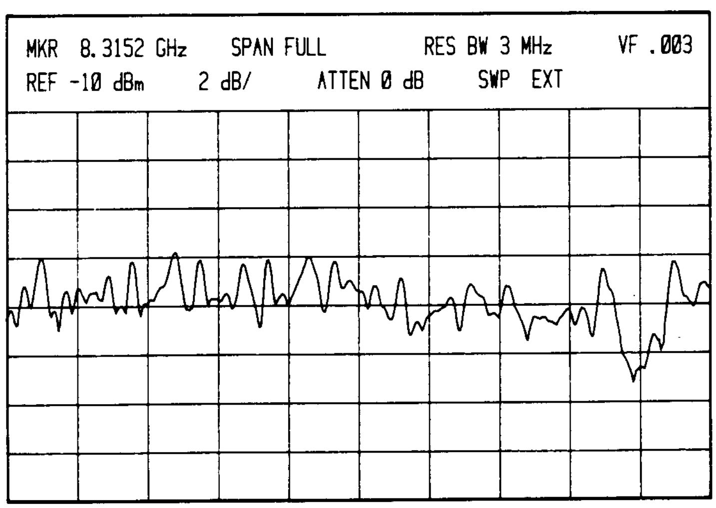


Figure 4-18. Typical Frequency Response, 8.5 to 18 GHz

4-22. FREQUENCY RESPONSE (Cont'd)

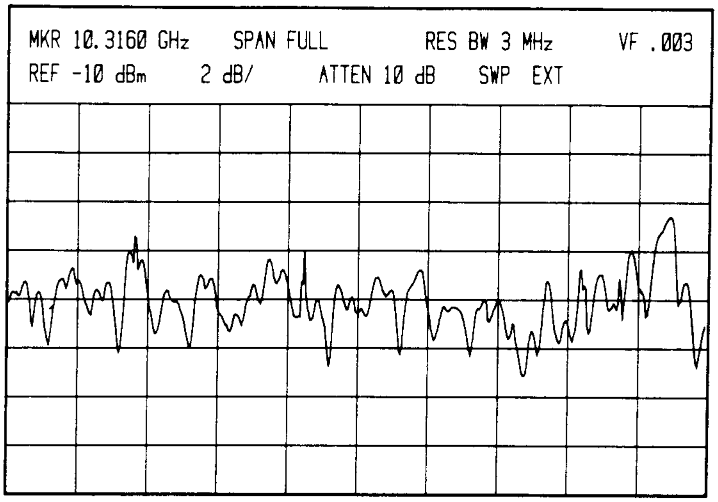


Figure 4-19. Typical Frequency Response, 10.5 to 22 GHz

Table 4-16. Correcting for Frequency Response of Signal Source

Frequency (GHz)	Power Meter Peak Deviation (dB)	CRT Horizontal Displacement (div)	Displayed Deviation (dB)	Corrected Deviation (dB)
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______
______	______	______	______	______

Table 4-17. Sample Corrections for Frequency Response of Signal Source

Frequency (GHz)	Power Meter Peak Deviation (dB)	CRT Horizontal Displacement (div)	Displayed 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

PERFORMANCE TESTS

4-23. AMPLITUDE ACCURACY, SWITCHING BETWEEN BANDWIDTHS

SPECIFICATION:

Switching between bandwidths: 3 MHz to 300 kHz, < ± 0.5 dB; 3 MHz to .1 kHz, < ± 1.0 dB.

DESCRIPTION:

The 100 MHz CAL OUTPUT signal of the spectrum analyzer is applied to the INPUT 50Ω port and displayed on the CRT. The peak of the displayed 100 MHz signal is centered on the CRT and adjusted for a vertical deflection of seven divisions. The amplitude variation of the 100 MHz signal is measured for each RESOLUTION BW control setting.

PROCEDURE:

1. Set all normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	– 8
RESOLUTION BW	3 MHz, Uncoupled
FREQUENCY SPAN/DIV	1 MHz
TUNING	0.100 GHz
AUTO STABILIZER	On (out)

2. Connect spectrum analyzer CAL OUTPUT signal to INPUT 50Ω.

3. Set AMPLITUDE SCALE to 1 dB (LOG/DIV) and center signal on CRT.

4. Adjust REFERENCE LEVEL FINE control to position peak of 100 MHz signal at seventh division (from bottom graticule line).

5. Change RESOLUTION BW and FREQUENCY SPAN/DIV controls in accordance with Table 4-18. Record the change in amplitude for each RESOLUTION BW setting. Changes in amplitude above reference level set in step 4 are positive (+). Changes below reference level are negative (–).

6. To find the overall variation in Table 4-18, algebraically subtract the greatest negative change in amplitude from the greatest positive change in amplitude. If all changes in amplitude are of the same sign, the overall variation is the largest positive or largest negative change in amplitude. The overall variation between 3 MHz and 300 kHz RESOLUTION BW settings should be ≤ 1.0 dB (± 0.5 dB). The overall variation between 3 MHz and .1 kHz RESOLUTION BW settings should be ≤ 2.0 dB (± 1.0 dB).

PERFORMANCE TESTS

4-23. AMPLITUDE ACCURACY, SWITCHING BETWEEN BANDWIDTHS (Cont'd)

Table 4-18. Amplitude Accuracy Switching Between Bandwidths

RESOLUTION BW Setting	FREQUENCY SPAN/DIV Setting	Change in Amplitude (dB)	Overall Variation Between 3 MHz and 300 kHz RESOLUTION BW Settings	Overall Variation Between 3 MHz and 1 kHz RESOLUTION BW Settings
3 MHz	1 MHz	0 (Ref.)		
1 MHz	.2 MHz	________	________	________
300 kHz	50 kHz	________		
100 kHz	20 kHz	________		
30 kHz	5 kHz	________		
10 kHz	2 kHz	________		
3 kHz	2 kHz	________		
1 kHz	1 kHz	________		
.3 kHz*	1 kHz	________		
.1 kHz*	1 kHz	________		

*Does not apply to Option 002 instruments.

PERFORMANCE TESTS

4-24. DISPLAY ACCURACY

SPECIFICATION:

Display accuracy:

Log: < ± 0.1 dB/dB but not more than ± 1.5 dB over full 70 dB display range.

Linear: ≤ ± 3% of reference level.

DESCRIPTION:

The display accuracy is tested with a digital voltmeter (DVM) connected to the rear-panel VERTICAL OUTPUT connector of the spectrum analyzer. ZERO SPAN mode is selected to provide a signal that appears a straight horizontal line on the CRT display. The DVM is used to provide good resolution for this measurement.

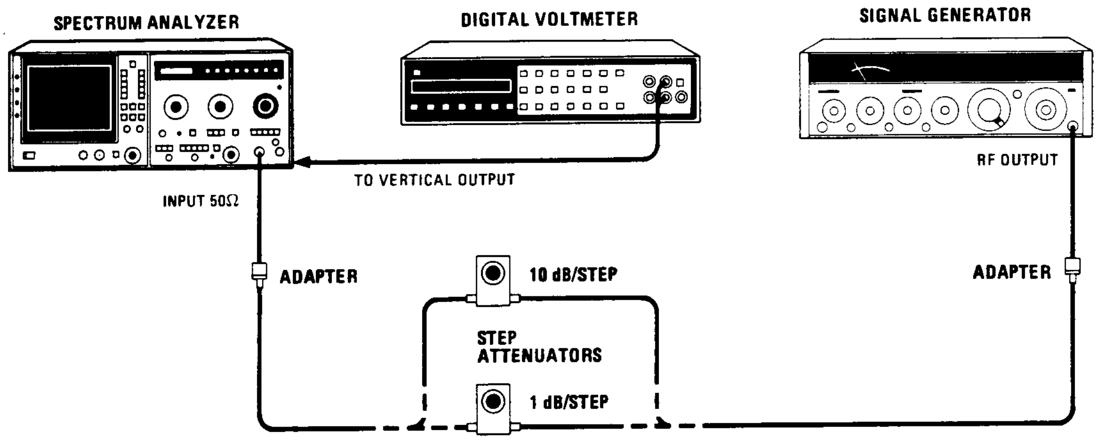


Figure 4-20. Display Accuracy Test Setup

EQUIPMENT:

Signal Generator	HP 8640B
Digital Voltmeter	HP 3455A
Step Attenuator (10 dB/Step)	HP 355D, Opt. H80
Step Attenuator (1 dB/Step)	HP 355C, Opt. H80
Adapter, Type N (m) to BNC (f) (2 required)	HP 1250-0780

PROCEDURE:

1. Set normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	0
RESOLUTION BW	Optimum, coupled
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.030 GHz
AMPLITUDE SCALE	LIN
AUTO STABILIZER	On (out)

4-24. DISPLAY ACCURACY (Cont'd)

Log Display Accuracy

2. With no signal at INPUT 50Ω, measure and record VERTICAL OUTPUT offset of spectrum analyzer. If offset is not within 0.000 ± 1mV, refer to adjustment procedure paragraph 5-17.

_________ mV

3. Connect equipment as shown in Figure 4-20 using 10-dB step attenuator. Set step attenuator to 0 dB. Set signal generator for an unmodulated 30 MHz output at approximately 0 dBm.

4. Set spectrum analyzer AMPLITUDE SCALE to 10 dB (LOG/DIV) and adjust TUNING control to center signal on CRT. Set FREQUENCY SPAN MODE to ZERO SPAN. Adjust FINE TUNING control to peak signal on CRT and DVM. If there is not enough tuning range, turn AUTO STABILIZER OFF while using TUNING control. Set signal to top graticule line with REFERENCE LEVEL control.

5. Calculate the difference between DVM reading and theoretical reading (800 mV) and record difference.

difference _________

6. Increase the attenuation of the step attenuator and record the DVM reading for each step (up to 70 dB) in Table 4-19. Observe trace on CRT for each step. Trace should not vary from graticule line by more than 0.1 division.

Table 4-19. Log Display Accuracy

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from Corrected DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	________	+800 (Ref.)	+800	0	
10	________	________	+700	________	________
20	________	________	+600	________	________
30	________	________	+500	________	________
40	________	________	+400	________	________
50	________	________	+300	________	________
60	________	________	+200	________	________
70	________	________	+100	________	________

*DVM reading minus offset recorded in step 2

4-24. DISPLAY ACCURACY (Cont'd)

Table 4-20. Sample Computations of Log Display Accuracy

Attenuator Setting (dB)	DVM Reading (mV)	Corrected DVM Reading* (mV)	Theoretical Reading (mV)	Theoretical Reading Subtracted from Corrected DVM Reading (mV)	Difference Between Adjacent Readings (mV)
0	+805	+800	+800	0	
10	+811	+703	+700	+3	–3
20	+599	+594	+600	–6	+9
30	+497	+492	+500	–8	+2
40	+406	+401	+400	+1	–9

*DVM reading minus offset of +5 mV

7. After recording the DVM readings for all step attenuator settings from 0 to 70 dB, arithmetically subtract theoretical reading from corrected DVM reading in each case and record results in Table 4-19.

8. To obtain the difference between adjacent readings, subtract each corrected reading (theoretical reading subtracted from corrected DVM reading) from the previous corrected reading. This subtraction must be performed algebraically. Record results in Table 4-19. (Sample results are shown in Table 4-20.)

9. The difference between adjacent readings (Table 4-20) should not exceed ± 10 mV ,which corresponds to ± 1dB/10dB or ± 0.1 dB/dB).

10. Note the highest positive and negative value recorded under "Theoretical Reading Subtracted from Corrected DVM Reading." Add their absolute values (disregarding their signs). If all of the signs are negative or all of the signs are positive, subtract the lowest absolute value from the highest absolute value (see Example 2). The sum or difference of the absolute values should not exceed 30 mV (3dB or ± 1.5 dB).

Example:

Refer to Table 4-20 and note that +9 mV is the highest positive value and 0 mV is the lowest positive value. Their absolute values being 9 mV and 0 mV: 9 – 0 = 9 mV (.9 dB).

Linear Display Accuracy

11. Replace 10-dB step attenuator with 1-dB step attenuator. Set step attenuator to 0 dB.

12. Set spectrum analyzer AMPLITUDE SCALE to LIN and adjust REF LEVEL FINE control to set signal to top graticule line. Note DVM reading. Subtract this reading from the theoretical reading (800 mV) and record.

difference ________

13. Set step attenuator to 6 dB. DVM should indicate +400 mV minus difference from step 12 ± 24 mV. Trace should be at fourth graticule line from top (mid scale) ± 0.24 division.

14. Set step attenuator to 12 dB. DVM should indicate +200 mV minus difference from step 12 ± 24 mV. Trace should be at the second graticule from the bottom ± 0.24 division.

PERFORMANCE TESTS

4-25. SWEEP TIME ACCURACY

SPECIFICATION:

Calibrated sweep times: 21 internal sweep times from 2 μsec/div in 1, 2, 5 sequence. Sweep time accuracy ±10% except for 2, 5, and 10 sec/div, which are ±20%.

DESCRIPTION:

For sweep times ≤50 milliseconds per division, the sine-wave output of a function generator is used to modulate a 500 kHz signal applied to the INPUT 50Ω of the spectrum analyzer. This signal is demodulated in the ZERO SPAN mode of the analyzer to display a sinusoidal waveform. The frequency output of the function generator is tuned to set the period averaging readout of the counter to match the sweep time of the analyzer. The peaks of the sine wave must align with the graticule lines on the analyzer display.

For sweep times ≥.2 second per division, the horizontal output from the rear panel is sent directly to the counter. The time interval of the sweep ramp is then read directly from the counter display.

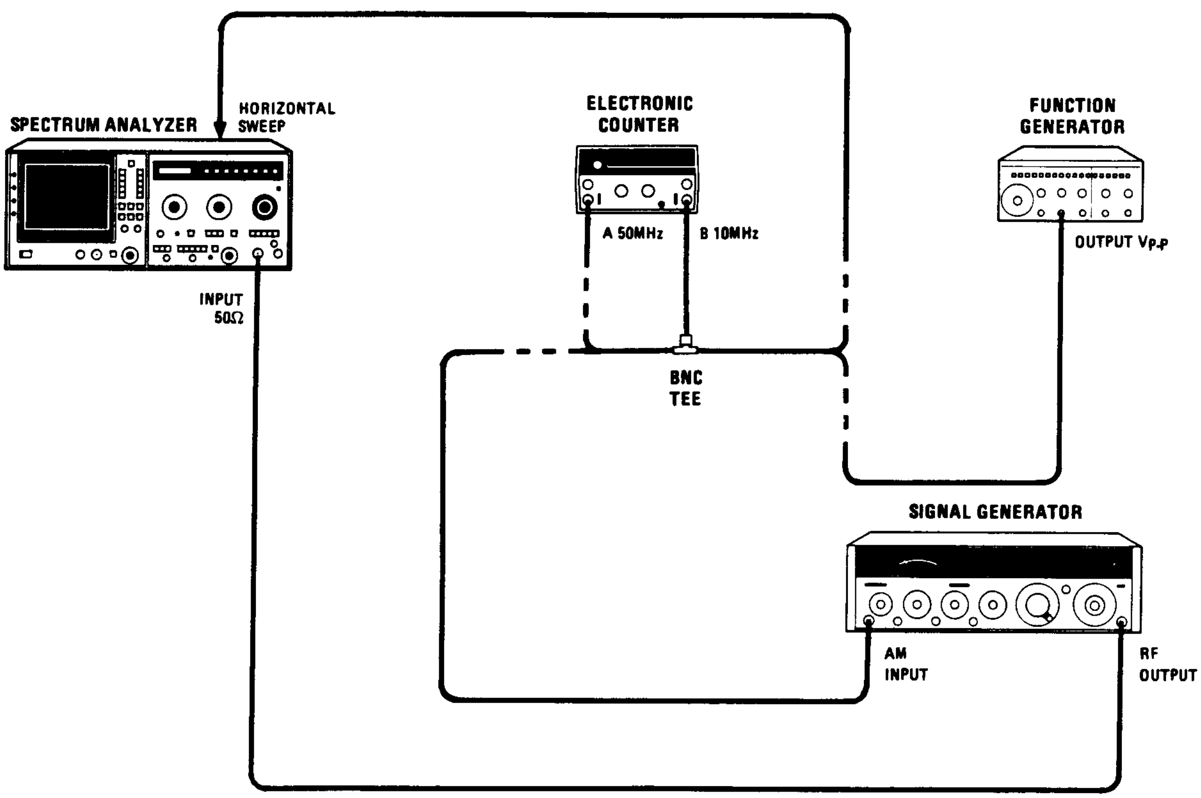


Figure 4-21. Sweep Time Accuracy Test Setup

PERFORMANCE TESTS

4-25. SWEEP TIME ACCURACY (Cont'd)

EQUIPMENT:

Function Generator .... HP 3312A
Electronic Counter .... HP 5300B/5302A
Signal Generator .... HP 8640B, Opt. 001

PROCEDURE:

1. Set normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

   TRACE A .... WRITE
   TRACE B .... STORE BLANK
   FREQUENCY BAND GHz .... .01 – 1.8
   INPUT ATTEN .... 10 dB
   REF LEVEL dBm 0
   REFERENCE LEVEL FINE 0
   RESOLUTION BW .... 3 MHz, Uncoupled
   FREQUENCY SPAN/DIV .... 10 MHz
   TUNING .... 0.500 GHz

2. Connect RF OUTPUT of signal generator to INPUT 50Ω of spectrum analyzer (see Figure 4-21). Connect BNC tee connector to B 10 MHz input of counter. Connect one side of BNC tee to OUTPUT Vp-p of function generator. Connect other side of BNC tee to AM INPUT of signal generator.

3. Set signal generator for an unmodulated 500 MHz output at approximately – 10 dBm.

4. Adjust spectrum analyzer TUNING control to center signal on CRT. Set AMPLITUDE SCALE to 2 dB, SWEEP TIME/DIV to 2 μSEC, and FREQUENCY SPAN MODE to ZERO SPAN.

5. Set function generator controls as follows:

   FREQUENCY .... Approximately 200 kHz
   FUNCTION .... Sine wave
   OFFSET .... CAL position (IN)
   AMPLITUDE .... Approximately 1 Vp-p
   SYM .... CAL position (IN)
   TRIGGER PHASE .... FREE RUN
   MODULATION .... All push buttons out

6. Set AM switch of HP 8640B to DC position. Adjust AMPLITUDE VERNIER of function generator and AM MODULATION 0 – 100% of signal generator for 50 percent modulation as indicated on signal generator meter.

7. Set SWEEP TRIGGER of spectrum analyzer to VIDEO. Adjust TRIGGER LEVEL for a triggered sweep.

8. Set FUNCTION of counter to PER AVG B. Adjust SENSITIVITY of B 10 MHz input to maximum. Adjust SAMPLE RATE fully counterclockwise. Tune frequency of function generator so period average of counter reads 4.00 ± 0.04 μS.

4-25. SWEEP TIME ACCURACY (Cont'd)

9. Adjust TRIGGER LEVEL of analyzer to place a peak of sine wave on graticule reference line (left-most graticule line). Fifth peak from reference should be within ±0.8 division of eighth graticule line. (See Figure 4-22.)

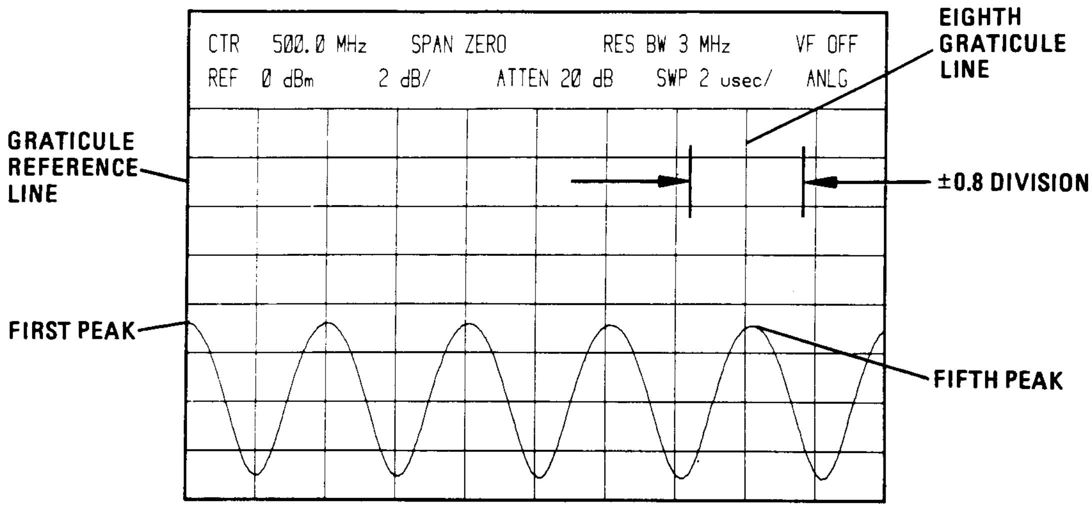


Figure 4-22. Sweep Time Accuracy, 2 μSEC/DIV

10. Use Table 4-21 to check sweep time accuracy for sweep times of 5 μSEC through .1 SEC. For these sweep times, 10 sweeps will be displayed. Adjust TRIGGER LEVEL of spectrum analyzer to place a peak of sine wave on graticule reference line. Sixth peak from reference should be within ±0.5 divisions of center graticule line. (See Figure 4-23 for an example of this display.)

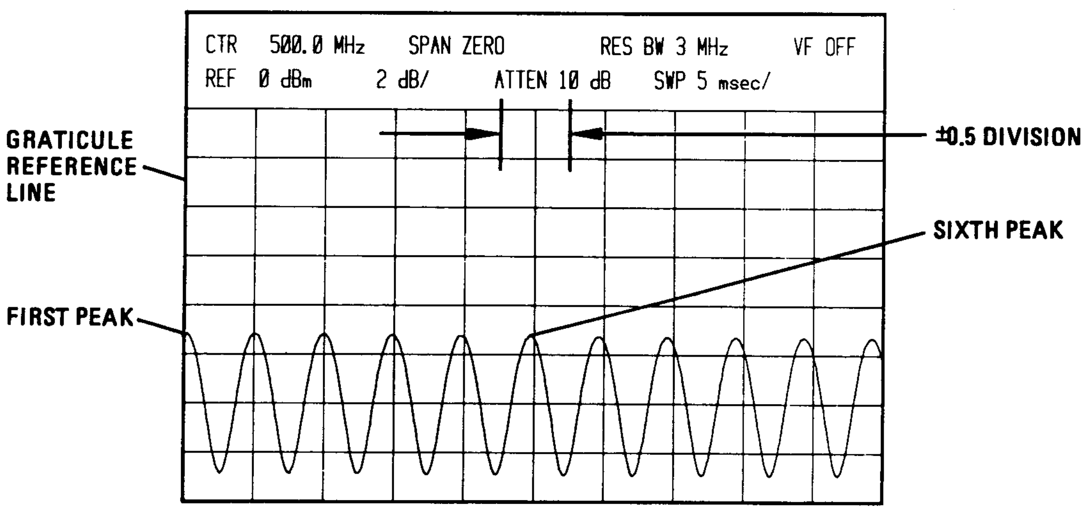


Figure 4-23. Sweep Time Accuracy, 5 mSEC/DIV

11. For sweep times of .2 through 10 SEC, connect rear-panel HORIZONTAL SWEEP output to a BNC tee at B 10 MHz input of counter. Connect other side of tee to A 50 MHz input of counter.

4-25. SWEEP TIME ACCURACY (Cont'd)

12. Set FUNCTION of counter to T.I. A to B, set A input to trigger on trailing edge of square wave, and set B input to trigger on leading edge of square wave.

13. Set spectrum analyzer SWEEP TIME/DIV to .1 SEC and SWEEP TRIGGER to SINGLE.

14. Reset counter by pushing in SAMPLE RATE knob. (This must be done before every measurement in Table 4-22.)

15. Trigger a sweep on spectrum analyzer by pressing START/RESET. Display of counter should read 2.08 ±0.21S. Use Table 4-22 to check accuracy of remaining sweep speeds.

Table 4-21. Sweep Time Accuracy, 5 μSEC through .1 SEC

Spectrum Analyzer SWEEP TIME/DIV	Electronic Counter PER AVG B
5 μSEC	5.0 ±0.05 μS
10 μSEC	10.0 ±0.1 μS
20 μSEC	20.0 ±0.2 μS
50 μSEC	50.0 ±0.5 μS
.1 mSEC	100.0 ±1.0 μS
.2 mSEC	200.0 ±2.0 μS
.5 mSEC	500.0 ±5.0 μS
1 mSEC	1000 ±10 μS
2 mSEC	2000 ±20 μS
5 mSEC	5000 ±50 μS
10 mSEC	10.0 ±0.1 MS
20 mSEC	20.0 ±0.2 MS
50 mSEC	50.0 ±0.5 MS
.1 SEC	100.0 ±1.0 MS

Table 4-22. Sweep Time Accuracy, .2 SEC through 10 SEC

Spectrum Analyzer SWEEP TIME/DIV	Electronic Counter T.I. A TO B
.2 SEC	2.08 ±0.21 S
.5 SEC	5.20 ±0.52 S
1 SEC	10.40 ±1.04 S
2 SEC	20.80 ±4.16 S
5 SEC	52.00 ±10.40 S
10 SEC	104.00 ±20.80 S

4-26. COMB GENERATOR FREQUENCY ACCURACY

SPECIFICATION:

Frequency Accuracy: ≤ ±0.007%
Frequency Range: 0.01 to 22 GHz

DESCRIPTION:

The comb generator signal is compared with an external synthesized signal. The frequency of the synthesized signal is adjusted to coincide with the comb generator signal on the spectrum analyzer display. The frequency readout on the signal generator should be 100.000000 ±0.007000 MHz.

EQUIPMENT:

Synthesized Signal Generator .... HP 8662A
Cable Assembly (SMA plug, both ends) .... HP 8120-1578
Adapter, Type N (m) to SMA (f) (2 required) .... HP 1250-1250

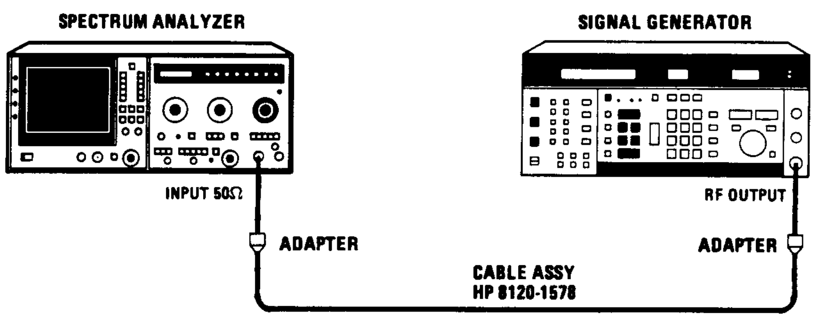


Figure 4-24. Comb Generator Frequency Accuracy Test Setup

PROCEDURE:

1. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

   FREQUENCY BAND GHz .... .01 – 1.8
   FREQUENCY GHz 0.100
   AUTO STABILIZER .... On (out)
   FREQUENCY SPAN/DIV (coupled) .... 1 MHz
   INPUT ATTEN .... 10 dB
   REF LEVEL dBm 0
   REFERENCE LEVEL FINE 0
   INTERNAL COMB GENERATOR .... On (in)

2. Connect equipment as shown in Figure 4-24. Set signal generator output FREQUENCY to 100.000000 MHz and AMPLITUDE to –20 dBm.

PERFORMANCE TESTS

4-26. COMB GENERATOR FREQUENCY ACCURACY (Cont'd)

3. Adjust TUNING control to center 100-MHz comb signal on spectrum analyzer display. While adjusting FINE tuning control to maintain signal at center of display, reduce FREQUENCY SPAN/DIV to 2 kHz.

4. Set TRACE B to STORE VIEW and turn INTERNAL COMB GENERATOR off (out).

5. Adjust AMPLITUDE control of signal generator until its output signal exactly coincides on the display with stored comb signal. Set TRACE A to STORE VIEW.

6. Adjust FREQUENCY control of signal generator until its output signal exactly coincides on the display with stored comb signal. Set TRACE A to STORE VIEW.

7. Record frequency shown on readout of signal generator. Frequency must be 100.000000 ±0.007000 MHz.

Table 4-23. Performance Test Record (1 of 6)

Hewlett-Packard Company Model 8569A Spectrum Analyzer 0.1 to 22 GHz	Tested by ______________
Serial No. ______________	Date ______________

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-10.	**Tuning Accuracy**			
	6. 0.010 GHz	0.005 GHz	______	0.015 GHz
	8. 1.000 GHz	0.995 GHz	______	1.005 GHz
	10. 1.800 GHz	1.795 GHz	______	1.805 GHz
	12. 1.700 GHz	1.695 GHz	______	1.705 GHz
	13. 3.000 GHz	2.294 GHz	______	3.006 GHz
	14. 4.100 GHz	4.092 GHz	______	4.108 GHz
	16. 3.800 GHz	3.792 GHz	______	3.808 GHz
	6.000 GHz	5.988 GHz	______	6.012 GHz
	8.500 GHz	8.483 GHz	______	8.517 GHz
	5.800 GHz	5.788 GHz	______	5.812 GHz
	8.000 GHz	7.984 GHz	______	8.016 GHz
	12.900 GHz	12.874 GHz	______	12.926 GHz
	8.500 GHz	8.483 GHz	______	8.517 GHz
	12.500 GHz	12.475 GHz	______	12.525 GHz
	18.000 GHz	17.964 GHz	______	18.036 GHz
	10.500 GHz	10.479 GHz	______	10.521 GHz
	16.500 GHz	16.467 GHz	______	16.533 GHz
	22.000 GHz	21.956 GHz	______	22.044 GHz
	21. 12.4 GHz	2.009 GHz	______	2.017 GHz
	25. 26.5 GHz	4.354 GHz	______	4.372 GHz
	26. 21.0 GHz	2.064 GHz	______	2.073 GHz
	44.0 GHz	4.359 GHz	______	4.377 GHz
	33.0 GHz	2.038 GHz	______	2.046 GHz
	71.0 GHz	4.408 GHz	______	4.426 GHz
	53.0 GHz	2.022 GHz	______	2.030 GHz
	115.0 GHz	4.402 GHz	______	4.420 GHz
4-11.	**Span Width Accuracy**			
	6. 500 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	10. 200 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	13. 100 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	14. 50 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	15. 20 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	16. 5 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	18. 2 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	19. 1 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	20. .5 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div
	22. .2 MHz FREQ SPAN/DIV	−0.4 div	______	+0.4 div

Table 4-23. Performance Test Record (2 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
	23. 100 kHz, stabilized	−1.2 div	________	+1.2 div
	100 kHz, unstabilized	−0.4 div	________	+0.4 div
	50 kHz, stabilized	−1.2 div	________	+1.2 div
	50 kHz, unstabilized	−0.4 div	________	+0.4 div
	20 kHz, stabilized	−1.2 div	________	+1.2 div
	20 kHz, unstabilized	−0.4 div	________	+0.4 div
	10 kHz, stabilized	−1.2 div	________	+1.2 div
	5 kHz, stabilized	−1.2 div	________	+1.2 div
	25. 2 kHz, stabilized	−1.2 div	________	+1.2 div
	26. 1 kHz, stabilized	−1.2 div	________	+1.2 div
4-12.	**Resolution Bandwidth Accuracy**			
	7. 3 MHz	2.55 MHz	________	3.45 MHz
	8. 1 MHz	850 kHz	________	1.15 MHz
	9. 300 kHz	255 kHz	________	345 kHz
	10. 100 kHz	85 kHz	________	115 kHz
	11. 30 kHz	25.5 kHz	________	34.5 kHz
	17. 10 kHz	8.5 kHz	________	11.5 kHz
	18. 3 kHz	2.55 kHz	________	3.45 kHz
	19. 1 kHz	0.85 kHz	________	1.15 kHz
	20. .3 kHz	255 Hz	________	345 Hz
	21. .1 kHz	85 Hz	________	115 Hz
4-13.	**Resolution Bandwidth Selectivity**			
	25. 3 MHz		________	15:1
	1 MHz		________	15:1
	300 kHz		________	15:1
	100 kHz		________	15:1
	30 kHz		________	15:1
	10 kHz		________	15:1
	3 kHz		________	15:1
	1 kHz		________	11:1
	.3 kHz		________	11:1
	.1 kHz		________	11:1
4-14.	**Residual FM**			
	8. Peak-to-Peak Variation of Trace with AUTO STABILIZER on		________	As calculated in step 6.
	16. Peak-to-Peak Variation of Trace with AUTO STABILIZER OFF		________	As calculated in step 14.

Table 4-23. Performance Test Record (3 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-15.	**Noise Sidebands**			
	7. Noise sidebands	75 dB	________	
4-16.	**Residual Responses**			
	8. Residual responses		________	−90 dBm
4-17.	**Average Noise Level**			
	3. .01 — 1.8 GHz		________	−113 dBm
	4. 1.7 — 4.1 GHz		________	−110 dBm
	3.8 — 8.5 GHz		________	−107 dBm
	5.8 — 12.9 GHz		________	−100 dBm
	8.5 — 18 GHz		________	−95 dBm
	10.5 — 22 GHz		________	−90 dBm
	12.4 – 26.5 GHz		________	−104 dBm
	21 – 44 GHz		________	−104 dBm
	33 – 71 GHz		________	−104 dBm
	53 – 115 GHz			−104 dBm
4-18.	**Reference Level Variation**			
	6. Corrected deviation from −10 to −70 dBm in log mode		________	±0.5 dB
	Corrected deviation from −10 to −100 dBm in log mode		________	±1.0 dB
	10. Corrected deviation from −10 to −70 dBm in linear mode		________	±0.5 dB
	Corrected deviation from −10 to −100 dBm in linear mode		________	±1.0 dB
	13. Corrected deviation of REFERENCE LEVEL FINE (Vernier)		________	±0.5 dB
4-19.	**Gain Compression**			
	8. Gain compression		________	1.0 dB

Table 4-23. Performance Test Record (4 of 6)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
4-20.	**Input Attenuator Accuracy**			
	6. Corrected deviation between adjacent settings from 0-60 dB at 0.100 GHz		________	±1.0 JB
	7. Maximum cumulative error from 0-60 dB at 0.100 GHz		________	±2.4 dB
	22. Corrected deviation between adjacent settings from 0-60 dB at 18 GHz		________	±1.0 dB
	23. Maximum cumulative error from 0-60 dB at 18 GHz		________	±2.4 dB
	35. Corrected deviation between adjacent settings from 0-40 dB at 22 GHz		________	±1.5 dB
	36. Maximum cumulative error from 0-40 dB at 22 GHz		________	±2.5 dB
4-21.	**Calibrator Output Accuracy**			
	1. Calibrator output level	−10.3 dBm	________	−9.7 dBm
	2. Calibrator output frequency	99.090 MHz	________	100.010 MHz
4-22.	**Frequency Response**			
	6. .01 to 1.8 GHz, 0 dB input attentuation		________	±1.2 dB
	7. .01 to 1.8 GHz, 10 dB input attenuation		________	±1.2 dB
	12. 1.7 to 4.1 GHz, 0 dB input attenuation		________	±1.7 dB
	13. 1.7 to 4.1 GHz, 10 dB input attenuation		________	±1.7 dB
	14. 3.8 to 8.5 GHz, 0 dB input attenuation		________	±2.2 dB
	15. 3.8 to 8.5 GHz, 10 dB input attenuation		________	±2.2 dB

Table 4-23. Performance Test Record (5 of 6)

Para. No.	Test Description	Results Min.	Results Actual	Results Max.
	16. 5.8 to 12.9 GHz, 0 dB input		________	±2.5 dB
	5.8 to 12.9 GHz, 10 dB input attenuation		________	±2.5 dB
	17. 8.5 to 18 GHz, 0 dB input attenuation		________	±3.0 dB
	8.5 to 18 GHz, 10 dB input attenuation		________	±3.0 dB
	21. 10.5 to 22 GHz, corrected deviation, 0 dB input attenuation		________	±4.5 dB
	22. 10.5 to 22 GHz, corrected deviation, 10 dB input attenuation		________	±4.5 dB
4-23.	**Amplitude Accuracy, Switching Between Bandwidths**			
	6. Overall variation between 3 MHz and 300 kHz RESOLUTION BW	0.5 dB	________	1.5 dB
	Overall variation between 3 MHz and .1 kHz RESOLUTION BW	1.0 dB	________	3.0 dB
4-24.	**Display Accuracy**			
	9. Difference between adjacent readings, log display		________	±10 mV (±.1 dB/dB)
	10. Sum or difference of absolute values of corrected DVM readings, log display		________	30 mV (3 dB or ±1.5 dB)
	13. Linear display offset, step attenuator set to 6 dB	382 mV + offset recorded in step 2	________	412 mV + offset recorded in step 2
	14. Linear display offset, step attenuator set to 12 dB	194 mV + offset recorded in step 2	________	206 mV + offset recorded in step 2

Table 4-23. Performance Test Record (6 of 6)

Para. No.	Test Description	Results Min.	Results Actual	Results Max.
4-25.	**Sweep Time Accuracy**			
	9. 2 μSEC	–0.8 div	________	+0.8 div
	10. 5 μSEC	–0.5 div	________	+0.5 div
	10 μSEC	–0.5 div	________	+0.5 div
	20 μSEC	–0.5 div	________	+0.5 div
	50 μSEC	–0.5 div	________	+0.5 div
	.1 mSEC	–0.5 div	________	+0.5 div
	.2 mSEC	–0.5 div	________	+0.5 div
	.5 mSEC	–0.5 div	________	+0.5 div
	1 mSEC	–0.5 div	________	+0.5 div
	2 mSEC	–0.5 div	________	+0.5 div
	5 mSEC	–0.5 div	________	+0.5 div
	10 mSEC	–0.5 div	________	+0.5 div
	20 mSEC	–0.5 div	________	+0.5 div
	50 mSEC	–0.5 div	________	+0.5 div
	.1 SEC	–0.5 div	________	+0.5 div
	15. .2 SEC	1.87 S	________	2.29 S
	.5 SEC	4.68 S	________	5.72 S
	1 SEC	9.36 S	________	11.44 S
	2 SEC	16.64 S	________	24.96 S
	5 SEC	41.60 S	________	62.40 S
	10 SEC	83.20 S	________	124.80 S
4-26.	**Comb Generator Frequency Accuracy**			
	7. Frequency	99.993000	________	100.007000

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments required to return the spectrum analyzer to peak operating condition when repairs are required. Table 5-1 lists all of the adjustments by adjustment name, reference designation, adjustment paragraph, and description. Included in this section are test setups as well as check and adjustment procedures.

5-3. Data taken during adjustment should be recorded in the spaces provided. Comparison of initial data with data taken during periodic adjustments is useful for preventive maintenance and troubleshooting.

WARNING

When the covers of the instrument are removed, terminals are exposed that have voltages capable of causing death. The adjustments in this section should be performed only by a skilled person who knows the hazard involved.

NOTE

Before performing any adjustments, allow 1 hour warm-up time.

5-4. EQUIPMENT REQUIRED

5-5. Table 1-3, Recommended Test Equipment, lists the test equipment and test accessories required in the adjustment procedures. In addition, the table provides the required minimum specifications and suggested manufacturers' model numbers.

5-6. Adjustment Tools

5-7. For adjustments requiring a non-metallic tuning tool, use a fiber tuning tool, HP Part Number 8710-0033. For adjustments not requiring a non-metallic tuning tool, an ordinary small screwdriver or other suitable tool is sufficient. Regardless of the tool used, never try to force any adjustment control in the analyzer. This is especially critical when tuning variable, slug-tuned inductors and variable capacitors.

5-8. RELATED ADJUSTMENTS

5-9. These adjustments should be performed when the troubleshooting information in Section VIII indicates that an adjustable circuit is not operating correctly. Perform the adjustments after repair or replacement of the circuit. The troubleshooting procedures and Table 5-2 specify the required adjustments.

5-10. FACTORY-SELECTED COMPONENTS

5-11. Table 5-3 contains a list of factory-selected components by reference designation, related adjustment paragraph, and basis of selection. Factory-selected components are identified by asterisks (*) in the schematic diagrams in Section VIII and in Table 6-3, Replaceable Parts. Part numbers for standard selected values can be found in Table 5-4.

Table 5-1. Adjustable Components (1 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A2A1R1	FREQ CAL		Calibrates FREQUENCY GHz readout.
A2A1R9	REF LEVEL CAL	5-18,5-30,5-32	Calibrates log reference level.
A2A1R14	BIAS ZERO	5-31	Adjusts EXT MIXING BIAS to 0V at detent.
A3R1	FOCUS	5-14	Adjusts focus of CRT display.
A3R2	TRACE ALIGN	5-14	Aligns X and Y axes with graticule display.
A3R3	HORIZ POSN	5-17	Adjusts horizontal position of CRT display.
A3R4	VERT POSN	5-17	Adjusts vertical position of CRT display.
A4C6	HF TRIM	5-14	Compensates for high frequency response of Control Gate Amplifier.
A4R4	INTEN GAIN	5-14	Adjusts the gain of the Voltage-To-Current Converter so +1.0V at input provides +70V at output of Control Gate Amplifier.
A4R16	PATTERN	5-14	Corrects for curvature in CRT trace.
A4R17	ASTIG	5-14	Adjusts for spot roundness on CRT screen.
A4R26	HF GAIN	5-14	Adjusts high frequency response of Control Gate Amplifier.
A4R30	INTEN DYN FOCUS	5-14	Adjusts amount of intensity dynamic correction of CRT focus.
A4R60	INTEN BAL	5-14	Adjusts Z Modulation amplifier for equal intensity of both upward and downward strokes.
A4R77	MIN INTEN	5-14	Adjusts minimum voltage in Control Gate Amplifier.
A4R81	INTEN OFFSET	5-14	Adjusts offset of Z Modulation output voltage.
A4R82	45 ASTIG		Adjusts for spot roundness along the 45 degree axes (in the 4 corners of the CRT screen).
A5R25	VERT GAIN	5-17	Adjusts gain of Y Axis Amplifier.
A5R64	HORIZ GAIN	5-17	Adjusts gain of X Axis Amplifier.
A5R91	X DYN FOCUS	5-14	Adjusts amount of X Axis dynamic focus correction of CRT display.
A5R100	DGTL X GAIN	5-16	Adjusts output level of Digital X Generator.
A5R108	DGTL X OFFSET	5-16	Adjusts output offset voltage of Digital X Generator.
A5R111	DGTL Y OFFSET	5-16	Adjusts digital vertical gain relative to CRT graticule.
A5R113	DGTL Y GAIN	5-16	Adjusts digital vertical gain relative to CRT graticule.
A6R4	HV	5-13	Adjusts CRT output voltage from the high voltage power supply.
A6R18	INT LIM	5-13	Sets maximum CRT trace intensity.
A6R29	FOCUS LIMIT	5-14	Sets range for front-panel focus control.
A9R8	PK OFFSET	5-16	Adjusts offset of Peak Detector.
A9R14	PK GAIN	5-16	Adjusts gain of Peak Detector.
A9R23	ADC OFFSET	5-16	Adjusts offset of Track and Hold.
A9R29	ADC GAIN	5-16	Adjusts gain of Track and Hold output amplifier A9U4.
A9R45	SWP OFFSET	5-16	Adjusts offset of horizontal sweep for use by ADC.
A9R47	SWP GAIN	5-16	Adjusts gain of horizontal sweep for use by ADC.
A9R59	STROKE-FB	5-16	Adjusts magnitude of feedback current in Digital Y Generator.

Table 5-1. Adjustable Components (2 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A9R62	STROKE GAIN	5-16	Adjusts overall gain of Digital Y Generator.
A12R18	REF ADJ	5-22	Adjusts negative reference voltage used in DVM.
A12R37	INPUT BAL	5-22	Balances DVM input amplifier.
A12R53	HYST	5-22	Adjusts scale offset of DVM near zero.
A12R56	ZERO ADJ	5-22	Adjusts point at which DVM polarity change occurs.
A14R57	TICK SWP	5-27	Adjusts sweep voltage to YTO tickler coil.
A14R68	FET OFF	5-27	Nulls offset in VCXO sweep voltage.
A14R71	VCXO SWP	5-27	Adjusts sweep voltage to VCXO.
A15R53	MAIN SWP OFFSET	5-26	Compensates for offset between wide and narrow frequency span widths.
A16R9	+10VTV	5-21	Adjusts +10V temperature variable supply.
A16R15	1MS	5-21	Calibrates 1 ms per division sweep time.
A16R19	2MS	5-21	Calibrates 2 ms per division sweep time.
A16R25	AST LIMIT	5-21	Adjusts AUTO sweep time current limit.
A16R74	SWP STOP	5-21	Sets maximum positive sweep ramp voltage.
A16R131	SWP START	5-21	Sets maximum negative sweep ramp voltage.
A17R11	+10VR	5-22	Adjusts +10V reference supply.
A17R43	YTF OFFSET N2	5-29	Adjusts YTF sweep offset in FREQUENCY BAND GHz 3.8–8.5.
A17R50	YTF OFFSET N3	5-29	Adjusts YTF sweep offset in FREQUENCY BAND GHz 5.8–12.9.
A17R57	YTF OFFSET N4	5-29	Adjusts YTF sweep offset in FREQUENCY BAND GHz 8.5–18.
A17R64	YTF OFFSET N5	5-29	Adjusts YTF sweep offset in FREQUENCY BAND GHz 10.5–22.
A17R125	CENTER FREQ OFFSET	5-22	Nulls offset in center frequency analog voltage.
A19R5	YTO OFFSET	5-23	Adjusts YTO lower frequency to 2.05 GHz.
A19R8	YTO GAIN	5-23	Adjusts YTO upper frequency to 4.4 GHz.
A19R14	YTF OFFSET	5-23, 5-29	Adjusts YTF tracking at 2 GHz.
A19R17	YTF GAIN	5-23, 5-29	Adjusts YTF tracking at 10 GHz.
A19R39	YTF LIN 13	5-29	Adjusts YTF tracking at 13 GHz.
A19R42	YTF LIN 16	5-29	Adjusts YTF tracking at 16 GHz.
A19R45	YTF LIN 18	5-29	Adjusts YTF tracking at 18 GHz.
A19R48	YTF LIN 20	5-29	Adjusts YTF tracking at 20 GHz.
A19R51	YTF LIN 22	5-29	Adjusts YTF tracking at 22 GHz.
A20R9	B1B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz .01–1.8.
A20R10	B1C	5-30	Adjusts frequency response compensation slope for upper part of FREQUENCY BAND GHz .01–1.8.
A20R14	B1A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz .01–1.8.
A20R18	B2B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 1.7–4.1

Table 5-1. Adjustable Components (3 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A20R22	B2A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 1.7–4.1.
A20R26	B3B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 3.8–8.5.
A20R30	B3A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 3.8–8.5.
A20R35	B4C	5-30	Adjusts frequency response compensation slope for upper part of FREQUENCY BAND GHz 5.8–12.9.
A20R36	B4B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 5.8–12.9.
A20R40	B4A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 5.8–12.9.
A20R45	B5C	5-30	Adjusts frequency response compensation slope for upper part of FREQUENCY BAND GHz 5.8–12.9.
A20R46	B5B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 8.5–18.
A20R50	B5A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 8.5–18.
A20R55	B6B	5-30	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 10.5–22.
A20R56	B6C	5-30	Adjusts frequency response compensation slope for upper part of FREQUENCY BAND GHz 10.5–22.
A20R60	B6A	5-30	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 10.5–22.
A20R71	V1	5-28, 5-30	Adjusts mixer diode bias for FREQUENCY BAND GHz 0.1–1.8.
A20R77	V3	5-28, 5-30	Adjusts mixer diode bias for FREQUENCY BAND GHz 3.8–8.5.
A20R85	V4	5-28, 5-30	Adjusts mixer diode bias for FREQUENCY BAND GHz 1.7–4.1 and 5.8–12.9.
A20R95	V5	5-28, 5-30	Adjusts mixer diode bias for FREQUENCY BAND GHz 8.5–18.
A20R105	V6	5-28, 5-30	Adjusts mixer diode bias for FREQUENCY BAND GHz 10.5–22.
A20R119	B7B	5-31	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 12.4–26.5.
A20R123	B7A	5-31	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 12.4–26.5.
A20R127	B8B	5-31	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 21–44.
A20R131	B8A	5-31	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 21–44.
A20R135	B9B	5-31	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 33–71.

Table 5-1. Adjustable Components (4 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A20R139	B9A	5-31	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 33–71.
A20R143	B10B	5-31	Adjusts frequency response compensation slope for FREQUENCY BAND GHz 53–115.
A20R147	B10A	5-31	Adjusts frequency response compensation offset for FREQUENCY BAND GHz 53–115.
A21R52	1 kHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 1 kHz (Option 002 only).
A21R55	3 kHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 3 kHz.
A21R58	10 kHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 10 kHz.
A21R71	300 kHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 300 kHz.
A21R74	1 MHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 1 MHz.
A21R77	3 MHz	5-19	Adjusts IF bandwidth for RESOLUTION BW of 3 MHz.
A21R92	OFFSET	5-17	Nulls offset generated in A22 Log Amplifier Assembly.
A21R132	OFFSET 2	5-17	Nulls offset generated in A22 Log Amplifier Assembly.
A22R10	OFFSET	5-18	Adjusts –8V temperature compensated supply.
A22R21	TC		Adjusts gain of +1V supply to provide temperature compensation for log mode temperature controlled variable gain amplifier. (Factory adjustable only.)
A22R23	SLOPE	5-18	Adjusts gain of log mode temperature controlled variable gain amplifier.
A22R27	G6	5-18	Adjusts combined gain of 2nd and 3rd stages in linear mode.
A22R30	G5	5-18	Adjusts gain of 4th stage in linear mode.
A22R33	G4	5-18	Adjusts gain of 5th stage in linear mode.
A22R34	LIN	5-18	Adjusts combined gain of 6th and 7th stages in linear mode.
A22R39	–10 dB	5-18	Adjusts shape of log fidelity curve at –10 dB.
A22R69	–30 dB	5-18	Adjusts shape of log fidelity curve at –30 dB.
A22R88	1 VT		Adjusts voltage at A22TP1 for approximately +1V. (Factory adjustable only.)
A22R121	LOG GAIN	5-18	Adjusts dc offset circuitry at output of A22 Log Amplifier Assembly for 10 dB steps in log mode.
A23C15	SYM	5-19	Adjusts symmetry of first stage of crystal bandwidth filter.
A23C23	LC CTR	5-19	Adjusts centering of first stage of LC bandwidth filter.
A23C25	CTR	5-19	Adjusts centering of first stage of crystal bandwidth filter.
A23C38	SYM	5-19	Adjusts symmetry of second stage of crystal bandwidth filter.
A23C45	LC CTR	5-19	Adjusts centering of second stage of LC bandwidth filter.
A23C54	CTR	5-19	Adjusts centering of second stage of crystal bandwidth filter.
A23C73	LC DIP	5-19	Compensates for capacitance of CR3.
A23C74	LC DIP	5-19	Compensates for capacitance of CR11.
A23R26	LC	5-19	Adjusts feedback in LC circuit of bandpass filter.
A23R31	XTAL	5-19	Adjusts feedback in crystal circuit of bandpass filter.
A24C35	F_0 100 Hz BW	5-19	Sets frequency of 18.4 MHz oscillator (standard instrument only).

Table 5-1. Adjustable Components (5 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A24R1	40 dB	5-20	Adjusts gain of 15-dB amplifier stage.
A24R2	20 dB	5-20	Adjusts gain of 3-dB amplifier stage (standard) or 20-dB amplifier stage (Option 002).
A24R3	10 dB	5-20	Adjusts gain of 10-dB amplifier stage.
A24R4	RF GAIN	5-20	Sets output level of IF Section for maximum RF input level.
A24R5	0 dB	5-20	Adjusted to calibrate 0 dB position of REFERENCE LEVEL FINE control.
A24R6	−12 dB	5-20	Adjusted to calibrate −12 dB position of REFERENCE LEVEL FINE control.
A25C24	LO NULL	5-19	Nulls fundamental and harmonics of 18.4 MHz oscillator in 21.4 MHz signal path. (Standard instrument only.)
A25R20	DC GAIN	5-19	Sets amplitude of 1 kHz, .3 kHz, and .1 kHz RESOLUTION BW to agree with 1 MHz amplitude. (Standard instrument only.)
A26C2	SYM	5-19	SYM adjusts shape of filter skirts. CTR optimizes centering and minimizes amplitude of filter shape. (Standard instrument only.)
A26C3	CTR	5-19	
A26C12	SYM	5-19	
A26C13	CTR	5-19	
A26C19	SYM	5-19	
A26C20	CTR	5-19	
A26C25	SYM	5-19	
A26C26	CTR	5-19	
A26C32	SYM	5-19	
A26C33	CTR	5-19	
A26C53	100 Hz GAIN	5-19	Sets gain of 100 Hz RESOLUTION BW.
A27C15	SYM	5-19	Adjusts symmetry of first stage of crystal bandwidth filter.
A27C23	LC CTR	5-19	Adjusts centering of first stage of LC bandwidth filter.
A27C25	CTR	5-19	Adjusts centering of first stage of crystal bandwidth filter.
A27C38	SYM	5-19	Adjusts symmetry of second stage of crystal bandwidth filter.
A27C45	LC CTR	5-19	Adjusts centering of second stage of LC bandwidth filter.
A27C54	CTR	5-19	Adjusts centering of second stage of crystal bandwidth filter.
A27C73	LC DIP	5-19	Compensates for capacitance of CR3.
A27C74	LC DIP	5-19	Compensates for capacitance of CR11.
A27R26	LC	5-19	Adjusts feedback in LC circuit of bandpass filter.
A27R31	XTAL	5-19	Adjusts feedback in crystal circuit of bandpass filter.
A28R7	PIN RES	5-30	Compensates for variations in PIN diode resistance.
A35C1	C1	5-24	Adjusts bandpass of 2050 MHz bandpass filter.
A35C2	C2	5-24	Adjusts bandpass of 2050 MHz bandpass filter.
A35C3	C3	5-24	Adjusts bandpass of 2050 MHz bandpass filter.
A35C4	2ND LO FREQUENCY	5-24	Adjusts second LO frequency of 1728.60 MHz.

Table 5-1. Adjustable Components (6 of 6)

Reference Designator	Adjustment Name	Adjustment Paragraph	Description
A35L5	2ND MIXER MATCH	5-24	Adjusts for optimum match between second converter output and third converter input.
A36A2C2	1.3 MHz NULL	5-27	Adjusted to balance out stray capacitance.
A36A2C3	LINEARITY	5-27	Adjusted for linear frequency change with linear sweep input.
A37C1	321.4 MHz BP ADJUST	5-25	Adjusts bandpass of 321.4 MHz bandpass filter.
A37C2	321.4 MHz BP ADJUST	5-25	Adjusts bandpass of 321.4 MHz bandpass filter.
A37C3	321.4 MHz BP ADJUST	5-25	Adjusts bandpass of 321.4 MHz bandpass filter.
A37C4	321.4 MHz BP ADJUST	5-25	Adjusts bandpass of 321.4 MHz bandpass filter.
A37C5	300 MHz BP ADJUST	5-25	Adjusts bandpass of 300 MHz bandpass filter.
A37C6	300 MHz BP ADJUST	5-25	Adjusts bandpass of 300 MHz bandpass filter.
A37A3L4	OSC PEAK	5-25	Peaks 100 MHz crystal oscillator.
A37A2R27	CAL OUT LEVEL	5-25	Adjusts 100 MHz CAL OUT to −10 dBm power out.
A40A2R17	+15VR ADJ	5-12	Adjusts +15V power supply.
A42A1C4	OSC PEAK	5-33	Adjusts resonant frequency of output tank circuit of 100 MHz crystal oscillator (Option 001).
A42A1C5	FREQ	5-33	Fine-tunes frequency of 100 MHz crystal oscillator (Option 001).
A42A1C15	OUTPUT MATCH	5-33	Adjusts output tank circuit of comb generator power amplifier for match to Step Recovery Diode Module (Option 001).

Table 5-2. Related Adjustments (1 of 2)

Assembly Replaced or Repaired	Perform the Following Related Adjustments	Para. No.
A1 Front Panel Display	No related adjustments	
A2A1 Front Switch	Absolute Amplitude Calibration	5-32
A2A2 Frequency Display	No related adjustments	
A2A3 Tuning	YIG Driver Adjustment	5-23
A2A4 Rear Switch	No related adjustments	
A3 Display Adjust	Front-panel adjustments only	
A4 Z Axis Assembly	Z Axis Adjustments Digital Storage Adjustments Horizontal and Vertical Gain Adjustments	5-14 5-16 5-17
A5 X-Y Amplifier	Digital Storage Adjustments Horizontal and Vertical Gain Adjustments	5-16 5-17
A6 High Voltage Power Supply	High Voltage Power Supply Adjustment Z Axis Adjustment	5-13 5-14
A7 Input/Output	No related adjustments	
A8 Microprocessor	No related adjustments	
A9 Data Converter	Digital Storage Adjustments	5-16
A10 Display Motherboard	No related adjustments	
A11 DVM Digital	No related adjustments	
A12 DVM Analog	+10V Reference and Digital Readout Adjustments	5-22
A13 Relay Driver	No related adjustments	
A14 Tuning Stabilizer Control	Tuning Stabilizer Control Adjustments	5-27
A15 Sweep Attenuator	Sweep Attenuator Adjustment	5-26
A16 Sweep Generator	Sweep Generator Adjustments	5-21
A17 Frequency Control	+10V Reference and Digital Readout Adjustments YIG Driver Adjustment	5-22 5-23
A18 Full Multiband	No related adjustments	
A19 YIG Driver	YIG Driver Adjustment	5-23
A20 Bias	Preliminary Bias Adjustment Frequency Response Adjustments	5-28 5-30
A21 Video 100 Hz	Digital Storage Adjustments Video Offset Adjustment Bandwidth Filter Adjustments	5-16 5-17 5-19
A21 Video (Opt. 002)	Digital Storage Adjustments Video Offset Adjustment Bandwidth Filter Adjustments	5-16 5-17 5-19
A22 Log Amplifier	Log Amplifier Adjustments	5-18
A23 Bandwidth Filter No. 2	Video Offset Adjustment Bandwidth Filter Adjustments	5-17 5-19
A24 Step Gain Amplifier/Oscillator	Step Gain Adjustments	5-20
A24 Step Gain Amplifier (Opt. 002)	Step Gain Adjustments	5-20

Table 5-2. Related Adjustments (2 of 2)

Assembly Replaced or Repaired	Perform the Following Related Adjustments	Para. No.
A25 Up-Down Converter	Bandwidth Filter Adjustments Step Gain Adjustments	5-19 5-20
A26 3 MHz Filter	Bandwidth Filter Adjustments	5-19
A27 Bandwidth Filter No. 1	Video Offset Adjustment Bandwidth Filter Adjustments	5-17 5-19
A28 Variable Gain	Frequency Response Adjustments Absolute Amplitude Calibration	5-30 5-32
A29 RF-IF Motherboard	No related adjustments	
A30 First Mixer	Preliminary Bias Adjustment Frequency Response Adjustments Absolute Amplitude Calibration	5-28 5-30 5-32
A31 YIG-Tuned Oscillator	YIG Driver Adjustment	5-23
A32 YIG-Tuned Filter	YIG Driver Adjustment YTF Tracking Adjustment	5-23 5-29
A33 Limiter	No related adjustments	
A34 RF Attenuator	No related adjustments	
A35 Second Converter	Second Converter Adjustment	5-24
A36 Tuning Stabilizer	Tuning Stabilizer Control Adjustments	5-27
A37 Third Converter	Third Converter Adjustment	5-25
A40 Power Supply	Low Voltage Power Supply Check and Adjustment	5-12
A41 Line Module and Cable Assembly	Low Voltage Power Supply Check and Adjustment	5-12
A42 Comb Generator (Opt. 001)	Comb Generator Adjustment	5-33
A43 HP-IB Connector	No related adjustments	

Table 5-3. Factory-Selected Components (1 of 3)

Reference Designator	Adjustment Paragraph	Basis of Selection
A5R23	5-17	Increases range of A5R25 VERT GAIN.
A5R62	5-17	Increases range of A5R64 HORIZ GAIN.
A12C23	5-22	Adjusts zero-crossing linearity of FREQUENCY GHz readout.
A12R52	5-22	Shifts range of A12R53 HYST.
A14C19	5-27	Selects cutoff frequency of 16-kHz low-pass filter in Tickler Coil Driver.
A17R9	5-22	Shifts range of A17R11 +10VR for +10V at A17TP1.
A19R37	5-29	Selects frequency at which A19R39 YTF LIN 13 begins to take effect.
A19R40	5-29	Selects frequency at which A19R42 YTF LIN 16 begins to take effect.
A19R43	5-29	Selects frequency at which A19R45 YTF LIN 18 begins to take effect.
A19R46	5-29	Selects frequency at which A19R48 YTF LIN 20 begins to take effect.
A19R49	5-29	Selects frequency at which A19R51 YTF LIN 22 begins to take effect.
A20R76	5-30	Minimizes peak-to-peak ripple variation of frequency response for FREQUENCY BAND GHz .01–1.8.
A20R90	5-30	Minimizes peak-to-peak ripple variation of frequency response for FREQUENCY BAND GHz 1.7–4.1 and 5.8–12.9.
A20R100	5-30	Minimizes peak-to-peak ripple variation of frequency response for FREQUENCY BAND GHz 8.5–18.
A20R110	5-30	Minimizes peak-to-peak ripple variation of frequency response for FREQUENCY BAND GHz 10.5–22.
A23C16	5-19	Shifts range of A23C23.
A23C20	5-19	Shifts range of A23C23.
A23C43	5-19	Shifts range of A23C45.
A23C64	5-19	Shifts range of A23C45.
A23R3	5-20	Selects gain of 10-dB Input Buffer Amplifier.
A23R7	5-19	Selected to divide input signal equally between crystal and LC paths.
A23R19	5-19	Selects correct IF bandwidth for RESOLUTION BW of 100 kHz.
A23R23	5-19	Selects correct IF bandwidth for RESOLUTION BW of 30 kHz.
A23R24	5-19	Increases range of A23R26 LC.
A23R25	5-19	Increases range of A23R26 LC.
A23R32	5-19	Shifts range of A23R26 LC.
A23R43	5-19	Selects correct IF bandwidth for RESOLUTION BW of 100 kHz.
A23R48	5-19	Selects correct IF bandwidth for RESOLUTION BW of 30 kHz.
A23R56	5-19	Selected to equalize feedback between LC stages.
A24C25	5-19	Selects center frequency of 21.4-MHz Bandpass Filter.
A24C34	5-19	Shifts range of A24C35 F_0 100 Hz BW.
A24L11	5-19	Adjusts frequency of 18.4-MHz Oscillator to match frequency of crystal A24Y1.
A24R55	5-19	Adjusts power level of 18.4-MHz Oscillator.
A25R23	5-19	Matches impedance of mixer output to impedance of crystal pole.
A25R48	5-19	Shifts range of A25R20 DC GAIN.
A26R7	5-19	Selects correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R9	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R10	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.

Table 5-3. Factory-Selected Components (2 of 3)

Reference Designator	Adjustment Paragraph	Basis of Selection
A26R17	5-19	Selects correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R18	5-19	Selects correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R19	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R20	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R27	5-19	Selects correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R28	5-19	Selects correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R29	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R30	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R36	5-19	Selects correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R37	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R39	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R40	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R45	5-19	Selects correct IF bandwidth for RESOLUTION BW of .1 kHz.
A26R46	5-19	Selects correct IF bandwidth for RESOLUTION BW of .3 kHz.
A26R48	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R49	5-19	Selects correct IF bandwidth for RESOLUTION BW of 1 kHz.
A26R54	5-19	Selected for equal amplitudes of .3 kHz and 1 kHz RESOLUTION BW.
A26R64	5-19	Selects correct IF bandwidth for RESOLUTION BW of .1 kHz.
A27C16	5-19	Shifts range of A27C23.
A27C20	5-19	Shifts range of A27C23.
A27C43	5-19	Shifts range of A27C45.
A27C64	5-19	Shifts range of A27C45.
A27R3	5-20	Selects gain of 10-dB Input Buffer Amplifier.
A27R7	5-19	Selected to divide input signal equally between crystal and LC paths.
A27R19	5-19	Selects correct IF bandwidth for RESOLUTION BW of 100 kHz.
A27R23	5-19	Selects correct IF bandwidth for RESOLUTION BW of 30 kHz.
A27R24	5-19	Increases range of A27R26 LC.
A27R25	5-19	Increases range of A27R26 LC.
A27R32	5-19	Shifts range of A27R26 LC.
A27R43	5-19	Selects correct IF bandwidth for RESOLUTION BW of 100 kHz.
A27R48	5-19	Selects correct IF bandwidth for RESOLUTION BW of 30 kHz.
A27R56	5-19	Selected to equalize feedback between LC stages.
A28R2	5-32	Shifts range of A2A1R9 REF LEVEL CAL.
A28R6	5-19	Shifts range of A28R7 PIN RES.
A28R19	5-30	Selects correct gain compensation of FREQUENCY BAND GHz 5.8–12.9.
A28R21	5-30	Selects correct gain compensation of FREQUENCY BAND GHz 5.8–12.9.
A28R23	5-30	Selects correct gain compensation of FREQUENCY BAND GHz 10.5–22.
A28R32		Minimizes distortion (not field-selectable).
A28R33		Minimizes distortion (not field-selectable).
A36A1C12		Corrects sensitivity error of differential comparator (not field-selectable).
A36A1R14		Corrects sensitivity error of differential comparator (not field-selectable).
A36A2C8	5-27	Shifts range of A36A2C16 1 MHz PEAK.

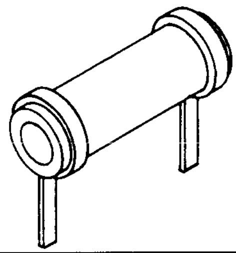
Table 5-3. Factory-Selected Components (3 of 3)

Reference Designator	Adjustment Paragraph	Basis of Selection
A36A2C18	5-27	Shifts range of A36A2C16 1 MHz PEAK.
A36A2R26	5-27	Sets gain of 1 MHz oscillator.
A36A2R27	5-27	Selects correct 1 MHz oscillator gain.
A42A1L3	5-33	Increases range of A42A1C5 FREQ.
A42A1R6	5-33	Sets output power of Comb Generator (Option 001).

Table 5-4. HP Part Numbers of Standard Value Replacement Components (1 of 3)

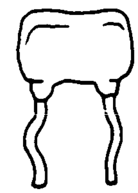
CAPACITORS

RANGE: 1 to 24 pF
TYPE: Tubular
TOLERANCE:
1 to 9.1 pF = ±.25 pF
10 to 24 pF = ±5%



Value (pF)	HP Part Number	C D
1.0	0160-2236	8
1.2	0160-2237	9
1.5	0150-0091	8
1.8	0160-2239	1
2.0	0160-2240	4
2.2	0160-2241	5
2.4	0160-2242	6
2.7	0160-2243	7
3.0	0160-2244	8
3.3	0150-0059	8
3.6	0160-2246	0
3.9	0160-2247	1
4.3	0160-2248	2
4.7	0160-2249	3
5.1	0160-2250	6
5.6	0160-2251	7
6.2	0160-2252	8
6.8	0160-2253	9
7.5	0160-2254	0
8.2	0160-2255	1
9.1	0160-2256	2
10.0	0160-2257	3
11.0	0160-2258	4
12.0	0160-2259	5
13.0	0160-2260	8
15.0	0160-2261	9
16.0	0160-2262	0
18.0	0160-2263	1
20.0	0160-2264	2
22.0	0160-2265	3
24.0	0160-2266	4

RANGE: 27 to 680 pF
TYPE: Dipped Mica
TOLERANCE: ±5%



Value (pF)	HP Part Number	C D
27	0160-2306	3
30	0160-2199	2
33	0160-2150	5
36	0160-2308	5
39	0140-0190	7
43	0160-2200	6
47	0160-2307	4
51	0160-2201	7
56	0140-0191	8
62	0140-0205	5
68	0140-0192	9
75	0160-2202	8
82	0140-0193	0
91	0160-2203	9
100	0160-2204	0
110	0140-0194	1
120	0160-2205	1
130	0140-0195	2
150	0140-0196	3
160	0160-2206	2
180	0140-0197	4
200	0140-0198	5
220	0160-0134	1
240	0140-0199	6
270	0140-0210	2
300	0160-2207	3
330	0160-2208	4
360	0160-2209	5
390	0140-0200	0
430	0160-0939	4
470	0160-3533	0
510	0160-3534	1
560	0160-3535	2
620	0160-3536	3
680	0160-3537	4

Table 5-4. HP Part Numbers of Standard Value Replacement Components (2 of 3)

RESISTORS

RANGE: 10 to 464K Ohms
TYPE: Fixed-Film
WATTAGE: .125 at 125°C
TOLERANCE: ±1.0%

Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0346	2	464	0698-0082	7	21.5K	0757-0199	3
11.0	0757-0378	0	511	0757-0416	7	23.7K	0698-3158	4
12.1	0757-0379	1	562	0757-0417	8	26.1K	0698-3159	5
13.3	0698-3427	0	619	0757-0418	9	28.7K	0698-3449	6
14.7	0698-3428	1	681	0757-0419	0	31.6K	0698-3160	8
16.2	0757-0382	6	750	0757-0420	3	34.8K	0757-0123	3
17.8	0757-0294	9	825	0757-0421	4	38.3K	0698-3161	9
19.6	0698-3429	2	909	0757-0422	5	42.2K	0698-3450	9
21.5	0698-3430	5	1.0K	0757-0280	3	46.4K	0698-3162	0
23.7	0698-3431	6	1.1K	0757-0424	7	51.1K	0757-0458	7
26.1	0698-3432	7	1.21K	0757-0274	5	56.2K	0757-0459	8
28.7	0698-3433	8	1.33K	0757-0317	7	61.9K	0757-0460	1
31.6	0757-0180	2	1.47K	0757-1094	9	68.1K	0757-0461	2
34.8	0698-3434	9	1.62K	0757-0428	1	75.0K	0757-0462	3
38.3	0698-3435	0	1.78K	0757-0278	9	82.5K	0757-0463	4
42.2	0757-0316	6	1.96K	0698-0083	8	90.9K	0757-0464	5
46.4	0698-4037	0	2.15K	0698-0084	9	100K	0757-0465	6
51.1	0757-0394	0	2.37K	0698-3150	6	110K	0757-0466	7
56.2	0757-0395	1	2.61K	0698-0085	0	121K	0757-0467	8
61.9	0757-0276	7	2.87K	0698-3151	7	133K	0698-3451	0
68.1	0757-0397	3	3.16K	0757-0279	0	147K	0698-3452	1
75.0	0757-0398	4	3.48K	0698-3152	8	162K	0757-0470	3
82.5	0757-0399	5	3.83K	0698-3153	9	178K	0698-3243	8
90.0	0757-0400	9	4.22K	0698-3154	0	196K	0698-3453	2
100	0757-0401	0	4.64K	0698-3155	1	215K	0698-3454	3
110	0757-0402	1	5.11K	0757-0438	3	237K	0698-3266	5
121	0757-0403	2	5.62K	0757-0200	7	261K	0698-3455	4
133	0698-3437	2	6.19K	0757-0290	5	287K	0698-3456	5
147	0698-3438	3	6.81K	0757-0439	4	316K	0698-3457	6
162	0757-0405	4	7.50K	0757-0440	7	348K	0698-3458	7
178	0698-3439	4	8.25K	0757-0441	8	383K	0698-3459	8
196	0698-3440	7	9.09K	0757-0288	1	422K	0698-3460	1
215	0698-3441	8	10.0K	0757-0442	9	464K	0698-3260	9
237	0698-3442	9	11.0K	0757-0443	0			
261	0698-3132	4	12.1K	0757-0444	1			
287	0698-3443	0	13.3K	0757-0289	2			
316	0698-3444	1	14.7K	0698-3156	2			
348	0698-3445	2	16.2K	0757-0447	4			
383	0698-3446	3	17.8K	0698-3136	8			
422	0698-3447	4	19.6K	0698-3157	3			

Table 5-4. HP Part Numbers of Standard Value Replacement Components (3 of 3)

RESISTORS

RANGE: 10 to 1.47M Ohms
TYPE: Fixed-Film
WATTAGE: .5 at 125°C
TOLERANCE: ±1%

Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D	Value (Ω)	HP Part Number	C D
10.0	0757-0984	4	215	0698-3401	0	4.64K	0698-3348	4	110K	0757-0859	2
11.0	0575-0985	5	237	0698-3102	8	5.11K	0757-0833	2	121K	0757-0860	5
12.1	0757-0986	6	261	0757-1090	5	5.62K	0757-0834	3	133K	0757-0310	0
13.3	0757-0001	6	287	0757-1092	7	6.19K	0757-0196	0	147K	0698-3175	5
14.7	0698-3388	2	316	0698-3402	1	6.81K	0757-0835	4	162K	0757-0130	2
16.2	0757-0989	9	348	0698-3403	2	7.50K	0757-0836	5	178K	0757-0129	9
17.8	0698-3389	3	383	0698-3404	3	8.25K	0757-0837	6	196K	0757-0063	0
19.6	0698-3390	6	422	0698-3405	4	9.09K	0757-0838	7	215K	0757-0127	7
21.5	0698-3391	7	464	0698-0090	7	10.0K	0757-0839	8	237K	0698-3424	7
23.7	0698-3392	8	511	0757-0814	9	12.1K	0757-0841	2	261K	0757-0064	1
26.1	0757-0003	8	562	0757-0815	0	13.3K	0698-3413	4	287K	0757-0154	0
28.7	0698-3393	9	619	0757-0158	4	14.7K	0698-3414	5	316K	0698-3425	8
31.6	0698-3394	0	681	0757-0816	1	16.2K	0757-0844	5	348K	0757-0195	9
34.8	0698-3395	1	750	0757-0817	2	17.8K	0698-0025	8	383K	0757-0133	5
38.3	0698-3396	2	825	0757-0818	3	19.6K	0698-3415	6	422K	0757-0134	6
42.2	0698-3397	3	909	0757-0819	4	21.5K	0698-3416	7	464K	0698-3426	9
46.4	0698-3398	4	1.00K	0757-0159	5	23.7K	0698-3417	8	511K	0757-0135	7
51.1	0757-1000	7	1.10K	0757-0820	7	26.1K	0698-3418	9	562K	0757-0868	3
56.2	0757-1001	8	1.21K	0757-0821	8	28.7K	0698-3103	9	619K	0757-0136	8
61.9	0757-1002	9	1.33K	0698-3406	5	31.6K	0698-3419	0	681K	0757-0869	4
68.1	0757-0794	4	1.47K	0757-1078	9	34.8K	0698-3420	3	750K	0757-0137	9
75.0	0757-0795	5	1.62K	0757-0873	0	38.3K	0698-3421	4	825K	0757-0870	7
82.5	0757-0796	6	1.78K	0698-0089	4	42.2K	0698-3422	5	909K	0757-0138	0
90.0	0757-0797	7	1.96K	0698-3407	6	46.4K	0698-3423	6	1M	0757-0059	4
100	0757-0198	2	2.15K	0698-3408	7	51.1K	0757-0853	6	1.1M	0757-0139	1
110	0757-0798	8	2.37K	0698-3409	8	56.2K	0757-0854	7	1.21M	0757-0871	8
121	0757-0799	9	2.61K	0698-0024	7	61.9K	0757-0309	7	1.33M	0757-0194	8
133	0698-3399	5	2.87K	0698-3101	7	68.1K	0757-0855	8	1.47M	0698-3464	5
147	0698-3400	9	3.16K	0698-3410	1	75.0K	0757-0856	9			
162	0757-0802	5	3.48K	0698-3411	2	82.5K	0757-0857	0			
178	0698-3334	8	3.83K	0698-3412	3	90.9K	0757-0858	1			
196	0757-1060	9	4.22K	0698-3346	2	100K	0757-0367	7			

ADJUSTMENTS

5-12. LOW VOLTAGE POWER SUPPLY CHECK AND ADJUSTMENT

REFERENCE:

A40A2 Schematic

DESCRIPTION:

The + 15V supply is adjusted for + 15.000 ±0.005 Vdc, and the remaining low voltage supplies are checked for correct output.

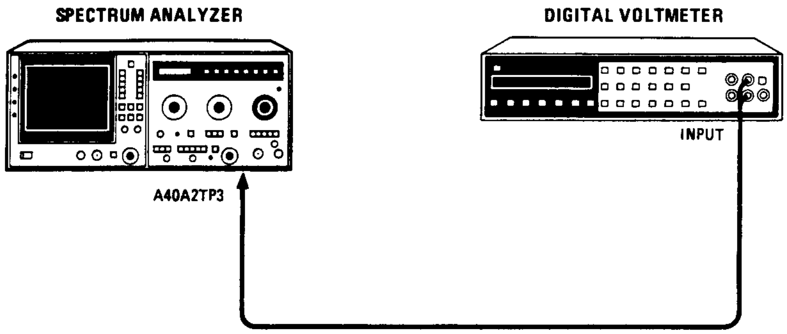


Figure 5-1. Low Voltage Power Supply Check and Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter .... HP 3455A

BOTTOM VIEW

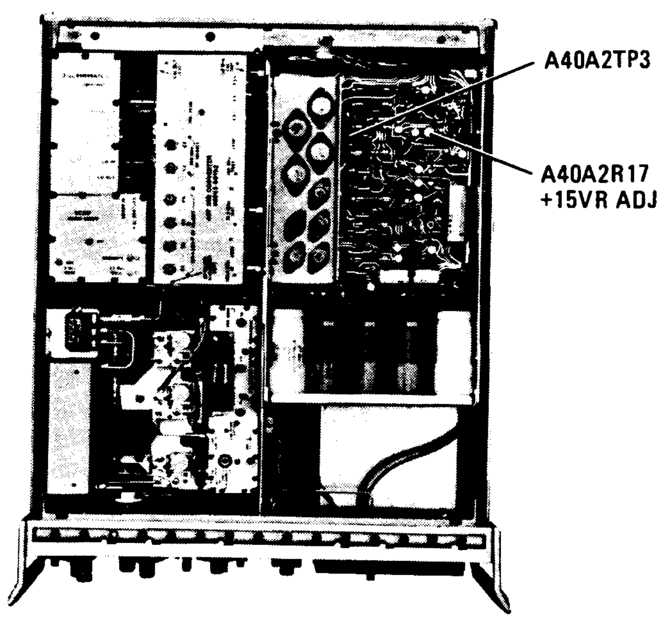


Figure 5-2. A40A2 Adjustment Locations

5-12. LOW VOLTAGE POWER SUPPLY CHECK AND ADJUSTMENT (Cont'd)

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B bottom cover to gain access to low voltage power supplies. Connect equipment as shown in Figure 5-1.
2. Reconnect power cord, set LINE switch ON, and connect digital voltmeter to A40A2TP3.
3. Adjust +15VR ADJ potentiometer A40A2R17 for +15.000 ±0.005 Vdc at A40A2TP3 (Figure 5-2).

WARNING

The following check probes voltages that, if contacted, might cause personal injury.

4. Check power supply voltages listed in Table 5-5.
5. When adjustment and checks are complete, set LINE switch to OFF, disconnect power cord, and replace HP 8569B bottom cover.

Table 5-5. Low Voltage Power Supplies

Test Point	Voltage (Vdc)	Tolerance (Vdc)
TP10	+158	±5.0
TP9	+30	±0.30
TP8	+20	±0.20
TP3	+15	±0.10
TP5	+10	±0.10
TP1	+5.2	±0.05
TP6	−10	±0.10
TP4	−15	±0.10
TP2	−40	±0.4

ADJUSTMENTS

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT

REFERENCE:

A6 Schematic

DESCRIPTION:

A high-voltage probe is required to measure the high-voltage cathode supply to the CRT. The probe accuracy is checked by comparing measurements of the + 158V supply with, and without, the probe in the test setup. Any error is compensated for when the CRT cathode supply voltage is set. The Intensity Limit adjustment is set to limit the CRT control grid voltage and, in effect, to limit the maximum CRT trace intensity.

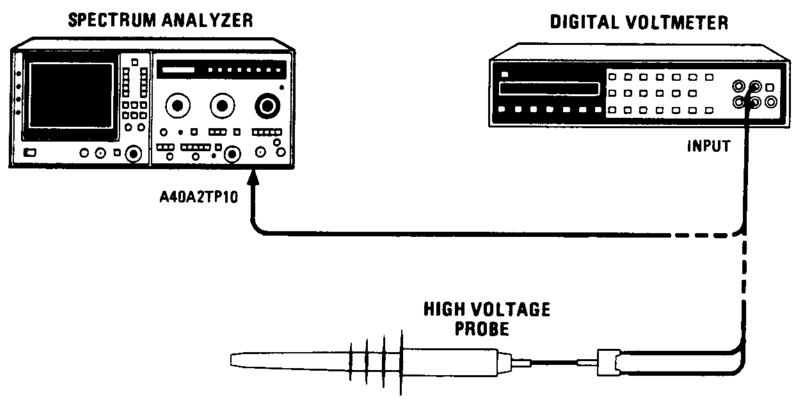


Figure 5-3. High Voltage Power Supply Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter .... HP 3455A
High-Voltage Probe (1000:1 Divider) .... HP 34111A

WARNING

To minimize shock hazard, use a non-metallic screwdriver for adjustments on A6 High Voltage Power Supply Assembly.

WARNING

The following procedure probes voltages that, if contacted, may cause personal injury or death.

ADJUSTMENTS

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

NOTE

Adjustment of A6 High Voltage Power Supply should not be a routine maintenance procedure. Adjustment should be done only when the high-voltage power supply or the CRT is repaired or replaced.

NOTE

If A6 High Voltage Power Supply Assembly, or an adjustable component in the assembly, is replaced, set all adjustments on the replaced assembly to midrange (except A6R18 INT LIM, which should be set fully counterclockwise) before turning the instrument on. If the CRT is replaced, set the front-panel INTENSITY control fully counterclockwise before applying power.

TOP VIEW

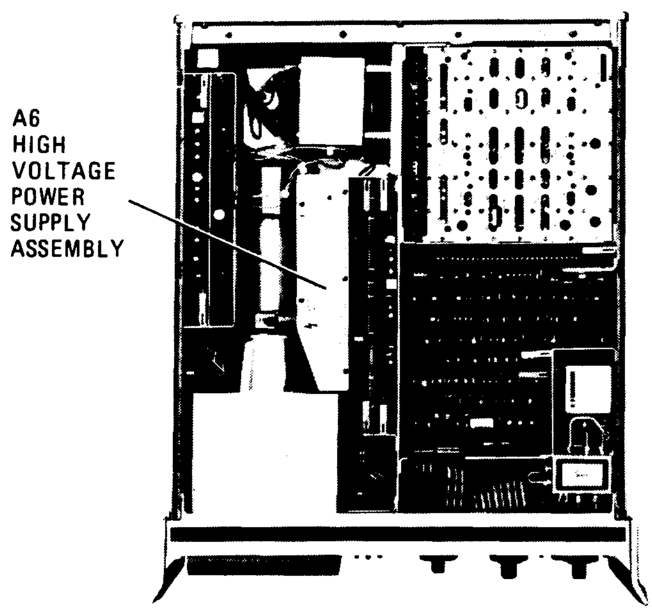


Figure 5-4. High Voltage Power Supply and Oscillator Driver Adjustment Locations

PROCEDURE:

WARNING

After disconnecting the ac line power cord, allow at least 30 seconds for capacitors in the high-voltage power supply to discharge before removing the protective cover of A6 High Voltage Power Supply Assembly.

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top and bottom covers. Remove protective cover of A6 High Voltage Power Supply Assembly.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

2. Remove screw that attaches A6 assembly to cavity. Partly remove board from cavity to read value of voltage written on A6A1 Transformer Assembly. Record this voltage.

WARNING

To prevent permanent damage to the CRT, be prepared to turn off the instrument if a bright spot appears. A6R18 INT LIM must be set fully counterclockwise when a new A6 High Voltage Power Supply Assembly is installed.

3. Reconnect power cord and set LINE switch ON. If a bright spot appears on screen, immediately turn off spectrum analyzer. If bright spot does not appear, set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
INPUT ATTEN	0 dB
REF LEVEL dBm	−10
AMPLITUDE SCALE	LIN
FOCUS	Midrange
INTENSITY	Dim CRT trace
SWEEP SOURCE	MNL

High Voltage Power Supply

4. Calibrate high-voltage probe as follows:

   a. Set digital voltmeter (DVM) to AUTO range, measure output of + 158V supply at A40A2TP10 with standard DVM probe, and record reading. (See Figure 5-3.)

   + ________ Vdc

   b. Connect 1000:1 divider probe to DVM, measure + 158B supply, and record reading.

   + ________ Vdc

   c. Divide reading recorded in step 4a into reading recorded in step 4b. This gives calibration factor of high-voltage probe.

WARNING

High voltage is present at A6TP1.

5. Set DVM to 10V range and measure output of high-voltage cathode power supply at A6TP1 CATH test hole.

6. Adjust A6R4 HV (Figure 5-4) for a reading equal to calibration factor (calculated in step 4c), times voltage recorded in step 2.

5-13. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT (Cont'd)

Focus Limit and Astigmatism

7. Refer to Z Axis Adjustments and adjust focus limit and astigmatism.

Intensity Limit

NOTE

The DVM must have 10 megohms input resistance for correct measurement. If the HP 3455A Digital Voltmeter is used, the 100-volt or the 1000-volt range must be used. Do not use AUTO range.

8. Disconnect 1000:1 divider probe from DVM and connect standard DVM probe. Connect DVM to A4TP5 CONT GATE. Set front-panel INTEN control for a voltage reading of 30.0 ±0.2V. (If voltage at A4TP5 CONT GATE cannot be reduced to +30V, decrease A4R77 MIN INTEN just enough to allow reading of +30 ±0.2V.)

WARNING

This voltage must be set correctly before A6R18 INT LIM is adjusted, or permanent damage to the CRT could result.

9. Adjust A6R18 INT LIM clockwise until a dot is barely visible on CRT. Then adjust A6R18 counterclockwise until dot disappears.

10. Refer to Z Axis Adjustments and (1) readjust focus limit and astigmatism and (2) adjust minimum intensity and intensity gain.

11. Set LINE switch OFF, disconnect power cord, and wait at least 30 seconds before replacing protective cover of A6 High Voltage Power Supply Assembly. Replace HP 8569B top and bottom covers.

ADJUSTMENTS

5-14. Z AXIS ADJUSTMENTS

REFERENCE:

A4, A5, and A6 Schematics

DESCRIPTION:

Internal test routines of the analyzer are used to adjust its astigmatism, dynamic focus, trace alignment, and frequency response.

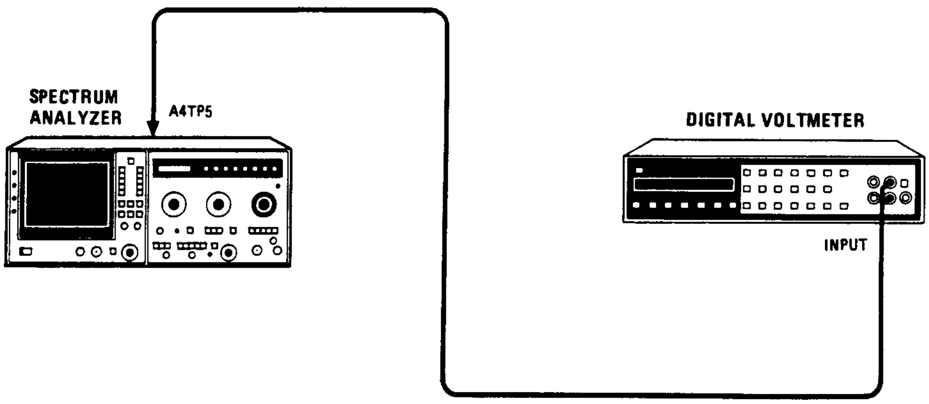


Figure 5-5. Z Axis Adjustment Test Setup

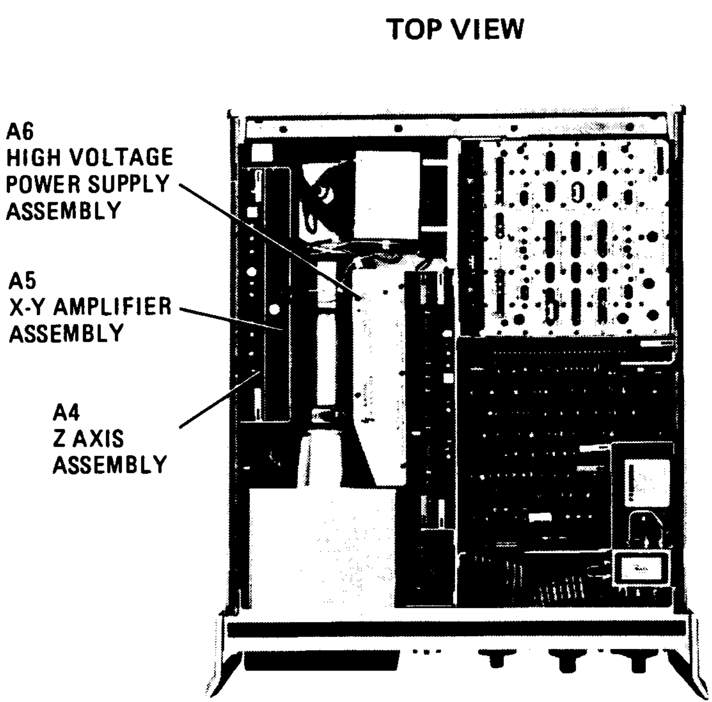


Figure 5-6. Z Axis Adjustment Locations

5-14. Z AXIS ADJUSTMENTS (Cont'd)

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON.

3. With normal (green) settings, set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE VIEW
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	– 10
REFERENCE LEVEL FINE	0
RESOLUTION BW	100 kHz, Coupled
TUNING	0.500 GHz

Focus Limit and Astigmatism

4. Center FOCUS screwdriver adjustment on front panel.

5. Simultaneously press PLOT GRAT and CLEAR/RESET to display test routine #0. (Test routine number is displayed in upper left portion of CRT annotation.)

6. Press PLOT CHAR until test routine #3 is selected. (See Figure 5-7.) This routine displays, in CRT annotation, two rows of X's that are formed by a dot matrix.

7. Set front-panel INTEN control to MAXIMUM. Adjust A4R17 ASTIG and A6R29 FOCUS LIMIT for sharpest dots at center of displayed annotation.

Dynamic Focus

8. Decrease intensity until characters are dim but visible. Adjust A5R91 X DYN FOCUS for sharpest dots at left and right edges of CRT annotation.

9. Adjust A4R30 INTEN DYN FOCUS for sharpest dots displayed throughout displayed annotation.

Z Axis Frequency Response

10. Adjust A4C6 HF TRIM and A4R26 HF GAIN for most uniform intensity of characters.

11. Return front-panel INTEN control to blue region.

Pattern and Trace Align

12. Press PLOT CHAR to select test routine #4. Observe horizontal and vertical lines that trace perimeter of CRT display.

5-14. Z AXIS ADJUSTMENTS (Cont'd)

13. Adjust front panel TRACE ALIGN screwdriver adjustment to align both horizontal lines for best match to graticule perimeter.

14. Adjust A4R16 PATTERN so that both horizontal and vertical traces have minimal curvature.

15. Repeat steps 7 through 14 until no further adjustment is necessary.

Minimum Intensity and Intensity Gain

NOTE

With INTEN control fully counterclockwise, the CRT trace should not turn off completely. This prolongs the life of the CRT. The following procedure adjusts for the best trace and character intensities for any INTEN setting.

16. Set normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
AMPLITUDE SCALE	LIN
SWEEP TIME/DIV	2 μSEC
SCALE INTEN	Full counterclockwise
INTEN	Full counterclockwise

17. Adjust A4R77 MIN INTEN potentiometer counterclockwise until trace disappears; then adjust clockwise until trace is barely visible.

18. Set SWEEP SOURCE to MNL. Set MANUAL SWEEP control fully counterclockwise until dot is off screen.

19. Connect voltmeter to A4TP5 CONT GATE (Figure 5-5). Gradually increase INTEN control to fully clockwise position. Voltage should not exceed +70V. Adjust A4R4 INTEN GAIN for a voltmeter reading of +70.0 ±0.2V.

20. Disconnect voltmeter from A4TP5. Adjust INTEN and SCALE INTEN to blue region.

Intensity Balance and Offset

21. Set TRACE A to WRITE and TRACE B to STORE VIEW. Simultaneously press PLOT GRAT and CLEAR/RESET to display test routine #0.

22. Press PLOT CHAR to view test routine #1. Observe displayed strokes in right half of CRT display. Both long and short strokes are displayed. Short strokes are above inverted 'V' and long strokes are below inverted 'V'. (See Figure 5-8.) If inverted 'V' is not symmetrical, refer to Stroke Generator adjustment.

23. Adjust A4R60 INTEN BAL for uniform intensity on right and left sides above inverted 'V'.

5-14. Z AXIS ADJUSTMENTS (Cont'd)

24. Adjust A4R81 INTEN OFFSET for uniform intensity above and below inverted 'V'.

25. If A4R81 does not adjust for uniform intensity, repeat steps 16 through 24.

26. Set LINE switch OFF, disconnect power cord, and replace HP 8569B top cover.

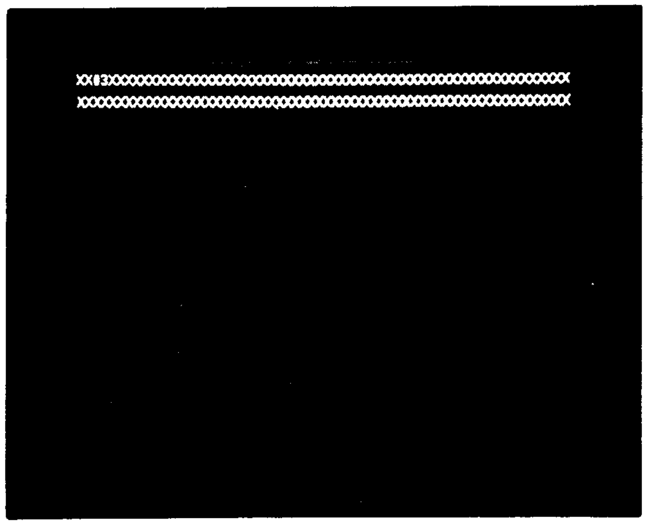


Figure 5-7. CRT Display of Test Routine #3

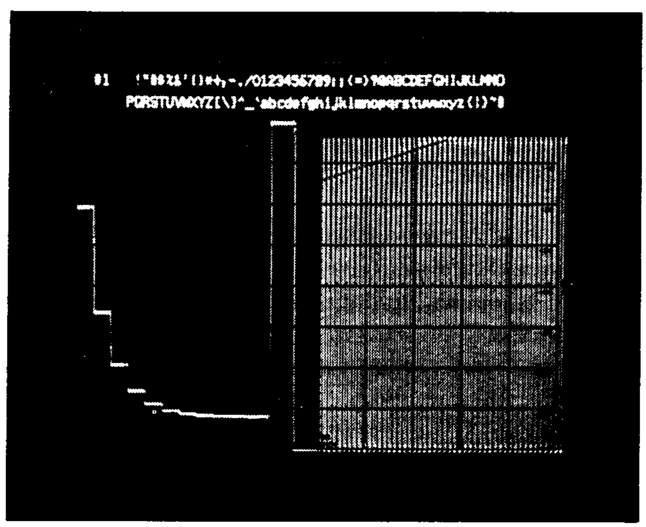


Figure 5-8. CRT Display of Test Routine #1

5-15. DIGITAL STORAGE TEST ROUTINES

Nine test routines are contained in the firmware of the HP 8569B. These are used to adjust, to verify correct operation of, and to troubleshoot the digital storage circuitry.

Test routines can be accessed in two ways. In the usual method, press and hold the PLOT GRAT push button, momentarily press the CLEAR/RESET push button, then release PLOT GRAT. In the other method, turn the instrument off, press and hold PLOT GRAT, turn instrument on, and release PLOT GRAT. In the latter method, less hardware and firmware needs to be functioning; therefore, it works for some malfunctions in which the first method fails to access the test routines.

In test routines #0 and #4, a four-character code, displayed in the upper right-hand corner of the CRT, represents the current revision to each of the four program ROMs.

The test routines are numbered from #0 through #8 in the upper left-hand corner of the CRT. To view the output of the test routines, set both TRACE A and TRACE B to WRITE. To enter and exit the test routines, proceed as follows:

1. Access test routine #0 by either of the methods in the preceding description.
2. To select test routines #1 through #5, momentarily press PLOT CHAR to step through these tests in sequence.
3. To select test routines #6 through #8, momentarily press PLOT TRACE to step through these tests in sequence.
4. To exit the test routine mode, either press CLEAR/RESET or turn the instrument off, then on.

Display Adjust Line Test Pattern

Test routine #0 (Figure 5-9) is used for the following front-panel adjustments:

- TRACE ALIGN
- HORIZ POSN
- VERT POSN

A somewhat different display output pattern in test routine #4 also may be used for these adjustments.

The trace is generated from fixed values in memory that correspond to the top horizontal graticule line and the vertical centerline. When trace alignment and position adjustments are properly made, the generated horizontal line should be displayed over the top horizontal graticule line, and the center tick mark should be positioned over the vertical centerline etched on the CRT. This matches the center of the top horizontal graticule line with the corresponding position sent through the Hewlett-Packard Interface Bus (HP-IB) to the plotter.

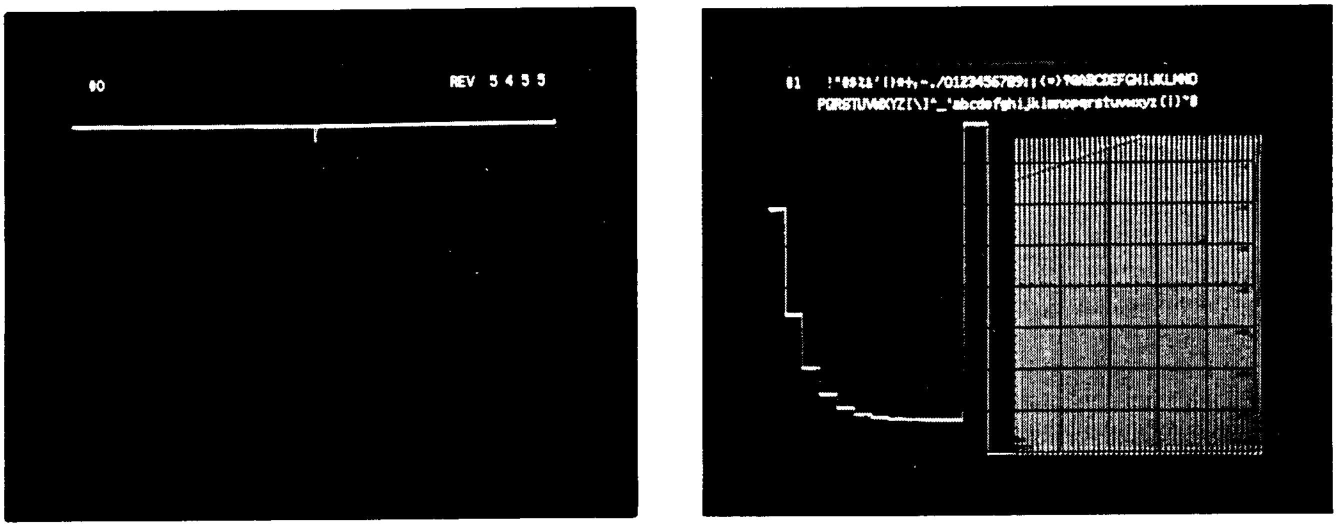
Stroke Generator Test Pattern

Test routine #1 (Figure 5-9) is used for the following adjustments:

- INTEN BAL (A4R60)
- MIN INTEN (A4R77)
- INTEN OFFSET (A4R81)
- STROKE-FB (A9R59)
- STROKE GAIN (A9R62)

ADJUSTMENTS

5-15. DIGITAL STORAGE TEST ROUTINES (Cont'd)



TEST ROUTINE #0

TEST ROUTINE #1

Figure 5-9. Test Routines #0 and #1

The character display verifies operation of the character ROM and associated circuitry. The full ASCII character set is displayed.

The stairstep display verifies operation of the output digital-to-analog converter (DAC). Eleven levels should be seen; these correspond to 512, 256, 128, 64, 32, 16, 8, 4, 2, 1, and 0. The transitions to the last two levels are difficult to see on the CRT trace. Note that the levels have been offset by 128 to position all of them within the graticule area.

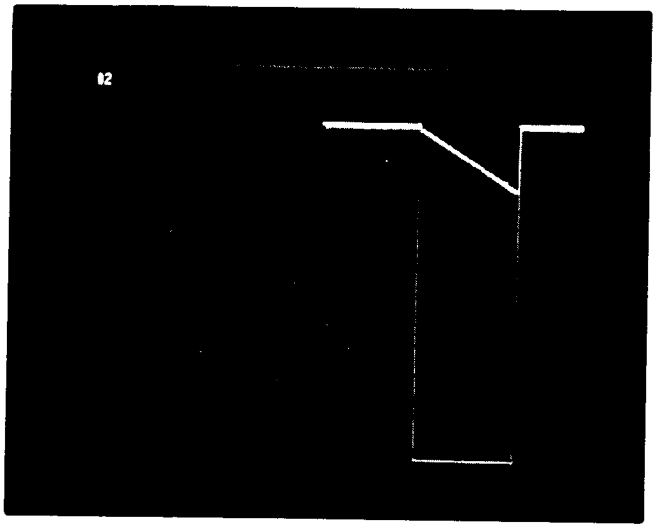
The square wave is used to adjust and verify the operation of the stroke generator; there should be no more than a minimal overshoot or undershoot. Note that the overshoot or undershoot appears at the right-hand edge of the square wave rather than at the usual left-hand edge. This is because the CRT traces are written backward (going from right to left).

The test pattern on the right half of the screen is used to adjust and verify the stroke intensity modulation circuitry. When the front-panel INTEN control is at midrange, the brightness of the short strokes (the inverted 'V') should be the same as that of the rest of the pattern.

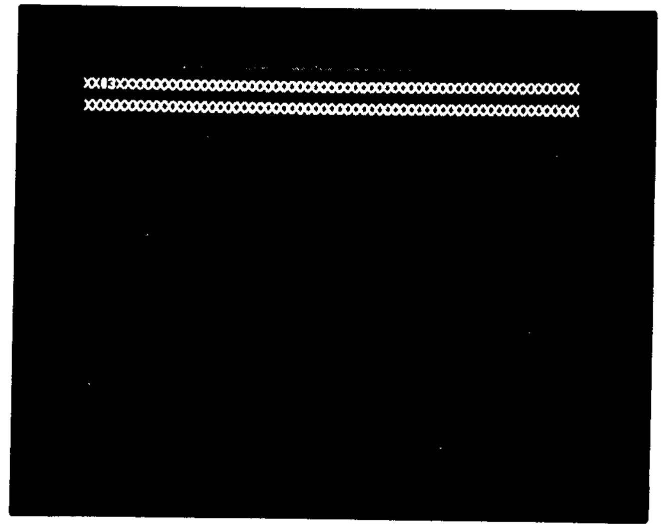
Peak Detector Droop Test

Test routine #2 (Figure 5-10) is used to measure the amount of hold-mode droop in the peak detector circuit. The droop is the amount the voltage on the hold capacitor decreases over time because of leakage of the hold capacitor and the components connected to this capacitor. The firmware implements a digital-storage oscilloscope mode. The sweep is triggered by a positive-going signal at the horizontal center of the screen. The sweep time per division is adjustable by the SWEEP TIME/DIV control from 10 mSEC to 1 SEC. Note that only the right half of the screen is used for the test mode. Trace A displays the data acquired by the sample detector, while Trace B displays the data acquired by the peak detector.

5-15. DIGITAL STORAGE TEST ROUTINES (Cont'd)



TEST ROUTINE #2



TEST ROUTINE #3

Figure 5-10. Test Routines #2 and #3

Focus Test Pattern

Test routine #3 (Figure 5-10) is used for the following adjustments:

- HF TRIM (A4C6)
- ASTIG (A4R17)
- HF GAIN (A4R26)
- INTEN DYN FOCUS (A4R30)
- X DYN FOCUS (A5R91)
- FOCUS LIMIT (A6R29)

The separate dots making up the letter X should be observed to determine how well the CRT beam is focused.

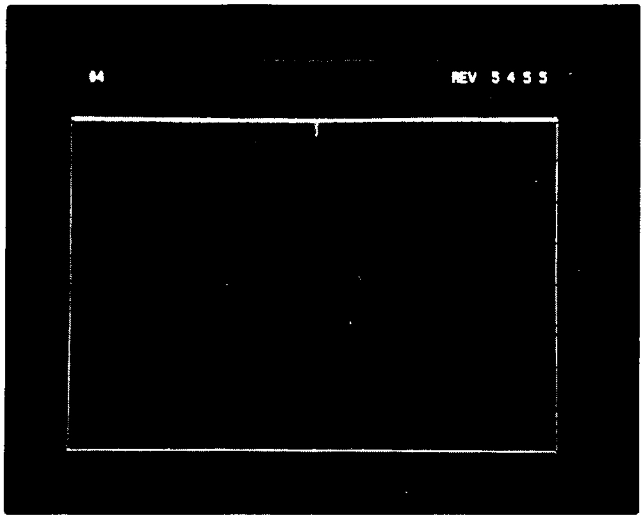
Output Test Pattern

Test routine #4 (Figure 5-11) provides the output test pattern that is used for the following adjustments:

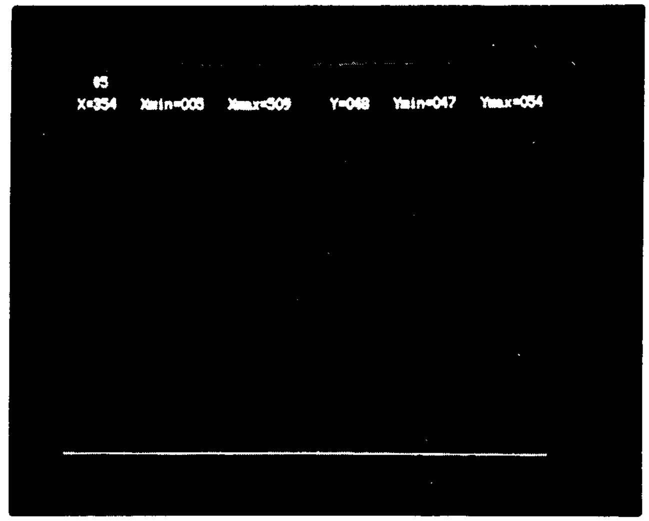
- TRACE ALIGN (Front panel)
- HORIZ POSN (Front panel)
- VERT POSN (Front panel)
- PATTERN (A4R16)
- DGTL X GAIN (A5R100)
- DGTL X OFFSET (A5R108)
- DGTL Y OFFSET (A5R111)
- DGTL Y GAIN (A5R113)

The lines are generated from fixed values in memory that correspond to the top, bottom, left, and right graticule lines that are transmitted on the HP-IB to a plotter. The generated horizontal lines should coincide with the top and bottom graticule lines etched on the CRT. The two vertical lines should be spaced 10 divisions apart, but they are usually offset from the edge because of nonlinearity of the CRT. (HORIZ POSN is adjusted so that the center tick mark lines up with the center vertical graticule line.)

5-15. DIGITAL STORAGE TEST ROUTINES (Cont'd)



TEST ROUTINE #4



TEST ROUTINE #5

Figure 5-11. Test Routines #4 and #5

Input Test Routine

Test routine #5 (Figure 5-11) is used for the following adjustments:

- PK OFFSET (A9R8)
- PK GAIN (A9R14)
- ADC OFFSET (A9R23)
- ADC GAIN (A9R29)
- SWP OFFSET (A9R45)
- SWP GAIN (A9R47)

The trace data is acquired using an algorithm similar to that used for normal operation, except that absolute rather than incremented X positions are used. To avoid gaps in the trace, use sweep times of 100 ms per division or slower. Only the TRACE A WRITE mode is functional in this test; however, the SAMPLE push button selects sample or peak detection in the normal manner. When manual sweep mode is used, the trace may be updated in either direction. The PLOT GRAT push button clears the trace and updates the minimum and maximum values for X and Y. The following information is displayed:

X: Instantaneous value of X
Xmin: Minimum value of sweep, updated at retrace
Xmax: Maximum value of sweep, updated at retrace
Y: Instantaneous value of Y
Ymin: Minimum value of video, updated at retrace
Ymax: Maximum value of video, updated at retrace

The readings are used primarily to set the gain and offset adjustment of sweep (X) and video (Y), preceding the analog-to-digital conversion.

No gaps in the trace should be seen when a horizontal line is displayed in linear mode with sweep times of 100 ms per division and slower. If there are gaps, the digital-to-analog converter (DAC) used in the ADC circuit is the primary suspect.

5-15. DIGITAL STORAGE TEST ROUTINES (Cont'd)

Memory Test Routines

Test routines #6, #7, and #8 perform tests on the various memories that are accessed by the microprocessor. The memory is repeatedly tested as long as the instrument is in a given test routine. This provides a convenient means to troubleshoot intermittent memory problems.

For example, run the test unattended for an extended length of time, or try heating, cooling, or shaking the microprocessor board (A8 Microprocessor Assembly). If a failure occurs, the test stops, and failure indicators are displayed on the CRT. The indicators are a horizontal line at a given position on the CRT and repeated characters in the annotation area of the CRT. These indicators assist in narrowing the fault location to a defective IC. (See Memory Fault Location Table.)

If two indicators point to different faults, start with the primary indicator given in the table.

When the instrument is turned on, a power-on verification test is performed. This test runs each of the memory test routines once and takes about 3 seconds to complete.

System Memory Test. Select test routine #6 to test system memory. Any failure that affects the data bus also shows up as a failure in this test. Since part of the system memory is in the character memory area, a pattern is seen moving through the annotation area of the CRT. The annotation '#6' is not displayed. If the test stops, refer to Memory Fault Location Table for an interpretation of the displayed failure indicators.

Program Memory Test. Select test routine #7 to test program memory. No trace or character, except for '#7,' is displayed unless a test fails. Refer to Memory Fault Location Table for an interpretation of displayed failure indicators.

Stroke Memory Test. Select test routine #8 to test stroke (trace) memory. A momentary display of '#8' is followed by an unfocused pattern moving through the entire CRT area. If a test fails, refer to Memory Fault Location Table for an interpretation of displayed failure indicators. Each cycle through the test takes about 3 seconds. If the CLEAR/RESET push button is pressed to exit this test, another power-on verification is performed.

MEMORY FAULT LOCATION TABLE

Primary Indicator	Secondary Indicator	Circuit Under Test	Defective IC	Test Routine Number
Line at 0 dB	Letter A	System Memory	*	#6
Line at −5 dB	Letter B	System Memory	U18	#6
Line at −10 dB	Letter C	System Memory	U12	#6
Letter D	Line at −15 dB	Program ROM	U8	#7
Letter E	Line at −20 dB	Program ROM	U22	#7
Letter F	Line at −25 dB	Program ROM	U29	#7
Letter G	Line at −30 dB	Program ROM	U36	#7
Letter H	Line at −35 dB	Stroke Memory	U33	#8
Letter I	Line at −40 dB	Stroke Memory	U13	#8
Letter J	Line at −45 dB	Stroke Memory	U19	#8
Letter K	Line at −50 dB	Stroke Memory	U26	#8

*Any failure that affects both high and low nibbles of data on data bus can cause this failure.

ADJUSTMENTS

5-16. DIGITAL STORAGE ADJUSTMENTS

REFERENCE:

A5 and A9 Schematics

NOTE

The analog horizontal and vertical gain adjustments and the video offset adjustment must be performed before the digital storage adjustments.

DESCRIPTION:

A description of all test routines is provided in the preceding section, with instructions for entering and exiting the routines. For convenience, some descriptions are repeated in this section. The test setup for digital storage adjustments is shown in Figure 5-12. Adjustment locations are shown in Figure 5-13.

The following adjustments are included in this section.

Digital-to-Analog Output Adjustments
- Stroke Generator Adjustments
- Digital Gain and Offset Adjustments

Analog-to-Digital Input Adjustments
- Peak Detector Droop Test
- ADC and Peak Detector Adjustments
- Sweep Offset and Gain Adjustments

EQUIPMENT:

Required equipment is listed with appropriate adjustment sections.

PROCEDURE:

Perform, as required, individual adjustment procedures provided in this section.

Stroke Generator Adjustments

DESCRIPTION:

In test routine #1, the character display verifies operation of the character ROM and associated circuitry. The full ASCII character set is displayed.

The stairstep display verifies operation of the output digital-to-analog converter (DAC). Eleven levels should be seen; these correspond to 512, 256, 128, 64, 32, 16, 8, 4, 2, 1, and 0. The transitions to the last two levels are difficult to see on the CRT trace. Note that the levels have been offset by 128 to position all of them within the graticule area.

ADJUSTMENTS

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

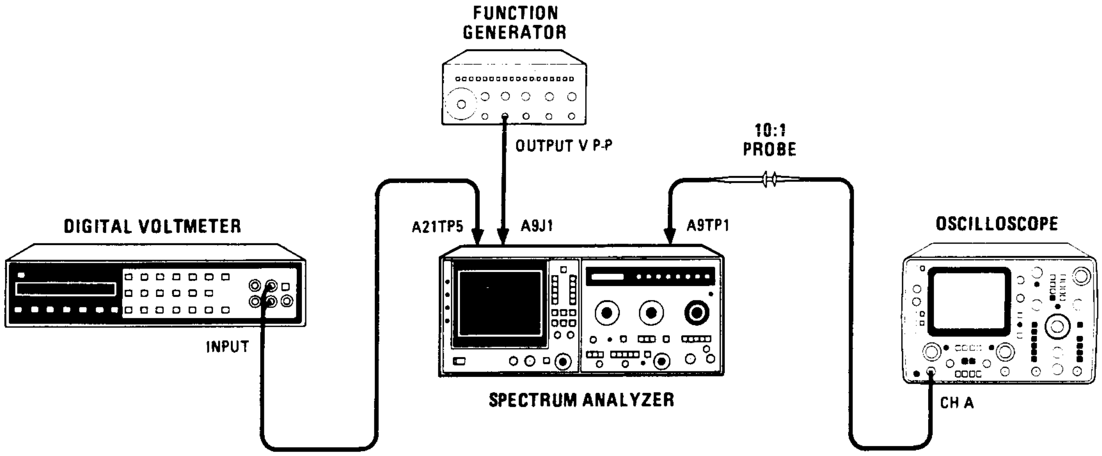


Figure 5-12. Digital Storage Adjustments Test Setup

The square wave is used to adjust and verify the operation of the stroke generator; there should be no more than a minimal overshoot or undershoot. Note that the overshoot or undershoot appears at the right-hand edge of the square wave rather than at the usual left-hand edge. This is because the CRT traces are written backward (going from right to left).

EQUIPMENT:

Oscilloscope .... HP 1741A
10:1 Divider Probe .... HP 10004D

PROCEDURE:

1. Set all normal (green) spectrum analyzer controls and other controls as follows:

HP 8569B:

TRACE A .... WRITE
TRACE B .... WRITE
INTEN .... Fully counterclockwise

HP 1741A:

CHANNEL A VOLTS/DIV .... .05 (with 10:1 probe)
TIME/DIV .... 2 msec

2. Select test routine #1.

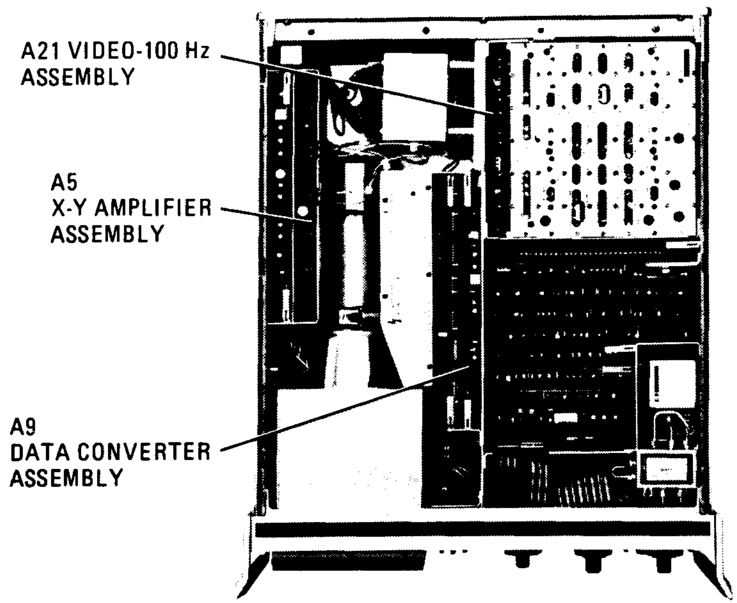
3. Connect oscilloscope probe to A9TP1 DGTL VERT and ground probe to A9TP2 GND 3 (Figure 5-12).

4. Adjust A9R62 STROKE GAIN (Figure 5-13) so that raster (large shaded area on oscilloscope) is 3V peak-to-peak.

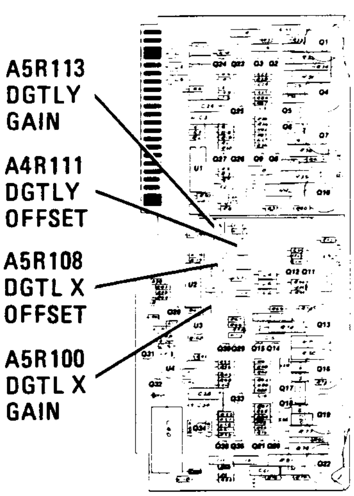
ADJUSTMENTS

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

TOP VIEW



A5



A9

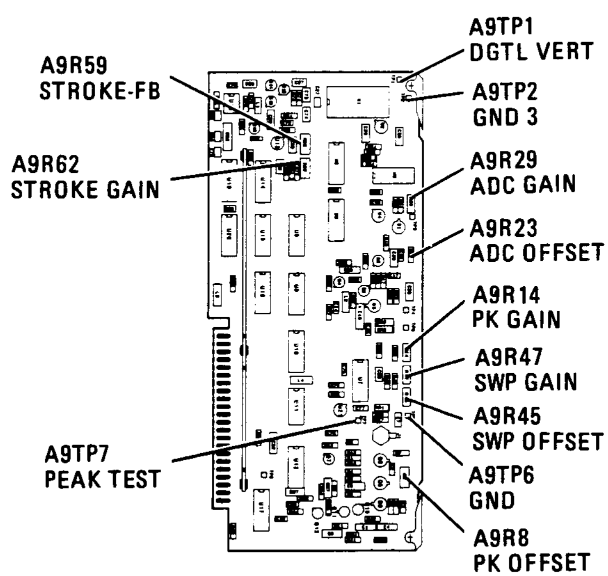


Figure 5-13. Digital Storage Adjustment Locations

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

5. Adjust A9R59 STROKE-FB to minimize overshoot or undershoot at top of square wave on CRT of spectrum analyzer.
6. Repeat steps 4 and 5 until no further adjustment is necessary.
7. Disconnect oscilloscope from A9TP1.
8. Verify that all characters are fully displayed on CRT.
9. Verify that there are 11 levels on the staircase displayed in test routine #1. (The last two transitions are difficult to discern.)

Digital Gain and Offset Adjustments

DESCRIPTION:

The digital gain and offset adjustments are performed after the analog horizontal and vertical gain adjustments and the video offset adjustment.

PROCEDURE:

1. Set all normal (green) spectrum analyzer settings.
2. Select test routine #4.
3. Adjust A5R100 DGTL X GAIN and A5R108 DGTL X OFFSET (Figure 5-13) so that vertical lines of test pattern coincide with left and right graticule lines of CRT. Exact coincidence should occur at graticule centerline. These two adjustments are interactive; repeat until best match is achieved.
4. Readjust A5R108 DGTL X OFFSET so that tick mark at center of display coincides with center graticule line.
5. Adjust A5R113 DGTL Y GAIN and A5R111 DGTL Y OFFSET so that two horizontal lines of test pattern coincide with top and bottom graticule lines of CRT. Exact coincidence should occur at graticule centerline. These two adjustments are interactive; repeat until best match is achieved.

Peak Detector Droop Test

DESCRIPTION:

Test routine #2 is used to measure the amount of hold-mode droop in the peak detector circuit. The droop is the amount the voltage on the hold capacitor decreases over time because of leakage of the hold capacitor and the components connected to this capacitor. The firmware implements a digital-storage oscilloscope mode. The sweep is triggered by a positive-going signal at the horizontal center of the screen. The sweep time per division is adjustable by the SWEEP TIME/DIV control from 10 mSEC to 1 SEC. Note that only the right half of the screen is used for the test mode. Trace A displays the data acquired by the sample detector, while Trace B displays the data acquired by the peak detector.

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

EQUIPMENT:

Function Generator .... HP 3312A
Extender Board, 44-pin .... HP 08565-60107

PROCEDURE:

1. Set all normal (green) spectrum analyzer controls, except as indicated, and other controls as follows:

   HP 8569B:

   TRACE A .... WRITE
   TRACE B .... STORE BLANK
   SWEEP TIME/DIV .... .5 SEC

   HP 3312A:

   FUNCTION .... SQ
   RANGE 1
   FREQUENCY 5

2. Select test routine #2.

3. Install A9 Data Converter Assembly on extender board and ground A9TP7 PEAK TEST to A9TP6 GND. Disconnect Video Cable from A9J1 and connect Vp-p output of function generator to A9J1.

4. Adjust OUTPUT OFFSET and AMPLITUDE of function generator so that square wave (nominally 0V to +0.8V) viewed on CRT extends between top and bottom graticule lines.

NOTE

The input signal must cross the horizontal center graticule line to trigger the display.

5. Adjust frequency of function generator so that one full cycle of square wave is 4 divisions wide on CRT. Set TRACE B to WRITE. Observe magnitude of droop (that is, distance of Trace B from top graticule line). At room ambient temperature, droop should be less than 8 major divisions (full-screen vertical) in 2 horizontal divisions (1 second).

6. Connect Video Cable to A9J1, remove short from A9TP6 and A9TP7, remove extender board, and replace A9.

ADC and Peak Detector Adjustments

DESCRIPTION:

The peak detector is adjusted to ensure accurate digitizing of analog amplitudes in the peak detection mode. The ADC adjustment ensures accurate conversion of horizontal and vertical analog information.

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

EQUIPMENT:

Digital Voltmeter (DVM) .... HP 3455A

PROCEDURE:

1. Set all normal (green) spectrum analyzer controls, except as indicated, and other controls as follows:

TRACE A	WRITE
TRACE B	WRITE
AMPLITUDE SCALE	LIN
SWEEP TIME/DIV	50 mSEC
RESOLUTION BW (coupled)	1 MHz
SAMPLE	Depressed
SWEEP SOURCE	MNL
MANUAL SWEEP	Midrange

NOTE

Tolerance for all adjustments is ±1 count.

2. Select test routine #5.
3. Connect DVM to A21TP5 VIDEO and adjust A9R23 ADC OFFSET for a Y reading of 048. Record offset read from DVM.
4. Connect CAL OUTPUT to INPUT 50Ω. Center signal and set ZERO SPAN.
5. Adjust FINE tuning control to peak voltage measured at A21TP5. Adjust REFERENCE LEVEL controls for a DVM reading of 800 mV plus offset recorded in step 3.
6. Adjust A9R29 ADC GAIN for a Y reading of 848.
7. Press and release SAMPLE push button to return it to normally out position. Disconnect CAL OUTPUT FROM INPUT 50Ω.
8. Adjust A9R8 PK OFFSET for a Y reading of 048.
9. Reconnect CAL OUTPUT and adjust A9R14 PK GAIN for a Y reading of 848.
10. Repeat steps 3 through 9 as necessary to achieve desired readings on CRT of spectrum analyzer.

5-16. DIGITAL STORAGE ADJUSTMENTS (Cont'd)

Sweep Offset and Gain Adjustments

DESCRIPTION:

Accurate analog-to-digital (ADC) input adjustments are necessary to ensure correct start of sweep blanking, end of sweep blanking, and maximum-level clipping. In addition, they provide an accurately calibrated HP-IB output of the trace data. X values of 15 and 495 correspond to the left- and right-edge graticule lines.

PROCEDURE:

1. Select test routine #5.

2. Set all normal (green) spectrum analyzer controls, except as indicated, and other controls as follows:

TRACE A	WRITE
TRACE B	WRITE
FREQUENCY SPAN MODE	ZERO
SWEEP SOURCE	INT
AMPLITUDE SCALE	LIN

3. Adjust A9R45 SWP OFFSET for an Xmin reading of 005.

4. Adjust A9R47 SWP GAIN for an Xmax reading of 505.

5. Repeat steps 3 and 4 as necessary to achieve the desired readings.

ADJUSTMENTS

5-17. HORIZONTAL AND VERTICAL GAIN AND VIDEO OFFSET ADJUSTMENTS

REFERENCE:

A5 and A21 Schematics

DESCRIPTION:

The CRT trace is horizontally centered, then horizontal gain is adjusted for a trace that is 10.4 divisions wide. The trace is positioned on the bottom horizontal graticule line, and the 100 MHz CAL OUTPUT signal is applied as the spectrum analyzer input. REF LEVEl is adjusted for an 800 mV output at A21TP5, and the vertical gain is adjusted for eight divisions of CRT trace deflection. Video offset is adjusted for 0 volts output with no signal in.

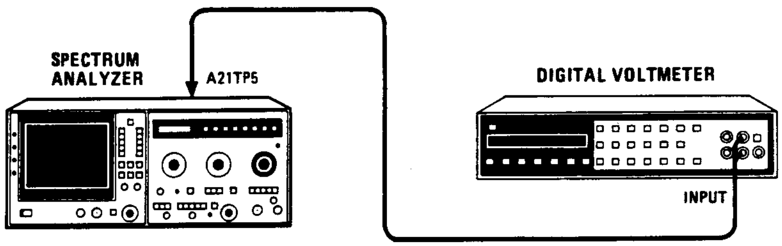


Figure 5-14. Horizontal and Vertical Gain Adjustments Test Setup

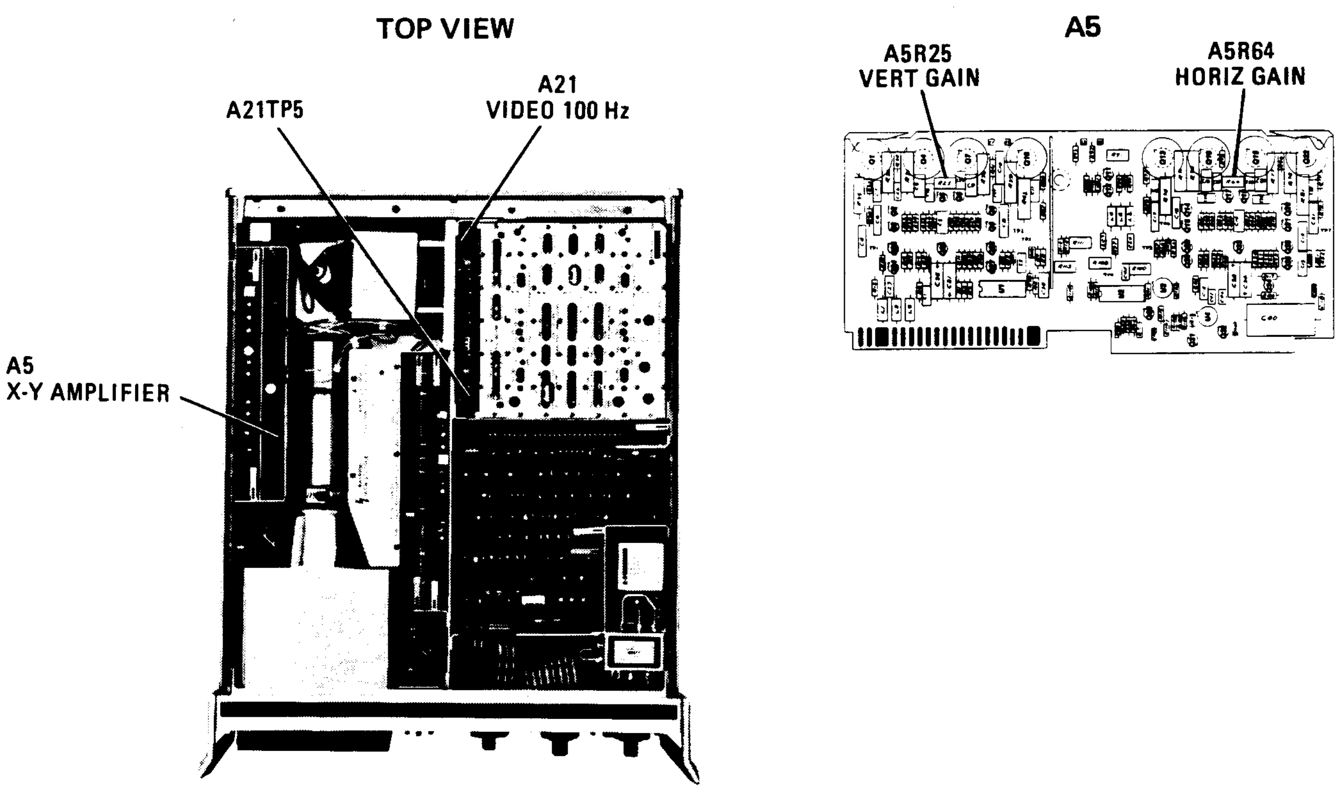


Figure 5-15. Horizontal and Vertical Gain Adjustment Locations

5-17. HORIZONTAL AND VERTICAL GAIN AND VIDEO OFFSET ADJUSTMENTS (Cont'd)

EQUIPMENT:

Digital Voltmeter .... HP 3455A

WARNING

To minimize shock hazard, use a non-metallic screwdriver for adjustment of A5 Deflection Amplifier.

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-14. Set spectrum analyzer controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
RESOLUTION BW (coupled)	30 kHz
FREQUENCY SPAN MODE	PER DIV
INPUT ATTEN	10 dB
REF LEVEL dBm	– 50
REFERENCE LEVEL FINE	0
AMPLITUDE SCALE	10 dB
AUTO STABILIZER	OFF
SWEEP TIME/DIV	AUTO
TUNING	0.100 GHz

NOTE

In adjusting the HORIZ GAIN potentiometer A5R64 (Figure 5-15), it is assumed that the INT SWP ramp output of A16 Sweep Generator Assembly is a – 5 to + 5 volts ramp. (Refer to Sweep Generator Adjustments.)

3. Adjust front-panel HORIZ POSN screwdriver adjustment to place left edge of noise on far left graticule line.

4. Set REF LEVEL dBm to – 10. Connect CAL OUTPUT to INPUT 50Ω. Tune signal to center graticule line.

5. Move signal 0.4 division to left using HORIZ POSN. Right-hand edge of noise should be on far right graticule line. If not, adjust A5R64 HORIZ GAIN.

6. Repeat steps 3 through 5 until no further adjustment is necessary.

Horizontal Gain Adjustment

7. Disconnect CAL OUTPUT from INPUT 50Ω. Set FREQUENCY SPAN MODE to ZERO SPAN and AMPLITUDE SCALE to LIN.

5-17. HORIZONTAL AND VERTICAL GAIN AND VIDEO OFFSET ADJUSTMENTS (Cont'd)

8. Adjust front-panel VERT POSN screwdriver adjustment for CRT trace two divisions above bottom horizontal graticule line.

9. Simultaneously depress EXT and INT SWEEP SOURCE push buttons to obtain a dot on CRT display.

10. Adjust front-panel HORIZ POSN screwdriver adjustment to set dot on center vertical graticule line.

11. Switch SWEEP SOURCE to INT. Switch HP 8569B off.

Vertical Gain and Video Offset Adjustment

12. Place Video Assembly A21 on extender and switch HP 8569B on.

13. With no signal in, adjust front-panel VERT POSN screwdriver adjustment to set CRT trace at bottom horizontal graticule line. Note voltage offset at A21TP5.

14. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust front-panel TUNING control to peak 100 MHz signal on CRT display.

15. Switch AMPLITUDE SCALE to 1 dB/div and adjust front-panel REF LEVEL controls for 800 mV plus offset as measured at A21TP5 (step 13).

16. Connect DVM to A21TP7 and adjust A21R92 OFFSET for 0.000V ± 1 mV.

17. Repeat steps 15 and 16 until no further adjustment is necessary.

18. Set AMPLITUDE SCALE to LIN and disconnect CAL OUTPUT from INPUT 50Ω. Connect DVM to A21TP8 and adjust A21R132 OFFSET 2 for 0.000V ± 1 mV as indicated on DVM.

19. Switch HP 8569B off. Replace Video Assembly A21 in HP 8569B without extender. Turn HP 8569B on.

20. Adjust VERT POSN control to set the trace on the bottom horizontal graticule line. Note voltage offset at A21TP5.

21. Connect CAL OUTPUT to INPUT 50Ω. Center signal on screen and switch to ZERO SPAN. Peak signal with FINE TUNING control and adjust REF LEVEL controls for 800 mV plus offset as measured at A21TP5 (step 20).

adjust for 1/2 db error

22. Adjust A5R25 VERT GAIN to set trace at top graticule line.

23. Repeat steps 20 through 22 until no further adjustment is necessary.

24. Set AMPLITUDE SCALE to 1 dB/DIV and adjust REF LEVEL controls for 800 mV plus offset as measured at A21TP5 (step 20). Adjust A21R92 OFFSET for a top line display.

25. Set AMPLITUDE SCALE to LIN. Adjust front-panel REF LEVEL controls for 800 mV plus offset as measured at A21TP5 (step 20) and adjust VERT POSN screwdriver adjust to set trace at top graticule line.

26. Repeat steps 24 and 25 until no further adjustment is necessary.

ADJUSTMENTS

5-18. LOG AMPLIFIER ADJUSTMENT

REFERENCE:

A22 Schematic

NOTE

The analog vertical and horizontal gain adjustments and the video offset adjustment must be completed before the log amplifier adjustment is performed.

DESCRIPTION:

Step attenuators are used to change the input signal level in calibrated steps. The input of Video Assembly A21 is monitored and adjustments are performed to calibrate A22 Log Amplifier Assembly.

EQUIPMENT:

Digital Voltmeter	HP 3455A
10-dB Step Attenuator	HP 355D, Opt. H80
1-dB Step Attenuator	HP 355C, Opt. H80

PROCEDURE:

1. Set LINE switch to OFF, disconnect power cord, remove HP 8569B top cover, set A24S1 TEST-NORM switch to TEST, and set A25S1 TEST-NORM switch to TEST.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-16. Set normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	0 dB
REF LEVEL dBm	– 50
REFERENCE LEVEL FINE	0
RESOLUTION BW	300 kHz
FREQUENCY SPAN/DIV	10 MHz
TUNING	0.100 GHz
AMPLITUDE SCALE	LIN

3. Set 10-dB step attenuator to 0 dB. Set 1-dB step attenuator to 5 dB.

4. Disconnect CAL OUTPUT from step attenuator. Measure offset at A21TP5 and record.

________ mV

ADJUSTMENTS

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

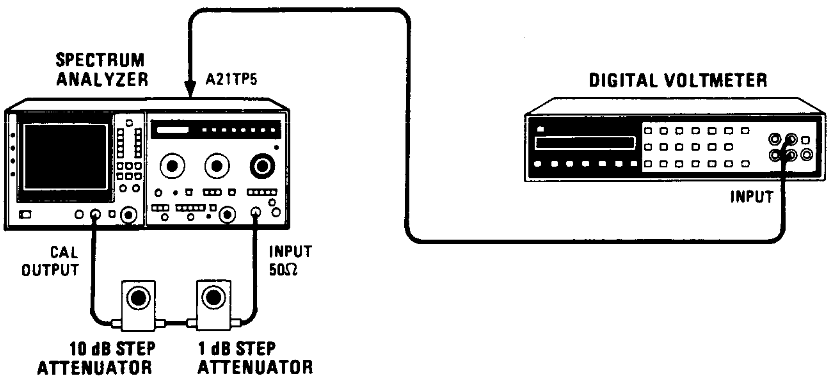


Figure 5-16. Log Amplifier Adjustment Test Setup

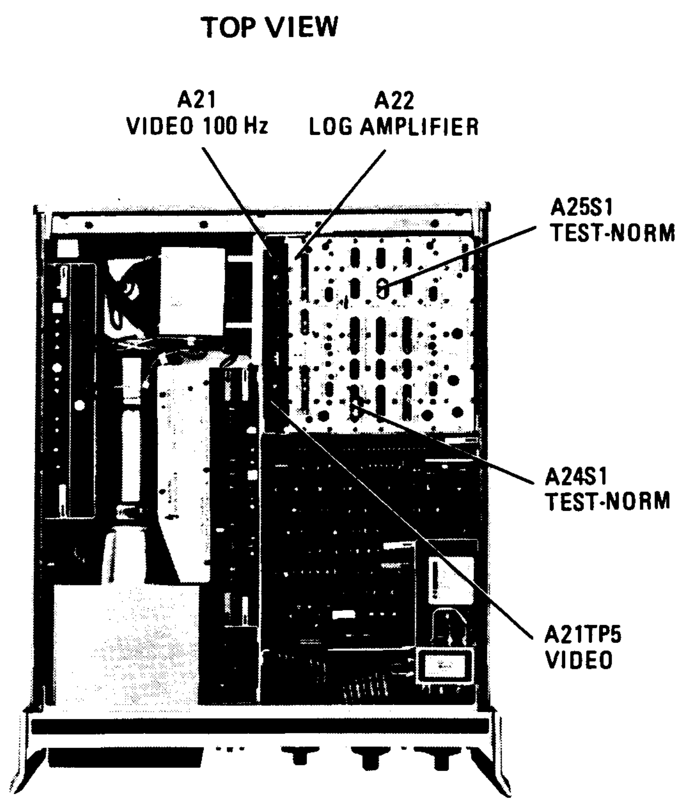


Figure 5-17. Log Amplifier Adjustment Locations

ADJUSTMENTS

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

5. Connect CAL OUTPUT to step attenuator and adjust TUNING control to center 100 MHz signal on CRT display. Set FREQUENCY SPAN MODE to ZERO SPAN and VIDEO FILTER to NOISE AVG. Peak signal with FINE tuning control.

6. Adjust front-panel REF LEVEL CAL screwdriver adjustment for 800 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

7. Set AMPLITUDE SCALE to 10 dB.

8. Adjust A22R23 SLOPE for a reading of 800 ±1 mV, plus offset recorded in step 4, as measured at A21TP5 (Figure 5-17).

NOTE

Always keep signal peaked with FINE tuning control for maximum output at A21TP5.

9. Set 10-dB step attenuator to 60 dB and adjust A22R10 OFFSET for 200 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

10. Repeat steps 8 and 9 until no further adjustment is necessary.

11. Set 10-dB step attenuator to 30 dB and adjust A22R23 SLOPE for 500 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

12. Set 10-dB step attenuator to 0 dB and adjust A22R69 −30 dB for 800 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

13. Repeat steps 11 and 12 until no further adjustment is necessary.

14. Set 10-dB step attenuator to 10 dB and adjust A22R23 SLOPE for 700 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

15. Set 10-dB step attenuator to 0 dB and adjust A22R39 −10 dB for 800 ±1 mV, plus offset recorded in step 4, as measured at A21TP5.

16. Repeat steps 14 and 15 until no further adjustment is necessary.

17. Repeat steps 8 through 16 until limits in Table 5-6 are met.

Linear Output and Linear Step Gain

18. Set spectrum analyzer controls as follows:

INPUT ATTEN .... 10 dB
REF LEVEL dBm .... −50
AMPLITUDE SCALE .... LIN

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

Table 5-6. Log Fidelity Check

Step Attenuator Setting (dB)	DVM Reading*
0	Ref: 800 ±1 mV
10	700 ±3 mV
20	600 ±4 mV
30	500 ±4 mV
40	400 ±5 mV
50	300 ±6 mV
60	200 ±7 mV
70	100 ±8 mV

*Plus offset

Table 5-7. Linear Gain Adjustments

Adjustment	Step Attenuator	Reference Level	DVM Reading*
A22R34	0	–50 dBm	Ref: 800 ±1 mV
A22R33	10	–60 dBm	800 ±5 mV
A22R30	20	–70 dBm	800 ±5 mV
A22R27	30	–80 dBm	800 ±5 mV
No Adjustment	40	–90 dBm	800 ±10 mV

*Plus offset

19. Set 10-dB step attenuator to 0 dB and adjust A22R34 LIN for 800 ± 1 mV, plus offset recorded in step 4, as measured at A21TP5.

20. Make adjustments indicated in Table 5-7.

Log Gain

21. Set spectrum analyzer controls as follows:

    INPUT ATTEN .... 10 dB
    REF LEVEL dBm .... –50
    AMPLITUDE SCALE .... 1 dB

22. Set 10-dB step attenuator to 0 dB. Digital voltmeter (DVM) should read 800 ± 1 mV, plus offset recorded in step 4, as measured at A21TP5.

5-18. LOG AMPLIFIER ADJUSTMENT (Cont'd)

23. Set 10-dB step attenuator to 40 dB. Set REF LEVEL dBm to −90 and adjust A22R121 LOG GAIN for 800 ± 1 mV, plus offset recorded in step 4, as measured at A21TP5.

24. Check log gain steps according to Table 5-8.

Error Check (1 dB/DIV)

25. Set 10-dB step attenuator to 0 and REF LEVEL dBm to −50. DVM should read 800 ± 1 mV, plus offset recorded in step 4, as measured at A21TP5. Increase attenuation in 1-dB steps and take DVM readings to check log amplifier output. (Refer to Table 5-9.)

26. Return A24S1 TEST-NORM switch and A25S1 TEST-NORM switch to NORM.

Table 5-8. Log Gain Adjustment Limits

Step Attenuator	Reference Level	DVM Reading*
0	−50 dBm	Ref: 800 ±1 mV
10	−60 dBm	800 ±3 mV
20	−70 dBm	800 ±3 mV
30	−80 dBm	800 ±3 mV
40	−90 dBm	800 ±3 mV

*Plus offset

Table 5-9. Log Amplifier Output Limits

STEP ATTENUATORS		DVM Reading*
10 dB	1 dB	
0	6	790 ±3 mV
0	7	780 ±3 mV
0	8	770 ±3 mV
0	9	760 ±3 mV
10	0	750 ±3 mV
10	1	740 ±3 mV
10	2	730 ±3 mV
10	3	720 ±3 mV
10	4	710 ±3 mV
10	5	700 ±3 mV
10	6	690 ±3 mV
10	7	680 ±3 mV
10	8	670 ±3 mV
10	9	660 ±3 mV

*Plus offset

5-19. BANDWIDTH FILTER ADJUSTMENTS

REFERENCE:

A21, A23/A27, A24, A25, and A26 Schematics

Option 002: A21 and A23/A27 Schematics

DESCRIPTION:

Each of four crystal filters is adjusted for a symmetrical and centered bandwidth while the other three filters are disabled with crystal shorts. The LC filters are adjusted by a similar method. The 3-dB bandwidths are checked for each RESOLUTION BW and, if necessary, adjustments are performed to give correct bandwidths.

NOTE

The following portion of the description does not apply to Option 002 instruments.

The first-stage center frequency of A26 3 MHz Filter Assembly is aligned with the center frequency of the 3 kHz bandwidth. The bandpass of each stage of A26 is adjusted for centering and symmetry while the spectrum analyzer is in the 1 kHz bandwidth. The LO NULL capacitor in A25 Up-Down Converter is adjusted for a minimum 18.4 MHz LO signal to A24 Step Gain/Oscillator Amplifier Assembly. (This signal is monitored in A23 Bandwidth Filter No. 2 Assembly.) DC GAIN in A25 is adjusted to set the amplitude of the 1 kHz bandwidth relative to the amplitude of the 1 MHz bandwidth. The 3-dB points of the .3 kHz and .1 kHz bandwidths are measured to ensure that they are within tolerance.

EQUIPMENT:

Oscilloscope	HP 1741A
Spectrum Analyzer	HP 140T/8552B
Frequency Counter	5342A, Opt. 005
DC Power Supply	HP 6214A
1:1 Divider Probe	HP 10007D
10:1 Divider Probe	HP 10004D
BNC Tee	HP 1250-0781
Cable	HP 11592-60001
Crystal Short (3 required)	See Figure 5-19.

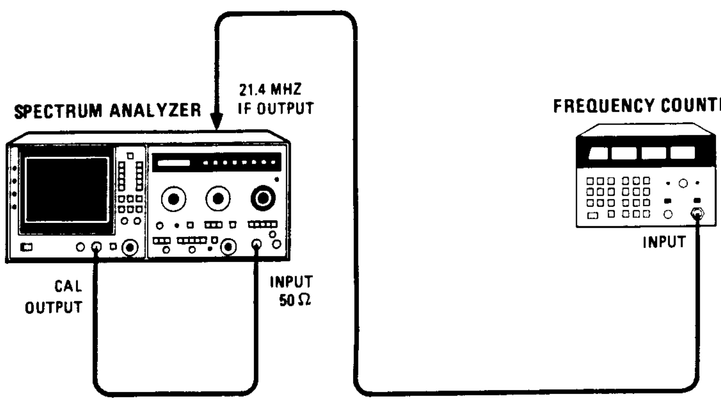
NOTE

A crystal short consists of a .01 μF capacitor (HP Part No. 0160-0161) and a 90.9 ohm resistor (HP Part No. 0757-0400) connected in series. Two square terminal connectors (HP Part No. 0362-0265) are used for connecting the crystal short across the test points.

ADJUSTMENTS

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

CONFIGURATION A



CONFIGURATION B

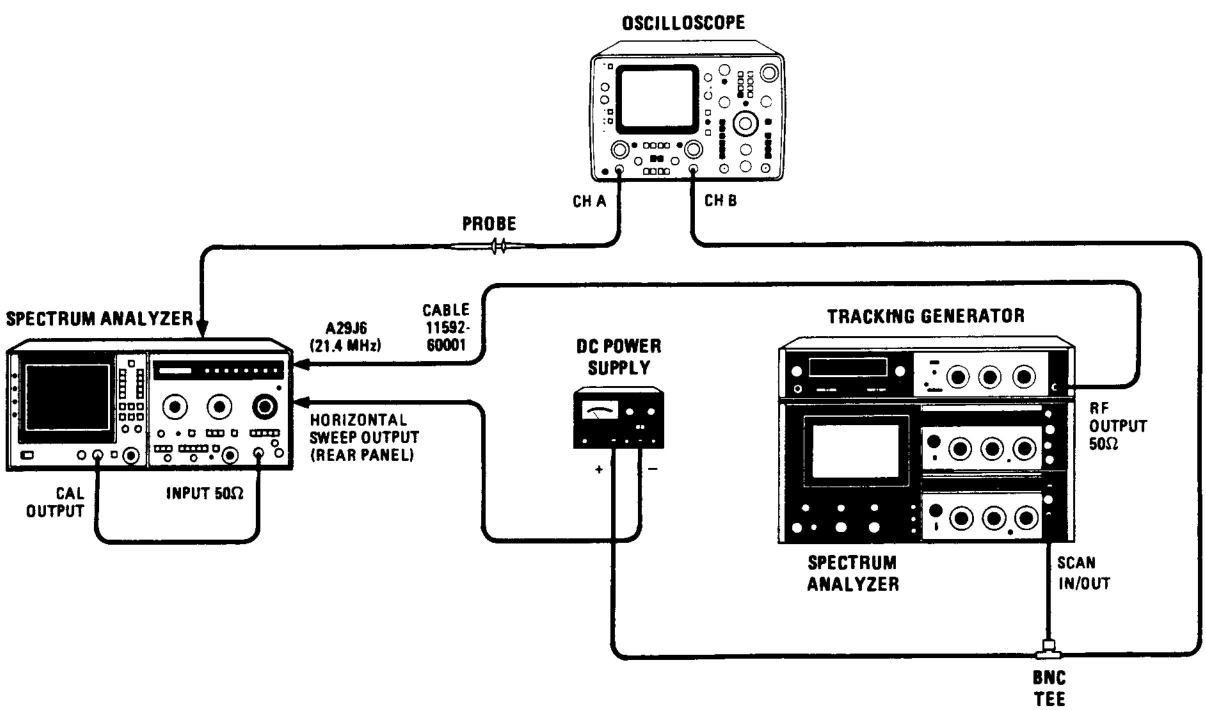


Figure 5-18. Bandwidth Filter Adjustment Test Setup

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

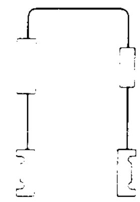


Figure 5-19. Crystal Short Configuration

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

Crystal Alignment

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-18. With normal settings (green), set spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	– 10
RESOLUTION BW	30 kHz
FREQUENCY SPAN/DIV	20 kHz
AMPLITUDE SCALE	LIN
TUNING	0.100 GHz

3. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust TUNING control to center 100 MHz signal on CRT display.

4. Connect crystal shorts (through cover access holes) across each pair of the following test points: A23TP1/A23TP2, A27TP1/A27TP2, and A27TP4/A27TP5.

5. Adjust front-panel TUNING control to center bandpass spike (Figure 5-21) on CRT display.

NOTE

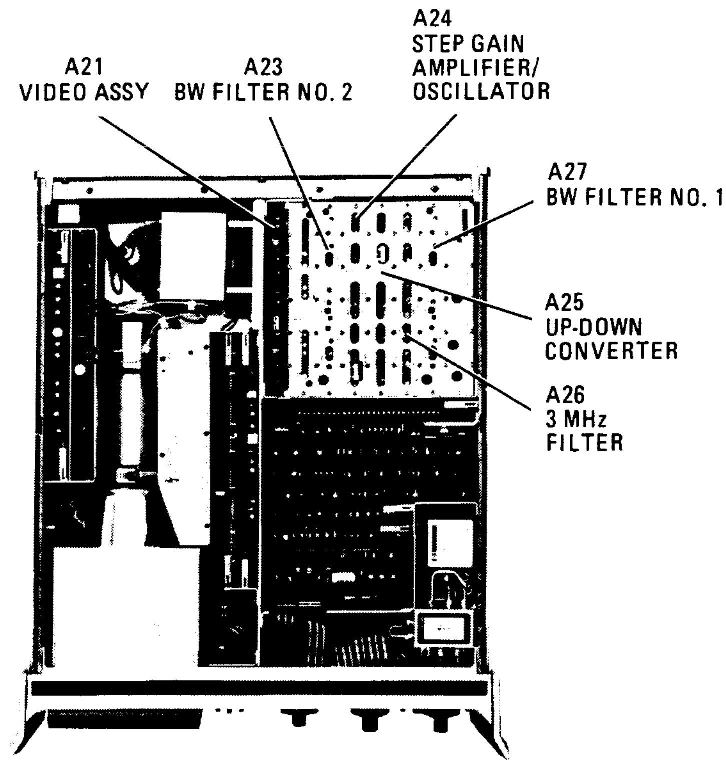
A non-metallic tuning tool is required for all crystal filter and LC filter adjustments

6. Adjust A23C54 CTR and A23C38 SYM (Figure 5-20) for a centered and symmetrical bandpass. Crystal center adjustment A23C54 is adjusted for minimum signal amplitude (Figure 5-21).

7. Remove crystal short across A23TP1/A23TP2 and short A23TP4 to A23TP5.

ADJUSTMENTS

TOP VIEW



A23/A27

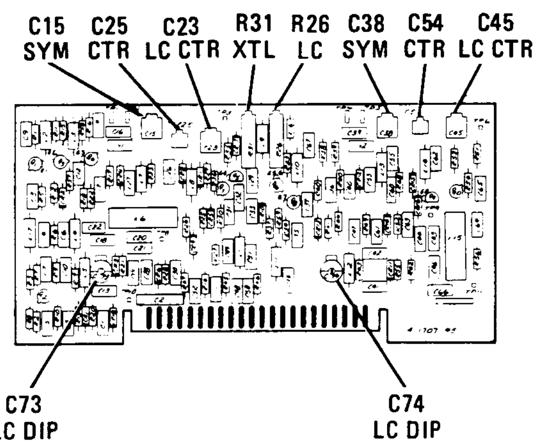


Figure 5-20. Bandwidth Filter Adjustment Locations

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

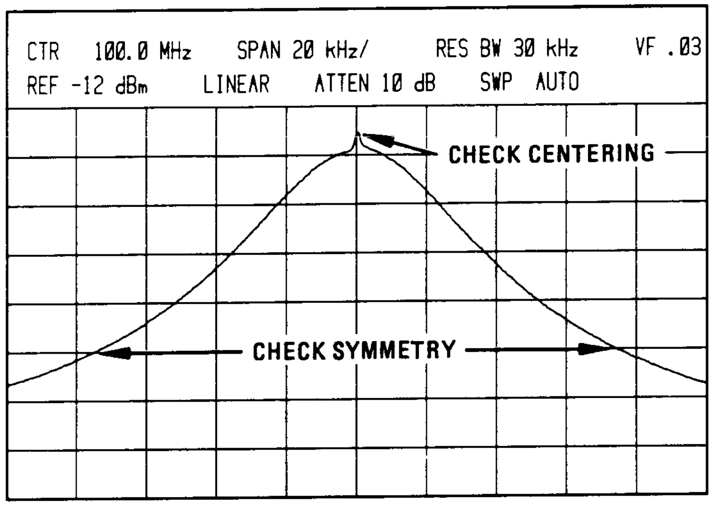


Figure 5-21. Crystal Filter Adjustment

8. Adjust A23C25 CTR and A23C15 SYM for a centered and symmetrical bandpass. Adjust A23C25 CTR for minimum signal amplitude (Figure 5-21).

9. Switch AMPLITUDE SCALE to 5 dB and remove crystal short from A27TP4/A27TP5 and short A23TP1 to A23TP2.

10. Adjust A27C54 CTR and A27C38 SYM for a centered and symmetrical bandpass. Adjust A27C54 CTR for minimum signal amplitude (Figure 5-21).

11. Remove crystal short from A27TP1/A27TP2 and short A27TP4 to A27TP5.

12. Adjust A27C25 CTR and A27C15 SYM for a centered and symmetrical bandpass. Adjust A27C25 CTR for minimum signal amplitude (Figure 5-21). Remove all crystal shorts from spectrum analyzer.

LC Alignment

13. Set FREQUENCY SPAN/DIV to 20 kHz and AMPLITUDE SCALE to LIN. Adjust TUNING control to center 100 MHz signal on CRT display, then set RESOLUTION BW control to 3 MHz. Set A21S1 NORM-TEST switch to TEST.

14. Install A23 Bandwidth Filter No. 2 Assembly on extender board and perform preliminary LC filter adjustment as follows:

NOTE

It might be necessary to adjust the REFERENCE LEVEL FINE control to obtain an on-screen display during the following adjustments.

a. Short to ground following test points: A23TP6, A27TP3, and A27TP6.

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

b. Center 100 MHz CAL OUTPUT signal on CRT display. Adjust A23C73 LC DIP for minimum signal amplitude.

c. Disconnect short to ground from A23TP6 and connect short to A23TP3. Center 100 MHz CAL OUTPUT signal on CRT display. Adjust A23C74 LC DIP for minimum signal amplitude.

d. Reinstall A23 and install A27 Bandwidth Filter No. 1 Assembly on extender board with shorts to ground connected to A23TP3, A27TP3, and A27TP6.

e. Disconnect short to ground from A27TP3 and connect short to A23TP6. Center 100 MHz CAL OUTPUT signal on CRT display. Adjust A27C73 LC DIP for minimum signal amplitude.

f. Disconnect short to ground from A27TP6 and connect short to A27TP3. Center 100 MHz CAL OUTPUT signal on CRT display. Adjust A27C74 LC DIP for minimum signal amplitude.

g. Remove jumpers to ground and reinstall A27 Bandwidth Filter No. 1 Assembly. Replace covers on A23 and A27 Bandwidth Filter Assemblies.

NOTE

When A23 and A27 Bandwidth Filter Assemblies are installed with covers in place, midget copper alligator clips (HP Part No. 1400-0483) can be used to short test points to cover.

15. Short to ground A23TP6, A27TP3, and A27TP6. Set RESOLUTION BW to 30 khz and center signal. Set RESOLUTION BW to 100 kHz. Adjust A23C23 LC CTR to center bandpass display on CRT screen.

16. Disconnect short to ground from A23TP6 and connect to A23TP3. Set RESOLUTION BW to 30 kHz and center signal. Set RESOLUTION BW to 100 kHz. Adjust A23C45 LC CTR to center bandpass display on CRT screen.

17. Disconnect short to ground from A27TP3. Short to ground A23TP3, A23TP6, and A27TP6.

18. Set RESOLUTION BW to 30 kHz and center signal. Set RESOLUTION BW to 100 kHz. Adjust A27C23 LC CTR to center bandpass display on CRT screen.

19. Disconnect short to ground from A27TP6 and connect to A27TP3. Set RESOLUTION BW to 30 kHz and center signal. Set RESOLUTION BW to 100 kHz. Adjust A27C45 LC CTR to center bandpass display on CRT screen.

20. Disconnect shorts to ground from A23TP3, A23Tp6, and A27TP3. Set A21S1 NORM-TEST switch to NORM. Set RESOLUTION BW to 30 kHz and FREQUENCY SPAN/DIV to 2 kHz. Adjust TUNING control to center bandpass display on CRT screen. Turn AUTO STABILIZER on.

21. Switch RESOLUTION BW from 30 kHz to 10 kHz and check that signal shift does not exceed 3 kHz (1.5 divisions). If signal shift is out of tolerance, repeat steps 2 through 12.

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

22. Set FREQUENCY SPAN/DIV to 10 kHz. Adjust FINE tuning control to center bandpass display on CRT screen. Set RESOLUTION BW to 100 kHz and note where signal crosses center vertical graticule line. Adjust A23C23, A23C45, A27C23, and A27C45 in succession so that amplitude of signal is peaked where it intersects center vertical graticule line. Repeat adjustments until 30- and 100-kHz bandwidths are centered. If signal shift between 30 kHz and 100 kHz is greater than 10 kHz (1 division), repeat steps 13 through 21.

Bandwidth Amplitude

23. Set RESOLUTION BW to 3 MHz, FREQUENCY SPAN/DIV to 2 kHz, and AUTO STABILIZER on.

24. Adjust FINE TUNING and REFERENCE LEVEL FINE for a centered signal with 7 division amplitude.

25. Set RESOLUTION BW to 100 kHz and center signal with FINE TUNING control. Adjust A23R26 LC and A27R26 LC equally to obtain a 7 division amplitude signal.

26. Set RESOLUTION BW to 3 kHz and center signal with FINE TUNING control. Adjust A23R31 XTL and A27R31 XTL equally to obtain a 7 division amplitude signal.

NOTE

Steps 27 through 29 are performed only on Option 002 instruments.

27. Uncouple RESOLUTION BW and FREQUENCY SPAN/DIV switches. Set TRACE A and TRACE B to STORE BLANK. Set FREQUENCY SPAN/DIV to 1 kHz and RESOLUTION BW to 1 kHz. Couple switches in this position. Set AMPLITUDE SCALE to 1 dB/DIV.

28. Center 100 MHz signal with FINE TUNING control and adjust REFERENCE LEVEL FINE to obtain a 7 division amplitude signal.

29. Step RESOLUTION BW switch from 1 kHz to 300 kHz and check that amplitude variation from seventh graticule line is less than ±0.5 dB. Check that signal amplitude for 300 kHz and 3 MHz RESOLUTION BW positions is within ±0.4 dB of seventh graticule line. (The 1 kHz RESOLUTION BW position was used for amplitude reference in step 27 and should be on seventh graticule line.) If signal amplitude for 300 kHz position is out of tolerance, repeat steps 14 through 21. If signal amplitude for 3 MHz position is out of tolerance, check Third Converter bandpass shape according to Third Converter adjustment procedure.

3-dB Bandwidth Adjustments

30. Set TRACE A to WRITE and TRACE B to STORE BLANK. Set AMPLITUDE SCALE to LIN, RESOLUTION BW to 3 MHz, and FREQUENCY SPAN/DIV to .5 MHz. Adjust REFERENCE LEVEL FINE to set signal peak 7.1 divisions above graticule baseline.

ADJUSTMENTS

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

NOTE

Adjustment of the 3 dB bandwidth for the 100 kHz and 30 kHz RESOLUTION BW positions requires changing the factory-selected resistors. The 100 kHz bandwidth narrows with an increase in resistor values. The 30 kHz bandwidth widens with an increase in resistor values. While the resistors selected for each bandwidth (100kHz or 30 kHz) do not need to be of the same value, they should not vary from each other by more than 10 percent.

NOTE

The 1 kHz bandwidth is adjusted here only in Option 002 instruments.

31. Perform 3-dB bandwidth adjustment listed in Table 5-10. Maintain signal peak 7.1 divisions above graticule baseline, and adjust for correct bandwidth 5 divisions above graticule baseline. Measure 3-dB bandwidth with a frequency counter as follows:

   a. Set SWEEP SOURCE to MNL, and connect frequency counter to rear panel 21.4 MHz IF OUTPUT connector.

Table 5-10. 3-dB Bandwidth Adjustments and Limits

RESOLUTION BW	FREQUENCY SPAN/DIV	ADJUSTMENT	3 dB BANDWIDTH LIMITS
3 MHz	.5 MHz	A21R77 3 MHz	2.55 to 3.45 MHz
1 MHz	.2 MHz	A21R74 1 MHz	0.85 to 1.15 MHz
300 kHz	50 kHz	A21R71 300 kHz	255 to 345 kHz
100 kHz	20 kHz	A23R19*, A23R43*, A27R19*, A27R43*	85 to 115 kHz
30 kHz	5 kHz	A23R23*, A23R48* A27R23*, A27R48*	25.5 to 34.5 kHz
10 kHz	2 kHz	A21R58 10 kHz	8.5 to 11.5 kHz
3 kHz	1 kHz	A21R55 3 kHz	2.5 to 3.5 kHz
1 kHz (Option 002 only)	1 kHz	A21R52 1 kHz	0.8 to 1.2 kHz

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

b. Adjust MANUAL SWEEP control to position CRT trace at lower frequency 3 dB point, then upper frequency 3-dB point. Note that frequency difference between 3-dB points is within 15 percent of selected RESOLUTION BW. If not, repeat corresponding 3-dB bandwidth adjustment. (The 3-dB point is 5 divisions above graticule baseline when signal peak is 7.1 divisions above graticule baseline.)

c. Set SWEEP SOURCE to INT.

32. For Option 002 instruments only, set LINE switch to OFF, remove power cord, and install HP 8569B top cover.

3 MHz Filter Adjustments

NOTE

In the following procedures, which do not apply to Option 002 instruments, dc power supply outputs should be floating.

33. Remove right side panel and disconnect green coax cable (W22) from A29J6 21.4 MHz IF input, located on right-hand side near rear of instrument. Connect equipment as shown in Figure 5-18, Configuration B. Set controls as follows:

HP 8569B:

TRACE A .... WRITE
TRACE B .... STORE BLANK
FREQUENCY BAND GHz .... .01 – 1.8
INPUT ATTEN .... 10 dB
REF LEVEL dBm 0
REFERENCE LEVEL FINE 0
RESOLUTION BW (coupled) .... 3 kHz
AMPLITUDE SCALE .... LIN
SWEEP TIME/DIV .... 20 mSEC

HP 8443A:

RF OUTPUT LEVEL .... –25 dBm
POWER .... ON
FUNCTION .... TRACK ANALYZER

HP 8552B:

SCAN MODE .... EXT

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

HP 8553B:

BANDWIDTH 10kHz
SCAN WIDTH .... .5 kHz/DIV
FREQUENCY .... 21.4 MHz

HP 1741A:

MODE .... A VS B
CHAN A .... .05/DIV (AC coupled)
CHAN B .... .5/DIV (DC coupled)
MAG X5

34. Adjust dc power supply to center scan on 140-series spectrum analyzer. Adjust oscilloscope horizontal position to center external horizontal sweep.

35. Set HP 8569B RESOLUTION BW to 3 kHz and adjust REF LEVEL dBm controls to place peak of signal approximately at sixth graticule line. Adjust HP 8553B FREQUENCY FINE TUNE control to center signal on HP 8569B CRT display.

36. Connect 1:1 divider probe to A26TP3 and set HP 8569B RESOLUTION BW to 1 kHz.

NOTE

A non-metallic tuning tool is required for all crystal filter and LO adjustments.

NOTE

In the following steps, keep signal centered on the HP 8569B CRT display by adjusting the HP 8553B FREQUENCY FINE TUNE control as necessary with the HP 8569B RESOLUTION BW set to 3 kHz.

37. Adjust A26C3 CTR for minimum signal amplitude on oscilloscope display.

38. Set RESOLUTION BW to 100 Hz and adjust A24C35 (LO adjustment) to center signal on oscilloscope display.

39. Repeat steps 36 and 38 until no further adjustment is necessary.

40. Set RESOLUTION BW to 1 kHz and adjust A26C2 SYM and A26C3 CTR for a centered and symmetrical bandpass of minimum amplitude on oscilloscope display.

41. Connect oscilloscope 1:1 divider probe to A26TP5 and adjust A26C12 SYM and A26C13 CTR for a centered and symmetrical bandpass of minimum amplitude on oscilloscope display.

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

42. Connect oscilloscope 1:1 divider probe to A26TP7 and adjust A26C19 SYM and A26C20 CTR for a centered and symmetrical bandpass of minimum amplitude on oscilloscope display.

43. Connect oscilloscope 1:1 divider probe to A26TP9 and adjust A26C25 SYM and A26C26 CTR for a centered and symmetrical bandpass of minimum amplitude on oscilloscope display.

44. Disconnect oscilloscope probe and adjust A26C32 SYM and A26C33 CTR for a centered and symmetrical bandpass on CRT display of spectrum analyzer.

45. Check that HP 8569B RESOLUTION BW is set to 1 kHz. Disconnect signal from tracking generator and reconnect W22 to A29J6. Disconnect CAL OUTPUT from INPUT 50Ω connector. Set INPUT ATTEN to 0 dB, REF LEVEL dBm to −50, REFERENCE LEVEL FINE to −12, FREQUENCY SPAN MODE to ZERO SPAN, and SWEEP TIME/DIV to 1 mSEC.

46. Connect oscilloscope 10:1 divider probe to A23TP1 in A23 Bandwidth Filter No. 2 Assembly. Set HP 1741A to MAIN sweep, CHAN A to .05 VOLTA/DIV, CHAN B off (push button out), TIME/DIV to .05 μSEC, and MAG to X5. Adjust A25C24 LO NULL for minimum signal amplitude on oscilloscope. Disconnect 10:1 divider probe from HP 8569B.

47. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector. Set HP 8569B REF LEVEL dBm to 0, INPUT ATTEN to 10 dB, RESOLUTION BW to 1 MHz, FREQUENCY SPAN MODE to PER DIV, SWEEP TIME/DIV to AUTO, and FREQUENCY SPAN/DIV to 1 MHz.

48. Adjust TUNING control to center signal on CRT display. Adjust REFERENCE LEVEL FINE control to set 100 MHz signal peak on fifth graticule line.

49. Set RESOLUTION BW to 1 kHz and FREQUENCY SPAN/DIV to 1 kHz (center signal on CRT). Adjust A25R20 DC GAIN to set 100 MHz signal peak on fifth graticule line. If adjustment does not have enough range, change value of factory-selected resistor A25R23*. An increase in resistance increases signal amplitude.

50. Set RESOLUTION BW to .1 kHz and center 100 MHz CAL OUTPUT signal on display. Adjust A26R53 100 Hz GAIN to set 100 MHz signal peak of fifth graticule line.

3 dB Bandwidth Verification

51. Set RESOLUTION BW to 1 kHz, FREQUENCY SPAN/DIV to 1 kHz, and AMPLITUDE SCALE to LIN. Connect frequency counter to rear panel 21.4 MHz IF OUTPUT connector.

52. Adjust REFERENCE LEVEL FINE control to set 100 MHz signal peak 7.1 divisions above bottom graticule line.

NOTE

When the signal peak is set to 7.1 divisions, the 3 dB bandwidth points are located 5 divisions above the bottom graticule line.

5-19. BANDWIDTH FILTER ADJUSTMENTS (Cont'd)

53. Measure 3-dB bandwidths for each RESOLUTION BW listed in Table 5-11 as follows:

    a. Set SWEEP SOURCE to MNL.

    b. Adjust MANUAL SWEEP control to position trace on lower frequency 3 dB point. Record frequency counter indication.

    Frequency ________ MHz

    c. Adjust MANUAL SWEEP control to position trace on upper frequency 3 dB point. Record frequency counter indication.

    Frequency ________ MHz

    d. Subtract frequency recorded in step 53b from frequency recorded in step 53c. This frequency difference is 3-dB bandwidth; check that is is within 3-dB bandwidth limits listed in Table 5-11.

    e. If 1 kHz RESOLUTION BW is out of tolerance, change values of factory-selected resistors listed in Table 5-11. These resistors must be changed in pairs (shown by parentheses), and parallel resistance of any pair should not vary more than 10 percent from parallel resistance of any other pair.

    f. If .3 kHz or .1 kHz RESOLUTION BW is out of tolerance, change values of factory-selected resistors listed in Table 5-11. Each resistor in a set must have a value within 10 percent of other resistors.

54. When adjustment is completed, set LINE switch OFF, disconnect power cord, and install HP 8569B top and side covers.

Table 5-11. Factory-Selected Resistors

Resolution BW	Factory-Selected Resistors	3 dB BW Limits
1 kHz (Except for Option 002)	(A26R9, A26R10), (A26R19, A26R20), (A26R29, A26R30), (A26R39, A26R40), (A26R49, A26R48)	0.8 to 1.2 kHz
.3 kHz	A26R7, A26R18, A26R28, A26R37, A26R46	255 to 345 Hz
.1 kHz	A26R17, A26R27, A26R36, A26R45, A26R64	85 to 115 Hz

ADJUSTMENTS

5-20. STEP GAIN ADJUSTMENTS

REFERENCE:

A21 and A24 Schematics

DESCRIPTION:

The 0 dB and −12 dB adjustments are set to calibrate the front-panel REFERENCE LEVEL FINE control. A24 Step Gain Amplifier Assembly is then adjusted for calibrated 10 dB steps.

EQUIPMENT:

Digital Voltmeter	HP 3455A
Signal Generator	HP 8640B, Opt. 001
10 dB Step Attenuator	HP 355D, Opt. H80
1 dB Step Attenuator	HP 355C, Opt. H80
Extender Board (2 x 22 pin)	HP 08565-60107
Resistor, 51.5Ω	HP 0757-0394
Terminal Connectors (2)	HP 0362-0227
Adapter, BNC (f) to Alligator Clips	HP 8120-1292

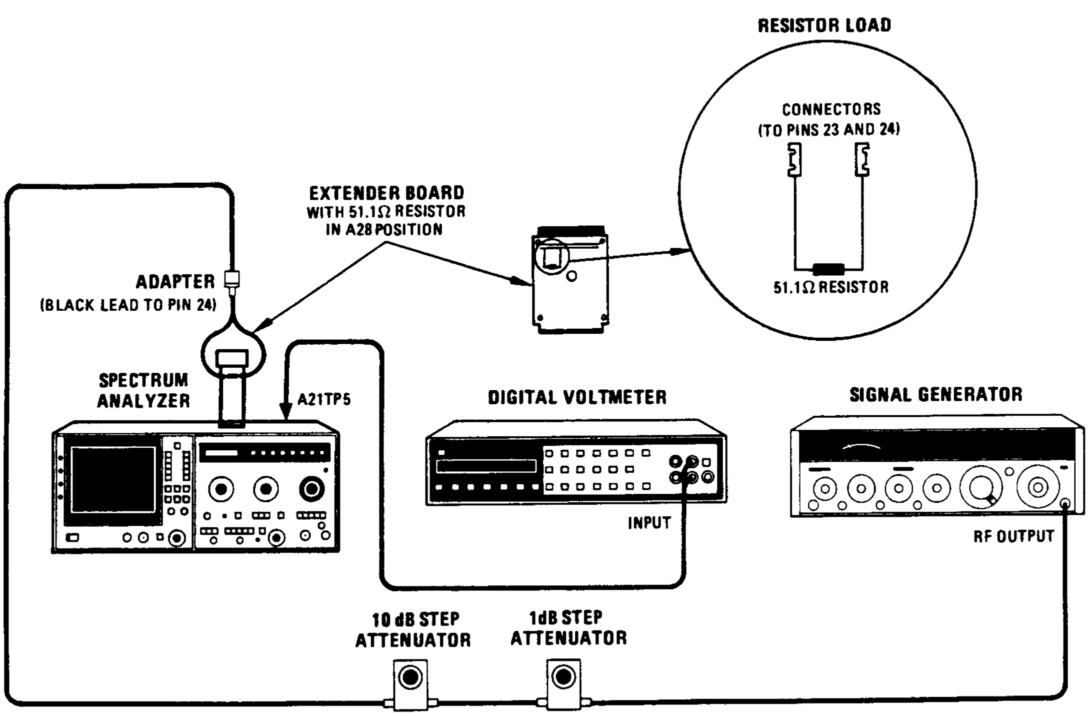


Figure 5-22. Step Gain Adjustment Test Setup

ADJUSTMENTS

5-20. STEP GAIN ADJUSTMENTS (Cont'd)

TOP VIEW

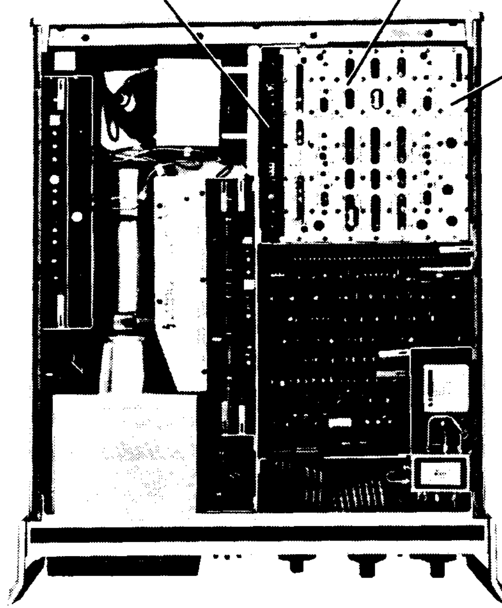


Figure 5-23. Step Gain Adjustment Locations

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Connect 51.5-ohm resistor between pins 23 and 24 on extender board (Figure 5-22). Remove A28 Variable Gain Amplifier and install extender board in its place. (Do not install A28 on extender board.)

3. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-22.

4. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
INPUT ATTEN	0
REF LEVEL dBm	−10
REFERENCE LEVEL FINE	−12
RESOLUTION BW	3 MHz
FREQUENCY SPAN/DIV	20 MHz
AMPLITUDE SCALE	1 dB

ADJUSTMENTS

5-20. STEP GAIN ADJUSTMENTS (Cont'd)

5. Set 10-dB step attenuator to 0 dB and 1-dB step attenuator to 12 dB. Set signal generator for a 21.4 MHz, – 3 dBm output.
6. Adjust signal generator output frequency for maximum signal level on CRT display.
7. Adjust A24R6 – 12 dB (Figure 5-23) clockwise until trace stops rising. Then adjust A24R6 counterclockwise to set signal level 0.4 division below maximum.
8. Adjust signal generator output level to position CRT trace on center horizontal graticule line.
9. Set REFERENCE LEVEL FINE control to 0 dB and 1-dB step attenuator to 0 dB.
10. Adjust A24R5 0 dB to position CRT trace on center horizontal graticule line.
11. Set RESOLUTION BW to 1 MHz, AMPLITUDE SCALE to LIN, and VIDEO FILTER to .01.
12. Disconnect alligator clips from extender board and record offset voltage measured at A21TP5.

    Offset ________ mV
13. Reconnect alligator clips to extender board and set output level of signal generator to 0 dBm. Adjust A24R4 RF GAIN for 800 mV plus offset measured at A21TP5 in step 11. (If A24R4 does not have sufficient adjustment range, change value of A27R3*. An increase in resistance will decrease voltage at A21TP5.
14. Perform step gain adjustments for each REF LEVEL dBm (at both 1- and 10-dB step attenuator settings) in Table 5-12.
15. Set LINE switch OFF, remove extender board, install A28 Variable Gain Amplifier Assembly, and set LINE switch to ON. Connect step attenuator output to INPUT 50Ω connector of spectrum analyzer. Tune spectrum analyzer to 21 MHz, center signal on screen, and set AMPLITUDE SCALE to 10 dB.
16. Set REF LEVEL dBm to – 10 and 10-dB step attenuator to 10 dB. Note signal level.
17. Set REF LEVEL dBm to – 50 and step attenuator to 50 dB. Adjust A24R1 40 dB to place signal at reference level noted in step 16.
18. When adjustment is complete, set LINE switch OFF, disconnect power cord, remove extender board, and install HP 8569B top cover.

Table 5-12. REF LEVEL Step Gain Adjustment

REF LEVEL	Step Attenuator		Adjustment	Voltage A21TP5
	10 dB	1 dB		
–10 dBm	0 dB	0 dB	A24R4 GAIN	Reference (800 mV + offset)
–20 dBm	10 dB	0 dB	A24R3 10 dB	Reference ±5 mV
–30 dBm	20 dB	0 dB	A24R2 20 dB	Reference ±5 mV
–40 dBm	30 dB	0 dB	None	Reference ±5 mV
–50 dBm	30 dB	5 dB	A24R1 40 dB	Reference ±5 mV
–60 dBm	40 dB	5 dB	None	Reference ±5 mV

5-21. SWEEP GENERATOR ADJUSTMENTS

REFERENCE:

A16 Schematic

DESCRIPTION:

The +10V Temperature Variable Supply (+10VTV) is adjusted during the first five minutes of instrument operation. The sweep generator is then adjusted to sweep at −5.2V and to start retrace when the sweep ramp reaches +5.2V. A counter with a time-interval function is used to calibrate the sweep times.

EQUIPMENT:

Digital Voltmeter .... HP 3455A
Electronic Counter .... HP 5300A/5302A

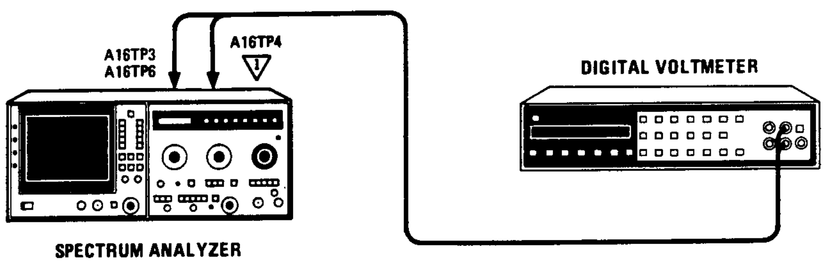


Figure 5-24. Sweep Generator Adjustment Test Setup, Voltage Measurements

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-24. Set all normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A .... STORE BLANK
TRACE B .... STORE BLANK
RESOLUTION BW .... 10 kHz
FREQUENCY SPAN/DIV .... 100 MHz
SWEEP TRIGGER .... SINGLE
VIDEO FILTER .... OFF

ADJUSTMENTS

5-21. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

TOP VIEW

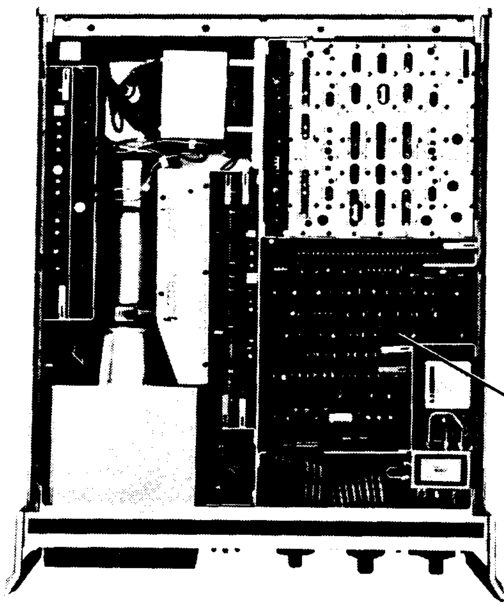


Figure 5-25. Sweep Generator Adjustment Locations

+ 10V Temperature Variable Supply

NOTE

The + 10V Temperature Variable Supply (+ 10 VTV) must be adjusted while the spectrum analyzer is still cold, during first five minutes of operation. If instrument has been operating, turn off spectrum analyzer and remove A16 Sweep Generator Assembly. Let A16 assembly cool for 15 minutes. Replace A16 board and proceed with adjustment of A16R9 + 10 VTV during first five minutes of operation.

3. Connect digital voltmeter to A16TP3 + 10 VTV and use A16TP4 for ground return. Adjust A16R9 + 10 VTV for + 10.00 ±0.01V (See Figure 5-25).

Sweep Ramp

4. Connect digital voltmeter to A16TP6 INT SWP and use A16TP4 for ground return. Press START/RESET and adjust A16R131 SWP START for a reading at A16TP6 of –5.200 ±0.005V.

5-21. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

NOTE

Adjustment of A16R74 SWP STOP is performed by noting the sweep ramp voltage just prior to sweep retrace. A16R74 is then adjusted to trigger sweep retrace when the sweep ramp reaches +5.2V. To accurately determine sweep ramp voltage, slow sweep time per division by setting VIDEO FILTER to .03 when CRT trace is within 0.5 division of right graticule edge.

5. Press START/RESET push button to start sweep. When trace is within 0.5 division of right graticule edge, set VIDEO FILTER to .03 or lower to slow sweep. Note digital voltmeter indication just before sweep retrace (maximum positive sweep ramp voltage).

6. Adjust A16R74 SWP STOP for a maximum sweep ramp voltage (step 5) of +5.200 ±0.005V. A clockwise adjustment of A16R74 increases the sweep ramp voltage required to trigger retrace. Continue adjustment until sweep retrace is triggered at +5.200 ±0.005V.

Sweep Time

NOTE

A simple differentiator circuit is required to be sure that triggering of the sweep is fast enough to provide an accurate counter reading. The circuit is included in Figure 5-26. Be sure the differentiator is connected with the resistor on the counter side of the circuit.

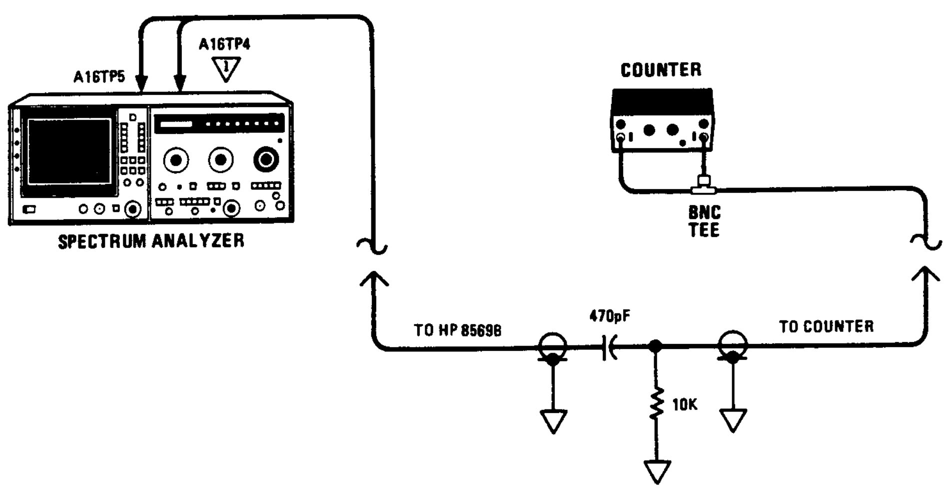


Figure 5-26. Sweep Generator Adjustment Test Setup, Sweep Time Measurements

7. Set all normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
SWEEP TIME/DIV	2 mSEC

5-21. SWEEP GENERATOR ADJUSTMENTS (Cont'd)

8. Set HP 5302A controls as follows:

   TIME BASE .... 10 μs
   FUNCTION .... T.I. A TO B
   A 50 MHz .... Pulse switch down
   B 10 MHz .... Pulse switch up

9. Connect A 50 MHz and B 10 MHz connectors of HP 5302A with a BNC tee and a short BNC cable.
10. Use A16TP5 LO SWP and A16TP4 signal ground for input to HP 5302A.
11. Adjust A16R19 2MS for a counter reading of 20.8 ±0.5 ms.
12. Set SWEEP TIME/DIV to 1 mSEC. Adjust A16R15 1 MS for a counter reading of 10.4 ±0.2 ms.
13. The 1 MS and 2 MS potentiometers are interactive. Repeat steps 11 and 12 until both the 1 MS and 2 MS adjustments are within limits.

Auto Sweep Time Limit

14. Set FREQUENCY SPAN/DIV to 100 MHz, RESOLUTION BW to 3 MHz, SWEEP TIME/DIV to AUTO.
15. Adjust A16R25 AST LIMIT for a counter reading of 72.8 ±1.0 ms.
16. With RESOLUTION BW set to 3 MHz, verify auto sweep times at the FREQUENCY SPAN/DIV settings in Table 5-13. If any counter reading is not within limits, troubleshoot and repair the board.
17. When adjustment is complete, set LINE switch OFF, disconnect power cord, and install HP 8569B top cover.

Table 5-13. Auto Sweep Time Limits

FREQUENCY SPAN/DIV	DGTL AVG	COUNTER READOUT (MS)		
		Min.	Actual	Max.
500 MHz	Out	234		286
200 MHz	Out	107		121
100 MHz	Out	68		78
100 MHz	In	107		121
50 MHz	Out	68		78
FULL (F), Band 1	Out	107		121
FULL (F), Band 2	Out	235		285
FULL (F), Band 3	Out	235		285
FULL (F), Band 4	Out	470		570
FULL (F), Band 5	Out	470		570
FULL (F), Band 6	Out	470		570
FULL (F), Band 7	Out	940		1140
FULL (F), Band 8	Out	940		1140
MULTIBAND (1.7–22 GHz)	Out	940		1140

ADJUSTMENTS

5-22. + 10V REFERENCE AND DIGITAL READOUT ADJUSTMENTS

REFERENCE:

A12 and A17 Schematics

DESCRIPTION:

The + 10V reference supply in A17 Frequency Control Assembly is adjusted, and the offset in the center frequency output (to A12 DVM Analog Assembly) is adjusted for a null. A12 DVM Analog Assembly is then adjusted to give a calibrated front-panel FREQUENCY GHz digital readout.

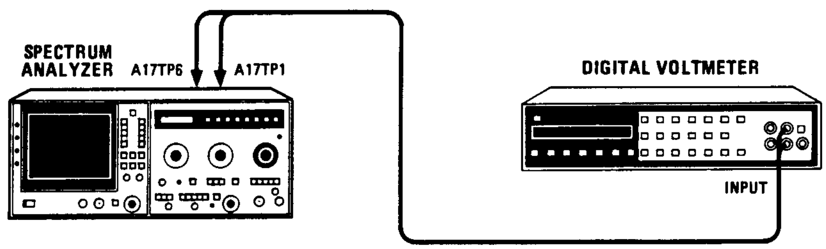


Figure 5-27. +10V Reference and Digital Readout Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter .... HP 3455A

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.
2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-27. Set all spectrum analyzer controls to normal (green) settings, and FREQUENCY BAND GHz to .01 – 1.8.

NOTE

For all digital voltmeter measurements, use A17TP6 for ground return.

+ 10V Reference Adjustment

3. Connect digital voltmeter to A17TP1 + 10VR and adjust A17R11 + 10VR (Figure 5-28) for + 10.000 ± 0.0002V. If unable to adjust A17R11 for + 10V, change factory-selected resistor A17R9*. Decrease in A17R9* decreases voltage.
4. Jumper A17TP5 CENT FREQ to A17TP8 and connect digital voltmeter to A17TP5 CENT FREQ.

5-22. +10V REFERENCE AND DIGITAL READOUT ADJUSTMENTS (Cont'd)

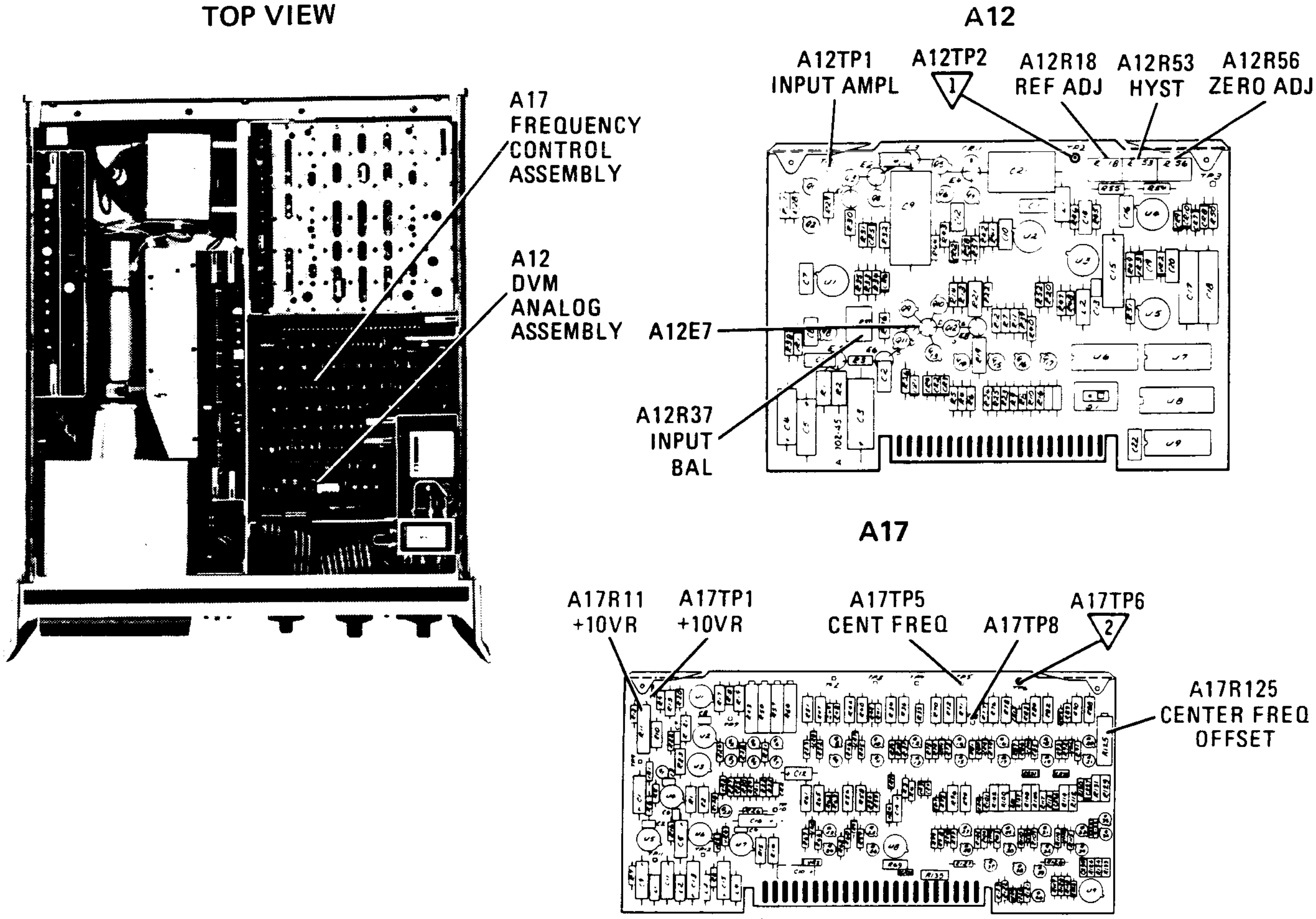


Figure 5-28. +10V Reference and Digital Readout Adjustment Locations

5. Adjust A17R125 CENTER FREQ OFFSET for a digital voltmeter reading of 0.0000 ±0.0002V.

6. Disconnect jumper between A17TP5 CENT FREQ and A17TP8.

Digital Readout Adjustment

7. Install A12 DVM Analog Assembly on extender board and connect jumper between A12E7 and A12TP2. Connect digital voltmeter to A12TP1.

8. Adjust A12R37 INPUT BAL for a digital voltmeter reading of 0.000 ±0.0001V. Disconnect jumpers and reinstall A12 DVM Analog Assembly.

9. Adjust front panel TUNING control for a 0.0000 ±0.0001V digital voltmeter reading at A17TP5 CENT FREQ.

10. Adjust A12R56 ZERO ADJ for a flickering minus sign on the front panel FREQUENCY GHz digital readout.

5-22. + 10V REFERENCE AND DIGITAL READOUT ADJUSTMENTS (Cont'd)

11. Adjust TUNING control for a 0.0005 ±0.0001V digital voltmeter reading at A17TP5 CENT FREQ.
12. Adjust A12R53 HYST for a FREQUENCY GHz display flickering between 0.000 GHz and 0.001 GHz.
13. Switch FREQUENCY BAND to 8.5 – 18 GHz and adjust front panel TUNING control for 10.0000 ±0.0002V at A17TP5 CENT FREQ.
14. Adjust A12R18 REF ADJ for a FREQUENCY GHz display of 10.000 GHz.
15. Set LINE switch OFF, disconnect power cord, and install HP 8569B top cover.

ADJUSTMENTS

5-23. YIG DRIVER ADJUSTMENT

REFERENCE:

A19 Schematic

DESCRIPTION:

The YIG-Tuned Oscillator (YTO) output frequency is calibrated by supplying a known tuning voltage and adjusting YTO offset and gain adjustments for the correct first local oscillator output frequency. The YIG-Tuned Filter (YTF) offset and gain adjustments are performed to track the YTF bandpass with the YTO frequency.

NOTE

Allow at least one hour warm-up before performing YIG Driver adjustments.

EQUIPMENT:

Digital Voltmeter .... HP 3455A
Frequency Counter .... HP 5342A, Opt. 005
Comb Generator .... HP 8406A
10 dB Attenuator .... HP 8419B, Opt. 010
Cable Assembly .... HP 8120-1578

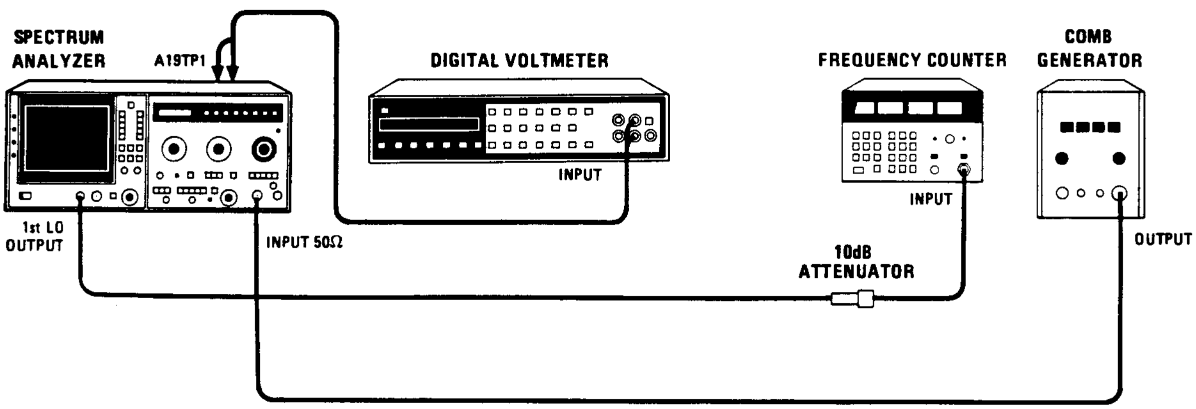


Figure 5-29. YIG Driver Adjustment Test Setup

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, remove HP 8569B top cover, and remove A14 Tuning Stabilizer Control Assembly.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-29.

3. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

FREQUENCY BAND GHz .... 1.7 – 4.1
FREQUENCY SPAN MODE .... ZERO SPAN
AUTO STABILIZER .... OFF

5-23. YIG DRIVER ADJUSTMENT (Cont'd)

TOP VIEW

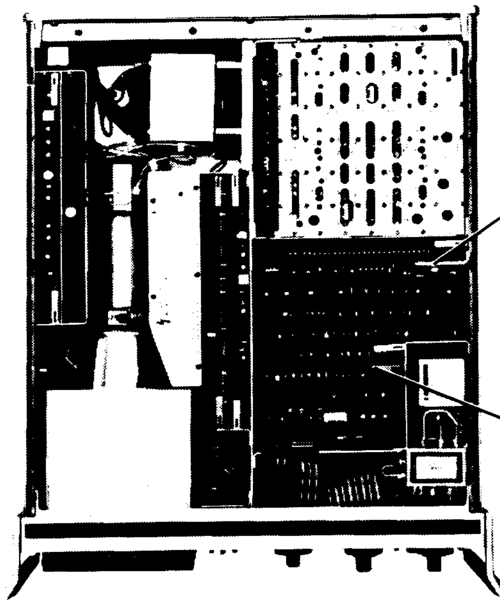


Figure 5-30. YIG Driver Adjustment Locations

NOTE

For all digital voltmeter measurements, use A19TP1 for the ground.

4. Connect frequency counter through a 10 dB attenuator to front-panel 1ST LO OUTPUT connector.
5. Connect digital voltmeter to A19TP4 YTO FA and adjust front-panel TUNING control for −10.2500 ±0.0005V.
6. Adjust A19R5 YTO OFFSET (Figure 5-30) for a frequency counter reading of 2.050 ±0.0002 GHz.
7. Adjust front-panel TUNING control for −22.00 ±0.001V at A19 YTO FA.
8. Adjust A19R8 YTO GAIN for a frequency counter reading of 4.400 ±0.001 GHz.
9. Adjust front-panel TUNING control for −10.2500 ±0.005V at A19TP4 YTO FA and check frequency at 1ST LO OUTPUT. Frequency should be 2.050 ±0.001 GHz. If not within tolerance, repeat steps 6 through 8.

5-23. YIG DRIVER ADJUSTMENT (Cont'd)

Preliminary YTF Tracking Adjustment

10. Install 50-ohm load on front-panel 1ST LO OUTPUT connector and connect 100 MHz comb generator output to front-panel INPUT 50Ω. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

    FREQUENCY BAND GHz .... 1.7 – 4.1
    INPUT ATTEN .... 0 dB
    RESOLUTION BW .... 3 MHz
    FREQUENCY SPAN/DIV .... 200 MHz
    FREQUENCY SPAN MODE .... ZERO SPAN
    AUTO STABILIZER .... OFF
    VIDEO FILTER 3
    TUNING .... 2.000 GHz

NOTE

The following procedure is a preliminary YTF tracking check and adjustment. If a tracking adjustment is required, also perform YTF Tracking Adjustment, Paragraph 5-29.

11. Set A19S2 YTF TRACK switch to TEST and be sure front-panel PRESELECTOR PEAK control is set to center of green area.
12. Adjust front-panel TUNING control to peak signal on CRT display. Remove hysteresis by switching to FULL BAND and then back to ZERO SPAN (FREQUENCY SPAN MODE) and again peak signal on CRT display.
13. Adjust A19R14 YTF OFFSET to center passband on CRT display (Figure 5-31).
14. Set FREQUENCY BAND GHz to 5.8 – 12.9. Tune spectrum analyzer to 10.0 GHz and peak signal on CRT display. Remove hysteresis by switching to FULL BAND, then back to ZERO SPAN (FREQUENCY SPAN MODE) and again peak signal on CRT display.
15. Adjust A19R17 YTF GAIN to center passband on CRT display (Figure 5-31).
16. If tracking adjustment is required, perform YTF Tracking Adjustment, Paragraph 5-30. If not, set A19S1 YTF TRACK switch to NORM, set LINE switch OFF, disconnect power cord, and install A14 Tuning Stabilizer Control Assembly. Install HP 8569B top cover.

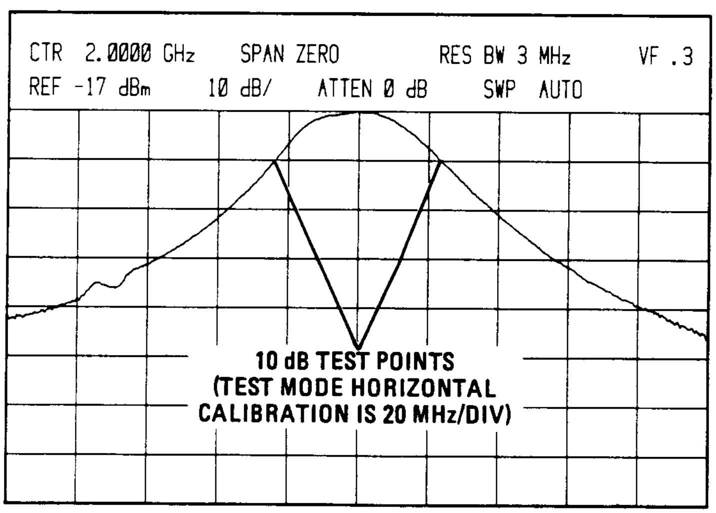


Figure 5-31. YTF Passband Display for YIG Driver Adjustment

ADJUSTMENTS

5-24. SECOND CONVERTER ADJUSTMENT

REFERENCE:

A35 Schematic

DESCRIPTION:

The second converter local oscillator is adjusted for 1728.60 MHz, and the second converter bandpass filter is adjusted for a 2050 MHz bandpass. If the second converter bandpass filter requires significant frequency tuning for correct bandpass adjustment, then the coarse bandpass adjustment must be performed to ensure correct second converter bandpass alignment. Once the second converter bandpass filter is tuned to 2050 MHz, adjustments are performed for compromise of best bandpass shape and minimum conversion loss.

EQUIPMENT:

Frequency Counter .... HP 5342A, Opt. 005
Oscilloscope .... HP 1741A
Crystal Detector .... HP 33330C
Adapter, SMA (f) to SMC (m) .... HP 1250-0675
Adapter, BNC (f) to SMC (f) (modified) .... HP 08565-60087
Adjustment Tool .... HP 08555-60107

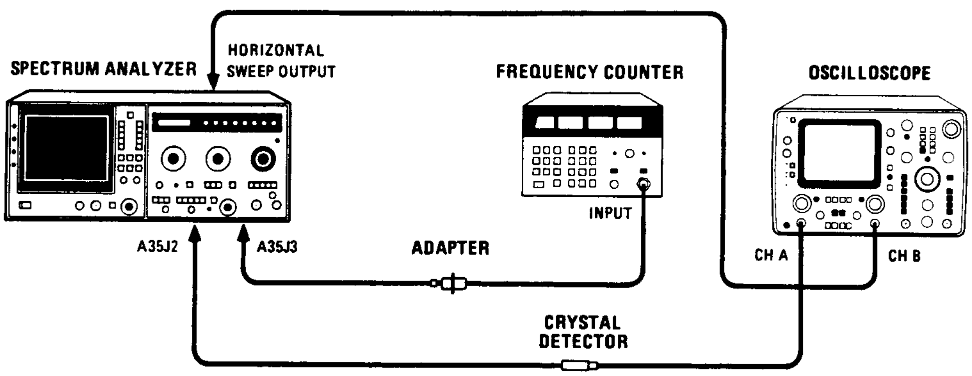


Figure 5-32. Second Converter Adjustment Test Setup

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, connect equipment as shown in Figure 5-32, and remove HP 8569B bottom cover.

2. Reconnect power cord and set LINE switch ON. Set all normal (green) settings, except as indicated, and other controls as follows:

TRACE A .... STORE BLANK
TRACE B .... STORE BLANK
FREQUENCY BAND GHz .... .01 – 1.8
RESOLUTION BW (coupled) .... 100 kHz
FREQUENCY SPAN/DIV .... 5 MHz
SWEEP SOURCE .... EXT
TUNING .... 0.000 GHz

5-24. SECOND CONVERTER ADJUSTMENT (Cont'd)

BOTTOM VIEW

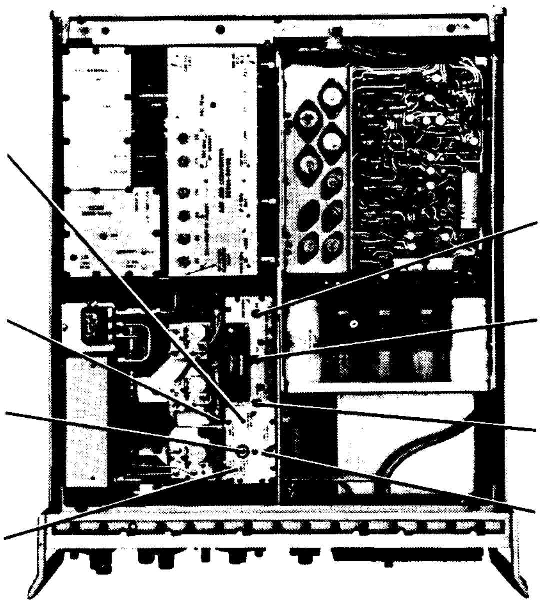


Figure 5-33. Second Converter Adjustment Locations

3. Connect frequency counter through modified adapter (HP 08565-60087) to A35J3 2ND LO (Figure 5-33) and adjust A35C4 2ND LO FREQUENCY for 1728.60 ±0.1 MHz.

4. Disconnect frequency counter, set HP 8569B SWEEP SOURCE to INT, and use TUNING control to center LO signal (0.000 GHz) on CRT display.

5. Externally sweep oscilloscope (CHAN B, DC coupled input) with spectrum analyzer HORIZONTAL SWEEP OUTPUT. Set oscilloscope sweep mode to A VS B, TRIGGER COMP to B, DISPLAY to B, and CHAN B VOLTS/DIV to 1.

6. Simultaneously depress spectrum analyzer SWEEP SOURCE push buttons EXT and INT and adjust oscilloscope horizontal position to place dot at center graticule line. Return SWEEP SOURCE to INT.

7. Loosen connector of cable W18 at A35J2 2ND CONV OUT and disconnect other end of cable W18. Connect oscilloscope (CHAN A, DC coupled input) through adapters, crystal detector, and cable W18 to A35J2 2ND CONV OUT. Set oscilloscope CHAN A VOLTS/DIV to .02.

NOTE

This procedure uses a negative-polarity crystal detector. If a positive-polarity crystal detector is used the waveforms in Figure 5-34 will be inverted.

5-24. SECOND CONVERTER ADJUSTMENT (Cont'd)

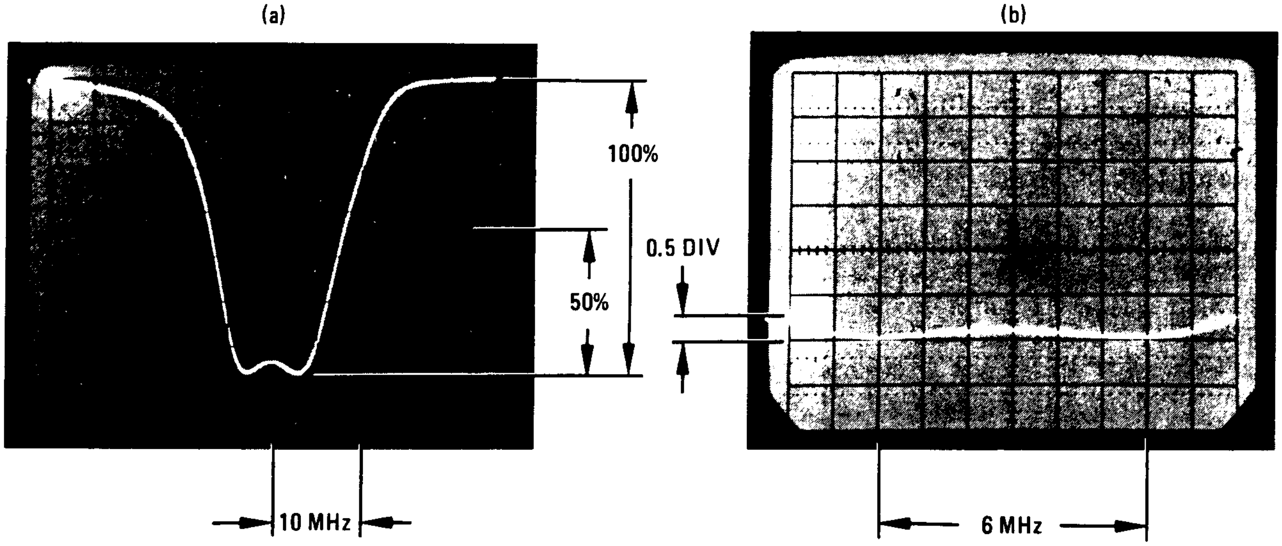


Figure 5-34. Second Converter Bandpass Displays

8. Adjust Channel A vertical position and VOLTS/DIV vernier for a 4-division display centered on the oscilloscope CRT. Check second converter bandpass display on oscilloscope CRT (Figure 5-34a). If center of second converter bandpass is within 2 divisions of being centered on oscilloscope display, proceed to second converter fine bandpass adjustment (step 9). If center of bandpass is greater than 2 divisions from center of oscilloscope display, perform second converter coarse bandpass adjustment as follows:

   a. Set FREQ SPAN/DIV to 50 MHz and loosen lock nuts on A35C1 and A35C3. Carefully turn tuning screws clockwise until they bottom on cavity.

   b. Turn A35C1 and A35C3 one turn counterclockwise and lightly tighten lock nuts.

   c. Carefully set A35L5 2ND MIXER MATCH fully clockwise, then adjust it two turns counterclockwise.

   d. Tune A35C2 to position signal at center of oscilloscope display.

   e. Set FREQUENCY SPAN/DIV to 5 MHz and adjust A35C1 for maximum negative signal at center of oscilloscope display.

   f. Adjust A35C3 and A35L5 for maximum negative signal at center of oscilloscope display.

9. Repetitively adjust in small increments A35C1, A35C2, A35C3, and A35L5 for a centered, symmetrical, and flat bandpass display with maximum amplitude as shown in Figure 5-34a. A slight amount of signal amplitude must be sacrificed in order to obtain the desired bandwidth, symmetry, and flatness.

10. Check that right bandpass skirt is at least 50 percent down at a point 10 MHz from center frequency (Figure 5-34a).

11. Set FREQUENCY SPAN/DIV to 1 MHz. Check flatness of bandpass within 3 MHz (3 divisions) each side of center (Figure 5-34b). Bandpass should be flat within 0.5 division (1 dB).

12. When adjustment is complete, set LINE switch OFF, disconnect power cord, reconnect cable W18, and install HP 8569B bottom cover.

5-25. THIRD CONVERTER ADJUSTMENT

REFERENCE:

A37 Schematic

DESCRIPTION:

The third converter local oscillator is adjusted for maximum output power, and the front panel CAL OUTPUT is calibrated for − 10 dBm. A spectrum analyzer is used to display the 300 MHz local oscillator signal at the 21.4 MHz output port, and the 300 MHz bandpass filter is adjusted for a maximum 300 MHz local oscillator signal. The 321.4 MHz bandpass is checked with an oscilloscope. If the resonant cavities are not closely tuned to 321.4 MHz, the bandpass filter must be detuned and each cavity tuned to 321.4 MHz.

EQUIPMENT:

Oscilloscope	HP 1741A
Spectrum Analyzer	HP 140T/8552B/8554B
Power Meter	HP 435B
Power Sensor	HP 8481A, Opt. C03
Crystal Detector	HP 33330C
Test Cable	HP 11592-60001
Adapter, SMC (f) to SMC (f)	HP 1250-1113
Adapter, SMC (m) to SMA (f)	HP 1250-0675

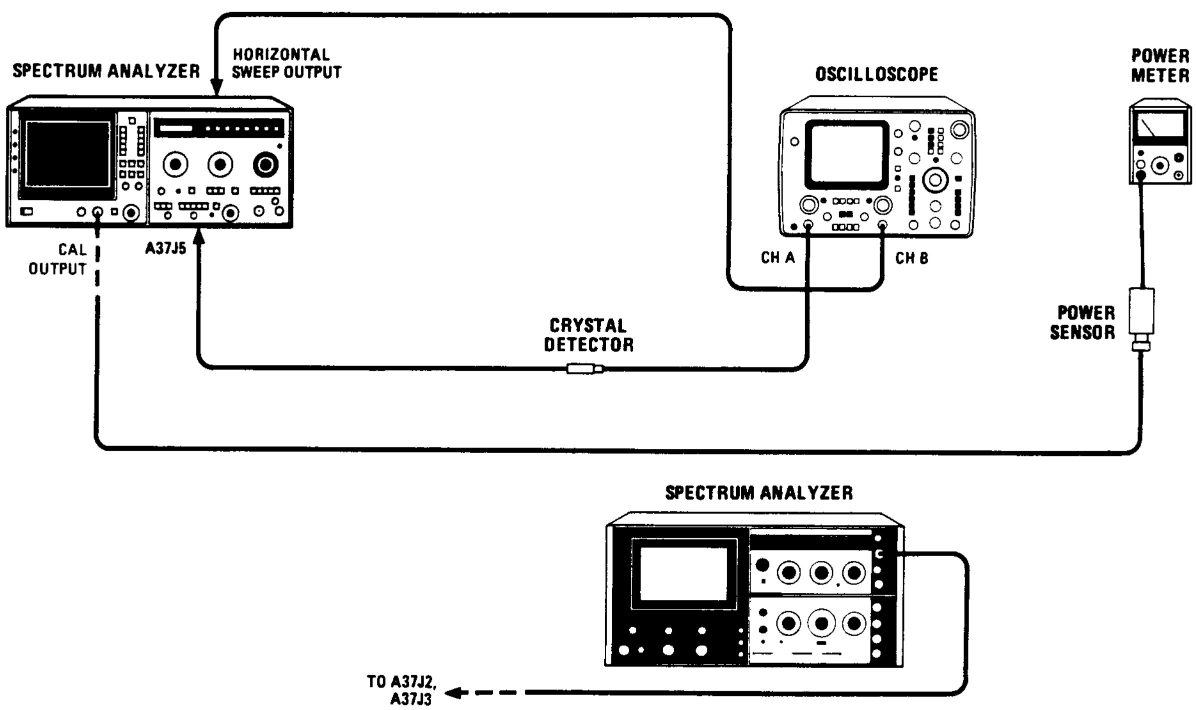


Figure 5-35. Third Converter Adjustment Test Setup

5-25. THIRD CONVERTER ADJUSTMENT (Cont'd)

BOTTOM VIEW

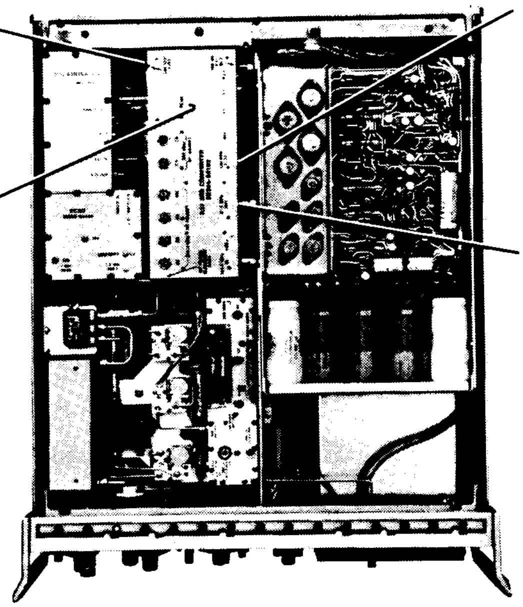


Figure 5-36. Third Converter Adjustment Locations

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top and bottom covers.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-35.

3. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
TUNING	0.050 GHz
RESOLUTION BW	100 kHz
FREQUENCY SPAN/DIV	5 MHz

4. Set LINE switch OFF and disconnect power cord.

5. Locate four Pozi-Drive screws holding A37 Third Converter Assembly in place.

NOTE

The upper and lower right-hand screws are mounted on the rear panel.

6. Remove upper left- and right-hand screws from assembly.

7. Loosen lower left- and right-hand screws a quarter turn.

5-25. THIRD CONVERTER ADJUSTMENT (Cont'd)

8. Tilt upper part of assembly forward until BP FILTER ALIGNMENT PORT is approximately 1/2 inch from adjacent sheet metal.

9. Tighten lower left- and right-hand screws a quarter turn.

10. Connect power cord and set LINE switch ON.

11. Connect test spectrum analyzer to A37J3 100 MHz TEST (Figure 5-36). Adjust A37A3L4 OSC PEAK for maximum 100 MHz signal level (use non-metallic adjusting tool). Disconnect test spectrum analyzer.

12. Connect power meter to front panel CAL OUTPUT connector. Adjust A37A3R27 CAL OUT LEVEL for −10 dBm. Disconnect power meter.

13. Disconnect cable assembly W22 from A37J2 21.4 MHz OUT and connect test spectrum analyzer to A37J2 21.4 MHz OUT.

14. Tune test spectrum analyzer to display 300 MHz local oscillator signal.

15. Iteratively tune A37C5 and A37C6 300 MHz BP ADJUST (using adjusting tool with slot screwdriver) for maximum 300 MHz signal.

16. Disconnect test spectrum analyzer and reconnect cable assembly W22 to A37J2 21.4 MHz OUT.

17. Use TUNING control to center LO signal (0.000 GHz) on CRT display.

18. Externally sweep oscilloscope (CHAN B, DC coupled input) with spectrum analyzer HORIZONTAL SWEEP OUTPUT. Set sweep mode of oscilloscope to A VS B. Simultaneously depress spectrum analyzer SWEEP SOURCE push buttons INT and EXT. Adjust oscilloscope horizontal position to center dot on CRT display. After centering dot, set spectrum analyzer SWEEP SOURCE to INT.

19. Connect oscilloscope (CHAN A, DC coupled input) through HP 11592-60001 cable assembly, crystal detector, and adapter to A37J5 BP FILTER ALIGNMENT PORT connector. Set oscilloscope MAG to X5. Set CHAN A VOLTS/DIV and vertical position for a 4-division display. Set CHAN B VOLTS/DIV to 1.

NOTE

This procedure uses a negative-polarity detector. If a positive-polarity crystal detector is used the waveforms in Figure 5-37 will be inverted.

20. Check that oscilloscope display is symmetrical as shown in Figure 5-37d. If not, perform 321.4 MHz coarse bandpass adjustment as follows (Third Converter cover must be installed):

    a. Loosen lock nuts on A37C2, A37C3, and A37C4. Carefully turn tuning screws clockwise until they are flush with lock nuts.

    b. Adjust A37C2 for a dip at center of oscilloscope display as shown in Figure 5-37a.

    c. Adjust A37C2 for a peak at center of oscilloscope display as shown in Figure 5-37b.

    d. Adjust A37C3 for dip at center of oscilloscope display as shown in Figure 5-37c.

    e. Adjust A37C4 for peak at center of oscilloscope display as shown in Figure 5-37d.

5-25. THIRD CONVERTER ADJUSTMENT (Cont'd)

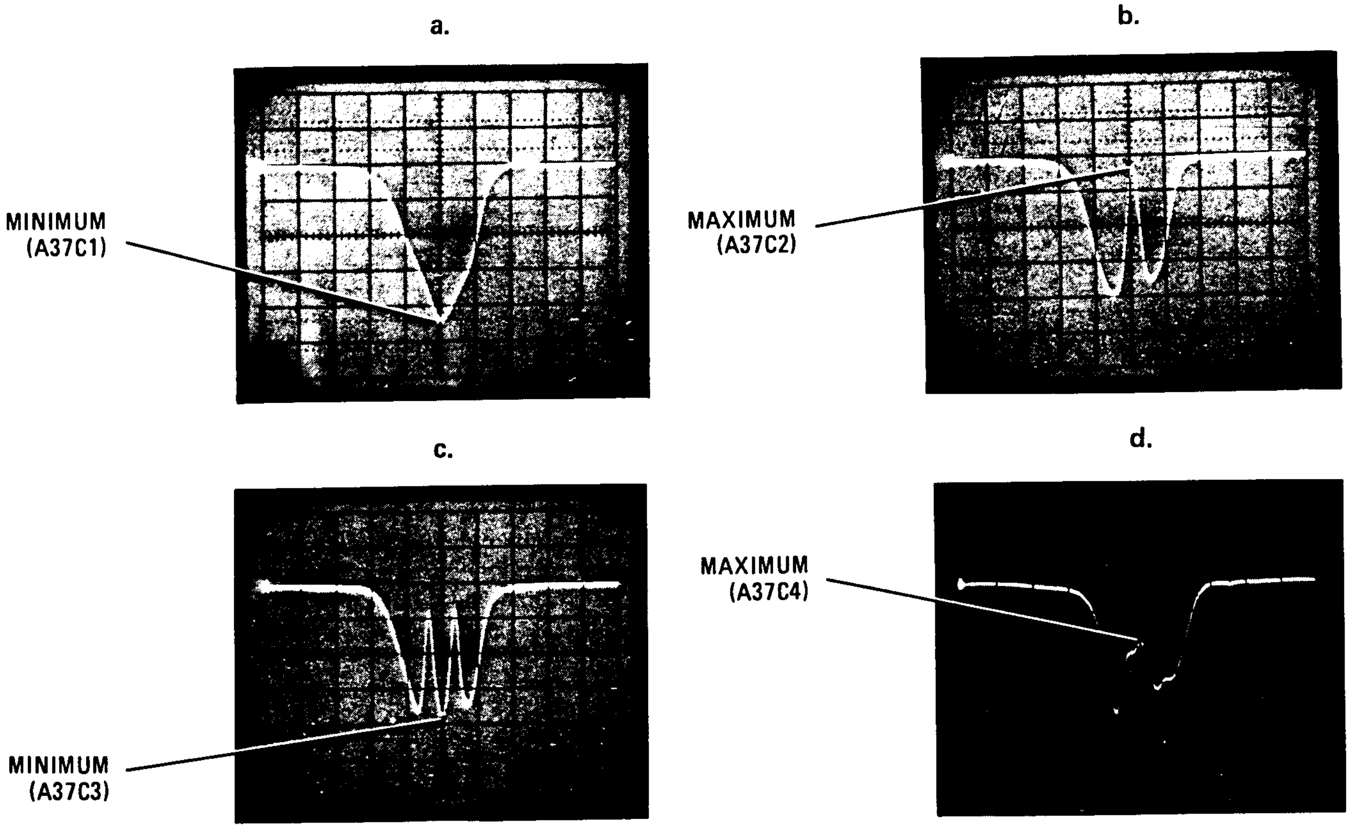


Figure 5-37. 321.4 MHz Bandpass Filter Alignment, Oscilloscope Display

21. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

RESOLUTION BW	3 MHz
FREQUENCY SPAN/DIV	2 MHz
TUNING	0.100 GHz
REF LEVEL dBm	−10

22. Check that 100 MHz signal on spectrum analyzer display has a symmetrical bandpass. A typical bandpass shape is shown in Figure 5-38. If bandpass symmetry is worse than shown in Figure 5-38, small adjustments of A37C1 through A37C4 should be performed to improve bandpass shape. However, do not sacrifice more than 1 dB of signal amplitude when adjusting for best bandpass shape (loss of signal amplitude reduces instrument sensitivity).

23. Adjust 3-dB bandwidth for the 3 MHz RESOLUTION BW switch position according to adjustment procedure in Bandwidth Filter Adjustments.

ADJUSTMENTS

5-25. THIRD CONVERTER ADJUSTMENT (Cont'd)

24. When adjustment is complete, set LINE switch OFF and disconnect power cord. Tilt A37 Third Converter Assembly back in place and install upper left- and right-hand screws that were previously removed. Install HP 8569B top and bottom covers.

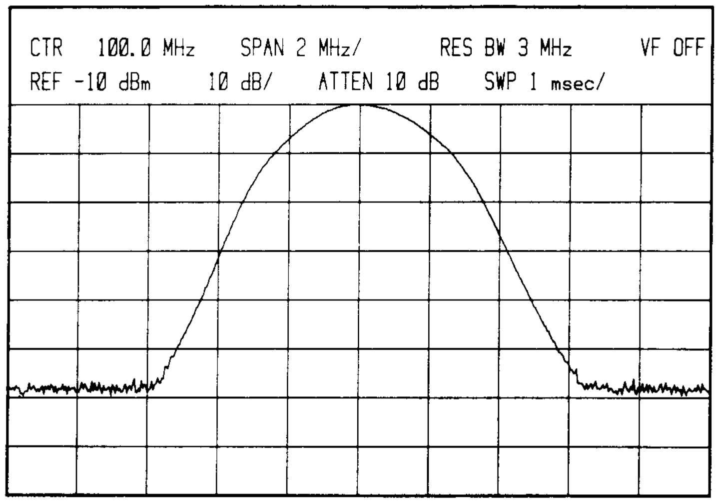


Figure 5-38. 321.4 MHz Bandpass Filter Alignment, Spectrum Analyzer Display

ADJUSTMENTS

5-26. SWEEP ATTENUATOR ADJUSTMENT

REFERENCE:

A15 Schematic

DESCRIPTION:

The MAIN SWP OFFSET is adjusted in the Sweep Attenuator Assembly so that a signal at center screen does not shift as FREQUENCY SPAN/DIV is switched between 5 MHz and 2 MHz. This adjustment is necessary because the sweep is applied to the YTO Main Coil for frequency spans ≥ 5 MHz/DIV and to the YTO Tickler Coil for frequency spans ≤ 2 MHz/DIV.

TOP VIEW

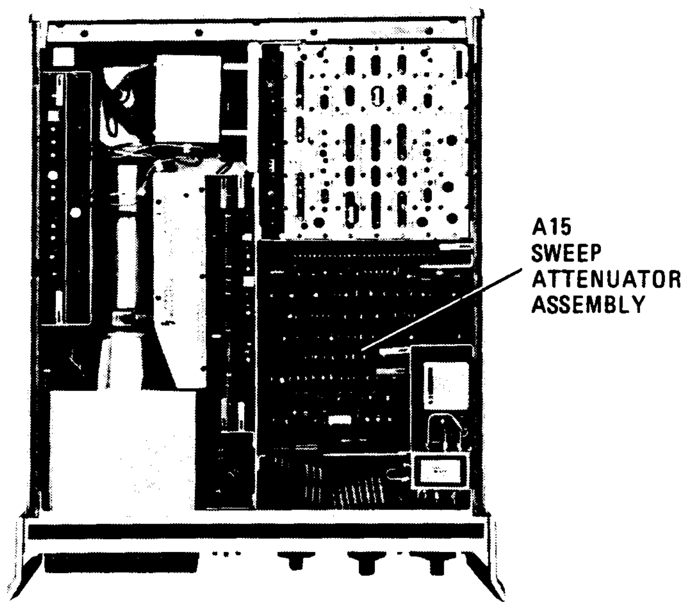


Figure 5-39. Sweep Attenuator Adjustment Locations

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

5-26. SWEEP ATTENUATOR ADJUSTMENT (Cont'd)

2. Reconnect power cord and set LINE switch ON. Set all normal (green) settings, except as indicated, and other spectrum analyzer controls as follows:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
RESOLUTION BW	100 kHz
FREQUENCY SPAN/DIV	2 MHz
INPUT ATTEN	10 dB
REF LEVEL	0 dBm
REF LEVEL FINE	0

3. Simultaneously press SWEEP SOURCE INT and EXT push buttons to obtain a dot on CRT display. Adjust front-panel HORIZ POSN screwdriver adjustment to position dot on center vertical graticule line.

4. Press SWEEP SOURCE INT push button to obtain swept CRT trace. Set TRACE A to WRITE. Connect 100 MHz CAL OUTPUT signal to INPUT 50Ω connector and adjust TUNING control to center 100 MHz signal on CRT display.

5. Switch FREQUENCY SPAN/DIV to 5 MHz and adjust A15R53 MAIN SWP OFFSET (Figure 5-39) to center 100 MHz signal on CRT display.

6. Repeat steps 4 and 5 until no further adjustment is necessary.

7. When adjustment is complete, set LINE switch OFF, disconnect power cord, and install HP 8569B top cover.

ADJUSTMENTS

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS

REFERENCE:

A14 and A36 Schematics

DESCRIPTION:

A14 Tuning Stabilizer Control Assembly adjustments are performed to set up the correct sweep voltages for the YTO tickler coil and Voltage-Controlled Crystal Oscillator (VCXO). A14R68 FET OFF is adjusted to provide a zero level output to the tuning stabilizer with the spectrum analyzer operating in ZERO SPAN mode and a zero-volt input from the front-panel FINE tuning control. A 50 MHz signal with 100 kHz frequency modulation is displayed on the spectrum analyzer, and A14R71 TICK SWEEP is adjusted for a modulation peak occurring every division when FREQUENCY SPAN/DIV is set to 100 kHz. The spectrum analyzer is then stabilized, and A14R57 VCXO SWP is adjusted for the same sweep display as in the TICK SWEEP adjustment. The VCXO is then checked for linearity. The VCXO ERROR OUT signal is monitored, and if the variation of the signal is within limits, no adjustment to the VCXO is necessary. If the error signal is out of tolerance, perform the adjustments in the order given. Small adjustments should be made, and the AUTO STABILIZER should be switched OFF and on after each adjustment to remove the dc component introduced by the adjustment.

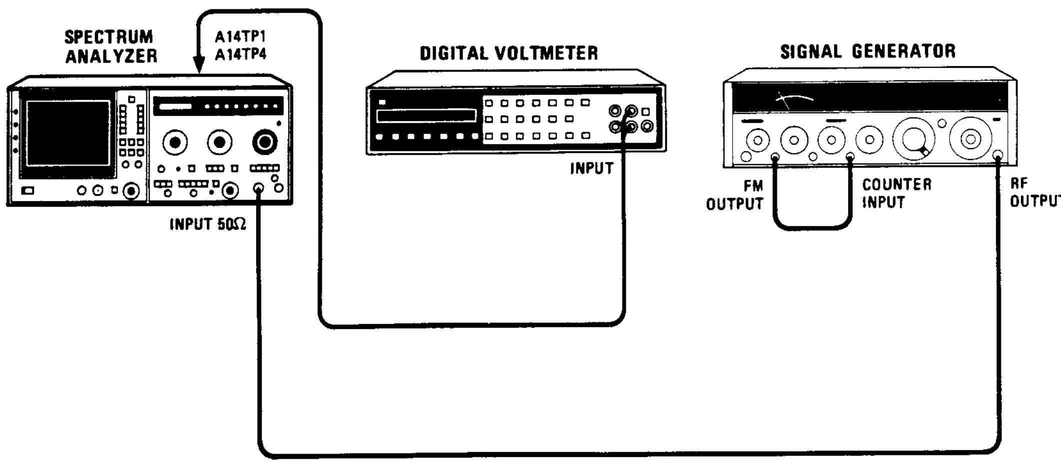


Figure 5-40. Tuning Stabilizer Control Adjustment Test Setup

EQUIPMENT:

Signal Generator	HP 8640B, Opt. 001
Digital Voltmeter	HP 3455A
Oscilloscope	HP 1741A
10:1 Probe	HP 10004D
1:1 Probe	HP 10007D
BNC Tee	HP 1250-0781

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

TOP VIEW

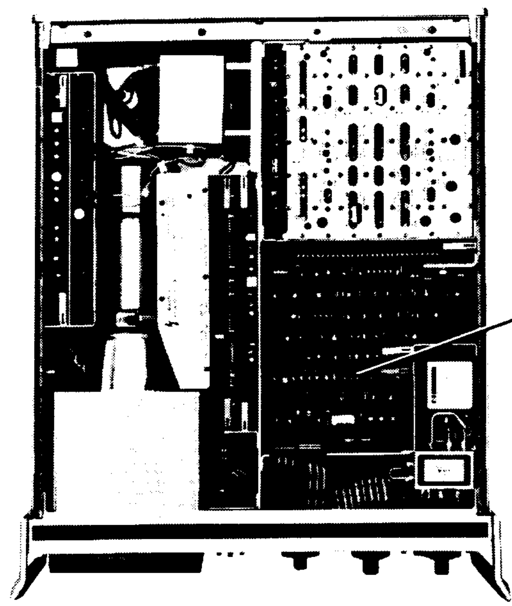


Figure 5-41. Tuning Stabilizer Control Adjustment Locations

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top and bottom covers.
2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-40 with signal generator RF switch off.

Tuning Stabilizer Control Adjustments

3. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

Spectrum Analyzer:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
RESOLUTION BW (coupled)	10 kHz
FREQUENCY SPAN/DIV	100 kHz
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	0
FREQUENCY SPAN MODE	ZERO SPAN
AUTO STABILIZER	OFF

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

Signal Generator:

OUTPUT LEVEL	−20 dBm
FREQUENCY MHz	50
MODULATION FREQUENCY	100 kHz
PEAK DEVIATION	300 kHz
FM	OFF
AUDIO OUTPUT LEVEL	1V

4. Connect digital voltmeter across A14TP1 TICK S + T (high DVM input) and A14TP4 (low DVM input). (See Figure 5-41.)
5. Adjust FINE tuning control for a digital voltmeter reading of 0.00 ±0.01V.
6. Connect high input of digital voltmeter to A14TP3 VCXO SWP and adjust A14R68 FET OFF for 0.00 ±0.01V.
7. Set FREQUENCY SPAN MODE to PER DIV and switch signal generator RF output to ON.
8. Use TUNING control to center 50 MHz carrier frequency on spectrum analyzer CRT display and set FM switch of signal generator to INT.
9. Connect FM output to COUNTER input on signal generator. Press and release INT EXT push button and depress EXT push button. Set COUNTER MODE EXPAND to X100. Adjust MODULATION FREQUENCY for 100 ±0.2 kHz.
10. Adjust PEAK DEVIATION of signal generator to display a total of 10 modulation peaks plus carrier, as shown in Figure 5-42.
11. Adjust A14R57 TICK SWP for 1 division spacing between modulation peaks (use FINE tuning control to align peaks on graticule line).
12. Set FINE tuning control to midrange and activate tuning stabilizer (AUTO STABILIZER push button out).
13. Adjust A14R71 VCXO SWP for 1 division spacing between modulation peaks (use FINE tuning control to align peaks on graticule line).

NOTE

In the following step, adjust signal generator carrier frequency (50 MHz) to set modulation peaks on graticule lines.

14. Set FREQUENCY SPAN/DIV to 20 kHz and RESOLUTION BW to 3 kHz. Note 5-division spacing between modulation peaks.
15. Check 5-division spacing between modulation peaks with FINE tuning control set at fully counterclockwise, midrange, and fully clockwise positions. Adjust A14R71 VCXO SWP for best compromise of 5-division spacing over the full range of FINE tuning control.

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

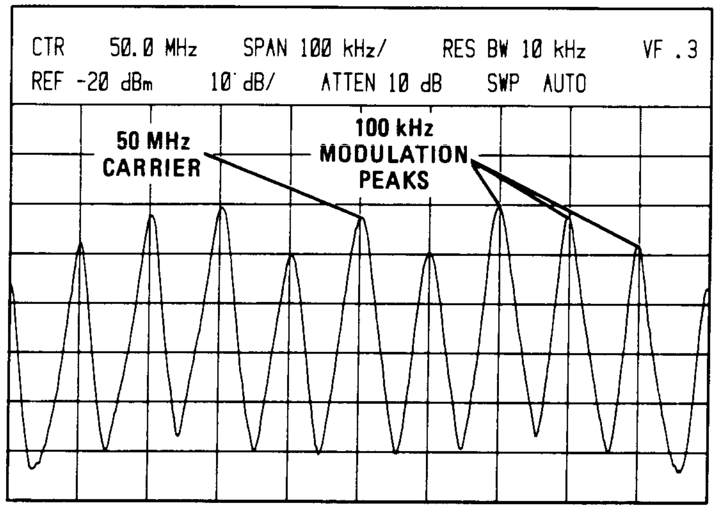


Figure 5-42. Spectrum Analyzer Plot with 100 kHz FM

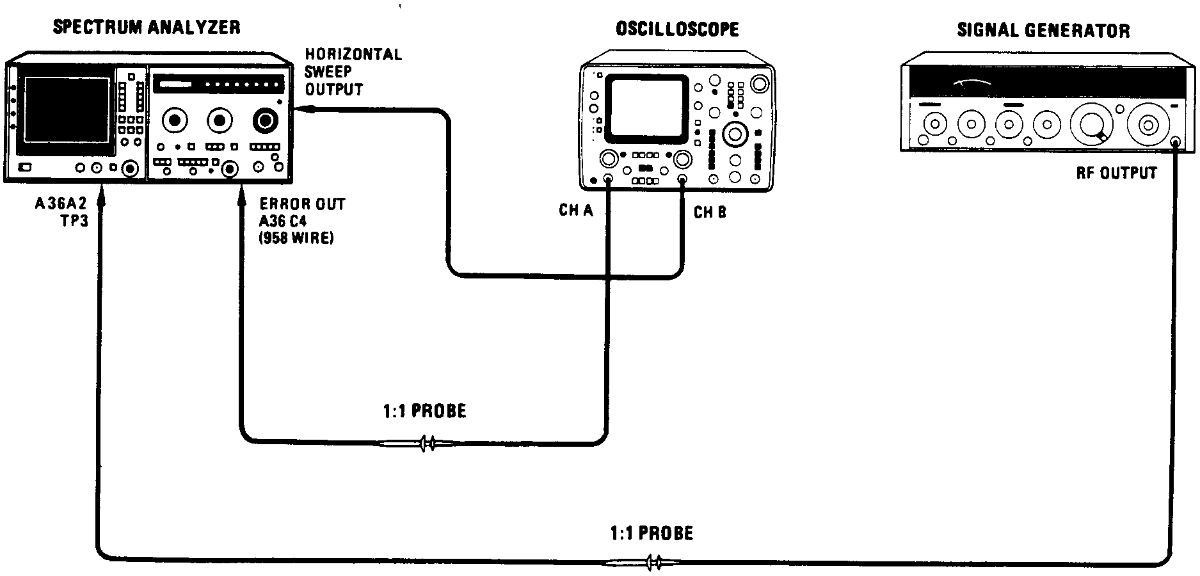


Figure 5-43. Tuning Stabilizer VCXO Check and Adjustment Test Setup

ADJUSTMENTS

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

BOTTOM VIEW

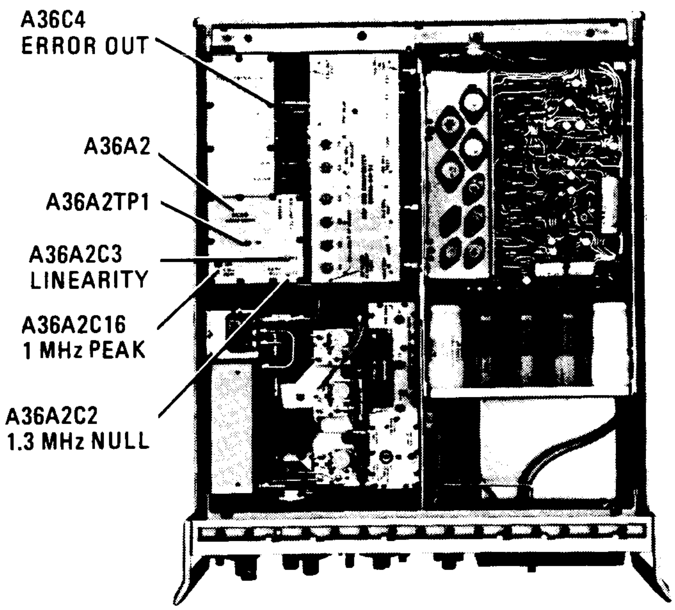


Figure 5-44. Tuning Stabilizer VCXO Adjustment Locations

16. Connect equipment as shown in Figure 5-43 and set oscilloscope for an externally swept (A VS B), DC coupled display. Set CHAN A to 10 mV/DIV and CHAN B to 1V/DIV. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

TRACE A	WRITE
TRACE B	STORE BLANK
FREQUENCY BAND GHz	.01 – 1.8
FREQUENCY GHz	0.000
RESOLUTION BW (coupled)	10 kHz
FREQUENCY SPAN/DIV	100 kHz
FREQUENCY SPAN MODE	PER DIV
FINE tuning	Midrange
AUTO STABILIZER	On (out)

17. Momentarily switch AUTO STABILIZER to OFF to remove dc component of ERROR OUT signal. Center oscilloscope trace with oscilloscope position controls.

18. Check slope of oscilloscope trace. The trace should not change more than 0.5 vertical division (5 mV) for every horizontal division swept.

5-27. TUNING STABILIZER CONTROL ADJUSTMENTS (Cont'd)

19. Adjust FINE tuning control over its full range while observing the oscilloscope trace. The trace should not change more than 0.5 vertical division (5 mv) for every horizontal division swept.

NOTE

If the slope of the oscilloscope trace is within tolerance, no further adjustment is necessary.

20. If slope of oscilloscope trace is out of tolerance, set up oscilloscope for MAIN sweep mode, DISPLAY A, TRIGGER COMP A. Set spectrum analyzer FREQUENCY SPAN MODE to ZERO SPAN and AUTO STABILIZER to OFF.

21. Remove A36A2 cover plate (Figure 5-44) for access to test points and center A36A2C3 LINEARITY.

22. Connect 1.3-MHz, + 14 dBm signal from signal generator through a 1:1 probe to A36A2TP3. (Connect ground clip to chassis ground.)

23. Connect oscilloscope through 10:1 probe to A36A2TP1 and adjust A36A2C2 1.3 MHz NULL for minimum 1.3 MHz signal. Disconnect signal generator from A36A2TP3.

24. Connect oscilloscope through 10:1 probe to A36A2TP2 and adjust A36A2C16 1 MHz PEAK for maximum 1 MHz signal.

25. Reinstall A36A2 cover plate and repeat steps 16 through 19. If slope of oscilloscope trace is out of tolerance (steps 18 and 19), make adjustments as follows:

NOTE

Perform each of the following adjustments in small steps and switch AUTO STABILIZER OFF and on after each adjustment.

a. With 1:1 probe connected to feedthrough capacitor A36C4 (ERROR OUT line), adjust A36A2C3 LINEARITY and A36A2C16 1 MHz PEAK for minimum slope of oscilloscope trace.

b. Check slope of oscilloscope trace while adjusting FINE TUNING control over its three turn range. Oscilloscope trace should not change more than 0.5 vertical division (5 mV) per horizontal division swept.

c. Repeat steps 25a and 25b until no further adjustment is necessary.

26. Check Tuning Stabilizer Control Adjustments (steps 3 through 15). If VCXO SWP adjustment is performed, repeat steps 16 through 19 to check VCXO linearity.

27. When adjustment is complete, set LINE switch OFF, disconnect power cord, and install HP 8569B top and bottom covers.

ADJUSTMENTS

5-28. PRELIMINARY BIAS ADJUSTMENT

REFERENCE:

A20 Schematic

DESCRIPTION:

NOTE

This is a preliminary adjustment and requires that the Frequency Response Adjustment also be performed.

A synchronizer and sweep oscillator are connected to make a tracking generator for the HP 8569B. The sweep oscillator is phase locked on each frequency band checked, and mixer bias adjustments are performed for minimum amplitude variation consistent with near minimum conversion loss across the frequency band.

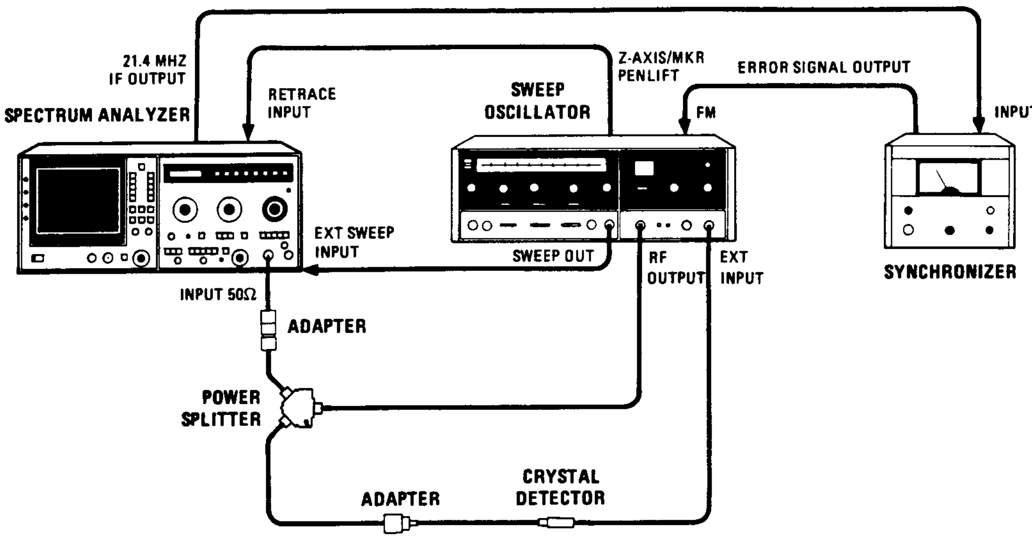


Figure 5-45. Preliminary Bias Adjustment Test Setup

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

EQUIPMENT:

Sweep Oscillator	HP 8620C/86290A-H08
Synchronizer	HP 8709A-H10
Power Splitter	HP 11667A, Opt. 002
Crystal Detector	HP 33330C
Adapter, APC-7 to Type N (m)	HP 11525A
Adapter, APC-7 to SMA (f)	HP 11534A
Adapter, APC-7 to Type N (f)	HP 11524A
Adapter, SMA (f) to Type N (f)	HP 86290-60005
Adapter, SMA (f) to Type N (m)	HP 1250-1404

5-28. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-45. Set all normal (green) spectrum analyzer controls, except as indicated, and other controls as follows:

   Spectrum Analyzer:

   TRACE A .... WRITE
   TRACE B .... STORE BLANK
   FREQUENCY BAND GHz .... 5.8 – 12.9
   INPUT ATTEN .... 10 dB
   REF LEVEL dBm 0
   REFERENCE LEVEL FINE 0
   FREQUENCY SPAN MODE .... FULL BAND
   AMPLITUDE SCALE .... 5 dB
   SWEEP SOURCE .... EXT
   PRESELECTOR PEAK .... Centered in green

   HP 8620C/86290A-H08:

   BAND 4
   START Frequency .... 5.8 GHz
   STOP Frequency .... 12.9 GHz
   SWEEP TRIGGER .... INT
   SWEEP-TIME .... 5 sec
   DISPL BLANK .... ON
   RF .... ON
   ALC Mode .... EXT
   FM-NORM-PL .... PL

3. Set A28S1 NORM-OFF-TEST switch to OFF. Set synchronizer ERROR SIGNAL switch to –.

4. Phase lock sweep oscillator as follows:

   a. Set TRACE A and TRACE B to STORE BLANK. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

   b. Set sweep oscillator start frequency to low frequency of selected spectrum analyzer FREQUENCY BAND GHz and adjust start frequency for synchronizer phase lock (minimum phase error).

   c. Set sweep oscillator manual sweep control fully clockwise and stop frequency to high frequency of selected spectrum analyzer FREQUENCY BAND GHz. Adjust stop frequency for synchronizer phase lock (minimum phase error).

   d. Set sweep oscillator to automatic sweep mode and check for phase locked spectrum analyzer CRT display (Figure 5-46). If system is breaking phase lock, adjust start and stop frequencies during slow sweep ($\geq$ 10 seconds) to obtain phase lock. Set TRACE A and TRACE B to WRITE.

ADJUSTMENTS

5-28. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

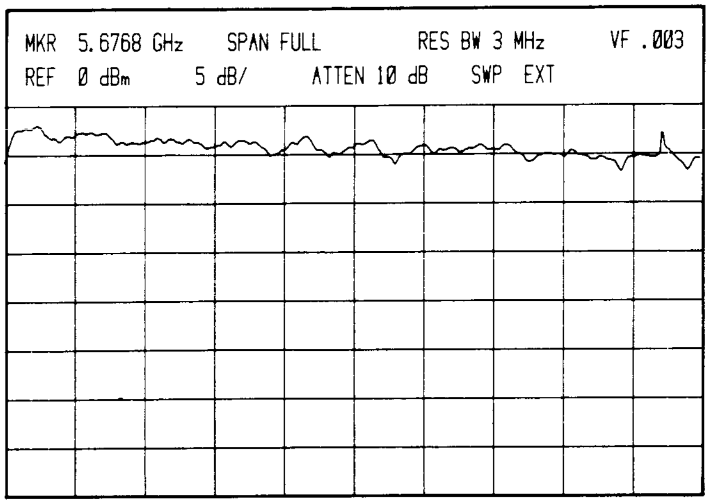


Figure 5-46. Phase Locked Spectrum Analyzer CRT Display

5. Set AMPLITUDE SCALE to 2 dB. Adjust A20R85 V4 (Figure 5-47) over full range and note position for minimum ripple on CRT trace. Set A20R85 V4 for minimum ripple.

TOP VIEW

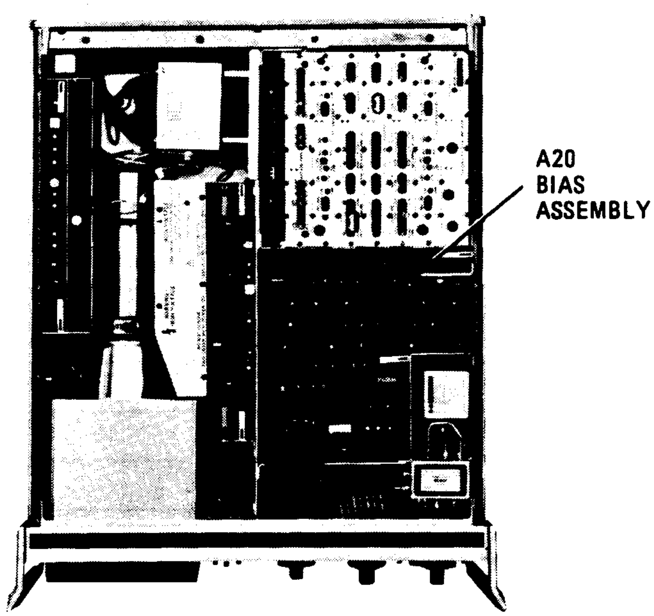


Figure 5-47. Preliminary Bias Adjustment Locations

5-28. PRELIMINARY BIAS ADJUSTMENT (Cont'd)

6. Set HP 8569B FREQUENCY BAND GHz to 3.8 – 8.5. Set HP 8620C sweep oscillator for a MARKER SWEEP of 3.8 GHz to 8.5 GHz. Phase lock sweep oscillator according to step 4.

7. Adjust A20R77 V3 over full range and note position for minimum ripple on CRT trace. Set A20R77 V3 for minimum ripple.

8. Set HP 8569B FREQUENCY BAND GHz to 8.5 – 18. Set synchronizer ERROR SIGNAL switch to +. Set HP 8620C sweep oscillator for a MARKER SWEEP of 8.5 GHz to 18 GHz. Phase lock sweep oscillator according to step 4.

9. Adjust A20R95 V5 over full range and note position for minimum ripple on CRT trace. Set A20R95 V5 for minimum ripple.

10. Set HP 8569B FREQUENCY BAND GHz to 10.5 – 22. Set HP 8620C/86290A-H08 sweep oscillator for a MARKER SWEEP of 10.5 GHz to 22 GHz. Phase lock sweep oscillator according to step 4.

11. Adjust A20R105 V6 over full range and note position for minimum ripple on CRT trace. Set A20R105 V6 for minimum ripple (see Figure 5-48).

12. Set HP 8569B FREQUENCY BAND GHz to .01 – 1.8. Replace HP 86290A-H08 RF Plug-in with HP 86222A. Set HP 8620C sweep oscillator for a MARKER SWEEP of .01 to 1.8 GHz. Set ERROR switch on HP 8709A to –. Phase lock sweep oscillator according to step 4.

13. Adjust A20R71 V1 over full range and set for minimum ripple.

14. Set A28S1 NORM-OFF-TEST switch to NORM. Perform Frequency Response Adjustments.

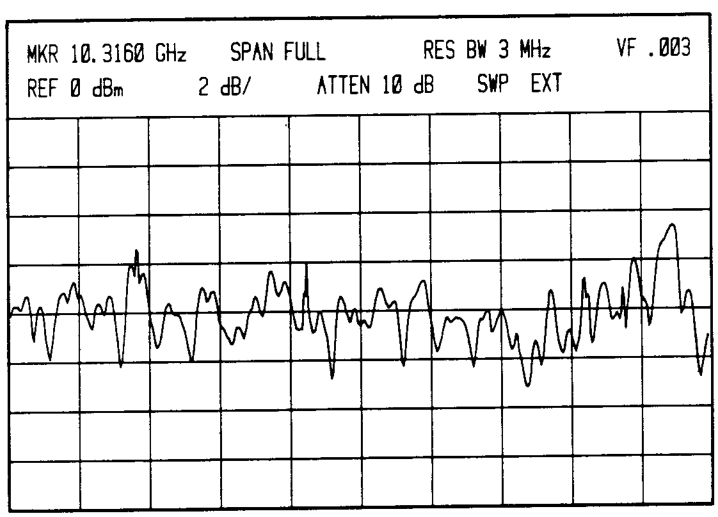


Figure 5-48. Phase Locked Spectrum Analyzer CRT Display (10.5–18 GHz)

5-29. YTF TRACKING ADJUSTMENT

REFERENCE:

A17 and A19 Schematics

DESCRIPTION:

With a signal applied to the INPUT 50Ω connector, the spectrum analyzer is set to ZERO SPAN (1ST LO in CW frequency), and the YIG-Tuned Filter (YTF) is swept around the center frequency. This results in the display of the YTF passband on the CRT screen. YTF tracking adjustments are performed to keep the YTF passband approximately centered around the center frequency vertical graticule line over the full frequency range of the spectrum analyzer.

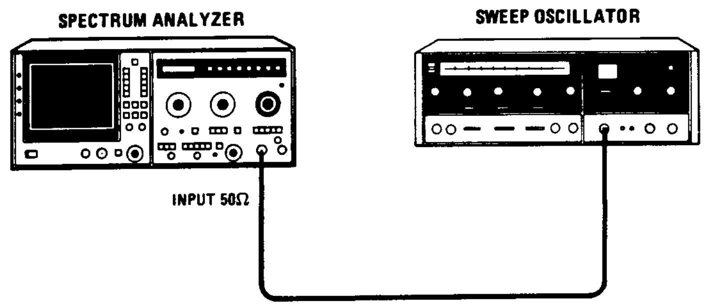


Figure 5-49. YTF Tracking Adjustment Test Setup

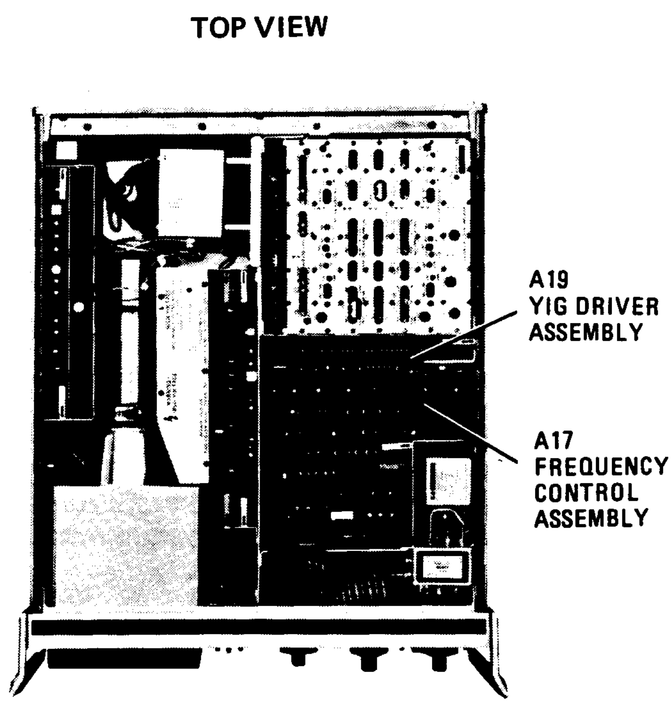


Figure 5-50. YTF Tracking Adjustment Locations

ADJUSTMENTS

5-29. YTF TRACKING ADJUSTMENT (Cont'd)

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

EQUIPMENT:

Sweep Oscillator .... HP 8620C/86290A-H08

NOTE

Allow at least one hour instrument warm-up before performing YTF Tracking Adjustment.

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-49. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

TRACE A	WRITE
TRACE B	WRITE
FREQUENCY BAND GHz	1.7 – 4.1
INPUT ATTEN	10 dB
AMPLITUDE SCALE	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	0
RESOLUTION BW	3 MHz
FREQUENCY SPAN MODE	ZERO SPAN
SWEEP TIME/DIV	20 mSEC
AUTO STABILIZER	OFF
PRESELECTOR PEAK	Centered in green
TUNING	2.000 GHz
SWEEP SOURCE	INT

3. Set A19S1 YTF TRACK switch (Figure 5-50) to TEST position.

4. Simultaneously depress PLOT GRAT and CLEAR/RESET push buttons to display test routine #0 on spectrum analyzer CRT display. Adjust front-panel HORIZ POSN screwdriver adjustment to position dot center tick mark on center vertical graticule line. Press CLEAR/RESET. Set FREQUENCY SPAN MODE to 1.5 – 22 GHz SPAN and allow spectrum analyzer to sweep several times. Then press PER DIV.

5-29. YTF TRACKING ADJUSTMENT (Cont'd)

NOTE

Ensure that PRESELECTOR PEAK remains in center of green region throughout adjustment procedure.

NOTE

When repeating adjustments in group A, readjust YTF GAIN only at 10.5 GHz. If there is insufficient range on YTF LIN adjustments in groups B and C, the YTF GAIN can be compromised at 10.5 GHz to aid the YTF LIN adjustment. The YTF OFFSET affects offsets on all bands. YTF GAIN has an increasing effect with increasing frequency. (For example, YTF GAIN has no effect at 2 GHz; but at 4 GHz, a 2-MHz shift in passband will result in a 6-MHz shift at 8 GHz, an 8-MHz shift at 10 GHz, and a 16-MHz shift at 18 GHz.)

5. Tracking adjustments in Table 5-14 are listed in three groups (A, B, and C). Perform adjustments according to groups, and repeat adjustments in each group to give best compromise of centered passbands for that group before proceeding to the next group of adjustments. Perform each tracking adjustment listed in Table 5-14 as follows:

   a. Select spectrum analyzer FREQUENCY BAND GHz and adjust TUNING control for given frequency.

   b. Remove error due to hysteresis by switching FREQUENCY SPAN MODE to FULL BAND, then back to ZERO SPAN.

   c. Set sweep oscillator for a CW frequency equal to spectrum analyzer frequency. Adjust sweep oscillator CW frequency for maximum signal amplitude on spectrum analyzer CRT display. (To locate CW signal, first set HP 8569B to FULL SPAN, tune sweep oscillator signal to marker, then press ZERO SPAN.

   d. Perform corresponding YTF tracking adjustment to center passband (10-dB points) on spectrum analyzer CRT display (Figure 5-51). Ensure that at least 25 percent of passband is on each side of center vertical graticule line.

6. Verify that PRESELECTOR PEAK is centered in green region, and without making adjustments, recheck tracking by repeating step 5.

7. Set A19S2 YTF TRACK switch to NORM. Set LINE switch OFF, disconnect power cord, and install HP 8569B top cover.

ADJUSTMENTS

5-29. YTF TRACKING ADJUSTMENT (Cont'd)

Table 5-14. YTF Tracking Adjustments

Adjustment Group	Frequency Band	Frequency	Tracking Adjustment	Adjustment Effect
A	1.7 – 4.1 GHz	2.0 GHz	A19R14 YTF OFFSET	Overall Offset
	1.7 – 4.1 GHz	4.0 GHz	A19R17 YTF GAIN	Overall Gain
	3.8 – 8.5 GHz	4.0 GHz	A17R43 YTF OFFSET N2	Offset 3.8 – 8.5 BAND
	3.8 – 8.5 GHz	8.5 GHz	A19R17 YTF GAIN	Overall Gain
	5.8 – 12.9 GHz	8.5 GHz	A17R50 YTF OFFSET N3	Offset 5.8 – 12.9 BAND
	5.8 – 12.9 GHz	10.5 GHz	A19R17 YTF GAIN	Overall Gain
B	8.5 – 18 GHz	10.5 GHz	A17R57 YTF OFFSET N4	Offset 8.5 – 18 BAND
	8.5 – 18 GHz	13.0 GHz	A19R39 YTF LIN 13	Δ Gain above 10 GHz
	8.5 – 18 GHz	16.0 GHz	A19R42 YTF LIN 16	Δ Gain above 14 GHz
	8.5 – 18 GHz	18.0 GHz	A19R45 YTF LIN 18	Δ Gain above 16 GHz
C	10.5 – 22 GHz	10.5 GHz	A17R64 YTF OFFSET N5	Offset 10.5 – 22 GHz BAND
	10.5 – 22 GHz	20.0 GHz	A19R48 YTF LIN 20	Δ Gain above 18 GHz
	10.5 – 22 GHz	22.0 GHz	A19R51 YTF LIN 22	Δ Gain above 20 GHz

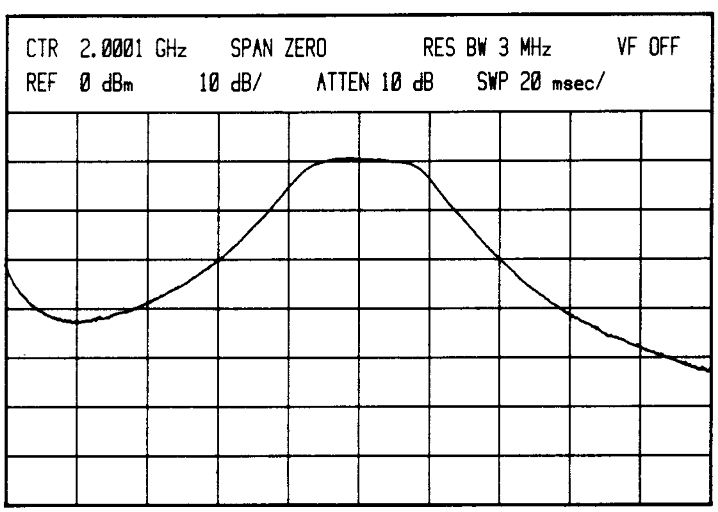


Figure 5-51. YTF Passband Display

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS

REFERENCE:

A20 and A28 Schematics

DESCRIPTION:

A synchronizer and sweep oscillator are connected to make a tracking generator for HP 8569B. The YTF is modulated with a 1 kHz sine wave to eliminate amplitude variations due to small errors in YTF Tracking. The sweep oscillator is phase locked across each frequency band, and frequency response adustments are performed.

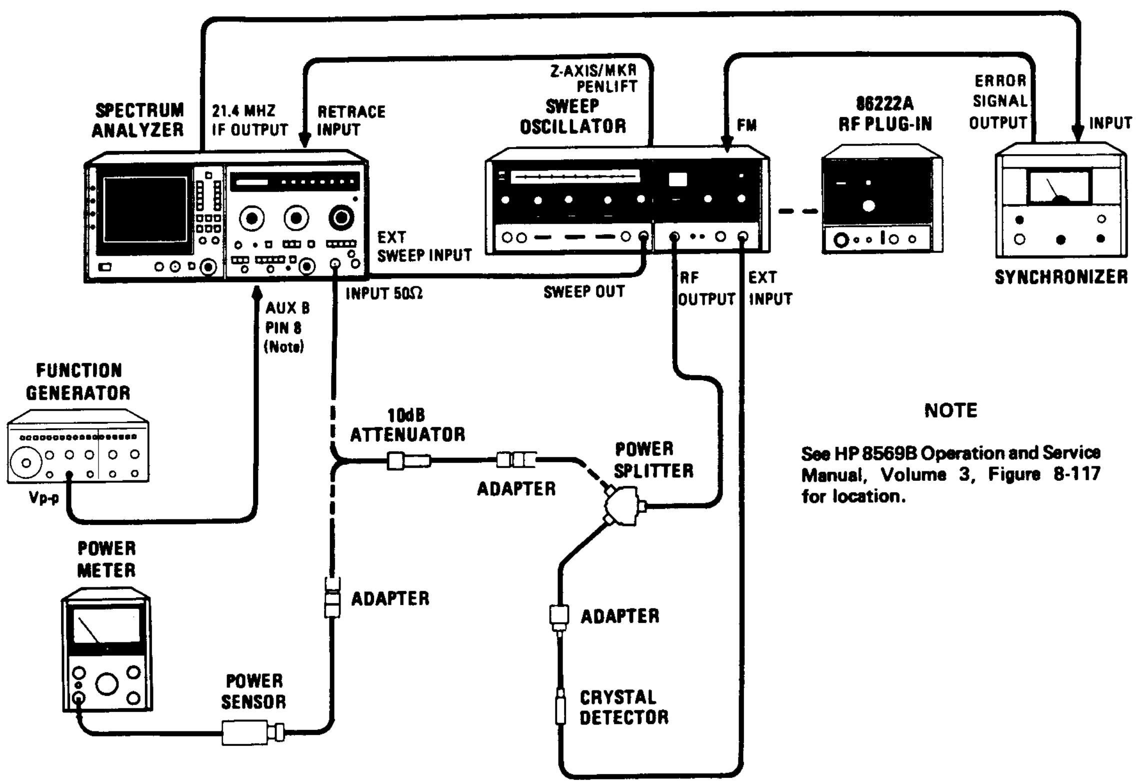


Figure 5-52. Frequency Response Adjustment Test Setup

NOTE

The HP 8350A Sweep Oscillator may be substituted for the HP 8620C in this procedure.

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

EQUIPMENT:

Sweep Oscillator	HP 8620C/86290A-H08
RF Plug-in	HP 86222A
Synchronizer	HP 8709A-H10
Function Generator	HP 3312A
Power Meter	HP 435B
Power Splitter	HP 11667A, Opt. 002
Power Sensor	HP 8481A, Opt. C03
Power Sensor	HP 8485A
Crystal Detector	HP 33330C
Adapter, APC-7 to Type N Male	HP 11525A
Adapter, APC-7 to SMA Female	HP 11534A
Adapter, SMA Female to Type N Female	HP 86290-60005
Adapter, SMA Female to Type N Male (2 required)	HP 1250-1404
Attenuator, 10 dB	HP 8491B, Opt. 010
Test Cable, SMA Female to BNC Male	HP 11592-60001
Cable Assembly (SMA plug, both ends)	HP 8120-1578

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-52. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

   Spectrum Analyzer:

TRACE A	STORE BLANK
TRACE B	STORE BLANK
FREQUENCY BAND GHz	3.8 – 8.5
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	0
SWEEP SOURCE	EXT
FREQUENCY SPAN MODE	FULL BAND
AMPLITUDE SCALE	10 dB
PRESELECTOR PEAK	Centered in green
TUNING	Fully counterclockwise

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

Sweep Oscillator (HP 8620C/86290A-H08):

BAND . . . . Band 4
MARKER SWEEP pushbutton . . . . Depressed
Start Frequency Pointer . . . . 3.8 GHz
Stop Frequency Pointer . . . . 8.5 GHz
SWEEP TIME-SECONDS . . . . 10 − 1
SWEEP TIME-SECONDS vernier . . . . Midrange
RF OFF-ON . . . . ON
ALC Switch . . . . EXT
POWER LEVEL . . . . Midrange
DISPLAY BLANKING/OFF (Rear Panel) . . . . DISPLAY BLANKING
FM-NORM-PL (Rear Panel) . . . . PL

Sweep Oscillator (HP 8350A/86290A-H08):

BAND 4
START Frequency . . . . 3.8 GHz
STOP Frequency . . . . 8.5 GHz
SWEEP − TIME − SEC . . . . 10 Seconds
RF OFF-ON . . . . ON
ALC Switch . . . . EXT
POWER LEVEL . . . . Midrange
DISPLAY BLANKING . . . . ON
FM-NORM-PL (Rear Panel) . . . . PL

3. Set synchronizer ERROR SIGNAL switch to −. Set function generator for a 1-kHz, 1-volt, peak-to-peak sine wave output.

4. Phase lock sweep oscillator and set output power level as follows:

   a. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise.

   b. Set sweep oscillator start frequency to low frequency of selected spectrum analyzer FREQUENCY BAND GHz and adjust start frequency for synchronizer phase lock (minimum phase error).

   c. Set sweep oscillator manual sweep control fully clockwise and stop frequency to high frequency of selected spectrum analyzer FREQUENCY BAND GHz. Adjust stop frequency for synchronizer phase lock (minimum phase error).

   d. Connect output of power meter, through 10-dB attenuator, to power sensor. With RF power off, zero power meter and set CAL FACTOR % to correct level. Turn RF power on.

   e. Slowly adjust manual sweep control of sweep oscillator over its entire range, and adjust power level for an average power meter reading of − 18 dBm.

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

f. Disconnect power meter and reconnect power splitter (with 10-dB atttenuator) to INPUT 50Ω connector of spectrum analyzer.

g. Set sweep oscillator to automatic sweep mode with a sweep time of 10 seconds. Check for phase locked spectrum analyzer CRT display. If system is breaking phase lock, adjust both start and stop frequencies during slow sweep (= > 10 seconds) to obtain phase lock.

h. Set TRACE A and TRACE B to WRITE.

5. Set A28S1 NORM-OFF-TEST switch (Figure 5-53) to OFF. Store signal level on screen by setting TRACE B to STORE VIEW after at least one complete sweep.

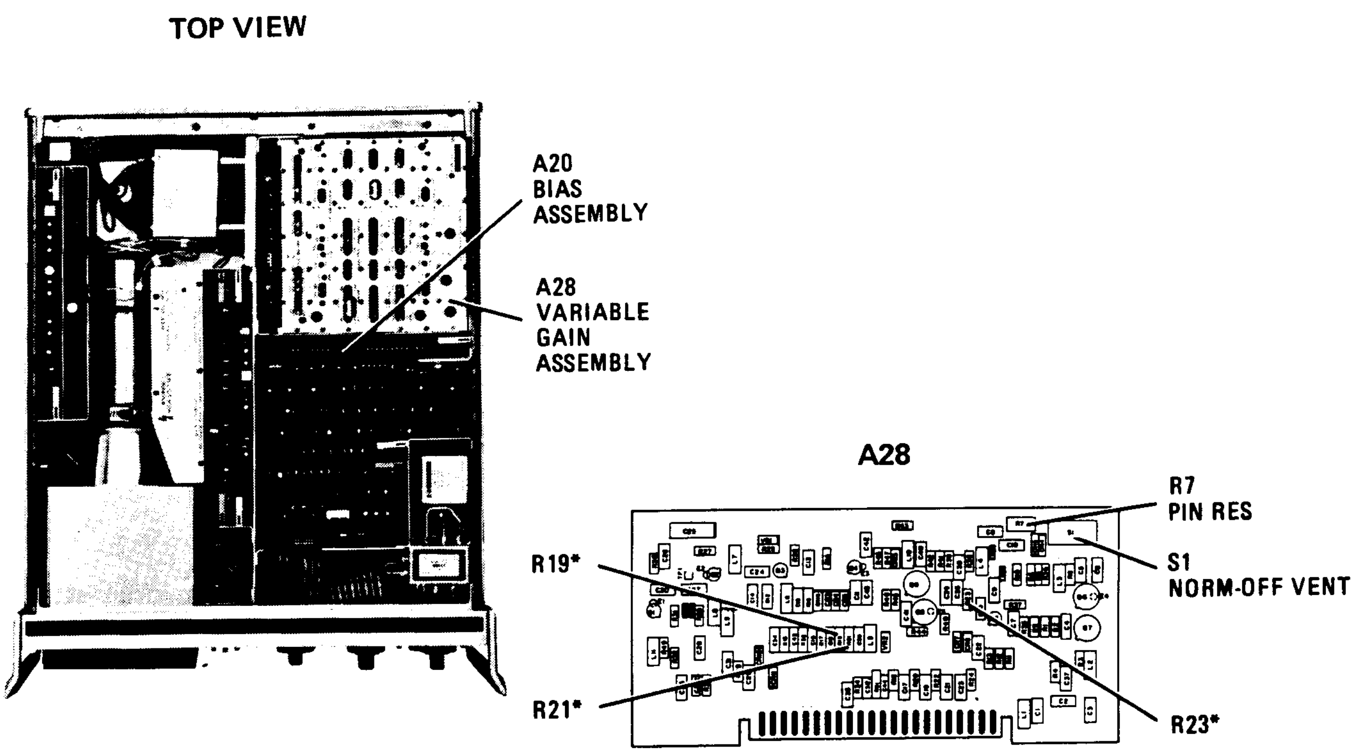


Figure 5-53. Frequency Response Adjustment Locations

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

6. Set A28S1 NORM-OFF-TEST switch to TEST, front-panel INPUT ATTEN to 0 dB, and REF LEVEL dBm to −10. Adjust A28R7 PIN RES for same signal level on CRT screen as that noted in step 5.

7. Set TRACE B to WRITE and AMPLITUDE SCALE to 2 dB.

NOTE

The 'best line,' as used in the following procedures, approximates the median line between the peaks and troughs of the upper edge of the 1 kHz modulation envelope. The best line is illustrated in Figure 5-54.

8. Note best line as illustrated in Figure 5-54. Adjust REFERENCE LEVEL controls to set lowest point of that line on center horizontal graticule line. This point is used as a reference in checking for approximately same power level in frequency bands 5.8 − 12.9 GHz, 8.5 − 18 GHz, and 10.5 − 22 GHz (steps 9 through 14).

9. Set HP 8569B FREQUENCY BAND GHz to 5.8 − 12.9. Set sweep oscillator to sweep from 5.8 GHz to 12.9 GHz. Set TRACE A and TRACE B to STORE BLANK. Phase lock sweep oscillator according to step 4.

10. Check that lowest point of best line (as defined above) is within ±2 dB of center horizontal graticule line. If not, change value of factory selected resistor A28R19* B4 GAIN. (Lower value increases signal level.)

11. Set spectrum analyzer FREQUENCY BAND GHz to 8.5 − 18 and synchronizer ERROR SIGNAL switch to +. Set sweep oscillator to sweep from 8.5 GHz to 18 GHz. Set TRACE A and TRACE B to STORE BLANK. Phase lock sweep oscillator according to step 4.

12. Check that lowest point of best line is within ±2 dB of center horizontal graticule line. If not, change value of factory-selected resistor A28R21* B5 GAIN. (Lower value increases signal level.)

13. Set HP 8569B FREQUENCY BAND GHz to 10.5 − 22. Set sweep oscillator to sweep from 10.5 GHz to 22 GHz. Set TRACE A and TRACE B to STORE BLANK. Phase lock sweep oscillator according to step 4.

14. Check that lowest point of line is within ±2 dB of center horizontal graticule line. If not, change value of factory-selected resistor A28R23* B6 GAIN. (Lower value increases signal level.)

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

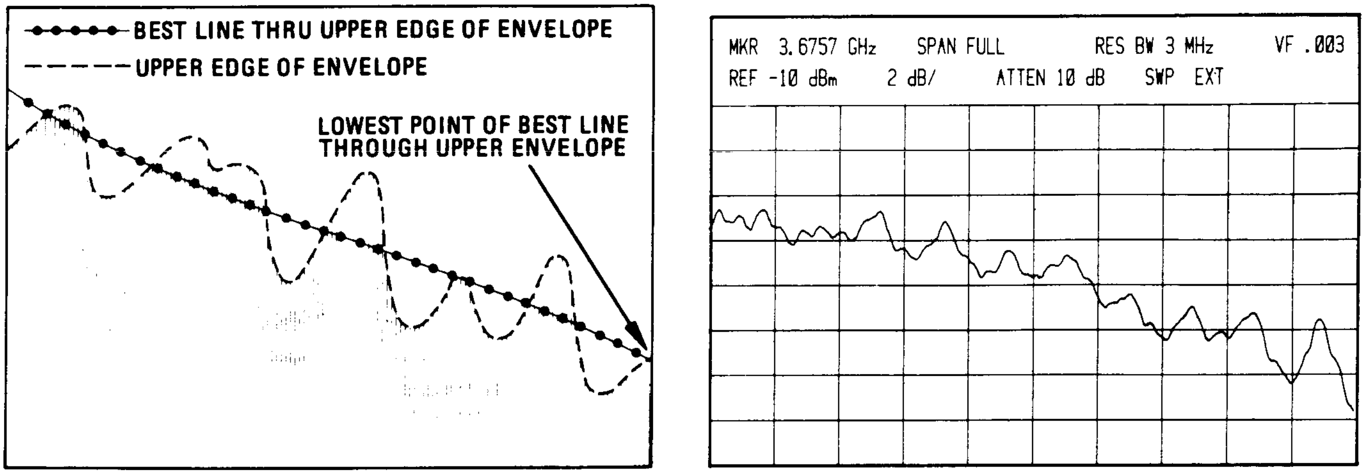


Figure 5-54. Best Line Relative to 1 kHz Modulation Envelope

15. With equipment connected as shown in Figure 5-54, set A28S1 NORM-OFF-TEST switch to NORM. Set spectrum analyzer FREQUENCY BAND GHz to 3.8 − 8.5, INPUT ATTEN to 10 dB, REF LEVEL dBm to −10, and REFERENCE LEVEL FINE to 0. Set synchronizer ERROR SIGNAL switch to −. Set sweep oscillator to sweep from 3.8 GHz to 8.5 GHz. Set TRACE A and TRACE B to STORE BLANK.

16. Phase lock sweep oscillator and set output power level according to step 4.

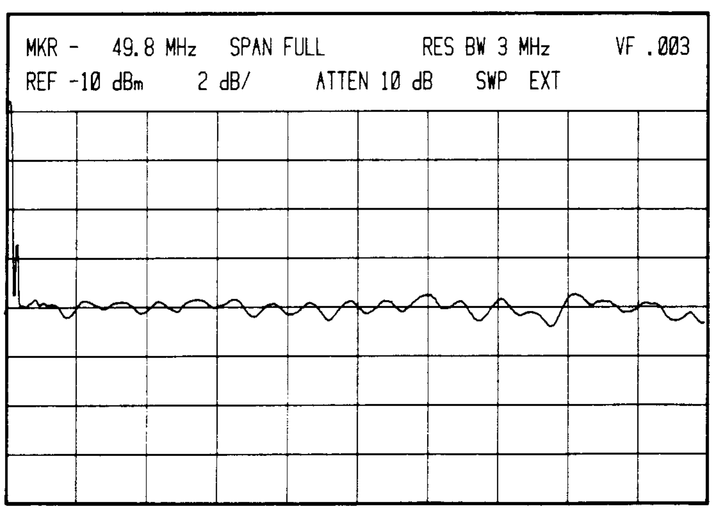


Figure 5-55. CRT Plot of Typical Frequency Response, 3.8 to 8.5 GHz

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

17. Center trace on center horizontal graticule line using REF LEVEL CAL screwdriver adjustment. Adjust A20R26 B3B for minimum slope of trace. Adjust A20R30 B3A counterclockwise so that right side of trace drops 2 dB. Readjust A20R26 B3B for minimum slope (see Figure 5-55). Using REF LEVEL CAL and REFERENCE LEVEL FINE, set best line at center horizontal graticule line. Do not readjust REF LEVEL CAL or REFERENCE LEVEL FINE in steps 19 through 32.

18. Adjust A20R77 V3 for minimum amplitude variations of upper edge of envelope on CRT trace. Repeat step 17.

19. Set spectrum analyzer FREQUENCY BAND GHz to 5.8 – 12.9. Set sweep oscillator to sweep from 5.8 GHz to 12.9 GHz. Set TRACE A and TRACE B to STORE BLANK. Phase lock sweep oscillator and set output power level according to step 4.

20. Adjust A20R40 B4A, A20R36 B4B, and A20R35 B4C to set best line at center horizontal graticule line, with minimum slope.

21. Adjust A20R85 V4 for minimum amplitude variations of upper edge of envelope on CRT trace. If amplitude variations on high frequency portion of band are excessive (> ±2.5 dB) change value of factory-selected resistor A20R90* and readjust A20R85 V4. Repeat step 20.

22. Set spectrum analyzer FREQUENCY BAND GHz to 8.5 – 18. Set synchronizer ERROR SIGNAL switch to +. Set sweep oscillator to sweep from 8.5 GHz to 18 GHz. Set TRACE A and TRACE B to STORE BLANK. Phase lock sweep oscillator and set output power level according to step 4.

23. Adjust A20R50 B5A, A20R46 B5B, and A20R45 B5C to set best line at center horizontal graticule line.

24. Adjust A20R95 V5 for minimum amplitude variations of upper edge of envelope on CRT trace. Repeat step 23.

25. Set spectrum analyzer FREQUENCY BAND GHz to 10.5 – 22. Set sweep oscillator to sweep from 10.5 GHz to 22 GHz. Phase lock sweep oscillator and set output power level according to step 4.

26. Adjust A20R60 B6A, A20R55 B6B, A20R56 B6C to set best line at center horizontal graticule line, with minimum slope.

27. Adjust A20R105 V6 for minimum amplitude variations on CRT trace. Repeat step 26 (see Figure 5-56).

28. With equipment connected as shown in Figure 5-54, set spectrum analyzer FREQUENCY BAND GHz to 1.7 – 4.1 GHz and set SWEEP SOURCE to EXT. Set synchronizer ERROR SIGNAL switch to –. Set sweep oscillator to CW and adjust CW control to approximately 2.9 GHz. Set ΔF X10 to 2.4 GHz. Phase lock sweep oscillator and set output power level as follows:

NOTE

On HP 8350A, set CF control to 2.9 GHz and ΔF to 2.4 GHz.

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

a. Set sweep oscillator to manual sweep mode with manual sweep control fully counterclockwise. Set TRACE A and TRACE B to STORE BLANK.

b. Adjust sweep oscillator ΔF control for synchronizer phase lock (minimum phase error).

c. Set sweep oscillator manual sweep control fully clockwise. Adjust CW control for synchronizer phase lock (minimum phase error).

d. Repeat steps 28a through 28c until no further adjustment is necessary.

e. Disconnect power splitter (with 10-dB attenuator) from INPUT 50Ω connector of spectrum analyzer and connect power meter to 10-dB attenuator port of power splitter.

f. Slowly adjust sweep oscillator manual sweep control over its entire range, and adjust power level for an average power meter reading of −18 dBm.

g. Disconnect power meter and reconnect power splitter (with 10-dB attenuator) to INPUT 50Ω connector of spectrum analyzer.

h. Set sweep oscillator to automatic sweep mode (sweep time = > 10 seconds) and check for phase locked spectrum analyzer CRT display. If system is breaking phase lock, repeat steps 28a through 28c.

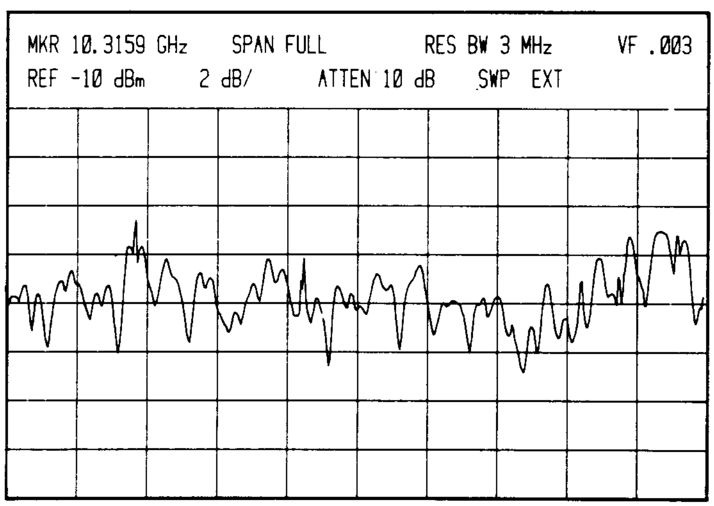


Figure 5-56. CRT Plot of Typical Frequency Response, 10.5 to 22 GHz

29. Adjust A20R22 B2A and A20R18 B2B to set best line at center horizontal graticule line, with minimum slope.

30. Set sweep oscillator LINE switch OFF and replace HP 86290A RF Plug-in with HP 86222A RF Plug-in. Set sweep oscillator LINE switch ON, POWER LEVEL to midrange, ALC switch to EXT, and rear-panel FM-NORM-PL switch to PL.

ADJUSTMENTS

5-30. FREQUENCY RESPONSE ADJUSTMENTS (Cont'd)

31. Set spectrum analyzer FREQUENCY BAND GHz to .01 – 1.8 GHz. Set sweep oscillator to sweep from .01 GHz to 1.8 GHz. Phase lock sweep oscillator and set output power level according to step 4.

32. Adjust A20R14 B1A, A20R9 B1B, and A20R10 B1C to set best line at center horizontal graticule line, with minimum slope (see Figure 5-57). If frequency response is ≥1.2 dB, adjust A20R71 V1 to minimize amplitude variations.

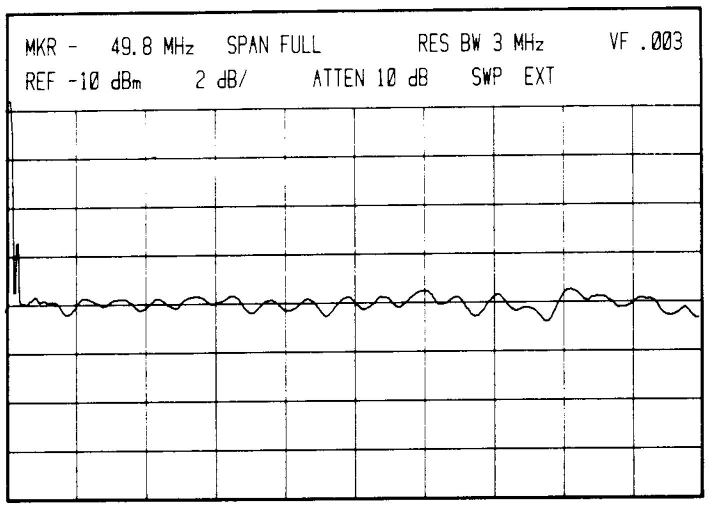


Figure 5-57. CRT Plot of Typical Frequency Response, .01 to 1.8 GHz

ADJUSTMENTS

5-31. AMPLITUDE CALIBRATION OF EXTERNAL MIXING BANDS

NOTE

Verify that the EXT MIXING BIAS output voltage is 0 ±.01V when in detent position. If not, adjust A2A1R14 BIAS ZERO for 0 volts.

NOTE

This adjustment should only be done to compensate for a specific external mixer.

REFERENCE:

A20 Schematic

DESCRIPTION:

All HP 8569B Spectrum Analyzer external mixing bands are set at the factory for a 30-dB external mixer conversion loss. Steps 4 and 5 show this adjustment. To calibrate the display for a specific mixer, the internal gain of the external mixing band in question has to be adjusted. First, the conversion loss of the mixer is measured. Then, the internal gain of the analyzer is adjusted to equal this conversion loss.

EQUIPMENT:

Signal Generator	HP 8640B
Sweep Oscillator	HP 8350A
RF Plug-in	HP 83595A
Diplexer	HP 5086-7721
Directional Coupler 10-dB	HP K752C
Directional Coupler 10-dB	HP P752C
Power Meter (2 required)	HP 432A
Thermistor Mount (2 required)	HP P486C
Thermistor Mount (2 required)	HP K486C
Waveguide Attenuator	HP K382A
Waveguide Attenuator	HP P382A

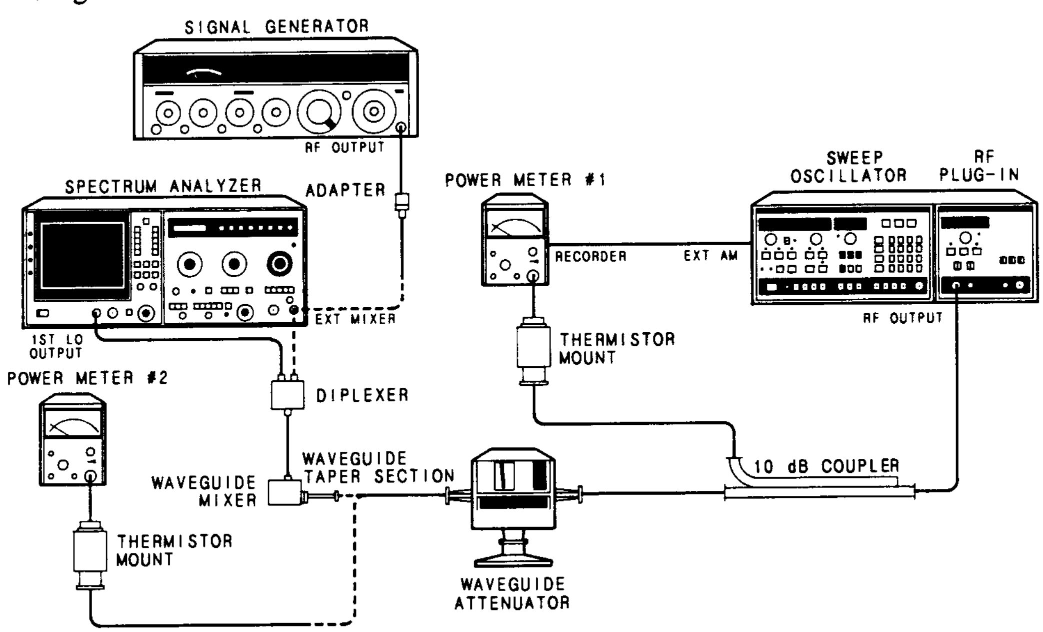


Figure 5-58. Amplitude Calibration of External Mixing Bands Adjustment Test Setup

5-31. AMPLITUDE CALIBRATION OF EXTERNAL MIXING BANDS (Cont'd)

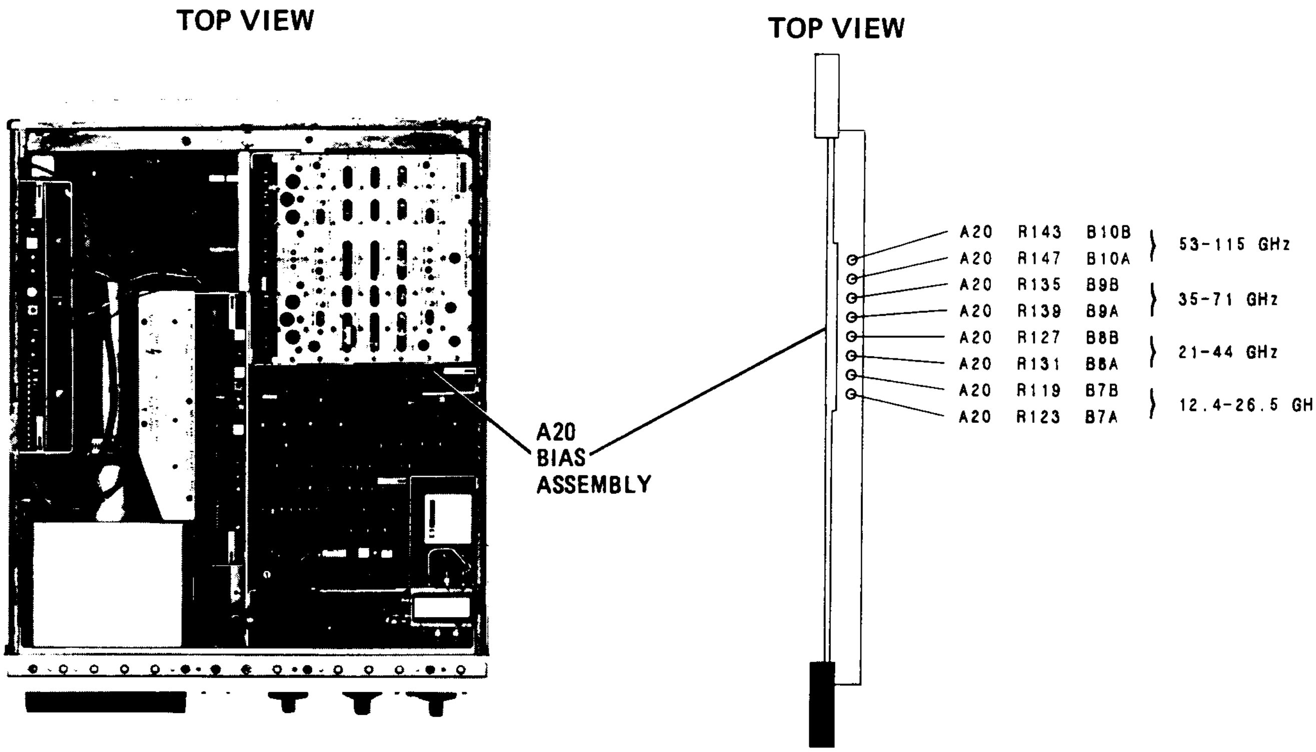


Figure 5-59. Amplitude Calibration of External Mixing Bands Adjustment Locations

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.
2. Reconnect power cord and set LINE switch ON.
3. Set spectrum analyzer controls to normal (green) settings, except as indicated, and other controls as follows:

RESOLUTION BANDWIDTH	Coupled (green)
INPUT ATTENUATOR	0 dB
REF LEVEL dBm	10
REFERENCE LEVEL FINE	0
FREQUENCY SPAN MODE	FULL BAND
MIXING MODE	EXT
SWEEP TIME/DIV	AUTO
FREQUENCY BAND GHz	12.4 – 26.5
EXT MIXER BIAS	0 (Detent)
FREQUENCY SPAN/DIV	100 MHz

ADJUSTMENTS

5-31. AMPLITUDE CALIBRATION OF EXTERNAL MIXING BANDS (Cont'd)

4. Connect signal generator to HP 8569B IF INPUT. Set FREQUENCY of signal generator to 321.4 MHz and OUTPUT LEVEL to −40 dBm.

5. Tune signal generator around 321.4 MHz for maximum amplitude on HP 8569B CRT. Verify trace is at top graticule line (reference level). If not, adjust A20R123 (B7A) and A20R119 (B7B) for a flat trace. A20R123 affects the low frequency end, and A20R119 affects the high frequency end.

6. Disconnect the signal generator and connect the equipment as in Figure 5-58.

7. Set power meter #1 CAL FACTOR to match thermistor mount calibration at frequency of interest. Set MOUNT RESISTANCE to 100 ohm for "P" band or 200 ohm for "K" band. Set RANGE to COARSE ZERO and adjust to zero meter. Set RANGE to −5 dBm and press FINE ZERO momentarily.

8. Set sweep oscillator CW frequency to 12.4 GHz. Adjust ALC GAIN for −10 dBm reading on power meter #1 (−5 dBm scale reading).

9. Set waveguide attenuator to 20 dB and verify a −20 dBm leveled signal at output of waveguide attenuator from 12.4 GHz to 18.0 GHz with power meter #2. Disconnect power meter #2 thermistor mount and connect external mixer.

10. Tune sweep oscillator to 12.4 GHz.

11. Set FREQUENCY SPAN MODE on HP 8569B to PER DIV. Locate signal pair with a 642.8 MHz separation and center the left hand signal. Reduce FREQUENCY SPAN/DIV to 1 MHz and press SIG IDENT button to verify correct signal.

12. Reduce FREQUENCY SPAN/DIV to 100 kHz and peak signal with EXT MIXING BIAS.

13. Measure signal amplitude and record. (The second graticule line from the top is calibrated for 30-dB conversion loss. If the signal is one major division down from the second graticule line, the conversion loss at this frequency would be 40 dB.)

Conversion loss ________

14. Repeat steps 11 through 13 every 500 MHz from 12.4 GHz to 18.0 GHz.

15. Replace "P" band equipment with "K" band equipment (see figure 5-58).

16. Repeat steps 7 through 9 substituting 18.0 GHz for 12.4 GHz, and 26.5 GHz for 18.0 GHz.

17. Tune sweep oscillator to 18.0 GHz and repeat steps 11 through 13 every 500 MHz up to 26.5 GHz.

18. Find mean conversion loss of mixer (see Figure 5-60 for example).

19. Set EXT MIXING BIAS to 0 (Detent).

ADJUSTMENTS

5-31. AMPLITUDE CALIBRATION OF EXTERNAL MIXING BANDS (Cont'd)

20. Connect signal generator to IF INPUT and set OUTPUT LEVEL to match the mean conversion loss at 12.4 GHz.

21. Set HP 8569B FREQUENCY SPAN MODE to FULL BAND and tune signal generator around 321.4 MHz to peak trace on HP 8569B.

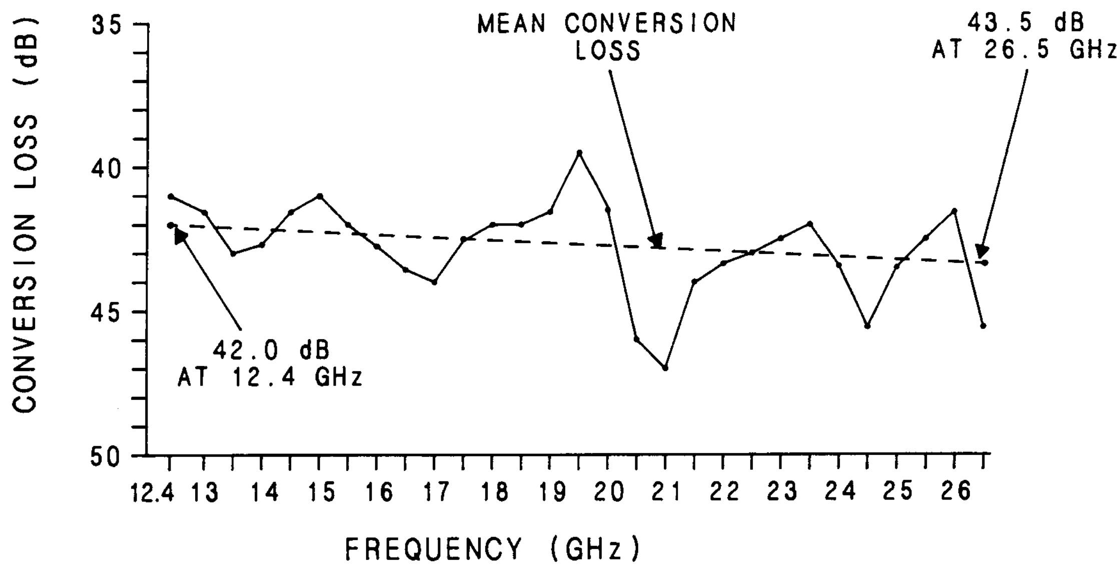
22. Adjust B7A (A20R123) for trace at top graticule line. (See Figure 5-59 for location of adjustments.)

23. Set signal generator OUTPUT LEVEL to the mean conversion loss at 26.5 GHz.

24. Adjust B7B (A20R119) for trace at top graticule line display.

25. Repeat steps 20 through 24 until no further adjustment is necessary.

26. Repeat steps 1 through 25 for the other external mixing bands, substituting appropriate equipment and frequency settings to cover the frequencies in those bands.



FREQUENCY (GHz)	12.4	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	18	18.5	19	19.5	20	20.5	21	21.5	22	22.5	23	23.5	24	24.5	25	25.5	26	26.5
CONVERSION LOSS (dB)	41	41.5	43	42.5	41.5	41	42	42.5	43.5	44	42.5	41	41	40.5	39.5	40.5	46	47	44	43.5	43	42.5	42	43.5	45.5	43.5	42.5	41.5	45.5

Figure 5-60. Mean Conversion Loss

5-32. ABSOLUTE AMPLITUDE CALIBRATION

REFERENCE:

A28 Schematic

DESCRIPTION:

The 100 MHz CAL OUTPUT signal is displayed on the spectrum analyzer CRT screen. Factory-selected resistor A28R2* is selected so that REF LEVEL CAL functions over the range that optimizes noise and distortion performance.

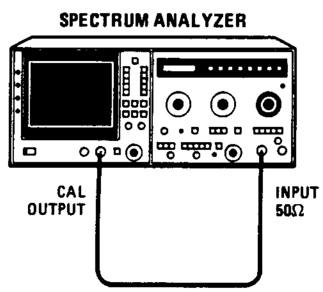


Figure 5-61. Absolute Amplitude Calibration Test Setup

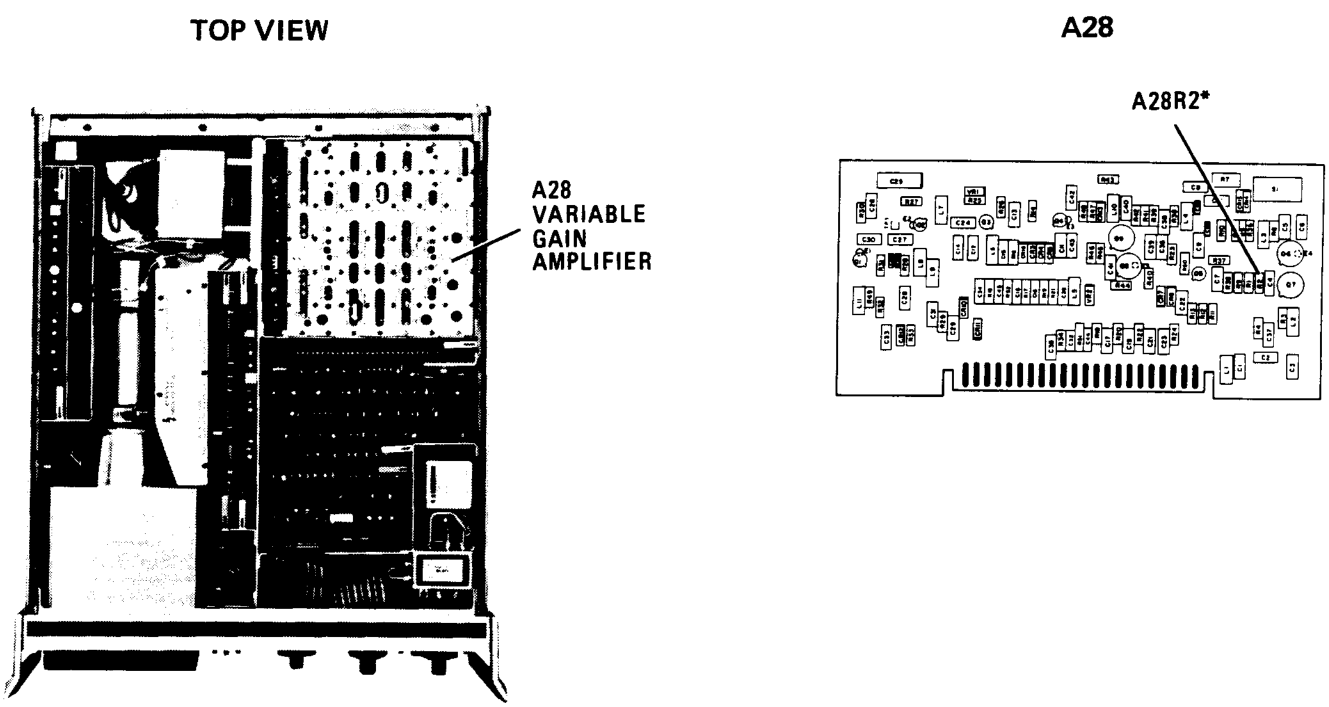


Figure 5-62. Absolute Amplitude Calibration Adjustment Locations

5-32. ABSOLUTE AMPLITUDE CALIBRATION (Cont'd)

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B top cover.

2. Reconnect power cord, set LINE switch ON, and connect equipment as shown in Figure 5-61. Set all normal (green) spectrum analyzer settings, except as indicated, and other controls as follows:

FREQUENCY BAND GHz	.01 – 1.8
INPUT ATTEN	10 dB
REF LEVEL dBm	0
REFERENCE LEVEL FINE	0
RESOLUTION BW	3 MHz
FREQUENCY SPAN MODE	ZERO SPAN
AMPLITUDE SCALE	2 dB
TUNING	0.100 GHz
REF LEVEL CAL	Fully counterclockwise

3. Adjust TUNING control to center 100 MHz signal on CRT display.

4. Adjust REF LEVEL CAL screwdriver adjustment clockwise to increase 100 MHz signal amplitude by 3 dB (1.5 divisions).

5. Note distance of signal peak (in dB) from third horizontal graticule line from bottom of display. For every dB signal peak is separated from this graticule line, change value of factory-selected resistor A28R2* (Figure 5-62) by 10 percent. (An increase in resistance increases signal level.) When signal is within 1 dB of graticule line, proceed to step 6.

6. Adjust REF LEVEL CAL to position signal peak on third horizontal graticule line from bottom of display.

7. When adjustment is complete, set LINE switch OFF, disconnect power cord, and install HP 8569B top cover.

ADJUSTMENTS

5-33. COMB GENERATOR ADJUSTMENTS (OPTION 001)

REFERENCE:

A42 Schematic

DESCRIPTION:

The output signal from A42 Comb Generator Assembly, with the Step Recovery Diode Module disconnected, is adjusted for a maximum peak-to-peak voltage swing. A42A1C5 FREQ is centered, and the comb generator frequency is measured with a frequency counter. If the measured frequency is not 100.000 ±0.0004 Mhz, A42A1L3* is selected to bring the frequency within tolerance.

The comb generator signal is adjusted for maximum output power as measured with a power meter. If the amplitude is not +16.0 ±0.8 dBm, A42A1R6* is selected to bring the amplitude within tolerance.

A42A1C5 FREQ is adjusted for a comb generator frequency of 100.000000 ±0.000010 MHz (tolerance of ±10 Hz).

EQUIPMENT:

Oscilloscope	HP 1741A
Frequency Counter	HP 5342A, Opt. 005
Power Meter	HP 435B
Power Sensor	HP 8481A, Opt. C03
Attenuator, 10 ±0.5 dB	HP 8491B, Opt. 010
Adapter, Type N (f) to BNC (m)	HP 1250-0077
Adapter, SMA (f) to Type N (m)	HP 1250-1250
Cable Assembly (SMA plug, both ends)	HP 8120-1578

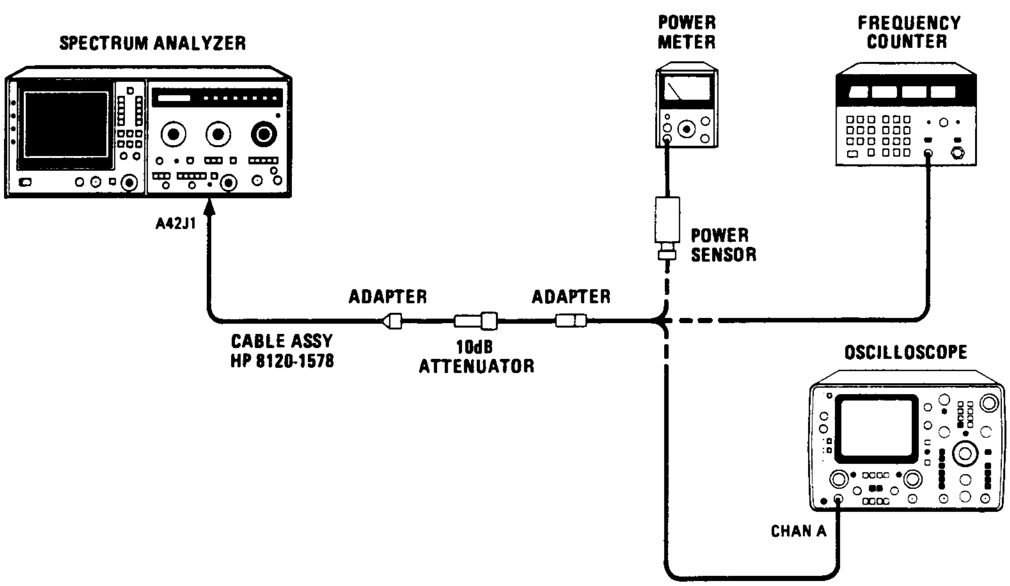


Figure 5-63. Comb Generator Adjustment Test Setup

5-33. COMB GENERATOR ADJUSTMENTS (OPTION 001) (Cont'd)

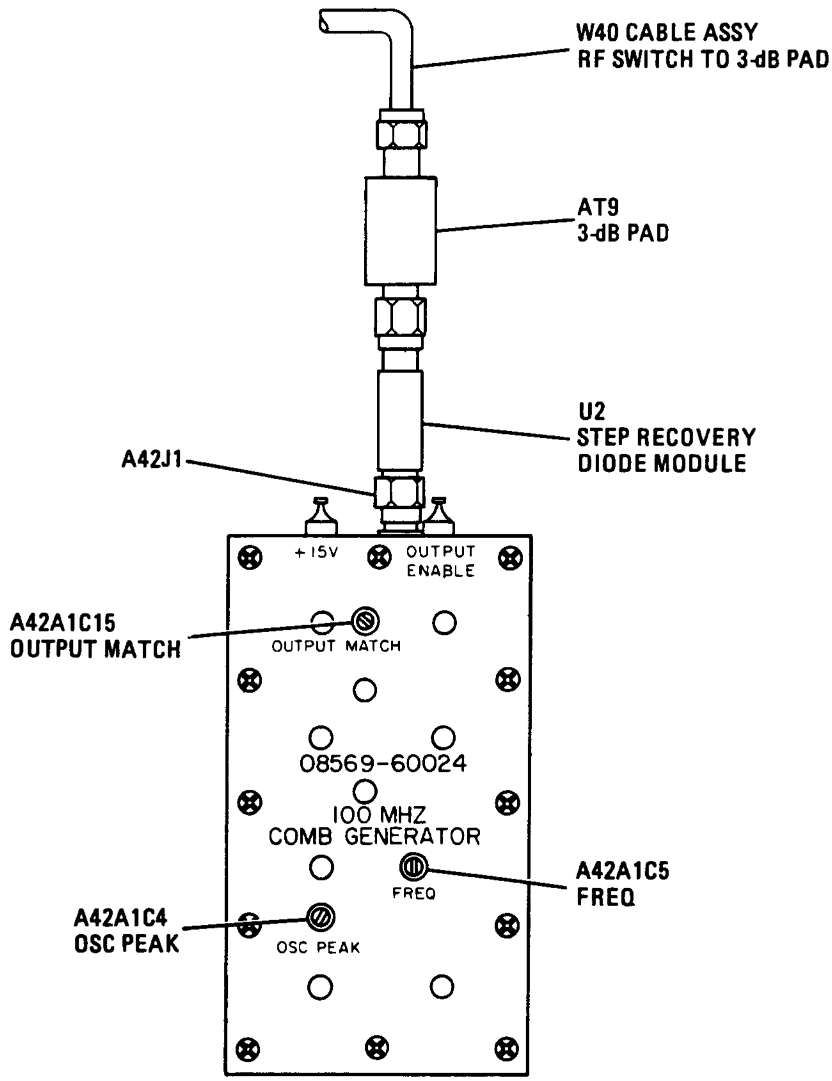


Figure 5-64. Comb Generator Adjustment Locations

ADJUSTMENTS

5-33. COMB GENERATOR ADJUSTMENTS (OPTION 001) (Cont'd)

PROCEDURE:

1. Set LINE switch OFF, disconnect power cord, and remove HP 8569B bottom cover. Use a 5/16 wrench to disconnect U2 Step Recover Diode Module from A42 Comb Generator Assembly at A42J1.

NOTE

It might be necessary to remove AT9 3-dB Pad (connected at cable assembly W40) as well as U2 Step Recovery Diode Module (connected at A42J1) to have sufficient space for connection of the test cable assembly to A42J1.

2. Connect oscilloscope as shown in Figure 5-63. Center A42A1C5 FREQ (Figure 5-64).

Frequency Adjustment

3. Connect power cord, set LINE switch ON, and press INTERNAL COMB GENERATOR push button (on).

4. Set oscilloscope controls as follows:

CHAN A VOLTS/DIV 5
DISPLAY .... A
TRIGGER COMP .... A
Trigger Mode .... AUTO
Sweep Mode .... MAIN
TIME/DIV .... 1 μSEC

5. Adjust A42A1C15 OUTPUT MATCH and A42A1C3 OSC PEAK for maximum peak-to-peak voltage.

6. Connect output of comb generator (through 10-dB attenuator and adapters) to frequency counter input. Comb generator frequency must be 100.0000 ±0.0004 MHz.

NOTE

Perform steps 7 through 9 only if the comb generator frequency is out of tolerance.

7. Set LINE switch OFF, disconnect power cord, and remove cover plate of A42 Comb Generator Assembly.

8. Change selected value of A42A1L3* to obtain output frequency of 100.0005 ±0.0004 MHz with A42A1C5 FREQ centered.

5-33. COMB GENERATOR ADJUSTMENTS (OPTION 001) (Cont'd)

NOTE

Increasing the value of A42A1L3* increases output frequency, while decreasing the value decreases output frequency. (Installation of the cover plate decreases the oscillator frequency by about 500 Hz.)

9. Each time the value of A42A1L3* is changed, re-connect power cord, set LINE switch ON, and adjust A42A1C3 OSC PEAK for maximum signal.

NOTE

The output frequency changes when A42A1C3 OSC PEAK is adjusted.

Output Power

10. Connect output of comb generator, through 10-dB attenuator, to power meter.

11. Adjust A42A1C15 OUTPUT MATCH for maximum power out. Comb generator output power should be +16.0 ±0.8 dBm.

NOTE

Perform steps 12 through 14 only if the output power of the comb generator is out of tolerance.

12. Set LINE switch OFF, remove power cord, and remove cover plate of A42 Comb Generator Assembly.

13. Change selected value of A42A1R6* to obtain an output power reading of +16.0 ±0.8 dBm.

NOTE

Increasing the value of A42A1R6* decreases the output power of the comb generator, while decreasing the value increases the output power.

14. Each time the value of A42A1R6* is changed, re-connect power cord, set LINE switch ON, and adjust A42A1C15 OUTPUT MATCH for maximum power out.

15. With cover plate of A42 Comb Generator Assembly installed and all screws in place, connect output of comb generator, through 10-dB pad, to frequency counter.

16. Adjust A42A1C5 FREQ for a frequency counter reading of 100.000000 ±0.000010 MHz (tolerance of ±10 Hz).

17. When adjustment is completed, set LINE switch OFF, disconnect power cord, install U2 Step Recovery Diode Module and AT9 3-dB Pad, and install HP 8569B bottom cover.