Performance Tests and Adjustments Manual

HP 8568B Spectrum Analyzer

HEWLETT
PACKARD

HP Part No. 08568-90118
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Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

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Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error-free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HEWLETT-PACKARD SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

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THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HEWLETT-PACKARD SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

Safety Symbols

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

Caution

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

Warning

The warning sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a *warning* sign until the indicated conditions are fully understood and met.

General Safety Considerations

Warning

Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.

Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.

Warning

There are many points in the instrument which can, if contacted, cause personal injury. Be extremely careful.

Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Caution

Before this instrument is *switched on,* make sure its primary power circuitry has been adapted to the voltage of the ac power source.

Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

HP 8568B Spectrum Analyzer Documentation Outline

Included with the HP Model 8568B Spectrum Analyzer are three manuals: the Installation and Verification Manual, the Operating and Programming Manual, and the Performance Tests and Adjustments Manual.

HP 8568B Installation and Verification Manual

General information, installation, specifications, characteristics, and operation verification.

HP 8568B Operating and Programming Manual

Manual and remote operation, including complete syntax and command description. Accompanying this manual is the separate, pocket-sized Quick Reference Guide.

HP 8568B Performance Tests and Adjustments Manual

Electrical performance tests and adjustment procedures.

HP 85680B RF Section Troubleshooting and Repair Manual

RF Section service information.

HP 85662A IF-Display Section Troubleshooting and Repair Manual

IF-Display Section service information.

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General Information

Introduction

This HP 8568B Tests and Adjustments Manual contains two sections: Performance Tests and Adjustments Procedures. The Performance Tests provided should be performed for the following reasons:

- If the test equipment for the Operation Verification Program is not available.
- If the instrument does not pass all of the Operation Verification tests.
- For complete verification of specifications not covered by the Operation Verification program.

The adjustment procedures should be performed for the following reasons:

- If the results of a performance test are not within the specifications.
- After the replacement of a part or component that affects electrical performance.

Warning

The adjustment procedures require access to the interior of the instrument and therefore should only be performed by qualified service personnel. There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustments should be performed only by trained service personnel.

Power is still applied to this instrument with the LINE switch in STANDBY. There is no OFF position on the LINE switch. Before removing or installing any assembly or printed circuit board, remove the power cord from the rear of both instruments and wait for the MAINS indicators (red **LEDs)** to go completely out.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of power.

Use a non-metallic tuning tool whenever possible.

Instruments Covered by this Manual

This manual contains procedures for testing and adjusting HP 8568B Spectrum Analyzers, including those with Option 001 (75 Ohm RF INPUT), Option 400 (400 Hz operation), Option 462, and Option 857 installed. The procedures in this manual can also be used to adjust HP 8568A Spectrum Analyzers that have been converted into HP 8568B Spectrum Analyzers through the installation of an HP 8568AB Retrofit Kit (formerly HP 8568A+ 01K Retrofit Kit).

Operation Verification

A high confidence level in the instrument's operation can be achieved by running only the Operation Verification Program, since it tests most of the instrument's specifications. It is recommended that the Operation Verification Program be used for incoming inspection and after repairs, since it requires much less time and test equipment. A description of the program can be found in the Installation and Verification manual.

Option 462 Instruments

Option 462 instruments require that the performance tests and adjustment procedures listed below be performed instead of their standard versions included in chapters two and three. Information on Option 462 versions are located in Chapter 4, Option 462.

6 dB Bandwidths:

Test 4, 6 dB Resolution Bandwidth Accuracy Test
Test 5, 6 dB Resolution Selectivity Test
Adjustment 9, 6 dB Bandwidth Adjustments

Impulse Bandwidths:

Test 4, Impulse and Resolution Bandwidth Accuracy Test
Test 5, Impulse and Resolution Selectivity Test
Test 6, Impulse and Resolution Bandwidth Switching Uncertainty Test
Adjustment 9, Impulse Bandwidth Adjustments

Option 857 Instruments

Option 857 instruments require that the performance test procedure listed below be performed instead of the standard version included in Chapter 2. Information on Option 857 is located in Chapter 5, Option 857.

Test 12, Option 857 Amplitude Fidelity Test

Table 1-1. Recommended Test Equipment (1 of 5)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Perf. Test	Adj.
SIGNAL SOURCES				
Synthesized Sweeper	Frequency: 10 MHz to 1500 MHz Output Power: + 10 dBm maximum (leveled) Aging Rate: <1 x 10^{-9}/day Spurious Signals: ≤35 dBc (<7 GHz) ≤25 dBc (<20 GHz) Amplitude Modulation: dc to 100 kHz Leveling: Internal, External Power Meter	HP 8340A	X	
Signal Generator	Frequency: 20 MHz to 450 MHz SSB Phase Noise: >130 dB below carrier at 20 kHz away Stability: <10 ppm/10 min. (HP 8340A may be substituted)	HP 8640B		X
Frequency Synthesizer	Frequency: 200 Hz to 80 MHz Stability: ± 1 x 10^{-8}/day Amplitude Range: + 13 to -86 dBm with 0.01 dB resolution Attenuator Accuracy: < ±0.07 dB (+ 13 to -47 dBm)	HP 3335A	X	X
Pulse Generator	Pulse Width: 10 nsec to 250 nsec Rise and Fall Times: <6 nsec Output Level: + 2.5V	HP 8116A		X
Function Generator	Output: Sine Wave and Triangle Wave, 2Vp-p Range: 100 Hz to 500 kHz (Sweep Function Available)	HP 3312A	X	X
Frequency Standard	Output: 1, 2, 5, or 10 MHz Accuracy: <±1 x 10^{-10} Aging Rate: <1 x 10^{-10}/day	HP 5061B	X	X

Table 1-1. Recommended Test Equipment (2 of 5)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Perf. Test	Adj.
ANALYZERS				
Spectrum Analyzer	Frequency: 100 Hz to 2.5 GHz 2 to 22 GHz Preselected	HP 8566A/B		X
Spectrum Analyzer	RF Spectrum Analyzer Frequency: 9 kHz to 1.8 GHz	8590B		X
AC Probe	High Frequency Probe	HP 85024A		X
Scalar Network Analyzer	10 MHz-l10 GHz	HP 8757E		X
Detector (2 required)	Compatible with HP 8757E	HP 11664A		X
COUNTERS				
Frequency Counter	Frequency: 10 MHz to 18 GHz Sensitivity: -30 dBm HP-IB Compatible (HP 5343A may be substituted)	HP 5340A		X
Electronic Counter	Range: >10 MHz Resolution: 2 x 10^{-9} gate time Ext. Time Base: 1, 2, 5, or 10 MHz	HP 5345A	X	
j = Universal Counter	Frequency: dc to 100 MHz Time Interval A → B: 100 nsec to 200 sec Sensitivity: 50 mV rms Range: 30 mV to 5V p-p	HP 5316B	X	
OSCILLOSCOPE				
Oscilloscope	Digitizing OSCOPE, 4 Channel Frequency: 100 MHz Sensitivity: .005V/Division	HP 54501A		X
Probe	10: 1 Divider, compatible with oscilloscope	HP 10432A		X

Table 1-1. Recommended Test Equipment (3 of 5)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Perf. Test	Adj.
METERS				
Digital Voltmeter	Resolution: ±0.1 mV Range: 0 Vdc to 100 Vdc Input Impedance 100 V Range: 10 MΩ HP-IB Compatible	HP 3456A or HP 3455A	X	X
High Voltage Probe	1000:1 Divider Impedance: 10MΩ	HP 34111A		X
Power Meter	Range: −20 dBm to +10 dBm Accuracy: ±0.02dB	HP436A	X	X
Power Sensor	Frequency: .01 to 18 GHz Compatible with HP 436A Power Meter	HP 8481A		X
Power Sensor	Frequency: 100 kHz to 4.2 GHz Compatible with HP 436A Power Meter	HP8482A	X	X
AMPLIFIERS				
Amplifier	Frequency: 269 MHz Gain: ≥26 dB	HP 8447F		X
ATTENUATORS				
10 dB Step Attenuator	Steps: 10 dB from 0 to 120 dB Frequency: 20 MHz to 1500 MHz Calibrated to uncertainty error of ±(0.02 dB +0.01 dB/10 dB step) at 20 MHz from 0 dB to 120 dB	HP 355D-H89		X
1 dB Step Attenuator	Steps: 1 dB from 0 to 12 dB Frequency: 20 MHz to 1500 MHz Calibrated to uncertainty error of ±(0.02 dB +0.01 dB/10 dB step) at 20 MHz from 0 dB to 12 dB	HP 355C-H25		X
10 dB Attenuator	Frequency: 200 Hz to 18 GHz Type N Connectors	HP 8491B, Option 010	X	

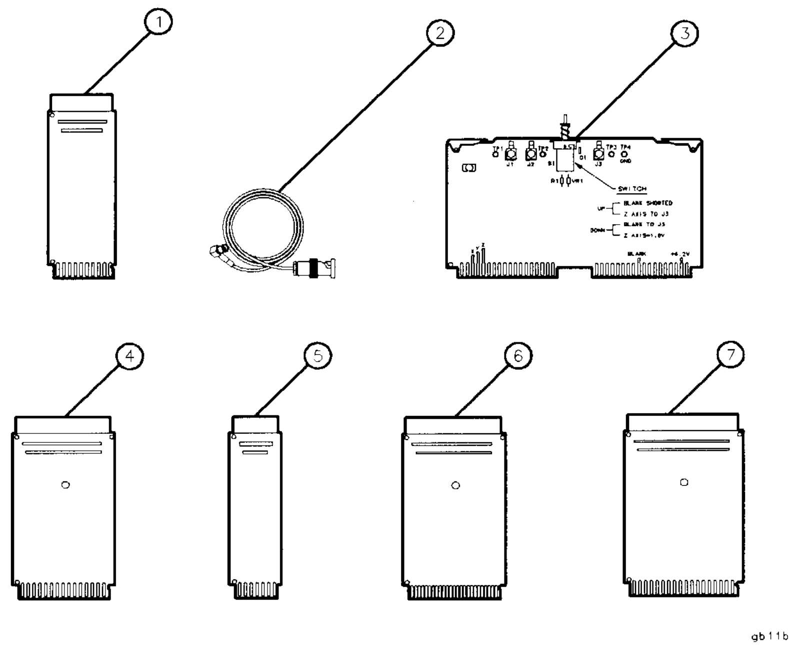
Table 1-1. Recommended Test Equipment (4 of 5)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Perf. Test	Adj.
ATTENUATORS (Cont'd)				
20 dB Attenuator	Frequency: 200 Hz to 18 GHz Type N Connectors	HP 8491B, Option 020		X
TERMINATIONS				
Termination	Impedance: 50Ω; BNC	HP 11593A	X	
FILTERS				
Low-Pass Filter	Flatness: ±0.25 dB Cut-off Frequency≥400 MHz and <500 MHz Rejection: >40 dB at 1750 MHz	Telonic TLS450-7EE		X
Low-Pass Filter	Cut-off Frequency: 300 MHz	HP 0955-0455	X	
Low-Pass Filter	Cut-off Frequency: 50 MHz	HP 0955-0306	X	
MISCELLANEOUS DEVICES				
Power Splitter	Frequency: 1 MHz to 1500 MHz Tracking: <0.2 dB	HP 11667A	X	X
Directional Bridge		HP 8721A	X	
SPECIAL DEVICES				
Display Adjustment PC Board	Required for preliminary display adjustments	HP 85662-60088		X
Low-Noise DC Supply	Refer to Figure 70 (Optional)			X
Crystal Filter Bypass Network (4 required)	Refer to Figure 71			X

Table 1-1. Recommended Test Equipment (5 of 5)

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Perf. Test	Adj.
CABLES				
Cable Assembly	Frequency Range: 200 Hz to 22 GHz APC 3.5 Male Connectors Length: 91 cm (36 inches) SWR: <1.4 at 22 GHz	HP 8120-4921	X	X
Cable	BNC, 122 cm (48 in.) (3 required)	10503A	x	x
Test Cable *	BNC (m) to SMB Snap-On (f)	HP 85680-60093		X
Test Cable	SMA (m) to SMA (m)	HP 85680-20094		X
Test Cable	SMA (m) to SMA (m)	HP5061-5458	X	X
ADAPTERS				
Adapter	Type N (f) to BNC (m)	HP1250-0077	X	
Adapter	Type N (m) to BNC (m)	HP1250-0082	X	
Adapter	Tee, SMB Male Connectors	HP 1250-0670		X
Adapter	Type N (m) to N (m)	HP1250-0778	X	
Adapter	Type N (m) to BNC (f)(2 required)	HP1250-0780	X	
Adapter	BNC Tee (m) (f) (f)	HP1250-0781	X	
Adapter	Type N (m) to SMA (f)	HP1250-1250	X	
Adapter	Type N (f) to BNC (f)(2 required)	HP1250-1474	X	
Adapter	APC—3.5 (f) to APC—3.5 (f)	HP1250-1749	X	
Adapter	APC—3.5 (f) TO N (f)(2 required)	HP 1250-1745		
BOARD EXTENDERS				
Extender * (2 required)	PC Board: 36 contacts; 2 rows of 18	HP 08505-60042		X
Extender * (3 required)	PC Board: 30 contacts; 2 rows of 15	HP 08505-60041		X
Extender *	PC Board: 20 contacts; 2 rows of 10	HP 85680-60028		X
Extender * (2 required)	PC Board: 12 contacts; 2 rows of 6	HP08505-60109		X
PC Board Extractor	PC Board extracting tool	HP 03950-4001		X

* Part of Service Accessories



Item	Qty	Description	HP Part Number
1	1	Extender Board: 20 contacts; 2 rows of 10	85680-60028
2	2	Cable: 4-foot long; BNC to SMB snap-on	85680-60093
3	1	PC Board: Display Adjustment Test	85662-60088
4	3	Extender Board: 30 contacts; 2 rows of 15	08505-60041
5	2	Extender Board: 12 contacts; 2 rows of 6	08505-60109
6	2	Extender Board: 50 contacts; 2 rows of 25	85680-60034
7	2	Extender Board: 36 contacts; 2 rows of 18	08505-60042

Figure 1-1. Service Accessories, HP Part Number 08568-60001

2

Performance Tests

Introduction

The procedures in this section test the instrument's electrical performance using the Specifications in the Installation and Verification Manual as the performance standards. None of the tests require access to the interior of the instrument. The manual Performance Tests provided in this section should be performed only if semi-automatic test equipment (for Operation Verification) is not available or the Performance Test is not in the Operation Verification Program. (Refer to the Installation and Verification Manual for information on Operation Verification.)

Verification of Specifications

When a complete verification of specifications is required, proceed as follows:

1. Run the Operation Verification Program.
2. The Operation Verification Program verifies compliance with specifications of all tests it performs. The tests not performed by the Operation Verification Program must be done manually and are as follows:
   - Center Frequency Readout Accuracy
   - Spurious Responses
   - Fast Sweep Time Accuracy
   - 1st LO Output Amplitude Responses
   - Frequency Reference Error

If the results of a performance test are marginally within specification, go to the Adjustments section of this manual and perform the related adjustment procedures. When an adjustment is directly related to a performance test, the adjustment procedure is referenced under RELATED ADJUSTMENT in the performance test.

Calibration Cycle

This instrument requires periodic verification of performance. The instrument should have a complete verification of specifications at least every six months.

Equipment Required

Equipment required for the manual performance tests and adjustments is listed in Table 2-1, Recommended Test Equipment, at the beginning of this manual. Any equipment that satisfies the critical specifications given in the list may be substituted for the recommended model.

Test Record

The Operation Verification Program provides a detailed test record when a printer is used with the controller. If manual performance tests are done, results of the performance tests may be tabulated in the HP 8568B Performance Test Record at the end of this section. The HP 8568B Performance Test Record lists all of the tested specifications and the acceptable ranges for the measurement values obtained during the tests.

Note

Allow 1/2-hour warm-up time for the HP 8568B before beginning the Performance Tests.

Table 2-1. Performance Test Cross-Reference

Function or Characteristic Tested	Test No.	Performance Test
Center Frequency Readout	1	Center Frequency Readout Accuracy Test
Frequency Spans	2	Frequency Span Accuracy Test
Sweep Time Accuracy ($\geq$20 ms)	3	Sweep Time Accuracy Test
3-dB Bandwidths	4	Resolution Bandwidth Accuracy Test
Bandwidth Shape	5	Resolution Bandwidth Selectivity Test
Bandwidth Amplitudes	6	Resolution Bandwidth Switching Uncertainty Test
Input Attenuator Accuracay	7	Input Attenuator Switching Uncertainty
Frequency Response	8	Frequency Response Test
RF Gains	9	RF Gain Uncertainty Test
IF Gains	10	IF Gain Uncertainty Test
Log Scales Accuracy	11	Log Scale Switching Uncertainty Test
Log and Linear Amplifier Fidelity	12	Amplitude Fidelity Test
Noise Floor	13	Average Noise Level Test
Residual Responses	14	Residual Responses Test
Spurious Responses	15	Spurious Responses Test
Residual FM	16	Residual FM Test
Line-Related Sidebands	17	Line-Related Sidebands Test
CAL OUTPUT Level	18	Calibrator Amplitude Accuracy Test
Fast Sweep Times	19	Fast Sweep Time Accuracy Test
1ST LO OUTPUT Amplitude	20	1ST LO OUTPUT Amplitude Test
Frequency Reference	21	Frequency Reference Error Test

1. Center Frequency Readout Accuracy Test

Related Adjustments

Frequency Control Adjustments

Time Base Adjustment

Step Gain and 18.4 MHz Local Oscillator Adjustments

50 MHz Voltage-Tuned Oscillator Adjustments

Specification

(uncorrected)

±2% of frequency span + frequency reference error x tune frequency +30% of resolution bandwidth setting + 10 Hz) in AUTO resolution bandwidth after adjusting FREQ ZERO at stabilized temperature.

Description

A synthesized signal source that is phase-locked to a known frequency standard is used to input a signal to the analyzer. The frequency readout of the analyzer is compared to the actual input frequency for several different frequency settings over the analyzer's range. The signal source is phase-locked to a standard known to be as accurate as the analyzer's internal frequency reference to minimize the "frequency reference error x center frequency" term of the specification.

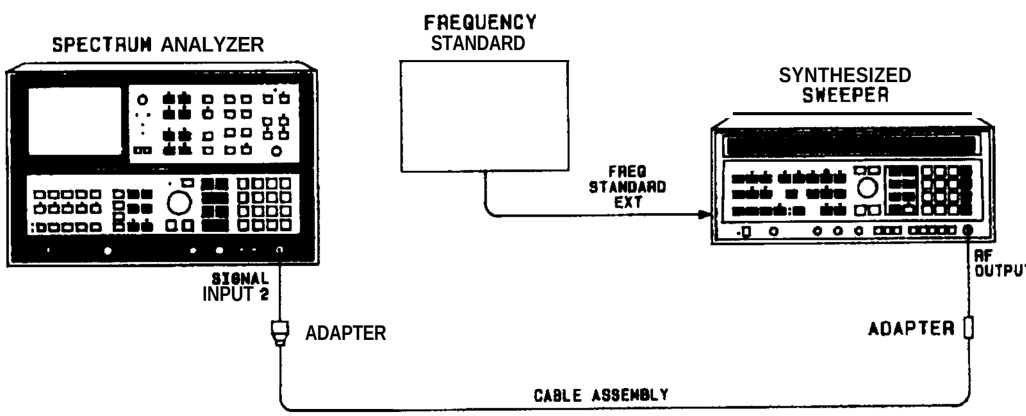


Figure 2-1. Center Frequency Accuracy Test Setup

Equipment

Synthesized Sweeper HP8340A
Frequency Standard . 10 MHz standard, accy within + 1 part in 10^{10}, e.g. HP 5061A
Adapter, Type N (m) to SMA (f) . . . HP1250-1250
61 cm (24 in.) Cable Assembly, SMA Male Connectors HP 5061-1086

Procedure

1. Connect CAL OUTPUT to SIGNAL INPUT 2.
2. Press (INSTR PRESET),(RECALL) (9) on the analyzer.
3. Adjust FREQ ZERO for a maximum amplitude trace.
4. Press (INSTR PRESET).
5. Set the synthesized sweeper for a 100.000 MHz signal at a level of approximately 0 dBm.
6. Connect equipment as shown in Figure 2-1.
7. Set analyzer (CENTER FREQUENCY) and (FREQUENCY SPAN) and synthesized sweeper frequency according to Table 2-2. At each setting, press (PEAK SEARCH).(MKR → CF) to center the signal. Adjust (REFERENCE LEVEL) as necessary to place signal peak at a convenient level.
8. Record the CENTER readout frequency in the table for each setting. The limits for this frequency are given in the table. See Figure 2-2.

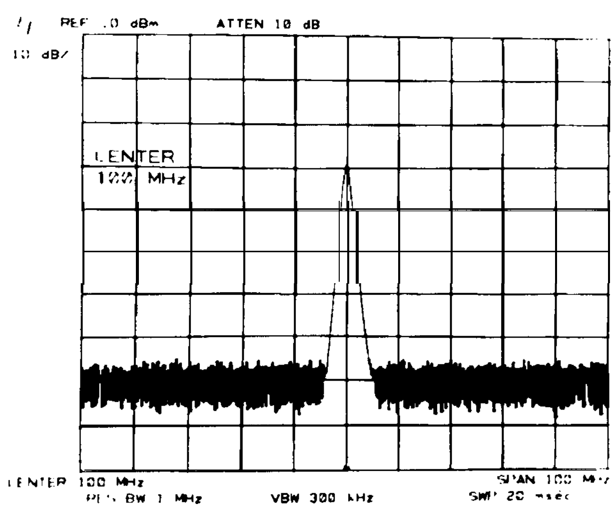


Figure 2-2. Center Frequency Readout Error Measurement

Note

Spectrum analyzer center frequency readout can fall outside of specified limits if 10 MHz frequency reference has not been calibrated within the past year. To eliminate "frequency reference error x tune frequency" term, substitute spectrum analyzer 10 MHz FREQ REFERENCE rear panel output for frequency standard and repeat test.

Table 2-2. Center Frequency Readout Error Test Record

Spectrum Analyzer				
(FREQUENCY SPAN)	(CENTER FREQUENCY) (MHz)	Center Readout (MHz)		
		Min	Measured	Max
100 MHz	100	98		102
100 MHz	500	498		502
100 MHz	1000	998		1002
10 MHz	100	99.8		100.2
10 MHz	500	499.8		500.2
10 MHz	1000	999.8		1000.2
10 MHz	1500	1499.8		1500.2
1 MHz	1000	999.98		1000.02
100 kHz	1000	999.998		1000.002
10 kHz	1000	999.9998		1000.0002

2. Frequency Span Accuracy Test

Related Adjustments

Frequency Control Adjustments

50 MHz Voltage-Tuned Oscillator Adjustments

Specification

Span	Uncertainty
>1 MHz	±(2% of the actual frequency separation between two points +0.5% of span setting)
≤1 MHz	±(5% of the actual frequency separation between two points +0.5% of span setting)

Description

Frequency Span accuracy is determined by measuring a frequency at 5% of sweep and then at 95% of sweep. These frequencies correspond to half a division from each edge of the CRT.

The spans chosen are based on the architecture of the HP 8568B RF hardware:

Span	Assembly Being Swept
200 Hz	VTO Oscillator (low divide)
100 kHz	VTO Oscillator (low divide)
100.1 kHz	VTO Oscillator (high divide)
1 MHz	VTO Oscillator (high divide)
1.01 MHz	FM Coil of Yig Oscillator
20 MHz	FM Coil of Yig Oscillator
20.1 MHz	Main Coil of Yig Oscillator
1.5 GHz	Main Coil of Yig Oscillator

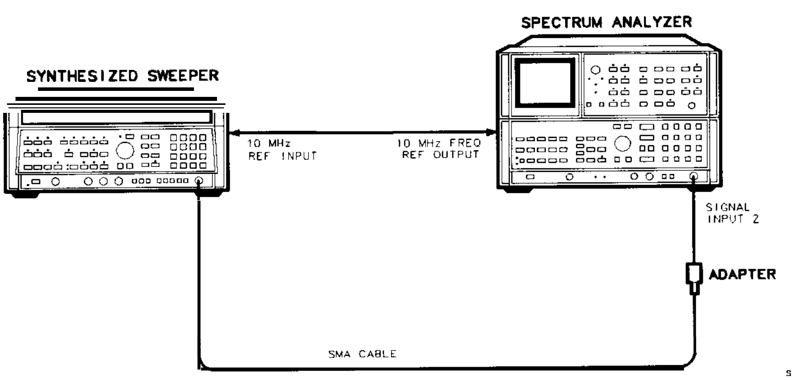


Figure 2-3. Frequency Span Accuracy Test Setup

Equipment

Synthesized Sweeper 83640A
AdapterTypeN(m) to SMA(f)...1250-1250
Cable;SMAconnectors..5061-5458
Cable; BNC122cm(48in)...HP10503A

Procedure

1. Connect equipment as shown in Figure 2-3.
2. Press (INSTR PRESET) on analyzer.
3. Press [CENTER FREQUENCY] 100 MHz, [FREQUENCY SPAN] 200 Hz.
4. Connect synthesized sweeper tot spectrum analyzer RF input 2.
5. On synthesized sweeper, select external REFERENCE and key in (Power level) 0 dBm.
6. Press (CW) and key in 99.999 910 MHz.
7. Press MARKER [PEAK SEARCH) on spectrum analyzer and record marker reading under FREQ C of Table 2-3.
8. Set synthesized sweeper frequency to 100.000 090 MHz.
9. Press MARKER [PEAK SEARCH] and record marker reading under FREQ D of Table 2-3.
10. Repeat the span measurement procedure of steps 6 through 9 for each frequency span listed in Table 2-3.
11. Determine the frequency difference between the two measured points. Enter this value under the A DUT column in Table 2-3.
12. The frequency span error is the difference between A DUT and A SYNTH. (See table 2-3 for values). Calculate the span error and record it in Table 2-4.
13. Compare the table 2-4 spec to the span error value calculated in step 12.

Table 2-3. Wide Span Error

Spectrum Analyzer		Synthesized Sweeper			DUT Measured		
Frequency Span	Center Frequency	Freq. A Cf−.45 span	Freq. B cf +.45 span	Δ Synth (B−A)	Freq. C	Freq. D	Δ DUT (D−C)
200 Hz	100 MHz	99.999 910 MHz	100.000090 MHz	180 Hz			
100 kHz	100 MHz	99.955 000 MHz	100.045 000 MHz	90.000 Hz			
100.1 kHz	100 MHz	99.954955 MHz	100.045 045 MHz	90.090 kHz			
1 MHz	100 MHz	99.550 000 MHz	100.450000 MHz	900.000 kHz			
1.01 MHz	100 MHz	99.550 550 MHz	100.450500 MHz	909.000 kHz			
20 MHz	100 MHz	91.000 000 MHz	109.000000 MHz	18.000 MHz			
20.1 MHz	100 MHz	90.955 000 MHz	109.045.000 MHz	18.090 MHz			
1.5GHz	900 MHz	225 MHz	1575 MHz	1350 MHz			

2. Frequency Span Accuracy Test

Table 2-4. Span Error

Freq Span	Span Error	Spec.	
	ADUT-ASyn from Table 2-3	Min	Max
200 Hz		-10 Hz	10 Hz
100 kHz		-5000 Hz	5000 Hz
100.1 kHz		-5,005 Hz	5,005 Hz
1 MHz		-50,000 Hz	50,000 Hz
1.01 MHz		-23,230 Hz	23,230 Hz
20 MHz		-460,000 Hz	460,000 Hz
20.1 MHz		-462,300 Hz	462,300 Hz
1 . 5 GHz		−34,500.000 Hz	34,5000.000 Hz

Note

The specification in Table 2-4 was derived using the following formula:

For spans > 1 MHz, the spec is: $>\pm[(.02)(\Delta$ synth freq) + (.005)(span)]

For spans $\leq$ 1 MHz, the spec is: $>\pm[(.05)(\Delta$ synth freq) + (.005)(span)]

3. Sweep Time Accuracy Test (≥20 ms)

Related Adjustment Frequency Control Adjustments

Specification

±10% for sweep times ≤100 seconds
±20% for sweep times >100 seconds

Description

Preferred Procedure

This test is for sweep times ≥20 ms. For faster sweep times, refer to Fast Sweep Time Accuracy Test (Test 19).

A universal counter is connected to the PENLIFT RECORDER OUTPUT (on the rear panel) of the spectrum analyzer. The counter is used in time interval mode to determine the "pen down" (sweep time) interval of the PENLIFT RECORDER OUTPUT. The penlift output voltage level corresponds directly to the sweeping of the analyzer (pen down = OV) and not-sweeping of the analyzer (pen up = l5V). A DVM is used to set the appropriate trigger level for the counter.

Alternate Procedure

Perform this procedure if the equipment for the preferred procedure is unavailable.

Sweep time accuracy for sweep times ≥20 ms can also be measured using the HP 8568B's internal frequency counter for a time interval measurement.

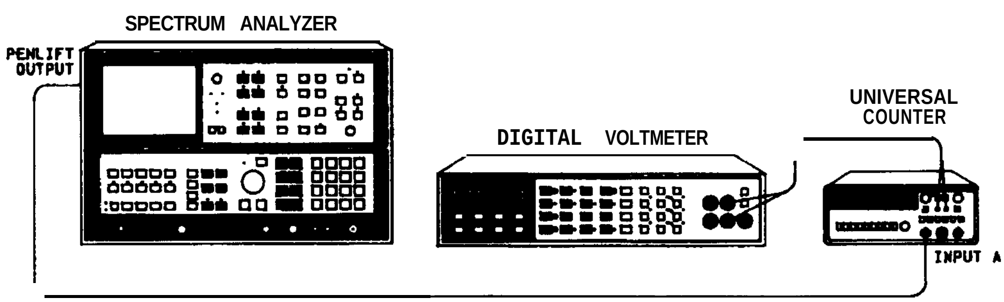


Figure 2-4. Sweep Time Accuracy Test Setup

3. Sweep Time Accuracy Test (≥20 ms)

Equipment

Universal Counter .... HP 5316A
Digital Voltmeter .... HP 3456A

Procedure

Sweep Times ≥20 ms

1. Connect equipment as shown in Figure 2-4.
2. Press (INSTR PRESET) on the spectrum analyzer.
3. Key in the following settings:

   (CENTER FREQUENCY) .... 500 MHz
   [FREQUENCY SPAN] .... 0 kHz

4. Set up the universal counter as follows:
   a. Set all front panel keys in "out" position.
   b. Set POWER switch to ON.
   c. Set GATE TIME vernier control to 9 o'clock.
   d. Set SEP/COM A switch to COM A position.
   e. Depress T.I. A → B switch (making sure the blue shift key is out).
   f. Set Channel A trigger level to trigger on negative slope.
   g. Set Channel B trigger level to trigger on positive slope.
   h. Set both Channel A and Channel B ac/dc switches to dc.
   i. Connect the digital voltmeter to Channel A TRIGGER LEVEL OUT. (Be sure to ground the DVM properly.)
   j. Adjust Channel A trigger level to set a DVM voltage reading of 0.3 v.
   k. Repeat steps i and j for Channel B.
5. Set analyzer (SWEEP TIME) to 20 ms. Allow the universal counter enough time to settle at this sweep time.

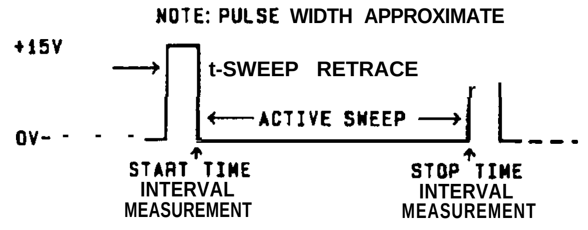


Figure 2-5. **Penlift** Output Signal

6. Note the measured sweep time on the universal counter and record this value in Table 2-5. The measured sweep time should be a value between the minimum and maximum values given in Table 2-5.
7. Repeat steps 5 and 6 for each sweep time setting in Table 2-5.

Table 2-5.
Sweep Time Accuracy, Sweep Times ≥**20** ms

(SWEEP TIME)	Marker A Time		
	Min	Measured	**Max**
20 ms	18 ms		22 ms
50 ms	45 ms		55 ms
100 ms	90 ms		110 ms
500 ms	450 ms		550 ms
1 s	900 ms		1.10 s

8. Press MARKER (NORMAL).
9. Use (⇩) to place the marker at the second vertical graticule.
10. Press (SHIFT),(SINGLE)u.
11. Set analyzer (SWEEP TIME) to 20 s. Allow the universal counter enough time to settle at this sweep time.
12. Note the measured sweep time on the universal counter and record this value in Table 2-6. The measured sweep time should be a value between the minimum and maximum values given in Table 2-6.
13. Repeat steps 11 and 12 for 200 s sweep time.

3. Sweep Time Accuracy Test (≥20 ms)

Table 2-6.
Sweep Time Accuracy, Sweep Times ≥**20** s

[SWEEP TIME]	Marker A Time		
	Min	Measured	Max
20 s	3.6 s	______	4.4 s
200 s	32 s	______	48 s

Sweep Times ≥20 ms (Alternate Procedure)

14. Sweep times ≥20 ms are tested without external test equipment by the following procedure.

15. Press (INSTR PRESET).

Start-Up Time Measurement

16. Set (SWEEP TIME] according to Table 2-7. Press MARKER (NORMAL). Rotate the DATA knob to place the marker on the left edge of the CRT display. Key in (SHIFT) (SINGLE)u.

17. Press (SHIFT) (RES BW)F three times. The Active Function Block reads SWEEP GEN followed by a measured sweep time. This is the start-up time. Record it in Table 2-7. The start-up time must be subtracted from the SWEEP GEN time measured in step 19. (Adding the start-up time to the [SWEEP TIME] setting effectively subtracts it from the SWEEP GEN time.)

18. Press MARKER (OFF).

Sweep Time Measurement

19. Press (SHIFT) (RES BW)F three times and note the SWEEP GEN reading. The limits for the SWEEP GEN reading are listed in Table 2-7. (For example, assume the start-up time measured in step 17 was 700 μs for a [SWEEP TIME] of 20 ms. The limits for the SWEEP GEN readings would be 19.3 to 22.7 ms.)

20. Repeat steps 16 to 19 for each sweep time shown in Table 2-7.

Table 2-7.
Sweep Time Accuracy, Sweep Times ≥**20** ms
(Alternate Procedure)

SWEEP TIME)	Sweep Gen Readout		
	Min	Measured	Max
20 ms	18.0 ms	______	22.0 ms
50 ms	45.0 ms	______	55.0 ms
100 ms	90.0 ms	______	110 ms
500 ms	450 ms	______	550 ms
1 s	900 ms	______	1.10 ms
10 s	9.00 ms	______	11.0 ms
50 s	45.0 ms	______	55.0 ms
100 s	90.0 ms	______	10.0 ms
150 s	20.0 s	______	80.0 ms

4. Resolution Bandwidth Accuracy Test

(For instruments with Option 462, refer to Chapter 4.)

Related Adjustment

3-dB Bandwidth Adjustments

Specification

±20%, 3 MHz

±10%, 3 kHz to 1 MHz

±20% 10 Hz to 1 kHz

30 kHz and 100 kHz bandwidth accuracy figures apply only with ≤90% Relative Humidity, ≤ 40°C.

Description

The 3 dB bandwidth for each resolution bandwidth setting is measured with the MARKER function to determine bandwidth accuracy. The CAL OUTPUT is used for a stable signal source.

Equipment

None Required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in spectrum analyzer setting as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... .5 MHz
   (RES BW) .... 3 MHz
   (REFERENCE LEVEL) .... -10 dBm

4. Press SCALE LIN pushbutton. Press (SHIFT),(AUTO)A (resolution bandwidth).
5. Adjust (REFERENCE LEVEL) to position peak of signal trace at reference level (top) graticule line. Press SWEEP (SINGLE).
6. Press MARKER (NORMAL) and place marker at peak of signal trace with DATA knob. Press MARKER In] and position movable marker 3 dB down from the stationary marker on the positive-going edge of the signal trace (the MARKER A amplitude readout should be -3.00 dB ±0.05 dB). It may be necessary to press SWEEP (CONT) and adjust (CENTER FREQUENCY) to center trace on screen.
7. Press MARKER (Δ) and position movable marker 3 dB down from the signal peak on the negative going edge of the trace (the MARKER A amplitude readout should be .OO dB ±0.05 dB). The 3 dB bandwidth is given by the MARKER A frequency readout (see Figure 2-6). Record this value in Table 2-8.

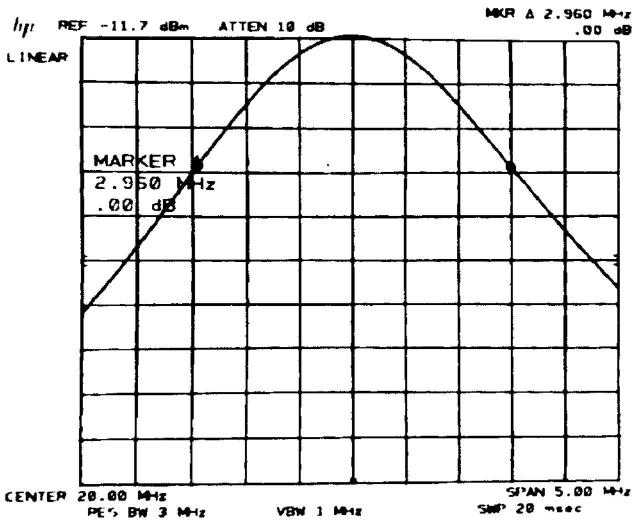


Figure 2-6. Resolution Bandwidth Measurement

8. Vary spectrum analyzer settings according to Table 2-8. Measure the 3 dB bandwidth for each resolution bandwidth setting by the procedure of steps 6 and 7 and record the value in Table 2-8. The measured bandwidth should fall between the limits shown in the table.

Table 2-8. Bandwidth Accuracy

(RES BW)	(FREQUENCY SPAN)	MARKER Δ Readout of 3 dB Bandwidth		
		Min	Measured	Max
3 MHz	5 MHz	2.400 MHz	______	3.600 MHz
1 MHz	2 MHz	900 kHz	______	1.100 MHz
300 kHz	500 kHz	270.0 kHz	______	330.0 kHz
100 kHz	200 kHz	90.0 kHz	______	110.0 kHz
30 kHz	50 kHz	27.00 kHz	______	33.00 kHz
10 kHz	20 kHz	9.00 kHz	______	11.00 kHz
3 kHz	5 kHz	2.700 kHz	______	3.300 kHz
1 kHz	2 kHz	800 Hz	______	1.200 kHz
300 Hz	500 Hz	240 Hz	______	360 Hz
100 Hz	200 Hz	80 Hz	______	120 Hz
30 Hz	100 Hz	24 Hz	______	36 Hz
10 Hz	100 Hz	8 Hz	______	12 Hz

5. Resolution Bandwidth Selectivity Test

(For instruments with Option 462, refer to Chapter 4.)

Related Adjustments

3 MHz Bandwidth Filter Adjustments 21.4 MHz Bandwidth Filter Adjustments

Step Gain and 18.4 MHz Local Oscillator Adjustments

Specification

60 dB/3 dB bandwidth ratio:

<15:1, 3 MHz to 100 kHz

<13:1, 30 kHz to 3 kHz

<11:1, 1 kHz to 30 Hz

60 dB points on 10 Hz bandwidth are separated by <100 Hz

Description

Bandwidth selectivity is found by measuring the 60 dB bandwidth and dividing this value by the 3 dB bandwidth for each resolution bandwidth setting from 30 Hz to 3 MHz. The 60 dB points for the 10 Hz bandwidth setting are also measured. The CAL OUTPUT provides a stable signal for the measurements.

Note

Resolution Bandwidth Accuracy Test must be performed before this test.

Equipment

None Required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in analyzer control settings as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 20 MHz
   (RES BW) .... 3 MHz
   (VIDEO BW) .... 100 Hz
   SWEEP .... (SINGLE)

4. Press MARKER (NORMAL) and position marker at peak of signal trace. Press MARKER (Δ) and position movable marker 60 dB down from the stationary marker on the positive-going edge of the signal trace (the MARKER Δ amplitude readout should be 60.00 dB ±1.00 dB). It may be necessary to press SWEEP (CONT) and to adjust (CENTER FREQUENCY) so that both 60 dB points are displayed (see Figure 2-7).
5. Press MARKER (Δ) and positive movable marker 60 dB down from the signal peak on the negative going edge of the signal trace (the MARKER Δ amplitude readout should be .00 dB ±0.50 dB).

6. Read the 60 dB bandwidth for the 3 MHz resolution bandwidth setting from the MARKER A frequency readout (see Figure 2-7) and record the value in Table 2-9.
7. Vary spectrum analyzer settings according to Table 2-9. Measure the 60 dB bandwidth for each resolution bandwidth setting by the procedure of steps 4 through 6 and record the value in Table 2-9.
8. Record the 3 dB bandwidths from Table 2-8 in Table 2-9.
9. Calculate the bandwidth selectivity for each setting by dividing the 60 dB bandwidth by the 3 dB bandwidth. The bandwidth ratios should be less than the maximum values shown in Table 2-9.
10. The 60 dB bandwidth for the 10 Hz resolution bandwidth setting should be less than 100 Hz.

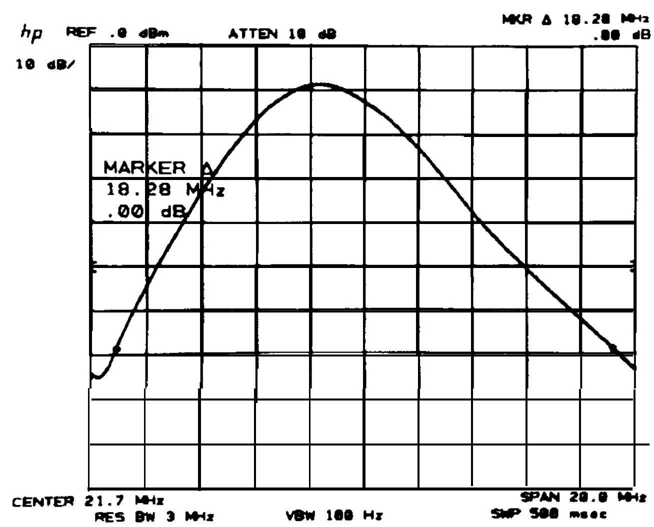


Figure 2-7. 60 dB Bandwidth Measurement

Table 2-9. Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 dB Bandwidth	Measured 3 dB Bandwidth	Bandwidth Selectivity (60 dB BW ÷ 3 dB BW)	Maximum Selectivity Ratio
RES BW	FREQUENCY SPAN	VIDEO BW				
3 MHz	20 MHz	100 Hz	________	________	________	15:1
1 MHz	15 MHz	300 Hz	________	________	________	15:1
300 kHz	5 MHz	AUTO	________	________	________	15:1
100 kHz	2 MHz	AUTO	________	________	________	15:1
30 kHz	500 kHz	AUTO	________	________	________	13:1
10 kHz	200 kHz	AUTO	________	________	________	13:1
3 kHz	50 kHz	AUTO	________	________	________	13:1
1 kHz	10 kHz	AUTO	________	________	________	11:1
300 Hz	5 kHz	AUTO	________	________	________	11:1
100 Hz	2 kHz	AUTO	________	________	________	11:1
30 Hz	500 Hz	AUTO	________	________	________	11:1
10 Hz	100 HZ	AUTO	________	60 dB points separated by <100 Hz		

6. Resolution Bandwidth Switching Uncertainty Test

(For instruments with Option 462, refer to Chapter 4.)

Related Adjustments

3 MHz Bandwidth Filter Adjustments

21.4 MHz Bandwidth Filter Adjustments Down/Up Converter Adjustments

Specification

(uncorrected; referenced to 1 MHz bandwidth; 20 - 30°C after 1 hour warm-up) ±2.0 dB, 10 Hz bandwidth

±0.8 dB, 30 Hz bandwidth ±0.5 dB, 100 Hz to 1 MHz bandwidth

fl.O dB, 3 MHz bandwidth 30 kHz and 100 kHz bandwidth switching uncertainty figures only applicable ≤90% Relative Humidity

Description

The CAL OUTPUT signal is applied to the input of the spectrum analyzer. The deviation in peak amplitude of the signal trace is then measured as each resolution bandwidth filter is switched in.

Equipment

None Required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in the following control settings:

   (CENTER FREQUENCY) . . . . 20 MHz
   [FREQUENCY SPAN) . . . . 5 MHz
   (REFERENNCE LEVEL] . . . . - 8 dBm
   (RES BW) . . . . 1 MHz

4. Press LOG (ENTER dB/DIV) and key in 1 dB. Press MARKER (PEAK SEARCH) (Δ).
5. Press (SHIFT),(⇩).
6. Key in settings according to Table 2-10. Press MARKER [PEAK SEARCH] at each setting, then read the amplitude deviation from the MARKER A readout at the upper right of the display (see Figure 2-8). The allowable deviation for each resolution bandwidth setting is shown in the table.

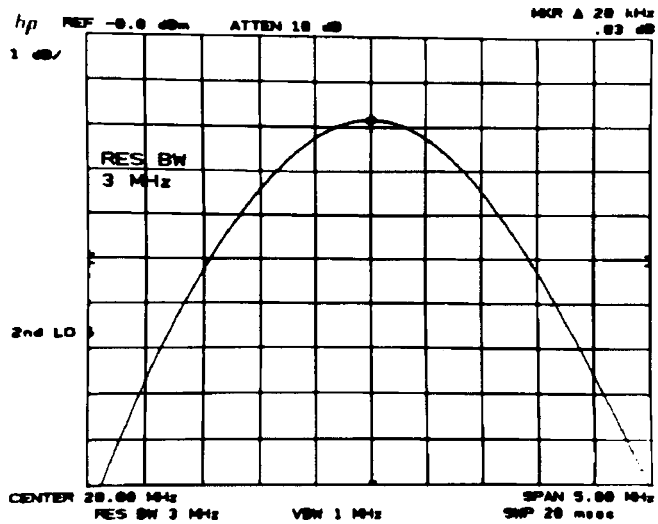


Figure 2-8. Bandwidth Switching Uncertainty Measurement

Table 2-10. Bandwidth Switching Uncertainty

(RES BW)	(FREQUENCY SPAN)	Deviation (MKR A Readout, **dB)**	Allowable Deviation **(dB)**
1 MHz	5 MHz	0 (ref)	0 (ref)
3 MHz	5 MHz	______	±1.00
300 kHz	5 MHz	______	±0.50
100 kHz	500 kHz	______	±0.50
30 kHz	500 kHz	______	±0.50
10 kHz	50 kHz	______	±0.50
3 kHz	50 kHz	______	±0.50
1 kHz	10 kHz	______	±0.50
300 Hz	1 kHz	______	±0.50
100 Hz	1 kHz	______	±0.50
30 Hz	200 Hz	______	±0.80
10 Hz	100 Hz	______	±2.00

7. Input Attenuator Switching Uncertainty Test

Specification

(uncorrected)

±1.0 dB over 10 dB to 70 dB range

Description

The input attenuator is tested over its 10 dB to 70 dB range using an RF substitution method. A calibrated signal source at 20 MHz provides the substitution.

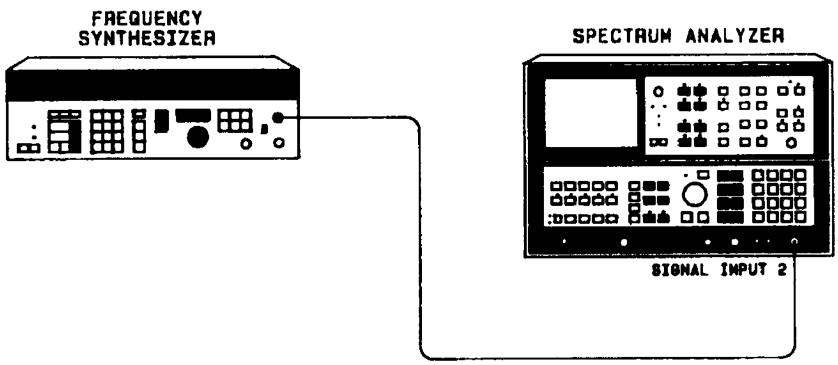


Figure 2-9. Attenuator Switching Uncertainty Test Setup

Equipment

Frequency Synthesizer .... HP 3335A
Adapter, Type N (m) to BNC (f) .... HP 1250-0780

Procedure

1. Press (INSTR PRESET) on the spectrum analyzer.
2. Key in analyzer settings as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 100 kHz
   (REFERENCE LEVEL) .... −50 dBm
   (RES BW) .... 30 kHz
   (VIDEO BW) .... 100 Hz

3. Set the frequency synthesizer for an output frequency of 20.0 MHz and an amplitude of −52 dBm.
4. Connect equipment as shown in Figure 2-9.
5. Press LOG (ENTER dB/DIV) and key in 1 dB per division.

6. Press MARKER (PEAK SEARCH),(Δ).

7. Set (ATTEN),(REFERENCE LEVEL], and frequency synthesizer amplitude according to Table 2-1 1. At each setting, press MARKER (PEAK SEARCH) and record the deviation from the 10 dB setting from the MARKER A amplitude readout (see Figure 2-10). The deviation should not exceed ±1.0 dB at any setting.

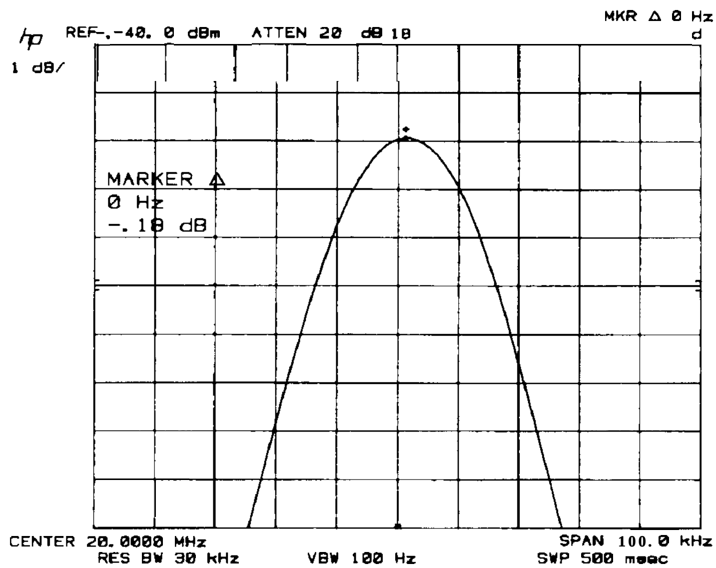


Figure 2-10. Attenuator Switching Uncertainty Measure]nent

Table 2-1 1. Input Attenuator Switching Uncertainty

ATTEN (dB)	[REFERENCE LEVEL) (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MARKER A Amplitude (dB)	Corrected Deviation (dB)	Allowable Deviation (dB)
10	-50	-52	0 (ref)	0 (ref)	
20	-40	-42			±1 dB
30	-30	-32			±1 dB
40	-20	-22			±1 dB
50	-10	-12			±1 dB
60	0	-2			±1 dB
70	+10	8			±1 dB

8. Frequency Response Test

Related Adjustment Slope Compensation Adjustment

Specification SIGNAL INPUT 1

±1.5 dB, 100 Hz to 1.5 GHz

±1 dB, 100 Hz to 500 MHz

SIGNAL INPUT 2

±1 dB, 100 kHz to 1.5 GHz

Description Frequency response at both analyzer inputs is tested by slowly sweeping a flat signal source over the frequency range and observing the peak-to-peak variation in trace amplitude. The test is divided into three parts. First, the response is tested from 20 MHz to 1.5 GHz with a power-meter-leveled synthesized sweeper. Next, a frequency synthesizer is used to check the response from 100 kHz to 20 MHz. Finally, SIGNAL INPUT 1 is tested from 100 Hz to 100 kHz with a function generator.

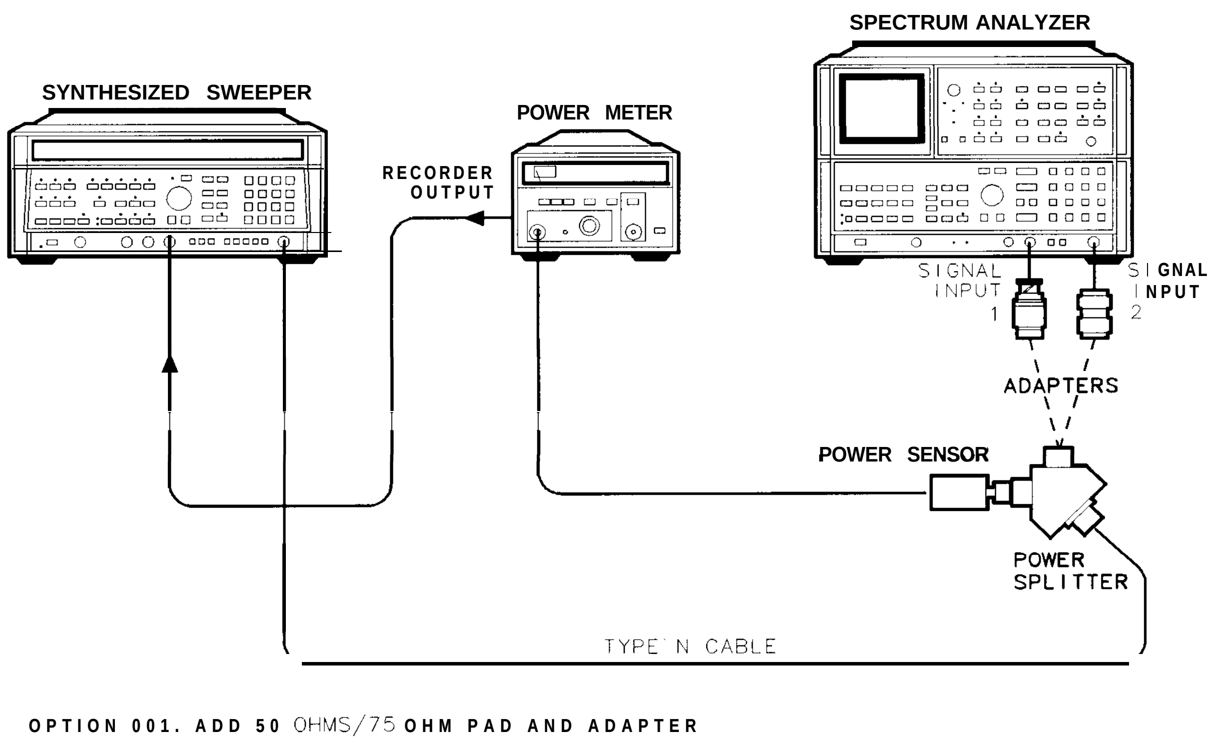


Figure 2-11. Frequency Response Test Setup (20 MHz to 1.5 GHz)

Note

Equipment listed is for three test setups, Figure 2-11, Figure 2-13, and Figure 2-15.

Equipment

Synthesized Sweeper .... HP 8340A
Power Meter .... HP 436A
Power Sensor .... HP 8482A
Frequency Synthesizer .... HP 3335A
Function Generator .... HP 3312A
Power Splitter .... HP 11667A
Adapter, Type N (m) to BNC (f) .... HP 1250-0780
Adapter, Type N (m) to BNC (m) .... HP 1250-0082
Adapter, Type N (m) to Type N (m) .... HP 1250-0778
Adapter, Type N (m) to SMA (f) .... HP 1250-1250
Adapter, APC-3.5 (f) to APC-3.5 (f) .... HP 1250-1749
Cable, SMA Connectors .... HP 5061-5458

Additional Equipment for *Option 001:*

50Ω/70Ω Minimum Loss Pad .... HP 11852A
Adapter, Type N (f) to BNC (m) (7561) .... HP 1250-1534

Procedure

20 MHz to 1.5 GHz

1. Press (INSTR PRESET) on spectrum analyzer and synthesized sweeper.
2. Set controls as follows:

   Power Meter

   MODE . . . . . . dBm
   RANGE HOLD . . . OFF
   CAL FACTOR % . . . 100

   Synthesized Sweeper

   START FREQ .... 20 MHz
   STOP FREQ .... 1.5 GHz
   SWEEP .... (SINGLE)
   SWEEP TIME .... 120 s
   POWER LEVEL .... 0.00 dBm

3. Connect equipment as shown in Figure 2-1 1. The RECORDER OUTPUT on rear panel of power meter is connected to LEVELING EXT INPUT of the synthesized sweeper. One output arm of the power splitter is connected directly to SIGNAL INPUT 2 of the spectrum analyzer via the N-to-N adapter. The power sensor connects directly to the other splitter output.
4. Depress RANGE HOLD button on power meter.
5. Select METER leveling on synthesized sweeper.
6. Key in the following spectrum analyzer settings:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) 10 MHz
   (RES BW) .... 3 MHz

7. Adjust POWER LEVEL on synthesized sweeper (using data knob) to place peak of 20 MHz signal near reference level (top) graticule line.
8. Press (ENTER dB/DIV), 1 dB on spectrum analyzer. Adjust POWER LEVEL on synthesized sweeper to position peak of signal 2 divisions below the reference level line.
9. Key in the following spectrum analyzer settings:

(START FREQ) 20.MHz
(STOP FREQ) .... 1.5 GHz

10. Press TRACE A (MAX HOLD) on the analyzer.
11. Press SWEEP SINGLE on the synthesized sweeper.

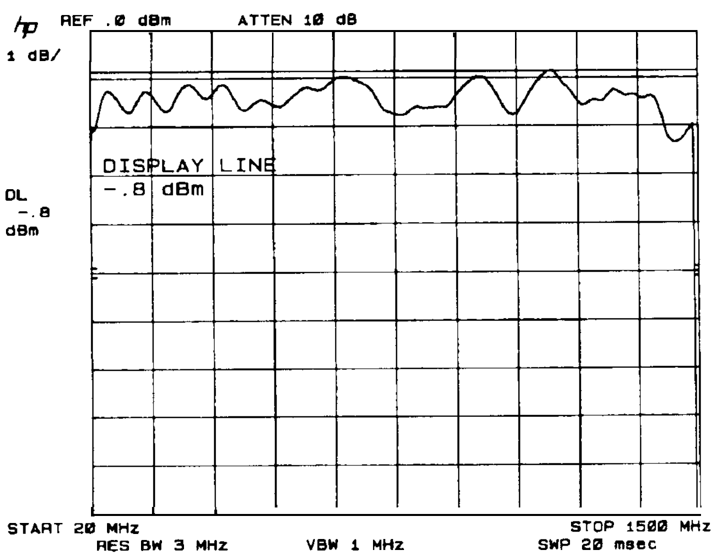


Figure 2-12. Frequency Response Measurement (20 MHz to 1.5 GHz)

12. Press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points on the trace. Record measurements below.

SIGNAL INPUT 2

(20 MHz to 1.5 GHz)

Maximum ______________ dBm

Minimum ______________ dBm

13. To check SIGNAL INPUT 1, use the type N male to BNC male adapter to connect the power splitter directly to SIGNAL INPUT 1.

Option 001: Use HP 11852A Minimum Loss Pad and adapters between splitter and spectrum analyzer input.

14. Press (INSTR PRESET) on spectrum analyzer, then activate SIGNAL INPUT 1 with the pushbutton.

Option 001: Set [REFERENCE LEVEL] TO -6.0 dBm.

15. Repeat steps 6 through 11. Press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points on the trace. Record measurements below.

    SIGNAL INPUT 1

    (20 MHz to 1.5 GHz)

    Maximum ______________ dBm

    Minimum ______________ dBm

16. Press MARKER (NORMAL) on spectrum analyzer. Set marker to 500 MHz. Press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points between 20 MHz and 500 MHz. Record measurements below.

    SIGNAL INPUT 1

    (20 MHz to 500 GHz)

    Maximum ______________ dBm

    Minimum ______________ dBm

100 kHz to 20 MHz

17. Set the frequency synthesizer controls as follows:

    FREQUENCY .... 20 MHz
    SWEEP WIDTH .... 19.9 MHz
    AMPLITUDE .... -2 dBm
    (*Option 001:* + 4 dBm)

18. Connect equipment as shown in Figure 2-13. The output of the frequency synthesizer should be connected to SIGNAL INPUT 1.

    Option 001: Use HP 11852 Minimum Loss Pad and adapters.

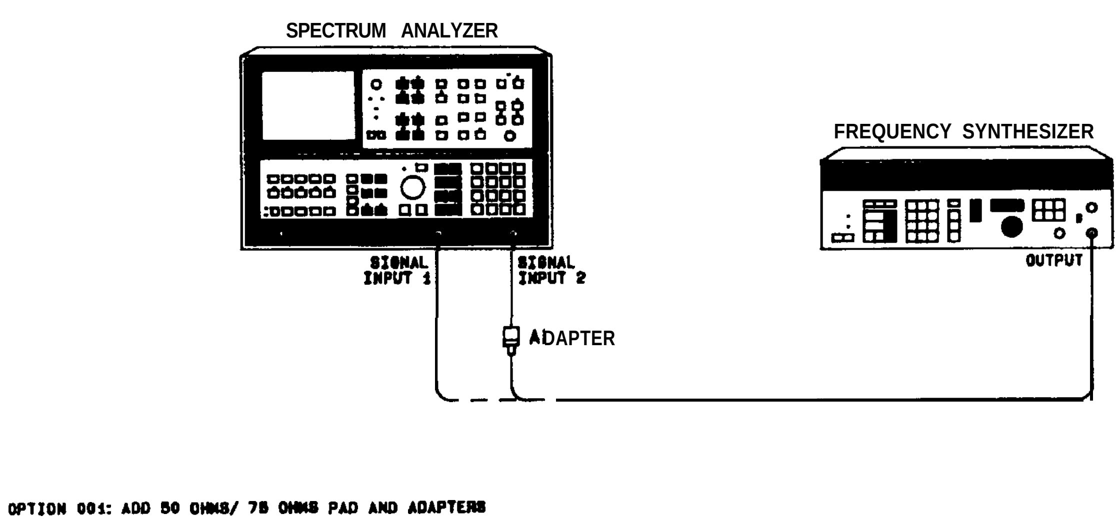


Figure 2-13. Frequency Response Test Setup (100 kHz to 20 MHz)

19. Press (INSTR PRESET) on the spectrum analyzer. Activate SIGNAL INPUT 1 with the pushbutton.

20. Key in the following spectrum analyzer settings:

(CENTER FREQUENCY) ....20 MHz
(FREQUENCY SPAN) ....1 MHz
(RES BW) ....100 kHz

21. Set frequency synthesizer AMPTD INCR to 1.0 dBm. Using the step keys, set frequency synthesizer output to place peak of 20 MHz signal at spectrum analyzer reference level (top graticule).
22. Press LOG (ENTER dB/DIV) 1 dB on spectrum analyzer. Set frequency synthesizer AMPTD INCR to 0.1 dBm. Position the peak of the signal 2 divisions below the reference level line.
23. Key in the following spectrum analyzer settings:

(START FREQ) ....100 kHz
(STOP FREQ) ....20 MHz
TRACE A (MAX HOLD)

24. Set frequency synthesizer FREQUENCY to 10.05 MHz and press SWEEP START SINGLE 50 S.

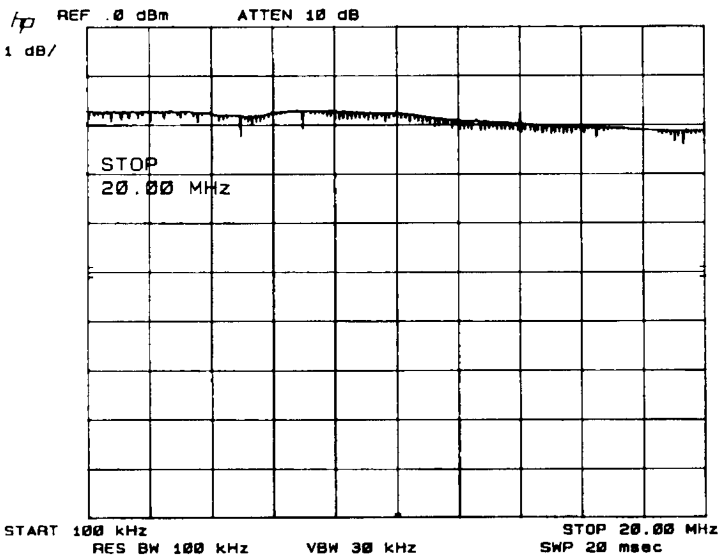


Figure 2-14. Frequency Response Measurement (100 kHz to 20 MHz)

25. After completion of sweep, press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points on the trace. Record the measurements below.

    SIGNAL INPUT 1

    (100 kHz to 20 MHz)

    Maximum ______________ dBm

    Minimum ______________ dBm

26. Measure and record signal level at start of trace (100 kHz).

    SIGNAL INPUT 1

    (100 kHz)

    ______________ dBm

27. Connect output of frequency synthesizer to SIGNAL INPUT 2. Activate this input with the pushbutton.

    Option 001. Do not use HP 11852A Minimum Loss Pad. Set frequency synthesizer output amplitude to -2 dBm.

28. Press TRACE A (CLEAR-WRITE) and DISPLAY LINE (OFF) on spectrum analyzer.

29. Set frequency synthesizer FREQUENCY to 20 MHz. Set spectrum analyzer (CENTER FREQUENCY) to 20 MHz, and (FREQUENCY SPAN) to 1 MHz.

30. Repeat steps 22 through 24.

31. After completion of sweep, press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points on the trace. Record the measurements below.

    SIGNAL INPUT 2

    (100 kHz to 20 MHz)

    Maximum ______________ dBm

    Minimum ______________ dBm

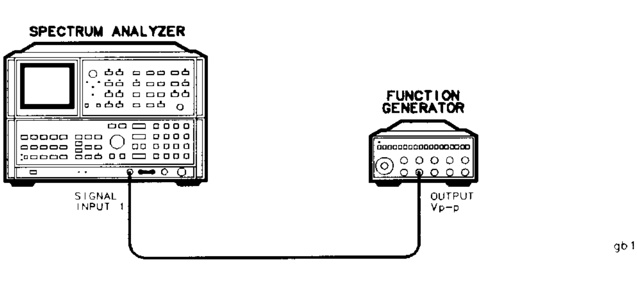


Figure 2-15.
Frequency Response Test Setup (100 Hz to 100 kHz)

100 Hz to 100 kHz

32. Press (INSTR PRESET) on the spectrum analyzer. Activate SIGNAL INPUT 1.
33. Key in the following spectrum analyzer settings:

    (START FREQ) .... 1 kHz
    (STOP FREQ) .... 100 kHz

34. Connect equipment as shown in Figure 2-15 with function generator to SIGNAL INPUT 1.
35. Set the function generator controls as follows:

    LINE .... ON
    RANGE Hz .... 10 K
    FUNCTION .... ~
    OFFSET .... CAL (button in)
    AMPLITUDE .... 1 V
    AMPLITUDE VERNIER .... midrange
    SYM .... CAL
    TRIGGER PHASE .... FREE RUN
    MODULATION .... all out
    MODULATION RANGE Hz I
    MODULATION RANGE Hz VERNIER .... fully CCW
    MODULATION SYM .... CAL
    Percent Modulation .... fully CW

36. Adjust function generator FREQUENCY to place signal between the last two graticule lines (right side) on the signal analyzer display.
37. Adjust AMPLITUDE VERNIER on the function generator until the peak of the signal is at the reference graticule line on the spectrum analyzer display.
38. Press LOG (ENTER dB/DIV) 1 dB on the spectrum analyzer. Press DISPLAY LINE (ENTER) and set the Display Line to the level recorded for 100 kHz in step 25.
39. Adjust function generator AMPLITUDE VERNIER to place peak of signal at the Display Line.
40. Adjust FREQUENCY on the function generator to position the signal trace at the right edge of the spectrum analyzer display (last graticule line).
41. Press MODULATION SWP on the function generator and allow the function generator to make at least two complete sweeps. Press TRACE A [MAX HOLD). Allow the function generator to make one complete sweep. After completion of the sweep, press TRACE A (VIEW).

42. Press DISPLAY LINE (ENTER) on the spectrum analyzer. Use the Display Line to measure the maximum and minimum points on the trace. (Disregard LO Feedthrough at 1 kHz.) Record the measurements below.

    SIGNAL INPUT 1

    (1 kHz to 100 kHz)

    Maximum ______________ dBm

    Minimum ______________ dBm

43. Set Display Line to peak of trace at 1 kHz.
44. Key in the following spectrum analyzer settings:

    TRACE A (CLEAR-WRITE)
    (CENTER FREQUENCY) .... 1 kHz
    (FREQUENCY SPAN) .... 1 kHz
    (RES BW) .... 100 Hz

45. Set function generator controls as follows:

    RANGE Hz .... 100 (button)
    FREQUENCY 10
    MODULATION .... all out

46. Adjust function generator FREQUENCY as necessary to place signal near center graticule line and adjust AMPLITUDE VERNIER to place peak of signal at Display Line.
47. Key in the following spectrum analyzer settings:

    (FREQUENCY SPAN) .... 100 Hz
    (RES BW) .... 30 Hz

48. Set (CF STEP SIZE) to 100 Hz. Step spectrum analyzer (CENTER FREQUENCY) from 1 kHz to 100 Hz with (⇩), while setting function generator FREQUENCY to match spectrum analyzer center frequency at each step. Record level-at each setting.

    SIGNAL INPUT 1

    1000 Hz ______________ dBm

    900 Hz ______________ dBm

    800 Hz ______________ dBm

    700 Hz ______________ dBm

    600 Hz ______________ dBm

    500 Hz ______________ dBm

    400 Hz ______________ dBm

    300 Hz ______________ dBm

    200 Hz ______________ dBm

    100 Hz ______________ dBm

49. For each input, subtract the lowest minimum level (greatest negative) from the highest maximum (least negative) measurement recorded in steps indicated. The result should not exceed 2 dB.

SIGNAL INPUT 1

100 Hz to 500 MHz (from steps 16, 25, 42, or 48)

Spec: <2 dB

Overall Maximum ____________ dBm

-Overall Minimum ____________ dBm

____

Overall Deviation ____________ dBm

SIGNAL INPUT 2

100 kHz to 1.5 GHz (from steps 12 or 31)

Spec: <2 dB

Overall Maximum ____________ dBm

-Overall Minimum ____________ dBm

____

Overall Deviation ____________ dBm

50. Subtract the lowest minimum level (greatest negative) from the highest maximum (least negative) measurement recorded in steps indicated. The result should not exceed 3 dB.

SIGNAL INPUT 1

100 Hz to 1.5 GHz (from steps 15, 16, 25, 42, or 48)

Spec: <3 dB

Overall Maximum ____________ dBm

-Overall Minimum ____________ dBm

____

Overall Deviation ____________ dBm

9. RF Gain Uncertainty Test

Related Adjustment Second Converter Adjustments

Specification RF gain uncertainty (due to 2nd LO shift): ±1.0 dB (uncorrected)

Description The analyzer's calibration signal is used as a stable input signal to observe the change in RF gain when the second LO is shifted in frequency.

Equipment None Required

Procedure

1. Press (INSTR PRESET).
2. Key in spectrum analyzer settings as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 1 MHz
   (REFERENCE LEVEL) .... −7 dBm
   (ENTER dB/DIV) .... 1 dB/DIV
   (RES BW) .... 300 kHz

3. Connect CAL OUTPUT to SIGNAL INPUT 2.
4. Adjust (REFERENCE LEVEL) to position peak of signal trace 3 dB (3 divisions) down from reference level (top) graticule line.
5. Press (SHIFT),(⇩),(PEAK SEARCH), MARKER (Δ).
6. Press (SHIFT),(⇧) and read MARKER (Δ) amplitude from display (see Figure 2-16). This amplitude should be between −1.0 dB and +1.0 dB.

   ____________dB

7. Press (SHIFT),(SIGNAL TRACK)[S] to return the second LO to automatic operation.

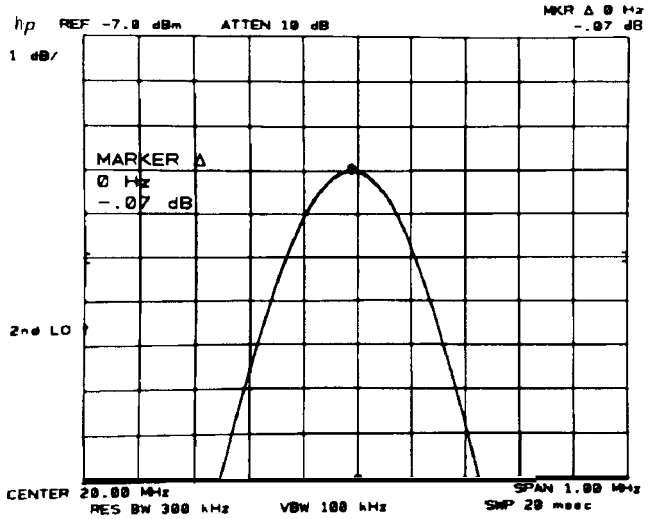


Figure 2-16. RF Gain Uncertainty Measurement

10. IF Gain Uncertainty Test

Related Adjustments

Step Gain and 18.4 MHz Local Oscillator Adjustments

21.4 MHz Bandwidth Filter Adjustments

Specification

Assuming the internal calibration signal is used to calibrate the reference level at -10 dBm and the input attenuator is fixed at 10 dB, any changes in reference level from the -10 dB setting will contribute to IF gain uncertainty as shown:

Range	Uncertainty (uncorrected; 20 – 30°C)
0 dBm to -55.9 dBm	Res BW ≥30 Hz, ±0.6 dB; Res BW = 10 Hz, ±1.6 dB
-56.0 dBm to -129.9 dBm	Res BW ≥30 Hz, ±1.0 dB; Res BW = 10 Hz, ±2.0 dB

Description

The IF gain steps are tested over the entire range from 0 dBm to -129.9 dBm using an RF substitution method. The 10 dB, 2 dB, and 0.1 dB steps are compared against a calibrated signal source provided by an HP 3335A Frequency Synthesizer.

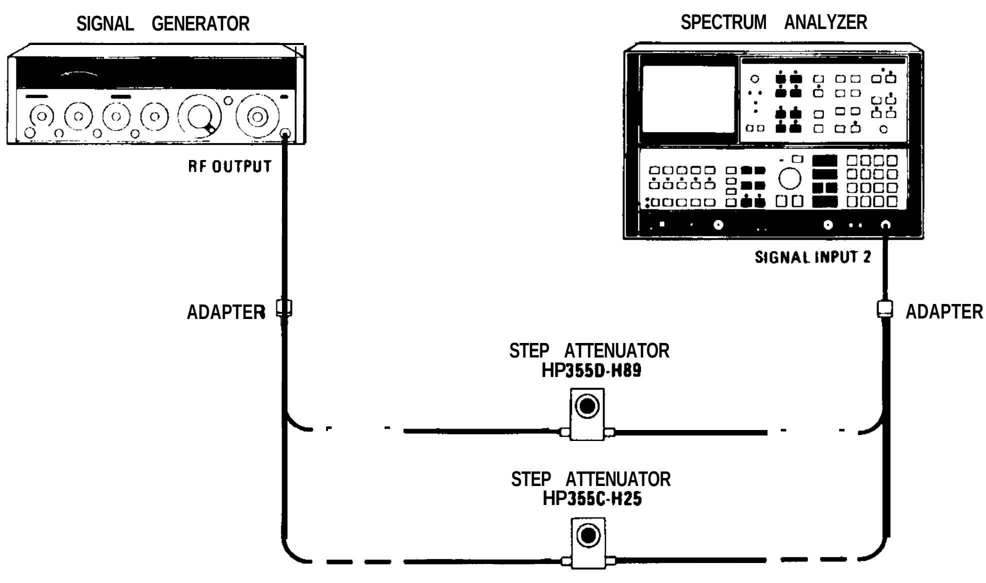


Figure 2-17. IF Gain Uncertainty Test Setup

Equipment

Frequency Synthesizer .... HP 3335A
Adapter, Type N (m) to BNC (f) .... HP 1250-0780

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT.
3. Press (RECALL) 8. Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.
4. Press (INSTR PRESET).

10 dB Gain Steps

5. Set the frequency synthesizer for an output frequency of 20.0010 MHz and an output power level of -2.0 dBm. Set the amplitude increment for 10 dB steps.
6. Connect the equipment as shown in Figure 2-17.
7. Key in analyzer settings as follows:

   (CENTER FREQUENCY) .... 20.001 MHZ
   (FREQUENCY SPAN) .... 2 kHz

8. Press MARKER (PEAK SEARCH).(MKR → CF) or adjust (CENTER FREQUENCY) to center signal trace on display.
9. Set analyzer as follows:

   (VIDEO BW) .... 100 Hz
   (RES BW) .... 1 kHz
   LOG (ENTER dB/DIV] .... 1 dB

10. Press MARKER (PEAK SEARCH),
11. Press (SHIFT),(ATTEN) to permit extended reference level settings.
12. Set the analyzer (REFERENCE LEVEL),(VIDEO BW), and frequency synthesizer amplitude according to Table 2-12 settings. (Use the frequency synthesizer (⇩) for 10 dB steps.) At each setting, note the MKR A amplitude displayed in the upper right corner of the analyzer display (deviation from the 0 dB reference setting) and record it in the table. See Figure 2-18.

Note

After measurement at the (REFERENCE LEVEL) = -70 dBm setting, press (SHIFT),(ENTER dB/DIV) as indicated in Table 2-12.

Table 2-12. IF Gain Uncertainty, 10 **dB** Steps

[REFERENCE LEVEL] (dBm)	Frequency Synthesizer Amplitude (dBm)	[VIDEO BW] (Hz)	Deviation (Marker Δ Amplitude (dB)
0	-2	100	0 (ref.)
-10	-12	100	
-20	-22	100	
-30	-32	100	
-40	-42	100	
-50	-52	100	
-60	-62	10	
-70	-72	10	
[SHIFT] [ENTER dB/DIV] q			
-80	-32	100	
-90	-42	100	
-100	-52	10	
-110	-62	10	
-120	-72	10	

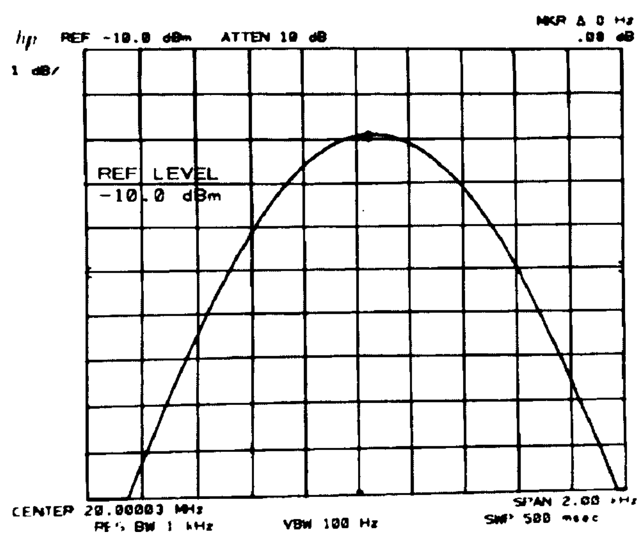


Figure 2-18. IF Gain Uncertainty Measurement

2 dB Gain Steps

13. Press (INSTR PRESET), (RECALL) 7.
14. Set (REFERENCE LEVEL) to -1.9 dBm.
15. Press MARKER (OFF). Set (VIDEO BW) to 100 Hz.
16. Set the frequency synthesizer for an output power level of -3.9 dBm. Set the amplitude increment for 2 dB steps.
17. Press MARKER (PEAK SEARCH), (Δ).
18. Set the analyzer (REFERENCE LEVEL) and the frequency synthesizer amplitude according to Table 2-13. At each setting, note the MKR Δ amplitude and record it in the table.

Table 2-13. IF Gain Uncertainty, 2 dB Steps

(REFERENCE LEVEL) (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MARKER Δ Amplitude (dB)
-1.9	-3.9	0 (ref)
-3.9	-5.9	______
-5.9	-7.9	______
-7.9	-9.9	______
-9.9	-11.9	______

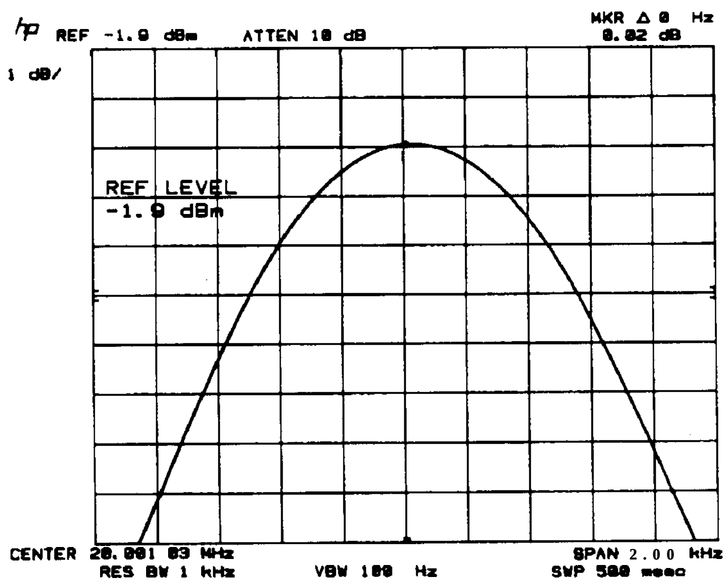


Figure 2-19. IF Gain Uncertainty Measurement (2 dB)

0.1 dB Gain Steps

19. Set [REFERENCE LEVEL] to 0 dB.
20. Set the frequency synthesizer for an output power level of -2.00 dBm. Set the amplitude increment for 0.1 dB steps.
21. Press MARKER [PEAK SEARCH], [Δ].
22. Set the analyzer and the frequency synthesizer amplitude according to Table 2-14. At each setting, note the MKR A amplitude and record it in the table.
23. Find the largest positive deviation and the largest negative deviation for reference level settings from 0 dBm to -70 dBm in Table 2-12. Also, find the largest positive and negative deviations for the last five settings in the table.

	A	B
Reference Level Range:	0 to -70 dBm	-80 to -120 dBm
Largest Positive Deviation:	________ dB	________ dB
Largest Negative Deviation:	________ dB	________ dB

24. Find the largest positive and negative deviations in Table 2-13 and Table 2-14:

	C **Table** 2-13	D **Table** 2-14
Largest Positive Deviation:	________ dB	________ dB
Largest Negative Deviation:	________ dB	________ dB

Table 2-14. IF Gain Uncertainty, 0.1 dB Steps

[REFERENCE LEVEL] (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MKR A Amplitude (dB)
0.0	-2.00	0 (ref)
-0.1	-2.10	
-0.2	-2.20	
-0.3	-2.30	
-0.4	-2.40	
-0.5	-2.50	
-0.6	-2.60	
-0.7	-2.70	
-0.8	-2.80	
-0.9	-2.90	
-1.0	-3.00	
-1.1	-3.10	
-1.2	-3.20	
-1.3	-3.30	
-1.4	-3.40	
-1.5	-3.50	
-1.6	-3.60	
-1.7	-3.70	
-1.8	-3.80	
-1.9	-3.90	

25. The sum of the positive deviations recorded in A, C, and D should not exceed 0.6 dB.
26. The sum of the negative deviations recorded in A, C, and D should not be less than -0.6 dB.
27. The sum of the positive deviations recorded in A, B, C, and D should not exceed 1.0 dB.
28. The sum of the negative deviations recorded in A, B, C, and D should not exceed – 1 .O dB.

11. Log Scale Switching Uncertainty Test

Related Adjustment Video Processor Adjustments

Specification ±0.5 dB (uncorrected; 20 to 30°C)

Description The log scale is stepped from 1 dB/DIV to 10 dB/DIV and the variation in trace amplitude from the 1 dB/DIV setting at each step is measured.

Equipment None required

Procedure

1. Press (INSTR PRESET).
2. Key in analyzer settings as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 100 kHz
   (REFERENCE LEVEL) .... −8 dBm
   (RES BW) .... 30 kHz

3. Press LOG (ENTER dB/DIV) and key in a log scale of 1 dB per division.
4. Connect CAL OUTPUT to SIGNAL INPUT 2.
5. Press MARKER (PEAK SEARCH) and (MKR →). Record the marker amplitude (upper right of display) in Table 2-7.
6. Step up through the log scales with (⇑). At each step, press MARKER (PEAK SEARCH), then record the marker amplitude in Table 2-15. Refer to Figure 2-20.
7. Subtract the marker amplitude at the 1 dB/DIV setting from the marker amplitudes recorded for the 2, 5, and 10 dB/DIV settings to obtain the amplitude deviations. The deviation should be less than ±0.5 dB for each log scale.

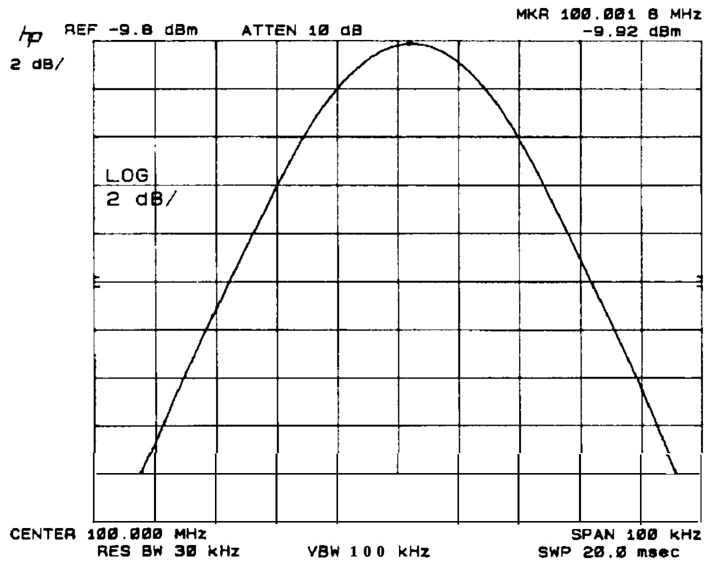


Figure 2-20. Log Scale Switching Uncertainty Measurement

Table 2-15. Log Scale Switching Uncertainty

SCALE (dB/DIV)	**MKR Amplitude (dBm)**	**Deviation (dB)**	Allowable Deviation **(dB)**
1	______	0 (ref)	0 (ref)
2	______	______	±0.5
5	______	______	±0.5
10	______	______	±0.5

12. Amplitude Fidelity Test

(For instruments with Option 857, refer to Chapter 5.)

Related Adjustment

Log Amplifier Adjustments

Specification

Log:

Incremental

±0.1 dB/dB over 0 to 80 dB display

Cumulative

3 MHz to 30 Hz Resolution Bandwidth
≤±1.0 dB max over 0 to 80 dB display (20 - 30°C).
≤± 1.5 dB max over 0 to 90 dB display

Linear:

±3% of Reference Level for top 9-1/2 divisions of display

Description

Amplitude fidelity in log and linear modes is tested by decreasing the signal level to the spectrum analyzer in 10 dB steps with a calibrated signal source and measuring the displayed amplitude change with the analyzer's MARKER A function.

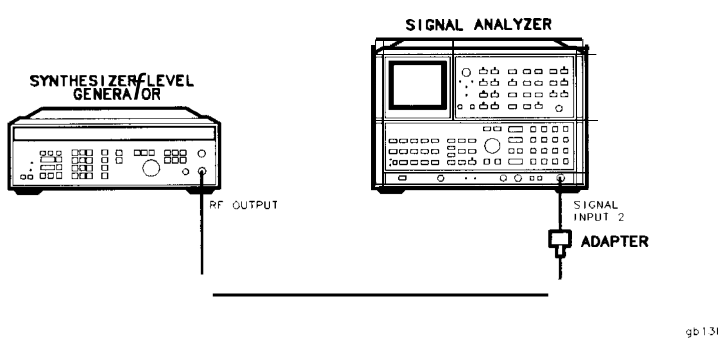


Figure 2-21. Amplitude Fidelity Test Setup

Equipment

Frequency Synthesizer .... HP 3335A
Adapter, Type N (m) to BNC (f) .... HP 1250-0780

Procedure

Log Fidelity

1. Set the frequency synthesizer for an output frequency of 20.000 MHz and an output power level of + 10 dBm. Set the amplitude increment for 10 dB steps.
2. Connect equipment as shown in Figure 2-21.
3. Press (INSTR PRESET) on the analyzer. Key in analyzer settings as follows:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 50 kHz
   (REFERENCE LEVEL) .... + 10 dBm

4. Press MARKER (PEAK SEARCH), (MKR → CF), (MKR → REF LVL) to center the signal on the display.
5. Key in the following analyzer settings:

   (FREQUENCY SPAN) .... 0 Hz
   (VIDEO BW) .... 1 Hz

6. Press MARKER Δ. Step the frequency synthesizer output amplitude from + 10 dBm to -80 dBm in 10 dB steps, noting the MARKER Δ amplitude (a negative value) at each step and recording it in column 2 of Table 2-16. Allow several sweeps after each step for the video filtered trace to reach its final amplitude (see Figure 2-22).
7. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.

Table 2-16. Log Amplitude Fidelity

Frequency Synthesizer Amplitude (dBm)	1 Calibrated Amplitude Step	2 MARKER Δ Amplitude (dB)	Fidelity Error (Column 2- Column 1) (dB)	Cumulative Error 0 to 80 dB (dB)	Cumulative Error 0 to 90 dB (dB)
+10	0 (ref)	0 (ref)	0 (ref)		
0	-10	______	______		
-10	-20	______	______		
-20	-30	______	______		
-30	-40	______	______		
-40	-50	______	______		
-50	-60	______	______		
-60	-70	______	______		
-70	-80	______	______		
-80	-90	______	______	≤±1.0 dB	≤±1.5 dB

8. The fidelity error for amplitude steps from -10 dB to -80 dB should be ≤± 1.0 dB.
9. The fidelity error at the -90 dB setting should be ≤±1.5 dB.

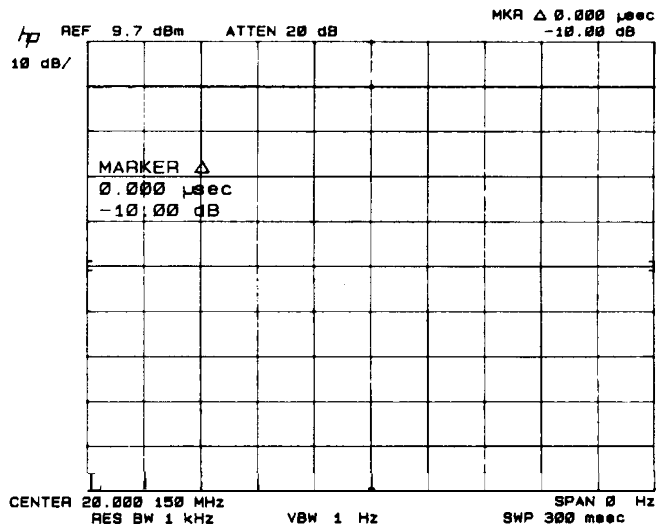


Figure 2-22. Amplitude Fidelity Measurement

Linear Fidelity

10. Key in analyzer settings as follows:

(VIDEO BW)	300 Hz
(FREQUENCY SPAN)	1 MHz
(RES BW)	1 MHz

11. Set the frequency synthesizer for an output power level of + 10 dBm.
12. Press SCALE LIN pushbutton. Press MARKER (PEAK SEARCH), (MKR → CF) to center the signal on the display.
13. Set (FREQUENCY SPAN) to 0 Hz and (VIDEO BW) to 1 Hz. Press (SHIFT), (AUTO) A (resolution bandwidth), MARKER (Δ).
14. Decrease frequency synthesizer output amplitude by 10 dB steps, noting the MARKER A amplitude and recording it in column 2 of Table 2-17.

12. Amplitude Fidelity Test

Table 2-17. Linear Amplitude Fidelity

Frequency Synthesizer Amplitude (dBm)	MARKER A Amplitude (dB)	Allowable Range (±3 % of Reference Level) (dB)	
		Min	Max
0	__________	-10.87	-9.21
-10	__________	-23.10	-17.72

13. Average Noise Level Test

Specification

<−135 dBm for frequencies >1 MHz, <−112 dBm for frequencies ≤1 MHz but >500 Hz with 10 Hz resolution bandwidth, 0 dB input attenuation, 1 Hz video filter.

Option 001: <−129 dBm for frequencies >1 MHz, <−106 dBm for frequencies ≤1 MHz but >500 Hz with 10 Hz resolution bandwidth, 0 dB input attenuation, 1 Hz video filter (SIGNAL INPUT 1 only).

Description

The average noise level is checked by observing the displayed noise level at several frequencies with no input signal applied.

Equipment

50 Ohm Termination . . . . .HP 11593A

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Press (RECALL) (8). Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.
4. Press (INSTR PRESET).
5. Disconnect CAL OUTPUT from analyzer. Terminate SIGNAL INPUT 2 with a 509 coaxial termination.
6. Key in spectrum analyzer settings as follows:

   (ATTEN) . . . . 0 dB
   (CENTER FREQUENCY) . . . . 501 HZ
   (FREQUENCY SPAN) . . . . .O Hz
   (RES BW) . . . . 10 Hz
   (REFERENCE LEVEL) . . . . -80 dBm
   (VIDEO BW) . . . . .1 Hz
   (SWEEP TIME) . . . . 20 seconds

7. Press SWEEP (SINGLE) and wait for completion of the sweep.
8. Press DISPLAY LINE (ENTER). Using DATA knob, place display line at the apparent average amplitude of the noise trace (see Figure 2-23).

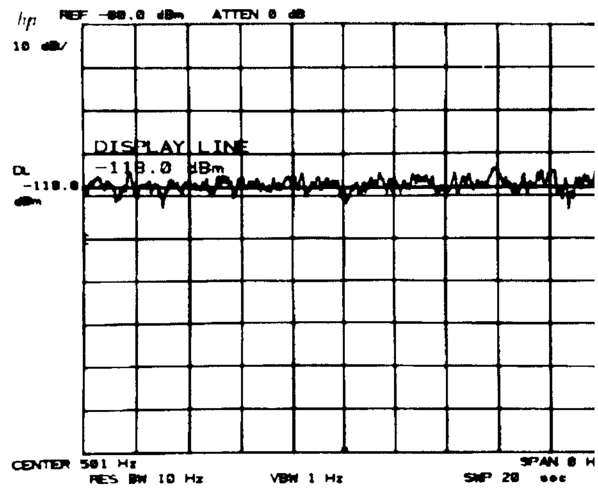


Figure 2-23. Average Noise Level Measurement

9. Read the average noise level from the DISPLAY LINE readout. The value should be <−112 dBm.

    ____________ dBm

10. Change [CENTER FREQUENCY] to 1.001 MHz. Follow the procedure to steps 7 through 9 to determine the average noise level. The value should be <−135 dBm.

    ____________ dBm

11. Change [CENTER FREQUENCY] to 1501 Mhz. Follow the procedure of steps 7 through 9 to determine the average noise level. The value should be <− 135 dBm.

    ____________ dBm

14. Residual Responses Test

Specification

<−105 dBm for frequencies >500 Hz with 0 dB input attenuation (no signal present at input) *Option 100:*

<−99 dBm for frequencies >500 Hz with 0 dB input attenuation (SIGNAL INPUT 1 only).

Option 400:

<−95 dBm for frequencies >500 Hz with 0 dB input attenuation.
<−105 dBm for frequencies >2.5 kHz with 0 dB input attenuation.

Description

The spectrum analyzer is checked for residual responses across its frequency range with no signal applied to the input and 0 dB input attenuation.

Equipment

50 Ohm Termination .... HP 11593A

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Press (RECALL) (8). Adjust AMPTD CAL for a MARKER amplitude of -10.00 dbm ±0.02 dB.
4. Press (INSTR PRESET).
5. Disconnect CAL OUTPUT from analyzer. Terminate SIGNAL INPUT 2 with a 50 ohm coaxial termination.
6. Key in control settings as follows:

(FREQUENCY)	50 MHz
(REFERENCE LEVEL)	-60 dBm
(CENTER FREQUENCY)	.25 MHz
(CF STEP SI.TEP SIZE)	.45 MHz
(VIDEO BW)	1 kHz
(RES BW)	3 kHz
(ATTEN)	0 dB

7. Press DISPLAY LINE (ENTER) and key in -105 dBm.
8. Reduce (RES BW) or (VIDEO BW), if necessary, for a margin of at least 4 dB between the noise trace and the display line (refer to Figure 2-24). Do not reduce either bandwidth to less than 300 Hz.

Note

This test will require approximately 30 minutes to complete using the settings given in step 6. If the resolution bandwidth or video bandwidth are further reduced, a full band check of residual responses will take up to 15 hours to complete

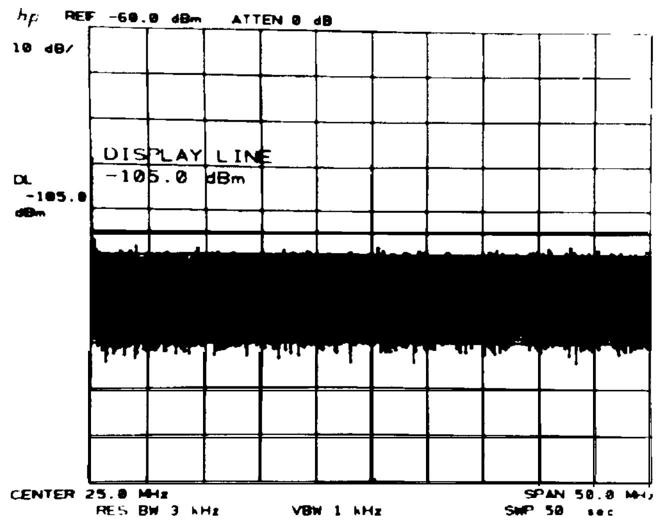


Figure 2-24. Residual Responses Measurement

9. Press SWEEP (SINGLE) and wait for completion of sweep. Look for any residual responses at or above the display line. If a residual is suspected, press SWEEP (SINGLE) again and see if the response persists. A residual will persist on repeated sweeps, but a noise peak will not. Any residual responses must be <−105 dBm.

   Option 400:

   Any residual 500 Hz to 2.5 kHz must be <−95 dBm; any residuals >2.5 kHz must be <−105 dBm

10. If a response appears marginal, do the following to determine whether or not it exceeds the specification.

    a. Press (SAVE) (1).
    b. Press MARKER (NORMAL) and place the marker on the peak of the response in question.
    c. Press MARKER (MKR → CF), then activate SWEEP (CONT).
    d. Reduce [FREQUENCY SPAN] to 1 MHz or less. The amplitude of the response should be <−105 dBm (below the display line).
    e. Press (RECALL] (1) to resume the search for residuals.

11. Step [CENTER FREQUENCY) to 1510 MHz with (⇧) checking for residual responses at each step by the procedure of steps 9 and 10. There should be no residual responses at or above the display line below 1500 MHz.

    Maximum Residual Response

    ______________ dBm

    ______________ MHz

15. Spurious Responses Test

Related Adjustment

Second Converter Adjustments

Specification

For total signal power of <−40 dBm at the input mixer of the analyzer, all image and out-of-band mixing responses, harmonic and intermodulation distortion products are >75 dB below the total signal power for input signals 10 Mhz to 1500 MHz; >70 dB below the total signal power for input signals 100 Hz to 10 MHz.

Second Harmonic Distortion

For a signal -30 dBm at the mixer and ≥10 MHz, second harmonic distortion is >70 dB down; 60 dB down for signals <10 MHz.

Third Order Intermodulation Distortion

For two signals each -30 dB at the mixer, third-order intermodulation products are:

Signal Separation	Center Products	Distortion Products	T.O.I
<100 kHz	>100 kHz	>70 dBc	+5 dBm
>100 kHz	>10 MHz	>80 dBc	+10 dBm

Description

Harmonic distortion (second and third) is tested using a signal source and a low-pass filter. The LPF insures that the harmonics measured are generated by the spectrum analyzer and not by the signal source.

Spurious responses due to image frequencies, out-of-band mixing, and intermodulation distortion are measured by applying signals from two separate sources to the spectrum analyzer input.

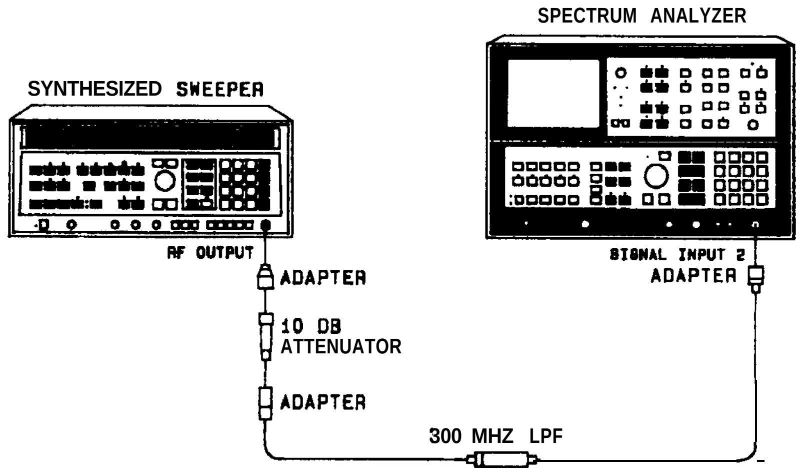


Figure 2-25. Harmonic Distortion Test Setup

Note Equipment listed is for two test setups, Figure 2-25 and Figure 2-26.

Equipment

Synthesized Sweeper	HP 8340A
Frequency Synthesizer	HP 3335A
10 dB Attenuator (2 *required)*	HP 8491A Opt 010
Lowpass Filter (300 MHz)	HP 0955-0455
Adapter, Type N (m) to BNC (f) (2 *required)*	HP 1250-0780
Adapter, Type N (m) to SMA (f)	HP 1250-1250
Adapter, Type N (f) to BNC (m)	HP 1250-0077
Adapter, Type N (f) to BNC (f)	HP 1250-1474
Directional Bridge	HP 8721A
Lowpass Filter (50 MHz) (2 *required)*	HP 0955-0306

Procedure

Harmonic Distortion

1. Connect equipment as shown in Figure 2-25.
2. On the spectrum analyzer, press (INSTR PRESET). Set the controls of the spectrum analyzer as follows:

CENTER FREQUENCY	280 MHz
FREQUENCY SPAN	10 kHz
REFERENCE LEVEL	– 20 dBm

3. On the synthesized sweeper, key in (INSTR PRESET), (CW) 280 MHz, (POWER LEVEL) -10 dBm.
4. On the spectrum analyzer, key in DISPLAY LINE (ENTER) -90 dBm, MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 280 MHz signal.
5. On the synthesized sweeper, press (POWER LEVEL) and use the ENTRY knob to adjust the amplitude of the displayed 280 MHz

signal for a marker indication of -20.00 dBm (-30.0 dBm at the input mixer with 10 dBm of input attenuation).

6 On the spectrum analyzer, key in MARKER (Δ), (CENTER FREQUENCY) 560 MHz, MARKER (PEAK SEARCH) to position a second marker on the peak of the second harmonic distortion product of the 280 MHz input signal. The response should be below the display line (>70 dB below the input signal level).

Second Harmonic ______________ dBm

7. On the synthesized sweeper, key in (POWER LEVEL) (↓) to decrease the amplitude of the 280 MHz signal by 10 dB.
8. On the spectrum analyzer, key in MARKER (OFF), (CENTER FREQUENCY) 280 MHz, [REFERENCE LEVEL] -30 dBm, DISPLAY LINE [ENTER] -105 dBm, MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 280 MHz signal.
9. On the synthesized sweeper, press [POWER LEVEL] and use the ENTRY knob to adjust the amplitude of the displayed 280 MHz signal for a marker indication of -30.00 dBm (-40.0 dBm at the input mixer with 10 dBm of input attenuation).
10. On the spectrum analyzer, key in MARKER (Δ), [CENTER FREQUENCY) 840 MHz, MARKER [PEAK SEARCH) to position a second marker on the peak of the third harmonic distortion product of the 280 MHz input signal. The response should be below the display line (>75 dB below the input signal level).

Third Harmonic ______________ dBm

Intermodulation Distortion

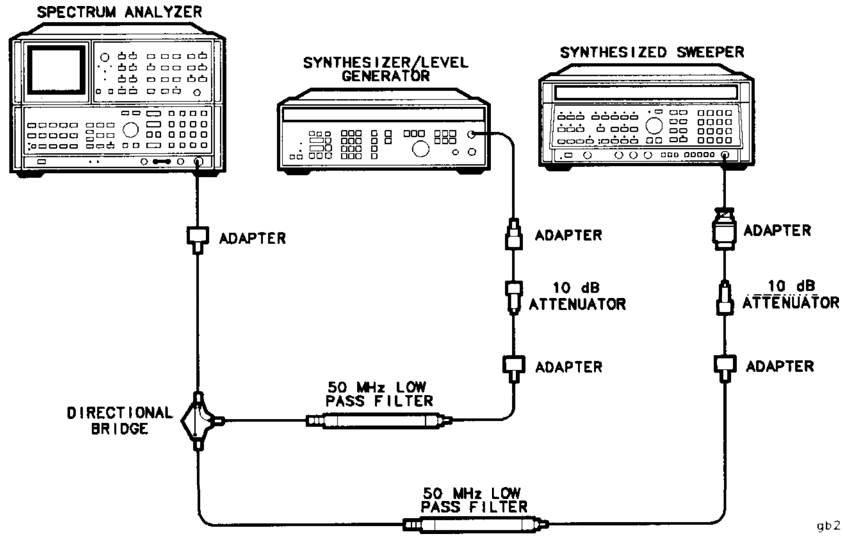


Figure 2-26. Intermodulation Distortion Test Setup

11. Connect equipment as shown in Figure 2-26.
12. Set the controls of the spectrum analyzer as follows:

    CENTER FREQUENCY .... 29.5 MHz
    FREQUENCY SPAN .... 5 MHz
    REFERENCE LEVEL .... -20 dBm
    DISPLAY LINE .... OFF

13. On the synthesized sweeper, key in (CW) 30 MHz, [POWER LEVEL], -4 dBm and use the ENTRY knob to position the peak of the displayed 30 MHz signal at the top CRT graticule line.
14. On the frequency synthesizer, key in [FREQUENCY] 29 MHz, (AMPLITUDE) -4 dBm. Readjust the signal amplitude as necessary to position the peak of the displayed 29 MHz signal at the top CRT graticule line.
15. Set the controls of the spectrum analyzer as follows:

    CENTER FREQUENCY .... 29 MHz
    FREQUENCY SPAN .... 500 Hz

16. On the spectrum analyzer, key in DISPLAY LINE (ENTER) -100 dBm, MARKER [PEAK SEARCH] to position a marker on the peak of the displayed 29 MHz signal.
17. On the frequency synthesizer, adjust the signal amplitude for a marker indication of -20.00 dBm.
18. On the spectrum analyzer, key in [CENTER FREQUENCY] 30 MHz, MARKER [PEAK SEARCH] to position a marker on the peak of the displayed 30 MHz signal.
19. On the synthesized sweeper, adjust the signal power level for a marker indication of -20.00 dBm.

Note

If unable to locate intermodulation distortion products, temporarily increase output power level of frequency synthesizer and synthesized sweeper by + 10 dB. Return the output power level of both signal sources to the previous settings before making distortion measurements.

20. On the spectrum analyzer, key in MARKER (Δ), [CENTER FREQUENCY] 31 MHz, MARKER [PEAK SEARCH] to position a marker at the peak of the 31 MHz third-order intermodulation product. The response should be below the display line (>80 dB below the input signals).

    TOI Distortion (1 MHz separation @ 30 MHz)
    ____________ dBm

21. On the spectrum analyzer, key in [CENTER FREQUENCY] 28 MHz, MARKER [PEAK SEARCH] to position a marker at the peak of the 28 MHz third-order intermodulation product. The response should be below the display line (>80 dB below the input signals).

    TOI Distortion (1 MHz separation @ 30 MHz)
    ____________ dBm

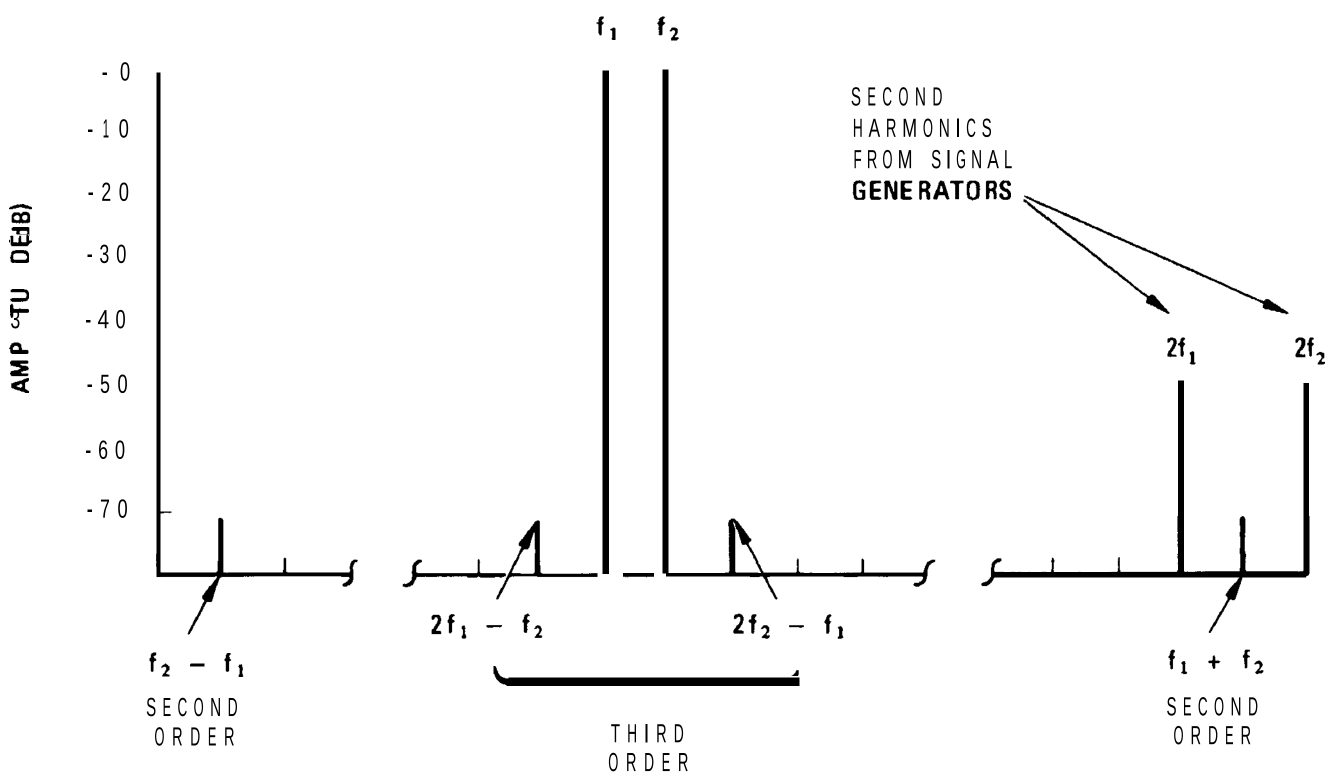


Figure 2-27. Intermodulation Distortion Products

22. On the frequency synthesizer, key in [FREQUENCY] 29.99 MHz.

23. On the spectrum analyzer, key in MARKER (OFF), (CENTER FREQUENCY) 29.99 MHz, DISPLAY LINE (ENTER) -90 dBm, MARKER (PEAK SEARCH).

24. On the frequency synthesizer, readjust the signal amplitude as necessary to position the peak of the displayed 29.99 MHz signal at the top CRT graticule line.

25. On the spectrum analyzer, key in MARKER (Δ), (CENTER FREQUENCY) 30.01 MHz, MARKER (PEAK SEARCH) to position a second marker at the peak of the 30.01 MHz third-order intermodulation product. The response should be below the display line (>70 dB below the input signals).

    TOI Distortion (10 kHz separation @ 30 MHz)
    ______________ dBm

26. On the spectrum analyzer, key in [CENTER FREQUENCY) 29.98 MHz, MARKER [PEAK SEARCH) to position a second marker at the peak of the 29.98 MHz third-order intermodulation product. The response should be below the display line (>70 dB below the input signals).

    TOI Distortion (10 kHz separation @ 30 MHz)
    ______________dBm

27. On the synthesized sweeper, press (POWER LEVEL] and decrease the amplitude of the 30 MHz signal by 13.0 dB from the current setting.

28. On the frequency synthesizer, key in [FREQUENCY] 29 MHz, (AMPLITUDE] and then decrease the amplitude of the 29 MHz signal by 13.0 dB from the current setting.

29. Set the controls of the spectrum analyzer as follows:

    CENTER FREQUENCY . . . . 29 MHz
    FREQUENCY SPAN . . . . .500 Hz
    REFERENCE LEVEL . . . . -33 dBm
    MARKER . . . . OFF

30. On the spectrum analyzer, key in DISPLAY LINE (ENTER) -105 dBm, MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 29 MHz signal.

31. On the frequency synthesizer, adjust the signal amplitude for a marker indication of -33.0 dBm.

32. On the spectrum analyzer, key in (CENTER FREQUENCY) 30 MHz, MARKER [PEAK SEARCH) to position a marker on the peak of the displayed 30 MHz signal.

33. On the synthesized sweeper, adjust the signal power level for a marker indication of -33.0 dBm (total signal power of -40 dBm at the input mixer with 10 dB of input attenuation).

34. On the spectrum analyzer, key in MARKER (Δ), [CENTER FREQUENCY) 1 MHz, MARKER [PEAK SEARCH) to position a second marker at the peak of the 1 MHz second-order intermodulation distortion product. The response should be below the display line (>75 dB below the total input power).

    SOI Distortion (1 MHz separation @ 30 MHz)
    ______________ dBm

35. On the spectrum analyzer, key in [CENTER FREQUENCY] 59 MHz, MARKER [PEAK SEARCH) to position a second marker at the peak of the 59 MHz second-order intermodulation distortion product. The response should be below the display line (>75 dB below the total input power).

SOI Distortion (1 MHz separation @ 30 MHz)
_____________ dBm

16. Residual FM Test

Specification

<3 Hz peak-to-peak in ≤10 s; frequency span <100 kHz, resolution bandwidth ≤30 Hz, video bandwidth ≤30 Hz.

Description

The spectrum analyzer CAL OUTPUT is used to supply a stable 20 MHz signal to the analyzer. The analyzer is tuned in zero span to a point on the 30 Hz bandwidth response for which the slope of the response is known from direct measurement. The residual FM is then slope detected over a 10 second interval, yielding a trace whose peak-to-peak excursion is proportional to the residual FM.

Equipment

None Required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Press (RECALL) 8 and adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.
4. Press (RECALL) 9 and adjust FREQ ZERO for a maximum amplitude trace.
5. Set (REFERENCE LEVEL) to -10 dBm. Adjust FREQ ZERO counterclockwise until trace is at the center graticule line.
6. Set (FREQUENCY SPAN) to 100 Hz. Press SWEEP (SINGLE) and wait for completion of the sweep.
7. Press MARKER (NORMAL), and place marker 1 division above the center graticule line on the negative-going side of the trace. Press MARKER In] and set the movable marker 1 division below the center graticule line. See Figure 2-28.

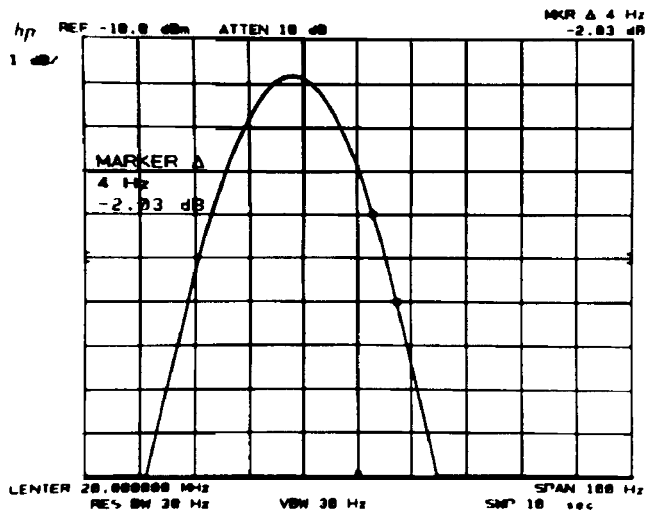


Figure 2-28. Bandwidth Filter Slope Measurement

8. Compute the detection slope of the 30 Hz filter between the markers by dividing the MARKER A amplitude by the MARKER A frequency:

   filter slope = MARKER A amplitude/MARKER Afrequency = _____________ dB/Hz

9. Press SWEEP (CONT),(MARKER) (OFF).

10. Change (FREQUENCY SPAN] to 0 Hz. Readjust FREQ ZERO, if necessary, to position the trace at the center graticule line. The amplitude variations of the trace (see Figure 2-29) represent the analyzer residual FM.

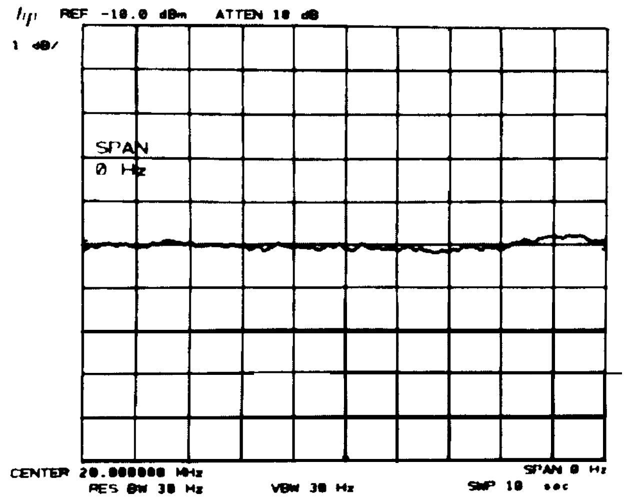


Figure 2-29. Slope Detected Residual FM

11. Press SWEEP (SINGLE) and wait for completion of the sweep.
12. Press MARKER [PEAK SEARCH]. Press DISPLAY LINE (ENTER) and position the display line at the lowest point on the trace.

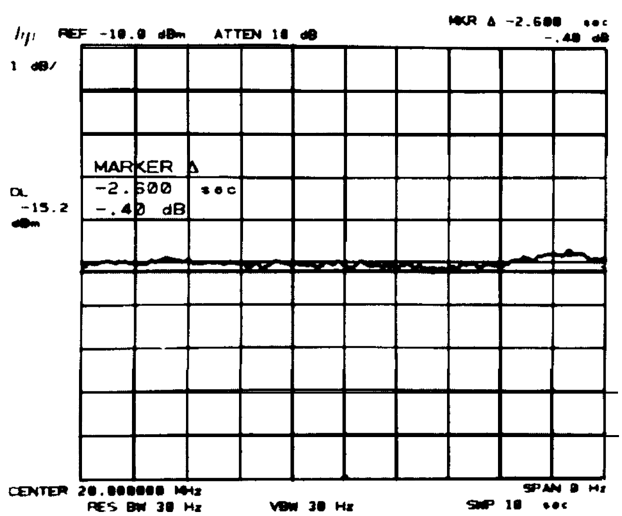


Figure 2-30. Peak-to-Peak Amplitude Measurement

13. Press MARKER (Δ) and position movable marker at the lowest point on the trace (see Figure 2-30). Read the MARKER A amplitude from the display and record its absolute value.

    MARKER A amplitude = p-p amplitude = ______________ dB

14. Divide the peak-to-peak amplitude by the slope computed in step 8 to obtain the residual FM:

    p-p amplitude/filter slope = residual FM

    ______________ dB/______________dB/Hz = ______________ Hz = residual FM

    The residual FM should be less than 3 Hz.

15. Press (INSTR PRESET).

16. Press (RECALL) 9 and adjust FREQ ZERO for a maximum amplitude trace.

17. Line-Related Sidebands Tests

Specification

>85 dB below the peak of a CW signal. *Option 400:* >75 dB below the peak of a CW signal.

Description

The spectrally pure calibrator signal of the spectrum analyzer is applied to the analyzer input and the line related sidebands near the signal are measured.

Equipment

None required

Procedure

1. Press (INSTR PRESET) on the analyzer. Connect CAL OUTPUT to SIGNAL INPUT 2.
2. Press (RECALL) 8 and adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.
3. Press (INSTR PRESET).
4. Key in the following analyzer settings:

   (CENTER FREQUENCY) .20 MHZ
   (REFERENCE LEVEL) . . . . -10 dBm
   (FREQUENCY SPAN) . . . . 600 Hz

5. Wait for completion of sweep, then press MARKER (PEAK SEARCH),(MKR → CF).
6. Press (SHIFT) (VIDEO BW)G, SWEEP (SINGLE), 10 (Hz μV μs) to initiate video averaging of 10 sweeps. Wait for completion of sweeps.
7. Press MARKER (PEAK SEARCH),(Δ) and position movable marker at the peak of each line related sideband (120 Hz, 180 Hz, and 240 Hz for 60 Hz line frequency; 100 Hz, 150 Hz, and 200 Hz for 50 Hz line frequency, etc.). The MARKER Δ amplitude for each sideband should be <−85 dB (see Figure 2-31).

   120 Hz (100 Hz) ______________ dB

   180 Hz (150 Hz) ______________ dB

   240 Hz (200 Hz) ______________ dB

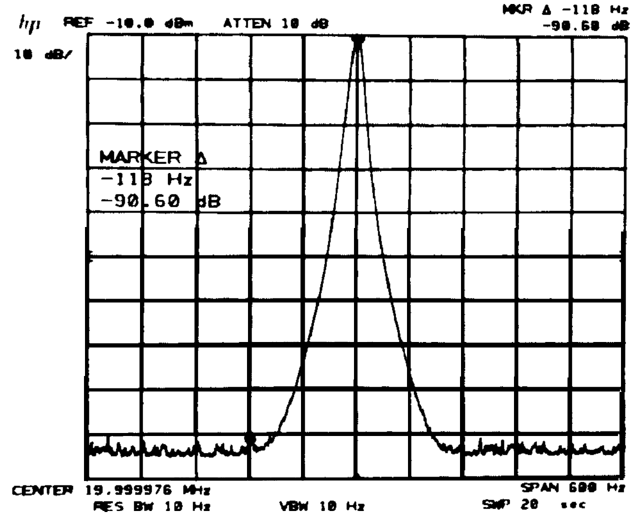


Figure 2-31. Line Related Sidebands Measurement

Option 400

1. Press (INSTR PRESET). Connect CAL OUTPUT to SIGNAL INPUT 2.
2. Press (RECALL) 8 and adjust AMPTD CAL for a MARKER amplitude of -10. 00 dBm ● 0.02 dB.
3. Press (INSTR PRESET).
4. Key in the following analyzer settings:

(CENTER FREQUENCY)	20 MHz
(REFERENCE LEVEL)	-10 dBm
(FREQUENCY SPAN)	3 kHz

5. Wait for completion of the sweep, then press MARKER (PEAK SEARCH), (MKR → CF).
6. Press (SHIFT) (VIDEO BW) G, SWEEP (SINGLE), 10 (Hz µV µs) to initiate video averaging of 10 sweeps. Wait for completion of sweeps.
7. Press MARKER (PEAK SEARCH), (Δ) and position movable marker at the peak of each line related sideband (400 Hz, 800 Hz, and 1200 Hz). The MARKER A amplitude for each sideband should be <−75 dB.

   400 Hz ______________ dB

   800 Hz ______________ dB

   1200 Hz ______________ dB

18. Calibrator Amplitude Accuracy Test

Related Adjustment 20 MHz Reference Adjustments

Specification -10 dBm ±0.3 dB

Description The output level of the calibrator signal is measured with a power meter.

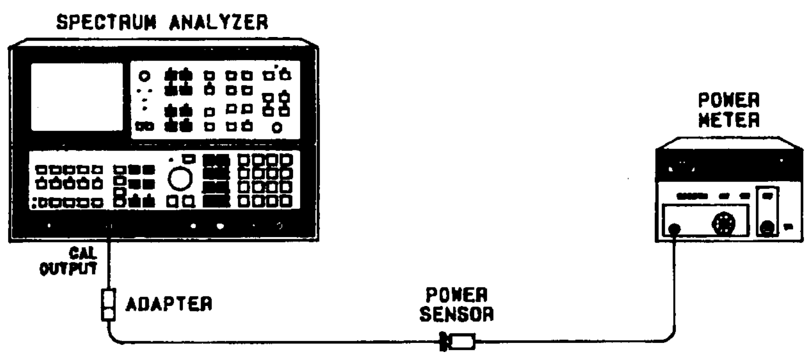


Figure 2-32. Calibrator Amplitude Accuracy Test Setup

Equipment

Power Meter .... HP 436A
Power Sensor .... HP 8482A
Adapter, Type N (f) to BNC (m) .... HP 1250-0077

Procedure

1. Connect equipment as shown in Figure 2-32.
2. Measure output level of the CAL OUTPUT signal. The value should be -10.0 dBm ±0.3 dB.

_____________ dBm

19. Fast Sweep Time Accuracy Test (<20 ms)

Related Adjustment None

Specification ±10% for sweep times ≤100 seconds

Description The triangular wave output of a function generator is used to modulate a 500 MHz signal which is applied to the spectrum analyzer SIGNAL INPUT. The signal is demodulated in the zero span mode to display the triangular waveform. Sweep time accuracy for sweep times <20 ms is tested by checking the spacing of the signal peaks on the displayed waveform.

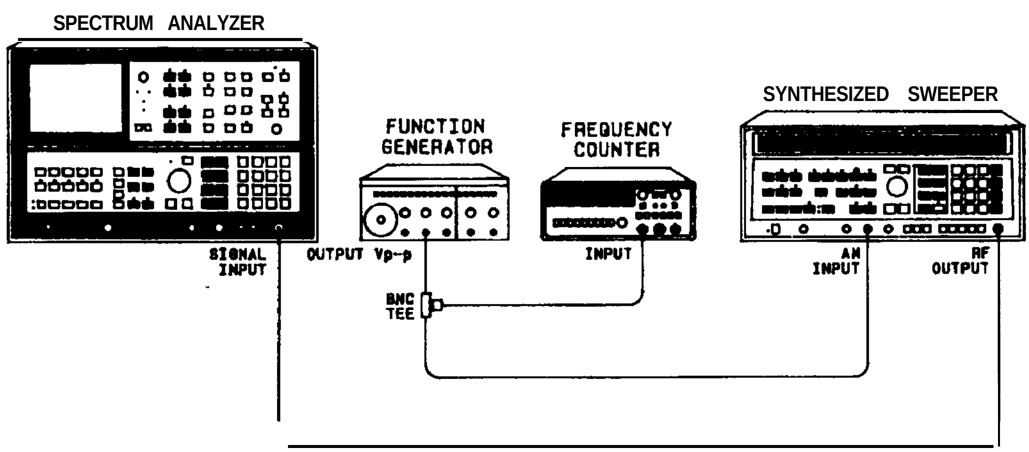


Figure 2-33. Fast Sweep Time Accuracy (<20 ms Test Setup)

Equipment

Function Generator	HP 3312A
Universal Counter	HP 5316A
Signal Generator	HP 8340A

Procedure

1. Connect equipment as shown in Figure 2-33.
2. Press (INSTR PRESET) on spectrum analyzer.
3. Key in analyzer settings as follows:

(CENTER FREQUENCY)	500 MHZ
(FREQUENCY SPAN)	100 kHz

4. Set synthesized sweeper for an output frequency of 500 MHz and an output power level of -10 dBm.

19. Fast Sweep Time Accuracy Test (<20 ms)

5. Press MARKER (PEAK SEARCH), (MKR → CF), (OFF).
6. Set (FREQUENCY SPAN) to 0 Hz, (RES BW) to 3 MHz, (VIDEO BW) to 3 MHz, and press TRIGGER (VIDEO).
7. Set synthesized sweeper for an amplitude-modulated output.
8. Set function generator controls as follows:

FUNCTION	triangular wave
AMPLITUDE	approximately 1 Vp-p
OFFSET	CAL position (in)
SYM	CAL position (in)
TRIGGER PHASE	FREE RUN
MODULATION	all out

9. Key in (SWEEP TIME) 5 ms and set function generator for a counter reading of 2.00 ±0.02 kHz.
10. Adjust spectrum analyzer TRIGGER LEVEL to place a peak of the triangular waveform on the first graticule from the left edge of the CRT display as a reference. (Adjust function generator amplitude, if necessary, to provide a signal large enough to produce a stable display). The fifth peak from the reference should be within ±0.5 division of the sixth graticule from the left edge of the display (see Figure 2-34).
11. Using sweep times and function generator frequencies in Table 2-18, check sweep time accuracy for sweep times <20 ms by procedure of step 10.

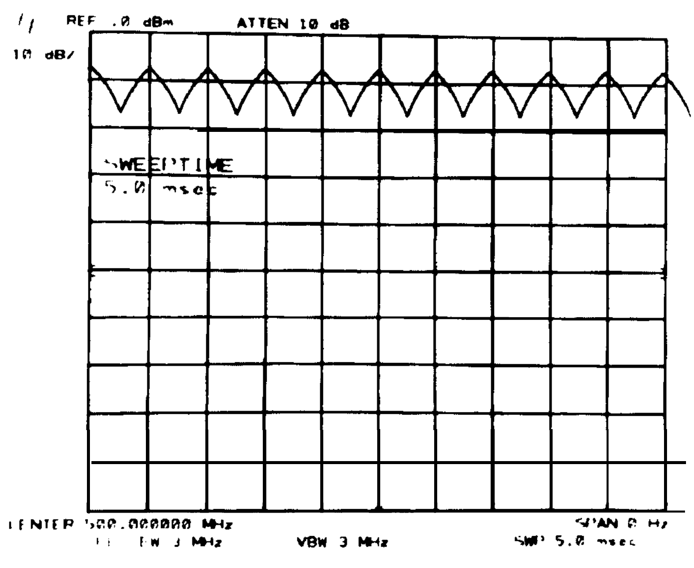


Figure 2-34. Fast Sweep Time Measurement (<20 ms)

Table 2-18. Fast Sweep Time Accuracy (<20 ms)

[SWEEP TIME]	Function Generator Frequency (kHz)	Sweep Time Error (divisions)
5 ms	2.00 ±0.02	
2 ms	5.00 ±0.05	
1 ms	10.0 ±0.1	
200 μs	50.0 ±0.5	
100 μs	100 ±1	

20. 1st LO Output Amplitude Test

Specification >+4 dBm from 2.0 GHz to 3.7 GHz

Description The power level at the 1ST LO OUTPUT connected is measured as the first L.O. is swept over its 2.0 GHz to 3.1 GHz range.

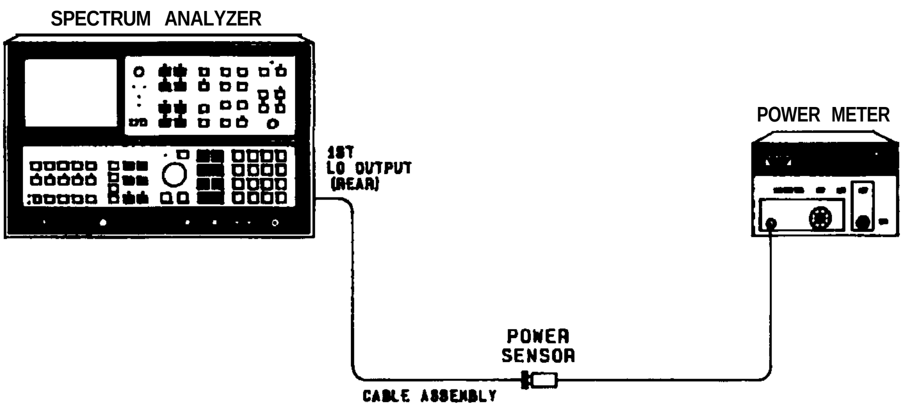


Figure 2-35. 1st LO Output Amplitude Test Setup

Equipment

Power Meter .... HP 436A
Power Sensor .... HP 8482A

Procedure

1. Press [INSTR PRESET].
2. Set [SWEEP TIME] to 100 seconds.
3. Calibrate power meter and sensor. Connect equipment as shown in Figure 2-35.
4. Observe the meter indication as the analyzer makes a complete sweep. The indication should be > + 4 dBm across the full sweep range.

   ____________ dBm

5. Replace 50 ohm terminator on 1ST LO OUTPUT.

21. Frequency Reference Error Test

Related Adjustment

Time Base Adjustment

Specification

Aging Rate

$<1 \times 10^{-9}$/day and $<2.5 \times 10^{-7}$ year; attained after 30 days warmup from cold start at 25°C.

Temperature Stability

$<7 \times 10^{-9}$ 0" to 55°C. Frequency is within 1×10^{-8} of final stabilized frequency within 30 minutes.

Description

The frequency of the spectrum analyzer time base oscillator is measured directly using a frequency counter locked to a frequency reference which has an aging rate less than one-tenth that of the time base specification. After a 30 day warmup period, a frequency measurement is made. The analyzer is left undisturbed for a 24-hour period and a second reading is taken. The frequency change over this 24-hour period must be less than one part in 10^9.

Note

This test requires that the spectrum analyzer be turned on (not in STANDBY) for a period of 30 days to ensure that the frequency reference attains its aging rate. However, after aging rate is attained, the frequency reference typically attains aging rate again in 72 hours of operation after being off for a period not exceeding 24 hours.

Care must be taken not to disturb the spectrum analyzer during the 24-hour test interval, since the frequency reference is sensitive to shock and vibration. The frequency reference should remain within its attained aging rate if the instrument is left on, the instrument orientation with respect to the earth's magnetic field is maintained, and the instrument does not sustain any mechanical shock. Frequency changes due to orientation with respect to the earth's magnetic field and altitude changes will usually be nullified when the instrument is returned to its original position. Frequency changes due to mechanical shock will usually appear as a fixed frequency error.

The frequency reference is also sensitive to temperature changes; for this reason the ambient temperature near the instrument at the first measurement time and the ambient temperature at the second measurement time should not differ by more than 1°C.

Placing the spectrum analyzer in STANDBY mode turns the instrument off while continuing to provide power for the frequency reference oven, helping to minimize warmup time. However, the frequency reference must be on to attain its aging rate.

21. Frequency Reference Error Test

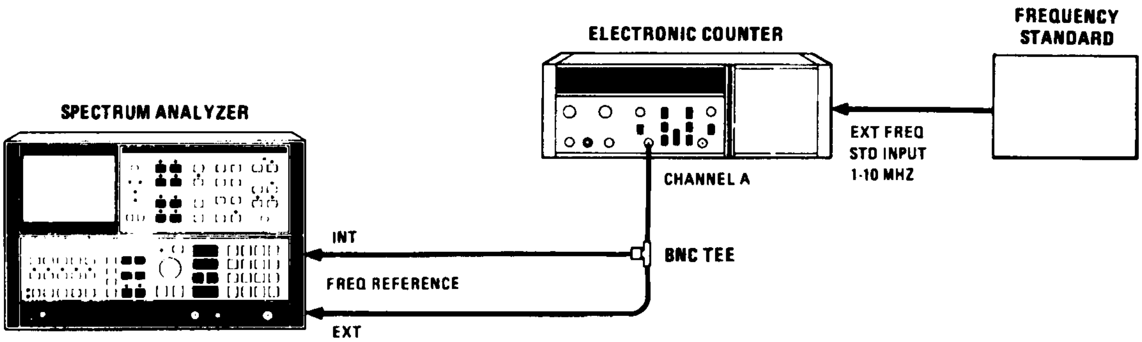


Figure 2-36. Frequency Reference Test Setup

Equipment

Electronic Counter .... HP 5345A
1,2,5, or 10 MHz Frequency Reference with aging rate <1 x 10^{-10}/day .... HP 5061A
BNC Tee .... HP 1250-0781

Procedure

1. Allow analyzer to warm up at 25°C ambient temperature for a period of 30 days.
2. Set controls of electronic counter as follows:

   FUNCTION .... FREQ A
   DISPLAY POSITION .... AUTO
   GATE TIME .... 100 S
   CHANNEL A Input Impedance 50
   CHANNEL A ATTEN x1
   CHANNEL A Coupling .... AC
   CHANNEL A LEVEL .... midrange

3. Connect equipment as shown in Figure 2-36.
4. Record the frequency of the analyzer time base as measured by the counter:

   Frequency: 10.____________ MHz
   Date: ____________
   Time: ____________
   Ambient Temperature: ____________

5. Allow the analyzer to remain undisturbed for 24 hours, then note the time base frequency again:

   Frequency: 10.____________ MHz
   Date: ____________
   Time: ____________
   Ambient Temperature: ____________

Note

If the ambient temperatures recorded in steps 4 and 5 differ by more than 1°C, the frequency measurements may be invalid.

6. The difference in frequency between the two measurements should be <1 part in 10^9 (<0.01 Hz at 10 MHz).

   ____________ Hz

Table 2-19. Performance Test Record

Hewlett-Packard Company	Tested by ____________
Model HP 8568B	Report No. ____________
Serial No. ____________	Date ____________
IF-Display Section ____________	
RF Section ____________	

Test 1. Center Frequency Readout Accuracy Test

Step 8. Center Frequency Readout Error Test Record

Comb Generator	Spectrum Analyzer				
Comb Frequency (MHz)	(FREQUENCY SPAN)	(CENTER FREQUENCY) (MHz)	**Center Readout (MHz)**		
			Min	**Measured**	**Max**
100 MC	100 MHz	100	98	______	102
	100 MHz	500	498	______	502
	100 MHz	1000	998	______	1002
EXT TRIG (1, 2, 5, or 10 MHz) trigger signal	10 MHz	100	99.8	______	100.2
	10 MHz	500	499.8	______	500.2
	10 MHz	1000	999.8	______	1000.2
	10 MHz	1500	1499.8	______	1500.2
	1 MHz	1000	999.98	______	1000.02
	100 kHz	1000	999.998	______	1000.002
	10 kHz	1000	999.9998	______	1000.0002

Test 2. Frequency Span Accuracy Test

Steps 7, 9, and 11. Wide Span Error

Spectrum Analyzer		Synthesized Sweeper			DUT Measured		
Frequency Span	Center Frequency	Freq. A Cf−.45 span	Freq. B cf + .45 span	Δ Synth (B−A)	Freq. C	Freq. D	Δ DUT (D−C)
200 Hz	100 MHz	99.999 910 MHz	100.000 090 MHz	180 Hz			
100 kHz	100 MHz	99.955 000 MHz	100.045 000 MHz	90.000 Hz			
100.1 kHz	100 MHz	99.954955 MHz	100.045045 MHz	90.090 kHz			
1 MHz	100 MHz	99.550000 MHz	100.450 000 MHz	900.000 kHz			
1.01 MHz	100 MHz	99.550 550 MHz	100.450 500 MHz	909.000 kHz			
20 MHz	100 MHz	91.000000 MHz	109.000000 MHz	18.000 MHz			
20.1 MHz	100 MHz	90.955 000 MHz	109.045.000 MHz	18.090 MHz			
1.5GHz	900 MHz	225 MHz	1575 MHz	1350 MHz			

Step 12. Span Error

Freq Span	Span Error	Spec.	
	ΔDUT- ΔSyn from Table 2-3	Min	Max
200 Hz		-10 Hz	10 Hz
100 kHz		-5000 Hz	5000 Hz
100.1 kHz		-5,005 Hz	5,005 Hz
1 MHz		-50,000 Hz	50,000 Hz
1.01 MHz		-23,230 Hz	23,230 Hz
20 MHz		-460,000 Hz	460,000 Hz
20.1 MHz		-462,300 Hz	462,300 Hz
1.5 GHz		−34,500.000 Hz	34,5000.000 Hz

Note

The specification in Table 2-4 was derived using the following formula:

For spans > 1 MHz, the spec is: $>\pm[(.02)(\Delta \text{ synth freq}) + (.005)(\text{span})]$

For spans ≤ 1 MHz, the spec is: $>\pm[(.05)(\Delta \text{ synth freq}) + (.005)(\text{span})]$

Step 6. Sweep Time Accuracy, Sweep Times ≥20 ms

[SWEEP TIME]	Marker A Time		
	Min	Measured	Max
20 ms	18 ms		22 ms
50 ms	45 ms		55 ms
100 ms	90 ms		110 ms
500 ms	450 ms		550 ms
1 s	900 ms		1.10 s

Step 12. Sweep Time Accuracy, Sweep Times ≥20 s

[SWEEP TIME]	Marker Δ Time		
	Min	Measured	Max
20 s	3.6 s		4.4 s
200 s	32 s		48 s

Step 19. Sweep Time Accuracy, Sweep Times ≥20 ms (Alternate Procedure)

[SWEEP TIME]	Sweep Gen Readout		
	Min	Measured	Max
20 ms	18.0 ms		22.0 ms
50 ms	45.0 ms		55.0 ms
100 ms	90.0 ms		110 ms
500 ms	450 ms		550 ms
1 s	900 ms		1.10 ms
10 s	9.00 s		11.0 s
50 s	45.0 s		55.0 s
100 s	90.0 s		10.0 s
150 s	20.0 s		80.0 s

Test 4. Resolution Bandwidth Accuracy

Step 8. Bandwidth Accuracy

(RES BW)	[FREQUENCY SPAN]	MARKER A Readout of 3 dB Bandwidth		
		Min	Measured	Max
3 MHz	5 MHz	2.400 MHz		3.600 MHz
1 MHz	2 MHz	900 kHz		1.100 MHz
300 kHz	500 kHz	270.0 kHz		330.0 kHz
100 kHz	200 kHz	90.0 kHz		110.0 kHz
30 kHz	50 kHz	27.00 kHz		33.00 kHz
10 kHz	20 kHz	9.00 kHz		11.00 kHz
3 kHz	5 kHz	2.700 kHz		3.300 kHz
1 kHz	2 kHz	800 Hz		1.200 kHz
300 Hz	500 Hz	240 Hz		360 Hz
100 Hz	200 Hz	80 Hz		120 Hz
30 Hz	100 Hz	24 Hz		36 Hz
10 Hz	100 Hz	8 Hz		12 Hz

Test 5. Resolution Bandwidth Selectivity

Steps 7, 8 and 9. Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 dB Bandwidth	Measured 3 dB Bandwidth	Bandwidth Selectivity (60dB BW ÷ 3dB BW)	Maximum Selectivity Ratio
(RES BW)	(FREQUENCY SPAN)	(VIDEO BW)				
3 MHz	20 MHz	100 Hz	______	______	______	15:1
1 MHz	15 MHz	300 Hz	______	______	______	15:1
300 kHz	5 MHz	AUTO	______	______	______	15:1
100 kHz	2 MHz	AUTO	______	______	______	15:1
30 kHz	500 kHz	AUTO	______	______	______	13:1
10 kHz	200 kHz	AUTO	______	______	______	13:1
3 kHz	50 kHz	AUTO	______	______	______	13:1
1 kHz	10 kHz	AUTO	______	______	______	11:1
300 Hz	5 kHz	AUTO	______	______	______	11:1
100 Hz	2 kHz	AUTO	______	______	______	11:1
30 Hz	500 Hz	AUTO	______	______	______	11:1
10 Hz	100 Hz	AUTO	______	60 dB points separated by <100 Hz		

Test 6. Resolution Bandwidth Switching Uncertainty Test

Step 6. Bandwidth Switching Uncertainty

(RES BW)	(FREQUENCY SPAN)	Deviation (MKR Δ Readout, dB)	Allowable Deviation (dB)
1 MHz	5 MHz	0 (ref)	0 (ref)
3 MHz	5 MHz		±1.00
300 kHz	5 MHz		±0.50
100 kHz	500 kHz		±0.50
30 kHz	500 kHz		±0.50
10 kHz	50 kHz		±0.50
3 kHz	50 kHz		±0.50
1 kHz	10 kHz		±0.50
300 Hz	1 kHz		±0.50
100 Hz	1 kHz		±0.50
30 Hz	200 Hz		±0.80
10 Hz	100 Hz		±2.00

Test 7. Input Attenuator Switching Uncertainty Test

Step 7. Input Attenuator Switching Uncertainty

(ATTEN) (dB)	(REFERENCE LEVEL) (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MARKER A Amplitude (dB)	Corrected Deviation (dB)	Allowable Deviation (dB)
10	-50	-52	0 (ref)	0 (ref)	
20	-40	-42			±1 dB
30	-30	-32			±1 dB
40	-20	-22			±1 dB
50	-10	-12			±1 dB
60	0	-2			±1 dB
70	+10	8			±1 dB

Test 8. Frequency Response Test

Step	Signal Input	Min	Measured	Max
12	SIGNAL INPUT 2 (20 MHz to 1.5 GHz)			
15	SIGNAL INPUT 1 (20 MHz to 1.5 GHz)			
16	SIGNAL INPUT 1 (20 MHz to 500 MHz)			
25	SIGNAL INPUT 1 (100 kHz to 20 MHz)			
26	SIGNAL INPUT 1 (100 kHz)			
31	SIGNAL INPUT 2 (100 kHz to 20 MHz)			
42	SIGNAL INPUT 1 (1 kHz to 100 kHz)			
48	SIGNAL INPUT 1			
	1000 Hz			
	900 Hz			
	800 Hz			
	700 Hz			
	600 Hz			
	500 Hz			
	400 Hz			
	300 Hz			
	200 Hz			
	100 Hz			
49	SIGNAL INPUT 1 (deviation in dB) 100 Hz to 500 MHz (steps 16, 25, 42, or 48) (overall max – overall min)			<2 dB
	SIGNAL INPUT 2 (deviation in dB) 100 kHz to 1.5 GHz (steps 12 or 31) (overall max – overall min)			<2 dB
50	SIGNAL INPUT 1 (deviation in dB) 100 Hz to 1.5 GHz (steps 15, 16, 25, 42, or 48) (overall max – overall min)			<3 dB

Test 9. RF Gain Uncertainty Test

Step 6. 2nd LO Shift

Min	Measured	Max
-1.0 dB		+ 1.0 dB

Test 10. IF Gain Uncertainty Test

Step 12. Step IF Gain Uncertainty, 10 dB Steps

REFERENCE LEVEL (dBm)	Frequency Synthesizer Amplitude (dBm)	VIDEO BW (Hz)	Deviation (Marker A Amplitude (dB)
0	-2	100	0 (ref.)
-10	-12	100	
-20	-22	100	
-30	-32	100	
-40	-42	100	
-50	-52	100	
-60	-62	10	
-70	-72	10	
SHIFT ENTER dB/DIV q			
-80	-32	100	
-90	-42	100	
-100	-52	10	
-110	-62	10	
-120	-72	10	

Step 18. IF Gain Uncertainty, 2 dB Steps

REFERENCE LEVEL (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MARKER A Amplitude (dB)
-1.9	-3.9	0 (ref)
-3.9	-5.9	
-5.9	-7.9	
-7.9	-9.9	
-9.9	-11.9	

Step 22. IF Gain Uncertainty, 0.1 dB Steps

[REFERENCE LEVEL] (dBm)	Frequency Synthesizer Amplitude (dBm)	Deviation (MKR Δ Amplitude (dB)
0.0	-2.00	0 (ref)
-0.1	-2.10	
-0.2	-2.20	
-0.3	-2.30	
-0.4	-2.40	
-0.5	-2.50	
-0.6	-2.60	
-0.7	-2.70	
-0.8	-2.80	
-0.9	-2.90	
-1.0	-3.00	
-1.1	-3.10	
-1.2	-3.20	
-1.3	-3.30	
-1.4	-3.40	
-1.5	-3.50	
-1.6	-3.60	
-1.7	-3.70	
-1.8	-3.80	
-1.9	-3.90	

Step 23. Recorded deviations from Step 12.

	A	B
Reference Level Range:	0 to -70 dBm	-80 to -120 dBm
Largest Positive Deviation:	_______ dB	_______ dB
Largest Negative Deviation:	_______ dB	_______ dB

Step 24. Recorded deviations from Steps 18 and 22.

	C **Step 18**	**D** **Step 22**
Largest Positive Deviation:	_______ dB	_______ dB
Largest Negative Deviation:	_______ dB	_______ dB

Steps 25 to 28. IF Gain Uncertainty

Step		Min	Measured	Max
25.	Sum of positive deviations of A, C, & D		_______	0.6 dB
26.	Sum of negative deviations of A, C, & D	-0.6 dB	_______	
27.	Sum of positive deviations of A, B, C, & D		_______	1.0 dB
28.	Sum of negative deviations of A, B, C, & D	-1.0 dB	_______	

Step 6. Log Scale Switching Uncertainty

SCALE (dB/DIV)	MKR Amplitude (dBm)	Deviation (dB)	Allowable Deviation (dB)
1	________	0 (ref)	0 (ref)
2	________	________	±0.5
5	________	________	±0.5
10	________	________	±0.5

Test 12. Amplitude Fidelity Test

Step 6. Log Amplitude Fidelity

Frequency 'Synthesizer Amplitude (dBm)	1 Calibrated Amplitude Step	2 MARKER A Amplitude (dB)	Fidelity Error (Column 2 - Column 1) (dB)
+10	0 (ref)	0 (ref)	0 (ref)
0	-10	________	________
-10	-20	________	________
-20	-30	________	________
-30	-40	________	________
-40	-50	________	________
-50	-60	________	________
-60	-70	________	________
-70	-80	________	________
-80	-90	________	________

Step 14. Linear Amplitude Fidelity

Frequency Synthesizer Amplitude (dBm)	MARKER A Amplitude (dB)	Allowable Range (±3 % of Reference Level) (dB)	
		Min	Max
0	________	– 10.87	-9.21
-10	________	-23.10	– 17.72

Test 13. Average Noise Level Test

Step	Center Freq	Min	Measured	Max
9.	501 Hz		________	−112 dBm
10.	1.001 MHz		________	−135 dBm
11.	1501 MHz		________	−135 dBm

Test 14. Residual Responses Test

Step 11. Maximum Residual Response

Frequency Range	Measured Max Amplitude	Measured Frequency	Max
500 Hz to 1500 MHz	________	________	-105 dBm
Option 400:			
500 Hz to 2.5 kHz	________	________	-95 dBm
2.5 kHz to 1500 MHz	________	________	-105 dBm

Test 15. Spurious Responses Test

Step	Description	Min	Measured	Max
6	Second Harmonic			-90 dBm
10	Third Harmonic			-105 dBm
20	Third Order Intermodulation Distortion 30 MHz input signals, 1 MHz separation			-100 dBm
21	Third Order Intermodulation Distortion 30 MHz input signals, 1 MHz separation			-100 dBm
25	Third Order Intermodulation Distortion 30 MHz input signals, 10 kHz separation			-90 dBm
26	Third Order Intermodulation Distortion 30 MHz input signals, 10 kHz separation			-90 dBm
34	Second Order Intermodulation Distortion 30 MHz input signals, $(f_2 - f_1)$			-105 dBm
35	Second Order Intermodulation Distortion 30 MHz input signals, $(f_1 + f_2)$			-105 dBm

Test 16. Residual FM Test

Step 14. Residual FM

Min	Measured	Max
	________	3 Hz

Test 17. Line-Related Sidebands Test

Step		Min	Measured	Max
7	120 Hz (100 Hz)		________	-85 dB
	180 Hz (150 Hz)		________	-85 dB
	240 Hz (200 Hz)		________	-85 dB
7. Option 400	400 Hz		________	-75 dB
	800 Hz		________	-75 dB
	1200 Hz		________	-75 dB

Test 18. Calibrator Amplitude Accuracy Test

Step 2. CAL OUTPUT Amplitude

Min	Measured	Max
-10.3 dBm		-9.70 dBm

Test 19. Fast Sweep Time Accuracy Test (<20 ms)

Step 11. Fast Sweep Time Accuracy (<20 ms)

[SWEEP TIME]	Function Generator Frequency (kHz)	Sweep Time Error (divisions)
5 ms	2.00 ±0.02	______
2 ms	5.00 ±0.05	______
1 ms	10.0 ±0.1	______
200 μs	50.0 ±0.5	______
100 μs	100 ±1	______

Test 20. 1st LO Output Amplitude Test

Step 4. 1st LO Output Level

Min	Measured	Max
+4 dBm	________	

Test 21. Frequency Reference Error Test

Step	Description	Min	Measured	Max
4.	Frequency (initial)		10.________ MHz	
5.	Frequency (after 24 hours)		10.________ MHz	
6.	Difference between 4 and 5		____________ Hz	0.01 Hz

3

Adjustments

Introduction

The procedures in this section are for the adjustment of the instrument's electrical performance characteristics.

Warning

The procedures require access to the interior of the instrument and therefore should only be performed by qualified service personnel. Refer to *Safety Considerations* in this introduction.

The adjustment procedures should not be performed as routine maintenance, but only when Performance Tests cannot meet specifications. Before attempting any adjustment, allow the instrument to warm up for one hour. Table 3-1 is a cross reference of Function Adjusted to the related Adjustment procedure. Table 3-2 lists all adjustable components by name, reference designator, and function.

Safety Considerations

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operations and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

Warning

Adjustments in this section are performed with power supplied to the instrument while protective covers are removed. There are voltages at many points in the instrument which can, if contacted, cause personal injury. Be extremely careful. Adjustment should be performed only by trained service personnel.

Power is still applied to this instrument with the LINE switch in STANDBY. There is no OFF position on the LINE switch. Before removing or installing any assembly or printed circuit board, remove the power cord from the rear of both instruments and wait for the MAINS indicators (red LEDs) to go completely out.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of power.

Use a non-metallic tuning tool whenever possible.

Equipment Required

The equipment required for the adjustment procedures is listed in Table l-l, Recommended Test Equipment, at the beginning of this manual. If the test equipment recommended is not available, substitutions may be used if they meet the "Critical Specifications" listed in the table. The test setup used for an adjustment procedure is referenced in each procedure.

Adjustment Tools

For adjustments requiring a non-metallic tuning tool, use fiber tuning tool HP Part Number 8710-0033. In situations not requiring non-metallic tuning tools, an ordinary small screwdriver or other suitable tool is sufficient. However, it is recommended that you use a non-metallic adjustment tool whenever possible. Never try to force any adjustment control in the analyzer. This is especially critical when tuning variable slug-tuned inductors and variable capacitors.

Table 3-1. Adjustment Cross Reference

Function Adjusted	Adjustment Procedure
Low Voltage	1. Low Voltage Power Supply Adjustments
High Voltage	2. High Voltage Adjustment
CRT Display (Standard)	3. Preliminary Display Adjustment
	4. Final Display Adjustments
CRT Display (Digital Storage)	25. Digital Storage Display Adjustments
IF Gains	5. Log Amplifier Adjustments
	10. Step Gain and 18.4 MHz Local Oscillator Adjustments
Log Scales	6. Video Processor Adjustments
Bandwidth Amplitudes	7. 3 MHz Bandwidth Filter Adjustments
	8. 21.4 MHz Bandwidth Filter Adjustments
	11. Down/Up Converter Adjustments
3 dB Bandwidth	9. 3 dB Bandwidth Adjustments
10 MHz Internal Time Base	12. Time Base Adjustments
CAL OUTPUT Level	13. 20 MHz Reference Adjustments
Phase Lock Loops	14. 249 MHz Phase Lock Oscillator Adjustments
	15. 275 MHz Phase Lock Oscillator Adjustments
	22. Comb Generator Adjustments
RF Signal Conversion and RF Gains	16. Second IF Amplifier Adjustments
	17. Pilot Second IF Amplifier Adjustments
	19. Second Converter Adjustments
Sweep Times	18. Frequency Control Adjustments
Frequency Tuning	18. Frequency Control Adjustments
	20. 50 MHz Voltage-Tuned Oscillator Adjustments
Frequency Span	18. Frequency Control Adjustments
START and STOP Frequency	18. Frequency Control Adjustments
FM Span	18. Frequency Control Adjustments
Frequency Response	21. Slope Compensation Adjustment
Digital Storage Video Processing	23. Analog-to-Digital Converter Adjustments
	24. Track and Hold Adjustments

Factory-Selected Components

Factory-selected components are identified with an asterisk (*) on the schematic diagram. For most components, the range of their values and functions are listed in Table 3-3, Factory- Selected Components. Part numbers for selected values are located in Table 3-4, HP Part Numbers of Standard Value Replacement Components.

Related Adjustments

Any adjustments which interact with, or are related to, other adjustments are indicated in the adjustments procedures. It is important that adjustments so noted are performed in the order indicated to ensure that the instrument meets specifications.

Location of Test Points and Adjustments

Illustrations showing the locations of assemblies containing adjustments, and the location of those adjustments within the assemblies, are contained within the adjustment procedures to which they apply. Major assembly and component location illustrations are located at the rear of this manual.

Table 3-2. Adjustable Components

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A1A2C308	C307	3	Adjusts rise and fall times of Z axis amplifier pulse.
A1A2R308	ZHF GAIN	3	Adjusts rise and fall times of Z axis amplifier pulse.
A1A2R319	INT GAIN	3	Sets adjustment range of front-panel INTENSITY control.
A1A2R409	FOCUS COMP	3	Corrects focus for beam intensity.
A1A2R426	T/B FOC		Magnitude of top/bottom focus correction.
A1A2R427	T/B CTR		Centering of top/bottom focus correction.
A1A2R437	R/L FOC		Magnitude of right/left focus correction.
A1A2R440	R/L CTR		Centering of right/left focus correction.
A1A2R512	ORTHO	3	Sets orthogonality of CRT.
A1A2R513	3 D	3	Adjusts spot size.
A1A2R515	INTENSITY LIMIT	3	Sets adjustment range of front-panel INTENSITY control.
A1A2R517	ASTIG	3	Adjusts astigmatism of CRT.
A1A3R14	FOCUS LIMIT	3	Coarse adjusts CRT focus.
A1A4C204	C204	3	Adjusts rise and fall times of X deflection amplifier pulse.
A1A4C209	C209	3	Adjusts rise and fall times of X deflection amplifier pulse.
A1A4R227	X POSN	3	Adjusts horizontal position of trace.
A1A4R219	X GAIN	3,4	Adjusts horizontal gain of trace.
A1A4R217	XHF GAIN	3	Adjusts rise and fall times or X deflection amplifier pulse.
A1A5C104	C104	3	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A5C109	C109	3	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A5R127	Y POSN	3,4	Adjusts vertical position of trace.
A1A5R120	Y GAIN	3,4	Adjusts vertical gain of trace.
A1A5R117	YHF GAIN	3,4	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A6R9	+ 15 ADJ	1	Adjusts + 15 V dc supply voltage.
A1A6R103	HV ADJUST	2	Adjusts CRT high voltage.
	For **Serial Prefix 3001A and below,** see back of table for exceptions to A1A2 through A1A6.		

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A3A1R34	SWEEP OFFSET	25	Adjusts digital sweep to begin at left edge of graticule.
A3A2R12	LL THRESH	25	Adjusts point at which graticule lines switch from short to long lines.
A3A2R50	X S&H	25	Adjusts horizontal sample and hold pulse.
A3A2R51	Y S&H	5	Adjusts vertical sample and hold pulse.
A3A3R1	X EXP	25	Adjusts horizontal position of annotation.
A3A3R2	Y EXP	25	Adjusts vertical position of annotation.
A3A3R4	X GAIN	25	Adjusts horizontal gain of graticule lines.
A3A3R5	Y GAIN	25	Adjusts vertical gain of graticule lines.
A3A3R6	XLL	25	Adjusts horizontal long lines on graticule information.
A3A3R7	XSL	25	Adjusts horizontal short lines on graticule information.
A3A3R8	YSL	25	Adjusts vertical short lines on graticule information.
A3A3R9	YLL	25	Adjusts vertical long lines on graticule information.
A3A3R43	YOS	25	Adjusts bottom line of graticule to align with fast sweep signal.
A3A8R5	GAIN	23	Adjusts high end of digitized sweep.
A3A8R6	OFFS	23	Adjusts low end of digitized sweep.
A3A9R36	OFS NEG	24	Adjusts offset of negative peak detect mode.
A3A9R39	GPOS	24	Adjusts gain for positive peak detect mode.
A3A9R44	OFS POS	24	Adjusts offset of positive peak detect mode.
A3A9R52	GNEG	24	Adjusts gain for negative peak detect mode.
A3A9R57	T/H GAIN	24	Adjusts overall gain of track and hold.
A3A9R59	(T/H) OFS	24	Adjusts overall offset of track and hold.
A4A1R2	LG OS	6	Adjusts linear gain offsets.
A4A1R14	OS	6	Adjusts video processor offset.
A4A1R32	ZERO	6	Adjusts low end of video processor sweep.
A4A1R36	FS	6	Adjusts high end of video processor sweep.
A4A2R14	LG20	5	Adjusts 20 dB linear gain step.
A4A2R79	ZERO	5	Adjusts log amplifier offset.
A4A2R61	-12 VTV	5	Adjusts log amplifier tuning voltage.
A4A3C55	CTR	5	Adjusts log amplifier center to IF.
A4A3R67	AMPTD	5	Adjusts amplitude of log amplifier bandpass filter.
A4A3R83	LG10	5	Adjusts 10 dB linear gain step.

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A4A4C9	SYM	8	Centers A4A4 bandwidth filter crystal pole #1 symmetry.
A4A4C19	LC CTR	8	Centers A4A4 bandwidth filter LC pole #1.
A4A4C20	CTR	8	Centers A4A4 bandwidth filter crystal pole #1.
A4A4C39	SYM	8	Adjusts A4A4 bandwidth filter crystal pole #2 symmetry.
A4A4C41	LC DIP	8	Dips A4A4 bandwidth filter LC pole #1.
A4A4C43	LC DIP	8	Dips A4A4 bandwidth filter LC pole #2.
A4A4C65	SYM	8	Adjusts A4A4 bandwidth filter crystal pole #3 symmetry.
A4A4C67	LC CTR	8	Centers A4A4 bandwidth filter LC pole #2.
A4A4C73	CTR	8	Centers A4A4 bandwidth filter crystal pole #3.
A4A4C74	CTR	8	Centers A4A4 bandwidth filter crystal pole #2.
A4A4R43	LC	8	Adjusts LC filter amplitudes.
A4A4R49	XTAL	8	Adjusts crystal filter amplitudes.
A4A5C10	FREQ ZERO COARSE	10	Coarse-adjusts 18.4 MHz Local Oscillator to set adjustment range of front-panel FREQ ZERO control.
A4A5R2	+10V ADJ	10	Adjusts +10V temperature compensation supply.
A4A5R32	SG10	10	Adjusts 10 dB step gain.
A4A5R33	CAL	10	Adjusts IF gain.
A4A5R44	SG20-1	10	Adjusts first 20 dB step gain.
A4A5R51	VR	10	Adjusts variable step gain.
A4A5R54	SG20-2	10	Adjusts second 20 dB step gain.
A4A6A1C31	18.4 MHz NULL	10	Nulls 18.4 MHz local oscillator signal.
A4A6A1R29	WIDE GAIN	11	Adjusts gain of down/up converter.
A4A7C6	SYM	7	Adjusts 3 MHz bandwidth filter pole #1 symmetry.
A4A7C7	CTR	7	Centers 3 MHz bandwidth filter pole #1.
A4A7C13	PK	7	Peaks 3 MHz bandwidth filter pole #2.
A4A7C14	SYM	7	Adjusts 3 MHz bandwidth filter pole #2 symmetry.
A4A7C15	CTR	7	Centers 3 MHz bandwidth filter pole #2.
A4A7C22	PK	7	Peaks 3 MHz bandwidth filter pole #3.
A4A7C23	SYM	7	Adjusts 3 MHz bandwidth filter pole #3 symmetry.
A4A7C24	CTR	7	Centers 3 MHz bandwidth filter pole #3.
A4A7C31	PK	7	Peaks 3 MHz bandwidth filter pole #4.
A4A7C32	SYM	7	Adjusts 3 MHz bandwidth filter pole #4 symmetry.
A4A7C33	CTR	7	Centers 3 MHz bandwidth filter pole #4.
A4A7C40	PK	7	Peaks 3 MHz bandwidth filter pole #5.
A4A7C41	SYM	7	Adjusts 3 MHz bandwidth filter pole #5 symmetry.

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A4A7C42	CTR	7	Centers 3 MHz bandwidth filter pole #5.
A4A7R30	10 Hz AMPTD	7	Adjusts 3 MHz bandwidth filter 10 Hz bandwidth amplitude.
A4A7R41	10 Hz AMPTD	7	Adjusts 3 MHz bandwidth filter 10 Hz bandwidth amplitude.
A4A8C13	SYM	8	Adjusts A4A8 bandwidth filter crystal pole #1 symmetry.
A4A8C29	CTR	8	Centers A4A8 bandwidth filter crystal pole #1.
A4A8C32	LC CTR	8	Centers A4A8 bandwidth filter LC pole #1.
A4A8C42	SYM	8	Adjusts A4A8 bandwidth filter crystal pole #2 symmetry.
A4A8C44	CTR	8	Centers A4A8 bandwidth filter crystal pole #2.
A4A8C46	LC CTR	8	Centers A4A8 bandwidth filter LC pole #2.
A4A8C66	LC DIP	8	Dips A4A8 bandwidth filter LC pole #1.
A4A8C67	LC DIP	8	Dips A4A8 bandwidth filter LC pole #2.
A4A8R6	A20 dB	8	Adjusts attenuation of 21.4 MHz bandwidth filter 20 dB step.
A4A8R7	A10 dB	8	Adjusts attenuation of 21.4 MHz bandwidth filter 10 dB step.
A4A8R35	LC	8	Adjusts LC filter amplitudes.
A4A8R40	XTAL	8	Adjusts crystal filter amplitudes.
A4A9R60	3 MHz	9	Adjusts 3 MHz bandwidth.
A4A9R61	1 MHz	9	Adjusts 1 MHz bandwidth.
A4A9R62	300 kHz	9	Adjusts 300 kHz bandwidth.
A4A9R65	10 kHz	9	Adjusts 10 kHz bandwidth.
A4A9R66	3 kHz	9	Adjusts 3 kHz bandwidth.
A4A9R73	1 kHz	9	Adjusts 1 kHz bandwidth (Option 067).
A6A3A1C8	C8	20	Adjusts 321.4 MHz bandpass filter.
A6A3A1C9	C9	20	Adjusts 321.4 MHz bandpass filter.
A6A3A1C10	C10	20	Adjusts 321.4 MHz bandpass filter.
A6A3A1C11	C11	20	Adjusts 321.4 MHz bandpass filter.
A6A3A1C12	C12	20	Adjusts 321.4 MHz bandpass filter.
A6A3A1C23	10.7 MHz NOTCH	20	Adjusts 10.7 MHz notch filter.
A6A9A1C29	TRIPLER MATCH	18	Adjusts for maximum 300 MHz output.
A6A9A1R11	CAL OUTPUT	19	Adjusts output level of CAL OUTPUT.
A6A9A1R38	BALANCE	21	Adjusts phase lock tune voltage level.

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A6A10R1	IO	21	Adjusts 3.3 GHz oscillator drive current.
A6A10R9	VE	21	Adjusts mixer bias 18.6 to 22 GHz.
A6A10R12	VD	21	Adjusts mixer bias 12.5 to 18.6 GHz.
A6A10R15	v c	21	Adjusts mixer bias 5.8 to 12.5 GHz.
A6A10R18	VB	21	Adjusts mixer bias 2 to 5.8 GHz.
A6A10R21	GA	21	Adjusts IF gain 0.01 to 2.5 GHz.
A6A10R23	GB	21	Adjusts IF gain 2 to 5.8 GHz.
A6A10R25	GC	21	Adjusts IF gain 5.8 to 12.5 GHz.
A6A10R27	GD	21	Adjusts IF gain 12.5 to 18.6 GHz.
A6A10R29	GE	21	Adjusts IF gain 18.6 to 22 GHz.
A6A10R31	LR1	21	Adjusts linearity 5.8 to 12.5 GHz (high end).
A6A10R34	LR2	21	Adjusts linearity 12.5 to 18.6 GHz (low end).
A6A10R37	LR3	21	Adjusts linearity 12.5 to 18.6 GHz (high end).
A6A10R40	LB1	21	Adjusts linearity 5.8 to 12.5 GHz.
A6A10R41	LB2	21	Adjusts linearity 12.5 to 18.6 GHz (low end).
A6A10R42	LB3	21	Adjusts linearity 12.5 to 18.6 GHz (high end).
A6A10R70	LB4	21	Adjusts linearity 18.6 to 22 GHz.
A6A10R76	LR4	21	Adjusts linearity 18.6 to 22 GHz (high end).
A6A10R81	GF	21	Adjusts IF gain in external mixer band.
A6A11R48	A1	21	Adjusts flatness 0.01 to 2.5 GHz (low end).
A6A11R51	B1	21	Adjusts flatness 2 to 5.8 GHz (low end).
A6A11R54	C1	21	Adjusts flatness 5.8 to 12.5 GHz (low end).
A6A11R57	D1	21	Adjusts flatness 12.5 to 18.6 GHz (low end).
A6A11R60	E1	21	Adjusts flatness 18.6 to 22 GHz (low end).
A6A11R66	A2	21	Adjusts flatness 0.01 to 2.5 GHz (high end).
A6A11R69	B2	21	Adjusts flatness 2 to 5.8 GHz (high end).
A6A11R72	C2	21	Adjusts flatness 5.8 to 12.5 GHz (high end).
A6A11R75	D2	21	Adjusts flatness 12.5 to 18.6 GHz (high end).
A6A11R78	E2	21	Adjusts flatness 18.6 to 22 GHz (high end).
A6A11R84	GAIN	21	Adjusts overall slope gain.
A6A12R24	D3	21	Adjusts auto-sweep tracking.
A6A12R25	D2	21	Adjusts auto-sweep tracking.
A6A12R26	D1	21	Adjusts auto-sweep tracking.
A6A12R63	5.8 GHz	21	Adjusts tracking at 5.8 GHz (2 to 5.8).
A6A12R66	2 GHz	21	Adjusts tracking at 2 GHz (2 to 5.8).

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A6A12R82	E	21	Adjusts tracking at 18.6 GHz (18.6 to 22).
A6A12R83	D	21	Adjusts tracking at 12.5 GHz (12.5 to 18.6).
A6A12R84	C	21	Adjusts tracking at 5.8 GHz (5.8 to 12.5).
A6A12R85	B	21	Adjusts tracking at 4 GHz (2 to 5.8).
A6A12R98	ZERO	21	Sets SWEEP + TUNE OUT zero indication.
A6A12R113	−9V	21	Sets -9 V and +9 V dc reference supplies.
A7A2C1	400 MHz OUT	14	Peaks 400 MHz output signal.
A7A2C2	400 MHz OUT	14	Peaks 400 MHz output signal.
A7A2C3	400 MHz OUT	14	Peaks 400 MHz output signal.
A7A2C4	100 MHz	14	Adjusts VCXO frequency.
A7A4A1A1C1	FREQ ADJUST	15	Adjusts VCO frequency.
A7A4A1A1C5	PWR ADJUST	15	Adjusts VCO output level.
A8R2	+22V ADJUST	1	Sets +22 V dc supply voltage.
A10A1L7	50 kHz NULL	17	Nulls 50 kHz output.
A10A1L8	50 kHz NULL	17	Nulls 50 kHz output.
A10A3L11	165 MHz NULL	17	Nulls signal at 165 MHz.
A10A3L12	160 MHz NULL	17	Nulls signal at 160 MHz.
A10A3L13	170 MHz NULL	17	Nulls signal at 170 MHz.
A10A4C50	160 MHz PEAK	17	Peaks 160 MHz output signal.
A10A4L11	VCO ADJ	17	Adjusts PLL3 VCO frequency.
A10A4L16	160 MHz PEAK	17	Peaks 160 MHz output signal.
A10A4L17	160 MHz PEAK	17	Peaks 160 MHz output signal.
A10A5R2	150 MHz ADJ	17	Adjusts VCO TUNE voltage at 150 MHz.
A10A5R4	100 MHz ADJ	17	Adjusts VCO TUNE voltage at 100 MHz.
A10A8R4	.2 MHz	17	Sets discriminator pretune at 0.2 MHz.
A10A8R9	.3 MHz	17	Sets discriminator pretune at 0.3 MHz.
A10A8R25	.5 MHz SCAN	17	Adjusts frequency span accuracy (20/30 sweep).
A10A8R27	5 MHz SCAN	17	Adjusts frequency span accuracy (20/30 sweep).
Al1A2R2	GATE BIAS ADJ	16	Adjusts CIA amplifier gate biasing.

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A11A5C1	IMPEDANCE MATCH	16	Optimizes sampler output.
A11A5C2	IMPEDANCE MATCH	16	Optimizes sampler output.
A11A5R1	IF GAIN	13	Adjusts level of 30 MHz output.
A16R62	OFFSET	13	Adjusts scan ramp offset.
A16R67	SWEEPTIME	13	Adjusts time of sweep ramp.
A16R68	AUX	13	Adjusts AUX OUT sweep ramp.
A16R71	GAIN 2	13	Adjusts frequency span accuracy (YTO sweep).
A16R72	GAIN 1	13	Adjusts frequency span accuracy (YTO sweep).
A17R50	+20V ADJ	1	Adjusts +20 V dc supply voltage.
A19R9	-12.6 VR	13	Adjusts -12.6 V reference for YTO dAC high end (6.2 GHz).
A19R19	OFFSET	13	Adjusts summing amplifier offset.
A19R32	2.5 GHz SPAN	13	Adjusts 5.8 GHz switchpoint overlap.
A19R41	25 GHz SPAN OFFSET	13	Adjusts 25 GHz span offset.
A19R43	25 GHz SPAN	13	Adjusts 5.8 and 12.5 GHz switchpoint overlaps.
A19R50	+10 VR	13	Adjusts HOV reference for YTO DAC low end (2 GHz).
A19R56	2.5 GHz SPAN OFFSET	13	Adjusts 2.5 GHz span offset.
A20R25	6.15 GHz	13	Sets high-end frequency of YTO.
A20R34	2.3 GHz	13	Sets low-end frequency YTO.
A22A2	FREQ ADJ	12	Adjusts reference oscillator frequency.
	For **Serial Prefix 2737A and below,** see back of table for A22 exceptions.		
IF Serial Prefix 3001A and Below			
A1A2C10	C10	3	Adjusts rise and fall times of Z axis amplifier pulse.
A1A2R5	INTENSITY GAIN	3	Sets adjustment range of front-panel INTENSITY control.
A1A2R22	HF GAIN	3	Adjusts rise and fall times of Z axis amplifier pulse.
A1A2R30	FOCUS GAIN	3	Coarse adjusts CRT focus; sets range of front-panel FOCUS control.

Table 3-2. Adjustable Components (continued)

Reference Designator	Adjustment Name	Adjustment Number	Adjustment Function
A1A2R31	ORTHO	3	Sets orthogonality of CRT.
A1A2R32	PATTERN	3	Adjusts for optimum rectangular shape of CRT display.
A1A2R35	INTENSITY LIMIT	3	Sets adjustment range of front-panel INTENSITY control.
A1A2R36	ASTIG	3	Adjusts astigmatism of CRT.
A1A2R30	FOCUS GAIN	4	Adjusts for optimum focus of CRT display.
A1A3R14	FOCUS LIMIT	3	Coarse adjusts CRT focus.
A1A4C10	C10	3	Adjusts rise and fall times of X deflection amplifier pulse.
A1A4C11	C11	3	Adjusts rise and fall times of X deflection amplifier pulse.
A1A4R7	X POSN	3	Adjusts horizontal position of trace.
A1A4R27	X GAIN	3,4	Adjusts horizontal gain of trace.
A1A4R28	HFGAIN	3	Adjusts rise and fall times or X deflection amplifier pulse.
A1A5C10	C10	3	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A5C11	C11	3	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A5R7	Y POSN	3,4	Adjusts vertical position of trace.
A1A5R27	Y GAIN	3,4	Adjusts vertical gain of trace.
A1A5R28	HF GAIN	3,4	Adjusts rise and fall times of Y deflection amplifier pulse.
A1A6R9	+ 15 SV ADJ	1	Adjusts + 15 V dc supply voltage.
A1A6R32	HV ADJUST	2	Adjusts CRT high voltage.
A3A8R9	FS	23	Adjusts high end of digitized sweep.
A3A8R14	ZERO	23	Adjusts low end of digitized sweep.
IF Serial Prefix 2637A and Below			
A22	COARSE	12	Coarse-adjusts reference oscillator frequency.
A22	FINE	12	Fine-adjusts reference oscillator frequency.

Table 3-3. Factory-Selected Components

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
A1A2R9	3	2.87 K to 6.19 K	Sets intensity level.
A3A1R72		19.6 K to 42.2 K	Sets intensity level.
A3A2R17		121 K to 162 K	Sets intensity level.
A3A2R21		10.0 K to 26.1 K	Sets intensity level.
A3A3C27		Open or 1.0-10.0	Compensates for feedthrough of INTG signal to U1.
A3A3C32		1.0 to 10.0	Compensates for feedthrough of INTG signal to U11.
A3A3R47		5.0 K to 12.5 K	Compensates for DAC ladder resistance.
A3A3R48		5.0 K to 12.5 K	Compensates for DAC ladder resistance.
A4A1R10		562 to 1.33 K	Sets adjustment range of A4A1R36 FS
A4A1R67		56.2 K to 825 K	Compensates for ON resistance of A4A1Q6
A4A2R18	5	68.1 to 178	Sets adjustment range of LG20.
A4A2R22		1.96 K to 5.11 K	Adjusts log fidelity.
A4A2R24		1 K to 31.6 K	Log fidelity.
A4A2R36		90.9 to 237	Adjusts overall linear gain.
A4A2R62	5	16.2 to 46.4	Sets adjustment range of ATTEN.
A4A2R86		100 to OPEN	Temperature compensation
A4A2R88		1 K to OPEN	Temperature compensation
A4A2R89		1 K to OPEN	Temperature compensation
A4A2R96		1 K to OPEN	Temperature compensation
A4A2R97		1 K to OPEN	Temperature compensation
A4A2R99		1 K to OPEN	Temperature compensation
A4A3C51		390 to 680	Adjusts bandpass filter shape in wide bandwidths (> 100 kHz).
A4A3C52	5	OPEN or 5.6-15.0	Sets adjustment range of CTR.
A4A3C53	5	91 to 130	Sets adjustment range of CTR.
A4A3R15		10.0 to 82.5	Log fidelity
A4A3R25		19.6 to 82.5	Log fidelity
A4A3R29		51.1 to 1 K	Log fidelity
A4A3R35		10.0 to 61.9	Log fidelity
A4A3R38		61.9 to 1.96 K	Log fidelity
A4A3R47		2.15 K to 13.3 K	Log fidelity
A4A3R54	5	51.1 to 133	Sets adjustment range of LG10.
A4A3R66	5	46.4 K to 215 K	Sets adjustment range of AMPTD.

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustmenl Procedure	Range of Values (Ω or pF)	Function of Component
A4A3R74		1.78 K to 13.3 K	Log fidelity
A4A3R79		8.25 K to 82.5 K	Bandpass filter temperature compensation
A4A3R80		1.0 K to 6.81 K	Bandpass filter temperature compensation
A4A3R81		1 K-OPEN	Bandpass filter temperature compensation
A4A4C10	8	1.0 to 8.2	Sets adjustment range of SYM.
A4A4C17	8	180 to 270	Sets adjustment range of LC CTR.
A4A4C38	8	1.0 to 8.2	Sets adjustment range of SYM.
A4A4C66	8	1.0 to 8.2	Sets adjustment range of SYM.
A4A4C70	8	180 to 270	Sets adjustment range of LC CTR.
A4A4C92	8	180 to 270	Sets adjustment range of LC CTR.
A4A4C97	8	180 to 270	
A4A4C99		4 to 13	Sets adjustment range of center cap.
A4A4C100		4 to 13	Sets adjustment range of center cap.
A4A4C101		‘4 to 13	Sets adjustment range of center cap.
A4A4R3		0 to 9.09	Matches amplitude of LC to XTAL bandwidths.
A4A4R16		3.16 K to 8.25 K	Adjusts LC filter bandwidth.
A4A4R20		6.19 K to 12.1 K	Adjusts crystal filter bandwidth.
A4A4R35		383 to 825	Matches amplitude of LC to XTAL bandwidths.
A4A4R40		6.19 K to 12.1 K	Adjusts crystal filter bandwidth.
A4A4R42		1 K to OPEN	Sets level of + 10 V TC supply.
A4A4R44		1 K to OPEN	Sets level of + 10 V TC supply.
A4A4R45		0 to 100	Adjusts bandwidth shape in 10 kHz bandwidth.
A4A4R60		3.1 6 K to 8.25 K	Adjusts LC filter bandwidth.
A4A4R64		6.19 K to 12.1 K	Adjusts crystal filter bandwidth.
A4A4R65		909 to 2.73 K	Adjusts positive feedback.
A4A4R94		100 K to 1M	Sets adjustment range of LC amplitudes.
A4A5C9	10	0-16	Sets adjustment range of FREQ ZERO COARSE.
A4A5R10	11	1.62 K to 2.61 K	Sets 18.4 MHz Local Oscillator power.
A4A5R62	10	1.33 K to 3.48 K	Adjusts A8dB step.
A4A5R70	10	472 to 1.62 K	Adjust A4dB step.
A4A5R86	10	215 to OPEN	Adjusts A2dB step.
A4A6A2R33		42.2 to 75.0	Adjusts level of 3 MHz output.
A4A7C5		56 to 82	Centers first pole.
A4A7C12	7	56 to 82	Sets adjustment range of second pole P K.
A4A7C21	7	56 to 82	Sets adjustment range of third pole P K.
A4A7C30	7	56 to 82	Sets adjustment range of fourth pole P K.
A4A7C39	7	56 to 82	Sets adjustment range of fifth pole P K.
A4A7C93	7	1.5 to 12.0	Centers first pole.
A4A7R12		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
A4A7R13		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R23		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R24		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R34		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R35		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R45		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R46		10.0 K to 17.8 K	Adjusts crystal filter bandwidth.
A4A7R56		7.50 K to 13.3 K	Adjusts crystal filter bandwidth.
A4A7R57		7.50 K to 13.3 K	Adjusts crystal filter bandwidth.
A4A7R60	10	38.3 to 68.1	Compensates for gain of A4A6A1.
A4A7R66		38.3 to 68.1	Adjusts crystal filter bandwidth.
A4A7R68		100 to 178	Adjusts crystal filter bandwidth.
A4A7R70		383 to 681	Adjusts crystal filter bandwidth.
A4A7R72		1.47 K to 2.61 K	Adjusts crystal filter bandwidth.
A4A7R74		38.3 to 68.1	Adjusts crystal filter bandwidth.
A4A7R76		100 to 178	Adjusts crystal filter bandwidth.
A4A7R78		383 to 681	Adjusts crystal filter bandwidth.
A4A7R80		1.47 K to 2.61 K	Adjusts crystal filter bandwidth.
A4A7R82		38.3 to 68.1	Adjusts crystal filter bandwidth.
A4A7R84		100 to 178	Adjusts crystal filter bandwidth.
A4A7R86		383 to 681	Adjusts crystal filter bandwidth.
A4A7R88		1.47 K to 2.61 K	Adjusts crystal filter bandwidth.
A4A7R90		3.83 to 68.1	Adjusts crystal filter bandwidth.
A4A7R92		100 to 178	Adjusts crystal filter bandwidth.
A4A7R94		383 to 681	Adjusts crystal filter bandwidth.
A4A7R96		1.47 K to 2.61 K	Adjusts crystal filter bandwidth.
A4A7R98		3.83 to 68.1	Adjusts crystal filter bandwidth.
A4A7R100		100 to 178	Adjusts crystal filter bandwidth.
A4A7R102		383 to 681	Adjusts crystal filter bandwidth.
A4A7R104		1.47 K to 2.61 K	Adjusts crystal filter bandwidth.
	For **Option** 462, see back of this table for exceptions to A4A7.		
A4A8C14	8	1.0 to 8.2	Sets adjustment range of SYM.
A4A8C35	8	180 to 270	Sets adjustment range of LC CTR.
A4A8C43	8	1.0 to 8.2	Sets adjustment range of SYM.
A4A8C49	8	180 to 270	Sets adjustment range of LC CTR.
A4A8C78		180 to 270	Sets adjustment range of LC CTR.
A4A8C81		180 to 270	Sets adjustment range of LC CTR.
A4A8C82		4 to 13	Sets adjustment range of center cap.
A4A8C83		4 to 13	Sets adjustment range of center cap.

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
A4A8R19		100 K1 to 1M	Sets adjustment range of LC amplitude.
A4A8R24		0 to 100	Adjusts bandwidth shape in 10 kHz bandwidth.
A4A8R26		3.83 K to 9.09 K	Adjusts crystal filter bandwidth.
A4A8R29		909 to 2.37 K	Adjusts LC mode feedback.
A4A8R30		3.16 K to 8.25 K	Adjusts LC filter bandwidth.
A4A8R34		100 K to OPEN	
A4A8R36		100 K to OPEN	(85662-60131 only)
A4A8R36		10 K to OPEN	(85662-60190 only)
A4A8R52		3.83 K to 9.09 K	Adjusts crystal filter bandwidth.
A4A8R55		3.16 K to 8.25 K	Adjusts LC filter bandwidth.
A4A9R3		6.81 K to 10.0 K	Sets TC of 3 kHz RBW
A4A9R6		38.3 K to 56.2 K	Sets TC of 10 kHz RBW
A4A9R7		28.7 K to 42.2 K	Sets TC of 300 kHz RBW
A4A9R10		6.19 K to 9.09 K	Sets TC of 1 MHz RBW
A4A9R11		1.96 K to 2.87 K	Sets TC of 3 MHz RBW
A4A9R46		82.5 K to 147 K	Sets 1.0 dB step size
A4A9R48		261 K to 464 K	Sets 0.2 dB step size
A4A9R50		56.2 K to 100 K	Sets 1.2 dB step size
A4A9R52		562 K to 1M	Sets 0.4 dB step size
A4A9R55		46.4 K to 82.5 K	Sets 1.8 dB step size
A4A9R57		316 K to 562 K	Sets 0.6 dB step size
A4A9R59		422 K to 750 K	Sets 0.8 dB step size
A4A9R70		619 K to 1.1M	Sets 0.1 dB step size.
A4A9R72		90.0 K to 162 K	Sets 1.6 dB step size.
A4A9R74		61.9 K to 110 K	Sets 1.4 dB step size.
A4A9R83		2.15 K to 8.25 K	Centers 3 kHz BW adjustment range.
A4A9R84		42.2 K to 100 K	Centers 10 kHz BW adjustment range.
A4A9R85		75 K to 178 K	Centers 300 kHz BW adjustment range.
A4A9R86		10.0 K to 17.5 K	Centers 1 MHz BW adjustment range.
A4A9R87		100 to 5.11 K	Centers 3 MHz BW adjustment range.

For **Serial Prefix 2813A to 2816A**, and **Serial Prefix 2810A and below,** see the back of this table for exceptions to A4A9.

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
A6A9A1R5	18	23.7 to 180	Sets sampler drive level
A6A9A1R10	19	909 to 1.21 K	Sets adjustment range of A6A9A1R11 CAL OUTPUT
A6A9A1R27	18	56.2 K	Sets HET UNLOCK delay time constant for HP 85660B (10 K = HP 85660A)
A6A10R86	21	10 to 40 K	Sets adjustment range of A6A10R21 GA
A6A10R87	21	10 to 40 K	Sets adjustment range of A6A10R23 GB
A6A10R88	21	10 to 40 K	Sets adjustment range of A6A10R25 GC
A6A10R89	21	10 to 40 K	Sets adjustment range of A6A10R27 GD
A6A10R90	21	10 to 40 K	Sets adjustment range of A6A10R29 GE
A6A10R91	21	10 to 40 K	Sets adjustment range of A6A10R81 GF
A6A11R2	21	100 K to 196 K	Adjusts band A breakpoint for best flatness.
A6A12C1	21	0.1 to 0.68 μF	Sets YTX delay compensation.
A6A12C2		0.1 to 0.68 μF	Sets YTX delay compensation.
A6A12C3	21	OPEN	Not loaded for HP 85660B
A6A12C11	21	0.1 to 0.68 μF	Sets YTX delay compensation.
A6A12C23	21	0.1 to 0.68 μF	Sets YTX delay compensation.
A6A12R64	21	13.356 K/15 K	Sets adjustment range of A6A12R63 5.8 GHz
A7A2C8	14	Open to 15 pF	Sets tuning range of A7A2C4.
A7A2L4	14	0.22 to 0.68 μH	Centers the adjustment range of A7A2 around 100 MHz.
A7A2R3		196 to 511	Sets biasing of A7A2Q5
A7A2R67	14	Open to 825	Sets -10 dBm output level of the 400 MHz signal.
A7A2R68	14	6.8 to 61.9	Sets -10 dBm output level of the 400 MHz signal.
A7A2R69	14	110 to 825	Sets -10 dBm output level of the 400 MHz signal.
A8R6	1	213 to 261	Sets adjustment range of A8R2 +22 V ADJ
A10A3C26		0 to 15	Selected to minimize mixer distortion.
A10A4C49	17	10 to 15 pF	Sets adjustment range of A10A4C50 160 MHz PEAK
A10A4C49	17	10 to 15 pF	Sets adjustment range of A10A4C50 160 MHz PEAK
A10A4R29	17	68.1 to 90.9	Sets output power to -20 dBm at A10A4J2
A10A4R33	17	68.1 to 90.9	Sets output power to -20 dBm at A10A4J2

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
Al 1A4R24		348 to 562	Sets YTO loop gain crossover to 20 ±2 kHz.
Al 1A5C22	16	130 to 220 pF	Sets YTO loop response <20 MHz.
A11A5L10	16	2.2 to 3.3 μF	Sets YTO loop response.
Al 1A5R22	16	15 to 51.1 Ω	Sets YTO loop response 20 to 30 MHz.
A13C22		620 to 1300	Sets period of microprocessor clock.
A15C10		62 to 91	Sets oscillator frequency to 10 MHz ±0.75 MHz.
A16R46	13	73.874 K/74.25 K	Sets adjustment range of A16R72 GAIN 1
Serial Prefix 2813A to 2816A			
A4A9R3		8.25 to 12.1 K	Centers 3 kHz BW adjustment range
A4A9R6		82.5 to 121 K	Centers 10 kHz BW adjustment range
A4A9R7		110 to 162 K	Centers 300 kHz BW adjustment range
A4A9R10		14.7 to 21.5 K	Centers 1 MHz BW adjustment range
A4A9R11		162 to 237 K	Centers 3 MHz BW adjustment range
A4A9R46		82.5 to 147 K	Sets 1.0 dB step size
A4A9R48		261 to 464 K	Sets 0.2 dB step size
A4A9R50		56.2 to 100 K	Sets 1.2 dB step size
A4A9R52		562 K to 1 MO	Sets 0.4 dB step size
A4A9R55		46.4 to 82.5 K	Sets 1.8 dB step size
A4A9R57		316 to 562 K	Sets 0.6 dB step size
A4A9R59		422 to 750 K	Sets 0.8 dB step size
A4A9R70		619 K to 1.1 MΩ	Sets 0.1 dB step size
A4A9R72		90 to 162 K	Sets 1.6 dB step size
A4A9R74		61.9 to 110 K	Sets 1.4 dB step size
Serial Prefix 2810A and Below			
A4A9R69		196 K to 348 K	Sets 1.4 dB step size.
A4A9R70		215 K to 383 K	Sets 1 dB step size.
A4A9R71		147 K to 261 K	Sets 1.8 dB step size.

Table 3-3. Factory-Selected Components (continued)

Reference Designator	Adjustment Procedure	Range of Values (Ω or pF)	Function of Component
Option 462			
A4A7R12		5.62 K to 7.5 K	
A4A7R13		5.62 K to 7.5 K	
A4A7R23		5.62 K to 7.5 K	
A4A7R24		5.62 K to 7.5 K	
A4A7R34		5.62 K to 7.5 K	
A4A7R35		5.62 K to 7.5 K	
A4A7R45		5.11 K to 6.81 K	
A4A7R46		5.11 K to 6.81 K	
A4A7R56		5.11 K to 6.81 K	
A4A7R57		5.11 K to 6.81 K	
A4A7R68		99 to 133	
A4A7R70		383 to 681	
A4A7R76		99 to 133	
A4A7R84		99 to 133	
A4A7R86		316 to 619	
A4A7R92		99 to 133	
A4A7R94		316 to 619	
A4A7R100		99 to 133	
A4A7R102		316 to 619	
A4A8R30		6.19 K to 16 K	
A4A8R55		6.8 K to 17.6 K	
A4A8C43		1.0 to 8.2	
A4A9R3		4.22 K to 6.19 K	
A4A9R6		21.5 K to 34.8 K	
A4A9R7		51.1 K to 75.0 K	
A4A9R10		11.0 K to 16.2 K	
A4A9R11		2.87 K to 4.22 K	
A4A9R83		7.50 K to 14.7 K	
A4A9R85		162 K to 348 K	
A4A9R86		28.7 K to 61.9 K	
A4A9R87		4.22 K to 8.25	
Option 067			
A4A9R2		215 K to 316 K	Sets TC of 1 kHz RBW (Opt 067)
A4A9R88		100 K to 511 K	Centers 1 kHz BW adjustment range. (Option 067)
A4A9R2		388 to 550 K	Centers 1 kHz BW adjustment range (Opt 067)

Table 3-4. Standard Value Replacement Capacitors

Capacitors					
Type: Tubular Range: 1 to 24 pF Tolerance: 1 to 9.1 pF = ±0.25 pF 10 to 24 pF = ±5%			Type: Dipped Mica Range: 27 to 680 pF Tolerance: ±5%		
Value (pF)	HP Fart Number	CD	Value (pF)	HP Fart Number	CD
1.0	0160-2236	8	27	0160-2306	3
1.2	0160-2237	9	30	0160-2199	2
1.5	0150-0091	8	33	0160-2150	5
1.8	0160-2239	1	36	0160-2308	5
2.0	0160-2240	4	39	0140-0190	7
2.2	0160-2241	5	43	0160-2200	6
2.4	0160-2242	6	47	0160-2307	4
2.7	0160-2243	7	51	0160-2201	7
3.0	0160-2244	8	56	0140-0191	8
3.3	0150-0059	8	62	0140-0205	5
3.6	0160-2246	0	68	0140-0192	9
3.9	0160-2247	1	75	0160-2202	8
4.3	0160-2248	2	82	0140-0193	0
4.7	0160-2249	3	91	0160-2203	9
5.1	0160-2250	6	100	0160-2204	0
5.6	0160-2251	7	110	0140-0194	1
6.2	0160-2252	8	120	0160-2205	1
6.8	0160-2253	9	130	0140-0195	2
7.5	0160-2254	0	150	0140-0196	3
8.2	0160-2255	1	160	0160-2206	2
9.1	0160-2256	2	180	0140-0197	4
10.0	0160-2257	3	200	0140-0198	5
11.0	0160-2258	4	220	0160-0134	1
12.0	0160-2259	5	240	0140-0199	6
13.0	0160-2260	8	270	0140-0210	2
15.0	0160-2261	9	300	0160-2207	3
16.0	0160-2262	0	330	0160-2208	4
18.0	0160-2263	1	360	0160-2209	5
20.0	0160-2264	2	390	0140-0200	0
22.0	0160-2265	3	430	0160-0939	4
24.0	0160-2266	4	470	0160-3533	0
			510	0160-3534	1
			560	0160-3535	2
			620	0160-3536	3
			680	0160-3537	4

Table 3-5.
Standard Value Replacement 0.125 Resistors

Resistors					
Type: Fixed-Film Range: 10 to 464K Ohms Wattage: 0.125 at 125°C Tolerance: ±1.0%					
Value (Ω)	**HP Part Number**	**CD**	**Value (Ω)**	**HP Part Number**	**CD**
10.0	0757-0346	2	422	0698-3447	4
11.0	0757-0378	0	464	0698-0082	7
12.1	0757-0379	1	511	0757-0416	7
13.3	0698-3427	0	562	0757-0417	8
14.7	0698-3428	1	619	0757-0418	9
16.2	0757-0382	6	681	0757-0419	0
17.8	0757-0294	9	750	0757-0420	3
19.6	0698-3429	2	825	0757-0421	4
21.5	0698-3430	5	909	0757-0422	5
23.7	0698-3431	6	1.0K	0757-0280	3
26.1	0698-3432	7	1.1K	0757-0424	7
28.7	0698-3433	8	1.21K	0757-0274	5
31.6	0757-0180	2	1.33K	0757-0317	7
34.8	0698-3434	9	1.47K	0757-1094	9
38.3	0698-3435	0	1.62K	0757-0428	1
42.2	0757-0316	6	1.78K	0757-0278	9
46.4	0698-4037	0	1.96K	0698-0083	8
51.1	0757-0394	0	2.15K	0698-0084	9
56.2	0757-0395	1	2.37K	0698-3150	6
61.9	0757-0276	7	2.61K	0698-0085	0
68.1	0757-0397	3	2.87K	0698-3151	7
75.0	0757-0398	4	3.16K	0757-0279	0
82.5	0757-0399	5	3.48K	0698-3152	8
90.9	0757-0400	9	3.83K	0698-3153	9
100	0757-0401	0	4.22K	0698-3154	0
110	0757-0402	1	4.64K	0698-3155	1
121	0757-0403	2	5.11K	0757-0438	3
133	0698-3437	2	5.62K	0757-0200	7
147	0698-3438	3	6.19K	0757-0290	5
162	0757-0405	4	6.81K	0757-0439	4
178	0698-3439	4	7.50K	0757-0440	7
196	0698-3440	7	8.25K	0757-0441	8
215	0698-3441	8	9.09K	0757-0288	1
237	0698-3442	9	10.0K	0757-0442	9
261	0698-3132	4	11.0K	0757-0443	0
287	0698-3443	0	12.1K	0757-0444	1
316	0698-3444	1	13.3K	0757-0289	2
348	0698-3445	2	14.7K	0698-3156	2
383	0698-3446	3	16.2K	0757-0447	4

Table 3-5.
Standard Value Replacement 0.125 Resistors
(continued)

Resistors					
Type: Fixed-Film Range: 10 to 464K Ohms Wattage: 0.125 at 125°C Tolerance: ±1.0%					
Value (Ω)	**HP Part Number**	**CD**	**Value (Ω)**	**HP Part Number**	**CD**
17.8K	0698-3136	8	100K	0757-0465	6
19.6K	0698-3157	3	110K	0757-0466	7
21.5K	0757-0199	3	121K	0757-0467	8
23.7K	0698-3158	4	133K	0698-3451	0
26.1K	0698-3159	5	147K	0698-3452	1
28.7K	0698-3449	6	162K	0757-0470	3
31.6K	0698-3160	8	178K	0698-3243	8
34.8K	0757-0123	3	196K	0698-3453	2
38.3K	0698-3161	9	215K	0698-3454	3
42.2K	0698-3450	9	237K	0698-3266	5
46.4K	0698-3162	0	261K	0698-3455	4
51.1K	0757-0458	7	287K	0698-3456	5
56.2K	0757-0459	8	316K	0698-3457	6
61.9K	0757-0460	1	348K	0698-3458	7
68.1K	0757-0461	2	383K	0698-3459	8
75.0K	0757-0462	3	422K	0698-3460	1
82.5K	0757-0463	4	464K	0698-3260	9
90.9K	0757-0464	5			

Table 3-6. Standard Value Replacement 0.5 Resistors

Resistors

Type: Fixed-Film
Range: 10 to 1.47M Ohms
Wattage: 0.5 at 125°C
Tolerance: ±1.0%

Value (Ω)	HP Part Number	CD	Value (Ω)	HP Fart Number	CD
10.0	**0757-0984**	4	383	**0698-3404**	3
11.0	**0575-0985**	5	422	**0698-3405**	4
12.1	**0757-0986**	6	464	**0698-0090**	7
13.3	0757-0001	6	511	0757-0814	9
14.7	0698-3388	2	562	0757-0815	0
16.2	0757-0989	9	619	0757-0158	4
17.8	0698-3389	3	681	0757-0816	1
19.6	0698-3390	6	750	0757-0817	2
21.5	0698-3391	7	825	0757-0818	3
23.7	0698-3392	8	909	0757-0819	4
26.1	0757-0003	8	1.00K	0757-0159	5
28.7	0698-3393	9	1.10K	0757-0820	7
31.6	0698-3394	0	1.21K	0757-0821	8
34.8	0698-3395	1	1.33K	0698-3406	5
38.3	0698-3396	2	1.47K	0757-1078	9
42.2	0698-3397	3	1.62K	0757-0873	0
46.4	0698-3398	4	1.78K	0698-0089	4
51.1	0757-1000	7	1.96K	0698-3407	6
56.2	0757-1001	8	2.15K	0698-3408	7
61.9	0757-1002	9	2.37K	0698-3409	8
68.1	0757-0794	4	2.61K	0698-0024	7
75.0	0757-0795	5	2.87K	0698-3101	7
82.5	0757-0796	6	3.16K	0698-3410	1
90.0	0757-0797	7	3.48K	0698-3411	2
100	0757-0198	2	3.83K	0698-3412	3
110	0757-0798	8	4.22K	0698-3346	2
121	0757-0799	9	4.64K	0698-3348	4
133	0698-3399	5	5.11K	0757-0833	2
147	0698-3400	9	5.62K	0757-0834	3
162	0757-0802	5	6.19K	0757-0196	0
178	0698-3334	8	6.81K	0757-0835	4
196	0757-1060	9	7.50K	0757-0836	5
215	0698-3401	0	8.25K	0757-0837	6
237	0698-3102	8	9.09K	0757-0838	7
261	0757-1090	5	10.0K	0757-0839	8
287	0757-1092	7	12.1K	0757-0841	2
316	0698-3402	1	13.3K	0698-3413	4
348	0698-3403	2	14.7K	0698-3414	5

Table 3-6.
Standard Value Replacement 0.5 Resistors
(continued)

Resistors					
Type: Fixed-Film Range: 10 to 1.47M Ohms Wattage: 0.5 at 125°C Tolerance: ±1.0%					
Value (Ω)	**HP Fart Number**	**CD**	**Value (Ω)**	**HP Fart Number**	**CD**
16.2K	0757-0844	5	162K	0757-0130	2
17.8K	0698-0025	8	178K	0757-0129	9
19.6K	0698-3415	6	196K	0757-0063	0
21.5K	0698-3416	7	215K	0757-0127	7
23.7K	0698-3417	8	237K	0698-3424	7
26.1K	0698-3418	9	261K	0757-0064	1
28.7K	0698-3103	9	287K	0757-0154	0
31.6K	0698-3419	0	316K	0698-3425	8
34.8K	0698-3420	3	348K	0757-0195	9
38.313	0698-342 1	4	383K	0757-0133	5
42.2K	0698-3422	5	422K	0757-0134	6
46.413	0698-3423	6	464K	0698-3426	9
51.1K	0757-0853	6	511K	0757-0135	7
56.2K	0757-0854	7	562K	0757-0868	3
61.9K	0757-0309	7	619K	0757-0136	8
68.1K	0757-0855	8	681K	0757-0869	4
75.0K	0757-0856	9	750K	0757-0137	9
82.5K	0757-0857	0	825K	0757-0870	7
90.9K	0757-0858	1	909K	0757-0138	0
100K	0757-0367	7	1M	0757-0059	4
110K	0757-0859	2	1.1M	0757-0139	1
121K	0757-0860	5	1.21M	0757-087 1	8
133K	0757-0310	0	1.33M	0757-0194	8
147K	0698-3175	5	1.47M	0698-3464	5

1. Low-Voltage Power Supply Adjustments

Reference

IF-Display Section:
- A1A6 ±15 V Regulator
- A1A7 + 120 V, +5.2 V Regulator (Serial Number Prefix 3004A and above)
- A1A7 + 100 V, +5.2 V Regulator (Serial Number Prefix 3001A and below)

RF Section:
- A24 Voltage Regulator

Description

The + 15 V supply is adjusted for the IF-display Section, and the +20 V supply is adjusted for the RF Section. All other low-voltage supplies are measured to ensure that they are within tolerance.

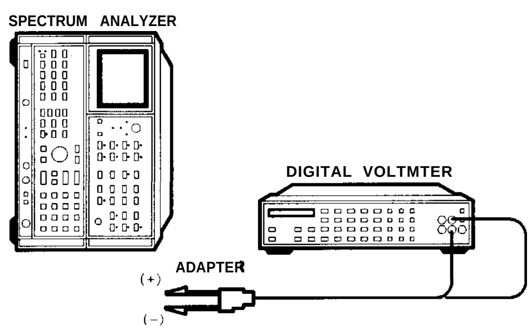


Figure 3-1. Low-Voltage Power Supply Adjustments Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A

Procedure

IF-Display Section

1. Position the instrument on its right side with the IF-Display Section facing right, as shown in Figure 3-1. Remove the top cover of the IF-Display Section and the bottom cover of the RF Section.
2. Set the LINE switch to ON and press (IP). Mains indicator A1A8DS1 (red LED) in the IF-Display Section should be lit. See Figure 3-2 and Figure 3-3 for the location of A1A8DS1.

Note

Use Figure 3-2 for IF-Display Sections with serial numbers 3001A and below. Use Figure 3-3 for IF-Display Sections with serial numbers 3004A and above.

3. Verify that the + 15 V indicator A1A6DS1 (yellow LED) is lit.

4. **Connect** the DVM to A1A6TP3 on the IF-Display Section. DVM indication should be + 15.000 ±0.010 V dc. If the voltage is out of tolerance, adjust A1A6R9 + 15 V ADJ for the specified voltage.

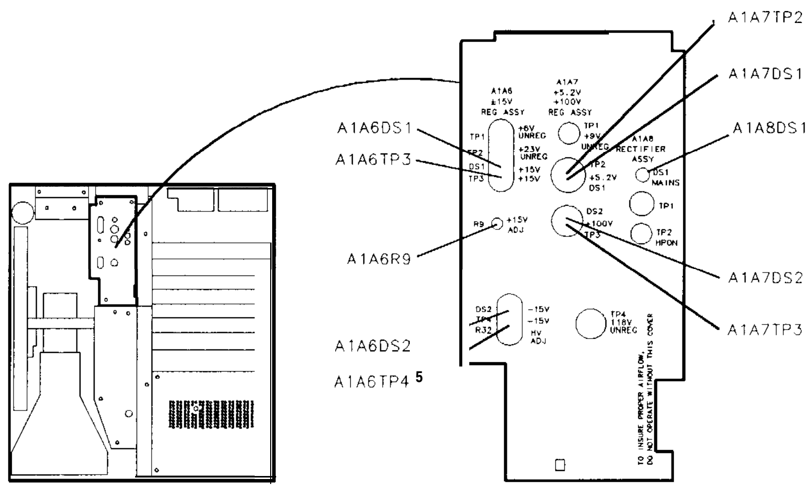


Figure 3-2. IF-Display Section Low-Voltage Adjustments (SN 3001A and Below)

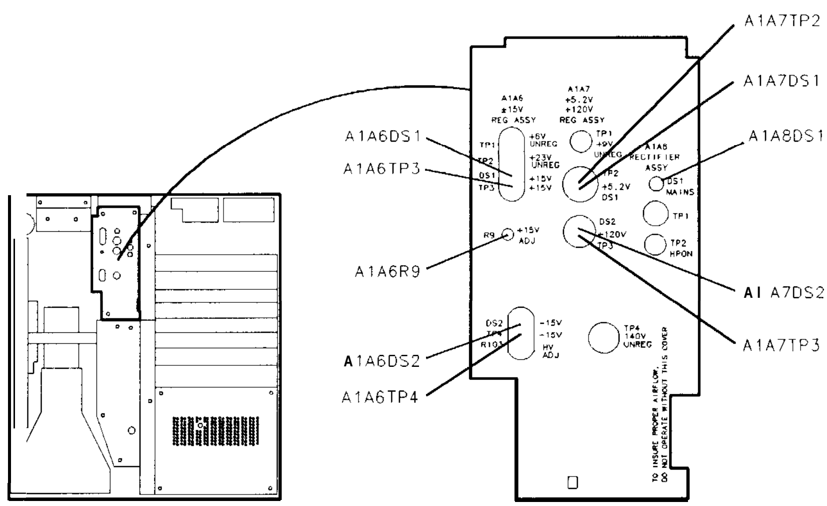


Figure 3-3. IF-Display Section Low-Voltage Adjustments (SN 3004A and Above)

5. Verify that the -15 V indicator A1A6DS2 (yellow LED) is lit.

6. **Connect the** DVM to A1A6TP4. DVM indication should be -15.000 ±0.050 V dc. The -15 V supply is referenced to the + 15 V supply; therefore, if the -15 V supply is out of tolerance, a circuit malfunction is indicated.

7. Verify that the + 120 V indicator A1A7DS2 (yellow LED) is lit.

Note

On IF-Display Sections serial prefixed 3001A and below, indicator A1A7DS2 is a + 100 V indicator.

8. Connect the DVM to A1A7TP3. DVM indication should be + 120.0 ±3.0 V dc. The + 120 V supply is referenced to the + 15 V supply; therefore, if the + 120 V supply is out of tolerance, a circuit malfunction is indicated.

Note

On IF-Display Sections serial prefixed 3001A and below, the DVM indication should be + 100.0 ±2.0 V dc.

9. Verify that the +5.2 V indicator A1A7DS1 (yellow LED) is lit.
10. Connect the DVM to A1A7TP2. DVM indication should be +5.200 ±0.050 V dc. The +5.2 V supply is referenced to the + 15 V supply; therefore, if the +5.2 V supply is out of tolerance, a circuit malfunction is indicated.

RF Section

11. The +20V indicator A24DS2 (yellow LED) should be lit. See Figure 3-4.

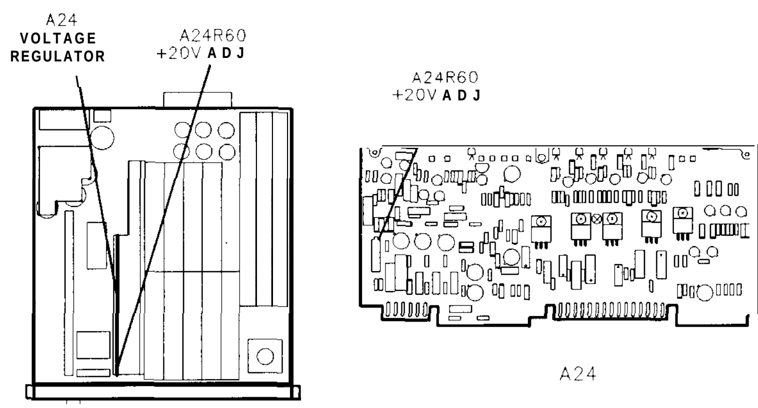


Figure 3-4. Location of RF Section Low-Voltage Adjustments

12. Connect the DVM to A24TP3 with the ground lead to A24TP1. Adjust A24R60 +20V ADJ for a DVM indication of +20.000 ±0.010 V dc.
13. The + 15V indicator A24DS4 (yellow LED) should be lit.
14. Connect the DVM to A24TP2. The DVM indication should be + 15.000 ±0.050 V dc. The + 15V supply is referenced to the +20V supply, therefore, if the + 15V supply is out of tolerance, a circuit malfunction is indicated.
15. The +5V indicator A24DS5 (yellow LED) should be lit.
16. Connect the DVM to A24TP5. The DVM indication should be +5.230 ±0.050 V dc. The +5V supply is referenced to the +20V

supply, therefore, if the +5V supply is out of tolerance, a circuit malfunction is indicated.

17. The −5V indicator A24DS6 (yellow LED) should be lit.
18. Connect the DVM to A24TP7. The DVM indication should be -5.200 ±0.050 V dc. The −5V supply is referenced to the +20V supply, therefore, if the −5V supply is out of tolerance, a circuit malfunction is indicated.
19. The −15V indicator A24DS3 (yellow LED) should be lit.
20. Connect the DVM to A24TP4. The DVM indication should be -15.000 ±0.050 V dc. The −15V supply is referenced to the + 20V supply, therefore, if the −15V supply is out of tolerance, a circuit malfunction is indicated.

2. High-Voltage Adjustment (SN 3001A and Below)

Note

This procedure is for IF-Display Sections with serial number prefixes 3001A and below. The procedure for serial prefixes 3004A and above is located immediately after this procedure.

Note

This procedure should be performed whenever the A1A11 High Voltage Multiplier, A1V1 CRT, or A1A3 High Voltage Regulator Assembly is repaired or replaced.

Reference

IF-Display Section:
- A1A2 Z-Axis Amplifier
- A1A3 High-Voltage Regulator
- A1A6 ±15 V Regulator
- A1A7 + 100 V, +5.2 V Regulator

Description

Warning

This procedure is intended for adjustment purposes only. Voltages are present which, if contacted, could cause serious personal injury. Approximately -4000 V dc can be present on the A1A3 High Voltage assembly even when the ac line cord is disconnected. Do not attempt to remove the A1A3 High-Voltage Assembly from the instrument. Do not disconnect the CRT's post-accelerator cable; the CRT can hold a + 18 kV dc charge for several days.

If for any reason the A1A3 High Voltage Assembly or the post accelerator cable must be removed, refer to "Discharge Procedure for High Voltage and CRT" at the end of this adjustment procedure.

A 1000:l divider probe is used to measure the CRT cathode voltage. First, the high-voltage probe is calibrated by comparing measurements of the + 100 V dc supply voltage with and without the probe. Any measurement error due to the use of the high-voltage probe is calculated into the adjustment specification of the CRT cathode voltage, which is adjusted with the A1A6 HV ADJUST control. When the CRT cathode voltage is properly adjusted, the CRT filament voltage will be +4.45 ±0.04 V rms measured with CRT beam at cut-off, which is required for maximum CRT life. The filament voltage is referenced to the high-voltage cathode and can only be measured directly with special equipment.

2. High-Voltage Adjustment (SN 3001A and Below)

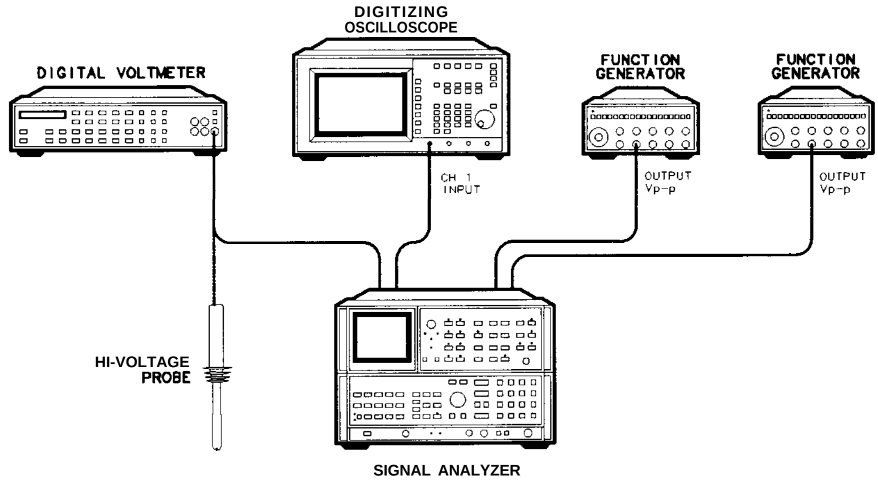


Figure 3-5. High Voltage Adjustment Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A
DC High-Voltage Probe (1000: 1 divider) .... HP 34111A
Display Adjustment PC Board (service accessory) 85662-60088
Digitizing Oscilloscope .... HP 54501A
10:1 Divider Probe .... HP 10432A
Function Generator *(2 required)* .... HP 3312A

High-Voltage Adjustment Procedure

Warning **In the following procedure, it is necessary to probe voltages which, if contacted, could cause serious personal injury. Use a nonmetallic alignment tool when making adjustments. Be extremely careful.**

Warning **Do not attempt to measure the CRT filament voltage directly. The filament voltage is referenced to the high-voltage cathode and can only be measured safely with a special high-voltage true-rms voltmeter and probe.**

1. Set the spectrum analyzer's LINE switch to STANDBY.
2. Remove the top cover from the IF-Display Section, and connect the equipment as shown in Figure 3-5 and described in the following steps.
3. Set the DVM to the 100 V range, and connect the DVM to A1A7TP3 (+ 100 V). Do not use the high-voltage probe. See Figure 3-6 for the location of A1A7TP3.

Note

The accuracy of the high-voltage probe is specified for a probe connected to a dc voltmeter with 10 MΩ input resistance. HP 3456A and HP 3455A digital voltmeters have a 10 MΩ input resistance on the 100 V and 1000 V ranges. All measurements in this procedure should be performed with the DVM manually set to the 100 V range (f00.000 on the HP 3456A display).

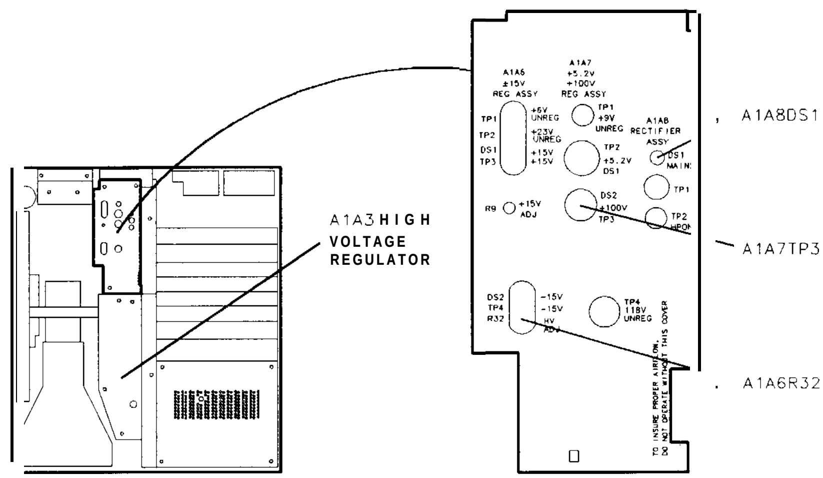


Figure 3-6. Location of High Voltage Adjustments

4. Set the LINE switch to ON. Set the front-panel INTENSITY control fully counterclockwise (CRT beam at cut-off) to prevent possible damage to the CRT.
5. Note the DVM indication at A1A7TP3.

DVM Indication: ________

6. Connect the high-voltage probe to the DVM. Connect the probe to A1A7TP3.
7. Note the DVM indication.

DVM Indication: ________

8. Divide the DVM indication in step 7 by the DVM indication in step 5. This gives the calibration factor needed to compensate for high-voltage probe error.

Calibration Factor: ________

9. Disconnect the high-voltage probe from A1A7TP3. Set the LINE switch to STANDBY. Remove the ac line cord from both instrument sections.

Warning

The MAINS power-on indicator A1A8DS1 (red LED) should be completely off before proceeding with this procedure. See Figure 3-6. The indicator will remain lit for several seconds after the ac line cord has been removed, and will go out slowly (the light becomes dimmer until it is completely out).

2. High-Voltage Adjustment (SN 3001A and Below)

Warning **With the protective cover removed in the following step, do not place hands near the A1A3 High-Voltage assembly. High voltage (approximately -4000 V dc) can be present even when the ac line cord is disconnected.**

10. Wait at least one minute for capacitors to discharge to a safe level.
11. Remove the protective cover from the A1A3 High-Voltage Regulator. A label should be visible on the A1A3T1 High-Voltage Transformer. Record the voltage listed on the label for use in step 15.

Note If the label is missing, use the nominal value of -3790 V dc.

12. Connect the high-voltage probe to A1A3TP3. See Figure 3-7 for the location of the test point.

Warning **With power supplied to the instrument, A1A3TP3 is at a voltage level of approximately -4000 V dc. Be extremely careful.**

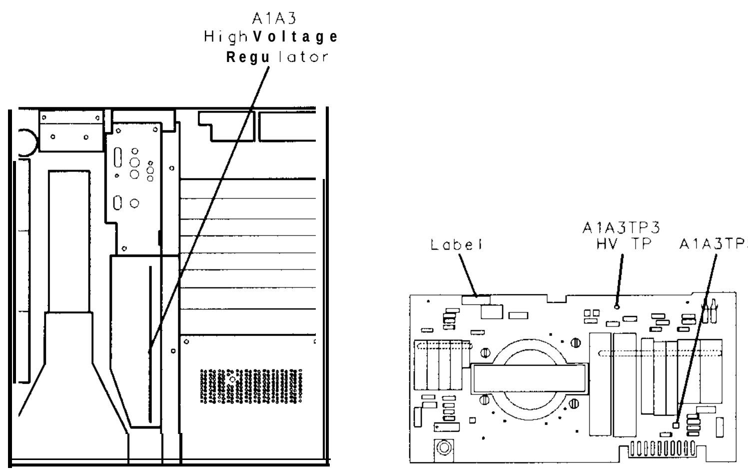


Figure 3-7. Location of Label and Test Point

13. Reconnect ac line cords to both instrument sections. Set the LINE switch to ON.
14. Wait approximately 30 seconds for the dc regulator circuits to stabilize.
15. Adjust A1A6R32 HV ADJ for a DVM indication equal to the calibration factor (calculated in step 8) times the voltage labeled on the top of A1A3 High-Voltage Regulator (noted in step 11). *See* Figure 3-6 for the location of the adjustment.

_________ V dc

EXAMPLE:

If the calibration factor calculated in step 8 is 0.00099, and A1A3T1 is labeled for -3875 V, then adjust A1A6R32 HV ADJ for a DVM indication of:

0.00099 x (-3875 V) = -3.836 V dc

16. With the front-panel INTENSITY control fully counterclockwise, wait approximately 30 minutes to allow the high-voltage supply to stabilize and the CRT to normalize. This *soft* turn-on will extend CRT life expectancy, particularly if a new CRT has just been installed.
17. Readjust A1A6R32 HV ADJ for a DVM indication equal to the voltage determined in step 15.
18. If a new CRT has just been installed do the following:
    a. Set the front-panel INTENSITY control so the CRT trace is barely visible.
    b. Wait an additional 30 minutes for the CRT to normalize.
    c. Readjust A1A6R32 HV ADJ for a DVM indication equal to the voltage determined in step 15.

Focus and Intensity Adjustments

19. Set the LINE switch to STANDBY. Remove the ac line cord from each instrument section.
20. Wait at least one minute for the MAINS power-on indicator A1A8DS1 (red LED) to go out completely before proceeding.
21. Disconnect the high-voltage probe from A1A3TP3.
22. Remove the A3A2 Intensity Control Assembly from the IF-Display Section and install in its place the Display Adjustment Board, HP part number 85662-60088. Set the switch on the Display Adjustment Board in the "down" position. (This applies approximately +2.7 V dc to the front-panel INTENSITY control.)
23. Connect a calibrated 10:1 divider probe to the oscilloscope Channel 1 input.
24. On the oscilloscope, press (RECALL) (CLEAR) to perform a soft reset.
25. On the oscilloscope, press (CHAN), more preset probe , select channel 1, and use the front-panel knob to select a 10:1 probe.
26. Set the oscilloscope controls as follows:

Press (CHAN):
- Channel 1 . . . on
- amplitude scale . . . 10.0V/div
- offset . . . 60.0000V
- coupling . . . dc

Press (TIME BASE):
- time scale . . . 50μs/div

Press (TRIG):
- EDGE TRIGGER . . . auto, edge
- source . . . 1
- level . . . 75.0000 V, rising edge

Press (DISPLAY):
- connect dots . . . on

2. High-Voltage Adjustment (SN 3001A and Below)

27. On the oscilloscope press (SHOW).
28. Connect the oscilloscope channel 1 probe to A1A3TP5 using a long probe extension. See Figure 3-7 for the location of A1A3TP5.
29. Reconnect the ac line cords to each instrument section. Adjust the front-panel INTENSITY control fully counter-clockwise, and then set the LINE switch to ON (the INSTR CHECK I LED will light.)
30. Wait approximately 30 seconds for the dc regulator circuits to stabilize again.
31. With the front-panel INTENSITY control fully counter clockwise, adjust A1A2R35 INT LIMIT (clockwise) until a spot is just visible in the lower left corner of the CRT. See Figure 3-8 for the location of the adjustment.

Note

The A1A2R35 INT LIMIT adjustment compensates for the variation in beam cut-off voltage of different CRTs and indirectly sets the maximum beam intensity. A1A2R35 INT LIMIT should have enough range to turn the CRT spot on and off. If the spot is always on, decrease the value of A1A2R9. If the spot is always off, increase the value of A1A2R9. Refer to Table 3-3 for the acceptable range of values, and to Table 3-4 for HP part numbers. Refer to Figure 3-8 for the location of A1A2R9.

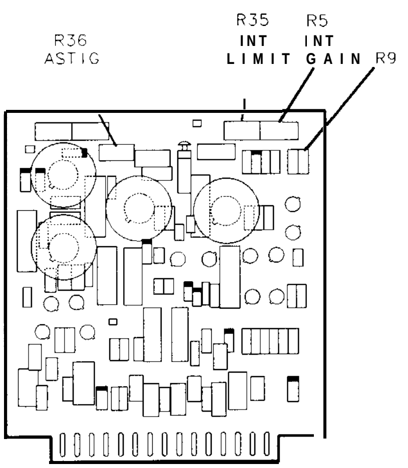


Figure 3-8. Location of A1A2 Components

32. Using a non-metallic alignment tool, center the front panel FOCUS control and adjust A1A2R36 ASTIG and A1A3R14 FOCUS LIMIT for a sharp, focused dot on the CRT display.
33. Adjust A1A2R35 INT LIMIT until the dot just disappears.

34. On the oscilloscope, adjust the channel 1 offset voltage as necessary to measure the peak-to-peak CRT cut-off voltage, V,,, at A1A3TP5. See Figure 3-9. This peak-to-peak voltage should be between 45-75 V_{p-p}. Note this voltage for use in step 39.

V_{co}: ________ V_{p-p}

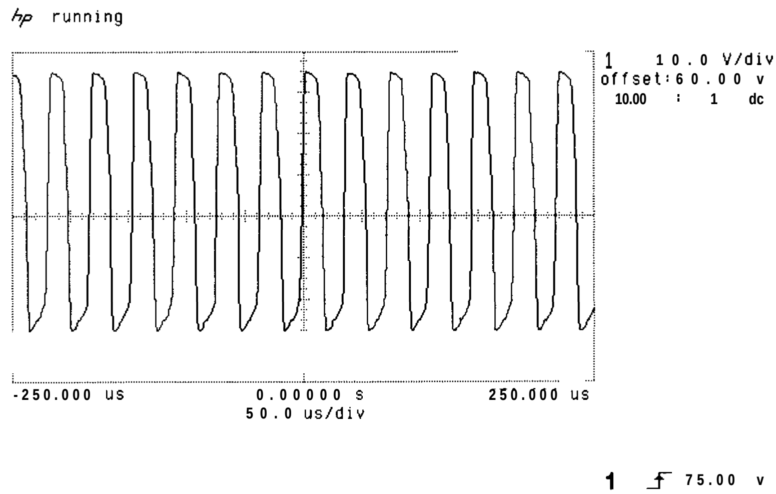


Figure 3-9. CRT Cut-Off Voltage

35. Connect a separate function generator to each of the X and Y inputs of the Display Adjustment Board, as shown in Figure 3-5. Set the function generators as follows:

   X input Jl:
   - frequency . . . . 500 kHz
   - wave . . . . sine
   - amplitude . . . . 2V_{p-p} (0—2 Vdc)

   Y input J2:
   - frequency . . . . 1 kHz
   - wave . . . . sine
   - amplitude . . . . 2V_{p-p} (0—2 Vdc)

36. Adjust A1A2R35 INT LIMIT clockwise until the display is just visible.

37. Adjust A1A4R7 POS, A1A5R7 POS, and if necessary the function generator dc offsets for a full-screen illumination.

38. Set the front-panel INTENSITY control fully counter-clockwise, and, if it is not sealed, adjust A1A2R5 INT GAIN fully clockwise. Adjust A1A2R35 INT LIMIT just below the threshold at which the display illumination becomes visible.

2. High-Voltage Adjustment (SN 3001A and Below)

39. Slowly adjust the front-panel INTENSITY control through its entire range while monitoring the peak-to-peak voltage at A1A3TP5. As the INTENSITY control is turned clockwise, the peak-to-peak voltage at A1A3TP5 will drop. To prevent long-term CRT damage, this voltage should **not** drop below $(V_{co} - 50)V_{p-p}$ or 12 V_{p-p}, whichever is greater. See Figure 3-10. (The value of V_{co} was recorded in step 34.)

    If the front-panel INTENSITY control cannot be set fully clockwise without dropping below this minimum peak-to-peak voltage, then perform the following:

    a. Set the INTENSITY control fully counter clockwise.
    b. Set the LINE switch to STANDBY.
    c. Increase the value of A1A2R9.
    d. Return to step 34.

Note

Maximum CRT life expectancy is obtained when the peak-to-peak voltage at A1A3TP5 is as large as possible with the INTENSITY control set fully clockwise. The display illumination must fully disappear with the INTENSITY control set fully counter clockwise.

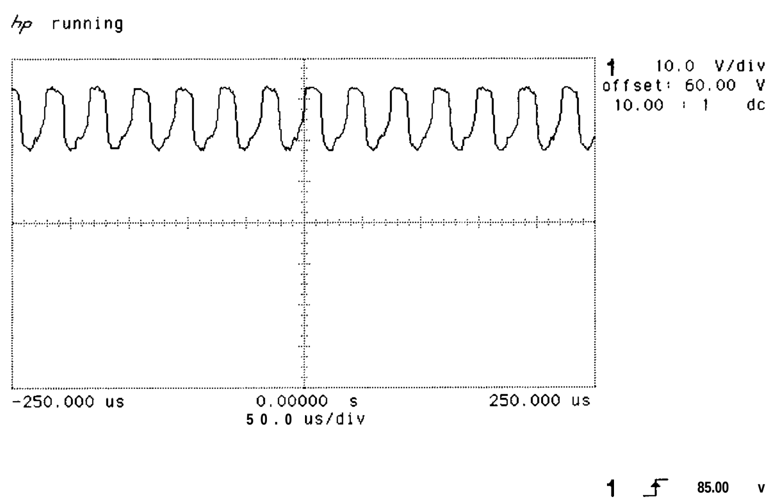


Figure 3-10. Waveform at A1A3TP5

40. Replace the cover **on** the A1A3 High-Voltage Regulator Assembly.

41. The High-Voltage Adjustment is completed. If an A1A2, A1A4, or A1A5 assembly has been repaired or replaced, perform adjustment procedure 3, "Preliminary Display Adjustment (SN 3001A and Below)", and then adjustment procedure 4, "Final Display Adjustments (SN 3001A and Below)". If the A1A2,

A1A4, and A1A5 assemblies function properly and do not require compensation, proceed directly to adjustment procedure 4, "Final Display Adjustments (SN 3001A and Below)".

Discharge Procedure for High Voltage and CRT

The adjustment procedures in this manual do not require the removal or discharge of the A1A3 High-Voltage Regulator or CRT assemblies. However, if for any reason the A1A3 High Voltage Regulator Assembly or the post-accelerator cable must be removed, the following procedure ensures the proper safety.

Warning

This procedure should be performed by qualified personnel only. Voltages are present which, if contacted, could cause serious personal injury. Approximately -4000 V dc is present on the A1A3 High-Voltage Regulator assembly even when the ac line cord is disconnected. The CRT can hold a + 18 kV dc charge for several days if the post-accelerator cable is improperly disconnected.

Warning

Do not handle the A1A3 High-Voltage Regulator Assembly or A1A11 High-Voltage Multiplier until the following high-voltage discharge procedure has been performed.

1. Set the spectrum analyzer's LINE switch to STANDBY, remove the ac line cords, and remove the A1A3 High Voltage Regulator safety cover.

Warning

With the ac power cord disconnected, voltages are still present which, if contacted, could cause serious personal injury.

Warning

In the following step, a large arc of high voltage should be drawn. Be careful.

2. Locate the snap connector on the CRT post-accelerator cable. It is shown in Figure 3-11 as item 1. Using a long flat-bladed screwdriver with an insulated handle, carefully pry the connector loose but do not disconnect the cable.
   a. Using one hand, remove the end of the cable labeled item 2 in Figure 3-1 1. As the end of the cable becomes free, touch the end of the cable to the CRT's metal cover. A large arc of high voltage should ground to the CRT cover. The CRT is not discharged yet!
   b. Reconnect the CRT post-accelerator cable, and repeat the above step until high-voltage arcs no longer appear.
3. Leave the CRT post-accelerator cable disconnected, and remove the cover on the A1A3 High Voltage Regulator.
4. Connect a jumper wire (insulated wire and two alligator clips) between the shaft of a small screwdriver and the chassis ground lug on the inside of the high-voltage shield.

5. While holding the insulated handle of the screwdriver, touch the grounded blade to the following connections:
   a. Both brown wires going to the rear of the CRT from A1A3 via cable harness W21.
   b. The yellow, blue, and orange wires in the same cable as "a." above.
   c. The top lead of each of the 11 large vertical capacitors on the A1A3 High-Voltage Regulator Assembly.
6. Connect the jumper wire from chassis ground to the black wire coming from the A1A11 High-Voltage Multiplier at the wire's connection to A1A3T1.

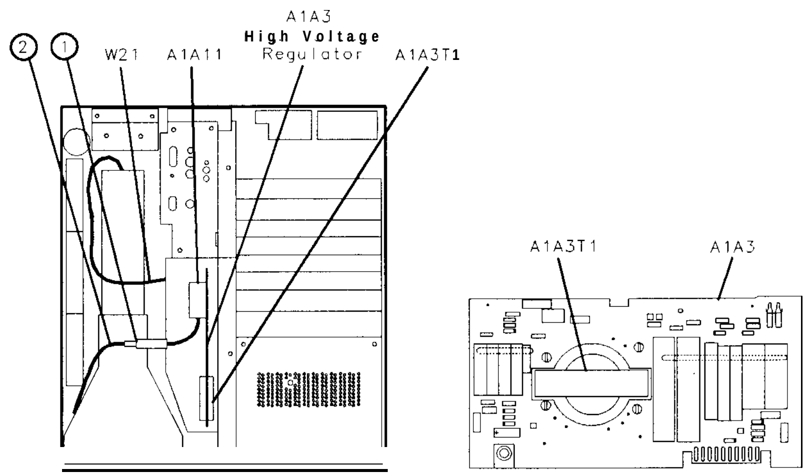


Figure 3-11. Discharging the CRT Post-Accelerator Cable

7. Remove all jumper wires. The A1A3 High-Voltage Regulator, A1A11 High-Voltage Multiplier, and A1V1 CRT assemblies should now be discharged.
8. A small bracket and screw secure the A1A3 High-Voltage Regulator Assembly to the A1A10 Display Motherboard Assembly. The bottom cover of the IF-Display Section must be removed to gain access to this screw prior to removal of the A1A3 High-Voltage Regulator Assembly.

2. High-Voltage Adjustment (SN 3004A and Above)

Note

This procedure is for IF-Display Sections with serial number prefixes 3004A and above. The procedure for serial prefixes 3001A and below is located immediately before this procedure.

Note

This procedure should be performed whenever the A1V1 CRT or A1A3 High Voltage Regulator Assembly is repaired or replaced.

Reference

IF-Display Section:
- A1A2 Z-Axis Amplifier
- A1A3 High-Voltage Regulator
- A1A6 ±15 V Regulator
- A1A7 + 120 V, +5.2 V Regulator

Description

Warning

This procedure is intended for adjustment purposes only. Voltages are present which, if contacted, could cause serious personal injury. Approximately -2400 V dc can be present on the A1A3 High Voltage Regulator Assembly even when the ac line cord is disconnected. Do not attempt to remove the A1A3 High-Voltage Regulator Assembly from the instrument. Do not disconnect the CRT's post-accelerator cable; the CRT can hold a + 9500 V dc charge for several days.

If for any reason the A1A3 High Voltage Assembly or the post accelerator cable must be removed, refer to "Discharge Procedure for High Voltage and CRT" at the end of this adjustment procedure.

A 1000:1 divider probe is used to measure the CRT cathode voltage. First, the high-voltage probe is calibrated by comparing measurements of the + 120 V dc supply voltage with and without the probe. Any measurement error due to the use of the high-voltage probe is calculated into the adjustment specification of the CRT cathode voltage, which is adjusted with the A1A6 HV ADJUST control. When the CRT cathode voltage is properly adjusted, the CRT filament voltage will be +6.00 ±0.05 V rms measured with CRT beam at cut-off, which is required for maximum CRT life. The filament voltage is referenced to the high-voltage cathode and can only be measured directly with special equipment.

2. High-Voltage Adjustment (SN 3004A and Above)

Equipment

Digital Voltmeter (DVM) .... .HP 3456A
DC High-Voltage Probe (1000: 1 divider) .... HP 34111A

High-Voltage Adjustment Procedure

Warning **In the following procedure, it is necessary to probe voltages which, if contacted, could cause serious personal injury. Use a nonmetallic alignment tool when making adjustments. Be extremely careful.**

Warning **Do not attempt to measure the CRT filament voltage directly. The filament voltage is referenced to the high-voltage cathode and can only be measured safely with a special high-voltage true-rms voltmeter and probe.**

1. Set the spectrum analyzer's LINE switch to STANDBY.
2. Remove the top cover from the IF-Display Section and connect the equipment as shown in Figure 3- 12.

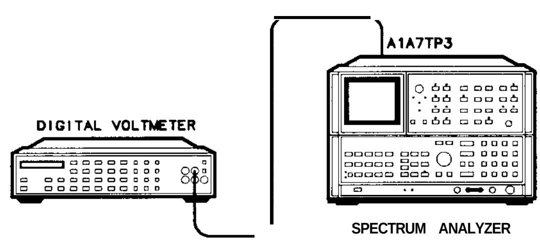


Figure 3-12. High Voltage Adjustment Setup

3. Set the DVM to the 100V range, and connect the DVM to A1A7TP3 (+ 120V) without the high-voltage probe. See Figure 3-13.

Note The accuracy of the high-voltage probe is specified for a probe connected to a dc voltmeter with 10 MO input resistance. HP 3456A and HP 3455A digital voltmeters have a 10 MΩ input resistance on the 100 V and 1000 V ranges. All measurements in this procedure should be performed with the DVM manually set to the 100 V range (±00.000 on the HP 3456A display).

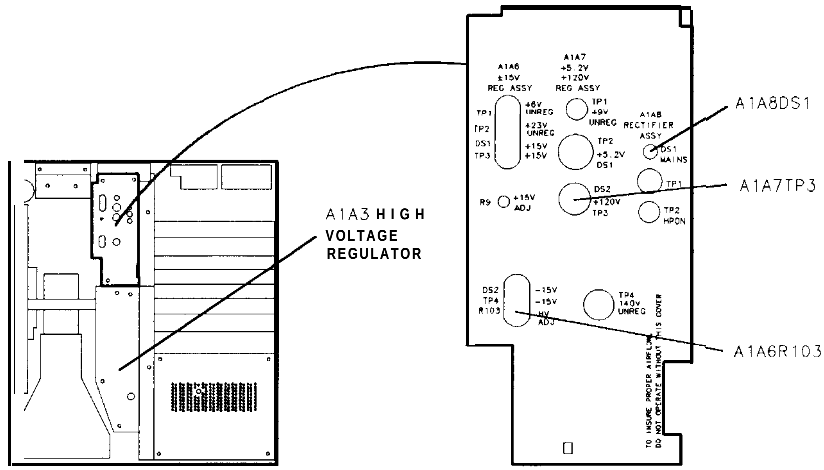


Figure 3-13. Location of High Voltage Adjustments

4. Set the LINE switch to ON. Set the front-panel INTENSITY control fully counterclockwise (CRT beam at cut-off) to prevent possible damage to the CRT.
5. Note the DVM indication at A1A7TP3.

DVM Indication: ________

6. Connect the high-voltage probe to the DVM, and connect the probe to A1A7TP3.
7. Note the DVM indication.

DVM Indication: ________

8. Divide the DVM indication in step 7 by the DVM indication in step 5. This gives the calibration factor needed to compensate for high-voltage probe error.

Calibration Factor: ________

9. Disconnect the high-voltage probe from A1A7TP3. Set the LINE switch to STANDBY. Remove the ac line cord from both instrument sections.

Warning **The MAINS power-on indicator A1A8DS1 (red LED) should be completely off before proceeding with this procedure. See Figure 3-13 The indicator will remain lit for several seconds after the ac line cord has been removed, and will go out slowly (the light becomes dimmer until it is completely out).**

Warning **With the protective cover removed in the following step, do not place hands near the A1A3 High-Voltage assembly. High voltage (approximately -2400 V dc) can present even when the ac line cord is disconnected.**

10. Wait at least one minute for capacitors to discharge to a safe level.

2. High-Voltage Adjustment (SN 3004A and Above)

11. Remove the protective cover from the A1A3 High-Voltage Regulator Assembly. A label should be visible on the A1A3A1 High Voltage Assembly. (A1A3A1 is mounted on the non-component side of the High-Voltage Regulator Assembly as shown in Figure 3-14.) Record the voltage listed on the label for use in step 15. In cases where more than one voltage is listed on this label, record the value which is closest to -2400 Vdc.

_________ V dc

Warning **With power supplied to the instrument, A1A3TP2A is at a voltage level of approximately -2400 V dc. Be extremely careful.**

12. Connect the high-voltage probe to A1A3TP2A. See Figure 3-14 for the location of the test point.

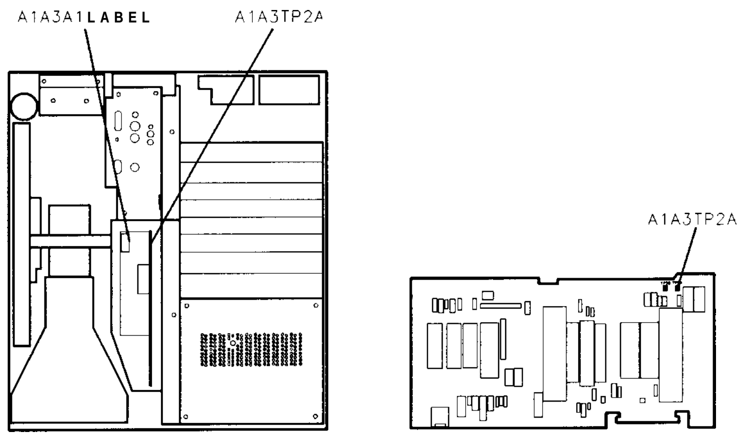


Figure 3-14. Location of A1A3 Label and Test Point

13. Reconnect ac line cords to both instrument sections. Set the LINE switch to ON.
14. Wait approximately 30 seconds for the dc regulator circuits to stabilize.
15. Adjust A1A6R103 HV ADJ for a DVM indication equal to the calibration factor (calculated in step 8) times the voltage labeled on the top of the A1A3A1 High-Voltage Assembly (noted in step 11). See Figure 3-13 for the location of the adjustment.

_________ V dc

EXAMPLE:

If the calibration factor calculated in step 8 is 0.00099, and A1A3A1 is labeled for -2400 V, then adjust A1A6R103 HV ADJ for a DVM indication of:

0.00099 x (-2400 V) = -2.376 V dc

16. With the front-panel INTENSITY control fully counter clockwise, wait approximately 10 minutes to allow the high-voltage supply to stabilize and the CRT to normalize. This *soft* turn-on will extend CRT life expectancy, particularly if a new CRT has just been installed.
17. Readjust A1A6R103 HV ADJ for a DVM indication equal to the voltage determined in step 15.
18. If a new CRT has just been installed do the following:
    a. Set the front-panel INTENSITY control so the CRT trace is barely visible.
    b. Wait an additional 30 minutes for the CRT to normalize.
    c. Readjust A1A6R103 HV ADJ for a DVM indication equal to the voltage determined in step 15.
19. Set the LINE switch to STANDBY. Remove the ac line cord from each instrument section.
20. Wait at least one minute for the MAINS power-on indicator A1A8DS1 (red LED) to go out completely before proceeding.
21. Disconnect the high-voltage probe from A1A3TP2A.
22. Replace the cover on the A1A3 High-Voltage Regulator Assembly.
23. The High-Voltage adjustments are now completed. If the A1A2 assembly has been repaired or replaced, perform adjustment procedure 3, "Preliminary Display Adjustment (SN 3004A and Above)", and then adjustment procedure 4, "Final Display Adjustments (SN 3004A and Above)". If the A1A2 assembly functions properly and does not require compensation, proceed directly to adjustment procedure 4, "Final Display Adjustments (SN 3004A and Above)".

Discharge Procedure for High Voltage and CRT

The High-Voltage Adjustment procedure does not require the removal or discharge of the Al A3 High-Voltage Regulator or A1V1 CRT assemblies. However, if for any reason the A1A3 High Voltage Regulator Assembly, the CRT, or the CRT post-accelerator cable must be removed, perform the following procedure to ensure proper safety.

Warning

This procedure should be performed by qualified personnel only. Voltages are present which, if contacted, could cause serious personal injury. Approximately -2400 V dc can be present on the A1A3 High-Voltage Regulator assembly even when the ac line cord is disconnected. The CRT can hold a + 9500 V dc charge for several days if the post-accelerator cable is improperly disconnected.

1. Remove the ac line cord from both instrument sections.

Warning

With the ac power cords disconnected, voltages can still be present which, if contacted, could cause serious personal injury.

2. Obtain an electrician's screwdriver which has a thin blade at least eight inches long. The handle of the screwdriver must be made of an insulating material.

3. Connect one end of a jumper wire (made of insulated wire and two alligator clips) to the blade of the screwdriver. Connect the other end of the jumper wire to the metal chassis of the IF Display Section. This grounds the screwdriver.
4. Slide the screwdriver's blade between the CRT and the sheet metal as shown in Figure 3-15. Gently work the tip of the screwdriver under the post-accelerator cable's rubber shroud. Make sure that the screwdriver's tip touches the connection between the post accelerator cable and the CRT. You should hear a cracking sound when the cable discharges.
5. Remove the cover from the A1A3 High-Voltage Regulator assembly.
6. Touch the screwdriver's tip to the top lead of each of the 11 large vertical capacitors on the A1A3 High-Voltage Regulator assembly.
7. The A1A3 High-Voltage Regulator and A1V1 CRT assemblies should now be discharged.

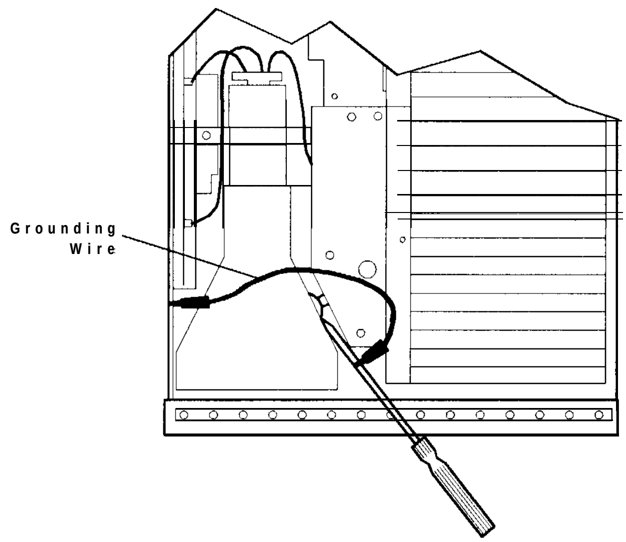


Figure 3-15. Discharging the CRT Post-Accelerator Cable

Note A small bracket and screw secure the A1A3 High-Voltage Regulator Assembly to the A1A10 Display Motherboard Assembly. The bottom cover of the IF-Display Section must be removed to gain access to this screw prior to removal of the A1A3 High-Voltage Regulator Assembly.

3. Preliminary Display Adjustments (SN 3001A and Below)

Reference

A1A1 Keyboard
A1A2 Z-Axis Amplifier
A1 A4 X-Deflection Amplifier
A1A5 Y-Deflection Amplifier

Note

Adjustment 2, "High-Voltage Adjustment," should be performed before performing the following adjustment procedure.

Note

Perform this adjustment only if components have been replaced on the A1A2 Z-Axis Amplifier, A1A4 X-Deflection Amplifier, or A1A5 Y Deflection Amplifier Assemblies. Components A1A2R22 HF GAIN, A1A2C10, A1A4R28 HF GAIN, A1A4C10, A1A4C11, A1A5R28 HF GAIN, A1A5C10, and A1A5C11 are factory adjusted and normally do not require readjustment.

Description

The Al Display Section is adjusted to compensate the CRT drive circuits for proper horizontal and vertical characteristics. These preliminary adjustments are necessary only when a major repair has been performed in the display section (for example, replacement or repair of the A1A2 Z Axis Amplifier, A1A4 X-Deflection Amplifier, or A1A5 Y-Deflection Amplifier assemblies). For routine maintenance, CRT replacement, or minor repairs, only adjustment procedure 4, "Final Display Adjustments," needs to be performed.

Caution

Be sure not to allow a high intensity spot to remain on the spectrum analyzer CRT. A fixed spot of high intensity may permanently damage the CRT's phosphor coating. Monitor the CRT closely during the following adjustment procedures. If a spot occurs, move it off-screen by adjusting either the front-panel INTENSITY control, or the horizontal or vertical deflection position controls.

Equipment

Digitizing Oscilloscope .... HP 54501A
Pulse/Function Generator .... HP 8116A
10:1 Divider Probe, 10 MΩ/7.5 pF ***(2 required)*** .... HP 10432A
Display Adjustment PC Board *(service accessory)* 85662-60088
Termination, BNC 500 .... HP 11593A

Adapters:

Adapter, BNC tee 1250-0781
Adapter, BNC(f) to SMB(f) 1250-1236

3. Preliminary Display Adjustments (SN 3001A and Below)

Procedure

X and Y Deflection Amplifier Pulse Response Adjustments

1. Connect a 10:1 (10 MΩ) divider probe to the oscilloscope's channel 1 input and a 10: 1 divider probe to the channel 4 input.
2. On the oscilloscope, press (RECALL) (CLEAR) to perform a soft reset.
3. On the oscilloscope, press (CHAN) more preset probe , select channel 1, and use the front-panel knob to select a 10:1 probe.
4. Select channel 4, and use the front-panel knob to select a 10:1 probe.
5. Press (SHOW).
6. Connect the channel 1 probe to the oscilloscope's rear panel PROBE COMPENSATION AC CALIBRATOR OUTPUT connector. Press (AUTO- SCALE). Adjust the channel 1 probe for an optimum square wave display on the oscilloscope.
7. Connect the channel 4 probe to the oscilloscope's rear panel PROBE COMPENSATION AC CALIBRATOR OUTPUT connector. Press (AUTO- SCALE). Adjust the channel 4 probe for an optimum square wave display on the oscilloscope.

Note

Each probe is now compensated for the oscilloscope input to which it is connected. Do not interchange probes without recompensating.

8. Connect the channel 1 10:1 divider probe to A1A4E1, and the channel 4 probe to A1A4E2, as shown in Figure 3-16. Connect the probe ground leads to chassis ground. See Figure 3-17 and Figure 3-18 for the location of the assemblies and test points.

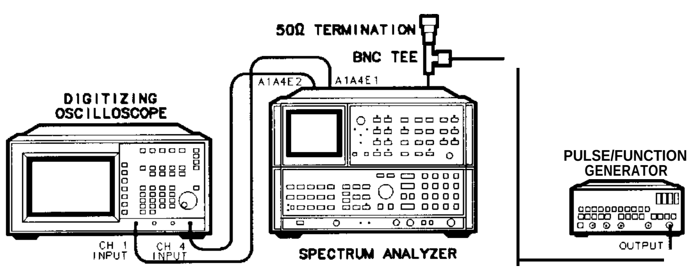


Figure 3-16. Preliminary Display Adjustments Setup

9. Remove the cover over A3 Digital Storage Section and remove A3A2 Intensity Control Assembly. Insert the Display Adjustment PC board (HP part number 85662-60088) into the A3A2 slot. See Figure 3-17 for the location of the A3A2 assembly.

3. Preliminary Display Adjustments (SN 3001A and Below)

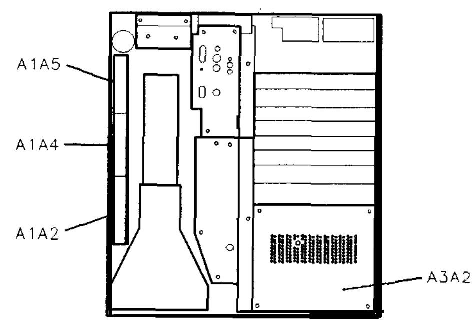


Figure 3-17. Location of A1A2, A1A4, A1A5, and A3A2

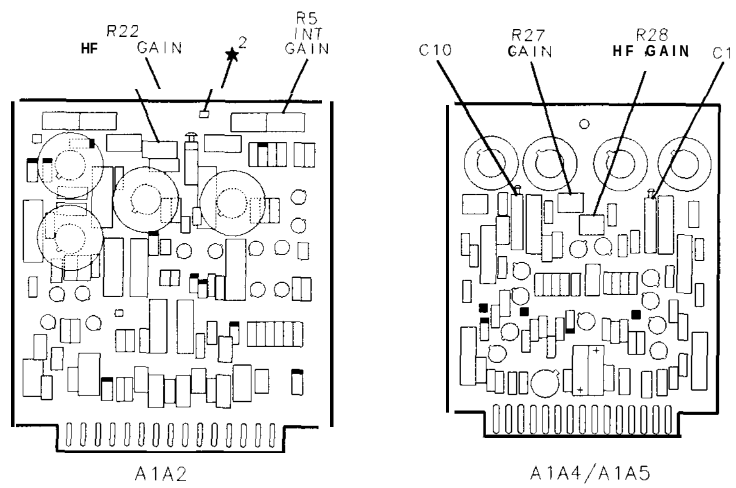


Figure 3-18. A1A2, A1A4, and A1A5 Adjustment Locations

10. Set the Pulse/Function Generator controls as follows:

MODE . . . . NORM
Waveform . . . . pulse
Frequency (FRQ) . . . . 200 kHz
Width(WID) . . . .250 ns
Amplitude (AMP) . . . . 2.00 V
Offset (OFS) . . . . .000 mV

Il. Connect the output of the Pulse/Function Generator to J1 (X input) on the Display Adjustment PC board in the A3A2 slot as shown in Figure 3-16.

Note

The Pulse/Function Generator's output must be terminated with 50 ohms. Use a BNC tee, a 500 termination, and a BNC female to SMB female adapter. Install the 500 termination as close to the Display Adjustment PC Board as possible.

12. Set the oscilloscope controls as follows:

Press (CHAN):
- Channel 1 .... on
- amplitude scale .... 10.0 V/div
- offset .... 25.0000 V
- Channel 4 .... on
- amplitude scale .... 10.0 V/div
- offset .... 60.0000 V

Press (TRIG):
- source 1
- level .... 25.0000 V

Press (TIME BASE):
- time scale .... 50.0 ns/div
- delay .... 125.000 ns

Press (DISPLAY):
- connect dots .... on

Press (SHOW).

13. Set the spectrum analyzer's front-panel INTENSITY control fully counterclockwise, and then set the LINE switch to ON.

14. The X+ deflection and X− deflection waveforms should be superimposed on the oscilloscope display, as shown in Figure 3-19. If necessary, adjust A1A4R7 X POSN and A1A4R27 X GAIN for a centered display of at least four vertical divisions. See Figure 3-18 for the location of the adjustments.

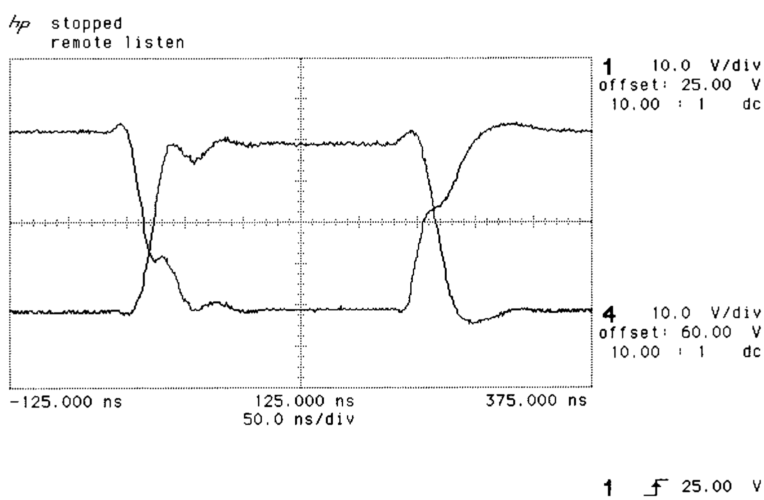


Figure 3-19. X+ and X− Waveforms

15. Set the oscilloscope controls as follows:

Press (WFORM MATH):
- f1 .... on
- display .... on
- math .... channel 1 − channel 4
- sensitivity .... 25.0 V/div

16. Three waveforms should be displayed on the oscilloscope, as shown in Figure 3-20. The lower composite waveform represents the combined X deflection voltage applied to the CRT. Use the oscilloscope's front-panel knob to adjust waveform fl sensitivity for approximately 8 vertical divisions.

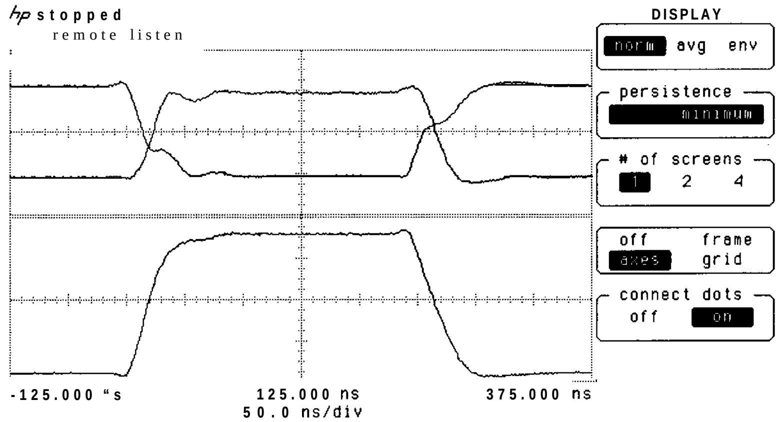


Figure 3-20. Composite X Deflection Waveform

17. Adjust A1A4R28 HF GAIN, A1A4C10, and A1A4C11 for minimum overshoot and minimum rise and fall times of the composite X deflection waveform.

Note Always adjust A1A4C10 and A1A4C11 in approximately equal amounts. Do not adjust one to its minimum value and the other to its maximum value.

18. Use the oscilloscope (ΔtΔV) markers to measure the risetime, falltime, and percent overshoot of the composite X defection waveform. Rise and fall times should both be less than approximately 65 ns between the 10% and 90% points on the waveform. Overshoot should be less than 3% (approximately 0.25 divisions). See Figure 3-2 1.

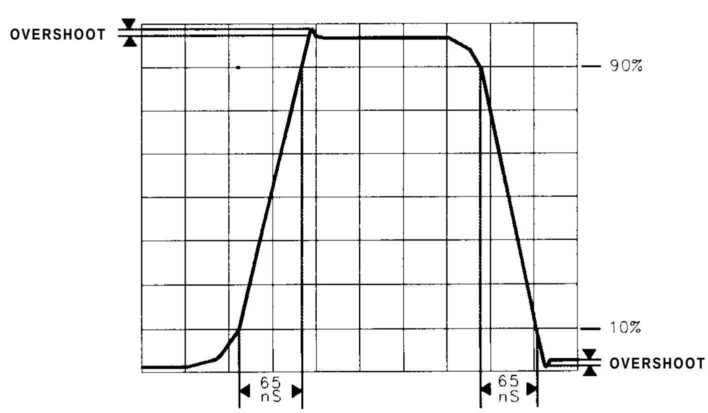


Figure 3-2 1.
Rise and Fall Times and Overshoot Adjustment Waveform

19. Connect the oscilloscope's channel 1 probe to A1A5E1 and the channel 4 probe to A1A5E2. See Figure 3-18 for the location of the test points. Connect the output of the pulse/function generator to J2 (Y input) on the Display Adjustment PC board in the A3A2 slot.
20. The Y Deflection Amplifier is identical to the X Deflection Amplifier. Repeat steps 12 through 18 for the Y Deflection Amplifier using R7, R27, R28, C10, and C11 respectively.

Pulse Response of Control Gate Z Amplifier to $\overline{\text{BLANK}}$ Input

21. Disconnect the oscilloscope channel 4 probe from the spectrum analyzer. Connect the oscilloscope channel 1 probe to A1A2TP2, and connect the probe's ground lead to chassis ground.
22. On the oscilloscope, press [RECALL) (CLEAR) to perform a soft reset.
23. Press (CHAN), CHANNEL 1 on, more preset probe , and use the front-panel knob to set the probe to 10.00: 1. Press more .
24. Set the oscilloscope controls as follows:

    Press (CHAN):
    amplitude scale . . . . 10.0 V/div
    offset . . . .25.0000 V
    Press (TIME BASE):
    time scale . . . . .50.0 ns/div
    delay . . . . 125.000 ns
    Press (TRIG):
    level . . . . 5.00000 V
    Press (DISPLAY):
    connect dots . . . . on
    Press (SHOW).

25. Connect the output of the Pulse/Function Generator to J3 (Z input) on the Display Adjustment PC Board in the A3A2 slot. Set the board's switch to the down position.

Note

The pulse/function generator's output must be terminated with 50 ohms. Use a BNC tee, a 50Ω termination, and a BNC female to SMB female adapter. Install the 50Ω termination as close to the Display Adjustment PC Board as possible.

26. Set the pulse/function generator's controls as follows:

    MODE . . . . NORM
    Waveform . . . .pulse
    Frequency (FRQ) . . . . 200 kHz
    Width(WID) . . . . 250 ns
    Amplitude (AMP) 4.00V
    Offset (OFS) 2.00V

27. Set the spectrum analyzer's front-panel INTENSITY control fully clockwise. Note the display on the oscilloscope. The pulse should be ≥55V peak-to-peak.

28. Set the oscilloscope controls as follows:

Press (CHAN):
Channel 1 . . . . on
amplitude scale . . . . 6.25 V/div
Press (SHOW).

29. Adjust A1A4R7 X POS and A1A5R7 Y POS to either extreme to position the CRT beam off-screen (to prevent possible damage to the CRT phosphor). If it is not sealed, adjust A1A2R5 INT GAIN fully clockwise.

30. Adjust the spectrum analyzer's front-panel INTENSITY control for 50V peak-to-peak (8 divisions) as indicated on the oscilloscope. See Figure 3-22.

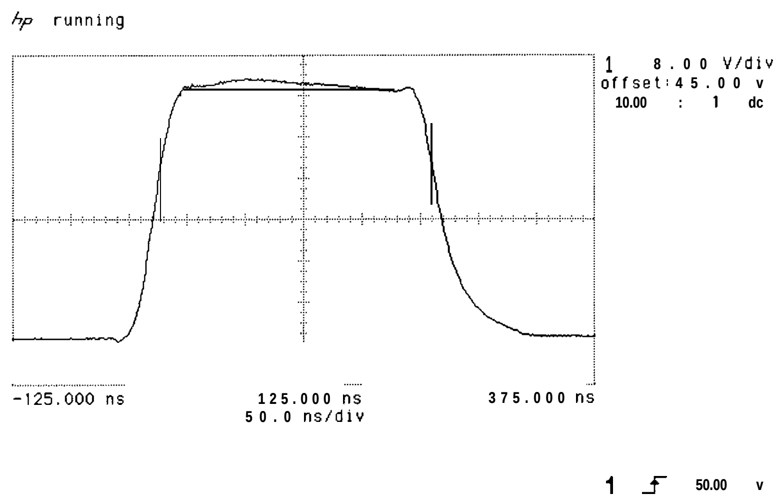


Figure 3-22. $50V_{p-p}$ Signal

31. Adjust A1A2R22 HF GAIN and A1A2C10 for minimum overshoot on rise and minimum rise and fall times of the pulse waveform.

32. Use the oscilloscope (ΔtΔV) markers to measure the risetime, falltime, and percent overshoot of the pulse waveform. Rise and falltimes should be less than 50 ns and 90 ns respectively. Overshoot on the rise should be less than 5% (approximately 0.4 divisions).

33. Set the spectrum analyzer's LINE switch to STANDBY, and center potentiometers A1A4R7 X POSN and A1A5R7 Y POSN.

34. Disconnect the oscilloscope channel 1 probe from the spectrum analyzer. Remove the Display Adjustment PC board from the A3A2 slot, and reinstall the A3A2 Intensity Control Assembly. Replace the A3 Section cover and cables.

35. Perform Adjustment Procedure 4, Final Display Adjustment (SN 3001A and Below).

3. Preliminary Display Adjustments (SN 3004A and Above)

Reference

A1A1 Keyboard
Al A2 X, Y, Z Axis Amplifier

Note

Adjustment Procedure 2, "High-Voltage Adjustment," should be performed before performing the following adjustment procedure.

Note

Perform this adjustment only if components have been replaced on the A1A2 X, Y, Z Axis Amplifier Assembly. Components R117, R217, R308, C104, C109, C204, C209, and C307 are factory adjusted and normally do not require readjustment. Components affecting these adjustments are located in function blocks F, H, M, N, 0, P, R, and S of the A1A2 X, Y, Z Axis Amplifier Assembly schematic diagram.

Description

The X, Y, Z Axis Amplifier Assembly is adjusted to compensate the CRT drive circuits for proper horizontal and vertical characteristics. These preliminary adjustments are necessary only after replacement or repair of the A1A2 X, Y, Z Axis Amplifier Assembly). For routine maintenance, CRT replacement, or minor repairs, only Adjustment Procedure 4, "Final Display Adjustments," needs to be performed.

Caution

Be sure not to allow a fixed spot of high intensity to remain on the spectrum analyzer CRT. A high intensity spot may permanently damage the CRT's phosphor coating. Monitor the CRT closely during the following adjustment procedures. If a spot occurs, move it off-screen by adjusting either the front-panel INTENSITY control, or the horizontal or vertical deflection position controls.

Equipment

Digitizing Oscilloscope .... HP 54501A
Pulse/Function Generator .... HP 8116A
10:1 Divider Probe, 10 MΩ/7.5 pF, *(2 required)* .... HP 10432A
Display Adjustment PC Board (service accessory) 85662-60088
Termination, BNC 50Ω .... HP 11593A

Adapters:

Adapter, BNC(f) to SMB(f) 1250-1236
Adapter, BNC tee 1250-0781

Procedure

X and Y Deflection Amplifier Pulse Response Adjustments

1. Connect a 10:1 (10 MΩ) divider probe to the oscilloscope's channel 1 input and a 10:1 divider probe to the channel 4 input.
2. On the oscilloscope, press (RECALL) (CLEAR) to perform a soft reset.
3. On the oscilloscope, press (CHAN) more preset probe , select channel 1, and use the front-panel knob to select a 10: 1 probe.
4. Select channel 4, and use the front-panel knob to select a 10:1 probe.
5. Press (SHOW).
6. Connect the channel 1 probe to the oscilloscope's rear panel PROBE COMPENSATION AC CALIBRATOR OUTPUT connector. Press (AUTO- SCALE). Adjust the channel 1 probe for an optimum square wave display on the oscilloscope.
7. Connect the channel 4 probe to the oscilloscope's rear panel PROBE COMPENSATION AC CALIBRATOR OUTPUT connector. Press [AUTO- SCALE]. Adjust the channel 4 probe for an optimum square wave display on the oscilloscope.

Note

Each probe is now compensated for the oscilloscope input to which it is connected. Do not interchange probes without recompensating.

8. Connect the channel 1 10:1 divider probe to A1A2TP204, and the channel 4 probe to A1A2TP205, as shown in Figure 3-23. Connect the probe ground leads to A1A2TP106. See Figure 3-24 and Figure 3-25 for the location of the assemblies and test points.

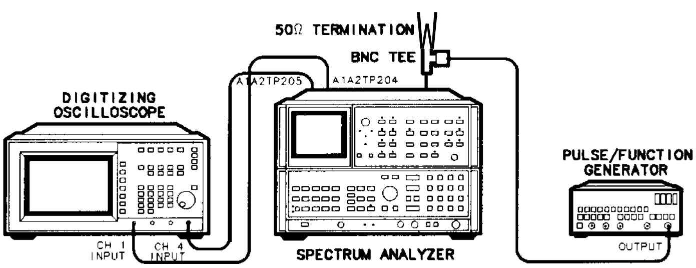


Figure 3-23. Preliminary Display Adjustments Setup

9. Remove the cover over A3 Digital Storage Section and remove A3A2 Intensity Control Assembly. Insert the Display Adjustment PC board (HP part number 85662-60088) into the A3A2 slot. See Figure 3-24 for the location of the A3A2 assembly.

3. Preliminary Display Adjustments (SN 3004A and Above)

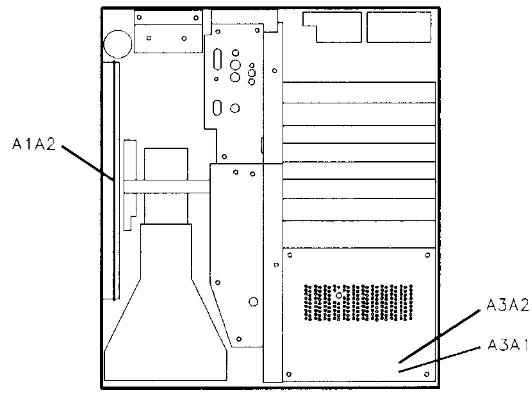


Figure 3-24. Location of A1A2 and A3A2

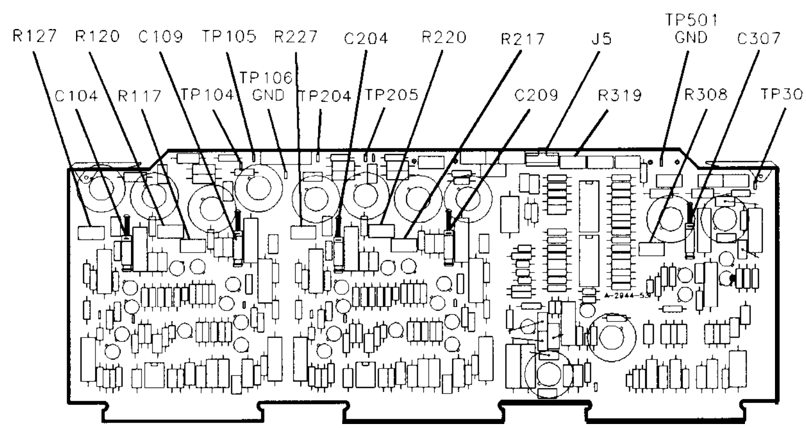


Figure 3-25. A1A2 Adjustment Locations

10. Set the Pulse/Function Generator controls as follows:

    MODE .... NORM
    Waveform .... pulse
    Frequency (FRQ) .... 200 kHz
    Width(WID) ....250 ns
    Amplitude (AMP) .... 2.00 V
    Offset (OFS) .... .O.OOO mV

11. Connect the output of the Pulse/Function Generator to J1 (X input) on the Display Adjustment PC board in the A3A2 slot as shown in Figure 3-23.

Note The pulse/function generator's output must be terminated with 50 ohms. Use a BNC tee, a 50Ω termination, and a BNC female to SMB female adapter. Install the 50Ω termination as close to the Display Adjustment PC Board as possible.

12. Set the oscilloscope controls as follows:

Press (CHAN):
- Channel 1 .... on
- amplitude scale .... 10.0 V/div
- offset .... 25.000 0 V
- Channel 4 .... on
- amplitude scale .... 10.0 V/div
- offset .... 60.000 0 V

Press (TRIG):
- source 1
- level .... 25.0000 V

Press (TIME BASE):
- time scale .... 50.0 ns/div
- delay .... 125.000 ns

Press (DISPLAY):
- connect dots .... on

Press (SHOW).

13. Set the spectrum analyzer's front-panel INTENSITY control fully counterclockwise, and then set the LINE switch to ON.

14. The X+ deflection and X- deflection waveforms should be superimposed on the oscilloscope display, as shown in Figure 3-26. If necessary, adjust A1A2R227 X POSN and A1A2R220 X GAIN for a centered display of at least four vertical divisions. See Figure 3-25 for the location of the adjustments.

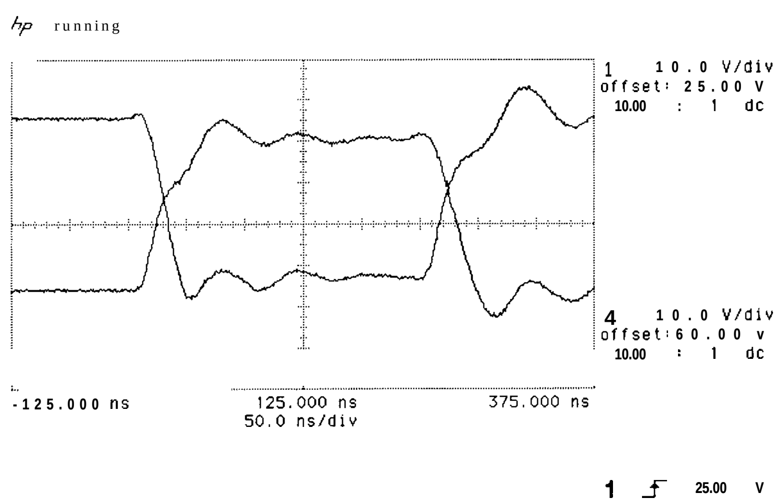


Figure 3-26. X + and X- Waveforms

15. Set the oscilloscope controls as follows:

Press (WFORM MATH):
- f1 .... on
- display .... on
- math .... channel 1 – channel 4
- sensitivity .... 25.0 V/div

16. Three waveforms should be displayed on the oscilloscope, as shown in Figure 3-27. The lower composite waveform represents

the combined X deflection voltage applied to the CRT. Use the oscilloscope's front-panel knob to adjust waveform fl sensitivity for approximately 8 vertical divisions.

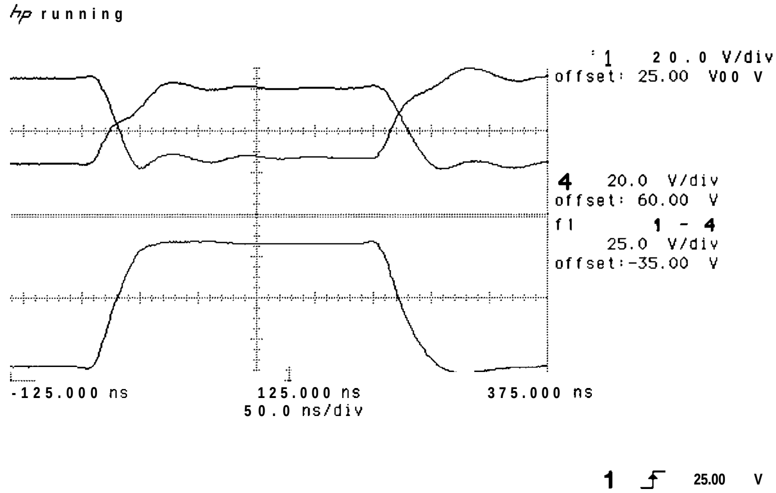


Figure 3-27. Composite X Deflection Waveform

17. Adjust A1A2R217 HF GAIN, A1A2C204, and A1A2C209 for minimum overshoot and minimum rise and fall times of the composite X deflection waveform.

Note

Always adjust A1A2C204 and A1A2C209 in approximately equal amounts. Do not adjust one to its minimum value and the other to its maximum value.

18. Use the oscilloscope (ΔtΔV) markers to measure the risetime, falltime, and percent overshoot of the composite X defection waveform. Rise and fall times should both be less than approximately 65 ns between the 10% and 90% points on the waveform. Overshoot should be less than 3% (approximately 0.25 divisions). See Figure 3-28.

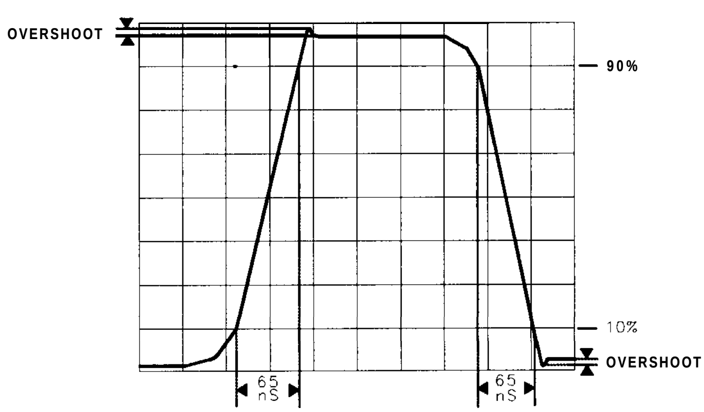


Figure 3-28.
Rise and Fall Times and Overshoot Adjustment Waveform

19. Connect the oscilloscope's channel 1 probe to A1A2TP104 and the channel 4 probe to A1A2TP105. See Figure 3-25 for the location of the test points. Connect the output of the pulse/function generator to J2 (Y input) on the Display Adjustment PC board in the A3A2 slot.

20. The Y Deflection Amplifier is identical to the X Deflection Amplifier. Repeat steps 12 through 18 for the Y Deflection Amplifier using R127, R120, R117, C104, and C109, respectively.

Pulse Response of Control Gate Z Amplifier to BLANK Input

21. Disconnect the oscilloscope channel 4 probe from the spectrum analyzer. Connect the oscilloscope channel 1 probe to A1A2TP301, and connect the probe's ground lead to A1A2TP501.

22. On the oscilloscope, press (RECALL) (CLEAR) to perform a soft reset.

23. Press (CHAN), CHANNEL 1 on, more preset probe , and use the front-panel knob to set the probe to 10.00:1. Press more .

24. Set the oscilloscope controls as follows:

Press (CHAN):
amplitude scale . . . . .20.0 V/div
offset . . . .45.0000 V
Press (TIME BASE):
time scale . . . . .50.0 ns/div
delay . . . . 125.000 ns
Press (TRIG):
level . . . . 50.00000 v
Press (DISPLAY):
connect dots . . . . on
Press (SHOW).

25. Connect the output of the Pulse/Function Generator to J3 (Z input) on the Display Adjustment PC Board in the A3A2 slot. Set the board's switch to the ***down*** position.

Note The pulse/function generator's output must be terminated with 50 ohms. Use a BNC tee, a 500 termination, and a BNC female to SMB female adapter. Install the 500 termination as close to the Display Adjustment PC Board as possible.

---

26. Set the Pulse/Function Generator's controls as follows:

MODE . . . . NORM
Waveform . . . . pulse
Frequency (FRQ) . . . . 200 kHz
Width (WID) . . . . 250 ns
Amplitude (AMP) 4.00V
Offset (OFS) 2.00V

27. Disconnect the black connector with three wires (8, 98, and 96) from A1A2J5, and set A1A2R319 INT GAIN fully clockwise.

28. Set the spectrum analyzer's front-panel INTENSITY control fully clockwise. Adjust the oscilloscope trigger level for a stable display. Note the display on the oscilloscope. The pulse should be ≥55V peak-to-peak.

29. Set the oscilloscope controls as follows:

    Press (CHAN):
    Channel 1 . . . . on
    amplitude scale . . . . .8.00 V/div
    Press (SHOW).

30. Adjust the spectrum analyzer's front-panel INTENSITY control for 50V peak-to-peak (8 divisions) as indicated on the oscilloscope. See Figure 3-29.

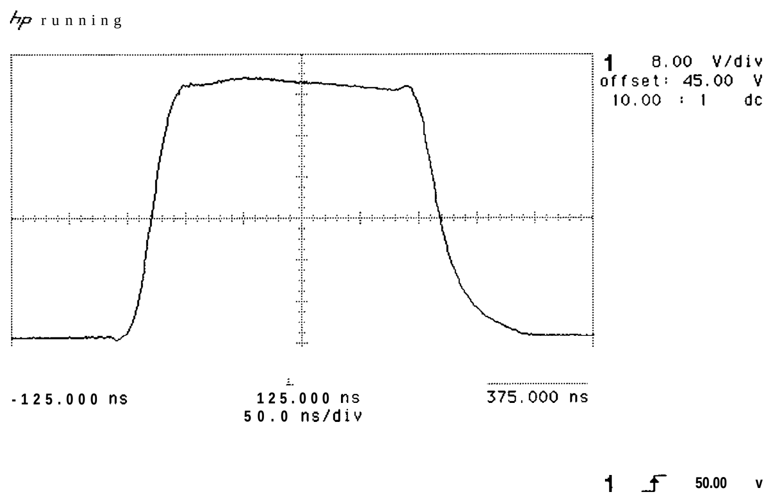


Figure 3-29. $50V_{p-p}$ Signal

31. Adjust A1A2R308 HF GAIN and A1A2C307 for minimum overshoot on rise and minimum rise and fall times of the pulse waveform.

32. Use the oscilloscope (ΔtΔV) markers to measure the risetime, falltime, and percent overshoot of the pulse waveform. Rise and falltimes should be less than 50 ns and 90 ns respectively. Overshoot on the rise should be less than 5% (approximately 0.4 divisions).

33. Set the spectrum analyzer's LINE switch to STANDBY and reconnect the cable to A1A2J5.

34. Disconnect the oscilloscope channel 1 probe from the spectrum analyzer. Remove the Display Adjustment PC board from the A3A2 slot, and reinstall the A3A2 Intensity Control Assembly. Replace the A3 Section cover and cables.

35. Reconnect the black connector with three wires (8, 98, and 96) to A1A2J5, and set A1A2R319 INT GAIN approximately two-thirds clockwise.

36. Perform Adjustment Procedure 4 Final Display Adjustment (SN 3004A and Above).

4. Final Display Adjustments (SN 3001A and Below)

Reference

A1A1 Keyboard
A1A2 Z Axis Amplifier
A1A4 X Deflection Amplifier
A1A5 Y Deflection Amplifier

Description

This procedure is used to optimize the appearance of the CRT display during routine maintenance or after CRT replacement or minor repairs. First, the display is adjusted for best focus over the full CRT, then the graticule pattern is adjusted for optimum rectangular display.

Note

Adjustment Procedure 2, High Voltage Adjustment (SN 3001A and Below) should be performed prior to performing the following adjustment procedure.

Procedure

1. With the spectrum analyzer LINE switch set to STANDBY, set the potentiometers listed in Table 3-5 as indicated. See Figure 3-30 for the location of the adjustments.

Note

In this procedure, do not adjust the following potentiometers and precision variable capacitors on the A1A2 Z-Axis Amplifier, A1A4 X-Axis Amplifier, or A1A5 Y-Axis Amplifier Assemblies: A1A2R36 INT LIMIT, A1A2R22 HF GAIN, A1A2C10, A1A4R28 HF GAIN, A1A4C10, A1A4C11, A1A5R28 HF GAIN, A1A5C10, or A1A5C11. These components are adjusted in Adjustment Procedure 2, High Voltage Adjustments (SN 3001A and Below) and Adjustment Procedure 3, Preliminary Display Adjustments (SN 3001A and Below).

Table 3-5. Initial Adjustment Positions

Adjustment	Position
Front-panel INTENSITY	fully clockwise
Front-panel FOCUS	centered
Front-panel ALIGN	centered
A1A2R5 INT GAIN	fully clockwise

2. Set the LINE switch to ON and wait at least 5 minutes to allow the CRT and high-voltage circuits to warm up. The spectrum analyzer power-up annotation should be visible on the CRT display.
3. For an initial coarse focus adjustment, adjust A1A3R15 FOCUS LIMIT, A1A2R36 ASTIG, and A1A2R30 FOCUS GAIN in sequence for best displayed results.
4. Adjust A1A4R7 X POSN, A1A4R27 X GAIN, A1A5R7 Y POSN, and A1A5R27 Y GAIN for optimum centering of the display annotation and graticule pattern.

4. Final Display Adjustments (SN 3001A and Below)

5. For best overall focusing of the display, adjust the following potentiometers in the sequence listed below:
   a. A1A3R14 FOCUS LIMIT for best focus of graticule lines (long vectors)
   b. A1A2R36 ASTIG
   c. A1A2R30 FOCUS GAIN for best focus of annotation (short vectors)
6. Adjust A1A2R31 ORTHO, the front-panel ALIGN control, and A1A2R32 PATT to optimize the orientation and appearance of the rectangular graticule pattern on the CRT display.
7. Repeat steps 4 through 6 as needed to optimize overall display focus and appearance.

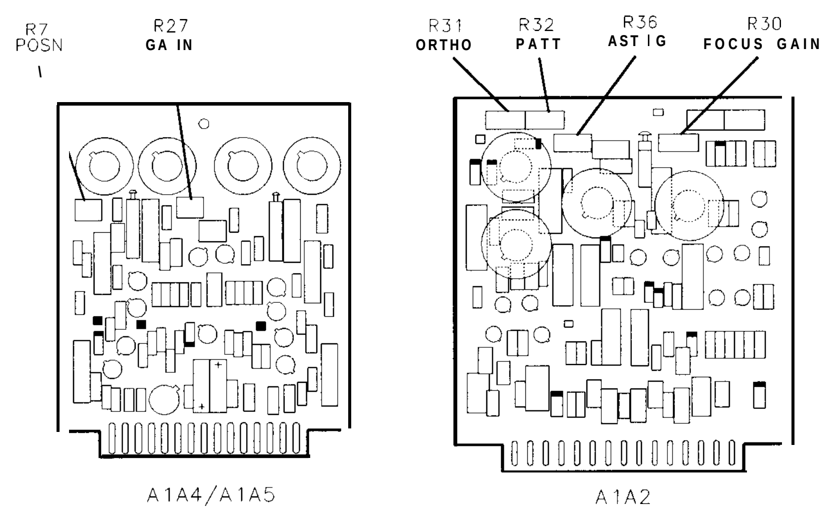


Figure 3-30.
Location of Final Display Adjustments on A1A2, A1A4, and A1A5

4. Final Display Adjustments (SN 3004A and Above)

Reference

A1A1 Keyboard
A1A2 X, Y, Z Axis Amplifiers

Description

This procedure is used to optimize the appearance of the CRT display during routine maintenance or after CRT replacement or minor repairs. First, the display is adjusted for best focus over the full CRT, then the graticule pattern is adjusted for optimum rectangular display.

Equipment

Digital Photometer .... Tektronix J-16, Option 02
Photometer Probe .... Tektronix 56503
Photometer interconnect cable .... Tektronix 012-0414-02
Photometer light occluder .... Tektronix 016-0305-00

Procedure

Note

Adjustment Procedure 2, High Voltage Adjustment (SN 3004A and Above) should be performed prior to performing the following adjustment procedure.

1. Connect the equipment as shown in Figure 3-31.

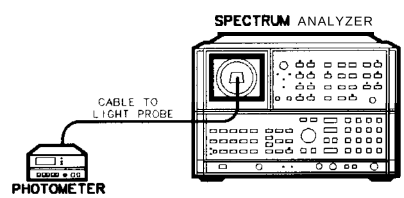


Figure 3-31. Final Display Adjustments Setup

2. Set the photometer probe to NORMAL. Press (POWER) on the photometer to turn it on and allow 30 minutes warm-up. Zero the photometer according to the manufacturer's instructions.
3. With the spectrum analyzer's LINE switch set to STANDBY, set the potentiometers listed in the Table 3-6 as indicated. See Figure 3-32 for the location of the adjustments.

Note

In this procedure, do not adjust the following potentiometers and variable capacitors on the A1A2 X, Y, Z Amplifier Assembly: C104, C109, C204, C209, C307, R117, R217, or R308. These components are adjusted in the factory and in Adjustment Procedure 3, Preliminary Display Adjustments (SN 3004A and Above).

4. Final Display Adjustments (SN 3004A and Above)

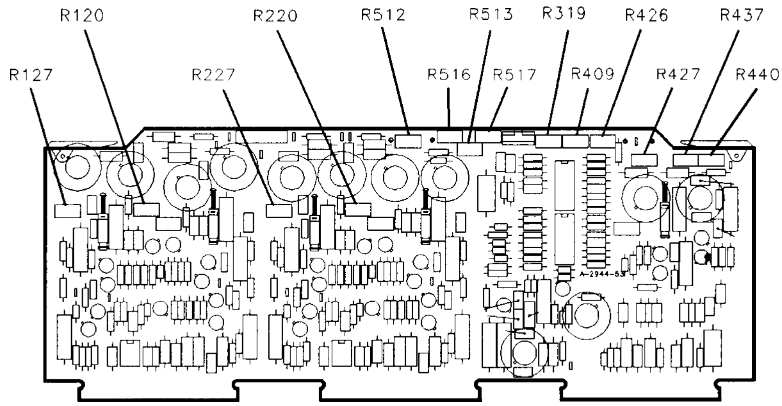


Figure 3-32. Location of Final Display Adjustments on A1A2

Table 3-6. Initial Adjustment Positions

Adjustment	Position
A1A2 R120 Y GAIN	centered
A1A2 R127 Y POSN	centered
A1A2 R220 X GAIN	centered
A1A2 R227 X POSN	centered
A1A2 R319 INT GAIN	two-thirds clockwise
A1A2 R409 FOCUS COMP	centered
A1A2 R426 T/B FOC	centered
Al A2 R427 T/B CTR	centered
Al A2 R437 R/L FOC	centered
A1A2 R440 R/L CTR	centered
A1A2 R512 ORTHO	centered
A1A2 R513 3D	centered
A1A2 R516 INT LIM	fully counterclockwise
A1A2 R517 ASTIG	centered
Front-panel INTENSITY	fully counterclockwise
Front-panel FOCUS	centered
Front-panel ALIGN	centered

4. Set the spectrum analyzer's LINE switch to ON, and wait at least 5 minutes to allow the CRT and high-voltage circuits to warm up.
5. Set the front panel INTENSITY control fully counterclockwise and adjust A1A2R516 INT LIM until the display is just visable. See Figure 3-32.
6. Set the front-panel INTENSITY control fully clockwise.
7. Adjust A1A2R220 X GAIN, A1A2R227 X POSN, A1A2R120 Y GAIN, and A1A2R127 Y POSN for optimum centering of the display annotation and graticule pattern.

8. For an initial coarse focus, adjust the following potentiometers in the sequence listed:

   A1A3R14 FOCUS LIMIT
   A1A2R517 ASTIG
   A1A2R513 3D
   A1A2R409 FOCUS COMP

9. Press (INSTR PRESET), then adjust the reference level to bring the displayed noise to the top division of the graticule. Press (CENTER dB/DIV) and key in 1 dB/DIV. The noise should now completely fill the CRT graticule pattern, illuminating a large rectangular area. If necessary, adjust the reference level until the graticule pattern is completely filled.

10. Press (SHIFT) (OFF)m and then (SHIFT) (OFF)o to turn off the CRT annotation and graticule pattern.

    Connect a 56503 photometer probe to the Tektronix J-16 digital photometer. Set the photometer to the Xl range.

11. Place the photometer light probe hood against the IF-Display Section glass RFI filter, and adjust A1A2R319 INT GAIN for a photometer reading of 80 NITS (cd/m^2).

Note

This reading must be made with the glass RFI filter in place in front of the CRT. It might be necessary to slightly trim the top and bottom of the photometer probe's hood so that it will fit flush against the glass RFI filter.

Note

If a standard J-16 photometer is used (instead of metric option 02), adjust A1A2R319 for a photometer reading of 23.5 fl (footlamberts).

12. Set the LINE switch to STANDBY and then back to ON. The spectrum analyzer power-up annotation should be visible on the CRT display. (This includes the firmware datecode.)

13. For the best focus near the center of the CRT display, adjust the following potentiometers in the sequence listed below. Repeat as needed to optimize center-screen focus.

    A1A3R14 FOCUS LIMIT
    A1A2R517 ASTIG
    A1A2R513 3D for best focus of annotation (short vectors)
    A1A2R409 FOCUS COMP for best focus of graticule lines (long vectors)

14. Adjust A1A2R426 T/B FOC for best focus at the top and bottom of the display.

15. Adjust A1A2R437 R/L FOC for best focus at the right and left sides of the display.

16. If the top and bottom (or right and left sides) of the display achieve best focus at different potentiometer settings, adjust A1A2R427 T/B CTR or A1A2R440 R/L CTR, and then readjust A1A2R426 T/B FOC or A1A2R437 R/L FOC to optimize overall focus.

4. Final Display Adjustments (SN 3004A and Above)

17. Adjust A1A2R512 ORTHO and the front-panel ALIGN control to optimize the orientation and appearance of the rectangular graticule pattern on the CRT display.
18. Repeat steps 13 through 17 as needed to optimize overall display focus and appearance.

5. Log Amplifier Adjustments

Reference

IF-Display Section
A4A3 Log Amplifier-Filter
A4A2 Log Amplifier-Detector

Related Performance Tests

Scale Fidelity Test

Note

The A4A3 Log Amplifier-Filter and A4A2 Log Amplifier Detector are temperature compensated as a matched set at the factory. In the event of a circuit failure, a new matched set must be ordered. Contact your nearest HP Service Center.

Description

First, the A4A2 Log Amplifier-Detector ZERO adjustment is checked and adjusted if necessary, then the A4A3 Log Amplifier-Filter is set for center frequency by injecting a signal and adjusting the bandpass filter center adjustment for maximum DVM indication. The bandpass filter amplitude is adjusted by monitoring the output of the filter control line shorted and not shorted to the + 15V supply. Next, log fidelity (gain and offset of the log curve) is adjusted by adjusting the -12 VTV and the PIN diode attenuator. Last, the linear gain step adjustments are performed to set the proper amount of step gain in the linear mode of operation.

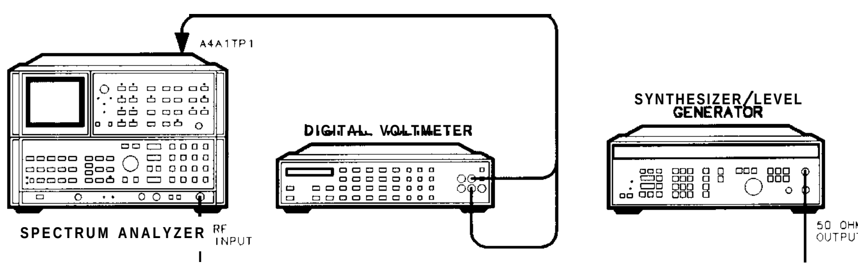


Figure 3-33. Log Amplifier Adjustments Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A
Frequency Synthesizer .... HP 3335A

Procedure

1. Position instrument upright as shown in Figure 3-33, with top cover removed.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Key in (FREQUENCY SPAN) 0 Hz, (CENTER FREQUENCY) 7.6 MHz, (REFERENCE LEVEL) + 10 dBm, (RES BW) 10 kHz, and press LIN pushbutton.

4. Connect DVM to A4A1TP1 and DVM ground to the IF casting. Connect the frequency synthesizer to the RF INPUT. Key in (FREQUENCY) 80 MHz and (AMPLITUDE) -86.98 dBm. The frequency synthesizer will now provide a 50Ω load.

Offset Adjustment Check

5. Adjust A4A2R79 ZERO for 0.0000 ±0.0005 V dc. See Figure 3-34 for location of adjustment.

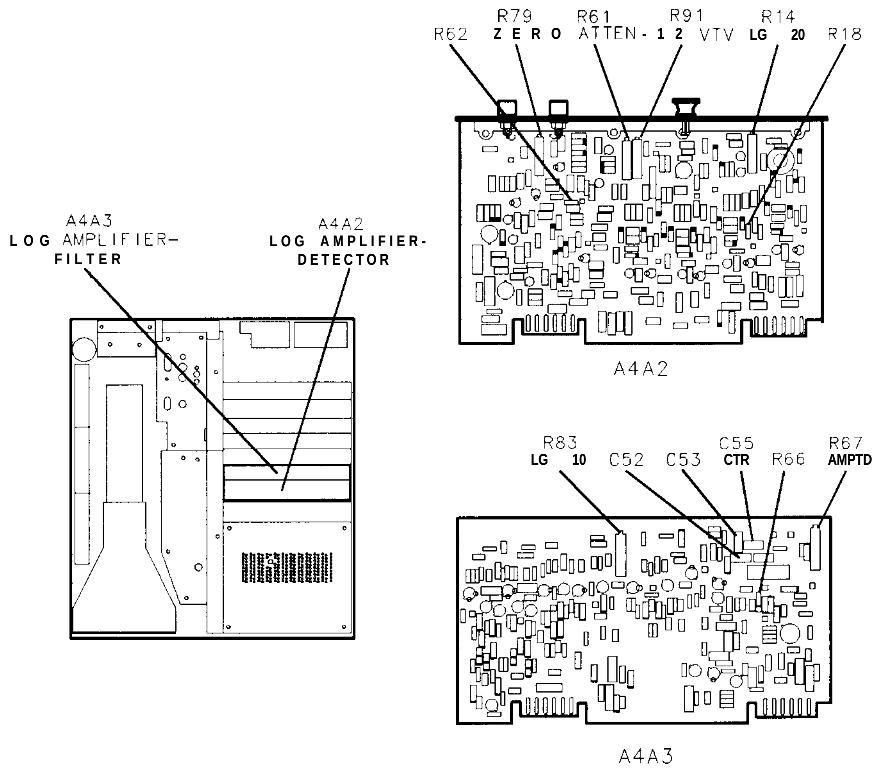


Figure 3-34. Location of Log Amplifier Adjustments

Bandpass Filter Center Adjustment

6. Press LOG (ENTER dB/DIV)
7. Set the frequency synthesizer for 7.6000 MHz at +5.0 dBm output level.
8. Adjust A4A3C55 CTR for maximum DVM indication. See Figure 3-34 for location of adjustment. If A4A3C55 is at an extreme of its adjustment range (fully meshed, maximum capacitance, or unmeshed, minimum capacitance), increase or decrease value of A4A3C52 and A4A3C53. Refer to Table 3-3 for range of values.

Note

A4A3C52 is a fine adjustment, and A4A3C53 is a coarse adjustment. If A4A3C55 is fully meshed, increase the value of A4A3C52 or A4A3C53.

Bandpass Filter Amplitude Adjustment

9. Connect one end of a jumper wire to A4A3TP8. Connect the other end of the jumper to A4A3TP7 (+ 15V). Connecting the jumper to A4A3TP8 first reduces the chance of shorting the + 15V to ground. Note DVM indication.

   ________ V dc

10. Remove the short from between A4A3TP7 and A4A3TP8.
11. Adjust A4A3R67 AMPTD for DVM indication the same as that noted in step 9 ±0.0005 V dc. See Figure 3-34 for location of adjustment. If unable to adjust A4A3R67 AMPTD for proper indication, increase or decrease value of A4A3R66. (If A4A3R67 is fully counter-clockwise, increase the value of A4A3R66.)

    Refer to Table 3-3 for range of values.
12. Repeat steps 9 through 11 until DVM indication is the same ±0.0005 V dc with A4A3TP7 jumpered to A4A3TP8, and with A4A3TP7 and A4A3TP8 not jumpered. Remove the jumper.

-12 VTV and ATTEN Adjustments

13. Press LIN pushbutton.
14. Adjust frequency synthesizer output level for DVM indication of + 1.000 ±0.0002 V dc.

    Synthesizer level: ________ dBm
15. Press LOG (ENTER dB/DIV)
16. Wait three minutes for the log assemblies to stabilize.
17. Decrease the frequency synthesizer output level by 50 dB.
18. Adjust A4A2R91 – 12 VTV for DVM indication of + 500 ± 1 mV dc. See Figure 3-34 for location of adjustment.
19. Increase the frequency synthesizer output level by 50 dB (to the level of step 14).
20. Adjust A4A2R61 ATTEN for DVM indication of + 1.000 ±0.0001 V dc. See Figure 3-34 for location of adjustment. If unable to adjust A4A2R61 ATTEN for proper indication, increase or decrease value of A4A2R62. (If A4A2R61 is fully clockwise, increase the value of A4A2R62.) Refer to Table 3-3 for range of values.
21. Repeat steps 17 through 20, until specifications of steps 18 and 20 are achieved without further adjustment. Because adjustments A4A2R61 and A4A2R91 are interactive, several iterations are needed.

Linear Gain Adjustments

22. Press LIN pushbutton. DVM indication at A4A1TP1 should be + 1.000 ±0.020 V dc (+ 0.980 to + 1.020 V dc). If indication is not within this range, repeat steps 14 through 21. If indication is within this range, press (SHIFT) (CENTER dB/div) q. This disables the IF step gains.

23. Decrease the frequency synthesizer's output level 10 dB. Press [REFERENCE LEVEL] 0 dBm, and adjust the frequency synthesizer's output level for a DVM indication of + 1.00 ±.001 Vdc.
24. Verify that attenuator is set at 10 dB. Decrease the frequency synthesizer output level by 10 dB. Press [REFERENCE LEVEL] -60 dB.
25. Adjust A4A3R83 LG10 for DVM indication of + 1.000 ±0.010 V dc. See Figure 3-34 location of adjustment. If unable to adjust LG10 for proper indication, increase or decrease value of A4A3R54. Refer to Table 3-3 for range of values.
26. Decrease the frequency synthesizer output level by 10 dB.
27. Key in [REFERENCE LEVEL] -70 dB.
28. Adjust A4A2R14 LG20 for DVM indication of + 1.000 ±0.010 V dc. See Figure 3-34 for location of adjustment. If unable to adjust LG20 for proper indication, increase or decrease value of A4A2R18. Refer to Table 3-3 for range of values.
29. Press [INSTR PRESET] to reenable IF Step Gains.

6. Video Processor Adjustments

Reference

IF-Display Section
A4A 1 Video Processor

Related Performance Test

Log Scale Switching Uncertainty Test

Description

The CAL OUTPUT signal is connected to the RF INPUT through a step attenuator. The instrument is placed in zero frequency span to produce a dc level output from the log amplifier. The A4A2 ZERO adjustment, which sets the dc offset of the output buffer amplifier of the log board, is checked and adjusted if necessary. The dc level into the video processor is adjusted by varying the input signal level and reference level. The offsets and gains on the A4A1 Video Processor are adjusted for proper levels using a DVM.

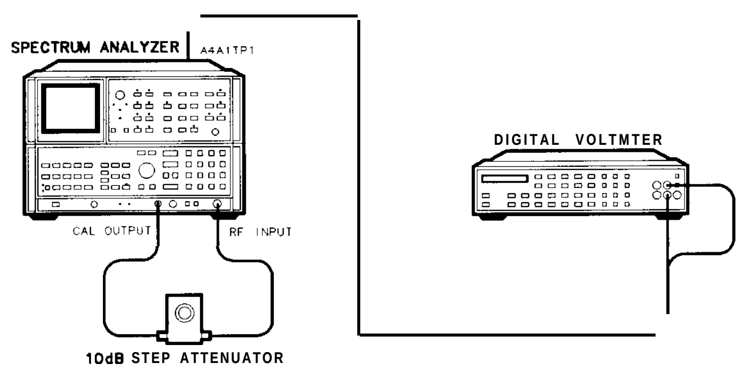


Figure 3-35. Video Processor Adjustments Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A
10 dB Step Attenuator .... HP 355D

Note

The voltage at A4A1TP3 may drift noticeably with temperature during this adjustment. Allow A4A1 (Video Processor) to warm up at least one-half hour prior to adjustment.

Procedure

1. Position instrument upright as shown in Figure 3-35. Remove the top cover.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect DVM to A4A1TP1 and DVM ground to the IF casting.
4. Connect CAL OUTPUT to RF INPUT through 10 dB step attenuator.
5. Key in [CENTER FREQUENCY) 20 MHz and [FREQUENCY SPAN) 0 Hz. Press LIN pushbutton.

6. Set step attenuator to 120 dB. DVM indication should be 0.000 ±0.0005 V dc. (If DVM indication is out of tolerance, adjust A4A2R79 ZERO on the log amplifier-detector board..)
7. Set step attenuator to 0 dB.
8. Key in (Reference Level) and adjust DATA knob for DVM indication as close to + 1.000 ±0.001 V dc as possible. (It may be necessary to slightly adjust the front panel AMPTD CAL control to achieve required tolerance.)
9. Connect DVM to A4A1TP2.
10. Adjust A4A1R14 OS for a DVM indication of 0.000 ±0.003 Vdc. See Figure 3-36 for **the** location of the adjustment.

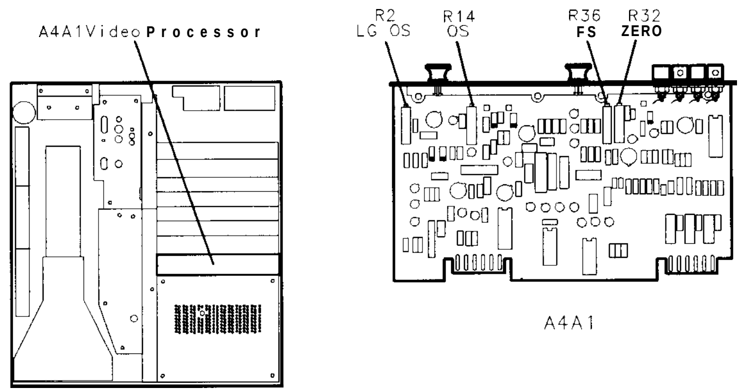


Figure 3-36. Location of Video Processor Adjustments

11. Connect the DVM to A4A1TP3.
12. Set the step attenuator to 120 dB.
13. Adjust A4A1R32 ZERO for a DVM indication of 0.000 ±0.001 Vdc.
14. Set the step attenuator to 0 dB.
15. Adjust A4A1R36 FS for DVM indication of +2.000 ± 0.001 V dc.
16. Repeat steps 12 through 15 until specifications of steps 13 and 15 are met.

LOG Offset Adjust

17. Set step attenuator to 40 dB.
18. Key in (SHIFT), (ATTEN) I, LOG (ENTER dB/DIV), **(SHIFT)** (ENTER dB/DIV q, (REFERENCE LEVEL] -50 dBm.
19. Connect DVM to A4A1TP1. Record DVM indication. Indication should be approximately +0.500 V dc.

_________ V de

20. Decrease reference level to -60 dBm using the step key.
21. Adjust A4A1R2 LG OS for DVM indication of +0.100 ±0.001 V dc greater than the DVM indication recorded in step 19. See Figure 3-36 for location of adjustment.

22. Decrease reference level to -70 dBm using the step key.
23. DVM indication should be +0.200 ● 0.002 V dc greater than the indication recorded in step 19. If not, readjust A4A1R2 LG OS.
24. Decrease reference level to -90 dBm using the step key.
25. DVM indication should be +0.400 ±0.004 V dc greater than the indication recorded in step 19. If not, readjust A4A1R2 LG OS.
26. Repeat steps 17 through 25 until the specifications are met.

7. 3 MHz Bandwidth Filter Adjustments

Reference

IF-Display Section
A4A7 3 MHz Bandwidth Filter

Related Performance Test

Resolution Bandwidth Switching Uncertainty Test
Resolution Bandwidth Selectivity Test

Description

With the CAL OUTPUT signal connected to the RF INPUT, the 18.4 MHz oscillator can be adjusted with the FREQ ZERO control (on the front panel) to peak the IF signal for maximum amplitude for the center of the 3 MHz bandpass. Each of the five stages of the 3 MHz Bandwidth Filter is adjusted for bandpass centering and symmetry. Four crystal filter bypass networks are required for alignment of the filter stages. See Figure 3-91 for information concerning the bypass networks.

A stable 21.4 MHz signal is then applied to the IF section of the instrument from a frequency synthesizer. Each of the first four stages of the 3 MHz Bandwidth Filter is peaked in a 10 Hz bandwidth using an oscilloscope display. The final stage is peaked using the spectrum analyzer CRT display.

After all five filter stages are adjusted for centering, symmetry, and peaking, the CAL OUTPUT signal is used to match the 10 Hz and 1 kHz bandwidth amplitudes.

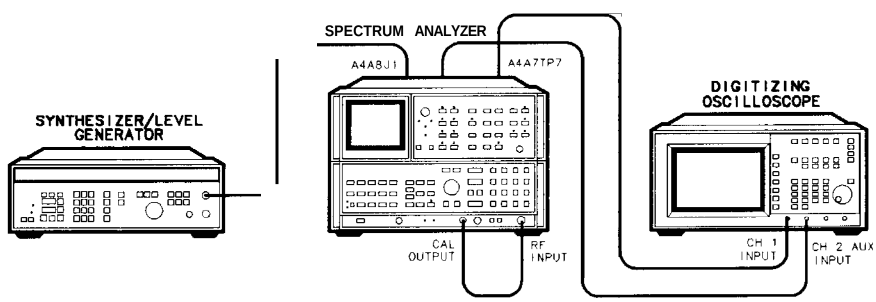


Figure 3-37. 3 MHz Bandwidth Filter Adjustments Setup

Equipment

Frequency Synthesizer HP3335A
Oscilloscope .... HP 54501A
Crystal Filter Bypass Network (4 required) See Figure 3-91
Test Cable: BNC to SMB snap-on .... HP 85680-60093

Procedure

1. Position instrument upright as shown in Figure 3-37 and remove top cover.
2. Set LINE switch to ON and press (INSTR PRESET).

Frequency Zero Check

3. Connect CAL OUTPUT signal to RF INPUT
4. Key in (RECALL) (9).
5. Adjust front panel FREQ ZERO control for maximum signal amplitude on the CRT display.

Filter Center and Symmetry Adjustments

6. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 10 kHz, (RES BW) 1 kHz, and press LIN pushbutton. Press (REFERENCE LEVEL) and adjust reference level, using step keys and front-panel knob to place signal peak near top CRT graticule line.
7. On the A4A7 assembly, connect crystal filter bypass networks between the pins above C41 SYM, C32 SYM, C23 SYM, and C14 SYM.
8. Adjust A4A7C7 CTR for minimum amplitude signal peak. Adjust A4A7C6 SYM for best symmetry of signal. Repeat adjustments to ensure that the signal is nulled and adjusted for best symmetry. See Figure 3-38 for location of adjustments.

Note

You may find it helpful to widen and narrow the frequency span of the instrument to adjust the bandpass symmetry and centering for each filter stage.

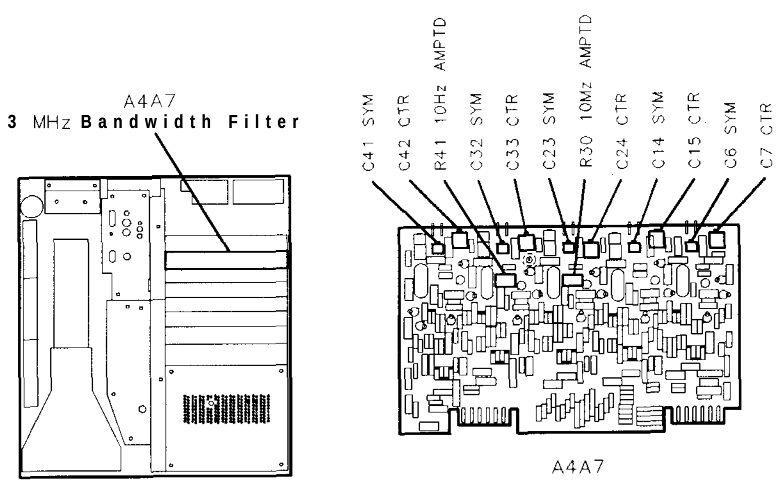


Figure 3-38.
Location of Center, Symmetry, and 10 Hz Amplitude Adjustments

9. Remove crystal filter bypass network near C14 SYM.

10. Adjust A4A7C15 CTR for minimum amplitude of signal peak. Adjust A4A7C14 SYM for best symmetry. Repeat adjustments to ensure that the signal is nulled and adjusted for best symmetry. See Figure 3-38 for location of adjustments.
11. Remove crystal filter bypass network near C23 SYM.
12. Adjust A4A7C24 CTR for minimum amplitude of signal peak. Adjust A4A7C23 SYM for best symmetry of signal. Repeat adjustments to ensure that signal is nulled and adjusted for best symmetry. See Figure 3-38 for location of adjustments.
13. Remove crystal filter bypass network near C32 SYM.
14. Adjust A4A7C33 CTR for minimum amplitude of signal peak. Adjust A4A7C32 SYM for best symmetry of signal. Repeat adjustments to ensure that signal is nulled and adjusted for best symmetry. See Figure 3-38 for location of adjustments.
15. Remove crystal filter bypass network near C41 SYM.
16. Adjust A4A7C42 CTR for minimum amplitude of signal peak. Adjust A4A7C41 SYM for best symmetry of signal. Repeat adjustments to ensure that the signal is nulled and adjusted for best symmetry. See Figure 3-38 for location of adjustments.
17. Signal should be centered on center graticule line on CRT display. If signal is not centered, go back to step 3 and repeat adjustments of each filter stage.

Filter Peak Adjust

18. Press (INSTR PRESET).
19. Key in (SWEEP TIME) 20 ms, (FREQUENCY SPAN) 0 Hz, (RES BW) 10 Hz, (REFERENCE LEVEL) -20 dBm.
20. Set the frequency synthesizer for 21.400 MHz at an amplitude level of -25.0 dBm.
21. Disconnect cable 97 (white/violet) from A4A8J1 and connect output of the frequency synthesizer to A4A8J1 using BNC to SMB snap-on cable.
22. Set the oscilloscope following settings:

    Channel 1
    amplitude . . . . 0.005 V/div
    time . . . .0.2 μs/div
    mag x . . . . 5 (vertical)
    coupling . . . .ac
    probe 10:1
    Channel 2
    amplitude 0.005V/div
    coupling . . . . ac
    probe 10:1

23. Connect oscilloscope Channel 1 probe to A4A7TP7 (left side of C14 SYM) and Channel B probe to A4A7TP5 (left side of C23 SYM).
24. Adjust frequency synthesizer output frequency to peak Channel 1 display.

25. Adjust A4A7C13 PK for maximum peak-to-peak signal on Channel 2 display. See Figure 3-39 for location of adjustment. If unable to achieve a “peak” in signal amplitude, increase or decrease value of A4A7C12. Refer to Table 3-3 for range of values.

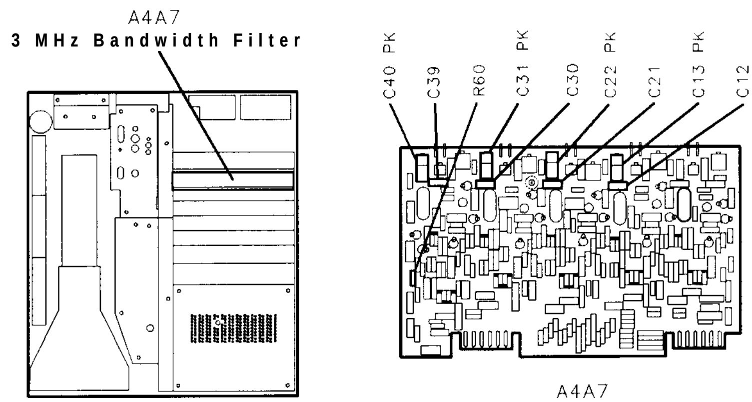


Figure 3-39. Location of 3 MHz Peak Adjustments

26. Move Channel 2 probe to A4A7TP3 (left side of C32 SYM).
27. Adjust frequency synthesizer output frequency to peak Channel 1 display.
28. Adjust A4A7C22 PK for maximum peak-to-peak signal on Channel 2 display. See Figure 3-39 for location of adjustment. If unable to achieve a “peak” in signal amplitude, increase or decrease value of A4A7C21. Refer to Table 3-3 for range of values.
29. Move Channel 2 probe to A4A7TP1 (left side of C41 SYM).
30. Adjust frequency synthesizer output frequency to peak Channel 1 display.
31. Adjust A4A7C31 PK for maximum peak-to-peak signal on Channel 2 display. See Figure 3-39 for location of adjustment. If unable to achieve a “peak” in signal amplitude, increase or decrease value of A4A7C30. Refer to Table 3-3 for range of values.
32. Disconnect Channel 2 probe from A4A7TP1.
33. Adjust frequency synthesizer output frequency to peak Channel 1 display.
34. Adjust [REFERENCE LEVEL] using step keys to place signal near top CRT graticule line.
35. Adjust A4A7C40 PK for maximum signal amplitude on the CRT display. See Figure 3-39 for the location of adjustment. If unable to achieve a “peak” in signal amplitude, increase or decrease value of A4A7C39. Refer to Table 3-3 for range of values.
36. Disconnect Channel 1 probe from A4A7TP7. Disconnect ‘frequency synthesizer output from A4A8J1 and reconnect cable 97 (white/violet).

10 Hz Amplitude Adjustments

37. Connect CAL OUTPUT to RF INPUT. Key in (INSTR PRESET), (RECALL) 9, (RES BW) 10 Hz.
38. Adjust the instrument front panel FREQ ZERO control for maximum signal amplitude on the CRT display.
39. Key in (RES BW) 1 kHz and DISPLAY LINE (ENTER). h e DATA knob, place the display line at the signal trace.
40. Key in (RES BW) 10 Hz.
41. Adjust the instrument front panel FREQ ZERO control for maximum signal amplitude on the CRT display.
42. Adjust A4A7R30 10 Hz AMPTD and A4A7R41 10 Hz AMPTD equal amounts to set the signal level the same as the reference level set in step 39. See Figure 3-38 for location of 10 Hz AMPTD adjusts.
43. Repeat steps 37 through 42 until no further adjustment is required.

8. 21.4 MHz Bandwidth Filter Adjustments

Reference

IF-Display Section
A4A4 Bandwidth Filter
A4A8 Attenuator-Bandwidth Filter

Related Performance Tests

IF Gain Uncertainty Test
Resolution Bandwidth Switching Uncertainty test
Resolution Bandwidth Selectivity Test

Description

First the LC Filters (100 kHz to 3 MHz bandwidths) on the A4A4 Bandwidth Filter are adjusted. The crystal filter poles (3 kHz to 30 kHz bandwidths) are then adjusted for center and symmetry by bypassing all but one pole at a time and adjusting the active pole.

Next, the LC filters and the crystal filter poles on the A4A8 Attenuator-Bandwidth Filter are adjusted in the same manner as on the A4A4 Bandwidth Filter.

Last, the 10 dB and 20 dB attenuators on the A4A8 Attenuator-Bandwidth Filter are adjusted for the proper amount of attenuation. This is done by connecting the CAL OUTPUT signal to the RF INPUT through two step attenuators, keying in the necessary reference level to activate the 10 dB and the 20 dB control lines, adjusting the step attenuators to compensate for the attenuation, and adjusting the attenuators for the proper amount of attenuation.

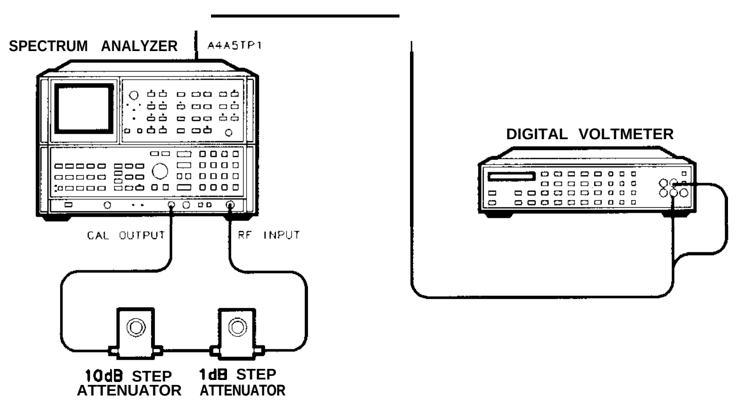


Figure 3-40. 21.4 MHz Bandwidth Filter Adjustments Setup

8. 21.4 MHz Bandwidth Filter Adjustments

Equipment

Digital Voltmeter (DVM) . . . . .HP 3456A
10 dB Step Attenuator . . . . HP 355D, Option H89
1 dB Step Attenuator . . . . HP 355C, Option H25
Crystal Filter Bypass Network (2 required) . . . . Refer to Figure 3-91

Procedure

1. Position instrument upright as shown in Figure 3-40 and remove top cover.
2. Set LINE switch to ON and press (INSTR PRESET).

+ 10 V Temperature Compensation Supply Check

3. Connect DVM to A4A5TP1 (+ 10 VF).
4. DVM indication should be between +9.0 V dc and + 10.0 V dc. If voltage is within tolerance, proceed to next step. If voltage is not within tolerance, refer to Adjustment 10, Step Gain and 18.4 MHz Local Oscillator Adjustments, for adjustment procedure.

A4A4 LC Adjustments

5. Set step attenuators to 0 dB.
6. Disconnect cable 97 (white/violet) from A4A8J1 and connect to A4A6J1.
7. Key in (CENTER FREQ) 20 MHz, (RES BW) 100 kHz, (FREQUENCY SPAN) 200 kHz, and press LIN pushbutton.
8. Press (REFERENCE LEVEL) and adjust front-panel knob to set signal peak on screen two divisions from the top graticule.
9. Adjust A4A4C67 LC CTR and A4A4C19 LC CTR for maximum MARKER level as indicated by CRT annotation. See Figure 3-41 for location of adjustments. If unable to adjust LC CTR adjustments for satisfactory signal amplitude, increase or decrease value of A4A4C17 and A4A4C70. Refer to Table 3-3 for range of values.

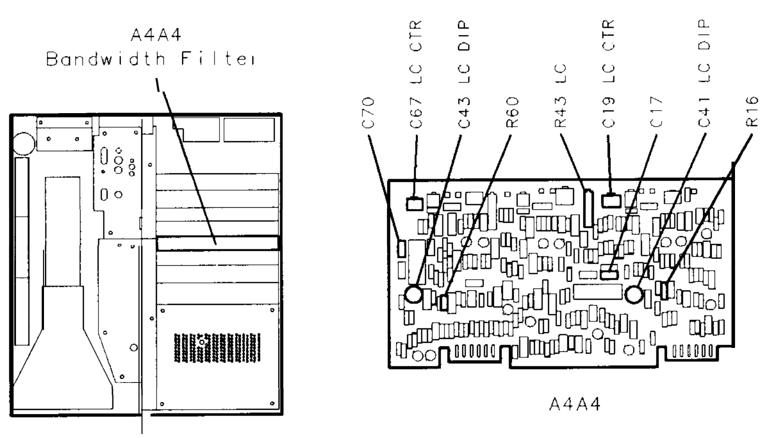


Figure 3-41.
Location of A4A4 21.4 MHz LC Filter Adjustments

10. Key in (RES BW) 1 MHz, and (SPAN) 1 MHz.
11. Press MARKER (PEAK SEARCH), MARKER (Δ).
12. Key in (RES BW) 100 kHz, (FREQ SPAN) 200 kHz, and MARKER (PEAK SEARCH).
13. Adjust A4A4R43 LC to align markers on display. MARKER Δ level should indicate 1.00 X. See Figure 3-41 for location of adjustment.
14. Repeat steps 10 through 13 until no further adjustment is necessary.

A4A4 XTAL Adjustments

15. Press MARKER (OFF). Key in (RES BW) 30 kHz and (FREQUENCY SPAN) 100 kHz.
16. Press (REFERENCE LEVEL) and adjust DATA knob to set signal peak on screen two divisions from the top graticule line.
17. Connect crystal filter bypass networks between A4A4TP1 and A4A4TP2 and between A4A4TP4 and A4A4TP5.
18. Adjust A4A4C20 CTR to center signal on center graticule line. Adjust A4A4C9 SYM for best symmetry of signal. See Figure 3-42 for location of adjustments. If unable to adjust SYM for satisfactory signal symmetry, increase or decrease value of A4A4C10. Refer to Table 3-3 for range of values.

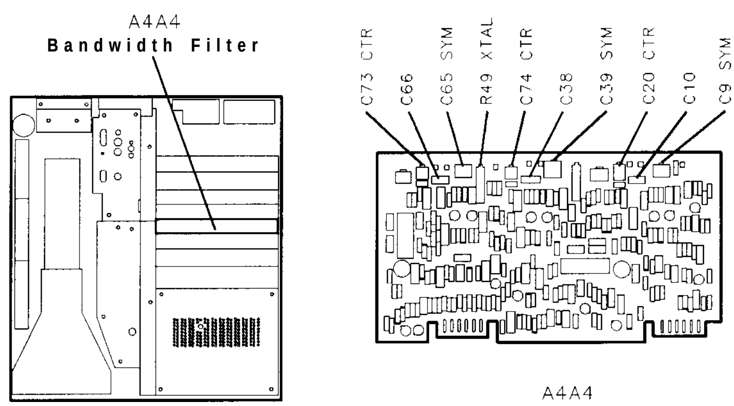


Figure 3-42. Location of A4A4 21.4 MHz Crystal Filter Adjustments

19. Remove crystal filter bypass network from between A4A4TP4 and A4A4TP5.
20. Adjust A4A4C74 CTR to center signal on center graticule line. Adjust A4A4C39 SYM for best symmetry of signal. See Figure 3-42 for location of adjustments. If unable to adjust A4A4C39 SYM for satisfactory signal symmetry, increase or decrease value of A4A4C38. Refer to Table 3-3 for range of values.
21. Remove crystal filter bypass network from between A4A4TP1 and A4A4TP2.

22. Adjust A4A4C73 CTR to center signal on center graticule line. Adjust A4A4C65 SYM for best symmetry of signal. See Figure 3-42 for location of adjustments. If unable to adjust A4A4C65 SYM for satisfactory signal symmetry, increase or decrease value of A4A4C66. Refer to Table 3-3 for range of values.
23. All crystal filter bypass networks are removed. Signal should be centered and symmetrical. If not, go back to step 16 and repeat adjustments.
24. Press MARKER (PEAK SEARCH] and MARKER In].
25. Key in (FREQUENCY SPAN] 20 kHz, (RES BW) 3 kHz, and MARKER (PEAK SEARCH].
26. Adjust A4A4R49 XTAL to align markers on display. MARKER A level should indicate 1.00 X. See Figure 3-42 for location of adjustment.

A4A8 LC Adjustments

27. Disconnect cable 97 (white/violet) from A4A6J1 and reconnect to A4A8J1. Reconnect cable 89 (gray/white) to A4A6J1.
28. Key in (RES BW) 100 kHz and [FREQUENCY SPAN] 200 kHz.
29. Press [REFERENCE LEVEL) and adjust DATA knob to place signal peak two division from the top graticule line.
30. Adjust A4A8C32 LC CTR and A4A8C46 LC CTR for maximum MARKER level as indicated by CRT annotation. See Figure 3-43 for location of adjustments. If unable to adjust A4A8C32 and A4A8C46 LC CTR adjustments for satisfactory signal amplitude, increase or decrease value of A4A8C35 and A4A8C49. Refer to Table 3-3 for range of values.

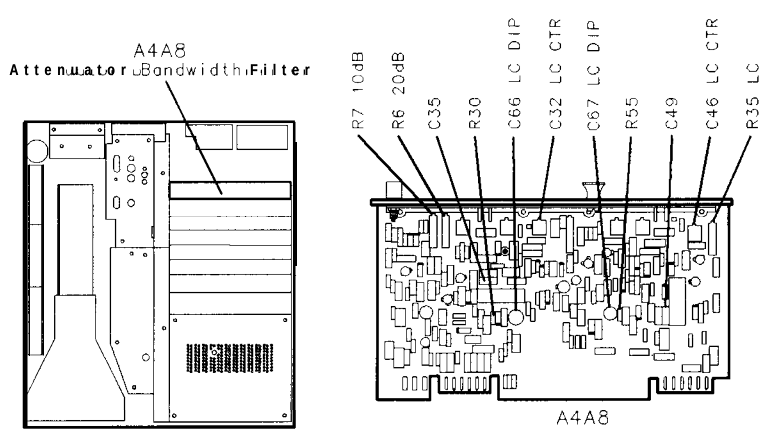


Figure 3-43.
Location of A4A8 21.4 MHz LC Filter and Attenuation Adjustments

31. Key in (RES BW) 1 MHz and (FREQ SPAN) 1 MHz.
32. Press MARKER (PEAK SEARCH] and MARKER (Δ).

33. Key in (RES BW) 100 kHz, (FREQ SPAN) 200 kHz, and MARKER [PEAK SEARCH].
34. Adjust A4A8R35 LC to align makers on display. MARKER A level should indicate 1.00 X. See Figure 3-43 for location of adjustment.
35. Repeat steps 31 through 34 until no further adjustment is necessary.

A4A8 XTAL Adjustments

36. Key in (RES BW) 30 kHz, [FREQUENCY SPAN] 100 kHz. Press MARKER (OFF).
37. Connect crystal filter bypass network between A4A8TP1 and A4A8TP2.
38. Press (REFERENCE LEVEL) and adjust DATA knob to place signal peak two division from the top graticule line.
39. Adjust A4A8C44 CTR to center signal on center graticule line. Adjust A4A8C42 SYM for best symmetry of signal. See Figure 3-44 for location of adjustments. If unable to adjust A4A8C42 SYM for satisfactory signal symmetry, increase or decrease value of A4A8C43. Refer to Table 3-3 for range of values.

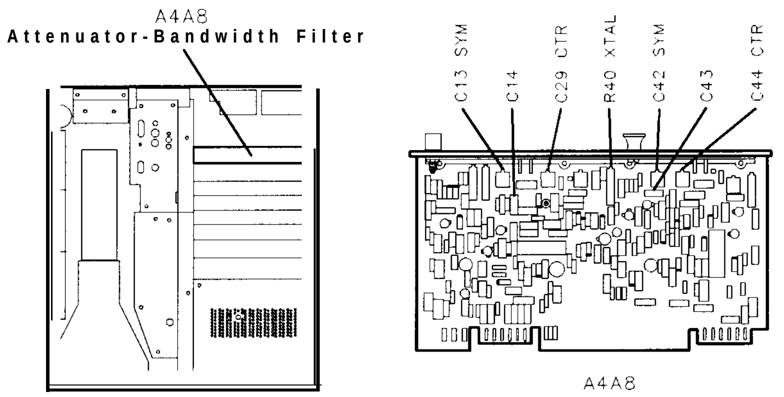


Figure 3-44. Location of A4A8 21.4 MHz Crystal Filter Adjustments

40. Remove crystal filter bypass network from between A4A8TP1 and A4A8TP2.
41. Adjust A4A8C29 CTR to center signal on center graticule line. Adjust A4A8C13 SYM for best symmetry of signal. See Figure 3-44 for location of adjustments. If unable to adjust A4A8C13 SYM for satisfactory signal symmetry, increase or decrease value of A4A8C14. Refer to Table 3-3 for range of values.
42. Press MARKER (PEAK SEARCH) and MARKER (Δ)
43. Key in [FREQUENCY SPAN] 10 kHz.
44. Key in (RES BW) 3 kHz and MARKER (PEAK SEARCH).

45. Adjust A4A8R40 XTAL to align markers on display. MARKER A level should indicate 1.00 X. See Figure 3-44 for location of adjustment.

LC Dip Adjustments

46. Refer to the Resolution Bandwidth Switching Uncertainty Performance Test, and check all bandwidth amplitudes. If amplitude of 300 kHz bandwidth is low but amplitude of 100 kHz and 1 MHz bandwidths are within tolerance, LC DIP adjustments must be performed. If all bandwidth amplitudes are within tolerance, do not perform the following adjustments.
47. Set LINE switch to STANDBY.
48. Disconnect cable 97 (white/violet) from A4A8J1 and connect to A4A6J1.
49. Remove A4A4 Bandwidth Filter and install on extenders.
50. Set LINE switch to ON. Press (INSTR PRESET).
51. Key in [CENTER FREQUENCY] 20 MHz, (RES BW) 100 kHz, (FREQUENCY SPAN] 1 MHz, (ATTEN) 0 dB, and LOG (ENTER dB/DIV) 2 dB.
52. Short A4A4TP3 to ground.
53. Adjust. A4A4C41 LC DIP for minimum amplitude of signal peak. See Figure 3-41 for location of adjustment. Key in (PEAK SEARCH) MARKER (Δ), and adjust LC DIP again to offset the signal peak approximately -17 kHz (to the left). This is done to compensate for the effect of placing the board on extenders. If unable to achieve a "dip" in signal amplitude, increase or decrease value of A4A4R16. Refer to Table 3-3 for range of values.
54. Remove short, from A4A4TP3 and short A4A4TP8 to ground.
55. Adjust A4A4C43 LC DIP for minimum amplitude of signal peak. See Figure 3-41 for location of adjustment. Key in [PEAK SEARCH) MARKER In], and adjust C43 LC DIP again to offset the signal peak approximately -17 kHz (to the left). If unable to achieve a "dip" in signal amplitude, increase or decrease value of A4A4R60. Refer to Table 3-3 for range of values.
56. Set LINE switch to STANDBY.
57. Reinstall A4A4 Bandwidth Filter without extenders. Short A4A4TP3 and A4A4TP8 to ground. Remove A4A8 Attenuator-Bandwidth Filter and install on extenders. Reconnect cable 97 to A4A8J1 and reconnect cable 89 to A4A6J1.
58. Set, LINE switch to ON. Press (INSTR PRESET).
59. Key in [CENTER FREQUENCY) 20 MHz, (RES BW) 100 kHz, (FREQUENCY SPAN) 1 MHz, (ATTEN) 0 dB, and LOG (ENTER dB/DIV) 2 dB.
60. Short A4A8TP6 to ground.
61. Adjust A4A8C66 LC DIP for minimum amplitude of signal peak. See Figure 3-43 for location of adjustment. Key in (PEAK SEARCH) MARKER (Δ), and adjust LC DIP again to offset the signal peak

approximately -17 kHz (to the left). If unable to achieve a "dip" in signal amplitude, increase or decrease value of A4A8R30. Refer to Table 3-3 for range of values.

62. Remove short from A4A8TP6 and short A4A8TP3 to ground.
63. Adjust A4A8C67 LC DIP for minimum amplitude of signal peak. See Figure 3-43 for location of adjustment. Key in [PEAK SEARCH] MARKER [Δ], and adjust LC DIP again to offset the signal peak approximately -17 kHz (to the left). If unable to achieve a "dip" in signal amplitude, increase or decrease value of A4A8R55. Refer to Table 3-3 for range of values.
64. Set LINE switch to STANDBY.
65. Reinstall A4A8 Attenuator-Bandwidth Filter without extenders. Remove short. from A4A8TP3.
66. Set LINE switch to ON. Press [INSTR PRESET].
67. Go back and repeat LC adjustments for both the A4A4 Bandwidth filter and the A4A8 Attenuator-Bandwidth Filter.

AlOdB and A20dB Adjustments

68. Set, step attenuators to 25 dB.
69. Key in [CENTER FREQUENCY] 20 MHz, [FREQUENCY SPAN] 3 kHz, [ATTEN] 0 dB, [RES BW] 1 kHz, and [REFERENCE LEVEL] -30 dBm.
70. Key in LOG [ENTER dB/DIV] 1 dB then press MARKER [PEAK SEARCH] MARKER [Δ]
71. Key in [REFERENCE LEVEL] -20 dBm. Set step attenuators to 15 dB.
72. Adjust A4A8R7 AlOdB to align markers on display. MARKER A level should indicate 0.00 dB. See Figure 3-43 for location of adjustment.
73. Key in [REFERENCE LEVEL] -10 dBm. Set step attenuators to 5 dB.
74. Adjust A4A8R6 A20dB to align markers on display. MARKER A level should indicate 0.00 dB. See Figure 3-43 for location of adjustment.

9. 3 dB Bandwidth Adjustments

Reference

IF-Display Section
A4A9 IF Control

Related Performance Test

Resolution Bandwidth Accuracy Test

Description

The CAL OUTPUT signal is connected to the RF INPUT. Each of the adjustable resolution bandwidths is selected and adjusted for the proper bandwidth at the 3 dB point.

Note

Do not perform this adjustment on Option 462 instruments. Option 462 instruments require a different procedure. Adjustment 9 for Option 462 (6 dB or Impulse Bandwidth) is located in Chapter 4, Option 462.

Equipment

No test equipment is required for this adjustment.

Procedure

1. Position instrument upright and remove top cover.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect CAL OUTPUT to RF INPUT.
4. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 5 MHz, LIN, and (RES BW) 3 MHz.
5. Press (REFERENCE LEVEL) and adjust DATA knob to place signal peak near top CRT graticule line. Signal should be centered about the center line on the graticule. If not, press (PEAK SEARCH) and (MRK → CF).
6. Press MARKER (Δ).
7. Using DATA knob, adjust marker down one side of the displayed signal to the 3 dB point; CRT MKR Δ annotation indicates .707 X.
8. Adjust A4A9R60 3 MHz for MKR Δ indication of 1.5 MHz while maintaining marker at 3 dB point (.707 X) using DATA knob. See Figure 3-45 for location of adjustment.

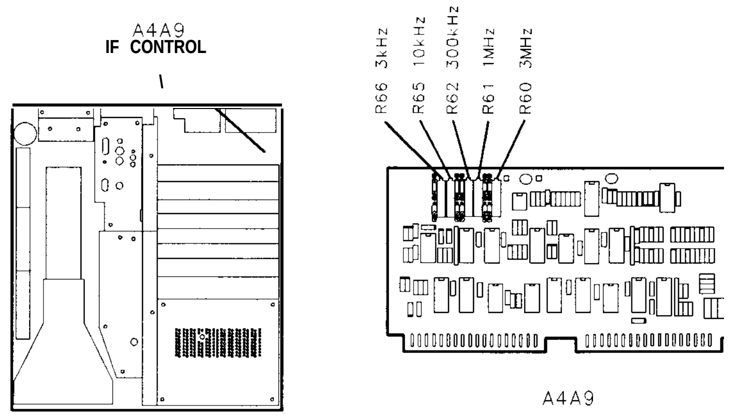


Figure 3-45. Location of 3 dB Bandwidth Adjustments

9. Press MARKER (Δ). Adjust marker to 3 dB point on opposite side of signal (CRT MKR A annotation indicates 1.00 X). There are now two markers; one on each side of the signal at the 3 dB points.
10. CRT MKR A annotation now indicates the 3 dB bandwidth of the 3 MHz bandwidth. 3 dB bandwidth should be 3.00 ±0.60 MHz.
11. Key in (RES BW) 1 MHz and [FREQUENCY SPAN] 2 MHz. If necessary, readjust [REFERENCE LEVEL] (CENTER FREQUENCY), using DATA knob to place signal peak near top of graticule and centered on center graticule line.
12. Press MARKER [OFF), then MARKER (Δ).
13. Using DATA knob, adjust marker down one side of displayed signal to the 3 dB point; CRT MKR A annotation indicates .707 X.
14. Adjust A4A9R61 1 MHz for MKR A indication of 500 kHz while maintaining marker at 3 dB point (.707 X) using DATA knob. See Figure 3-45 for location of adjustment.
15. Press MARKER (Δ). Adjust marker to 3 dB point on opposite side of signal (CRT MKR A annotation indicates 1.00 X). There are now two markers; one on each side of the signal at the 3 dB point.
16. CRT MKR A annotation now indicates the 3 dB bandwidth of the 1 MHz bandwidth. 3 dB bandwidth should be 1.00 ±0.10 MHz.
17. Key in (RES BW) 300 kHz and (FREQUENCY SPAN) 500 kHz. If necessary, readjust (REFERENCE LEVEL) and [CENTER FREQUENCY], using DATA knob to place signal peak near top of graticule and centered on center graticule line.
18. Press MARKER (OFF), then MARKER (Δ).
19. Using DATA knob, adjust marker down one side of the displayed signal to the 3 dB point; CRT MKR A annotation indicates .707 X.
20. Adjust A4A9R62 300 kHz for MKR A indication of 150 kHz while maintaining marker at 3 dB point (.707 X) using DATA knob. See Figure 3-45 for location of adjustment.
21. Press MARKER (Δ). Adjust marker to 3 dB point on opposite side of signal (CRT MKR A annotation indicates 1.00 X).

22. CRT MKR A annotation now indicates the 3 dB bandwidth of the 300 kHz bandwidth. 3 dB bandwidth should be 300.0 ±30.0 kHz.
23. Key in (RES BW) 10 kHz and [FREQUENCY SPAN) 20 kHz. If necessary, readjust (REFERENCE LEVEL) and [CENTER FREQUENCY), using DATA knob to place signal peak near top of graticule and centered on center graticule line.
24. Press MARKER (OFF), then MARKER [ ].
25. Using DATA knob, adjust marker down one side of the displayed signal to the 3 dB point; CRT MKR A annotation indicates .707 X.
26. Adjust A4A9R65 10 kHz for MKR A indication of 5.00 kHz while maintaining marker at 3 dB point (. 707 X) using DATA knob. See Figure 3-45 for location of adjustment.
27. Press MARKER A. Adjust marker to 3 dB point on opposite side of signal (CRT MKR A annotation indicates 1.00 X).
28. CRT MKR A annotation now indicates the 3 dB bandwidth of the 10 kHz bandwidth. 3 dB bandwidth should be 10.0 fl.O kHz.
29. Key in (RES BW) 3 kHz and (FREQUENCY SPAN) 5 kHz. If necessary, readjust [REFERENCELEVEL) and [CENTER FREQUENCY], using DATA knob to place signal peak near top of graticule and centered on center graticule line.
30. Press MARKER (OFF), then MARKER (Δ).
31. Using DATA knob, adjust marker down one side of the displayed signal to the 3 dB point; CRT MKR A annotation indicates .707 X.
32. Adjust A4A9R66 3 kHz for MKR A indication of 1.5 kHz while maintaining marker at 3 dB point (.707 X) using DATA knob. See Figure 3-45 for location of adjustments.
33. Press MARKER (Δ). Adjust marker to 3 dB point on opposite side of signal (CRT MKR A annotation indicates 1.00 X).
34. CRT MKR A annotation now indicates the 3 dB bandwidth of the 3 kHz bandwidth. 3 dB bandwidth should be 3.00 ±0.30 kHz.

10. Step Gain and 18.4 MHz Local Oscillator Adjustments

Reference

IF-Display Section
A4A7 3 MHz Bandwidth Filter
A4A5 Step Gain

Related Performance Tests

Resolution Bandwidth Selectivity Test
IF Gain Uncertainty Test
Center Frequency Readout Accuracy Test

Description

First, the IF signal from the RF Section is measured with a power meter and adjusted for proper level. Next, the 10 dB gain steps are adjusted by connecting the CAL OUTPUT signal through two step attenuators to the RF INPUT and keying in the REFERENCE LEVEL necessary to activate each of the gain steps, while compensating for the increased gain with the step attenuators.

The 1 dB gain steps are checked in the same fashion as the 10 dB gain steps, and then the variable gain is adjusted. The 18.4 MHz oscillator frequency is adjusted to provide adequate adjustment range of front-panel FREQ ZERO control; and last, the + 10V temperature compensation supply used by the A4A4 Bandwidth Filter and A4A8 Attenuator-Bandwidth Filter is checked and adjusted if necessary.

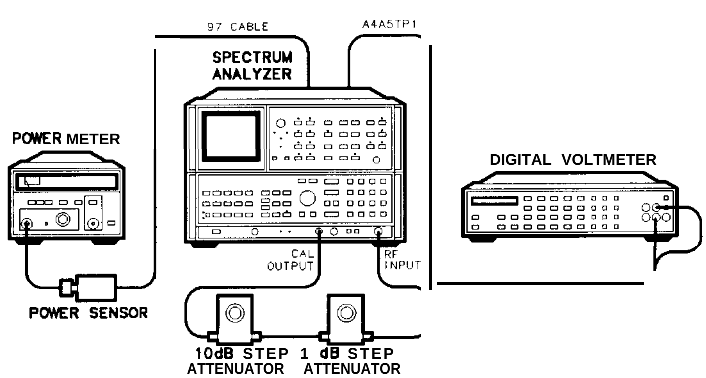


Figure 3-46. Step Gain and 18.4 MHz Local Oscillator Adjustments Setup

10. Step Gain and 18.4 MHz Local Oscillator Adjustments

Equipment

Digital Voltmeter (DVM) .... HP 3456A
Power Meter .... HP 436A
Power Sensor .... HP 8481A
10 dB Step Attenuator .... HP 355D, Option H89
1 dB Step Attenuator .... HP 355C, Option H25

Procedure

1. Position instrument upright as shown in Figure 3-46 and remove top cover.
2. The validity of the results of this adjustment procedure is based in part on the performance of the Log Amplifiers, the Video Processor, and the Track and Hold. These adjustments must be done before proceeding with the adjustment procedure of the Step Gain and 18.4 MHz Local Oscillator.
3. Set instrument LINE switch to ON and press (INSTR PRESET). Connect CAL OUTPUT to RF INPUT.
4. Key in [CENTER FREQUENCY] 20 MHz, [REFERENCE LEVEL] -10 dBm, (ATTEN) 0 dB, [FREQUENCY SPAN] 0 Hz, (RES BW) 1 kHz, (VIDEO BW) 100 Hz, and [SWEEP TIME] 20 ms.

IF Gain Adjustment

5. Disconnect cable 97 (white/violet) from A4A8J1 and connect cable to power meter/power sensor. Refer to Figure 3-47 for location of cable 97 and A4A8J1.
6. Adjust front-panel AMPTD CAL adjustment for a power meter indication of -5 dBm.
7. Disconnect power meter and reconnect cable 97 to A4A8J1.
8. Press LIN pushbutton and MARKER (NORMAL).
9. Note MARKER amplitude in mV and adjust A45A5R33 CAL to 70.7 mV (top CRT graticule line). See Figure 3-47 for location of adjustment.

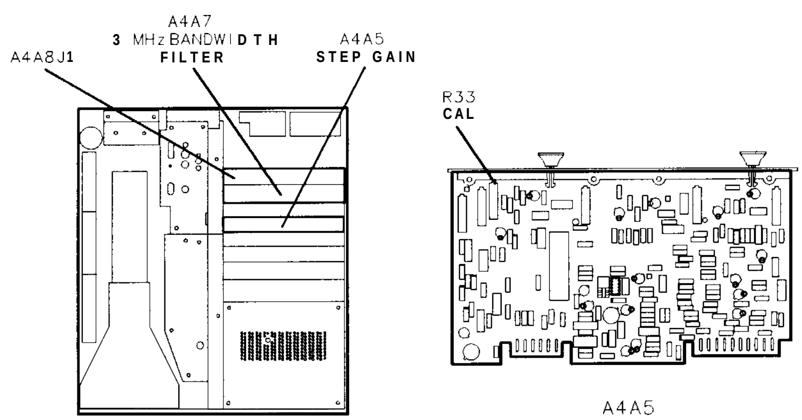


Figure 3-47. Location of IF Gain Adjustment

10. If A4A5R33 CAL adjustment does not have sufficient range to adjust trace to the top CRT graticule line, increase or decrease the value of A4A7R60 as necessary to achieve the proper adjustment range of A4A5 CAL adjustment. See Figure 3-39 for the location of A4A7R60. Refer to Table 3-3 for range of values for A4A7R60.

10 dB Gain Step Adjustment

11. Connect CAL OUTPUT to RF INPUT through 10 dB step attenuator and 1 dB step attenuator.
12. Key in LOG (ENTER dB/DIV) 1 dB and [REFERENCE LEVEL] -30 dBm.
13. Set step attenuators to 25 dB.
14. Key in MARKER A. Signal trace should be at the center CRT graticule line, and MKR A level, as indicated by CRT annotation, should be .OO dB.
15. Key in [REFERENCE LEVEL] -40 dBm. Set step attenuators to 35 dB.
16. Adjust A4A5R32 SG10 for MKR A level of .OO dB (CRT MKR A annotation is now in upper right corner of CRT display). See Figure 3-48 for location of adjustment.

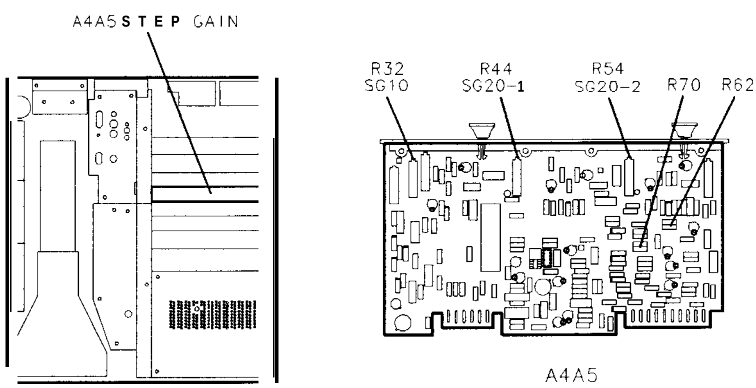


Figure 3-48. Location of 10 dB Gain Step Adjustments

17. If A4A5R32 SG10 adjustment does not have sufficient range to perform adjustment in step 16, increase or decrease the value of A4A7R60 as necessary to achieve the proper adjustment range of A4A5 SG10. See Figure 3-39 for the location of A4A7R60. Refer to Table 3-3 for range of values for A4A7R60. Repeat steps 3 through 16 if the value of A4A7R60 is changed.
18. Key in [REFERENCE LEVEL] -50 dBm. Set step attenuators to 45 dB.
19. Adjust A4A5R44 SG20-1 for MKR A level of .OO dB. See Figure 3-48 for location of adjustment.
20. Key in (REFERENCE LEVEL) -70 dBm. Set step attenuators to 65 dB.
21. Adjust A4A5R54 SG20-2 for MKR A level of .OO dB. See Figure 3-48 for location of adjustment.

10. Step Gain and 18.4 MHz Local Oscillator Adjustments

1 dB Gain Step Checks

22. Key in [REFERENCE LEVEL] -19.9 dBm. Set step attenuators to 15 dB. Press MARKER (Δ) twice to establish a new reference.
23. Key in (REFERENCE LEVEL) -17.9 dBm. Set step attenuators to 13 dB.
24. MKR A level, as indicated by CRT annotation, should be .OO ±0.5 dB. If not, increase or decrease the value of A4A5R86. Refer to Table 3-3 for range of values.
25. Key in (REFERENCE LEVEL) -15.9 dBm. Set step attenuators to 11 dB.
26. MKR A level should be .OO ±0.5 dB. If not, increase or decrease the value of A4A5R70. Refer to Table 3-3 for range of values.
27. Key in [REFERENCE LEVEL) -11.9 dBm. Set step attenuators to 7 dB.
28. MKR A level should be .OO ±0.5 dB. If not, increase or decrease the value of A4A5R62. Refer to Table 3-3 for range of values.

.1 dB Gain Step Adjustment

29. Key in LIN, (SHIFT) A (AUTO] (resolution bandwidth), and (REFERENCE LEVEL) -19.9 dBm. Set step attenuators to 13 dB. Press MARKER (Δ) twice to establish a new reference.
30. Key in [REFERENCE LEVEL) -18.0 dBm. Set step attenuators to 11 dB.
31. Adjust A4A5R51 VR for MKR A level of + 0.10 dB. See Figure 3-49 for location of adjustment.
32. Remove all test equipment from the spectrum analyzer. Connect CAL OUTPUT to RF INPUT.

18.4 MHz Local Oscillator Adjustment

33. Press (INSTR PRESET] and (RECALL) (9).
34. Set front-panel FREQ ZERO control to midrange.
35. Adjust A4A5C10 FREQ ZERO to peak signal trace on CRT. See Figure 3-49 for location of adjustment.

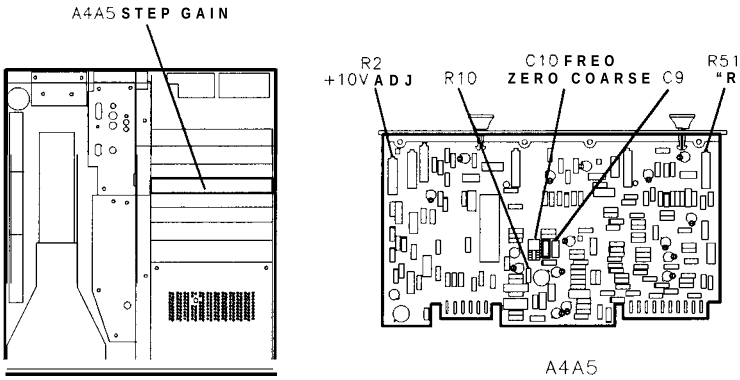


Figure 3-49.
Location of .1 dB Gain Step, 18.4 MHz LO, and + 10V Adjustments

36. Key in [FREQUENCY SPAN] 1kHz, (RES BW) 100 Hz, and [PEAK SEARCH] (Δ).
37. Adjust front-panel FREQ ZERO control fully clockwise. Press (PEAK SEARCH). Signal should move at least 60 Hz away from center CRT graticule line.
38. Adjust front-panel FREQ ZERO control fully counterclockwise. Press [PEAK SEARCH). Signal should move at least 60 Hz away from center CRT graticule line.
39. If proper indications are not achieved, increase or decrease value of A4A5C9 and repeat adjustment from step 33. Refer to Table 3-3 for range of values.
40. Press (INSTR PRESET) and (RECALL) (9).
41. Adjust front panel FREQ ZERO to peak the signal trace on the CRT.

+ 10V Temperature Compensation Supply Adjustment

42. Connect DVM to A4A5TP1 (+ 10VF).
43. If DVM indication is between +9 V dc and 10.0 V dc, no adjustment is required.
44. If DVM indication is not within tolerance of step 43, adjust A4A5R2 + 10V ADJ for DVM indication of +9.5 ±0.1 V dc at normal room temperature of approximately 25°C. Voltage change is approximately 30 mV/°C. Therefore, if room temperature is higher or lower than 25°C, adjustment should be made higher or lower, accordingly.

11. Down/Up Converter Adjustments

Reference

IF-Display Section
A4A6 Down/Up Converter

Related Performance Test

Resolution Bandwidth Switching Uncertainty Test

Description

The CAL OUTPUT signal is connected to the RF INPUT connector of the instrument and controls are set to display the signal in a narrow bandwidth. A marker is placed at the peak of the signal to measure the peak amplitude. The bandwidth is changed to a wide bandwidth and the Down/Up Converter is adjusted to place the peak amplitude of the signal the same as the level of the narrow bandwidth signal. Optionally, the input signal is removed and the IF signal is monitored at the output of the Bandwidth Filters using a spectrum analyzer with an active probe. The 18.4 MHz Local Oscillator and all harmonics are then adjusted for minimum amplitude.

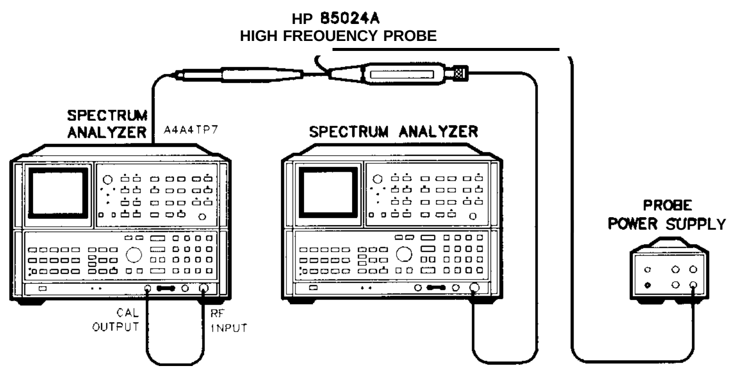


Figure 3-50. Down/Up Converter Adjustments Setup

Equipment

Spectrum Analyzer .... HP 8566B
Active Probe .... HP 85024A

Procedure

1. Position Instrument upright as shown in Figure 3-50 and remove top cover.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect CAL OUTPUT to RF INPUT.
4. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 10 kHz, (ATTEN) 0 dB, (RES BW) 1 kHz. ress LIN pushbutton, (PEAK SEARCH), and then MARKER (Δ).
5. Key in (RES BW) 1 MHz.

6. Adjust A4A6A1R29 WIDE GAIN to align markers on CRT display. MKR A level should indicate 1.00 X. See Figure 3-51 for location of adjustment.
7. Disconnect CAL OUTPUT from RF INPUT.

Optional

Note Perform the following procedure if the A4A6A1 assembly is replaced or the A4A6A1 21.4 MHz Bandpass Amplifier Filter is worked on.

1. Disconnect CAL OUTPUT from RF INPUT.
2. Key in [REFERENCE LEVEL] -70 dBm, (RES BW) 1 kHz, and MARKER (OFF).
3. Set the second spectrum analyzer's to the following settings:

RESOLUTION BANDWIDTH .... 100 kHz
FREQUENCY SPAN .... 10 MHz
CENTER FREQUENCY .... 18.4 MHz
RF ATTENUATION .... 10 dB
REFERENCE LEVEL .... 0 dBm
SCALE .... LOG 10 dB/div

4. Connect the second spectrum analyzer to A4A4TP7 using and active probe. See Figure 3-50 for test setup.
5. Adjust A4A6A1C31 18.4 MHz NULL to null the 18.4 MHz Local Oscillator signal and all displayed harmonics. See Figure 3-51 for location of adjustment.

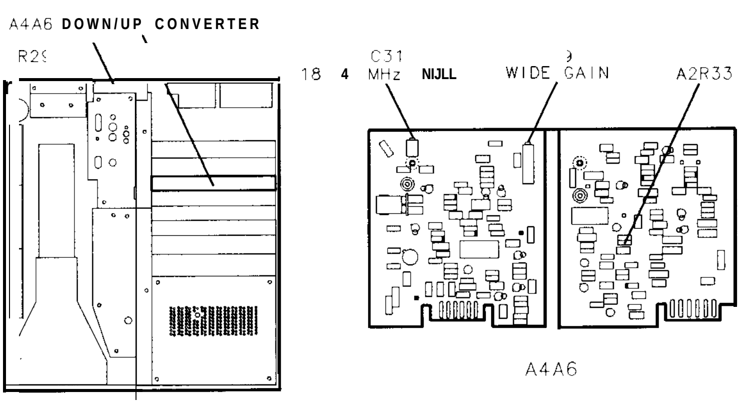


Figure 3-51. Location of Down/Up Converter Adjustments

6. 18.4 MHz signal and displayed harmonics should be below -10 dBm (-30 dBm on display due to 10:1 divider). If unable to adjust A4A6A1C31 18.4 MHz NULL for proper indication, increase value of A4A5R10. See Figure 3-49 for the location of A4A5R10. Refer to Table 3-3 for range of values.

Down Converter Gain Adjustment

Note If a gain problem is suspected in the 10 Hz to 1 kHz resolution bandwidths, perform the following procedure to test and adjust the gain through A4A6A2.

1. Place A4A6 on extender boards.
2. On the spectrum analyzer being tested, press (INST PRESET), and set the spectrum analyzer to the following settings:

   CENTER FREQUENCY . . . . 20 MHz
   RESOLUTION BANDWIDTH . . . . 1 kHz
   FREQUENCY SPAN . . . . 0 Hz
   REFERENCE LEVEL . . . . -10 dBm
   INPUT ATTENUATION . . . . 10 dB

3. Connect an active probe to a second spectrum analyzer, and set the spectrum analyzer to the following settings:

   CENTER FREQUENCY . . . . 21.4 MHz
   RESOLUTION BANDWIDTH . . . . 100 kHz
   FREQUENCY SPAN . . . . 200 Hz
   REFERENCE LEVEL . . . . -30 dBm
   INPUT ATTENUATION . . . . 10 dB
   SCALE . . . . LOG 1 dB/div

4. Measure the signal at A4A6A2TP4 using the active probe and record below. The signal level should be approximately -33 dBm.

   Signal level at TP4 ________ dBM

5. Change the center frequency of the spectrum analyzer used for measuring the signals to 3 MHz. Measure the signal at A4A6A2P1-9. The signal level should be 10 dB ±0.6 dB lower than the signal measured in the previous step.

   Signal level at P1-9 ________ dBM

6. If the signal at A4A6A2P1-9 needs adjusting, change A4A6A2R33. (Decreasing R33 ten percent increases the signal level by 0.6 dB.) Refer to Table 3-3 for the acceptable range of values for A4A6A2R33.

12. Time Base Adjustment (SN 2840A and Below, also 3217A05568 and Above)

Reference

RF Section:
A27A1 10 MHz Quartz Crystal Oscillator

Related Performance Test

Center Frequency Readout Accuracy Test

Description

The frequency of the internal 10 MHz Frequency Standard is compared to a known frequency standard and adjusted for minimum frequency error. This procedure does not adjust the short-term stability or long-term stability of the 10 MHz Quartz Crystal Oscillator, which are determined by characteristics of the particular oscillator and the environmental and warmup conditions to which it has been recently exposed. The spectrum analyzer must be ON continuously (not in STANDBY) for at least 72 hours immediately prior to oscillator adjustment to allow both the temperature and frequency of the oscillator to stabilize.

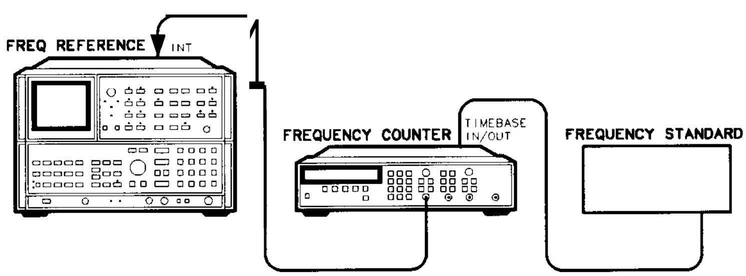


Figure 3-52. Time Base Adjustment Setup

Equipment

Frequency Standard .... HP 5061B
Frequency Counter .... HP 5334A/B

Cables:
BNC cable, 122 cm (48 in) (2 required) . . . . HP 10503A

12. Time Base Adjustment (SN 2840A and Below, also 3217A05568 and Above)

Procedure

Note The spectrum analyzer must be ON continuously (not in STANDBY) for at least 72 hours immediately prior to oscillator adjustment to allow both the temperature and frequency of the 10 MHz Quartz Crystal Oscillator to stabilize. Adjustment should not be attempted before the oscillator is allowed to reach its specified aging rate. Failure to allow sufficient stabilization time could result in oscillator misadjustment.

The A27A1 10 MHz Quartz Crystal Oscillator (HP P/N 0960-0477) will typically reach its specified aging rate again within 72 hours after being switched off for a period of up to 24 hours. If extreme environmental conditions were encountered during storage or shipment (i.e. mechanical shock, temperature extremes) the oscillator could require up to 30 days to achieve its specified aging rate.

1. Set the rear-panel FREQ REFERENCE switch on the spectrum analyzer RF Section to INT.

Note The +22 Vdc STANDBY supply provides power to the heater circuit in the A27 10 MHz Frequency Standard assembly whenever line power is applied to the RF Section. This allows the A27 10 MHz Frequency Standard oven to remain at thermal equilibrium, minimizing frequency drift due to temperature variations. The OVEN COLD message should typically appear on the spectrum analyzer display for 10 minutes or less after line power is first applied to the RF Section.

Note The rear-panel FREQ REFERENCE switch enables or disables the RF Section +20 Vdc switched supply, which powers the oscillator circuits in the A27 10 MHz Frequency Standard. This switch must be set to INT and the spectrum analyzer must be switched ON continuously (not in STANDBY) for at least 72 hours before adjusting the frequency of the A27 10 MHz Frequency Standard.

2. Set the LINE switch to ON. Leave the spectrum analyzer ON (not in STANDBY) and undisturbed for at least 48 hours to allow the temperature and frequency of the A27 10 MHz Frequency Standard to stabilize.
3. Press (SHIFT) TRACE B [CLEAR-WRITE] g to turn off the display. This prolongs CRT life while the spectrum analyzer is unattended. To turn the CRT back on press (SHIFT) TRACE B (MAX HOLD) h.
4. Connect the (Cesium Beam) Frequency Standard to the Frequency Counter's rear-panel TIMEBASE IN/OUT connector as shown in Figure 3-52.
5. Disconnect the short jumper cable on the RF Section rear panel from the FREQ REFERENCE INT connector. Connect this output (FREQ REFERENCE INT) to INPUT A on the Frequency Counter. A REF UNLOCK message should appear on the CRT display.

6. Set the Frequency Counter controls as follows:

   INPUT . . . . A
   ATTENUATION x10
   DC Coupled . . . . OFF
   1 MΩ input impedance . . . . OFF
   AUTO TRIG . . . . ON
   100 kHz FILTER . . . . OFF
   INT/EXT switch (rear panel) . . . . EXT

7. On the Frequency Counter, select a 10 second gate time by pressing, (GATE TIME) 10 (GATE TIME).
8. Offset the displayed frequency by -10.0 MHz by pressing, MATH (SELECT/ENTER) (CHS/EEX) 10 (CHS/EEX) 6 (SELECT/ENTER) SELECT/ENTER]. The Frequency Counter should now display the difference between the frequency of the INPUT A signal (A27 10 MHz Frequency Standard) and 10.0 MHz with a displayed resolution of 1 mHz (0.001 Hz).
9. Wait at least two gate periods for the Frequency Counter to settle, and record the frequency of the A27 10 MHz Frequency Standard as reading #1.

   Reading 1: ________ mHz

10. Allow the spectrum analyzer to remain powered (not in STANDBY) and undisturbed for an additional 24 hours.
11. Repeat steps 3 through 7 and record the frequency of the A27 10 MHz Frequency Standard as reading #2.

    Reading 2: ________ mHz

12. If the difference between reading #2 and reading #1 is greater than 1 mHz, the A27 10 MHz Frequency Standard **has not** achieved its specified aging rate; the spectrum analyzer should remain powered (not in STANDBY) and undisturbed for an additional 24-hour interval. Then, repeat steps 3 through 7, recording the frequency of the 10 MHz Frequency Standard at the end of each 24-hour interval, until the specified aging rate of 1 mHz/day (1x10E9/day) is achieved.

    Reading 3: ________ mHz

    Reading 4: ________ mHz

    Reading 5: ________ mHz

    Reading 6: ________ mHz

    Reading 7: ________ mHz

    Reading 8: ________ mHz

    Reading 9: ________ mHz

    Reading 10: ________ mHz

13. Position the spectrum analyzer on its right side as shown in Figure 3-52 and remove the bottom cover. Typically, the frequency of the A27 10 MHz Frequency Standard will shift slightly when the spectrum analyzer is reoriented. Record this shifted frequency of the A27 10 MHz Frequency Standard.

Reading 11: ________ mHz

14. Subtract the shifted frequency reading in step 11 from the last recorded frequency in step 10. This gives the frequency correction factor needed to adjust the A27 10 MHz Frequency Standard.

Frequency Correction Factor: ________ mHz

15. On the Frequency Counter, select a 1 second gate time by pressing, (GATE TIME) 1 (GATE TIME). The Frequency Counter should now display the difference between the frequency of the INPUT A signaland 10.0 MHz with a resolution of 0.01 Hz (10 mHz).

16. Remove the two adjustment cover screws from the A27 10 MHz Quartz Crystal Oscillator. See Figure 3-53 for the location of the A27 10 MHz Frequency Standard.

Note Do not use a metal adjustment tool to tune an oven-controlled crystal oscillator (OCXO). The metal will conduct heat away from the oscillator circuit, shifting the operating conditions.

17. Use a nonconductive adjustment tool to adjust the 18-turn FREQ ADJ capacitor on the A27A1 10 MHz Quartz Crystal Oscillator for a Frequency Counter indication of 0.00 Hz. See Figure 3-53 for the location of the A27A1 10 MHz Quartz Crystal Oscillator.

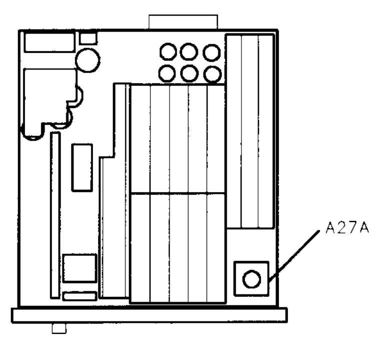


Figure 3-53. Location of A27A1 Adjustment

18. On the Frequency Counter, select a 10 second gate time by pressing, (GATE TIME) 10 (GATE TIME). The Frequency Counter should now display the difference between the frequency of the INPUT A signal and 10.0 MHz with a resolution of 0.001 Hz (1 mHz).

19. Wait at least 2 gate periods for the Frequency Counter to settle, and then adjust the 16-turn FINE adjustment on the A27 10 MHz Frequency Standard for a stable Frequency Counter indication of (0.000 + Frequency Correction Factor) ±0.010 Hz.

20. Replace the RF Section bottom cover and reconnect the short jumper cable between the FREQ REFERENCE INT and EXT connectors,

12. Time Base Adjustment (SN 2848A to 3217A05567)

Reference

RF Section:
A27A1 Frequency Standard Regulator
A27A2 10 MHz Quartz Crystal Oscillator

Related Performance Test

Center Frequency Readout Accuracy Test

Description

The frequency of the internal 10 MHz Frequency Standard is compared to a known frequency standard and adjusted for minimum frequency error. This procedure does not adjust the short-term stability or long-term stability of the 10 MHz Quartz Crystal Oscillator, which are determined by characteristics of the particular oscillator and the environmental and warmup conditions to which it has been recently exposed. The spectrum analyzer must be ON continuously (not in STANDBY) for at least 72 hours immediately prior to oscillator adjustment to allow both the temperature and frequency of the oscillator to stabilize.

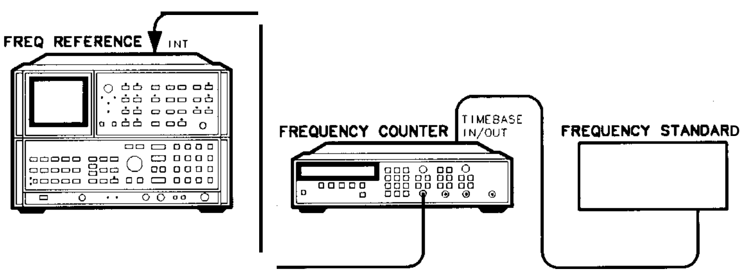


Figure 3-54. Time Base Adjustment Setup

Equipment

Frequency Standard .... HP 5061A/B
Frequency Counter .... HP 5334A/B

Cables:
BNC cable, 122 cm (48 in) (2 required) . . . . HP 10503A

Procedure

Note

The spectrum analyzer must be ON continuously (not in STANDBY) for at least 72 hours immediately prior to oscillator adjustment. This allows both the temperature and frequency of the oscillator to stabilize. Adjustment should not be attempted before the oscillator is allowed to reach its specified aging rate. Failure to allow sufficient stabilization time could result in oscillator misadjustment.

12. Time Base Adjustment (SN 2848A to 3217A05567)

The A27A2 10 MHz Quartz Crystal Oscillator (HP P/N 10811-60111) typically reaches its specified aging rate again within 72 hours after being switched off for a period of up to 30 days, and within 24 hours after being switched off for a period less than 24 hours. If extreme environmental conditions were encountered during storage or shipment (i.e. mechanical shock, temperature extremes) the oscillator could require up to 30 days to achieve its specified aging rate.

Replacement oscillators are factory-adjusted after a complete warmup and after the specified aging rate has been achieved. Readjustment should typically not be necessary after oscillator replacement, and is generally not recommended.

1. Set the rear-panel FREQ REFERENCE switch on the spectrum analyzer RF Section to INT.

Note The + 22 Vdc STANDBY supply provides power to the heater circuit in the A27 10 MHz Frequency Standard assembly whenever line power is applied to the RF Section. This allows the A27 10 MHz Frequency Standard oven to remain at thermal equilibrium, minimizing frequency drift due to temperature variations. The OVEN COLD message should typically appear on the spectrum analyzer display for 10 minutes or less after line power is first applied to the RF Section.

Note The rear-panel FREQ REFERENCE switch enables or disables the RF Section +20 Vdc switched supply, which powers the oscillator circuits in the A27 10 MHz Frequency Standard. This switch must be set to INT and the spectrum analyzer must be switched ON continuously (not in STANDBY) for at least 72 hours before adjusting the frequency of the A27 10 MHz Frequency Standard.

2. Set the LINE switch to ON. Leave the spectrum analyzer ON (not in STANDBY) and undisturbed for at least 48 hours to allow the temperature and frequency of the A27 10 MHz Frequency Standard to stabilize.
3. Press (SHIFT) TRACE B (CLEAR-WRITE) g to turn off the display. This prolongs CRT life while the spectrum analyzer is unattended. To turn the CRT back on press (SHIFT) TRACE B (MAX HOLD) h
4. Connect the (Cesium Beam) Frequency Standard to the Frequency Counter's rear-panel TIMEBASE IN/OUT connector as shown in Figure 3-54.
5. Disconnect the short jumper cable on the RF Section rear panel from the FREQ REFERENCE INT connector. Connect this output (FREQ REFERENCE INT) to INPUT A on the Frequency Counter. A REF UNLOCK message should appear on the CRT display.
6. Set the Frequency Counter controls as follows:

INPUT	A
ATTENUATION	x10
DC Coupled	OFF
1 MΩ input impedance	OFF
AUTO TRIG	ON
100 kHz FILTER	OFF

INT/EXT switch (rear panel) . . . . EXT

7. On the Frequency Counter, select a 10 second gate time by pressing, (GATE TIME) 10 (GATE TIME).
8. Offset the displayed frequency by -10.0 MHz by pressing, MATH (SELECT/ENTER) (CHS/EEX) 10 (CHS/EEX) 6 (SELECT/ENTER) (SELECT/ENTER). The Frequency Counter should now display the difference between the frequency of the INPUT A signal (A27 10 MHz Frequency Standard) and 10.0 MHz with a displayed resolution of 1 mHz (0.001 Hz).
9. Wait at least two gate periods for the Frequency Counter to settle, and record the frequency of the A27 10 MHz Frequency Standard as reading #1.

Reading 1: ________ mHz

Note The A27A2 Quartz Crystal Oscillator has a typical adjustment range of 10 MHz ±10 Hz. The oscillator frequency should be within this range after 48 hours of continuous operation.

10. Allow the spectrum analyzer to remain powered (not in STANDBY) and undisturbed for an additional 24 hours.
11. Repeat steps 3 through 7 and record the frequency of the A27 10 MHz Frequency Standard as reading #2.

Reading 2: ________ mHz

12. If the difference between reading #2 and reading #1 is greater than 1 mHz, the A27 10 MHz Frequency Standard has not achieved its specified aging rate; the spectrum analyzer should remain powered (not in STANDBY) and undisturbed for an additional 24-hour interval. Then, repeat steps 3 through 7, recording the frequency of the 10 MHz Frequency Standard at the end of each 24-hour interval, until the specified aging rate of 1 mHz/day (1x10E9/day) is achieved.

Reading 3: ________ mHz

Reading 4: ________ mHz

Reading 5: ________ mHz

Reading 6: ________ mHz

Reading 7: ________ mHz

13. Position the spectrum analyzer on its right side as shown in Figure 3-54 and remove the bottom cover. Typically, the frequency of the A27 10 MHz Frequency Standard will shift slightly when the spectrum analyzer is reoriented. Record this shifted frequency of the A27 10 MHz Frequency Standard.

Reading 8: ________ mHz

14. Subtract the shifted frequency reading in step 8 from the last recorded frequency in step 7. This gives the frequency correction factor needed to adjust the A27 10 MHz Frequency Standard.

Frequency Correction Factor: ________ mHz

15. On the Frequency Counter, select a 1 second gate time by pressing, (GATE TIME) 1 (GATE TIME). The Frequency Counter should now display the difference between the frequency of the INPUT A signal and 10.0 MHz with a resolution of 0.01 Hz (10 mHz).

Note Do not use a metal adjustment tool to tune an oven-controlled crystal oscillator (OCXO). The metal will conduct heat away from the oscillator circuit, shifting the operating conditions.

16. Use a nonconductive adjustment tool to adjust the 18-turn FREQ ADJ capacitor on the A27A2 10 MHz Quartz Crystal Oscillator for a Frequency Counter indication of 0.00 Hz. See Figure 3-55 for the location of the A27A2 10 MHz Quartz Crystal Oscillator.

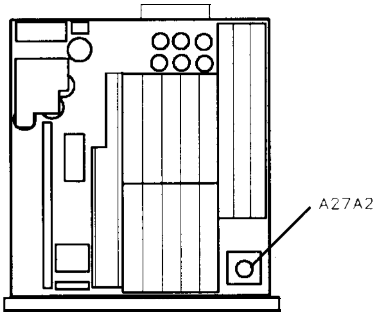


Figure 3-55. Location of A27A2 Adjustment

17. On the Frequency Counter, select a 10 second gate time by pressing, (GATE TIME) 10 (GATE TIME). The Frequency Counter should now display the difference between the frequency of the INPUT A signal and 10.0 MHz with a resolution of 0.001 Hz (1 mHz).
18. Wait at least 2 gate periods for the Frequency Counter to settle, and then adjust the FREQ ADJ capacitor on the A27A2 10 MHz Quartz Crystal Oscillator for a stable Frequency Counter indication of (0.000 + Frequency Correction Factor) ±0.010 Hz.
19. Replace the RF Section bottom cover and reconnect the short jumper cable between the FREQ REFERENCE INT and EXT connectors.

13. 20 MHz Reference Adjustments

Reference

RF Section:
A16 20 MHz Reference

Related Performance Test

Calibrator Amplitude Accuracy Test

Description

The 20 MHz output is peaked and amplitude checked for proper level. The INTERNAL REFERENCE output level is then checked for proper output level as compared to input from A27 Time Base. Finally, the COMB DRIVE and CAL OUTPUT are adjusted for proper power levels.

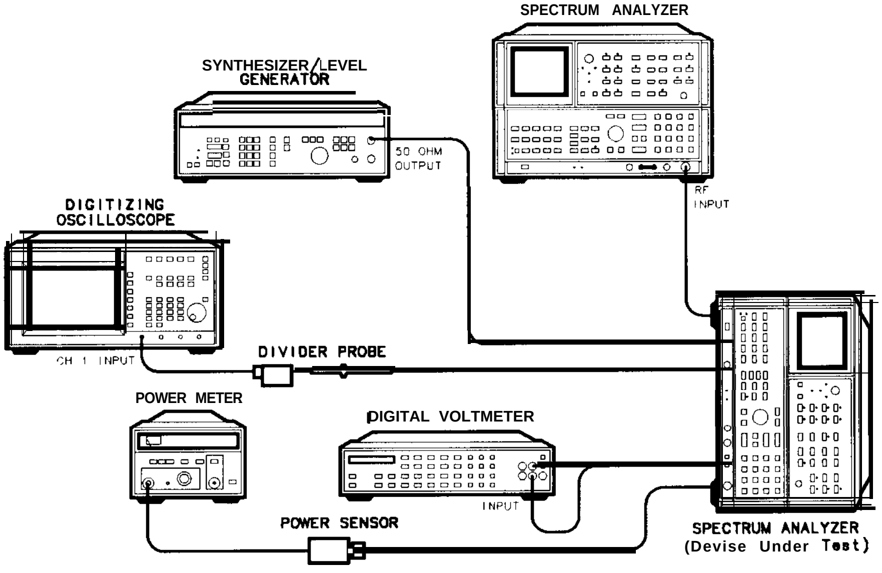


Figure 3-56. 20 MHz Reference Adjustments Setup

Equipment

Spectrum Analyzer .... HP 8566A/B
Digital Voltmeter (DVM) .... HP 3456A
Frequency Synthesizer .... HP 3335A
Power Meter ....HP 436A
Power Sensor .... HP 8482
Digitizing Oscilloscope .... HP 54501A
10:1 Divider Probe .... HP 10432A

Adapters:

Type N (m) to BNC (f) 1250-0780
Type N (f) to BNC (f) 1250-1474

Cables:

BNC to SMB cable Snap-On (2 required) 85680-60093

13. 20 MHz Reference Adjustments

Procedure

1. Position instrument on right side as shown in Figure 3-56 and remove bottom cover. Remove A16 20 MHz Reference and install on extenders. See Figure 3-57 for the location of A16 components.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Set rear-panel FREQ REFERENCE INT/EXT switch to INT. Disconnect cable 2 (red) from A16J1. Connect power meter to output of Time Base (A27J1) using cable 2 (red). Note power meter indication for reference later.

   _________ dBm
4. Reconnect A27 Time Base output to A16J1.
5. Jumper A16TP4 to Ground. Set the HP 8566A/B Spectrum Analyzer to (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 1 MHz, (REFERENCE LEVEL) +20 dBm, and (RES BW) 100 kHz. Connect A16J3 to RF INPUT of HP 8566A/B Spectrum Analyzer and set (REFERENCE LEVEL) to place of signal at reference line (top graticule line).
6. Set HP 8566A/B Spectrum Analyzer to 1 dB/division SCALE and reset reference level to place peak of signal at reference line.
7. Connect DVM to A16TP1 and ground to A22 TP12. Adjust A16 COMB DRIVE A16R31 for DVM indication of > + 0.1 V dc. Disconnect DVM. (If DVM remains connected, it may load circuit.) See Figure 3-57 for location of adjustment.

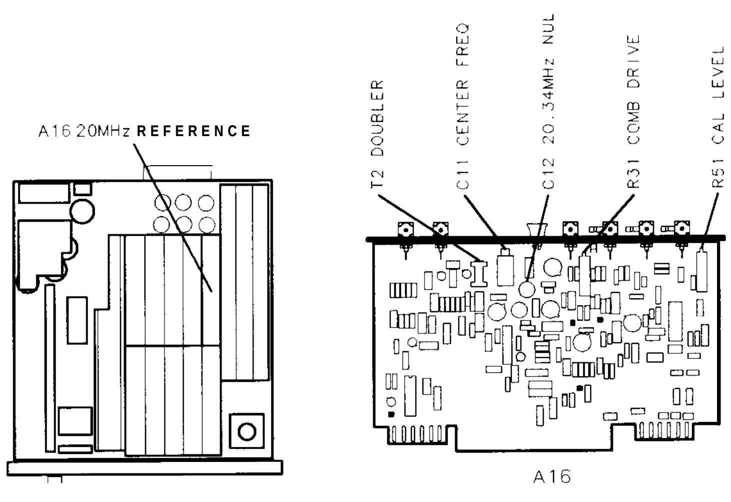


Figure 3-57. Location of 20 MHz Reference Adjustments

8. Adjust A16 DOUBLER A16T1 to lower signal peak approximately 3 dB. Adjust A16 CENTER FREQ A16C11 to peak signal on HP 8566A/B Spectrum Analyzer display. Next, adjust A16 DOUBLER A16T1 for signal peak.
9. Disconnect cable 2 (red) from A16J1 and connect 50Ω OUTPUT of frequency synthesizer to A16J1. Set FREQUENCY of frequency synthesizer to 10.17 MHz and set AMPLITUDE to + 3 dBm. Set HP

8566A/B Spectrum Analyzer (CENTER FREQUENCY) to 20.34 MHz and SCALE to 10 dB/division.

10. Adjust A16 20.34 MHz NULL A16C12 for minimum 20.34 MHz signal at A16J3 as indicated by HP 8566A/B Spectrum Analyzer display. With signal nulled, the plates of the NULL adjustment capacitor should be meshed approximately halfway. If fully meshed or fully unmeshed, a circuit malfunction is indicated.
11. Disconnect frequency synthesizer from A16J1 and reconnect cable 2 (red) to A16J1. Connect power meter to rear-panel INT REF OUT connector.
12. Power meter indication should be no more than 5 dB less than that noted in step 3 (A27 Time Base output).
13. Disconnect A16TP4 from ground. Connect power meter to A16J3.
14. Adjust A16 COMB DRIVE A16R31 for power meter indication of + 10.0 dBm ±1.0 dB.
15. Connect power meter to A16J4 through cable 3 (orange). Power meter indication should be at least -15 dBm. Reconnect cable 3 (orange) to A6J2.
16. Connect power meter to A16J5 through cable 4 (yellow). Power meter indication should be at least -10 dBm. Reconnect cable 4 (yellow) to A8J1.
17. On the oscilloscope, key in (RECALL) (CLEAR) to perform a soft reset.
18. Connect the channel 1 probe to the oscilloscope's rear panel PROBE COMPENSATION AC CALIBRATOR OUTPUT connector. Press (AUTO SCALE). Adjust the channel 1 probe for an optimum square wave display on the oscilloscope.
19. Connect oscilloscope with the HP 10432A probe to A16TP3 and the ground to the analyzer's chassis ground.
20. Set the oscilloscope controls as follows:

Press (CHAN):

Channel 1 ....on
amplitude scale .... 1V / div
offset ....OV
coupling ....dc
probe 10:1
Channel 2 .... off
Channel 4 .... off

Press (TRIG):

EDGE TRIGGER .... trig'd auto
source 1
level .... 800 mv edge

Press (TIME BASE):

time scale .... 20 ns
delay .... 40 ns
reference ....CNTR

Press (DISPLAY):

connect dots .... on
DISPLAY .... AVG

13. 20 MHz Reference Adjustments

Press (SHOW)
Press (ΔTΔV):
ΔV markers .... on
Vmarker 1 .... 800 mv
Vmarker 2 .... 2.7V
start marker .... place at 2.7V crossing
stop marker .... place at next 2.7V crossing

21. Oscilloscope display should be a 10 MHz signal of TTL level; less than +0.8V to greater than +2.7V. See Figure 3-58 for a typical signal.

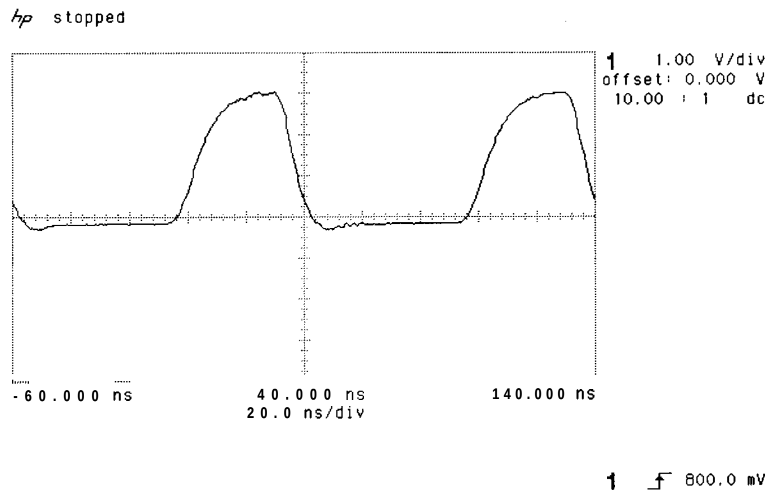


Figure 3-58. Typical Signal at A16TP3

22. Install A16 20 MHz Reference without extenders and reconnect cable 7 (violet) to A16J3.

23. Connect power meter to front-panel CAL OUTPUT.

24. Adjust A26 CAL LEVEL A16R51 for power meter indication of -10.0 dBm ±0.2 dB.

25. the A23A6 Comb Generator must be readjusted after adjusting the 20 MHz Reference. Refer to Adjustments 22, Comb Generator Adjustments, for adjustment procedure.

14. 249 MHz Phase Lock Oscillator Adjustments

Reference

RF Section:
A7 249 MHz Phase Lock Oscillator

Description

Two center frequencies are chosen: one which will tune the 249 MHz Oscillator to its low-end frequency and one which will tune the 249 MHz Oscillator to the high-end frequency. The voltage is monitored with a DVM at the output of the oscillator, and the oscillator frequency is adjusted to produce the proper dc voltage output for each frequency (low-end and high-end). Next, the 500 kHz Trap is adjusted to null the 500 kHz sidebands using the sixth harmonic of the 249 MHz signal.

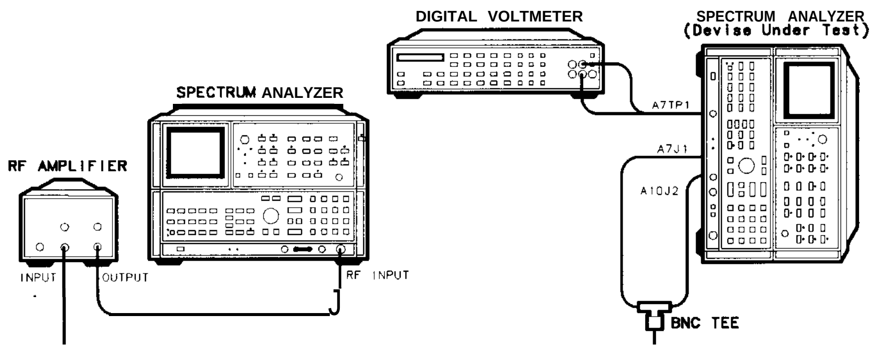


Figure 3-59. 249 MHz Phase Lock Oscillator Adjustments Setup

Equipment

Spectrum Analyzer .... HP 8566A/B
Amplifier .... HP 8447F
Digital Voltmeter (DVM) .... HP 3456A
Tee, SMB Male .... HP 1250-0670

Adapters:
Type N (m) to BNC (f) 1250-1250

Cables:
BNC cable, 122 cm (48 in) (2 required) 10503A
BNC to SMB Snap-On cable (2 required) 85680-60093

14. 249 MHz Phase Lock Oscillator Adjustments

Procedure

1. Place instrument on right side with IF-Display Section facing right as shown in Figure 3-59.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect DVM to A7TP1 and ground to A22TP12.
4. Key in [CENTER FREQUENCY) 17.6 MHz and [FREQUENCY SPAN) 0 Hz on HP 8568B.
5. Adjust A7 PLO A7C3 for DVM indication between +5.2 V dc and +6.0 V dc. See Figure 3-60 for location of adjustment.

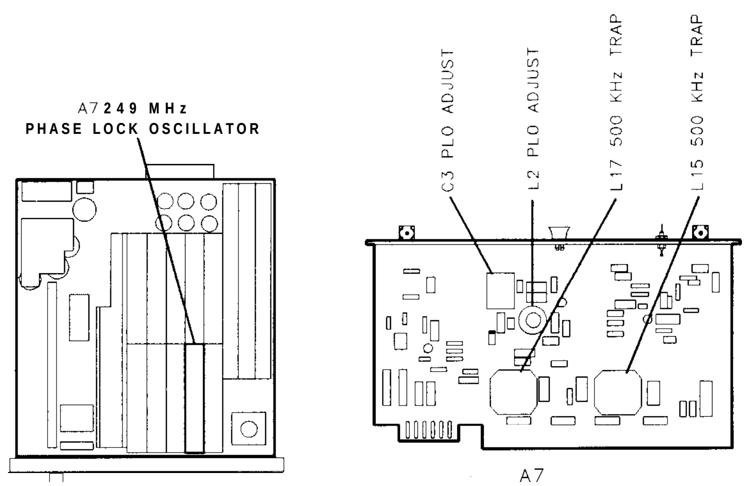


Figure 3-60.
Location of 249 MHz Phase Lock Oscillator Adjustments

6. Key in (CENTER FREQUENCY] 37.1 MHz.
7. DVM indication should be between + 12.9 V dc and + 16.9 V dc. If DVM indication is within the given range, disconnect DVM from A7TP1 and proceed to step 18. Otherwise, key in (SAVE) 2, SET LINE switch to STANDBY, and place A7 249 MHz PLO on extender (with DVM still connected to A7TP1).
8. Set LINE switch to ON and key in (RECALL) 2 on HP 8568B Spectrum Analyzer.
9. Adjust A7 PLO A7C3 for DVM indication of + 13.0 ±0.1 V dc.
10. Key in [CENTER FREQUENCY) 17.6 MHz, (FREQUENCY SPAN] 0 Hz, and (SAVE) 1.
11. Adjust A7 PLO A7L2 for DVM indication of +5.2 ±0.05 V dc. (A7L2 slug should be near center of coil form when A7L2 is properly adjusted.)
12. Key in (RECALL) 2 and adjust A7C3 for + 13.0 fO.l V dc at A7P1.
13. Press 1 (RECALL 1) and adjust A7L2 for +5.2 ±0.05 V dc.
14. Repeat steps 12 and 13 until A7C3 and A7L2 need **no** further adjustment.

15. Set LINE switch to STANDBY. Adjust A7L2 one-half turn counterclockwise before placing A7 249 MHz PLO in HP 8568B Spectrum Analyzer without extender. (Leave DVM connected to A7TP1).
16. Set LINE switch to ON and key in (RECALL) 1. DVM indication should be between +5.2 V dc and +6.0 V dc.
17. Press 2 (RECALL 2). DVM indication should be between + 12.9 V dc and + 16.9 V dc. Disconnect DVM from A7TP1.
18. Set LINE switch to STANDBY and place A7 249 MHz PLO on extender.
19. Set LINE switch to ON, press (INSTR PRESET), and set the analyzer as follows:

(CENTER FREQUENCY)	16.5 MHz
(FREQUENCY SPAN)	0 Hz
(SWEEP)	SINGLE

20. Disconnect cable from A7J1 and connect cable 89 (gray/white) to one branch of a tee. Using a short coaxial cable (see Note below), connect the other branch of the tee back to A7J1. Connect the stem of the tee to the HP 8566A/B Spectrum Analyzer RF INPUT.

Note The short cable 9 (white) in the IF-Display Section (A3A9J2 to A3A2J1) can be disconnected and used for this adjustment. Be sure to reconnect the cable 9 (white) when finished.

21. Press (2 - 22 GHz) on the HP 8566A/B Spectrum Analyzer and key in (FREQUENCY SPAN) 5 MHz, (CENTER FREQUENCY) 1547 MHz, (PEAK SEARCH) and (MKR → CF).
22. On the HP 8566A/B Spectrum Analyzer, key in (SIGNAL TRACK), (FREQUENCY SPAN) 10 kHz, (RES BW) 300 Hz, (REFERENCE LEVEL) -50 dBm, and (ATTEN) 0 dB.
23. On the HP 8566A/B Spectrum Analyzer, turn off (SIGNAL TRACK) and set (CF STEP SIZE) to 500 kHz on the HP 8566A/B Spectrum Analyzer. Press (CENTER FREQUENCY), then (⇧) key.
24. Disconnect cable from the HP 8566A/B Spectrum Analyzer RF INPUT and connect cable (from tee) to PRE AMP input of HP 8447F Amplifier. Connect cable from PRE AMP output to the HP 8566A/B Spectrum Analyzer RF INPUT.
25. Adjust A7 500 kHz TRAP adjustments A7L15 and A7L17 to null the 500 kHz sideband displayed on the spectrum analyzer. The 500 kHz sideband should be less than -90 dBm. See Figure 3-60 for location of adjustments.
26. Press (SAVE) 1 on HP 8568B Spectrum Analyzer. Set LINE switch to STANDBY and place A7 249 MHz PLO in HP 8568B Spectrum Analyzer without extender (leave tee connected).
27. Set LINE switch to ON and press (RECALL) 1. Verify that 500 kHz remains less than -90 dBm in amplitude.
28. Disconnect tee and reconnect cable 89 (gray/white) to A7J 1.

15. 275 MHz Phase Lock Oscillator Adjustment

Reference

RF Section:
A18 275 MHz Phase Lock Oscillator
A21 275 MHz Phase Lock

Description

The 275 MHz Phase Lock Oscillator frequency is adjusted using a DVM.

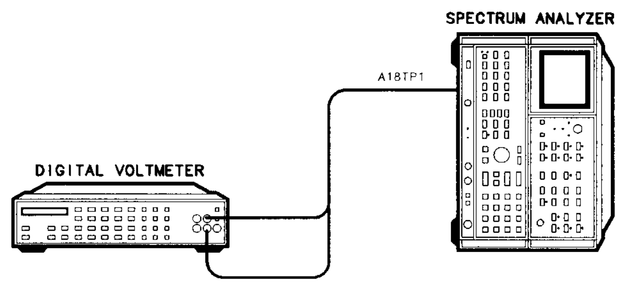


Figure 3-61. 275 MHz Phase Lock Oscillator Adjustment Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A

Procedure

1. Place instrument on right side with IF-Display Section facing right as shown in Figure 3-61 with bottom cover removed.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Set controls as follows:

   (CENTER FREQUENCY) .... 19.850000 MHz
   (FREQUENCY SPAN) .... 1 MHz
   MARKER .... (NORMAL)

4. Using DATA control knob on HP 8568B, adjust marker to a position one-half of a major division from the right edge of the graticule. Press (SHIFT) u (SINGLE).
5. Connect DVM to A18TP1 (on lid) and ground to A22TP12.
6. Adjust A18 PLO ADJUST A18C8 for DVM indication of +6.5 V dc ±0.5 V dc. See Figure 3-62 for location of adjustment.

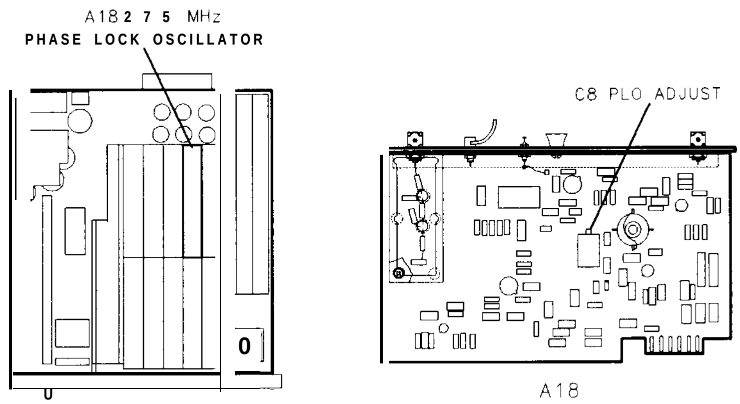


Figure 3-62. Location of 275 MHz PLO Adjustment

7. Disconnect test equipment from instrument.

16. Second IF Amplifier and Third Converter Adjustment

Reference

RF Section:
A19 Second IF Amplifier
A20 Third Converter

Description

A synthesized sweeper is used to inject a signal of 301.4 MHz at -20 dBm in to the A19 Second IF Amplifier. The output of the amplifier is displayed on a scalar network analyzer. The amplifier is adjusted for a bandpass of greater than 7 MHz and less than 14 MHz centered at 301.4 MHz. Its gain should be greater than 14 dB and less than 17 dB. A spectrum analyzer is used to view the output of the 280 MHz Oscillator on the A20 Third Converter and the oscillator is centered in its adjustment range.

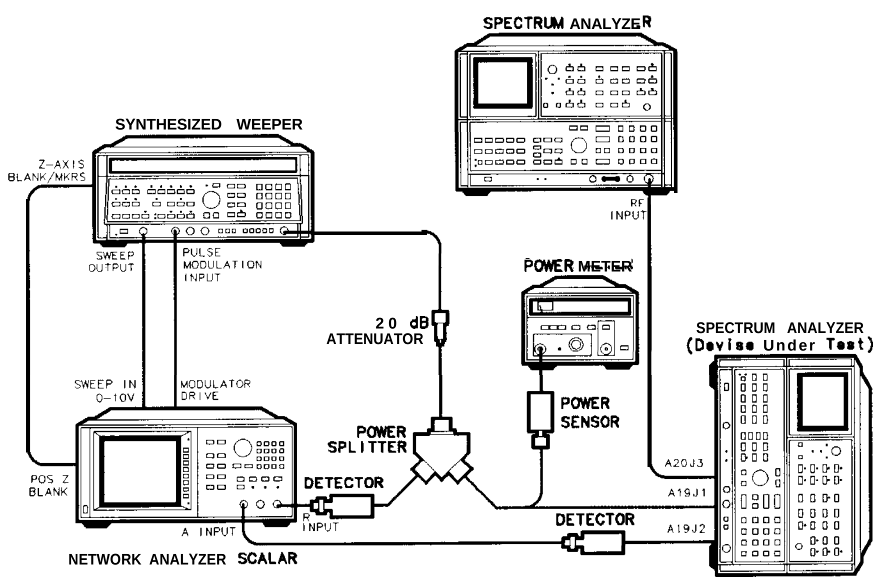


Figure 3-63. Second IF Amplifier Adjustments Setup

Equipment

Spectrum Analyzer	HP 8566A/B
Synthesized Sweeper	HP 8340A/B
Scalar Network analyzer	HP 8757A
Power Splitter	HP 11667A Opt. 001
Power Meter	HP 436A
Power Sensor	HP 8482A
Detector (2 required)	HP 11664A
20 dB Attenuator	HP 8491A, Opt. 020

Adapters:
Type N (f) to APC-3.5 (f) 1250-1745
Type N (m) to BNC (f) (2 required) 1250-0780
Type N (f) to BNC (f) (2 required) 1250-1474
APC 3.5 (f) to APC 3.5 (f) 1250-1749

Cables:
BNC to SMB Snap-On (*Service* Accessory) (2 required) . 85680-60093

BNC 122 cm (48 in) (3 required) 10503A
SMA (m) to (m) 5061-5458

Procedure

1. Position instrument on right side as shown in Figure 3-63, with bottom cover removed.
2. Set LINE switch to ON and press (INST PRESET) on HP 8568B, HP 8566A/B, HP 8757A, and HP 8340A/B.

Second IF Amplifier Adjustments

3. Connect 20 dB Attenuator and power splitter to RF OUTPUT of synthesized sweeper. Connect one arm of power splitter to R input of scalar network analyzer through Detector. See Figure 3-63.
4. Set synthesized sweeper FREQUENCY MARKERS (M1) to 291.4 MHz and (M2) to 311.4 MHz.
5. Press (CW) 301.4 MHz on synthesized sweeper.
6. Connect Power meter to other power splitter port and set synthesized sweeper (POWER LEVEL) for Power Meter indication of -20.0 ±0.1 dBm.
7. Disconnect Power Meter and connect power splitter output to A19J1, using adapter and a BNC to SMB test cable. Refer to Figure 3-64.
8. Connect A19J2 to A input of scalar network analyzer, using adapter and another BNC to SMB test cable.
9. Connect synthesized sweeper SWEEP OUTPUT (rear panel), Z-AXIS BLANK/MKRS (rear panel), and PULSE MODULATION INPUT to proper rear-panel connectors on scalar network Analyzer, as shown in Figure 3-63.
10. On the scalar network analyzer, turn Channel 2 off and press (MEAS) (A/R).
11. Set scalar network analyzer (SCALE) to 1 dB and set (REF) (RF LEVEL) to + 14 dB. Set REF POSN (press REF POSN) to the fourth division from bottom using the data knob.
12. On synthesized sweeper, press (PULSE) (ON) (MKR SWEEP), and (ΔF). Set (SWEEP TIME) to 500 ms.
13. Adjust A19 301.4 MHz Bandpass Filter, A19C9 through C12, for the best bandpass filter response with a gain of > + 14 dBm but < + 17 dBm. See Figure 3-64 for the location of the bandpass adjustments.

16. Second IF Amplifier and Third Converter Adjustment

See Figure 3-65 for the typical response when the bandpass filter is properly adjusted.

14. On the scalar network analyzer, press (CURSOR) MAX. Press cursor A, ON and set the cursor to the -3 dB point on the low side of the filter response (±0.1 dB).
15. Press cursor A and set the cursor to the -3 dB point on the high side on the filter response. The cursor A should read 0 fO.l dB.

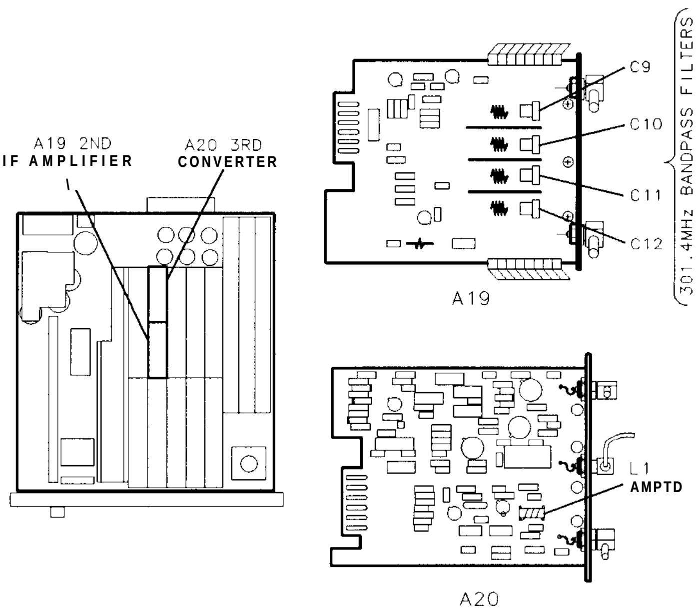


Figure 3-64.
Location of 301.4 MHz BPF and 280 MHz AMPTD Adjustments

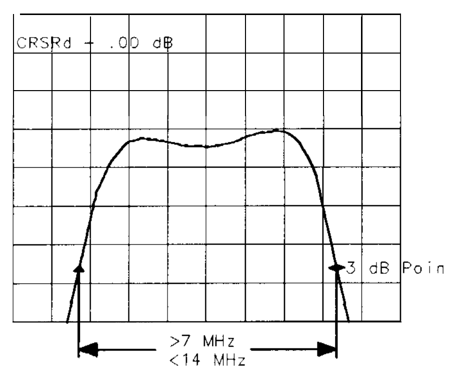


Figure 3-65.
301.4 MHz Bandpass Filter Adjustment Waveform

16. On the synthesized sweeper, press (M3) and set the Marker to the -3 dB point on the low side of the filter response.
17. On the synthesized sweeper, press (M4) and set the Marker to the -3 dB point on the high side of the filter response.

Note

Place the Markers as accurately as possible within the cursor markers for maximum frequency accuracy.

18. On the synthesized sweeper, press (MKR Δ). M3 – M4 should read between 7 and 14 MHz.
19. On the synthesized sweeper, press (MKR Δ) OFF and (SHIFT) OFF.
20. Set the synthesized sweeper FREQUENCY MARKERS (M1) to 251.4 MHz and (M2) to 351.4 MHz.
21. Set the Scalar Network Analyzer (SCALE) to 10 dB and set (REF) (REF LEVEL) to + 14 dB. Set the REF POSN to one division down from the top.
22. Adjust A19C12 for minimum amplitude response at 258.4 MHz. Refer to Figure 3-64 for the location of the bandpass adjustments. Refer to Figure 3-66 for the typical response when the bandpass filter is properly adjusted.

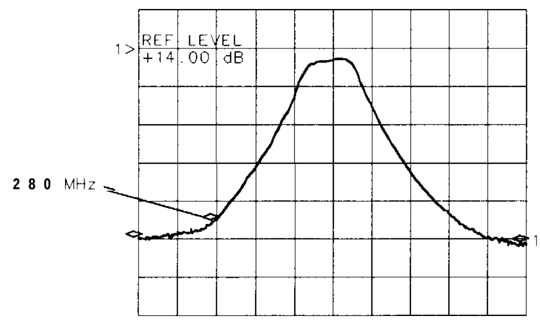


Figure 3-66. Minimum Image Response at 258.4 MHz

23. Repeat the adjustments in steps 13 and 22 to assure that the bandpass is between 7 MHz and 14 MHz and the image response at 258.4 MHz is minimized.

Note

Remember to use the appropriate set up for steps 13 and 20.

24. Disconnect the cables from A19J1 and A19J2 and reconnect the instrument cables.

Third Converter Adjustment

25. Disconnect cable 83 (gray/orange) from A20J3 and connect A20J3 to the input of HP 8566A/B Spectrum Analyzer, using a BNC to SMB test cable.
26. Press (INSTR PRESET) on the HP 8566A/B Spectrum Analyzer, then key in [CENTER FREQUENCY) **280** MHz, [FREQUENCY SPAN) **2** MHz. Set MARKER (NORMAL), (REFERENCE LEVEL) + 2 dBm, and [ENTER dB/DIV) 1 dB.
27. Adjust A20 AMPTD A20L1 for maximum signal level as indicated on spectrum analyzer display.
28. Disconnect spectrum analyzer and reconnect cable 83 (gray/orange) to A20J3.

17. Pilot Second IF Amplifier Adjustments

Reference

RF Section:
A9 Pilot Second IF Amplifier
A10 Pilot Third Converter

Description

A synthesized sweeper is used to inject a signal of 269 MHz at -20 dBm into the A9 Pilot Second IF Amplifier. The output of the amplifier is displayed on a scaler network analyzer. The amplifier is adjusted for a bandpass of greater than 21 MHz centered at 269 MHz and a gain of greater than + 10 dB.

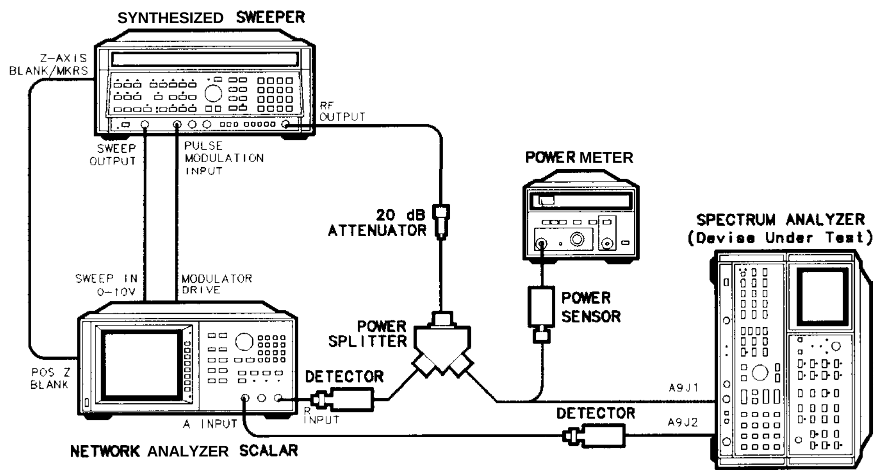


Figure 3-67. Pilot Second IF Amplifier Adjustments Setup

Equipment

Synthesized Sweeper .... HP 8340A/B
Scalar Network analyzer .... HP 8757A
Power Splitter .... HP 11667A Opt. 001
Power Meter ....HP 436A
Power Sensor ....HP 8482A
Detector (2 required) .... HP 11664A
20 dB Attenuator .... HP 8491A, Opt. 020

Adapters:

Type N (f) to APC-3.5 (f) 1250-1745
Type N (m) to BNC (f) (2 required) 1250-0780
Type N (f) to BNC (f) (2 required) 1250-1474
APC 3.5 (f) to APC 3.5 (f) 1250-1749

Cables:

BNC to SMB Snap-On (Service Accessory) (2 required) . 85680-60093

BNC 122 cm (48 in) (3 required) 10503A
SMA (m) to (m) 5061-5458

Procedure

1. Position instrument on right side as shown in Figure 3-67, with bottom cover removed.
2. Set LINE switch to ON and press (INST PRESET) on HP 8568B (DUT), HP 8757A, and HP 8340A/B.
3. Connect 20 dB Attenuator and power splitter to RF OUTPUT of synthesized sweeper. Connect one arm of power splitter to R input of scalar network analyzer through detector as shown in Figure 3-67.
4. Set synthesized sweeper FREQUENCY MARKERS (M1) to 254 MHz and (M2) to 284 MHz.
5. Press (CW) 269 MHz on synthesized sweeper.
6. Connect Power Meter to the other power splitter port and set synthesized sweeper (POWER LEVEL) for a Power Meter indication of -20.0 ±0.2 dBm.
7. Disconnect Power Meter and connect power splitter output to A9J1, using adapter and BNC to SMB test cable.
8. Connect A9J2 to A input of scalar network analyzer through detector, using adapter and another BNC to SMB test cable.
9. Connect synthesized sweeper SWEEP OUTPUT (rear panel), Z-AXIS BLANK/MKRS (rear panel), and PULSE MODULATION INPUT (front panel) to proper rear-panel connectors on scalar network analyzer, shown in Figure 3-67.
10. On scalar network analyzer, turn channel 2 off and press (MEAS) (A/R).
11. Set the scalar network analyzer (SCALE) to 1 dB, and set (REF) (REF LEVEL) to + 10.00 dB. Set REF POSN (press REF POSN) to the fourth division from the bottom using the data knob.
12. On synthesized sweeper, press (PULSE) (ON), (MKR SWEEP), and (ΔF). Set SWEEP TIME to 500 ms.
13. Adjust REF LEVEL for a mid-screen response of signal on HP 8757A.
14. Adjust A9 269 MHz Bandpass Filter, A9C9, A9C10, A9C11, and A9C12, for best bandpass filter response with gain of greater than + 10 dB (above REF 1 line). See Figure 3-68 for location of adjustments. Figure 3-69 shows typical response when the bandpass filter is properly adjusted.

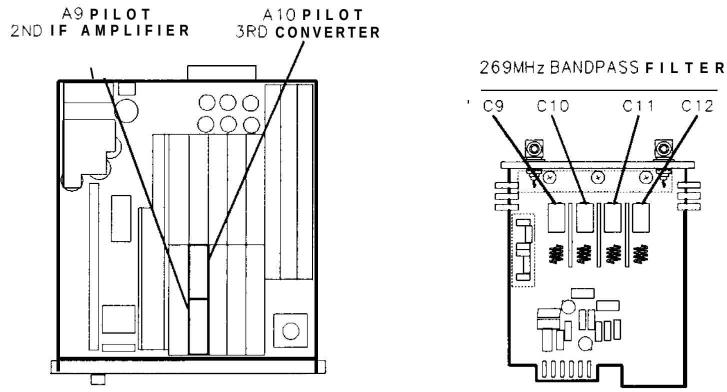


Figure 3-68.
Location of 269 MHz Bandpass Filter Adjustments

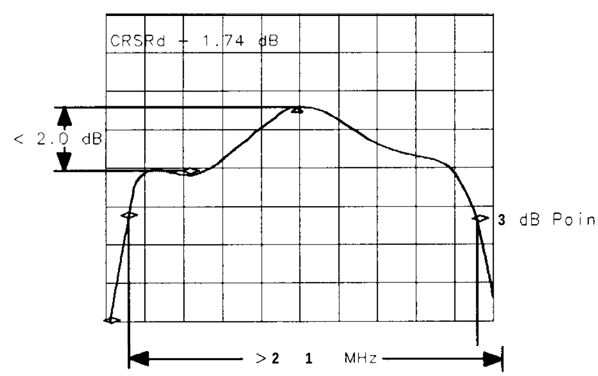


Figure 3-69.
269 MHz Bandpass Filter Adjustments Waveforms

15. On the scalar network analyzer, press (CURSOR) MAX. Press cursor A, ON and set the cursor to the -3 dB point on the low side of the filter response (±0.1 dB).
16. Press cursor A and set the cursor to the -3 dB point on the high side on the filter response. The cursor A should read 0 ±0.1 dB.
17. Press (M3) on synthesized sweeper and set to three divisions down (3 dB) from top of bandpass filter response. Press (M4) and set to three divisions down on opposite side of bandpass filter response.
18. Press MKR A **on** synthesized sweeper. M3-M4 should be greater than 21 MHz.
19. Disconnect cable 80 (grey/black) from A9J1 and cable 81 (grey/brown) from A9J2 and reconnect instrument cables.

18. Frequency Control Adjustments

Reference

RF Section:
A22 Frequency Control

Related Performance Tests

Sweep Time Accuracy Test
Frequency Span Accuracy Test
Center Frequency Readout Accuracy Test

Description

The sweep reference voltage is adjusted and then the sweep times are adjusted for proper tolerances. The sweep tune voltage is adjusted. Then the YTO DAC, VTO DAC, and LSD VTO DAC are adjusted, each to within its tolerance. Next, the Start and Stop frequencies are adjusted. FM Span is adjusted next for the proper amount of FM deviation.

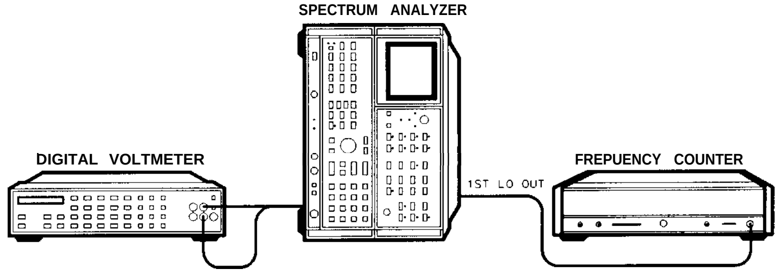


Figure 3-70. Frequency Control Adjustments Setup

Equipment

Digital Voltmeter (DVM) . . . . HP 3456A
Frequency Counter . . . . HP 5340A

Procedure

1. Place instrument on right side with IF-Display facing right as shown in Figure 3-70 and remove bottom cover.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect DVM to A22TP15 and ground to A22TP12.
4. Adjust A22 REF A22R94 for DVM indication of + 10.00 ±0.01 V dc.

   See Figure 3-71 for location of adjustment.

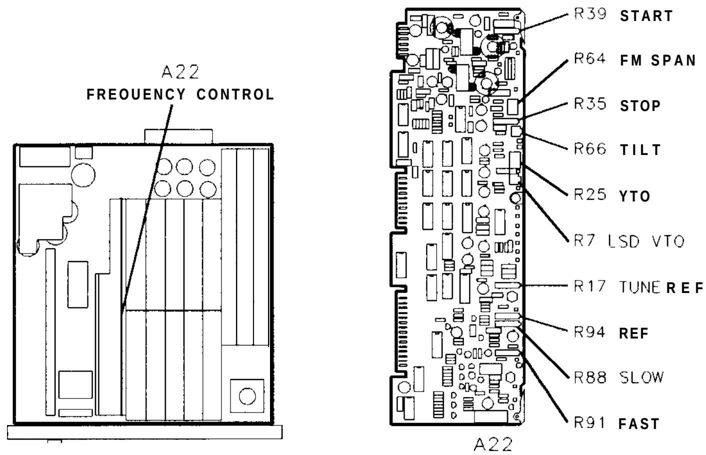


Figure 3-71. Location of Frequency Control Adjustments

5. Connect DVM to A22TP13 and ground to A22TP12.
6. Adjust A22 TUNE REF A22R17 for DVM indication of -10.285 ±0.001 V dc. See Figure 3-71 for location of adjustment.
7. Key in [CENTER FREQUENCY) 10 MHz, (FREQUENCY SPAN] 0 Hz, Trace A [CLEAR-WRITE), Sweep (SINGLE), Scale LIN.

Start-Up Time Measurement

8. Key in (SWEEP TIME) 1s, Marker (NORMAL). Adjust marker to the left edge of the CRT. Key in (SHIFT) (SINGLE) u, then key in (SHIFT) (RES BW) F three times. CRT annotation should indicate SWEEP GEN measured sweep time.

1 second start-up time: ________

Note

The start-up time measured in step 8 uses the (SHIFT) (RES BW) F function that displays a sweep time value which is 1% to 5% longer than the actual spectrum analyzer sweeptime. This error is compensated when using the shift F function to adjust the sweep times in the following procedure.

9. Key in Marker (OFF) then (SINGLE).

Slow Sweep Adjustment

10. Key in [SHIFT) (RES BW) F three times and note the CRT annotation. The annotation should indicate SWEEP GEN measured sweep time of (1 .OO s + start-up time from step 8) ±0.01 s. To adjust sweep time, adjust A22R88 SLOW slightly, then key in (SHIFT) (RES BW) F and note new SWEEP GEN measured sweep time as indicated by CRT annotation. Repeat this process until the 1 s sweep time is within spec.

Note

Adjusting A22R88 CW decreases the sweeptime.

Full Sweep Adjustment

11. Repeat Start-Up Time Measurement procedure in step 8 and step 9 for (SWEEP TIME) of 20 ms. Note value of measurement.

    20 ms start-up time: ________

12. Key in [Shift_) (RES BW) F three times and note the CRT annotation. The annotation should indicate SWEEP GEN measured sweeptime of (20 ms + start-up time noted in step 11)±0.1 ms. If it is not in spec, determine the difference between this measured sweep time and the target sweep time of 20 ms + start-up time noted in step 11.

    (measured sweep time) – (20.00 ms + start-up time) = ________

13. Adjust A22R91 FAST for three times the difference; and in the opposite direction, as noted in step 12. See note below. Adjust A22R91 slightly then key in [SHIFT) (RES BW) F and note new SWEEP GEN measured sweep time as indicated by CRT annotation. Repeat this process until the 20 ms sweep time is set to the value calculated in this step.

Note

Adjusting A22R91 CW increases the sweeptime. If the difference between the measured 20 ms sweep time and the target sweep time is less than approximately 0.3 ms, adjust A22R91 for the target sweeptime. Adjusting A22R91 to 3 times the difference noted in step 12 is only needed if the difference noted in step 12 is greater than 0.3 ms.

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14. Repeat the adjustments in step 8 through step 13 until the measured sweep time at 20 ms is 20 ms plus the Start-Up Time measured in step 11 (±0.1 ms) and the measured sweep time at 1 s is 1.00 s plus the start-up time measured in step 8 (50.01 s).

YTO and VTO DAC Adjustments

15. Key in (SHIFT) (CF STEP SIZE) J 0 MHz. The CRT annotation should indicate DACS 0.
16. Connect DVM to A22TP6 and ground to A22TP12. If using an HP 3456A DVM, press (STORE) (7) Z, (ENTER EXP) (8) Y, (0), (STORE) (8) Y, then (MATH), (7) (X-Z)/Y. If not using an HP 3456A DVM, note voltage indication for reference later.
17. Key in (SHIFT) (CF STEP SIZE) J 1023 MHz. (CRT annotation may still indicate DACS 1023.)
18. Adjust A22 YTO A22R25 for DVM indication of + 10.230 ±0.001 V dc. If not using an HP 3456A DVM, adjust for specified voltage plus the DVM indication noted in step 16. See Figure 3-71 for location of adjustment.
19. On the HP 3456A, Press (MATH) (0) OFF.
20. Connect DVM to A22TP9.
21. Key in (SHIFT) (CF STEP SIZE) J 0 Hz. If using an HP 3456A DVM, press (STORE) (7) Z, (ENTER EXP) (8) Y, (0), (STORE) (8) Y, then (MATH), (7) (X-Z)/Y. If not using an HP 3456A DVM, note voltage indication for reference later.

22. Key in (SHIFT) (CF STEP SIZE) J 1023 Hz.
23. Adjust A22 LSD VTO A22R7 for DVM indication of +0.0218 ±0.0001 V dc. If not using an HP 3455A DVM, adjust for specified voltage plus the DVM indication in step 20. See Figure 3-71 for location of adjustment.
24. On the HP 3456A, press (MATH) (0) OFF.

START and STOP Adjustments

25. Connect frequency counter to rear-panel 1ST LO OUTPUT connector.
26. Press (INSTR PRESET), then key in (SHIFT) (CF STEP SIZE) J. CRT annotation should indicate DACS 0.
27. Adjust A22 START A22R39 for frequency counter indication of 2.050 GHz ± 0.002 GHz. See Figure 3-71 for location of adjustment.
28. Key in (SHIFT) (CF STEP SIZE) J 1023 MHz. CRT annotation should indicate DACS 1023.
29. Adjust A22 STOP A22 STOP A22R35 for frequency counter indication of 3.7891 ±0.002 GHz. See Figure 3-71 for location of adjustment.

FM SPAN Adjustment

30. Press (INSTR PRESET), then key in (CENTER FREQUENCY) 10 MHz, (FREQUENCY SPAN) 20 MHz.
31. Connect CAL OUTPUT to SIGNAL INPUT 2.
32. Adjust A22 FM SPAN A22R64 so that the LO Feedthrough signal is centered on the left edge graticule and the 20 MHz CAL OUTPUT signal is centered on the right edge graticule. See Figure 3-71 for location of adjustment.

19. Second Converter Adjustments

Reference

RF Section:
A23 RF Converter

Related Performance Test

RF Gain Uncertainty Test
Spurious Responses Test

Description

First, the second LO frequency is adjusted for proper frequency and then the LO shift is adjusted by using the front-panel keys to shift the LO up and down. Next, the Pilot IF Bandpass Filter is adjusted for proper bandpass and amplitude, then the signal IF Bandpass Filter is adjusted. The second LO frequency and shift are checked and readjusted, if necessary.

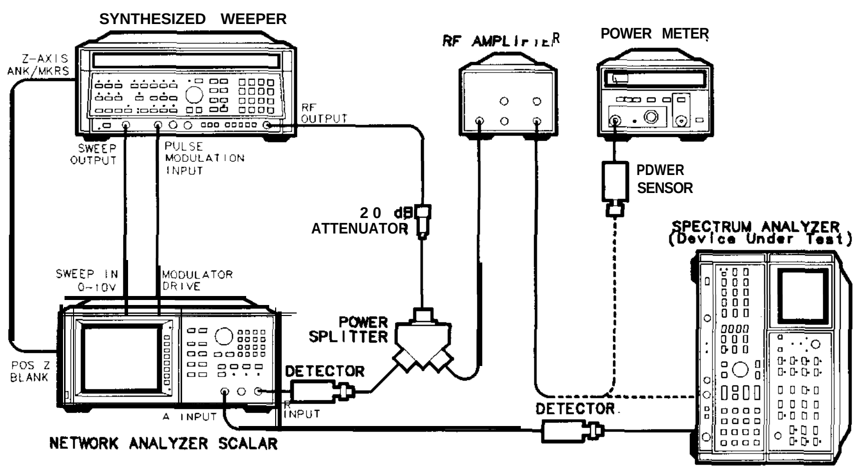

Figure 3-72. Second Converter Adjustments Setup

Equipment

Frequency Counter .... HP 5340A
Scalar Network Analyzer .... HP 8757A
Synthesized Sweeper .... HP 8340A/B
Amplifier .... HP 8447F
Power Splitter .... HP 11667A Opt. 001
Power Meter ....HP 436A
Power Sensor ....HP 8482A
Detector *(2 required)* .... HP 11664A

19. Second Converter Adjustments

Procedure

1. Remove A23 RF Converter assembly from HP 8568B Spectrum Analyzer. Removal and installation procedures are contained as a repair procedure in the RF Section of the Troubleshooting and Repair Manual, Volume 1.
2. Position instrument on right side as shown in Figure 3-72 with the RF Converter removed but with cables still connected.

Second LO Frequency and Shift Adjustments

3. Set HP 8568B Spectrum Analyzer LINE to ON and press (INSTR PRESET).

Note

The second LO and pilot second LO output power is typically -35 dBm or less. An HP 8447F amplifier is used in steps 1 through 26 to amplify the LO power to a useable level for the counter and power meter.

Note

The following adjustment tools are required to adjust the second converter: allen driver (08555-20121) and hex nut driver (08555-20122). Place the allen driver through the center hole of the hex nut driver. Loosen the adjustment nut using the hex nut driver while adjusting the bandpass with the allen driver. Do not over tighten the nut on the second converter.

4. Connect the amplifier's input to A23A3J3 and the power meter to the amplifier's output.
5. Adjust A23A3 2ND MIXER A23A3Z4 for maximum power meter indication. See Figure 3-73 for location of adjustment.

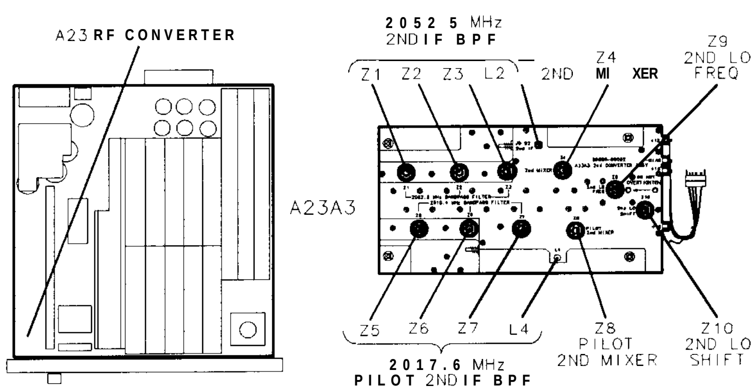

Figure 3-73. Location of Second Converter Adjustments

6. Disconnect power meter and connect frequency counter to amplifier's output.
7. Adjust A23A3 2ND LO FREQ A23A3Z9 for frequency counter indication of 1748.6 MHz fl.O MHz. See Figure 3-73 for location of adjustment.
8. Disconnect frequency counter and reconnect power meter to amplifier's output.

9. Readjust A23A3 2ND MIXER A23A3Z4 for maximum power indication.
10. Disconnect the amplifier's input from A23A3J3 and connect to A23A3J4.
11. Adjust A23A3 PILOT 2ND MIXER A23A3Z8 for maximum power meter indication. See Figure 3-73 for location of adjustment.
12. Disconnect power meter and connect frequency counter to amplifier's output.
13. Key in [SHIFT] (⇧) U to shift Second LO up and (SHIFT) (⇩) T to shift Second LO down.
14. Continue to shift Second LO up and down while adjusting A23A3 2ND LO SHIFT A23A3Z10 for a frequency difference of 5.0 MHz fO.l MHz. Ignore the absolute value of either frequency. Clockwise rotation of A23A3Z10 decreases the frequency difference.
15. Key in (SHIFT) (⇩) T (Second LO shifted down).
16. Adjust A23A3 2ND LO FREQ A23A3Z9 for frequency counter indication of 1748.6 MHz fO.l MHz.
17. Repeat steps 13 through 16 until specifications of steps 14 and 16 are achieved.
18. Disconnect frequency counter and connect power meter to the amplifier's output.
19. Shift Second LO up and down, using (SHIFT) (⇧) U and (SHIFT) (⇩) T while adjusting A23A3 PILOT 2ND MIXER A23A3Z8 for equal power out in both states of Second LO.
20. Power difference between Second LO shifted up and shifted down should be less than 0.5 dB.
21. Disconnect amplifier's input from A23A3J4 and connect to A23A3J3.
22. Shift Second LO up and down, using (SHIFT) (⇩) U and (SHIFT) (⇧) T while adjusting A23A3 2ND MIXER A23A3Z4 for equal power out in both states of the Second LO.
23. Power differences between Second LO shifted up and shifted down should be less than 0.5 dB.
24. Disconnect power meter and connect frequency counter to amplifier's output.
25. Key in (SHIFT) (⇩) T. Note frequency counter indication. If necessary, readjust A23A3 2ND LO FREQ A23A3Z9 for frequency counter indication of 1748.6 fO.l MHz.
26. Shift Second LO up and down, using (SHIFT) (⇧) U and (SHIFT) (⇩) T and note frequency difference between low and high state of Second LO. If necessary, readjust A23A3 2ND LO SHIFT A23A3Z10 for a frequency difference of 5.0 MHz fO.l. Repeat steps 27 and 28 until specifications contained in each step are achieved.

Second Converter Bandpass Filter Adjustments

27. Key in (SHIFT) (⇩) T, [FREQUENCY SPAN] 0 Hz.
28. On the synthesized sweeper, key in (CF) 240 MHz, (Δ F) 50 MHz, and (Power Level) – 10 dBm.
29. Connect the synthesized sweeper's SWEEP OUTPUT (rear panel), Z-AXIS BLANK/MKRS (rear panel), and PULSE MODULATION INPUT (front panel) to the proper rear-panel connectors on the scalar network analyzer as shown in Figure 3-73.
30. On the scalar network analyzer, press PRESET, turn channel 2 off, and press (MEAS) (A/R).
31. Connect the synthesized sweeper's output to the power splitter as shown in Figure 3-72.
32. Connect one arm of power splitter to scalar network analyzer R input. Connect other arm of power splitter to A input, using a BNC to SMB snap-on test cable and necessary adapters.
33. Set the scalar network analyzer (SCALE) to 1 dB, and set (REF) (REF LEVEL) to -16.00 dB. Set REF POSN (press REF POSN) to the fourth division from the bottom using the data knob.
34. On the synthesized sweeper, press (PULSE) (ON), (MKR SWEEP), and (ΔF). Set (SWEEP TIME) to 500 ms.
35. Adjust REF LEVEL for a mid-screen response of the bandpass signal on the scalar network analyzer.
36. Connect the test cable from the power splitter output arm to A23A3J2 Pilot First IF IN.
37. Connect cable 80 (gray/black) from A23A3J6 (PILOT 2ND IF) to the scalar network analyzer's A input. Set (SCALE) to 10 dB/DIV.
38. On the spectrum analyzer, key in [SHIFT] (FREERUN)v.

Note Hold (SHIFT] in until the LED lights, then press (FREERUN)v until the sweep is free running.

39. On the synthesized sweeper, set (CF) for a frequency of 2017.6 MHz and (ΔF) to 50 MHz.
40. Adjust (CF) on the synthesized sweeper to center the bandpass signal.
41. Adjust A23A3 Z5, Z6, Z7, and L4 for best bandpass shape and flatness at maximum amplitude of signal displayed on Scalar network analyzer. A typical properly-adjusted bandpass filter response is shown in Figure 3-74. See Figure 3-73 for location of adjustments. The bandpass filter response at the 3 dB points should be ≥22 MHz. See Figure 3-74 and Figure 3-75 for a typical PILOT 2ND IF bandpass response for a SHIFT LO ↑ and a SHIFT LO ↓.

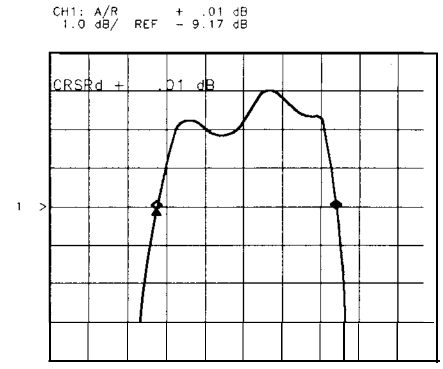

Figure 3-74. Typical PILOT 2ND IF Bandpass (SHIFT ↑)

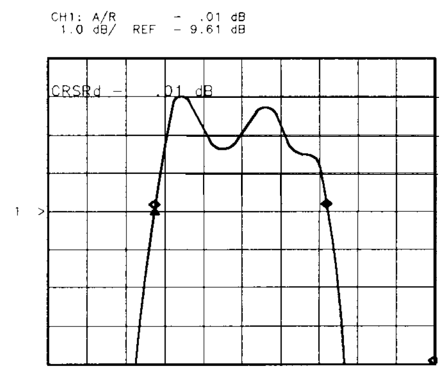

Figure 3-75. Typical PILOT 2ND IF Bandpass (SHIFT ↓)

42. Key in (SHIFT) (⇧) U and note amplitude of signal. Key in (SHIFT) (⇩) T and note amplitude of the bandpass signal peak.
43. Continue to key in (SHIFT) (⇧) U then (⇩) T while adjusting A23A3Z8 for maximum amplitude and the same amplitude in both states of the Second LO ● <0.25 dB.
44. Check the bandpass at the 3 dB points for both the 2ND LO ↑ and ↓. On the scalar network analyzer, press (CURSOR) Max. Press cursor A (ON) and set the cursor at the -3 dB point fO.l dB. Press cursor A, cursor A, and set the cursor to the corresponding -3 dB point on the opposit side of the signal. The cursor should now read 0 fO.l dB.
45. On the synthesized sweeper, press (M3) and place the marker on either cursor A. Press (M4), and place the marker on the cursor A on the opposite side of the trace.
46. On the synthesized sweeper, press (MKR Δ), and read the bandpass (M3 – M4) shown on the ENTRY DISPLAY. Press (MKR Δ) OFF. See Figure 3-74 and Figure 3-75.
47. Disconnect the detector from cable 80 (gray/black) and connect cable 92 (white/red) from A23A3J5 (2ND IF) to the scalar network analyzer's A input.

48. Disconnect cable connected to A23A3J2 and connect to A23A3J1 (1ST IF IN). Reconnect semi-rigid cable to A23A3J2 that was disconnected in step 36.

49. Set the synthesized sweeper's (CF) for 2052.5 MHz ±0.1 MHz. Adjust (CF) to center the bandpass signal.

50. Adjust A23A3 Z1, Z2, Z3, and L2 for best bandpass shape and flatness at maximum amplitude of signal displayed on Scalar network analyzer. A typical properly-adjusted bandpass filter response is shown in Figure 3-76 and Figure 3-77. See Figure 3-73 for location of adjustments. The bandpass response should be ≥22 MHz.

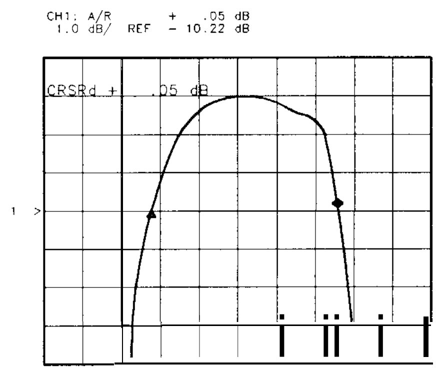

Figure 3-76. Typical Bandpass (SHIFT ↑)

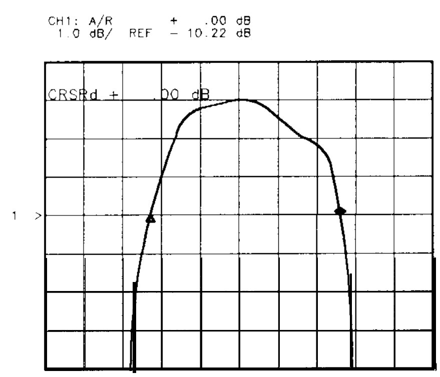

Figure 3-77. Typical Bandpass (SHIFT ↓)

51. Key in (SHIFT) (⇧) U and note amplitude of the bandpass signal peak. Key in (SHIFT) (⇩) T and note amplitude of the bandpass signal peak.

52. Continue to key in (SHIFT) (⇧) U then (SHIFT) (⇩) T while adjusting A23A3Z4 for maximum amplitude and the same amplitude in both states of the Second LO ±<0.1 dB.

Second Converter Final Adjustments

53. Repeat steps 14 through 19 to ensure that Second LO frequency and shift are still properly adjusted.
54. Check the bandpass at the 3 dB points for both the 2ND LO ↑ and ↓. On the scalar network analyzer, press (CURSOR) Max. Press cursor A (ON) and set the cursor at the -3 dB point ±0.1 dB. Press cursor A, cursor A, and set the cursor to the corresponding -3 dB point on the opposite side of the signal. The cursor should now read 0 ±0.1 dB.
55. On the synthesized sweeper, press (M3) and place the marker on either cursor A. Press (M4), and place the marker on the cursor A on the opposite side of the trace.
56. On the synthesized sweeper, press (MKR Δ), and read the bandpass (M3 – M4) shown on the ENTRY DISPLAY. Press (MKR Δ) OFF. See Figure 3-74 and Figure 3-75.
57. Disconnect all test equipment from HP 8568B Spectrum Analyzer and reconnect all cables within the instrument: cable 80 (gray/black) between A23A3J6 and A9J1, and cable 92 (white/red) between A23A3J5 and A19J1.
58. Connect HP 8568B Spectrum Analyzer CAL OUTPUT to SIGNAL INPUT 2. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 1 MHz, (REFERENCE LEVEL) -7 dBm, SCALE LOG (ENTER dB/DIV) 1 dB, (RES BW) 300 kHz.
59. Key in (SHIFT) (⇑) U , (PEAK SEARCH) Key in (SHIFT) (⇓) T and note signal amplitude as indicated by marker level CRT annotation.
60. Continue to key in (SHIFT) (⇑) U then (SHIFT) (⇓) T while adjusting A23A3Z4 for maximum amplitude and the same amplitude in both states of the Second LO ±<0.1 dB.
61. Reinstall RF Converter in instrument. See installation procedure in RF Section of Troubleshooting and Repair Manual, Volume 1.

20. 50 MHz Voltage-Tuned Oscillator Adjustments

Reference

RF Section:
All 50 MHz Voltage-Tuned Oscillator (VTO)

Related Performance Test

Frequency Span Accuracy Test
Center Frequency Readout Accuracy Test

Description

First, the voltage reference for the Shaping network is set by measuring the voltage required to tune the 50 MHz Oscillator to its high limit (57.5 MHz) and then setting the reference voltage (+ 15 VR) to that voltage.

Next, the VTO tuning accuracy is adjusted at both the low and high end by setting the tune voltage to the proper levels to tune the VTO to its low and high end limits (42.5 MHz and 57.5 MHz). This is done using the output of the tuning DACS from the A22 Frequency Control; therefore, it is necessary that the DAC adjustments on the Frequency Control have been performed before adjusting the 50 MHz VTO.

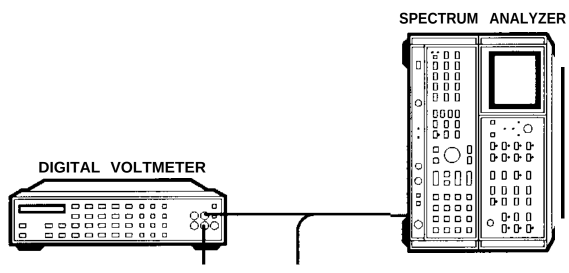

Figure 3-78. 50 MHz Voltage-Tuned Oscillator Adjustments Setup

Equipment

Digital Voltmeter (DVM) . . . . HP 3456A

Procedure

1. Position Instrument on right side as shown in Figure 3-78 and remove bottom cover. Remove All 50 MHz Voltage-Tuned Oscillator and place on extenders.
2. Set LINE switch to ON and press (INSTR PRESET).

DACS Accuracy Check

3. Connect DVM to A22TP9 and ground lead to A22TP12.
4. Key in [SHIFT] (CF STEP SIZE) J 0 Hz. If using an HP3456A DVM, press (STORE) (7) Z, (ENTER EXP) (8) Y, (0), (STORE) (8) Y, then (MATH) (7) (X−Z)/Y. If not using an HP 3456A DVM, note voltage indication for reference later.
5. Key in (SHIFT) (CF STEP SIZE) J 1023 kHz.
6. If using an HP 3456A DVM, voltage indication should typically be be + 10.230 ±0.010 V dc. If not using an HP 3456A DVM, voltage indication should be + 10.230 ±0.010 V dc plus the indication noted in step 4. If voltage is within tolerance, proceed to next step. If voltage indication is incorrect, go to Adjustments 18, Frequency Control Adjustments, and perform YTO and VTO DAC adjustments.
7. On the HP 3456A, press MATH off.

Positive Supply Adjustment

8. Key in &ENTER FREQUENCY) 1 MHz, [FREQUENCY SPAN) 1 MHz. Connect DVM to A11TP5 and ground lead to Al 1 cover.
9. Key in (SHIFT) (CF STEP SIZE) J 12 kHz. (CRT annotation should indicate DACS 12.)
10. Key in (SHIFT) (MKR → CF) N. (CRT annotation should indicate VTO frequency of approximately 28.75 MHz. This corresponds to a VTO frequency of 57.5 MHz, since the counter indication is divided by two.)
11. Adjust All OFFSET A11R10 and/or All GAIN A11R9 for VTO frequency of 28.750 MHz ±0.005 MHz as indicated by CRT annotation. See Figure 3-79 for location of adjustment.

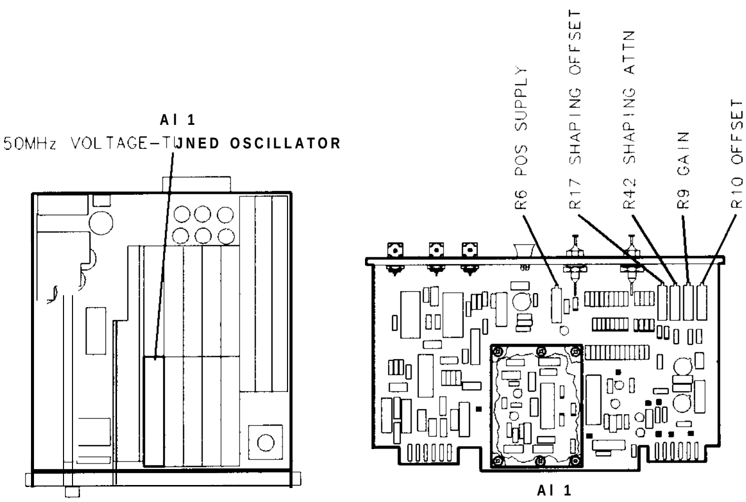

Figure 3-79. Location of 50 MHz VTO Adjustments

12. Note DVM indication for reference later.
13. Connect DVM to A11TP1 (located on All cover).

14. Adjust All POS SUPPLY A11R6 for a DVM indication the same as that noted in step 12. See Figure 3-79 for location of adjustment.

VTO High-Frequency End Adjustment

15. Key in (SHIFT) (CF STEP SIZE] J 112 kHz and (SHIFT) (MKR → CF) N.
16. Adjust All OFFSET A11R10 for VTP frequency indication 28.000 MHz ±0.005 MHz.
17. Key in (SHIFT) (CF STEP SIZE) J 12 kHz and (SHIFT) (MKR → CF) N.
18. Adjust All GAIN A11R9 for VTO frequency indication of 28.750 MHz ±0.005 MHz.
19. Repeat steps 15 through 18 until specifications of steps 16 and 18 are achieved.

VTO Low-Frequency End Adjustment

20. Key in (SHIFT) (CF STEP SIZE] J 912 kHz (SHIFT) (MKR → CF) N.
21. Adjust All SHAPING ATTN A11R42 for VTO indication of 22.000 MHz ±0.005 MHz. See Figure 3-78 for location of adjustment.
22. Key in (SHIFT) (CF STEP SIZE) J 1012 kHz and (SHIFT) (MKR → CF) N.
23. Adjust All SHAPING OFFSET A11R17 for VTO frequency indication of 21.250 MHz ±0.005 MHz. See Figure 3-78 for location of adjustment.
24. Repeat steps 21 through 23 until specifications of steps 20 and 23 are achieved.
25. Go back to step 15 and repeat both High-Frequency End and Lo-Frequency End adjustments until specifications of both (contained in steps 16, 18, 21, and 23 are achieved.

VTO Center-Frequency Checks

26. Key in (SHIFT) (CF STEP SIZE) J 512 kHz and (SHIFT) (MKR → CF) N.
27. VTO frequency indication should be 25.00 MHz ±0.02 MHz. If it is not, and specifications of steps 16, 18, 21, and 23 are met, a malfunction is indicated. The most likely suspects would be varactor diodes CR15 and CR16.
28. Key in (SHIFT) (CF STEP SIZE] J 612 kHz and (SHIFT) (MKR → CF) N.
29. VTO frequency indication should be 24.25 MHz ±0.02 MHz. If it is not, and specifications of steps 16, 18, 21, and 23 are met, a malfunction is indicated. The most likely suspects would be varactor diodes CR15 and CR16.
30. Set LINE switch to STANDBY.
31. Replace Al1 50 MHz Voltage-Tuned Oscillator in instrument without extenders and replace screws in cover.

21. Slope Compensation Adjustments

Reference

RF Section:
A22 Frequency Control

Related Performance Test

Frequency Response Test

Description

The HP 8568B Spectrum Analyzer is swept between 10 MHz and 1500 MHz, using a synthesized sweeper which has been power-meter leveled. The resulting response curve is displayed on the HP 8568B Spectrum Analyzer CRT and the slope compensation (TILT) adjustment is performed to compensate for the frequency response roll-off of the first mixer.

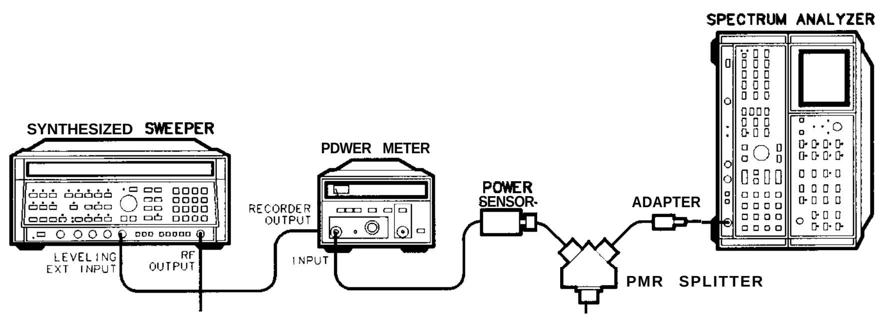

Figure 3-80. Slope Compensation Adjustment Setup

Equipment

Synthesized Sweeper .... HP 8340A/B
Power Meter ....HP 436A
Power Sensor ....HP 8482A
Power Splitter .... HP 11667A Opt. 001

Adapters:
Type N (m) to N (m) 1250-0778
Type N (m) to APC 3.5 (f) 1250-1744
APC 3.5 (f) to APC 3.5 (f) 1250-1749

Cables:
SMA (m) (m) 5061-5458

Procedure

1. Place instrument on right side as show in Figure 3-80, and remove bottom cover.
2. Connect equipment as shown in Figure 3-80 with power splitter connected to the output of the synthesized sweeper with a cable. Connect one arm of the splitter directly to the SIGNAL INPUT of the HP 8568B Spectrum Analyzer, using a Male-to-Male adapter, and the other arm to the power sensor.
3. Connect the power meter's recorder output to the HP 8340A/B's LEVELING EXT INPUT.
4. Press (INSTR PRESET) on the synthesized sweeper, and set its controls to the following settings:

   CW .... 100 MHz
   POWER LEVEL .... -9.0 dBm
   RF .... on
   LEVELING .... INT

5. On the synthesized sweeper, press (POWER LEVEL) and adjust the ENTRY knob as necessary for a power meter indication of -15.00 dBm ±2.00 dB at 100 MHz.
6. On the power meter, press (RANGE HOLD) (turning it on).
7. On the synthesized sweeper, press (POWER LEVEL) and adjust the ENTRY knob for a power meter indication of -10.00 dBm ±0.03 dB at 100 MHz.
8. On the synthesized sweeper, press (METER) LEVELING and adjust the ENTRY knob (REF in dBV with ATN: 0 dB) for a power meter indication of -10.00 dBm ±0.03 dB at 100 MHz.

Note

Do not vary the synthesized sweeper POWER LEVEL setting (internal leveling) or METER REF and METER ATN settings (external power meter leveling) for the remaining steps in this section of the adjustment procedure. The frequency response adjustments are referenced to the -10.00 dBm power level at 100 MHz.

9. Set the synthesized sweeper to the following settings:

   START .... 10 MHz
   STOP .... 1500 MHz
   SWEEP TIME 40s
   SWEEP .... SINGLE

10. Set HP 8568B LINE switch to ON and press (INSTR PRESET).
11. Key in (START FREQ) 10 MHz, (STOP FREQ) 1500 MHz, (REFERENCE LEVEL) -10 dBm, LOG (CENTER dB/DIV) 1 dB.
12. On the spectrum analyzer, press TRACE A, (CLEAR WRITE), and (MAX HOLD).
13. Trigger two full sweeps on the synthesized sweeper.

Note At this sweep time, some trace discontinuities are common.

14. Adjust A22R66 TILT for best flatness (clockwise rotation increases the power slope), and trigger two sweeps on the synthesized sweeper. See Figure 3-81 for the location of A22R66. Compare the resultant trace with the specification. Continue adjusting A22R66 until best flatness is achieved.

Note Best flatness is achieved when the maximum number of frequency points are on or near the -14 dBm reference.

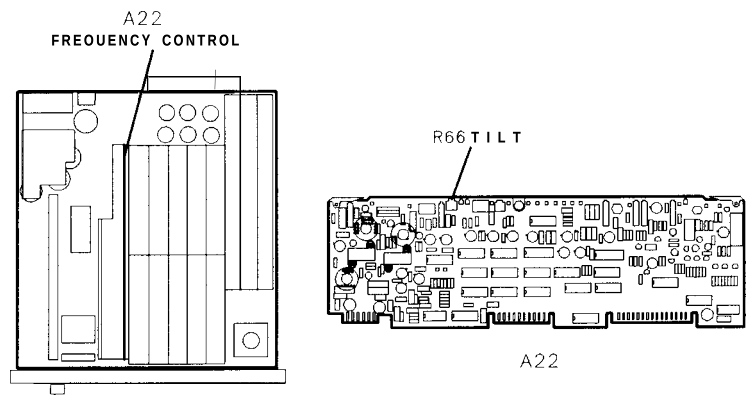

Figure 3-81. Location of A22R66 TILT Adjustment

15. Press TRACE A, (VIEW), [PEAK SEARCH], and [MARKER DELTA]. Using the data knob, place the marker on the lowest power peak. The marker's absolute value should be less than 2 dB.
16. See Figure 3-82 for examples of typical displays of frequency response correctly and incorrectly adjusted.

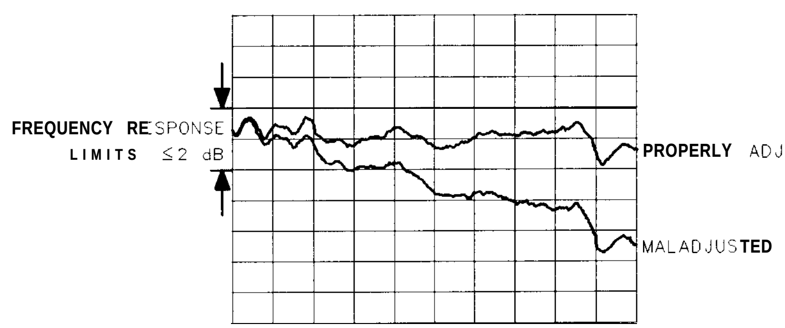

Figure 3-82. Slope Compensation Adjustment Waveforms

22. Comb Generator Adjustments

Reference

RF Section:
- A23 RF Converter
- A16 20 MHz Reference

Description

The output of the Pilot First Converter is connected to the signal input of the Second Converter. This allows the comb teeth from the A23A6 Comb Generator to be displayed on the CRT display. The phase lock flags are disabled, using a shift key function to prevent the instrument from “locking up” due to the phase lock loops being open. A display line is placed on the CRT at the level to which the comb teeth are to be adjusted. the comb teeth are adjusted for best overall flatness and to the proper amplitude.

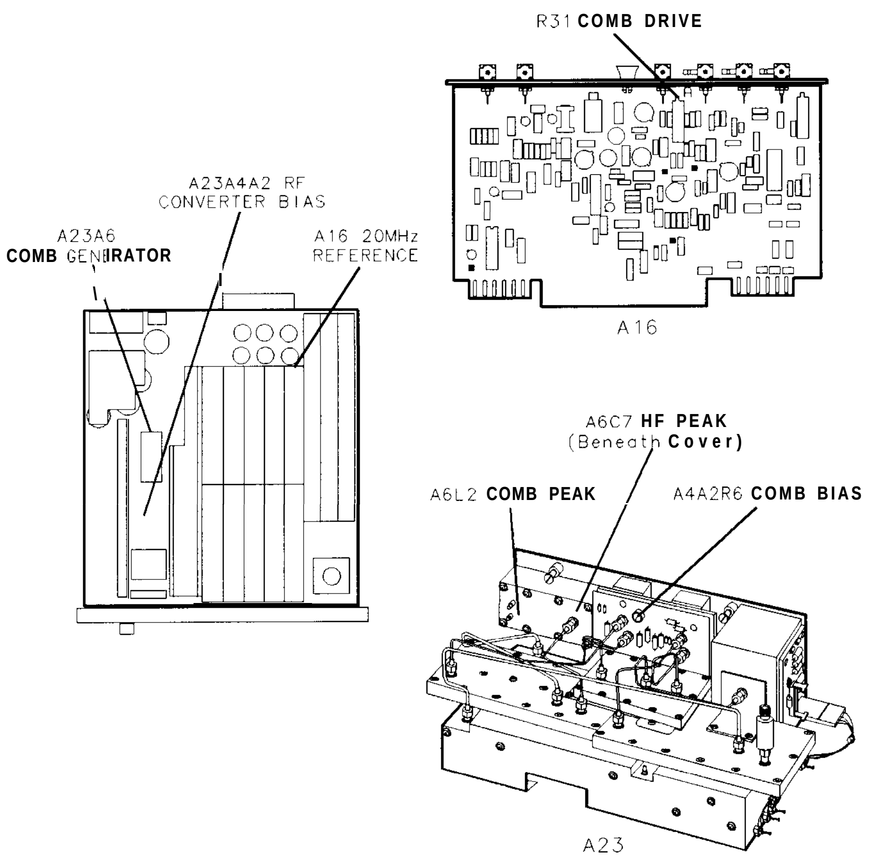

Figure 3-83. Location of Comb Generator Adjustments

Equipment Cable, SMA (m) to SMA (m) . . . . HP 85680-20094

Procedure

1. Set instrument LINE switch to ON and press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 100 kHz, (ATTEN) 0 dB, LOG (ENTER dB/DIV) 2 dB.
4. Adjust front-panel AMPTD CAL for signal peak at top graticule line (-10 dBm).
5. Press (INSTR PRESET).
6. Key in (SHIFT) (FREE RUN) V. This disables phase lock flags.
7. Position instrument on right side and remove bottom cover.
8. Disconnect cables from A23A5J2 (PILOT IF OUT) and A23A3J1 (1ST IF IN) and connect a short, low-loss coaxial cable with SMA male connectors (do not use adapters) between A23A5J2 and A23A3J1. Use coaxial cable, HP Part Number 85680-20094. If not available, remove A23FL2 FILTER and use between A23A5J2 and A23A3J1 to adjust comb generator.
9. Key in (START FREQ) 40 MHz. Wait for CRT annotation at lower left of CRT display to indicate START 40 MHz.
10. Key in (STOP FREQ) 1560 MHz. Wait for CRT annotation at lower right of CRT display to indicate STOP 1560 MHz.
11. Key in (REFERENCE LEVEL) -20 dBm, (ATTEN) 0 dB, LOG (ENTER dB/DIV) 2 dB, DISPLAY LINE (ENTER) -30 dBm.
12. Adjust A16 COMB DRIVE A16R31 for peak amplitude of CRT trace until comb teeth begin to “wiggle.” Then adjust COMB DRIVE A16R31 slightly counterclockwise until the lowest comb tooth (near START frequency) just begins to fall. See Figure 3-84 for a typical comb tooth display. See Figure 3-83 for location of adjustments.

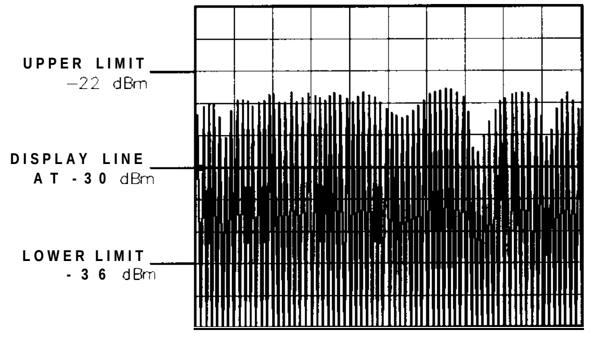

Figure 3-84. Comb Teeth Display

13. Adjust COMB BIAS A23A4A2R6 for peak amplitude of CRT trace until comb teeth begin to “wiggle. ” Then adjust COMB BIAS A23A4A2R6 slightly counterclockwise until the lowest comb tooth (near START) frequency) just begins to fall. See Figure 3-84 for

a typical comb tooth display. See Figure 3-83 for location of adjustments.

14. The majority of the comb teeth should be above the -30 dBm Display Line. No comb teeth should exceed -22 dBm, and no comb teeth should be less than -36 dBm.
15. If unable to adjust comb teeth as described in previous steps, proceed with the next step. If comb teeth are adjusted properly, do not perform the adjustments in the following steps. Skip to step 21.
16. Adjust A23A6 COMB PEAK A23A6L2 for maximum amplitude of comb teeth. See Figure 3-83 for location of adjustment.
17. If the highest-frequency comb tooth is too low (<−36 dBm), remove screws from cover of A23A6 Comb Generator and lift cover from housing, being careful not to break wire connections to internal circuit. It will be necessary to hold cover away from housing while performing the following adjustment.
18. Adjust A23A6 HF PEAK A23A6C7 for maximum amplitude of the highest-frequency comb tooth displayed (comb tooth to far right of CRT). See Figure 3-84 for location of adjustment.
19. Replace cover on A23A6 and install screws.
20. Go back to step 12 and proceed with adjustments.
21. Remove cable from between A23A65J2 and A23A3J 1 and reconnect instrument cables to connectors from which they were removed.

23. Analog-To-Digital Converter Adjustments

Reference

A3A8 Analog-to-Digital Converter

Description

The Analog-to-Digital Ramp Converter is adjusted at zero and full-scale by injecting a 0 V dc input and + 10 V dc input and adjusting the OFFS and GAIN controls until the ramp output at A3A8TP11 toggles high to low. This sets the horizontal end points for the CRT trace display; when the sweep ramp input is at 0 V dc (the left graticule edge), trace position 1 is set, and when the sweep ramp input is at + 10 V dc (the right graticule edge), trace position 1000 is set.

This procedure requires a + 10 V dc source which is stable and noise-free. A simple supply circuit which can be built with common components is illustrated in Figure 3-93. If these components are unavailable, the alternate procedure provided below (using only the digital voltmeter) can then be used.

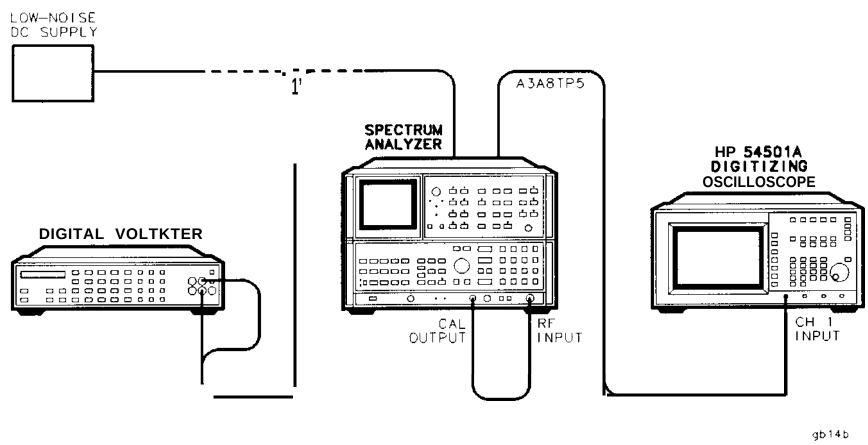

Figure 3-85. Analog-To-Digital Converter Adjustments Setup

Equipment

Oscilloscope .... HP 54501
Digital Voltmeter .... HP 3456A
Low-Noise DC Supply (Optional) .... See Figure 3-93

23. Analog-To-Digital Converter Adjustments

Procedure

1. Position instrument upright as shown in Figure 3-85 and remove top cover.
2. Set LINE switch to ON and press (INSTR PRESET).

Standard Procedure

3. Procedure using Low-Noise DC Supply is illustrated in Figure 3-93.
   a. Key in (BLANK) TRACE A and SWEEP (SINGLE).
   b. Disconnect cable 0 (black) from sweep ramp input A3A8J1.
   c. Short A3A8TP4 to A3A8TP5 or connect SMB snap-on short to A3A8J1.
   d. Connect the oscilloscope's 10:1 probe to A3A8TP11 and ground the probe's ground to the A3 section's card cage.
   e. Set the oscilloscope settings as follows:

      amplitude scale .... 0.1 V/div
      time scale 5.0μs
      coupling .... dc

   f. Adjust A3A8R6 OFFS for a square wave displayed on the oscilloscope. The square wave should be approximately 4 V_{p-p}. See Figure 3-86 for location of adjustment.

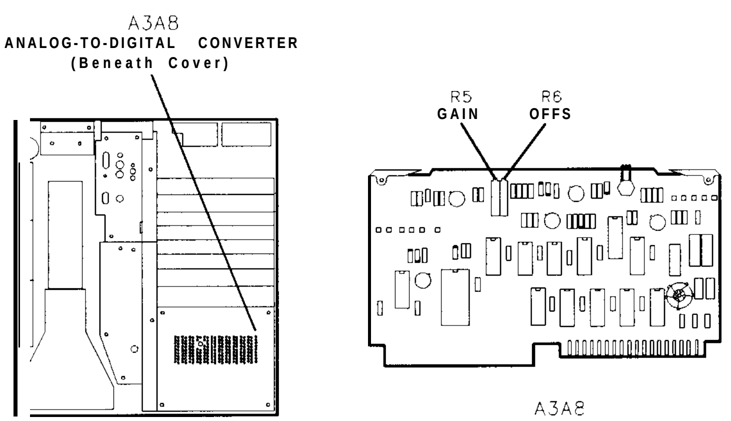

Figure 3-86. Location of Analog-To-Digital Converter Adjustments

   g. Remove short from A3A8TP4 and A3A8TP5 or disconnect the SMB snap-on short from A3A8J1.
   h. Press (INSTR PRESET).
   i. Press MARKER (NORMAL), 1498 (MHz), and (SHIFT) (SINGLE) u.
   j. Connect DVM to A3A8TP5 and ground to A3A8TP4. Set DVM for V dc.
   k. Connect output of the Low-Noise DC Supply to A3A8J1. Adjust the Low-Noise DC Supply for DVM indication of + 10.000 ±.001V dc.

1. Adjust A3A8R5 GAIN for a square wave displayed on the oscilloscope. The square wave should be approximately 4 V_{p-p}. See Figure 3-86 for location of adjustment.

Alternate Procedure

4. Procedure without using Low-Noise DC Supply:
   a. Press (INSTR PRESET).
   b. Key in TRACE A (BLANK) and SWEEP (SINGLE).
   c. Disconnect cable 0 (black) from sweep ramp input A3A8J1.
   d. Short A3A8TP4 to A3A8TP5 or connect SMB snap-on short to A3A8J1.
   e. Connect DVM to A3A8TP11 and ground to A3A8TP4. Set DVM for V ac.
   f. Adjust A3A8R6 OFFS until the level at A3A8TP11 is at a maximum ac voltage as indicated by the DVM (approximately 2.0 V ac). See Figure 3-86 for location of adjustment.
   g. Remove short from A3A8TP4 and A3A8TP5. Reconnect cable 0 (black) to A3A8J 1.
   h. Press (INSTR PRESET).
   i. Connect DVM to A3A8TP5 and ground to A3A8TP4. Set DVM for V dc.
   j. Press SWEEP (SINGLE). Note DVM reading at end of the sweep. The voltage will begin to drift immediately after the sweep ends. Therefore, the first indication after the sweep ends is the valid indication. It may be helpful to press (SINGLE) several times to ensure a valid indication at the end of the sweep.
   k. If DVM indication is + 10.020 ±0.005 V dc at the end of the sweep, no further adjustment is necessary. Otherwise, adjust A3A8R5 GAIN and repeat step j until the voltage at the end of the sweep is + 10.020 ±0.005 V dc.

24. Track and Hold Adjustments

Reference A3A9 Track and Hold

Description The CAL OUTPUT signal is connected to the RF INPUT. The instrument is placed in zero frequency span to produce a dc level output from the IF-Video section and this dc level is regulated by adjusting the reference level. The Offsets and Gains on the Track and Hold assembly are adjusted for proper levels using a DVM.

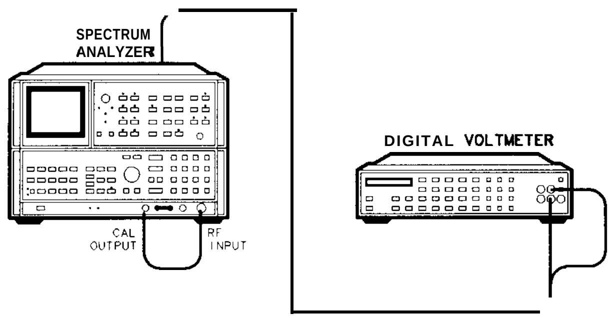

Figure 3-87. Track and Hold Adjustments Setup

Equipment Digital Voltmeter (DVM) .... HP 3456A

Procedure

1. Place instrument upright as shown in Figure 3-87 with top and A3 Digital Storage covers removed.
2. Set LINE switch to ON and press (INSTR PRESET).
3. Connect CAL OUTPUT to RF INPUT.
4. Connect DVM to A3A9TP3 and ground to A3A9TP1.
5. Key in (CENTER FREQUENCY) 20 MHz, (FREQUENCY SPAN) 0 Hz.
6. Disconnect cable 7 (violet) from A4A1J1.
7. Short A3A9TP1 to A3A9TP3, or use an SMB snap-on short to A3A9J1. DVM indication should be 0.000 ±0.001 V dc.
8. Key in (SINGLE), TRACE A (CLEAR-WRITE), MARKER (NORMAL), MARKER (Δ), SWEEP (CONT), (SHIFT) TRACE A (BLANK) e.
9. Adjust A3A9R59 (T/H) OFS until MARKER Δ level indication as indicated by CRT annotation flickers back and forth between .OO and .10 dB. See Figure 3-88 for location of adjustment.

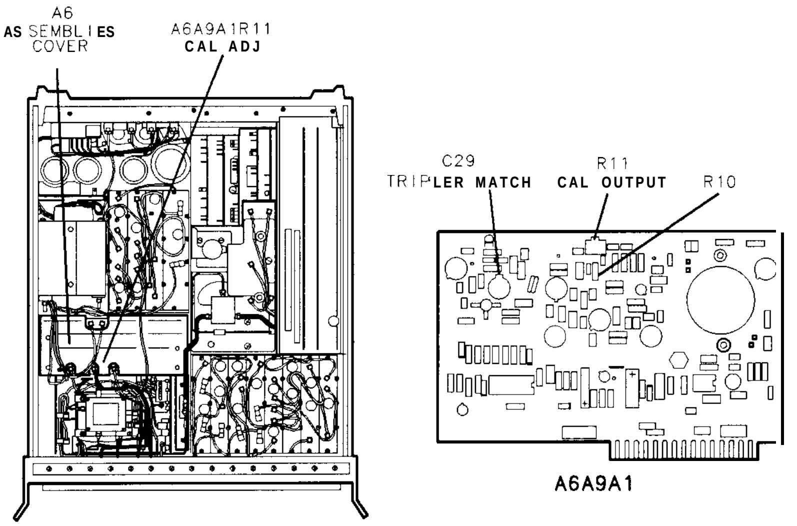

Figure 3-88. Location of Track and Hold Adjustments

10. Key in (SHIFT) TRACE A (MAX HOLD). [b]
11. Adjust A3A9R44 OFFS POS until MARKER A level indication as indicated by CRT annotation flickers back and forth between .OO and .10 dB.
12. Key in (SHIFT) TRACE A (VIEW) [d].
13. Adjust A3A9R36 OFS NEG until MARKER A level indication as indicated by CRT annotation flickers back and forth between .OO and . 10 dB.
14. Key in (SHIFT) TRACE A (BLANK) [e].
15. Remove short from between A3A9TP1 and A3A9TP3 or remove the SMB short from A3A9J1. Reconnect cable 7 (violet) to A4A1J1.
16. Connect the DVM to A4A1TP3. Connect DVM's ground to the IF section's casting.
17. Press [REFERENCE LEVEL] and adjust DATA knob and front-panel AMPTD CAL adjust for a DVM indication of +2.000 ±0.001 V dc at A4A1TP3.
18. Disconnect DVM from instrument.
19. Key in (SINGLE), TRACE A (CLEAR-WRITE], MARKER (NORMAL), MARKER In], SWEEP (CONT).
20. Adjust A3A9R57 T/H GAIN for GAIN for MARKER A level indication as indicated by CRT annotation of 100 ±0.1 dB.
21. Key in (SHIFT) TRACE A (MAX HOLD) [b].
22. Adjust A3A9R39 GPOS for MARKER A level indication as indicated by CRT annotation of 100 fO.l dB.
23. Key in [SHIFT) TRACE A (VIEW) [d].

24. Track and Hold Adjustments

24. Adjust A3A9R52 GNEG for MARKER A level indication as indicated by CRT annotation of 100 ±0.1 dB.
25. Repeat steps 4 through 24 until no further adjustments are required.

25. Digital Storage Display Adjustments

Reference

A3A 1 Trigger
A3A2 Intensity Control
A3A3 Line Generator

Description

First, preliminary CRT graticule adjustments are performed to position the graticule on the CRT. These preliminary adjustments assume that repair has been performed on the associated circuitry. If no repair has been performed on the assemblies listed under REFERENCE, the preliminary adjustments are not necessary.

Next, the Sample and Hold Balance adjustments are performed. The horizontal and vertical Offset and Gain adjustments are performed, then the final CRT graticule adjustments are performed.

Last, the CRT annotation adjustments are performed to place the CRT annotation in proper location with respect to the CRT graticule.

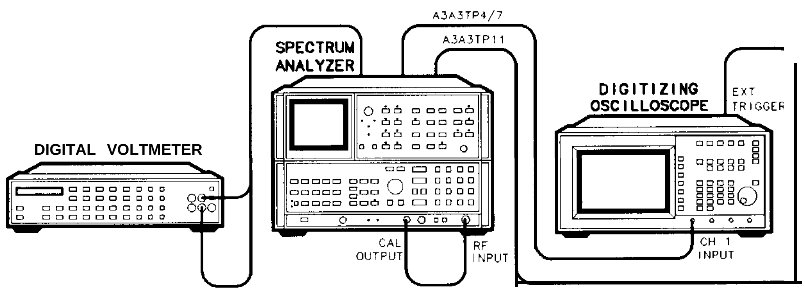

Figure 3-89. Digital Storage Display Adjustments Setup

Equipment

Digital Voltmeter (DVM) .... HP 3456A
Digitizing Oscilloscope .... HP 54501A

Procedure

1. Place instrument upright as shown in Figure 3-89 with top and A3 Digital Storage cover removed.
2. Set LINE switch to ON and press (INSTR PRESET).

Preliminary Graticule Adjustments

3. Press TRACE A (BLANK).
4. Adjust A3A3R4 X GAIN and A3A3R5 Y GAIN to place graticule information completely on CRT. See Figure 3-90 for location of adjustment.

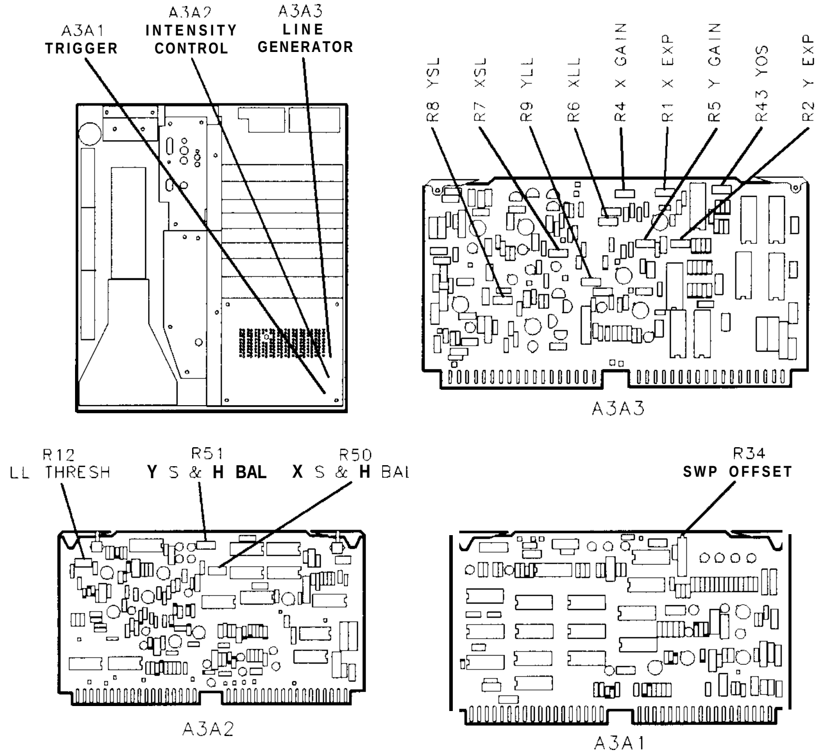

Figure 3-90. Location of Digital Storage Display Adjustments

5. Adjust A3A2R12 LL THRESH fully clockwise. See Figure 3-90 for location of adjustment.
6. Adjust A3A3R6 XLL so that horizontal graticule lines just meet the vertical graticule lines at the left and right sides of the graticule. See Figure 3-90 for location of adjustment.
7. Adjust A3A3R9 YLL so that vertical graticule lines just meet the horizontal graticule lines at the top and bottom of the graticule. See Figure 3-90 for location of adjustment.
8. Repeat steps 6 and 7 until horizontal and vertical lines are adjusted so that they meet the edges of the graticule but do not overshoot.
9. Adjust A3A2R12 LL THRESH fully counterclockwise.
10. Adjust A3A3R7 XSL so that horizontal graticule lines just meet the vertical graticule lines at the left and right sides of the graticule.
11. Adjust A3A3R8 YSL so that the vertical graticule lines just meet the horizontal graticule lines at the top and bottom of the graticule.
12. Repeat steps 10 and 11 until horizontal and vertical graticule lines are adjusted so that they meet at the edges of the graticule but do not overshoot.

Sample and Hold Balance Adjustments

13. Set LINE switch to STANDBY.
14. Place A3A3 Line Generator on extender boards.
15. Set LINE switch to ON. Press (INSTR PRESET).
16. Key in (SHIFT) ( ) z (RECORDER LOWER LEFT) 0 [Hz). Press (SHIFT) ( ) | (RECORDER UPPER RIGHT) 1028 (Hz).
17. Connect oscilloscope to A3A3TP4.
18. Connect A3A3TP11 to oscilloscope External Trigger Input and adjust oscilloscope controls for display as shown in Figure 3-91.
19. Adjust A3A2R50 X S&H BAL for minimum dc offset between the level of the signal inside the two pulses to the signal level outside the two pulses. Figure 3-91 shows a properly adjusted waveform. Figure 3-92 shows the waveform before adjustment. Refer to Figure 3-90 for location of adjustment.

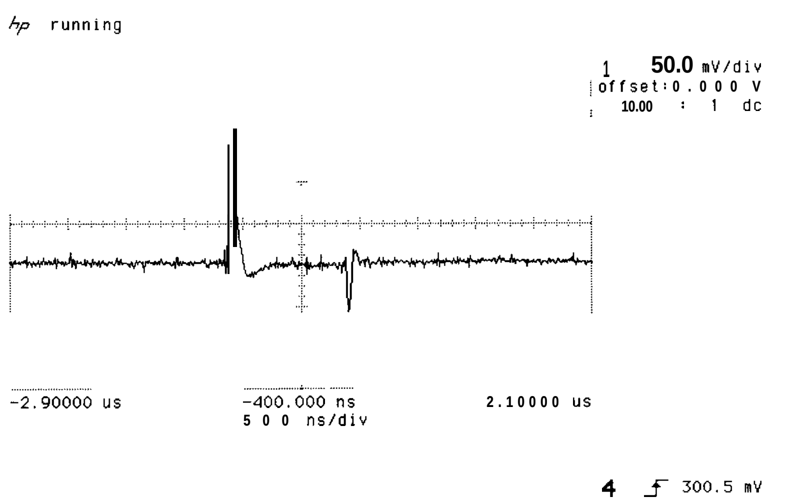

Figure 3-91. Sample and Hold Balance Adjustment Waveforms

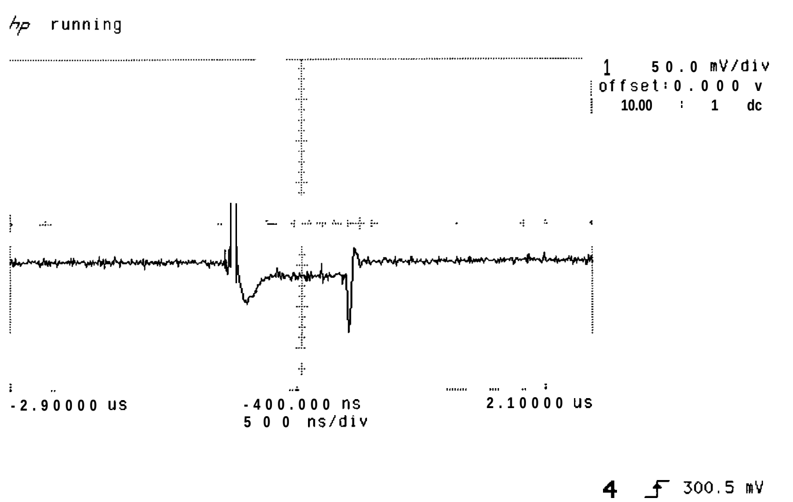

Figure 3-92. Waveform Before Adjustment

20. Connect oscilloscope to A3A3TP7.
21. Adjust A3A2R51 Y S&H BAL for minimum dc offset between the level of the signal inside the two pulses to the signal level outside the two pulses.
22. Set LINE switch to STANDBY.
23. Reinstall A3A3 Line Generator in instrument without extender boards.
24. Set LINE switch to ON.

X and Y Offset and Gain Adjustments

25. Press (INSTR PRESET).
26. Key in [FREQUENCY SPAN] 0 Hz, [SWEEP TIME] 100 μs.
27. Disconnect cable 9 (white) from A3A9J2 and connect to A3A2J2 LG/FS test connector on A3A2 Intensity Control; the other end of the cable remains connect connected to A3A2J1.
28. Select TRIGGER (VIDEO) and adjust front-panel LEVEL control for a stable display on instrument CRT.
29. Adjust A3A1R34 SWP OFFSET so that the signal trace begins at the left edge graticule line. Refer to Figure 3-90 for location of adjustment.
30. Adjust A3A3R4 X GAIN for twenty cycles displayed on the CRT graticule. This may be made easier by adjusting A3A1R34 SWP OFFSET so that the first peak is centered on the left edge graticule line, then adjusting A3A3R4 X GAIN for two cycles per division with the twentieth cycle being centered on the right edge graticule line. A3A1R34 SWP OFFSET must then be readjusted so that the trace begins at the left edge graticule line. See Figure 3-90. for location of adjustment.
31. Remove the cable 9 (white) from A3A2J2 LG/FS test connector and reconnect to A3A9J2.
32. Remove cable 7 (violet) from A4A1J1. Short A3A9TP1 to A3A9TP3 or connect an SMB snap-on short to A3A9J1.
33. Connect DVM to A3A9TP3 and DVM ground to A3A9TP1.
34. Press LIN pushbutton.
35. DVM indication should be 0.000 ±0.002 V dc.
36. Adjust A3A3R43 YOS to align the bottom graticule line with the fast sweep signal trace.
37. Remove the short between A3A9TP1 and A3A9TP3 (or the SMB snap-on short) and reconnect cable 7 (violet) to A4A1J1.
38. Key in [CENTER FREQUENCY] 20 MHz. Connect CAL OUTPUT to RF INPUT. Press LOG (ENTER dB/DIV) 10 dB.
39. Connect the DVM to A4A1TP3 and the DVM ground to the IF casting.
40. Press [REFERENCE LEVEL] and adjust DATA knob and the frontpanel AMPTD CAL adjust for DVM indication of +2.000 50.002 V dc.

41. Adjust A3A3R5 Y GAIN to align the top graticule line with the fast sweep signal trace.

Final Graticule Adjustments

42. Press (INSTR PRESET), TRACE A (BLANK).
43. Set A3A2R12 LL THRESH fully clockwise.
44. Adjust A3A3R6 XLL and A3A3R9 YLL to align horizontal and vertical lines so that each line meets the edge line (right, left, top, or bottom) but does not overshoot.
45. Adjust A3A2R12 LL THRESH fully counterclockwise.
46. Adjust A3A3R7 XSL and A3A348 YSL to align horizontal and vertical graticule lines so that each line meets the edge line (right, left, top, or bottom) but does not overshoot.
47. Adjust A3A2R12 LL THRESH clockwise until all graticule lines switch over to long lines. This is indicated by a noticeable increase in graticule line intensity. (All graticule lines should increase in intensity.)

X and Y Expand Adjustments

48. Press (INSTR PRESET).
49. Key in MARKER (NORMAL).
50. Adjust A3A3R1 X EXP to center the letter "F" in "REF" (CRT annotation in upper left corner of display) over the left edge graticule line.
51. Adjust A3A3R2 Y EXP to align the remainder of the CRT annotation so that the upper annotation (MARKER data) is above the top graticule line and the lower annotation (START and STOP data) is below the bottom graticule line. Adjust for equal spacing above and below the graticule pattern.

Low-Noise DC Supply

The Low-Noise DC Supply shown in Figure 3-93 can be constructed using the parts listed in Table 3-7.

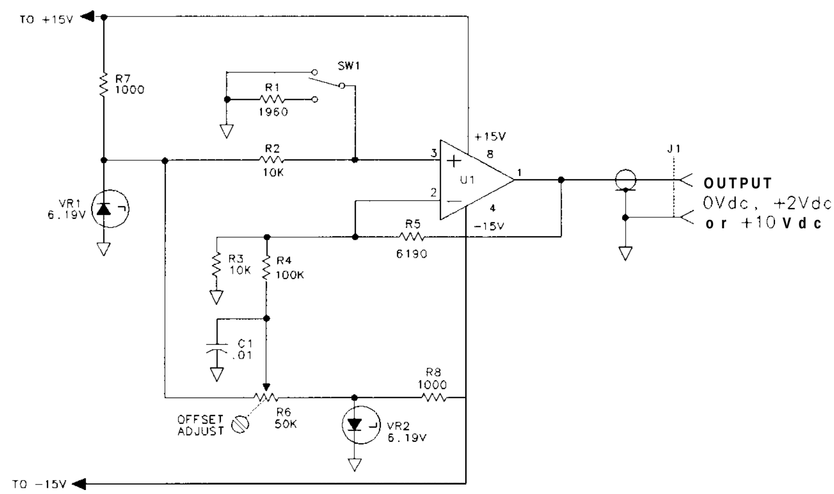

Figure 3-93. Low-Noise DC Supply

Table 3-7. Parts for Low-Noise DC Supply

Reference/Designation	HP Fart Number	CD	Description
Cl	0160-2055	9	CAPACITOR FXD .01 μf
J1	1250-0083	1	CONNECTOR BNC
R1	0698-0083	8	RESISTOR FXD 1.96K 1% .125W
R2	0757-0442	9	RESISTOR FXD 10K 1% .125W
R3	0757-0442	9	RESISTOR FXD 10K 1% .125W
R4	0757-0465	6	RESISTOR FXD 100K 1% .125W
R5	0757-0290	5	RESISTOR FXD 6.19 K 1% .125W
R6	2100-2733	6	RESISTOR VARIABLE 50K 20%
R7	0757-0280	3	RESISTOR FXD 1K 1% .125W
R8	0757-0280	3	RESISTOR FXD 1K 1% .125W
S1	3101-1792	8	SWITCH TOGGLE, S-POSITION
U1	1826-0092	3	IC DUAL OP-AMP
VR1	1902-0049	2	DIODE BREAKDOWN 6.19V
VR2	1902-0049	2	RESISTOR FXD 1.96K 1% .125W

Crystal Filter Bypass Network Configuration

The Crystal Filter Bypass Network Configuration shown in Figure 3-94 can be constructed using the parts listed in Table 3-8 and Table 3-9. Table 3-8 list the parts required for the construction of 21.4 MHz IF crystal-filter bypass networks used with the A4A4 and A4A8 assemblies. Two 21.4 MHz bypass networks are required. Table 3-9 list the parts required for the construction of 3 MHz IF crystal-filter bypass networks used with the A4A7 assembly. Four 3 MHz bypass networks are required.

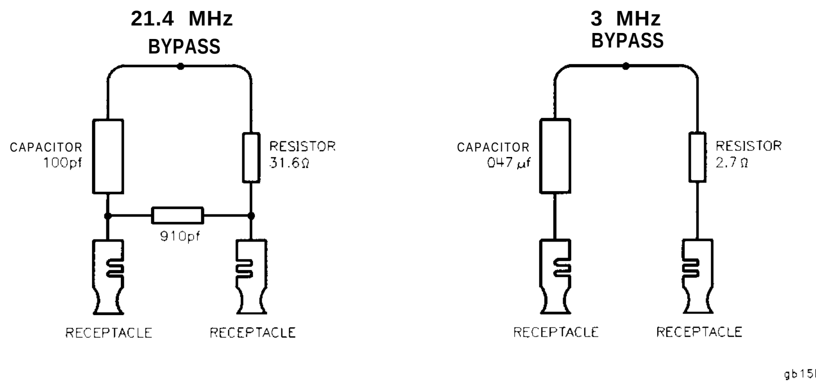

Figure 3-94. Crystal Filter Bypass Network Configurations

Table 3-8.
Crystal Filter Bypass Network Configuration for A4A4 and A4A8 (21.4 MHz)

Part	Value	Qty.	CD	HP Part Number
Resistor	31.662	2	2	0698-7200
Capacitor	100 pF	2	9	0160-4801
Capacitor	910 pF	2	9	0160-6146
Receptacle	–	4	1	1251-3720

Table 3-9.
Crystal Filter Bypass Network Configuration for A4A7 (3 MHz)

Part	Value	Qty.	CD	HP Part Number
Resistor	2.70	4	4	0683-0275
Capacitor	0.047 µF	4	9	0170-0040
Receptacle	–	8	1	1251-3720

4

Option 462

Introduction

This chapter contains modified performance tests and adjustment procedures for Option 462 instruments. When working on Option 462 instruments, substitute the procedures in this chapter for the standard versions contained in chapters two and three. For earlier Option 462 instruments (HP 85662A serial prefixes below 3341A) in which impulse bandwidths are specified, use the tests and adjustment under "Impulse Bandwidths" .The procedures included in this chapter are listed below:

4. 6 dB Resolution Bandwidth Accuracy Test

Related Adjustment

6 dB Bandwidth Adjustments

Specification

±20%, 3 MHz bandwidth
±10%, 30 Hz to 1 MHz bandwidths
+ 50%, -0%, 10 Hz bandwidth

30 kHz and 100 kHz bandwidth accuracy figures only applicable ≤90% Relative Humidity, ≤40° C.

Description

The 6 dB bandwidth for each resolution bandwidth setting is measured with the MARKER function to determine bandwidth accuracy. The CAL OUTPUT is used for a stable signal source.

Equipment

None required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in spectrum analyzer settings as follows:

   [CENTER FREQUENCY) .... 20 MHZ
   (FREQUENCY SPAN) .... 5 MHz
   (RES BW) .... 3 MHz
   [REFERENCE LEVEL] .... -10 dBm

4. Press SCALE LIN pushbutton. Press (SHIFT), (AUTO)A (resolution bandwidth) for units in dBm.
5. Adjust [REFERENCE LEVEL) to position peak of signal trace at (or just below) reference level (top) graticule line. Press SWEEP (SINGLE).
6. Press MARKER [NORMAL) and place marker at peak of signal trace with DATA knob. Press MARKER (Δ) and position movable marker 6 dB down from the stationary marker on the positive-going edge of the signal trace (the MARKER A amplitude readout should be -6.00 dB ±0.05 dB). It **may** be necessary to press SWEEP (CONT) and adjust [CENTER FREQUENCY] to center trace on screen.
7. Press MARKER (Δ) and position movable marker 6 dB down from the signal peak **on** the negative-going edge of the trace (the MARKER Aamplitude readout should be .OO dB ±0.05 dB). The 6 dB bandwidth is given by the MARKER A frequency readout. (See Figure 4- 1.) Record this value in Table 4- 1.

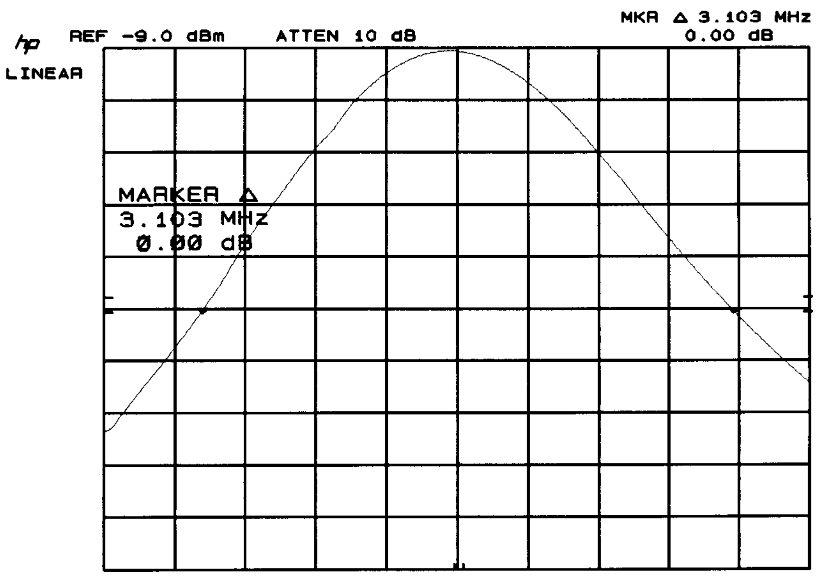

Figure 4-1. Resolution Bandwidth Measurement

8. Vary spectrum analyzer settings according to Table 4-1. Press SWEEP (SINGLE) and measure the 6 dB bandwidth for each resolution bandwidth setting by the procedure of steps 6 and 7 and record the value in Table 4-1. The measured bandwidth should fall between the limits shown in the table.

Table 4-1. 6 dB Resolution Bandwidth Accuracy

(RES BW)	(FREQUENCY SPAN)	MARKER Δ Readout of 6 dB Bandwidth		
		Min	Actual	Max
3 MHz	5 MHz	2.400 MHz	________	3.600 MHz
1 MHz	2 MHz	900 kHz	________	1.100 MHz
300 kHz	500 kHz	270.0 kHz	________	330.0 kHz
100 kHz	200 kHz	90.0 kHz	________	110.0 kHz
30 kHz	50 kHz	27.00 kHz	________	33.00 kHz
10 kHz	20 kHz	9.00 kHz	________	11.00 kHz
3 kHz	5 kHz	2.700 kHz	________	3.300 kHz
1 kHz	2 kHz	900 Hz	________	1.100 kHz
300 Hz	500 Hz	270 Hz	________	330 Hz
100 Hz	200 Hz	90 Hz	________	110 Hz
30 Hz	100 Hz	27.0 Hz	________	33.0 Hz
10 Hz	100 Hz	10.0 Hz	________	15.0 Hz

4. Impulse and Resolution Bandwidth Accuracy Test

Related Adjustment Impulse Bandwidth Adjustments

Specification

±20%, 3 MHz bandwidth
±10%, 1 MHz to 1 kHz bandwidths
-0, +50%, 300 Hz to 10 Hz (6 dB bandwidths)

Description A frequency synthesizer and pulse/function generator are used to input pulses to the spectrum analyzer. The amplitude of the pulses is measured, and the impulse bandwidths are calculated for each impulse bandwidth from 3 MHz to 1 kHz. The 6 dB resolution bandwidths are then measured using the spectrum analyzer (MARKER) function. The CAL OUTPUT signal is used as a stable signal source to measure the 6 dB resolution bandwidths.

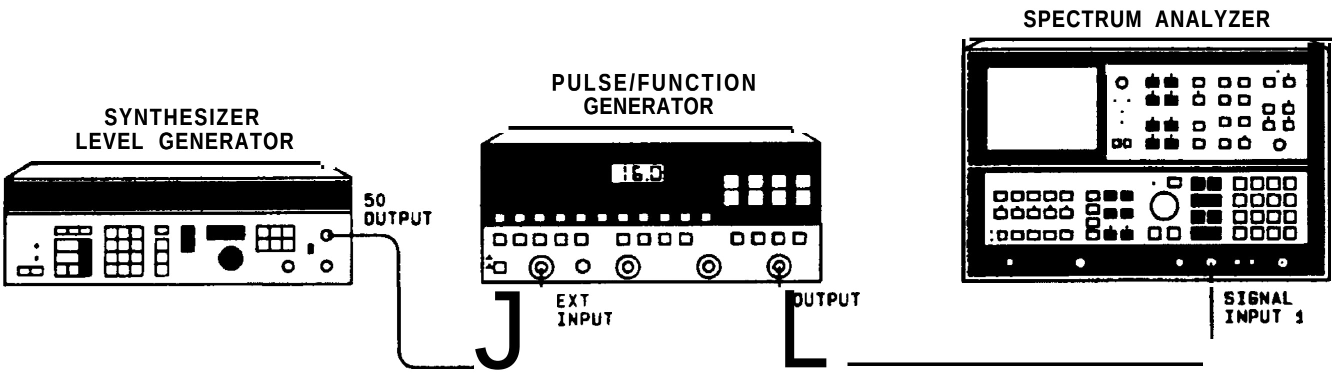

Figure 4-2. Impulse Bandwidth Test Setup

Equipment

Frequency Synthesizer .... HP 3335A
Pulse/Function Generator .... HP 8116A

Procedure

1. Set the frequency synthesizer for a 15 MHz, + 13 dBm output. Connect the output of the frequency synthesizer to the EXT INPUT of the pulse/function generator.
2. Set the pulse/function generator controls as follows:

   MODE .... TRIG
   EXT INPUT .... positive-going
   EXT INPUT LEVEL .... midrange
   OUTPUT .... pulse
   LOL .... .OV
   HIL 0.4V
   WIDTH (WID) .... 10 ns
   DISABLE .... off

Note

The spectrum analyzer (REFERENCE LEVEL) setting should remain at 0 dBm throughout steps 4 through 38 to prevent possible IF gain compression of the pulse signal.

3. On the spectrum analyzer, press (INSTR PRESET) and select SIGNAL INPUT 1. Set the controls as follows:

   (CENTER FREQUENCY) .... 15 MHz
   (FREQUENCY SPAN) .... 12 MHz
   (ATTEN) .... 20 dB
   (RES BW) .... 3 MHz (i)
   (VIDEO BW) .... 3 MHz
   (REFERENCE LEVEL) .... 0 dBm

4. On the spectrum analyzer, press (SHIFT), (ATTEN) (AUTO) D, SWEEP (SINGLE) MARKER (PEAK SEARCH). Note the MARKER amplitude for the 3 MHz filter in the HIGH FREQUENCY REPITITION RATE column in Table 4-2.
5. Set the frequency synthesizer (FREQUENCY) to 300 kHz.
6. On the spectrum analyzer, press (FREQUENCY SPAN) 0 Hz, (SWEEP TIME) 0.5 seconds, SWEEP (SINGLE).
7. Press MARKER (PEAK SEARCH). Note the MARKER amplitude for the 3 MHz filter in the LOW FREQUENCY REPITITION RATE column in Table 4-2.
8. Calculate the Impulse Bandwidth of the 3 MHz filter using the formula shown below and record the results for the 3 MHz filter in Table 4-2.

   BW(i) = High frequency rep rate (15 MHz) x (Low frequency reading (step 7)/Hi frequency reading(step 4))

9. Set the frequency synthesizer (FREQUENCY) to 10 MHz.
10. On the spectrum analyzer, key in (CENTER FREQUENCY) 10 MHz, (RES BW) 1 MHz (i), (FREQUENCY SPAN) 4 MHz, SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2
11. Set the frequency synthesizer (FREQUENCY) to 100 kHz.
12. On the spectrum analyzer, key in (FREQUENCY SPAN) 0 Hz, (SWEEP TIME) 0.5 seconds, SWEEP (SINGLE).
13. Press MARKER (PEAK SEARCH). Record the MARKER amplitude in Table 4-2.
14. Calculate the impulse bandwidth of the 1 MHz filter using the formula in step 8. Record the result in Table 4-2.
15. Set the frequency synthesizer (FREQUENCY) to 3 MHz. Set the pulse/function generator WID to 33.3 ns.
16. On the spectrum analyzer, key in: (RES BW) 300 kHz (i), (CENTER FREQUENCY) 3 MHz, (FREQUENCY SPAN) 1.2 MHz, SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.

17. Set the frequency synthesizer (FREQUENCY) to 30 kHz. On the spectrum analyzer key in [FREQUENCY SPAN] 0 Hz, [SWEEP TIME] 0.5 seconds, SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.
18. Calculate the Impulse BW of the 300 kHz filter using the formula in step 8. Record in Table 4-2.
19. Set the frequency synthesizer (FREQUENCY] to 1 MHz. Set the pulse/function generator WID to 100 ns.
20. On the spectrum analyzer key in: (RES BW) 100 kHz (i), (VIDEO BW) 1 MHz, [CENTER FREQUENCY) 1 MHz, (FREQUENCY SPAN) 400 kHz, SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER [PEAK SEARCH]. Record MARKER amplitude in Table 4-2.
21. Set the frequency synthesizer [FREQUENCY] to 10 kHz. On the spectrum analyzer, key in: [FREQUENCY SPAN) 0 Hz, (SWEEP TIME] 0.5 seconds, SWEEP (SINGLE), MARKER [PEAK SEARCH). Record MARKER amplitude in Table 4-2.
22. Calculate the Impulse BW of the 100 kHz filter using the formula in step 8. Record in Table 4-2.
23. Set the frequency synthesizer (FREQUENCY] to 300 kHz. Set the pulse/function generator WID to 333 ns.
24. On the spectrum analyzer, key in: (RES BW) 30 kHz (i), (VIDEO BW) 300 kHz, (CENTER FREQUENCY) 300 kHz, [FREQUENCY SPAN) 120 kHz, SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER, (PEAK SEARCH). Record MARKER amplitude in Table 4-2.
25. Set the frequency synthesizer (FREQUENCY) to 3 kHz. On the spectrum analyzer, key in: (FREQUENCY SPAN] 0 Hz, (SWEEP TIME) 0.5 seconds, SWEEP (SINGLE), MARKER (PEAK SEARCH]. Record MARKER amplitude in Table 4-2.
26. Calculate the Impulse BW of the 30 kHz filter using the formula in step 8. Record in Table 4-2.
27. Set the frequency synthesizer [FREQUENCY) to 100 kHz. Set the pulse/function generator WID to 1 μs.
28. On the spectrum analyzer key in (RES BW) 10 kHz (i), (VIDEO BW) 100 kHz, (CENTER FREQUENCY] 100 kHz, (FREQUENCY SPAN) 40 kHz, SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER [PEAK SEARCH). Record MARKER amplitude in Table 4-2.
29. Set the frequency synthesizer (FREQUENCY) to 1 kHz. On the spectrum analyzer key in: (FREQUENCY SPAN) 0 Hz, [SWEEP TIME] 0.5 seconds, SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.
30. Calculate the Impulse BW of the 10 kHz filter using the formula in step 8. Record in Table 4-2.
31. Set the frequency synthesizer [FREQUENCY) to 30 kHz. Set the pulse/function generator WID to 3.33 μs.
32. On the spectrum analyzer key in: (RES BW) 3 kHz (i), (VIDEO BW) 30 kHz, (CENTER FREQUENCY) 30 kHz, [FREQUENCY SPAN) 12 kHz,

SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.

33. Set the frequency synthesizer (FREQUENCY) to 300 Hz. On the spectrum analyzer key in: (FREQUENCY SPAN) 0 Hz, (SWEEP TIME) 0.5 seconds, SWEEP (SINGLE) MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.

34. Calculate the Impulse BW of the 3 kHz filter using the formula in step 8. Record in Table 4-2.

35. Set the frequency synthesizer (FREQUENCY) to 10 kHz. Set the pulse/function generator WID to 10 μs.

36. On the spectrum analyzer key in (RES BW) 1 kHz (i), (VIDEO BW) 10 kHz, (CENTER FREQUENCY) 10 kHz, (FREQUENCY SPAN) 4 kHz SWEEP TIME (AUTO), SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table 4-2.

37. Set the frequency synthesizer (FREQUENCY) to 200 Hz. On the spectrum analyzer key in: (FREQUENCY SPAN) 0 Hz. (SWEEP TIME) 0.5 seconds, SWEEP (SINGLE), MARKER (PEAK SEARCH). Record MARKER amplitude in Table Table 4-2.

38. Calculate the Impulse BW of the 1 kHz filter using the formula in step 8. Record in Table 4-2.

39. On the spectrum analyzer, press (INSTR PRESET) and select SIGNAL INPUT 1.

40. Connect the spectrum analyzer CAL OUTPUT to SIGNAL INPUT 1.

41. On the spectrum analyzer, key in the following settings:

(CENTER FREQUENCY)	20 MHz
(FREQUENCY SPAN)	5 MHz
(RES BW)	3 MHz (i)
(REFERENCE LEVEL)	−10 dBm

42. On the spectrum analyzer, press SCALE (LIN). Press (SHIFT) RES BW (AUTO) ^{A}, for units in dBm.

43. On the spectrum analyzer, press the (REFERENCE LEVEL) and use the DATA knob to position the signal peak near the reference level (top graticule line). Press SWEEP (SINGLE).

44. On the spectrum analyzer, press MARKER (NORMAL), and place the marker at the signal peak with the DATA knob. Press MARKER (Δ) and position the movable marker 6 dB down from the stationary marker on the positive going edge of the signal trace (the MARKER (Δ) amplitude readout should be −6.00 dB ±0.05 dB). To center the trace on screen, it may be necessary to press SWEEP (CONT) and adjust (CENTER FREQUENCY).

45. Press MARKER (Δ) and position movable marker 6 dB down from the signal peak on the negative going edge of the trace (the MARKER (Δ) amplitude readout should be 0.00 dB ±0.05dB). The 6 dB bandwidth is given by the MARKER (Δ) frequency readout. (See Figure 4-3.) Record in Table 4-2.

Note 6 dB resolution bandwidth measurements are used in Performance Test 5, Impulse and Resolution Bandwidth Selectivity Test.

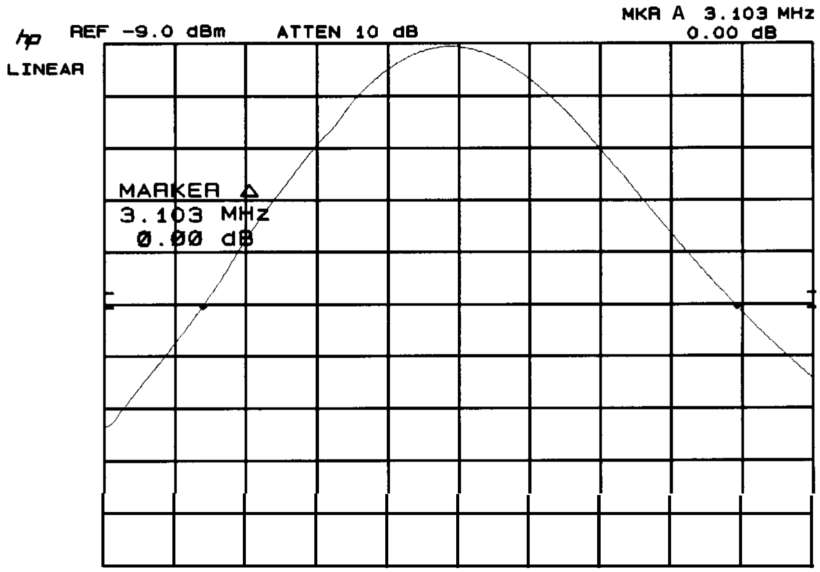

Figure 4-3. 6 **dB** Resolution Bandwidth Measurement

46. Select the spectrum analyzer (RES BW) and (FREQUENCY SPAN) settings according to Table 4-3. Press SWEEP (SINGLE) and measure the 6 dB bandwidth for each resolution bandwidth setting using the procedure of steps 43 through 45 and record the value in Table 4-3. The measured bandwidths for 300 Hz, 100 Hz, 30 Hz, and 10 Hz should fall between the limits shown in the table.

Table 4-2. Impulse Bandwidth Accuracy

(Res BW)	(VIDEO BW)	Marker Readouts for:		Calculated **Impulse** Bandwidth		
		High Frequency Repetition Rate	Low Frequency Repetition Rate	Minimum	Actual	Maximum
3 MHz (i)	3 MHz	________	________	2.40 MHz	________	3.60 MHz
1 MHz (i)	3 MHz	________	________	900 kHz	________	1.1 MHz
300 kHz (i)	3 MHz	________	________	270 kHz	________	330 kHz
100 kHz (i)	1 MHz	________	________	90 kHz	________	110 kHz
30 kHz (i)	300 kHz	________	________	27 kHz	________	33 kHz
10 kHz (i)	100 kHz	________	________	9 kHz	________	11 kHz
3 kHz (i)	30 kHz	________	________	2.7 kHz	________	3.3 kHz
1 kHz (i)	10 kHz	________	________	900 Hz	________	1.1 kHz

Table 4-3. 6 **dB** Resolution Bandwidth Accuracy

Res BW	Frequency Span	MARKER A Readout of 6 **dB** Bandwidth		
		Minimum	Actual	Maximum
3 MHz (i)	5 MHz		________	
1 MHz (i)	2 MHz		________	
300 kHz (i)	500 kHz		________	
100 kHz (i)	200 kHz		________	
30 kHz (i)	50 kHz		________	
10 kHz (i)	20 kHz			
3 kHz (i)	5 kHz		________	
1 kHz (i)	2 kHz		________	
300 Hz (i)	500 Hz	300 Hz	________	450 Hz
100 Hz (i)	200 Hz	100 Hz	________	150 Hz
30 Hz (i)	100 Hz	30 Hz	________	45 Hz
10 Hz (i)	100 Hz	10 Hz	________	15 Hz

5. 6 dB Resolution Bandwidth Selectivity Test

Related Adjustments

3 MHz Bandwidth Filter Adjustments
21.4 MHz Bandwidth Filter Adjustments
Step Gain and 18.4 MHz Local Oscillator Adjustments

Specification

60 dB/6 dB bandwidth ratio:

<11:1, 3 MHz to 100 kHz bandwidths
<8:1, 30 kHz to 30 Hz bandwidths

60 dB points on 10 Hz bandwidth are separated by <100 Hz

Description

Bandwidth selectivity is found by measuring the 60 dB bandwidth and dividing this value by the 6 dB bandwidth for each resolution bandwidth setting from 30 Hz to 3 MHz. The 60 dB points for the 10 Hz bandwidth setting are also measured. The CAL OUTPUT provides a stable signal for the measurements.

Equipment

None required

Note

Performance Test 4, 6 dB Resolution Bandwidth Accuracy Test, must be performed before starting this test.

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in analyzer control settings as follows:

   [CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN] .... 20 MHz
   (RES BW) .... 3 MHz
   (VIDEO BW) .... 100 Hz
   SWEEP (SINGLE)

4. Press MARKER (NORMAL) and position marker at peak of signal trace. Press MARKER (Δ) and position movable marker 60 dB down from the stationary marker on the positive-going edge of the signal trace (the MARKER A amplitude readout should be -60.00 dB ±1.00 dB). It may be necessary to press SWEEP (CONT) and adjust (CENTER FREQUENCY_) so that both 60 dB points are displayed. (See Figure 4-4.)
5. Press MARKER (Δ) and position movable marker 60 dB down from the signal peak on the negative-going edge of the signal trace (the MARKER A amplitude readout should be .OO dB ±0.50 dB).
6. Read the 60 dB bandwidth for the 3 MHz resolution bandwidth setting from the MARKER A frequency readout (Figure 4-4) and record the value in Table 4-4.

7. Vary spectrum analyzer settings according to Table 4-4. Press SWEEP (SINGLE) and measure the 60 dB bandwidth for each resolution bandwidth setting by the procedure of steps 4 through 6. Record the value in Table 4-4.
8. Record the 6 dB bandwidths from Table 4-1 in Table 4-4.
9. Calculate the bandwidth selectivity for each setting by dividing the 60 dB bandwidth by the 6 dB bandwidth. The bandwidth ratios should be less than the maximum values shown in Table 4-4.
10. The 60 dB bandwidth for the 10 Hz resolution bandwidth setting should be less than 100 Hz.

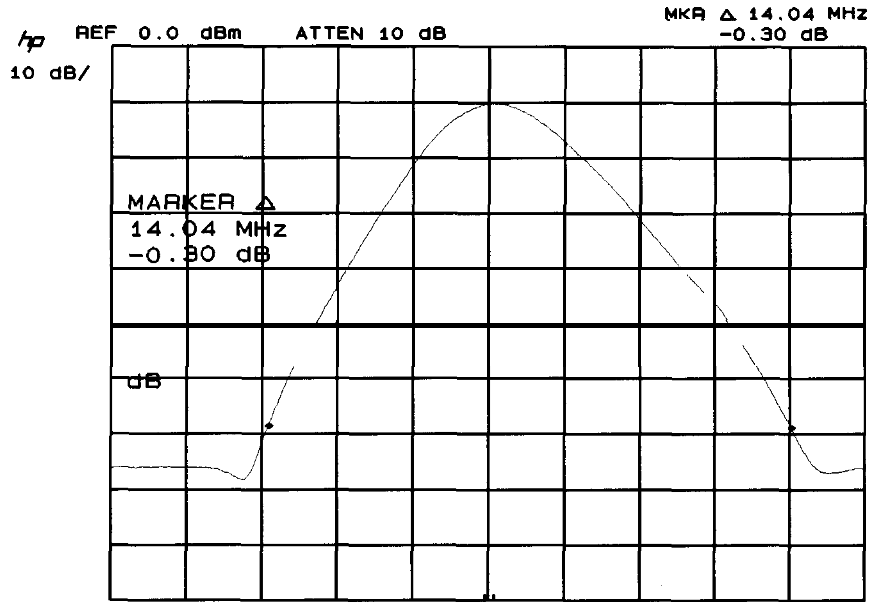

Figure 4-4. 60 dB Bandwidth Measurement

5. 6 **dB** Resolution Bandwidth Selectivity Test

Table 4-4. 6 **dB** Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 **dB** Bandwidth	Measured 6 **dB** Bandwidth	Bandwidth Selectivity (60 **dB** BW ÷ 6 **dB** BW)	Maximum Selectivity Ratio
(RES BW)	(FREQUENCY SPAN)	(VIDEO BW)				
3 MHz	20 MHz	100 Hz	______	______	______	11:1
1 MHz	15 MHz	300 Hz	______	______	______	11:1
300 kHz	5 MHz	AUTO	______	______	______	11:1
100 kHz	2 MHz	AUTO	______	______	______	11:1
30 kHz	500 kHz	AUTO	______	______	______	8:1
10 kHz	200 kHz	AUTO	______	______	______	8:1
3 kHz	50 kHz	AUTO	______	______	______	8:1
1 kHz	10 kHz	AUTO	______	______	______	8:1
300 Hz	5 kHz	AUTO	______	______	______	8:1
100 Hz	2 kHz	AUTO	______	______	______	8:1
30 Hz	500 Hz	AUTO	______	______	______	8:1
10 Hz	100 HZ	AUTO	______	60 dB points separated by <100 Hz		

5. Impulse and Resolution Bandwidth Selectivity Test

Related Adjustment

3 MHz Bandwidth Filter Adjustments
21.4 Bandwidth Filter Adjustments
Step Gain and 18.4 MHz Local Oscillator Adjustments

Specification

60 dB/6 dB bandwidth ratio:
<11:1, 3 MHz to 100 kHz
<8:1, 30 kHz to 30 Hz
60 dB points on 10 Hz bandwidth are separated by <100 Hz

Description

Bandwidth selectivity is found by measuring the 60 dB bandwidth and dividing this value by the 6 dB bandwidth for each resolution bandwidth setting from 30 Hz to 3 MHz. The 60 dB points for the 10 Hz bandwidth setting are also measured. The CAL OUTPUT provides a stable signal for the measurements.

Note

Resolution Bandwidth Accuracy Test must be performed before this test.

Equipment

None required

Procedure

1. On the spectrum analyzer press (INSTR PRESET) and connect the CAL OUTPUT to SIGNAL INPUT 2.
2. Key in spectrum analyzer control settings as following:

   (CENTER FREQUENCY) .... 20 MHz
   (FREQUENCY SPAN) .... 20 MHz
   (RES BW) .... 3 MHz
   (VIDEO BW) .... 100 Hz
   SWEEP .... (SINGLE)

3. On the spectrum analyzer, press MARKER (NORMAL) and position the marker at the peak of the signal trace using the DATA knob. Press MARKER (Δ) and position the movable marker 60 dB down from the stationary marker on the positive going edge of the signal trace (the MARKER (Δ) amplitude readout should be −60.00 dB ±1.00 dB). It may be necessary to press SWEEP (CONT) and to adjust (CENTER FREQUENCY) so that both 60 dB points are displayed (see Figure 4-5).

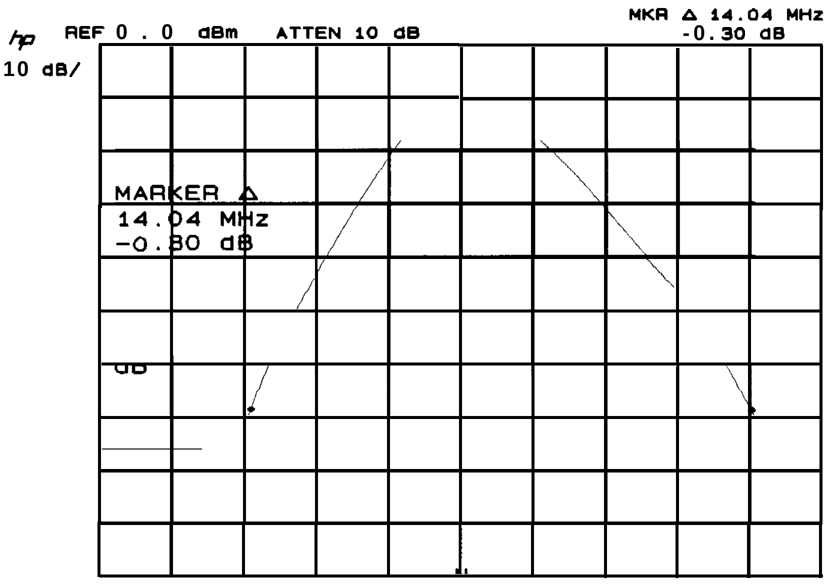

Figure 4-5. 60 **dB** Bandwidth Measurement

4. Press MARKER In] and position the positive movable marker 60 dB down from the signal peak on the negative-going edge of the signal trace (the MARKER (Δ) amplitude readout should be 0.00 dB ±0.50 dB).
5. Read the 60 dB bandwidth for the 3 MHz resolution bandwidth setting from the MARKER (Δ) frequency readout (see Figure 4-5) and record the value in Table 4-5.
6. Select the spectrum analyzer (RES BW), (FREQUENCY SPAN), and (VIDEO BW) according to Table 4-5. Measure the 60 dB bandwidth for each resolution bandwidth setting by the procedure of steps 3 through 5 and record the value in Table 4-5.
7. Record the 6 dB bandwidths for each resolution bandwidth setting from Table 4-3 in Table 4-5.
8. Calculate the bandwidth selectivity for each setting by dividing the 60 dB bandwidth by the 6 dB bandwidth. The bandwidth ratios should be less than the maximum values shown in Table 4-5.
9. The 60 dB bandwidth for the 10 Hz resolution bandwidth setting should be less than 100 Hz.

Table 4-5. Impulse and Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 **dB** Bandwidth	Measured 6 **dB** Bandwidth	Bandwidth Selectivity (60 **dB** BW ÷ 6 **dB** BW)	Maximum **Selectivity** Ratio
Res BW	**Frequency** Span	**Video BW**				
3 MHz (i)	20 MHz	100 Hz				11:1
1 MHz (i)	15 MHz	300 Hz				11:1
300 kHz (i)	5 MHz	AUTO				11:1
100 kHz (i)	2 MHz	AUTO				11:1
30 kHz (i)	500 kHz	AUTO				8:1
10 kHz (i)	200 kHz	AUTO				8:1
3 kHz (i)	50 kHz	AUTO				8:1
1 kHz (i)	10 kHz	AUTO				8:1
300 Hz (i)	5 kHz	AUTO				8:1
100 Hz (i)	2 kHz	AUTO				8:1
30 Hz (i)	500 Hz	AUTO				8:1
10 Hz (i)	100 Hz	AUTO		60 dB points separated by <100 Hz		

6. Impulse and Resolution Bandwidth Switching Uncertainty Test

Related Adjustment

3 MHz Bandwidth Filter Adjustments
21.4 Bandwidth Filter Adjustments
Down/Up Converter Adjustments

Specification

±2.0 dB, 10 Hz bandwidth
±0.8 dB, 30 Hz bandwidth
±0.5 dB, 100 Hz to 1 MHz bandwidth
± 1 .O dB, 3 MHz bandwidth
30 kHz and 100 kHz bandwidth switching uncertainty figures only applicable ≤90% Relative Humidity.

Description

The CAL OUTPUT signal is applied to the input of the spectrum analyzer. The deviation in peak amplitude of the signal trace is then measured as each resolution bandwidth filter is switched in.

Equipment

None required

Procedure

1. Press (INSTR PRESET).
2. Connect CAL OUTPUT to SIGNAL INPUT 2.
3. Key in the following control settings:

(CENTER FREQUENCY)	20 MHz
(FREQUENCY SPAN)	5 MHz
(REFERENCE LEVEL)	-8 dBm
(RES BW)	1 MHz

4. Press LOG (ENTER dB/DIV) and key in 1 dB. Press MARKER (PEAK SEARCH) (Δ).
5. Key in settings according to Table 4-6. Press MARKER (PEAK SEARCH) at each setting, then read the amplitude deviation from the MARKER (Δ) readout at the upper right of the display (see Figure 4-6). The allowable deviation for each resolution bandwidth setting is shown in the table.

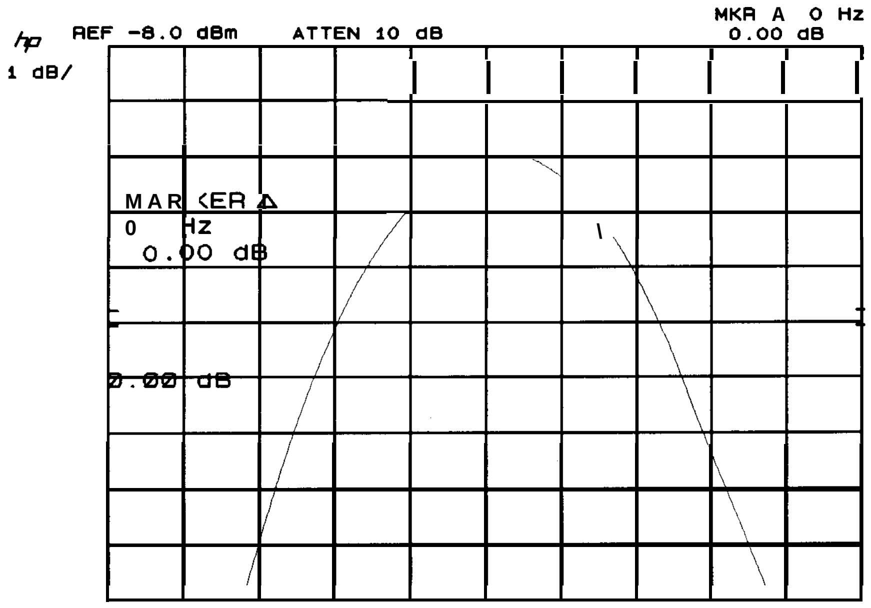

Figure 4-6. Bandwidth Switching Uncertainty Measurement

Table 4-6. Bandwidth Switching Uncertainty

Res BW	Frequency Span	Deviation (MKR Δ Readout, dB)	Allowable Deviation (dB)
1 MHz (i)	5 MHz	0 (ref.)	0 (ref.)
3 MHz (i)	5 MHz	________	± 1.0
300 kHz (i)	5 MHz	________	± 0.5
100 kHz (i)	500 kHz	________	± 0.5
30 kHz (i)	500 kHz	________	± 0.5
10 kHz (i)	50 kHz	________	± 0.5
3 kHz (i)	50 kHz	________	± 0.5
1 kHz (i)	10 kHz	________	± 0.5
300 Hz (i)	1 kHz	________	± 0.5
100 Hz (i)	1 kHz	________	± 0.5
30 Hz (i)	200 Hz	________	± 0.8
10 Hz (i)	100 Hz	________	± 2.0

Test 4. 6 dB Resolution Bandwidth Accuracy Test (p/o Table 2-19, Performance Test Record)

Step 8. 6 **dB** Resolution Bandwidth Accuracy

(RES BW)	(FREQUENCY SPAN)	**MARKER Δ** Readout of 3 **dB** Bandwidth		
		Min	Actual	Max
3 MHz	5 MHz	2.400 MHz		3.600 MHz
1 MHz	2 MHz	900 kHz		1.100 MHz
300 kHz	500 kHz	270.0 kHz		330.0 kHz
100 kHz	200 kHz	90.0 kHz		110.0 kHz
30 kHz	50 kHz	27.00 kHz		33.00 kHz
10 kHz	20 kHz	9.00 kHz		11.00 kHz
3 kHz	5 kHz	2.700 kHz		3.300 kHz
1 kHz	2 kHz	900 Hz		1.100 kHz
300 Hz	500 Hz	270 Hz		330 Hz
100 Hz	200 Hz	90 Hz		110 Hz
30 Hz	100 Hz	27.0 Hz		33.0 Hz
10 Hz	100 Hz	10.0 Hz		15.0 Hz

Test 4. Impulse and Resolution Bandwidth Accuracy Test (p/o Table 2-19, Performance Test Record)

Steps 1 through 38. Impulse Bandwidth Accuracy

(Res BW)	(VIDEO BW)	Marker Readouts for:		Calculated Impulse Bandwidth		
		High Frequency Repetition Rate	Low Frequency Repetition Rate	Minimum	Actual	Maximum
3 MHz (i)	3 MHz	________	________	2.40 MHz	________	3.60 MHz
1 MHz (i)	3 MHz	________	________	900 kHz	________	1.1 MHz
300 kHz (i)	3 MHz	________	________	270 kHz	________	330 kHz
100 kHz (i)	1 MHz	________	________	90 kHz	________	110 kHz
30 kHz (i)	300 kHz	________	________	27 kHz	________	33 kHz
10 kHz (i)	100 kHz	________	________	9 kHz	________	11 kHz
3 kHz (i)	30 kHz	________	________	2.7 kHz	________	3.3 kHz
1 kHz (i)	10 kHz	________	________	900 Hz	________	1.1 kHz

Test 4. Impulse and Resolution Bandwidth Accuracy Test (p/o **Table** 2-19, Performance Test Record)

Steps 39 through 46. 6 **dB** Resolution Bandwidth Accuracy

Res BW	**Frequency Span**	**MARKER Δ Readout of 6 dB Bandwidth**		
		Minimum	**Actual**	**Maximum**
3 MHz (i)	5 MHz		________	
1 MHz (i)	2 MHz		________	
300 kHz (i)	500 kHz		________	
100 kHz (i)	200 kHz		________	
30 kHz (i)	50 kHz		________	
10 kHz (i)	20 kHz		________	
3 kHz (i)	5 kHz		________	
1 kHz (i)	2 kHz		________	
300 Hz (i)	500 Hz	300 Hz	________	450 Hz
100 Hz (i)	200 Hz	100 Hz	________	150 Hz
30 Hz (i)	100 Hz	30 Hz	________	45 Hz
10 Hz (i)	100 Hz	10 Hz	________	15 Hz

Test 5. 6 dB Resolution Bandwidth Selectivity (p/o Table 2-19, Performance Test Record)

Step 9. 6 dB Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 dB Bandwidth	Measured 6 dB Bandwidth	Bandwidth Selectivity (60 dB BW ÷ 6 dB BW)	Maximum Selectivity Ratio
(RES BW)	(FREQUENCY SPAN)	[VIDEO]				
3 MHz	20 MHz	100 Hz	______	______	______	11:1
1 MHz	15 MHz	300 Hz	______	______	______	11:1
300 kHz	5 MHz	AUTO	______	______	______	11:1
100 kHz	2 MHz	AUTO	______	______	______	11:1
30 kHz	500 kHz	AUTO	______	______	______	8:1
10 kHz	200 kHz	AUTO	______	______	______	8:1
3 kHz	50 kHz	AUTO	______	______	______	8:1
1 kHz	10 kHz	AUTO	______	______	______	8:1
300 Hz	5 kHz	AUTO	______	______	______	8:1
100 Hz	2 kHz	AUTO	______	______	______	8:1
30 Hz	500 Hz	AUTO	______	______	______	8:1
10 Hz	100 HZ	AUTO	______	60 dB points separated by <100 Hz		

Test 5. Impulse and Resolution Bandwidth Selectivity (p/o Table 2-19, Performance Test Record)

Steps 5 through 9. Impulse and Resolution Bandwidth Selectivity

Spectrum Analyzer			Measured 60 dB Bandwidth	Measured 6 dB Bandwidth	Bandwidth Selectivity (60 dB BW ÷ 6 dB BW)	Maximum Selectivity Ratio
Res BW	Frequency Span	Video BW				
3 MHz (i)	20 MHz	100 Hz				11:1
1 MHz (i)	15 MHz	300 Hz				11:1
300 kHz (i)	5 MHz	AUTO				11:1
100 kHz (i)	2 MHz	AUTO				11:1
30 kHz (i)	500 kHz	AUTO				8:1
10 kHz (i)	200 kHz	AUTO				8:1
3 kHz (i)	50 kHz	AUTO				8:1
1 kHz (i)	10 kHz	AUTO				8:1
300 Hz (i)	5 kHz	AUTO				8:1
100 Hz (i)	2 kHz	AUTO				8:1
30 Hz (i)	500 Hz	AUTO				8:1
10 Hz (i)	100 Hz	AUTO		60 dB points separated by <100 Hz		

Test 6. Impulse and Resolution Bandwidth Switching Uncertainty (p/o Table 2-19, Performace Test Record)

Step 5. Impulse and Resolution Bandwidth Switching Uncertainty

Res BW	Frequency Span	Deviation (MKR A Readout, dB)	Allowable Deviation (dB)
1 MHz (i)	5 MHz	0 (ref.)	0 (ref.)
3 MHz (i)	5 MHz	________	± 1.0
300 kHz (i)	5 MHz	________	± 0.5
100 kHz (i)	500 kHz	________	± 0.5
30 kHz (i)	500 kHz	________	± 0.5
10 kHz (i)	50 kHz	________	± 0.5
3 kHz (i)	50 kHz	________	± 0.5
1 kHz (i)	10 kHz	________	± 0.5
300 Hz (i)	1 kHz	________	± 0.5
100 Hz (i)	1 kHz	________	± 0.5
30 Hz (i)	200 Hz		± 0.8
10 Hz (i)	100 Hz	________	± 2.0

9. 6 dB Resolution Bandwidth Adjustments

Reference

IF-Display Section
A4A9 IF Control

Related Performance Test

6 dB Resolution Bandwidth Accuracy Test

Description

The CAL OUTPUT signal is connected to the RF INPUT. Each of the adjustable resolution bandwidths is selected and adjusted for the proper bandwidth.

Equipment

No test equipment is required for this adjustment.

Procedure

1. Position the instrument upright and remove the top cover.
2. Set the LINE switch to On, press (INSTR PRESET) and select SIGNAL INPUT 1.
3. Connect CAL OUTPUT to SIGNAL INPUT 1.
4. Key in (CENTER FREQUENCY) 100 MHz, (FREQUENCY SPAN) 5 MHz (RES BW) 3 MHz, and (LIN).
5. Press (REFERENCE LEVEL) and adjust the DATA knob to place the signal peak near the top CRT graticule. The signal should be centered about the center line on the graticule.
6. Press PEAK SEARCH , MKR → (CF), and MARKER (al.
7. Using the DATA knob, adjust the marker down one side of the display signal to the 6 dB point; CRT MKR A annotation indicates .500 x
8. Adjust A4A9R60 3 MHz for MKR In] indication of 1.5 MHz while maintaining the marker at .500 X using the DATA knob. Refer to Figure 4-7 for the adjustment location.
9. Press MARKER (Δ). Adjust the marker to the 6 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X. There are now two markers; one on each side of the signal at the 6 dB point.
10. CRT MKR A annotation now indicates the 6 dB bandwidth of the 3 MHz bandwidth filter. The bandwidth should be 3.00 MHz ±0.60 MHz
11. Key in (RES BW) 1 MHz, (FREQUENCY SPAN) 2 MHz, (PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing (REFERENCE LEVEL) and using the DATA knob to place the signal peak near the top of the graticule.
12. Press MARKER (OFF) then MARKER (Δ).

13. Using the DATA knob, adjust the marker down one side of the display signal to the 6 dB point; CRT MKR A annotation indicates .500 x.

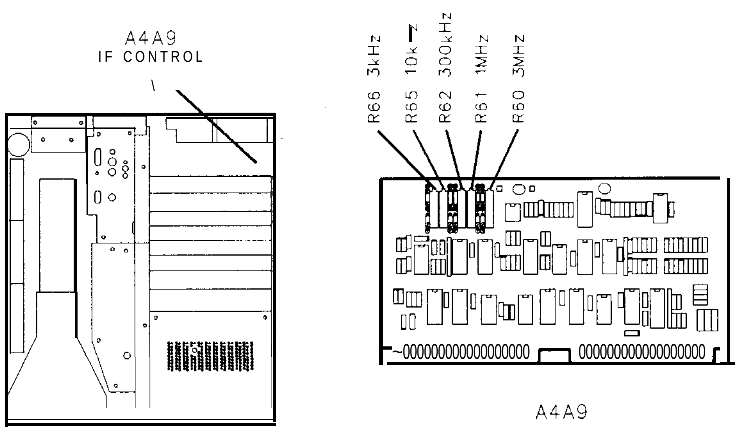

Figure 4-7. Location of Bandwidth Adjustments

14. Adjust A4A9R61 1 MHz for MKR A indication of 500 kHz while maintaining the marker at 0.500 X using the DATA knob. Refer to Figure 4-7 for the adjustment location.
15. Press MARKER (Δ). Adjust marker to the opposite side of the signal (CRT MKR A annotation indicate 1.00 X). There are now two markers; one on each of the signal at the 6 dB point.
16. The CRT MKR A annotation now indicates the 6 dB bandwidth of the 1 MHz bandwidth filter. The 6 dB bandwidth should be 1.00 MHz ±0.10 MHz.
17. Key in (RES BW) 300 kHz, (FREQUENCY SPAN) 500 kHz, [PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing [REFERENCE LEVEL]] and using the DATA knob to place the signal peak at the top of the graticule.
18. Press MARKER (OFF) then MARKER (Δ).
19. Using the DATA knob, adjust the marker down one the displayed signal to the 6 dB point; CRT MKR A annotation indicates .500 X.
20. Adjust A4A9R62 300 kHz for MKR A indication of 150 kHz while maintaining marker at .500 X using the data knob. Refer to Figure 4-7 for location of adjustment.
21. Press MARKER In]. Adjust the marker to the 6 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).
22. The CRT MKR A annotation now indicates the bandwidth of the 300 kHz bandwidth filter. The bandwidth should be 300.00 ±30.00 kHz.
23. Key in (RES BW) 10 kHz, (FREQUENCY SPAN) 20 kHz, [PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing (REFERENCE LEVEL) and using the DATA knob to place the signal peak near the top of the graticule.

24. Press MARKER (OFF), then MARKER In].
25. Using the DATA knob, adjust the marker down one side of the displayed signal to the 6 dB point; CRT MKR annotation indicates .500 x.
26. Adjust A4A9R65 10 kHz for MKR A indication of 5.00 kHz while maintaining the marker at .500 X using the DATA knob. Refer to Figure 4-7 for the adjustment location.
27. Press MARKER (Δ). Adjust the marker to the 6 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).
28. The CRT MKR A annotation now indicates the 6 dB bandwidth of the 10 kHz bandwidth filter. The bandwidth should be 10.0 fl.O kHz
29. Key in (RES BW) 3 kHz, (FREQUENCY SPAN] 5 kHz, (PEAK SEARCH], and (MKR → CF). If necessary, readjust by pressing [REFERENCE LEVEL] and using the DATA knob to place the signal peak near the top of the graticule.
30. Press MARKER (OFF) and MARKER (Δ).
31. Using the DATA knob, adjust the marker down one side of the displayed signal to the 6 dB point; CRT MKR A annotation indicates .500 X.
32. Adjust A4A9R66 3 kHz for MKR A indication of 1.5 kHz while maintaining the marker at .500 X using the DATA knob. Refer to Figure 4-7 for the adjustment location.
33. Press MARKER In]. Adjust the marker to the 6 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).
34. The CRT MKR (Δ) annotation now indicates the 6 dB bandwidth of the 3 kHz bandwidth filter. The bandwidth should be 3.00 ±0.30 kHz

9. Impulse Bandwidth Adjustments

Reference

IF-Display Section
A4A9 IF Control

Related Performance Test

Impulse Bandwidth Accuracy Test

Description

The CAL OUTPUT signal is connected to the SIGNAL INPUT 1. Each of the adjustable resolution bandwidths is selected and adjusted for the proper impulse bandwidth.

Equipment

No test equipment is required for this adjustment.

Procedure

1. Position the instrument upright and remove the top cover.
2. Set the LINE switch to On, press (INSTR PRESET), and select SIGNAL INPUT 1.
3. Connect CAL OUTPUT to SIGNAL INPUT 1.
4. Key in (CENTER FREQUENCY) 100 MHz, [FREQUENCY SPAN) 5 MHz (RES BW) 3 MHz, and (LIN).
5. Press [REFERENCE LEVEL) and adjust the DATA knob to place the signal peak near the top CRT graticule. The signal should be centered about the center line on the graticule.
6. Press [PEAK SEARCH), MKR → (CF), and MARKER (Δ).
7. Using the DATA knob, adjust the marker down one side of the display signal to the 7.3 dB point; CRT MKR A annotation indicates 0.430 X
8. Adjust A4A9R60 3 MHz for MKR In] indication of 1.5 MHz while maintaining the marker at 0.430 X using the DATA knob. Refer to Figure 4-8 for the adjustment location.
9. Press MARKER In]. Adjust the marker to the 7.3 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X. There are now two markers; one on each side of the signal at the 7.3 dB point.
10. CRT MKR A annotation now indicates the impulse bandwidth of the 3 MHz bandwidth. Impulse bandwidth should be 3.00 MHz ±0.60 MHz
11. Key in (RES BW) 1 MHz, [FREQUENCY SPAN) 2 MHz, [PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing [REFERENCE LEVEL) and using the DATA knob to place the signal peak near the top of the graticule.
12. Press MARKER (OFF) then MARKER [al.

13. Using the DATA knob, adjust the marker down one side of the display signal to the 7.3 dB point; CRT MKR A annotation indicates 0.430 X.

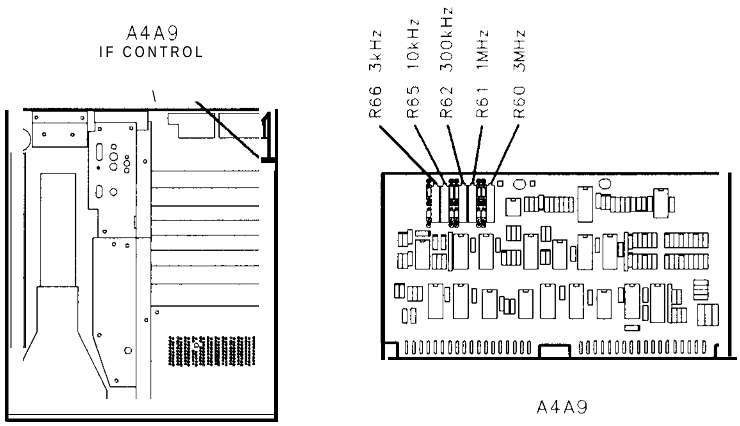

Figure 4-8. Location of Bandwidth Adjustments

14. Adjust A4A9R61 1 MHz for MKR A indication of 500 kHz while maintaining the marker at 0.430 X using the DATA knob. Refer to Figure 4-8 for the adjustment location.

15. Press MARKER (Δ). Adjust marker to the opposite side of the signal (CRT MKR A annotation indicate 1.00 X). There are now two markers; one on each of the signal at the 7.3 dB point.

16. The CRT MKR A annotation now indicates the impulse bandwidth of the 1 MHz bandwidth. The impulse bandwidth should be 1.00 MHz ±0.10 MHz.

17. Key in (RES BW) 300 kHz, (FREQUENCY SPAN) 500 kHz, (PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing [REFERENCE LEVEL]] and using the DATA knob to place the signal peak at the top of the graticule.

18. Press MARKER (OFF) then MARKER (Δ).

19. Using the DATA knob, adjust the marker down one the displayed signal to the 7.3 dB point; CRT MKR A annotation indicates 0.430 X.

20. Adjust A4A9R62 300 kHz for MKR A indication of 150 kHz while maintaining marker at 0.430 X using the data knob. Refer to Figure 4-8 for location of adjustment.

21. Press MARKER (Δ). Adjust the marker to the 7.3 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).

22. The CRT MKR A annotation now indicates the impulse bandwidth of the 300 kHz bandwidth. The impulse bandwidth should be 300.00 ±30.00 kHz.

23. Key in (RES BW) 10 kHz, [FREQUENCY SPAN] 20 kHz, [PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing

[REFERENCE LEVEL] and using the DATA knob to place the signal peak near the top of the graticule.

24. Press MARKER (OFF), then MARKER (al.
25. Using the DATA knob, adjust the marker down one side of the displayed signal to the 7.3 dB point; CRT MKR annotation indicates 0.430 X.
26. Adjust A4A9R65 10 kHz for MKR A indication of 5.00 kHz while maintaining the marker at 0.430 X using the DATA knob. Refer to Figure 4-8 for the adjustment location.
27. Press MARKER (Δ). Adjust the marker to the 7.3 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).
28. The CRT MKR A annotation now indicates the impulse bandwidth of the 10 kHz bandwidth. The impulse bandwidth should be 10.0 f1.O kHz
29. Key in (RES BW) 3 kHz, [FREQUENCY SPAN] 5 kHz, [PEAK SEARCH), and (MKR → CF). If necessary, readjust by pressing [REFERENCE LEVEL) and using the DATA knob to place the signal peak near the top of the graticule.
30. Press MARKER (OFF) and MARKER (Δ).
31. Using the DATA knob, adjust the marker down one side of the displayed signal to the 7.3 dB point; CRT MKR A annotation indicates 0.430 X.
32. Adjust A4A9R66 3 kHz for MKR A indication of 1.5 kHz while maintaining the marker at 0.430 X using the DATA knob. Refer to Figure 4-8 for the adjustment location.
33. Press MARKER In]. Adjust the marker to the 7.3 dB point on the opposite side of the signal (CRT MKR A annotation indicates 1.00 X).
34. The CRT MKR (Δ) annotation now indicates the impulse bandwidth of the 3 kHz bandwidth. The impulse bandwidth should be 3.00 ±0.30 kHz

5

Option 857

Introduction

This chapter contains a modified performance test for Option 857 instruments. When working on Option 857 instruments, substitute the procedure in this chapter for the standard version contained in Chapter 2. The procedure included in this chapter is listed below:

12. Option 857 Amplitude Fidelity Test

Related Adjustment Log Amplifier Adjustments

Specification Log:

Incremental

fO.l dB/dB over 0 to 80 dB display

Cumulative

3 MHz to 30 Hz Resolution Bandwidth:
$\leq\pm0.6$ dB max over 0 to 70 dB display (20 - 30°C).
$\leq\pm1.5$ dB max over 0 to 90 dB display
10 Hz Resolution Bandwidth:
$\leq\pm0.8$ dB max over 0 to 70 dB display (20 - 30°C).
$\leq\pm2.1$ dB max over 0 to 90 dB display

Linear:

±3% of Reference Level for top 9-1/2 divisions of display

Description Amplitude fidelity in log and linear modes is tested by decreasing the signal level to the spectrum analyzer in 10 dB steps with a calibrated signal source and measuring the displayed amplitude change with the analyzer's MARKER A function.

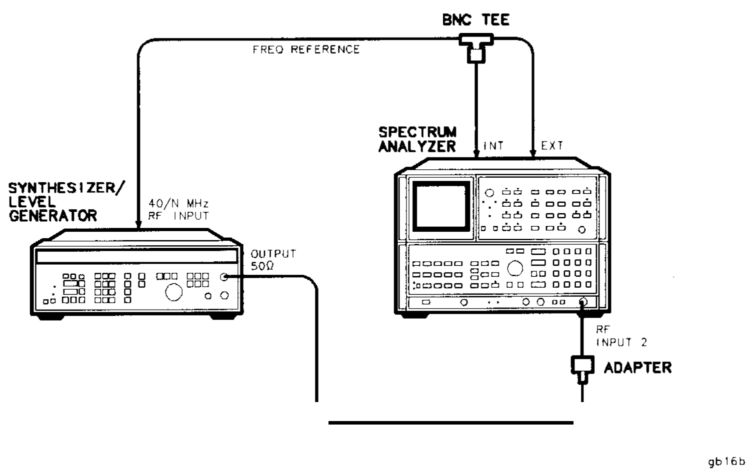

Figure 5-1. Option 857 Amplitude Fidelity Test Setup

Equipment

Frequency Synthesizer . . . . HP 3335A
Adapter, Type N (m) to BNC (f) . . . . HP 1250-0780
(2) BNC to BNC cable . . . . HP 10503A

Procedure

Log Fidelity

1. On the spectrum analyzer, connect the CAL OUTPUT to INPUT 2. Press (RECALL) (9) and adjust the FREQ ZERO pot for maximum amplitude.
2. Press (INSTR PRESET] on the analyzer. Key in analyzer settings as follows:

   (CENTER FREQUENCY] . . . . .20 MHZ
   [FREQUENCY SPAN) . . . . .50 kHz
   (REFERENCE LEVEL) . . . . + 10 dBm

3. Set the frequency synthesizer for an output frequency of 20.000 MHz and an output power level of + 10 dBm. Set the amplitude increment for 10 dB steps.
4. Connect equipment as shown in Figure 5-1.
5. Press MARKER [PEAK SEARCH), (MKR → CF), (MKR →REF LVL) to center the signal on the display.
6. Press SWEEP (SINGLE) on the spectrum analyzer and wait for the sweep to be completed.
7. Press MARKER [PEAK SEARCH), MARKER In].
8. Step the frequency synthesizer output amplitude down 10 dB.
9. On the spectrum analyzer, press SWEEP (SINGLE) and wait until the sweep is completed. Press MARKER [PEAK SEARCH), and record the marker A amplitude (a negative value) in column 2 of Table 5-1.
10. Repeat steps 8 and 9, decreasing the output power from the frequency synthesizer in 10 dB steps from -10 dBm to -80 dBm.
11. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.

12. Option 857 Amplitude Fidelity Test

Table 5-1. Log Amplitude Fidelity (10 Hz **RBW;** Option 857)

Frequency Synthesizer Amplitude **(dBm)**	1 Calibrated Amplitude Step	2 MARKER A Amplitude **(dB)**	Fidelity Error (Column 2 - Column 1) **(dB)**	Cumulative Error 0 to 80 **dB** **(dB)**	Cumulative Error 0 to 90 **dB** **(dB)**
+ 10	0 (ref)	0 (ref)	0 (ref)		
0	-10	______	______		
-10	-20	______	______		
-20	-30	______	______		
-30	-40	______	______		
-40	-50	______	______		
-50	-60	______	______		
-60	-70	______	______		
-70	-80	______	______		
-80	-90	______	______	≤±1.0 dB	≤±1.5 dB

12. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -70 dB. The results should be ≤±0.8 dB.

    ______ dB

13. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -90 dB. The results should be ≤±2.1 dB.

    ______ dB

14. Set the frequency synthesizer for output amplitude to + 10 dBm.

15. Key in the following analyzer settings:

    (FREQUENCY SPAN) .... 100 kHz
    (RES BW) .... 10 kHz
    SWEEP (CONT)

16. Press MARKER [PEAK SEARCH], (MKR→CF), (MKR→REF LVL) to center the signal on the display.

17. Key in the following analyzer settings:

    (FREQUENCY SPAN) .... 0 Hz
    (VIDEO BW) .... 1 Hz

18. Press MARKER A. Step the frequency synthesizer output amplitude from + 10 dBm -80 dBm in 10 dB steps, noting the MARKER A amplitude (a negative value) at each step and recording it in column 2 of Table 5-2. Allow several sweeps after each step for the video filtered trace to reach its final ampltitude.

19. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.

20. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -70 dB. The results should be $\leq$0.6 dB.

_____________ dB

21. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -90 dB. The results should be $\leq$1.5 dB.

_____________ dB

Table 5-2. Log Amplitude Fidelity (10 **kHz RBW;** Option 857)

Frequency Synthesizer Amplitude **(dBm)**	1 Calibrated Amplitude Step	2 MARKER A Amplitude **(dB)**	Fidelity Error (Column 2 - Column 1) **(dB)**	Cumulative Error 0 to 80 **dB** **(dB)**	Cumulative Error 0 to 90 **dB** **(dB)**
+10	0 (ref)	0 (ref)	0 (ref)		
0	-10	_______	_______		
-10	-20	_______	_______		
-20	-30	_______	_______		
-30	-40	_______	_______		
-40	-50	_______	_______		
-50	-60	_______	_______		
-60	-70	_______	_______		
-70	-80	_______	_______		
-80	-90	_______	_______	$\leq\pm$1.0 dB	$\leq\pm$1.5 dB

Linear Fidelity

22. Key in analyzer settings as follows:

(VIDEO BW) .... 300 Hz
(FREQUENCY SPAN) .... 20 kHz
(RES BW) .... 10 kHz

23. Set the frequency synthesizer for an output power level of + 10 dBm.

24. Press SCALE LIN pushbutton. Press MARKER (PEAK SEARCH), (MKR → CF) to center the signal on the display.

25. Set (FREQUENCY SPAN) to 0 Hz and (VIDEO BW) to 1 Hz. Press (SHIFT), (AUTO)A (resolution bandwidth), MARKER (Δ).

26. Decrease frequency synthesizer output amplitude by 10 dB steps, . noting the MARKER A amplitude and recording it in column 2 of Table 5-3.

12. Option 857 Amplitude Fidelity Test

Table 5-3. Linear Amplitude Fidelity

Frequency Synthesizer Amplitude (dBm)	MARKER Δ Amplitude (dB)	Allowable Range (±3% of Reference Level) (dB)	
		Min	Max
0	________	−10.87	−9.21
−10	________	−23.10	−17.72

Performance Test Record

Hewlett-Packard Company	Tested by ______________
Model HP 8568B	Report No. ______________
Serial No. ______________	Date ______________
IF-Display Section ______________	
RF Section ______________	

Test 12. Option 857 Amplitude Fidelity Test

Step 9. Log Amplitude Fidelity (10 **Hz RBW;** Option 857)

Frequency Synthesizer Amplitude **(dBm)**	1 Calibrated Amplitude Step	2 MARKER A Amplitude **(dB)**	Fidelity Error (Column 2 - Column 1) **(dB)**	**Cumulative** Error 0 to 80 **dB (dB)**	Cumulative Error 0 to 90 **dB (dB)**
+10	0 (ref)	0 (ref)	0 (ref)		
0	-10	________	________		
-10	-20	________	________		
-20	-30	________	________		
-30	-40	________	________		
-40	-50	________	________		
-50	-60	________	________		
-60	-70	________	________		
-70	-80	________	________		
-80	-90	________	________	≤±1.0 dB	≤±1.5 dB

Step 18. Log Amplitude Fidelity (10 **kHz RBW;** Option 857)

Frequency Synthesizer Amplitude **(dBm)**	1 Calibrated Amplitude Step	2 MARKER A Amplitude **(dB)**	Fidelity Error (Column 2 - Column 1) **(dB)**	**Cumulative** Error 0 to 80 **dB (dB)**	Cumulative Error 0 to 90 **dB (dB)**
+10	0 (ref)	0 (ref)	0 (ref)		
0	-10	________	________		
-10	-20	________	________		
-20	-30	________	________		
-30	-40	________	________		
-40	-50	________	________		
-50	-60	________	________		
-60	-70	________	________		
-70	-80	________	________		
-80	-90	________	________	≤±1.0 dB	≤±1.5 dB

Step 26. Linear Amplitude Fidelity

Frequency Synthesizer Amplitude (dBm)	MARKER A Amplitude (dB)	Allowable Range (±3% of Reference Level) (dB)	
		Min	Max
0	______	– 10.87	-9.21
-10	______	-23.10	-17.72

6

Major Assembly and Component Locations

IF-Display Section Figure Index

RF Section Figure Index

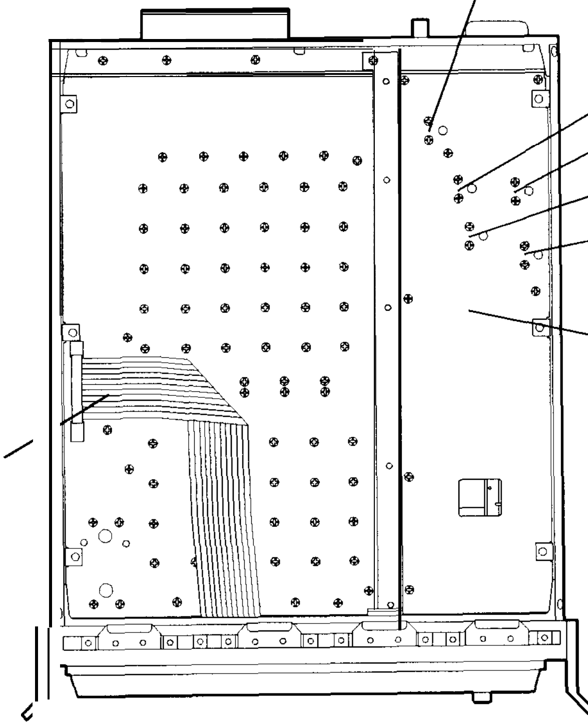

Figure **6-1.** RF Section, Top View

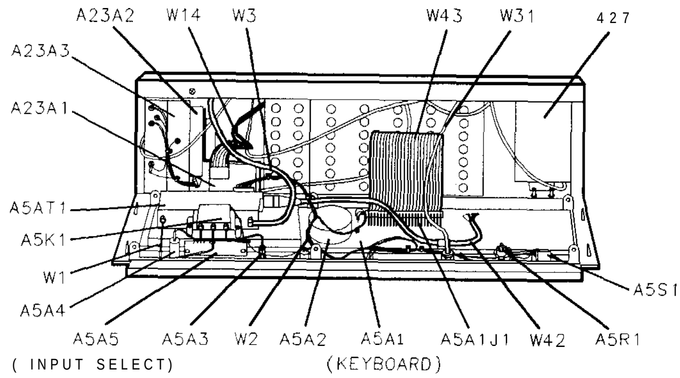

Figure 6-2. RF Section, Front View

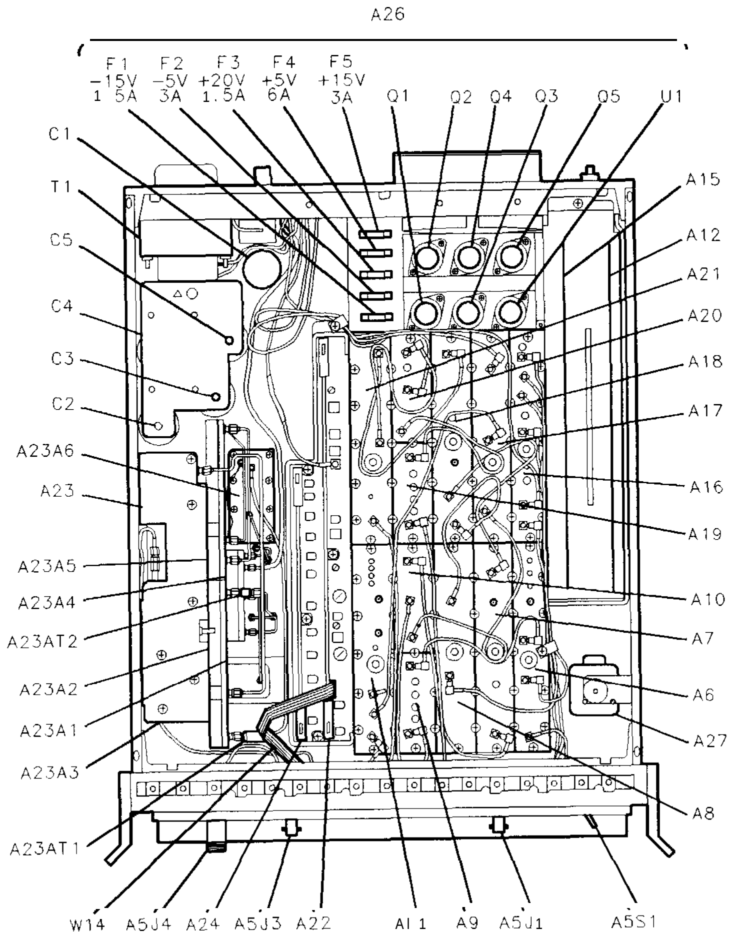

Figure 6-3. RF Section, Bottom View

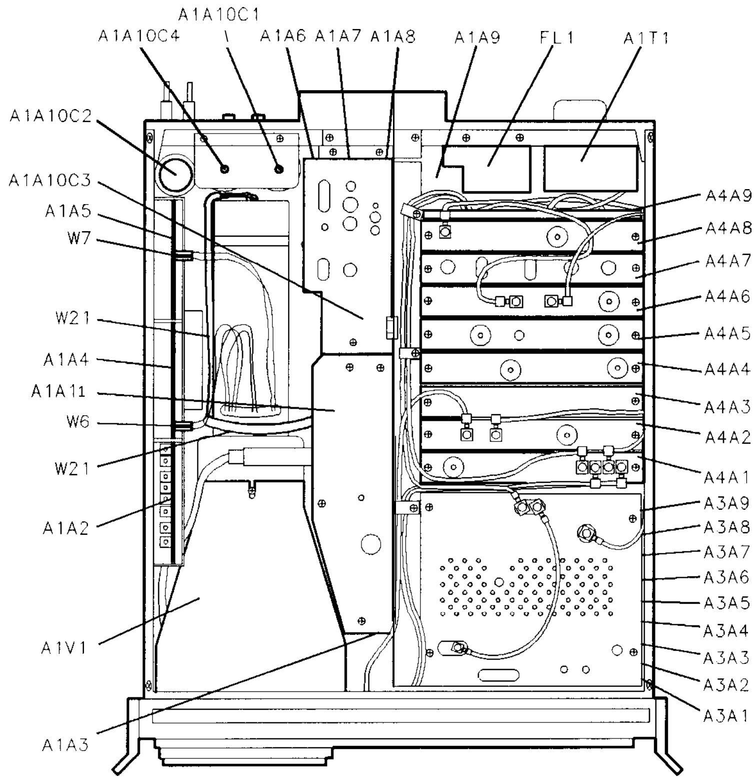

Figure 6-4. IF Section, Top View (SN **3001A** and Below)

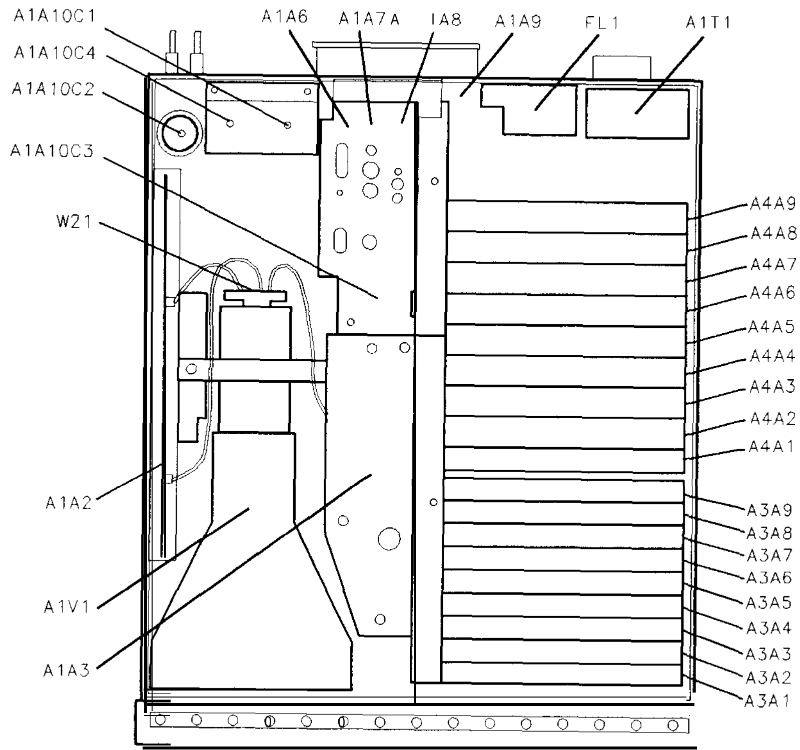

Figure 6-5. IF Section, Top View (SN **3004A** and Above)

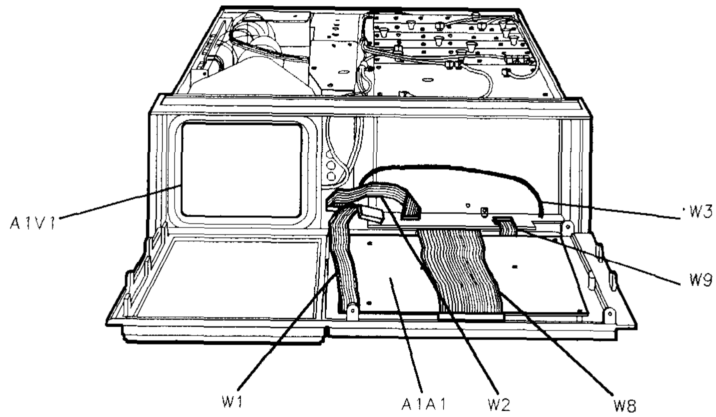

Figure 6-6. IF Section, Front View

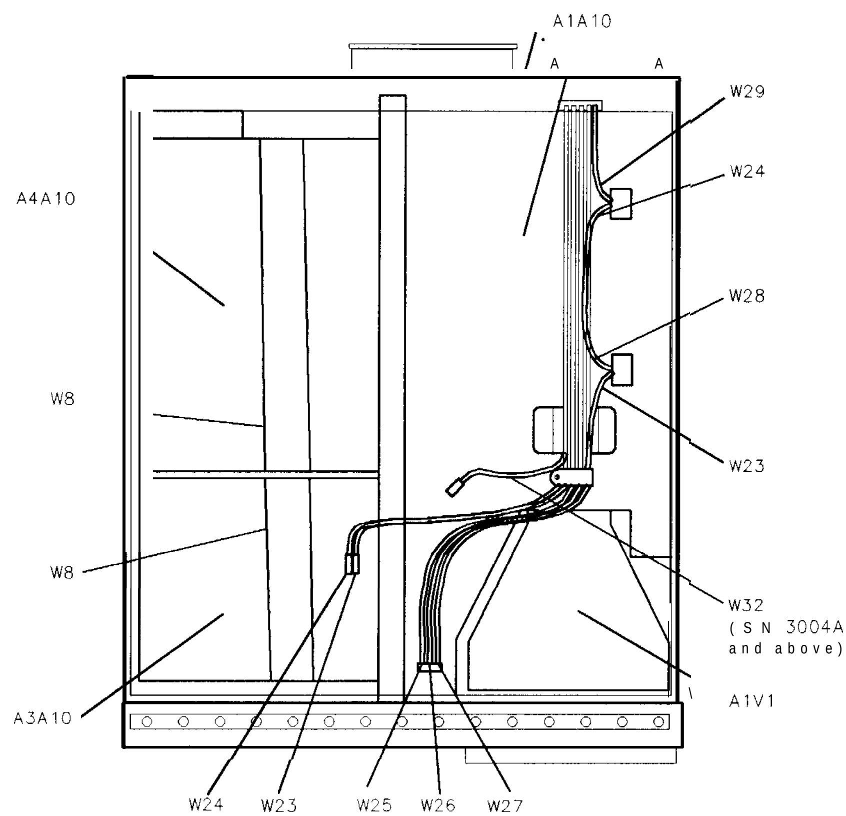

Figure 6-7. IF Section, Bottom View