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# Performance Tests and Adjustments Manual

## HP 8566B Spectrum Analyzer

HEWLETT
PACKARD

HP Part No. 08566-90168
Printed in USA September 1993

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### Caution

*Caution* denotes a hazard. It calls attention to a procedure that, 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

***Warning* 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* note until the indicated conditions are fully understood and met.**

**Instruction Manual**

⚠

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

## 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.

## How to Use This Manual

**This manual uses the following conventions:**

| | |
|---|---|
| Front-Panel Key | This represents a key physically located on the instrument. |
| Screen Text | This indicates text displayed on the instrument's screen. |

## HP 8566B Documentation Description

Included with the HP Model 8566B spectrum analyzer are manuals: The Installation and Verification Manual, the Operating and Programming Manual, and the Performance Tests and Adjustments Manual.

**HP 8566B Installation and Verification Manual**

HP part number 08566-90169

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

**HP 8566B Operating and Programming Manual**

HP part number 08566-90040

Contents: Manual and remote operation, including complete syntax and command description. Accopanying this manual is the seperate, pocket-sized Quick Reference Guide, HP part number 5955-8970.

**HP 8566B Performance Tests and Adjustments Manual**

HP part number 08566-90168

Contents: Electrical performance tests and adjustment procedures.

**HP 8566B RF Section Troubleshooting and Repair Manual**

HP part number 08566-90210

Contents: RF section service information.

**HP 8566B IF-Display Section Troubleshooting and Repair Manual**

HP part number 08566-90085

Contents: IF-Display section service information.

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# 1

# General Information

## Introduction

This HP 8566B Tests and Adjustments Manual contains two main sections: Performance Tests and Adjustments Procedures. This chapter lists the required test equipment for both sections. 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 8566B spectrum analyzers, including those with Option 400 (400 Hz operation), Option 462 (impulse bandwidths and 6 dB bandwidths), and Option 857 installed. The procedures in this manual can also be used to adjust HP 8566A spectrum analyzers that have been converted into HP 8566B spectrum analyzers through the installation of an HP 8566AB Retrofit Kit (formerly HP 8566A+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 is located in Chapter 4, Option 462.

6 dB Bandwidths:
- Test 3, 6 dB Resolution Bandwidth Accuracy Test
- Test 4, 6 dB Resolution Selectivity Test
- Adjustment 9, 6 dB Bandwidth Adjustment Procedure

Impulse Bandwidths:
- Test 3, Impulse Resolution Bandwidth Accuracy Test
- Test 4, Impulse and Resolution Selectivity Test
- Test 5, Impulse and Resolution Bandwidth Switching Uncertainty Test
- Adjustment 9, Impulse Bandwidth Adjustment Procedure

## Option 857 Instruments

Option 857 instruments are used in EMC receiver applications. Information on Option 857 is located in Chapter 5, Option 857.

Table l-l. Recommended Test Equipment (1 of 6)

| Instrumenl | Critical Specifications for Equipment Substitution | Recommended Model | Perf. Test | Adj. |
|---|---|---|---|---|
| **SIGNAL SOURCES** | | | | |
| Synthesized Sweeper | Frequency: 10 MHz to 22 GHz<br>Output Power: + 10 dBm maximum (leveled)<br>Aging Rate: $<1 \times 10^{-9}$/day<br>Spurious Signals: $\leq$35 dBc (<7 GHz)<br>$\leq$25 dBc (<20 GHz)<br>Amplitude Modulation: dc to 100 kHz<br>Leveling: Internal, External Power Meter | HP 8340A/B | X | X |
| Synthesized Signal Generator | Frequency: 2 – 18 GHz<br>Stability: $<5 \times 10^{-10}$ | HP 8672A | X | X |
| Frequency Synthesizer | Frequency: 200 Hz to 80 MHz<br>Stability: $\pm 1 \times 10^{-8}$/day<br>Amplitude Range: + 13 to -86 dBm with 0.01 dB resolution<br>Attenuator Accuracy: < ±0.07 dB (+ 13 to -47 dBm) | HP 3335A | X | X |
| Pulse Generator | Pulse Width: 10 nsec to 250 nsec<br>Rise and Fall Times: <6 ns<br>Output Level: +2.5V | HP 8116A | | X |
| Function Generator | Output: Sine Wave and Triangle Wave, 2Vp-p<br>Range: 100 Hz to 500 kHz (Sweep Function Available)<br>*(2 required)* | HP 3312A | X | X |
| Frequency Standard | Output: 1, 2, 5, or 10 MHz<br>Accuracy: $<\pm 1 \times 10^{-10}$<br>Aging Rate: $< 1 \times 10^{-10}$/day | HP 5061B | X | X |

## Table 1-1. Recommended Test Equipment (2 of 6)

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model | Perf Test | Adj |
|---|---|---|---|---|
| **ANALYZERS** | | | | |
| Spectrum Analyzer | Frequency: 100 Hz to 2.5 GHz<br>2 to 22 GHz Preselected | HP 8566A/B | X | X |
| Active Probe | Resistive Divider for measuring fast transition signals | HP 10020A | | X |
| Probe Power Supply | For use with HP 10020A | HP 1122A | | X |
| High Frequency Active Probe | Bandwidth: 5 Hz to 500 MHz<br>Input R: 100 kΩ Input C: 3 pF | HP 41800A | | X |
| **COUNTERS** | | | | |
| Frequency Counter | Frequency: 20 MHz to 400 MHz<br>Sensitivity: -30 dBm<br>HP-IB Compatible | HP 5343A | | X |
| Electronic Counter | Range: >10 MHz<br>Resolution: 2 x $10^{-9}$ gate time<br>Ext. Time Base: 1, 2, 5, or 10 MHz | HP 5345A | X | |
| Universal Counter | Frequency: dc to 100 MHz<br>Time Interval A → B: 100 ns to 200s<br>Sensitivity: 50 mV rms<br>Range: 30 mV to 5V p-p | HP 5316B<br>HP 5334A/B | X | |
| **OSCILLOSCOPES** | | | | |
| Digitizing Oscilloscope | 4 Channel<br>Frequency: 100 MHz<br>Sensitivity: .005V/Division | HP 54501A | | X |
| Oscilloscope Probe | 10: 1 Divider, compatible with oscilloscope<br>*(2 required)* | HP 10432A | | X |

**Table l-l. Recommended Test Equipment (3 of 6)**

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model | Perf. Test | Adj |
|---|---|---|---|---|
| **METERS** | | | | |
| Digital Voltmeter | Resolution: fO.l mV<br>Range: 0 Vdc to 100 Vdc<br>Input Impedance 100 V Range: 10 MΩ<br>HP-IB Compatible | HP 3456A<br>or<br>HP 3455A | X | X |
| DC High Voltage Probe | 1000: 1 Divider<br>Impedance: 10MΩ | HP 34111A | | X |
| Power Meter | Range: -20 dBm to + 10 dBm<br>Accuracy: ±0.02dB | HP436A | X | X |
| Power Sensor | Frequency: .01 to 18 GHz<br>Compatible with HP 436A Power Meter | HP 8481A | | X |
| Power Sensor | Frequency: 50 MHz to 26.5 GHz<br>Compatible with HP 436A Power Meter | HP8485A | X | |
| Digital Photometer | | Tektronix J-16<br>Option 02 | | X |
| Photometer Probe | for Tektronix J-16<br>range: 1 to 100 NITS (cd/m$^2$)<br>acceptance angle: 8°<br>spectral response: CIE Photopic curve | Tektronix<br>56503 | | X |
| Interconnect Cable | for Tektronix J-16 | Tektronix<br>012-0414-02 | | X |
| Photometer Light Occluder | Por Tektronix J-16 | Tektronix<br>016-0305-00 | | X |
| **ATTENUATORS** | | | | |
| 10 dB Step 4ttenuator | Steps: 10 dB from 0 to 120 dB<br>Frequency: 20 MHz to 1500 MHz<br>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 |

Table 1-1. Recommended Test Equipment (4 of 6)

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model | Perf. Test | Adj. |
|---|---|---|---|---|
| 1 dB Step Attenuator | Steps: 1 dB from 0 to 12 dB<br>Frequency: 20 MHz to 1500 MHz<br>Calibrated to uncertainty error of f(0.02 dB +0.01 dB/10 dB step) at 20 MHz from 0 dB to 12 dB | HP 355C-H25 | | X |
| 3 dB Attenuator | Frequency: 200 Hz to 18 GHz<br>SMA Connectors | HP 8493B, Option 003 | X | |
| 20 dB Attenuator | Frequency: 200 Hz to 18 GHz<br>SMA Connectors *(2 required)* | HP 8493B, Option 020 | X | |
| **TERMINATIONS** | | | | |
| Termination | Impedance: 50Ω; BNC | HP 11593A | | X |
| Termination | Impedance: 50Ω; SMA (m) | HP 1810-0118 | | X |
| Termination | Type N Male Connector<br>Frequency: dc to 18 GHz<br>Impedance: 50Ω | HP 909A, Option 012 | X | |
| **FILTERS** | | | | |
| Low-Pass Filter | Cut-off Frequency: 250 MHz<br>Rejection at 460 MHz: >60 dB | K&L 5L380-250-B/B | X | |
| Low-Pass Filter | Cut-off Frequency: 8 GHz<br>Rejection at 14 GHz: >80 dB | K&L 6L250-8000-NP/N | X | |
| Low-Pass Filter | Cut-off Frequency: 1200 MHz<br>Rejection at 1500 MHz: >50 dB | HP 360B | X | |
| **MISCELLANEOUS DEVICES** | | | | |
| Precision Power Supply | 0-20 volts, 0-2 amperes | HP 6114A | | X |

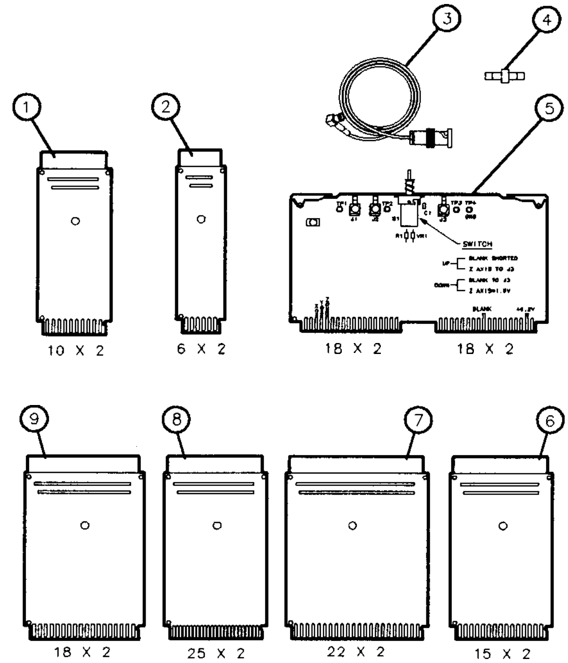
**Table 1-1. Recommended Test Equipment (5 of 6)**

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model | Perf. Test | Adj. |
|---|---|---|---|---|
| AC Line-Power Source *(For Option 400)* | Frequency: 400 Hz<br>Voltage: 100, 120, 220, or 240 $V_{ac}$<br>Power: >600VA | California Instruments Model 153T Opt. 400 | X | |
| Power Splitter | Frequency: 1 MHz to 22 GHz<br>Tracking: <0.2 dB | HP 11667B | | X |
| Planar-doped Barrier Diode Detector | 10 MHz to 33 GHz | HP 8473D/ HP 8474C | | X |
| Reactive Power Divider | Range: 2 to 22 GHz<br>Isolation: ≥20 dB | Omni-Spectra 2090-6202-00 | X | |
| **SPECIAL DEVICES** | | | | |
| Display Adjustment PC Board* | Required for preliminary display adjustment! | HP 85662-60088 | | X |
| Low-Noise DC Supply | *(Optional)* Refer to Figure 3-108. | | | X |
| Crystal Filter Bypass Network | Refer to Figure 3-109. (4 *required)* | | | X |
| **CABLES** | | | | |
| Low-Loss Microwave Cable | APC 3.5 (m) | HP 8120-4921 | | X |
| Cable | BNC, 122 cm (48 in.) (3 *required)* | 10503A | | X |
| Cable | SMA (m) to SMA (m) | 5061-1086 | X | |
| Test Cable* | BNC (m) to SMB Snap-On (f) | HP 85680-60093 | | X |

Table l-l. Recommended Test Equipment (6 of 6)

| Instrument | Critical Specifications for Equipment Substitution | Recommended Model | Perf. Test | Adj. |
|---|---|---|---|---|
| **ADAPTERS** | | | | |
| Adapter | Type N (f) to BNC (m) | 1250-0077 | X | |
| Adapter | SMB snap on (m) (m) | 1250-0672 | | X |
| Adapter | SMB (m) to SMA (f) | 1250-0674 | | X |
| Adapter | SMB (m) bulkhead | 1250-0691 | | X |
| Adapter | Type N (f) to N (f) | 1250-1477 | X | |
| Adapter | Type N (m) to N (m) | 1250-0778 | X | |
| Adapter | Type N (m) to BNC (f) (2 *required,* | 1250-0780 | X | |
| Adapter | BNC Tee (m)(f)(f) (2 *required)* | 1250-0781 | X | X |
| Adapter | SMA (f) to SMA (f) | 1250-l 158 | X | |
| Adapter | SMA (m) to SMA (m) | 1250-1159 | X | |
| Adapter | BNC (f) to SMA (m) | 1250-1200 | | X |
| Adapter | BNC (f) to SMB (f) | 1250-1236 | | X |
| Adapter | Type N (m) to SMA (f) | 1250-1250 | X | |
| Adapter | BNC to aligator clip | 1250-1292 | | X |
| Adapter | Type N (f) to BNC (m) | 1250-1477 | | X |
| Adapter | APC-3.5 (m) to Type N (m) | 1250-1743 | | X |
| Adapter | Type N (m) to APC-3.5 (f) | 1250-1744 | | X |
| Adapter | APC-3.5 (f) TO N (f) (2 *required)* | 1250-1745 | | X |
| Adapter | APC-3.5 (f) to APC-3.5 (f) | 1250-1749 | | X |
| Adapter | APC-3.5 (m) to Type N (f) | 1250-1750 | | X |
| Adapter | BNC (f) to dual bannana plug | 1251-2277 | | X |
| Adapter | Type N (f) to SMA (f) | HP 86290-60005 | X | |
| BOARD **EXTENDERS** | | | | |
| | See Figure l-l. | | | |
| ?C Board Extractor | PC Board extracting tool | HP 03950-4001 | | X |

* Part of Service Accessories




| Item | Qty | Description | HP Fart Number |
|---|---|---|---|
| 1 | 1 | Extender Board: 20 contacts, 2 rows of 10 | 85680-60028 |
| 2 | 2 | Extender Board: 12 contacts, 2 rows of 6 | 08505-60109 |
| 3 | 2 | Cable: 4-foot long; BNC to SMB snap-on | 85680-60093 |
| 4 | 1 | Adapter: SMB snap-on male to SMB snap-on male | 1250-0669 |
| 5 | 1 | PC Board: Display Adjustment Test | 85662-60088 |
| 6 | 3 | Extender Board: 30 contacts; 2 rows of 15 | 08505-60041 |
| 7 | 1 | Extender Board: 44 contacts; 2 rows of 22 | 08505-60107 |
| 8 | 1 | Extender Board: 50 contacts; 2 rows of 25 | 85680-60034 |
| 9 | 2 | Extender Board: 36 contacts; 2 rows of 18 | 08505-60042 |

**Figure l-l. Service Accessories, HP Part Number 08566-60001**

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:
   - Sweep Time Accuracy (including Fast Sweep Time Accuracy)
   - Noise Sidebands
   - Harmonic and Intermodulation Distortion
   - Image, Multiple, and Out-of-Band Responses
   - Frequency Reference Error
   - Center Frequency Readout Accuracy

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

**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 |
| 3-dB Bandwidths* | 3 | Resolution Bandwidth Accuracy Test |
| Bandwidth Shape* | 4 | Resolution Bandwidth Selectivity Test |
| Bandwidth Amplitudes* | 5 | Resolution Bandwidth Switching Uncertainty Test |
| Log Scales | 6 | Log Scale Switching Uncertainty Test |
| IF Gains | 7 | IF Gain Uncertainty Test |
| Log and Linear Amplifier Fidelity† | 8 | Scale Fidelity Test |
| CAL OUTPUT Level | 9 | Calibrator Amplitude Accuracy Test |
| Frequency Response | 10 | Frequency Response Test |
| Sweep Times | 11 | Sweep Time Accuracy Test |
| Noise Sidebands | 12 | Noise Sidebands Test |
| Line-Related Sidebands | 13 | Line-Related Sidebands Test |
| Noise Floor | 14 | Average Noise Level Test |
| Residual Responses | 15 | Residual Responses Test |
| Harmonic and Intermodulation Distortion | 16 | Harmonic and Intermodulation Distortion Test |
| Image, Multiple, and Out-of-Band Responses | 17 | Image, Multiple, and Out-of-Band Responses Test |
| Gain Compression | 18 | Gain Compression Test |
| 1ST LO OUTPUT Amplitude | 19 | 1ST LO OUTPUT Amplitude Test |
| SWEEP+ TUNE OUT | 20 | SWEEP + TUNE OUT Amplitude Test |
| Fast Sweep Times | 21 | Fast Sweep Time Accuracy Test (<20 ms) |
| Frequency Reference | 22 | Frequency Reference Error Test |

‘For Option 462 instruments, refer to Chapter 4.

†For Option 857 instruments, refer to Chapter 5.

## 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 l-l, Recommended Test Equipment. Any equipment that satisfies the critical specifications given in the list may be substituted for the recommended model.

## Performance 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, the results of the performance tests may be tabulated on the HP 8566B Performance Test Record at the end of this chapter. The HP 8566B 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 8566B before beginning the Performance Tests.

# 1. Center Frequency Readout Accuracy Test

**Related Adjustments**

10 MHz Standard Adjustment

Sweep, DAC, and Main Coil Driver Adjustments

**Specifications**

For spans ≤n X 5 MHz, ± (2% of frequency span + frequency reference error X center frequency + 10 Hz).

For spans >n X 5 MHz, ± (2% of frequency span + n X 100 kHz + frequency reference error X center frequency).

| n* | Center Frequency |
|---|---|
| 1 | 100 Hz to 5.8 GHz |
| 2 | 5.8 GHz to 12.5 GHz |
| 3 | 12.5 GHz to 18.6 GHz |
| 4 | >18.6 GHz |

* n is the harmonic mixing number, depending on center frequency.

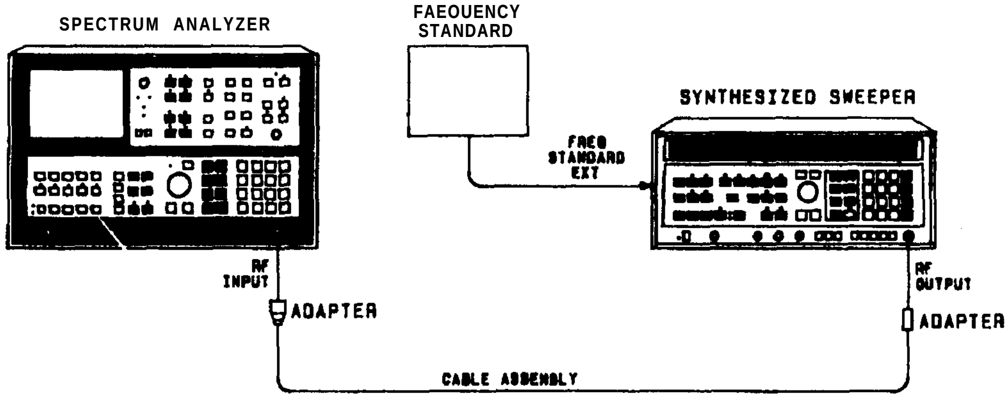



**Figure 2-1. Center Frequency Test Setup**

## 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 specifications.

## Equipment

Synthesized Sweeper . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A
Frequency Standard . . . . . a 10 MHz standard with accuracy within ± 1 part in $10^{10}$ such as HP 5061A
Adapter, Type N (m) to SMA (f) , . . . . . . . . . . . . . . . . . . . . . 1250-1250
Adapter, SMA (f) to SMA (f) . . . . . . . . . . . . . . . . . . . . . . . 1250-1158
Cable Assembly, SMA Male Connectors . . . . . . . . . . . . . . . . . . 5061-1086

## Procedure

1. Connect CAL OUTPUT to RF INPUT.
2. Press (2 - 22 GHz), (RECALL) (9).
3. Adjust FREQ ZERO for a maximum amplitude trace.
4. Press (2 - 22 GHz).
5. Set the synthesized sweeper for a 2.000000 GHz signal at a level of approximately 0 dBm.
6. Connect equipment as shown in Figure 2-l.
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 FREQUENCY readout in the table for each setting. The limits for this frequency are given in the table. Refer to Figure 2-2.

## 1. Center Frequency Readout Accuracy Test

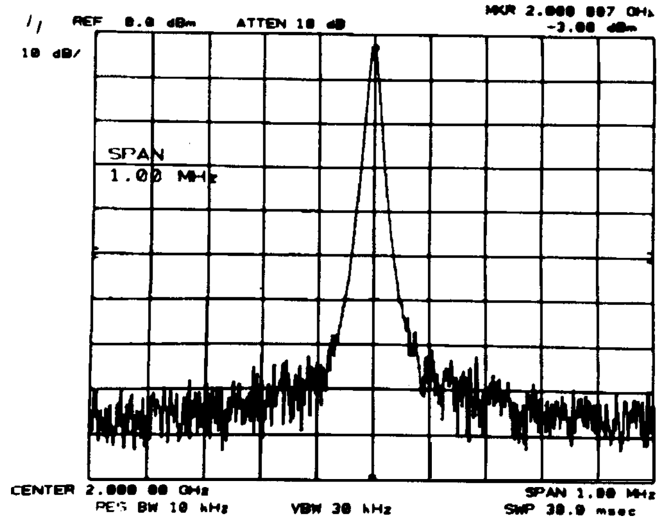



**Figure 2-2. Center Frequency Accuracy Measurement**

**Note** The spectrum analyzer CENTER FREQUENCY readout may fall outside of the specified limits if the internal frequency reference of the analyzer has not been calibrated within the past year. To eliminate the “frequency reference error X center frequency” error, the analyzer’s 10 MHz Frequency Reference Output (on the rear panel) may be substituted for the frequency standard.

**Table 2-2. Center Frequency Readout Accuracy**

| Synthesized Sweeper Frequency | [FREQUENCY SPAN] | [CENTER FREQUENCY] | Center Frequency Readout Min | Actual | Max |
|---|---|---|---|---|---|
| 2 GHz | 1 MHz | 2 GHz | 1.999 98 GHz | | 2.000 02 GHz |
| 2 GHz | 10 MHz | 2 GHz | 1.999 7 GHz | | 2.000 3 GHz |
| 2 GHz | 100 MHz | 2 GHz | 1.998 GHz | | 2.002 GHz |
| 2 GHz | 1 GHz | 2 GHz | 1.98 GHz | | 2.02 GHz |
| 3 GHz | 1 MHz | 3 GHz | 2.999 98 GHz | | 3.000 02 GHz |
| 3 GHz | 10 MHz | 3 GHz | 2.999 7 GHz | | 3.000 3 GHz |
| 3 GHz | 100 MHz | 3 GHz | 2.998 GHz | | 3.002 GHz |
| 3 GHz | 1 GHz | 3 GHz | 2.98 GHz | | 3.02 GHz |
| 6 GHz | 1 MHz | 6 GHz | 5.999 98 GHz | | 6.000 02 GHz |
| 6 GHz | 10 MHz | 6 GHz | 5.999 8 GHz | | 6.000 2 GHz |
| 6 GHz | 100 MHz | 6 GHz | 5.998 GHz | | 6.002 GHz |
| 6 GHz | 1 GHz | 6 GHz | 5.98 GHz | | 6.02 GHz |
| 9 GHz | 1 MHz | 9 GHz | 8.999 98 GHz | | 9.000 02 GHz |
| 9 GHz | 10 MHz | 9 GHz | 8.999 8 GHz | | 9.000 2 GHz |
| 9 GHz | 100 MHz | 9 GHz | 8.998 GHz | | 9.002 GHz |
| 9 GHz | 1 GHz | 9 GHz | 8.98 GHz | | 9.02 GHz |
| 9 GHz | 10 GHz | 9 GHz | 8.8 GHz | | 9.2 GHz |
| 12 GHz | 1 MHz | 12 GHz | 11.999 98 GHz | | 12.000 02 GHz |
| 12 GHz | 10 MHz | 12 GHz | 11.999 8 GHz | | 12.000 2 GHz |
| 12 GHz | 100 MHz | 12 GHz | 11.998 GHz | | 12.002 GHz |
| 12 GHz | 1 GHz | 12 GHz | 11.98 GHz | | 12.02 GHz |
| 12 GHz | 10 GHz | 12 GHz | 11.8 GHz | | 12.2 GHz |
| 15 GHz | 1 MHz | 15 GHz | 14.999 98 GHz | | 15.000 02 GHz |
| 15 GHz | 10 MHz | 15 GHz | 14.999 8 GHz | | 15.000 2 GHz |
| 15 GHz | 100 MHz | 15 GHz | 14.998 GHz | | 15.002 GHz |
| 15 GHz | 1 GHz | 15 GHz | 14.98 GHz | | 15.02 GHz |
| 15 GHz | 10 GHz | 15 GHz | 14.8 GHz | | 15.2 GHz |
| 18 GHz | 1 MHz | 18 GHz | 17.999 98 GHz | | 18.000 02 GHz |
| 18 GHz | 10 MHz | 18 GHz | 17.999 8 GHz | | 18.000 2 GHz |
| 18 GHz | 100 MHz | 18 GHz | 17.998 GHz | | 18.002 GHz |
| 18 GHz | 1 GHz | 18 GHz | 17.98 GHz | | 18.02 GHz |
| 18 GHz | 10 GHz | 18 GHz | 17.8 GHz | | 18.2 GHz |

## 2. Frequency Span Accuracy Test

**Related Adjustment** Sweep, DAC, and Main Coil Driver Adjustments

**Specification** For spans ≤**n** X 5 MHz, ±1% of indicated frequency separation.

For spans >**n** X 5 MHz, ± 3% of indicated frequency separation.

| n* | Center Frequency |
|---|---|
| 1 | 100 Hz to 5.8 GHz |
| 2 | 5.8 GHz to 12.5 GHz |
| 3 | 12.5 GHz to 18.6 GHz |
| 4 | >18.6 GHz |

* **n** is the harmonic mixing number, depending on center frequency.

**Description** Spans less than 100 MHz are checked with a frequency synthesizer by comparing the displayed frequency span of two signals with their known span. Wider spans are tested by tuning a synthesized sweeper from one edge of the analyzer display to the other and measuring the frequency change with a frequency counter.

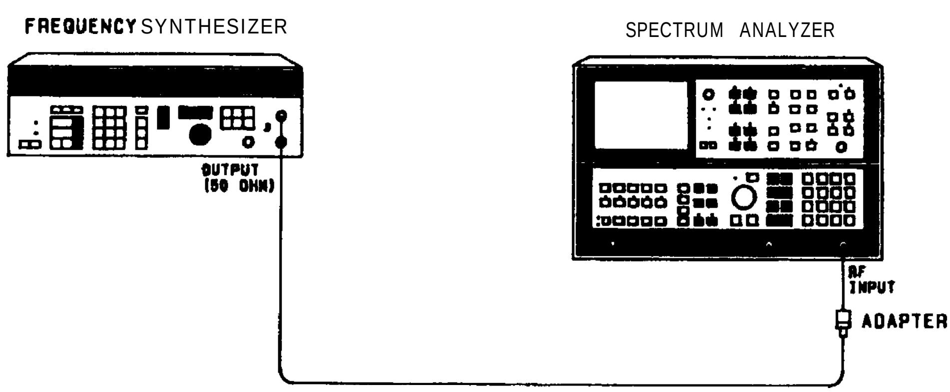



**Figure 2-3. Narrow Span Test Setup**

**Note** Equipment listed is for two test setups, Figure 2-3 and Figure 2-4.

## Equipment

Frequency Synthesizer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3335A
Synthesized Sweeper . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8340A
Adapter, Type N (m) to BNC (f) . . . . . . . . . . . . . . . . . . 1250-0780
Adapter, Type N (m) to SMA (f) . . . . . . . . . . . . . . . . . . . . . . . . . 1250-1250
Adapter, SMA Female Connectors . . . . . . . . . . . . . . . . . . . . 1250-1158
Cable Assembly, SMA Male Connectors . . . . . . . . . . . . . . 5061-1086

## Procedure

1. Press [2 - 22 GHz].
2. Connect equipment as shown in Figure 2-3.
3. Set the frequency synthesizer for an output frequency of 40 MHz and an output power level of -10 dBm.
4. Key in the following analyzer settings:

   [CENTER FREQUENCY] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 40 MHZ
   [FREQUENCY SPAN] . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 20 kHz

5. Set the frequency synthesizer to 39,992,000 Hz. (See Table 2-3.)
6. Press MARKER [NORMAL] and [PEAK SEARCH].
7. Press MARKER la] and set the frequency synthesizer to 40,008,000 Hz. (See Table 2-3.) Press MARKER [PEAK SEARCH].
8. Using the procedure of steps 5, 6, and 7, measure the frequency separation of the indicated signals for each setting in Table 2-3. The MARKER A frequency should be within the limits given in the table.

**Table 2-3. Narrow Span Accuracy**

| Spectrum Analyzer | Frequency Synthesizer | | MARKER A Frequency | | |
|---|---|---|---|---|---|
| [FREQUENCY SPAN] | Low (Hz) | High (Hz) | Min | Actual | Max |
| 20 kHz | 39,992,000 | 40,008,000 | 15.84 kHz | | 16.16 kHz |
| 50 kHz | 39,980,000 | 40,020,000 | 39.60 kHz | | 40.40 kHz |
| 150 kHz | 39,940,000 | 40,060,000 | 118.80 kHz | | 121.20 kHz |
| 200 kHz | 39,920,000 | 40,080,000 | 158.4 kHz | | 161.6 kHz |
| 1 MHz | 39,600,000 | 40,400,000 | 792.00 kHz | | 808.00 kHz |
| 2 MHz | 39,200,000 | 40,800,000 | 1.584 MHz | | 1.616 MHz |
| 6 MHz | 37,600,000 | 42,400,000 | 4.656 MHz | | 4.944 MHz |
| 10 MHz | 36,000,000 | 44,000,000 | 7.76 MHz | | 8.240 MHz |
| 50 MHz | 20,000,000 | 60,000,000 | 38.80 MHz | | 41.2 MHz |

9. Disconnect the frequency synthesizer from the analyzer input. Connect equipment as shown in Figure 2-4.

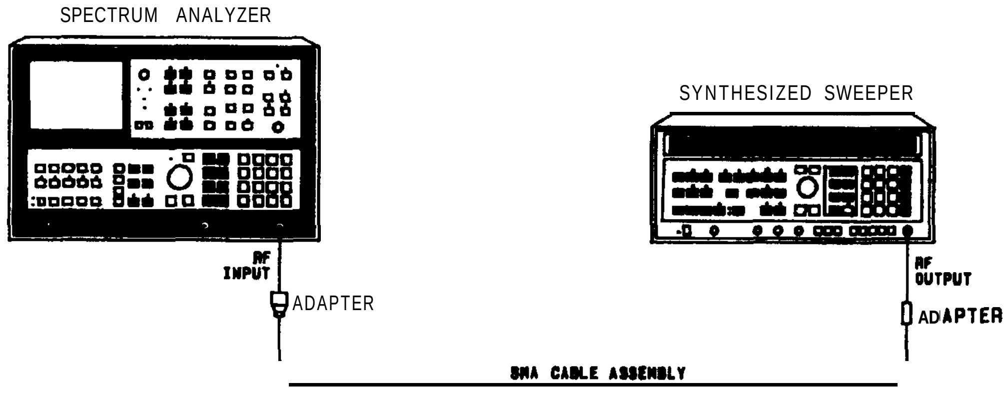



**Figure 2-4. Wide Span Test Setup**

10. Press (INSTR PRESET) on HP 8340A Synthesized Sweeper.
11. Set the synthesized sweeper to a 4 GHz CW signal and power level of -10 dBm.
12. Press (2 - 22 GHz) on the analyzer.
13. Set spectrum analyzer as follows:

    (CENTER FREQUENCY) ........................................ 4 GHz
    (FREQUENCY SPAN) ...................................... ..50 0 MHZ

14. Set the synthesized sweeper to 3.8 MHz. (See Table 2-4.) Press (PEAK SEARCH).
15. Press MARKER (NORMAL) and (PEAK SEARCH).
16. Press MARKER A and set the synthesized sweeper to 4.2 GHz. (See Table 2-4.) Press (PEAK SEARCH).
17. The MARKER A frequency should be between 388 MHz and 412 MHz.
18. Set spectrum analyzer (FREQUENCY SPAN) and (CENTER FREQUENCY) according to Table 2-4 and measure the frequency span by the procedure of steps 13 through 16. The limits for the difference between the two frequency measurements are given in the table.

**Table 2-4. Wide Span Accuracy**

| Spectrum Analyzer | | Synthesized Sweeper | | MARKER Δ Frequency | | |
|---|---|---|---|---|---|---|
| CENTER FREQUENCY | FREQUENCY SPAN | Low (GHz) | High (GHz) | Min | Actual | Max |
| 4 GHz | 500 MHz | 3.800 | 4.200 | 388MHz | | 412 MHz |
| 10 GHz | 500 MHz | 9.800 | 10.200 | 388 MHz | | 412 MHz |
| 15 GHz | 500 MHz | 14.800 | 15.200 | 388MHz | | 412 MHz |
| 20 GHz | 500 MHz | 19.800 | 20.200 | 388MHz | | 412 MHz |
| 4 GHz | 1 GHz | 3.600 | 4.400 | 776MHz | | 824MHz |
| 10 GHz | 1 GHz | 9.600 | 10.400 | 776MHz | | 824 MHz |
| 15 GHz | 1 GHz | 14.600 | 15.400 | 776 MHz | | 824MHz |
| 20 GHz | 1 GHz | 19.600 | 20.400 | 776 MHz | | 824MHz |
| 10 GHz | 5 GHz | 8.000 | 12.000 | 3.88 GHz | | 4.12 GHz |
| 15 GHz | 5 GHz | 13.000 | 17.000 | 3.88 GHz | | 4.12 GHz |
| 18 GHz | 5 GHz | 16.000 | 20.000 | 3.88 GHz | | 4.12 GHz |
| 10 GHz | 10 GHz | 6.000 | 14.000 | 7.76 GHz | | 8.24 GHz |
| 15 GHz | 10 GHz | 11.000 | 19.000 | 7.76 GHz | | 8.24 GHz |

## 3. Resolution Bandwidth Accuracy Test

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

**Related Adjustment**

3 dB Bandwidth Adjustments

**Specification**

±20%, 10 Hz to 1 kHz and 3 MHz bandwidths

± 10%, 3 kHz to 1 MHz bandwidths

30 kHz and 100 kHz bandwidth accuracy figures only applicable ≤90% Relative Humidity.

**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 (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Key in spectrum analyzer settings as follows:

   (CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 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 [al 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 f0.05 dB). The 3 dB bandwidth is given by the MARKER A frequency readout. (See Figure 2-5.) Record this value in Table 2-5.

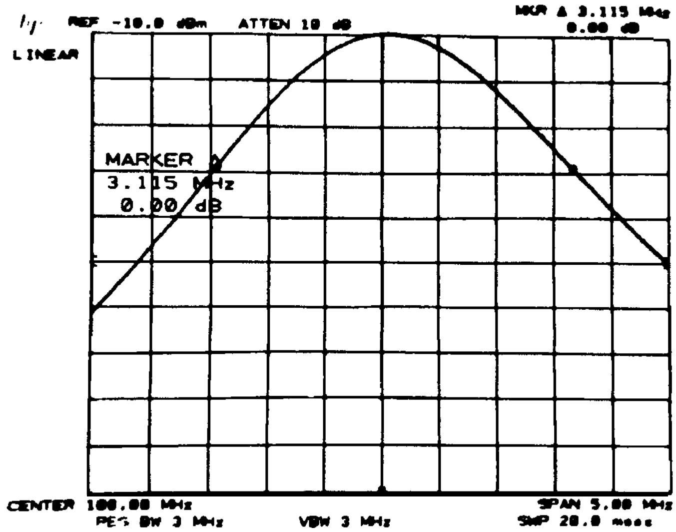



**Figure 2-5. Resolution Bandwidth Measurement**

8. Vary spectrum analyzer settings according to Table 2-5. Press SWEEP (SINGLE) and measure the 3 dB bandwidth for each resolution bandwidth setting by the procedure of steps 6 and 7 and record the value in Table 2-5. The measured bandwidth should fall between the limits shown in the table.

**Table 2-5. 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 | 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 | 24.0 Hz | ______ | 36.0 Hz |
| 10 Hz | 100 Hz | 8.0 Hz | ______ | 12.0 Hz |

## 4. 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 bandwidths
<13:1, 30 kHz to 10 kHz bandwidths
<11:1, 3 kHz to 30 Hz bandwidths
60 dB points on 10 Hz bandwidths 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.

**Equipment**

None required

**Note**

Performance Test 3, RESOLUTION BANDWIDTH ACCURACY TEST, must be performed before starting this test.

**Procedure**

1. Press (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Key in analyzer control settings as follows:

   (CENTER FREQUENCY) . . . . . . . . . . 100 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 2-6.)
5. Press MARKER In] 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 f0.50 dB).
6. Read the 60 dB bandwidth for the 3 MHz resolution bandwidth setting from the MARKER A frequency readout (Figure 2-6) and record the value in Table 2-6.

7. Vary spectrum analyzer settings according to Table 2-6. 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 2-6.
8. Record the 3 dB bandwidths from Table 2-5 in Table 2-6.
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 2-6.
10. The 60 dB bandwidth for the 10 Hz resolution bandwidth setting should be less than 100 Hz.

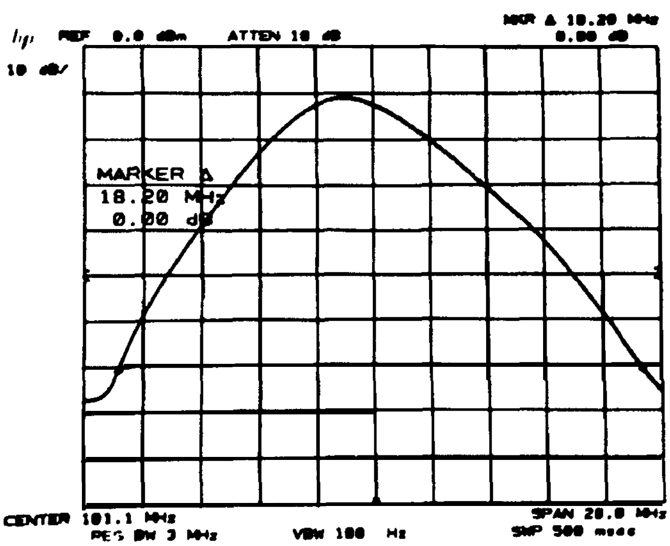



**Figure 2-6. 60 dB Bandwidth Measurement**

## 4. Resolution Bandwidth Selectivity Test

**Table 2-6. Resolution Bandwidth Selectivity**

| Spectrum Analyzer | | | Measured 60 dB Bandwidth | Measured 3 dB Bandwidth | Bandwidth Selectivity (60 dB BW ÷ 3dBBW) | 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 | ______ | ______ | ______ | 11:1 |
| 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 | | |

# 5. 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 to 30° C)

| | Resolution Bandwidth |
|---|---|
| ±2.0 dB | 10 Hz |
| ±0.8 dB | 30 Hz |
| ±0.5 dB | 100 Hz to 1 MHz |
| ±1.0 dB | 3 MHz |

## 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 [2 - 22 GHz].
2. Connect CAL OUTPUT to RF INPUT.
3. Key in the following control settings:

   [CENTER FREQUENCY] . . . . . . . . . . . . . . . . . . . . . . . . . 100 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], [a].
5. Key in settings according to Table 2-6. 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 2-7.) The allowable deviation for each resolution bandwidth setting is shown in the table.

## 5. Resolution Bandwidth Switching Uncertainty Test

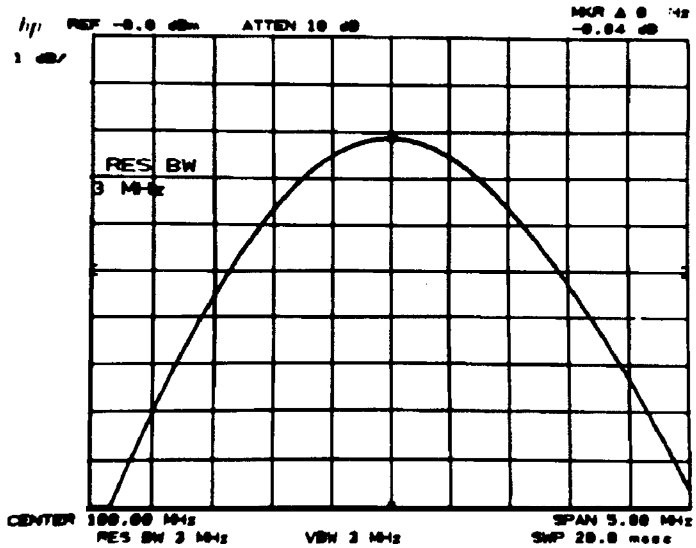



**Figure 2-7. Bandwidth Switching Uncertainty Measurement**

**Table 2-7. Bandwidth Switching Uncertainty**

| (RES BW) | (FREQUENCY) (SPAN) | i o n (MKR A Readout, dB) | Allowable Deviation (dB) |
|---|---|---|---|
| 1 MHz | 5 MHz | 0 (ref) | 0 (ref) |
| 3 MHz | 5 MHz | | fl.OO |
| 300 kHz | 5 MHz | | f0.50 |
| 100 kHz | 500 kHz | | f0.50 |
| 30 kHz | 500 kHz | | f0.50 |
| 10 kHz | 50 kHz | | f0.50 |
| 3 kHz | 50 kHz | | f0.50 |
| 1 kHz | 10 kHz | | f0.50 |
| 300 Hz | 1 kHz | | f0.50 |
| 100 Hz | 1 kHz | | f0.50 |
| 30 Hz | 200 Hz | | ±0.80 |
| 10 Hz | 100 Hz | | f2.00 |

# 6. Log Scale Switching Uncertainty Test

**Related Adjustment** Video Processor Adjustments

**Specification** f0.5 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 (2 - 22 GHz).
2. Key in analyzer settings as follows:

   (CENTER FREQUENCY] ...................................... ,100 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 RF INPUT.
5. Press MARKER (PEAK SEARCH] and (MKR → REF LVL). Record the marker amplitude (upper right of display) in Table 2-8.
6. Step up through the log scales with (⇧). At each step, press MARKER [PEAK SEARCH], then record the marker amplitude in Table 2-8. Refer to Figure 2-8.
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 f0.5 dB for each log scale.

## 6. Log Scale Switching Uncertainty Test

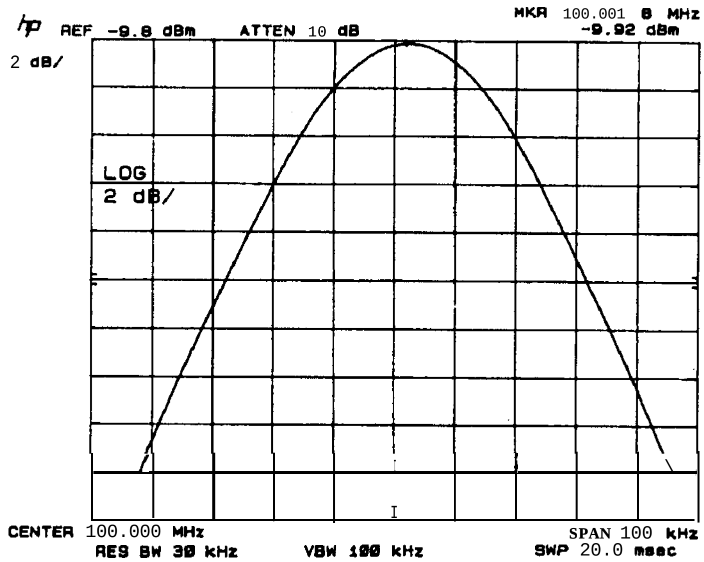



Figure 2-8. Log Scale Switching Uncertainty Measurement

Table 2-8. Log Scale Switching Uncertainty

| SCALE (dB/DIV) | MKR Amplitude (dBm) | Deviation (dB) | Allowable Deviation (dB) |
|---|---|---|---|
| 1 | ________ | 0 (ref) | 0 (ref) |
| 2 | ________ | ________ | f0.5 |
| 5 | ________ | ________ | f0.5 |
| 10 | ________ | ________ | f0.5 |

# 7. 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 to 30°C) |
|---|---|
| 0 dBm to -55.9 dBm | Res BW ≥30 Hz, f0.6 dB; Res BW = 10 Hz, f1.6 dB |
| -56.0 dBm to -129.9 dBm | Res BW ≥30 Hz, ±1.0 dB; Res BW = 10 Hz, f2.0 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.

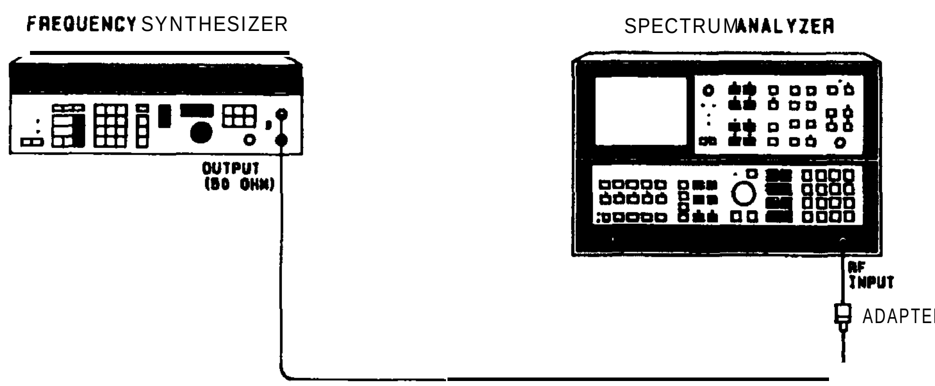



**Figure 2-9. IF Gain Uncertainty Test Setup**

## 7. IF Gain Uncertainty Test

### Equipment

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

### Procedure

1. Press (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Press (RECALL) (8). Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm f0.02 dB.
4. Press (2 - 22 GHz).

### 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 2-9.
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), (Δ).
11. Press (SHIFT), (ATTEN)I to permit extended reference level settings.
12. Set the analyzer (REFERENCE LEVEL], (VIDEO BW), and frequency synthesizer amplitude according to Table 2-9 settings. (Use the frequency synthesizer (⇩) for 10 dB steps.) At eachsetting, 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 2-10.

### Note

After measurement at the (REFERENCE LEVEL] = -70 dBm setting, press (SHIFT), CENTER dB/DIV)q as indicated in Table 2-9.

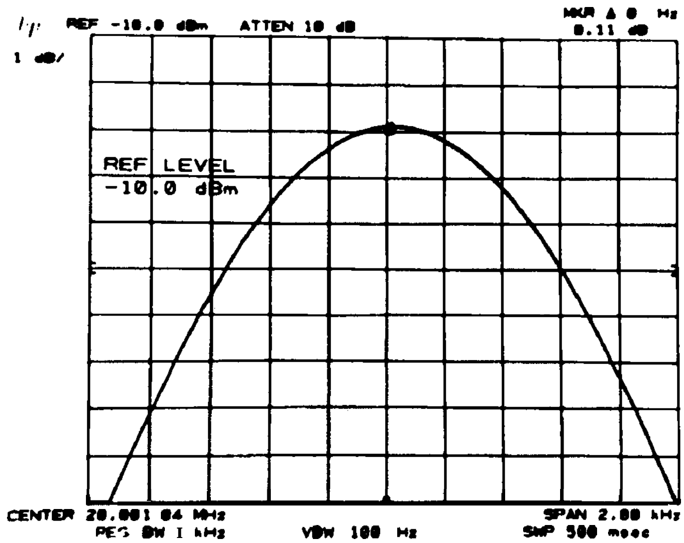



**Figure 2-10. IF Gain Uncertainty Measurement**

**Table 2-9. 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) | | | |
| -80 | -32 | 100 | |
| -90 | -42 | 100 | |
| -100 | -52 | 10 | |
| -110 | -62 | 10 | |
| -120 | -72 | 10 | |

## 2 dB Gain Steps

13. Press (2 - 22 GHz), (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 2-10. At each setting, note the MKR Δ amplitude and record it in the table.

**Table 2-10. 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 | |

## 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 (REFERENCE LEVEL) and the frequency synthesizer amplitude according to Table 2-11. At each setting, note the MKR Δ amplitude and record it in the table.

**Table 2-11. IF Gain Uncertainty, 0.1 dB Steps**

| (REFERENCE LEVEL) (dBm) | Frequency Synthesize1 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 | |

23. Find the largest positive deviation and the largest negative deviation for reference level settings from 0 dBm to -70 dBm in Table 2-9. 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 2-10 and Table 2-11:

| | C<br>Table 10 | D<br>Table 11 |
|---|---|---|
| Largest Positive Deviation: | ______dB | ______dB |
| Largest Negative Deviation: | ______dB | ______dB |

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.

## 8. Amplitude Fidelity Test

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

### 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

≤±1.0 dB over 0 to 80 dB display (20 to 30°C)

≤±1.5 dB 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.

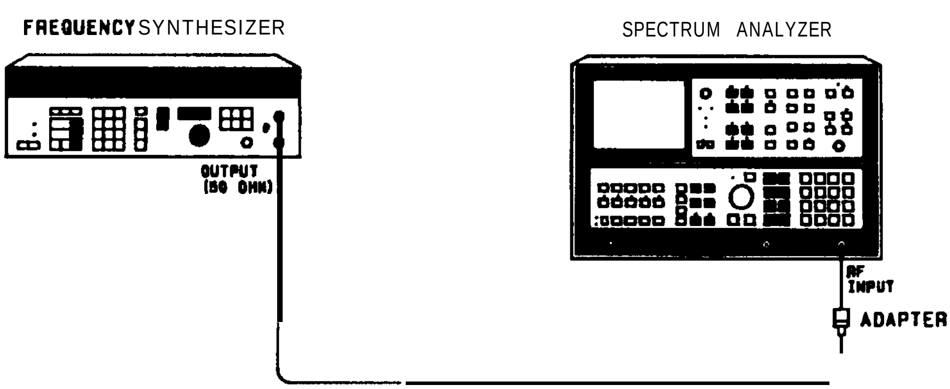



**Figure 2-11. Amplitude Fidelity Test Setup**

## 8. Amplitude Fidelity Test

**Equipment**

Frequency Synthesizer .................................... HP 3335A
Adapter, Type N (m) to BNC (f) ............................ 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-l 1.
3. Press (2 - 22 GHz) 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:

   (FREQUENC' SPAN) . .........................................O 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 A amplitude (a negative value) at each step and recording it in column 2 of Table 2-12. Allow several sweeps after each step for the video filtered trace to reach its final amplitude. (See Figure 2-12.)
7. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.
8. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -80 dB. The result should be ≤1.0 dB

   ______________ dB

9. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -90 dB. The result should be ≤ 1.5 dB

   ______________ dB

**Table 2-12. Log Scale Fidelity**

| Frequency Synthesizer Amplitude (dBm) | 1 Calibrated Amplitude Step (dB) | 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 | ______ | ______ |

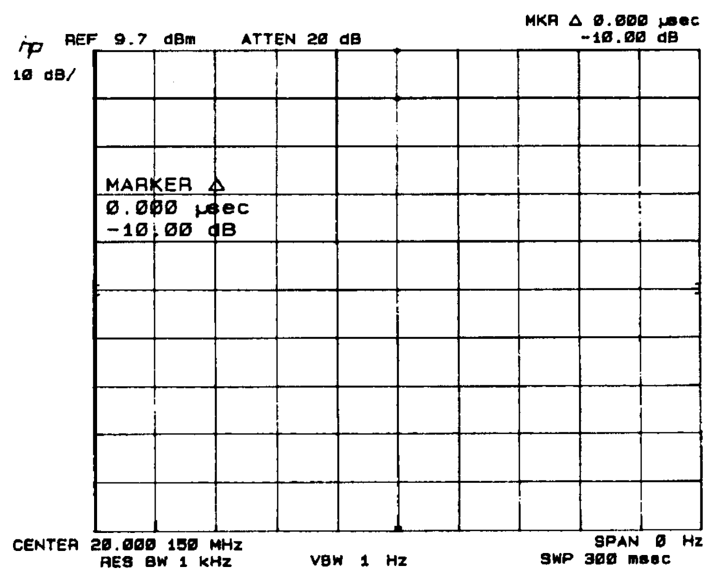



**Figure 2-12. Amplitude Fidelity Measurement**

## 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 [a.

14. Decrease frequency synthesizer output amplitude by 10 dB steps, noting the MARKER A amplitude and recording it in column 2 of Table 2-13.

**Table 2-13. 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 |

# 9. Calibrator Amplitude Accuracy Test

**Related Adjustment** CAL OUTPUT Adjustment

**Specification** -10 dBm f0.3 dB; 100 MHz

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

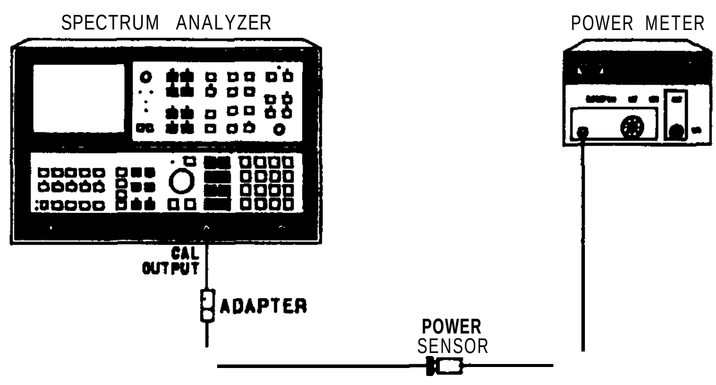



**Figure 2-13. Calibrator Amplitude Accuracy Test Setup**

**Equipment**

Power Meter .............................................. HP 436A
Power Sensor .............................................. HP 8481A
Adapter, Type N (f) to BNC (m) .............................. 1250-1477

**Procedure**

1. Connect equipment as shown in Figure 2-13.
2. Measure output level of the CAL OUTPUT signal. The value should be – 10.0 dBm ±0.3 dB.

____________dBm

# 10. Frequency Response Test

**Related Adjustments**

Frequency Response Adjustments

**Specifications**

(Includes input attenuator flatness in the 10 dB setting and mixing mode gain variations, and assumes PRESELECTOR PEAK in current instrument state.)

| | Flatness (20 to 30°C) |
|---|---|
| **Tuned Frequency** | |
| 100 Hz to 2.5 GHz non-preselected band | ±0.6 dB |
| 2 to 12.5 GHz preselected bands | f1.7 dB |
| 12.5 to 18.6 GHz preselected band | f2.2 dB |
| 18.6 to 20 GHz preselected band | f2.2 dB |
| 20 to 22 GHz preselected band | ±3.0 dB |
| **Cumulative** | |
| 100 Hz to 20 GHz | k2.2 dB |
| 100 Hz to 22 GHz | ±3.0 dB |
| **Absolute Amplitude Calibration** | f0.6 dB |

**Description**

Frequency response is checked across the full range of the spectrum analyzer. In the non-preselected range from 100 Hz to 2.5 GHz, three signal sources are used to make swept measurements: a function generator (100 Hz to 100 kHz), a frequency synthesizer (100 kHz to 60 MHz), and a synthesized sweeper (60 MHz to 2.5 GHz). In the preselected bands from 2 GHz to 22 GHz, a synthesized sweeper is used to check the frequency response. From 100 Hz to 60 MHz, the source flatness permits a direct display of analyzer response. Above 60 MHz, the externally levelled source is first characterized with a power meter. The power sensor Cal Factor % switch is used to compensate for the frequency response of the power meter.

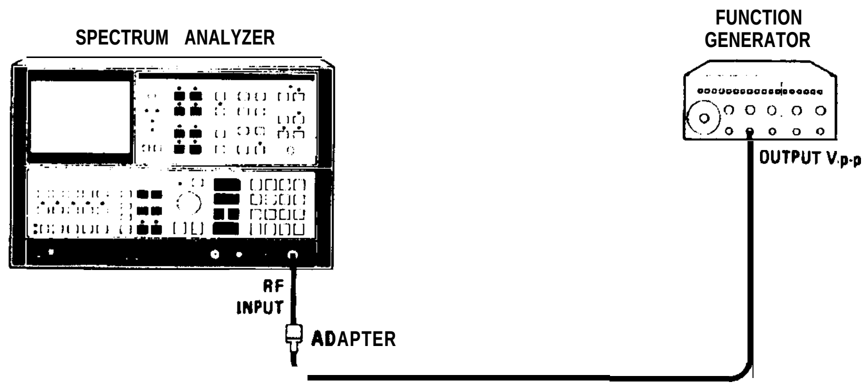



**Figure 2-14. Frequency Response Test Setup (100 Hz to 100 kHz)**

**Note**

Equipment listed is for three test setups, Figure 2-14, Figure 2-16, and Figure 2-18.

## Equipment

| | |
|---|---|
| Synthesized Sweeper | HP 8340A/B |
| Frequency Synthesizer | HP 3335A |
| Function Generator | HP 3312A |
| Power Meter | HP 436A |
| Power Sensor | HP 8485A |
| Adapter, Type N (m) to APC 3.5 (m) | 1250-1743 |
| Adapter, Type N Male Connectors | 1250-0778 |
| Adapter, Type N (m) to BNC (f) | 1250-0780 |
| Adapter, APC 3.5 (f) to APC 3.5 (f) (two required) | 1250-1749 |
| Power Splitter | HP 11667B |
| Low-loss Microwave Test Cable (APC 3.5) | 8120-4921 |

## Procedure

### 100 Hz to 100 kHz

1. Connect CAL OUTPUT to the RF INPUT on the spectrum analyzer.
2. Press (2 - 22 GHz), (RECALL) (8), MARKER (PEAK SEARCH), and adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm f0.02 dB.
3. Press (2 - 22 GHz) on the spectrum analyzer. Connect function generator to analyzer RF INPUT as shown in Figure 2-14.
4. Key in analyzer settings as follows:

   (START FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . kHz
   (STOP FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..10 0 kHz

5. Set function generator controls as follows:

   RANGE Hz . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 K
   FUNCTION . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ∿
   OFFSET . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CAL
   AMPLITUDE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 V
   AMPLITUDE VERNIER . . . . . . . . . . . . . . . . . . . . . . . . midrange
   SYM . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CAL
   TRIGGER PHASE . . . . . . . . . . . . . . . . . . . . . . . . . . FREE RUN
   MODULATION . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . all out
   MODULATION RANGE Hz . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
   MODULATION RANGE Hz VERNIER . . . . . . . . . 10 o'clock
   MODULATION SYM . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CAL
   Percent Modulation . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..fullycw

6. Adjust function generator FREQUENCY to place generator signal near the center graticule on the analyzer display.
7. Adjust the AMPLITUDE VERNIER on the function generator until the peak of the generator signal is at the reference level line on the analyzer display.
8. Press LOG [ENTER dB/DIV) on the analyzer and key in 1 dB per division.
9. Adjust function generator AMPLITUDE VERNIER to place peak of generator signal 2 dB (2 divisions) down from the reference level. Do not readjust AMPLITUDE VERNIER during test.
10. Adjust FREQUENCY on the function generator to position the signal trace at the right edge of the analyzer display.,
11. Press TRACE A (MAX HOLD). Press MODULATION SWP on the function generator. When function generator completes one sweep, press TRACE A (VIEW). Trace should appear as in Figure 2-15.

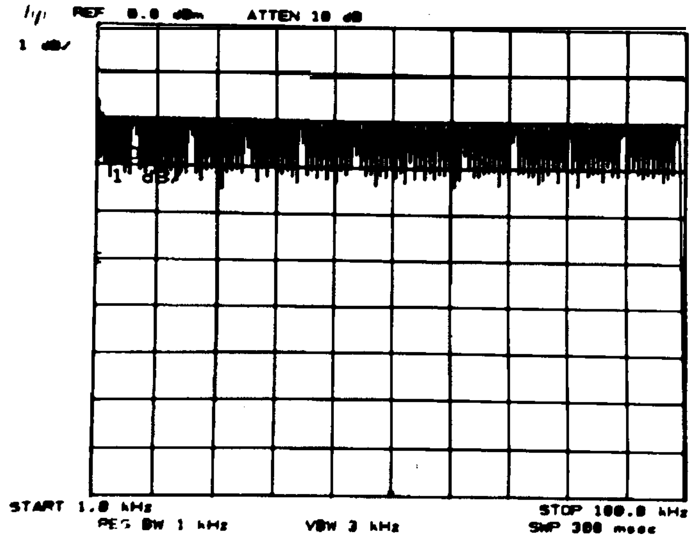


**Figure 2-15.**
**Frequency Response Measurement (1 kHz to 100 kHz)**

12. The closely spaced series of signal peaks on the display defines the analyzer response over this frequency range. The maximum and minimum peak amplitudes should not differ by more than 1.2 dB. The MARKER A function may be used to measure this amplitude difference.

    Deviation 1 kHz to 100 kHz ____________

13. Press (2 - 22 GHz) on the analyzer. Key in the following settings:

    [CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . 100 HZ
    [FREQUENCY SPAN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 Hz

14. Press LOG (ENTER dB/DIV) and key in 1 dB.

15. Set function generator controls as follows:

    RANGE Hz . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100
    FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
    MODULATION . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . all out

16. Adjust function generator FREQUENCY to center signal on analyzer display.

17. Press MARKER [PEAK SEARCH). The MKR amplitude should be -2.00 dBm f0.6 dB.

18. Set (CF STEP SIZE) to 100 Hz. Step analyzer (CENTER FREQUENCY) from 100 Hz to 1 kHz with (⇧) and set function generator FREQUENCY to center signal on display at each step. Press MARKER (PEAK SEARCH) at each frequency. The MKR amplitude should be -2 dBm f0.6 dB.

   Deviation 100 Hz to 1 kHz ____________

**100 kHz to 4 MHz**

19. Connect equipment as shown in Figure 2-16.

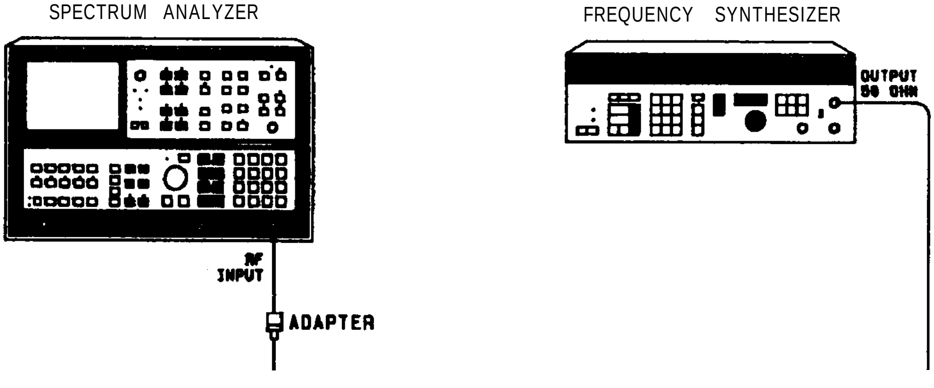



**Figure 2-16.**
**Frequency Response Test Setup (100 kHz to 60 MHz)**

20. Press (0 - 2.5 GHz) on the analyzer. Key in the following settings:

   (CENTER FREQUENCY) .......................... 4 MHZ
   (FREQUENCY SPAN) .......................... 2 MHz
   (CENTER dB/DIV) .......................... 1 dB

21. Set the controls of the frequency synthesizer as follows:

   FREQUENCY .......................... 4 MHz
   AMPLITUDE .......................... -2 dBm

22. Adjust the output amplitude of the frequency synthesizer to place the signal at the 8th graticule line.

23. Key in the analyzer settings as follows:

   (STOP FREQ) .......................... 4 MHz
   (START FREQ) .......................... O Hz

24. Key in the frequency synthesizer settings as follows:

   FREQUENCY .......................... 2,000,100 Hz
   SWEEP WIDTH .......................... 3,998,000 Hz

25. Press TRACE A (CLEAR-WRITE) and (MAX) on the analyzer.

26. Press START SINGLE 50 SEC SWEEP on the frequency synthesizer. Wait for completion of the sweep.
27. Activate MARKER (NORMAL) on the analyzer. Determine minimum and maximum amplitude points by using DATA knob to position the marker. Record the amplitude and frequency for each of the minimum and maximum points in Table 2-14.

**Note** Disregard any response ≤100 kHz.

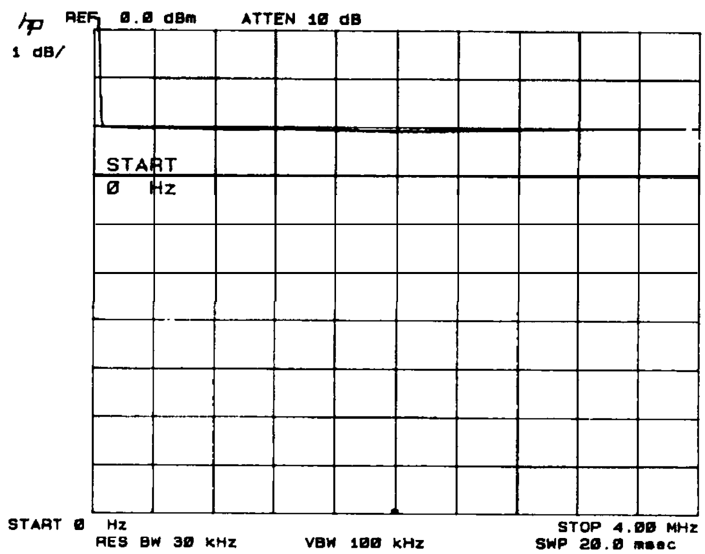



**Figure 2-17.**
**Frequency Response Measurement (100 kHz to 4 MHz)**

**Table 2-14. 100 Hz to 2.5 GHz Frequency Rand**

| Spectrum Analyzer | | Frequency Synthesizer | | Synthesized Sweeper | | Trace Limits | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Sweep Time 150 s | | Spec f0.6 dB | | | |
| START FREQ | STOP FREQ | Freq | Sweep Width | START FREQ | STOP FREQ | Minimum | | Maximum | |
| | | | | | | Amp | Freq | Amp | Freq |
| 100 Hz | 4 MHz | 2,000,100 Hz | 3,998,000 Hz | | | | | | |
| 4 MHz | 60 MHz | 30050 kHz | 59900 kHz | | | | | | |
| 60 MHz | 2.5 GHz | | | 60 MHz | 2.5 GHz | | | | |

## 4 MHz to 60 MHz

28. Press (0 - 2.5 GHz) on the spectrum analyzer. Set the spectrum analyzer controls as follows:

    [CENTER FREQUENCY] .......................................... 4 MHZ
    (FREQUENCY SPAN) .......................................... 4 MHz
    (RES BW) .......................................... 300 kHz
    (ENTER dB/DIV) .......................................... dB

29. Set the frequency of the frequency synthesizer to 4 MHz.
30. Adjust the output amplitude of the frequency synthesizer to place the signal at the 8th graticule line.
31. Key in the analyzer settings as follows:

    (START FREQ) .......................................... 100 kHz
    (STOP FREQ) .......................................... 60 MHz

32. Key in the frequency synthesizer settings as follows:

    FREQUENCY .......................................... 30,050,000 Hz
    SWEEP WIDTH .......................................... 59,900,000 Hz

33. Press TRACE A (CLEAR-WRITE) and (MAX HOLD) on the analyzer.
34. Press START SINGLE 50 SEC SWEEP on the frequency synthesizer. Wait for completion of the sweep.
35. Activate MARKER (NORMAL) on the analyzer. Determine minimum and maximum amplitude points by using the DATA knob to position the marker. Record the amplitude and frequency for each of the minimum and maximum points in Table 2-14.

**Note**

Disregard any response below 4 MHz.

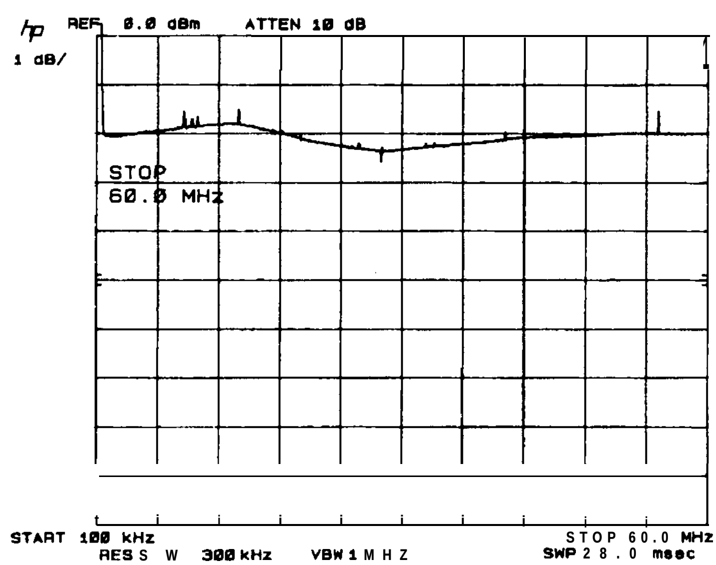



**Figure 2-18.**
**Frequency Response Measurement (4 MHz to 60 MHz)**

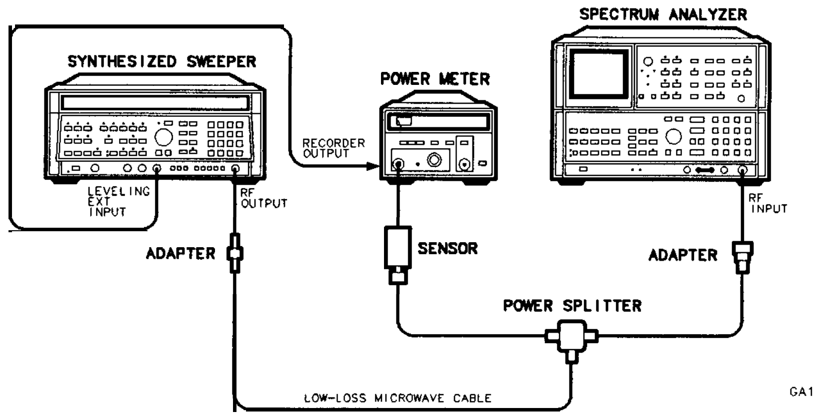



**Figure 2-19.**
**Frequency Response Test Setup (60 MHz to 2.5 GHz, 2 to 22 GHz)**

## 60 MHz to 2.5 GHz

36. Connect equipment as shown in Figure 2-19, with one resistive output of the power splitter connected to the power meter/power sensor, and the second resistive output connected to the spectrum analyzer RF INPUT using an APC 3.5 (m) to Type N (m) adapter. Connect the power meter rear panel RECORDER OUTPUT to the synthesized sweeper front panel LEVELING EXT INPUT.
37. On the power meter, verify that the [RANGE HOLD] switch is off.

    Consult the power sensor Cal Factor versus Frequency graph or table and set the power meter CAL FACTOR % switch to the 100 MHz calibration setting.
38. Press [INSTR PRESET] on the synthesized sweeper. Set the controls of the synthesized sweeper as follows:

    CW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 MHz
    POWER LEVEL . . . . . . . . . . . . . . . . . . . . . . -9.0 dBm
    RF . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on
    LEVELING . . . . . . . . . . . . . . . . . . . . . . . . . . . . INT
39. On the synthesized sweeper, press [POWER LEVEL] and adjust the ENTRY knob for a power meter indication of -15.00 dBm fO.10 dB at 100 MHz.
40. On the power meter, press [RANGE HOLD] (turning it on).
41. On the synthesized sweeper, press [POWER LEVEL] and adjust the ENTRY knob for a power meter indication of -10.00 ±0.03 dB at 100 MHz.
42. 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 test procedure.

**Note**

lb provide the spectrum analyzer with a 60 MHz to 22 GHz input signal of sufficient flatness for measuring frequency response and absolute amplitude accuracy, the synthesized sweeper must be externally leveled with a power meter, using a relatively slow sweep time (at least 40 seconds).

43. On the spectrum analyzer, key in (2-22 GHz), (SHIFT) TRACE A (MAX HOLD) (KSb). Set he spectrum analyzer controls as follows:

    CENTER FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 MHz
    FREQUENCY SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 MHz
    RES BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . , . . . . . . . . . . . . . . 3 MHz
    VIDEO BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3 MHz
    LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 dB/DIV
    REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -7 dBm

44. On the spectrum analyzer, press MARKER [PEAK SEARCH) and adjust the front-panel AMPTD CAL control for a MARKER indication of -10.00 dBm fO.O1 dB.

45. On the synthesized sweeper, key in [START FREQ) 60 MHz, (STOP FREQ) 2.5 GHz, (SWEEP TIME) 150 s, SWEEP (SINGLE), SWEEP (SINGLE).

46. On the spectrum analyzer, key in (START FREQ) 60 MHz, (STOP FREQ) 2.5 GHz, TRACE B (CLEAR-WRITE), TRACE B (MAX HOLD).

47. On the synthesized sweeper, press SWEEP (SINGLE) and wait for a sweep to complete (150 seconds) and the SWEEP LED to turn off. As the synthesized sweeper tunes from 60 MHz to 2.5 GHz, the spectrum analyzer frequency response is displayed as TRACE B (TRACE A displays the current input signal). When the sweep has completed, the display should appear as shown in Figure 2-20.

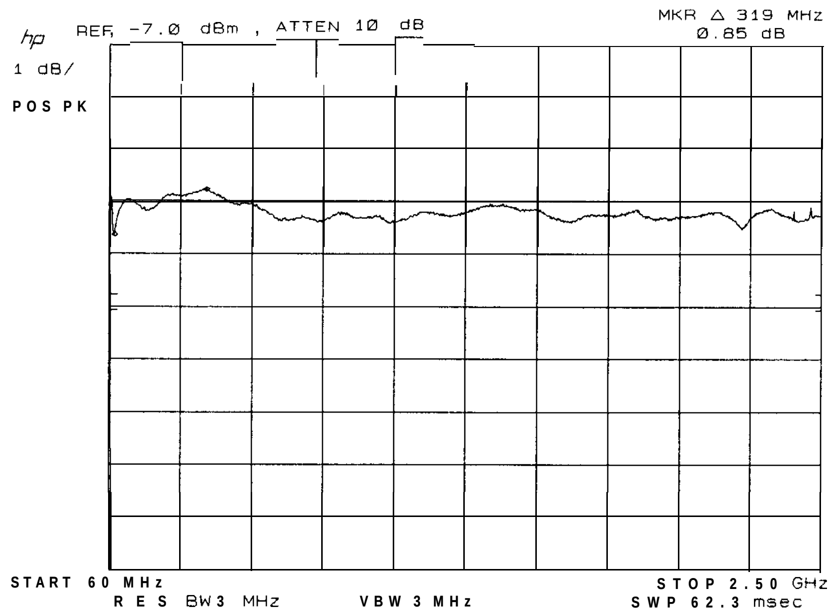



**Figure 2-20. Frequency Response Measurement (60 MHz to 2.5 GHz)**

48. On the spectrum analyzer, key in TRACE B (VIEW), TRACE A (BLANK), MARKER (NORMAL) and use the DATA knob to position a marker on the highest point on the TRACE B waveform. Record the amplitude and frequency for this maximum point in Table 2-14. The maximum absolute amplitude should be less than -8.80 dBm.

49. On the spectrum analyzer, use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Record the amplitude and frequency for this minimum point in Table 2-14. The minimum absolute amplitude should be greater than – 11.20 dBm.

50. On the spectrum analyzer, press MARKER [al and use the DATA knob to position a second marker on the highest point on the TRACE B waveform. Flatness (total peak-to-peak amplitude deviation) of the displayed trace should be less than 1.20 dB.

### 2 to 22 GHz (Preselected Range)

51. On the spectrum analyzer, key in (2-22 GHz), [SHIFT) (PRESEL PEAK) (KS=), (SHIFT) TRACE A (MAX HOLD) (KSb). Set the spectrum analyzer controls as follows:

| | |
|---|---|
| START FREQ | 2.0 GHz |
| STOP FREQ | 3.9 GHz |
| RES BW | 3 MHz |
| VIDEO BW | 3 MHz |
| REFERENCE LEVEL | -7 dBm |
| LOG SCALE | 1 dB/DIV |

52. Consult the power sensor Cal Factor versus Frequency graph or table and set the power meter CAL FACTOR % switch to the 3 GHz calibration setting.

53. On the synthesized sweeper, key in (CW) 3.0 GHz, (START FREQ) 2.0 GHz, (STOP FREQ) 3.9 GHz, [SWEEP TIME) 150 s, SWEEP (SINGLE), SWEEP (SINGLE).
54. On the spectrum analyzer, key in TRACE B [CLEAR-WRITE), TRACE B (MAX HOLD), (SHIFT) (GHz) (KS/).
55. On the synthesized sweeper, key in [START FREQ), SWEEP (SINGLE) and wait for a sweep to complete (150 seconds) and the SWEEP LED to turn off. As the synthesized sweeper tunes from 2.0 GHz to 3.9 GHz, the spectrum analyzer frequency response is displayed as TRACE B (TRACE A displays the current input signal).
56. On the synthesized sweeper, press (CW) and use the ENTRY knob to position the peak of the displayed TRACE A signal at the lowest point on the TRACE B waveform.
57. On the spectrum analyzer, key in (PRESEL PEAK) and wait for the PEAKING! message to clear from the CRT.
58. Repeat steps 55 through 57 until the level of the lowest point on the TRACE B waveform does not change.
59. On the spectrum analyzer, key in TRACE B (VIEW), TRACE A (BLANK), MARKER (NORMAL) and use the DATA knob to position a marker on the highest point on the TRACE B waveform. Record the amplitude and frequency for this maximum point in Column 4 of Table 2-15. The maximum absolute amplitude should be less than -7.70 dBm.
60. On the spectrum analyzer, use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Record the amplitude and frequency for this minimum point in Column 4 of Table 2-15. The minimum absolute amplitude should be greater than -12.30 dBm.
61. On the spectrum analyzer, press MARKER [al, and use the DATA knob to position a second marker on the highest point on the TRACE B waveform. Flatness (total peak-to-peak amplitude deviation) of the displayed trace should be less than 3.40 dB.
62. Set the spectrum analyzer controls as follows:

    START FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3.9 GHz
    STOP FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5.8 GHz

63. Consult the power sensor Cal Factor versus Frequency graph or table and set the power meter CAL FACTOR % switch to the 5 GHz calibration setting.
64. On the synthesized sweeper, key in (CW) 5.0 GHz, (START FREQ) 3.9 GHz, (STOP FREQ) 5.8 GHz.
65. On the spectrum analyzer, key in TRACE A [CLEAR-WRITE), TRACE B (CLEAR-WRITE), TRACE B (MAX HOLD), [SHIFT] (GHz) (KS/).
66. On the synthesized sweeper, key in [START FREQ), SWEEP (SINGLE) and wait for a sweep to complete (150 seconds) and the SWEEP LED to turn off. As the synthesized sweeper tunes from 3.9 GHz to 5.8 GHz, the input signal is displayed as a TRACE A response, and the spectrum analyzer frequency response is displayed as TRACE B.

67. On the synthesized sweeper, press (CW) and use the ENTRY knob to position the peak of the displayed TRACE A signal at the lowest point on the TRACE B waveform.
68. On the spectrum analyzer, key in (PRESEL PEAK) and wait for the PEAKING! message to clear from the CRT.
69. Repeat steps 66 through 68 until the level of the lowest point on the TRACE B waveform does not change.
70. On the spectrum analyzer, key in TRACE B (VIEW], TRACE A (BLANK), MARKER (NORMAL) and use the DATA knob to position a marker on the highest point on the TRACE B waveform. Record the amplitude and frequency for this maximum point in Column 4 of Table 2-15. The maximum absolute amplitude should be less than -7.70 dBm.
71. On the spectrum analyzer, use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Record the amplitude and frequency for this minimum point in Column 4 of Table 2-15. The minimum absolute amplitude should be greater than -12.30 dBm.
72. On the spectrum analyzer, press MARKER (Δ), and use the DATA knob to position a second marker on the highest point on the TRACE B waveform. Flatness (total peak-to-peak amplitude deviation) of the displayed trace should be less than 3.40 dB.
73. Repeat steps 62 through 72 for the six remaining frequency ranges listed in Table 2-15, setting both the power meter CAL FACTOR % switch and the synthesized sweeper (CW) frequency for the power sensor Cal Frequency listed in Column 3.
74. For each frequency band tested, calculate the overall flatness by subtracting the maximum amplitude value from the minimum amplitude value recorded in Column 4 of Table 2-15. Record the result for each frequency band in Column 5 of Table 2-15. Flatness (total peak-to-peak amplitude deviation) for each frequency band should be less than the specified values listed in Column 5 of Table 2-15.
75. Calculate the cumulative flatness for both the 100 Hz to 20 GHz and the 100 Hz to 22 GHz frequency ranges by subtracting the appropriate maximum amplitude value from the appropriate minimum amplitude value recorded in either Table 2-14 or Column 4 of Table 2-15. Record the result for both frequency ranges at the bottom of Table 2-15.

## External Mixer Bands (18.6 GHz to 325 GHz)

76. Connect the low-loss microwave test cable to the synthesized sweeper RF OUTPUT using an APC 3.5 (f) to APC 3.5 (f) adapter. Connect the power meter/power sensor to the opposite end of the test cable using an APC 3.5 (f) to APC 3.5 (f) adapter.
77. Press (INSTR PRESET) on the synthesized sweeper. Set the controls of the synthesized sweeper as follows:

| | |
|---|---|
| CW | 321.4 MHz |
| POWER LEVEL | -20.0 dBm |
| RF | on |

LEVELING . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . INT

78. On the synthesized sweeper, press (POWER LEVEL) and adjust the ENTRY knob for a power meter indication of -20.00 dBm f0.03 dB at 321.4 MHz (with the power meter RANGE HOLD switch off).

79. On the synthesized sweeper, key in (POWER LEVEL) (⇩) to decrease the output power by 10.0 dB to -30 dBm.

80. Disconnect the jumper cable from between the spectrum analyzer front panel 321.4 MHz IF INPUT and IF OUTPUT connectors.

81. Disconnect the low-loss microwave test cable from the power meter/power sensor, and connect the test cable to the spectrum analyzer front panel 321.4 MHz IF INPUT connector.

82. On the spectrum analyzer, key in (2-22 GHz), (SHIFT) (⇧) (KSU), 6 Hz, (SHIFT) (REFERENCE LEVEL) (KSZ) 0 dB, setting the K-band conversion loss to 30 dB. Set the spectrum analyzer controls as follows:

RES BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 MHz
REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +3 dBm
LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 dB/DIV

83. On the spectrum analyzer, press MARKER (NORMAL). The MARKER indication should be 0.00 dBm fl.OO dB. Subtract 0.00 dBm from the MARKER amplitude, and record the result.

321.4 MHz IF INPUT Sensitivity ____________ dB

84. Disconnect the low-loss microwave test cable from the spectrum analyzer front panel 321.4 MHz IF INPUT connector. Reconnect the jumper cable between the spectrum analyzer front panel 321.4 MHz IF INPUT and IF OUTPUT connectors.

85. On the spectrum analyzer, key in (SHIFT) (⇧) (KSU), 6 Hz, (SHIFT) (REFERENCE LEVEL) (KSZ) -12 dBm, setting the K-band conversion loss to 18 dBm (default value).

## Table 2-15. Frequency Response (Flatness)

| 1<br>Frequency<br>Rand | 2<br>Spectrum Analyzer and Synthesized Sweeper<br>START FREQ | <br>STOP FREQ | 3<br>C d<br>Frequency<br>Power Sensor | 4<br>Trace Limits<br>Minimum<br>Amplitude (dBm) | <br><br>Minimum<br>Frequenc y | <br><br>Maximum<br>Amplitude (dBm) | <br><br>Maximum<br>Frequenc y | 5<br>Flatness (dB) |
|---|---|---|---|---|---|---|---|---|
| 60 MHz - 2.5 GHz | 60 MHz | 2.5 GHz | 100 MHz | | | | | |
| Spec | | | | -11.20 | | -8.80 | | 1.20 |
| 2 - 5.8 GHz | 2 GHz | 3.9 GHz | 3 GHz | | | | | |
| | 3.9 GHz | 5.8 GHz | 5 GHz | | | | | |
| Spec | | | | – 12.30 | | -7.70 | | 3.40 |
| 5.8 - 12.5 GHz | 5.8 GHz | 9.15 GHz | 7 GHz | | | | | |
| | 9.15 GHz | 12.5 GHz | 11 GHz | | | | | |
| Spec | | | | – 12.30 | | -7.70 | | 3.40 |
| 12.5 - 18.6 GHz | 12.5 GHz | 15.55 GHz | 14 GHz | | | | | |
| | 15.55 GHz | 18.6 GHz | 17 GHz | | | | | |
| Spec | | | | -12.80 | | -7.20 | | 4.40 |
| 18.6 - 20 GHz | 18.6 GHz | 20 GHz | 19 GHz | | | | | |
| Spec | | | | – 12.80 | | -7.20 | | 4.40 |
| 20 - 22 GHz | 20 GHz | 22 GHz | 21 GHz | | | | | |
| Spec | | | | -13.60 | | -6.40 | | 6.00 |
| umulative Flatness (dB) | | | | | | | | |
| 100 Hz to 20 GHz | | | | | | | | |
| Specification: 4.40 dB | | | | | | | | |
| 100 Hz to 22 GHz | | | | | | | | |
| Specification: 6.00 dB | | | | | | | | |

## 11. Sweep Time Accuracy Test

**Related Adjustment** Sweep, DAC, and Main Coil Driver Adjustment

**Specification** For sweep times ≤200 seconds, ±10%

For sweep times >200 seconds, ±30%

**Description** A universal counter is connected to the PENLIFT RECORDER OUTPUT (on the rear panel) of the 8566B. The counter is used in time interval mode to determine the "pen down" interval of the PENLIFT RECORDER OUTPUT. The penlift output voltage level corresponds directly to the sweeping of the analyzer (pen down = 0V) and not-sweeping of the analyzer (pen up = 15V). A DVM is used to set the appropriate trigger level of the counter.

This test is for sweep times ≥20 ms. For faster sweep times, refer to Test 21, Fast Sweep Time Accuracy Test.

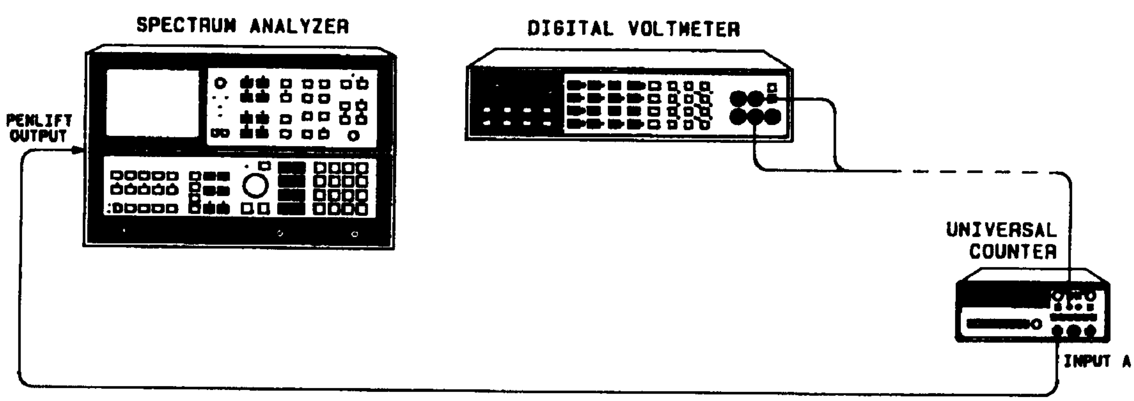



**Figure 2-21. Sweep Time Accuracy Test Setup**

**Equipment**

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

## Procedure

1. Connect equipment as shown in Figure 2-21.
2. Press (2 - 22 GHz) SWEEP (SINGLE) on the analyzer.
3. Key in the following settings:

   (CENTER FREQUENCY) .................................... 500 MHz
   (FREQUENCY SPAN) ........................................... 0 Hz

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. Reset the universal counter and press SWEEP (SINGLE) on the spectrum analyzer.
6. Note the measured sweep time on the universal counter and record this value in Table 2-16. The measured sweep time should be a value between the minimum and maximum values given in Table 2-16.
7. Repeat steps 5 and 6 for each sweep time setting in Table 2-16.

## 11. Sweep Time Accuracy Test

**Table 2-16. Sweep Time Accuracy, Sweep Times ≥20 ms**

| (SWEEP TIME) | Sweep Time | | |
|---|---|---|---|
| | Min | Measured | Max |
| 20 ms | 18 ms | ______ | 22 ms |
| 30 ms | 27 ms | ______ | 33 ms |
| 50 ms | 45 ms | ______ | 55 ms |
| 70 ms | 63 ms | ______ | 77 ms |
| 90 ms | 81 ms | ______ | 99 ms |
| 110 ms | 99 ms | ______ | 121 ms |
| 170 ms | 153 ms | ______ | 187 ms |
| 200 ms | 180 ms | ______ | 220 ms |
| 2 s | 1.8 s | ______ | 2.2 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 2-17. The measured sweep time should be a value between the minimum and maximum values given in Table 17.
13. Repeat steps 11 and 12 for 200 s and 240 s sweep times.

**Table 2-17. Sweep Time Accuracy**

| (SWEEP TIME) | MARKER Δ Time | | |
|---|---|---|---|
| | Min | Measured | Max |
| 20 s | 3.6 s | ______ | 4.4 s |
| 200 s | 36 ms | ______ | 44 ms |
| 240 s | 33.6 ms | ______ | 62.4 ms |

# 12. Noise Sidebands Test

**Related Adjustments**

100 MHz Voltage-Controlled Crystal Oscillator Adjustments

Sweep, DAC, and Main Coil Driver Adjustments

M/N Loop Adjustments

RF Module Phase Lock Adjustments

YTO Loop Adjustments

20/30 Phase Lock Adjustments

**Specification**

For Frequency Span ≤25 kHz (except 100 kHz offset) and Center Frequencies from 100 Hz to 5.8 GHz:

| Offset from Carrier | Sideband Level (dBc/Hz) |
|---|---|
| 320 Hz | -80 |
| 1 kHz | -85 |
| 10 kHz | -90 |
| 100 kHz | -105 |

**Description**

A 5.7 GHz signal with low phase noise is input to the spectrum analyzer. The signal and noise sidebands are displayed on the analyzer and the trace is video-averaged. The displayed noise sideband level at various frequency offsets is measured and the measured values are corrected for log amplification and detection errors, then normalized to a 1 Hz bandwidth. A second HP 8566A/B Spectrum Analyzer is used as the signal source for this test. Therefore, if the measured values are not within specification limits, either analyzer may be at fault.

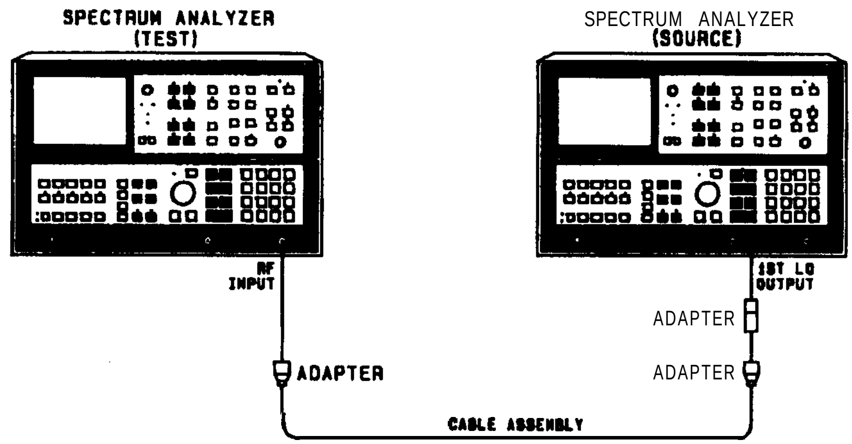



**Figure 2-22. Noise Sidebands Test Setup**

## Equipment

Spectrum Analyzer (1ST LO OUTPUT) .................. HP 8566A/B
Adapter, Type N (m) to SMA (f) (2 required) .............. 1250-1250
Adapter, Type N (f) to BNC (m) ........................... 1250-0077
Cable Assembly, SMA Male Connectors .................. 5061-1086

## Procedure

1. Allow both analyzers to warm up for at least one-half hour with LINE switch in either the STANDBY or ON position.
2. On one of the analyzers, connect the CAL OUTPUT to the RF INPUT. Press (2 - 22 GHz) then (RECALL) (9) and adjust FREQ ZERO control for maximum signal amplitude. Repeat this frequency calibration on the other analyzer. When completed, press (2 - 22 GHz) again on each of the analyzers.
3. Connect 1ST LO OUTPUT of source analyzer to RF INPUT of analyzer under test as shown in Figure 2-22.

**Note**

Do not connect the frequency reference (on the rear panel) of the analyzers to a common frequency reference.

4. Key in the following on the source analyzer:

(CENTER FREQUENCY) .................... . . . . 5.7 GHz
(FREQUENCY SPAN) . . . . . . . . . . . . . ................ 0 Hz
SHIFT MKR → REF LVL)R (Display diagnostics for convenience)
[SHIFT] (RES BW)F (YTO Pretest Mode)
SWEEP (SINGLE)

The first line of the diagnostic display and the CENTER readout should both now indicate 5.700 000 000 GHz. This is the 1ST LO OUTPUT frequency.

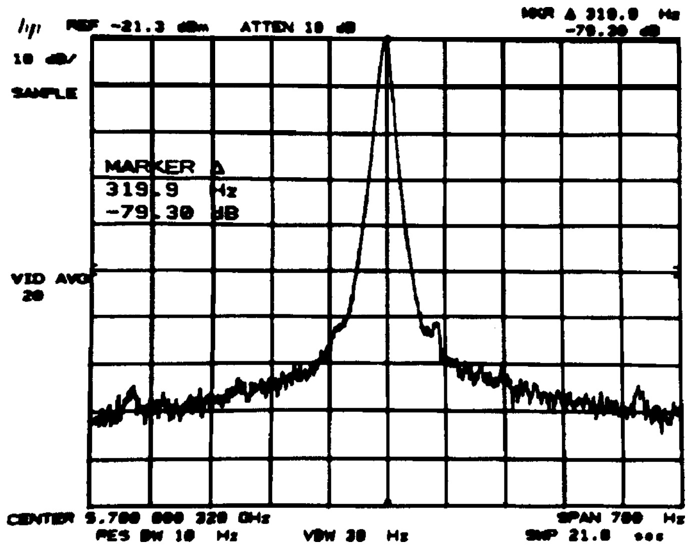



**Figure 2-23. Noise Sidebands Measurement**

5. Key in the following on the analyzer under test:

   (CENTER FREQUENCY) .................................... 5.7 GHz
   (FREQUENCY SPAN) ........................................ .5 kHz

6. Wait for completion of the sweep (the asterisk * at the upper right of the display will disappear), then press MARKER (PEAK SEARCH), (MKR → CF), (MKR → REF LVL).

7. Change (FREQUENCY SPAN) to 700 Hz. Wait for completion of the sweep, then press MARKER (PEAK SEARCH), (MKR → CF). Wait again for the completion of the sweep.

8. Press (SHIFT) (VIDEO BW) G to initiate video averaging. When the VID AVG readout at the left edge of the display reaches 20, press (SHIFT), TRACE B (BLANK).

9. Press MARKER (PEAK SEARCH), In] and key in 320 Hz.

   Record the MARKER A amplitude: ____________ dBc.

   See Figure 2-23.

10. Find the equivalent noise power bandwidth, $BW_{enp}$, for the 10 Hz resolution bandwidth filter by multiplying the 3 dB bandwidth recorded in Table 2-5 of the Resolution Bandwidth Accuracy Test by 1.13:

    $BW_{enp}$ = 1.13 x ____ Hz

    = ____________ Hz

11. A correction factor of 2.5 dB must be added to the value measured in step 9 to compensate for logarithmic amplification and envelope detection. Add this correction, then subtract 10 log ($BW_{enp}$) to compute the noise sideband level in dBc referenced to a 1 Hz bandwidth:

    ____________dBc + 2.5 dB – 10 log($BW_{enp}$) = ____________ dBc/1 Hz

    The result should be < -80 dBc/1 Hz.

12. Press (SHIFT) [SWEEP TIME]H.
13. Change [FREQUENCY SPAN] to 2.5 kHz.
14. Press [SHIFT] [VIDEO BW]G. When the VID AVG readout reaches 10, press [SHIFT], TRACE B [BLANK].
15. Press MARKER [PEAK SEARCH], [Δ] and key in 1 kHz.

    Record the MARKER Δ amplitude: ____________dBc.

16. Compute the noise sideband level at a 1 kHz offset by the procedure of steps 10 and 11, but find $BW_{enp}$ for the 30 Hz resolution bandwidth filter:

    ____________dBc + 2.5 dB -10 log($BW_{enp}$) = dBc/1 Hz

    The result should be < –85 dBc/1 Hz.

17. Press [SHIFT] [SWEEP TIME]H.
18. Change [FREQUENCY SPAN] to 25 kHz.
19. Press (SHIFT) (VIDEO]G. When the VID AVG readout reaches 20 or higher, press [SHIFT], TRACE B [BLANK].
20. Press MARKER [PEAK SEARCH], [Δ] and key in 10 kHz.

    Record the MARKER Δ amplitude: ____________dBc.

21. Compute the noise sideband level at a 10 kHz offset by the procedure of steps 10 and 11, using the 3 dB bandwidth recorded in Table 2-5 for the 300 Hz resolution bandwidth filter:

    ____________dBc + 2.5 dB – 10 log($BW_{enp}$) = ____________dBc/1 Hz

    The result should be < –90 dBc/1 Hz.

22. Press [SHIFT] (SWEEP.
23. Change [FREQUENCY SPAN] to 250 kHz.
24. Press [SHIFT] [VIDEO BW]G. When the VID AVG readout reaches 30 or greater, press [SHIFT], TRACE B [BLANK].
25. Press MARKER [PEAK SEARCH] [Δ] and key in 100 kHz.

    Record the MARKER Δ amplitude: ____________dBc.

26. Compute the noise sideband level at a 100 kHz offset by the procedure of steps 10 and 11, using $BW_{enp}$ for the 3 kHz filter:

    ____________dBc + 2.5 dB – 10 log ($BW_{enp}$) = dBc/1 Hz.

    The result should be < –105 dBc/1 Hz.

# 13. Line-Related Sidebands Test

## Specification

| Offset from Carrier | Center Frequency | Sidebands |
|---|---|---|
| <360 HZ | 100 Hz to 100 MHz<br>100 MHz to 5.8 GHz | -70 dBc<br>-60 dBc |
| 360 Hz to 2 kHz | 100 Hz to 100 MHz | -75 dBc |

**Option 400:** For center frequencies >100 Hz and <5.8 GHz:

| Offset from Carrier | Center Frequency | Sidebands |
|---|---|---|
| ≤2 kHz | 100 Hz to 5.8 GHz | −55 dBc |
| 2 kHz to 5.5 kHz | 100 Hz to 5.8 GHz | −65 dBc |

## Description

The line-related sidebands are measured on signals of 100 MHz, 2.4 GHz, 2.6 GHz, and 5.7 GHz. A second HP 8566A/B Spectrum Analyzer is used as the signal source for this test. Therefore, if measured values are not within specified limits, either analyzer may be at fault.

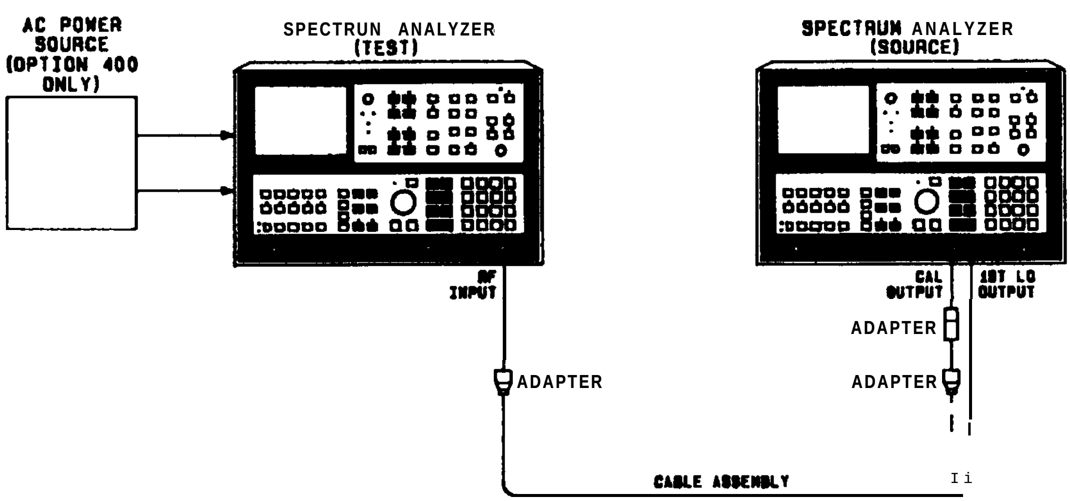



Figure 2-24. Line Related Sidebands Test Setup

## 13. Line-Related Sidebands Test

### Equipment

Spectrum Analyzer (1ST LO OUTPUT) . . . . . . . . . . . . . . . . HP 8566A/B
AC Power Source (Option 400 ONLY) . . California Instruments Model 153T
Adapter, Type N (m) to SMA (f) (2 required) . . . . . . . . . . . 1250-1250
Adapter, Type N (f) to BNC (m) . . . . . . . . . . . . . . . . . . . . . 1250-0077
Cable Assembly, SMA Male Connectors . . . . . . . . . . . . . . . . . 5061-1086

### Procedure

1. Allow both analyzers to warm up for at least one-half hour with LINE switch in either the STANDBY or ON position.
2. Connect CAL OUTPUT to RF INPUT on one of the analyzers. Press (2 - 22 GHz) then (RECALL) (9) and adjust FREQ ZERO control for maximum signal amplitude. Repeat this frequency calibration on the other analyzer. When complete, press (2 - 22 GHz) on each analyzer.
3. Connect CAL OUTPUT of source analyzer to RF INPUT of analyzer under test as shown in Figure 2-24.
4. Key in the following on the analyzer under test:

   (CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 MHZ
   (FREQUENCY SPAN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1.2 kHz

   Wait for asterisk (*) in upper-right of display to disappear.
5. Press MARKER (PEAK SEARCH), (MKR → CF), (MKR → REF LVL) and wait for asterisk (*) to disappear. Trace should now be centered on display.
6. Press (SHIFT) (VIDEO BW)$^{G}$, SWEEP (SINGLE), (1) (0) (Hz μ μsec) to initiate video averaging of 10 sweeps.
7. When VID AVG = 10, press (SHIFT), TRACE B (BLANK), TRACE A (VIEW).
8. Press MARKER (PEAK SEARCH) [al and position the marker at the peaks of the line-related sidebands separated from the signal by multiples of the line frequency (e.g., 120, 180, 240, 300, 360, 420, 480, and 540 Hz for a 60 Hz line frequency). The fundamental line frequency cannot be resolved. Refer to Figure 2-25.

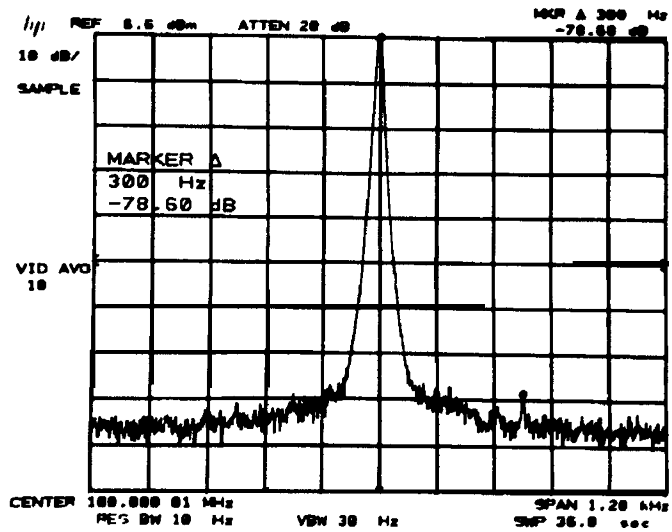



**Figure 2-25. Line-Related Sidebands Measurement**

9. The MARKER Δ amplitude for all line-related sidebands <360 Hz away from the signal should be <−70 dB. The MARKER Δ amplitude for all line-related sidebands from 360 Hz to 600 Hz away from the signal should be <−75 dB.

   Largest Level <360 Hz ____________dB at ____ Hz

   Largest Level 360 to 600 Hz ____________dB at ____ Hz

10. Press (SHIFT) (SWEEP TIME) H, SWEEP (CONT), TRACE A (CLEAR-WRITE).
11. Connect 1ST LO OUTPUT of source analyzer to RF INPUT of analyzer under test as shown in Figure 2-24.
12. Key in the following on the source analyzer:

    (CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . 2.4 GHz
    (FREQUENCY SPAN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 Hz
    (SHIFT) (MKR → REF LVL) R (Display diagnostics for convenience)
    (SHIFT) (RES BW) F (YTO Pretest Mode)
    SWEEP (SINGLE)

    The first line of the diagnostic display and the CENTER readout should both now indicate 2.400 000 000 GHz. This is the 1ST LO OUTPUT frequency.

13. Key in (CENTER FREQUENCY) 2.4 GHz and (REFERENCE LEVEL) + 10 dBm on the analyzer under test. Wait for asterisk (*) to disappear.
14. Repeat steps 5 through 8.
15. The MARKER Δ amplitude for all line-related sidebands <360 Hz away from the signal should be <−60 dB.

    Largest Level <360 Hz ____________dB at ____ Hz

16. Press (SHIFT) (SWEEP TIME)[H], SWEEP (CONT), TRACE A (CLEAR-WRITE).
17. Change (CENTER FREQUENCY) of both the source and test analyzer to 2.6 GHz. Wait for asterisk (*) to disappear.
18. Press MARKER (OFF), (PRESEL PEAK) and wait for PEAKING! message to disappear from the CRT.
19. Repeat steps 5 through 8.
20. The MARKER A amplitude for all line-related sidebands <360 Hz away from the signal should be <–60 dB.

    Largest Level <360 Hz ____________dB at Hz
21. Press (SHIFT) (SWEEP TIME)[H], SWEEP (CONT), TRACE A (CLEAR-WRITE).
22. Change [CENTER FREQUENCY] of both the source and test analyzer to 5.7 GHz. Wait for asterisk (*) to disappear.
23. Press MARKER (OFF) [PRESEL PEAK] and wait for the PEAKING! message to disappear from the CRT.
24. Repeat steps 5 through 8.
25. The MARKER A amplitude for all line-related sidebands <360 Hz away from the signal should be <–60 dB.

    Largest Level <360 Hz ____________dB at Hz

## Option 400

1. Set the AC power source output equal to the required line voltage and frequency. The analyzer under test should be operated at 400 Hz and the source analyzer at 50 to 60 Hz.
2. Allow both analyzers to warm up for at least one-half hour with LINE switch in either STANDBY or ON position.
3. Perform frequency calibration of each analyzer as specified in step 2 of standard instrument procedure.
4. Connect 1ST LO OUTPUT of source analyzer to RF INPUT of analyzer under TEST and key in settings on source analyzer as specified in step 12 of standard instrument procedure.
5. Key in (CENTER FREQUENCY) 2.4 GHz, [FREQUENCY SPAN] 1 MHz on analyzer under test.
6. Press MARKER (PRESEL PEAK) and wait for PEAKING! message to disappear from display.
7. Press MARKER [PEAK SEARCH], (MKR → CF), (MKR → REF LVL), (SIGNAL TRACK).
8. Change [FREQUENCY SPAN] to 12 kHz. Wait for signal trace to be centered.
9. Change (RES BW) to 30 Hz.
10. Press (SHIFT), (VIDEO BW)[G], SWEEP (SINGLE), (1) (0) (Hz µV µsec) to initiate video averaging of 10 sweeps.
11. When the VID AVG readout reaches 10, press [SHIFT), TRACE B (BLANK), TRACE A (VIEW).

12. Press MARKER [PEAK SEARCH), [al and position the marker at the peaks of the line-related sidebands separated from the signal by multiples of the line frequency; for example, 400 Hz, 800 Hz, 1200 Hz, . . .

13. The MARKER A amplitude for all line sidebands below 2 kHz should be <−55 dB. The A amplitude for sidebands from 2 kHz to 5.5 kHz should be <−65 dB.

    Largest Level <2 kHz ______________dB at Hz

    Largest Level <2 kHz to 5.5 kHz ______________dB at Hz

14. Change (CENTER FREQUENCY) of source analyzer to 5.7 GHz and repeat steps 5 through 13 for 5.7 GHz.

## 14. Average Noise Level Test

**Related Adjustment** Last Converter Adjustments

**Specification** Displayed average noise level (0 dB input attenuation, 10 Hz resolution bandwidth):

| Non-Preselected | Preselected |
|---|---|
| <−95 dBm, 100 Hz to 50 kHz | <−132 dBm, 2.0 GHz to 5.8 GHz |
| <−112 dBm, 50 kHz to 1 MHz | <−125 dBm, 5.8 GHz to 12.5 GHz |
| <−134 dBm, 1 MHz to 2.5 GHz | <−119 dBm, 12.5 GHz to 18.6 GHz |
| | <−114 dBm, 18.6 GHz to 22 GHz |

**Description** The displayed average noise level is measured in a 10 Hz bandwidth at various frequencies with no signal applied to the analyzer input.

**Equipment**

50 Ohm Coaxial Termination . . . . . . . . . . . . . . . HP 909A, Option 012

**Procedure**

1. Press (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Press (RECALL) (8). Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm f0.02 dB.
4. Disconnect CAL OUTPUT. Terminate RF INPUT with a 50 ohm coaxial termination.
5. Press (0 - 2.5 GHz). Key in settings as follows:

   (START FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..8 0 Hz
   (STOP FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 180 Hz
   (REFERENCE LEVEL] . . . . . . . . . . . . . . . . . . . . . . . . . . -70 dBm
   (ATTEN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .0 dB
   (VIDEO BW) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Hz

6. Press (SHIFT) (VIDEO BW)G. Wait about 2 minutes for the VID AVG readout to reach 10 sweeps or more, then press [SHIFT), TRACE B (BLANK).
7. Press MARKER (NORMAL). Tune to 100 Hz, or the nearest frequency that is not on the slope of the LO feedthrough or on a line-related sideband (e.g., 120 Hz). Refer to Figure 2-26.

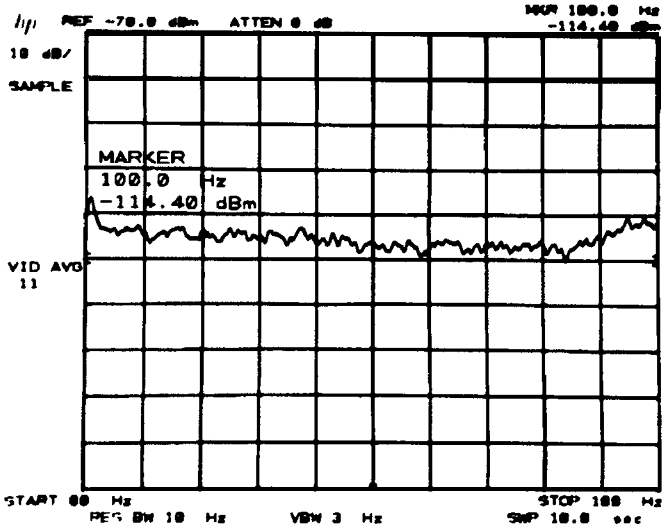



**Figure 2-26. Average Noise Level Measurement**

8. Read the noise level from the MARKER amplitude readout. The value should be less than -95 dBm.

   ____________dBm

9. Key in the following settings:

   (CENTER FREQUENCY) 51 kHz
   (FREQUENCY SPAN) .. ......... . 0 Hz
   (SWEEP TIME) ............................................ 20 ms

10. Wait several seconds for the trace to stabilize (VID AVG >20). Read the amplitude from the MARKER readout. The value should be less than -112 dBm.

    ____________dBm

11. Set (CENTER FREQUENCY) according to Table 2-18. At each setting allow several seconds for the trace to stabilize before reading the amplitude from the MARKER readout. The maximum allowable level for each frequency is given in the table.

## 14. Average Noise Level Test

**Table 2-18. Average Noise Level**

| (CENTER FREQUENCY) | MARKER Amplitude (dBm) | Maximum Amplitude (dBm) |
|---|---|---|
| 2.0 MHz | ______ | -134 |
| 1.001 GHz | ______ | -134 |
| 2.499 GHz | ______ | -134 |
| 2.510 GHz | ______ | -132 |
| 5.799 GHz | ______ | -132 |
| 5.810 GHz | ______ | -125 |
| 12.499 GHz | ______ | -125 |
| 12.510 GHz | ______ | -119 |
| 18.59 GHz | ______ | -119 |
| 18.61 GHz | ______ | -114 |
| 22.0 GHz | ______ | -114 |

# 15. Residual Responses Test

**Specification**

<−100 dBm, 100 Hz to 5.8 GHz

<−95 dBm, 5.8 GHz to 12.5 GHz

<−85 dBm, 12.5 GHz to 18.6 GHz <−80 dBm, 18.6 GHz to 22 GHz

**Description**

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

**Equipment**

50 Ohm Coaxial Termination . . . . . . . . . . . . . . . . . HP 909A, Option 012

**Procedure**

1. Press (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT. Press (RECALL) (8).
3. Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.
4. Press (0 - 2.5 GHz). Disconnect CAL OUTPUT and terminate RF INPUT with a 50 ohm coaxial termination.
5. Key in the following:

   (REFERENCE LEVEL) . . . . . . . . . . . . . . . . . . . . -20 dBm
   (ATTEN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 0 dB
   (RES BW) . . . . . . . . . . . . . . . . . . . . . 30 kHz
   (VIDEO) . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 kHz
   (STOP FREQ) . . . . . . . . . . . . . . . . . . . . . . 1.5 GHz

6. Press DISPLAY LINE (ENTER) and key in -100 dBm.

**Note**

There should be at least 3 dB margin between the noise trace and the display line so that any residual responses may be distinguished from the noise. It may be necessary to reduce the resolution or video bandwidths from the settings given in this procedure to achieve this margin. If this causes the MEAS UNCAL message to appear, it will be necessary to reduce the frequency span and use more sweeps to cover the frequency range.

7. Press TRACE A (CLEAR-WRITE), SWEEP (SINGLE). Wait for completion of the sweep. (See Figure 2-27.)

## 15. Residual Responses Test

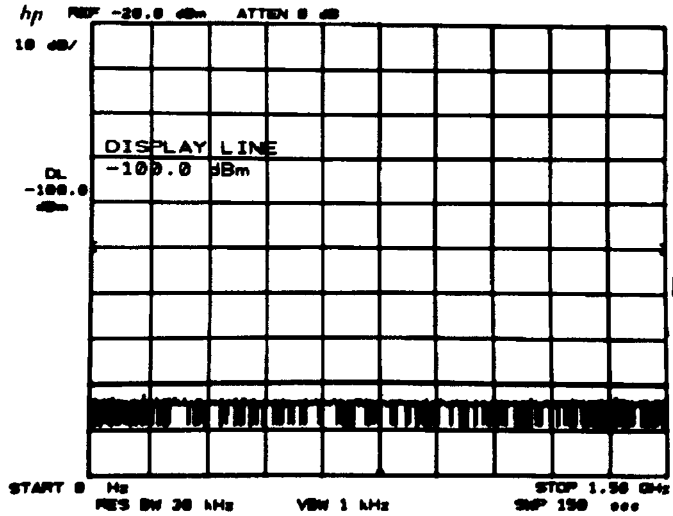



**Figure 2-27. Residual Responses Measurement**

8. 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 below the display line.

   Largest Residual Level ____________ dBm at
   H Z

9. If a response appears to be marginal, perform the following check 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 (SIGNAL TRACK) then activate SWEEP (CONT).

   d. Reduce (FREQUENCY SPAN) to 1 MHz. Reduce (RES BW) until there is at least a 7 dB margin between the display line and the average noise level. The amplitude of the response must be less than the display line setting.

   e. Press (RECALL) (1) to resume the search for residuals.

10. Key in control settings as follows:

   (START FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1.4 GHz
   (STOP FREQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2.5 GHz

11. Follow the procedure of steps 7 through 9 to determine if there are any residuals >–100 dBm in this frequency range.

    Largest Residual Level ____________dBm at
    **H** **Z**

12. Key in the following settings:

    (RES BW) .................................................. 3 kHz
    (VIDEO BW) .................................................. 3 kHz
    (START FREQ) .................................................. 2.4 GHz
    (STOP FREQ) .................................................. 5.8 GHz

13. Look for residual responses >–100 dBm by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    **H** **Z**

14. Key in settings as follows:

    (CENTER FREQUENCY) 6.2 GHz
    (CF STEP SIZE) .................................................. ‘990 MHz
    (FREQUENCY SPAN) .................................................. 1 GHz
    (VIDEO BW) .................................................. 1 kHz

15. Set the display line at -95 dBm. Check for residual responses >–95 dBm by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    ____________Hz

16. Step (CENTER FREQUENCY) to 11.150 GHz with (⇧) and check for residual responses >–95 dBm at each step by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    **H** **Z**

17. Key in the following settings:

    (START FREQ) .................................................. 11.6 GHz
    (STOP FREQ) .................................................. 12.5 GHz
    (VIDEO BW) .................................................. 3 kHz

18. Check for residual responses >–95 dBm by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    ____________Hz

19. Key in analyzer settings as follows:

    (START FREQ) .................................................. 12.4 GHz
    (STOP FREQ) .................................................. 18.6 GHz
    (RES BW) .................................................. 100 kHz
    (VIDEO BW) .................................................. 3 kHz

20. Set the display line at -85 dBm.
21. Check for residual responses >−85 dBm by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    H Z

22. Key in the following:

    (START FREQ) .......................................... 18.5 GHz
    (STOP FREQ) .......................................... 22 GHz

23. Set the display line at -80 dBm.
24. Check for residual responses >−80 dBm by using steps 7 through 9.

    Largest Residual Level ____________dBm at
    H Z

# 16. Harmonic and Intermodulation Distortion Test

## Specification

**Second Harmonic Distortion**

| Center Frequency | Level at Mixer | Harmonic Distortion |
|---|---|---|
| 50 MHz to 700 MHz Non-Preselected | $\leq -40$ dBm | <-80 dBc |
| 100 Hz to 2.5 GHz Non-Preselected | $\leq -40$ dBm | <-70 dBc |
| 2 to 22 GHz Preselected | $\leq -10$ dBm | <-100 dBc |

**Third Order Intermodulation Distortion**

Third-Order Intercept (TOI): > +5 dBm, 100 Hz to 5 MHz
> +7 dBm, 5 MHz to 5.8 GHz
> +5 dBm, 5.8 GHz to 18.6 GHz

## Description

Second harmonic distortion in the non-preselected and preselected bands is checked with a signal source and low-pass filter. The low-pass filter ensures that the harmonics measured are due to the analyzer and not the source. Third-order intermodulation distortion is measured in the non-preselected and preselected bands with two signal sources. To prevent source interaction, the synthesizer outputs are padded and combined in a reactive power divider.

## 16. Harmonic and Intermodulation Distortion Test

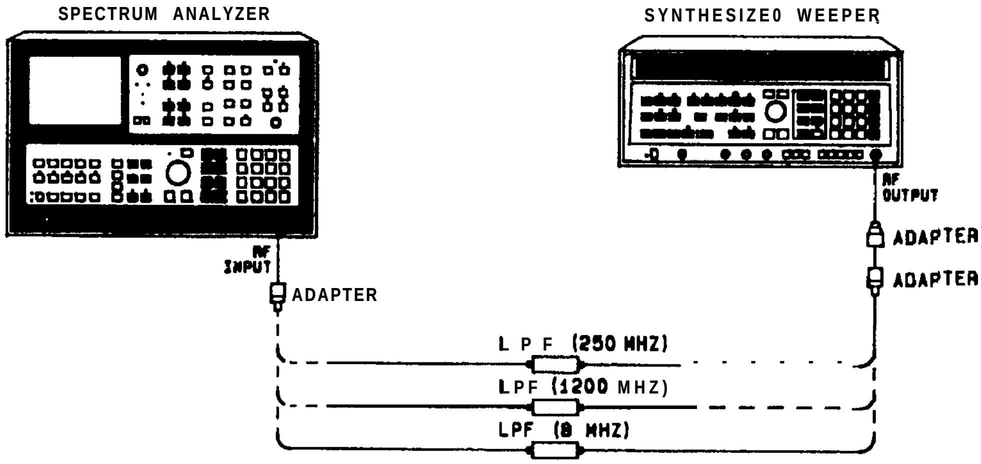



**Figure 2-28. Harmonic Distortion Test Setup**

**Note** Equipment listed is for two test setups, Figure 2-28 and Figure 2-29.

### Equipment

| | |
|---|---|
| Synthesized Sweeper | HP 8340A |
| Synthesized Signal Generator | HP 8672A |
| Power Meter | HP 436A |
| Power Sensor | HP 8485A |
| Reactive Power Divider | Omni-Spectra 2090-6202-00 |
| 20 dB Attenuator (2 required) | HP 8493B, Option 020 |
| 3 dB Attenuator | HP 8493B, Option 003 |
| Low-Pass Filter (250 MHz) | K&L 5L380-250-B/B |
| Low-Pass Filter (8 GHz) | K&L 6L250-8000-NP/N |
| Low-Pass Filter (1200 MHz) | HP 360B |
| 61 cm (24 in.) Cable Assembly, SMA Male Connectors (2 required) | 5061-1086 |
| Adapter, Type N (m) to BNC (f) (2 required) | 1250-0780 |
| Adapter, Type N (m) to SMA (f) | 1250-1250 |
| Adapter, Type N (f) to SMA (f) | 86290-60005 |
| Adapter, SMA Female Connectors | 1250-1158 |
| Adapter, SMA Male Connectors | 1250-1159 |
| BNC Tee (2 required) | 1250-0781 |

### Procedure

## Harmonic Distortion

1. Set the synthesized sweeper for an output CW frequency of 230.00 MHz and an output level of approximately -30 dBm.
2. Press (2 - 22 GHz) on the analyzer. Key in the following settings:

   (CENTER FREQUENCY) .................................... 230 MHz
   (FREQUENCY SPAN) ........................................100 kHz
   (REFERENCE LEVEL) ...................................... -30 dBm

3. Connect equipment as shown in Figure 2-28, using the 250 MHz low-pass filter. Adjust the synthesized sweeper output level to place peak of signal trace at the top graticule line.
4. Press DISPLAY LINE (ENTER) and key in – 110 dBm.
5. Press MARKER (PEAK SEARCH), (MKR → CF), (MKR/Δ→ STP SIZE).
6. Activate (CENTER FREQUENCY) and press (⇑) to tune to the second harmonic of the input signal.
7. Reduce (FREQUENCY SPAN) to 10 kHz and (VIDEO BW) to 30 Hz. Reduce (RES BW) if necessary, for a margin of ≥5 dB between the displayed noise and the display line.
8. The second harmonic should be below the display line (<−80 dBc).

   Second harmonic level of 230 MHz ____________dBc

9. Replace the 250 MHz low-pass filter with the 1200 MHz low-pass filter.
10. Set the synthesized sweeper for an output CW frequency of 800.000 MHz.
11. Press (2 - 22 GHz) on the analyzer. Key in:

    (CENTER FREQUENCY) .................................... 800 MHz
    (FREQUENCY SPAN) ...................................... .100 kHz
    (REFERENCE LEVEL) ...................................... -30 dBm

12. Adjust synthesized sweeper output level to place peak of signal trace at the reference level line.

**Note** If unable to locate a harmonic distortion product, increase the output level by 10 dB. Be sure to return the output level to the original setting before making a measurement.

13. Press DISPLAY LINE (ENTER) and key in -100 dBm.
14. Press MARKER (PEAK SEARCH), (MKR → CF), (MKR/Δ→ STP SIZE), (CENTER FREQUENCY) (⇑), (FREQUENCY SPAN) 10 kHz.
15. The second harmonic of the input signal should be below the display line (<−70 dBc).

    Second harmonic level of 800 MHz ____________dBc

16. Replace the 1200 MHz low-pass filter with the 8 GHz low-pass filter.
17. Set the synthesized sweeper for an output frequency of 7200.000 MHz and an output level of 0 dBm.

18. Press (2 - 22 GHz) on the analyzer. Key in the following:

    (CENTER FREQUENCY) .................................... 7.2 GHz
    (FREQUENCY SPAN) ........................................100 kHz

19. Press MARKER (PEAK SEARCH), (MKR → CF).
20. Set (FREQUENCY SPAN) to 10 kHz. Press MARKER [PEAK SEARCH], (MKR → CF), MKR/Δ→ STP SIZE .
21. Adjust synthesized sweeper output level to place peak of signal trace at the reference level line.
22. Press DISPLAY LINE (ENTER) and key in -80 dBm.
23. Activate (CENTER FREQUENCY) and press (⇧) to tune to the second harmonic of the input signal.
24. Key in the following:

    (REFERENCE LEVEL] ..................................... -20 dBm
    [FREQUENCY SPAN] ......................................... 1 kHz

25. The second harmonic should be below the display line (<– 100 dBc).

    Second harmonic level of 7200 MHz ____________dBc

## Intermodulation Distortion

26. Set both synthesized sources as follows:

    RANGE ........................................... + 10 dBm
    METER MODE ......................................LEVEL
    RF OUTPUT ............................................. OFF
    ALC ............................................... INT
    AM ............................................... OFF
    FM DEVIATION MHz ................................. OFF

27. Connect equipment as shown in Figure 2-29 with "output" of power divider connected to power sensor. The FREQ REFERENCE switch on the rear panel of the analyzer should be set to INT and the FREQ REFERENCE switch on both synthesized source rear panels should be set to EXT.
28. Set one synthesized source for an output frequency of 2099.500 MHz, the other to 2100.500 MHz.
29. Set one synthesized source RF OUTPUT switch to ON and adjust the output power level for a power meter indication of -25.00 dBm f0.20 dB. Return the RF OUTPUT switch to the OFF setting.

30. Set the other synthesized source RF OUTPUT switch to ON and adjust the output power level for a power meter indication of -25.00 dBm ±0.20 dB. Set both synthesized source RF OUTPUT switches to the ON position (power meter reading should be approximately -22 dBm).
31. Connect output of power divider to analyzer RF INPUT as shown in Figure 2-29.

**Note**

Be careful to flex the cable assemblies as little as possible, as flexing can cause a change in the measured power level. To minimize flexing, place the power sensor close to the analyzer input.

32. Press (2 - 22 GHz) on the spectrum analyzer.

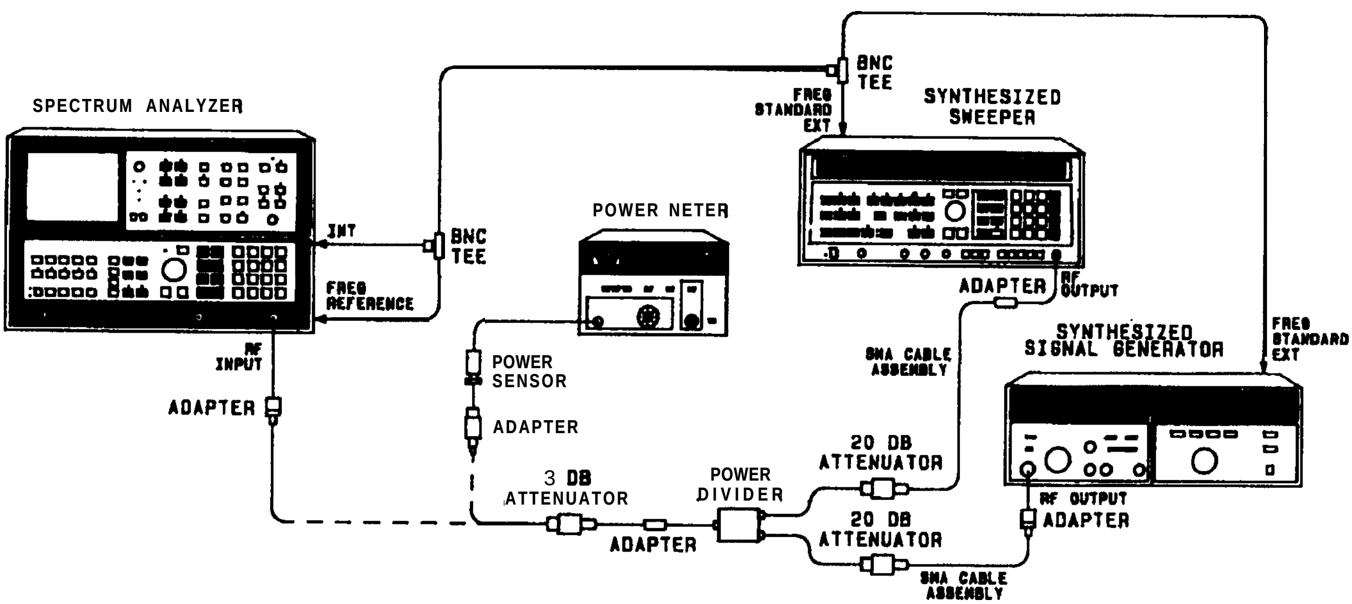



**Figure 2-29. Intermodulation Distortion Test Setup**

33. Key in analyzer settings as follows:

| | |
|---|---|
| [CENTER FREQUENCY] | 2099.5 MHZ |
| (CF STEP SIZE) | 1 MHz |
| (FREQUENCY SPAN) | 2 kHz |
| (ATTEN) | 0 dB |

34. Wait for completion of the sweep (asterisk should not appear on display), then press MARKER (PEAK SEARCH), (MKR → CF). Wait for completion of the sweep.
35. Press MARKER (Δ). Activate [CENTER FREQUENCY] and press (⇩) once to tune to the third order product at 2098.5 MHz.

36. Wait for completion of the sweep, then press MARKER (PEAK SEARCH).

    Record the MKR A amplitude: ____________ dB.

37. Press (⇧) three times to tune to the third order product at 2101.5 MHz. Wait for completion of the sweep, then press MARKER (PEAK SEARCH).

    Record the MKR A amplitude: ____________ dB.

38. Choose the smallest MKR A amplitude in steps 36 and 37.

    Record its absolute value: ____________ dB.

    (For example, if one MKR A amplitude is -82 dB and the other is -79 dB, record +79 dB.) This value is S, the third order suppression.

39. Compute the third order intercept (TOI) as follows:

TO1 = P + S/2, where P = input signal power, and S = third order suppression from step 38.

TOI = -25 dBm + ____________ dB/2

= ____________ dBm

40. The result should be > + 7 dBm. Refer to Figure 2-30.

    TO1 for signals of 2099.5 MHz and 2100.5 MHz
    ____________ dBm

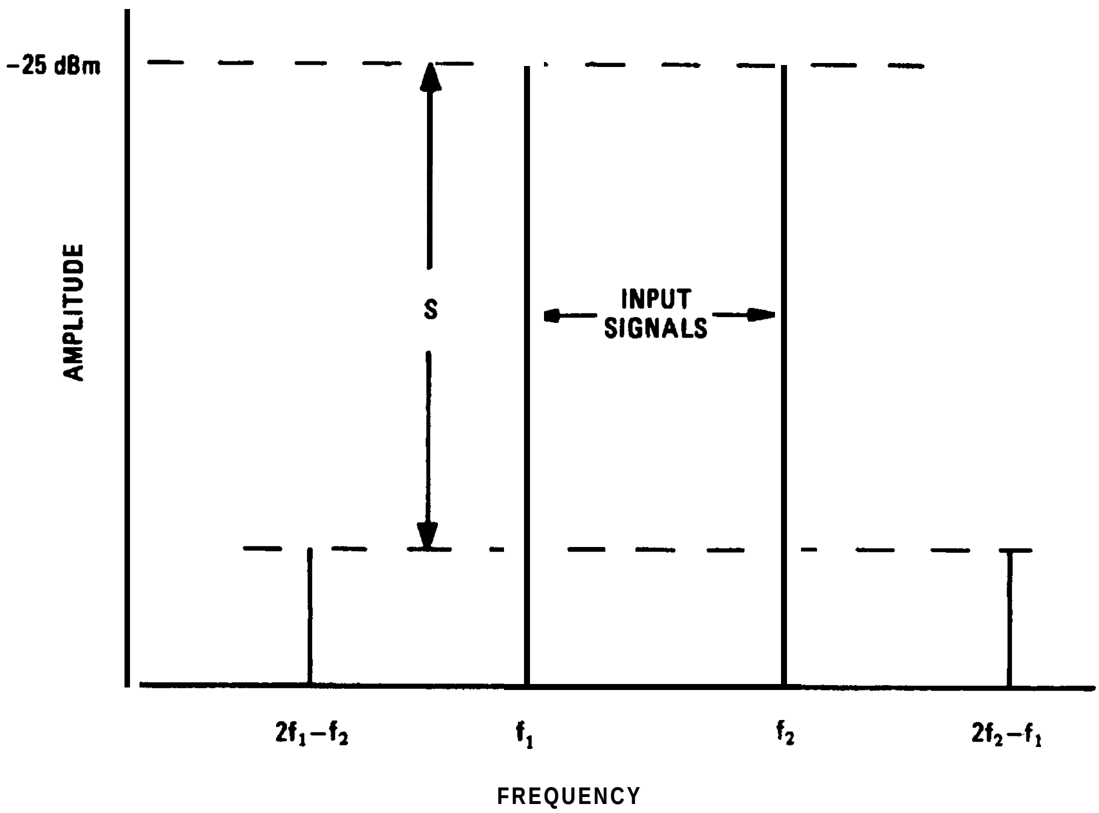



**Figure 2-30. Third Order Intermodulation Products**

41. Set one synthesizer to 3999.500 MHz, the other to 4000.500 MHz.
42. Connect the output of the power divider to the power sensor as shown in Figure 2-29.
43. Set RF OUTPUT switch on both synthesizers to the OFF position. Set output levels of synthesizers according to the procedure of steps 29 and 30.
44. Connect the output of the power divider to the analyzer input as shown in Figure 2-29.
45. Key in the following analyzer settings:

   (CENTER FREQUENCY) ................................ 3999.5 MHZ
   (FREQUENCY SPAN) .......................................... 1 MHz
   (REFERENCE LEVEL) ...................................... -20 dBm

46. Press MARKER (OFF), (PEAK SEARCH) and wait for PEAKING! message to disappear from display.
47. Set (FREQUENCY SPAN) to 2 kHz and wait for completion of the sweep.
48. Press MARKER (PEAK SEARCH), (MKR → REF LVL). Wait for completion of the sweep.

49. Press MARKER (Δ). Activate [CENTER FREQUENCY] and press (⇩) once to tune to the third order product at 3998.5 MHz. Wait for completion of the sweep.
50. Press MARKER [PEAK SEARCH]

    Record the MKR A amplitude: ____________dB
51. Press (⇧) three times to tune to the third order product at 4001.5 MHz. Wait for completion of the sweep, then press MARKER [PEAK SEARCH].

    Record the MKR A amplitude: ____________dB.
52. Choose the smallest MKR A amplitude in steps 50 and 51.

    Record its absolute value: S = ____________dB.
53. Compute the TOI:

    TO1 = P + S/2

    = -25 dBm + ____________dB/2

    = ____________dBm
54. The result should be > + 7 dBm.

    TO1 for signals of 3999.5 MHz and 4000.5 MHz ____________dBm
55. Repeat steps 41 through 53 for the input signal frequencies and the third order products shown in Table 2-19. The TO1 for each setting should be > + 5 dBm.

**Table 2-19. TO1 Measurement Settings**

| Input Signal Frequencies (MHz) | | Third Order Products (MHz) | | Third Order Suppression (dB) | TOI (dBm) |
|---|---|---|---|---|---|
| **8999.500** | **9000.500** | **8998.500** | 9001.500 | ____________ | ____ |
| 13999.500 | 14000.499 | 13998.501 | 14001.498 | ____________ | ____ |

# 17. Image, Multiple, and Out of Band Responses Test

## Description

Image and out-of-band responses are checked by setting the analyzer center frequency to several frequencies across the analyzer range and tuning a leveled signal source to the frequencies determined by the tuning equation, $F_{sig} = nF_{LO} \pm F_{IF}$. Input signals at these frequencies will excite all possible image and out-of-band responses for a given 1st LO frequency and all positive integer values of n. In this test, only values of n corresponding to the analyzer mixing modes are used. Multiple responses are checked by applying an input signal and measuring the response at those center frequencies for which a harmonic of the 1st LO mixes with the input signal.

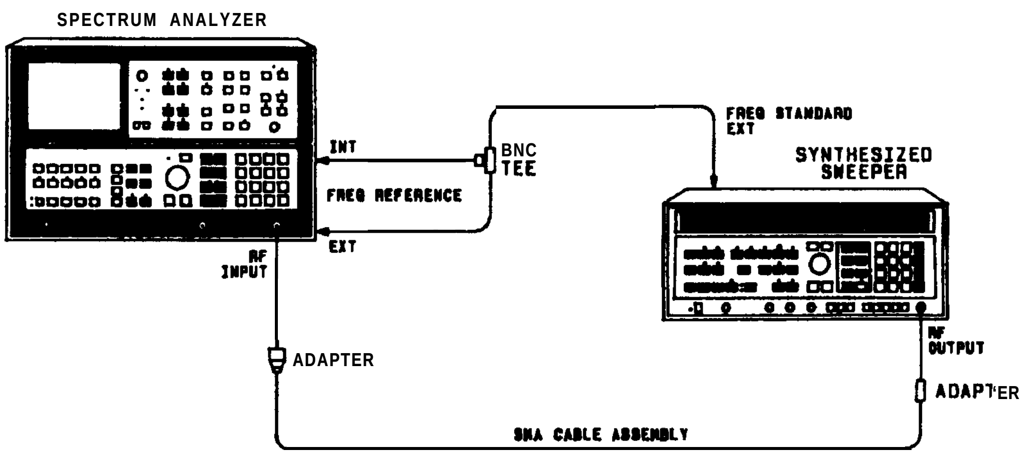



**Figure 2-31. Image, Multiple, and Out-of-Rand Responses Test Setup**

## Equipment

| | |
|---|---|
| Synthesized Sweeper | HP 8340A |
| 61 cm (24 in.) Cable Assembly, SMA Male Connectors | 5061-1086 |
| Adapter, Type N (m) to SMA (f) | 1250-1250 |
| Adapter, SMA Female Connectors | 1250-1158 |
| BNC Tee | 1250-0781 |

## Procedure

1. Connect equipment as shown in Figure 2-31 with the synthesized sweeper RF OUTPUT connected to the analyzer input.
2. Press INSTR PRESET on the synthesized sweeper. Key in the following sweeper settings:

   CW FUNCTION .................................... 3000.000 MHz
   POWER LEVEL ........................................ 0.0 dBm

3. Press (2 - 22 GHz) on the analyzer. Key in the following analyzer settings:

   [CENTER FREQUENCY) ...................................... 3 GHz
   [FREQUENCY SPAN) ........................................ 100 kHz

4. Press DISPLAY LINE (ENTER) and key in -70 dBm.
5. Press MARKER (PRESEL PEAK) and wait for PEAKING! message to disappear from the display. Press MARKER (NORMAL).
6. Adjust the power level of the synthesized sweeper to place the peak of the signal trace at the top CRT graticule line.

**Note**

If the maximum output power level of the synthesized sweeper is not enough to place the signal peak at the top CRT graticule line, then adjust the spectrum analyzer REFERENCE LEVEL as required to place the signal peak at the top CRT graticule line.

7. Press MARKER (Δ). Using the DATA knob, determine the amplitude of the spurious response and enter the result in Table 2-20.
8. Set the synthesized sweeper to the frequencies in Table 2-20 corresponding to an analyzer center frequency of 3 GHz. The maximum allowable amplitude of the spurious response at the analyzer center frequency for each setting is shown in the table.

**Table Z-20. Image and Out-of-Rand Response**

| Spectrum Analyzer [CENTER FREQUENCY] (GHz) | Synthesized Sweeper Frequency (MHz) | Displayed Spurious Amplitude Measured (dBc) | Displayed Spurious Amplitude Maximum (dBc) |
|---|---|---|---|
| 3 | 3642.800 | | -70 |
| | 6321.400 | | -60 |
| | 6964.200 | | -60 |
| 6 | 2517.900 | | -60 |
| | 3160.700 | | -60 |
| | 5357.200 | | -70 |
| 9 | 4017.900 | | -60 |
| | 4660.700 | | -60 |
| | 8357.200 | | -70 |
| | 12696.500 | | -60 |
| | 13339.300 | | -60 |
| 12 | 5517.900 | | -60 |
| | 6160.700 | | -60 |
| | 11357.200 | | -70 |
| | 17196.500 | | -60 |
| | 17839.300 | | -60 |
| 5 | 4571.500 | | -60 |
| | 5214.300 | | -60 |
| | 9464.300 | | -60 |
| | 10107.100 | | -60 |
| | 14357.200 | | -70 |
| 7 | 5238.100 | | -60 |
| | 5880.900 | | -60 |
| | 10797.700 | | -60 |
| | 11440.500 | | -60 |
| | 16357.200 | | -70 |
| 9 | 4348.300 | | -60 |
| | 4991.100 | | -60 |
| | 9017.900 | | -60 |
| | 9660.700 | | -60 |
| | 13687.600 | | -60 |
| | 14330.400 | | -60 |
| | 18357.200 | | -60 |
| 1 | 4848.300 | | -60 |
| | 5491.100 | | -60 |
| | 10017.900 | | -60 |
| | 10660.700 | | -60 |
| | 15187.600 | | -60 |
| | 15830.400 | | -60 |
| | 20357.200 | | -50 |

9. Repeat steps 4 through 9 for all remaining (CENTER FREQUENCY) and synthesized sweeper settings in Table 2-20. Steps 4 through 8 need only be done once for each (CENTER FREQUENCY) setting.

10. Set the synthesized sweeper for an output CW frequency of 5700.000 MHz.

11. Key in the following analyzer settings:

    (CENTER FREQUENCY) .................................... 5.7 GHZ
    (REFERENCE LEVEL) ...................................... 0.0 dBm

12. Press MARKER (PRESEL PEAK) and wait for PEAKING! message to disappear from display. Press MARKER (NORMAL).

13. Change (FREQUENCY SPAN) to 5 kHz. Adjust the synthesized sweeper output power level to place peak of signal trace at the top CRT graticule line.

14. Press MARKER (Δ). Using the DATA knob, determine the amplitude of the spurious response and enter the result in Table 2-21.

15. Change (CENTER FREQUENCY) to 2.36790 GHz. The multiple response at the center frequency should be below the (SHIFT), SWEEP (CONT)T display line (≤−70 dBc).

    Multiple response at 2.36790 GHz ____________dBc

16. Press (SHIFT), (MKR/Δ→ STP SIZE)Q.

17. Set the synthesized sweeper output CW frequency and analyzer (CENTER FREQUENCY) according to Table 2-21. Before checking the amplitude of the multiples for a given signal frequency, set the input signal amplitude by the procedure of steps 11 through 14.

**Table 2-2 1. Multiple Responses**

| Synthesized Sweeper Frequency (MHz) | (CENTER FREQUENCY) (Multiple Response) (GHz) | Displayed Spurious Amplitude | |
|---|---|---|---|
| | | Measured (dBc) | Maximum (dB) |
| 5700.000 | 2.68930 | | -70 |
| 6000.000 | 1.18930 | | -50 |
| 12000.000 | 8.107133 | | -70 |
| | 8.535667 | | -70 |
| 13000.000 | 1.06790 | | -45 |
| | 1.9107 | | -45 |
| | 0.53395 | | -45 |
| 15000.000 | 10.107133 | | -60 |
| | 10.535667 | | -60 |

# 18. Gain Compression Test

**Specification** <1.0 dB, 100 Hz to 22 GHz with ≤−5 dBm at the input mixer

**Description** Gain compression is measured by changing the power level at the spectrum analyzer input mixer from -15 dBm to -5 dBm (2 to 22 GHz). The displayed signal level will change by less than 10 dB, indicating gain compression of the input mixer. Since a 10 dB change in IF gain is used to keep the signal trace near the same point on the display when the input power is increased, the error due to this IF gain change is first measured, then subtracted from the displayed deviation to give the deviation due to gain compression only.

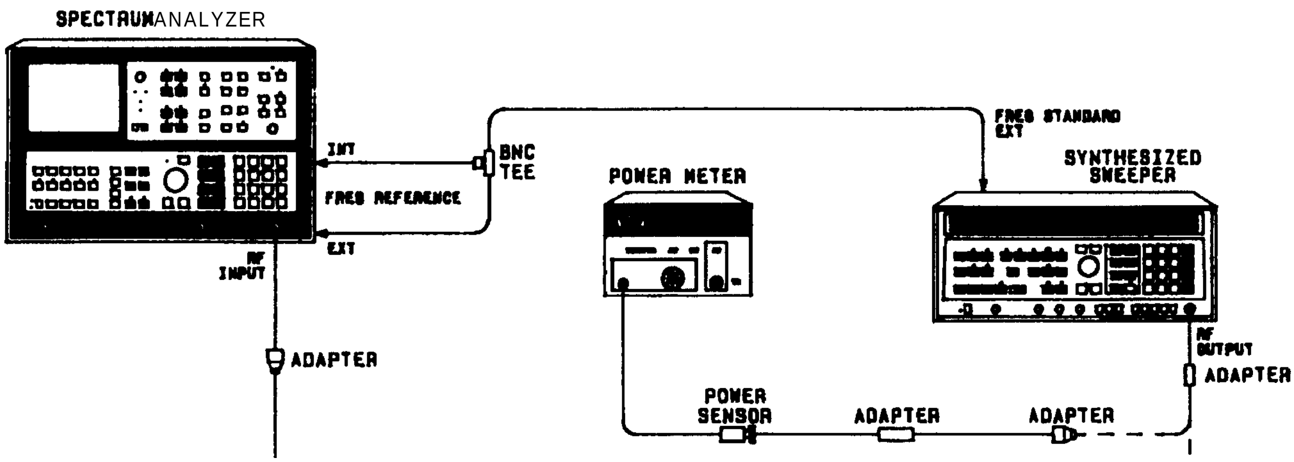



**Figure 2-32. Gain Compression Test Setup**

**Equipment**

| | |
|---|---|
| Synthesized Signal Generator | HP 8340A |
| Power Meter | HP 436A |
| Power Sensor | HP 8485A |
| Adapter, Type N (m) to SMA (f) (2 required) | 1250-1250 |
| Adapter, Type N Female Connectors | 1250-0777 |
| Adapter, SMA (f) to SMA (f) | 1250-1158 |
| Adapter, BNC Tee (m)(f)(f) | 1250-0781 |
| Low Loss Microwave Test Cable (APC 3.5) | 8120-4921 |

**Procedure**

1. Press (2 - 22 GHz), (SHIFT) (ATTEN), (SHIFT) (0 −2.5 GHz) 0 dBm on the spectrum analyzer. Set FREQ REFERENCE switch on rear panel of analyzer to INT and set FREQ STANDARD switch on rear panel of synthesizer to EXT.
2. Set synthesizer frequency to 2000.000 MHz. Set other synthesizer controls as follows:

| | |
|---|---|
| ALC | INT |
| AM | OFF |
| FM | OFF |
| RF OUTPUT | ON |

OUTPUT LEVEL RANGE . . . . . . . . . . . . . . . . . . . . . . . . . . -20 dBm

**Note**

Care should be taken to disturb the cable assembly as little as possible, since flexing may cause a change in the measured power level. The power sensor should be placed near the spectrum analyzer input to minimize flexing when the cable is moved.

3. Connect equipment as shown in Figure 2-32, with output of synthesizer connected to power sensor. Power is measured at the end of the cable assembly, not at the synthesizer output connector. Adjust synthesizer output level for a power meter indication of -25.00 dBm f0.05 dB.
4. Disconnect cable assembly from power sensor and connect free end to spectrum analyzer RF INPUT as indicated in Figure 2-32. Key in analyzer settings as follows:

   (CENTER FREQUENCY) . . . 2 GHz
   (FREQUENCY SPAN) . . . . . . 0 Hz
   (ATTEN) . . . . . . . . . . . . . . . . . 0 dB
   (REFERENCE LEVEL) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . $-15$ dBm
   (VIDEO BW) . . . . . . . . . . . . 30 Hz
   (RES BW) . . . . . . . . . . . . . . 3 MHz

5. Press the SCALE LIN pushbutton, then press (SHIFT) (RES BW) (AUTO)A to obtain amplitude readouts in dBm. Turn the AMPTD CAL control fully clockwise.
6. Press MARKER (NORMAL) (Δ).
7. Connect cable to power sensor and adjust synthesizer output level for a power meter reading of -15.00 dBm ±0.02 dB.
8. Reconnect cable to the spectrum analyzer RF INPUT.
9. Change spectrum analyzer (REFERENCE LEVEL) to -5 dBm.

   Record the MKR A amplitude: ____________dB. This is the IF gain error in changing the reference level from -15 dBm to -5 dBm with 0 dB input attenuation.

10. Set (REFERENCE LEVEL) to -15 dBm. Adjust AMPTD CAL to place the signal trace approximately 1 division down from the reference level line.
11. Press MARKER (NORMAL), (Δ).
12. Connect cable to power sensor and adjust synthesizer output level for a power meter indication of -5 dBm f0.02 dB. Reconnect cable to spectrum analyzer input.
13. Change (REFERENCE LEVEL) to -5 dBm.

    Record the MKR A amplitude: ____________dB.

14. Subtract the value obtained in step 9 from the value recorded in step 13 to find the gain compression: ____________dB. The result should be $>-1.0$ dB (less than 1 dB compression).
15. Press (2 - 22 GHz) on the spectrum analyzer. Press (SHIFT) (ATTEN)I, (SHIFT) (0 - 2.5 GHz) 0 dBm.

16. Set synthesizer to 3000.000 MHz. Connect cable to power sensor and adjust output level of synthesizer for an indication of -15.00 ±0.05 dB on the power meter. Reconnect cable to the spectrum analyzer input.
17. Key in the following settings:

| | |
|---|---|
| (CENTER FREQUENCY) | 3 GHz |
| (FREQUENCY SPAN) | .1 MHz |
| (ATTN) | 0 dB |

18. Press MARKER (PRESEL PEAK) and wait for PEAKING! message to disappear from the display.
19. Press SCALE LIN pushbutton, then press (SHIFT) (RES BW) (AUTO)[A]. Key in:

| | |
|---|---|
| (REFERENCE LEVEL) | -15 dBm |
| (FREQUENCY SPAN) | .0 Hz |
| (VIDEO BW) | 30 Hz |
| (RES BW) | . MHz |

20. Press MARKER (NORMAL), (Δ).
21. Connect the cable to the power sensor and adjust synthesizer level for a power meter indication of -5.00 dBm f0.02 dB. Reconnect cable to spectrum analyzer input.
22. Change (REFERENCE LEVEL) to -5 dBm. Record the MKR Aamplitude: ____________dB.
23. Subtract the value recorded in step 9 from the value obtained in step 22 to find the gain compression: ____________dB. The result should be >–1.0 dB (less than 1 dB compression).
24. Press (2 - 22 GHz) on the spectrum analyzer. Press (SHIFT) (ATTEN)[I], (SHIFT) (0 - 2.5 GHz) 0 dBm.
25. Set synthesizer to 9000.000 MHz. Connect cable from synthesizer to power sensor and adjust synthesizer output level for a power meter reading of -15.00 ±0.02 dB. Reconnect cable to spectrum analyzer input.
26. Key in the following analyzer settings:

| | |
|---|---|
| (CENTER FREQUENCY) | 9 GHz |
| (FREQUENCY SPAN) | .1 MHz |
| (ATTEN) | 0 dB |

27. Press MARKER (PRESEL PEAK) and wait for the PEAKING! message to disappear from the display.
28. Press the SCALE LIN pushbutton, then press (SHIFT) (RES BW) (AUTO). Key in the following:

| | |
|---|---|
| (REFERENCE LEVEL) | -15 dBm |
| (FREQUENCY SPAN) | .0 Hz |
| (VIDEO BW) | 30 Hz |
| (RES BW) | . MHz |

29. Press MARKER (NORMAL), [a.

30. Connect cable to power sensor and adjust output level of synthesizer for a power meter indication of -5.00 ±0.02 dB. Reconnect cable to spectrum analyzer input.

31. Change [REFERENCE LEVEL] to -5 dBm.

    Record the MKR A amplitude: ____________dB.

32. Subtract the value recorded in step 9 from the value obtained in step 31 to find the gain compression: ____________dB. The result should be >− 1.0 dB (less than 1 dB compression).

33. Disconnect cable from the spectrum analyzer RF INPUT. Connect the spectrum analyzer CAL OUTPUT to RF INPUT.

34. Press (RECALL) (8), MARKER (PEAK SEARCH). Adjust AMPTD CAL for a MARKER amplitude of -10.00 dBm ±0.02 dB.

# 19. 1st LO Output Amplitude Test

**Specification**

> + 5 dBm from 2.3 GHz to 6.1 GHz

**Description**

The power level at the 1ST LO OUTPUT connector is measured as the first LO is swept over its 2.3 GHz to 6.1 GHz range.

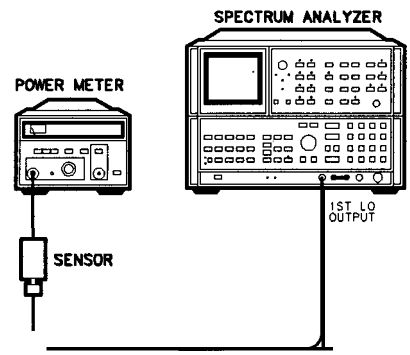



**Figure 2-33. 1st LO Output Amplitude Test Setup**

**Equipment**

Power Meter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 436A
Power Sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8485A

**Procedure**

1. Press (2’. Key in a (STOP FREQ) of 5.8 GHz.
2. Set (SWEEP TIME) to 100 seconds.
3. Calibrate power meter and sensor. Connect equipment as shown in Figure 2-33.
4. Observe the meter indication as the analyzer sweeps from 2.0 to 5.8 GHz. The indication should be > + 5 dBm across the full sweep range.

   ____________dBm

## 20. Sweep + Tune Out Accuracy Test

**Specification** -1 V/GHz X Center Frequency (GHz) ±(2% + 10 mV)

**Description** The spectrum analyzer is set to zero frequency span and the SWEEP + TUNE OUT auxiliary output is measured with a voltmeter as the analyzer is tuned across its frequency range.

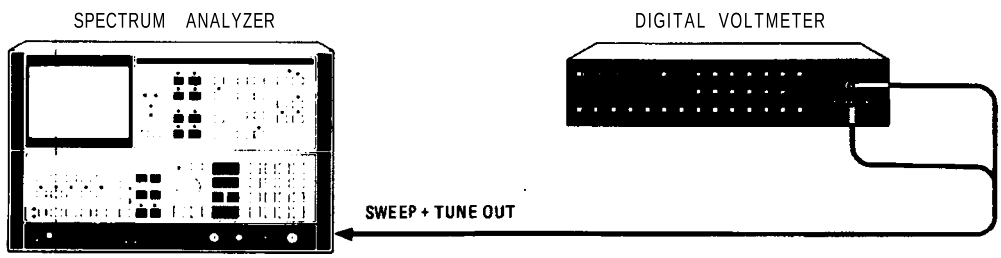



**Figure 2-34. Sweep + Tune Out Accuracy Test Setup**

**Equipment** Digital Voltmeter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A

**Procedure**

1. Press (2 - 22 GHz) on the analyzer. Set (FREQUENCY SPAN) to 0 Hz
2. Connect digital voltmeter to the SWEEP + TUNE OUT auxiliary output on the rear panel of the analyzer as indicated in Figure 2-34.
3. Set (CENTER FREQUENCY) according to Table 2-22 and record the voltmeter readings in the table. The allowable range for each measurement is shown in the table.

Table 2-22. Sweep + Tune Out Accuracy

| CENTER FREQUENCY | Voltmeter Reading (Volts) | | |
|---|---|---|---|
| | Min | Actual | Max |
| 0 Hz | -0.010 | | + 0.010 |
| 1 MHz | -0.011 | | + 0.009 |
| 12 MHz | -0.022 | | -0.002 |
| 130 MHz | -0.143 | | -0.117 |
| 670 MHz | -0.693 | | -0.647 |
| 1.3 GHz | − 1.336 | | -1.264 |
| 5.7 GHz | -5.824 | | -5.576 |
| 12.5 GHz | -12.760 | | -12.240 |
| 18.6 GHz | -18.982 | | -18.218 |
| 22 GHz | -22.450 | | -21.550 |

## 21. 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 RF 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.

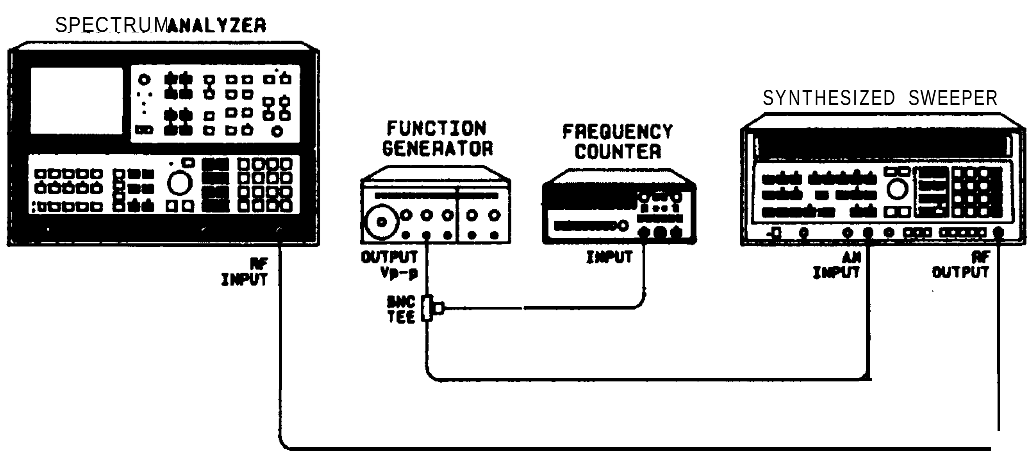



**Figure 2-35. Fast Sweep Time Accuracy (<20 ms) Test Setup**

**Equipment**

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

**Procedure**

1. Connect equipment as shown in Figure 2-35.
2. Press (2 - 22 GHz) on spectrum analyzer.
3. Key in analyzer settings as follows:

| | |
|---|---|
| (CENTER FREQUENCY) | 500 MHZ |
| (FREQUENCY SPAN) | 10 0 kHz |

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

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 reading of 2.00 f0.02 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 2-36.)
11. Using sweep times and function generator frequencies in Table 2-23, check sweep time accuracy for sweep times <20 ms by the procedure of step 10.

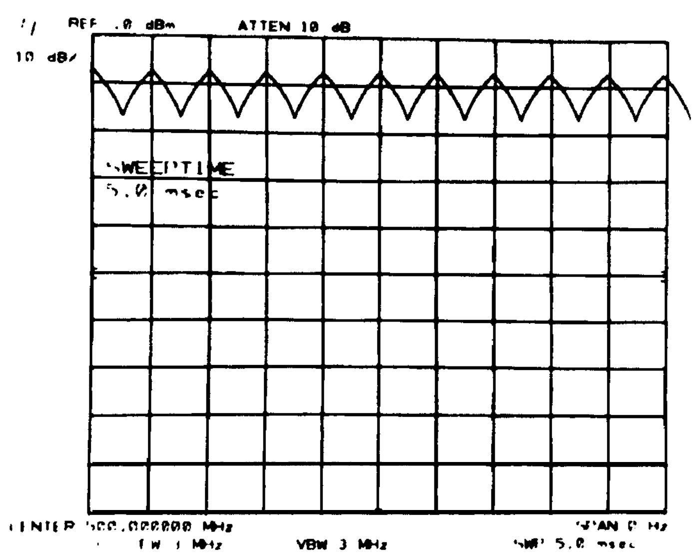



**Figure 2-36. Fast Sweep Time Measurement (<20 ms)**

## 21. Fast Sweep Time Accuracy Test (<20 ms)

**Table 2-23. Fast Sweep Time Accuracy (<20 ms)**

| [SWEEP TIME] | Function Generator Frequency (kHz) | Sweep Time Error (divisions) |
|---|---|---|
| 5 ms | 2.00 f0.02 | |
| 2 ms | 5.00 f0.05 | |
| 1 ms | 10.0 ±0.1 | |
| 200 μs | 50.0 f0.5 | |
| 100 μs | 100 ±1 | |

# 22. Frequency Reference Error Test

**Related Adjustment**

10 MHz Standard Adjustment

**Specification**

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

Temperature Stability: $<7 \times 10^{-9}$ 0° to 55°C

Frequency is within $1 \times 10^{-8}$ 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 warm-up 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 specified aging rate. However, after the aging rate is attained, the frequency reference typically attains its aging rate again in 72 hours of operation after being off for a period not exceeding 24 hours.

Because the frequency reference is sensitive to shock and vibration, care must be taken not to disturb the spectrum analyzer during the 24 hour period in which the frequency measurement is made.

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 turns the instrument off while continuing to provide power for the frequency reference oven, which minimizes warm up time. However, the spectrum analyzer must be ON to allow the frequency reference to attain its specified aging rate.

---

## 22. Frequency Reference Error Test

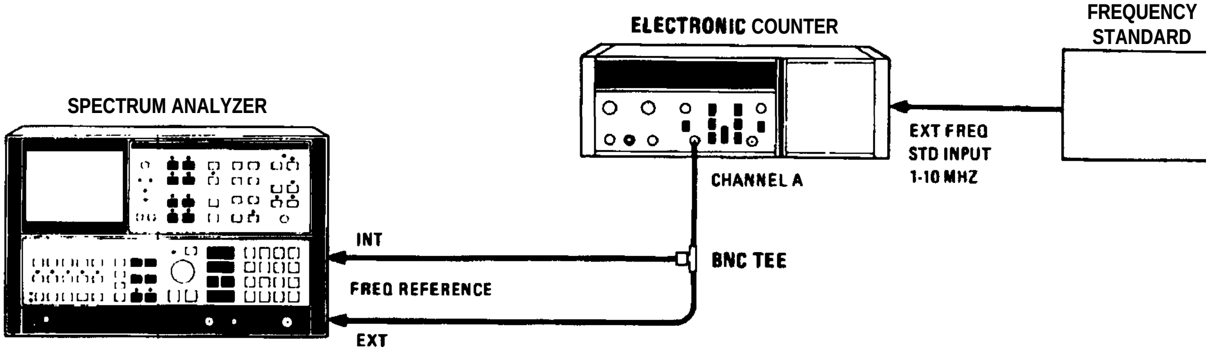



Figure 2-37. Frequency Reference Test Setup

### Equipment

Electronic Counter .................................... HP 5345A
1, 2, 5, or 10 MHz Frequency Reference with again rate <1 X $10^{-10}$/day .............................................. HP 5061A
BNC Tee ................................................ 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 ..................................... xl
   CHANNEL A Coupling .................................. AC
   CHANNEL A LEVEL ............................. midrange

3. Connect equipment as shown in Figure 2-37.
4. Record the frequency of the analyzer time base as measured by the counter:

   Frequency: 10. M H z
   Date: _____ Time: _____________
   Ambient Temperature: _____________

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

   Frequency: 10. M H z
   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).

   H z

## Table 2-24. Performance Test Record

| | |
|---|---|
| Hewlett-Packard Company | Tested by ______ |
| Model HP 8566B | Report No. ______ |
| Serial No. ______ | Date ______ |
| IF-Display Section ______ | |
| RF Section ______ | |

## Test 1. Center Frequency Readout Accuracy

**Step 8. CENTER Readout**

| Synthesized Sweeper Frequency | (FREQUENCY SPAN) | (CENTER FREQUENCY) | Center Frequency Readout | | |
|---|---|---|---|---|---|
| | | | Min | Actual | Max |
| 2 GHz | 1 MHz | 2 GHz | 1.999 98 GHz | | 2.000 02 GHz |
| 2 GHz | 10 MHz | 2 GHz | 1.999 7 GHz | | 2.000 3 GHz |
| 2 GHz | 100 MHz | 2 GHz | 1.998 GHz | | 2.002 GHz |
| 2 GHz | 1 GHz | 2 GHz | 1.98 GHz | | 2.02 GHz |
| 3 GHz | 1 MHz | 3 GHz | 2.999 98 GHz | | 3.000 02 GHz |
| 3 GHz | 10 MHz | 3 GHz | 2.999 7 GHz | | 3.000 3 GHz |
| 3 GHz | 100 MHz | 3 GHz | 2.998 GHz | | 3.002 GHz |
| 3 GHz | 1 GHz | 3 GHz | 2.98 GHz | | 3.02 GHz |
| 6 GHz | 1 MHz | 6 GHz | 5.999 98 GHz | | 6.000 02 GHz |
| 6 GHz | 10 MHz | 6 GHz | 5.999 8 GHz | | 6.000 2 GHz |
| 6 GHz | 100 MHz | 6 GHz | 5.998 GHz | | 6.002 GHz |
| 6 GHz | 1 GHz | 6 GHz | 5.98 GHz | | 6.02 GHz |
| 9 GHz | 1 MHz | 9 GHz | 8.999 98 GHz | | 9.000 02 GHz |
| 9 GHz | 10 MHz | 9 GHz | 8.999 8 GHz | | 9.000 2 GHz |
| 9 GHz | 100 MHz | 9 GHz | 8.998 GHz | | 9.002 GHz |
| 9 GHz | 1 GHz | 9 GHz | 8.98 GHz | | 9.02 GHz |
| 9 GHz | 10 GHz | 9 GHz | 8.8 GHz | | 9.2 GHz |
| 12 GHz | 1 MHz | 12 GHz | 11.999 98 GHz | | 12.000 02 GHz |
| 12 GHz | 10 MHz | 12 GHz | 11.999 8 GHz | | 12.000 2 GHz |
| 12 GHz | 100 MHz | 12 GHz | 11.998 GHz | | 12.002 GHz |
| 12 GHz | 1 GHz | 12 GHz | 11.98 GHz | | 12.02 GHz |
| 12 GHz | 10 GHz | 12 GHz | 11.8 GHz | | 12.2 GHz |
| 15 GHz | 1 MHz | 15 GHz | 14.999 98 GHz | | 15.000 02 GHz |
| 15 GHz | 10 MHz | 15 GHz | 14.999 8 GHz | | 15.000 2 GHz |
| 15 GHz | 100 MHz | 15 GHz | 14.998 GHz | | 15.002 GHz |
| 15 GHz | 1 GHz | 15 GHz | 14.98 GHz | | 15.02 GHz |
| 15 GHz | 10 GHz | 15 GHz | 14.8 GHz | | 15.2 GHz |
| 18 GHz | 1 MHz | 18 GHz | 17.999 98 GHz | | 18.000 02 GHz |
| 18 GHz | 10 MHz | 18 GHz | 17.999 8 GHz | | 18.000 2 GHz |
| 18 GHz | 100 MHz | 18 GHz | 17.998 GHz | | 18.002 GHz |
| 18 GHz | 1 GHz | 18 GHz | 17.98 GHz | | 18.02 GHz |
| 18 GHz | 10 GHz | 18 GHz | 17.8 GHz | | 18.2 GHz |

# Test 2. Frequency Span Accuracy Test

**Step 7. Narrow Span Accuracy**

| Spectrum Analyzer | Frequency Synthesizer | | MARKER A Frequency | | |
|---|---|---|---|---|---|
| (FREQUENCY SPAN) | Low (Hz) | High (Hz) | Min | Actual | Max |
| 20 kHz | 39,992,000 | 40,008,000 | 15.84 kHz | | 16.16 kHz |
| 50 kHz | 39,980,000 | 40,020,000 | 39.60 kHz | | 40.40 kHz |
| 150 kHz | 39,940,000 | 40,060,000 | 118.80 kHz | | 121.20 kHz |
| 200 kHz | 39,920,000 | 40,080,000 | 158.4 kHz | | 161.6 kHz |
| 1 MHz | 39,600,000 | 40,400,000 | 792.00 kHz | | 808.00 kHz |
| 2 MHz | 39,200,000 | 40,800,000 | 1.584 MHz | | 1.616 MHz |
| 6 MHz | 37,600,000 | 42,400,000 | 4.656 MHz | | 4.944 MHz |
| 10 MHz | 36,000,000 | 44,000,000 | 7.76 MHz | | 8.240 MHz |
| 50 MHz | 20,000,000 | 60,000,000 | 38.80 MHz | | 41.2 MHz |

**Step 18. Wide Span Accuracy**

| Spectrum Analyzer | | Synthesized Sweeper | | MARKER A Frequency | | |
|---|---|---|---|---|---|---|
| (CENTER FREQUENCY) | (FREQUENCY SPAN) | Low (GHz) | High (GHz) | Min | Actual | Max |
| 4 GHz | 500 MHz | 3.800 | 4.200 | 388 MHz | | 412 MHz |
| 10 GHz | 500 MHz | 9.800 | 10.200 | 388 MHz | | 412 MHz |
| 15 GHz | 500 MHz | 14.800 | 15.200 | 388 MHz | | 412 MHz |
| 20 GHz | 500 MHz | 19.800 | 20.200 | 388 MHz | | 412 MHz |
| 4 GHz | 1 GHz | 3.600 | 4.400 | 776 MHz | | 824 MHz |
| 10 GHz | 1 GHz | 9.600 | 10.400 | 776 MHz | | 824 MHz |
| 15 GHz | 1 GHz | 14.600 | 15.400 | 776 MHz | | 824 MHz |
| 20 GHz | 1 GHz | 19.600 | 20.400 | 776 MHz | | 824 MHz |
| 10 GHz | 5 GHz | 8.000 | 12.000 | 3.88 GHz | | 4.12 GHz |
| 15 GHz | 5 GHz | 13.000 | 17.000 | 3.88 GHz | | 4.12 GHz |
| 18 GHz | 5 GHz | 16.000 | 20.000 | 3.88 GHz | | 4.12 GHz |
| 10 GHz | 10 GHz | 6.000 | 14.000 | 7.76 GHz | | 8.24 GHz |
| 15 GHz | 10 GHz | 11.000 | 19.000 | 7.76 GHz | | 8.24 GHz |

# Test 3. Resolution Bandwidth Accuracy Test

**Step 8. 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 | 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 | 24.0 Hz | | 36.0 Hz |
| 10 Hz | 100 Hz | 8.0 Hz | | 12.0 Hz |

# Test 4. Resolution Bandwidth Selectivity

**Step 9. Resolution Bandwidth Selectivity**

| Spectrum Analyzer | | | Measured 60 dB Bandwidth | Measured 3 dB Bandwidth | Bandwidth Selectivity (60 dB BW ÷ 3dBBW) | 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 | | | | 11:1 |
| 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 5. Resolution Bandwidth Switching Uncertainty

**Step 5. Bandwidth Switching Uncertainty**

| RES BW | FREQUENCY SPAN | Deviation (MKR A Readout, dB) | Allowable Deviation (dB) |
|---|---|---|---|
| 1 MHz | 5 MHz | 0 (ref) | 3 (ref) |
| 3 MHz | 5 MHz | | fl.OO |
| 300 kHz | 5 MHz | | f0.50 |
| 100 kHz | 500 kHz | | f0.50 |
| 30 kHz | 500 kHz | | ±0.50 |
| 10 kHz | 50 kHz | | ±0.50 |
| 3 kHz | 50 kHz | | f0.50 |
| 1 kHz | 10 kHz | | f0.50 |
| 300 Hz | 1 kHz | | f0.50 |
| 100 Hz | 1 kHz | | f0.50 |
| 30 Hz | 200 Hz | | ±0.80 |
| 10 Hz | 100 Hz | | f2.00 |

# Test 6. Log Scale Switching Uncertainty Test

**Step 6. Log Scale Switching Uncertainty**

| SCALE (dB/DIV) | MKR Amplitude (dBm) | Deviation (dB) | Allowable Deviation (dB) |
|---|---|---|---|
| 1 | ________ | 0 (ref) | 0 (ref) |
| 2 | ________ | ________ | f0.5 |
| 5 | ________ | ________ | f0.5 |
| 10 | ________ | ________ | f0.5 |

## Test 7. IF Gain Uncertainty

**Step 12. 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 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 | |

## Test 7. IF Gain Uncertainty

**Steps 23 through 28.**

| Steps | Min | Measured | Max |
|---|---|---|---|
| **23. Recorded deviations from step 12.** | | | |
| Largest Positive 0 to -70 dBm | | | |
| Largest Negative 0 to -70 dBm | | | |
| Largest Positive -80 to -120 dBm | | | |
| Largest Negative -80 to -120 dBm | | | |
| **24. Recorded deviation from steps 18 and 22.** | | | |
| Largest Positive step 18 | | | |
| Largest Negative step 18 | | | |
| Largest Positive step 22 | | | |
| Largest Negative step 22 | | | |
| 25. | | | |
| Sum of Positive Deviations of steps 23 and 24 | | | 0.6 dB |
| 26. | | | |
| Sum of Negative Deviations of steps 23 and 24 | -0.6 dB | | |
| 27. | | | |
| Sum of Positive Deviations of steps 23 and 24 | | | 1.0 dB |
| 28. | | | |
| Sum of Positive Deviations of steps 23 and 24 | -1.0 dB | | |

# Test 8. Amplitude Fidelity

### Step 6. Log Scale Fidelity

| 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 14. Linear Scale 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 9. Calibrator Amplitude Accuracy

**Step 2. CAL OUTPUT Level**

| | Min | Measured | Max |
|---|---|---|---|
| Cal OUTPUT level | – 10.30 dB | ________ | I-9.70 dB |

# Test 10. Frequency Response Test

Step 12

| | Min | Measured | Max |
|---|---|---|---|
| Deviation 1 kHz to 100 kHz | | | 1.2 dB |

Step 18

| Signal Level | Min | Measured | Max |
|---|---|---|---|
| 100 Hz | -1.4 dB | | -2.6 dB |
| 200 Hz | -1.4 dB | | -2.6 dB |
| 300 Hz | -1.4 dB | | -2.6 dB |
| 400 Hz | -1.4 dB | | -2.6 dB |
| 500 Hz | -1.4 dB | | -2.6 dB |
| 600 Hz | -1.4 dB | | -2.6 dB |
| 700 Hz | -1.4 dB | | -2.6 dB |
| 800 Hz | -1.4 dB | | -2.6 dB |
| 900 Hz | -1.4 dB | | -2.6 dB |
| 1 kHz | -1.4 dB | | -2.6 dB |
| **Deviation** 100 Hz to 1 kHz | | | 1.2 dB |

Steps 27, 35 and 49. 100 Hz to 2.5 GHz Frequency Rand

| Spectrum Analyzer | | Frequency Synthesizer | | Synthesized Sweeper Sweep Time 150 s | | Trace Limits Spec f0.6 dB | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Minimum | | Maximum | |
| START FREQ | STOP FREQ | Freq | Sweep Width | START FREQ | STOP FREQ | Amp | Freq | Amp | Freq |
| 100 kHz | 4 MHz | 2,000,100 Hz | 3,998,000 Hz | | | | | | |
| 4 MHz | 60 MHz | 30050 kHz | 59900 kHz | | | | | | |
| 60 MHz | 2.5 GHz | – | – | 60 MHz | 2.5 GHz | | | | |

## Test 10. Frequency Response Test

### Table 2-24. Frequency Response (Flatness)

| 1<br>Frequency<br>Rand | 2<br>Spectrum Analyzer and Synthesized Sweeper | | 3<br>Cal Frequency | 4<br>Trace Limits | | | | 6<br>Flatness (dB) |
|---|---|---|---|---|---|---|---|---|
| | | | | Minimum | | Maximum | | |
| | START FREQ | STOP FREQ | Power Sensor | Amplitude (dBm) | Frequenc y | Amplitude (dBm) | Frequenc y | |
| MHz - 2.5 GHz | 60 MHz | 2.5 GHz | 100 MHz | | | | | |
| Spec | | | | -11.20 | | -8.80 | | 1.20 |
| 2 - 5.8 GHz | 2 GHz | 3.9 GHz | 3 GHz | | | | | |
| | 3.9 GHz | 5.8 GHz | 5 GHz | | | | | |
| Spec | | | | – 12.30 | | -7.70 | | 3.40 |
| i.8 - 12.5 GHz | 5.8 GHz | 9.15 GHz | 7 GHz | | | | | |
| | 9.15 GHz | 12.5 GHz | 11 GHz | | | | | |
| Spec | | | | – 12.30 | | -7.70 | | 3.40 |
| 2.5 - 18.6 GHz | 12.5 GHz | 15.55 GHz | 14 GHz | | | | | |
| | 15.55 GHz | 18.6 GHz | 17 GHz | | | | | |
| Spec | | | | – 12.80 | | -7.20 | | 4.40 |
| 18.6 - 20 GHz | 18.6 GHz | 20 GHz | 19 GHz | | | | | |
| Spec | | | | – 12.80 | | -7.20 | | 4.40 |
| 20 - 22 GHz | 20 GHz | 22 GHz | 21 GHz | | | | | |
| Spec | | | | – 13.60 | | -6.40 | | 6.00 |
| ımulative Flatness (dB) | | | | | | | | |
| 100 Hz to 20 GHz<br>Specification: 4.40 dB | | | | | | | | |
| 100 Hz to 22 GHz<br>Specification: 6.00 dB | | | | | | | | |

# Test 11. Sweep Time Accuracy

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

| [SWEEP TIME] | Sweep Time | | |
|---|---|---|---|
| | Min | Measured | Max |
| 20 ms | 18 ms | ______ | 22 ms |
| 30 ms | 27 ms | ______ | 33 ms |
| 50 ms | 45 ms | ______ | 55 ms |
| 70 ms | 63 ms | ______ | 77 ms |
| 90 ms | 81 ms | ______ | 99 ms |
| 110 ms | 99 ms | ______ | 121 ms |
| 170 ms | 153 ms | ______ | 187 ms |
| 200 ms | 180 ms | ______ | 220 ms |
| 2 s | 1.8 s | ______ | 2.2 s |

**Step 12. Sweep Time Accuracy**

| (SWEEP TIME) | MARKER A Time | | |
|---|---|---|---|
| | Min | Measured | Max |
| 20 s | 3.6 s | ______ | 4.4 s |
| 200 s | 36 ms | ______ | 44 ms |
| 240 s | 33.6 ms | ______ | 62.4 ms |

## Test 12. Noise Sidebands Test

| Steps | Min | Measured | Max |
|---|---|---|---|
| **11. Noise Sideband Level** 320 Hz offset | | | -80 dBc |
| **16. Noise Sideband Level** 1 kHz offset | | | -85 dBc |
| **2 1. Noise Sideband Level** 10 kHz offset | | | -90 dBc |
| **26. Noise Sideband Level** 100 kHz offset | | | -105 dBc |

# Test 13. Line-Related Sidebands

| Steps | Min | Measured | Max |
|---|---|---|---|
| **9. Line-Related Sidebands Levels for 100 MHz signal** | | | |
| Largest level <360 Hz away from signal | | ____dB at Hz | -70 dB |
| Largest level 360 Hz to 600 Hz away from signal | | ____dB at Hz | -75 dBm |
| **15. Line-Related Sidebands Levels for 2.4 GHz signal** | | | |
| Largest level <360 Hz away from signal | | ____dB at Hz | -60 dBm |
| **20. Line-Related Sidebands Levels for 2.6 GHz signal** | | | |
| Largest level <360 Hz away from signal | | ____dB at Hz | -60 dB |
| **25. Line-Related Sidebands Levels for 5.7 GHz signal** | | | |
| Largest level <360 Hz away from signal | | ____dB at Hz | -60 dB |
| **Option 400** | | | |
| **13. Line-Related Sidebands Levels for 5.7 GHz signal** | | | |
| Largest level <2 kHz away from signal | | ____dB at Hz | -55 dB |
| Largest level 2 kHz to 5.5 kHz away from signal | | ____dB at -Hz | -65 dB |

# Test 14. Average Noise Level

| Steps | Min | Measured | Max |
|---|---|---|---|
| **8 and 10. Marker Amplitude Readout** | | | |
| 100 Hz | | | -95 dBm |
| 51 kHz | | | -112 dBm |

**Step 11. Average Noise Level**

| CENTER FREQUENCY | MARKER Amplitude (dBm) | Maximum Amplitude (dBm) |
|---|---|---|
| 2.0 MHz | | -134 |
| 1.001 GHz | | -134 |
| 2.499 GHz | | -134 |
| 2.510 GHz | | -132 |
| 5.799 GHz | | –132 |
| 5.810 GHz | | -125 |
| 12.499 GHz | | -125 |
| 12.510 GHz | | -119 |
| 18.59 GHz | | -119 |
| 18.61 GHz | | -114 |
| 22.0 GHz | | -114 |

# Test 15. Residual Responses

| Steps | Min | Measured | Max |
|---|---|---|---|
| **8. Residual Responses 0 Hz to 1.5 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -100 dBm |
| **11. Residual Responses 1.4 to 2.5 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -100 dBm |
| **13. Residual Responses 2.4 to 5.8 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -100 dBm |
| **15. Residual Responses 5.7 to 6.7 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -95 dBm |
| **16. Residual Responses 6.690 to 11.650 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -95 dBm |
| **18. Residual Responses 11.6 to 12.5 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -95 dBm |
| **21. Residual Responses 12.4 to 18.6 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -85 dBm |
| **24. Residual Responses 18.5 to 22 GHz** | | | |
| Largest Residual Level | | ____dBm at Hz | -80 dBm |

## Test 16. Harmonic And Intermodulation Distortion

| Steps | Min | Measured | Max |
|---|---|---|---|
| 8. Second Harmonic Level of 230 MHz | | | -80 dBc |
| 15. Second Harmonic Level of 800 MHz | | | -70 dBc |
| 25. Second Harmonic Level of 7200 MHz | | | -100 dBc |
| 40. TO1 for signals of 2099.5 and 2100.5 MHz | +7 dBm | | |
| 54. TO1 for signals of 3999.5 and 4000.5 MHz | +7 dBm | | |
| 55. TO1 for signals of 8999.5 and 9000.5 MHz | +5 dBm | | |
| TO1 for signals of 13999.500 and 14000.499 MHz | +5 dBm | | |

# Test 17. Image, Multiple, and Out-of-Band Responses

**Step 8. Image and Out-of-Rand Response**

| Spectrum Analyzer (CENTER FREQUENCY) (GHz) | Synthesized Sweeper Frequency (MHz) | Displayed Spurious Amplitude | |
|---|---|---|---|
| | | Measured (dBc) | Maximum (dBc) |
| 3 | 3642.800 | | -70 |
| | 6321.400 | | -60 |
| | 6964.200 | | -60 |
| 6 | 2517.900 | | -60 |
| | 3160.700 | | -60 |
| | 5357.200 | | -70 |
| 9 | 4017.900 | | -60 |
| | 4660.700 | | -60 |
| | 8357.200 | | -70 |
| | 12696.500 | | -60 |
| | 13339.300 | | -60 |
| 12 | 5517.900 | | -60 |
| | 6160.700 | | -60 |
| | 11357.200 | | -70 |
| | 17196.500 | | -60 |
| | 17839.300 | | -60 |
| 15 | 4571.500 | | -60 |
| | 5214.300 | | -60 |
| | 9464.300 | | -60 |
| | 10107.100 | | -60 |
| | 14357.200 | | -70 |
| 17 | 5238.100 | | -60 |
| | 5880.900 | | -60 |
| | 10797.700 | | -60 |
| | 11440.500 | | -60 |
| | 16357.200 | | -70 |

Step 8. Image and Out-of-Rand Response (continued)

| Spectrum Analyzer [CENTER FREQUENCY] (GHz) | Synthesized Sweeper Frequency (MHz) | Displayed Spurious Amplitude Measured (dBc) | Displayed Spurious Amplitude Maximum (dBc) |
|---|---|---|---|
| 19 | 4348.300 | | -60 |
| | 4991.100 | | -60 |
| | 9017.900 | | -60 |
| | 9660.700 | | -60 |
| | 13687.600 | | -60 |
| | 14330.400 | | -60 |
| | 18357.200 | | -60 |
| 21 | 4848.300 | | -60 |
| | 5491.100 | | -60 |
| | 10017.900 | | -60 |
| | 10660.700 | | -60 |
| | 15187.600 | | -60 |
| | 15830.400 | | -60 |
| | 20357.200 | | -50 |

Step 17. Multiple Responses

| Synthesized Sweeper Frequency (MHz) | [CENTER FREQUENCY) (Multiple Response) (GHz) | Displayed Spurious Amplitude Measured (dBc) | Displayed Spurious Amplitude Maximum (dB) |
|---|---|---|---|
| 5700.000 | 2.68930 | | -70 |
| 6000.000 | 1.18930 | | -50 |
| 12000.000 | 8.107133 | | -70 |
| | 8.535667 | | -70 |
| 13000.000 | 1.06790 | | -45 |
| | 1.9107 | | -45 |
| | 0.53395 | | -45 |
| 15000.000 | 10.107133 | | -60 |
| | 10.535667 | | -60 |

# Test 18. Gain Compression

| Steps | Min | Measured | Max |
|---|---|---|---|
| 14. Gain Compression for input -10 to 0 dBm at 2 GHz | -1.0 dB | ________ | |
| 27. Gain Compression for input -15 to -5 dBm at 3 GHz | -1.0 dB | ________ | |
| 36. Gain Compression for input -15 to -5 dBm at 9 GHz | -1.0 dB | ________ | |

## Test 19. 1st LO Output Amplitude

| Steps | Min | Measured | Max |
|---|---|---|---|
| 4. 1st LO OUTPUT Level | + 5 dBm | | |

# Test 20. Sweep + Tune Out Accuracy

**Step 3. Sweep + Tune Out Accuracy**

| CENTER FREQUENCY | Voltmeter Reading (Volts) | | |
|---|---|---|---|
| | Min | Actual | Max |
| 0 Hz | -0.010 | | + 0.010 |
| 1 MHz | -0.011 | | + 0.009 |
| 12 MHz | -0.022 | | -0.002 |
| 130 MHz | -0.143 | | -0.117 |
| 670 MHz | -0.693 | | -0.647 |
| 1.3 GHz | -1.336 | | -1.264 |
| 5.7 GHz | -5.824 | | -5.576 |
| 12.5 GHz | -12.760 | | -12.240 |
| 18.6 GHz | – 18.982 | | -18.218 |
| 22 GHz | -22.450 | | -21.550 |

## Test 21. Fast Sweep Time Accuracy (< 20 ms)

**Step 10. Fast Sweep Time Accuracy (<20 ms)**

| (SWEEP TIME) | Function Generator Frequency (kHz) | Sweep Time Error (divisions) |
|---|---|---|
| 5 ms | 2.00 f0.02 | ______ |
| 2 ms | 5.00 f0.05 | ______ |
| 1 ms | 10.0 ±0.1 | ______ |
| 200 $\mu$s | 50.0 f0.5 | ______ |
| 100 $\mu$s | 100 ±1 | ______ |

# Test 22. Frequency Reference Error Test

| Steps | Min | Measured | Max |
|---|---|---|---|
| 4. Initial Frequency | | 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-l 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.

## 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 through Table 3-6, 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 3-1. Adjustment Cross Reference

| Function Adiusted | Test Number | 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) | 24 | 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 | 10 MHz Standard Adjustment |
| CAL OUTPUT Level | 19 | CAL Output Adjustments |
| Frequency Span | 13 | Sweep, DAC, and Main Coil Driver Adjustments |
| START and STOP Frequency | 13 | Sweep, DAC, and Main Coil Driver Adjustments |
| Sweep Times | 13 | Sweep, DAC, and Main Coil Driver Adjustments |
| Frequency Tuning | 13 | Sweep, DAC, and Main Coil Driver Adjustments |
| | 14 | 100 MHz VCXO Adjustments |
| | 15 | MM Loop Adjustments |
| Phase Lock Loops | 18 | RF Module Phase Lock Adjustments |
| | 16 | YTO Loop Adjustments |
| | 17 | 20/30 Loop Phase Lock Adjustments |
| RF Signal Conversion and RF Gains | 20 | Last Converter Adjustments |
| | 21 | Frequency Response Adjustments |
| Frequency Response | 21 | Frequency Response Adjustments |
| Digital Storage Video Processing | 22 | Analog-to-Digital Converter Adjustments |
| | 23 | Track and Hold Adjustments |

## 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 | 3D | 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 | Cl04 | 3 | Adjusts rise and fall times of Y deflection amplifier pulse. |
| A1A5C109 | Cl09 | 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. |

'or **Serial Prefix 3001A and below,** see back of table for exceptions to **A1A2** through AlA6.

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 | 25 | 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 | Cl0 | 20 | Adjusts 321.4 MHz bandpass filter. |
| A6A3A1C11 | Cl1 | 20 | Adjusts 321.4 MHz bandpass filter. |
| A6A3A1C12 | C12 | 20 | Adjusts 32 1.4 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 | vc | 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 | Al | 21 | Adjusts flatness 0.01 to 2.5 GHz (low end). |
| A6A11R51 | B1 | 21 | Adjusts flatness 2 to 5.8 GHz (low end). |
| A6A11R54 | Cl | 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 | El | 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 | Dl | 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 | Adjustmen 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 | -9 v | 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). |
| A11A2R2 | 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 | Cl0 | 3 | Adjusts rise and fall times of X deflection amplifier pulse. |
| A1A4C11 | Cl1 | 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 | Cl0 | 3 | Adjusts rise and fall times of Y deflection amplifier pulse. |
| A1A5C11 | Cl1 | 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. F&tory-Selected Components (continued)

| Reference Designator | Adjustment 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 | |
| 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 | O-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. |
| 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. |

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

| Reference Designator | adjustment Procedure | Range of Values (Ω or pF) | Function of Component |
|---|---|---|---|
| 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 | | 180-270 | Sets adjustment range of LC CTR. |
| A4A8C81 | | 180-270 | Sets adjustment range of LC CTR. |

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. F&tory-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 |
| A6A9A1R1( | 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 |
|---|---|---|---|
| A11A4R24 | | 348 to 562 | Sets YTO loop gain crossover to 20 ±2 kHz. |
| A11A5C22 | 16 | 130 to 220 pF | Sets YTO loop response <20 MHz. |
| A11A5L10 | 16 | 2.2 to 3.3 μF | Sets YTO loop response. |
| A11A5R22 | 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 16K | |
| 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<br>Range: 1 to 24 pF<br>Tolerance: 1 to 9.1 pF = f0.25 pF<br>10 to 24 pF = ±5% | | | Type: Dipped Mica<br>Range: 27 to 680 pF<br>Tolerance: ±5% | | |
| **Value (pF)** | **KP Part Number** | **CD** | **Value (pF)** | **HP Part 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<br>Range: 10 to 464K Ohms<br>Wattage: 0.125 at 125°C<br>Tolerance: ± 1 .O% | | | | | |
| **Value (Ω)** | **HP Part Number** | **CD** | **Value (Ω)** | **HP Fart 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 | 0757-03 17 | 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 | 3.4813 | 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 | 0698-3 132 | 4 | ll.OK | 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<br>Range: 10 to 464K Ohms<br>Wattage: 0.125 at 125°C<br>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 | 0698-345 1 | 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 | 0757-08 17 | 2 |
| 21.5 | 0698-3391 | 7 | 825 | 0757-08 18 | 3 |
| 23.7 | 0698-3392 | 8 | 909 | 0757-08 19 | 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 | 0757-082 1 | 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)**

| Value (Ω) | HP Part Number | i i i | Value (Ω) | HP Fart Number | CD |
|---|---|---|---|---|---|
| **Resistors** | | | | | |
| Type: Fixed-Film<br>Range: 10 to 1.47M Ohms<br>Wattage: 0.5 at 125°C<br>Toler'ance: ±1.0% | | | | | |
| 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 |
| 46.4K | 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 | 0757-0871 | 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:
- A8 Rectifier
- Al7 Positive Regulator
- A 18 Negative Regulator

**Description**

The + 15 Vdc power supply is adjusted for the IF-Display Section, and the +22 Vdc and +20 Vdc power supplies are adjusted for the RF Section. All other low-voltage supplies are measured to ensure that they are within tolerance.

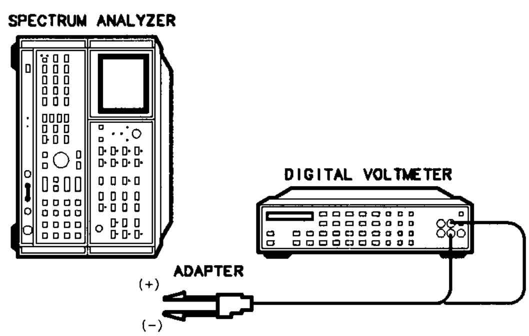



**Figure 3-1. Low-Voltage Power Supply Adjustments Setup**

**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-l. Remove the top cover of the IF-Display Section and the bottom cover of the RF Section.
2. Set the spectrum analyzer LINE switch to ON. The MAINS power-on indicator **A1A8DS1** (red LED) in the IF-Display Section should be lit. See Figure 3-2 or Figure 3-3 for the location of **A1A8DS1**.

**Note**

Use Figure 3-2 for IF-Display Sections with serial number prefix 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. The DVM indication should be + 15.000 fO.O1O V dc. If the voltage is out of tolerance, adjust **A1A6R9** + 15 V ADJ for the specified voltage.

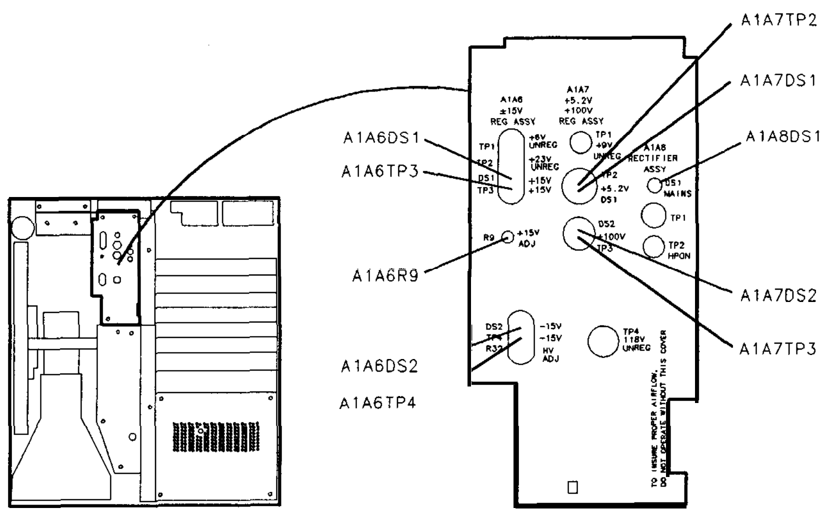



**Figure 3-2.**
**IF-Display Section Adjustments (SN 3001A and Below)**

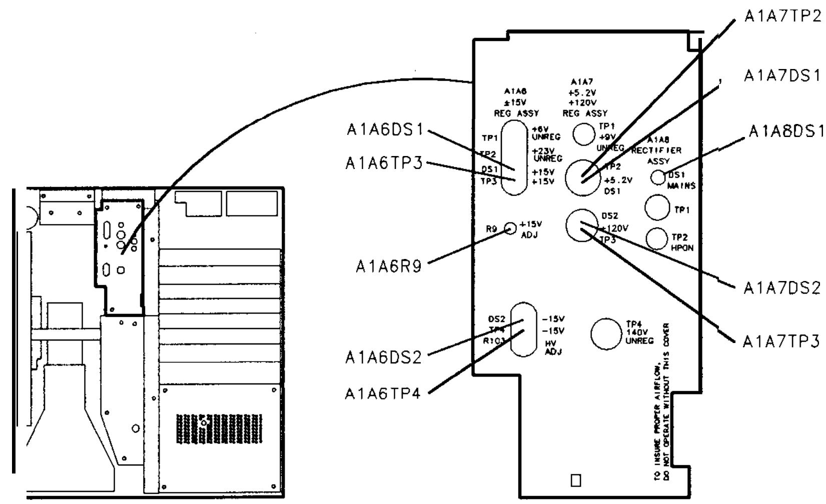



**Figure 3-3.**
**IF-Display Section Adjustments (SN 3004A and Above)**

5. Verify that the -15 V indicator **A1A6DS2** (yellow LED) is lit.
6. Connect the DVM to **A1A6TP4**. The DVM indication should be -15.000 f0.050 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 with serial number prefix 3001A and below, indicator **A1A7DS2** is a + 100 V indicator.

8. Connect the DVM to **A1A7TP3**. The DVM indication should be + 120.0 f3.0 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 with serial number prefix 3001A and below, the DVM indication should be + 100.0 f2.0 V dc.

9. Verify that the +5.2 V indicator **A1A7DS1** (yellow LED) is lit.
10. Connect the DVM to **A1A7TP2**. The DVM indication should be +5.200 f0.050 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. With the LINE switch still ON, the RF Section's +22 V indicator **A8DS1** (yellow LED) should be lit. See Figure 3-4.
12. Connect the DVM to **A8TP1** and the DVM ground lead to chassis ground. Adjust **A8R2** +22 V ADJ for a DVM indication of +22.000 ±0.020 V dc.

---

**Note**

If **A8R2** +22V ADJ does not provide sufficient adjustment range, select a new value for factory-select component **A8R6**. An increase in the value of **A8R6** decreases the voltage at **A8TP1**. Conversely, a decrease in the value of **A8R6** increases the voltage at **A8TP1**. Refer to Table 3-3 for the acceptable range of values and corresponding HP part numbers for **A8R6**, and to Figure 3-4 for the location of **A8R6**.

---

13. Verify that the +20 V indicator **A17DS2** (yellow LED) is lit.
14. Connect the DVM to **A17TP4**. Adjust **A17R50** +20 V ADJ for a DVM indication of +20.000 fO.OO1 V dc.
15. Verify that the + 12 V indicator **A17DS4** (yellow LED) is lit.
16. Connect the DVM to **A17TP6**. The DVM indication should be + 12.25 ±0.30 V dc. The + 12 V supply voltage is set by a precision voltage regulator; therefore, if the + 12 V supply is out of tolerance, a circuit malfunction is indicated.
17. Verify that the +5.2 V indicator **A17DS1** (yellow LED) is lit.

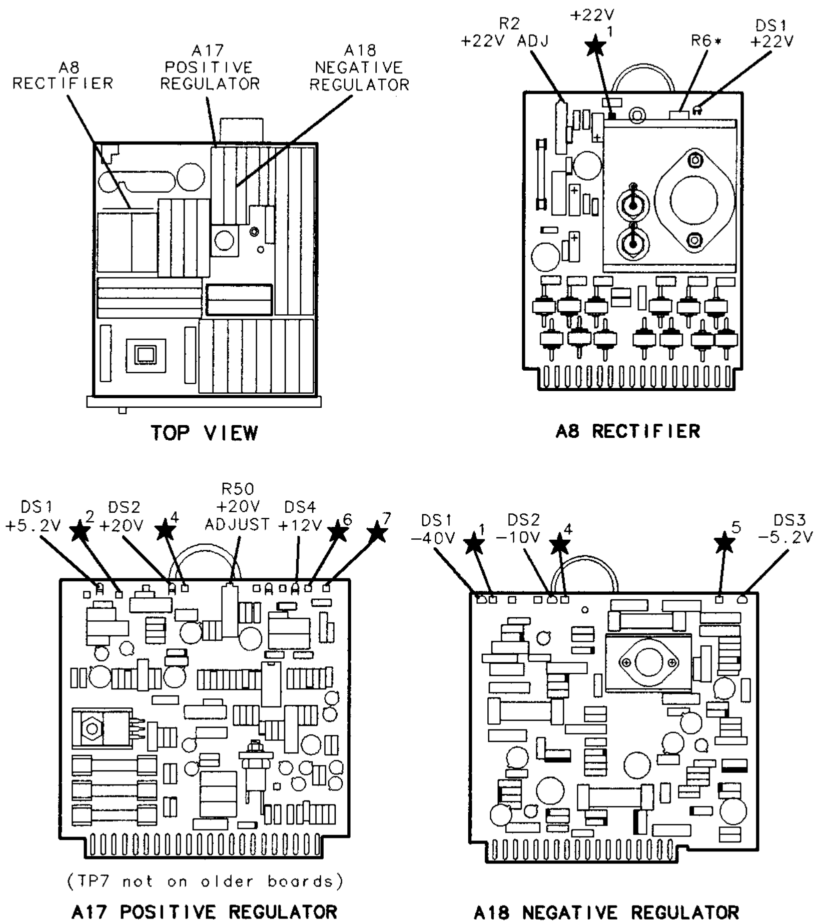



**Figure 3-4. Location of RF Section Low-Voltage Adjustments**

18. Connect the DVM to A17TP2. The DVM indication should be +5.20 ±0.05 V dc. The +5.2 V supply is referenced to the +20 V supply; therefore, if the +5.2 V supply is out of tolerance, a circuit malfunction is indicated.
19. Verify that the −5.2 V indicator A18DS3 (yellow LED) is lit.
20. Connect the DVM to A18TP5. The DVM indication should be −5.20 ±0.05 V dc. The −5.2 V supply is referenced to the +20 V supply; therefore, if the −5.2 V supply is out of tolerance, a circuit malfunction is indicated.
21. Verify that the −40 V indicator A18DS1 (yellow LED) is lit.
22. Connect the DVM to A18TP1. The DVM indication should be −39.8 ±0.4 V dc. The −40 V supply is referenced to the +20 V supply; therefore, if the −40 V supply is out of tolerance, a circuit malfunction is indicated.
23. Verify that the −10 V indicator A18DS2 (yellow LED) is lit.

24. Connect the DVM to A18TP4. The DVM indication should be -10.0 ±0.1 V dc. The -10 V supply is referenced to the +20 V supply; therefore, if the -10 V 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 postaccelerator 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 + 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 f0.04 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)

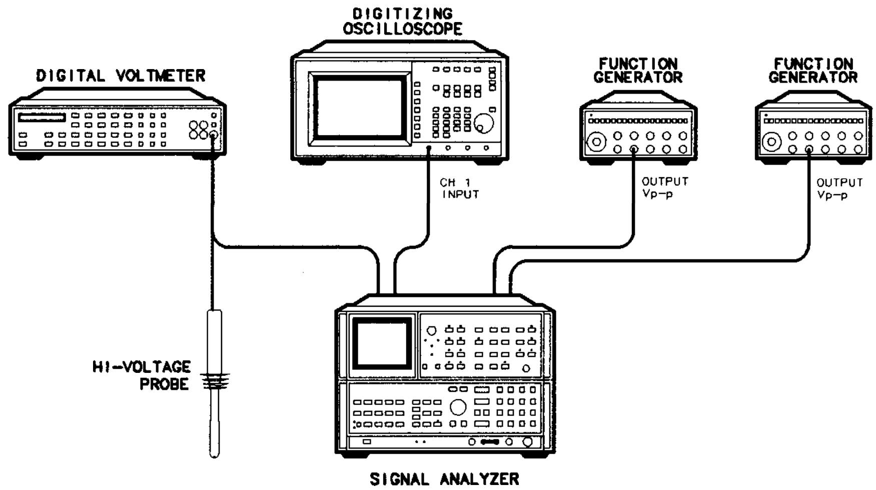



**Figure 3-5. High Voltage Adjustment Setup**

### Equipment

Digital Voltmeter (DVM) .................................. HP 3456A
DC High-Voltage Probe (1000: 1 divider) ................. HP 34111A
Display Adjustment PC Board *(service* accessory) ... HP 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 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 (±00.000 on the HP 3456A display).

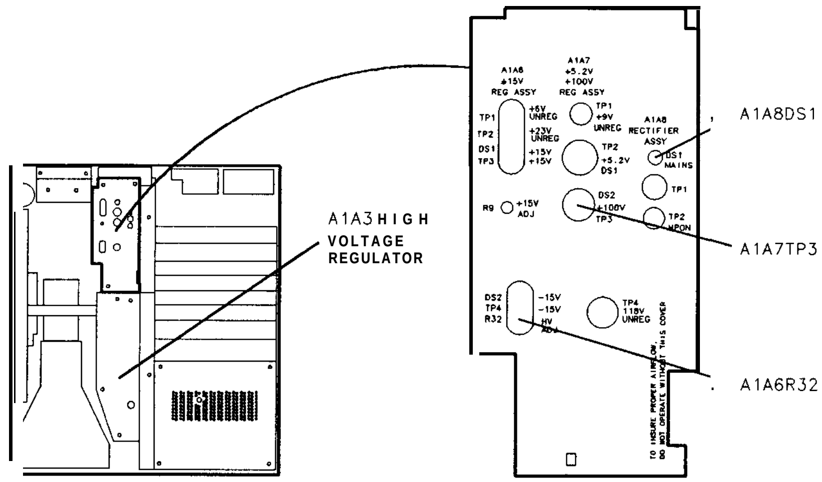



**Figure 3-6. Location of High Voltage Adjustments**

4. Set the spectrum analyzer 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 spectrum analyzer 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).**

**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 Vdc.

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.**

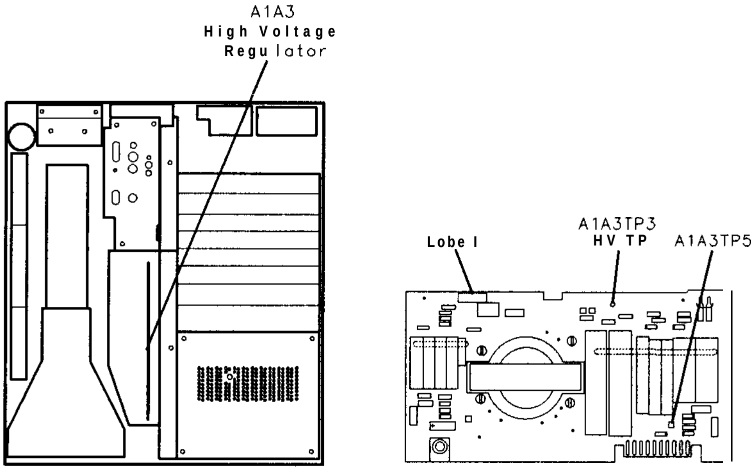



**Figure 3-7. Location of Label and Test Point**

13. Reconnect ac line cords to both instrument sections. Set the spectrum analyzer 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 spectrum analyzer 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 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..l
    level . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 75.0000 V, rising edge
    Press (DISPLAY):
    connect dots . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ..on

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.

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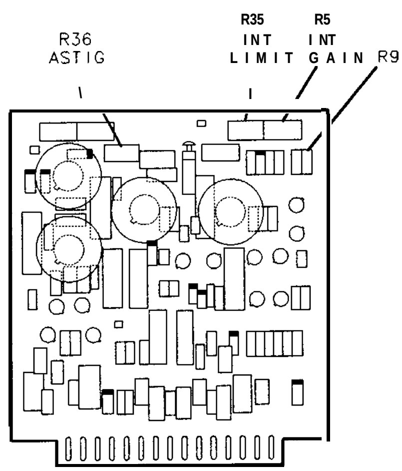


**Figure 3-8. Location of A1A2 Components**

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.

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

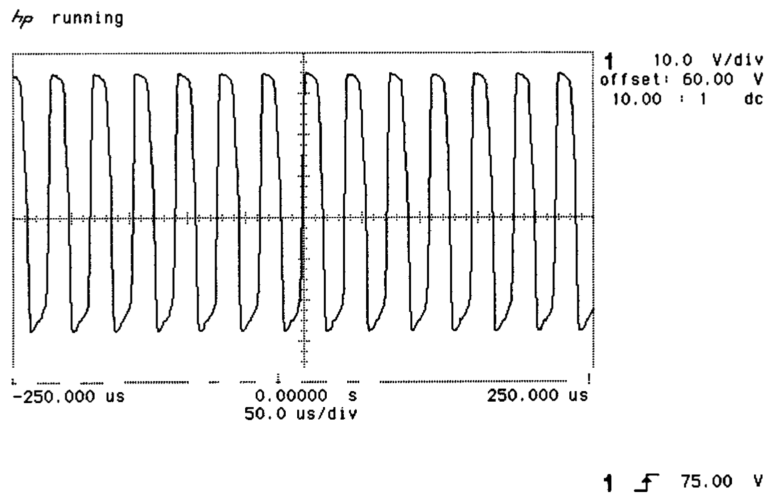


**Figure 3-9. CRT Cut-Off Voltage**

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 J1:
    - 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.
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,, – 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.

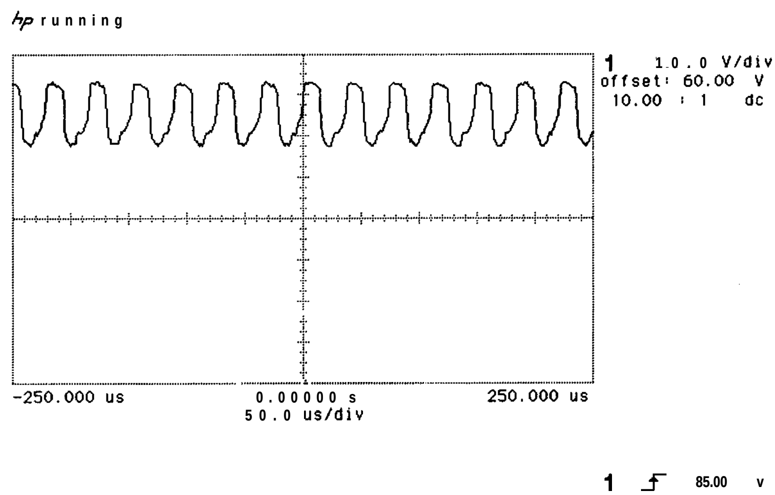


**Figure 3-10. Waveform at A1A3TP5**

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 AlA2, 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 personel 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 A1A1 1 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-l 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 W2 1.
   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**.

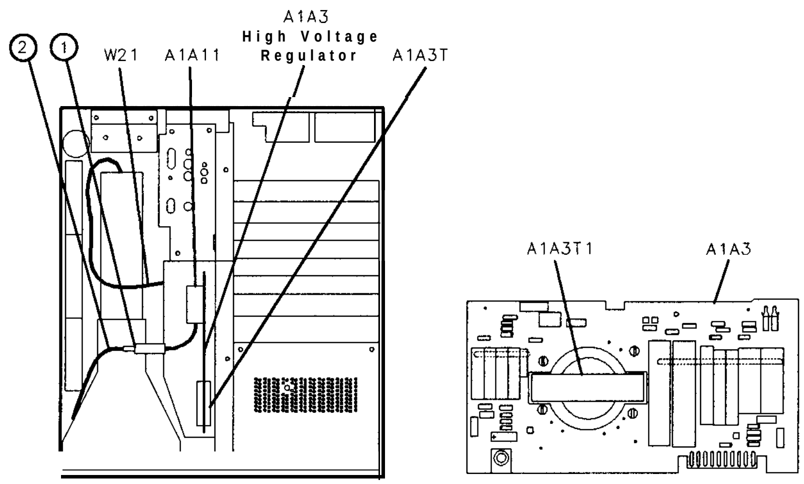


**Figure 3-11. Discharging the CRT Post-Accelerator Cable**

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 postaccelerator 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 LINE switch to STANDBY.
2. Remove the top cover from the IF-Display Section and connect the equipment as shown in Figure 3-12.

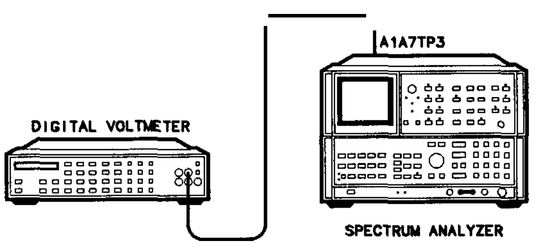


**Figure 3-12. High Voltage Adjustment Setup**

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 MO 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).

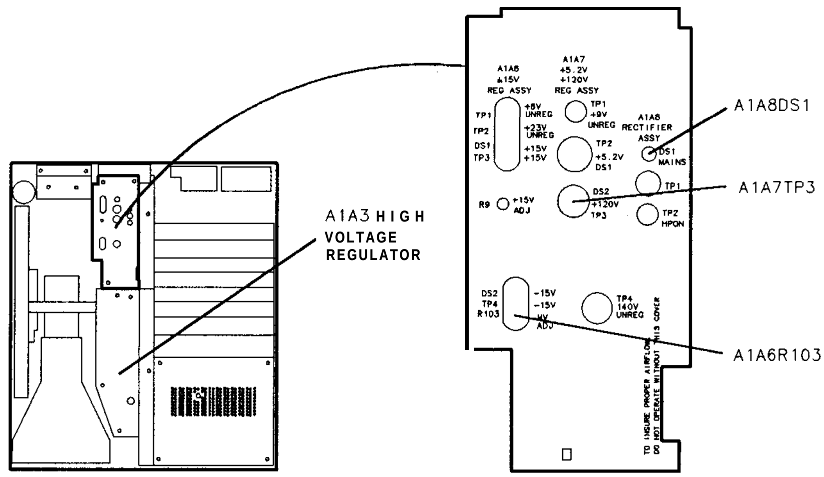


**Figure 3-13. Location of High Voltage Adjustments**

4. Set the spectrum analyzer 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 spectrum analyzer 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 HighVoltage 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.

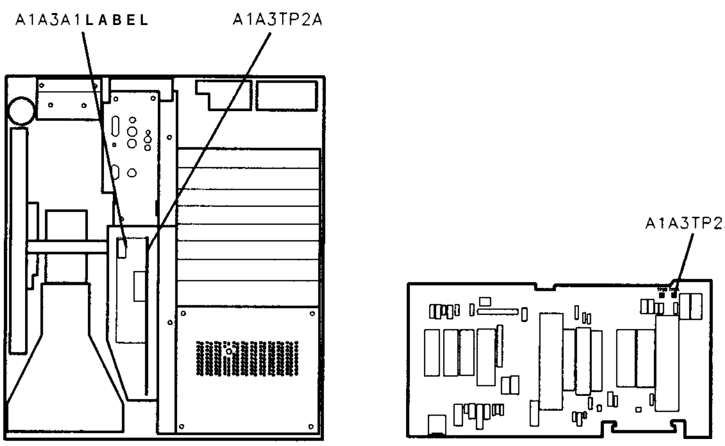


**Figure 3-14. Location of A1A3 Label and Test Point**

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:

$$0.00099 \times (-2400 \text{ V}) = -2.376 \text{ V dc}$$

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)".

**2. High-Voltage Adjustment (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 A1A3 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 IFDisplay 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 postaccelerator 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.

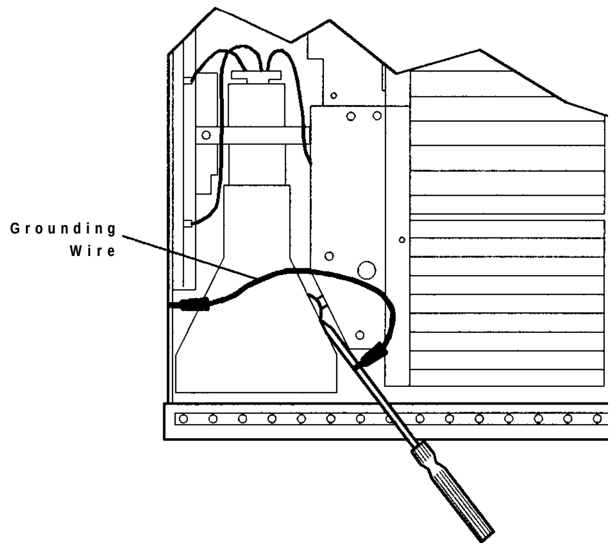


**Figure 3-15. Discharging the CRT Post-Accelerator Cable**

**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
A1A4 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 YDeflection 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 MW7.5 pF *(2 required)* . . . . . . . . . . . HP 10432A
Display Adjustment PC Board *(service* accessory) . . . . . . . 85662-60088
Termination, BNC 50Ω . . . . . . . . . . . . . . . . . . . . . HP 11593A

**Adapters:**
Adapter, BNC tee . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1250-0781
Adapter, BNC(f) to SMB(f) . . . . . . . . . . . . . . . . . . . . 1250-1236

## 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 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 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.

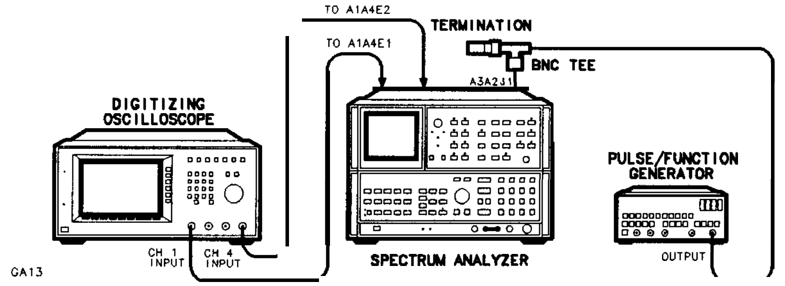


**Figure 3-16. Preliminary Display Adjustments Setup**

9. Set the spectrum analyzer LINE switch to STANDBY. 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)

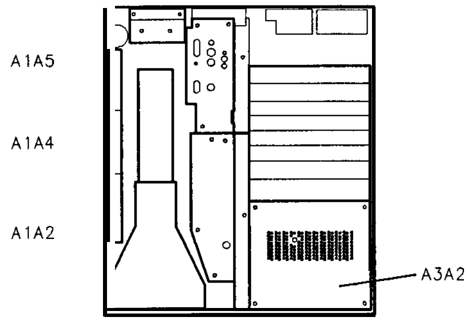


**Figure 3-17. Location of A1A2, A1A4, A1A5, and A3A2**

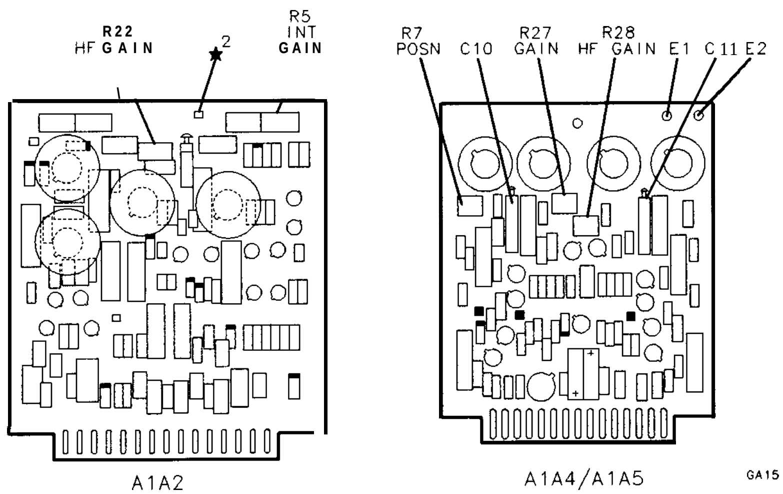


**Figure 3-18. A1A2, A1A4, and A1A5 Adjustment Locations**

10. Set the pulse/funtion generator controls as follows:

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

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 3-16.

**Note**

The pulse/function generator output must be terminated with 50 ohms. Use a BNC tee, a 500 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 ............................................ .. 25.0000 V
- Channel 4 .................................................. on
- amplitude scale .................................. ..10.0 V/div
- offset ............................................ ..60.000 0 V

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

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

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

Press (SHOW).

13. Set the spectrum analyzer 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.

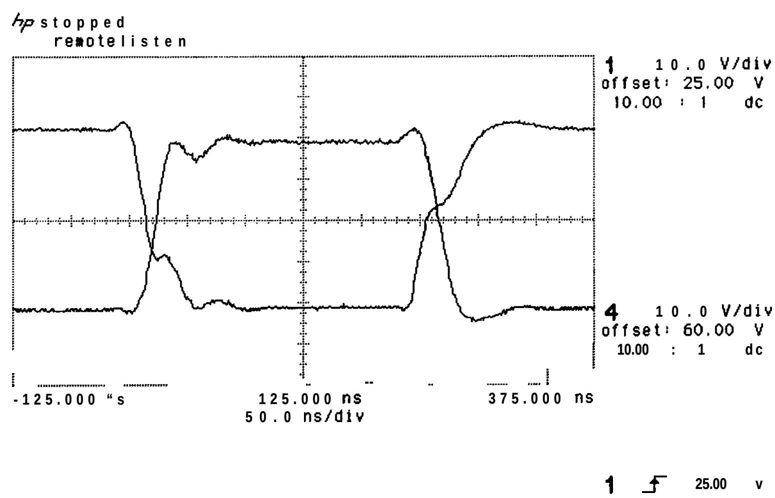


**Figure 3-19. X + and X- Waveforms**

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 front-panel knob to adjust waveform fl sensitivity for approximately 8 vertical divisions.

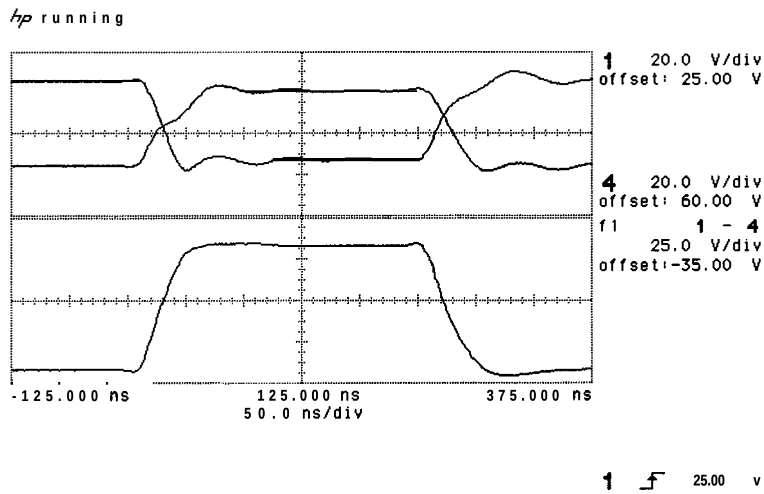


**Figure 3-20. Composite X Deflection Waveform**

17. Adjust A1A4R28 HF GAIN, A1A4C10, and A1A4C11 for minimum overshoot and minimum rise **and** fall times of the composite X-deflection waveform. See Figure 3-18 for the location of the adjustments.

**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 Xdefection 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 3-21.

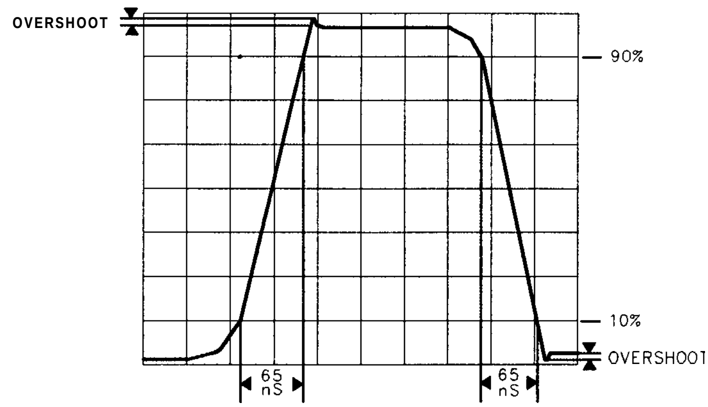


**Figure 3-2 1.**
**Rise and Fall Times and Overshoot Adjustment Waveform**

19. Connect the oscilloscope 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 Cl1 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 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.

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

**Note** The pulse/function generator 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 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 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.

28. Set the oscilloscope controls as follows:

    Press (CHAN):
    Channel 1 . . . . . . . . . . . . . . . . . . . . on
    amplitude scale . . . . . . . . . . . . . . . . 8.0 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 front-panel INTENSITY control for 50 V peak-to-peak (6.25 divisions) as indicated on the oscilloscope. See Figure 3-22.

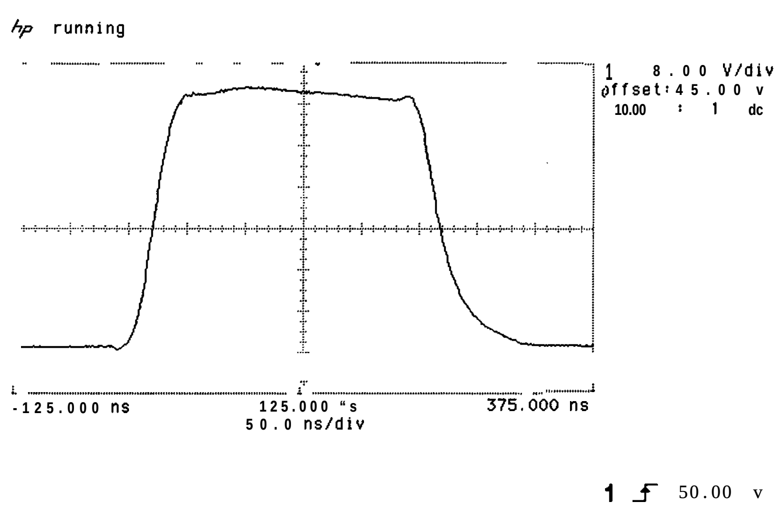


**Figure 3-22. $50V_{p-p}$ Signal**

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 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
A1A2 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 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 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.

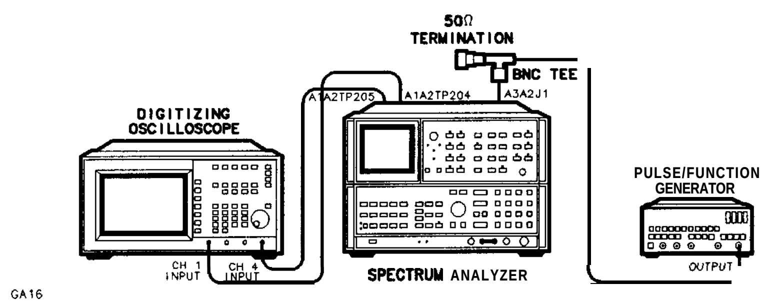


**Figure 3-23. Preliminary Display Adjustments Setup**

9. Set the spectrum analyzer LINE switch to standby. 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)

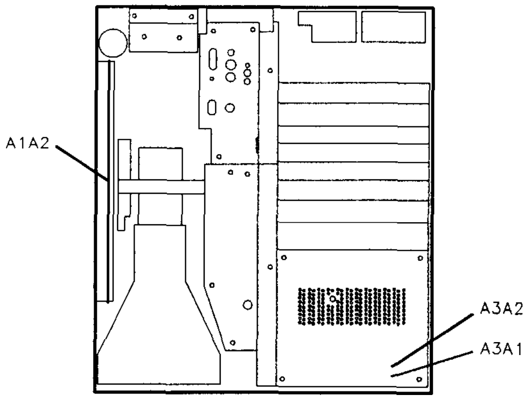


**Figure 3-24. Location of A1A2 and A3A2**

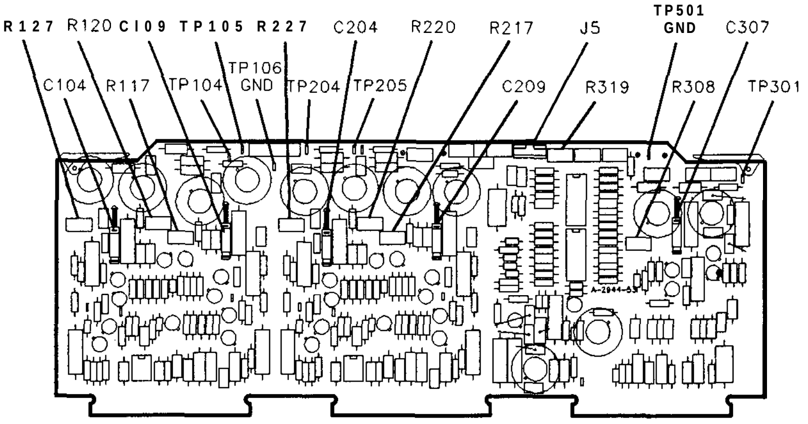


**Figure 3-25. A1A2 Adjustment Locations**

10. Set the pulse/funtion generator controls as follows:

    MODE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . NORM
    Waveform . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .pulse
    Frequency (FRQ) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 200 kHz
    Width (WID) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 250 ns
    Amplitude (AMP) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2.00 V
    Offset (OFS) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .0.000 mV
    Disable . . . . . . . . . . . . . . . . . . . . . . . . . . . . off (OUTPUT enabled)

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 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 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.

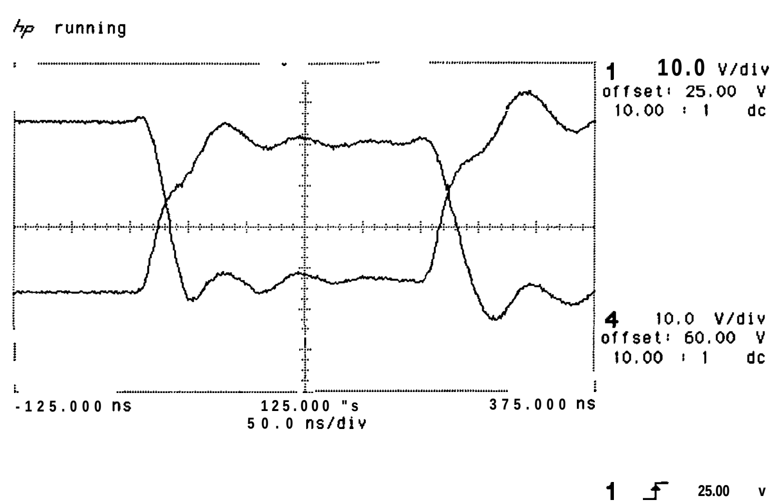


**Figure 3-26. X+ and X- Waveforms**

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 front-panel knob to adjust waveform fl sensitivity for approximately 8 vertical divisions.

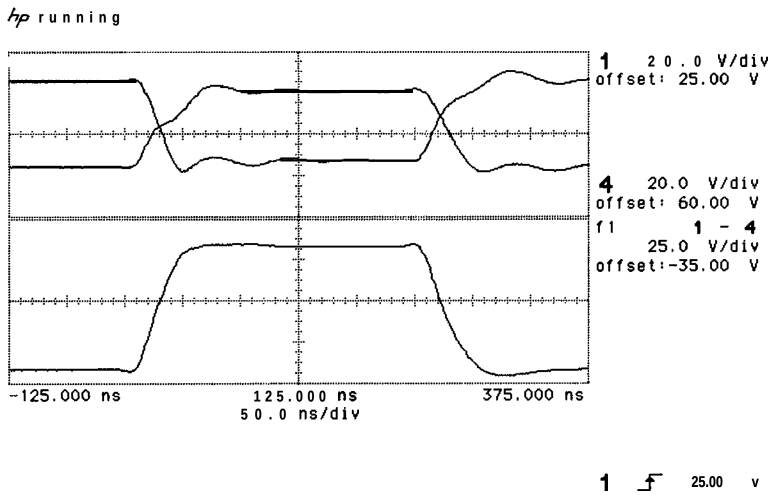


**Figure 3-27. Composite X Deflection Waveform**

17. Adjust A1A2R217 HF GAIN, A1A2C204, and A1A2C209 for minimum overshoot and minimum rise and fall times of the composite Xdeflection 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 Xdefection 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.

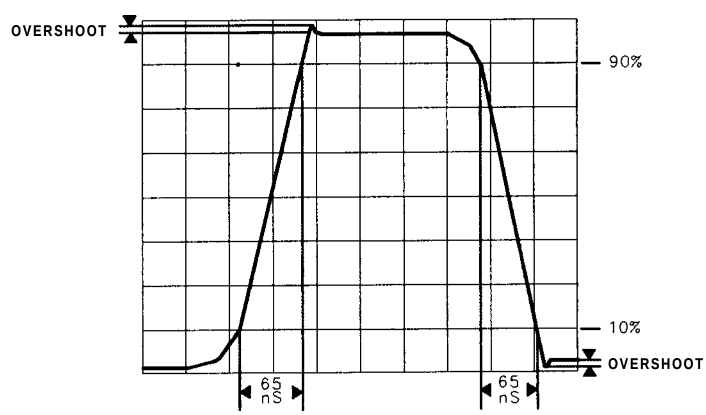


**Figure 3-28.**
**Rise and Fall Times and Overshoot Adjustment Waveform**

19. Connect the oscilloscope 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 $\overline{\text{BLANK}}$ Input

21. Disconnect the oscilloscope channel 4 probe from the spectrum analyzer. Connect the oscilloscope channel 1 probe to A1A2TP301, and connect the probe 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 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. 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 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 front-panel INTENSITY control for 50 V peak-to-peak (6.25 divisions) as indicated on the oscilloscope. See Figure 3-29.

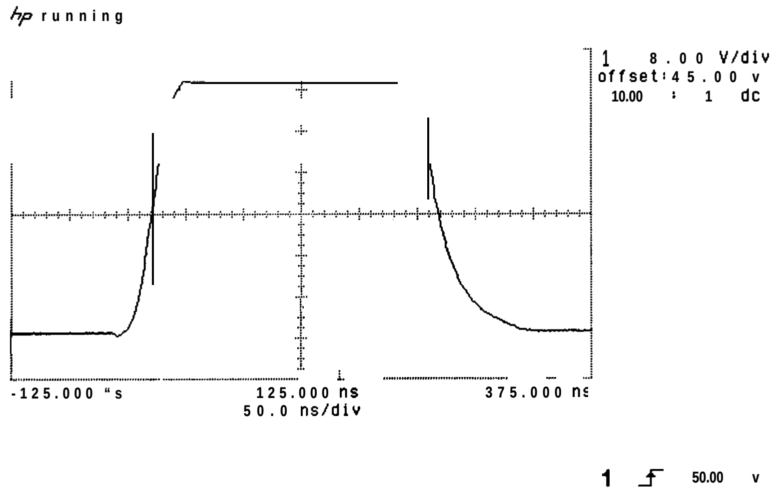


**Figure 3-29. $50V_{p-p}$ Signal**

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 LINE switch to STANDBY.

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
Al A2 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 spectrum analyzer 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.

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.

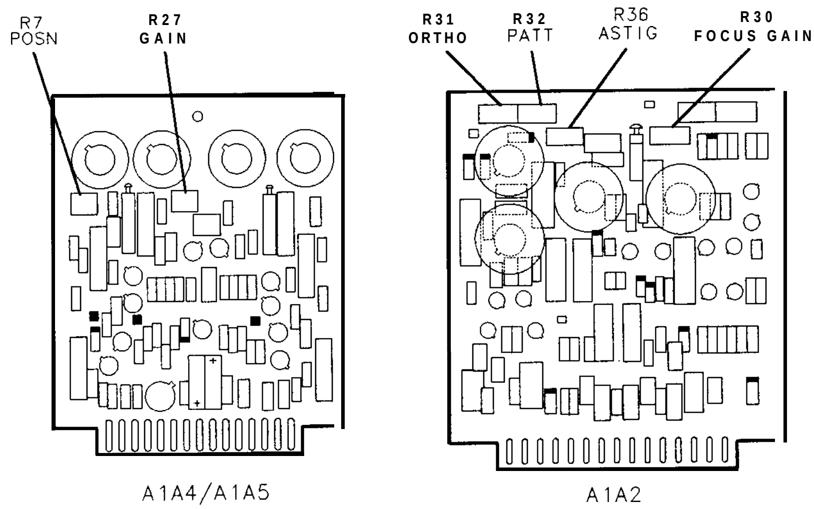


**Figure 3-30.**
**Location of Final Display Adjustments on A1A2, A1A4, and A1A5**

# 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.

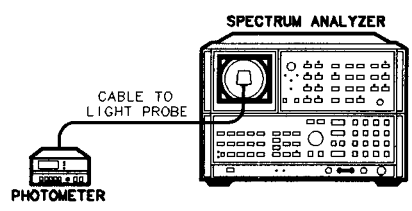


**Figure 3-31. Final Display Adjustments Setup**

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 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)

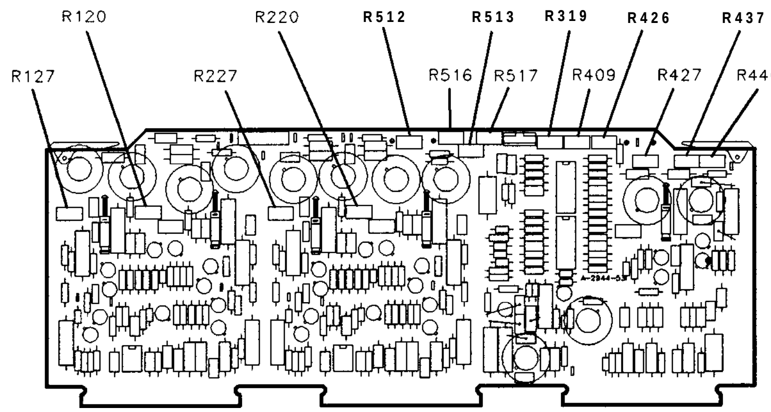


**Figure 3-32. Location of Final Display Adjustments on A1A2**

**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 |
| A1A2 R437 R/L FOC | centered |
| Al A2 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 (0--2.5 GHz), (REFERENCE LEVEL) and then adjust the reference level to bring the displayed noise to the top division of the graticule ((REFERENCE LEVEL)). Press (ENTER 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 SWEEP (SINGLE), (SHIFT) DISPLAY LINE (OFF)m, and then (SHIFT) THRESHOLD (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/m²).

**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 (foot-lamberts).

12. Set the spectrum analyzer 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.

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**

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.

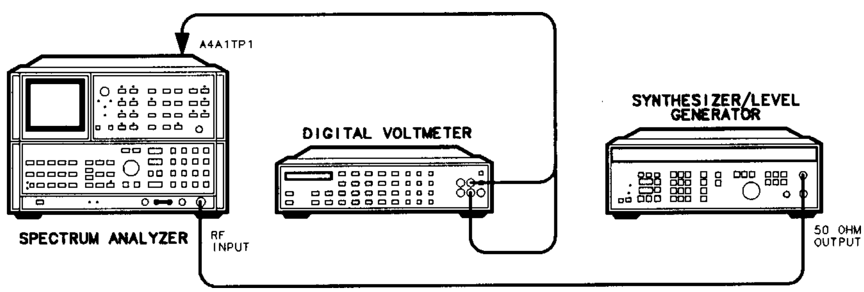


**Figure 3-33. Log Amplifier Adjustments Setup**

**Equipment**

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

## 5. Log Amplifier Adjustments

### Procedure

1. Position the spectrum analyzer upright as shown in Figure 3-33. Remove the IF-Display section top cover.
2. Set spectrum analyzer LINE switch to ON and press (2-22 GHz).

### Offset Adjustment Check

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 provides a 50Ω load to the spectrum analyzer RF INPUT.
5. Check A4A2R79 ZERO for a DVM indication of 0.0000 f0.0005 V dc. See Figure 3-34 for location of adjustment. If A4A2R79 ZERO requires adjustment, perform Adjustment Procedure 6, “Video Processor Adjustment” before continuing.

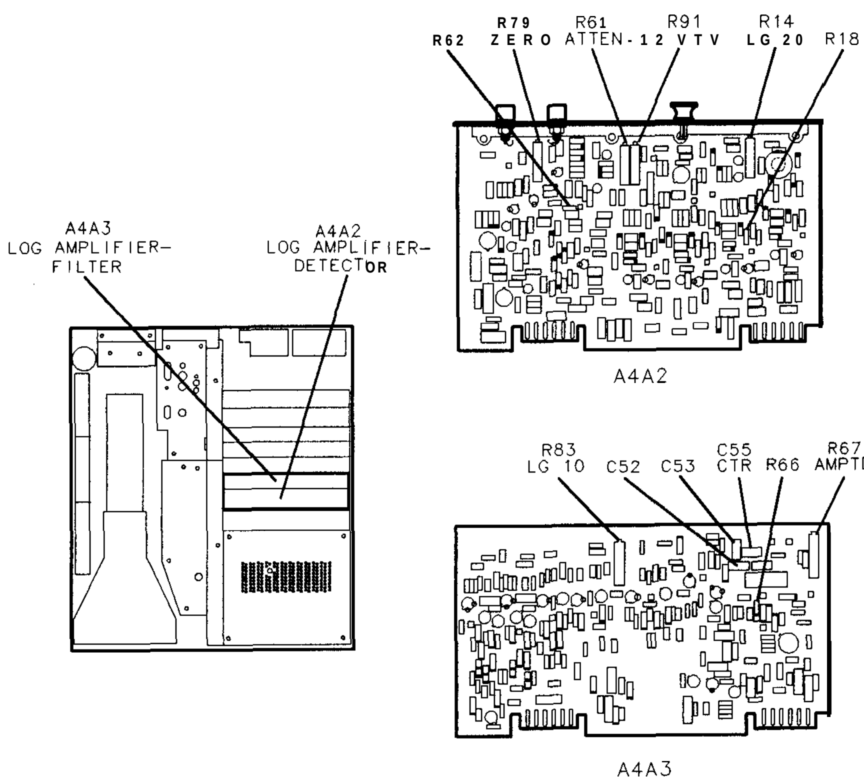


**Figure 3-34. Location of Log Amplifier Adjustments**

### Bandpass Filter Center Adjustment

6. Press LOG (CENTER 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 jumper 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 f0.0005 V dc with A4A3TP7 jumpered to A4A3TP8, and with A4A3TP7 and A4A3TP8 not jumpered. Remove the jumper.

### −12 VTV and ATTEN Adjustments

13. Press the LIN pushbutton.
14. Adjust frequency synthesizer output level for DVM indication of + 1.000 f0.0002 V dc, and note the frequency synthesizer amplitude setting.

    Frequency Synthesizer output level: ________ dBm
15. Press LOG [ENTER dB/DIV).
16. Wait three minutes for the A4A3 Log Amplifier-Filter and A4A2 Log Amplifier Detector 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 fO.OO01 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 the 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) (ENTER dB/DIV) q. This disables the IF step gains.
23. Decrease the frequency synthesizer output level 10 dB. Press (REFERENCE LEVEL) 0 dBm, and adjust the frequency synthesizer output level for a DVM indication of + 1.00 f.OO1 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 fO.O1O 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 fO.O1O 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 (2-22 GHz) to reenable the IF step gains.

# 6. Video Processor Adjustments

**Reference**

IF-Display Section
A4A1 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 A4A2R79 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 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.

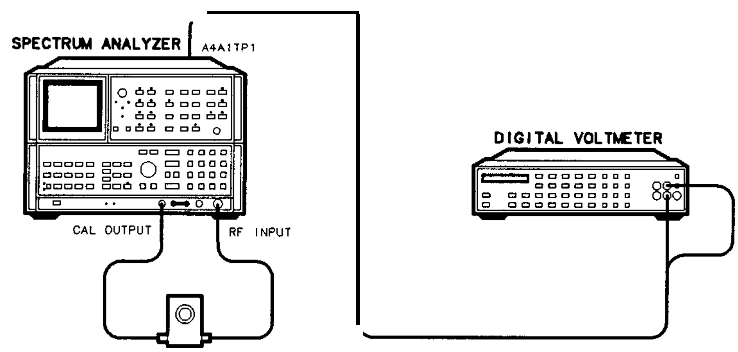


**Figure 3-35. Video Processor Adjustments Setup**

**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 the A4A1 Video Processor to warm up at least one-half hour prior to adjustment.

**Procedure**

1. Position the spectrum analyzer upright as shown in Figure 3-35. Remove the IF-Display Section top cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).
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] 100 MHz and [FREQUENCY SPAN] 0 Hz. Press the LIN pushbutton.

6. Set step attenuator to 120 dB. DVM indication should be 0.0000 f0.0005 V dc. If DVM indication is out of tolerance, adjust A4A2R79 ZERO on A4A2 Log Amplifier-Detector. See Figure 3-34 for the adjustment location.
7. Set the step attenuator to 0 dB.
8. Key in (REFERENCE LEVEL) and adjust DATA knob, and then the front panel AMPTD CAL control, for DVM indication as close to + 1.000 fO.OO1 Vdc as possible.
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.

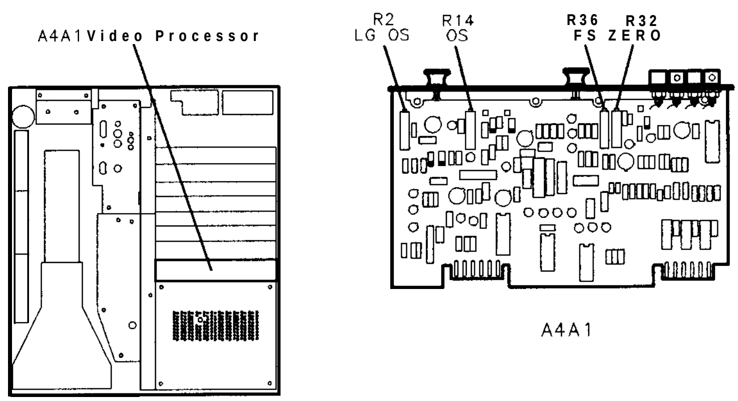


**Figure 3-36. Location of Video Processor Adjustments**

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 fO.OO1 Vdc.
14. Set the step attenuator to 0 dB.
15. Adjust A4A1R36 FS for DVM indication of +2.000 ± 0.001 Vdc.
16. Repeat steps 12 through 15 until no further adjustments are required.

## 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 Vdc.

________ Vdc

20. Decrease reference level to -60 dBm using the step key.
21. Adjust A4A1R2 LG OS for DVM indication of +0.100 fO.OO1 Vdc 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 no further adjustments are required.

## 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 is 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 3-109 or 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.

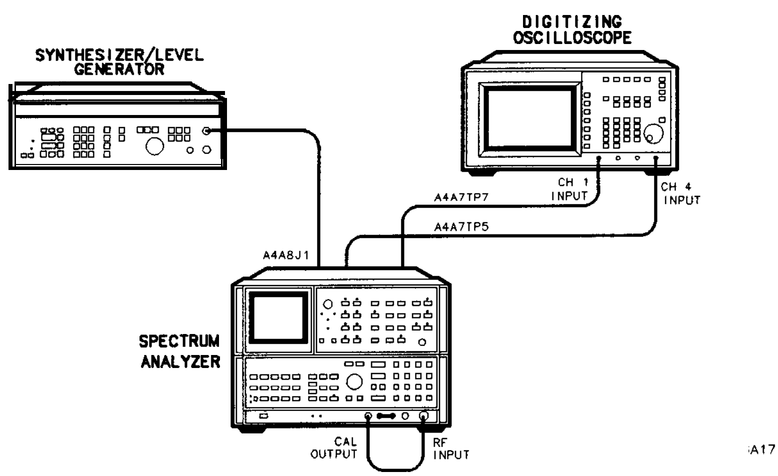


**Figure 3-37. 3 MHz Bandwidth Filter Adjustments Setup**

## Equipment

10:1 Divider Probe, 10 MΩ/7.5 pF (*2* required). ........... HP 10432A
Frequency Synthesizer ...................................... HP3335A
Oscilloscope ............................................... HP 54501A
Crystal Filter Bypass Network (4 *required)* ......... See Figure 3-109
Test Cable: BNC to SMB snap-on .................... HP 85680-60093

## Procedure

1. Position the spectrum analyzer upright as shown in Figure 3-37 and remove the IF-Display Section top cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).

## 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) 100 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 A4A7 3 MHz Bandwidth Filter Assembly connect crystal filter bypass networks between the two test points above C41 SYM, C32 SYM, C23 SYM, and Cl4 SYM. See Figure 3-38 for the location of A4A7 3MHz Bandwidth filter.
8. Adjust A4A7C7 CTR for minimum amplitude of the displayed signal peak. Adjust A4A7C6 SYM for best symmetry of the displayed signal. Repeat adjustments to ensure that the displayed 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 spectrum analyzer frequency span to adjust the bandpass symmetry and centering for each filter stage.

## 7. 3 MHz Bandwidth Filter Adjustments

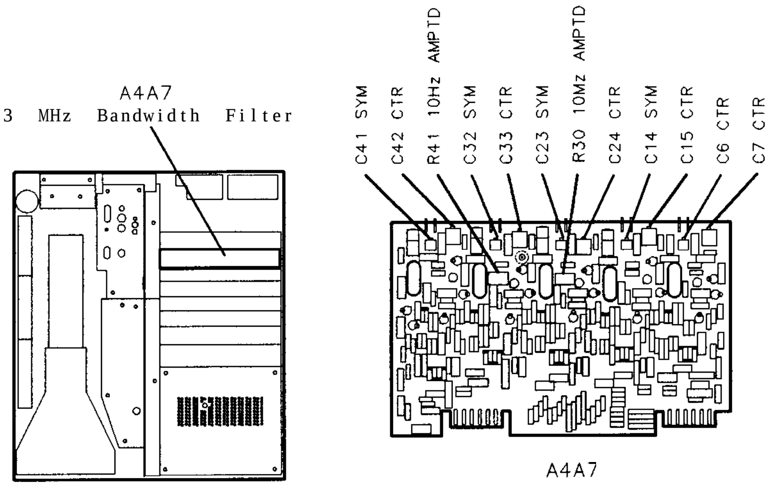


**Figure 3-38.**
**Location of Center, Symmetry, and 10 Hz Amplitude Adjustments**

9. Remove crystal filter bypass network near Cl4 SYM.
10. Adjust A4A7C15 CTR for minimum amplitude of the displayed signal peak. Adjust A4A7C14 SYM for best symmetry of the displayed signal. 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 the displayed signal peak. Adjust A4A7C23 SYM for best symmetry of the displayed 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 the displayed signal peak. Adjust A4A7C32 SYM for best symmetry of the displayed 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 the displayed signal peak. Adjust A4A7C41 SYM for best symmetry of the displayed 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, repeat steps 3 through 16 to readjust each filter stage.

## Filter Peak Adjust

**Note**

The adjustment ranges of A4A7C13 PK, A4A7C22 PK, A4A7C31 PK, and A4A7C40 PK are all indirectly affected by factory-select components A4A7C93 and A4A7C5. A4A7C93 and A4A7C5 set the peak frequency for the first 3 MHz filter pole, setting the reference for peaking the amplitudes of the remaining 4 poles. In the following steps, decrease or increase the value of A4A7C93 and A4A7C5 as necessary only if adjustments A4A7C13 PK, A4A7C22 PK, A4A7C31 PK, and A4A7C40 PK are all near the same end of their adjustment range (fully meshed, maximum capacitance, or unmeshed, minimum capacitance). If the adjustable capacitors are fully meshed, decrease the value of A4A7C93.

18. Press (2-22 GHz).
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:

Press (CHAN)
- Channel 1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .on
- probe . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .10:1
- amplitude scale . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .50 mV/div
- coupling . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ac
- Channel 4 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on
- probe . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10:1
- amplitude scale . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50 mV/div
- coupling . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . ac

Press (TRIG)
- EDGE TRIGGER . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . auto, edge
- source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . Channel 1

Press (TIME)
- time scale . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 200 ns/div

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

Press (SHOW)

23. Connect the oscilloscope channel 1 probe to A4A7TP7 (left side of Cl4 SYM) and the channel 4 probe to A4A7TP5 (left side of C23 SYM).
24. Adjust the frequency synthesizer output frequency for maximum peak-to-peak signal on the oscilloscope channel 1 display.
25. Adjust A4A7C13 PK for maximum peak-to-peak signal on channel 4 display. See Figure 3-39 for location of adjustment. If unable to achieve 1 "peak" in signal amplitude, increase or decrease value of A4A7C12. Refer to Table 3-3 for range of values.

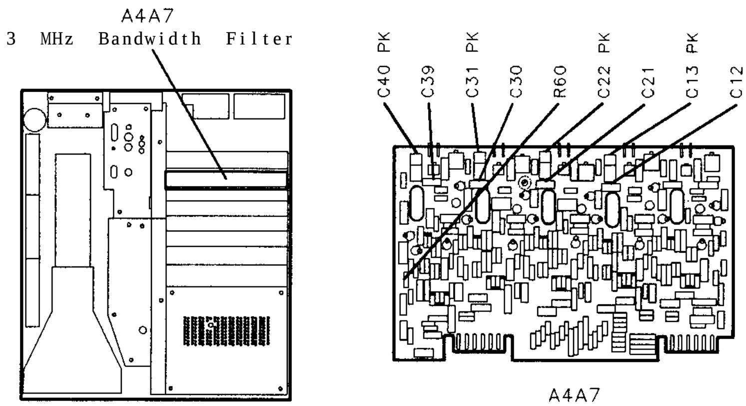


**Figure 3-39. Location of 3 MHz Peak Adjustments**

26. Move the oscilloscope channel 4 probe to A4A7TP3 (left side of C32 SYM).
27. Adjust frequency synthesizer output frequency to peak the oscilloscope channel 1 display.
28. Adjust A4A7C22 PK for maximum peak-to-peak signal on channel 4 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 the oscilloscope channel 4 probe to A4A7TP1 (left side of C41 SYM).
30. Adjust frequency synthesizer output frequency to peak the oscilloscope channel 1 display.
31. Adjust A4A7C31 PK for maximum peak-to-peak signal on the oscilloscope channel 4 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 the oscilloscope channel 4 probe from A4A7TP1.
33. Adjust frequency synthesizer output frequency to peak the oscilloscope channel 1 display.
34. On the spectrum analyzer, adjust (REFERENCE LEVEL) using step keys to place signal near top CRT graticule line.
35. Adjust A4A7C40 PK for maximum signal amplitude on the spectrum analyzer 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 the oscilloscope channel 1 probe from A4A7TP7. Disconnect frequency synthesizer output from A4A8J1 and reconnect cable 97 (white/violet) to A4A8J1.

## 10 Hz Amplitude Adjustments

37. Connect CAL OUTPUT to RF INPUT. Key in (2-22 GHz), (RECALL) 9, (RES BW) 10 Hz.
38. Adjust the spectrum analyzer front panel FREQ ZERO control for maximum signal amplitude on the CRT display.
39. Key in (RES BW) 1 **kHz** and DISPLAY LINE (ENTER). Using the DATA knob, place the display line at the signal trace.
40. Key in (RES BW) 10 Hz.
41. Adjust the spectrum analyzer 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.

**Note**

Factory-select component **A4A7R60** sets the overall gain of the **A4A7** 3 MHz Bandwidth Filter, and is selected as required in Adjustment Procedure 10, "Step Gain and 18.4 MHz Local Oscillator Adjustments." This procedure should be performed if the **A4A7** 3 MHz Bandwidth Filter or the **A4A5** Step Gain Assembly is replaced or repaired.

**Note**

The remaining adjustments and selection of factory-select components for the **A4A7** 3 MHz Bandwidth Filter are performed in Adjustment Procedure 9, "3-dB Bandwidth Adjustments. " This procedure should be performed if the **A4A7** 3 MHz Bandwidth Filter is replaced or repaired.

## 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.

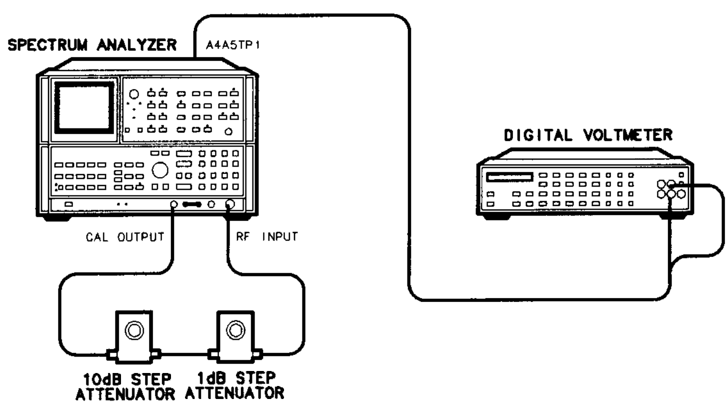


**Figure 3-40. 21.4 MHz Bandwidth Filter Adjustments Setup**

### Equipment

Digital Voltmeter (DVM) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A
10 dB Step Attenuator . . . . . . . . . . . . . . . . . . . . . . . . HP 355D, Option H89
1 dB Step Attenuator . . . . . . . . . . . . . . . . . . HP 3556, Option H25
Crystal Filter Bypass Network *(2 required)* . . Refer to Figure 3-109

### Procedure

1. Position the spectrum analyzer upright as shown in Figure Figure 3-40 and remove the IF-Display Section cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).

### + 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 not within tolerance, perform Adjustment Procedure 10, "Step Gain and 18.4 MHz Local Oscillator Adjustments," before continuing.

### A4A4 LC Adjustments

5. Connect spectrum analyzer CAL OUTPUT to RF INPUT through 1 dB and 10 dB step attenuators, as shown in Figure 3-40. Set step attenuators to 0 dB.
6. Disconnect cable 97 (white/violet) from A4A8J1 and connect to cable A4A6J 1.
7. Key in (CENTER FREQ) 100 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 approximately 2 divisions down from top CRT graticule line.
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.

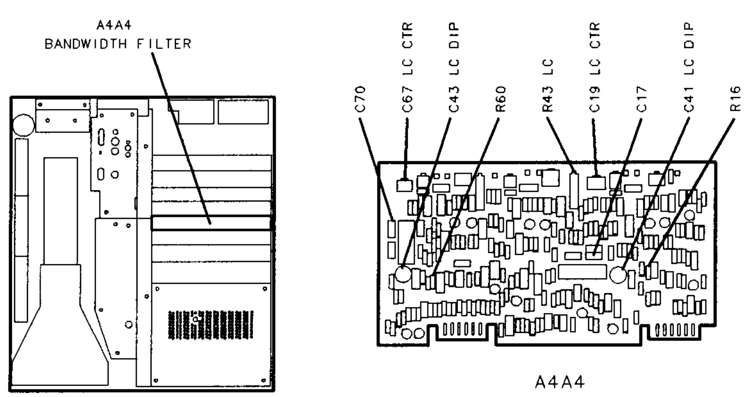


**Figure 3-41.**
**Location of A4A4 21.4 MHz LC Filter Adjustments**

10. Key in (RES BW) 1 MHz, and (SPAN) 2 MHz, MARKER (PEAK SEARCH), MARKER (Δ).

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

## A4A4 XTAL Adjustments

14. Key in MARKER [OFF] [RES BW] 30 **kHz** and [FREQUENCY SPAN] 100 **kHz**.
15. Press [REFERENCE LEVEL] and adjust DATA knob to set signal peak approximately 2 divisions down from the top CRT graticule line.
16. Connect crystal filter bypass networks between **A4A4TP1** and **A4A4TP2** and between **A4A4TP4** and **A4A4TP5.**
17. 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.

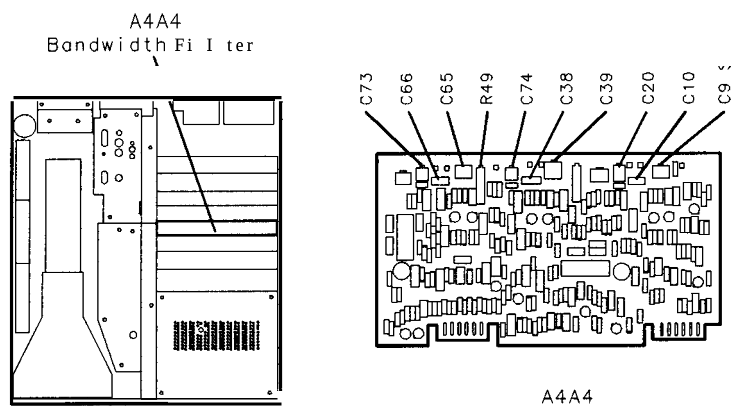


**Figure 3-42.**
**Location of A4A4 21.4 MHz Crystal Filter Adjustments**

18. Remove crystal filter bypass network from between **A4A4TP4** and **A4A4TP5.**
19. 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.
20. Remove crystal filter bypass network from between **A4A4TP1** and **A4A4TP2.**
21. 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.

22. All crystal filter bypass networks are removed. Signal should be centered and symmetrical. If not, go back to step 14 and repeat adjustments.
23. Press MARKER [PEAK SEARCH] and MARKER [Δ].
24. Key in [FREQUENCY SPAN] 20 kHz, [RES BW] 3 kHz, and MARKER [PEAK SEARCH].
25. Adjust A4A4R49 XTAL to align markers on display. MARKER Δ level should indicate 1.00 X. See Figure 3-42 for location of adjustment.

## A4A8 LC Adjustments

26. Disconnect cable 97 (white/violet) from A4A6J1 and reconnect cable to A4A8J1. Reconnect cable 89 (gray/white) to A4A6J1.
27. Key in [RES BW] 100 kHz and [FREQUENCY SPAN] 200 kHz.
28. Press [REFERENCE LEVEL] and adjust DATA knob to place signal peak approximately two divisions down from the top graticule line.
29. 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.

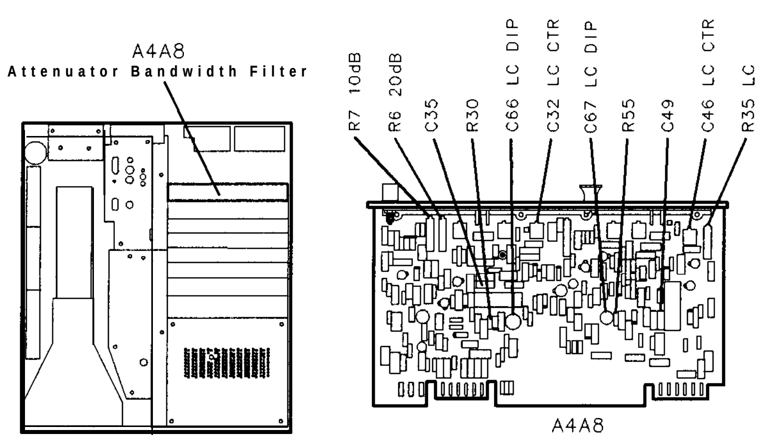


**Figure 3-43.**
**Location of A4A8 21.4 MHz LC Filter and Attenuation Adjustments**

30. Key in [RES BW] 1 MHz and [FREQ SPAN] 2 MHz, MARKER [PEAK SEARCH] and MARKER [Δ].
31. Key in [RES BW] 100 kHz, [FREQ SPAN] 200 kHz, and MARKER [PEAK SEARCH].

32. Adjust **A4A8R35** LC to align markers on display. MARKER A level should indicate 1.00 X. See Figure 3-43 for location of adjustment.
33. Repeat steps 30 through 32 until no further adjustment is necessary.

## A4A8 XTAL Adjustments

34. Key in (RES BW) 30 **kHz,** [FREQUENCY SPAN) 100 **kHz** MARKER (OFF).
35. Press (REFERENCE LEVEL) and adjust DATA knob to set signal peak approximately 2 divisions down from top CRT graticule line.
36. Connect crystal filter bypass network between **A4A8TP1** and **A4A8TP2.**
37. 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.

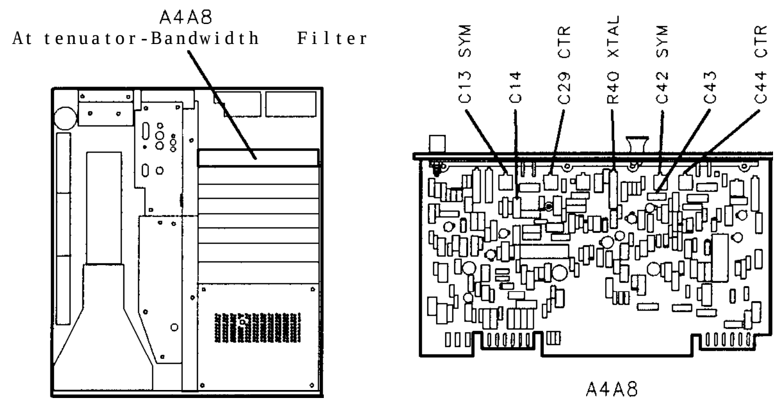


**Figure 3-44.**
**Location of A4A8 21.4 MHz Crystal Filter Adjustments**

38. Remove crystal filter bypass network from between **A4A8TP1** and **A4A8TP2.**
39. 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.
40. Key in (FREQUENCY SPAN) 10 **kHz,** MARKER [PEAK SEARCH), and MARKER (Δ)
41. Key in (RES BW) 3 **kHz** and MARKER [PEAK SEARCH).
42. Adjust **A4A8R40** XTAL to align markers on display. MARKER A level should indicate 1.00 X. See Figure 3-44 for location of adjustment.

## A10 dB and A20 dB Adjustments

43. Connect CAL OUTPUT to RF INPUT through 1 dB and 10 dB step attenuators. Set step attenuators to 25 dB.
44. Key in (CENTER FREQUENCY) 100 MHz, (FREQUENCY SPAN) 3 kHz, (ATTEN) 0 dB, (RES BW) 1 kHz, (REFERENCE LEVEL) -30 dBm.
45. Key in LOG (ENTER dB/DIV) 1 dB, MARKER [al
46. Key in (REFERENCE LEVEL) -20 dBm. Set step attenuators to 15 dB.
47. Adjust A4A8R7 A10dB to align markers on display. MARKER A level should indicate 0.00 dB. See Figure 3-43 for location of adjustment.
48. Key in [REFERENCE LEVEL] -10 dBm. Set step attenuators to 5 dB.
49. Adjust A4A8R6 A20dB to align markers on display. MARKER A level should indicate 0.00 dB. See Figure 3-43 for location of adjustment.
50. Refer to Performance Test 5, "Resolution Bandwidth Switching Uncertainty Test", and check the amplitudes of resolution bandwidths from 1 kHz through 3 MHz. If the amplitude of the 300 kHz resolution bandwidth is more than 0.3 dB low relative to the 100 kHz and 1 MHz resolution bandwidths, perform steps 51 through 71, LC Dip Adjustments.

    If the amplitudes of the 3 kHz, 10 kHz, and 30 kHz resolution bandwidths are not within ±0.4 dB of the amplitude of the 1 MHz resolution bandwidth, perform steps 1 through 12 (Bandpass Filter Adjustments) of Adjustment Procedure 5, "Log Amplifier Adjustments" and then check the amplitudes of the resolution bandwidths from 3 kHz through 3 MHz again. If the amplitudes of the 3 kHz, 10 kHz, and 30 kHz resolution bandwidths are still not within f0.4 dB of the 1 MHz resolution bandwidth, change the value of factory-select component A4A4R35 or A4A4R3. An increase of one standard value of A4A4R35 decreases the amplitudes of the 100 kHz through 3 MHz resolution bandwidths by approximately 0.15 dB. An increase of one standard value of A4A4R3 decreases the amplitudes of the 3 kHz through 30 kHz resolution bandwidths by approximately 0.05 dB.

    If the amplitudes of the 3 kHz through 3 MHz resolution bandwidths are not within ±0.4 dB of the amplitude of the 1 kHz resolution bandwidth, perform Adjustment Procedure 7, "3 MHz Bandwidth Filter Adjustments," and Adjustment Procedure 11, "Down/Up Converter Adjustments."

## LC Dip Adjustments

51. Set spectrum analyzer LINE switch to STANDBY.
52. Disconnect cable 97 (white/violet) from A4A8J1 and connect cable to A4A6J1.
53. Remove A4A4 Bandwidth Filter and install on 2 extender boards.
54. Set spectrum analyzer LINE switch to ON. Press (2-22 GHz).
55. Key in (CENTER FREQUENCY) 100 MHz, (RES BW) 100 kHz, (FREQUENCY SPAN) 1 MHz, (ATTEN) 0 dB, LOG (ENTER dB/DIV) 2 dB.
56. Set step attenuators to 0 dB. Short A4A4TP3 to ground.

57. Adjust A4A4C41 LC DIP for minimum amplitude of signal peak. See Figure 3-41 for location of adjustment. Key in MARKER (PEAK SEARCH), MARKER (Δ), and then press MARKER (PEAK SEARCH) and re-adjust LC DIP to offset the signal peak approximately -17 kHz (to the left). This is done to compensate for operating the A4A4 Bandwidth Filter on extender boards. If unable to achieve a "dip" in signal amplitude, increase or decrease value of A4A4R16. Refer to Table 3-3 for range of values.
58. Remove short from A4A4TP3 and short A4A4TP8 to ground.
59. Adjust A4A4C43 LC DIP for minimum amplitude of signal peak. See Figure 3-41 for location of adjustment. Key in MARKER (PEAK SEARCH] MARKER (Δ), and then press MARKER (PEAK SEARCH] and re-adjust LC DIP 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.
60. Set spectrum analyzer LINE switch to STANDBY.
61. Reinstall A4A4 Bandwidth Filter without extender boards. 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.
62. Set spectrum analyzer LINE switch to ON. Press (2-22 GHz).
63. Key in (CENTER FREQUENCY) 100 MHz, (RES BW) 100 kHz, (FREQUENCY SPAN) 1 MHz, (ATTEN) 0 dB, LOG (ENTER dB/DIV) 2 dB.
64. Short A4A8TP6 to ground.
65. Adjust A4A8C66 LC DIP for minimum amplitude of signal peak. See Figure 3-43 for location of adjustment. Key in MARKER (PEAK SEARCH) MARKER (Δ), and then press MARKER (PEAK SEARCH) and re-adjust LC DIP 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.
66. Remove short from A4A8TP6 and short A4A8TP3 to ground.
67. Adjust A4A8C67 LC DIP for minimum amplitude of signal peak. See Figure 3-43 for location of adjustment. Key in MARKER (PEAK SEARCH) MARKER [a, and then press MARKER (PEAK SEARCH) and re-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.
68. Set spectrum analyzer LINE switch to STANDBY.
69. Reinstall A4A8 Attenuator-Bandwidth Filter without extender boards. Remove short from A4A8TP3.
70. Set spectrum analyzer LINE switch to ON. Press (2-22 GHz).
71. Repeat LC adjustments for both the A4A4 Bandwidth filter (steps 5 through 13) and the A4A8 Attenuator-Bandwidth Filter (steps 26 through 33).

## 9. 3 dB Bandwidth Adjustments

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

### Reference

IF-Display Section
A4A9 IF Control

### Related Performance Test

Resolution Bandwidth Accuracy Test

### Description

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

### Equipment

No test equipment is required for this adjustment.

### Procedure

1. Position the spectrum analyzer upright and remove the IF-Display Section top cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).
3. Connect the spectrum analyzer CAL OUTPUT to the RF INPUT.
4. On the spectrum analyzer, key in the following settings:

   (CENTER FREQUENCY) .................................... 100 MHz
   (FREQUENCY SPAN) .......................................... 3 MHz
   (RES BW) .................................................. 3 MHz
   SCALE ...................................................... LIN

5. On the spectrum analyzer, key in (SHIFT) RES BW A [AUTO], (REFERENCE LEVEL) and use the DATA knob to position the signal peak near the reference level (top graticule line).
6. On the spectrum analyzer, key in (PEAK SEARCH), MARKER (Δ), and press (⇩) several times to position the second marker at the leftmost graticule line.
7. Adjust A4A9R60 3 MHz for a MARKER A indication of -3.00 dB ±0.05 dB. See Figure 3-45 for location of adjustment.
8. On the spectrum analyzer, press (⇧) several times to position the second marker at the rightmost graticule line. Then, press (STOP FREQ) and use the DATA knob to adjust the centering of the displayed signal for a MARKER A indication of -3.00 dB ±0.05 dB.

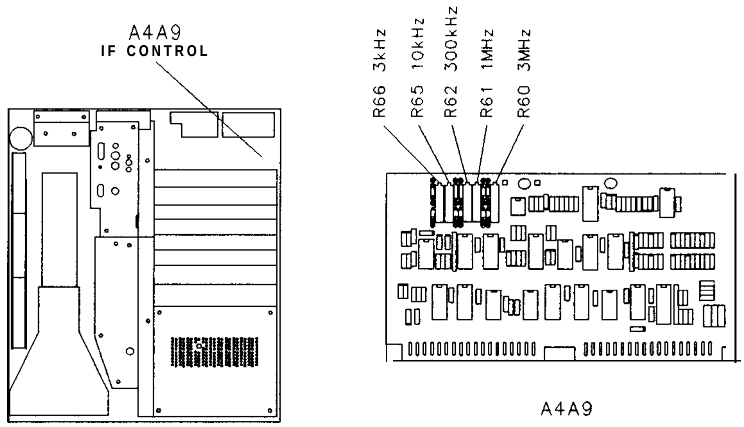


**Figure 3-45. Location of 3 dB Bandwidth Adjustments**

9. On the spectrum analyzer, key in [FREQUENCY SPAN] 3 MHz, MARKER (OFF), [PEAK SEARCH], MARKER [Δ], and press [⇓] several times to position the second marker at the leftmost graticule line.
10. Readjust **A4A9R60** 3 MHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
11. Repeat steps 8 through 10 as necessary until no further adjustment is required.
12. On the spectrum analyzer, key in the following settings:

| | |
|---|---|
| [CENTER FREQUENCY] | 100 MHZ |
| [FREQUENCY SPAN] | 1 MHz |
| [RES BW] | 1 MHz |

13. On the spectrum analyzer, press [REFERENCE LEVEL] and use the DATA knob to position the signal peak near the reference level (top graticule line).
14. On the spectrum analyzer, key in [PEAK SEARCH], MARKER [Δ], and press [⇓] several times to position the second marker at the leftmost graticule line.
15. Adjust **A4A9R61** 1 MHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
16. On the spectrum analyzer, press [⇑] several times to position the second marker at the rightmost graticule line. Then, press [STOP FREQ] and use the DATA knob to adjust the centering of the displayed signal for a MARKER Δ indication of -3.00 dB f0.05 dB.
17. On the spectrum analyzer, key in [FREQUENCY SPAN] 1 MHz, MARKER [OFF], [PEAK SEARCH], MARKER la], and press [⇓] several times to position the second marker at the leftmost graticule line.
18. Readjust **A4A9R61** 1 MHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
19. Repeat steps 16 through 18 as necessary until no further adjustment is required.

20. On the spectrum analyzer, key in the following settings:

    (CENTER FREQUENCY) .................................... 100 MHz
    (FREQUENCY SPAN) ........................................ 300 kHz
    (RES BW) ................................................ 300 kHz

21. On the spectrum analyzer, press (REFERENCE LEVEL) and use the DATA knob to position the signal peak near the reference level (top graticule line).

22. On the spectrum analyzer, key in (PEAK SEARCH), MARKER (Δ), and press (⇩) several times to position the second marker at the leftmost graticule line.

23. Adjust **A4A9R62** 300 **kHz** for a MARKER A indication of -3.00 **dB** f0.05 **dB**.

24. On the spectrum analyzer, press (⇧) several times to position the second marker at the rightmost graticule line. Then, press (STOP FREQ) and use the DATA knob to adjust the centering of the displayed signal for a MARKER A indication of -3.00 **dB** f0.05 **dB**.

25. On the spectrum analyzer, key in (FREQUENCY SPAN) 300 **kHz**, MARKER (OFF), (PEAK SEARCH), MARKER (Δ), and press (⇩) several times to position the second marker at the leftmost graticule line.

26. Readjust **A4A9R62** 300 **kHz** for a MARKER A indication of -3.00 **dB** f0.05 **dB**.

27. Repeat steps 24 through 26 as necessary until no further adjustment is required.

---

**Note** The 100 **kHz 3-dB** bandwidth is set with factory-select components **A4A8R30**, **A4A8R55**, **A4A4R16**, and **A4A4R60**. If it is necessary to increase the 100 **kHz 3-dB** bandwidth, increase the value of one or more of these factory-select components. The 30 **kHz 3-dB** bandwidth is set with factory-select components **A4A8R26**, **A4A8R52**, **A4A4R20**, **A4A4R40**, and **A4A4R64**. If it is necessary to increase the 30 **kHz 3-dB** bandwidth, decrease the value of one or more of these **factory**-select components. Refer to **Table** 3-3 for the acceptable range of values for **A4A8R30**, **A4A8R55**, **A4A4R16**, **A4A4R60**, **A4A8R26**, **A4A8R52**, **A4A4R20**, **A4A4R40**, and **A4A4R64**, and to Table 3-4 for HP part numbers.

---

28. On the spectrum analyzer, key in the following settings:

    (CENTER FREQUENCY) .................................... 100 MHZ
    (FREQUENCY SPAN) ........................................ 10 kHz
    (RES BW) ................................................ 10 kHz

29. On the spectrum analyzer, press (REFERENCE LEVEL) and use the DATA knob to position the signal peak near the reference level (top graticule line).

30. On the spectrum analyzer, key in (PEAK SEARCH), MARKER (a, and press (⇩) several times to position the second marker at the leftmost graticule line.

31. Adjust A4A9R65 10 kHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
32. On the spectrum analyzer, press ⇧ several times to position the second marker at the rightmost graticule line. Then, press (STOP FREQ) and use the DATA knob to adjust the centering of the displayed signal for a MARKER Δ indication of -3.00 dB ±0.05 dB.
33. On the spectrum analyzer, key in (FREQUENCY SPAN) 10 kHz, MARKER (OFF), (PEAK SEARCH), MARKER (Δ), and press ⇩ several times to position the second marker at the leftmost graticule line.
34. Readjust A4A9R65 10 kHz for a MARKER (Δ) indication of -3.00 dB ±0.05 dB.
35. Repeat steps 32 through 34 as necessary until no further adjustment is required.
36. On the spectrum analyzer, key in the following settings:

| | |
|---|---|
| (CENTER FREQUENCY) | 100 MHZ |
| (FREQUENCY SPAN) | 3 kHz |
| (RES BW) | .3 kHz |

37. On the spectrum analyzer, press (REFERENCE LEVEL) and use the DATA knob to position the signal peak near the reference level (top graticule line).
38. On the spectrum analyzer, key in (PEAK SEARCH), MARKER (Δ), and press ⇩ several times to position the second marker at the leftmost graticule line.
39. Adjust A4A9R66 3 kHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
40. On the spectrum analyzer, press ⇧ several times to position the second marker at the rightmost graticule line. Then, press (STOP FREQ) and use the DATA knob to adjust the centering of the displayed signal for a MARKER Δ indication of -3.00 dB ±0.05 dB.
41. On the spectrum analyzer, key in (FREQUENCY SPAN) 3 kHz, MARKER (OFF), (PEAK SEARCH), MARKER (Δ), and press ⇩ several times to position the second marker at the leftmost graticule line.
42. Readjust A4A9R66 3 kHz for a MARKER Δ indication of -3.00 dB ±0.05 dB.
43. Repeat steps 40 through 42 as necessary until no further adjustment is required.

**Note** The 1 kHz 3-dB bandwidth is set with factory-select components A4A7R12/A4A7R13, A4A7R23/A4A7R24, A4A7R34/A4A7R35, A4A7R45/A4A7R46, and A4A7R56/A4A7R57. If it is necessary to increase the 1 kHz 3-dB bandwidth, increase the value of one or more pairs of these factory-select components. The 300 Hz, 100 Hz, 30 Hz, and 10 Hz 3-dB bandwidths are set with factory-select components A4A7R66, A4A7R68, A4A7R70, A4A7R72, A4A7R74, A4A7R76, A4A7R78, A4A7R80, A4A7R82, A4A7R84, A4A7R86, A4A7R88, A4A7R90, A4A7R92, A4A7R94, A4A7R96, A4A7R98, A4A7R100, A4A7R102, and A4A7R104. If it is necessary to increase one of these 3-dB bandwidths, increase the value of one or more of these factory-select components. Refer to Table 3-3 for the acceptable range of values for A4A7R12/A4A7R13, A4A7R23/A4A7R24, A4A7R34/A4A7R35, A4A7R45/A4A7R46, A4A7R56/A4A7R57, A4A7R66, A4A7R68, A4A7R70, A4A7R72, A4A7R74, A4A7R76, A4A7R78, A4A7R80, A4A7R82, A4A7R84, A4A7R86, A4A7R88, A4A7R90, A4A7R92, A4A7R94, A4A7R96, A4A7R98, A4A7R100, A4A7R102, and A4A7R104, and to Table 3-4 for HP part numbers.

# 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.

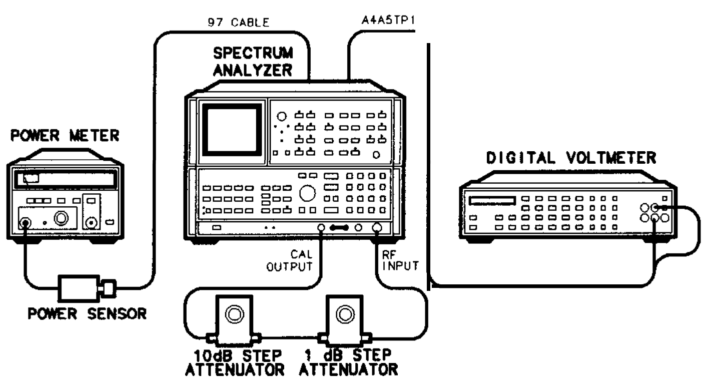


**Figure 3-46.**
**Step Gain and 18.4 MHz Local Oscillator Adjustments Setup**

## 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

**Note** Adjustment A4A5R33 CAL sets the gain of the A4A5 Step Gain Assembly with no gain steps enabled. Perform Adjustment Procedure 5, "Log Amplifier Adjustments," (steps 1-12) Adjustment Procedure 6, "Video Processor Adjustments, " Adjustment Procedure 8, "2 1.4 MHz Bandwidth Filter Adjustments," and Adjustment Procedure 23, "Track and Hold Adjustments" to ensure that the signal level at the top CRT graticule line is properly set before adjusting A4A5R33 CAL.

1. Position the spectrum analyzer upright as shown in Figure Figure 3-46 and remove the IF-Display Section top cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).
3. Connect the spectrum analyzer CAL OUTPUT to the RF INPUT.
4. On the spectrum analyzer, key in (RECALL) 8 and adjust the front panel AMPTD CAL control for a displayed signal level of -10.00 dBm.
5. On the spectrum analyzer, key in (RECALL) 9 and adjust the front panel FREQ ZERO control for maximum amplitude of the displayed signal trace.

### + 10 V Temperature Compensation Supply Adjustment

6. Connect DVM to A4A5TP1 (+ 10VF).
7. If DVM indication is between +9 V dc and 10.0 V dc, no adjustment is required.
8. If DVM indication is not within tolerance of step 5, adjust A4A5R2 + 10V ADJ for DVM indication of +9.5 fO.l 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.

### IF Gain Adjustment

9. Key in (CENTER FREQUENCY) 100 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.
10. Disconnect cable 97 (white/violet) from A4A8J1 and connect cable to the calibrated power meter/power sensor. Refer to Figure 3-47 for location of cable 97 and A4A8J1.
11. Adjust front-panel AMPTD CAL adjustment for a power meter indication of -5 dBm.
12. Disconnect power meter and reconnect cable 97 to A4A8J1.
13. Press LIN pushbutton and MARKER (NORMAL).

14. Note MARKER amplitude in mV and adjust A4A5R33 CAL to 70.7 mV (top CRT graticule line). See Figure 3-47 for location of adjustment.

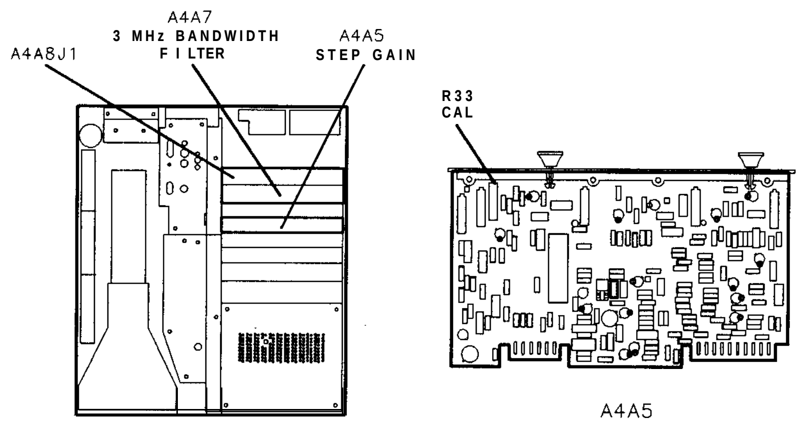


**Figure 3-47. Location of IF Gain Adjustment**

15. 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

16. Connect CAL OUTPUT to RF INPUT through 10 dB step attenuator and 1 dB step attenuator.
17. Key in LOG (CENTER dB/DIV) 1 dB, (VIDEO BW) 3 Hz, and (REFERENCE LEVEL) -30 dBm.
18. Set step attenuators to 25 dB.
19. 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.
20. Key in (REFERENCE LEVEL) -40 dBm. Set step attenuators to 35 dB.
21. 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.

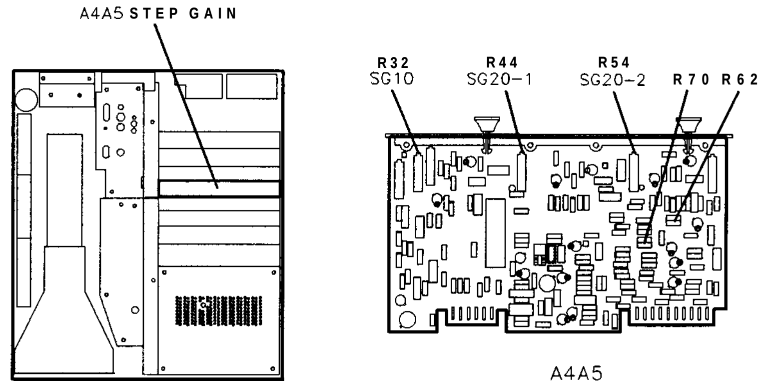


**Figure 3-48. Location of 10 dB Gain Step Adjustments**

22. If A4A5R32 SG10 adjustment does not have sufficient range to perform adjustment in step 19, 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 9 through 21 if the value of A4A7R60 is changed.
23. Key in [REFERENCE LEVEL] -50 dBm. Set step attenuators to 45 dB.
24. Adjust A4A5R44 SG20-1 for MKR A level of .OO dB. See Figure 3-48 for location of adjustment.
25. Key in [REFERENCE LEVEL] -70 dBm. Set step attenuators to 65 dB.
26. Adjust A4A5R54 SG20-2 for MKR A level of .OO dB. See Figure 3-48 for location of adjustment.

## 1 dB Gain Step Checks

27. Key in [REFERENCE LEVEL] -19.9 dBm. Set step attenuators to 15 dB. Press MARKER [Δ] twice to establish a new reference.
28. Key in [REFERENCE LEVEL] -17.9 dBm. Set step attenuators to 13 dB.
29. MKR A level, as indicated by CRT annotation, should be .OO ±0.05 dB. If not, increase or decrease the value of A4A5R86. Refer to Table 3-3 for range of values.
30. Key in [REFERENCE LEVEL] -15.9 dBm. Set step attenuators to 11 dB.
31. MKR A level should be .OO f0.05 dB. If not, increase or decrease the value of A4A5R70. Refer to Table 3-3 for range of values.
32. Key in [REFERENCE LEVEL] -11.9 dBm. Set step attenuators to 7 dB.
33. MKR A level should be .00 ±0.05 dB. If not, increase or decrease the value of A4A5R62. Refer to Table 3-3 for range of values.

## 0.1 dB Gain Step Adjustment

34. 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.
35. Key in (REFERENCE LEVEL] -18.0 dBm. Set step attenuators to 11 dB.
36. Adjust A4A5R51 VR for MKR A level of +0.10 dB. See Figure 3-49 for location of adjustment.
37. Remove all test equipment from the spectrum analyzer. Connect CAL OUTPUT to RF INPUT.

## 18.4 MHz Local Oscillator Adjustment

38. Press (2-22 GHz) and (RECALL) (9).
39. Set front-panel FREQ ZERO control to midrange.
40. Adjust A4A5C10 FREQ ZERO to peak signal trace on CRT. See Figure 3-49 for location of adjustment.

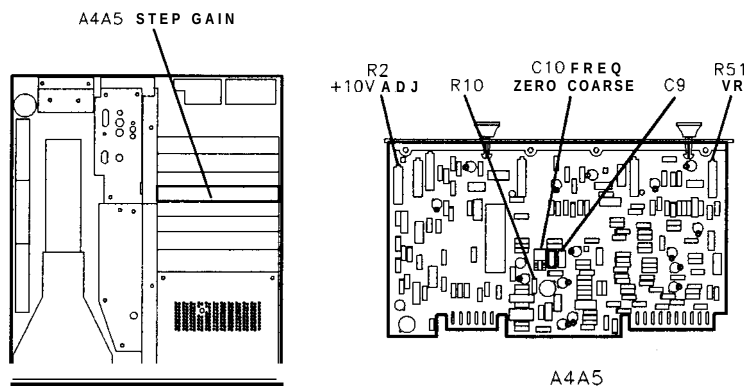


**Figure 3-49.
Location of .1 dB Gain Step, 18.4 MHz LO, and + 10V Adjustments**

41. Key in (FREQUENCY SPAN] 1 kHz, (RES BW) 100 Hz, and (PEAK SEARCH] [a.
42. Adjust front-panel FREQ ZERO control fully clockwise. Press (PEAK SEARCH]. Signal should move at least 60 Hz away from center CRT graticule line.
43. Adjust front-panel FREQ ZERO control fully counterclockwise. Press (PEAK SEARCH). Signal should move at least 60 Hz away from center CRT graticule line.
44. 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.
45. Press (2-22 GHz) and (RECALL) (9).
46. Adjust front panel FREQ ZERO for maximum amplitude of the displayed signal trace.

**Note**

Factory-select component A4A7R60 affects the adjustment of A4A6A1R29 WIDE GAIN. If the value of A4A7R60 is changed, perform Adjustment Procedure 11, "Down/Up Converter Adjustments".

## 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 spectrum analyzer 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.

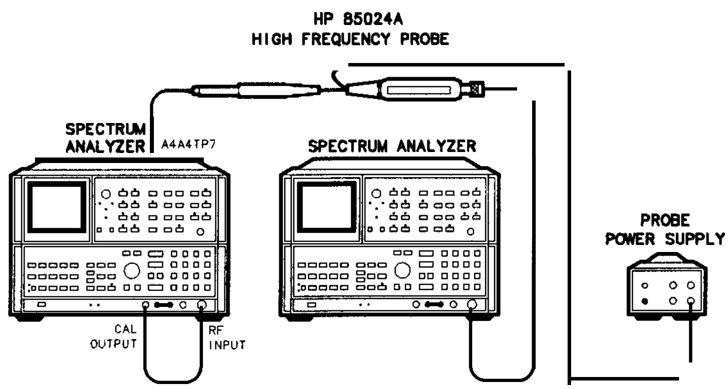


**Figure 3-50. Down/Up Converter Adjustments Setup**

**Equipment**

Spectrum Analyzer ........................................ HP 8566B
Active Probe ............................................. HP 85024A
Probe Power Supply ....................................... HP 1122A

**Procedure**

**Note**

Adjustment A4A6A1R29 WIDE GAIN adjusts the amplitude of the 21.4 MHz Bandwidth Filters (3 kHz through 3 MHz) relative to the amplitude of the 3 MHz Bandwidth Filters (1 kHz through 10 Hz). Perform Adjustment Procedure 6, “Log Amplifier Adjustments,” (steps 1-12) Adjustment Procedure 8, “21.4 MHz Bandwidth Filter Adjustments,” and Adjustment Procedure 7, “3 MHz Bandwidth Filter Adjustments” to ensure that the amplitudes of the bandwidth filters are optimized before adjusting A4A6A1R29 WIDE GAIN (steps 14-17).

**Note**

The adjustment of A4A6A1R29 WIDE GAIN is affected by factory-select component A4A7R60, which sets the overall gain of the A4A7 3 MHz Bandwidth Filter Assembly. If the A4A7 3 MHz Bandwidth Filter Assembly or the A4A5 Step Gain Assembly is repaired or replaced, perform Adjustment Procedure 10, “Step Gain and 18.4 MHz Local Oscillator Adjustments” to select (if necessary) A4A7R60 before adjusting A4A6A1R29 WIDE GAIN (steps 14-17).

1. Position the spectrum analyzer upright as shown in Figure 3-50 and remove the IF-Display Section top cover.
2. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).
3. Connect the spectrum analyzer CAL OUTPUT to the RF INPUT.
4. On the spectrum analyzer, key in [RECALL-] 8 and adjust the front-panel AMPTD CAL control for a displayed signal level of -10.00 dBm.
5. On the spectrum analyzer, key in (RECALL) 9 and adjust the front-panel FREQ ZERO control for maximum amplitude of the displayed signal.

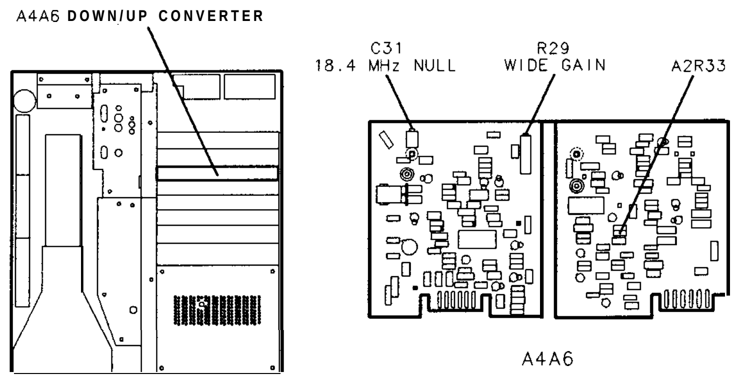


**Figure 3-51. Location of Down/Up Converter Adjustments**

## Down Converter Gain Adjustment

**Note**

Perform steps 6 through 15 if the A4A6 Down/Up Converter Assembly has been repaired, or if factory-select component A4A7R60 has insufficient adjustment range. Otherwise, skip to step 17.

6. Set the spectrum analyzer LINE switch to STANDBY. Remove A4A6 Down/Up Converter Assembly from the IF-Display Section and install on two extender boards.
7. Set the spectrum analyzer LINE switch to ON, and key in (2-22 GHz), (CENTER FREQUENCY) 100 MHz, (FREQUENCY SPAN) 0 Hz, (RES BW) 1 kHz, (REFERENCE LEVEL) -10 dBm.
8. Connect the active probe to the probe power supply and the RF INPUT of the second spectrum analyzer, as shown in Figure 3-50. On the second spectrum analyzer, key in (2-22 GHz),

(CENTER FREQUENCY) 21.4 MHz, (FREQUENCY SPAN) 50 kHz, (RES BW) 10 kHz, [REFERENCE LEVEL) -30 dBm.

9. Connect the tip of the active probe to A4A6A2TP4. On the second spectrum analyzer, press [REFERENCE LEVEL] and use the DATA knob to position the peak of the displayed 2 1.4 MHz signal near the top CRT graticule line.
10. On the second spectrum analyzer, key in (LOG dB/DIV) 2 dB, MARKER (PEAK SEARCH] and record the level of the displayed 21.4 MHz signal:

    Signal level at A4A6A2TP4: ____________dBm
11. On the second spectrum analyzer, key in MARKER [a], (CENTER FREQUENCY] 3 MHZ.
12. Connect the tip of the active probe to A4A6A2P1-9. On the second spectrum analyzer, key in MARKER [PEAK SEARCH] and record the level of the displayed 3 MHz signal:

    Signal level at A4A6A2P1-9: ____________dB
13. The 3 MHz signal level at A4A6A2P1-9 measured in step 12 should be 10.0 dB f0.6 dB lower than the 21.4 MHz signal level at A4A6A2TP4 measured in step 10. If not, change the value of factory-select resistor A4A6A2R33. A 10% decrease in the value of A4A6A2R33 increases the signal level at A4A6A2P1-9 by approximately 0.6 dB. Refer to Table 3-3 for the acceptable range of values for A4A6A2R33 and to Table 3-4 for HP part numbers.
14. Set the spectrum analyzer LINE switch to STANDBY.
15. Remove A4A6 Down/Up Converter Assembly from the two extender boards and reinstall in the IF-Display Section.

### 21.4 MHz Gain

16. Set the spectrum analyzer LINE switch to ON and press (2-22 GHz).
17. On the spectrum analyzer, key in [CENTER FREQUENCY) 100 MHz, (FREQUENCY SPAN) 10 kHz, (RES BW) 1 kHz, [REFERENCE LEVEL) -7 dBm, and press the LIN pushbutton.
18. On the spectrum analyzer, key in MARKER (PEAK SEARCH), MARKER (Δ), (RES BW) 1 MHz.
19. Adjust A4A6A1R29 WIDE GAIN for a MKR A indication of 1.00 X, aligning the two markers on the CRT display. See Figure 3-51 for the adjustment location.

### 18.4 MHz Null Adjustment

20. Disconnect the spectrum analyzer CAL OUTPUT from the RF INPUT.
21. On the spectrum analyzer, key in (REFERENCE LEVEL) -70 dBm, (RES BW) 1 kHz, MARKER (OFF).
22. On the second spectrum analyzer, key in (2-22 GHz), [START FREQ) 5 MHz, (STOP FREQ) 50 MHz, (RES BW) 100 kHz.

23. Connect the tip of the active probe to **A4A4TP7,** and adjust **A4A6A1C31** 18.4 MHz NULL for minimum amplitudes of the displayed 18.4 MHz and 36.8 MHz signals on the second spectrum analyzer. The level of the displayed 18.4 MHz signal should be below -10 dBm.

    If **A4A6A1C31** has insufficient adjustment range, increase the **value** of factory-select resistor **A4A5R10**. See Figure 3-49 for the location of **A4A5R10**. Refer to **Table** 3-3 for the acceptable range of values for **A4A5R10** and to **Table** 3-4 for HP part numbers.

## 12. 10 MHz Standard Adjustment (SN 2637A and Below)

**Reference**

RF-Section:
A22 10 MHz Frequency Standard
A22A2 Frequency Standard Regulator

**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.

**Equipment**

Frequency Standard
*(10 MHz with aging rate of $<\pm 1X10^{-10}$)* . . . . . . . . . . . . . . . . . HP 5061B
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 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 A22A1 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 A22 10 MHz Frequency Standard assembly whenever line power is applied to the RF Section. This allows the A22 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 A22 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 A22 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 A22 10 MHz Frequency Standard to stabilize.

**Note** ‘lb prolong CRT life, press (SHIFT) (CLEAR-WRITE) g to turn off the CRT display while the spectrum analyzer is unattended, and (SHIFT) (MAX HOLD) h to turn the CRT back on.

3. Connect the (Cesium Beam) Frequency Standard to the Frequency Counter rear-panel TIMEBASE IN/OUT connector as shown in Figure 3-52.

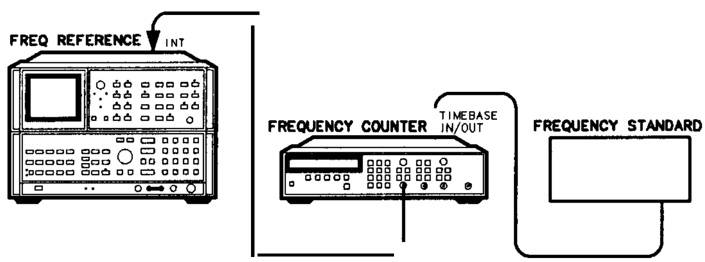


**Figure 3-52. 10 MHz Frequency Standard Adjustments Setup**

4. 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.

5. Set the Frequency Counter controls as follows:

FUNCTION/DATA .................................... FREQ A
INPUT A:
  x10 ATTN ............................................ OFF
  AC ................................ OFF (DC coupled)
  50Ω Z ...................OFF (1 MΩ input impedance)
  AUTO TRIG ........................................ ON
  100 kHz FILTER A ............................. OFF
INT/EXT switch (rear panel) ..................... EXT

6. On the Frequency Counter, select a 10 second gate time by pressing (GATE TIME) 10 (GATE). 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 (A22 10 MHz Frequency Standard) and 10.0 MHz with a displayed resolution of 1 mHz (0.001 Hz).

7. Wait at least two gate periods for the Frequency Counter to settle, and record the frequency of the A22 10 MHz Frequency Standard as reading #1 .

Reading # 1: ________ mHz

8. Allow the spectrum analyzer to remain powered (not in STANDBY) and undisturbed for an additional 24 hours.

9. Repeat steps 3 through 7 and record the frequency of the A22 10 MHz Frequency Standard as reading #2.

Reading #2: ________ mHz

10. If the difference between reading #2 and reading #1 is greater than 1 mHz, the A22 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 ( $1 \times 10^{-9}$/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

Reading # 11: ________ mHz

11. Position the spectrum analyzer on its right side as shown in Figure 3-52, and remove the bottom cover. Typically, the frequency of the A22 10 MHz Frequency Standard will shift slightly when the spectrum analyzer is reoriented. Record this shifted frequency of the A22 10 MHz Frequency Standard.

Reading # 11: ________ mHz

12. 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 A22 10 MHz Frequency Standard.

Frequency Correction Factor: ________ mHz

13. 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).

14. Remove the two adjustment cover screws from the A22 10 MHz Frequency Standard. Refer to Figure 3-53 for the location of the A22 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.

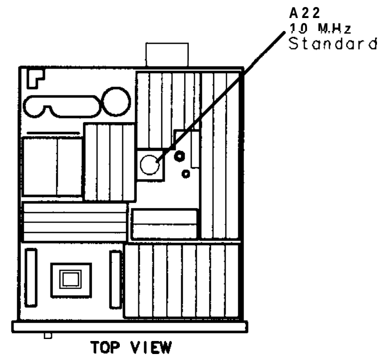


**Figure 3-53. Location of 10 MHz Standard Adjustments**

15. Use a nonconductive adjustment tool to adjust the 16-turn FINE frequency adjustment on the A22 10 MHz Frequency Standard for a Frequency Counter indication of 0.00 Hz. If the FINE frequency adjustment has insufficient range, center the adjustment and then adjust the COARSE frequency adjustment for a Frequency Counter indication of 0.00 Hz.
16. 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).
17. Wait at least 2 gate periods for the Frequency Counter to settle, and then adjust the 16-turn FINE adjustment on the A22 10 MHz Frequency Standard for a stable Frequency Counter indication of (0.000 + Frequency Correction Factor) ±0.010 Hz.
18. Replace the two adjustment cover screws on the A22 10 MHz Frequency Standard.
19. Replace the RF Section bottom cover and reconnect the short jumper cable between the FREQ REFERENCE INT and EXT connectors.

## 12. 10 MHz Standard Adjustment (SN 2728A and Above)

**Reference**

RF-Section:
A22 10 MHz Frequency Standard
A22A1 Frequency Standard Regulator
A22A2 10 MHz Quartz Crystal Oscillator

**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.

**Equipment**

Frequency Standard
*(10 MHz with aging rate of $<\pm 1X10^{-10}$)* .................. .HP 5061B
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 to allow 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.

The A22A2 10 MHz Quartz Crystal Oscillator (HP P/N 10811-60111) will typically reach 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 A22 10 MHz Frequency Standard assembly whenever line power is applied to the RF Section. This allows the A22 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 A22 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 A22 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 A22 10 MHz Frequency Standard to stabilize.

**Note** To prolong CRT life, press (SHIFT) (CLEAR-WRITE) g to turn off the CRT display while the spectrum analyzer is unattended, and (SHIFT) (MAX HOLD) h to turn the CRT back on.

3. Connect the (Cesium Beam) Frequency Standard to the Frequency Counter rear-panel TIMEBASE IN/OUT connector as shown in Figure 3-54.

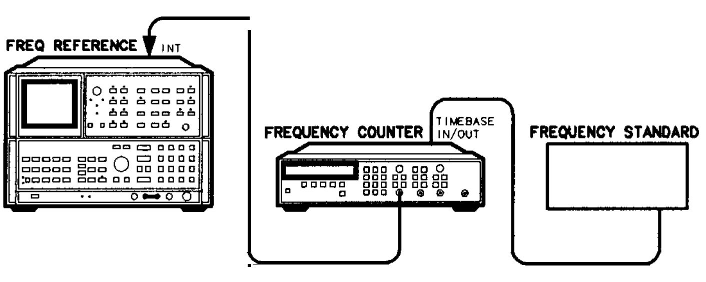


**Figure 3-54. 10 MHz Frequency Standard Adjustments Setup**

## 12. 10 MHz Standard Adjustment (SN 2728A and Above)

4. 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.

5. Set the Frequency Counter controls as follows

   FUNCTION/DATA .................................. FREQ A
   INPUT A:
   - x10 ATTN ................................................ OFF
   - AC ........................................ OFF (DC coupled)
   - 50Ω Z ............................ OFF (1 MΩ input impedance)
   - AUTO TRIG ............................................ ON
   - 100 kHz FILTER A ................................ OFF

   INT/EXT switch (rear panel) ................................ EXT

6. On the Frequency Counter, select a 10 second gate time by pressing (GATE TIME) 10 (GATE TIME). Offset the displayed frequency by – 10.0 MHz by pressing MATH (SELECT/ENTER) (CHS/EEX) 10 (CHS/EEX) 6 (SELECT/ENTER) (SELECT/ENTER). e Frequency Counter should now display the difference between the frequency of the INPUT A signal (A22 10 MHz Frequency Standard) and 10.0 MHz with a displayed resolution of 1 mHz (0.001 Hz).

7. Wait at least two gate periods for the Frequency Counter to settle, and record the frequency of the A22 10 MHz Frequency Standard as reading #1.

   Reading # 1: ________ mHz

---

**Note** The A22A2 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.

---

8. Allow the spectrum analyzer to remain powered (not in STANDBY) and undisturbed for an additional 24 hours.

9. Repeat steps 3 through 7 and record the frequency of the A22 10 MHz Frequency Standard as reading #2.

   Reading #2: ________ mHz

10. If the difference between reading #2 and reading #1 is greater than 1 mHz, the A22 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 ($1X10^{-9}$/day) is achieved.

Reading #3: ________ mHz

Reading #4: ________ mHz

Reading #5: ________ mHz

Reading #6: ________ mHz

Reading #7: ________ mHz

11. Position the spectrum analyzer on its right side as shown in Figure 3-54, and remove the bottom cover. Typically, the frequency of the A22 10 MHz Frequency Standard will shift slightly when the spectrum analyzer is reoriented. Record this shifted frequency of the A22 10 MHz Frequency Standard.

Reading #8: ________ mHz

12. 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 A22 10 MHz Frequency Standard.

Frequency Correction Factor: ________ mHz

13. 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.

14. Use a nonconductive adjustment tool to adjust the 18-turn FREQ ADJ capacitor on the A22A2 10 MHz Quartz Crystal Oscillator for a Frequency Counter indication of 0.00 Hz. Refer to Figure 3-55 for the location of the A22A2 10 MHz Quartz Crystal Oscillator.

## 12. 10 MHz Standard Adjustment (SN 2728A and Above)

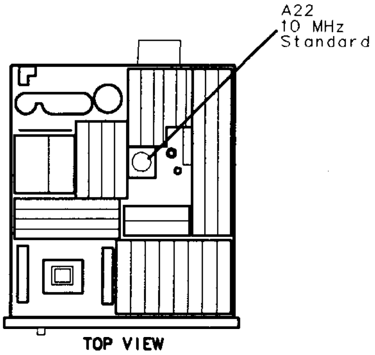


**Figure 3-55. Location of 10 MHz Standard Adjustments**

15. 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).
16. Wait at least 2 gate periods for the Frequency Counter to settle, and then adjust the FREQ ADJ capacitor on the A22A2 10 MHz Quartz Crystal Oscillator for a stable Frequency Counter indication of (0.000 + Frequency Correction Factor) f0.010 Hz.
17. Replace the RF Section bottom cover and reconnect the short jumper cable between the FREQ REFERENCE INT and EXT connectors.

# 13. Sweep, DAC, and Main Coil Driver Adjustments

## Reference

RF-Section:
- Al6 Scan Generator
- A19 Digital-to-Analog Converter (DAC)
- A20 Main Coil Driver

## Related Performance Tests

Center Frequency Readout Accuracy Test
Frequency Span Accuracy Test
Sweep Time Accuracy Test

## Description

The Sweep Time is adjusted first by viewing the Scan Ramp on an oscilloscope and adjusting for proper levels. Next, the AUX OUT Ramp (SWEEP RECORDER OUTPUT) is adjusted to produce a continuous stepped ramp over multi-band sweeps. Offset adjustments are performed on both the Al6 Scan Generator and A19 DAC Assemblies to set the start voltages of the various sweep and span ramps. The A20 Main Coil Driver Assembly is adjusted to set the two frequency end-points of the YIG-tuned oscillator. Finally, frequency span accuracy for YTO Spans (>5 MHz) is adjusted by adjusting the Sweep Attenuator gains on the Al6 Scan Generator Assembly and the 5.8 and 12.5 GHz Band Overlap adjustments on the A19 DAC Assembly.

**Note**

Adjustments in this procedure affect YTO/YTX tracking. Adjustment Procedure 2 1, "Frequency Response Adjustments" should be performed after this procedure to ensure specified performance.

## Equipment

Universal Counter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 5316A
Synthesized Sweeper . . . . . . . . . . . . . . . . . . . . . . . . . . . . .HP 8340A/B
Digitizing Oscilloscope . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 54501A
10:1 Divider Probe, 10 MHz/7.5 pF . . . . . . . . . . . . . . . . . . HP 10432A
Digital Voltmeter (DVM) . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3456A
Frequency Counter . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 5343A

**Adapters:**
Adapter, BNC (f) to SMA (m) . . . . . . . . . . . . . . . . . . . . . . HP 1250-1200

**Cables:**
Low-Loss Microwave Test Cable (APC 3.5) . . . . . . . . . . . HP 8120-4921

## Procedure

1. Position the spectrum analyzer on its right side as shown in Figure 3-56, with bottom cover removed. Remove RF Digital Section cover over the Al2 through Al6 assemblies. Jumper A12TP2 to A12TP3 (Lock Indicator Disable).

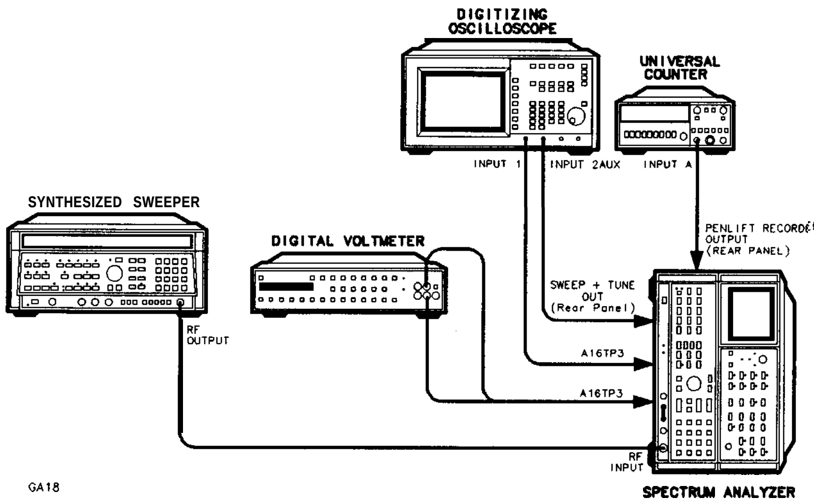


**Figure 3-56. Sweep and DAC Adjustments Setup**

2. Set the spectrum analyzer LINE switch to ON.
3. Key in (0--2.5 GHz), [SWEEP TIME] 500 ms.
4. Connect the oscilloscope channel 1 probe to A16TP3 (Scan Ramp). Connect rear panel SWEEP + TUNE OUT to the oscilloscope channel 2 input.
5. Set the oscilloscope controls as follows:

Press (CHAN)

Channel 1 .................................................. .on
probe .................................................. 10:1
amplitude scale ...................................... . V/div
offset ................................................ ..3.5 V
coupling .............................................. ..d c

Channel 2 .................................................. off

amplitude scale .................................. 500 mV/div
offset ................................................ ..-1.2 5
coupling .............................................. ..d c
probe .................................................. . 1:1

Press [TRIG)

EDGE TRIGGER ................................... auto, edge
source ........................................... ..Channel 2
level ..................................... 1.375 V, rising edge

Press (TIME BASE)

time Scale ........................................ . . 50 ms/div

Press (DISPLAY)

connect dots . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on

Press (SHOW)

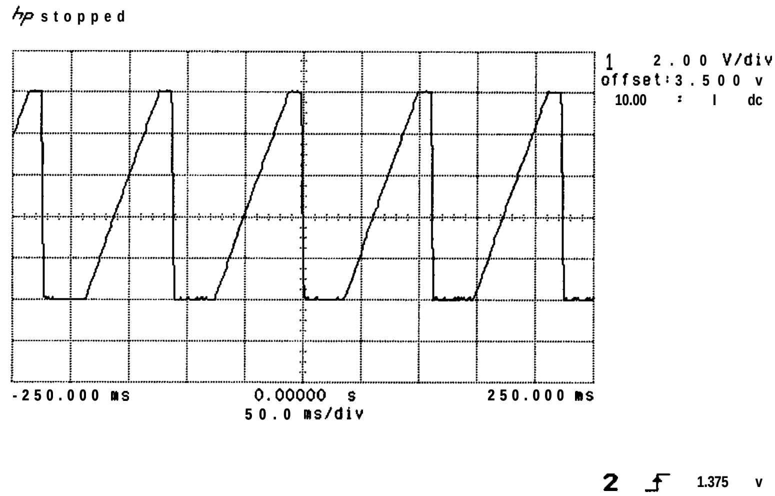


**Figure 3-57. OV to + 10V Sweep Ramp at A16TP3**

## Sweep Time Adjustment (Preferred Procedure)

6. Connect universal counter INPUT A to the spectrum analyzer rear panel PENLIFT RECORDER OUTPUT.
7. Set universal counter controls as follows:

Counter mode . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .TI A→B
FILTER NORM/100 kHz . . . . . . . . . . . . . . . . . . . . FILTER NORM
SEP/COM A . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . COM A
GATE TIME . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . fully ccw
Channel A/Channel B:
Trigger Slope (A) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .in (negative)
Trigger Slope (B) . . . . . . . . . . . . . . . . . . . . . . out (positive)
TRIGGER LEVEL/SENSITIVITY . . . . . . . . . . . . . . . . . . . . . . . . . . . out
AC/DC . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . DC
ATTEN X1/X20 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . X20

8. Adjust universal counter channel A and channel B TRIGGER LEVEL controls as necessary to trigger both channels on PENLIFT RECORDER OUTPUT signal.
9. Adjust A16R67 SWEEP TIME adjustment for counter time interval indication of 500 ±1 ms. See Figure 3-58 for the location of A16R67.

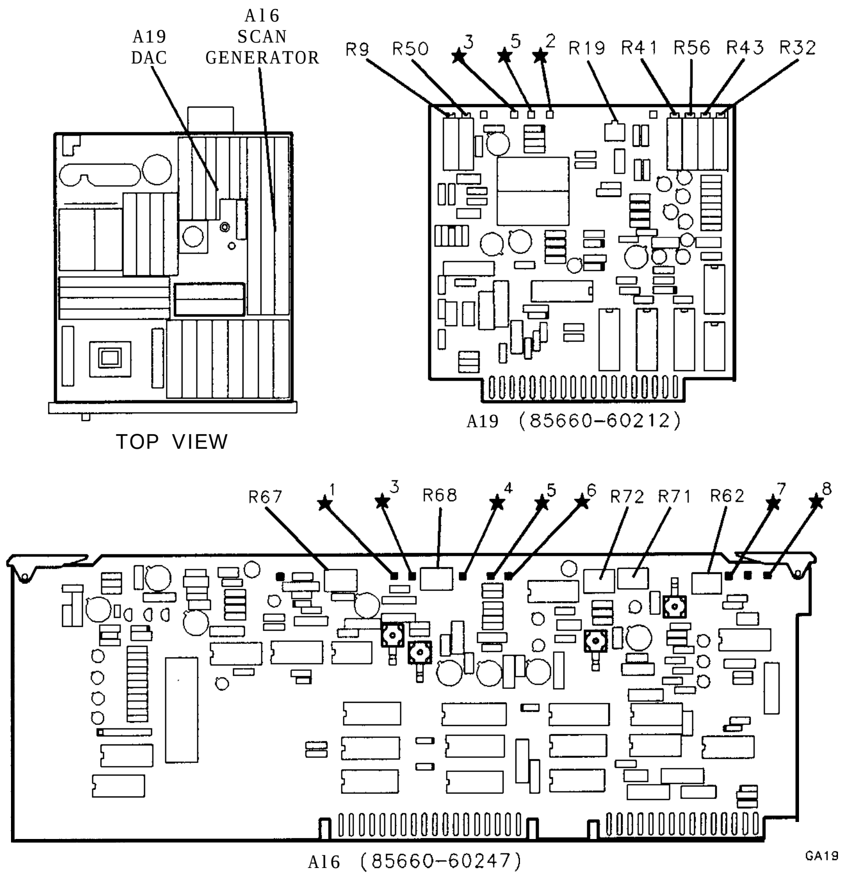


**Figure 3-58. Location of Sweep and DAC Adjustments**

### Sweep Time Adjustment (Alternate Procedure)

10. Adjust **A16R67** SWEEP TIME adjustment for sweep ramp of 500 ms duration (not including dead time at beginning and end of each ramp) as measured on the oscilloscope.

### Aux Out Adjustment

11. Press (2-22 GHz).
12. Connect the oscilloscope channel 1 to **A16TP4** (AUX OUT). Display should be a stepped series of 4 sweep ramps similar to that shown in Figure 3-59.

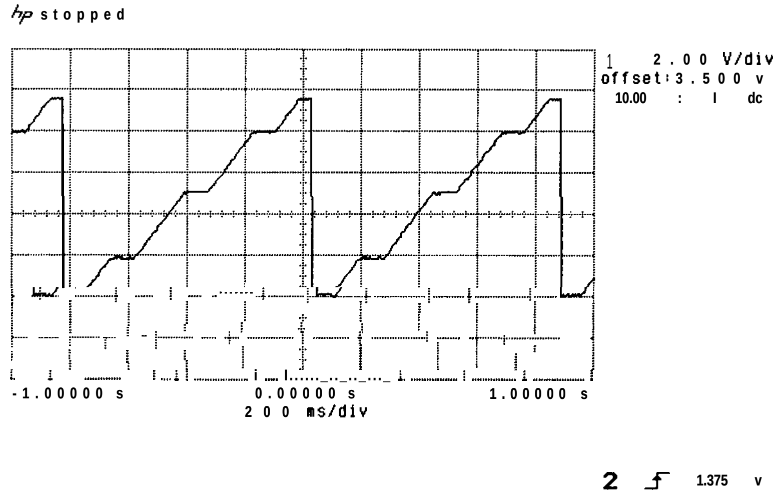


**Figure 3-59. Properly Adjusted DC Levels Between Sweep Ramps**

13. Adjust **A16R68** AUX adjustment to align dc level of 3 dead time steps with upper dc level of each preceding sweep ramp. Refer to Figure 3-59 and Figure 3-60 for typical display of proper and improper adjustment.

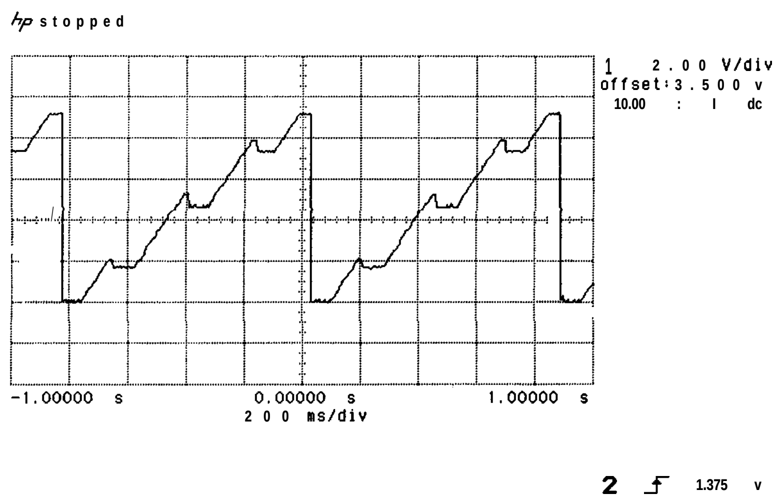


**Figure 3-60. Improperly Adjusted DC Levels Between Sweep Ramps**

14. Disconnect the oscilloscope (and universal counter) from the spectrum analyzer.

## Offset and YTO DAC Adjustments

15. Perform this step only if the Al6 Scan Generator is P/N 85660-60134 or 85660-60034. (HP 85660A/B with serial number prefix 2235A or below.)
    a. Connect DVM to A16TP3 and DVM ground to A16TP1 GND.
    b. Key in (2--22 GHz), SWEEP (SINGLE), (SHIFT) (RES BW)F (forces spectrum analyzer to reset Scan Ramp to 0 Vdc after each single sweep).
    c. Press SWEEP (SINGLE).
    d. After sweep has completed, adjust A16R74 Scan Reset OFFSET for stable DVM indication of 0.0000 f0.0005 Vdc.
    e. Repeat steps c through d until no further adjustment is necessary.
    f. Connect DVM to A16TP5 and DVM ground to A16TP6 GND.
    g. Key in (SHIFT) (RECALL)), [CENTER FREQUENCY) 4 GHz, (FREQUENCY SPAN) 2.4 GHz, [SAVE) 1, (FREQUENCY SPAN) 260 MHz, (SAVE) 2, (FREQUENCY SPAN) 240 MHz, (SAVE) 3, [FREQUENCY SPAN) 80 MHz, (SAVE) 4.
    h. Key in (RECALL) 1 and note stable DVM indication after sweep has completed.
    i. Key in (RECALL) 2 and note change in stable DVM indication from previous step.
    j. Adjust A16R75 Scan Width DAC OFFSET while alternating between (RECALL) 1 and (RECALL) 2 so that stable DVM indication varies less than 1 mVdc.
    k. Connect DVM to A16TP8 and DVM ground to A16TP7 GND.
    l. Key in (RECALL) 3 and note stable DVM indication after sweep has completed.
    m. Key in (RECALL) 4 and note change in stable DVM indication from previous step.
    n. Adjust A16R76 Integer Number Attenuator OFFSET while alternating between (RECALL) 3 and (RECALL) 4 so that stable DVM indication varies less than 1 mVdc.
16. Perform this step only if the Al6 Scan Generator is P/N 85660-60188, 85660-60198, or 85660-60247. (HP 85660A/B with serial number prefix 2240A or above.)
    a. Connect DVM to A16TP8 and DVM ground to A16TP7.
    b. Key in (2--22 GHz), SWEEP (SINGLE), (SHIFT) (RES BW)F (forces instrument to reset Scan Ramp to 0 Vdc after each single sweep).
    c. Press SWEEP (SINGLE).
    d. After sweep is completed, adjust A16R62 RAMP OFFSET for stable DVM indication of 0.0000 ±0.0005 Vdc.
    e. Repeat steps c through d until no further adjustment is necessary.

17. Perform this step only if the A19 Digital-to-Analog Converter is P/N 85660-60164 or 85660-60038. (HP 85660A/B with serial number prefix 2407A or below.)
    a. Connect DVM to A19TP2 and DVM ground to A19 GND.
    b. Key in (2--22 GHz), (SHIFT) (RECALL), SWEEP (SINGLE), (SHIFT) (RES BW), (START FREQ) 2.5 GHz, (STOP FREQ) 4.9 GHz, (SAVE) 1, (STOP FREQ) 2.51 GHz, (SAVE) 2, (STOP FREQ) 22 GHz, (SAVE) 3, (FREQUENCY SPAN) 0 HZ, (CENTER FREQUENCY) 2.0 GHz, (SAVE) 4, (CENTER FREQUENCY) 6.2 GHz, (SAVE) 5, (CENTER FREQUENCY) 2.3 GHz, (SAVE) 6.
    c. Key in (RECALL) 1 and note stable DVM indication after sweep has completed (approximately -7.5 Vdc).
    d. Key in (RECALL) 2 and note change in stable DVM indication from previous step.
    e. Adjust A19R19 Summing Amplifier OFFSET while alternating between (RECALL) 1 and (RECALL) 2 so that stable DVM indication varies less than 1 mVdc.
    f. Key in (RECALL) 1 and note stable DVM indication after sweep has completed.
    g. Key in (RECALL) 3 and note change in stable DVM indication from previous step.
    h. Adjust A19R41 25 GHz SPAN OFFSET while alternating between (RECALL) 1 and (RECALL) 3 so that stable DVM indication varies less than 3 mVdc.
    i. Key in (RECALL) 4 (to set YTO Pretune DAC to 0).
    j. After sweep has completed, adjust A19R5 DC for stable DVM indication of -6.0000 ±0.0005 Vdc.
    k. Key in (RECALL) 5 (to set YTO Pretune DAC to 4095).
    l. After sweep has completed, adjust A19R2 AV for stable DVM indication of -18.6000 ±0.0005 Vdc.
    m. Key in (RECALL) 6 (to set YTO Pretune DAC to 293).
    n. After sweep has completed, readjust A19R5 DC for stable DVM indication of -6.9010 ±0.0005 Vdc.
    o. Repeat steps k through n until no further adjustments are necessary.
18. Perform this step only if the A19 Digital-to-Analog Converter is P/N 85660-60212. (HP 85660A/B with serial number prefix 2409A and above.)
    a. Connect DVM to A19TP5 and DVM ground to A19TP3.
    b. Key in (2--22 GHz), (SHIFT) (RECALL), SWEEP (SINGLE), (SHIFT) (RES BW), (FREQUENCY SPAN) 0 HZ, (CENTER FREQUENCY) 2 GHz, (SAVE) 1, (CENTER FREQUENCY) 6.2 GHz, (SAVE) 2, (CENTER FREQUENCY) 2.3 GHz, (SAVE) 3, (START FREQ) 2.5 GHz, (STOP FREQ) 2.51 GHz, (SAVE) 4, (STOP FREQ) 5 GHz, (SAVE) 5, (STOP FREQ) 10 GHz, (SAVE) 6.

c. Key in (RECALL) 1 (to set YTO Pretune DAC to 0).

d. Adjust A19R50 for DVM indication of + 10.0000 f0.0005 Vdc.

e. Connect DVM to A19TP2 (DVM ground to A19TP3).

f. Key in (RECALL) 2 (to set YTO Pretune DAC to 4095).

g. After sweep has completed, adjust A19R9 for stable DVM indication of -18.6000 ±0.0005 Vdc.

h. Key in (RECALL) 3 (to set YTO Pretune DAC to 293).

i. After sweep has completed, adjust A19R19 Summing Amplifier OFFSET for a stable DVM indication of -6.9010 ±0.0005 Vdc.

j. Repeat steps f through i until no further adjustments are necessary.

k. Key in (RECALL) 4 and note stable DVM indication after sweep has completed.

l. Key in (RECALL) 5 and note change in stable DVM indication from previous step.

m. Adjust A19R56 2.5 GHz SPAN OFFSET while alternating between (RECALL) 4 and (RECALL) 5 so that stable DVM indication varies less than 1 mVdc.

n. Key in (RECALL) 4 and note stable DVM indication after sweep has completed.

o. Key in (RECALL) 6 and note change in stable DVM indication from previous step.

p. Adjust A19R41 25 GHz SPAN OFFSET while alternating between (RECALL) 4 and (RECALL) 6 so that stable DVM indication varies less than 1 mVdc.

## YTO Main Coil Driver Adjustments (Preferred Procedure)

19. Jumper A20TP5 GND to A21TP2 and disconnect DVM from A19TP2 and A19TP3.

20. Disconnect the cable 8 (grey) from All YTO Loop Assembly at A11J1 0 DET OUT.

21. Connect frequency counter to front-panel 1ST LO OUTPUT as shown in Figure 3-61.

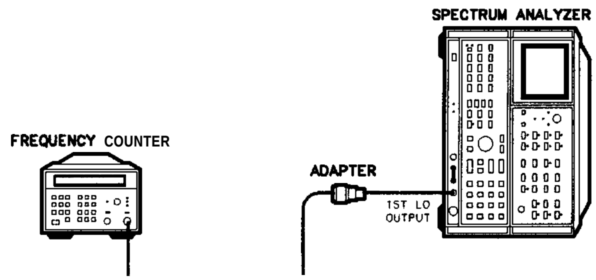


**Figure 3-61. YTO Main Coil Driver Adjustments Setup**

22. Key in (2--22 GHz), (SHIFT) (RECALL)), SWEEP (SINGLE), (SHIFT) (RES BW)F, (FREQUENCY SPAN) 0 Hz, (CENTER FREQUENCY) 2.3 GHz, (SAVE) 1, (CENTER FREQUENCY) 6.15 GHz, (SAVE) 2.
23. Key in (RECALL) 1.
24. Adjust A20R34 2.3 GHz adjustment for frequency counter indication of 2300.0 fO.l MHz, allowing time for frequency counter display to settle. Refer to Figure 3-62 for location of adjustments.

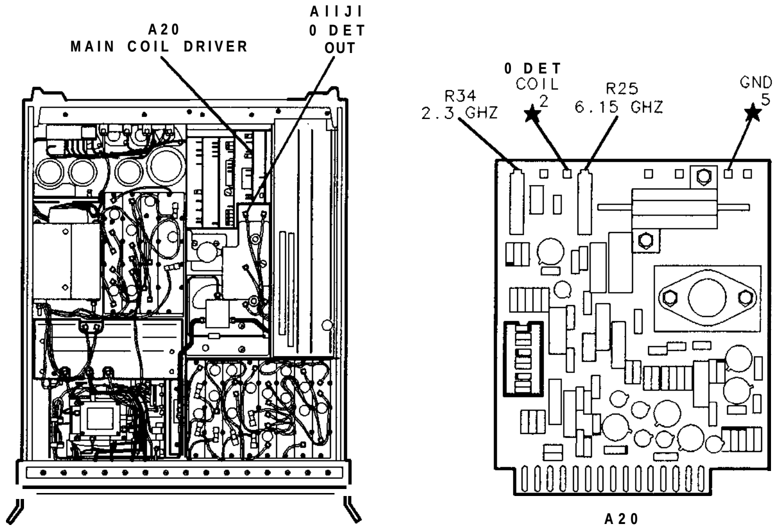


**Figure 3-62. Location of YTO Main Coil Driver Adjustments**

25. Key in (RECALL) 2.
26. Adjust A20R25 6.15 GHz adjustment for frequency counter indication of 6150.0 fO.l MHz, allowing time for frequency counter display to settle.
27. Repeat steps 23 through 26 several times until no further adjustments are necessary.
28. Remove jumpers from between A20TP5 and A21TP2 and between A12TP2 and A12TP3. Reconnect cable 8 (grey) to AllJl 0 DET OUT. Disconnect frequency counter from front-panel 1ST LO OUTPUT and reconnect 50Ω load.

## YTO Main Coil Driver Adjustments (Alternate Procedure)

29. Disconnect cable 8 (grey) from AllJl 0/ DET OUT. Jumper A20TP5 GND to A21TP2 and disconnect DVM from A19TP2 and A19TP3.
30. Connect front-panel CAL OUTPUT to RF INPUT as shown in Figure 3-63.

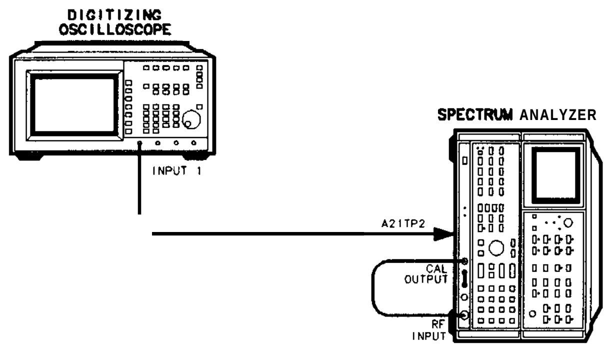


**Figure 3-63. YTO Main Coil Driver Adjustments Setup (Alternate Procedure)**

31. Key in (2--22 GHz), (CENTER FREQUENCY) 0 Hz (Frequency Span readout should indicate 2 GHz).
32. Adjust A20R25 6.15 GHz adjustment to obtain two comb teeth (±100 MHz harmonics of CAL OUTPUT signal) per division on display. Comb teeth should be evenly spaced but not necessarily aligned with CRT graticule lines (counterclockwise rotation of adjustment increases spacing between comb teeth).
33. Adjust A20R34 2.3 GHz adjustment to align LO feedthrough signal (0 Hz) with center CRT graticule line. It might be necessary to disconnect RF INPUT to locate LO feedthrough signal (counterclockwise rotation of adjustment moves signal to right).
34. Repeat steps 32 through 33 until comb teeth are spaced two per division and aligned with CRT graticule lines (every other comb tooth will align with a graticule line).
35. Key in (CENTER FREQUENCY) 2 GHz, (FREQUENCY SPAN) 100 MHz, (RES BW) 30 KHz, (SAVE) 1, (CENTER FREQUENCY) (SHIFT) (HOLD) .9 GHz, (SAVE) 2, (CENTER FREQUENCY) 2 GHz, (FREQUENCY SPAN) 10 MHz, (RES BW) 10 kHz, (SAVE) 3, (CENTER FREQUENCY) (SHIFT) (HOLD) .9 GHz, (SAVE) 4.
36. Key in (RECALL) 1. With CAL OUTPUT connected to RF INPUT, at least one comb tooth should be visible on display.
37. Adjust A20R25 6.15 GHz to align nearest comb tooth with center CRT graticule line.
38. Key in (RECALL) 2.
39. Adjust A20R34 2.3 GHz to align nearest comb tooth with center CRT graticule line.
40. Repeat steps 36 through 39 until no further adjustments are necessary.
41. Key in (RECALL) 3.

42. Adjust **A20R25** 6.15 **GHz** to align nearest comb tooth with center CRT graticule line.
43. Key in (RECALL) 4.
44. Adjust **A20R34** 2.3 **GHz** to align nearest comb tooth with center CRT graticule line.
45. Repeat steps 41 through 44 until no further adjustments are necessary.
46. Reconnect cable 8 (grey) to **A11J1 0/** DET OUT. Remove jumpers from between **A12TP2** and **A12TP3** and between **A20TP5** GND and **A21TP2.** Connect **the** oscilloscope channel 1 to **A21TP2.**
47. Key in (RECALL) **3.**
48. Adjust **A20R25** 6.15 **GHz** for oscilloscope indication of 0.0 f0.2 Vdc.
49. Key in (RECALL) 4.
50. Adjust **A20R34** 2.3 **GHz** for oscilloscope indication of 0.0 f0.2 Vdc.
51. Repeat steps 47 through 50 until **no** further adjustments are necessary.
52. Disconnect the oscilloscope from **A21TP2.**

## Sweep Attenuator Gain Adjustments

53. Key in (2--22 GHz), (SHIFT), (PRESEL PEAK)=, (START FREQ) 3928 MHz, (STOP FREQ) 4008 MHz.
54. Connect synthesized sweeper RF OUTPUT to front-panel RF INPUT with low-loss microwave test cable. Set synthesized sweeper for output of 4000.000 MHz at 0 **dBm.**
55. Signal should be visible at right side of CRT display. Press (PEAK SEARCH), MARKER (NORMAL) to place display marker on signal peak.
56. Alternately press (PEAK SEARCH) and adjust **A16R72** GAIN 1 for marker frequency of 4.000 00 **GHz** as indicated by display annotation.

**Note**

If adjustment **A16R72** GAIN 1 has insufficient range, perform Adjustment Procedure 22, "Analog-To-Digital Converter Adjustments" to ensure that adjustments **A3A8R6** OFFS **and A3A8R5** GAIN are properly set (for a 0.00 V dc to 10.00 V dc Scan Ramp). If adjustment **A16R72** GAIN 1 still has insufficient range, check the value of factory-select precision resistor **A16R46,** which has allowable values of **74.25K** (HP Part Number 0699-0311) or **73.874K** (HP Part Number 0699-0380).

57. Key in (START FREQ) 3784 MHz, (STOP FREQ) 4024 MHz.
58. Signal should be visible at right side of CRT display. Press (PEAK SEARCH), MARKER (NORMAL) to place display marker on signal peak.

59. Alternately press [PEAK SEARCH] and adjust A16R71 GAIN 2 for marker frequency of 4.000 GHz as indicated by display annotation.

### Band Overlap Adjustments

60. Key in [2--22 GHz], [SHIFT], [PRESEL PEAK]=, [START FREQ] 4.5 GHz, [STOP FREQ] 7.1 GHz.
61. Adjust A19R43 25 GHz SPAN and A19R32 2.5 GHz SPAN fully counterclockwise.
62. For HP 8566A, set synthesized sweeper for output of 5.820 GHz at 0 dBm. For HP 8566B, set synthesized sweeper for output of 5.805 GHz at 0 dBm.
63. Two separate signal peaks should be visible on display. Readjust A19R43 25 GHz SPAN until separate peaks are barely discernible from each other.
64. Use synthesized sweeper TUNING control to vary synthesized sweeper output frequency ±50 MHz from frequency in step 62, pressing [PRESEL PEAK] both times to peak preselector on each side of band overlap point.
65. Use synthesized sweeper TUNING control to vary synthesized sweeper output frequency ±50 MHz (from frequency in step 62) in 1 MHz steps. Readjust A19R43 25 GHz SPAN slightly as necessary so that amplitude of displayed signal peak varies less than 3 dB over entire ±50 MHz range bracketing band overlap point.
66. For HP 8566A, set synthesized sweeper for output of 5.800 GHz at 0 dBm. For HP 8566B, set synthesized sweeper for output of 5.800 GHz at 0 dBm.
67. Key in [START FREQ] 5.55 GHz, [STOP FREQ] 6.05 GHz, [RES BW] 300 kHz.
68. Two separate signal peaks should be visible on display. Readjust A19R32 2.5 GHz SPAN until separate peaks are barely discernible from each other.
69. Use synthesized sweeper TUNING control to vary synthesized sweeper output frequency -5 MHz (from frequency in step 66) in 100 kHz steps. Readjust A19R32 2.5 GHz SPAN slightly as necessary so that amplitude of displayed signal peak varies less than 3 dB over entire ±5 MHz range bracketing band overlap point.
70. For HP 8566A, set synthesized sweeper for output of 12.520 GHz at 0 dBm. For HP 8566B, set synthesized sweeper for output of 12.510 GHz at 0 dBm.
71. Key in [SHIFT], [PRESEL PEAK]=, [START FREQ] 11.2 GHz, [STOP FREQ] 13.8 GHz, RES BW (AUTO.
72. Use synthesized sweeper TUNING control to vary synthesized sweeper output frequency ±100 MHz from frequency in step 70, pressing [PRESEL PEAK] both times to peak preselector on each side of band overlap point.

73. Use signal generator TUNING control to vary signal generator output frequency ±100 MHz (from frequency in step 70) in 1 MHz steps. Readjust A19R43 25 GHz SPAN slightly as necessary so that amplitude of displayed signal peak varies less than 3 dB over entire ±100 MHz range bracketing band overlap point.

74. Key in (SHIFT), (PRESEL PEAK)=.

75. Verify that jumper between A12TP2 and A12TP3 (Lock Indicator Disable) has been removed. Replace RF Digital Section cover over Al2 through Al6 assemblies.

# 14. 100 MHz VCXO Adjustments

**Reference**

RF-Section:
A7A2 100 MHz VCXO

**Related Performance Tests**

Noise Sidebands Test
Residual Responses Test

**Description**

The open loop frequency and maximum power output of the 100 MHz VCXO is centered around 100 MHz. The 400 MHz signal is adjusted for maximum 400 MHz output with minimum spurious output. The 400 MHz output is set to -10 dBm by selecting proper resistor values for the attenuator network A7A2R67, R68, and R69.

**Equipment**

Frequency Counter ........................................ HP 5343A
Spectrum Analyzer ........................................ HP 8566B
Precision Power Supply .................................. HP 6114A

**Adapters:**
Adapter, SMB (snap-on) (m) (m) .......................... 1250-0672

**Cables:**
BNC to SMB Snap-On Test Cable (2 *required*) ........... 85680-60093

**Procedure**

**Note** The A7A2 100 MHz VCXO Assembly must be installed in the RF Section with all cover screws in place during this adjustment procedure.

1. Position the spectrum analyzer on its right side as shown in Figure 3-64, and remove the bottom cover.

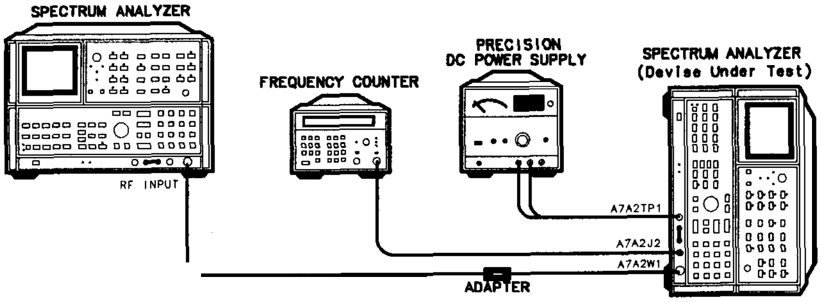


**Figure 3-64. 100 MHz VCXO Adjustment Setup**

2. Set the spectrum analyzer LINE switch to ON. Verify that the rear-panel FREQ REFERENCE switch is set to INT and that the

short BNC jumper cable W15 is connected between **J2** FREQ REFERENCE EXT and **J3** FREQ REFERENCE INT.

3. Set the dc power supply for an output of -8 Vdc. Connect the -8 Vdc output of the dc power supply to the **A7A2TP1** TUNE test point. Refer to Figure 3-65 for the location of the **A7A2** 100 MHz VCXO Assembly and test point **A7A2TP1** TUNE.

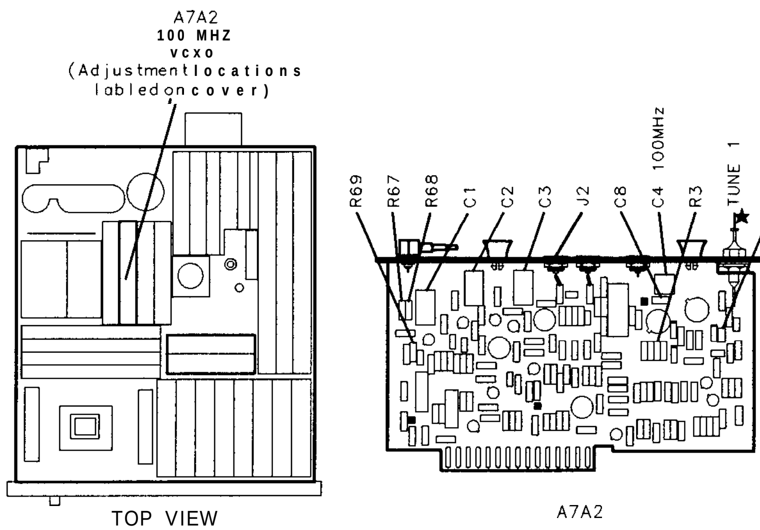


**Figure 3-65. Location of 100 MHz VCXO Adjustments**

4. Disconnect the cable 83 (gray/orange) from **A7A2J2** 100 MHz OUT, and connect the RF INPUT of the second spectrum analyzer to **A7A2J2** using a BNC to SMB snap-on test cable.

5. Press (2--22 GHz) on the second spectrum analyzer, and then set the controls as follows:

| | |
|---|---|
| CENTER FREQUENCY | 100 MHz |
| FREQUENCY SPAN | 3 kHz |
| REFERENCE LEVEL | +3 dBm |
| RES BW | 1 kHz |
| LOG SCALE | 1 dB/div |
| TRACE A | CLEAR-WRITE |
| TRACE B | MAX HOLD |

6. Adjust **A7A2C4** 100 MHz slowly through its full range while monitoring the display of the second spectrum analyzer. **A7A2C4** 100 MHz should provide enough adjustment range to shift the frequency of the 100 MHz VCXO a minimum of ±300 Hz from 100 MHz (99.999700 MHz to 100.000300 MHz), and the output power should not vary by more than 1 dB within this range, as shown in Figure 3-66.

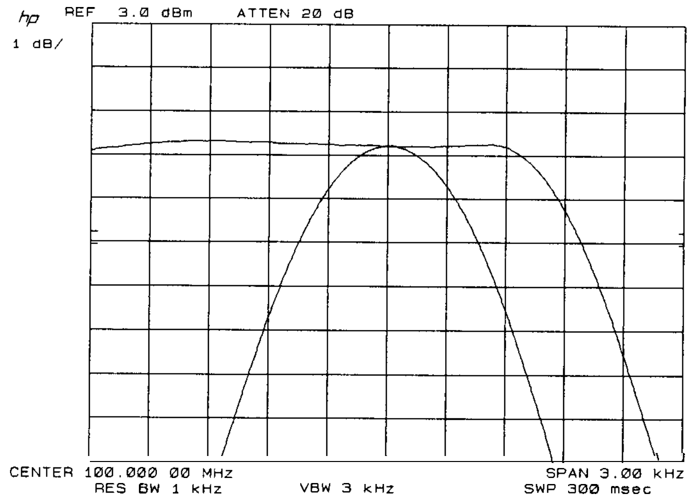


**Figure 3-66. Typical Tuning Range of A7A2 100 MHz VCXO**

**Note** If the output power of the 100 MHz VCXO drops off by more than 1 dB within ±300 Hz of 100 MHz, select a new value for factoryselect component A7A2L4. An increase of A7A2L4 by one standard value will shift the tuning range of the 100 MHz VCXO lower in frequency by approximately 500-600 Hz; conversely, a decrease in the value of A7A2L4 will shift the 100 MHz VCXO tuning range higher in frequency by the same amount. Refer to Table 3-7 for the acceptable range of values and corresponding HP part numbers for A7A2L4, and to Figure 3-65 for the location of A7A2L4.

**Note** If A7A2C4 100 MHz does not have sufficient adjustment range to tune the 100 MHz VCXO +300 Hz to 100.000300 MHz, select a lower value for factory- selected component A7A2C8; conversely, select a higher value for A7A2C8 if A7A2C4 does not have sufficient range to tune the 100 MHz VCXO -300 Hz to 99.999700 MHz. Refer to Table 3-3 for the acceptable range of values, and to Table 3-4 for HP part numbers; refer to Figure 3-65 for the location of A7A2C8.

**Table 3-7. Standard Values for A7A2L4**

| Value | HP Fart Number |
|---|---|
| 560 nH | 9100-2256 |
| 470 nH | 9100-2255 |
| 390 nH | 9100-2254 |
| 330 nH | 9100-0368 |
| 270 nH | 9100-2252 |
| 220 nH | 9100-2251 |

7. Set the controls of the second spectrum analyzer as follows:

| | |
|---|---|
| CENTER FREQUENCY | 100 MHz |
| FREQUENCY SPAN | .200 MHz |
| REFERENCE LEVEL | +3 dBm |
| RES BW | AUTO |
| LOG SCALE | 10 dB/div |

TRACE A .................................... CLEAR-WRITE
TRACE B .......................................... BLANK

8. Adjust A7A2C4 100 MHz slowly through its full range while monitoring the display of the second spectrum analyzer. The output of the 100 MHz VCXO should be a single output signal near 100 MHz, with no spurious oscillations at other frequencies. If spurious oscillations are present, increase the value of factoryselected component A7A2R3 by one standard value and check again for spurious oscillations. Refer to Table 3-3 for the acceptable range of values, and to Table 3-4 for HP part numbers; refer to Figure 3-65 for the location of A7A2R3.
9. Disconnect the second spectrum analyzer from A7A2J2 100 MHz OUT, and connect the frequency counter to A7A2J2.
10. Adjust A7A2C4 100 MHz for a frequency counter indication of 100.0000 ±0.0001 MHz (±100 Hz).
11. Disconnect the dc power supply from the A7A2TP1 TUNE test point, and jumper A7A2TP1 TUNE to ground.
12. Verify that the frequency counter indication is less than 100.0000 MHz. If it is not, repeat, steps 3 through 11.
13. Disconnect, the jumper from A7A2TP1 TUNE and ground. Set the dc power supply for an output of -25 Vdc, and connect the -25 Vdc output of the dc power supply to A7A2TP1 TUNE.
14. Verify that the frequency counter indication is greater than 100.0000 MHz. If it is not, repeat steps 3 through 13.
15. Disconnect the dc power supply from A7A2TP1 TUNE, and reconnect the cable 83 (gray/orange) to A7A2J2 100 MHz OUT.

## 400 MHz Output Adjustment

16. Disconnect the cable 96 (white/blue) from A7A3J1 400 MHz IN, and connect this cable to the RF INPUT of the second spectrum analyzer using a BNC-to-SMB snap-on test cable and an SMB male-to-male adapter.
17. Set the controls of the second spectrum analyzer as follows:

    CENTER FREQUENCY ............................ 500 MHz
    FREQUENCY SPAN .................................. 1 GHz
    REFERENCE LEVEL ............................... -7 dBm
    RES BW ........................................... AUTO
    LOG SCALE ...................................... 10 dB/div
    TRACE A ............................... CLEAR-WRITE

18. The 400 MHz output signal should be visible on the display of the second spectrum analyzer, along with other harmonics of 100 MHz. Adjust the A7A2C3, A7A2C2, and A7A2C1 400 MHz adjustments in sequence to maximize the power level of the 400 MHz output signal and minimize all other harmonics of 100 MHz. Be sure to perform the adjustments in the proper sequence; it might be necessary to repeat the sequence more than once.
19. Note the level of any 100 MHz harmonics displayed on the second spectrum analyzer relative to the power level of the 400 MHz

output signal. Verify that the 100 MHz harmonics do not exceed the levels listed in Table 3-8

**Table 3-8. Limits for 100 MHz Harmonics**

| Harmonic Frequency | Maximum Allowable Level |
|---|---|
| 100 MHz | –40 dBc |
| 200 MHz | –25 dBc |
| 300 MHz | –40 dBc |
| (400 MHz) | (0 dBc) |
| 500 MHz | –40 dbc |
| 600 MHz | –40 dBc |
| 700 MHz | –40 dBc |
| 800 MHz | –15 dBc |
| >800 MHz | –40 dBc |

20. Set the controls of the second spectrum analyzer as follows:

    CENTER FREQUENCY .............................. 400 MHz
    FREQUENCY SPAN .................................. 1 kHz
    REFERENCE LEVEL .............................. -7 dBm
    RES BW .......................................... 300 Hz
    LOG SCALE .................................. 1 dB/div

21. Slightly readjust the A7A2C3, A7A2C2, and A7A2C1 400 MHz adjustments in sequence to maximize the power level of the 400 MHz output signal, and then verify that the maximized power level of the 400 MHz output signal is -10 dBm ±2 dB. If it is not, note the amplitude and change the values of attenuator network resistors A7A2R67, A7A2R68, and A7A2R69 as necessary. Table 3-9 contains a list of attenuations in 1-dB steps and the corresponding

    values for the attenuator resistors to adjust the 400 MHz output power level to -10 dBm. Refer to Table 3-10 for HP part numbers, and to Figure 3-65 for the location of A7A2R67, A7A2R68, and A7A2R69.

**Table 3-9.**
**Selection Chart for Attenuator Resistors**

| | Resistors | | |
|---|---|---|---|
| **Attenuation (dB)** | **R67** | **R68** | **R69** |
| 0 | open | short | open |
| -1 | 825 | 6.8 | 825 |
| -2 | 422 | 12.1 | 422 |
| -3 | 261 | 17.8 | 261 |
| -4 | 215 | 23.7 | 215 |
| -5 | 178 | 31.6 | 178 |
| -6 | 147 | 38.3 | 147 |
| -7 | 133 | 46.4 | 133 |
| -8 | 121 | 51.1 | 121 |
| -9 | 110 | 61.9 | 110 |

**Table 3-10. Resistor Values**

| Resistor | HP Fart Number |
|---|---|
| 6.8 | 0683-0685 |
| 12.1 | 0757-0379 |
| 17.8 | 0757-0294 |
| 23.7 | 0698-343 1 |
| 31.6 | 0757-0180 |
| 38.3 | 0698-3435 |
| 46.4 | 0698-4037 |
| 51.1 | 0757-0394 |
| 61.9 | 0757-0276 |
| 110 | 0757-0402 |
| 121 | 0757-0403 |
| 133 | 0698-3437 |
| 147 | 0698-3438 |
| 178 | 0698-3439 |
| 215 | 0698-3441 |
| 261 | 0698-3132 |
| 422 | 0698-3447 |
| 825 | 0757-042 1 |

22. Set the controls of the second spectrum analyzer as follows:

    CENTER FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 400 MHz
    FREQUENCY SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 50 MHz
    REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . -7 dBm
    LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB/div
    RES BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 30 kHz
    VIDEO BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 kHz

23. Check for 10 MHz sidebands on the 400 MHz output signal at 390 MHz and 410 MHz. If 10 MHz sidebands are visible, they should be greater than 70 dB down (>–70 dBc) from the power level of the 400 MHz output signal.

24. Disconnect the second spectrum analyzer from the A7A2 100 MHz VCXO Assembly. Reconnect the cable 96 (white/blue) to A7A3J1 400 MHz IN.

## 15. M/N Loop Adjustments

**Reference**

RF-Section:
A7A4 M/N Output

**Description**

The M/N VCO tuning range end points and output level are set and checked to ensure an adequate RF output level across the tuning range of the M/N phase-lock loop.

**Equipment**

Frequency Counter .......................................... HP 5343A
Spectrum Analyzer .......................................... HP 8566B
Digital Voltmeter (DVM) .................................... HP 3456A
Precision Power Supply ..................................... HP 6114A
15x2 Extender Board *(service accessory)* ............... 08505-60041

**Adapters:**
Adapter, SMB Male-to-Male *(service accessory)* . . . . 1250-0669

**Cables:**
BNC to SMB Test Cable (service accessory) ............ 085680-60093

**Procedure**

1. Position the spectrum analyzer on its right side as shown in Figure 3-67. Remove the bottom cover of the RF Section.
2. Connect the frequency counter's rear-panel 10 MHz FREQ STD OUT connector to the RF Section's rear-panel FREQ REFERENCE EXT connector. See Figure 3-67. Set the RF Section's rear-panel switch to EXT.
3. Connect a jumper between A12TP2 and A12TP3 (LOCK INDICATOR DISABLE) in the RF Section. Refer to Figure 3-68 for the location of A12TP2 and A12TP3.

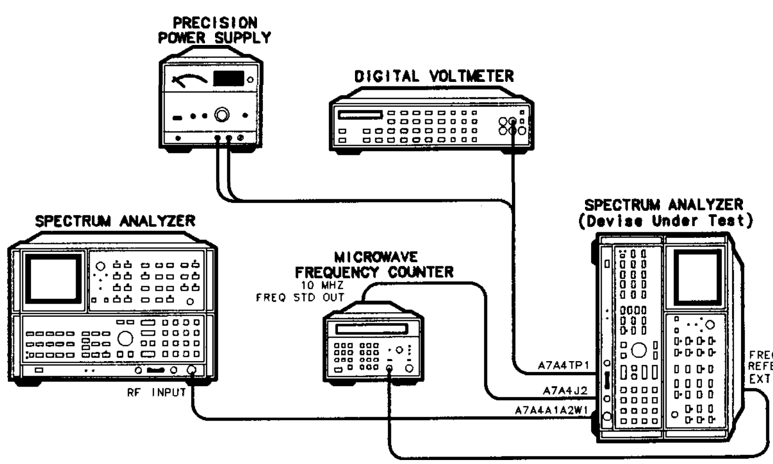


**Figure 3-67. M/N Loop Adjustment Setup**

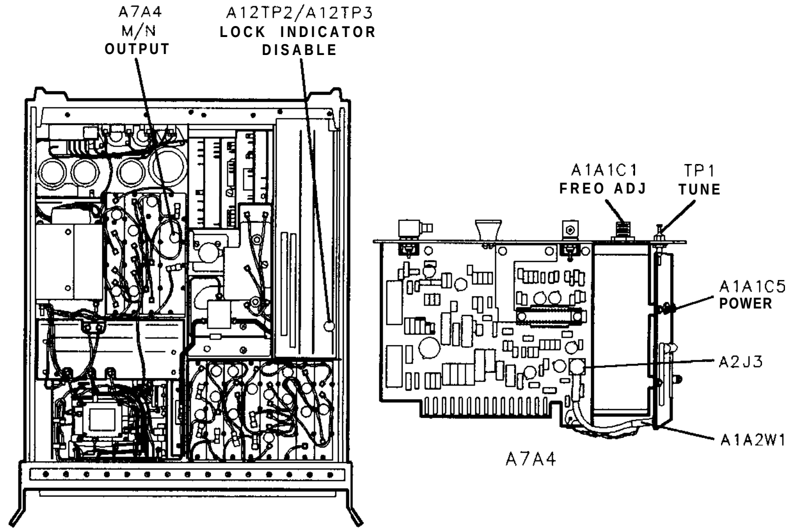


**Figure 3-68. Location of PLL Adjustments**

4. Disconnect the cable 93 (white/orange) from A7A4J2 M/N OUT in the RF Section. Refer to Figure 3-68 for the location of the A7A4 M/N Output Assembly.
5. Connect the frequency counter BNC input to A7A4J2 M/N OUT using a BNC to SMB Snap-on Test Cable. Set the input selector switch on the frequency counter to (10 HZ - 500 MHZ), and set the impedance switch to (50 Ω).
6. Set the RF Section LINE switch to ON and press (2-22 GHz). Key in (SHIFT) (RES BW)F, (CENTER FREQUENCY) 6090.000 MHz, (FREQUENCY SPAN) 0 Hz. The frequency counter indication should be 197.419355 MHz ±1 count.
7. Connect the DVM to A7A4TP1 TUNE test point.
8. Adjust A7A4A1A1C1 FREQ ADJ tuning slug for a DVM indication of -35.0 ±0.5 Vdc. Slightly loosen the hex locking nut before adjusting the FREQ ADJ tuning slug, and tighten the nut after the appropriate voltage is set.
9. Key in (CENTER FREQUENCY) 2100.000 MHz on the RF Section. The frequency counter indication should be 177.500000 MHz ±1 count, and the DVM indication should be -2.3 f0.5 Vdc.
10. Set the RF Section LINE switch to STANDBY.
11. Disconnect the frequency counter and DVM from the A7A4 M/N Output Assembly.
12. Disconnect the cable 92 (white/red) from A7A4J1 355-395 MHz OUT on the A7A4 M/N Output Assembly. Remove the A7A4 M/N Output Assembly from the RF Section, and install it on an extender board.
13. Press (2-22 GHz) on the second spectrum analyzer. Connect the CAL OUTPUT signal to the RF INPUT on the second spectrum analyzer, and press (RECALL) 8.

14. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal, and then press (SHIFT) (FREQUENCY SPAN) W.

15. Set the controls of the second spectrum analyzer as follows:

| | |
|---|---|
| CENTER FREQUENCY | 375 MHz |
| FREQUENCY SPAN | 100 MHz |
| REFERENCE LEVEL | +5 dBm |
| LOG SCALE | 2 dB/DIV |

16. Disconnect the cable 9 (white) A7A4A1A2W1 from A7A4A2J3 on the A7A4 M/N Output Assembly. Refer to Figure 3-68 for the location of A7A4A1A2W1 and A7A4A2J3. Use an SMB male-to-male adapter and a BNC to SMB Snap-on Test Cable to connect the white cable to the input of the second spectrum analyzer.

17. Set the RF Section LINE switch to ON.

**Caution** Damage might occur to the M/N VCO tuning diodes on A7A4 M/N Output Assembly if a positive voltage is applied to A7A4TP1 TUNE test point.

18. Set the dc power supply for an output of -35.0 ± 0.5 Vdc.

    Connect the positive lead of the dc power supply to the RF Section chassis (ground). Then, connect the negative lead to A7A4TP1 TUNE test point.

19. Adjust A7A4A1A1C5 PWR for an M/N VCO output level of 0.0 dBm ± 2.0 dB as indicated on the second spectrum analyzer display. Refer to Figure 3-68 for the location of A7A4A1A1C5 PWR adjustment.

20. Slowly reduce the output voltage of the dc power supply from -35.0 Vdc to -2.3 Vdc while monitoring the M/N VCO output level displayed on the second spectrum analyzer. The M/N VCO output level at A7A4A2J3 should be greater than -2.0 dBm between 355 MHz (-2.3 Vdc) and 395 MHz (-35 Vdc).

21. Set the RF Section LINE switch to STANDBY.

22. Reconnect the white cable to A7A4A2J3 on the A7A4 M/N Output Assembly, and then reinstall the A7A4 M/N Output Assembly in the RF Section. Reconnect the cable 92 (white/red) to A7A4J1 355-395 OUT.

23. Repeat steps 5 through 11.

24. Reconnect the cable 93 (white/orange) to A7A4J2 M/N OUT.

25. Remove the LOCK INDICATOR DISABLE jumper from A12TP2 and A12TP3. Disconnect the frequency counter from the RF Section rear-panel FREQ REFERENCE INT connector, and reconnect the short jumper cable between the FREQ REFERENCE INT and EXT connectors. Set the RF Section rear-panel switch to INT.

# 16. YTO Loop Adjustments

## Reference

RF-Section:
Al 1A5 Sampler
A11A2 YTO Loop Interconnect

## Related Performance Tests

Average Noise Level Test

## Description

The output power level of the A11A1 Coupler/Isolator/Amplifier (CIA) is checked over the 2.2 GHz to 6.2 GHz tuning range of the All YTO Loop, and the Al 1A3 YTO is tuned to the minimum power frequency. Then, the CIA GATE BIAS is adjusted for a -5.0 dBm output power level at the coupled output of the A11A1 CIA. The YTO Loop A11A5 Sampler is driven by a synthesized sweeper and the dc output of Sampler Al 1U1 is monitored with an oscilloscope. The Sampler Driver circuit is adjusted for maximum amplitude and flatness over the range of the M/N Loop. The YTO Loop Sampler IF amplifiers are then adjusted for correct output level and frequency response.

## Equipment

Spectrum Analyzer ........................................ HP 8566B
Synthesized Sweeper .................................... HP 8340A/B
Digitizing Oscilloscope .................................. HP 54501A
Power Meter/Power Sensor .......................... HP 436A/8481A
SMA (m) 50 ohm Termination ............................. 1810-0118

**Adapters:**
Type N (m) to APC 3.5 (f) Adapter .................... 1250-1744
Adapter, BNC to Alligator Clip ........................ 1250-1292

**Cables:**
Low-loss Microwave Test Cable, APC 3.5 ................ 8120-4921
BNC TO SMB Snap-On Test Cable (2 *required*) .......... 85680-60093

## Procedure

1. Set the spectrum analyzer (DUT) LINE switch to STANDBY. Turn the spectrum analyzer over to position the RF Section on top, as shown in Figure 3-69. Remove the RF Section's bottom cover.
2. Disconnect semi-rigid coax cable W11 from A11A1 CIA Assembly's YTO OUT connector. Disconnect the opposite end of W11 from AT2 (for RF Sections 2526A and below, disconnect from cable A6W6). See Figure 3-70 for the location of A11A1, W11, A6W6, and AT2.

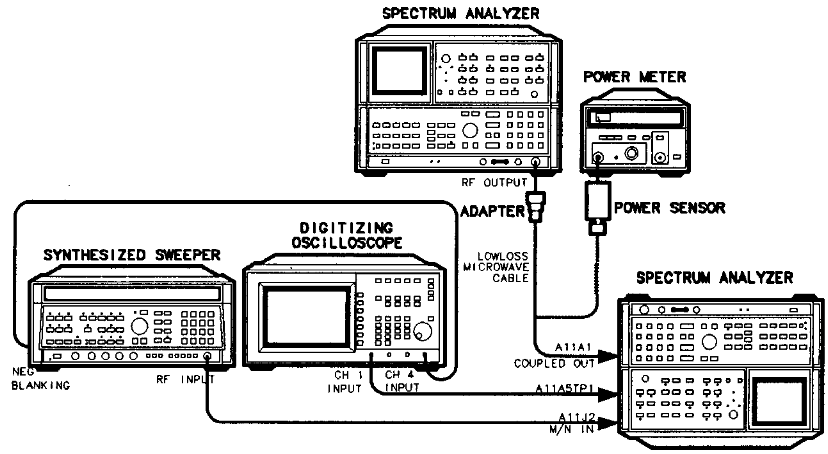


**Figure 3-69. YTO Loop Adjustment Setup**

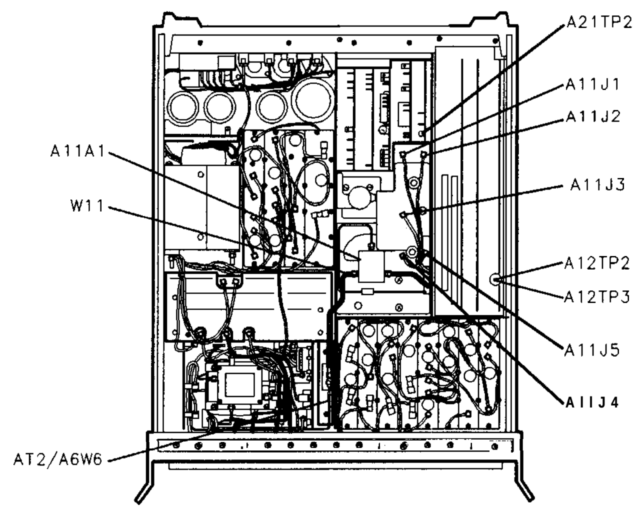


**Figure 3-70. Location of Assemblies, Cables, and Test Points**

3. On the All YTO Loop Assembly, disconnect the cable 8 (gray) from AllJl PHASE DET OUT, the cable 93 (white/orange) from AllJ2 M/N IN, and the cable 5 (green) from AllJ3 20/30 IN. Disconnect cable 0 (black) from AllJ4 IF IN and AllJ5 IF OUT. See Figure 3-70.
4. Connect a jumper between A12TP2 and A12TP3 (LOCK INDICATOR DISABLE) on the Al2 Front Panel Interface Assembly in the RF Section. Connect a jumper between A21TP2 TUNE VOLTAGE and the RF Section chassis ground. See Figure 3-70.
5. Install the All YTO Loop Assembly in the Service Position by removing the three screws (marked with the letter A) securing the Al 1 YTO Loop Assembly in the RF Section. Figure 3-71 shows the All service position. Grasp the two metal extractors on the All assembly, and slide the assembly upwards until it just clears the RF Section. Rotate the assembly 90° towards the front. of the RF Section and secure the Servicing Support Screw to the threaded

mounting hole located on the chassis divider next, to the A10A1 PLL1 VCO Assembly.

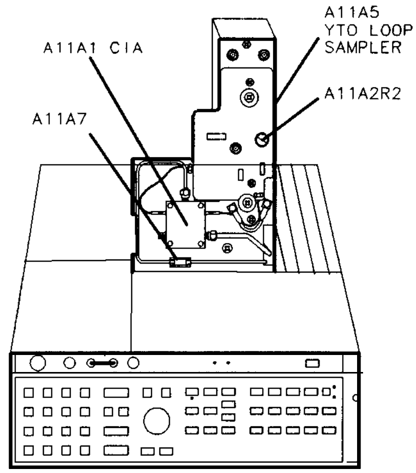


**Figure 3-71. All YTO Loop Service Position**

6. Remove the SMA 50 ohm termination from the RF Section frontpanel 1ST LO OUTPUT connector. Install the termination on the YTO OUT connector of Al 1A1 CIA Assembly.

## CIA Gate Bias Adjustment

**Note**

Al 1A7 6.20 GHz Lowpass Filter/Attenuator/Cable Assembly and semirigid cable W 11 can both be damaged if the semi-rigid coax cable is bent excessively in the following steps.

7. Disconnect Al 1A7 6.20 GHz Lowpass Filter/Attenuator/Cable Assembly from the COUPLED OUT connector of A11A1 CIA Assembly. See Figure 3-71 for the location of AllA7.
8. Carefully unclip A11A7 from the YTO Loop cover allowing the cable's free end to be moved to one side.
9. Connect the SMA male end of W11 to the COUPLED OUT connector of A11A1 CIA Assembly. (W11 was removed from the YTO OUT connector in step 2.)
10. Connect a low-loss microwave test cable to the RF INPUT of the second spectrum analyzer using a Type N to APC 3.5 adapter. Connect the opposite end of the cable to the SMA female end of W11 (on the COUPLED OUT connector of A11A1 CIA Assembly).
11. On the RF Section, adjust A11A2R2 GATE BIAS ADJ fully counterclockwise. See Figure 3-71 for the location of A11A2R2.
12. Press (2-22 GHz) on the second spectrum analyzer. Set the controls of the second spectrum analyzer as follows:

    START FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2.2 GHz
    STOP FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6.2 GHz

REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +5 dBm
LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB/DIV

13. Set the Spectrum Analyzer (DUT) LINE switch to ON, and key in (FREQUENCY SPAN) 0 Hz, (CENTER FREQUENCY) 5.6786 GHz. This tunes the A11A3 YTO to approximately 6.00 GHz.
14. On the second spectrum analyzer, key in (SHIFT) TRACE A (MAX HOLD), (SHIFT) (GHz) /, (PEAK SEARCH) to position a marker on the peak of the displayed 6.00 GHz signal. Press (PRESEL PEAK) on the second spectrum analyzer, and wait for the preselector peaking routine to complete.
15. On the Spectrum Analyzer (DUT), key in (CENTER FREQUENCY) 3.6786 GHz. This tunes the A11A3 YTO to approximately 4.00 GHz.
16. On the second spectrum analyzer, key in (PEAK SEARCH) to position a marker on the peak of the displayed 4.00 GHz signal. Press (PRESEL PEAK) on the second spectrum analyzer and wait for the preselector peaking routine to complete.
17. On the second spectrum analyzer, key in LOG SCALE (ENTER dB/DIV) 2 dB, TRACE B (CLEAR-WRITE), TRACE B (MAX HOLD), (SHIFT) (GHz) /.
18. On the spectrum analyzer (DUT), key in SWEEP (SINGLE), (SWEEP TIME) 200 sec, (SHIFT) SWEEP (CONT) t. A "HARMONIC LOCK 1" message should appear on the CRT display of the spectrum analyzer (DUT).
19. On the spectrum analyzer (DUT), key in (START FREQUENCY) 1.8786 GHz, (STOP FREQUENCY) 5.8786 GHz, (SAVE) 4, SWEEP (SINGLE). This tunes the A11A3 YTO from approximately 2.20 GHz to 6.20 GHz. Wait for the sweep to complete (200 seconds) and the SWEEP LED to turn off.
20. On the Spectrum Analyzer (DUT), key in (FREQUENCY SPAN) 0 Hz, (CF STEP SIZE) 100 MHz, (CENTER FREQUENCY). Using the DATA knob and step keys, tune the A11A3 YTO to position the TRACE A signal at the lowest point on the TRACE B waveform on the display of the second spectrum analyzer. See Figure 3-72. Key in (SAVE) 5 on the Spectrum Analyzer (DUT).

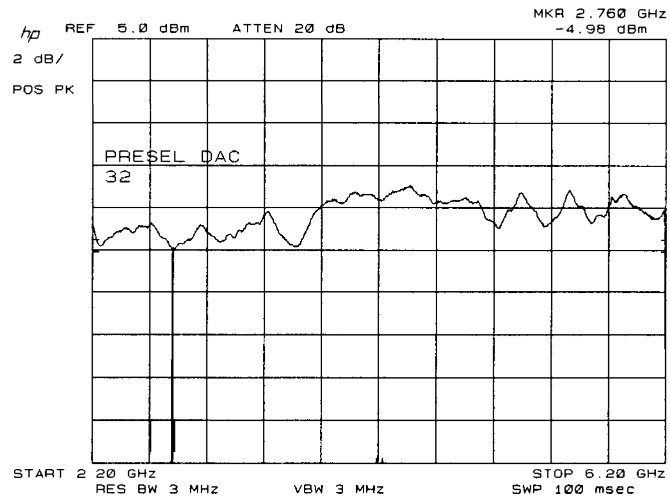


**Figure 3-72.**
**Typical YTO Loop Swept Frequency Response at A11A1**

21. On the second spectrum analyzer, key in [PEAK SEARCH] to position a marker on the peak of the TRACE A displayed signal. Press [PRESEL PEAK] on the second spectrum analyzer and wait for the preselector peaking routine to complete.
22. On the Spectrum Analyzer (DUT), key in [RECALL] **4** and wait for the sweep to complete (200 seconds) and the SWEEP LED to turn Off.
23. On the Spectrum Analyzer (DUT), key in [RECALL] 5, [CENTER FREQUENCY]. Use the DATA knob to tune the **A11A3** YTO to position the TRACE A signal at the lowest point on the TRACE B waveform on the display of the second spectrum analyzer, as shown in Figure 3-72.
24. Repeat steps 21 through 23 as necessary until the lowest point in the TRACE B waveform does not change.
25. On the spectrum analyzer (DUT), key in [SHIFT] [MKR → REF LVL] **R** to activate the Frequency Diagnostics function. Six lines of numerical data should appear in the upper left corner of the spectrum analyzer CRT; the top line is the 10 digit YTO Start Frequency, ranging from 2.000 000 000 **GHz** to 6.200 000 000 **GHz.** Note the currently-selected YTO Start Frequency (the minimum power frequency of the All YTO Loop). This frequency should be approximately the same as the marker frequency displayed on the second spectrum analyzer.

All YTO Loop Minimum Power Frequency: ______________________ **GHz**

26. Disconnect the low-loss microwave test cable from the SMA female end of **W11** and from the RF INPUT of the second spectrum analyzer.
27. Connect the power sensor to the power meter's POWER REF output, and zero and calibrate the power meter. Determine the power sensor cal factor for the Al 1 YTO Loop Minimum Power

Frequency determined in step 25, and set the power meter CAL FACTOR control accordingly. Connect the power sensor to the SMA female end of W 11 (W 11 should still be connected to the COUPLED OUT connector of **A11A1** CIA Assembly).

28. Adjust **A11A2R2** GATE BIAS ADJ for a power meter indication of -5.0 **dBm** fO.l **dB**.
29. Disconnect the power sensor from semi-rigid coax cable **W11**. Disconnect semi-rigid coax cable W 11 from the COUPLED OUT connector of **A11A1** CIA Assembly, and reconnect **A11A7** to the **A11A1** CIA Assembly.

## YTO Sampler Adjustments

30. Remove the cover from **A11A5** YTO Loop Sampler Assembly. Locate DRIVER MATCHING adjustments Al **1A5C1** and Al **1A5C2**, SAMPLER DC test point **A11A5TP1**, and IF GAIN adjustment **A11A5R1**. These parts are indicated on the cover of the **A11A5** YTO Loop Sampler Assembly and in Figure 3-73.

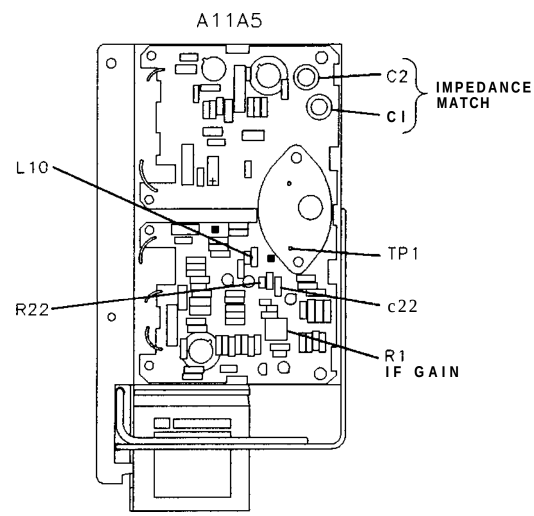


**Figure 3-73. Al 1A5 Adjustment Locations**

31. On the oscilloscope, key in (RECALL) (CLEAR) to perform a soft reset.

32. Set the oscilloscope controls as follows:

    Press (CHAN):
    - Channel 1 .............................................. on
    - amplitude scale ................................ 200 mV/div
    - offset ........................................... −300.000 mV
    - coupling ................................................ dc
    - Channel 4 .............................................. on
    - amplitude scale ............................... 2.00 V/div
    - offset ........................................... 0.00000 V
    - coupling ................................................ dc

    Press (TRIG):
    - EDGE TRIGGER ........................... trig'd, edge
    - source ............................................ Channel 4
    - level ............................... -3.00000 V, rising edge

    Press (TIME BASE):
    - time scale .................................... 2.00 msec/div
    - reference ............................................... left

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

    Press [SHOW)

33. Press (INSTR PRESET) on the synthesized sweeper. Set the synthesized sweeper controls as follows:

    - START FREQUENCY ......................... 87.5 MHz
    - STOP FREQUENCY ......................... 287.5 MHz
    - POWER LEVEL ............................ +3.0 dBm
    - FREQUENCY MARKER Ml ..................... 160 MHz
    - FREQUENCY MARKER M2 ..................... 210 MHz
    - FREQUENCY MARKER M3 .................... 187.5 MHz
    - SWEEP TIME ................................ 20 ms
    - AMPTD MKR .................................... on

34. Connect the RF OUTPUT of the synthesized sweeper to AllJ2 M/N IN using a BNC to SMB snap-on test cable.

35. Use a BNC to alligator clip adapter to connect the oscilloscope Channel 1 input to the RF Section A11A5TP1 test point, and connect the Channel 1 ground to the All YTO Loop cover. Connect the oscilloscope Channel 4 input to the synthesized sweeper rear-panel NEG BLANKING output. Adjust the oscilloscope triggering as necessary for a stable display, and then key in (CHAN) Channel 4 off, (SHOW).

36. The A11A5TP1 SAMPLER DC waveform displayed on the oscilloscope should be similar to Figure 3-74. The left, middle, and right vertical spikes visible on the voltage waveform correspond to synthesized sweeper marker frequencies of 160 MHz, 187 MHz, and 210 MHz, respectively. Adjust A11A5C2 to widen the waveform as far to the left as possible.

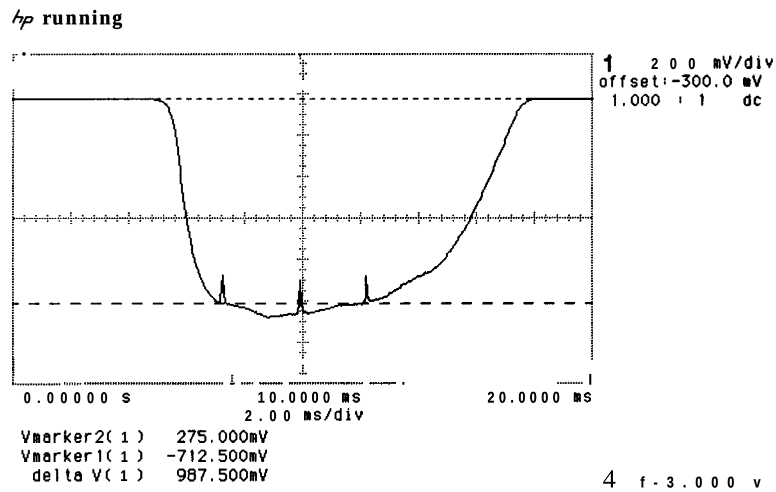


**Figure 3-74. Sampler Waveform at A11A5TP1**

37. Adjust A11A5C1 for a minimum voltage level at the 210 MHz (right) marker. Readjust A11A5C2 to make the voltages at the 160 MHz (left) and 210 MHz (right) markers equally negative. Carefully readjust A11A5C1 and A11A5C2 as necessary for maximum flatness and lowest possible voltage of the displayed waveform between the 160 MHz and 210 MHz markers.

38. On the oscilloscope, press (ΔTΔV), and turn on the voltage markers for the Channel 1 input. Place one voltage marker at the level of the 160 MHz (left) and 210 MHz (right) markers, and place the second voltage marker at the maximum voltage level of the displayed waveform, as shown in Figure 3-74. The voltage level of the displayed waveform between the 160 MHz and 210 MHz markers should be a minimum of 0.50 Vdc lower than the maximum voltage level.

39. Disconnect the oscilloscope's Channel 1 input from A11A5TP1 SAMPLER DC.

40. On the spectrum analyzer (DUT), note the fourth line of numerical data appearing in the upper left corner of the spectrum analyzer CRT; this is the g-digit M/N Loop Frequency, ranging from 177.500 000 MHz to 197.419 355 MHz. Note the currentlyselected M/N Loop Frequency (corresponding to the minimum power YTO Start Frequency from step 25).

All YTO Loop Frequency: ______________ MHz

41. On the synthesized sweeper, press (CW) and key in the M/N Loop Frequency from step 40.
42. Press (2-22 GHz) on the second spectrum analyzer. Connect the CAL OUTPUT signal on the second spectrum analyzer to the RF INPUT on the second spectrum analyzer, and press (RECALL) 8.
43. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal. Then, key in (2-22 GHz), (SHIFT) (FREQUENCY SPAN) W on the second spectrum analyzer and wait for the self-correction routine to complete. Key in (SHIFT) TRACE A (MAX HOLD) on the second spectrum analyzer.
44. Use a second BNC to SMB snap-on test cable to connect the RF INPUT of the second spectrum analyzer to AllJ5 IF OUT.
45. Set the controls of the second spectrum analyzer as follows:

    START FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 MHz
    STOP FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 70 MHz
    REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . + 10 dBm
    LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB/DIV
    RESOLUTION BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 300 kHz

46. The IF OUT fundamental and second harmonics should be visible at approximately 30 MHz and 60 MHz on the display of the second spectrum analyzer, as shown in Figure 3-75. Key in MARKER (NORMAL) 30 MHz to position a marker at 30.03 MHz on the display of the second spectrum analyzer.

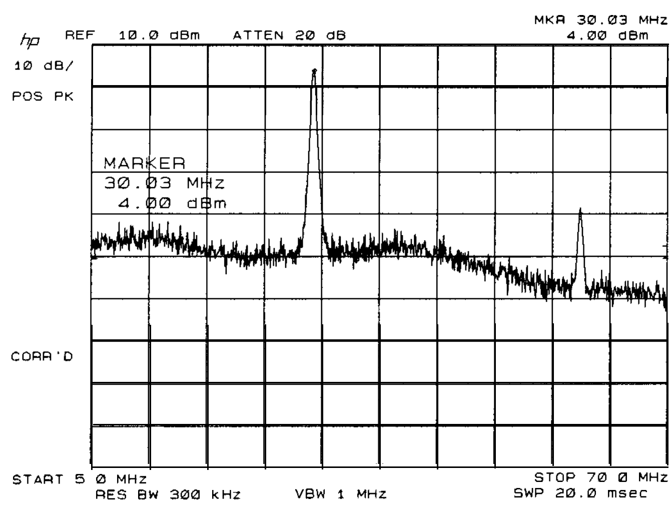


**Figure 3-75.**
**30 MHz YTO Loop Sampler Response at A 1155 IF OUT**

47. On the Spectrum Analyzer (DUT), turn the DATA knob as necessary to tune the IF OUT fundamental to 30.0 MHz ± 0.5 MHz, as indicated by the marker on the display of the second spectrum analyzer.

48. On the second spectrum analyzer, key in (ENTER dB/DIV) 2 dB, (RES BW) 3 MHz, MARKER (NORMAL), (PEAK SEARCH) to position a marker on the peak of the displayed 30 MHz fundamental signal. Adjust A11A5R1 IF GAIN for an IF OUT power level (the 30 MHz fundamental signal) of +4.0 dBm.

**Note**

If A11A5R1 IF GAIN does not have sufficient adjustment range, change the value of factory-select component A11A5L10. An increase in the value of A11A5L10 will increase the IF OUT power level at A11J5 IF OUT. Refer to Table 3-3 for the acceptable range of values for A11A5L10, and to Table 3-4 for HP part numbers. See Figure 3-73 for the location of A11A5L10.

49. On the second spectrum analyzer, press TRACE A (MAX HOLD), TRACE B (CLEAR-WRITE).

50. On the synthesized sweeper, key in (SHIFT) (CW) (⇧)(⇧) to set the CW RES to 0.001 MHz. Then, use the ENTRY knob to gradually tune the synthesized sweeper up and down from the frequency set in step 41, tuning the IF OUT fundamental (displayed on the second spectrum analyzer) from 5 MHz to 70 MHz as shown in Figure 3-76.

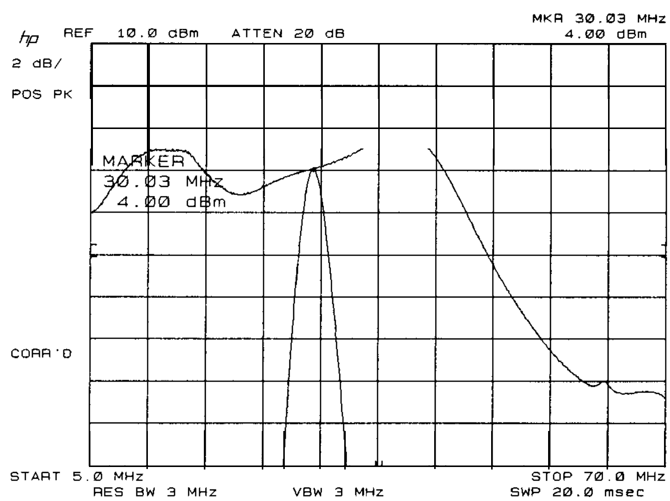


**Figure 3-76. Tuning the IF OUT Fundamental**

51. On the second spectrum analyzer, press MARKER (NORMAL), and use the DATA knob to verify the power level of the displayed fundamental signal over the frequency ranges listed in Table 3-11.

**Table 3-11. Power Level of Fundamental Signal**

| Frequency Range | Power Level |
|---|---|
| 5 MHz to 20 MHz | -3 dBm ≥ power level ≤ + 10 dBm |
| 20 MHz to 30 MHz | + 2 ≥ power level ≤ + 6 dBm |
| 30 MHz to 70 MHz | -10 dBm ≥ power level ≤ + 10 dBm |

**Note**

If the power level of the displayed fundamental below 20 MHz is too low, decrease the value of factory-select component A11A5C22. If the power level of the displayed fundamental between 20 MHz and 30 MHz is too low, decrease the value of factory-select component A11A5R22. If the power level of the displayed fundamental above 30 MHz is too high, increase the value of factory-select component A11A5L10. Refer to Table 3-3 for the acceptable range of values for A11A5C22, A11A5R22, A11A5L10, and to Table 3-4 for HP part numbers. See Figure 3-73 for the location of A11A5C22, A11A5R22, and Al 1A5L10.

52. Set the Spectrum Analyzer (DUT) LINE switch to STANDBY. Disconnect the second spectrum analyzer from the RF Section AllJ5 IF OUT. Disconnect the synthesized sweeper from the RF Section A11J2 M/N IN.
53. Replace the cover on A11A5 YTO Loop Sampler Assembly. Loosen the Servicing Support Screw holding the All YTO Loop Assembly in the Service Position. Grasp the two metal extractors on the All YTO Loop Assembly and slide the assembly back into the RF Section, mating the two guide pins with the corresponding guide sleeves on the A23 Motherboard Assembly. Replace the three screws (marked with the letter A) securing the All YTO Loop Assembly in the RF Section.
54. Reconnect cable 8 (gray) to Al 1J1 PHASE DET OUT, cable 93 (white/orange) to Al 1J2 M/N IN, and the cable 5 (green) to Al 1J3 20/30 IN. Reconnect the cable 0 (black) to AllJ4 IF IN and Al 1J5 IF OUT.
55. Remove the SMA 50 ohm termination from the YTO OUT connector of A11A1 CIA Assembly. Install the termination on the RF Section front-panel 1ST LO OUTPUT connector.
56. Reconnect semi-rigid coax cable W 11 to the YTO OUT connector of A11A1 CIA Assembly. Reconnect the opposite end of W11 to AT2 (for RF Sections 2526A and below, W11 connects to cable A6W6).
57. Remove the jumper from between A21TP2 and ground. Remove the jumper between A12TP2 and A12TP3 (LOCK INDICATOR DISABLE).
58. Replace the RF Section's bottom cover.

## 17. 20/30 Loop Phase Lock Adjustments

**Reference**

RF-Section:
A10 20/30 Synthesizer
A10A1 PLL1 VCO
A10A3 PLL1 IF
A10A4 PLL3 Up Converter
A10A5 PLL2 VCO
A 1 OA8 PLL2 Discriminator

**Description**

*Phase* Lock *Loop 1 (PLL1):* On the A10A1 PLL1 VCO Assembly, the Loop Amplifier 40 kHz LPF is first adjusted for >65 dB rejection of the 50 kHz subharmonics from fractional-n division. A frequency synthesizer is used to inject a signal into the 40 kHz LPF, and the filter output is measured with a spectrum analyzer using a high-impedance active probe. Then, the centering and tuning range of the PLL1 VCO is checked and adjusted as required. On the A10A3 PLL1 IF Assembly, the 140 MHz Lowpass Filter is checked and adjusted for maximum rejection of mixing products between 160 MHz and 166 MHz. A synthesized sweeper is substituted for the PLL1 VCO, and the output of the A10A3 PLL1 IF Assembly is measured with a spectrum analyzer.

*Phase* Lock *Loop* 2 *(PLL2):* On the A10A5 PLL2 VCO Assembly and A10A8 PLL2 Discriminator Assembly, four interactive biasing adjustments are used to set the centering and tuning range of the PLL2 VCO. PLL2 VCO biasing is adjusted by setting up proper voltage levels at A10A8TP5 VCO TUNE and adjusting for corresponding PLL2 VCO frequencies at A10A5J4 (SCAN ≤.1 MHz OUT). If PLL2 will not phase lock (PL2 UNLOCK indicated), the A10A6 PLL2 Phase Detector Assembly is first disabled for coarse biasing adjustments. Fine biasing adjustments of the PLL2 VCO are made with the A10A6 PLL2 Phase Detector Assembly installed. Then, span accuracy for narrow spans is checked and adjusted by positioning the 100 MHz CAL OUTPUT signal on the 9th CRT graticule line.

*Phase Lock Loop* 3 *(PLL3):* On the A10A4 PLL3 Up Converter Assembly, the 160 MHz BPF is adjusted for maximum output of the 1.6 Frequency Multiplier. The PLL3 VCO biasing is then adjusted by setting up proper voltage levels at A10A4TP3, and the PLL3 VCO output power level is verified.

## Equipment

Spectrum Analyzer ........................................ HP 8566B
High-frequency Active Probe ............................ HP 41800A
Probe Power Supply ....................................... HP 1122A
Frequency Counter ........................................ HP 5343A
Frequency Synthesizer ................................... HP 3335A
Synthesized Sweeper .................................. .HP 8340A/B
Precision Power Supply .................................. HP 6114A
Digital Voltmeter .......................................... HP 3456A
15x2 Extender Board *(service accessory)* .............. .08505-60041

**Adapters:**
Adapter, SMB (m)(m) .................................... 1250-0672
Adapter, BNC to Alligator Clip .............................. 1250-1292

**Cables:**
BNC to SMB Test Cable (2 *required) (service accessory) 85680-60093*

## Procedure

### Phase Lock Loop 1 (PLL1)

1. Set **the** spectrum analyzer LINE switch to STANDBY. Turn the spectrum analyzer over to position the RF Section on top, as shown in Figure 3-77 and remove the RF Section bottom cover.

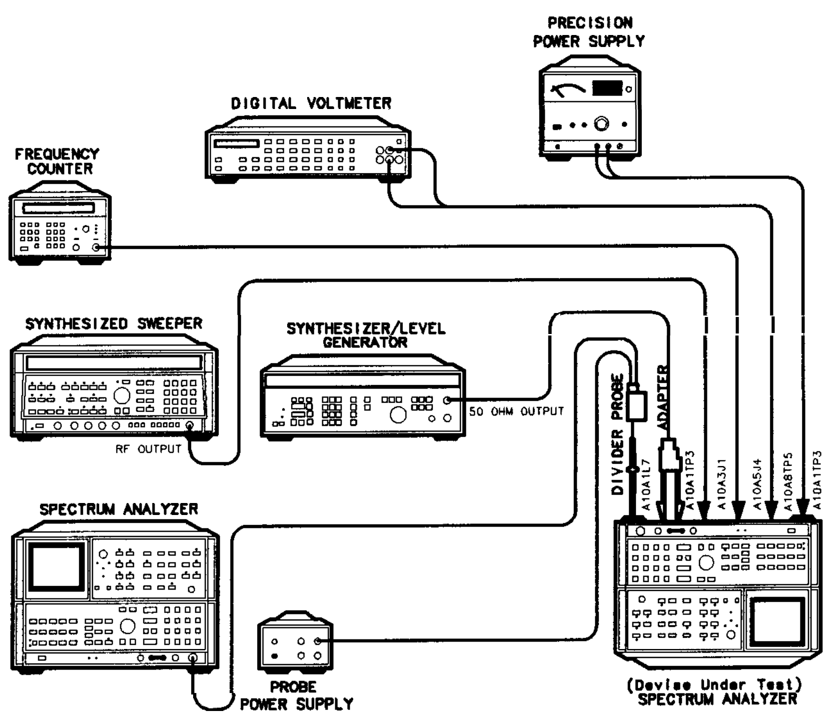


**Figure 3-77. 20/30 PLL Adjustment Setup**

2. Remove the **A10A1 PLL1** VCO Assembly from the spectrum analyzer. Disconnect cable 1 (brown) from **A10A5J5** SCAN .l-5 MHz OUT, cable 5 (green) from **A10A1J2** OUT 20-30 MHz, and the yellow cable from **A10A1J3** OUT 200-300 MHz.

3. Set the frequency synthesizer for a 20 kHz, 0 dBm output. Connect the frequency synthesizer 50-ohm OUTPUT to A10A1TP3 using a BNC to Alligator clip adapter. Connect the ground lead of the adapter to the metal cover of the A10A1 PLL1 VCO Assembly.
4. Connect the high-frequency active probe to the RF INPUT of the second spectrum analyzer and to the probe power supply, as shown in Figure 3-77.
5. Press (2-22 GHz) on the second spectrum analyzer. Connect the active probe tip to the CAL OUTPUT signal, and press (RECALL].
6. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal, and then press (SHIFT) (FREQUENCY SPAN)W.
7. Set the controls of the second spectrum analyzer as follows:

| | |
|---|---|
| CENTER FREQUENCY | 35 kHz |
| FREQUENCY SPAN | 50 kHz |
| REFERENCE LEVEL | 0 dBm |
| LOG SCALE | 10 dB/DIV |
| VIDEO BW | 300 Hz |

8. Connect the active probe tip to the lead of A10AlL7 closest to A10A1C22, as indicated in Figure 3-78. The 20 kHz signal (from the 40 kHz LPF) should be visible on the display of the second spectrum analyzer.
9. Press MARKER [PEAK SEARCH], (MKR → REF LVL) on the second spectrum analyzer to position the peak of the 20 kHz signal at the top graticule line. Press MARKER la] on the second spectrum analyzer.
10. Set the frequency synthesizer for an output frequency of 50 kHz.

**Note** Adjustments A10A1L7 and A10A1L8 are **sealed** at the factory and normally do not require readjustment unless a component failure has occurred. To verify their proper adjustment, skip to step 12.

11. Adjust A10A1L7 and A10A1L8 50 kHz NULL adjustments to minimize the amplitude of the 50 kHz signal displayed on the second spectrum analyzer. Refer to Figure 3-78 for the location of A10A1L7 and A10A1L8 50 kHz NULL adjustments.

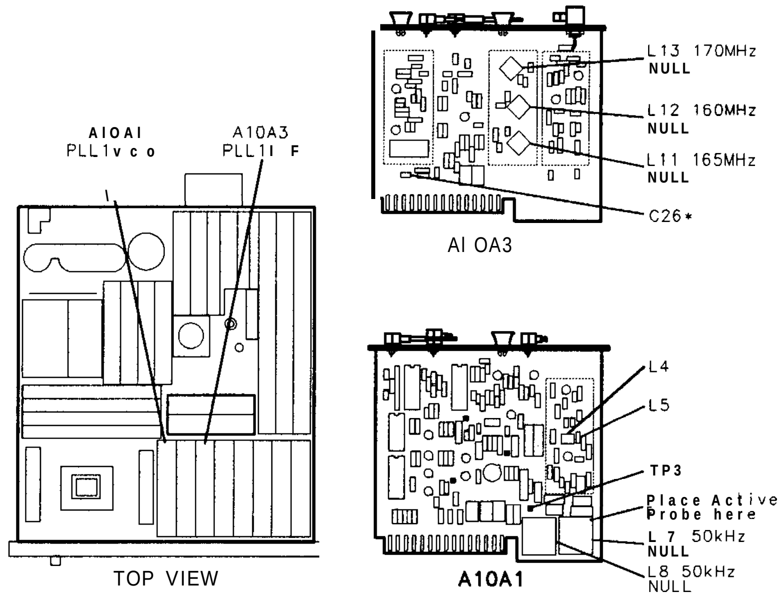


**Figure 3-78. Location of PLL1 Adjustments**

12. On the second spectrum analyzer, press [CENTER FREQUENCY] 100 MHz [FREQUENCY SPAN] 6 MHz MARKER [PEAK SEARCH] to place the second marker on the displayed 50 kHz signal. This level should be at least 65 dB down from the level of the 20 kHz signal in step 9.
13. Disconnect the active probe and frequency synthesizer from AlOAl PLL1 VCO Assembly.
14. Install AlOAl PLL1 VCO Assembly in the RF Section using an extender board. Reconnect the cable 1 (brown) to A10A5J5 SCAN .l-5 MHz OUT and the cable 5 (green) to A10A1J2 OUT 20-30 MHz.
15. Set the RF Section LINE switch to ON, and key in (2-22 GHz), [FREQUENCY SPAN] 0 HZ.
16. Disconnect the active probe from the RF INPUT of the second spectrum analyzer.
17. Press (2-22 GHz) on the second spectrum analyzer. Connect the CAL OUTPUT signal to the RF INPUT on the second spectrum analyzer, and press (RECALL 8).
18. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal, and then press (SHIFT) (FREQUENCY SPAN) W.
19. Use a BNC to SMB Snap-on Test Cable to connect the RF INPUT of the second spectrum analyzer to A10A1J3 OUT 200-300 MHz.

20. Press (2-22 GHz) on the second spectrum analyzer. Set the controls of the second spectrum analyzer as follows:

    CENTER FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . 300 MHz
    FREQUENCY SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 500 MHz
    REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . +3 dBm

21. Set the dc power supply for an output of + 16.0 ± 0.1 Vdc. Connect the positive lead of the dc power supply to A10A1TP3 and the negative lead to the RF Section chassis (ground).
22. Press MARKER (PEAK SEARCH) on the second spectrum analyzer. The output frequency of the PLL1 VCO should be 310 MHz ± 10 MHz as indicated by the marker on the display of the second spectrum analyzer. If it is not, remove the metal shield from AlOAl PLL1 VCO Assembly and increase or decrease the spacing between turns of coil A10A1L4.

    The PLL1 VCO frequency is increased by spreading the turns of A10AlL4 apart (decreasing the inductance), and decreased by compressing the turns of A10A1L4 together (increasing the inductance). Adjust A10A1L4 for a PLL1 VCO output frequency of approximately 308 MHz, since the metal shield increases the PLL1 VCO frequency approximately 2 MHz when reinstalled.
23. Set the dc power supply for an output of +4.0 ± 0.1 Vdc.
24. Press MARKER [PEAK SEARCH] on the second spectrum analyzer. The frequency of the PLL1 VCO output signal should drop below 200 MHz, and the power level should be at least -7 dBm, as indicated by the marker on the display of the second spectrum analyzer.
25. Repeat steps 21 through 24 as necessary until no further adjustment is required.
26. Set the RF Section LINE switch to STANDBY. Replace the metal shield on AlOAl PLL1 VCO Assembly if it was removed, and reinstall AlOAl PLL1 VCO Assembly in the RF Section. Reconnect the cable 1 (brown) to A10A5J5 SCAN .l-5 MHz OUT and the cable 5 (green) to A10A1J2 OUT 20-30 MHz.
27. Remove A10A3 PLL1 IF Assembly from the RF Section, and install it on an extender board. Reconnect the cable 6 (blue) to A10A4J2 OUT 160-166 MHz. Leave the cable 4 (yellow) disconnected from A10A1J3 OUT 200-300 MHz, and the cable 3 (orange) disconnected from A10A3J3 OUT PLL1 IF.
28. Use a BNC to SMB Snap-on Test Cable to connect the RF INPUT of the second spectrum analyzer to A10A3J3 OUT PLL1 IF

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

| | |
|---|---|
| CENTER FREQUENCY | 165 MHz |
| FREQUENCY SPAN | 15 MHz |
| RES BW | 30 kHz |
| REFERENCE LEVEL | -7 dBm |
| LOG SCALE | 10 dB/DIV |
| MARKER | OFF |

30. Press (INSTR PRESET) on the synthesized sweeper, and key in (CW) 330.3 MHz, (POWER LEVEL) 0 dBm.
31. Use a second BNC to SMB Snap-on Test Cable and an SMB adapter to connect the cable 4 (yellow) from A10A3J1 IN 200-300 MHz to the RF OUTPUT of the synthesized sweeper.
32. Set the RF Section LINE switch to ON, and key in (2-22 GHz), (CENTER FREQUENCY) 42.57 MHz, (FREQUENCY SPAN) 0 Hz.

**Note**

Adjustments A10A3L11 165 MHz NULL, A10A3L12 160 MHz NULL, and A10A3L13 170 MHz NULL are sealed at the factory and normally do not require readjustment unless a component failure has occurred. To verify their proper adjustment, skip to step 39.

33. Adjust A10A3L11 165 MHz NULL, A10A3L12 160 MHz NULL, and A10A3L13 170 MHz NULL fully clockwise.
34. Adjust A10A3L13 170 MHz NULL to minimize the amplitude of the 170 MHz signal displayed on the second spectrum analyzer. Refer to Figure 3-78 for the location of A10A3L3 170 MHz NULL adjustment.
35. On the synthesized sweeper, key in (CW) 325.3 MHz.
36. Adjust A10A3L11 165 MHz NULL to minimize the amplitude of the 165 MHz signal displayed on the second spectrum analyzer. Refer to Figure 3-78 for the location of A10A3L11 165 MHz NULL adjustment.
37. On the synthesized sweeper, key in (CW) 320.3 MHz.
38. Adjust A10A3L12 160 MHz NULL to minimize the amplitude of the 160 MHz signal displayed on the second spectrum analyzer. Refer to Figure 3-78 for the location of A10A3L12 160 MHz NULL adjustment.
39. On the synthesized sweeper, key in (CW) 260.3 MHz.
40. On the second spectrum analyzer, press (CENTER FREQUENCY) 100 MHz (FREQUENCY SPAN) 6 MHz MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 100 MHz signal, and verify that the output power level of the PLL1 IF is at least -14 dBm.

    If it is not, a lower value can be selected for factory-select component A10A3C26 to improve the impedance match between the double-balanced mixer A10A3U1 and the IF Input Amplifier circuit on A10A3 PLL1 IF Assembly. Refer to Table 3-3 for the acceptable range of values for A10A3C26, and to Table 3-4 for HP part numbers; refer to Figure 3-78 for the location of A10A3C26.
41. On the synthesized sweeper, key in (START FREQ) 300.3 MHz.

42. On the second spectrum analyzer, press (CENTER FREQUENCY) 140 MHz MARKER (PEAK SEARCH] to position a marker on the peak of the displayed 140 MHz signal, and verify that the output power level of the PLL1 IF is at least -14 dBm.

    If it is **not,** slightly readjust A10A3L11 165 MHz NULL to increase the amplitude of the 140 MHz signal displayed on the second spectrum analyzer to -14 dBm. Refer to Figure 3-78 for the location of A10A3L11 165 MHz NULL adjustment.

43. Key in MARKER (PEAK SEARCH], (MKR → REF LVL) on the second spectrum analyzer to position the peak of the 140 MHz signal at the top graticule line. Press MARKER la] on the second spectrum analyzer.

44. On **the** synthesized sweeper, key in (START FREQ) 320.3 MHz (STOP FREQ) 326.3 MHz (SWEEP TIME) 100 **s** (CW) 320.3 MHz.

45. Press [CENTER FREQUENCY) 163 MHz TRACE A (MAX HOLD) on the second spectrum analyzer. Allow the synthesized sweeper to tune slowly from 320.3 MHz to 326.3 MHz, noting the corresponding 160 MHz to 166 MHz signal on the display of the second spectrum analyzer.

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**Note**

The corresponding 160 MHz to 166 MHz signal might be below the displayed noise level on the second spectrum analyzer.

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46. On the second spectrum analyzer, press MARKER [PEAK SEARCH) to position the second marker on **the** peak response between 160 MHz and 166 MHz. This level should be at least 60 dB down from the level of the 140 MHz signal in step 42.

47. Set the RF Section LINE switch to STANDBY. Disconnect the second spectrum analyzer from A10A3J3 OUT PLL1 IF, and disconnect the synthesized sweeper from the cable 4 (yellow).

48. Reinstall A10A3 PLL1 IF Assembly in the RF Section. Reconnect the cable 6 (blue) to A10A4J2 OUT 160-166 MHz, the cable 4 (yellow) to A10A1J3 OUT 200-300 MHz, and the cable 3 (orange) to A10A3J3 OUT PLL1 IF.

## Phase Lock Loop 2 (PLL2)

**Note**

If PLL2 is phaselocked, proceed to step 12. If PLL2 will not phaselock (PL2 UNLOCK indicated on CRT), start with step 1.

1. Set the RF Section LINE switch to STANDBY. Remove A10A6 PLL2 Phase Detector Assembly from its connector on the A23 Motherboard Assembly. It is **not** necessary to completely remove the A10A6 PLL2 0 Detector Assembly from the RF Section.
2. Set the RF Section LINE switch to ON and press (2-22 GHz).
3. Disconnect the cable 7 (violet) from A10A5J4 SCAN $\leq$.1 MHz OUT, and connect the frequency counter BNC input to A10A5J4 using a BNC to SMB Snap-on Test Cable. Set **the** input selector switch on the frequency counter to (10 HZ - 500 MHZ), and set the impedance switch to (50 Ω).
4. **On** the RF Section, key in (STOP FREQ) 10 MHz, (START FREQ) 8.600 MHz, (SHIFT) (MKR→ REF LVL)R, SWEEP (SINGLE), TRACE A (CLEAR-WRITE).
5. Connect the DVM to A10A8TP5 VCO TUNE. Refer to Figure 3-79 for the location of A10A8TP5 VCO TUNE.

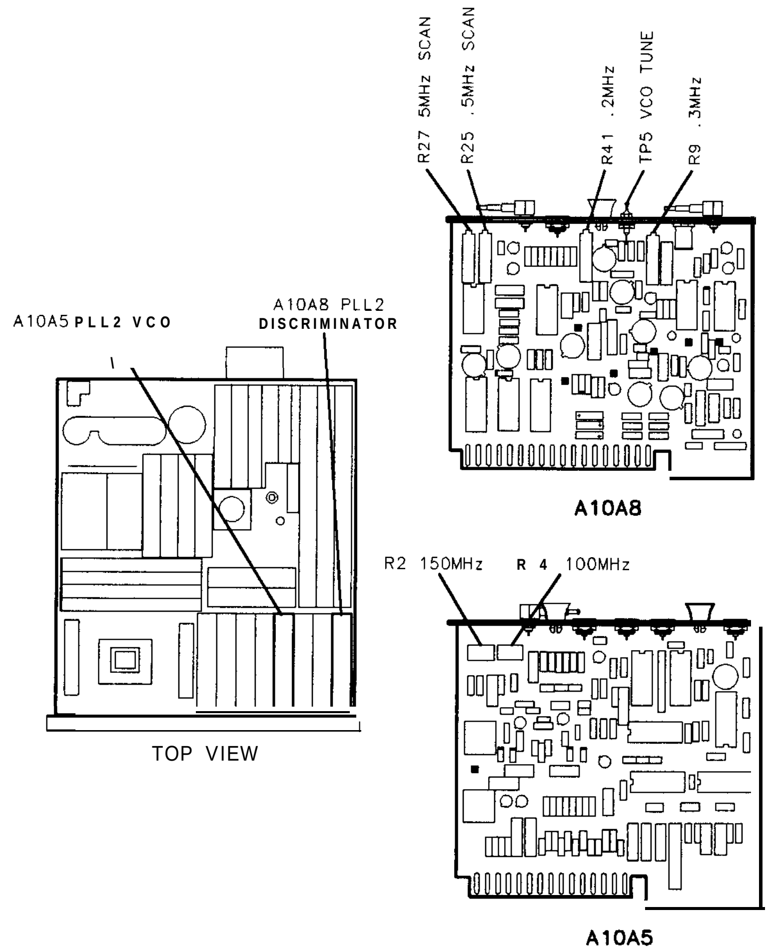


**Figure 3-79. Location of PLL2 Adjustments**

6. Adjust **A10A5R2** 150 MHz adjustment for a DVM indication of +3.0 ± 0.5 Vdc. Refer to Figure 3-79 for the location of **A10A5R2** 150 MHz adjustment.
7. Adjust **A10A8R9 .3** MHz adjustment for a frequency counter indication of 0.300 MHz ± 0.001 MHz. Refer to Figure 3-79 for the location of **A10A8R9 .3** MHz adjustment.
8. On the RF Section, key in [START FREQ] 8.599 MHz, SWEEP (SINGLE), TRACE A (CLEAR-WRITE).

**Note** The CRT annotation will round off to 8.59 MHz, but the RF Section is actually set to a start frequency of 8.599 MHz.

9. Adjust **A10A5R4** 100 MHz adjustment for a DVM indication of + 15.0 ± 0.5 Vdc. Refer to Figure 3-79 for the location of **A10A5R4** 100 MHz adjustment.
10. Adjust **A10A8R41 .2** MHz adjustment for a frequency counter indication of 0.200 ± 0.001 MHz. Refer to Figure 3-79 for the location of **A10A8R41 .2** MHz adjustment.

11. Set the RF Section LINE switch to STANDBY. Disconnect the frequency counter from A10A5J4 SCAN $\leq$.1 MHz OUT. Reinstall A10A6 PLL2 Phase Detector Assembly in the RF Section and reconnect the cable 7 (violet) to A10A5J4 SCAN $\leq$.1 MHz OUT.
12. Set the RF Section LINE switch to ON, and key in (2-22 GHz), (STOP FREQ) 10 MHz, (START FREQ) 8.600 MHz, SWEEP (SINGLE), TRACE A (CLEAR-WRITE).
13. Connect the DVM to A10A8TP5 VCO TUNE.
14. Adjust A10A5R2 150 MHz adjustment for a DVM reading of +3.00 ± 0.05 Vdc.
15. Connect the DVM to A10A6TP7 PHASE DET OUT, located on the cover of the A10A6 PLL2 Phase Detector Assembly.
16. Press SWEEP (CONT). Adjust A10A8R9 .3 MHz adjustment for a DVM indication of + 3.50 ± 0.05 Vdc.
17. On the RF Section, key in (START FREQ) 8.599 MHz, SWEEP (SINGLE), TRACE A (CLEAR-WRITE).

**Note**

The CRT annotation will round off to 8.60 MHz, but the RF Section is actually set to a start frequency of 8.599 MHz.

18. Connect the DVM to A10A8TP5 VCO TUNE.
19. Adjust A10A5R4 100 MHz adjustment for a DVM indication of + 15.00 ± 0.05 Vdc.
20. Connect the DVM to A10A6TP7 PHASE DET OUT.
21. Adjust A10A8R41 .2 MHz adjustment for a DVM indication of 3.50 ± 0.05 Vdc.
22. Repeat steps 12 through 21 as necessary until no further adjustment is required.
23. On the RF Section, connect the front-panel CAL OUTPUT signal to the RF INPUT.
24. On the RF Section, key in (STOP FREQ) 100.5 MHz, (START FREQ) 95.5 MHz, SWEEP (CONT), (SWEEP TIME) 100 ms.
25. Adjust A10A8R27 5 MHz SCAN to center the 100 MHz CAL OUTPUT signal on the center graticule line. Refer to Figure 3-79 for the location of A10A8R27 5 MHz SCAN adjustment.
26. On the RF Section, key in (STOP FREQ) 100.05 MHz, (START FREQ) 99.55 MHz, (SWEEP TIME) 500 msec.
27. Adjust A10A8R25 .5 MHz SCAN to center the 100 MHz CAL OUTPUT signal on the center graticule line. Refer to Figure 3-79 for the location of A10A8R25 .5 MHz SCAN adjustment.

## Phase Lock Loop 3 (PLL3)

1. Set the RF Section LINE switch to STANDBY. Remove A10A4 PLL3 Up Converter Assembly from the RF Section, and install it on an extender board. Reconnect the cable 7 (violet) to A10A5J4 SCAN ≤.1 MHz OUT and the cable 8 (gray) to A10A4J3 IN 100 MHz.
2. Connect the RF INPUT of the second spectrum analyzer to SMB test connector A10A4J4. Refer to Figure 3-80 for the location of test connector A10A4J4.

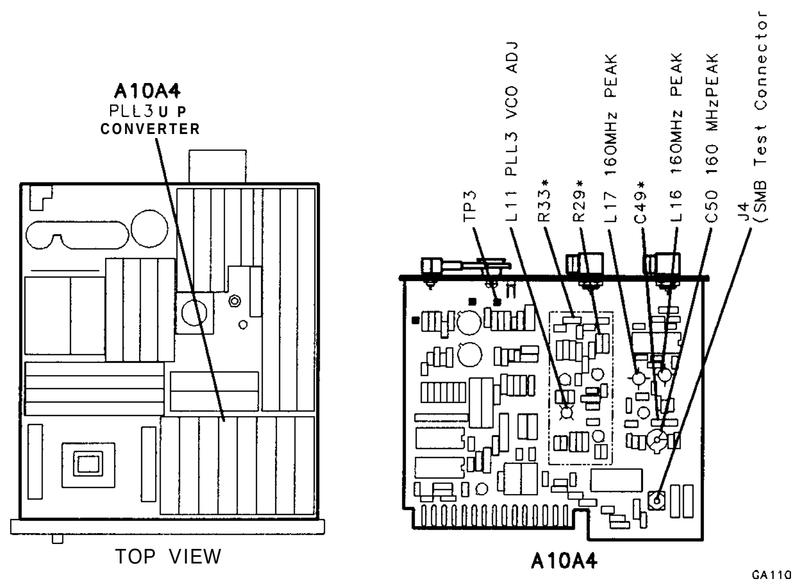


**Figure 3-80. Location of PLL3 Adjustments**

3. Set the RF Section LINE switch to ON, and key in (2-22 GHz), (FREQUENCY SPAN) 0 HZ.
4. On the second spectrum analyzer, key in (2-22 GHz), (SHIFT) (START FREQ) X. Set the controls of the second spectrum analyzer as follows:

   CENTER FREQUENCY .......... 160 MHz
   FREQUENCY SPAN .......... 200 kHz
   RES BW (MANUAL) .......... 10 kHz
   REFERENCE LEVEL .......... -20 dBm

**Note** In addition to the displayed 160 MHz signal, other signals should be present at A10A4J4 at approximately 160.3 MHz and 300 kHz.

5. On the second spectrum analyzer, key in MARKER (PEAK SEARCH), MKR → REF LVL to position the peak of the displayed 160 MHz signal at the top CRT graticule line. Then, key in (ENTER dB/DIV) 2 dB, (FREQUENCY SPAN) 50 kHz, (REFERENCE LEVEL) STEP (⇧) (⇧) (⇧) on the second spectrum analyzer to lower the peak of the displayed signal by three major graticule divisions.

**Note**

Adjustments A10A4L16 160 MHz PEAK and A10A4L17 160 MHz PEAK are sealed at the factory and normally do **not** require readjustment unless a component failure has occurred. lb verify their proper adjustment, skip to step 7.

6. Adjust A10A4L16 160 MHz PEAK and A10A4L17 160 MHz PEAK to maximize the amplitude of the 160 MHz signal displayed on the second spectrum analyzer. The two adjustments are interactive; repeat the adjustment as necessary to ensure maximum signal amplitude. Refer to Figure 3-80 for the location of A10A4L16 160 MHz PEAK and A10A4L17 160 MHz PEAK adjustments.
7. Adjust A10A4C50 160 MHz PEAK to maximize the amplitude of the 160 MHz signal displayed on the second spectrum analyzer. If after adjustment A10A4C50 is completely open, select a lower value for factory-selected component A10A4C49; conversely, if after adjustment A10A4C50 is completely closed, select a higher value for factory-selected component A10A4C49. Refer to Table 3-12 for the acceptable range of values and corresponding HP part numbers for A10A4C49, and to Figure 3-80 for the location of A10A4C50 160 MHz PEAK and A10A4C49.

**Table 3-12. Standard Values for A10A4C49**

| Value | HP Part Number |
|---|---|
| 10 pF | 0160-3874 |
| 11 pF | 0160-4520 |
| 12 pF | 0160-4521 |
| 13 pF | 0160-4522 |
| 15 pF | 0160-4289 |

8. On the RF Section, key in (CENTER FREQUENCY) 42.450 MHz, (FREQUENCY SPAN) 100 kHz, SWEEP (SINGLE), TRACE A (CLEARWRITE).
9. Set the controls of the second spectrum analyzer as follows:

   CENTER FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 6 MHz
   FREQUENCY SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 MHz
   RES BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . (AUTO)
   REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . -30 dBm
   LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB/DIV
   MARKER . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . (OFF)

10. On the second spectrum analyzer, press MARKER (PEAK SEARCH) to position the marker on the peak response. If this level is not at least -42 dBm, repeat steps 3 through 10.
11. Disconnect the second spectrum analyzer from SMB test connector A10A4J4. Connect the second spectrum analyzer to A10A4J2 OUT 160 – 166 MHz. Connect the DVM to A10A4TP3. Refer to Figure 3-80 for the location of A10A4TP3.

12. Set the controls of the second spectrum analyzer as follows:

CENTER FREQUENCY .................................. 166 MHz
FREQUENCY SPAN ...................................... .50 MHz
REFERENCE LEVEL .................................. -14 dBm
MARKER ............................................... (NORMAL)

**Note** Adjustment A10A4L11 PLL3 VCO ADJ is sealed at the factory and normally does not require readjustment unless a component failure has occurred. A10A4L11 PLL3 VCO ADJ should be adjusted with the metal shield installed over the PLL3 VCO on A10A4 PLL3 Up Converter Assembly.

13. A 166 MHz signal should be centered on the display of the second spectrum analyzer, indicating that PLL3 is phaselocked. If not, coarse adjust A10A4L11 PLL3 VCO ADJ to center the signal displayed on the second spectrum analyzer and phaselock PLL3.
14. With PLL3 phaselocked, readjust A10A4L11 PLL3 VCO ADJ as necessary for a DVM indication of -7.0 ± 0.1 Vdc.
15. On the RF Section, key in (CENTER FREQUENCY) 42.569999 MHz, (FREQUENCY SPAN) 0 HZ, SWEEP (SINGLE), TRACE A (CLEARWRITE). The DVM indication should be -3.5 ± 0.6 Vdc.
16. On the RF Section, key in (CENTER FREQUENCY) 42.6499 MHz, (FREQUENCY SPAN) 100 kHz, SWEEP (SINGLE), TRACE A (CLEARWRITE).
17. Set the controls of the second spectrum analyzer as follows:

CENTER FREQUENCY ............................ 164.001 MHz
FREQUENCY SPAN ........................................ 1 MHz
REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . -14 dBm

18. On the second spectrum analyzer, press MARKER (PEAK SEARCH) and verify that the output power level of the PLL3 VCO at 164.001 MHz is -20 dBm ± 2 dB as indicated by the marker.

If it is not, note the amplitude and change the values of factory-select resistors A10A4R29 and A10A4R33 as necessary. Refer to Table 3-13 for a list of standard resistor values and corresponding change in circuit gain to adjust the PLL3 VCO output power level to -20 dBm, and to Table 3-4 for HP part numbers.

**Table 3-13.**
**Standard Values for A10A4R29 and A10A4R33**

| Gain (dB) | Resistors | |
|---|---|---|
| | R29 | R33 |
| 0 | 68.1 | 68.1 |
| +0.7 | 68.1 | 75 |
| +1.2 | 75 | 75 |
| +2.0 | 68.1 | 82.5 |
| +3.5 | 75 | 90.9 |

19. Set the RF Section LINE switch to STANDBY. Disconnect the DVM from **A10A4TP3** and the second spectrum analyzer from **A10A4J2** OUT 160-166 MHz.
20. Reinstall **A10A4** PLL3 Up Converter Assembly in the RF Section. Reconnect the cable 7 (violet) to **A10A5J4** SCAN $\leq$**.1** MHz OUT, the cable 6 (blue) to **A10A4J2** OUT 160-166 MHz, and the cable 8 (gray) to **A10A4J3** IN 100 MHz.

# 18. RF Module Phase Lock Adjustments

## Reference

RF-Section:
A6A9 Phase Lock

## Description

The 3.3 GHz Heterodyne Phase Lock Loop sampler circuits and 300 MHz Tripler circuits on the A6A9 Phase Lock Assembly are adjusted and checked for proper operation. The match between the Sampler Driver circuit and the A6A9U1 Sampler is adjusted. Then, the output balance of the A6A9U1 Sampler is set. A second spectrum analyzer is used to adjust the output match between the Tripler circuit and the 300 MHz Power Amplifier. Tripler match is adjusted for maximum 300 MHz output signal with all harmonics more than 15 dB down.

## Equipment

Spectrum Analyzer ........................................ HP 8566B
Digitizing Oscilloscope .................................... HP 54501A
Digital Voltmeter ........................................... HP 3456A
15x2 Extender Board (*service* accessory) ................ 08505-60041
BNC 50-ohm Termination ................................. HP 11593A

**Cables:**
BNC to SMB Cable (*service* accessory) . . . . . . . . . . . . . 85680-60093

## Procedure

1. Set the spectrum analyzer LINE switch to STANDBY. Turn the spectrum analyzer over to position the RF Section on top, as shown in Figure 3-81, and remove the RF Section bottom cover.
2. In the RF Section, disconnect the cable 84 gray/yellow from A6A12J1 and the cable 82 (gray/red) from A6A12J2. Remove the cover from the A6 RF Module, and then reconnect the cable 84 (gray/yellow) to A6A12J1 and the cable 82 (gray/red) to A6A12J2. Refer to Figure 3-82 for the location of the A6A12 YTX Driver Assembly and the A6 RF Module.

## Sampler Match and HET Unlock Detector Delay Adjustments

**Caution**

A6A9U1 Sampler is very susceptible to damage from electrostatic discharge (ESD). Be sure to use proper grounding techniques when handling A6A9 Phase Lock assembly and when disconnecting and connecting cables to A6A9J5 3.3 GHz INPUT and test points A6A9A1E5 and A6A9A1E6.

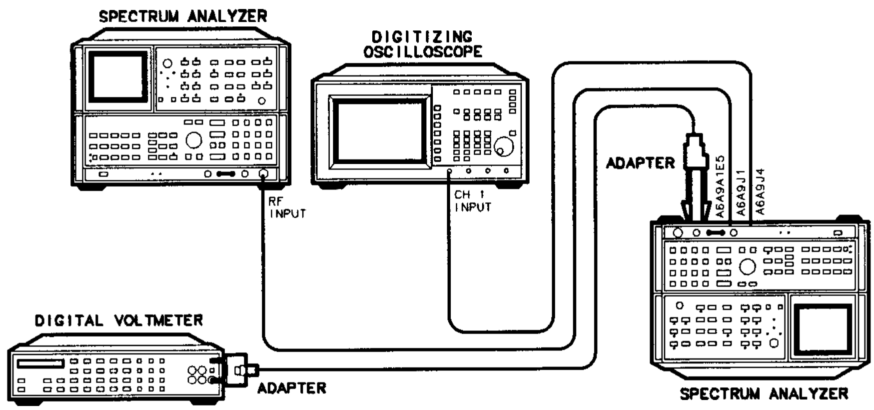


**Figure 3-81. RF Module Phase Lock Adjustments Setup**

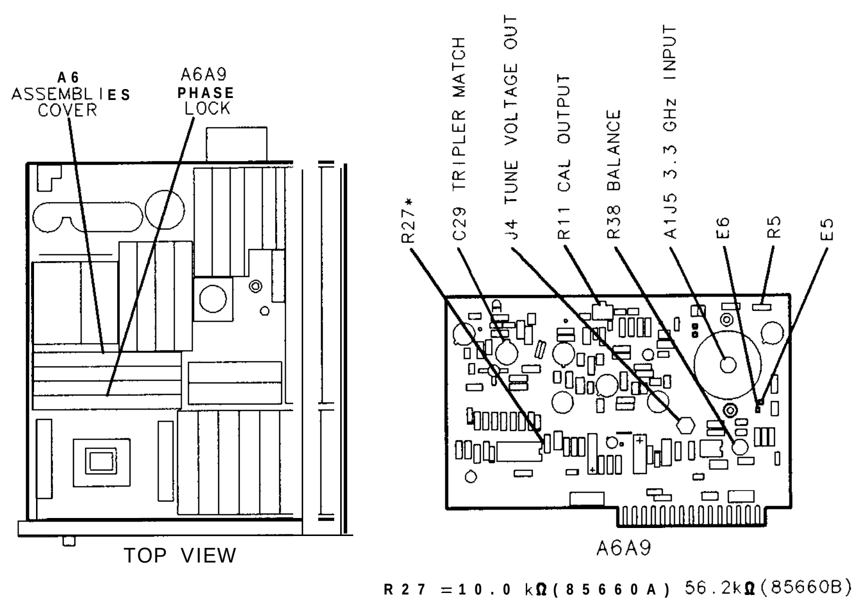


**Figure 3-82. Location of RF Module Phase Lock Adjustments**

3. Disconnect the cable 2 (red) from A6A9J1 300 MHz OUTPUT, the cable 0 (black) from A6A9J2 CAL OUTPUT, the cable 85 (gray/green) from A6A9J3 100 MHz INPUT, the cable 4 (yellow) from A6A9J4 VCO TUNE, and the cable 5 (green) from A6A9J5 3.3 GHz INPUT. Remove the A6A9 Phase Lock Assembly from the RF Section.
4. Remove the front cover from the A6A9 Phase Lock Assembly, and install it in the RF Section on an extender board. Reconnect the cable 85 (gray/green) to A6A9J3 100 MHz INPUT, the cable 4 (yellow) to A6A9J4 VCO TUNE, and cable 5 (green) to A6A9J5 3.3 GHz INPUT.
5. Set the spectrum analyzer LINE switch to ON, and press (0—2.5 GHz).

6. Connect the DVM to A6A9A1E5, and connect the DVM ground to the metal case/shield of the A6A9 Phase Lock Assembly. Refer to Figure 3-82 for the location of A6A9A1E5 and A6A9A1E6.
7. Note the DVM indication at A6A9A1E5.

   Voltage at A6A9A1E5: ________Vdc

8. Connect the DVM to A6A9A1E6, and note the DVM indication.

   Voltage at A6A9A1E6: ________Vdc

9. Add the voltage measured in step 7 to the voltage measured in step 8. The absolute value of the resulting sum should be less than 0.20 Vdc. If the resulting sum is greater than 0.20 Vdc, suspect a failure of A6A9U1 Sampler or related circuit components.

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**Note**

The voltage at A6A9A1E5 should fall in the range of -0.55 Vdc and -0.85 Vdc, and the voltage at A6A9A1E6 should fall in the range of 0.55 Vdc to 0.85 Vdc. If either of the voltages at A6A9A1E5 and A6A9A1E6 do not fall within these ranges, change the value of factory-select component A6A9A1R5. Decreasing the value of A6A9A1R5 decreases the magnitude of the voltages at both A6A9A1E5 and A6A9A1E6. Conversely, an increasing the value of A6A9A1R5 increases the magnitude of the voltages at both A6A9A1E5 and A6A9A1E6. Refer to Table 3-3 for the acceptable range of values for A6A9A1R5, and to Table 3-4 for HP part numbers. Refer to Figure 3-82 for the location of A6A9A1R5.

For example, if the voltage measured at A6A9A1E5 is -0.87 Vdc and the voltage measured at A6A9A1E6 is 0.86 Vdc, then the absolute value of the resulting sum is -0.87 + 0.86 = 0.01 Vdc. Since the resulting sum is less than 0.20 Vdc, the A6A9U1 Sampler is probably not faulty. For this example, the value of A6A9A1R5 should be reduced to decrease the magnitude of both measured voltages to within the recommended ranges. The magnitudes of the voltages measured at A6A9A1E5 and A6A9A1E6 are:

Voltage at A6A9A1E5 = -0.87 = 0.87 Vdc
Voltage at A6A9A1E6 = 0.86 = 0.86 Vdc

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10. Verify that the loaded value of factory-select resistor A6A9A1R27 is 56.2K ohms. Refer to Figure 3-82 for the location of A6A9A1R27.

---

**Note**

Factory-select resistor A6A9A1R27 must be loaded with a value of 56.2K ohms for proper operation of the HET UNLOCK Detector circuit in HP 85660B RF Sections (A6A9 Phase Lock Assembly HP Part Number 85660-60226 and 85660-60256). A6A9A1R27 must be loaded with a value of 10K ohms for use in HP 85660A RF Sections.

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11. Set the spectrum analyzer LINE switch to STANDBY.

12. Disconnect cable 85 (gray/green) from A6A9J3 100 MHz INPUT, cable 4 (yellow) from A6A9J4 VCO TUNE, and cable 5 (green) from A6A9J5 3.3 GHz INPUT. Remove the A6A9 Phase Lock Assembly from the extender board in the RF Section, and replace the A6A9 Phase Lock Assembly front cover.

## 100 MHz Tripler Adjustments

13. Install the A6A9 Phase Lock Assembly in the RF Section on an extender board. Reconnect cable 0 (black) to A6A9J2 CAL OUTPUT, cable 85 (gray/green) to A6A9J3 100 MHz INPUT, cable 4 (yellow) to A6A9J4 VCO TUNE, and cable 5 (green) to A6A9J5 3.3 GHz INPUT.
14. Set the spectrum analyzer LINE switch to ON and press (0—2.5 GHz). Connect a 50-ohm termination to the RF Section front-panel CAL OUTPUT connector.
15. Press (2—22 GHz) on the second spectrum analyzer. Connect the CAL OUTPUT signal on the second spectrum analyzer to the RF INPUT on the second spectrum analyzer, and press (RECALL) 8.
16. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal, and then press (SHIFT) (FREQUENCY SPAN) W.
17. Connect the RF INPUT of the second spectrum analyzer to the RF Section A6A9J1 300 MHz OUTPUT. Set the controls of the second spectrum analyzer as follows:

| | |
|---|---|
| CENTER FREQUENCY | 550 MHz |
| FREQUENCY SPAN | 1 GHz |
| REFERENCE LEVEL | +25 dBm |
| ATTEN | 40 dB |
| LOG dB/DIV | 10 dB |

18. The 300 MHz output signal should be visible on the display of the second spectrum analyzer, along with other harmonics of 100 MHz. Press MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 300 MHz signal. Adjust A6A9A1C29 TRIPLER MATCH to maximize the power level of the 300 MHz signal.
19. Press MARKER (PEAK SEARCH) and verify that the power level of the 300 MHz signal is greater than + 16.5 dBm. Press MARKER (Δ), and then press the (⇑) and (⇓) keys (or turn the DATA knob) to position the second marker on the peak of each of the other displayed harmonics in succession, and verify that the level of each harmonic is greater than 15 dB down relative to the peak of the 300 MHz signal.
20. Disconnect the second spectrum analyzer from the RF Section A6A9J1 300 MHz OUTPUT. Remove the 50-ohm termination from the RF Section front-panel CAL OUTPUT connector.

## Sampler Output Balance Adjustment

2 1. Use a BNC to SMB snap-on test cable to connect the oscilloscope Channel 1 input to the RF Section **A6A9J4** VCO TUNE connector.

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

23. Set the oscilloscope controls as follows:

Press (CHAN):

Channel 1 . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on
amplitude scale . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **10.0V/div**
offset . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -10.0000V
coupling . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **dc**

Press (TIME BASE):

time scale . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **1 msec/div**
reference . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **left**

Press (TRIG):

EDGE TRIGGER . . . . . . . . . . . . . . . . . . . . . . . . . auto, edge
source . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1
level . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **–** lO.OOOV, rising edge

Press (DISPLAY):

connect dots . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . **on**

24. On the oscilloscope press (SHOW). The VCO TUNE waveform displayed on the oscilloscope should be similar to Figure 3-83. Use the oscilloscope (ΔTΔV) markers to measure the waveform maximum and minimum voltages, and the dead time between consecutive voltage ramps.

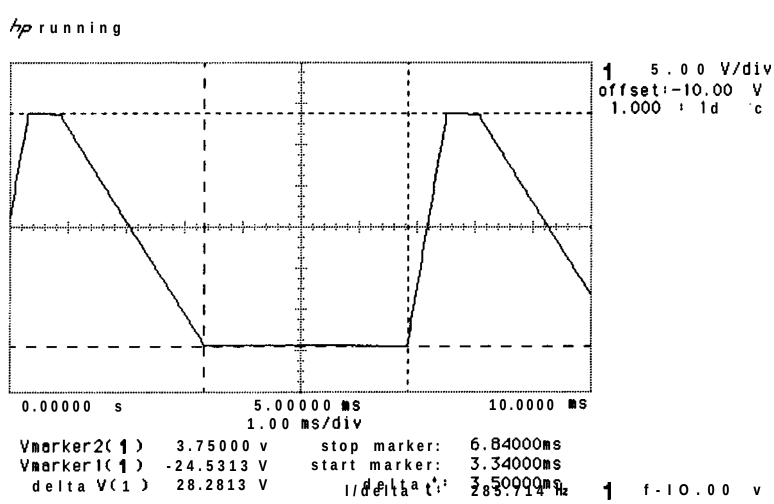


**Figure 3-83. A Sampler Balance Adjustment Waveform**

25. Adjust A6A9A1R38 BALANCE for a dead time between consecutive voltage ramps of 3.5 ± 0.1 msec. Each voltage ramp should have a "flattened" top and reach a maximum voltage of approximately +3.7 Vdc. The minimum voltage between consecutive voltage ramps should be approximately -24.4 Vdc.
26. Set the spectrum ananlyzer LINE switch to STANDBY. Disconnect the oscilloscope from the RF Section A6A9J4 VCO TUNE. Disconnect cable 0 (black) from A6A9J2 CAL OUTPUT, the cable 85 (gray/green) from A6A9J3 100 MHz INPUT, and cable 5 (green) from A6A9J5 3.3 GHz INPUT.
27. Remove the A6A9 Phase Lock Assembly from the extender board, and remove the extender board from the RF Section. Reinstall the A6A9 Phase Lock Assembly in the RF Section.
28. Disconnect cable 84 (gray/yellow) from A6A12J1 and the cable 82 (gray/red) from A6A12J2. Replace the cover to the A6 RF Module, and then reconnect cable 84 (gray/yellow) to A6A12J1 and cable 82 (gray/red) to A6A12J2.
29. Reconnect cable 2 (red) to A6A9J1 300 MHz OUTPUT, cable 0 (black) to A6A9J2 CAL OUTPUT, cable 85 (gray/green) to A6A9J3 100 MHz INPUT, cable 4 (yellow) to A6A9J4 VCO TUNE, and cable 5 (green) to A6A9J5 3.3 GHz INPUT on the A6A9 Phase Lock Assembly.
30. Perform adjustment procedure 19, "CAL Output Adjustment".

## 19. CAL Output Adjustment

**Reference**

, RF-Section:
A6A9 Phase Lock

Related Performance Test:
Calibrator Amplitude Accuracy Test

**Description**

A power meter is used to measure the output level of the 100 MHz CAL OUTPUT signal. The 100 MHz Calibrator circuit on the A6A9 Phase Lock Assembly is adjusted as necessary for a -10.00 dBm output level. The harmonic level of the calibrator output signal is then checked using a second spectrum analyzer.

**Equipment**

Power Meter . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 436A
Power Sensor . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8481A
Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B

**Procedure**

1. Set the spectrum analyzer LINE switch to STANDBY. Position the spectrum analyzer on its right side as shown in Figure 3-84, and remove the RF Section bottom cover.

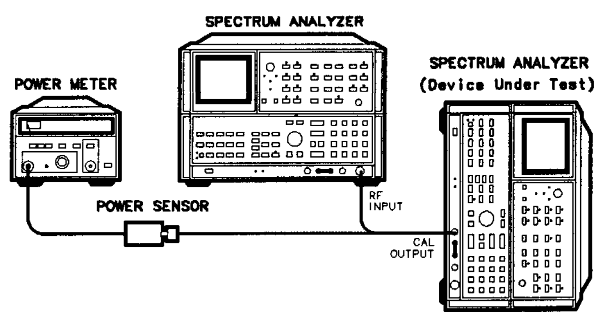


**Figure 3-84. Cal Output Adjustment Setup**

2. Set the RF Section LINE switch to ON, and allow the RF Section and power meter/power sensor to warm up for at least 5 minutes.
3. Connect the power sensor to the power meter POWER REF output, and zero and calibrate the power meter. Connect the power meter/power sensor to the RF Section front-panel CAL OUTPUT connector.
4. Adjust A6A9A1R11 CAL OUTPUT fully clockwise for maximum circuit gain and verify that the power meter indication is -9.0 dBm or greater. Adjust A6A9A1R11 CAL OUTPUT fully counterclockwise for minimum circuit gain and verify that the power meter indication is – 11 .0 dBm or less.

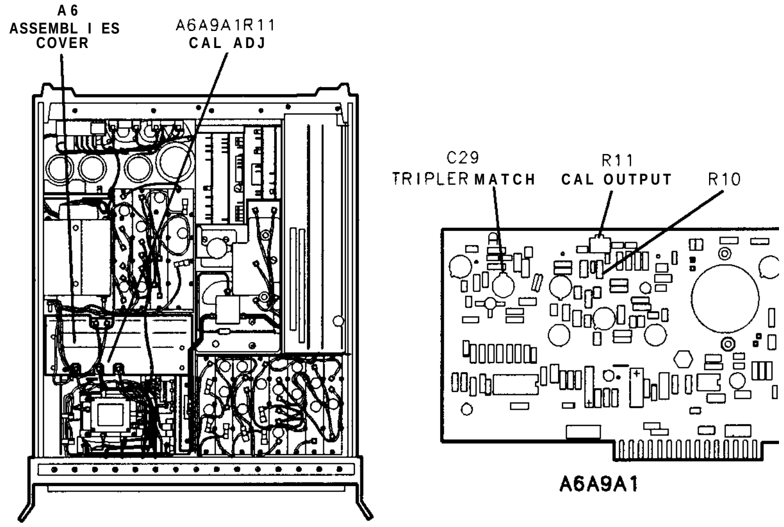


**Figure 3-85. Location of CAL OUTPUT Adjustment**

**Note**

A6A9A1R11 CAL OUTPUT should have at least 2.0 dB of adjustment range, centered at a front-panel CAL OUTPUT signal level of -10.0 dBm. If A6A9A1R11 CAL OUTPUT does not have sufficient range to adjust the CAL OUTPUT signal level to -9.0 dBm, decrease the value of factory-select component A6A9A1R10; conversely, increase the value of A6A9A1R10 if A6A9A1R11 CAL OUTPUT does not have sufficient range to adjust the CAL OUTPUT signal level to – 11 .0 dBm. Select the value of factoryselect component A6A9A1R10 to center the range of A6A9A1R11 CAL OUTPUT as close as possible to the range of -9.0 dBm to -11.0 dBm. Refer to Table 3-3 for the acceptable range of values for A6A9A1R10, and Table 3-4 for HP part numbers. Refer to Figure 3-85 for the location of A6A9A1R10.

5. Adjust A6A9A1R11 CAL OUTPUT for a power meter indication of -10.00 ± 0.01 dBm.
6. Disconnect the power meter/power sensor from the RF Section front-panel CAL OUTPUT connector.
7. Press (2-22 GHz) on the second spectrum analyzer. Connect the CAL OUTPUT signal on the second spectrum analyzer to the RF INPUT on the second spectrum analyzer, and press (RECALL) 8.
8. Adjust the AMPTD CAL control on the second spectrum analyzer for a -10.00 dBm displayed signal, and then press (SHIFT) (FREQUENCY SPAN) W.
9. Connect the second spectrum analyzer RF input to the RF Section front-panel CAL OUTPUT connector. Set the controls of the second spectrum analyzer as follows:

CENTER FREQUENCY . . . . . . . . . . . . . . . . . . . . . . . . . 550 MHz
FREQUENCY SPAN . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 GHz
REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -7 dBm
LOG dB/DIV . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 dB

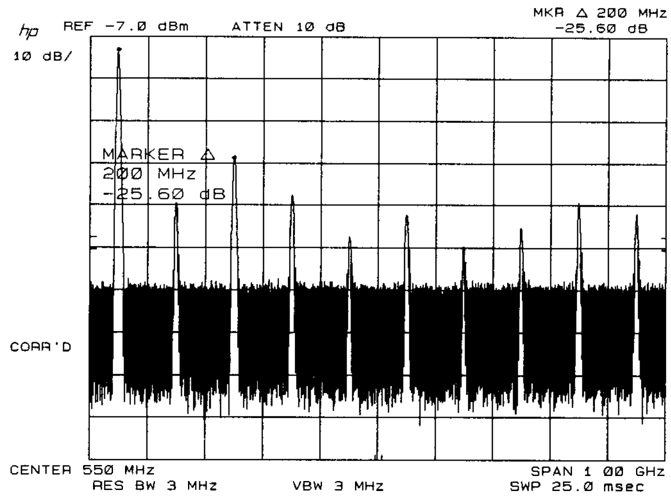


**Figure 3-86. CAL OUTPUT Harmonics**

10. On the second spectrum analyzer, press MARKER [PEAK SEARCH], [al to position a marker on the peak of the displayed 100 MHz signal. Then, press the (⇧) key (or turn the DATA knob) to position the second marker on the peak of each displayed harmonic of the 100 MHz signal in succession, and verify that the level of each harmonic is greater than 25 dB down relative to the peak of the 100 MHz CAL OUTPUT signal. See Figure 3-86.

    If the level of each harmonic of the 100 MHz CAL OUTPUT is not greater than 25 dB down perform the following steps:

    a. On the second spectrum analyzer, press the (⇧) and (⇩) keys to place the second marker on the peak of the highest harmonic of the 100 MHz signal.
    b. Adjust A6A9A1C29 TRIPLER MATCH only as much as required to lower the level of the highest harmonic to greater than 25 dB down relative to the peak of the 100 MHz CAL OUTPUT signal. Refer to Figure 3-85 for the location of A6A9A1C29 TRIPLER MATCH.
    c. Disconnect cable 2 (red) from A6A9J1 300 MHz OUTPUT on the A6A9 Phase Lock Assembly. Connect the RF INPUT of the second spectrum analyzer to A6A9J1 300 MHz OUTPUT.
    d. On the second spectrum analyzer, key in (REFERENCE LEVEL) +25 dBm, (ATTEN) 40 dB, MARKER (OFF), MARKER [PEAK SEARCH] to position a marker on the peak of the displayed 300 MHz signal. Readjust A6A9A1C29 TRIPLER MATCH as necessary for a 300 MHz signal level of at least + 16.5 dBm.
    e. Disconnect the second spectrum analyzer from A6A9J1 300 MHZ OUTPUT, and reconnect cable 2 (red) to A6A9J1 300 MHz OUTPUT.
    f. Repeat steps 9 through 10E until no further adjustment is required.

11. Replace the RF Section bottom cover.

# 20. Last Converter Adjustments

## Reference

RF-Section:
A6A3 Last Converter

## Description

A 321.4 MHz signal from a synthesized sweeper is applied to the 321.4 MHz IF input of the A6A3 Last Converter Assembly, and the 321.4 MHz Bandpass Filter is adjusted. Then, a 310.7 MHz signal is applied to the 321.4 MHz IF input, and the 10.7 MHz Notch Filter is adjusted to null 10.7 MHz subharmonic spurious responses.

## Equipment

Synthesized Sweeper . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .HP 8340A/B
Spectrum Analyzer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 8566B
15x2 Extender Board (service *accessory)* . . . . . . . . . . . . . . 08505-60041
Probe (SMB Male Bulkhead Connector) . . . . . . . . . . . . . . . . . . . 1250-0691

**Cables:**
BNC to SMB Cable (2 *required) (service accessory)* . . . . . *85680-60093*

## Procedure

1. Set the spectrum analyzer LINE switch to STANDBY. Turn the spectrum analyzer over to position the RF Section on top, as shown in Figure 3-87, and remove the RF Section bottom cover.
2. In the RF Section, disconnect cable 84 (gray/yellow) from A6A12J1 and cable 82 (gray/red) from A6A12J2. Disconnect cable 2 (red) from A6A9J1 300 MHz OUTPUT, cable 0 (black) from A6A9J2 CAL OUTPUT, cable 85 (gray/green) from A6A9J3 100 MHz INPUT, cable 4 (yellow) from A6A9J4 VCO TUNE, and cable 5 (green) from A6A9J5 3.3 GHz INPUT.
3. Remove the cover from the A6 RF Module. Remove the A6A9 Phase Lock Assembly, the A6A10 Miscellaneous Bias/Relay Driver Assembly, the A6A11 Slope Generator Assembly, and the A6A12 YTX Driver Assembly from the RF Section.

## 20. Last Converter Adjustments

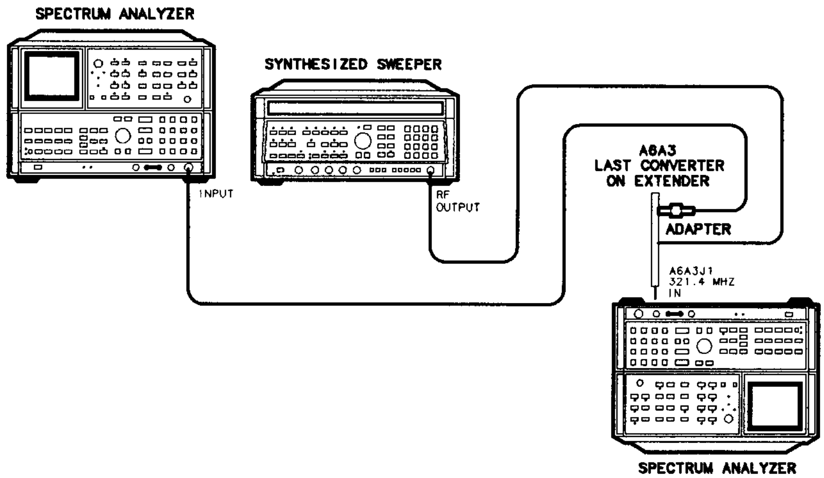


**Figure 3-87. Last Converter Adjustments Setup**

4. Remove the RF Section right side cover (now on the left), and remove the two screws attaching the A6A3 Last Converter Assembly to the RF Section chassis.
5. Disconnect cable 1 (brown) from A6A3J1 321.4 MHz IN, cable 2 (red) from A6A3J2 300 MHz IN, and cable 81 (gray/brown) from A6A3J3 (21.4 MHz OUT) on the A6A3 Last Converter Assembly. Remove the A6A3 Last Converter Assembly from the RF Section.
6. Adjust the five variable capacitors A6A3A1C8, A6A3A1C9, A6A3A1C10, A6A3A1C11, and A6A3A1C12 in the 321.4 MHz Bandpass Filter for maximum capacitance. The capacitors are visible through five evenly-spaced, unlabeled access holes in the bottom cover of the A6A3 Last Converter Assembly; position each capacitor with its adjustment slot vertical and plates fully meshed. Refer to Figure 3-88 for the location of A6A3A1C8, A6A3A1C9, A6A3A1C10, A6A3A1C11, and A6A3A1C12.
7. Install the A6A3 Last Converter Assembly in the RF Section using an extender board. Reconnect cable 2 (red) to A6A3J2 300 MHz IN.
8. Reinstall the A6A9 Phase Lock Assembly, the A6A10 Miscellaneous Bias/Relay Driver Assembly, the A6A11 Slope Generator Assembly, and the A6A12 YTX Driver Assembly in the RF Section.
9. Reconnect cable 2 (red) to A6A9J1 300 MHz OUTPUT and cable 85 (gray/green) to A6A9J3 100 MHz INPUT.

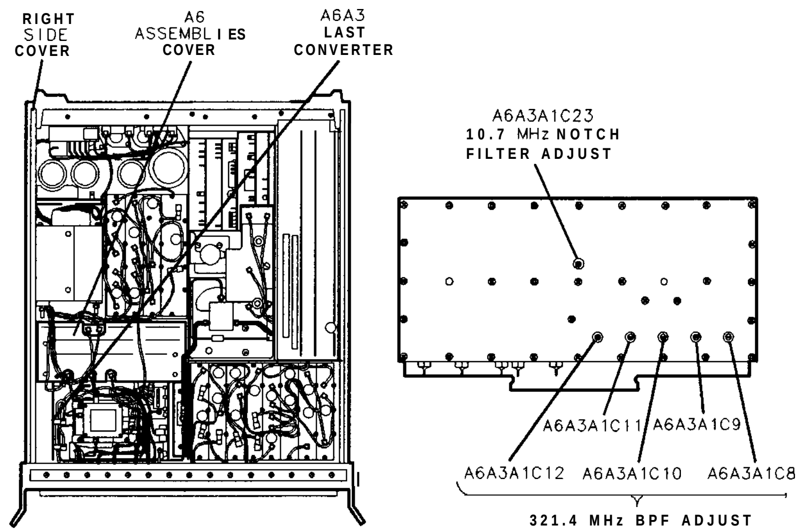


**Figure 3-88. Location of Last Converter Adjustments**

10. Set the spectrum analyzer LINE switch to ON, and key in (0 - 2.5 GHz), SWEEP (SINGLE). A HET UNLOCK message should appear on the CRT display.
11. Connect a BNC to SMB snap-on test cable and probe (SMB male bulkhead connector) to the RF INPUT of the second spectrum analyzer.
12. Press (2—22 GHz) on the second spectrum analyzer. Set the controls of the second spectrum analyzer as follows:

    CENTER FREQUENCY .............................. 321.4 MHz
    FREQUENCY SPAN ................................ 500 kHz
    REFERENCE LEVEL .............................. -30 dBm

13. Press (2-22 GHz) on the synthesized sweeper, and key in (CW) 321.4 MHz, (POWER LEVEL) -20.0 dBm. Connect the RF OUTPUT of the synthesized sweeper to A6A3J1 321.4 MHz IN using a second BNC to SMB snap-on test cable.

**Note** In the following steps, an SMB male bulkhead connector is used as an input probe for the second spectrum analyzer. The probe tip is partially inserted through access holes in the bottom cover of the A6A3 Last Converter Assembly. If the probe tip is allowed to touch one of the adjustable capacitors, false readings will result as indicated by a sudden jump in the amplitude of the 321.4 MHz signal displayed on the second spectrum analyzer.

14. Partially insert the probe connected to the second spectrum analyzer into the access hole above A6A3A1C9 (the second access hole from the right). Using a non-metallic adjustment tool, adjust A6A3A1C8 (the right-most of the five access holes) to maximize the amplitude of the 321.4 MHz signal displayed on the second spectrum analyzer.

15. Move the probe to the access hole above A6A3A1C8 (the rightmost access hole). Adjust A6A3A1C9 (second access hole from the right) to minimize the amplitude of the 321.4 MHz signal displayed on the second spectrum analyzer.
16. With the probe still in the access hole above A6A3A1C8, adjust A6A3A1C10 (center access hole) to maximize the amplitude of the 32 1.4 MHz signal displayed on the second spectrum analyzer.
17. Adjust A6A3A1C11 (second access hole from the left) to minimize the amplitude of the 321.4 MHz signal displayed on the second spectrum analyzer.
18. Adjust A6A3A1C12 (left-most of the five access holes) to maximize the amplitude of the 321.4 MHz signal displayed on the second spectrum analyzer.
19. Remove the probe from the access hole above A6A3A1C8, and disconnect the probe from the BNC to SMB snap-on test cable. Use the BNC to SMB snap-on test cable to connect the RF INPUT of the second spectrum analyzer to A6A3J3 (21.4 MHz OUT).
20. Set the spectrum analyzer controls as follows:

    CENTER FREQUENCY .......................... 10.7 MHz
    FREQUENCY SPAN .......................... 500 kHz
    REFERENCE LEVEL .......................... -30 dBm

21. On the synthesized sweeper, key in (CW) 310.7 MHz, [POWER LEVEL] -40 dBm.
22. Locate the 10.7 MHz Notch Filter adjustment, visible through the remaining unlabeled access hole near the center of the bottom cover of the A6A3 Last Converter Assembly (refer to Figure 3-88). Adjust A6A3A1C23 to minimize the amplitude of the 10.7 MHz signal displayed on the second spectrum analyzer.
23. Set the RF Section LINE switch to STANDBY.
24. Disconnect the synthesized sweeper from A6A3J1 321.4 MHz IN. Disconnect the second spectrum analyzer from A6A3J3 (21.4 MHz OUT).

    Disconnect cable 2 (red) from A6A3J2 300 MHz IN.
25. Disconnect cable 2 (red) from A6A9J1 300 MHz OUTPUT and cable 85 (gray/green) from A6A9J3 100 MHz INPUT. Remove the A6A9 Phase Lock Assembly, the A6A10 Miscellaneous Bias/Relay Driver Assembly, the A6A11 Slope Generator Assembly, and the A6A12 YTX Driver Assembly from the RF Section.
26. Reinstall the A6A3 Last Converter Assembly in the RF Section, and replace the two screws attaching the A6A3 Last Converter Assembly to the RF Section chassis. Replace the RF Section right side cover.
27. Reconnect cable 1 (brown) to A6A3J1 321.4 MHz IN, cable 2 (red) to A6A3J2 300 MHz IN, and cable 81 (gray/brown) to A6A3J3 (21.4 MHz OUT) on the A6A3 Last Converter Assembly.
28. Reinstall the A6A9 Phase Lock Assembly, the A6A10 Miscellaneous Bias/Relay Driver Assembly, the A6A11 Slope

Generator Assembly, and the A6A12 YTX Driver Assembly in the RF Section. Replace the cover on the A6 RF Module.

29. Reconnect cable 84 (gray/yellow) to A6A12J1 and cable 82 (gray/red) to A6A12J2. Reconnect cable 2 (red) to A6A9J1 300 MHz OUTPUT, cable 0 (black) to A6A9J2 CAL OUTPUT, cable 85 (gray/green) to A6A9J3 100 MHz INPUT, cable 4 (yellow) to A6A9J4 VCO TUNE, and cable 5 (green) to A6A9J5 3.3 GHz INPUT.

30. Replace the RF Section bottom cover.

## 21. Frequency Response Adjustments

**Reference**

RF Section:
A6A3 Last Converter
A6A10 Miscellaneous Bias/Relay Driver
A6A11 Slope Generator
A6A12 YTX Driver

**Related Performance Test**

Frequency Response Test
Sweep + Tune Output Test

**Description**

The frequency response (flatness) and amplitude adjustments are performed for each of the spectrum analyzer frequency bands listed in Table 3-14.

**Table 3-14. Frequency Bands**

| Bands | Harmonic Mixing Number/Mode | Frequency Range | IF Frequency |
|---|---|---|---|
| 0 Band A | 1− | 100 Hz – 2.5 GHz | 3.6214 GHz |
| **Preselected Mixing Bands:** | | | |
| 1 Band B | 1− | 2.0 GHz – 5.8 GHz | 0.3214 GHz |
| 2 Band C | 2+ | 5.8 GHz – 12.5 GHz | 0.3214 GHz |
| 3 Band D | 3+ | 12.5 GHz – 18.6 GHz | 0.3214 GHz |
| 4 Band E | 4+ | 18.6 GHz – 22.0 GHz | 0.3214 GHz |
| **External Mixing Bands (Band F; nominal conversion losses listed):** | | | |
| 6 (K) | 6+ | 18.6 GHz – 26.5 GHz | 0.3214 GHz 18 dB |
| 7 (A) | 8+ | 26.5 GHz – 40.0 GHz | 0.3214 GHz 20 dB |
| 8 (Q) | 10+ | 33.0 GHz – 50.0 GHz | 0.3214 GHz 22 dB |
| 9 (U) | 10+ | 40.0 GHz – 60.0 GHz | 0.3214 GHz 24 dB |
| 10 (V) | 14+ | 50.0 GHz – 75.0 GHz | 0.3214 GHz 26 dB |
| 11 (E) | 16+ | 60.0 GHz – 90.0 GHz | 0.3214 GHz 28 dB |
| 12 (W) | 18+ | 75.0 GHz – 110 GHz | 0.3214 GHz 30 dB |
| 13 (F) | 24+ | 90.0 GHz – 140 GHz | 0.3214 GHz 32 dB |
| 14 (D) | 30+ | 110 GHz – 170 GHz | 0.3214 GHz 34 dB |
| 15 (G) | 36+ | 140 GHz – 210 GHz | 0.3214 GHz 36 dB |
| 16 (Y) | 44+ | 170 GHz – 260 GHz | 0.3214 GHz 38 dB |
| 17 (J) | 54+ | 170 GHz – 325 GHz | 0.3214 GHz 40 dB |

In Band A (100 Hz – 2.5 GHz), the A6A6 First Converter Assembly functions as the spectrum analyzer input mixer. In Bands B, C, D, and E (2 GHz – 22 GHz), the A6A8 YIG-Tuned Mixer (YTX) Assembly functions as both a tracking preselector and an harmonic input mixer. A preselector is a YIG-tuned bandpass filter that tunes in synchronism with the tuning of the spectrum analyzer's 1st LO. This prevents undesired mixing products from being generated in the harmonic input mixer. In Band F (the external mixing bands), the output of an external harmonic mixer is connected to the front-panel 321.4 MHz IF INPUT, bypassing the two internal mixers.

The frequency response of the spectrum analyzer is mainly determined by the two input mixers - the A6A6 First Converter Assembly and A6A8 YTX Assembly - and the associated A6A5 Amplifier/Coupler/Load Unit (ACLU) Assembly. Additional signal path components that affect frequency response include the A6J3 RF INPUT Connector Assembly, A6A1 Coaxial RF Switch, A6A2 RF Attenuator, A6A14 Limiter, and semi-rigid cables A6W1, A6W2, A6W3, A6W4, A6W5, and A6W20. When any of these components is adjusted or replaced, the spectrum analyzer frequency response must be verified and adjusted as necessary.

To adjust frequency response, an externally-leveled synthesized sweeper is used as a reference signal source. The synthesized sweeper output is connected to the spectrum analyzer RF INPUT using a low-loss microwave cable, a precision resistive splitter, and a power sensor or planar-doped, barrier diode detector. The power meter or detector output is connected to the synthesized sweeper LEVELING EXT INPUT to precisely level the signal power at the input of the spectrum analyzer. Since the synthesized sweeper and spectrum analyzer both sweep independently of each other, one must be swept quickly relative to the other to review the frequency response across a given frequency band.

The ±9 Vdc precision reference is initially checked and adjusted. Then, the drive current to the A6A4 Second Converter 3.3 GHz oscillator is set at 15 mA, and the SWEEP+TUNE offset is adjusted for Band A.

Over each frequency band, the leveled reference signal from the synthesized sweeper is used to adjust the spectrum analyzer for optimum flatness and amplitude. In Band A (100 Hz – 2.5 GHz, not preselected), overall RF gain and flatness are adjusted. In Bands B, C, D, and E (2 GHz – 22 GHz), the adjustments necessary to align the A6A8 YIG-Tuned Mixer (YTX) include YTX mixer diode biasing, YTX/YTO tracking and linearity, and YTX delay compensation. After the A6A8 YTX is aligned in each of these four preselected bands, RF Gain and flatness are then optimized with the Preselector DAC centered at the default setting of 32 and the YTX modulated with a 20 Hz sinusoid. In the external mixing bands (Band F), the conversion loss is set to 30 dB and the spectrum analyzer RF gain is adjusted with a 321.4 MHz, -30 dBm reference signal connected to the front panel 32 1.4 MHz IF INPUT.

## Equipment

Synthesized Sweeper .................................... HP 8340A/B
Power Meter .............................................. HP 436A
Power Sensor (50 MHz to 18 GHz) ......................... HP 8481A
Frequency Synthesizer .................................... HP 3335A
Digital Voltmeter ......................................... HP 3456A
Pulse/Function Generator ................................. HP 8116A
Planar-doped Barrier Diode Detector (10 MHz to 33 GHz) ........ HP 8473D/8474C
Power Splitter ............................................ HP 11667B

**Adapters:**

| | |
|---|---|
| Type N (f) to BNC (m) | HP 1250-1477 |
| Type N (f) to APC 3.5 (f) | HP 1250-1745 |
| APC 3.5 (f) to APC 3.5 (f) | HP 1250-1749 |
| SMB (m) to SMA (f) | HP 1250-0674 |
| APC 3.5 (m) to Type N (f) | HP 1250-1750 |
| APC 3.5 (m) to Type N (m) | HP 1250-1743 |
| BNC (f) to Dual Banana Plug | HP 1251-2277 |

**Cables:**

| | |
|---|---|
| Low Loss Microwave Test Cable (APC 3.5) | HP 8120-4921 |
| BNC to SMB Snap-on Test Cable | HP 85680-60093 |

**Note**

Adjustment procedure 13, "Sweep, DAC, and Main Coil Driver Adjustments" should be performed prior to this procedure, particularly if the Al6 Scan Generator Assembly, A19 DAC Assembly, A20 Main Coil Driver Assembly, or A11A3 YTO are adjusted, repaired, or replaced. The YTX TUNE/YTO TUNE 1 (-3 V/GHz) signal from the A19 DAC Assembly directly affects the tuning of both the A11A3 YTO and A6A8 YTX. Adjustments on the Al6 Scan Generator Assembly, A19 DAC Assembly, and A20 Main Coil Driver Assembly have a direct affect on YTX/YTO tracking in the preselected (2 GHz – 22 GHz) frequency bands.

## Procedure

### Preliminary Adjustments

1. Set the spectrum analyzer LINE switch to STANDBY. Turn the spectrum analyzer over to position the RF Section on top, as shown in Figure 3-89 and remove the RF Section bottom cover.

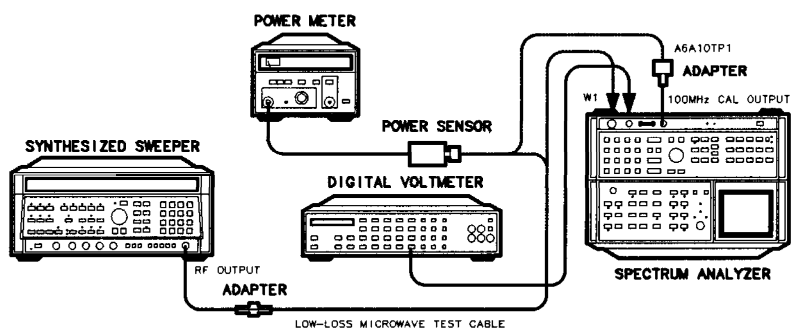


**Figure 3-89. Frequency Response Preliminary Adjustments Setup**

2. Connect a jumper between A12TP2 to A12TP3 (LOCK INDICATOR DISABLE) on the Al2 Front Panel Interface Assembly in the RF Section. See Figure 3-90 for the location of A12TP2 and A12TP3.

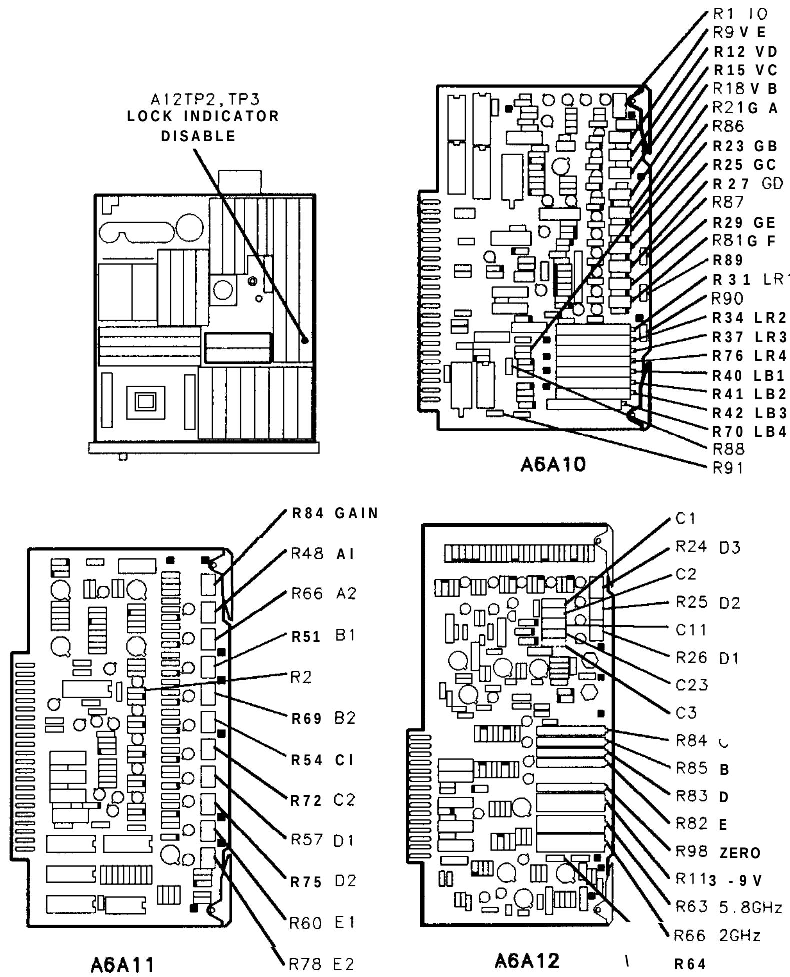


**Figure 3-90. Location of Frequency Response Adjustments**

3. In the RF Section, disconnect cable 84 (gray/yellow) from **A6A12J1** and cable 82 (gray/red) from **A6A12J2**. Remove the cover from the A6 RF Module, and then reconnect cable 84 (gray/yellow) to **A6A12J1** and cable 82 (gray/red) to **A6A12J2**. See Figure 3-90 for the location of the **A6A12** YTX Driver Assembly and the A6 RF Module.

**Note** The spectrum analyzer must be ON continuously (not in STANDBY) and set to the (2—22 GHz) settings for at least 30 minutes prior to performing the following adjustment procedure to allow the temperature and tuning of the **A6A8** YTX and associated circuitry to fully stabilize.

4. Set the RF Section LINE switch to ON, and allow the spectrum analyzer to warm up for at least 30 minutes.

5. Connect the power sensor to the power meter POWER REF output, and zero and calibrate the power meter. Connect the power meter/power sensor to the RF Section front-panel CAL OUTPUT connector using a Type N (f) to BNC (m) adapter, and

verify that the power meter indication is -10.00 dBm ±0.10 dB. If the 100 MHz CAL OUTPUT power level is not within this tolerance, perform adjustment procedure 19, "CAL OUTPUT Adjustment", before continuing with this adjustment procedure.

6. Disconnect the power meter/power sensor from the spectrum analyzer front-panel CAL OUTPUT connector.
7. Press (2-22 GHz) on the synthesized sweeper. Set the synthesized sweeper controls as follows:

   CW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . .21.4 MHz
   POWER LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . – 15.0 dBm

8. Connect the low-loss microwave test cable to the frequency synthesizer RF OUTPUT using an APC 3.5 (f) to APC 3.5 (f) adapter. Connect the power meter/power sensor to the opposite end of the test cable using a Type N (f) to APC 3.5 (f) adapter.
9. On the synthesized sweeper, press (POWER LEVEL) and adjust the ENTRY knob for a power meter indication of -15.00 dBm ±0.03 dB at 21.4 MHz.
10. Disconnect cable 81 (gray/brown) W1 from A6A3J3 (21.4 MHz OUT) on the A6A3 Last Converter Assembly. Disconnect the power sensor from the low-loss microwave test cable, and connect the test cable to cable 81 (gray/brown) W1 using an SMB (m) to SMA (f) adapter. See Figure 3-90 for the location of A6A3J3 (21.4 MHz OUT).
11. On the spectrum analyzer, key in (RECALL) 8. Verify that the displayed signal amplitude indicated by the MARKER is -10.00 dBm ±0.40 dB. If the displayed signal amplitude is not within this tolerance, perform the following adjustment procedures as necessary to adjust the overall RF gain of the HP 85662A IF/Display Section before continuing with this adjustment procedure:

    5. Log Amplifier Adjustments
    6. Video Processor Adjustments
    10. Step Gain and 18.4 MHz Local Oscillator Adjustments
    8. 21.4 MHz Bandwidth Filter Adjustments
    11. Down/Up Converter Adjustments

12. Disconnect the low-loss microwave test cable from cable 81 (gray/brown) W1, and reconnect cable 81 (gray/brown) W1 to A6A3J3 (21.4 MHz OUT) on the A6A3 Last Converter Assembly.
13. Connect the DVM to A6A10TP1, and connect the DVM ground to A6A10TP2. See Figure 3-90 for the location of A6A10TP1 and A6A10TP2.
14. Adjust A6A10R1 IO (3.3 GHz Oscillator Drive, to IE on A6A4 Second Converter) for a DVM indication of -0.15 ±0.01 Vdc. See Figure 3-90 for the location of A6A10R1.
15. Connect the DVM to A6A12TP3 (-9 V), and connect the DVM ground to A6A12TP2 (YTX COM) in the RF Section. See Figure 3-90 for the location of A6A12TP3 and A6A12TP2.

**Note**

±9 Vdc Reference Supplies adjustment A6A12R113 -9 V affects YTX/YTO tracking, YTX diode bias, and Slope Generator Upper/Lower Segment frequency breakpoints in all preselected frequency bands (Bands B, C, D, and E, 2 GHz – 22 GHz).

16. Adjust 17-turn potentiometer A6A12R113 -9 V for a DVM indication of -9.000 fO.OO1 Vdc. See Figure 3-90 for the location of A6A12R113.
17. Press (2–22 GHz) on the spectrum analyzer. Set the controls of the spectrum analyzer as follows:

    CENTER FREQUENCY .......................... 0 Hz
    FREQUENCY SPAN .......................... 0 Hz
    SWEEP .......................... SINGLE
18. Use a BNC cable and a BNC (f) to dual banana plug adapter to connect the DVM to the RF Section rear-panel SWEEP+TUNE OUT connector.
19. Adjust 25-turn potentiometer A6A12R98 ZERO for a DVM indication of 0.000 fO.OO1 Vdc. See Figure 3-90 for the location of A6A12R98.

### Band A, 10 MHz to 2.5 GHz

20. Connect the equipment as shown in Figure 3-91, with one resistive output of the power splitter connected to the power meter/power sensor using an APC 3.5 (m) to Type N (f) adapter, and the second resistive output connected to the spectrum analyzer RF INPUT using an APC 3.5 (m) to Type N (m) adapter. Connect the power meter rear panel RECORDER OUTPUT to the synthesized sweeper front panel LEVELING EXT INPUT.
21. Press (INSTR PRESET) on the synthesized sweeper. Set the controls of the synthesized sweeper as follows:

    CW .......................... 100 MHz
    POWER LEVEL .......................... -9.0 dBm
    RF .......................... on
    LEVELING .......................... INT

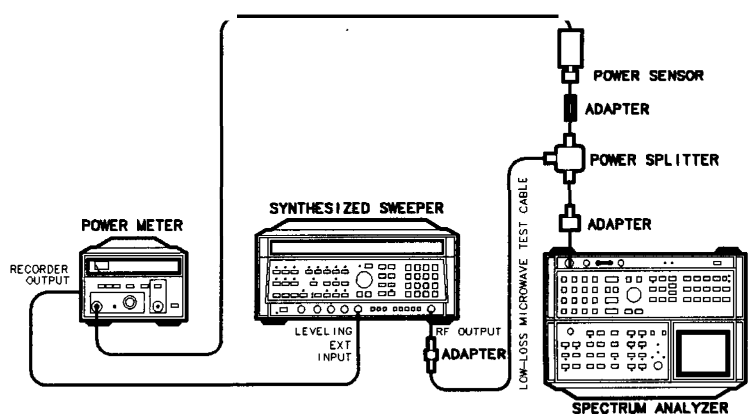


**Figure 3-91. Frequency Response Adjustments Setup (10 MHz to 2.5 GHz)**

22. 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.
23. On the power meter, press (RANGE HOLD) (turning it on).
24. 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.
25. 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.

26. Press (2–22 GHz) on the spectrum analyzer. Set the RF Section front-panel AMPTD CAL control to the approximate center of its adjustment range.

**Note** Do not vary the spectrum analyzer front-panel AMPTD CAL control setting for the remaining steps in this adjustment procedure.

27. Set (Band A Lower Segment) A6A11R48 Al and (Band A Upper Segment) A6A11R66 A2 each to the approximate center of its adjustment range.

    Then, adjust A6A11R84 GAIN fully clockwise for maximum RF gain. See Figure 3-90 for the locations of A6A11R48 Al, A6A11R66 A2, and A6A11R84 GAIN.
28. On the spectrum analyzer, key in (RECALL) 8, (REFERENCE LEVEL) -4 dBm and then press the (⇧) and (⇩) keys as necessary to position the peak of the displayed 100 MHz signal within one division of the top graticule line. Key in MARKER (PEAK SEARCH), MARKER (Δ) on the spectrum analyzer to position two markers on the peak of the displayed 100 MHz signal.
29. Readjust A6A11R84 GAIN counterclockwise to decrease the RF gain 5.00 dB ±0.02 dB, as indicated by the MARKER Δ indication on the spectrum analyzer display.
30. On the spectrum analyzer, key in (RECALL) 8.
31. Adjust 17-turn potentiometer (Band A Step Gain) A6A10R21 GA to adjust the amplitude of the displayed 100 MHz signal to – 10.00 dBm ±0. 10 dB. Adjust A6A10R21 GA counterclockwise to increase the signal level, and clockwise to decrease the signal level. If A6A10R21 GA does not have sufficient range, adjust the amplitude of the 100 MHz displayed signal as close as possible to -10.00 dBm.

32. On the spectrum analyzer, key in (2–22 GHz), (SHIFT) TRACE A (MAX HOLD) b. Set the spectrum analyzer controls as follows:

| | |
|---|---|
| START FREQ | 10 MHz |
| STOP FREQ | 2.5 GHz |
| RES BW | 3 MHz |
| REFERENCE LEVEL | -7 dBm |
| LOG SCALE | 1 dB/DIV |
| SWEEP TIME | .2s |

33. Set the synthesized sweeper controls as follows:

| | |
|---|---|
| START FREQ | 10 MHz |
| STOP FREQ | 2.5 GHz |
| RF | on |
| LEVELING | INT |
| SWEEP TIME | 30 ms |
| SWEEP | CONT |

34. On the spectrum analyzer, key in TRACE A (CLEAR-WRITE), (SWEEP TIME) 2s, MARKER (NORMAL) 500 MHz, (HOLD). As the spectrum analyzer completes each sweep, a series of approximately 18 new responses should be displayed, as shown in Figure 3-92. The peaks of these responses coarsely outline the spectrum analyzer frequency response.

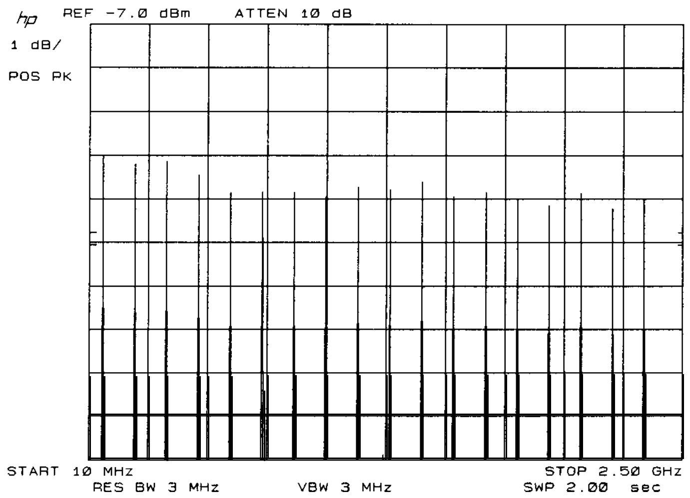


**Figure 3-92. Typical Coarse Frequency Response (10 MHz – 2.5 GHz)**

35. Gradually readjust (Band A Lower Segment) A6A11R48 Al and (Band A Upper Segment) A6A11R66 A2 for maximum flatness of the displayed signal responses. The adjustments are interactive, with A6A11R48 Al having the most effect on the level of the displayed signals below approximately 500 MHz (the marker position), and A6A11R66 A2 having the most effect on the level of the displayed signals above approximately 500 MHz. Adjust A6A11R48 Al counterclockwise to increase the level of the displayed signal responses below 500 MHz. Adjust A6A11R66 A2

clockwise to increase the level of the displayed signal responses above 500 MHz.

**Note**

It might be helpful to increase or decrease the spectrum analyzer [SWEEP TIME] setting while adjusting A6A11R66 A2 and A6A11R48 Al, particularly when making fine adjustments. An increase in spectrum analyzer sweep time results in closer spacing of the displayed responses, but slows the adjustment.

36. On the synthesized sweeper, key in (METER) LEVELING, [SWEEP TIME] 150s, SWEEP (SINGLE), SWEEP (SINGLE).
37. On the spectrum analyzer, key in SWEEP TIME (AUTO), TRACE B (CLEAR-WRITE], TRACE B (MAX HOLD).
38. On the synthesized sweeper, press SWEEP (SINGLE) and wait for a sweep to complete (150 seconds) and the SWEEP LED to turn off. As the synthesized sweeper tunes from 10 MHz to 2.5 GHz, the input signal should be displayed as a TRACE A response, and the spectrum analyzer frequency response should be displayed as TRACE B, as shown in Figure 3-93.

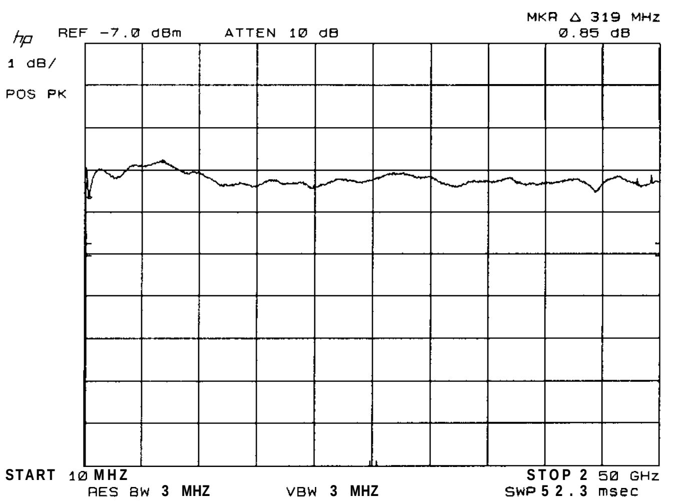


**Figure 3-93. Typical Frequency Response (10 MHz – 2.5 GHz)**

39. On the spectrum analyzer, key in TRACE B (VIEW), TRACE A (BLANK), MARKER (NORMAL) and use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Then, press MARKER (Δ), MARKER (PEAK SEARCH) to position a second marker on the highest point on the TRACE B waveform. Total peak-to-peak deviation of the displayed trace should be less than 1.20 dB.

**Note**

To provide the spectrum analyzer with a 10 MHz to 2.5 GHz input signal of sufficient flatness for measuring frequency response, the synthesized sweeper must be leveled externally with a power meter with a relatively slow sweep time (at least 40 seconds). However, relative flatness adjustments are made with the synthesized sweeper set to internal leveling, which introduces minor leveling errors but permits much faster sweep times.

---

40. Repeat steps 33 through 39 as necessary until the total peak-to-peak deviation of the TRACE B waveform is less than 1.20 dB. Leave the TRACE B reference waveform in VIEW for steps 33 through 36 to indicate which portions of the frequency response waveform require relative adjustment.

    If necessary, change the value of factory-select component A6A10R2 to shift the Band A frequency breakpoint determining the adjustment ranges of A6A11R48 Al and A6A11R66 A2. A decrease in the value of A6A10R2 shifts the Band A frequency breakpoint higher in frequency, widening the Band A Lower Segment and narrowing the Band A Upper Segment. Conversely, an increase in the value of A6A10R2 shifts the Band A frequency breakpoint lower in frequency. See Table 3-3 for the acceptable range of values for A6A10R2, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R2.

41. On the synthesized sweeper, key in (CW) 100 MHz, (METER) LEVELING.
42. On the spectrum analyzer, key in (RECALL) 8, MARKER (PEAK SEARCH) to position a marker on the peak of the displayed 100 MHz signal.
43. With the RF Section front-panel AMPTD CAL control still set to the approximate center of its adjustment range, readjust 17-turn potentiometer (Band A Step Gain) A6A10R21 GA to adjust the amplitude of the displayed 100 MHz marker to -10.00 dBm fO.O1 dB. Adjust A6A10R21 GA counterclockwise to increase the signal level, and clockwise to decrease the signal level.

    For A6A10 Miscellaneous Bias/Relay Driver Assembly, HP P/N 85660-60322 (HP 85660A/B RF Sections with serial number prefix 2747A or above):

    If A6A10R21 GA does not have sufficient range to adjust the amplitude of the 100 MHz displayed signal to -10.00 dBm, change the value of factory-select component A6A10R86. Increase the value of A6A10R86 to decrease the signal level, and decrease the value of A6A10R86 to increase the signal level. See Table 3-3 for the acceptable range of values for A6A10R86, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R86.

44. On the synthesized sweeper, key in (INT) LEVELING, RF (OFF). Disconnect the power splitter from the spectrum analyzer RF INPUT.
45. On the power meter, press (RANGE HOLD) (turning it off). Disconnect the power meter rear panel RECORDER OUTPUT from the synthesized sweeper front panel LEVELING EXT INPUT.

**Band B, 2.0 GHz to 5.8 GHz**

46. On the spectrum analyzer, key in (2–22 GHz), (FREQUENCY SPAN) **0** Hz, (CENTER FREQUENCY) 4 **GHz**, SWEEP (SINGLE).
47. Connect the DVM to **A6A12TP3** (-9 V), and connect the DVM ground to **A6A12TP2** (YTX COM) in the RF Section. See Figure 3-90 for the location of **A6A12TP3** and **A6A12TP2.**

**Note** ±9 Vdc Reference Supplies adjustment **A6A12R113** -9 V affects **YTX/YTO** tracking, YTX diode bias, and Slope Generator Upper/Lower Segment frequency breakpoints in all preselected frequency bands (Bands B, C, D, and E, 2 **GHz** – 22 **GHz**).

48. If necessary, readjust **17-turn** potentiometer **A6A12R113** -9 V for a DVM indication of -9.000 fO.OO1 Vdc.
49. Connect the DVM to **A6A12TP5** (-525 **V/GHz**). Leave the DVM ground connected to **A6A12TP2** (YTX COM). See Figure 3-90 for the location of **A6A12TP5.**
50. Adjust 22-turn (YTX IF Offset) potentiometer **A6A12R85** B for a DVM indication of -2.100 **±0.001** Vdc. See Figure 3-90 for the location of **A6A12R85** B.

**Note** YTX Linearity adjustments **A6A10R40 LB1, A6A10R41** LB2, **A6A10R42** LB3, **A6A10R70** LB4, **A6A10R31 LR1, A6A610R34** LR2, **A6A10R37** LR3, and **A6A10R76** LR4 affect **YTX/YTO** tracking in all preselected frequency bands (Bands B, C, D, and E, 2 **GHz** – 22 **GHz**). These adjustments overlap and have a cumulative effect on **YTX/YTO** tracking with increasing frequency.

51. If the **A6A10** Miscellaneous Bias/Relay Driver Assembly or **A6A7** YTX Current Driver Assembly has been repaired or replaced, or if the **A6A8** YTX has been replaced, adjust 22-turn (YTX Linearity) potentiometers **A6A10R40 LB1, A6A10R41** LB2, **A6A10R42** LB3, **A6A10R70** LB4, **A6A10R31 LR1, A6A610R34** LR2, **A6A10R37** LR3, and **A6A10R76** LR4 fully counterclockwise. See Figure 3-90 for the location of YTX Linearity adjustments **A6A10R40 LB1, A6A10R41** LB2, **A6A10R42** LB3, **A6A10R70** LB4, **A6A10R31 LR1, A6A610R34** LR2, **A6A10R37** LR3, and **A6A10R76** LR4.
52. On the spectrum analyzer, key in (2–22 GHz), (SHIFT) (PRESEL PEAK) =, (SHIFT) TRACE A (MAX HOLD) b. Set the spectrum analyzer controls as follows:

| | |
|---|---|
| START FREQ | **2.0 GHz** |
| STOP FREQ | 5.8 **GHz** |
| RES BW | **3** MHz |
| REFERENCE LEVEL | -7 **dBm** |
| LOG SCALE | 10 dB/DIV |
| SWEEP TIME | 500 ms |

53. Connect the equipment as shown in Figure 3-94, with one resistive output of the power splitter connected to the power meter/power sensor using an APC 3.5 (m) to Type N (f) adapter, and the second resistive output connected to the diode detector. Connect the diode detector SMC output to the synthesized

sweeper front panel LEVELING EXT INPUT using a BNC to SMB snap-on test cable.

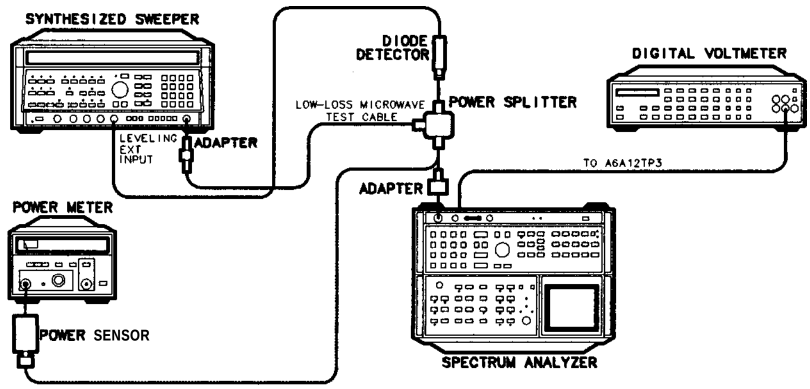


**Figure 3-94.**
**Frequency Response Adjustments Setup (2.0 GHz to 22.0 GHz)**

54. Press (2-22 GHz) on the synthesized sweeper. Set the controls of the synthesized sweeper as follows:

    CW .......... 100 MHz
    POWER LEVEL .......... -4.0 dBm
    RF .......... on
    LEVELING .......... INT

55. 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. Then, press (XTAL) 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 XTAL REF and XTAL ATN settings (external diode detector leveling) for the remaining steps in this adjustment procedure. The frequency response adjustments are referenced to the -10.00 dBm power level at 100 MHz.

56. Disconnect the power sensor from the power splitter, and connect this power splitter resistive output to the spectrum analyzer RF INPUT using an APC 3.5 (m) to Type N (m) adapter.
57. On the synthesized sweeper, key in (CW) 5.7 GHz.

**Note** YTX Drive adjustments A6A12R63 5.8 GHz and A6A12R66 2 GHz are interactive and affect YTX/YTO tracking in all preselected frequency bands (Bands B, C, D, and E, 2 GHz – 22 GHz).

58. Adjust 25-turn (YTX Drive) potentiometer A6A12R63 5.8 GHz and 17-turn (Band B YTX Diode Bias) potentiometer A6A10R18 VB as necessary to maximize the amplitude of the 5.7 GHz

signal on the spectrum analyzer display. See Figure 3-90 for the locations of A6A12R63 5.8 GHz and A6A10R18 VB.

**Note**

If A6A12 YTX Driver Assembly is HP P/N 85660-60235 (HP 85660A/B RF Sections serial number prefixed 2503A or above), and A6A12R63 5.8 GHz does not have sufficient adjustment range in this step (or steps 61, 66, or 75), check the value of factory-select component A6A12R64. The normal value of 15K ohms (HP P/N 0698-7133) for A6A12R64 provides sufficient adjustment range of A6A12R63 5.8 GHz for most A6A8 YTX assemblies. The alternate value of 13.35613 ohms (HP P/N 0698-8079) for A6A12R64 provides additional range of A6A12R63 5.8 GHz in cases where the adjustment will otherwise not peak the A6A8 YTX tracking sufficiently. See Figure 3-90 for the location of A6A12R64.

59. On the synthesized sweeper, key in (CW) 2.1 GHz.
60. Adjust 25-turn (YTX Drive) potentiometer A6A12R66 2 GHz as necessary to maximize the amplitude of the 2.1 GHz signal on the spectrum analyzer display. See Figure 3-90 for the location of A6A12R66 2 GHz.
61. Repeat steps 57 through 60 as necessary until no further adjustment is necessary.
62. On the synthesized sweeper, key in (CW) 3.9 GHz.
63. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAK SEARCH) to position a marker at the peak of the displayed 3.9 GHz signal. Adjust 17-turn (Band B Step Gain) potentiometer A6A10R23 GB as necessary to adjust the amplitude of the displayed 3.9 GHz marker to -10.00 dBm f0.10 dB. Adjust A6A10R23 GB counterclockwise to increase the signal level, and clockwise to decrease the signal level. If A6A10R23 GB does not have sufficient range, adjust the amplitude of the displayed 3.9 GHz marker as close as possible to -10.00 dBm. See Figure 3-90 for the location of A6A10R23 GB.
64. On the spectrum analyzer, key in LOG SCALE (ENTER dB/DIV) 2 dB, MARKER (NORMAL).
65. On the synthesized sweeper, key in (CW) 5.7 GHz.
66. On the spectrum analyzer, key in MARKER (PEAK SEARCH) to position a marker at the peak of the displayed 5.7 GHz signal. Readjust 25-turn (YTX Drive) potentiometer A6A12R63 5.8 GHz as necessary to maximize the amplitude of the 5.7 GHz signal on the spectrum analyzer display.
67. On the synthesized sweeper, key in (CW) 2.1 GHz.
68. On the spectrum analyzer, key in MARKER (PEAK SEARCH) to position a marker at the peak of the displayed 2.1 GHz signal. Readjust 25-turn (YTX Drive) potentiometer A6A12R66 2 GHz as necessary to maximize the amplitude of the 2.1 GHz signal on the spectrum analyzer display.
69. Repeat steps 65 through 68 as necessary until no further adjustment is necessary.

70. Set the synthesized sweeper controls as follows:

    START FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 2.0 GHz
    STOP FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5.8 GHz
    RF . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on
    LEVELING . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XTAL
    SWEEP TIME . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 30 ms
    SWEEP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CONT

71. On the spectrum analyzer, key in TRACE A [CLEAR-WRITE], [SWEEP TIME] 2s, MARKER (OFF), [HOLD]. As the spectrum analyzer completes each sweep, a series of approximately 22 new responses should be displayed, as shown in Figure 3-95. The peaks of these responses coarsely outline the spectrum analyzer frequency response.

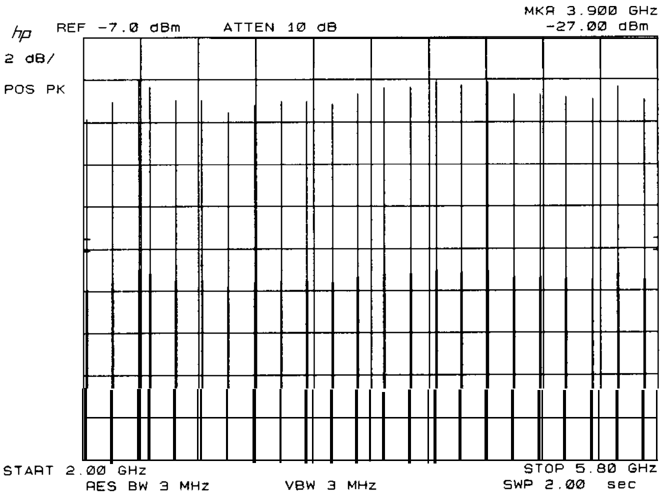


**Figure 3-95. Typical Coarse Frequency Response (2 GHz – 5.8 GHz)**

72. Gradually adjust (Band B Lower Segment) A6A11R51 B1 and (Band B Upper Segment) A6A11R69 B2 for maximum flatness of the displayed signal responses. The adjustments are interactive, with A6A11R51 B1 having the most effect on the level of the displayed signals below mid-band (approximately 3.9 GHz), and A6A11R69 B2 having the most effect on the level of the displayed signals above mid-band. Adjust A6A11R51 Bl counterclockwise to increase the level of the displayed signal responses below mid-band. Adjust A6A1 1R69 B2 clockwise to increase the level of the displayed signal responses above mid-band. See Figure 3-90 for the locations of A6A11R51 B1 and A6A11R69 B2.

**Note** It might be helpful to increase or decrease the spectrum analyzer [SWEEP TIME] setting while adjusting A6A11R66 B2 and A6A11R48 B1, particularly when making fine adjustments. An increase in spectrum analyzer sweep time results in closer spacing of the displayed responses, but slows the adjustment.

73. On the spectrum analyzer, key in (SWEEP TIME) 5s, LOG SCALE [ENTER dB/DIV] 1 dB, TRACE B (VIEW), (SAVE) 4, (SWEEP TIME) 2s, TRACE B (BLANK), (HOLD).

74. Readjust 17-turn (YTX Diode Bias) potentiometer A6A10R18 VB to maximize the overall level of the displayed signal responses from 2.0 GHz to 5.8 GHz on the spectrum analyzer display.

75. Readjust 25-turn (YTX Drive) potentiometers A6A12R63 5.8 GHz and A6A12R66 2 GHz to maximize the overall level of the displayed signal responses from 2.0 GHz to 5.8 GHz on the spectrum analyzer display.

76. Gradually readjust (Band B Lower Segment) A6A11R51 B1 and (Band B Upper Segment) A6A11R69 B2 as necessary for maximum flatness of the displayed signal responses.

77. On the spectrum analyzer, key in SWEEP (SINGLE), (SWEEP TIME) 150s, TRACE A (BLANK), TRACE B (MAX HOLD), (SAVE) 6, TRACE B (CLEAR-WRITE), (SAVE) 5, (HOLD).

78. Press SWEEP (SINGLE) on the spectrum analyzer and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off. As the spectrum analyzer tunes from 2.0 GHz to 5.8 GHz, the spectrum analyzer frequency response should be displayed as TRACE B, as shown in Figure 3-96.

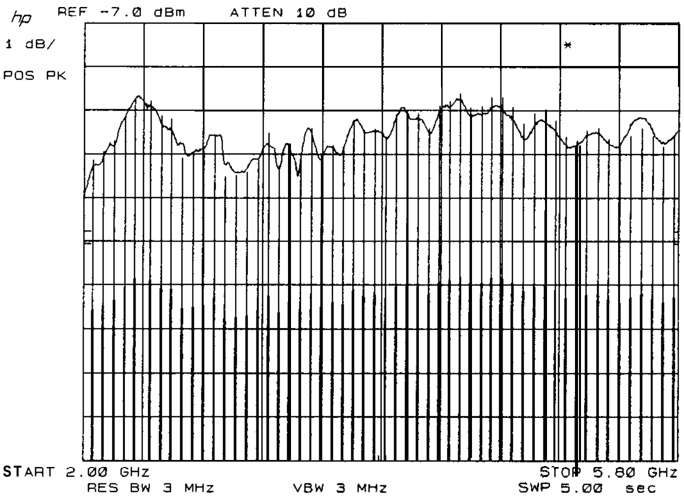


**Figure 3-96.**
**Typical Frequency Response (2.0 GHz – 5.8 GHz)**

79. On the spectrum analyzer, key in (RECALL) 4, (HOLD) and repeat steps 74 through 76 as necessary.

80. On the spectrum analyzer, key in (RECALL) 5 and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn Off.

81. On the spectrum analyzer, key in (RECALL) 4, (SHIFT) (GHz) / and use the DATA knob to gradually change the PRESELECTOR DAC setting from 32, maximizing the level of the TRACE A displayed signal responses at the lowest point on the TRACE B waveform. Note the PRESELECTOR DAC setting.
82. On the spectrum analyzer, key in (RECALL) 6, (SHIFT) (GHz) / and enter in the PRESELECTOR DAC setting from step 81. Press SWEEP (SINGLE) and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off.
83. Repeat steps 81 and 82 until the level of the lowest point on the TRACE B waveform does not change. Repeat step 82 with a PRESELECTOR DAC value of 30 and 34.
84. On the spectrum analyzer, key in TRACE B [VIEW), MARKER (NORMAL) and use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Then, press MARKER (Δ), MARKER (PEAK SEARCH) to position a second marker on the highest point on the TRACE B waveform. Note the total peak-to-peak deviation of the displayed trace.

   Band B total peak-to-peak deviation: ________ dB
85. On the spectrum analyzer, press MARKER (NORMAL) and note the frequency of the highest point on the TRACE B waveform.

   Band B highest point: ________ GHz
86. Repeat steps 79 through 85 if necessary until the total peak-to-peak deviation of the TRACE B waveform is less than 3.40 dB. See the TRACE B reference waveform to indicate which portions of the frequency response waveform require relative adjustment.
87. On the spectrum analyzer, key in (RECALL) 4, (HOLD).
88. On the synthesized sweeper, press (CW) and enter the frequency recorded in step 85, positioning the displayed TRACE A signal response at the highest point on the TRACE B waveform.

**Note** The RF Section front-panel AMPTD CAL control should still be set to the approximate center of its adjustment range from step 26.

89. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAK SEARCH) to position a marker at the peak of the displayed TRACE A signal response. Adjust 17-turn (Band B Step Gain) potentiometer A6A10R23 GB to adjust the amplitude of the marker to -10.00 dBm + (1/2 of Band B total peak-to-peak deviation) ±0.01 dB. Adjust A6A10R23 GB counterclockwise to increase the signal level, and clockwise to decrease the signal level.

**Note** If the A6A10 Miscellaneous Bias/Relay Driver Assembly is HP P/N 85660-60322 (HP 85660A/B RF Sections with serial number prefix 2747A or above), and A6A10R23 GB does not have sufficient range, change the value of factory-select component A6A10R87. Increase the value of A6A10R87 to decrease the signal level, and decrease the value of A6A10R87 to increase the signal level. See Table 3-3 for the acceptable range of values for A6A10R87, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R87.

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## Band C, 5.8 GHz to 12.5 GHz

90. On the spectrum analyzer, key in (2–22 GHz), (SHIFT) (PRESEL PEAK) =, (SHIFT) TRACE A (MAX HOLD) b. Set the spectrum analyzer controls as follows:

    START FREQ . . . . . . . . . . 5.8 GHz
    STOP FREQ . . . . . . . . . . 12.5 GHz
    RES BW . . . . . . . . . . 3 MHz
    REFERENCE LEVEL . . . . . . . . . . -7 dBm
    LOG SCALE . . . . . . . . . . 10 dB/DIV
    SWEEP TIME . . . . . . . . . . 500 ms

91. On the synthesized sweeper, key in (CW) 6.0 GHz.

**Note**

The POWER LEVEL of the synthesized sweeper should still be leveled to a calibrated -10.00 dBm at 100 MHz at the spectrum analyzer RF INPUT from step 55.

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92. Adjust 22-turn (IF Offset) potentiometer A6A12R84 C and 17-turn (YTX Bias) potentiometer A6A10R15 VC for maximum signal amplitude at 6.0 GHz on the spectrum analyzer display. See Figure 3-90 for the locations of A6A12R84 C and A6A10R15 VC.

93. On the spectrum analyzer, key in MARKER (NORMAL), MARKER [PEAK SEARCH) to position a marker at the peak of the displayed 6.0 GHz signal. Adjust 17-turn (Band C Step Gain) potentiometer A6A10R25 GC as necessary to adjust the amplitude of the displayed 6.0 GHz marker to -10.00 dBm fO.10 dB. Adjust A6A10R25 GC counterclockwise to increase the signal level, and clockwise to decrease the signal level. If A6A10R25 GC does not have sufficient range, adjust the amplitude of the displayed 6.0 GHz marker as close as possible to -10.00 dBm. See Figure 3-90 for the location of A6A10R25 GC.

94. On the spectrum analyzer, key in LOG SCALE (ENTER dB/DIV) 2 dB, MARKER (NORMAL).

95. Readjust 22-turn (IF Offset) potentiometer A6A12R84 C as necessary to maximize the amplitude of the 6.0 GHz signal on the spectrum analyzer display.

96. Set the synthesized sweeper controls as follows:

    START FREQ . . . . . . . . . . 5.8 GHz
    STOP FREQ . . . . . . . . . . 12.5 GHz
    RF . . . . . . . . . . on
    LEVELING . . . . . . . . . . XTAL
    SWEEP TIME . . . . . . . . . . 30 ms
    SWEEP . . . . . . . . . . CONT

97. On the spectrum analyzer, key in TRACE A (CLEAR-WRITE), (SWEEP TIME) 2s, MARKER (OFF), (HOLD). As the spectrum analyzer completes each sweep, a series of approximately 23 new responses should be displayed, as shown in Figure 3-97. The

peaks of these responses coarsely outline the spectrum analyzer frequency response.

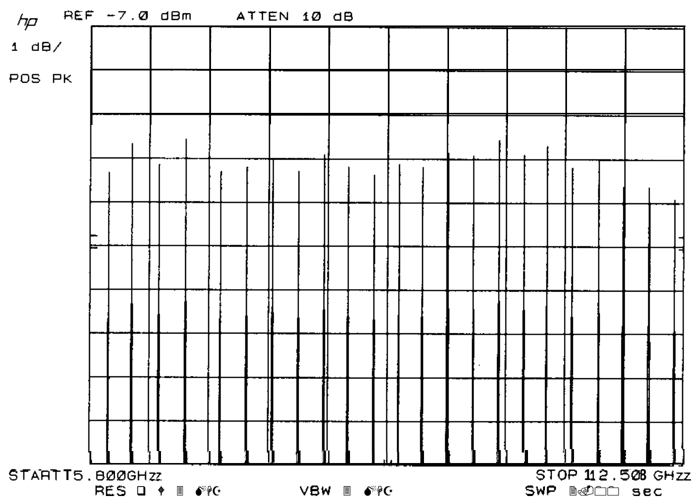


**Figure 3-97. Typical Coarse Frequency Response (5.8 GHz – 12.5 GHz)**

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**Note**

It might be helpful to temporarily change the spectrum analyzer [SWEEP TIME] setting while adjusting frequency response, particularly when making fine adjustments. An increase in spectrum analyzer sweep time results in closer spacing of the displayed responses, but slows the adjustment. Do not decrease the [SWEEP TIME] setting below 1s. before the YTX Delay Compensation adjustments have been made.

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98. Gradually adjust (Band C Lower Segment) A6A11R54 C1 and (Band C Upper Segment) A6A11R72 C2 for maximum flatness of the displayed signal responses. The adjustments are interactive, with A6A11R54 C1 having the most effect on the level of the displayed signals below mid-band (approximately 9.1 GHz), and A6A11R72 C2 having the most effect on the level of the displayed signals above mid-band. Adjust A6A11R54 C1 counterclockwise to increase the level of the displayed signal responses below mid-band. Adjust A6A11R72 C2 clockwise to increase the level of the displayed signal responses above mid-band. See Figure 3-90 for the locations of A6A11R54 C1 and A6A11R72 C2.

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**Note**

If the displayed signals at the high end of the band drop off by more than 2-3 dB, center A6A11R72 C2 and proceed to step 99.

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99. On the spectrum analyzer, key in [SWEEP TIME] .5s, LOG SCALE [ENTER dB/DIV] 1 dB, TRACE B [VIEW], [SAVE] 4, [SWEEP TIME] 2s, TRACE B [BLANK], [HOLD].
100. Readjust 17-turn (YTX Diode Bias) potentiometer A6A10R15 VC to maximize the overall level of the displayed signal responses from 5.8 GHz to 12.5 GHz on the spectrum analyzer display. Then, adjust A6A10R15 VC clockwise until signal responses at the high end of the band drop in amplitude by approximately 0.5 dB.

101. Readjust 22-turn (IF Offset) potentiometer A6A12R84 C as necessary to maximize the overall level of the displayed signal responses from 5.8 GHz to 12.5 GHz on the spectrum analyzer display. If the displayed signal responses above mid-band drop off in amplitude and peak at a different setting of A6A12R84 C perform the following steps:

   a. Perform step 51 if it has not already been performed.
   b. Readjust 22-turn (IF Offset) potentiometer A6A12R84 C to maximize the displayed signal responses at the low end of the band.
   c. Key in MARKER (NORMAL) and position the marker at the point in the band where the signal responses begin to fall off from their maximum value.
   d. Adjust 22-turn (YTX Linearity) potentiometer A6A10R40 LB1 clockwise until the displayed signal responses at the high end of the band begin to drop. Continue to adjust A6A10R40 LB1 until the rolloff point aligns with the position of the marker. See Figure 3-90 for the locations of A6A10R40 LB1 and A6A10R31 LR1.
   e. Readjust 22-turn (YTX Linearity) potentiometer A6A10R31 LR1 clockwise to maximize the displayed signal responses at the high end of the band.
   f. Readjust A6A12R84 C and A6A10R31 LR1 as necessary to maximize the displayed signal responses from 5.8 GHz to 12.5 GHz on the spectrum analyzer display.

102. Gradually readjust (Band C Lower Segment) A6A11R54 Cl and (Band C Upper Segment) A6A11R72 C2 as necessary for maximum flatness of the displayed signal responses.

103. On the spectrum analyzer, key in SWEEP (SINGLE), (SWEEP TIME) 150s, TRACE A (BLANK), TRACE B (MAX HOLD), (SAVE) 6, TRACE B (CLEAR-WRITE), (SAVE) 5, (HOLD).

104. Press SWEEP (SINGLE) on the spectrum analyzer and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off. As the spectrum analyzer tunes from 5.8 GHz to 12.5 GHz, the spectrum analyzer frequency response should be displayed as TRACE B, as shown in Figure 3-98.

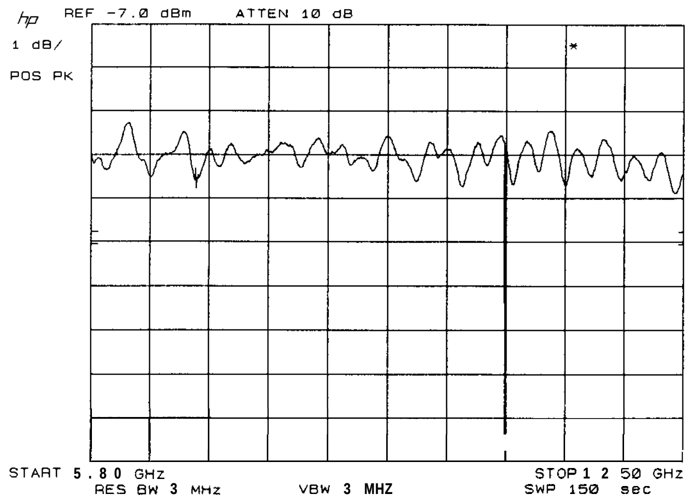


**Figure 3-98.**
**Typical Frequency Response (5.8 GHz – 12.5 GHz)**

105. On the spectrum analyzer, key in (RECALL) 4, (HOLD) and repeat steps 100 through 102 as necessary.

106. On the spectrum analyzer, key in (RECALL) 5 and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn Off.

107. On the spectrum analyzer, key in (RECALL) 4, (SHIFT) (GHz) / and use the DATA knob to gradually change the PRESELECTOR DAC setting from 32, maximizing the level of the TRACE A displayed signal responses at the lowest point on the TRACE B waveform. Note the PRESELECTOR DAC setting.

108. On the spectrum analyzer, key in (RECALL) 6, (SHIFT) (GHz) / and enter in the PRESELECTOR DAC setting from step 107. Press SWEEP (SINGLE) and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off.

109. Repeat steps 107 and 108 until the level of the lowest point on the TRACE B waveform does not change. Repeat step 108 with a PRESELECTOR DAC value of 30 and 34.

110. On the spectrum analyzer, key in TRACE B [VIEW), MARKER (NORMAL) and use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Then, press MARKER [a, MARKER (PEAK SEARCH) to position a second marker on the highest point on the TRACE B waveform. Note the total peak-to-peak deviation of the displayed trace.

Band C total peak-to-peak deviation: ________ **dB**

111. On the spectrum analyzer, press MARKER (NORMAL) and note the frequency of the highest point on the TRACE B waveform.

Band C highest point: ________ **GHz**

112. Repeat steps 105 through 111 if necessary until the total peak-to-peak deviation of the TRACE B waveform is less than

3.40 dB. See the TRACE B reference waveform to indicate which portions of the frequency response waveform require relative adjustment. 113. On the spectrum analyzer, key in (RECALL) 4, (HOLD).

113. On the synthesized sweeper, press (CW) and enter the frequency recorded in step 111, positioning the displayed TRACE A signal response at the highest point on the TRACE B waveform.

**Note** The RF Section front-panel AMPTD CAL control should still be set to the approximate center of its adjustment range from step 26.

114. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAK SEARCH) to position a marker at the peak of the displayed TRACE A signal response. Adjust 17-turn (Band C Step Gain) potentiometer A6A10R25 GC to adjust the-amplitude of the marker to -10.00 dBm + (1/2 of Band C total peak-to-peak deviation) ±0.01 dB. Adjust A6A10R25 GC counterclockwise to increase the signal level, and clockwise to decrease the signal level.

**Note** If A6A10 Miscellaneous Bias/Relay Driver Assembly is HP P/N 85660-60322 (HP 85660A/B RF Sections with serial number prefix 2747A or above), and A6A10R25 GC does not have sufficient range, change the value of factory-select component A6A10R88. Increase the value of A6A10R88 to decrease the signal level, and decrease the value of A6A10R88 to increase the signal level. See Table 3-3 for the acceptable range of values for A6A10R88, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R88.

### Band D, 12.5 to 18.6 GHz

115. On the spectrum analyzer, key in (2—22 GHz), (SHIFT) (PRESEL PEAK) = , (SHIFT) TRACE A (MAX HOLD) b. Set the spectrum analyzer controls as follows:

| | |
|---|---|
| START FREQ | 12.5 GHz |
| STOP FREQ | 18.6 GHz |
| RES BW | 3 MHz |
| REFERENCE LEVEL | -7 dBm |
| LOG SCALE | 10 dB/DIV |
| SWEEP TIME | 500 ms |

116. On the synthesized sweeper, key in (CW) 15.0 GHz.

**Note** The POWER LEVEL of the synthesized sweeper should still be leveled to a calibrated -10.00 dBm at 100 MHz at the spectrum analyzer RF INPUT from step 55.

117. Adjust 22-turn (IF Offset) potentiometer A6A12R83 D and 17-turn (YTX Bias) potentiometer A6A10R12 VD for maximum signal amplitude at 15.0 GHz on the spectrum analyzer display. See Figure 3-90 for the locations of A6A12R83 D and A6A10R15 VD.

118. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAKSEARCH) to position a marker at the peak of

the displayed 15.0 GHz signal. Adjust 17-turn (Band D Step Gain) potentiometer A6A10R27 GD as necessary to adjust the amplitude of the displayed 15.0 GHz marker to -10.00 dBm fO.10 dB. Adjust A6A10R27 GD counterclockwise to increase the signal level, and clockwise to decrease the signal level. If A6A10R27 GD does not have sufficient range, adjust the amplitude of the displayed 15.0 GHz marker as close as possible to -10.00 dBm. See Figure 3-90 for the location of A6A10R27 GD.

119. On the spectrum analyzer, key in LOG SCALE (ENTER dB/DIV) 2 dB, MARKER (NORMAL).
120. Readjust 22-turn (IF Offset) potentiometer A6A12R83 D as necessary to maximize the amplitude of the 15.0 GHz signal on the spectrum analyzer display.
121. Set the synthesized sweeper controls as follows:

    START FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 12.5 GHz
    STOP FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 18.6 GHz
    RF . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . on
    LEVELING . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . XTAL
    SWEEP TIME . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 30 ms
    SWEEP . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . CONT

122. On the spectrum analyzer, key in TRACE A [CLEAR-WRITE), (SWEEP TIME) 2s, MARKER (OFF), (HOLD. As the spectrum analyzer completes each sweep, a series of approximately 22 new responses should be displayed, as shown in Figure 3-98. The peaks of these responses coarsely outline the spectrum analyzer frequency response.
123. Gradually adjust (Band D Lower Segment) A6A11R57 D1 and (Band D Upper Segment) A6A11R75 D2 for maximum flatness of the displayed signal responses. The adjustments are interactive, with A6A11R57 D1 having the most effect on the level of the displayed signals below mid-band (approximately 15.5 GHz), and A6A11R75 D2 having the most effect on the level of the displayed signals above mid-band. Adjust A6A11R57 D1 counterclockwise to increase the level of the displayed signal responses below mid-band. Adjust A6A11R75 D2 clockwise to increase the level of the displayed signal responses above mid-band. See Figure 3-90 for the locations of A6A11R57 D1 and A6A11R75 D2.

**Note** If the displayed signals at the high end of the band drop off by more than 2-3 dB, center A6A11R75 D2 and proceed to step 125.

124. On the spectrum analyzer, key in (SWEEP TIME) 5s, LOG SCALE [ENTER dB/DIV) 1 dB, TRACE B [VIEW), (SAVE) 4, (SWEEP TIME) 2s, TRACE B [BLANK), (HOLD).
125. Readjust 17-turn (YTX Diode Bias) potentiometer A6A10R12 VD to maximize the overall level of the displayed signal responses from 12.5 GHz to 18.6 GHz on the spectrum analyzer display. Then, adjust A6A10R12 VD clockwise until signal responses at

the high end of the band drop in amplitude by approximately 0.75 dB.

126. Readjust 22-turn (IF Offset) potentiometer A6A12R83 D as necessary to maximize the overall level of the displayed signal responses from 12.5 GHz to 18.6 GHz on the spectrum analyzer display. If the displayed signal responses peak at widely different settings of A6A12R83 D, perform the following steps:

    a. Adjust 22-turn (YTX Linearity) potentiometers A6A10R41 LB2, A6A10R42 LB3, A6A10R70 LB4, A6A610R34 LR2, A6A10R37 LR3, and A6A10R76 LR4 fully counterclockwise if they have not already been so adjusted; do not readjust A6A12R40 LB1 or A6A10R31 LR1.
    b. Readjust 22-turn (IF Offset) potentiometer A6A12R83 D as necessary to maximize the overall level of the displayed signal responses at the low end of the band.
    c. On the spectrum analyzer, key in MARKER (NORMAL) and position the marker at the point in the band where the signal responses begin to fall off from their maximum value.
    d. Adjust 22-turn (YTX Linearity) potentiometer A6A10R41 LB2 clockwise until the displayed signal responses at the high end of the band begin to drop. Continue to adjust A6A10R41 LB2 until the rolloff point aligns with the position of the marker. See Figure 3-90 for the location of A6A10R41 LB2, A6A10R42 LB3, A6A10R34 LR2 and A6A10R37 LR3.
    e. Readjust 22-turn (YTX Linearity) potentiometer A6A10R34 LR2 clockwise to maximize the displayed signal responses for approximately 3 divisions to the right of the marker.
    f. On the spectrum analyzer, key in MARKER (NORMAL) and position the marker at the point in the band where the signal responses begin to fall off from their maximum value.
    g. Readjust 22-turn (YTX Linearity) potentiometer A6A10R42 LB3 clockwise until the displayed signal responses at the high end of the band begin to drop. Continue to adjust A6A10R42 LB3 until the rolloff point aligns with the position of the marker.
    h. Readjust 22-turn (YTX Linearity) potentiometer A6A10R37 LR3 clockwise to maximize the displayed signal responses at the high end of the band.
    i. Readjust A6A12R83 D, A6A10R34 LR2, and A6A10R37 LR3 as necessary to maximize the displayed signal responses from 12.5 GHz to 18.6 GHz on the spectrum analyzer display.

127. Gradually readjust (Band D Lower Segment) A6A11R57 D1 and (Band D Upper Segment) A6A11R75 D2 as necessary for maximum flatness of the displayed signal responses.

128. On the spectrum analyzer, key in SWEEP (SINGLE), (SWEEP TIME) 150s, TRACE A (BLANK), TRACE B (MAX HOLD), (SAVE) 6, TRACE B (CLEAR-WRITE), (SAVE) 5, (HOLD).

129. Press SWEEP (SINGLE) on the spectrum analyzer and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off. As the spectrum analyzer tunes from 12.5 GHz to 18.6 GHz, the spectrum analyzer frequency response should be displayed as TRACE B.

130. On the spectrum analyzer, key in (RECALL) 4, (HOLD) and repeat steps 126 through 128 as necessary.

131. On the spectrum analyzer, key in (RECALL) 5 and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn Off.

132. On the spectrum analyzer, key in (RECALL) 4, (SHIFT) (GHz) / and use the DATA knob to gradually change the PRESELECTOR DAC setting from 32, maximizing the level of the TRACE A displayed signal responses at the lowest point on the TRACE B waveform. Note the PRESELECTOR DAC setting.

133. On the spectrum analyzer, key in (RECALL) 6, (SHIFT) (GHz) / and enter in the PRESELECTOR DAC setting from step 132. Press SWEEP (SINGLE) and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off.

134. Repeat steps 132 and 133 until the level of the lowest point on the TRACE B waveform does not change. Repeat step 133 with a PRESELECTOR DAC setting of 30 and 34.

135. On the spectrum analyzer, key in TRACE B (VIEW), MARKER (NORMAL) and use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Then, press MARKER (Δ), MARKER (PEAK SEARCH) to position a second marker on the highest point on the TRACE B waveform. Note the total peak-to-peak deviation of the displayed trace.

Band D total peak-to-peak deviation: ________ dB

136. On the spectrum analyzer, press MARKER (NORMAL) and note the frequency of the highest point on the TRACE B waveform.

Band D highest point: ________ GHz

137. Repeat steps 130 through 136 as necessary until the total peak-to-peak deviation of the TRACE B waveform is less than 4.40 dB. See the TRACE B reference waveform to indicate which portions of the frequency response waveform require relative adjustment.

138. On the spectrum analyzer, key in (RECALL) 4, (HOLD).

139. On the synthesized sweeper, press (CW) and enter the frequency recorded in step 136, positioning the displayed TRACE A signal response at the highest point on the TRACE B waveform.

**Note**

The RF Section front-panel AMPTD CAL control should still be set to the approximate center of its adjustment range from step 26.

140. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAK SEARCH) to position a marker at the peak of the displayed TRACE A signal response. Adjust 17-turn (Band D Step Gain) potentiometer A6A10R27 GD to adjust the amplitude of the marker to -10.00 dBm + (1/2 of Band D total peak-to-peak deviation) f0.01 dB. Adjust A6A10R27 GD counterclockwise to increase the signal level, and clockwise to decrease the signal level.

**Note**

If A6A10 Miscellaneous Bias/Relay Driver Assembly is HP P/N 85660-60322 (HP 85660A/B RF Sections with serial number prefix 2747A or above), and A6A10R27 GD does not have sufficient range, change the value of factory-select component A6A10R88. Increase the value of A6A10R89 to decrease the signal level, and decrease the value of A6A10R89 to increase the signal level. See Table 3-3 for the acceptable range of values for A6A10R89, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R89.

## Band E, 18.6 GHz to 22 GHz

141. On the spectrum analyzer, key in (2—22 GHz), (SHIFT) (PRESEL PEAK) =, (SHIFT) TRACE A (MAX HOLD) b. Set the spectrum analyzer controls as follows:

| | |
|---|---|
| START FREQ | 18.6 GHz |
| STOP FREQ | 22 GHz |
| RES BW | 3 MHz |
| REFERENCE LEVEL | -7 dBm |
| LOG SCALE | 10 dB/DIV |
| SWEEP TIME | 500 ms |

142. On the synthesized sweeper, key in (CW) 20.0 GHz.

**Note**

The POWER LEVEL of the synthesized sweeper should still be leveled to a calibrated -10.00 dBm at 100 MHz at the spectrum analyzer RF INPUT from step 55.

143. Adjust 22-turn (IF Offset) potentiometer A6A12R82 E and 17-turn (YTX Bias) potentiometer A6A10R9 VE for maximum signal amplitude at 20.0 GHz on the spectrum analyzer display. See Figure 3-90 for the locations of A6A12R82 E and A6A10R95 VE.
144. On the spectrum analyzer, key in MARKER (NORMAL), MARKER [PEAK SEARCH] to position a marker at the peak of the displayed 20.0 GHz signal. Adjust Ill-turn (Band E Step Gain) potentiometer A6A10R29 GE as necessary to adjust the amplitude of the displayed 20.0 GHz marker to -10.00 dBm fO.10 dB. Adjust A6A10R29 GE counterclockwise to increase the signal level, and clockwise to decrease the signal level. If A6A10R29 GE does not have sufficient range, adjust the amplitude of the displayed 20.0 GHz marker as close as possible to -10.00 dBm. See Figure 3-90 for the location of A6A10R29 GE.
145. On the spectrum analyzer, key in LOG SCALE CENTER dB/DIV) 2 dB, MARKER (NORMAL).
146. Readjust 22-turn (IF Offset) potentiometer A6A12R82 E as necessary to maximize the amplitude of the 20.0 GHz signal on the spectrum analyzer display.
147. Set the synthesized sweeper controls as follows:

| | |
|---|---|
| START FREQ | 18.6 GHz |
| STOP FREQ | 22.0 GHz |
| RF | on |
| LEVELING | XTAL |

SWEEP TIME ............................................. 30 ms
SWEEP .................................................. CONT

148. On the spectrum analyzer, key in TRACE A [CLEAR-WRITE], [SWEEP TIME] 2s, MARKER (OFF), [HOLD]. As the spectrum analyzer completes each sweep, a series of approximately 23 new responses should be displayed. The peaks of these responses coarsely outline the spectrum analyzer frequency response.

149. Gradually adjust (Band E Lower Segment) A6A11R60 El and (Band E Upper Segment) A6A11R78 E2 for maximum flatness of the displayed signal responses. The adjustments are interactive, with A6A11R60 El having the most effect on the level of the displayed signals below mid-band (approximately 20.3 GHz), and A6A11R78 E2 having the most effect on the level of the displayed signals above mid-band. Adjust A6A11R60 El counterclockwise to increase the level of the displayed signal responses below mid-band. Adjust A6A11R78 E2 clockwise to increase the level of the displayed signal responses above mid-band. See Figure 3-90 for the locations of A6A11R60 El and A6A11R78 E2.

**Note**

If the displayed signals at the high end of the band drop off by more than 3-4 dB, center A6A11R78 E2 and proceed to step 150.

150. On the spectrum analyzer, key in [SWEEP TIME] 5s, LOG SCALE CENTER dB/DIV 1 dB, TRACE B (VIEW), [SAVE] 4, [SWEEP TIME] 2s, TRACE B [BLANK], [HOLD].

151. Readjust 17-turn (YTX Diode Bias) potentiometer A6A10R95 VE to maximize the overall level of the displayed signal responses from 18.6 GHz to 22.0 GHz on the spectrum analyzer display. Then, adjust A6A10R95 VE clockwise until signal responses at the high end of the band drop in amplitude by approximately 1.5 dB.

152. Readjust 22-turn (IF Offset) potentiometer A6A12R82 E as necessary to maximize the overall level of the displayed signal responses from 18.6 GHz to 22.0 GHz on the spectrum analyzer display. If the displayed signal responses peak at widely different settings of A6A12R82 E, perform the following steps:

a. Adjust 22-turn (YTX Linearity) potentiometers A6A10R70 LB4 and A6A10R76 LR4 fully counterclockwise if they have not already been so adjusted; do not readjust A6A12R40 LB1, A6A10R41 LB2, A6A10R42 LB3, A6A10R31 LR1, A6A610R34 LR2, or A6A10R37 LR3.
b. Readjust 22-turn (IF Offset) potentiometer A6A12R82 E as necessary to maximize the overall level of the displayed signal responses at the low end of the band.
c. On the spectrum analyzer, key in MARKER [NORMAL] and position the marker at the point in the band where the signal responses begin to fall off from their maximum value.
d. Readjust 22-turn (YTX Linearity) potentiometer A6A10R70 LB4 clockwise until the displayed signal responses at the high end of the band begin to drop. Continue to adjust A6A10R70 LB4 until the rolloff point aligns with the position of the

marker. See Figure 3-90 for the locations of A6A10R70 LB4 and A6A10R76 LR4.

e. Readjust 22-turn (YTX Linearity) potentiometer A6A10R76 LR4 clockwise to maximize the displayed signal responses at the high end of the band.

f. Readjust A6A12R82 E and A6A10R76 LR4 as necessary to maximize the displayed signal responses from 18.6 GHz to 22.0 GHz on the spectrum analyzer display.

153. Gradually readjust (Band E Lower Segment) A6A11R60 El and (Band E Upper Segment) A6A11R78 E2 as necessary for maximum flatness of the displayed signal responses.

154. On the spectrum analyzer, key in SWEEP (SINGLE), (SWEEP TIME) 150s, TRACE A (BLANK), TRACE B (MAX HOLD), (SAVE) 6, TRACE B (CLEAR-WRITE), (SAVE) 5, (HOLD).

155. Press SWEEP (SINGLE) on the spectrum analyzer and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off. As the spectrum analyzer tunes from 18.6 GHz to 22.0 GHz, the spectrum analyzer frequency response should be displayed as TRACE B.

156. On the spectrum analyzer, key in (RECALL) 4, (HOLD) and repeat steps 152 through 154 as necessary.

157. On the spectrum analyzer, key in (RECALL) 5 and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn Off.

158. On the spectrum analyzer, key in (RECALL) 4, (SHIFT) (GHz) / and use the DATA knob to gradually change the PRESELECTOR DAC setting from 32, maximizing the level of the TRACE A displayed signal responses at the lowest point on the TRACE B waveform. Note the PRESELECTOR DAC setting.

159. On the spectrum analyzer, key in (RECALL) 6, (SHIFT) (GHz) / and enter in the PRESELECTOR DAC setting from step 158. Press SWEEP (SINGLE) and wait for the sweep to complete (150 seconds) and the SWEEP LED to turn off.

160. Repeat steps 158 and 159 until the level of the lowest point on the TRACE B waveform does not change. Repeat step 159 with a PRESELECTOR DAC value of 30 and 34.

161. On the spectrum analyzer, key in TRACE B (VIEW), MARKER (NORMAL) and use the DATA knob to position a marker on the lowest point on the TRACE B waveform. Then, press MARKER (Δ), MARKER (PEAK SEARCH) to position a second marker on the highest point on the TRACE B waveform. Note the total peak-to-peak deviation of the displayed trace.

Band E total peak-to-peak deviation: ________ dB

162. On the spectrum analyzer, press MARKER (NORMAL) and note the frequency of the highest point on the TRACE B waveform.

Band E highest point: ________ GHz

163. Repeat steps 156 through 162 if necessary until the total peak-to-peak deviation of the TRACE B waveform is less than

4.40 dB from 18.6 GHz to 20.0 GHz, and 6.00 dB from 20.0 GHz to 22.0 GHz. See the TRACE B reference waveform to indicate which portions of the frequency response waveform require relative adjustment.

164. On the spectrum analyzer, key in (RECALL) 4, (HOLD).

165. On the synthesized sweeper, press (CW) and enter the frequency recorded in step 163, positioning the displayed TRACE A signal response at the highest point on the TRACE B waveform.

**Note** The RF Section front-panel AMPTD CAL control should still be set to the approximate center of its adjustment range from step 26.

166. On the spectrum analyzer, key in MARKER (NORMAL), MARKER (PEAK SEARCH) to position a marker at the peak of the displayed TRACE A signal response. Adjust 17-turn (Band E Step Gain) potentiometer A6A10R29 GE to adjust the amplitude of the marker to -10.00 dBm + (1/2 of Band E total peak-to-peak deviation) fO.O1 dB. Adjust A6A10R29 GE counterclockwise to increase the signal level, and clockwise to decrease the signal level.

**Note** IF A6A10 Miscellaneous Bias/Relay Driver Assembly is HP P/N 85660-60322 (HP 85660A/B RF Sections with serial number prefix 2747A or above), and A6A10R29 GE does not have sufficient range, change the value of factory-select component A6A10R90. Increase the value of A6A10R90 to decrease the signal level, and decrease the value of A6A10R90 to increase the signal level. See Table 3-3 for the acceptable range of values for A6A10R90, and Table 3-4 for HP part numbers. See Figure 3-90 for the location of A6A10R90.

## YTX Delay Compensation, 2.0 GHz – 22 GHz

**Note** YTX Delay Compensation adjustments A6A12R25 D2, A6A12R24 D3, and factory-select components A6A12C1, A6A12C2, A6A12C11, and A6A12C23 affect YTX/YTO dynamic tracking in all preselected frequency bands (Bands B, C, D, and E, 2 GHz – 22 GHz) for (SWEEP TIME) settings faster than approximately Is/frequency band.

**Note** YTX Delay Compensation adjustment A6A12R26 D1 is used in HP 85660A RF Sections only, and has no effect in HP 85660B RF Sections (A6A12C3 is not installed in the HP 85660B). YTX Delay Compensation adjustments A6A12R25 D2 and A6A12R24 D3 have very little effect in HP 85660B RF Sections, and are usually set near the counterclockwise end of their adjustment range.

167. On the spectrum analyzer, key in (2–22 GHz), (SHIFT) (PRESEL PEAK) =, (SHIFT) TRACE A (MAX HOLD) r u m a n a l y z e r controls as follows:

START FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 12.5 GHz

STOP FREQ . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 18.6 GHz
RES BW . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 3 MHz
REFERENCE LEVEL . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . -7 dBm
LOG SCALE . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 5 dB/DIV
SWEEP TIME . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1 sec

168. On the synthesized sweeper, key in (CW) 13.1 GHz.

**Note** The POWER LEVEL of the synthesized sweeper should still be leveled to a calibrated -10.00 dBm at 100 MHz at the spectrum analyzer RF INPUT from step 55.

169. If the A11A3 YTO, A6A8 YTX, or A6A12 YTX Driver Assembly have been repaired or replaced, adjust (YTX Delay Compensation) potentiometers A6A12R25 D2 and A6A12R24 D3 45° clockwise from fully counterclockwise.

170. On the spectrum analyzer, key in MARKER (PEAK SEARCH), (SHIFT) (GHz) /.

171. On the spectrum analyzer, press (PRESEL PEAK) and wait for the preselector peaking routine to complete. Record the Preselector DAC value in the 1 second SWEEP TIME column of Table 3-15.

**Table 3-15. Preselector Delay Compensation DAC Values**

| | Preselector DAC Value | |
|---|---|---|
| Trial Number | 1s SWEEP TIME | (AUTO) SWEEP TIME |
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| Average Value | | |

172. Repeat step 171 to record four additional Preselector DAC value entries in the 1s SWEEP TIME column of Table 3-15.

173. On the spectrum analyzer, key in SWEEP TIME (AUTO), MARKER (PEAK SEARCH).

174. On the spectrum analyzer, press (PRESEL PEAK) and wait for the preselector peaking routine to complete. Record the Preselector DAC value in the (AUTO) SWEEP TIME column of Table 3-15.

175. Repeat step 174 to record four additional Preselector DAC value entries in the (AUTO) SWEEP TIME column of Table 3-15.

176. Calculate the average Preselector DAC value for the 1 second SWEEP TIME and (AUTO) SWEEP TIME settings, and enter them in Table 3-15. Subtract the average Preselector DAC value for 1 second SWEEP TIME from the value for (AUTO) SWEEP TIME, and record the difference in the following line:

preselector DAC value difference: ________

177. If the Preselector DAC value difference recorded in step 176 is greater than f0.5, remove the **A6A12** YTX Driver Assembly from the RF Section and determine the current values of factory-select components **A6A12C1**, **A6A12C2**, **A6A12C11**, and **A6A12C23**. Then, refer to **Table** 3-16 to determine the **final** capacitor values to install for **A6A12C1**, **A6A12C2**, **A6A12C11**, and **A6A12C23**. Find the line in **the** table that corresponds to the current **values** of the four factory-select capacitors (**A6A12C1** and **A6A12C2** are in parallel, and **A6A12C11** and **A6A12C23** are in parallel). Add the difference recorded in step 176 to the line number corresponding to the current values to determine the line number of the **final** capacitor **values** to install for **A6A12C1**, **A6A12C2**, **A6A12C11**, and **A6A12C23**. See **Table** 3-4 for HP part numbers. See Figure 3-90 for the locations of **A6A12C1**, **A6A12C2**, **A6A12C11**, and **A6A12C23**.

For example, if the average Preselector DAC **value** for [AUTO) SWEEP TIME is 35.4 and the average **value** for [SWEEP TIME) **1s** is 32.0, the difference recorded in step 177 is **+3.4**. Assume that the currently installed **value** of **A6A12C1** is 0.33 $\mu$F, the value of **A6A12C11** is 0.22 $\mu$F, and that **A6A12C2**, **A6A12C3**, and **A6A12C23** are **not** installed. These values correspond to line 0 of **Table** 3-16. The final capacitor values are listed in line 3, determined by adding the difference of **+3.4** to line number 0. The value of **A6A12C1** is correct already, and **A6A12C11** is changed to a 0.1 $\mu$F capacitor.

**Table 3-16. A6A12 YTX Driver Assembly Factory-Select Capacitor Values**

| Line | Capacitor Values ($\mu$F) | | | | |
|---|---|---|---|---|---|
| | A6A12C1 | A6A12C2 | A6A12C11 | A6A12C23 | A6A12C3 |
| -8 | 0.33 | 0.22 | 0.22 | 0.33 | open |
| -7 | 0.33 | 0.22 | 0.22 | 0.22 | open |
| -6 | 0.33 | 0.22 | 0.22 | 0.22 | open |
| -5 | 0.33 | open | 0.22 | 0.33 | open |
| -4 | 0.33 | open | 0.22 | 0.33 | open |
| -3 | 0.33 | open | 0.22 | 0.22 | open |
| -2 | 0.33 | open | 0.22 | 0.15 | open |
| -1 | 0.33 | open | 0.22 | 0.10 | open |
| 0 | 0.33 | open | 0.22 | open | open |
| +1 | 0.33 | open | 0.22 | open | open |
| +2 | 0.33 | open | 0.15 | open | open |
| +3 | 0.33 | open | 0.10 | open | open |
| +4 | 0.15 | open | 0.22 | open | open |
| +5 | 0.33 | open | open | open | open |
| +6 | open | open | 0.22 | open | open |
| +7 | open | open | 0.22 | open | open |
| +8 | open | open | 0.15 | open | open |

178. If the factory-select capacitor values listed in Line 0 are installed, the LINE column corresponds to the average Preselector DAC value difference of step 177

179. On the spectrum analyzer, key in (SHIFT) (PRESEL PEAK) =.

## External Mixing – 18.6 GHz to 325 GHz

180. Connect the low-loss microwave test cable to the synthesized sweeper RF OUTPUT using an APC 3.5 (f) to APC 3.5 (f) adapter. See Figure 3-95. Connect the power meter/power sensor to the opposite end of the test cable using a Type N (f) to APC 3.5 (f) adapter.

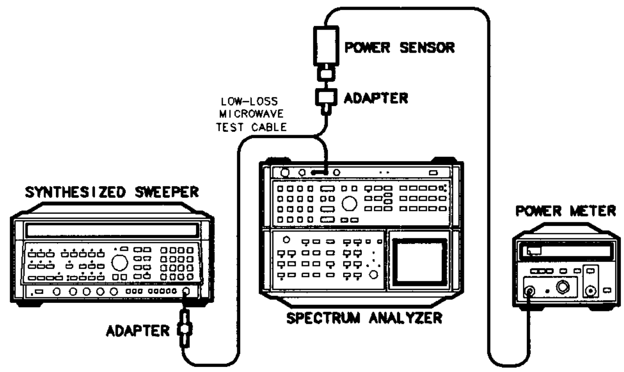


**Figure 3-99.**
**Frequency Response Adjustments Setup (18.6 to 325 GHz)**

181. Press (2-22 GHz) on the synthesized sweeper. Set the controls of the synthesized sweeper as follows:

| | |
|---|---|
| CW | 321.4 MHz |
| POWER LEVEL | –20.0 dBm |
| RF | on |
| LEVELING | INT |

182. On the synthesized sweeper, press (POWER LEVEL) and adjust the ENTRY knob for a power meter indication of –20.00 dBm ±0.03 dB at 321.4 MHz.

183. On the synthesized sweeper, key in (SHIFT) (ATTEN) –10 dB to decrease the output power by 10.0 dB.

184. Disconnect the jumper cable from between the spectrum analyzer front panel 321.4 MHz IF INPUT and IF OUTPUT connectors.

185. Disconnect the low-loss microwave test cable from the power meter/power sensor, and connect the test cable to the spectrum analyzer front panel 321.4 MHz IF INPUT connector.

186. On the spectrum analyzer, key in (2–22 GHz), (SHIFT) (⇧) U, 6 Hz, (SHIFT) (REFERENCE LEVEL) Z 0 dB. Set the spectrum analyzer controls as follows:

| | |
|---|---|
| RES BW | 1 MHz |
| REFERENCE LEVEL | +3 dBm |

LOG SCALE .......................................... 1 dB/DIV

187. Press MARKER (NORMAL) and adjust (IF Step Gain) potentiometer **A6A10R81** GF for a marker indication of 0.00 **dBm** fO.O1 **dB.**

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**Note**

If **A6A10** Miscellaneous Bias/Relay Driver Assembly is HP **P/N** 85660-60322 (HP **85660A/B** RF Sections with **serial** number prefix 2747A or above), and **A6A10R81** GF does not have sufficient range, change the **value** of factory-select component **A6A10R91.** Increase the **value** of **A6A10R91** to decrease the signal level, and decrease the value of **A6A10R91** to increase the signal level. See **Table** 3-3 for the acceptable range of **values** for **A6A10R91,** and **Table** 3-4 for HP part numbers. See Figure 3-90 for the location of **A6A10R91.**

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188. Disconnect the low-loss microwave test cable from the spectrum analyzer front panel 321.4 MHz IF INPUT connector. Reconnect the jumper cable between the spectrum analyzer front panel 32 1.4 MHz IF INPUT and IF OUTPUT connectors.

189. On the spectrum analyzer, key in (SHIFT) (⇧) U, 6 Hz, (SHIFT) (REFERENCE LEVEL) Z -12 **dBm.**

190. In the RF Section, disconnect cable 84 (gray/yellow) from **A6A12J1** and cable 82 (gray/red) from **A6A12J2.** Replace the cover to the A6 RF Module, and then reconnect cable 84 (gray/yellow) to **A6A12J1** and cable 82 (gray/red) to **A6A12J2.**

191. Remove the jumper between **A12TP2** and **A12TP3** (LOCK INDICATOR DISABLE) on the Al2 Front Panel Interface Assembly in the RF Section.

192. Replace the RF Section bottom cover.

# 22. 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 3-108. If these components are unavailable, the alternate procedure provided below (using only the digital voltmeter) can then be used.

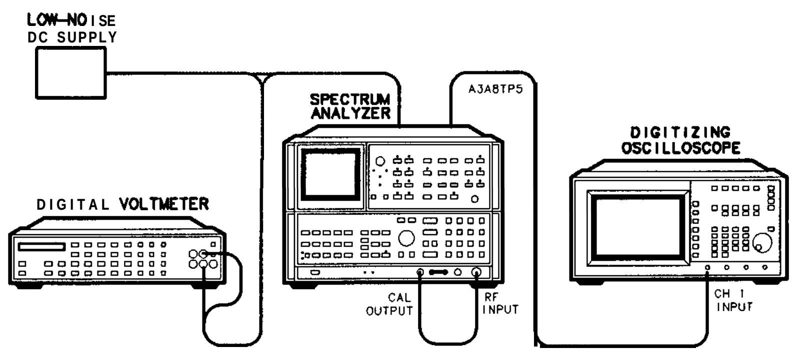


**Figure 3-100. Analog-To-Digital Converter Adjustments Setup**

**Equipment**

| | |
|---|---|
| Oscilloscope | HP 54501A |
| Digital Voltmeter | HP 3456A |
| Low-Noise DC Supply (Optional) | See Figure 3-108 |
| 10:1 Divider Probe, 10 MΩ/7.5 pF | HP 10432A |

**Procedure**

1. Position spectrum analyzer upright as shown in Figure 3-100 and remove IF-Display Section top cover.
2. Set spectrum analyzer LINE switch to ON and press (2-22 GHz).
3. Procedure using Low-Noise DC Supply is illustrated in Figure 3-108.
   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 channel 1, 10: 1 probe to A3A8TP11 and ground the probe ground to the A3 section's card cage.

e. Set the oscilloscope settings as follows:

Press (CHAN)

Channel 1 . . . . . . . . . . on
probe . . . . . . . . . . 10:1
amplitude scale . . . . . . . . . . 1 V/div
offset . . . . . . . . . . 2 V
coupling . . . . . . . . . . dc

Press (TRIG)

EDGE TRIGGER . . . . . . . . . . auto, edge
source . . . . . . . . . . Channel 1

Press (TIME BASE)

time scale . . . . . . . . . . 5 $\mu$s/div

Press Display

connect dots . . . . . . . . . . on

Press (SHOW)

f. Adjust A3A8R6 OFFS for a square wave displayed on the oscilloscope. The square wave sould be approximately 4 V,,. See Figure 3-101 for location of adjustment.

g. Remove short from A3A8TP4 and A3A8TP5 or disconnect the SMB snap-on short from A3A8J1.

h. Press (0-2.5 GHz).

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 sould be approximately 4 $V_{p-p}$. See Figure 3-101 for location of adjustment.

m. Disconnect low-noise dc supply from A3A8J1. Reconnect 0 cable to A3A8J 1.

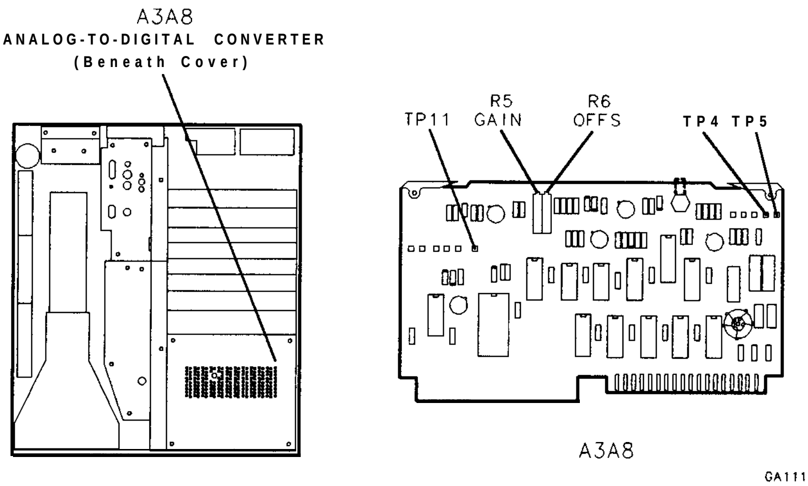


**Figure 3-101.**
**Location of Analog-lb-Digital Converter Adjustments**

## Alternate Procedure

4. Procedure without using Low-Noise DC Supply:
   a. Press (2-22 GHz).
   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 3-101 for location of adjustment.
   g. Remove short from A3A8TP4 and A3A8TP5. Reconnect cable 0 (black) to A3A8J1.
   h. Press (0-2.5 GHz).
   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 until the voltage at the end of the sweep is + 10.020 ±0.005 V dc.

# 23. Track and Hold Adjustments

**Reference** A3A9 Track and Hold

**Description** The CAL OUTPUT signal is connected to the RF INPUT. The spectrum analyzer 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.

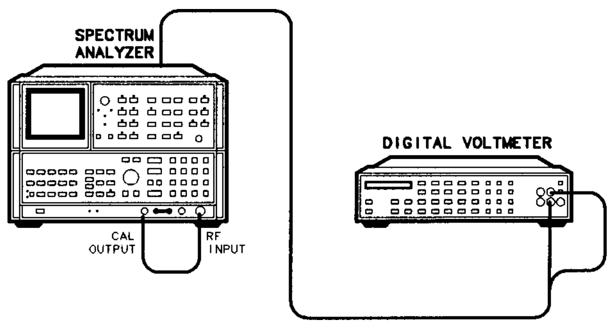


**Figure 3-102. Track and Hold Adjustments Setup**

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

**Procedure**

1. Place spectrum analyzer upright as shown in Figure 3-102 with IF-Display Section top cover and A3 Digital Storage covers removed.
2. Set spectrum analyzer LINE switch to ON and press (2-22 GHz).
3. Connect CAL OUTPUT to RF INPUT.
4. Connect DVM to A3A9TP3 and ground to A3A9TP1.
5. Key in [CENTER FREQUENCY) 100 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 fO.OO1 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 A level indication as indicated by CRT annotation flickers back and forth between .00 and .10 dB. See Figure 3-103 for location of adjustment.

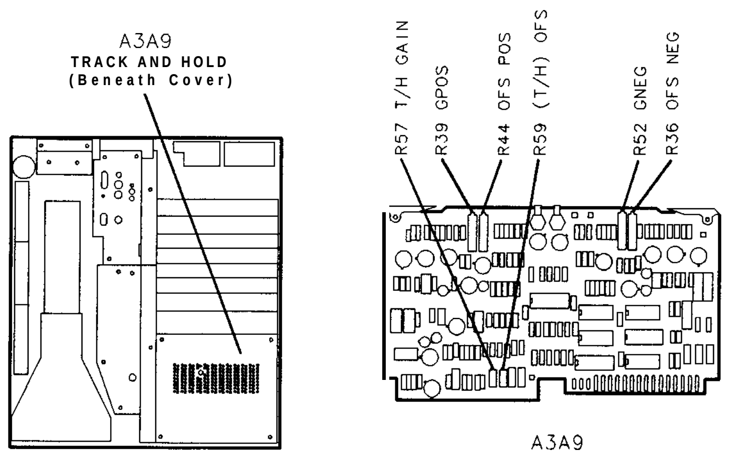


**Figure 3-103. Location of Track and Hold Adjustments**

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 fO.OO1 V dc at A4A1TP3.
18. Disconnect DVM from instrument.
19. Key in (SINGLE), TRACE A (CLEAR-WRITE), MARKER (NORMAL), MARKER (Δ), SWEEP (CONT).
20. Adjust A3A9R57 T/II GAIN for GAIN for MARKER A level indication as indicated by CRT annotation of 100 fO.l 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. 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.

# 24. 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.

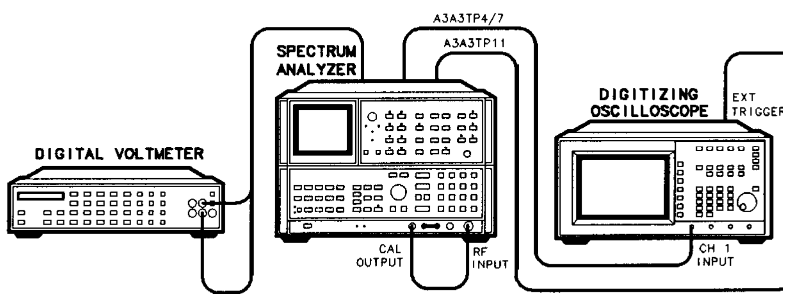


**Figure 3-104. Digital Storage Display Adjustments Setup**

**Equipment**

Digital Voltmeter (DVM) .................................. .HP 3456A
Digitizing Oscilloscope .................................. HP 54501A
10: 1 Divider Probe, 10 MΩ/7.5 pF (2 *required*) .......... HP 10A32A

**Procedure**

1. Place spectrum analyzer upright as shown in Figure 3-104 with IF-Display Section top cover and A3 Digital Storage cover removed.
2. Set spectrum analyzer LINE switch to ON and press (2-22 GHz)

## 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 3-105 for location of adjustment.
5. Adjust **A3A2R12** LL THRESH fully clockwise. See Figure 3-105 for location of adjustment.

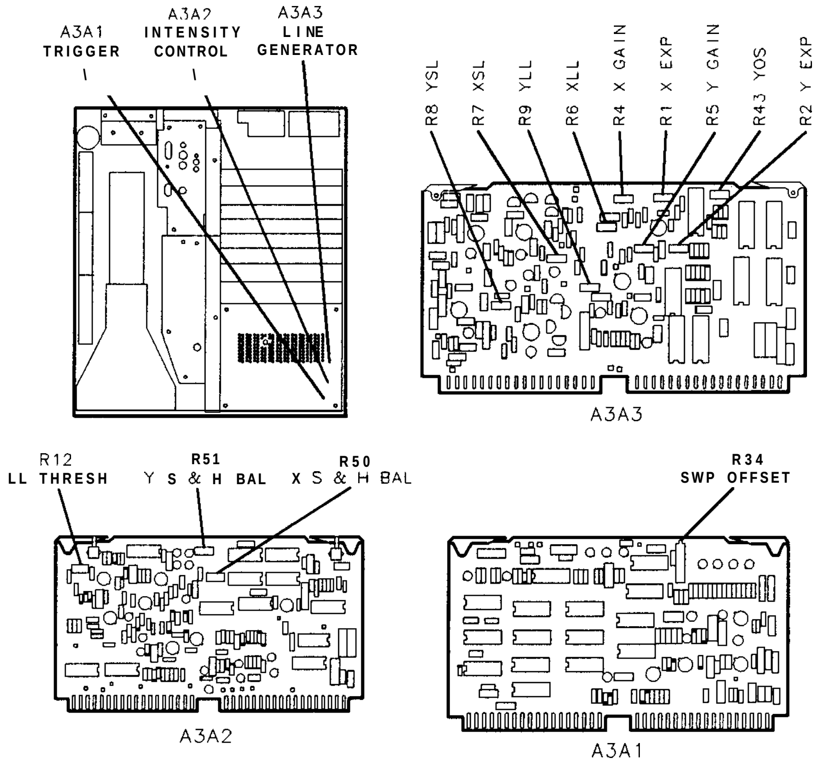


**Figure 3-105. Location of Digital Storage Display Adjustments**

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 3-105 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 3-105 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 spectrum analyzer LINE switch to STANDBY.
14. Place A3A3 Line Generator on extender boards.
15. Set spectrum analyzer LINE switch to ON. Press (2-22 GHz).
16. Key in (SHIFT) ▢ z (RECORDER LOWER LEFT) 0 (Hz). Press (SHIFT) ▢ | (RECORDER UPPER RIGHT) 1028 (Hz).
17. Set the oscilloscope controls as follows:

Press (CHAN)
- Channel 1 . . . . . . . . . . . . . . . . on
- probe . . . . . . . . . . . . . . . . 10:1
- amplitude scale . . . . . . . . . . . . . . . . 50 mV/div
- offset . . . . . . . . . . . . . . . . 0 V
- coupling . . . . . . . . . . . . . . . . dc
- Channel 4 . . . . . . . . . . . . . . . . off
- probe . . . . . . . . . . . . . . . . 10:1
- amplitude scale . . . . . . . . . . . . . . . . 2 V/div
- offset . . . . . . . . . . . . . . . . 0 V
- coupling . . . . . . . . . . . . . . . . dc

Press (TRIG)
- source . . . . . . . . . . . . . . . . Channel 4
- level . . . . . . . . . . . . . . . . 300 mV, edge

Press (TIME BASE)
- time scale . . . . . . . . . . . . . . . . 500 ns/div
- delay . . . . . . . . . . . . . . . . -400 ns

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

Press (SHOW)

18. 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 3-106 shows a properly adjusted waveform. Figure 3-107 shows the waveform before adjustment. Refer to Figure 3-105 for location of adjustment.

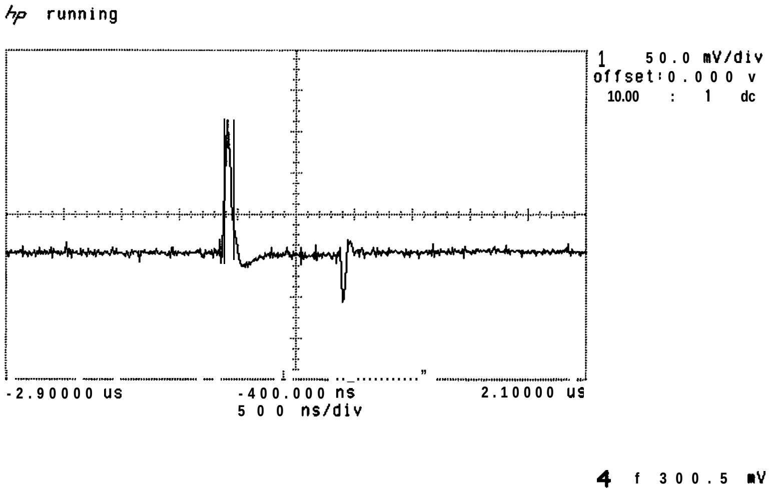


**Figure 3-106. Sample and Hold Balance Adjustment Waveforms**

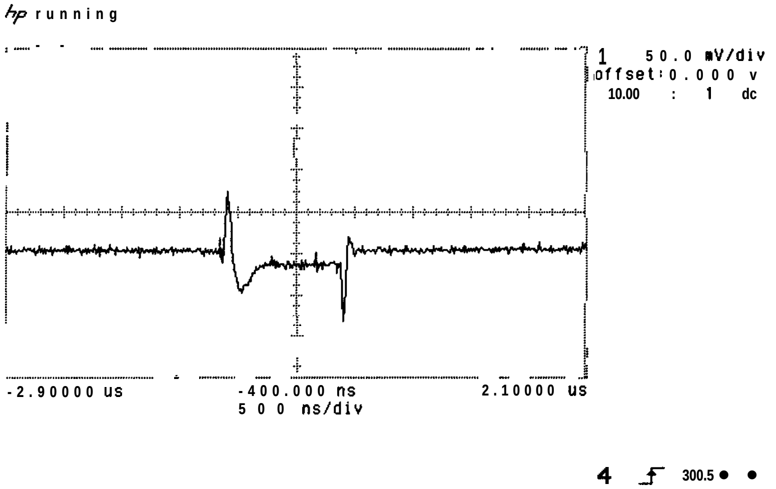


**Figure 3-107. Waveform Before Adjustment**

19. Connect the oscilloscope Channel 1 probe to A3A3TP7.
20. 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.
21. Set spectrum analyzer LINE switch to STANDBY.
22. Reinstall A3A3 Line Generator in spectrum analyzer without extender boards.
23. Set spectrum analyzer LINE switch to ON.

### X and Y Offset and Gain Adjustments

24. Press (2-22 GHz).
25. Key in (FREQUENCY SPAN) 0 Hz, (SWEEP TIME) 100 $\mu s$.
26. 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.
27. Select TRIGGER (VIDEO) and adjust front-panel LEVEL control for a stable display on instrument CRT.
28. Adjust A3A1R34 SWP OFFSET so that the signal trace begins at the left edge graticule line. Refer to Figure 3-105 for location of adjustment.
29. 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 twenty-first 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 3-105. for location of adjustment.
30. Remove the cable 9 (white) from A3A2J2 LG/FS test connector and reconnect to A3A9J2.
31. Remove cable 7 (violet) from A4A1J1. Short A3A9TP1 to A3A9TP3 or connect an SMB snap-on short to A3A9J1.
32. Connect DVM to A3A9TP3 and DVM ground to A3A9TP1.
33. Press LIN pushbutton.
34. DVM indication should be 0.000 f0.002 V dc.
35. Adjust A3A3R43 YOS to align the bottom graticule line with the fast sweep signal trace.
36. Remove the short between A3A9TP1 and A3A9TP3 (or the SMB snap-on short) and reconnect cable 7 (violet) to A4A1J1.
37. Key in (CENTER FREQUENCY) 100 MHz. Connect CAL OUTPUT to RF INPUT. Press LOG (ENTER dB/DIV) 10 dB.
38. Connect the DVM to A4A1TP3 and the DVM ground to the IF casting.
39. Press (REFERENCE LEVEL) and adjust DATA knob and the frontpanel AMPTD CAL adjust for DVM indication of +2.000 f0.002 V dc.
40. Adjust A3A3R5 Y GAIN to align the top graticule line with the fast sweep signal trace.

### Final Graticule Adjustments

41. Press (2 - 22 GHz), TRACE A (BLANK).
42. Set A3A2R12 LL THRESH fully clockwise.
43. 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.
44. Adjust A3A2R12 LL THRESH fully counterclockwise.
45. 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.
46. 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

47. Press (2 — 22 GHz).
48. Key in MARKER (NORMAL).
49. 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.
50. 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 3-108 can be constructed using the parts listed in Table 3-17.

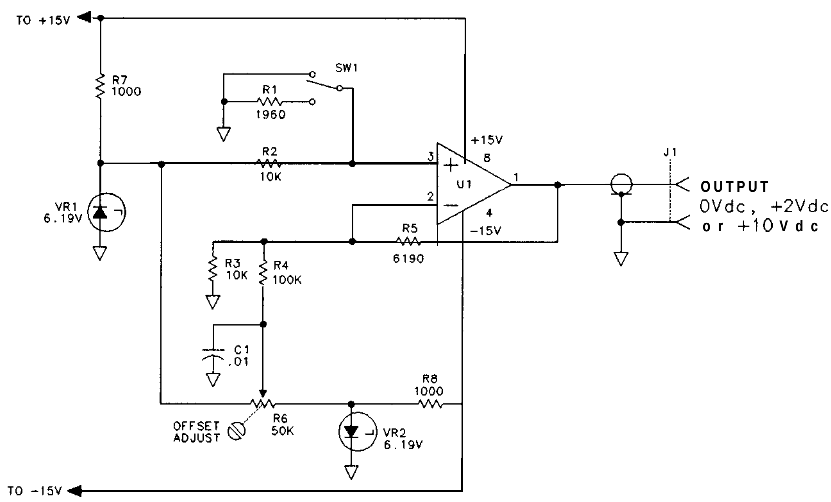


**Figure 3-108. Low-Noise DC Supply**

**Table 3-17. Parts for Low-Noise DC Supply**

| Reference/Designation | HP Fart Number | CD | Description |
|---|---|---|---|
| Cl | 0160-2055 | 9 | CAPACITOR FXD .01 $\mu$f |
| 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, 3-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 3-109 can be constructed using the parts listed in Table 3-18 and Table 3-19. Table 3-18 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 3-19 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.

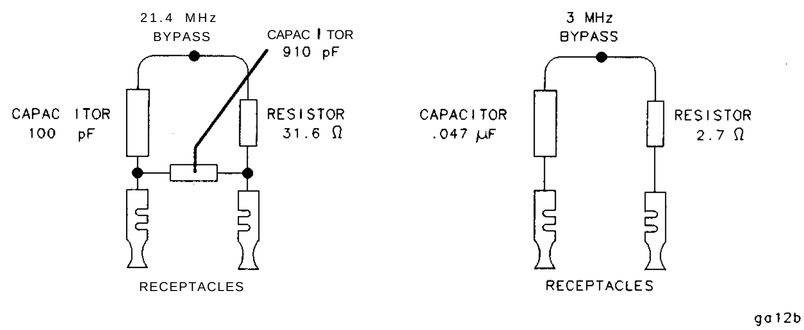


**Figure 3-109. Crystal Filter Bypass Network Configurations**

**Table 3-18.**
**Crystal Filter Bypass Network Configuration for A4A4 and A4A8 (21.4 MHz)**

| Part | Value | Qty. | HP Part Number |
|---|---|---|---|
| Resistor | 31.69 | 2 | 0698-7200 |
| Capacitor | 100 pF | 2 | 0160-4801 |
| Capacitor | 910 pF | 2 | 0160-6146 |
| Receptacle | | 4 | 1251-3720 |

**Table 3-19.**
**Crystal Filter Bypass Network Configuration for A4A7 (3MHz)**

| Part | Value | Qty. | HP Part Number |
|---|---|---|---|
| Resistor | 2.79 | 4 | 0683-0275 |
| Capacitor | 0.047 μF | 4 | 0170-0040 |
| Receptacle | | 8 | 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:

## 3. 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 (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Key in spectrum analyzer settings as follows:

| | |
|---|---|
| [CENTER FREQUENCY) | 100 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 la] 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 f0.05 dB). It may be necessary to press SWEEP (CONT) and adjust (CENTER FREQUENCY ) to center trace on screen.
7. Press MARKER La] 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 f0.05 dB). The 6 dB bandwidth is given by the MARKER A frequency readout. (See Figure 4-l.) Record this value in Table 4-l.

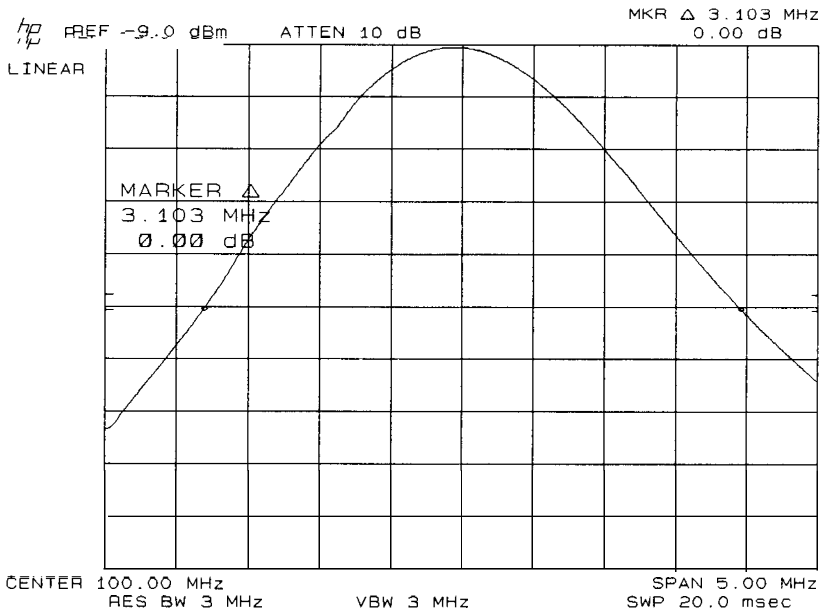


**Figure 4-1. Resolution Bandwidth Measurement**

8. Vary spectrum analyzer settings according to Table 4-l. 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 |

## 3. 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.

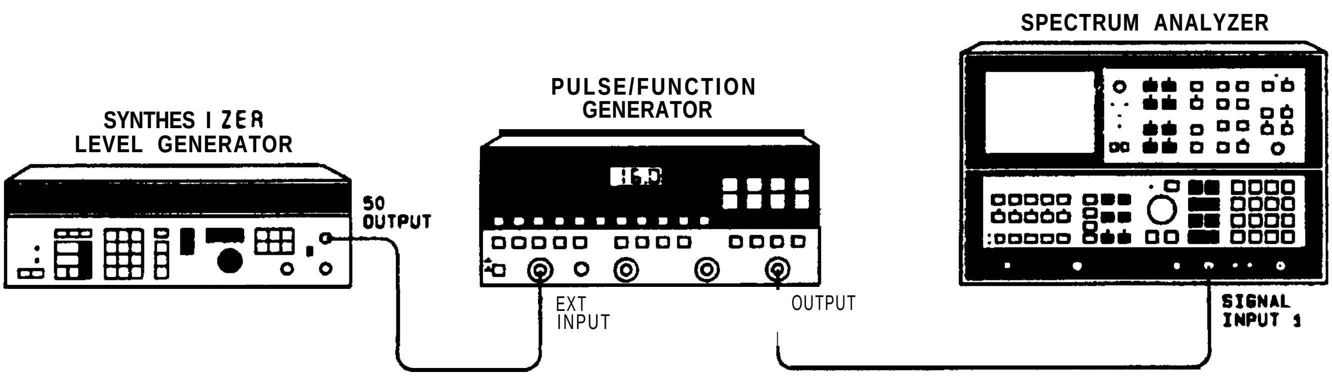


**Figure 4-2. Impulse Bandwidth Test Setup**

**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 (2-22 GHz) and 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) .......... .OdBm

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 Alter 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 $\mu$s.
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 $\mu$s.
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 $\mu$us.
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 (2-22 GHz).
40. Connect the spectrum analyzer CAL OUTPUT to RF INPUT.
41. On the spectrum analyzer, key in the following settings:

| | |
|---|---|
| (CENTER FREQUENCY) | 100 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 la] 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 f0.05

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 4, Impulse and Resolution Bandwidth Selectivity Test.

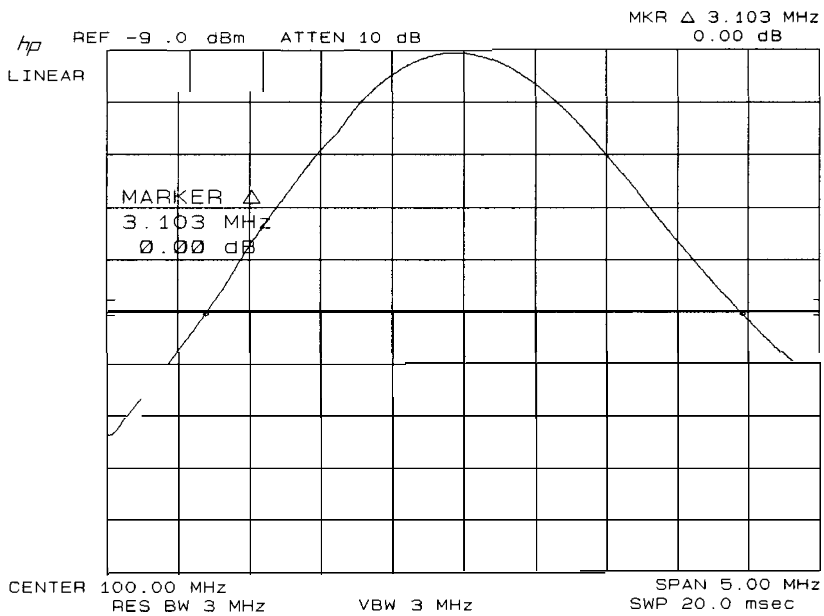


**Figure 4-3. 6 dB Resolution Bandwidth Measurement**

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 Δ Readout of 6 dB Bandwidth | | |
|---|---|---|---|---|
| | | Minimum | Actual | Maximum |
| 3 MHz (i) | 5 MHz | | ________ | |
| 1 MHz (i) | 2 MHz | | ________ | |
| 00 kHz (i) | 500 kHz | | ________ | |
| 00 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 |

## 4. 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 bandwidths 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 3, 6 dB Resolution Bandwidth Accuracy Test, must be performed before starting this test.

**Procedure**

1. Press (2 - 22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Key in analyzer control settings as follows:

   (CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 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 fl.OO 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 Δ amplitude readout should be .OO dB f0.50 dB).
6. Read the 60 dB bandwidth for the 3 MHz resolution bandwidth setting from the MARKER Δ 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-l 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.

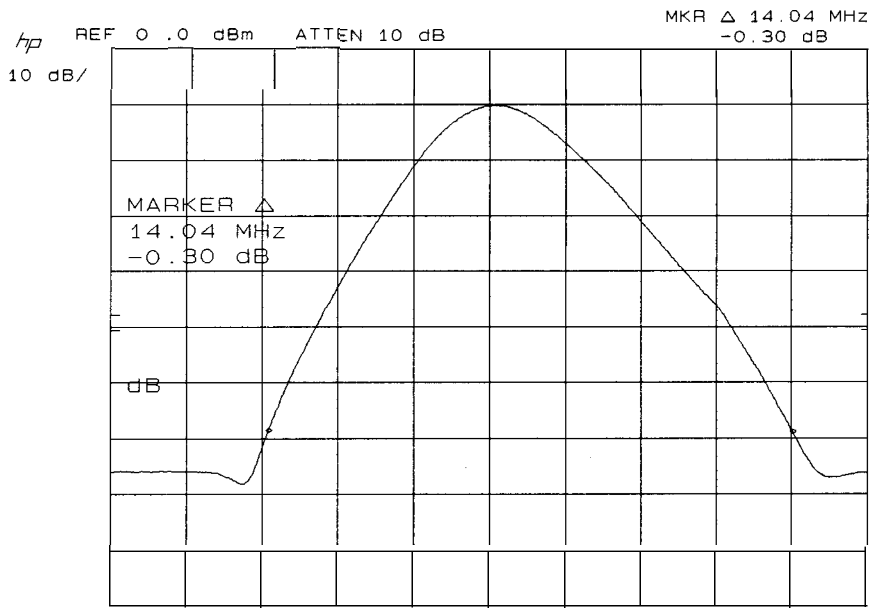


**Figure 4-4. 60 dB Bandwidth Measurement**

## 4. 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 | | | | |
| 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 | | |

# 4. Impulse and Resolution Bandwidth Selectivity Test

**Related Adjustment**

3 MHz Bandwidth Filter Adjustments
2 1.4 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 (2-22 GHz) and connect the CAL OUTPUT to RF INPUT.
2. Key in spectrum analyzer control settings as following:

| | |
|---|---|
| [CENTER FREQUENCY) | 100 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 In] 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 fl.OO 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).

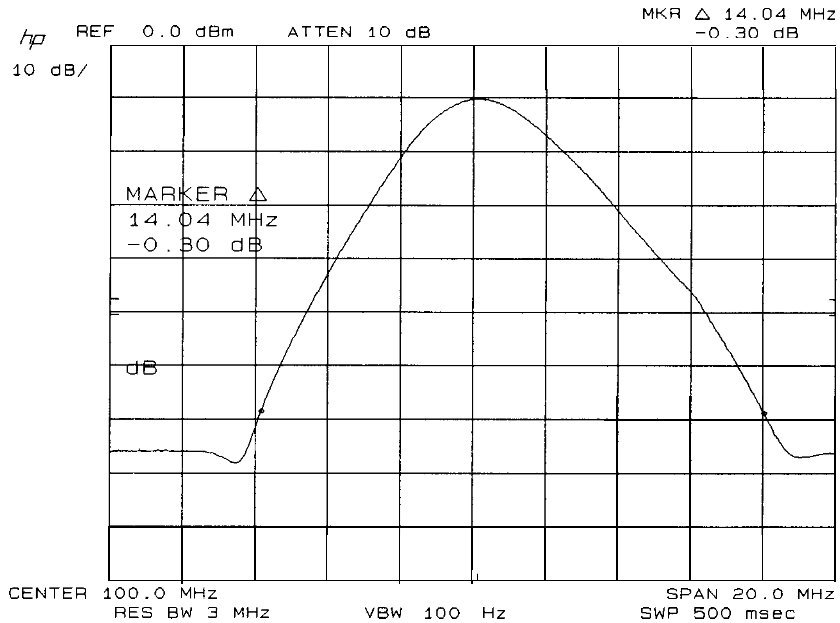


**Figure 4-5. 60 dB Bandwidth Measurement**

4. Press MARKER [al 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 f0.50 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-l 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 | | 50 dB points separated by <100 Hz | | |

## 5. Impulse and Resolution Bandwidth Switching Uncertainty Test

**Related Adjustment**

3 MHz Bandwidth Filter Adjustments
21.4 MHz Bandwidth Filter Adjustments
Down/Up Converter Adjustments

**Specification**

f2.0 dB, 10 Hz bandwidth
±0.8 dB, 30 Hz bandwidth
f0.5 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 (2–22 GHz).
2. Connect CAL OUTPUT to RF INPUT.
3. Key in the following control settings:

   (CENTER FREQUENCY) ....................................... 100 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 La] 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.

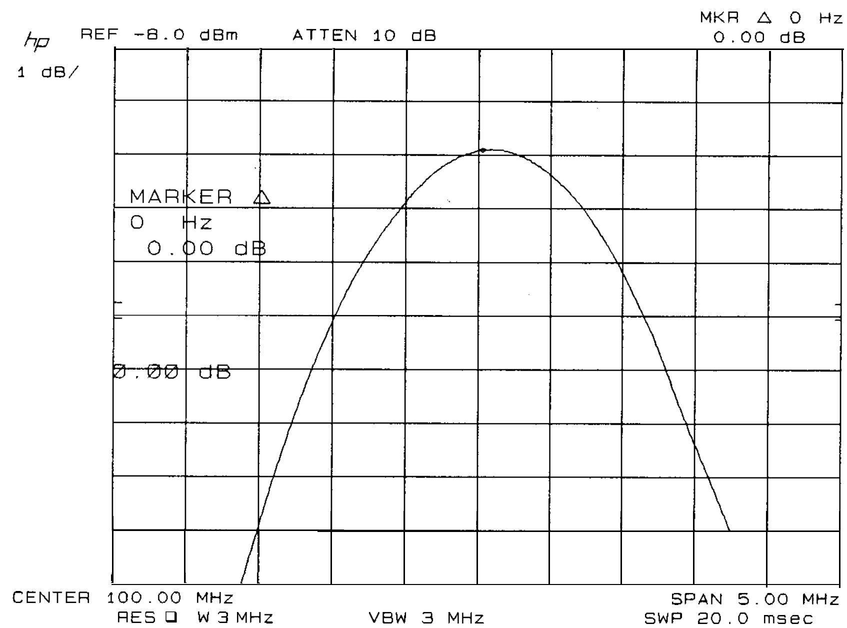


**Figure 4-6. Bandwidth Switching Uncertainty Measurement**

**Table 4-6. Bandwidth Switching Uncertainty**

| **Res BW** | **Frequency Span** | **Deviation (MKR A Readout, dB)** | **Allowable Deviation (dB)** |
|---|---|---|---|
| 1 MHz (i) | 5 MHz | 0 (ref.) | 0 (ref.) |
| 3 MHz (i) | 5 MHz | ________ | ± 1.0 |
| 00 kHz (i) | 5 MHz | ________ | ± 0.5 |
| 00 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 3. 6 dB Resolution Bandwidth Accuracy Test (p/o Table 2-24, 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 3. Impulse and Resolution Bandwidth Accuracy Test (p/o Table 2-24, 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 3. Impulse and Resolution Bandwidth Accuracy Test (p/o Table 2-24, 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 | | ________ | |
| 00 kHz (i) | 500 kHz | | ________ | |
| 00 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 4. 6 dB Resolution Bandwidth Selectivity (p/o Table 2-24, 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 point separated by <100 Hz | | |

## Test 4. Impulse and Resolution Bandwidth Selectivity (p/o Table 2-24, 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 |
| LOO 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 5. Impulse and Resolution Bandwidth Switching Uncertainty (p/o Table 2-24, 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 and press (2-22 GHz).
3. Connect CAL OUTPUT to RF INPUT.
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 6 dB point; CRT MKR A annotation indicates .500 x
8. Adjust A4A9R60 3 MHz for MKR [al 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 f0.60 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.

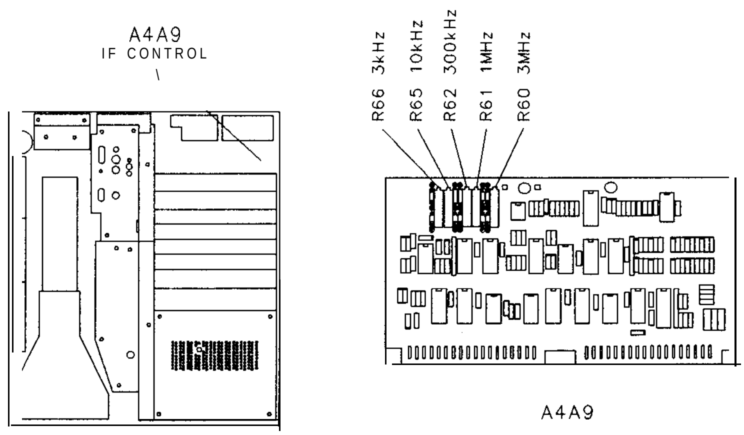


**Figure 4-7. Location of Bandwidth Adjustments**

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 la]. 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 (Δ). 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 (Δ).
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 la]. 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 [al 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 RF INPUT. 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 and press (2–22 GHz).
3. Connect CAL OUTPUT to RF INPUT.
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 la] 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 (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. 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 (Δ).

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.

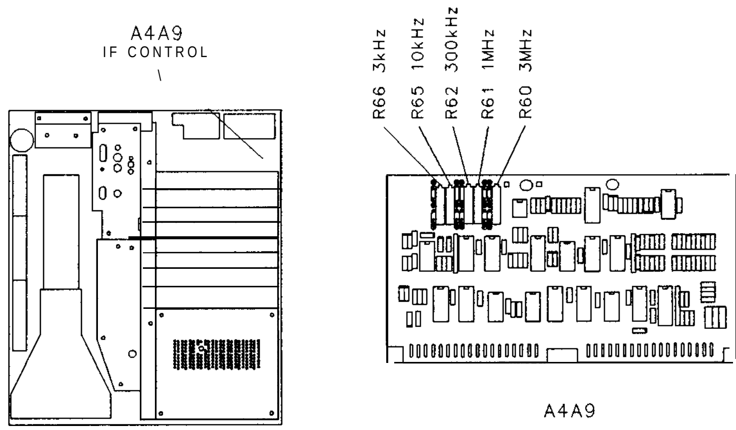


**Figure 4-8. Location of Bandwidth Adjustments**

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 (Δ).
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 la]. 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 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 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 la). 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 La] 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 the modified amplitude fidelity performance test for Option 857 instruments. This chapter also contains the modified amplitude fidelity portion of the Test Record for Option 857 instruments.

# 8. Option 857 Amplitude Fidelity Performance Test

**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:

≤±0.6 dB max over 0 to 70 dB display (20 to 30°C)

≤± 1.5 dB over 0 to 90 dB display

10 Hz Resolution Bandwidth:

≤±0.8 dB over 0 to 70 dB display (20 to 30°C)

≤±2.1 dB 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.

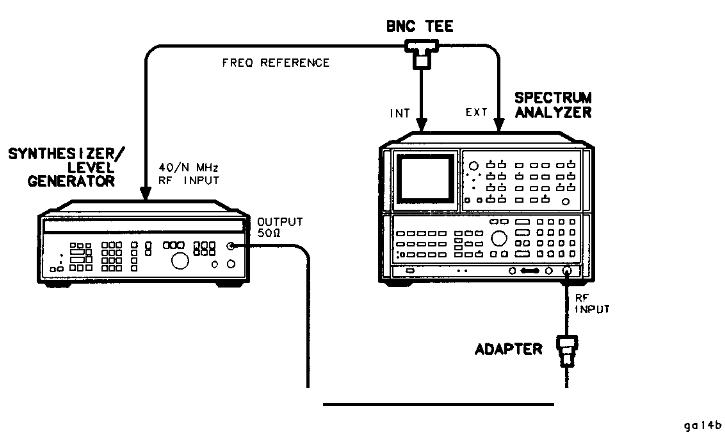


**Figure 5-1. Option 857 Amplitude Fidelity Test Setup**

## Equipment

Frequency Synthesizer . . . . . . . . . . . . . . . . . . . . . . . . . . . . . HP 3335A
Adapter, Type N (m) to BNC (f) . . . . . . . . . . . . . . . . 1250-0780
BNC Tee . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 1250-0781

## Procedure

Log Fidelity

1. On the spectrum analyzer, connect the CAL OUTPUT to the RF INPUT. Press (RECALL) 9 and adjust the FREQ ZERO pot for maximum amplitude.
2. Press (2 - 22 GHz) on the analyzer. Key in analyzer settings as follows:

   (CENTER FREQUENCY) . . . . . . . . . . . . . . . . . . . . . . . . . . . .20 MHz
   (FREQUENCY SPAN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 HZ
   (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-l.
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 (Δ). Step the frequency synthesizer output amplitude down 10 dB.
8. 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.
9. Repeat steps 8 and 9, decreasing the output of the frequency sythesizer in 10 dB steps from -10 dBm to -80 dBm.
10. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.
11. 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
12. 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
13. Set the frequency synthesizer amplitude to + 10 dBm.

14. Key in the following analyzer settings:

    (FREQUENCY SPAN) . . . . . . . . . . . . . . . . . . . . . . . . . . . . 100 kHz
    (RES. BW) . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 10 kHz
    SWEEP (CONT)

15. Press MARKER (PEAK SEARCH), (MRK → CF), (MRK → REF LVL) to center the signal on the display.

16. Key in the following analyzer settings:

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

17. Press MARKER A. Step the frequency synthesizer output amplitude from + 10 dBm to -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 amplitude.

18. Subtract the value in column 1 from the value in column 2 for each setting to find the fidelity error.

19. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -70 dB. The result should be ≤0.6 dB

    ____________ dB

20. Subtract the greatest negative fidelity error from the greatest positive fidelity error for calibrated amplitude steps from -10 dB to -90 dB. The result should be ≤1.5 dB

    ____________ dB

**Table 5-l.**
**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) |
|---|---|---|---|
| +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 | ____________ | ____________ |

**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) |
|---|---|---|---|
| +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 | ________ | ________ |

## Linear Fidelity

21. Key in analyzer settings as follows:

(VIDEO BW) .............................................. 300 Hz
(FREQUENCY SPAN) .............................................. 20 kHz
(RES BW) .............................................. 10 kHz

22. Set the frequency synthesizer for an output power level of + 10 dBm.

23. Press SCALE LIN pushbutton. Press MARKER (PEAK SEARCH), (MKR → CF) to center the signal on the display.

24. Set (FREQUENCY SPAN) to 0 Hz and (VIDEO BW) to 1 Hz. Press (SHIFT), (AUTO)A (resolution bandwidth), MARKER (Δ).

25. Decrease frequency synthesizer output amplitude by 10 dB steps, noting the MARKER A amplitude and recording it in column 2 of Table 5-3.

**Table 5-3. 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 |

# Performance Test Record

| | |
|---|---|
| Hewlett-Packard Company | Tested by __________ |
| Model HP 8566B | Report No. __________ |
| Serial No. __________ | Date __________ |
| IF-Display Section __________ | |
| RF Section __________ | |

# Test 8. Option 857 Amplitude Fidelity

Step 9. Log Amplitude Fidelity (10 Hz RBW)

| Frequency Synthesizer Amplitude (dBm) | 1 Calibrated Amplitude Step | 2 MARKER A Amplitude (dB) | Fidelity Error (Column 2 - Column 1) (dB) | Cumulative Error 0 to 70 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 | ______ | ______ | ≤±0.8 dB | ≤±2.1 dB |

Step 18. Log Amplitude Fidelity (10 kHz RBW)

| Frequency Synthesizer Amplitude (dBm) | 1 Calibrated Amplitude Step | 2 MARKER A Amplitude (dB) | Fidelity Error (Column 2 - Column 1) (dB) | Cumulative Error 0 to 70 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 | ______ | ______ | ≤±0.6 dB | ≤±1.5 dB |

**Test 8. Option 857 Amplitude Fidelity**

**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 |

# Major Assembly and Component Locations

## IF-Display Section Figure Index

## RF Section Figure Index

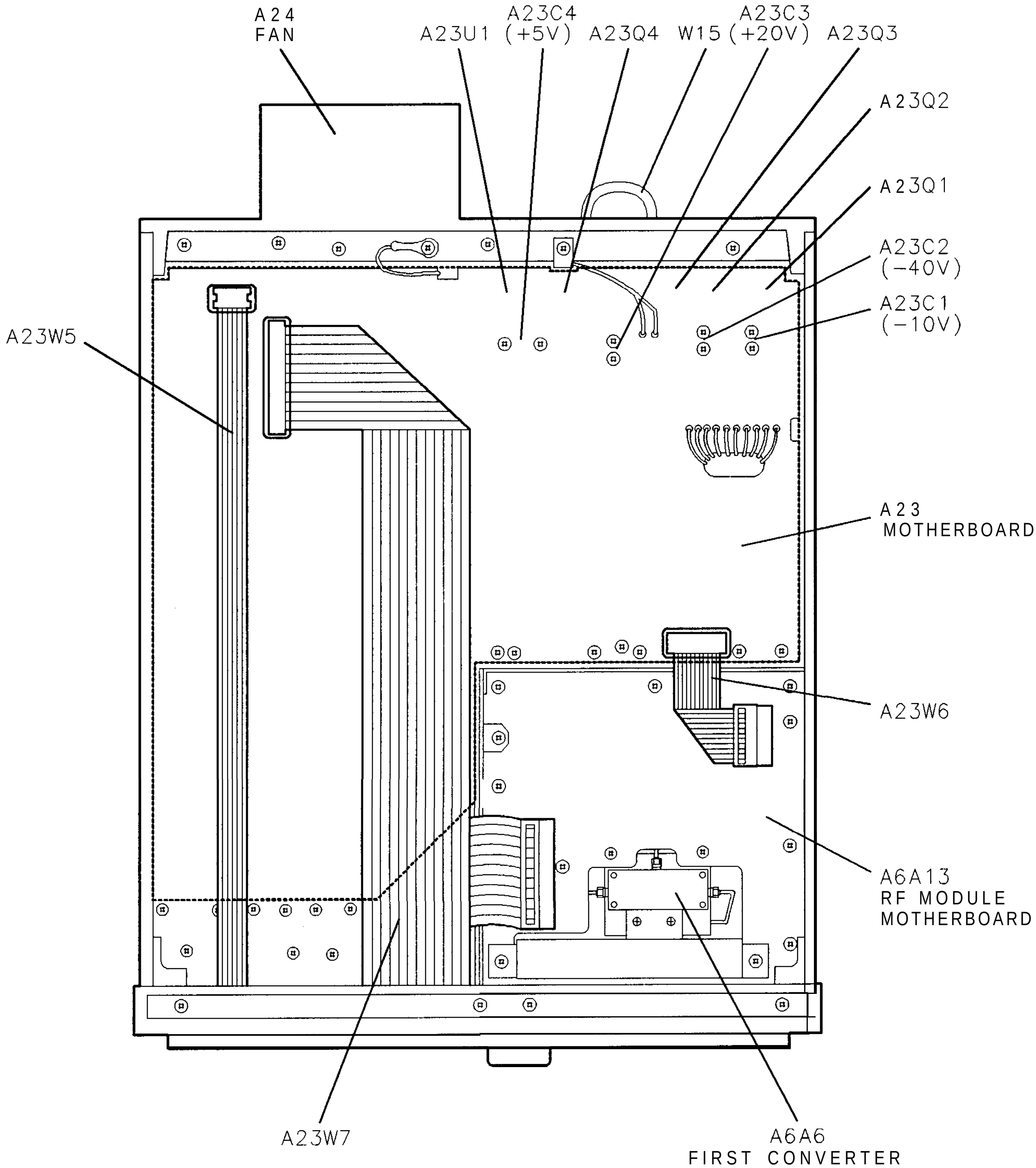


**Figure 6-1. RF Section, Top View**

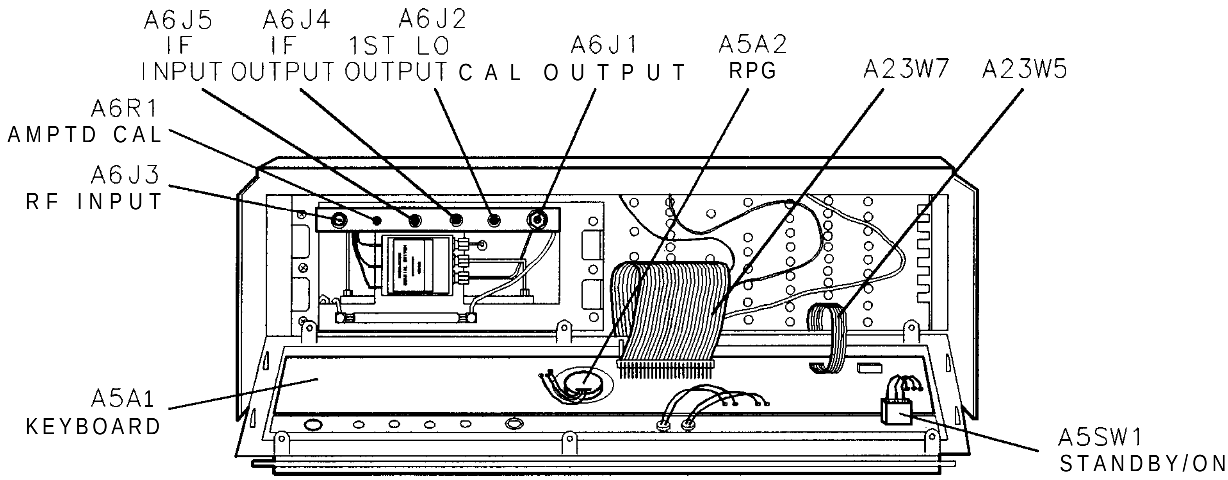


**Figure 6-2. RF Section, Front View**

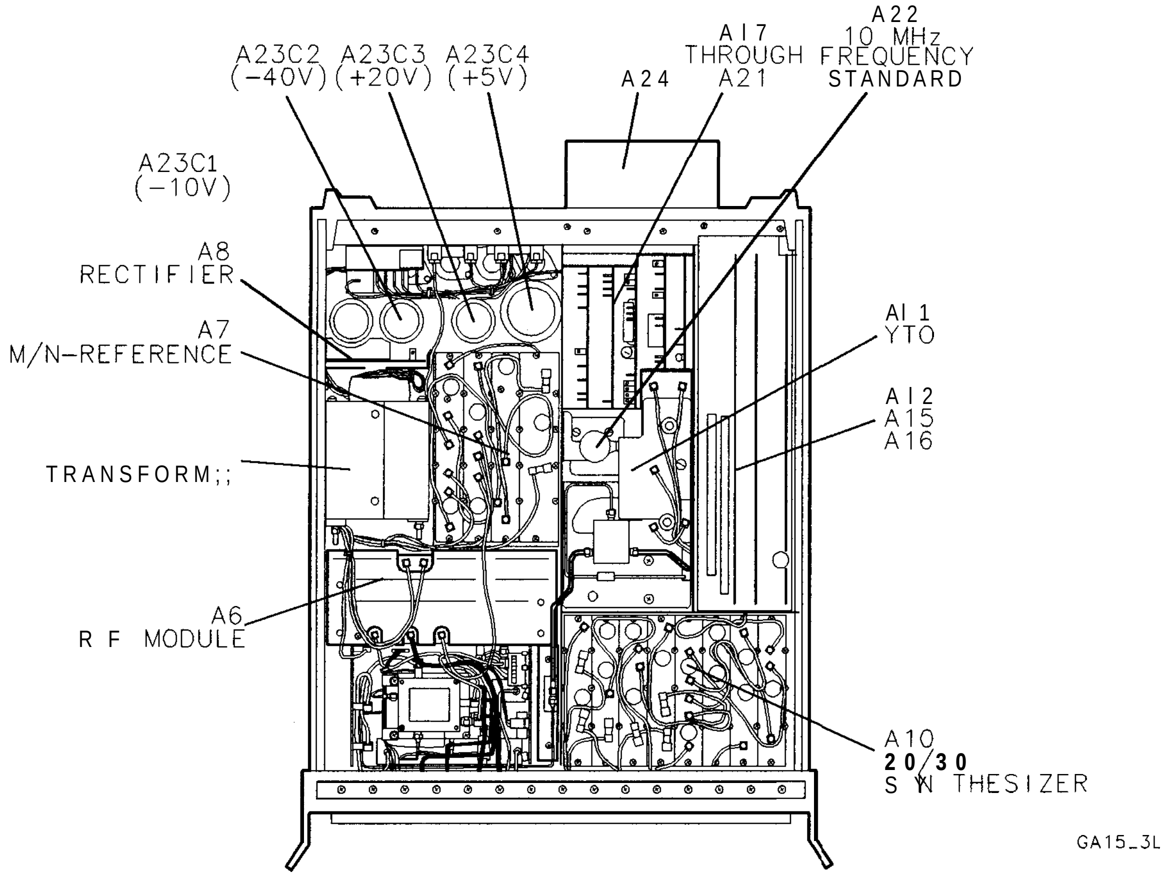


**Figure 6-3. RF Section, Bottom View**

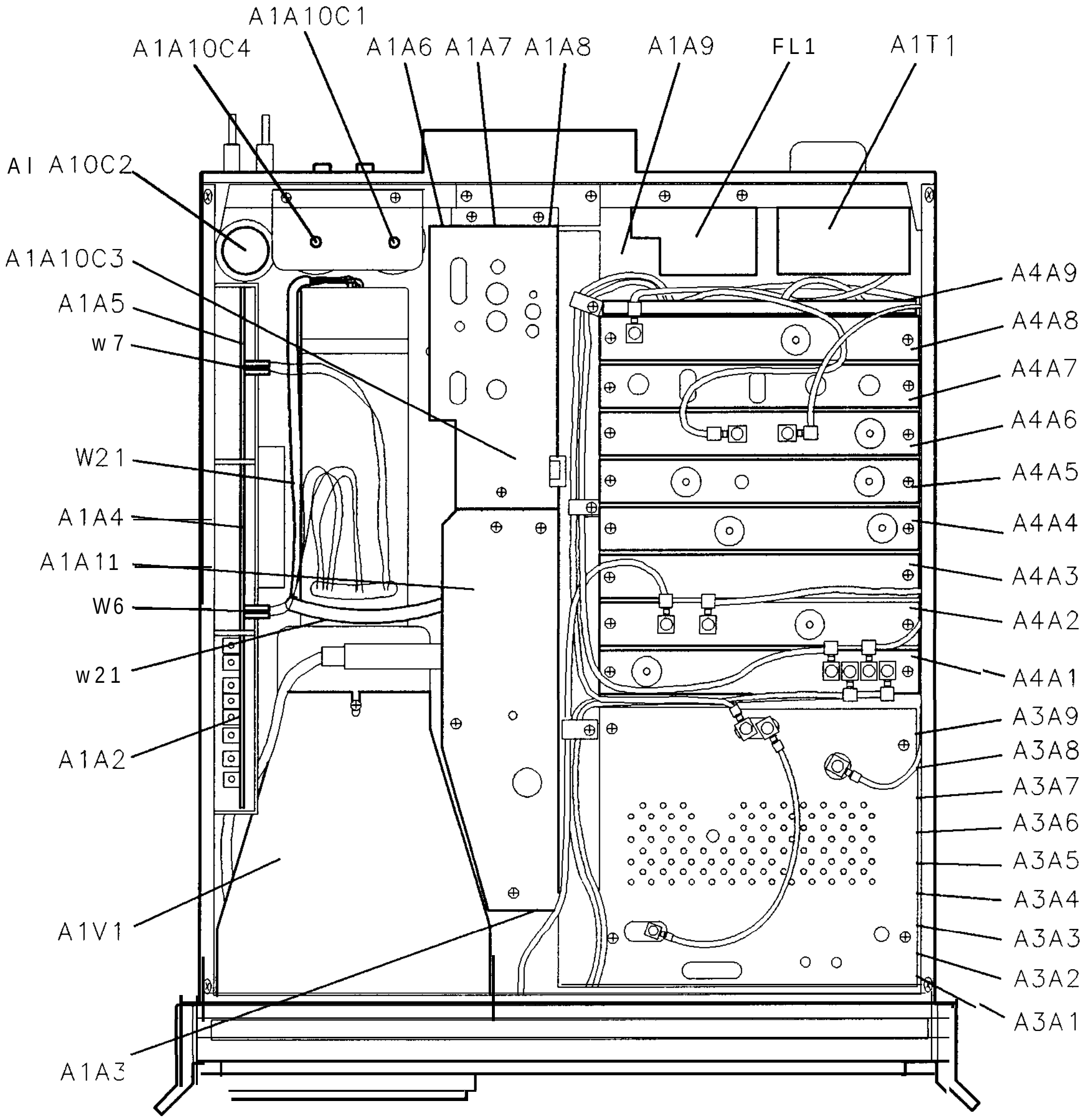


**Figure 6-4. IF Section, Top View (SN 3001A and Below)**

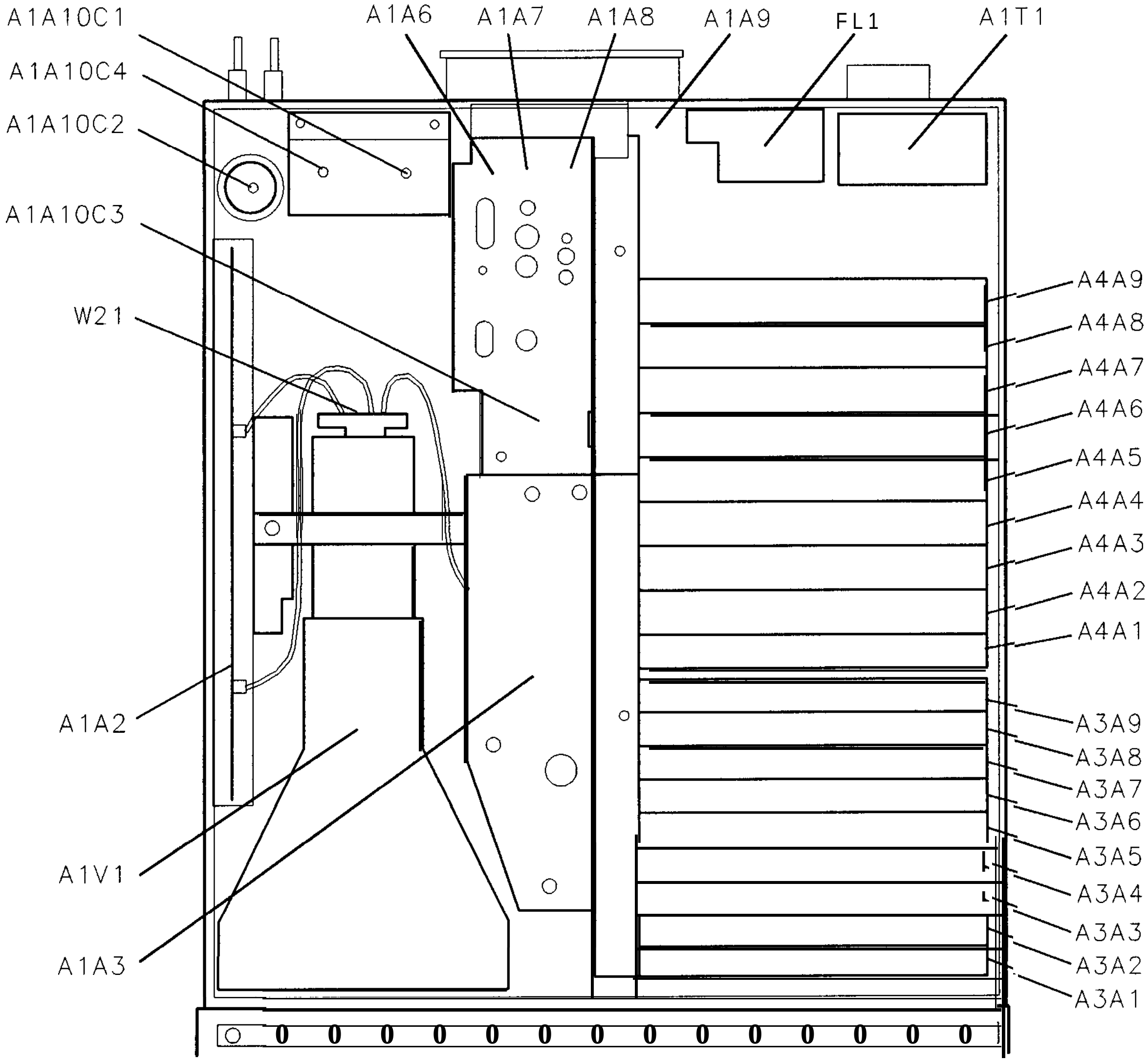


**Figure 6-5. IF Section, Top View (SN 3004A and Above)**

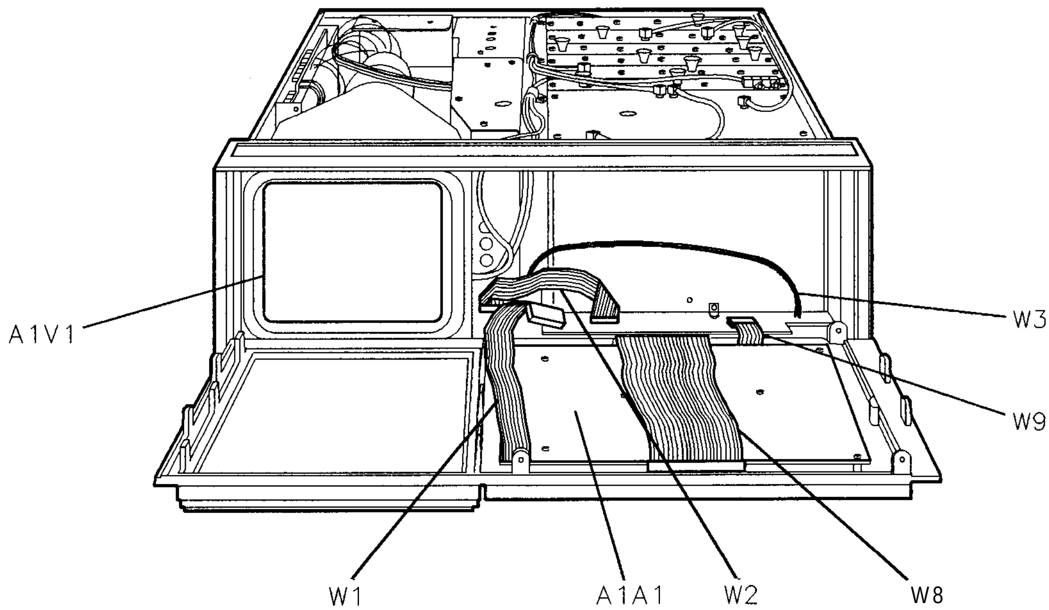


**Figure 6-6. IF Section, Front View**

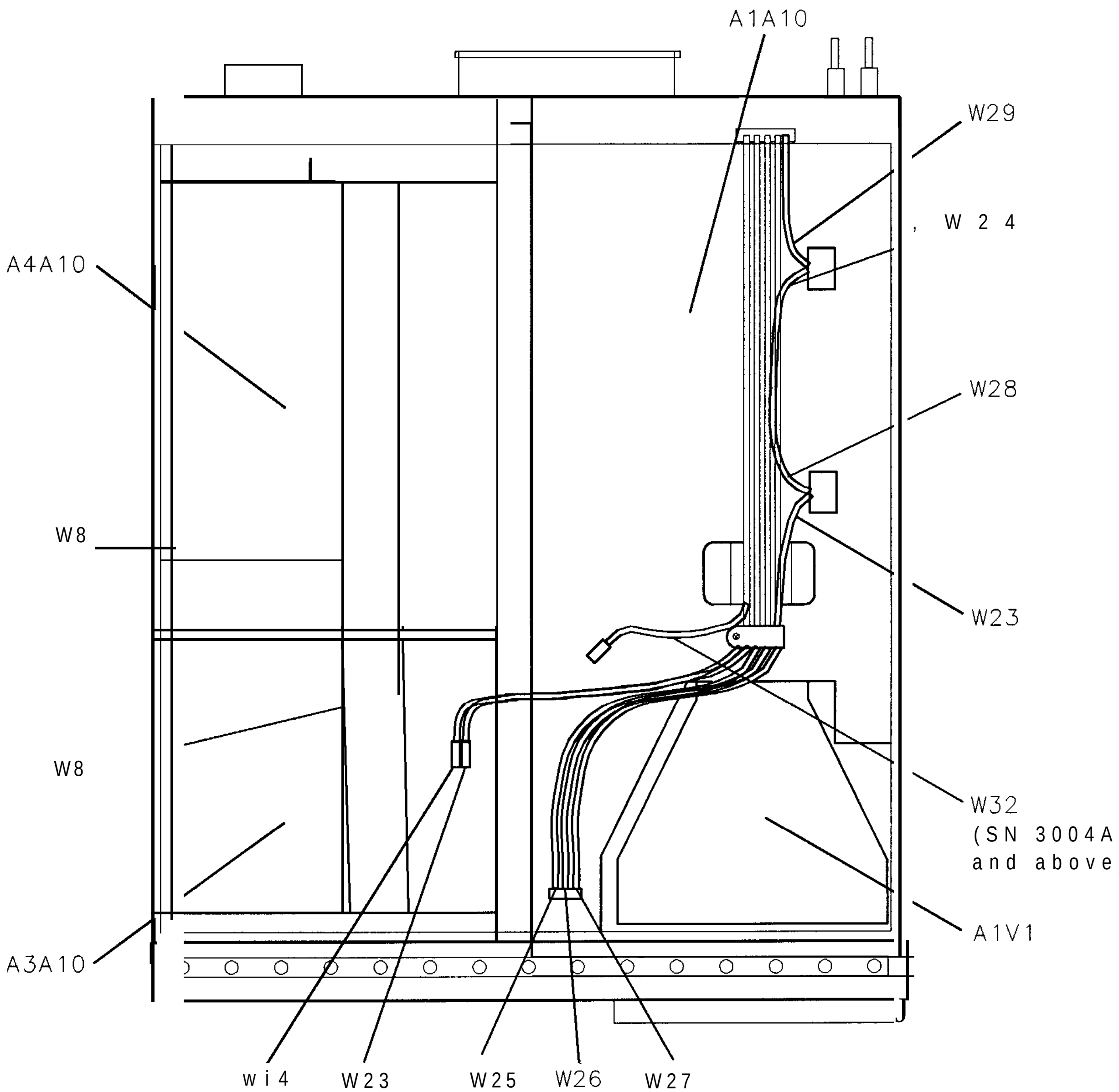


**Figure 6-7. IF Section, Bottom View**