HEWLETT
PACKARD

HP 8563A SPECTRUM ANALYZER

Service Manual

08563-90017

HEWLETT-PACKARD

Service Manual

HP 8563A Spectrum Analyzer



HP Part No. 08563-90017 Microfiche Part No. 08563-90018
Printed in USA September 1990

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Certification

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

Warranty

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

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

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

Assistance

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

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

Safety Symbols

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

Caution



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

Warning



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

General Safety Considerations

Warning



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

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

Warning



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

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

Caution



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

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

HP 8563A Documentation Outline

For ordering information, contact a Hewlett-Packard Sales and Service Office.

Manuals Shipped with Your Instrument

HP 8563A Installation and Verification Manual (08563-90003)

- Tells you how to install the spectrum analyzer.
- Tells you what your analyzer's specifications are.

HP 8560A/8561B/8563A Operating and Programming Manual (5958-7052)

- Tells you how to make measurements with your spectrum analyzer.
- Tells you how to program your spectrum analyzer.

HP 8560A/8561B/8563A Quick Reference Guide (5958-7050)

- Is an abbreviated version of the *HP 8560A/8561B/8563A Operation and Programming Manual.*
- Provides you with a listing of all remote programming commands.

Options

Option 915: HP 8563A Service Manual (08563-90017)

HP 8560A/8561B/8563A Component-Level Information (5958-7187)

- The service manual provides information to service your analyzer to the assembly-level (not always immediately available for new products).
- The component-level information binder provides component-level information for component-level repair of the analyzer or analyzer family (not always immediately available for new products).

Option 910: Extra Manual Set

- Doubles all documentation shipped with a standard instrument.

Option 916: Quick Reference Guide

- Adds an extra Quick Reference Guide to the document package.

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1

General Information

This *HP 8563A Spectrum Analyzer Service Manual* contains information required to adjust and service the HP 8563A Spectrum Analyzer to the assembly level.

Manual Organization

Volume 1

Chapter 1, General Information, contains information about service kit contents, recommended test equipment, returning an instrument for service, and sales and service offices.

Chapter 2, Adjustment Procedures, contains the necessary adjustment procedures to adjust the instrument properly after repair.

Chapter 3, Assembly Replacement, contains instructions for removal and replacement of all major assemblies.

Chapter 4, Replaceable Parts, contains the information necessary to order parts or assemblies for the instrument.

Chapter 5, Major Assembly and Cable Locations, contains figures identifying all major assemblies and cables.

Chapter 6, General Troubleshooting, contains instrument-level troubleshooting information, block diagrams, and troubleshooting information covering the instrument's six functional areas.

Chapters 7 through 12 contain troubleshooting information covering the instrument's six functional areas.

Appendixes contain component-level information matrixes.

Manual Text Conventions

The following text conventions are used throughout this manual:

(Key)	Boxed text in this typeface represents a mechanical key physically located on the instrument.
Softkeys	Shaded text indicates a softkey. Softkey labels appear on the display and can be activated by pressing corresponding keys surrounding the display. The labels displayed are determined by the mechanical front-panel key depressed and the instrument's firmware.
`Display Text`	Text printed in this typeface indicates text appearing on the screen.

Serial Numbers

Hewlett-Packard makes frequent improvements to its products to enhance their performance, usability, or reliability. HP service personnel have access to complete records of design changes to each type of equipment, based on the equipment's serial number. Whenever you contact HP about your analyzer, have the complete serial number available to ensure obtaining the most complete and accurate information possible.

The serial number label is attached to the rear of the analyzer. The serial number has two parts: the prefix (the first four numbers and a letter), and the suffix (the last five numbers). See Figure 1-1.

The first four numbers of the prefix are a code identifying the date of the last major design change incorporated in your analyzer. The letter identifies the country in which the unit was manufactured. The five-digit suffix is a sequential number and is different for each unit. Whenever you list the serial number or refer to it in obtaining information about your analyzer, be sure to use the complete number, including the full prefix and the suffix.

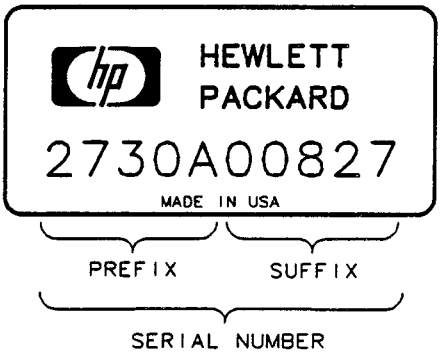


Figure 1-1. Serial Number Label Example

Instrument Variations

There are options available to the HP 8563A Spectrum Analyzer. The following table lists these options and identifies the assemblies which are unique to them.

Table 1-1. Instrument Variations

Option	Added	Deleted
HP 8563A Option 103 (Delete OCXO)	A15 RF Assembly	W49 Cable Assembly W50 Cable Assembly A21 OCXO
HP 8563A Option 104 (Delete HP 85620A)		HP 85620A Mass Memory Module
HP 8563A Option 026 (26.5 GHz Extended Frequency Range)	A12 YTF Assembly A9 Input Attenuator W41 Front-Panel Attenuator Cable J1 50Ω 3.5 mm RF Input Connector	J1 Type-N 50Ω RF Input Connector

HP 85629B Test and Adjustment Module

When attached to the spectrum analyzer's rear panel, the HP 85629B Test and Adjustment Module (TAM) provides diagnostic functions for the HP 8563A. Because the TAM connects directly to the analyzer's internal data and address bus, it controls the analyzer's hardware directly. It would be impossible to control the hardware to the same extent either from the analyzer's front panel or over HP-IB.

The TAM measures voltages at key points in the circuitry and flags a failure whenever the voltage falls outside the limits. The TAM locates the failure to a small functional area which can be examined manually.

Service Kit

The HP 8563A Service Kit (HP part number 08562-60021) contains service tools required to repair the instrument. Refer to Table 1-2 for a list of items in the service kit.

Table 1-2. Service Kit Contents

Description	Quantity	HP Part Number
Cable Puller	1	5021-6773
PC Board Prop	1	5021-7459
Line Filter Assembly	1	5061-9032
Line Switch Cable	1	5062-0728
Extender Cable	1	5062-0737
BNC to SMB (snap-on) Cable	2	85680-60093
Connector Extractor Tool Kit	1	8710-1791

Recommended Test Equipment

Equipment required for operation verification, performance tests, adjustments, troubleshooting, and the Test and Adjustment Module is listed in Table 1-5. Other equipment may be substituted if it meets or exceeds the critical specifications listed in the table. (Refer to the *HP 8563A Installation and Verification Manual* for the performance tests.)

Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. Therefore, all work performed on assemblies consisting of electronic components should be done at a static-free work station. Figure 1-2 is an example of a static-safe work station using two kinds of ESD protection:

- Conductive table mat and wrist-strap combination.
- Conductive floor mat and heel-strap combination.

These methods may be used together or separately.

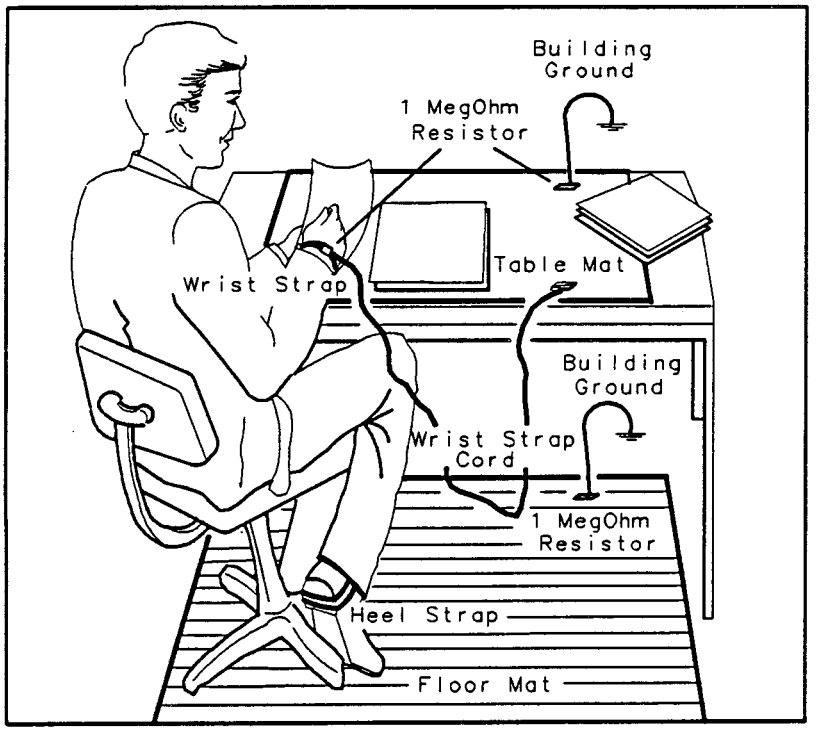


Figure 1-2. Example of a Static-Safe Work Station

Reducing Potential for ESD Damage

The suggestions that follow may help reduce ESD damage that occurs during instrument testing and servicing.

- Before connecting any coaxial cable to an analyzer connector for the first time each day, momentarily ground the center and outer connectors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center in of any connector and before removing any assembly from the unit.
- Be sure all instruments are properly earth-grounded to prevent build-up of static discharge.

Static Safe Accessories

Table 1-3 lists static-safe accessories that can be obtained from Hewlett-Packard by ordering the HP part numbers shown.

Table 1-3. Static-Safe Accessories

Accessory	Description	HP Part Number
Static-control mat and ground wire	Set includes: 3M static-control mat, 0.6 m × 1.2 m (2 ft × 4 ft) ground wire, 4.6 m (15 ft) (The wrist strap and wrist-strap cord are *not* included. They must be ordered separately.)	9300-0797
Wrist-strap cord	1.5 m (5 ft)	9300-0980
Wrist strap	Black, stainless steel with four adjustable links and 7-mm post-type connector (The wrist-strap cord is *not* included.)	9300-1383
ESD heel strap	Reusable 6 to 12 months	9300-1169
Hard-surface static-control mat*	Large, black, 1.2 m × 1.5 m (4 ft × 5 ft) Small, black, 0.9 m × 1.2 m (3 ft × 4 ft)	92175A 92175C
Soft-surface static-control mat*	Brown, 1.2 m × 2.4 m (4 ft × 8 ft)	92175B
Tabletop static-control mat*	58 cm × 76 cm (23 in × 30 in)	92175T
Antistatic carpet*	Small, 1.2 m × 1.8 m (4 ft × 6 ft) natural color russet color Large, 1.2 m × 2.4 m (4 ft × 8 ft) natural color russet color	 92176A 92176C 92176B 92176D

* These accessories can be ordered either through a Hewlett-Packard Sales Office or through HP DIRECT Phone Order Service. In the USA, the HP DIRECT phone number is (800) 538-8787. Contact your nearest Hewlett-Packard Sales Office for more information about HP DIRECT availability in other countries.

Returning Instruments for Service

Service Tag

If you are returning the instrument to Hewlett-Packard for servicing, fill in and attach a blue service tag. Service tags are supplied in the back of this volume.

Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen, or have completed a performance test record, or have any other specific data on the performance of the analyzer, please send a copy of this information with the unit.

Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials are unavailable, identical packaging materials may be acquired through any Hewlett-Packard Sales and Service Office. Descriptions of the packaging materials are listed in Figure 1-3.

Other Packaging

Caution

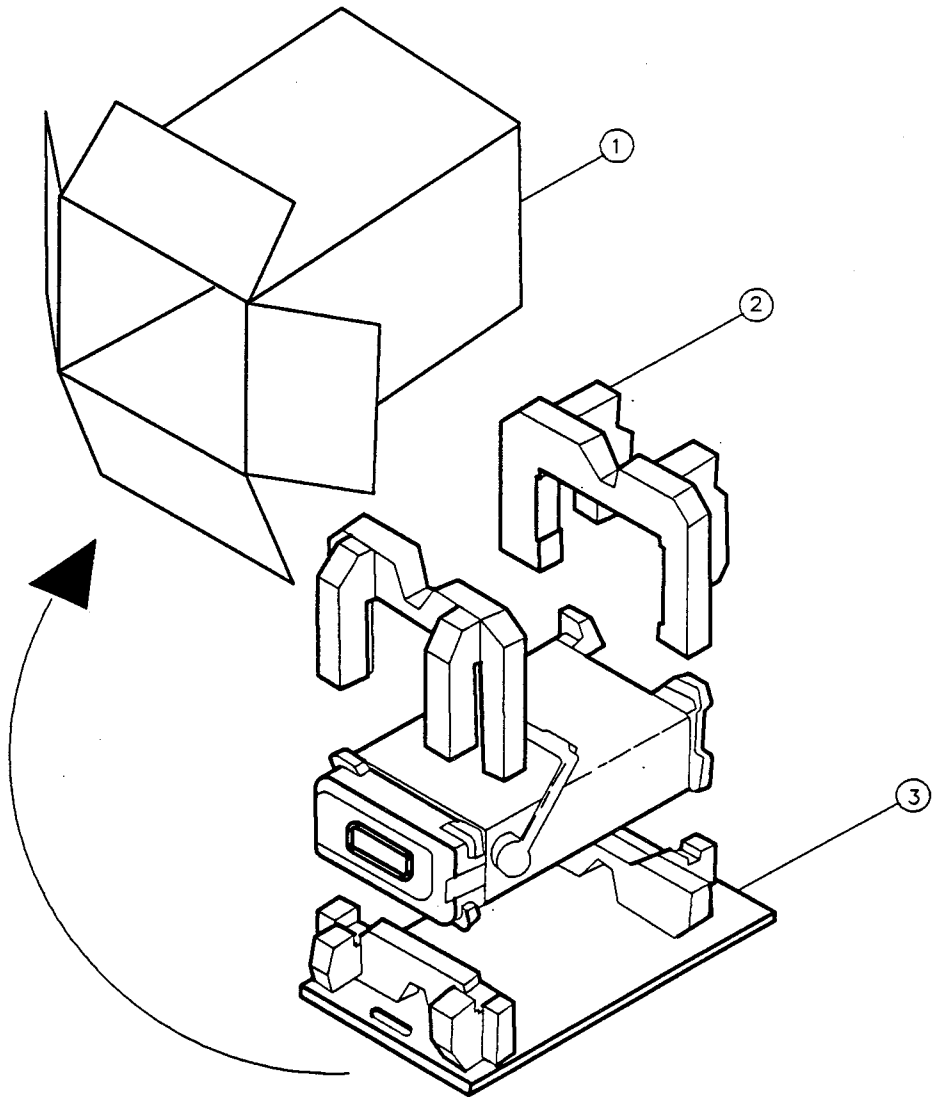


Analyzer damage can result from using packaging materials other than those specified. Never use styrene pellets in any shape as packaging materials. They do not adequately cushion the equipment or prevent it from shifting in the carton. They cause equipment damage by generating static electricity and by lodging in the analyzer fan.

Repackage the analyzer in the original packaging materials or with commercially available materials described in steps 4 and 5, below.

1. Attach a completed service tag to the instrument.
2. Install the front-panel cover on the instrument.
3. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
4. Use the original materials or a strong shipping container that is double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength. The carton must be both large enough and strong enough to accommodate the analyzer and allows at least 3 to 4 inches on all sides of the analyzer for packing material.
5. Surround the equipment with at least 3 to 4 inches of packing material, or enough to prevent the equipment from moving in the carton. If packing foam is unavailable, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Commerce, CA 90001). Air Cap looks like a plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrap the equipment several times in this material to both protect the equipment and prevent it from moving in the carton.
6. Seal the shipping container securely with strong nylon adhesive tape.
7. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to assure careful handling.

8. Retain copies of all shipping papers.



Item	Description	HP Part Number
1	9211-5636	Outer Carton
2	08590-80013	Pads (2)
3	08590-80014	Bottom Tray

Figure 1-3. HP8563A Shipping Container and Cushioning Materials

Sales and Service Offices

Hewlett-Packard has sales and service offices around the world providing complete support for Hewlett-Packard products. To obtain servicing information, or to order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office listed in Table 1-4.

In any correspondence, be sure to include the pertinent information about model numbers, serial numbers, and assembly part numbers.

Note



Within the USA, a toll-free phone number is available for ordering replacement parts. Refer to the "Ordering Information" section in Chapter 4, "Replaceable Parts," for the phone number and more information.

Table 1-4. Hewlett-Packard Sales and Service Offices

IN THE UNITED STATES

California
Hewlett-Packard Co.
1421 South Manhattan Ave.
P.O. Box 4230
Fullerton, CA 92631
(714) 999-6700

Hewlett-Packard Co.
301 E. Evelyn
Mountain View, CA 94039
(415) 694-2000

Colorado
Hewlett-Packard Co.
24 Inverness Place, East
Englewood, CO 80112
(303) 649-5000

Georgia
Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
Atlanta, GA 30339
(404) 955-1500

Illinois
Hewlett-Packard Co.
5201 Tollview Drive
Rolling Meadows, IL 60008
(312) 255-9800

New Jersey
Hewlett-Packard Co.
120 W. Century Road
Paramus, NJ 07653
(201) 265-5000

Texas
Hewlett-Packard Co.
930 E. Campbell Rd.
Richardson, TX 75081
(214) 231-6101

IN AUSTRALIA
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130
895-2895

IN CANADA
Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
Kirkland, Quebec H9J 2X8
(514) 697-4232

IN FRANCE
Hewlett-Packard France
F-91947 Les Ulis Cedex
Orsay
(6) 907-78-25

IN GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 Frankfurt 56
(0611) 50-04-1

IN GREAT BRITAIN
Hewlett-Packard Ltd.
King Street Lane
Winnersh, Wokingham
Berkshire RG11 5AR
0734 784774

IN OTHER EUROPEAN COUNTRIES
Hewlett-Packard (Schweiz) AG
Allmend 2
CH-8967 Widen (Zurich)
(0041) 57 31 21 11

IN JAPAN
Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3 Chome
Suginami-ku Tokyo 168
(03) 331-6111

IN PEOPLE'S REPUBLIC OF CHINA
China Hewlett-Packard, Ltd.
P.O. Box 9610, Beijing
4th Floor, 2nd Watch Factory
Main Bldg.
Shuang Yu Shu, Bei San Huan Rd.
Beijing, PRC
256-6888

IN SINGAPORE
Hewlett-Packard Singapore
Pte. Ltd.
1150 Depot Road
Singapore 0410
273 7388
Telex HPSGSO RS34209
Fax (65) 2788990

IN TAIWAN
Hewlett-Packard Taiwan
8th Floor, Hewlett-Packard
Building
337 Fu Hsing North Road
Taipei
(02) 712-0404

IN ALL OTHER LOCATIONS
Hewlett-Packard Inter-Americas
3495 Deer Creek Rd.
Palo Alto, California 94304

Table 1-5. Recommended Test Equipment

Equipment	Critical Specifications	Recommended Model	Use[1]
Spectrum Analyzer	Frequency Range: 4 kHz to 7 GHz Typical Residual FM: <1 Hz Pk-to-Pk in 20 ms	HP 8566A/B	A,T
Synthesized Sweeper *(2 required)*	Frequency Range: 10 MHz to 22 GHz Frequency Accy (CW): 1×10^{-9}/day Leveling Modes: Internal and External Modulation Modes: AM and Pulse Power Level Range: −35 dBm to +16 dBm	HP 8340A/B[2]	P,A,M,T,V
Synthesizer/Level Generator	Frequency Range: 1 kHz to 80 MHz Frequency Accy: 1×10^{-7}/mo Flatness: ±0.15 dB Attenuator Accuracy: <±0.09 dB	HP 3335A[2]	P,M,T,V
Synthesizer/ Function Generator	Frequency Range 50 Hz to 10 MHz Amplitude Accuracy (sine wave) <±0.6 dB External Frequency Reference Input	HP 3325A/B	P
Synthesized Signal Generator	Frequency Range: 100 kHz to 2.5 GHz Residual SSB Phase Noise at 10 kHz offset (320 MHz < fc < 640 MHz): <−131 dBc/Hz	HP 8663A	P,V
Pulse/Function Generator	Frequency Range: 10 kHz to 50 MHz Pulse Width: 200 ns Output Amplitude: 5 V Pk-to-Pk Functions: Pulse and Triangle TTL Sync Output	HP 8116A	P
AM/FM Signal Generator	Frequency Range: 1 MHz to 200 MHz Frequency Modulation Mode Modulation Oscillator Frequency: 1 kHz FM Peak Deviation: 5 kHz	HP 8640B	A
Microwave Frequency Counter	Frequency Range: 9 MHz to 22 GHz Timebase Accy (Aging): $<5 \times 10^{-10}$/day External Frequency Reference Input	HP 5343A Option 001	P,A,M,V

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation

Table 1-5. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use[1]
Frequency Counter	Frequency Range: 9 to 11 MHz Resolution: 1 mHz (milliherts) External Frequency Reference Input	HP 5386A	P
Universal Counter	Modes: TI A ▸ B, Frequency Count Time Interval Measurement Range: 45 μs to 120 s Timebase Accy (Aging): $<3 \times 10^{-7}$/mo	HP 5316A	P
Oscilloscope	Bandwidth (3 dB): dc to 100 MHz Minimum Vertical Deflection Factor: $\leq$2 mV/DIV	HP 1980A/B[2]	A
Measuring Receiver	Compatible with Power Sensor's dB Relative Mode Resolution: 0.01 dB Reference Accuracy: $<\pm$1.2%	HP 8902A[2]	P,A,M,T,V
Power Sensor	Frequency Range: 250 MHz to 350 MHz Power Range: 100 nW to 10 μW Maximum SWR: 1.15 (250 to 350 MHz)	HP 8484A	P,A
Power Sensor	Frequency Range: 10 MHz to 18 GHz Maximum SWR: 1.40 (10 MHz to 30 MHz) Maximum SWR: 1.18 (30 MHz to 50 MHz) Maximum SWR: 1.10 (50 MHz to 2 GHz) Maximum SWR: 1.18 (2 GHz to 12.4 GHz) Maximum SWR: 1.28 (12.4 GHz to 18 GHz)	HP 8481A	V
Power Sensor	Frequency Range: 100 kHz to 2.9 GHz Maximum SWR: 1.1 (1 MHz to 2.0 GHz) Maximum SWR: 1.30 (2.0 GHz to 2.9 GHz)	HP 8482A[2]	P,A,T,M,V
Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Maximum SWR: 1.15 (50 to 100 MHz) Maximum SWR: 1.10 (100 MHz to 2 GHz) Maximum SWR: 1.15 (2.0 to 12.4 GHz) Maximum SWR: 1.20 (12.4 GHz to 18 GHz) Maximum SWR: 1.25 (18 GHz to 26.5 GHz)	HP 8485A[2]	P,A,T,M,V

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation

Table 1-5. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use[1]
Amplifier	Frequency Range: 2.0 to 8.0 GHz Minimum Output Power (Leveled): 2.0 to 8.0 GHz: +16 dBm Output SWR (Leveled): <1.7	HP 11975A	P
Digital Voltmeter	Range: −15 V dc to +120 V dc Accuracy: <±1 mV on 10 V Range Input Impedance: ≥1 Megohm	HP 3456A[2]	A
DVM Test Leads	≥36 inches long, alligator clips, probe tips	HP 34118A	A,T
Power Supply	Output Voltage: ≥24 V dc Output Voltage Accuracy: <±0.2 V	HP 6114A	A
10 dB Step Attenuator	Attenuation Range: 30 dB Frequency Range: dc to 80 MHz Connectors: BNC female	HP 355D	P,V
1 dB Step Attenuator	Attenuation Range: 12 dB Frequency Range: dc to 80 MHz Connectors: BNC female	HP 355C	P,V,A
20 dB Fixed Attenuator	Attenuation Accy: <±1 dB Frequency Range: dc to 18 GHz Maximum SWR: 1.2 (dc to 8 GHz) Maximum SWR: 1.5 (12.4 to 18 GHz)	HP 8491B Option 020	P,V
10 dB Fixed Attenuator	Attenuation Accy: <±0.6 dB Frequency Range: dc to 18 GHz Maximum SWR: 1.2 (dc to 8 GHz) Maximum SWR: 1.5 (12.4 to 18 GHz)	HP 8491B Option 010	P,V
10 dB Fixed Attenuator	Attenuation Accy: <±0.3 dB Frequency Range: dc to 2.9 GHz Maximum SWR: 1.25 (12.4 to 22 GHz)	HP 8493C Option 010	P,V
Signature Multimeter	Clock Frequency >10 MHz	HP 5005A/B	T
Reference Attenuator	Supplied with HP 8484A	HP 11708A	P,A

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation

Table 1-5. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use[1]
Termination	Frequency Range: dc to 22 GHz Impedance: 50Ω Maximum SWR: <1.22 Connector: APC 3.5	HP 909D	P,M,V
Blocking Capacitor	Frequency Range: 4 kHz to 1 MHz Impedance: 50Ω nominal	HP 08553-60169	P
Low-Pass Filter	Cutoff Frequency: 50 MHz Rejection at 65 MHz: >50 dB	HP 0955-0306	P,M,V
Low-Pass Filter	Cutoff Frequency: 12 MHz Rejection at 18 MHz: >45 dB 0.1 dB ripple	See Figure 1-4	P
Low-Pass Filter *(2 required)*	Cutoff Frequency: 4.4 GHz Rejection at 5.5 GHz: >50 dB	HP 11689A	P,V
Directional Coupler	Frequency Range: 1.7 to 22 GHz Coupling: 16.0 dB (nominal) Max. Coupling Deviation: ±1 dB Directivity: 14 dB minimum Flatness: 0.75 dB maximum VSWR: <1.45 Insertion Loss: <1.3 dB	HP 0955-0125	P
Power Splitter	Frequency Range: 1 kHz to 22 GHz Insertion Loss: 6 dB (nominal) Output Tracking: <0.25 dB Equivalent Output SWR: <1.22	HP 11667B	P,A,M,V
Product Support Kit	No Substitute	HP 08562-60021	A
Adapter	Type N (f) to BNC (m)	HP 1250-1477	A
Adapter *(3 required)*	Type N (m) to BNC (f)	HP 1250-1476	P,A,M,V
Adapter	Type N (f) to APC 3.5 (m)	HP 1250-1750	A

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation

Table 1-5. Recommended Test Equipment (continued)

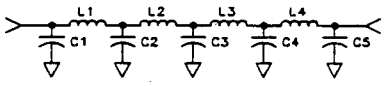
Equipment	Critical Specifications	Recommended Model	Use[1]
Adapter *(2 required)*	Type N (m) to SMA (f)	HP 1250-1250	P,V
Adapter *(2 required)*	Type N (m) to APC 3.5 (m)	HP 1250-1743	P,A,M,V
Adapter	Type N (m) to APC 3.5 (f)	HP 1250-1744	P,V,A
Adapter	Type N (f) to BNC (f)	HP 1250-1474	P,V
Adapter	Type N (f) to SMA (f)	HP 1250-1772	P,A
Adapter	BNC (f) to BNC (f)	HP 1250-0059	A
Adapter	BNC Tee (f) (m) (f)	HP 1250-0781	P,A,M,V
Adapter	BNC (f) to SMA (m)	HP 1250-1200	P,A,V
Adapter *(2 required)*	Type N (f) to APC 3.5 (f)	HP 1250-1745	P,V
Adapter *(2 required)*	APC 3.5 (f) to APC 3.5 (f)	HP 5061-5311	P,A,M,V
Adapter	BNC (f) to Dual Banana Plug	HP 1251-2816	A
Cable	RG-214/U with Type N (m) connectors Length: ≥36 in	HP 11500A	P,V
Cable *(5 required)*	48 in, 50Ω, coaxial cable with BNC (m) connectors on both ends	HP 10503A	P,A,V
Cable *(2 required)*	Frequency Range: 1 kHz to 26.5 GHz Maximum SWR: <1.4 at 22 GHz Length: ≥91 cm (36 in) Connectors: APC 3.5 (m), both ends Maximum Insertion Loss: 2 dB	HP 8120-4921	P,A,M,V

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation

Table 1-5. Recommended Test Equipment (continued)

Equipment	Critical Specifications	Recommended Model	Use[1]
Cable *(12 required)*	HP-IB (required for using Operation Verification Software and using HP 85629B TAM) Length: 2 m (6.6 ft)	HP 10833B	P,A,M
Test Cable	Connectors: BNC (m) to SMB (f) Length: ≥61 cm (24 in)	HP 85680-60093	A,M
Controller	Required for using Operation Verification Software, No Substitute	HP 9816A, HP 9836A/C, HP 9000 Model 310	

[1]P=Performance Tests; A=Adjustments; M=Test and Adjustment Module; T=Troubleshooting; V=Operation Verification
[2]Part of Microwave Workstation



Reference Designator	CD	HP Part Number	Description
C1	7	0160-5491	CAPACITOR-FXD 240PF CER
C2	5	0160-5439	CAPACITOR-FXD 510PF CER
C3	5	0160-4825	CAPACITOR-FXD 560PF CER
C4	5	0160-5439	CAPACITOR-FXD 510PF CER
C5	7	0160-5491	CAPACITOR-FXD 240PF CER
L1	5	9100-3551	COIL-MLD 1μH
L2	5	9140-0264	COIL-MLD 1.2μH
L3	5	9100-0264	COIL-MLD 1.2μH
L4	5	9100-3551	COIL-MLD 1μH

NOTE: Capacitors must be ceramic, and small body inductors must not be used.

Figure 1-4. 12 MHz Low-Pass Filter, Schematic with Parts Identification

2

Adjustment Procedures

Introduction

This chapter contains information on automated and manual adjustment procedures. Perform the automated procedures using the HP 85629B Tests and Adjustment Module (TAM). Never perform adjustments as routine maintenance. Adjustments should be performed after a repair or performance test failure.

Automated Procedures

Using the TAM 2-9

Manual Procedures

1. High-Voltage Power Supply Adjustment 2-12
2. Display Adjustment 2-14
3. IF Bandpass Adjustment 2-18
4. IF Amplitude Adjustment 2-23
5. Sampling Oscillator Adjustment 2-27
6. YTO Adjustment 2-32
7. 1ST LO Distribution Amplifier Adjustment 2-35
8. Dual Band Mixer Bias Adjustment 2-37
9. Frequency Response Adjustment 2-39
10. Calibrator Amplitude Adjustment 2-42
11. 10 MHz Reference Adjustment—OCXO (Standard) 2-44
12. 10 MHz Reference Adjustment—TCXO (Option 103) 2-47
13. Demodulator Adjustment 2-49
14. External Mixer Bias Adjustment 2-52
15. External Mixer Amplitude Adjustment 2-54
16. Second IF Gain Adjustment 2-57
17. SIG ID Oscillator Adjustment 2-60
18. YTF Adjustment 2-63

Note Before performing any adjustments, allow the instrument to warm up for 5 minutes.

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 operation and to prevent damage to the instrument. Service and adjustments should be performed only by qualified service personnel.

Warning  **Adjustments in this section are performed with power supplied to the instrument and protective covers removed. 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.**

Warning  **Power is still applied to this instrument with the (LINE) switch in the off position. Before removing or installing any assembly or printed circuit board, remove the line-power cord.**

Warning  **Capacitors inside the instrument may still be charged, even if the instrument has been disconnected from its source of supply.**

Warning  **Use a nonmetallic adjustment tool whenever possible.**

Which Adjustments Should Be Performed?

Table 2-1 lists the manual adjustments that should be performed when an assembly is repaired or changed. It is important to perform the adjustments in the order indicated to ensure that the instrument meets its specifications.

Test Equipment

The equipment required for the manual adjustment procedures is listed in Table 1-4, "Recommended Test Equipment." Any equipment that satisfies the critical specifications given in the table may be substituted for the preferred test equipment.

Adjustable and Factory-Selected Components

Table 2-2 lists the adjustable components by reference designation and name. For each component, the table provides a description and lists the adjustment number.

Refer to Table 2-3 for a complete list of factory-selected components used in the instrument along with their functions. Factory-selected components are identified with an asterisk on the schematic diagrams.

Adjustment Tools

For adjustments requiring a nonmetallic tuning tool, use fiber tuning tool, HP part number 8170-0033. For adjustments to the IF Bandpass, use tuning tool, HP part number 8710-1010. Never try to force an adjustment control. This is especially critical when tuning variable capacitors and slug-tuned inductors.

Required service accessories, with part numbers, are listed in "Service Kit" in Chapter 1.

Instrument Service Position

Refer to Chapter 3 for information on removing the analyzer cover assembly and accessing all internal assemblies.

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

Assembly Changed or Repaired	Perform the Following Related Adjustments in the Order Listed	Adjustment Number
A1A1 Keyboard	No related adjustment	
A1A2 RPG	No related adjustment	
A2 Controller	Display Adjustment	2
	If EEROM from old A2 Controller could not be used in new A2 or if EEROM must be replaced, also perform the following adjustments:	
	External Mixer Amplitude Adjustment	15
	Frequency Response Adjustment	9
	Dual Band Mixer Bias Adjustment	8
A3 Interface	Display Adjustment (Fast Zero Span)	2
	Frequency Response Adjustment	9
A4 Log Amplifier	Display Adjustment (Fast Zero Span)	2
	Demodulator Adjustment	13
	IF Amplitude Adjustment	4
A5 IF	IF Bandpass Adjustment	3
	IF Amplitude Adjustment	4
A6 Power Supply	High Voltage Power Supply Adjustment	1
	Display Adjustment	2
A6A1 HV Module	High Voltage Power Supply Adjustment	1
	Display Adjustment	2
A7 1ST LO	First LO Distribution Amplifier Adjustment	7
Distribution Amplifier	Frequency Response Adjustment *(Perform this adjustment or frequency response performance test, whichever is quicker. Perform the adjustment only if the performance test fails.)*	9
A8 Dual Mixer	Dual Band Mixer Bias Adjustment	8
	Frequency Response Adjustment	9
A9 Input Attenuator	Frequency Response Adjustment *(Perform this adjustment or frequency response performance test, whichever is quicker. Perform the adjustment only if the performance test fails.)*	9
A10 YTF	YTF Adjustment	18
	Frequency Response Adjustment	9
A11 YTO	YTO Adjustment	6
A12 RF Switch	Frequency Response Adjustment *(Perform this adjustment or frequency response performance test, whichever is quicker. Perform the adjustment only if the performance test fails.)*	9
A13 2nd Converter	Frequency Response Adjustment	9

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

Assembly Changed or Repaired	Perform the Following Related Adjustments in the Order Listed	Adjustment Number
A14 Frequency Control	Display Adjustment (Fast Zero Span)	2
	YTO Adjustment	6
	First LO Distribution Amplifier Adjustment	7
	Frequency Response Adjustment	9
A15 RF	10 MHz Reference Adjustment (TCXO)	11
	Calibrator Amplitude Adjustment	10
	External Mixer Bias Adjustment	14
	Sampling Oscillator Adjustment	5
	Signal ID Oscillator Adjustment	17
	External Mixer Amplitude Adjustment	15
	Frequency Response Adjustment	9
A15A1 2nd IF Amplifier	Second IF Gain Adjustment	16
A15A2 Sampler	Sampling Oscillator Adjustment	5
A16 Cal Oscillator	IF Amplitude Adjustment	4
A17 CRT Driver	Display Adjustment	2
A18V1 CRT	Display Adjustment	2
A19 HP-IB	No related adjustment	
A21 OCXO	10 MHz Reference Adjustment (OCXO)	12

Table 2-2. Adjustable Components (1 of 3)

Reference Designator	Adjustment Name	Adjustment Number	Description
A2R206	DGTL X GAIN	2	Adjusts the horizontal gain in the X line generator.
A2R209	SWEEP OFFSET	2	Adjusts the beginning of the trace to the leftmost vertical graticule line in fast-analog zero-span mode.
A2R215	DGTL Y GAIN	2	Adjusts the vertical gain in the Y line generator.
A2R218	VIDEO OFFSET	2	Adjusts the vertical position in fast-analog zero span to match the digital zero-span input.
A2R262	STOP BLANK	2	Adjusts the blanking at the end of a vector on the display.
A2R263	START BLANK	2	Adjusts the blanking at the start of a vector on the display.
A2R268	VIDEO GAIN	2	Adjusts the vertical gain in fast-analog zero span to match with the digital zero-span input.
A2R271	SWEEP GAIN	2	Adjusts the end of the trace to the rightmost vertical-graticule line in fast-analog zero-span mode.
A4C853	FM DEMOD	13	Adjusts the FM demodulation for a peak response.
A5L300	LC CTR 1	3	Adjusts center frequency of first stage of LC bandwidth filter to 10.7 MHz.
A5L301	LC CTR 2	3	Adjusts center frequency of second stage of LC bandwidth filter to 10.7 MHz.
A5L700	LC CTR 3	3	Adjusts center frequency of third stage of LC bandwidth filter to 10.7 MHz.
A5L702	LC CTR 4	3	Adjusts center frequency of fourth stage of LC bandwidth filter to 10.7 MHz.
A5R343	15 DB ATT	4	Adjusts the attenuation of the Reference 15 dB attenuator for 15 db between minimum and maximum attenuation.
A5T200	XTAL CTR 1	3	Adjusts center frequency of first stage of crystal bandwidth filter to 10.7 MHz.
A5T202	XTAL CTR 2	3	Adjusts center frequency of second stage of crystal bandwidth filter to 10.7 MHz.
A5T500	XTAL CTR 3	3	Adjusts center frequency of third stage of crystal bandwidth filter to10.7 MHz.

Table 2-2. Adjustable Components (2 of 3)

Reference Designator	Adjustment Name	Adjustment Number	Description
A5T502	XTAL CTR 4	3	Adjusts center frequency of fourth stage of crystal bandwidth filter to 10.7 MHz.
A6R410	HV ADJ	1	Adjusts the voltage between A6TP405 and A6TP401 to the voltage marked on the A6A1 High Voltage Module.
A14R42	6.01 GHz	6	Adjusts the main coil tune driver current at a YTO frequency of 6.01 GHz (near the upper YTO frequency limit).
A14R76	FM SPAN	6	Adjusts the FM span accuracy by affecting the sensitivity of the FM coil driver.
A14R93	3.2 GHz	6	Adjusts the main coil fixed driver current at a YTO frequency of 3.2 GHz (near the lower YTO frequency limit).
A14R621	LO AMPTD	7	Adjusts the amplitude of the first LO by changing the reference voltage for the leveling loop.
A14R628	GATE BIAS	7	Adjusts the gate bias for the A7 LO Distribution Amplifier.
A15C100	SMPL MATCH 1	5	Transforms the sampler input impedance to 50 ohms over the 280 to 298 MHz range.
A15C210	VCO RANGE	5	Adjusts the VCO tank capacitance so that 21V on the VCO tune line equals 298 MHz VCO frequency.
A15C629	298 MHz ADJ	17	Fine adjusts the 298 MHz SIG ID Oscillator frequency to optimize its performance.
A15R237	SMPL PWR ADJ	5	Adjusts the signal power level to the Sampler.
A15U302	10 MHz ADJ	11	Adjusts frequency of the temperature compensated crystal oscillator (TCXO) to 10 MHz.
A15R453	PHASE DET BIAS	5	Adjusts bias at pin 3 of phase detector U408 to 1.80V.

Table 2-2. Adjustable Components (3 of 3)

Reference Designator	Adjustment Name	Adjustment Number	Description
A15R561	CAL AMPTD	10	Adjusts amplitude of the 300 MHz calibrator signal to −10.0 dBm.
A15R926	EXT BIAS ZERO	14	Adjusts zero bias point of external mixer bias.
A16R32	CAL OSC AMPTD	4	Sets calibration oscillator output power (nominally −35 dBm). This power is injected into the IF during the AUTO IF ADJUST routines.
A17R4	Z GAIN	2	Adjusts maximum intensity.
A17R11	CUTOFF	2	Adjusts intensity to turn off blanked lines.
A17R21	Z FOCUS	2	Adjusts focus for lines of different brightness.
A17R26	X FOCUS	2	Adjusts focus at the left and right corners of the display.
A17R34	COARSE FOCUS	2	Adjusts focus at the center of the display.
A17R55	X GAIN	2	Adjusts the horizontal-deflection amplifier gain.
A17R57	X POSN	2	Adjusts the CRT horizontal position.
A17R75	Y GAIN	2	Adjusts the vertical-deflection amplifier gain.
A17R77	Y POSN	2	Adjusts the CRT vertical position.
A17R90	TRACE ALIGN	2	Adjusts the display axis rotation.
A17R92	DDD	2	Adjusts focus of the center of the display.
A17R93	ASTIG	2	Adjusts for the spot roundness on the CRT display.

Table 2-3. Factory Selected Components

Reference Designator	Adjustment Number	Basis of Selection
A5C204	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C216	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C326	3	Selected to optimize LC pole center frequency.
A5C327	3	Selected to optimize LC pole center frequency.
A5C505	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C516	3	Selected to optimize center frequency of LC tank that loads the crystal.
A5C717	3	Selected to optimize LC pole center frequency.
A5C718	3	Selected to optimize LC pole center frequency.
A15U802	16	Selected to set the gain of the second IF to 12 dB.

Using the TAM

The HP 85629B TAM can be used to perform 12 of the 18 HP 8563A adjustment procedures. Table 2-4 lists the TAM adjustments and their corresponding manual adjustments.

The TAM adjustments do not include procedures for choosing factory-selected components. If an adjustment cannot be made and a factory-selected component must be changed, refer to the corresponding manual adjustment.

To select an adjustment, press (MODULE) to display the TAM Main Menu, then press (ADJUST). Position the pointer next to the desired adjustment using either the knob or step keys. Press EXECUTE, then follow the on-screen instructions displayed.

Test Equipment

During the TAM adjustments, instructions for setting test equipment controls are displayed, with the exclusion of the two tests listed below. Test equipment for these adjustments are controlled automatically.

Test 8. Low Band Flatness
Test 9. High Band Flatness and YTF

Table 2-5 lists the test equipment needed to perform each TAM adjustment. Required models must be used. Substitutions may be made for recommended models. Substitute sources must operate over the frequency ranges indicated. Recommended substitutes are listed in the Config Menu. If you must substitute the source with a user-defined model, the adjustments run faster using a synthesized source rather than an unsynthesized source.

Note

When connecting signals from the HP 8340A/B (or any microwave source) to the adjustment setup, use a high-frequency test cable with minimum attenuation to 22 GHz. HP part number 8120-4921 is recommended for its ruggedness, repeatability, and low insertion loss.

Adjustment Indicator

To aid in making adjustments, the TAM displays an "Analog Voltmeter Display Box" along the left-hand side of the display. A horizontal line moves inside the box to represent the needle of an analog voltmeter. A digital readout appears below the box. Tick marks are often displayed on the inside edges of the box indicating the desired needle position. (The tick marks and needle are intensified when the needle is within this acceptable region.) During some adjustments, an arrow appears along the right edge of the box. This arrow always indicates the highest position the needle has reached. The arrow is useful when a component must be adjusted for a peak response; if the peak is overshot, the arrow indicates where the peak was. The component can be readjusted until the needle is at the same position as the arrow.

Table 2-4. TAM Adjustments

TAM Adjustment	Corresponding Manual Adjustment	Adjustment Number
1. IF Bandpass, LC Poles	IF Bandpass Adjustment	3
2. IF Bandpass, Crystal Poles	IF Bandpass Adjustment	3
3. IF Amplitude	IF Amplitude Adjustment	4
4. Sampling Oscillator	Sampling Oscillator Adjustment	5
5. YTO	YTO Adjustment	6
6. LO Distribution Amp	First LO Distribution Amplifier Adjustment	7
7. Dual Band Mixer	Dual Band Mixer Bias Adjustment	8
8. Low Band Flatness	Frequency Response Adjustment	9
9. High Band Flatness and YTF	Frequency Response Adjustment	9
10. Calibrator Amplitude	Calibrator Amplitude Adjustment	10
11. 10 MHz Reference Oscillator	10 MHz Reference Adjustment – TCXO (Option 103)	12
12. External Mixer Bias	External Mixer Bias Adjustment	14
13. External Mixer Amplitude	External Mixer Amplitude Adjustment	15

Table 2-5. Required Test Equipment for TAM

Adjustment	Equipment Used	Required Model	Recommended Model
1. IF Bandpass, LC Poles	None		
2. IF Bandpass, Crystal Poles	None		
3. IF Amplitude	Synthesizer/Level Generator	HP 3335A	
	Test Cable (SMB to BNC)		85680-60093
4. Sampling Oscillator	Manual Probe Cable		
5. YTO	Frequency Counter (3 to 6.8 GHz)		HP 5342A, HP 5343A
6. LO Distribution Amplifier	Power Meter		HP 8902A, HP 436A, HP 438A
	Power Sensor (3 to 6.8 GHz, 10 to 20 dBm)		HP 8485A
7. Dual Band Mixer	Manual Probe Cable		
8. Low Band Flatness	Source (10 MHz to 2.9 GHz)		HP 8340A/B
	Power Meter		HP 8902A, HP 436A, HP438A
	Power Sensor (10 MHz to 2.9 GHz)		HP 8482A, HP 8481A
	Power Splitter (10 MHz to 2.9 GHz)		HP 11667B
9. High Band Flatness and YTF	Source (2.8 to 18/22 GHz)		HP 8340A
	Power Meter		HP 8902A, HP 436A, HP 438A
	Power Sensor (1.8 to 22 GHz) (Option 026: 2.8 to 26.5 GHz)		HP 8485A
	Power Splitter (2.8 to 22 GHz) (Option 026: 2.8 to 26.5 GHz)		HP 11667B
10. Calibrator Amplitude	Power Meter		HP 8902A, HP 436A, HP 438A
	Power Sensor	HP 8482A, HP 8481A	
11. 10 MHz Reference Oscillator	Frequency Counter (9 to 11 MHz)		HP 5342A, HP 5343A
12. External Mixer Bias	Manual Probe Cable		
13. External Mixer Amplitude	Power Meter		HP 8902A, HP 436A, HP 438A
	Power Sensor (310.7 MHz, −25 to −35 dBm)		HP 8484A
	Source (310.7 MHz, −30 dBm)		HP 8340A/B

1. High-Voltage Power Supply

Assembly Adjusted

A6 Power Supply

Related Performance Test

There is no related performance test for this adjustment.

Description

The high-voltage power supply is adjusted to the voltage marked on the A6A1 HV Module. The A6A1 HV Module is characterized in the factory to ensure that the display filament voltage is set to 6.0 V rms when the +110 V dc (nominal) supply is set to the voltage marked on the HV Module.

Warning **To minimize shock hazard, use a nonmetallic adjustment tool when adjusting the A6 Power Supply.**

Warning **The following procedure probes voltages that, if contacted, could cause personal injury or death.**

Note Adjustment of the high-voltage power supply should not be a routine maintenance procedure. Any adjustments should be done only if the A6 Power Supply, A6A1 HV Module, or A18 CRT (display) is repaired or replaced.

Note You must perform the display adjustments after this adjustment if either the display or HV Module has been replaced.

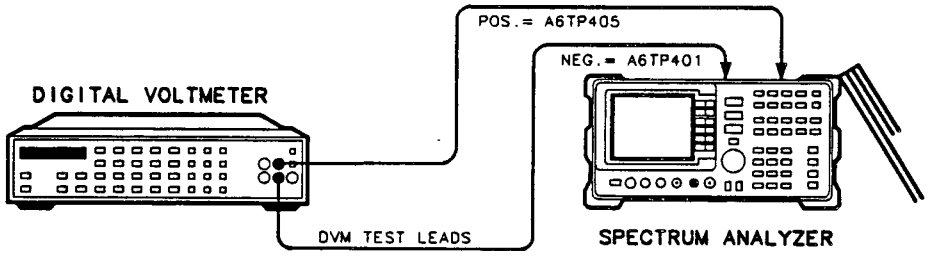


Figure 2-1. High-Voltage Power Supply Adjustment Setup

Equipment

Digital Multimeter ..... HP 3456A
DVM Test Leads ..... HP 34118A

Procedure

Warning  **After disconnecting the ac power cord, allow capacitors in the high-voltage supply to discharge for at least 30 seconds before removing the protective cover from the A6 Power Supply.**

1. Set the HP 8563A (LINE) switch off, disconnect the power cord, and remove the analyzer cover. Fold down the A2 Controller, A3 Interface, A4 Log Amplifier, and A5 IF assemblies. Remove the A6 Power Supply cover.
2. Position the HP 8563A as shown in Figure 2-1. Connect the positive DVM lead to A6TP405 and the negative DVM lead to A6TP401.
3. Set the HP 3456A controls as follows:

   FUNCTION ..... DC VOLTS
   RANGE ..... 1000 VOLTS

4. Reconnect the power cord to the HP 8563A and set the (LINE) switch on.
5. Record the voltage marked on the A6A1 HV Module.

   Voltage marked on A6A1 HV Module = _____ V dc

6. Adjust A6R410 HV ADJ for a voltage equal to the voltage recorded in step 5.
7. Set the HP 8563A (LINE) switch off and disconnect the power cord. Wait at least 30 seconds for the high-voltage power supply capacitors to discharge.
8. Disconnect the DVM test leads from A6TP401 and A6TP405. Reinstall the power supply cover.

2. Display Adjustment

Assembly Adjusted

A2 Controller
A17 CRT Driver

Related Performance Test

Sweep Time Accuracy (Sweep Times <30 ms)

Description

Coarse adjustment of the deflection amplifiers, Z-axis amplifiers, and line generators is done using the CRT adjust pattern. Fine adjustments use the graticule. The fast zero-span amplitude adjustments correct for differences between analog and digital display modes. The displayed sweep time accuracy is adjusted in the fast zero-span sweep adjustments.

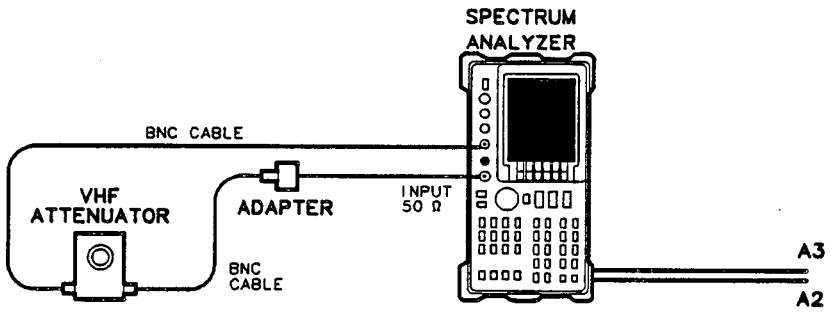


Figure 2-2. Display Adjustment Setup

Equipment

10 dB VHF Step Attenuator ..... HP 355D

Adapters
Type N (m) to BNC (f) 1250-1476

Cables
BNC, 122 cm *(2 required)* ..... HP 10503A

Procedure

1. Set the analyzer's (LINE) switch OFF. Remove the analyzer's cover and fold out the A2 Controller and A3 Interface assemblies as illustrated in Figure 2-2. Connect the CAL OUTPUT to the INPUT.

Preliminary Adjustments

2. Set A17R55 X GAIN, A17R75 Y GAIN, A17R92 DDD, A17R93 ASTIG, A2R206 DGTL X GAIN, A2R215 DGTL Y GAIN, A2R262 STOP BLANK, and A2R263 START BLANK to midrange. Also set the rear-panel X POSN, Y POSN, and TRACE ALIGN to midrange.
3. Set A17R21 Z FOCUS, A17R26 X FOCUS, and A17R11 CUTOFF fully counterclockwise.
4. Set A17R4 Z GAIN fully clockwise.
5. Turn the analyzer on and allow it to warm up for at least 3 minutes. Adjust A17R11 CUTOFF until the display is visible and A17R34 COARSE FOCUS for best possible focus.

Cutoff Adjustment

6. Press (PRESET), (DISPLAY), INTENSITY, 255 (ENTER), STORE INTENSITY, MORE 1of2, FOCUS, 127 (ENTER), STORE FOCUS, then GRAT OFF. Adjust A17R11 CUTOFF until the line between the bottom of trace A and the annunciators at the bottom of the display just disappears.

Deflection Adjustments

7. Press GRAT ON, MORE 2of2, INTENSITY, 80 (ENTER), STORE INTENSITY, (CAL), MORE 1of2, and CRT ADJ PATTERN. Fold up the A3 Interface assembly.
8. Refer to Figure 2-3 for locating the lines used for adjusting DGTL X GAIN and DGTL Y GAIN. Each of these lines is actually two lines adjusted for coincidence. The two lines will form an "X" if they are not adjusted properly.
9. Adjust A2R206 DGTL X GAIN until the two vertical lines near the left edge of the display appear to be one single line.
10. Adjust A2R215 DGTL Y GAIN until the two horizontal lines near the top edge of the display appear to be one single line.
11. Adjust A2R262 STOP BLANK and A2R263 START BLANK for the sharpest corners of the outer box in the test pattern. The intensity of the corners should be the same as the middle of the lines between the corners.
12. Adjust the rear-panel TRACE ALIGN until the leftmost line of the test pattern is parallel with the CRT bezel. See Figure 2-3.
13. Adjust the rear-panel X POSN and A17R55 X GAIN until the leftmost "@" characters and the softkey labels appear just inside the left and right edges of the CRT bezel.
14. Adjust the rear-panel Y POSN and A17R75 Y GAIN until the softkey labels align with their appropriate softkeys.
15. Press (PRESET). If necessary, readjust STOP BLANK and START BLANK for the best-looking intersection of the graticule lines. This will be most noticeable along the center vertical and horizontal graticule lines.

Intensity Adjustments

16. Press (AMPLITUDE) then set the REF LVL to −70 dB and the LOG dB/DIV to 1. This should almost completely fill the screen with the noise floor. Press (SGL SWP). Adjust A17R4 Z GAIN until the intensity at the center of the screen is 15 NITs.
17. Press (CAL), MORE 1of2, and CRT ADJ PATTERN. Locate the dot just below the HP logo. Adjust A17R93 ASTIG for the smallest round dot possible.

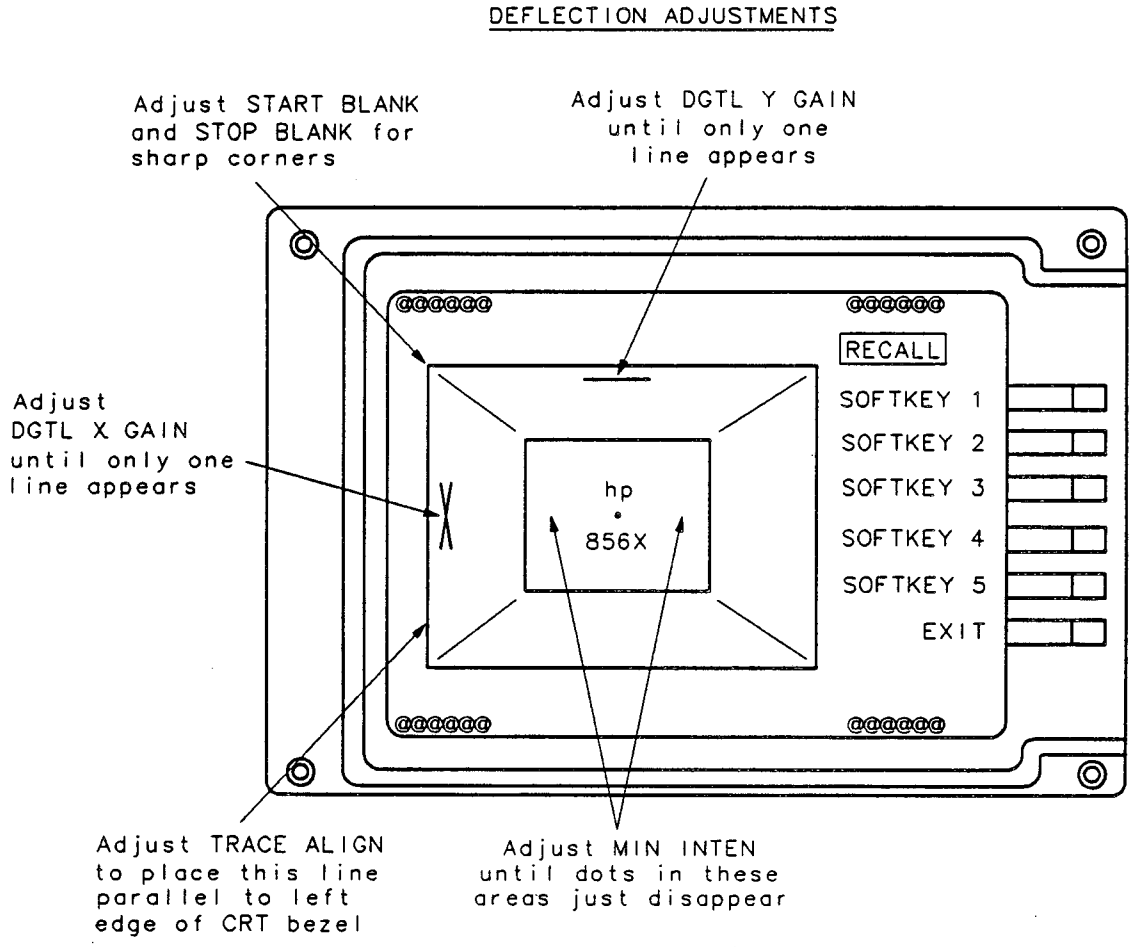


Figure 2-3. CRT Adjust Pattern

18. Adjust A17R34 COURSE FOCUS and A17R92 DDD for the best focus of the characters at the center of the screen.
19. Adjust A17R21 Z FOCUS for the best focus of the test pattern's outside box.
20. Adjust A17R26 X FOCUS for best focus of the "@" characters at the corners of the test pattern.
21. Repeat steps 17 through 20 to obtain the best overall focus quality.

Fast Zero Span Adjustments

22. Set A2R218 VIDEO OFFSET and A2R268 VIDEO GAIN to midrange.
23. Set the HP 355D to 30 dB attenuation.
24. Press (PRESET) on the analyzer, and connect the equipment as shown in Figure 2-2. Set the analyzer's controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz
    REF LVL ..... −40 dBm
    RES BW ..... 1 kHz
    VIDEO BW ..... 300 Hz

25. Press (MKR), (MKR->), MARKER-> REF LVL. Press (SWEEP) and set the sweep time to 10 ms.
26. Adjust A2R209 SWEEP OFFSET to place the beginning of the trace at the leftmost vertical graticule line.
27. Adjust A2R271 SWEEP GAIN to place the end of the trace at the tenth vertical graticule line (one division from the right edge of the graticule).
28. Press (SAVE), SAVE STATE, and STATE 0.
29. Press (AMPLITUDE) and set reference level to +30 dBm. Press (SAVE), SAVE STATE, STATE 1. Press (SWEEP) and set the sweep time to 50 ms.
30. Press (SAVE), SAVE STATE, and STATE 2.
31. Press (RECALL) and RECALL STATE.
32. Press STATE 2.
33. Note the vertical position of the trace.
34. Press STATE 1.
35. Adjust A2R218 VIDEO OFFSET to position the trace halfway between its original position and the position noted in step 33.

3. IF Bandpass Adjustment

Assembly Adjusted

A5 IF Assembly

Related Performance Test

Resolution Bandwidth Accuracy and Selectivity

Description

The center frequency of each IF bandpass filter pole is adjusted by DAC-controlled varactor diodes and an inductor (for the LC poles) or a transformer (for the crystal poles). The inductors and transformers are for coarse tuning and the varactors are for fine tuning by the microprocessor. The inductors and transformers are adjusted such that the varactor diodes are biased near the middle of their capacitance range. The varactor diode bias is measured with the DVM.

Note

This procedure is not a routine adjustment. It should be performed only if repairs to the A5 IF assembly are made. If the entire A5 IF assembly is replaced, the assembly arrives pre-adjusted from the factory and requires no further adjustment.

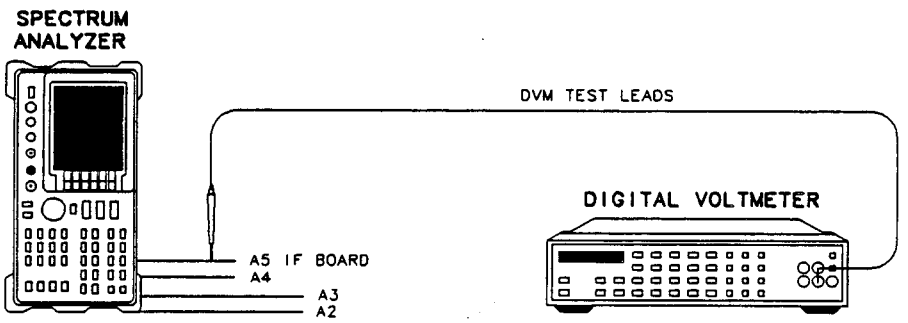


Figure 2-4. IF Bandpass Adjustment Setup

Equipment

Digital Voltmeter	HP 3456A
DVM Test Leads	HP 34118A
Special Tuning Tool	8710-1010

Procedure

1. Set the HP 8563A (LINE) switch off and disconnect the power cord. Remove the analyzer cover and fold down the A2 Controller, A3 Interface, A4 Log Amp, and A5 IF assemblies. Reconnect the power cord and set the (LINE) switch on. Allow the analyzer to warm up for at least 30 minutes.
2. Connect the negative DVM lead to pin 6 of A5J6. See Figure 2-4. Set the HP 3456A controls as follows:

   FUNCTION ..... DC VOLTS
   RANGE 10V

3. On the HP 8563A press (PRESET) (SPAN) 2 (MHz) (CAL) and IF ADJ OFF.

LC Bandpass Adjustments

4. On the HP 8563A, press ADJ CURR IF STATE. Wait for the IF ADJUST STATUS message to disappear before continuing with the next step.
5. Read the voltage on A5TP5 (this is an empty-hole type of test point). If the voltage is less than +6.06 V dc, turn A5L300 LC CTR 1 clockwise. If the voltage is greater than +6.26 V dc, turn LC CTR 1 counterclockwise.
6. Repeat steps 4 and 5 until the voltage reads +6.16 V dc ±100 mV.

Note



If the range for the LC CTR adjustment is insufficient, replace the appropriate factory-selected capacitor as listed in Table 2-6. To determine the correct replacement value, center the LC CTR adjustment and press ADJ CURR IF STATE. After the IF ADJUST STATUS message disappears, read the DVM display. Choose a capacitor value from Table 2-7, based on the DVM reading and the presently loaded capacitor value. Table 2-10 lists a few capacitor part numbers.

Caution



Set the HP 8563A (LINE) switch off before removing or replacing any shield.

7. Move the positive DVM lead to A5TP6.
8. Adjust A5L301 LC CTR 2 by repeating steps 4 through 6.
9. Move the positive DVM test lead to A5TP1 (this is a resistor-lead type of test point).
10. Adjust A5L700 LC CTR 3 by repeating steps 4 through 6.
11. Move the positive DVM test lead to A5TP2 (this is a resistor-lead type of test point).
12. Adjust A5L702 LC CTR 4 using the procedure in steps 4 through 6.

Table 2-6. Factory-Selected LC Filter Capacitors

LC CTR Adjustment	Fixed Factory Select Capacitor
A5L300 LC CTR 1	A5C326
A5L301 LC CTR 2	A5C327
A5L700 LC CTR 3	A5C717
A5L702 LC CTR 4	A5C718

Table 2-7. LC Factory-Selected Capacitor Selection

DVM Reading (V)	Currently Loaded Capacitor Value (pF)					
	Replace 6.8 with:	Replace 8.2 with:	Replace 10 with:	Replace 12 with:	Replace 15 with:	Replace 18 with:
0 to 1.5	*	*	*	*	*	*
1.5 to 2.5	18	18	*	*	*	*
2.5 to 3.5	15	15	18	18	*	*
3.5 to 4.5	10	12	15	15	18	*
4.5 to 5.5	8.2	10	12	15	18	*
5.5 to 6.5	no change	no change	no change	no change	no change	no change
6.5 to 7.5	no change	no change	no change	no change	no change	no change
7.5 to 8.5	*	6.8	8.2	10	12	15
8.5 to 9.5	*	*	6.8	8.2	12	15
9.5 to 10	*	*	6.8	8.2	10	12
* Indicates a condition that should not exist; suspect broken hardware.						

XTAL Bandpass Adjustments

13. On the HP 8563A, press [SPAN] 1 [MHz] and [CAL].
14. Move the positive DVM test lead to A5TP7.
15. On the HP 8563A, press `ADJ CURR IF STATE`. Wait for the `IF ADJUST STATUS` message to disappear before continuing to the next step.
16. Read the voltage displayed on the DVM. If the voltage is less than +6.06 V dc, turn A5T200 XTAL CTR 1 clockwise. If the voltage is greater than +6.26 V dc, turn XTAL CTR 1 counterclockwise.
17. Repeat steps 15 and 16 until the voltage reads +6.16 V dc ±100 mV.

Note

If the range for the XTAL CTR adjustment is insufficient, replace the appropriate factory-selected capacitor as listed in Table 2-8. To determine the correct replacement value, center the XTAL CTR adjustment, and press `ADJ CURR IF STATE`. After the `IF ADJUST STATUS` message disappears, read the DVM display. Choose a capacitor value from Table 2-9, based on the

DVM reading and the presently loaded capacitor value. Table 2-10 lists a few capacitor part numbers.

Caution Set the HP 8563A [LINE] switch off before removing or replacing any shield.



18. Move the positive DVM test lead to A5TP8.
19. Adjust A5T202 XTAL CTR 2 using the procedure in steps 15 through 17.
20. Move the positive DVM test lead to A5TP3.
21. Adjust A5T500 XTAL CTR 3 using the procedure in steps 15 through 17.
22. Move the positive DVM test lead to A5TP4.
23. Adjust A5T502 XTAL CTR 4 using the procedure in steps 15 through 17.

Table 2-8. Factory-Selected XTAL Filter Capacitors

XTAL CTR Adjustment	Fixed Factory Select Capacitor
A5T200 XTAL CTR 1	A5C204
A5T202 XTAL CTR 2	A5C216
A5T500 XTAL CTR 3	A5C505
A5T502 XTAL CTR 4	A5C516

Table 2-9. XTAL Factory-Selected Capacitor Selection

DVM Reading (V)	Currently Loaded Capacitor Value (pF)					
	Replace 15 with:	Replace 18 with:	Replace 20 with:	Replace 22 with:	Replace 24 with:	Replace 27 with:
0 to 1.5	*	*	*	*	*	*
1.5 to 2.5	27	*	*	*	*	*
2.5 to 3.5	22	27	27	*	*	*
3.5 to 4.5	18	22	24	27	27	*
4.5 to 5.5	18	20	22	24	27	*
5.5 to 6.5	no change	no change	no change	no change	no change	no change
6.5 to 7.5	no change	no change	no change	no change	no change	no change
7.5 to 8.5	*	15	18	18	22	24
8.5 to 9.5	*	15	15	18	20	24
9.5 to 10	*	*	15	18	20	24

* Indicates a condition that should not exist; suspect broken hardware.

Table 2-10. Capacitor Part Numbers

Capacitor Value (pF)	HP Part Number
6.8	0160-4793
8.2	0160-4792
10	0160-4791
12	0160-4790
15	0160-4789
18	0160-4788
20	0160-5699
22	0160-4787
24	0160-5903
27	0160-4786

4. IF Amplitude Adjustment

Assembly Adjusted

A16 Cal Oscillator
A5 IF Assembly

Related Performance Test

IF Gain Uncertainty Test
Scale Fidelity Test

Description

This adjustment sets the output amplitude of the A16 Cal Oscillator and the absolute amplitude of the reference 15 dB attenuator.

The A16 Cal Oscillator is adjusted so that a −55 dBm signal applied to the 10.7 MHz IF input on the A5 IF assembly (A5J3) causes a displayed signal of −60 dBm. The effect of this adjustment is visible only after the `ADJ CURR IF STATE` sequence is complete. `ADJ CURR IF STATE` causes the IF gain adjustment to use the "new" output amplitude from the A16 Cal Oscillator. When the adjustment sequence is complete, the result of the adjustment should cause the −35 dBm signal at A5J5 to be displayed at −60 dBm.

This procedure sets the attenuation of the reference 15 dB attenuator so that a source amplitude change of 50 dB combined with a spectrum analyzer reference level change of 50 dB displays an amplitude difference of 50 dB.

Note

The 15 dB Reference Attenuator adjustment is preset at the factory and need not be done if the entire A5 IF assembly is replaced.

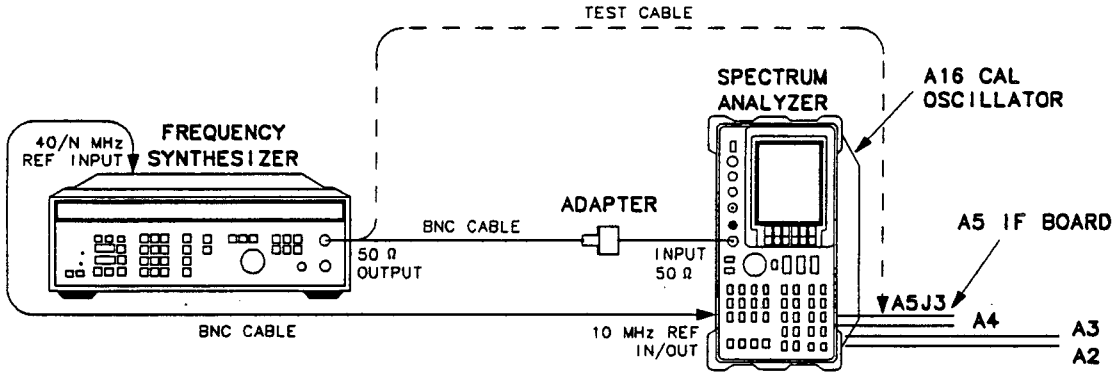


Figure 2-5. IF Amplitude Adjustment Setup

Equipment

Frequency Synthesizer ..... HP 3335A

Adapters
Type N (m) to BNC (f) 1250-1476

Cables
BNC, 122 cm (48 in) ..... HP 10503A
Test Cable 85680-60093

Procedure

1. Set the HP 8563A (LINE) switch to off. Remove the analyzer cover and place the analyzer in the service position as illustrated in Figure 2-5.
2. Disconnect W29, violet coax cable, from A5J3. Connect the test cable between A5J3 and the 50Ω output of the HP 3335A. Set the HP 8563A (LINE) switch on.

A16 Cal Oscillator Amplitude Adjustment

3. Set the HP 8563A controls as follows:

   CENTER FREQ ..... 10.7 MHz
   SPAN ..... 200 kHz
   REF LVL ..... −60 dBm
   ATTEN ..... 0 dB
   dB/DIV ..... 1 dB/DIV
   RES BW ..... 300 kHz
   VIDEO BW ..... 100 Hz

4. On the HP 8563A, press (MKR) (CAL) and IF ADJ OFF.
5. Set the HP 3335A controls as follows:

   FREQUENCY ..... 10.7 MHz
   AMPLITUDE ..... −55 dBm

6. Note the marker value. Ideally it should read −60 dBm ±0.1 dB.
7. If the marker reads below −60.1 dBm, rotate A16R32 CAL OSC AMPTD one-third turn counterclockwise for every 0.1 dB below −60 dBm. If the marker reads above −59.9 dBm, rotate A16R32 CAL OSC AMPTD one-third turn clockwise for every 0.1 dB above −60 dBm. A change in the displayed amplitude will not be seen at this point.

Note If A16R32 has inadequate range, refer to "Inadequate CAL OSC AMPTD Range" in Chapter 9.

---

8. Press ADJ CURR IF STATE. The displayed amplitude and the MARKER reading should change.
9. Repeat steps 7 and 8 until the marker reads −60 dBm ±0.1 dB.

10. Disconnect the test cable from A5J3 and reconnect W29 to A5J3.

Reference Attenuator Adjustment

11. Set the HP 3335A [AMPLITUDE] to −60 dBm.
12. Connect a BNC cable between the 50Ω output of the HP 3335A and the HP 8563A INPUT 50Ω.
13. On the HP 8563A, press [CAL] and REF LEVEL ADJUST. Use the front-panel knob or step keys to place the peak of the displayed signal 3 dB to 5 dB below the reference level.
14. Press [PEAK SEARCH] and MARKER DELTA on the HP 8563A. Set the analyzer reference level to −10 dBm.
15. Change the HP 3335A [AMPLITUDE] to −10 dBm.
16. Press [CAL] on the HP 8563A.
17. Note the ΔMKR amplitude. Ideally, it should read 50.00 dB ±0.1 dB.
18. If the ΔMKR amplitude is less than 49.9 dB, rotate A5R343 15 dB ATTEN one-half turn counterclockwise for each 0.1 dB below 50.00 dB. If the ΔMKR amplitude is greater than 50.1 dB, rotate A5R343 15 dB ATTEN one-half turn clockwise for each 0.1 dB above 50.00 dB. Do not adjust 15 dB ATTEN more than five turns before continuing with the next step.
19. Press ADJ CURR IF STATE on the HP 8563A. Note the ΔMKR amplitude reading.
20. Set the HP 8563A reference level to −60 dBm and press [MKR] and MARKERS OFF. Repeat steps 18 and 19 until the ΔMKR amplitude reads 50.00 dB ±0.1 dB.
21. Repeat steps 11 through 20 until the ΔMKR amplitude reading is 50.00 dB ±0.1 dB.

Adjustment Verification

22. On the HP 8563A, disconnect W29 from A5J3. Connect the test cable between A5J3 and the 50Ω output of the HP 3335A.
23. Set the HP 8563A reference level to −10 dBm.
24. Set the HP 3335A [AMPLITUDE] to −5 dBm.
25. Press [MKR] and MARKER NORMAL on the HP 8563A.
26. The MARKER amplitude should read −10 dBm ±0.13 dB. If the reading is outside of this range, repeat steps 4 through 21.
27. On the HP 8563A, reconnect W29 to A5J3. Press [PRESET] and set the controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz
REF LVL	−10 dBm
RES BW	300 kHz

28. Connect a BNC cable between the HP 8563A CAL OUTPUT and INPUT 50Ω.
29. On the HP 8563A, press [MKR] [CAL] and REF LVL ADJ.

4. IF Amplitude Adjustment

30. Use the knob or step keys to adjust the REF LEVEL CAL setting until the MKR reads −10.00 dBm ±0.1 dB.
31. On the HP 8563A, press STORE REF LVL.

5. Sampling Oscillator Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

There is no related performance test for this adjustment procedure.

Description

The phase detector bias is adjusted for 1.8 V dc. The sampling oscillator tank circuit is adjusted for a tuning voltage of 0.9 V dc when the oscillator is set to 288 MHz. The voltage monitored is actually the tuning voltage divided by 4.05. A coarse-tune procedure is also included, but should only be necessary when the coaxial resonator is replaced. The power and match of the sampling oscillator signal to the A15A2 Sampler are also adjusted.

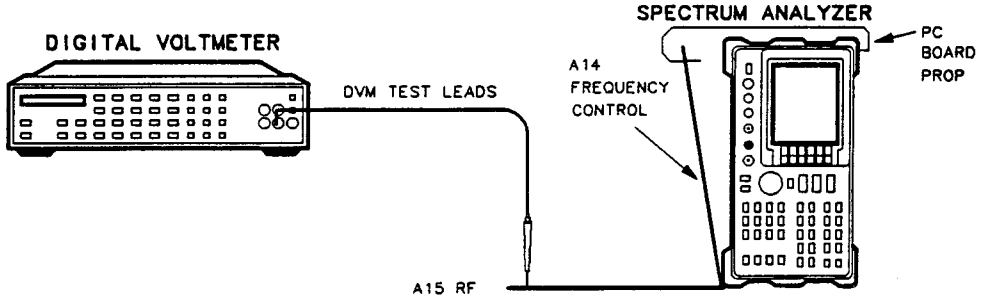


Figure 2-6. Sampler Adjustment Setup

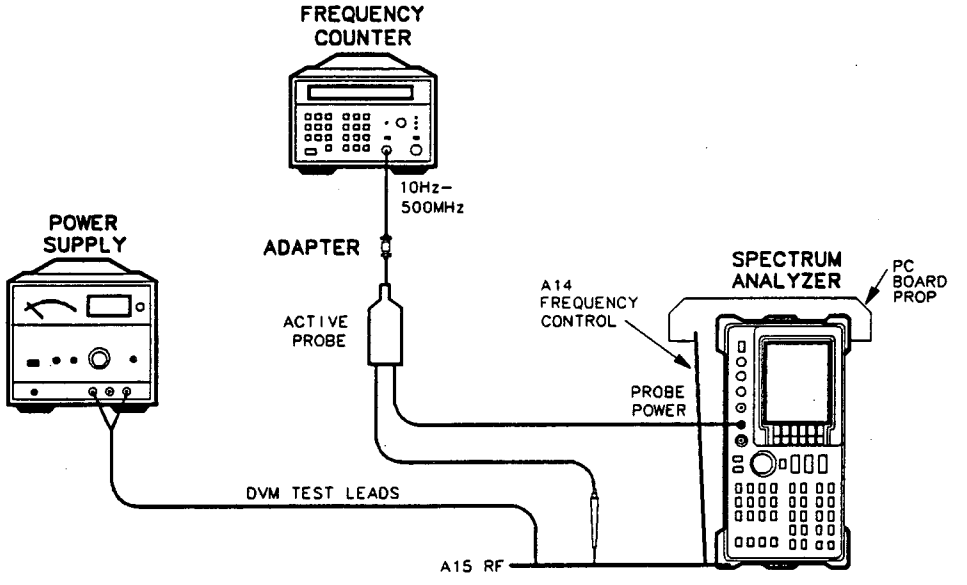


Figure 2-7. Coarse-Tune Adjustment Setup

Equipment

An asterisk (*) indicates equipment used only for the coarse-tune procedure.

Digital Voltmeter	HP 3456A
DVM Test Leads	HP 34118A
Frequency Counter*	HP 5343A
Active Probe*	HP 1121A
Power Supply*	HP 6114A
1 MΩ Resistor*	0757-0080

Adapters

Type BNC (f) to BNC (f)*	1250-0059

Cables

BNC, 122 cm (48 in)*	HP 10503A

Procedure

1. Set the HP 8563A (LINE) switch to off and disconnect the line power cord. Remove the analyzer cover and fold down the A15 RF and A14 Frequency Control assemblies. Prop up the A14 Frequency Control assembly. Reconnect the line power cord and set the (LINE) switch on. Connect the equipment as illustrated in Figure 2-6.
2. Press (PRESET) on the HP 8563A and set the controls as follows:

CENTER FREQ	661 MHz
CF STEP	30 MHz
SPAN	0 Hz

3. Set the HP 3456A controls as follows:

FUNCTION	DC VOLTS
RANGE	10V, MANUAL

Phase Detector Bias Adjustment

4. Connect the negative DVM lead to A15J200 pin 6, and the positive lead to A15J200 pin 15.
5. Adjust A15R453 PHASE DET BIAS for a DVM reading of +1.8 ±0.02 V dc.

Sampling Oscillator Fine-Tune Adjustment

6. Connect the positive DVM lead to A15J200 pin 13. Leave the negative DVM lead connected to A15J200 pin 6.
7. Adjust A15C210 VCO RANGE for a DVM reading of +5.18 ±0.05 V dc.

Note If A15C210 cannot be adjusted for 5.18 V dc, perform the coarse-tune adjustment located at the end of this procedure.

Power and Sampler Match Adjustments

8. Connect the negative DVM test lead to A15J400 pin 6, and the positive DVM test lead to A15J400 pin 1.
9. Press (FREQUENCY) and set the HP 8563A center frequency to 511 MHz. This sets the sampling oscillator to 288 MHz.
10. Adjust A15C100 SMPL MATCH 1 to peak the voltage displayed on the DVM.

Note If a peak cannot be obtained, the sampling oscillator power might be too low. Adjust A15R237 SMPL PWR ADJ clockwise one-eighth turn and repeat step 10. If necessary, continue increasing the oscillator power, but do not allow the displayed voltage to exceed +3 V dc when peaked.

11. Adjust A15R237 SMPL PWR ADJ to set the displayed voltage to +0.9 ±0.2 V dc.
12. Record the displayed voltage in Table 2-11 as the displayed voltage for the sampling oscillator frequency of 288 MHz.
13. Press (FREQUENCY) on the HP 8563A. Use the step keys to set the analyzer center frequency to the frequencies listed in Table 2-11. At each listed frequency, record the displayed voltage in the table.
14. If the difference between the maximum and minimum voltages is less than 0.50 V, and all voltage readings are between +0.5 and +2.5 V dc, proceed to step 19.
15. Locate the center frequency at which the voltage is lowest. Use the (▲) and (▼) keys to set the HP 8563A to this frequency.
16. Readjust SMPL MATCH 1 to set the displayed voltage to 0.8 ±0.1 V dc.
17. Move the positive DVM test lead to A15J400 pin 3.
18. Set the HP 8563A center frequency to 511 MHz.
19. Readjust A15R237 SMPL PWR ADJ if necessary, until the voltage at A15J400 pin 3 is −0.5 to −2.5 V dc and the voltage at A15J400 pin 1 is −0.5 to +2.5 V dc.
20. Disconnect the DVM probes from A15J400.

Coarse-Tune Adjustment

Note This adjustment should be necessary only if the coaxial resonator Z200 has been replaced or if there was insufficient range in the Sampling Oscillator Fine-Tune Adjustment.

21. Set the HP 8563A [LINE] switch off and remove the top shield over the sampling oscillator. Connect the equipment as shown in Figure 2-7.
22. Remove any existing shorts from the exposed center-conductor of coaxial resonator Z200 to the ground plane.
23. Set the HP 6114A Power Supply for a 21 V dc output ±0.2 V. Connect the positive supply lead to X201 pin 1 and the negative supply lead to X201 pin 4.
24. Connect the active probe to TP201.
25. Set the HP 8563A [LINE] switch on and set the controls as follows:

    CENTER FREQ ..... 661 MHz
    SPAN ..... 0 Hz

26. Set the HP 5343A Frequency Counter as follows:

    SAMPLE RATE ..... Counterclockwise
    50Ω—MΩ SWITCH 50Ω
    10 Hz—500 MHz/500 MHz—26.5 GHz SWITCH ..... 10 Hz—500 MHz
    RESOLUTION ..... 100 kHz

27. Starting at the end of Z200 nearest X201, short the center conductor to a hole in the ground plane with the lead of a 1 MΩ resistor (HP part number 0757-0059) until the frequency counter reads 298 MHz ±4 MHz.
28. Once the proper tap has been found, solder the resistor lead to the ground plane and the center conductor of Z200. Cut away the rest of the resistor.
29. Remove the power supply leads and the active probe.
30. Set the HP 8563A [LINE] switch off and reinstall the top shield. Set the [LINE] switch on.
31. Repeat the procedure beginning at step 2 for the remaining center frequencies listed in Table 2-11.

Table 2-11. Sampling Adjustments

Center Frequency (MHz)	Sampling Oscillator (MHz)	Displayed Voltage (V dc)				
		1st Trial	2nd Trial	3rd Trial	4th Trial	5th Trial
361	280					
451	284					
481	286					
511	288					
541	290					
571	292					
601	294					
631	296					
661	298					

6. YTO Adjustment

Assembly Adjusted

A14 Frequency Control Assembly

Related Performance Test

Frequency Span Accuracy
Frequency Readout Accuracy and Frequency Count Marker Accuracy

Description

The YTO main coil adjustments are made with the phase-lock loops disabled. The YTO endpoints are adjusted to bring these points within the capture range of the main loop. The YTO FM coil is adjusted to place the 300 MHz CAL OUTPUT signal at the center vertical graticule in a 20 MHz span.

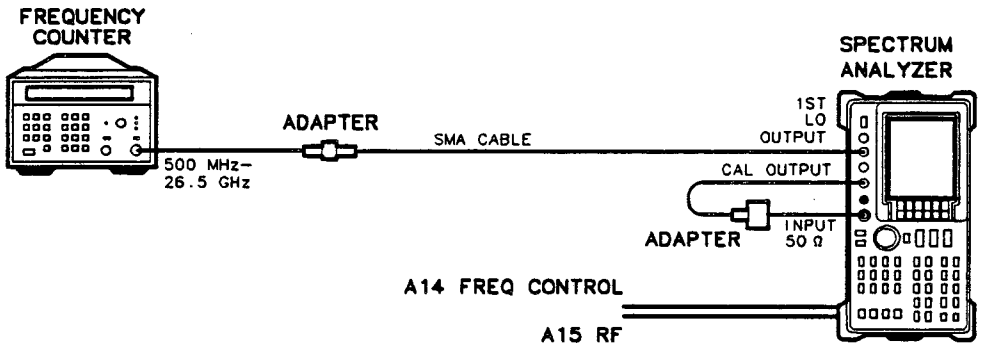


Figure 2-8. YTO Adjustment Setup

Equipment

Microwave Frequency Counter ..... HP 5343A Option 001

Adapters
Type N (m) to BNC (f) 1250-1476
Type N (f) to APC 3.5 (f) *(Option 026 only)* 1250-1745
APC 3.5 (f) to APC 3.5 (f) 5061-5311

Cables
BNC, 122 cm (48 in) ..... HP 10503A
SMA, 61 cm (24 in) 8120-1578

Procedure

Note This adjustment cannot be performed if the analyzer preselected external mixer mode is selected.

YTO Main Coil Adjustments

1. Set the HP 8563A (LINE) switch off. Remove the analyzer cover and fold down the A15 RF and A14 Frequency Control assemblies.
2. Disconnect the 50Ω termination from the 1ST LO OUTPUT. Connect the equipment as shown in Figure 2-8. Set the (LINE) switch on.
3. Move the jumper on A14J23 from the NORM position (pins 1 and 2 jumpered) to the TEST position (pins 2 and 3 jumpered).
4. On the HP 8563A, press the following keys:

   (AUX CTRL) (EXTERNAL MIXER) LOCK HARMONIC 6 (Hz),
   (SPAN) ZERO SPAN
   (FREQUENCY) CENTER FREQ 18.8893 (GHz) (SGL SWP), then press
   (SAVE) SAVE LOCK OFF SAVE STATE STATE 0. Press (FREQUENCY) 35.7493 (GHz)
   (SAVE) SAVE STATE STATE 1, then press (RECALL) RECALL STATE STATE 0.

5. On the HP 5343A, press (SHIFT) 7 and set the controls as follows:

   SAMPLE RATE ..... Fully Counterclockwise
   10 Hz—500 MHz/500 MHz—26.5 GHz SWITCH ..... 500 MHz—26.5 GHz

6. Adjust A14R93 3.2 GHz for the appropriate frequency counter reading of 3.200 GHz ±1 MHz.
7. On the HP 8563A, press STATE 1.
8. Adjust A14R42 6.01 GHz for a frequency counter reading of 6.010 GHz ±1 MHz.
9. On the HP 8563A, press STATE 0.
10. Repeat steps 6 through 9 until both of these interacting adjustments meet their tolerances.
11. Place the jumper on A14J23 in the NORM position (pins 1 and 2 jumpered).
12. Disconnect the SMA cable from the 1ST LO OUTPUT jack and reconnect the 50Ω termination on the 1ST LO OUTPUT.

YTO FM Coil Adjustments

13. On the HP 8563A, press (PRESET) and set the controls as follows:

    CENTER FREQ .....300 MHz
    SPAN .....20 MHz

14. Adjust A14R76 FM SPAN until the 300 MHz CAL OUTPUT SIGNAL is aligned with the center vertical graticule line.

7. 1ST LO Distribution Amplifier Adjustment

Assembly Adjusted

A14 Frequency Control Assembly

Related Performance Test

1ST LO OUTPUT Amplitude

Description

The gate bias for the A7 LO Distribution Amplifier is adjusted to the value specified on A7. LO AMPTD is adjusted so that the LO SENSE voltage is 6 mV more negative than the value specified on the A7 LODA label.

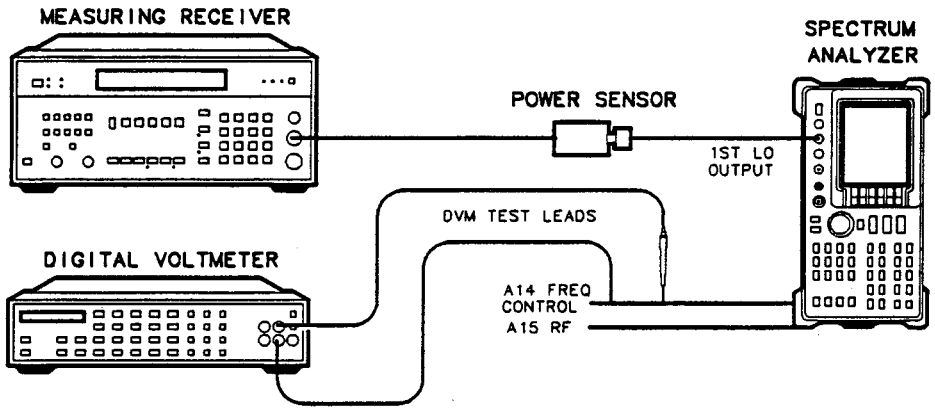


Figure 2-9. 1st LO Distribution Amplifier Adjustment Setup

Equipment

Measuring Receiver	HP 8902A
DVM	HP 3456A
Power Sensor	HP 8485A
DVM Test Leads	HP 34118A

Adapters

Type N (f) to APC (m)	1250-1750

Procedure

1. Set the HP 8563A [LINE] switch off and disconnect the line cord. Remove the cover and fold down the A15 RF and A14 Frequency Control assemblies. Reconnect the line cord.
2. Remove the 50Ω termination from the 1ST LO OUTPUT.
3. Connect the positive lead of the DVM probe to pin 15 of A14J18. Connect the DVM ground lead to pin 6 of A14J18. See Figure 2-9.

4. Set the HP 3456A controls as follows:

   FUNCTION ..... DC VOLTS
   RANGE ..... 10 V
   RESOLUTION ..... 1 mV

5. Turn the HP 8563A (LINE) switch on.
6. Adjust A14R628 GATE BIAS for a DVM reading within 5% of the GATE BIAS voltage printed on the A7 LO Distribution Amplifier label.
7. Zero and calibrate the HP 8902A/HP 8485A in LOG mode (power levels read in dBm). Enter the power sensor 1 GHz Cal Factor into the HP 8902A.
8. Connect the power sensor to the 1ST LO OUTPUT on the HP 8563A.
9. On the HP 8563A, press (PRESET) (SPAN) ZERO SPAN (FREQUENCY) 1.0893 (GHz).
10. Connect the positive DVM lead to A14J18 pin 13.
11. Note the LO SENSE voltage printed on the A7 LODA label. Adjust A14R621 LO AMPTD until the DVM reads 6 mV more negative than the LO SENSE voltage printed on the A7 LODA label. For example, if the LO SENSE voltage is −170 mV, adjust A14R621 until the DVM reads −176 mV.
12. Check that the HP 8902A power level reads greater than +15.2 dBm.
13. Disconnect the power sensor from the 1ST LO OUTPUT and reconnect the 50Ω termination.
14. Disconnect the DVM leads from A14J18.

8. Dual Band Mixer Bias Adjustment

Assembly Adjusted

A14 Frequency Control Assembly

Related Performance Test

Frequency Response
Second Harmonic Distortion (>2.9 GHz)
Third Order Intermodulation Distortion (>2.9 GHz)

Description

The A8 Dual Band Mixer bias is set by a DAC on the A14 Frequency Control assembly. The DAC values for high band are stored in the EEROM on the A2 Controller assembly. The EEROM is placed in its WR ENA (write-enable) mode and the DAC value is adjusted to yield the factory-derived bias for each band. The new DAC value is stored in the EEROM, then the EEROM is placed in WR PROT (write-protect) mode.

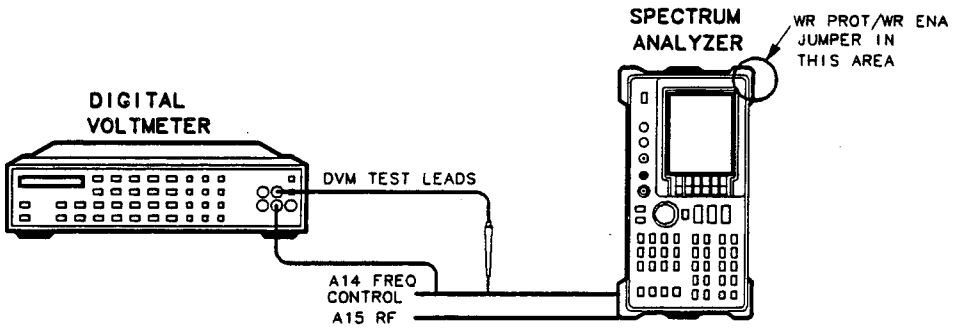


Figure 2-10. Dual Band Mixer Bias Adjustment Setup

Equipment

DVM	HP 3456A
DVM Test Leads	HP 34118A

Procedure

1. Connect the equipment as shown in Figure 2-10. Connect the positive DVM probe lead to A14J19 pin 13. Connect the ground lead to pin 6 of A14J19. Set the DVM to 10 V dc range with 10 mV resolution.
2. Copy the bias voltages printed on the A8 Dual Band Mixer label into Table 2-12.
3. On the HP 8563A, place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR ENA position. Press (PRESET) (SPAN) ZERO SPAN (FREQUENCY) 3 (GHz). Press (CAL) MORE 1 OF 2 SERVICE CAL DATA and MIXER BIAS. The current mixer bias DAC value for Band 1 should appear in the active function area on the display.

4. Adjust the DAC value, using only the front-panel knob or keypad, for a DVM reading within 50 mV of the Band 1 mixer bias voltage listed in Table 2-12.
5. Press (FREQUENCY) 8 (GHz). Press (CAL) MORE 1 OF 2 SERVICE CAL DATA and MIXER BIAS. The current mixer bias DAC value for Band 2 should appear in the active function area on the display.
6. Adjust the DAC value, using only the front-panel knob or keypad, for a DVM reading within 50 mV of the Band 2 mixer bias voltage listed in Table 2-12.
7. Press (FREQUENCY) 15 (GHz). Press (CAL) MORE 1 OF 2 SERVICE CAL DATA and MIXER BIAS. The current mixer bias DAC value for Band 3 should appear in the active function area on the display.
8. Adjust the DAC value, using only the front-panel knob or keypad, for a DVM reading within 50 mV of the Band 3 mixer bias voltage listed in Table 2-12.
9. Press (FREQUENCY) 20 (GHz). Press (CAL) MORE 1 OF 2 SERVICE CAL DATA and MIXER BIAS. The current mixer bias DAC value for Band 4 should appear in the active function area on the display.
10. Adjust the DAC value, using only the front-panel knob or keypad, for a DVM reading within 50 mV of the Band 4 mixer bias voltage listed in Table 2-12.
11. On the HP 8563A, press STORE DATA and YES.
12. Place the WR PROT/WR ENA jumper on the A2 Controller assembly to the WR PROT position.

Table 2-12. A8 Bias Voltage

Band	Bias Voltage
1	_____
2	_____
3	_____
4	_____

9. Frequency Response Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

Displayed Average Noise Level
Frequency Response

Description

A signal of the same known amplitude is applied to the spectrum analyzer at several *different* frequencies. At each frequency, the DAC controlling the flatness compensation amplifiers is adjusted to place the peak of the displayed signal at the same place on the screen. The preselector is centered at each frequency before setting the DAC value. The DAC values are stored in EEROM.

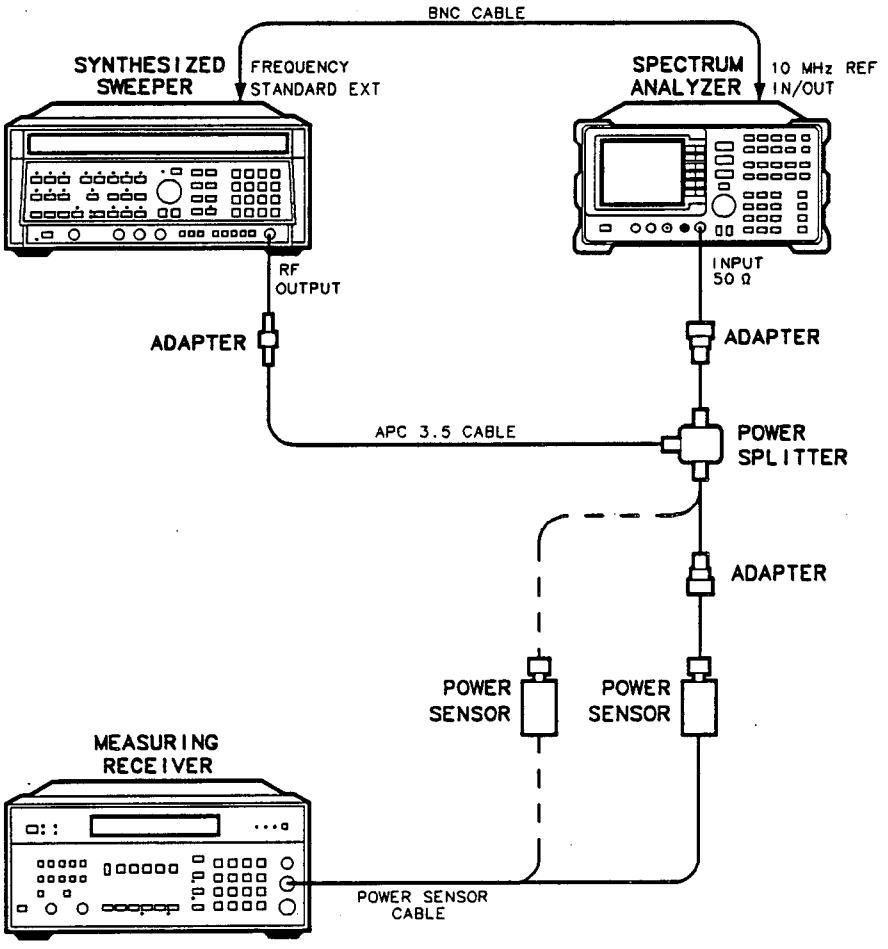


Figure 2-11. Frequency Response Adjustment Setup

Equipment

Synthesized Sweeper ..... HP 8340A/B
Measuring Receiver ..... HP 8902A
Power Sensor ..... HP 8482A
Power Sensor ..... HP 8485A
Power Splitter ..... HP 11667B

Adapters
Type N (m) to Type N (m) 1250-1475
Type N (f) to APC 3.5 (m) 1250-1750
Type APC 3.5 (f) to APC 3.5 (f) 5061-5311

Cables
BNC, 122 cm (48 in) ..... HP 10503A
APC 3.5, 91 cm (36 in) 8120-4921

Procedure

1. Connect the equipment as shown in Figure 2-11. Do not connect the HP 8482A Power Sensor to the HP 11667B Power Splitter.
2. Zero and calibrate the HP 8902A/HP 8482A combination in log mode (power levels read out in dBm) and connect the power sensor through an adapter to the power splitter.
3. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR ENA position.
4. Press [PRESET] on the HP 8563A and set the controls as follows:

   CENTER FREQ ..... 10 MHz
   SPAN ..... 0 Hz
   RES BW ..... 300 kHz
   dB/DIV ..... 2 dB

5. Press [INSTR PRESET] on the HP 8340A/B and set the controls as follows:

   CW ..... 10 MHz
   POWER LEVEL ..... −4 dBm

6. On the HP 8563A, press [MKR] [CAL] MORE 1 OF 2 SERVICE CAL DATA, then FLATNESS. The current value of the RF Gain DAC should be displayed in the active function area.
7. Enter the appropriate Power Sensor Calibration factor into the HP 8902A.
8. Set the HP 8340A/B [CW] output to the frequency indicated in the active function area of the HP 8563A display. Adjust the HP 8340A/B POWER LEVEL for a −10 dBm reading on the HP 8902A.
9. On the HP 8563A, adjust the RF Gain DAC value using the front-panel knob or keypad until the marker reads −10 dBm ±0.10 dB.
10. On the HP 8563A, press [▲] to proceed to the next frequency.
11. Repeat steps 7 through 10 for all low band frequencies (Band 0).
12. Press NEXT BAND on the HP 8563A.

13. Disconnect the HP 8482A and its adapter from the HP 11667B. Connect the HP 8485A to the HP 8902A. Zero and calibrate the HP 8902A/HP 8485A combination. Connect the HP 8485A to the HP 11667B Power Splitter.
14. Enter the appropriate power sensor calibration factor into the HP 8902A.
15. Set the HP 8340A/B (CW) output to the frequency indicated in the active function area of the HP 8563A display.
16. Adjust the HP 8340A/B POWER LEVEL to place the signal midscreen on the HP 8563A display.
17. On the HP 8563A, press PRESEL AUTO CTR.
18. On the HP 8563A, press FLATNESS DATA.
19. Adjust the HP 8340A/B POWER LEVEL for a −10 dBm reading on the HP 8902A.
20. On the HP 8563A, adjust the RF gain DAC value using the knob or keypad until the marker reads −10 dBm ±0.10 dB.
21. On the HP 8563A, press (▲) to proceed to the next frequency.
22. Repeat steps 14 through 21 for the remaining frequencies in Band 1.
23. On the HP 8563A, press (NEXT BAND) to proceed to Band 2.
24. Repeat steps 15 through 21 for the remaining frequencies in Band 2.
25. On the HP 8563A, press (NEXT BAND) to proceed to Band 3.
26. Repeat steps 15 through 21 for the remaining frequencies in Band 3.
27. On the HP 8563A, press (NEXT BAND) to proceed to Band 4.
28. Repeat steps 15 through 21 for the remaining frequencies in Band 4.
29. Press PREV MENU STORE DATA, then YES on the HP 8563A.
30. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR PROT position.

10. Calibrator Amplitude Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

Calibrator Amplitude and Frequency Accuracy

Description

The CAL OUTPUT amplitude is adjusted for −10.00 dBm measured directly at the front panel CAL OUTPUT connector.

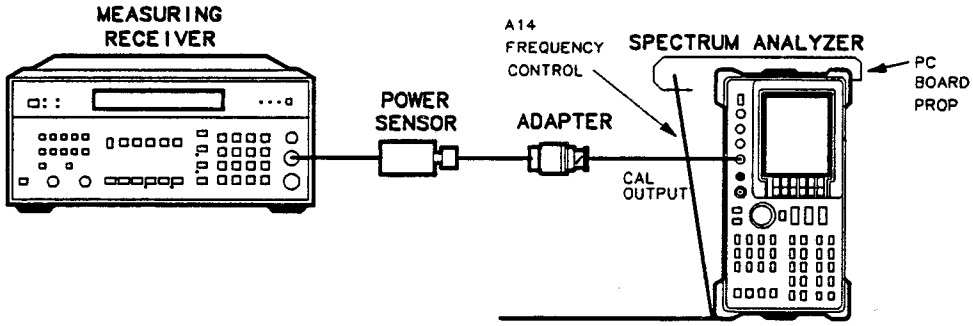


Figure 2-12. Calibrator Amplitude Adjustment Setup

Equipment

Measuring Receiver	HP 8902A
Power Sensor	HP 8482A

Adapters

Type N (f) to BNC (m)	1250-1477

Procedure

Note

The HP 8563A should be allowed to warm up for at least 30 minutes before performing this adjustment.

1. Place the HP 8563A in the service position shown in Figure 2-12. Prop the A14 Frequency Control Board assembly in the service position.
2. Zero and calibrate the HP 8902A/HP 8482A combination in log display mode. Enter the power sensor 300 MHz Cal Factor into the HP 8902A.
3. Connect the HP 8482A through an adapter directly to the HP 8563A CAL OUTPUT connector.

4. Adjust A15R561 CAL AMPTD for a −10.00 dBm reading on the HP 8902A display.

11. 10 MHz Reference Adjustment—OCXO

Assembly Adjusted

A21 OCXO Assembly

Note

Replacement oscillators are factory adjusted after a complete warmup and after the specified aging rate has been achieved. Thus, readjustment should typically not be necessary after oscillator replacement and is generally not recommended.

Related Performance Test

10 MHz Reference Accuracy

Description

The 10 MHz frequency reference level is compared with 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 A21 10 MHz OCXO (ovenized crystal oscillator). OCXO stability is determined by the characteristics of the particular oscillator, the environmental conditions, and warm-up conditions to which it was recently exposed. The spectrum analyzer must be on continuously for at least 24 hours immediately prior to oscillator adjustment. During this time, the spectrum analyzer must not be set to external frequency reference, because this setting interrupts power to the OCXO. This warm-up time allows the oscillator temperature and frequency to stabilize.

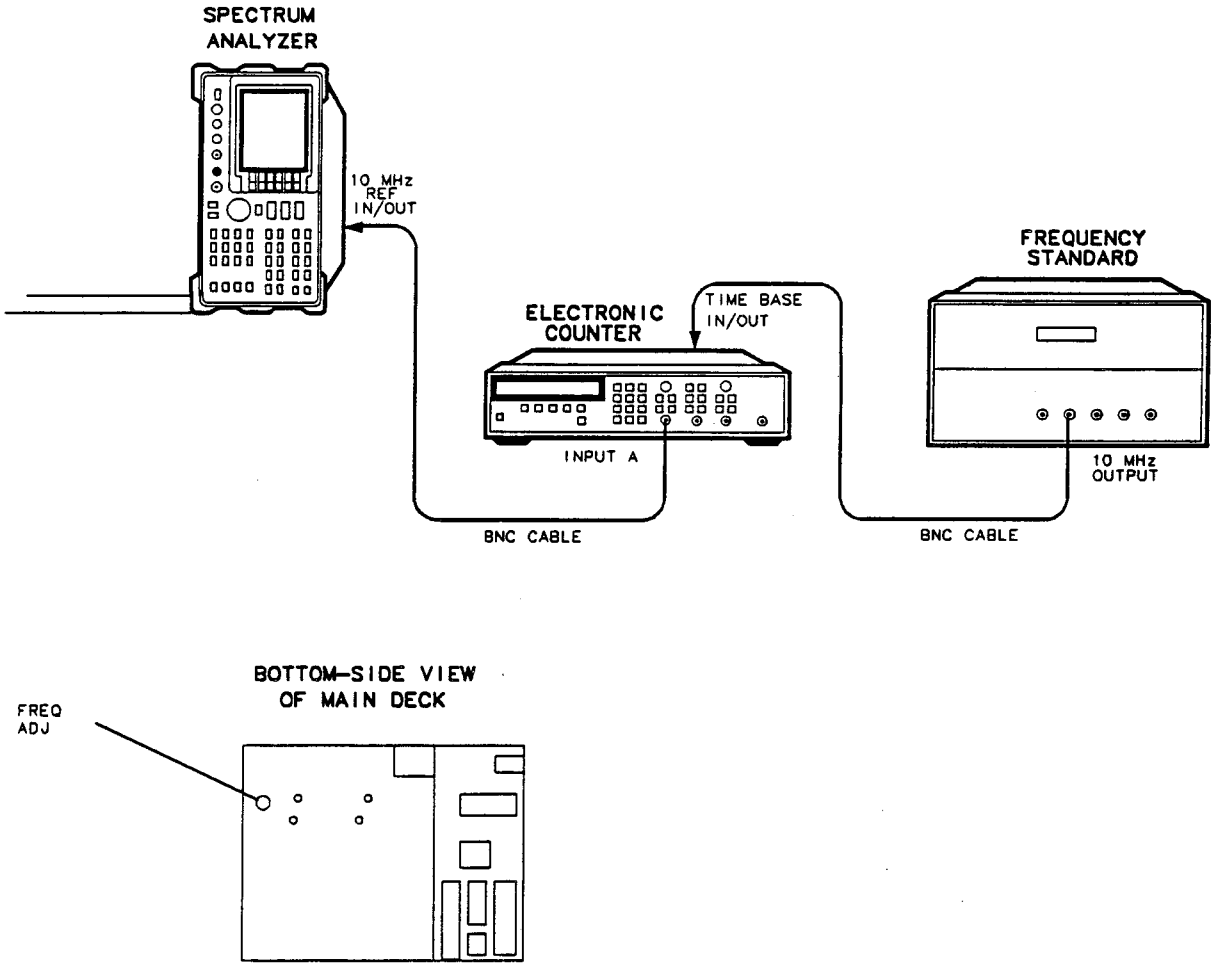


Figure 2-13. 10 MHz Reference Adjustment Setup and Adjustment Location

Equipment

Frequency Counter ..... HP 5334A/B
Frequency Standard HP 5061B Cesium Beam Standard (or any 10 MHz frequency standard with aging rate $<\pm 1 \times 10^{-10}$ per day)

Cable
BNC, 122 cm *(2 required)* ..... HP 10503A

Procedure

Note

Failure to allow a 24 hour minimum warm-up time for OCXO frequency and temperature stabilization may result in oscillator misadjustment.

11. 10 MHz Reference Adjustment—OCXO

1. Connect equipment as shown in Figure 2-13 as follows:
   a. Set the [LINE] switch of the spectrum analyzer to on. After the automatic power-on adjustment sequence is complete, press [PRESET] to ensure that the frequency reference is set to internal.
   b. Allow the spectrum analyzer to remain powered on continuously for at least 24 hours to ensure that the A21 OCXO temperature and frequency stabilize.

Note

If the reference is set to `10 MHz EXT`, press `10 MHz INT`. Allow the 24 hour warm-up for the OCXO before continuing. When the 10 MHz reference is set to `10 MHz EXT`, the OCXO is not operating or warmed up.

   c. Connect the frequency standard to the frequency counter rear panel TIMEBASE IN/OUT connector.
   d. Connect a BNC cable between the spectrum analyzer rear panel 10 MHz REF IN/OUT connector and INPUT A on the frequency counter.
2. Set the frequency counter controls as follows:

FUNCTION/DATA	FREQ A
INPUT	A:
×10 ATTN	OFF
AC	OFF (DC coupled)
50ΩZ	OFF (1 MΩ input impedance)
AUTO TRIG	ON
100 kHz FILTER A	OFF
INT/EXT switch (rear panel)	EXT

3. Select a 1 second gate time on the HP 5334A/B Frequency Counter by pressing [GATE TIME] 1 [GATE TIME].
4. To offset the displayed frequency by −10.0 MHz, press MATH [SELECT/ENTER] [CHX/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 and 10.0 MHz with a displayed resolution of 0.010 Hz (10 mHz).
5. Locate the FREQ ADJ control on the HP 8563A. This control is accessible through the center deck of the spectrum analyzer. See Figure 2-13.
6. Remove the dust-cap screw.
7. Use a nonconductive adjustment tool to adjust the FREQ ADJ control on the A21 OCXO for a frequency counter reading of 0.00 Hz.
8. On the HP 5334A/B 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).
9. Wait at least two gate periods for the frequency counter to stabilize, then adjust the FREQ ADJ control on A21 OCXO for a stable frequency counter reading of 0.000 Hz ±0.010 Hz.
10. Replace the dust-cap screw to A21 OCXO.

12. 10 MHz Reference Adjustment—TCXO (Option 103 only)

Assembly Adjusted

A15 RF Assembly

Related Performance Test

10 MHz Reference Output Accuracy (Option 103)

Description

The frequency counter is connected to the analyzer CAL OUTPUT. The CAL OUTPUT is locked to the 10 MHz frequency reference which yields better effective resolution. The temperature-compensated crystal oscillator (TCXO) is adjusted for a frequency counter reading of 300 MHz.

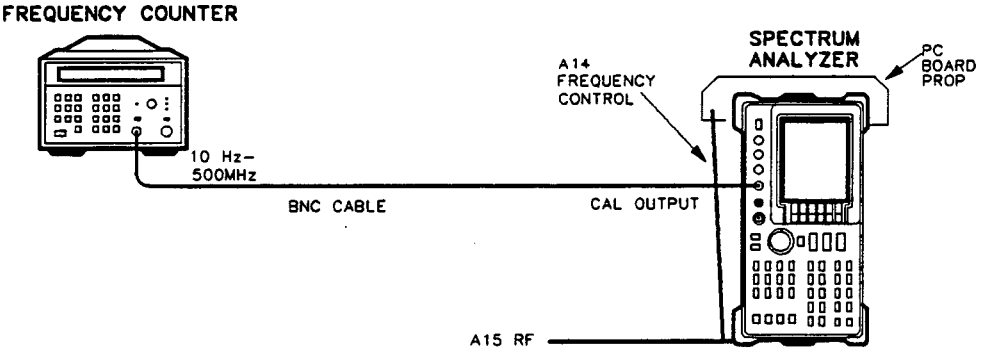


Figure 2-14. 10 MHz Reference Adjustment Setup—TCXO

Equipment

Microwave Frequency Counter ..... HP 5343A Option 001

Cables

BNC, 122 cm (48 in) ..... HP 10503A

Procedure

Note Allow the HP 8563A to warm up for at least 30 minutes before performing this adjustment.

1. Connect the equipment as shown in Figure 2-14. Prop up the A14 Frequency Control assembly.

2. Set the HP 5343A controls as follows:

SAMPLE RATE	Midrange
50Ω—1 MΩ SWITCH	50Ω
10 Hz—500 MHz/500 MHz—26.5 GHz SWITCH	10 Hz—500 MHz

3. Press (AUX CTRL) REAR PANEL. Verify that the 10 MHz reference is set to 10 MHz INT.

Note

If the reference is set to 10 MHz EXT, press 10 MHz INT. Allow the 30 minute warm-up for the TCXO before continuing. When the 10 MHz reference is set to 10 MHz EXT, the TCXO is not operating or warmed up.

4. Locate the dust cap to A15U302, TCXO toward the rear of the analyzer and remove it.
5. Adjust 10 MHz ADJ on A15U302 for a frequency counter reading of 300.000000 MHz ±30 Hz.
6. Replace the dust cap to A15U302.

13. Demodulator Adjustment

Assembly Adjusted

A4 Log Amplifier Assembly

Related Performance Test

There are no related performance tests for this adjustment procedure.

Description

A 5 kHz peak-deviation FM signal is applied to the INPUT 50Ω. The detected audio is monitored by an oscilloscope. FM DEMOD is adjusted to peak the response displayed on the oscilloscope.

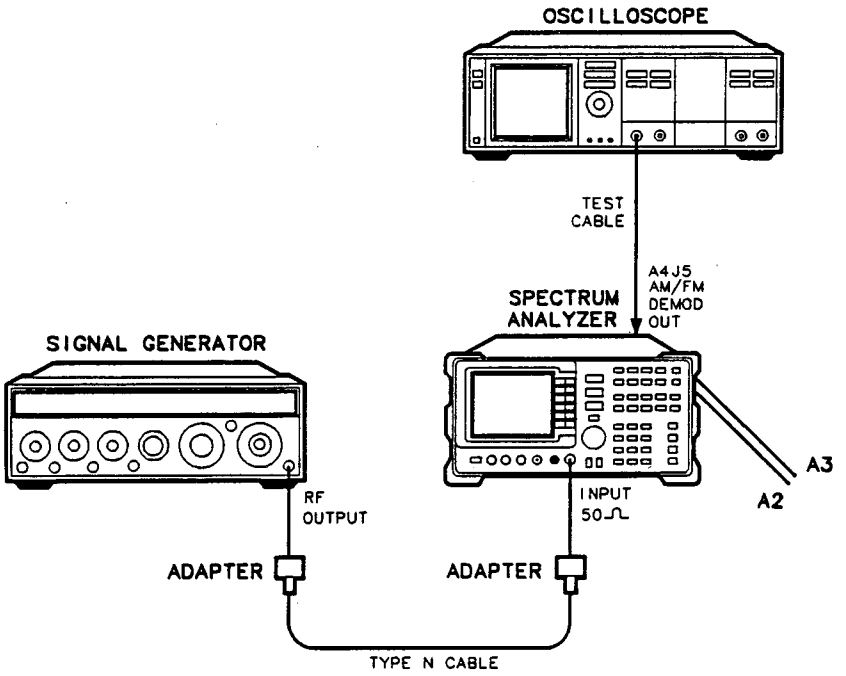


Figure 2-15. Demodulator Adjustment Setup

Equipment

AM/FM Signal Generator	HP 8640B
Oscilloscope	HP 1980A/B

Adapters

Type N (m) to BNC (f) *(2 required)*	1250-1476
Type N (f) to APC 3.5 (f) *(Option 026 only)*	1250-1745

Cables

BNC, 122 cm (48 in) ..... HP 10503A
Test Cable 85680-60093

Procedure

1. Set the HP 8563A [LINE] switch off. Place the analyzer in the service position as illustrated in Figure 2-15. Disconnect W28 from A4J5.
2. Connect the test cable from the oscilloscope Channel 1 input to A4J5. Set the HP 8563A [LINE] switch on. Connect the HP 8640B RF OUTPUT to the HP 8563A INPUT 50Ω.
3. Set the HP 8640B controls as follows:

   RANGE MHz 61-128
   FREQUENCY ..... 100.000 MHz
   OUTPUT LEVEL ..... −10 dBm
   RF ..... ON
   AM ..... OFF
   FM ..... INT
   MODULATION FREQUENCY ..... 1000 Hz
   PEAK DEVIATION ..... 5 kHz
   SCALE FM .....(k/MHz)

4. Adjust the HP 8640B FM Deviation vernier for a full-scale reading on the meter. Set the FM to off.
5. Set the HP 1980A/B controls as follows:

   CH 1 ..... ON
   CH 2 ..... OFF
   CH 1 VOLTS/DIV .....50 mV
   TIMEBASE .....MAIN
   CH A COUPLING ..... AC
   SECS/DIV .....1.00 ms/DIV
   TRIGGER .....INT
   HF REJ..... ON
   TRIGGER COUPLING..... AC

6. On the HP 8563A, press [PRESET] and set the controls as follows:

   CENTER FREQ .....100 MHz
   SPAN .....5 MHz
   REF LVL ..... −10 dBm
   RES BW ..... 100 kHz

7. On the HP 8563A, press [PEAK SEARCH] MARKER ▶ CF. Press [SPAN] ZERO SPAN, then [AUX CTRL] AM/FM DEMOD FM DEMOD ON [TRIG] and SINGLE.
8. Set the FM to INT on the HP 8640B.
9. A 1 kHz sine wave should be observed on the oscilloscope.
10. Adjust A4C853 FM DEMOD for a maximum peak-to-peak response on the oscilloscope.

Note



It is possible to do this procedure without an oscilloscope by adjusting A4C853 FM DEMOD for the loudest audio tone from the internal speaker. This adjustment method may give broader and less accurate results than when using the oscilloscope to peak the response.

11. Set the HP 8563A (LINE) switch to off. Disconnect the test cable from A4J5 and reconnect W28 to A4J5.

14. External Mixer Bias Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

There are no related performance tests for this adjustment procedure.

Description

A voltmeter is connected to the HP 8563A IF INPUT with the external mixer bias set to off. The bias is adjusted for a 0 V dc output.

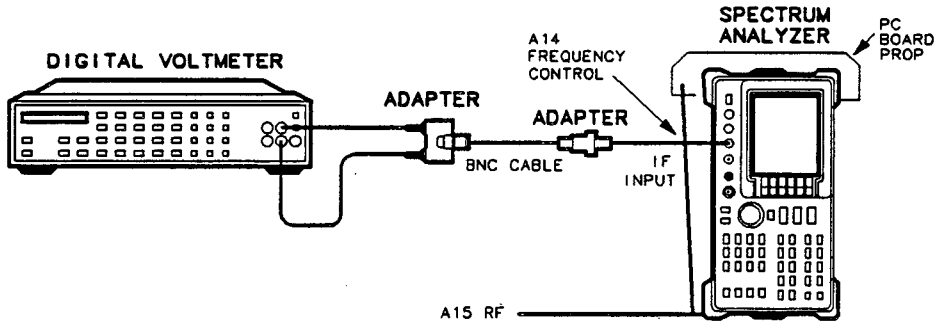


Figure 2-16. External Mixer Bias Adjustment Setup

Equipment

DVM ..... HP 3456A

Adapters

Type BNC (f) to SMA (m) 1250-1200
Type BNC (f) to dual banana plug 1251-2816

Cables

BNC, 122 cm (48 in) ..... HP 10503A

Procedure

1. Set the HP 8563A (LINE) switch off and disconnect the ac power cord. Remove the analyzer cover and connect the equipment as illustrated in Figure 2-16. Reconnect the power cord and set the (LINE) switch on.
2. Set the HP 3456A controls as follows:

   FUNCTION ..... DC VOLTS
   RANGE ..... 0.1 V
   RESOLUTION ..... 100 mV

3. On the HP 8563A press (AUX CTRL) EXTERNAL MIXER BIAS, then BIAS OFF.

4. Adjust A15R926 EXT BIAS ZERO for a DVM reading of 0.000 V dc ±12.5 mV.

15. External Mixer Amplitude Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

IF Input Amplitude Accuracy

Description

The slope of the flatness compensation amplifiers is determined. The user-loaded conversion losses for K-band are recorded and reset to 30 dB. A 310.7 MHz signal is applied to the power sensor and the power level of the source is adjusted for a −30 dBm reading. The signal is then applied to the IF INPUT. The flatness compensation amplifiers are then adjusted (via DACs) to place the displayed signal at the reference level.

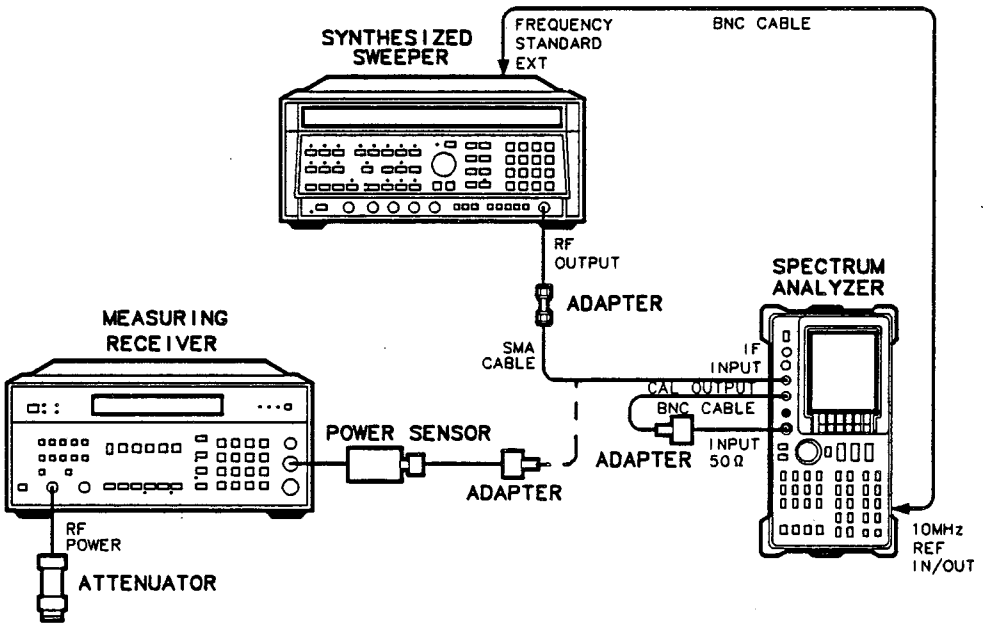


Figure 2-17. External Mixer Amplitude Adjustment Setup

Equipment

Synthesized Sweeper	HP 8340A/B
Measuring Receiver	HP 8902A
Power Sensor	HP 8484A
50 MHz Reference Attenuator *(supplied with HP 8484A)*	HP 11708A

Adapters

Type N (f) to SMA (f) 1250-1772
Type N (m) to BNC (f) 1250-1476
Type N (f) to APC 3.5 (f) *(Option 026 only)* 1250-1745
Type APC 3.5 (f) to APC 3.5 (f) 5061-5311

Cables

BNC, 122 cm (48 in) ..... HP 10503A
SMA, 61 cm (24 in) 8120-1578

Procedure

1. Set the HP 8563A [LINE] switch off and disconnect the power cord. Remove the analyzer cover and reconnect the power cord.
2. Set up the equipment as illustrated in Figure 2-17. Do not connect the SMA cable to the HP 8563A.
3. Move the WR PROT/WR ENA jumper on the A2 Controller assembly to the WR ENA position. Set the HP 8563A [LINE] switch on.
4. On the HP 8563A, press [AUX CTRL] EXTERNAL MIXER AMPTD CORRECT, then CNV LOSS VS FREQ.
5. Press [▲] or [▼] to display the conversion loss value for each frequency listed in Table 2-13. Record any conversion loss reading *not equal* to 30 dB in Table 2-13 at the appropriate frequency.
6. If all conversion loss values equal 30 dB, skip to step 7, otherwise continue to step a.
   a. Refer to Table 2-13 and press [▲] or [▼] to select a frequency at which the conversion loss value does not equal 30 dB.
   b. Use the analyzer front-panel keys to set the conversion loss value to 30 dB.
   c. Repeat steps a and b for all frequencies having a conversion loss value other than 30 dB.
7. Press [INSTR PRESET] on the HP 8340A/B and set the controls as follows:

   CW ..... 310.7 MHz
   POWER LEVEL ..... −30 dBm

Table 2-13. Conversion Loss Data

Frequency (GHz)	Conversion Loss (dB) (≠30 dB)
18	
20	
22	
24	
26	
27	

8. Zero and calibrate the HP 8902A/HP 8484A combination in log mode. Enter the power sensor 50 MHz Cal Factor into the HP 8902A. Connect the power sensor, through an adapter, to the SMA cable.
9. Adjust the HP 8340A (POWER LEVEL) until the power displayed on the HP 8902A reads −30 dBm ±0.05 dB.
10. Disconnect the SMA cable from the power-sensor/adapter and connect the cable to the HP 8563A IF INPUT.
11. On the HP 8563A, press (CAL) MORE 1 OF 2 SERVICE CAL DATA 3RD IF AMP, then CAL 3RD AMP GAIN.
12. Wait until the message ADJUSTMENT-DONE appears in the active function block and press EXT MXR REF CAL.
13. Use the HP 8563A front-panel knob, step keys, or keypad to change the amplitude of the displayed signal until the marker reads 0 dBm ±0.17 dB.
14. Press PREV MENU STORE DATA and YES on the HP 8563A.
15. Place the WR PROT/ WR ENA jumper on the A2 Controller assembly in the WR PROT position.

Note The following steps should only be performed if you need to replace the 30 dB conversion loss values to those recorded in Table 2-13.

---

16. Press (AUX CTRL) EXTERNAL MIXER AMPTD CORRECT, then CNV LOSS VS FREQ on the HP 8563A.
17. Press (▲) or (▼) to select frequencies where the conversion loss value was recorded in Table 2-13.
18. Use the analyzer front panel keys to enter the conversion loss values recorded for the frequency.

16. Second IF Gain Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

IF Input Amplitude Accuracy

Description

The gain of the Second IF (between A15J801 INT Second IF and the third mixer) is set to 12 dB.

Note This adjustment is necessary after replacing either A15A1 Second IF Amplifier or A15U802 Second IF pad.

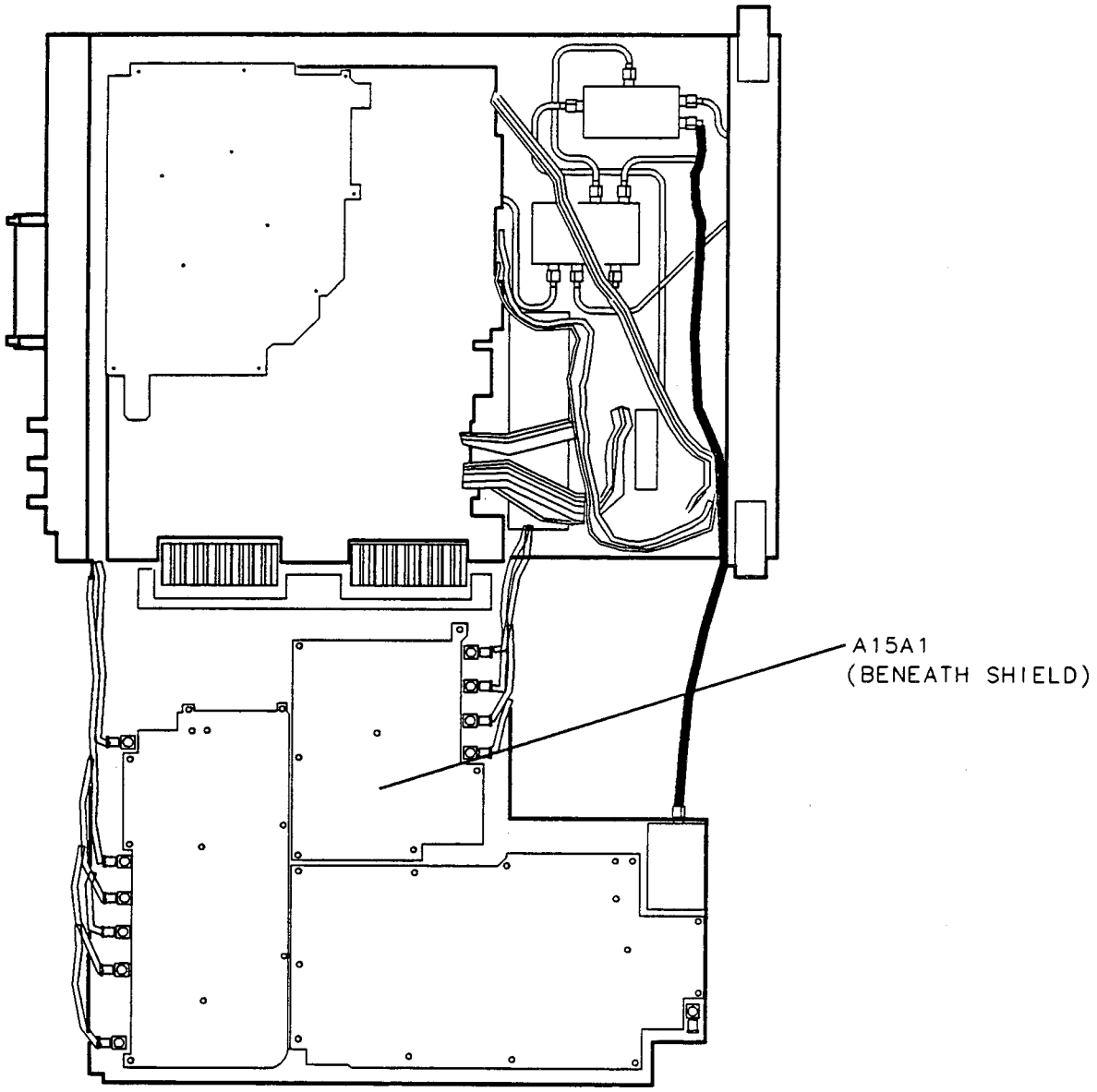


Figure 2-18. Location of A15A1

Equipment

No test equipment or test setup is required for this adjustment procedure.

Procedure

1. Set the HP 8563A [LINE] switch off, disconnect the power cord, and remove the analyzer cover. Fold down the A15 RF and A14 Frequency Control assemblies. Prop up the A14 Frequency Control assembly.
2. Remove the shield covering the third converter and A15A1 Second IF Amplifier. See Figure 2-18.

3. Read the gain printed on the A15A1 Second IF Amplifier label. Select a value for A15U802 from Table 2-14 based upon the gain of the Second IF Amplifier.
4. Reinstall the shield on the A15 assembly.
5. Perform the External Mixer Amplitude Adjustment.

Note

If the second IF input switch is repaired, there might be insufficient range in the External Mixer Amplitude Adjustment. If this is the case, select a new value for A15U802. Greater attenuation values of U802 will lower the signal amplitude, and lower attenuation values will increase the signal amplitude.

Table 2-14. A15U802 Values

Second IF Amplifier Gain Range (dB)	U802 Value (dB)	Second IFA Pad Part Number
13.1 to 14.2	1	0955-0308
14.3 to 15.2	2	0955-0309
15.3 to 16.2	3	0955-0310
16.3 to 17.2	4	0955-0311
17.3 to 18.2	5	0955-0312
18.3 to 19.2	6	0955-0313
19.3 to 20.2	7	0955-0314

17. SIG ID Oscillator Adjustment

Assembly Adjusted

A15 RF Assembly

Related Performance Test

There are no related performance tests for this adjustment procedure.

Description

The frequency range of the 298 MHz SIG ID Oscillator is determined by counting the 10.7 MHz IF as A15C629 is rotated through its range of adjustment. The SIG ID Oscillator is then set to the frequency determined by the following equation:

$$\text{Oscillator frequency} = 298\ \text{MHz} - \left(\frac{\text{Oscillator frequency range}}{4}\right)$$

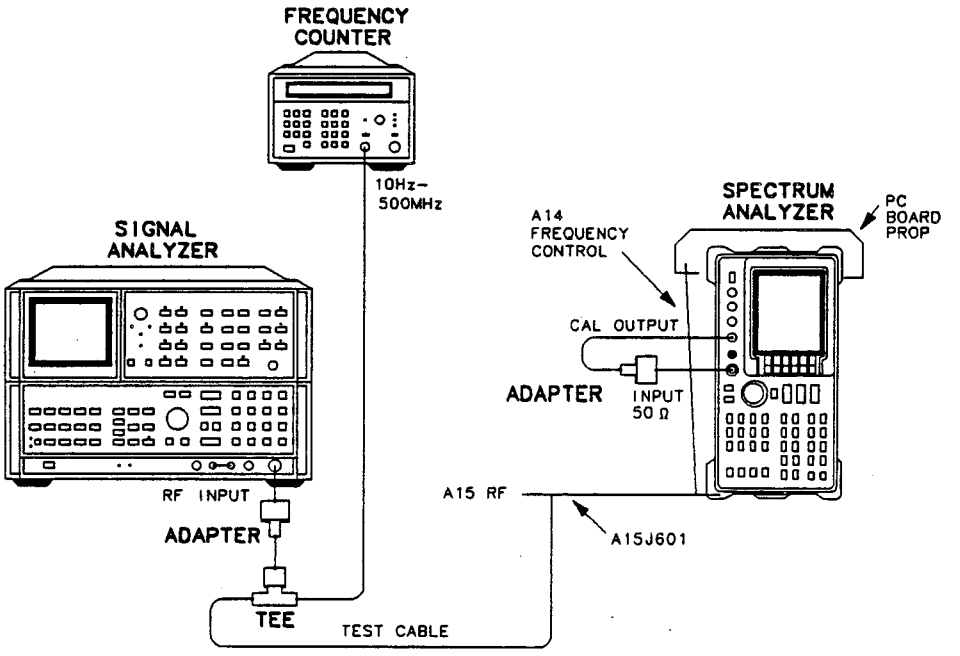


Figure 2-19. Signal ID Oscillator Adjustment Setup

Equipment

Microwave Frequency Counter ..... HP 5343A
Spectrum Analyzer ..... HP 8566A/B

Adapters
Type N (m) to BNC (f) *(2 required)* 1250-1476
BNC Tee (f, m, f) 1250-0781

Cables

BNC, 122 cm (48 in) *(2 required)* ..... HP 10503A
Test Cable, BNC (m) to SMB (f) 85680-60093

Procedure

1. Set the HP 8563A [LINE] switch off, disconnect the power cord, and remove the analyzer cover. Fold down the A15 RF and A14 Frequency Control assemblies. Prop up the A14 Frequency Control assembly.
2. Connect the HP 8563A CAL OUTPUT to the INPUT 50Ω using an adapter. Disconnect the W29 cable from A15J601 (10.7 MHz IF out) and connect the SMB end of the test cable to A15J601. Connect the rest of the equipment as shown in Figure 2-19.
3. Reconnect the power cord and set the [LINE] switch on. After the power-on sequence is complete, set the HP 8563A controls as follows:

   CENTER FREQ .....300 MHz
   SPAN ..... 0 Hz

4. Press [AUX CTRL] INTERNAL MIXER SIG ID ON SGL SWP.
5. Press [INSTR PRESET] on the HP 8566A/B and set the controls as follows:

   CENTER FREQUENCY ..... 10.7 MHz
   FREQUENCY SPAN ..... 200 kHz

6. Set the HP 5343A controls as follows:

   SAMPLE RATE ..... Fully Counterclockwise
   50 Ω—1 MΩ SWITCH ..... 50 Ω
   10 Hz—500 MHz/500 MHz—26.5 GHz SWITCH .....10 Hz—500 MHz

7. If no signal is displayed on the HP 8566A/B, adjust A15C629 SIG ID until a signal is displayed.

Note If the 298 MHz SIG ID oscillator is severely mistuned, it might be necessary to widen the span on the HP 8566A/B to see the shifted sweep.

---

8. Rotate A15C629 SIG ID slightly while observing the HP 8566A/B display. If the displayed signal frequency does not change, press SGL SWP on the HP 8563A.

17. SIG ID Oscillator Adjustment

9. While observing the HP 8566A/B display, adjust A15C629 SIG ID for the highest obtainable frequency with less than 3 dB decrease in amplitude from maximum. Read this frequency from the frequency counter and record as $F_{3\ dB\ HIGH}$.

$F_{3\ dB\ HIGH}$ = _____ Hz

10. Observe the HP 8566A/B display as you adjust A15C629 SIG ID for the lowest obtainable frequency with less than 3 dB decrease in amplitude from maximum. Record the frequency counter reading as $F_{3\ dB\ LOW}$.

$F_{3\ dB\ LOW}$ = _____ MHz

11. Calculate the difference between $F_{3\ dB\ HIGH}$ and $F_{3\ dB\ LOW}$, then divide results by four. Enter the result as F_{OFFSET}.

F_{OFFSET} = _____ kHz

12. Add F_{OFFSET} to $F_{3\ dB\ LOW}$ recorded in step 10 and record the result as F_{SIGID}.

F_{SIGID} = _____ MHz

13. Adjust A15C629 for a frequency counter reading equaling F_{SIGID}. The final adjusted frequency must equal 10.7 MHz ±50 kHz.

18. YTF Adjustment

Assembly Adjusted

A14 Frequency Control Assembly

Related Performance Test

Image, Multiple, and Out-of-Band Responses
Second Harmonic Distortion
Frequency Response

Description

The slope and offset of the A12 YTF tuning voltage are set by DACs on the A14 Frequency Control assembly. The offset DAC value is optimized at a low frequency and the slope DAC value is optimized at a high frequency.

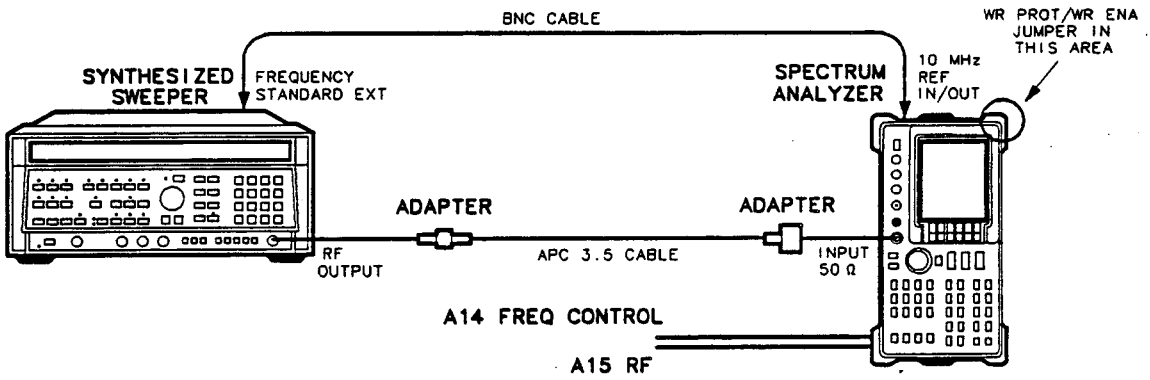


Figure 2-20. YTF Adjustment Setup

Equipment

Synthesized Sweeper ..... HP 8340A/B

Adapters
Type N (m) to APC 3.5 (f) 1250-1744
Type APC 3.5 (f) to APC 3.5 (f) 5061-5311

Cables
APC 3.5, 91 cm (36 in) 8120-4921

Procedure

1. Set the HP 8563A (LINE) switch off and disconnect the line cord. Remove the analyzer cover and connect the line cord. Connect the equipment as illustrated in Figure 2-20. Set the (LINE) switch on.
2. Move the WR PROT/WR ENA jumper on the A2 Controller assembly to the WR ENA position.
3. Press (PRESET) on the HP 8563A and set the controls as follows:

   CENTER FREQ ..... 5.8 GHz
   SPAN ..... 0 Hz

4. On the HP 8563A, press (CAL) `IF ADJ OFF` `MORE 1 OF 2` `SERVICE CAL DATA` `PRESEL ADJ`, then `PRESET ALL DACS`.
5. Press (INSTR PRESET) on the HP 8340A and set the controls as follows:

   CW ..... 5.8 GHz
   POWER LEVEL ..... −10 dBm
   FREQUENCY STANDARD Switch (rear panel) ..... EXT

6. Press (PRESEL OFFSET) on the HP 8563A. Use the front-panel knob to peak the displayed trace. Record the offset value below:

   Offset at 5.8 GHz = _____

7. Set the HP 8563A center frequency and the HP 8340A (CW) to 19.2 GHz.
8. On the HP 8563A, press (CAL) `MORE 1 OF 2` `SERVICE CAL DATA` `PRESEL ADJ`, then `PRESEL OFFSET`. Key in the offset value noted in step 6.
9. Press `PRESEL SLOPE` on the HP 8563A. Use the front-panel knob to peak the displayed trace. Record the slope value below:

   Slope at 19.2 GHz = _____

10. Set the HP 8563A center frequency and the HP 8340A (CW) to 5.8 GHz.
11. On the HP 8563A, press (CAL) `MORE 1 OF 2` `SERVICE CAL DATA` `PRESEL ADJ`, then `PRESEL SLOPE`. Key in the slope value noted in step 9.
12. Repeat steps 6 through 11 until both SLOPE and OFFSET are peaked. Adjust the OFFSET only at 5.8 GHz and the SLOPE only at 19.2 GHz.
13. Press (CAL) `MORE 1 OF 2` `SERVICE CAL DATA` `PRESEL ADJ`, then `PRESEL OFFSET`. Press (▲) to display `OFFSET FOR BAND #2`. Key in the offset value recorded in step 6.
14. Press `PRESEL SLOPE`, then key in the slope value noted in step 9.

    For Option 026 analyzers, skip steps 15 through 20, and perform steps 21 through 33.

15. Press (▲) on the HP 8563A until `SLOPE FOR BAND #4` is displayed. Key in slope value noted in step 9.

16. Set the HP 8563A CENTER FREQ and the HP 8340A (CW) to 20 GHz.
17. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA PRESEL ADJ, then PRESEL OFFSET. Press (▲), if necessary, until OFFSET FOR BAND #4 is displayed.
18. Use the data entry knob to peak the displayed trace.
19. Press PREV MENU STORE DATA and YES on the HP 8563A.
20. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR PROT position. Continue at step 34.
21. Set the HP 8563A, Option 026 CENTER FREQ and the HP 8340A (CW) frequency to 19.2 GHz.
22. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA PRESEL ADJ, then PRESEL OFFSET.
23. Use the data entry knob to peak the displayed trace. Record the offset value below:

    Offset at 19.2 GHz = _____
24. Set the HP 8563A, Option 026 CENTER FREQ and the HP 8340A (CW) frequency to 26.2 GHz.
25. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA PRESEL ADJ, then PRESEL OFFSET. Key in the offset value noted in step 23.
26. Press PRESEL SLOPE. Use the front panel data knob to peak the displayed trace. Record the slope value below:

    Slope at 26.2 GHz = _____
27. Set the HP 8563A, Option 026 CENTER FREQ and the HP 8340A (CW) frequency to 19.2 GHz.
28. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA PRESEL ADJ, then PRESEL SLOPE. Key in the slope value recorded in step 26.
29. Repeat steps 22 through 28 until both the slope and offset are peaked. Adjust the offset only at 19.2 GHz and the slope at 26.2 GHz.
30. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA PRESEL ADJ, then PRESEL OFFSET. Press (▲) on the HP 8563A to display OFFSET FOR BAND #3. Key in the offset value recorded in step 6.
31. Press PRESEL SLOPE. Key in the slope value noted in step 9.
32. Press PREV MENU STORE DATA and YES on the HP 8563A.
33. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR PROT position.
34. On the HP 8563A, press (RECALL) MORE 1 OF 2 FACTORY PRSEL PK (SAVE), then SAVE PRESEL PK.

3

Assembly Replacement

This chapter describes the removal and replacement of all major assemblies. The following replacement procedures are provided:

Assembly	Page
1. Analyzer Cover Assembly	3-3
2. A1 Front Frame/A18 CRT	3-4
3. A1A1 Keyboard Assembly/Front Panel Keys	3-12
4. A1A2 RPG	3-14
5. A2, A3, A4, and A5 Assemblies	3-15
6. A6 Power Supply	3-21
7. A6A1 High Voltage Assembly	3-24
8. A7 through A13 Assemblies	3-27
8a. A7 First LO Distribution Amplifier	3-30
8b. A8 Dual Band Mixer	3-31
8c. A9 Input Attenuator	3-32
8d. A10 YTF	3-33
8e. A11 YTO	3-34
8f. A12 RF Switch	3-35
8g. A13 Second Converter	3-38
9. A14 Frequency Control and A15 RF Assemblies	3-39
10. A16 CAL Oscillator/A17 CRT Display Driver	3-42
11. B1 Fan	3-44
12. BT1 Battery	3-45
13. Rear Frame/Rear Dress	3-46
14. W3 Line-Switch Cable	3-50
15. EEROM (A2U501)	3-57
16. A21 OCXO	3-59

Tools required to perform the procedures are listed in Table 3-1.

The words *right* and *left* are used throughout the replacement procedures to indicate the side of the analyzer as viewed from the front panel.

Numbers in parentheses are used throughout the replacement procedures to indicate numerical callouts on the figures.

Caution 

The spectrum analyzer contains static-sensitive components. Read the section entitled "Electrostatic Discharge" in Chapter 1.

Access to Internal Assemblies

Servicing the HP 8563A requires the removing the spectrum analyzer cover assembly and folding down six board assemblies. Four of these assemblies lay flat along the top of the analyzer and two lay flat along the bottom of the analyzer. All six assemblies are attached to the analyzer right-side frame with hinges. The assemblies fold out of the analyzer allowing access to all major assemblies. See Figure 3-1.

- To remove the analyzer cover assembly, refer to Procedure 1.
- To access the A2, A3, A4, and A5 assemblies, refer to Procedure 5.
- To access the A14 and A15 assemblies, refer to Procedure 9.

Cable Color Code

Coaxial cables and wires are identified in the procedures by reference designation, or name, followed by a color code. The code translation is identical to resistor color codes. The first number indicates the base color, the second and third numbers indicate any colored stripes. For example, W23, coax 93, indicates a white cable with an orange stripe.

Table 3-1. Required Tools

Description	HP Part Number
5/16-inch open-end wrench	8720-0015
3 mm hex (allen) wrench	8710-1366
4 mm hex (allen) wrench	8710-1164
#6 hex (allen) wrench	5020-0289
7 mm nut driver	8710-1217
3/8-inch nut driver	8720-0005
7/16-inch nut driver	8720-0006
9/16-inch nut driver (drilled out, end covered with heat-shrink tubing)	8720-0008
Small #1 Pozidrive screwdriver	8710-0899
Large #2 Pozidrive screwdriver	8710-0900
Long-nose pliers	8710-0030
Wire cutters	8710-0012
Torx-Driver Bit	8710-1898
Torx Driver	8710-1614

Procedure 1. Analyzer Cover Assembly

Removal/Replacement

1. Disconnect the ac power cord, and place the analyzer on its front panel.
2. Loosen (but do not remove) the four rear-bumper screws, using a 4-mm hex wrench. Pull the cover assembly off towards the rear of the instrument.

Caution When you replace the analyzer cover, be careful not to bind, pinch, or damage any cables.



3. When replacing the cover assembly, orient the cover air-vent holes so that they are on the bottom side of the analyzer. Attach the cover with the four screws loosened in step 2. Tighten the four screws gradually to ensure that the cover is evenly seated in the front-frame gasket groove.
4. Torque each screw to a recommended 40 or 50 inch-pounds.

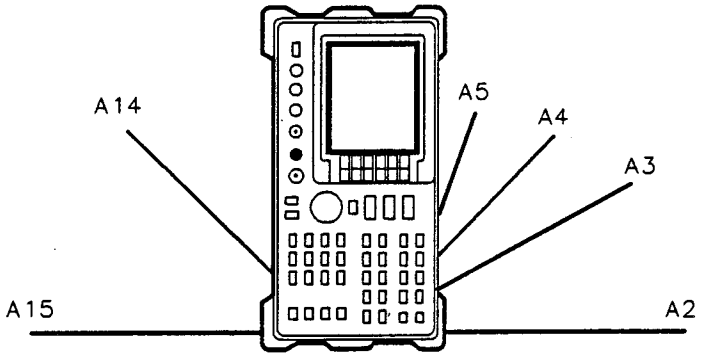


Figure 3-1. HP 8563A Hinged Assemblies

Procedure 2. A1 Front Frame/A18 CRT

Removal

Warning 

To protect you from possible contact with high voltages, disconnect the analyzer ac power cord before beginning this procedure.

1. Remove the analyzer cover assembly as described in Procedure 1.
2. Place the analyzer on its right-side frame.
3. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled on the back of the A2 board assembly.
4. Remove ribbon cable W4 from A2J6. The cable location is illustrated in Figure 3-8.

Caution 

Do not fold the board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies, and may damage an assembly and hinge.

5. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
6. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
7. Disconnect A1A1W1 from A3J602. Refer to Figure 3-2.
8. Place the analyzer top-side-up on the work bench.

Warning 

The voltage potential at A6A1W3 is +9 kV. Disconnect at the CRT with caution! Failure to discharge A6A1W3 can result in *severe electrical shock* to personnel and damage to the instrument.

9. Use a small screwdriver to discharge the post-accelerator. With the screwdriver shank in contact with the CRT shield assembly, slip the tip of the screwdriver under the A6A1W3 post-accelerator cable rubber shroud, and short the cable to ground on the CRT shield assembly as shown in Figure 3-3.
10. Pry out the black grommet that protects the A6A1W3 post-accelerator cable from the CRT shield assembly as shown in the illustration.
11. Carefully unsnap the A6A1W3 post-accelerator cable from the CRT and discharge it by shorting the cable to chassis ground on the CRT shield assembly. See Figure 3-2.
12. Place the analyzer on its right-side frame with the front-frame assembly hanging over the front edge of the work bench.
13. Fold out the A14 and A15 assemblies by removing the eight screws and washers holding the A14 and A15 assemblies to the bottom of the analyzer. These screws are identified as (1) and (2) in Figure 3-22.

Caution



The board assemblies are attached with two hinges to the analyzer right-side frame. Always fold out the A14 and A15 assemblies as a unit, not individually. Folding out one assembly at a time binds the hinges attaching the assemblies, and can damage an assembly or its hinge.

Caution



The washers are not captive. Once the assembly screws are removed, the washers can fall into the instrument. Any loose washers in the instrument can cause internal damage. Be sure to account for all washers when assemblies are replaced.

Warning



The voltage potential at A6A1W3 is +9 kV. Disconnect the analyzer ac power cord before performing this procedure. Failure to discharge A6A1W3 correctly can result in *severe electrical shock* to personnel and damage to the instrument.

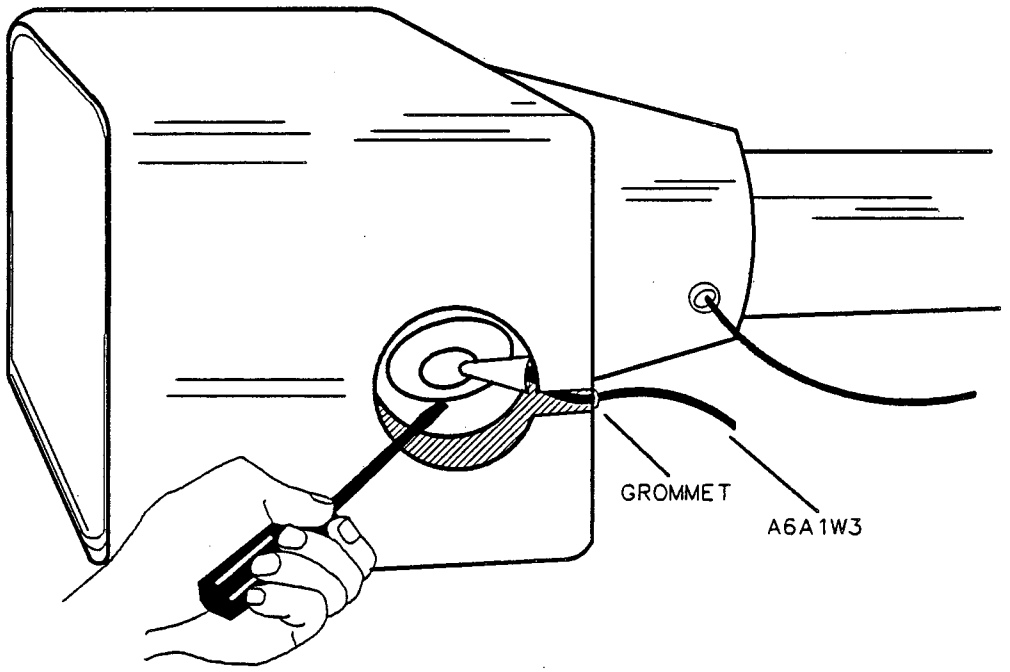


Figure 3-2. Grounding the A6A1W3 Post-Accelerator Cable

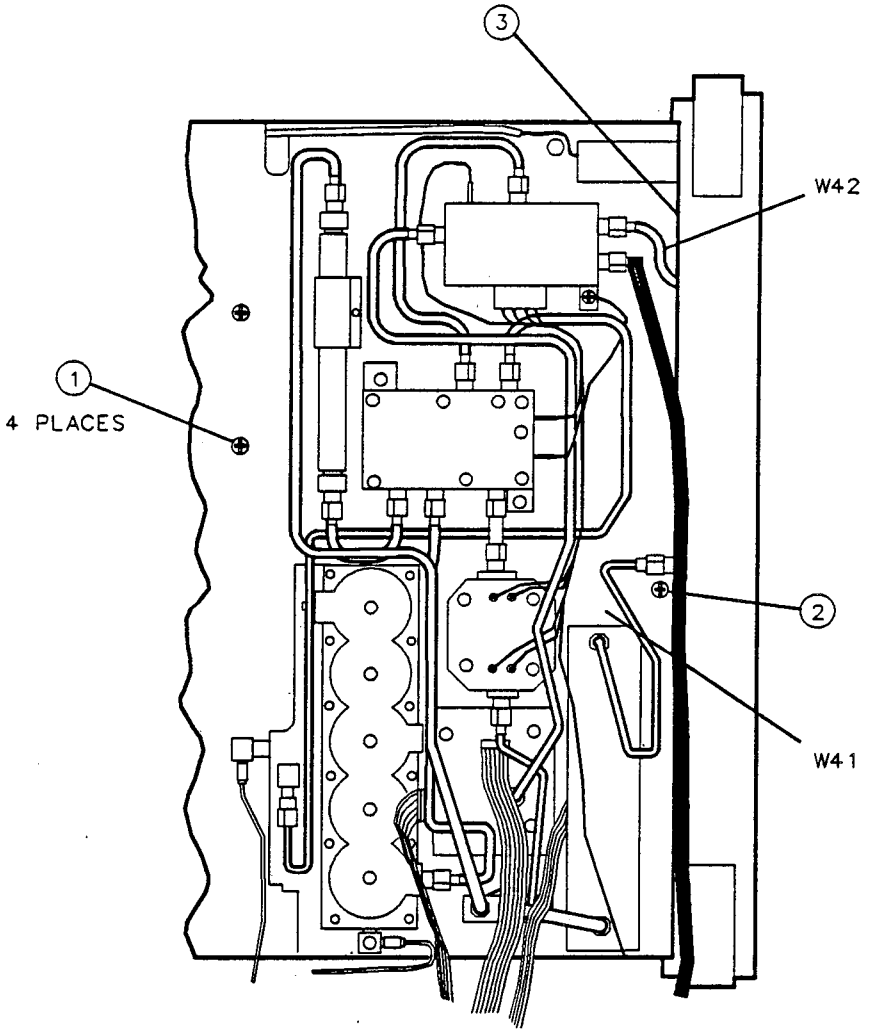


Figure 3-3. A9, A18, and Line-Switch Assembly Mounting Screws

14. Remove the screw (2) securing the A9 Input Attenuator assembly to the center support on the front frame. See Figure 3-3.
15. Use a 5/16-inch open-end wrench to disconnect W41 from the front-panel INPUT 50Ω connector. Loosen the opposite end of W41.
16. Disconnect W42 from A7J3 and the front-panel 1ST LO OUTPUT connector.
17. Disconnect W36, coax 86, from the front-panel IF INPUT connector.
18. Remove the VOLUME knob and potentiometer from the front-panel. If necessary, drill out the 5/16-inch nut driver used to remove the VOLUME potentiometer. Cover the nut-driver tip with heat-shrink tubing or tape to avoid scratching the enameled front panel.
19. Use a 9/16-inch deep-socket nut driver to remove the dress nut holding the front-panel CAL OUTPUT connector to the front panel. If necessary, drill out the 9/16-inch nut driver to fit over the BNC connectors. Cover the nut-driver tip with heat-shrink tubing or tape to avoid scratching the enameled front panel.
20. Remove screw (3) securing the line-switch assembly to the front frame.

21. Gently remove the line-switch assembly, using caution to avoid damaging A1W1 and the power indicator LED A1W1DS1.
22. Remove A1W1 and A1W1DS1 from the line switch assembly.
23. Remove the three screws (1) securing the front frame to the analyzer right-side frame. See Figure 3-4.

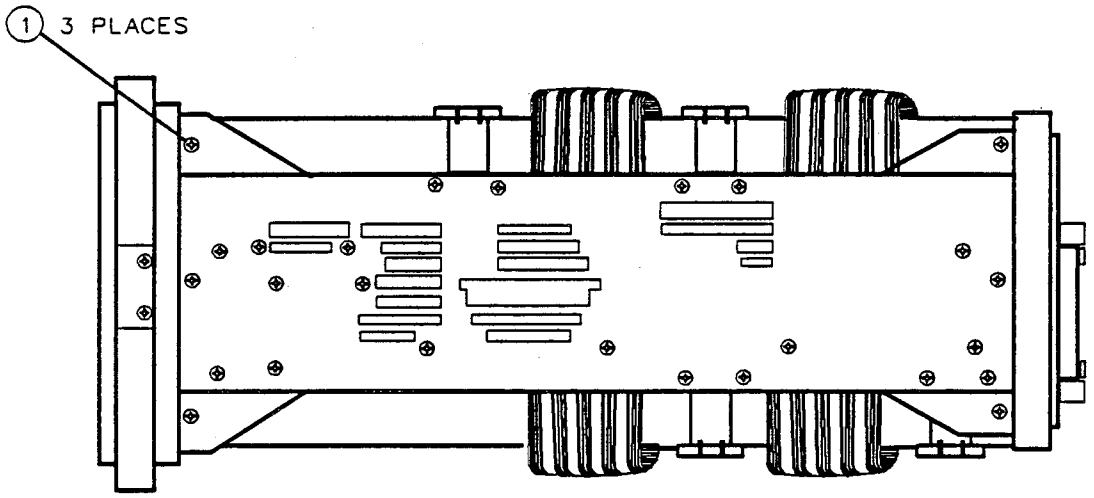


Figure 3-4. Front-Frame Mounting Screws

24. Remove the three screws securing the front frame to the analyzer left-side frame.
25. Remove the four screws (1) (in Figure 3-3) securing the CRT clamps to the deck.
26. Pull the cable tie (1) (in Figure 3-5) to free W9. Gently pry CRT cable W9 from the end of the CRT assembly.
27. Support the A18 CRT assembly while gently pulling the front frame and CRT out of the analyzer 1 or 2 inches.
28. Disconnect A18W1, the trace align wires, from A17J5. Remove the front frame and CRT assemblies.
29. Gently pull the CRT assembly off of the front-frame assembly.

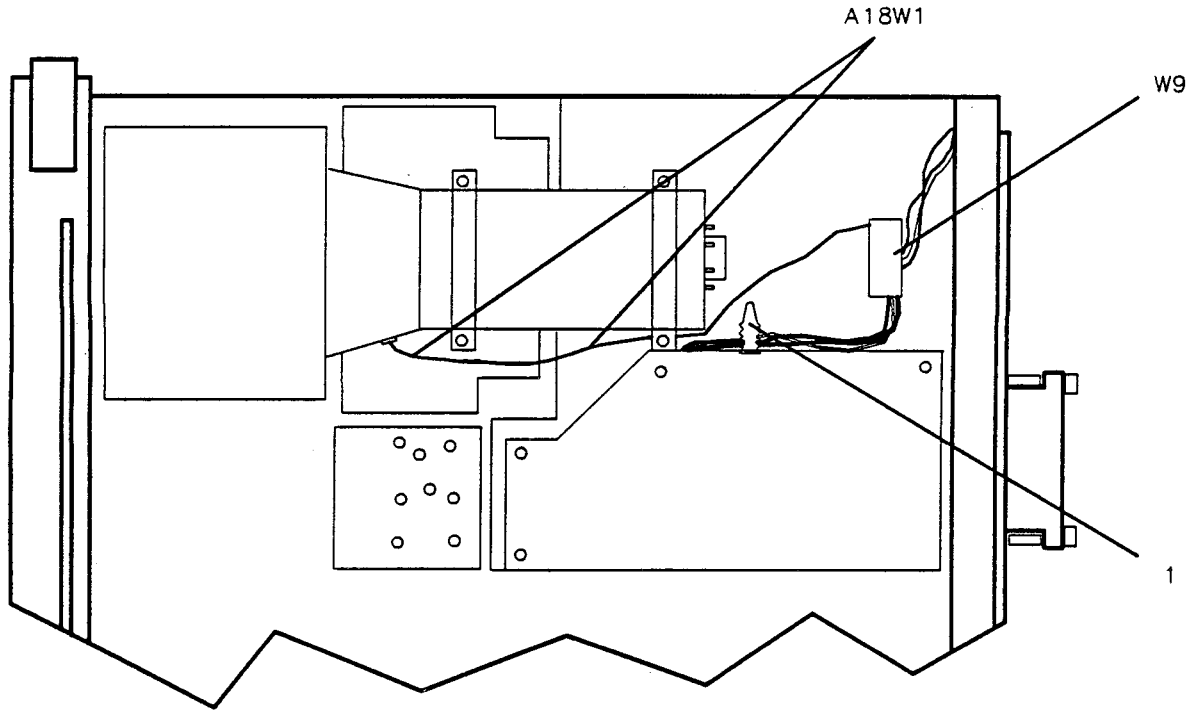


Figure 3-5. Installing the CRT and Front-Frame Assemblies

Replacement

Note

Use care when handling the glass CRT EMI shield. Clean the glass using thin-film cleaner (HP part number 8500-2163) and a lint-free cloth. When installing the glass shield, face the side of the glass with the silver coated edge toward the inside of the analyzer.

1. Place the analyzer on its right-side frame with the front end extending slightly over the front of the work bench.
2. Gently place the A18 CRT assembly into the A1 Front Frame assembly as illustrated in Figure 3-6.
3. Place the front frame and CRT assemblies into the analyzer, using caution to avoid pinching any cables.
4. Dress the A18W1 trace-align wires between the CRT assembly mounts and the A6 Power Supply top shield.

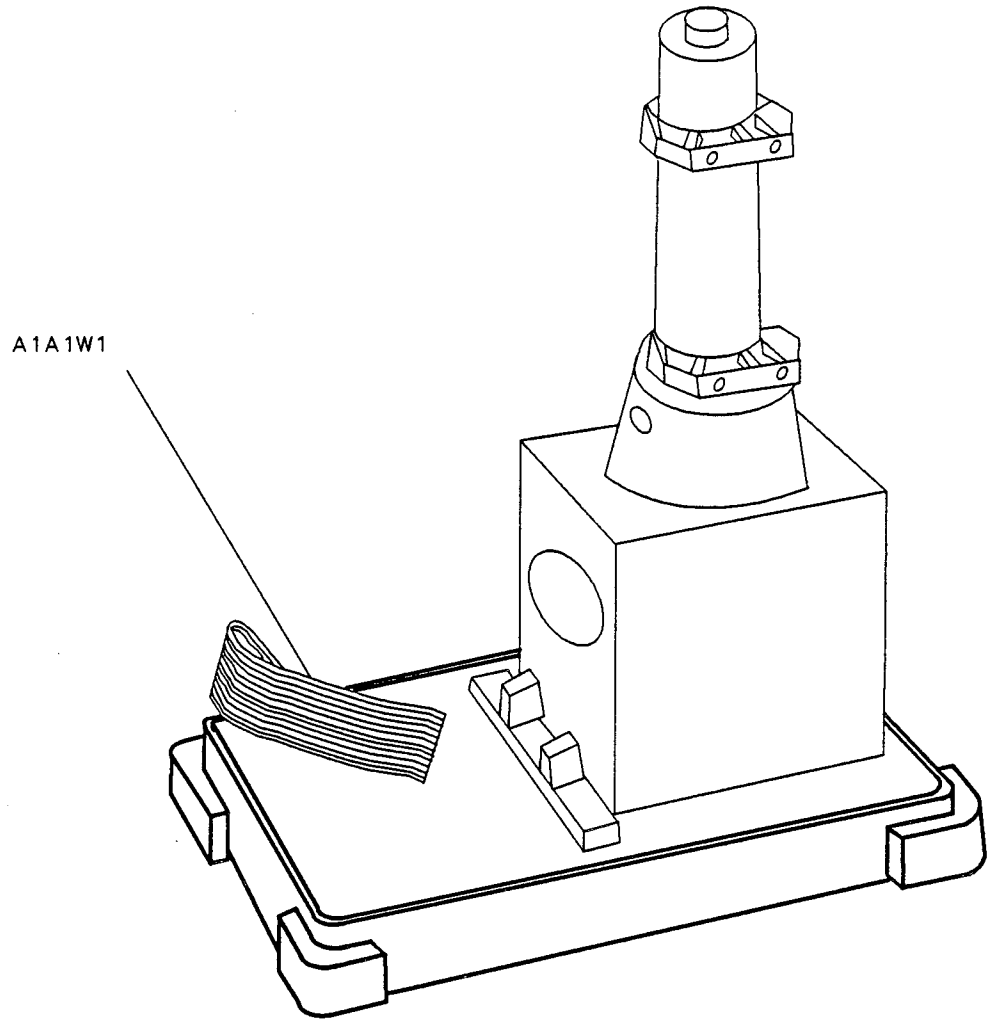


Figure 3-6. Placing the CRT into the Front Frame

5. Connect A18W1 to A17J5.
6. Snap CRT cable W9 onto the end of the CRT assembly.
7. Fully seat the front frame and CRT assemblies into the analyzer.
8. Secure the front frame to the analyzer side frames, using three flathead screws per side (1) (in Figure 3-4).
9. Tighten the four screws securing the CRT clamps to the deck.
10. Place W9 between the CRT assembly and the A6 Power Supply top shield so that the W9 wires are below the surface of the top shield.
11. Connect W42 to A7J3 and the front-panel 1ST LO OUTPUT connector.
12. Use a 9/16-inch nut driver to reconnect CAL OUTPUT connector to the front-panel.
13. Connect the VOLUME potentiometer and knob to the front panel.
14. Connect W36, coax 86, to the front-panel IF INPUT connector.

15. Use a 5/16-inch wrench to connect W41 from the A9 Input Attenuator to the front-panel INPUT 50Ω connector. Make sure that W40, W36, and A1W1 are routed between W41 and the attenuator bracket. Secure the A9 Input Attenuator bracket to the center support on the front-frame using one panhead screw (2) (in Figure 3-3).
16. Place A1W1DS1 LED into the line switch assembly.
17. Secure the line switch assembly to the front frame using one panhead screw. Be sure to tighten the line switch grounding lug screw. The screw is captive.
18. To replace the A14 and A15 assemblies, lay them flat against each other in the folded-out position. Make sure that the cables do not become pinched between the two assemblies. Ensure that all coaxial cables are clear of hinges and standoffs before continuing with the next step.
19. Fold both board assemblies into the analyzer as a unit. Use caution to avoid damaging any cable assemblies.
20. Secure A14 and A15 using the eight screws and washers. Place a washer on the appropriate screw (2) (in Figure 3-22).
21. Place the analyzer top-side-up on the work bench and connect A1A1W1 to A3J602.
22. Snap post-accelerator cable A6A1W3 to the A18 CRT assembly.
23. Snap the black grommet onto the CRT shield to protect A6A1W3.
24. Fold up assemblies A2, A3, A4, and A5 as described in Procedure 5, "Replacement," steps 6 through 12.
25. Ensure that all cable assemblies are cleared from potential damage, then replace the analyzer cover assembly.
26. Connect the ac power cord and switch the analyzer power on. If the display does not operate properly, turn off the analyzer power, disconnect the ac line cord, and recheck the analyzer.

Procedure 3. A1A1 Keyboard/Front Panel Keys

Removal

1. Remove the front frame from the analyzer as described in Procedure 2.
2. Place the front frame face-down on the work bench and remove the front frame center support.
3. Disconnect A1W1 from A1A1J3 and the RPG cable from A1A1J2.
4. Remove the nine screws holding the A1A1 Keyboard assembly to the front-frame and remove the assembly. Be careful to keep the front frame horizontal and level. All front-panel keys are now loose and held in place only by gravity.
5. Remove the rubber keypad.

Note



The front-panel softkey actuators are part of the CRT bezel assembly and are not replaceable. Should the softkeys become damaged, replace the bezel assembly.

Replacement

1. Check that all front-panel keys are correctly placed in the front-frame assembly. Figure 3-7 illustrates the positions of all keys as viewed from the backside of the front panel. Make sure the indented orientation mark located on the back of each key is next to the raised marks located in the front-frame casting beside each key.
2. Place the rubber keypad over the keys, ensuring that the screw holes are visible through the pad.
3. Place the A1A1 Keyboard assembly over the rubber keypad and secure it with nine panhead screws.
4. Connect the RPG cable to A1A1J2, and A1W1 to A1A1J3.
5. Secure the center support to the front frame using two panhead screws. The arrow stamped on the center support should point toward the top of the frame.
6. Replace the front frame assembly as described in Procedure 2.

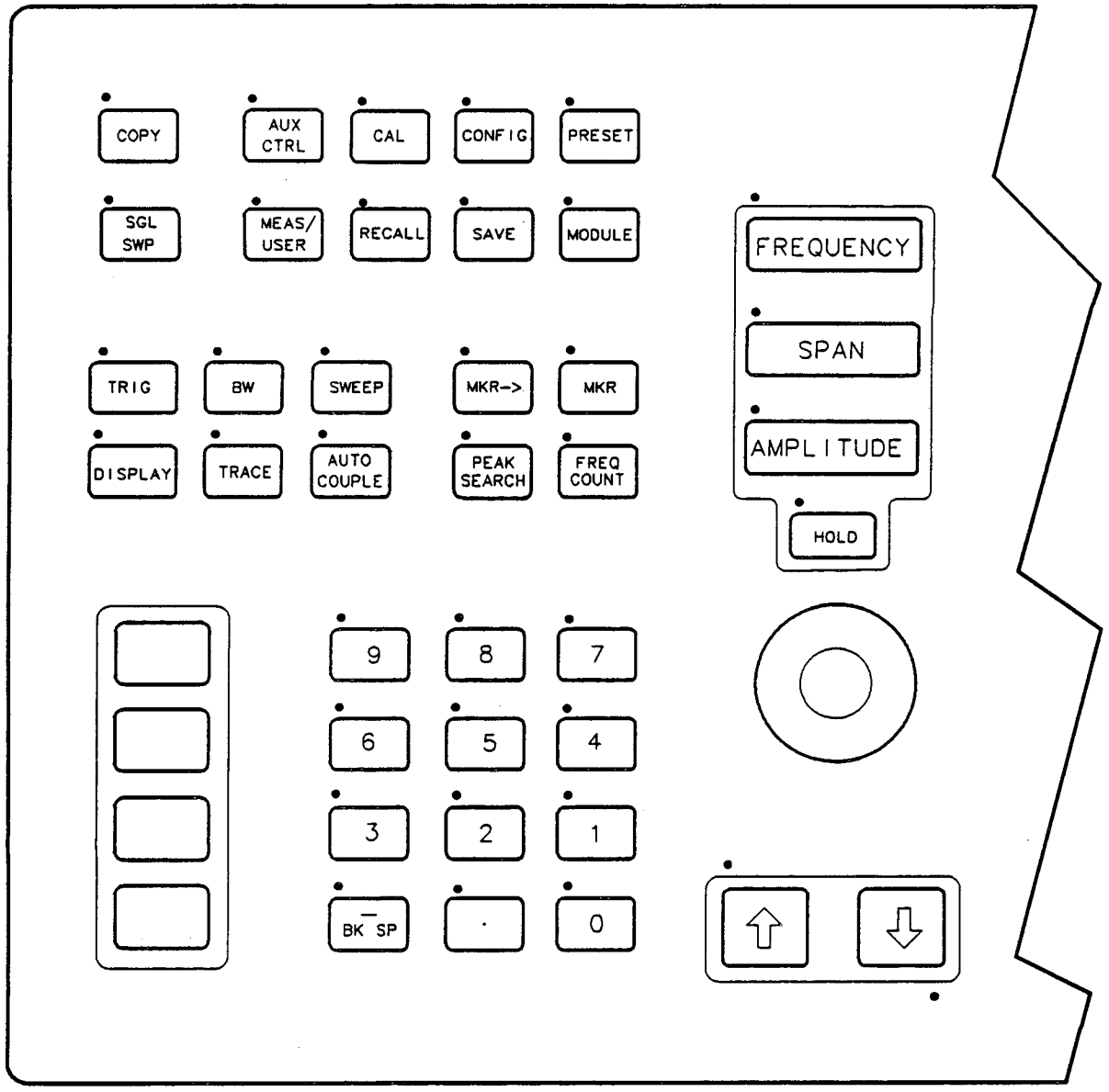


Figure 3-7. Key Positions As Viewed from Inside

Procedure 4. A1A2 RPG (Rotary Pulse Generator)

Removal

1. Remove the A9 Input Attenuator as described in Procedure 8.
2. Disconnect the RPG cable from the A1A1 keyboard assembly.
3. Remove the front-panel RPG knob using a #6 hex (allen) wrench. Use a 7/16-inch nut driver to remove the nut holding the RPG shaft to the front panel.
4. Remove the RPG knob.

Replacement

1. Place the RPG into the front-frame with the cable facing the bottom of the analyzer. Place a lock washer and nut on the RPG shaft to hold it in the frame.
2. Use a 7/16-inch nut driver to secure the RPG assembly to the front-frame.
3. Connect the RPG cable to A1A1J2.
4. Attach the RPG knob using a #6 hex (allen) wrench.
5. Replace the A9 Input Attenuator as described in Procedure 8.

Procedure 5. A2, A3, A4, and A5 Assemblies

Removal

1. Remove the analyzer cover assembly as described in Procedure 1.
2. Place the analyzer on its right-side frame.
3. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled (2), (3), and (4) in Figure 3-8. They are also labeled on the back of the A2 board assembly.
4. Remove ribbon cable W4 from A2J6. See Figure 3-8.

Caution 

Do not fold the A2, A3, A4, and A5 board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.

5. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
6. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
7. Disconnect the cables from the assembly being removed. Refer to Figure 3-9.
8. Remove the two screws that attach the assembly to its mounting hinges.

Caution 

Do not torque shield screws to more than 5 inch-pounds. Applying excessive torque damages the screws.

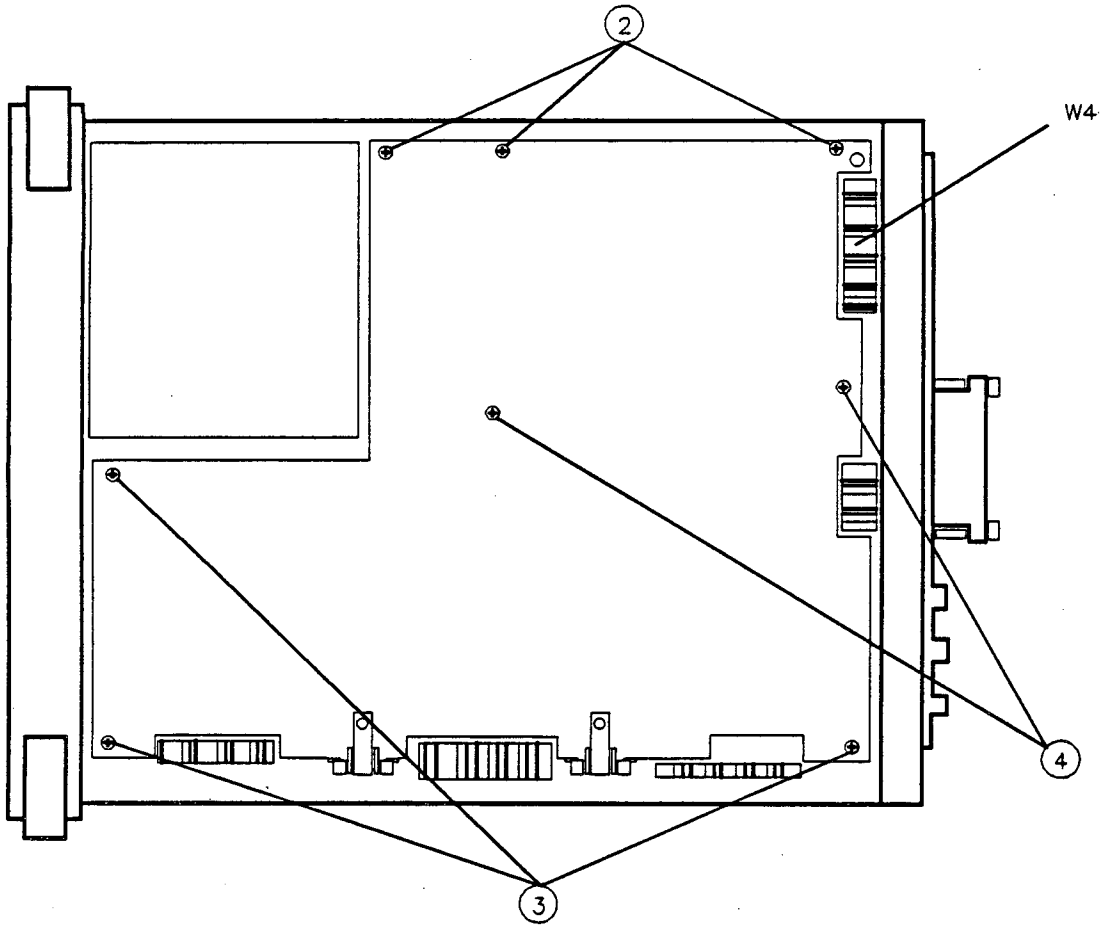


Figure 3-8. A2, A3, A4, and A5 Assembly Removal

Replacement

1. Place the analyzer top-side-up on the work bench.
2. Attach the assembly being installed to the chassis hinges with two panhead screws.
3. Leave the assembly in the folded-out position and attach ribbon cables W1 and W2.
4. Attach all coaxial cables to the assembly, as illustrated in Figure 3-9.
5. Locate the cable clip on the inside of the right-side frame. Make sure that the coaxial cables are routed properly through the clip as illustrated in Figure 3-10.
6. Lay the A2, A3, A4, and A5 assemblies flat against each other in the folded-out position. Make sure that the cables are not pinched between the two assemblies.

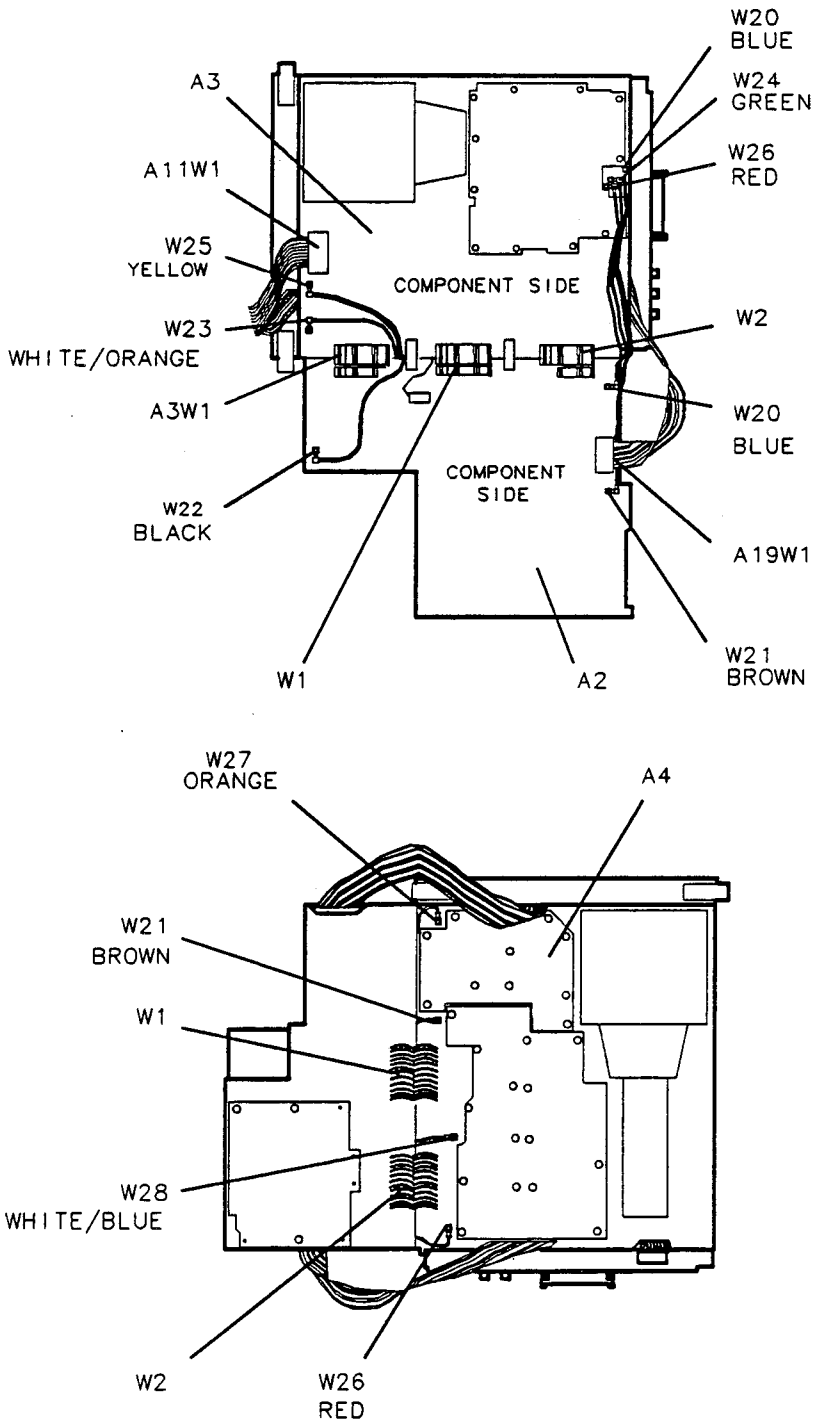
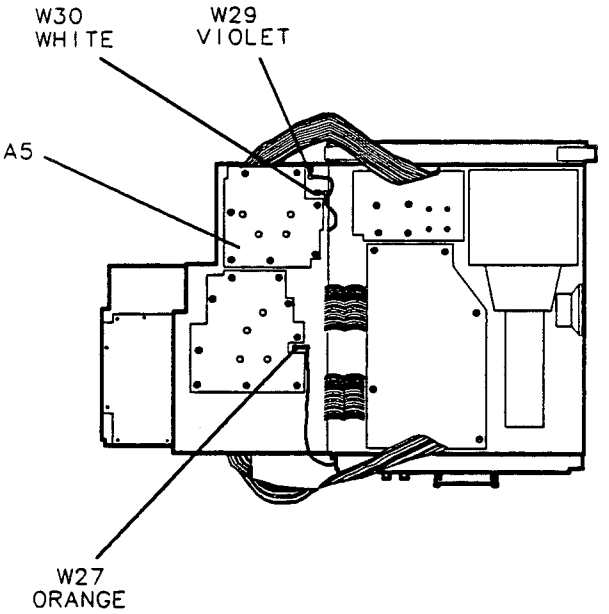


Figure 3-9. Assembly Cables (1 of 2)



Assembly Cables (2 of 2)

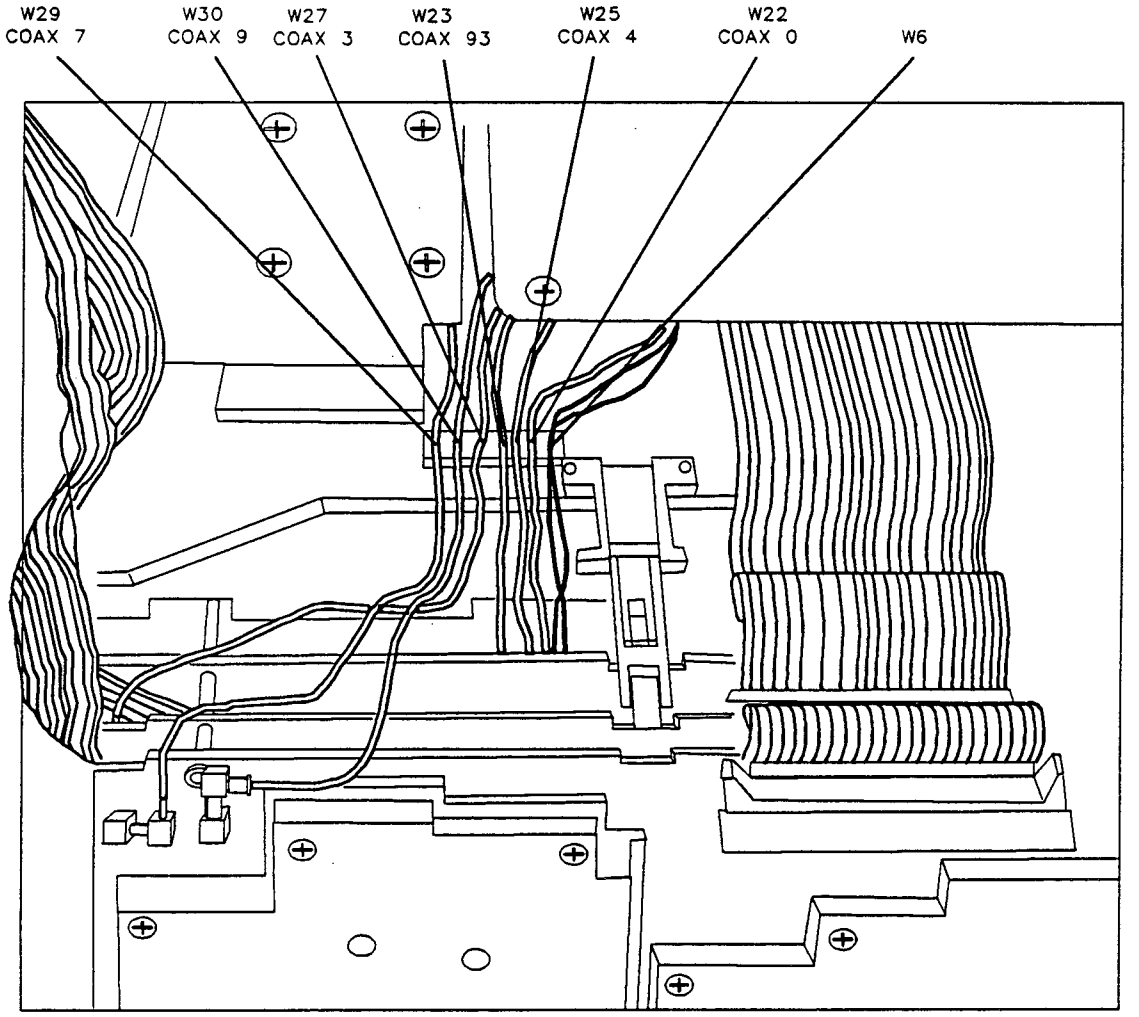


Figure 3-10. Coaxial Cable Clip

Caution Make sure that the cables are not pinched between the hinges when folding up the A4 and A5 assemblies.

7. Fold the A4 and A5 assemblies together as a unit into the analyzer. Avoid damaging any cable assemblies. The standoffs on the A5 assembly must fit into the cups on the A6 Power Supply top shield.
8. Fold the A2 and A3 assemblies together as a unit into the analyzer. Be sure to fold HP-IB cable A19W1 between the A3 and A4 assemblies, using the two sets of hook and loop (velcro) fasteners.
9. Fold ribbon cable A1A1W1 between A3 and A4 assemblies. Take care to fit the protective tubing as close to A3J602 connector as possible, so that the tubing does not fold with the cable. See Figure 3-11.
10. Attach ribbon cable W4 to A2J6 while folding up the assemblies. See Figure 3-8.

11. Secure the assemblies using the eight screws removed in "Removal," step 3. Place a flat washer on each screw.

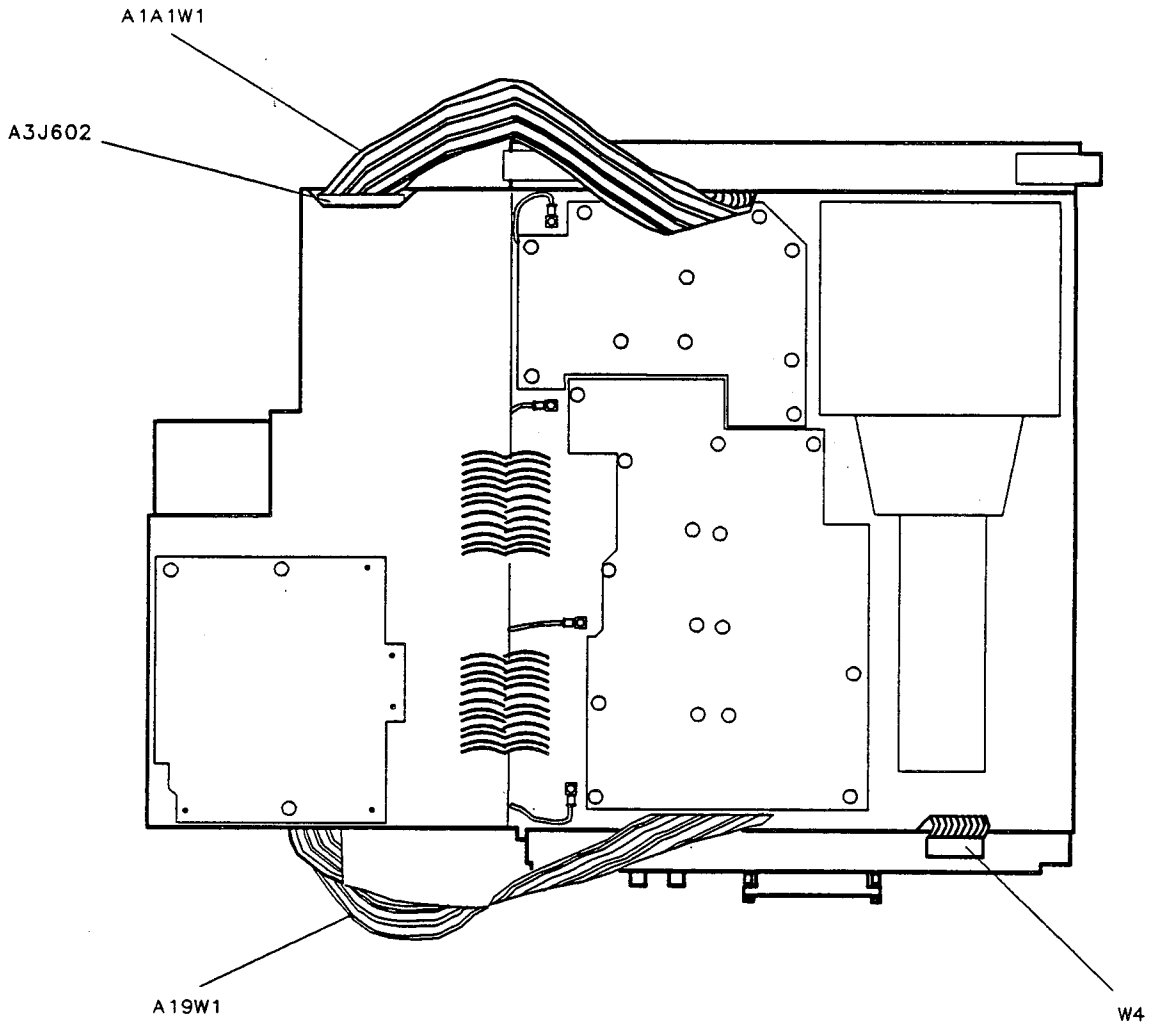


Figure 3-11. HP-IB and A1A1 W1 Cable Placement

Procedure 6. A6 Power Supply

Removal

Warning



The A6 Power Supply and A6A1 High Voltage assemblies contain lethal voltages with lethal currents in all areas. Use extreme care when servicing these assemblies. Always disconnect the ac power cord from the instrument before beginning this procedure. Failure to follow this precaution can result in a shock hazard to personnel.

1. Disconnect the power cord from the analyzer.
2. Remove the analyzer cover assembly. Refer to Procedure 1.
3. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled on the back of the A2 board assembly.
4. Remove ribbon cable W4 from A2J6. The cable location is illustrated in Figure 3-8.

Caution



Do not fold the A2, A3, A4, and A5 board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.

5. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
6. Place the analyzer top-side-up on the work bench with A2, A3, A4, and A5 folded out to the right.

Warning



The voltage potential at A6A1W3 is +9 kV. Disconnect at the CRT with caution! Failure to discharge A6A1W3 may result in *severe electrical shock* to personnel and damage to the instrument.

7. Using a small screwdriver with the shank in contact with the CRT shield assembly, slip the tip of the screwdriver under the A6A1W3 post-accelerator cable rubber shroud and short the cable to ground on the CRT shield assembly. See Figure 3-2.
8. Remove the three screws securing the power supply shield to the power supply and remove the shield.
9. Remove the three screws and washers securing the A6A1 High Voltage assembly to the A6 Power Supply assembly.
10. Disconnect ribbon cable A6A1W1 from A6J5 and lift the A6A1 assembly out of the way. See Figure 3-12.
11. Disconnect all cables from the A6 Power Supply assembly. See Figure 3-12.
12. Use a screwdriver to remove three standoffs from the A6 Power Supply assembly.
13. Remove the A6 Power Supply assembly by lifting from the regulator heat-sink toward the front of the analyzer.

Replacement

1. Attach the A6 Power Supply assembly to the analyzer chassis using the three standoff screws.
2. Connect W1 to A6J1, W3 to A6J2, fan power wires to A6J3, W8 to A6J4, and the line-power connector to A6J101. See Figure 3-12.
3. Secure the A6A1 High Voltage assembly to the A6 Power Supply, using three panhead screws and washers. Connect ribbon cable A6A1W1 to A6J5.
4. Snap post-accelerator cable A6A1W3 to the CRT assembly.

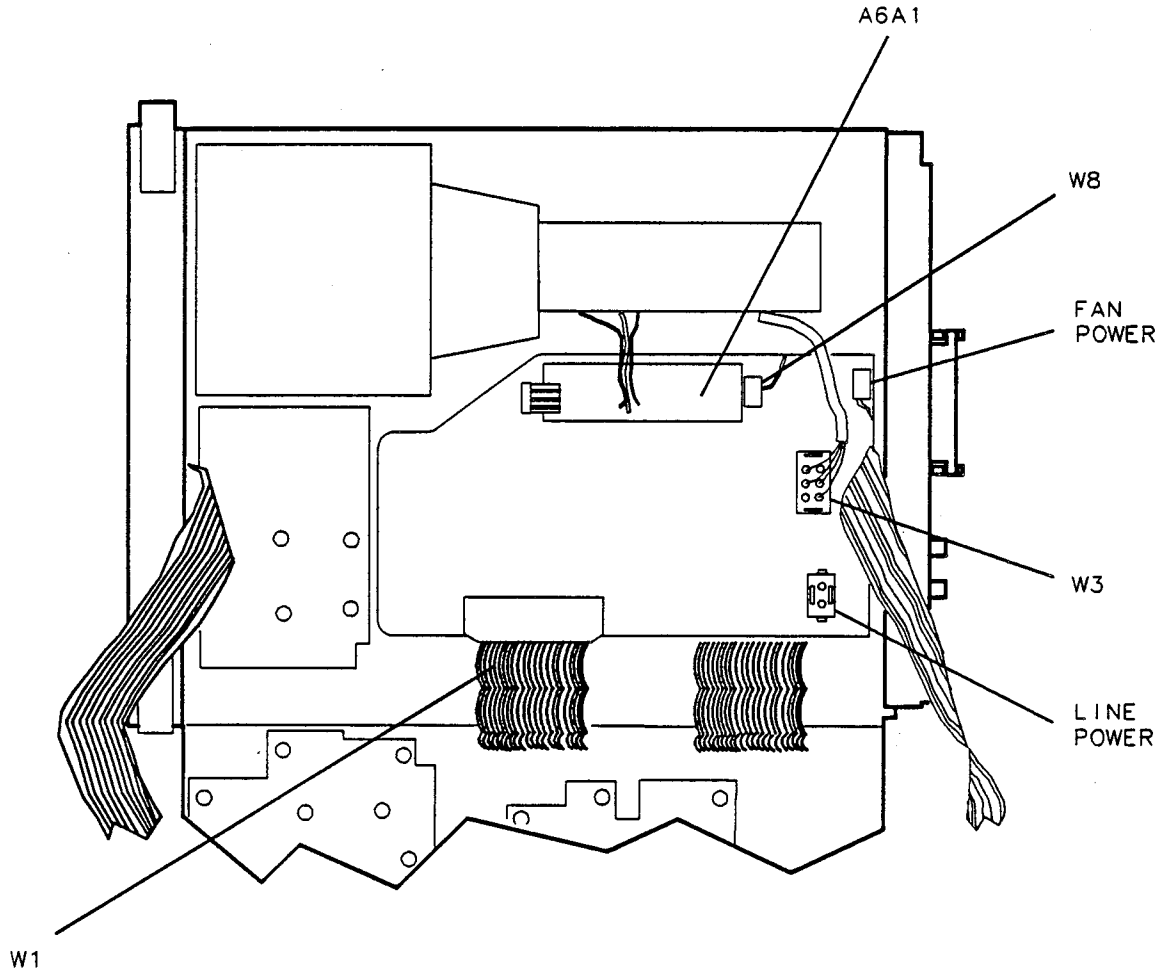


Figure 3-12. A6 Power Supply Connections

5. Ensure that all cables are safely routed and cannot become damaged when securing the A6 cover.
6. Secure the power supply cover to the power supply using three flathead screws (1) (in Figure 3-13). One end of the cover fits into a slot provided in the rear frame assembly.
7. Fold the A2, A3, A4, and A5 assemblies into the analyzer as described in Procedure 5, "Replacement," steps 6 through 12.

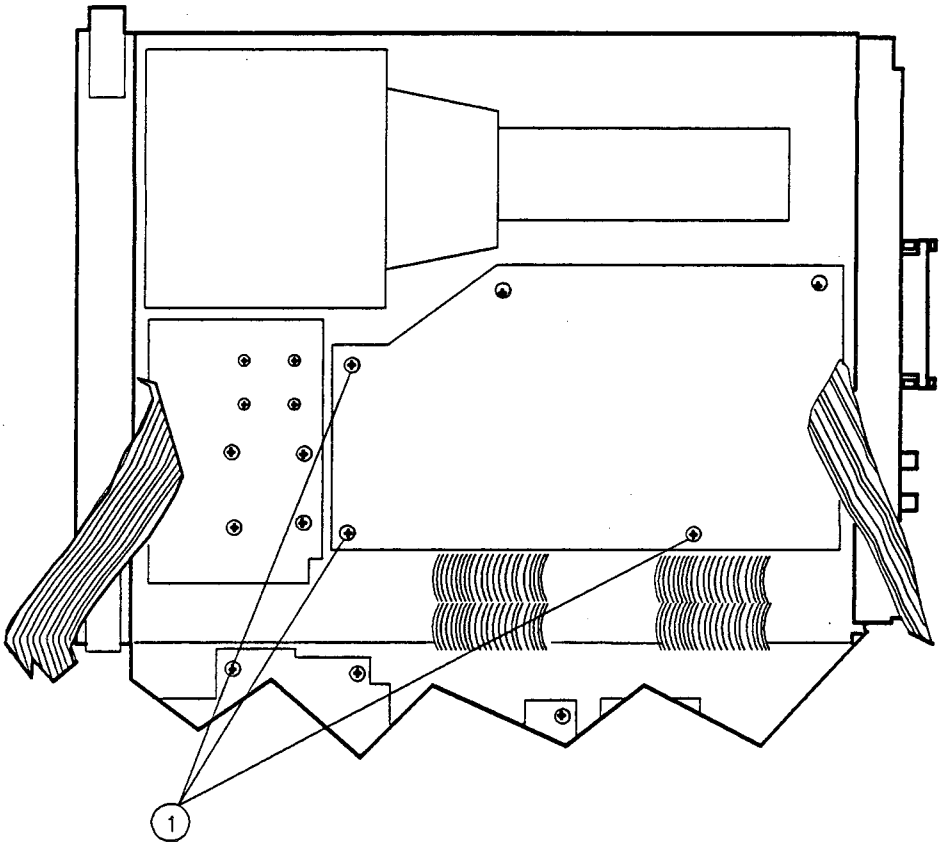


Figure 3-13. A6 Power Supply Cover

Procedure 7. A6A1 High Voltage Assembly

Removal

Warning



The A6 Power Supply and A6A1 High Voltage assemblies contain lethal voltages with lethal currents in all areas. Use extreme care when servicing these assemblies. Always disconnect the ac power cord from the instrument before beginning this procedure. Failure to follow this precaution can result in a shock hazard to personnel.

1. Disconnect the power cord from the analyzer.
2. Remove the analyzer cover assembly as described in Procedure 1.
3. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled on the back of the A2 board assembly.
4. Remove ribbon cable W4 from A2J6. The cable location is illustrated in Figure 3-8.

Caution



Do not fold the board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies, and may damage an assembly and hinge.

5. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
6. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
7. Place the analyzer top-side-up on the work bench.

Warning



The voltage potential at A6A1W3 is +9 kV. Disconnect at the CRT with caution! Failure to discharge A6A1W3 may result in *severe electrical shock* to personnel and damage to the instrument.

8. Using a small screwdriver with the shank in contact with the CRT shield assembly, slip the tip of the screwdriver under the A6A1W3 post-accelerator cable rubber shroud and short the cable to ground on the CRT shield assembly. See Figure 3-2.
9. Pry out the black grommet protecting post-accelerator cable A6A1W3 from the CRT shield assembly. See Figure 3-2.
10. Carefully unsnap the A6A1W3 post-accelerator cable from the CRT and discharge it by shorting the cable to chassis ground on the CRT shield assembly. See Figure 3-2.
11. Remove the three screws securing the power supply shield to the power supply and remove the shield.
12. Remove the three screws and washers securing the A6A1 High Voltage assembly to the A6 Power Supply assembly.
13. Disconnect ribbon cable A6A1W1 from A6J5. See Figure 3-12.

14. Remove the two screws (1) securing two board-mounting posts to the left-side frame and remove the posts. See Figure 3-14.
15. Remove the two left-side frame screws (2) securing the A16 and A17 assemblies.
16. Lift up the A16 Cal Oscillator assembly and swing it out of the analyzer. Do not remove any cables.
17. Lift up the A17 CRT driver assembly and disconnect A6A1W2 from A17J6. Do not remove any other cables from the A17 assembly.
18. Disconnect the tie wraps from the A6A1 assembly cables and remove the A6A1 High Voltage assembly from the analyzer.

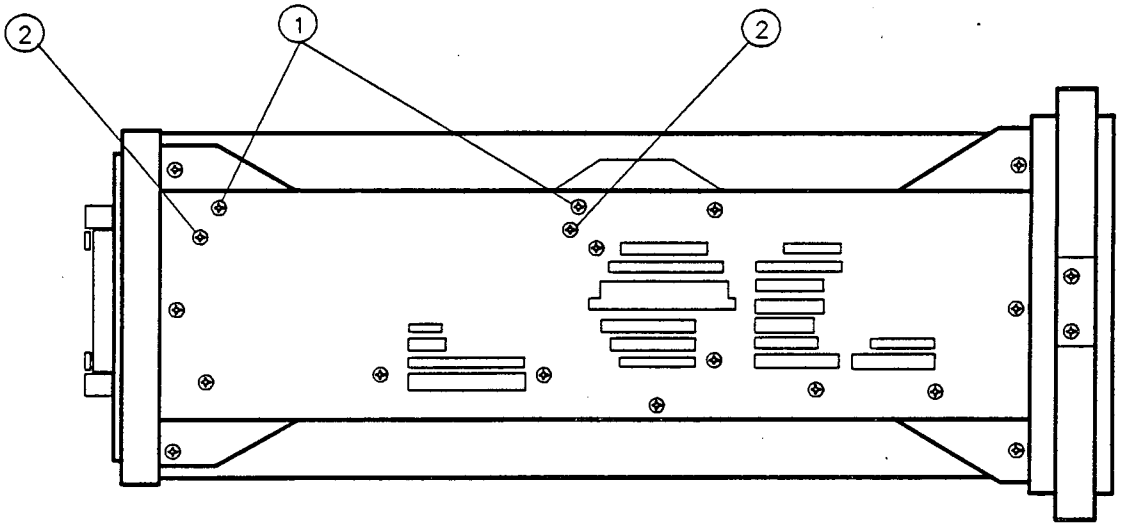


Figure 3-14. A17 CRT Driver Mounting Screws

Replacement

1. Secure the A6A1 High Voltage assembly to the A6 Power Supply using three panhead screws and washers. Connect ribbon cable A6A1W1 to A6J5.
2. Snap post-accelerator cable A6A1W3 to the CRT assembly.
3. Place the black grommet protecting the post-accelerator cable into the CRT shield.
4. Ensure that all cables are safely routed and will not be damaged when securing the A6 cover.
5. Secure the power-supply cover to the power supply using three flathead screws (1). See Figure 3-13. One end of the cover fits into a slot provided in the rear frame assembly.
6. Connect A6A1W2 to A17J6.
7. Place the A17 CRT Driver assembly into the center-deck mounting slot nearest the CRT. Use caution when routing cables to avoid damage.
8. Place the A16 Cal Oscillator assembly into the center-deck mounting slot nearest the left-side frame. Figure 3-15 shows the left-side frame removed in order to view proper A16 assembly cable routing.

9. Secure the A16 and A17 assemblies with two flathead screws. See (2) on Figure 3-14.
10. Connect the two mounting posts to the left-side frame using two screws (1) (in Figure 3-14).
11. Fold the A2, A3, A4, and A5 assemblies into the analyzer and secure the analyzer cover assembly as described in Procedure 5.

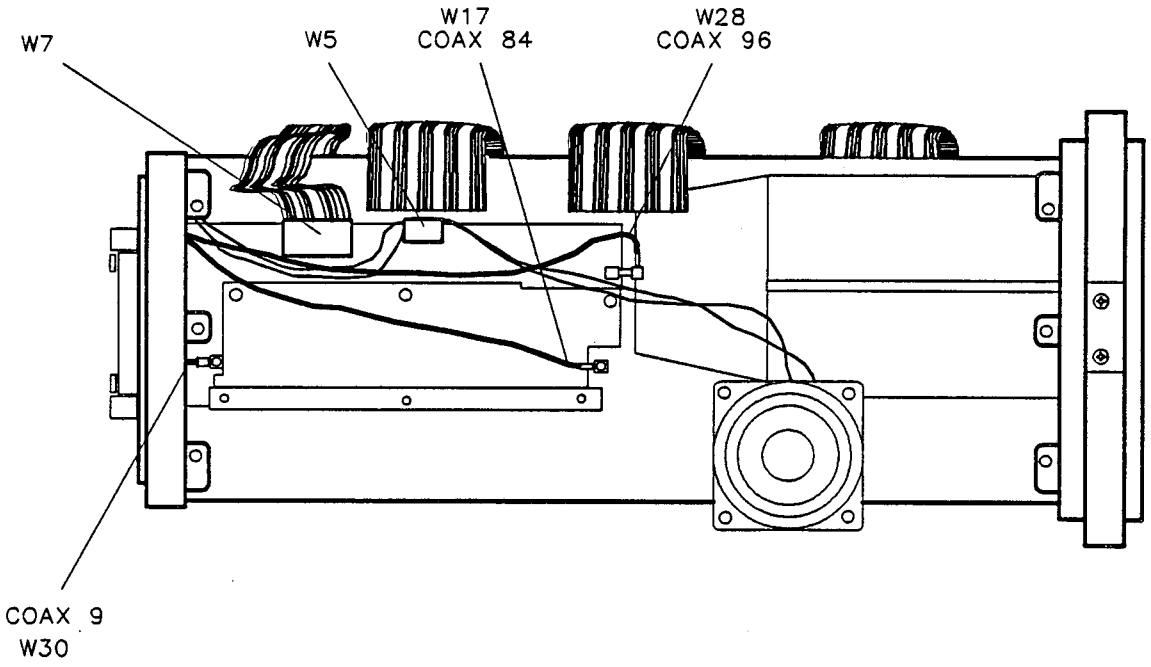


Figure 3-15. A16 Cable Routing

Procedure 8. A7 through A13 Assemblies

A separate replacement procedure is supplied for each assembly listed below.

A7 First LO Distribution Amplifier
A8 Low Band Mixer
A9 Input Attenuator
A10 YTF
A11 YTO
A12 RF Switch
A13 Second Converter

Before beginning a procedure, do the following:

- Fold out the A14 and A15 assemblies by removing the eight screws and washers holding the A14 and A15 assemblies to the bottom of the analyzer. These screws are identified as (1) and (2) in Procedure 9, Figure 3-22.

Caution 

The board assemblies are attached with hinges to the analyzer right-side frame. Always fold out the A14 and A15 assemblies as a unit, the A2 and A3 assemblies as a unit, and the A4 and A5 assemblies as a unit, never individually. Folding out one assembly at a time binds the hinges attaching the assemblies and can damage an assembly or its hinge.

Caution 

The washers are not captive. Once the assembly screws are removed, the washers can fall into the instrument. Any loose washers in the instrument can cause internal damage. Be sure to account for all washers when assemblies are replaced.

- If the A11 YTO or A10 YTF assembly is being removed, also fold down the A2, A3, A4, and A5 assemblies. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled on the back of the A2 board assembly. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
- Remove ribbon cable W4 from A2J6. The cable location is illustrated in Figure 3-8.

Figure 3-16 illustrates the location of the assemblies, and Figure 3-17 provides the colors and locations of the assembly bias wires.

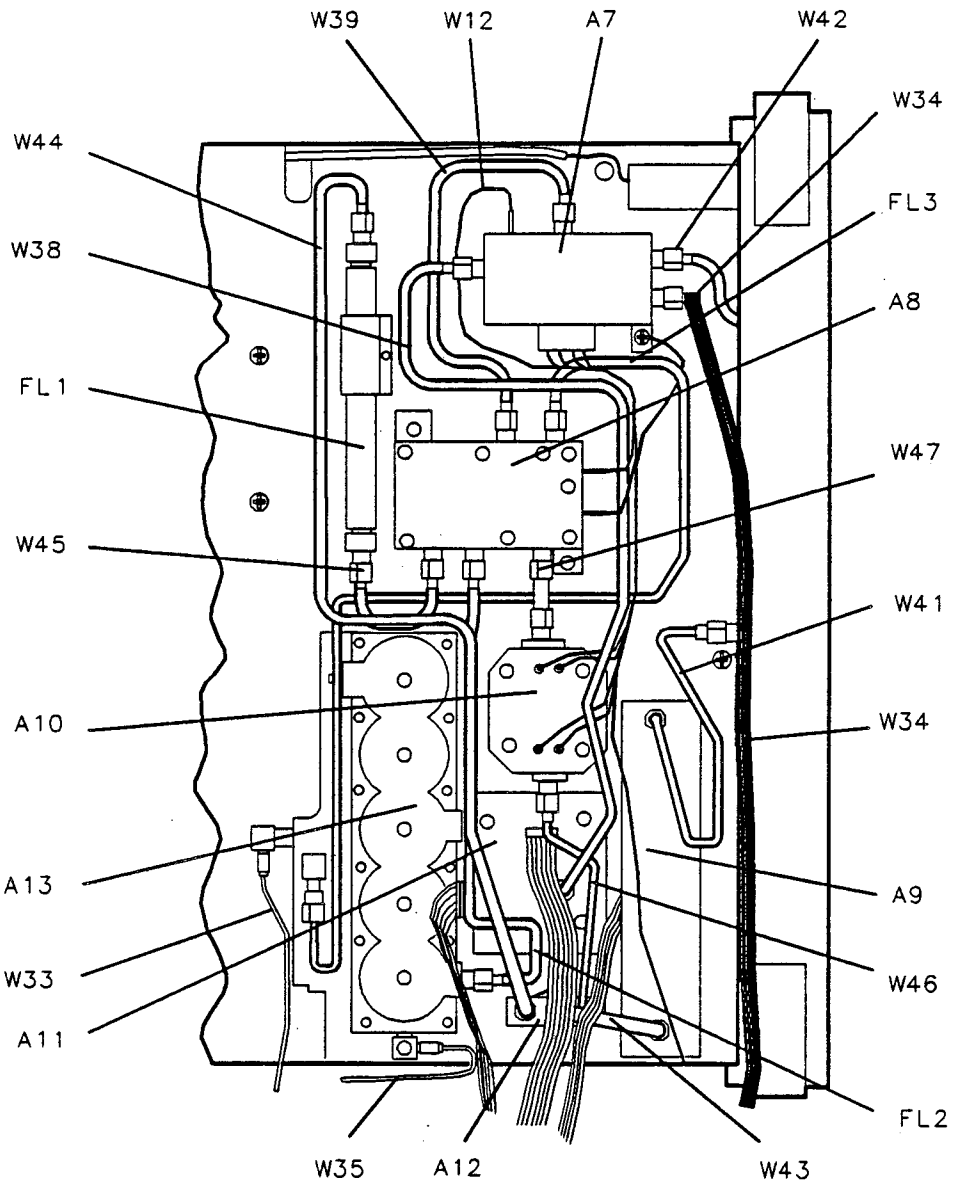


Figure 3-16. Assembly Locations

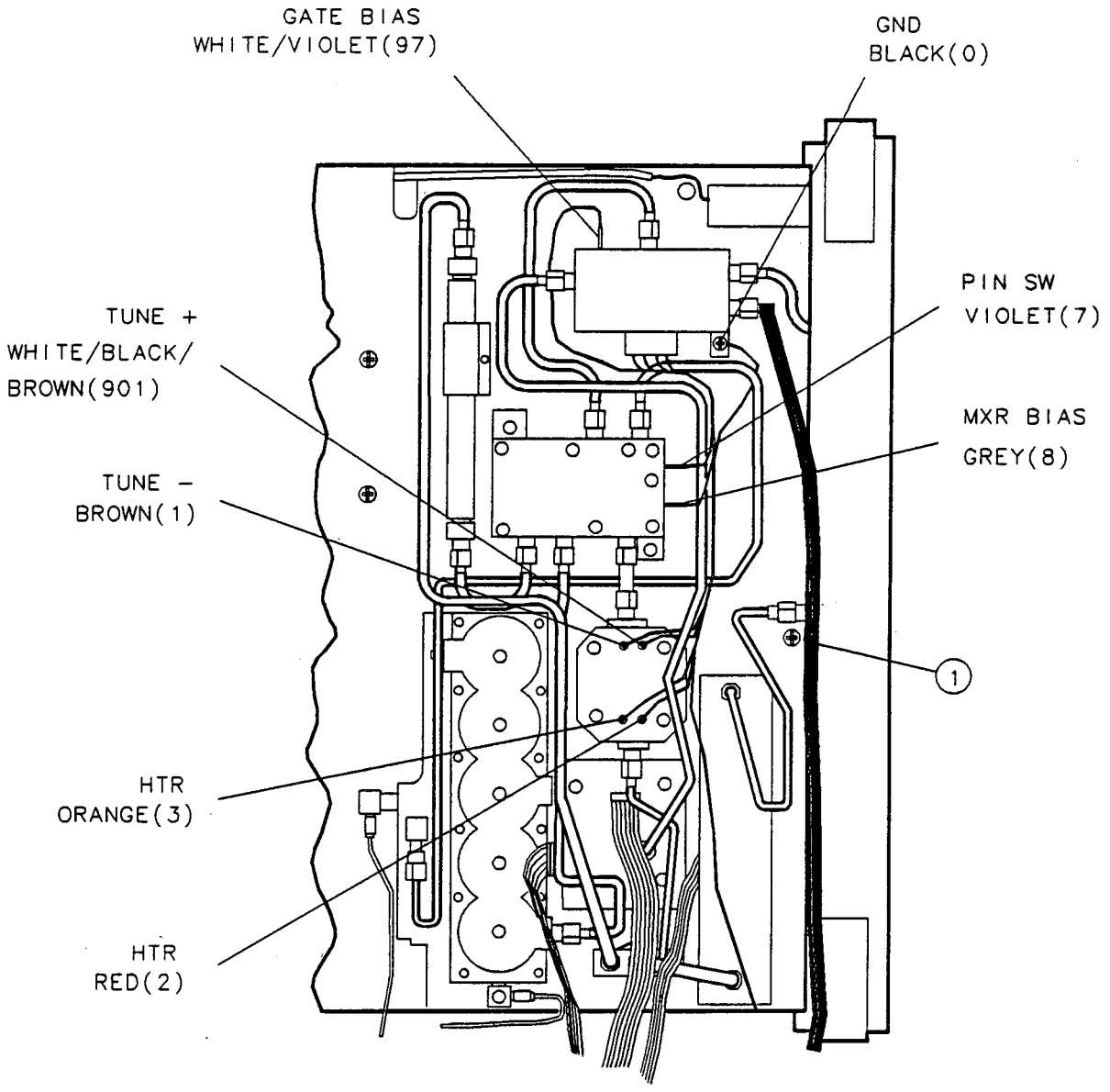


Figure 3-17. RF Section Bias Connections

Procedure 8a. A7 1st LO Distribution Amplifier

Removal

1. Remove the two screws securing the assembly to the analyzer center deck.
2. Use a 5/16-inch wrench to disconnect W38 and W39 at A7J1 and J2.
3. Disconnect W42 at the front-panel 1ST LO OUTPUT connector. Loosen W42 at A7J3.
4. Remove the gate bias wire, color code 97, and W12 from the A7 assembly.
5. Remove the assembly and disconnect W34.

Replacement

1. Use a 5/16-inch wrench to attach W34 to A7J4 and W42 to A7J3.
2. Connect gate bias wire, color code 97, to the A7 gate bias connection next to A7J2.
3. Connect cable W12 to the 5-pin connector on the A7 assembly.
4. Place gate bias wire, color code 97, beneath W38 and connect W38 to A7J1. Connect W42 to the front-panel 1ST LO OUTPUT connector. Connect W39 to A7J2.
5. Use two panhead screws to secure A7 to the center deck. Be sure to attach the ground lug to the screw beside A7J4.
6. Tighten all RF cable connections.

Procedure 8b. A8 Dual Band Mixer

Removal

1. Disconnect W34 at A15A2J1, and place the analyzer upside-down on the work bench with A14 and A15 folded out to the left.
2. Remove wire, color code 7, from the A8 PIN SW connection and wire, color code 8, from the A8 MXR BIAS connection.
3. Remove W45 from FL1 and A8J1
4. Use a 5/16-inch wrench to loosen the semirigid coax cable connections at A8J2, J3, J4, and J5.
5. Remove the two screws securing A8 to the center deck.
6. Remove all semirigid coax cables from the A8 assembly.

Replacement

1. Place A8 on the center deck and attach all semirigid cables, starting with A8J3. Use caution to avoid damaging any cables' center conductor pins.
2. Use two panhead screws to secure A8 to the center deck. Reconnect W45 to FL1 and A8.
3. Connect wire, color code 7, to the A8 PIN SW pin. Connect wire, color code 8, to the A8 MXR BIAS pin.
4. Tighten all semirigid coax connections on A8. Ensure that all other cable connections are tight.

Procedure 8c. A9 Input Attenuator

Removal

1. Disconnect W34 at A15A2J1, and place the analyzer upside-down on the work bench.
2. Remove W41 and W43.
3. Remove the screw (1) securing the attenuator to the front-frame center support. See Figure 3-17.
4. Remove two screws (1) securing the A9 Input Attenuator to the right-side frame. See Figure 3-18.
5. Remove the attenuator and disconnect the attenuator-control ribbon cable.

Replacement

1. Connect the attenuator-control ribbon cable to the A9 Input Attenuator.
2. Place the A9 Input Attenuator into the analyzer with the A9 mounting brackets resting against the front-frame center support and the right-side frame. Use caution to avoid damaging any cables.
3. Attach the attenuator to the center support with one panhead screw (1). See Figure 3-17.
4. Attach the attenuator to the right-side frame, using two flathead screws (1). See Figure 3-18.
5. Connect semirigid cables W41 and W43 to the attenuator assembly.

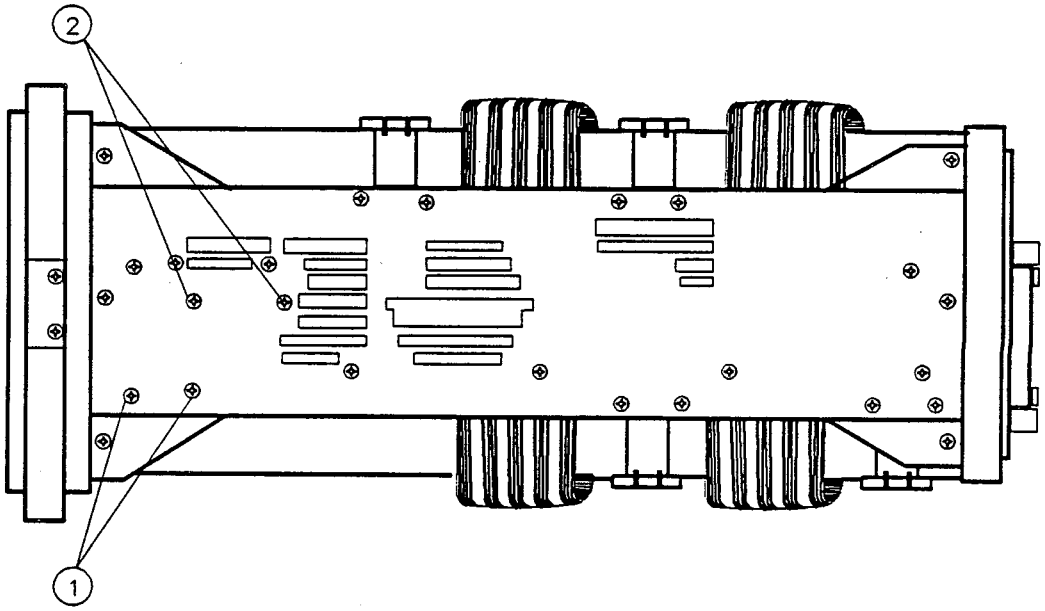


Figure 3-18. A9 Mounting Screws at Right Frame

Procedure 8d. A10 YTF

Removal

1. Use a 5/16-inch wrench to remove W46.
2. Remove FL2 and disconnect W38 at the A11 assembly.
3. Disconnect the four bias wires connected to the A10 assembly.
4. Remove four screws (1) securing A10 to the center deck. These screws are located on the top-side of the center deck as illustrated in Figure 3-19. *Screws (2) are identified for another replacement procedure.*
5. While holding on to the A10 assembly, disconnect W47 and remove the assembly.

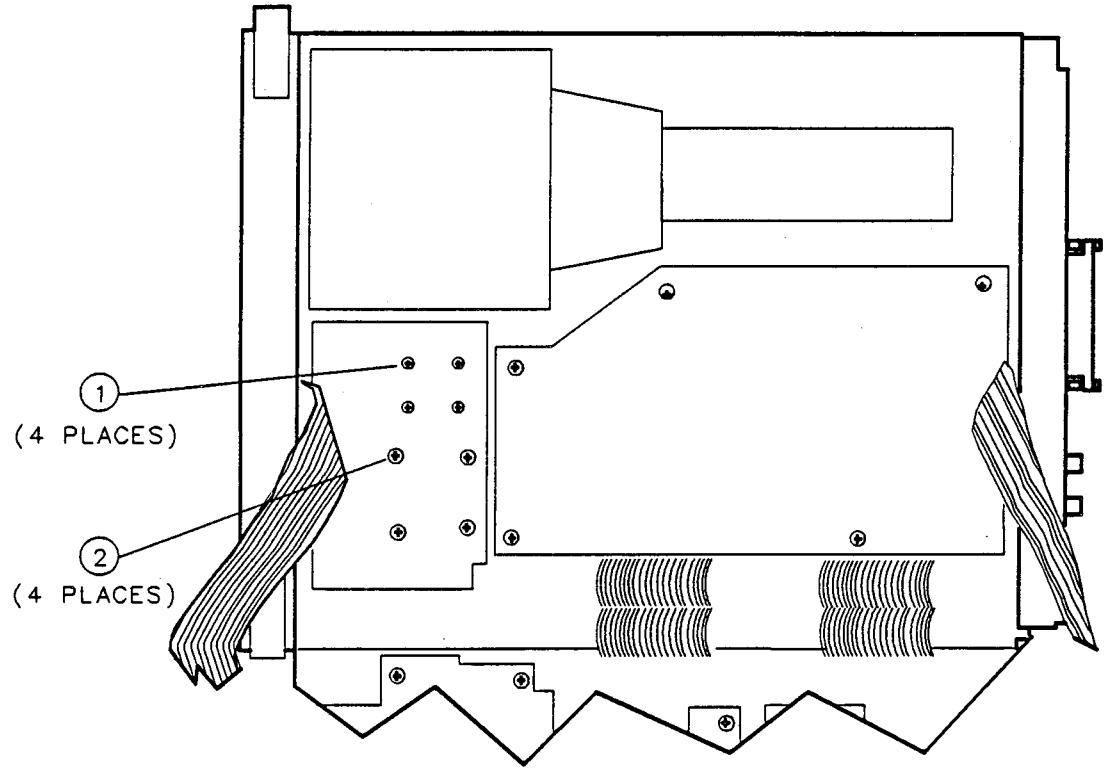


Figure 3-19. A10 Mounting Screws

Replacement

1. Orient the A10 assembly so that A10J2 connects to W47 and A10J1 connects to W46. Loosely attach A10 to W47.
2. Tighten the RF connections on W47.
3. Secure A10 to the analyzer center deck using four screws.
4. Connect the four A10 bias wires as illustrated in Figure 3-17.
5. Connect W38 to A11 and install FL2 and W46. Ensure that FL2 does not contact the terminals on the A10 assembly.

Procedure 8e. A11 YTO

Removal

1. Use a 5/16-inch wrench to remove W46.
2. Remove FL2 and disconnect W38 at the A11 assembly.
3. Disconnect W44 at A12 RF Switch.
4. Tilt the analyzer onto its right-side frame to allow access to the four A11 mounting screws (2) (in Figure 3-19). Remove the screws while holding onto A11.
5. Disconnect W10 from A11.

Replacement

1. Reconnect W10 to A11.
2. Orient the A11 assembly in the analyzer as illustrated in Figure 3-16.
3. Tilt the analyzer on its right-side frame and secure the A11 assembly to the center deck using four screws.
4. Connect W44 at A12 RF Switch. Ensure that the connector at the opposite end of W44 remains tight.
5. Connect W38 to A11. Install W46 to A12J1 and to A11.
6. Install FL2, ensuring that it does not touch any terminals on the A10 assembly.

Procedure 8f. A12 RF Switch

Removal

1. Disconnect W34 from A15A2J1 and place the analyzer upside-down on the work bench.
2. Use a 5/16-inch wrench to remove W46 and W43. Disconnect W44 from the A12 assembly.
3. Remove the two screws (2) securing the A12 RF Switch bracket to the right-side frame. See Figure 3-18.
4. Remove A12, using caution to avoid damaging the attenuator ribbon cable.
5. Desolder the two control wires located on the underside of A12. Remove the switch bracket from the assembly.

Replacement

1. Attach the mounting bracket to the A12 RF Switch as illustrated in Figure 3-20.

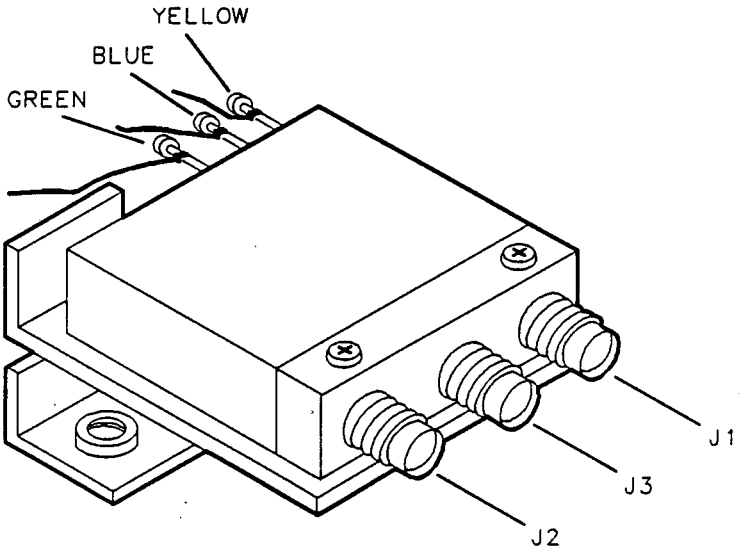


Figure 3-20. A12 Mounting Screws

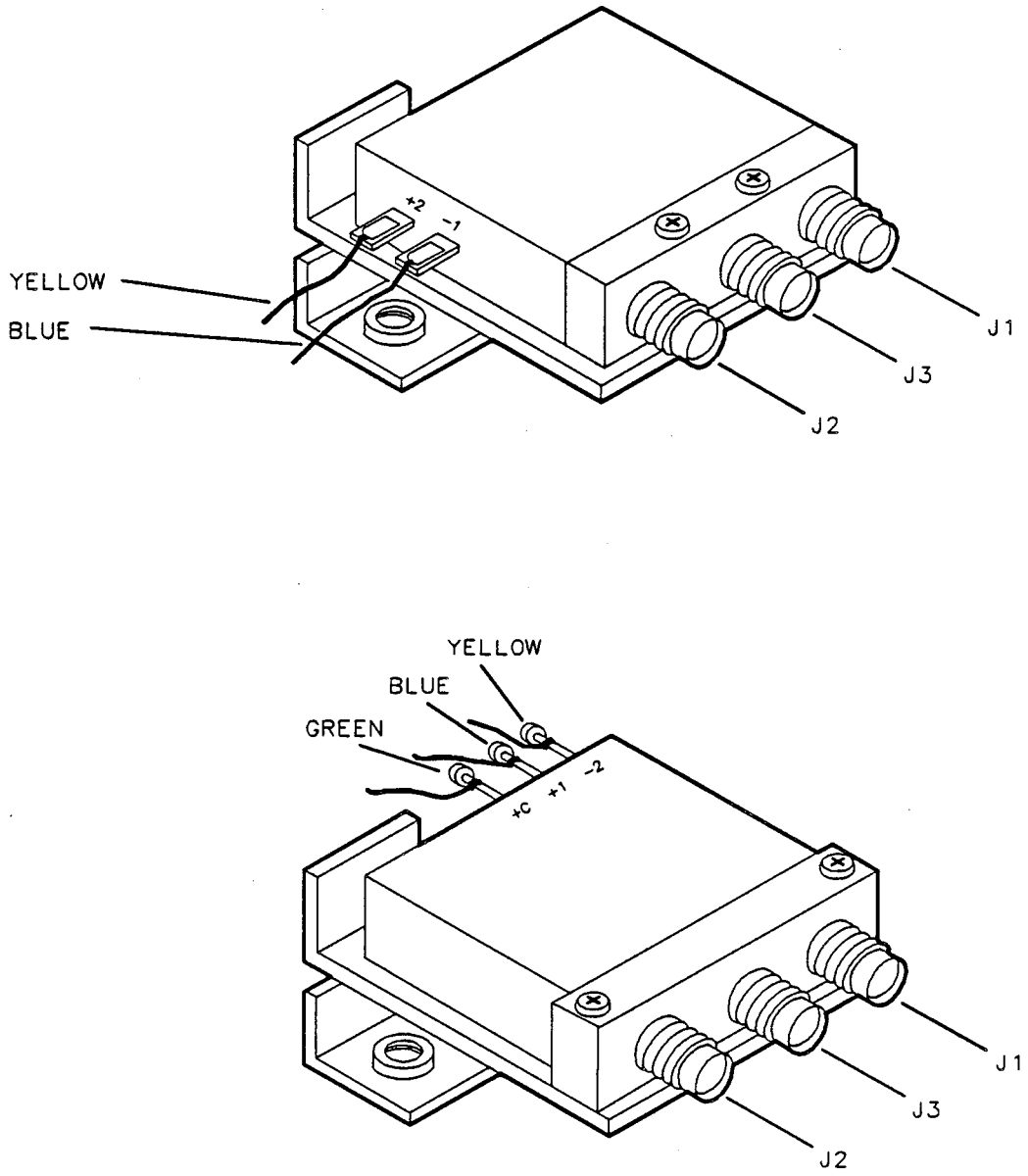


Figure 3-21. A12 Wiring Diagram

2. For standard HP 8563A analyzers, refer to Figure 3-21 and solder the control wires to the A12 assembly as follows:

   Blue wire to A12 −1 terminal.
   Yellow wire to A12 +2 terminal.

3. For HP 8563A Option 026 analyzers, solder the control wires to the A12 assembly as follows:

   Blue wire to A12 −1 terminal.
   Yellow wire to A12 +C terminal.
   Green wire to A12 −2 terminal.

4. Mount the A12 assembly to the analyzer right-side frame using two flathead screws (2). See Figure 3-18. Use caution to avoid damaging any cables.
5. Connect W44 to A12J2. Install W43 from the A9 Input Attenuator to A12J3.
6. Install W46 to A12J1.

Procedure 8g. A13 Second Converter

Caution Turn off the analyzer power when replacing the A13 Second Converter assembly. Failure to turn off the power may result in damage to the assembly.



Removal

1. Disconnect W34 at A15A2J1, and place the analyzer upside-down on the work bench.
2. Disconnect ribbon cable W13 from the A13 assembly.
3. Disconnect W33, coax 81, and W35, coax 92, from the A13 assembly.
4. Disconnect W48 from A13J3.
5. Disconnect FL2 from A13J1.
6. Remove the four screws securing A13 to the main deck and, remove the assembly.

Replacement

1. Connect ribbon cable W13 to the A13 assembly before replacing A13 into the analyzer.
2. Secure A13 to the analyzer main deck, using four panhead screws.
3. Connect W48 to A13J3 and FL2 to A13J1. Ensure that the connections on both ends of FL2 and W48 are tight.
4. Connect W35, coax 92, to A13J2 310.7 MHz OUT connector. Route the cable between W48 and the main deck.
5. Connect W33, coax 81, to A13J4 600 MHz IN connector. Route the cable over A13J3.

Procedure 9. A14 Frequency Control and A15 RF Assemblies

Removal

1. Remove the analyzer cover as described in Procedure 1.
2. Place the analyzer on its right-side frame.

Caution



These washers are not captive. Once the assembly screws are removed, the washers can fall into the instrument. Any loose washers in the instrument can cause internal damage. Be sure to account for all washers when assemblies are replaced.

3. Remove the eight screws and washers holding the A14 and A15 assemblies to the bottom of the analyzer. These screws are identified as (1) and (2) in Figure 3-22.

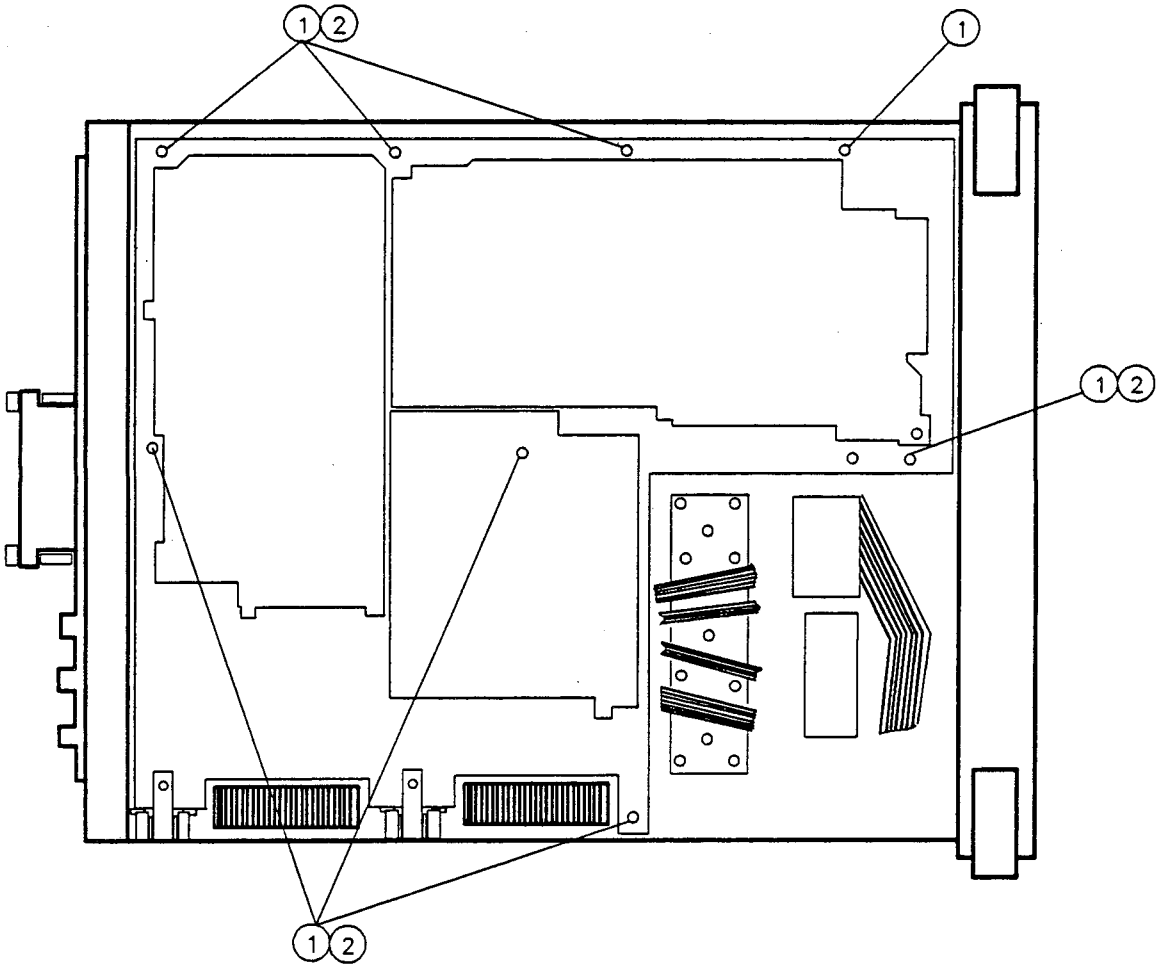


Figure 3-22. A14 Frequency Control and A15 RF Assembly Removal

Caution Always fold the A14 and A15 assemblies as a unit, not individually. Folding out one assembly at a time binds the hinges attaching the assemblies and can damage an assembly or its hinge.

4. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A14 and A15 assemblies out of the analyzer as a unit.
5. Remove all cables from the assembly being removed.
6. Remove the two screws that attach the assembly being removed to its two mounting hinges.

Caution Do not torque shield screws to more than 5 inch-pounds. Applying excessive torque damages the screws.

Replacement

1. Attach the removed assembly to the two chassis hinges with two panhead screws.
2. Attach all cables to the assembly as illustrated in Figure 3-23.
3. Lay the A14 and A15 assemblies flat against each other in the folded out position. Make sure that the cables do not become pinched between the two assemblies. Ensure that all coaxial cables are clear of hinges and standoffs before continuing with the next step.
4. Fold both board assemblies into the analyzer as a unit. Use caution to avoid damaging any cable assemblies.
5. Secure the assemblies using the eight screws and washers removed in "Removal," step 3. Place a washer (2) on the appropriate screws.
6. Secure the analyzer cover assembly as described in Procedure 1.

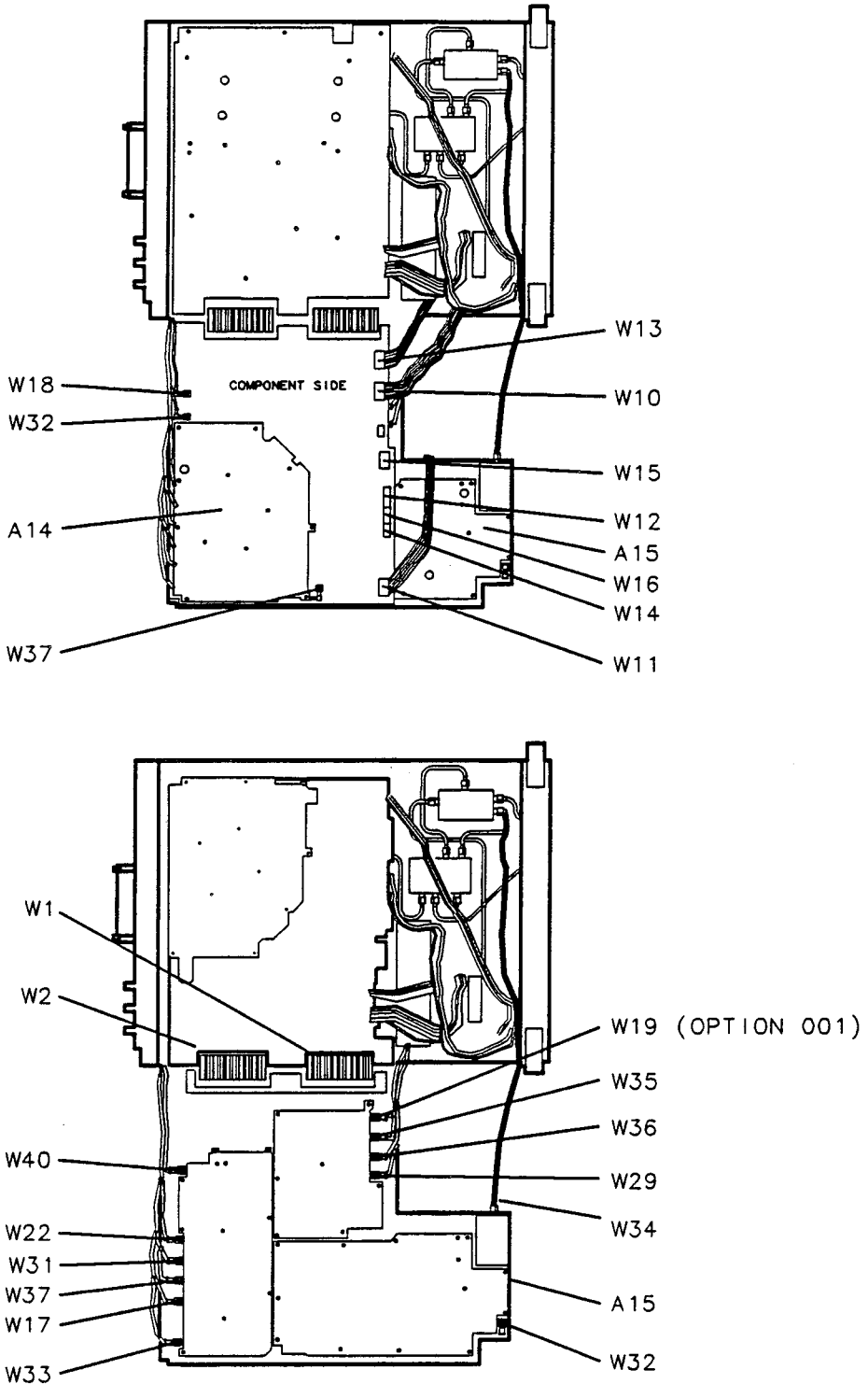


Figure 3-23. A14 and A15 Assembly Cables

Procedure 10. A16 CAL Oscillator/A17 CRT Driver

Removal

1. Remove the analyzer cover assembly and fold out the A2, A3, A4, and A5 assemblies.

Caution



Do not fold the A2, A3, A4, and A5 board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.

2. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
3. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
4. Place the analyzer top-side-up on the work bench with A2, A3, A4, and A5 folded out to the right.
5. Remove the two screws (1) securing the two board-mounting posts to the left-side frame, and remove the posts. See Figure 3-24.
6. Remove the two screws (2) securing the A16 and A17 assemblies to the left-side frame.
7. Pull the A16 assembly out of the analyzer.
8. Pull the A17 assembly out of the analyzer.

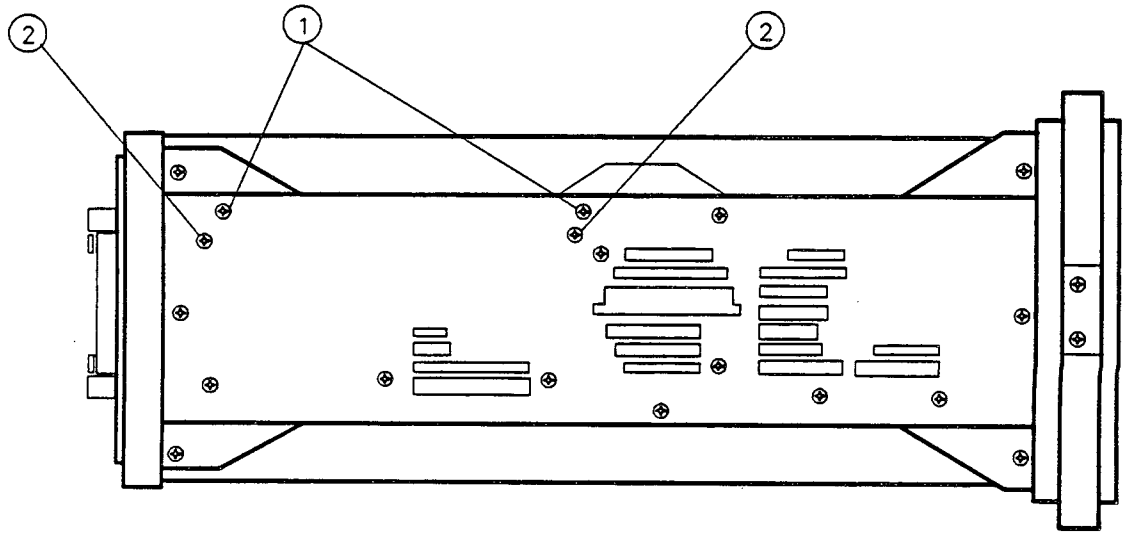


Figure 3-24. A16 and A17 Mounting Screws

Replacement

1. Connect W7, W8, W9, A6A1W2, and A18W1 to the A17 CRT Driver assembly. Place the assembly into the center-deck mounting slot next to the CRT assembly.
2. Connect all A16 assembly cables as illustrated in Figure 3-25, which shows the left-side frame removed in order to view proper A16 assembly cable routing. Place the assembly into the center-deck mounting slot nearest the left-side frame.
3. Secure the A16 and A17 assemblies to the left-side frame using two flathead screws. Attach the two board mounts to the left-side frame using two flathead screws. See Figure 3-24.

Caution Redress W7 Line Generator ribbon cable behind the board mount before securing A2, A3, A4, and A5 assemblies with the screws.

4. Place the analyzer on its right-side frame.
5. Fold the A2, A3, A4, and A5 assemblies into the analyzer as described in Procedure 5. Replace and secure the analyzer cover assembly.

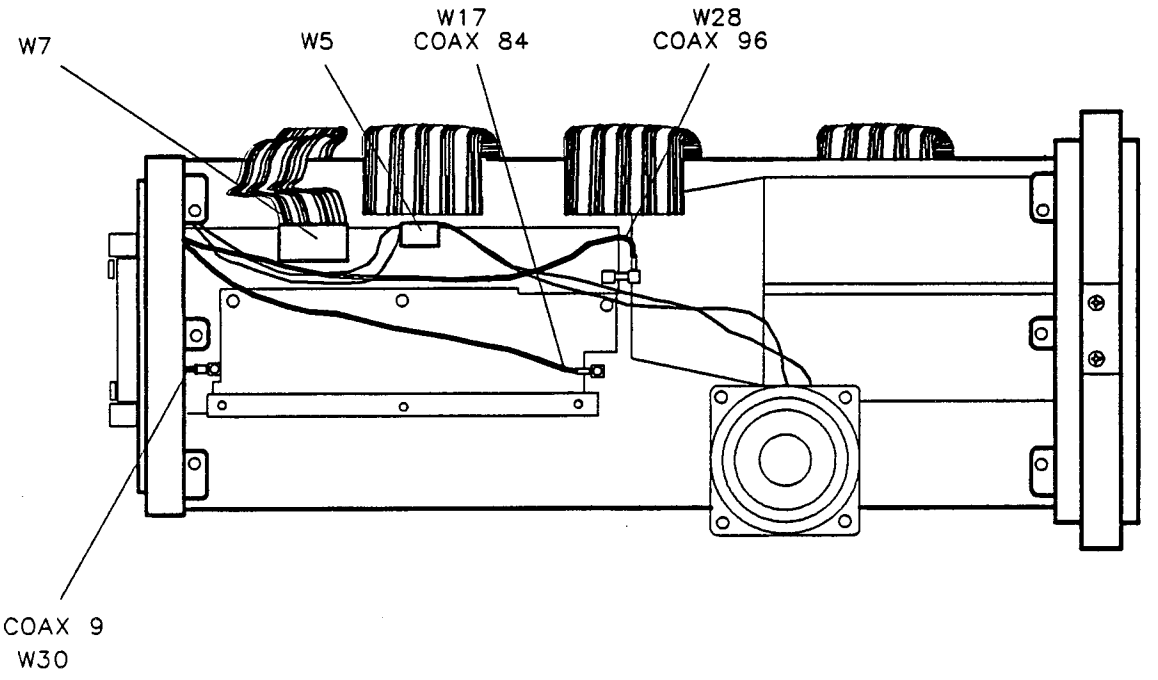


Figure 3-25. A16 Cable Routing

Procedure 11. B1 Fan

Removal/Replacement

Warning 

Always disconnect the ac power cord from the instrument before beginning this procedure. Failure to follow this precaution can result in a shock hazard to personal.

1. Remove the four screws securing the fan assembly to the rear frame.
2. Remove the fan, and disconnect the fan wire from the A6 Power Supply assembly.
3. To reinstall the fan, carefully align the fan wire and connect the it to A6J3. It is easy to connect this wire incorrectly. Place the wire into the channel provided on the left side of the rear frame opening. Secure the fan to the rear frame using four panhead screws.

Note 

The fan must be installed so that the air passes through the instrument and exits at the front of the instrument.

Procedure 12. BT1 Battery

Warning



Battery BT1 contains lithium iodide. Do not incinerate or puncture this battery. Dispose of the discharged battery in a safe manner.

Caution



To avoid loss of the calibration constants stored on the A2 Controller assembly, connect the analyzer to the main power source and turn on before removing the battery.

Removal/Replacement

1. Locate the battery assembly cover on the analyzer rear panel. Remove the two flathead screws securing the cover to the analyzer.
2. Remove the old battery and replace it with the new one. Ensure proper polarity.
3. Measure the voltage across the new battery. Nominal new battery voltage is approximately +3.6 V. If this is not the case, check the battery cable and A2 Controller assembly.
4. Secure the battery assembly into the analyzer.

Procedure 13. Rear Frame/Rear Dress Panel

Removal

Warning



The A6 Power Supply and A6A1 High Voltage assemblies contain lethal voltages with lethal currents in all areas. Use extreme care when servicing these assemblies. Always disconnect the ac power cord from the instrument before beginning this procedure. Failure to follow this precaution can result in a shock hazard to personnel.

1. Disconnect the ac power cord from the analyzer.
2. Remove the analyzer cover, and place the analyzer on its right-side frame.
3. Fold out the A2, A3, A4, and A5 assemblies.

Caution



Do not fold the A2, A3, A4, and A5 board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.

4. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
5. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
6. Disconnect the HP-IB cable at A2J5.
7. Place the analyzer top-side-up on the work bench with A2, A3, A4, and A5 folded out to the right.

Warning



The voltage potential at A6A1W3 is +9 kV. Disconnect at the CRT with caution! Failure to discharge A6A1W3 may result in *severe electrical shock* to personnel and damage to the instrument.

8. Using a small screwdriver with the shank in contact with the CRT shield assembly, slip the tip of the screwdriver under the A6A1W3 post-accelerator cable rubber shroud and short the cable to ground on the CRT shield assembly. See Figure 3-2.
9. Remove the three screws securing the power-supply shield to the power supply, and remove the shield.
10. Disconnect the fan and line-power cables from A6J3 and A6J101 on the A6 Power Supply assembly.
11. Remove the two flathead screws securing the rear-panel battery assembly, and remove the assembly. Remove the battery and desolder the two wires attached to the battery assembly.
12. Use a 9/16-inch deep-socket nut driver to remove the dress nuts holding the BNC connectors to the rear frame. If necessary, drill out a nut driver to fit over the BNC connectors, and cover it with heat-shrink tubing or tape to avoid scratching the dress panel.

13. Disconnect the two cable ties holding ribbon cable W7 to the A19 HP-IB assembly.
14. Remove four screws (1) securing the rear frame to the main deck. See Figure 3-26.
15. Remove the six screws securing the rear frame to the left- and right-side frames.
16. Carefully remove the nut securing the earphone jack, then remove the jack from the inside of the rear-frame assembly. Replace the nut onto the jack for safekeeping.
17. Remove the rear frame assembly.
18. To remove the rear-dress panel, remove the two nuts with 7-mm nut driver. The nuts are located on the inside of the rear frame near the display adjustment holes.

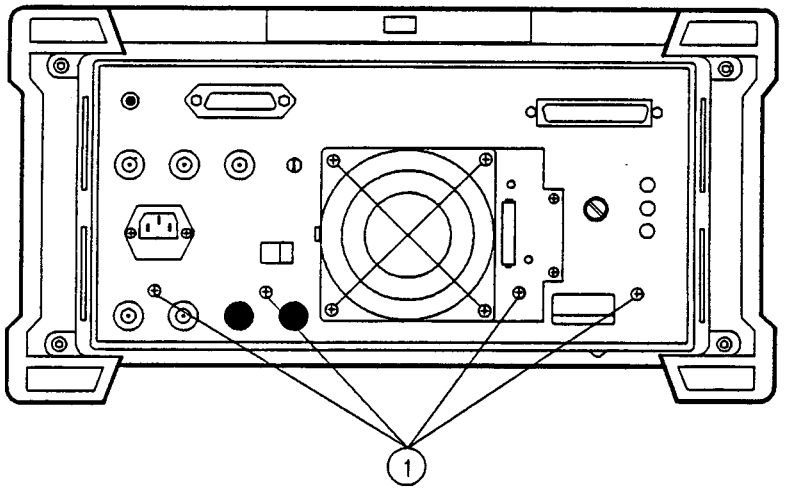


Figure 3-26. Main Deck Screws

Replacement

1. If the rear-dress panel is removed, secure it to the rear frame using two 7-mm nuts. Take care to seat the panel tight against the frame.
2. Place the analyzer on its front panel allowing easy access to the rear frame area.
3. Place the rear frame on the analyzer and use a 3/8-inch nut driver to secure the earphone jack. Use a lock washer on the inside of the rear frame and a flat washer on the outside.
4. Place the coax cable BNC connectors into the appropriate rear-frame holes as described below. Use a 9/16-inch nut driver to attach the dress nuts holding the BNC connectors to the rear frame.

Rear Panel Connector	RF Cable
J4	W24, coax 5
J5	W23, coax 93
J6	W25, coax 4
J8	W18, coax 97
J9	W31, coax 8

5. Secure the rear frame to the analyzer main deck, using four panhead screws (1). See Figure 3-26.

6. Secure the rear frame to the analyzer side frames using three flathead screws per side. Use caution to avoid damaging any coaxial cables.
7. Place the analyzer top-side-up on the work bench.
8. Pull the red and black battery wires through the rear-frame battery-assembly hole. Solder the red wire to the battery-assembly positive lug and the black wire to the negative lug. Replace the battery.
9. Secure the battery assembly to the rear frame, using two flathead screws.
10. Reconnect the two cable ties on the A19 HP-IB assembly to hold ribbon cable W7 to the A19 assembly.
11. Connect the fan and line-power cables to A6J3 and A6J101 on the A6 Power Supply.
12. Snap the A6A1W3 post-accelerator cable to the CRT assembly.
13. Snap the black grommet protecting A6A1W3 into the CRT shield.
14. Ensure that all cables are safely routed and cannot be damaged when replacing the A6 cover.
15. Use three flathead screws (1) to secure the power-supply cover to the power supply. One end of the cover fits into a slot provided in the rear frame assembly.
16. Connect the HP-IB cable to A2J5.
17. Fold the A2, A3, A4, and A5 assemblies into the analyzer as described in Procedure 5.

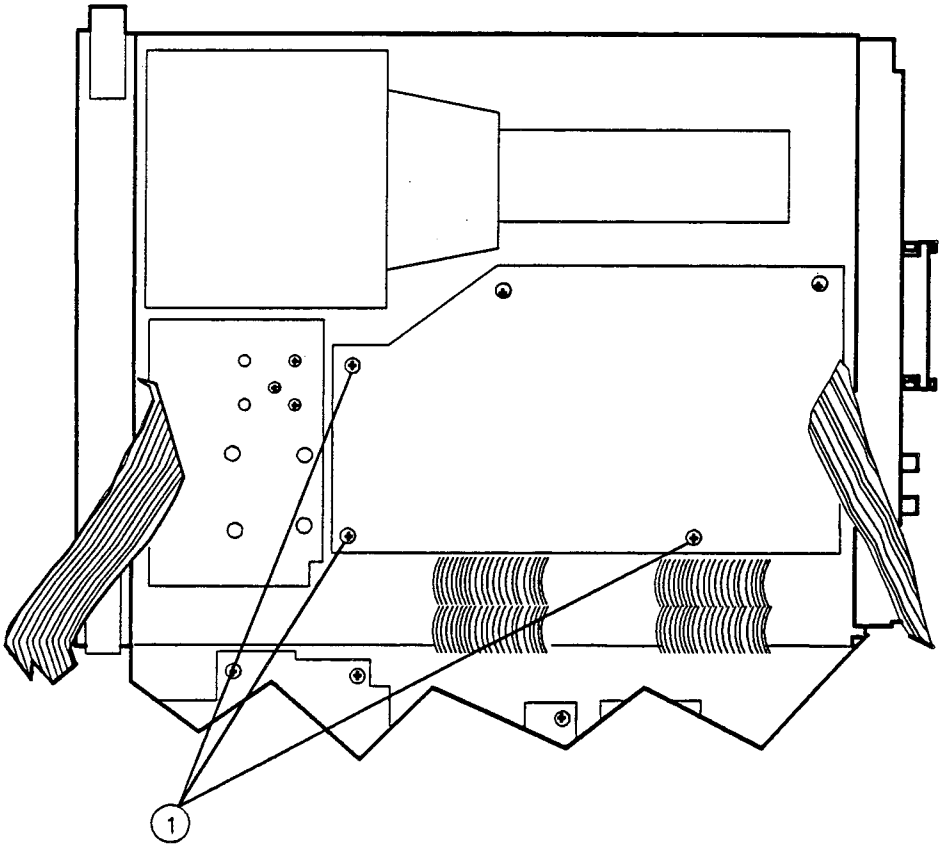


Figure 3-27. A6 Power-Supply Cover

Procedure 14. W3 Line Switch Cable

Removal

Warning  **Due to possible contact with high voltages, disconnect the analyzer ac power cord before beginning this procedure.**

1. Remove the analyzer cover assembly as described in Procedure 1.
2. Remove the eight screws holding the A2, A3, A4, and A5 assemblies to the top of the analyzer. These screws are labeled on the back of the A2 board assembly.
3. Remove ribbon cable W4 from A2J6. The cable location is illustrated in Figure 3-8.

Caution  Do not fold the board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.

4. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
5. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
6. Disconnect A1A1W1 from A3J602.
7. Place the analyzer top-side-up on the work bench with A2, A3, A4, and A5 folded out to the right.

Warning  **The voltage potential at A6A1W3 is +9 kV. Disconnect the analyzer line-power cord before performing this procedure. Failure to discharge A6A1W3 correctly can result in *severe electrical shock* to personnel and damage to the instrument.**

8. Using a small screwdriver with the shank in contact with the CRT shield assembly, slip the tip of the screwdriver under the A6A1W3 post-accelerator cable rubber shroud and short the cable to ground on the CRT shield assembly. See Figure 3-2.
9. Remove the three screws securing the power supply shield to the power supply, and remove the shield.
10. Pull the cable tie (1) (in Figure 3-28), to free W9 and the post-accelerator cables.
11. Disconnect W3 from A6J2.
12. Pull W3 up from between the power supply and the CRT assembly.
13. Continue pulling W3 away from the instrument.
14. Place the analyzer on its right-side frame. Fold out the A14 and A15 assemblies.

Caution Always fold the A14 and A15 assemblies out as one unit, not individually. Folding out one assembly at a time binds the hinges attaching the assemblies and can damage an assembly or its hinge.

15. Remove the eight screws and washers holding the A14 and A15 assemblies to the bottom of the analyzer. Fold out both the A14 and A15 assemblies together. The screws are identified as (1) and (2) in Figure 3-22.

Caution These washers are not captive. Once the assembly screws are removed, the washers can fall into the instrument. Any loose washers in the instrument can cause internal damage. Be sure to account for all washers when assemblies are replaced.

16. Remove the screw (1) securing the W3 line switch assembly to the front-frame. See Figure 3-29. The screw is captive.

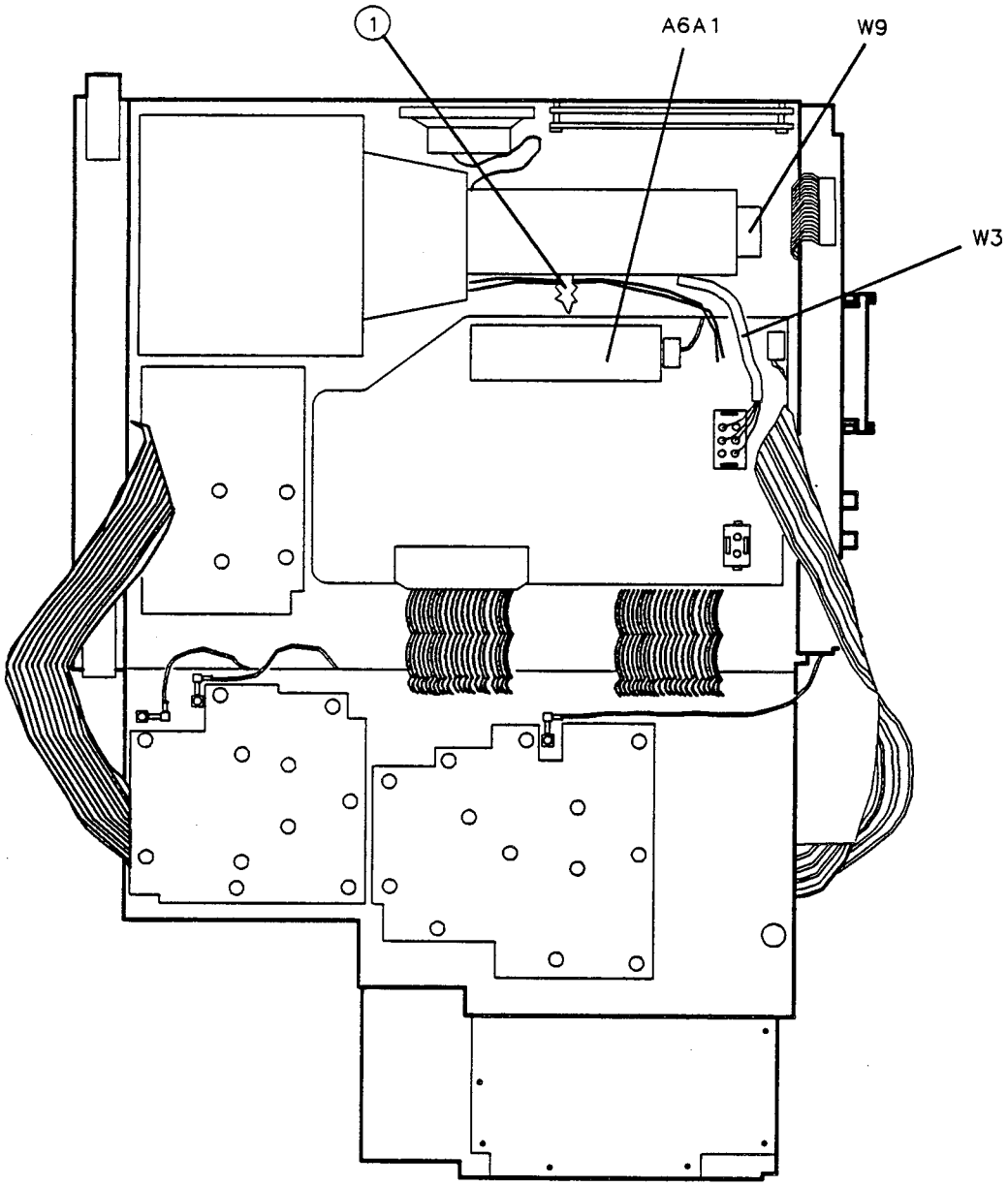


Figure 3-28. W3 Dress and Connection to A6 Power Supply

17. Remove A1W1 and A1W1DS1 from the line switch assembly. Let these cables hang freely.

Note If contact removal tool, HP part number 8710-1791, is available, complete assembly removal by performing steps 18 and 19. Otherwise, skip to step 20.

18. From the top side of the analyzer, use contact removal tool, HP part number 8710-1791, to remove the four wires from the W3 connector. See Figure 3-30. With wire cutters, clip the tie wrap holding the cable to the contact housing.
19. Completely remove W3 cable from the instrument.

20. Remove the A1 Front Frame assembly and A18 CRT assembly as described in Procedure 2, "Removal," steps 10 through 23.
21. Remove the left side frame from the analyzer using the hardware listed below. (The side frame remains attached by the speaker wires. Do not let the side frame hang freely from the wires.)

    Screw

    (1) SCREW-MACH M4 X 0.7 8 mm-LG FLAT HD (three total)
    (2) SCREW-MACH M3 X 0.5 35 mm-LG FLAT HD (two total)
    (3) SCREW-MACH M3 X 0.5 6 mm-LG FLAT HD (six total)
22. Remove the line switch cable assembly.

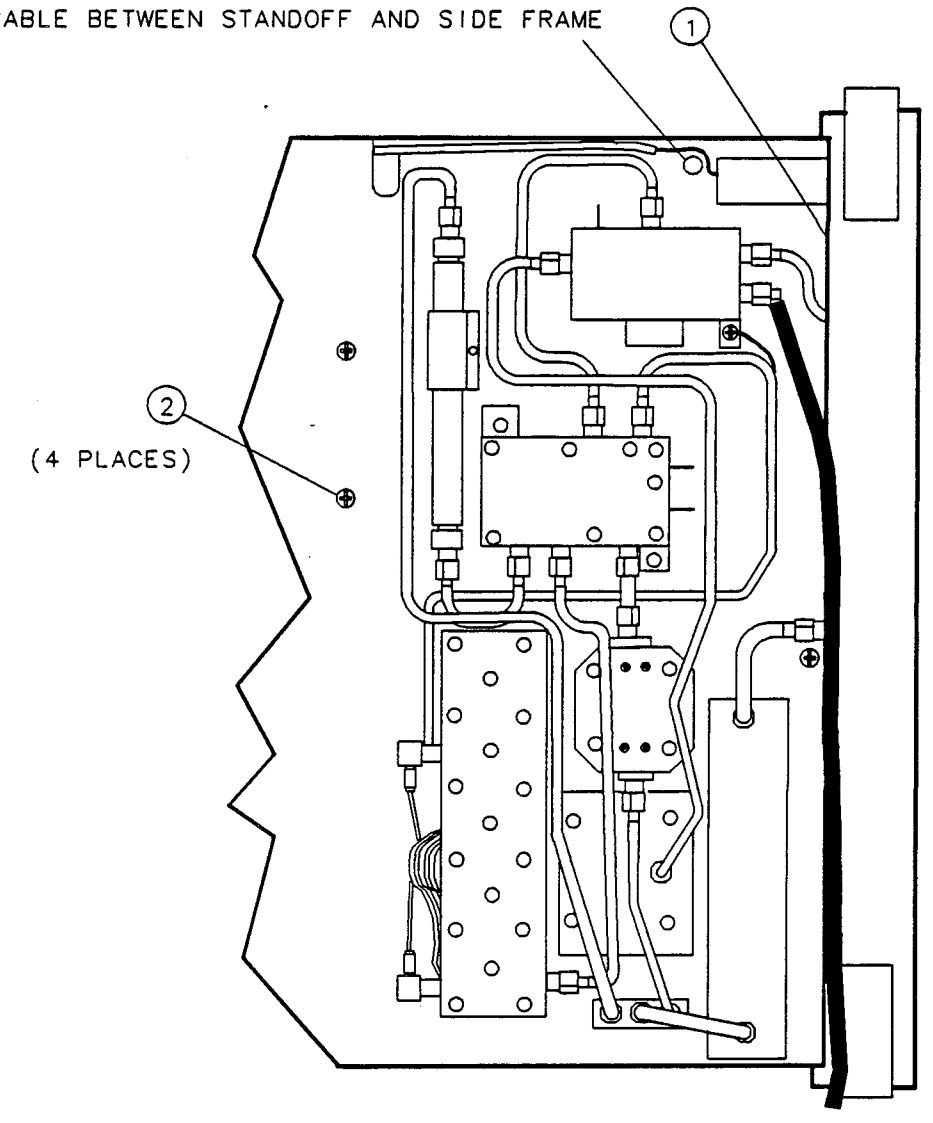


Figure 3-29. Line Switch Mounting Screw and Cable Dress

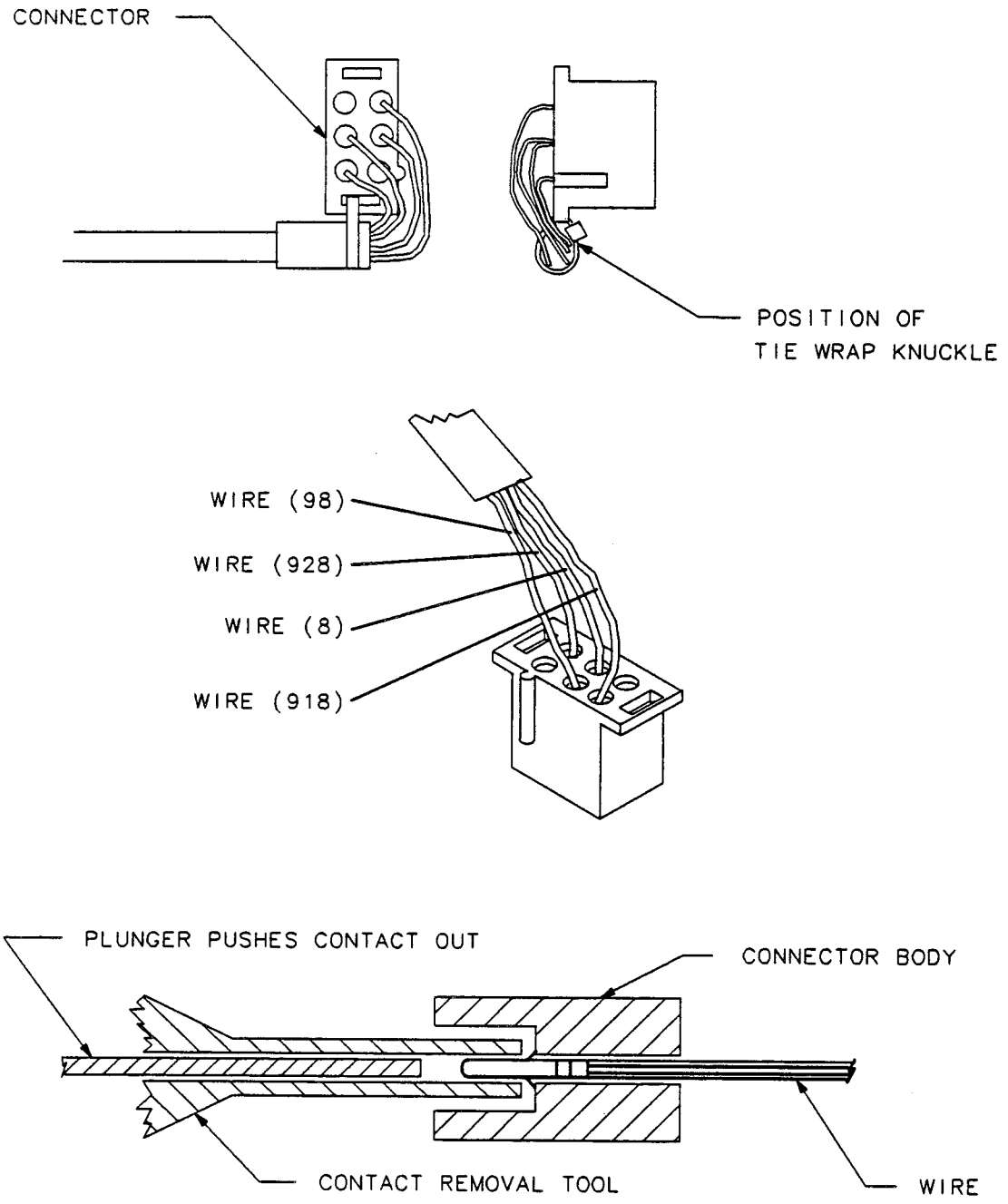


Figure 3-30. W3 Cable Connector

Replacement (Using Contact Removal Tool, HP part number 8710-1791)

1. Ensure that the action of the switch is working properly. With a pair of wire cutters, clip the tie wrap holding the cable to the contact housing of the W3 replacement assembly.
2. Using the contact removal tool, remove the four wires from the connector of the replacement cable assembly.

3. From the bottom side of the analyzer, insert the contact end of W3 through the slotted opening in the main deck. W3 should come through to the top side of the analyzer between the A18 CRT assembly and the post-accelerator cable.
4. Place LED A1W1DS1 into the line switch assembly.
5. Attach the line switch assembly into the front-frame, using the captive panhead screw. Be sure to secure the line switch grounding lug with the screw.
6. Route W3 between the main deck standoff and the side frame. See Figure 3-28.
7. On the top side of the analyzer, secure W3 with tie wraps and route the cable as illustrated in Figure 3-28.
8. Insert the four contacts into the W3 connector.
9. Attach the cable to the connector housing using the supplied tie wrap.
10. Connect W3 to A6J2. Route W3 through the slotted opening in the deck.
11. Connect A1A1W1 to A3J602.
12. Secure the power-supply cover to the power supply, using three flathead screws. One end of the cover fits into a slot provided in the rear-frame assembly.
13. Route W3 and the other cable assemblies between the CRT assembly and the power supply cover so that the W9 wires are below the surface of the power-supply cover.
14. Fold up the A2, A3, A4, and A5 assemblies into the analyzer as described in Procedure 5.
15. Fold up A14 and A15 assemblies.
16. Lay the A14 and A15 assemblies flat against each other in the folded-out position. Make sure that the cables do not get pinched between the two assemblies. Ensure that all coaxial cables are clear of hinges and standoffs before continuing with the next step.
17. Fold both board assemblies into the analyzer as a unit. Use caution to avoid damaging any cable assemblies.
18. Secure the assemblies using the eight screws and washers. Place a washer on the appropriate screw as shown in Figure 3-22, item (2).

Replacement (Without Contact Removal Tool)

1. Lay the replacement line-switch cable assembly between the side frame and main deck. Ensure that the action of the switch is working properly.
2. Attach the left side frame to the deck and rear frame. See Figure 3-31.

   Screw
   (1) SCREW-MACH M4 X 0.7 8 mm-LG FLAT HD (three total)
   (2) SCREW-MACH M3 X 0.5 35 mm-LG FLAT HD (two total)
   (3) SCREW-MACH M3 X 0.5 6 mm-LG FLAT HD (six total)
3. Route W3 between the main deck standoff and the side frame. See Figure 3-28.
4. Attach the A1 Front Frame assembly and the A18 CRT assembly as described in Procedure 2.
5. Place LED A1W1DS1 into the line-switch assembly.

6. Attach the line-switch assembly to the front-frame using the captive panhead screw. Be sure to secure the line-switch grounding lug with the screw.

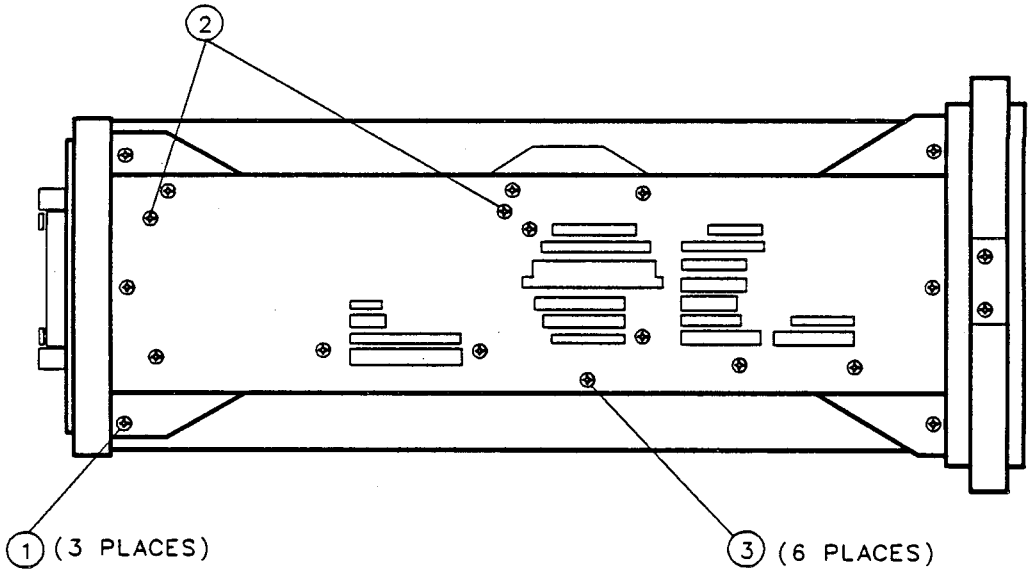


Figure 3-31. Side Frame Mounting Screws

7. On the top side of the analyzer, reroute W3.
8. Connect W3 to A6J2. Route W3 through the slotted opening in the deck.
9. Connect A1A1W1 to A3J602.
10. Secure the power-supply cover shield to the power supply using three flathead screws. One end of the cover fits into a slot provided in the rear frame assembly.
11. Place W3 and the other cable assemblies between the CRT assembly and the power supply cover so the W9 wires are below the surface of the power-supply cover.
12. Fold up the A2, A3, A4, and A5 assemblies into the analyzer as described in Procedure 5.
13. Fold up A14 and A15 assemblies.
14. Lay the A14 and A15 assemblies flat against each other in the folded out position. Make sure that the cables do not get pinched between the two assemblies. Ensure that all coaxial cables are clear of hinges and standoffs before continuing with the next step.
15. Fold both board assemblies into the analyzer as a unit. Use caution to avoid damaging any cable assemblies.
16. Secure the assemblies using the eight screws and washers. Place a washer on the appropriate screw as shown in Figure 3-22, item (2).
17. Replace the analyzer cover assembly.
18. Connect the ac power cord and switch the analyzer power on. If the analyzer does not operate properly, turn off the analyzer power, disconnect the ac line cord, and recheck the analyzer.

Procedure 15. EEROM (A2U501)

Removal/Replacement

Note The EEROM is replaced with the power on. Use a nonmetallic tool to remove the defective EEROM and install the new EEROM.



1. Turn the analyzer (LINE) switch off. Remove the analyzer cover assembly and fold out the A2, A3, A4, and A5 assemblies.

Caution Do not fold the A2, A3, A4, and A5 board assemblies out of the analyzer one at a time. Always fold the A2 and A3 assemblies as a unit and the A4 and A5 assemblies as a unit. Folding out one assembly at a time binds the hinges attaching the assemblies and may damage an assembly and hinge.



2. The board assemblies are attached to the analyzer right-side frame with two hinges. Fold both the A2 and A3 assemblies out of the analyzer as a unit.
3. Fold both the A4 and A5 assemblies out of the analyzer as a unit.
4. Turn the analyzer (LINE) switch on.
5. Set the WR PROT/WR ENA jumper on the A2 Controller assembly to the WR ENA position.
6. Press (CAL) MORE 1 OF 2 SERVICE CAL DATA, and COPY TO EEROM. The analyzer stores the contents of the EEROM into the program RAM.
7. Using a nonmetallic tool, carefully remove the defective EEROM.
8. Carefully install a new EEROM.
9. Press COPY TO EEROM. The analyzer stores the contents of the program RAM into the new EEROM.
10. Turn the analyzer (LINE) switch off, then on, cycling the analyzer power. Allow the power-on sequence to finish.
11. If error message 701, 702, or 703 is displayed, press (RECALL), MORE 1 OF 2, and RECALL ERRORS. Use the STEP keys to view any other errors.
12. If error message 701 or 703 is displayed, perform the Frequency Response adjustment. (If a TAM is available, perform the module "Low Band Flatness" tests. Press (MODULE), ADJUST to enter the TAM Adjust Menu.)
13. If error message 704 is displayed, press (SAVE) SAVE PRSEL PK and (PRESET).
14. If there are no errors after cycling the analyzer power, the EEROM is working properly, but the frequency-response correction data may be invalid. Check the analyzer frequency response.
15. Place the WR PROT/WR ENA jumper in the WR PROT position.

16. Fold the A2 and A3 assemblies into the analyzer as described in Procedure 5. Secure the analyzer cover assembly.

Procedure 16. A21 OCXO

Removal

1. Remove the rear-frame assembly as described in Procedure 13.
2. Place the analyzer on its right-side frame.
3. Fold out the A14 and A15 assemblies.

Caution 

Always fold the A14 and A15 assemblies out as one unit, not individually. Folding out one assembly at a time binds the hinges attaching the assemblies and can damage an assembly or its hinge.

4. Remove the eight screws and washers holding the A14 and A15 assemblies to the bottom of the analyzer. Fold out both the A14 and A15 assemblies together. The screws are identified as (1) and (2) in Figure 3-22.

Caution 

These washers are not captive. Once the assembly screws are removed, the washers can fall into the instrument. Any loose washers in the instrument can cause internal damage. Be sure to account for all washers when assemblies are replaced.

5. Remove the three screws (1) securing the OCXO to the main deck. See Figure 3-32.
6. Disconnect W49, coax 82, and W50 from the OCXO and remove the OCXO from the analyzer.

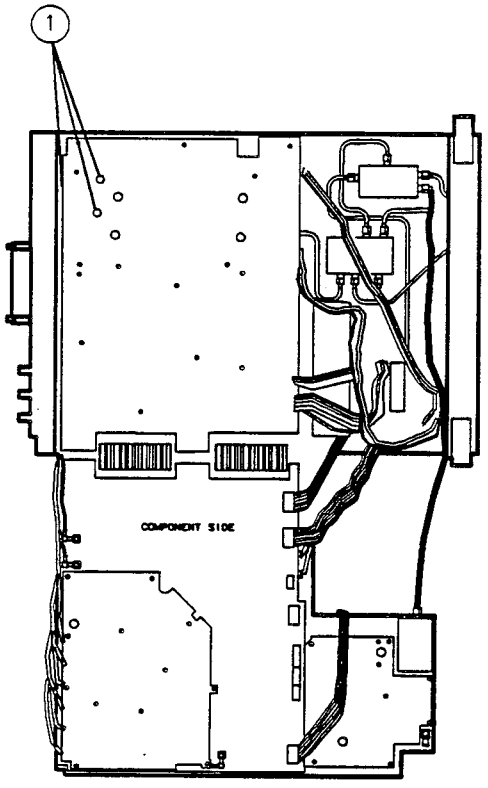


Figure 3-32. A21 OCXO Mounting Screws

Replacement

1. Connect W49, coax 82, and W50 to the OCXO and position the OCXO in the analyzer.
2. Secure the OCXO to the analyzer main deck using three screws (1). See Figure 3-32.
3. Fold A14 and A15 assemblies into the analyzer.
4. Lay the A14 and A15 assemblies flat against each other in the folded-out position. Make sure that the cables do not get pinched between the two assemblies. Ensure that all coaxial cables are clear of hinges and standoffs before continuing with the next step.
5. Fold both board assemblies into the analyzer as a unit. Use caution to avoid damaging any cable assemblies.
6. Secure the assemblies using the eight screws and washers. Place a washer on the appropriate screw as shown in Figure 3-22, item (2).
7. Replace the rear-frame assembly as described in Procedure 13.

4

Replaceable Parts

This chapter contains information on ordering all replaceable parts and assemblies. Instrument parts are identified in the following figures and tables:

	Page
Table 4-1. Firmware-Dependent Part Numbers	4-2
Table 4-2. Reference Designations, Value Multipliers, and Abbreviations	4-3
Table 4-3. Manufacturers Code List	4-7
Table 4-4. Replaceable Parts	4-10
Figure 4-1. Parts Identification, Assy Mounting Screws	4-18
Figure 4-2. Parts Identification, Cover Assembly	4-21
Figure 4-3. Parts Identification, Main Chassis	4-25
Figure 4-4. Parts Identification, Front Deck	4-29
Figure 4-5. Parts Identification, Front Frame	4-33
Figure 4-6. Parts Identification, Rear Frame	4-37

Ordering Information

To order a part or assembly, quote the Hewlett-Packard part number (with check digit), indicate the quantity required, and address the order to the nearest Hewlett-Packard Sales and Service Office. The check digit helps ensure accurate and timely processing of your order.

To order a part not listed in the replaceable parts table, include the instrument model number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard Sales and Service Office.

Direct Mail Order System

Within the USA, Hewlett-Packard can supply parts through a direct mail order system. Advantages of using the system are as follows:

- Direct ordering and shipment from the Support Materials Organization (SMO) in Roseville, California.
- No maximum or minimum on any mail order (there is a minimum order amount for parts ordered through a local HP office when the orders require billing and invoicing).
- Prepaid transportation (there is a small handling charge for each order).
- No invoices.

To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information is available through your local HP Sales and Service Office.

Direct Phone-Order System

Within the USA, a phone order system is available for regular and hotline replacement parts service. A toll-free phone number is available, and Mastercard and Visa are accepted.

Regular Orders: The toll-free phone number, (800) 227-8164, is available 6 AM to 5 PM, Pacific time, Monday through Friday. Regular orders have a 4-day delivery time.

Hotline Orders: Hotline service for ordering emergency parts is available 24 hours a day, 365 days a year. There is an additional hotline charge to cover the cost of freight and special handling.

The toll-free phone number is (800) 227-8164, is available 6 AM to 5 PM, Pacific time, Monday through Friday. Phone (415) 968-2347 after-hours, weekends, and holidays. Hotline orders are normally delivered the following business day.

Parts List Format

The following information is listed for each part:

- Reference designator of the part (if any). This is abbreviated as "Ref Desig."
- The Hewlett-Packard part number.
- The part number check digit (CD).
- The total quantity (Qty) in the assembly. This quantity is given only once, at the first appearance of the part in the list.
- The description of the part.
- A five-digit code indicating a typical manufacturer of the part.
- The manufacturer part number.

Firmware-Dependent Part Numbers

Table 4-1 lists the part numbers for EPROMs A2U306 through A2U309. These part numbers are dependent on the firmware date code used in the analyzer. To determine the firmware date code, press [PRESET] and look in the active-function display area for firmware revision information.

Table 4-1. Firmware-Dependent Part Numbers

Firmware Date Code	A2U306	A2U307	A2U308	A2U309
890930	08563-80002	08563-80003	08563-80004	08563-80005
891201	08560-80023	08560-80024	08560-80025	08560-80026
900301	08563-80006	08563-80007	08563-80008	08563-80009

Table 4-2. Reference Designations, Abbreviations and Multipliers (1 of 4)

REFERENCE DESIGNATIONS					
A	Assembly	F	Fuse	RT	Thermistor
AT	Attenuator, Isolator, Limiter, Termination	FL	Filter	S	Switch
		HY	Circulator	T	Transformer
B	Fan, Motor	J	Electrical Connector (Stationary Portion), Jack	TB	Terminal Board
BT	Battery			TC	Thermocouple
C	Capacitor			TP	Test Point
CP	Coupler	K	Relay	U	Integrated Circuit, Microcircuit
CR	Diode, Diode Thyristor, Step Recovery Diode, Varactor	L	Coil, Inductor		
		M	Meter	V	Electron Tube
		MP	Miscellaneous Mechanical Part	VR	Breakdown Diode (Zener), Voltage Regulator
DC	Directional Coupler	P	Electrical Connector (Movable Portion), Plug		
DL	Delay Line			W	Cable, Wire, Jumper
DS	Annunciator, Lamp, Light Emitting Diode (LED), Signaling Device (Visible)			X	Socket
		Q	Silicon Controlled Rectifier (SCR), Transistor, Triode Thyristor	Y	Crystal Unit (Piezoelectric, Quartz)
				Z	Tuned Cavity, Tuned Circuit
E	Miscellaneous Electrical Part	R	Resistor		

ABBREVIATIONS					
	A	BSC	Basic	CNDCT	Conducting, Conductive, Conductivity, Conductor
		BTN	Button		
A	Across Flats, Acrylic, Air (Dry Method), Ampere		**C**		
				CONT	Contact, Continuous, Control, Controller
ADJ	Adjust, Adjustment	C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression		
ANSI	American National Standards Institute (formerly USASI-ASA)			CONV	Converter
				CPRSN	Co mpression
ASSY	Assembly	CCP	Carbon Composition Plastic	CUP-PT	Cup Point
AWG	American Wire Gage			CW	Clockwise, Continuous Wave
		CD	Cadmium, Card, Cord		
	B				
		CER	Ceramic		
BCD	Binary Coded Decimal	CHAM	Chamfer		**D**
		CHAR	Character, Characteristic, Charcoal		
BD	Board, Bundle			D	Deep, Depletion, Depth, Diameter, Direct Current
BE-CU	Beryllium Copper				
BNC	Type of Connector	CMOS	Complementary Metal Oxide Semiconductor		
BRG	Bearing, Boring				
BRS	Brass			DA	Darlington

Table 4-2. Reference Designations, Abbreviations, and Multipliers (2 of 4)

ABBREVIATIONS					
DAP-GL	Diallyl Phthalate Glass	FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot	JFET	Junction Field Effect Transistor
DBL	Double				
DCDR	Decoder				**K**
DEG	Degree				
D-HOLE	D-Shaped Hole	FXD	Fixed	K	Kelvin, Key, Kilo, Potassium
DIA	Diameter				
DIP	Dual In-Line Package		**G**	KNRLD	Knurled
DIP-SLDR	Dip Solder			KVDC	Kilovolts
D-MODE	Depletion Mode	GEN	General, Generator		Direct Current
DO	Package Type Designation	GND	Ground		
		GP	General Purpose, Group		**L**
DP	Deep, Depth, Diametric Pitch, Dip			LED	Light Emitting Diode
DP3T	Double Pole Three Throw		**H**		
				LG	Length, Long
DPDT	Double Pole Double Throw	H	Henry, High	LIN	Linear, Linearity
		HDW	Hardware	LK	Link, Lock
DWL	Dowell	HEX	Hexadecimal, Hexagon, Hexagonal	LKG	Leakage, Locking
				LUM	Luminous
	E				
		HLCL	Helical		
E-R	E-Ring	HP	Hewlett-Packard Company, High Pass		**M**
EXT	Extended, Extension, External, Extinguish				
				M	Male, Maximum, Mega, Mil, Milli, Mode
			I		
	F				
		IC	Collector Current, Integrated Circuit	MA	Milliampere
F	Fahrenheit, Farad, Female, Film (Resistor), Fixed, Flange, Frequency			MACH	Machined
		ID	Identification, Inside Diameter	MAX	Maximum
				MC	Molded Carbon Composition
		IF	Forward Current, Intermediate Frequency		
FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face			MET	Metal, Metallized
				MHZ	Megahertz
		IN	Inch	MINTR	Miniature
		INCL	Including	MIT	Miter
FDTHRU	Feedthrough	INT	Integral, Intensity, Internal	MLD	Mold, Molded
FEM	Female			MM	Magnetized Material, Millimeter
FIL-HD	Fillister Head				
FL	Flash, Flat, Fluid		**J**	MOM	Momentary
FLAT-PT	Flat Point			MTG	Mounting
FR	Front	J-FET	Junction Field Effect Transistor	MTLC	Metallic
FREQ	Frequency			MW	Milliwatt

Table 4-2. Reference Designations, Abbreviations, and Multipliers (3 of 4)

ABBREVIATIONS					
	N	PLSTC	Plastic	SMA	Subminiature,
		PNL	Panel		A Type (Threaded
N	Nano, None	PNP	Positive Negative		Connector)
N-CHAN	N-Channel		Positive (Transistor)	SMB	Subminiature,
NH	Nanohenry	POLYC	Polycarbonate		B Type (Slip-on
NM	Nanometer,	POLYE	Polyester		Connector)
	Nonmetallic	POT	Potentiometer	SMC	Submi niature,
NO	Normally Open,	POZI	Pozidriv Recess		C-Type (Threaded
	Number	PREC	Precision		Connector)
NOM	Nominal	PRP	Purple, Purpose	SPCG	Spacing
NPN	Negative Positive	PSTN	Piston	SPDT	Single Pole
	Negative (Transistor)	PT	Part, Point,		Double Throw
NS	Nanosecond,		Pulse Time	SPST	Single Pole
	Non-Shorting, Nose	PW	Pulse Width		Single Throw
NUM	Numeric			SQ	Square
NYL	Nylon (Polyamide)			SST	Stainless Steel
			Q	STL	Steel
	O			SUBMIN	Subminiature
		Q	Figure of Merit	SZ	Size
OA	Over-All				
OD	Outside Diameter		**R**		
OP AMP	Operational				
	Amplifier	R	Range, Red,		**T**
OPT	Optical, Option,		Resistance, Resistor,		
	Optional		Right, Ring	T	Teeth,
		REF	Reference		Temperatu re,
	P	RES	Resistance, Resistor		Thickness, Time,
		RF	Radio Frequency		Timed, Tooth,
PA	Picoampere, Power	RGD	Rigid		Typical
	Amplifier	RND	Round	TA	Ambient
PAN-HD	Pan Head	RR	Rear		Temperature,
PAR	Parallel, Parity	RVT	Rivet, Riveted		Tantalum
PB	Lead (Metal),			TC	Temperature
	Pushbutton		**S**		Coeffi cient
PC	Printed Circuit			THD	Thread, Threaded
PCB	Printed Circuit	SAWR	Surface Acoustic	THK	Thick
	Board		Wave Resonator	TO	Package Type
P-CHAN	P-Channel	SEG	Segment		Designation
PD	Pad, Power	SGL	Single	TPG	Tapping
	Dissipation	SI	Silicon,	TR-HD	Truss Head
PF	Picofarad, Power		Square Inch	TRMR	Trimmer
	Factor	SL	Slide, Slow	TRN	Turn, Turns
PKG	Package	SLT	Slot, Slotted	TRSN	Torsion

Table 4-2. Reference Designations, Abbreviations, and Multipliers (4 of 4)

ABBREVIATIONS					
	U	VAR	Variable		**Y**
		VDC	Volts—Direct Current		
UCD	Microcandela			YIG	Yttrium-Iron-Garnet
UF	Microfarad				
UH	Microhenry		**W**		
UL	Microliter, Underwriters' Laboratories, Inc.	W	Watt, Wattage, White, Wide, Width		**Z**
UNHDND	Unhardened	W/SW	With Switch	ZNR	Zener
		WW	Wire Wound		
	V				
			X		
V	Variable, Violet, Volt, Voltage	X	By (Used with Dimensions), Reactance		
VAC	Vacuum, Volts—Alternating Current				

MULTIPLIERS					
Abbreviation	**Prefix**	**Multiple**	**Abbreviation**	**Prefix**	**Multiple**
T	tera	10^{12}	m	milli	10^{-3}
G	giga	10^{9}	μ	micro	10^{-6}
M	mega	10^{6}	n	nano	10^{-9}
k	kilo	10^{3}	p	pico	10^{-12}
da	deka	10^{2}	f	femto	10^{-15}
d	deci	10^{-1}	a	atto	10^{-18}
c	centi	10^{-2}			

Table 4-3. Manufacturers Code List (1 of 3)

Mfr. Code	Manufacturer Name	Address	
C0633	RIFA AB	STOCKHOLM	SW
C1433	AB ELEKTRONICK GMBH	SALZBURG	AU
D8350	GROSS A	STUTTGART	GM
D8351	MARQUARDT GMBH	RIETHEIM	GM
D8439	ROEDERSTEIN/RESISTA GMBH	LANDSHUT	GM
K7253	STC/STANTEL	DEVON	EG
K8479	HOLSWORTHY ELECTRONICS LTD	HOLSWORTHY	EG
S0545	NEC ELECTRONICS INC	MTN VIEW	CA
S0562	TOSHIBA CORP	TOKYO	JP
00000	ANY SATISFACTORY SUPPLIER		
00471	DOW-KEY CO INC	BROOMFIELD	WY
00494	ADDRESSOGRAPH FARRINGTON	TREVOSE	PA
00779	AMP INC	HARRISBURG	PA US
00853	SANGAMO WESTON INC	NORCROSS	GA US
01121	ALLEN-BRADLEY CO INC	EL PASO	TX US
01295	TEXAS INSTRUMENTS INC	DALLAS	TX US
01686	RCL ELECTRONICS INC	NORTHBROOK	IL US
01766	INTL CRYSTAL MFG CO INC	OKLAHOMA CITY	OK
01961	PULSE ENGINEERING INC	SAN DIEGO	CA
02113	COILCRAFT INC	CARY	IL
02114	FERROXCUBE CORP	SAUGERTIES	NY US
02768	ITW FASTEX	DES PLAINES	IL
04222	AVX CORP	GREAT NECK	NY US
04713	MOTOROLA INC	ROSELLE	IL US
05791	LYN-TRON INC	BURBANK	CA
05972	LOCTITE CORP	NEWINGTON	CT
06001	MEPCO/ELECTRA INC	MORRISTOWN	NJ US
06132	COMPUTER TERMINAL CORP	SAN ANTONIO	TX
06156	BAUM W A CO INC	COPIAGUE	NY
06341	PRODUCTS/TECHNIQUES INC	LOS ANGELES	CA
06383	PANDUIT CORP	TINLEY PARK	IL US
06394	HOOVER UNIVERSAL INC BALL & RLR DIV	SALINE	MI
06424	SPERRY U-WAVE ELEK DIV SPERRY RAND	CLEARWATER	FL
06560	JEFFERS ELECTRONICS INC	NOGALES	AZ US
06665	PRECISION MONOLITHICS INC	SANTA CLARA	CA US
07047	MILTON ROSS CO	SOUTHHAMPTON	PA
07263	FAIRCHILD SEMICONDUCTOR CORP	CUPERTINO	CA US
07933	RAYTHEON CO SEMICONDUCTOR DIV HQ	MOUNTAIN VIEW	CA
09023	CORNELL-DUBILIER/SANGAMO	WAYNE	NJ
09795	DIXON INDUSTRIES CORPORATION	BRISTOL	RI
09922	BURNDY CORP	NORWALK	CT
11236	CTS CORP	ELKHART	IN
11502	IRC INC	BOONE	NC US

Table 4-3. Manufacturers Code List (2 of 3)

Mfr. Code	Manufacturer Name	Address	
15542	MINI-CIRCUITS LAB	BROOKLYN	NY US
15801	FENWAL ELECTRONICS INC	SADDLE BROOK	NJ
15818	TELEDYNE SEMICONDUCTOR	MOUNTAIN VIEW	CA
16179	M/A-COM INC	BURLINGTON	MA US
16299	CORNING ELECTRONICS	RALEIGH	NC US
16428	COOPER INDUSTRIES INC	HOUSTON	TX
17856	SILICONIX INC	SANTA CLARA	CA US
18324	SIGNETICS CORP	SUNNYVALE	CA US
18612	VISHAY INTERTECHNOLOGY INC	MALVERN	PA
18873	DUPONT E I DE NEMOURS & CO	WILMINGTON	DE US
19701	MEPCO/CENTRALAB INC	WEST PALM BEACH	FL US
2M627	ROHM CORP	IRVINE	CA US
24022	TELEDYNE INC	LOS ANGELES	CA US
24226	GOWANDA ELECTRONICS CORP	GOWANDA	NY US
24355	ANALOG DEVICE INC	NORWOOD	MA US
25403	NV PHILIPS ELCOMA	EINDHOVEN	NE
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA	CA US
28480	HP DIV 01 SAN JOSE COMPONENTS	SAN JOSE	CA
29005	STORM PRODUCTS CO	LOS ANGELES	CA
30043	SOLID STATE DEVICES INC	LA MIRADA	CA
3L585	RCA CORP	NEW YORK	NY US
30161	AAVID ENGINEERING INC	LACONIA	NH US
32159	WEST-CAP ARIZONA	SAN FERNANDO	CA US
32293	INTERSIL INC	CUPERTINO	CA CA
32997	BOURNS INC	RIVERSIDE	CA US
33096	COLORADO CRYSTAL CORP	LOVELAND	CO
33399	TELE-TECH CORP	BOZEMAN	MT US
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE	CA US
34371	HARRIS CORP	MELBOURNE	FL US
34649	INTEL CORP	SANTA CLARA	CA US
34899	FAIR RITE PRODUCTS CORP	WALLKILL	NY
4G819	OVERLAND PRODUCTS CORP	PHOENIX	AZ
50157	MIDWEST COMPONENTS	MUSKEGON	MI
52063	EXAR INTEGRATED SYSTEMS INC	SUNNYVALE	CA
52763	STETTNER & CO	LAUF	GM
55719	SNAP-ON TOOLS CORP	KENOSHA	WI US
55210	GETTIG ENGRG & MFG CO INC	SPRING MILLS	PA
55285	BERGWUIST CO	MINNEAPOLIS	MN
55322	SAMTEC	NEW ALBANY	IN
55680	NICHICON (AMERICA) CORP	SCHAUMBERG	IL US
56289	SPRAGUE ELECTRIC CO	LEXINGTON	MA US

Table 4-3. Manufacturers Code List (3 of 3)

Mfr. Code	Manufacturer Name	Address	
6E259	AMETEK INC	PAOLI	PA US
70276	ALLEN MFG CO	HARTFORD	CT
71744	GENERAL INSTRUMENT CORP	CLIFTON	NJ
71984	DOW CORNING CORP	MIDLAND	MI
72228	CONTINENTAL SCREW CO DIV OF AMCA	BEDFORD	MA
73138	BECKMAN INDUSTRIAL CORP	FULLERTON	CA US
76381	3M CO	ST PAUL	MN US
78553	EATON CORP	CLEVELAND	OH
83701	ELECTRONIC DEVICES INC	YONKERS	NY
84411	AMERICAN SHIZUKI CORP	CONOGA PARK	CA US
9M011	INTL RECTIFIER CORP	LOS ANGELES	CA US
9N171	UNITRODE CORP	LEXINGTON	MA US
91506	AUGAT INC	MANSFIELD	MA
91637	DALE ELECTRONICS INC	COLUMBUS	NE US
92194	ALPHA WIRE CORP	ELIZABETH	NJ
92895	AMERICAN OIL & SUPPLY CO	NEWARK	NJ
96900	HARDMAN INC	BELLEVILLE	NJ
98978	INTL ELECTRONIC RESEARCH CORP	BURBANK	CA
98291	SEALECTRO CORP	TRUMBULL	CT US
99800	AMER PRCN IND INC DELEVAN DIV	AURORA	NY
01561	CHASSIS TRAK DIV GENERAL DEVICES CO	INDIANAPOLIS	IN
10183	GRAHAM MAGNETICS INC	FT WORTH	TX US
11591	STUART RADIATOR CO	SAN FRANCISCO	CA
16179	M/A-COM INC	BURLINGTON	MA US
16428	COOPER INDUSTRIES INC	HOUSTON	TX US
24022	TELEDYNE INC	LOS ANGELES	CA US
24931	SPECIALTY CONNECTOR CO	FRANKLIN	IN US

Table 4-4. Replaceable Parts (1 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				ACCESSORIES SUPPLIED		
	5180-9055	0	1	SUN HOOD	28480	5180-9055
	1810-0118	1	1	TERMINATION-COAXIAL SMA; 0.5W; 50Ω	16179	2003-6113-02
	1250-0780	5	1	ADAPTER-COAX F-BNC M-N	24931	29JP104-2
	10502A	9	1	50Ω COAX CABLE WITH BNC MALE	28480	10502A
	8120-2682	2	1	CABLE ASSY-COAX 50Ω 30 PF/FT	28480	8120-2682
	8710-1755	9	3	WRENCH-HEX KEY	55719	AWML4
				OPTION 908		
	5062-0800	5	1	RACK KIT WITH FLANGES (Includes Parts Listed Below)		
	5001-8739	7	2	PANEL-DRESS	28480	5001-8739
	5001-8740	0	2	PANEL-SUB	28480	5001-8740
	5001-8742	2	2	SUPPORT-REAR	28480	5001-8742
	5021-5807	6	2	FRAME-FRONT	28480	5021-5807
	5021-5808	7	2	FRAME-REAR	28480	5021-5808
	5021-5836	1	5	CORNER-STRUT	28480	5021-5836
	0510-1148	2	10	RETAINER-PUSH-ON KB-TO-SHFT EXT	11591	669
	0515-0886	3	16	SCREW-MACH M3 x 0.5 6MM-LG PAN-HD	28480	0515-0886
	0515-0887	4	8	SCREW-MACH M3.5 x 0.6 6MM-LG PAN-HD	28480	0515-0887
	0515-0889	6	12	SCREW-MACH M3.5 x 0.6 6MM-LG	28480	0515-0889
	0515-1241	6	8	SCREW-MACH M5 x 0.8 12 MM-LG PAN-HD	28480	0515-1241
	0515-1331	5	22	SCREW-METRIC SPECIALTY M4 x 0.7 THD; 7MM	28480	0515-1331
	5061-9679	2	2	MOUNT FLANGE	28480	5061-9679
	0515-1114	2	6	SCREW-MACH M4 x 0.7 10MM-LG PAN-HD	28480	0515-1114
	8710-1755	9		WRENCH-HEX KEY	55719	AWML4
	5958-6573	0	2	ASSEMBLY INSTRUCTIONS	28480	5958-6573
				OPTION 909		
	5062-1900	8	1	RACK KIT WITH FLANGES AND HANDLES (Includes Parts Listed Below)		
	5001-8739	7		PANEL-DRESS	28480	5001-8739
	5001-8740	0		PANEL-SUB	28480	5001-8740
	5001-8742	2		SUPPORT-REAR	28480	5001-8742
	5021-5807	6		FRAME-FRONT	28480	5021-5807
	5021-5808	7		FRAME-REAR	28480	5021-5808
	5021-5836	1		CORNER-STRUT	28480	5021-5836
	0510-1148	2		RETAINER-PUSH-ON KB-TO-SHFT EXT	11591	669
	0515-0886	3		SCREW-MACH M3 x 0.5 6MM-LG PAN-HD	28480	0515-0886
	0515-0887	4		SCREW-MACH M3.5 x 0.6 6MM-LG PAN-HD	28480	0515-0887

Table 4-4. Replaceable Parts (2 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
	0515-0889	6		SCREW-MACH M3.5 x 0.6 6MM-LG	28480	0515-0889
	0515-1241	6		SCREW-MACH M5 x 0.8 12MM-LG PAN-HD	28480	0515-1241
	0515-1331	5		SCREW-METRIC SPECIALTY M4 x 0.7 THD; 7MM	28480	0515-1331
	5061-9501	9	2	FRONT HANDLE ASS'Y	28480	5061-9501
	5061-9685	0	2	MOUNT FLANGE	28480	5061-9685
	0515-1106	2	6	SCREW-MACH M4 x 0.7 16MM-LG PAN-HD	28480	0515-1106
	8710-1755	9		WRENCH-HEX KEY	55719	AWML4
	5958-6573	0		ASSEMBLY INSTRUCTIONS	28480	5958-6573
				RACK SLIDE KIT		
	1494-0060	0	1	SLIDE-CHAS 25-IN-LG 21.84-IN-TRVL (Includes parts listed below. Slides cannot be ordered separately.)	01561	C858-2
	0515-0949	9	4	SCREW-MACH M5 x 0.8 14MM-LG PAN-HD	28480	0515-0949
	0515-1013	0	9	SCREW-MACH M4 x 0.7 12MM-LG	28480	0515-1013
	0515-0909	1	4	SCREW-MACH M4 x 0.7 12MM-LG PAN-HD	28480	0515-0909
	0535-0080	1	8	NUT-CHANNEL M4 x 0.7 3.5MM-THK 10.3MM-WD	28480	0535-0080

Table 4-4. Replaceable Parts (3 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				MAJOR ASSEMBLIES		
A1	08561-60016	4	1	FRONT FRAME ASSEMBLY (A1 assembly includes the front frame, front faceplate, front-panel keys, and other hardware. Figure 4-5 lists the individual part numbers.)	28480	08561-60016
A1A1	See Table A-1		1	BD AY-KEYBOARD	28480	See Table A-1
A1A2	0960-0745	6	1	RPG ASSEMBLY (Includes Cable)	28480	0960-0745
A2	See Table A-1		1	CONTROLLER ASSEMBLY*	28480	See Table A-1
A3	See Table A-1		1	INTERFACE ASSEMBLY	28480	See Table A- 1
A4	See Table A-1		1	LOG AMPLIFIER ASSEMBLY*	28480	See Table A-1
A5	See Table A-1	8	1	IF FILTER ASSEMBLY	28480	See Table A- 1
A6	See Table A-1		1	POWER SUPPLY ASSEMBLY* (DOES NOT INCLUDE A6A1)	28480	See Table A-1
A6A1	5062-7089	6	1	HIGH VOLTAGE ASSEMBLY	28480	5062-7089
A7	5086-7744	0	1	FIRST LO DISTRIBUTION AMPLIFIER	28480	5086-7744
A8	5086-7838	3	1	DUAL BAND MIXER	28480	5086-7838
	5086-6838	1	1	REBUILT A8, EXCHANGE REQUIRED	28480	5086-6744
A9	5086-7783	7	1	PORT ATTEN 22 GHz	28480	5086-7783
	5086-6783	5	1	REBUILT A9, EXCHANGE REQUIRED	28480	5086-6783
	5086-7796	2	1	PORT ATTEN, OPT. 026, 26.5 GHz	28480	5086-7796
	5086-6796	0	1	REBUILT A9 FOR OPT. 026 EXCHANGE REQUIRED	28480	5086-6796
A10	0955-0277	8	1	YTF, 22 GHZ	28480	0955-0277
	5086-7850	4	1	YTF, 26.5 GHZ (OPT. 026)	28480	5086-7850
A11	5086-7781	5	1	PORTABLE LVLD YTO	28480	5086-7781
	5086-6781	3	1	REBUILT A11, EXCHANGE REQUIRED	28480	5086-6781
A12	3106-0022	9	1	RF SWITCH (STANDARD)	28480	3106-0022
	3106-0032	2	1	RF SWITCH (OPT. 026) 26.5 GHZ	28480	3106-0032
A13	5086-7812	3	1	SECOND CONVERTER	28480	5086-7812

* These assemblies are part of the rebuilt board exchange program. To order a rebuilt board, use the same number as that of the new board with the exception of the 7th number which should be a 9. Example: new board number is 08562-60094. therefore, the rebuilt board number will be 08562-69094.

Table 4-4. Replaceable Parts (4 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A14	See Table A-1		1	FREQUENCY CONTROL ASSEMBLY	28480	See Table A-1
A15	See Table A-1		1	RF ASSEMBLY	28480	See Table A- 1
A15A1	5086-7751	9	1	SECOND IF AMP	28480	5086-7751
A15A2	5086-7750	8	1	SAMPLER	28480	5086-7750
A16	See Table A-1	1	1	CAL OSCILLATOR ASSEMBLY	28480	See Table A-1
A17	See Table A-1	2	1	CRT DRIVER ASSEMBLY	28480	See Table A-1
A18				CRT ASSEMBLY (Order by Individual Parts)		
A18MP1	5062-7097	6	1	CRT WIRING ASSEM. (Includes Shield A18L1, and A18W1)	28480	5062-7097
A18MP2	5041-3987	1	1	SPACER, CRT	28480	5041-3987
A18V1	2090-0225	4	1	TUBE, CRT 6.7 IN	28480	2090-0225
A18W1				CABLE ASSEMBLY, TWO WIRE, TRACE ALIGN (P/O A18MP1, A17J5 to A18L1)		
A19	See Table A-1	7	1	HP-IB ASSEMBLY	28480	See Table A- 1
A19W1	5061-9031	0	1	CABLE ASSEMBLY, RIBBON, HP-IB (A2J5 to Rear Panel J2)	28480	5061-9031
A20	5062-0797	9	1	BATTERY ASSY (Includes W6, BT1)	28480	5062-0797
A21	1813-0644	4	1	OCXO 10.0 MHz (Not in Opt. 103)	28480	1813-0644
B1	5061-9036	5	1	FAN ASSEMBLY (Includes Wire)	28480	5083-9036
BT1	1420-0315	3	1	BATTERY 3.4V 1.7A-HR LITHIUM	10183	TL-5104/S
F1	2110-0709	3	1	THIONYL FUSE 5A 250V NTD FE IEC (230 VAC Operation)	16428	GDA-5
F1	2110-0756	0	1	FUSE 5A 125V NTD UL (115 VAC Operation)	28480	2110-0756
FL1	0955-0420	3	1	LOW PASS FILTER	28480	0955-0420
FL2	9135-0307	4	1	LOW PASS FILTER, A8J2 TO A13J1	28480	9135-0307
FL3				NOT ASSIGNED		
FL4	5061-9032	1	1	LINE FILTER ASSEMBLY	28480	5061-9032
LS1	9160-0282	9	1	LOUDSPEAKER 2.5 IN SQ (Part of W5)	28480	9160-0282

Table 4-4. Replaceable Parts (5 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				ASSEMBLY SHIELDS		
A3 Assembly	5021-6723	7	1	PEAK DETECTOR (TOP)	28480	5021-6723
	5021-6724	8	1	PEAK DETECTOR (BOTTOM)	28480	5021-6723
	0515-2080	8	2	SCREW CPT M2.5 14L	28480	0515-2080
	0515-1486	9	10	SCREW CPT M2.5 9.5L	28480	0515-1486
	0905-0375	2	12	0-RING .070ID	28480	0905-0375
	2190-0583	9	12	WSHR LK M2.5ID	28480	2190-0583
A4 Assembly	5021-6725	9	1	AMP 1 (BOTTOM)	28480	5021-6725
	5021-6726	0	1	AMP 1 (TOP)	28480	5021-6726
	5021-6727	1	1	AMP 2 (TOP)	28480	5021-6727
	5021-6728	2	1	AMP 2 (BOTTOM)	28480	5021-6728
	0515-2080	8	24	SCREW CPT M2.5 14L	28480	0515-2080
	2190-0583	9	24	WSHR LK M2.5ID	28480	2190-0583
A5 Assembly	5021-6729	3	1	IF 1 (TOP)	28480	5021-6729
	5021-6730	6	1	IF 1 (BOTTOM)	28480	5021-6730
	5021-6731	7	1	IF 2 (TOP)	28480	5021-6731
	5021-6732	8	1	IF 2 (BOTTOM)	28480	5021-6732
	0515-2081	3	16	SCREW 5MM 2.5 16 PNPDS	28480	0515-2081
	0905-0375	2	16	0-RING .070ID	28480	0905-0375
	2190-0583	9	16	WSHR LK M2.5ID	28480	2190-0583
A14 Assembly	5021-6733	9	1	RLR OSC (TOP)	28480	5021-6733
	5021-6734	0	1	RLR OSC (BOTTOM)	28480	5021-6734
	0515-0951	3	13	SCREW 5MM 2.5 16 PNPDS	28480	0515-0951
	0905-0375	2	13	0-RING .070ID	28480	0905-0375
	2190-0583	9	13	WSHR LK M2.5ID	28480	2190-0583
A15 Assembly	5021-6735	1	1	REF (TOP)	28480	5021-6735
	5021-6736	2	1	REF (BOTTOM)	28480	5021-6736
	5021-6737	3	1	SYNTHZR (TOP)	28480	5021-6737
	5021-9391	1	1	SYNTHZR (BOTTOM)	28480	5021-6738
	5021-9392	2	1	SIGPATH (TOP)	28480	0515-6739
	5021-6740	8	1	SIGPATH (BOTTOM)	28480	0905-6740
	5002-0631	4	1	BRACE, RF BD	28480	5002-0631
	0515-1777	3	2	SCREW	28480	0515-1777
	0515-0951	3	31	SCREW 5MM 2.5 16 PNPDS	28480	0515-0951
	0905-0375	2	33	0-RING .070ID	28480	0905-0375
	2190-0583	9	31	WSHR LK M2.5 ID	28480	2190-0583
A16 Assembly	5021-6741	9	1	CAL OSC (TOP)	28480	5021-6741
	5021-6742	0	1	CAL OSC (BOTTOM)	28480	5021-6742
	0515-2081	3	2	SCREW 5MM 2.5 16 PNPDS	28480	0515-2081
	0905-0375	2	6	0-RING .070ID	28480	0905-0375
	2190-0583	9	6	WSHR LK M2.5 ID	28480	2190-0583
	1390-0745	8	4	SCREW CPT M2.5 14L	28480	1390-0745

Table 4-4. Replaceable Parts (6 of 8)

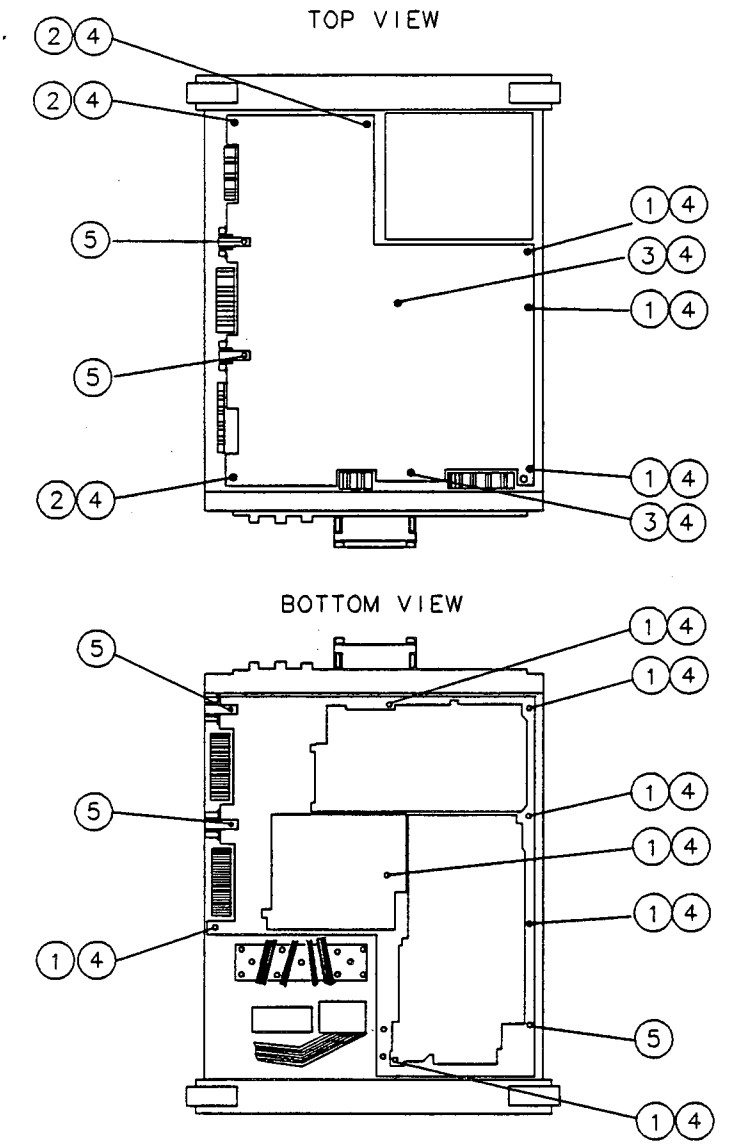
Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
				CABLE ASSEMBLIES		
W1	5061-9024	1	1	POWER CABLE, RIBBON	28480	5061-9024
W2	5061-9025	2	1	CONTROL CABLE, RIBBON	28480	5061-9025
W3	5062-0728	6	1	CABLE ASSEMBLY LINE SWITCH	28480	5062-0728
W4	5061-9033	2	1	CABLE ASSEMBLY, RIBBON, OPTION MODULE (A2J6 to Rear Panel J3)	28480	5061-9033
W5	5062-4838	7	1	CABLE ASSEMBLY, AUDIO (A16J102 to LS1J1 and Rear Panel J1) (Includes LS1)	28480	5062-4838
W6	5062-0767	3	1	CABLE ASSEMBLY, BATTERY (A2J9 to Rear Panel Battery Holder)	28480	5086-0767
W7	5061-9034	3	1	CABLE ASSEMBLY, RIBBON, DISPLAY/CAL OSC (A2J3 to A16J3 and A17J1)	28480	5061-9034
W8	5061-9030	9	1	CABLE ASSEMBLY, DISPLAY POWER (A6J4 to A17J2)	28480	5061-9030
W9	5062-6842	7	1	CABLE ASSEMBLY, CRT, YOKE (A17J3 and J7 to A18V1)	28480	5062-6842
W10	5062-0742	4	1	CABLE ASSEMBLY, RIBBON, A11 YTO DRIVE (A14J3 to A11J1)	28480	5062-0742
W11	5062-0741	3	1	CABLE ASSEMBLY, RIBBON, A9 ATTEN. DRIVE (A14J6 to A9)	28480	5062-0741
W12	5062-0740	2	1	CABLE ASSEMBLY, A7 LODA DRIVE (A14J10, to A7) Part of Cable Assembly-Microcircuit, 08562-60045)	28480	5062-0740
W13	5062-0743	5	1	CABLE ASSEMBLY, RIBBON, A13 2ND CONV (a14J12 to A12) (Part of Cable Assembly-Microcircuit, 08562-60045)	28480	5062-0743
W14	08562-60019	8	1	CABLE ASSEMBLY, RIBBON, A12 RF SWITCH DRIVE (A14J8 to A12) (Part of Cable Assembly-Microcircuit, 08562-60045)	28480	08562-60019
W15	08562-60017	6	1	CABLE ASSEMBLY, A8 DUAL BAND MIXER DRIVE (A14J11 to A8) (Part of Cable Assembly-Microcircuit, 08562-60045)	28480	08562-60017
W16	08562-60018	7	1	CABLE ASSEMBLY, A10 YTF DRIVE (A14J9 to A10) (Part of Cable Assembly-Microcircuit, 08562-60045)	28480	08562-60018

Table 4-4. Replaceable Parts (7 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W17	5062-0708	2	1	CABLE ASSEMBLY, COAX 84, 10 MHz REF-2, (A15J304 to A16J1)	28480	5086-0708
W18	5062-0721	8	1	CABLE ASSEMBLY, COAX 97, LO SWEEP 0.5 V/GHz (A14J7 to Rear Panel J8)	28480	5062-0721
W19	5062-0723	1	1	CABLE ASSEMBLY, COAX 83, 2ND IF OUT (A15J803 to Rear Panel J10)	28480	5062-0723
W20	5062-0717	3	1	CABLE ASSEMBLY, COAX 6, 0 SPAN VIDEO (A3J103 to A2J4)	28480	5062-0717
W21	5062-0715	1	1	CABLE ASSEMBLY, COAX 1, FREQ. COUNTER (A4J4 to A2J7)	28480	5062-0715
W22	5062-0709	3		CABLE ASSEMBLY, COAX 0, 10 MHz FREQ. COUNT (A15J302 to A2J8)	28480	5062-0709
W23	5062-0719	5	1	CABLE ASSEMBLY, COAX 93, EXT TRIG IN (Rear Panel J5 to A3J600)	28480	5062-0719
W24	5062-0720	8	1	CABLE ASSEMBLY, COAX, 5 VIDEO OUT (A3J102 to Rear Panel J4)	28480	5062-0720
W25	5062-0718	4	1	CABLE ASSEMBLY, COAX 4, BLANKING OUT (A3J601 to Rear Panel J6)	28480	5062-0718
W26	5062-0716	2	1	CABLE ASSEMBLY, COAX 2, VIDEO (A4J6 to A3J101)	28480	5062-0716
W27	5062-0714	0	1	CABLE ASSEMBLY, FILTER 10.7 MHz (A5J5 to A4J3)	28480	5062-0714
W28	5062-0713	9	1	CABLE ASSEMBLY, COAX 96, AM/FM DEMOD (A4J5 to A16J101)	28480	5062-0713
W29	5062-0711	7	1	CABLE ASSEMBLY, COAX 7, 10.7 IF (A15J601 to A5J3)	28480	5062-0711
W30	5062-0712	8	1	CABLE ASSEMBLY, COAX 9, 10.7 CAL SIG (A16J2 to A5J4)	28480	5062-0712
W31	5062-0722	0	1	CABLE ASSEMBLY, COAX 8, REF IN/OUT (A15J301 to Rear Panel J9)	28480	5062-0722
W32	5062-0705	9	1	CABLE ASSEMBLY, COAX 87, SAMPLER IF (A15J101 to A14J101)	28480	5062-0705
W33	5062-0706	0	1	CABLE ASSEMBLY, COAX 81, 2ND LO DRIVE (A15J701 to A13J4)	28480	5062-0706
W34	5062-0761	7	1	CABLE ASSEMBLY, COAX 0, 1ST LO SAMP. (A7J4 to A15A2J1)	28480	5062-0761

Table 4-4. Replaceable Parts (8 of 8)

Ref Desig	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
W35	5062-0710	6	1	CABLE ASSEMBLY, COAX 92, INT 2ND IF (A13J2 to A15J801)	28480	5062-0710
W36	5062-0725	3	1	CABLE ASSEMBLY, COAX 86, EXT 2ND IF (Front Panel J3 to A15J802)	28480	5062-0725
W37	5062-0707	1	1	CABLE ASSEMBLY, COAX 85, 10 MHz REF 1 (A15J303 to A14J301)	28480	5062-0707
W38	5021-6704	4	1	CABLE ASSEMBLY, SEMI-RIGID, 1ST LO (A11J2 to A7J1)	28480	5021-6704
W39	08562-20019	4	1	CABLE ASSEMBLY, SEMI-RIGID, 1ST MIXER LO (A7J2 to A8J3)	28480	08562-20019
W40	5062-0724	2	1	CABLE ASSEMBLY, COAX 89, CAL OUT (A15J501 to Front Panel J5)	28480	5062-0724
W41	5021-8635	4	1	CABLE ASSEMBLY, SEMI-RIGID, RF INPUT (Front panel J1 to A9J1)	28480	5021-8635
W41 (Opt. 026)	5021-7481	6	1	CABLE ASSEMBLY, SEMI-RIGID, RF INPUT (Front panel J1 to A9J1)	28480	5021-7481
W42	5021-6705	5	1	CABLE ASSEMBLY, SEMI-RIGID, 1ST LO OUT(A7J3 to Front Panel J4)	28480	5021-6705
W43	08562-20014	9	1	CABLE ASSEMBLY, SEMI-RIGID (A9J2 to A12J3)	28480	08562-20014
W44	08562-20016	1	1	CABLE ASSEMBLY, SEMI-RIGID (A12J2 to FL1J1)	28480	08562-20016
W45	5021-6706	6	1	CABLE ASSEMBLY, SEMI-RIGID (FL1J2 to A8J1)	28480	5021-6706
W46	08562-20015	0	1	CABLE ASSEMBLY, SEMI-RIGID (A12J1 to A10J1)	28480	08562-20015
W47	1250-1159	4	1	CABLE ASSEMBLY, SMA ADAPTER (A10J7 to A8J3)	28480	1250-1159
W48	5021-9369	3	1	CABLE ASSEMBLY, SEMI-RIGID (A8J5 to A13J3)	28480	5021-9369
W49	5062-4892	3	1	CABLE ASSEMBLY, COAX 82, A21 OCXO (A21 to A15J305)	28480	5062-4892
W50	5062-4891	2	1	CABLE ASSEMBLY, OCXO DRIVE (A21 to A15J306)	28480	5062-4891



Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1323	5	11	SCREW-MACH M3 x 0.5 30MM-LG PAN- HD	2848	0515-1323
2	0515-1646	5	11	SCREW-MACH M3 x 0.5 60MM-LG PAN- HD	2848	0515-1646
3	0515-1647	6	11	SCREW-MACH M3 x 0.5 100MM-LG PAN- HD	2848	0515-1647
4	3050-0105	6	11	WASHER-FL MTLC NO. 4 .125-IN-ID	2848	3050-0105
5	0515-0886	3	11	SCREW-MACH M3 x 0.5 6MM-LG PAN- HD	2848	0515-0886

Figure 4-1. Parts Identification, Assembly Mounting Hardware

Parts List for Figure 4-2
Cover Assembly

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	5041-8911	1	1	BAIL HANDLE	28480	5041-8911
2	5041-8912	2	2	TRIM CAP	28480	5041-8912
3	0515-1114	2	4	SCREW MACH M4 X 0.7 10MM-LG PAN-HD	28480	0515-1114
4	1460-2164	0	2	SPRING-CPRSN .845 IN-OD 1.25-IN-OA-LG	28480	1460-2108
5	5021-6343	7	2	RING GEAR	28480	5021-6343
6	5021-6344	8	2	SOCKET GEAR	28480	5021-6344
7	5021-8667	2	2	HANDLE PLATE	28480	5021-8667
8	5001-8728	4	2	BACKUP PLATE	28480	5001-8728
9	0515-1367	0	6	SCREW MACH M4 X 0.7 8MM-LG 90DEG-FLH-HD	28480	0515-1397
10	0515-1133	5	2	SCREW-MACH M5 X 0.8 16MM-LG	28480	0515-1133
11	5001-8800	3	1	COVER	28480	5001-8800
12	5041-7238	3	1	MOISTURE DEFLECTOR-LF	28480	5041-7238
13	5041-3989	3	1	MOISTURE DEFLECTOR-RT	28480	5041-3989
14	5041-8913	3	2	SIDE TRIM	28480	5041-8913
15	0515-1114	2	2	SCREW-MACH M4 X 0.7 10MM-LG PAN-HD	28480	0515-1114
16	5041-8907	5	2	REAR FOOT	28480	5041-8907
17	0900-0024	8	4	O-RING .145-IN-XSECT-DIA SIL	51633	AS568-007
18	2190-0587	3	4	WASHER-LK HLCL 5.0 MM 5.1-MM-ID	28480	2190-0587
19	0515-1218	7	4	SCREW-SKT-HD-CAP M5 X 0.8 40MM-LG	28480	0515-1218
20	08562-80028	1	1	INSULATOR 292 X 355 MM .51 THK	28480	08562-80028

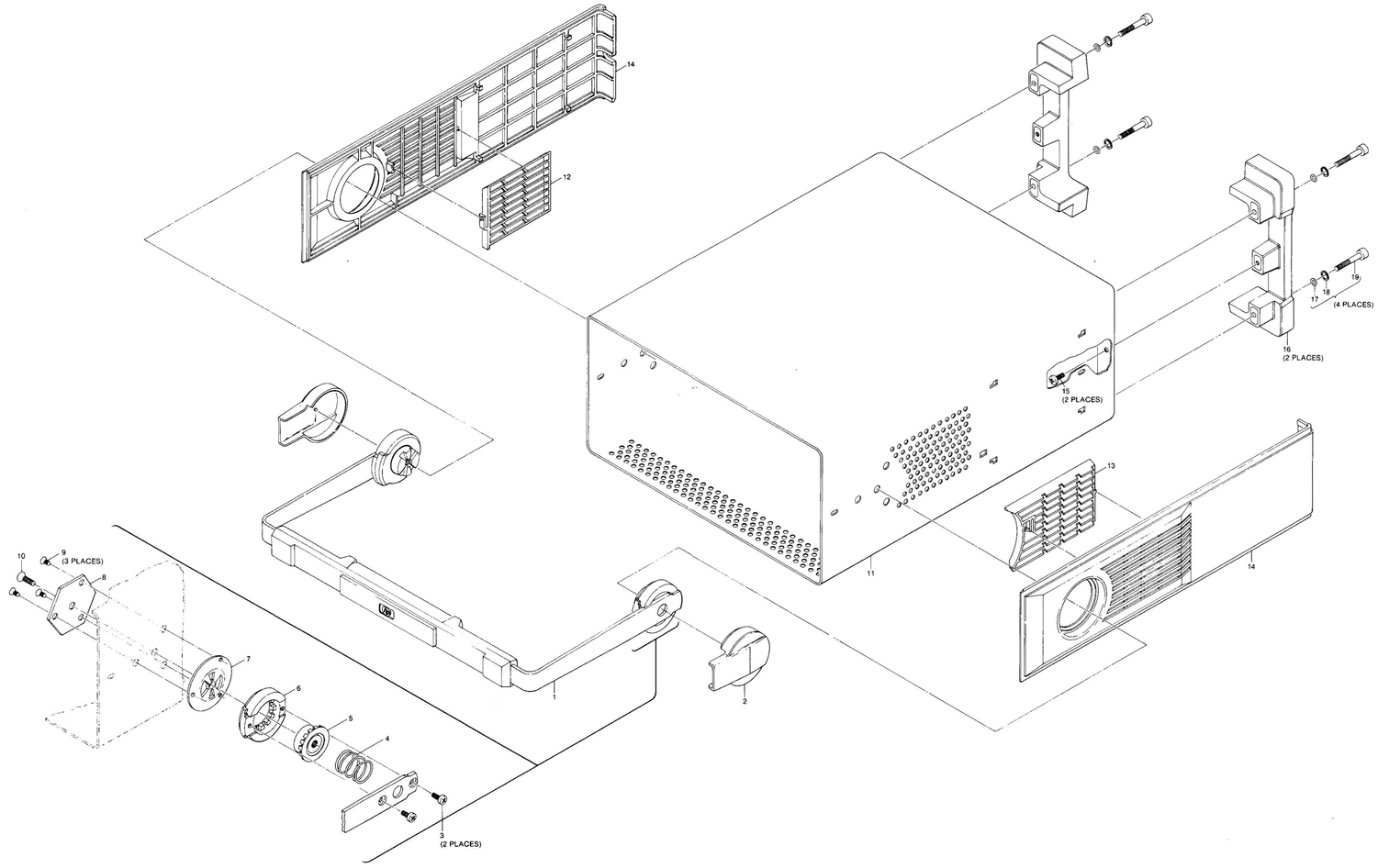


Figure 4-2. Parts Identification, Cover Assembly

Parts List for Figure 4-3
Main Chassis

Item	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1079	3	4	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD SEM	28480	0515-1079
2	5180-9023	2	3	SMM 3.0 35 PCPDS	28480	5180-9023
3	0515-1826	0	3	SCREW-MACH M3 X 0.5 35MM-LG PAN-HD SEM	28480	0515-1826
4	3050-0891	7	3	WASHER-FL MTLC NO.4 .125-IN-ID	28480	3050-0891
5	5062-1992	8	1	COVER, A6 POWER SUPPLY (Includes label)	28480	5062-1992
6	0515-1590	8	3	SCREW-MACH M3 X 0.5 45MM-LG	28480	0515-1590
7	5041-7246	3	1	BOARD MOUNT	28480	5041-7246
8	0515-1079	3	4	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD SEM	28480	0515-1079
9	5041-7249	6	1	COVER, A17	28480	5041-7249
10	5021-5486	7	2	CRT MOUNT	28480	5021-5486
11	5001-5870	1	2	CRT MOUNT STRAP	28480	5001-5870
12	3050-0891	7	3	WASHER-FL MTLC NO.4 .125-IN-ID	28480	3050-0891
13	0515-1079	3	4	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD SEM	28480	0515-1079
14	5001-8705	7	1	MAIN DECK	28480	5001-8705
15	5001-5872	3	1	FRONT END DECK	28480	5001-5872
16	0515-1367	7	4	SCREW-MACH M4 X 0.7 8MM-LG 90DEG-FLH-HD	28480	0515-1367
17	0515-1461	9	2	SCREW MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-1461
18	5021-7464	5	1	SIDE FRAME	28480	5021-7464
19	0515-1367	7	4	SCREW-MACH M4 X 0.7 8MM-LG 90DEG-FLH-HD	28480	0515-1367
20	0515-1461	9	2	SCREW MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-1461
21	0515-1461	9	2	SCREW MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-1461
22	0515-1461	9	2	SCREW MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-1461
23	5021-5484	5	5	MOUNTING POST	28480	5021-5484
24	5062-0750	4	2	HINGE, 2 BOARD	28480	5062-0750
25	5062-0751	5	2	HINGE, 4 BOARD	28480	5062-0751
26	5041-7250	9	1	CABLE CLAMP	28480	5041-7250
27	0515-1010	7	2	SCREW- MACH M3 X 0.5 35MM-LG	28480	0515-1010
28	0515-1461	2	2	SCREW-MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-1461
29	3050-0894	0	1	WASHER-FL M5 .0ID	28480	3050-0894
A18MP1	5062-0745	7	1	CRT WIRING ASSY (INCLUDES A18L1, A18W1)	28480	5062-0745
A18MP2	5041-3987	1	1	SPACER, CRT	28480	5041-3987
A18V1	5083-6451	8	1	TUBE, CRT	28480	5083-6451
A18W1				P/O A18MP1		

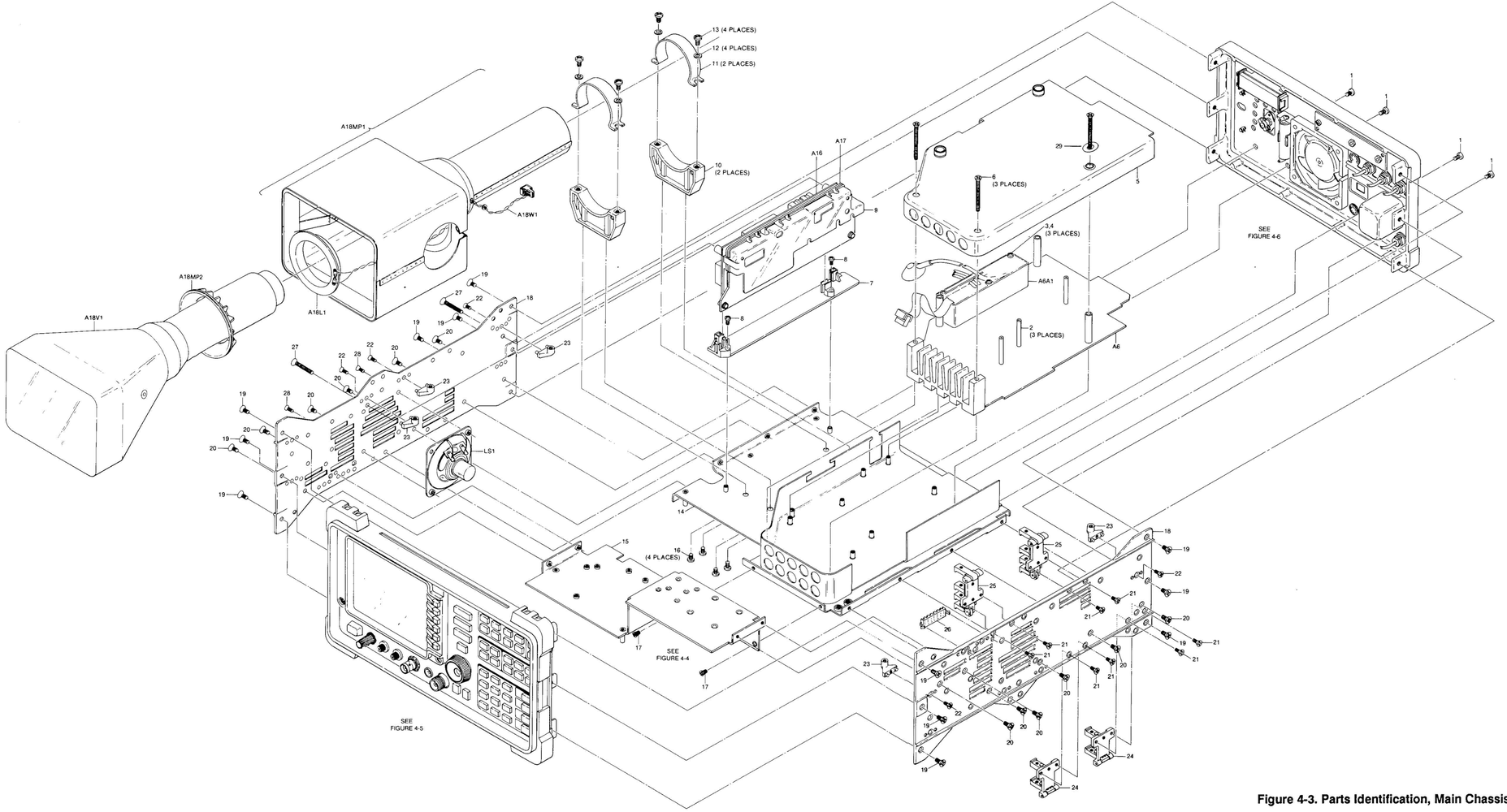


Figure 4-3. Parts Identification, Main Chassis

Parts List for Figure 4-4
Front Deck

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
2	0515-1457	6	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-1457
3	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
4	5021-6749	7	1	FILTER CLAMP	28480	5021-6749
5	08562-20025	3	1	YTF SPACER CLAMP	28480	08562-20025
6	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
7	5001-8705	7	1	MAIN DECK	28480	5001-8705
8	0515-0890	9	2	SCREW-MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-0890
9	5001-5872	3	1	FRONT END DECK	28480	5001-5872
10	0515-0890	9	2	SCREW-MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-0890
11	2360-0507	8	4	SCREW-MACH 6-32 1.625-INLG 82 DEG	28480	2360-0507
12	2360-0183	6	4	SCREW-MACH 6-32 .375-IN-LG 82DEG	28480	2360-0183
13	0515-0866	9	1	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD	28480	0515-0866
14	0515-1146	0	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-1146
15	5001-8731	9	1	ATTENUATOR BRACKET	28480	5001-8731
16	0515-1057	2	1	SCREW-MACH M2.5 X 0.45 18MM-LG PAN-HD	28480	0515-0157
17	08562-00001	1	1	RF SWITCH BRACKET	28480	08562-00001
18	08560-00002	1	1	ATTENUATOR BRACKET	28480	08560-00002
19	0515-0886	3	2	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0886
20	0515-1461	9	1	SCREW-MACH M3 X 0.5 6MM-LG SEM FLHD	28480	0515-1461
21	0515-0890	9	2	SCREW-MACH M3 X 0.5 6MM-LG 90DEG-FL-HD	28480	0515-0890
22	0515-0890	9	3	SCREW-MACH M3 X 0.5 6MM-LG 90 DEG-FLH-HD	28480	0515-0890

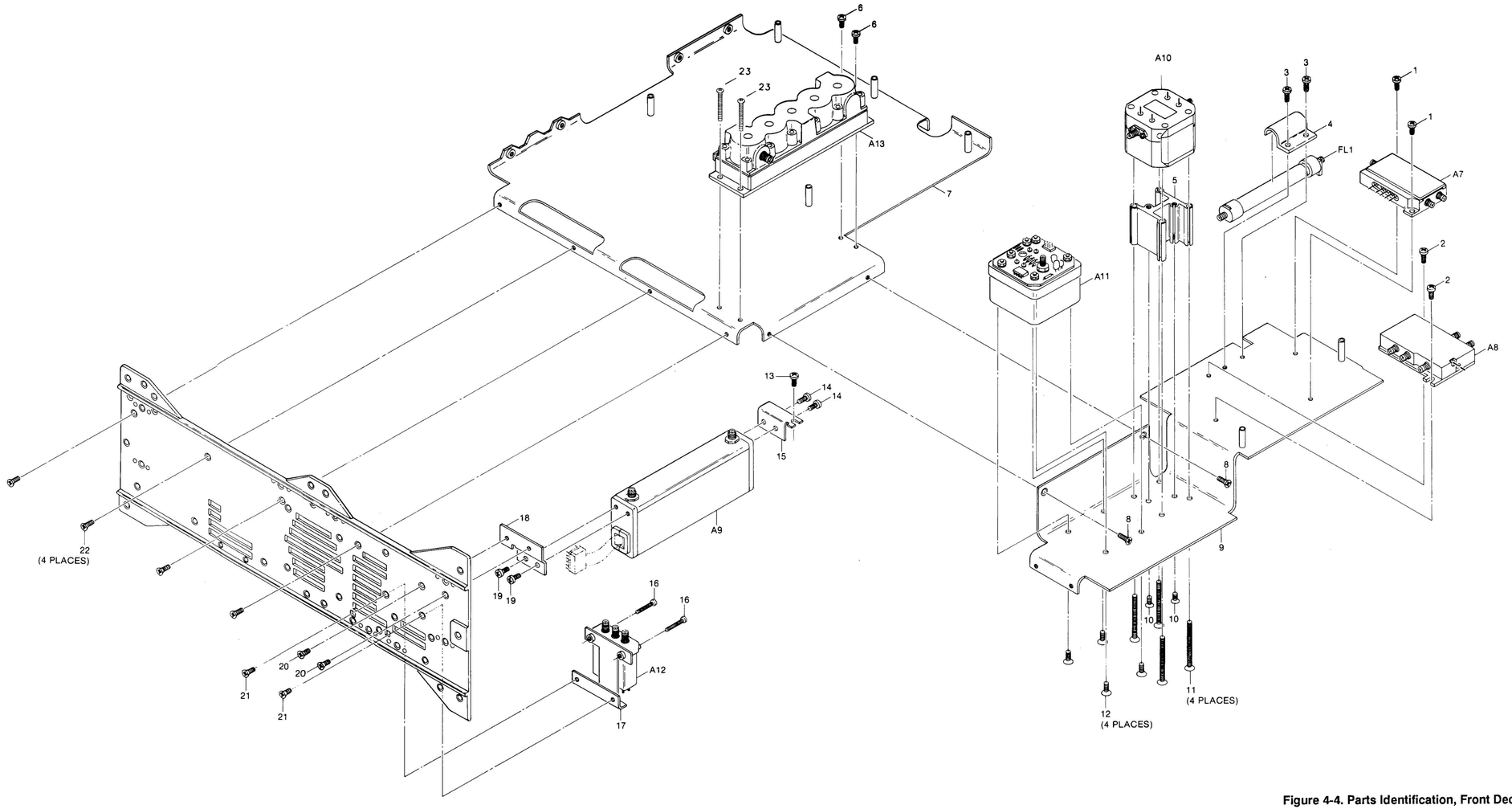


Figure 4-4. Parts Identification, Front Deck

Parts List for Figure 4-5
Front Frame

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-1622	7	4	SCREW-SKT-HD-CAP M4 X 0.7 8MM-LG	28480	0515-1622
2	5041-8906	4	1	CRT BEZEL	28480	5041-8906
3	8160-0270	4	1	RFI CRT FACEPLATE PLSTC-MET-CTD AU-PL	28480	8160-2750
4	0370-3069	2	1	KNOB BASE 1-1/8 JGK .252-IN-ID (INCLUDES ITEM 5)	28480	0370-3069
5	3030-0022	4	2	SCREW-SET 6-32 .125-IN-LG SMALL CUP-PT	00000	BY DESCRIPTION
6	2950-0043	8	2	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	BY DESCRIPTION
7	2190-0016	3	2	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
8	08563-00001		1	FRONT PANEL-DRESS	28480	08563-00001
(Option 026)	08563-00002		1	FRONT PANEL-DRESS	28480	08563-00002
9	5060-0467	6	1	PROBE POWER JACK	28480	5060-0467
10	0590-1251	6	1	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	BY DESCRIPTION
11	1250-1753	4	2	ADAPTOR COAX STR F-SMA F-SMA	28480	1250-1753
12	0515-1079	8	6	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD	28480	0515-1079
13	5062-4806	9	1	BUMPER KIT (Includes 4 bumpers)	28480	5062-4806
14	0905-1018	2	4	O-RING .126TD	28480	0905-1018
15	5021-5483	4	2	CATCH LATCH	28480	5021-5483
16	0515-0894	3	13	SCREW-MACH M2.5 X 0.45 6MM-LG PAN-HD	28480	0515-0894
17	5021-8689	8	1	FRONT FRAME	28480	5021-8689
18	8160-0662	8	1	RFI ROUND STRIP SPIRA .150	28480	8160-0662
19	0510-0082	3	2	NVTM W-LKWR-M4	28480	0510-0082
20	5041-8921	3	1	KEY "COPY"	28480	5041-8921
21	5041-8919	9	1	KEY "SGL SWP"	28480	5041-8919
22	5041-3948	4	1	KEY "BK SP"	28480	5041-3948
23	5041-3940	6	1	KEY "."	28480	5041-3940
24	5041-3939	3	1	KEY "0"	28480	5041-3939
25	5041-3941	7	1	KEY "1"	28480	5041-3941
26	5041-3942	8	1	KEY "2"	28480	5041-3942
27	5041-3943	9	1	KEY "3"	28480	5041-3943
28	5041-3944	0	1	KEY "4"	28480	5041-3944
29	5041-3945	1	1	KEY "5"	28480	5041-3945
30	5041-3954	2	1	KEY "6"	28480	5041-3954
31	5041-3946	2	1	KEY "7"	28480	5041-3946
32	5041-3947	3	1	KEY "8"	28480	5041-3947
33	5041-3954	2	2	KEY "9"	28480	5041-3954
34	5041-7254	3	1	KEY "CONFIG"	28480	5041-7254
35	5041-7256	5	1	KEY "MKR"	28480	5041-7256
36	5041-3950	8	1	KEY "MKR ->"	28480	5041-3950
37	5041-3949	5	1	KEY "PEAK SEARCH"	28480	5041-3949
38	5041-3977	9	1	KEY "SWEEP"	28480	5041-3977
39	5041-3967	7	1	KEY "AUTO COUPLE"	28480	5041-3967
40	5041-3972	4	1	KEY "BW"	28480	5041-3972
41	5041-3973	5	1	KEY "TRACE"	28480	5041-3973
42	5041-3976	8	1	KEY "TRIG"	28480	5041-3976
43	5041-3974	6	1	KEY "DISPLAY"	28480	5041-3974
44	5041-3957	5	1	KEY "PRESET"	28480	5041-3957
45	5041-3963	3	1	KEY "FREQ COUNT"	28480	5041-3963
46	5041-7253	2	1	KEY "CAL"	28480	5041-7253
47	5041-3964	4	1	KEY "SAVE"	28480	5041-3964
48	5041-3966	6	1	KEY "MODULE"	28480	5041-3966
49	5041-3965	5	1	KEY "RECALL"	28480	5041-3965
50	5041-8920	2	1	KEY "AUX CTRL"	28480	5041-8920
51	5041-8923	5	1	KEY "MEAS/USER"	28480	5041-8923
52	5041-3951	9	1	KEY "HOLD"	28480	5041-3951
53	5041-3960	0	1	KEY "FREQUENCY"	28480	5041-3960
54	5041-3961	1	1	KEY "SPAN"	28480	5041-3961

Parts List for Figure 4-5
Front Frame

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
55	5041-3962	2	1	KEY "AMPLITUDE"	28480	5041-3962
56	5041-3995	1	6	ACTUATOR SOFTKEY	28480	5041-3995
57	5041-3956	4	4	KEY-BLANK	28480	5041-3956
58	5041-3955	3	2	KEY "UP ARROW"	28480	5041-3955
59	5041-3955	3	1	KEY "DOWN ARROW"	28480	5041-3955
60	2190-0016	3	1	WASHER-LK INTL T 3/8 IN .377-IN-ID	28480	2190-0016
61	2950-0043	8	1	NUT-HEX-DBL-CHAM 3/8-32-THD .094-IN-THK	00000	BY DESCRIPTION
62	1250-2191	6	1	RF INPUT ASSEMBLY	28480	1250-2191
63	0515-1146	6	2	SCREW-MACH M3 X 0.5 8MM-LG PAN-HD	28480	0515-1146
64	5041-3938	2	1	RUBBER KEYPAD	28480	5041-3938
65	1990-1131	0	1	LED-LAMP LUM-INT=560UCD IF=20MA-MAX	2M627	LD-101MG
66	5041-1682	9	1	KEYCAP "LINE"	28480	5041-1682
67	0900-0010	2	1	O-RING .101-IN-ID .07-IN-XSECT-DIA NTRL	51633	AS568-005
68	0515-1552	2	1	SCREW-MACHINE ASSEMBLY M3 X 0.5 12MM-LG	U0421	M3.0X0.5X12
69	5021-5482	3	1	SUPPORT CENTER	28480	5021-5482
70	0515-1106	2	2	SCREW-MACH M4 X 0.7 16MM-LG PAN-HD	28480	0515-1106
71	0515-1146	0	9	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD (P/O A1W1)	28480	0515-1146
72	2100-4232	4	1	R-VC 20K 20% LOG	28480	2100-4232
73	3050-0103	4	1	WASHER-FL .250ID12	28480	3050-0103
74	0370-3079	4	1	KNOB RND .125 JG	28480	0370-3079

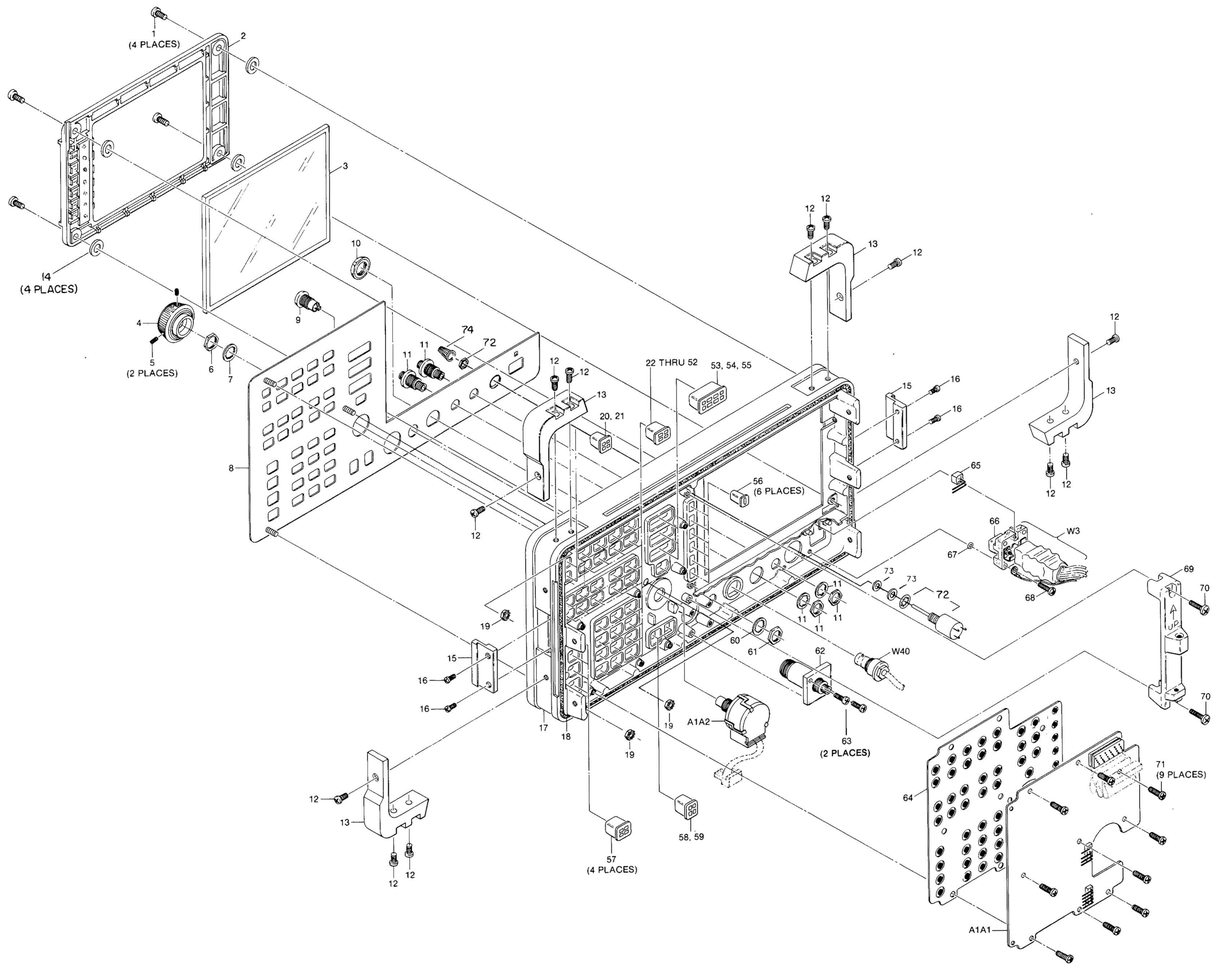


Figure 4-5. Parts Identification, Front Frame

Parts List for Figure 4-6
Rear Frame

Item	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
1	0515-0890	9	2	SCREWMACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-0890
2	5062-0797	9	1	BATTERY HOLDER (Includes wires)	28480	5062-0797
3	0515-1669	2	4	SCREW-MACH M4 X 0.7 40MM-LG PAN-HD	28480	0515-1669
4	3160-0309	5	1	FAN GRILLE	28480	3160-0309
5	0380-0012	0	4	SPACER-RND .875-IN-ID	28480	0380-0012
6				NOT ASSIGNED		
7	6960-0002	4	1	PLUG-HOLE TR-HD FOR 0.5-D-HOLE STL	05093	SS-48152
8	6960-0023	9	2	PLUG-HOLE DOME-HD FOR 0.312-D-HOLE STL	04213	D-2730-LC2
9	1250-1753	4	1	ADAPTOR-COAX STR F-SMA (INCLUDES WASHER AND NUT)	28480	1250-1753
10	0515-0890	9	4	SCREW-MACH M3 X 0.5 6MM-LG 90DEG-FLH-HD	28480	0515-0890
11	0515-0898	7	1	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0898
12	0590-1251	6	5	NUT-SPCLY 15/32-32-THD .1-IN-THK .562-WD	00000	BY DESCRIPTION
13	1252-0995	8	1	CONNECTOR-TEL 2-CKT .141-SHK-DIA (INCLUDES NUT AND JACK)	28480	1252-0995
14	5001-8719	3	1	REAR PANEL-DRESS	28480	5001-8719
15	0515-1461	2	4	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-1461
16	8160-0662	8	1	RFI ROUND STRIP STL SPIRA .150	28480	8160-0662
17	5021-5479	8	1	REAR FRAME	28480	5021-5479
18	5021-6391	5	2	SCREW-CONN HPIB	28480	5021-6391
19	2200-0104	3	2	SCREW-MACH 4-40 .25-IN-LG 82 DEG	00000	BY DESCRIPTION
20	0515-1148	2	2	RETAINER-PUSH ON KB-TO-SHFT EXT	28480	0510-1148
21	0515-0898	7	1	SCREW-MACH M3 X 0.5 6MM-LG PAN-HD	28480	0515-0898
22	0535-0023	2	2	NUT-HEX DBL-CHAM M4 X 0.7 3.2MM-THK	00000	BY DESCRIPTION
B1	5061-9036	5	1	FAN ASSEMBLY (Includes wire)	28480	5061-9036
BT1	1420-0315	3	1	BATTERY 3.4V 1.7A-HR LITHIUM THIONYL	10183	TL-5104/S

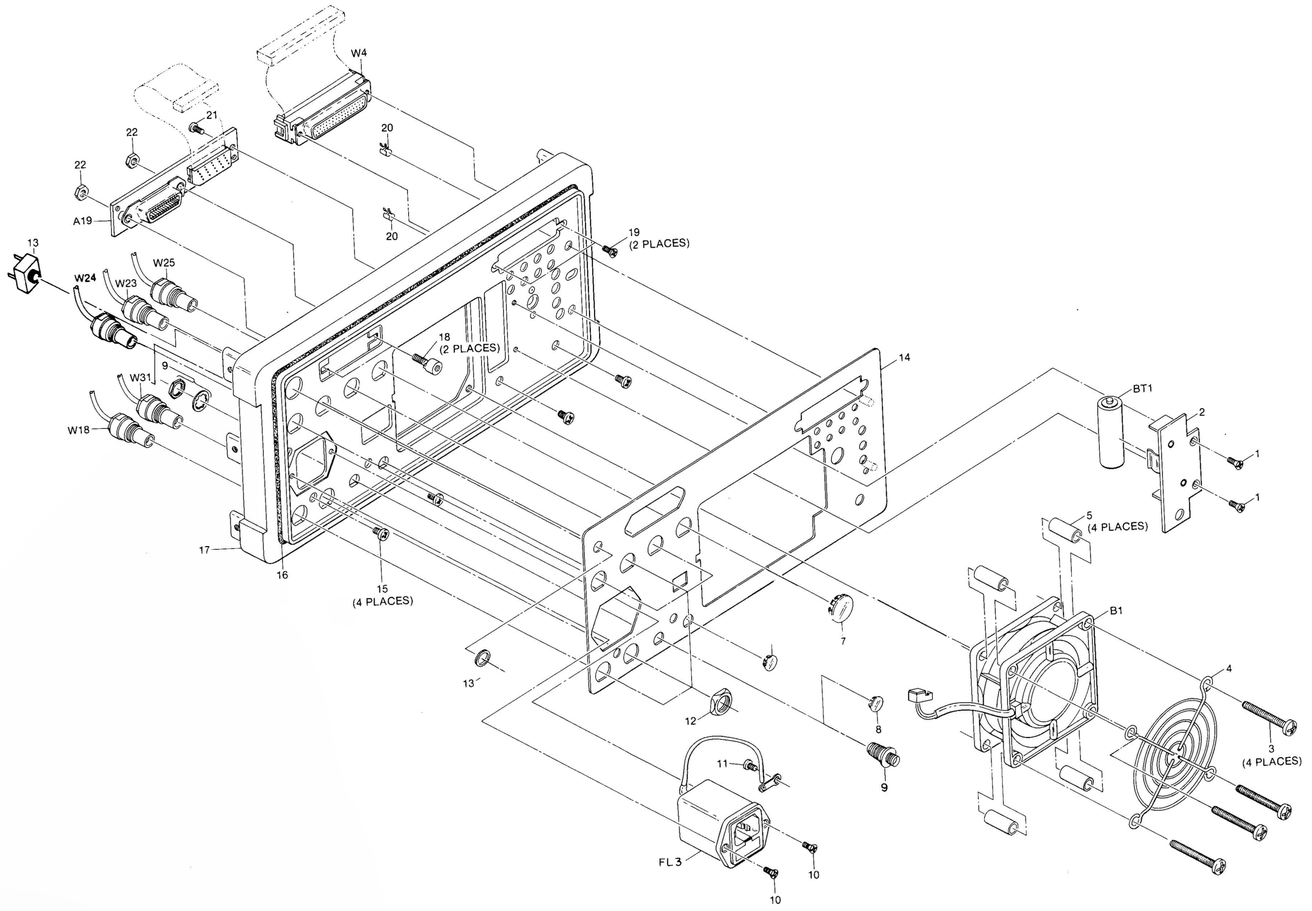


Figure 4-6. Parts Identification, Rear Frame

5

Major Assembly and Cable Locations

Introduction

This chapter identifies the instrument's assemblies and cables, and contains the following figures:

	Page
Figure 5-1. Hinged Assemblies	5-4
Figure 5-2. Top View (A2 Unfolded)	5-5
Figure 5-3. Top View (A2 and A3 Unfolded)	5-6
Figure 5-4. Top View (A2, A3, A4, and A5 Unfolded)	5-7
Figure 5-5. Bottom View (A15 Unfolded)	5-8
Figure 5-6. Bottom View (A15 and A14 Unfolded)	5-9
Figure 5-7. Front End	5-10
Figure 5-8. Rear View	5-11

Use the list below to determine which figure(s) illustrates the desired assembly or cable.

Assembly	Illustrated in Figure
A1 Front Frame	5-6
A1A1 Keyboard	5-6
A2 Controller	5-1, 5-2
A3 Interface	5-1, 5-2
A4 Log Amplifier	5-1, 5-3
A5 IF Filter	5-1, 5-4
A6 Power Supply	5-4
A6A1 High Voltage Module	5-4
A7 LO Distribution Amplifier	5-7
A8 Dual Band Mixer	5-7
A9 RF Attenuator	5-7
A10 YTF	5-7
A11 YTO	5-7
A12 RF Switch	5-7
A13 Second Converter	5-7
A14 Frequency Control	5-1, 5-6
A15 RF	5-1, 5-5, 5-6
A16 Cal Oscillator	5-4
A17 CRT Driver	5-4
A18 CRT Assembly	5-4
A19 HP-IB	5-4
A20 Battery Assembly	5-8
A21 OCXO	5-4
B1 Fan	5-8
BT1 Battery	5-8

Assembly (Continued)	Illustrated in Figure
FL1 Low Pass Filter	5-7
FL2 Low Pass Filter	5-7
FL3 (NOT ASSIGNED)	
FL4 Line Filter	5-8
LS1 Speaker	5-4

Cable Assembly	Illustrated in Figure
A1A1W1 Keyboard Cable	5-2, 5-4
A3W1 Interface Cable	5-2
A19W1 HP-IB Cable	5-2, 5-4
W1 Power Cable	5-2, 5-3, 5-4, 5-5
W2 Control Cable	5-2, 5-3, 5-4, 5-5
W3 Line Switch Cable	5-4, 5-7
W4 Option Module Cable	5-4
W5 Audio Cable	5-4
W6 Battery Cable	5-2
W7 Display/Cal Osc Cable	5-2
W8 Display Power Cable	5-4
W9 CRT Yoke Cable	5-4
W10 YTO Drive Cable	5-6, 5-7
W11 Attenuator Drive Cable	5-6
W12 A7 LODA Drive Cable	5-6, 5-7
W13 A13 Second Converter Drive Cable	5-6
W14 A12 RF Switch Cable	5-6, 5-7
W15 A8 Dual Mixer Cable	
W16 A10 YTF Drive Cable	5-7
W17 10 MHz Ref 2 (Coax 84)	5-5
W18 LO Sweep (Coax 97)	5-6
W19 Second IF Out (Coax 83)	5-5
W20 Zero-Span Video (Coax 6)	5-2
W21 Frequency Counter (Coax 1)	5-2, 5-3
W22 10 MHz Frequency Count (Coax 0)	5-2, 5-5
W23 External Trigger In (Coax 93)	5-2
W24 Video Out (Coax 5)	5-2
W25 Blanking Out (Coax 4)	5-2
W26 Video (Coax 2)	5-2, 5-3
W27 Filter 10.7 MHz	5-3, 5-4
W28 AM/FM Demod (Coax 96)	5-3
W29 10.7 MHz IF (Coax 7)	5-4, 5-5
W30 10.7 MHz Cal Signal (Coax 9)	5-4
W31 Reference In/Out (Coax 8)	5-5
W32 Sampler IF (Coax 87)	5-5, 5-6
W33 Second LO Drive (Coax 81)	5-5, 5-7

Cable Assembly (Continued)	Illustrated in Figure
W34 First LO Samp. (Coax 0)	5-5, 5-6, 5-7
W35 Int Second IF (Coax 92)	5-5, 5-7
W36 Ext Second IF (Coax 86)	5-5
W37 10 MHz Ref 1 (Coax 85)	5-5, 5-6
W38 First LO	5-7
W39 Dual Band Mixer	5-7
W40 Calibrator Out (Coax 89)	5-5
W41 RF Input	5-7
W42 First LO Out	5-7
W43 Semirigid	5-7
W44 Semirigid	5-7
W45 Semirigid	5-7
W46 Semirigid	5-7
W47 SMA Adapter	5-7
W48 Semirigid	5-5
W49 A21 OCXO (Coax 82)	5-5
W50 A21 OCXO Drive	5-5

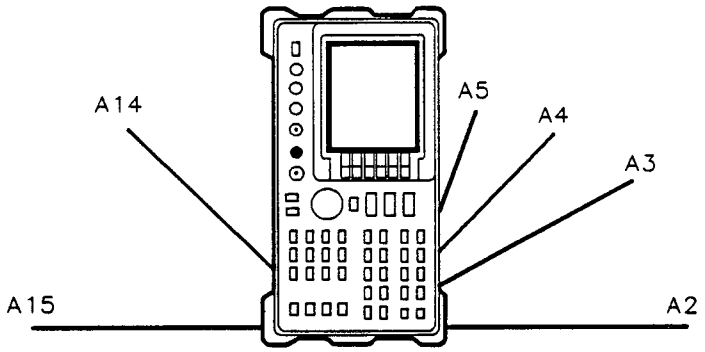


Figure 5-1. Hinged Assemblies

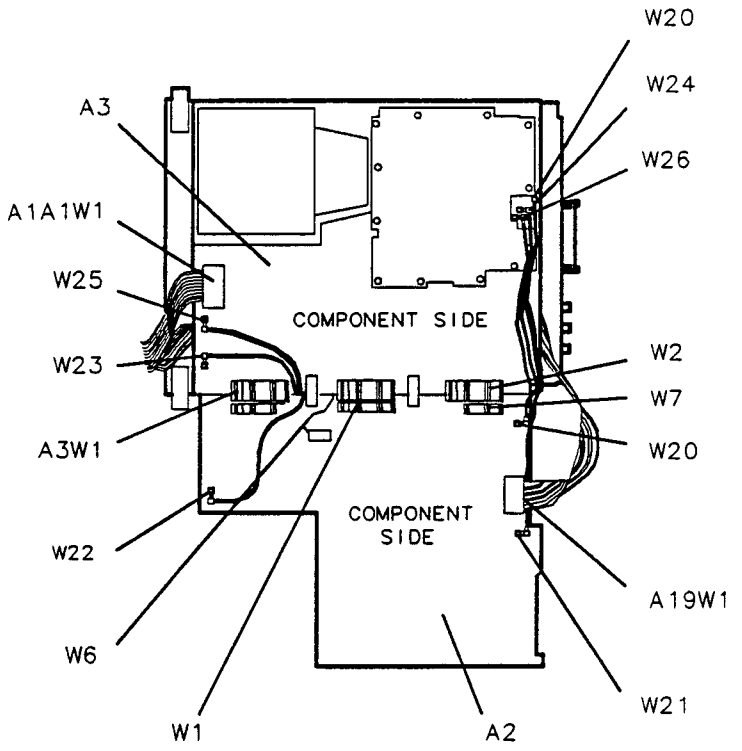


Figure 5-2. Top View (A2 Unfolded)

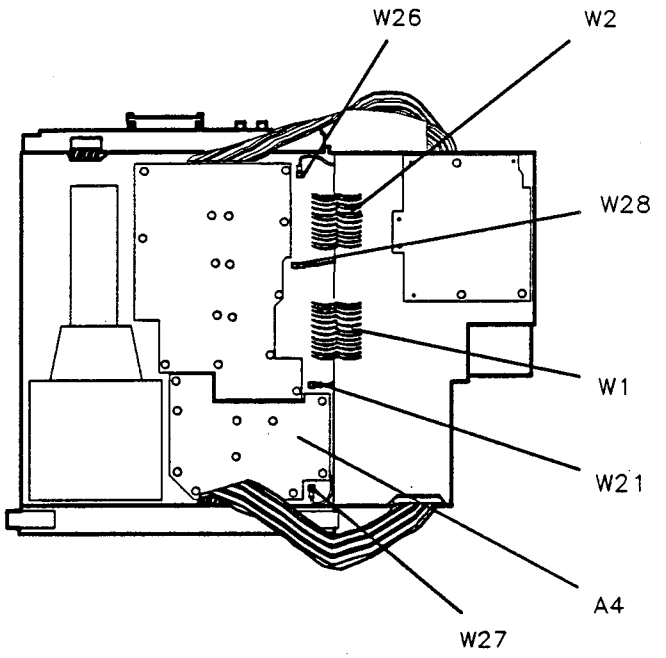


Figure 5-3. Top View (A2 and A3 Unfolded)

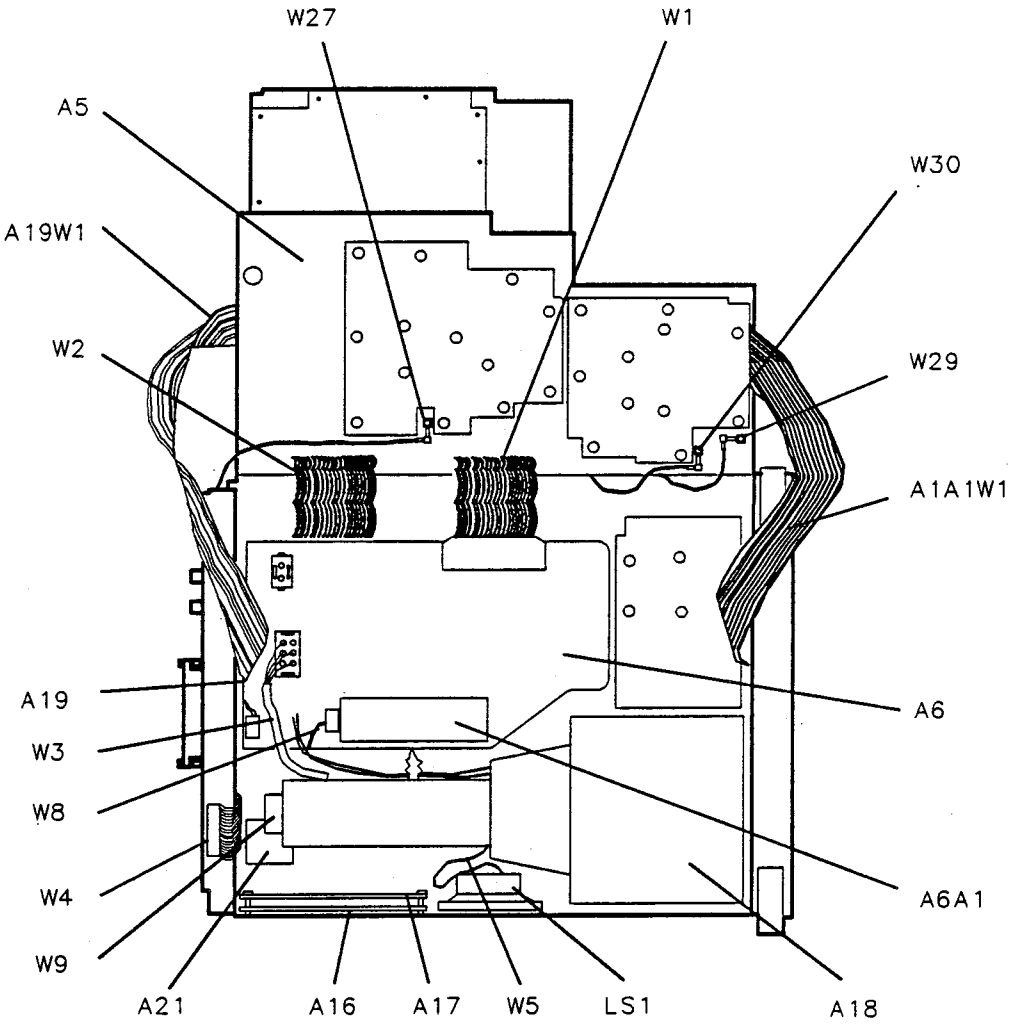


Figure 5-4. Top View (A2, A3, A4, and A5 Unfolded)

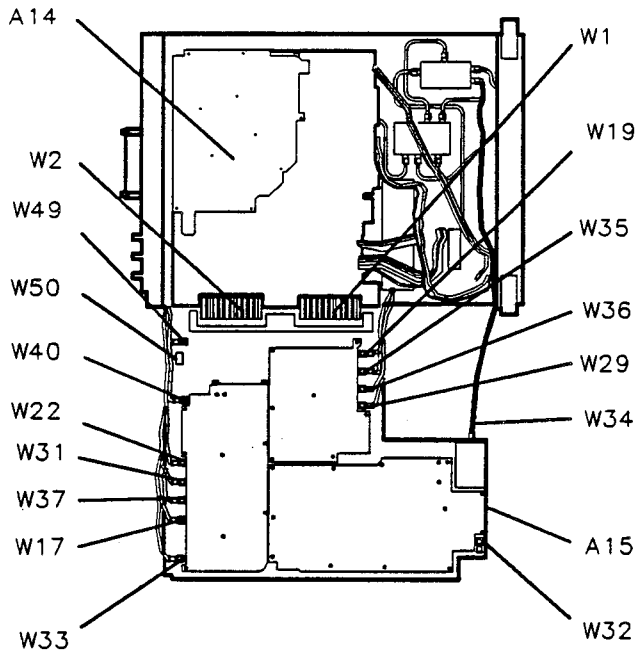


Figure 5-5. Bottom View (A15 Unfolded)

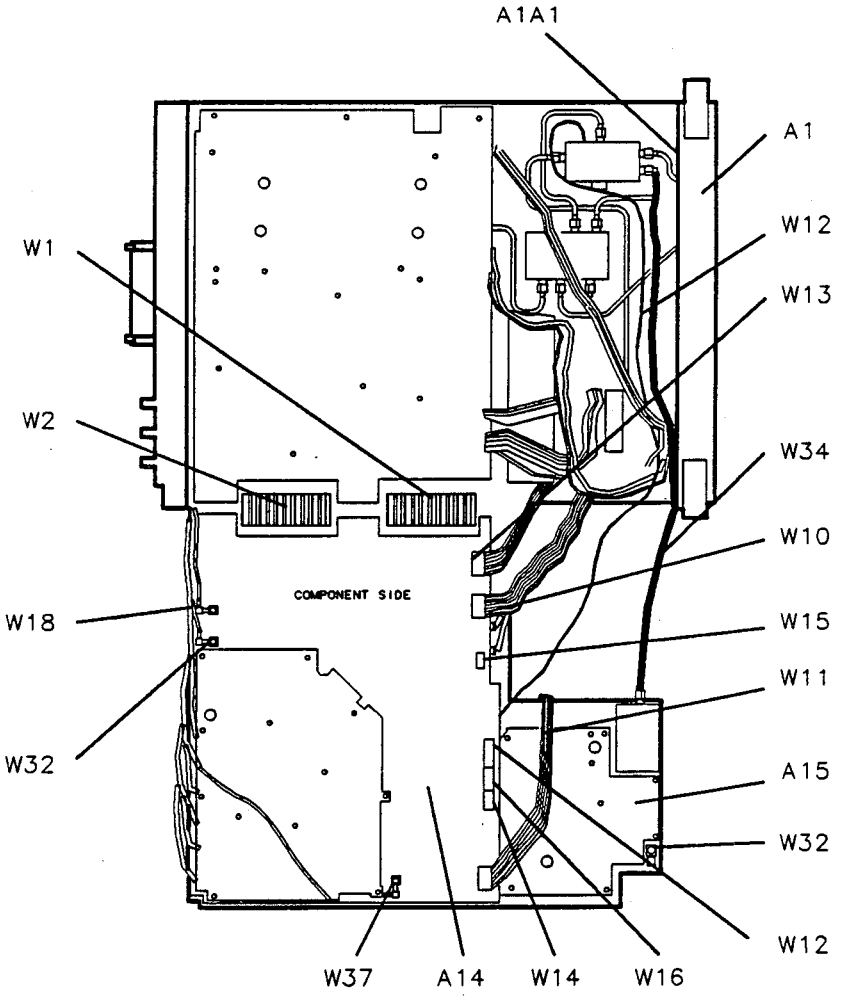


Figure 5-6. Bottom View (A14 and A15 Unfolded)

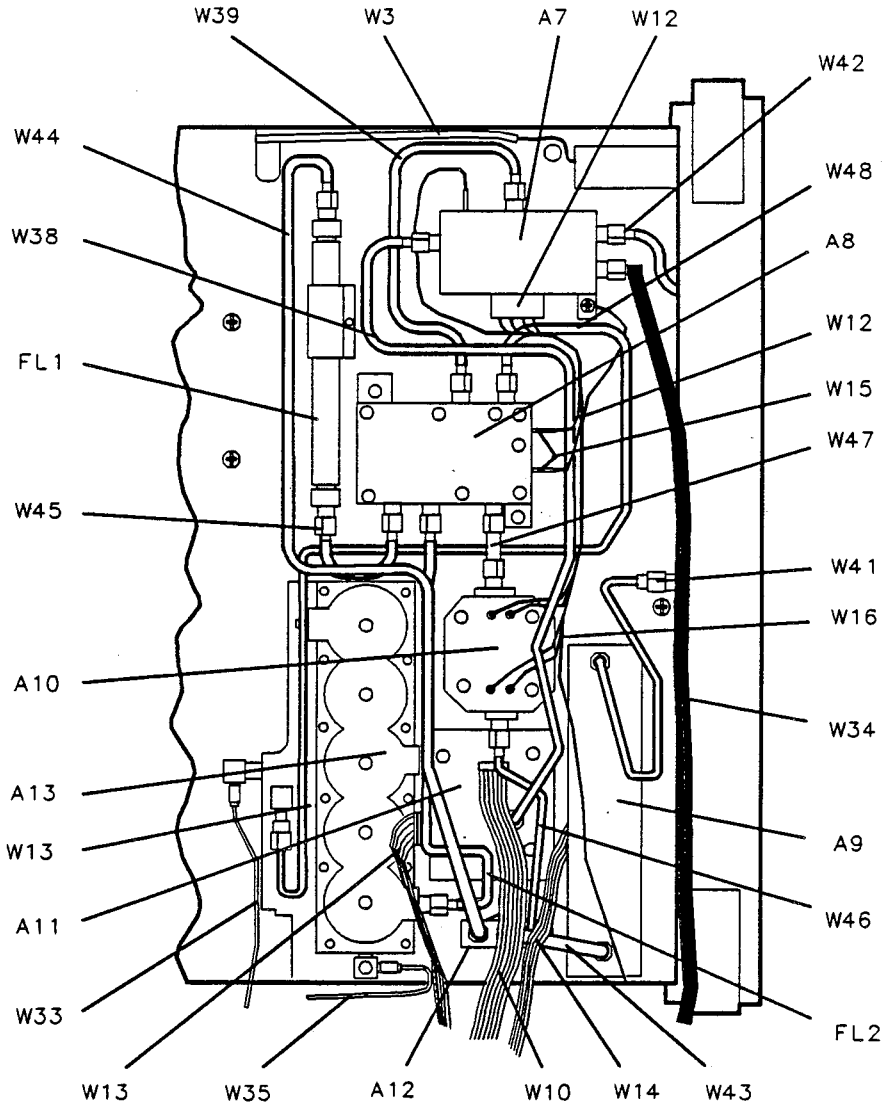


Figure 5-7. RF Section

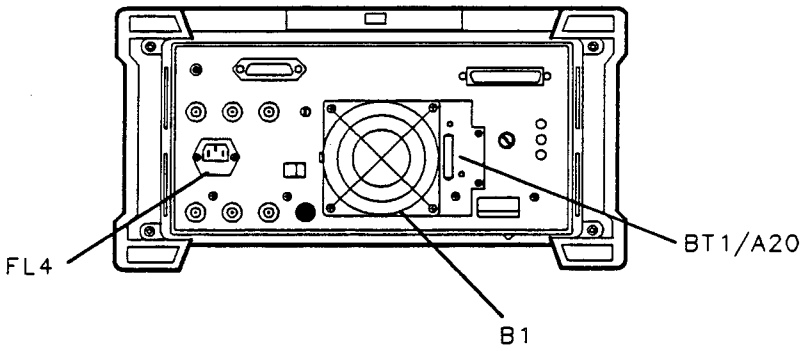


Figure 5-8. Rear View

6

General Troubleshooting

Introduction

This chapter contains information for troubleshooting the instrument down to one of the six major functional sections listed below.

RF Section
Synthesizer Section
IF Section
ADC/Interface Section
Controller Section
Display/Power Supply Section

Chapters 7 through 12 provide detailed troubleshooting information about each of the functional sections.

Note



Read the rest of this introduction before beginning troubleshooting. It contains descriptions of terms used throughout the text and other troubleshooting-specific information. Refer to "Troubleshooting to a Functional Section" to begin troubleshooting.

Topic
Troubleshooting to a Functional Section
Using the TAM
Error Messages
Block Diagram Description

Note



When a part or assembly is replaced, adjustment of the affected circuitry is usually required. Refer to Table 2-1, "Related Adjustments."

Warning



Troubleshooting and repair of this instrument with the cover removed exposes high voltage points that may, if contacted, cause personal injury. Maintenance and repair of this instrument should, therefore, be performed only by skilled personel who know the hazards involved. Where maintenance can be performed without power applied, the power should be removed. When any repair is completed, be sure that all safety features are intact and functioning and that all necessary parts are grounded.

Assembly-Level Text

To locate troubleshooting information for an individual assembly, refer to Table 6-1. Component-Level Information can be found in the *HP 8560A/8561B/8563A Component-Level Information* binder.

Block Diagrams

Instrument-level block diagrams are located at the end of this chapter. Power levels and voltages shown on block diagrams are provided as a troubleshooting aid only. They should not be used for making instrument adjustments.

Assembly Test Points

The analyzer board assemblies contain four types of test points: post, pad, extended component lead, and test jack. Figure 6-1 illustrates each type of test point as seen on both block diagrams and circuit boards. The name of the test point is etched into the circuit board next to the test point (for example, TP2). In some instances, the test point is identified on the board by its number only.

Test Point Pads

Each test point pad uses a square pad and a round pad etched into the board assembly. The square pad is the point being measured. The round pad supplies a grounding point for the test probe.

Test Jack (Connectors)

The test jack is a collection of test points located on a 16-pin connector. There are over 26 test jacks used throughout the analyzer. The HP 85629B Test and Adjustment Module uses the analyzer test jacks during diagnostic and adjustment procedures. The pins on the test jack may be manually probed, provided caution is used to prevent accidental shorting between adjacent pins.

Figure 6-1 illustrates the pin configuration for the test jack. All test jacks use the following mnemonics for line names:

MS, "measured signal"
TA, "test and adjustment module address line"
OS, "output signal"

Test points are identified on block diagrams by both the jack/pin number and line name.

Ribbon Cables

Ribbon cables are used extensively in the analyzer. The following five cables use different pin numbering methods on the connectors (signal names remain the same but the pin numbers vary):

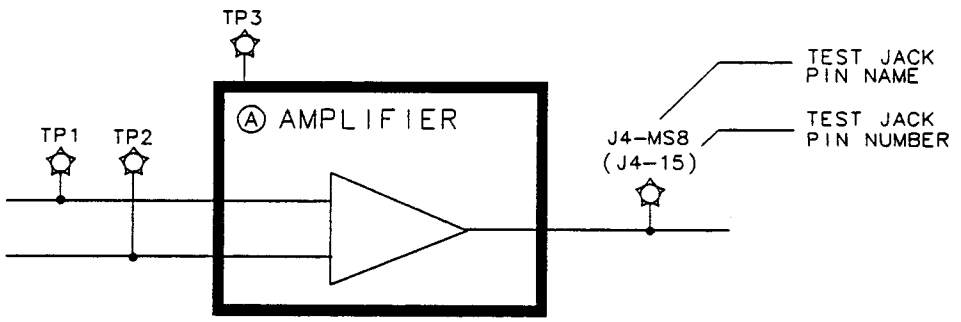
W1, Power Cable
W2, Control Cable
W4, Option Cable
A3W1, Interface Cable
A19W1, HPIB Cable

Figure 6-2 illustrates the pin configurations of these five cables. Cables W1 and W2 use two pin numbering methods on their connectors. These methods are identified on the interconnect and block diagrams by the letters "A" and "B" next to the connector designator, such as J1(A). Board assembly connections to W1 are always labeled J1. Board assembly connections to W2 are always labeled J2.

WR PROT/WR ENA Softkey Menus

The jumper on A2J12 is shipped from the factory in the WR PROT (write protect) position (jumper on pins 2 and 3). When the jumper is set to the WR ENA (write enable) position (jumper on pins 1 and 2), an alternate softkey menu is displayed under [CAL]. Figure 6-3 illustrates the unique keys of the [CAL] menu that are displayed when the WR ENA mode is activated.

TEST POINTS ON BLOCK DIAGRAM



TEST POINTS ON CIRCUIT BOARD ASSEMBLY

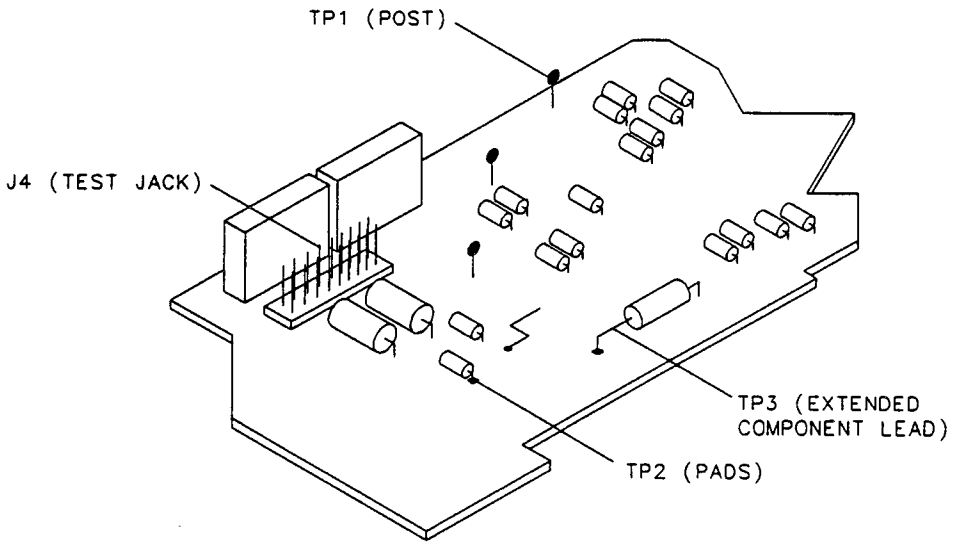
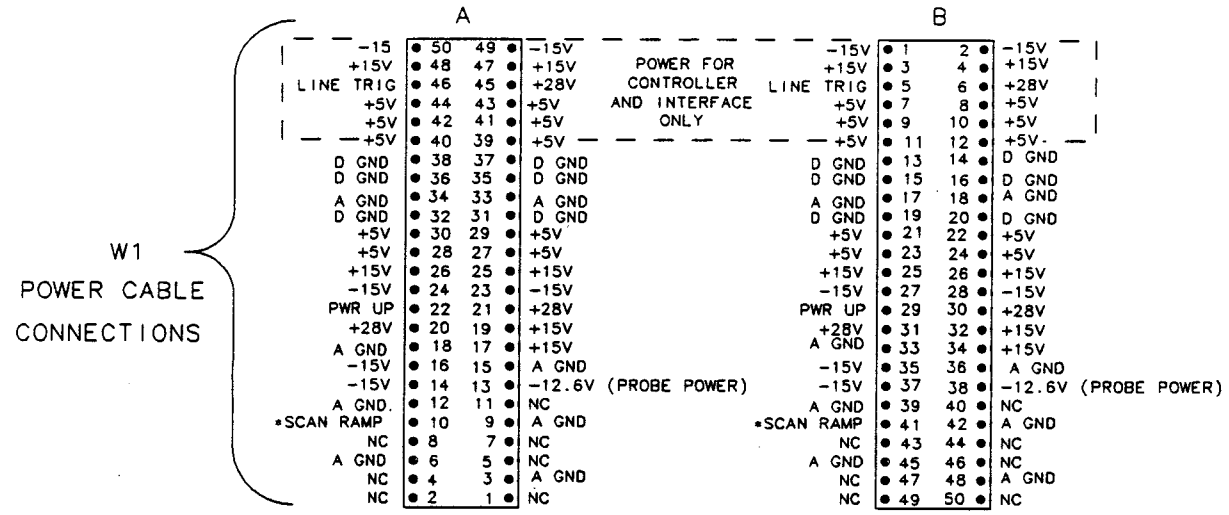


Figure 6-1. Assembly Test Points



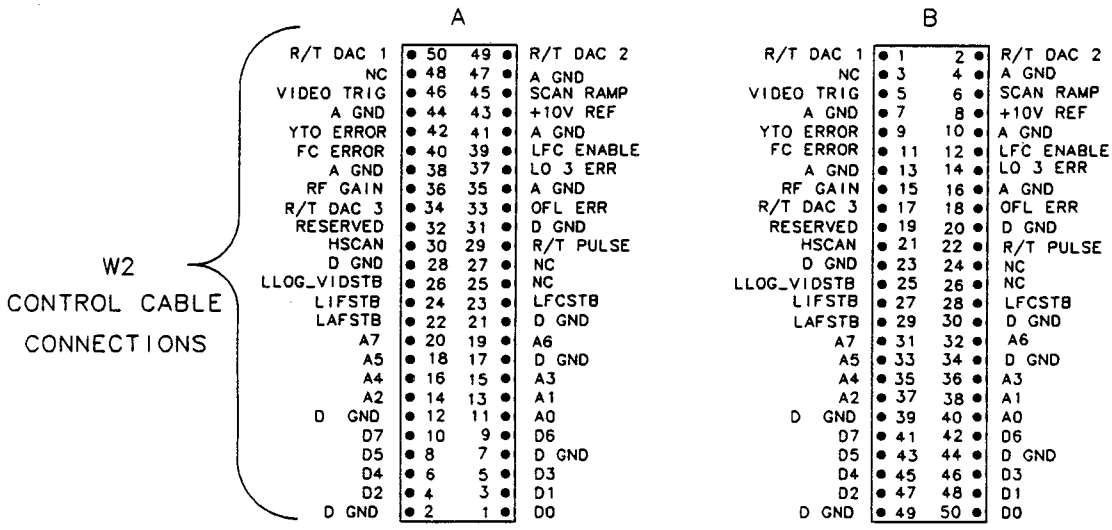


Figure 6-2. Ribbon Cable Connections (1 of 2)

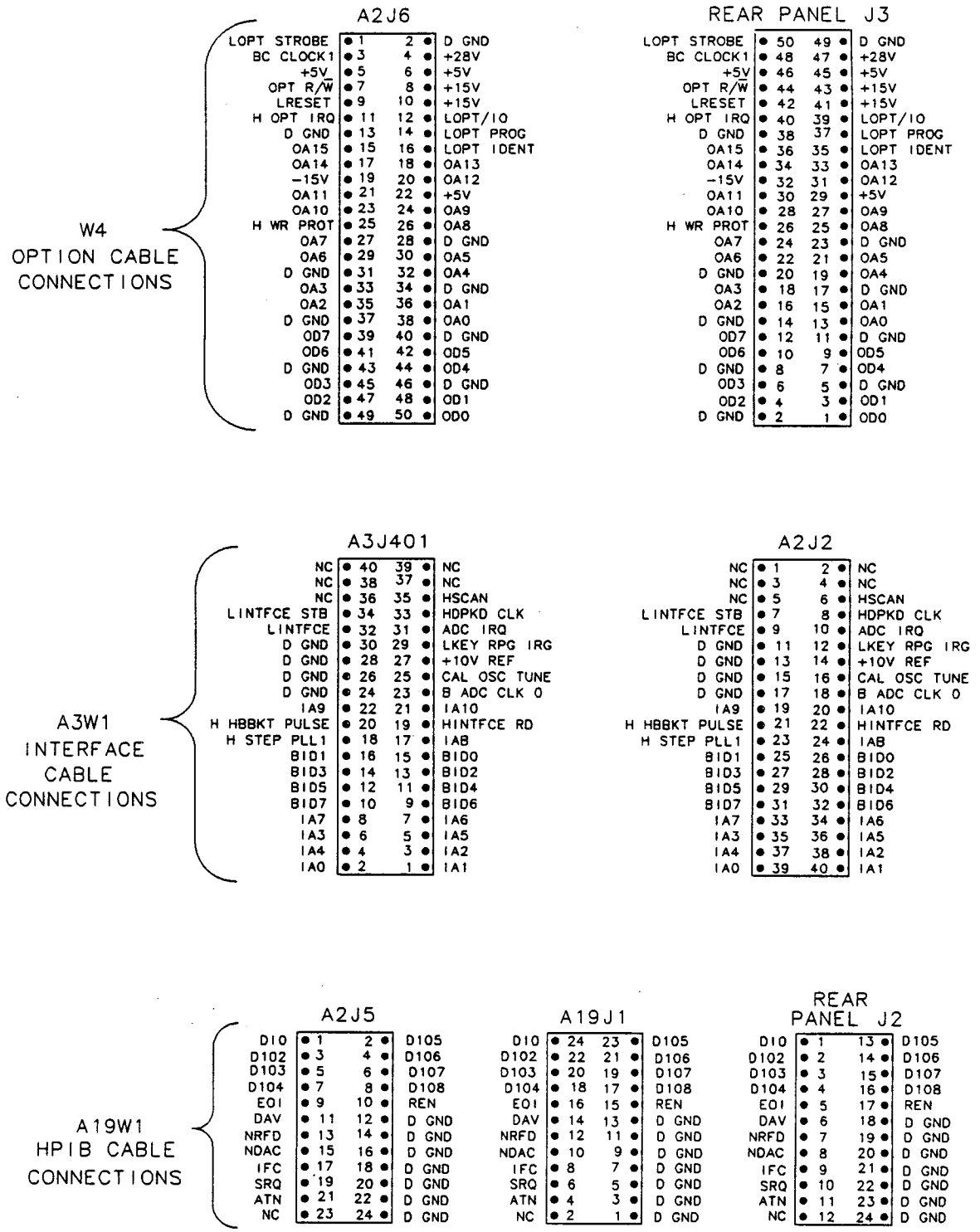


Figure 6-2. Ribbon Cable Connections (2 of 2)

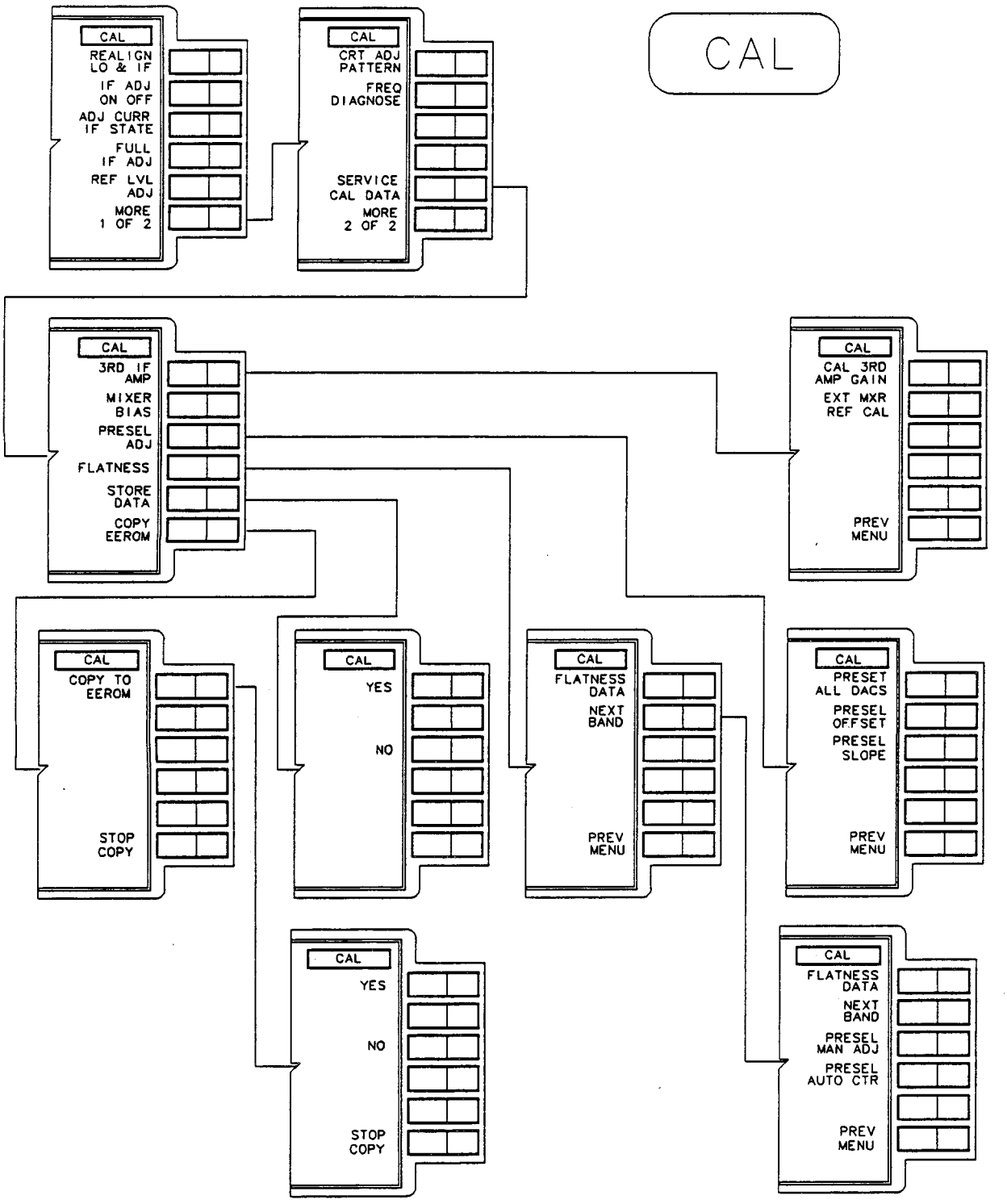


Figure 6-3. WR ENA Softkey Menu

Troubleshooting to a Functional Section

- Table 6-1 lists the location of assembly-specific troubleshooting information.
- If the HP 85629B Test and Adjustment Module (TAM) is available, refer to the "Using the TAM" section in this chapter.
- If error messages are displayed, refer to "Error Messages" in this chapter. You can find both error descriptions and brief troubleshooting information.
- If no signal is visible, and no errors messages are displayed, the fault is probably in the RF Section. Refer to the troubleshooting information in Chapter 11, "RF Section."
- Blank displays result from problems caused by either the Controller or Display/Power-Supply Sections. Because error messages 700 to 755 caused by the Controller Section cannot be seen on a blank display, use the following BASIC program to read these errors over HP-IB. If the HP-IB program returns an error code of 0, there are no errors.

```
10 DIM Err$[128]
20 OUTPUT 718;"ERR?;"
30 ENTER 718; Err$
40 PRINT Err$
50 END
```

  a. If there is no response over HP-IB, set the controls of an oscilloscope as follows:

     Sweep Time ..... 2 ms/DIV
     Amplitude Scale ..... 1 V/DIV

  b. The signals at A2J202 pin 3 and pin 14 should measure about 4 Vp-p. If they do not, refer to Chapter 9 and troubleshoot the A2 Controller assembly.

  c. Set the oscilloscope controls as follows:

     Sweep Time ..... 1 ms/DIV
     Amplitude Scale ..... 2 V/DIV

  d. The signal at A2J202 pin 15 should indicate TTL pulses. If the signal is at a constant level (high or low), troubleshoot the A2 Controller assembly.

- Display problems such as intensity or distortion are caused by either the Controller or Display/Power-Supply Sections. Refer to the troubleshooting information in Chapter 9.

Table 6-1. Location of Assembly Level Troubleshooting Text

Instrument Assembly	Location of Troubleshooting Text
A1A1 Keyboard	Chapter 7. ADC/Interface Section
A1A2 RPG	Chapter 7. ADC/Interface Section
A2 Controller	Chapter 9. Controller Section
A3 Interface	Chapter 7. ADC/Interface Section
	Chapter 8. IF Section
A4 Log Amplifier	Chapter 8. IF Section
A5 IF	Chapter 8. IF Section
A6 Power Supply	Chapter 12. Display/Power Supply Section
A6A1 HV Module	Chapter 12. Display/Power Supply Section
A7 1ST LO Dist. Ampl.	Chapter 11. RF Section
A8 Dual Band Mixer	Chapter 11. RF Section
A9 Input Attenuator	Chapter 11. RF Section
A10 YTF	Chapter 11. RF Section
A11 YTO	Chapter 10. Synthesizer Section
A12 RF Switch	Chapter 11. RF Section
A13 2nd Converter	Chapter 11. RF Section
A14 Frequency Control	Chapter 10. Synthesizer Section
	Chapter 11. RF Section
A15 RF Assembly	Chapter 10. Synthesizer Section
	Chapter 11. RF Section
A16 Cal Oscillator	Chapter 8. IF Section
A17 CRT Driver	Chapter 12. Display/Power Supply Section
A18 CRT	Chapter 12. Display/Power Supply Section
A19 HP-IB	Chapter 9. Controller Section
A21 OCXO	Chapter 10. Synthesizer Section
FL1,2	Chapter 11. RF Section

Using the TAM

When attached to the rear panel of the spectrum analyzer, the HP 85629B Test and Adjustment Module (TAM) provides diagnostic functions for supporting the HP 8563A. Because the TAM is connected directly to the analyzer internal data and address bus, it controls the analyzer hardware directly through firmware control. It would be impossible to control the hardware to the same extent either from the analyzer front panel or over the HP-IB.

- The HP 85629B Rev D firmware (Revision 890930 or later) supports the HP 8563A Spectrum Analyzer.

The TAM measures voltages at key points in the circuitry and flags a failure whenever the voltage falls outside limits. The TAM locates the failure to a small functional area which can be examined manually. Remember the following when using the TAM:

- *Always turn off* the spectrum analyzer power when installing or removing the TAM.
- Use the HELP softkey (found in all menus) for useful information.
- Press (MODULE) to return to the TAM main menu.
- The TAM acts as the active controller on the HP-IB. Disconnect any other controller from HP-IB when the TAM is functioning.

Diagnostic Functions

The TAM provides the four diagnostic functions listed below. (Additional menu selections support the TAM itself.) Refer to the indicated page for a description of each function.

1. Automatic Fault Isolation 6-12
2. Manual Probe Troubleshooting *(needs cover removed)* 6-13
3. RF Path Fault Isolation 6-14
4. Cal Oscillator Troubleshooting Mode *(needs cover removed)* 6-14

Note

The HP 85629A Test and Adjustment Module (all firmware revisions) and the HP 85629B Test and Adjustment Module with firmware revision A and B do not properly execute Automatic Fault Isolation on the spectrum analyzer.

TAM Requirements

For the TAM to function properly, certain parts of the analyzer must be operating properly. These include the central processing unit (CPU), parts of the programmed ROM and programmed RAM, the keyboard and keyboard interface, and the display.

Even though the TAM communicates with the operator via the display, some display problems can be checked using the TAM. This is possible by using the `Print Page` softkey. Even if the display is dead, `Print Page` is still active. Refer to Chapter 12 for instructions on using the TAM when the display is not functioning.

Test Connectors

The TAM uses a built-in dc voltmeter and digital-to-analog converter (DAC) to measure voltages on any one of 26 test jacks (connectors) located throughout the spectrum analyzer.

Revision Connectors

One test connector on each assembly is reserved as a "revision connector." The TAM uses the revision connector to identify the assembly design revision. A "revision voltage" indicates design changes.

The TAM must be plugged into the revision connector first to determine which tests to use for the assembly. If the revision connector has not been probed, a message appears instructing you to connect the probe to the revision connector and press `TEST`. You can then probe the rest of the assembly connectors.

Note

If the revision of the PC board is newer than the TAM, a message is displayed stating that the revision code for this board is not known by this module. The choices presented are to use the test for the latest known revision board, measure only voltages, or exit. In general, most points do not change from one board revision to another, so using the most current tests is still very useful. However, any failure should be verified using the manual troubleshooting procedures before doing a repair.

Inconsistent Results

Many of the signals measured by the TAM are digitally controlled. If inconsistent results are obtained, or if failures appear in unrelated areas, the digital control may be at fault. Refer to the manual troubleshooting procedures related to the assembly which displays inconsistant results. The manual troubleshooting procedure can be used to isolate failures of this nature.

Erroneous Results

If the TAM manual probe troubleshooting seems to be giving erroneous results, its performance can be checked by placing the probe on the TAM test connector (A2J11) located on the A2 Controller assembly and executing the manual probe diagnostics. If either of the tests fail, the TAM is malfunctioning and should be serviced.

Blank Display

It is possible to use the TAM Manual Probe Troubleshooting without a display if an HP-IB printer is available. Refer to Chapter 12 for more information.

Automatic Fault Isolation

Automatic Fault Isolation is designed to isolate most faults to one or two assemblies. Automatic Fault Isolation can be run with the analyzer cover in place and requires only the CAL OUTPUT signal as a stimulus. The entire procedure takes less than 2 minutes to complete if no failures are found.

Automatic Fault Isolation performs checks of five functional areas in a predefined sequence. The sequence minimizes the chance of making false assumptions. The TAM checks the analyzer "from the inside out." For example, the ADC is checked before the IF is checked. This ensures that if no signal is detected through the IF, the fault is in the IF Section and not a faulty ADC. (The ADC measures the video signal from the IF Section.)

The sequence of checks is as follows:

1. Controller Check
2. ADC/Interface Check
3. IF/LOG Check
4. LO Control Check
5. RF Low Band Check

Note



Only the low band path of the spectrum analyzer is checked with Automatic Fault Isolation. This is because the only stimulus to the RF Section is from the 300 MHz CAL OUTPUT signal. A signal greater than 2.9 GHz would be required to check the high band path.

Display/Power Supply

Automatic Fault Isolation cannot check the Display/Power-Supply Section because this section powers the TAM and provides the display of Automatic Fault Isolation results.

Controller Check

The TAM performs a check sum of all ROMs, RAMs, and the EEROM. The CPU is also checked, since parts of the CPU could be nonfunctional while the TAM still operates. These checks are very similar to those done by the analyzer at power-on.

ADC/Interface Check

The keyboard interface and strobe-select circuitry must be functioning correctly, since these are required to operate the TAM. The TAM checks the ADC by attempting to measure three

signals from three different locations. This ensures that an open or short in one cable does not hide the fact that the ADC is operating satisfactorily.

The analog bus (W2 Control Cable) is checked by sending data out on the data lines and reading the data back. If this check fails, disconnect one board at a time and rerun AFI to determine if an assembly causes the problem. If the fault remains with all assemblies disconnected from W2, troubleshoot W2 or the A3 Interface assembly.

IF/LOG Check

The TAM uses the A16 Cal Oscillator assembly as the stimulus for checking the IF Section. If the signal is undetected, the TAM repeats the test with a signal originating from the RF Section. The presence of this signal through the IF indicates a faulty A16 assembly.

LO Control Check

The LO Control Check verifies that all phase-lock loops (PLLs) in the Synthesizer Section lock. (Some oscillators are checked to ensure that they lock outside their normal operating frequency ranges.) The TAM also performs an operational check on several DACs in the Synthesizer Section.

RF Check

The TAM tests the operation of A8 Dual Band Mixer, A9 Input Attenuator, second IF Distribution, and most of the A13 Second Converter.

Automatic Fault Isolation also checks the Flatness Compensation Amplifiers (part of the A15 RF assembly), ensuring that their gain can be adjusted over a certain range.

If no signal is detected through the RF Section, Automatic Fault Isolation substitutes the 298 MHz SIG ID oscillator for the third LO while simultaneously decreasing the first LO frequency by 2 MHz. If a signal can now be detected, troubleshoot the third LO Driver Amplifier on the A15 RF assembly.

Manual Probe Troubleshooting

Manual Probe Troubleshooting checks the instrument test connectors to perform the following types of measurements:

- Amplifier and oscillator dc current draw. Manual Probe Troubleshooting monitors the voltage across a resistor of known value.
- Oscillator tune voltages. Manual Probe Troubleshooting verifies proper operation of the phase/frequency detectors and loop integrators.
- Static bias voltages. Manual Probe Troubleshooting checks the level of the bias voltages.

If probing a connector for a check yields a "FAIL" indication, select the desired check using either the knob or step keys and press `More Info`. A description of the function checked (with measured and expected voltages/currents) is displayed with a list of additional areas to check. These areas can sometimes be checked by looking at another TAM connector, but usually require manual troubleshooting techniques to isolate the problem further. If an HP-IB printer is connected, press `Print Page` to provide a hard copy of the currently displayed screen (the softkey labels are not printed).

Each test connector has 15 pins (one pin is missing to act as a key). The pins contain eight measured signal lines denoted as Measured Signal 1 (MS1) through Measured Signal 8 (MS8), one input signal line (OS1), one ground, and five pins encoding a 5-bit connector address.

One test connector on each assembly is reserved as a "revision connector." The TAM uses the revision connector to identify the assembly design revision. A "revision voltage" indicates design changes. The TAM needs to probe each assembly revision connector once; subsequent readings are not necessary. It is possible, for example, to probe the A5 IF assembly, then the A4 Log Amplifier assembly, and then return to A5 without having to re-probe A5 revision connector. However, the revision connector must be re-probed if the spectrum analyzer is returned to normal operation and then back to TAM control. (This is also true if the analyzer is turned off.)

RF Path Fault Isolation

RF Path Fault Isolation checks high-band RF paths. (Automatic Fault Isolation checks the low-band RF path.) An external microwave source with a frequency range of 5 GHz is required. The source is not controlled over HP-IB. The user sets the source to 5 GHz at −10 dBm. (The TAM expects −10 dBm at the input of the spectrum analyzer; the amplitude at the source output may have to be higher to account for cable loss.)

The frequency provides a signal for high band. The TAM checks the operation of the A9 Input Attenuator and the A8 Dual Mixer at 5 GHz. If no signal is present, the TAM uses the 298 MHz SIG ID oscillator, as is done in Automatic Fault Isolation.

Cal Oscillator Troubleshooting Mode

The Cal Oscillator Troubleshooting Mode enables front-panel control of the A16 Cal Oscillator assembly oscillator. The Cal Oscillator can be fixed-tuned to three different frequencies. The Cal Oscillator may also be set to one of four sweep widths, centered at 10.7 MHz.

Fixed-tuned settings:

11.5 MHz
10.7 MHz
9.9 MHz

Sweep-width settings:

20 kHz
10 kHz
4 kHz
2 kHz

The Cal Oscillator Troubleshooting Mode sends A16 output (−35 dBm) to the A5 IF assembly. On the A5 IF assembly all crystal filter poles are shorted, all LC poles enabled, and the 15 dB attenuator disabled. Signals from the RF Section are attenuated as much as possible.

Error Messages

The spectrum analyzer displays error messages in the lower right-hand corner of the display. A number, or error code, is associated with each error message. These error messages alert the user to errors in spectrum analyzer function or use. Multiple error messages may exist simultaneously. Refer to "Viewing Multiple Messages" below.

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Viewing Multiple Messages

Although multiple errors may exist, the spectrum analyzer displays only one error message at a time. To view any additional messages, do the following:

1. Press (RECALL) and MORE 1 OF 2.
2. Press RECALL ERRORS. An error message is displayed in the active function block.
3. Use the up and down step keys to scroll through any other error messages which might exist, making note of each error code.

Error Message Elimination

When an error message is displayed, always perform the following procedure.

1. Press (SAVE) and SAVE STATE.
2. Store the current state in a convenient STATE register. (It may be necessary to set SAVELOCK to OFF.)
3. Press (CAL) and REALIGN LO & IF. Wait for the sequence to finish.
4. Press (RECALL) and RECALL STATE.
5. Recall the previously stored STATE.
6. If an error message is still displayed, refer to the list of error messages below for an explanation of the error messages.

Remote HP-IB Errors (100 to 150)

Refer to the spectrum analyzer Operating and Programming Manual for information on programming the analyzer.

100 NO PWRON	Power-on state is invalid; default state is loaded. Press (SAVE), PWR ON STATE to clear error message.
101 NO STATE	State to be RECALLed not valid or not SAVEd.
106 ABORTED!	Current operation is aborted; HP-IB parser reset.
107 HELLO ??	No HP-IB listener is present.
108 TIME OUT	Analyzer timed out when acting as controller.
109 CtrlFail	Analyzer unable to take control of the bus.
110 NOT CTRL	Analyzer is not system controller.
111 # ARGMTS	Command does not have enough arguments.
112 ??CMD??	Unrecognized command.
113 FREQ NO!	Command cannot have frequency units.
114 TIME NO!	Command cannot have time units.
115 AMPL NO!	Command cannot have amplitude units.
116 ?UNITS??	Unrecognizable units.
117 NOP NUM	Command cannot have numeric units.
118 NOP EP	Enable parameter cannot be used.
119 NOP UPDN	UP/DN are not valid arguments for command.
120 NOP ON/OF	ON/OFF are not valid arguments for command.
121 NOP ARG	AUTO/MAN are not valid arguments for command.
122 NOP TRC	Trace registers are not valid for command.
123 NOP ABLK	A-block format not valid here.

124 NOP IBLK	I-block format not valid here.
125 NOP STRNG	Strings are not valid for this command.
126 NO ?	This command cannot be queried.
127 BAD DTMD	Not a valid peak detector mode.
128 PK WHAT?	Not a valid peak search parameter.
129 PRE TERM	Premature A-block termination.
130 BAD TDF	Arguments are only for TDF command.
131 ?? AM/FM	AM/FM are not valid arguments for this command.
132 !FAV/RMP	FAV/RAMP are not valid arguments for this command.
133 !INT/EXT	INT/EXT are not valid arguments for this command.
134 ??? ZERO	ZERO is not a valid argument for this command.
135 ??? CURR	CURR is not a valid argument for this command.
136 ??? FULL	FULL is not a valid argument for this command.
137 ??? LAST	LAST is not a valid argument for this command.
138 !GRT/DSP	GRT/DSP are not valid arguments for this command.
139 PLOTONLY	Argument can only be used with PLOT command.
140 ?? PWRON	PWRON is not a valid argument for this command.
141 BAD ARG	Argument can only be used with FDIAG command.
142 BAD ARG	Query expected for FDIAG command.
143 NO PRESL	Attempt to control preselector which is not present in HP8561B.
144 COUPL ??	Invalid COUPLING argument. Expected AC or DC.

System Errors (200 to 201)

These errors are directly related to the ADC/Interface Section. Suspect a faulty A2 Controller or A3 Interface assembly.

200 SYSTEM	Hardware/firmware interaction; check other errors.
201 SYSTEM	Hardware/firmware interaction; check other errors.

ADC Errors (250 to 251)

These errors often require troubleshooting the A2 Controller and A3 Interface assemblies.

250 OUTOF RG	ADC input is outside of ADC range.
251 NO IRQ	Microprocessor not receiving interrupt from ADC.

YTO Loop Errors (300 to 301)

These errors often require troubleshooting the A14 Frequency Control assembly (Synthesizer Section) or the ADC circuits.

300 YTO UNLK	YTO (1st LO) Loop is unlocked. The ADC measures YTO_ERR voltage under phase-lock condition. ERR 301 is set if the voltage is outside certain limits.
301 YTO UNLK	YTO Loop is unlocked. Same as ERR 300.

Roller PLL Errors (302 to 316)

These errors indicate a faulty roller oscillator on the A14 Frequency Control assembly. Refer to Chapter 10. The A3 Interface ADC circuits may also be faulty. If error codes 333 and 499 are present, suspect the 10 MHz Reference, the A21 OCXO, or on the A15 assembly (Option 103).

302 OFF UNLK	Offset roller oscillator PLL is unlocked. May indicate loss of 10 MHz reference. The 10 MHz reference should measure greater than −7 dBm at A15J303. The ADC measures OFFSENSE at the beginning of each sweep and, if the voltage is outside certain limits, the offset oscillator pretuned DAC is adjusted to bring OFFSENSE within the proper range. ERR 302 is set if this cannot be accomplished.
303 XFR UNLK	Transfer roller oscillator PLL is unlocked. May indicate loss of 10 MHz reference. The 10 MHz reference should measure greater than −7 dBm at A15J303. The ADC measures XFRSENSE at the beginning of each sweep and, if the voltage is outside certain limits, the transfer oscillator pretuned DAC is adjusted to bring XFRSENSE within the proper range. ERR 303 is set if this cannot be accomplished.
304 ROL UNLK	Main roller oscillator PLL is unlocked. May indicate loss of 10 MHz reference. The 10 MHz reference should measure greater than −7 dBm at A15J303. The ADC measures MAINSENSE at the beginning of each sweep and, if the voltage is outside certain limits, the main roller pretune DAC is adjusted to bring OFFSENSE within the proper range. ERR 304 is set if this cannot be accomplished.
305 FREQ ACC	Unable to adjust MAINSENSE close to 0 volts using the coarse adjust DAC. The coarse adjust and fine adjust DAC are used together to set MAINSENSE to 0 volts with the loop opened. ERR 305 is set if the coarse adjust DAC cannot bring MAINSENSE close enough to 0 volts for the fine adjust DAC to bring MAINSENSE to exactly 0 volts.

306 FREQ ACC

Unable to adjust MAINSENSE to 0 volts using the fine adjust DAC. The coarse adjust and fine adjust DAC are used together to set MAINSENSE to 0 volts with the loop opened. ERR 306 is set if the fine adjust DAC cannot bring MAINSENSE to 0 volts.

307 FREQ ACC

Transfer oscillator pretuned DAC out of range. The transfer oscillator pretune procedure attempts to find pretuned DAC values by programming the PLL to 25 different frequencies and incrementing the transfer oscillator pretune DAC until XFRSENSE changes polarity. ERR 307 is set if the DAC is set to 255 (maximum) before XFRSENSE changes polarity.

308 FREQ ACC

Offset oscillator pretune DAC not within prescribed limits at low frequency. The offset oscillator pretune DAC is set to provide a frequency less than 189 MHz while the PLL is programmed for 189 MHz. ERR 308 is set if XFRSENSE is greater than +5 V (it should be at the negative rail).

309 FREQ ACC

Offset oscillator pretune DAC not within prescribed limits at high frequency. The offset oscillator pretune DAC is set to provide a frequency less than 204 MHz while the PLL is programmed for 204 MHz. ERR 309 is set if XFRSENSE is greater than +5 V (it should be at the negative rail).

310 FREQ ACC

Main roller pretune DAC set to 255. The main roller pretune DAC is set to 5, causing MAINSENSE to go to the positive rail. The DAC is incremented until MAINSENSE changes polarity. ERR 310 is set if the DAC is set to 255 before MAINSENSE changes to a negative polarity.

311 FREQ ACC

Main roller pretune DAC set to 255. The main roller pretune DAC is set to 5, causing MAINSENSE to go to the positive rail. The DAC is incremented until MAINSENSE changes polarity. ERR 311 is set if the DAC is set to 255 before MAINSENSE changes to a negative polarity.

312 FREQ ACC

Unable to adjust MAINSENSE to 0 volts using the fine adjust DAC. The coarse adjust and fine adjust DAC are used together to set MAINSENSE to 0 volts with the loop opened. ERR 312 is set if the fine adjust DAC cannot bring MAINSENSE to 0 volts.

313 FREQ ACC

Error in LO synthesis algorithm. ERR 313 is set if a combination of Sampler oscillator and roller oscillator frequencies could not be found to correspond to the required YTO start frequency. Contact the factory.

314 FREQ ACC

Indicates problems in the span calibration. Troubleshoot any unlocks before attempting to troubleshoot span calibration problems, because the loops must all lock in order to perform the calibration. If LO spans greater than 1 MHz are correct, check A14U114B , A14U115A, A14U116, or A14Q101. This error message appears when the main roller oscillator sweep sensitivity is 0. A sweep ramp is injected into the locked main roller loop which should generate a negative-going ramp on MAINSENSE. ERR 314 is set if the slope of this ramp is 0. This is an indication of an unlocked main roller loop or lack of a sweep ramp.

315 FREQ ACC

Indicates problems in the span calibration. Troubleshoot any unlocks before attempting to troubleshoot span calibration problems, because the loops must all lock in order to perform the calibration. If LO spans greater than 1 MHz are correct, check A14U114B , A14U115A, A14U116, or A14Q101. This error message appears when the roller Span Attenuator DAC is out of range. This DAC value is recalculated each time there are changes to the span or start frequency. ERR 315 is set if this value is less than 10 or greater than 245.

316 FREQ ACC

Sensitivity of main roller pretune DAC is 0. Once the main roller is locked, the MAINSENSE voltage is measured and the pretune DAC value is incremented by two. ERR 316 is set if the difference between the new MAINSENSE voltage and the previous MAINSENSE voltage is 0.

YTO Loop Errors (317 to 318)

These messages indicate that the YTO Main Coil Coarse DAC (ERR 317) or fine DAC (ERR 318) is at its limit. If error codes 300 or 301 are not present, a hardware problem exists in the YTO loop but the loop can still acquire lock. Refer to Chapter 10 to troubleshoot the YTO PLL. The ADC circuit on the A3 Interface assembly may also cause this error.

317 FREQ ACC

Main coil coarse DAC at limit. The main coil coarse DAC is set to bring YTO ERR close enough to 0 volts for the main coil fine DAC to bring YTO ERR to exactly 0 volts. ERR 317 is set if the main coil coarse DAC is set to one of its limits before bringing YTO ERR close enough to 0 volts.

318 FREQ ACC

Main coil fine DAC at limit. The main coil fine DAC is set to bring YTO ERR to 0 volts after the main coil coarse DAC has brought YTO ERR close to 0 volts. ERR 318 is set if the main coil fine DAC is set to one of its limits before bringing YTO ERR to 0 volts.

Roller Oscillator Errors (321 to 329)

These errors indicate a faulty roller oscillator on the A14 Frequency Control assembly. Refer to Chapter 10. The A3 Interface ADC circuits may also be faulty. If error codes 333 and 499 are also present, suspect the 10 MHz Reference, the A21 OCXO, or the A15 assembly (Option 103).

321 FREQ ACC

Main roller tuning sensitivity is not greater than 0. The MAINSENSE voltage is noted in a locked condition and the main roller is

programmed to a frequency 400 kHz higher. ERR 321 is set if the new MAINSENSE voltage is not greater than the previous MAINSENSE voltage.

322 FREQ ACC — Main roller pretune DAC value set greater than 255. During the LO adjust sequence, the main roller is locked and then programmed to a frequency 1.6 MHz higher. A new pretune DAC value is calculated based upon the main roller tuning sensitivity. ERR 322 is set if this calculated value is greater than 255.

324 FREQ ACC — Unable to adjust MAINSENSE close to 0 volts using the coarse adjust DAC. The coarse adjust and fine adjust DAC are used together to set MAINSENSE to 0 volts with the loop opened. ERR 324 is set if the coarse adjust DAC cannot bring MAINSENSE close enough to 0 volts for the fine adjust DACs to bring MAINSENSE to exactly 0 volts.

325 FREQ ACC — Unable to adjust MAINSENSE to 0 volts using the fine adjust DAC. The coarse adjust and fine adjust DAC are used together to set MAINSENSE to 0 volts with the loop opened. ERR 325 is set if the fine adjust DAC cannot bring MAINSENSE to 0 volts.

326 FREQ ACC — Fine adjust DAC near end of range. The fine adjust DAC is set to bring MAINSENSE to 0 volts. ERR 326 is set if the fine adjust DAC value is set to less than 5 or greater than 250.

327 OFF UNLK — Offset roller oscillator PLL is unlocked. May indicate loss of 10 MHz reference. The 10 MHz reference should measure greater than −7 dBm at A15J303. The ADC measures OFFSENSE at the beginning of each sweep and, if the voltage is outside certain limits, the offset oscillator pretune DAC is adjusted to bring OFFSENSE within the proper range. ERR 327 is set if this cannot be accomplished.

328 FREQ ACC — Roller fine adjust DAC sensitivity less than or equal to 0. During the LO adjust routine, the fine adjust DAC is set to two different values and the MAINSENSE voltage is measured at each setting. ERR 328 is set if the difference between these voltages is 0 or negative. This is typically the result of the main roller loop's being unlocked.

329 FREQ ACC — Roller coarse adjust DAC sensitivity less than or equal to 0. During the LO adjust routine, the coarse adjust DAC is set to two different values and the MAINSENSE voltage is measured at each setting. ERR 329 is set if the difference between these voltages is 0 or negative. This is typically the result of the main roller loop's being unlocked.

YTO Loop Errors (331)

This error rarely occurs but is usually indicative of a digital hardware failure.

331 FREQ ACC — Invalid YTO frequency. Firmware attempted to set the YTO to a frequency outside the range of the YTO (2.95 to 6.8107 GHz). Suspect a digital hardware problem, such as a bad RAM on the A2 Controller assembly. Contact the factory.

600 MHz Reference Loop (333)

This error requires troubleshooting the A14 Frequency Control assembly (Synthesizer Section) or the ADC circuits.

333 600 UNLK — The 600 MHz Reference Oscillator PLL is unlocked. If error codes 302, 303, 304, 327 or 499 are also present, suspect the 10 MHz Reference, the A21 OCXO, or the TCXO on Option 103, or the A15 RF assembly. ERR 333 is set if LO3ERR is outside of its prescribed limits.

YTO Leveling Loop (334)

This error often requires troubleshooting the A14 Frequency Control assembly or A7 LODA (Synthesizer Section) or the ADC circuits.

334 LO AMPL — 1ST LO Distribution Amplifier is unleveled. This error is usually accompanied by error codes 300 or 301. ERR 301 YTO UNLK is cleared once ERR 334 has been cleared. Check the output of the A11 YTO with the jumper on A14J23 in the TEST position. The YTO power output should be between +9 and +13 dBm. If the YTO is working properly, refer to "A7 LODA Drive" in Chapter 10. The LODA AGC voltage is monitored by the ADC. ERR 334 is set if LODA AGC is outside of its prescribed limits. Refer to "A7 LODA Drive" in Chapter 11.

Sampling Oscillator (335)

This error indicates an unlocked Sampling oscillator (also known as the offset Lock Loop).

335 SMP UNLK — Sampling oscillator PLL is unlocked. ERR 335 is set if OFL_ERR is outside its prescribed limits.

Automatic IF Errors (400 to 599)

These error codes are generated when the automatic IF adjustment routine detects a fault. This routine first adjusts amplitude parameters, then resolution bandwidths in this sequence: 300 kHz, 1 MHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz, 100 Hz, 30 Hz, 10 Hz, and 2 MHz. The routine restarts from the beginning if a fault is detected. Parameters adjusted after the routine begins but before the fault is detected are correct; parameters adjusted later in the sequence are suspect. Refer to "Automatic IF Adjustment" in Chapter 8.

The IF Section relies on the ADC and video circuitry to perform its continuous IF adjustments. IF-related errors occur if the ADC, video circuitry, or A4 assembly linear path is faulty.

Errors 405 to 416: When these 10K resolution bandwidth (RBW) error messages appear, use the following steps to check for errors 581 or 582.

1. Set the spectrum analyzer (LINE) switch OFF.
2. Set the spectrum analyzer (LINE) switch ON and observe the lower right-hand corner of the display for 10 seconds.

3. If ERR 581 or ERR 582 appears, the fault is most likely on the A16 Cal oscillator. Refer to errors 581 and 582.
4. If ERR 581 or ERR 582 does not appear, troubleshoot the A5 IF assembly.

Multiple IF Errors During IF adjust: If a FULL IF ADJ sequence (pressing CAL and FULL IF ADJ) results in IF errors while displaying IF ADJUST STATUS: AMPLITUDE, A16 might not be providing the correct output signal. Perform the following steps:

1. Disconnect W30 (white) from A5J4.
2. Connect W30 to the input of a second spectrum analyzer and set its controls as follows:

   Center Frequency ..... 10.7 MHz
   Reference Level ..... −30 dBm

3. Observe the spectrum analyzer display while pressing FULL IF ADJ on the spectrum analyzer. If a −35 dBm signal does not appear, troubleshoot the A16 Cal Oscillator.
4. If a −35 dBm signal does appear, troubleshoot the A5 IF assembly.

400 AMPL 100	Unable to adjust amplitude of 100 Hz Resolution Bandwidth.
401 AMPL 300	Unable to adjust amplitude of 300 Hz Resolution Bandwidth.
402 AMPL 1K	Unable to adjust amplitude of 1 kHz Resolution Bandwidth.
403 AMPL 3K	Unable to adjust amplitude of 3 kHz Resolution Bandwidth.
404 AMPL 10K	Unable to adjust amplitude of 10 kHz Resolution Bandwidth.
405 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in first XTAL pole.
406 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in second XTAL pole.
407 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in third XTAL pole.
408 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in Fourth XTAL pole.
409 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in first XTAL pole.
410 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in second XTAL pole.
411 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in third XTAL pole.
412 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in Fourth XTAL pole.
413 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in first XTAL pole.
414 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in second XTAL pole.
415 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in third XTAL pole.
416 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in Fourth XTAL pole.
417 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in first XTAL pole.
418 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in second XTAL pole.
419 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in third XTAL pole.
420 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in Fourth XTAL pole.
421 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in first XTAL pole.
422 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in second XTAL pole.
423 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in third XTAL pole.
424 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth in Fourth XTAL pole.
425 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in first XTAL pole.
426 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in second XTAL pole.
427 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in third XTAL pole.
428 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth in Fourth XTAL pole.
429 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
430 RBW 300	Unable to adjust 300 Hz Resolution Bandwidth.
431 RBW 1K	Unable to adjust 1 kHz Resolution Bandwidth.
432 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth.
433 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth.
434 RBW 300	300 Hz Resolution Bandwidth amplitude low in first XTAL pole.

435 RBW 300	300 Hz Resolution Bandwidth amplitude low in second XTAL pole.
436 RBW 300	300 Hz Resolution Bandwidth amplitude low in third XTAL pole.
437 RBW 300	300 Hz Resolution Bandwidth amplitude low in Fourth XTAL pole.
438 RBW 1K	1 kHz Resolution Bandwidth amplitude low in first XTAL pole.
439 RBW 1K	1 kHz Resolution Bandwidth amplitude low in second XTAL pole.
440 RBW 1K	1 kHz Resolution Bandwidth amplitude low in third XTAL pole.
441 RBW 1K	1 kHz Resolution Bandwidth amplitude low in Fourth XTAL pole.
442 RBW 3K	3 kHz Resolution Bandwidth amplitude low in first XTAL pole.
443 RBW 3K	3 kHz Resolution Bandwidth amplitude low in second XTAL pole.
444 RBW 3K	3 kHz Resolution Bandwidth amplitude low in third XTAL pole.
445 RBW 3K	3 kHz Resolution Bandwidth amplitude low in Fourth XTAL pole.
446 RBW 10K	10 kHz Resolution Bandwidth amplitude low in first XTAL pole.
447 RBW 10K	10 kHz Resolution Bandwidth amplitude low in second XTAL pole.
448 RBW 10K	10 kHz Resolution Bandwidth amplitude low in third XTAL pole.
449 RBW 10K	10 kHz Resolution Bandwidth amplitude low in Fourth XTAL pole.
450 IF SYSTM	IF hardware failure. Check other error messages.
451 IF SYSTM	IF hardware failure. Check other error messages.
452 IF SYSTM	IF hardware failure. Check other error messages.
454 AMPL	Unable to adjust step gain amplifiers.
455 AMPL	Unable to adjust fine attenuator.
456 AMPL	Unable to adjust fine attenuator.
457 AMPL	Unable to adjust fine attenuator.
458 AMPL	Unable to adjust first step gain stage.
459 AMPL	Unable to adjust first step gain stage.
460 AMPL	Unable to adjust first step gain stage.
461 AMPL	Unable to adjust second step gain stage.
462 AMPL	Unable to adjust second step Gain stage.
463 AMPL	Unable to adjust third step Gain stage.
464 AMPL	Unable to adjust third step Gain stage.
465 AMPL	Unable to adjust third step Gain stage.
466 LIN AMPL	Unable to adjust linear amplifier scale.
467 AMPL	Unable to adjust step gain amplifiers.
468 AMPL	Unable to adjust third step Gain stage.
469 AMPL	Unable to adjust step gain amplifiers.
470 AMPL	Unable to adjust third step Gain stage.

471 RBW 30K	Unable to adjust 30 kHz Resolution Bandwidth in first LC pole.
472 RBW 100K	Unable to adjust 100 kHz Resolution Bandwidth in first LC pole.
473 RBW 300K	Unable to adjust 300 kHz Resolution Bandwidth in first LC pole.
474 RBW 1M	Unable to adjust 1 MHz Resolution Bandwidth in first LC pole.
475 RBW 30K	Unable to adjust 30 kHz Resolution Bandwidth in second LC pole.
476 RBW 100K	Unable to adjust 100 kHz Resolution Bandwidth in second LC pole.
477 RBW 300K	Unable to adjust 300 kHz Resolution Bandwidth in second LC pole.
478 RBW 1M	Unable to adjust 1 MHz Resolution Bandwidth in second LC pole.
483 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth.
484 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth.
485 RBW 1K	Unable to adjust 1 kHz Resolution Bandwidth.
486 RBW 300	Unable to adjust 300 Hz Resolution Bandwidth.
487 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
488 RBW 10	Unable to adjust 100 Hz Resolution Bandwidth.
489 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
490 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
491 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
492 RBW 300	Unable to adjust 300 Hz Resolution Bandwidth.
493 RBW 1K	Unable to adjust 1 kHz Resolution Bandwidth.
494 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth.
495 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth.
496 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
497 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
498 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
499 CAL UNLK	A16 Cal Oscillator is unlocked. Verify the unlocked conditions as follows:

1. Place A16 in its service position and disconnect W17 (gray-yellow) from A16J1.
2. Connect W17 to the input of another spectrum analyzer. This is the 10 MHz reference for A16.
3. If a 10 MHz signal (approximately 0 dBm) is not present, suspect the A15 RF assembly, the A21 OCXO, or the A15 assembly TCXO (Option 103). If the 10 MHz reference is present, continue with step 4.
4. Reconnect W17 to A16J1 and monitor the tune voltage at A16J4 pin 3 with an oscilloscope.
5. Press [PRESET] on the spectrum analyzer under test.

6. If the voltage is either +15 V dc or −15 V dc, the A16 Cal Oscillator is probably at fault. Normally, the voltage should be near +15 V during a sweep, and between −9 V and +9 V during retrace.

An *intermittent* error 499 indicates the A16 phase-locked-loop probably can lock at 10.7 MHz, but cannot lock at the 9.9 and 11.5 MHz extremes. This may prevent the Cal Oscillator from adjusting the 1 MHz or 30 kHz through 300 kHz bandwidths. This symptom implies a failure in the oscillator, function block B. (See the A16 Cal Oscillator schematic.) The oscillator is unable to tune the required frequency range with the −9 V to +9 V control voltage. Troubleshoot A16CR1 (most probable cause), L1, C3, C4, and U3.

500 AMPL 30K	Unable to adjust amplitude of 30 kHz Resolution Bandwidth.
501 AMPL .1M	Unable to adjust amplitude of 100 kHz Resolution Bandwidth.
502 AMPL .3M	Unable to adjust amplitude of 300 kHz Resolution Bandwidth.
503 AMPL 1M	Unable to adjust amplitude of 1 MHz Resolution Bandwidth.
504 AMPL 30K	Unable to adjust amplitude of 30 kHz Resolution Bandwidth.
505 AMPL .1M	Unable to adjust amplitude of 100 kHz Resolution Bandwidth.
506 AMPL .3M	Unable to adjust amplitude of 300 kHz Resolution Bandwidth.
507 AMPL 1M	Unable to adjust amplitude of 1 MHz Resolution Bandwidth.
508 AMPL 30K	Unable to adjust amplitude of 30 kHz Resolution Bandwidth.
509 AMPL .1M	Unable to adjust amplitude of 100 kHz Resolution Bandwidth.
510 AMPL .3M	Unable to adjust amplitude of 300 kHz Resolution Bandwidth.
511 AMPL 1M	Unable to adjust amplitude of 1 MHz Resolution Bandwidth.
512 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
513 RBW 300	Unable to adjust 300 Hz Resolution Bandwidth.
514 RBW 1K	Unable to adjust 1 kHz Resolution Bandwidth.
515 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth.
516 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth.
517 RBW 100	Unable to adjust 100 Hz Resolution Bandwidth.
518 RBW 300	Unable to adjust 300 Hz Resolution Bandwidth.
519 RBW 1K	Unable to adjust 1 kHz Resolution Bandwidth.
520 RBW 3K	Unable to adjust 3 kHz Resolution Bandwidth.
521 RBW 10K	Unable to adjust 10 kHz Resolution Bandwidth.
522 RBW 10K	Unable to adjust symmetry of 10 kHz Resolution Bandwidth in first XTAL pole.
523 RBW 10K	Unable to adjust symmetry of 10 kHz Resolution Bandwidth in second XTAL pole.

524 RBW 10K	Unable to adjust symmetry of 10 kHz Resolution Bandwidth in third XTAL pole.
525 RBW 10K	Unable to adjust symmetry of 10 kHz Resolution Bandwidth in Fourth XTAL pole.
526 RBW <300	ADC timeout during IF ADJUST of <300 Hz Resolution Bandwidth.
527 RBW <300	Step gain correction failed for <300 Hz Resolution Bandwidth.
528 RBW <300	Calibration of dc level at ADC failed for <300 Hz Resolution Bandwidth.
529 RBW <300	Invalid demodulated data for <300 Hz Resolution Bandwidth flatness and IF down-converter.
530 RBW <300	Adjustment of TCXO down-converter failed.
531 RBW <300	Flatness correction data for Resolution Bandwidths <300 Hz not acceptable.
532 RBW <300	Absolute gain data for Resolution Bandwidths <300 Hz not acceptable.
533 RBW <300	ADC timeout using <300 Hz Resolution Bandwidth.
534 RBW <300	Unable to do frequency count of CAL OSC using IF down-converter.
535 RBW <300	Unable to obtain adequate FM demod range to measure 500 Hz IF filter.
536 RBW <300	Unable to auto-range chirp signal while setting VCXO or doing flatness calibration for <300 Hz Resolution Bandwidth.
537 RBW <300	Unable to auto-range CW CAL OSC signal to count VCXO signal.
538 RBW <300	Shape of 500 Hz IF filter appears too noisy to adjust VCXO down-converter.
539 RBW <300	Unable to auto-range the CW CAL OSC signal to pretune VCXO.
540 RBW <300	Unable to find CW CAL OSC signal during VCXO pretune at power-up.
550 LOG AMPL	Unable to adjust amplitude of log scale.
551 AMPL	Unable to adjust step gain amplifiers.
552 LOG AMPL	Unable to adjust amplitude of log scale.
553 LOG AMPL	Unable to adjust amplitude of log scale.
554 LOG AMPL	Unable to adjust amplitude of log scale.
555 LOG AMPL	Unable to adjust amplitude of log scale.
556 LOG AMPL	Unable to adjust amplitude of log scale.
557 LOG AMPL	Unable to adjust amplitude of log scale.
558 LOG AMPL	Unable to adjust amplitude of log scale.
559 LOG AMPL	Unable to adjust amplitude of log scale.
560 LOG AMPL	Unable to adjust amplitude of log scale.

561 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in second step gain stage.
562 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in second step gain stage.
563 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in third step gain stage.
564 LOG AMPL	Unable to adjust amplitude of log scale.
565 LOG AMPL	Unable to adjust amplitude of log scale.
566 LOG AMPL	Unable to adjust amplitude of log scale.
567 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in Log offset/Log Expand stage.
568 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in Log offset/Log Expand stage.
569 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in Log offset/Log Expand stage.
570 LOG AMPL	Unable to adjust amplitude of log scale. Possible problem in Log offset/Log Expand stage.
571 AMPL	Unable to adjust step gain amplifiers.
572 AMPL 1M	Unable to adjust amplitude of 1 MHz Resolution Bandwidth.
573 LOG AMPL	Unable to adjust amplitude of log scale. Check video offset circuitry.
574 LOG AMPL	Unable to adjust amplitude of log scale. Check video offset circuitry.
575 LOG AMPL	Unable to adjust amplitude of log scale. Check video offset circuitry.
576 LOG AMPL	Unable to adjust amplitude of log scale. Check video offset circuitry.
577 LOG AMPL	Unable to adjust amplitude of log scale. Check video offset circuitry.
581 AMPL	Unable to adjust 100 kHz and 10 kHz Resolution Bandwidths. Refer to Error 582.
582 AMPL	Unable to adjust 100 kHz and 10 kHz Resolution Bandwidths. Test the 100 kHz Resolution Bandwidth filter 3 dB bandwidth as follows:

1. Connect the CAL OUTPUT signal to the INPUT 50Ω.
2. Press (PRESET) and set the controls as follows:

   CENTER FREQ .....300 MHz
   SPAN ..... 500 kHz
   Resolution Bandwidth ..... 100 kHz
   LOG dB/DIV ..... 1 dB
   REF LEVEL ....adjust to place signal peak at top of the screen

3. Press (PEAK SEARCH) and MARKER DELTA and turn the knob clockwise to position the marker until the delta MKR reads −3 dB ±0.1 dB.

4. Press MARKER DELTA and move the marker to the other side of the peak until the delta MKR reads 0 dB ±0.1 dB.
5. If the delta MKR frequency is between 90 kHz and 110 kHz, the 100 kHz Resolution Bandwidth is working properly. If the frequency is outside these limits, read the following information on the A16 Cal Oscillator sweep generator.

If the 100 kHz Resolution Bandwidth works properly, the A16 assembly sweep generator is failing to sweep its oscillator frequency at the correct rate. The error is detected in sweeping on the skirts of the 100 kHz Resolution Bandwidth.

A properly operating sweep generator generates a series of negative-going parabolas. These parabolas generate the sweeps used to adjust resolution bandwidths of 10 kHz and below. Check the sweep generator with the following steps. Refer also to "300 Hz to 3 kHz Resolution Bandwidth Out of Specification" in the A16 troubleshooting text in Chapter 8.

1. Remove the shields.
2. Connect an oscilloscope probe to A16U10 pin 8.
3. On the spectrum analyzer, press (CAL) and FULL IF ADJ.
4. Approximately 8 seconds after starting the FULL IF ADJ, check for negative-going parabolas (similar to half-sine waves) 5 ms wide and approximately −4 V at their peak. Refer to Chapter 8, "IF Section," for more information on the A16 assembly.

583 RBW 30K	Unable to adjust 30 kHz Resolution Bandwidth.
584 RBW 100K	Unable to adjust 100 kHz Resolution Bandwidth.
585 RBW 300K	Unable to adjust 300 kHz Resolution Bandwidth.
586 RBW 1M	Unable to adjust 1 MHz Resolution Bandwidth.
587 RBW 30K	Unable to adjust 30 kHz Resolution Bandwidth.
588 RBW 100K	Unable to adjust 100 kHz Resolution Bandwidth.
589 RBW 300K	Unable to adjust 300 kHz Resolution Bandwidth.
590 RBW 1M	Unable to adjust 1 MHz Resolution Bandwidth.
591 LOG AMPL	Unable to adjust amplitude of log scale.
592 LOG AMPL	Unable to adjust amplitude of log scale.

ADC Errors (600 to 651)

ADC timeout errors occur if the A2 Controller assembly frequency counter is faulty. Refer to Chapter 7, "ADC/Interface Section."

600 SYSTEM	Hardware/firmware interaction; check other errors.
601 SYSTEM	Hardware/firmware interaction; check other errors.
650 OUTOF RG	ADC input is outside of the ADC range.
651 NO IRQ	Microprocessor is not receiving interrupt from ADC.

EEROM Checksum Errors (700 to 704)

Faults on the A2 Controller assembly cause these errors. Refer to Chapter 9, "Controller Section." Although some of these errors might result in a blanked display, it is possible to read these errors over HP-IB. Refer to "Troubleshooting to a Functional Section" in this chapter.

The EEROM on A2 is used to store data for frequency response correction, elapsed time, focus, and intensity levels. Error codes from 700 to 703 indicate that some part of the data in EEROM is invalid. An EEROM error could result from either a defective EEROM or an improper sequence of storing data in EEROM. Check the EEROM with the following steps:

1. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR ENA position.
2. On the spectrum analyzer, press (CAL) MORE 1 OF 2, SERVICE CAL DATA, FLATNESS, and FLATNESS DATA. Enter a value of 130. Press PREV MENU, STORE DATA, YES, and (DISPLAY).
3. Press INTEN, enter an intensity value of 90, and press STORE INTEN.
4. Press MORE 1 OF 2 FOCUS, enter a focus value of 128, and press STORE FOCUS. Turn the (LINE) switch off, then on, cycling the power.
5. If errors are still present, the EEROM A2U501 is defective. Refer to the EEROM replacement procedure in Chapter 3.

700 EEROM	Check-sum error of EEROM A2U501.
701 AMPL CAL	Check-sum error of frequency response correction data.
702 ELAP TIM	Check-sum error of elapsed time data.
703 AMPL CAL	Check-sum error of frequency response correction data. Default values being used.
704 PRESELCT	Check-sum error of customer preselector peak data. External preselector data recalled in internal mode, or internal preselector data recalled in external mode. To clear the error, press (RECALL), MORE 1 OF 2, FACTORY PRSEL PK, (SAVE), and SAVE PRSEL PK.

Program ROM Check-sum Errors (705 to 708)

The instrument power-on diagnostics perform a check-sum on each programmed ROM (A2 Controller assembly). If an invalid check-sum is found for a particular ROM, an error code is generated. If a defective programmed ROM is found, replace it with another ROM with the same HP part number. Refer to Chapter 4, "Replaceable Parts."

Although some of these errors might result in a blanked display, it is possible to read these errors over HP-IB. Refer to "Troubleshooting to a Functional Section" in this chapter.

`705 ROM U306`	Check-sum error of program ROM A2U306.
`706 ROM U307`	Check-sum error of program ROM A2U307.
`707 ROM U308`	Check-sum error of program ROM A2U308.
`708 ROM U309`	Check-sum error of program ROM A2U309.

RAM Check Errors (713 and 714)

The instrument power-on diagnostics check the program RAM. This includes the two RAMs used for STATE storage. If any STATE information is found to be invalid, all data in that RAM is destroyed. A separate error code is generated for each defective program RAM. All RAM is battery-backed.

`713 RAM U301`	Check-sum error of system RAM A2U301.
`714 RAM U300`	Check-sum error of system RAM A2U300.

Microprocessor Error (717)

Refer to Chapter 9, "Controller Section."

`717 BAD uP!!`	Microprocessor not fully operational.

Battery Problem (718)

If STATE or TRACE data is found to be corrupt, the processor tests the display RAMs and the program RAMs containing the STATE information. If the RAMs are working properly, this error message is generated. To check the BT1 Battery and the battery backup circuitry, refer to "STATE and TRACE Storage Problems" in Chapter 9.

`718 BATTERY?`	Nonvolatile RAM not working; check battery BT1. This error can also be generated if the battery has been disconnected then reconnected. If this is the cause, cycling power clears the error.

Model Number Error (719)

If this error occurs, return the instrument to a service center for repair.

`719 MODEL #?`	Could not read ID string from EEROM A2U501.

System Errors (750 to 757)

These errors often require troubleshooting the A2 Controller and A3 Interface assemblies.

750 SYSTEM	Hardware/firmware interaction; check other errors.
751 SYSTEM	Hardware/firmware interaction; check other errors.
752 SYSTEM	Hardware/firmware interaction; check other errors.
753 SYSTEM	Hardware/firmware interaction; check other errors.
754 SYSTEM	Hardware/firmware interaction; check other errors.
755 SYSTEM	Hardware/firmware interaction; check other errors.
757 SYSTEM	BCD overflow.

Module Errors (800 to 899)

These error codes are reserved for option modules, such as the HP 85629 Test and Adjustment Module and the HP 85620A Mass Memory Module. Refer to the option module manual for a listing of error messages.

User-Generated Errors (902 to 904)

These error codes indicate user-generated errors.

902 BAD NORM	State of stored trace does not match the current state of the analyzer.
903 A > DLMT	Unnormalized trace A is off-screen with trace math or normalization on.
904 B > DLMT	Calibration trace (trace B) is off-screen with trace math or normalization on.
905 EXT REF	Unable to lock Cal Oscillator when set to external frequency reference. Check that the external 10 MHz reference is within tolerance.
906 OVENCOL	The OCXO oven is cold.
907 DO IF CAL	Still performing IF Cals, or in need of IF Cals which were not yet done due to an OVENCOLD condition.

Block Diagram Description

The spectrum analyzer is comprised of the six main sections shown in Figure 6-4. The following descriptions apply to the Simplified Block Diagram, and Overall Block Diagram located at the end of this chapter. assembly level block diagrams are located in chapters 7 through 12.

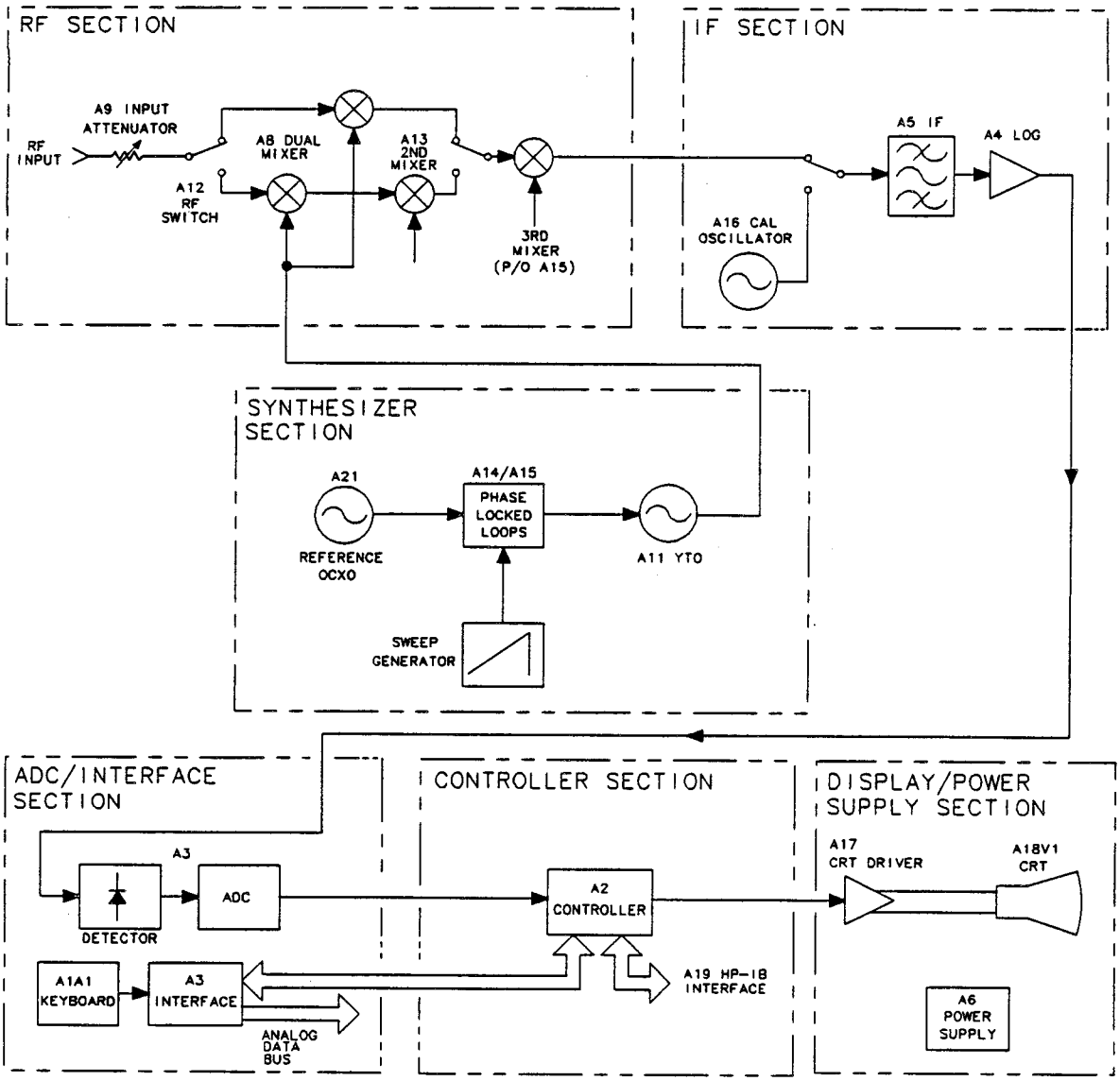


Figure 6-4. Functional Sections

RF Section

The RF Section includes the following assemblies:

A7 LODA (LO Distribution Amplifier)
A8 Dual Band Mixer
A9 Input Attenuator
A10 YTF (YIG-Tuned Filter)
A11 YTO (YIG-Tuned Oscillator)
A12 RF Switch
A13 Second Converter
A14 Frequency Control Assembly (also in Synthesizer Section)
A15 RF Assembly (also in Synthesizer Section)
FL1, Two Low-Pass Filters

The RF Section converts all input signals to a fixed IF of 10.7 MHz. The RF Section microcircuits are controlled by signals from the A14 Frequency Control and A15 RF assemblies.

Band 0 ..... 9 kHz to 2.9 GHz
Bands 1 through 4 ..... 2.75 to 22 GHz

Band 0 uses triple conversion to produce the 10.7 MHz IF and a fourth conversion used only in 100 Hz, 30 Hz, and 10 Hz resolution bandwidths. A8 Dual Band Mixer up-converts the RF input to a first IF of 3.9107 GHz. A13 Second Converter down-converts the 3.9107 GHz IF to an IF of 310.7 MHz. A third conversion on the A15 RF assembly down-converts the second IF to the 10.7 MHz third IF. A fourth conversion on the A4 Log Amplifier assembly down-converts the third IF to the 4.8 kHz fourth IF used only in 100 Hz, 30 Hz, and 10 Hz resolution bandwidths.

Bands 1 through 4 use double conversion. A third conversion is used for the 100 Hz, 30 Hz, and 10 Hz resolution bandwidths. A8 Dual Mixer down-converts the RF input to a first IF of 310.7 MHz. Although this IF passes through the A13 Second Converter, it bypasses the second mixer. The second conversion on the A15 RF assembly down-converts the 310.7 MHz IF to 10.7 MHz. A third conversion on the A4 Log Amplifier assembly down-converts the second IF to the 4.8 kHz third IF used only in 100 Hz, 30 Hz, and 10 Hz resolution bandwidths.

A7 LODA

The A7 LODA (LO Distribution Amplifier) levels the output of the A11 YTO and distributes the power to the front-panel 1ST LO OUTPUT, A8 Dual Mixer, and A15A2 Sampler. The leveling circuitry is on the A14 Frequency Control assembly.

A8 Dual Band Mixer

A8 Dual Band Mixer contains two separate mixers: one for the low band and one for the high bands. The low-band mixer is ac-coupled and contains a limiter. The high-band mixer uses ac coupling. A PIN diode switch (controlled by the A14 Frequency Control assembly) directs the 1st LO to the appropriate mixer.

The A14 Frequency Control assembly provides the high-band bias for each band. This bias minimizes second- and third-order distortion and conversion loss. The analyzer stores the bias values in EEROM.

A9 Input Attenuator

The attenuator is a 50Ω precision, coaxial step attenuator. Attenuation in 10 dB steps from 0 dB to 70 dB is accomplished by switching the signal path through one or more of the four resistive pads. (Note that the input attenuator is not field-repairable.)

A10 YTF

The YTF is a tracking preselector. It functions as a tunable bandpass filter for high band signals. Coarse frequency control originates from slope and offset DACs located on the A14 Frequency Control assembly. (Slope and offset DAC values are loaded into EEROM.)

Fine frequency control originates from a preselector peak DAC located on the A3 Interface assembly. Values for the preselector peak DAC are interpolated approximately every 17 MHz based upon data taken during the Frequency Response Adjustment.

The preselector bandwidth varies from 25 MHz (at 2.75 GHz) to approximately 40 MHz (at 22 GHz).

A12 RF Switch

The A12 RF Switch directs the RF input to either the low-band or high-band paths.

A13 Second Converter

The A13 Second Converter down-converts the 3.9107 GHz first IF to a 310.7 MHz second IF. In high band, it passes the 310.7 MHz first IF from the A8 Dual Band Mixer to the A15 RF assembly. The converter generates a 3.6 GHz second LO by multiplying a 600 MHz reference. Bandpass filters remove unwanted harmonics of the 600 MHz driving signal. First IF and second LO signals are filtered by cavity filters.

A15A1 Second IF Distribution Amplifier (part of A15)

The A15A1 Second IF Distribution Amplifier (SIFA) amplifies and filters the second IF. Access to this pre-filtered signal is available at the rear-panel 2ND IF OUTPUT. Factory select attenuator A15U802 ensures that the gain provided by the SIFA is 12 dB ±2 dB.

The external mixing input from the front-panel IF INPUT connector is also directed through the SIFA. A dc bias is placed onto the IF INPUT line for biasing external mixers.

Third Converter (part of A15)

The third converter down-converts the 310.7 MHz IF to 10.7 MHz. A PIN-diode switch selects the LO signal used. For normal operation, a 300 MHz LO signal is used. The signal is derived from the 600 MHz Reference PLL. During signal identification (SIG ID ON), the 298 MHz SIG ID Oscillator is fed to the double-balanced mixer on alternate sweeps.

Flatness Compensation Amplifiers (part of A15)

The flatness compensation amplifiers amplify the output of the double-balanced mixer. The amplifier variable gain (8 to 32 dB) compensates for flatness variations within a band. Band conversion loss is compensated by step gain amplifiers in the IF Section.

Control for the amplifiers originates from two DACs on the A3 Interface assembly. (DAC values are interpolated approximately every 17 MHz based on data obtained during the Frequency Response Adjustment.) A15 flatness-compensation control circuitry converts the

RF GAIN voltage, from A3, into two currents: RF GAIN1 and RF GAIN2. These currents drive PIN diodes in the flatness compensation amplifiers.

Synthesizer Section

The first LO is phase-locked to the instrument internal 10 MHz standard by four PLLs. See Figure 6-5.

The Reference PLL supplies reference frequencies for the instrument. The three remaining PLLs tune and phase-lock the LO through its frequency range. To tune the LO to a particular frequency, the instrument microprocessor must set the programmable feedback dividers (N) and reference dividers (R) contained in each PLL.

Sweeping the First LO

The analyzer uses a method called "lock and roll" to sweep the first LO (A11 YTO). This applies to all frequency spans and involves phase-locking the analyzer at the start frequency during the retrace of the sweep. The sweep ramp, generated on the A14 Frequency Control assembly, is applied to either A11 YTO main coil, A11 YTO FM coil, roller oscillator PLL main oscillator, or roller oscillator PLL offset oscillator. The frequency/span relationships are as follows:

A11 YTO Span Width	Sweep Applied To
20.1 MHz to 3.8107 GHz	A11 YTO main coil
1.01 MHz to 20.0 MHz	A11 YTO FM coil
100 kHz to 1 MHz	Roller Oscillator PLL Main Oscillator
100 Hz to 100 kHz	Roller Oscillator PLL Offset Oscillator

When the sweep ramp is applied to one of the PLLs, the analyzer must prevent this loop from trying to compensate for changes in the output frequency. To accomplish this, the analyzer breaks the PLL by switching the output of the PLL phase detector to ground.

Reference PLL (part of A15)

The 600 MHz reference PLL provides 600 MHz for the second LO, 300 MHz for the third LO, and the Sampling oscillator reference. The PLL is locked to a 10 MHz OCXO (oven-controlled crystal oscillator) or Option 103 TCXO (temperature-controlled crystal oscillator). The PLL can also be locked to an external frequency reference. The 10 MHz reference also supplies the reference for the roller oscillators, the frequency counter on the A2 Controller assembly, and the A16 Cal Oscillator assembly.

YTO PLL (A7, A11, part of A14, part of A15)

The YTO PLL produces the instrument first LO (3.0 to 6.81 GHz). The oscillator output is sampled by the Sampling oscillator, and the resulting frequency is phase-locked to the output of the roller oscillator PLL.

The A15A2 Sampler mixes the LO signal from the A7 LODA with a harmonic of the Sampling oscillator. The mixing product, the Sampler IF, is between 63 and 105.5 MHz (same frequency range as the roller oscillator PLL).

Offset Lock Loop (part of A15)

The 280 MHz to 298 MHz Sampling oscillator is used to sample the YTO. By changing the offset Lock Loop programmable dividers, the YTO frequency can be changed.

A11 YTO

A11 is a YTO. YIG (yttrium-iron-garnet) is a ferro-magnetic material which is polished into a small sphere and precisely oriented in a magnetic field. Changes in this magnetic field alter the frequency generated by the YTO. Current control of the magnetic field surrounding the YIG sphere tunes the oscillator to the desired frequency.

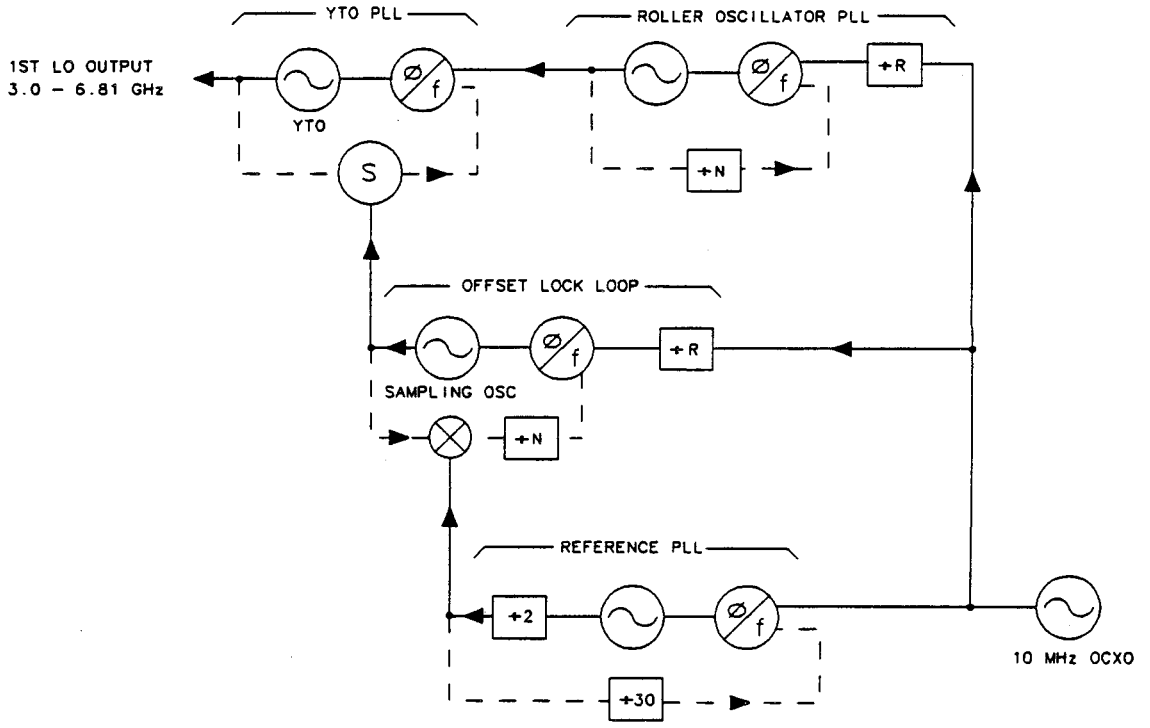


Figure 6-5. Phase-Lock Loops

Roller Oscillator PLL (part of A14)

This PLL output serves as the reference frequency for the YTO PLL. A one-to-one relationship in frequency tracking exists between the roller oscillator PLL and the YTO. (A change of 1 MHz in the roller oscillator PLL produces a 1 MHz change in the YTO frequency.)

The roller oscillator PLL actually contains three PLLs that collectively produce an output of 63 MHz to 105.5 MHz. The three PLLs are the main roller PLL, offset roller PLL, and transfer roller PLL.

The offset roller PLL tunes from 189 MHz to 204 MHz. Because the output of the PLL is divided by 100, a 100-to-1 relationship exists between frequency changes in the offset roller PLL and the YTO. The offset roller PLL can be synthesized in 2.5 kHz steps, yielding an effective frequency resolution on the YTO of 25 Hz.

The transfer roller PLL tunes from 61 MHz to 103.5 MHz in 50 kHz steps.

IF Section

The IF Section processes the 10.7 MHz output of the RF Section and sends the detected video to the ADC/Interface Section. The following major assemblies are included in this section:

A3 Interface Assembly
A4 Log Amplifier Assembly
A5 IF Assembly
A16 Calibration Oscillator Assembly

The spectrum analyzer uses trace-data manipulation to generate the 5 dB/DIV scale from the 10 dB/DIV scale. The A3 Interface assembly amplifies and offsets the 10 dB/DIV video to generate the 2 dB/DIV scale. The 1 dB/DIV scale is generated from the 2 dB/DIV scale through trace data manipulation.

The first 50 dB of IF gain (log and linear mode) is achieved using the A5 assembly linear step-gain amplifiers. The A4 assembly video-offset circuit provides the remaining 60 dB of log mode IF gain. The A4 assembly linear amplifiers provide 40 dB of linear mode gain. IF gain steps of less than 10 dB (regardless of the reference level) are accomplished on the A5 assembly.

A4 LOG Amplifier Assembly

The A4 Log Amplifier has separate log and linear amplifier paths. After log or linear amplification the signal path consists of a detector, buffer amplifier, video offset, and video buffer amplifier. Other auxiliary functions include the frequency counter prescaler/conditioner, the AM/FM demodulator, and down-conversion to 4.8 kHz for digital resolution bandwidths of 10, 30, and 100 Hz.

A5 IF Assembly

The A5 IF assembly has four crystal filter poles, four LC filter poles, and step gain amplifiers. The crystal filters provide resolution bandwidths of 300 Hz to 10 kHz. The LC filters provide resolution bandwidths of 30 kHz to 2 MHz. All filter stages are in series. PIN diode switches bypass unwanted stages.

An Automatic IF Adjustment, in analyzer firmware, sets center frequency and 3 dB bandwidth of all filter poles through varactor and PIN diodes. The firmware also controls crystal-pole symmetry and the step gain amplification.

A16 Calibrator Oscillator

The A16 Calibrator Oscillator supplies the stimulus signal for Automatic IF adjustments. Normally, the oscillator operates only during retrace (for a few milliseconds) to adjust part of the IF. (All IF parameters are readjusted approximately every 5 minutes.) With continuous IF adjust ON, a group of IF parameters are adjusted during each retrace period (non-disruptive adjustments). If continuous IF adjust is OFF, the last IF calibration data is used.

The IF parameters adjusted include step gains, log amplifier gain and offset, bandwidth centering, 3 dB bandwidth, bandwidth amplitude, crystal-filter symmetry, and oscillator frequency used in 10 Hz, 30 Hz, and 100 Hz resolution bandwidths.

A16 output has three forms (all −35 dBm):

- 10.7 MHz
- 9.9 to 11.5 MHz in 100 kHz steps
- Frequency sweeps from 20 kHz to 2 kHz centered at 10.7 MHz (lasting 5 to 60 ms, respectively)

The purposes of these signals are listed below:

- Adjust gains, log amplifiers, and video slopes and offsets
- Adjust 3 dB bandwidth and center frequencies of LC resolution bandwidth filters (30 kHz through 1 MHz).
- Adjust 3 dB bandwidth, symmetry, and gain of the crystal resolution bandwidth filters (300 Hz through 10 kHz).
- Adjust gain and gain-vs-frequency for digital resolution bandwidths (10 Hz through 100 Hz).

The low-pass filter is illustrated in function block D. The low-pass filter filters the square wave output of the variable gain amplifier so that harmonics do not subtly degrade the performance of the IF adjust process.

ADC/Interface Section

The ADC/Interface Section is the link between the Controller Section and the rest of the spectrum analyzer. It controls the RF, Synthesizer, and IF sections through address and data lines on the W2 Control Cable (analog bus). Analog signals from these sections are monitored by the ADC/Interface Section ADC (analog-to-digital converter) circuit.

The ADC/Interface section includes the A3 Interface assembly, A1A1 Keyboard, and A1A2 RPG (front-panel knob). The A3 assembly includes log expand, video filter, peak detector, track-and-hold, real-time DACs, RF gain DACs, +10 V reference , and ADC circuitry. The assembly digital section includes ADC ASM (algorithmic-state machine), sweep trigger, keyboard interface, RPG interface, and analog bus interface circuitry.

ADC

The spectrum analyzer uses a successive-approximation type of ADC. The ADC ASM controls the interface between the Start/Stop Control and the ADC itself, switching between positive and negative peak detectors when the NORMAL detector mode is selected, and switching the Ramp Counter into the ADC for comparison to the analog sweep ramp.

Log Expand/Video Functions (P/O A3)

The A3 Interface assembly performs log expand and offset functions. The Log Expand/Log offset Amplifier provides a 2 dB/DIV log scale. The 5 dB/DIV scale is derived by multiplying the digitized 10 dB/DIV trace data by two in the CPU. The 1 dB/DIV scale is similarly derived by multiplying the 2 dB/DIV trace data by two.

The analyzer uses two types of video filters. An RC low-pass circuit provides 300 Hz to 3 MHz video bandwidths. Video bandwidths of 1 Hz to 100 Hz are filtered digitally by the CPU. When a digital filter is selected, a "D" appears along the left edge of the CRT, indicating that something other than the normal detector mode is being used. Digitally filtered bandwidths use a sample detector.

After filtering, the video is sent to the Positive and Negative Peak Detectors. These detectors are designed for optimum pulse response. The Positive Peak Detector resets at the end of each horizontal "bucket" (there are 601 such buckets across the screen). The Negative Peak Detector resets at the end of every other bucket. When reset, the output of the peak detector equals its input.

Triggering

The spectrum analyzer has five trigger modes: free run, single, external, video, and line. The free run and single trigger signal comes from the 1 MHz ADC clock. The line trigger signal comes from the A6 Power Supply. Video triggering originates from A3 video filter buffer circuit. External triggering requires a TTL logic high level received from a rear-panel BNC connector. A DAC in the trigger circuit sets the video trigger level. The trigger circuit is responsible for setting HSCAN high.

Controller Section

The Controller Section includes the A2 Controller assembly and A19 HP-IB assembly. The A2 assembly controls the A16 Cal Oscillator and A17 CRT driver through W7. The battery on the rear panel provides battery backup for STATE and TRACE storage.

A2 contains the CPU, RAM, ROM, the Display ASM and Line Generators, CRT blanking, focus, intensity control, HP-IB Interface, Frequency Counter, Display RAM, Option Module interface, and EEROM. The A19 HP-IB is a mechanical interface between the standard HP-IB connector and the ribbon cable connector on the A2 Controller assembly.

All four RAM ICs are battery-backed. The battery-backed RAM stores trace information (two display memory RAMs) and analyzer state information (two program RAMs). A total of eight traces and ten states may be stored. Typical battery life is 5 years with the lithium battery. Trace and state information may be retained for up to 30 minutes with a dead battery and power turned off. This is due to the RAM very low data retention current.

EEROM

The EEROM stores important amplitude-related correction data. This includes data for mixer-bias DACs, YTF Slope and offset DACs, RF Gain DACs (flatness correction), and Preselector Peak DAC. The analyzer serial number, model number, and a list of installed options are also stored in EEROM.

Firmware

The analyzer firmware reads the model number and installed options from the EEROM to determine how to respond to certain keystrokes.

Display ASM

Much of the miscellaneous digital control is performed by A2U100. U100 functions as the display ASM and character ROM. It also converts the 16-bit CPU data bus to an 8-bit data bus for the rest of the analyzer.

Display/Power Supply Section

A6 Power Supply

The A6 Power Supply is a switching supply operating at 40 kHz for the low voltages and 30 kHz for the CRT supplies (cathode, filament, +110 V dc, and post-accelerator). A6A1 High Voltage Module contains the high-voltage transformer and post-accelerator multiplier. Power is distributed through W8 to A17 and through W1 to the rest of the assemblies. A6A1W2 supplies CRT cathode and filament voltages to the A17 assembly.

The speed of the analyzer fan is variable. A thermistor on A6 senses the temperature and adjusts the fan speed accordingly. This allows the analyzer to run quietly in most room-temperature environments.

A17 CRT Display Driver

The A2 assembly line generators drive the A17 CRT Driver. The A17 assembly contains X and Y deflection amplifiers, focus and intensity grid amplifiers, and miscellaneous CRT bias circuitry. The high voltage is supplied by A6A1 High Voltage Module.

In fast-analog zero-span mode (sweep times $\leq$30 ms), the 0-SPAN VIDEO signal from A3 and the sweep ramp from A14 go to the A17 CRT Driver. The graticule and annotation are still digitally drawn.

8563A SIMPLIFIED BLOCK DIAGRAM

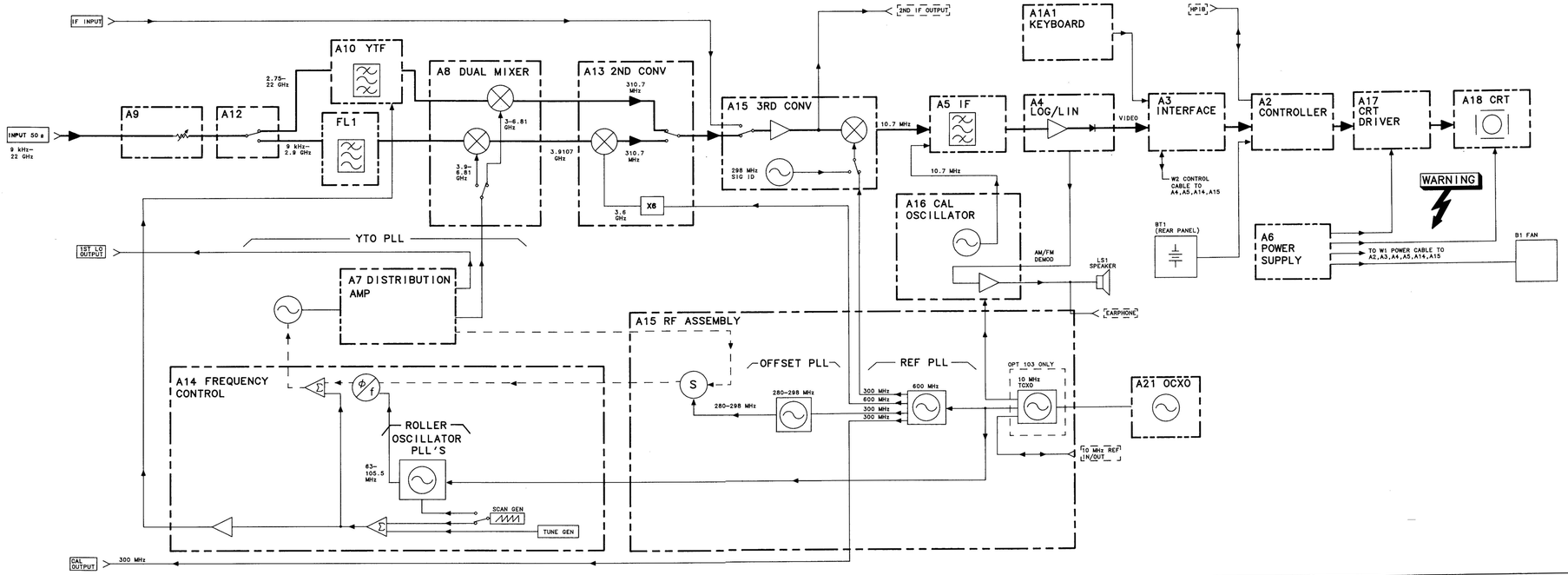


FIGURE 6-6. SIMPLIFIED BLOCK DIAGRAM

8563B OVERALL BLOCK DIAGRAM (SHEET 1 OF 3)

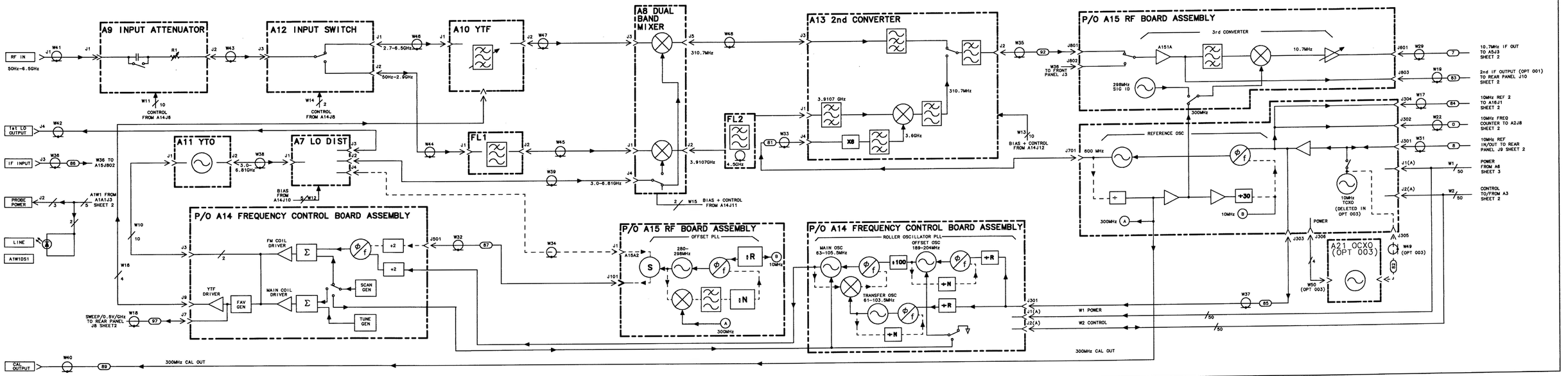


FIGURE 6-7. HP MODEL 8563B OVERALL BLOCK DIAGRAM (SHEET 1 OF 3)

8563A OVERALL BLOCK DIAGRAM (SHEET 2 OF 3)

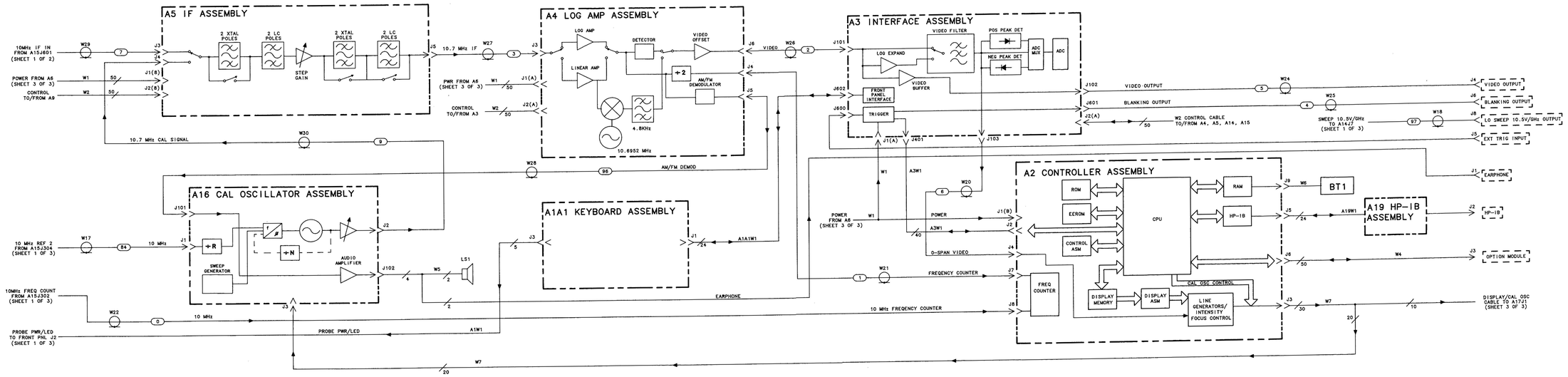


FIGURE 6-7. HP MODEL 8563B OVERALL BLOCK DIAGRAM (SHEET 2 OF 3)

8563B OVERALL BLOCK DIAGRAM (SHEET 3 OF 3)

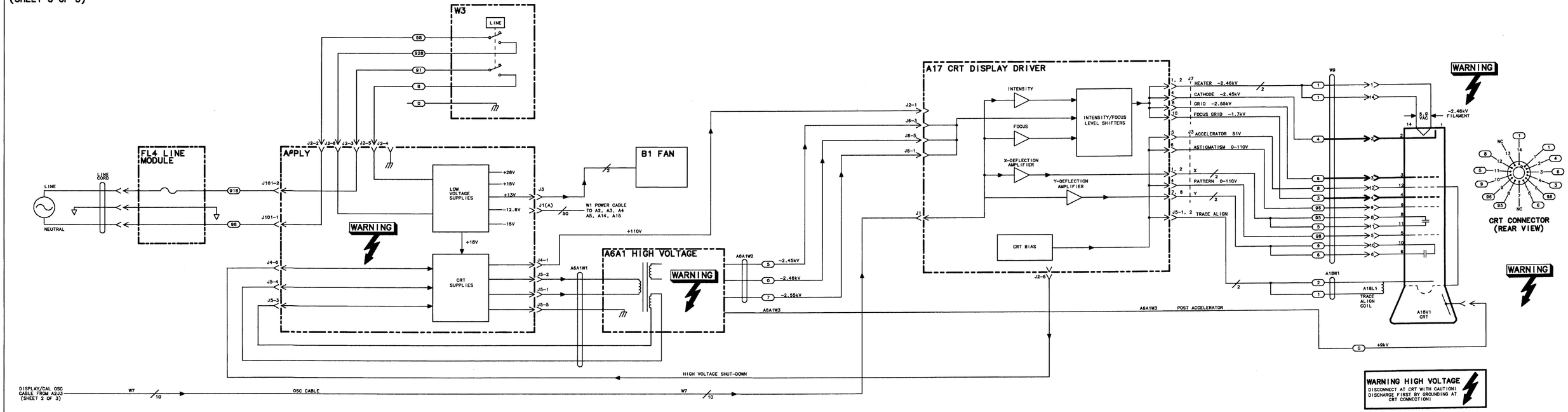


FIGURE 6-7 HP MODEL 8563B OVERALL BLOCK DIAGRAM (SHEET 3 OF 3)

7

ADC/Interface Troubleshooting

The ADC/Interface Section includes the A1A1 Keyboard, A1A2 RPG (rotary pulse generator), and A3 Interface assemblies. Topics covered in this chapter are listed below. Table 7-1 lists signal versus pin numbers for control cable W2.

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Table 7-1. W2 Control Cable Connections (1 of 2)

Signal	A3J2 (pins)	A4J2 (pins)	A5J2 (pins)	A14J2 (pins)	A15J2 (pins)
D0	1*	1	50	1	1
D GND	2*	2	49	2	2
D1	3*	3	48	3	3
D2	4*	4	47	4	4
D3	5*	5	46	5	5
D4	6*	6	45	6	6
D GND	7*	7	44	7	7
D5	8*	8	43	8	8
D6	9*	9	42	9	9
D7	10*	10	41	10	10
A0	11*	11	40	11	11
D GND	12*	12	39	12	12
A1	13*	—	38	13	13
A2	14*	—	37	14	14
A3	15*	15	36	15	15
A4	16*	—	35	16	16
D GND	17*	17	34	17	17
A5	18*	—	33	18	—
A6	19*	—	32	—	—
A7	20*	—	31	20	—
D GND	21*	21	30	21	21
LRF_STB	22*	—	—	—	22
LFC_STB	23*	—	—	23	—
LIF_STB	24*	—	27	—	—
NC	—	—	—	—	—
LLOG_STB	26*	26	—	—	—
VCMON	—	—	—	27	—
D GND	28*	28	23	28	28
RT PULSE	29*	—	—	—	—
HSCAN	30*	—	—	30	—
D GND	31*	31	20	31	31
RESERVED	—	—	—	—	—
OFL ERR	33	—	—	—	33*
R/T DAC3	34*	—	—	—	—
A GND	35*	35	16	35	35
RF GAIN	36*	—	—	—	36
LO3 ERR	—	—	—	37	37*
A GND	38*	38	13	38	38
LVFC_ENABLE	39*	—	—	39	—
FC ERR	40	—	—	40*	—
A GND	41*	41	10	41	41
YTO ERR	42	—	—	42*	—
+10V REF	43*	43	—	—	43

* Indicates signal source connectors.

Table 7-1. W2 Control Cable Connections (2 of 2)

Signal	A3J2 (pins)	A4J2 (pins)	A5J2 (pins)	A14J2 (pins)	A15J2 (pins)
A GND	44*	44	7	44	44
SCAN RAMP	45	—	—	45*	—
VIDEO TRIGGER	46*	—	—	—	—
A GND	47*	47	4	47	47
NC	—	—	—	—	—
R/T DAC2	49*	—	—	—	—
R/T DAC1	50*	—	—	50	—
* Indicates signal source connectors					

Troubleshooting Using the TAM

When using Automatic Fault Isolation, the TAM indicates suspected circuits that need to be manually checked. Use Table 7-2 to locate the manual procedure.

Table 7-3 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 7-1 illustrates the location of A3 test connectors.

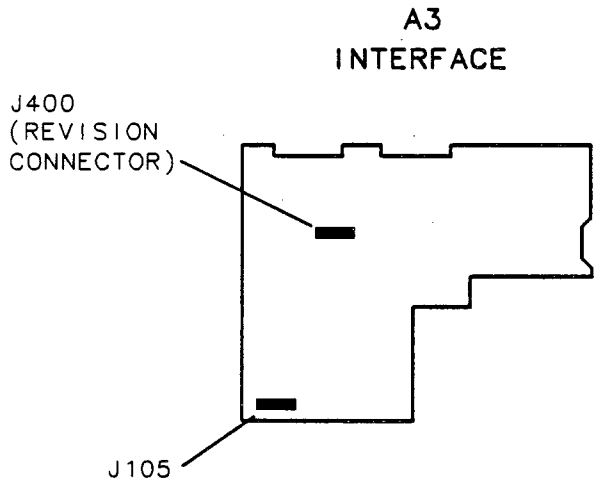


Figure 7-1. A3 Test Connectors

Automatic Fault Isolation

Analog-data bus errors that occur during automatic fault isolation result from either a shorted W2 control cable or a faulty A3 assembly. Perform the following steps to determine the cause of the error.

1. Disconnect W2 from A3J2 and repeat the Automatic Fault Isolation procedure.
2. If the analog-data bus error is still present, troubleshoot the A3 Interface assembly. If the error disappears, look for a short on W2 or another assembly connected to it.
3. To isolate a short on W2, reconnect W2 to A3J2 and disconnect W2 from all other assemblies.
4. Repeat the Automatic Fault Isolation routine.
5. If the analog-data bus error is still present, W2 is shorted. If the error disappears, reconnect the other assemblies one at a time and repeat the procedure after each connection. Once the faulty assembly is reconnected to W2, the error should reappear.

Table 7-2. Automatic Fault Isolation References

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check ADC ASM	ADC ASM
Check ADC MUX	ADC MUX
Check ADC Start/Stop Control	ADC Start/Stop Control
Check Analog Bus Drivers	Automatic Fault Isolation *(in this chapter)* Analog Bus Drivers
Check Analog Bus Timing	Automatic Fault Isolation *(in this chapter)* Analog Bus Timing
Check Interface Strobe Select	Interface Strobe Select
Check Keyboard Interface	Keyboard/RPG Problems
Check Negative Peak Detector	Positive/Negative Peak Detectors *(steps 3 through 10)*
Check Peak Detector Reset	Peak Detector Reset
Check Positive Peak Detector	Positive/Negative Peak Detectors *(steps 3 through 10)*
Check Real Time DAC	Preselector Peaking Control (Real Time DAC)
Check Ramp Counter	Ramp Counter
Check RF Gain DACs	Band Flatness Control (RF Gain DACs)
Check Rosenfell Detector	Rosenfell Detector
Check RPG Interface	Keyboard/RPG Problems
Check Track and Hold	Track and Hold
Check Trigger	Triggering Problems
Check Variable Gain Amplifier (VGA)	Variable Gain Amplifier (VGA)
Check Video Filter	Video Filter
Check Video Filter Buffer Amplifier	Video Filter Buffer Amplifier
Check Video MUX	Video MUX

Table 7-3. TAM Tests versus A3 Test Connectors

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A3J105	Video Input to Interface	MS1
	Video to Rear Panel	MS2
	Video MUX	MS3
	LOG Offset/LOG Expand	MS1, MS3
	Video Filter Buffer Amp.	MS3, MS5, OS1
	Video Peak Detectors	MS5, MS6
	ADC MUX	MS6
	Variable Gain Amplifier	MS6, MS7
	Track and Hold	MS7, MS8
A3J400	Revision	MS2
	Trigger	MS8
	ADC Start/Stop Control	MS7
	Video Trigger DAC	MS1
	Real Time DAC #1	MS3
	RF Gain DACs	MS6

Keyboard/RPG Problems

Keyboard Interface

Refer to function block G of A3 Interface Assembly Schematic Diagram (sheet 3 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

A pressed key results in a low on a keyboard sense line (LKSNS0 through LKSNS7). This sets the output of NAND gate U607 high, generating KBD/RPG_IRQ. The CPU determines the key pressed by setting only one keyboard scan line (LKSCN0 through LKSCN5) low through U602 and reading the keyboard sense lines.

1. If none of the keys or the RPG respond to presses, check ribbon cable, A1A1W1. (This cable connects the A1A1 Keyboard to the A3 Interface assembly.) The keys are arranged in a row/column matrix, as shown in Table 7-4.
2. If an entire row or column of keys does not respond, nor does the RPG respond, check for an open or shorted wire in A1A1W1.

Table 7-4. Keyboard Matrix

	LKSNS0	LKSNS1	LKSNS2	LKSNS3	LKSNS4	LKSNS5	LKSNS6	LKSNS7
LKSCN0	CONFIG	SAVE	RECALL	GHz	MHz	kHz	Hz	PRESET
LKSCN1	MODULE	TRIG	DISP	9	6	3	BK SP	⇑
LKSCN2	PEAK SEARCH	BW	TRACE	8	5	2	•	⇓
LKSCN3	FREQ COUNT	AUTO COUPLE	MKR ⇒	7	4	1	0	HOLD
LKSCN4	SWEEP	SK1	SK2	SK3	SK4	SK5	SK6	MKR
LKSCN5	AUX CTRL	MEAS/USER	CAL	SGL SWP	COPY	FRE-QENCY	SPAN	AMPLI-TUDE

3. Check that all inputs to NAND gate A3U607 (LKSNS lines) are high before any key is pressed. If any input is low, continue with the following. If not, skip to step 4.
   a. Disconnect A1A1W1 from A3J602 and again check all inputs to U607.
   b. If any input is low with A1A1W1 disconnected, suspect A3U604, A3U607, or A3U602.
   c. Reconnect A1A1W1 to A3J602.
4. Monitor A3U607 pin 8 with a logic probe. A TTL high should be present when any key is held down. Monitor this point as you press each key in succession.
5. Check that the LKSCN lines (outputs of A3J602 pins 1 through 6) read a TTL low before any key is pressed. (Any TTL high indicates a faulty A3 Interface assembly.)
6. Check for a pulse at each LKSCN output of U602 when a key is pressed.
7. Check that only one input to U607 (LKSNS lines) goes low when a key is pressed.
8. Check that U602 pin 9 (LKBD_RESET) pulses low when a key is pressed.
9. If LKBD_RESET is incorrect and a pulse is not present at each of the LKSCN outputs of U602 when a key is pressed, check for LWRCLK and LSCAN_KBD.

RPG (Rotary Pulse Generator) Interface

Refer to function block J of A3 Interface Assembly Schematic Diagram (sheet 3 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

U608B latches the RPG direction from the two RPG outputs, RPG_01 and RPG_02. Counterclockwise RPG rotation produces low-going pulses which result in a high output on U608B. Clockwise RPG rotation results in a low output from U608B. U612A provides the edge to trigger one-shot U423B, which generates a 90 ms pulse. This pulse gates U610A and counts RPG pulses with U606. Gates U610D and U614D prevent retriggering of U423B until its 90 ms pulse has timed out.

1. Monitor A3U401 pin 2 with a logic probe or oscilloscope. Pulses should be present as the RPG is rotated.
2. Monitor A3U608 pin 12 as the RPG is rotated. Pulses should be detected.
3. If no pulses are detected at either point, check for power and ground signals to A1A1W1 and A1A2W1. If both power and ground are there, A1A2 RPG is probably defective.
4. If pulses are missing at only one point, check for an open or short on A1A1W1 and A1A2W1. If these cables are working properly, A1A2 RPG is probably defective.
5. Set the (LINE) switch OFF and disconnect A1A1W1 from A3J602. Jumper A3U608 pin 12 (RPG_01) to U608 pin 14 (+5 V dc). Jumper U401 pin 2 (RPG_02) to U511 pin 11 (HDPKD_CLK). This provides a 7.8 kHz square wave to the RPG_02 input of the RPG interface.
6. Set the (LINE) switch ON.
7. Check A3U608 pin 9 for narrow, low-going pulses occurring approximately every 90 ms.
8. Check A3U608 pin 13 (LRPG_RESET) for narrow, low-going pulses occurring approximately every 90 ms.
9. Check A3U612 pin 5 for narrow, low-going pulses occurring approximately every 90 ms.

10. Check U608 pin 5 (HRPG_IRQ) for narrow, high-going pulses occurring approximately every 90 ms.
11. If HRPG_IRQ is correct but LRPG_RESET is incorrect, check U505 pin 13 (LKBD/RPG_IRQ) for narrow, low-going pulses occurring approximately every 90 ms.
12. If HRPG_IRQ and LKBD/RPG_IRQ are correct but LRPG_RESET is incorrect, suspect a failure on the A2 Controller assembly.
13. Check U610 pin 3 for a 7.8 kHz square wave. Check U606 pin 2 (HRPG_RESET) for narrow, high-going pulses occurring approximately every 90 ms. Refer to Table 7-5 and check the frequencies at the divide-by-16 counter A3U606.
14. If all the checks above are correct but the analyzer does not respond to the RPG, suspect a problem in either the A1A2 RPG or the A1A1 Keyboard.
15. Set the (LINE) switch OFF.
16. Reconnect A1A1W1 to A3J602 and remove all jumpers.

Table 7-5. Counter Frequencies

A3U606 pin #	Nominal Frequency (Hz)
3	3900
4	1950
5	975
6	488
11	244
10	122
9	61

Triggering Problems

Refer to function block H of A3 Interface Assembly Schematic Diagram (sheet 3 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The 1 MHz ADC clock provides synchronization in free run and single triggering. Line triggering synchronization originates on the A6 Power Supply. Trigger MUX A3U613A selects between free run, video, line, and external trigger sources. The trigger signal sets the output of the HSCAN latch high. HBADC_CLK0 provides the trigger signal for free run. The VIDEO TRIG signal must be at least 25 mV (0.25 divisions) peak-to-peak to trigger in video trigger mode.

1. Check that the trigger MUX is receiving the proper trigger source information by selecting each of the following trigger modes and checking the TRIG_SOURCE0 and TRIG_SOURCE1 lines as indicated in Table 7-6 below.
2. If a trigger mode does not work, check that a trigger signal is present at the appropriate MUX input, as indicated in Table 7-6.

Table 7-6. Trigger MUX Truth Table

Trigger Mode	TRIG_SOURCE0 U613 pin 14	TRIG_SOURCE1 U613 pin 2	MUX Input Pin Number U613
FREE RUN	L	L	6
VIDEO	H	L	5
LINE	H	H	3
EXTERNAL	L	H	4

3. Check that the appropriate MUX input signal is present at the MUX output (A3U613 pin 7).
4. To check the video-trigger level DAC, connect a positive DVM lead to A3J400 pin 1 and the negative DVM lead to A3TP4.
5. Press (TRIG) and VIDEO.
6. Press (▼) several times as you monitor the DVM reading and the video-trigger level position on the display.
7. Check that the DVM measurement reading increases by 1 V at each step of the VIDEO TRIG level.
8. If the voltage changes incorrectly, proceed as follows:
   a. Check the −10 V dc reference (A3U409 pin 4).
   b. While using the front-panel knob to adjust the video-trigger level, check for pulses on A3U409 pin 15 (LDAC2).
   c. While using the front-panel knob to adjust the video-trigger level, check for pulses on A3U409 pin 16 (LWRCLK).
   d. Check for pulses on U409 pin 6 (IA0).
9. If the LWRCLK and LDAC2 signals are not correct, refer to "Interface Strobe Select" in this section.

Preselector Peaking Control (Real-Time DAC)

Refer to function block L of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The spectrum analyzer uses a real-time DAC (R/T DAC1) to peak the preselector.

1. Press (PRESET) on the spectrum analyzer and set the span to 0 Hz.
2. Connect a positive DVM lead to A3J400 pin 3 and the negative DVM lead to A3TP4.
3. Press (MKR), then (AUX CTRL), INTERNAL MIXER, and PRESEL MAN ADJ.
4. Monitor the DVM reading as you change the PRESELECTOR TUNE value from 0 to 255. The PRESELECTOR TUNE value is the R/T DAC1 setting.
5. Check that the DVM reading increases from 0 to approximately +10 V dc as R/T DAC1 is set from 0 to 255.
6. If the voltage does not change as stated above, set the analyzer to single-trigger mode. Press (TRIG), SINGLE, and check the following:
   a. Check that A3U409B pin 18 is at −10 V dc.
   b. While using the front-panel knob to change the PRESELECTOR TUNE value, check for pulses at U409 pin 6 (IA0).
   c. Check that U409 pin 15 (LDAC2) is a TTL high.
   d. Check for pulses at U409 pin 16 (LWRCLK).
7. If the LDAC2 or LWRCLK signals are incorrect, refer to "Interface Strobe Select."

Flatness Control (RF Gain DACs)

Refer to function block M of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

RF gain DACs control the A15 assembly flatness compensation amplifiers. The RF gain DACs are arranged so that the output of one DAC is the voltage reference for the other DAC. This results in an RF gain voltage exponentially proportional to the DAC settings. Each DAC is set to the same value. The A15 RF assembly converts the RF GAIN signal to a current which drives the PIN diode attenuators in the flatness compensation amplifiers. The exponentially-varying voltage compensates for the nonlinear resistance-versus-current characteristic of the PIN diodes.

1. Place the WR PROT/WR ENA jumper on the A2 Controller assembly in the WR ENA position.
2. Press (CAL), MORE 1 OF 2, SERVICE CAL DATA, FLATNESS, FLATNESS DATA. Press NEXT BAND until FLATNESS BAND # 0 is displayed.
3. Press (▲) until DATA @ 300 MHz is displayed. Note the number directly below DATA @ 300 MHz; this is the RF gain DAC value.
4. Connect a positive DVM lead to A3J400 pin 13 and the negative DVM lead to A3TP4.

5. Check that the DVM reading increases from about 0 V dc to between +3.5 and +5.0 V dc as the RF gain DAC setting is increased from 0 to 255.
6. If the DVM readings are incorrect, press (PRESET), (TRIG), SINGLE, then (CAL), MORE 1 OF 2, SERVICE CAL DATA, FLATNESS, and FLATNESS DATA. Press NEXT BAND until FLATNESS BAND # 0 is displayed. Press (▲) until DATA @ 300 MHz is displayed. Proceed as follows:
   a. Check the +10 V reference.
   b. Check for pulses at A3U417 pin 16 (LWRCLK).
   c. Rotate the front-panel knob as you check for pulses at A3U417 pin 15 (LDAC1).
   d. Rotating the front-panel knob as you check for pulses at U417 pin 6 (IA0).
7. If LWRCLK and LDAC1 are incorrect, refer to the Interface Strobe Select block diagram.
8. Place the WR PROT/ WR ENA jumper on the A2 Controller assembly in the WR PROT position.

A3 Assembly Video Circuits

Voltages from A3J101 to the A3 Variable Gain Amplifier correspond (approximately) to on-screen signal levels. (One volt corresponds to the top of the screen and zero volts corresponds to the bottom of the screen.) This is true for both log and linear settings except when the analyzer is set for 1 dB/DIV or 2 dB/DIV. In these cases the log-expand amplifier is activated, and 1 V corresponds to top-screen and 0.8 or 0.9 V corresponds to bottom-screen. The analyzer can be set for zero span at the peak of a signal to generate a constant dc voltage in the video circuits during sweeps.

1. Disconnect W26 from A3J101 and W20 from A2J4.
2. Connect W26 to A2J4.
3. Set the spectrum analyzer controls as follows:

   SPAN ..... 0 Hz
   SWEEP TIME ..... 20 ms
   RES BW ..... 1 MHz
   LOG/DIV ..... 10 dB/DIV

4. If a trace is displayed, troubleshoot the A3 assembly. If a trace is absent, connect an oscilloscope to the rear-panel BLANKING OUTPUT.
5. The presence of a TTL signal (TTL low during 20 ms sweep) indicates a good A3 Interface assembly. Troubleshoot the IF Section.
6. If the BLANKING OUTPUT is always TTL high or low, troubleshoot the A3 trigger circuits.
7. Reconnect W26 to A3J101 and W20 to A2J4.
8. Remove the A3 assembly shield.
9. If the video filters appear to be faulty, refer to "Video Filter" in this chapter.

10. If there appears to be a peak detector problem, refer to "Positive/Negative Peak Detectors" in this chapter.

11. Connect the spectrum analyzer CAL OUTPUT to the INPUT 50Ω and set the controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz
    REF LVL ..... −10 dBm

12. If the analyzer works correctly in 5 dB/DIV and 10 dB/DIV but not in 1 dB/DIV or 2 dB/DIV, refer to "Log Offset/Log Expand." Continue with step 13 if the problem involves on-screen amplitude errors which appear to originate in the video chain.

13. Monitor A3TP9 with an oscilloscope. If the voltage is not approximately +1 V dc, troubleshoot the A4 Log Amplifier. (Refer to the IF Troubleshooting Procedure.)

14. To confirm proper video circuit input, change the reference level in 10 dB steps from −10 dBm to +30 dBm. At each 10 dB step, the input voltage should change 100 mV. The input level should be +0.6 V dc for a +30 dBm reference level.

Note



The on-screen amplitude level may not change as expected, since the video circuitry is assumed to be faulty.

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15. Monitor A3TP14 while stepping the reference level from −10 dBm to +30 dBm. If the voltage does not step approximately 100 mV per 10 dB step, refer to "Video MUX" in this chapter.

16. If the Video MUX is working properly, monitor A3TP15 with the oscilloscope and step the reference level from −10 dBm to +30 dBm. If the voltage does not change 100 mV per 10 dB step, refer to "Video Filter" in this chapter.

17. If the voltage at A3TP15 is correct, move the oscilloscope probe to A3TP17 and step the reference level between −10 dBm and +30 dBm. If the voltage does not change 100 mV per 10 dB step, refer to "Video Filter Buffer Amplifier" in this chapter.

18. If the voltage at A3TP17 is correct, move the oscilloscope probe to A3TP6. Set the following controls to keep the ADC MUX set to the MOD_VIDEO input during the sweep.

    SWEEP TIME ..... 50 s
    DETECTOR MODE ..... SAMPLE

19. Step the reference level from −10 dBm to +30 dBm while monitoring the voltage change on the oscilloscope. If the voltage does not change 100 mV per 10 dB step, refer to "ADC MUX" in this chapter.

20. If the voltage at A3TP6 is correct, move the oscilloscope probe to A3TP8 and step the reference level between −10 dBm and +30 dBm. If the voltage at A3TP8 is not the same as that at A3TP6, replace A3U110.

21. If the voltages at A3TP8 and A3TP6 are equal, move the oscilloscope probe to A3TP7.

22. Change the reference level from −10 dBm to 0 dBm. The voltage change on A3TP7 should be between 670 mV and 730 mV. If the voltage change is outside of these limits, refer to "Variable Gain Amplifier (VGA)." The gain of the VGA should be 7 ±10%.

Log Offset/Log Expand

Refer to function block X of A3 Interface Assembly Schematic Diagram (sheet 5 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The log scales are modified using a combination of amplification and digital trace manipulation. The video input to the A3 assembly is either 10 dB/DIV or linear. To obtain the 5 dB/DIV scale, the CPU manipulates trace data from the 10 dB/DIV scale. To obtain the 2 dB/DIV scale, the video signal is amplified and offset so that top-screen in 10 dB/DIV corresponds to top-screen in 2 dB/DIV. To obtain the 1 dB/DIV scale, the CPU manipulates trace data from the 2 dB/DIV scale.

In 2 dB/DIV, Log Offset/Log Expand amplifies the top 20 dB of the display. This is done by offsetting the video signal by −0.8 V and providing a gain of 5 to the top 0.2 V of the video signal. The −0.8 V offset is accomplished by sinking 2 mA through R114 by current source U105/Q101.

1. On the spectrum analyzer press (PRESET), (SPAN), and ZERO SPAN.
2. Disconnect W26 (coax 2) from A3J101 and connect the output of a function generator to A3J101.
3. Set the function generator controls as follows:

   Output ..... Sine wave
   Amplitude ..... 1 V pk-to-pk
   DC Offset ..... +500 mV
   Frequency ..... 50 Hz

4. Set the spectrum analyzer (SWEEP TIME) to 50 ms.
5. Adjust the function generator amplitude and offset until the sine wave fills the entire graticule area.
6. Use an oscilloscope to measure the function generator peak-to-peak voltage, then record it below.

   $V_{(10\ dB/DIV)}$ = _____ V

7. Set the spectrum analyzer (dB/DIV) to 2 dB.
8. Readjust the function generator amplitude and offset until the sine wave again fills the entire graticule area.
9. Measure and record the function generator peak-to-peak voltage and dc offset.

   $V_{(2\ dB/DIV)}$ = _____ V

10. The ratio of voltage recorded in step 6 to the voltage recorded in step 9 should be 5 ±3%. If it is not, troubleshoot the A3 Interface assembly.
11. Reconnect W26 to A3J101.

Video MUX

Refer to function block U of A3 Interface Assembly Schematic Diagram (sheet 5 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The AUX VIDEO port and the 0 SPAN CAL function are not used. Both Q220 and Q219 should be off at all times.

1. Press (PRESET) and set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

2. Press (SWEEP) and SINGLE.
3. Check for TTL high on A3U104 pin 2 and TTL low on U104 pins 7, 10, and 15. Set the analyzer to 2 dB/DIV and check for a TTL high on A3U104 pin 10 and a TTL low on A3U104 pins 2, 7, and 15.
4. If the logic levels on A3U104 are incorrect, check the LLOG_STB signal as follows:
   a. Monitor A3U104 pin 9 with an oscilloscope or logic probe. Check that a pulse occurs when switching between 10 dB/DIV and 2 dB/DIV.
   b. Check the inputs to A3U104 (pins 4 and 12) while switching between 10 dB/DIV and 2 dB/DIV.
   c. If the logic signals are incorrect, refer to "Analog Bus Timing" and "Analog Bus Drivers."
5. Check comparators A3U109A/C/D for proper outputs. The outputs should be high when the noninverting input is greater than the threshold voltage of +2.4 V dc.
6. If A3U104 and A3U109 are working properly, set the REF LEVEL to 0 dBm.
7. Monitor the voltage at A3TP14 while switching the analyzer between 10 dB/DIV and 2 dB/DIV. The voltage should switch between 0.9 and 0.5 V dc.
8. If the voltage at A3TP14 is incorrect, suspect either A3Q220 or A3Q221.
9. The Video MUX appears to be faulty if A3CR109 is shorted or leaky. Diode A3CR109 "clamps" the voltage at A3TP14 to −0.4 V when in log expand with less than 0.8 V at J101. To confirm this failure, lift the cathode of diode A3CR109 and perform steps 1 through 7 again.

Video Filter

Refer to function block V of A3 Interface Assembly Schematic Diagram (sheet 5 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder. The spectrum analyzer uses digital filtering for 1 Hz to 100 Hz video bandwidths. An RC low-pass filter is used for 300 Hz to 3 MHz video bandwidths. Various series resistances and shunt capacitances switch into the video filter to change its cutoff frequency.

1. Press (PRESET) and set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 225 MHz
   SPAN ..... 550 MHz
   SWEEP TIME ..... Uncoupled (MAN)

2. Press (SWEEP) and SINGLE.

3. Step the video bandwidth from 3 MHz to 10 kHz. At each step, the peak-to-peak noise deviation should decrease.
4. Step the video bandwidth to 1 Hz. At each step, the amplitude of the LO feedthrough should decrease.
5. Refer to Table 7-7 and check for correct latch settings for the selected video bandwidth setting.
6. If latch A3U102 output is not correct, trigger an oscilloscope on LLOG_STB (U102 pin 9). Monitor U102 pin 1 and other latch inputs while changing the video bandwidth.
7. If the inputs are incorrect, troubleshoot the analog bus. Correct inputs with bad outputs indicate a faulty U102.
8. Check that the outputs of A3U111A, A3U111B, and A3U107A/B/C/D are correct for their inputs. The outputs should be high with noninverting inputs higher than the +1.4 V threshold voltage. If a voltage drop is noticed across these components, suspect A3CR109 or A3Q317B. Since no dc current flows through any of the series resistances or FETS (drain to source), no voltage drops should occur.

Table 7-7. A3U102 Latch Outputs

Video BW	Pin 2	Pin 5	Pin 7	Pin 10	Pin 12	Pin 15
300 Hz	H	L	L	L	L	L
1 kHz	L	L	L	L	L	H
3 kHz	L	H	L	L	L	L
10 kHz	L	L	L	L	H	L
30 kHz	H	L	H	L	L	L
100 kHz	L	L	H	L	L	H
300 kHz	L	H	H	L	L	L
1 MHz	L	L	H	L	H	L
3 MHz	L	L	L	H	L	L

Video Filter Buffer Amplifier

Refer to function block W of A3 Interface Assembly Schematic Diagram (sheet 5 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The video filter buffer amplifier provides outputs for video trigger, positive and negative peak detectors, and the analog zero-span (sweeps less than 30 ms). The zero-span video output is terminated in 500Ω on the A2 Controller assembly. The amplifier is a high-input impedance-buffer amplifier with a gain of 1 when properly terminated.

Current source U307C provides twice the current of Q316. Resistor R145 and current source U307D shift the dc level. Resistor R260 terminates the peak detector inputs in 500Ω. The unterminated gain is 1.1. Diode CR114 prevents latch-up during positive overdrive conditions while CR113 protects Q318 during overdrive. Zener diode CR117 has a 12.7 V breakdown, which limits the peak detector output to +1.5 V. Typically, limiting occurs at +1.1 V.

Positive/Negative Peak Detectors

Refer to function blocks Y and Z of A3 Interface Assembly Schematic Diagram (sheet 5 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The following information pertains to the positive peak detector but is applicable to troubleshooting the negative peak detector.

The positive peak detector consists of an input amplifier, A3U204 and A3Q210, followed by detector diodes, A3CR203 and A3CR204, and hold capacitor A3C217. Output amplifiers A3Q206, Q211, and Q212 buffer the hold capacitor. Both the input and output amplifiers have a gain of 1. Each amplifier has local feedback. On the output amplifier, the emitter of Q212 connects to the gate of Q206. On the input amplifier the feedback goes through Q209 and Q208 back to the base of U204D. Global feedback occurs from the output amplifier through R223 back to U204D input amplifier. The peak detector resets through Q207.

1. Press (PRESET) and set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 500 MHz
   RES BW ..... Auto
   VIDEO BW ..... Auto
   LOG dB/DIV ..... 10 dB/DIV

2. If the spectrum analyzer does not meet the conditions in steps a through e below, the positive and negative peak detectors are probably faulty. Continue with step 3 to check the detectors.

   a. The peak-to-peak deviation of the noise in NORMAL detector mode should be approximately two divisions. Note the amplitude levels of the top and bottom of the displayed noise.
   b. Select positive-peak detector mode by pressing (TRACE), MORE 1 OF 3, DETECTOR MODES, then DETECTOR POS PEAK.
   c. Confirm that the noise is about one-third of a division peak-to-peak. The noise should also be no higher than the top of the noise level in DETECTOR NORMAL mode.
   d. Select DETECTOR NEG PEAK mode. The noise should be about one-third of a division peak-to-peak. The noise should also be no lower than the bottom of the noise in DETECTOR NORMAL mode.
   e. Select DETECTOR SAMPLE mode. Check that the noise appears between the top and bottom of the noise in DETECTOR NORMAL mode.

3. On the spectrum analyzer, connect the front-panel CAL OUTPUT to the INPUT 50Ω and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   SWEEP TIME ..... 5 s
   DETECTOR MODE ..... POS PEAK

4. Monitor A3TP17 and A3TP16 simultaneously with an oscilloscope.

5. Change the reference level from −10 dBm to +30 dBm and verify a voltage change at both A3TP17 and A3TP16 of 1 V to 0.6 V in 100 mV steps.

6. Check the entire range of the detector by substituting a dc source at J101 and varying its output from 0 to 1 volt.
7. If the peak detector appears to be latched up, check LPOS_RST for negative TTL level reset pulses. The reset pulses should occur every 130 μs and be approximately 250 ns wide.
8. If the reset pulses are absent, troubleshoot the peak detector reset circuitry.
9. If the reset pulses are present, check the gate of Q207. The pulses should be positive-going from −12.7 V to −1.35 V.
10. The peak detector can be made into a unity-gain amplifier by shorting the cathode of CR203 to the anode of CR204. If the peak detector functions normally as a unity-gain amplifier, suspect Q208 or CR203 or CR204.

Peak Detector Reset

Refer to function block R of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder].

1. Press [PRESET] on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   SWEEP TIME ..... 5 s
   DETECTOR MODE ..... POS PEAK

2. Check that HHOLD (A3U526 pin 11) has 18 μs wide pulses every 128 μs.
3. Check that HODD (A3U408 pin 5) is a square wave with a period of 16.7 ms (2 × sweep time/600).
4. Check LPOS_RST (A3U422 pin 4) for 200 ns low-going pulses every 128 μs.
5. Check LNEG_RST (A3U422 pin 12) for 200 ns low-going pulses every 128 μs.
6. Set the detector to DETECTOR NORMAL and check that LNEG_RST (A3U422 pin 12) has two pulses spaced 40 μs apart, and then a single pulse approximately 88 μs from the second pulse.
7. Check HMUX_SEL0 (A3U408 pin 3) and HMUX_SEL1 (A3U408 pin 9) according to Table 7-8.

Table 7-8. HMUX_SELO/1 Versus Detector Mode

Detector Mode	HMUX_SEL0	HMUX_SEL1
NORMAL	40 μs pulse every 128 μs	40 μs pulse every 128 μs
SAMPLE	H	H
POS PEAK	H	L
NEG PEAK	L	H

Rosenfell Detector

Refer to function block S of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

If both HPOS_HLDNG and HNEG_HLDNG are high during the same bucket, HROSENFELL is also set high. This indicates that the video signal probably consists of noise, since it rose and fell during the same period. The HROSENFELL signal is valid only when the DETECTOR NORMAL (rosenfell) mode is selected.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   SWEEP TIME ..... 5 s
   DETECTOR MODE ..... NORMAL

2. Check LPOS_RST and LNEG_RST as described in "Peak Detector Reset."
3. Check A3U423 pin 4 for two low-going 3.3 μs pulses 40 μs apart occurring every 130 μs.
4. Check that HROSENFELL (A3U610 pin 6) has two pulses spaced approximately 20 ms apart, and then a third pulse 60 ms from the second pulse at 50 ms sweep time. Each pulse should be approximately 10 ms wide and low-going.
5. Monitor HROSENFELL with an oscilloscope while reducing the video bandwidth from 1 MHz to 1 kHz.
6. As the video bandwidth is decreased to 1 kHz, the HROSENFELL line should increasingly indicate a low-logic level. With a video bandwidth of 1 kHz, a nearly flat line should be displayed on the CRT.
7. Set the sweep time to 5 ms.
8. Check that HPOS_HLDNG (A3U416 pin 4) is mostly high with a 1 MHz video bandwidth and mostly low with a 1 kHz video bandwidth.
9. Check that HNEG_HLDNG (A3U416 pin 9) is mostly high with a 1 MHz video bandwidth and mostly low with a 1 kHz video bandwidth.

ADC MUX

Refer to function block AA of A3 Interface Assembly Schematic Diagram (sheet 6 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The ADC MUX switches various inputs into the video path for conversion by the ADC. The SCAN RAMP input is used during non-zero-span sweeps. The YTO ERR, FCMUX, CAL OSC TUNE, and OFL ERR inputs are used only during diagnostic and auto-adjust routines and during retrace.

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   REF LEVEL ..... −10 dBm
   SWEEP TIME ..... 50 s
   DETECTOR MODE ..... SAMPLE

2. Refer to Table 7-9 and check for correct logic levels at A3U108 pins 1, 15, and 16. Check for proper output signals at A3TP6. If the select lines are not changing, suspect the ADC ASM or the VGA/ADC MUX Control. If the select lines are changing, but the proper video inputs are not switching to the output, replace A3U108.
3. Use an oscilloscope to check for the presence of the YTO ERR signal at A3J2 pin 42.
4. If ERR 300 YTO UNLK or 301 YTO UNLK occurs and the voltage is zero during a sweep and positive during retrace (YTO is being locked), the fault is on the A3 assembly. If a constant dc voltage is present, refer to Chapter 10, "Synthesizer Section."

Table 7-9. Logic Levels at A3U108

Detector Mode	U108 pin 1	U108 pin 15	U108 pin 16
SAMPLE	H	L	H
POS PEAK	H	L	L
NEG PEAK	L	H	H

5. Set the spectrum analyzer controls as follows:

   SPAN ..... 1 MHz
   SWEEP TIME ..... 50 ms

6. Check for the presence of the SCAN RAMP signal by connecting an oscilloscope probe to A3J2 pin 45 (component side of A3J2). Connect the negative lead to A3TP4.
7. A 0 to 10 V ramp should be present in both line and free run trigger modes. If the waveform is present only in LINE trigger, ADC control signal HBADC_CLK0 may be faulty. Refer to "ADC Control Signals" in this chapter.
8. If SCAN RAMP is present, but is not being switched to the output of U108, replace U108. If SCAN RAMP is absent in either mode, do the following:
   a. Connect the oscilloscope probe to A3J400 pin 15 (HSCAN).
   b. A TTL signal (high during 50 ms sweep time and low during retrace) should be present, indicating A3 is working properly. Refer to Chapter 10, "Synthesizer Section" for the troubleshooting procedure. A faulty TTL signal indicates a bad A3 Interface assembly.
9. Set the spectrum analyzer controls as follows:

   SWEEP TIME ..... 100 ms
   SPAN ..... 100 MHz
   IF Adjust ..... ON

10. Check for the presence of the CAL OSC TUNE signal by monitoring A3J401 pin 25 with an oscilloscope. If ERR 499 CAL UNLK is displayed and a signal greater than 10 V peak-to-peak during part of the retrace period is present, the fault is on the A3 assembly.
11. If a constant dc voltage is present during the sweep and all of the retrace period, refer to Chapter 8, "IF Section" for the troubleshooting procedure.

Variable Gain Amplifier (VGA)

Refer to function block AB of A3 Interface Assembly Schematic Diagram (sheet 6 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The VGA provides adjustable gain in the video path. Its nominal gain of 7 can be adjusted ±10%. A3U112 removes dc offset to keep A3U113 in its monotonic range. (Both A3U112 and A3U113 are set to the same value.) The DAC settings cannot be changed from the front panel.

Track and Hold

Refer to function block AC of A3 Interface Assembly Schematic Diagram (sheet 6 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Press [PRESET] on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   DETECTOR MODE ..... Sample
   REF LVL ..... −70 dBm
   LOG dB/DIV ..... 2 dB/DIV
   SWEEP TIME ..... 50 ms

2. Disconnect any signal from the analyzer input. A full scale display of sampled noise should be present.
3. Trigger an oscilloscope on the positive going edge of HHOLD (A3U506 pin 16).
4. The waveform at A3TP10 should be random noise with an average level of approximately 4 V. The noise should have a flat spot in its response while HHOLD is high, indicating proper operation of A3U114.

A3 Assembly ADC Circuits

The ADC consists of a 12-bit DAC, 12-bit successive approximation register (SAR), data multiplexers, and data latches. The ADC algorithmic state machine (ASM) controls the ADC. Eight inputs are controlled by the ADC MUX. These include a positive peak detector, negative peak detector, sampled video, SCAN RAMP, YTO error voltage, FC MUX voltages, cal oscillator tune voltage, and offset lock error voltage. A MUX on the A14 Frequency Control assembly selects which voltage is sent to the ADC MUX on the FC MUX signal line.

During normal detector mode sweeps, when noise is detected by the rosenfell detector, the ADC ASM automatically switches between POS PEAK and NEG PEAK.

ADC Control Signals

Refer to function blocks B and F of A3 Interface Assembly Schematic Diagram (sheet 2 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The ADC requires two signals from the A2 Controller assembly: HBADC_CLK0 and HBBKT_PULSE. HBBKT_PULSE is used only in zero span. Use the following steps to verify the signals.

1. Disconnect W22 from A2J8.
2. If a 10 MHz TTL signal is absent on W22, refer to the 10 MHz Reference (on the A15 RF assembly) troubleshooting procedure.
3. Set the spectrum analyzer (SPAN) to zero.
4. Reconnect W22.
5. With an oscilloscope probe, monitor A3J401 pin 20.
6. If TTL pulses are absent, the A2 Controller assembly is faulty. Refer to Chapter 9. The presence of TTL pulses indicates a faulty A3 assembly.
7. Monitor A3J401 pin 23 (HBADC_CLK0). If a 1 MHz TTL clock signal is present, HBADC_CLK0 is working properly.
8. If HBKT_PULSE or HBADC_CLK0 is missing, disconnect A3W1 from A2J2.
9. Monitor A2U5 pin 3 for HBKT_PULSE and A2U5 pin 7 for HBADC_CLK0.
10. If HBADC_CLK0 is absent, troubleshoot the A2 Controller assembly.
11. HBKT_PULSE is absent, refer to the information on troubleshooting the frequency counter.
12. Reconnect A3W1 to A2J2.

ADC Start/Stop Control

Refer to function block B of A3 Interface Assembly Schematic Diagram (sheet 2 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The ADC Start/Stop Control determines the start time of all ADC conversions. Multiplexer A3U509 chooses the source of the start signal. Both HSTART_SRC and HBUCKET tell the ASM to start a conversion.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   SPAN ..... 0 Hz
   SWEEP TIME ..... 60 s
   DETECTOR MODE ..... Sample

2. Check for a TTL high at A3U509 pin 2 and a TTL low at A3U509 pin 14.
3. Set the detector mode to normal by pressing (TRACE), MORE 1 OF 3, DETECTOR MODES, then DETECTOR NORMAL.
4. Check that A3U509 pins 2 and 14 are both TTL low.
5. Set the spectrum analyzer controls as follows:

   SPAN ..... 1 MHz
   DETECTOR MODE ..... Sample

6. Check that A3U509 pins 2 and 14 are both TTL high.
7. Press (CAL) and REALIGN LO & IF. During the realignment, A3U509 pin 2 should be TTL low and pin 14 should be TTL high. If correct, the Start/Stop Control circuitry is being selected properly by the processor and U508 in the ADC register block is working properly.
8. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   SPAN ..... 0 Hz
   DETECTOR MODE ..... Sample
   SWEEP TIME ..... 400 ms

9. Check that A3U509 pin 7 has positive 15 μs pulses with a 667 μs period (sweep time/600). Check that A3U509 pin 9 has negative 15 μs pulses with a 667 μs period (sweep time/600). The pulses should be present during the sweep but absent during retrace.
10. Set the detector mode to normal by pressing (TRACE), MORE 1 OF 3, DETECTOR MODES, then DETECTOR NORMAL.
11. Check that A3U509 pin 9 has pulses every 130 μs and U509 pin 7 has pulses every 333 μs (although pulse widths may be changing).

ADC ASM

Refer to function block F of A3 Interface Assembly Schematic Diagram (Sheet 2 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   SPAN ..... 0 Hz
   SWEEP TIME ..... 60 s
   DETECTOR MODE ..... Sample

2. Check that HSTART_SRC (U504 pin 4) goes TTL high, causing HHOLD (U506 pin 16) to go high 15 μs later.
3. Check that HSTART_ADC (U506 pin 15) goes TTL high 19 μs after HSTART_SRC goes high.
4. HHOLD should stay TTL high for approximately 18 μs, and HSTART_ADC should stay high for approximately 31 μs.
5. Check that LCMPLT (U504 pin 15) goes TTL low 12 μs after HSTART_ADC goes high (12 bits at 1 μs per bit). LCMPLT indicates that the successive-approximation register (SAR) has completed the ADC conversion.
6. Check that LDONE (U506 pin 19) goes TTL low approximately 2 μs after LCMPLT goes low.

ADC

Refer to function block A of A3 Interface Assembly Schematic Diagram (sheet 2 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The successive-approximation register (SAR) consists of A3U513. Upon the occurrence of HSTART_ADC, the SAR successively toggles bits from high to low starting with the most significant bit. The digital result is then converted to an analog current in DAC U518 and compared with the sampled video. If the DAC current is too high, the output of U512 should be high, telling the SAR that the "guess" was high and that the bit just toggled should be set low. It then moves on to the next most significant bit until all 12 bits have been "guessed" at. Each "guess" takes 1 μs (one cycle of HBADC_CLK0), or 12 μs to complete a conversion. When the conversion is completed, the SAR sets LCMPLT low. The bits are written to the data bus by buffers U514 and U516.

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   SWEEP TIME ..... 60 s
   DETECTOR MODE ..... Sample

2. Trigger an oscilloscope on HSTART_ADC (U506 pin 15) and monitor the outputs Q1 through Q11 of the SAR. With the exception of Q11, each bit should start high and be switched low. It either stays low or returns to a high state 1 μs later, depending on the comparison at U512.
3. If the Q outputs do not exhibit this bit pattern, and the ADC ASM checks are working properly, replace U513. If the output of comparator U512 does not toggle back and forth during a conversion, replace either U512 or CR502.

Note



Since U512 pin 2 is at a virtual ground (currents are being summed at this node), voltage levels at this point are difficult to interpret.

Ramp Counter

Refer to function block D of A3 Interface Assembly Schematic Diagram (sheet 2 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

The ramp counter is used for nonzero-span sweeps and for zero-span sweep times greater than 30 ms. The analog sweep ramp is compared with digital ramp counter. When the analog sweep ramp exceeds the DAC output generated for that ramp counter setting, HRAMP_COMP toggles high, indicating the end of a bucket. The ramp counter counts horizontal buckets. There are 601 buckets per sweep, so the ramp (bucket) counter counts from 0 to 600. The ramp counter is incremented by HRST_PK_ENA.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   SPAN ..... 1 MHz
   DETECTOR MODE ..... SAMPLE

2. For sweep times between 100 ms and 60 s, HODD (A3U525 pin 3) generates a square wave with a period defined by (2 × sweep time/600). For example, for a 6 s sweep time, HODD has a period of 20 ms. The ramp (bucket) counter should be odd every other bucket.

A3 Assembly Control Circuits

If the next three steps fail, a digital control problem is indicated.

1. On the spectrum analyzer, press (AMPLITUDE), ATTEN MAN, 70 (dB).
2. A click should be heard after pressing dB in step 1, unless ATTEN was previously set to 70 dB.
3. Press 10 (dB). Another click should be heard. If no clicks are heard, but the ATTEN value displayed on the CRT changed, the digital control signals are not operating properly.

Use the following procedures to help isolate control problems.

Analog Bus Drivers

Refer to function block N of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   SPAN ..... 0 Hz
   TRIGGER ..... Single

2. Monitor A3U401 pin 3 (LRF_STB) with an oscilloscope or logic probe. This is the strobe for the A15 RF assembly.
3. Press (AUX CTRL), INTERNAL MIXER and check that pulses occur when you toggle between SIG ID ON and SIG ID OFF.
4. Monitor U401 pin 5 (LFC_STB) with an oscilloscope or logic probe. This is the strobe for the A14 Frequency Control assembly.
5. Press (AMPLITUDE) and check that pulses occur when toggling between ATTEN settings of 10 and 20 dB.
6. Monitor U401 pin 7 (LIF_STB) with an oscilloscope or logic probe. This is the strobe for the A5 IF assembly.
7. Press (AMPLITUDE) and check that pulses occur when toggling between REF LVL settings of −10 dBm and −20 dBm.
8. Monitor U401 pin 9 (LLOG_STB) with an oscilloscope or logic probe. This is the strobe for the A4 Log Amplifier assembly.
9. Press (AMPLITUDE) and check that pulses occur when toggling between LINEAR and LOG dB/DIV.
10. Check address and data lines. Place a jumper from A3TP1 and A3TP2 to A3U406 pin 20 (+5 V).
11. Check that address lines A0 through A7, and data lines D0 through D7, are all TTL high.
12. If any address or data line is low, set the (LINE) switch OFF and disconnect the W2 control cable from A3J2. Set the (LINE) switch ON. Ignore any error messages.
13. Check that address lines A0 through A7 and data lines D0 through D7 are all high. If all address and data lines are high, suspect a fault either in W2 or one of the other four assemblies which connect to W2.

14. If any address or data line is low, check the appropriate input of either U405 (data lines) or U406 (address lines).
15. If a data line input is stuck low, check the data bus buffer. If an address line input is stuck low, check A3W1 and the A2 Controller assembly.
16. If the appropriate input is high or toggling between high and low, suspect a failure in either U405 (data lines) or U406 (address lines).
17. Remove jumpers.

Analog Bus Timing

Refer to function block P of A3 Interface Assembly Schematic Diagram (sheet 4 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

Analog bus timing generates the strobes for the A4, A5, A14, and A15 assemblies. The A14 Frequency Control assembly also requires a qualifier for its strobe, LVFC_ENABLE. A3U400 and A3U414 provide a 2 μs delay between the time HANA_BUS goes high and the enable line to demultiplexer A3U407 goes low.

1. Press (PRESET) on the spectrum analyzer and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 100 MHz

2. Check that A3U407 pin 1 goes low approximately 2 μs after HANA_BUS (A3U400 pin 3) goes high.
3. If HANA_BUS is absent, check for pulses on ABT A3U505 pin 2 and IA10 (A3U505 pin 5).
4. If A3U407 pin 1 is not delayed 2 μs from HANA_BUS, check for the presence of the 1 MHz HBADC_CLK0.
5. If A3U407 pin 1 is not delayed 2 μs from HANA_BUS and HBADC_CLK0 is correct, suspect a fault in either A3U414 or A3U400.
6. Press (PRESET) and set the controls as follows:

   SPAN ..... 0 Hz
   TRIGGER ..... Single

7. Monitor A3U401 pin 3 (LR_STB) with an oscilloscope or logic probe. This is the strobe for the A15 RF assembly.
8. Press (AUX CTRL) INTERNAL MIXER and check that pulses occur when toggling between SIG ID ON and SIG ID OFF.
9. Monitor A3U401 pin 5 (LF_STB) with an oscilloscope or logic probe. This is the strobe for the A14 Frequency Control assembly.
10. Press (AMPLITUDE) and check that pulses occur when toggling between ATTEN settings of 10 and 20 dB.
11. Monitor A3U401 pin 7 (LI_STB) with an oscilloscope or logic probe. This is the strobe for the A5 IF assembly.

12. Press (AMPLITUDE) and check that pulses occur when toggling between REF LVL settings of −10 dBm and −20 dBm.
13. Monitor A3U401 pin 9 (LV_STB) with an oscilloscope or logic probe. This is the strobe for the A4 Log Amplifier assembly.
14. Press (AMPLITUDE) and check that pulses occur when toggling between LINEAR and LOG DB/DIV.

Interface Strobe Select

Refer to function block K of A3 Interface Assembly Schematic Diagram (sheet 3 of 6) in the *HP8560A/8561B/8563A Component Level Information* binder.

Interface-strobe select generates the various strobes used by circuits on the A3 Interface assembly. Table 7-10 and Table 7-11 are the truth tables for demultiplexers A3U410 and A3U500.

Table 7-10. Demultiplexer A3U410 Truth Table

Selected Output Line	IA1	IA2	IA3
Pin 15, LSCAN_KBD	L	L	L
Pin 14, not used	H	L	L
Pin 13, LDAC1	L	H	L
Pin 12, LDAC2	H	H	L
Pin 11, LDAC3	L	L	H
Pin 10, not used	H	L	H
Pin 9, not used	L	H	H
Pin 7, LADC_REG1	H	H	H

Table 7-11. Demultiplexer A3U500 Truth Table

Selected Output Line	IA0	IA1	IA2
Pin 15, LSENSE_KBD	L	L	L
Pin 14, LINT_PRIOR	H	L	L
Pin 13, LADC_DATA1	L	H	L
Pin 12, LDAC_DATA0	H	H	L
Pin 11, HCNTR_LD0	L	L	H
Pin 10, HCNTR_LD1	H	L	H
Pin 9, LRPG_RD	L	H	H
Pin 7, LADC_REG0	H	H	H

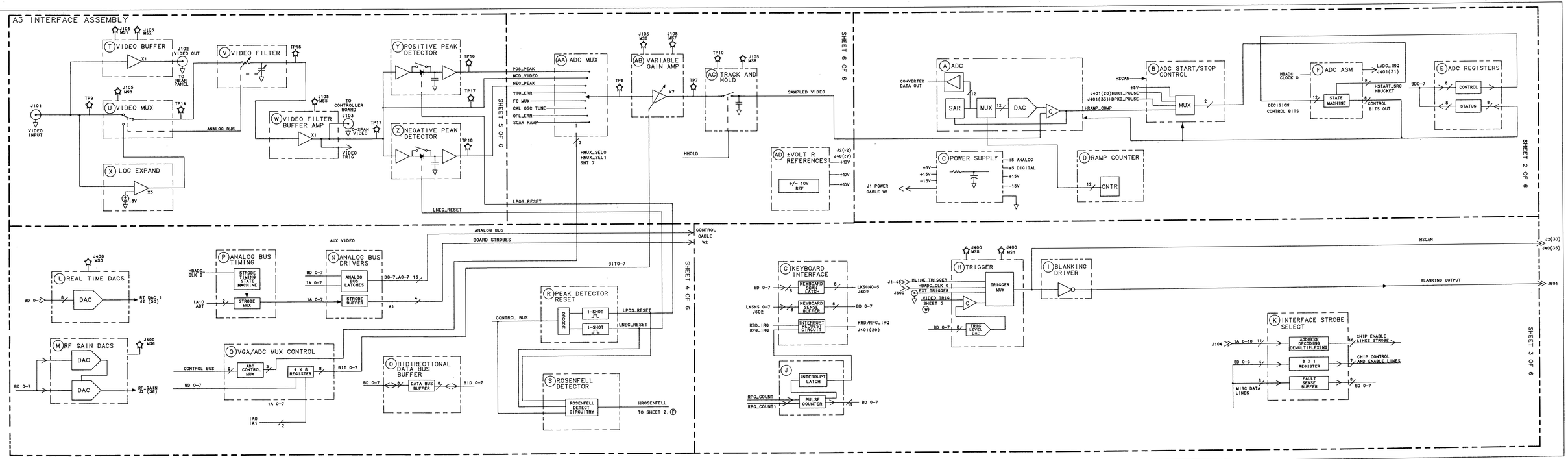


FIGURE 7-2. A3 INTERFACE ASSEMBLY BLOCK DIAGRAM

8

IF Section

The IF Section contains the A4 Log Amplifier, A5 IF, and A16 Cal Oscillator assemblies.

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Note

Because the A16 Cal Oscillator assembly is such an integral part of the IF adjustment, always check this assembly first before checking the rest of the IF Section. A faulty A16 can cause many apparent "faults" in the rest of the IF Section.

Troubleshooting Using the TAM

When using Automatic Fault Isolation, the TAM indicates suspected circuits that need to be manually checked. Use Table 8-1 to locate the manual procedure.

Table 8-2 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 8-1 illustrates the location of A3, A4, and A5 test connectors. Figure 8-2 illustrates the IF Section.

Note

HP 85629A Test and Adjustment Modules with firmware revisions A, B, or C cannot make valid measurements on test connector A5J8, A4J7, or A4J8.

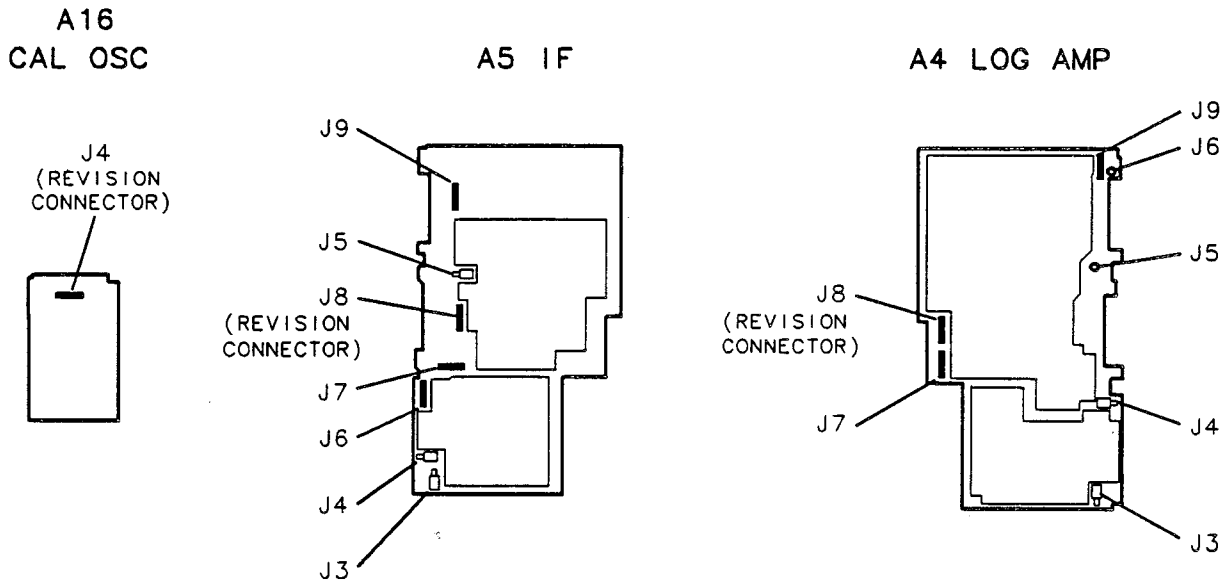


Figure 8-1. A4, A5, and A16 Test Connectors

Table 8-1. Automatic Fault Isolation References

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check A16 Cal Oscillator	Troubleshooting A16 with the TAM
Check Input Switch on A5 IF Assembly	Troubleshooting A5 with the TAM
Check Linear Amplifiers on A4 Log Amplifier	Linear Amplifiers
Check Log Expand on A3 Interface Assembly	Refer to "Log Expand" in this chapter
Check Step Gains on A5 IF Assembly	Step Gains
Check Video Offsets on A4 Log Amplifier Assembly	Video Offset *(steps 1 through 4)*
Check VIDEO OUT of A4 Log Amplifier Assembly	Video Output

Troubleshooting A4 with the TAM

Manual Probe Troubleshooting tests this assembly's nine cascaded amplifiers by calculating the bias currents into each stage. If this bias current is out of the specified range, a failure is flagged. (This technique locates dead stages, but might not report slightly degraded ones.)

Troubleshooting A5 with the TAM

Manual Probe Troubleshooting calculates stage bias-currents which test the operation of the IF chain. (This technique locates dead stages, but might not report slightly degraded ones.) DACs that are monitored are listed below:

IFDAC1: A5U812
IFDAC2: A5U813
IFDAC3: A5U809
IFDAC4: A5U807
IFDAC5: A5U810
IFDAC6: A5U806

Table 8-2. TAM Tests Versus Test Connectors (1 of 2)

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A3J105	Video Input to Interface	MS1
	Video to Rear Panel	MS2
	Video MUX	MS3
	Log Offset/Log Expand	MS1,MS3
	Video Filter Buffer Amplifier	MS3, MS5, OS1
	Video Peak Detectors	MS5, MS6
	ADC MUX	MS6
	Variable Gain Amplifier	MS6, MS7
	Track and Hold	MS7, MS8
A3J400	Revision	MS2
	Trigger	MS8
	ADC Start/Stop Control	MS7
	Video Trigger DAC	MS1
	Real Time DAC #1	MS3
	RF Gain DACs	MS6
A4J7	Input Converter	MS1
	Positive 15 V Supply	MS5
	1st Log Amplifier Stage	MS2
	2nd Log Amplifier Stage	MS3
	3rd Log Amplifier Stage	MS4
	4th Log Amplifier Stage	MS7
	5th Log Amplifier Stage	MS8
	6th Log Amplifier Stage	MS6
A4J8	Revision	MS5
	Voltage Reference	MS6, MS7, MS8
	7th Log Amplifier Stage	MS1, MS2
	8th Log Amplifier Stage	MS1, MS3
	9th Log Amplifier Stage	MS1, MS4
A4J9	Linear Amplifier Stage 1 Output	MS1
	Linear Amplifier Stage 2 Output	MS2
	Detector Bias Test	MS5
	Detector Buffer Test	MS6
	Video Offset/Buffer Test	MS8
A5J6	1st Step Gain Stage 1	MS1, MS2, MS8
	1st Step Gain Stage 2	MS1, MS2, MS3
	1st XTAL Pole Stage	MS2, MS3, MS4
	2nd XTAL Pole Stage	MS3, MS4, MS5
	1st LC Pole Stage 1	MS4, MS5, MS6
	1st LC Pole Stage 2	MS5, MS6, MS7

Table 8-2. TAM Tests Versus Test Connectors (2 of 2)

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A5J7	Ref 15 dB Attenuator Stage	MS1, MS2, MS3
	2nd Step Gain Stage	MS2, MS3, MS4
	2nd/3rd Step Gain Stage	MS3, MS4, MS5
	3rd Step Gain Stage	MS4, MS5, MS6
	Fine Atten/3rd XTL Pole	MS5, MS6, MS7
	3rd XTAL Pole Stage	MS6, MS7, MS8
A5J8	Revision	MS8
	4th XTAL Pole Stage	MS1, MS2, MS3
	Post Amplifier Stage 1	MS2, MS3, MS4
	Post Amplifier Stage 3	MS3, MS4, MS5
	3rd LC Pole Stage	MS5, MS6, MS7
	4th LC Pole Stage	MS6, MS7
A5J9	IFDAC Channels 'A'	MS1
	IFDAC Channels 'B'	MS4
	IFDAC Channels 'C'	MS3
	IFDAC Channels 'D'	MS2
	Latched IF Control Lines	MS5
	Negative 15 V Supply	MS6
	5 Volt Supply	MS7
	10 Volt Reference	MS8
A16J4	Revision	MS8
	Cal Osc Sweep Gen Hardware	MS1, MS2
	Cal Osc Tune Line Test	MS3
	Cal Osc ALC Test	MS4
	Cal Osc Sweep Gen Output	MS6

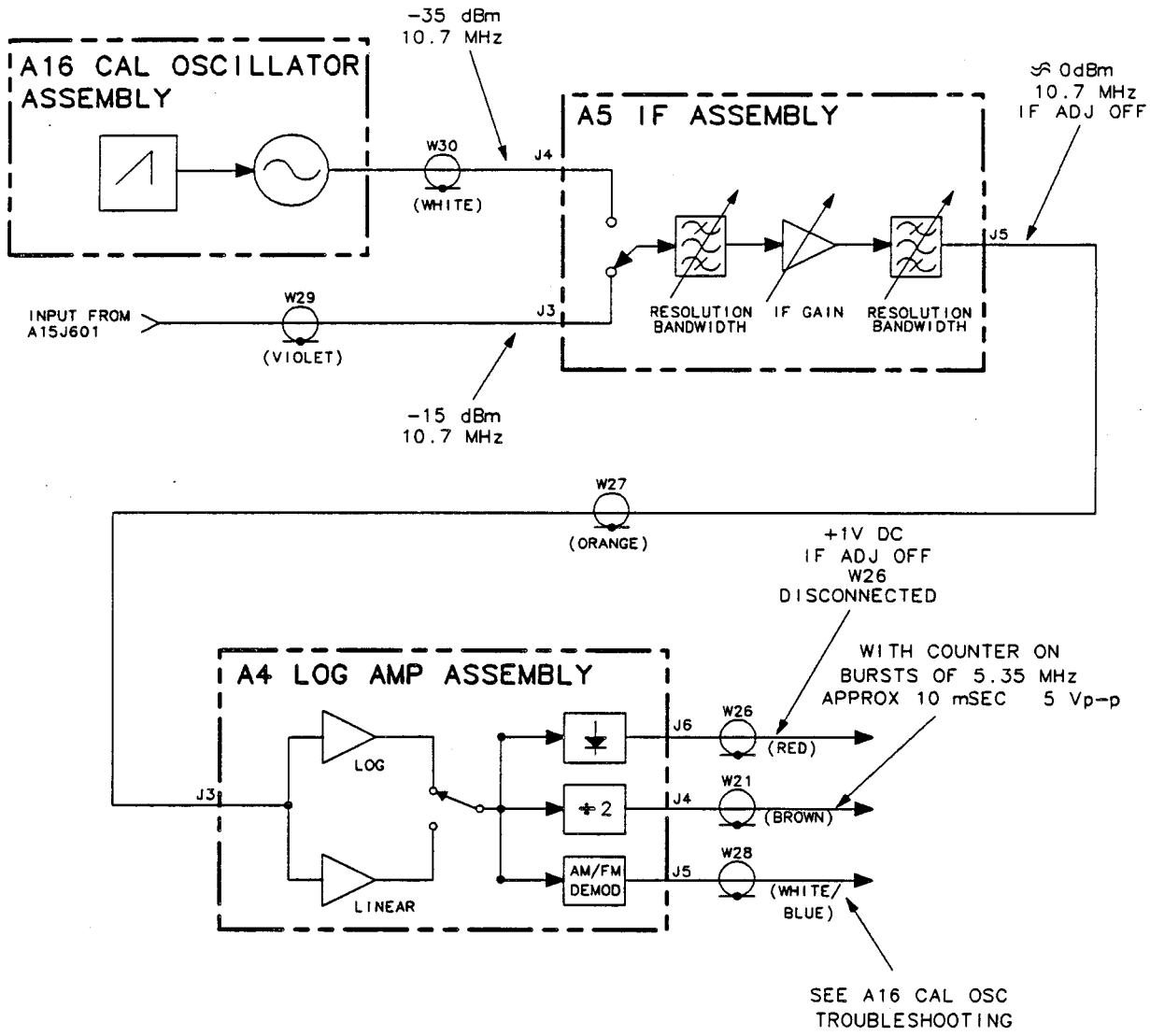


Figure 8-2. IF Section Troubleshooting with TAM

Both the digital control and DACs are multiplexed onto test point "channels" through resistive networks. One DAC from each of the quad-DAC packages feeds into a network. The TAM varies each DAC individually to isolate which ones failed. Similarly, 10 digitally-controlled lines feed into a network and are monitored by the TAM. The channels used to monitor the DACs are listed below:

Channel A: A5J9 pin 1 (MS1)
Channel B: A5J9 pin 3 (MS3)
Channel C: A5J9 pin 4 (MS4)
Channel D: A5J9 pin 2 (MS2)

1. Enter the TAM Cal Osc Troubleshooting Mode.
2. Disconnect W27 (coax 3) from A5J5 and monitor the output of A5J5 with a second spectrum analyzer.

3. Set the other spectrum analyzer controls as follows:

SPAN	5 MHz
REFERENCE LEVEL	+10 dBm
CENTER FREQUENCY	10.7 MHz

4. Set the A16 Cal Oscillator to 10.7 MHz.
5. A +10 dBm signal from A5J5 should be displayed. If the signal is missing, disconnect W30 (coax 9) from A5J4. This is the cal oscillator signal input from the A16 assembly. The signal should be −35 dBm at 10.7 MHz.
6. If the cal oscillator signal is correct, the A5 IF assembly is probably at fault.

Troubleshooting A16 with the TAM

1. Enter the TAM Cal Osc Troubleshooting Mode.
2. On the spectrum analyzer, disconnect W30 (coax 9) from A5J4 and connect W30 to the input of a second spectrum analyzer.
3. Set the controls of the second spectrum analyzer connected to W30 to the following:

SPAN	5 MHz
REFERENCE LEVEL	−30 dBm
CENTER FREQUENCY	10.7 MHz

4. Select each of the fixed-tuned frequencies. Verify at each frequency that the signal amplitude measures −35 dBm. If the frequency is incorrect, do the following:
   a. Verify that the reference divider output (A16U13 pin 9) is 100 kHz. If it is not, verify that the 10 MHz reference is present at A16U13 pin 1.
   b. Verify that the frequency found on the output of the divider (A16U4 pin 15) matches the output of the reference divider. Matching frequencies indicate the oscillator loop is locked. If the loop is not locked, troubleshoot the divider, oscillator, or phase detector.
   c. Verify that the frequency found at the divider input (A16U4 pin 3) matches the CW frequency chosen in step a. Matching frequencies indicate a properly working oscillator. If the frequency is different, troubleshoot the divider.
   d. Repeat step c for all the CW frequencies provided by the test.
5. Select each of the sweep widths (these sweeps are centered about 10.7 MHz).
6. Reduce the span of the other spectrum analyzer to check that the A16 Cal Oscillator is actually sweeping. If the oscillator is not sweeping, perform the following steps:
   a. The output of the sweep generator circuit (A16U10 pin 8 of function block L) should be a series of negative-going parabolas (frequency and amplitude vary depending on the sweep width chosen). Table 8-3 lists the RANGE, MA0, and MA1 values for the sweep widths. If a failure is indicated in the IF/LOG CHECK, press `More Info` to provide more detailed information about the detected failure. If an HP-IB printer is available, connect it to the analyzer HP-IB connector, then press `Print Page` for a hard copy output.

Table 8-3. Sweep Width Settings

Sweep Width	Sweep Time	RES BW Adjusted	RANGE	MA1	MA0
20 kHz	5 ms	10 kHz	+5 V	0 V	0 V
10 kHz	10 ms	3 kHz	+5 V	0 V	+5 V
4 kHz	30 ms	1 kHz	+5 V	+5 V	0 V
2 kHz	60 ms	300 Hz	+5 V	+5 V	+5 V

Automatic IF Adjustment

The spectrum analyzer performs an automatic adjustment of the IF Section whenever needed. The A16 Cal Oscillator provides a stimulus signal which is routed through the IF during the retrace period. The A3 Interface assembly measures the response using its analog-to-digital converter (ADC). The spectrum analyzer turns the A16 Cal Oscillator off during a sweep.

When IF ADJ is ON, the analyzer readjusts part of the IF circuitry during each retrace period to readjust the IF completely every 5 minutes.

Automatic IF adjustment is performed upon the following conditions:

- **Power on:** (unless `STOP ALIGN` is pressed). The IF parameter variables are initialized to values loaded in program ROM and all possible IF adjustments are made. If `STOP ALIGN` is pressed, the adjustment is halted.
- If `REALIGN LO & IF` is selected: All possible IF adjustments (and LO adjustments) are made with the most recent IF parameter variables used as the starting point.
- If `FULL IF ADJ` is selected: All possible IF adjustments are made with the most recent IF parameter variables used as the starting point. (`FULL IF ADJ` is located in the [CAL] menu.)
- If `ADJ CURR IF STATE` is selected: All amplitude data and some resolution bandwidths are adjusted. The bandwidths adjusted are a function of the currently selected resolution bandwidth setting.
- **Between sweeps:** IF ADJ must be set to ON. When IF ADJ is OFF, an `A` is displayed along the left side of the graticule.

If a FULL IF ADJ sequence cannot proceed beyond the amplitude portion, check the output of the A16 Cal Oscillator as follows:

1. Disconnect W30 (coax 9) from A5J4. Connect W30 to the input of a second spectrum analyzer.
2. Set the other spectrum analyzer center frequency to 10.7 MHz and the reference level to −30 dBm.
3. Observe the spectrum analyzer display while pressing `FULL IF ADJ` on the HP 8563A.
4. If a −35 dBm signal does not appear, the A16 Cal Oscillator is probably at fault.

Parameters Adjusted

The following IF parameters are adjusted in the sequence listed:

1. Amplitude
   - A. Video Offsets: analog (using A4 Log Amplifier video offset DAC) and digital (applying stored constant to all readings)
     1. Linear Scale Offset
     2. Log Scale Offset
        - a. Wideband and Narrowband modes.
        - b. 0 to 60 dB range in 10 dB steps.
        - c. 10 dB/DIV and 2 dB/DIV (log expand) modes.
   - B. Step Gains (A5 IF Assembly)
     1. First Step Gain for 16 different DAC settings.
     2. Second Step Gain for 16 different DAC settings.
     3. Third Step Gain for 0, 15, and 30 dB attenuation relative to maximum gain.
     4. Fine Attenuator for 32 evenly-spaced DAC settings.
   - C. Log Amplifier Slopes
     1. Wideband (RES BW 300 kHz through 2 MHz) and Narrowband modes (RES BW 300 Hz through 100 kHz)
     2. 10 dB/DIV and 2 dB/DIV (log expand) modes
   - D. Linear Scale Gains - On A4 Log Amplifier Assembly
   - E. Peak Detector Offsets (both Positive and Negative Peak Detectors with respect to normal sample path used by Auto IF Adjust)
2. LC Bandwidths
   - A. 300 kHz resolution bandwidth center frequency, bandwidth, and gain.
   - B. 1 MHz resolution bandwidth center frequency, bandwidth, and gain.
   - C. 2 MHz resolution bandwidth gain.
   - D. 100 kHz resolution bandwidth center frequency, bandwidth, and gain.
   - E. 30 kHz resolution bandwidth center frequency, bandwidth, and gain.
   - F. Gain of all resolution bandwidth relative to the 300 kHz RES BW.
3. Crystal Bandwidths
   - A. A16 Cal Oscillator sweep rate is measured against the 100 kHz resolution bandwidth filter skirt. This result is used in compensating the sweeps used for adjusting the crystal bandwidths.

B. 10 kHz resolution bandwidth
   1. Center frequency of LC tank that loads the crystal
   2. Symmetry adjustment to cancel crystal case capacitance.
   3. Bandwidth
C. 3 kHz resolution bandwidth: center frequency of LC tank and bandwidth of resolution bandwidth
D. 1 kHz RBW bandwidth
E. 300 Hz RBW bandwidth
F. Gain of all resolution bandwidth relative to the 300 kHz RES BW.

4. DIGITAL BANDWIDTHS (10 Hz through 100 Hz)

A. VCXO (final LO) tuned to align digital bandwidths with crystal bandwidth center frequency.
B. Overall gain.
C. Gain variation with input frequency.

Requirements

For the Automatic IF Adjustment routine to work, the spectrum analyzer must provide the following basic functions:

- Power supplies
- Control signals
- ADC
- 10 MHz Frequency Reference to A16 Cal Oscillator
- A15 RF Assembly isolation from the RF signal during IF adjustment.

A15 RF Assembly isolation is a function of the REDIR signal in the A15 Flatness Compensation Control block.

The references against which the Automatic IF Adjustment routine aligns are:

- 10 MHz reference (A15)
- Linear Scale Fidelity, especially the 10 dB gain stage in A4 Linear Amplifier block.
- 15 dB Reference Attenuator (A5)
- A16 Cal Oscillator output power

Performance Test Failures

Failures in IF-Section-related performance tests may be investigated using the following information.

IF Gain Uncertainty Performance Test

Failure of this performance test indicates a possible problem with the spectrum analyzer IF gain circuits. Assuming no major IF problems causing IF adjustment errors, IF gain problems in the first 50 dB of IF gain (REF LVLs of 0 dBm to −50 dBm with 10 dB ATTEN) are a result of faults on the A5 IF Assembly. IF gain problems in the next 60 dB of IF gain (REF LVLs of −60 dBm to −110 dBm, 10 dB ATTEN) result from faults on the A4 Log Amplifier assembly.

Table 8-4 lists the reference level range available in each band with 0 dB input attenuation. Table 8-5 lists the input required at A5J3 for displaying a signal at top screen with *10 dB* input attenuation and a 0 dBm reference level.

Table 8-4. Available Reference Level Range

Band	Frequency Range (GHz)	Ref. Level Range (dBm) (0 dB Input Atten.)
0	0 to 2.9	−10 to −120
1	2.75 to 6.5	−10 to −120
2	5.9 to 13.0	−10 to −115
3	12.4 to 19.7	−10 to −105
4	19.1 to 22	−10 to −100

Table 8-5. Signal Level for Reference Level Display

Band	Frequency Range (GHz)	Input at A5J3 (dBm) (0 dB Input Atten.)
0	0 to 2.9	−5
1	2.75 to 6.5	−5
2	5.9 to 13.0	−10
3	12.4 to 19.7	−20
4	19.1 to 22	−25

Isolate IF gain problems on A4 Log Amplifier assembly with the following steps:

1. On the spectrum analyzer press (PRESET), (SPAN), ZERO SPAN, (FREQUENCY), 1 (GHz), (AMPLITUDE), 50 (−dBm).
2. Press (CAL), IF ADJ OFF.
3. Disconnect W27 (coax 3) from A5J5 and connect W27 to the output of a signal generator.

4. Set the signal generator controls as follows:

   Amplitude ..... +10 dBm
   Frequency ..... 10.7 MHz

5. Simultaneously decrease the signal generator output and the spectrum analyzer REF LVL in 10 dB steps. The signal displayed by the spectrum analyzer should remain at the reference level for each step. Troubleshoot the A4 assembly if the signal deviates from the reference level.

6. Repeat steps 1 through 4 with the spectrum analyzer set to linear.

Scale Fidelity Performance Test

Failure of this performance test indicates a possible problem with the A4 assembly.

- If the Linear, 5 dB/DIV, or 10 dB/DIV scales are out of specification, the fault is most likely on the A4 Log Amplifier assembly.
- If only the 1 dB/DIV or 2 dB/DIV scales are out of specification, the fault is most likely on the A3 Interface assembly.

Resolution Bandwidths Performance Tests

Most resolution bandwidth problems are a result of A5 IF assembly failures. The resolution bandwidths are adjusted in the following sequence using 300 kHz as the reference: 1 MHz, 100 kHz, 30 kHz, 10 kHz, 3 kHz, 1 kHz, 300 Hz, 100 Hz, 30 Hz, 10 Hz, and 2 MHz.

If the IF adjustment routine encountered an error, the previously adjusted resolution bandwidths should be working properly and default DAC values are used for the remaining resolution bandwidth settings.

If the IF bandpass adjustments and the automatic IF adjustments fail to bring the resolution bandwidths within specification, troubleshoot the A5 IF Assembly.

A4 Log Amplifier Assembly

The A4 Log Amplifier assembly is responsible for several functions. The main signal path consists of either the 90 dB log amplifier or the 40 dB linear amplifier, detector, buffer amplifier, video offset, and video buffer amplifier. Other functions include the Frequency Counter Prescaler/Conditioner, the AM/FM Demodulator, and the down-conversion to 4.8 kHz for digital resolution bandwidths.

The detector is essentially a full wave rectifier. The detector linearity is factory adjusted with R549 and should not be readjusted. The differential amplifier provides gain and does the differential-to-single-ended conversion. The video offset provides 60 dB of apparent IF gain in log mode and also removes offsets from the video amplifiers. The Frequency Counter Prescaler/Conditioner divides the IF frequency by two and converts the signal to HCT levels.

Caution



For troubleshooting, it is recommended that you use an active probe, such as an HP 85024A, and another spectrum analyzer. If an HP 1120A Active Probe is being used with a spectrum analyzer having dc coupled inputs, such as the HP 8566A/B, HP 8569A/B and the HP 8562A/B, either set the active probe for an ac-coupled output or use a dc-blocking capacitor between the active probe and the spectrum analyzer input. Failure to do this can result in damage to the analyzer or the probe.

Log Amplifier

Refer to function blocks B, C, D, E, F, G, H, J, and K of A4 Log Amplifier Schematic Diagram (sheets 2 of 4 and 3 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The log amplifier contains nine gain-limiting stages providing 90 dB of gain. Factory adjustment of each stage optimizes log fidelity. These stages should not be readjusted.

The log amplifiers should not be repaired due to the factory-only log-fidelity adjustments. Use the following steps to verify proper operation of the log amplifier chain:

1. On the spectrum analyzer press (PRESET), (SWEEP), and SINGLE.
2. Remove W27 from A4J3 and inject a 10.7 MHz signal of +10 dBm into A4J3.
3. Check the signal levels at TP405 and TP406. Use an active probe with an HP 8566A/B Spectrum Analyzer set to linear mode.
4. Verify 1 V rms signal levels at TP405 and TP406.
5. Adjust the reference level of the HP 8566A/B to place the signal at the reference level.
6. Reduce the input signal level in 10 dB steps while noting the signal amplitude displayed on the HP 8566A/B. The signal displayed should decrease by one division for each 10 dB step. Troubleshoot the A4 assembly if the signal does not decrease properly.
7. Set the spectrum analyzer resolution bandwidth to 100 kHz to place the wide/narrow filter in narrow mode.
8. Repeat steps 2 through 6.
9. If log fidelity is poor near the bottom of the screen or the 1 MHz resolution bandwidth is narrow, a fault might exist in the wide/narrow filter switch. (Refer to function block I of A4 Log Amplifier Schematic Diagram in the *HP8560A/8561B/8563A Component Level Information* binder.) Check this switch as follows:
   a. Monitor voltages on A4U309 pins 1 and 7 while changing the spectrum analyzer resolution bandwidth from 100 kHz to 300 kHz.
   b. If the voltages do not come within a few volts of the +15 V and −15 V supplies, replace U704 and U309.
   c. Disconnect the HP 8566A/B and reconnect W27 to A4J3.

Linear Amplifiers

Refer to function block N of A4 Log Amplifier Schematic Diagram (sheet 3 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The linear amplifier chain is made up of two common emitter gain stages, a 180° splitter, and four buffer stages. The common emitter stages, U701C and U701D, have programmable gains. The gain of these stages is selected by using switches U701B and U701E to change the emitter load. The gains can be selected by setting the analyzer reference level. The linear amplifier provides 0 dB to 40 dB of IF gain in 10 dB steps.

1. On the spectrum analyzer press (PRESET), (SPAN), ZERO SPAN, (FREQUENCY), 1 (GHz), (AMPLITUDE), 50 (−dBm), LINEAR, MORE, AMPTD UNITS, (dBm), and (AMPLITUDE).
2. Disconnect W27 (coax 3) from A5J5 and connect W27 to the output of a signal generator.
3. Set the signal generator controls as follows:

   Amplitude ..... +6 dBm
   Frequency ..... 10.7 MHz

4. Simultaneously decrease the signal generator output and spectrum analyzer REF LVL in 10 dB steps to −90 dBm. At each step, the signal displayed on the spectrum analyzer should be within one division of the previous position.
5. If there is a problem, isolate it to the linear gains as follows:
6. Set the signal generator amplitude to −30 dBm.
7. Set the spectrum analyzer REF LVL to −50 dBm.
8. Measure the gain from TP101 to TP703 and from TP101 to TP704 using an active probe and another spectrum analyzer. The gains should be approximately 4 dB.
9. Decrease the spectrum analyzer reference level to −90 dBm in 10 dB steps. Verify that the levels at TP703 and TP704 increase by 10 dB with each step.
10. If there is a problem with the linear gains, check the individual stages as follows:
    a. To check the first gain stage, set the reference level to −50 dBm and measure the gain from TP101 to TP701. It should be approximately 1 dB.
    b. Change the analyzer reference level to −80 dBm and verify that the level at TP701 increases by 20 dB.
    c. To check the second gain stage, set the reference level to −50 dBm and measure the gain from TP701 to TP702. It should be approximately 2.5 dB.
    d. Change the reference level to −60 dBm and then −70 dBm and verify that the level at TP702 increases by 10 dB at each setting.
11. Reconnect W27 (coax 3) to A5J5.

Detector

Refer to function block O of A4 Log Amplifier Schematic Diagram (sheet 3 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

Note The detector can only be factory-repaired; replace the A4 assembly if the detector is faulty. Do not adjust R549, the factory-only linearity adjustment.

1. On the spectrum analyzer, press (PRESET), (SWEEP), and SINGLE.
2. Remove W27 (coax 3) from A4J3.
3. The voltages at TP505 and TP506 should measure approximately +2 to +3 V dc.
4. If the difference between the voltages on TP505 and TP506 is much greater than 30 mV, there is a problem with the detector balance; replace the A4 Log Amplifier assembly.
5. Inject 10.7 MHz signal of +10 dBm into A4J3.
6. Decrease the signal in 10 dB steps while observing the voltage at A4TP505. The voltage should decrease by approximately 8 to 9 mV for each 10 dB decrease in input power. If the voltage does not change (or if the change is excessive) replace the A4 assembly.
7. Reconnect W27 (coax 3) to A4J3.

Differential Amplifier

Refer to function block R of A4 Log Amplifier Schematic Diagram (sheet 4 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The differential amplifier is a differential input/single-ended output video amplifier with a gain of 6. The differential amplifier includes two input buffers (U502A and U502B) and operational amplifier U501.

Note U501 may be either a 14 or 8 pin DIP. The 14-pin version is shown on the schematic.

1. On the spectrum analyzer press (PRESET), (CAL), IF ADJ OFF, (SPAN), 300 (Hz).
2. Remove W27 (coax 3) from A4J3.
3. The voltage at U501 pin 10 should be between 0 V dc and −200 mV dc. If the voltage at U501 pin 10 is less than −200 mV dc, check for excessive detector offsets (refer to "Detector" above).
4. Isolate the differential amplifier offset by shorting TP505 to TP506. Check the differential amplifier gain as follows:
   a. Inject a 10.7 MHz signal of 0 dBm into A4J3.
   b. The voltage at U501 pin 10 should decrease 100 mV for a 10 dB decrease in input signal level.
5. Reconnect W27 (coax 3) to A4J3.

Video Offset

Refer to function block S of A4 Log Amplifier Schematic Diagram (sheet 4 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The circuit provides a programmable offset of 161 mV to +485 mV in 5 mV steps.

1. On the spectrum analyzer press [PRESET], [SPAN], ZERO SPAN, [FREQUENCY], 1 [GHz], [AMPLITUDE], 50 [−dBm].
2. Disconnect W27 (coax 3) from A4J3 and connect a signal generator to A4J3.
3. Set the signal generator controls as follows:

   Amplitude ..... +10 dBm
   Frequency ..... 10.7 MHz

4. Simultaneously decrease the signal generator output and spectrum analyzer reference level in 10 dB steps. At each step, the signal displayed on the spectrum analyzer should be close to the reference level.
5. Reconnect W27 (coax 3) to A4J3 and cycle the analyzer power.
6. Press [SWEEP] and SINGLE on the spectrum analyzer.
7. The offset DAC, A4U602, should now be set to its default value, 203 (decimal). In this setting, the voltage difference from TP507 to TP601 should be approximately −90 mV.
8. If this default offset voltage is incorrect, check the operation of the DAC as follows:
   a. Measure the voltage from U602 pin 2 to TP507. The voltage should be approximately 54 mV. If the voltage is incorrect, the fault is either in the DAC, its reference current, or control latch U601.
   b. If the DAC is working properly, check the current source made up of U603B and Q601.

Video Output

1. On the spectrum analyzer press [PRESET], [SPAN], 100 [Hz], [FREQUENCY], 300 [MHz], [AMPLITUDE], 10 [−dBm], and [SGL SWP].
2. Connect the CAL OUTPUT to the INPUT 50Ω.
3. Disconnect W26 (coax 2) from A4J6. Connect a test cable from A4J6 to the input of an oscilloscope.
4. Set the oscilloscope controls as follows:

   Amplitude scale ..... 0 to +1 V
   Coupling ..... dc
   Sweep time ..... 5 ms/DIV

5. The oscilloscope should display a 4.8 kHz sine wave.
6. For resolution bandwidths less than 300 Hz, the video offset, measured at pin 3 of U503, should be approximately 0.37 V dc.
7. For resolution bandwidths greater than 100 Hz in log mode with a reference level of −90 dBm and an input attenuation of 10 dB, the video offset, measured at pin 3 of U503, should be approximately 190 mV. A 10 dB step in reference level to −80 dBm should decrease this voltage by approximately 50 mV.

8. Disconnect the CAL OUTPUT from the INPUT 50Ω.
9. Broadband noise should be displayed on the oscilloscope from approximately +200 mV to +400 mV.
10. As the REF LVL is decreased in 10 dB steps from −10 dBm to −70 dBm, the noise displayed on the oscilloscope should increase in 100 mV increments. If this response is not observed, refer to "Step Gains" and "Video Offset" in this chapter.
11. Reconnect W26 (coax 2) to A4J6.

Frequency Counter Prescaler/Conditioner

Refer to function block P of A4 Log Amplifier Schematic Diagram (sheet 3 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

The Frequency Counter Prescaler/Conditioner converts the IF signal to TTL levels, divides the frequency by two, and then attenuates it. The circuit consists of an input attenuator, 50 dB integrated amplifier (U803), line receiver (U804), frequency divider (U805A), and an output attenuator. The integrated amplifier and line receiver turn on only when the instrument is counting.

AM/FM Demodulator

Refer to function block O of A4 Log Amplifier Schematic Diagram (sheet 4 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The demodulator circuitry on the A4 Log Amplifier produces a low-level audio signal. This audio signal is amplified by the A16 Cal Oscillator assembly. The FM demodulator demodulates narrowband FM (5 kHz deviation) signals. The detector also demodulates AM signals.

1. If demodulation problems occur when the spectrum analyzer is in the frequency domain, perform the Frequency Span Accuracy performance test and, if necessary, the YTO Adjustments procedure.
2. Disconnect W28 (coax 96) from A4J5.
3. Inject a 1 kHz, 50 mV peak-to-peak signal into W28.
4. On the spectrum analyzer press (AUX CTRL), AM/FM DEMOD, AM DEMOD ON, and adjust the volume knob.
5. A 1 kHz tone should be heard through the loudspeaker. If no tone is heard, increase the volume with the volume knob. The volume should increase.
6. If no tone is heard at any volume setting, troubleshoot A16 Cal Oscillator, the loudspeaker, or W5.
7. If an FM signal cannot be demodulated, perform the Demodulator Adjustment procedure. If the output of A4J5 cannot be adjusted for 50 mVp-p as described in the Demodulator Adjustment procedure, troubleshoot the A4 Log Amplifier.

4.8 kHz IF Filters

Refer to function block V of A4 Log Amplifier Schematic Diagram (sheet 4 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

Problems with the 4.8 kHz filters can result in spurious signals appearing 2.88 kHz to 3.52 kHz above the frequency of the desired response. Also, error message 536 may occur when problems exist with the 4.8 kHz IF filters.

Measure the passband of the 4.8 kHz IF Filters as described in the following procedure.

1. On the spectrum analyzer press (CAL), IF ADJ OFF, (SPAN), 300 (Hz).
2. Disconnect W27 from A4J3 and inject a 10.7 MHz signal of −20 dBm into A4J3.
3. Fine-tune the frequency of the signal generator to center the signal on the screen. Set the signal generator to sweep one 2 kHz span about this center frequency. Set the spectrum analyzer to single sweep.
4. Set the HP 8566A/B to 4.8 kHz center frequency and 2 kHz span.
5. Connect the VIDEO OUTPUT (rear panel) of the spectrum analyzer through a 20 dB attenuator and dc block to the input of the HP 8566A/B. Set the sweep time of the HP 8566A/B to 10 seconds.

Caution 

If a dc block is not used, damage to the HP 8566A/B results. The HP 8566A/B and many other spectrum analyzers have dc-coupled inputs and cannot tolerate dc voltages on their inputs.

---

6. Set the HP 8566A/B to single trigger and press TRACE A (CLEAR-WRITE). Trigger a sweep of the HP 8566A/B and the signal generator simultaneously. The HP 8566A/B shows the passband of the 4.8 kHz IF filters. The 3 dB bandwidth of the filters should be 420 Hz ±20 Hz.
7. If continuing to the next procedure, "4.8 kHz and 10.7 MHz IF Filters," press TRACE A (VIEW) on the HP 8566A/B.
8. Reconnect W27 (coax 3) to A4J3.

4.8 kHz and 10.7 MHz IF Filters

1. Connect a 10.7 MHz signal from a signal generator to the input of the A5 IF assembly and decrease the signal generator level to −50 dBm.
2. Fine tune the frequency of the signal generator to center the signal on the screen. Set the signal generator to sweep one 2 kHz span about this center frequency. Set the spectrum analyzer to single sweep.
3. Set the HP 8566A/B to 4.8 kHz center frequency and 2 kHz span.
4. Connect the VIDEO OUTPUT (rear panel) of the spectrum analyzer through a 20 dB attenuator and dc block to the input of the HP 8566A/B. Set the sweep time of the HP 8566A/B to 10 seconds.

Caution Damage to the HP 8566A/B results if a dc block is not used. The HP 8566A/B and many other spectrum analyzers have dc-coupled inputs and cannot tolerate dc voltages on their inputs.

5. Set the HP 8566A/B to single trigger and press TRACE B [CLEAR-WRITE]. Trigger a sweep of the HP 8566A/B and the signal generator simultaneously. The HP 8566A/B shows a 3 dB bandwidth of approximately 320 Hz.
6. To view the bandwidth of the 10.7 MHz IF filters alone, proceed as follows:
   a. If the peak of the active trace (trace B) is not at the same amplitude as the stored trace (trace A), adjust the HP 8566A/B reference level as necessary and repeat step 5.
   b. Press TRACE B [VIEW] on the HP 8566.
   c. On the HP 8566, press [A−B▶A]. The bandwidth of the 10.7 MHz filters is displayed upside down and may have "wings" toward the sides. These "wings" should be ignored.
   d. Press [A=B], DISPLAY LINE [ENTER]. Adjust the display line such that it is at the peak of trace B (the dimmer trace). Press [B−DL▶B]. The signal disappears from the screen; it is actually below the bottom of the screen.
   e. On the HP 8566A/B, press [FREQUENCY SPAN], 0 [Hz], [LOG dB/DIV], 1 [dB], [SWEEPTIME], 50 [ms]. Disconnect the signal from the RF INPUT. Press TRACE A [CLEAR WRITE], [SINGLE].
   f. Press [A−B▶A], [FREQUENCY SPAN], 2 [kHz]. The response should now be displayed right-side up. Ignore any "wings" to the left and right of the passband.
   g. The 3 dB bandwidth should be between 450 Hz and 550 Hz.

10.6952 MHz VCXO

Refer to function block U of A4 Log Amplifier Schematic Diagram (sheet 4 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The purpose of the 10.6952 MHz voltage-controlled crystal oscillator (VCXO) is to provide an LO for down-converting the peak of the 10.7 MHz IF filters passband to 4.8 kHz. Since the peak of the passband of the 10.7 MHz IF filters is 10.7 MHz ±10 Hz, the frequency of the VCXO is between 10.69519 MHz and 10.69521 MHz. This frequency can best be measured at the collector (case) of Q601.

The center frequency of the 300 Hz resolution-bandwidth filters and the 10 Hz to 100 Hz filters should differ no more than 10 Hz. If the center frequency is different by more than this, or if no signal is present in the 10 Hz to 100 Hz resolution-bandwidth settings, troubleshoot the 10.6952 MHz VCXO.

Error message 539 may occur if the VCXO is not oscillating. If problems exist with the VCXO control voltage, error messages 536 or 530 may occur.

Between sweeps the VCXO, at times, is turned off. To prevent the oscillator from turning off, press [PRESET], [FREQUENCY], 0.3 [GHz], [SPAN], 1 [kHz], [SGL SWP].

A5 IF Section

The input switch connects the IF to either the A16 Cal Oscillator or the 10.7 MHz IF output from the A15 RF assembly. The Automatic IF Adjustment uses the A16 Cal Oscillator at instrument turn-on and between sweeps to align the IF filters and step-gain amplifiers. During sweeps the input switch selects the 10.7 MHz IF output from A15.

The LC filters are variable-bandwidth filters that provide resolution bandwidths from 30 kHz to 2 MHz. The Automatic IF Adjustment sets the bandwidths and center frequencies of each filter stage.

The crystal filters are variable-bandwidth filters that provide resolution bandwidths from 300 Hz to 10 kHz. The Automatic IF Adjustment sets the filter bandwidths and symmetry.

The step-gain amplifiers consist of the first step-gain stage, second step-gain stage, and third step-gain stage. These amplifiers provide gain when the analyzer reference level is changed. The amplifiers also provide gain range to compensate for variations in the IF filter gains, which change with bandwidth and environmental conditions, and band conversion loss in the front end. Fixed-gain amplifiers shift the signal levels to lower the noise figure of the IF chain.

The assembly has two variable attenuators. The fine attenuator provides the 0.1 dB reference level steps. The reference 15 dB attenuator provides a reference for automatic adjustment of the step-gain amplifiers and the A4 Log Amplifier assembly. The reference 15 dB attenuator also provides gain for changes in analyzer reference level.

Various buffer amplifiers provide a high-input impedance to prevent loading of the previous filter pole and a low-output impedance to drive the next filter pole.

Digital control signals from the W2 Control Cable, the "analog bus," drive the control circuitry. At the beginning of each sweep the analog bus sets each control line for instrument operation. At the end of each sweep the analog bus sets each control line for the next portion of the Automatic IF Adjustment routine. IF adjustments continuously remove the effects of component drift as the analyzer temperature changes.

The assembly contains a reference limiting amplifier. This amplifier provides a known amount of limiting for the Automatic IF Adjustment routines. (Limiting occurs only during the Automatic IF Adjustment routines.) The LC34_Short switches are open during sweeps. The current in the reference limiter is increased during sweeps to prevent limiting.

Caution



For troubleshooting, it is recommended that you use an active probe, such as an HP 85024A, and another spectrum analyzer. If an HP 1120A Active Probe is being used with a spectrum analyzer having dc-coupled inputs, such as the HP 8566A/B, HP 8569A/B and the HP 8562A/B, either set the active probe for an ac-coupled output or use a dc-blocking capacitor between the active probe and the spectrum analyzer input.

Caution



Do not short control voltages to ground. These voltages are not short-circuit protected. DACs damaged by shorting these voltages might not fail until several weeks after the shorting takes place.

Caution Do not short power-supply voltages to ground. The analyzer power-supply current limiting cannot protect the resistors in series with the power supply.

Note Some transistors have collectors connected to the case. Electrical connection of the case to the collector might not be reliable, making collector voltage measurements on the transistor case unreliable.

IF Signature

1. Disconnect W27 (coax 3) from A5J5.
2. Connect the source connection of a 3 dB power splitter to A5J5. (Minicircuits Model: ZSC J-2-1) Connect one output of the power splitter to the input of an HP 8566A/B Spectrum Analyzer. Connect the other output of the power splitter to cable W27 (coax 3).

Note If a 3 dB power splitter is not available, an SMB tee and an active probe with a 10:1 divider may be substituted. Connect the active probe between the tee and the other spectrum analyzer. The absolute power levels are approximately 17 dB lower than those stated below, due to the elimination of the 3 dB power splitter and the 20 dB loss through the 10:1 divider.

3. Set the HP 8566A/B controls as follows:

REFERENCE LEVEL	+10 dBm
CENTER FREQUENCY	10.7 MHz
SPAN	0 Hz
RESOLUTION BANDWIDTH	300 kHz
VIDEO BANDWIDTH	300 kHz
SWEEP TIME	4.5 s
TRIGGER	Single

4. On the HP 8566A/B press (SHIFT), (trace A blank) to set detector to SAMPLE mode.
5. On the spectrum analyzer, press (PRESET) and set the controls as follows:

CENTER FREQ	300 MHz
SPAN	2 MHz

6. On the spectrum analyzer, press (TRIG), SINGLE, (CAL).
7. Simultaneously press (SINGLE) on the HP 8566A/B and ADJ CURR IF STATE on the spectrum analyzer. The IF signature is displayed on the HP 8566A/B display.
8. Compare the IF signature to the signature of a properly operating spectrum analyzer illustrated in Figure 8-3. If the signatures do not closely resemble each other, a more detailed view of the signature may show the failed hardware.
   a. Set the HP 8566A/B controls as follows:

Sweep Time	0.5 s
dB/DIV	5 dB

b. Simultaneously press SINGLE on the HP 8566A/B and ADJ CURR IF STATE on the spectrum analyzer. Figure 8-4 through Figure 8-8 illustrate detailed IF signatures of a properly operating HP 8563A.

9. Reconnect W27 (coax 3) to A5J5.

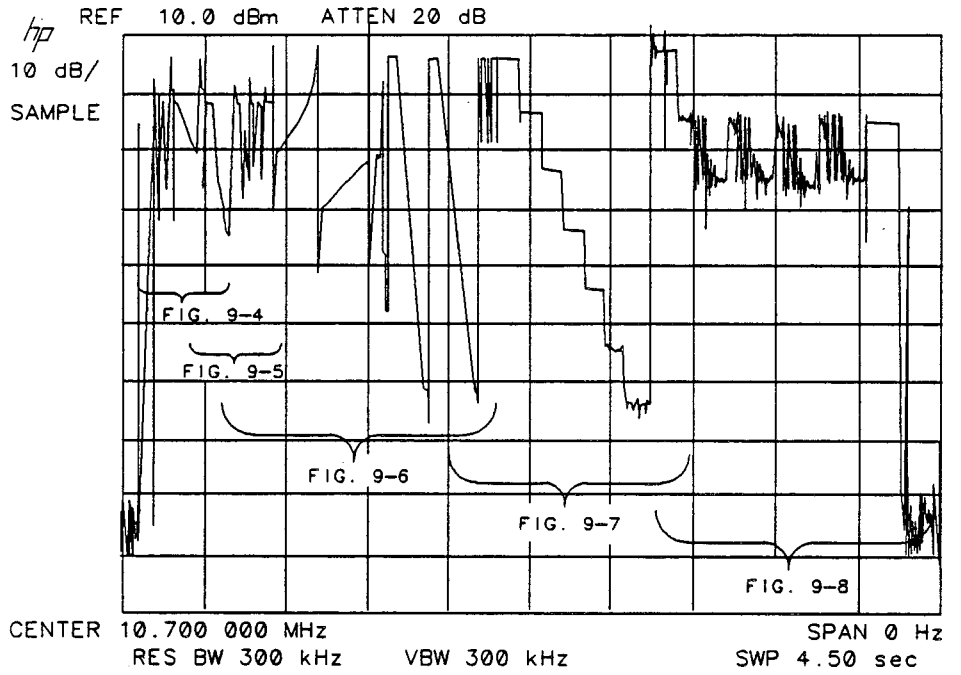


Figure 8-3. IF Adjust Signature

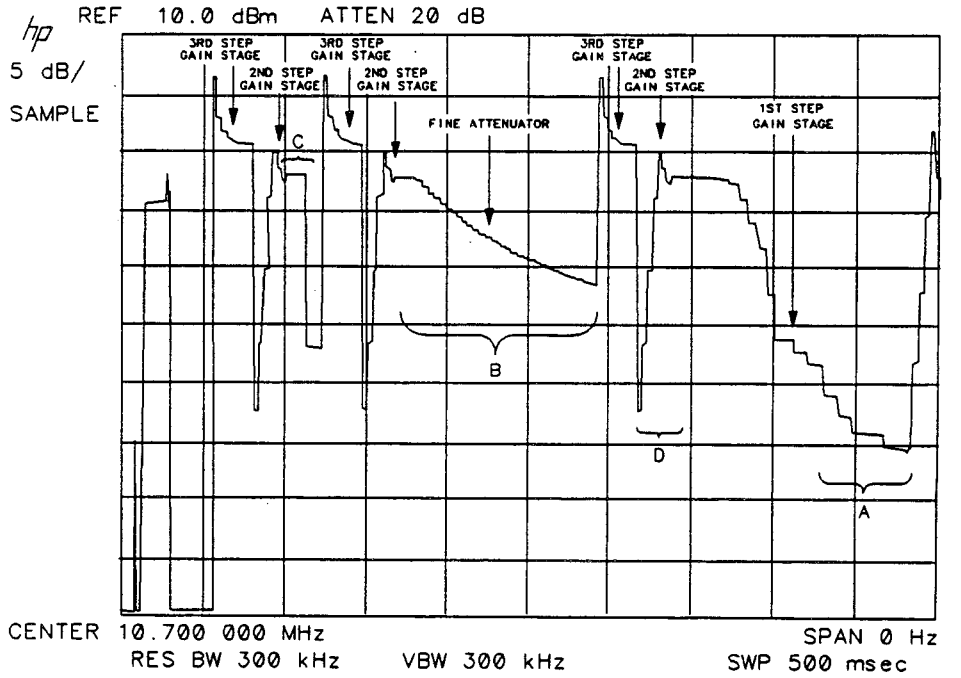


Figure 8-4. Detailed IF Adjust Signature (1)

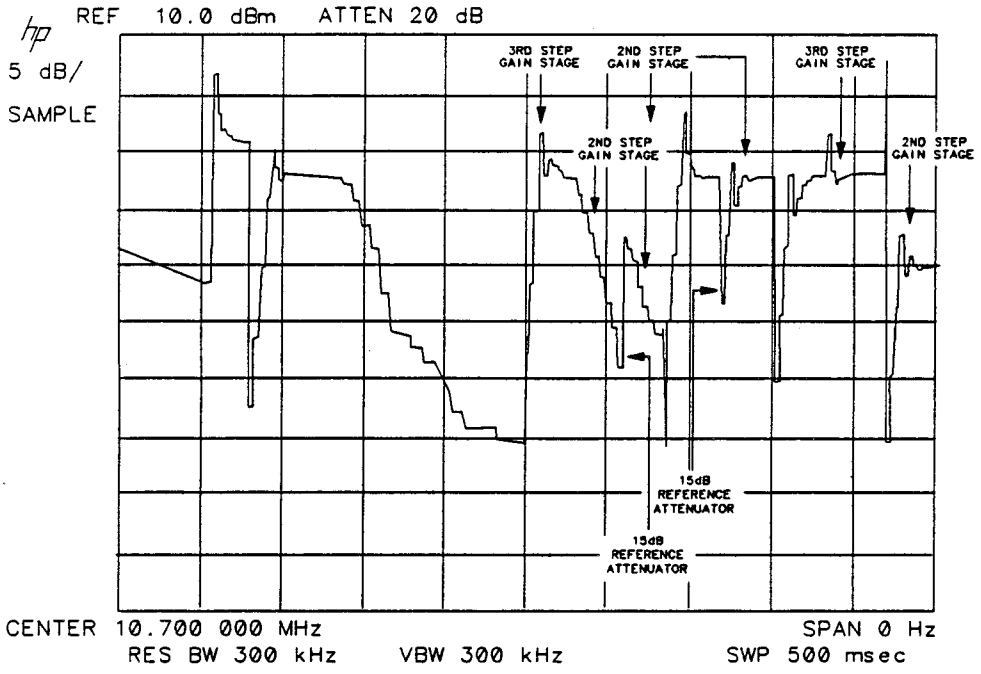


Figure 8-5. Detailed IF Adjust Signature (2)

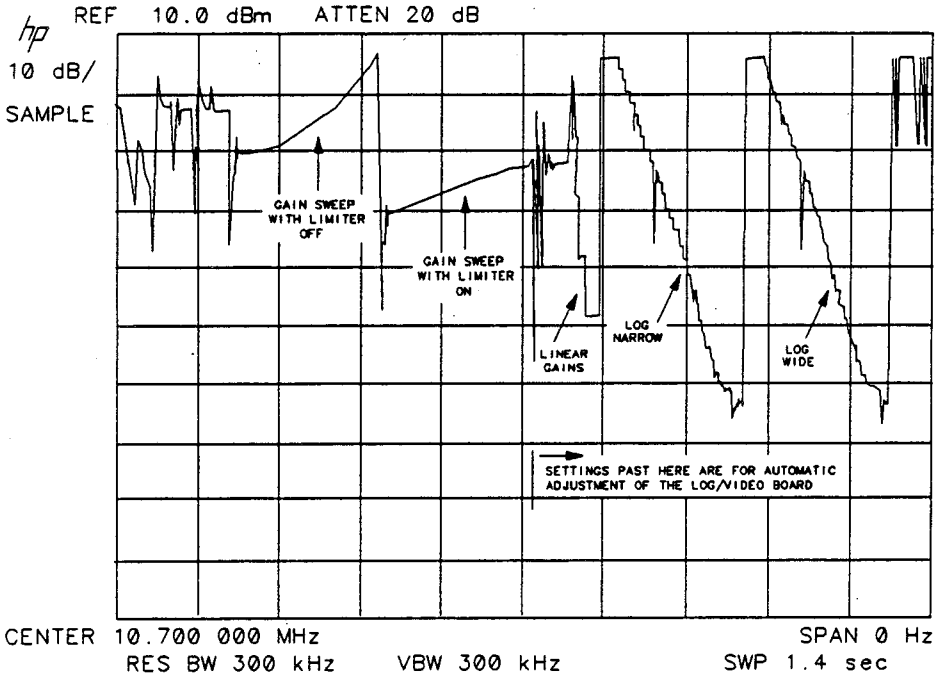


Figure 8-6. Detailed IF Adjust Signature (3)

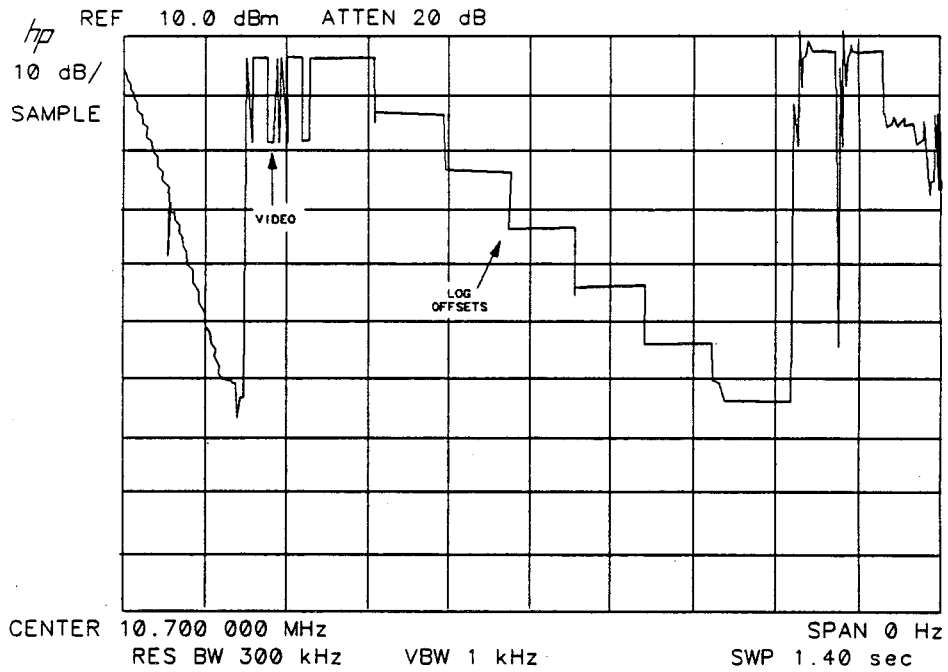


Figure 8-7. Detailed IF Adjust Signature (4)

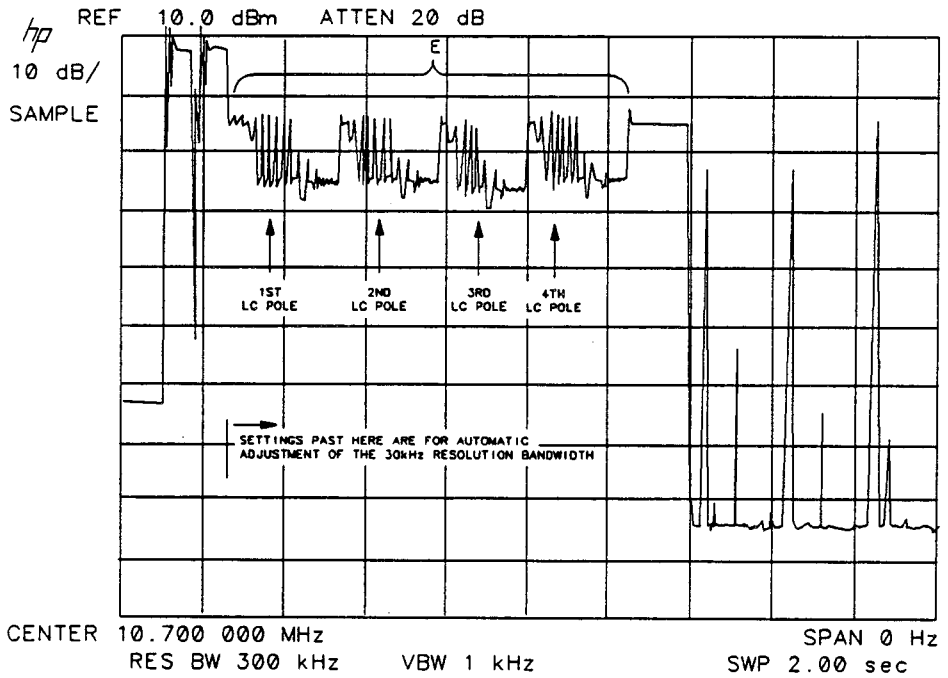


Figure 8-8. Detailed IF Adjust Signature (5)

Common IF Signature Problems

- **Region A of Figure 8-4 is noisy:** Suspect the first LC pole.
- **Region B of Figure 8-4 is flat:** Suspect the third step-gain stage, the fine attenuator, or the fourth LC-pole output amplifier.
- **Region C of Figure 8-4 has no 15 dB step:** Suspect the reference 15 dB attenuator.
- **Region D of Figure 8-4 is flat:** Suspect the second step-gain stage.
- **Entire signature noisy:** If the signature resembles Figure 8-9, suspect a broken first step-gain stage or a break in the signal path in the input switch, first crystal pole, or second crystal pole.
- **Correct shape but noisy:** If the signature resembles Figure 8-10, suspect the second crystal-pole output amplifier.
- **Amplitude of Region B of Figure 8-11 varies more than 12 dB:** Suspect the third step-gain stage output amplifier.
- **Region B of Figure 8-12 is kinked:** Suspect the fourth LC-pole output amplifier.

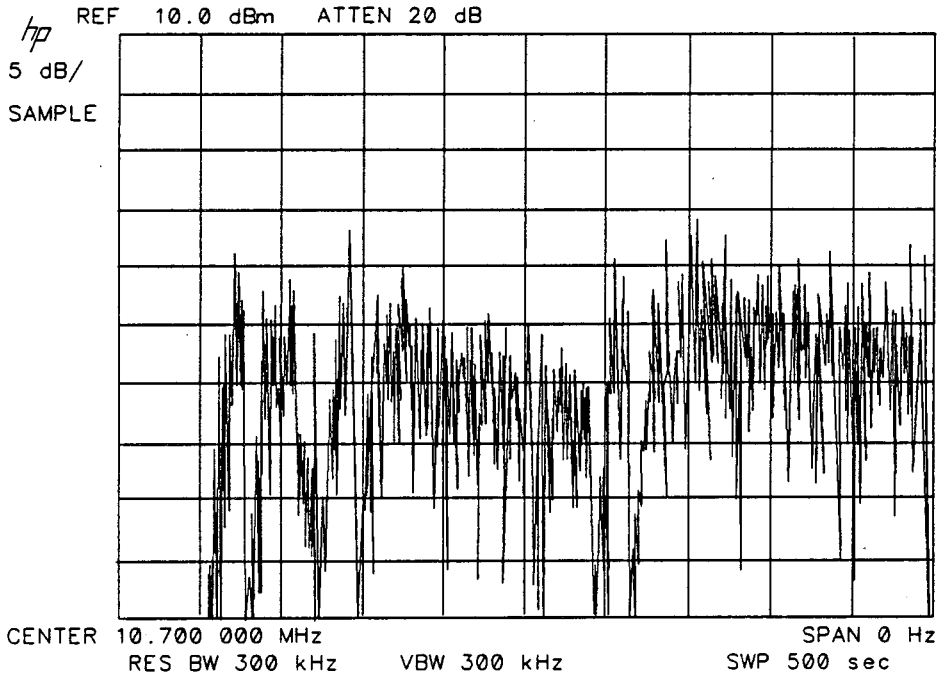


Figure 8-9. Noisy Signature

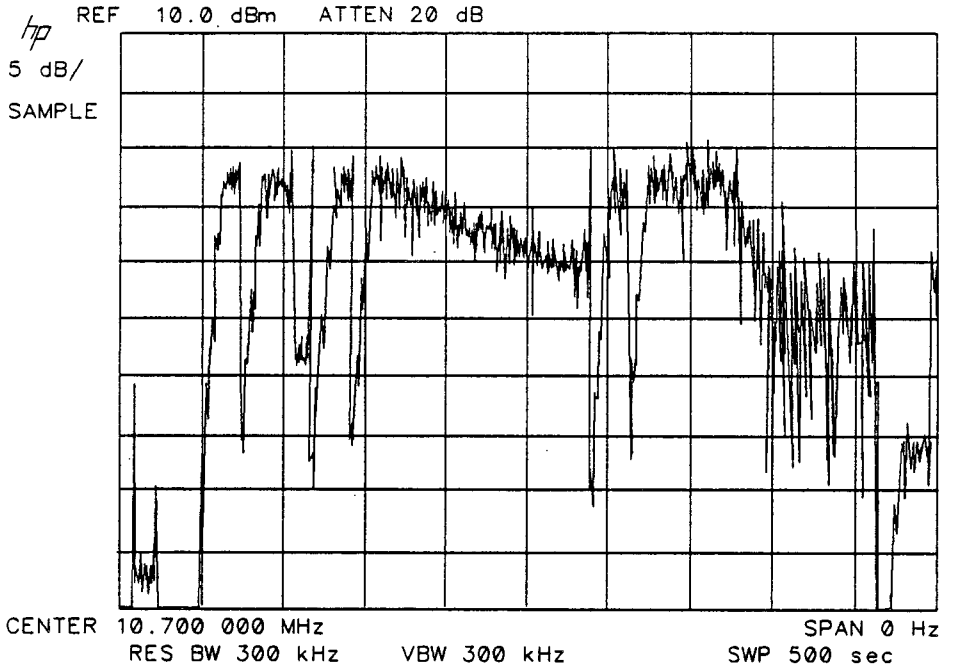


Figure 8-10. Noise with Correct Shape

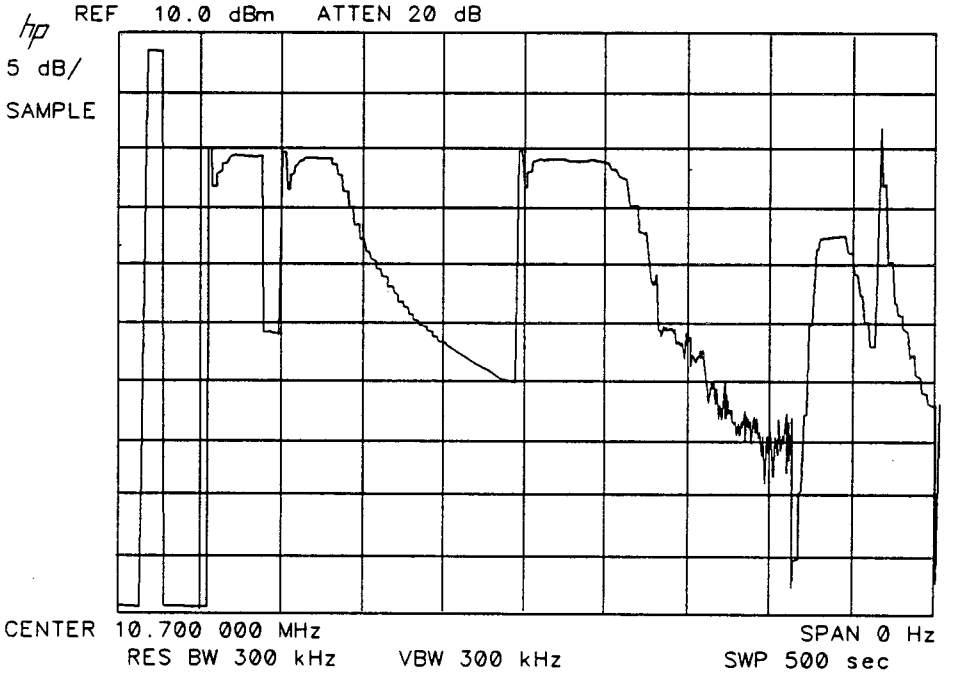


Figure 8-11. Region B Amplitude Variation

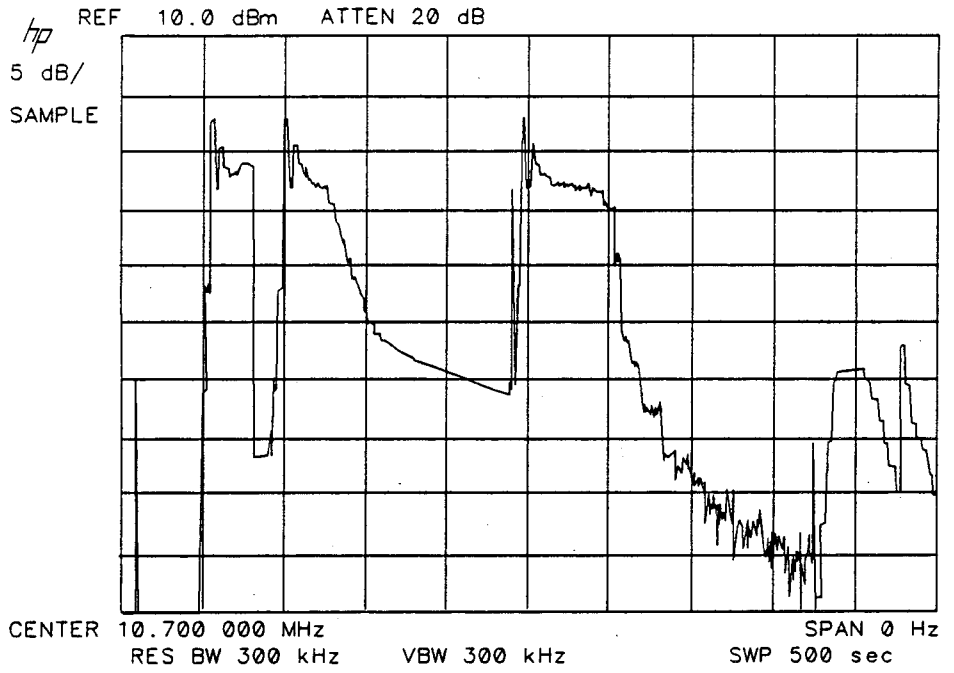


Figure 8-12. Region B Amplitude Offset

1 MHz Resolution Bandwidth Problems

Check the crystal shorting switches as follows:

1. On the spectrum analyzer press (PRESET) and set the controls as follows:

   RES BW ..... 1 MHz
   SPAN ..... 500 kHz
   FREQUENCY ..... 300 MHz

2. On the spectrum analyzer connect the 300 MHz CAL OUTPUT to the INPUT 50Ω.
3. If the trace flatness is not within 2.5 dB, a failure probably exists.
4. A trace similar to Figure 8-13 indicates a crystal short failure.
5. Set the spectrum analyzer (SPAN) to 3 MHz. A trace that slopes across the screen (see Figure 8-14) indicates a failed LC pole. To isolate the broken pole refer to the shape factor information in "30 kHz Resolution Bandwidth Problems."

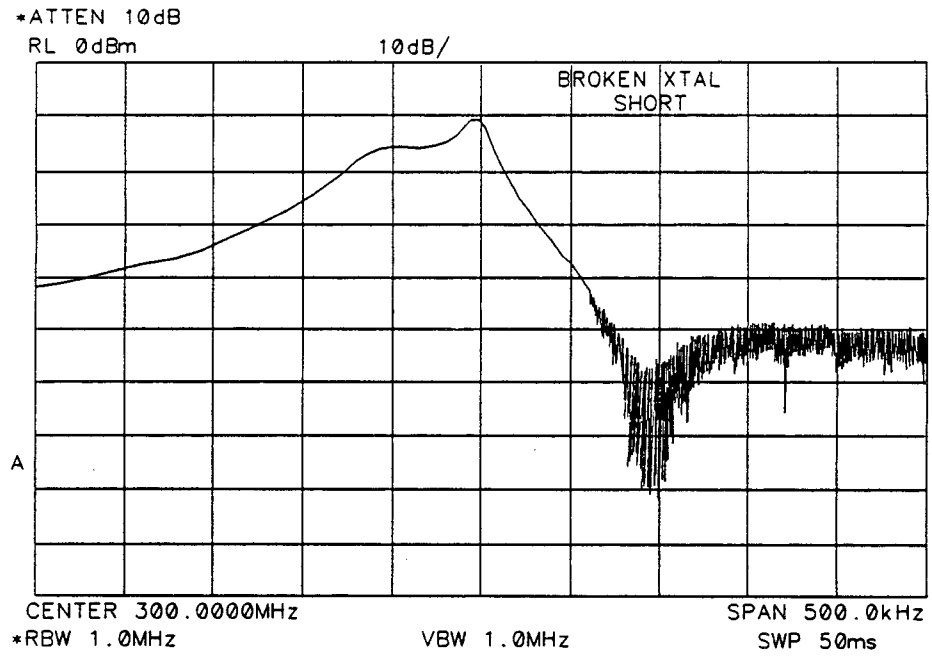


Figure 8-13. Faulty Crystal Short

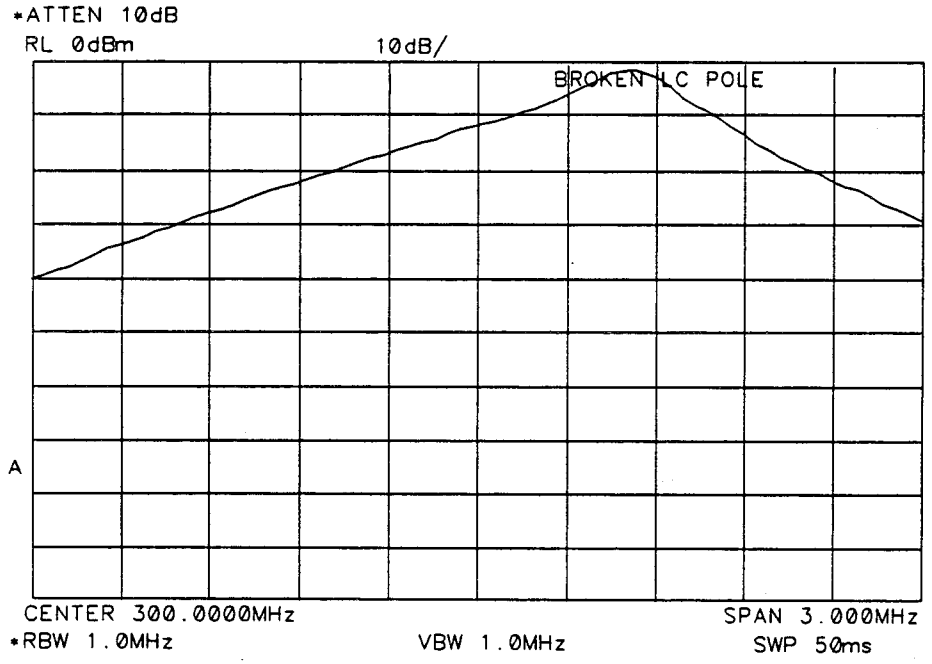


Figure 8-14. Faulty LC Pole

30 kHz Resolution Bandwidth Problems

Shape factor too high: Shape factor is the ratio of the 60 dB bandwidth to the 3 dB bandwidth. Shape factor should be less than 15:1. If one of the LC poles malfunctions, the shape factor may be the only indication of the failure. Isolate the non-functioning pole with the IF signature. Region E of Figure 8-8 illustrates the four LC- pole adjustments. Take several signatures to examine the LC-pole adjustments. If one of the four sections of Region E is consistently longer than the others, the corresponding LC pole is faulty.

IF gain compression: FET transistors Q301, Q303, Q700, and Q701 can deteriorate with age. Measuring less than 0 volts on the FET source indicates a bad FET.

Bandwidth too wide: Check for contamination on the printed-circuit board. Clean the board as required.

3 kHz and 10 kHz Resolution Bandwidth Problems

Asymmetric Filter Response: Check the crystal symmetry control with the following steps.

1. Press (PRESET).
2. Set the spectrum analyzer controls as follows:

RES BW	3 kHz
SPAN	100 kHz
FREQUENCY	100 kHz

3. On the spectrum analyzer, connect the 300 MHz CAL OUTPUT to the INPUT 50Ω.
4. A trace similar to Figure 8-15 indicates a failed crystal-symmetry circuit.

Narrow 10 kHz resolution bandwidth: Check for printed-circuit board contamination. Clean the board as required.

IF Gain Compression in 10 kHz resolution bandwidth: FET transistors Q202, Q203, Q501, and Q503 can deteriorate with age. Measuring less than 0 volts on the FET source indicates a bad FET.

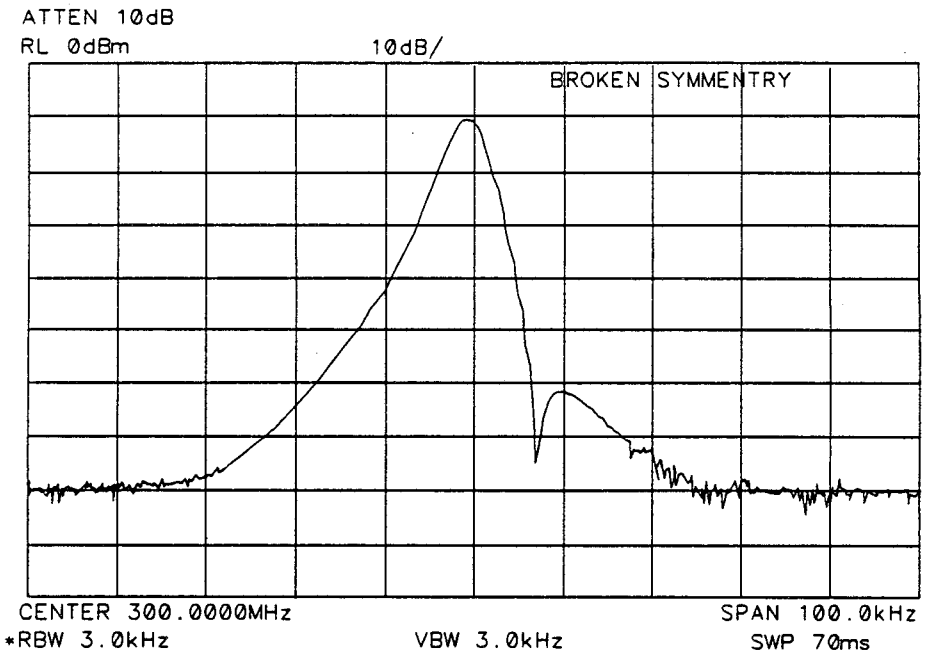


Figure 8-15. Faulty Crystal Symmetry

Step Gains

Refer to function blocks B, H, and I of A5 IF Filter Schematic Diagram (sheets 1 of 3 and 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. On the spectrum analyzer press (PRESET), (SPAN), ZERO SPAN, (FREQUENCY), 1 (GHz).
2. Press (CAL), IF ADJ OFF.
3. Disconnect W29 (coax 7) from A5J3 and W27 (coax 3) from A5J5.
4. Inject a −5 dBm, 10.7 MHz signal into A5J3.
5. Monitor the output of A5J5 with another spectrum analyzer.
6. Simultaneously decrease the signal generator output and spectrum analyzer reference level in 10 dB steps.
7. At each step, the signal displayed on the other spectrum analyzer should be close to +10 dBm. (More subtle IF gain problems might require smaller signal generator and reference level steps.)
8. Reconnect W29 to A5J3 and W27 (coax 3) to A5J5.

A16 Cal Oscillator Assembly

The A16 Cal Oscillator supplies the stimulus signal for Automatic IF adjustments. Normally, the oscillator operates only during retrace (for a few milliseconds) to adjust part of the IF. (All IF parameters are to be readjusted about every 5 minutes.) With continuous IF adjust ON, a group of IF parameters are adjusted during each retrace period (non-disruptive). If continuous IF adjust is OFF, the most recent IF calibration data is used.

The IF parameters adjusted include step gains, log amplifier gain and offset, bandwidth centering, 3 dB bandwidth, bandwidth amplitude, and crystal-filter symmetry.

A16 provides three output frequencies (all −35 dBm):

- 10.7 MHz
- 9.9 to 11.5 MHz in 100 kHz steps
- Frequency sweeps from 20 kHz to 2 kHz centered at 10.7 MHz (lasting 5 to 60 ms respectively)

The signals perform the following functions:

- Adjust gains, log amps, and video slopes and offsets.
- Adjust 3 dB bandwidth and center frequencies of LC resolution bandwidth filters (30 kHz through 1 MHz).
- Adjust 3 dB bandwidth, symmetry, and gain of the crystal resolution bandwidth filters (300 Hz through 10 kHz).

The cal oscillator uses a phase-locked loop (PLL). The oscillator (function block B) is locked to the instrument 10 MHz reference. The reference divider (function block C) divides the reference and delivers a 100 kHz logic signal to the phase detector (function block D). The divide-by-N circuitry (function block G) divides the oscillator output of 9.9 MHz to 11.5 MHz (by 99 to 115) resulting in a 100 kHz output to the phase detector. When the cal-oscillator PLL is locked, narrow positive and negative of equal width pulses occur at the phase detector output. Since the phase detector drives a low-input impedance at the loop integrator, observe the positive pulses at A16CR5 anode and negative pulses at A16CR3 cathode.

The loop integrator acts as a low-pass filter that filters the pulses and inverts the result. If the anode of CR5 is more positive (with respect to ground) than the cathode of CR3 is negative, the loop integrator output should saturate to approximately −13 V. Conversely, if the anode of CR5 is less positive than the cathode of CR3 is negative, the integrator should saturate to a positive voltage.

Note



If error messages `581 AMPL` or `582 AMPL` appears, refer to error message 582 AMPL in Chapter 6 and perform the procedure provided.

1. The oscillator output frequency should exceed 11.5 MHz if the CAL OSC TUNE line, A16U10 pin 14, exceeds +9 V. The oscillator frequency should be less than 9.9 MHz if CAL OSC TUNE is below −9 V. The oscillator only operates when LCAL_OSC_ON is low (0 V).

2. If A16 remains locked (no error code 499 displayed) but does not have the correct output level, troubleshoot the A16 assembly output leveling circuitry (function blocks C, D, E, F and H) or output attenuator (function block I).

Cal Oscillator Unlock at Beginning of IF Adjust

1. Turn the spectrum analyzer (LINE) switch OFF and then ON. The words IF ADJUST STATUS appear on the display 10 seconds after the instrument is turned on (assuming the rest of the instrument is working correctly). Immediately observe the lower right corner of the display for error messages. If the message ERR 499 CAL UNLK appears (before errors ERR 561, 562 and 565), the cal oscillator is unable to phase-lock. Expect to see the ERR 499 message for only about 1 second.
2. If the spectrum analyzer registers an unlocked cal oscillator, continue with step 3 to verify the presence of externally supplied signals.
3. Check A16U13 pin 9 for a 100 kHz TTL-level square wave verifying operation of U13, Q3, and the 10 MHz input signal from J1.
4. Check the +15 VF, +5 VF and −15 V power supplies, and +10 V reference on the A16 assembly.
5. Check that A16U3 pin 5 (LCAL_OSC_ON) becomes TTL low (0 V) at the start of a FULL IF ADJ (press (CAL) and FULL IF ADJ). The phase modulation output at A16U10 pin 8 should also remain at 0 volts. If these checks are correct, troubleshoot blocks A, B, G, and J. See Figure 9-25, A16 Cal Oscillator Block Diagram.

Inadequate CAL OSC AMPTD Range (A16R32)

Refer to function block E of A16 Calibration Oscillator Schematic Diagram in the *HP8560A/8561B/8563A Component Level Information* binder.

1. If A16R32, CAL OSC AMPTD, has inadequate range to perform the IF Amplitude Adjustment, press (CAL).
2. Rotate R32 fully clockwise and disconnect W30 (coax 9) from A5J4.
3. Connect A5J4 to the input of a second spectrum analyzer.
4. Set the other spectrum analyzer controls as follows:

   Center Frequency ..... 10.7 MHz
   Reference Level ..... −30 dBm

5. Observe the spectrum analyzer display while pressing FULL IF ADJ. The signal level should be above −34.55 dBm. If the signal level is incorrect, continue with step 7.
6. Rotate R32 fully counterclockwise. The signal should be below −36.25 dBm. If the signal level is correct at both settings, troubleshoot the A5 IF assembly. If the signal level is incorrect, continue with step 7.
7. Troubleshoot the ALC loop on this assembly using the following steps:
   a. Connect a positive DVM probe to A16J4 pin 4.
   b. On the spectrum analyzer press (CAL).

c. Press FULL IF ADJ. Observe the DVM reading between the displayed messages IF ADJUST STATUS: 300 kHz RBW and IF ADJUST STATUS: 3 kHz RBW. During this time period, the voltage should be within a 2 to 10 V dc range.
d. Observe the DVM reading while IF ADJUST STATUS: AMPLITUDE is displayed. The reading should be within the 2 to 10 V dc range.
e. If the DVM reading is outside the range in step c but inside the range in step d, suspect one of the filter-reactive components.

8. If the ALC loop is working correctly (J4 pin 4 within the test tolerances given), then either the output attenuator is defective, or U5B pin 5 (in ALC loop integrator) is outside of its +3 to +6 V dc range.
9. Reconnect W30 (coax 9) to A5J4.

300 Hz to 3 kHz Resolution Bandwidth Out of Specification

1. If the 3 dB bandwidth of one of these filters is incorrect, suspect a failure of one of the five available sweeps from A16 sweep generator (function block L). These sweeps are generated by changing the switch settings of U7 which routes signals through U11 and U12.
2. Disconnect W30 (coax 9) from A16J2.
3. Connect the source connection of a 3 dB power splitter (Minicircuits Model: ZSC J-2-1) to A16J2. Connect one output of the power splitter to the input of an HP 8566A/B Spectrum Analyzer. Connect the other output of the power splitter to cable W30 (coax 9).

Note

If a 3 dB power splitter is not available, an SMB tee and an active probe may be substituted. Connect the active probe between the tee and the other spectrum analyzer. The absolute power levels are approximately 3 dB higher than those stated below, due to the elimination of the 3 dB power splitter.

4. Press (INSTR PRESET) on the HP 8566A/B and set the controls as follows:

CENTER FREQUENCY	10.8 MHz
SPAN	0 Hz
REFERENCE LEVEL	−43 dBm
RESOLUTION BANDWIDTH	100 kHz
VIDEO BW	10 kHz
SWEEP TIME	50 ms
SCALE	1 dB/DIV
SWEEP	SINGLE

5. On the spectrum analyzer, press (PRESET), (CAL).
6. Press FULL IF ADJ. When the display reads ADJUSTING IF: 10 kHz RBW, press (SINGLE) on the HP 8566A/B.
7. The HP 8566A/B screen illustrates frequency versus time of the A16 output sweeps. See Figure 8-16. The slope of the HP 8566A/B 100 kHz resolution bandwidth is used to detect frequency changes. Sweeps that vary (greater than 30%) from the normal levels, trigger error code 581 or 582.

8. Press FULL IF ADJ. When the display reads ADJUSTING IF: 3 kHz, press (SINGLE) on the HP 8566A/B.
9. Figure 8-17 illustrates normal operation. Severe failures (slope error greater than 30%) and subtle 3 kHz resolution bandwidth errors (less than 30%) indicate a problem with A16 U7, U11, and U12.
10. Severe failure of the bandwidth accompanied by subtle errors in the A16 output signal indicate an A5 failure.
11. Set the HP 8566A/B controls as follows:

    RESOLUTION BANDWIDTH ..... 10 kHz
    VIDEO BW ..... 1 kHz
    SWEEP TIME ..... 200 ms

12. On the spectrum analyzer, press FULL IF ADJ. When the message IF ADJUST STATUS:1 kHz RBW appears, press (SINGLE) on the HP 8566A/B.

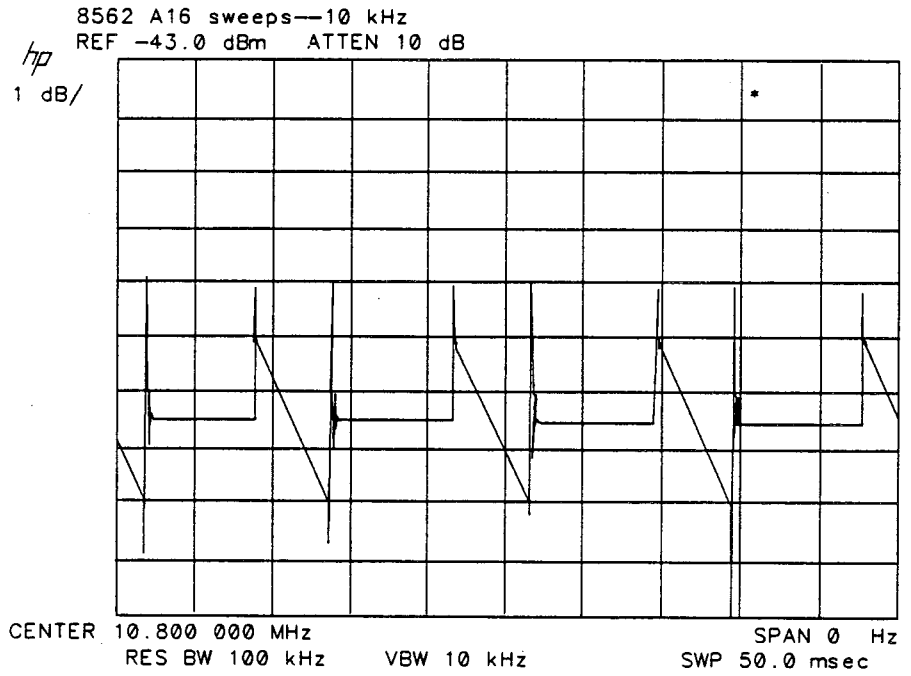


Figure 8-16. Output Waveform, 10 kHz Resolution Bandwidth

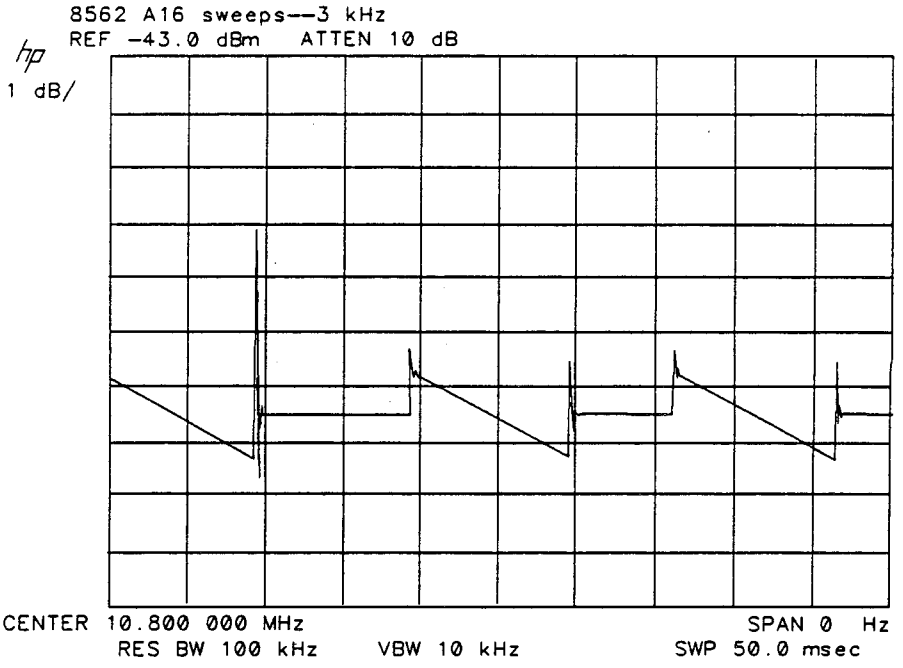


Figure 8-17. Output Waveform, 3 kHz Resolution Bandwidth

13. Figure 8-18 illustrates normal operation. Severe failures (slope error greater than 30%) and subtle 3 kHz resolution bandwidth errors (less than 30%) indicate a problem with A16U7, U11, and U12.
14. On the spectrum analyzer, press **FULL IF ADJ**. When the message **IF ADJUST STATUS: 300 Hz RBW** appears, press (SINGLE) on the HP 8566A/B.
15. Figure 8-19 illustrates normal operation. Severe failures (slope error >30%) and 3 kHz resolution bandwidth errors (less than 30%) indicate a problem with A16U7, U11, and U12.
16. Reconnect W30 (white) to A16J2.

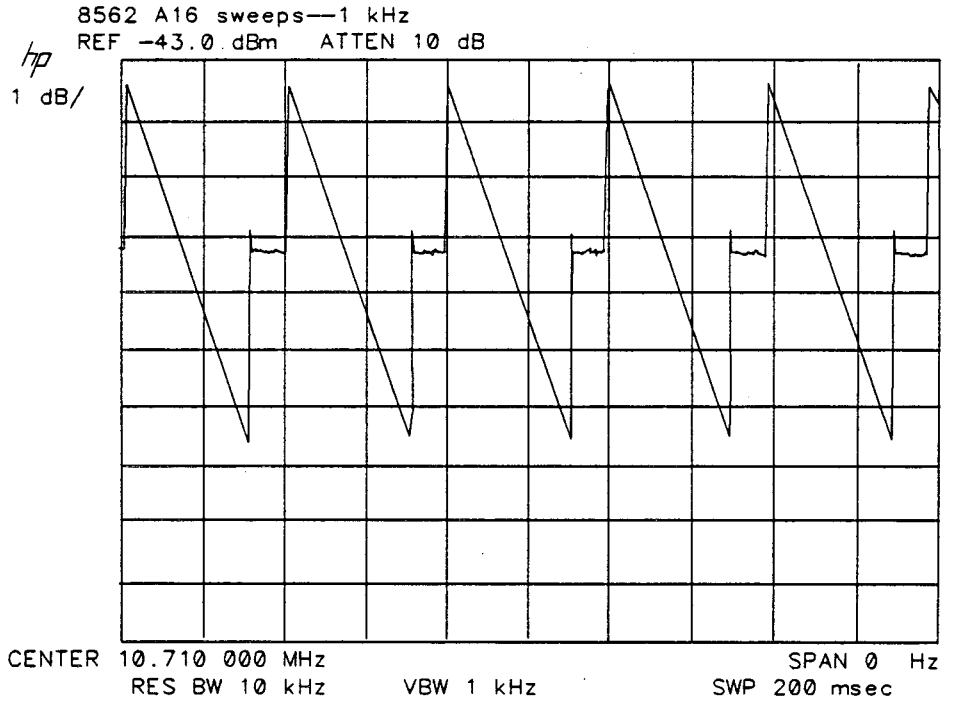


Figure 8-18. Output Waveform, 1 kHz Resolution Bandwidth

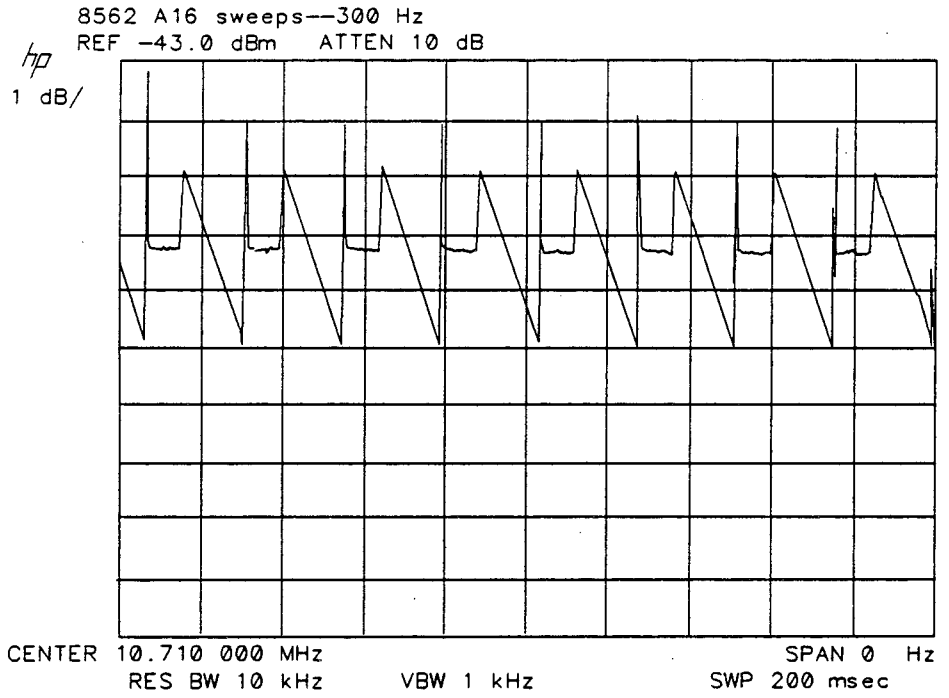


Figure 8-19. Output Waveform, 300 Hz Resolution Bandwidth

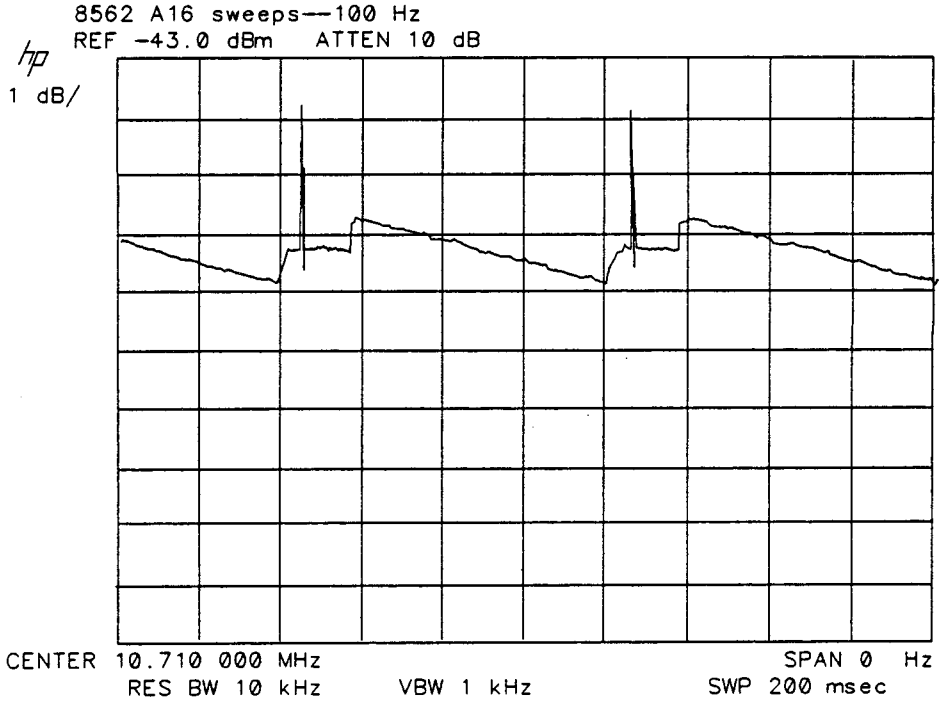


Figure 8-20. Failed Crystal Set Symptoms

Low-Pass Filter

Refer to function block D of A16 Calibration Oscillator Schematic Diagram in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Connect a DVM positive probe to A16J4 pin 4.
2. On the spectrum analyzer, press (CAL).
3. Press FULL IF ADJUST. Observe the DVM reading between the displayed messages IF ADJUST STATUS: 300 kHz RBW and IF ADJUST STATUS: 3 kHz RBW. During this time period, the voltage should be within a 2 to 10 V dc range.
4. Observe the DVM reading while IF ADJUST STATUS: AMPLITUDE is displayed. The reading should be within the 2 to 10 V dc range.
5. If the DVM reading is outside the range in step 3 but inside the range in step 4, suspect one of the filter reactive components.

Sweep Generator

Refer to function block L of A16 Calibration Oscillator Schematic Diagram in the *HP8560A/8561B/8563A Component Level Information* binder.

A properly operating sweep generator generates a series of negative-going parabolas. Before the sweep, switches U9B and U9D turn on, shorting C15 and C14 (the output is at 0 volts). These switches open to start the sweep. The output of U10A, pin 1, is 0.35 V to 10 V, depending on the sweep width selected by U7A and U9A. This voltage appears across R31. Capacitor C15 integrates the current through R31. The output of U10B is a straight, negative-going ramp. Capacitor C14 and resistor R25 integrate the output of U10A which starts a negative ramp (U10C) at the beginning of the sweep. The ramp from U10B is added to the current in R25 via U7B. Integrating this ramp results in the parabolic output waveform.

AM/FM Demodulation, Audio Amplifier, and Speaker

Refer to function blocks M and N of A16 Calibration Oscillator Schematic Diagram in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Set an AM signal generator controls as follows:

Frequency	100 MHz
Amplitude	−6 dBm
Modulation Type	80% AM
Modulation Frequency	400 Hz

2. Set the spectrum analyzer controls as follows:

CENTER FREQ	100 MHz
SPAN	0 Hz
SWEEP TIME	50 ms
REF LVL	0 dBm
RES BW	10 kHz
SCALE	LINEAR

3. Adjust the spectrum analyzer reference level and center frequency to display the 400 Hz modulation frequency eight divisions peak-to-peak.

4. On the spectrum analyzer press (AUX CTRL), AM/FM DEMOD, AM DEMOD ON, and set the sweep time to 5 seconds.
5. Vary the volume and listen for the variation in speaker output level. Clipping is normal on the highest settings.
6. If the audio is not working correctly, disconnect the cable W28 connecting the audio signal from A4 to A16 at A4J5.
7. Monitor the signal at A4J5 with an oscilloscope. The signal should be 190 mV rms ±25%. If the signal measures outside these limits, troubleshoot the A4 assembly.
8. If the signal is correct, troubleshoot W28, the loudspeaker cable, and the A16 assembly.

LOG AMPLIFIER BLOCK DIAGRAM

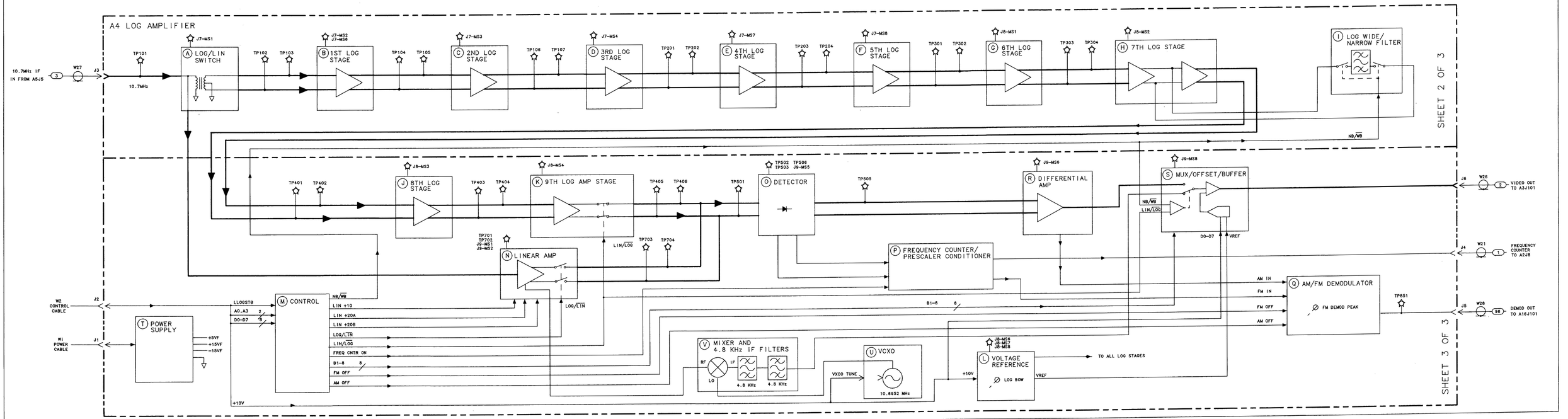


FIGURE 8-21. A4 LOG AMPLIFIER BLOCK DIAGRAM

IF ASSEMBLY BLOCK DIAGRAM

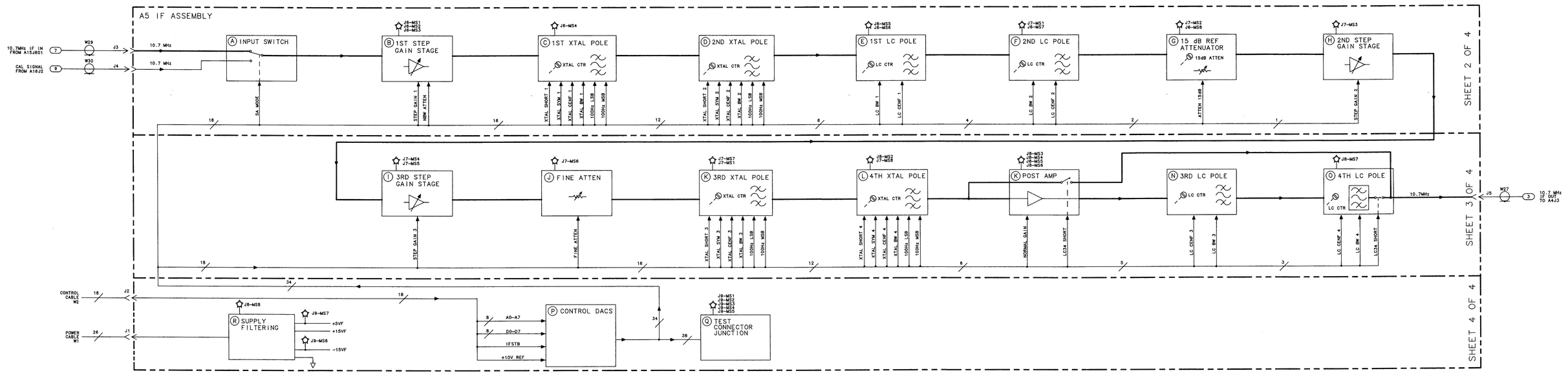


FIGURE 8-22. A5 IF ASSEMBLY BLOCK DIAGRAM

CAL OSCILLATOR BLOCK DIAGRAM

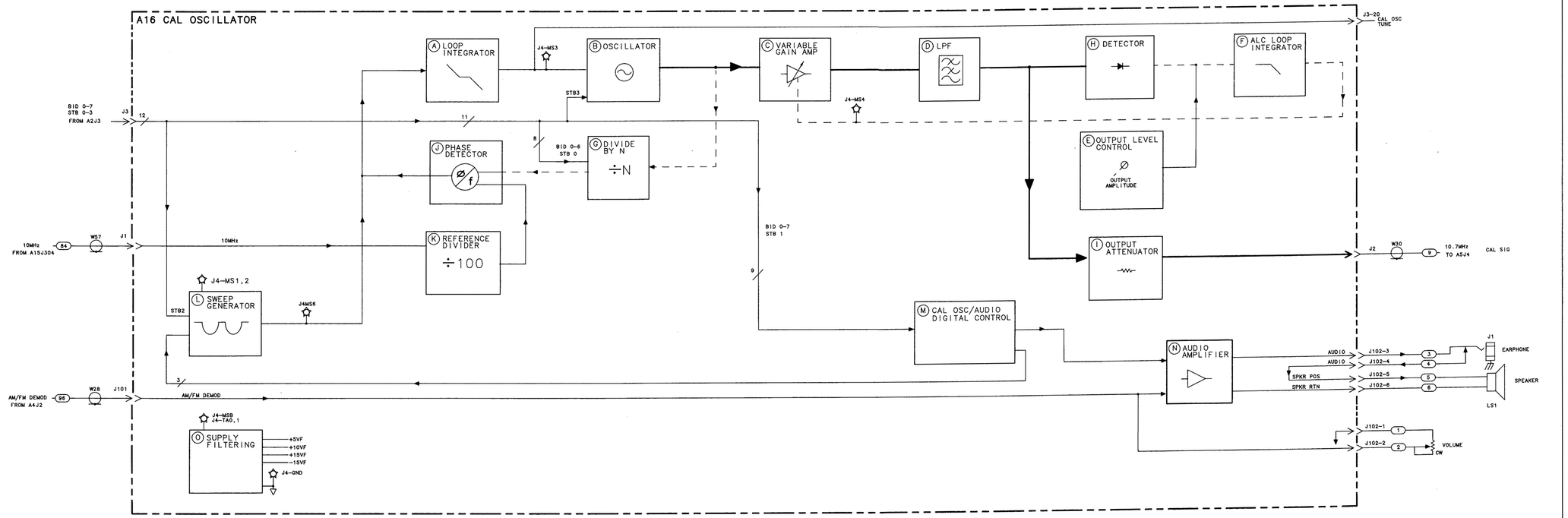


FIGURE 8-23. CAL OSCILLATOR BLOCK DIAGRAM

9

Controller Section

The Controller Section includes the A2 Controller assembly, A19 HP-IB assembly, and BT1 Battery. The presence of a display (graticule and annotation) verifies that most of A2 Controller assembly is operating properly.

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Note



When measuring voltages or waveforms, make ground connections to A2TP3. The metal board-standoffs are not grounded and should not be used when taking measurements.

Troubleshooting Using the TAM

Table 9-1 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 9-1 illustrates the location of the A2 test connectors.

Table 9-1. TAM Tests Versus Test Connectors

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A2J11	ADC/MUX Test	MS1, MS3 through MS6, MS8
	DAC Test	MS2, MS7, OS1
A2J201	10 Volt Reference Test	MS4
	Switch Drive Test	MS8
	Buffered X & Y DAC Outputs	MS2, MS7
	X Line Gen Test	MS6
	Y Line Gen Test	MS1
	Intensity Offset Output	MS3
A2J202	Revision	MS1
	X, Y, & Z Output Offset	MS3, MS4, MS7
	X Output Amplifier	MS3
	Y Output Amplifier	MS7
	Blanking Test	MS8
	Focus DAC Test	MS2

Blank Display

Use the following procedure if the instrument display is blank. This procedure substitutes an HP-IB printer for the display.

1. Connect the printer to the spectrum analyzer and set the printer address to the value required by the TAM. This is usually 1.
2. All of the power-supply indicator LEDs along the edge of the A2 Controller assembly should be lit. The rear-panel CRT +110 VDC ON indicator might not be lit.
3. Connect the TAM-probe cable to A2J11.
4. Press (MODULE), press the third softkey from the top, press (▼), and then press the first softkey (top key).

Note



The softkeys have different labels depending on the version of TAM you have; therefore, they will be referred to by their position on the instrument.

5. The yellow LED next to A2J11 should blink approximately 10 times. If the LED fails to blink correctly, troubleshoot the digital section of the A2 Controller assembly.
6. Move the probe cable to A2J202. Press the first softkey and wait 5 seconds.
7. Press the fourth softkey. The results should be sent to the printer.
8. Move the probe cable to A2J201, press the first softkey and wait 5 seconds.

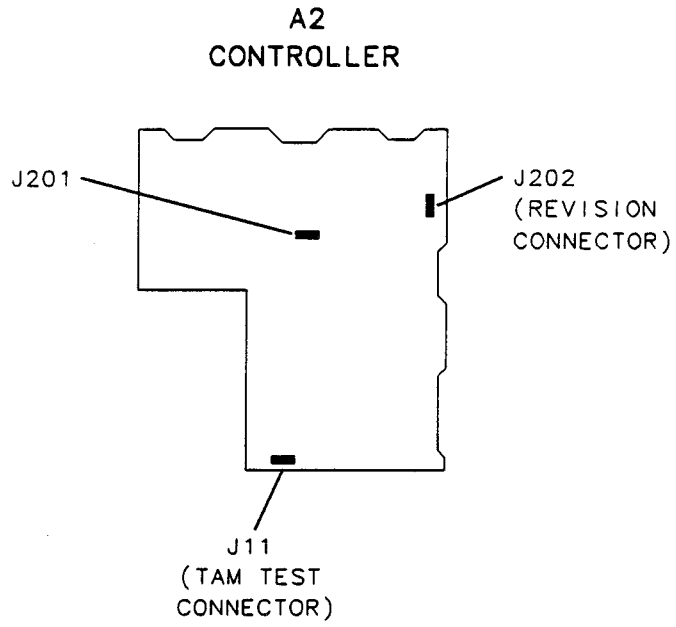


Figure 9-1. A2 Test Connectors

9. Press the fourth softkey. The results are sent to the printer.
10. If a failure is indicated in any of these tests, the fault lies on the A2 Controller assembly. To obtain more information:
    a. Press (▼) one less time than the test number. (For example, press it twice for the third test on the list.)
    b. Press the third softkey, then the fourth softkey. After the printout is complete, press the sixth softkey.
11. If no failures were indicated in testing the A2 Controller, move the probe cable to A17J4.
12. Press the first softkey and wait 5 seconds.
13. Press the fourth softkey. The results are sent to the printer.
14. If no failure is indicated in the printout, refer to "High Voltage Supplies" in Chapter 12.

Digital Signature Analysis (DSA)

Digital signature analysis (DSA) places microprocessor A2U1 in a simplified, known state. This simplified state consists of placing a one-word instruction, MOVE QUICK, (0111 XX10 XXXX XXX0) on the data bus. The microprocessor cycles through its address range continually reading the instruction. Perform the following DSA procedure to test the operation of microprocessor A2U1:

1. Set the spectrum analyzer (LINE) switch off.
2. Move the DSA jumper (located in the middle of the A2 assembly) from between E6 and E7 so that it connects E5 and E6.
3. Remove jumper A2E1. A2E1 is a 16-pin dual-in-line package located in the middle of the A2 assembly. Set the spectrum analyzer (LINE) switch on.
4. Use an oscilloscope to confirm that address lines, address strobe, and chip selects are toggling at proper levels.
5. Use an oscilloscope to check the address line sequencing. The signal on each line (starting with A1 and ending with A23) should be one-half the frequency of the previous line.
6. If step 4 reveals problems, microprocessor A2U1 is probably faulty.
7. Set the spectrum analyzer (LINE) switch off. Replace jumper A2E1. Move the DSA jumper from between E5 and E6 so that it connects E6 and E7.

Display Problems

Line Generators

Refer to function blocks D and I of A2 Controller Schematic Diagram (sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The line generators convert digital display information to an analog output suitable to drive the A17 CRT Driver assembly. These circuits change digital words into vectors, or lines, which move the beam across the CRT. The vectors are each 6 μs long (width of the INTEGRATE pulse) followed by a 1 μs SAMPLE pulse. When characters of text are being drawn, the vectors are 3 μs long.

1. On the spectrum analyzer, press (PRESET).
2. On the spectrum analyzer, press (CAL) MORE 1 OF 2 CRT ADJ PATTERN. If the display is blank, press the third softkey.
3. Set the controls on an oscilloscope to the following:

   Amplitude scale ..... 3 V/DIV
   Sweep time ..... 1 ms/DIV
   Triggering ..... External

4. Externally trigger the oscilloscope off the signal at A2U207 pin 8 (LBRIGHT).

5. Compare the signals at the following test points with those illustrated in Figure 9-2.

   X POS: A2J202 pin 14
   Y POS: A2J202 pin 3
   Z OUT: A2J201 pin 3
   BLANKING: A2J202 pin 15

Note It is normal for waveforms displayed on an analog oscilloscope to show more spikes due to the wider displayed bandwidth.

6. Troubleshoot the circuits associated with any bad waveforms.

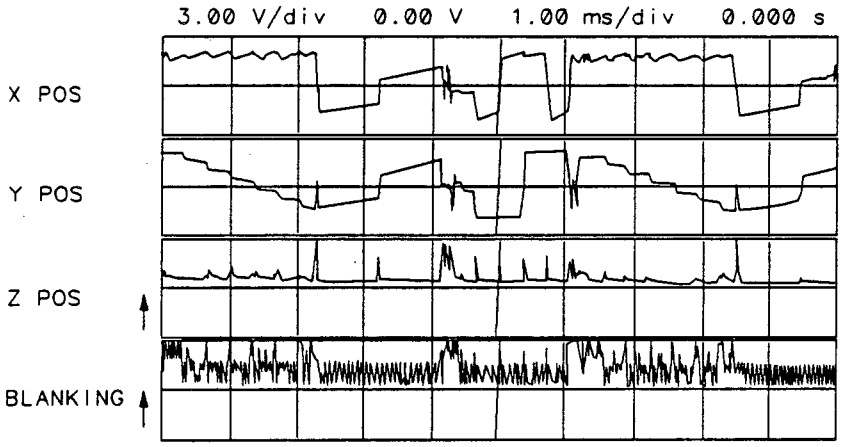


Figure 9-2. Line Generator Output Waveforms

Blanking

Refer to function block J of A2 Controller Schematic Diagram (sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Using an oscilloscope, check for blanking pulses at A2J202 pin 15. A2U206 pin 6 should be at a TTL high. Blanking pulses turn the CRT beam off during the sample time of the line generators and when moving the CRT beam to a new position for drawing the next vector.
2. Set the controls of an oscilloscope to the following:

   Amplitude Scale ..... 4 V/DIV
   Amplitude Offset ..... +2.5 V
   Sweep Time ..... 20 μs/DIV
   Triggering ..... External

3. Externally trigger the oscilloscope off the signal at A2U207 pin 8 (LBRIGHT).

4. Compare the blanking-circuit input signals at the following test points with those illustrated in Figure 9-3.

   BLANKING: J202 pin 15
   BLANK: U214 pin 12
   VECTOR: U214 pin 11
   U213 pin 13

5. The waveforms in Figure 9-3 must match the timing of the vectors being drawn. To do this, U215B is used to adjust the leading edge, and U215A is used to adjust the trailing edge. The first six horizontal divisions show the line drawing mode where the VECTOR pulses are 6 μs apart. The remaining divisions show character mode (VECTOR pulses 3 μs apart). The BLANK pulses are synchronized to the VECTOR pulses by U214B. The fourth trace shows the double pulses which delay the leading and trailing edges of the blanking pulses.

6. Set the controls of an oscilloscope to the following to expand the first and fourth traces. This displays how the rising edges of U21313 determine the transitions of the blanking pulses. See Figure 9-4.

   Amplitude Scale ..... 4 V/DIV
   Amplitude Offset ..... +2.5 V
   Sweep Time ..... 2 μs/DIV
   Delay from Trigger ..... 96 μs
   Triggering ..... External

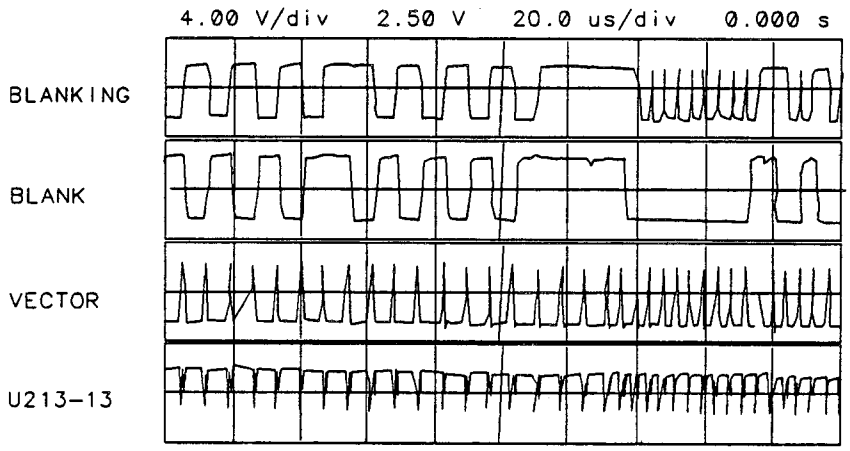


Figure 9-3. Blanking Waveforms

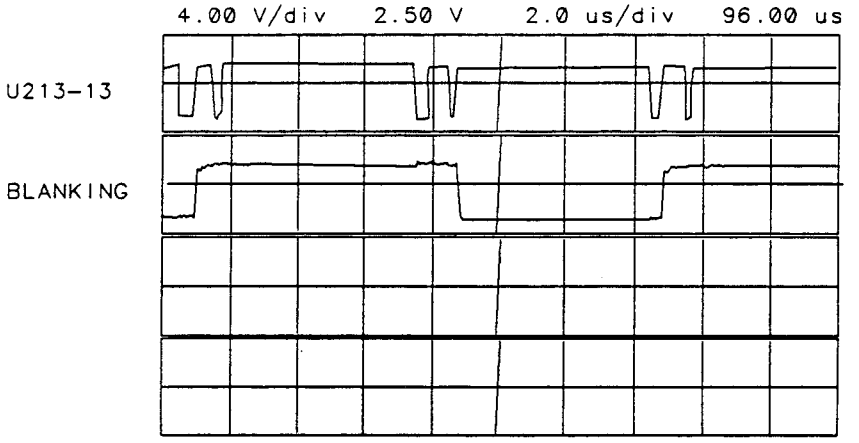


Figure 9-4. Expanded Blanking Waveforms

Display Jumbled or Trace Off Screen

Refer to function blocks D and I of A2 Controller Schematic Diagram (sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The two line generators are identical circuits, so the following steps apply to both; references are to the X generator with Y references in parentheses.

1. The voltage at A2U202B pin 7 should measure 10.0 V.
2. Perform steps 1 through 5 of "Line Generators" in this chapter. If the X POS and Y POS waveforms look different from those illustrated in Figure 9-2, check the waveforms at the low-pass filter input (function block E).
3. The waveform at the low-pass filter should look like X POS in Figure 9-2 but have an amplitude from 0 V to +5 V.
4. If the waveform in step 3 is incorrect, set an oscilloscope to the following settings:

   Amplitude Scale ..... 10 V/DIV
   Sweep Time ..... 20 μs/DIV
   Triggering ..... External

5. Trigger the oscilloscope on the signal at U207 pin 8 (LBRIGHT).

6. Compare the line-generator input signals at the following test points with those illustrated in Figure 9-5. INTEGRATE and SAMPLE waveforms are replicas of VECTOR except for polarity and amplitude. LCHAR is low when characters are drawn.

   INTEGRATE: Q202 collector
   SAMPLE: Q201 collector
   LCHAR: U207 pin 9
   VECTOR: U213 pin 9

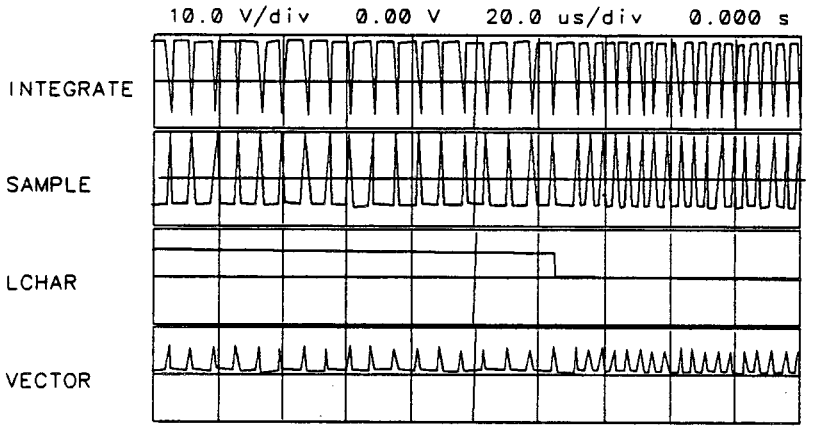


Figure 9-5. Switch Driver Waveform LCHAR

7. All of the DAC inputs should change state two or more times within a 5 ms window. If one or more DAC bits are not working correctly, this affects the entire display, but especially in the diagonal lines that go from lower left to upper right. When these lines are drawn, both the X and Y DACs are stepped one count at a time. A "stuck" bit distorts the diagonal in a repetitive manner. The quicker the repetition, the less significant the "stuck" bit. Horizontal distortions apply to the X LINE GENERATOR DAC, while vertical distortions apply to the Y LINE GENERATOR DAC. The DACS have current outputs so they are not readily observable with an oscilloscope. Continue with step 8 to observe the DAC outputs.

8. To break the effect of feedback in the line generators and to observe the output of the DACs, short J201 pin 1 to TP3 to observe U203 pin 1 and TP1. Continue with step 9.

9. Set an oscilloscope to the following settings:

   Amplitude Scale ..... 5 V/DIV
   Sweep Time ..... 1 ms/DIV
   Coupling ..... AC
   Triggering ..... External

10. Trigger the oscilloscope on the signal at U207 pin 8 (LBRIGHT).

11. The following waveforms should look like Figure 9-6 on the oscilloscope. The top two traces are for the X Line Generator and the bottom two traces for the Y Line Generator.

    X Line Generator
      U201 pin 1
      TP2
    Y Line Generator

U203 pin 1
TP1

12. Figure 9-7 illustrates the waveforms in step 11. expanded to show relative timing. the second and fourth traces are delayed by 5 ms from the first and third. The oscilloscope settings are changed as follows:

    Sweep Time ..... 20 μs/DIV

13. Figure 9-8 illustrates the waveforms of properly working line generators. Whenever there is a pulse on TP1 or TP2, the appropriate integrator (U201B or U203B) generates a ramp (the output vector) which feeds back to U201A (U203A) and shows on its output.

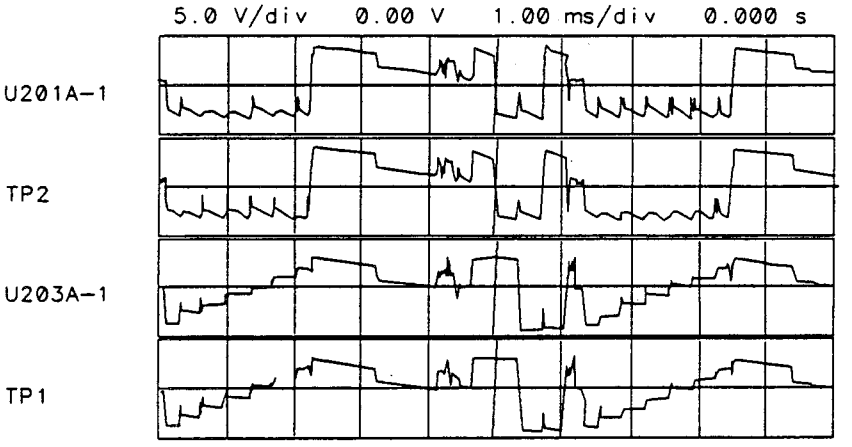


Figure 9-6. Distorted X/Y Line Generator Waveforms

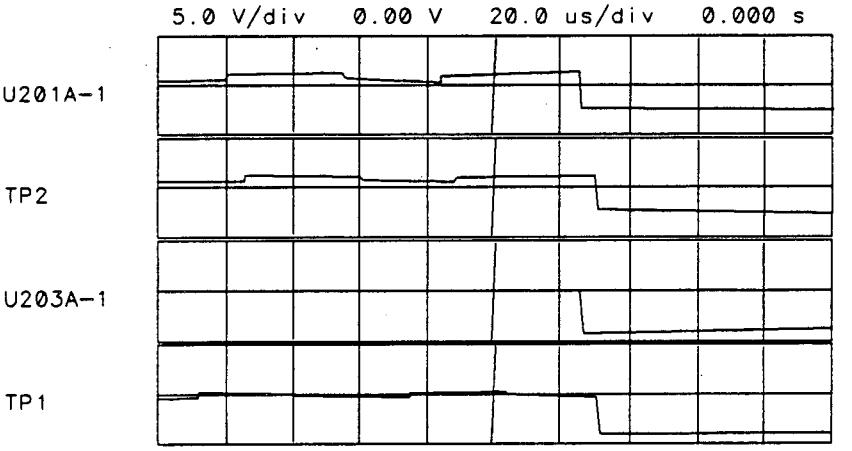


Figure 9-7. Expanded X/Y Line Generator Waveforms

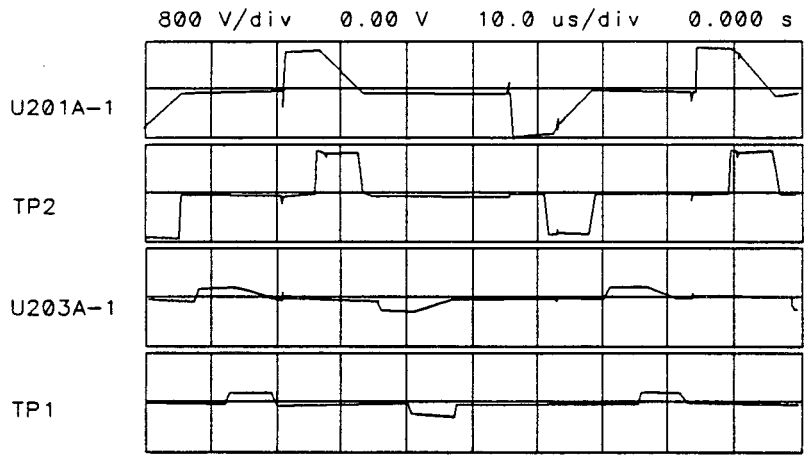


Figure 9-8. Normal X/Y Line Generator Waveforms

Intensity

1. The length of the vector being drawn can affect intensity (U210A, U210C, and U210D). Refer to "Long Lines Dimmer Than Short Lines."
2. Short A2U207 pin 2 to pin 7. If the display does not brighten, troubleshoot LBRIGHT switch, U207B. This switch intensifies trace A and active softkeys.
3. Short A2U207 pin 2 to pin 3. If the display does not darken, troubleshoot DEF1 switch, U207A. This switch is used in analog zero-span.
4. Change the intensity (under DISPLAY). If the intensity does not change, troubleshoot the intensity DAC, A2U212A. (A2U212A is controlled from the front panel.) The amplitude of the waveform at U211A pin 1 should increase or decrease with intensity changes.
5. Clamp U211B limits the voltage to about 4.2 V. Short A2J201-1 to ground and set the intensity DAC to a number greater than 80. A major portion of the waveform should be limited to 4.2 V.
6. Troubleshoot the maximum brightness clamp, A2U211C.

Distorted Characters or Graticule

If the characters displayed appear to be distorted, but the graticule displayed is clear (or if the symptoms are reversed), troubleshoot the X- and Y-generator switches A2U207D and A2U207C. Check that the switch-driver signal LCHAR is working properly. Refer to "Display Jumbled or Trace Off-Screen" in this chapter.

Long Lines Dimmer Than Short Lines

Refer to function block M of A2 Controller Schematic Diagram (sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The Z Output function block contains the absolute value circuits which determine the intensity of vectors drawn on the display. The vector length is approximated by the sum of the X length and Y length. The voltage corresponding to the X length, ΔX, is converted to current by R274. (If the voltage is negative, it is amplified by two in A2U210C, converted to current by A2R246, and added to the current from A2R274.) This effectively turns both negative and positive voltages into positive currents, hence absolute values.

1. Short A2J201 pin 13 to ground (A2TP3).
2. Connect channel A of an oscilloscope to A2J201 pin 2. Connect channel B to A2U210D-14.
3. Set the controls of an oscilloscope to the following:

   Amplitude scale ..... 10 V/DIV
   Sweep time ..... 1 ms/DIV
   Triggering ..... External

4. Externally trigger the oscilloscope off the signal at A2U207 pin 8 (LBRIGHT).
5. The waveforms should look like those illustrated in Figure 9-9. If the waveform at J201 pin 2 is bad, troubleshoot the X Line Generator (function block D of the A2 Controller Schematic, sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.
6. If the waveform at U210D pin 14 is bad, troubleshoot the Z Output circuit (function block M of A2 Controller Schematic, sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.
7. Remove the short from J201 pin 13 to ground. Short A2J201 pin 1 to ground.

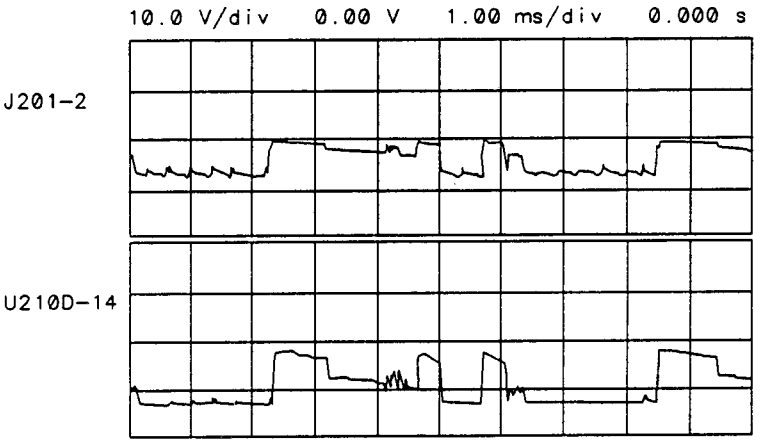


Figure 9-9. Delta X Waveform

8. Move the channel A oscilloscope probe to J201 pin 14.

9. The waveforms should look like those illustrated in Figure 9-10. If the waveform at J201 pin 14 is bad, troubleshoot the Y line generator (function block I of A2 Controller Schematic, sheet 1 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.
10. If the waveform at U210D pin 14 is bad, troubleshoot the Z output circuit (function block M of A2 Controller Schematic, sheet 1 of 4).
11. Remove the jumpers.

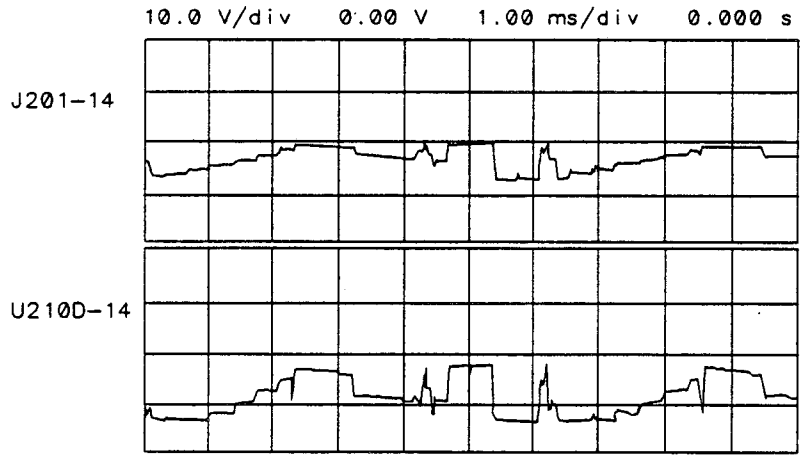


Figure 9-10. Delta Y Waveform

Analog Zero-Span Problems

1. On the spectrum analyzer press (PRESET), (SPAN), ZERO SPAN, (SWEEP), 1 (ms), (CAL), MORE 1 OF 2, and CRT ADJ PATTERN.
2. Set the controls of an oscilloscope to the following:

   Amplitude scale ..... 10 V/DIV
   Sweep time ..... 1 ms/DIV
   Triggering ..... External
3. Externally trigger the oscilloscope off the signal at A2U207 pin 8 (LBRIGHT).
4. The display should be similar to Figure 9-11 except that the untriggered trace should show at the left edge of the screen. In these settings, DEF1 causes switching between the line generators and the analog inputs (sweep and video). DEF1 remains high when the CRT adjust pattern is on. Refer to function block M of the A2 Controller Schematic, sheet 1 of 4.
5. The sweep input from J1-41 should go from 0 V to +10 V; the video-in signal should measure from about 0 V to 1 V from the bottom to the top of the screen. Apply a dc voltage to A2J4, Video In, to test the circuit.

6. In Figure 9-11, there is no synchronization between DEF1 and the video patterns X POS and Y POS when DEF1 is TTL high. The Y POS level when DEF1 is low is the Video In level.

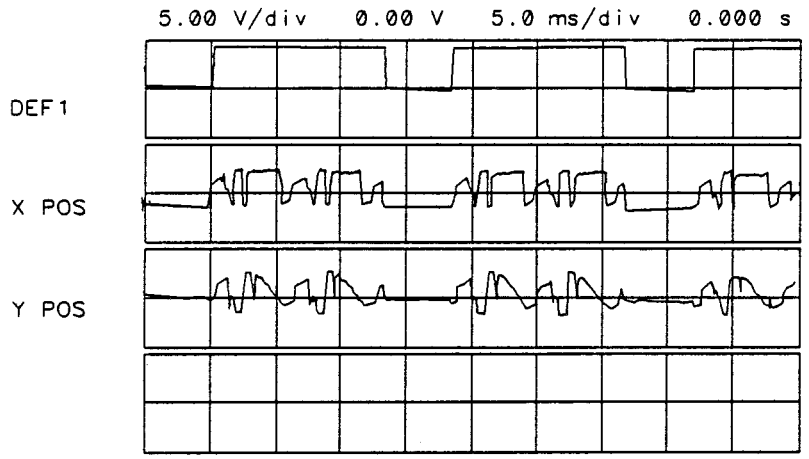


Figure 9-11. DEF1 Synchronization

Frequency-Count Marker Problems

The FREQ COUNT function works by dividing the 10.7 MHz IF signal by two (prescaling) and counting the divided-down signal using the frequency counter. The prescaler is on the A4 Log Amplifier assembly. Perform the following steps to determine whether the problem is on the A4 Log Amplifier or A2 Controller assembly:

1. Disconnect W21 from A2J7.
2. Connect the output of a synthesized source, such as an HP 3335A, to A2J7.
3. Set the synthesized source controls as follows:

   Amplitude ..... +10 dBm
   Frequency ..... 5.35 MHz

4. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 1 MHz

5. On the spectrum analyzer, press (FREQ COUNT). The frequency counter actually reads one half the frequency of the 10.7 MHz IF. If the counter frequency display reads all asterisks, the frequency counter is probably at fault.
6. If a valid frequency is displayed, troubleshoot the prescaler on the A4 Log Amplifier assembly.
7. Reconnect W21 to A2J7.

Frequency Counter

Refer to function block Z of A2 Schematic Diagram (sheet 4 of 4).

The frequency counter counts the last IF frequency and provides accurate timing signals for digital zero-spans. The circuit also provides timing signals to the A3 Interface assembly analog to digital converter (ADC). The nominal input frequency is 5.35 MHz (10.7 MHz divided by two). The 10 MHz reference from the A15 RF assembly provides circuit frequency.

In the frequency-count mode, U702 prescales the 10 MHz reference by five to generate a 2 MHz time base. This time base feeds through MUX U704, to the CLK2 input of programmable-timer U700. OUT2 is the programmable-timer output. It is the gating signal (HBKT_PULSE) for performing the frequency count. The gating time interval is a function of the counter resolution which may be set between 10 Hz and 1 MHz. Table 9-2 lists the gate time for each setting of COUNTER RES. The gate time is the period during which U511 pin 3 is high.

The FREQ COUNT input, A2J7, is gated in U511B by HBKT_PULSE. The gated signal clocks the divide-by-16 counters U703A and U703B. These counters are cascaded to form a divide-by-256 counter. The MSB of counter CD7 clocks the CLK0 input of U700. The frequency of CD7 is a function of COUNTER RES as shown in Table 9-2. If timer U700 overflows, OUT0 is set and U701B clocked, generating CNTOVFLIRQ, which interrupts the CPU.

If IRQAK2 is high, HBKT_PULSE clocks U701A, generating FREQCNTLIRQ. Upon receiving the FREQCNTLIRQ interrupt, the CPU latches the CD0 to CD7 onto the BID bus by setting LCDRD (low counter data read) low and reading the counter data from the BID bus. The CPU also reads the data from timer U700 by setting L8254CS and LCNTLRD low, placing the timer data on the BID bus. The CPU resets U701A by setting IRQAK2 low via the BID bus and latch U506.

Table 9-2. Gate Times

Counter Res	Gate Time* (U511 pin 3 high state)	A2TP16	A2TP15
10 Hz	200 ms	2 MHz	4.18 kHz
100 Hz	20 ms	2 MHz	418 Hz
1 kHz	2 ms	2 MHz	41.8 Hz
10 kHz	2 ms	2 MHz	41.8 Hz
100 kHz	2 ms	2 MHz	41.8 Hz
1 MHz	2 ms	2 MHz	41.8 Hz
* TP15 = (FREQ COUNT input × Gate Time)/256			

1. Disconnect W22 from A2J8.
2. If a 10 MHz, TTL-level signal is not present at the end of W22, continue with step 9. If a 10 MHz signal is present at W22, proceed as follows:
   a. Reconnect W22 to A2J8.
   b. Set the spectrum analyzer controls as follows:

      SPAN ..... Zero Span
      SWEEP TIME ..... 20 ms

c. Monitor the signal at A2J2 pin 21. This is an output of the frequency counter, HBUCKET PULSE.

d. If HBUCKET PULSE is stuck high, troubleshoot the frequency counter.

3. Check for a 10 MHz signal at A15J302. If the signal is not present at A15J302, the A15 RF assembly is probably defective.

State- and Trace-Storage Problems

State-storage is located in the two programmed RAMs, and trace- storage in the two display RAMs. With low battery voltage, it is normal for states and traces to be retained if the power is off for less than 1 minute. If the power is left off for more than 30 minutes with low battery voltage, the stored states and traces are lost. The following steps test battery backup:

1. Measure the voltage on W6 at A2J10. If the voltage is less than 3.5 V, check the BT1 battery.
2. If the battery voltage is correct, reconnect W6 to A2J10, set the analyzer (LINE) off and wait 5 minutes.
3. Measure the voltage at A2U101 pin 28 and A2U102 pin 28.
4. If the voltage is less than 2.0 V dc, the RAM power battery-backup circuitry on the A2 Controller assembly is probably at fault.

Keyboard Problems

If the analyzer does not respond to key presses or knob rotation (RPG), the fault could be either on the A3 Interface assembly or the A2 Controller assembly. To isolate the A2 Controller assembly, use the following procedure. This procedure tests the analyzer response over HP-IB and the keyboard/RPG interrupt request signal.

1. Enter and run the following BASIC program.

```
10 OUTPUT 718; "IP; SP 1 MHz;"
20 WAIT 2 ! Wait 2 seconds
30 OUTPUT 718;"AT 70 DB;"
40 WAIT 2 ! Wait 2 seconds
50 OUTPUT 718;"AT 30 DB;"
60 WAIT 2 ! Wait 2 seconds
70 OUTPUT 718;"AT 10 DB;"
80 END
```

2. When the program runs, three or four clicks should be heard. This is the A9 Input Attenuator changing attenuation value.
   - If the display shows the analyzer to be in RMT and the ATTEN value displayed on the CRT changed according to the program, the A2 Controller assembly is working properly. Refer to Chapter 7, "ADC/Interface Section."
   - If there was no response over HP-IB, the A2 Controller is probably defective. Be sure to also check the A19 HP-IB assembly and A19W1.

- If there was an improper response (for example, the displayed ATTEN value changed but no clicks were heard), the A2 Controller is probably working properly.

3. Monitor A2U2 pin 2 with a logic probe for pulses while pressing a key and rotating the knob. This is the interrupt-request signal for the keyboard and RPG.
   - If the interrupt-request signal is always low, troubleshoot the A2 Controller assembly.
   - If the interrupt-request signal is always high, the fault is on either the A3 Interface or A1A1 Keyboard assembly.

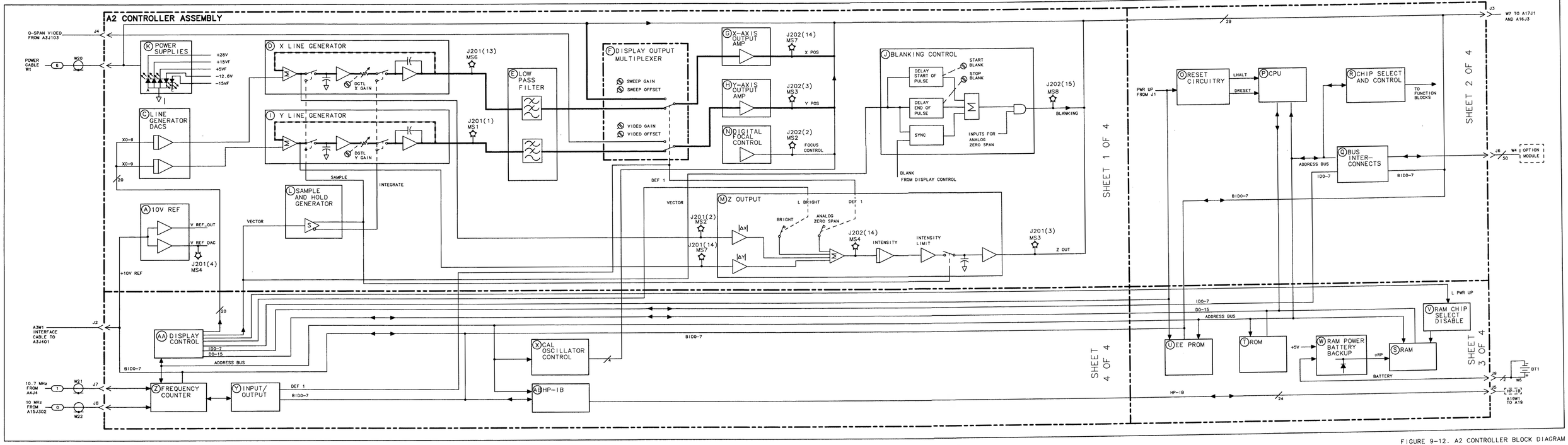


FIGURE 9-12. A2 CONTROLLER BLOCK DIAGRAM

10

Synthesizer Section

The Synthesizer Section includes the A7 First LO Distribution Amplifier, A11 YTO, and parts of the A14 Frequency Control and A15 RF assemblies. Simplified and detailed block diagrams for each assembly are located at the end of this chapter.

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Caution



All of the assemblies are extremely sensitive to electrostatic discharge (ESD). For further information regarding electrostatic precautions, refer to "Electrostatic Discharge Information" in Chapter 1.

Caution



For troubleshooting, it is recommended that you use an active probe, such as an HP 85024A, with a spectrum analyzer. If an HP 1120A Active Probe is being used with a spectrum analyzer having dc-coupled inputs, such as the HP 8566A/B, HP 8569A/B and the HP 8562A/B, either set the active probe for an ac-coupled output or use a dc-blocking capacitor (HP 11240B) between the active probe and the spectrum-analyzer input. Failure to do this can result in damage to the analyzer or the probe.

Confirming a Faulty Synthesizer Section

The A11 YTO (the spectrum analyzer first LO) is a yig-tuned oscillator which tunes from 2.95 to 6.8107 GHz. The A7 1ST LO Distribution Amplifier (LODA) levels the A11 output and distributes the signal to the A8 Dual Band Mixer, A15A2 Sampler, and the front panel 1ST LO OUTPUT. The synthesizer section includes the following PLLs (Phase Locked Loops):

YTO PLL	A7, A11, A14 and A15 RF Assembly
Offset PLL (Sampling Oscillator PLL)	A15 RF Assembly
Roller Oscillator PLL	A14 Frequency Control Assembly
Reference PLL	A15 RF Assembly

In addition, the A14 assembly roller oscillator PLL is actually comprised of the following three PLLs:

Main Oscillator PLL
Transfer Oscillator PLL
Offset Oscillator PLL (This is not the same as A15 Offset PLL)

The main oscillator PLL is sometimes swept backward (higher frequency to lower frequency). This is necessary because of the way in which the sampler IF signal is produced.

Note



The frequency-control board is primarily digitally controlled. If multiple failures appear in unrelated areas of the circuitry, the control may be at fault. Refer to the manual troubleshooting procedures for further help on isolating those failures.

Note



The TAM is unable to test the signal path on the RF board. It tests the circuitry by digitally controlling the hardware and monitoring the control lines to make sure they are responding properly. Use the TAM Automatic Fault Isolation routine or verify the RF levels manually to ensure proper operation.

1. Connect a positive DVM lead to A15J502 pin 3 and the negative lead to A15J502 pin 6. This measures the reference oscillator tune voltage which is an input to the A3 Interface Assembly ADC MUX.
2. Set the spectrum analyzer controls as follows:

SPAN ..... 0 Hz
CENTER FREQ ..... 389.5 MHz
CF STEP ..... 7.5 MHz

3. Use the step keys to tune the CENTER FREQ to the values listed in Table 10-1.

4. As the sampling oscillator frequency is increased, the DVM reading should also increase. The voltage remains at approximately +5.5 V dc. If the tune voltage is correct, but the ADC measures the voltage and determines it to be out of specification, troubleshoot the A3 assembly ADC MUX.

Table 10-1. Center Frequency Tuning Values

HP 8563A Center Frequency (MHz)	Sampling Oscillator Frequency (MHz)
389.5	280.0
427.0	282.5
449.5	284.0
464.5	285.0
479.5	286.0
502.0	287.5
509.5	288.0
539.5	290.0
569.5	292.0
577.0	292.5
599.5	294.0
614.5	295.0
629.5	296.0
652.0	297.5
659.5	298.0

5. Disconnect W37 (coax 85) from A14J301.

6. Connect a test cable from W37 (coax 85) to the input of another spectrum analyzer. Set the other spectrum analyzer controls as follows:

   Center Frequency ..... 10 MHz
   Span ..... 2 MHz

7. The amplitude of the 10 MHz reference signal should measure greater than −1 dBm. If the signal does not measure greater than −1 dBm, troubleshoot the A15 10 MHz distribution and A21 OCXO.

8. Reconnect W37 (coax 85) from A14J301.

9. Connect the CAL OUTPUT to INPUT 50Ω.

10. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 100 MHz

11. If the 1st LO is present, a signal should be displayed at about −10 dBm (approximately ±20 MHz from the center frequency). If neither a signal nor ERR 334 LO AMPL is displayed,

troubleshoot the A7 LODA. If neither a signal nor ERR 334 LO AMPL is displayed, check A11 YTO as follows:

a. Set jumper A14J23 to the TEST position.
b. Set the spectrum analyzer controls as follows:
   CENTER FREQ ..... 50 Hz
   CF STEP .....300 MHz
   SPAN ..... 0 Hz
c. Connect a power meter directly to the output of A11 YTO.
d. Press (▲) on the spectrum analyzer and measure the YTO output power at each step.
e. Check that the A11 YTO output power is between +9 and +13 dBm.
f. Set jumper A14J23 to the NORM position and reconnect the A11 YTO.

12. On the spectrum analyzer press (PRESET), (CAL), MORE 1 OF 2, FREQ DIAGNOSE, and MAIN ROLLER. Note the main-roller oscillator frequency.

    Main-Roller Oscillator Frequency: _____MHz

13. Disconnect W32 (coax 87) from A14J501 and connect the output of a signal source to A14J501. Connect a positive DVM lead to A14J17 pin 1 and negative lead to A14J17 pin 6. See Figure 10-1.

14. Set the signal source controls as follows:

    Power .....0 dBm
    Frequency .....Recorded value from step 12

15. Tune the source 1 MHz below the main roller frequency. The voltage measured on the DVM should be approximately 8.2 V dc.

16. Tune the source 1 MHz above the main roller frequency. The voltage measured on the DVM should be approximately −8.2 V dc.

17. If the DVM reading does not change, the A14 Frequency Control assembly is defective. Reconnect W32 (coax 87) to A14J501.

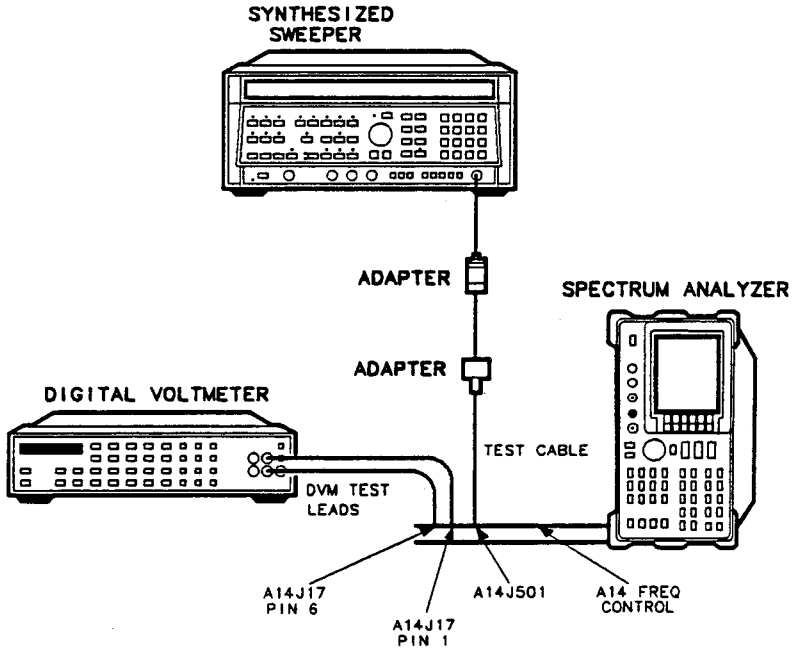


Figure 10-1. YTO Loop Test Setup

18. Disconnect W34 (coax 0) from A15A2J1 and disconnect W32 (coax 87) from A15J101.
19. Connect a frequency counter to A15J101. Connect a high-frequency test cable from an HP 8340A/B Synthesized Sweeper to A15A2J1. See Figure 10-2.
20. Connect a BNC cable from the spectrum analyzer 10 MHz REF IN/OUT to the HP 8340A/B FREQUENCY STANDARD EXT input.
21. Set the HP 8340A/B controls as follows:

    FREQUENCY STANDARD ..... EXT
    POWER LEVEL ..... −5 dBm
    FREQ STEP ..... 7.5 MHz

22. Set the spectrum analyzer controls as follows:

    SPAN ..... 0 Hz
    CF STEP ..... 7.5 MHz

23. Set the spectrum analyzer and HP 8340A/B frequencies to the combinations listed in Table 10-2. (Use the frequency step keys on both instruments.)

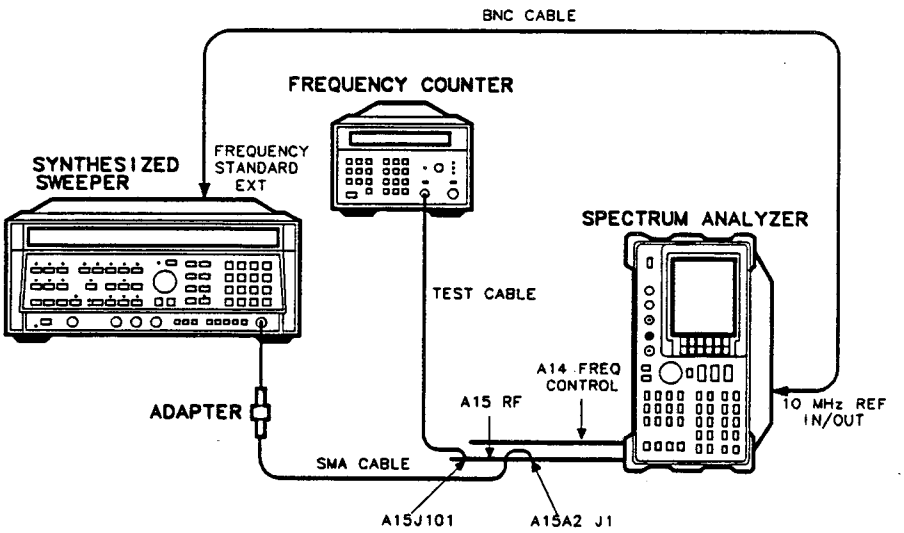


Figure 10-2. Sampler and Sampling Oscillator Test Setup

24. At each combination, the frequency counter should measure a sampler IF of 100.2 MHz ±500 Hz. (The Offset PLL sampling oscillator tunes to the frequencies listed in the table.) If the frequency counter does not read a sampler IF of 100.2 MHz, suspect the A15 RF assembly.
25. Reconnect W34 (coax 0) to A15A2J1 and W32 (coax 87) to A15J101.
26. If YTO unlocks only with certain center frequency and span combinations, terminate the 1ST LO OUTPUT in 50Ω.
27. Set the spectrum analyzer CENTER FREQ and (SPAN) to generate the unlock condition.
28. Set the spectrum analyzer trigger to SINGLE.
29. Move jumper A14J23 to the TEST position.
30. Disconnect W34 (coax 0) from A15A2J1 and measure the power of the signal at the end of W34 (coax 0).
31. If the power is less than −6.5 dBm, suspect W34 (coax 0), A7 LODA, or A11 YTO.
32. Move jumper A14J23 to the NORM position.

Table 10-2. Sampling Oscillator Test Frequencies

HP 8563A Center Frequency (MHz)	HP 8340A CW Frequency (MHz)	Frequency of Offset PLL Sampling Oscillator (MHz)
389.5	4300.2	280.0
427.0	4337.7	282.5
449.5	4360.2	284.0
464.5	4375.2	285.0
479.5	4390.2	286.0
502.0	4412.7	287.5
509.5	4420.2	288.0
539.5	4450.2	290.0
569.5	4480.2	292.0
577.0	4487.7	292.5
599.5	4510.2	294.0
614.5	4525.2	295.0
629.5	4540.2	296.0
652.0	4562.7	297.5
659.5	4570.2	298.0

Troubleshooting Test Setup

Some Synthesizer Section problems require placing the YTO PLL in an unlocked condition. Do this by moving jumper A14J23 to the TEST position. This grounds the YTO LOOP ERROR signal, disabling the ability of the CPU to detect an unlocked YTO. The FM Coil Driver output is set to mid-range level, causing the YTO to be controlled only by the main-coil tune DAC.

Synthesizer Section troubleshooting is best done with the spectrum analyzer [SPAN] set to 0 Hz (even though it is still possible to sweep the main and FM coils of the YTO).

With the YTO in its unlocked state and [SPAN] set to 0 Hz, the nominal YTO frequency is not necessarily the value listed as LO FREQ in the Frequency Diagnose Menu. The YTO has an initial pretune accuracy of ±20 MHz, but this pretune accuracy shifts ±10 MHz as a function of the sampler IF frequency. This enables the YTO loop to acquire lock when the sampler IF is near its extremes. As a result, the nominal YTO frequency also shifts ±10 MHz depending on the sampler IF frequency.

The roller oscillator frequency is the same as the desired sampler IF. Table 10-3 outlines the changes in YTO pretune accuracy and nominal YTO frequency as a function of the roller oscillator frequency.

- To display the roller oscillator frequency press [CAL], MORE 1 OF 2, FREQ DIAGNOSE, MAIN ROLLER. If the sampler IF is negative (YTO frequency is lower than the desired sampling- oscillator harmonic), the main-roller frequency is displayed as a negative number.

- To display the nominal YTO frequency, press (CAL), MORE 1 OF 2, FREQ DIAGNOSE, LO FREQ.

Table 10-3. YTO Frequency in TEST Position

Roller Oscillator Frequency	YTO Pretune Accuracy	Nominal YTO Frequency
−104 to −93 MHz	+30/−10 MHz	LO Frequency + 10 MHz
−93 to −73 MHz	±20 MHz	LO Frequency
−73 to −65 MHz	+10/−30 MHz	LO frequency −10 MHz
65 to 73 MHz	+30/−10 MHz	LO Frequency +10 MHz
73 to 93 MHz	±20 MHz	LO Frequency
93 to 104 MHz	+10/−30 MHz	LO Frequency −10 MHz

Troubleshooting with the TAM

When using Automatic Fault Isolation, the TAM indicates suspected circuits that need to be manually checked. Use Table 10-4 to locate the manual procedure.

Table 10-5 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 10-3 illustrates the location of A14 and A15 test connectors.

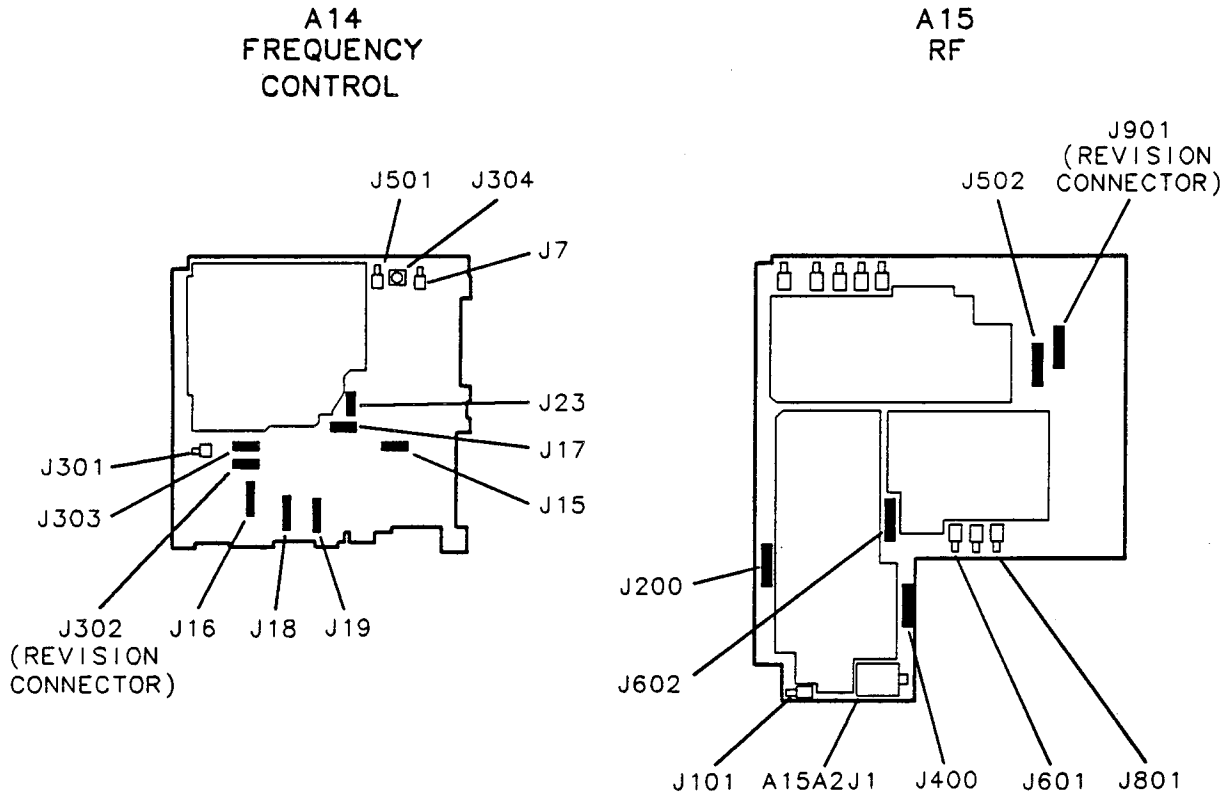


Figure 10-3. A14 and A15 Test Connectors

Table 10-4. Automatic Fault Isolation References (1 of 2)

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check the YTO Loop	
Check 1st LO	Confirming a Faulty Synthesizer Section *(steps 9-11)*
Check 1st LO Pretune Frequency and Amplitude	Unlocked YTO PLL *(steps 10-13)*
Check 3rd LO Drive	Third LO Driver amplifier *(steps 1-6)*
Check 10 MHz Reference to Phase Frequency Detector	Unlocked Reference PLL *(steps 8-13)*
Check for 10 MHz Signal at Other Input to Phase/Frequency Detector	Unlocked Reference PLL *(steps 12 and 13)*
Check A3 ADC MUX Function Block	Confirming a Faulty Synthesizer Section *(steps 1-4)*
Check A14 Frequency Control Assembly	Confirming a Faulty Synthesizer Section *(steps 12-17)*
Check A14J301 10 MHz REF Input	Confirming a Faulty Synthesizer Section *(steps 5-8)*
Check A15 RF Assembly	Confirming a Faulty Synthesizer Section *(steps 18-25)*
Check Current Source U307	First-LO Span Problems (All Spans) *(steps 14-21)*
Check FM Loop Sense	Unlocked YTO PLL *(steps 28-34)*
Check YTF Gain and OFFset DACs	YTF Driver Circuit *(steps 10-23)*
Check Level at Amplifier Input	Third LO Driver Amplifier *(steps 1-6)*
Check Levels into Mixer U400	Unlocked Offset PLL *(steps 3-13)*
Check Loop References	Unlocked Offset PLL *(steps 1 and 2)*
Check Main Coil Tune DAC	Unlocked YTO PLL *(steps 45-49)*
Check Main Coil Coarse and Fine DACs	Unlocked YTO PLL *(steps 41-44)*
Check Main Roller Mixer	Main Oscillator PLL *(steps 10-15)*
Check Main Roller Oscillator and Output Buffer Amp	Main Oscillator PLL *(steps 1-4)*
Check Main Roller PLL	Main Oscillator PLL *(steps 16-22)*
Check Main Roller Pretune DAC	Main Oscillator PLL *(steps 5-9)*
Check Main Roller Sweep/Hold Switches	First-LO Span Problems $\leq$1 MHz *(step 9)*
Check Offset Oscillator and Buffer Amp	Offset Oscillator PLL *(steps 1-3)*

Table 10-4. Automatic Fault Isolation References (2 of 2)

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check Offset Oscillator PLL	Offset Oscillator PLL *(steps 14-18)*
Check Offset Oscillator PLL Pre-Scaler	Offset Oscillator PLL *(steps 9-13)*
Check Offset Oscillator Pretune Circuitry	Offset Oscillator PLL *(steps 4-8)*
Check Offset Span Accuracy	First-LO Span Problems $\leq$1 MHz *(step 8)*
Check Offset Oscillator Sweep/Hold	Offset Oscillator PLL *(steps 20-23)*
Check Phase/Frequency Detector	Unlocked Reference PLL *(steps 17-22)*
Check Path to Phase/Frequency Detector	Unlocked Offset PLL *(steps 3-7, 14-19)*
Check Roller Oscillator	Unlocked YTO PLL *(steps 14-18)*
Check Sampler Drive Output of A7 LODA	Unlocked YTO PLL *(steps 19-22)*
Check Sampler IF	Unlocked YTO PLL *(steps 23-27)*
Check Sampler/Sampler IF Operation	Sampler and Sampler IF *(steps 1-15)*
Check Span Attenuator	First-LO Span Problems (All Spans) *(steps 6-13)*
Check Sweep Generator	Sweep Generator Circuit
Check Sweep + Tune Multiplier	YTF Driver Circuit *(steps 4-9)*
Check the 600 MHz Reference Loop Amplifier	Unlocked Reference PLL *(steps 23-26)*
Check the YTO Loop	Unlocked YTO PLL
Check Transfer Oscillator	Transfer Oscillator PLL *(steps 1 and 2)*
Check Transfer Oscillator PLL	Transfer Oscillator PLL *(steps 15-16)*
Check Transfer Oscillator Pre-Scaler	Transfer Oscillator PLL *(steps 11-14)*
Check Transfer Oscillator Pretune DAC	Transfer Oscillator PLL *(steps 11-14)*
Check YTF Gain and Offset DACs	Transfer Oscillator PLL *(steps 1-10)*
Check YTO FM Coil Driver	First-LO Span Problems (1 MHz to 20 MHz) *(step 6)*
Check YTO FM Coil Driver and Main Loop Error Voltage Driver	Unlocked YTO PLL *(steps 35-40)*

Table 10-5. TAM Tests versus Test Connectors (1 of 2)

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A14J15	Sweep Generator	MS8
	Span Attenuator DAC	MS7
	Span Attenuator Switches	MS7
	Sweep + Tune Mult Input Amp	MS1, OS1
	Sweep + Tune Mult Input Switches	MS1, MS3
	VCO Sweep Driver	MS6, OS1
A14J16	FAV Generator	MS4
	FAV Gen 0.5 V/GHz Output	MS5
	YTF Offset DAC	MS6
	YTF Gain and Offset Input	MS2
	YTF Gain DAC	MS1
	YTF Drive	MS3
	Band Switch Driver	MS8
A14J17	Main Coil Course DAC	MS3
	Main Coil Fine DAC	MS2
	Main Coil DACs Output	MS5
	YTO Loop Phase Detector	MS1
	Main Loop Error Volt DVR	MS4
	Option Drive	MS8
	Option Drive Switch	MS7
	Option Drive DAC	MS6
A14J18	±10 V Reference	MS1, MS2
	LODA Drive	MS5, MS6, MS7, MS8
A14J19	Main Coil Tune DAC	MS3
	Sweep Generator DAC	MS4
	Sweep Generator Switches	MS4
	Second Conv PIN Switch	MS8
	Second Conv Mixer Bias	MS1
	Second Conv Drain Bias	MS3
	Second Conv Doubler Bias	MS4
	Second Conv Driver Bias	MS5
	First Mixer Drive Switch	MS7
	First Mixer Drive DAC	MS6
A14J302	Revision	MS7
	XFER Osc Bias	MS1
	XFER Pretune DAC	MS6
	Offset Osc Bias	MS2
	Offset Pretune DAC	MS8
	Offset Amp Bias	MS5

Table 10-5. TAM Tests versus Test Connectors (2 of 2)

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A14J303	XFER Amp Bias	MS3
	Main Amp Bias	MS4
	Out Amp Bias	MS1
	Main Osc Bias	MS2
	Main Pretune DAC	MS7
	Course Adj DAC	MS8
	Fine Adj DAC	MS6
	Span Multiplier DAC	MS5
A15J200	Positive 15 Volt Supply	MS1
	Sampler Drive Buffer Bias	MS2
	Sampling Oscillator Bias	MS3
	Offset Lock Drive Buffer	MS4
	OFL Error Voltage	MS6
	Phase Detector Bias Adjust	MS8
A15J400	Positive 15 Volt Supply	MS2
	Offset Lock RF Buffer	MS4
	IF AMP/Limiter Bias	MS6
	Offset Lock Loop Buffer D	MS7
	Offset Lock Loop Buffer C	MS8
	Sampler Bias Test	MS3
A15J502	Positive 15 Volt Supply	MS2
	Third LO Tune Voltage	MS3
	Offset Lock Loop Buffer	MS4
	600 MHz Oscillator Bias	MS5
	Calibrator AGC Amp Bias	MS6
	Calibrator Ampl Adj	MS7
	3rd LO Driver Amp	MS1, MS8
A15J602	Positive 15 Volt Supply	MS8
	Flatness Compensation 3	MS2
	Flatness Compensation 2	MS5
	Flatness Compensation 1	MS6
	SIG ID Collector Bias	MS7
	RF Gain Control Test	MS1, MS3
A15J901	Revision	MS4, MS3
	External Mixer Switch	MS1, MS8
	Signal ID Switch	MS5, MS6
	Ten Volt Reference	MS4
	External Mixer Bias	MS7
	RF Gain Test	MS2

General PLL Troubleshooting

The synthesizer section relies heavily on phase-lock loops (PLLs). Typically, faulty PLLs are either locked at the wrong frequency or unlocked. The information below applies to troubleshooting these two classes of problems on a generalized PLL.

PLL Locked at Wrong Frequency

Numbers in the following text identify items on Figure 10-4.

- Any frequency errors at reference (1) is multiplied by N/M on the PLL outputs.
- A sampler reference-frequency error (2) is multiplied by its harmonic on the PLL output.
- A mixer reference-frequency error (3) produces the identical error on the PLL output.
- If divider input or output frequencies (4) are wrong, check for incorrect divide numbers and data that control the dividers.

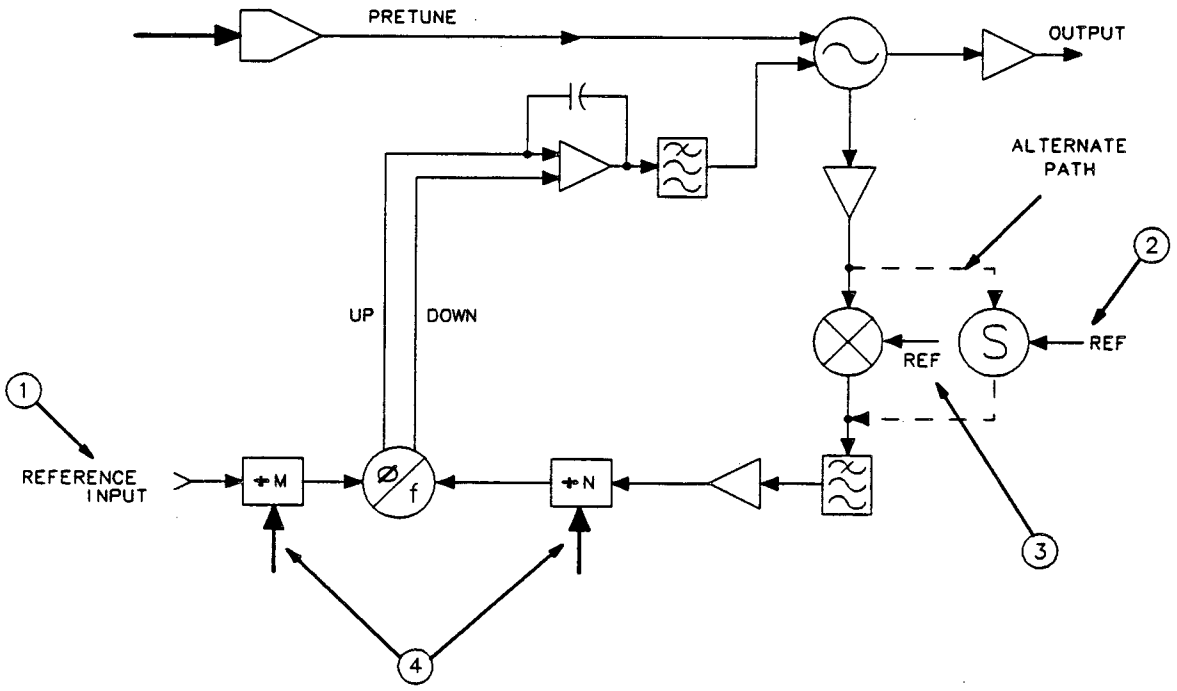


Figure 10-4. PLL Locked at Wrong Frequency

Unlocked PLL

An unlocked PLL can be caused by problems inside or outside the PLL. Troubleshoot this problem by working backward from the oscillator as described in the steps below. Numbers in the following text identify items on Figure 10-5.

1. The loop integrator output voltage (1) should be attempting to tune the oscillator to the correct frequency.

a. The voltage at (1) should increase as the frequency increases on the following PLLs:

YTO PLL	A14J17 pin 1 (YTO LOOP ERROR)
Reference PLL	A15J502 pin 3 (LO3 ERR)
Sampler PLL	A15J200 pin 13 (OFL ERR)

b. The voltage at (1) should increase as the frequency decreases on the following PLLs:

Main Roller PLL	A14U115B pin 7 (MAINSENSE)
Offset Roller PLL	A14U111A pin 1 (OFFSENSE)
Transfer Roller PLL	A14U126A pin 1 (XFRSENSE)

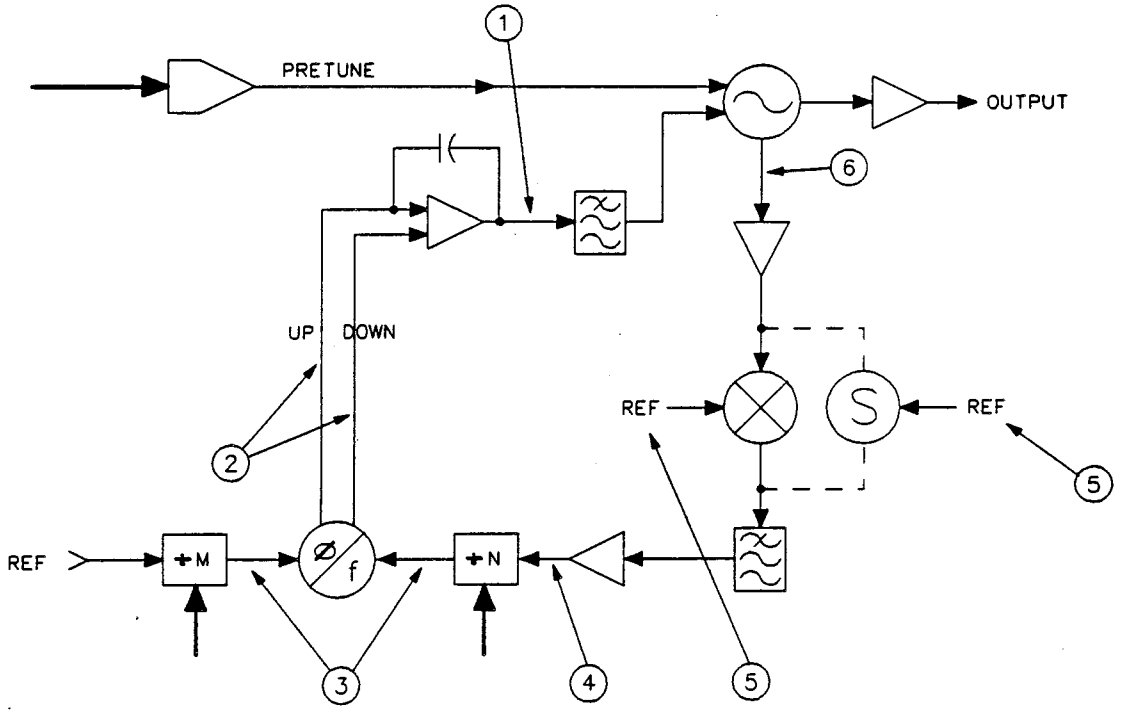


Figure 10-5. Unlocked PLL

2. If the integrator output voltage changes in the manner described in step 1, the problem is external to the PLL (for example, the pretune DAC could be faulty). If the integrator output voltage appears to be incorrect, confirm that the pulses out of the phase detector (2) are attempting to tune the oscillator in the correct direction.
3. If the phase detector output is bad, check the inputs to the detector (3). One input should be higher in frequency than the other; this should match the phase detector outputs.
4. Confirm proper power levels for the signals at the input to the "N" dividers (4), the reference input (5), and the loop feedback path (6).

Frequency Span Accuracy Problems

The spectrum analyzer employs lock-and-roll tuning to sweep the 1st LO. The 1st LO is locked to the start frequency immediately after the previous sweep is completed. The 1st LO is then unlocked, and, when a trigger signal is detected, the 1st LO sweeps (rolls).

When there is a considerable delay between the end of one sweep and the beginning of the next, the actual 1st LO start frequency may differ from the locked start frequency. This start frequency drift is be most noticeable in a 1.01 MHz LO span (the narrowest FM coil span). This drift is not noticeable in either free-run mode or line-trigger mode.

The sweep signal is applied to different oscillators in the Synthesizer Section depending on the desired 1st LO span (due to harmonic mixing, this is not necessarily the same as the span setting of the analyzer). Refer to Table 10-6 for a listing of sweep-signal destinations versus 1st LO spans.

Sweeping the roller oscillator/offset oscillator PLL results in sweeping the YTO FM coil. There is a one-to-one relationship between the roller-oscillator frequency span and the 1st LO span.

Table 10-6. Sweep Signal Destination versus Span

First LO Span	Sweep Signal Destination
>20 MHz	A11 YTO Main Coil
1.01 MHz to 20 MHz	A11 YTO FM Coil
1.01 kHz to 1 MHz	Main Roller Oscillator
≤100 kHz	Offset Roller Oscillator

Determining the First-LO Span

The 1st LO span depends on the spectrum analyzer harmonic-mixing number. Use the following steps to determine the 1st LO span:

1. Read the span setting displayed on the spectrum analyzer.
2. Determine the harmonic-mixing number from the information in Table 10-7.

Table 10-7. Harmonic Mixing Number versus Center Frequency

Center Frequency	Harmonic Mixing Number
9 kHz to 2.9 GHz	1
2.75 GHz to 6.46 GHz	1
5.86 GHz to 13.0 GHz	2
12.4 GHz to 19.7 GHz	3
19.1 GHz to 22.0 GHz	4
18 GHz to 325 GHz	6 through 52 depending upon lock harmonic selected

3. Use the following equation to determine the 1st LO span used.

$$1ST\ LO\ Span = \frac{Display\ Span\ Setting}{Current\ Band\ Harmonic\ Mixing\ Number}$$

4. Refer to Table 10-6 to determine the circuit associated with the span.

Confirming Span Problems

1. If all 1st LO spans or only 1st LO spans of 1.01 MHz or above are affected, perform the YTO Adjustment procedure in Chapter 2.
   a. On the spectrum analyzer press (CAL), REALIGN LO & IF, and retest all spans.
   b. If the YTO Adjustment has sufficient range and only LO spans of 1.01 MHz or above are faulty, test YTO linearity by performing step c.
   c. Test the span in question at different center frequencies in the same band. If the span accuracy changes significantly (2% or more), suspect the A11 YTO.
2. If only 1st LO spans of 1 MHz or less are faulty, suspect A14 Roller Oscillator PLL.
3. If there are several spans in the main coil, FM coil, and roller span ranges affected, suspect the A14 span attenuator.

YTO Main Coil Span Problems (LO Spans Greater Than 20 MHz)

For YTO main-coil spans, the YTO is locked at the beginning of the sweep and the sweep ramp is summed into the main-coil tune driver.

1. Perform the YTO Adjustment procedure in Chapter 2. If the YTO Adjustments cannot be performed, continue with step 2.
2. Set the spectrum analyzer controls as follows:

   START FREQ ..... 10 MHz
   STOP FREQ ..... 2.9 GHz

3. Verify that a −1.2 V to −4.8 V ramp (approximately) is present at A14U331 pin 2.
4. If this ramp is not present, troubleshoot the Main/FM/VCO Sweep Switch. See function block G of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
5. Measure the output of the Main Coil Tune DAC at A14J18 pin 3. At the frequency settings of step 2, this should be −2.49 V. If the voltage is not −2.49 V, troubleshoot the Main Coil Tune DAC. See function block C of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

YTO FM Coil Span Problems (LO Spans 1.01 MHz to 20 MHz)

In YTO FM Coil spans, the YTO loop is locked and then opened while the sweep ramp is summed into the FM coil. FM spans are adjusted by changing the sensitivity of the FM coil driver.

1. Perform the YTO Adjustment procedure in Chapter 2. If the YTO adjustments cannot be performed, continue with this procedure.
2. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 20 MHz
   SWEEP TIME ..... 50 ms
3. Check for the presence of a 0 V to −10 V sweep ramp at A14J15 pin 14 (input to the Main/FM/VCO/Sweep Switch). Refer to function block G of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
4. Check for the presence of a 0 V to +5 V sweep ramp at A14U405 pin 6 (YTO FM Coil Driver). Refer to function block N of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
5. Check the state of the Main/FM/VCO Sweep Switches as indicated in Table 10-8.
6. The rest of the procedure troubleshoots the YTO FM Coil Driver. Refer to function block N of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

Table 10-8. Settings of Sweep Switches

Switch	Switch State	Switch Control Line (Pin #)	Control Line State (TTL)
U318A	Open	1	High
U318C	Open	9	High
U318D	Closed	16	Low
U324A	Closed	1	High
U324B	Closed	8	High
U324C	Open	9	Low

7. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   TRIG ..... SINGLE
8. On the spectrum analyzer press (SAVE), SAVE STATE, STATE 0.
9. Remove jumper A14J23 and connect a dc voltage source to A14J23 pin 2.
10. Connect a microwave frequency-counter or spectrum analyzer to the spectrum analyzer 1ST LO OUTPUT.
11. Set the dc-voltage source output for 0 V dc and note the 1st LO frequency.

12. Set the dc-voltage source output for +10 V dc. The 1st LO frequency should increase approximately +15.6 MHz.
13. The voltage at A14U332 pin 2 should be approximately 19% of the voltage at A14J23 pin 2.
14. If the 1st LO frequency did not change in step 12, set the spectrum analyzer (LINE) switch OFF and disconnect W10 from A14J3.
15. Place a jumper between A14J3 pins 9 and 10 and set the (LINE) switch ON.
16. On the spectrum analyzer press (RECALL), STATE, STATE 0.
17. Repeat steps 6 through 13.
18. If the voltage at U332 pin 2 is correct with A14J3 pins 9 and 10 shorted, but was incorrect with W10 connected, the YTO FM Coil is probably open; replace the A11 YTO.
19. Replace jumper A14J23.

Roller Oscillator Span Problems (LO Spans Less Than or Equal to 1 MHz)

The following procedure troubleshoots problems with the main oscillator of the roller oscillator PLL (101 kHz to 1 MHz) and offset oscillator (less than or equal to 100 kHz).

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 1 MHz
   RES BW ..... 10 kHz
   VIDEO BW ..... 10 kHz
   SWEEP TIME ..... 50 ms

2. Set the oscilloscope controls to the settings listed below and monitor A14J17 pin 1. The waveform should look similar to Figure 10-6.

   Amplitude Scale ..... 250 mV/DIV
   Sweep Time ..... 50 ms/DIV

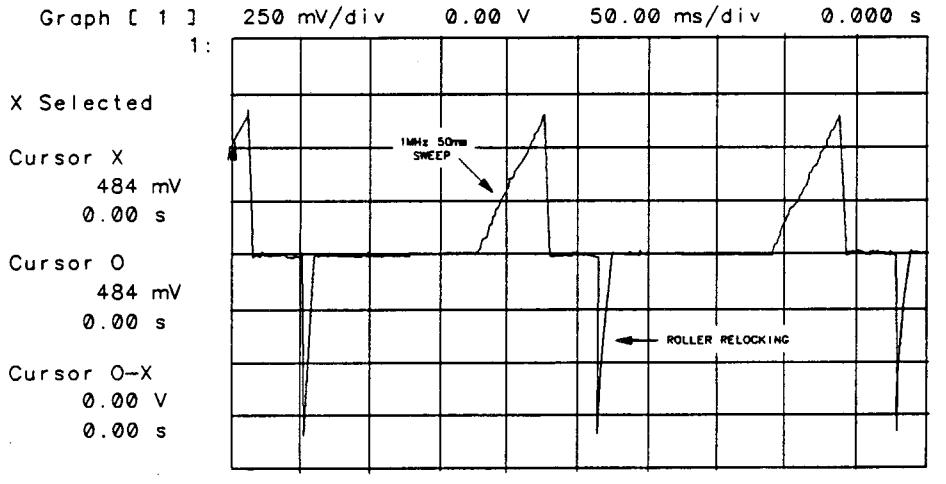


Figure 10-6. Input to YTO FM Coil Driver

3. If A14J17 pin 1 does not appear to be correct, verify that the sweep ramp is reaching the Main/FM/VCO Sweep Switch as follows:
   - Change the oscilloscope amplitude scale to 1.25 V/DIV and monitor the A14J15 pin 14. The waveform should be a 0 V to −10 V sweep of 50 ms duration. See Figure 10-7.
   - Check for a 0 V to −10 V ramp at A14J15 pin 13. Refer to function block H of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
   - Check the state of the Main/FM/VCO Sweep Switches. Their states should match those indicated in Table 10-9.

Note

Switches U324A and U318C can change the polarity of A14U404B. This allows the roller oscillator to sweep backward when the YTO is locked to a lower sideband of a sampling oscillator comb tooth. The YTO always sweeps forward (lower frequency to higher frequency), but the roller oscillator sometimes sweeps backwards (higher frequency to lower frequency). The Freq Diagnose Menu indicates a negative main roller frequency in this instance.

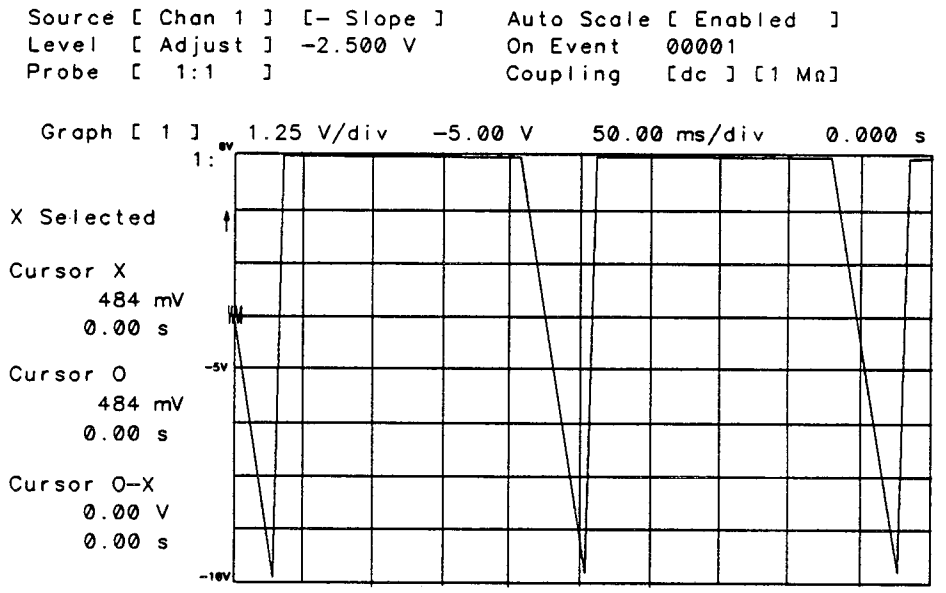


Figure 10-7. Input to Main/FM/VCO Sweep Switch

Table 10-9. Settings of Sweep Switches

Switch	Switch State	Switch Control Line (Pin #)	Control Line State (TTL)
U318A	Open	1	High
U318C	Open	9	High
U318D	Open	16	High
U324A	Closed	1	High
U324B	Closed	8	High
U324C	Closed	9	High

4. Set the spectrum analyzer controls as listed below to open U324A and close U418C. This inverts the waveform at A14J15 pin 13.

   START FREQ ..... 678.8 MHz
   SPAN ..... 1 MHz

5. The waveform at A14J15 pin 13 should be a ramp from 0 V to −10 V.

6. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 1 MHz

7. Monitor the output of A14J304 ROLLER TST with another spectrum analyzer and check that the roller oscillator is sweeping from 94.2 to 95.2 MHz.

8. If spans less than or equal to 100 kHz are faulty, troubleshoot the Offset Oscillator circuits as follows:

   - If the sweep ramp is correct at A14J15 pin 13, but the Roller Oscillator is not sweeping properly in spans less than or equal to 100 kHz, troubleshoot the Offset Oscillator Sweep/Hold circuit. Refer to function block AD of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
   - If the Offset Oscillator Sweep/Hold circuit is operating properly, Replace the A14A101 Offset Oscillator. Refer to function block AE of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

Note



In LO spans less than or equal to 100 kHz, the roller oscillator PLL offset oscillator is swept. The main roller oscillator remains locked to the offset oscillator frequency which is divided by 100. (In a 100 kHz span, the offset oscillator rolls 10 MHz while the main roller oscillator rolls 100 kHz. The YTO is locked to the main roller oscillator and also rolls 100 kHz.)

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9. If all LO spans less than or equal to 1 MHz are faulty, troubleshoot the Main Roller Sweep/Hold switches. Refer to function block AM of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

Note



The switching network, U116A/C/D and Q101, determines the main roller oscillator voltage source. When the oscillator is locked, U116A is closed to apply the PLL error voltage to the oscillator. When the oscillator is swept, U116A opens and U116C closes, applying the span ramp to the oscillator. U116D also closes providing the same impedance to ground as during the lock mode.

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10. If the spans are still faulty, refer to "Unlocked Roller Oscillator PLL" in this chapter.

First LO Span Problems (All Spans)

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 1 MHz
   RES BW ..... 1 MHz
   VIDEO BW ..... 1 MHz
   SWEEP TIME ..... 50 ms

2. Check that there is 0 V to +10 V ramp of 50 ms duration at A14J15 pin 15.
3. If a scan ramp is not present, refer to "Sweep Generator" in this chapter.
4. If there is a 0 to −10 V ramp at A14J15 pin 14, the fault is probably in the Main/FM/VCO Sweep Switch. See function block G of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
5. Check that there is a 0 V to +10 V ramp at U325 pin 1. The analyzer ADC obtains information about the sweep from this node.
6. Continue with step 7 to check the span attenuator. See function block M of A14 Frequency Control Schematic (sheet 2 of 5).
7. With the analyzer set to the settings in step 1, monitor A14U323 pin 6 with an oscilloscope. A 0 V to −10 V ramp should be present.
8. Change the spectrum analyzer span to 500 kHz and check for a 0 V to −5 V ramp at U323 pin 6.
9. Change the spectrum analyzer span to 200 kHz and check for a 0 V to −2 V ramp at U323 pin 6.
10. Set the spectrum analyzer controls as follows:

    START FREQ ..... 10 MHz
    STOP FREQ ..... 2.9 GHz
    SWEEP TIME ..... 80 ms

11. Monitor A14J15 pin 14 for a 0 V to −9 V ramp. Switches U317A, U317B, and U317D should be open and U317C should be closed.
12. Change the spectrum analyzer [SPAN] to 365 MHz and check for a 0 mV to −900 mV ramp at A14J15 pin 14. Switch U317C should be open and U317B closed.
13. Change the spectrum analyzer [SPAN] to 36.5 MHz and check for a 0 mV to −90 mV ramp at A14J15 pin 14. Switch U317B should be open and U317A closed.
14. Check the sweep generator current source with the following steps. See function block K of A14 Frequency Control Schematic diagram (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
15. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 1 MHz
    SWEEP TIME ..... 50 ms

16. Use a DVM to monitor the voltage at A14J18 pin 4. The voltage should measure approximately −8.45 V dc.

17. Set the spectrum analyzer sweep time to 100 ms. The voltage at J18 pin 4 should measure approximately −4.21 V dc.
18. Set the spectrum analyzer sweep time to 200 ms. The voltage at J18 pin 4 should measure approximately −2.1 V dc.
19. The analog switches and comparators should be set as listed in Table 10-10.
20. Check that U312D opens when the sweep time is set to 2 seconds.
21. Check that U312B and U312C close when the sweep time is set to 20 seconds.

Table 10-10. Settings for Switches and Comparators

Sweep Time	Switch U312B	Switch U312C	Switch U312D	Comparator U319A Pin 1	Comparator U319B Pin 7
200 ms	Open	Open	Closed	High	High
2 s	Open	Open	Open	High	High
20 s	Closed	Closed	Open	High	High

1st LO Span Problems (Multiband Sweeps)

During multiband sweeps, the sweep ramp at A14J15 pin 15 should go from 0 V to +10 V for each band or portions of a band covered. See function block K of A14 Frequency Control Schematic diagram (sheet 1 of 5). However, the scan ramp at A14U325A pin 1 is scaled according to the percentage of the total span that the band is covering. See function block L of A14 Schematic Diagram (sheet 1 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder. Also, the sum of the individual ramps is 10 V. Figure 10-8 illustrates both sweep and the scan ramp for a 2.75 to 22 GHz span (the preset state).

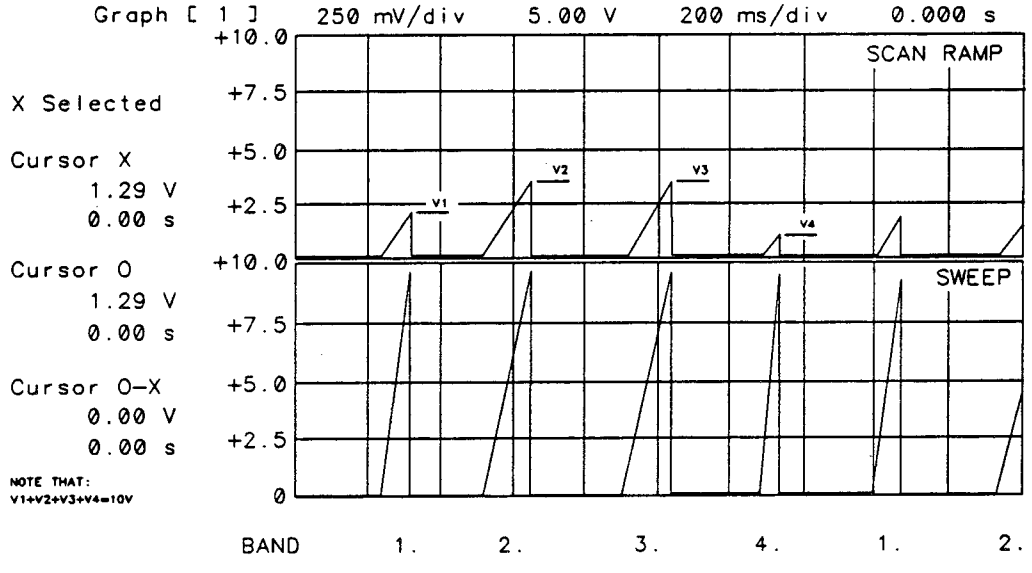


Figure 10-8. Sweep and Scan Ramps

Unlocked YTO PLL

Operation

The A11 YTO is locked to two other oscillators, the roller PLL main oscillator and the offset PLL sampling oscillator. For LO spans of 1.01 MHz and above, either the FM or Main Coil of the YTO is swept directly. For LO spans of 1 MHz and below, the roller PLL main oscillator is swept. The sampling oscillator remains fixed-tuned during all sweeps.

The output of A11 YTO feeds through the A7 LO Distribution Amplifier (LODA) to the A15A2 Sampler. The offset PLL sampling oscillator, which drives the sampler, oscillates between 280 and 298 MHz. The sampler generates harmonics of the sampling oscillator and one of these harmonics mixes with the YTO frequency to generate the sampler IF frequency. As a result, the frequency of the sampler IF is determined by the following equation:

$$F_{IF} = F_{YTO} - (N \times F_{SAMP})$$

Where:

F_{IF} is the Sampler IF

F_{YTO} is the YTO frequency

N is the desired Sampling Oscillator harmonic

F_{SAMP} is the Sampling Oscillator frequency

Notice that F_{IF} can be positive or negative depending on whether the sampling-oscillator harmonic used is below or above the YTO frequency. Of course, the actual sampler IF is always positive, but the sign is carried along as a "bookkeeping" function which determines which way to sweep the roller oscillator (up or down) and what polarity the YTO error voltage should have (positive or negative) to maintain lock.

To check if a negative Sampler IF is selected, press (CAL), MORE 1 OF 2, FREQ DIAGNOSE, MAIN ROLLER. If the main roller oscillator frequency is positive, the sampler IF is also positive. A negative main roller frequency indicates that the sampler IF is negative.

Notice that the polarity of the YTO loop error voltage (YTO LOOP ERROR) out of the YTO Loop phase/frequency detector changes as a function of the polarity of the sampler IF. That is, for positive sampler IF, an increasing YTO frequency results in an increasing YTO LOOP ERROR signal. For negative sampler IF, a decreasing YTO frequency results in a decreasing YTO LOOP ERROR signal. This implies that to maintain lock in both cases, the sense of YTO LOOP ERROR must be reversed such that, with a negative sampler IF, an increasing YTO LOOP ERROR results in an increasing YTO frequency. This is accomplished with error-sign amplifier, A14U328D. This amplifier can be firmware-controlled to operate as either an inverting or noninverting amplifier. Digital control line ERRSGN (from A14U313 pin 12) controls the polarity of this amplifier. When ERRSGN is high, the amplifier has a positive polarity.

In roller spans (LO spans less than 1 MHz) the YTO remains locked to the sweeping roller oscillator PLL. Thus, the sampler IF must always equal the main roller oscillator frequency (conditions for lock). Since the YTO must always sweep up in frequency, for negative sampler

IF, the main roller oscillator must sweep from a higher frequency to a lower frequency. This is necessary since an increasing YTO frequency decreases the sampler IF for negative sampler IF. The opposite is true for positive sampler IF, so in these cases, the main roller oscillator sweeps more conventionally from a lower frequency to a higher frequency. This implies that the sense of the span ramp sweeping the roller oscillator PLL must change between negative and positive sampler IF. This is accomplished by controlling the polarity of the VCO sweep driver. The polarity is controlled by VCOSGN from A14U425 pin 12. When VCOSGN is high, the VCO sweep driver has positive polarity.

The main and offset roller oscillators have opposite sense with respect to the VCO span ramp (VCO RAMP). A positive-going ramp moves the main roller oscillator lower in frequency (main roller spans) while a positive-going ramp moves the offset roller oscillator higher in frequency (offset roller spans). Thus the polarity of the VCO sweep driver depends on whether a main roller or offset roller LO span is selected.

Table 10-11 summarizes the amplifier polarities for the various combinations of sampler IF polarities and LO spans.

The YTO main coil filter is used to improve residual FM in FM spans. See function block E of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder. Transistors Q304 and Q305 switch the filter (capacitor C36 and resistor R48) into the circuit. Transistor Q303 and U333 keep C36 charged during main spans so the frequency does not jump when C36 is switched in.

Table 10-11. Amplifier Polarities

		YTO Error Sign Amplifier	VCO Sweep Driver Amplifier	ERRSGN (A14U313 pin 12)	VCOSGN (A14U425 pin 12)
Roller Offset	Positive	Positive	Negative	TTL High	TTL Low
Oscillator Swept	Sampler IF				
	Negative Sampler IF	Negative	Negative	TTL Low	TTL High
Roller Main	Positive	Positive	Positive	TTL High	TTL High
Oscillator Swept	Sampler IF				
	Negative Sampler IF	Negative	Negative	TTL Low	TTL Low
FM/Main YTO Coils Swept	Positive Sampler IF	Positive	Does not apply	TTL High	Does not apply
	Negative Sampler IF	Negative	Does not apply	TTL Low	Does not apply

Troubleshooting an Unlocked YTO PLL

1. If the YTO PLL is unlocked, error code 301 should be displayed. Set the spectrum analyzer [SPAN] to zero. Figure 10-9 illustrates the simplified YTO PLL.
2. Move the jumper on A14J23 to connect pins 2 and 3 (TEST position). Refer to Figure 10-3 for the location of A14J23. Error code 301 should no longer be displayed. (The YTO PLL feedback path is now open.)
3. On the spectrum analyzer, press [CAL], MORE 1 OF 2, FREQ DIAGNOSE, and LO FREQ. The displayed LO FREQ is the desired YTO frequency. Record the calculated YTO frequency below:

   YTO Frequency (calculated): _____MHz

4. Measure and record the YTO frequency from the front-panel 1ST LO OUTPUT connector below:

   YTO Frequency (measured) = _____MHz

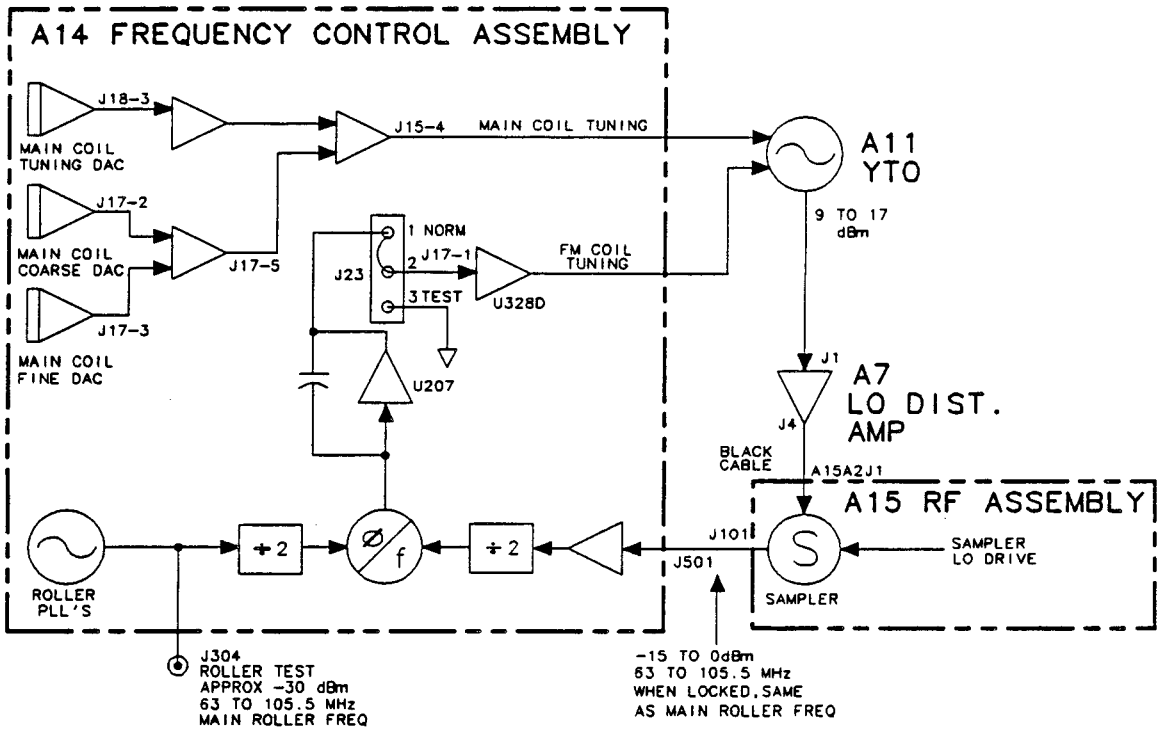


Figure 10-9. Troubleshooting an Unlocked YTO PLL

5. Calculate the YTO frequency-error by subtracting the frequency recorded in step 3 from the frequency recorded in step 4. Record the result below:

YTO Frequency Error = _____MHz

$$\text{YTO Frequency Error} = \text{YTO Frequency}_{(\text{MEASURED})} - \text{YTO Frequency}_{(\text{CALCULATED})}$$

6. On the spectrum analyzer, press `MORE 1 OF 2`, `FREQ DIAGNOSE`, and `MAIN ROLLER`. Record the main roller frequency below:

Main Roller Frequency = _____MHz

7. If the YTO Frequency Error recorded in step 5 is greater than 30 MHz, do the following:
   a. Check the YTO Adjustments using the TAM or the procedure in Chapter 2.
   b. Check the YTO DACs using steps 41 through 49 of this procedure, or using the TAM Manual Probe Troubleshooting on A14J17 and A14J18.
   c. Refer to steps 10 through 34 below.
8. If the YTO Frequency Error recorded in step 5 is less than 10 MHz, do the following:
   a. Measure the frequency at A14J304. The frequency should be equal to the frequency recorded in step 6. If it is not, refer to "Unlocked Roller Oscillator PLL."
   b. Measure the input and output levels of the A15A2 Sampler. If the sampler appears defective, check the LO drive to the sampler as described in "Sampler and Sampler IF."
   c. Refer to steps 35 through 49 below.
9. If the YTO Frequency Error recorded in step 5 is between 10 and 30 MHz, do the following:
   a. Find the main roller frequency in Table 10-12 that matches the frequency recorded in step 6. Locate the corresponding acceptable YTO Frequency Error range in the table.

Note

Table 10-12 shows how close in frequency the YTO must be in order to phase-lock when the loop is closed. The range is a function of where the main roller oscillator is tuned. The main roller frequency column (showing polarity) indicates whether the YTO frequency is above (+) or below (−) the sampler harmonic.

   b. If the YTO Frequency Error recorded in step 5 is outside the range listed in Table 10-12, perform the following steps.
      i. Check the YTO Adjustments using the TAM.
      ii. Check the YTO DACs either by using the procedure in steps 41 through 49 below, or by using the TAM Manual Probe Troubleshooting on A14J17 and A14J18.
      iii. Refer to steps 10 through 34 below.
   c. If the YTO Frequency Error recorded in step 5 is within the range listed in Table 10-12.

i. Measure the frequency at A14J304. The frequency should be equal to the frequency recorded in step 6. If it is not, refer to "Unlocked Roller Oscillator PLL."

ii. Measure the input and output levels of the A15A2 Sampler. If the sampler appears to be defective, check the LO drive to the sampler as described in "Sampler and Sampler IF."

iii. Refer to steps 35 through 49 below.

Table 10-12. YTO Frequency Errors with A14J23 on Pins 2 and 3

Main Roller Frequency	YTO Frequency Error (with J23 on pins 2 and 3)	Gain of U328B
−104 to −93 MHz	−10 to +30 MHz	−1
−93 to −73 MHz	−20 to +20 MHz	−1
−73 to −65 MHz	−30 to +10 MHz	−1
+65 to +73 MHz	−10 to +30 MHz	+1
+73 to +93 MHz	−20 to +20 MHz	+1
+93 to +104 MHz	−30 to +10 MHz	+1

10. The pretuned 1st LO frequency must be sufficiently accurate for the YTO loop to achieve lock. The 1st LO amplitude must be sufficient to drive the A15A2 Sampler. Perform the YTO Adjustment procedure, particularly the YTO Main Coil adjustments. (If available, use a synthesized microwave spectrum analyzer instead of the microwave frequency counter specified in the adjustment procedure.)

11. If the main YTO coil cannot be adjusted, proceed to step 33 to troubleshoot the Main Coil Coarse and Fine DACs and Main Coil Tune DAC.

12. The front-panel 1ST LO OUTPUT should measure between +14.5 and +18.5 dBm in amplitude.

13. If the 1ST LO OUTPUT amplitude is out of the specified range, perform the First LO Distribution Amplifier Adjustment procedure. Refer to Chapter 2.

14. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

15. Monitor the roller oscillator PLL output at A14J304 (ROLLER TST) with a synthesized spectrum analyzer such as an HP 8568A/B or HP 8566A/B. Refer to function block AQ of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

16. The signal at A14J304 (ROLLER TST) should measure approximately −30 dBm at 94.7 MHz.

17. If a problem exists only at particular CENTER FREQ and (SPAN) settings, determine the desired roller oscillator frequency by pressing (CAL), MORE 1 OF 2, FREQ DIAGNOSE, MAIN ROLLER and setting the spectrum analyzer to SINGLE trigger mode.

18. If the roller oscillator frequency is not correct, refer to "Unlocked Roller Oscillator PLL."

19. Set jumper A14J23 to the TEST position and set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 2.9 GHz
    SPAN ..... 0 Hz

20. Disconnect cable W34 (coax 0) from A15A2J1.

21. Use a power meter to measure A7 LODA sampler-drive output at the end of W34 (coax 0). The power should measure greater than −9 dBm.

22. Place jumper A14J23 in the NORMAL position and reconnect W34 (coax 0) to A15A2J1.

23. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

24. Place jumper A14J23 in the TEST position.

25. Disconnect W32 from A15J101. Monitor the sampler IF output (A15J101, SAMPLER IF) with a synthesized spectrum analyzer such as an HP 8568A/B or HP 8566A/B.

26. The sampler IF should measure between 74 MHz and 114 MHz at −15 dBm to +2 dBm. If the signal frequency or amplitude is incorrect, refer to "Unlocked Offset PLL."

27. Set jumper A14J23 in the NORMAL position. Reconnect W32 to A15J101.

Note



The A11 YTO has an initial pretune accuracy of ±20 MHz. However, when the roller oscillator frequency is <73 MHz, this is changed to +30/−10 MHz. If the roller oscillator is >93 MHz, the accuracy is changed to +10/−30 MHz. This is done by changing the main coil coarse DAC to keep the sampler IF within the acquisition range of the YTO Loop. When dealing with the sampler IF and an unlocked YTO, the same frequency differences apply to the sampler IF.

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28. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

29. Connect the output from an RF signal generator to A14J501. Set the signal generator controls as follows:

    Frequency ..... 84 MHz
    Amplitude ..... 0 dBm

30. Monitor A14J17 pin 1 with a DVM or an oscilloscope.

31. As the signal generator frequency is increased to 104 MHz, the voltage at A14J17 pin 1 should change from +8.2 to −8.2 V dc ±1 V.

32. Set the signal generator controls as follows and repeat step 23.

    Frequency ..... 84 MHz
    Amplitude ..... −15 dBm

33. If the voltage monitored in step 23 is correct with a 0 dBm output but not with −15 dBm output, suspect A14U201 or A14U202. If the voltage does not change, check the YTO PLL Loop divide-by-two circuits as follows:

Set the signal generator for an 80 MHz output.
Measure A14U203 pin 2 with an active probe and a spectrum analyzer. The signal should be approximately 0 dBm (ECL levels) and 47.35 MHz (94.7 MHz main roller frequency divided by two).
The signal at A14U205 pin 2 should measure 40 MHz at approximately 0 dBm.

Note A14U205 is turned off during YTO FM coil sweeps (LO spans between 1.01 and 20 MHz).

34. Place jumper A14J23 in the NORMAL position and connect W32 to A14J501.
35. Steps 27 through 31 verify that the YTO-loop error voltage is reaching the FM coil. Refer to function blocks N and O of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder. To troubleshoot the YTO FM Coil Driver, refer to step 6 of "First-LO Span Problems (1 MHz to 20 MHz)."
36. Remove jumper A14J23 and connect a dc power supply to A14J23 pin 2. Set the dc power supply to +7.5 V dc.
37. Verify the nominal test-point voltages listed in Table 10-13.
38. Change the input voltage to −7.5 V and reverify that the voltages listed in Table 10-13 are the same except for a change in polarity.
39. The main-loop error-voltage driver has a gain of either 1.5 or 15; the analyzer firmware controls the gain during the locking process. The error voltage is read by the ADC on the A3 Interface assembly. U324D calibrates out any offsets from true ground. A14U326A inverts the sense of the YTO loop to lock the YTO on lower sampler-sidebands [YTO frequency less than (sampler frequency ×sampler harmonic)]. The main roller frequency indicated in the Freq Diagnose Menu is negative in this situation. Changing the CENTER FREQ to 678.8 MHz with a SPAN of 0 Hz changes the switch setting of U326A and invert the voltages listed in Table 10-13.

Table 10-13. Voltages in FM Coil and Main Loop Drivers

Measurement Points	Voltages
A14U405 pin 6	+2.8 V dc
A14U322 pin 2	0 V dc
A14J17 pin 4	>+12 V dc

40. Place jumper A14J23 in the TEST position.
41. The main coil coarse and fine DACs correct any initial pretune errors in the YTO main coil. The DACs adjust the FM-coil current to zero before any sweep begins. Refer to function block I of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder. Place jumper A14J23 in the NORMAL position.

42. Set the spectrum analyzer to the settings listed below. These set both DACs to 128 (the DAC setting range is 0 to 255).

CENTER FREQ ..... 300 MHz
SPAN ..... 0 Hz
TRIG ..... CONT

43. Verify the voltages listed in Table 10-14.

Table 10-14. Main Coil Coarse and Fine DACs Voltages

Measurement Points	Voltages
A14J17 pin 2	−7.0 V dc
A14J17 pin 3	−7.0 V dc
A14J17 pin 5	+8.1 V dc

44. Place jumper A14J23 in the NORMAL position.

Note

The A11 YTO has an initial pretune accuracy of ±20 MHz. However, when the roller oscillator frequency is less than 73 MHz this is changed to +30/−10 MHz. If the roller oscillator frequency is greater than 93 MHz, the accuracy is changed to +10/−30 MHz. This is done by changing the main coil coarse DAC to keep the sampler IF within the acquisition range of the YTO Loop. When dealing with the sampler IF and an unlocked YTO, the same frequency differences apply to the sampler IF.

45. Set the spectrum analyzer controls as follows:

CENTER FREQ ..... 300 MHz
SPAN ..... 0 Hz

46. Place jumper A14J23 in the TEST position.

47. Measure the output of the main coil tune DAC (A14J18 pin 3) with a DVM. Refer to function block C of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

48. If the spectrum analyzer center frequency is 300 MHz, the voltage at A14J18 pin 3 should measure −3.35 V ±0.25 V. The voltage may also be determined from the following equation:

$$V = -(\text{1st LO Frequency} - 2.95\ \text{GHz}) \times 2.654\text{V/GHz}$$

49. The voltage at A14U330 pin 2 should measure 3.4 V ±0.2 V dc. This represents a current setting the YTO to approximately 2.95 GHz.

Unlocked Roller Oscillator PLL

Operation

The roller oscillator is used in the spectrum analyzer as a reference for the 1st LO phase-lock loop. It provides the 25 Hz start-frequency resolution for the 1st LO, and is the means by which the 1st LO is swept in LO spans of 1 MHz or less (roller spans). It is composed of the following three separate phase-lock loops:

Offset Oscillator PLL
Transfer Oscillator PLL
Main Oscillator PLL

These three PLLs operate together to produce an output frequency in the range of 65 MHz to 104 MHz, selectable in 25 Hz increments. The output frequency can be swept (increasing or decreasing) over a 2.5 kHz to 1 MHz range.

To determine the roller frequency for any given center frequency, press (CAL), MORE 1 OF 2, FREQ DIAGNOSE, and MAIN ROLLER. The MAIN ROLLER frequency displayed is the frequency measured at A14J304 ROLLER TST with the spectrum analyzer in zero span.

Note



Because the three roller loops are all interdependent, an error message displayed on-screen might not describe the primary cause of the failure. Be sure to query the error message buffer for all encountered errors by pressing (RECALL), MORE 1 OF 2, RECALL ERRORS and using the knob or step keys to scroll through all listed errors. The frequency displayed for the offset roller using the above procedure is the offset roller frequency divided by 100.

During the LO ADJUST sequence performed at power-on, pretune-DAC values for roller oscillator frequencies, spaced 2 MHz apart, are determined and stored. Pretune-DAC values for frequencies locked during instrument operation are interpolated from these calibration values. Tuning sensitivities for the main and offset rollers are determined and used to adjust U114B Roller Span Attenuator DAC to improve span accuracy.

Confirming an Unlocked Condition

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

2. Connect A14J304 ROLLER TST to the input of a synthesized spectrum analyzer and view the roller oscillator output at 94.7 MHz.

Note



If a synthesized spectrum analyzer is not available, connect A14J304 to the input of a 20 dB gain amplifier, such as an HP 8447E. Connect the output of the amplifier to the input of a frequency counter.

3. If the roller oscillator measures a stable 94.7 MHz, the roller oscillator PLLs are probably locked.
4. If the roller oscillator is off-frequency or unstable and no error message is displayed, check Roller MUX U305, Roller MUX Amplifier U328, and MUX Gain Control Switch U328B. Refer to function block AG of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

Note



Although J304 is the output of the main roller oscillator, an unstable signal here does not necessarily mean the main roller oscillator is unlocked; the main roller oscillator tracks the frequency movements of the other two roller PLLs.

Offset Oscillator PLL

The offset oscillator PLL provides a synthesized frequency in the range of 189 MHz to 204 MHz in 2.5 kHz steps. This frequency is divided by 100 to provide a 1.89 MHz to 2.04 MHz signal with 25 Hz resolution to the main oscillator PLL. It is swept in LO spans less than or equal to 100 kHz.

1. Confirm an output from the offset oscillator at the points listed below. Refer to function block AE of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

A14TP302 (A14A101)	189 MHz to 204 MHz
U102 pin 2	189 MHz to 204 MHz (>−3 dBm)

2. Measure the offset amplifier and offset oscillator bias voltages at the following test points:

A14J302 pin 5 (Offset Amp Bias)	between +2 and +4 V dc
A14J302 pin 2 (Offset Osc Bias)	between +7 and +8 V dc

3. The oscillator power level, measured with an active probe at TP302, should measure −15 dBm.
4. Set the spectrum analyzer controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz

5. Measure the unlocked offset oscillator frequency at A14TP302. If the frequency is not 200 MHz ±10 MHz, short U416 pin 14 to ground. Refer to function block AD of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
6. The offset oscillator frequency should measure 200 MHz ±1 MHz. If the frequency is not in this range, measure the pretune voltage at J302 pin 15.
7. If the pretune voltage is not −5.25 ±1.75 V dc, troubleshoot U126B, U119B, and the offset pretune DAC address decoder U302. Refer to function block AF of A14 Frequency Control Schematic (sheet 5 of 5) and function block B of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
8. Remove the short from U416.

Note If the transfer roller oscillator is locked, the address decoder is not at fault. Address decoder U302 decodes a single address for both the offset oscillator pretune DAC and the transfer oscillator pretune DAC.

9. If the pretune voltage is within the range listed in step 7, the offset oscillator is probably at fault.
10. Measure the offset oscillator frequency at A14TP302. If the frequency is not 200 MHz ±10 MHz, connect a frequency counter to U101 pin 3 (using a ×10 oscilloscope probe). Place the counter in the high-input impedance function.
11. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

12. Check that U101 pin 1 is high. This indicates that prescaler U101 is in the divide-by-128 mode. Refer to function block AC of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
13. The signal frequency at U101 pin 3 should be the offset oscillator frequency divided by 128. The frequency would be 1.562500 MHz if the offset oscillator were locked at 200 MHz.
14. The amplitude of the signal at U110 pin 3 should measure greater than 0.1 V p-p.

Note Integrated circuit U110 contains the reference and VCO dividers, phase detector and modulus (pre-scalar) control circuitry.

15. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

16. Check that there are narrow (less than 1 μs) pulses 400 μs apart at U110 pin 18 (reference divider output) and U110 pin 15 (VCO divider output). Refer to function block AC of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
17. Short A14A101 pin 14 of the offset oscillator to A14A101 pin 20. This sets the offset oscillator TUNE+ line at +10 V, setting the offset oscillator to its maximum frequency.
18. The error voltage measured at U111 pin 1 should be greater than +9 V dc.
19. Short A14A101 pin 14 of the offset oscillator to ground. The error voltage at U111 pin 1 should measure less than −9 V dc.

Note Under some unlocked conditions, the offset oscillator loop may appear to become unstable. (The error voltage oscillates wildly.) This is normal behavior brought on by the conduction of zener diodes VR308 and VR309, which short out R336 to improve the lock time.

20. Remove the shorts from A14A101.

21. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

22. Check that the voltage at U112 pin 5 is the same as that on U112 pin 3.

23. Set the spectrum analyzer [SPAN] to 100 kHz.

Note

A14U112 is a sample-and-hold IC that stores the phase-lock error voltage during offset sweeps (less than or equal to 100 kHz). Refer to function block AD of A14 Frequency Control Schematic (sheet 5 of 5). When the loop is locked, U112 is in the hold mode and U112 pin 8 should be low.

24. Trigger a dual-trace oscilloscope from U112 pin 8 (OFFHOLD), and observe the sample-and-hold action on U112 pins 3 and 5.

25. If ERRs 302 or 327 are displayed and the offset oscillator loop is locked, troubleshoot Roller MUX U305, MUX Amp U328, and MUX Gain Control Switch U326B. Refer to function block AG in A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

26. If U305, U328, and U326B are working properly, suspect a malfunction of the A3 Interface assembly or the W2 Control Cable.

Transfer Oscillator PLL

The transfer oscillator PLL provides a synthesized signal from 65 MHz to 110 MHz in 50 kHz steps. This signal mixes with the main roller PLL output, producing the roller IF at approximately 2 MHz. The roller IF is compared to the offset oscillator divided output to phase-lock the main roller oscillator.

1. Use an active probe (or sniffer loop) connected to a spectrum analyzer to test for an output from the A14A102 Transfer Oscillator. The amplitude at TP301 should be approximately −4 dBm. Refer to function block AI of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

2. The voltage at A14J302 pin 1, XFER OSC BIAS, should measure +7.5 V dc ±1 V.

3. If the transfer oscillator output contains noise sidebands, phase noise, or jitter, troubleshoot switches Q102 and Q103 in function block AK, and Q104 in function block AN.

4. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

5. If the transfer oscillator frequency at TP301 is 96.7 MHz ±2 MHz, the oscillator is unlocked. Refer to function block AI of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

6. If the transfer oscillator frequency is not within the range in step 5, short A14A102 pin 12.

7. If the transfer oscillator frequency is not 96.7 MHz ±1 MHz, check that the transfer oscillator pretune voltage at J302 pin 13 is +13.6 V dc ±1.8 V.

8. If the pretune voltage is not within the range in step 5, check U119A, U122A, Q102, Q103 and the transfer oscillator pretune DAC address decoder, U302. Refer to function block AK of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
9. If the offset roller is locked, then the address decoder is correct; U302 decodes a single address for both the offset oscillator pretune DAC and the transfer oscillator pretune DAC.
10. If the pretune voltage is within the range in step 5, the A14A102 transfer oscillator is probably defective.
11. Remove the short from A14A102.
12. If the transfer oscillator frequency, measured at A14TP301, is 96.7 MHz ±2 MHz, set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 87.3 MHz
    SPAN ..... 0 Hz

13. Use a frequency counter with a 10:1 oscilloscope probe to measure the frequency at U127 pin 3. (Place the counter in the high-input-impedance mode.)
14. The measured frequency should equal the transfer oscillator frequency divided by 32.
15. Confirm that U127 pin 1 is high. The signal amplitude at U127 pin 3 is greater than or equal to 1 V p-p.
16. Set the spectrum analyzer controls as follows:

    CENTER FREQ .....300 MHz
    SPAN ..... 0 Hz

Note



Integrated circuit U124 contains the reference dividers, VCO dividers, phase detector, and modulus (pre-scalar) control circuitry. Refer to function block AH of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

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17. Check for narrow (less than 1 μs) pulses 20 μs apart at U124 pin 18 (reference divider output) and pin 15 (VCO divider output).
18. Short U126 pin 3 to ground. The voltage at U126 pin 1 should be less than −9.5 V dc.
19. Short U126 pin 2 to ground. The voltage at U126 pin 1 should be +9.5 V dc.
20. If ERR 303 is displayed and the transfer oscillator loop is locked, troubleshoot Roller MUX U305, MUX Amp U328, and MUX Gain Control Switch U326B. Refer to function block AG in A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
21. If U305, U328, and U326B are working properly, suspect a malfunctioning A3 Interface assembly or W2 Control Cable.

Main Oscillator PLL

The main oscillator PLL provides an output signal in the range of 63 MHz to 106 MHz. This signal is the reference to the YTO PLL. The sampler IF signal from the A15 RF assembly is compared with this signal in the YTO loop, providing an error voltage to phase-lock the YTO.

The main oscillator PLL sample-and-hold function is performed digitally using two DACs, U113A Coarse Adjust and U113B Fine Adjust. When the main roller oscillator is locked after retrace and before the start of a main roller span, these DACs are adjusted to zero. When the PLL error voltage is zero it provides no frequency correction and can thus be disconnected (via switch U116A) without affecting the main roller frequency. The span ramp is then applied to sweep the main roller over the desired range.

Assuming the DACs and their address decoder are working properly, suspect a bad calibration performed in the power-on sequence, an unstable main roller loop or oscillator, or an intermittent failure in the main roller PLL circuitry.

Note



Before proceeding with the following steps, confirm that the roller oscillator PLL, transfer oscillator PLL, and offset oscillator PLL loops are locked.

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1. Measure the signal power at A14J304. The signal should measure greater than −33 dBm.
2. Measure the signal at A14TP305. The nominal signal power should measure −16 dBm.
3. If the output of A14TP305 is not correct, confirm that the voltage at J303 pin 1, Out Amp Bias, is between +3 V dc and +6 V dc. Refer to function block AO of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
4. Confirm that the voltage at J303 pin 2, Main Osc Bias, is +8 V dc ±1 V.
5. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

6. Confirm that the voltage at A14A103 pin 14, TUNE+, is +12.6 V dc ±1.4 V. Refer to function blocks AO and AN of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
7. If TUNE+ is within range, short A14A103 pin 12 to ground.
8. Measure the frequency at C345 (lead closest to mixer U117) with a frequency counter and a ×10 oscilloscope probe.
9. If the frequency is not within 94.7 MHz ±1 MHz, the main roller oscillator, A14A103, is probably defective.
10. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 300 MHz
    SPAN ..... 0 Hz

11. Measure the PLL IF amplitude at U109 pin 1 with an oscilloscope and a ×10 oscilloscope probe. A 50 mV signal at approximately 2 MHz should be observed.

12. If the PLL IF is not correct, check for transfer oscillator drive at U117 pin 1 (−13 dBm nominal drive).
13. If the transfer oscillator drive signal is not present, check the XFER AMP BIAS at J303 pin 3. The voltage should measure +2 V dc to +4 V dc.
14. Check that the voltage at U424B pin 7 is nominally −14 V dc. Diodes CR302 and CR303 form a PIN diode switch that turns off the transfer oscillator drive to the mixer in main roller spans (100 kHz <LO span ≤1 MHz). Refer to function block AI of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
15. Check that control signal XFEROSCSW is near 0 V (U424B pin 5). If XFEROSCSW is not near 0 V, check U401 Roller Interface Latch and its address decoder U303. Refer to function block AG of A14 Frequency Control Schematic (sheet 5 of 5) and function block B of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
16. If the signal amplitude at U109 pin 1 (refer to step 11) is within range and near 2 MHz in frequency, measure the signal with an oscilloscope at U109 pin 7. The voltage should nominally be 100 mV p-p.
17. The waveform at U106 pin 7 should be a square wave with a lower limit between 0 V and +0.5 V and an upper limit between +3 V and +5 V. Refer to function block AL of A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
18. The signal at U105 pin 1 should have a similar waveform as U106 pin 7, but may be different in amplitude from the U103 and U104 Offset Oscillator Dividers.
19. The offset oscillator divider, function block AJ, is probably at fault if the signal at U105 pin 1 is not present and the offset roller is locked.
20. If the input signals to U105 Main Roller Phase Detector (measured in steps 17 and 18) are in range, check for narrow (less than 0.1 μs) pulses 0.5 μs apart on U105 pins 2 and 13.
21. Short U115B pin 5 to ground and check that U115B pin 7 is nominally −9.1 V dc.
22. Short U115B pin 6 to ground and check that U115B pin 7 is nominally +9.1 V dc.
23. If ERR 304 is displayed and the main oscillator PLL is locked, troubleshoot Roller MUX U305, MUX Amp U328, and MUX Gain Control Switch U326B. Refer to function block AG in A14 Frequency Control Schematic (sheet 5 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.
24. If U305, U328, and U326B are working properly, suspect a malfunction of the A3 Interface assembly or the W2 Control Cable.
25. Remove the jumpers.

Unlocked Offset Lock Loop (Sampling Oscillator)

Operation

The offset lock loop drives the A15A2 Sampler. The offset lock loop sampling oscillator tunes to one of fifteen discrete frequencies between 280 MHz and 298 MHz. Refer to A15 Schematic (sheet 3 of 3). Mixer A15U400 mixes the oscillator output with 300 MHz from the reference PLL, producing a 2 MHz to 20 MHz IF signal. The 2 MHz to 20 MHz signal is divided down to 2 MHz or 2.5 MHz and compared in the phase/frequency detector with the divided-down 10 MHz from the reference PLL. The phase/frequency detector drives a voltage-to-current (V/I) diode switch which drives the loop integrator. Loop bandwidth switches vary the loop bandwidth to minimize noise sidebands. The sampling oscillator must produce low noise because the A15A2 Sampler multiplies noise by a factor of approximately 24.

Table 10-15 lists the divide ratios and control-line settings for each of the 15 discrete frequencies to which the offset lock loop may be set.

Troubleshooting

1. Use an active probe and spectrum analyzer to confirm the presence of the following references to the offset lock loop input.

A15TP404	300 MHz at +5 dBm
A15TP408	10 MHz TTL-level

2. If either of these signals is not correct, refer to "Unlocked Reference PLL."
3. Force the PLL to unlock by shorting A15X201 pin 1 to A15X201 pin 5 with a short length of wire.
4. Connect a dc power supply to A15J200 pin 16.
5. Monitor A15TP201 with an active-probe/spectrum-analyzer combination. Vary the dc supply until the frequency of the sampling oscillator is 280 MHz.
6. The voltage required to tune the oscillator should measure between +2 V dc and +8 V dc. If the voltage is out of this range, perform the Sampling Oscillator Adjustment in Chapter 2.
7. Vary the voltage to tune the sampling oscillator to 280 MHz.
8. With the active-probe/spectrum-analyzer combination, measure the 300 MHz LO signal at test point A15TP402 for +7 dBm.
9. If the signal does not measure about 7 +dBm, troubleshoot the Offset Lock Loop Buffer (function block AM of A15 RF Schematic sheet 3 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

Table 10-15. Sampling Oscillator PLL Divide Ratios

Sampling Oscillator Freq. (MHz)	Center Freq.* (MHz)	Divide Ratios		TP 406, TP 407† (MHz)	N Control Lines			M Control Lines	
		N	M		B1	B2	B3	B4	B5
280.0	389.5	8	4	2.5	high	high	high	high	low
282.5	427.0	7	4	2.5	low	high	high	high	low
284.0	449.5	8	5	2.0	high	high	high	low	high
285.0	464.5	6	4	2.5	high	low	high	high	low
286.0	479.5	7	5	2.0	low	high	high	low	high
287.5	502.0	5	4	2.5	low	low	high	high	low
288.0	509.5	6	5	2.0	high	low	high	low	high
290.0	539.5	5	5	2.0	low	low	high	low	high
292.0	569.5	4	5	2.0	high	high	low	low	high
292.5	577.0	3	4	2.5	low	high	low	high	low
294.0	599.5	3	5	2.0	low	high	low	low	high
295.0	614.5	2	4	2.5	high	low	low	high	low
296.0	629.5	2	5	2.0	high	low	low	low	high
297.5	652.0	1	4	2.5	low	low	low	high	low
298.0	659.5	1	5	2.0	low	low	low	low	high

* To set the Sampling Oscillator to a desired frequency, set (SPAN) to 0 Hz and CENTER FREQ to the value listed in the table.
†The signals at TP406 and TP407 are TTL levels.

10. Measure the 280 MHz loop-feedback signal at A15TP400 for 0 dBm.

11. If the feedback signal is not near the indicated power, measure the signal at the following test points on the feedback path. Refer to function blocks AD, AG, and AH of A15 RF Schematic (sheet 3 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

A15TP200	+7 dBm
A15TP201	+17 dBm
A15TP202	+8 dBm

12. Measure the 20 MHz loop-IF signal at test point A15TP401 for −6 dBm.
13. If the IF signal is not near the indicated power, troubleshoot the loop mixer (function block AI).
14. Measure U401 pin 2, the loop-IF signal, at the input to the IF Amplifier/Limiter (function block AK), at 20 MHz for approximately −6 dBm.
15. Confirm the presence of a 20 MHz square-wave signal at TP405. The square wave should go from +0.6 V to +2.2 V.
16. Set spectrum analyzer controls as follows:

CENTER FREQ	369.3 MHz
SPAN	0 Hz

17. Use an oscilloscope to confirm the presence of a 2.5 MHz TTL-level signal at TP406.
18. Confirm the presence of a 2.5 MHz TTL-level signal at TP407.
19. Force the loop-phase/frequency-detector to a locked condition by unsoldering one end of R436. Resistor R436 is located at the base of Q402 (see function block AK of A15 RF Schematic, sheet 3 of 3). This opens the path between the sampling oscillator and the phase/frequency detector.
20. If the dc power supply is connected to A15J200 pin 16, disconnect the power supply.
21. Connect A15TP406 to A15TP407. This forces both phase/frequency detector inputs to the same 2.5 MHz signal.
22. Observe the phase/frequency detector outputs, U406 pins 5 and 8, with an oscilloscope. Narrow TTL pulses should be present. Pin 5 is normally low, pulsing high, and pin 8 is normally high, pulsing low.
23. Check the cathode of CR401 with an oscilloscope. With the oscilloscope input ac-coupled, a sawtooth waveform approximately 5 mV p-p should be present.
24. Short C441 with a wire jumper. This changes loop integrator into a voltage follower. Refer to function block AB of A15 RF Schematic (sheet 3 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.
25. The voltage at A15J200 pin 15 should measure +1.8 V dc. Adjust A15R453 PHASE DET BIAS for +1.8 V dc, if necessary.
26. If the voltage at U408 pin 2 is not +1.8 V dc, suspect U408.
27. Check the voltages at the following points:

A15U408 pin 6	+2 V dc (approximately)
A15J200 pin 16	+2 V dc (approximately)

28. Remove the jumpers.

Unlocked Reference PLL

Operation

The reference PLL 600 MHz output is generated by a 600 MHz surface acoustical wave resonator (SAWR) VCO. The SAWR provides a high Q feedback path in the oscillator, ensuring good phase noise. If the oscillator is off-frequency, the phase-lock circuitry is probably at fault. If there is no signal present at A15J701, or if the level is less than −3 dBm, the oscillator has failed. Transistor Q703 provides active bias for oscillator transistor Q701. Transistor Q704 provides active bias for 600 M Hz buffer amplifier Q702. Refer to function blocks Q and R of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

Troubleshooting

1. If Q701 and Q703 are functioning, check the bias on varactors CR701 and CR702. The varactors should be reverse-biased between 0 V and 18 V, depending on tune voltage.
2. If the active devices are functioning properly, check the SAWR by placing a 100Ω resistor across U701 pins 1 and 2. This bypasses the SAWR, but provides the equivalent loss of a correctly functioning SAWR.
3. If the oscillator begins to oscillate, the SAWR is probably defective.
4. On the spectrum analyzer, press (AUX CTRL), REAR PANEL, and 10 MHz INT.
5. Measuring tune line voltage (LO3 ERR) indicates if the reference PLL is locked. Measure the voltage at A15J502 pin 3. Connect the ground lead to A15J502 pin 6.
6. If voltage is not between 0 V and 5.75 V, the loop is unlocked and ERR 333 600 UNLK should be displayed on the CRT.
7. If the 600 MHz oscillator is working, the reason for the unlocked condition is either a problem in the 10 MHz reference or a fault in the signal path around the loop.
8. On the spectrum analyzer, press (AUX CTRL), REAR PANEL, and 10 MHz INT.
9. Check the 10 MHz reference frequency accuracy by connecting a frequency counter to A15J301. Verify that the reference frequency is 10 MHz ±40 Hz after a 5 minute warm-up period.
10. If a 10 MHz TTL level signal is not present, refer to the "10 MHz Reference" in Chapter 12.
11. Measure the signal on U504 pin 3 with an oscilloscope. Refer to function block O of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.
12. Measure the signal at U504 pin 11 with an oscilloscope. Refer to function block O of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.
13. If TTL-level signals (approximately 10 MHz) are not present, check signals backward through the loop to find a fault in the signal path.

14. Use an oscilloscope to check for 10 MHz ECL level at U503 pin 3. Refer to function block X of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

15. Measure the signals at the following test points with an active-probe/spectrum-analyzer combination such as an HP 85024A/HP 8566A/B. The signal level at TP701 should be sufficient to drive an ECL input.

TP506	50 MHz, ≥+3 dBm
U502 pin 15	300 MHz, ≥+3 dBm
TP503	300 MHz, approximately +8 dBm
TP502	300 MHz (ECL level), approximately +3 dBm
TP701	600 MHz

16. If an approximately 10 MHz TTL signal is present at U504 pin 11, and the RF portion of the phase-lock loop is functioning, the fault probably lies in the phase/frequency detector or the 600 MHz reference loop amplifier.

17. Monitor U504 pins 5 and 9 with an oscilloscope. These are the two outputs of the phase/frequency detector. Refer to function block O of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

18. A locked loop exhibits stable, narrow (approximately 20 μs wide), and positive-going TTL pulses occurring at a 10 MHz rate at U504 pins 5 and 9.

19. If the loop is unlocked, but signals are present on both inputs of the phase/frequency detector, the outputs pulses are superimposed on each other.

20. If the loop is unlocked, and there is no signal at one of the phase/frequency detector inputs, one phase detector output is at TTL low and the other is at TTL high. For example, if there is no input signal at U504 pin 3, U504 pin 5 is TTL low and U504 pin 9 is TTL high. If there is no input signal at U504 pin 11, U504 pin 9 is TTL low and U504 pin 5 is TTL high.

21. To remove the 10 MHz reference input to the phase/frequency detector, press (AUX CTRL), REAR PANEL, and 10 MHz EXT with no signal applied to the rear-panel 10 MHz REF IN/OUT connector.

22. To remove the divided-down 600 MHz signal from the phase/frequency detector, remove C519 from X501. Refer to function block W of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

23. Remove 10 MHz reference input to the phase/frequency detector by pressing (AUX CTRL), REAR PANEL, and 10 MHz EXT. No signal should be connected to the rear-panel 10 MHz REF IN/OUT connector.

Note

The outputs of phase/frequency detector are low-pass filtered to reduce the 10 MHz component of the signal. The filtered signals are then integrated by U506 and the result is fed to the tune line of the 600 MHz oscillator.

24. Check that the voltage on A15J502 pin 3 is approximately −6 V dc. Refer to function block P of A15 RF Schematic (sheet 2 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.

25. Press (AUX CTRL), REAR PANEL, and 10 MHz INT and remove the divided-down 600 MHz input to the phase/frequency detector by removing C519 from X501.
26. Check that the voltage on A15J502 pin 3 is approximately 7 V.
27. Replace C519 in X501.
28. If the loop is locked, the voltage on A15J502 pin 3 should be between 0 V and +5.75 V dc.
29. If the front panel CAL OUTPUT amplitude is out of specification and cannot be brought within specification by adjusting A15R561, CAL AMPTD, check the calibrator automatic gain controller (AGC) amplifier with the following steps. Refer to function block W of A15 RF Schematic (sheet 3 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

Note

The 300 MHz CAL OUTPUT signal comes from the divided-down 600 MHz, which is passed through a leveling loop. The 300 MHz signal passes through a low-pass filter for reducing higher harmonics. These harmonics can fool the detector. The 300 MHz signal passes through a variable attenuator controlled by PIN diode CR503 which is controlled by the feedback loop. Diode CR504 is the detector diode (the same type as CR505). Diode CR504 provides temperature compensation between the reference voltage and the detected RF voltage.

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a. Measure the level of 300 MHz at A15TP505 with an active-probe/spectrum-analyzer combination. If the signal is less than +2 dBm, repeat the first 29 steps of this procedure.
   - If the signal at this point is correct, place a short across the PIN diode CR503.
   - If the signal level at the CAL OUTPUT is still less than −10 dBm with CR503 shorted out, troubleshoot the RF forward path through amplifier Q505.
   - If the CAL OUTPUT signal level is greater than −10 dBm, troubleshoot the PIN diode attenuator, the detector, or the feedback path.

30. Measure the detector voltage at A15J502 pin 14. The voltage should measure approximately +0.3 V dc when the CAL OUTPUT signal is at −10 dBm. This voltage should change with adjustment of A15R561, CAL AMPTD.
31. Check that the voltage at U507A pin 3 is +1.7 V dc. If this voltage is not correct, there may be a problem with the +10 V reference.
32. Measure voltage at U507B pin 5 while adjusting R561. This is the temperature-compensated adjustable voltage reference to which the detected voltage is compared. It should vary between +1.3 V and −0.6 V.
33. Adjust R561 to its limits and verify that the output U507B pin 7 measures approximately +9 V dc at one limit and −12 V dc at the other limit.

3rd LO Driver Amplifier

The 3rd LO Driver Amplifier (Q503) amplifies the 300 MHz from the 600 MHz phase-lock loop to a level sufficient to drive the LO port of the double-balanced mixer. During the SIG ID operation, diodes CR501 and CR502 turn off the 3rd LO driver amplifier in order to minimize the amount of 300 MHz going to the double-balanced mixer.

1. Press (AUX CTRL), INTERNAL MIXER, and SIG ID OFF.
2. Use an active-probe/spectrum-analyzer combination to confirm the power level of the 300 MHz signal at the following test points:

A15TP602	≥+7 dBm
A15TP504	≥+15 dBm

3. If the signal at A15TP602 is low, but the signal at A15TP504 is correct, press (AUX CTRL), INTERNAL MIXER, and SIG ID OFF.
4. Check that PIN diode switches CR603 and CR605 are reverse-biased by approximately +10 V dc. Refer to function block F of A15 RF Schematic (sheet 1 of 3) in the *HP8560A/8561B/8563A Component Level Information* binder.
5. Measure 300 MHz signal at A15TP503 using an active-probe/spectrum-analyzer combination. If the signal is not approximately +10 dBm, refer to "Unlocked Reference PLL."
6. If the level at the TP503 is correct, but signal at TP504 is too low, the fault is probably in the amplifier.

Sampler and Sampler IF

The A15A2 Sampler creates and mixes harmonics of the sampling oscillator with the first LO. The resulting sampler IF (63 MHz to 105 MHz) is used to phase-lock the YTO. The sampler IF filters unwanted products from A15A2 output and amplifies the IF to a level sufficient to drive the YTO loop. When the IF is between 78 and 87 MHz, PIN diodes switch a 120 MHz notch filter in the sampler IF section.

1. Set spectrum analyzer controls as follows:

CENTER FREQ	300 MHz
SPAN	0 Hz

2. Disconnect W32 from A15J101.
3. Connect the input of a power splitter to A15J101. Connect W32 to one of the splitter outputs. Connect the other splitter output to the input of another spectrum analyzer.
4. If a 94.7 MHz signal, greater than −15 dBm, is not displayed on the other spectrum analyzer, set a microwave source controls as follows:

Frequency	4.2107 GHz
Amplitude	−5 dBm

5. Connect the microwave source to A15A2J1. A 94.7 MHz signal at approximately 0 dBm should be displayed on the other spectrum analyzer.
6. Use an active-probe/spectrum-analyzer combination to measure the signal at the following test points:

A15TP101	94.7 MHz, −25 dBm
A15TP201	294 MHz, +17 dBm

7. If a correct signal is seen at A15TP201 but the signal at A15TP101 is wrong, proceed as follows:
   - Use an oscilloscope to measure the signals at the following test points:

A15J400 pin 1	+1.8 V dc to +2.4 V dc (≤0.5 V p-p variation)
A15J400 pin 3	−1.8 V dc to −2.4 V dc (≤0.5 V p-p variation)

   - If these levels are wrong, perform the "Power and Sampler Match Adjustments" in the Sampler Oscillator Adjustment procedure. Refer to Chapter 2.
   - If adjusting the sampler match does not bring the signal at A15TP101 within specification when the signal at A15TP201 is correct, the A15A2 Sampler is defective.
8. If the signal at A15TP101 is correct, but the signal at A15J101 is wrong, the fault lies in the sampler IF circuitry. Continue with the following steps.
9. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
10. Set a microwave source to the following settings:

    Frequency ..... 4.2107 GHz
    Amplitude ..... −5 dBm
11. Connect the microwave source to A15A2J1.
12. Measure the signal at U103 pin 1 using an active-probe/spectrum-analyzer combination.
13. If a 94.7 MHz signal, approximately −14 dBm, is present, but the signal at A15J101 is low, suspect U103.
14. When U104 pin 3 is at TTL low, U104 pin 6 should near −15 V dc and PIN diodes CR101, CR102, and CR103 should be reverse-biased.
15. Set spectrum analyzer controls as follows:

    CENTER FREQ ..... 89.3 MHz
    SPAN ..... 0 Hz
16. Check that U104 pin 3 is at a TTL high and U104 pin 6 is greater than +7 V. PIN diodes CR101, CR102, and CR103 should all be turned on with about 7 mA of forward current.
17. Disconnect the power splitter and reconnect W32 to A15J101.

Sweep Generator Circuit

The sweep generator operates by feeding a constant current from DAC U307 into an integrator, U320B. See function block K of A14 Frequency Control Schematic (sheet 2 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder. This current is scaled by resistors R20 through R24 and U312B/C/D. See Figure 10-10. The capacitors used in the integrator depend on the sweep-time range; smaller-value capacitors provide faster sweep times.

The integration is initiated by HSCAN going high. This opens U312A which places the output of U320A near −15 V dc, turning CR6 off and allowing the output of integrator U320B to ramp from 0 V to +10 V dc. The analyzer ADC (via the scan ramp attenuator U320B pin 7) monitors the scan ramp at U325A pin 1. When the ramp reaches +10 V (for single-band sweeps), HSCAN is brought low and the integration ends. During normal non-fast-zero spans (sweep times greater than 30 ms), comparators U319A and B are high. This turns on diodes CR1, CR2, CR3, and CR4. Note that the integrating current (maximum value 236 μA) actually flows backward through diodes CR3 and CR4.

During retrace, HSCAN is low, closing U306B and U312A. See Figure 10-11. The output of U320A tries to go high, turning CR6 on and sourcing current through R26. This current discharges the capacitors in the integrator, forcing U320B pin 7 toward 0 V dc. Ultimately, the output of U320B is set and held to 0 V by U320A supplying a current equal to that which is sunk by the current source.

For more information, refer to "1st LO Span Problems (Multiband Sweeps)."

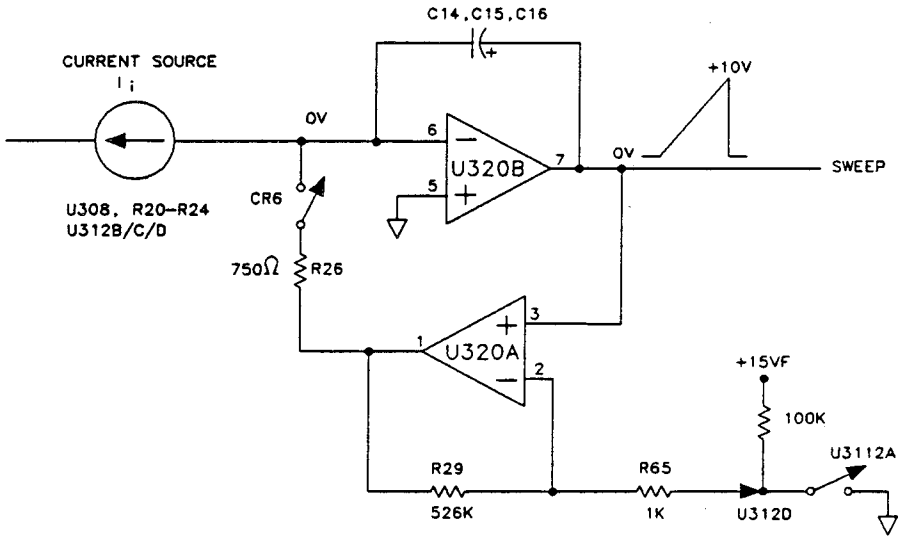


Figure 10-10. Simplified Sweep Generator

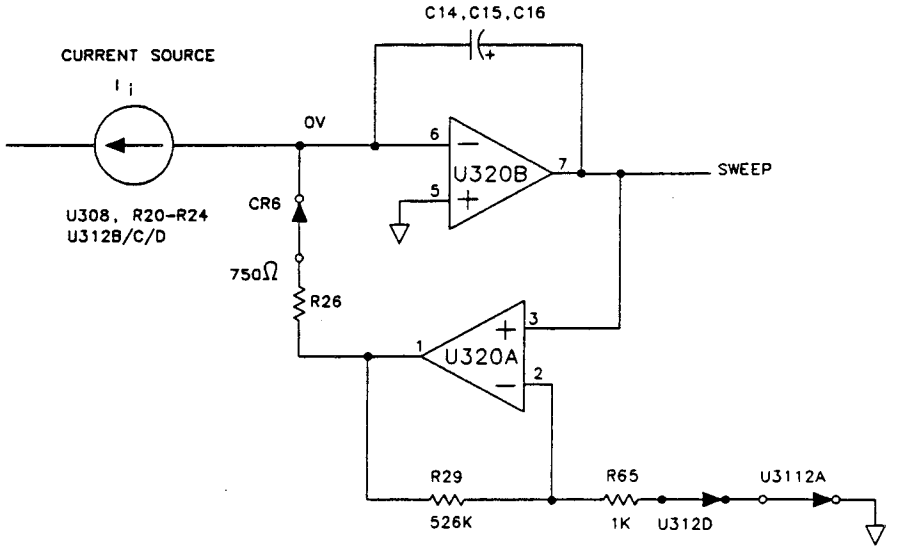


Figure 10-11. Simplified Sweep Generator During Retrace

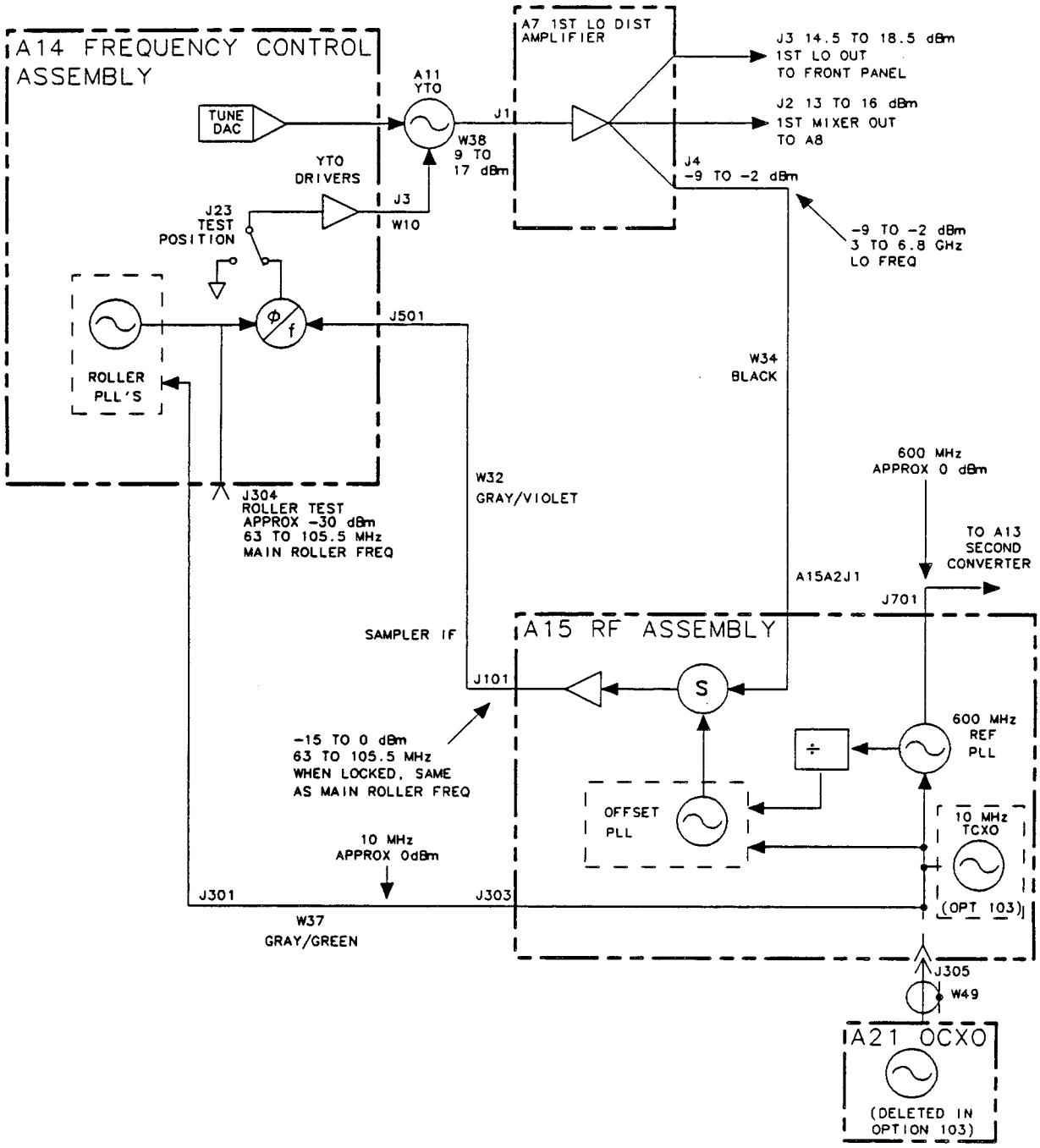


Figure 10-12. Simplified Synthesizer Section

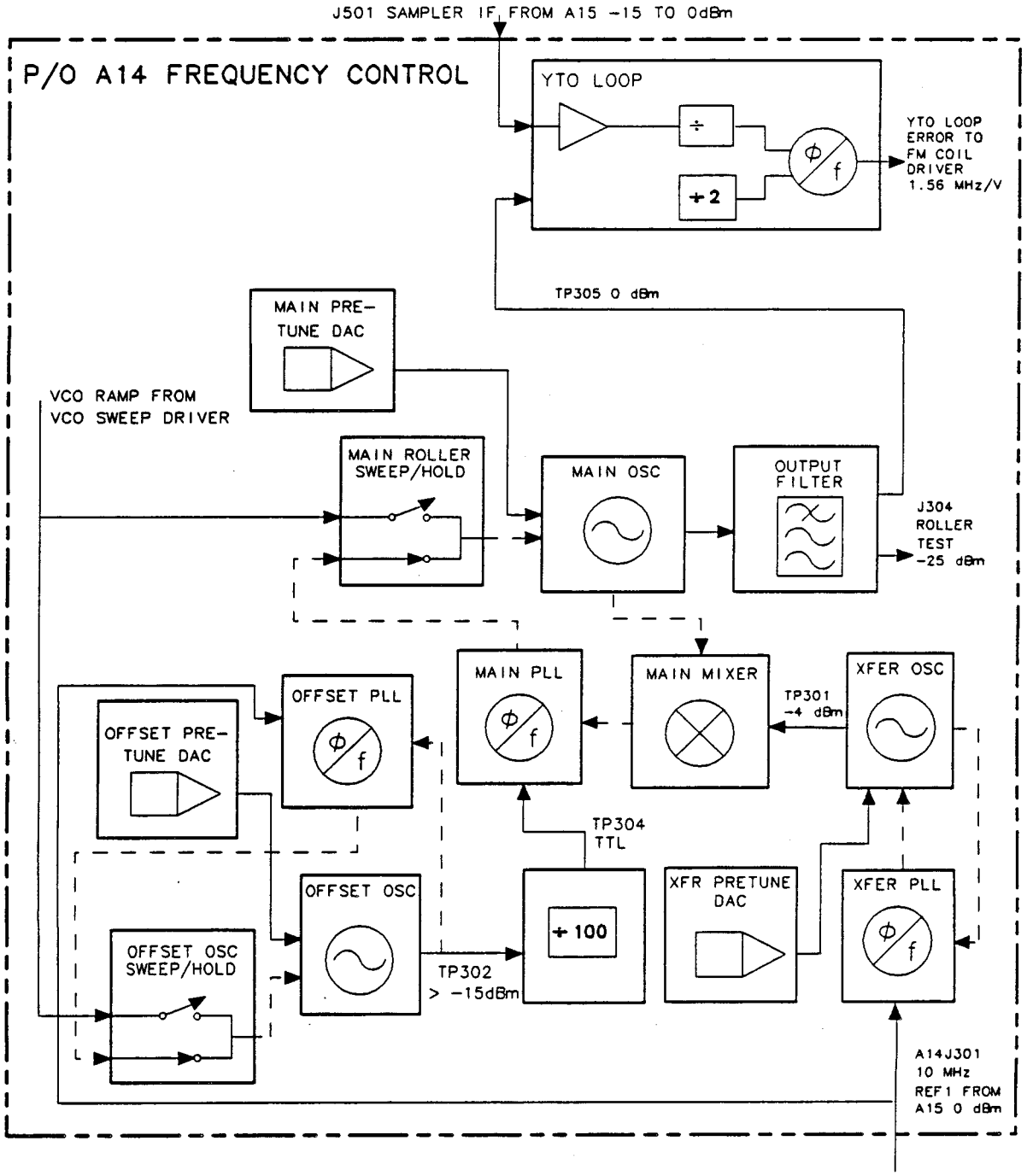


Figure 10-13. Simplified A14 Assembly Block Diagram

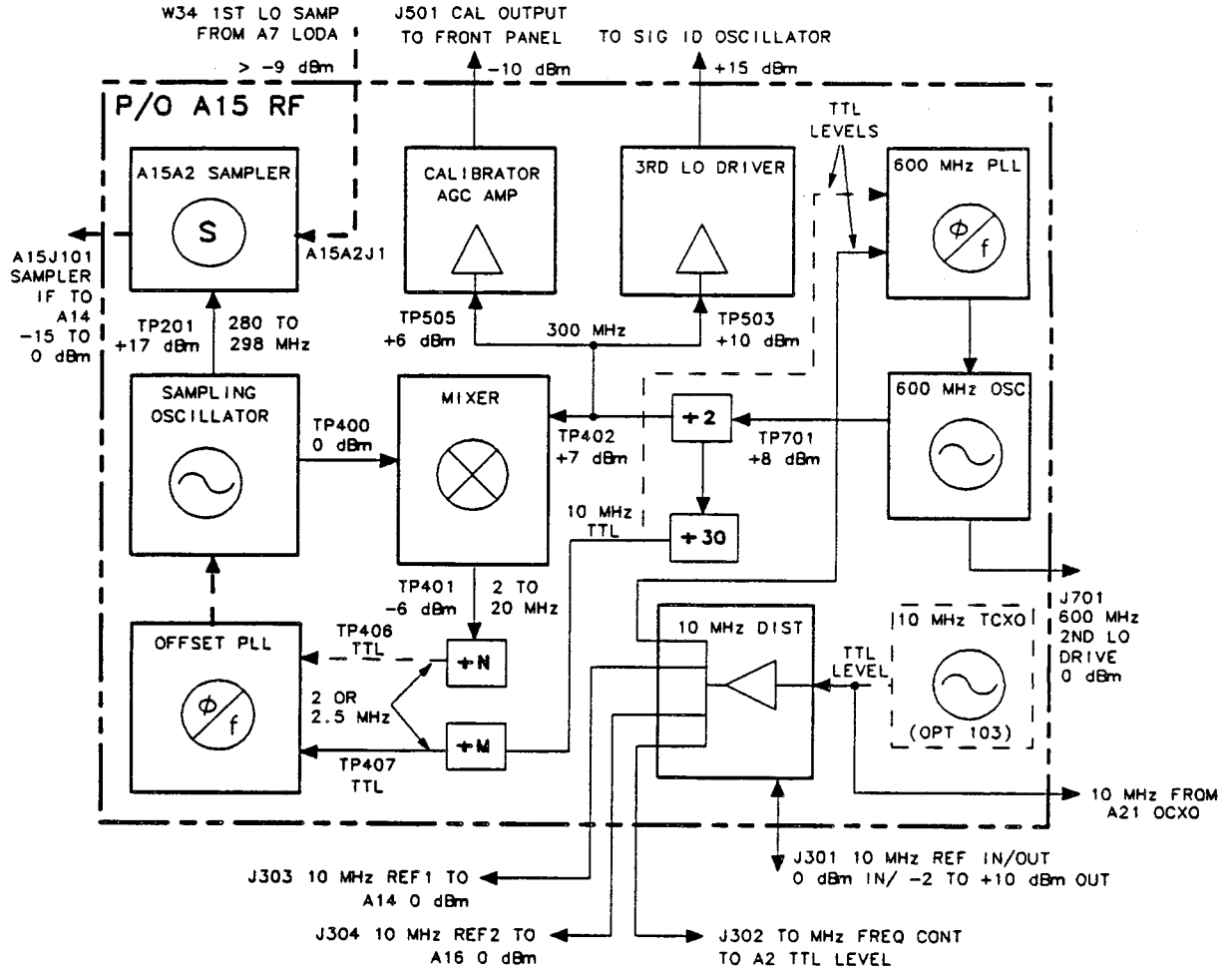


Figure 10-14. Simplified A15 Assembly Block Diagram

A21 OCXO

The spectrum analyzer uses an oven-controlled crystal oscillator (OCXO). It is deleted in Option 103 and replaced by a temperature-compensated crystal oscillator (TCXO), located on the A15 RF assembly. Connectors J305 and J306 on the A15 RF assembly are located where the TCXO would be installed in an Option 103.

Power is supplied to the oven in the OCXO only when the spectrum analyzer is powered on and the internal frequency reference is selected; there is no standby mode of operation. Control line HEXT (High = EXTernal frequency reference) is inverted by A15U303B (refer to the function block M of A15 RF Assembly Schematic Diagram, sheet 2 of 4) to generate LEXT. LEXT is sent to the OCXO via A15J306 pin 4. When LEXT is low, the oven and the oscillator in the OCXO are turned off.

Replacement OCXOs are factory-adjusted after a complete warm-up and after the specified aging rate has been achieved. Thus, readjustment should typically not be necessary after OCXO replacement, and is generally not recommended.

If adjustment is necessary, the spectrum analyzer must be *on* and the internal frequency reference selected continuously for a minimum of 24 hours immediately prior to oscillator adjustment, to allow both the temperature and frequency of the oscillator to stabilize. Failure to allow sufficient stabilization time could result in oscillator misadjustment.

Check operation of the A21 OCXO as follows:

1. Disconnect W49 (coax 82) from A15J305. Connect the output of W49 to the input of another spectrum analyzer.
2. Check that the fundamental frequency is 10 MHz and that the power level is 0 dBm ±3 dB. Also check that the harmonics are at least −25 dBc. Excessive harmonics can generate spurious responses on the roller oscillators on the A14 Frequency Control assembly.
3. If the OCXO has no output, check A15J306 pin 1 for +15 V dc. Check A15J306 pin 4 for a TTL-high level.
4. If A15J306 pin 4 is at a TTL-low level, press (AUX CTRL) and REAR PANEL. Press 10 MHz EXT INT until INT is underlined. A15J306 pin 4 should read a TTL-high level. Press 10 MHz EXT INT until EXT is underlined. A15J306 pin 4 should read a TTL-low level.

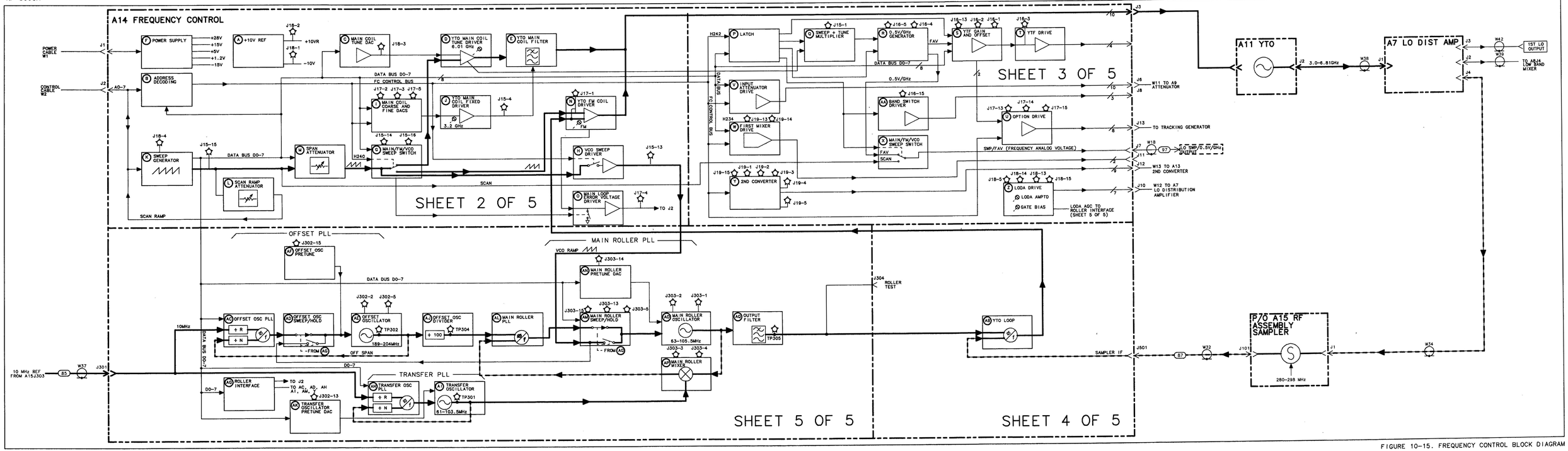


FIGURE 10-15. FREQUENCY CONTROL BLOCK DIAGRAM

RF ASSEMBLY BLOCK DIAGRAM

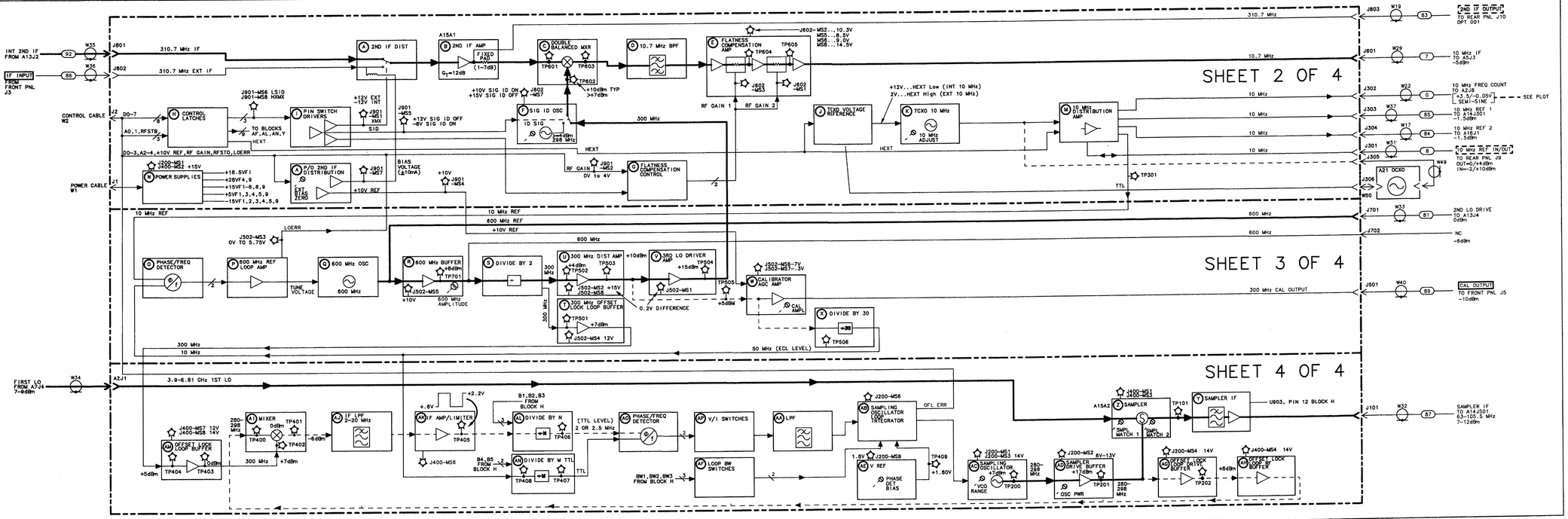


FIGURE 10-16 RF ASSEMBLY BLOCK DIAGRAM

11

RF Section

The RF Section converts the input signal to a 10.7 MHz IF. See Figure 11-5 for a detailed block diagram.

Note The block diagrams for the A14 and A15 assemblies are located in Chapter 10, "Synthesizer Section."

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Caution All of the RF assemblies are extremely sensitive to electrostatic discharge (ESD). For further information regarding electrostatic cautions, refer to "Electrostatic Discharge Information" in Chapter 1.

Caution



For troubleshooting, it is recommended that you use an active probe, such as an HP 85024A, and another spectrum analyzer. If an HP 1120A Active Probe is being used with a spectrum analyzer having dc-coupled inputs, such as the HP 8566A/B, HP 8569A/B and the HP 8562A/B, either set the active probe for an ac-coupled output or use a dc-blocking capacitor between the active probe and the spectrum analyzer input. Failure to do this can result in damage to the analyzer or to the probe.

Troubleshooting Using the TAM

When using Automatic Fault Isolation, the TAM indicates suspected circuits that need to be manually checked. Use Table 11-2 to locate the manual procedure.

Table 11-1 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 11-1 illustrates the location of A15 test connectors.

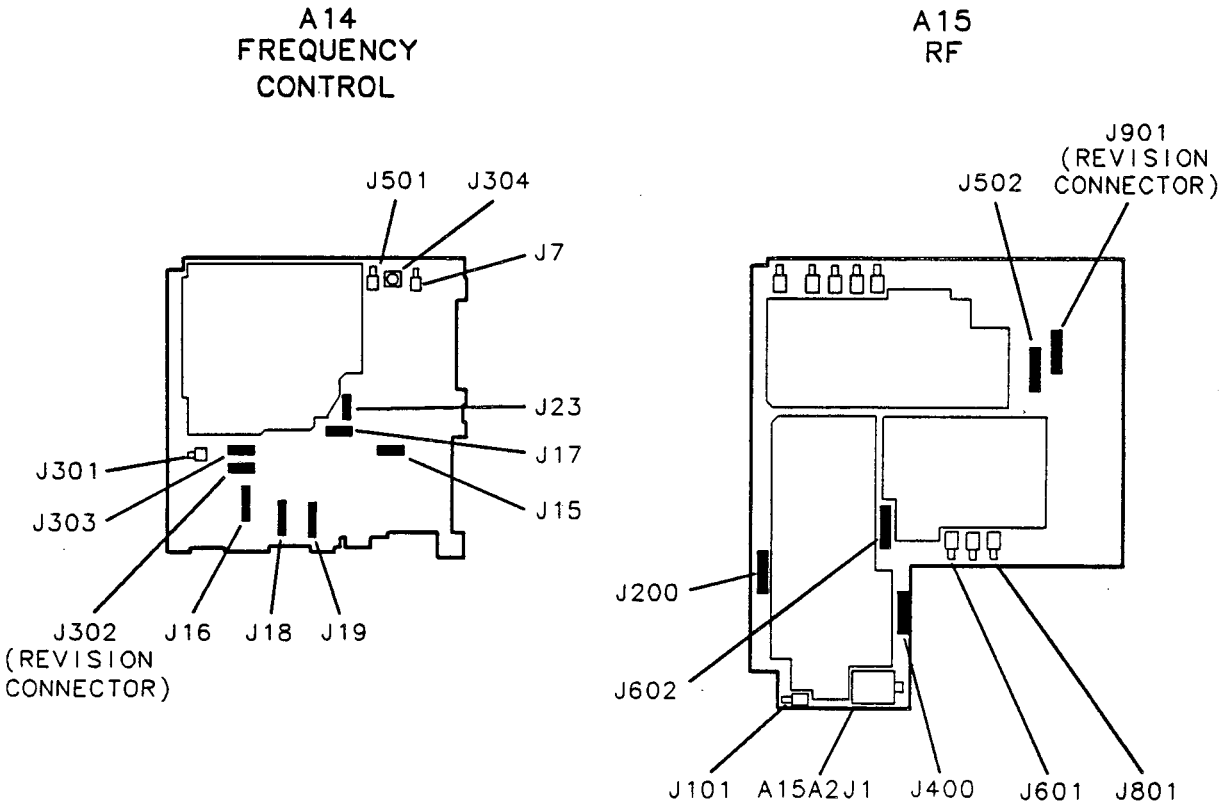


Figure 11-1. A14 and A15 Test Connectors

Table 11-1. Automatic Fault Isolation References

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check 2nd IF Amplifier	Third Converter
Check 2nd IF Distribution	Third Converter
Check 10.7 MHz IF Out of Double Balanced Mixer	Third Converter
Check 300 MHz CAL OUTPUT	Calibrator Amplitude Adjustment in Chapter 2
Check A7 1st LO Distribution Amplifier	A7 LODA (LO Distribution Amplifier)
Check A8 Dual Band Mixer	A8 Dual Band Mixer
Check A9 Input Attenuator	A9 Input Attenuator
Check A12 RF Switch	A12 RF Switch
Check A13 Second Converter	A13 Second Converter
Check A13J2 INT 2nd IF	A13 Second Converter *(steps 1 to 6)*
Check A14 Latch	Control Latch for Band-Switch Driver
Check A15 Control Latches	Control Latches
Check A15J601 10.7 MHz	Third Converter Output
Check External 10 MHz Reference Operation	10 MHz Reference *(steps 5 to 11)*
Check Gain of Flatness Compensation Amplifier	Third Converter
Check High-Band Bias	High-Band Bias
Check INT 10 MHz Reference Operation	10 MHz Reference *(steps 1 to 4)*
Check LO Feedthrough	Low Band Problems (1 kHz to 2.9 GHz) *(steps 1 to 3)*
Check LO Power	Low and High Band Problems *(steps 4 to 9)*
Check PIN Switch	PIN Switch
Check PIN Switches in SIG ID Oscillator	SIG ID Oscillator
Check Second Converter Control	A13 Second Converter
Check SIG ID Oscillator	Signal ID Oscillator Adjustment in Chapter 2
Check SIG ID Oscillator Operation	SIG ID Oscillator
Check Third Converter	Low and High Band Problems *(step 10)*

Table 11-2. TAM Tests versus Test Connectors

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A14J16	YTF Offset DAC	MS6
	YTF Gain and Offset Input	MS2
	YTF Gain DAC	MS1
	YTF Drive	MS3
	Band Switch Driver	MS8
A14J17	Main Coil Course DAC	MS3
A14J18	LODA Drive	MS5, MS6, MS7, MS8
A14J19	Second Conv PIN Switch	MS8
	Second Conv Mixer Bias	MS1
	Second Conv Drain Bias	MS3
	Second Conv Doubler Bias	MS4
	Second Conv Driver Bias	MS5
	First Mixer Drive Switch	MS7
	First Mixer Drive DAC	MS6
A14J302	Revision	MS7
A15J400	IF AMP/Limiter Bias	MS6
A15J502	Third LO Tune Voltage	MS3
	3rd LO Driver Amp	MS1, MS8
A15J602	SIG ID Collector Bias	MS7
	RF Gain Control Test	MS1, MS3
A15J901	Revision	MS3
	External Mixer Switch	MS1, MS8
	Signal ID Switch	MS5, MS6
	External Mixer Bias	MS7
	RF Gain Test	MS2

Low Band Problems (9 kHz to 2.9 GHz)

1. Disconnect all inputs from the front-panel INPUT 50Ω connector.
2. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 0 Hz
   SPAN ..... 1 MHz
   INPUT ATTEN ..... 0 dB

3. The LO feedthrough amplitude observed on the display should be between −6 and −30 dBm.

Note

The marker does not "peak search" on the LO feedthrough signal in a nonzero span. To measure the LO feedthrough amplitude with markers, set the span to 0 Hz and CENTER FREQ to 0 Hz. Press (MKR) to activate marker operation.

4. If the LO feedthrough amplitude is within limits, but signals are low, the RF path following the A8 Dual Band Mixer is operating properly.
5. If the LO feedthrough amplitude is higher than −5 dBm (the signal is "clipped" at the top of the screen) and signals are low in amplitude, suspect a defective A8 Dual Band Mixer.

   Perform the "Control Latch for Band-Switch Driver" troubleshooting procedure in this chapter.
6. Check A13 Second Converter mixer diode bias at A14J19 pin 1. The bias voltage should be between −150 and −900 mV dc.
7. Troubleshoot the signal path. Refer to the voltage levels provided on Figure 11-3, Rear-Panel SWP Output.

High-Band Problems (2.75 GHz to 22 GHz)

1. Perform the "PIN Switch" troubleshooting procedure in this chapter to confirm A8 Dual Band Mixer operation.
2. Perform the "High Band Bias" troubleshooting procedure in this chapter to confirm A8 Dual Band Mixer operation.
3. Perform the "Control Latch for Band-Switch Driver" troubleshooting procedure in this chapter.
4. Troubleshoot the signal path. Refer to the voltage levels provided on Figure 11-3, Rear-Panel SWP Output.

Low and High Band Problems

1. On the spectrum analyzer, press (PRESET), (CAL), and REALIGN LO & IF. If any error messages are displayed, refer to "Error Messages" in Chapter 6.
2. Perform "External Mixer Amplitude Adjustment" in Chapter 2. If this adjustment cannot be completed, perform the "Third Converter" troubleshooting procedure in this chapter.
3. Perform the "First LO Output Amplitude" performance test. (Refer to the *HP 8563A Installation and Verification Manual* or use TAM functional test).
4. If the performance test fails, perform the "First LO Distribution Amplifier Adjustment" located in Chapter 2. If the adjustment fails, set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
5. Place the jumper on A14J23 in the TEST position. Remove W38 from A7 LODA input.
6. Use a power meter or another spectrum analyzer to measure the output of A11 YTO. The power should be between +9 dBm and +13 dBm.
7. Reconnect W38 to A7 LODA input. Place the jumper on A14J23 in the NORM position.

8. If ERR 334 (unlevelled output) occurs and A11 YTO power output is correct, the A7 LODA drive circuit may be defective. Refer to "A7 LODA (LO Distribution Amplifier)" in this chapter.
9. Troubleshoot the signal path. Refer to the voltage levels provided on Figure 11-5, Rear-Panel SWP Output.
10. Check the third converter as follows:
    a. On the spectrum analyzer, press [PRESET], then set the controls as follows:
       CENTER FREQ ..... 300 MHz
       SPAN ..... 0 Hz
    b. Apply a −28 dBm, 310.7 MHz signal into A15J801.
    c. If a flat line is displayed within 2 dB of the reference level, but the External Mixer Amplitude Adjustment fails, troubleshoot the A15 RF Section.

A7 LODA (LO Distribution Amplifier)

Note



YTO unlock errors may occur if the power delivered to A15A2 Sampler is less than −9.5 dBm. Frequency response is degraded in both internal and external mixing modes if the output power is low or unleveled.

Caution



The A7 LODA is destroyed if you connect or disconnect W7 from A7 LODA bias while the spectrum analyzer [LINE] switch is ON. Always set the analyzer [LINE] switch OFF before removing or reinstalling W12 to either A7 LODA or A14J10.

1. Set the spectrum analyzer [LINE] switch to OFF. Disconnect W12 from A14J10.
2. Connect a jumper between A14J10 pin 5 and A14J19 pin 6. Connect a jumper between A14J18 pin 13 and A14J18 pin 1.
3. Connect a positive DVM lead to A14J18 pin 14 and the negative lead to A14J18 pin 6.
4. Set the spectrum analyzer [LINE] switch to ON.
5. The voltage measured by the DVM should be more negative than −9.4 V dc.
6. Move the jumper from A14J18 pin 1 to A14J18 pin 2. The voltage measured by the DVM should be more positive than +12.3 V dc.
7. If the voltages do not meet the above limits, troubleshoot A14 Frequency Control assembly.
8. Connect the positive DVM lead to A14J10 pin 1.
9. The measured voltage should be approximately +5 V dc. If it is not, troubleshoot A14 Frequency Control assembly.
10. Connect the positive DVM lead to A14J18 pin 1. The voltage should measure within 5% of the GATE BIAS voltage provided on the A7 LODA label.
11. If the measured GATE BIAS voltage is not within the above limit, rotate A14R628 GATE BIAS through its range while monitoring the DVM.

12. If the voltage varies between 0 V dc and −2 V dc, adjust A14R628 GATE BIAS for a DVM reading within 5% of the GATE BIAS voltage provided on the A7 LODA label. If the voltage does not vary between 0 V dc and −2 V dc, troubleshoot A14 Frequency Control assembly.
13. Disconnect the jumper from A14J19 to A14J10. Set the [LINE] switch OFF. Reconnect W12 to A14J10. Set the [LINE] switch ON.
14. If the DVM reading changes significantly, the A7 LODA is probably defective.

A8 Dual Band Mixer

PIN Switch

1. Connect the positive DVM test lead to A14J19 pin 14 and the negative test lead to A14J19 pin 6.
2. Set the spectrum analyzer center frequency to 1 GHz.
3. The voltage measured by the DVM should be between +10 V dc and +13 V dc.
4. Set the spectrum analyzer center frequency to 4 GHz.
5. The voltage measured by the DVM should be between −10 V dc and −13 V dc.
6. If the voltages measured above are within the limits, the PIN switch is operating properly. If the voltages are not within the limits, disconnect W15 from A14J11.
7. Set the spectrum analyzer center frequency to 1 GHz.
8. The voltage measured by the DVM should be between +14 V dc and +15 V dc.
9. Set the spectrum analyzer center frequency to 4 GHz.
10. The voltage measured by the DVM should be between −14 V dc and −15 V dc.
11. If the voltages measured in steps 8 and 10 are within the limits, the PIN switch driver is operating properly. If the voltages are not within the limits, troubleshoot A14 Frequency Control assembly.
12. Reconnect W15 to A14J11.

High Band Bias

1. Connect the positive DVM test lead to A14J19 pin 13 and the negative lead to A14J19 pin 6.
2. Set the spectrum analyzer [SPAN] to 0 Hz.
3. Record the DVM reading at a center frequency setting of 5 GHz.

5 GHz (Band 1) = _____V

4. The DVM reading recorded in step 3 should be within 50 mV of the mixer-bias voltage printed on the A8 assembly label. If the voltage is not within the limits, perform the

"Dual Band Mixer Bias Adjustment" in Chapter 2. If the voltage is within limits, continue with step 5.

5. Set the A2 assembly WR PROT/WR ENA jumper to the WR ENA position.
6. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 5 GHz
   SPAN ..... 10 MHz
   Log scale ..... 2 dB/DIV

7. On the spectrum analyzer, press (CAL), MORE 1 OF 2, SERVICE CAL DATA, and MIXER BIAS. The MIXER BIAS DAC value should be displayed in the active function block.
8. Apply a 5 GHz, 0 dBm signal to the INPUT 50Ω.
9. Record the MIXER BIAS DAC value; it needs to be reset later.

   MIXER BIAS DAC value = _____

10. Observe the voltage indicated on the DVM while stepping the DAC from 0 to 255. The voltage should increase as the DAC is stepped through this range.
11. The displayed signal should exhibit a peak (sometimes two peaks) as the DAC is stepped through its range.
12. If the bias voltage does not vary, disconnect W15 from A14J11 and continue with step 13.
13. Step the DAC through its 0 to 255 range. If the bias voltage does not vary, the A14 Frequency Control assembly is probably defective. If the bias voltage varies from approximately 0 V dc to +10 V dc, the A8 Dual Band Mixer is probably defective.
14. Reset the DAC to the value recorded in step 9.
15. Reconnect W15 to A14J11 and place the WR PROT/WR ENA jumper in the WR PROT position.

A9 Input Attenuator

1. Perform the "Input Attenuator Accuracy" performance test in Chapter 3 of the *HP 8563A Installation and Verification Manual*.
2. If there is a step-to-step error of approximately 10 dB or more, continue with step 3.
3. On the spectrum analyzer, press (AMPLITUDE), and ATTEN AUTO MAN until MAN is highlighted.
4. Step the attenuator from 0 dB to 70 dB. Listen for the "click" sound at each step. The absence of a click indicates a faulty attenuator drive circuit.
5. Monitor the pins of A14U420 with a logic probe or DVM while setting the attenuator to the values listed in Table 11-3.

Note The logic levels listed in Table 11-3 show the default ac usage (pin 5 low, pin 6 high). DC usage (pin 5 high, pin 6 low) is not shown.

6. If one or more logic levels listed in Table 11-3 are incorrect, disconnect W11 from A14J6 and repeat step 4 checking only pins 3, 5, 11, and 13 of A14U420. Pins 4, 6, 10, and 12 should all read low TTL levels.
7. If one or more logic levels listed in Table 11-3 are incorrect with W11 disconnected, troubleshoot the A14 Frequency Control assembly.
8. If all logic levels are correct, the A9 Input Attenuator is probably defective.

Table 11-3. Attenuator Pin Values

	A14U420 Pin Number							
ATTEN Setting (dB)	3 20 dB	4 20 dB	5 20 dB	6 20 dB	10 20 dB	11 20 dB	12 10 dB	13 10 dB
0	high	low	high	low	low	high	low	high
10	high	low	high	low	low	high	high	low
20	high	low	low	high	low	high	low	high
30	high	low	low	high	low	high	high	low
40	high	low	low	high	high	low	low	high
50	high	low	low	high	high	low	high	low
60	low	high	low	high	high	low	low	high
70	low	high	low	high	high	low	high	low

A12 RF Switch

The A12 RF Switch is a latching switch; current flows only during the switching period.

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

2. Set the center frequency to 3 GHz. A click should be heard.
3. Set the center frequency to 300 MHz. A click should be heard.
4. If clicks are heard at both center frequency settings, the band switch driver on A14 Frequency Control assembly is operating properly.
5. Connect a DVM to A14J16, pin 15.
6. Switch the analyzer between high and low bands (center frequency 300 MHz and 3 GHz). The DVM should measure approximately +5.6 V dc at each setting.

a. If no click or buzzing sound occurs, and the voltage for one setting was greater than +5.6 V dc, the fault is probably on A14. If the voltage for one setting was less than +5.6 V dc, the fault is probably on A12.
b. If a buzzing sound occurred, and the voltage setting when the switch buzzed was less than +5.6 V dc, the fault is probably on A14. If the voltage when the switch buzzed was greater than +5.6 V dc, the fault is probably on A12.

7. Disconnect W14 from A14J8.
8. Switch the analyzer between high and low bands (center frequency 300 MHz and 3 GHz). The DVM should measure approximately +0.2 V dc at each setting.
9. If the voltage measures approximately 0.2 V dc, the A12 RF Switch is probably defective.
10. Reconnect W14 to A14J18. Remove W44 (the cable from A12 RF Switch to FL1 Low Band Low-Pass Filter).
11. Connect a second spectrum analyzer to J2 on A12 RF Switch. Set the analyzer center frequency to 300 MHz.
12. Connect the HP 8563A CAL OUTPUT to the INPUT 50Ω, then set the controls as follows:

    CENTER FREQ ..... 300 MHz
    INPUT ATTEN ..... 0 dB

13. The signal amplitude should measure −10 dBm ±2 dB.
14. Set the HP 8563A center frequency to 3 GHz. The displayed signal should disappear.
15. Remove the W46 cable from A12 RF Switch. This cable is between A10 YTF and A12 RF Switch.
16. Connect a second spectrum analyzer to J1 on A12 RF Switch.
17. Set the HP 8563A controls as follows:

    CENTER FREQ ..... 3 GHz
    INPUT ATTEN ..... 0 dB

18. Set the second spectrum analyzer center frequency to 300 MHz. The signal amplitude should measure −10 dBm ±2 dB.
19. Set the HP 8563A center frequency to 300 MHz. The signal displayed on the second spectrum analyzer should disappear.
20. Reconnect W46 from A10 YTF to A12 RF Switch.

A13 Second Converter

Caution The A13 Second Converter is extremely sensitive to electrostatic discharge (ESD). For further information regarding electrostatic precautions, refer to "Electrostatic Discharge Information" in Chapter 1.

1. Connect the spectrum analyzer CAL OUTPUT to INPUT 50Ω.
2. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   ATTEN ..... 0 dB

3. Disconnect W35 (coax 92) from A13J2.
4. Connect a test cable from A13J2 to the input of a second spectrum analyzer.
5. Tune the other spectrum analyzer to 310.7 MHz. The signal displayed on the second spectrum analyzer should be approximately −28 dBm.
6. Remove the test cable from A13J2 and reconnect W35 (coax 92) to A13J2.
7. Disconnect W33 (coax 81) from A13J4 and connect W33 through a test cable to the input of the second spectrum analyzer.
8. Tune the second spectrum analyzer center frequency to 600 MHz.
9. If the 600 MHz signal is not displayed, or its amplitude is less than −5 dBm, the fault is probably on the A15 RF Section.
10. Reconnect W33 to A13J4.
11. Connect a positive DVM test lead to A14J19 pin 15 and the negative lead to A14J19 pin 6.
12. If the DVM measurement is not between +14.0 V dc and +15.0 V dc, do the following:
    a. Set the spectrum analyzer [LINE] switch OFF and disconnect W13 from A14J12.
    b. Set the spectrum analyzer [LINE] switch ON and set the analyzer controls as follows:
       CENTER FREQ ..... 300 MHz
       SPAN ..... 10 MHz
    c. The voltage should measure +15 V dc ±0.2V. If the measurement is outside this limit, the A14 Frequency Control assembly is probably defective.
    d. Set the spectrum analyzer [LINE] switch OFF, reconnect W13 to A14J12, and set the [LINE] switch ON. Set the spectrum analyzer controls as follows:
       CENTER FREQ ..... 300 MHz
       SPAN ..... 0 Hz
13. Move the positive DVM test lead to A14J19 pin 1. The voltage should measure between −150 mV dc and −900 mV dc. If the voltage measurement is outside this limit, measure the voltages on A14J19 pin 2 and pin 3.
14. The voltage on A14J19 pin 2 should be 150 mV to 200 mV more positive than on A14J19 pin 3. If the difference is not within this limit, the A13 Second Converter is probably defective.
15. Reconnect W13 to A14J12.

A14 Frequency Control Assembly

Note The block diagrams for the A14 and A15 assemblies are located in Chapter 11, "Synthesizer Section."

A7 LODA Drive

Refer to function block Z on the A14 Frequency Control Schematic Diagram (sheet 3 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 2 MHz
   TRIGGER ..... Single

2. Measure the signal power at the output of A7 (see item (1) of Figure 11-2).
3. If the output power is low, A14U424A output voltage, item (2), (A14J18 pin 14) should be above 0 V. If the output power is high, the voltage should be more negative than −10 V. If the voltages do not measure as indicated, check that the voltages at A14J18 pins 5 and 13, item (4), are consistent with the operational amplifier output.

Note If a TAM is available, use Manual Probe Troubleshooting to make measurements on A14J18 pins 5, 13, and 14. These voltages are referred to as AMP CNTL, LO SENSE, and PIN ATTEN, respectively.

4. If the voltages measure as indicated in step 3, measure the A11 YTO output. (See item (3) of Figure 11-2.)
5. If all measurements are within limits, refer to "A7 LODA (LO Distribution Amplifier)" in this chapter.

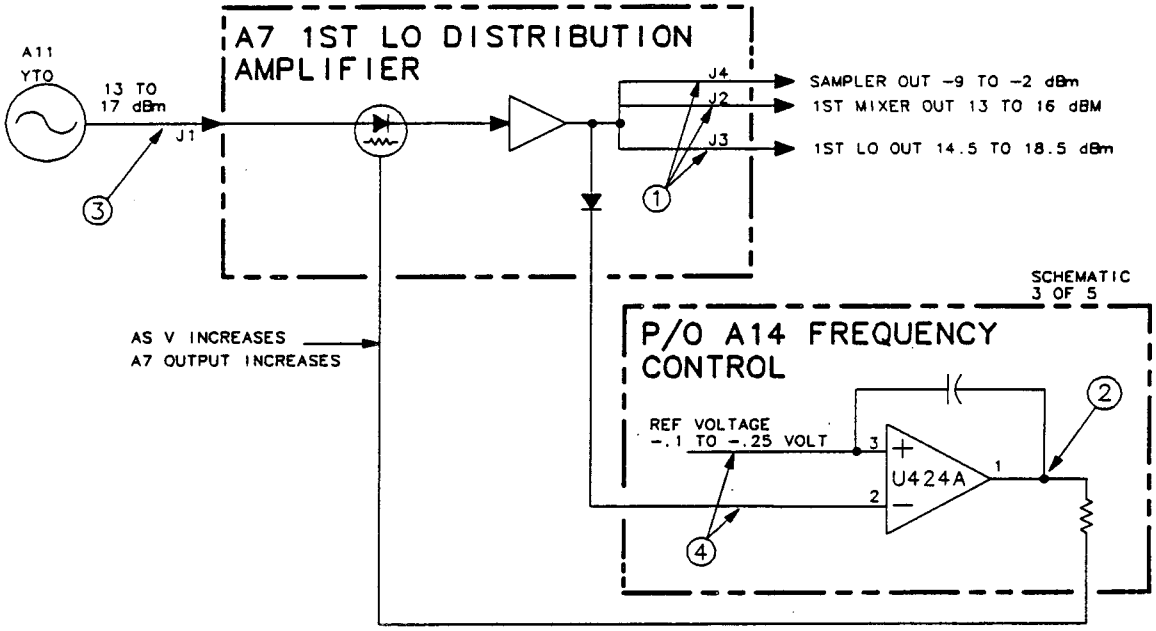


Figure 11-2. A7 LODA Drive

Control Latch for Band-Switch Driver

Refer to function block P on A14 Frequency Control Schematic Diagram (sheet 3 of 5) in the *HP8560A/8561B/8563A Component Level Information* binder.

1. Connect a positive DVM test lead to A14U417 pin 5 and the negative lead to A14J18 pin 6.
2. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

   The voltage should measure approximately 0 V dc (TTL low).
3. Set the spectrum analyzer center frequency to 3 GHz.

   The voltage should measure approximately +5 V dc (TTL high).

YTF Driver Circuit

The YTF driver circuitry consists of the Sweep + Tune Multiplier, frequency analog voltage (FAV) Generator, YTF Gain and Offset, and YTF Drive. Refer to A14 Frequency Control Schematic (sheet 3 of 5). The FAV Generator produces the 0.5 V/GHz signal. The YTF driver circuitry can be half-split by checking the rear-panel 0.5 V/GHz output.

Note The rear-panel output changes according to the external-mixer mode selected. The preselected external-mixer mode must not be selected while executing this procedure.

The Sweep + Tune Multiplier takes tune information (YTO start frequency) and sweep (based on LO span), then multiplies it to make it correct for the activated YTF band.

The FAV Generator sample-and-hold switch, U415B, and C31 hold the YTF steady during retraces between multiband sweeps. Switch U415C and R94 provide the YTF dehysteresis pulse. A dehysteresis pulse is activated at the end of spans greater than 1 MHz. In high band, amplifier U402A provides an offset voltage to account for the 310.7 MHz offset (U415A open) between the desired harmonic of the YTO frequency and the center frequency. In low band, switch U415A is closed to account for the 3.9107 GHz 1st IF offset between the YTO frequency and the center frequency. This signal is 0.5 V/GHz of tuned frequency and is available at the rear panel.

1. On the spectrum analyzer, press (PRESET), and set the controls as follows:

   START FREQ ..... 2.75 GHz
   STOP FREQ ..... 22 GHz

2. On the spectrum analyzer, press (AUX CTRL), REAR PANEL, and .5 V/GHz (FAV).
3. Monitor the rear-panel LO SWP | 0.5 V/GHz OUTPUT with an oscilloscope. The waveform should resemble Figure 11-3.
4. Set the spectrum analyzer controls as follows:

   START FREQ ..... 8 GHz
   STOP FREQ ..... 10 GHz

5. Monitor A14J15 pin 1 with an oscilloscope. The waveform should resemble Figure 11-4.
6. If the ramp is incorrect, confirm the operation of the Main Coil Tune DAC and Sweep Generator. Refer to "Unlocked YTO PLL" steps 37 through 41, and "Sweep Generator Circuit."
7. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 5 GHz
   SPAN ..... 0 Hz

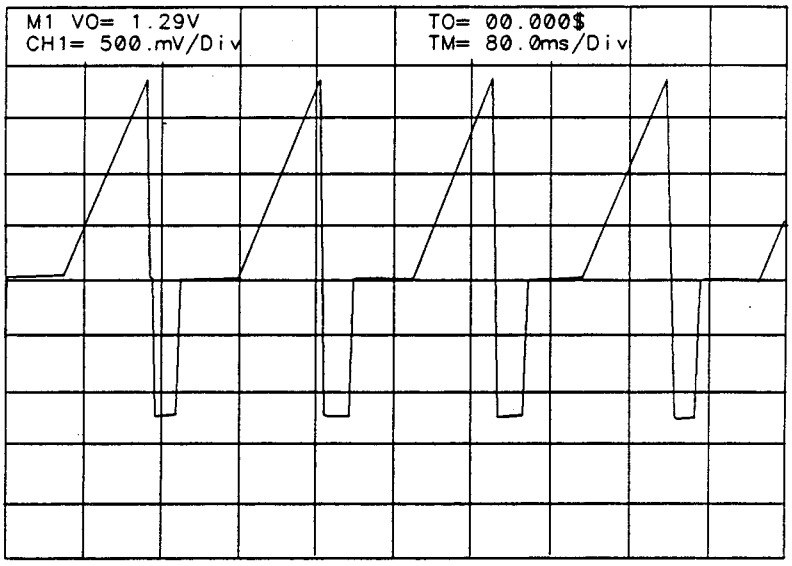


Figure 11-3. Rear-Panel SWP Output

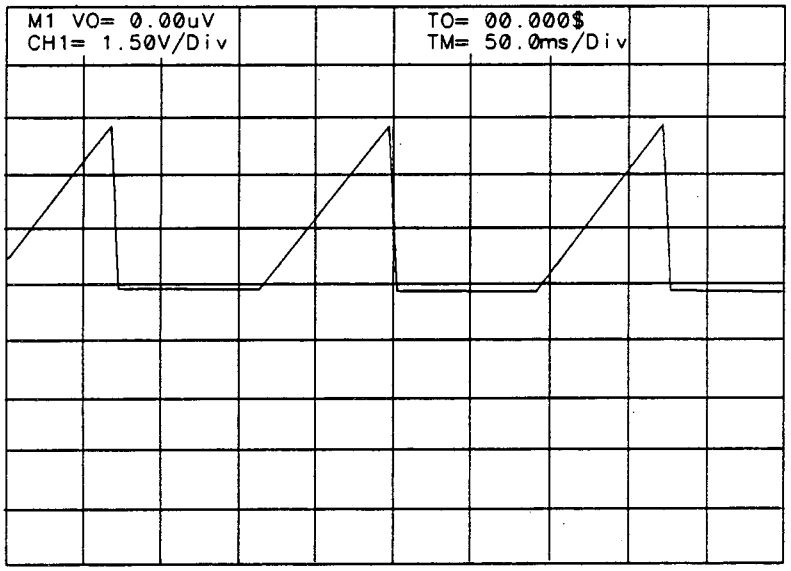


Figure 11-4. Signal at A14J15 Pin 1

8. Monitor A14J15 pin 3 with a DVM. For a center frequency of 5 GHz, the voltage should measure −1.33 V dc ±0.2 V dc. Use the following formula to calculate the voltage:

$$V_{(\text{J15 pin 3})} = \frac{-0.25\ \text{V}}{\text{GHz}} (\text{freq in GHz}) - 0.078\ \text{V}$$

9. Check the voltage at A14J15 pin 3 with the spectrum analyzer center frequency set to the frequencies listed in Table 11-4. The following table lists the voltage that should be measured at A14J15 pin 3, the settings for the three switches (U416 in function block Q), and the gain through the Sweep + Tune Multiplier.

Table 11-4. Sweep + Tune Multiplier Values

Center Frequency	A14J15 Pin 3 (V dc)	U416A	U416B	U416C	Gain
5 GHz	−1.33	Open	Closed	Closed	X1
10	−2.50	Open	Closed	Open	X2
15	−3.82	Closed	Open	Open	X3
20	−5.07	Open	Open	Open	X4

10. Move the WR PROT/WR ENA jumper on A2 Controller to the WR ENA position.
11. Set the spectrum analyzer controls as follows:

    CENTER FREQ ..... 5 GHz
    SPAN ..... 0 Hz

12. On the spectrum analyzer, press (CAL), MORE 1 OF 2, SERVICE CAL DATA, PRESEL ADJ, and PRESEL OFFSET.
13. Connect a DVM to A14J16 pin 13.
14. Set the DAC to values from 0 to 255 to yield DVM readings from 0 V to −10 V, respectively.
15. Move the jumper on A14J14 from NORM to OPT position.
16. Connect the DVM to A14J16 pin 1.
17. Press PRESEL SLOPE.
18. Set the DAC to values from 0 to 255 to yield DVM readings from 0 V to +10 V, respectively.
19. Move the jumper on A14J14 from the OPT to the NORM position.
20. On the spectrum analyzer, press (CAL) and REALIGN LO & IF.
21. Connect the DVM to A14J16 pin 3.
22. Change the center frequency in 1 GHz steps and confirm that the voltage changes by 266 mV/GHz.
23. Move the WR PROT/WR ENA jumper on A2 Controller to the WR PROT position.

A15 RF Section

Note The block diagrams for the A14 and A15 assemblies are located in Chapter 10, "Synthesizer Section."

Confirming a Faulty Third Converter

1. Perform the "IF Input Amplitude Accuracy" performance test in the *HP 8563A Installation and Verification Manual*. This exercises most of the third converter.
2. If the performance test fails, perform the "External Mixer Amplitude Adjustment" in Chapter 2 of this manual.
3. If adjustment cannot be made, disconnect W35 (coax 92) from A15J801.
4. On the spectrum analyzer, press (PRESET) and set the controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz

5. Connect a signal generator to A15J801.
6. Set the signal generator controls as follows:

   Frequency ..... 310.7 MHz CW
   Power ..... −28 dBm

7. If a flat line is displayed within 2 dB of the reference level and the performance test passed, troubleshoot microcircuits A7, A8, A9, and A13.
8. If a flat line is displayed within 2 dB of the reference level and the performance test failed, troubleshoot the A15 RF Section.

Confirming Third Converter Output

1. Connect the spectrum analyzer CAL OUTPUT to INPUT 50Ω.
2. Set the spectrum analyzer controls as follows:

   CENTER FREQ ..... 300 MHz
   SPAN ..... 0 Hz
   ATTEN ..... 0 dB

3. Press (SGL SWP).
4. Disconnect W29 (coax 7) from A15J601.
5. Connect a test cable from A15J601 to the input of a second spectrum analyzer.
6. Tune the second spectrum analyzer to 10.7 MHz. The signal displayed on the second spectrum analyzer should be approximately −5 dBm.
7. Remove the test cable from A15J601 and reconnect W29 to A15J601.

Third Converter

Refer to function blocks A, B, C, D, and E on A15 RF Section Schematic Diagram (sheet 2 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The Third Converter consists of the Second IF distribution, A15A1 Second IF Amplifier, double-balanced mixer, 10.7 MHz bandpass filter, and flatness compensation amplifiers. The second IF distribution switches between two possible second IF inputs: the internally generated second IF, or the external mixing IF INPUT. A variable dc bias can be applied to the IF INPUT for external mixers which require such bias. The selected input is fed to the A15A1 2nd IF Amplifier. This is a microcircuit consisting of two stages of gain and two stages of SAW filters for image frequency rejection.

The second IF amplifier factory-selected attenuator is chosen to achieve a gain from A15J801 or A15J802 to A15TP601 of 12 dB ±2 dB.

The flatness compensation amplifier consists of three fixed-gain stages and two stages of variable attenuation. This provides an overall adjustable gain of 8 dB to 32 dB. This gain is adjusted during an analyzer sweep to compensate for front-end conversion loss versus frequency. Complete the following steps to test the amplifier gain.

The 10.7 MHz bandpass filter provides a broadband termination to the mixer while filtering out unwanted mixer products.

1. Press (AUX CTRL) on the spectrum analyzer, then INTERNAL MIXER.
2. In the second IF distribution (function block A), diode CR802 should be forward-biased and diode CR801 should be reverse-biased.
3. Connect a signal source to A15J801 and set the controls as follows:

   Frequency ..... 310.7 MHz
   Amplitude ..... −30 dBm

4. Use an active probe with a second spectrum analyzer to measure the signal at A15TP601. If the signal measures −18 dBm ±2 dB, the second IF amplifier is operating correctly.
5. Use an active probe with a second spectrum analyzer to measure the 300 MHz into the LO into the mixer (A15TP602). The signal should measure at least +7 dBm.
6. Measure the output power of the mixer 10.7 MHz IF (A15TP603). The signal level should be approximately −24 dBm.
7. Move the A2 Controller assembly WR PROT/WR ENA jumper to the WR ENA position.
8. While measuring the signal at TP603, adjust the signal source until the level of the 10.7 MHz IF is −40 dBm.
9. On the spectrum analyzer press (SWEEP), then SINGLE.
10. Press (AUX CTRL), INTERNAL MIXER, and FLATNESS. Increase the gain of the flatness compensation amplifiers to maximum by entering 255 with the data keys. This sets the attenuators in the flatness compensation amplifiers to minimum values.
11. Connect the second spectrum analyzer to A15J601 and measure the 10.7 MHz IF signal level. The signal should measure about −10 dBm. If the signal level is much greater or much less than −10 dBm, continue with step 13.

12. Use the data keys to enter 0 as the spectrum analyzer flatness data. The signal level at A15J601 should measure less than −32 dBm. This sets the flatness compensation amplifiers gain to a minimum value (attenuators to maximum attenuation). If the signal level is incorrect, continue with step 13.
13. Check that the gain stages are properly biased and functioning.
14. Check the attenuator stages and flatness compensation control circuitry.
    a. For maximum gain (flatness data equals 255), RF GAIN (A15J901 pin 2) should be at +4 V dc and the current through each attenuator section as measured across R606 or R614 should be about 7 mA.
    b. For minimum gain (flatness data equals 0), RF GAIN (A15J901 pin 2) should be at 0 V dc and the current through each attenuator section should be close to 0 mA.

Caution 

As long as the flatness data just entered is not stored, the previously stored flatness data is present after the power is cycled.

---

15. Move the A2 Controller assembly WR PROT/WR ENA jumper to the WR PROT position.
16. Reconnect the cable to A15J801.

Flatness Compensation Control

Refer to function block G on A15 RF Section Schematic Diagram (sheet 2 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The flatness-compensation control consists of a buffer amplifier (U901B) and two identical voltage-to-current converters (U901A and U901C). The thermistor RT901 in the buffer amplifier provides temperature compensation for the PIN diodes in the attenuator stages. The gain of the flatness compensation amplifiers is driven to a minimum by the REDIR line going low during Automatic IF Adjustment.

Control Latches

Refer to function block H on A15 RF Section Schematic Diagram (sheet 2 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The control latches control the PIN Switch Drivers illustrated in function block I.

1. Connect a positive DVM lead to A15J901 pin 15 (HXMX). Connect the negative lead to A15J901 pin 6. The measured signal controls the switching between internal and external IF signals.
2. On the spectrum analyzer press (AUX CTRL) and EXTERNAL MIXER. The voltage measured by the DVM should be approximately +5 V dc (TTL high).
3. On the spectrum analyzer press (AUX CTRL) and INTERNAL MIXER. The voltage measured by the DVM should be approximately 0 V dc (TTL low).
4. Connect the positive DVM lead to A15J901 pin 13 (LSID). The signal measured turns on the SIG ID oscillator.
5. On the spectrum analyzer press SIG ID ON, (TRIG), and SINGLE.

6. Subsequent SINGLE key presses should cause the signal measured by the DVM to toggle between TTL high and low levels.
7. Connect an oscilloscope probe to A15U902 pin 7 (REDIR) and the probe ground lead to A15J901 pin 6. The signal measured is the one that controls the flatness compensation circuit.
8. On the spectrum analyzer press [PRESET] and set [SPAN] to 1 MHz.
9. Set the oscilloscope controls as follows:

   Amplitude Scale ..... 2 V/DIV
   Sweep Time ..... 20 ms/DIV

10. The waveform should indicate TTL high during part of the retrace period and TTL low during the sweep (about 50 ms).

SIG ID Oscillator

Refer to function block F on A15 RF Section Schematic Diagram (sheet 2 of 4) in the *HP8560A/8561B/8563A Component Level Information* binder.

The SIG ID Oscillator generates approximately 298 MHz, which is a shifted third LO, to distinguish true signals from false signals (such as image or multiple responses). When the spectrum analyzer is set to SIG ID ON, the SIG ID Oscillator turns on during alternate sweeps.

1. Set the spectrum analyzer controls as follows:

   TRIGGER ..... SINGLE
   SIG ID ..... ON

2. Use an active probe with a second spectrum analyzer to measure the signal level at A15TP602.
3. On the spectrum analyzer press [SWEEP] and SINGLE. With each press of SINGLE, the analyzer alternates between the following two states:

State 1:	
A15J901 pin 13 (LSID)	TTL low
SIG ID Oscillator	ON
Signal at A15TP602	298 MHz ±50 kHz (at least +1 dBm)

State 2:	
A15J901 pin 13 (LSID)	TTL high
SIG ID Oscillator	OFF
3rd LO Driver Amplifier	Provides LO for double-balanced mixer

4. With the SIG ID Oscillator on, measure the frequency at A15TP602 using a frequency counter and an active probe. If the frequency is not 298 MHz ±50 kHz, refer to the "SIG ID Oscillator Adjustment" in Chapter 2 of this manual.
5. On the spectrum analyzer, press [SWEEP] and SINGLE until A15J901 pin 13 is at TTL low. Diodes CR603 and CR605 should be forward-biased and CR604 should be reverse-biased

(approximately 6 V dc reverse bias). Diodes CR501 and CR502 should be forward-biased, disabling the 3rd LO Driver Amplifier.

6. The voltage at the R622/R623 node should measure approximately −5 V dc, biasing Q604 on.
7. If oscillator bias voltages are correct, place a 100Ω resistor across SAWR U602 pins 1 and 2. If the SAWR has failed, this provides the equivalent loss of a correctly functioning SAWR. As a result, the circuit begins to oscillate.

10 MHz Reference

The spectrum analyzer 10 MHz reference consists of 10 MHz OCXO (Option 103: TCXO) with associated TTL level generator and distribution amplifier. The OCXO (or TCXO) and TTL level generator are turned off when an external 10 MHz reference is used. Also, with the analyzer set to EXTernal frequency reference, line receiver U304B is disabled and U304A is on. In INTernal frequency reference, U304A is disabled and U304B is turned on.

Check the 10 MHz reference by performing the following steps:

1. Set the spectrum analyzer 10 MHz reference to internal by pressing (AUX CTRL), REAR PANEL, and 10 MHz INT.
2. Use another spectrum analyzer to confirm the presence of a 10 MHz signal at the following test points:

   A15J303 ..... ≥−10 dBm
   A15J304 ..... ≥−10 dBm
   A15J301 ..... ≥−2 dBm

3. Check for a 3 V p-p waveform at A15J302 with an oscilloscope (see Figure 11-5).
4. Check that the signal at A15J301 is 10 MHz ±40 Hz (with Option 103 TCXO reference) using a frequency counter. If necessary, perform the appropriate 10 MHz reference adjustment.
5. If there is no problem with INTernal 10 MHz reference operation, check EXTernal 10 MHz reference operation as follows:
6. Set the spectrum analyzer 10 MHz reference to external by pressing 10 MHz EXT.
7. Connect a 10 MHz, −2 dBm, signal to the rear-panel 10 MHz REF IN/OUT.
8. Check the signals at A15J301, A15J302, A15J303, and A15J304 according to the procedure in steps 2 through 4.
9. If the signals are correct in EXTernal operation, but not in INTernal operation, the problem lies in A21 OCXO (or Option 103 TCXO), its voltage reference, or the TTL level generator. Check these areas as follows:
   a. On the spectrum analyzer, press 10 MHz INT.
   b. Check U305 pin 3 for approximately +12 V dc.
   c. Check for a 10 MHz sine wave greater than or equal to 1 V p-p at J305 (standard HP 8563A), or at U302 pin 2 with an oscilloscope (Option 103).
10. If the signal at U303 pin 5 is correct (see Figure 11-6), but there is a problem with the signals at A15J301, A15J302, A15J303, or A15J304, suspect U303, U304, or U306 in the 10 MHz Distribution Amplifier.

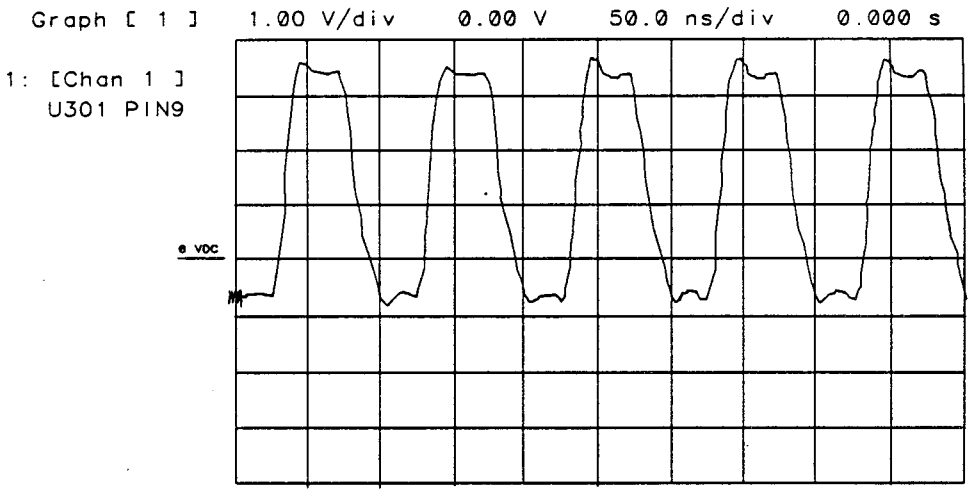


Figure 11-5. 10 MHz Reference at A15J302

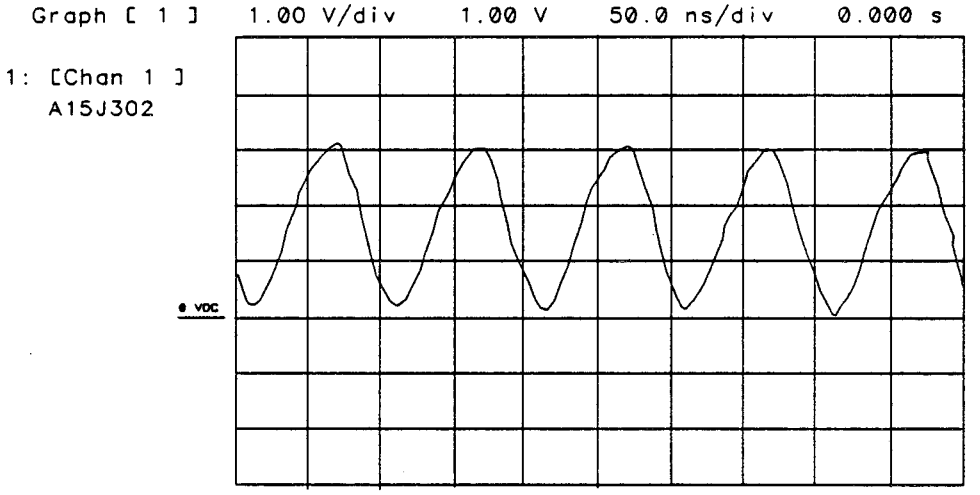


Figure 11-6. 10 MHz TTL Reference at U303 Pin 5

Table 11-5 lists the RF Section mnemonics shown in Figure 12-7 and provides a brief description of each.

Table 11-5. RF Section Mnemonic Table

Mnemonic	Description
TUNE+, TUNE–	YTF Tune Signal
HTR+, HTR–	YTF Heater Power
MAIN COIL+, MAIN COIL–	YTO Main Coil Tune Signal
FM+, FM–	YTO FM Coil Tune Signal
LO SENSE	LO Amplitude Sense Voltage
LEVEL ADJUST	LO Amplitude Adjustment Voltage (PIN ATTEN)
GATE BIAS	LODA Gate Bias Voltage
XMX	External Mixer: +12V=EXT MIX –12V=INT MIX
SID	SIG ID Oscillator ON: +12V=SIG ID OFF –8V=SIG ID ON
PIN SW	PIN Diode Switch Control
MIXER BIAS	Bias Signal for Dual Band Mixer
PIN DIODE SWITCH	PIN Diode Switch Control For 2ND Conv. IF Output
MIXER BIAS	Detected Voltage on 2ND Converter Mixer Diode
RFGAIN	Voltage to Control Gain of Flatness Comp. Amps.
RFGAIN 1 and RFGAIN 2	Currents to Drive PIN Diodes in Flatness Comp. Amps.
L10dBA, L20dBB, L20dBC, L20dBD	Control Lines to Set Attenuator Sections A, B, C, and D to Attenuate Position (Active Low)
10dBA, 20dBB, 20dBC, 20dBD	Control Lines to Set Attenuator Sections A, B, C, and D to Attenuate Position (Active High)

8563A RF SECTION BLOCK DIAGRAM

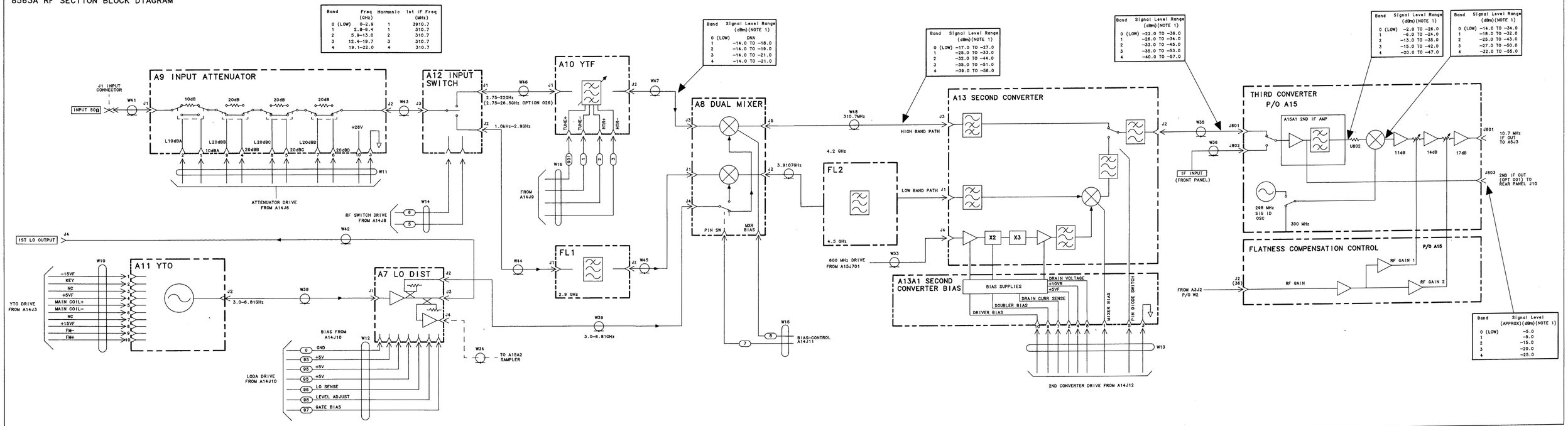


FIGURE 11-7 RF SECTION, TROUBLESHOOTING BLOCK DIAGRAM

12

Display/Power Supply Section

The Display/Power Supply Section contains A6 Power Supply, A6A1 HV Module, A17 CRT Driver, and A18 CRT. Figure 12-1 illustrates this section block diagram. Table 12-1 lists signal versus pin numbers for W1 Power Cable.

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Line Fuse Blowing 12-13
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CRT Supply Dropping Out 12-15
Blanking Signal 12-15
Buck Regulator Control 12-16
DC-DC Converter Control 12-16
Power Up 12-16

Warning



The A6 Power Supply and A6A1 High Voltage Assemblies contain lethal voltages with lethal currents in all areas. Use extreme care when servicing these assemblies. Always disconnect the power cord from the instrument before servicing these assemblies. Failure to follow this precaution can represent a shock hazard which may result in personal injury.

Warning



The voltage potential at A6A1W3 is +9 kV. If the cable must be disconnected, remove the instrument power cord first. Always disconnect at the CRT with caution! Failure to discharge A6A1W3 may result in severe electrical shock to personnel and damage to the instrument.

Warning



Always use an isolation transformer when troubleshooting either the A6 Power Supply or the A6A1 HV Module. When using an isolation transformer, connect a jumper between A6TP101 and A6TP301. This connects the circuit common to earth ground. Remove this jumper when the isolation transformer is not used.

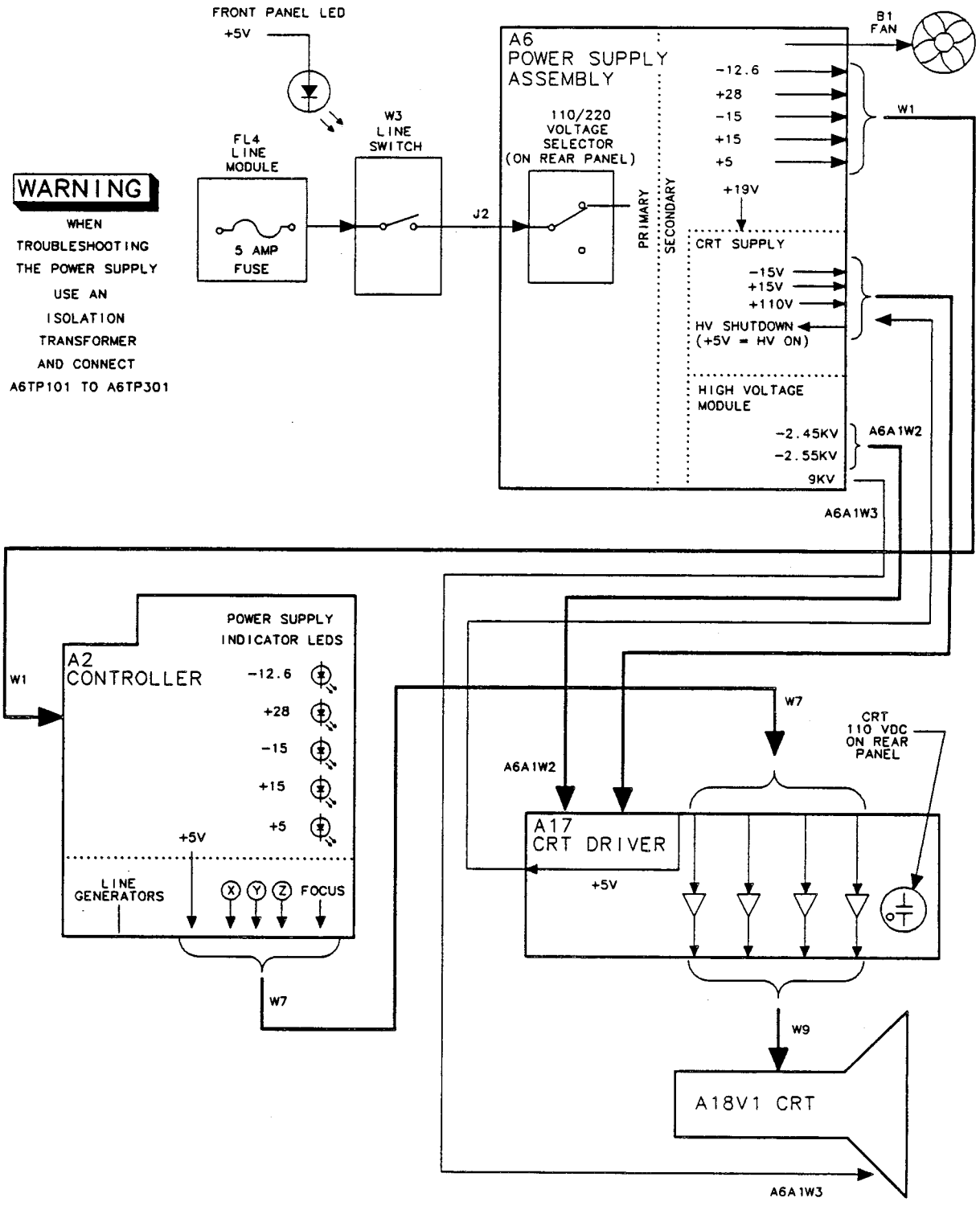


Figure 12-1. Simplified Section Block Diagram

Table 12-1. W1 Power-Cable Connections (1 of 2)

Signal	A2J1 (pins)	A3J1 (pins)	A4J1 (pins)	A5J1 (pins)	A6J1- (pins)	A14J1 (pins)	A15J1 (pins)
						-	
NC	-	-	-	-	-	-	-
NC	-	-	-	-	-	-	-
A GND	-	3	3	48	3*	3	3
NC	-	-	-	-	-	-	-
NC	-	-	-	-	-	-	-
A GND	-	6	6	45	6*	6	6
NC	-	-	-	-	-	-	-
NC	-	-	-	-	-	-	-
A GND	-	9	9	42	9*	9	9
SCAN RAMP	41	10	-	-	-	10*	-
NC	-	-	-	-	-	-	-
A GND	-	12	12	39	12*	12	12
−12.6 V	38	13	-	-	13*	-	-
−15 V	-	14	14	37	14*	14	14
A GND	-	15	15	36	15*	15	15
−15 V	-	16	16	35	16*	16	16
+15 V	-	17	17	34	17*	17	17
A GND	-	18	18	33	18*	18	18
+15 V	-	19	19	32	19*	19	19
+28 V	-	20	-	-	20*	20	20
+28 V	-	21	-	-	21*	21	21
PWR UP	29	-	-	-	22*	-	-
−15 V	-	23	23	28	23*	23	23
−15 V	-	24	24	27	24*	24	24
+15 V	-	25	25	26	25*	25	25
+15 V	-	26	26	25	26*	26	26
+5 V	-	27	27	24	27*	27	27
+5 V	-	28	28	23	28*	28	28
+5 V	-	29	29	22	29*	29	29
+5 V	-	30	30	21	30*	30	30
D GND	20	31	31	20	31*	-	31
D GND	19	32	32	19	32*	-	32
A GND	18	33	33	18	33*	33	33
A GND	17	34	34	17	34*	34	34
D GND	16	35	35	16	35*	35	35
D GND	15	36	36	15	36*	36	36
D GND	14	37	37	14	37*	37	37
D GND	13	38	38	13	38*	38	38
						-	

* Indicates signal source connectors.

Table 12-1. W1 Power-Cable Connections (2 of 2)

Signal	A2J1 (pins)	A3J1 (pins)	A4J1 (pins)	A5J1 (pins)	A6J1- (pins)	A14J1 (pins)	A15J1 (pins)
						-	
+5 V	12	39	-	-	39*	-	-
+5 V	11	40	-	-	40*	-	-
+5 V	10	41	-	-	41*	-	-
+5 V	9	42	-	-	42*	-	-
+5 V	8	43	-	-	43*	-	-
+5 V	7	44	-	-	44*	-	-
+28 V	6	45	-	-	45*	-	-
LINE TRIGGER	-	46	-	-	46*	-	-
+15 V	4	47	-	-	47*	-	-
+15 V	3	48	-	-	48*	-	-
−15 V	2	49	49	-	49*	-	-
−15 V	1	50	50	-	50*	-	-
						-	

* Indicates signal source connectors.

Troubleshooting Using the TAM

When using Automatic Fault Isolation, the TAM indicates suspected circuits that need to be manually checked. Use Table 12-2 to locate the manual procedure.

Table 12-3 lists assembly test connectors associated with each Manual Probe Troubleshooting test. Figure 12-2 illustrates the location of all A17 test connectors.

Table 12-2. Automatic Fault Isolation References

Suspected Circuit Indicated by Automatic Fault Isolation	Manual Procedure to Perform
Check A2 Controller	Blanking Signal
Check All Power Supply Outputs	Dead Power Supply *(steps 1-5)*
Check Buck Regulator	Dead Power Supply *(steps 22-23)*
Check Buck Regulator Control Circuitry	Dead Power Supply *(steps 11-21)*
Check High-Voltage Supplies	High Voltage Supplies
Check Input Rectifier	Dead Power Supply *(steps 6-7)*
Check Intensity Adjustments	Intensity Problems *(steps 1- 4)*
Check Kick-Start/Bias Circuitry	Dead Power Supply *(steps 8- 10)*
Check Low-Voltage Supplies	Low Voltage Supplies

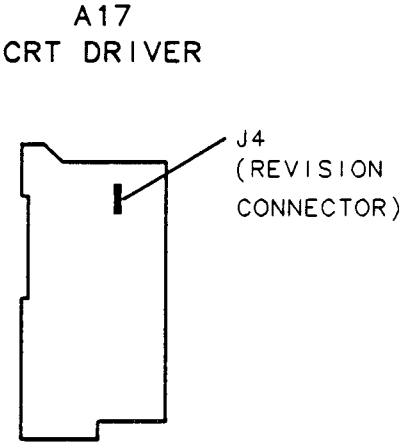


Figure 12-2. A17 Test Connector

Table 12-3. TAM Tests versus Test Connectors

Connector	Manual Probe Troubleshooting Test	Measured Signal Lines
A17J4	Revision	MS5
	X-Deflection Amplifier	MS2, MS3
	Constant Current Source	MS1
	Focus Amplifier Bias	MS4
	Intensity Amplifier Bias	MS6
	Intensity Input	MS7
	Intensity Offset	MS7
	Blanking Control	MS8

Blank Display

Use the following procedure if the instrument display is blank. This procedure substitutes an HP-IB printer for the display.

1. Connect the HP-IB printer to the spectrum analyzer and set the printer address to the value required by the TAM (which is usually 1).

   All of the power-supply indicator LEDs along the edge of the A2 Controller assembly should be lit.

   The rear-panel CRT +110 V dc ON indicator should also be lit.

2. Connect the TAM probe cable to A2J11.
3. Press (MODULE), then the third softkey from the top, then press (▼), then the first (top) softkey.

Note



The softkeys have different labels depending on the version of TAM you have; therefore, they will be referred to by their position on the instrument.

4. The yellow LED next to A2J11 should blink approximately 10 times. If the LED fails to blink correctly, troubleshoot the digital section of A2 Controller assembly.
5. Move the probe cable to A2J202. Press the first softkey and wait 5 seconds.
6. Press the fourth softkey. The results should be sent to the printer.
7. Move the probe cable to A2J201, press the first softkey and wait 5 seconds.
8. Press the fourth softkey. The results should be sent to the printer.
9. If a failure is indicated in any of these tests, the fault lies on the A2 Controller assembly. To obtain more information:
   a. Press the (▼) key one time fewer than the test number. (For example, press it twice for the third test on the list.)
   b. Press the third softkey, then the fourth softkey. After the printout is completed, press the sixth softkey.
10. If no failures are indicated from testing A2 Controller, move the probe cable to A17J4.
11. Press first softkey and wait 5 seconds.
12. Press the fourth softkey. The results should be sent to the printer.
13. If no failure is indicated in the printout, check the high-voltage supplies as described "High Voltage Supplies" in this chapter.

Blank Display

If the LED above the front-panel (LINE) switch is lit, most of the A6 Power Supply is functioning properly.

1. Carefully check the voltages of the front-panel PROBE POWER socket. Be careful to avoid shorting pins together. See Figure 12-3.
2. Check that the fan is operating. If the PROBE POWER voltages are correct, and the fan is working, the A6 Power Supply is probably working properly.

   If the rear-panel CRT +110 V dc ON LED is lit, the high-voltage supplies should also be operating. (The high-voltage supplies turn off if the HV SHUT_DOWN line is low.) The A6 Power Supply feeds +5 V to the A2 Controller through W1. The A2 assembly distributes this +5 V to the A17 CRT Driver through W7. A17 sends +5 V back to A6 as the HV SHUT_DOWN signal over W8. As a result, A2, A17, W1, W7, and W8 must all be in place for the high-voltage supplies to operate.

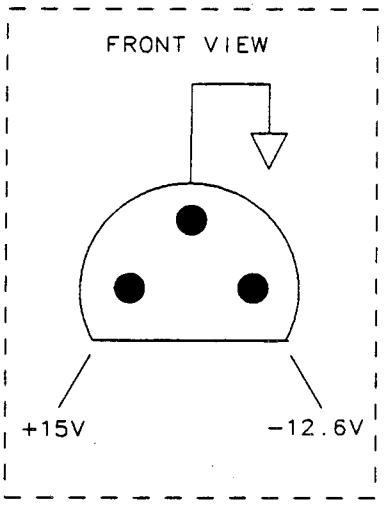


Figure 12-3. Probe Power Socket

3. If all power supply indicators along the outside edge of the A2 Controller assembly are lit, the A6 Power Supply is probably working properly.
4. Press FREQUENCY, 1 (GHz).
5. Allow the analyzer to warm up for at least 1 minute.
6. While observing the display, set the (LINE) switch OFF. If a green dot moves across the display, the CRT is probably working properly; troubleshoot either the A2 Controller or the A17 CRT Driver.
7. If a green dot does not move across the display, the A2 Controller, A6A1 HV Module, A17 CRT Driver, or A18V1 CRT might be at fault.

Display Distortion

The spectrum analyzer uses a vector display. The graticule lines, traces, and characters are composed of a series of straight lines ("vectors") displayed end-to-end. If the vectors do not begin and end at the proper points, the display appears distorted, but in focus. Symptoms range from characters appearing elongated and graticule lines not meeting perpendicularly, to an entirely unreadable display.

1. Use the CRT ADJ PATTERN to check for distortion. Press (CAL), MORE 1 OF 2, then CRT ADJ PATTERN. If vector distortion (described above) occurs, perform the "Display Adjustment" in Chapter 2 to test the function of the A2 Controller assembly.
2. If distortion occurs along with slight focus degradation, but the graticule lines meet (not necessarily *squarely*), the A17 CRT Driver, CRT, DDD/TRACE ALIGN adjustments, or cable connections might be at fault.
3. Perform the "Display Adjustment" in Chapter 2. Isolate the problem to either the X or Y axis by noting the behavior of the adjustments. If the line generator or fast zero-span portion of the adjustment fails, troubleshoot the A2 assembly.

4. If the display adjustment does not remedy the problem, set the spectrum analyzer (LINE) switch OFF and place the A17 CRT Driver in the service position.
5. Distortion confined to one axis (vertical or horizontal only), indicates a faulty A17 assembly X or Y Deflection Amplifier. Use the alternate good deflection amplifier for obtaining typical voltages. (There is enough symmetry in a typical display that the voltages should be similar between these circuits.)
6. Monitor the waveforms at A17TP11 and A17TP14 (or TP12 and TP13). The 50 to 100 V p-p ac component of the waveforms at the and X′ (or Y and Y′) outputs should be mirror images of each other. The dc average should be 55 V.
7. The appropriate POSN adjustment (A17R57 or A17R77) should change the dc component of both X and X′ (or Y and Y′) outputs in opposite directions.
8. The appropriate GAIN adjustment (A17R55 or A17R75) should change the ac component in both outputs by the same amount.
9. If the display is a single dot, check the base of A17Q18 for −10.3 V ±0.3 V. Verify the signals at TP11, TP14, TP12, and TP13.
10. If signals are correct and cables to the CRT are good, suspect the A18V1 CRT.

Focus Problems

Focus problems may be due to a defective A18V1 CRT, improper adjustments, improper connections, or absence of high voltage. The A2 Controller focus-control circuitry has minor effect on the overall focus.

A17 Grid Level Shifter (function block D) is the leading cause of A17 focus problems. Function blocks C, E, F, and H generally have less effect on focus, but may cause poor focus that is a function of screen position, length of line, or intensity.

1. Connect a DVM positive lead to A2J202, pin 2. Connect the negative lead to A2J202 pin 6.
2. Use the knob to change the focus value from 0 to 255.
3. If the DVM measurement reads about 0 V dc while the focus is set to 0, and about −10 V dc while the focus is set to 255, the A2 focus control circuitry is working properly.
4. Perform the Display Adjustment in Chapter 2. Notice that A17R34 COURSE FOCUS has the greatest effect on focus. Adjustment A17R93 ASTIG and A17R92 DDD have less effect. A17R21 Z FOCUS, A17R26 X FOCUS, and the front-panel adjustment (press (DISPLAY), MORE 1 OF 2, FOCUS, and turn the knob) have very little effect on focus.
5. If some areas on the screen have worse focus than others, continue with step 11. If no area on the screen can be sharply focused, continue with step 6. (There is always some typical CRT focus variation across the screen.)
6. Turn off the analyzer and place A17 in the service position. Connect the ground lead of a high-voltage probe (HP 34111A) to the chassis. Use the DVM to measure A17J7(10).
7. The nominal A17J7(10) voltage is −1600 V dc, but the CRT functions if this voltage is within 200 V of −1600 V dc.

8. Adjusting A17R34 COURSE FOCUS should vary A17J7(10) voltage by 150 V. If these voltages are correct, suspect the CRT.
9. Check the A6A1 High Voltage Module cathode supply output at A17TP16 using a high-voltage probe. If the cathode voltage is −2450 V ±250 V, check the Focus Grid Level Shifter.
10. If the cathode voltage is incorrect, check the A6A1 High Voltage Module and its connections.
11. Connect an oscilloscope probe to A17TP9. This signal corrects the focus for the X position of the CRT beam, and for intensity level. It also provides the front-panel focus adjusting voltage.
12. Press (DISPLAY), MORE 1 OF 2, and FOCUS. While turning the front-panel knob, verify that the dc level of the signal at TP9 adjusts about 30 V p-p.
13. Verify that the front-panel INTEN adjustment and A17R21 Z FOCUS changes the peak-to-peak voltage at TP9 by 25 V.
14. Set the front-panel INTEN to minimum and Z FOCUS fully counterclockwise and A17R26 Z FOCUS fully counterclockwise. Verify that the peak-to-peak voltage at TP9 is about 40 V p-p (due to X-dynamic focus circuit).
15. If circuit operation seems correct, A18V1 CRT is probably at fault.

Intensity Problems

Intensity problems, or absence of display, can be due to the A17 CRT Driver assembly intensity amplifier (function block A), Intensity Grid Level Shifter (function block B), CRT (A18V1), interconnections, or lack of proper supplies or inputs to A17.

1. On the spectrum analyzer, press (DISPLAY), More 1 of 2 then INTEN.
2. Rotate the front-panel knob (RPG), and check that the intensity changes from dim, but readable, to bright.
3. If the intensity does not vary properly, troubleshoot the A2 Controller assembly.
4. Perform the preliminary and Z-axis portions of the Display Adjustment in Chapter 2. Verify that A17R11 CUTOFF functions properly. If A17R11 CUTOFF does not function properly, place the A17 CRT Driver in the service position.
5. Using an oscilloscope, verify that blanking pulses are present at A17TP2 . The pulses should be normal TTL levels, approximately 1 μs wide and 4 or 7 μs apart. If the blanking pulses are incorrect, check the BLANKING output of the A2 Controller assembly and cable W7.
6. If blanking pulses are present, check A17TP10 with the oscilloscope. The TP10 signal should vary with the front-panel INTEN adjustment, and be approximately 55 V p-p maximum. The signal is composed of both blanking pulses and varying intensity levels for the lines being drawn.
   a. If a proper signal is not present at A17TP10, check A17Q1, Q2, CR1, and CR2.

b. If the TP10 signal does not vary with the front-panel INTEN adjustment, check the signals at A17TP4 and A17TP1. Both signals should vary with the front-panel INTEN adjustment. The TP4 signal should be less than or equal to 4 V p-p, and TP1 signal should be up to approximately 12 V p-p.

Warning



The A17 CRT Driver contains lethal voltages with lethal currents. Use extreme care when servicing this assembly. Always disconnect the power cord from the instrument before servicing this assembly. Failure to follow this precaution can represent a shock hazard which may result in personal injury.

Note



The following measurements should be made with a high-voltage probe, such as the HP 34111A. When using the high-voltage probe, connect the ground lead securely to the spectrum analyzer chassis.

7. Carefully measure the grid voltage at A17J7 pin 6, and the cathode voltage at A17J7 pin 4. The display works with a cathode voltage of −2450 V ±250 V, provided the grid voltage (A17J7 pin 6) is 30 to 100 V more negative than the cathode. A17R11, CUTOFF, should be able to adjust the voltage difference over a 60 V range to account for tube variations, and achieve proper intensity.
8. If the grid and cathode voltages are correct, turn off the spectrum analyzer and check CR10 with an ohmmeter. If CR10 is good, suspect the A18V1 CRT.
9. If the grid and cathode voltages are too low, turn off the power and disconnect W8 from the base of A18V1 CRT, and recheck the grid and cathode voltages.
10. If the grid and cathode voltages are still too low, refer to "CRT Supply" in this chapter and the High-Voltage Power Supply Adjustment procedure.
11. If voltages are correct when the tube is disconnected, the CRT is probably defective.

Caution



The pins on the A18V1 CRT bend easily. Be careful not to bend these pins when connecting W8 to A18V1.

A6 Power Supply Assembly

The spectrum analyzer uses a switching power supply operating at 40 kHz to supply the low voltages for most of the analyzer hardware and a 30 kHz switching supply (CRT supply) to provide the high voltages for the CRT display. The CRT supply is treated as a separate supply since the remainder of A6 must be operating for the CRT supply to operate.

Kick-starting occurs when there is a fault either on the power supply or on one of the other assemblies. The power supply tries to start by generating a 200 ms pulse ("kick") every 1.5 seconds. A kick-starting power supply often appears to be dead, but the fan makes one or two revolutions, then stops every 1.5 seconds.

Warning 

The A6 Power Supply and A6A1 High Voltage Assemblies contain lethal voltages with lethal currents in all areas. Use extreme care when servicing these assemblies. Always disconnect the power cord from the instrument before servicing these assemblies. Failure to follow this precaution can represent a shock hazard which may result in personal injury.

Warning 

The voltage potential at A6A1W3 is +9 kV. Disconnect at the CRT with caution! Failure to discharge A6A1W3 may result in severe electrical shock to personnel and damage to the instrument.

Warning 

Always use an isolation transformer when troubleshooting either the A6 Power Supply or the A6A1 HV Module. When using an isolation transformer, connect a jumper between A6TP101 and A6TP301. This connects the circuit common to earth ground. Remove this jumper when the isolation transformer is not used.

Dead Power Supply

1. Connect the negative lead of a DVM to A6TP301.
2. Check TP308 for +5 V.
3. Check TP302 for +15 V.
4. Check TP303 for −15 V.
5. Check TP304 for +28 V.
6. Check TP305 for −12.6 V.
7. Measure the voltage at TP108 to verify the output of the input rectifier. The voltage should be between +215 V dc and +350 V dc.
8. If it is not within this range, check the input rectifier, input filter, and the rear-panel line voltage selector switch.
9. Measure the voltage at TP206 to verify the output of the Kick-Start/Bias Circuitry. The voltage should be approximately +14 V dc.
10. If there is no voltage at TP206, check TP210 for pulses 200 ms wide with an amplitude of 14.7 V. If there are no pulses present, the kick-start circuitry is probably defective. If the pulses are low in amplitude (about 1 V), Q201 is probably shorted.
11. If there are pulses at TP206, or there are pulses at TP210, but not at TP206, the Buck Regulator Control circuitry is probably faulty.
12. Disconnect the power cord from the spectrum analyzer.
13. Connect the positive output of a current-limited dc power supply to the cathode of A6CR201 and the ground to A6TP201.
14. Set the current limit to about 500 mA and the voltage to 12 V dc.
15. Connect a jumper from the power supply +12 V output to the end of A6R202 physically nearest A6U211.

16. Connect a jumper from A6TP101 to A6TP301. This independently powers the Buck Regulator Control circuitry.
17. Connect a jumper from +12 V dc to the end of C207 nearest C209.
18. If the current draw exceeds approximately 50 mA, suspect a short in the Buck Regulator Control circuitry or a shorted CR201.
19. Check TP204 for an 80 kHz sawtooth (4 V p-p).
20. Check TP203 and TP207 for 40 kHz square (12 V p-p). If the waveforms at either TP203 or TP207 are bad, one of the FETs in the DC-DC Converter is probably defective.
21. Check TP105 and TP106 for a 12 V p-p sawtooth waveform that is flattened at the bottom. If the waveform is a squarewave, the FET to which the test point is connected has failed or shorted.
22. Check TP202 for 80 kHz pulses (12 V p-p).
23. Short TP401 to TP102. Check TP103 for a waveform similar to that in Figure 12-4.
24. If the waveform at TP202 is correct but the waveform at TP103 is bad, suspect either Q102 or CR106.

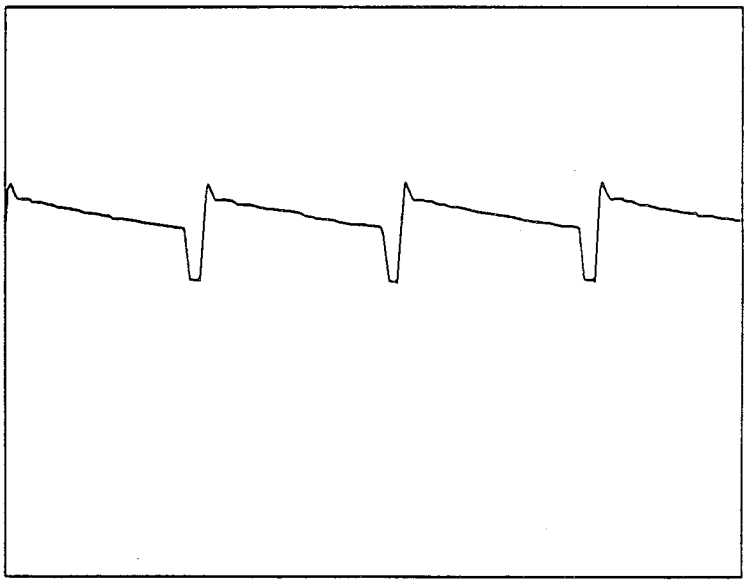


Figure 12-4. Buck Regulator Waveform

Line Fuse Blowing

1. If the line fuse blows with the (LINE) switch OFF, suspect either the Input Filter or the power switch cable assembly.
2. If the line fuse blows when the spectrum analyzer is turned on, disconnect the power cord and lift the drain of A6Q102 from TP108. If the line fuse still blows, suspect U102.
3. If the fuse is working properly, check A6TP108 for a voltage of between +215 V and +350 V.
4. If the voltage at TP108 is correct, disconnect the power cord; remove and check A6Q102.

5. If Q102 is shorted, Q103, Q104, CR106, and CR108 are also probably shorted. If Q102 is working properly, measure the resistance between TP102 and TP101 (positive ohmmeter lead to TP102).
6. If the resistance is less than 1 kΩ, suspect either Q103 or Q104 in the DC-DC Converter.

Supply Restarting Every 1.5 Seconds (Kick-Start)

Refer to function blocks G and L of A6 Power Supply Schematic Diagram.

If there is a short on the power supply or on one of the other assemblies, the power supply attempts to "kick-start." (Every 1.5 seconds the supply attempts to start, but shuts down due to a fault condition.) The kick-start and bias circuits provide power for the control circuitry during power-up. The kick-start circuitry is an RC oscillator which emits a 200 ms pulse every 1.5 seconds. These pulses switch current from the input rectifier through Q201 to charge C201. When the power supply is operating, a winding on T103 provides power to the control circuitry. This voltage is high enough to keep Q201 turned off.

1. Simultaneously monitor the waveforms at TP206 and TP208 with an oscilloscope.
2. If the signal at TP208 goes high before the signal at TP206 goes low, an overcurrent condition exists. Suspect a short in the secondary (output rectifier, voltage regulators, or another assembly).

Low Voltage Supplies

1. Connect the negative DVM lead to A6TP301.
2. Check A6TP302 for +15 V dc.
3. Check A6TP303 for −15 V dc.
4. Check A6TP304 for +28 V dc.
5. Check A6TP305 for −12.6 V dc.
6. Check A6TP308 for +5 V dc.
7. If the voltages measured above are correct, but the power supply LEDs on the A2 Controller assembly are not lit, check W1.
8. If the voltages are low, disconnect W1 from A6J1 and measure the test point voltages again. Unless a dummy load is connected to the A6 Power Supply, the voltages should return to their nominal voltages but be unregulated.
9. If the voltages do not return to near their nominal range, the A6 Power Supply is probably at fault.
10. If the +5 V supply is low, suspect the feedback circuit. Measure the voltage of the +5 V reference (U305 pin 5) and the ±7.5 V references (U306B pin 7 and U306D pin 14).
11. Check the output at U306A pin 1. If the feedback circuit is working properly, the output of U306A should be near +13 V dc.
12. Check the output at U302; its output should be high if the feedback circuit is working properly.

High Voltage Supplies

1. Set the (LINE) switch OFF, disconnect the power cord, and remove the power supply shield.
2. Connect the negative DVM lead to A6TP401 and the positive lead to A6TP405.
3. Set the (LINE) switch ON.
4. If the voltage displayed on the DVM is approximately +110 V dc and the rear-panel CRT +110 V dc ON indicator is lit, A6A1 HV Module is probably at fault.

Note



Ideally the DVM voltage measurement should equal the value written on the label of the A6A1 HV Module. If necessary, perform the "High Voltage Power Supply Adjustment" in Chapter 2.

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5. If the DVM measurement is not approximately +110 V dc, measure the voltage on A6U401 pin 10. This is the HV_SHUT_DOWN signal which should be near +5 V dc.
6. If HV_SHUT_DOWN is low, suspect a bad connection along W8 between the A6 Power Supply and the 17 CRT Driver.
7. If HV_SHUT_DOWN is correct, connect an oscilloscope to A6TP402. Connect the negative scope probe to TP401. Set the oscilloscope controls as follows:

   Sweep Time ..... 10 μs/DIV
   Vertical Scale ..... 10 V/DIV

8. A nearly sinusoidal waveform, greater than 30 V p-p, with an approximately +18 V dc offset, should be displayed.
9. If the waveform is a dc voltage about 0 V dc with narrow, positive- and negative-going pulses, the A6A1 HV Module is faulty. If the waveform is a dc voltage about +18 V dc with narrow, positive- and negative-going pulses, connect the probe to TP403.
10. If the waveform at TP403 is a sawtooth waveform with a 1.8 V amplitude, the A6A1 HV Module is faulty.
11. If the TP403 waveform has pulses similar to those on TP402, the A6 Power Supply is probably faulty.

CRT Supply Dropping Out

Refer to function block K of A6 Power Supply Schematic Diagram.

The CRT supply is a separate switching supply that provides +110 V dc for the A17 CRT Driver from a winding on the A6A1 HV Module. The CRT supply operates at approximately 30 kHz. The exact frequency is determined by the inductance of the primary winding of A6A1T1 and A6C407. The supply only operates if the HV_SHUT_DOWN line is high.

If the power supply keeps dropping out, there is probably a short on the A17 CRT Driver assembly.

1. Disconnect W8 from A6J4.
2. Connect an IC clip to U401 and connect a jumper between U401 pin 10 and TP308 (+5 V dc).

3. Connect a voltmeter to TP405 and set the LINE switch ON.
4. Check TP405 for a voltage of approximately +110 V dc. It probably measures higher since there is no load on the supply.
5. If the voltage at TP405 is correct, suspect a short on A17. If the voltage at TP405 is not correct, check pin U401 pin 8 for a sawtooth signal. The sawtooth should be flat-topped and about 5 V p-p at a frequency of about 30 kHz.
6. If the sawtooth is not flat-topped, suspect U402A and its associated circuitry.
7. If the sawtooth is correct, check the base of Q401 for 30 kHz pulses.
8. If the duty cycle is high, but there is no +110 V dc, suspect the bridge rectifier, CR401 through CR404.

Blanking Signal

1. Connect an oscilloscope probe to A2J202 pin 3. Connect the oscilloscope ground lead to TP3. Set the oscilloscope to the following settings:

   Sweep Time 2ms/DIV
   Vertical Scale ..... 1 V/DIV

2. If a 4 V p-p signal is not observed, the A2 Controller assembly is faulty.
3. Repeat steps 1 and 2 with the oscilloscope probe on A2J202 pin 14.
4. Set the oscilloscope controls as follows:

   Sweep Time ..... 1 μs/DIV
   Vertical Scale ..... 2 V/DIV

5. Connect the positive probe lead to A2J202 pin 15. This is the blanking output.
6. TTL-level pulses should be displayed. If the signal is either always high or always low and the display is blanked, suspect the A2 Controller assembly.
7. If the signals on A2J202 pins 3, 14, and 15 are correct, troubleshoot the A17 CRT Driver.

Buck Regulator Control

Refer to function block H of A6 Power Supply Schematic Diagram.

The Buck Regulator Control pulse-width modulates the Buck Regulator and provides a synchronized signal to the DC-DC Converter Control circuitry. The Buck Regulator Control has two feedback paths. The first is the output of the Buck Regulator, which provides coarse regulation. The second is the Feedback Circuit which samples and compares the +5 V dc output of the output rectifier.

U202B and associated circuitry sense the output of the Input Rectifier and turns off U203 if the voltage at TP108 goes below approximately +170 V dc. Also, it does not allow U203 to start up until this voltage exceeds +215 V dc. A low on the output of U202B also clears the overcurrent latch in the DC-DC Converter Control circuitry.

Thermal shutdown occurs when RT201, mounted on the main heat-sink, reaches a temperature of 100°C. When this occurs, the voltage at U203 pin 13 exceeds 0.6 V and inhibits pulses to the Buck Regulator.

R203, R204, U211, and associated circuitry provide feed-forward for U203. This makes the loop gain independent of input line voltage, which cancels the 120 Hz ripple by more than 10 dB.

U202C and its associated circuitry permit the power supply to start up at low-line voltages at low temperatures. At low-line voltages U202C draws charge away from C206 through R205. This allows the Buck Regulator to turn on and draw current through the input rectifier thermistors. This warms up the thermistors, thereby decreasing their resistance and increasing the voltage at TP108. When the voltage is sufficiently high at TP108, the output of U202C opens and C206 is allowed to charge normally.

U202A converts the sawtooth at TP204 to a square wave to drive the DC-DC Converter Control circuitry. The frequency of the sawtooth is determined by the resistance at pin 7 of U203 and the capacitance at pin 8 of U203.

DC-DC Converter Control

Refer to function block I of A6 Power Supply Schematic Diagram.

The DC-DC Converter Control circuitry divides the 80 kHz square wave from U202A into two complementary 40 kHz squarewaves. These drive the FETs in the DC-DC Converter. Also, U202D and its associated circuitry monitors the voltage across sense-resistor R116 in the DC-DC Converter. When the DC-DC Converter current through the FETs exceeds 1.8 A, the voltage across R116 causes the output of U202D to go high. This sets the latch in U204 that turns off U203.

Power Up

Refer to function block M of A6 Power Supply Schematic Diagram.

The Power Up circuitry generates the PWR UP signal, which tells the microprocessor that the supplies are up and stable. PWR UP goes high when the +5 V dc supply exceeds +4.99 V dc. PWR UP goes low when this voltage drops below +4.895 V dc. Once PWR UP is set low, it stays low for at least 50 ms before going high, even if the +5 V dc supply exceeds +4.99 V dc before 50 ms have elapsed.

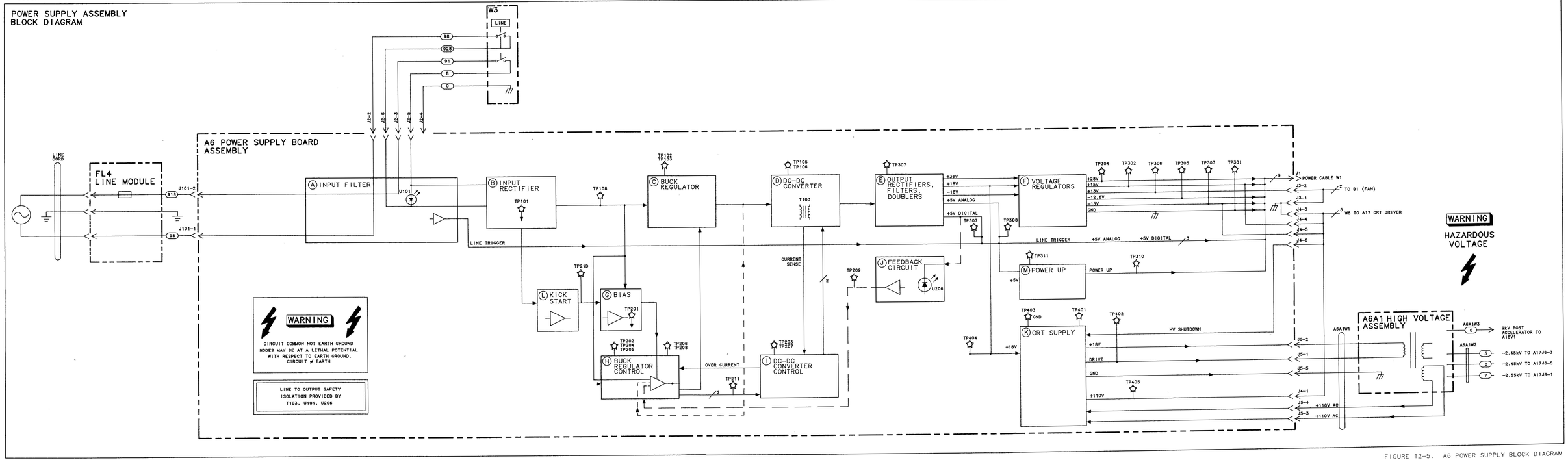


FIGURE 12-5. A6 POWER SUPPLY BLOCK DIAGRAM

A17 CRT DISPLAY DRIVER BLOCK DIAGRAM

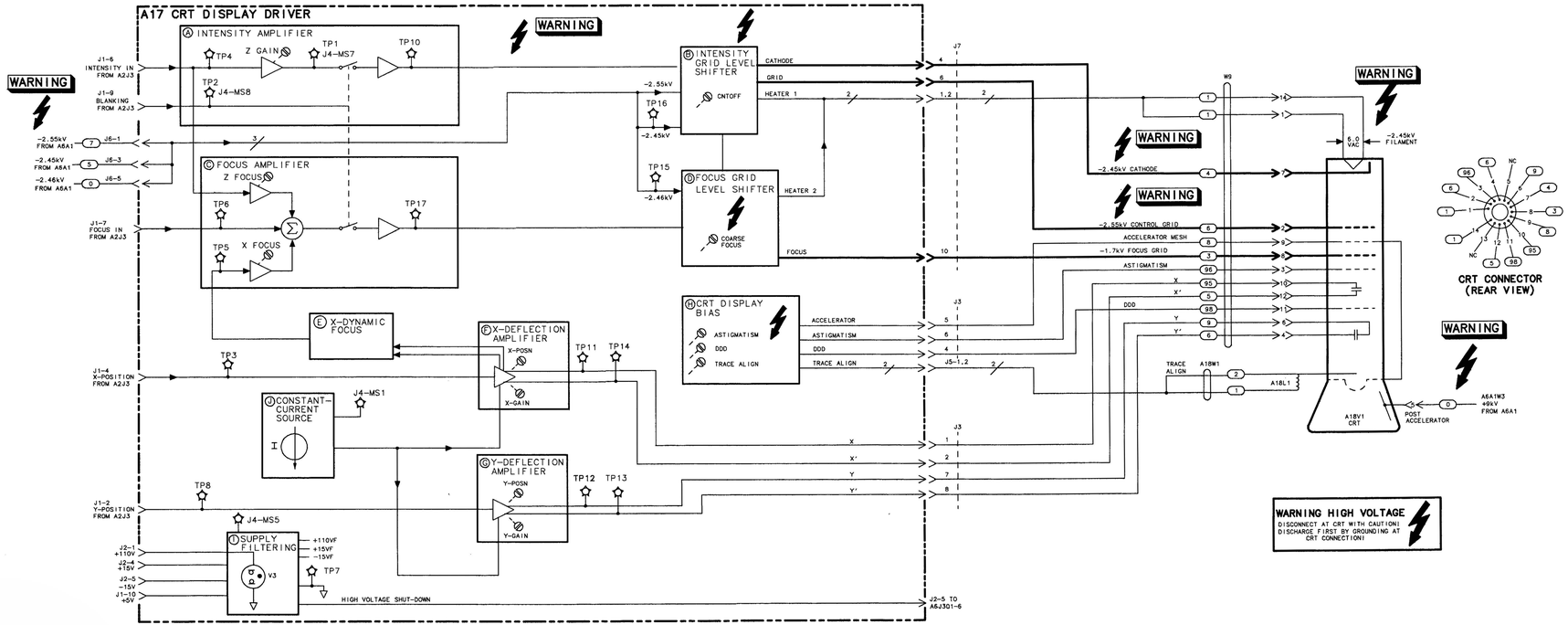


FIGURE 12-6. A17 CRT DRIVER BLOCK DIAGRAM

A

Component-Level Information Packets

Component-Level information is available for selected instrument assemblies. The information for each repairable assembly is provided in the form of Component-Level Information Packets (CLIPs). Each CLIP contains a parts list, component-location diagram, and schematic diagram. Each CLIP has an HP part number which is changed whenever the HP part number for its related instrument assembly is changed.

Updated or replacement CLIPs may be ordered through your local Hewlett-Packard Sales or Service office using the CLIP part number provided in Table A-1.

A complete set of the latest version of CLIPs can be ordered using HP Part Number 5958-7187.

Table A-1 lists board assembly part numbers and corresponding component-level information packet (CLIP) part numbers. Table A-2 lists documented RF board assemblies shipped with instrument serial prefixes below 3029A.

CLIPs are packaged in protective plastic envelopes. To use and store your CLIPs effectively, the following accessories are available.

2-1/2 inch CLIP binder (for 25 to 30 packets)	HP part number 9282-1134
2 inch CLIP binder (for 15 to 25 packets)	HP part number 9282-1133
1-1/2 inch CLIP binder (for fewer than 15 packets)	HP part number 9282-1132
Replacement plastic CLIP envelopes	HP part number 9222-1536

Note CLIPs may not be available for recently introduced assemblies.



Table A-1. HP 8563A Spectrum Analyzer Documented Assemblies

Board Assembly	Instrument Serial Prefix	Assembly Part Number	CLIP Part Number*
A1A1 Keyboard	2913A and above	08562-60031	**08562-90110***
A2 Controller Assembly	2913A through 2925A 2948A through 2949A 3003A and above	08563-60013 08563-60002 08563-60005	08563-90010 08563-90011 **08563-90012***
A3 Interface Assembly	2913A through 3009A 3014A and above	08560-60015 08563-60003	08560-90021 **08560-90042***
A4 Log Amplifier	2913A through 2948A 2929A 2950A and above	08560-60010 08560-60033 08560-60035	08560-90022 08560-90023 **08560-90024***
A5 IF Filter	2913A through 2949A 2950A and above	08560-60011 08560-60029	08560-90025 **08560-90026***
A6 Power Supply	2913A and above	08562-60094	**08562-90111***
A14 Frequency Control	2913A through 3003A 3006A through 3017A 3020A and above	08563-60001 08563-60004 08563-60006	08563-90018 08563-90019 **08563-90020***
A15 RF Board (Std, Opt. 001, 002, 012)	3029A and above	08562-60118	**08562-90112***
A15 RF Board (Opt. 003, 013, 123, 023)	3029A and above	08562-60117	**08562-90113***

*Denotes the current version of board assembly.

Table A-1.
HP 8563A Spectrum Analyzer Documented Assemblies (continued)

Board Assembly	Instrument Serial Prefix	Assembly Part Number	CLIP Part Number*
A16 CAL OSC	2913A and above	08560-60014	**08560-90027***
A17 CRT Driver	2913A and above 3032A and above	08562-60039 08562-60112	08562-90114 **08562-90117***
A19 HP-IB	2913A and above	08562-60042	**08562-90115***
*Denotes the current version of board assembly.			

Table A-2.
RF Board Assemblies Shipped with HP 8563A's Serial Prefixed below 3029A

RF Board Option	Instrument Serial Prefix	Assembly Part Number	CLIP Part Number
A15 RF Board, Standard	2913A through 3009A 3017A through 3027A	08562-60103 08562-60122	08562-90104 08562-90107
A15 RF Board, Option 001	2913A through 3009A 3017A through 3027A	08562-60104 08562-60126	08562-90105 08562-90109
A15 RF Board, Option 002	2913A through 3009A 3017A through 3027A	08560-60024 08560-60037	08560-90030 08560-90031
A15 RF Board, Option 012	2913A through 3009A 3017A through 3027A	08560-60025 08560-60038	08560-90032 08560-90033
A15 RF Board, Option 003	2913A through 3009A 3017A through 3027A	08562-60101 08562-60121	08562-90102 08562-90106
A15 RF Board, Option 013	2913A through 3009A 3017A through 3027A	08562-60102 08562-60125	08562-90103 08562-90108
A15 RF Board, Option 023	2913A through 3009A 3017A through 3027A	08560-60026 08560-60039	08560-90034 08560-90035
A15 RF Board, Option 123	2913A through 3009A 3017A through 3027A	08560-60027 08560-60040	08560-90036 08562-90037

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MODEL NO. SERIAL NO.

MODEL NO. SERIAL NO.

P.O. NO. DATE

Accessories returned with unit

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☐ POWER CABLE ☐ ADAPTER(S)

OTHER _____

over

Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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If unit is part of system list model number(s) of other interconnected instruments. _____

_____

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Service needed

☐ CALIBRATION ONLY

☐ REPAIR ☐ REPAIR & CAL

OTHER _____

_____

Observed symtoms/problems

FAILURE MODE IS:

☐ CONSTANT ☐ INTERMITTENT

SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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If unit is part of system list model number(s) of other interconnected instruments. _____

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Service needed

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☐ REPAIR ☐ REPAIR & CAL

OTHER _____

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Observed symtoms/problems

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FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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OTHER _____

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SENSITIVE TO:

☐ COLD ☐ HEAT ☐ VIBRATION

FAILURE SYMPTOMS/SPECIAL CONTROL SETTINGS_____

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If unit is part of system list model number(s) of other interconnected instruments. _____

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8563A INTERCONNECT DIAGRAM

A15 RF ASSEMBLY
A16 CAL OSC ASSEMBLY
INSIDE VIEW REAR PANEL
BT1 BATTERY
B1 FAN
A7 1st LO DIST
A11 YTO
A8 DUAL MIXER
A13 2nd CONVERTER
A10 YTF
A12 RF SW
A9 ATTENUATOR
A21 OCXO (DELETE FOR OPT 103)
A14 FREQUENCY CONTROL ASSEMBLY
A6 POWER SUPPLY ASSY
A6A1 HIGH VOLTAGE
A5 IF ASSEMBLY
A4 LOG AMP ASSEMBLY
A3 INTERFACE ASSEMBLY
A2 CONTROLLER ASSEMBLY
A17 CRT DISPLAY DRIVER ASSEMBLY
A18 CRT ASSEMBLY A18V1 CRT
A1A1 KEY BOARD ASSEMBLY
A1A2 RPG
A1 FRONT PANEL
HPIB CABLE AT REAR PANEL J2
HPIB CABLE AT A19J1
HPIB CABLE AT A2J5
OPTION MODULE CABLE AT REAR PANEL J3
OPTION MODULE CABLE AT A2J6
A3W1 INTERFACE CABLE
POWER CABLE W1
CONTROL CABLE W2
W7 AT CONTROLLER
A1A1W1
W1 POWER CABLE CONNECTORS
W2 CONTROL CABLE CONNECTORS
A3W1 INTERFACE CABLE CONNECTORS
A3J401
A2J2
+9kV
WARNING
* NOTE: SCAN RAMP FOR CONTROLLER AND INTERFACE ONLY

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Binder Only Part No. 9282-1079

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