

Service Guide

Agilent Technologies

E8663B Analog Signal Generator

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1. Troubleshooting

Electrostatic Discharge (ESD) Information	1-1
Handling of Electronic Components and ESD	1-1
Getting Started with Troubleshooting	1-2
Running Self-Test	1-2
A18 CPU Turn-On Test	1-3
Failure Symptoms	1-3
A2 Display Not Functioning or A2 Display Not Functioning After Turn-on	1-3
A18 CPU Fails to Complete the Turn-On Check	1-3
Checking the A18 CPU Voltages	1-4
Verifying the A18 CPU Turn-On Sequence	1-4
No Instrument Control From the Front Panel	1-4
Error Messages	1-4
Self-Test Failures and Related Troubleshooting	1-5
Troubleshooting Assembly-Level Problems	1-7
Front-Panel Display Assembly Troubleshooting	1-7
Power Supply Troubleshooting	1-11
Self-Tests 2xx: A5 Sampler Self-Test Errors	1-18
Self-Tests 6xx: A9 YIG Driver Self-Test Errors	1-20
Self-Tests 7xx: A6 Frac-N Self-Test Errors	1-22
Self-Tests 9xx: A10 ALC Self-Test Errors.	1-25
Self-Tests 10xx: A7 Reference Self-Test Errors	1-27
Self-Tests 11xx: A18 CPU Self-Test Errors	1-28
Self-Tests 12xx: A26 MID Self-Test Errors	1-29
Self-Tests 13xx: A11 Analog/Pulse Modulation Generator Self-Test Errors	1-32
Self-Tests 22xx: A8 Output Self-Test Errors	1-34
Troubleshooting Unlocks	1-35
508 A6 Frac-N Loop Unlock	1-35
512 A7 Reference Unlock	1-35
513 1 GHz Out of Lock.	1-35
514 Reference Oven Cold	1-35
515 10 MHz Signal Bad.	1-36
520 Sampler Unlocked	1-36
521 YO Loop Unlocked	1-36
625 Internal Pulse Generator Unlock.	1-36
626 Internal Mod Source Unlock.	1-36
Troubleshooting Unlevels.	1-37
Troubleshoot and correct any unlock problems before troubleshooting unlevelled problems.	1-37
Troubleshooting Adjustment Problems	1-40
Troubleshooting ADC Adjustment Failures	1-41
Troubleshooting Performance Test Problems	1-42
Troubleshooting the RF Path	1-43
Troubleshooting RF Power Levels	1-43
ALC and RF problems	1-43
Troubleshooting Pulse Modulation.	1-44
Troubleshooting AT1 Attenuator	1-45

Contents

Troubleshooting Harmonic Spurious	1-46
Option 509 Models	1-46
Troubleshooting Non-Harmonic Spurious	1-47
Troubleshooting Phase Noise	1-48
Overall Description	1-48
A18 CPU	1-48
A19 Power Supply	1-48
Input/Output Interface	1-49
Frequency Generation	1-50
Overall Analog Signal Generator	1-53
Reference/Synthesis Loop Description	1-55
A5 Sampler	1-55
A6 Frac-N	1-56
A7 Reference	1-56
A9 YIG Driver	1-56
A28 YIG Oscillator (YO)	1-56
A29 20 GHz Doubler	1-57
Reference/Synthesis Loop	1-59
RF Path Description (Frequency Generation, Level Control, and Modulation)	1-61
A6 Frac-N	1-61
A8 Output	1-61
A12 <3.2 GHz Fast Pulse Modulator (Option UNW)	1-61
A23 Lowband Coupler/Detector, A24 Highband Coupler, and A25 High Band Detector	1-62
A29 20 GHz Doubler	1-62
A30 Modulation Filter	1-62
ALC Loop	1-62
Modulation (AM, FM, Φ M, Standard Pulse, Option UNW-Fast Pulse)	1-63
Approximate Device Gains and Losses	1-64
Analog RF Path Block Diagram	1-65
Self-Test Overview	1-67
How self-test works:	1-67
Independent failures	1-67
Contacting Agilent Technologies	1-68
Agilent Sales and Service Offices	1-70
Packaging a Signal Generator for Return	1-70

2. Replaceable Parts

Ordering Information	3-1
Order Parts Fast	3-1
Save Money with Rebuilt-Exchange Assemblies	3-1
Shipping a Defective Assembly Back to Agilent Technologies	3-2
Frequency, Hardware, and Personality Options	3-3
Assemblies and Hardware Options	3-4
Assemblies from the Inside Front Panel View	3-5
Assemblies from a Top View	3-6
Assemblies from the Inside Rear Panel View	3-7

Assemblies from a Microcircuit Deck View	3-8
Assemblies from a Bottom View	3-9
A18BT1 Lithium Battery	3-10
Cables	3-11
Hardware	3-14
Front Panel View	3-15
Disassembled Front Panel View	3-16
Disassembled Rear Panel View	3-18
Disassembled A32 10 MHz Crystal Oscillator	3-20
Disassembled AT1 115dB Attenuator View	3-21
Disassembled A24 20GHz Highband Coupler and A25B Highband Detector Bias Board	3-22
Microcircuit Interface Deck Top View	3-23
Main Chassis and MID Bottom View	3-24
Type-N RF Output Connector	3-26
Main Chassis with Inside Cover and Right-Side Support Wall	3-27
Outer and Inner Instrument Covers and Associated Parts	3-28
Miscellaneous	3-29
Accessories	3-29
Documentation	3-29
Electrostatic Discharge (ESD) Protective Supplies	3-30
Abbreviations Used in Part Descriptions	3-30
3. Assembly Replacement	
Before You Replace an Assembly	2-1
After Replacing or Repairing an Assembly	2-1
Assemblies That You Can Replace	2-1
Outer Instrument Cover	2-3
Tools Required	2-3
Removal Procedure	2-3
Replacement Procedure	2-3
Inner Instrument Cover	2-5
Tools Required	2-5
Removal Procedure	2-5
Replacement Procedure	2-5
Front Panel	2-6
Tools Required	2-6
Removal Procedure	2-6
Replacement Procedure	2-7
A1 Keyboard	2-8
Tools Required	2-8
Removal Procedure	2-8
Replacement Procedure	2-8
A2 Display	2-10
Tools Required	2-10
Removal Procedure	2-10
Replacement Procedure	2-10

Contents

A2DS1 Display Backlight	2-12
Tools Required	2-12
Removal Procedure	2-12
Replacement Procedure	2-12
A3 Power Switch	2-14
Tools Required	2-14
Removal Procedure	2-14
Replacement Procedure	2-14
A4 Inverter	2-16
Tools Required	2-16
Removal Procedure	2-16
Replacement Procedure	2-16
A5 Sampler, A6 Frac-N, A7 Reference, and A8 Output	2-17
Tools Required	2-17
Removal Procedure	2-17
Replacement Procedure	2-17
A9 YIG Driver	2-18
Tools Required	2-18
Removal Procedure	2-18
Replacement Procedure	2-18
A10 ALC	2-19
Tools Required	2-19
Removal Procedure	2-19
Replacement Procedure	2-19
A11 Pulse/Analog Modulation Generator	2-20
Tools Required	2-20
Removal Procedure	2-20
Replacement Procedure	2-20
A12 Pulse Modulator Board	2-22
Tools Required	2-22
Removal Procedure	2-22
Replacement Procedure	2-22
A18 CPU	2-24
Tools Required	2-24
Removal Procedure	2-24
Replacement Procedure	2-24
A18BT1	2-26
Tools Required	2-26
Removal Procedure	2-26
Replacement Procedure	2-26
A19 Power Supply	2-28
Tools Required	2-28
Removal Procedure	2-28
Replacement Procedure	2-28
A21 Rear-Panel Interface	2-30
Tools Required	2-30
Removal Procedure	2-30
Replacement Procedure	2-30

A22 Line Module.	2-32
Tools Required	2-32
Removal Procedure.	2-32
Replacement Procedure	2-32
A23 Lowband Coupler/Detector	2-34
Tools Required	2-34
Removal Procedure.	2-34
Replacement Procedure	2-34
A24 20 GHz Highband Coupler	2-36
Tools Required	2-36
Removal Procedure.	2-36
Replacement Procedure	2-36
A25 20 GHz Highband Detector	2-38
Tools Required	2-38
Removal Procedure.	2-38
Replacement Procedure	2-38
A25B Highband Detector Bias Board.	2-40
Tools Required	2-40
Removal Procedure	2-40
Replacement Procedure	2-40
A26 MID (Microcircuit Interface Deck)	2-42
Tools Required	2-42
Removal Procedure.	2-42
Replacement Procedure	2-42
A28 YIG Oscillator.	2-44
Tools Required	2-44
Removal Procedure.	2-44
Replacement Procedure	2-44
A29 20 GHz Doubler	2-46
Tools Required	2-46
Removal Procedure.	2-46
Replacement Procedure	2-46
A30 Modulation Filter	2-48
Tools Required	2-48
Removal Procedure.	2-48
Replacement Procedure	2-48
A31 Motherboard.	2-50
Tools Required	2-50
Removal Procedure.	2-50
Replacement Procedure	2-50
A32 10 MHz Crystal Oscillator.	2-52
Tools Required	2-52
Removal Procedure.	2-52
Replacement Procedure	2-52
Rear Panel	2-54
Tools Required	2-54
Removal Procedure.	2-54

Contents

Replacement Procedure2-54
AT1 115 dB Attenuator2-56
Tools Required2-56
Removal Procedure2-56
Replacement Procedure2-56
B1 Fan.2-58
Tools Required2-58
Removal Procedure2-58
Replacement Procedure2-58
4. Post-Repair Procedures	
Post-Repair Procedures Matrix	4-1
5. Safety and Regulatory	
General Safety Considerations.	5-1
Lithium Battery Disposal.	5-2
Assistance.	5-2
Certification	5-2

Documentation Overview

Installation Guide	<ul style="list-style-type: none">• Safety Information• Getting Started• Operation Verification• Regulatory Information
User's Guide	<ul style="list-style-type: none">• Signal Generator Overview• Basic Operation• Optimizing Performance• Analog Modulation• Troubleshooting
Programming Guide	<ul style="list-style-type: none">• Getting Started with Remote Operation• Using IO Interfaces• Programming Examples• Programming the Status Register System• Creating and Downloading Waveform Files• Creating and Downloading User-Data Files
SCPI Reference	<ul style="list-style-type: none">• Using this Guide• System Commands• Basic Function Commands• Analog Commands• SCPI Command Compatibility
Service Guide	<ul style="list-style-type: none">• Troubleshooting• Replaceable Parts• Assembly Replacement• Post-Repair Procedures• Safety and Regulatory Information
Key Help	<ul style="list-style-type: none">• Key function description

1 Troubleshooting

- “Electrostatic Discharge (ESD) Information” on page 1-1
- “Getting Started with Troubleshooting” on page 1-2
- “A18 CPU Turn-On Test” on page 1-3
- “Self-Test Failures and Related Troubleshooting” on page 1-5
- “Troubleshooting Assembly-Level Problems” on page 1-7
- “Troubleshooting Unlocks” on page 1-35
- “Troubleshooting Unlevels” on page 1-37
- “Troubleshooting Adjustment Problems” on page 1-40
- “Troubleshooting ADC Adjustment Failures” on page 1-41
- “Troubleshooting Performance Test Problems” on page 1-42
- “Troubleshooting the RF Path” on page 1-43
- “Troubleshooting Harmonic Spurious” on page 1-46
- “Troubleshooting Non-Harmonic Spurious” on page 47
- “Troubleshooting Phase Noise” on page 1-48
- “Overall Description” on page 1-48
- “Reference/Synthesis Loop Description” on page 1-55
- “RF Path Description (Frequency Generation, Level Control, and Modulation)” on page 1-61
- “Self-Test Overview” on page 1-67
- “Contacting Agilent Technologies” on page 1-68

WARNING Troubleshooting instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any troubleshooting unless qualified.

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the signal generator from all voltage sources before it is opened.

Electrostatic Discharge (ESD) Information

WARNING The following techniques related to ESD and static-safe workstations should not be used when working on circuitry with a voltage potential greater than 500 volts.

ESD can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation using two types of static-safe workstation protection:

- conductive table-mat and wrist-strap combination
- conductive floor-mat and heel-strap combination

Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 M Ω of isolation from ground.

Handling of Electronic Components and ESD

CAUTION Many of the assemblies in this instrument are very susceptible to damage from ESD. Perform troubleshooting procedures only at a static-safe workstation, and wear a grounding strap.

Always handle a printed circuit board assembly by its edges. This reduces the possibility of ESD damage to components, and prevents contamination of exposed plating.

The possibility of unseen damage caused by ESD is present whenever components are transported, stored, or used. The risk of ESD damage can be greatly reduced by close attention to how all components are handled.

- Perform work on all components at a static-safe workstation.
- Keep static-generating materials at least one meter away from all components.
- Store or transport components in static-shielding containers.

Getting Started with Troubleshooting

Referring to [Table 1-1](#):

- determine where to begin troubleshooting
- work on problems in the order they are presented in the table
- use the descriptions provided in this chapter that explain how the signal generator operates, and the function of each assembly: the overall description ([page 1-48](#)), the synthesis loop ([page 1-55](#)), the RF path ([page 1-61](#)), and self-test ([page 1-67](#)).

Table 1-1

If able to run self-test...	Go to this section...
Run Self-Test	“Running Self-Test” on page 1-2 and refer to “Self-Test Failures and Related Troubleshooting” on page 1-5 .
If unable to run self-test, check...	Go to this section...
Power supply failures	“Power Supply Troubleshooting” on page 1-11
A18 CPU turn-on failures	“A18 CPU Turn-On Test” on page 1-3
Front panel display or keyboard operations	“Front-Panel Display Assembly Troubleshooting” on page 1-7
If other conditions occur...	Go to this section...
Unlocked Conditions	“Troubleshooting Unlocks” on page 1-35
Uneveled Conditions	“Troubleshooting Unevels” on page 1-37
Adjustment Problems	“Troubleshooting Adjustment Problems” on page 1-40
Performance Test Problems	“Troubleshooting Performance Test Problems” on page 1-42

Running Self-Test

NOTE A bad assembly can cause other assemblies to fail self-test. The internal failure tree will identify the most likely failed assembly and report it as the “most independent failure.” Troubleshoot and replace that assembly before troubleshooting and replacing other assemblies.

When you replace an assembly a good assembly will pass self-test without any adjustments.

1. On the instrument front panel, press the **Utility** hardkey.
2. Select the following softkeys:
 - a. **Instrument Info/Help Mode**
 - b. **Self Test**
 - c. **Run Complete Self Test**
3. When the Self-Test finishes, one of the following messages displays:
 - If the Self Test passed: “The current status of self test is: Success All self tests have passed.”
 - If the Self-Test failed: “The current status of self test is: Failed.” The message also reports the most independent failure.

4. If the Self-Test failed, look up the reported most independent failure in the “[Self-Test Failures and Related Troubleshooting](#)” section on [page 1-5](#).
5. Troubleshoot and repair the most independent failure.
6. After you replace the failed assembly, run the Self-Test again.
7. If another assembly is reported as the most independent failure, repeat steps 4 through 6 until the Self-Test passes.

A18 CPU Turn-On Test

At turn-on, the A18 CPU is designed to complete a series of operational checks. If all power supply voltages are present and the A18 CPU is working correctly, the operational checks are completed. Errors are reported if the A18 CPU has problems identifying other assemblies or communicating with the backup memory located on the A31 Motherboard.

Failure Symptoms

- display is not functioning
- CPU fails to complete the turn-on check and does not reach normal LCD operation
- display is not functioning after turn-on
- unable to control signal generator from front panel
- error message is displayed after turn-on

A2 Display Not Functioning or A2 Display Not Functioning After Turn-on

Refer to “[Front-Panel Display Assembly Troubleshooting](#)” on [page 1-7](#).

A18 CPU Fails to Complete the Turn-On Check

1. Turn power off and remove outer and inner covers.
2. Turn on power and verify A18 CPU LED DS9 (+3.4 Vdc) and DS10 (+5.2 Vdc) are on. If either of the LEDs are off, check the voltages in [Table 1-2](#). Refer to the illustration in “[Self-Tests 11xx: A18 CPU Self-Test Errors](#)” on [page 1-28](#) for LED locations.

Table 1-2

Connector P222 (A31 Motherboard)	Supply Voltage	Acceptable Range
Pin 45-48, 95-98	+3.4 Vdc	+3.4 ± 0.07 Vdc
Pin 49, 50, 99, 100	+5.2 Vdc	+5.2 ± 0.1 Vdc

3. If the voltages are present on connector P222, turn power off and remove the A18 CPU.
4. Inspect the pins on the A31 Motherboard connector. If the pins look good replace the A18 CPU.
5. If either of the voltages are missing, refer to “[Power Supply Troubleshooting](#)” on [page 1-11](#).
6. If DS9 and DS10 are on, proceed to “[Checking the A18 CPU Voltages](#)” on [page 1-4](#).

Checking the A18 CPU Voltages

1. With the external and internal covers removed and the signal generator on its side, turn power on and check to see if all the power supply LEDs on the A31 Motherboard are on. If any of the power supply LEDs are not on, refer to “Power Supply Troubleshooting” on page 1-11 to troubleshoot.
2. If all the power supply LEDs on the motherboard are on, check the A18 CPU and A31 Motherboard connector pins for the voltages listed in the following table.

Connector	Supply Voltage	Acceptable Range
P223-2, 22	+5 VA	+5.2 ± 0.16 Vdc
P223-3	-15 V_In	-15 ± 0.45 Vdc
P223-4	+32 V_In	+32 ± 0.96 Vdc
P223-21	+15 V_Standby	+14.85 ± 0.6 Vdc
P223-23	+15 V_In	+15 ± 0.75 Vdc
P223-37	-7 Vdc	-7.0 ± 0.14 Vdc
P223-39	+10 Vdc	+10.2 ± 0.2 Vdc
P223-40	+8 Vdc	+7.95 ± 0.21 Vdc

3. If any main power supply voltage problems are detected, refer to “Power Supply Troubleshooting” on page 1-11.
4. If all power supply voltages are good, replace A18 CPU.

Verifying the A18 CPU Turn-On Sequence

Verify the A18 CPU turn-on sequence by observing DS1 to DS8 sequence patterns (See the diagram on page 1-28 for LED locations). DS1 to DS8 should match the sequence shown in Table 1-3. Before verifying the turn-on sequence, make sure all switches in the upper left-hand corner of the A18 CPU are in the CLOSED (up) position. If the lights fail to step through the sequence, replace A18 CPU.

Table 1-3 A18 CPU LED Sequence Table

Sequence	DS1	DS2	DS3	DS4	DS5	DS6	DS7	DS8
1	X	X	X	X	X	X	X	X
2	0	0	X	0	0	0	0	0
3	X	X	X	0	0	0	0	0
4	0	X	X	X	X	X	X	X
5	0	0	0	0	0	0	0	0
6	X	X	X	X	X	X	X	0

X = LED is on; 0 = LED is off

No Instrument Control From the Front Panel

Refer to “Front-Panel Display Assembly Troubleshooting” on page 1-7.

Error Messages

If error messages are reported after the turn-on check is completed, refer to the *Error Messages* list, located on the *E8663B Signal Generator Documentation Set CD* (part number E8663-90010) for details.

Self-Test Failures and Related Troubleshooting

NOTE Self-test results are valid only when all external cables and connectors are removed from the signal generator.

Table 1-4 Self-test Failures and Related Troubleshooting

If this self-test fails...	Go to this troubleshooting section...
A5 Sampler 200 Power Supply 201 Tuning + Bias Test 202 Coarse Loop Detector 203 YO Loop Detector	“Self-Tests 2xx: A5 Sampler Self-Test Errors” on page 1-18
A9 YIG Driver 600 Post Regulator 601 DACs 602 PLL Interface 603 FM Driver 604 Sweep DACs 605 Sweep Lock	“Self-Tests 6xx: A9 YIG Driver Self-Test Errors” on page 1-20
A6 Frac-N 700 Ref Voltage 701 Loop Gain 702 Tuning Voltage 703 Output Voltage 704 Filter Test 705 F/2 Test 706 FM Path Test 707 Sweep Phase Detector Test	“Self-Tests 7xx: A6 Frac-N Self-Test Errors” on page 1-22
A10 ALC 900 Power Supply 901 Detector Test 902 Detector Level to ALC Ref 903 Level Test 904 Scalar Pulse Test 905 ALC Mod	“Self-Tests 9xx: A10 ALC Self-Test Errors” on page 1-25
A7 Reference 1000 Power Supply 1001 10 MHz Test 1002 1 GHz Test	“Self-Tests 10xx: A7 Reference Self-Test Errors” on page 1-27
A18 CPU 1100 Power Supply	“Self-Tests 11xx: A18 CPU Self-Test Errors” on page 1-28
A26 Micro Interface Deck 1200 Power Supply 1201 Mod Filter 1202 20 GHz Doubler 1204 RF Path 1205 LB Pulse Mod	“Self-Tests 12xx: A26 MID Self-Test Errors” on page 1-29

Table 1-4 Self-test Failures and Related Troubleshooting (Continued)

If this self-test fails...	Go to this troubleshooting section...
<p>A11 Pulse/Analog Modulation Generator</p> <ul style="list-style-type: none"> 1300 Power Supply 1301 Internal Pulse Generator Clock 1302 Output 1303 Voltage Ref DAC 1304 20 GHz Pulse 1305 44 GHz Upconverter Pulse 1306 Standard 3 GHz Pulse 1307 High Performance 3 GHz Pulse 1308 Numeric Synthesizer 1309 Function Generator Channel 1 1310 Function Generator Channel 2 1311 Frequency Modulation 1312 Low Frequency Out 1313 Amplitude Modulation 1314 External 1 1315 External 2 1316 AM Path Loss 	<p>“Self-Tests 13xx: A11 Analog/Pulse Modulation Generator Self-Test Errors” on page 1-32</p>
<p>A8 Output</p> <ul style="list-style-type: none"> 2200 Ground and PTAT Test 2201 Prelevel Loop Test 2202 Switched Filters Test 2203 ALC Mod System Test 2204 Pulse Mod System Test 2205 RF Path Test 	<p>“Self-Tests 22xx: A8 Output Self-Test Errors” on page 1-34</p>

Troubleshooting Assembly-Level Problems

This section provides the following:

- “Front-Panel Display Assembly Troubleshooting” on page 1-7
- “Power Supply Troubleshooting” on page 1-11
- “Self-Tests 2xx: A5 Sampler Self-Test Errors” on page 1-18
- “Self-Tests 6xx: A9 YIG Driver Self-Test Errors” on page 1-20
- “Self-Tests 7xx: A6 Frac-N Self-Test Errors” on page 1-22
- “Self-Tests 9xx: A10 ALC Self-Test Errors” on page 1-25
- “Self-Tests 10xx: A7 Reference Self-Test Errors” on page 1-27
- “Self-Tests 11xx: A18 CPU Self-Test Errors” on page 1-28
- “Self-Tests 12xx: A26 MID Self-Test Errors” on page 1-29
- “Self-Tests 13xx: A11 Analog/Pulse Modulation Generator Self-Test Errors” on page 1-32
- “Self-Tests 22xx: A8 Output Self-Test Errors” on page 1-34

Front-Panel Display Assembly Troubleshooting

Overview

The Front-Panel Display Assembly comprises the following:

- a 640 x 320 pixels liquid crystal display (LCD)
- a power switch/flat panel interface board, which contains the power on/off switch, standby LED, and power-on LED

This board contains the circuitry to disable the power supply. The ON_OFF control line is pulled to a TTL *low* to disable the power supply.

Another function of the power switch/flat panel interface board is to route the 8 data bits from the A18 CPU to the A2 Display.
- a front panel board that contains the front-panel hardkeys, softkeys, and RPG
- a dc to ac inverter, which turns the LCD on and off via control lines received from the CPU

The inverter also converts the 5.2 Vdc to approximately a 160 Vrms, 40 kHz signal to drive the LCD.

Display Controls

Contrast

There are two contrast hardkeys below the A2 Display. The left up arrow key increases the contrast while the right down arrow key decreases the contrast.

Brightness

The A2 Display brightness can be adjusted from 50 (high brightness) to 1 (low brightness) using the RPG, arrow keys, or the numeric keypad.

Other display features located under the **Utility > Display** softkey, include a screen saver and inverse video.

Display Tests

The following two screen tests are available for the LCD:

- the Black Pixel Screen Test turns the display dark
- the White Pixel Screen Test turns the display bright

Softkey Location: **Utility > Display > More (1 of 2)**

To exit the test, press any front panel key.

Symptom: Dark display

1. Ensure that the front panel green power on LED is on. If not, refer to [“Power Supply Troubleshooting” on page 1-11](#).
2. Press any front panel key to disable the screen saver.
3. If the display is still bad, check P12 on the A31 Motherboard for the following signals:

Signal	State
P12-1	5.2 Vdc
P12-3 LIGHT_EN	>3 Vdc
P12-4 VDISP	Brightness = 50, VDSP < 50 mV Brightness = 1, VDSP = 3 Vdc

- If the 5.2 Vdc line is bad, refer to [“Power Supply Troubleshooting” on page 1-11](#).
- If either the LIGHT_EN or VDISP are bad, check them at P221-16 and P221-55 respectively on the A31 Motherboard. If *either* signal is bad at P221, replace the A18 CPU.
- If all the above signals are good, check the output of the dc to ac inverter as follows:
 - a. Remove the front panel from the frame, and lay the front panel face down.
 - b. With CN2-1 open, there is typically a 160 Vrms 40 kHz signal. If not, replace the dc to ac inverter. If the signal is there, replace the LCD.

Symptom: Bright display without characters

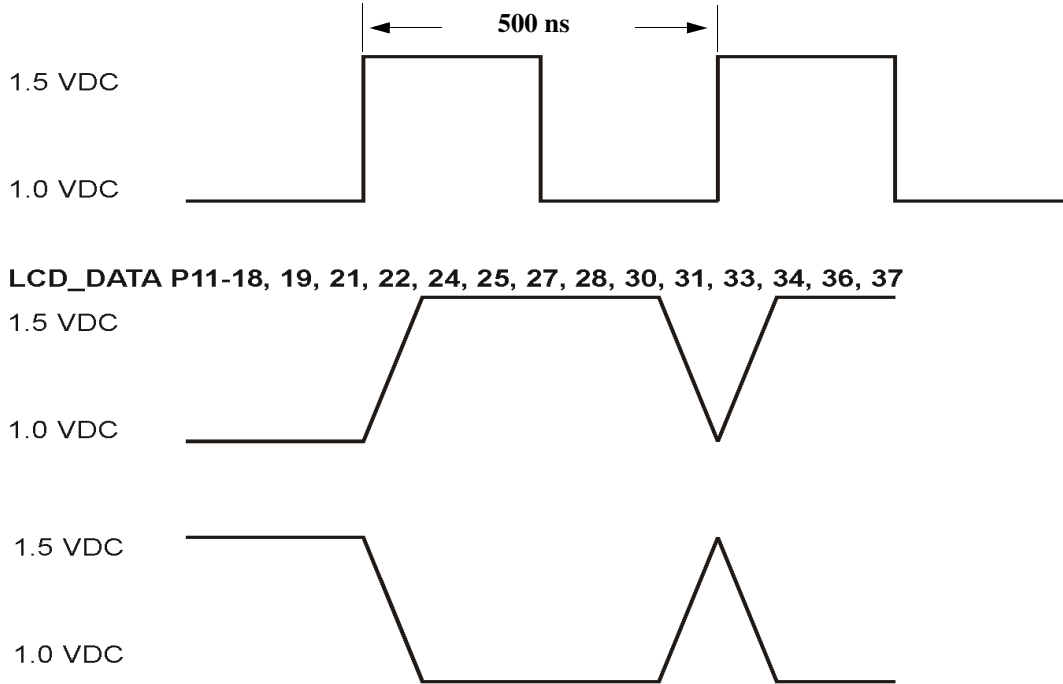
1. Ensure that the front-panel green power on LED is on. If not, refer to [“Power Supply Troubleshooting” on page 1-11](#).
2. Try adjusting the contrast controls.
3. Check the connection of the ribbon cable at J9 of the power switch/flat panel interface board.
4. If the display is still too bright, use an oscilloscope to check P11 of the A31 Motherboard for the following signals:

Signal	State
P11-4 VLCD	approximately 19.5 to 21 Vdc ^a
P11-6 LCD_ENABLE_H	>3 Vdc
P11-9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 24, 25, 27, 28, 30, 31, 33, 34, 36, 37, 39, 40	Refer to Figure 1-1 .

^aIf >21V check the power supplies. If the power supplies are good, replace the motherboard.

The pulse state signals are control lines, clock, and data for the LCD.

Figure 1-1 Pulsing Activity
LCD_CLK P11-9, P221-50



Se991a

5. If *all* the signals measured in Step 4 are good, go to Step 6.

If any of the signals measured in Step 4 are bad, check the following signals at P221 of the motherboard:

Signal	State
P221-14 VLCD	approximately 21 Vdc
P221-53 LCD_ENABLE_H	>3 Vdc
P221-1 to 13, 15, 41, 43, 45, 47, 49 to 52	Refer to Figure 1-1 on page 1-9.

If any of these signals are bad, change the CPU board.

6. If all the signals measured in Step 4 are good, check the following signals at J9 of the power switch. To access J9 the front panel must be removed from the chassis frame and laid face down.

Signal	State
J9-7 VLCD	approximately 21 Vdc
J9-4 LCD_ENABLE_H	>3 Vdc
J9-5	5.2 Vdc
J9-1, 2, 3, 8 to 15	Refer Figure 1-1 on page 1-9.

If these signals are good, replace the LCD.

If these signals are not good, replace the power switch/flat panel interface board.

Symptom: Hardkeys or softkeys do not work

The A1 Keyboard contains the hardkeys and softkeys switches. The keys are arranged in a matrix (shown below) with the control lines KEYCOLx and KEYROWx on the x and y axis. When you press a hardkey or softkey, one cell of the matrix is activated; the normally TTL low KEYROWx of the active cell pulses high, and the normally TTL high KEYCOLx of the active cell pulses low.

	KEYCOL0	KEYCOL1	KEYCOL2	KEYCOL3	KEYCOL4	KEYCOL5	KEYCOL6	KEYCOL7
KEYROW0	softkey 3	N/A	Cont Up	N/A	LF Out	N/A	I/Q	Pulse
KEYROW1	softkey 2	Incr/Set	Cont Down	Ampl	Ampl Menu	Mode Setup	Aux Fctn	FM/φM
KEYROW2	softkey 1	Up	N/A	Freq	Sweep List	Mode	Mux	AM
KEYROW3	softkey 4	N/A	N/A	Right Arrow	Help	Save	Recall	Trigger
KEYROW4	softkey 6	N/A	Local	Hold	Mod On/Off	4	5	6
KEYROW5	softkey 5	N/A	Return	Down Arrow	N/A	7	8	9
KEYROW6	N/A	N/A	N/A	Left Arrow	RF On/Off	0	.	+/-
KEYROW7	softkey 7	N/A	Preset	N/A	N/A	1	2	3

1. Ensure that the front panel green power on LED is on. If it is not on, refer to [“Power Supply Troubleshooting” on page 1-11](#).
2. To ensure the signal generator is not being controlled remotely, press the **Local** hardkey.
3. Use an oscilloscope to monitor the KEYCOLx and KEYROWx pins of the key that is not working at P13 on the motherboard. Use the following table to identify the appropriate pin number:

KEYCOL pins should be a TTL high	
KEYCOL0	P13-1
KEYCOL1	P13-3
KEYCOL2	P13-5
KEYCOL3	P13-7
KEYCOL4	P13-9
KEYCOL5	P13-11
KEYCOL6	P13-13
KEYCOL7	P13-15

KEYROW pins should be a TTL low	
KEYROW0	P13-17
KEYROW1	P13-19
KEYROW2	P13-21
KEYROW3	P13-23
KEYROW4	P13-25
KEYROW5	P13-26
KEYROW6	P13-24
KEYROW7	P13-22

4. If *either* signal is incorrect, use the following table and check the signal at P221, as it leaves the CPU board. If the signal is bad at P221, replace the A18 CPU.

KEYCOL pins should be a TTL high	
KEYCOL0	P221-18
KEYCOL1	P221-19
KEYCOL2	P221-52
KEYCOL3	P221-20
KEYCOL4	P221-60
KEYCOL5	P221-21
KEYCOL6	P221-61
KEYCOL7	P221-22

KEYROW pins should be a TTL low	
KEYROW0	P221-62
KEYROW1	P221-23
KEYROW2	P221-63
KEYROW3	P221-24
KEYROW4	P221-25
KEYROW5	P221-65
KEYROW6	P221-26
KEYROW7	P221-27

5. If both signals are correct, press the faulty hardkey or softkey while monitoring the KEYCOL or KEYROW on the oscilloscope. The KEYCOL line should pulse low; the KEYROW line should pulse high.

If *either* line does not function properly, replace the front panel board.

Symptom: RPG not working properly

1. Ensure that the front panel green power on LED is on. If it is not on, refer to [“Power Supply Troubleshooting” on page 1-11](#).
2. Check the front panel operation by checking random hardkey operation.
3. Check P13–12 for +5.2 Vdc. If the voltage is not present, refer to [“Power Supply Troubleshooting” on page 1-11](#) for troubleshooting.
4. Press the Frequency hardkey on the front panel.
5. Using an oscilloscope, monitor P13–14 and P13–10 while rotating the RPG knob. The LCD frequency value should change, and both signals at P13 should pulse to a TTL high. If *either* signal does not pulse, replace the A1 Keyboard.
6. If the signals pulse at P13, check the signal at P221 pins 57 and 17 of the motherboard. If the signals pulse at P221, replace the CPU board.

Symptom: Screen saver not working properly

The screen saver delay can be set for any integer from 1 to 12 hours. The CPU board controls the screen saver by pulling the LIGHT_EN line low.

1. If the delay time elapses and the display does not go dark, check the LIGHT_EN signal at P12–3.
 - If the signal is a TTL low, replace the dc to ac inverter.
2. If the signal is a TTL high, check it at P221–16 of the motherboard.
 - If the signal is high at P221, replace the CPU board.

Power Supply Troubleshooting

The power supply is a switching supply with automatic line-voltage and frequency selection. Because of this, a switch is not required to set 115 VAC or 240 VAC operation. The input power line is fused, but the fuse is not replaceable; if the fuse opens, you must replace the power supply.

WARNING After unplugging the instrument, wait 30 seconds to allow the supplies to discharge before removing or installing an assembly.

Tables 1-5 through 1-7 list the motherboard test points (connector and pin number) and power supply voltages. See [Figure 1-2](#) on page 1-14 for connector locations.

Table 1-5 Power Supply vs. Assembly Matrix (1 of 3)

Motherboard test points:	+32 Vdc	+15 Vdc	+10 Vdc	+8 Vdc	+9 Vdc	+5.2 Vdc
A1 Keyboard						P13-12
A2 Display						P11-44
A3 Power Supply	P231-1,41	P231-3, 4, 43, 44	P231-6, 7, 46, 47			P231-15, 16, 18, 19, 55, 56, 58, 59
A5 Sampler	P22-7	P22-6,21			P22-20, 5	P22-14, 29
A6 Frac-N	P32-7	P32-6, 21			P32-20, 5	P32-14, 29
A7 Reference	P42-7	P42-6, 21			P42-20, 5	P42-14, 29
A8 Output	P52-7	P52-6, 21			P52-20, 5	P52-14, 29
A9 YIG Driver	P112-6	P112-5, 30	P112-15, 16, 40		P112-17, 18, 42	P112-3, 28
A10 ALC	P122-4	P122-28				P122-2, 27
A11 Mod Gen	P132-4	P132-28				P132-2, 27
A12 Pulse Modulator	J14-10	J14-9				

Table 1-5 Power Supply vs. Assembly Matrix (1 of 3)

Motherboard test points:	+32 Vdc	+15 Vdc	+10 Vdc	+8 Vdc	+9 Vdc	+5.2 Vdc
A18 CPU	P223-4	P223-23	P223-39	P223-40	P223-18	P223-2, 22
A21 Rear Panel		P241-13, 14	P241-17, 18			P241-11, 12
A26 Microwave Interface	P201-1	P201-2, 3, 4	P201-5, 6, 7, 8, 9, 10	P201-29		P201-13, 14, 15, 16, 17, 18
A23 Lowband Coupler/Detector		J15-8				
A29 20 GHz Doubler		J32-5	J32-19	J32-21		J32-7, 9
A30 Mod Filter		J31-5	J31-19	J31-21		J31-7, 9
AT1 Attenuator		J13-1				

Table 1-6 Power Supply vs. Assembly Matrix (2 of 3)

Motherboard test points:	+5.2 Digital	+3.4 Digital	+2.6 Vdc	-7 Vdc	-6 Vdc	+1.8 Vdc
A2 Display	P11-44					
A2DS1 Backlight	P12-1					
A3 Power Supply	P231-21, 22, 25, 61, 62, 65,	P231-28, 29, 32, 35, 36, 68, 69, 72, 75, 76		P231-9, 10, 49, 50		
A5 Sampler					P22-3, 18	
A6 Frac-N					P32-3, 18	
A7 Reference					P42-3, 18	
A8 Output					P52-3, 18	
A9 YIG Driver	P111-64, 65, 129, 130	P111-60, 61, 62, 63, 125, 126, 127, 128	P11-57, 58, 59, 123, 124	P112-11, 12, 13, 14, 38	P112-19, 44	
A10 ALC	P121-64, 65, 129, 130	P121, 60, 61, 62, 63, 125, 126, 127, 128	P121-57, 58, 59, 123, 124			
A11 Mod Gen	P131-64, 65, 129, 130	P131-60, 61, 62, 63, 125, 126, 127, 128	P131-57, 58, 59, 123, 124			
A18 CPU	P222-49, 50, 99, 100	P222-45, 46, 47, 48, 95, 96, 97, 98		P223-37	P223-17	
A26 Microwave Interface	P201-23	P201-24		P201-30, 33, 46		
AT1 Attenuator		J13-2				

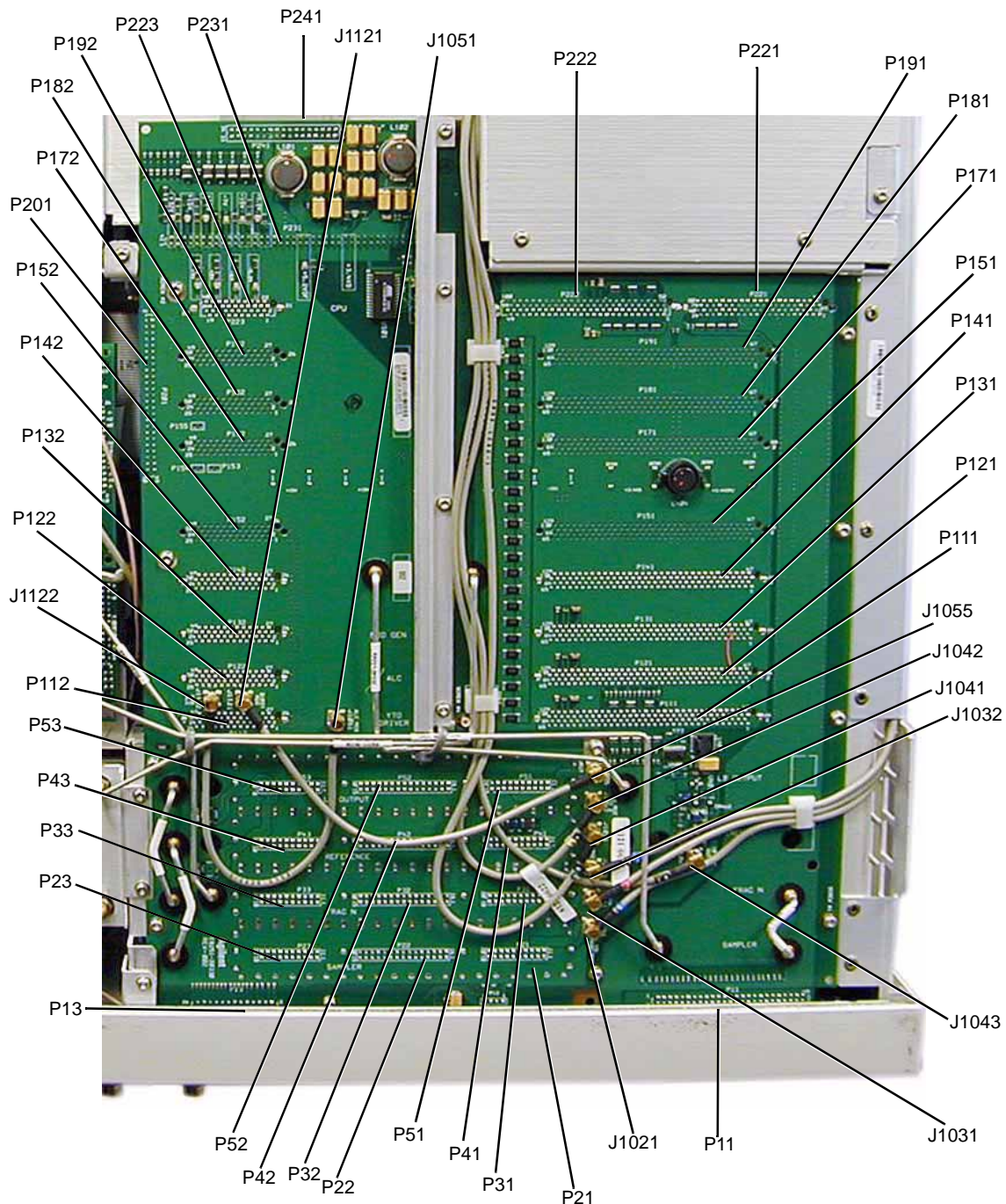
Table 1-7 Power Supply vs. Assembly Matrix (3 of 3)

Motherboard test points:	-15 Vdc	-5.2 Vdc	-3 Vdc	+3.5 Vdc	+6.5 Vdc	+12 Vdc	+15 Vdc st by	Fan Voltage
A2 Display							P11-43	
A3 Power Supply	P231-12, 13, 52, 53						P231-80	
A5 Sampler	P22-2, 17	P22-4, 19						

Table 1-7 Power Supply vs. Assembly Matrix (3 of 3) (Continued)

Motherboard test points:	-15 Vdc	-5.2 Vdc	-3 Vdc	+3.5 Vdc	+6.5 Vdc	+12 Vdc	+15 Vdc supply	Fan Voltage
A6 Frac-N	P32-2, 17	P32-4, 19						
A7 Reference	P42-2, 17	P42-4, 19						
A8 Output	P52-2, 17	P52-4, 19						
A9 YIG Driver	P112-4, 29	P112-1, 2, 26, 27						
A10 ALC	P122-3	P122-1, 26						
A11 Mod Gen	P132-3	P132-1, 26						
A12 Pulse Modulator	J14-7	P201-31, 32						
A18 CPU	P223-3	P223-1					P223-21	
A21 Rear Panel	P241-15, 16	P241-9, 10					P241-5, 6, 7, 8	
A23 Lowband Coupler/Detector	J15-10							
A26 Microwave Interface	P201-11,12	P201-31, 32						
A29 20 GHz Doubler	J32-4	J32-8				J32-1, 3		
A30 Mod Filter	J31-4	J31-8				J31-1, 3		
B1 Fan								Fan+P252-2 P 252-2 Fan- P252-1 P252-1

Figure 1-2 Motherboard Connectors - Bottom View



Symptom: amber standby LED not working properly

With the instrument plugged in and the power turned off, the front panel amber standby LED should be on, as well as the green +15 Standby LED on the motherboard. This is controlled by the +15 Standby line supplied by the power supply, which is routed via the motherboard to the front panel.

To troubleshoot, turn the instrument off and follow the signal path.

Symptom: front-panel green LED not working properly

When the front panel power switch is turned on, the amber LED should go out and the green LED should come on. Also, the fan should start rotating and the front panel display should illuminate.

Troubleshooting:

- Verify the supply voltages at P11 of the A31 Motherboard.
- If the supply voltages are correct, replace the Power Switch/Flat Panel Interface Board.

Symptom: fan not working

The fan is connected to the motherboard, and is audible when the instrument is on. The fan voltage is +14V.

To troubleshoot, verify that all supplies are working; disconnect the fan from the rear panel assembly at P6 and check the fan voltage at P6-2. If the fan voltage is correct, replace the fan.

Symptom: Instrument does not power up; power supply LEDs not on
Checking Power Supplies

Each of the power supplies has an LED on the bottom of the motherboard (see [Figure 1-3](#) on page 1-16). When the power supply is functioning, the green LED lights. Use a DVM to measure the supplies on the motherboard, and ensure they meet the following power supply specifications.

Table 1-8 Supply Voltage Specifications

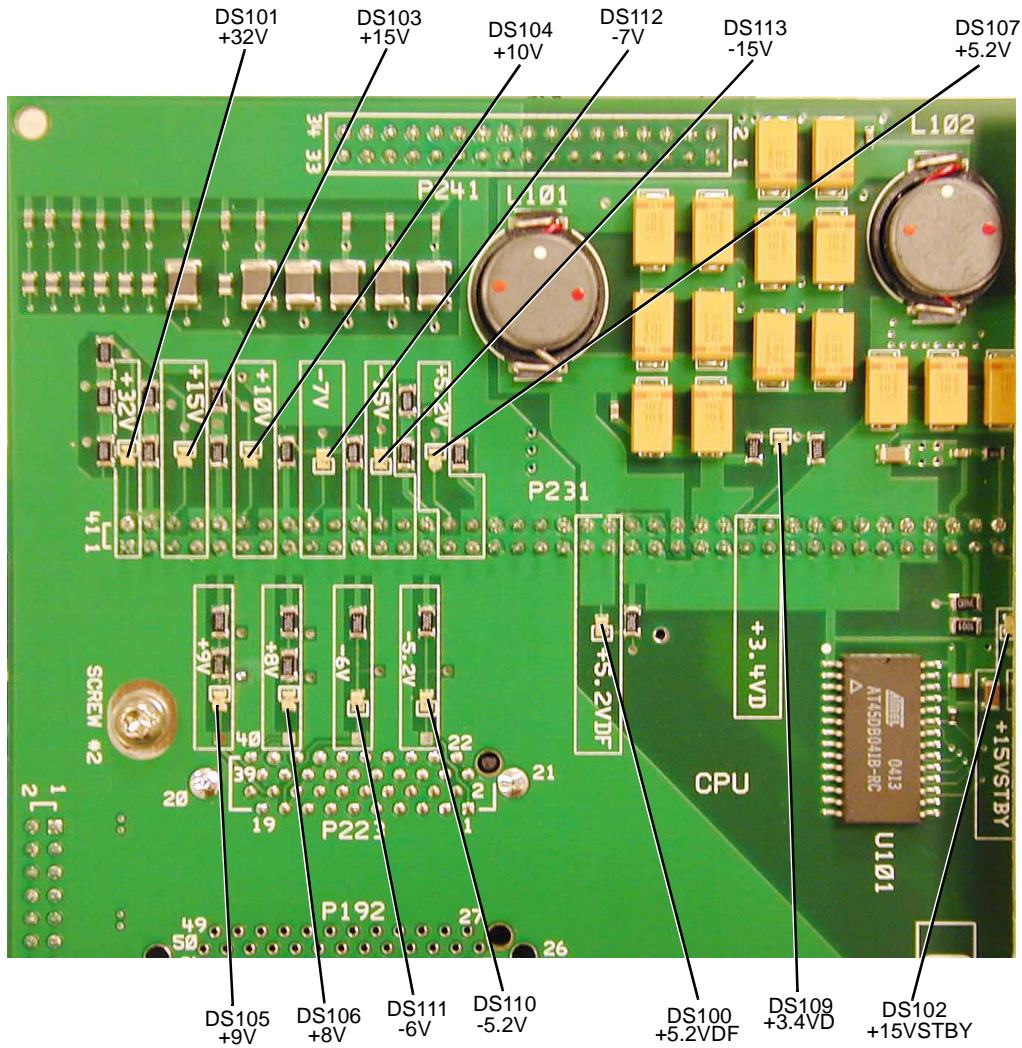
Supply Voltage	Acceptable Voltage (Vdc)	Maximum Ripple (mVpp)	Supply Voltage	Acceptable Voltage (Vdc)	Maximum Ripple (mVpp)
+32	32 ± 1.0	10	+5.2VDF	5.2 ± 0.15	10
+15	15 ± 0.5	10	+3.4 VD	3.4 ± 1.0	10
+15 Standby	15 ± 0.75	20	-5.2	-5.2 ± 0.1	10
+10	10.2 ± 0.2	10	-6	-6 ± 0.12	10
+9	9 ± 0.18	10	-7	-7 ± 0.1	10
+8	8 ± 0.5	10	-15	-15 ± 0.5	10
+5.2	5.2 ± 0.15	10			

If a supply LED is not lit, or a measured voltage is less than the acceptable value, an assembly may be loading down that supply. Using the appropriate [Power Supply vs. Assembly Matrix](#), determine where each supply is used, then use the following steps to isolate the defective assembly.

CAUTION Remove a *minimum* number of assemblies at one time. If the power supply does not have a minimum load on it, the supply voltage increases to an overvoltage condition.

1. Turn off the instrument and remove one of the assemblies biased by the faulty supply.
2. Turn the instrument on and check the faulty supply. If the supply LED lights, replace the assembly removed in Step 1. If not, continue with Step 3.
3. Turn the instrument off and reinstall the assembly removed in Step 1. Remove the next assembly and see if the supply LED lights. Continue this process until the supply functions properly.
4. Replace the last assembly that you removed.

Figure 1-3 Motherboard Power Supply LEDs



Power Switch On/Off Line

If the control line (ON/OFF) from the A3 Power Switch located in the front panel assembly goes to a TTL low state, or if the line impedance is less than 500 ohms, the power supply shuts down. This signal can be measured on the A31 Motherboard at pin 79 of P241.

To troubleshoot:

1. Turn the front panel switch on and ensure that the +15 Standby is good.
2. Verify that the ON/OFF control line is > 3.5 Vdc.

The Power Switch/Flat-Panel Interface Board in the front panel assembly controls this signal.

Symptom: Green front panel LED and power supply LEDs on motherboard blinking**Overvoltage or Overcurrent**

The individual supplies in the instrument are not fused, but an overvoltage or overcurrent condition can shut them down. With either of these conditions, the front panel green LED and the power supply LEDs blink at approximately 2 Hz. The power supply tries to revive, but if the condition does not clear, the instrument stays in this mode. In some cases, cycling power fixes the problem.

To troubleshoot, use the following steps to isolate the defective assembly:

CAUTION Remove a *minimum* number of assemblies at one time. If the power supply does not have a minimum load on it, the supply voltage increases to an overvoltage condition.

NOTE Refer to the Power Supply vs. Assembly matrix tables, starting on [page 1-12](#), for help in determining which assembly uses which power supplies.

1. Turn off the instrument and remove one of the assemblies biased by the faulty supply.
2. Turn the instrument on and check whether the overvoltage or overcurrent condition still exists. If it does not, replace the assembly removed in Step 1. If it does, continue with Step 3.
3. Turn the instrument off and reinstall the assembly removed in Step 1. Remove the next assembly and see if that fixes the problem. Continue this process until the supply functions properly.
4. Replace the last assembly that you removed.

Symptom: Amber front panel LED blinking**Thermal shutdown**

With thermal shutdown, the front panel green LED and the power supply LEDs blink as long as the condition exists. There are two temperature sensing devices in the instrument: one on the A8 Output, and one on the A19 Power Supply.

To troubleshoot:

1. If the instrument is hot, ensure that the fan is working and let the instrument cool off.
2. If the instrument still shuts down, remove the Output assembly.
3. If the instrument still shuts down, replace the Power Supply.

or

If the instrument powers on, but the amber LED continues to blink, replace the A3 Power Switch assembly.

Symptom: +9, -6, or -5.2 V LEDs not on

These supplies are generated on the YIG Driver Assembly.

Troubleshoot using the [Power Supply vs. Assembly Matrix](#) that begins on [page 1-11](#).

1. At P112 of the Motherboard, ensure the YIG Driver Assembly is receiving the +32, +15, +10, -7, -15 Vdc supplies.
2. If the supplies are present at P112, note in the matrix where each supply is used.
3. Power down the instrument and remove one of the assemblies that is biased by the faulty supply.
4. Power the instrument up again and check the faulty supply. If it is still bad, power down and re-install the first assembly removed.
5. Remove the next assembly and see if that fixes the problem. Continue this process until the supply functions properly.
6. Replace the last assembly that you removed.

Symptom: +1.95 VD, +1.8 VD LEDs not on

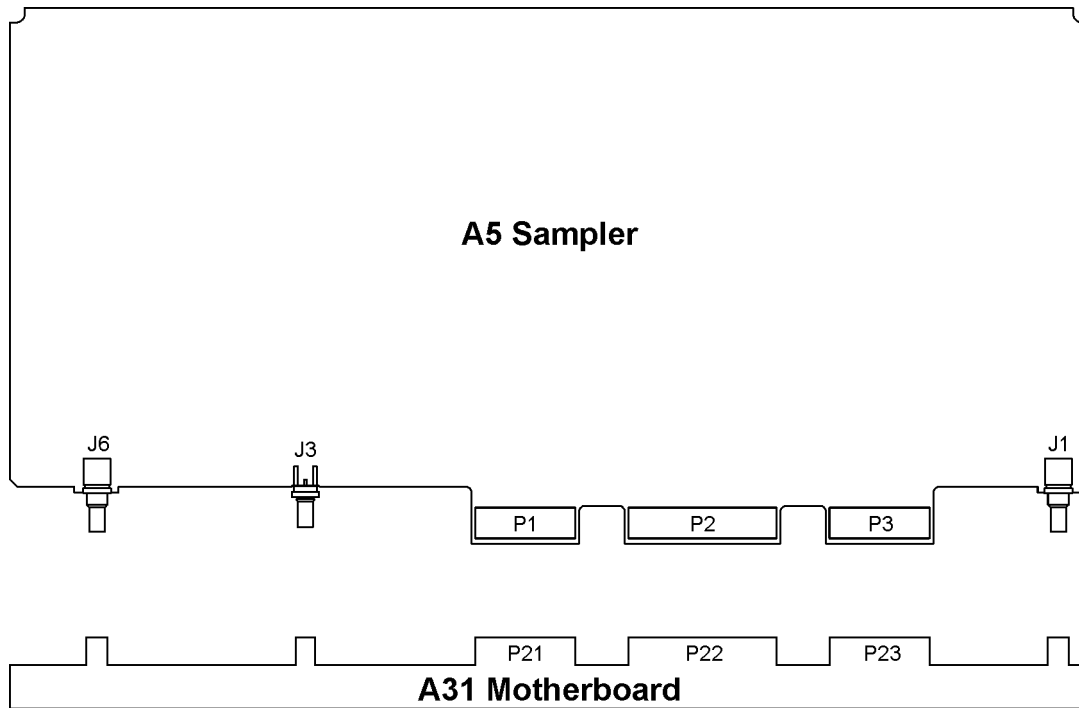
These supplies are generated by voltage regulators on the A31 Motherboard.

Troubleshoot by checking the following voltages at the A19 Power Supply:

- +3.4 VD, which is regulated down to +1.95 VD
- +2.6 VD, which is regulated down to +1.8 VD

If the supplies are good at the A19 Power Supply, replace the A31 Motherboard.

Self-Tests 2xx: A5 Sampler Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any voltages are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+32	P22-7	+31.04	+32.96	Main Supply
+15	P22-6, 21	+14.55	+15.45	Main Supply
-15	P22-2, 17	-14.55	-15.45	Main Supply
+5.2	P22-14, 29	+5.04	+5.37	Main Supply
+9	P22-5, 20	+8.82	+9.18	YIG Driver

200 Power Supply

1. If the supply voltages are good on the connector pins indicated, replace the A5 Sampler.
2. If the supply voltages are bad on any of the connector pins indicated, check the origin of the supply.
3. If the supply voltages are good at the origin, replace the A31 Motherboard.
4. If the supply voltages are bad at the origin, troubleshoot the problem using that assembly's troubleshooting procedure.

201 Tuning + Bias Test

1. Turn power off and remove the A5 Sampler and connect a signal analyzer to the A5 Sampler J1 input cable on the A31 Motherboard.
2. Turn the signal generator on and check for the presence of a 1 GHz signal at the level of 0 dBm.
3. If the signal is good on the cable connector J1, replace the A5 Sampler.
4. If the signal is bad, remove the A7 Reference and ohm the cable between the center pins (a short should occur) and between the center pins and shielding (an open should occur) of J3 on the A7 Reference and J1 on the A5 Sampler.
5. If an open is measured between the center pins or a short between center pins and the shielding, replace the cable.
6. If the cable is good, replace the A7 Reference.

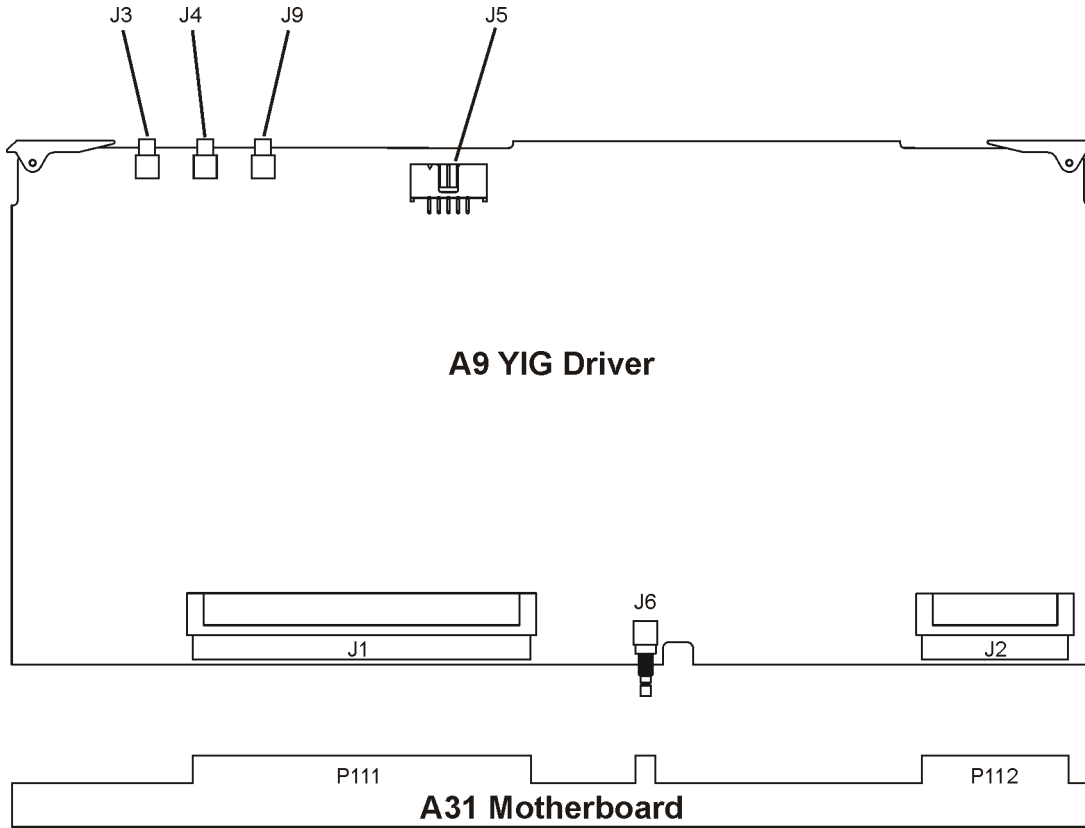
202 Coarse Loop Detector

1. Replace the A5 Sampler

203 YO Loop Detector

1. With power on carefully remove the A5 Sampler, connect a signal analyzer to J3 on the A31 Motherboard. Set the signal generator to 8 GHz CW then check for an 8 GHz signal at a power level greater than or equal to -7 dBm on J3.
2. If the J3 signal is bad, troubleshoot the A29 20 GHz Doubler using the procedure in the RF path section. If the J3 signal is good, go to the next step.
3. Connect the signal analyzer to the A6 Frac-N VCO signal on the J6 connection on the A31 Motherboard. With the signal generator set to 8 GHz CW, the A6 Frac-N signal should be at a frequency of 593.75 MHz and at a power level of $+7$ dBm.
4. If the signal is good, replace the A5 Sampler, if the signal is bad go to the A6 Frac-N troubleshooting procedure.

Self-Tests 6xx: A9 YIG Driver Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+32	P112-6	+31.04	+32.96	Main Supply
+15	P112-5, 30	+14.55	+15.45	Main Supply
-15	P112-4, 29	-14.55	-15.45	Main Supply
+5.2	P112-3, 28	+5.04	+5.37	Main Supply
+10	P112-15, 16, 40	+10	+10.4	Main Supply
-7	P112-11, 12, 13, 14, 38	-6.86	-7.14	Main Supply
+5.2 Digital high	P111-64, 65, 129, 130	+5.04	+5.36	Main Supply
+3.4 Digital Low	P111-60, 61, 62, 63, 125, 126, 127, 128	+3.29	+3.5	Main Supply

A9 YIG Driver Output Voltages

If any of the following voltages are out of specification, replace the A9 YIG Driver:

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)
+9	P112- 17, 18, 42	+8.82	+9.18
-5.2	P112- 1, 2, 26, 27	-5.1	-5.3
-6	P112- 19, 44	-5.88	-6.12

600 Post Regulator

- Replace the A9 YIG Driver.

601 DACs

- Replace the A9 YIG Driver.

602 PLL Interface

1. Remove the cable that goes from the A5 Sampler to J4 on the A9 YIG Driver.
2. Loop self-test 602, and use an oscilloscope to measure the voltage on J4. The voltage should pulse to +10 Vdc.
 - If the voltage is +10 Vdc, replace the A9 YIG Driver.
 - If the voltage on J4 is bad, replace the A5 Sampler.

603 FM Driver

1. Remove the cable that goes from the A6 Frac-N to J3 on the A9 YIG Driver.
2. Loop self-test 603, and use an oscilloscope to measure the voltage on J3. The voltage should be approximately -1.3 Vdc.
 - If the voltage is approximately -1.3 Vdc, replace the A9 YIG Driver.
3. If the voltage is bad at J3, check it entering the A6 Frac-N at P31-11.

The voltage on J3 originates on the A11 Pulse/Analog Modulation Generator and passes through the A6 Frac-N.

 - If the voltage is good entering the A6 Frac-N, troubleshoot the A6 Frac-N.
 - If the voltage is bad at P31, troubleshoot the A11 Pulse/Analog Modulation Generator.

604 Sweep DACs

- Replace the A9 YIG Driver.

605 Sweep Lock

1. Using an oscilloscope with high input impedance, measure the center pin of J9 on the A9 YIG Driver.

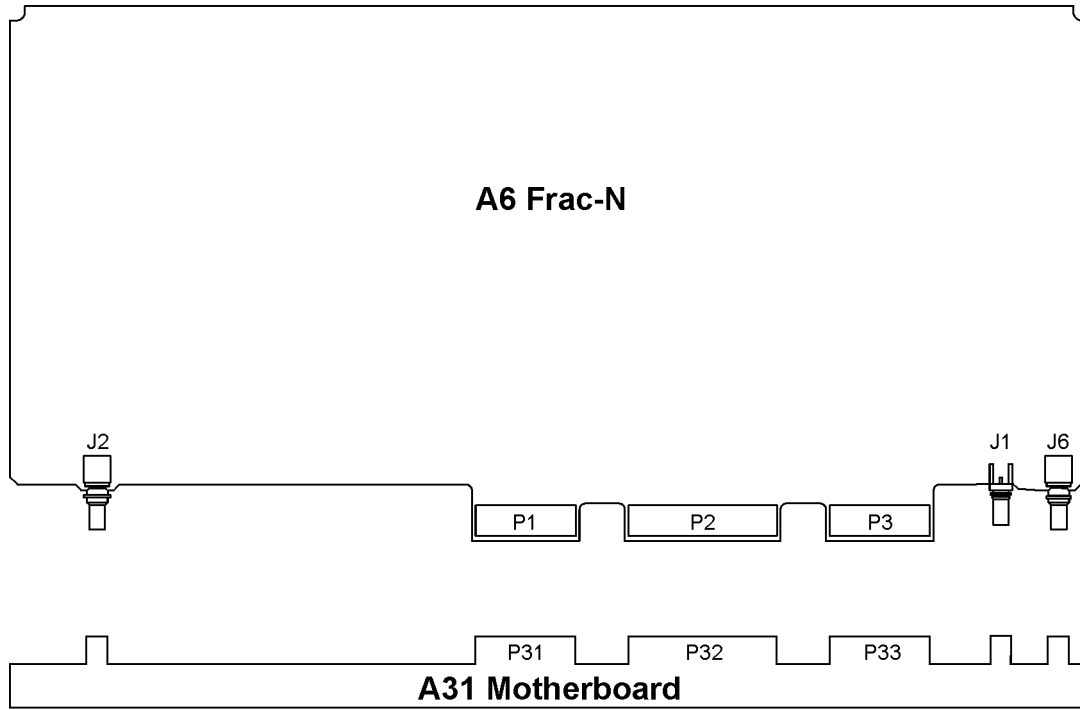
Source Setup		Oscilloscope Setup
Start:	5 GHz	10 ms/div
Stop:	10 GHz	5V/div
Sweep:	Freq	1 MΩ
Sweep Time:	Auto	
Sweep Repeat:	Continuous	

A positive- and negative-going signal should be present.

- If the signal is present at J9, replace the A9 YIG Driver.

2. If the signal is not present at J9, measure the center pin of J1032 on the motherboard.
 - If the signal is present, replace the cable.
 - If the signal is not present, replace the A6 Frac-N.

Self-Tests 7xx: A6 Frac-N Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any voltages are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+32	P32- 7	+31.04	+32.96	Main Supply
+15	P32- 6, 21	+14.55	+15.45	Main Supply
-15	P32- 2, 17	-14.55	-15.45	Main Supply
+5.2	P32- 14, 29	+5.04	+5.37	Main Supply
+9	P32- 5, 20	+8.82	+9.18	YIG Driver
-5.2	P32- 4, 19	-5.1	-5.3	YIG Driver
-6	P32- 3, 18	-5.88	-6.12	YIG Driver

700 Ref Voltage

- Replace the A6 Frac-N.

701 Loop Gain

- Replace the A6 Frac-N.

702 Tuning Voltage

1. Using an oscilloscope, check 10 MHz Synthesis line on P33–15. The signal period should be 100 ns with an amplitude of approximately $3V_{pp}$.
 - If the signal is good, replace the A6 Frac–N.
2. If the signal is bad, turn the signal generator power off, remove the A6 Frac–N, and measure the signal at P33–15 again.
 - If the signal is good, replace the A6 Frac–N.
3. If the signal is still bad, measure P41–5 on the A7 Reference.
 - If the signal is good at P41–5, replace the A31 Motherboard.
 - If the signal is bad at P41–5, replace the A7 Reference.

703 Output Voltage

1. Using an oscilloscope, check 10 MHz Synthesis line on P33–15. The signal period should be 100 ns with an amplitude of approximately $3V_{pp}$.
 - If the signal is good, replace the A6 Frac–N.
2. If the signal is bad, turn the signal generator power off, remove the A6 Frac–N, and measure P33–15 again.
 - If the signal is good, replace the A6 Frac–N.
3. If the signal is still bad, measure P41–5 on the A7 Reference.
 - If the signal is good at P41–5, replace the A31 Motherboard.
 - If the signal is bad at P41–5, replace the A7 Reference.

704 Filter Test

1. Refer to [Table 1-9](#), and check J1 on the A6 Frac–N:
 - a. Turn the signal generator on and remove the A6 Frac–N.
 - b. Set the signal generator to the first center frequency.
 - c. Use an extender board cable to connect a spectrum analyzer to J1.
 - d. Tune the spectrum analyzer to the first J1 frequency, and check for the correct power.
 - e. Repeat Step d for the remaining frequencies.
 - If *all* the signals at J1 are good, continue with [Step 3](#).

Table 1-9

Center Frequency (GHz)	J1 Frequency (GHz)	Power at J1 (dBm)
0.300	4.771	> -6
0.500	7.969	
0.750	5.971	
1.25	4.976	
2.0	7.969	
3.0	5.971	

2. If *any* signal measured in Step 1 is bad, check the signal out of the A6 Frac–N output port on the A29 20 GHz Doubler.
 - If the signal out the A29 20 GHz Doubler is good, replace the cable.
 - If the signal out the A29 20 GHz Doubler is bad, replace the A29 20 GHz Doubler.

3. If all of the signals at J1 are good, turn the signal generator off and reinstall the A6 Frac-N.
4. Check J4 at the A8 Output (shown on [page 1-34](#)):
 - a. Power the signal generator on and remove the A8 Output.
 - b. Use an extender cable to connect a spectrum analyzer to J4.
 - c. Tune the spectrum analyzer to the first frequency in column one of [Table 1-9](#), and check for approximately +10 dBm.
 - If an RF signal is present on J4, replace the A8 Output.
 - If an RF signal is not present on J4, replace the A6 Frac-N.

705 F/2 Test

1. Using an oscilloscope, check the 10 MHz Synthesis line on P33-15. The signal period should be 100 ns with an amplitude of approximately $3V_{pp}$.
 - If the signal is good, replace the A6 Frac-N.
2. If the signal is bad, turn the signal generator power off, remove the A6 Frac-N, and measure P33-15 again.
 - If the signal is good, replace the A6 Frac-N.
3. If the signal is still bad, measure P41-5 on the A7 Reference.
 - If the signal is good at P41-5, replace the A31 Motherboard.
 - If the signal is bad at P41-5, replace the A7 Reference.

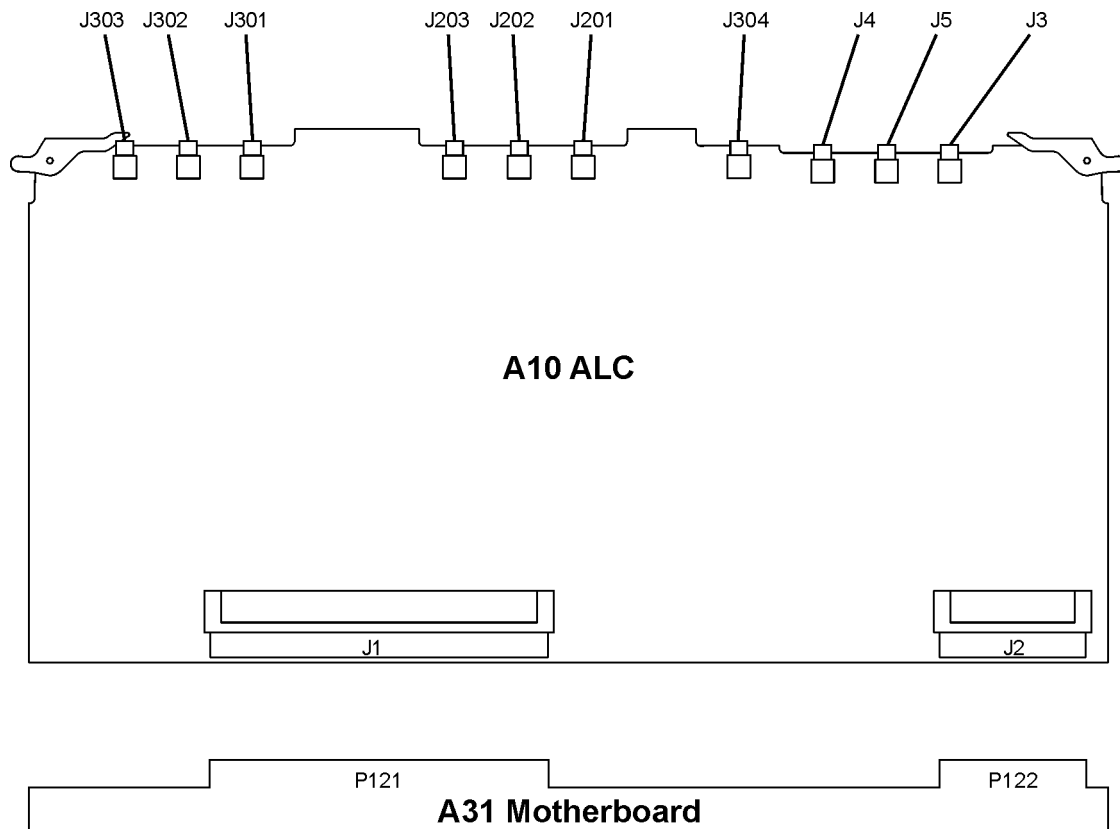
706 FM Path Test

1. Using an oscilloscope, check P31-22 (FM_On_H):
 - a. Loop self-test 706
 - b. Check for a TTL transition from 0 Vdc to +5 Vdc.
 - If the signal is not present, refer to A5 Sampler troubleshooting.
2. If the signal is present, check P31-11 (FM):
 - a. Loop self-test 706.
 - b. Check for a 0 to 3.3 Vdc transition.
 - If the signals is present, replace the A6 Frac-N.
 - If the signal is not present, refer to A11 Pulse/Analog Modulation Generator troubleshooting.

707 Sweep Phase Detector Test

1. Replace the A6 Frac-N.

Self-Tests 9xx: A10 ALC Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any voltages are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+32	P122-4	+31.04	+32.96	Main Supply
+15	P122-28	+14.55	+15.45	Main Supply
-15	P122-3	-14.55	-15.45	Main Supply
+5.2	P122-2, 27	+5.04	+5.37	Main Supply
-5.2	P122-1, 26	+5.30	+5.10	Main Supply
+5.2 Digital high	P121-64, 65, 129, 130	+5.04	+5.36	Main Supply
+3.4 Digital Low	P121-60, 61, 62, 63, 125, 126, 127, 128	+3.29	+3.5	Main Supply

900 Power Supply

- Replace the 10 ALC assembly.

901 Detector Test

1. Using a digital voltmeter, check J3 for approximately -0.29 Vdc:
 - a. Turn the signal generator's RF power on.
 - b. Set the frequency to 10 GHz and the RF power level to +20 dBm.
 - c. Disconnect the cable from J3 of the A10 ALC (W15) and connect the cable to the voltmeter.
 - If the signal is not present, refer to highband RF loop troubleshooting.
2. If the signal is present, check J5 for approximately -2.3 Vdc:
 - a. On the signal generator, change the frequency to 1 GHz.
 - b. Disconnect the cable from J5 of the A10 ALC (W14) and connect the cable to the voltmeter.
 - If the signal is not present, refer to lowband RF loop troubleshooting.
 - If the signal is present, replace the A10 ALC.

902 Detector Level to ALC Ref

1. Using a digital voltmeter, check J5 for -2.3 Vdc:
 - a. Turn the signal generator's RF power on.
 - b. Set the frequency to 1 GHz and the RF power level to +20 dBm.
 - c. Disconnect the cable from J5 of the A10 ALC (W14) and connect the cable to the voltmeter.
 - If the signal is not present, refer to lowband RF loop troubleshooting.
2. If the signal is present, check J3 for -0.29 Vdc:
 - a. On the signal generator, change the frequency to 10 GHz.
 - b. Disconnect the cable from J3 of the A10 ALC (W15) and connect the cable to the voltmeter.
 - If the signal is not present, refer to highband RF loop troubleshooting.
 - If the signal is present, replace the A10 ALC.

903 Level Test

1. Using a digital voltmeter, check J3 for -0.29 Vdc:
 - a. Turn the signal generator's RF power on.
 - b. Set the frequency to 10 GHz and the RF power level to +20 dBm.
 - c. Disconnect the cable from J3 of the A10 ALC (W15) and connect the cable to the voltmeter.
 - If the signal is not present, refer to highband RF loop troubleshooting.
 - If the signal is present, replace the A10 ALC.

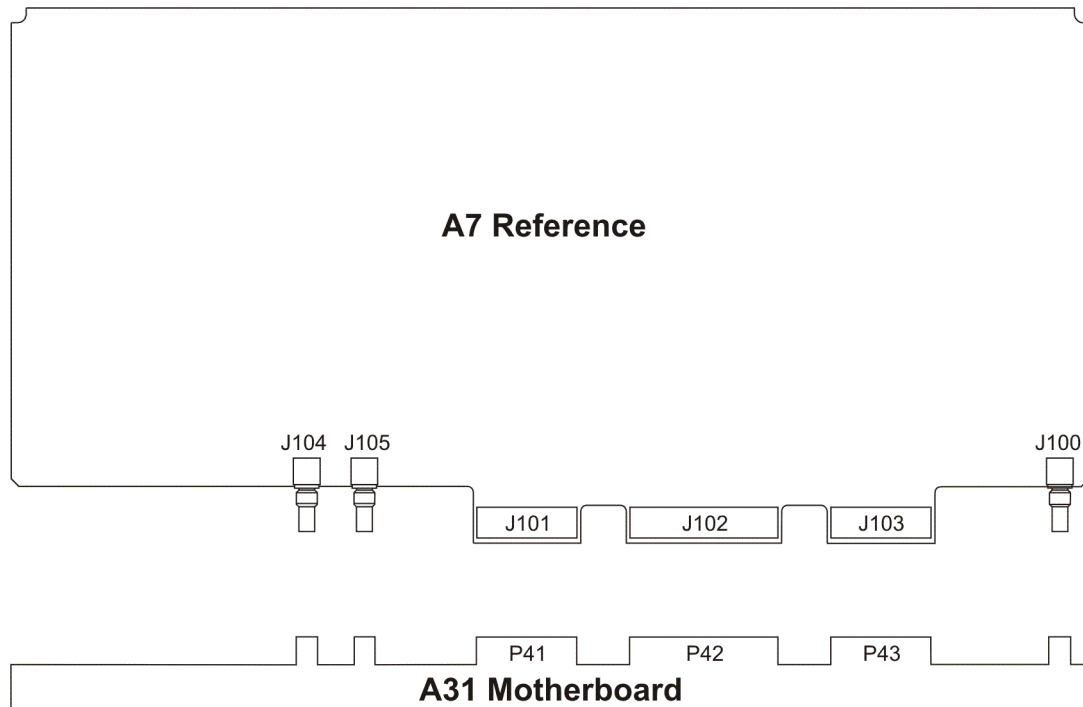
904 Scalar Mod Pulse

- Replace the A10 ALC.

905 ALC Mod Test

- Replace the A10 ALC.

Self-Tests 10xx: A7 Reference Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any voltages are out of specification troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+15	P42-6, 21	+14.55	+15.45	Main Supply
-15	P42-2, 17	-14.55	-15.45	Main Supply
+9	P42-5, 20	+8.82	+9.18	YIG Driver

1000 Power Supply

- Replace the A7 Reference.

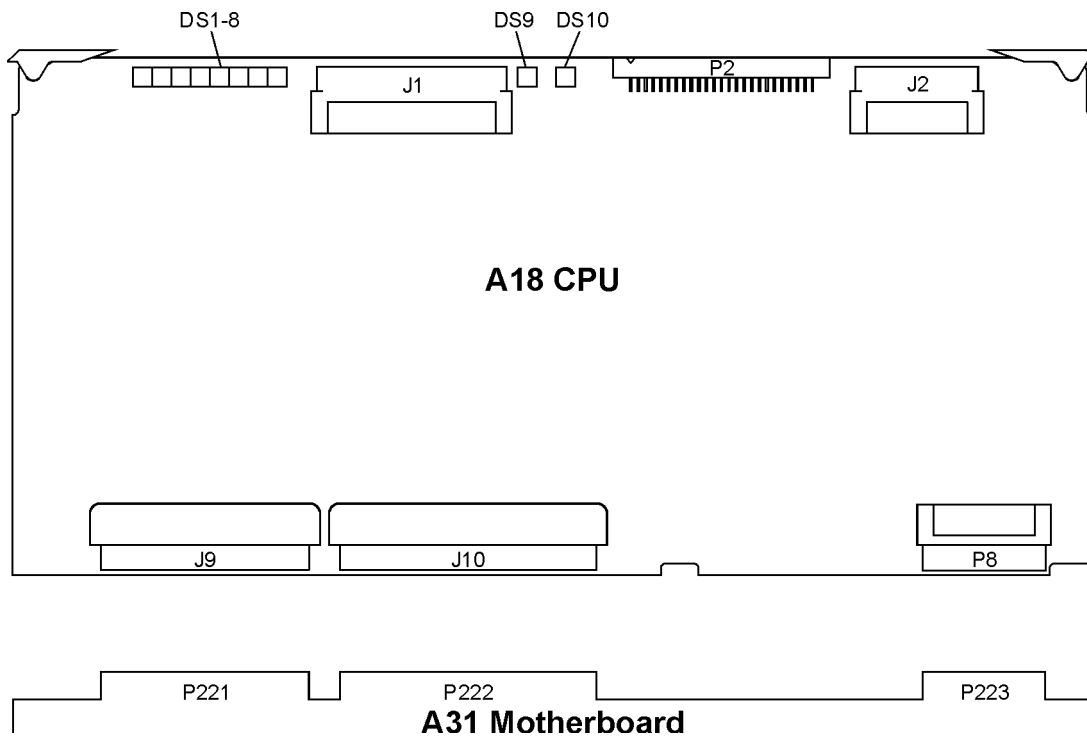
1001 10 MHz Test

- Using an oscilloscope, check P41-2 for a 10 MHz signal greater than 1.12 V_{pp}. If the signal is present, replace the A7 Reference.
- If the signal is not present, replace the internal 10 MHz standard.

1002 1 GHz Test

- Replace the A7 Reference.

Self-Tests 11xx: A18 CPU Self-Test Errors



1100 Power Supply

The A18 CPU self-test verifies the presence of the supplies listed. These supplies are not checked during the turn-on check and are not necessary for the turn-on check to pass.

1. After running self-test, View Details and see which supply failed.
2. If the 10 VRef has failed, replace the A18 CPU. The 10 VRef is generated on the A18 CPU and used for the ADC circuit.
3. For a self-test failure other than the 10 VRef, measure the appropriate connector pin listed in the following table.

Connector P223	Supply Voltage	Voltage Range
Pin 1	-5.2 Vdc	-5.2 \pm .1 Vdc
Pin 17	-6 Vdc	-6 \pm .12 Vdc
Pin 18	+9 Vdc	+9 \pm .18 Vdc

4. If the voltages are present on the A31 Motherboard, turn power off, remove the A18 CPU and inspect the connector. If the pins look good, replace the A18 CPU.

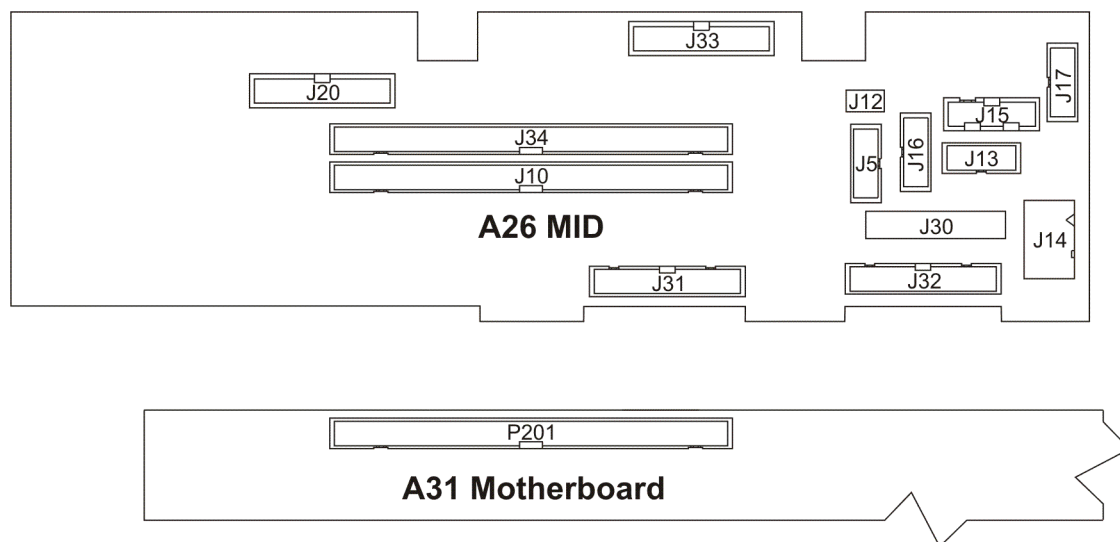
5. If a supply voltage is not present on the connector, measure the appropriate point listed in the following table:

Connector P112	Supply Voltage	Voltage Range
Pin 1, 2, 26, 27	-5.2 Vdc	-5.2 ± 0.1 Vdc
Pin 19, 44	-6 Vdc	-6 ± 0.12 Vdc
Pin 17, 18, 42	+9 Vdc	+9 ± 0.18 Vdc

6. If the voltage is present on P112 but not present on P223, replace the A31 Motherboard.

7. If the voltages are not present on P112, troubleshoot the A9 YIG Driver.

Self-Tests 12xx: A26 MID Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages in. If any of these voltages are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	E8663B Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+32	P201-11	+31.04	+32.96	Main Supply
+15	P201-12, 13, 14	+14.55	+15.45	Main Supply
-15	P201-21, 22	-15.45	-14.55	Main Supply
+5.2	P201-7, 8, 9, 10, 23, 24, 25, 26, 27, 28	+5.04	+5.36	Main Supply
+10	P201-15, 16, 17, 18, 19, 20	+9.7	+10.3	Main Supply
+8	P201-39	+7.5	+8.5	MID
-7	P201-40, 43, 56	-7.21	-6.79	Main Supply
-5.2	P201-41, 42	-5.30	-5.10	YIG Driver

Supply Voltage (Vdc)	E8663B Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+5.2 Digital high	P201-33	+5.04	+5.36	Main Supply
+3.4 Digital Low	P201-34	+3.3	+3.5	Main Supply

1200 Power Supply

1. Press **View Test Info** and highlight Self Test 1200. Press **View Details**.
2. From the displayed self-test results, determine which supply or supplies failed.
3. Refer to the following table; disconnect one microcircuit at a time and run self-test 1200.

Microcircuit	A26 MID Connector	+12V	+8V	+6.5V	+3.5V	-3V
A30 Modulation Filter	J31	✓	✓			
A29 20 GHz Doubler	J32	✓	✓			
A27 40 GHz Doubler	J33		✓			

- If the test passes after disconnecting one or more microcircuits, replace the microcircuit.
- If self-test still fails after disconnecting all the microcircuits, replace the A26 MID.

1201 Mod Filter

1. Disconnect the cable between the A23 Lowband Coupler/Detector and the A30 Modulation Filter, and connect a spectrum analyzer to the cable.
2. Tune the source across the lowband frequencies (250 kHz to 3.2 GHz) and record the lowest power level.
3. Disconnect the cable coming from the A29 20 GHz Doubler, and connect the spectrum analyzer to this cable.
4. Tune the source across the A29 20 GHz Doubler band of frequencies (3.2 GHz to 20 GHz) and record the lowest power level.
5. Determine the expected levels using the tools described in [“Troubleshooting RF Power Levels” on page 1-43](#), and compare them to the measured levels.
 - If the power level in both paths is good, replace the A30 Modulation Filter.
 - If the power level in *either* path is bad, troubleshoot that path.
 - If the power level in both paths is bad, check the signal levels out of the A28 YIG Oscillator.

1202 A29 20 GHz Doubler

1. Disconnect the cable between the A28 YIG Oscillator and the A29 20 GHz Doubler, and connect a spectrum analyzer to the cable.
2. Tune the source frequency across the A28 YIG Oscillator range (3.2 GHz to 10 GHz) noting the lowest power level.
3. Determine the expected levels using the tools described in [“Troubleshooting RF Power Levels” on page 1-43](#), and compare them to the measured levels.
 - If the power level is good, replace the A29 20 GHz Doubler.
 - If the power level is bad, replace the A28 YIG Oscillator.

1204 RF Path

This test checks for a dc voltage on the A10 ALC from the A23 Lowband Coupler/Detector and A24 Highband Coupler and A25 Highband Detector.

1. Connect a spectrum analyzer to the RF output of the signal generator.
2. Turn the RF power on and verify the presence of an RF signal on the output.

- If no RF signal is present, troubleshoot the RF path problem (see [“Troubleshooting the RF Path” on page 1-43](#)).
3. If an RF signal is present on the RF output, set the signal generator to 4 GHz and 0 dBm.
 4. Measure the dc voltage on the cable going to J3 of the A10 ALC. The signal should be > -600 mV.
 - If the signal at J3 is good, go to step 6.
 5. If no dc signal is present on the cable to J3, check the output at the highband detector.
 - If the signal is good at the detector, replace the cable.
 - If no signal is present at the output of the highband detector, replace the highband detector.
 6. If the signal at J3 is good, set the signal generator's frequency to <1 GHz, the power to 0 dBm, and measure the dc voltage on the cable going to J5 on the A10 ALC.
 - If the dc voltage is -5.25 Vdc, replace the A10 ALC.
 7. If other dc voltages are present, check for dc voltage on the output of the lowband detector.
 - If a dc voltage is present, replace the cable.
 - If no dc voltage is present, replace the lowband detector.

1205 LB Pulse Mod

Lowband Pulse On

1. Disconnect the cable from J5 of A10 ALC, and connect the cable to a DVM (this is the lowband detector output).
2. On the signal generator, set the following:
 - Center Frequency: 3 GHz
 - Power: +20 dBm
 - Pulse Modulation: On
 - Period: 40s
 - Pulse Width: 10 ns
 - RF: On
3. The voltage measured by the DVM should be approximately 0V. If it is not, use an oscilloscope to view P131-6 of the A31 Motherboard (this is the pulse signal out of the A11 Pulse/Analog Modulation Generator).

Change the pulse period to 1 ms and the pulse width to 500 μ s.

 - If the pulse is not present, perform the A11 Pulse/Analog Modulation Generator self-test, and follow the troubleshooting procedure.
4. If pulse modulation is working, perform the A8 Output self-test.
 - If the self-test passes, refer to [“Troubleshooting the RF Path” on page 1-43](#), and check the lowband path.
 - If the self-test fails, refer to the A8 Output test troubleshooting.

Lowband Pulse Off

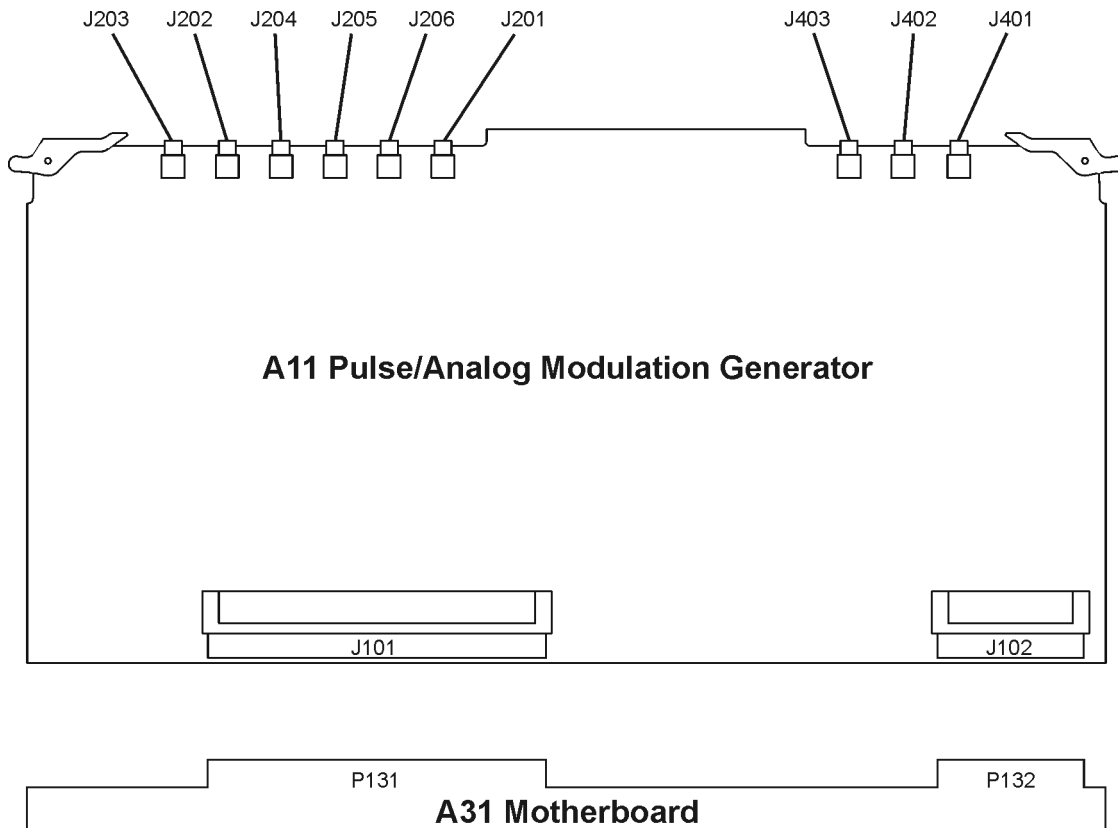
1. Disconnect the cable from J5 of A10 ALC, and connect the cable to a DVM (this is the lowband detector output).
2. On the signal generator, set the following:
 - Center Frequency: 3 GHz
 - Power: +20 dBm
 - Pulse Modulation: On
 - Period: 40s
 - Pulse Width: 39.9s
 - RF: On
3. The voltage measured by the DVM should be approximately -2.2 V. If it is not, use an oscilloscope to view P131-6 of the A31 Motherboard (this is the pulse signal out of the A11 Pulse/Analog Modulation Generator).

Change the pulse period to 1 ms and the pulse width to 500 μ s.

 - If the pulse is not present, perform the A11 Pulse/Analog Modulation Generator self-test, and follow the troubleshooting procedure.

4. If pulse modulation is working, perform the A8 Output self-test.
 - If the self-test passes, refer to “[Troubleshooting the RF Path](#)” on page 1-43, and check the lowband (<3.2 GHz) path.
 - If the self-test fails, refer to the A8 Output test troubleshooting.

Self-Tests 13xx: A11 Analog/Pulse Modulation Generator Self-Test Errors



se977a

Before proceeding to the reported self-test error code, check the following voltages. If any of these voltages are out of specification troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+15	P132-28	+14.55	+15.45	Main Supply
-15	P132-3	-14.55	-15.45	Main Supply
+5.2	P132-2, 27	+5.04	+5.37	Main Supply
-5.2	P132-1, 26	-5.3	-5.1	YIG Driver
+5.2 Digital high	P131-64, 65, 129, 130	+5.04	+5.36	Main Supply
+3.4 Digital Low	P131-60, 61, 62, 63, 125, 126, 127, 128	+3.29	+3.5	Main Supply

1300 Power Supply

- Replace the A7 Reference.

1301 Internal Pulse Generator Clock

1. Using an oscilloscope, measure P131–91 for a 10 MHz signal at 3.5 V_{pp}.
 - If the signal is good, replace the A11 Pulse/Analog Modulation Generator.
2. If the signal is bad, check P41–7.
 - If the signal is good on P41–7, replace the A31 Motherboard.
 - If the signal is bad on P41–7, replace the A7 Reference.

1302 Output

- Replace A11 Pulse/Analog Modulation Generator.

1303 Voltage Ref DAC

- Replace A11 Pulse/Analog Modulation Generator.

1304 20 GHz Pulse

- Replace A11 Pulse/Analog Modulation Generator.

1305 Not Used**1306 Standard 3 GHz Pulse**

- Replace A11 Pulse/Analog Modulation Generator.

1307 High Performance 3 GHz Pulse

- Replace A11 Pulse/Analog Modulation Generator.

1308 Numeric Synthesizer

- Replace A11 Pulse/Analog Modulation Generator.

1309 Function Generator Channel 1

- Replace A11 Pulse/Analog Modulation Generator.

1310 Function Generator Channel 2

- Replace A11 Pulse/Analog Modulation Generator.

1311 Frequency Modulator

- Replace A11 Pulse/Analog Modulation Generator.

1312 Low Frequency Out

- Replace A11 Pulse/Analog Modulation Generator.

1313 Amplitude Modulation

- Replace A11 Pulse/Analog Modulation Generator.

1314 External 1

- Replace A11 Pulse/Analog Modulation Generator.

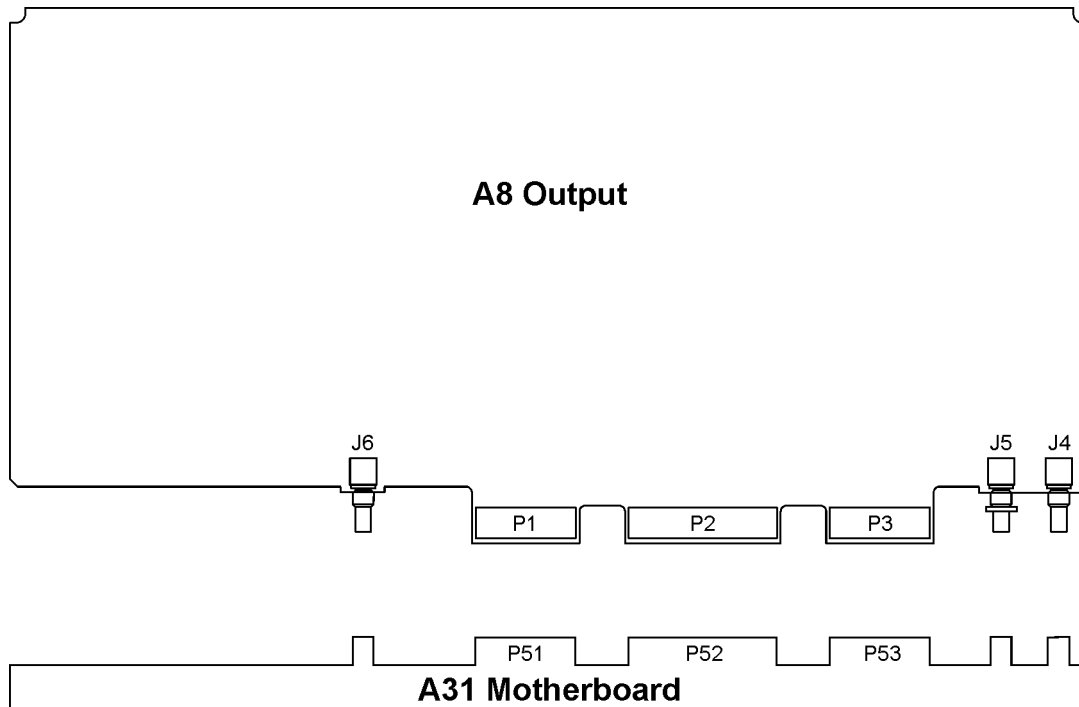
1315 External 2

- Replace A11 Pulse/Analog Modulation Generator.

1316 AM Path Loss

- Replace A11 Pulse/Analog Modulation Generator.

Self-Tests 22xx: A8 Output Self-Test Errors



Before proceeding to the reported self-test error code, check the following voltages. If any voltages are out of specification, troubleshoot the supply problem first.

Supply Voltage (Vdc)	Connector Pins	Minimum Value (Vdc)	Maximum Value (Vdc)	Origin
+15	P52- 6, 21	+14.55	+15.45	Main Supply
-15	P52- 2, 17	-15.45	-14.55	Main Supply
+5.2	P52- 14, 29	+5.04	+5.36	Main Supply
+9	P52- 5, 20	+8.82	+9.18	YIG Driver
-6	P52- 3, 18	-6.12	-5.88	YIG Driver

2200 Ground and PTAT Test

- Replace A8 Output.

2201 Prelevel Loop Test

1. With the signal generator powered on, carefully remove the A8 Output.
2. Set the signal generator to 3 GHz CW.
3. Connect a spectrum analyzer to the A6 Frac-N RF output at J4 of the A8 Output. The signal at J4 should be at 3 GHz and ≥ 0 dBm.
 - If the signal is not present or at the correct level, replace the Frac-N.
 - If the signal is present, replace the A8 Output.

WARNING Do not re-install the A8 Output with the signal generator powered on. This can cause serious damage to the signal generator.

2202 Switching Filter Test

- Replace the A8 Output.

2203 ALC Mod System Test

- Replace the A8 Output.

2204 Pulse Mod System Test

- Replace the A8 Output.

2205 RF Path Test

- Replace the A8 Output.

Troubleshooting Unlocks

The phase lock loop refers to part of the frequency generating circuit used to maintain the phase relationship between the frequency generation loop and a reference frequency. By maintaining the phase relationship the frequency accuracy of the signal generator is guaranteed.

To maintain frequency accuracy the phase lock loop compares the phase of a signal from the reference assembly to the phase of the frequency loop signal. If the signals are slightly out of phase, the phase comparator circuit adjusts the frequency loop signal until the two signals are in phase. If the phase comparator circuit cannot adjust the phase of the frequency loop signal to agree with the reference signal, the phase comparator rails and generates an unlocked message. The unlock message is immediately displayed on the front panel display.

There are four phase lock circuits in the frequency generation loop that can generate error messages. These phase lock loops are located on the A6 Frac-N, A5 Sampler, and A7 Reference. There is also one other phase lock loop on the A11 Pulse/Analog Modulation Generator that can generate an error message when the signal generator is in phase modulation mode.

508 A6 Frac-N Loop Unlock

A 508 Frac-N unlock message indicates a failure of the A6 Frac-N.

1. Check P33-15 on the A31 Motherboard for the 10 MHz sync. approximately 2 V_{pp}.
2. If the signal is present replace the A6 Frac-N.
3. If the signal is not present, troubleshoot back to the A7 Reference.

512 A7 Reference Unlock

The instrument's reference is unlocked. If an external reference is connected, check the frequency and power. It is possible for this to occur during a poor connection or disconnection of an external reference. If this error reoccurs when no external reference is connected, replace the A7 Reference.

513 1 GHz Out of Lock

A 513 1 GHz Out of Lock message indicates a failure on the A7 Reference.

- Replace the A7 Reference.

514 Reference Oven Cold

The Reference Oven Cold Error message indicates the reference has not been connected to electrical power for 30 minutes. This message appears when the signal generator is unplugged or the reference assembly is removed. The message is controlled by a timer and should turn off after 30 minutes. This is not a failure unless the message does not go off after 30 minutes. If it continues to be displayed after 30 minutes, replace the A7 Reference.

515 10 MHz Signal Bad

A 515 10 MHz Signal Bad message indicates a problem on the A7 Reference.

A7 Reference (Standard)

- Replace the A7 Reference.

A7 Reference

1. Check the 10 MHz signal into the A7 Reference from the 10 MHz standard. The signal should be 10 MHz 1.8 V_{pp} into 1 MΩ.
2. If the 10 MHz signal is bad, replace the A32 10 MHz Crystal Oscillator.
3. If the signal is good, replace the A7 Reference.

520 Sampler Unlocked

A 520 Sampler unlock message indicates a failure of the A5 Sampler VCO loop.

1. Run self-test. If self-test fails, troubleshoot the problem reported.
2. Power-up the signal generator. Remove the A5 Sampler. Probe the mmx connection center pin on the right side of the A31 Motherboard in the A5 Sampler slot. There should be a 1 GHz signal >0 dBm.
3. If the 1 GHz signal is present, replace the A5 Sampler.
4. If the 1 GHz signal is not present, replace the A7 Reference.

NOTE Turn the signal generator off before re-installing any assembly.

521 YO Loop Unlocked

A 521 YO Loop unlocked message indicates a failure of the A5 Sampler's YO Phase detector circuit.

1. Set the signal generator to 5 GHz.
2. With the signal generator on, remove the A5 Sampler. Probe the mmx connectors on the A31 Motherboard

Table 1-10

Connector	Signal
right mmx connector	1 GHz >0 dBm from A7 Reference
center mmx connector	5 GHz from A29 20 GHz Doubler -6 dBm
left mmx connector	approximately 850 MHz >-6 dBm from A5 Sampler

3. If all signals are present replace the A5 Sampler.
4. If any signal is not present, troubleshoot to the signal generator and replace that assembly.

NOTE Turn the signal generator off before re-installing any assembly.

625 Internal Pulse Generator Unlock

A 625 internal pulse generator unlocked message indicates a failure on the A11 Pulse/Analog Modulation Generator.

- Replace the A11 Pulse/Analog Modulation Generator.

626 Internal Mod Source Unlock

A 626 Internal Mod Source Unlock error message indicates a problem with the digital 10 MHz signal to the A11 Pulse/Analog Modulation Generator. This error message is turned on if the signal generator is in phase modulation mode and there is a problem with the 10 MHz digital signal to the in phase clock.

1. Set the signal generator to phase modulation mode.
2. Measure pin P131–91. The waveform is not a sine wave, but more like a distorted pulse waveform $>2 V_{pp}$.
3. If the waveform is present, replace the A11 Pulse/Analog Modulation Generator.
4. If the signal is not present, replace the A7 Reference.

Troubleshooting Unlevels

A leveled output power is obtained by comparing a detected voltage with a reference voltage. The reference voltage is generated using DACs on the A10 ALC and the detected voltage is generated by coupling off a portion of the RF output signal and converting it to dc using detector diodes. When the reference and detected levels are the same the integrated output level remains constant. When the detected and reference levels are not the same, the integrator output ramps either up or down to increase or decrease the detected level. If the integrator can not get the detected voltage and the reference voltage to match, an unlevelled annunciator is displayed.

The Automatic Leveling Circuit (ALC) uses two detectors and two modulator diodes. The A23 Lowband Coupler/Detector is used for frequencies 2 GHz and below. The A25 Highband Coupler/Detector is used for all frequencies above 2 GHz. The modulator in the A23 Lowband Coupler/Detector is used to control the RF amplitude for frequencies 3.2 GHz and below. The modulator in the A30 Modulation Filter is used to control the amplitude for frequencies above 3.2 GHz.

The RF path must provide a minimum power level to the ALC loop for the ALC loop to work properly. The minimum power required is slightly higher than the maximum leveled power. The first step to troubleshooting a leveling problem is to verify the RF path power level.

Troubleshoot and correct any unlock problems before troubleshooting unlevelled problems.

If the unlevelled annunciator is on:

1. Verify the signal generator's amplitude is not set higher than the maximum level specified on the data sheet. Verify that the signal generator's RF output is terminated into 50 ohms. If the unlevelled indication turns off after resetting the amplitude or terminating the RF output into 50 ohms, the signal generator is operating correctly. If the unlevelled indicator remains on, proceed to step 2.
2. Using a spectrum analyzer check the RF signal level at the RF output connector.
 - a. Signal generator and spectrum analyzer setup:

Signal Generator:

 - Turn ALC Off
 - Set Amplitude to 30 dBm
 - Turn Modulation Off
 - Turn RF On
 - Set Sweep to Frequency
 - Set Sweep Type to Step
 - Set Start Frequency to 250 kHz
 - Set Stop Frequency to 3.2 GHz
 - Set Number of Points to 500

Spectrum Analyzer:

 - Set Start Frequency to 225 kHz
 - Set Stop Frequency to 3.25 GHz
 - Set Reference Level to +30 dBm
 - Set Display to Max Hold
 - b. Connect the RF output of the signal generator to the spectrum analyzer. Measure and record the minimum power level.
 - c. Set the signal generator and spectrum analyzer start/stop frequencies to the next start/stop frequency in [Table 1-11](#).

Table 1-11 Start/Stop Frequencies and Maximum Levelled Power (dbm)^a

Signal Generator		Spectrum Analyzer		Max Levelled Power	
Start	Stop	Start	Stop	Standard	Option UNW
250 kHz	3.2 GHz	200 kHz	3.25 GHz	+15	+13
>3.2 GHz	9 GHz	3 GHz	9.2 GHz	+21	+21

^aalways check data sheet for updates to specifications

- d. If any of the frequency ranges do not produce power levels \geq the maximum levelled power shown in [Table 1-11](#), set the signal generator to the frequency with the lowest power level and measure the power with a power meter. If the power level is low, troubleshoot the RF path before proceeding.
3. If the RF signal levels are good, most likely the problem is either a detector, ALC, or modulator. Before proceeding, turn ALC On and set the signal generator to maximum levelled power for the model and options you have and note the frequencies where the unlevelled condition occur. Later, when troubleshooting in ALC Off mode the unlevelled indication is turned off.
4. For each of the failed conditions listed, always start with the following signal generator settings:
 - ALC Mode ALC Off
 - Amplitude +30 dBm (max.)
 - Attenuator Hold Mod On
 - RF On
 - Modulation Off

Conditions:

5. Unlevelled only between 250 kHz and 2 GHz.
If the unlevelled problem only occurs between 250 kHz and 2 GHz, the problem is most likely the A23 Lowband Coupler/Detector.
 - a. Checking the A23 Lowband Coupler/Detector:
 - Set the signal generator to 1.9 GHz or an unlevelled signal generator frequency.
 - Connect a power meter or spectrum analyzer to the A23 Lowband Coupler/Detector output.
 - Set the signal generator to 1 GHz. Using the RPG, adjust the amplitude level so the detected voltage on cable J5 of A10 ALC (W14) is -0.117 Vdc. Using a power meter, measure the signal level at the end of the cable going to J3 of A30 Modulation Filter (W27). See [Table 1-12](#) to determine the expected power level. If the power can not be adjusted to this level, troubleshoot the RF path.
 - If the problem is at some frequency other than 1 GHz, repeat the above step using the problem frequency. The dB p-p variation from 250 kHz to 2 GHz should be <2 dB.
 - If the dc level is bad, replace the A23 Lowband Coupler/Detector.
 - If the signal is good, replace the A10 ALC.

Table 1-12

Option	Expected Power Level
Standard	2.3 dBm \pm 0.5 dBm
UNW	4.5 dBm \pm 0.6 dBm

6. Unlevelled only between 250 kHz and 3.2 GHz. If the unlevelled problem only occurs between 250 kHz and 3.2 GHz, the problem is most likely the A8 Output or A10 ALC.
 - a. Checking Lowband Modulator Drive signal:
 - Set the signal generator to a frequency between 250 kHz and 3.2 GHz. Set the amplitude so the power meter reads +21 dBm (or the maximum settable power) on cable W27 going to J3 on A30 Modulation Filter.

If the power can not be set and option UNW is installed, use the RF path block diagram to verify the power levels through each device.

- Measure the voltage on the center pin on A31 Motherboard connector J1122. The voltage should be around +2.0 Vdc.
 - Reduce the amplitude setting to 0 dBm and the voltage on J1122 should move towards +0.15 Vdc.
 - If the voltages are not correct or do not change as power is changed, replace the A10 ALC.
 - If the voltage changes, replace the A8 Output.
7. Unleveled only between 2 GHz and the maximum frequency. If the unleveled condition occurs only for frequencies >2 GHz to the maximum frequency, the problem is most likely the A25 Highband Coupler/Detector.
- a. Checking the A25 Highband Coupler/Detector:
- Set the signal generator frequency to maximum frequency or a frequency where the signal generator is unleveled.
 - Connect a power meter or spectrum analyzer to the RF output connector.
 - Using the RPG, adjust the power to the highest level possible. This level will be +18 dBm. If the power can not be adjusted to this level, troubleshoot the RF path.
 - Remove the cable from J3 on the A10 ALC and measure the dc voltage on the center pin of the cable. Use [Table 1-13](#) to determine the expected power level.
 - Set the power level to 0 dBm and repeat the center pin measurement. The voltage should be -5 mVdc \pm 10 mVdc.
 - If the voltages are good, go to step 8.
 - If the voltages are the same, replace the A25 Highband Coupler/Detector.

Table 1-13

Power Level	Expected Voltage Level at J3 Center Pin
+9 dBm	-30 mVdc \pm 10Vdc
+7 dBm	-20 mVdc \pm 10Vdc
+3 dBm	-10 mVdc \pm 10Vdc

8. Option 509. Unleveled only between 3.2 GHz and 9 GHz.
 If the unleveled condition occurs between 3.2 GHz and 9 GHz, the problem is most likely the A30 Modulation Filter.
- a. Checking the A30 Modulation Filter:
- Set the signal generator to 9 GHz or a frequency where the signal generator is unleveled and measured RF output level is +7 dBm or +3 dBm, depending on options. If the power can not be set to +7 dBm or +3 dBm, troubleshoot the RF path.
 - Remove the cable going to J6 on the A30 Modulation Filter and measure the voltage on the center pin. The voltage should be approximately +5.4 Vdc.
 - Set the amplitude to -15 dBm. The voltage on the center pin should decrease a few mVdc.
 - If the voltages are good, replace the A30 Modulation Filter.
 - If the voltages are bad, go to step 7.
9. Unleveled at all frequencies.
 If the signal generator is unleveled at all frequencies, the problem is most likely the A10 ALC.
- a. Checking the A10 ALC:
- Run a complete self-test and troubleshoot the reported failure.

Troubleshooting Adjustment Problems

When an adjustment does not work or fails to resolve a problem and all self-tests have passed, use the following table to locate the most likely failure.

Table 1-14 Troubleshooting Help for Failed Adjustments

Adjustment that is failing...	Assemblies most likely causing failure...
ADC Calibration	A18 CPU
YIG-Driver Pre-Tune Calibration	A9 YIG Driver A28 YIG Oscillator A5 Sampler A6 Frac-N
VCO Bias Frac-N Calibration	A6 Frac-N
Internal Source Calibration	A11 Pulse/Analog Modulation Generator
AM Audio Path Offset Calibration	A11 Pulse/Analog Modulation Generator
KV vs. Frequency Calibration	A6 Frac-N
Timebase Calibration	A7 Reference
FM Scale Offset Calibration	A11 Pulse/Analog Modulation Generator
FM Path Offset Calibration	A11 Pulse/Analog Modulation Generator A6 Frac-N
FM In-band Offset Calibration	A6 Frac-N
FM Inverting Amplifier Offset Calibration	A6 Frac-N
FM 1/2 Path Ratio Gain Calibration	A11 Pulse/Analog Modulation Generator
Mod Source Relative Gain Calibration	A11 Pulse/Analog Modulation Generator
FM/PM Out-of- Band Calibration	A6 Frac-N
FM/PM YO Frequency Compensation Calibration	A9 YIG Driver A28 YIG Oscillator
DC FM Calibration	A6 Frac-N A11 Pulse/Analog Modulation Generator
Low Frequency Output Calibration	A11 Pulse/Analog Modulation Generator
External Input Peak Detector Calibration	A11 Pulse/Analog Modulation Generator
ALC Dynamic Calibration	A10 ALC A30 Modulation Filter A8 Output
Power Flatness Calibration	A10 ALC RF Path
ALC Modulator Calibration	A30 Modulation Filter A8 Output
Attenuator Calibration-Lowband and Highband Power	AT1 RF Path
Attenuator Calibration-Highband and High Power	AT1 RF Path
Attenuator Calibration-Lowband and Low Power	AT1 RF Path

Table 1-14 Troubleshooting Help for Failed Adjustments (Continued)

Adjustment that is failing...	Assemblies most likely causing failure...
Attenuator Calibration-Highband and Low Power	AT1 RF Path
AM Gain Calibration	A11 Pulse Modulation Generator
Gain Adjustment Bypass Calibration (Frequencies \leq 3.2 GHz)	A8 Output A6 Frac-N
Pulse Width Calibration	A11 Pulse/Analog Modulation Generator A30 Modulation Filter A8 Output
9v PTAT	A10 ALC
Lowband Digital Pre-level Gain Calibration	A6 Frac-N
Lowband Digital Mixer Bias Calibration	A8 Output
Lowband Digital Gain Adjust	A8 Output
Modulator Bias DAC Sensitivity	A10 ALC A8 Output A30 Modulation Filter

Troubleshooting ADC Adjustment Failures

The ADC adjustment adjusts the ADC reference voltage to match the A18 CPU +10 Vdc reference. There are three reasons the adjustment could fail:

- problems with the +10 Vdc reference
- A18 CPU problems
- analog mux on another assembly is starting to fail

Procedure:

1. Run self-test 1100. If self-test 1100 passes, the +10 Vdc reference is good; proceed to step 2.
2. To see if an analog mux is failing and loading the supply, turn power off and remove the A5 Sampler, A6 Frac-N, and A7 Reference.
3. Run the adjustment. If the adjustment passes, turn power off, reinstall one assembly at a time and run the adjustment until the problem assembly is located.
4. If self-test fails, turn power off, reinstall the assemblies and remove the A8 Output, A9 YIG Driver, and A10 ALC.
5. Run the adjustment. If the adjustment passes, turn power off, reinstall one assembly at a time and run the adjustment until the problem assembly is located.
6. If self-test fails, turn power off, reinstall the assemblies and remove the ribbon cable from J10 on the A26 MID (W35).
7. If self-test passes, replace the A26 MID.
8. If self-test fails, replace A18 CPU.

Troubleshooting Performance Test Problems

If a performance test fails and all self-tests pass, use the following to find the most likely failure:

Performance test that is failing...	Action to perform...
Maximum Levelled Output Power	Refer to "Troubleshooting the RF Path" on page 1-43.
Power Level Accuracy	Perform Power Flatness Calibration, Attenuator Calibration-Lowband and Highband Power, Attenuator Calibration-Highband and High Power, Attenuator Calibration-Lowband and Low Power, and Attenuator Calibration-Highband and Low Power.
Internal Pulse Modulation Level Accuracy Internal Pulse Modulation Rise/Fall Time Internal Pulse Modulation Minimum Pulse Width	If the frequency ≤ 3.2 GHz, check the A11 Pulse/Analog Modulation Generator or the A8 Output. If the frequency is >3.2 GHz, check A11 Pulse/Analog Modulation Generator and the A10 ALC. If the Internal Pulse Modulation Minimum Pulse Width test fails, perform a Pulse Width Calibration prior to replacing any assembly.
DC FM Carrier Offset	Perform DC FM Calibration. If still failing, check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
External AM Frequency Response	A11 Pulse/Analog Modulation Generator or the A8 Output.
Internal FM Frequency Response	Perform FM adjustments. If still failing, check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
External Phase Modulation Frequency Response	If the frequency is ≤ 3.2 GHz, check the A11 Pulse/Analog Modulation Generator or the A8 Output. If the frequency is >3.2 GHz, check the A11 Pulse/Analog Modulation Generator and the A10 ALC.
Internal FM Distortion	Perform FM adjustments. If still failing check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
Internal Phase Modulation Distortion	Perform FM adjustments. If still failing, check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
External FM Deviation Accuracy	Perform FM adjustments. If still failing, check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
External Phase Modulation Deviation Accuracy	Perform FM adjustments. If still failing, check A11 Pulse/Analog Modulation Generator and A6 Frac-N.
External Pulse Modulation ON/OFF Ratio	If the frequency is ≤ 3.2 GHz, check the A11 Pulse/Analog Modulation Generator or the A8 Output. If the frequency is >3.2 GHz, check the A11 /Analog Modulation Generator and the A10 ALC.
Harmonic Spurious Sub-Harmonic Spurious	Refer to "Option 509 Models" on page 1-46.
Non-Harmonic Spurious	Refer to "Troubleshooting Non-Harmonic Spurious" on page 1-47.
Single-Sideband Phase Noise	Refer to "Troubleshooting the RF Path" on page 1-43.

Troubleshooting the RF Path

Troubleshooting RF Path procedure:

- preset the signal generator
- set a frequency
- open ALC loop (ALC Off)
- set signal generator to maximum power
- check power levels in the RF path using “[Troubleshooting RF Power Levels](#)”, below.

Troubleshooting RF Power Levels

The following information has been provided to aid in troubleshooting power levels in the RF path:

- RF Block Diagram (see [Figure 1-6](#) on page 1-65). The block diagram shows signal flow, path frequency ranges, and minimum power levels at a few key points in the RF path.
- A Gain/Loss table ([Table 1-14](#) on page 1-40). The table provides the minimum gain or maximum loss level between the input and output for each part

When troubleshooting the instrument, the troubleshooting procedure may refer you to the RF Block Diagram, the Gain/Loss table, or both.

Examples:

Verifying the gain or loss of a part - Locate the part in the Gain/Loss table. Measure the output and input power levels. Subtract the input from the output to determine the gain or loss. If the part is not meeting the gains or losses specified (the gain is less than specified or the loss is more than specified), the part most likely needs to be replaced. In cases where the part fails to meet its specification but comes very close, calculate and measure the minimum input power level into the part before replacing the part.

Verifying the minimum power into a part - Locate a point on the RF path where output power is specified, then use the Gain/Loss table to calculate the minimum power level at the specific location. If the minimum power level is not present, measure the output of the first device showing a power level on the RF Block Diagram, then measure the input and output power level for each device in the path until the defective part is located.

ALC and RF problems

1. Run a full self-test and troubleshoot any reported failures before proceeding.
2. From [Table 1-15](#), determine the frequencies where the problem occurs.

Table 1-15

Frequencies	Assemblies
All frequencies	A28 YIG Oscillator A29 20 GHz Doubler A30 Modulation Filter AT1 RF Output Connector
250 kHz to 2 GHz	A6 Frac-N A8 Output A29 20 GHz Doubler A30 Modulation Filter A23 Lowband Coupler/Detector AT1 RF Output Connector
2 GHz to 3.2 GHz	A24 Highband Coupler/Detector A8 Output

Table 1-15

Frequencies	Assemblies
>3.2 GHz to 9 GHz	A29 20 GHz Doubler A30 Modulation Filter AT1 RF Output Connector

3. Perform the following steps:
 - press Preset
 - press Frequency, and set signal generator to frequency in problem area
 - press Amplitude, and set to +25 dBm
 - press RF ON/OFF (turn RF On)
 - turn ALC Off
 - Power Search Manual
 - Do Power Search
4. Using the RF Path Block Diagram, check the power levels at the points shown.
5. Once the problem is located, verify that the cables between the two assemblies are good before replacing the assembly.
6. To measure the A6 Frac-N output level, with the signal generator on, remove the A8 Output and probe the right hand mmx connector's center pin. The power level should be $\geq +5$ dBm.

WARNING Always turn the signal generator off before installing any assembly.

7. If power levels look good through the path in ALC Off mode, the problem is most likely in the ALC loop. Go to troubleshooting the ALC loop.

Troubleshooting Pulse Modulation

1. Verify a license key has been entered for Option UNW.
2. Run a full self-test and troubleshoot any reported failures before proceeding.
3. Determine the frequency of the pulse modulation problem.
4. Configure the signal generator to the pulse modulation setting that produces the problem.
5. Connect an oscilloscope to the LF OUTPUT connector. The waveform should be present on the oscilloscope.
6. If the waveform is present, continue to step 7.
7. If the waveform is not present or the signal is not the correct amplitude or type, replace the A11 Pulse/Analog Modulation Generator.
8. Turn ALC Off. In ALC On mode, the ALC bandwidth limits pulse amplitudes at pulse widths $< 1\mu\text{s}$. If turning ALC Off corrects the problem, then verify that pulse modulation is setup in either ALC Off or Power Search Modes.

Troubleshooting Problems <3.2 GHz

9. Check P52-23 on the A31 Motherboard. Compare the results with [Table 1-16](#).

Table 1-16

Pulse On	Pulse Off
+5 Vdc	0 to +5 Vdc (pulses at modulation rate)

10. If signal levels are good, replace the A8 Output.
11. If the signals are bad, check the cable continuity. If the cable is bad, replace the cable. If the cable is good replace the A11 Pulse/Analog Modulation Generator.

Troubleshooting Problems >3.2 GHz

12. If the pulse modulation problem occurs >3.2 GHz, remove the cable A30 Modulation Filter J7 (W17). Probe the end of the cable. Compare the results with [Table 1-17](#).

Table 1-17

Pulse On	Pulse Off
+5 Vdc	0 to +5 Vdc (pulses at modulation rate)

13. If the signal levels are good, replace the A30 Modulation Filter.

14. If the signal levels are bad, check the cable continuity. If the cable is bad, replace the cable. If the cable is good replace the A11 Pulse/Analog Modulation Generator.

Troubleshooting AT1 Attenuator

The attenuator steps 5 dBm for the first change, then ever 10 dBm.

1. If the attenuator switches at the switch points but the power does not change or the power changes more or less than expected, replace the attenuator.
2. If the attenuator does not switch, turn the signal generator off and remove W36 from J13 on the A26 MID.
3. Turn the signal generator on and probe the following pins on J13.
 - Pin 1 +15 Vdc \pm 0.75 Vdc
 - Pin 2 +5.2 Vdc \pm 0.5 Vdc

[Table 1-18](#) shows the amplitude ranges and the corresponding attenuator switch control line voltages. Attenuation is switched in at +3 Vdc \pm 0.75 Vdc and switched out at 0 Vdc.

Table 1-18

Amplitude Levels	Pin Numbers and Voltages				
	J13-5 40B dB Atten. Step	J13-6 20 dB Atten. Step	J13-7 40C dB Atten. Step	J13-9 10 dB Atten. Step	J13-10 5 dB Atten. Step
+25 to +5.1 dBm	0	0	0	0	0
+5.0 to -4.99 dBm	0	0	0	0	+3
-5.0 to -14.99 dBm	0	0	0	+3	+3
-15.0 to -24.99 dBm	0	+3	0	0	+3
-25.0 to -34.99 dBm	0	+3	0	+3	+3
-35.0 to -44.99 dBm	+3	0	0	0	+3
-45.0 to -54.99 dBm	+3	0	0	+3	+3
-55.0 to -64.99 dBm	+3	+3	0	0	+3
-65.0 to -74.99 dBm	+3	+3	0	+3	+3
-75.0 to -84.99 dBm	+3	0	+3	0	+3
-85.0 to -94.99 dBm	+3	0	+3	+3	+3
-95.0 to -104.99 dBm	+3	+3	+3	0	+3
>-105.0 dBm	+3	+3	+3	+3	+3

4. If the voltages are correct, replace the attenuator.

- If the voltages are not correct, replace the A26 MID.

Troubleshooting Harmonic Spurious

Harmonics are multiples of the output frequency. The second harmonic should be two times the output frequency at an x dBc down. This section contains procedures for checking spurious harmonic emission levels to make sure they are within specifications.

NOTE If the harmonic falls beyond the frequency range of the signal generator, the harmonic is not specified or measured.

To measure harmonics that fall within the signal generator frequency range, set the signal generator and spectrum analyzer to the harmonic frequency and set the signal generator to a specified power level. Measure the output signals peak power level on the spectrum analyzer. This peak power level is the reference level for the harmonic measurement. Turn on Marker Delta, set the signal generator to the fundamental frequency, and measure the power level of the fundamental frequency. The dBc value is the difference between the fundamental peak power level and the harmonic frequency power level.

Table 1-19

Harmonic Specifications	
< 10 MHz	-28 dBc
10 MHz to 2 GHz	-30 dBc
> 2 GHz to 9 GHz	-55 dBc

Use this procedure to troubleshoot harmonic problems with a fundamental frequency between 500 kHz and 3.2 GHz.

- Set the signal generator as follows:
 - Frequency: set to harmonic frequency to be measured
 - Amplitude: +10 dBm
 - ALC Off
 - Amplitude Power Search (softkey)
- Remove the cable on A30 Modulation Filter J3 (W27). Connect the spectrum analyzer to the cable.
- Set the spectrum analyzer to the harmonic frequency, then press peak search and delta marker.
- Set the signal generator to the fundamental frequency of the harmonic.
- Using the delta marker, read the harmonic power level on the spectrum analyzer. Compare the spectrum analyzer reading to the specifications in [Table 1-19 on page 1-46](#).
- If the harmonics do not meet specifications, replace the A8 Output.
- If harmonic meet specifications reconnect the cable to the A30 Modulation Filter J3 and remove the cable going to A30 Modulation Filter J2 (W31). Connect the spectrum analyzer to the A30 Modulation Filter J2.
- Set the signal generator and spectrum analyzer to the harmonic frequency, then on the spectrum analyzer, press marker peak search and then delta marker.
- Set the signal generator to the fundamental frequency of the harmonic.
- Using the delta marker, read the harmonic power level on the spectrum analyzer. Harmonic level should be ≤ -55 dBc.
- If the harmonic level is > -55 dBc, replace the A30 Modulation Filter.

Option 509 Models

Use this procedure to troubleshoot harmonic problems with a fundamental frequency between 3.2 GHz and 10 GHz.

- Set the signal generator as follows:
 - Frequency: set to harmonic frequency to be measured

- Amplitude: +10 dBm
 - ALC Off
 - Amplitude Power Search (softkey)
2. Remove the cable from the A29 20 GHz Doubler J2. Connect the spectrum analyzer to A29 20 GHz Doubler J2.
 3. Set the spectrum analyzer to the harmonic frequency, press marker peak search and then delta marker.
 4. Set the signal generator to the fundamental frequency of the harmonic.
 5. Using the delta marker, read the harmonic power level on the spectrum analyzer. Compare the spectrum analyzer reading to the specifications in [Table 1-19 on page 1-46](#).
 6. If harmonics do not meet specification, replace the A29 20 GHz Doubler.
 7. If harmonics meet or exceed specification, reconnect the cable to the A29 20 GHz Doubler J2 and remove the cable going to the A30 Modulation Filter J2 (W31). Connect the spectrum analyzer to the A30 Modulation Filter J2.
 8. Set the signal generator and spectrum analyzer to the harmonic frequency. On the spectrum analyzer, press marker peak search and delta marker.
 9. Set the signal generator to the fundamental frequency of the harmonic.
 10. Using the delta marker, read the harmonic power level on the spectrum analyzer. Compare the spectrum analyzer reading to the specifications in [Table 1-19 on page 1-46](#).
 11. If the harmonics do not meet specification, replace the A30 Modulation Filter.

Troubleshooting Non-Harmonic Spurious

There are nine different groupings a spur can fall into. The grouping determines what assembly is most likely generating the spur. The procedure for troubleshooting spurs is to identify the grouping based on failing a performance test, checking for loose or broken cables or castings, and replacing the assembly.

Table 1-20

Mixing Spurs	These spurs are generated by the mixing products of the RF and IF signals on the A8 Output. The instrument is tuned to a frequency in the Heterodyne-Band (250 kHz to 250 MHz) to measure these spurs.
Power Supply Spurs	These spurs are generated by the power supply switching at a 100 kHz rate. If the test fails for these spurs, change A19 Power Supply.
Offset Reference Spurs	These spurs are generated by the 10 MHz frequency reference on the A7 Reference.
Clock Spurs	Two clocks on the A11 Pulse/Analog Modulation Generator generate these spurs. The first clock is 33.554432 MHz and is used by the numeric synthesizer. The second clock is 100 MHz and is used by the internal pulse generator.
RF and LO Feedthrough Spurs	When the instrument is tuned to a Heterodyne Band (250 kHz to 250 MHz) frequency, the RF and LO feeds through from the mixer on the A8 Output and generates spurs on the RF output.
Frac-N Feedthrough	These spurs are generated by the Frac-N frequency coupling onto the low-band signal as it leaves the A6 Frac-N. The spurs then appear at the Frac-N frequency at the RF output.
Sampler Spurs	These spurs are generated on the A5 Sampler by the sampler LO and IF frequencies.
Frac-N 250 MHz Crossing Spurs	These spurs are generated by either the A5 Sampler, A6 Frac-N, or A7 Reference. They occur when a harmonic of the Frac-N frequency equals a harmonic of 250 MHz. The spurs are measured in highband at 133 kHz offset from the CW frequency.
IF 250 MHz Crossing Spurs	These spurs are generated on the A5 Sampler. They are caused by harmonics of the A5 Sampler IF. The spurs are measured in highband at 133 kHz offset from the CW frequency.

Troubleshooting Phase Noise

Poor grounds or shielding problems in either the test environment or the measurement system can cause the phase noise measurement to fail. Physical vibration is another common cause of phase noise. Before performing a phase noise measurement make sure all covers are installed, the work surface is free of physical vibrations, and the phase noise system is working properly.

Phase noise failures at specific offsets are fairly predictable. After making sure the measurement accurately reflects a failure, use [Table 1-21](#) to troubleshoot phase noise problems. The troubleshooting procedure consists of assembly substitution.

Table 1-21

Frequency Offset	Most Likely Assembly
0 to 100 Hz	A32 High Stability Time Base
100 Hz to 10 kHz	A7 Reference
<5 kHz to 10 kHz	A6 Frac-N
10 kHz to 100 kHz	A5 Sampler
>100 kHz to 1 MHz	A28 YIG Oscillator or A9 YIG Driver
Frequencies <3.2 GHz	A8 Output
Frequencies >3.2 GHz	A29 20 GHz Doubler or A30 Modulation Filter

Overall Description

The overall description provides a functional overview of the Agilent signal generators.

Common functions:

- [A18 CPU](#)
- [A19 Power Supply](#)
- [Input/Output Interface](#)

Specific signal generator functions:

- [Frequency Generation](#)
- [Output Power Level/Automatic Leveling Control](#)
- [Analog Modulation \(Pulse, AM/FM, UNW Fast Pulse and Phase Modulation\)](#)

A18 CPU

The A18 CPU controls all activities in the signal generator:

- translating information entered from the front panel keys, LAN, GPIB, or Auxiliary Interface (RS-232) into machine-level instructions
- communicating translated instructions on the internal buses
- monitoring critical circuits for problems, such as unlevelled and unlocked conditions
- reporting (on the front panel display) any problems with critical circuits

A19 Power Supply

Voltages

The main power supply converts line voltage (120 Vac or 240 Vac) to regulated dc voltages. Some of the required dc voltages are not directly available from the main power supply and are provided by re-regulating one of the main power supply voltages to the required voltage. This regulation can take place on any assembly and then routed to the required assemblies.

Line Module

The line voltage connects to the power supply through the A22 Line Module. Because the power supply automatically detects and adjusts to different line voltages, manual line voltage selection is neither necessary nor available. The power supply has an internal line fuse that cannot be replaced. If the fuse opens, the power supply must be replaced.

Power Supply Thermal Sensors and fans

Two thermal sensors prevent the signal generator from overheating. One sensor is internal to the A19 Power Supply; the other sensor is on the A8 Output. If the signal generator goes into thermal shutdown, the amber and green LEDs on the front panel blink on and off.

There are two fans in the instrument. One fan cools the power supply. The other is a variable speed fan that increases and decreases its speed to regulate the instrument's internal temperature. For reliability, it is important to operate the instrument with the covers installed to ensure proper airflow and cooling.

Input/Output Interface

Front Panel

The signal generator accepts inputs through the front panel hardkeys and the display softkeys, and provides outputs on the front panel display, and through the RF output connector and rear panel connectors. Depending on the model, features, and options, the front panel may have modulation input/output BNC connectors installed but not operational if the option associated with that connector is not also installed.

When line voltage is present and the signal generator is in standby mode, the amber LED above the power switch lights. When the signal generator is in power-on mode, the green LED (also above the power switch) lights.

Hardkeys/Softkeys

The front panel has two types of keys:

Hardkeys are dedicated to specific functions, entering values for the most commonly used features, and controlling the display's contrast and intensity.

The front panel keypad uses a row and column configuration. Pressing a key makes a connection between a row and column. The row and column information is routed to the A18 CPU where it is interpreted, and the corresponding function executed.

Softkeys, located along the display, are used to select the function displayed to the left of the key (on the display). When a softkey is pressed, the displayed function changes.

A2 Display

A liquid crystal display (LCD) provides information about the instrument's settings and condition. The LCD requires a power supply, lighting, and data:

- The A4 inverter converts dc voltage to the ac voltage required by the display.
- A backlight (a bulb powered by the A4 Inverter) lights the display so that information is visible.
- The A18 CPU generates data, which is routed to the LCD through the A3 Power Switch assembly.
- To extend the life of the LCD, an available sleep mode turns the LCD off after a defined inactive period (no key presses or program commands) and turns it back on with any key press.

RF Output Connector

The RF output connector is a Type-N.

Rear Panel

The rear panel contains the power line module, LAN, GPIB, RS-232, scalar interface, and BNC connectors used for sweep interface. BNC and SMB connectors may be present on the rear panel but not operational if the option associated with that connector is not installed.

Frequency Generation

The YIG oscillator generates frequencies from 3.2 to 10 GHz.

Output Frequency	Oscillator Frequency	Path	Notes
< 250 MHz	3.2 to 10 GHz	Lowband path, and part of highband path	A6 Frac-N signal is mixed with a 1 GHz signal on the A8 output assembly; the difference is used to generate the lower frequencies.
250 MHz to 3.2 GHz	4 to 8 GHz		Oscillator output is divided by 2/4/8/16 on the A6 Frac-N assembly.
> 3.2 GHz	3.2 to 10 GHz	Highband path	

Highband Path – Frequencies 3.2 GHz and Above

The output of the YIG oscillator (>3.2 GHz) is routed to the A29 20 GHz Doubler microcircuit. The signal is routed through a bypass circuit, then the signal is amplified and filtered.

The A29 20 GHz Doubler output is routed to the A30 Modulation Filter. The A30 contains amplitude and pulse modulators, amplifiers, and filters.

The output of the A30 Modulation Filter is routed to the A24 Highband Coupler and A25 Highband Detector, then through the AT1 attenuator to the front panel RF output connector.

Lowband Path – Frequencies Below 3.2 GHz

The YIG oscillator output is tuned between 4 and 8 GHz. The YIG oscillator output is routed to the A29 20 GHz Doubler microcircuit, where a portion of the signal is coupled off and routed to the A6 Frac-N. A divider on the A6 Frac-N divides the 4 to 8 GHz signal to a frequency between 250 MHz and 3.2 GHz. This signal is then routed to the A8 Output assembly where it is amplified, filtered and modulated.

Frequencies below 250 MHz are generated on the A8 Output by mixing the output signal from the A6 Frac-N (between 1000 and 750 MHz) with a 1 GHz LO from the A7 Reference.

The 100 kHz to 3.2 GHz signal is routed to the A23 Lowband Coupler/Detector, and then switched to the A25 Highband Coupler/Detector by a switch in the A30 Modulation Filter microcircuit, then to the attenuator and RF output connector.

Frequency Control

CW Mode

The A9 YIG Driver, A18 CPU, A7 Reference, A5 Sampler, and A6 Frac-N establish frequency accuracy and stability. This circuitry is commonly referred to as a phase lock loop (PLL).

In CW operation, the A18 CPU programs the A9 YIG Driver pre-tune DAC to output a voltage that coarsely tunes the YIG oscillator to the desired frequency. The A18 CPU also sets the A6 Frac-N VCO and the A5 Sampler phase dividers and VCO to a frequencies such that when the A6 Frac-N, A5 Sampler signal, and the YIG oscillator signals are in phase, the output of the phase comparator is 0 volts, and the phase lock loop is at the desired output frequency. When the phases of these two signals (YO feedback and reference) are *not* the same (in phase), the output of the phase detector changes to some voltage other than 0 volts.

The phase detector output is then integrated (the integrator voltage is proportional to the frequency error), and routed to the A9 YIG Driver where it is summed with the pre-tune DAC voltage, causing the YIG's output frequency to change. Once the phase of the two signals matches, the phase detector output voltage returns to 0 volts, and the integrator maintains a constant output voltage, holding the YIG output frequency constant.

To perform a phase comparison between the A6 Reference signal and the RF signal coupled off by the A20 Doubler, a sampling function on the A5 Sampler converts the RF (in GHz) to an IF frequency in the MHz range. A 10 MHz signal from the A7 Reference Assembly is used as the reference to the A6 Frac-N VCO (Voltage Controlled Oscillator) to maintain the A6 Frac-N frequency accuracy. The frequency reference for the A7 Reference can be an:

- external 10 MHz signal
- internal high stability 10 MHz OCXO (Oven Controlled Crystal Oscillator) and the A7 Reference

In summary:

- The A18 CPU coarse tunes the YIG, and sets the A5 Sampler VCO frequency and the A6 Frac-N VCO frequencies.
- The A5 Sampler and A6 Frac-N VCO frequencies are not fixed, and vary according to the YIG frequency.
- In some modes, the A6 Frac-N's VCO is divided on the A5 Sampler.
- The A5 Sampler converts the RF signal to an IF signal for phase comparison.
- After a phase detector determines the phase difference between the two signals, the phase detector output is integrated. The integrated voltage is summed with the A9 YIG Driver pre-tune DAC voltage, causing the YIG oscillator output frequency to change to the desired frequency.

Output Power Level/Automatic Leveling Control

The output power control circuitry, commonly referred to as the ALC loop, comprises the following:

- Two detectors: the A23 Lowband Coupler/Detector (frequencies ≤ 2 GHz) and the A24 Highband Coupler/A25 Highband Detector (frequencies > 2 GHz).

The couplers couple off a small portion of the RF signal and route it to the detectors. The detectors convert the RF signal to a dc voltage proportional to the RF power level. This dc voltage is routed to the A10 ALC and used to adjust the output power.

- An ALC assembly (A10)
- Two ALC modulators

In ALC leveling on (closed loop operation), the output level is detected and a voltage fed back and compared to a reference voltage. The output of the comparator controls the modulator drive current, which controls the output power level. When the detected and reference voltage levels are the same, the modulator drive current remains constant. When the detected and reference levels are not the same, the modulator drive current changes, causing the RF output power to increase or decrease until the reference and detected voltages are the same.

In ALC leveling off (open loop operation), only a reference voltage is used to control the modulation drive current. The comparator output is the sum of the reference voltage and stored calibration data for that frequency point; no feedback is provided. The stored calibration data is correction information stored in the instrument during power level calibration; it adjusts for any losses that occur after the coupler/detector. The reference voltage is generated on the A10 ALC by a DAC, the output voltage of which is the result of the power level set on the front panel.

Analog Modulation (Pulse, AM/FM, UNW Fast Pulse and Phase Modulation)

Pulse modulation provides pulse widths of 500 ns or greater with ALC off or in search mode, and 2 ns or greater with ALC on. Pulse option UNW provides pulse widths of 20 ns or greater for all frequencies with ALC off.

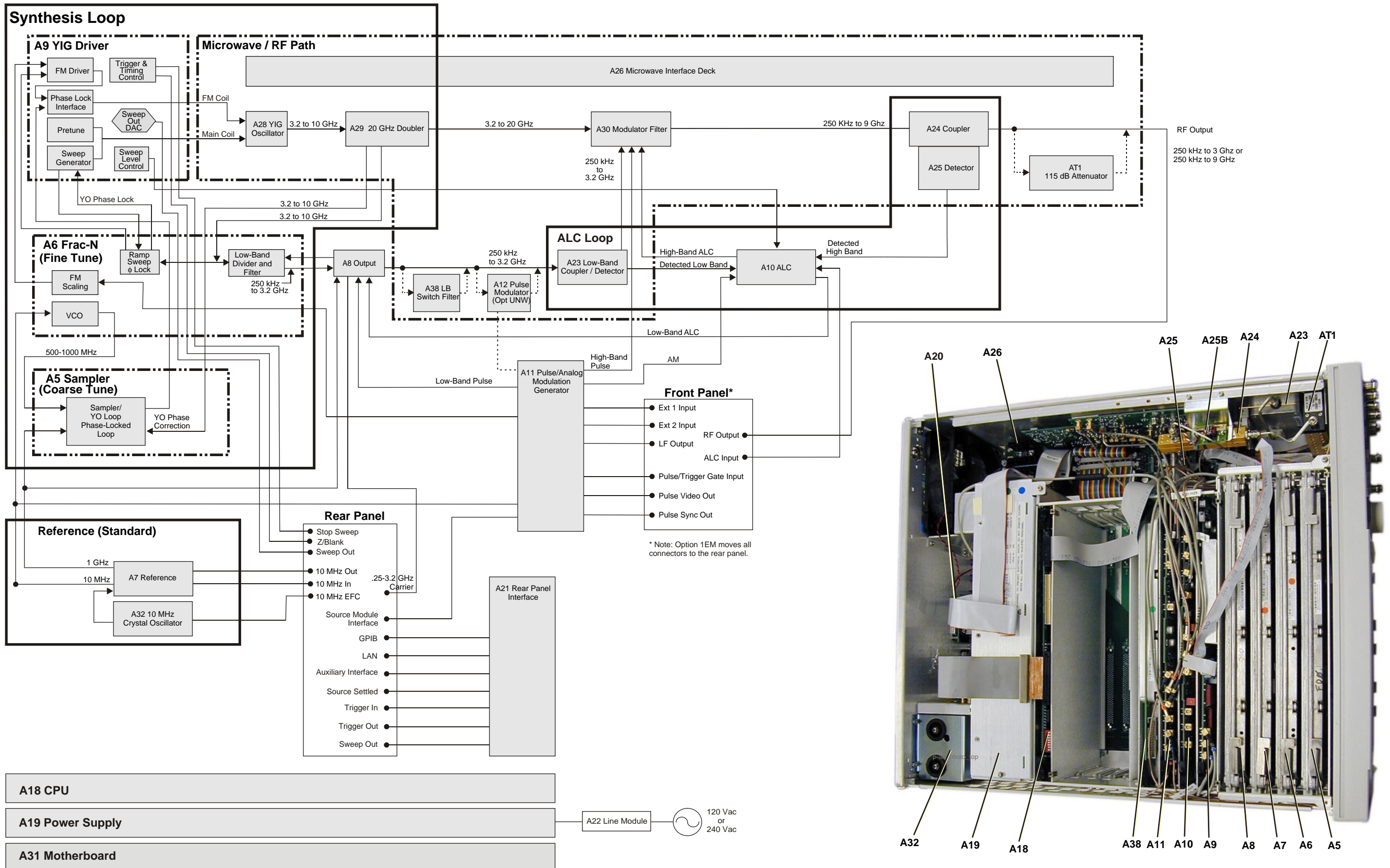
The RF can be modulated using either external or internal signals from the A11 Pulse/Analog Generator. The A11 Pulse/Analog Generator includes a pulse generator and a numeric synthesizer that provides AM, FM, PM, and pulse modulation capabilities. For better phase modulation control, the internal generator is tied to the A7 Reference 10 MHz.

Internally generated signals up to 1 MHz can be switched to the LF Output BNC on the front panel.

A11 Pulse/Analog output signals are routed as follows:

Modulation Type	Routed to
Amplitude	A10 ALC
Pulse	A30 Modulation Filter A8 Output
Frequency and Phase	A6 Frac-N

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Block Diagram for the Overall E8663B Analog Signal Generator

Reference/Synthesis Loop Description

The Reference/Synthesis Loop establishes the frequency characteristics of the signal generator. Frequency requirements include the following:

- fundamental frequency range generation
- phase noise
- frequency accuracy

Reference/Synthesis Loop Hardware

The hardware used includes the A7 Reference, A5 Sampler, A6 Frac-N, A7 Reference, A9 YIG Driver, A28 YIG Oscillator (YO), and A29 20 GHz Doubler.

CW Mode

The following two basic functions are used to generate an accurate frequency:

- coarse and fine tuning

The Pre-tune DACs on the A9 YIG Driver provide coarse tuning; the A5 Sampler and A6 Frac-N assembly provide fine-tuning.

- frequency monitoring or feedback

Example (5 GHz CW)

The A18 CPU sets the A9 YIG Driver Pre-tune DAC to a value such that the YIG oscillator output is approximately 5 GHz (within approximately 3 MHz). The A18 CPU also sets the A5 Sampler VCO and the A6 Frac-N VCO frequencies to the values necessary to generate a 5 GHz YIG Oscillator output.

The A29 20 GHz Doubler receives the output of the YIG oscillator, and couples off and routes a portion of the signal to the A5 Sampler.

On the A5 Sampler, the VCO output samples the 5 GHz from the A29 20 GHz Doubler and converts it to an IF frequency between 30 and 64 MHz. The IF signal is then filtered and routed to a phase detector.

The output of the VCO on the A6 Frac-N is also routed to the A5 Sampler, where a divide circuit generates the phase detector reference frequency.

At this point, the reference IF and the sampled IF are approximately at the same frequency/phase. When the two signals are in phase, the output of the phase comparator is 0 volts. If the two signals are not in phase, the phase detector generates a voltage proportional to the phase (frequency) difference or error.

The phase detector error voltage is integrated and summed with the YIG oscillator pre-tune voltage on the A9 YIG Driver, fine tuning the YIG oscillator output to exactly 5 GHz.

A5 Sampler

The A5 Sampler contains a microwave sampler used to convert a portion of the YIG oscillator output frequency to an IF frequency for phase comparison.

The A5 Sampler VCO provides the LO input to the sampler and the YIG oscillator provides the RF input. The VCO is phase locked to the 1 GHz reference board output. The 1 GHz signal is split into 2 paths. One path is divided by 4 and mixed with the other path to generate a 750 MHz signal. The 750 MHz signal is then split into 2 paths, one of which is divided down and input to a phase detector. The other path goes through a low pass filter and becomes the LO side of the mixer. The RF side of the mixer is the sampler VCO output. The mixer IF output then passes through a 155 MHz low pass filter and into the sampler phase detector. If the divided down 750 MHz path and the mixer output do not agree, a sampler lock is reported.

The A5 VCO output frequency (LO input) is set between 618 and 905 MHz, the RF input is between 3.2 and 10 GHz and the sampler output is an IF signal between 30 and 64 MHz. The IF signal passes through an 80 MHz low pass filter, eliminating all signals above 80 MHz that might pass through the sampler.

The IF signal is one input to a phase comparator. The second input to the phase comparator is 10 to 80 MHz, and is the result of dividing or mixing the 500 to 1000 MHz signal from the A6 Frac-N VCO. The output of the phase comparator is a voltage proportional to the difference in phase that is integrated and summed with the pre-tune voltage on the A9 YIG Driver, fine tuning the YIG oscillator to the desired frequency.

The sampler contributes to the phase noise at offsets between 10 KHz and 100 KHz. Phase noise is better in FM off mode than in FM on mode. In off mode the A6 Frac-N VCO signal on the A5 Sampler is divided down to get the phase comparator reference frequency of 10 and 80 MHz. In FM on mode, and for FM rates above 230 Hz, phase noise performance degrades because the A6 Frac-N VCO uses a mixer (required for higher FM rates) to get to the reference frequency.

A6 Frac-N

CW Mode

The A6 Frac-N uses a dividing technique to set the YIG Oscillator to the desired frequency. Because the A6 Frac-N VCO output is the phase reference for the comparator on the A5 Sampler, small changes in the Frac-N programmable divider number result in small changes in the A6 Frac-N VCO output frequency, which result in small changes in the YIG Oscillator frequency.

The A6 Frac-N can contribute to phase noise between 5 and 10 KHz. This overlaps with the frequencies over which the A7 Reference contributes to phase noise. There is no easy way to identify if a phase noise problem in the overlapping area is generated by the A6 Frac-N or A7 Reference, other than to try new assemblies.

FM Mode

FM rates up to 230 Hz are accomplished by combining the FM signal and the A6 Frac-N VCO tune signal to drive the YIG Driver main coil.

FM rates above 230 Hz are accomplished using the FM drive circuit on the A9 YIG Driver to drive the FM coil in the YIG Oscillator.

A7 Reference

Clean and stable reference signals are essential for low phase noise. In this case, two reference signals are provided:

- 1 GHz (to the A5 Sampler and the A8 Output, for down conversion)
- 10 MHz (to the A6 Frac-N for VCO phase coherency, and the A9 YIG Driver for DDS clock and baseband generator accuracy).

The *low phase noise* A7 Reference uses a 100 MHz VCXO that is multiplied by 10 to achieve 1 GHz, and a high performance 10 MHz OCXO.

The A7 Reference contributes to phase noise between 100 Hz and 10 KHz. See the “A6 Frac-N” assembly description on [page 1-56](#), for more information on phase noise.

A9 YIG Driver

CW Mode

The A9 YIG Driver provides the A28 YIG Oscillator tune voltage. Coarse tuning of the A28 YIG Oscillator occurs when the A18 CPU sets the pre-tune DAC's output voltage to a value that sets the YIG oscillator frequency close to the desired frequency. 3.2 volts out of the pre-tune DAC results in a 3.2 GHz YIG oscillator output. The A28 YIG Oscillator output (in GHz) is proportional to the pre-tuned DAC output (in volts).

The A6 Frac-N and A5 Sampler compare the phase of a reference signal and the YIG oscillator frequency. A correction voltage is generated and summed with the pre-tune voltage on the A9 YIG Driver, which fine tunes the A28 YIG Oscillator to the desired frequency. For higher rate FM operation, the FM signal is scaled and the gain calibrated on the A9 YIG Driver before being used to drive the FM coil in the A28 YIG Oscillator.

Both the A9 YIG Driver and the A28 YIG Oscillator contribute to phase noise between 100 KHz and 1 MHz.

A28 YIG Oscillator (Y0)

The A28 YIG Oscillator output frequency (3.2 to 10 GHz) is controlled by the amount of current through the main and FM coils. The main coil is used to set the frequency and for FM ≤ 230 Hz. The FM coil is used for FM rates > 230 Hz.

Both the A9 YIG Driver and the A28 YIG Oscillator contribute to phase noise between 100 KHz and 1 MHz.

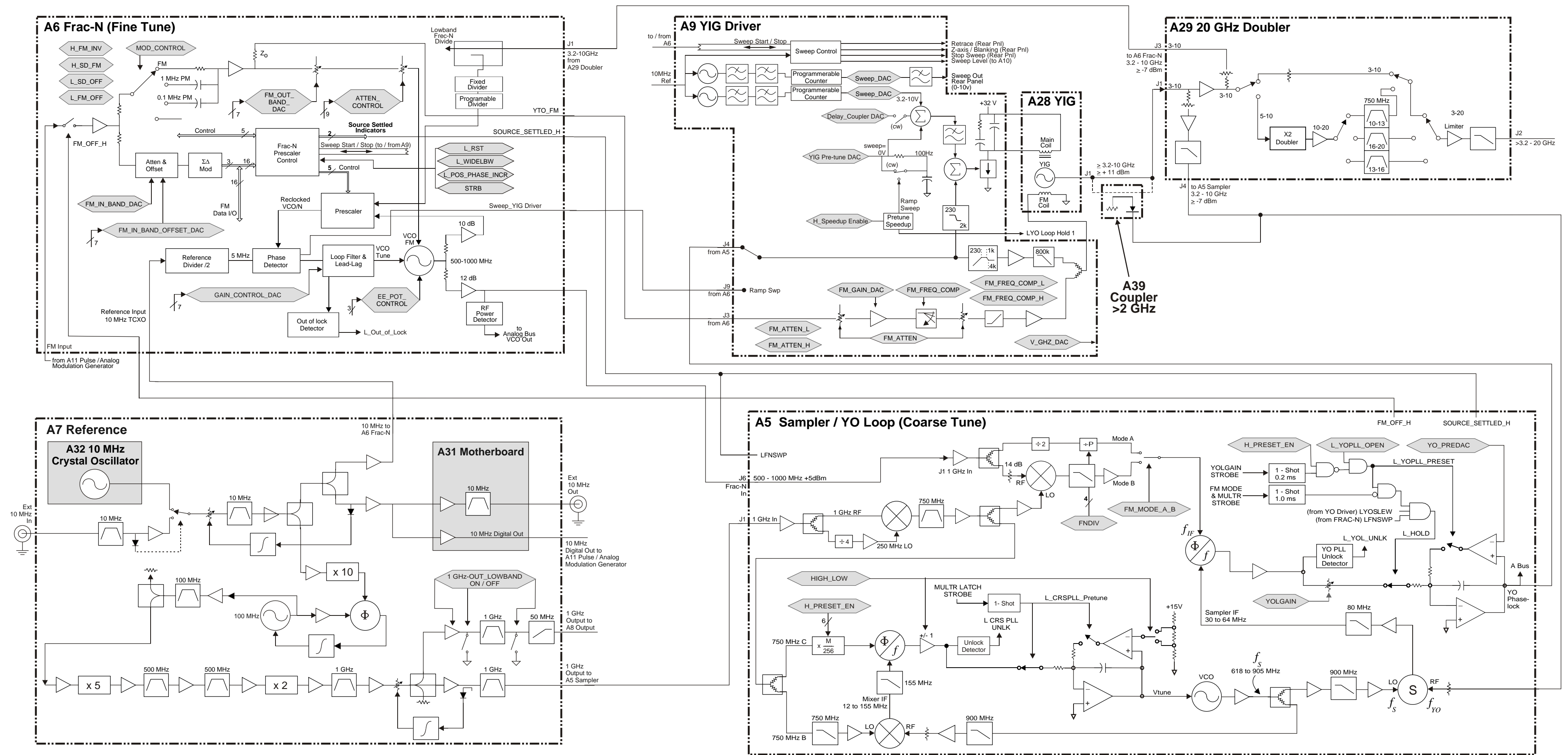
A29 20 GHz Doubler

The A29 20 GHz Doubler provides:

- a thru path for output frequencies from 3.2 to 10 GHz
- two internal couplers that provide a 3.2 to 10 GHz signal to both the A6 Frac-N to generate RF frequencies ≤ 3.2 GHz; and the A5 Sampler to provide the feedback needed for fine tune correction in CW mode
- RF signal amplification and filtering

Both the A29 20 GHz Doubler and the A30 Modulation Filter contribute to phase noise >3.2 GHz.

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RF Path Description (Frequency Generation, Level Control, and Modulation)

The RF path includes hardware for amplitude and pulse modulation, and to control the RF output power level. The Synthesis/Reference Block Description provides additional information on generating fundamental frequencies >3.2 GHz to 9 GHz.

All RF signals originate from the A28 YIG Oscillator (YO) output frequencies of 3.2 GHz to 10 GHz. RF output frequencies below 3.2 GHz are generated by dividing the YO signal on the A6 Frac-N and A8 Lowband Output assembly. RF output frequencies between 3.2 and 10 GHz pass through the A29 20 GHz Doubler.

Hardware

The RF Path comprises the following:

- A6 Frac-N
- A8 Output
- A12 Fast Pulse Modulation (Option UNW)
- A29 20 GHz Doubler
- A30 Modulation Filter
- AT1 Attenuator

A6 Frac-N

The A6 Frac-N is part of the Synthesis Loop *and* the RF lowband path.

The RF signal from the A29 20 GHz Doubler is amplified, filtered, divided (dividers generate RF output frequencies below 3.2 GHz), and then amplified again before being routed to the A8 Output.

The A8 Output provides the A6 Frac-N a pre-level bias voltage to maintain the required RF output level to the A8 Output assembly.

Troubleshooting note: To check the A6 Frac-N RF output level to the A8 Output, remove the A8 Output from the signal generator while the signal generator is powered on. If the A8 Output is removed while the power is on, the pre-level bias is maintained on the A6 Frac-N, maintaining the RF power level on the A6 Frac-N output. Turn the instrument off before reinstalling the A8 Output.

A8 Output

The A8 Output is in the RF lowband path; it provides:

- pre-level bias voltage to the RF output level control on the A6 Frac-N
 - For frequencies up to 3.2 GHz, the ALC diode controls the RF output power level. Without bias applied to the ALC diode, the output power goes to the maximum level. In closed-loop operation, the A10 ALC uses a negative voltage from both the A23 (< 2 GHz) and A24/25 (>2 GHz) coupler/detectors to control the ALC diode's bias.
- pulse modulation
 - Pulse modulation (RF pulsed on) is achieved by applying +5 Vdc to the pulse circuitry on the A8 Output. +5 Vdc turns the RF signal on; removing the +5Vdc turns the RF signal off. In instruments with Option UNW (fast pulse) the pulse modulation input cable is moved from the A8 Output to the A12 Fast Pulse Modulator and the A8 diode is biased on.
- amplitude modulation
- the circuitry to generate under-range frequencies (<250 kHz)

Under-range frequencies are the result of mixing the A6 Frac-N RF signal with a 1 GHz signal from the A7 Reference and using the difference between the two signals for the output. The A8 Output signal passes through the A23 Lowband Coupler/Detector to the A30 Modulation Filter.

A12 <3.2 GHz Fast Pulse Modulator (Option UNW)

Option UNW is a hardware/firmware (license key) option that provides improved pulse performance (see the data sheet for specific pulse width performance). A firmware license key is required to turn Option UNW on; additional hardware is also required. The additional hardware for this option is installed in the lowband path between the A8 Output and the A23 Lowband Coupler Detector. The pulse drive signal is electrically switched from the A8 Output to the UNW hardware, and the pulse diode on the A8 Output is biased on, allowing the RF signal to pass through. The pulse shaper circuitry on the A11 Pulse Modulator needs to be set using a license key to provide narrower pulse widths.

A23 Lowband Coupler/Detector, A24 Highband Coupler, and A25 High Band Detector

The coupler couples off a portion of the RF signal which is then detected and used to monitor the RF output power level. The detector converts the coupled RF signal to a dc voltage that is routed to the A10 ALC, where it is compared to a reference voltage and integrated. The integrated output provides the ALC diode bias.

The A23 Lowband Coupler/Detector is used for frequencies ≤ 2 GHz; the A24 Highband Coupler and A25 Highband Detector are used for frequencies > 2 GHz.

The A24 Highband Coupler and A25 Highband Detector are located after the A30 Modulation Filter. The output of the A24 Coupler is routed to the attenuator and then to the RF output connector.

The A23 Lowband Coupler/Detector is located prior to the A30 Modulation Filter where the low band signal is switched into the highband path. Because the A23 Lowband Coupler/Detector is a single unit, the coupler and detector must be replaced together; the A24 Highband Coupler and A25 Highband Detector are separate units that you can replace independently.

A29 20 GHz Doubler

The A29 20 GHz Doubler provides RF signals to the:

- synthesis loop (described on [page 1-59](#))
- low (< 3.2 GHz) band RF path (to the A6 Frac-N)
- high (> 3.2 GHz) band RF path

Frequencies 3.2 to 10 GHz pass through the A29 20 GHz Doubler and are routed to the A30 Modulation Filter.

A30 Modulation Filter

The A30 Modulation Filter routes the highband and lowband signals to the A24 Coupler. The output frequency range of the A30 Modulation Filter is 100 kHz to 20 GHz. For frequencies > 3.2 GHz, the A30 Modulation Filter provides amplitude and pulse modulation circuitry, power level control, and filtering. Frequencies < 3.2 GHz are simply switched through the A30 Modulation Filter and are not filtered or modulated by any circuitry in the A30 Modulation Filter.

At frequencies ≥ 3.2 GHz, the highband ALC diode within the A30 Modulation Filter provides level control and amplitude modulation. With no bias applied to the ALC diode, output power is at the maximum power level.

ALC Loop

The ALC loop maintains power level control and power level accuracy. Level accuracy is achieved by converting a portion of the RF signal to a dc voltage, comparing the measured dc voltage to a reference dc voltage, integrating the difference, and using the integrated output to drive the ALC modulation diode. Level control is achieved by adjusting the reference voltage.

The A23 Lowband Coupler/Detector, A24 Highband Coupler and A25 Highband Detector couple off the RF signal and convert it to a dc voltage. Because the coupled signal is a known ratio of the RF output power, it can be used to control the RF output level. On the A10 ALC assembly, the dc is compared to a reference voltage and integrated. The integrated voltage is used to drive the modulator diodes on the A8 Output and the A30 Modulation Filter. Temperature-sensing circuits maintain level correction over the specified temperature range.

A10 ALC

The A10 ALC assembly provides circuitry for level control and amplitude modulation. In *ALC On* mode (closed-loop operation), the output signal level is continually monitored and used to adjust the modulator diode output to produce the desired RF output level. In *ALC On* mode, the A10 ALC integrates the difference between the detected voltage and the reference voltage to adjust the modulator diode drive until both voltages agree. The A23 Lowband Coupler/Detector, A24 Highband Coupler, and A25 Highband Detector provide the feedback (detected DC) voltage to the A10 ALC. On the A10 ALC, the reference voltage is generated by DACs that are controlled by the CPU. The DAC's output voltage is calibrated to the RF output power level.

In *ALC Off* mode (open-loop operation), the feedback path (the RF detected voltage path) is opened, and only the reference voltage is used to set the output power level. With the modulator reference level set to a fixed drive level, and without the output level being monitored, the RF output level can vary from the set power level. In open-loop operation, the power level can also drift over time due to changes in temperature.

In *external leveling* operation, the internal detectors are replaced with an external detector, so the level control voltage is provided by the external detector. The external detector must be a negative detector to provide the correct

polarity for the A10 ALC. In standard instruments, the external leveling operating range is option-dependent, but is either -20 dBm or -15 dBm to maximum power.

Level accuracy is a function of the detector and instrument calibration. Because the instrument is calibrated with internal detectors, external level accuracy depends on the difference in characteristics between the internal and external detectors.

When *internally* leveled, the ALC circuit is temperature compensated to improve level accuracy over the specified temperature range. Temperature compensation for the A25 Highband Detector consists of a temperature sensing circuit on the A24 Highband Coupler. A resistor pack calibrates the A25 Highband Detector; if the A25 Highband Detector is replaced, a new resistor pack is provided with the new detector, and must be installed on the A24 Highband Coupler. Although rare, unstable level performance above 2 GHz can result from poorly soldered resistors on the resistor pack, or with other components in the temperature compensation circuit.

The A23 Lowband Coupler Detector temperature correction circuit is inside the A23 Lowband Coupler Detector package. Because the lowband detector and coupler are in one package, they cannot be replaced independently.

Modulation (AM, FM, Φ M, Standard Pulse, Option UNW–Fast Pulse)

The A11 Pulse/Analog Modulation Generator provides modulation signals for AM, FM, pulse, and phase, and SYNC OUT and VIDEO OUT. For phase synchronization and modulation accuracy, a dual function generator on the A11 Pulse/Analog Modulation Generator is tied to the 10 MHz reference from A7 Reference. Pulse Input, EXT1, and EXT2 provide external modulation input connections. A front panel low frequency output connector (LF Output) can be selected to output the signal generated by the A11 Pulse/Analog Modulation Generator and can be used to drive other instruments.

EXT 1 and EXT 2 inputs contain modulation drive level detection circuits that generate error messages if the signal applied to the input is too small or too large. The input impedance of EXT 1 and EXT 2 can be set for 50 or 600 ohms, and can be configured for dc or ac coupling.

AM

The AM signal from the A11 Pulse/Analog Modulation Generator is routed to the A10 ALC, where it is summed with the ALC reference voltage where it is used to drive the A30 Modulation Filter, and A8 Output ALC diodes.

FM/ Φ M

The FM/ Φ M signal is routed from the A11 Modulation Generator to the A6 Frac-N. On the A6 Frac-N:

- FM rates < 4 kHz are applied to the pre-scale control circuit and the A6 Frac-N VCO. This generates a change in the pre-scaled drive (feedback from the VCO) to the VCO's phase detector, causing a VCO frequency change.
- FM rates 4 kHz to 100 kHz are applied only to the A6 Frac-N VCO.
- FM rates >100 kHz are routed from the A6 Frac-N to the A9 YIG Driver and applied to the FM coil in the YIG Oscillator.
- For phase modulation, the FM drive signal is routed through an LCR circuit Other than the LCR circuit, Φ M signals are routed the same as FM signals.

Pulse (Option UNW)

Pulse modulation signals from the A11 Pulse/Analog Modulation Generator depend on the option and are routed directly to the A8 Output or the A12 Pulse Modulation (UNW) pulse diodes. Pulse diodes must be biased on to pass RF signals. Because ALC bandwidth is limited, the ALC circuit can only level pulse widths > 1 microsecond. To level pulse widths < 1 microsecond, use search mode. Search mode calibration sequencing is as follows:

1. Modulation is turned off.
2. The ALC feedback loop is closed and the RF power leveled.
3. The ALC feedback loop is opened and the integrated output voltage used to drive the ALC diodes is maintained at the level determined during closed loop operation (step 2).

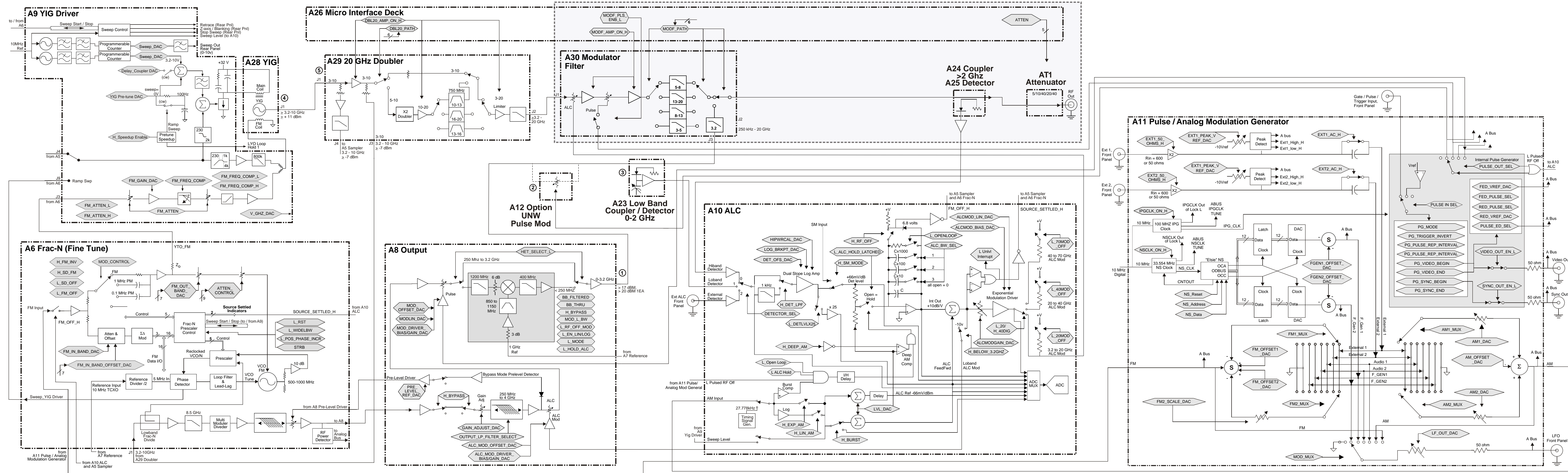
Changes in power level, frequency, or pulse settings cause the signal generator to repeat the search mode leveling procedure and determine a new ALC diode drive level. Because drift in that leveling circuit can occur over time in open-loop operation, it is not recommended to stay in search mode for extended periods of time without closing the loop and refreshing the ALC diode drive voltage.

Approximate Device Gains and Losses

You can troubleshoot assemblies in the RF path by measuring gains and losses and comparing them to [Table 1-22](#), below. See [“Troubleshooting RF Power Levels” on page 1-43](#) for more information.

Table 1-22 Approximate Device Gains and Losses

Item #	Device	Gain/Loss	Value (dB)
1	A8 Output	N/A	> 20
2	A23 Lowband Coupler	Loss	< 3
3	A28 YO Output	N/A	> 11
4	A29 20 GHz Doubler J1 to J2 J1 to J3 and J4	Gain	> 1
		Loss	< 18
5	A30 Modulator Filter J1 to J2 J1 to J4 J3 to J4	Gain	> 8
		Gain	> 9
		Loss	< 3
6	A24 Highband Coupler < 3.2 GHz 2–9 GHz	Loss	< 2.5
			< 0.5
7	AT1 (0 dB step)	Loss	< 2.5



Self-Test Overview

A group of tests (self-tests) are embedded in the signal generator's firmware that can evaluate the condition of the circuitry on many of the assemblies. Self-tests check hardware performance under controlled conditions, and compare test results to predetermined limits. If the results fall within the limits the signal generator passes. If the results of one or more tests fall outside the limits, the self-test routine evaluates the failures and reports the most independent failure.

Because self-tests are designed to check signal generator *hardware*, the signal generator does not need to be calibrated for self-tests to pass. Self-tests are designed with the philosophy that it is better to pass a defective signal generator than to fail a good one; some failures will pass, rather than be detected and reported. If the signal generator powers on and self-tests can be run, always start troubleshooting by running self-tests and resolving reported problems.

How self-test works:

1. When the signal generator is tested at the factory, self-test limits are loaded into the A18 CPU memory from devices on each assembly, or from fixed files. Most assemblies contain limit information, while microcircuit limits must be loaded.
2. When the program runs, latches and DACs are set to a known state.
3. An analog mux routes the detected dc signal from the selected test node to the A18 CPU.
4. The A18 CPU compares the detected dc level to the test limit. If the detected value is within the limits, the A18 CPU reports a pass.
5. If one or more detected values fall outside the limits, the most independent failure is determined and reported.

Independent failures

An example best illustrates independent failures; in this example, there are three assemblies in a series: A1, A2, and A3. The output of A1 is the input for A2, and the output of A2 is the input for A3. If the output of A1 is bad, A2 and A3 outputs are also bad. If the output of A2 is bad, the output of A3 is also bad. A file in the signal generator contains this dependency knowledge for the signal generator to use to identify the most independent failure. If A1, A2, and A3 self-tests all fail, the signal generator reports A1 as the most independent failure. If A1 passes but A2 and A3 fail, self-test reports A2 as the most independent failure. If A2 passes and A3 fails, self-test reports A3 as the most independent failure. If two independent failures occur, self-test reports only one failure at a time and reports the second failure after the first reported failure is repaired.

Troubleshooting procedures in this chapter are based on the most independent failure, and no lower level information is needed. Although not needed for troubleshooting, the self-test overhead does provide features to view lower level detailed information about the subroutines, and select specific routines to run. These features include:

- Select/Deselect Test
- Select/Deselect All
- View Details
- Run Highlighted Tests
- Run Selected Tests
- When View Details is selected, the highlighted test's measured value, lower, and upper limits are displayed.

Contacting Agilent Technologies

If you have a problem with your signal generator, contact your nearest sales and service office (refer to [page 1-70](#)). When calling, please be prepared with the following information:

Model Number: _____ **Serial Number:** _____
Firmware Revision: _____ **Installed Options:** _____
Firmware Date: _____

If you are having problems with an option upgrade

What option(s) are you trying to install: _____
Describe the problem: _____

If you suspect a hardware problem

Self-test results:
Pass/Fail: _____
Reported self-test failure: _____
Error message reported on the front panel:
Unlock: _____
Unleveled: _____
Other: _____
Did the instrument fail when it arrived, has it been degrading over time, or was it working for some time and then failed?
Describe the problem: _____
What action has been taken: _____

If you are having a problem with performance tests or adjustments

Software revision: _____
Name of adjustment or performance test: _____
Reported software message: _____
Describe the problem: _____

If you are having a problem with an application

Describe what you want to do: _____

Describe the problem: _____

Agilent Sales and Service Offices

Assistance with test and measurements needs, and information on finding a local Agilent office is available on the Web at:

<http://www.agilent.com/find/assist>

If you do not have access to the Internet, please contact your field engineer.

NOTE In any correspondence or telephone conversation, refer to the signal generator by its model number and full serial number. With this information, the Agilent representative can determine whether your unit is still within its warranty period.

Packaging a Signal Generator for Return

1. Use the original packaging materials or a strong shipping container that is made of double-walled, corrugated cardboard with 159 kg (350 lb.) bursting strength. The carton must be both large enough and strong enough to accommodate the signal generator and allow at least 3 to 4 inches on all sides of the signal generator for packing material.

CAUTION Signal generator 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 instrument or prevent it from shifting in the carton. Styrene pellets cause equipment damage by generating static electricity and by lodging in the signal generator fan.

2. Surround the instrument with at least 3 to 4 inches of packing material, or enough to prevent the instrument from moving in the carton. If packing foam is not available, the best alternative is SD-240 Air Cap™ from Sealed Air Corporation (Hayward, CA 94545). Air Cap looks like a pink plastic sheet covered with 1-1/4 inch air-filled bubbles. Use the Air Cap to reduce static electricity. Wrap the instrument several times in the material to both protect the instrument and prevent it from moving in the carton.
3. Seal the shipping container securely with strong, nylon adhesive tape.
4. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to ensure careful handling.
5. Retain copies of all shipping papers.

2 Replaceable Parts

Ordering Information

To order a part, do the following:

1. Determine the part number.
2. Determine the quantity required.
3. Mail this information to the nearest Agilent Technologies office or, in the U.S., call the hot-line number listed in the following section.

To order a part not listed in the replaceable parts lists, mail the following information to the nearest Agilent Technologies office or, in the United States, call the hot-line number listed in the following section.

1. the instrument model number
2. the serial number and options, if any (see rear panel)
3. a description of the part
4. a description of the part's function
5. the quantity required

Order Parts Fast

When you have gathered the information required to place an order, go to the Agilent Technologies Technical Support website:

<http://www.agilent.com/find/techsupport>

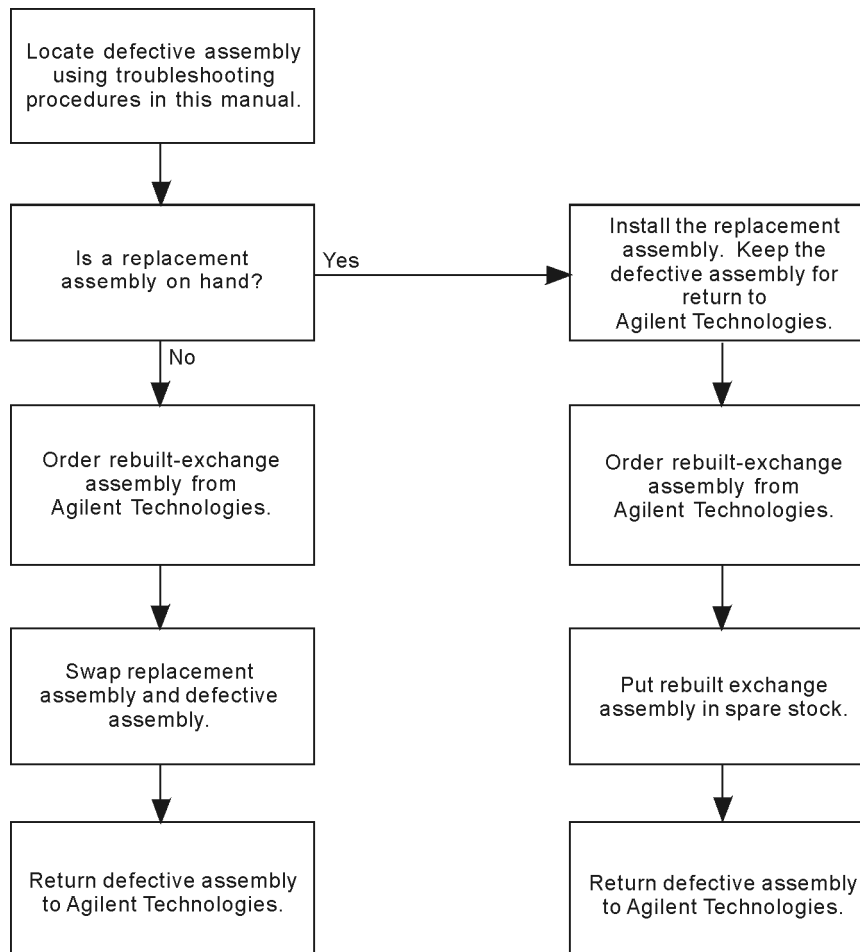
Save Money with Rebuilt-Exchange Assemblies

Under the rebuilt-exchange assembly program, certain factory-repaired and tested assemblies are available on a trade-in basis. These assemblies cost less than a new assembly, and meet all factory specifications required of a new assembly.

The defective assembly must be returned for credit under the terms of the rebuilt-exchange assembly program. The figure below illustrates the assembly exchange procedure in flowchart format.

NOTE When ordering replacement parts, ask about exchange assemblies.

Figure 2-1 Assembly Exchange Procedure



Shipping a Defective Assembly Back to Agilent Technologies

1. When you receive the rebuilt assembly, be careful not to damage the box in which it was shipped. You will use that box to return the defective assembly. The box you receive should contain the following:
 - the rebuilt assembly
 - an exchange assembly failure report
 - a return address label
2. Complete the failure report.
3. Place the failure report and the defective assembly in the box. Be sure to remove the enclosed return address label.
4. Seal the box with tape.

If you are inside the United States, stick the pre-printed return address label over the label that is already on the box and return the box to Agilent Technologies. (Agilent Technologies pays postage on boxes mailed within the United States.)

If you are outside the United States, do not use the return address label; instead, address the box to the nearest Agilent Technologies sales and service office.

Frequency, Hardware, and Personality Options

This section lists the options available with the Agilent E8663B analog signal generator.

Frequency Options	
503	100 kHz to 3.2 GHz frequency range
509	100 kHz to 9.0 GHz frequency range

Hardware Options	
1EM	Moves all front panel connectors to rear panel
1EZ	Extends support life
UNW	Adds fast pulse < 3.2 GHz

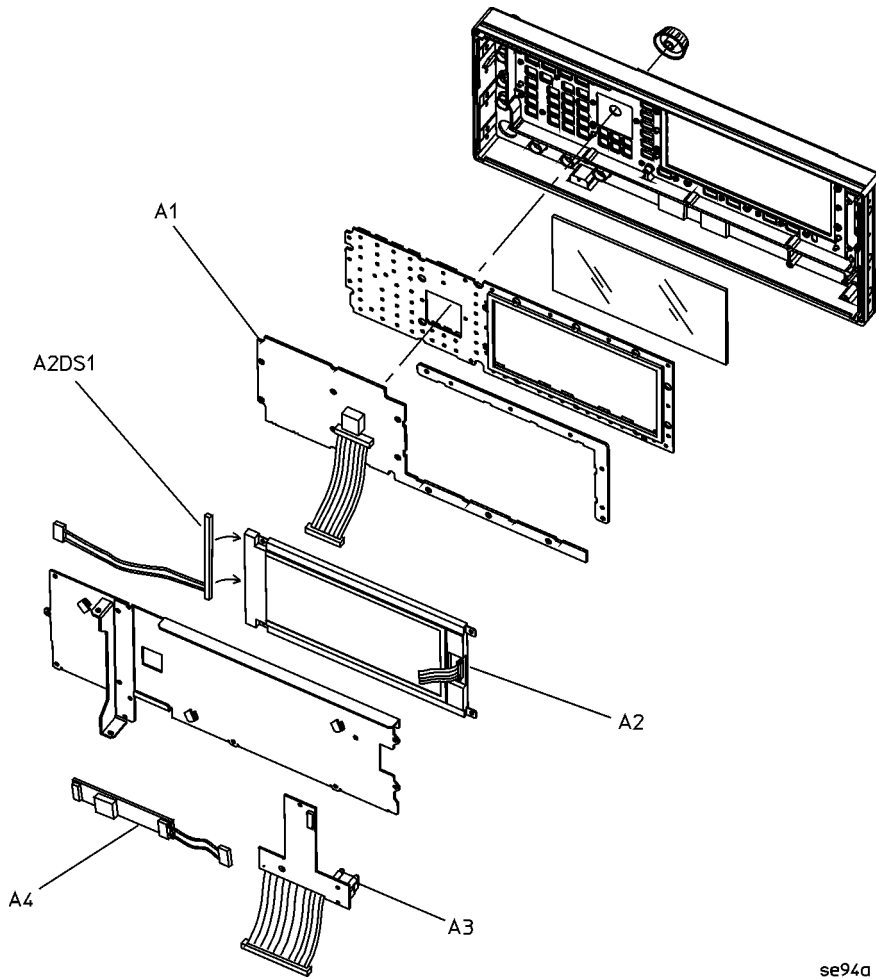
Assemblies and Hardware Options

Assembly	Part Number	Page Number
A1 Keyboard	E8251-60058	2-5
A2 Display	2090-0375	2-5
A2DS1 Display Backlight	1513-5204	2-5
A3 Power Switch	E8251-60042	2-5
A4 Inverter	0950-3757	2-5
A5 Sampler	E8251-60043	2-6
A6 Frac-N	E8251-60328	2-6
A7 Reference	E8251-60348	2-6
A8 Output	E8251-60075 ^a	2-6
A9 YIG Driver	E8251-60080	2-6
A10 ALC	E8251-60375	2-6
A11 Pulse/Analog Modulation Generator	E8251-60306	2-6
A12 Pulse Modulator Board	E8251-60064	2-9
A18 CPU	E8251-60006	2-6 and 2-10
A18BT1 Lithium Battery	1420-0314	2-10
A19 Power Supply	0950-3700	2-6
A20 SMI (Source Module Interface)	E8251-60211	2-6 and 2-7
A21 Rear Panel Interface	E8251-60203	2-7 and 2-9
A22 Line Module	5064-5053	2-7 and 2-9
A23 Lowband Coupler/Detector	E8251-60010	2-6, 2-7, and 2-9
A24 20 GHz Highband Coupler	0955-0148	2-6 and 2-8
A25 20 GHz Highband Detector	08360-60058	2-6 and 2-8
A25B Highband Detector Bias Board	08360-60091	2-6 and 2-8
A26 MID (Microwave Interface Deck)	E8251-60303	2-6 and 2-8
A28 YIG Oscillator	5087-7113	2-8 and 2-9
A29 20 GHz Doubler	5087-7058	2-9
A30 Modulation Filter with High Power	5087-7061	2-9
A31 Motherboard	E8251-60330	2-9
A32 10 MHz Crystal Oscillator	E8251-60071	2-6, 2-7, and 2-9
AT1 115 dB Mechanical Attenuator	E8251-60070	2-6, 2-8 and 2-9
B1 Fan	3160-4121	2-6, 2-7, and 2-9
RF Output Connector (Type-N)	08559-60002	2-26

^aRequires firmware version C.04.53 or greater.

Assemblies from the Inside Front Panel View

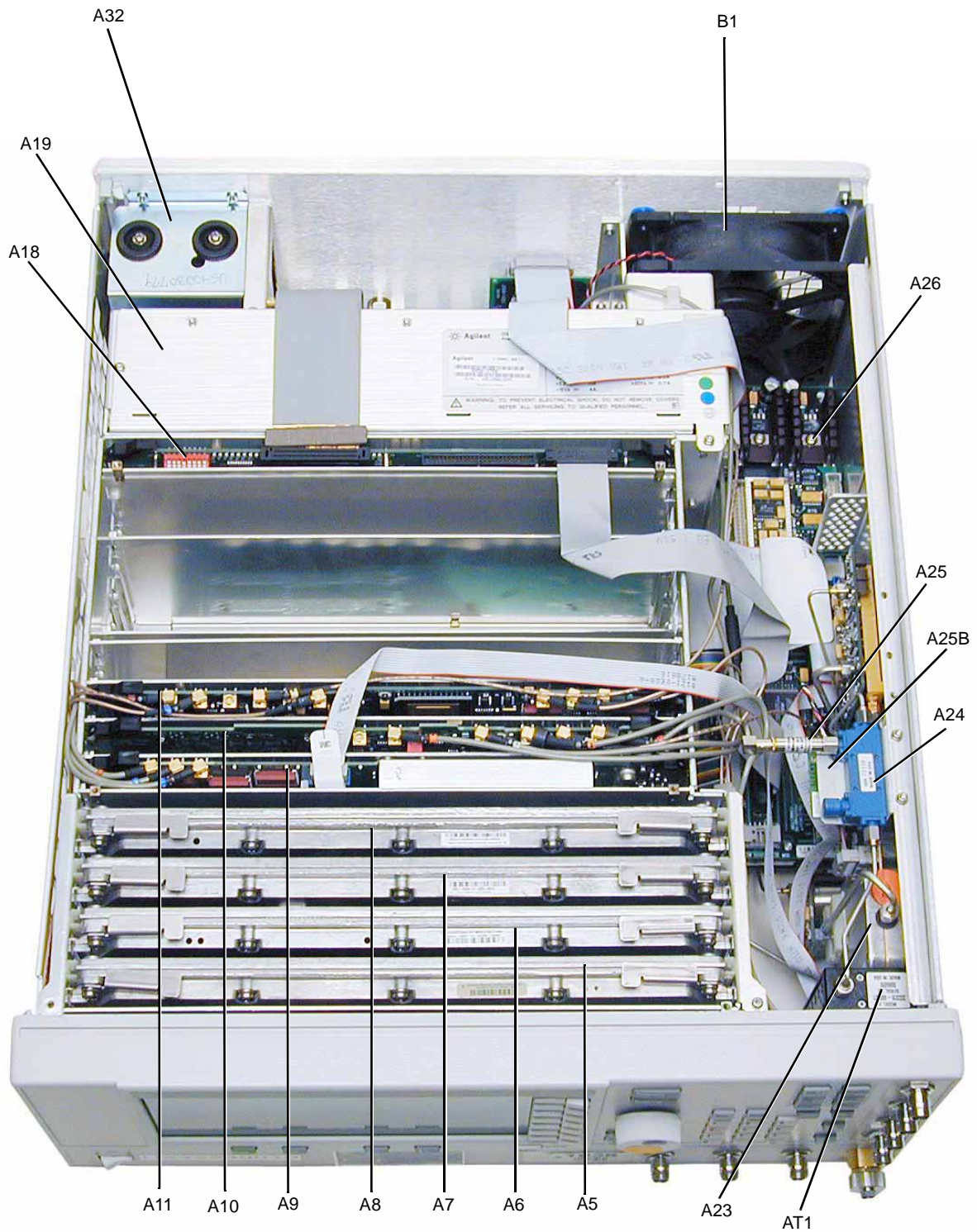
Figure 2-2 Assemblies from the Inside Front Panel View



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Assemblies from a Top View

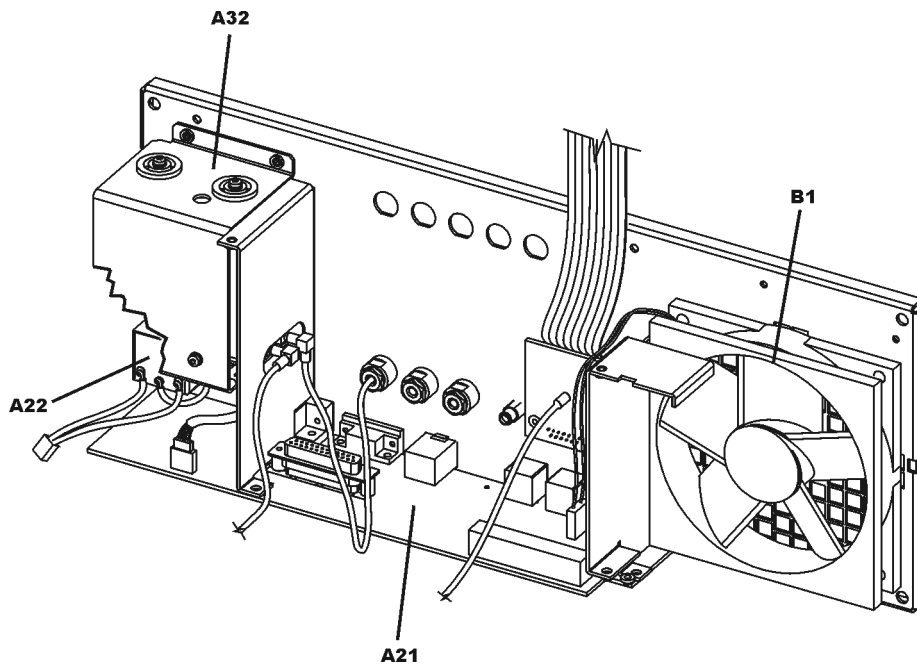
Figure 2-3 Assemblies from a Top View



analog_top

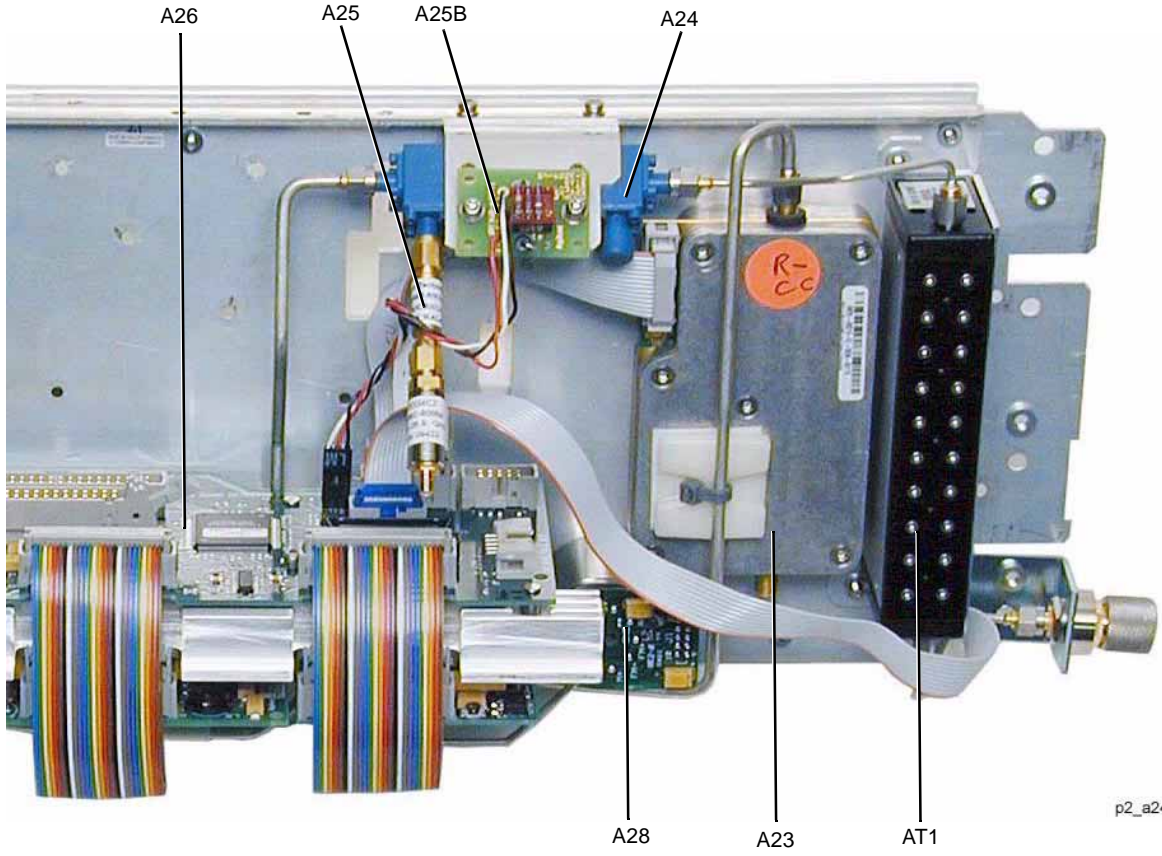
Assemblies from the Inside Rear Panel View

Figure 2-4 Assemblies from the Inside Rear Panel View



Assemblies from a Microcircuit Deck View

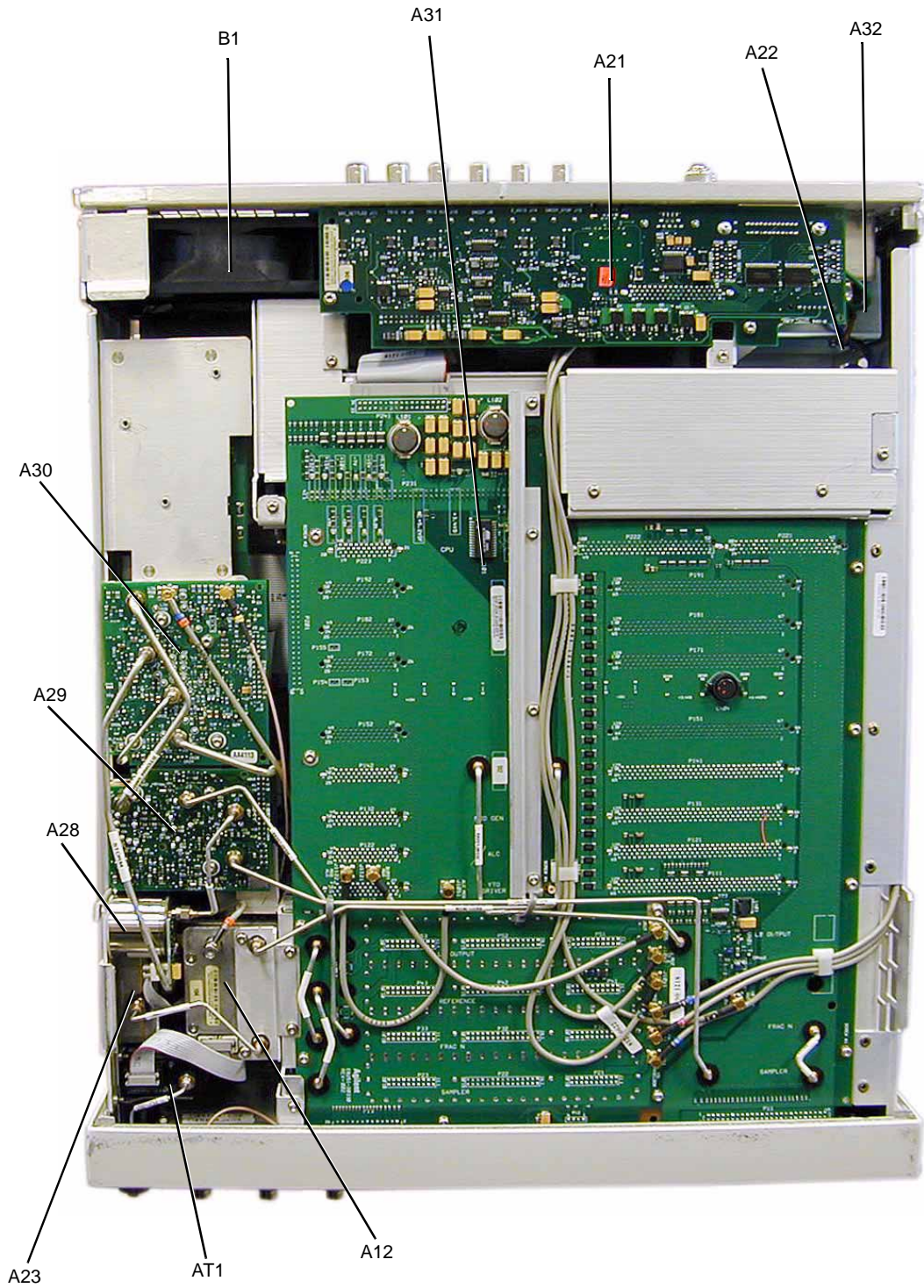
Figure 2-5 Assemblies from a Microcircuit Deck View



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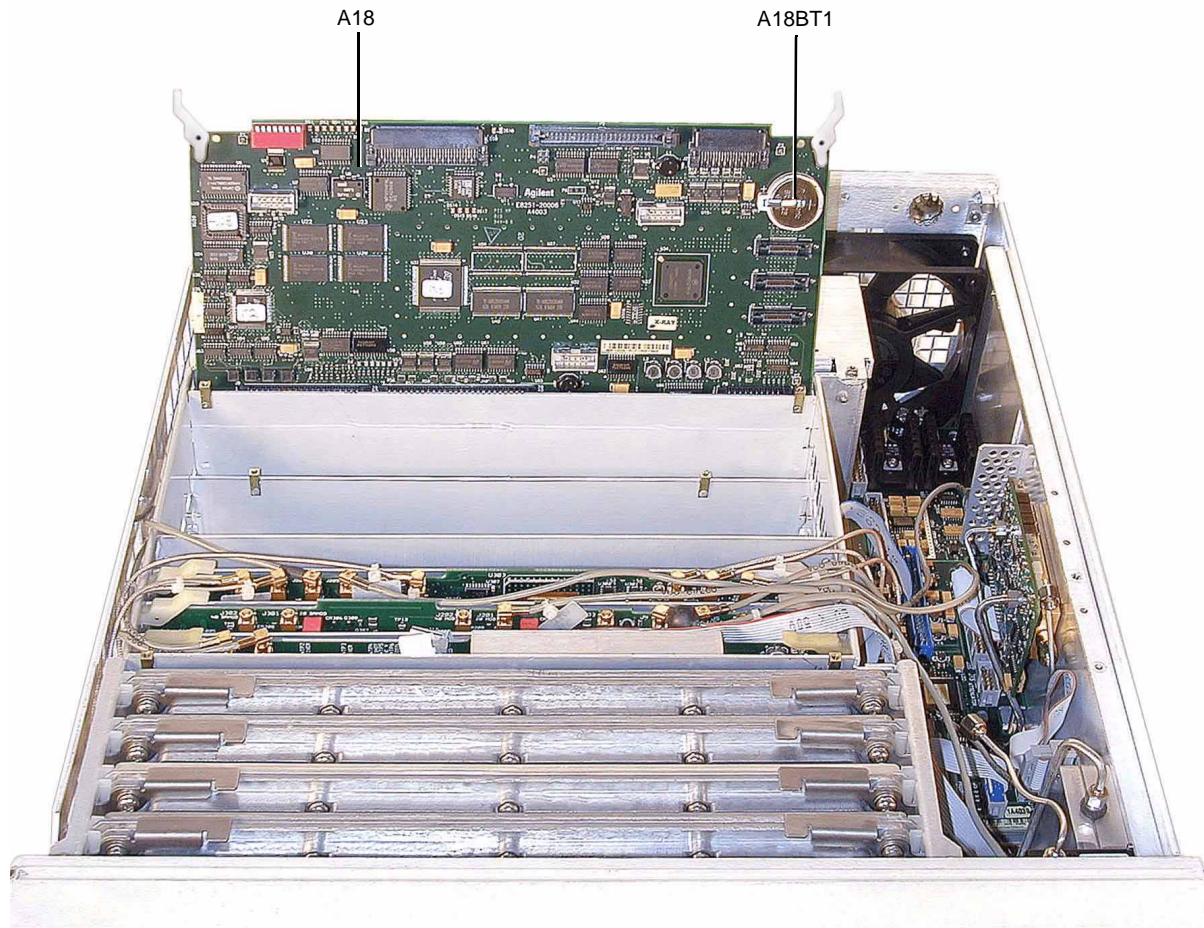
Assemblies from a Bottom View

Figure 2-6 Assemblies from a Bottom View



A18BT1 Lithium Battery

Figure 2-7 A18BT1 Lithium Battery



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Cables

This section lists part numbers for the cables in your signal generator.

Table 2-1

Reference Designator	Input	Output	Part Number
A1W1 ^a	Ribbon Cable, A1 Keyboard	A31P13	(part of A1)
A2DS1W1 ^a	Wire Cable, A2DS1	A4 Inverter	(part of A2)
A4W1 ^a	Wire Cable, A4 Inverter	A31P12	(part of A4)
A22W1 ^a	A22 Line Module	A19 Power Supply	(part of A22)
A22W2 ^a	A22 Line Module	Chassis ground post on Rear Panel and A19 Power Supply	(part of A22)
A25BW1 ^a	Wire Cable, A25B Highband Detector Bias board	A26J12	(part of A25)
A32W1 ^a	Wire Cable, A32 10 MHz Crystal Oscillator	A21P2	(part of A32)
B1W1 ^a	Wire Cable, B1 Fan	A21P251	(part of B1)
W1	Front Panel (EXT 1)	A11J401	8121-0628
W2	Front Panel (EXT 2)	A11J402	8121-0628
W3	Front Panel (LF OUTPUT)	A11J403	8121-0628
W4	Front Panel (ALC INPUT)	A10J4	8121-0609
W5	Front Panel (PULSE/TRIGGER GATE INPUT)	A11J201	8121-0625
W6	Front Panel (PULSE VIDEO OUT)	A11J203	8121-0625
W7	Front Panel (PULSE SYNC OUT)	A11J202	8121-0625
W8	A3 Power Switch (DATA CABLE)	A2 Display	8121-0165
W9	A3P1	A31P11	8121-0614
W10	A9J3	A31J1031	8121-0624
W11	A9J4	A31J1021	8121-0624
W12	A9J5	A28J1	8121-0608
W13	A10J201	A30J6	8121-0624
W14	A10J5	A23J104	8121-0627
W15	A10J3	A25 40 GHz Highband Detector	8121-0900
W16	A11J204	A12 Pulse Modulator Board	8121-0623
W17	A11J205	A30J7	8121-0626
W18	A18J1	A21J3	8121-0617
W19	A18J2	A26J30	8121-0619
W20	A20J1	A26J20	8121-0677

Table 2-1

Reference Designator	Input	Output	Part Number
W21	A31J1043	Rear Panel (10MHz OUT)	8121-0622
W22	A31J1042	Rear Panel (10MHz IN)	8121-0622
W23	A21J2	A31P241	8121-0611
W24	Semi-Rigid Cable, A24 (output)	AT1 115 dB Mechanical Attenuator	E8251-20025
W25	Semi-Rigid Cable, AT1 (output)	2.4 mm RF Output adapter	E8251-20028
W27	A23J2	A30J3	E8251-20031
W28	A23J100	A26J15	8121-0616
W29	A27J10	A26J33	8121-0613
W33	A26J32	A29J10	8121-0613
W34	A26J31	A30J10	8121-0921
W35	A26J10	A31P201	8121-1240
W36	Ribbon Cable, AT1 90 dB/115 dB Mechanical Attenuator	A26J13	8121-0982
W37	Semi-Rigid Cable, A23 Lowband Coupler/Detector	A31 Motherboard (Output)	E8251-20225
W38	Semi-Rigid Cable, A28 YIG Oscillator (out)	A29J1	E8251-20014
W39	A29J4	A31 Motherboard (Sampler)	E8251-20343
W40	A29J3	A31 Motherboard (Frac-N)	E8251-20224
W41	A29J2	A30J1	E8251-20017
W42	Semi-Rigid Cable, A31 Motherboard (Sampler)	A31 Motherboard (Reference)	E8251-20226
W43	Semi-Rigid Cable, A31 Motherboard (Frac-N)	A31 Motherboard (Output)	E8251-20226
W44	A31J1051	A31J1122	8121-0620
W45	A31J1055	A31J1121	8121-0620
W46	Semi-Rigid Cable, A31 Motherboard (Sampler)	A31 Motherboard (Frac-N)	E8251-20029
W47	A32J1	A31J1041	8121-0621
W48	A32J2	Rear Panel (10 MHz EFC)	8120-6839
W54	A9J9	A31J1032	8121-0624
W69	A26J14	A12 Pulse Modulator Board	8121-0912
W71	Semi-Rigid Cable, A24 20 GHz Highband Coupler IN	A30J2	E8251-20093
W72	Semi-Rigid Cable, A24 20 GHz Highband Coupler output	AT1 115 dB Mechanical Attenuator input	E8251-20094
W74	A37J3	A30J2	E8251-20219

Table 2-1

Reference Designator	Input	Output	Part Number
W75	Semi-Rigid Cable, A23 Lowband Coupler/Detector	A12 Pulse Modulator Board	E8251-20033
W76	Semi-Rigid Cable, A12 Pulse Modulator Board	A31 Motherboard, Lowband Switch Filter (out)	E8251-20334
W86	Semi-Rigid Cable, AT1 output	3.5 mm or Type-N RF Output connector	E8251-20027
W97	A35J8	A37J8	8121-0627
W98	A30J1	A37J2	E8251-20218
W100	A27J2 (RF out)	A37J5 (LO in)	E8251-20216
W101	A28	A39 (in)	E8251-20331
W104	A27J1	A35J3	E8251-20215
W118 (standard)	A31 Motherboard (LB Filter Output)	A31 Motherboard (Lowband Switch Filter) (IN)	E8251-20332
W119 (with Option UNW)	A31 Motherboard (Lowband Switch Filter) (OUT)	A23 Lowband Coupler/Detector (IN)	E8251-20333
W121	A29 20 GHz Doubler	AT1 115 dB Mechanical Attenuator (IN)	E8251-20026

^aThis cable is not replaceable by itself. You must order the corresponding assembly.

Hardware

This section lists part numbers for hardware and other instrument parts in your signal generator.

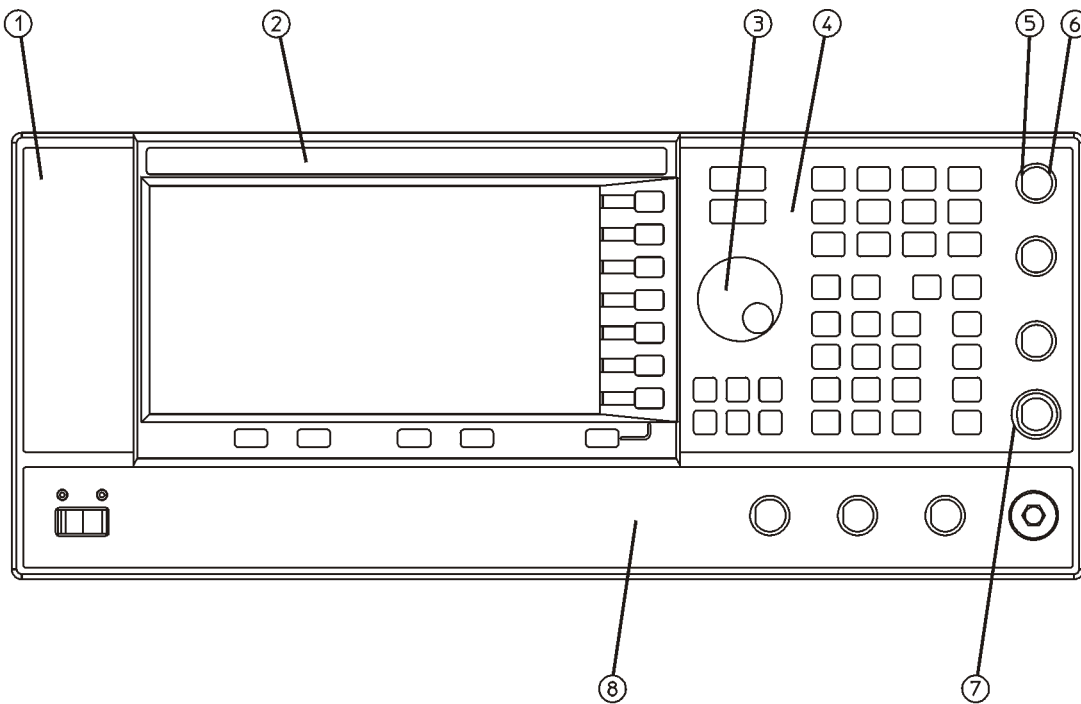
- “Front Panel View” on page 2-15
- “Disassembled Front Panel View” on page 2-16
- “Disassembled Rear Panel View” on page 2-18
- “Disassembled A32 10 MHz Crystal Oscillator” on page 2-20
- “Disassembled AT1 115dB Attenuator View” on page 2-21
- “Disassembled A24 20GHz Highband Coupler and A25B Highband Detector Bias Board” on page 2-22
- “Microcircuit Interface Deck Top View” on page 2-23
- “Main Chassis and MID Bottom View” on page 2-24
- “Type-N RF Output Connector” on page 2-26
- “Main Chassis with Inside Cover and Right-Side Support Wall” on page 2-27
- “Outer and Inner Instrument Covers and Associated Parts” on page 2-28

Front Panel View

Table 2-2 Front Panel View

Item No.	Description	Qty	Part Number
1	Small Overlay	1	E4400-80011
2	Nameplate	1	E8251-80027
3	RPG Knob	1	E4400-40003
4	Large Keypad Overlay	1	E8251-80001
5	Nut-Hex 15/32-32	7	2950-0035
6	Washer-Wavy .490ID	7	3050-1919
7	Washer-Shoulder	2	00310-48801
8	Bottom Overlay	1	E8251-80003

Figure 2-8 Front Panel View

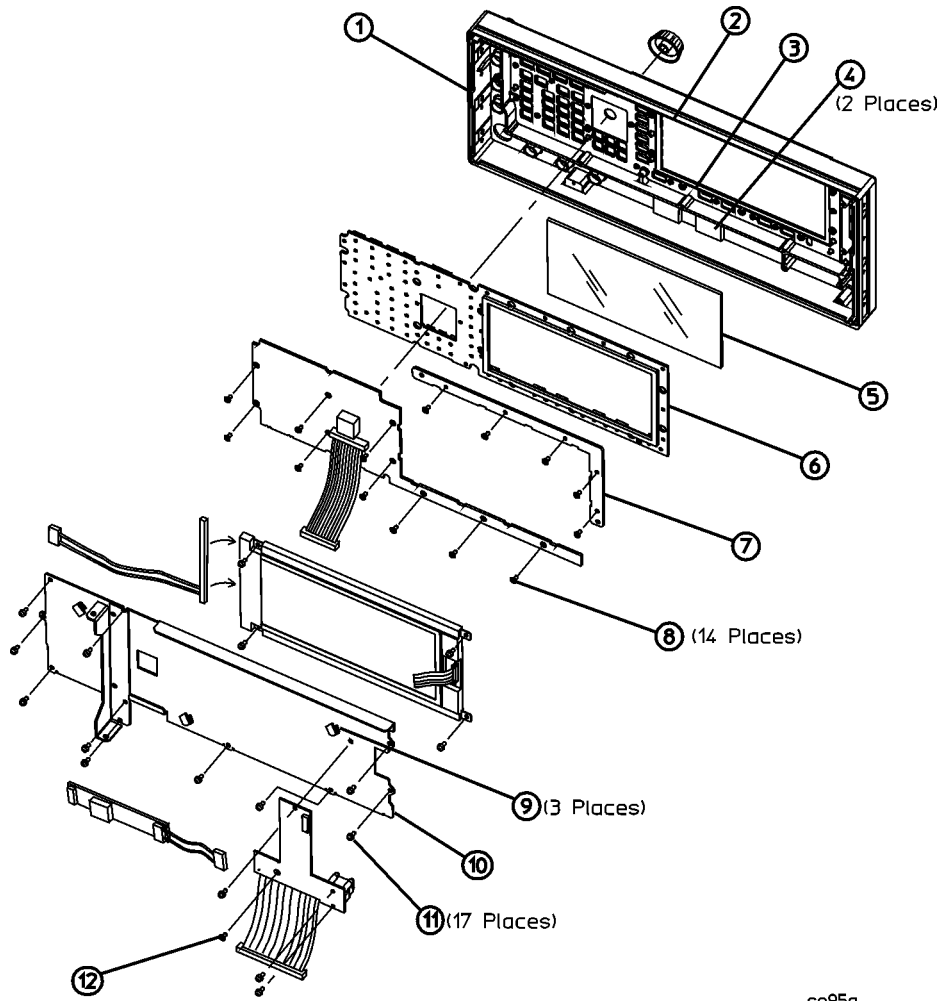


Disassembled Front Panel View

Table 2-3 Disassembled Front Panel View

Item No.	Description	Qty	Part Number
1	Front Panel Frame	1	E8251-20102
2	Gasket RFI Round Mesh .125 inch	1	8160-0660
3	Gasket RFI Round Mesh .062 inch	1	8160-0723
4	Velcro Attachment	1	0510-1303
5	Glass Filter 70% Xmt	1	4330-1711
6	Rubber Keypad	1	E8251-40006
7	Bracket Filter	1	E4400-00009
8	Screw-Machine M3.0 x 08 FL-TX	14	0515-1227
9	Cable Retainer Clip	3	1400-1439
10	Sub Panel	1	E8251-00009
11	Screw-Machine M3.0 x 06 CW-PN-TX	17	0515-0372
12	Screw-Machine M3.0 x 08 FL-TX	1	0515-1035

Figure 2-9 Disassembled Front Panel View



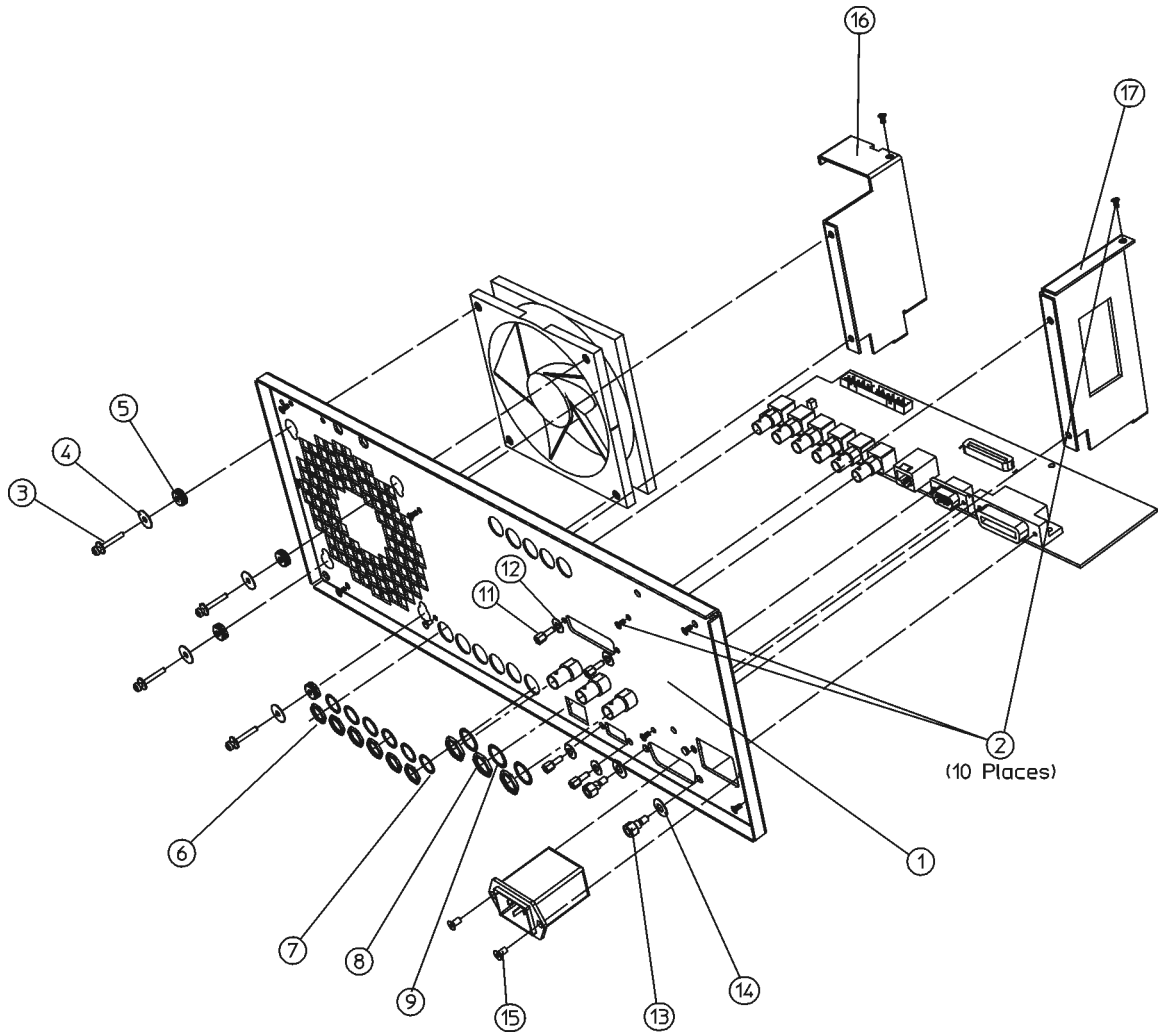
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Disassembled Rear Panel View

Table 2-4 Disassembled Rear Panel View

Item No.	Description	Qty	Part Number
1	Rear Panel	1	E8251-00020
2	Screw-Machine M3.0 8 CW-PN-TX (mounting screws for rear-panel and rear struts)	10	0515-0372
3	Screw-Machine M3.0 14CW-PN-TX (screw to mount B1 fan to rear-panel)	4	0515-0665
4	Beveled Washer (fan)	4	3050-1628
5	Grommet (fan)	4	0400-0356
6	Nut-Hex 1/2-28 (6 BNC connectors on rear-panel board)	6	2950-0054
7	Washer Lock .505ID (6 BNC connectors on rear-panel)	6	2190-0068
8	Nut-Hex 15/32-32 (10 MHz In/Out BNC connectors)	3	2950-0035
9	Washer .490ID (10 MHz In/Out BNC connectors)	3	3050-1919
10	Standoff Screw-Hex .321I 4-40ss (Auxiliary Interface and SMI)	4	0380-2079
11	Split Lock Washer .115ID 4 (Auxiliary Interface and SMI)	4	2190-0003
12	Standoff Screw-Hex .327 6-32 (GPIB interface)	2	0380-0644
13	Split Lock Washer .194ID 10 (GPIB interface)	2	2190-0577
14	Screw-Machine M3.0 8 FL-TX (line module)	2	0515-1035
15	Right Rear Strut	1	E8251-00006
16	Left Rear Strut	1	E8251-00030

Figure 2-10 Disassembled Rear Panel View

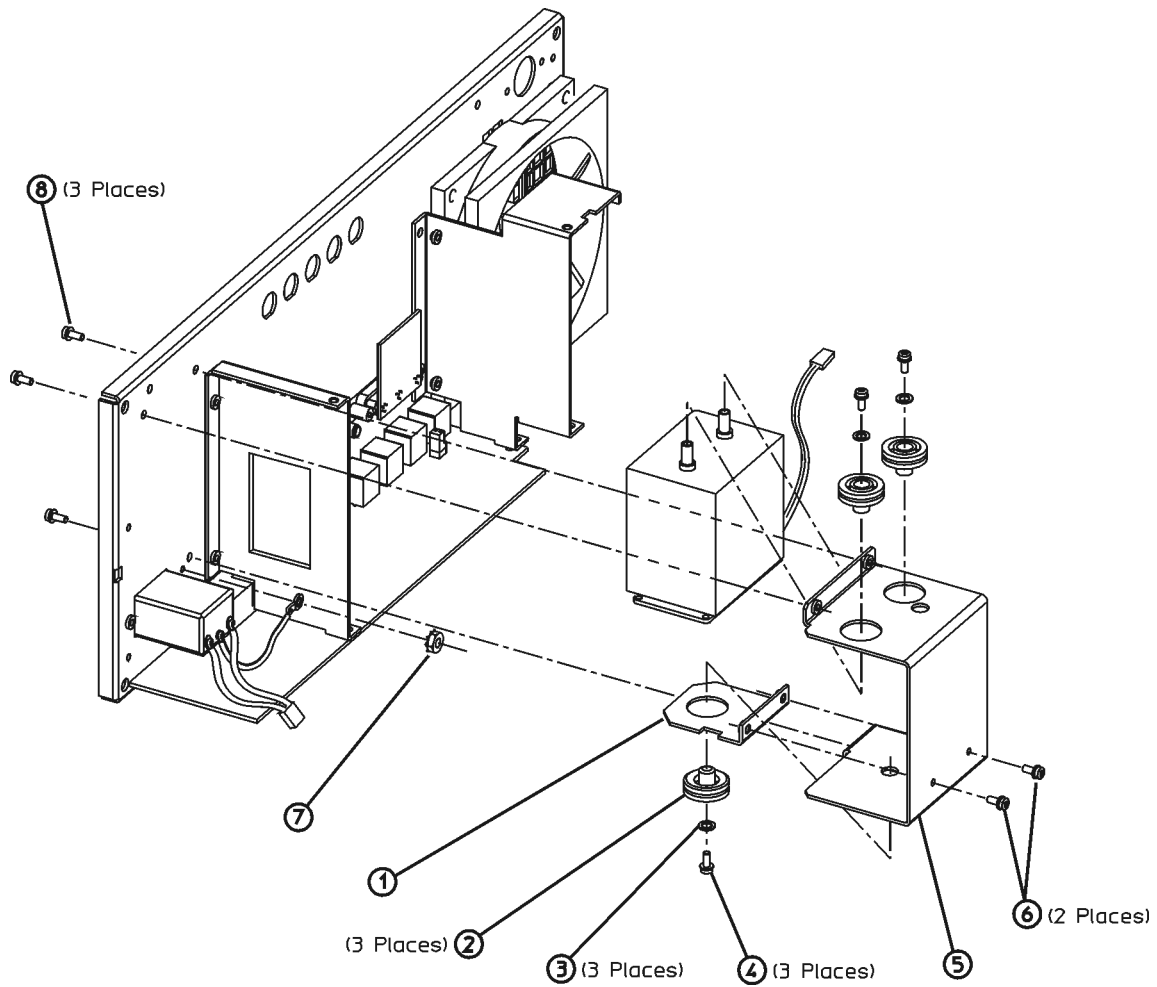


Disassembled A32 10 MHz Crystal Oscillator

Table 2-5 Disassembled A32 10 MHz Crystal Oscillator

Item No.	Description	Qty	Part Number
1	C-Bracket	1	E8251-00040
2	Shock Mount	3	1520-0205
3	Flathead Washer	3	3050-0105
4	Screw-Machine 4.0 x 40 .250	3	2200-0103
5	L-Bracket	1	E8251-00041
6	Screw-Machine M3.0 x 8 CW-PN-TX	2	0515-0372
7	Nut-Hex M3.0 (line module ground)	1	0535-0031
8	Screw-Machine M3.0 x 8 CW-PN-TX	2	0515-0372

Figure 2-11 Disassembled A32 10 MHz Crystal Oscillator

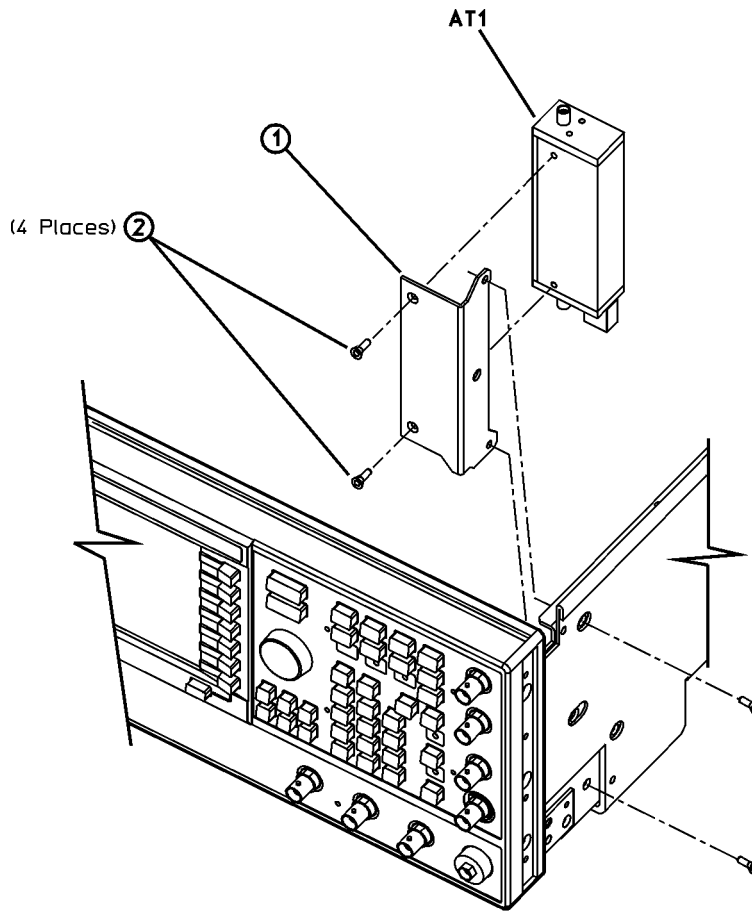


Disassembled AT1 115dB Attenuator View

Table 2-6 Disassembled AT1 115 dB Attenuator View

Item No.	Description	Qty	Part Number
1	Bracket	1	E8251-00038
2	Screw-Machine M3.0 x 8 FL-TX	4	0515-1035

Figure 2-12 Disassembled AT1 115dB Attenuator View



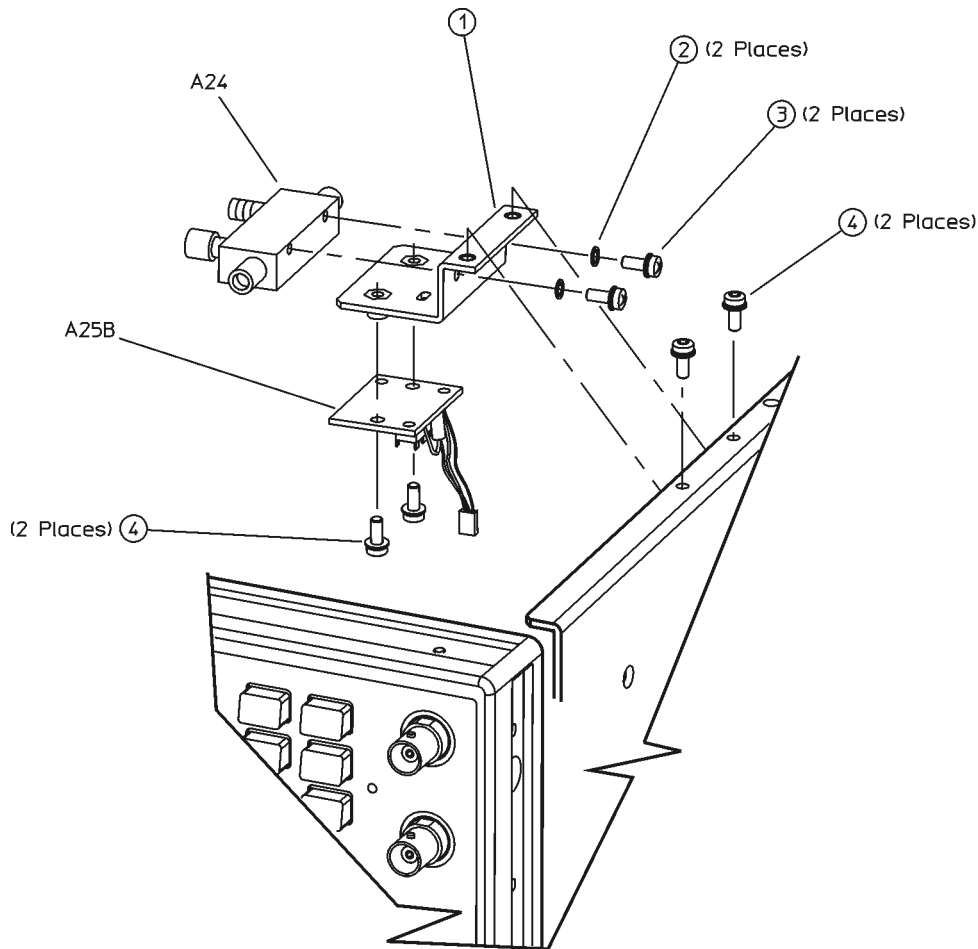
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Disassembled A24 20GHz Highband Coupler and A25B Highband Detector Bias Board

Table 2-7 Disassembled A24 20 GHz Highband Coupler and A25B Highband Detector Bias Board

Item No.	Description	Qty	Part Number
1	Coupler Bracket	1	E8251-00039
2	Washer Lock M2.0	2	2190-0654
3	Screw-Machine SM 256 .250 PN-PN	2	0520-0128
4	Screw-Machine M3.0 x 8 CW-PN-TX	4	0515-0372

Figure 2-13 Disassembled A24 20GHz Highband Coupler and A25B Highband Detector Bias Board



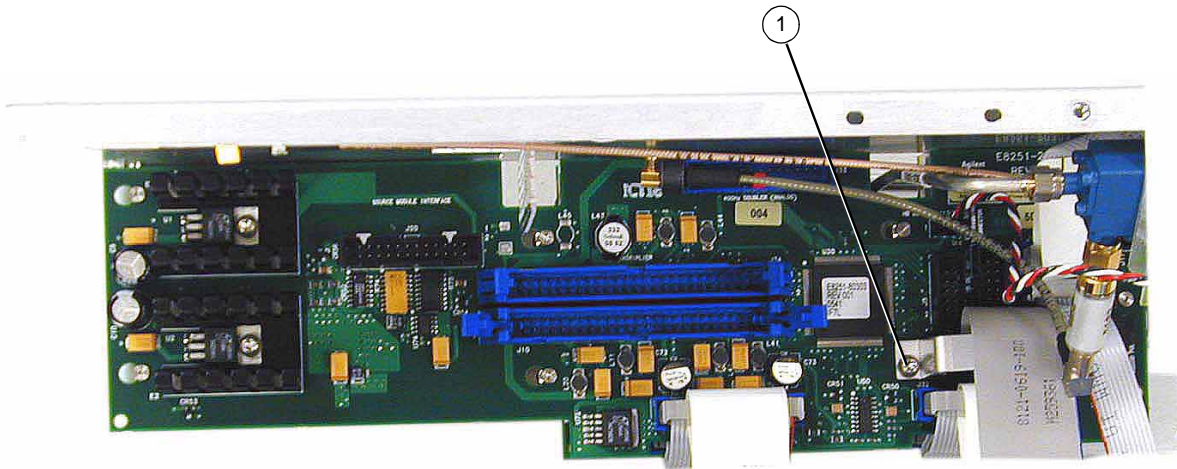
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Microcircuit Interface Deck Top View

Table 2-8 Microcircuit Interface Deck Top View

Item No.	Description	Qty	Part Number
1	Screw-Machine M3.0 x 14 CW-PN-TX	1	0515-0665

Figure 2-14 Microcircuit Interface Deck Top View

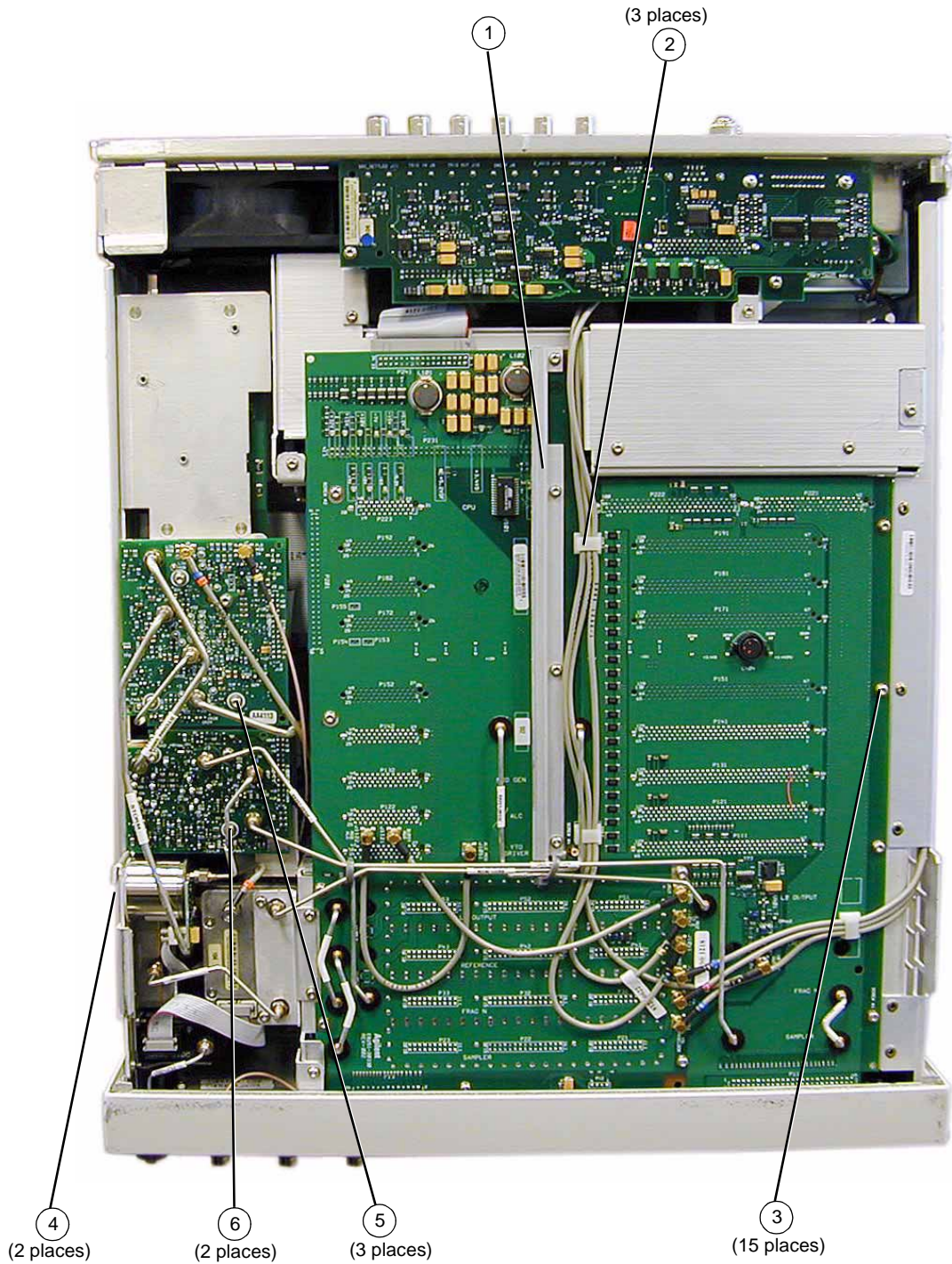


Main Chassis and MID Bottom View

Table 2-9 Main Chassis and MID Bottom View

Item No.	Description	Qty	Part Number
1	Rib Bracket	1	E8251-00008
2	Cable Retainer Clip	3	E8251-40001
3	Screw-Machine M30. x 8 CW-PN-TX (A31 Motherboard to main chassis)	15	0515-0372
4	Screw-Machine M30. x 8 CW-PN-TX (A28 YIG Oscillator to MID)	2	0515-0372
5	Screw-Machine M30. x 20 CW-PN-TX (A30 Modulator Filter with Standard or High Power to MID)	3	0515-1410
6	Screw-Machine M30. x 20 CW-PN-TX (A29 20 GHz Doubler to MID)	2	0515-1410

Figure 2-15 Main Chassis and MID Bottom View

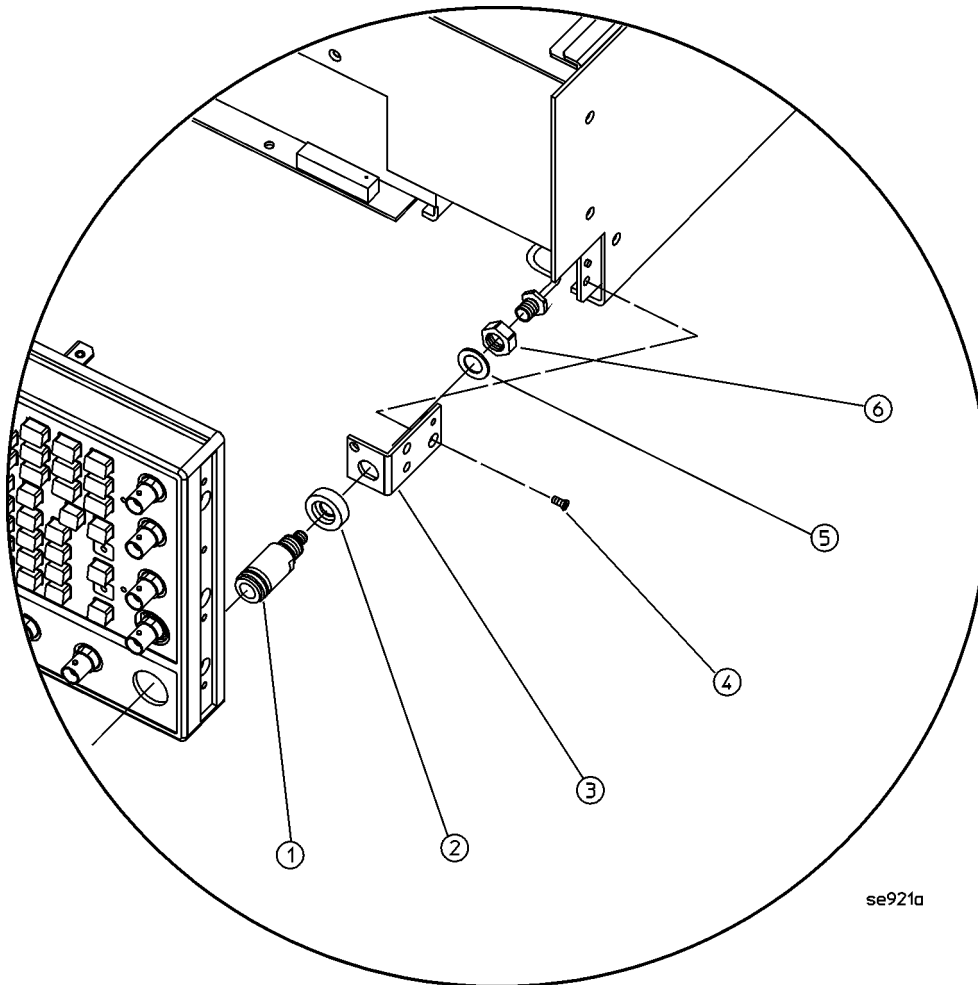


Type-N RF Output Connector

Table 2-10 Type-N RF Output Connector

Item No.	Description	Qty	Part Number
1	Adapter-Type-N (f)	1	08559-60002
2	Spacer	1	E8251-20067
3	Adapter Bracket	1	E8251-00216
4	Screw-Machine M4.0 x 10 FL-TX	1	0515-1035
5	Washer lock	1	2190-0102
6	Nut-Hex	1	2950-0132
	W86 Semi-Rigid Cable (refer to Table 2-1 on page 11.)		

Figure 2-16 Type-N RF Output Connector

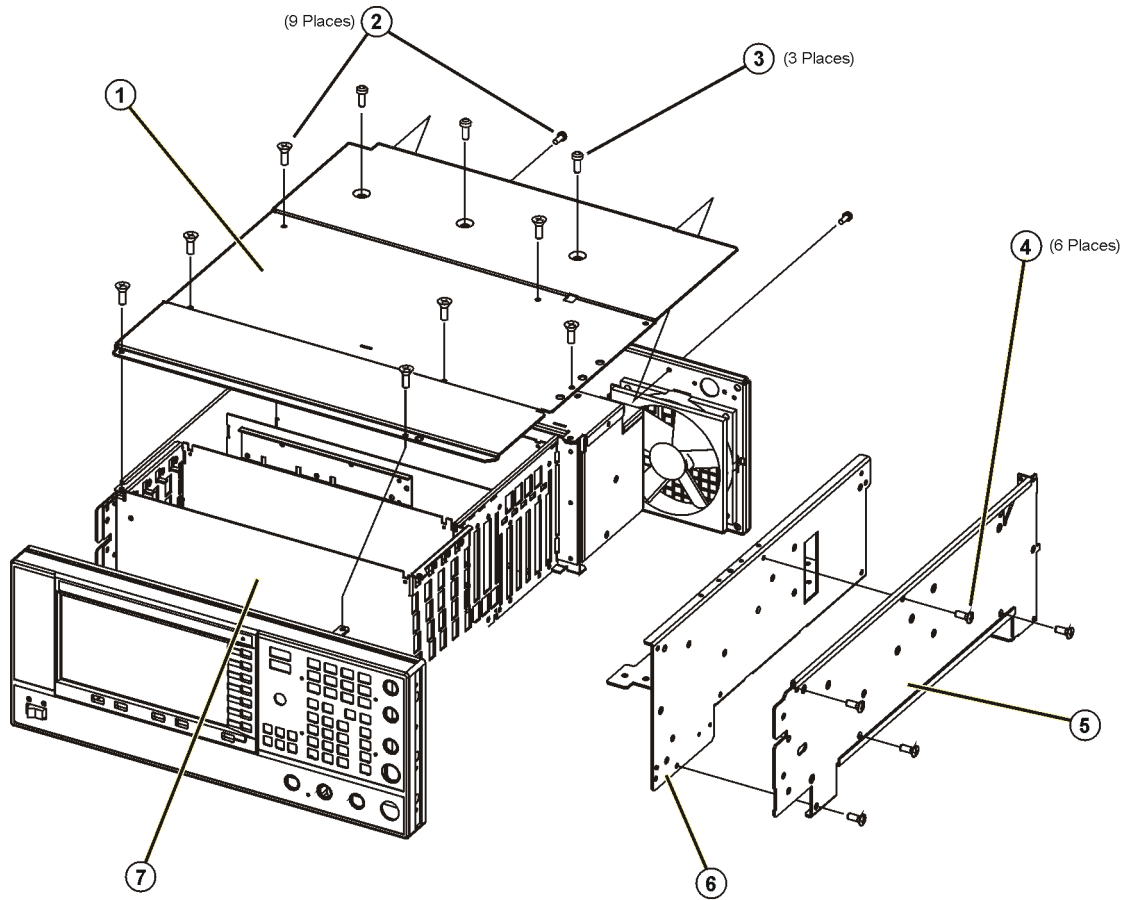


Main Chassis with Inside Cover and Right-Side Support Wall

Table 2-11 Main Chassis with Inside Cover and Right-Side Support Wall

Item No.	Description	Qty	Part Number
1	Main Chassis Inside Top Cover	1	E8251-00011
2	Screw-Machine M3.0 x 08 FL-TX (inside top cover to main chassis and rear panel)	9	0515-0430
3	Screw-Machine M3.0 x 08 CW-PN-TX (rear panel to right-side support wall)	3	0515-0372
4	Screw-Machine M3.0 x 08 FL-TX (microcircuit interface deck to right-side support wall)	6	0515-1035
5	Right-Side Support Wall	1	E8251-00014
6	Microcircuit Interface Deck	1	E8251-00004
7	Main Chassis	1	E8251-60354

Figure 2-17 Main Chassis with Inside Cover and Right-Side Support Wall



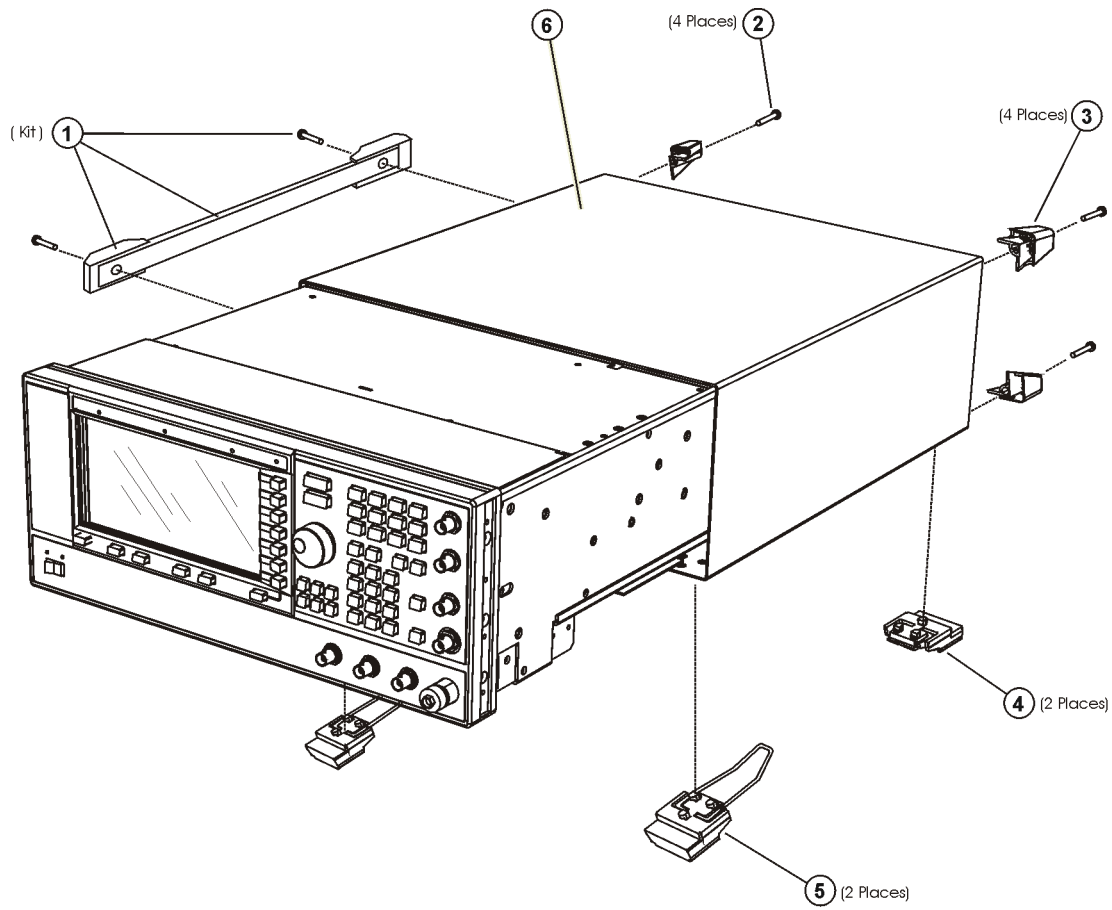
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Outer and Inner Instrument Covers and Associated Parts

Table 2-12 Outer and Inner Instrument Covers and Associated Parts

Item No.	Description	Qty	Part Number
1	Assy-Strap Handle - includes the following parts:	1	E8251-60067
	Strap Assembly	1	
	Ground Spring	2	
	Handle Retainer	2	
	End Cap	2	
	Screw-Machine M5 x 18 FL-TX	2	
2	Rear Feet Screws	4	0515-1619
3	Rear-Panel Feet	4	5041-9611
4	Feet-Bottom	4	5041-9167
5	Tilt Stand	2	1460-1345
6	Outside Instrument Cover	1	E8251-00012

Figure 2-18 Outer and Inner Instrument Covers and Associated Parts



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Miscellaneous

This section lists part numbers for miscellaneous items that can be used with your signal generator.

Accessories

Table 2-13 Accessories

Description	Part Number
Test Cable (extension cable for accessing A31 Motherboard coax connectors)	E8251-20088
Adapter 2.4 mm (F) - 2.4 mm (F)	33311-82005
Adapter-Coax STR F 2.4 mm (F) - K	1250-2187
Adapter 3.5 mm (F) - Type-N (M)	1250-1744
Adapter 1.85 mm (F) - 1.85 mm (F)	85085-60114
Adapter 3.5 mm (F) - 3.5 mm (F)	5061-5311

Documentation

Table 2-14 Documentation

Description	Part Number
E8663B Documentation Set	E8663-90001
CD-ROM Documentation	E8663-90010
Installation Guide	E8663-90002
User's Guide	E8663-90003
Key Reference	E8663-90004
Programming Guide	E8663-90005
SCPI Command Reference	E8663-90006
Service Guide	E8663-90009
Specifications/Data Sheet	5989-4866EN

NOTE The E8663B documentation can also be found on the web at <http://www.agilent.com/find/e8663b>.

Electrostatic Discharge (ESD) Protective Supplies

Table 2-15 Electrostatic Discharge (ESD) Protective Supplies

Description	Part Number
ESD connector end cap front-panel RF output	1401-0247
ESD connector end cap rear panel SMI	1252-4690
ESD connector end cap-GPIB	1252-5007
ESD connector end cap coherent carrier cut	1252-4696
2 X 4 Ft. Antistatic Table Mat with 15 FT. Ground Wire	9300-0797
5 Ft. Grounding Cord (for wrist strap)	9300-0980
Adjustable Antistatic Wrist Strap	9300-1367

Abbreviations Used in Part Descriptions

This section defines the reference designators, abbreviations, and option numbers that are used in the part descriptions throughout this chapter.

Reference Designator	Definition
A	assembly
AT	attenuator
B	fan
DS	lamp
J	electrical connector; jack
W	cable; transmission path; wire

Abbreviation	Definition
BN	buttonhead (screws)
CPU	central processing unit
CW	conical washer (screws)
EXT	external
FL	flathead (screws)
Ft	feet
Hex	hexagonal
GPIB	general purpose interface bus
HX	hexagonal recess (screws)
I	in-phase
LF	low frequency
M	meters or metric hardware
PC	patch lock (screws) or printed circuit

Abbreviation	Definition
PN	panhead (screws)
Q	quadrature
Qty	quantity
RF	radio frequency
RPP	reverse power protection
SMA	subminiature type-A
TX	TORX recess (screws)

3 Assembly Replacement

Before You Replace an Assembly

CAUTION Many of the assemblies in this instrument are very susceptible to damage from electrostatic discharge (ESD). Perform service procedures only at a static-safe workstation and wear a grounding strap.

Be sure to review the warning and caution statements described in [Chapter 5, "Safety and Regulatory," on page 5-1](#), prior to replacing an assembly in your signal generator.

After Replacing or Repairing an Assembly

After you have replaced or repaired an assembly, certain performance tests and adjustments may have to be performed. Please refer to [Chapter 4, "Post-Repair Procedures," on page 1](#), for the list of performance tests and adjustments required for each assembly.

Assemblies That You Can Replace

- ["Outer Instrument Cover" on page 3-3](#)
- ["Inner Instrument Cover" on page 3-5](#)
- ["Front Panel" on page 3-6](#)
- ["A1 Keyboard" on page 3-8](#)
- ["A2 Display" on page 3-10](#)
- ["A2DS1 Display Backlight" on page 3-12](#)
- ["A3 Power Switch" on page 3-14](#)
- ["A4 Inverter" on page 3-16](#)
- ["A5 Sampler, A6 Frac-N, A7 Reference, and A8 Output" on page 3-17](#)
- ["A9 YIG Driver" on page 3-18](#)
- ["A10 ALC" on page 3-19](#)
- ["A11 Pulse/Analog Modulation Generator" on page 3-20](#)
- ["A12 Pulse Modulator Board" on page 3-22](#)
- ["A18 CPU" on page 3-24](#)
- ["A18BT1" on page 3-26](#)
- ["A19 Power Supply" on page 3-28](#)
- ["A21 Rear-Panel Interface" on page 3-30](#)
- ["A22 Line Module" on page 3-32](#)
- ["A23 Lowband Coupler/Detector" on page 3-34](#)
- ["A24 20 GHz Highband Coupler" on page 3-36](#)
- ["A25 20 GHz Highband Detector" on page 3-38](#)
- ["A25B Highband Detector Bias Board" on page 3-40](#)
- ["A26 MID \(Microcircuit Interface Deck\)" on page 3-42](#)
- ["A28 YIG Oscillator" on page 3-44](#)
- ["A29 20 GHz Doubler" on page 3-46](#)
- ["A30 Modulation Filter" on page 3-48](#)
- ["A31 Motherboard" on page 3-50](#)
- ["A32 10 MHz Crystal Oscillator" on page 3-52](#)

- “Rear Panel” on page 3-54
- “AT1 115 dB Attenuator” on page 3-56
- “B1 Fan” on page 3-58

Outer Instrument Cover

Tools Required

- T-15 driver
- T-20 driver

Removal Procedure

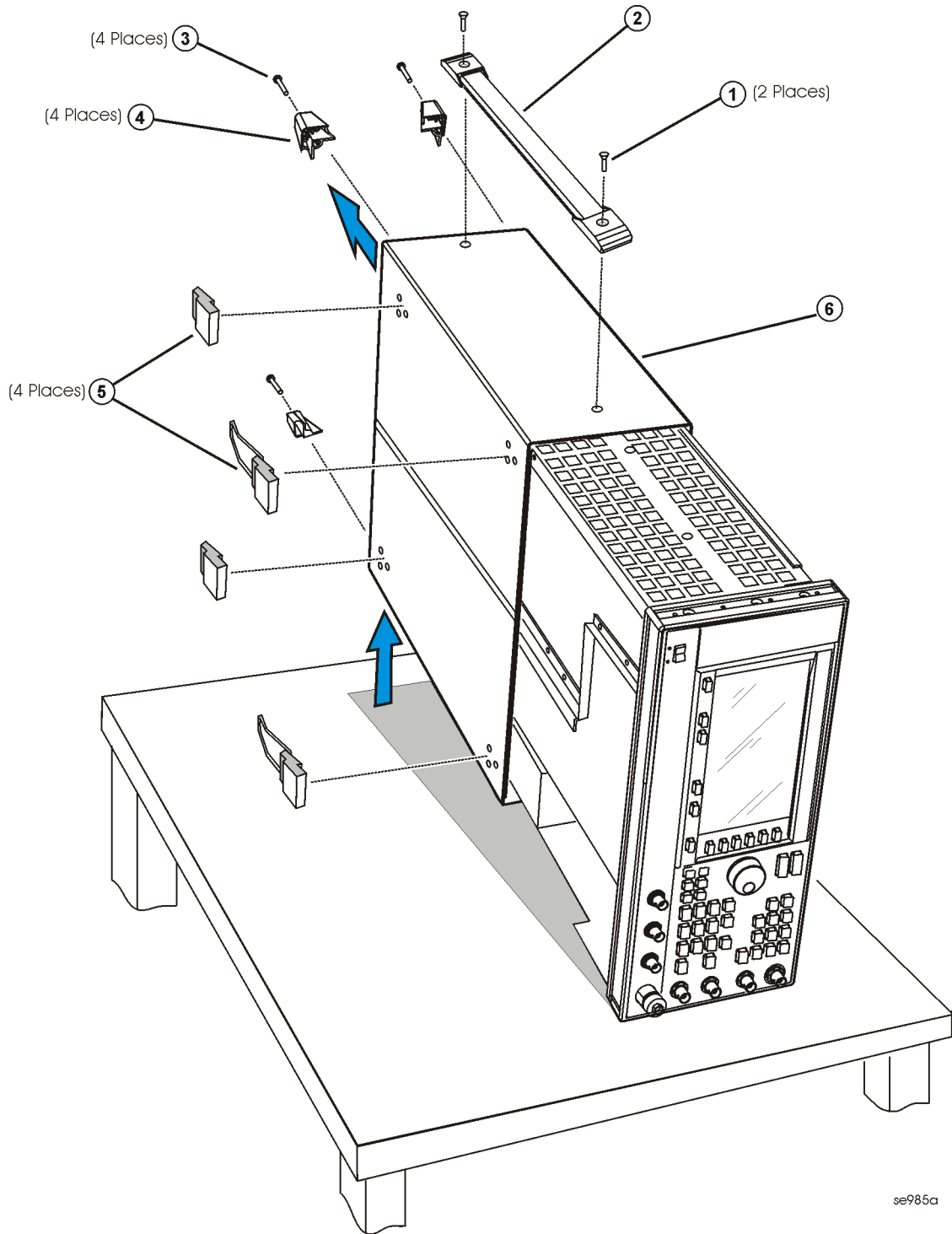
Refer to [Figure 3-1](#) for this procedure.

1. Disconnect the power cord.
2. Using the T-20 driver, loosen and remove the two screws (1) and remove the strap handle (2).
3. Using the T-15 driver, remove the center screws (3) from the four rear-panel feet (4).
4. Remove the four bottom feet (5) from the cover by lifting the tab and sliding the foot toward the tab.
5. Place the signal generator on its side.
6. Tilt the signal generator forward and slide the outer cover (6) back to remove it from the frame.

Replacement Procedure

- Reverse the order of the removal procedures.
- Torque all T-15 screws to 21 in-lbs.
- Torque all T-20 screws to 21 in-lbs.

Figure 3-1 Outer Instrument Cover Removal



se985a

Inner Instrument Cover

Tools Required

- T-10 driver

Removal Procedure

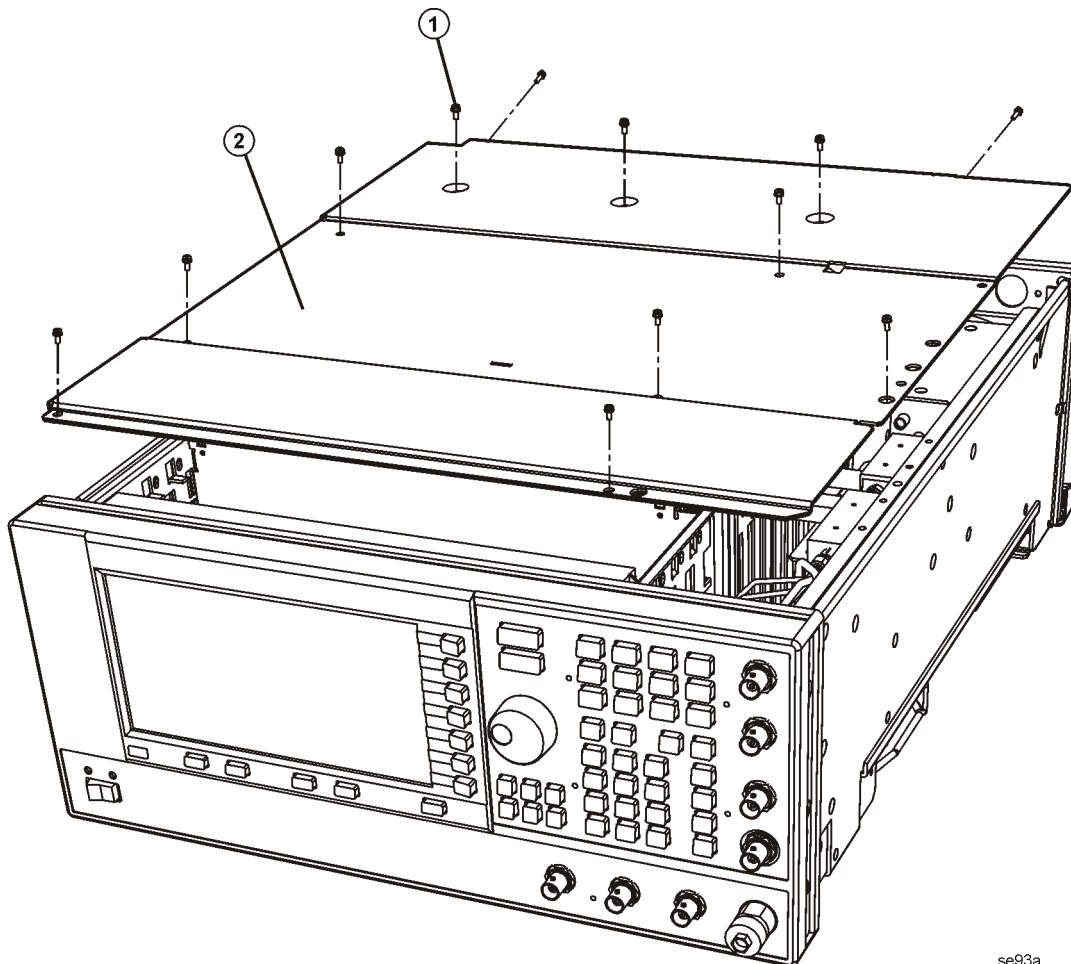
Refer to [Figure 3-2](#) for this procedure.

1. Disconnect the power cord.
2. Remove the outer-cover from the signal generator. Refer to [“Outer Instrument Cover”](#) on page 3-3.
3. Place the signal generator flat and upright with the front panel facing you.
4. Using the T-10 driver, remove the twelve screws (1) from the inner cover (2).
5. Remove the inner cover.

Replacement Procedure

- Reverse the order of the removal procedures.
- Torque all T-10 screws to 9 in-lbs.

Figure 3-2 Inner Instrument Cover Removal



se93a

Front Panel

Tools Required

- T-10 driver
- T-15 driver
- needle-nose pliers

Removal Procedure

Refer to [Figure 3-3](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on page 3-3 and “[Inner Instrument Cover](#)” on page 3-5.
3. Using the T-10 driver, remove the four screws from the Baseband Generator cover.
4. Remove the side trims that cover the six screws.
5. Using the T-15 driver, remove the six screws (1) from the sides of the frame.
6. Using the T-10 driver, remove one screw on the top (2) and bottom (3) frame.

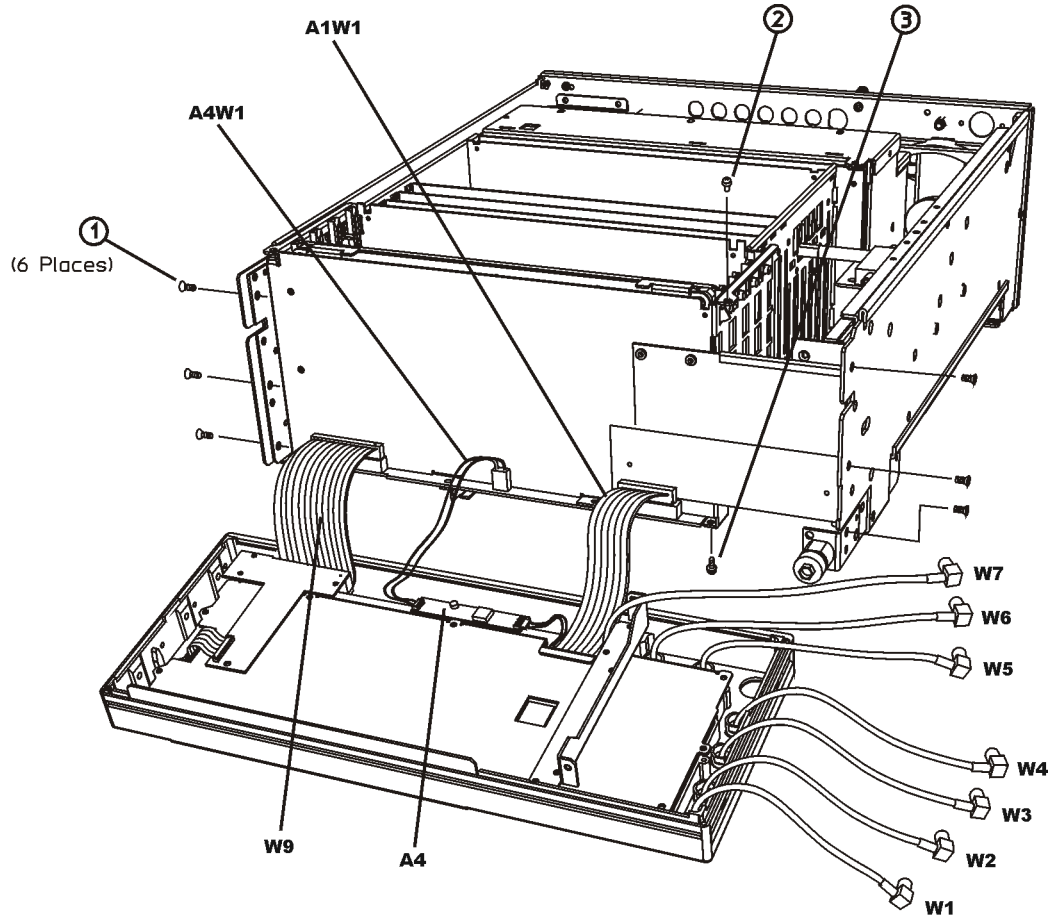
CAUTION Before removing the front panel from the signal generator, lift and support the front of the signal generator’s frame.

7. Slide the front panel over the RF output connector.
8. Using the needle-nose pliers, disconnect the following flexible cables:
 - W1 (EXT 1 INPUT) from the A11 Pulse/Analog Modulation Generator J401.
 - W2 (EXT 2 INPUT) from the A11 Pulse/Analog Modulation Generator J402.
 - W3 (LF OUTPUT) from the A11 Pulse/Analog Modulation Generator J403.
 - W4 ALC INPUT) from the A10 ALC J4.
 - W5 (PULSE/TRIGGER GATE INPUT) from the A11 Pulse/Analog Modulation Generator J201.
 - W6 (PULSE VIDEO OUTPUT) from the A11 Pulse/Analog Modulation Generator J203.
 - W7 (PULSE SYNC OUTPUT) from the A11J202.
9. Disconnect the A1W1 display cable from the A31 Motherboard P13.
10. Disconnect the A4W1 inverter cable from the A31 Motherboard P12.
11. Disconnect the W9 ribbon cable from the A31 Motherboard P11.
12. Remove the front panel.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all T-15 screws to 21 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-3 Front Panel Removal



p-se98a

A1 Keyboard

Tools Required

- T-10 driver

Removal Procedure

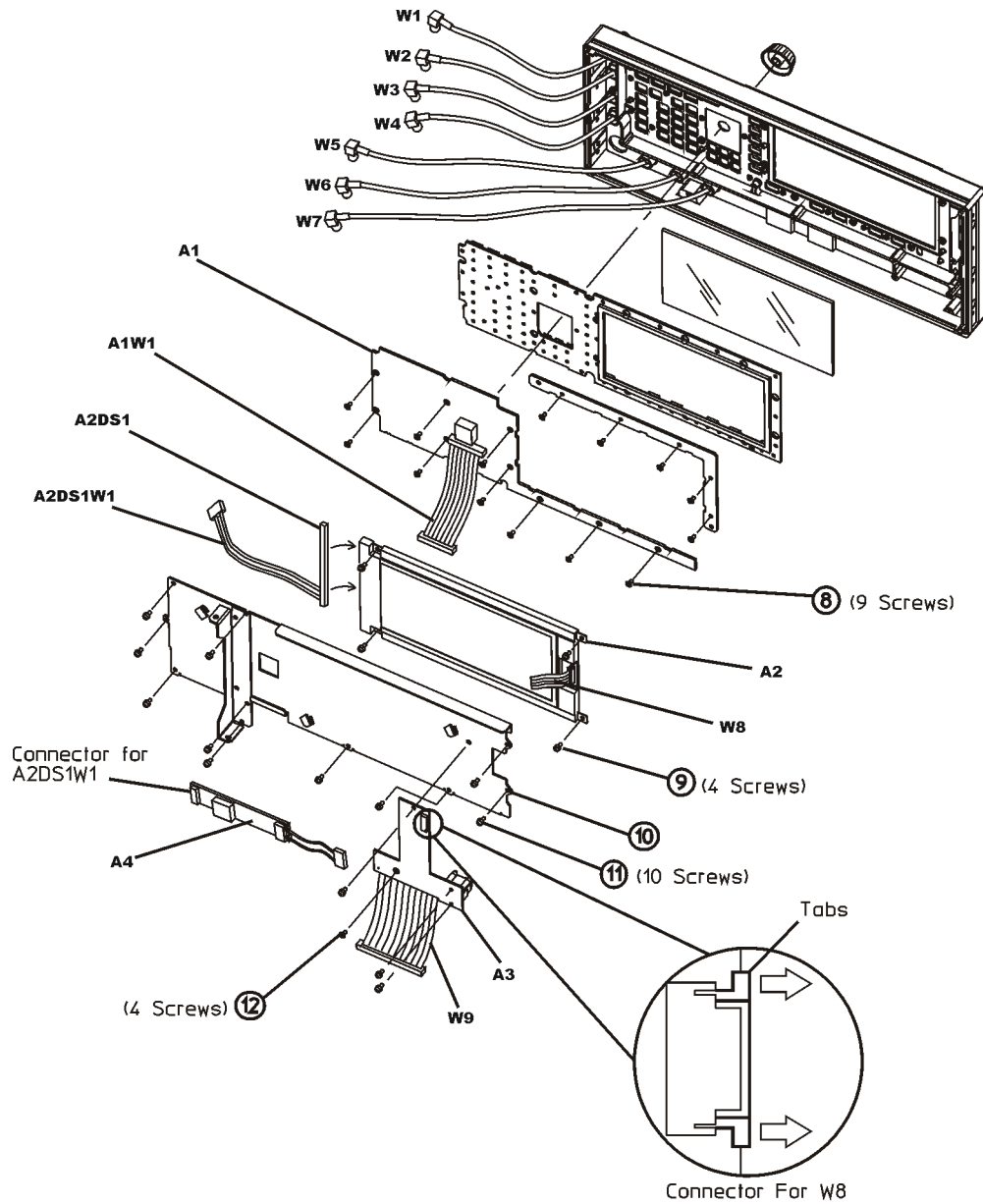
Refer to [Figure 3-4](#) for this procedure.

1. Disconnect the power cord.
2. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
3. Disconnect the A2DS1W1 cable from the A4 Inverter.
4. Disconnect the W8 ribbon cable from the A3 Power Switch by lifting the white tabs on the connector.
5. Using the T-10 driver, remove the four screws (12) from the A3 Power Switch.
6. Remove the A3 Power Switch.
7. Using the T-10 driver, remove the ten screws (11) that secure the RFI shielding (10) to the front panel.
8. Remove the metal shielding.
9. Using the T-10 driver, remove the four screws (9) that secure the A2 Display to the front panel.
10. Remove the A2 Display.
11. Using the T-10 driver, remove the nine screws (8) that secure the A1 Keyboard to the front panel.
12. Remove the A1 Keyboard.

Replacement Procedure

1. Reverse the order of the removal procedures.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-4 A1 Keyboard Removal



p-se97a

A2 Display

Tools Required

- T-10 driver

Removal Procedure

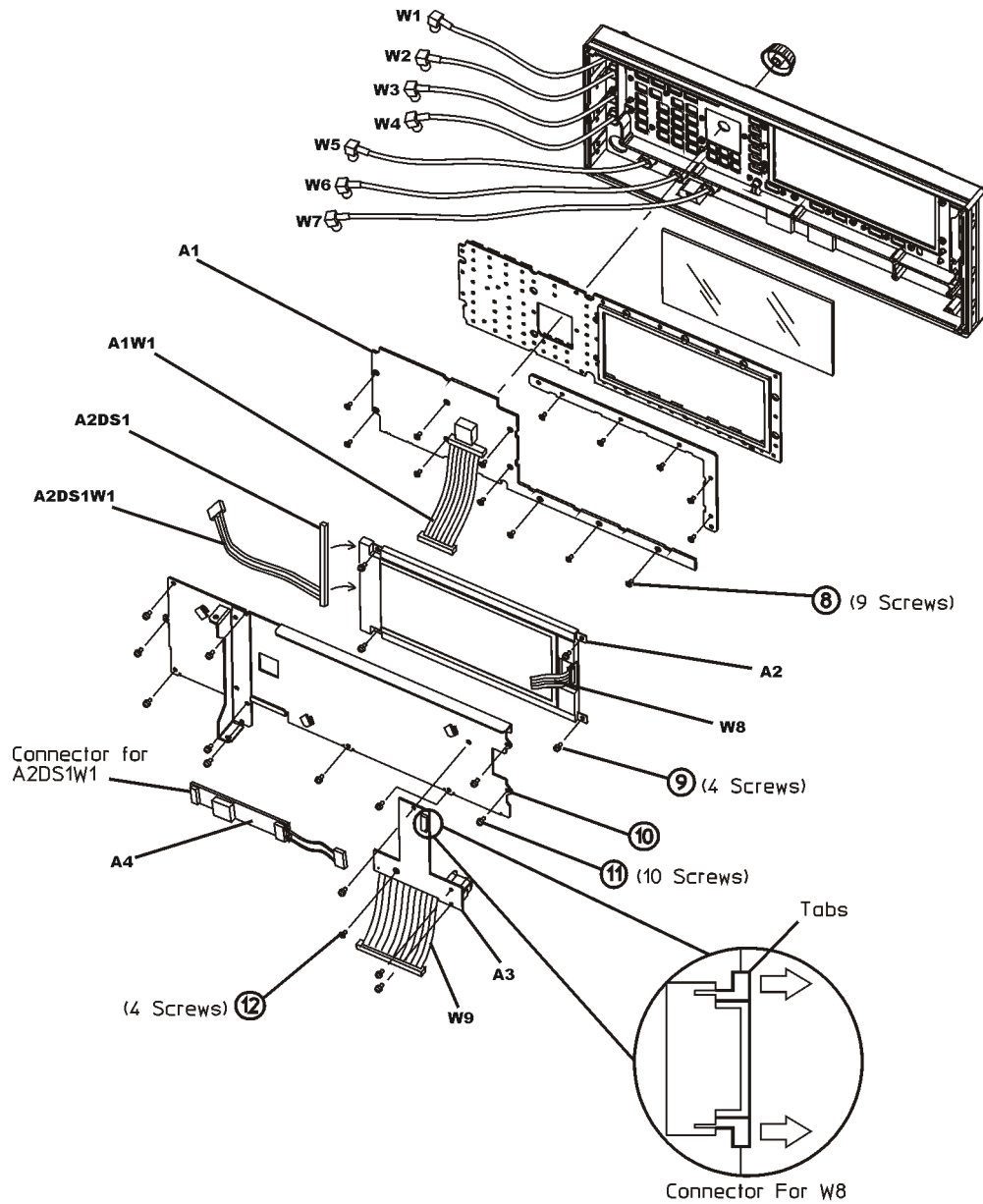
Refer to [Figure 3-5](#) for this procedure.

1. Disconnect the power cord.
2. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
3. Disconnect the A2DS1W1 cable from the A4 Inverter.
4. Disconnect the W8 ribbon cable from the A3 Power Switch by lifting the white tabs on the connector.
5. Using the T-10 driver, remove the four screws (12) from the A3 Power Switch.
6. Remove the A3 Power Switch.
7. Using the T-10 driver, remove the ten screws (11) that secure the RFI shielding (10) to the front panel.
8. Remove the metal shielding.
9. Using the T-10 driver, remove the four screws (9) that secure the A2 Display to the front panel.
10. Remove the A2 Display.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-5 A2 Display Removal



p-se97a

A2DS1 Display Backlight

Tools Required

- T-10 driver
- small phillips screw driver

Removal Procedure

Refer to [Figure 3-6](#).

1. Disconnect the power cord.
2. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
3. Disconnect the A2DS1W1 cable from the A4 Inverter.
4. Disconnect the W8 ribbon cable from the A3 Power Switch by lifting the white tabs on the connector.
5. Using the T-10 driver, remove the four screws (12) from the A3 Power Switch.
6. Remove the A3 Power Switch.
7. Using the T-10 driver, remove the ten screws (11) that secure the RFI shielding (10) to the front panel.
8. Remove the metal shielding.
9. Using the T-10 driver, remove the four screws (9) that secure the A2 Display to the front panel.
10. Remove the A2 Display.
11. Using a small phillips screw driver, remove the screw (1) that secures the cover (2) over the A2DS1 Display Backlight.
12. Remove the A2DS1 Display Backlight.

Replacement Procedure

NOTE When replacing the A2DS1 Display Backlight make sure the reflective paper is behind the light.

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

A3 Power Switch

Tools Required

- T-10 driver

Removal Procedure

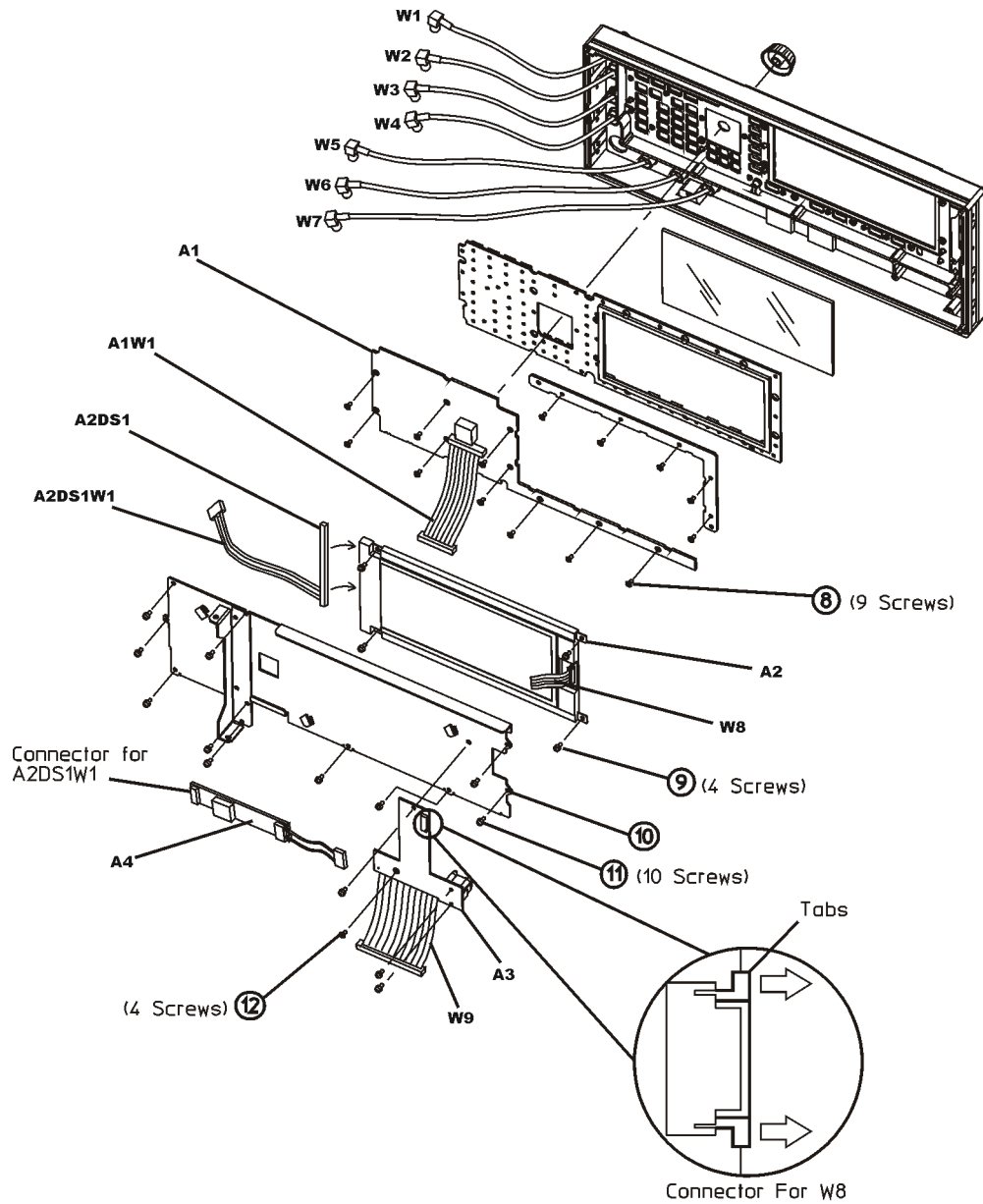
Refer to [Figure 3-7](#) for this procedure.

1. Disconnect the power cord.
2. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
3. Disconnect the W8 ribbon cable from the A3 Power Switch by lifting the white tabs on the connector.
4. Using the T-10 driver, remove the four screws (12) from the A3 Power Switch.
5. Remove the A3 Power Switch.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-7 A3 Power Switch Removal



A4 Inverter

Tools Required

- none

Removal Procedure

Refer to [Figure 3-8](#) for this procedure.

1. Disconnect the power cord.
2. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
3. Disconnect the A4W1 cable from the A31 Motherboard P12.
4. Disconnect the A2DSW1 cable from the A4 Inverter.

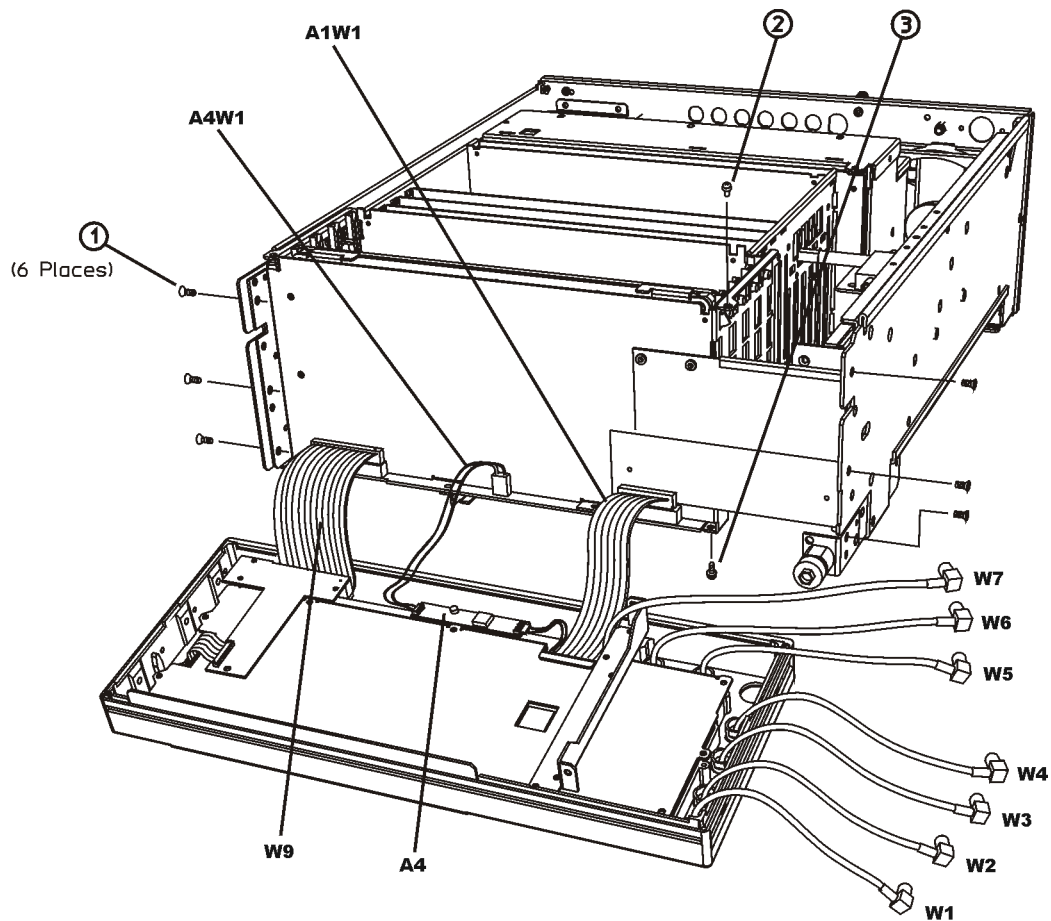
CAUTION The A4 Inverter is fragile and can be damaged when pulled away from the velcro attachment.

5. Remove the A4 Inverter by carefully pulling it away from the front panel.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-8 A4 Inverter Removal



p-se98a

A5 Sampler, A6 Frac-N, A7 Reference, and A8 Output

Tools Required

- none

Removal Procedure

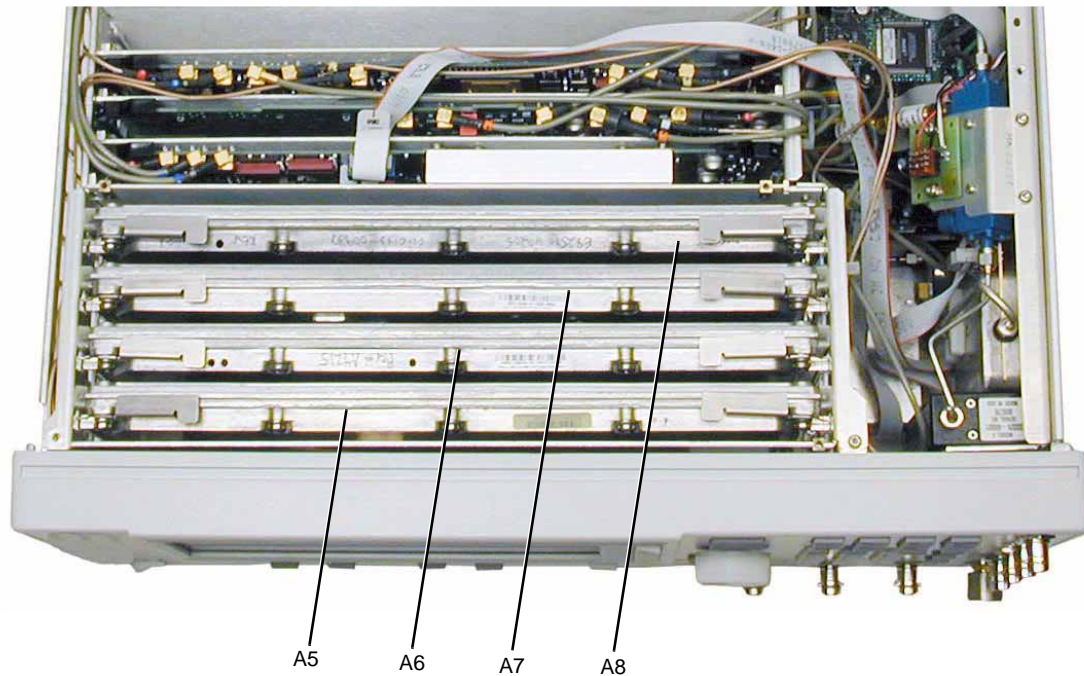
Refer to [Figure 3-9](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on [page 3-3](#) and “[Inner Instrument Cover](#)” on [page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Lift the retention levers and disconnect the board assembly from the A31 Motherboard.
5. Lift the board assembly out of the slot.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-9 A5 Sampler, A6 Frac-N, A7 Reference, and A8 Output



A9 YIG Driver

Tools Required

- needle-nose pliers

Removal Procedure

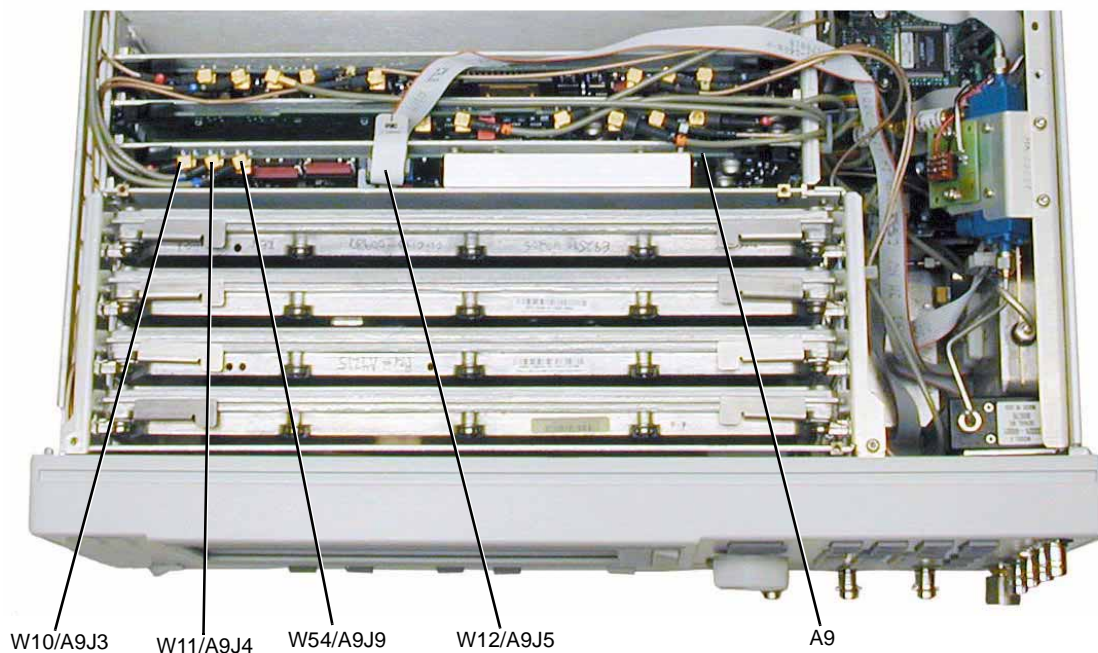
Refer to [Figure 3-10](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on [page 3-3](#) and “[Inner Instrument Cover](#)” on [page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Disconnect the W12 ribbon cable from A9J5.
5. Using the needle-nose pliers, disconnect the following flexible cables:
 - W54 from A9J9
 - W11 from A9J4
 - W10 from A9J3
6. Lift the retention levers and disconnect the A9 YIG Driver from the A31 Motherboard.
7. Lift the A9 YIG Driver out of the slot.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-10 A9 YIG Driver



A10 ALC

Tools Required

- needle-nose pliers

Removal Procedure

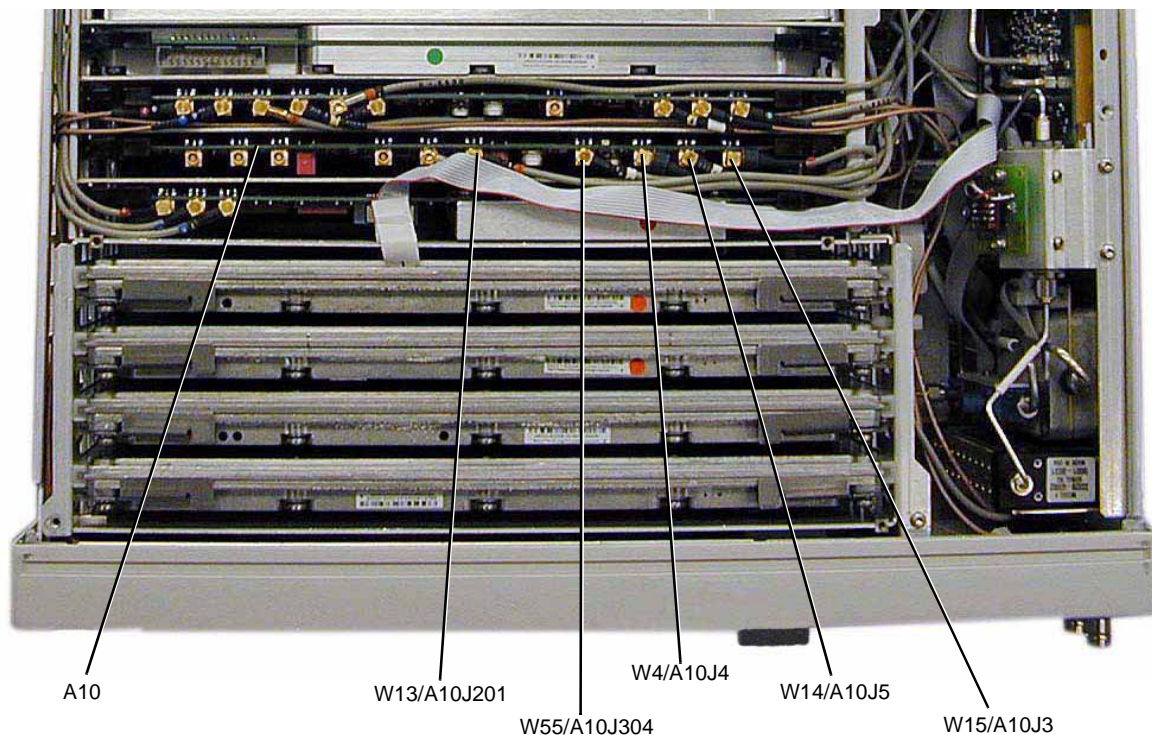
Refer to [Figure 3-11](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Using the needle-nose pliers, disconnect the following flexible cables:
 - W15 from A10J3
 - W14 from A10J5
 - W4 from A10J4
 - W55 from A10J303
 - W13 from A10J201
5. Lift the retention levers and disconnect the A10 ALC from the A31 Motherboard.
6. Lift the A10 ALC out of the slot.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-11 A10 ALC



A11 Pulse/Analog Modulation Generator

Tools Required

- needle-nose pliers

Removal Procedure

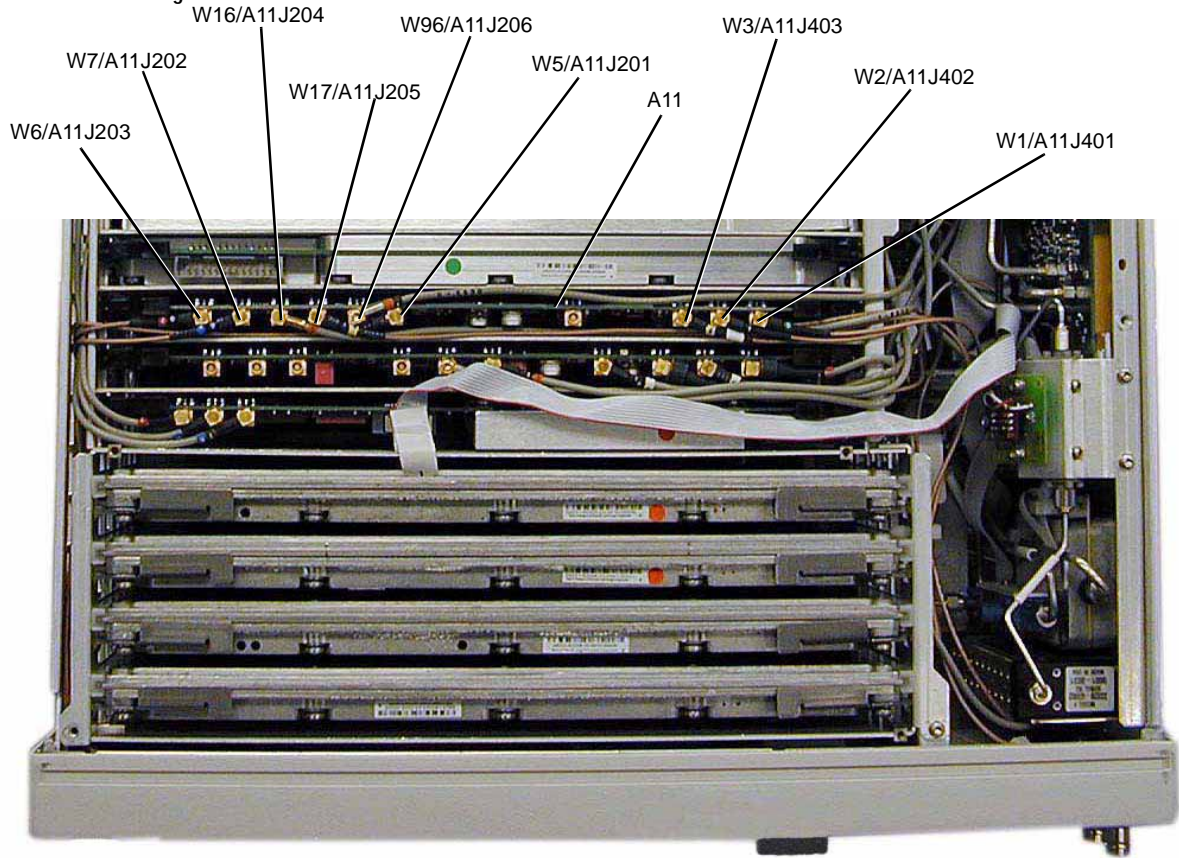
Refer to [Figure 3-12](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Using the needle-nose pliers, disconnect the following flexible cables:
 - W1 from A11J401
 - W2 from A11J402
 - W3 from A11J403
 - W5 from A11J201
 - W96 from A11J206
 - W17 from A11J205
 - W16 from A11J204
 - W7 from A11J202
 - W6 from A11J203
5. Lift the retention levers and disconnect the A11 Pulse/Analog Modulation Generator from the A31 Motherboard.
6. Lift the A11 Pulse/Analog Modulation Generator out of the slot.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-12 A11 Pulse/Analog Modulation Generator



A12 Pulse Modulator Board

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

Refer to [Figure 3-13](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator so that the A31 Motherboard is facing you and the RF deck is on top.
4. Using the 5/16" open-ended wrench, disconnect the W16, W75, and W76 RF cables from the A12 Pulse Modulator Board.
5. Disconnect the W69 ribbon cable from the A12 Pulse Modulator Board.
6. Using the T-10 driver, remove the two screws (1) that attach the A12 Pulse Modulator Board to the main chassis.
7. Remove the A12 Pulse Modulator Board from the RF deck.
8. Using the T-10 driver, remove the sheet metal from A12 Pulse Modulator Board.

Replacement Procedure

- Reverse the order of the removal procedure.
- Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

A18 CPU

Tools Required

- none

Removal Procedure

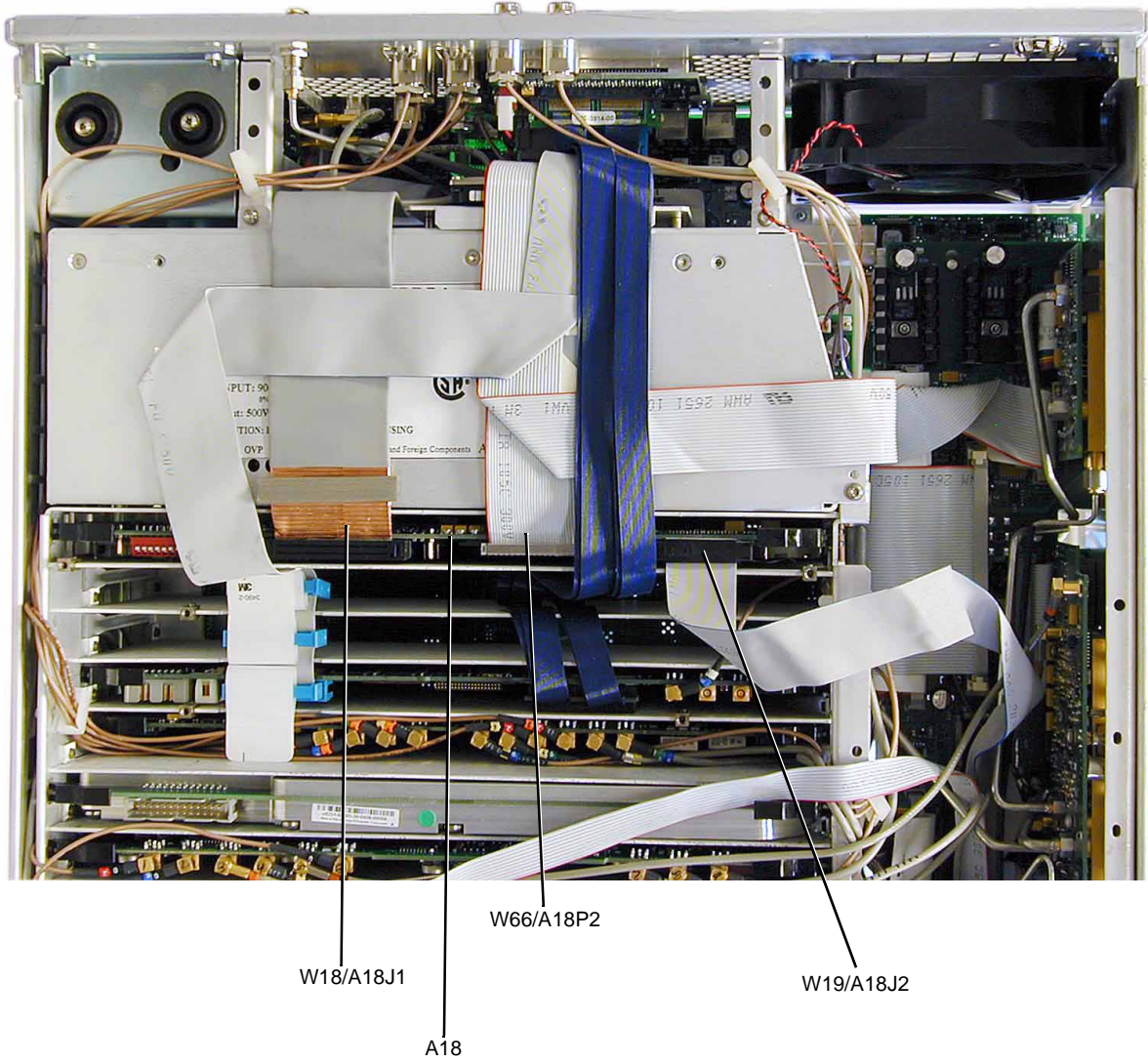
Refer to [Figure 3-14](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Disconnect the following ribbon cables:
 - W19 from A18J2
 - W66 from A18P2
 - W18 from A18J1
5. Lift the retention levers and disconnect the A18 CPU from the A31 Motherboard.
6. Lift the A18 CPU out of the slot.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Send command "DIAG:FILE:REST", this copies data to the CPU board.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-14 A18 CPU



A18BT1

WARNING This battery contains lithium. Do not incinerate or puncture this battery. Do not install this battery backwards. To dispose of the battery in a safe manner, refer to [“Lithium Battery Disposal” on page 5-2](#).

Tools Required

- flat-head screw driver

Removal Procedure

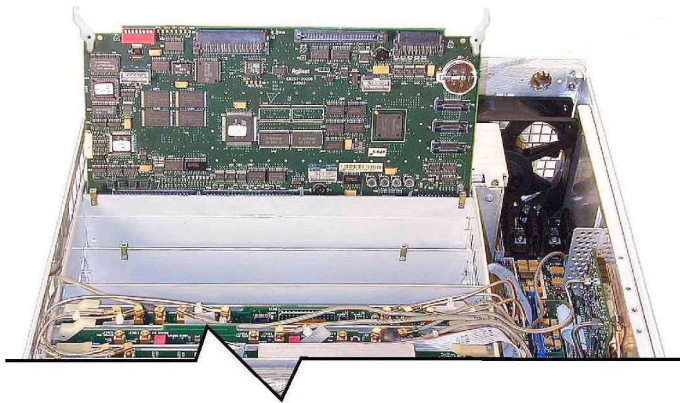
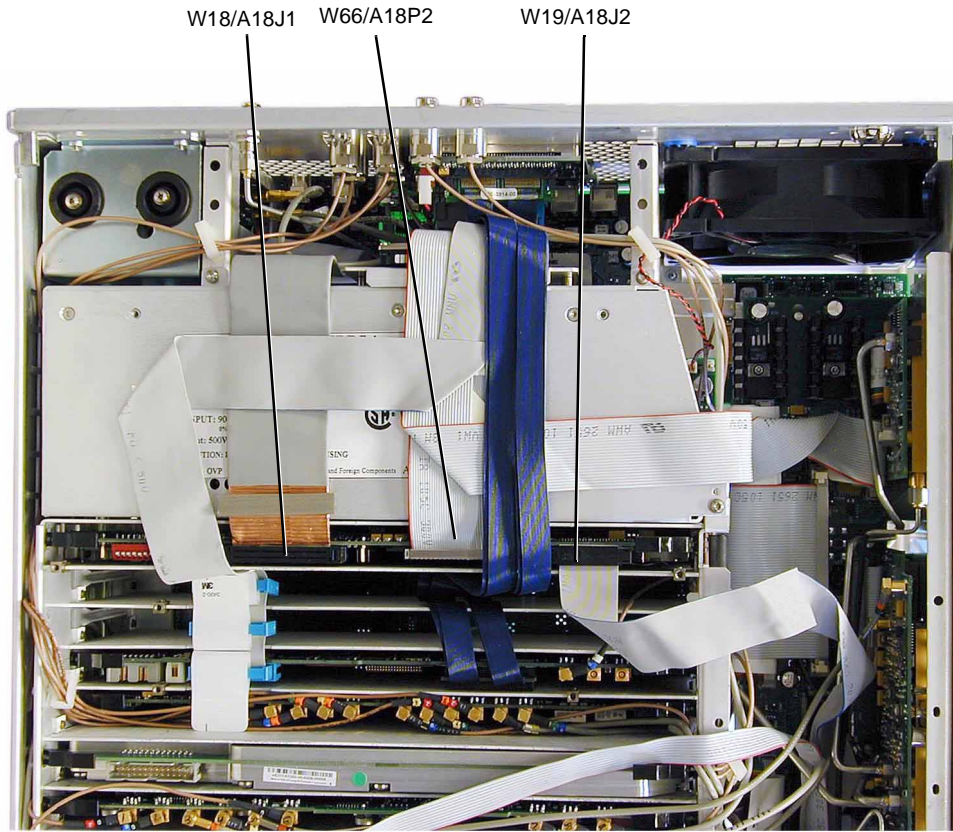
Refer to [Figure 3-14](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the front panel facing you.
4. Disconnect the following ribbon cables:
 - W19 from A18J2
 - W66 from A18P2
 - W18 from A18J1
5. Lift the retention levers and disconnect the A18 CPU from the A31 Motherboard.
6. Lift the A18 CPU out of the slot.
7. Using the flat-head screw driver, remove the A18BT1 by leveraging the battery out of the battery’s socket.

Replacement Procedure

1. To install the battery, the positive side is aligned with the positive sign on the A18’s battery clip.
2. Reverse the remaining steps of the removal procedure.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-15 A18BT1



p2_a18bt1

A19 Power Supply

Tools Required

- T-10 driver
- needle-nose pliers

Removal Procedure

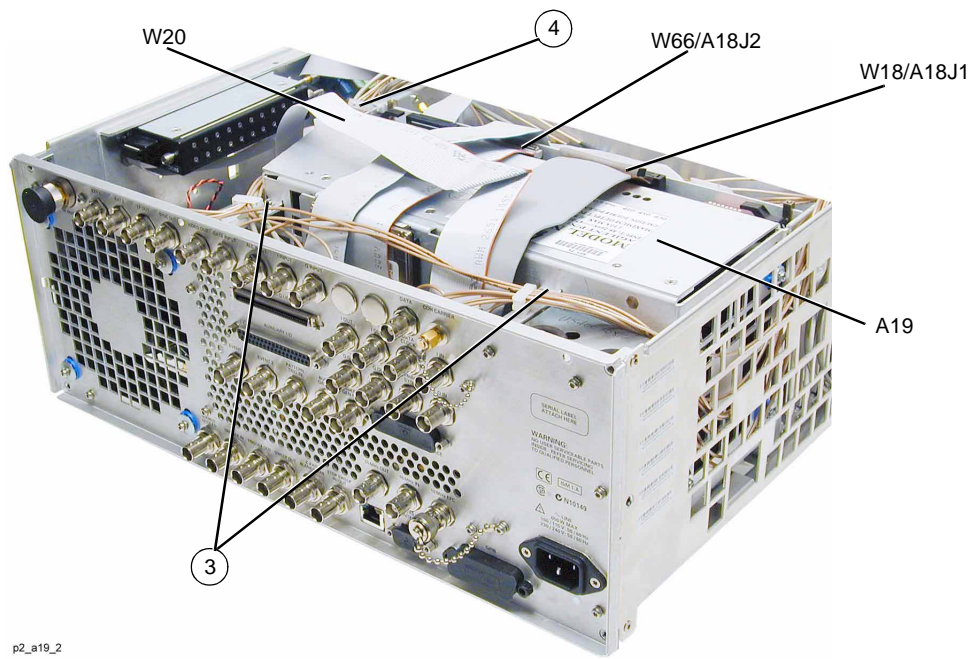
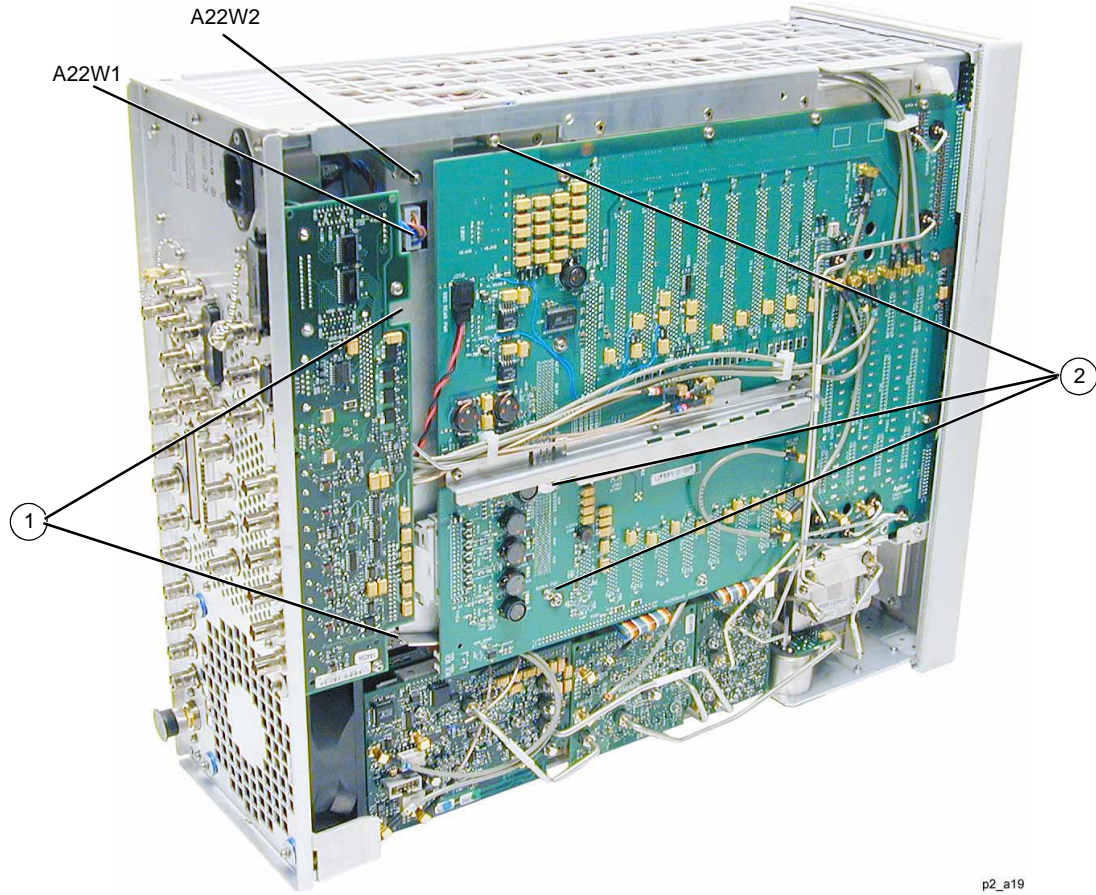
Refer to [Figure 3-16](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you.
4. Disconnect the W20 ribbon cable from the A20 SMI.
5. Using the T-10 driver, remove the two screws (1) that secure the A19 Power Supply to the struts located on the bottom.
6. Using the T-10 driver, remove the three additional screws (2) that are attached to the bottom frame.
7. Using the needle-nose pliers, disconnect A22W1 from the power supply.
8. Using the T-10 driver, remove the screw securing the A22W2 to the A19 Power Supply.
9. Position the signal generator with the A31 Motherboard flat on the work surface and the rear panel facing you.
10. Disconnect the following ribbon cables:
 - W66 from A18 CPU P2
 - W18 from A18 CPU J1
11. Using the T-10 driver, remove the two screws (3) that secure the A19 Power Supply to the struts located on the top and an additional screw (4) located on the top frame.
12. Move W20 to the side and remove the A19 Power Supply from the signal generator’s chassis.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-16 A19 Power Supply Removal



A21 Rear-Panel Interface

Tools Required

- T-10 driver
- 9/16" hex-nut driver
- 5.0 mm hex-nut driver
- 7.0 mm hex-nut driver
- needle-nose pliers

Removal Procedure

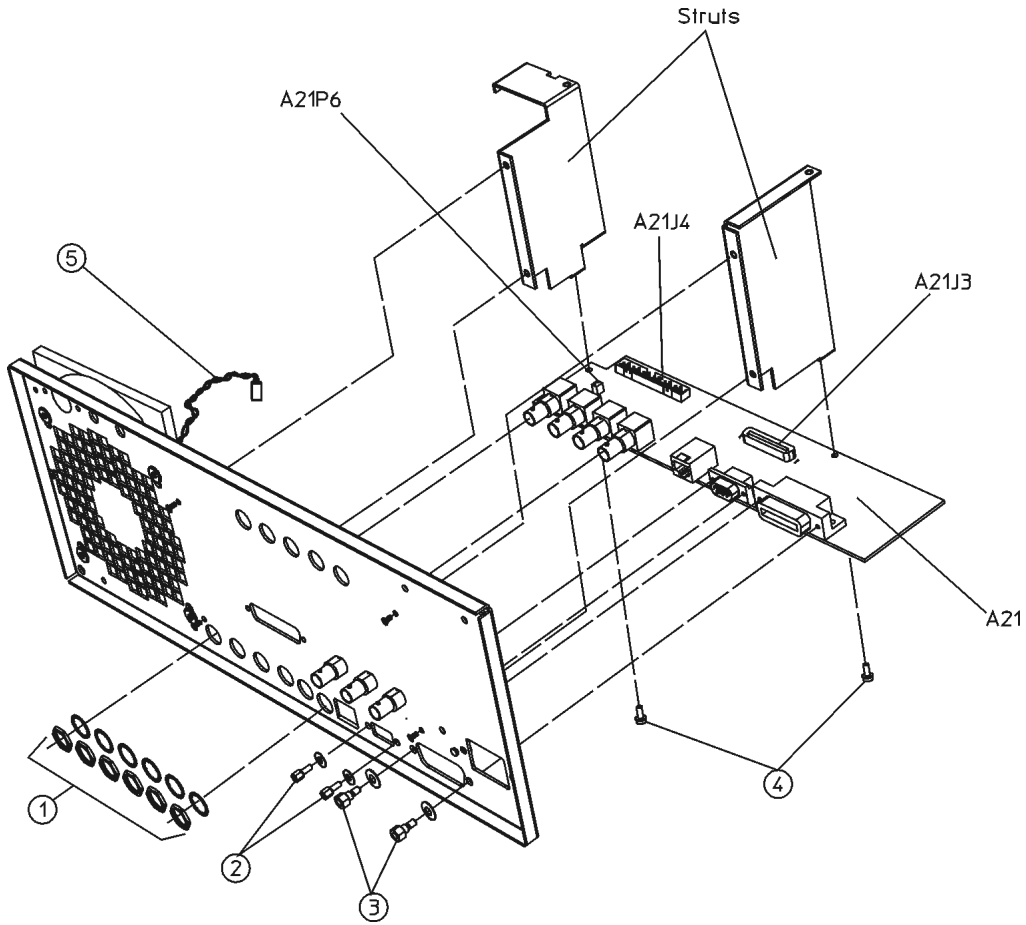
Refer to [Figure 3-17](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Remove the rear panel. Refer to [“Rear Panel” on page 3-54](#).
4. Using the 9/16" hex-nut driver, remove the nuts and washers securing the six BNC connectors (1) at the base of the rear panel.
5. Using the 5.0 mm hex-nut driver, remove the screws (2) from the RS-232 port.
6. Using the 7.0 mm hex-nut driver, remove the screws (3) from the GPIB port.
7. Using the T-10 driver, remove the two screws (4) from the bottom of the A21 Rear-Panel Interface.
8. Disconnect the B1 Fan cable (5) from A31P251.
9. Disconnect the A32 10 MHz Crystal Oscillator cable from A21P2.
10. Remove the A21 Rear-Panel Interface.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all hex-nuts to 9 in-lbs.
4. Torque all BNC nuts to 21 in-lbs.
5. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-17 A21 Rear-Panel Interface



A22 Line Module

Tools Required

- T-10 driver
- 5.0 mm wrench
- needle-nose pliers

Removal Procedure

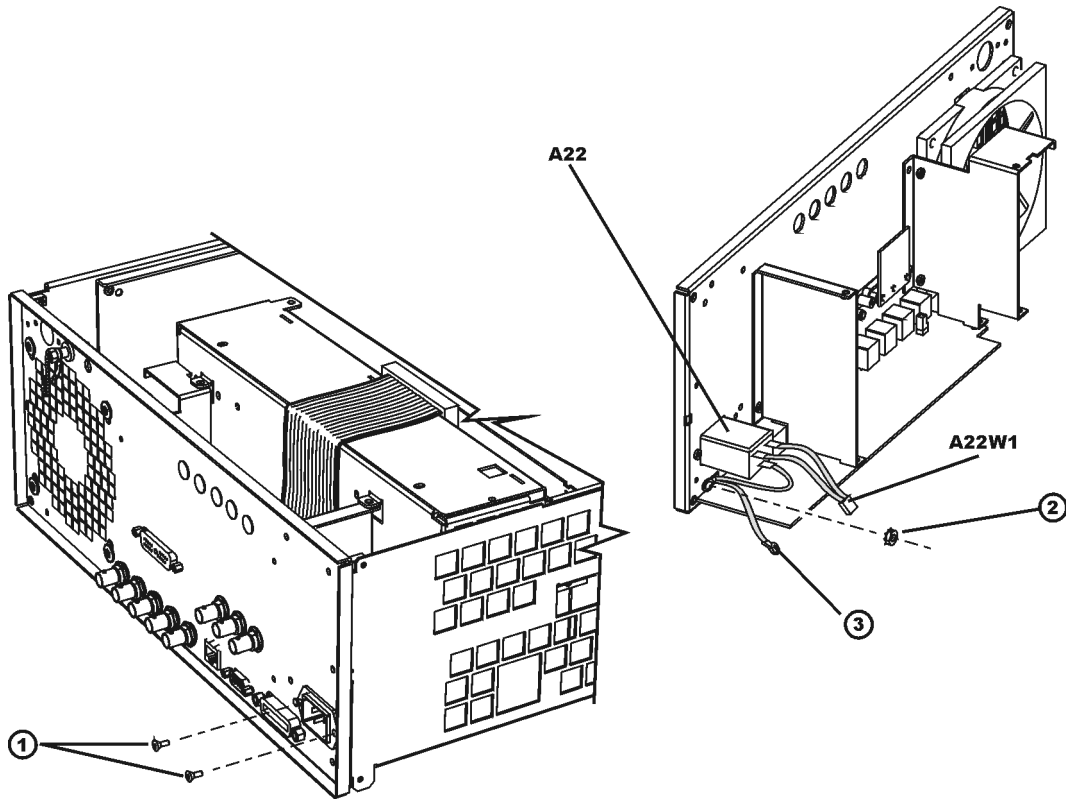
Refer to [Figure 3-18](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on page 3-3 and “[Inner Instrument Cover](#)” on page 3-5.
3. Position the signal generator with the rear panel facing you.
4. Remove the crystal oscillator assembly. Refer to “[A32 10 MHz Crystal Oscillator](#)” on page 3-52.
5. Using the T-10 driver, remove the two screws (1) that attach the A22 Line Module to the rear panel.
6. Using the 5.0 mm wrench, remove the nut (2) and washer from the grounding screw connecting A22W2 to the rear panel.
7. Using the needle-nose pliers, disconnect the A22W1 from the bottom of the A19 Power Supply.
8. Remove the A22 Line Module.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all nuts to 9 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-18 A22 Line Module Removal



A23 Lowband Coupler/Detector

Tools Required

- T-10 driver
- 5/16" open-ended wrench
- wire cutters

Removal Procedure

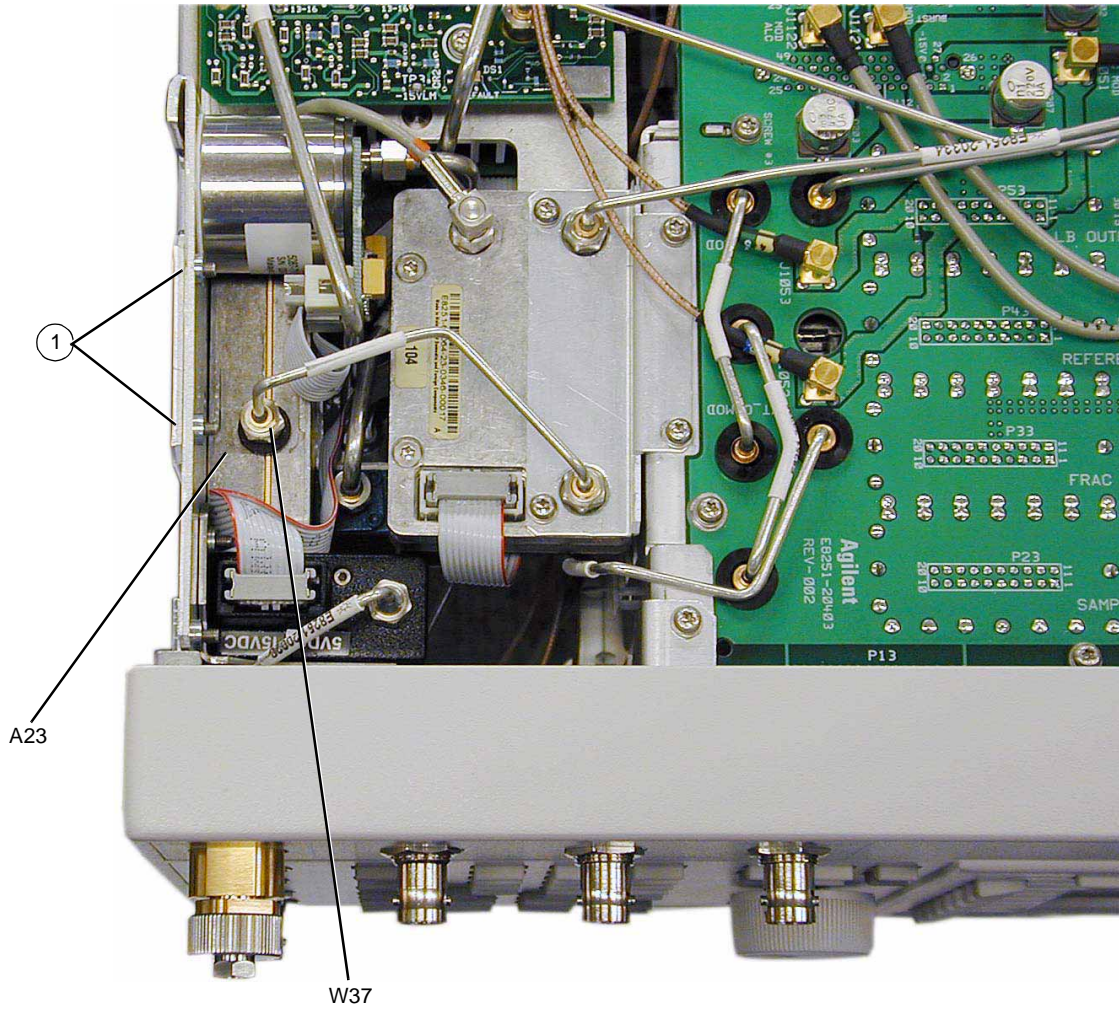
Refer to [Figure 3-19](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on page 3-3 and “[Inner Instrument Cover](#)” on page 3-5.
3. Position the signal generator so that the A31 Motherboard is facing you and the RF deck is on top.
4. Using the 5/16" open-ended wrench, disconnect the W27 RF cable from the A23 Lowband Coupler/Detector.
5. Using the wire cutters, cut the tie wrap that secures the W27 RF cable to the A23 Lowband Coupler/Detector.
6. Using the 5/16" open-ended wrench, disconnect the W37 RF cable from the A23 Lowband Coupler/Detector.
7. Using the T-10 driver, remove the two screws that attach the A23 Lowband Coupler/Detector to the side panel.
8. Disconnect the W28 ribbon cable from the A23 Lowband Coupler/Detector (not shown in [Figure 3-19](#)).
9. Disconnect the W14 flexible cable from the A23 Lowband Coupler/Detector (not shown in [Figure 3-19](#)).
10. Remove the A23 Lowband Coupler/Detector.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-19 A23 Lowband Coupler/Detector



A24 20 GHz Highband Coupler

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

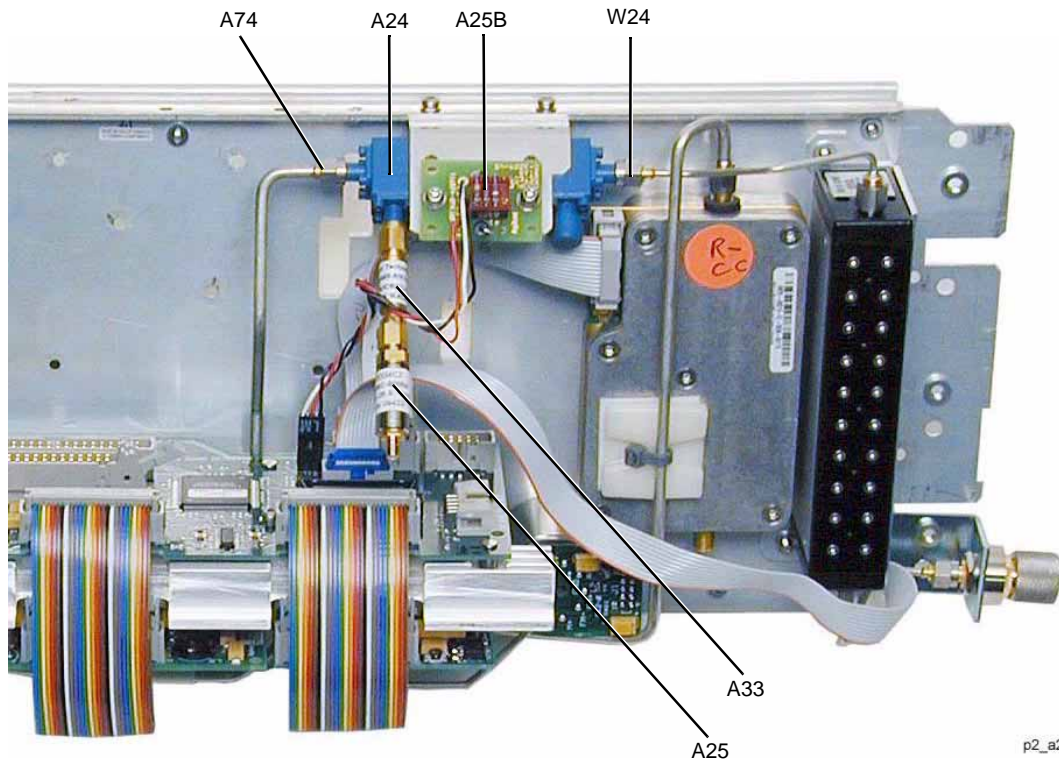
Refer to [Figure 3-20](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing away from you and the RF deck on top.
4. Using the 5/16" open-ended wrench, disconnect the A25 20 GHz Highband Detector from the A24 20 GHz Highband Coupler.
5. Using the 5/16" open-ended wrench, disconnect W74 and W24 RF cables from the A24 20 GHz Highband Coupler's input and output.
6. Using the T-10 driver, remove the two screws that connect the A25B Highband Detector Bias Board to the A24 20 GHz Highband Coupler.
7. Using the T-10 driver, remove the two screws that attach the coupler to the side panel.
8. Remove the A24 20 GHz Highband Coupler.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-20 A24 20 GHz Highband Coupler



p2_a24

A25 20 GHz Highband Detector

Tools Required

- 5/16" open-ended wrench
- needle-nose pliers

Removal Procedure

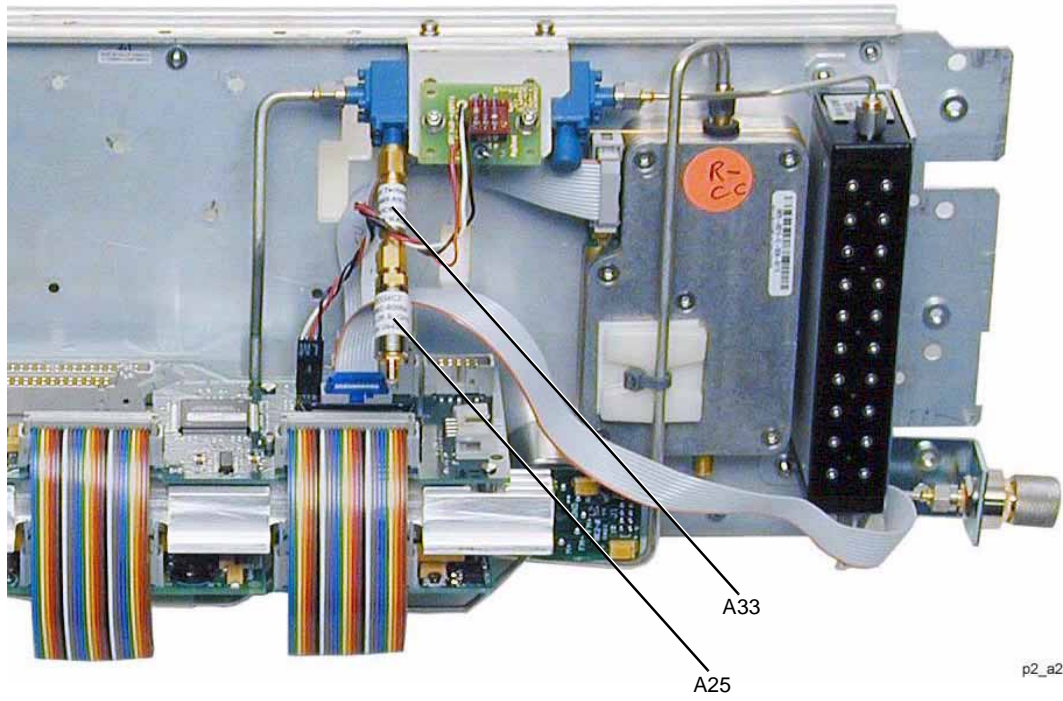
Refer to [Figure 3-21](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing away from you and the RF deck on top.
4. Using the 5/16" open-ended wrench, disconnect the A25 20 GHz Highband Detector from the A24 20 GHz Highband Coupler.
5. Using the needle-nose pliers, disconnect W15 (not shown) from the A25 20 GHz Highband Detector.
6. Remove the A25 20 GHz Highband Detector.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-21 A25 20 GHz Highband Detector



A25B Highband Detector Bias Board

Tools Required

- T-10 driver

Removal Procedure

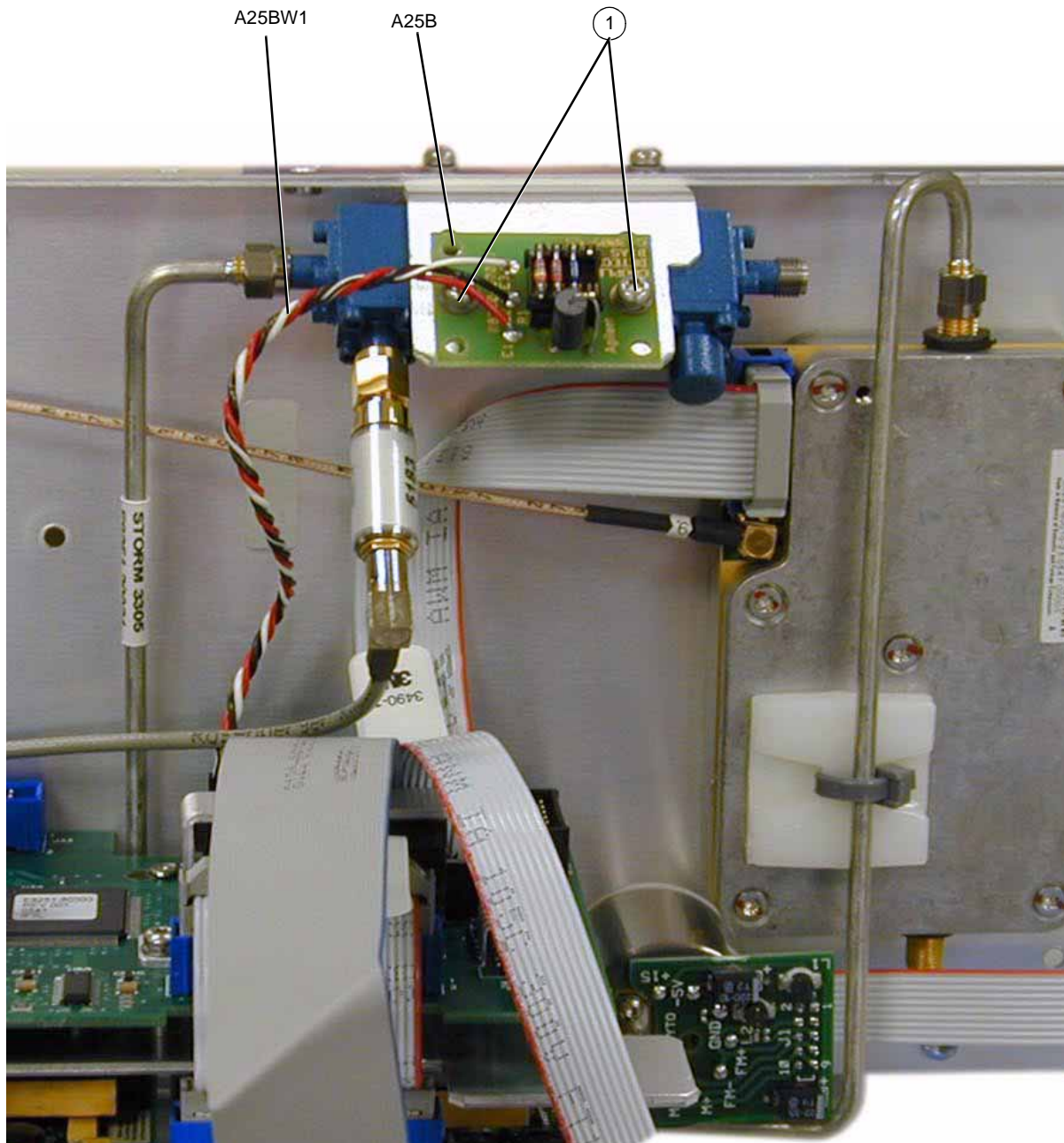
Refer to [Figure 3-22](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing away from you and the RF deck on top.
4. Disconnect the A25BW1 bias board power cable from the A26 MID J12.
5. Using the T-10 driver, remove the two screws (1) that attach the A25B Highband Detector Bias Board to the A24 Highband Coupler.
6. Remove the A25B Highband Detector Bias Board.

Replacement Procedure

- Reverse the order of the removal procedure.
- Torque all T-10 screws to 9 in-lbs.
- Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-22 A25B Highband Detector Bias Board



A26 MID (Microcircuit Interface Deck)

Tools Required

- T-10 driver

Removal Procedure

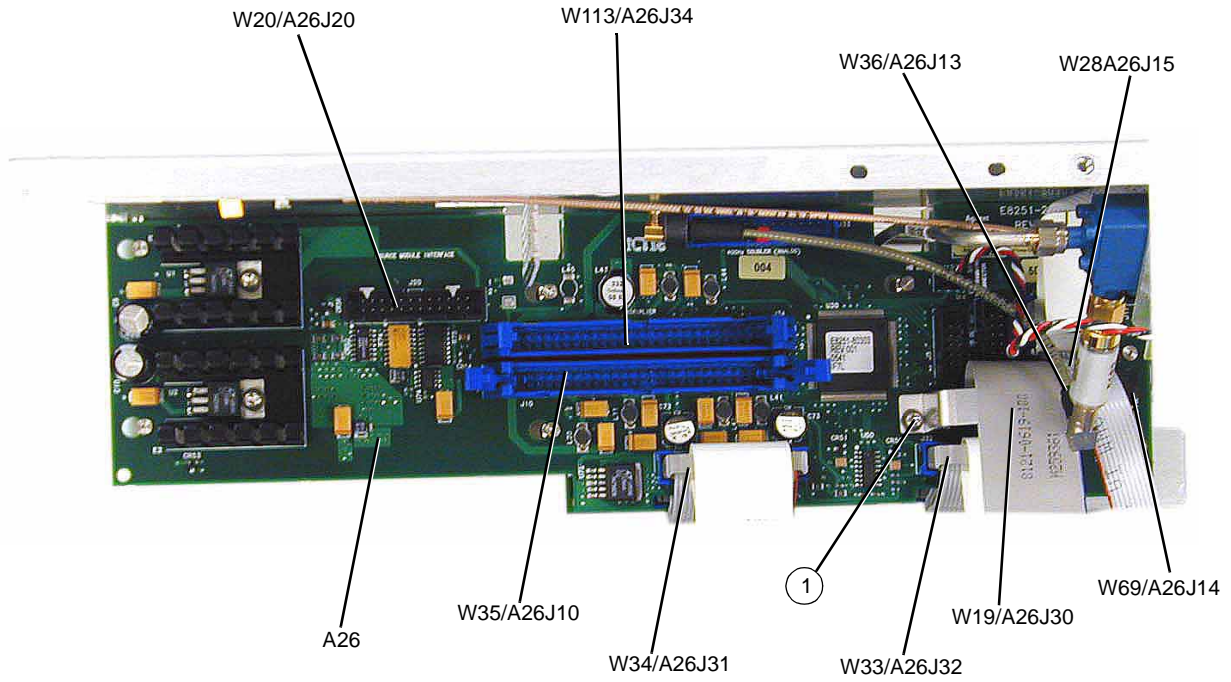
Refer to [Figure 3-23](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you and the RF deck on top.
4. Disconnect the following ribbon cables:
 - W69 from A26J14
 - W28 from A26J15
 - W19 from A26J30
 - W36 from A26J13
 - W33 from A26J32
 - W34 from A26J31
 - W35 from A26J10
 - W20 from A26J20
 - W113 from A26J34
5. Disconnect the A25BW1 power cable from A26J12.
6. Using the T-10 driver, loosen the screw (1) that secures the A26 MID to the RF deck.
7. Slide the A26 MID towards the front panel until the locking standoffs are free.
8. Remove the A26 MID from the RF bracket.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-23 A26 MID



A28 YIG Oscillator

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

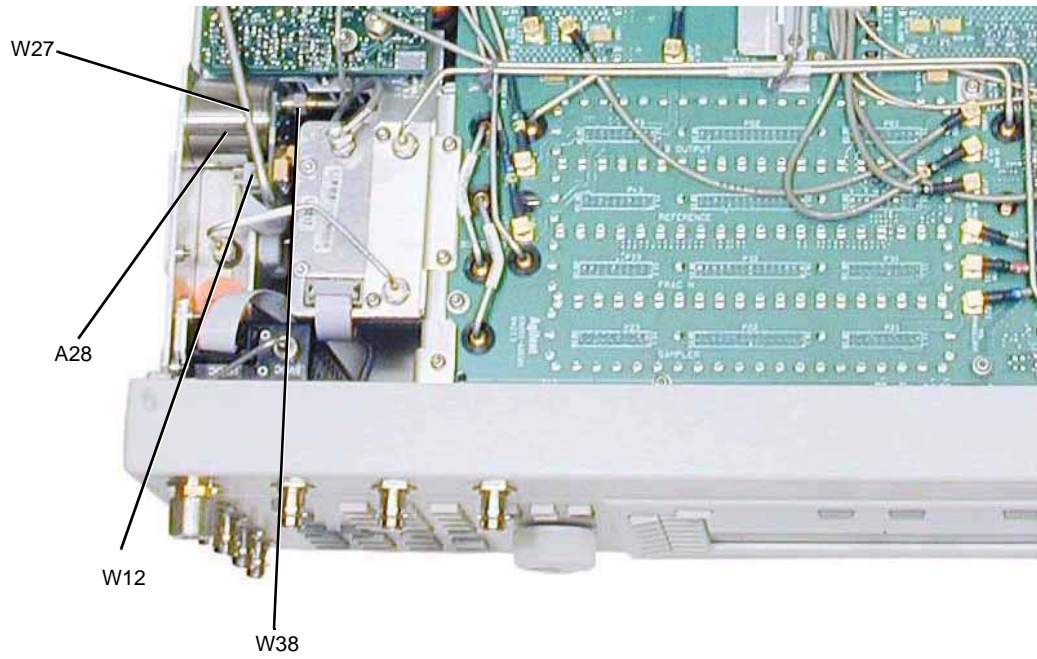
Refer to [Figure 3-24](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you and the RF deck on top.
4. Using the 5/16" open-ended wrench, disconnect the W41 RF cable from the A28J1.
5. Disconnect the W12 ribbon cable from the A28 YIG Oscillator's driver board.
6. Using the T-10 driver, remove the two screws (1) that attach the A28 YIG Oscillator to the side panel.
7. Using the 5/16" open-ended wrench, disconnect the W27 RF cable from the A30 Modulation Filter with High Power.
8. Remove the A28 YIG Oscillator.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-24 A28 YIG Oscillator



A29 20 GHz Doubler

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

Refer to [Figure 3-25](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you and the RF deck on top.
4. Using the 5/16" open-ended wrench, disconnect the following RF cables:
 - W39 from A29J4
 - W40 from A29J3
5. Using the 5/16" open-ended wrench, disconnect the W41 RF cable from A29J2 and the W38 RF cable from A29J1.
6. Using the T-10 driver, remove the two screws (1) that attach the A29 20 GHz Doubler to the RF deck.
7. Disconnect the W33 ribbon cable from A29J10.
8. Remove the A29 20 GHz Doubler from the RF deck.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

A30 Modulation Filter

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

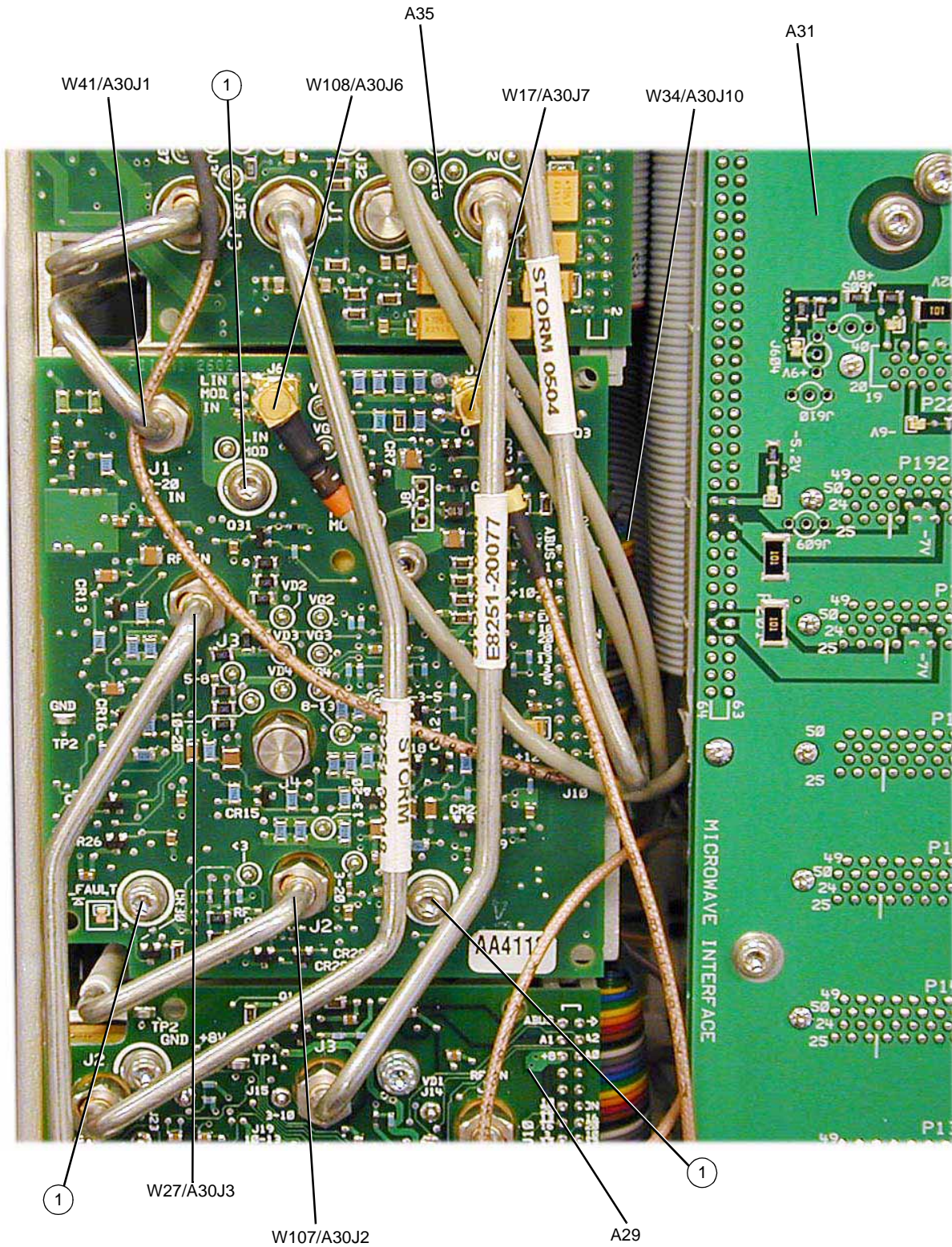
Refer to [Figure 3-26](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing away from you and the RF deck on top.
4. Disconnect the following flexible cables:
 - W17 from A30J7
 - W108 from A30J6
5. Using the 5/16" open-ended wrench, disconnect the W41 RF cable from A30J1.
6. Disconnect the W34 ribbon cable from the A30 Modulator Filter.
7. Using the 5/16" open-ended wrench, disconnect the following RF cables:
 - W41 from A30J1
 - W74 from A30J2
 - W27 from A30J3
 - W32 from A30J4
8. Using the T-10 driver, remove the three screws (1) that attach the A30 Modulator Filter to the RF bracket.
9. Remove the A30 Modulator Filter from the RF deck.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-26 A30 Modulator Filter



A31 Motherboard

Tools Required

- T-10 driver
- 5/16" open-ended wrench
- needle-nose pliers

Removal Procedure

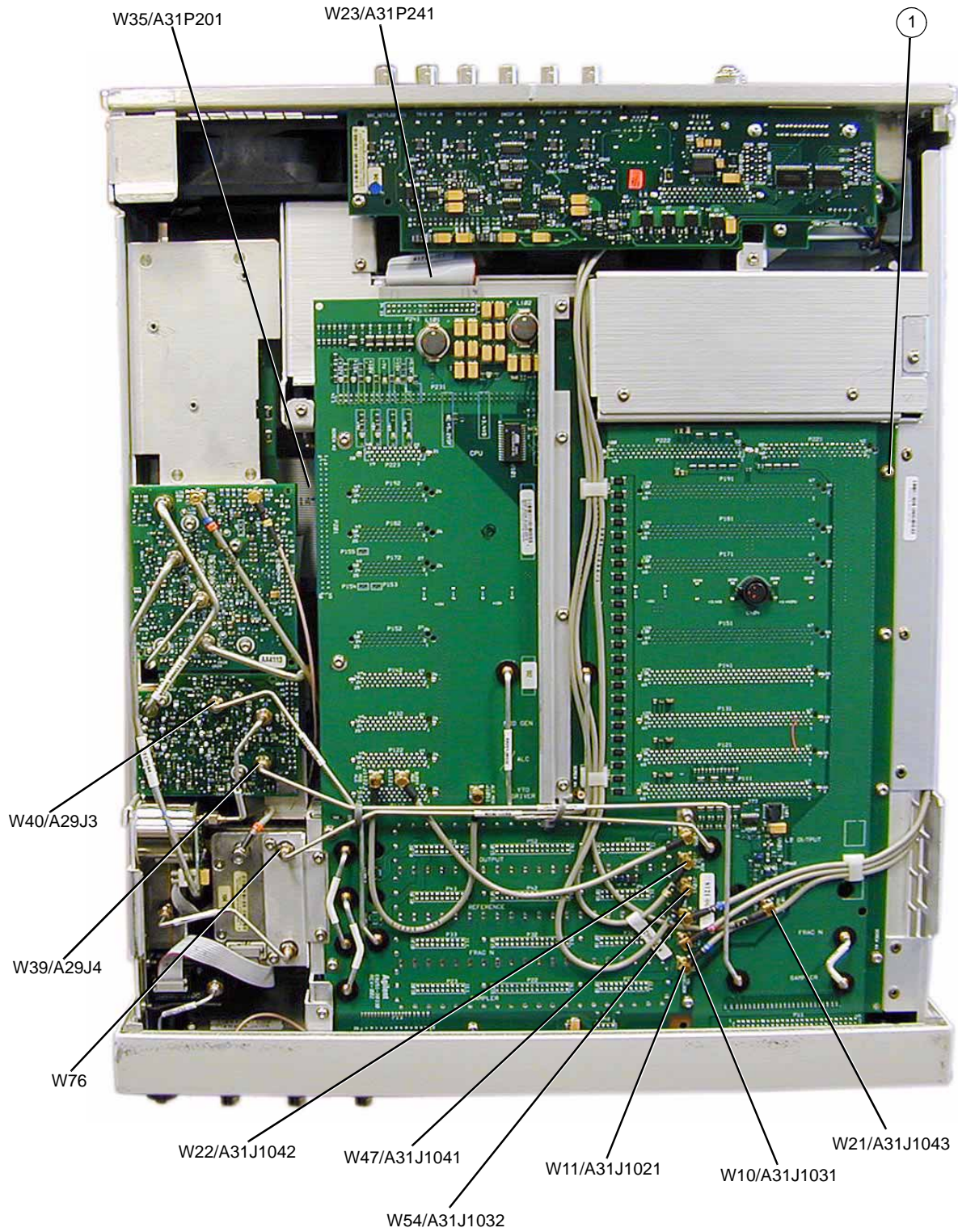
Refer to [Figure 3-27](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you and the RF deck on top.
4. Remove the front panel. Refer to [“Front Panel” on page 3-6](#).
5. Remove the assemblies that are inserted into the A31 Motherboard. Refer to [“A5 Sampler, A6 Frac-N, A7 Reference, and A8 Output” on page 3-17](#), [“A9 YIG Driver” on page 3-18](#), [“A10 ALC” on page 3-19](#), [“A11 Pulse/Analog Modulation Generator” on page 3-21](#), and [“A18 CPU” on page 3-25](#).
6. Using the 5/16" open-ended wrench, disconnect the following RF cables:
 - W40 from A29J3
 - W39 from A29J4
 - W76 from A12 Pulse Modulator Board
7. Using the needle-nose pliers, disconnect the following flexible cables:
 - W21 from A31J1043
 - W10 from A31J1031
 - W11 from A31J1021
 - W54 from A31J1032
 - W47 from A31J1041
 - W22 from A31J1042
8. Disconnect the W23 ribbon cable from the A21 Rear Panel Interface while removing the A31 Motherboard from the chassis.
9. Disconnect the W35 ribbon cable from the A26 MID J10.
10. Using the T-10 driver, remove the 15 screws (1) that hold the A31 Motherboard to the chassis.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Send command "DIAG:FILE:BACK", this copies data to the Motherboard.
3. Torque all T-10 screws to 9 in-lbs.
4. Torque all RF connectors to 8 in-lbs.
5. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-27 A31 Motherboard



A32 10 MHz Crystal Oscillator

Tools Required

- T-10 driver
- needle-nose pliers

Removal Procedure

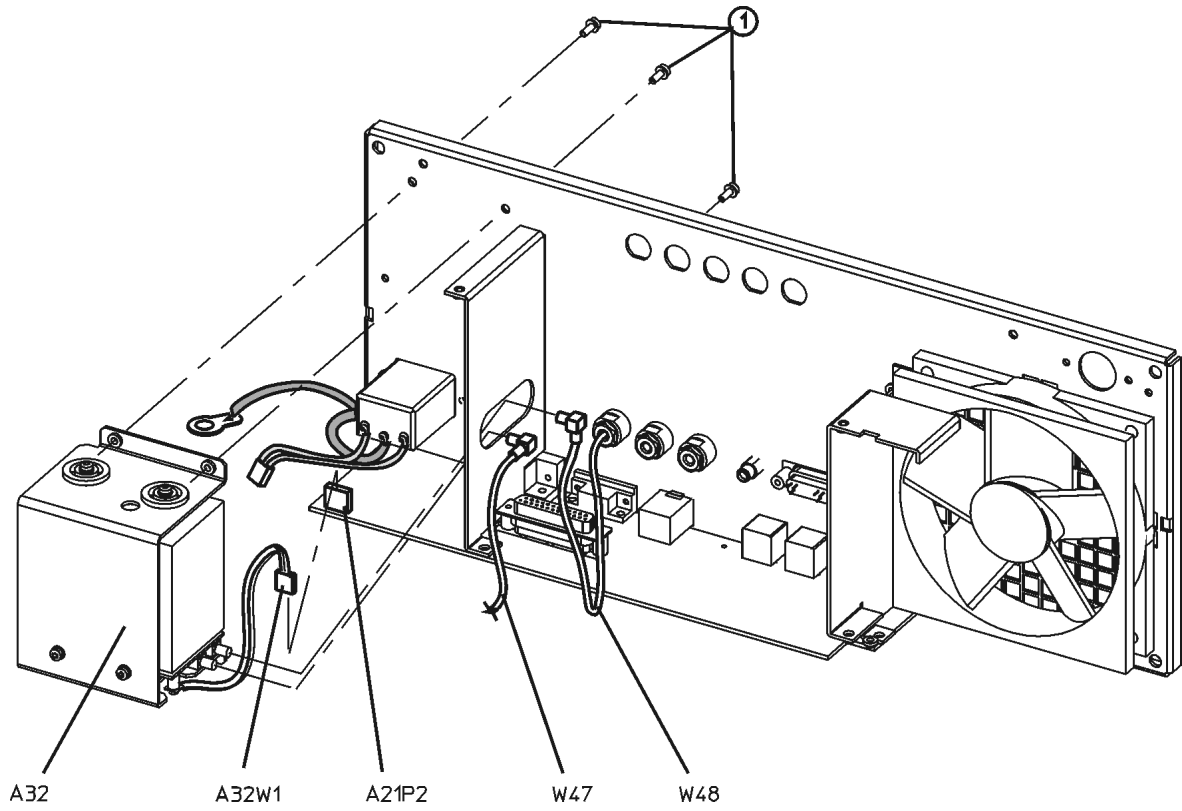
Refer to [Figure 3-28](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to “[Outer Instrument Cover](#)” on page 3-3 and “[Inner Instrument Cover](#)” on page 3-5.
3. Position the signal generator with the Rear Panel facing you.
4. Using the needle-nose pliers, disconnect the W47 flexible cable (A31 Motherboard J1041) from A32J2.
5. Using the needle-nose pliers, disconnect the W48 flexible cable (10 MHz EFC) from A32J1.
6. Disconnect the A32W1 bias cable from the A21 Rear Panel Interface P2.
7. Using the T-10 driver, remove the three screws (1) that attach the A32 10 MHz Crystal Oscillator to the rear panel.
8. Remove the A32 10 MHz Crystal Oscillator.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-28 A32 Crystal Oscillator



Rear Panel

Tools Required

- T-10 driver
- needle-nose pliers
- 5/16" open-ended wrench

Removal Procedure

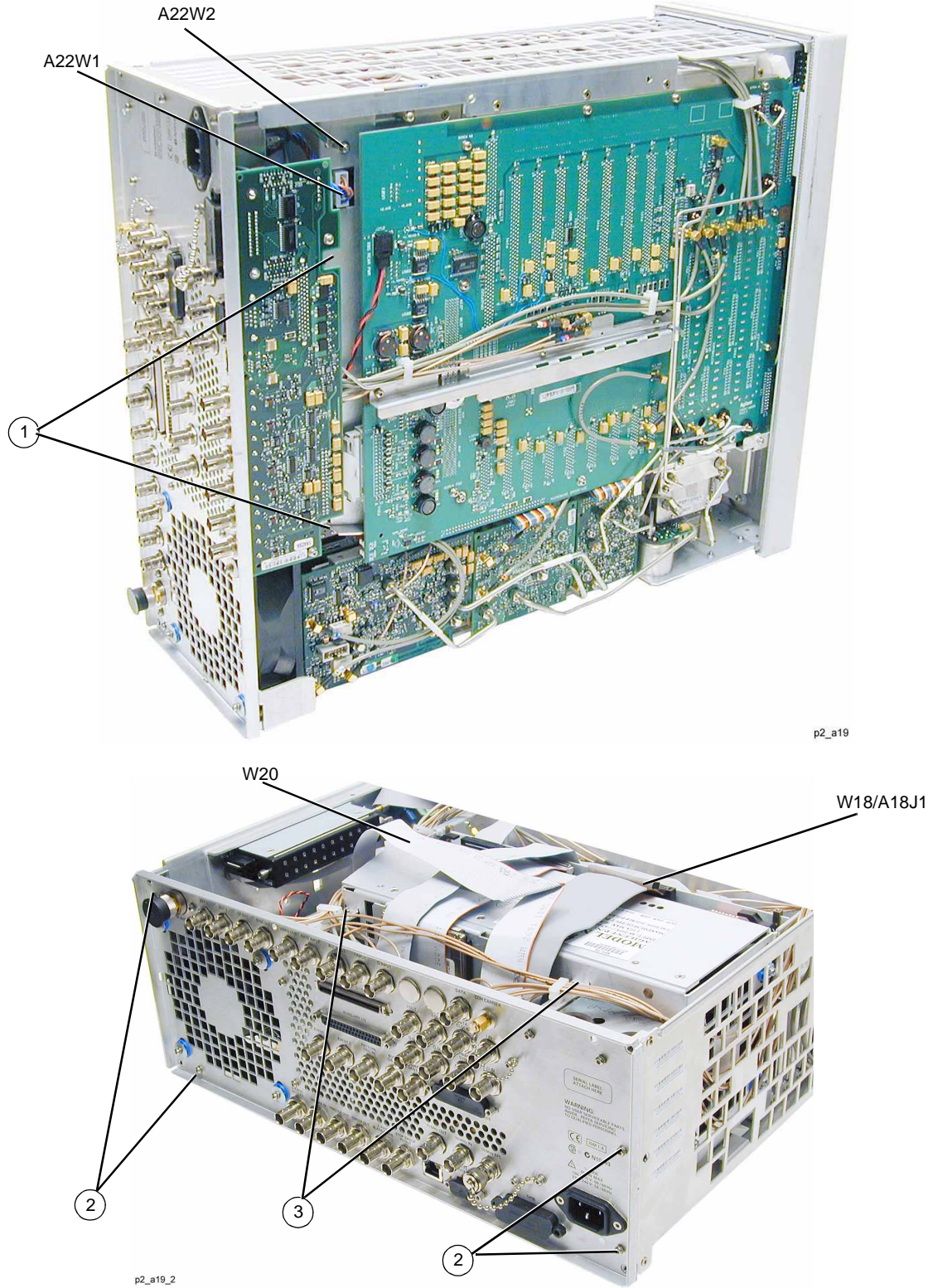
Refer to [Figure 3-29](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard panel facing you.
4. Using the needle-nose pliers, disconnect the following flexible cables:
 - W21 (10 MHz output) from A31 Motherboard J1043
 - W47 from A31 Motherboard J1041
 - W22 (10 MHz input) from A31 Motherboard J1042
5. Position the signal generator with the rear panel facing you.
6. Using the needle-nose pliers, disconnect the following flexible cables:
 - W55 (SOURCE MOD INTERFACE) from A10 ALC J304
7. Using the 5/16" open-ended wrench, disconnect the W67 RF cable (.25-3.2 GHz COH CARRIER) from the Rear Panel.
8. Disconnect the following ribbon cables:
 - W20 from A20 SMI J1
 - W18 from A21 Rear-Panel Interface J3
 - W23 from A21 Rear-Panel Interface J2
9. Disconnect the W48 flexible cable from A32 10 MHz Crystal Oscillator.
10. Using the T-10 driver, remove the two screws (1) that secure the Rear Panel to the left and right struts.
11. Using the T-10 driver, remove the four screws (2) that attach the rear panel to the frame.
12. Using the T-10 driver, remove the two screws (3) that secure the Rear Panel to the left and right struts.
13. Using the needle-nose pliers, disconnect A22W1 from the power supply.
14. Using the T-10 driver, remove the screw securing the A22W2 to the A19 Power Supply.
15. Disconnect the B1 Fan cable from the A31 Motherboard P251.
16. Pull the rear panel away from the signal generator's chassis.

Replacement Procedure

- Reverse the order of the removal procedure.
- Torque all T-10 screws to 9 in-lbs.
- Torque all RF connectors to 8 in-lbs.
- Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-29 Rear Panel Removal



AT1 115 dB Attenuator

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

Refer to [Figure 3-30](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the A31 Motherboard facing you so that the RF deck is on top.
4. Using the 5/16" open-ended wrench, disconnect the W24 and W25 RF cables from the AT1 90 dB Attenuator.

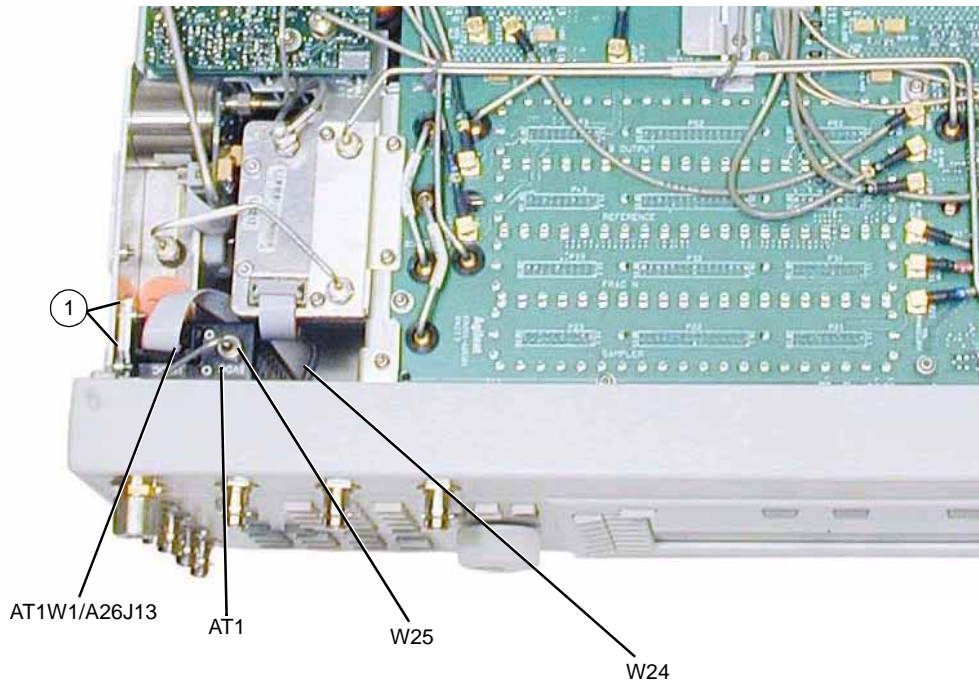
NOTE Cables W24 and W25 are easily damaged. DO NOT bend them. Bending the cables can damage the center conductor, which could result in power “holes”.

5. Using the T-10 driver, remove the two screws (1) that attach the AT1 115 dB Attenuator to the side panel.
6. Disconnect the AT1W1 ribbon cable from A26J13.
7. Remove the attenuator from the A26 MID bracket.
8. Using the T-10 driver, remove the sheet metal from the attenuator.

Replacement Procedure

1. Reverse the order of the removal procedure.
2. Torque all T-10 screws to 9 in-lbs.
3. Torque all RF connectors to 8 in-lbs.
4. Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-30 AT1 115 dB Attenuator



B1 Fan

Tools Required

- T-10 driver
- 5/16" open-ended wrench

Removal Procedure

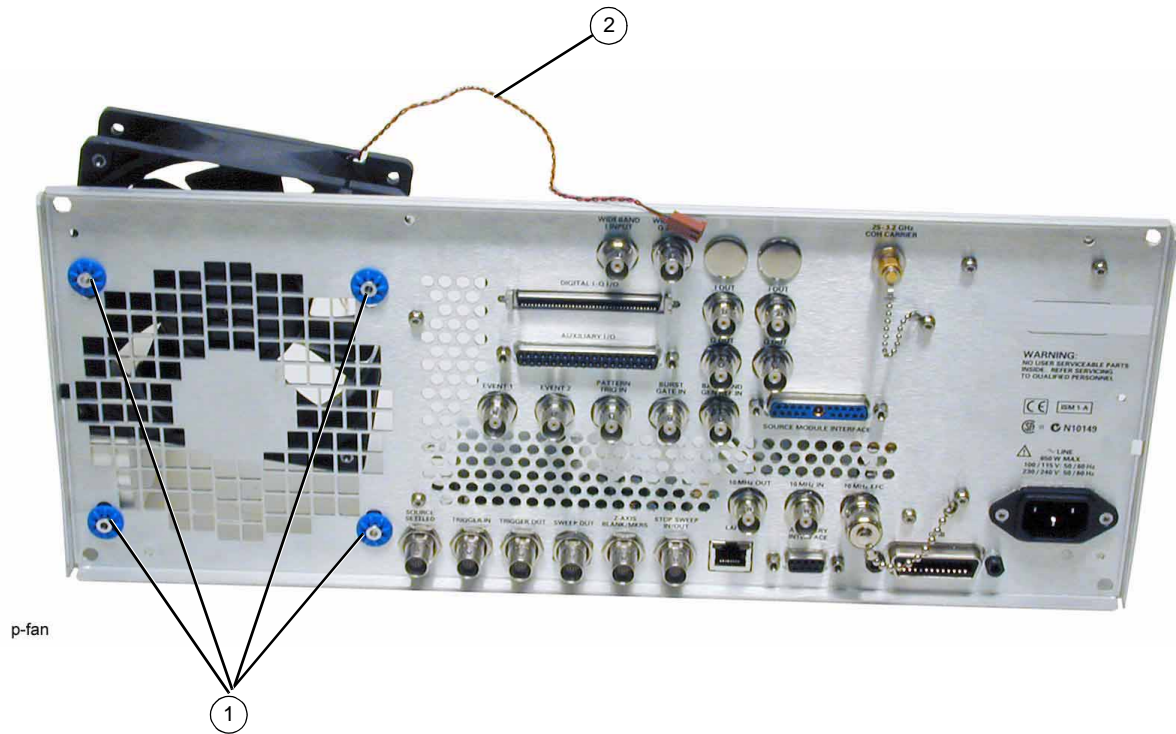
Refer to [Figure 3-31](#) for this procedure.

1. Disconnect the power cord.
2. Remove the covers from the signal generator. Refer to [“Outer Instrument Cover” on page 3-3](#) and [“Inner Instrument Cover” on page 3-5](#).
3. Position the signal generator with the rear panel facing you.
4. For Option 1EM signal generators only, use the 5/16" open-ended wrench to disconnect W73 RF cable from the AT1 115 dB Attenuator and the RF Out.
5. Using the T-10 driver, remove the four screws (1) that attach the B1 Fan to the rear panel.
6. Disconnect the fan cable (2) from the A31 Motherboard P251.
7. Remove the B1 Fan.

Replacement Procedure

- Reverse the order of the removal procedure.
- Torque all T-10 screws to 9 in-lbs.
- Torque all RF connectors to 8 in-lbs.
- Perform the post-repair adjustments and performance tests that pertain to this removal procedure.

Figure 3-31 B1 Fan



p-fan

4 Post-Repair Procedures

- “Adjustments: Assemblies A1–A12” on page 4-1
- “Adjustments: Assemblies A18–A26” on page 4-2
- “Adjustments: Assemblies A28–A39, AT1, B1, and RF Output Connector” on page 4-2
- “Performance Tests: Assemblies A1–A12” on page 4-3
- “Performance Tests: Assemblies A18–A29” on page 4-3
- “Performance Tests: Assemblies A30–A39, AT1, B1, and RF Output Connector” on page 4-4

Post-Repair Procedures Matrix

Table 4-1 Adjustments: Assemblies A1–A12

Adjustments	Replaced Assembly												
	A1 Keyboard	A2 Display	A2DS1 Display Backlight	A3 Power Switch	A4 Inverter	A5 Sampler	A6 Frac-N	A7 Reference	A8 Output	A9 YIG Driver	A10 ALC	A11 Pulse/Analog Mod Gen	A12 Low Band Fast Pulse
The following adjustments are listed in the order that they should be performed for proper calibration.													
ADC Calibration						✓	✓	✓	✓	✓	✓	✓	✓
YIG-Driver Pre-Tune Calibration										✓			
VCO Bias Frac-N Calibration							✓						
Internal Source Calibration												✓	
AM Audio Path Offset Calibration											✓	✓	
KV vs. Frequency Calibration							✓						
Timebase Calibration (Non UNX and/or UNJ Options)													
FM Path Offset Calibration							✓			✓		✓	
FM In-band Offset Calibration							✓			✓		✓	
FM Inverting Amplifier Offset Calibration												✓	
FM Scale Offset Calibration							✓			✓		✓	
FM 1/2 Path Ratio Gain Calibration							✓			✓		✓	
Mod Source Relative Gain Calibration							✓			✓		✓	
FM/PM Out-of-Band Calibration							✓			✓		✓	
FM/PM YO Frequency Compensation Calibration							✓			✓		✓	
DC FM Calibration							✓			✓		✓	
Low Frequency Output Calibration												✓	
External Input Peak Detector Calibration												✓	
ALC Dynamic Calibration									✓		✓		✓
Power Flatness Calibration									✓		✓		✓
ALC Modulator Calibration									✓		✓		
AM Gain Calibration									✓		✓	✓	
Gain Adjustment Bypass Calibration (Frequencies ≤3.2 GHz)							✓		✓	✓			
Power Clamp									✓		✓		
Pulse Width Calibration									✓			✓	✓

Table 4-2 Adjustments: Assemblies A18—A26

Adjustments	Replaced Assembly								
	A18 CPU	A19 Power Supply	A21 Rear Panel	A22 Line Module	A23 Lowband Coupler/Detector	A24 20 GHz Coupler	A25 20 GHz Detector	A25B Detector Bias Board	A26 MID
The following adjustments are listed in the order that they should be performed for proper calibration.									
ADC Calibration	✓								✓
ALC Dynamic Calibration					✓	✓	✓	✓	
Power Flatness Calibration					✓	✓	✓	✓	
Lowband Attenuator Calibration (<3.2GHz)									
High Band Attenuator Calibration (>3.2GHz)									

Table 4-3 Adjustments: Assemblies A28—A39, AT1, B1, and RF Output Connector

Adjustments	Replaced Assembly									
	A28 YIG Oscillator	A29 20 GHz Doubler	A30 Mod Filter	A31 Motherboard	A32 10 MHz Crystal Oscillator	A39 Directional Coupler	AT1 115 dB Attenuator	B1 Fan	RF Output Connector	
The following adjustments are listed in the order that they should be performed for proper calibration.										
ADC Calibration	✓	✓	✓							
YIG-Driver Pre-Tune Calibration	✓									
FM Path Offset Calibration	✓									
FM In-band Offset Calibration	✓									
FM Scale Offset Calibration	✓									
FM 1/2 Path Ratio Gain Calibration	✓									
Mod Source Relative Gain Calibration	✓									
FM/PM YO Frequency Compensation Calibration	✓									
DC FM Calibration	✓									
External Input Peak Detector Calibration	✓									
ALC Dynamic Calibration			✓							
Upconverter Gain Adjustment Calibration										
Power Flatness Calibration				✓			✓			✓
ALC Modulator Calibration				✓						
AM Gain Calibration				✓						
Pulse Width Calibration				✓						
Lowband Attenuator Calibration (<3.2GHz)							✓			
High Band Attenuator Calibration (>3.2GHz)							✓			

Table 4-4 Performance Tests: Assemblies A1—A12

Performance Tests	Replaced Assembly												
	A1 Keyboard	A2 Display	A2DS1 Backlight	A3 Power Switch	A4 Inverter	A5 Sampler	A6 Frac. N	A7 Reference	A8 Output	A9 YIG Driver	A10 ALC	A11 Pulse/Analog Mod Gen	A12 Lowband Fast Pulse
<p>The following performance tests are listed in the order that they should be performed to minimize changes in test equipment configurations.</p> Self Tests	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum Leveled Output Power							✓		✓		✓		
Power Level Accuracy									✓		✓		
Internal Pulse Modulation Level Accuracy									✓			✓	✓
Internal Pulse Modulation Rise/Fall Time									✓			✓	✓
DC FM Carrier Offset							✓					✓	
Internal FM Frequency Response							✓			✓		✓	
External Phase Modulation Frequency Response							✓			✓		✓	
Internal FM Distortion							✓					✓	
Internal Phase Modulation Distortion							✓					✓	
External FM Deviation Accuracy							✓			✓		✓	
Internal Phase Modulation Deviation Accuracy							✓			✓		✓	
External Pulse Modulation ON/OFF Ratio									✓			✓	✓
Harmonic Spurious							✓	✓	✓				
Sub-Harmonic Spurious							✓	✓					
Non-Harmonic Spurious					✓	✓	✓	✓					
Single-Sideband Phase Noise					✓	✓	✓	✓	✓				

Table 4-5 Performance Tests: Assemblies A18—A29

Performance Tests	Replaced Assembly										
	A18 CPU or BTI	A19 Power Supply	A21 Rear Panel Interface	A22 Line Module	A23 Lowband Coupler/Detector	A24 20 GHz Coupler	A25 20 GHz Detector	A25B Detector Bias Board	A26 MID [Microcircuit Interface Deck]	A28 YIG Oscillator	A29 20 GHz Doubler
<p>The following performance tests are listed in the order that they should be performed to minimize changes in test equipment configurations.</p> Self Tests	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum Leveled Output Power					✓	✓	✓		✓	✓	✓
Power Level Accuracy					✓	✓	✓	✓	✓		✓
Internal FM Frequency Response										✓	
External Phase Modulation Frequency Response										✓	

Table 4-5 Performance Tests: Assemblies A18—A29

Performance Tests	Replaced Assembly										
	A18 CPU or BT1	A19 Power Supply	A21 Rear Panel Interface	A22 Line Module	A23 Lowband Coupler/Detector	A24 20 GHz Coupler	A25 20 GHz Detector	A25B Detector Bias Board	A26 MID [Microcircuit Interface Deck]	A28 YIG Oscillator	A29 20 GHz Doubler
The following performance tests are listed in the order that they should be performed to minimize changes in test equipment configurations.											
External FM Deviation Accuracy										✓	
Internal Phase Modulation Deviation Accuracy										✓	
Harmonic Spurious								✓	✓	✓	
Sub-Harmonic Spurious									✓	✓	
Non-Harmonic Spurious		✓									
Single-Sideband Phase Noise									✓		

Table 4-6 Performance Tests: Assemblies A30—A39, AT1, B1, and RF Output Connector

Performance Tests	Replaced Assembly						
	A30 Mod Filter	A31 Motherboard	A32 10 MHz Crystal Oscillator	A39 Directional Coupler	AT1 115 dB Attenuator	B1 Fan	RF Output Connector
The following performance tests are listed in the order that they should be performed to minimize changes in test equipment configurations.							
Self Tests	✓	✓	✓	✓	✓	✓	✓
Maximum Leveled Output Power	✓				✓		✓
Power Level Accuracy	✓	✓			✓		✓
Internal Pulse Modulation Level Accuracy	✓						
Internal Pulse Modulation Rise/Fall Time	✓						
External Pulse Modulation ON/OFF Ratio	✓						
Harmonic Spurious	✓						
Sub-Harmonic Spurious							
Non-Harmonic Spurious		✓	✓			✓	
Single-Sideband Phase Noise			✓				
Optional Performance Test							
Timebase Aging Rate			✓				

5 Safety and Regulatory

This chapter provides information on the following:

- “General Safety Considerations” on page 5-1
- “Lithium Battery Disposal” on page 5-2
- “Assistance” on page 5-2
- “Certification” on page 5-2

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

CAUTION Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, would result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

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

General Safety Considerations

The following safety notes apply specifically to signal generators. These notes also appear in other chapters of this service guide as required.

WARNING These servicing instructions are for use by qualified personal only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.

WARNING The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources before starting to open.

WARNING The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).

WARNING The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.

WARNING This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.

WARNING Replace battery only with the same or equivalent type recommended. Discard used batteries according to manufacturer’s instructions.

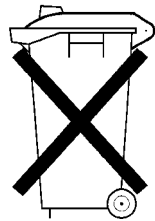
WARNING If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

CAUTION Many of the assemblies in this instrument are very susceptible to damage from electrostatic discharge (ESD). Perform service procedures only at a static-safe workstation and wear a grounding strap.

Lithium Battery Disposal

When the battery on the A14 CPU is exhausted and/or ready for disposal, dispose of it according to your country's requirements. You can return the battery to your nearest Agilent Technologies Sales and Service office for disposal, if required.

Figure 5-1



**DO NOT THROW BATTERIES AWAY BUT
COLLECT AS SMALL CHEMICAL WASTE.**

sk780a

Assistance

Product maintenance agreements and other customer assistance agreements are available for Agilent Technologies products. For any assistance, contact your nearest Agilent Technologies sales and service office (see [“Agilent Sales and Service Offices”](#) on page 1-70).

Certification

Agilent Technologies Company certifies that this product met its published specifications at the time of shipment from the factory. Agilent Technologies 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.

Numerics

- 10 MHz crystal oscillator, replacement, [2-52](#)
- 115 dB attenuator, replacement, [2-56](#)
- 20 GHz
 - doubler, replacement, [2-46](#)
 - highband coupler, replacement, [2-36](#)
 - highband detector, replacement, [2-38](#)

A

- A5 Sampler
 - description, [1-55](#)
 - self-test, [1-18](#)
- A6 Frac-N
 - description, [1-56](#), [1-61](#)
 - self-test, [1-22](#)
- A7 Reference
 - description, [1-56](#)
 - self-test, [1-27](#)
- A8 Output
 - description, [1-61](#)
 - self-test, [1-34](#)
- A9 YIG Driver
 - description, [1-56](#)
 - self-test, [1-20](#)
- A10 ALC
 - description, [1-62](#)
 - self-test, [1-25](#)
- A11 Analog/Pulse Modulation Generator
 - description, [1-63](#)
 - self-test, [1-32](#)
- A18 CPU
 - description, [1-48](#)
 - self-test, [1-28](#)
- A19 Power Supply, description, [1-48](#)
- A23 Lowband Coupler/Detector, description, [1-62](#)
- A24 Highband Coupler, description, [1-62](#)
- A25 Highband Detector, description, [1-62](#)
- A26 MID, self-test, [1-29](#)
- A28 YIG Oscillator, description, [1-56](#)
- A29 20 GHz Doubler, description, [1-57](#), [1-62](#)
- A30 Modulation Filter, description, [1-62](#)
- accessories
 - test cable, [3-29](#)
- ADC adjustment failures, [1-41](#)
- adjustment problems, [1-40](#)
- adjustments
 - required after repair, [4-1](#)
- ALC loop, description, [1-62](#)
- ALC, replacement, [2-19](#)
- ALC, troubleshooting, [1-43](#)
- antistatic materials, [1-1](#), [3-30](#)
- assemblies list, [3-4](#)
- assembly replacement
 - A1 Keyboard, [2-8](#)
 - A2 Display, [2-10](#)
 - A2DS1 Display Backlight, [2-12](#)
 - A3 Power Switch, [2-14](#)
 - A4 Inverter, [2-16](#)
 - A5 Sampler, [2-17](#)
 - A6 Frac-N, [2-17](#)
 - A7 Reference, [2-17](#)
 - A8 Output, [2-17](#)
 - A9 YIG driver, [2-18](#)

 assembly replacement (*continued*)

- A10 ALC, [2-19](#)
 - A11 Pulse/Analog Modulation Generator, [2-20](#)
 - A12 Pulse Modulator Board, [2-22](#)
 - A18 CPU, [2-24](#)
 - A18BT1 Battery, [2-26](#)
 - A19 Power Supply, [2-28](#)
 - A21 Rear Panel Interface, [2-30](#)
 - A22 Line Module, [2-32](#)
 - A23 Lowband Coupler/Detector, [2-34](#)
 - A24 20 GHz Highband Coupler, [2-36](#)
 - A25 20 GHz Highband Detector, [2-38](#)
 - A25B Highband Detector Bias Board, [2-40](#)
 - A26 Microcircuit Interface Deck (MID), [2-42](#)
 - A28 YIG Oscillator, [2-44](#)
 - A29 20 GHz Doubler, [2-46](#)
 - A30 Modulator Filter, [2-48](#)
 - A31 Motherboard, [2-50](#)
 - A32 10 MHz Crystal Oscillator, [2-52](#)
 - AT1 115 dB Attenuator, [2-56](#)
 - B1 Fan, [2-58](#)
 - front panel, [2-6](#)
 - instrument cover, inner, [2-5](#)
 - instrument cover, outer, [2-3](#)
 - preparation, [2-1](#)
 - rear panel, [2-54](#)
- assembly-level troubleshooting, [1-7](#)
- AT1 Attenuator, troubleshooting, [1-45](#)
- attenuator
 - 115 dB, replacement, [2-56](#)

B

- battery disposal, [5-2](#)
- battery, replacement, [2-26](#)
- block descriptions
 - overall, [1-48](#)
 - reference/synthesis loop, [1-55](#)
 - RF path loop, [1-61](#)
- block diagrams
 - overall, [1-53](#)
 - reference/synthesis loop, [1-59](#)
 - RF path block diagram, [1-65](#)

C

- cables, [3-11](#)
- certification, [5-2](#)
- components, safe handling, [1-1](#)
- coupler
 - 20 GHz highband, replacement, [2-36](#)
 - lowband, replacement, [2-34](#)
- CPU, replacement, [2-24](#)
- CPU, troubleshooting, [1-3](#)
- crystal oscillator, 10 MHz, replacement, [2-52](#)
- CW mode, description, [1-55](#)

D

- detector
 - 20 GHz highband, replacement, [2-38](#)
 - highband bias board, replacement, [2-40](#)
 - lowband, replacement, [2-34](#)
- device gains and losses, [1-64](#)
- display backlight, replacement, [2-12](#)
- display, replacement, [2-10](#)

documentation, [ii-ix](#)
driver, YIG, [2-18](#)

E

electrostatic discharge
 general information, [1-1](#)
 supplies, [3-30](#)
ESD, [1-1](#)

F

fan, replacement, [2-58](#)
frac-n, replacement, [2-17](#)
frequency generation, description, [1-50](#)
front panel
 replacement, [2-6](#)
 subassemblies replacement
 display, [2-6](#)
 inverter, [2-16](#)

G

gains, device, [1-64](#)
getting started, [1-2](#)
guides, content of, [ii-ix](#)

H

hardware, [3-14](#)
hardware list, [3-4](#)
harmonic spurs, troubleshooting, [1-46](#)
harmonics, specifications, [1-46](#)
highband detector bias board, replacement, [2-40](#)

I

I/O interface, description, [1-49](#)
installation guide content, [ii-ix](#)
instrument cover replacement, [2-3](#), [2-5](#)
inverter, replacement, [2-16](#)

K

keyboard, replacement, [2-8](#)

L

line module, replacement, [2-32](#)
lists
 assemblies and hardware options, [3-4](#)
 cables, [3-11](#)
 hardware, [3-14](#)
 replaceable assemblies, [2-1](#)
lithium battery disposal, [5-2](#)
lithium battery, replacement, [2-26](#)
losses, device, [1-64](#)
lowband coupler/detector, replacement, [2-34](#)

M

manuals, content of, [ii-ix](#)
microcircuit interface deck (MID), replacement, [2-42](#)
modulator filter, replacement, [2-48](#)
motherboard
 connector locations, [1-14](#)
 LED locations, [1-16](#)
 test points, [1-11](#)
motherboard, replacement, [2-50](#)

N

non-harmonic spurs, troubleshooting, [1-47](#)

O

options, descriptions, [3-3](#)
oscillator
 10 MHz crystal, [2-52](#)
 YIG, [2-44](#)
output, replacement, [2-17](#)
overall block description, [1-48](#)
overall block diagram, [1-53](#)
overcurrent, [1-17](#)
overvoltage, [1-17](#)

P

performance test failures, troubleshooting, [1-42](#)
performance tests, required after repair, [4-1](#)
phase noise, troubleshooting, [1-48](#)
post-repair procedures, [4-1](#)
power
 RF levels, troubleshooting, [1-43](#)
power supply
 dc voltage specifications, [1-15](#)
 motherboard LED locations, [1-16](#)
 troubleshooting, [1-11](#)
power supply, replacement, [2-28](#)
power switch, replacement, [2-14](#)
programming guide content, [ii-ix](#)
pulse modulation, troubleshooting, [1-44](#)
pulse modulator board, replacement, [2-22](#)
pulse/analog modulation generator, replacement, [2-20](#)

R

rear panel, replacement, [2-54](#)
rear-panel interface, replacement, [2-30](#)
reference, replacement, [2-17](#)
reference/synthesis loop block diagram, [1-59](#)
reference/synthesis loop description, [1-55](#)
reference/synthesis loop, description, [1-55](#)
references, content of, [ii-ix](#)
repair
 adjustments required, [4-1](#)
 performance tests required, [4-1](#)
repair, troubleshooting, [1-1](#)
replaceable parts
 assemblies, [2-1](#)
 hardware, [3-14](#)
 ordering information, [3-1](#)
RF path
 description, [1-61](#)
 troubleshooting, [1-43](#)
RF path block diagram, [1-65](#)
RF path description, [1-61](#)
RF power levels, troubleshooting, [1-43](#)

S

safety, general considerations, [5-1](#)
sampler, replacement, [2-17](#)
SCPI
 reference content, [ii-ix](#)
self-tests
 2xx, [1-18](#)

self-tests (*continued*)

- 6xx, [1-20](#)
- 7xx, [1-22](#)
- 9xx, [1-25](#)
- 10xx, [1-27](#)
- 11xx, [1-28](#)
- 12xx, [1-29](#)
- 13xx, [1-32](#)
- 22xx, [1-34](#)
- failure table, [1-5](#)
- overview, [1-67](#)
- running, [1-2](#)

service

- Agilent sales and service offices, [1-70](#)
- guide content, [ii-ix](#)
- packaging signal generator, [1-70](#)

signal generator

- overall block diagram, [1-53](#)
- overall description, [1-48](#)
- reference/synthesis loop block diagram, [1-59](#)
- reference/synthesis loop, description, [1-55](#)
- RF path block diagram, [1-65](#)
- RF path, description, [1-61](#)

specifications

- dc voltages, [1-15](#)
- harmonics, [1-46](#)

- spurious harmonic emissions, troubleshooting, [1-46](#)

- spurious non-harmonic emissions, troubleshooting, [1-47](#)

T

- thermal shutdown, [1-17](#)

troubleshooting, [1-48](#)

- ADC adjustment failures, [1-41](#)
- adjustment problems, [1-40](#)
- ALC, [1-43](#)
- AT1 Attenuator, [1-45](#)
- chapter TOC, [1-1](#)
- CPU turn-on test, [1-3](#)
- dc voltages, [1-11](#)
- front-panel display, [1-7](#)
- motherboard test points, [1-11](#)
- performance test failures, [1-42](#)
- phase noise, [1-48](#)
- power supply, [1-11](#)
- pulse modulation, [1-44](#)
- RF path, [1-43](#)
- RF power levels, [1-43](#)
- self-test failure table, [1-5](#)
- spurious harmonic emissions, [1-46](#)
- spurious non-harmonic emissions, [1-47](#)
- unlevels, [1-37](#)
- unlocks, [1-35](#)
- where to begin, [1-2](#)

U

- unlevels, troubleshooting, [1-37](#)

- unlocks, troubleshooting, [1-35](#)

user

- documentation content, [ii-ix](#)

V

voltages, supply

- A5 Sampler, [1-18](#)

voltages, supply (*continued*)

- A6 Frac-N, [1-22](#)
- A7 Reference, [1-27](#)
- A8 Output, [1-34](#)
- A9 YIG Driver, [1-20](#)
- A10 ALC, [1-25](#)
- A11 Analog/Pulse Modulation Generator, [1-32](#)
- A18 CPU, [1-28](#)
- A26 MID, [1-29](#)

Y

- YIG driver, replacement, [2-18](#)

- YIG oscillator, replacement, [2-44](#)

