

# **Service Guide**

## **Agilent Technologies E4406A VSA Series Transmitter Tester**



**Agilent Technologies**

**Manufacturing Part Number: E4406-90178  
Supersedes E4406-90125**

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## Safety Information

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

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<b>WARNING</b>	<b>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.</b>
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<b>CAUTION</b>	Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.
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<b>WARNING</b>	<b>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 protected 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.</b>
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<b>WARNING</b>	<b>These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.</b>
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<b>WARNING</b>	<b>The power cord is connected to internal capacitors that may remain live for 5 seconds after disconnecting the plug from its power supply.</b>
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# Contents

## 1. Troubleshooting

Introduction . . . . .	12
Before You Start . . . . .	13
Replacement Assemblies . . . . .	14
After an Instrument Repair . . . . .	14
ESD Information . . . . .	15
Service Equipment You Will Need . . . . .	18
Check the Basics . . . . .	23
Problems at Instrument Power-Up . . . . .	25
Troubleshooting an Inoperative Instrument . . . . .	26
Check the Instrument Setup . . . . .	26
Initial Checks . . . . .	26
If the Fans Are Not Operating . . . . .	27
Troubleshooting LCD Display Problems . . . . .	28
Verifying the A3A1 and A3A2 Inverter Boards . . . . .	28
Verifying HSYNC, VSYNC, and LCD Clock . . . . .	30
Check for Basic Functionality . . . . .	31
Auto-Align Tests . . . . .	32
Power Supply Check . . . . .	34
Measure the Individual Voltage Supplies . . . . .	35
Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem . . . . .	39
Verifying the A17 RF Assembly . . . . .	39
Verifying the A12 Analog IF Assembly . . . . .	43
Verifying the A10 Digital IF Assembly . . . . .	47
Verifying the A18 Reference Assembly . . . . .	50
Verifying the A19 Synthesizer Assembly . . . . .	52
Verifying the A22 CPU Assembly . . . . .	54
Troubleshooting Performance Test Failures . . . . .	58
Contacting Agilent Technologies . . . . .	60
Software Technical Support . . . . .	60
Calling Agilent Technologies Sales and Service Offices . . . . .	60
Updating Firmware . . . . .	63
How to Return Your Instrument for Service . . . . .	64
Service Tag . . . . .	64
Original Packaging . . . . .	64
Other Packaging . . . . .	65

## 2. Block Diagrams

Introduction . . . . .	68
A6 Power Supply Assembly . . . . .	69
A17 RF Assembly . . . . .	70
Input Attenuator . . . . .	70
RF Input Switch . . . . .	70
50 MHz Calibrator . . . . .	71
First Mixer . . . . .	71
321.4 MHz Amplifiers . . . . .	71
Calibrator Switch . . . . .	71
Image Filter . . . . .	71
Second Mixer . . . . .	71

---

# Contents

21.4 MHz Output Buffer Amplifiers and Filter . . . . .	72
Pre-level Drive . . . . .	72
Interconnections to other assemblies . . . . .	72
A12 Analog IF Assembly . . . . .	73
Pre-filters . . . . .	73
Variable Gain Amplifier . . . . .	73
21.4 MHz Anti-Alias Filter . . . . .	74
Mixer . . . . .	74
Third L.O. . . . .	74
Post Down Conversion Filtering . . . . .	74
Calibrator and Sample Rate Oscillators . . . . .	74
Clock Generator . . . . .	74
Triggering . . . . .	75
Power Supply Switching Frequency Generator . . . . .	75
Interconnections to other assemblies . . . . .	75
A10 Digital IF Assembly . . . . .	76
7.5 MHz IF . . . . .	76
Gain Range Select/Rules . . . . .	76
ADC . . . . .	76
Input Selector Switch . . . . .	76
Offset Adjust and Dither . . . . .	77
Interconnections to other assemblies . . . . .	77
A18 Reference Assembly . . . . .	78
100 MHz VCXO . . . . .	78
300 MHz Output . . . . .	79
Reference Unlock Detector . . . . .	79
50 MHz Calibrator Output . . . . .	79
10 MHz Outputs . . . . .	79
Interconnections to other assemblies . . . . .	79
A19 Synthesizer Assembly . . . . .	80
Lock Detector . . . . .	80
VCO Phase Lock Loop . . . . .	80
Bandpass Filters . . . . .	80
First Doubler . . . . .	80
Second Doubler . . . . .	81
Interconnections to other assemblies . . . . .	81
A22 Processor Assembly . . . . .	82
A7 Baseband I/Q Assembly (Option B7C) . . . . .	83
I/Q Input Circuitry . . . . .	83
Input Amplifiers . . . . .	83
ADC . . . . .	83
Digital Signal Processing Block (DSP) . . . . .	83
Miscellaneous . . . . .	84
A14 Fan Control Board . . . . .	84
A15 Daughter Board . . . . .	84
A21 Motherboard . . . . .	84
A25 SCSI . . . . .	85
Front Frame . . . . .	86
A27 Rear Panel . . . . .	86

---

# Contents

Mnemonics and Connectors .....	87
Mnemonic Pin Locations .....	92
Motherboard Connectors .....	99
Daughterboard Connectors .....	110
Block Diagrams .....	119
<b>3. Parts List</b>	
Introduction .....	126
How to Order Parts .....	127
Direct Mail-Order System .....	127
Direct Phone-Order System .....	127
Replaceable Parts .....	134
Hardware .....	142
<b>4. Assembly Replacement</b>	
Introduction .....	166
Before You Start .....	167
Service tools you will need .....	167
After an instrument repair .....	167
Removal and Replacement Procedures .....	168
Instrument Outer Case .....	171
Removal .....	171
Replacement .....	172
Top Brace .....	173
Removal .....	173
Replacement .....	174
Front Frame .....	175
Drop the Front Frame .....	175
Removal .....	175
Replacement .....	176
A4 Disk Drive and A5 Disk Drive Board .....	177
Removal .....	177
Replacement .....	179
A6 Power Supply .....	180
Removal .....	180
Replacement .....	181
A7 Baseband I/Q Assembly (Option B7C) .....	182
Removal .....	182
Replacement .....	184
A10 Digital IF and	
A12 Analog IF Assemblies .....	185
Removal .....	185
Replacement .....	186
A14 Fan Control Board .....	187
Removal .....	187
Replacement .....	188
A15 Daughter Board .....	189
Removal .....	189

---

# Contents

Replacement . . . . .	190
A17 RF, A18 Reference, and A19 Synthesizer Assemblies . . . . .	191
Removal . . . . .	191
Replacement . . . . .	192
Mid Web/Fans . . . . .	193
Fan Removal . . . . .	193
Fan Replacement . . . . .	194
Mid Web . . . . .	195
A21 Motherboard . . . . .	198
Removal . . . . .	198
Replacement . . . . .	201
A22 Processor Assembly . . . . .	202
Removal . . . . .	202
Replacement . . . . .	204
A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards . . . . .	205
Removal . . . . .	205
Replacement . . . . .	206
A25 SCSI Board . . . . .	207
Removal . . . . .	207
Replacement . . . . .	207
A27 Rear Panel Connector Board . . . . .	208
Removal . . . . .	208
Replacement . . . . .	209
Rear Frame . . . . .	210
Removal . . . . .	210
Replacement . . . . .	211
Center Web Cables W9, W11, and W12 . . . . .	212
Removal and Replacement . . . . .	212
RF Input Connector . . . . .	214
Removal . . . . .	214
Replacement . . . . .	215
Front Frame Subassemblies . . . . .	216
Front Frame Exploded View . . . . .	218
A2 Display, Backlights, and Filter . . . . .	219
A3 Front Panel Interface Board . . . . .	224
Bezel and Keypad . . . . .	226
Front Panel RPG . . . . .	229
Front Panel External Trigger Cable . . . . .	230

## 5. Post-Repair Procedures

Introduction . . . . .	232
Safety . . . . .	232
Before You Start . . . . .	233
Abnormal Indications during Procedure Execution . . . . .	233
After Assembly Replacement . . . . .	233
Post-Repair Procedures . . . . .	234
Test equipment you will need . . . . .	236
Manual Test, Adjustment, and Configuration Procedures . . . . .	237

---

# Contents

Internal Front Panel Test .....	238
Description .....	238
Procedure .....	238
External Keyboard Test .....	239
Description .....	239
Procedure .....	239
Configuring a Replacement CPU Assembly .....	241
Description .....	241
Procedure .....	241
Configuring a Replacement Flash Memory Assembly .....	244
Description .....	244
Procedure .....	245
Internal 10 MHz Frequency Reference Adjustment .....	248
Adjustment Description .....	248
Required Equipment .....	248
Test Setup .....	249
Procedure .....	249
Internal 50 MHz Calibrator Adjustment .....	250
Description .....	250
Required Equipment .....	250
Test Setup .....	251
Procedure .....	251
Burst Trigger Check .....	254
Description .....	254
Procedure .....	254
Baseband I/Q Amplitude Accuracy Test .....	255
Description .....	255
Test Limits .....	255
Procedure .....	255
Using the Alpha Editor Menu .....	258
Front Panel Test .....	259
Purpose .....	259
Test Setup .....	259
Results .....	260
Troubleshooting Hints .....	260
Automated Adjustments .....	261



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# **1 Troubleshooting**

## Introduction

This chapter provides information and procedures that are useful for troubleshooting common instrument failures. Assembly descriptions are located in [Chapter 2](#) , “[Block Diagrams](#)”.

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## Before You Start

There are four things you should do before starting to troubleshoot a failure:

- ❑ Check that you are familiar with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions given in the front of this guide.
- ❑ The instrument contains static sensitive components. Read the section entitled “[ESD Information](#)” in this chapter.
- ❑ Become familiar with the organization of the troubleshooting information in this chapter.
- ❑ Read the rest of this section.

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

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**WARNING**      **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

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**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).**

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

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## Replacement Assemblies

The instrument assemblies are not repairable to the component level. Refer to [Chapter 3](#) to determine how to disassemble and assemble the instrument. The following assemblies must be replaced as an assembly.

- A1 keyboard (does not include keypads)
- A2 flat panel display
- A3 front panel interface assembly (includes inverter boards)
- A4 disk drive assembly
- A6 power supply assembly
- A7 baseband I/Q assembly (Option B7C)
- A10 digital IF assembly
- A12 analog IF assembly
- A14 fan control board
- A15 daughter board
- A17 RF assembly
- A18 reference assembly
- A19 synthesizer assembly
- A21 motherboard
- A22 CPU (processor) assembly (does not include A22A1, -A2, or -A3)
- A22A1 DRAM card
- A22A2 Flash memory board
- A22A3 GP-IB capacitor board
- A25 SCSI board
- A27 rear panel connector board
- A3A1, A3A2 inverter board

## After an Instrument Repair

If an instrument assembly has been repaired or replaced, perform the related adjustments and performance verification tests, using the N7812A E4406A Calibration Application Software. The software can be downloaded via the web at

<http://www.agilent.com/find/calibrationsoftware>. Licenses to use the software for each instrument can be purchased through an Agilent Technologies Sales and Service office. [Table 1-2 on page 18](#) details the computer and test equipment needed to use the software.

## ESD Information

### Protection from Electrostatic Discharge

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. [Figure 1-1](#) shows an example of a static-safe workstation using two types of ESD 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  $\Omega$  of isolation from ground. Refer to [Table 1-1](#) for information on ordering static-safe accessories.

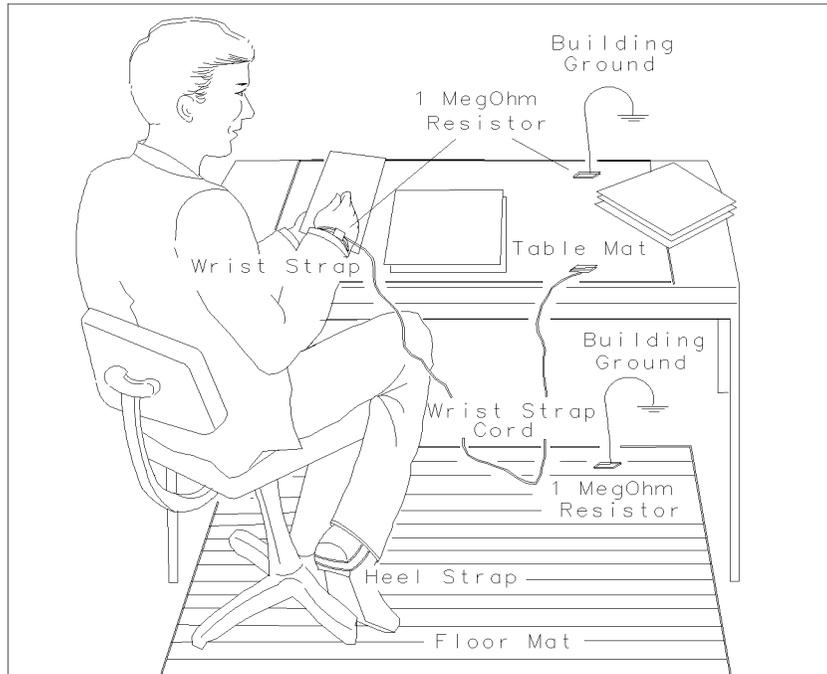
---

**WARNING**

**These techniques for a static-safe workstation should not be used when working on circuitry with a voltage potential greater than 500 volts.**

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**Figure 1-1 Example of a Static-Safe Workstation**



FORMAT 46

**Table 1-1 Static Safe Accessories**

Part Number	Description
9300-0797	Set includes: 3M static control mat 0.6 m × 1.2 m (2 ft. × 4 ft.) and 4.6 cm (15 ft.) ground wire. (The wrist-strap and wrist-strap cord are not included. They must be ordered separately.)
9300-0980	Wrist-strap cord 1.5 m (5 ft.)
9300-1383	Wrist-strap, color black, stainless steel, without cord, has four adjustable links and a 7 mm post-type connection.
9300-1308	ESD heel-strap (reusable 6 to 12 months)

### Handling of Electronic Components and ESD

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.

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**CAUTION**

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Always handle printed circuit board assemblies by the edges. This will reduce the possibility of ESD damage to components and prevent contamination of exposed plating.

### Test Equipment Usage and ESD

- ❑ Before connecting any coaxial cable to an instrument connector for the first time each day, momentarily short the center and outer conductors of the cable together.
- ❑ Personnel should be grounded with a 1 M  $\Omega$  resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the instrument.
- ❑ Be sure that all instruments are properly earth-grounded to prevent build-up of static charge.

### For Additional Information about ESD

For more information about preventing ESD damage, contact the Electrical Over Stress/Electrostatic Discharge (EOS/ESD) Association, Inc. The ESD standards developed by this agency are sanctioned by the American National Standards Institute (ANSI).

## Service Equipment You Will Need

This table provides a list of the recommended test equipment needed to troubleshoot, adjust, and verify the performance of the instrument. For the most up-to-date list of equipment, please refer to the help documentation in the N7812A Performance Verification and Adjustment Software. Only the recommended and alternate equipment is compatible with the performance verification software.

**Table 1-2 Required Test Equipment Summary**

Instrument	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number	Use <sup>a</sup>
<b>Signal Sources</b>				
Synthesized Signal Generator	Frequency: 1 MHz to 2.5 GHz Spectral purity: 1 MHz to 1321 MHz SSB Phase Noise at 1 GHz: ≤ -106 dBc/Hz at 1 kHz offset (or residual FM ≤0.5 Hz, 300 Hz to 3 kHz integration BW). Spurious (non-harmonic): <-78 dBc SWR: ≤1.5	8663A		A, P, T
Synthesized Signal Generator	Frequency: 960 MHz Spectral purity: SSB Phase Noise: -150 dBc/Hz at 100 kHz offset Harmonics: -30 dBc at +10 dBm output	8665A/B		P
Synthesized Swept Signal Generator	Frequency: 10 MHz to 4.0 GHz Harmonic level: < -40 dBc Amplitude range: +15 to -20 dBm	83620B	83623B, 83630A, B, L 83640A, B, L 83650A, B, L	A, P, T
Arbitrary Waveform Generator	Ability to create 64 synchronous tones across a 5 MHz span from 5 MHz to 10 MHz	E4433B Option UND	E4430B E4431B E4432B E4434B E4435B E4436B E4437B Option UND	A, P, T
<b>Analyzers</b>				
Network Analyzer	Frequency: 7 MHz to 4.0 GHz	8753E, ET, ES Option 6	8753D, ES, ET Option 6	P
Spectrum Analyzer	Frequency: 1 MHz to 8.0 GHz	8562E	8563E, E4440A, E4443A, E4445A E4446A, E4448A	T

**Table 1-2 Required Test Equipment Summary (Continued)**

Instrument	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number	Use <sup>a</sup>
<b>Counters</b>				
Universal Counter	Frequency: 10 MHz Gate time: 10 to 100 seconds Must be capable of measuring signal at +7dBm (0.5V rms)	53132A		P, T
<b>Meters</b>				
Digital Multimeter		3458A		A, T
Power Meter	Dual Channel Absolute Accuracy: $\pm 0.5\%$ Power Reference Accuracy: $\pm 0.9\%$	E4419A	E4419B	A, P
Power Sensor	Frequency Range: 1 MHz to 4.0 GHz. SWR: 50 MHz: $\leq 1.05$ 1 MHz to 4 GHz SWR: $\leq 1.22$ Connector: Type-N (m), 50 $\Omega$ Cal Factor: Characterized by standards lab to: $\pm 0.6\%$	8482A Option H84	8482A STD Note: The use of this model will increase measurement uncertainty	A, P
Power Sensor	Frequency Range: 1 MHz to 4 GHz. SWR: 50 MHz: $\leq 1.10$ 1 MHz to 4 GHz: $\leq 1.30$	8482A		P
Power Sensor	High sensitivity: Used to measure -25 dBm signal at 50 MHz only (requires a 30 dB pad)	8481D		A
<b>Oscilloscope</b>				
Digitizing Oscilloscope	150 MHz	54602B	54820A	T
<b>Standards</b>				
Frequency Standard	Frequency: 10 MHz Accuracy: $< \pm 1 \times 10^{-10}$	5071A		A, P
<b>Attenuators</b>				
10 dB Step Attenuator	Range: 0 to 110 dB Accuracy: Characterized by standards lab to: $\pm 0.005 + 0.0052/10$ dB step Calibrated at 50 MHz SWR at 50 MHz: $\leq 1.2$	8496G		P
1 dB Step Attenuator	Range: 0 to 11 dB Accuracy: Characterized by standards lab to: $\pm 0.01$ dB Calibrated at 50 MHz SWR at 50 MHz: $\leq 1.2$	8494G		P
Attenuator Driver	Compatible with the 8496G and 8494G step attenuators.	11713A		P

**Table 1-2 Required Test Equipment Summary (Continued)**

Instrument	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number	Use <sup>a</sup>
6 dB Fixed Attenuator	6 dB SWR at 50 MHz: $\leq 1.1$	8491A Options 006 & H47	8491B Option 006 8491C Option 006	P
20 dB Fixed Attenuator	20 dB Accuracy: +0.5 dB	8491A Option 020		A
30 dB Fixed Attenuator	30 dB Accuracy: $\pm 0.5$ dB SWR: 1.05:1	11708A (included as part of 8481D)		A
<b>Terminations</b>				
50 $\Omega$ Termination	50 $\Omega$ Connector: Type-N (m) Frequency: 1 MHz to 4 GHz	909A Option 012		P, T
50 $\Omega$ Termination	50 $\Omega$ Connector: BNC (m) Frequency: 100 kHz to 5 MHz	1250-0207		P, T
<b>Miscellaneous Devices</b>				
50 $\Omega$ Calibration Kit	Type-N For network analyzer	85032B		P
Power Splitter	Frequency: 1 MHz to 4.0 GHz SWR: $\leq 1.1$	11667A	11667B	P
Directional Bridge	Frequency Range: 0.1 to 110 MHz Directivity: >40 dB VSWR: $\leq 1.1$ Transmission Arm Loss: 6 dB (nominal) Coupling Arm Loss: 6 dB (nominal)	8721A		P
High Frequency Probe	300 kHz to 3 GHz Input Resistance: 1 M $\Omega$ (nominal)	85024A		T
Attenuator Interconnector Kit	Type-N For 8496G and 8494G attenuators.	11716A		P
<b>Cables</b>				
Type-N 2 required	Precision Type-N (m) 62 cm (24 in.)	11500C		A, P, T
BNC 2 required	50 $\Omega$ Coax BNC (m) 120 cm (48 in.)	10503A		A, P, T
<b>Adapters</b>				
Type-N (f) to Type-N (f)	Type-N, Precision adaptor, 50 $\Omega$	1250-1472		P
Type-N (m) to Type-N (m)	Type-N, Precision adaptor, 50 $\Omega$	1250-1475		P

**Table 1-2 Required Test Equipment Summary (Continued)**

Instrument	Critical Specifications	Recommended Agilent Model Number	Alternative Agilent Model Number	Use <sup>a</sup>
Type-N (f) to BNC (m)	50Ω	1250-1477		P, T
Type-N (m) to BNC (m)	50Ω	1250-1473		P, T
Type-N (m) to BNC (f)	50Ω	1250-1476		A, P, T
APC-3.5 mm (f) to Type-N (f)	For 83620B	1250-1745		A, P
7 mm to Type-N (f)	(included in calibration kit)			P
<b>Filters</b>				
50 MHz Low Pass	Cutoff Frequency: 50 MHz Rejection at 65 MHz: >40 dB Rejection at 75 MHz: >60 dB	0955-0306		P, T
<b>Controller</b>				
Computer	IBM compatible PC Intel Pentium 200 MHz + higher Windows 2000 <sup>®</sup> or NT <sup>®</sup> 4.0 or XP <sup>®</sup> 32 MB RAM At least 200 MB of free hard disk space CD-ROM Drive 800x600 Minimum monitor resolution Web browser <sup>b</sup>			P, A
<b>Accessories</b>				
IEEE 488 Interface Card	High-performance GP-IB or GPIB <sup>c</sup> (Must support VTL)	82341D, 82350B, 82357A	National p/n AT-GPIB/TNT	P, A
Software	Performance verification and adjustment software for E4406 VSA	N7812A		P, A
Service Kit	Includes three extender boards required for troubleshooting	E4406-60114		T
<b>Hand Tools</b>				
Torx Driver	T-10	8710-1623		
Torx Driver	T-15	8710-1622		
Torx Driver	T-20	8710-1615		
Nut Driver	9/16 inch deep socket for BNC removal	8720-0008		
Diagonal Cutters	no specification	8710-1294		

- a. A = Adjustments, P = Performance Testing, T = Troubleshooting.  
Use the N7812A software to perform the tests and adjustments.
- b. Microsoft<sup>®</sup> Internet Explorer<sup>®</sup> 4.0 or greater or Netscape<sup>®</sup> 4.0 or greater.

Troubleshooting  
**Service Equipment You Will Need**

- c. National Instruments<sup>®</sup> GPIB card or GP-IB card with VISA I/O library installed (available at [http://www.natinst.com/gpib/gpib\\_dl.htm](http://www.natinst.com/gpib/gpib_dl.htm)).

## Check the Basics

A problem can often be solved by repeating the procedure you were following when the problem occurred. Before calling Agilent Technologies or returning the instrument for service, please make the following checks:

1. Is there power at the receptacle?
2. Is the instrument turned on? Check to see if the front panel LED is green. This indicates the power supply is on.
3. If other equipment, cables, and connectors are being used with the instrument, make sure they are connected properly and operating correctly.
4. Review the procedure for the measurement being performed when the problem appeared. Are all the settings correct?
5. If the instrument is not functioning as expected, return the unit to a known state by pressing the **Preset** key.
6. Is the measurement being performed, and the results that are expected, within the specifications and capabilities of the instrument? Refer to the specifications book for instrument specifications.
7. In order to meet specifications, the instrument must be aligned. Press **System, Alignments, Align All Now**. The diagnostic tests should all pass. If the instrument displays a failure during these tests, refer to “[Auto-Align Tests](#)” on page 32.
8. Check to see if the instrument has the latest firmware before starting the troubleshooting procedure. Press **System, More, Show System**. The firmware revision is listed under **Firmware Rev**. Go to the web site <http://www.agilent.com/find/vsa> to check for the latest revision and download new firmware if necessary. Refer to “[Updating Firmware](#)” on page 63.
9. Is the instrument displaying an error message? If so, refer to the *Agilent Technologies E4406A VSA Instrument Messages and Functional Tests* manual.
10. If the necessary test equipment is available, perform the functional checks in the user’s guide for your instrument.
11. Determine which troubleshooting section to start with by comparing the instrument’s symptoms to the symptoms in the following table.

Troubleshooting  
Check the Basics

Symptom	Troubleshooting Section
No front or rear panel LEDs	"Troubleshooting an Inoperative Instrument" on page 26
Blank LCD screen	"Troubleshooting an Inoperative Instrument" on page 26
Fans not operating	"Troubleshooting an Inoperative Instrument" on page 26
Instrument did not boot	"Check for Basic Functionality" on page 31
Power-on auto-align tests failed	"Auto-Align Tests" on page 32
No response when a key is pressed	"Check for Basic Functionality" on page 31
Error messages	See the <i>Agilent Technologies E4406A VSA Instrument Messages and Functional Tests</i> manual
Low signal level	"Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem" on page 39
Performance test fails	"Troubleshooting Performance Test Failures" on page 58

---

## Problems at Instrument Power-Up

This section describes symptoms that can occur when the instrument is first powered on.

---

### CAUTION

Immediately unplug the instrument from the ac power line if the unit shows any of the following symptoms:

- Smoke, arcing, or unusual noise from inside the unit.
- No response of any kind when unit is plugged into ac power mains and turned on.
- A circuit breaker or fuse on the main ac power line opens.

These potentially serious faults must be corrected before proceeding. Refer to [“Troubleshooting an Inoperative Instrument” on page 26](#).

---

The instrument will perform a boot process followed by an auto-alignment routine when powered up. These tests evaluate the instrument operation and will return an error message if a problem is detected.

1. If the instrument appears to be dead (no display), or the fans are not operating, refer to ["Troubleshooting an Inoperative Instrument" on page 26](#).
2. If the instrument appears to abort the boot process, or there is no response when a front panel key is pressed, refer to ["Check for Basic Functionality" on page 31](#).
3. Check for error messages.
  - a. Power on the instrument and let it warm up for at least five minutes.
  - b. Cycle the power to the instrument and verify that the green LED on the front panel is lit.
  - c. After the instrument auto-alignment routine is finished, review the status of the displayed results.
  - d. Check for other error messages by pressing **System, Show Errors**.
  - e. See the *Agilent Technologies E4406A VSA Instrument Messages and Functional Tests* manual for a description of the error messages.

## Troubleshooting an Inoperative Instrument

When the instrument appears to be dead (no display and no fans), there is often little evidence that points directly to the cause. This section provides steps and solutions to typical failure modes relating to an inoperative instrument.

### Check the Instrument Setup

Before troubleshooting the instrument, ensure that it has been set up correctly. Perform the steps in ["Check the Basics" on page 23](#).

### Initial Checks

Perform the following initial checks when first troubleshooting an inoperative instrument.

1. Check the instrument display and fans.
  - a. If the display is dark and the fans are not running, suspect a power supply or CPU problem. Refer to the ["Power Supply Check" on page 34](#).
  - b. If the display is dark but the fans are running, suspect either an LCD problem, or a problem with the CPU boot sequence. Refer to ["Troubleshooting LCD Display Problems" on page 28](#).
  - c. If the display looks good but the fans are not running, refer to ["If the Fans Are Not Operating" on page 27](#).
2. If the instrument appears to abort the boot process, experiences a failure during the self-diagnostic tests, or there is no response when a front panel key is pressed, refer to ["Check for Basic Functionality" on page 31](#).

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## If the Fans Are Not Operating

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### CAUTION

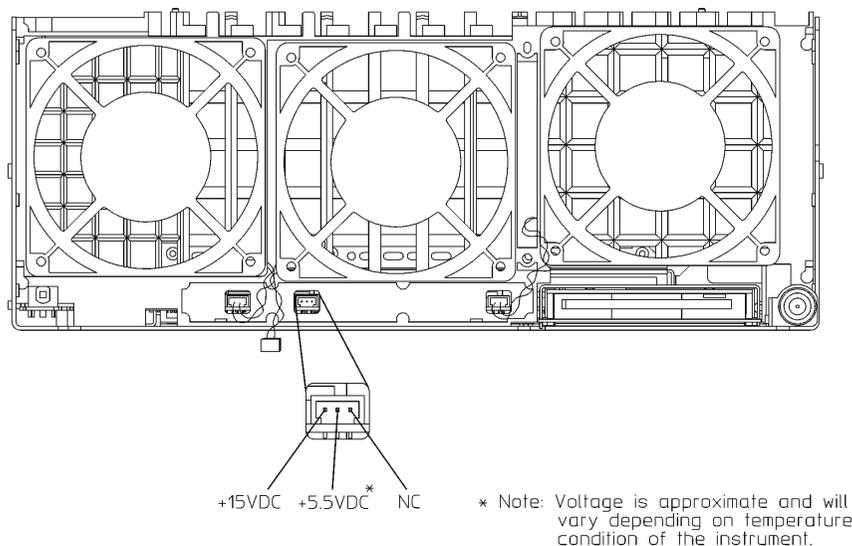
The power supply may be in thermal shutdown if the instrument has been operating without the fans running. Allow the instrument to cool down before troubleshooting.

If all three fans are not operating, suspect a power supply problem or defective A14 fan control board. Refer to [“Power Supply Check” on page 34](#) to check the individual supplies. If the supplies are within specifications, the most probable cause is a defective A14 fan control board. Refer to [Chapter 3](#) for assembly replacement procedures.

If only one or two fans are not functioning, and the power supplies are within specifications, suspect the A14 fan control board or a defective fan.

1. Remove the front frame from the instrument. Refer to [Chapter 3](#) for removal procedures.
2. Refer to [Figure 1-2](#). Measure all of the fan voltages at J1, J3, and J4 on the motherboard.

**Figure 1-2** Fan Voltages



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3. If the correct voltage is present and the fan connector is in good mechanical condition, suspect a defective fan. Refer to [Chapter 3](#) for assembly replacement procedures.
4. If the voltage is not present, suspect a defective A14 fan control board. Refer to [Chapter 3](#) for assembly replacement procedures.

## Troubleshooting LCD Display Problems

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**NOTE** There are no front panel adjustments for intensity and contrast of the LCD.

---

1. Verify the instrument went through a complete power-on sequence. Refer to "[Check for Basic Functionality](#)" on page 31.
2. If the display is dark, (not visible), connect an external VGA monitor to the rear panel VGA output connector on the instrument. Some multisync monitors might not be able to lock to a 60 Hz sync pulse. If the video information is not present on the external VGA monitor, the most probable cause is the A22 CPU assembly.
3. If the external VGA monitor is functioning, verify that the front panel interface ribbon cable (W8) is properly plugged into the motherboard at connector J11.
4. If W8 is properly connected, suspect a defective A3 front panel interface board, one or both of the inverter boards (A3A1 and A3A2) mounted on the interface board, the backlight assemblies (DS1 and DS2), or the LCD assembly itself (A2).
5. If the display is dim, suspect the backlight assemblies. Always replace both backlight bulbs at the same time.

### Verifying the A3A1 and A3A2 Inverter Boards

---

**WARNING** **High voltage is present on the inverter boards and the front panel interface board. Be careful when measuring the following signals and voltages.**

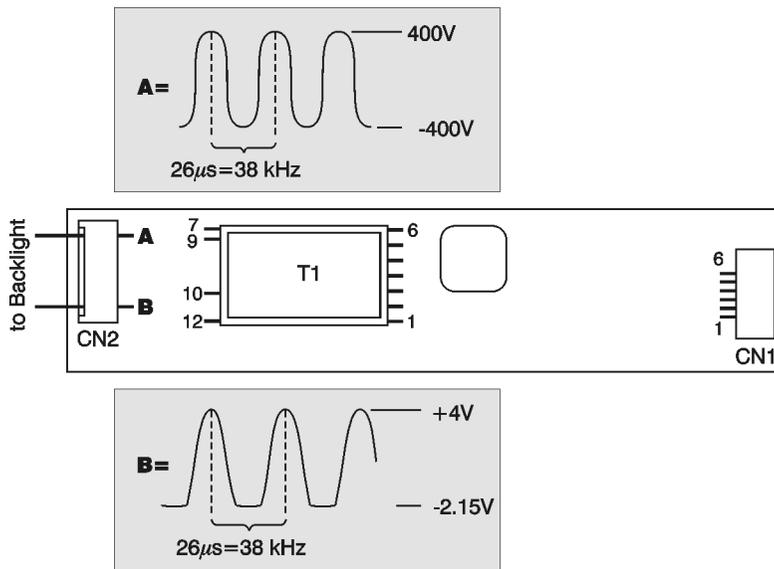
---

**NOTE** In order to access the front panel boards for measurements, it is necessary to drop the front frame from the deck and remove the front frame shield. Refer to [Chapter 3](#) for these procedures.

---

Measure the signals and voltages as indicated in [Figure 1-3](#). If the signals and voltages measure good, the inverter boards are functioning correctly.

**Figure 1-3** Verifying the Inverter Boards



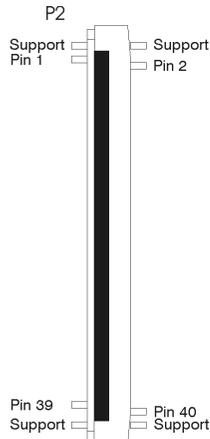
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Test Point	Signal or Voltage	Test Point	Signal or Voltage
CN1 pin 1	+4.9 Vdc	T1 pin 4 (input)	+3.3 Vdc
CN1 pin 2	+4.9 Vdc	T1 pin 5 (input)	+33.4 mV
CN1 pin 3	26 mV	T1 pin 6 (input)	-.30 Vdc
CN1 pin 4	+33 mV	T1 pin 7 (output)	60 V p-p sinewave @ 38 kHz
CN1 pin 5	+33 mV	T1 pin 9 (output)	77 V p-p sinewave @ 38 kHz
CN1 pin 6	+33 mV	T1 pin 10 (output)	450 V p-p sinewave @ 38 kHz
T1 pin 1 (input)	-.30 Vdc	T1 pin 12 (output)	45 V p-p sinewave @ 38 kHz
T1 pin 2 (input)	+3.3 Vdc	CN2 A	-400 V to +400 V sinewave @ 38 kHz (see figure)
T1 pin 3 (input)	+3.3 Vdc	CN2 B	-2.15 V to +4 V sinewave @ 38 kHz (see figure)

## Verifying HSYNC, VSYNC, and LCD Clock

To verify that the HSYNC (horizontal sync), VSYNC (vertical sync), and LCD clock are functioning correctly, measure the following signals as indicated in [Figure 1-4](#). If all of these signals measure correctly, suspect a defective backlight or LCD. The backlight is the most probable cause.

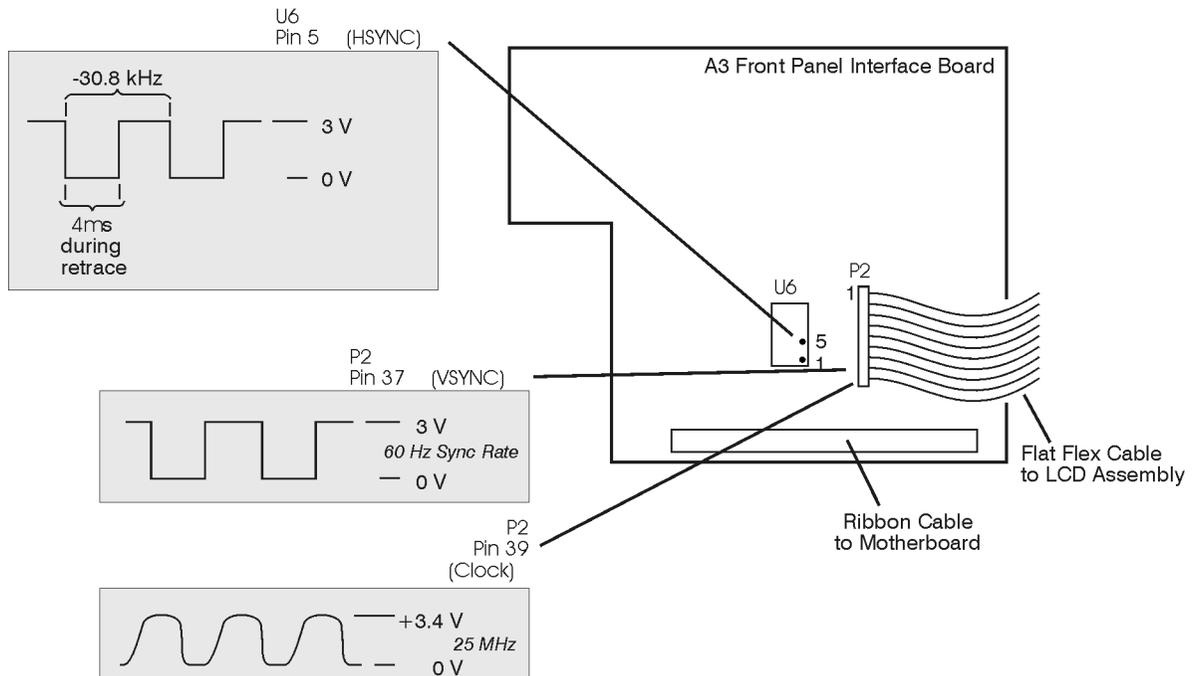
### NOTE



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The P2 connector on the front panel interface board has supports soldered at each end, as shown in the figure. Make sure to measure the correct pins. Be very careful when measuring these signals to ensure you do not short out any pins.

**Figure 1-4** Verifying HSYNC, VSYNC, and LCD Clock



## Check for Basic Functionality

The instrument will perform a boot process followed by a routine of internal self-calibration and self-diagnostic tests when powered up. These tests evaluate the instrument operation and will return an error message if a problem is detected.

If the instrument does not boot, check that the CPU is functioning. Refer to ["Verifying the A22 CPU Assembly" on page 54](#).

If the instrument boots and there are auto-alignment error messages, refer to ["Auto-Align Tests" on page 32](#) to help isolate the problem.

## Auto-Align Tests

The following tests are part of the auto-alignment procedure that occurs at instrument power-up. All alignment procedures have one of three outcomes:

SUCCESS	data is propagated to the alignment database
FAILURE	no data stored, and an ERROR is propagated until future success
ABORT	no data stored, and no ERROR messages

The data collected during the auto-align procedure, called the “cal database”, is stored in DRAM by the CPU.

All alignments are accessible via SCPI, and the query form of alignment requests returns ZERO for SUCCESS, non-ZERO for FAILURE or ABORT. All alignments can be aborted at any time by using the ESCAPE key.

**Table 1-3 Sequence for Auto-Align Procedures**

Procedure Name	Procedure Description
Diagnostic Check	As a precursor to any alignment (or full alignment), this procedure runs a quick diagnostic check to see if the system is even capable of completing the alignment. It checks for the possible presence of incoming RF energy at 50 MHz to be less than approximately 0 dBm. RF input power levels greater than 0 dB could leak through the calibrator switch and add energy to the calibrator signal. It also checks for unlock condition of the 28.9 MHz and 30 MHz oscillators on the A12 analog IF assembly.
Trigger Interpolator	The trigger interpolator provides a way to measure trigger timing to a fine precision. A unique trigger is used, which has timing that can be varied relative to the sample clock using an 8-bit control dac on the A12 analog IF. If it is not monotonic, or the expected variation is not verified, this alignment will FAIL.
ADC Offset DACs	Offset dacs for each of the 6 ADC range positions on the A10 digital IF assembly are aligned to reduce the overall DC offset.
ADC Dither CF	The ADC dither needs to be centered to prevent its own harmonics from folding back into the center of the IF passband. This routine adjusts the dither dac on the A10 digital IF.
ADC RAM Gains	Each of the 6 ADC range positions has its own page of RAM memory. This is a mapping of ADC bits to “output” Data bits. This RAM memory is on the A10 digital IF assembly.  This alignment uses the 50 MHz CW signal, from the A17 RF assembly, to measure the response of each range page. The RF input attenuator and analog IF main gain dac are dynamically adjusted to help keep the actual ADC signal level approximately the same. Relative measurements between each page transition ensure correctness even when moving main gain or attenuator around. Gain values for each page are stored away into the Cal database, and the RAM pages are then re-written.
IF Image Filter	The 321 MHz cal osc, on the A17 RF assembly, is used to align the 8 dacs of the image filter on the A12 analog IF assembly.
IF Gain Curve	The A12 analog IF assembly has a gain control dac that is called the “Main Gain”. It is used to compensate for analog IF Prefilter BW gain variations, so that the gain of the entire IF path (before ADC) remains approximately constant. It is the only gain stage that gets varied during normal instrument operation. This alignment generates the curve coefficients which characterize the gain vs dac number associated with this stage.

**Table 1-3 Sequence for Auto-Align Procedures**

Procedure Name	Procedure Description
Nominal System Gain	With the analog IF preFilter OFF and IF BW set to 5 kHz, alignment is done using the 50 MHz ref cal signal to measure the residual amplitude error (offset) at the center frequency in default (reference) settings (eg. 10 dB atten). This error is used to compensate acquisition data whenever there is an “absence” of a valid current system gain alignment; in other words, this becomes the “default” gain correction to fall back on.
321 MHz Amplitude	The 321 MHz cal osc signal from the A17 RF assembly is used for many internal alignments. This alignment merely calibrates the amplitude control dac for this signal, for use by the other alignments when necessary to set fairly accurate amplitude levels.
LC Prefilter Wide	This alignment is run once for WIDE (BW>1.2 MHz) and once for NARROW. The 321 MHz Comb cal osc is used to align BW and CF for the analog IF LC path. Coefficients are generated for a curve that maps BW-Dac to requested BW. Another curve is generated which represents Gain vs BW. Both these curves are then used during Prefilter and IF gain setup during a measurement.
LC Prefilter Narrow	See description for LC Prefilter Wide.
XTAL Prefilter Wide	This alignment is run once for WIDE (BW>20 kHz) and once for NARROW. The 321 MHz Comb cal osc is used to align BW, SYM, & CF for the analog IF XTAL path. Coefficients are generated for a curve that maps BW-Dac to requested BW. Another curve is generated which represents Gain vs BW. Both these curves are then used during Prefilter and IF gain setup during a measurement.
XTAL Prefilter Narrow	See description for XTAL Prefilter Wide.
ADC Autorange	The ADC autoranging subsystem has several hardware components that need to be setup. This alignment takes care of 3 dacs: 2 dacs on the A10 digital IF assembly that set the positive and negative thresholds for range switches; and 1 dac on the A12 analog IF assembly that sets the GAIN of the autoranging detector signal. It also generates 4 gain values to be used for 4 possible measurement setups. The 4 setups cover the on/off positions of dither and analog IF post-filter. This is necessary since these positions produce different relative signal levels between the main path and the autorange path.
Attenuator Steps	Align the relative error of each attenuator step at 50 MHz. The 10 dB attenuator setting is considered the reference, with 0 dB error by default. A CW signal is injected at 50 MHz and each attenuator step is measured to yield an error relative to the step's assumed value (for example: an attenuator setting of 21 is expected to produce 21 dB of attenuation... if it produces 21.12, the error is 0.12 dB).
Trigger Delays	This alignment currently is used ONLY for delay compensation within the CDMA personality for measurements which synchronize to an “even second clock”. This alignment measures the delay of the IF path for the one particular setup used for this CDMA application.
Measure Comb Teeth	The amplitude of the internal 50 MHz reference is compared to the amplitude of the 20 comb teeth (used during IF flatness alignment) by tuning the LO. If the resulting comparison is greater than a particular amount, the alignment fails. Mainly used for wide span comb settings that require measurements in order to achieve flatness down to 0.1 or 0.2 dB in the 10 MHz span.

**NOTE**

Additional auto-alignment procedures are performed for instruments equipped with base band I/Q inputs (Option B7C).

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## Power Supply Check

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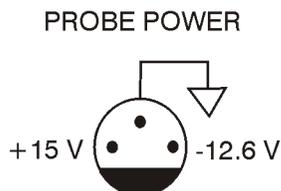
### NOTE

There are no fuses to replace within the power supply. If you determine that the power supply is the failed assembly, replace the power supply.

Observing the LED on the front of the instrument, and measuring the probe power connector, will determine if there is catastrophic failure in the power supply assembly.

1. Ensure the instrument is plugged in with the power switch in the Standby position (power not switched on). Verify that the yellow LED next to the power switch is lit. A lit yellow LED indicates the +15 VDC line (P15 STB) is providing enough voltage to light the LED. (The actual voltage may not be +15 VDC.)
2. Power on the instrument and verify that the green LED on the front panel is lit. A lit green LED indicates the power supply has received an "ON" command and that the +5.2 VDC supply can at least light the LED.
3. The front panel probe power connector can be used to check the +15 VDC and -12.5 VDC (-15 VDC) supplies. The -12.5 VDC is produced by post regulating the -15 VDC supply. Refer to [Figure 1-5](#) for a diagram of the probe power connector.

**Figure 1-5** Probe Power Connector



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If all of these supplies seem dead, it is likely that the problem is a defective A6 power supply assembly, or some other assembly is loading down the A6 power supply. Continue with ["If All Voltage Supplies Are Dead" on page 37](#), to determine the cause of the problem.

If the correct LEDs are lit and the probe power voltages measure within the specifications listed in the table below [Figure 1-6 on page 36](#), the power supply has not suffered a catastrophic failure; however, the power supply could still be at fault. Continue with the next section to measure the individual voltage supplies.

## Measure the Individual Voltage Supplies

If any one individual supply line from the A6 power supply assembly develops an over voltage/current problem, all supply lines are affected. The supply will go into a “burp” mode where the supplies will cycle on and off at a low voltage level. The cause of the over voltage/current condition can be the supply itself or any assembly that the power supply provides voltage to. If the power supply is in the “burp” mode, continue with the assembly removal process as described in the section titled ["If All Voltage Supplies Are Dead" on page 37](#).

---

**WARNING**

**The instrument contains potentially hazardous voltages. Refer to the safety symbols provided on the instrument, and in the general safety instructions in this guide, before operating the unit with the cover removed. Ensure that safety instructions are strictly followed. Failure to do so can result in severe or fatal injury.**

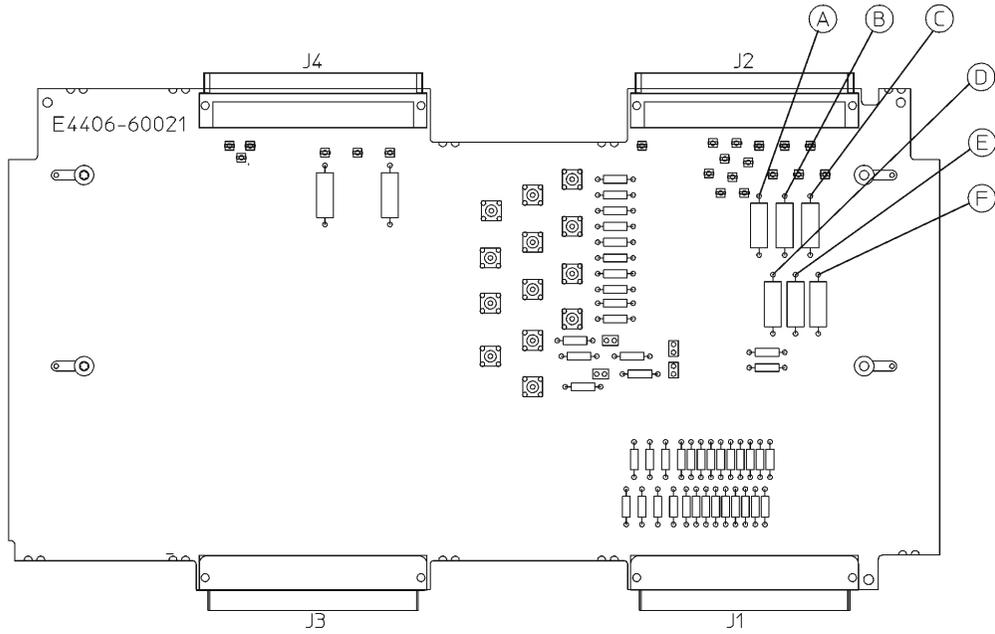
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The power supply voltages are checked using a digital voltmeter. Voltages measured should be within the tolerances listed in the table below [Figure 1-6 on page 36](#).

In order to measure the power supply voltages, it is necessary to remove the instrument’s outer case and top brace. Refer to [Chapter 3](#) for removal procedures. Use the E4406-60021 extender board to measure the individual power supply voltages. Insert the extender board into the empty slot next to the digital IF board.

Refer to [Figure 1-6](#) for the power supply test points on the extender board. Use the point marked as “ACOM” for the ground connection.

**Figure 1-6 E4406-60021 Extender Measurement Locations**



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Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	+5.2 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-15 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC

### If All Voltage Supplies Are Dead

In this case it is necessary to sequentially remove the assemblies, taking care to disconnect the line-power cord before removing any assembly. Remove the easy assemblies first, one at a time, and verify the supply each time (measuring on the E4406-60021 extender board).

After an assembly is disconnected or removed, plug the line-power cord back into the instrument and re-measure the supply that was down. If it is still down, continue with the assembly removal.

---

**NOTE**

If the supply is now up, suspect the last assembly removed as being defective.

Remove these assemblies first (refer to [Chapter 3](#) for removal instructions):

- A17 RF assembly
- A18 reference assembly
- A19 synthesizer assembly
- A12 analog IF assembly
- A10 digital IF assembly
- A7 base band IQ assembly (Option B7C)

Other assemblies to remove include:

- A25 SCSI
- A3 front panel interface assembly
- A15 daughterboard assembly
- A4 floppy disk drive

The **Minimum Assemblies** required to power up the instrument are:

- A21 motherboard
- A6 power supply assembly
- A22 CPU assembly
- A14 fan control board

---

**NOTE**

The line switch input logic goes into the A14 fan control board to power up the instrument. Therefore this board must be left in the instrument when isolating power supply failures.

---

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**NOTE**

To further isolate the failure in the four remaining “minimum assemblies”, measure the resistance (with the power turned off) from the power supply test points on the digital IF extender board to ACOM on the extender board. Make the measurements with the digital IF board removed from the extender board.

Refer to [Figure 1-6](#).

Measurement Location	Supply	Approximate Resistance ( $\Omega$ )
A	+5.2 VDC	41
B	-5.2 VDC	47
C	+15 VDC	366
D	-15 VDC	141
E	+9 VDC	78
F	+32 VDC	939

Check for shorts (zero  $\Omega$ ) or very low resistance (approx. 1  $\Omega$ ). If a short or low resistance is measured, pull the remaining boards from the instrument in the following order, and recheck the shorted test point after each board is pulled. Note that the resistance will be different from the table, but you should be able to tell if the shorted condition has changed. First pull the A14 fan control board, followed by the A22 CPU assembly, and finally the A6 power supply.

---

**If All Voltage Supplies Are Good**

If all of the supplies have measured within tolerances, and the instrument still appears dead, refer to "[Verifying the A22 CPU Assembly](#)" on page 54 and troubleshoot the A22 CPU assembly.

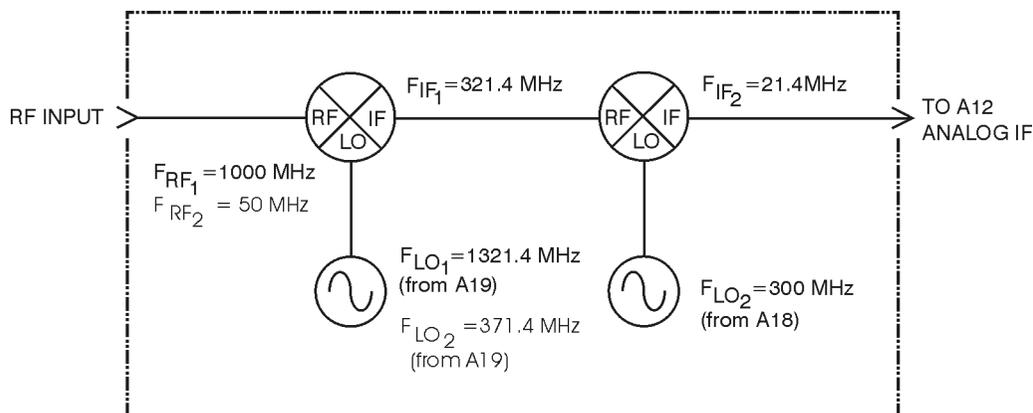
## Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem

This section provides information and techniques for isolating amplitude failures along the main signal path.

### Verifying the A17 RF Assembly

The A17 RF assembly uses two internal mixers to down-convert the instrument's input signal to the 2nd IF of 21.4 MHz. You can verify the performance of the RF assembly by injecting a 50 MHz CW signal at the front panel RF input connector, and measuring the 21.4 MHz output signal level. The default attenuator setting is 0 dB. Refer to [Figure 1-7](#) for two examples of the down conversion process; one with an input frequency of 1000 MHz, and one with an input frequency of 50 MHz.

**Figure 1-7** Example of Down Conversion



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### RF Assembly Quick Check

Turn the instrument on and let it go through the internal Cal Diagnostic routine. This routine will have some failures if the signal level is incorrect through the system. This will cause the red ERR message to appear in the upper right-hand corner of the instrument display.

1. Inject a CW signal at 50 MHz at  $-25$  dBm into the RF input of the instrument.
2. Press **Preset** and then tune the instrument to 50 MHz by pressing **Input, Input Port, RF, Frequency, 50, MHz**.
3. Press the **Input** key and verify the input attenuation is set to 0 dB by viewing the 5th softkey from the top. If it is not at 0 dB, press **Input Atten** and enter 0 dB.
4. Disconnect the flexible orange coaxial cable (W12) going into the A12 analog IF assembly at A12J13. Refer to [Figure 3-21 on page 163](#) for cable locations.
5. Connect a calibrated spectrum analyzer to the end of this flexible coaxial cable. Measure the 21.4 MHz 2nd IF output from the A17 RF assembly going to the A12 analog IF assembly.
6. If the A17 RF assembly is operating properly, the 21.4 MHz 2nd IF out of the A17 RF assembly will measure  $-25$  dBm on the calibrated spectrum analyzer.

---

**NOTE**

Note that this power level was obtained using a  $50\Omega$  BNC to SMB cable. If a high frequency probe, such as the 85024A, is used, the power level will read 6 dB higher, or  $-19$  dBm.

---

### RF Assembly Detailed Troubleshooting

If the quick check power level is not correct, several signals coming into the A17 RF assembly must be verified. Set up the instrument by performing steps 1 to 4 in the “[RF Assembly Quick Check](#)” and perform the following measurement:

1. The input attenuator could cause excessive loss. Press **Input, Input Atten**, and press the “up” arrow key ( $\uparrow$ ). The 21.4 MHz 2nd IF should decrease 1 dB at a time on the calibrated spectrum analyzer. If at any time the 21.4 MHz 2nd IF jumps in amplitude, the input attenuator or driver circuitry located on the A17 RF assembly is the most probable cause.

---

**NOTE**

Set the input attenuator back to 0 dB once this measurement has been completed. Reconnect the flexible coaxial cable back to A12J13.

---

2. Toggle the Cal Switch before the 2nd Mixer by pressing **Input, Input Port, IF Align, IF Align Signal, Signal Type, Comb, Span, 5, MHz, Meas Setup, Res BW, 20, kHz**. If the Image Filter and following RF circuitry is functioning correctly, there should be ~10 comb teeth on the instrument display at ~-40 dBm. These comb tooth signals come from the Cal Oscillator on the A12 analog IF assembly and are separated by ~468.5 kHz. If the comb teeth signal amplitudes are correct, but a signal injected into the RF input is displayed at the wrong amplitude, the failure is most likely caused from the RF input connector up to the Cal Switch on the A17 RF assembly. Toggle the input switch by pressing **Input, Input Port, 50 MHz Ref, Frequency, 50, MHz**. The power level with the internal calibrator switched in should read -25 dBm on the instrument display. If this power level is correct and the RF input signal from the external 50 MHz source is displayed at the wrong amplitude, the AT1 7 dB pad, the RF input connector, or the input switch on the A17 RF assembly may be defective.

The remaining detailed checks require the A17 RF assembly to be placed on an extender board (p/n E4406-60042). Turn the instrument off before removing a PC board assembly from the instrument.

3. Turn the instrument on and wait for the CPU to boot and the Cal Diagnostics to run.
4. Press **Preset, Input, Input Port, RF, Frequency 50 MHz**.
5. Refer to [Figure 1-8](#) for the measurement locations.

---

**NOTE**

To view the 50 MHz internal calibrator signal (location I in [Figure 1-8](#)) on the calibrated spectrum analyzer, press **Input, Input Port, 50 MHz Ref**.

If all the signal levels in the detailed troubleshooting section are correct and the 21.4 MHz 2nd IF output signal measured on the calibrated spectrum analyzer is incorrect, the most probable cause is the A17 RF assembly.

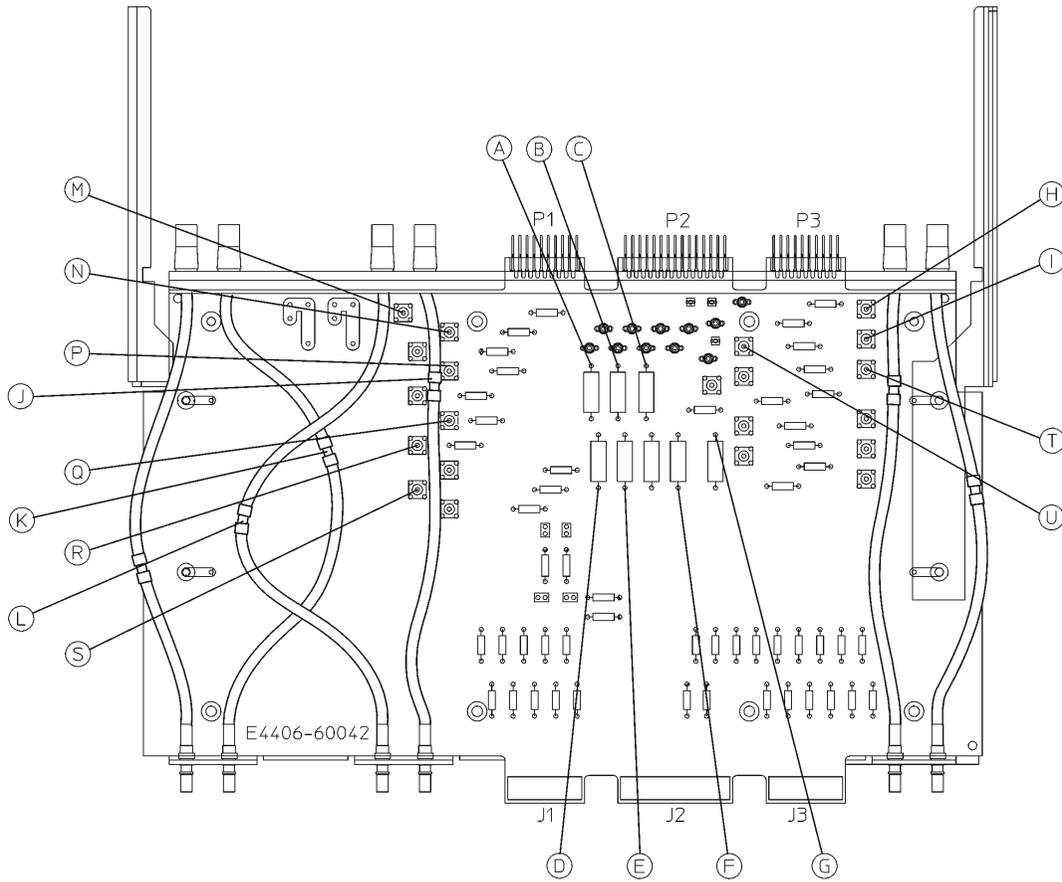
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**NOTE**

Note that these power levels are obtained using a 50Ω BNC to SMB cable.

---

**Figure 1-8 E4406-60042 Extender Board Measurement Locations**



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Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	-15 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-6 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC
G	power supply	DVM	+5.2 VDC
H	300 MHz 2nd L.O. In	calibrated spectrum analyzer	-8.75 dBm
I	50 MHz Internal Calibrator	calibrated spectrum analyzer	-18.4 dBm
J	321.4 MHz 1st IF Out	calibrated spectrum analyzer	-29 dBm
K	RF Input	calibrated spectrum analyzer	-32 dBm
L <sup>a</sup>	371.4 MHz 1st LO Input	calibrated spectrum analyzer	+11.4 dBm

a. Remember to measure on the LO board side of the cable and not the RF board side.

## **Verifying the A12 Analog IF Assembly**

This procedure assumes the A17 RF assembly is functioning correctly. To verify proper RF functionality, refer to the [“RF Assembly Quick Check” on page 40](#). The A12 analog IF down-converts the 21.4 MHz 2nd IF to the 7.5 MHz 3rd and final IF. Several modes of pre- and post-filtering occur on this board to minimize distortion products and unwanted spurious signals.

### **Analog IF Assembly Quick Check**

1. Inject a CW signal at 50 MHz at  $-25$  dBm into the RF input of the instrument.
2. Press **Preset** on the instrument and tune to 50 MHz by pressing **Input, Input Port, RF, Frequency 50 MHz**.
3. Press **Input** and verify the input attenuation is set to 0 dB by viewing the 5th softkey from the top. If it is not at 0 dB, press **Input Atten** and enter 0 dB.
4. Disconnect the flexible gray cable (W13) going into the A10 digital IF assembly at A10P7. Refer to [Figure 3-21 on page 163](#) for cable locations.
5. Connect a calibrated spectrum analyzer to the end of this flexible cable, and measure the 7.5 MHz output from the A12 analog IF assembly going to the A10 digital IF assembly.
6. If the A12 analog IF assembly is operating properly, the 7.5 MHz 3rd IF out of the A12 assembly will measure  $-22.5$  dBm on the calibrated spectrum analyzer.
7. Reconnect the cable to A10P7.

### **Analog IF Assembly Detailed Troubleshooting**

If the quick check power level is not correct, other items can be checked to verify the A12 analog IF assembly.

This assembly has five switchable modes of pre-filtering on the input section of the PC board. These modes are: LC Wide, LC Narrow, Crystal Wide, Crystal Narrow, and Bypass Mode. If one or more of these filter modes are defective, it will cause low gain in certain instrument settings through the system. The signal path through these pre-filters is determined by the Pre-FFT Bandwidth, the instrument Span setting, and the type of filtering that is selected (Gaussian or Flattop). To further isolate the A12 analog IF assembly performance, these various filter modes can be selected. If the signal level on the instrument display improves when selecting a different filter mode, the power level problem will have been isolated to the A12 analog IF assembly.

**Qualifying Each Filter Mode**

1. Inject a 50 MHz CW signal at  $-25$  dBm into the RF input of the instrument.
2. Tune to 50 MHz by pressing **Input, Input Port, RF, Frequency 50 MHz**.
3. Press **Input** and verify the input attenuation is set to 0 dB by viewing the 5th softkey from the top. If it is not at 0 dB, press **Input Atten** and enter 0 dB.
4. Press **Meas Setup, More, Advanced, Pre-FFT Fltr Gaussian/Flat** to underline Gaussian.
5. Press **Pre-ADC BPF On/Off** to Off. This bypasses the LC and XTAL prefilters. If the signal level on screen returns to  $-25$  dBm, the failure is in LC Wide mode and the A12 analog IF assembly is defective.
6. Reset the Pre-ADC BPF back to On.
7. To change the pre-filters to LC Narrow, press **Pre-FFT BW** from Auto to Man and enter 400 kHz. If the signal level on screen is  $-25$  dBm, the failure is the LC Wide mode or the 12.5 MHz Low Pass Post-Filter, and the A12 analog IF assembly is defective.
8. Change the span on the instrument by pressing **Span, 30, kHz**.
9. Press **Meas Setup, More, Advanced, Pre-FFT Fltr**. Check that Gaussian is still underlined.
10. Press **Pre-FFT BW** and enter 50 kHz. If the signal level on screen is  $-25$  dBm, the failure mode is in the LC Narrow mode and the A12 analog IF assembly is defective.
11. If the Pre-FFT BW is the active function, enter 2 kHz. If the signal level on screen is  $-25$  dBm the failure mode is in the XTAL Wide mode and the A12 analog IF assembly is defective.

---

**NOTE**

The 12.5 MHz Low Pass Filter and the 7.5 MHz Bandpass Filter are post-filters after the 3rd mixer. These post-filters are switched according to which pre-filter mode has been selected. If the LC and XTAL pre-filters are electronically bypassed or the Pre-FFT BW is greater than 400 kHz, the 12.5 MHz Low Pass post-filter is selected. If the Pre-FFT BW is less than or equal to 400 kHz, the 7.5 MHz Bandpass post-filter is selected. Refer to the following table to see which pre-filter and post-filter are being used.

---

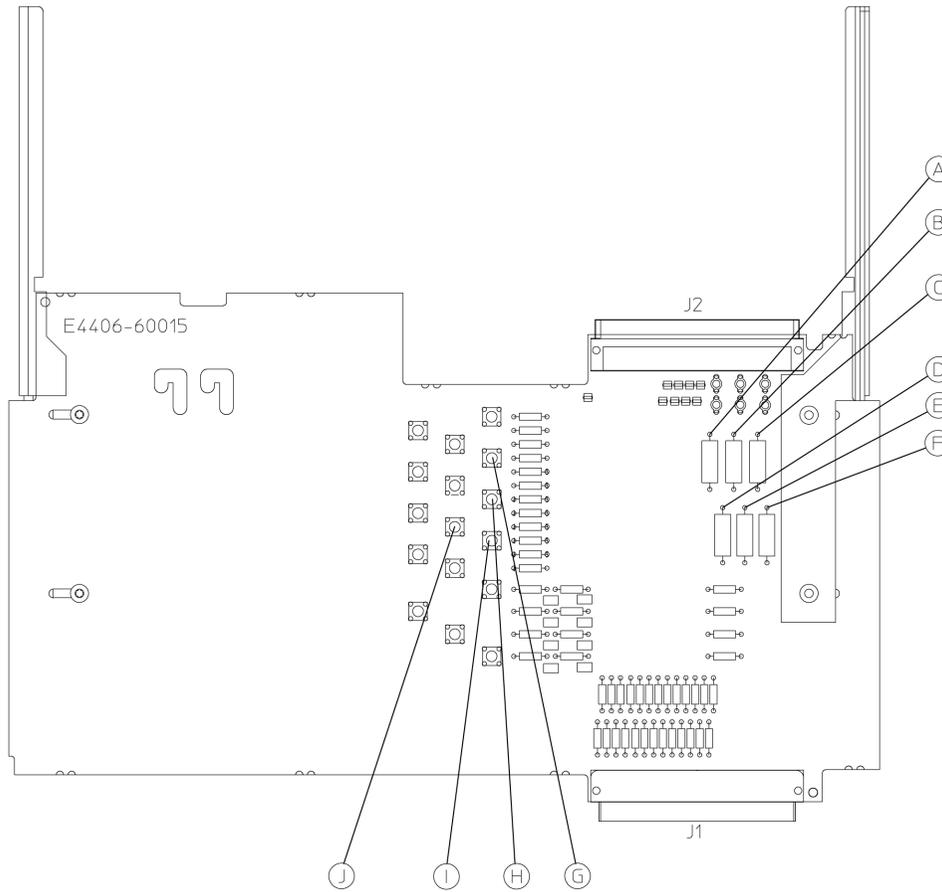
<b>Pre-FFT BW Setting</b>	<b>Pre-filter Being Used</b>	<b>Actual Pre-filter BW (Gaussian Fltr Mode)</b>	<b>Pre-filter BW Range</b>	<b>Post-filter Being Used</b>
2 kHz	XTAL Narrow	5 kHz	2.5 Hz to 20 kHz	7.5 MHz BPF
50 kHz	XTAL Wide	125 kHz	20.01 kHz to 200 kHz	7.5 MHz BPF
400 kHz	LC Narrow	1 MHz	201 kHz to 1.2 MHz	7.5 MHz BPF
1.5 MHz	LC Wide	3.75 MHz	1.21 MHz to 7.5 MHz	12.5 MHz LPF
>3 MHz	Bypass Mode	N/A	N/A	12.5 MHz LPF

The remaining detailed checks require the A12 analog IF assembly to be placed on an extender board (p/n E4406-60015). Turn the instrument off before removing a PC board assembly from the instrument. It is also necessary to remove the A10 digital IF assembly to access the measurement locations. Refer to [Chapter 3](#) for removal procedures.

- Press **Preset** and refer to [Figure 1-9](#) for the measurement locations. Verify the voltages in the table below the figure.

If the levels in the table are correct and bypassing the pre- and post-filters does NOT improve the power level, the most probable cause is the A12 analog IF assembly

**Figure 1-9 E4406-60015 Extender Measurement Locations**



sa866a

Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	+5.2 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-15 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC
G	Gate Arm	DVM	+3.7 VDC
H	Gate Trig	DVM	+3.7 VDC
I	Sweep Arm	DVM	+3.7 VDC
J	Sweep Trig	DVM	+3.7 VDC

## Verifying the A10 Digital IF Assembly

This procedure assumes the A17 RF assembly and the A12 analog IF assembly are functioning correctly. To verify proper RF and analog IF functionality, refer to the “[RF Assembly Quick Check](#)” on page 40 and the “[Analog IF Assembly Quick Check](#)” on page 43. The A10 digital IF will digitize the 7.5 MHz 3rd and final IF in the analog to digital converter. There is a 21.4 MHz “tapped” autoranging signal from the A12 analog IF assembly that pre-adjusts an amplifier on the A10 digital IF before the 7.5 MHz down-converted IF signal reaches the ADC. This pre-adjusted amplifier gain is electronically adjusted so the power level at the ADC input is optimized for maximum efficiency.

### Digital IF Assembly Quick Check

The A10 digital IF assembly requires a 30 MHz clock from the A12 analog IF assembly or the instrument will not boot.

1. Inject a CW signal at 50 MHz at  $-25$  dBm into the RF input of the instrument.
2. Press **Preset** on the instrument and tune to 50 MHz by pressing **Input, Input Port, RF, Frequency 50 MHz**.
3. Press **Input** and verify the input attenuation is set to 0 dB by viewing the 5th softkey from the top. If it is not at 0 dB, press **Input Atten** and enter 0 dB.
4. Connect a calibrated spectrum analyzer to A10TP5.
5. The 7.5 MHz 3rd IF power level at A10TP5 should measure  $-22.5$  dBm on the calibrated spectrum analyzer if the circuitry up to the ADC is operating correctly.

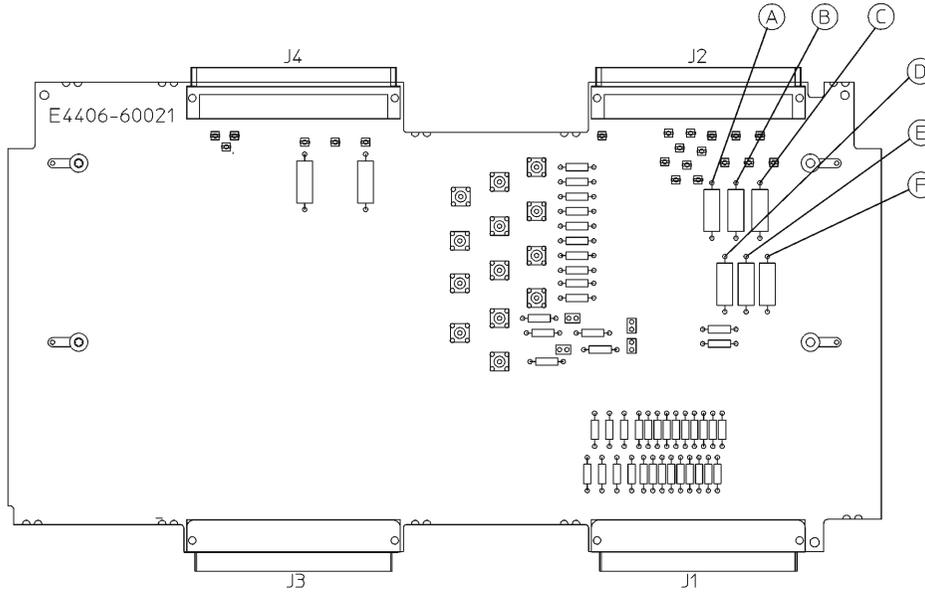
### Digital IF Assembly Detailed Troubleshooting

If the quick check power level is not correct, other items can be checked to verify the A10 digital IF assembly.

The remaining detailed checks require the digital IF assembly to be placed on an extender board (p/n E4406-60021). Turn the instrument off before removing a PC board assembly from the instrument.

If the levels in the table below [Figure 1-10](#) are incorrect, or the clock measurements (using an oscilloscope) or dc levels in [Figure 1-11](#) (if the part number of the digital IF assembly in your instrument is E4406-60006 see [Figure 1-12](#)) are incorrect, suspect that the A10 digital IF assembly is defective.

**Figure 1-10 E4406-60021 Extender Measurement Locations**

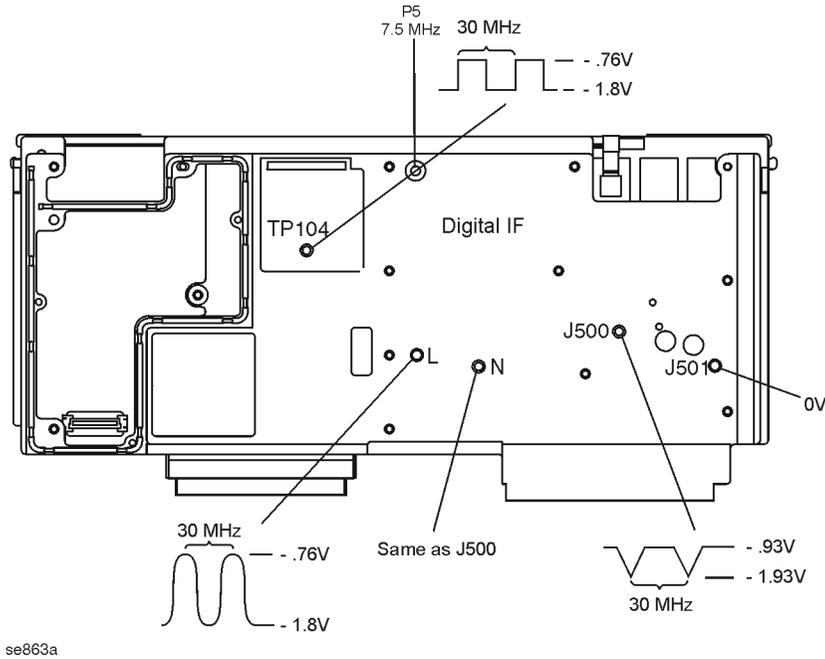


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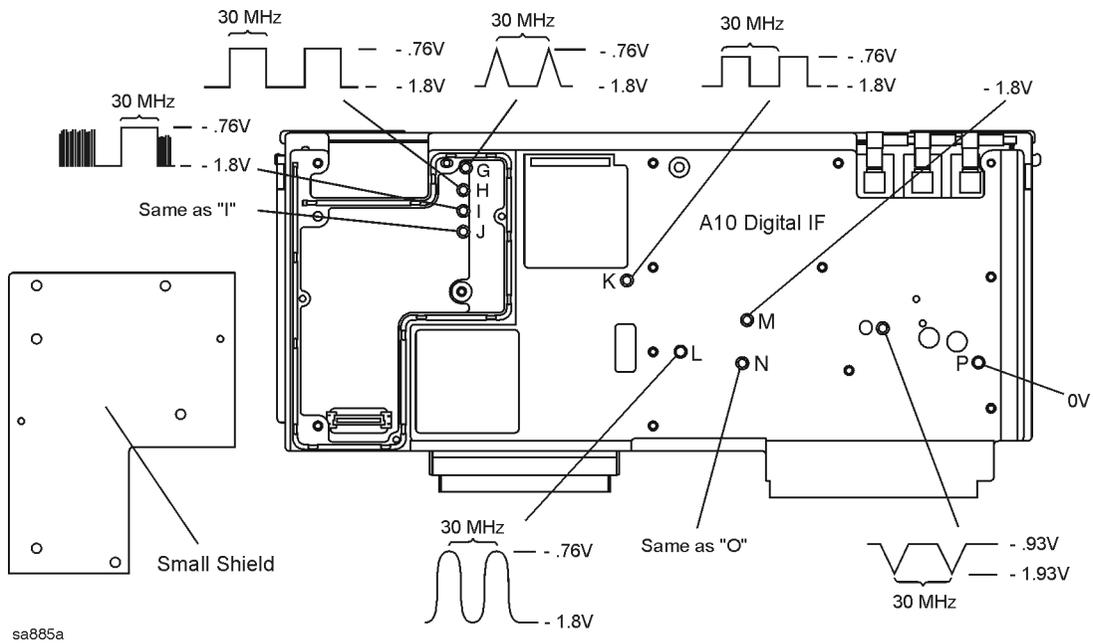
Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	+5.2 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-15 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC

**NOTE** To access the G through J measurement points in [Figure 1-11](#), it is necessary to remove the small shield on the A10 digital IF assembly.

**Figure 1-11 A10 Clock Measurements for the E4440-60025, E4440-60195 Digital IF Assembly**



**Figure 1-12 A10 Clock Measurements for the E4406-60006 Digital IF Assembly**



## Verifying the A18 Reference Assembly

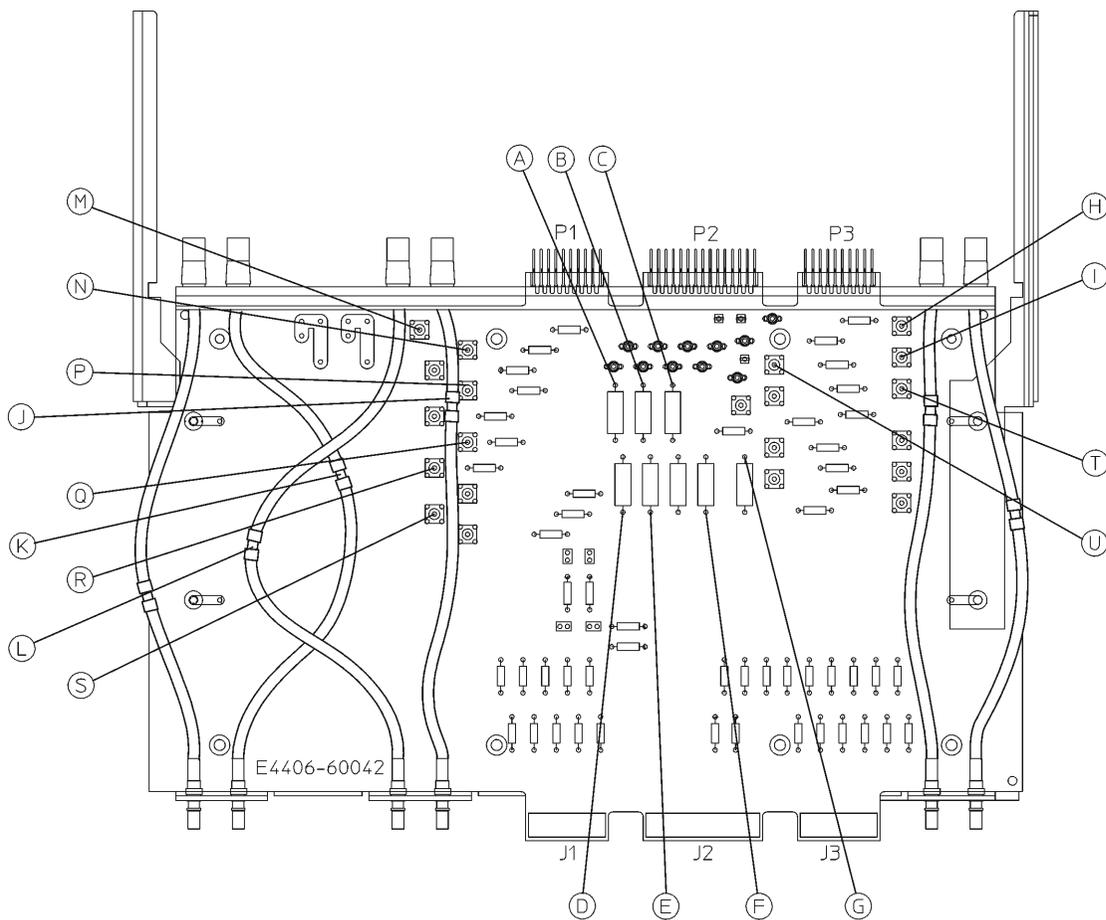
The instrument achieves its frequency stability from the phase locked circuitry on the A18 reference assembly. The 100 MHz phase locked VCXO is the heart of this assembly. This VCXO is divided by 10 to a phase locked 10 MHz reference for use on several other PC board assemblies in the instrument. The 100 MHz VCXO is also multiplied by 3 for the 2nd L.O. in the RF assembly. The 50 MHz internal calibrator signal is derived from this assembly as well by dividing the 100 MHz VCXO by 2. Verify the 10 MHz references by extending the A18 reference assembly.

### Reference Assembly Quick Check

Turn the instrument off before removing a PC board assembly from the instrument. The remaining quick checks require the A18 reference assembly to be placed on an extender board (p/n E4406-60042). The A17 RF assembly must also be removed to be able to access the SMB snap-on connectors on the extender board assembly. The red ERR message will appear at turn-on since the Cal Diagnostics will fail due to the absence of the A17 RF assembly.

Turn the instrument on and verify the correct power levels in the following table. If these levels are incorrect, suspect the A18 reference assembly as being defective.

**Figure 1-13 E4406-60042 Extender Measurement Locations**



sa879a

Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	-15 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-6 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC
G	power supply	DVM	+5.2 VDC
H	300 MHz 2nd L.O.	calibrated spectrum analyzer	-5.5 dBm
I	50 MHz Int. Cal. <sup>a</sup>	calibrated spectrum analyzer	-13 dBm
M	10 MHz Synth From Ref	calibrated spectrum analyzer	-17.5 dBm
N	10 MHz Opt	calibrated spectrum analyzer	-13 dBm
P	10 MHz RF from Ref	calibrated spectrum analyzer	-12.5 dBm
Q	10 MHz CPU	calibrated spectrum analyzer	-7 dBm
R	10 MHz Ext. Out	calibrated spectrum analyzer	-8.5 dBm
S	10 MHz AIF	calibrated spectrum analyzer	-44 dBm

a. The internal calibrator must be switched in to obtain an accurate level for the 50 MHz Int. Cal. measurement. Press **Input**, **Input Port**, **50 MHz Ref**.

## Verifying the A19 Synthesizer Assembly

The main function of the A19 synthesizer assembly is to provide the 1st L.O. to the A17 RF assembly. This is accomplished by using a variable VCO with a fundamental frequency range of 500 MHz to 1000 MHz. This signal will be divided, bandpassed, and doubled 2 or 4 times to achieve the correct 1st L.O. frequency. The 1st L.O. frequency depends on the setting of the instrument's center frequency. In most cases the L.O. will be 321.4 MHz higher than where the center frequency of the instrument is tuned.

For example, if the center frequency of the instrument is set to 1000 MHz, the 1st L.O. from the A19 synthesizer assembly will be  $1000 \text{ MHz} + 321.4 \text{ MHz}$  or 1321.4 MHz.

Since the maximum 1st L.O. frequency is 4000 MHz, the 1st L.O. will shift 321.4 MHz lower in frequency when the instrument is set to a center frequency of 3678.6 MHz.

For example, if the center frequency of the instrument is set to 3678.5 MHz, the 1st L.O. is  $3678.5 \text{ MHz} + 321.4 \text{ MHz} = 3999.9 \text{ MHz}$  (almost max). As soon as the instrument is set to a center frequency of 3678.6 MHz and greater the 1st L.O. will shift to  $3678.6 \text{ MHz} - 321.4 \text{ MHz} = 3357.2 \text{ MHz}$ . The best location to measure the 1st L.O. frequency and power level is when the A17 RF assembly is placed on an extender board (p/n E4406-60042).

The [A17 RF Assembly Detailed Troubleshooting](#) provided a process for measuring the 1st L.O. power when the instrument was tuned to 50 MHz. Power holes or defective circuitry on the A19 synthesizer assembly can cause low gain at other frequencies. For example, if the instrument has low gain at 1234.5 MHz, measuring the 1st L.O. power would be a good troubleshooting step to narrow the failure to the A19 assembly.

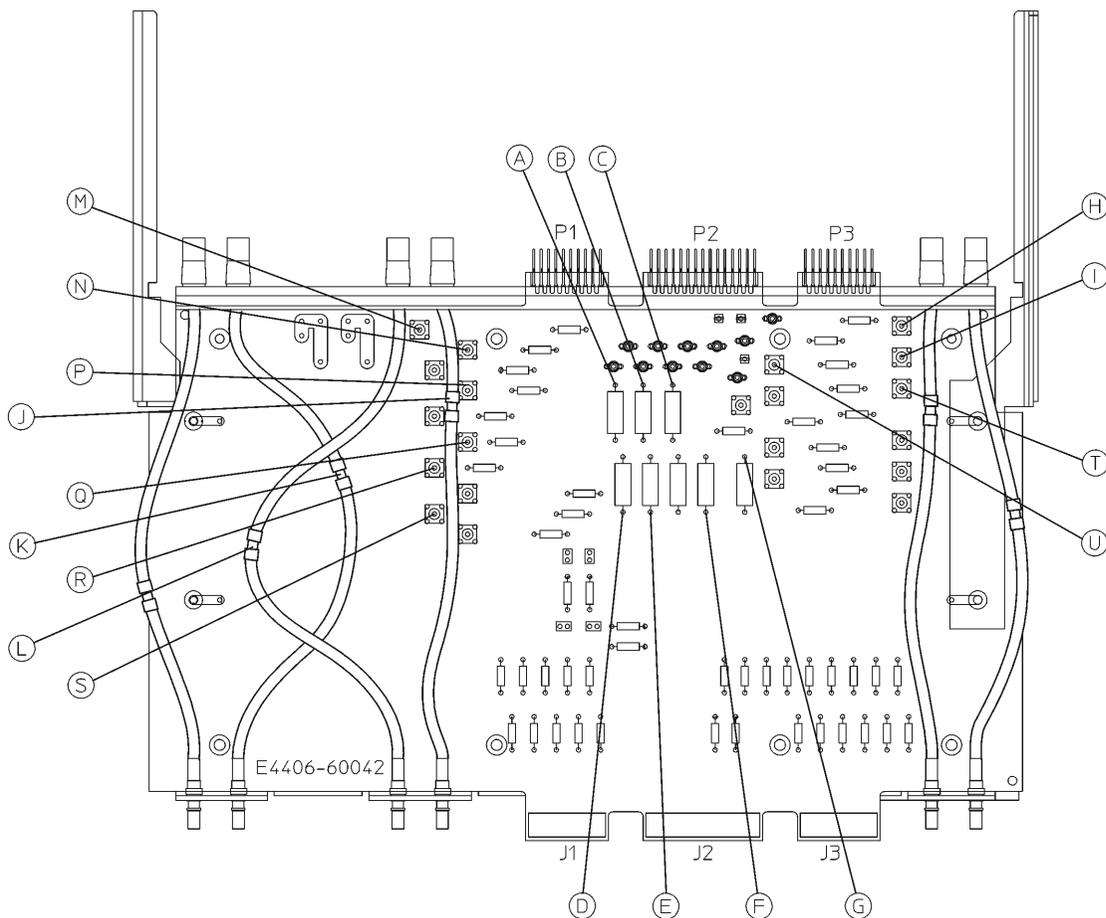
### Synthesizer Assembly Quick Check

Refer to [Figure 1-8](#) (test point L) on [page 42](#) to measure the 1st L.O.

### Synthesizer Assembly Detailed Troubleshooting

Turn the instrument on with the A19 synthesizer on an extender board (p/n E4406-60042) and verify the following levels. If the levels are incorrect, suspect the A19 synthesizer assembly as being defective.

**Figure 1-14 E4406-60042 Extender Measurement Locations**



sa879a

Measurement Location	Signal Description	Test Equipment Used	Expected Level
A	power supply	DVM	-15 VDC
B	power supply	DVM	-5.2 VDC
C	power supply	DVM	+15 VDC
D	power supply	DVM	-6 VDC
E	power supply	DVM	+9 VDC
F	power supply	DVM	+32 VDC
G	power supply	DVM	+5.2 VDC
T	10 MHz Synth to Synth	calibrated spectrum analyzer	-17.5 dBm
U	Pre Level Drive	DVM	+2.5 VDC

## Verifying the A22 CPU Assembly

The A22 CPU assembly slides into the instrument from the rear and connects to the A21 motherboard assembly. The GP-IB interface connector, LAN connector, RS-232 connector, Parallel Interface connector, and the external VGA monitor output connector are all soldered directly onto the CPU board. If you want to remove the CPU assembly from the instrument, several of the other assemblies must be removed before sliding the CPU out. Refer to [Chapter 3](#) for removal instructions. There is no extender board for the CPU assembly.

---

**NOTE**

The replacement processor board DOES NOT include the A22A1 DRAM board, the A22A2 Flash memory board, or the A22A3 GP-IB capacitor board. It is important that these boards be transferred to the replacement processor board. The Flash contains all of the instrument firmware, the synthesizer cal values, plus any options and keywords loaded into the instrument.

---

### CPU Assembly Quick Check

Following power-up, the instrument will perform a boot process as follows:

Once power is applied to the instrument, the screen will remain blank for several seconds.

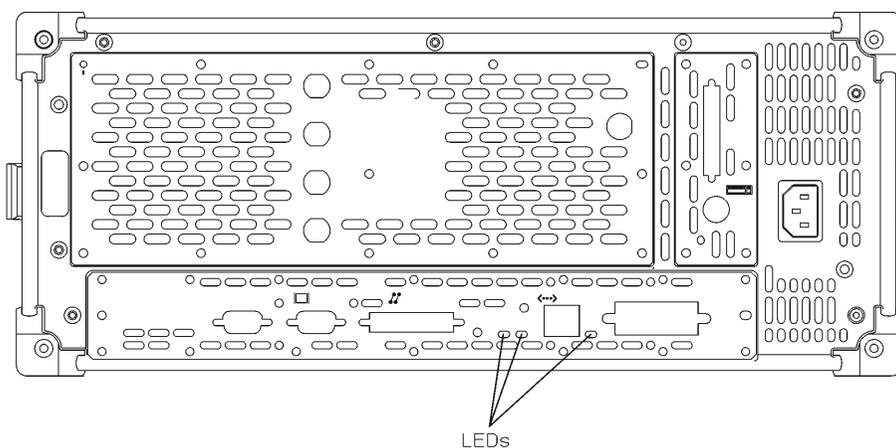
Text begins to scroll by on the instrument display as the instrument boots from the bootrom. During this time you will see information on the screen, such as what the primary and secondary boot paths are, what the keyboard path is, and messages that indicate the autoboot process has started and the CPU is booting. When the message `HARD booted` appears, the instrument has stopped booting from bootrom and is now booting from the main Flash.

Next, a series of keys appear on-screen and the instrument loads its operating system. More messages appear which tell you what is happening during the boot process. During this time the instrument is looking for LAN connections and checking for a floppy disk in the disk drive. When the message `user name: arcturus` appears on the instrument display, the CPU has successfully booted from Flash memory.

Once the boot process is complete, the instrument runs the auto-align procedure documented on [page 32](#).

If the instrument does not boot, look to see if the LEDs on the processor are flashing. When the instrument power is turned on, you can observe the processor LEDs from the rear panel access holes by the LAN connector as indicated in [Figure 1-15](#). Upon power-up, the green LEDs will flash on and off as the instrument steps through the boot-up sequence. At the end of the sequence, all of the green LEDs should be off. If one or more of the green LEDs remains on, suspect the processor assembly as being defective. If a LAN cable is attached, it is normal for the yellow LEDs to flash indicating LAN activity. If a LAN cable is attached the link integrity LED will also light up.

**Figure 1-15 Processor LEDs**



sa865a

If the screen remains blank (dark) and the green LEDs never blink, the instrument was not able to boot from bootrom. Bootrom on the A22 processor assembly could be bad, or the instrument clock signals could be missing. The bootrom is not a replaceable part.

If the 30 MHz sample clock from the A12 analog IF assembly to the A10 digital IF assembly is not present, the display signal processor chip on the digital IF assembly will not reset, causing the PCI bus to hang up and the instrument will not boot.

To check the 30 MHz sample clock:

- Put the A10 digital IF assembly on an extender board (E4406-60021).
- Check A10J4 for a 30 MHz signal using an oscilloscope, as shown in [Figure 1-11](#).
- If the signal is not present, the cause could be the A12 analog IF assembly, or the A18 reference assembly. Go to ["Verifying the A18 Reference Assembly" on page 50](#) to check the reference assembly.

If the boot-up process stops after the message Processor starting auto-boot process appears, the firmware files on the A22A2 Flash board may be defective. Try loading new firmware before replacing the A22 processor or A22A2 Flash assemblies.

Look at the instrument screen and read any error messages that might appear. The messages can give you a clue as to what is happening when the instrument hangs up.

### Battery

If you are experiencing problems with the real-time clock in your instrument, it might be time to change the battery that is located on the A22 processor assembly. The main purpose of the battery is to power the real-time clock when no power is applied to the instrument. To replace the battery, it is necessary to remove the A22 processor assembly. Refer to [Chapter 3](#) for removal procedures. The battery is easily replaced by unclipping it from the board. Take care to install the new battery correctly to ensure proper polarity.

---

#### WARNING

**Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instructions.**

---



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

sk780a

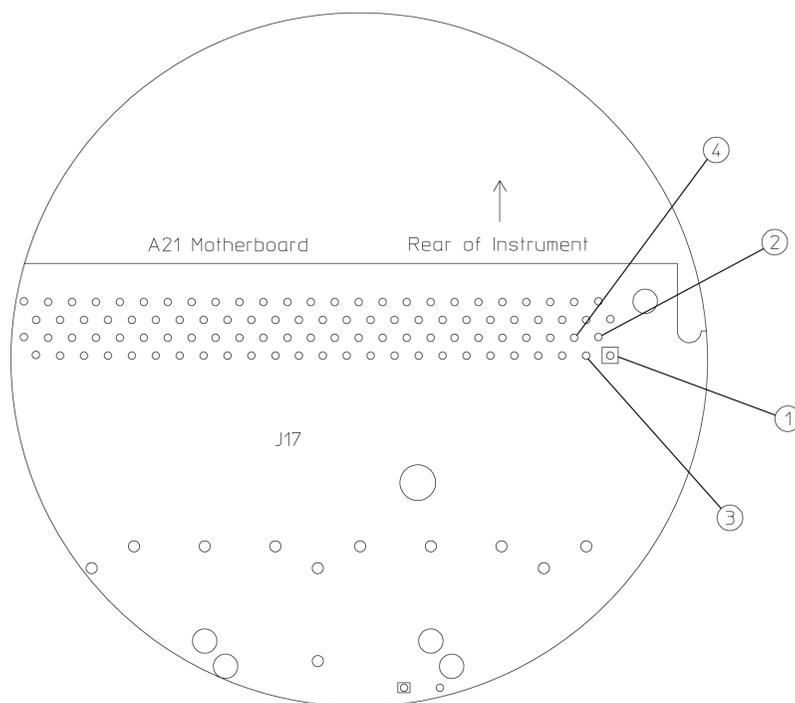
### CPU Assembly Detailed Troubleshooting

There are a few items that should be checked before suspecting a defective A22 CPU assembly. The CPU must have all the DC power supplies coming from the A6 power supply assembly through the A21 motherboard. Carefully measure the DC supplies on A21J17. Pins 1 and 2 should measure  $-12\text{ VDC}$ . Pins 3 and 4 should measure  $+12\text{ VDC}$ .

If the power supplies measure correctly, and the CPU does not boot properly, the I/O lines could be loaded down by another assembly, or a clock signal could be missing. Remove the A10 digital IF assembly and try rebooting. The A12 analog IF assembly must be installed and providing the 30 MHz sample clock before the CPU will boot. See the previous page for troubleshooting hints.

If the instrument will still not boot, suspect the A22 processor assembly is faulty.

**Figure 1-16** Motherboard Test Points



sa868a

## Troubleshooting Performance Test Failures

This information assumes the analyzer is making measurements but a performance test is failing by a small margin, or only a few measurements are failing. If most of the performance tests are failing, go to "Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem" on page 39.

- Step 1.** Determine if an adjustment is causing the analyzer to fail the performance test. Do the adjustments, if any, associated with the failing performance test.
- Step 2.** Determine the probable faulty assembly, and the next step to perform, by comparing the performance test results to [Table 1-4](#).

**Table 1-4 Performance Test Failures**

Failing Performance Test	Adjustment	Probable Faulty Assembly	Next Step
Displayed Average Noise Level (DANL)	None	A17 RF A12 analog IF A10 digital IF	<b>Step 5</b>
Attenuator Accuracy at 50 MHz	None	A17 RF	
Amplitude Linearity	None	A10 digital IF A12 analog IF	<b>Step 3</b>
Absolute Amplitude Accuracy	Frequency Response (Flatness) Internal 50 MHz Calibrator <sup>a</sup>	A12 analog IF A17 RF A10 digital IF	<b>Step 4</b>
Third-Order Intermodulation Distortion	None	A17 RF A12 analog IF A10 digital IF	<b>Step 3</b>
Gain Compression	None	A17 RF A12 analog IF A10 digital IF	<b>Step 3</b>
Residual Responses	None	A17 RF A12 analog IF A19 synthesizer	<b>Step 5</b>
Spurious Responses	Synthesizer Adjustment Number 1	A19 synthesizer A18 reference A17 RF A12 analog IF	<b>Step 6</b>
Residual FM	None	A19 synthesizer A18 reference	<b>Step 3</b>
Phase Noise	Synthesizer Adjustment Number 2	A19 synthesizer A18 reference	<b>Step 3</b>
Internal 10 MHz Frequency Reference	Internal 10 MHz Frequency Reference <sup>a</sup>	A18 reference	

**Table 1-4 Performance Test Failures**

Failing Performance Test	Adjustment	Probable Faulty Assembly	Next Step
Input VSWR	None	AT1 Input connector A17 RF	<b>Step 7</b>

- a. Refer to the N7812A software to do this adjustment.

**NOTE**

If more than one performance test fails, use the entry closest to the beginning of the table. However, please note that a failure on any assembly in the input RF path could cause many of the performance tests to fail. See the E4406A Overall Block Diagram in [Chapter 2](#)

[Table 1-4](#) lists the assembly or assemblies most likely to cause the failure. Multiple probable faulty assemblies are listed in order of probability.

- Step 3.** Go to ["Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem"](#) on page 39.
- Step 4.** The Absolute Amplitude Accuracy test combines the amplitude and frequency data taken in the Frequency Response (Flatness) test and the Amplitude Accuracy at 50 MHz test. Look at the data for these two tests to see what measurements may be causing the failure. Use this information to help isolated the failure. Go to ["Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem"](#) on page 39.
- Step 5.** Use a spectrum analyzer to trace a signal through the RF input path to determine where the extra noise is being added. See the E4406A Overall Block Diagram in Chapter 2. Go to ["Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem"](#) on page 39 to help isolate the problem.
- Step 6.** Use a spectrum analyzer to trace a signal through the RF input path using the failing spurious setup. See the E4406A Overall Block Diagram in Chapter 2. Go to ["Isolating an RF, Analog IF, Digital IF, Reference, Synthesizer, or CPU Problem"](#) on page 39 to help isolate the problem.
- Step 7.** Check the condition of the input connector. See the E4406A Overall Block Diagram in [Chapter 2](#) .

## Contacting Agilent Technologies

If you have a problem with your instrument, first check the basics. This chapter contains a checklist that will help identify some of the most common problems. If further troubleshooting is necessary, continue with the troubleshooting steps earlier in this chapter, or return the instrument to Agilent Technologies.

There is also support on the world-wide web. The address is:

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

FAQs, firmware upgrades, documentation, and other support information can be accessed from this site.

## Software Technical Support

If you have a problem with your *Agilent N7812A Calibration Application Software*, contact Agilent Technologies for assistance. For software technical support, contact the Agilent Technologies Test and Measurement Call Center at **1-800-452-4844**.

## Calling Agilent Technologies Sales and Service Offices

Use the information in this section to obtain Agilent Technologies sales and service offices information. Sales and service offices are located around the world to provide complete support for your instrument. To obtain servicing information or to order replacement parts, contact an Agilent Technologies Sales and Service office listed on [page 61](#). In any correspondence or telephone conversations, refer to the instrument by its model number and full serial number. With this information, the Agilent Technologies representative can quickly determine whether your unit is still within its warranty period.

By internet, phone, or fax, get assistance with all your test and measurement needs.

**Table 1-5**

<b>Online assistance:</b> <a href="http://www.agilent.com/find/assist">www.agilent.com/find/assist</a>			
<b>United States</b> (tel) 1 800 829 4444	<b>Latin America</b> (tel) (305) 269 7500 (fax) (305) 269 7599	<b>Canada</b> (tel) 1 877 894 4414 (fax) (905) 282-6495	<b>Europe</b> (tel) (+31) 20 547 2323 (fax) (+31) 20 547 2390
<b>New Zealand</b> (tel) 0 800 738 378 (fax) (+64) 4 495 8950	<b>Japan</b> (tel) (+81) 426 56 7832 (fax) (+81) 426 56 7840	<b>Australia</b> (tel) 1 800 629 485 (fax) (+61) 3 9210 5947	

### Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

## Instrument Serial Numbers

Agilent makes frequent improvements to its products enhancing performance, usability, or reliability. Agilent service personnel have access to complete records of design changes to each type of instrument, based on the instrument's serial number and option designation.

Whenever you contact Agilent about your instrument, have the complete serial number available. This will ensure that you obtain accurate service information.

A serial number label is attached to the rear of the instrument. This label has two instrument identification entries: the first provides the identification number for each option built into the instrument and the second provides the instrument's serial number.

The serial number has two parts: the prefix (two letters and the first four numbers), and the suffix (the last four numbers). Refer to [Figure 1-17](#).

**Figure 1-17** Example Serial Number



The first two letters of the prefix identify the country in which the unit was manufactured. The remaining four numbers of the prefix identify the date of the last major design change incorporated in your instrument. The four digit suffix is a sequential number and, coupled with the prefix, provides a unique identification for each unit produced. Whenever you list the serial number or refer to it in obtaining information about your instrument, be sure to use the complete number, including the full prefix and the suffix.

## Updating Firmware

Please refer to <http://www.agilent.com/vsa> for the latest E4406A firmware and installation instructions. Firmware updates are performed via a LAN hub or LAN cross-over cable.

## How to Return Your Instrument for Service

### Service Tag

If you are returning the instrument to Agilent Technologies for servicing, fill in and attach a blue service tag. Several service tags are supplied in this manual. Please be as specific as possible about the nature of the problem. If you have recorded any error messages that appeared on the screen, or have completed a Performance Test Record, or have any other specific data on the performance of the instrument, please send a copy of this information with the unit.

### Original Packaging

Before shipping, pack the unit in the original factory packaging materials if they are available. If the original materials were not retained, see [“Other Packaging”](#).

## Other Packaging

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**CAUTION**

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

---

You can repackage the instrument with commercially available materials, as follows:

1. Attach a completed service tag to the instrument.
2. If you have a front-panel cover, install it on the instrument; if not, protect the control panel with cardboard.
3. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
4. Use a strong shipping container. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. The carton must be both large enough and strong enough to accommodate the instrument. Allow at least 3 to 4 inches on all sides of the instrument for packing material.
5. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation (Hayward, California, 94545). Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
6. Seal the shipping container securely with strong nylon adhesive tape.
7. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.
8. Retain copies of all shipping papers.

Troubleshooting  
**How to Return Your Instrument for Service**

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## **2** **Block Diagrams**

## Introduction

This chapter provides information about the operation of the instrument that is useful when you first troubleshoot an instrument failure.

The Agilent Technologies VSA is a 7 MHz to 4 GHz transmitter tester that integrates frequency-domain and time-domain analysis to provide advanced measurements of complex and time varying signals. The instrument performs complex signal analysis, such as digital modulation analysis, AM/FM/PM demodulation, vector spectrum analysis, and time-gated spectrum analysis. Simultaneous time and frequency domain measurements and displays improve productivity and enhance ease of use.

This chapter briefly describes each of the following instrument assemblies:

- [A6 Power Supply Assembly on page 69](#)
- [A10 Digital IF Assembly on page 76](#)
- [A12 Analog IF Assembly on page 73](#)
- [A17 RF Assembly on page 70](#)
- [A18 Reference Assembly on page 78](#)
- [A19 Synthesizer Assembly on page 80](#)
- [A22 Processor Assembly on page 82](#)
- [A7 Baseband I/Q Assembly \(Option B7C\) on page 83](#)
- [Miscellaneous](#)
  - [A14 Fan Control Board on page 84](#)
  - [A15 Daughter Board on page 84](#)
  - [A21 Motherboard on page 84](#)
  - [A25 SCSI on page 85](#)
  - [Front Frame on page 86](#)
  - [A4 Disk Drive on page 86](#)

## A6 Power Supply Assembly

The A6 power supply assembly is a switching power supply operating at 121.95 kHz switching frequency. The input power ranges for the power supply are 90 to 132 V or 195 to 250 Vrms. The power supply automatically senses the input power and switches between these two ranges. The output voltages are: +5.2 V, -5.2 V, +9 V, +15 V, -15 V, +32 V, VCC (5.2 V for processor) and VDL (3.3 V to processor). A low TTL level on the PS\_off\_L line turns off the power supply and places it in standby mode. In standby mode, the front panel standby LED is powered on by the P15SBY line from the power supply.

When the power supply is on, the “power on” front panel LED is powered by the 5.2 V supply. The power supply plugs directly into the motherboard.

## A17 RF Assembly

The A17 RF assembly uses two-stage frequency conversion to convert RF signals to a 21.4 MHz second IF. The RF front-end creates a first IF of 321.4 MHz which is down-converted to a second IF of 21.4 MHz. The 21.4 MHz IF is applied to the A12 analog IF board.

The input signal to the first mixer can be either a 7 MHz to 4 GHz signal from the RF input connector, or the internal 50 MHz calibrator signal from the A18 reference board. Signal path switching is accomplished by a solid state switch which is located before the input of the 0-40 dB input attenuator. A step-tuned 328.4 MHz to 4 GHz LO signal is provided by the A19 synthesizer board. The 321.4 MHz mixing product from the first converter is filtered and amplified before being split off, either to the second converter through the cal switch, or to the 321.4 MHz OUT connector. The 321.4 MHz signal passes through amplifiers and image filters before mixing with the 300 MHz second LO and being down converted to 21.4 MHz

The cal switch allows a 321.4 MHz cal signal to be switched into the signal path when the instrument performs auto-cal. The 321.4 MHz cal signal is produced by mixing the 300 MHz second LO signal with a 21.4 MHz modulated Cal\_Osc signal. The Cal\_Osc signal is produced on the A12 analog IF assembly, and can be a pulse, a comb, or a cw signal.

The RF assembly performs the following functions:

- provides input attenuation
- adjusts the 50 MHz internal calibrator level for -32 dBm
- converts RF input signals to the 21.4 MHz second IF
- generates pre-level drive for the A19 synthesizer assembly
- provides the 321.4 MHz IF calibrator signal and the 50 MHz calibrator signal used for auto-alignment

### Input Attenuator

The input attenuator provides 0 to 40 dB of attenuation in 1 dB steps. Press **Preset** to select 0 dB attenuation. The power up attenuator setting is 0 dB.

### RF Input Switch

The 50 MHz internal calibrator from the A18 reference assembly can be used to monitor power levels in the instrument. Enter a center frequency of 50 MHz. Press **Input, Input Port, 50 MHz Ref** to select the 50 MHz cal signal. Verify that the power levels on screen are correct.

## 50 MHz Calibrator

The 50 MHz calibrator is adjusted to a final level of  $-32$  dBm before the signal goes through the RF input switch. The on-screen level in spectrum mode should be  $-25$  dBm, when calibrated. The on-screen signal level reads  $-25$  dBm because the 7 dB pad (AT1) is compensated for through video shift further down in the system.

## First Mixer

The first mixer converts incoming RF signals to a 321.4 MHz first IF by mixing the input signal with a 321.4 to 4 GHz first local oscillator (LO). This LO originates on the A19 synthesizer assembly. For input signals less than or equal to 3678.6 MHz, the LO frequency is calculated as the RF +321.4 MHz. For signals above 3678.6 MHz, the LO frequency is calculated as the RF  $-321.4$  MHz.

## 321.4 MHz Amplifiers

The amplifiers in the 321.4 MHz IF path are low-noise, high dynamic range.

## Calibrator Switch

A 321.4 MHz calibrator signal is generated on the A17 RF assembly. The cal switch selects between the main measurement path and the IF calibration signal.

## Image Filter

The image filter is centered at 321.4 MHz and is approximately 20 MHz wide at the 3 dB bandwidth point.

## Second Mixer

The second mixer converts the 321.4 MHz first IF to a 21.4 MHz second IF by mixing the 321.4 MHz IF with the 300 MHz second LO. The second LO originates on the A18 reference assembly.

## 21.4 MHz Output Buffer Amplifiers and Filter

The buffer amplifiers provide good isolation from the second converter output to the input of the A12 analog IF assembly. The 21.4 MHz bandpass filter is centered at 21.4 MHz, and has a 3 dB bandwidth of approximately 12 MHz.

### Pre-level Drive

The pre-level drive is part of the AGC loop. After detecting the level of the LO on the RF board, the pre-level drive drives a variable attenuator on the A19 synthesizer board, which then adjusts the level of the LO.

### Interconnections to other assemblies

- **A17P1.** 21.4 MHz out to the A12 analog IF board
- **A17P2.** RF input (7 MHz to 4 GHz, from the front-panel port)
- **A17P3.** 321.4 MHz out (currently not in use)
- **A17P4.** LO input from the A19 synthesizer board

## A12 Analog IF Assembly

The A12 analog IF assembly receives a 21.4 MHz signal from the RF Board. The 21.4 MHz signal is amplified, pre-filtered, mixed with the 28.9 MHz third LO to provide a 7.5 MHz final IF, amplified again, and post filtered.

The analog IF assembly also provides anti-alias filter protection, and routes the 21.4 MHz signal, that is used in ranging, to the A10 digital IF board.

The A12 analog IF assembly also performs the following functions:

- prefilters the 21.4 MHz second IF frequency
- uses a variable gain amplifier to provide the optimum level to the mixer
- provides a 21.4 MHz anti-alias filter
- provides the final down conversion
- performs post down-conversion filtering
- provides calibrator oscillator and sample rate oscillator
- provides a clock generator
- performs the third LO conversion
- triggering
- provides the power supply switching frequency generator

### Pre-filters

LC and XTAL prefilters are used to attenuate the out of band signals that are not in the measurement bandwidth, in order to improve TOI distortion and spurious responses. The pre-filters are adjusted to 2.5 times the resolution bandwidth; if the instrument resolution bandwidth is at 1 kHz, the XTAL pre-filter will be at 2.5 kHz.

### Variable Gain Amplifier

The gain of the amplifier is adjusted electronically to provide +2 dB of gain from the front panel RF input to the A12 output.

## 21.4 MHz Anti-Alias Filter

This filter serves two purposes. First, it rejects the image band at 31.4 MHz to 41.4 MHz. Second, it band limits the signal to a width of 10 MHz, and so provides much of the anti-alias filtering for the ADC.

## Mixer

The third mixer converts the incoming 21.4 MHz second IF down to the final third IF at 7.5 MHz. This is accomplished by mixing the 21.4 MHz second IF with a 28.9 MHz third LO. The difference frequency is 7.5 MHz

## Third L.O.

The 28.9 MHz third LO signal is phase locked to the 10 MHz frequency reference from the A18 reference assembly.

## Post Down Conversion Filtering

There are two post-mixing filters for the 7.5 MHz final IF. The 12.5 MHz low pass filter removes high order mixing products from the third LO, as well as the 21.4 MHz feed-through. The 2 MHz wide band pass filter provides additional filtering for narrow resolution bandwidths, and is used to improve dynamic-range, free of spurious signals.

## Calibrator and Sample Rate Oscillators

A host of complex signals are used during the vector calibration. This output is fed to the A17 RF assembly. The vector calibration is performed at instrument power up, and a background calibration will be performed if the auto cal feature is activated (press **System**, **Alignments**, **Auto Align**, and toggle the **Auto Align** key to On, to activate the auto cal feature).

## Clock Generator

The clock is a 30MSa/s differential ECL clock that is distributed on the motherboard to the digital IF as SR\_L and SR\_H (Sample Rate low and high). The clock generator is locked to the 10 MHz reference signal.

## Triggering

The analog IF board has a second IF strip for generating triggers.

## Power Supply Switching Frequency Generator

The power supply switches at a rate of 244 kHz. This frequency rate is determined by the power supply switching circuitry on the A12 analog IF assembly.

## Interconnections to other assemblies

- **A12J13.** 21.4 MHz (at -2 dBm) in from the A17 RF board.
- **A12J5.** Front panel external trigger input.
- **A12J18.** Rear panel external trigger input.
- **A12P2.** 7.5 MHz (at +5 dBm) out to A10 digital IF assembly.

## A10 Digital IF Assembly

The A10 digital IF assembly digitizes the 7.5 MHz third IF, by processing the time domain continuous data into I/Q (in-phase and quadrature) signals, and delivers the data to the CPU for further processing and display.

The digital IF assembly performs the following main functions:

- digitizes the 7.5 MHz third IF
- provides input selector switching
- pre-adjusts the variable amplifier for optimum ADC input levels using the gain range/select rules circuitry
- performs analog to digital conversion
- performs dither generation

### 7.5 MHz IF

The 7.5 MHz third IF comes from the A12 analog IF assembly. The maximum input level to the A10 digital IF assembly is +4 dBm. Exceeding this level will cause distortion and will clip the ADC causing erroneous measurement results.

### Gain Range Select/Rules

This input path is a tapped 21.4 MHz second IF from the A12 analog IF assembly, which bypasses the 10 MHz anti-alias filters. The gain range for the A10 assembly with the variable amplifier before the ADC is 0 to 18 dB. (Note: For instruments that have an A10 assembly with part number E4406-60006 the gain range is -6 dB to 24 dB.) The gain range select/rules “pre-adjusts” the variable amplifier for optimum ADC input levels before the 7.5 MHz third IF arrives at the ADC. Incorrect levels will cause distortion and will clip the ADC, resulting in erroneous measurements.

### ADC

The ADC has one input for the 7.5 MHz third IF from the Analog IF assembly. The ADC converts these input signals from analog to digital for processing to the instrument display.

### Input Selector Switch

The input selector switch routes the appropriate input signal to the ADC. The select switch logic comes from the ASIC/Zoom filter.

## Offset Adjust and Dither

These signals are requirements for the complex ADC chip to function properly. The dither generator adds noise to the ADC, which converts distortion errors into excess noise. It is desirable to diminish distortion, at the cost of noise.

## Interconnections to other assemblies

- **A10P7** 7.5 MHz (at +5 dBm) in from A12 Analog IF board.

## A18 Reference Assembly

The purpose of the A18 reference assembly is to provide a phase locked 10 MHz signal to other boards within the instrument. The 10 MHz reference is phase locked to either an internal reference source, or an externally applied signal of arbitrary frequency ranging from 1 MHz to 30 MHz.

The 10 MHz signal is provided to the A19 synthesizer assembly, the A12 analog IF assembly, the A22 CPU assembly, and the rear panel BNC output connector. In addition, a 50 MHz signal and a 300 MHz signal are provided to the A17 RF assembly. The 50 MHz signal is used for calibration purposes, and is switched on when amplitude calibration is performed. The 300 MHz signal is used as a second LO for the RF assembly, and is always on.

The reference assembly utilizes a phase-lock loop which provides stabilization for all the internal reference oscillators used throughout the instrument.

The reference assembly performs the following function:

- phase locks the 100 MHz VCXO to an internal 10 MHz frequency reference or to an externally provided standard ranging from 1 MHz to 30 MHz.
- provides a phase-locked 300 MHz ( $100 \text{ MHz} \times 3$ ) second LO to the A17 RF assembly.
- provides the reference unlock detector which, through the A22 CPU assembly, warns the user that the reference lock loop is unlocked.
- provides a phase-locked 50 MHz ( $100 \text{ MHz} \div 2$ ) internal calibrator signal to the A17 RF assembly.
- provides the 10 MHz phase-locked reference for various assemblies in the instrument.

### 100 MHz VCXO

The 100 MHz voltage controlled crystal oscillator is used as the main reference in the instrument. It is phase-locked with either an internal or external frequency reference. The overall frequency accuracy of the instrument is determined by the accuracy of the frequency reference.

## 300 MHz Output

The 300 MHz output provides the 2nd LO signal and the LO signal for the IF calibrator on the A17 RF assembly.

## Reference Unlock Detector

If the A18 reference assembly is not receiving the correct reference signal, an unlock error message will appear in red text in the annunciator bar on the front panel. This state is detected by the A22 CPU assembly from the A18 reference assembly.

## 50 MHz Calibrator Output

The 50 MHz (100 MHz x 2) internal calibrator is used to perform background calibration on various assemblies in the instrument. This signal is routed to the A17 RF assembly where it is level shifted.

## 10 MHz Outputs

The 100 MHz VCXO, which is phase locked to a frequency reference, is divided by ten, resulting in a 10 MHz signal. This signal is used on various assemblies in the instrument, including the A22 CPU, A17 RF, A12 analog IF, A18 reference, the output to the rear panel (switched), and the A19 synthesizer.

## Interconnections to other assemblies

- **A18J2P13.** External reference in (1 to 30 MHz) from the A15 daughterboard.

## A19 Synthesizer Assembly

The A19 synthesizer assembly supplies the first local oscillator frequency and power to the A17 RF assembly. This LO is fed to the first mixer for the first down conversion to a 321.4 MHz first IF.

The synthesizer assembly performs the following main functions:

- detects unlock problems
- provides VCO phase lock loop
- provides three selectable bandpass filters
- provides the first doubler
- provides the second doubler

### Lock Detector

If the 500 to 1000 MHz VCO phase lock loop is not able to lock to the 10 MHz internal reference, the lock detector output logic will be interpreted by the A22 CPU and display an LO unlock error message in the error message block on the instrument display.

### VCO Phase Lock Loop

The VCO range is 500 MHz to 1000 MHz. The frequency output of the VCO depends on the center frequency of the instrument. This output frequency is very stable because it is phase locked to the 10 MHz reference signal from the A18 reference assembly.

### Bandpass Filters

There are three firmware selectable bandpass filters. The frequency ranges of the filters are 250 to 396 MHz, 396 to 628 MHz, and 628 to 1000 MHz. The center frequency of the instrument will determine the VCO frequency, and which one of these bandpass filters will be switched in.

### First Doubler

The center frequency of the instrument determines the signal path through the first doubler. The fundamental VCO frequency may bypass this block of circuitry.

## Second Doubler

The center frequency of the instrument will determine the signal path through the second doubler. The fundamental VCO frequency may bypass this block of circuitry.

## Interconnections to other assemblies

- **A19J6.** LO out (250 MHz to 4 GHz at  $\geq +10$  dBm) to the A17 RF board.

## A22 Processor Assembly

The A22 processor assembly consists of four boards: the base CPU processor board, the A22A1 128M DRAM card, the A22A2 Flash memory board, and the A22A3 Capacitor board.

The A19 synthesizer tuning sensitivity numbers, the license key word, measurement applications, the operating system and main firmware are stored in Flash memory. All of this information can be transferred to a replacement CPU board by transferring the A22A2 flash board, if the original CPU board fails.

The A22 CPU board contains the instrument serial number.

There are several I/O connections on the rear panel of the instrument. Many of these connectors are soldered directly into the CPU board or plug into the CPU. These connections include the following:

- SCSI-2 connector. Used for connecting an external CD-ROM drive that can be used to update the operating system.
- Parallel interface connector. Used to connect the instrument to a parallel printer.
- LAN connector. Used for downloading firmware into the instrument.
- GP-IB. Used for automated testing and remote control operation.
- Keyboard connector. Used for connecting an external PS-2 keyboard.
- RS-232 connector. Enables connection of instrument to a PC, or for remote control.
- VGA monitor output connector. Used to connect an external, non-interlaced VGA compatible monitor with a signal that has 31.5 kHz horizontal/60 Hz vertical synchronization rate.

## A7 Baseband I/Q Assembly (Option B7C)

The A7 assembly processes I and Q baseband signals to facilitate analyzer measurement of I and Q signals, both independently and together. The baseband I/Q assembly performs the following functions:

- provides selectable load impedances of 50 $\Omega$ , 600 $\Omega$ , and 1M $\Omega$
- provides input voltage protection
- provides balanced and unbalanced input options
- performs both digital and analog calibration of the baseband signals
- performs analog to digital conversion
- prepares the input signals for further processing by the CPU

### I/Q Input Circuitry

The external I,  $\bar{I}$ , Q, and  $\bar{Q}$  connectors allow input of balanced and unbalanced signals. Input impedances of 50 $\Omega$ , 600 $\Omega$ , and 1 M $\Omega$  can be selected through the front panel. The 50 $\Omega$  and 1 M $\Omega$  can be used for unbalanced inputs, while the 600 $\Omega$  and 1 M $\Omega$  impedance setting can be used for balanced inputs. Protection is provided against excessive ESD transient and DC input voltages using varister clamps.

### Input Amplifiers

The first of three input amplifiers allows for high impedance, positive and negative inputs signals, while the second and third amplifiers convert differential signal inputs to single-ended signals.

### ADC

The ADC converts the analog I and Q signals to digital and has a resolution of 14 bits.

### Digital Signal Processing Block (DSP)

The DSP block consists of a deserializer, a MUX, and a custom ASIC chip that performs essential signal processing tasks, such as filtering and decimation. The deserializer converts the serial output of the ADC, whether an I, Q, or I/Q signal, to multiple lines that feed into the MUX. The MUX distributes the signals to the ASIC chip.

## Miscellaneous

### A14 Fan Control Board

Three fans are used to cool the various assemblies in the instrument. The fan speed varies with internal instrument temperature; as the internal temperature increases, the fan speed also increases. The front panel power switch line that turns the power supply on and off is input from the fan control board. An over-temperature circuit is provided that will turn off the instrument if necessary.

### A15 Daughter Board

The daughter board plugs into the A21 motherboard. It serves the following functions:

- Supplies the 10 MHz reference signal to the A17 (RF), A19 (Synthesizer), A12 (Analog IF), and A18 (Frequency Reference Assembly) boards. The 10 MHz reference signal comes from the A18 board.
- If the 1 to 30 MHz external reference is selected, the A15 daughterboard will output the external reference signal to the A18 board.
- Triggering signals for external equipment are input into the A15 daughter board.

### A21 Motherboard

The A21 motherboard provides the following functions:

1. Provides a load to the power supply assembly for the +9 V, -5.2 V, -15 V, +5.2 V supply lines. This allows a minimum set of PC board assemblies to be present for power supply operation. See the power supply troubleshooting section of this manual for a list of minimum assemblies required. This will help isolate power supply problems.
2. The on/off switch is located here.
3. Provides regulated +12 V and -12 V supplies to the processor board.
4. Provides interconnections between many assemblies.

## **A25 SCSI**

The SCSI board assembly plugs directly into the A22 CPU assembly. Any SCSI drive can be used with this SCSI board. The SCSI board will mainly be used for connecting an external CD-ROM drive. The SCSI board assembly also provides a connector for an external keyboard. This keyboard connector is compatible with an external AT style PC keyboard.

## Front Frame

The front frame assembly contains the following four assemblies.

### A1 Keyboard

The keyboard allows entry of keyboard characters, immediate activation of some features including the print, restart, and display navigation features, and selection of some softkey menus.

### A2 Flat Panel Display

The LCD display assembly provides annotation, graticule, and trace information, as processed by the CPU through the front panel interface board. Two backlights are used to illuminate the LCD display. The LCD display will function when only one backlight is working. The backlights can be easily replaced, and should be replaced as a pair.

### A3 Front Panel Interface Assembly

The front panel interface board interprets which key has been pressed, and provides voltage supplies to the inverter boards, the RPG tuning circuitry, and the probe power bias voltage outputs. The front panel interface assembly is comprised of three boards. The A3A1 and A3A2 inverter boards are identical. The inverter boards provide a stepped-up voltage to both backlights on the LCD display.

### A4 Disk Drive

The disk drive is used to download information from a 3.5 inch floppy disk to instrument memory, and to load information from the instrument onto a floppy disk.

## A27 Rear Panel

Four connectors are located on the rear panel of the instrument.

**External Reference.** The external reference allows you to select an external reference to phase lock all oscillators in the instrument. You can select any external reference frequency between 1 and 30 MHz. The A18 reference assembly then converts any external reference frequency to 10 MHz. A green Ext Ref message on the front panel annunciator bar indicates that the instrument is locked to the external reference. A red Ext Ref message indicates that the external reference has been selected but that the instrument is not locked.

**10 MHz out (switched).** The 10 MHz out allows you to lock other test equipment to the same frequency reference that is being used by the transmitter tester. Once the 10 MHz out is set to an On state, it will persist an On state until an Off state is selected.

**Trigger out (1 + 2).** These two trigger outputs enable you to trigger external test equipment.

## Mnemonics and Connectors

**Table 2-1 Mnemonic Descriptions**

Mnemonic	Description
(AUDIO_SPKR+) NC	Speaker positive output from CPU board to motherboard - not used
(AUDIO_SPKR-) NC	Speaker negative output from CPU board to motherboard - not used
(LINE_IN_L) AUDIO	Left channel line level audio input to CODEC on CPU board from the audio output of the 4 option board slots on the motherboard
(LINE_IN_R) AUDIO	Right channel line level audio input to CODEC on CPU board from the audio output of the 4 option board slots on the motherboard
10MHZ_AIF	10 MHz reference from reference board to analog IF board
10MHZ_CPU	10 MHz reference from reference board to CPU board
10MHZ_EXT_IN	External reference input from rear panel BNC to reference board
10MHZ_EXT_OUT	External 10 MHz reference output from reference board to rear panel BNC
10MHZ_OPT	10 MHz reference from reference board to the 4 option board slots on the motherboard
10MHZ_RF	10 MHz reference from the reference board to the top option board slot on the daughterboard
10MHZ_SYNTH	10 MHz reference from the reference board to the synthesizer board
50MHZ	50 MHz reference from the reference board to the RF board
300MHZ	300 MHz reference from the reference board to the RF board
ABUS	Analog bus output from the synthesizer board to test point on the daughterboard
ACOM	Analog ground (chassis)
AUDIO	Line level audio output from the 4 option board slots on the motherboard to the CPU board
CALOSC_H	Differential ECL 21.4 MHz calibration oscillator output from the analog IF board to the RF board
CALOSC_L	Differential ECL 21.4 MHz calibration oscillator output from the analog IF board to the RF board
CLEAN_CK	Serial bus clock signal from the serial bus bridge on the daughterboard to the top option slot on the daughterboard
CLEAN_DATA	Serial bus data signal from the serial bus bridge on the daughterboard to the top option slot on the daughterboard
CLEAN_EN	Serial bus enable signal from the serial bus bridge on the daughterboard to the top option slot on the daughterboard
DAUGHTER_OTP	Daughterboard thermometer chip output to the fan control board
DCOM	Digital ground (single point ground inside the power supply)
DPT_TRIG1	
DPT_TRIG2	
FLOPPY_DCHGL	Disk change signal from the floppy drive to the floppy controller chip on the CPU board
FLOPPY_DIRCL	Direction signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_DS1L	Drive select #1 signal from the floppy controller chip on the CPU board to the floppy drive

**Table 2-1 Mnemonic Descriptions**

Mnemonic	Description
FLOPPY_DS3L	Drive select #3 signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_HSL	Head select signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_IDXL	Index signal from the floppy drive to the floppy controller chip on the CPU board
FLOPPY_MID	
FLOPPY_RDDL	Read disk data from the floppy drive to the floppy controller chip on the CPU board
FLOPPY_READY	
FLOPPY_STEPL	Step pulse signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_TR00L	Track 00 status signal from the floppy drive to the floppy controller chip on the CPU board
FLOPPY_WDL	Write data signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_WEL	Write enable signal from the floppy controller chip on the CPU board to the floppy drive
FLOPPY_WPL	Write protect signal from the floppy drive to the floppy controller chip on the CPU board
FP_A0	Front panel bus address 0 (LSB) signal from the CPU board to the front panel interface board
FP_A1	Front panel bus address 1 signal from the CPU board to the front panel interface board
FP_A2	Front panel bus address 2 signal from the CPU board to the front panel interface board
FP_A3	Front panel bus address 3 signal from the CPU board to the front panel interface board
FP_BLUE0	Flat panel display blue 0 (LSB) signal from the CPU board to the front panel interface board
FP_BLUE1	Flat panel display blue 1 signal from the CPU board to the front panel interface board
FP_BLUE2	Flat panel display blue 2 signal from the CPU board to the front panel interface board
FP_BLUE3	Flat panel display blue 3 (MSB) signal from the CPU board to the front panel interface board
FP_CBLANKL	Flat panel display blanking signal from the CPU board to the front panel interface board
FP_CLK	Front panel bus 7.5 MHz clock signal from the CPU board to the front panel interface board
FP_CSL	Front panel bus chip select signal from the CPU board to the front panel interface board
FP_D0	Front panel bus data 0 (LSB) signal from the CPU board to the front panel interface board
FP_D1	Front panel bus data 1 signal from the CPU board to the front panel interface board
FP_D2	Front panel bus data 2 signal from the CPU board to the front panel interface board
FP_D3	Front panel bus data 3 signal from the CPU board to the front panel interface board
FP_D4	Front panel bus data 4 signal from the CPU board to the front panel interface board
FP_D5	Front panel bus data 5 signal from the CPU board to the front panel interface board
FP_D6	Front panel bus data 6 signal from the CPU board to the front panel interface board
FP_D7	Front panel bus data 7 (MSB) signal from the CPU board to the front panel interface board
FP_DOTCLK	Flat panel display 25 MHz dot clock signal from the CPU board to the front panel interface board
FP_GREEN0	Flat panel display green 0 (LSB) signal from the CPU board to the front panel interface board
FP_GREEN1	Flat panel display green 1 signal from the CPU board to the front panel interface board

**Table 2-1 Mnemonic Descriptions**

Mnemonic	Description
FP_GREEN2	Flat panel display green 2 signal from the CPU board to the front panel interface board
FP_GREEN3	Flat panel display green 3 (MSB) signal from the CPU board to the front panel interface board
FP_HSYNCL	Flat panel display horizontal sync signal from the CPU board to the front panel interface board
FP_INTRL	Front panel bus interrupt signal from the front panel interface board to the CPU board
FP_P12	12V power supply output from the CPU board to the motherboard (not used)
FP_P15SBY	Front panel +15V standby power supply from the fan control board to the front panel interface board
FP_P5.2	Front panel +5.2V power supply from the fan control board to the front panel interface board
FP_PS2_KBCLK	Front panel PS2 keyboard clock signal from the CPU board to the motherboard (not used)
FP_PS2_KBDATA	Front panel PS2 keyboard data signal from the CPU board to the motherboard (not used)
FP_PS2_MSCLK	Front panel PS2 mouse clock signal from the CPU board to the motherboard (not used)
FP_PS2_MSDATA	Front panel PS2 mouse data signal from the CPU board to the motherboard (not used)
FP_PWR_RST_L	Front panel bus power on reset signal from the CPU board to the front panel interface board
FP_RED0	Flat panel display red 0 (LSB) signal from the CPU board to the front panel interface board
FP_RED1	Flat panel display red 1 signal from the CPU board to the front panel interface board
FP_RED2	Flat panel display red 2 signal from the CPU board to the front panel interface board
FP_RED3	Flat panel display red 3 (MSB) signal from the CPU board to the front panel interface board
FP_VSYNCL	Flat panel display vertical sync signal from the CPU board to the front panel interface board
FP_W_RL	Front panel bus read/write signal from the CPU board to the front panel interface board
GATE_ARM	Gate arm signal from the analog IF board to the digital IF board
GATE_TRIG	Gate trigger signal from the analog IF board to the digital IF board
GPIB_TRIG	GPIB group execute trigger signal from the CPU board to the analog IF board
HPUP	Motherboard serial bus power on reset signal from the digital IF board to all vertical boards
LADDR	Motherboard serial bus address strobe signal from the digital IF board to all vertical boards
LCNTRL	Motherboard serial bus control strobe signal from the digital IF board to all vertical boards
LDATA	Motherboard serial bus data strobe signal from the digital IF board to all vertical boards
LINE_OUT_COM	Line level audio output common signal from the audio CODEC chip on the CPU board to the front panel interface board
LINE_OUT_L	Line level audio output left channel signal from the audio CODEC chip on the CPU board to the front panel interface board
LINE_OUT_R	Line level audio output right channel signal from the audio CODEC chip on the CPU board to the front panel interface board
LINE_TRIG	Line trigger signal from the power supply to the analog IF board
LO_LOCK	LO lock signal from the digital IF board to the daughterboard
LSRQ	Motherboard serial bus service request signal from all vertical boards to the digital IF board

**Table 2-1 Mnemonic Descriptions**

Mnemonic	Description
MISO	Motherboard serial bus master in slave out data signal from all vertical boards to the digital IF board
MOSI	Motherboard serial bus master out slave in data signal from the digital IF board to all vertical boards
N12	-12 V power supply from the motherboard to the CPU board
N15	-15 V power supply on the motherboard
N5.2	-5.2 V power supply on the motherboard
N6	-6 V power supply from the fan control board to the synthesizer board
NC	No connect
OPT_TRIG1	Option trigger signal #1 output from the 4 motherboard option slots to the analog IF board
OPT_TRIG2	Option trigger signal #2 output from the 4 motherboard option slots to the analog IF board
P12	+12 V power supply from the motherboard to the CPU board
P15	+15 V power supply on the motherboard
P15SBY	+15 V standby power supply on the motherboard
P32	+32 V power supply on the motherboard
P5.2	+5.2 V power supply on the motherboard
ID0	Motherboard option board slot ID bit 0
ID1	Motherboard option board slot ID bit 1
P9	+9 V power supply on the motherboard
PCMCIA_AD0	not used
PCMCIA_AD1	not used
PCMCIA_AD2	not used
PCMCIA_CLK7	not used
PCMCIA_CS1L	not used
PCMCIA_CS2L	not used
PCMCIA_D0 to D7	not used
PCMCIA_INTRL	not used
PCMCIA_LTCHENL	not used
PCMCIA_OEL	not used
PCMCIA_RSTL	not used
PCMCIA_WEL	not used
POWFAILL	
PRE_LEVEL_DRIVE	LO leveling loop feedback signal from the RF board to the synthesizer board
PROBE_N12.6	Probe power -12.6 V power supply from the fan control board to the front panel interface board

**Table 2-1 Mnemonic Descriptions**

Mnemonic	Description
PROBE_P15	Probe power +15 V power supply from the fan control board to the front panel interface board
PS_FREQ	Power supply clock frequency from analog IF board to the power supply
PS_OFF_L	Power supply on/off control signal from the fan control board to the power supply
RANGE	IF range signal from the analog IF board to the digital IF board
REF_CK	Serial bus clock signal from the serial bus bridge on the daughterboard to the reference board
REF_DATA	Serial bus data signal from the serial bus bridge on the daughterboard to the reference board
REF_EN	Serial bus enable signal from the serial bus bridge on the daughterboard to the reference board
REMOTE_ON_L	
RF_CK	Serial bus clock signal from the serial bus bridge on the daughterboard to the RF board
RF_DATA	Serial bus data signal from the serial bus bridge on the daughterboard to the RF board
RF_EN	Serial bus enable signal from the serial bus bridge on the daughterboard to the RF board
SCLK	Motherboard serial bus clock signal from the digital IF board to the all vertical boards
SR_H	Differential ECL sample rate clock from the analog IF board to the digital IF board
SR_L	Differential ECL sample rate clock from the analog IF board to the digital IF board
SWEEP_ARM	Sweep arm signal from the analog IF board to the digital IF board
SWEEP_TRIG	Sweep trigger signal from the analog IF board to the digital IF board
SW_IN_L	Power switch signal from the front panel power switch to the fan control board
SYNTH_CK	Serial bus clock signal from the serial bus bridge on the daughterboard to the synthesizer board
SYNTH_DATA	Serial bus data signal from the serial bus bridge on the daughterboard to the synthesizer board
SYNTH_EN	Serial bus enable signal from the serial bus bridge on the daughterboard to the synthesizer board
TRIG1	Trigger #1 output from the digital IF board to all vertical boards
TRIG2	Trigger #2 output from the digital IF board to all vertical boards
VCC	+5.2 V digital power supply
VDL	+3.4 V digital power supply
VFAN+	Cooling fans positive power supply from the fan control board to the fan connectors on the motherboard
VFAN-	Cooling fans negative power supply from the fan control board to the fan connectors on the motherboard

## Mnemonic Pin Locations

The following tables, [Table 2-2 “A21 Motherboard Mnemonic Locations”](#) and [Table 2-3 “A15 Daughterboard Mnemonic Locations”](#), list the signals routed on the motherboard and daughterboard. The source of the signal is shown in boldface type. If a signal goes to multiple pins on a connector, the first pin will be shown followed by (...) to indicate the signal is also located on other pins on this connector. Refer to the pinout tables of the individual connectors (later in this chapter) for a complete listing.

**Table 2-2 A21 Motherboard Mnemonic Locations**

Mnemonic	A21 Motherboard Connector										
	J2	J5	J6	J7	J8/J13 J14/J15	J9	J10	J11	J12	J16	J17
(AUDIO_ SPKR+) NC										<b>92</b>	
(AUDIO_ SPKR-) NC										<b>93</b>	
10MHZ_AIF			46			57					
10MHZ_CPU			50							51	
10MHZ_OPT			48		52						
ACOM	4 (...)	2 (...)	1 (...)		1 (...)	1 (...)	1 (...)	35 (...)	1 (...)	1 (...)	49 (...)
AUDIO					<b>62</b>						
AUDIO (LINE_IN_L)										96	
AUDIO (LINE_IN_R)										97	
CALOSC_H			44			<b>59</b>					
CALOSC_L			43			<b>60</b>					
DAUGHTER_OTP	28		<b>40</b>								
DCOM		23 (...)		2 (...)				1 (...)	6 (...)	2 (...)	5 (...)
DPT_TRIG1			38								
DPT_TRIG2			39								
FLOPPY_DCHGL				<b>21</b>					58		
FLOPPY_DIRCL				15					<b>50</b>		
FLOPPY_DS1L				23					<b>52</b>		
FLOPPY_DS3L				17					<b>53</b>		
FLOPPY_HSL				1					<b>51</b>		
FLOPPY_IDXL				<b>25</b>					57		

**Table 2-2            A21 Motherboard Mnemonic Locations**

Mnemonic	A21 Motherboard Connector										
	J2	J5	J6	J7	J8/J13 J14/J15	J9	J10	J11	J12	J16	J17
FLOPPY_MID				18					46		
FLOPPY_RDDL				3					54		
FLOPPY_READY				19					59		
FLOPPY_STEPL				13					49		
FLOPPY_TR00L				7					56		
FLOPPY_WDL				11					48		
FLOPPY_WEL				9					47		
FLOPPY_WPL				5					55		
FP_A0								52		53	
FP_A1								53		54	
FP_A2								54		55	
FP_A3								55		56	
FP_BLUE0								80		81	
FP_BLUE1								81		82	
FP_BLUE2								82		83	
FP_BLUE3								83		84	
FP_CBLANKL								69		70	
FP_CLK								65		66	
FP_CSL								67		68	
FP_D0								56		57	
FP_D1								57		58	
FP_D2								58		59	
FP_D3								59		60	
FP_D4								60		61	
FP_D5								61		62	
FP_D6								62		63	
FP_D7								63		64	
FP_DOTCLK								68		69	
FP_GREEN0								76		77	
FP_GREEN1								77		78	
FP_GREEN2								78		79	

**Table 2-2 A21 Motherboard Mnemonic Locations**

Mnemonic	A21 Motherboard Connector										
	J2	J5	J6	J7	J8/J13 J14/J15	J9	J10	J11	J12	J16	J17
FP_GREEN3								79		80	
FP_HSYNCL								70		71	
FP_INTRL								51		52	
FP_P12									7, 9 11		
FP_P15SBY	19							94			
FP_P5.2	17							91, 92 93			
FP_PS2_KBCLK										90	
FP_PS2_KBDATA										91	
FP_PS2_MSCLK										88	
FP_PS2_MSDATA										89	
FP_PWR_RST_L								66		67	
FP_RED0								72		73	
FP_RED1								73		74	
FP_RED2								74		75	
FP_RED3								75		76	
FP_VSYNCL								71		72	
FP_W_RL								64		65	
GATE_ARM						27	27				
GATE_TRIG						29	29				
GPIB_TRIG						65				87	
HPUP			35		72	72	72				
LADDR			28		79	79	79				
LCNTRL			32		75	75	75				
LDATA			30		77	77	77				
LINE_OUT_COM								98		45	
LINE_OUT_L								99		94	
LINE_OUT_R								97		95	
LINE_TRIG		40				67					
LO_LOCK			41				66				
LSRQ			34		73	73	73				

**Table 2-2 A21 Motherboard Mnemonic Locations**

Mnemonic	A21 Motherboard Connector										
	J2	J5	J6	J7	J8/J13 J14/J15	J9	J10	J11	J12	J16	J17
MIS0			33		74	74	74				
MOSI			31		76	76	76				
N12											1, 2 51, 52
N15	36	12, 13 52, 53	21, 22 71, 72		35, 36 85, 86	35, 36 85, 86	35, 36 85, 86				
N5.2		9, 10 49, 50	16 (...)		39, 40 89, 90	39, 40 89, 90	39, 40 89, 90				
N6	20		20								
OPT_TRIG1					69	69	69				
OPT_TRIG2					68	68	68				
P12											3, 4 53, 54
P15	24, 25 26, 34	3, 4 43, 44	8 (...)		46, 47 96, 97	46, 47 96, 97	46, 47 96, 97				
P15SBY	40	80	2, 3 52, 53								
P32		1, 41	5, 6 55, 56		49, 99	49, 99	49, 99				
P5.2	38	15 (...)	24 (...)		32, 33 82, 83	32, 33 82, 83	32, 33 82, 83				
P5.2 (ID0)					27						
P5.2 (ID1)					29						
P9		6, 7 46, 47	12 (...)		42, 43 92, 93	42, 43 92, 93	42, 43 92, 93				
PCMCIA_AD0									68		
PCMCIA_AD1									69		
PCMCIA_AD2									70		
PCMCIA_CLK7									62		
PCMCIA_CS1L									63		
PCMCIA_CS2L									64		
PCMCIA_D0									71		
PCMCIA_D1									72		
PCMCIA_D2									73		
PCMCIA_D3									74		

**Table 2-2 A21 Motherboard Mnemonic Locations**

Mnemonic	A21 Motherboard Connector										
	J2	J5	J6	J7	J8/J13 J14/J15	J9	J10	J11	J12	J16	J17
PCMCIA_D4									75		
PCMCIA_D5									76		
PCMCIA_D6									77		
PCMCIA_D7									78		
PCMCIA_INTRL									66		
PCMCIA_LTCHENL									67		
PCMCIA_OEL									61		
PCMCIA_RSTL									65		
PCMCIA_WEL									60		
POWFAILL	31									85	
PROBE_N12.6	15							88 89 90			
PROBE_P15	13							85 86 87			
PS_FREQ		39				52					
PS_OFF_L	30	79									
RANGE						62	62				
REMOTE_ON_L	32									86	
SCLK			29		78	78	78				
SR_H						55	55				
SR_L						54	54				
SWEEP_ARM						23	23				
SWEEP_TRIG						25	25				
SW_IN_L	29										
TRIG1			36		71	71	71				
TRIG2			37		70	70	70				
VCC		21 (...)		22 24 26				19 (...)	21 (...)	3 (...)	55 (...)
VDL		28 (...)						3, 7 11, 15	13, 15 17, 19		56 (...)
VFAN+	21, 22 23										
VFAN-	1, 2, 3										

**Table 2-3 A15 Daughterboard Mnemonic Locations**

Mnemonic	A15 Daughterboard Connector										
	J11/ J41	J12	J13	J21	J22/ J32	J23/ J33	J31	J42	J43	J51/ J53	J52
10MHZ_AIF							19				
10MHZ_CPU							15				
10MHZ_EXT_IN							13				
10MHZ_EXT_OUT							2				
10MHZ_OPT							17				
10MHZ_RF				16			6				
10MHZ_SYNTN							8		15		
50MHZ						13					
300MHZ						18					
ABUS								9			
ACOM	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)	1 (...)
CALOSC_H				18							
CALOSC_L				19							
CLEAN_CK		24									
CLEAN_DATA		11									
CLEAN_EN		25									
MIDGEN_CLEAN	10										
N15		2, 17			2, 17			2, 17			2, 17
N5.2		4, 19			4, 19			4, 19			4, 19
N6		3, 18			3, 18			3, 18			3, 18
P15		6, 21			6, 21			6, 21			6, 21
P15SBY					22 (J32)						
P32		7			7			7			7
P5.2		14, 29			14, 29			14, 29			14, 29
P9		5, 20			5, 20			5, 20			5, 20
PRE_LEVEL_ DRIVE				2					17		
REF_CK					24 (J32)						
REF_DATA					11 (J32)						

**Table 2-3 A15 Daughterboard Mnemonic Locations**

Mnemonic	A15 Daughterboard Connector										
	J11/ J41	J12	J13	J21	J22/ J32	J23/ J33	J31	J42	J43	J51/ J53	J52
REF_EN					25 (J32)						
RF_CK					24 (J22)						
RF_DATA					11 (J22)						
RF_EN					25 (J22)						
SYNTH_CK								24			
SYNTH_DATA								11			
SYNTH_EN								25			

## Motherboard Connectors

**Table 2-4**      **A21J1/J3/J4 Fan Connectors**

Pin	Signal
1	NC
2	VFAN -
3	VFAN +

**Table 2-5**      **A21J2 Fan Control Connector**

Pin	Signal	Pin	Signal
1	VFAN -	21	VFAN +
2	VFAN -	22	VFAN +
3	VFAN -	23	VFAN +
4	ACOM	24	P15
5	ACOM	25	P15
6	ACOM	26	P15
7	ACOM	27	NC
8	ACOM	28	DAUGHTER_OTP
9	ACOM	29	SW_IN_L
10	ACOM	30	PS_OFF_L
11	ACOM	31	POWFAILL
12	ACOM	32	REMOTE_ON_L
13	PROBE_P15	33	ACOM
14	ACOM	34	P15
15	PROBE_N12.6	35	ACOM
16	ACOM	36	N15
17	FP_P5.2	37	ACOM
18	ACOM	38	P5.2
19	FP_P15SBY	39	ACOM
20	N6	40	P15SBY

**Table 2-6 A21J5 Power Supply Connector**

Pin	Signal	Pin	Signal
1	P32	41	P32
2	ACOM	42	ACOM
3	P15	43	P15
4	P15	44	P15
5	ACOM	45	ACOM
6	P9	46	P9
7	P9	47	P9
8	ACOM	48	ACOM
9	N5.2	49	N5.2
10	N5.2	50	N5.2
11	ACOM	51	ACOM
12	N15	52	N15
13	N15	53	N15
14	ACOM	54	ACOM
15	P5.2	55	P5.2
16	P5.2	56	P5.2
17	ACOM	57	ACOM
18	P5.2	58	P5.2
19	P5.2	59	P5.2
20	ACOM	60	ACOM
21	VCC	61	VCC
22	VCC	62	VCC
23	DCOM	63	DCOM
24	DCOM	64	DCOM
25	VCC	65	VCC
26	DCOM	66	DCOM
27	DCOM	67	DCOM
28	VDL	68	VDL
29	VDL	69	VDL
30	DCOM	70	DCOM
31	DCOM	71	DCOM
32	VDL	72	VDL
33	DCOM	73	DCOM
34	DCOM	74	DCOM
35	VDL	75	VDL
36	VDL	76	VDL
37	DCOM	77	DCOM
38	ACOM	78	ACOM
39	PS_FREQ	79	PS_OFF_L
40	LINE_TRIG	80	P15SBY

**Table 2-7 A21J6 Daughter Board Connector**

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	P15SBY	52	P15SBY
3	P15SBY	53	P15SBY
4	ACOM	54	ACOM
5	P32	55	P32
6	P32	56	P32
7	ACOM	57	ACOM
8	P15	58	P15
9	P15	59	P15
10	P15	60	P15
11	ACOM	61	ACOM
12	P9	62	P9
13	P9	63	P9
14	P9	64	P9
15	ACOM	65	ACOM
16	N5.2	66	N5.2
17	N5.2	67	N5.2
18	N5.2	68	N5.2
19	ACOM	69	ACOM
20	N6	70	N15
21	N15	71	N15
22	N15	72	N15
23	ACOM	73	ACOM
24	P5.2	74	P5.2
25	P5.2	75	P5.2
26	P5.2	76	P5.2
27	ACOM	77	ACOM
28	LADDR	78	ACOM
29	SCLK	79	ACOM
30	LDATA	80	ACOM
31	MOSI	81	ACOM
32	LCNTRL	82	ACOM
33	MISO	83	ACOM
34	LSRQ	84	ACOM
35	HPUP	85	ACOM
36	TRIG1	86	ACOM
37	TRIG2	87	ACOM
38	DPT_TRIG1	88	ACOM
39	DPT_TRIG2	89	ACOM
40	DAUGHTER_OTP	90	ACOM
41	LO_LOCK	91	ACOM
42	ACOM	92	ACOM
43	CALOSC_L	93	ACOM
44	CALOSC_H	94	ACOM
45	ACOM	95	ACOM
46	10MHZ_AIF	96	ACOM
47	ACOM	97	ACOM
48	10MHZ_OPT	98	ACOM
49	ACOM	99	ACOM
50	10MHZ_CPU	100	ACOM

**Table 2-8 A21J7 Floppy FFC Cable Connector**

Pin	Signal	Pin	Signal
1	FLOPPY_HSL	14	NC
2	DCOM	15	FLOPPY_DIRCL
3	FLOPPY_RDDL	16	NC
4	DCOM	17	FLOPPY_DS3L
5	FLOPPY_WPL	18	FLOPPY_MID
6	DCOM	19	FLOPPY_READY
7	FLOPPY_TR00L	20	NC
8	DCOM	21	FLOPPY_DCHGL
9	FLOPPY_WEL	22	VCC
10	DCOM	23	FLOPPY_DS1L
11	FLOPPY_WDL	24	VCC
12	DCOM	25	FLOPPY_IDXL
13	FLOPPY_STEPL	26	VCC

**Table 2-9 A21J8/J13/J14/J15 Option Connector**

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	ACOM	52	10MHZ_OPT
3	ACOM	53	ACOM
4	ACOM	54	NC
5	ACOM	55	NC
6	ACOM	56	ACOM
7	ACOM	57	NC
8	ACOM	58	ACOM
9	ACOM	59	ACOM
10	ACOM	60	ACOM
11	ACOM	61	ACOM
12	ACOM	62	AUDIO
13	ACOM	63	ACOM
14	ACOM	64	ACOM
15	ACOM	65	NC
16	ACOM	66	NC
17	ACOM	67	NC
18	ACOM	68	OPT_TRIG2
19	ACOM	69	OPT_TRIG1
20	ACOM	70	TRIG2
21	ACOM	71	TRIG1
22	ACOM	72	HPUP
23	ACOM	73	LSRQ
24	ACOM	74	MIS0
25	ACOM	75	LCNTRL
26	ACOM	76	MOSI
27	P5.2 (ID0)	77	LDATA
28	ACOM	78	SCLK
29	P5.2 (ID1)	79	LADDR
30	ACOM	80	ACOM
31	ACOM	81	ACOM
32	P5.2	82	P5.2
33	P5.2	83	P5.2
34	ACOM	84	ACOM
35	N15	85	N15
36	N15	86	N15
37	ACOM	87	ACOM
38	ACOM	88	ACOM
39	N5.2	89	N5.2
40	N5.2	90	N5.2
41	ACOM	91	ACOM
42	P9	92	P9
43	P9	93	P9
44	ACOM	94	ACOM
45	ACOM	95	ACOM
46	P15	96	P15
47	P15	97	P15
48	ACOM	98	ACOM
49	P32	99	P32
50	ACOM	100	ACOM

Table 2-10

**A21J9 Analog IF Connector**

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	ACOM	52	PS_FREQ
3	ACOM	53	ACOM
4	ACOM	54	SR_L
5	ACOM	55	SR_H
6	ACOM	56	ACOM
7	ACOM	57	10MHZ_AIF
8	ACOM	58	ACOM
9	ACOM	59	CALOSC_H
10	ACOM	60	CALOSC_L
11	ACOM	61	ACOM
12	ACOM	62	RANGE
13	ACOM	63	ACOM
14	ACOM	64	ACOM
15	ACOM	65	GPIB_TRIG
16	ACOM	66	NC
17	ACOM	67	LINE_TRIG
18	ACOM	68	OPT_TRIG2
19	ACOM	69	OPT_TRIG1
20	ACOM	70	TRIG2
21	ACOM	71	TRIG1
22	ACOM	72	HPUP
23	SWEEP_ARM	73	LSRQ
24	ACOM	74	MISO
25	SWEEP_TRIG	75	LCNTRL
26	ACOM	76	MOSI
27	GATE_ARM	77	LDATA
28	ACOM	78	SCLK
29	GATE_TRIG	79	LADDR
30	ACOM	80	ACOM
31	ACOM	81	ACOM
32	P5.2	82	P5.2
33	P5.2	83	P5.2
34	ACOM	84	ACOM
35	N15	85	N15
36	N15	86	N15
37	ACOM	87	ACOM
38	ACOM	88	ACOM
39	N5.2	89	N5.2
40	N5.2	90	N5.2
41	ACOM	91	ACOM
42	P9	92	P9
43	P9	93	P9
44	ACOM	94	ACOM
45	ACOM	95	ACOM
46	P15	96	P15
47	P15	97	P15
48	ACOM	98	ACOM
49	P32	99	P32
50	ACOM	100	ACOM

**Table 2-11 A21J10 Digital IF Connector**

Pin	Signal	Pin	Signal
1	ACOM	51	ACOM
2	ACOM	52	ACOM
3	ACOM	53	ACOM
4	ACOM	54	SR_L
5	ACOM	55	SR_H
6	ACOM	56	ACOM
7	ACOM	57	NC
8	ACOM	58	ACOM
9	ACOM	59	ACOM
10	ACOM	60	ACOM
11	ACOM	61	ACOM
12	ACOM	62	RANGE
13	ACOM	63	ACOM
14	ACOM	64	ACOM
15	ACOM	65	NC
16	ACOM	66	LO_LOCK
17	ACOM	67	NC
18	ACOM	68	OPT_TRIG2
19	ACOM	69	OPT_TRIG1
20	ACOM	70	TRIG2
21	ACOM	71	TRIG1
22	ACOM	72	HPUP
23	SWEEP_ARM	73	LSRQ
24	ACOM	74	MISO
25	SWEEP_TRIG	75	LCNTRL
26	ACOM	76	MOSI
27	GATE_ARM	77	LDATA
28	ACOM	78	SCLK
29	GATE_TRIG	79	LADDR
30	ACOM	80	ACOM
31	ACOM	81	ACOM
32	P5.2	82	P5.2
33	P5.2	83	P5.2
34	ACOM	84	ACOM
35	N15	85	N15
36	N15	86	N15
37	ACOM	87	ACOM
38	ACOM	88	ACOM
39	N5.2	89	N5.2
40	N5.2	90	N5.2
41	ACOM	91	ACOM
42	P9	92	P9
43	P9	93	P9
44	ACOM	94	ACOM
45	ACOM	95	ACOM
46	P15	96	P15
47	P15	97	P15
48	ACOM	98	ACOM
49	P32	99	P32
50	ACOM	100	ACOM

Table 2-12

**A21J11 Front Panel Ribbon Cable Connector**

Pin	Signal	Pin	Signal
1	DCOM	51	FP_INTRL
2	DCOM	52	FP_A0
3	VDL	53	FP_A1
4	DCOM	54	FP_A2
5	DCOM	55	FP_A3
6	DCOM	56	FP_D0
7	VDL	57	FP_D1
8	DCOM	58	FP_D2
9	DCOM	59	FP_D3
10	DCOM	60	FP_D4
11	VDL	61	FP_D5
12	DCOM	62	FP_D6
13	DCOM	63	FP_D7
14	DCOM	64	FP_W_RL
15	VDL	65	FP_CLK
16	DCOM	66	FP_PWR_RST_L
17	DCOM	67	FP_CSL
18	DCOM	68	FP_DOTCLK
19	VCC	69	FP_CBLANKL
20	DCOM	70	FP_HSYNCL
21	DCOM	71	FP_VSYNCL
22	DCOM	72	FP_RED0
23	VCC	73	FP_RED1
24	DCOM	74	FP_RED2
25	DCOM	75	FP_RED3
26	DCOM	76	FP_GREEN0
27	VCC	77	FP_GREEN1
28	DCOM	78	FP_GREEN2
29	DCOM	79	FP_GREEN3
30	DCOM	80	FP_BLUE0
31	VCC	81	FP_BLUE1
32	DCOM	82	FP_BLUE2
33	DCOM	83	FP_BLUE3
34	DCOM	84	ACOM
35	ACOM	85	PROBE_P15
36	ACOM	86	PROBE_P15
37	ACOM	87	PROBE_P15
38	ACOM	88	PROBE_N12.6
39	ACOM	89	PROBE_N12.6
40	ACOM	90	PROBE_N12.6
41	ACOM	91	FP_P5.2
42	ACOM	92	FP_P5.2
43	ACOM	93	FP_P5.2
44	ACOM	94	FP_P15SBY
45	ACOM	95	NC
46	ACOM	96	ACOM
47	ACOM	97	LINE_OUT_R
48	ACOM	98	LINE_OUT_COM
49	ACOM	99	LINE_OUT_L
50	ACOM	100	ACOM

**Table 2-13 A21J12 CPU - PCMCIA/Floppy Connector**

Pin	Signal	Pin	Signal
1	ACOM	41	NC
2	NC	42	NC
3	NC	43	NC
4	NC	44	NC
5	NC	45	ACOM
6	DCOM	46	FLOPPY_MID
7	FP_P12	47	FLOPPY_WEL
8	DCOM	48	FLOPPY_WDL
9	FP_P12	49	FLOPPY_STEPL
10	DCOM	50	FLOPPY_DIRCL
11	FP_P12	51	FLOPPY_HSL
12	DCOM	52	FLOPPY_DS1L
13	VDL	53	FLOPPY_DS3L
14	DCOM	54	FLOPPY_RDDL
15	VDL	55	FLOPPY_WPL
16	DCOM	56	FLOPPY_TR00L
17	VDL	57	FLOPPY_IDXL
18	DCOM	58	FLOPPY_DCHGL
19	VDL	59	FLOPPY_READY
20	DCOM	60	PCMCIA_WEL
21	VCC	61	PCMCIA_OEL
22	DCOM	62	PCMCIA_CLK7
23	VCC	63	PCMCIA_CS1L
24	DCOM	64	PCMCIA_CS2L
25	VCC	65	PCMCIA_RSTL
26	DCOM	66	PCMCIA_INTRL
27	VCC	67	PCMCIA_LTCHENL
28	DCOM	68	PCMCIA_AD0
29	VCC	69	PCMCIA_AD1
30	DCOM	70	PCMCIA_AD2
31	VCC	71	PCMCIA_D0
32	DCOM	72	PCMCIA_D1
33	VCC	73	PCMCIA_D2
34	DCOM	74	PCMCIA_D3
35	VCC	75	PCMCIA_D4
36	DCOM	76	PCMCIA_D5
37	VCC	77	PCMCIA_D6
38	DCOM	78	PCMCIA_D7
39	NC	79	NC
40	NC	80	NC

Table 2-14

**A21J16 CPU - Front Panel Connector**

Pin	Signal	Pin	Signal
1	ACOM	51	10MHZ_CPU
2	DCOM	52	FP_INTRL
3	VCC	53	FP_A0
4	DCOM	54	FP_A1
5	VCC	55	FP_A2
6	DCOM	56	FP_A3
7	VCC	57	FP_D0
8	DCOM	58	FP_D1
9	VCC	59	FP_D2
10	DCOM	60	FP_D3
11	VCC	61	FP_D4
12	DCOM	62	FP_D5
13	VCC	63	FP_D6
14	DCOM	64	FP_D7
15	VCC	65	FP_W_RL
16	DCOM	66	FP_CLK
17	VCC	67	FP_PWR_RST_L
18	DCOM	68	FP_CSL
19	VCC	69	FP_DOTCLK
20	DCOM	70	FP_CBLANKL
21	VCC	71	FP_HSYNCL
22	DCOM	72	FP_VSYNCL
23	VCC	73	FP_RED0
24	DCOM	74	FP_RED1
25	VCC	75	FP_RED2
26	DCOM	76	FP_RED3
27	VCC	77	FP_GREEN0
28	DCOM	78	FP_GREEN1
29	VCC	79	FP_GREEN2
30	DCOM	80	FP_GREEN3
31	VCC	81	FP_BLUE0
32	DCOM	82	FP_BLUE1
33	VCC	83	FP_BLUE2
34	DCOM	84	FP_BLUE3
35	ACOM	85	POWFAILL
36	ACOM	86	REMOTE_ON_L
37	ACOM	87	GPIB_TRIG
38	ACOM	88	FP_PS2_MSCLK
39	ACOM	89	FP_PS2_MSDATA
40	ACOM	90	FP_PS2_KBCLK
41	ACOM	91	FP_PS2_KBDATA
42	ACOM	92	(AUDIO_SPKR+) NC
43	ACOM	93	(AUDIO_SPKR-) NC
44	ACOM	94	LINE_OUT_L
45	LINE_OUT_COM	95	LINE_OUT_R
46	ACOM	96	(LINE_IN_L) AUDIO
47	ACOM	97	(LINE_IN_R) AUDIO
48	ACOM	98	NC
49	ACOM	99	NC
50	ACOM	100	ACOM

**Table 2-15 A21J17 CPU - Power Supply Connector**

Pin	Signal	Pin	Signal
1	N12	51	N12
2	N12	52	N12
3	P12	53	P12
4	P12	54	P12
5	DCOM	55	VCC
6	DCOM	56	VDL
7	DCOM	57	VDL
8	DCOM	58	VDL
9	DCOM	59	VCC
10	DCOM	60	VDL
11	DCOM	61	VDL
12	DCOM	62	VDL
13	DCOM	63	VCC
14	DCOM	64	VDL
15	DCOM	65	VDL
16	DCOM	66	VDL
17	DCOM	67	VCC
18	DCOM	68	VDL
19	DCOM	69	VDL
20	DCOM	70	VDL
21	DCOM	71	VCC
22	DCOM	72	VDL
23	DCOM	73	VDL
24	DCOM	74	VDL
25	DCOM	75	VCC
26	DCOM	76	VDL
27	DCOM	77	VDL
28	DCOM	78	VDL
29	DCOM	79	VCC
30	DCOM	80	VDL
31	DCOM	81	VDL
32	DCOM	82	VDL
33	DCOM	83	VCC
34	DCOM	84	VDL
35	DCOM	85	VDL
36	DCOM	86	VDL
37	DCOM	87	VCC
38	DCOM	88	VDL
39	DCOM	89	VDL
40	DCOM	90	VDL
41	DCOM	91	VCC
42	DCOM	92	VDL
43	DCOM	93	VDL
44	DCOM	94	VDL
45	DCOM	95	VCC
46	DCOM	96	VDL
47	DCOM	97	VDL
48	DCOM	98	VDL
49	ACOM	99	ACOM
50	ACOM	100	ACOM

## Daughterboard Connectors

### RF Assembly Connectors

**Table 2-16**

**A15J21**

Pin	Signal	Pin	Signal
1	ACOM	11	ACOM
2	PRE_LEVEL_DRIVE	12	ACOM
3	ACOM	13	ACOM
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	10MHZ_RF
7	ACOM	17	ACOM
8	ACOM	18	CALOSC_H
9	ACOM	19	CALOSC_L
10	ACOM	20	ACOM

**Table 2-17**

**A15J22**

Pin	Signal	Pin	Signal
1	ACOM	16	ACOM
2	N15	17	N15
3	N6	18	N6
4	N5.2	19	N5.2
5	P9	20	P9
6	P15	21	P15
7	P32	22	ACOM
8	ACOM	23	ACOM
9	ACOM	24	RF_CK
10	ACOM	25	RF_EN
11	RF_DATA	26	ACOM
12	ACOM	27	ACOM
13	ACOM	28	ACOM
14	P5.2	29	P5.2
15	ACOM	30	ACOM

**Table 2-18**      **A15J23**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	50MHZ
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	ACOM
7	ACOM	17	ACOM
8	ACOM	18	300MHZ
9	ACOM	19	ACOM
10	ACOM	20	ACOM

**Reference Assembly Connectors**

**Table 2-19**

**A15J31**

Pin	Signal	Pin	Signal
1	ACOM	11	ACOM
2	10MHZ_EXT_OUT	12	ACOM
3	ACOM	13	10MHZ_EXT_IN
4	ACOM	14	ACOM
5	ACOM	15	10MHZ_CPU
6	10MHZ_RF	16	ACOM
7	ACOM	17	10MHZ_OPT
8	10MHZ_SYNT	18	ACOM
9	ACOM	19	10MHZ_AIF
10	ACOM	20	ACOM

**Table 2-20**

**A15J32**

Pin	Signal	Pin	Signal
1	ACOM	16	ACOM
2	N15	17	N15
3	N6	18	N6
4	N5.2	19	N5.2
5	P9	20	P9
6	P15	21	P15
7	P32	22	P15SBY
8	ACOM	23	ACOM
9	ACOM	24	REF_CK
10	ACOM	25	REF_EN
11	REF_DATA	26	ACOM
12	ACOM	27	ACOM
13	ACOM	28	ACOM
14	P5.2	29	P5.2
15	ACOM	30	ACOM

**Table 2-21 A15J33**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	50MHZ
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	ACOM
7	ACOM	17	ACOM
8	ACOM	18	300MHZ
9	ACOM	19	ACOM
10	ACOM	20	ACOM

### Synthesizer Assembly Connectors

**Table 2-22**

**A15J41**

Pin	Signal	Pin	Signal
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	ACOM
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	ACOM
7	ACOM	17	ACOM
8	ACOM	18	ACOM
9	ACOM	19	ACOM
10	MIDGEN_CLEAN	20	ACOM

**Table 2-23**

**A15J42**

Pin	Signal	Pin	Signal
1	ACOM	16	ACOM
2	N15	17	N15
3	N6	18	N6
4	N5.2	19	N5.2
5	P9	20	P9
6	P15	21	P15
7	P32	22	ACOM
8	ACOM	23	ACOM
9	ABUS	24	SYNTH_CK
10	ACOM	25	SYNTH_EN
11	SYNTH_DATA	26	ACOM
12	ACOM	27	ACOM
13	ACOM	28	ACOM
14	P5.2	29	P5.2
15	ACOM	30	ACOM

**Table 2-24**      **A15J43**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	ACOM
4	ACOM	14	ACOM
5	ACOM	15	10MHZ_SYNTH
6	ACOM	16	ACOM
7	ACOM	17	PRE_LEVEL_DRIVE
8	ACOM	18	ACOM
9	ACOM	19	ACOM
10	ACOM	20	ACOM

**Unused Connectors**

**Table 2-25**

**A15J11**

Pin	Signal	Pin	Signal
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	ACOM
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	ACOM
7	ACOM	17	ACOM
8	ACOM	18	ACOM
9	ACOM	19	ACOM
10	MIDGEN_CLEAN	20	ACOM

**Table 2-26**

**A15J12**

Pin	Signal	Pin	Signal
1	ACOM	16	ACOM
2	N15	17	N15
3	N6	18	N6
4	N5.2	19	N5.2
5	P9	20	P9
6	P15	21	P15
7	P32	22	ACOM
8	ACOM	23	ACOM
9	ACOM	24	CLEAN_CK
10	ACOM	25	CLEAN_EN
11	CLEAN_DATA	26	ACOM
12	ACOM	27	ACOM
13	ACOM	28	ACOM
14	P5.2	29	P5.2
15	ACOM	30	ACOM

**Table 2-27**      **A15J13**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	ACOM
4	ACOM	14	ACOM
5	ACOM	15	ACOM
6	ACOM	16	ACOM
7	ACOM	17	ACOM
8	ACOM	18	ACOM
9	ACOM	19	ACOM
10	ACOM	20	ACOM

**Table 2-28**      **A15J51**

<b>Pin</b>	<b>Signal</b>	<b>Pin</b>	<b>Signal</b>
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	NC
4	ACOM	14	ACOM
5	ACOM	15	NC
6	ACOM	16	ACOM
7	ACOM	17	NC
8	ACOM	18	ACOM
9	ACOM	19	NC
10	ACOM	20	ACOM

**Table 2-29**

**A15J52**

Pin	Signal	Pin	Signal
1	ACOM	16	ACOM
2	N15	17	N15
3	N6	18	N6
4	N5.2	19	N5.2
5	P9	20	P9
6	P15	21	P15
7	P32	22	ACOM
8	ACOM	23	ACOM
9	ACOM	24	NC
10	ACOM	25	NC
11	NC	26	ACOM
12	ACOM	27	ACOM
13	ACOM	28	ACOM
14	P5.2	29	P5.2
15	ACOM	30	ACOM

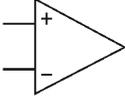
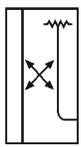
**Table 2-30**

**A15J53**

Pin	Signal	Pin	Signal
1	ACOM	11	ACOM
2	ACOM	12	ACOM
3	ACOM	13	NC
4	ACOM	14	ACOM
5	ACOM	15	NC
6	ACOM	16	ACOM
7	ACOM	17	NC
8	ACOM	18	ACOM
9	ACOM	19	NC
10	ACOM	20	ACOM

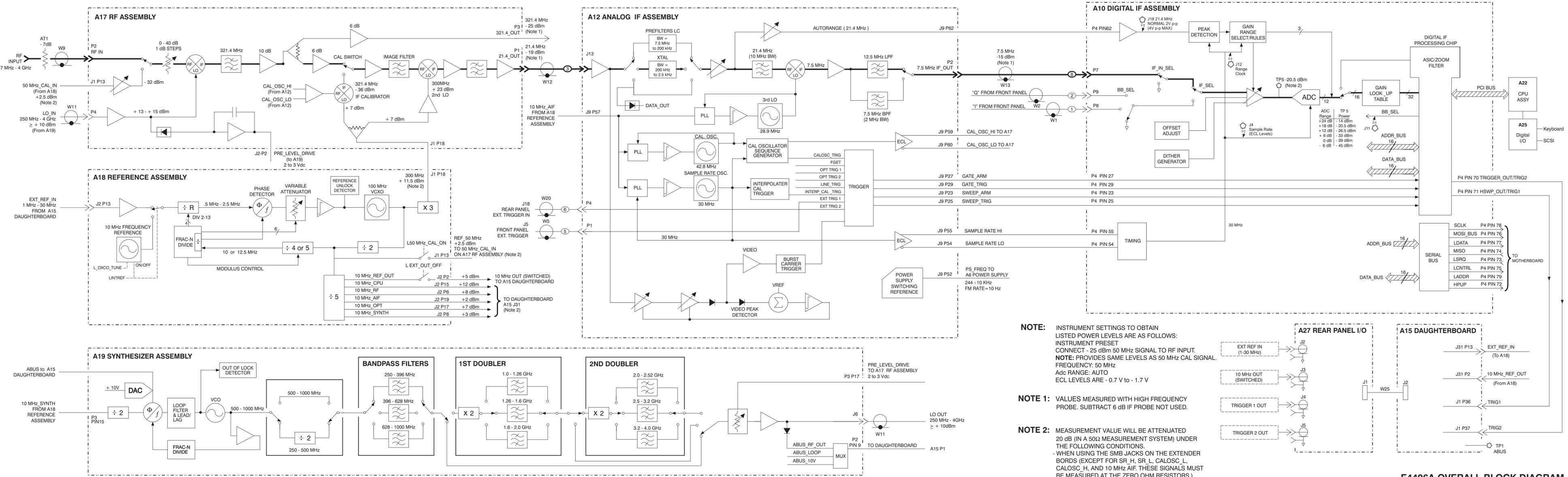
## Block Diagrams

### Graphic Symbols Used On Block Diagrams

	Bus Line		Op Amplifier		Band Pass Filter
	Indicates a plug-in connection (F) to (M)		Summer		High Pass Filter
	Connection symbol indicating plug (movable)		Phase Frequency Detector		Low Pass Filter
	Connection symbol indicating jack (movable)		Mixer		Band Reject Filter
	Heavy line indicates path and direction of main signal		Oscillator or Generator		Common Return
	Color code for cable		Capacitor		Numbered Test Point. Measurement aid provided.
	Variable Gain Amplifier		Resistor		Lettered Test Point. No Measurement aid provided.
	Amplifier Buffer		Variable Resistor		Slide, Toggle, or Rocker, Switch
	Inverter Buffer		Switch Open		Grounded Coaxial Shielding
	Limiter		Diode		Analog Digital Convertor
	Variable Integrator		Digital Analog Convertor		Directional Coupler



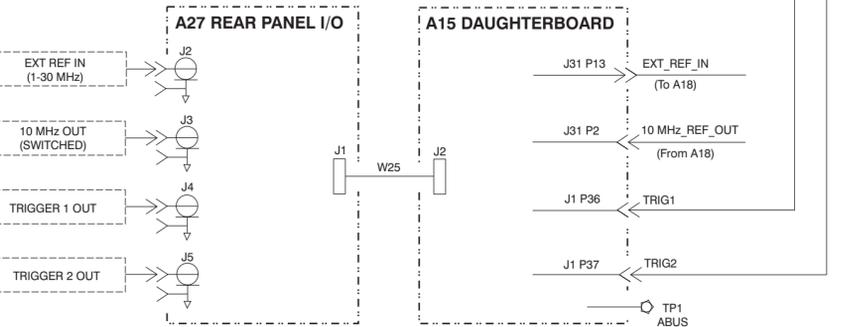
# E4406A OVERALL BLOCK DIAGRAM



**NOTE:** INSTRUMENT SETTINGS TO OBTAIN LISTED POWER LEVELS ARE AS FOLLOWS:  
 INSTRUMENT PRESET  
 CONNECT - 25 dBm 50 MHz SIGNAL TO RF INPUT.  
**NOTE:** PROVIDES SAME LEVELS AS 50 MHz CAL SIGNAL.  
 FREQUENCY: 50 MHz  
 Adc RANGE: AUTO  
 ECL LEVELS ARE - 0.7 V to - 1.7 V

**NOTE 1:** VALUES MEASURED WITH HIGH FREQUENCY PROBE. SUBTRACT 6 dB IF PROBE NOT USED.

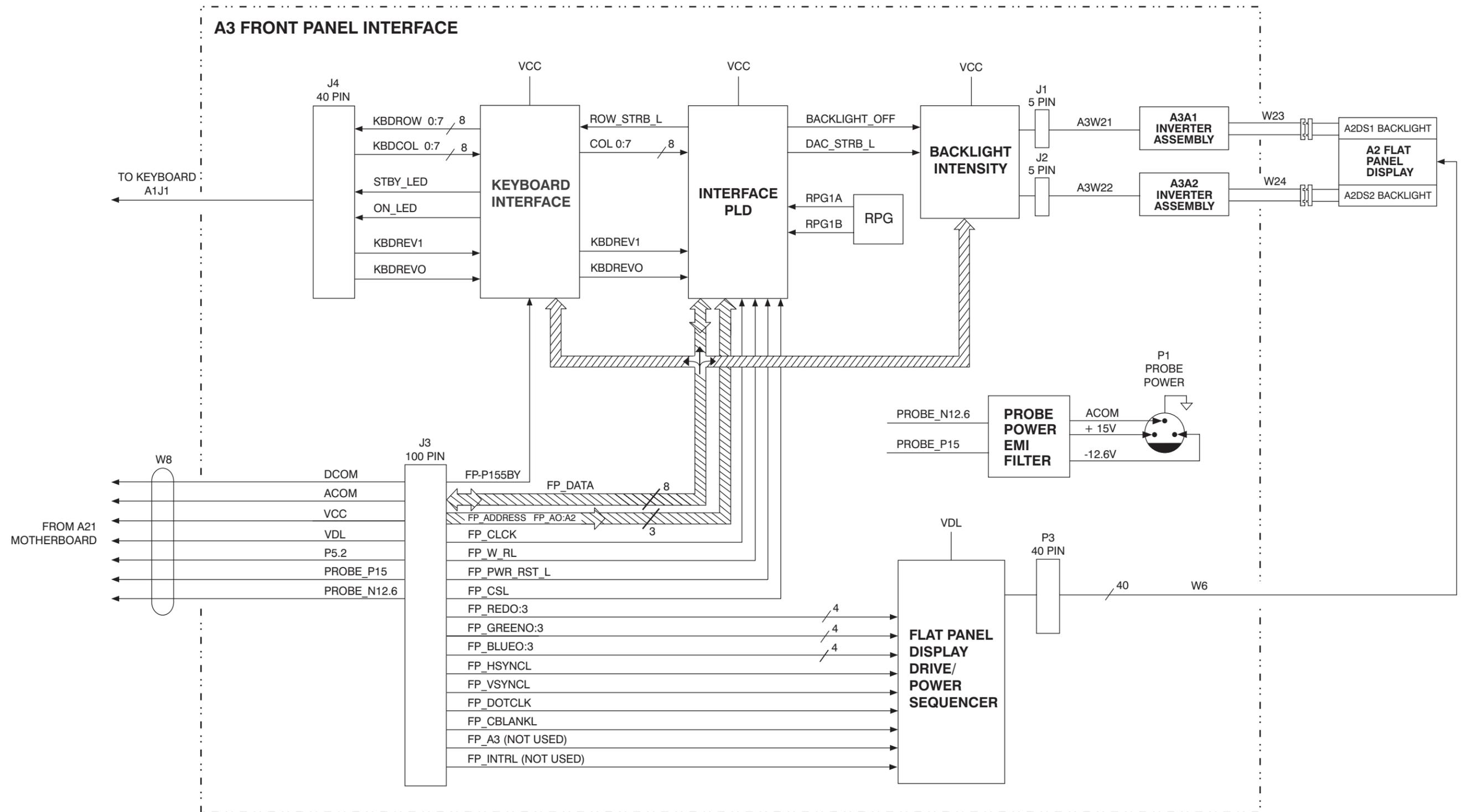
**NOTE 2:** MEASUREMENT VALUE WILL BE ATTENUATED 20 dB (IN A 50Ω MEASUREMENT SYSTEM) UNDER THE FOLLOWING CONDITIONS.  
 - WHEN USING THE SMB JACKS ON THE EXTENDER BORDS (EXCEPT FOR SR\_H, SR\_L, CALOSC\_L, CALOSC\_H, AND 10 MHz AIF. THESE SIGNALS MUST BE MEASURED AT THE ZERO OHM RESISTORS.)  
 - WHEN USING A10,TP5.



E4406A OVERALL BLOCK DIAGRAM



# E4406A FRONT PANEL INTERFACE BLOCK DIAGRAM



E4406A FRONT PANEL INTERFACE BLOCK DIAGRAM





## Introduction

This chapter contains information for identifying and ordering replacement assemblies.

Major assembly descriptions are located in [Chapter 2](#) .

Component level information containing material lists, schematics, and component location diagrams, is available separately. Refer to the end of this chapter for ordering information.

The following tables and figures are also included in this chapter:

- [Table 3-1](#) lists reference designator descriptions.
- [Table 3-2](#) lists abbreviations used in the parts list.
- [Table 3-3](#) lists value multipliers.
- [Table 3-4](#) lists replacement parts.

## How to Order Parts

To order an assembly or mechanical part listed in this chapter, quote the Agilent part number and indicate the quantity required.

To order a part that is *not* listed, include the following information with the order:

- instrument model number
- instrument serial number
- Description of where the part is located, what it looks like, and its function (if known).
- Quantity needed

Parts can be ordered by addressing the order to the nearest Agilent Technologies office. Customers within the USA can also use either the direct mail-order system, or the direct phone-order system described below. The direct phone-order system has a toll-free phone number available.

### Direct Mail-Order System

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

- Direct ordering and shipment from Agilent Technologies.
- No maximum or minimum on any mail order. (There is a minimum order amount for parts ordered through a local Agilent Technologies office when the orders require billing and invoicing.)
- Prepaid transportation. (There is a small handling charge for each order.)
- No invoices.

To provide these advantages, a check or money order must accompany each order. Mail-order forms and specific ordering information are available through your local Agilent Technologies office.

### Direct Phone-Order System

Within the USA, a phone order system is available for regular and hotline replacement parts service. A toll-free phone number is available, and Mastercard and Visa are accepted. Outside the USA, contact your local sales and service office or visit <http://agilent.com/find/assist>.

[Parts List](#)

[How to Order Parts](#)

### **Regular and Hotline Orders**

The toll-free phone number (800) 227-8164 is available Monday through Friday, 6 a.m. to 5 p.m. (Pacific time). Regular orders have a four-day delivery time. For after hours there is also a fax number available, (800) 329-4470.

**Table 3-1 Reference Designations**

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

**Table 3-2 Abbreviations**

<b>A</b>		<b>D</b>	
A	Across Flats, Acrylic, Air (Dry Method), Ampere	D	Deep, Depletion, Depth, Diameter, Direct Current
ADJ	Adjust, Adjustment	DA	Darlington
ANSI	American National Standards Institute (formerly USASI-ASA)	DAP-GL	Diallyl Phthalate Glass
ASSY	Assembly	DBL	Double
AWG	American Wire Gage	DCCR	Decoder
<b>B</b>		DEG	Degree
BCD	Binary Coded Decimal	D-HOLE	D-Shaped Hole
BD	Board, Bundle	DIA	Diameter
BE-CU	Beryllium Copper	DIP	Dual In-Line Package
BNC	Type of Connector	DIP-SLDR	Dip Solder
BRG	Bearing, Boring	D-MODE	Depletion Mode
BRS	Brass	DO	Package Type Designation
BSC	Basic	DP	Deep, Depth, Diametric Pitch, Dip
BTN	Button	DP3T	Double Pole Three Throw
<b>C</b>		DPDT	Double Pole Double Throw
C	Capacitance, Capacitor, Center Tapped, Cermet, Cold, Compression	DWL	Dowell
CCP	Carbon Composition Plastic	<b>E</b>	
CD	Cadmium, Card, Cord	E-R	E-Ring
CER	Ceramic	EXT	Extended, Extension, External, Extinguish
CHAM	Chamfer	<b>F</b>	
CHAR	Character, Characteristic, Charcoal	F	Fahrenheit, Farad, Female, Film
CMOS	Complementary Metal Oxide Semiconductor	F	(Resistor), Fixed, Flange, Frequency
CNDCT	Conducting, Conductive, Conductivity, Conductor	FC	Carbon Film/ Composition, Edge of Cutoff Frequency, Face
CONT	Contact, Continuous Control, Controller	FDTHRU	Feedthrough
CONV	Converter	FEM	Female
CPRSN	Compression	FIL-HD	Fillister Head
CUP-PT	Cup Point	FL	Flash, Flat, Fluid
CW	Clockwise, Continuous Wave	FLAT-PT	Flat Point
		FR	Front
		FREQ	Frequency
		FT	Current Gain Bandwidth Product (Transition Frequency), Feet, Foot
		FXD	Fixed

**Table 3-2 Abbreviations**

<b>G</b>		<b>M</b>	
GEN	General, Generator	M	Male, Maximum, Mega, Mil, Milli, Mode
GND	Ground	MA	Milliampere
GP	General Purpose, Group	MACH	Machined
<b>H</b>		MAX	Maximum
H	Henry, High	MC	Molded Carbon Composition
HDW	Hardware	MET	Metal, Metallized
HEX	Hexadecimal, Hexagon, Hexagonal	MHZ	Megahertz
HLCL	Helical	MINTR	Miniature
HP	High Pass	MIT	Miter
<b>I</b>		MLD	Mold, Molded
IC	Collector Current, Integrated Circuit	MM	Magnetized Material, Millimeter
ID	Identification, Inside Diameter	MOM	Momentary
IF	Forward Current, Intermediate Frequency	MTG	Mounting
IN	Inch	MTLC	Metallic
INCL	Including	MW	Milliwatt
INT	Integral, Intensity, Internal	<b>N</b>	
<b>J</b>		N	Nano, None
J-FET	Junction Field Effect Transistor	N-CHAN	N-Channel
JFET	Junction Field Effect Transistor	NH	Nanohenry
<b>K</b>		NM	Nanometer, Nonmetallic
K	Kelvin, Key, Kilo, Potassium	NO	Normally Open, Number
KNRLD	Knurled	NOM	Nominal
KVDC	Kilovolts Direct Current	NPN	Negative Positive Negative (Transistor)
<b>L</b>		NS	Nanosecond, Non-Shorting, Nose
LED	Light Emitting Diode	NUM	Numeric
LG	Length, Long	NYL	Nylon (Polyamide)
LIN	Linear, Linearity	<b>O</b>	
LK	Link, Lock	OA	Over-All
LKG	Leakage, Locking	OD	Outside Diameter
LUM	Luminous	OP AMP	Operational Amplifier
		OPT	Optical, Option, Optional

**Table 3-2 Abbreviations**

<b>P</b>		<b>S</b>	
PA	Picoampere, Power Amplifier	SAWR	Surface Acoustic Wave Resonator
PAN-HD	Pan Head	SEG	Segment
PAR	Parallel, Parity	SGL	Single
PB	Lead (Metal), Pushbutton	SI	Silicon, Square Inch
PC	Printed Circuit	SL	Slide, Slow
PCB	Printed Circuit Board	SLT	Slot, Slotted
P-CHAN	P-Channel	SMA	Subminiature, A Type (Threaded Connector)
PD	Pad, Power Dissipation	SMB	Subminiature, B Type (Slip-on Connector)
PF	Picofarad, Power Factor	SMC	Subminiature, C-Type (Threaded Connector)
PKG	Package	SPCG	Spacing
PLSTC	Plastic	SPDT	Single Pole Double Throw
PNL	Panel	SPST	Single Pole Single Throw
PNP	Positive Negative Positive (Transistor)	SQ	Square
POLYC	Polycarbonate	SST	Stainless Steel
POLYE	Polyester	STL	Steel
POT	Potentiometer	SUBMIN	Subminiature
POZI	Pozidriv Recess	SZ	Size
PREC	Precision		
PRP	Purple, Purpose	<b>T</b>	
PSTN	Piston	T	Teeth, Temperature, Thickness, Time, Timed, Tooth, Typical
PT	Part, Point, Pulse Time	TA	Ambient Temperature, Tantalum
PW	Pulse Width	TC	Temperature Coefficient
		THD	Thread, Threaded
<b>Q</b>		THK	Thick
Q	Figure of Merit	TO	Package Type Designation
		TPG	Tapping
<b>R</b>		TR-HD	Truss Head
R	Range, Red, Resistance, Resistor, Right, Ring	TRMR	Trimmer
REF	Reference	TRN	Turn, Turns
RES	Resistance, Resistor	TRSN	Torsion
RF	Radio Frequency		
RGD	Rigid		
RND	Round		
RR	Rear		
RVT	Rivet, Riveted		

**Table 3-2 Abbreviations**

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

**Table 3-3 Multipliers**

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

## Replaceable Parts

**Table 3-4 Assemblies**

Reference Designator	Description	Agilent Part Number
AT1	RF IN 7 dB Attenuator	0955-0807
A1	Keyboard (Does not include key pad)	E4406-60004
A2	Flat Panel Display (Includes back lights)	2090-0897 (Prefix US/MY44xx & above)
A2	Front Panel Display Retrofit Kit	E4406-60201 (Prefix US/MY4402 & below) Note: Instruments with Prefix US3948 & below must also order CPU assembly E4406-60060 and SCSI assembly E4406-60065
A2A1	Display Converter Board	E4440-63265
A3	Front Panel Interface Assembly (includes Inverter Boards and cables)	E4406-60007 (Prefix US3948 & below with CPU assembly E4406-60040 or E4406-60073)
A3	Front Panel Interface Assembly (includes Inverter Boards and cables)	E4406-63199 (Prefix US4004 & MY0000 & above or older instruments with CPU assembly E4406-60060)
A3A1, A3A2	Inverter Board (2 per instrument)	0950-3379
A4	Disk Drive	0950-2782
A5	Disk Drive Board	E4406-60014
A6	Power Supply Assembly	0950-2797
A6	Power Supply Exchange Assembly	E4406-69051
A7	Baseband I/Q Assembly	E4406-60158
A10	Digital IF Assembly (14-bit Digital IF Assembly)	E4440-60195
A12	Analog IF Assembly	E4440-60029
A14	Fan Control Board	E4406-60044

**Table 3-4 Assemblies**

Reference Designator	Description	Agilent Part Number
A15	Daughter Board	E4406-60022
A17	RF Assembly	E4406-60197
A17	RF Exchange Assembly	E4406-69197
A18	OCXO Reference Assembly	E4406-60008
A18	OCXO Reference Exchange Assembly	E4406-69008
A19	Synthesizer Assembly	E4406-60177
A21	Motherboard Assembly	E4406-60001
A22	CPU (Processor) Assembly (does not include A22A1 or A22A2)	E4406-60060 (Prefix US4004 & MY0000 & above or instruments retrofitted with CPU upgrade kit E4406-60238)
A22	CPU (Processor) Assembly Retrofit Kit (includes Front Panel Interface Assembly E4406-60064 and SCSI Board Assembly E4406-60065)	E4406-60238 (Prefix US3948 & below)
A22A1	128M DRAM Replacement Kit (includes replacement standoffs)	E4406-60053
A22A2	64 MB Flash Memory Replacement Kit (includes replacement standoffs)	E4406-60194
A22A3	GP-IB Capacitor Board	E4406-60061 (Prefix US3948 & below)
A22BT1	CPU Battery (Panasonic BR2325 Lithium Polycarbon Monofluoride 3V, 0.16 AH)	1420-0314
A25	SCSI Board with PS-2 keyboard connector	E4406-60065 (Prefix US4004 & MY0000 & above or instruments with CPU assembly E4406-60060)
A25	SCSI Board with PS-2 keyboard connector	E4406-60050 (Prefix US3948 & below)
A26	Display Shield Board (includes gaskets)	E4406-60052
A27	Rear Panel I/O Board	E4406-60135
B1, B2, B3	Fan Replacement Kit (includes 3 fans and EMI Fan Shields)	E4406-60159

**Table 3-5 Mechanical Parts**

<b>Description</b>	<b>Agilent Part Number</b>
Display EMI Filter	1000-1001
Display Mount	E4406-40004 (Prefix US/MY4402 & below)
Display Mount	E4406-40013 (Prefix US/MY46xx & above)
Display Protector Pressure Plate	E4406-00037 (Prefix US/MY46xx & above)
Shield Front	E4406-00002
Display Bezel Assembly	E4406-60046
Dress Panel Assembly	E4406-60047
Instrument Label	E4406-80009
RPG Knob	0370-3229
Keypad	E4406-40010
Line Key (push rod)	E4406-40005
RF Input Bracket	E4406-20110
RF Input Connector, Type N (f) to SMA (f)	1250-1811
Disk Drive Mount	E4406-40006
Instrument Cover	E4406-00016
Front Frame Assembly	E4406-60155 <sup>a</sup>
Mid Web	E4406-20109
Chassis	E4406-00073 <sup>a</sup>
Center Web	E4406-60054
Cover, Disk	E4406-00006
Top Brace	E4406-00078
Rear Frame Assembly	E4406-60154 <sup>a</sup>
Rear Dress Panel	E4406-00032
Plate, CPU	E4406-00034 (For CPU assembly E4406-60060 and E4406-60073)
CPU shim 1 (refer to <a href="#">Figure 3-20 on page 162</a> )	E4406-00076

**Table 3-5 Mechanical Parts**

<b>Description</b>	<b>Agilent Part Number</b>
CPU shim 2 (refer to <a href="#">Figure 3-20 on page 162</a> )	E4406-00077
Dress Panel, SCSI	E4406-00017
Trim, Side	5041-9172
Rear Feet	5041-9611
Bottom Feet	5041-9167
Strap Handles	E4400-60026
Motherboard Shield Assembly	E4406-60024
Ferrite, W6 Flat Panel Interface Cable	9170-1727
Ferrite, W10 Disk Drive Cable	9170-1726
Shield, Ferrite	E4406-20105
CPU Bottom Plastic Spacers	0380-4163
Memory Plastic Standoffs	0380-4663
Mid Web Fan Plastic Rivet	0361-1272
Nut, W20	2950-0035
Nut, A27	2950-0154
Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
Screw M3x0.5 6mm-LG (Flat Head - TORX)	0515-1227
Screws, Jack	0380-1858
Screwlock Stand Off-Hex 0.312-IN-LG, SCSI	1252-5828
Screw M4x0.7 25mm-LG, Rear Feet	0515-1619
Washer-LK HLC No. 10 0.194-IN-ID, GPIB	2190-0034
Standoff-HEX 0.327-IN-LG, GPIB	0380-0644

- a. For instruments with serial numbers between US3845101 and US40061423, you must replace the Front Frame Assembly, Chassis, and Rear Frame Assembly together.

**Table 3-6 Cables**

Reference Designator	Description	Agilent Part Number
W3	Cable, Coax Ext Trig In, Front Panel	E4406-60139
W6	Cable, Flat Flex Flat Panel Interface	8120-8480 (Prefix US/MY4402 and below)
W6	Cable, Flat Flex Flat Panel Interface	8121-1419 (Prefix US/MY46xx and above)
W8	Cable, Ribbon Front Panel	8120-8463
W9	Cable, Semi-Rigid, SMA RF Input	E4406-20041 <sup>a</sup>
W10	Cable, Flat Flex Disk Drive	8120-8461
W11	Cable, Semi-Rigid, Type-M 4 GHz LO	E4406-20040 <sup>a</sup>
W12	Cable, Coax 21.4 MHz - RF to Analog IF	E4406-60027 <sup>a</sup>
W13	Cable, Coax 7.5 MHz - Digital IF to Analog IF	8120-5022
W19	Cable, Coax, Type-M BNC 321.4 MHz OUT, Rear Panel (Option 300)	E4406-60071 <sup>a</sup>
W20	Cable, Coax EXT Trig In, Rear Panel	8120-5055
W21, W22	Inverter, A3	8120-8462
W23	Backlight, Top (235 mm)	8120-8460
W24	Backlight, Bottom (264 mm)	8120-8459
W25	Cable, Flat Flex Rear Panel, I/O	8120-8493
W26	Fan Part of B1, B2, B3	
W27	Cable, Backlight Extension (63 mm)	8121-1420 (Prefix US/MY46xx and above)
W32	Cable, Coax I (12) Input (Option B7C)	E4406-60161

**Table 3-6 Cables**

<b>Reference Designator</b>	<b>Description</b>	<b>Agilent Part Number</b>
W33	Cable, Coax Ī (13) Input (Option B7C)	E4406-60162
W34	Cable, Coax Q (14) Input (Option B7C)	E4406-60163
W35	Cable, Coax Q̄ (12) Input (Option B7C)	E4406-60164

a. For replacement also order:

Cable Retainer, E4400-40002  
 Snap Ring, 0510-1643

**Table 3-7 Connectors**

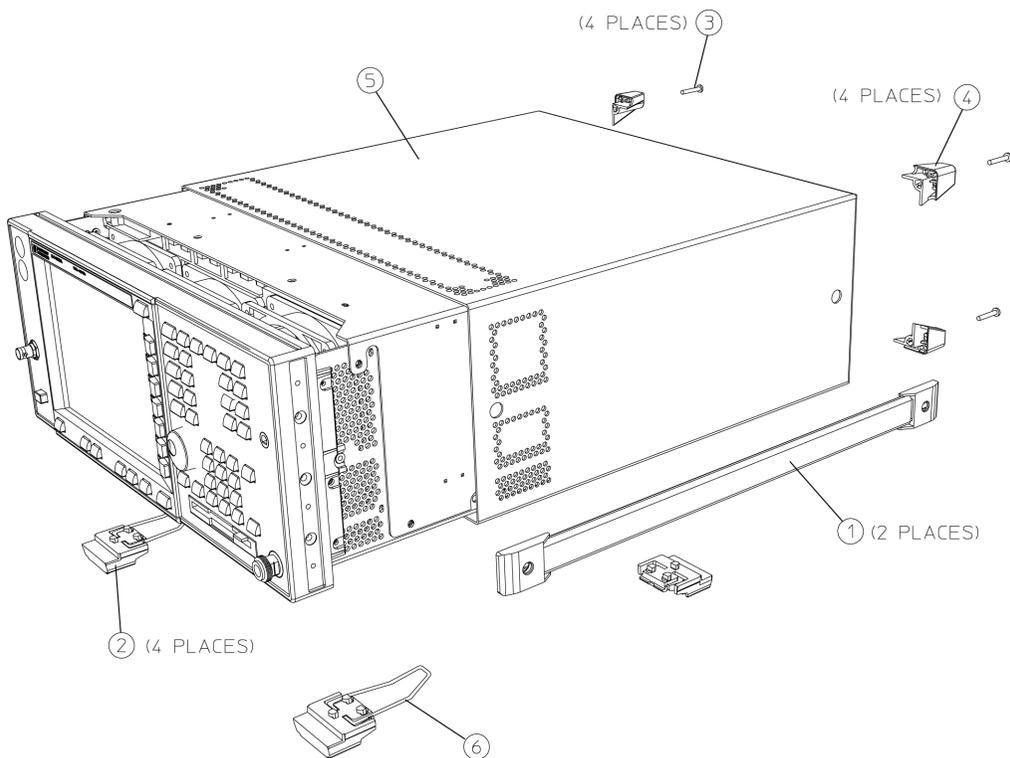
<b>Reference Designator</b>	<b>Description</b>	<b>Agilent Part Number</b>
J5	Ext Trigger Part of W3 cable	
J7	Probe Power Part of A3 Front Panel Interface Assembly	1252-7437
J10	RF In	1250-1811
A27 J2	Ext Ref IN Part of A27 Rear Panel Connector Board	
A27 J3	10 MHz Out Part of A27 Rear Panel Connector Board	
A27 J4	Trig 1 Out Part of A27 Rear Panel Connector Board	
A27 J5	Trig 2 Out Part of A27 Rear Panel Connector Board	
J22	SCSI Part of the A25 PS2 Board Plus SCSI	
J23	KEYBD Part of the A25 Digital I/O Board	
P7	Serial Part of A22 CPU (Processor) Assembly	1252-6672
J13	Monitor Part of A22 CPU (Processor) Assembly	1252-6671
J14	Parallel Part of A22 CPU (Processor) Assembly	1252-5706
J12	LAN-TP Part of A22 CPU (Processor) Assembly	1252-5586
J15	GPIB Part of A22 CPU (Processor) Assembly	1252-2161
J18	Ext Trig Input Part of W20	

**Table 3-8                      Miscellaneous Parts**

Reference Designator	Description	Agilent Part Number
AT1	RF IN Attenuator	0955-0807
A21S1	Power Switch	3101-2976
A22 BT1	CPU Battery (Panasonic BR2325)	1420-0314
DS1, DS2	Back Light, Flat Panel (see <a href="#">Figure 3-5 on page 146</a> )	0960-1314 (For display marked VB02) 4.1 mm width tube  2090-0365 (For display marked VB01) 4.6 mm width tube)
	Rack Mount Kit Contains SYSII slide kit and screws	E4406-60115
	Service Kit Contains extender boards	E4406-60114

## Hardware

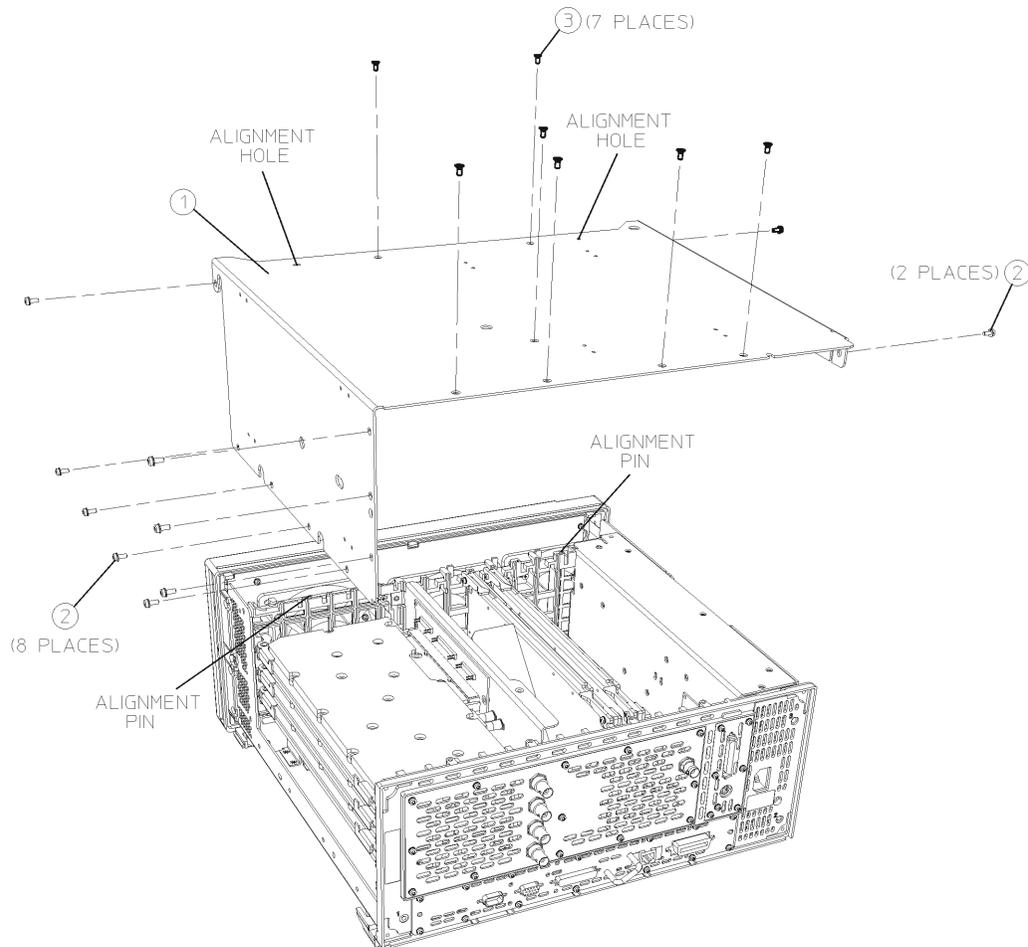
**Figure 3-1 External Hardware**



sa85a

Item	Description	Agilent Part Number
1	Strap Handle Assembly (includes the following parts:)	E4400-60026
	Screw-Machine M5×18 FL-TX	0515-0710
2	Bottom Feet	5041-9167
3	Screw M4x0.7 25mm-LG	0515-1619
4	Rear Feet	5041-9611
5	Instrument Cover	E4406-00016
6	Spring - Wire Frame	1460-1345

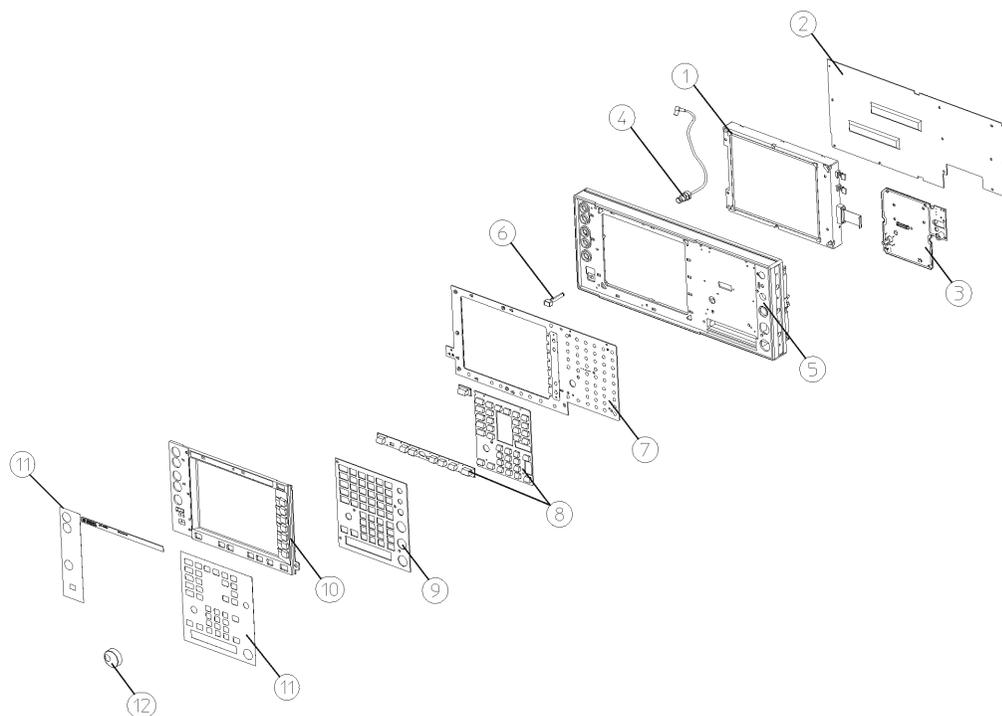
**Figure 3-2 Top Brace Hardware**



sa87a

Item	Description	Agilent Part Number
1	Top Brace	E4406-00078
2	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
3	Screw M3x0.5 6mm-LG	0515-1227

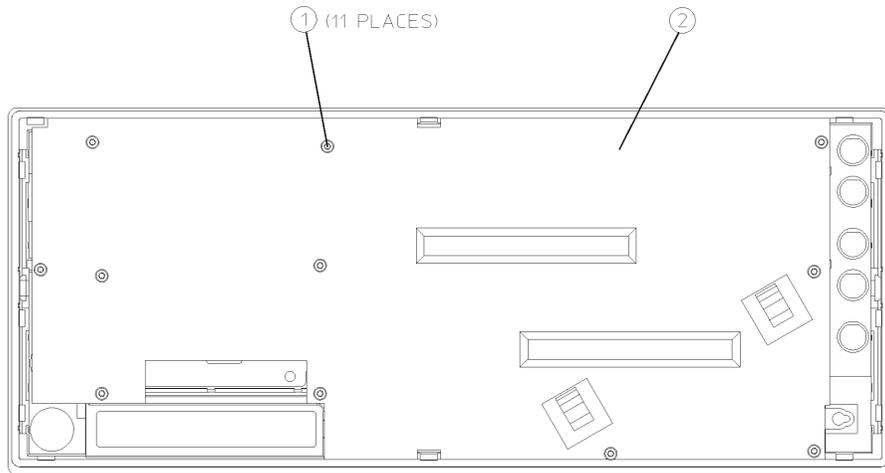
**Figure 3-3 Front Panel Parts**



sa882a

Item	Description	Agilent Part Number
1	Display Assembly	See <a href="#">Figure 3-12</a>
2	Front Shield	E4406-00002
3	Front Panel Interface Assembly (includes Inverter Boards and cables)	E4406-63199 (Prefix US4004/MY0000 & above)
4	W3 Cable, Coax Ext Trig In, Front Panel	E4406-60139
5	Front Frame Assembly with EMI gasket and trim strip	E4406-60155
6	Line Key (push rod) Compression Spring Retainer Ring	E4406-40005 1460-2580 0510-1055
7	Keyboard	E4406-60004
8	Keypad	E4406-40010
9 and 11	Dress Panel Assembly	E4406-60047
10	Display Bezel Assembly (includes E4406-80007)	E4406-60046
12	RPG Knob	0370-3229
13	Front Panel Overlay, Left (non B7C instruments) (B7C, BBIQ instruments)	E4406-80007 E4406-80041
14	Plug, Hole, Nylon	6960-0149
15	Name Plate Overlay	E4406-80009

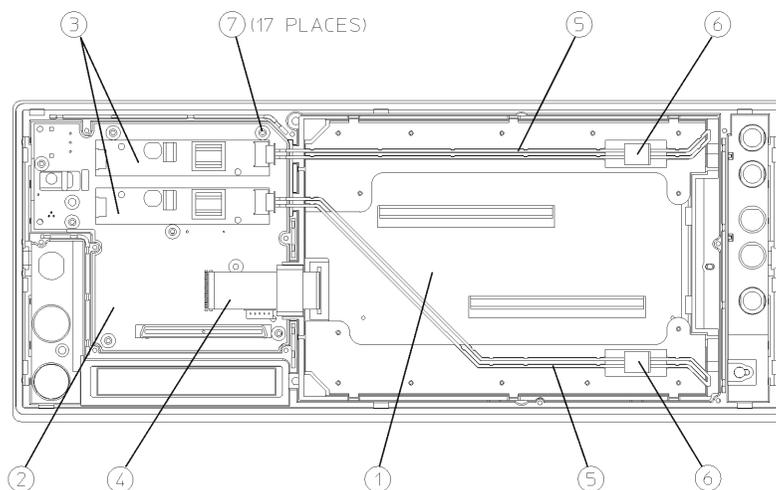
**Figure 3-4 Front Panel Shield Hardware**



sa887a

Item	Description	Agilent Part Number
1	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
2	Shield Front	E4406-00002

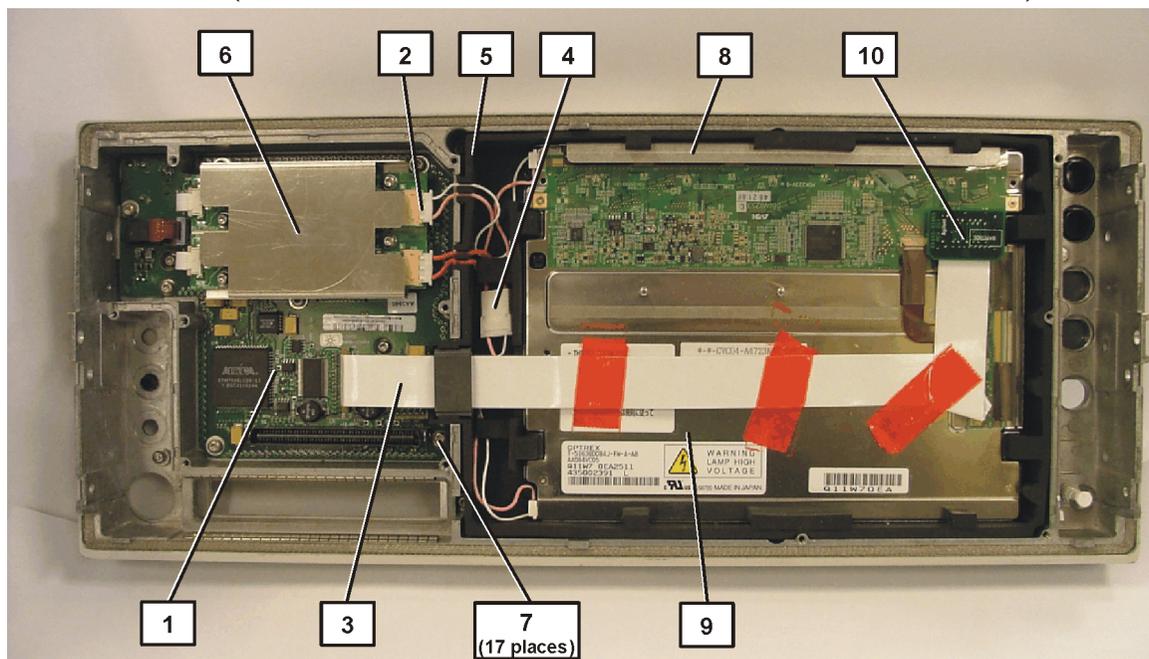
**Figure 3-5 Front Panel Assemblies  
(Instruments with Serial Prefix US/MY4402 & below)**



sa829a

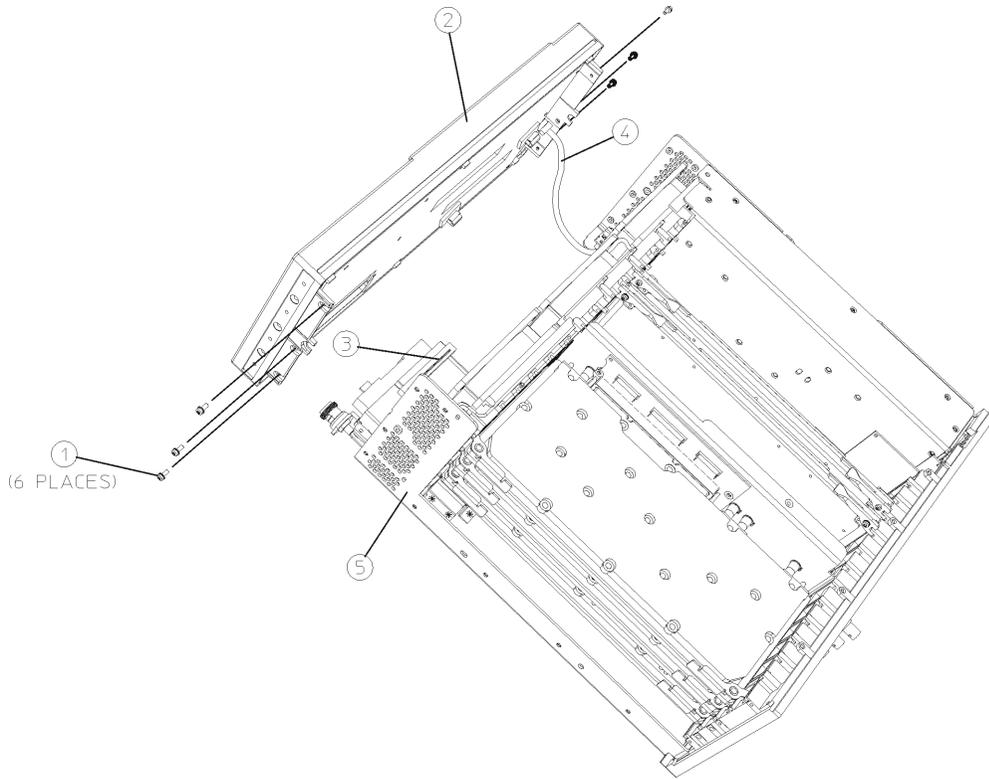
Item	Description	Agilent Part Number
1	A26 Display Shield Board (with EMC gaskets)	E4406-60052
	EMC gaskets for Display Shield Board	8160-0968
2	A3 Front Panel Interface Assembly (includes inverter boards)	E4406-63199(Prefix US4004/MY0000 & above)
3	Inverter Boards	0950-3379
4	W6 Cable, Flat Flex Flat Panel Interface	8120-8480
5	Backlight Extension Cable	Top (235 mm) 8120-8460 Bottom (264 mm) 8120-8459
6	Backlight For use with display 2090-0396 (VB02 display): For use with display 2090-0576 (VB01 display):	0960-1314 2090-0365
7	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372

**Figure 3-6 Front Panel Assemblies**  
(Instruments with Serial Prefix US/MY 46xx & above)



Item	Description	Agilent Part Number
1	A3 Front Panel Interface	E4440-63199
2	Inverter Boards (under Inverter Shield)	0950-3379
3	W6 Cable Flat flex, Front Panel Interface to display converter board	8120-1419
4	W27 Cable, backlight extension	8121-1420
5	Display Mount	E4406-40013
6	Shield, Inverter Board	E4440-00068
7	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
8	Display Protector Pressure Plate	E4406-00037
9	A2 Flat Panel Display	2090-0897
10	A2A1 Display Converter Board	E4440-63265

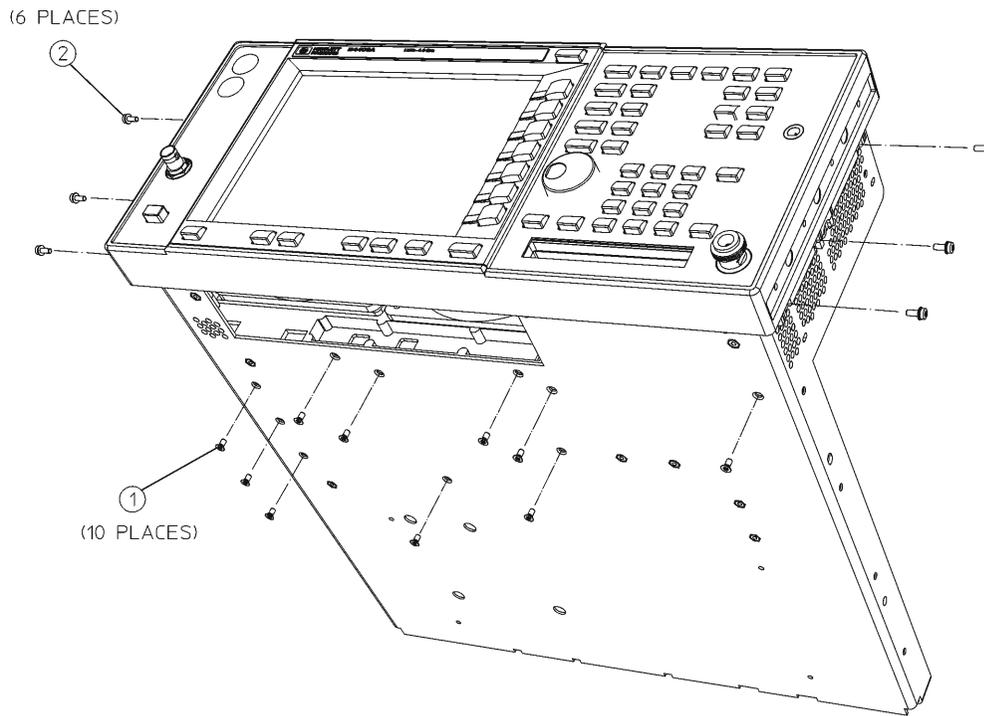
**Figure 3-7 Front Frame Hardware**



sa88a

Item	Description	Agilent Part Number
1	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
2	Front Frame Assembly	Refer to <a href="#">Table 3-5</a>
3	W8 Cable, Front Panel Ribbon	8120-8463
4	W3 Cable, Coax Ext Trig In, Front Panel	E4406-60139
5	Chassis	Refer to <a href="#">Table 3-5</a>

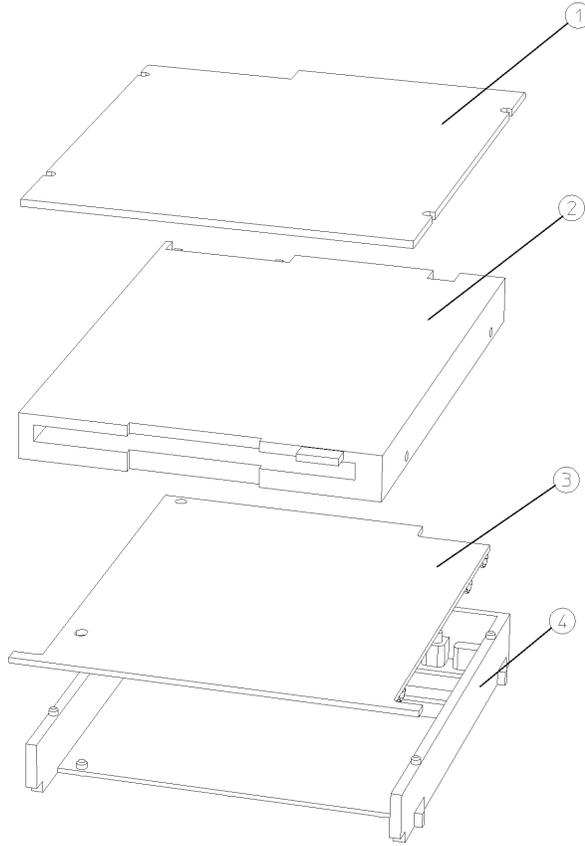
**Figure 3-8 Bottom Hardware**



sa831a

Item	Description	Agilent Part Number
1	Screw M3x0.5 6mm-LG	0515-1227
2	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372

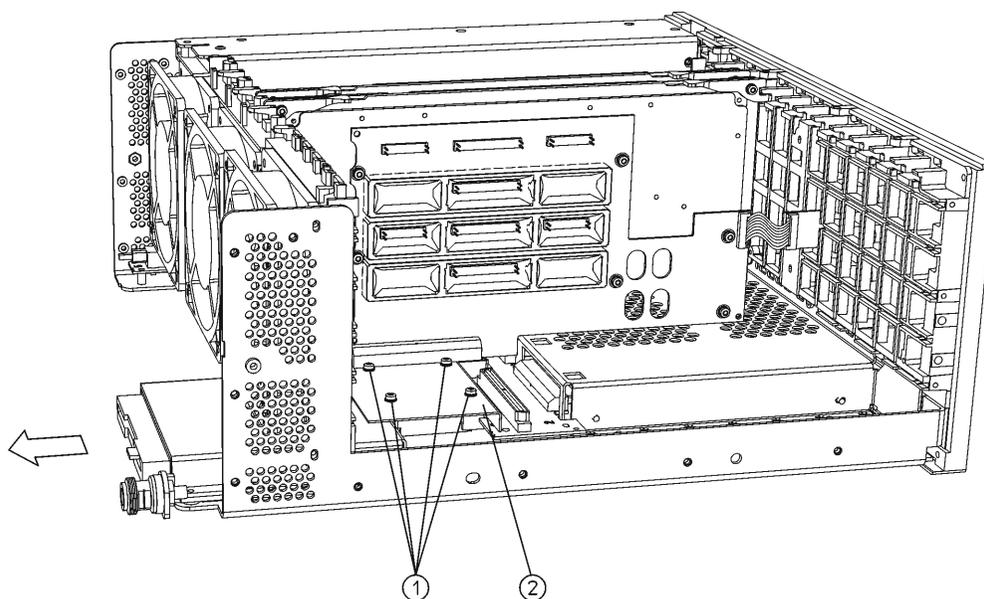
**Figure 3-9**      **Disk Drive Parts**



sa838a

<b>Item</b>	<b>Description</b>	<b>Agilent Part Number</b>
1 and 4	Disk Drive Mount	E4406-40006
2	Disk Drive	0950-2782
3	Disk Drive Board	E4406-60014

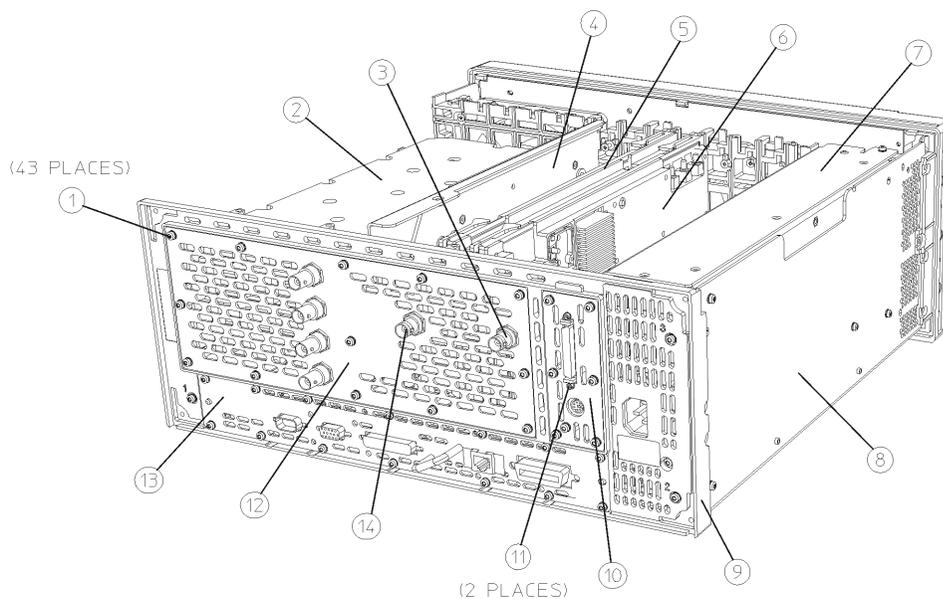
**Figure 3-10 Disk Drive Chassis Hardware**



sa89a

Item	Description	Agilent Part Number
1	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
2	Disk Drive Cover	E4406-00006

**Figure 3-11 Rear Frame Hardware**

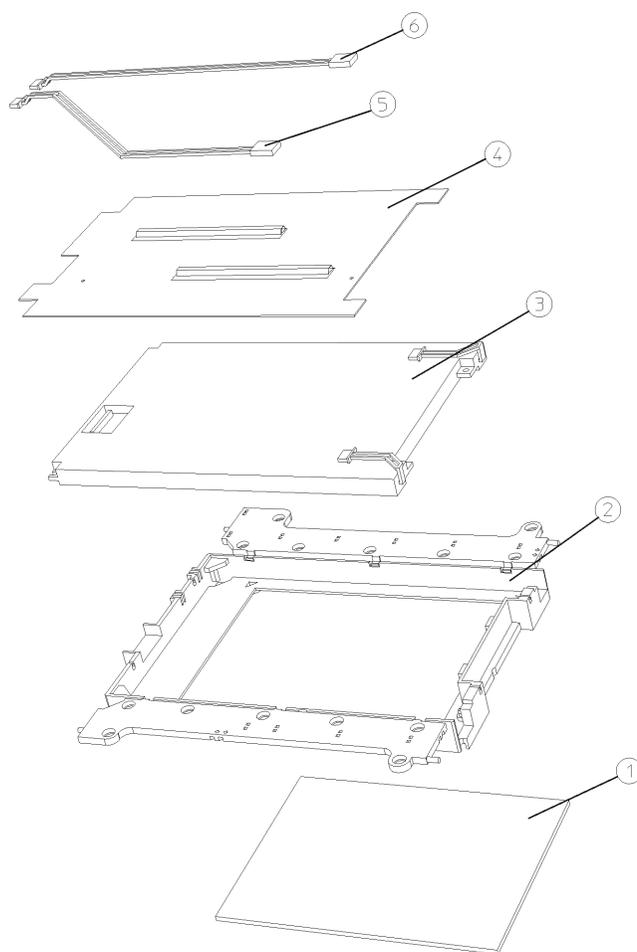


sq894a

Item	Description	Agilent Part Number
1	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
2	A17 RF Assembly	<a href="#">E4406-60197</a>
3	W20 Cable, Coax EXT Trig In, Rear Panel	8120-5055
4	Center Web	E4406-60054
5	A12 Analog IF Assembly	<a href="#">E4440-60029</a>
6	A10 Digital IF Assembly	<a href="#">E4440-60195</a>
7	A6 Power Supply Assembly	0950-2797
8	Chassis	E4406-00073
9	Rear Frame Assembly and EMI gaskets	E4406-60154
10	Dress Panel, SCSI	E4406-00017
11	Screwlock	1252-5828
12	Rear Dress Panel	E4406-00032

Item	Description	Agilent Part Number
13	A22 CPU (Processor) Assembly (does not include A22A1 or A22A2)	E4406-60060 (Prefix US4004 & MY0000 & above or instruments retrofitted with CPU upgrade kit E4406-60238)
13	A22 CPU (Processor) Assembly Retrofit Kit (includes Front Panel Interface Assembly E4406-60064 and SCSI Board Assembly E4406-60065)	E4406-60238 (Prefix US3948 & below)
14	W19 Cable, Coax 321.4 MHz OUT (Option 300)	E4406-60071

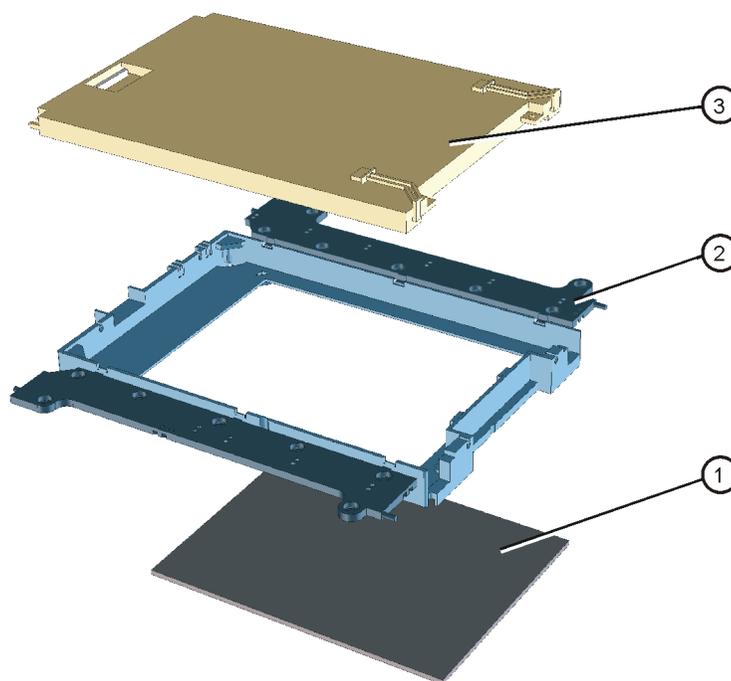
**Figure 3-12 Display Parts**  
(Instruments with Serial Prefix US/MY4402 & below)



sa830a

Item	Description	Agilent Part Number
1	Display EMI Filter	1000-1001
2	Display Mount	E4406-40004
3	Flat Panel Display	2090-0396
4	Display Shield Board (includes gaskets)	E4406-60052
5	W24 Cable, Backlight Extension Bottom (264 mm)	8120-8459
6	W23 Cable, Backlight Extension Top (235 mm)	8120-8460

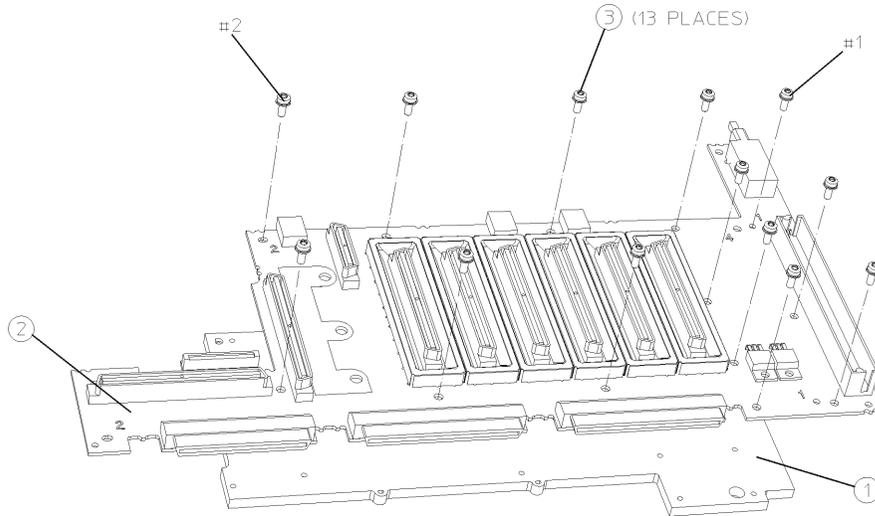
**Figure 3-13**      **Display Parts**  
(Instruments with Serial Prefix US/MY46xx & above)



se847a

Item	Description	Agilent Part Number
1	Display EMI Filter	1000-1001
2	Display Mount	E4406-40013
3	Flat Panel Display	2090-0897

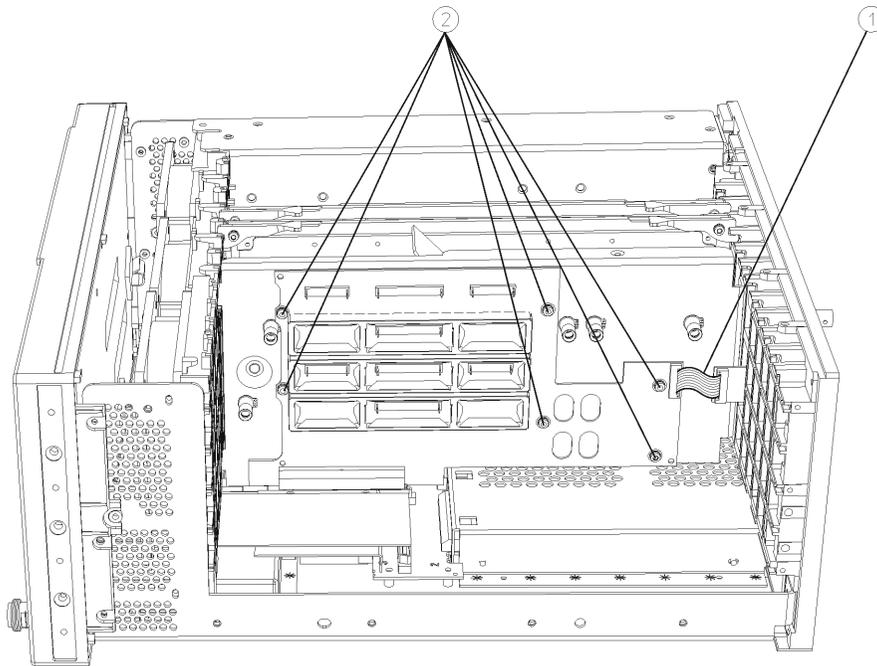
**Figure 3-14**      **Motherboard and Shield**



sa843a

Item	Description	Agilent Part Number
1	Motherboard Shield Assembly	E4406-60024
2	Motherboard	E4406-60001
3	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372

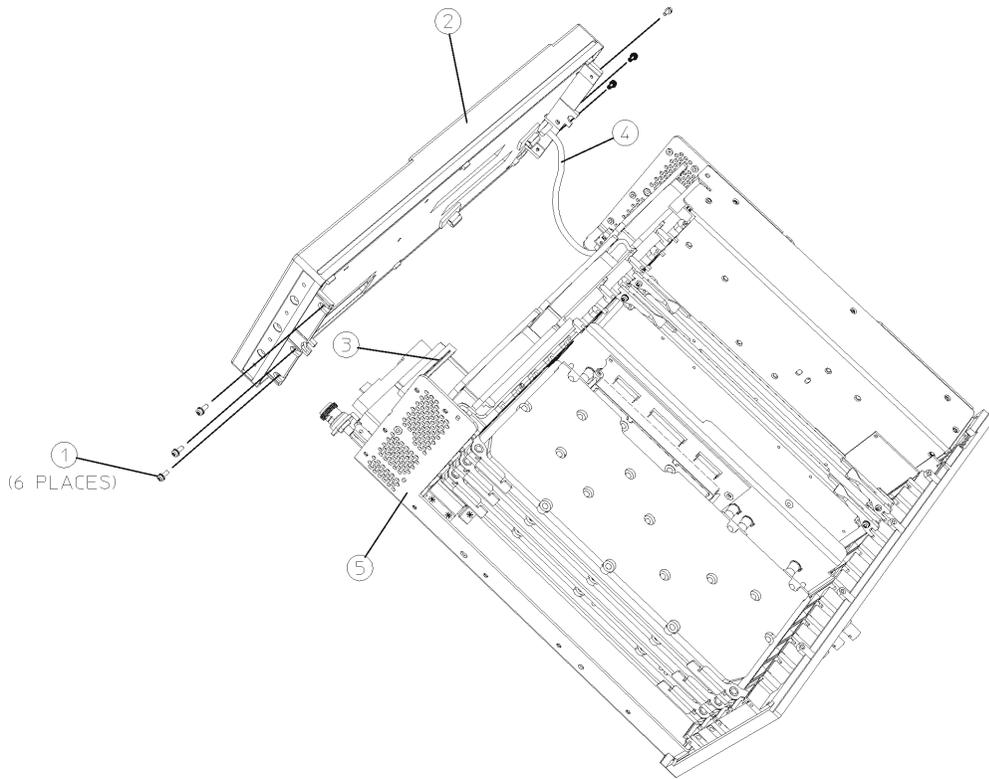
**Figure 3-15 Center Web Parts**



sa815a

Item	Description	Agilent Part Number
1	W25 Cable, Flat Flex Rear Panel, I/O	8120-8493
2	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372

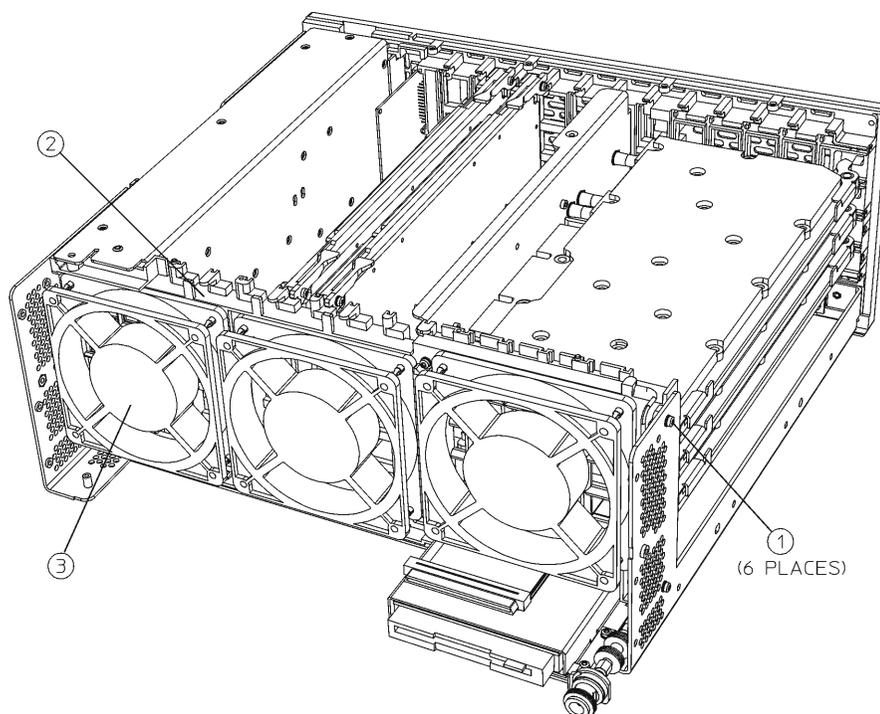
**Figure 3-16 Center Web Cables**



sa88a

Item	Description	Agilent Part Number
1	Snap Ring	0510-1643
2	Cable Retainer	E4400-40002
W9	Cable, Semi-Rigid, SMA RF Input	E4406-20041
W11	Cable, Semi-Rigid, Type-M 4 GHz LO	E4406-20040
W12	Cable, Coax 21.4 MHz - RF to Analog IF	E4406-60027

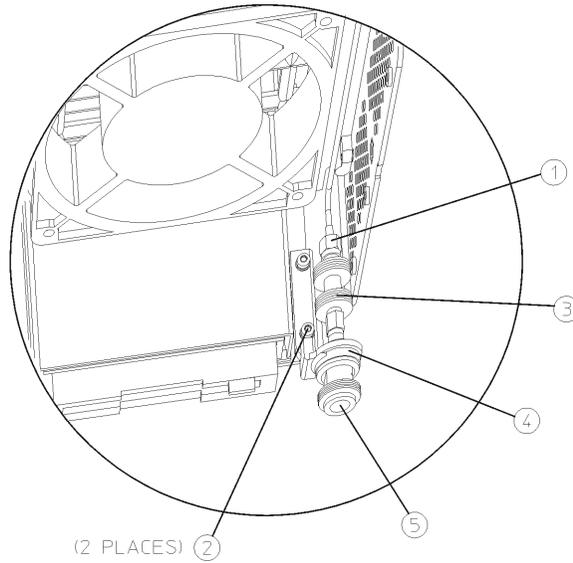
**Figure 3-17 Mid Web Parts**



sa863a

Item	Description	Agilent Part Number
1	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
2	Mid Web	E4406-20109
3	Fan Replacement	E4406-60159

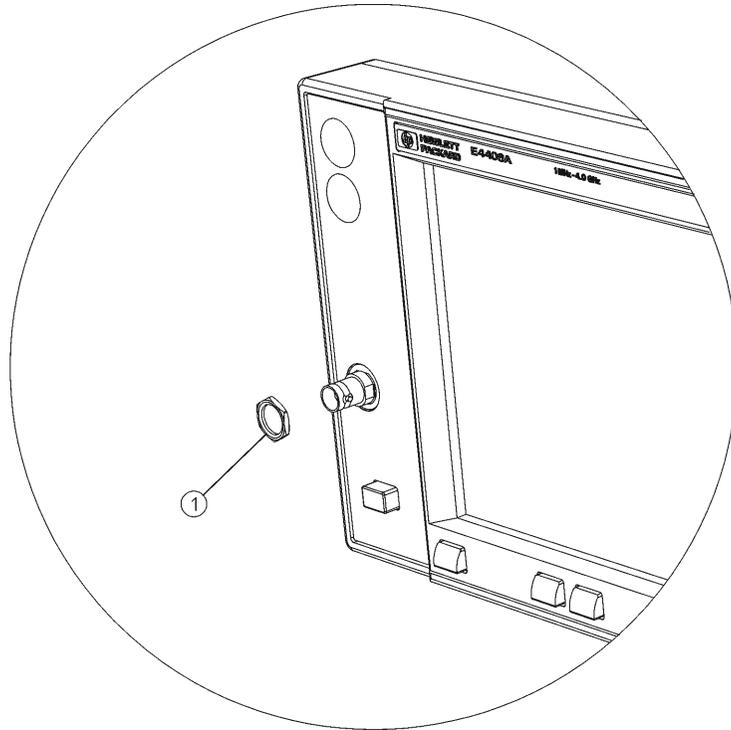
**Figure 3-18 RF Input Connector**



sd884a

Item	Description	Agilent Part Number
1	W9 Cable, Semi-Rigid, SMA RF Input	E4406-20041
2	Screw M3x0.5 8mm-LG (Crest Washer-Pan Head-TORX)	0515-0372
3	RF In Attenuator, AT1	0955-0807
4	RF Input Bracket	E4406-20110
5	RF Input Connector Type N (f) to SMA (f)	1250-1811
6	Nut, Hex	2950-0154

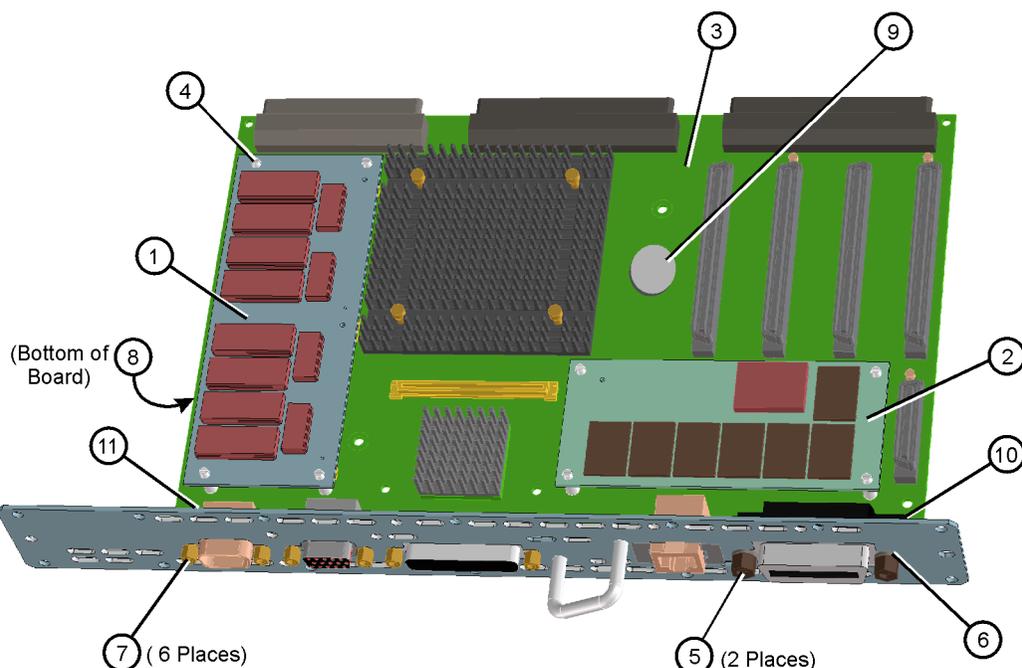
**Figure 3-19 Front Panel External Trigger Connector Hardware**



sa824a

Item	Description	Agilent Part Number
1	Nut, W3	2950-0035

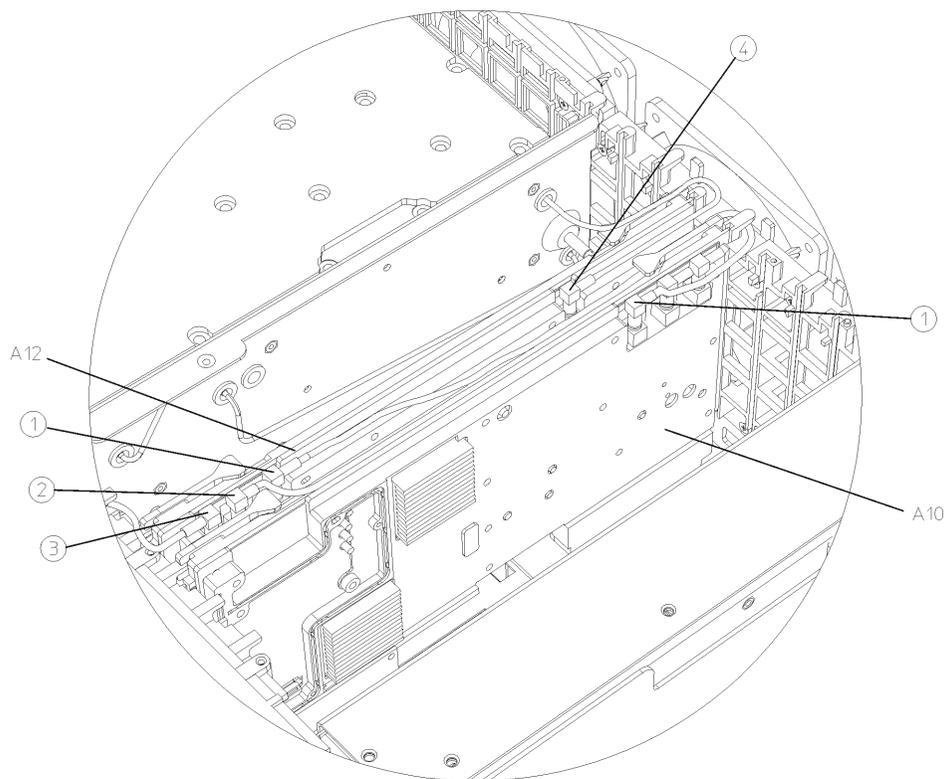
**Figure 3-20 CPU Parts**



se845a

Item	Description	Agilent Part Number
1	A22A1 128M DRAM Replacement Kit (includes replacement standoffs)	E4406-60053
2	A22A2 64 MB Flash Memory Replacement Kit (includes replacement standoffs)	E4406-60194
3	A22 CPU (Processor) Assembly (does not include A22A1 or A22A2)	E4406-60060 (Prefix US4004 & MY0000 & above or instruments retrofitted with CPU upgrade kit E4406-60238)
4	Memory Plastic Standoffs	0380-4663
5	Standoff-HEX 0.327-IN-LG, GPIB	0380-0644
8	CPU Bottom Plastic Spacers	0380-4163
9	CPU Battery (Panasonic BR2325 Lithium Polycarbon Monofluoride 3V, 0.16 AH)	1420-0314
10	CPU shim 2	E4406-00077
11	CPU shim 1	E4406-00076

**Figure 3-21 Cables**



sa848a

Item	Description	Agilent Part Number
1	W13 - Cable, Coax 7.5 MHz - Digital IF to Analog IF	8120-5022
2	W3 - Cable, Coax Ext Trig In, Front Panel	E4406-60139
3	W20 - Cable, Coax Ext Trig In, Rear Panel	8120-5055
4	W12 - Cable, Coax 21.4 MHz - RF to Analog IF	E4406-60027





## Introduction

The procedures in this chapter describe the location, removal and replacement of major assemblies in your instrument. Refer to [Chapter 3](#) , “[Parts List](#),” for part numbers, assembly descriptions, and ordering information.

## Before You Start

Before starting to disassemble the instrument:

- ❑ Check that you are familiar with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions given in the front of this guide.
- ❑ The instrument contains static sensitive components. Read the section entitled “[ESD Information](#)” on [page 15](#).

### WARNING

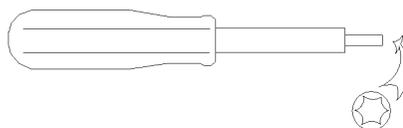
**The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.**

### WARNING

**The instrument contains potentially hazardous voltages. Refer to the safety symbols on the instrument and the general safety considerations at the beginning of this service guide before operating the unit with the cover removed. Failure to heed the safety precautions can result in severe or fatal injury.**

## Service tools you will need

**Figure 4-1 TORX Tool**



s1736a

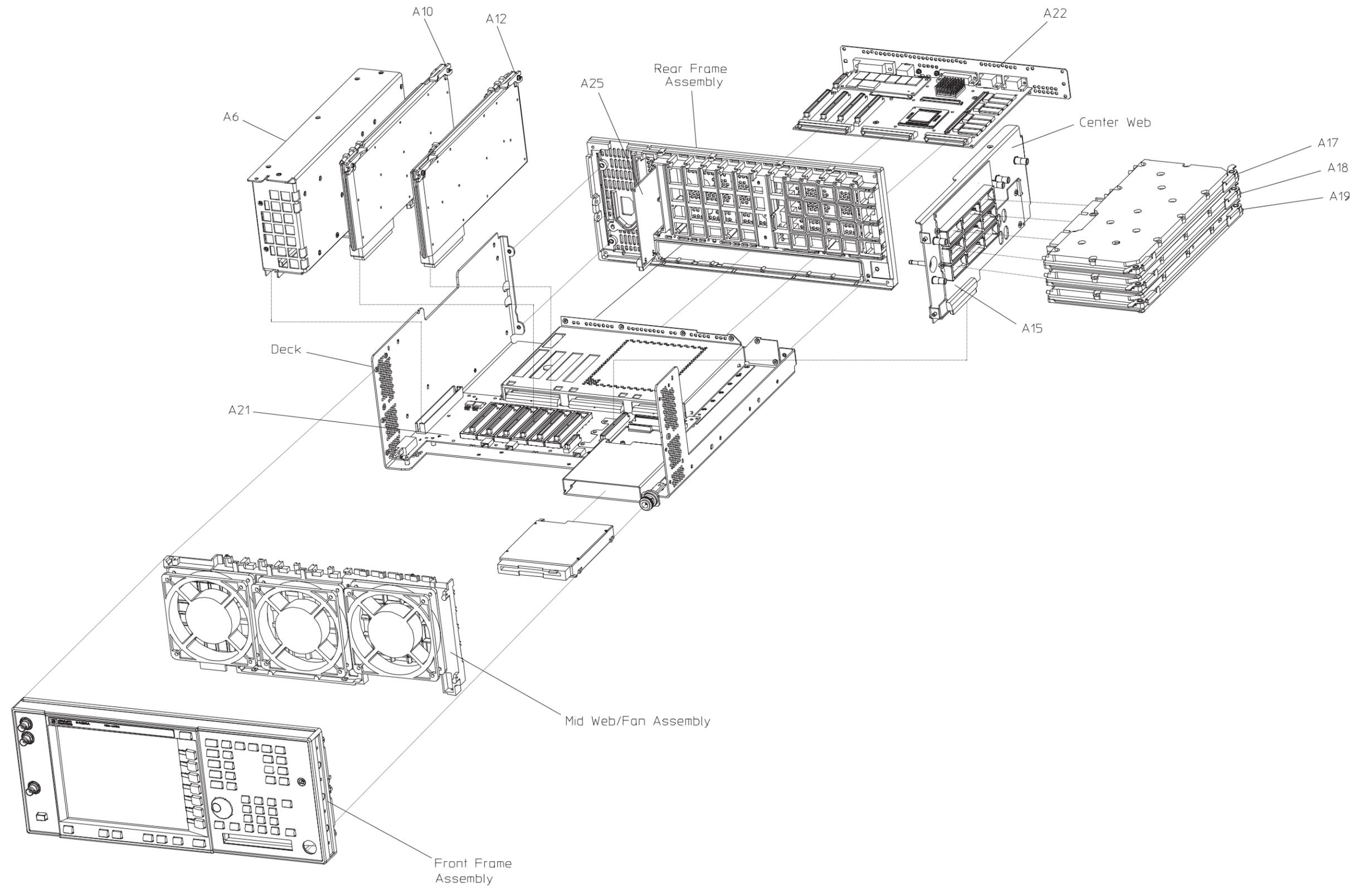
Description	Agilent Part Number	Description	Agilent Part Number
TORX Hand Driver - Size T10	8710-1623	flat blade screwdriver - 0.01 in. thick blade	8730-0008
TORX Hand Driver - Size T15	8710-1622	9/16" nut driver (or open-end wrench)	8720-0008
TORX Hand Driver - Size T20	8710-1615	snap ring tool	NA
Pozidriv screwdriver - #1	8710-0899		

## After an instrument repair

If one or more instrument assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Refer to [Table 1-5 on page 61](#) for the related adjustments and performance verification tests required for each assembly.

## Removal and Replacement Procedures

- "Instrument Outer Case" on page 171
- "Top Brace" on page 173
- "Front Frame" on page 175
- "A4 Disk Drive and A5 Disk Drive Board" on page 177
- "A6 Power Supply" on page 180
- "A7 Baseband I/Q Assembly (Option B7C)" on page 182
- "A10 Digital IF and A12 Analog IF Assemblies" on page 185
- "A14 Fan Control Board" on page 187
- "A15 Daughter Board" on page 189
- "A17 RF, A18 Reference, and A19 Synthesizer Assemblies" on page 191
- "Mid Web/Fans" on page 193
- "A21 Motherboard" on page 198
- "A22 Processor Assembly" on page 202
- "A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards" on page 205
- "A25 SCSI Board" on page 207
- "A27 Rear Panel Connector Board" on page 208
- "Rear Frame" on page 210
- "Center Web Cables W9, W11, and W12" on page 212
- "RF Input Connector" on page 214
- "Front Frame Subassemblies" on page 216



Assembly Replacement  
**Removal and Replacement Procedures**

## Instrument Outer Case

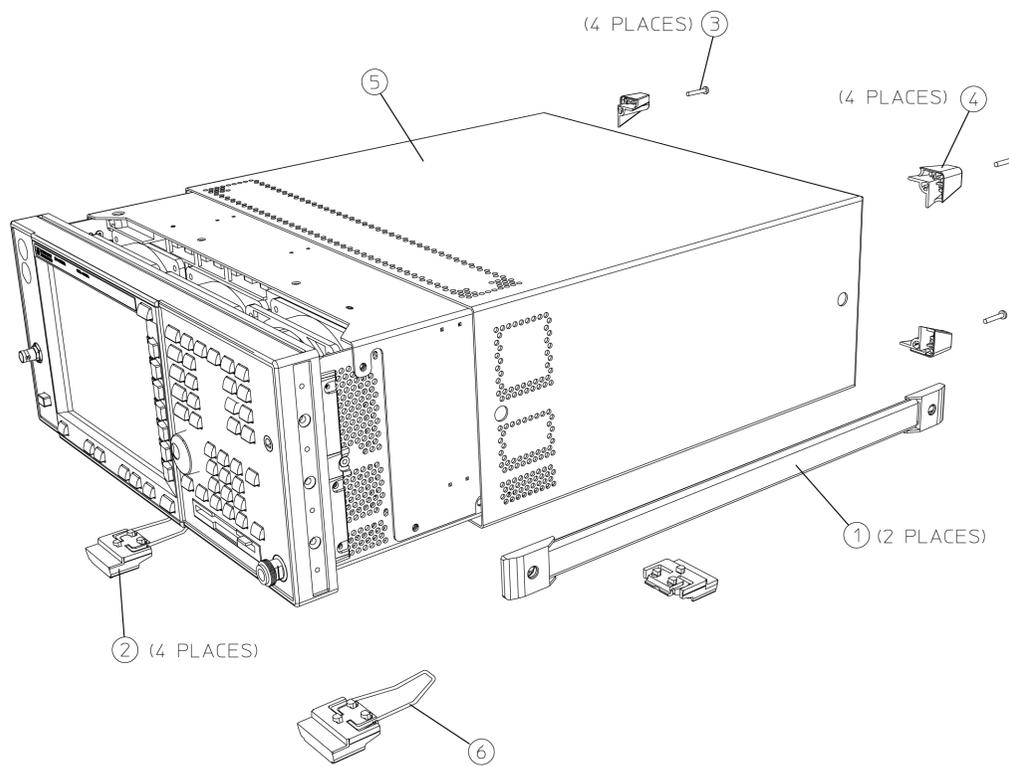
### CAUTION

If the instrument is placed on its face during any of the following procedures, be sure to use a soft surface or soft cloth to avoid damage to the front panel, keys, or input connector.

### Removal

1. Disconnect the instrument from ac power.
2. There are two handles on the sides of the instrument that must be taken off. Refer to [Figure 4-2](#). Using the T-20 driver, loosen the screws that attach each handle (1). Remove the handles.
3. Remove the four bottom feet (2). This is done by lifting up on the tabs on the feet, and sliding the feet in the direction indicated by the arrows.
4. Using the T-15 driver, remove the four screws (3) that hold the rear feet (4) in place.
5. Pull the instrument cover (5) off towards the rear of the instrument.

**Figure 4-2 Instrument Outer Case Removal**



sa85a

## Replacement

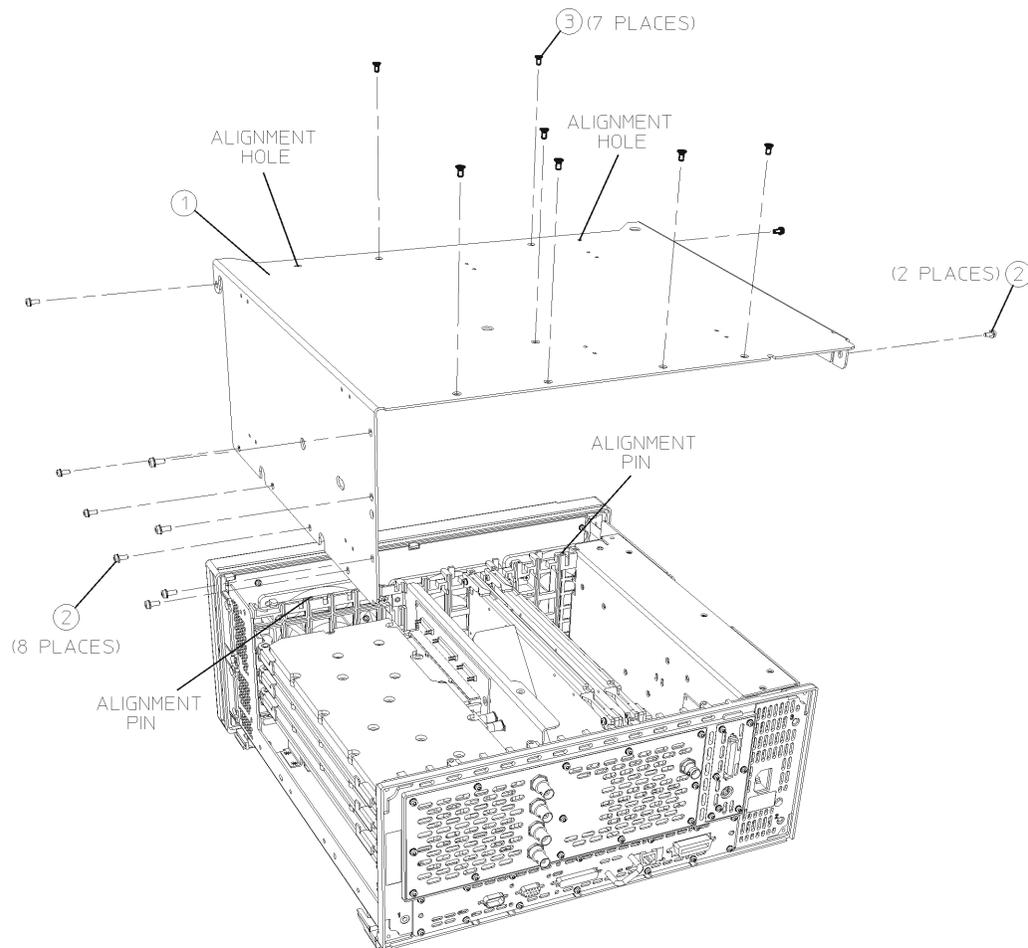
1. Disconnect the instrument from ac power.
2. Slide the instrument cover back onto the deck from the rear. The seam on the cover should be on the bottom. Be sure the cover seats into the gasket groove in the front frame.
3. Using the T-15 driver, attach the four rear feet with the four screws to the instrument. Torque to 21 inch pounds.
4. Using the T-20 driver, replace the handles. Torque to 21 inch pounds.
5. Replace the four bottom feet by pressing them into the holes in the case and sliding in the opposite direction of the arrows until they click into place. Note that the feet at the front have the tilt stands.

## Top Brace

### Removal

1. If you haven't already done so, remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Using the T-10 driver, remove the 7 top screws (3) and the 10 side screws (2) attaching the top brace (1) to the deck. The top screws are different from the side screws. Be careful not to mix them. Refer to Figure 4-3.
3. The top brace can now be removed from the deck.

**Figure 4-3** Top Brace



sa87a

## Replacement

1. Carefully position the top brace on the deck. Reference the two alignment pins and the two alignment holes. Make sure that no coaxial cables will get pinched underneath the brace.
2. Using the T-10 driver, replace the 7 top screws first, and then the 10 side screws after the top screws are tightened. Torque to 9 inch pounds.
3. Replace the outer case. Refer to the [“Instrument Outer Case”](#) replacement procedure.

---

## Front Frame

For most service situations, the front frame assembly can be “dropped” from the deck without disconnecting any cables. Refer to the section [“Drop the Front Frame”](#). To completely remove the front frame, continue with the [“Removal”](#) section.

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### CAUTION

Use ESD precautions when performing this replacement procedure.

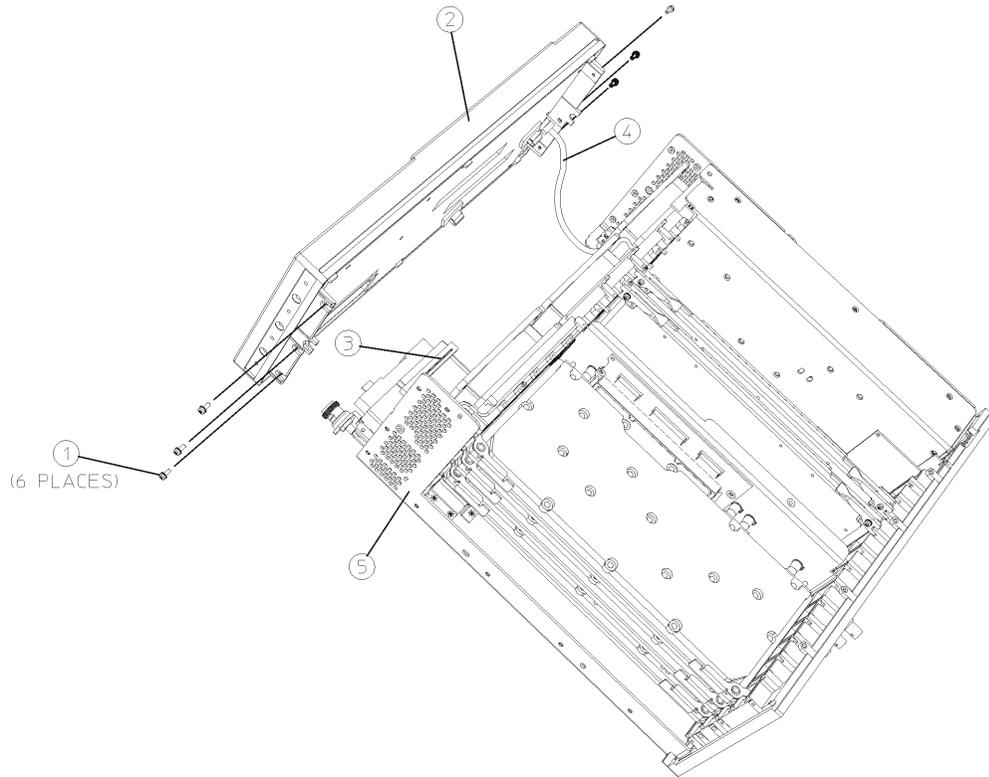
## Drop the Front Frame

1. Remove the instrument outer case. Refer to the [“Instrument Outer Case”](#) removal procedure.
2. Refer to [Figure 4-4](#). Using the T-10 driver, remove the 6 screws (1) that attach the front frame assembly (2) to the deck.
3. Pull the front frame off of the deck until it is disengaged from the disc drive.
4. At this point, the front frame can be placed flat on the bench for service while still attached to the instrument. If you want to completely remove the front frame, continue with the [“Removal”](#) section.

## Removal

1. Using a 9/16” socket drive, remove the nut securing the **External Trigger Input** BNC connector. Take care to not scratch the front dress panel. A 9/16” deep-socket nut driver, part number 8720-0008, is available from Agilent Technologies.
2. Refer to [Figure 4-4](#). Disconnect the ribbon cable (3) from the A3 front panel interface board. Pull the coaxial cable (4) from the front frame and unclip from the two cable clamps.
3. Lift the front frame assembly away from the deck.

**Figure 4-4 Front Frame Assembly Removal**



sa88a

## Replacement

1. Place the front frame assembly in front of the deck.
2. Connect the ribbon cable (3) to the A3 front panel interface board.
3. Feed the coaxial cable BNC connector through the **External Trigger Input** hole in the front frame. Secure with the nut removed earlier, using a 9/16” socket. Torque to 21 inch pounds.
4. Clip the coaxial cable into the two cable clamps positioned on the front frame shield.
5. Position the front frame on the deck using the alignment bosses on the deck (5). Remember to tuck the ribbon cable under the fans when pushing the frame onto the deck. This will insure proper airflow to cool the instrument. Using the T-10 driver, replace the 6 screws (1) that secure the front frame to the deck. Torque to 9 inch pounds.
6. Replace the instrument outer case. Refer to the “[Instrument Outer Case](#)” replacement procedure.

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## A4 Disk Drive and A5 Disk Drive Board

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**CAUTION** Use ESD precautions when performing this replacement procedure.

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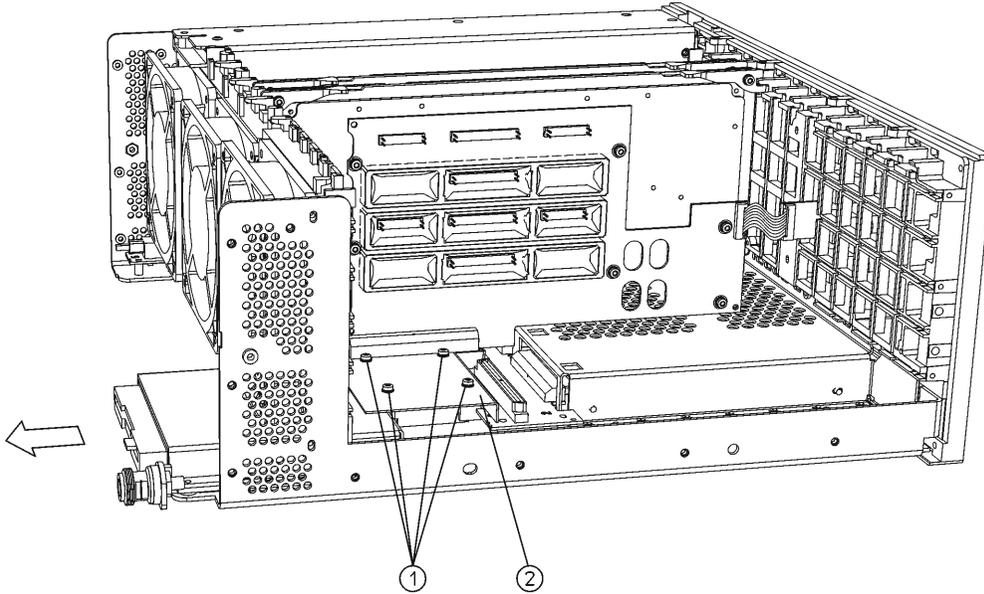
**NOTE** The disk drive assembly consists of the A4 disk drive and the A5 disk drive board. These are removed from the instrument as a unit, but they can be replaced separately.

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### Removal

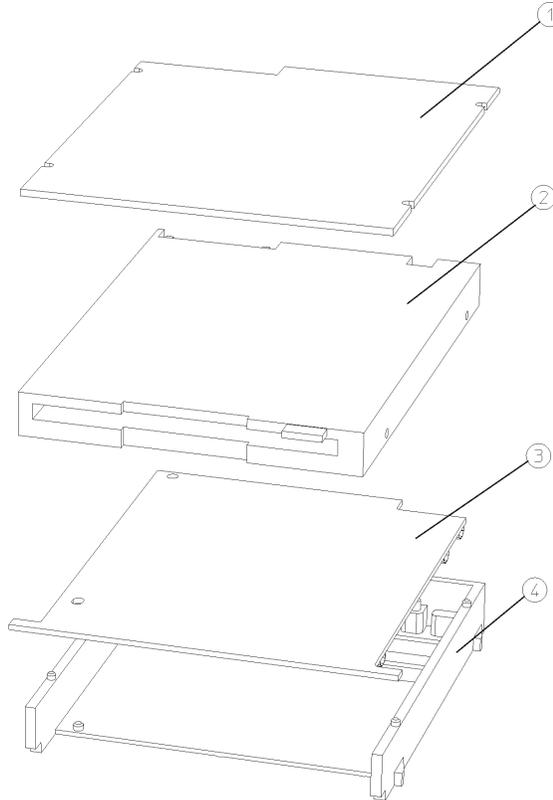
1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Remove the front frame. Refer to the [“Front Frame”](#) removal procedure.
3. Remove the A17, A18, and A19 assemblies. Refer to [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
4. Unplug the ribbon cable from the motherboard.
5. Refer to [Figure 4-5](#). Using the T-10 driver, remove the 4 screws (1) that attach the disk drive cover (2) to the deck.
6. Unplug the flat flex cable from the motherboard and the disk drive connectors. It is necessary to unlock these connectors before removing this cable.
7. Remove the disk drive assembly by sliding it forward out of the disc shield.
8. To separate the disk drive board from the disk drive, refer to [Figure 4-6](#). Remove the top part of the disk drive mount (1). The disk drive (2) and the disk drive board (3) can now be lifted out of the bottom part of the mount (4).

**Figure 4-5**      **Disk Drive Removal**



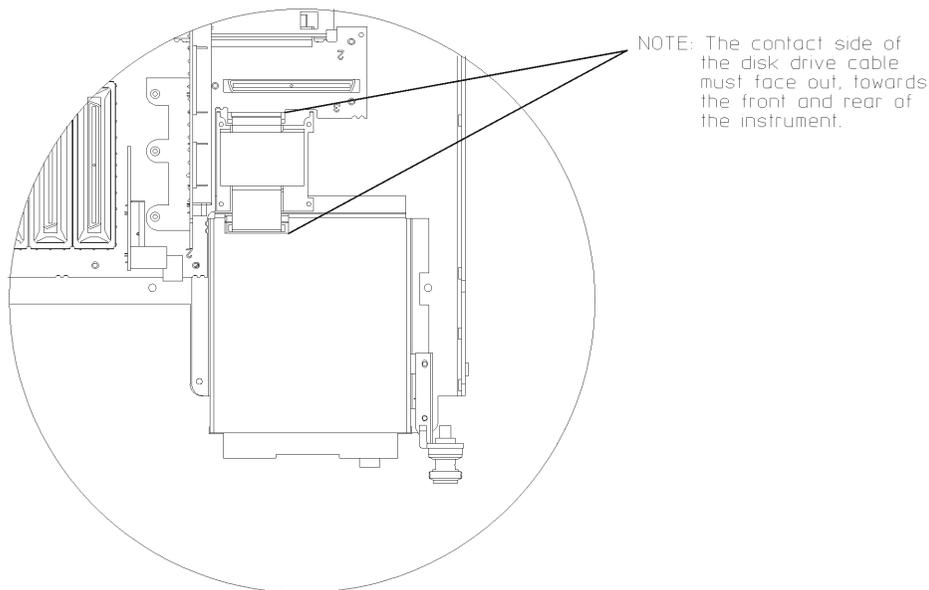
sa89a

**Figure 4-6**      **Disk Drive Board Removal**



sa838a

**Figure 4-7**      **Disk Drive Flat Flex Cable**



sa812a

## Replacement

1. To install the disk drive board (3) into the mount, align the pins on the mount with the hole and the slot on the board. Refer to [Figure 4-6](#).
2. Install the disk drive (2) into the mount over the pc board. Ensure the drive is located over the pin at the rear of the mount. Place the top cover of the disk mount over the 4 pins.
3. Refer to [Figure 4-5](#). Slide the disk drive assembly into the disk shield.
4. Plug in the flat flex cable to the disk drive and the motherboard. Refer to [Figure 4-7](#) for the proper orientation of the cable.
5. Refer to [Figure 4-5](#). Place the disk cover over the ferrite shield. Using the T-10 driver, replace the 4 screws. Torque to 9 inch pounds.
6. Plug the ribbon cable onto the motherboard.
7. Replace the front frame. Refer to the “[Front Frame](#)” replacement procedure.
8. Replace the A17, A18, and A19 assemblies. Refer to “[A17 RF, A18 Reference, and A19 Synthesizer Assemblies](#)” replacement procedure.
9. Replace the instrument top brace. Refer to the “[Top Brace](#)” replacement procedure.

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## A6 Power Supply

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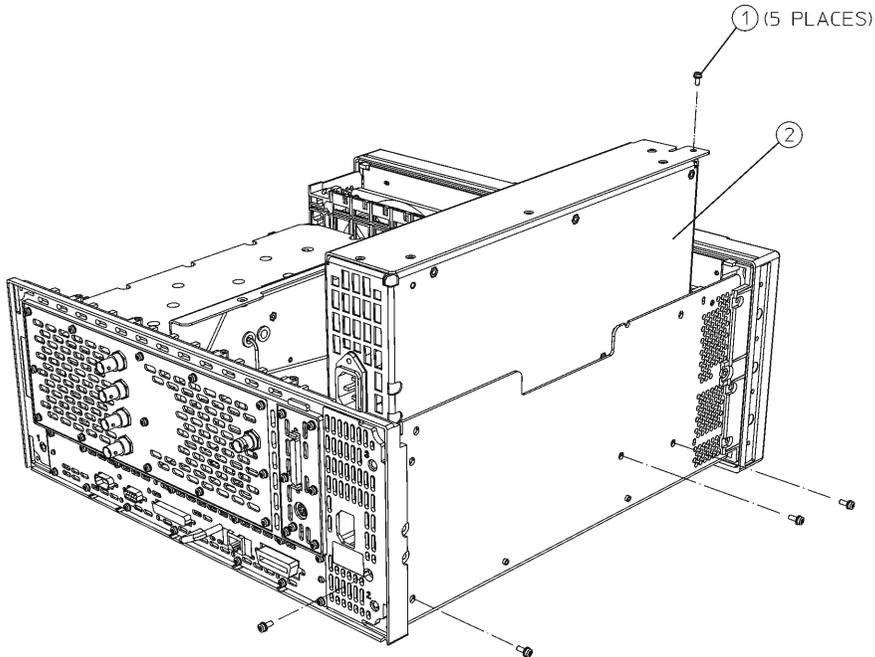
**CAUTION**

Use ESD precautions when performing this replacement procedure.

### Removal

1. Remove the instrument top brace. Refer to the “[Top Brace](#)” removal procedure.
2. Refer to [Figure 4-8](#). Using the T-10 driver, remove the 5 screws (1) securing the A6 power supply assembly (2) to the deck and the rear frame.
3. Carefully pull up on the power supply assembly to disengage from the motherboard connector.

**Figure 4-8**      **Power Supply Removal**



sa810a

## Replacement

1. Place the power supply assembly into position in the deck. Push down to mate the assembly with the motherboard connector.
2. Refer to [Figure 4-8](#). Using the T-10 driver, replace the 5 screws. Torque to 9 inch pounds.
3. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

## A7 Baseband I/Q Assembly (Option B7C)

### Removal

#### Step 1 Remove the Outer Case and Top Brace

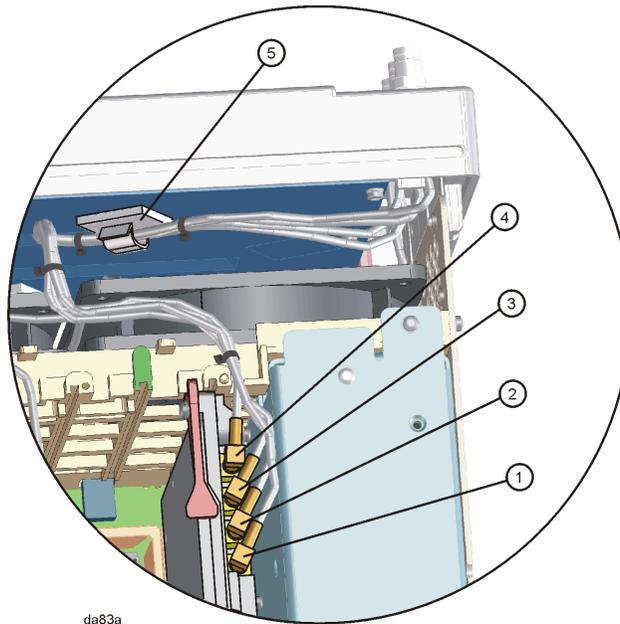
1. If you haven't already done so, remove the instrument outer case. Refer to the removal procedure for the "Instrument Outer Case" on page 171.
2. Remove the instrument top brace. Refer to the removal procedure for the "Top Brace" on page 173.

#### Step 2 Remove the Baseband I/Q Cable Assembly

1. Disconnect the I,  $\bar{I}$ , Q, and  $\bar{Q}$  cables from their respective connectors on the top-front of the A7 assembly. Each connector is labeled both with the I/Q designation and the numerical code of the cable. For example, the Q connector is labeled "Q, 14". In Figure 4-9:

- Item 1 is the Q (14) cable.
- Item 2 is the  $\bar{Q}$  (15) cable.
- Item 3 is the I (12) cable.
- Item 4 is the  $\bar{I}$  (13) cable.

**Figure 4-9** Cable Routing from Front Panel to A7 Assembly

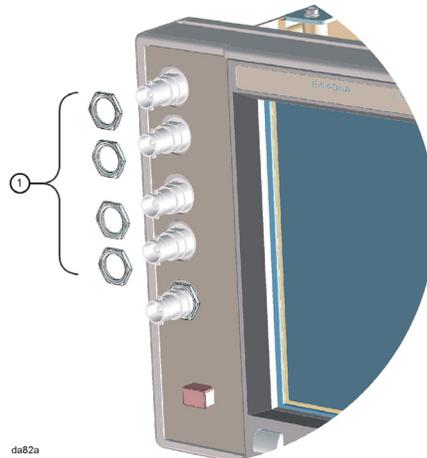


2. Detach the four, bundled I/Q wires from the cable clip (1400-3014) that is located on the rear of the front panel assembly, as shown in

item 5 of [Figure 4-9](#).

3. Use the 9/16 deep socket nut driver to remove the four 15/32-32 hex nuts (2950-0035) that secure the I/Q baseband connectors to the front panel. See item 1 in [Figure 4-10](#).

**Figure 4-10 Front Panel Baseband I/Q Connectors**

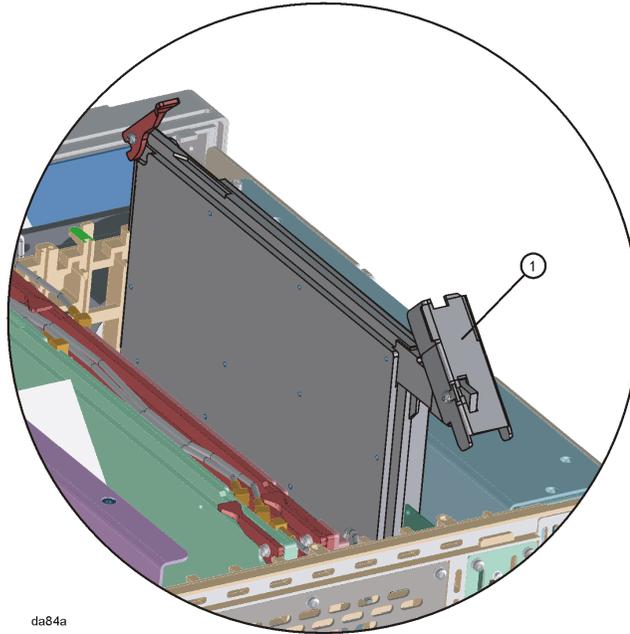


4. Remove the baseband I/Q cable connectors through the rear of the front panel assembly.

#### **Step 5. Remove the A7 assembly from the instrument**

1. Carefully pull up on the baseband I/Q assembly ejectors to detach the A7 assembly from the motherboard.
2. Unhook the front and rear ejectors under the tabs that are located on the rear frame and mid web of the instrument.
3. Slide the A7 assembly out of the front and rear guides of slot 0. (Note: if the A7 assembly was retrofitted into the instrument, the A7 assembly may be located in slot 1; in this case the A7 assembly will have a standard rear ejector, not the large rear ejector shown as item 1 in [Figure 4-11](#)).

**Figure 4-11**      **A7 Assembly with Baseband I/Q Rear Ejector**



## Replacement

### Step 1. Insert the A7 assembly into the instrument

1. Slide the A7 assembly into the front and rear guides of slot 0 ( Note: if the A7 assembly was retrofitted into the instrument, the A7 assembly may be located in slot 1; in this case the A7 assembly will have a standard rear ejector, not the large rear ejector shown as item 1 in [Figure 4-11](#)).
2. Carefully insert the baseband I/Q assembly ejectors into from the motherboard.
3. Hook the front and rear ejectors under the tabs that are located on the rear frame and mid web of the instrument.

### Step 2 Attach the Baseband I/Q Cable Assembly

1. Connect the I,  $\bar{I}$ , Q, and  $\bar{Q}$  cables to their respective connectors on the top-front of the A7 assembly, if they are not already connected.
2. Attach the four, bundled I/Q wires to the cable clip (1400-3014) that is located on the rear of the front panel assembly, as shown in item 5 of [Figure 4-9](#).
3. Insert the I,  $\bar{I}$ , Q and  $\bar{Q}$  cables into their respective openings in the rear of the front panel assembly. These openings are labelled.
4. Use the 9/16 deep socket nut driver to secure the four 15/32-32 hex nuts (2950-0035) to the I,  $\bar{I}$ , Q and  $\bar{Q}$  connectors on the front panel. See item 1 in [Figure 4-10](#).

## A10 Digital IF and A12 Analog IF Assemblies

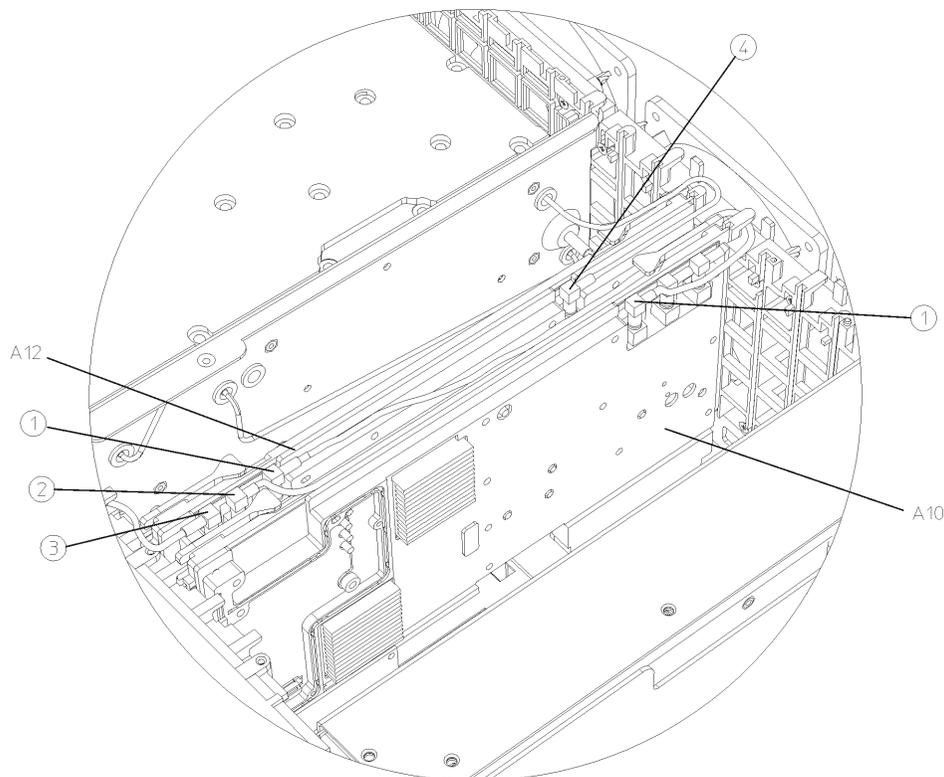
**CAUTION**

Use ESD precautions when performing this replacement procedure.

### Removal

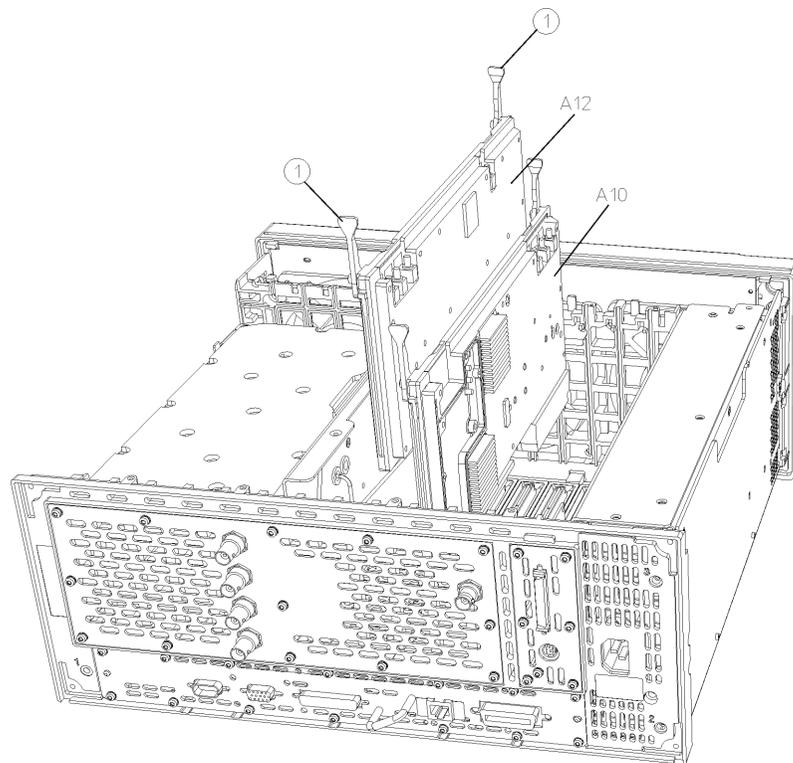
1. Remove the instrument top brace. Refer to the “[Top Brace](#)” removal procedure.
2. Refer to [Figure 4-12](#). Remove the coaxial cables at the locations indicated. To remove the A10 digital IF assembly, disconnect the cable (1) from the A10 board. To remove the A12 analog IF assembly, disconnect the cables (1), (2), (3), and (4) from the A12 board.
3. Refer to [Figure 4-13](#). Carefully pull up on the ejectors (1) to disengage the assembly from the connectors and remove from the deck.

**Figure 4-12** Cable Locations



sa848a

**Figure 4-13** Digital IF and Analog IF Assembly Removal



sa811a

## Replacement

1. Slide the assembly down in the correct front and rear guide slots. Refer to the silkscreened locations on the motherboard or the top brace to ensure correct placement of the assemblies. Hook the ejectors under the tabs on the rear frame and mid web. Carefully push down on the ejectors to mate the assembly with the motherboard connectors.
2. Reconnect the coaxial cables that were removed. Replace the cables to the correct connectors. Refer to the silkscreen on the instrument top brace for correct placement of cables. Take care to dress the cables correctly so they aren't pinched when the top brace is replaced.
3. Replace the instrument top brace. Refer to the "Top Brace" replacement procedure.

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## A14 Fan Control Board

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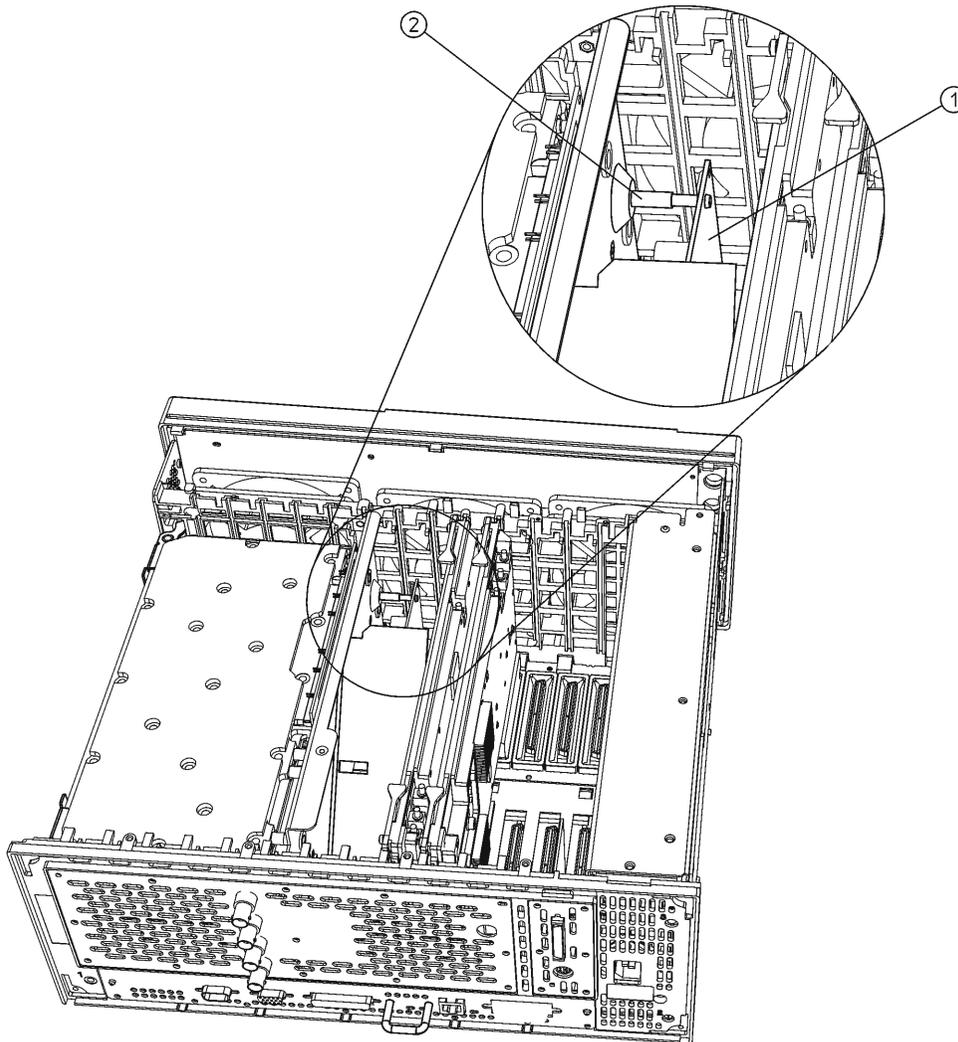
**CAUTION**

Use ESD precautions when performing this replacement procedure.

### Removal

1. Remove the instrument top brace. Refer to the “[Top Brace](#)” removal procedure.
2. The A14 fan control board (1) is attached to the center-web by a snap-top standoff (2). Refer to [Figure 4-14](#). Carefully pull the fan control board away from the daughter board until it unsnaps from this standoff.
3. Pull up on the fan control board to disengage from the motherboard.

**Figure 4-14** Fan Control Board Removal



sa813a

## Replacement

1. Place the fan control board into position and carefully push down to mate with the motherboard connector.
2. Push the top of the fan control board towards the daughter board until it snaps onto the snap-top standoffs.
3. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

---

## A15 Daughter Board

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**CAUTION** Use ESD precautions when performing this replacement procedure.

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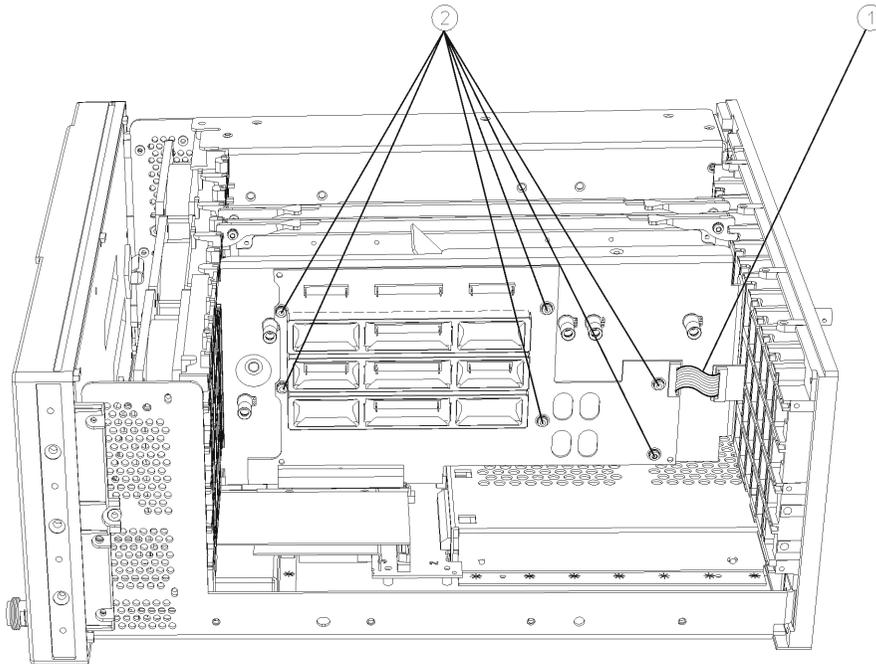
**NOTE** The A15 daughter board is attached to part of the frame called the center-web. The daughter board can be removed from the instrument without removing the center-web.

---

### Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Remove the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
3. Refer to [Figure 4-15](#). Unplug the flat flex cable (1) from the rear of the daughter board. It is necessary to unlock the connector before removing the cable.
4. Using the T-10 driver, remove the 6 screws (2) that secure the daughter board to the center-web.
5. Carefully pull up on the daughter board until the connector is disengaged from the motherboard. Remove the board from the deck.

**Figure 4-15**      **Daughter Board Removal**



sa815a

## Replacement

1. Position the daughter board connector over the motherboard connector and carefully press down to mate the connectors.
2. Refer to [Figure 4-15](#). Using the T-10 driver, replace the 6 screws that secure the daughter board to the center web. For alignment purposes, tighten the screws marked with a #1 and a #2 (marked on the daughter board) first, then tighten the remaining screws. Torque to 9 inch pounds.
3. Reconnect the flat flex cable to the daughter board. Lock the connector.
4. Replace the A17, A18, and A19 assemblies. Refer to the “[A17 RF, A18 Reference, and A19 Synthesizer Assemblies](#)” replacement procedure.
5. Replace the instrument top brace. Refer to the “[Top Brace](#)” replacement procedure.

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## A17 RF, A18 Reference, and A19 Synthesizer Assemblies

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**CAUTION** Use ESD precautions when performing this replacement procedure.

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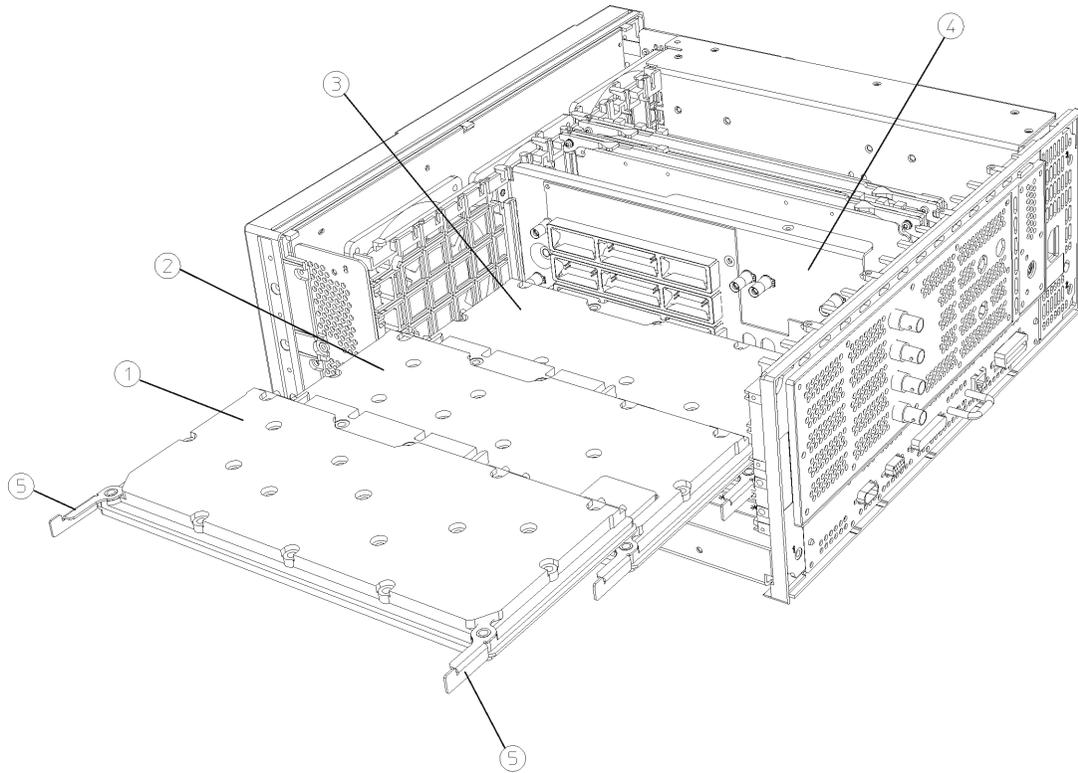
**NOTE** The A17 RF, A18 reference, and A19 synthesizer assemblies all use the same procedures for removal. Refer to [Figure 4-16](#) to locate the assembly you wish to replace. The A17 RF assembly is identified with (1), A18 reference assembly is (2), and A19 synthesizer assembly is (3).

---

### Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Carefully pull out on the ejectors (5) located on the assembly you wish to remove. Refer to [Figure 4-16](#).
3. Slide the assembly away from the daughter board/center-web (4) assembly and out of the deck.

**Figure 4-16**      **A17, A18, A19 Removal**



sa814a

## Replacement

1. Refer to [Figure 4-16](#) or the diagram printed on the top brace for correct placement of assemblies.

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### NOTE

A rebuilt A19 synthesizer assembly may require the removal of a “keying tab” before it can be inserted into the instrument.

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2. Place the assembly into the slots on the mid-web and rear frame. Hook the board ejectors over the vertical tabs.
3. Carefully slide the assembly into the daughter board and push on the ejectors to engage the connectors. Make certain the rigid cables attached to the center-web also engage the assemblies as they are installed.
4. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

---

## Mid Web/Fans

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**NOTE** The fans are attached to a part of the instrument known as the mid web. It is possible to remove a fan without removing the mid web from the instrument. The 3 fans in the instrument can be replaced individually. Depending on the fan to be replaced, it might be necessary to remove other assemblies as noted in the procedure.

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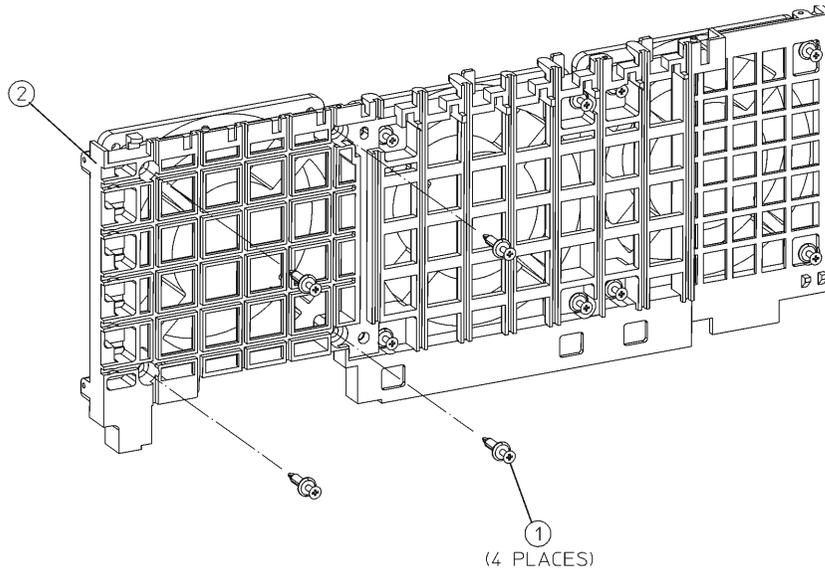
**CAUTION** Use ESD precautions when performing this replacement procedure.

---

### Fan Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Drop the front frame. Refer to the [“Drop the Front Frame”](#) procedure.
3. Remove the A6 power supply, if necessary. Refer to the [“A6 Power Supply”](#) removal procedure.
4. Remove the A14 fan control board, if necessary. Refer to the [“A14 Fan Control Board”](#) removal procedure.
5. Remove the A17, A18, and A19 boards, if necessary. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
6. Unplug the fan cable from the motherboard.
7. Refer to [Figure 4-17](#). To remove a fan, it is necessary to remove the 4 plastic rivets (1) that attach it to the mid-web (2). To do this use the Pozidriv screwdriver and a small blade screwdriver to turn and/or push respectively.
8. Once the rivets are removed, the fan can be lifted from the mid web.

**Figure 4-17 Fan Removal**



sa819a

## Fan Replacement

1. Place the new fan on the mid-web, assuring the arrow on the fan is pointing toward the mid-web and the fan cables are positioned so they won't interfere with the fan operation or airflow.
2. Install the 4 plastic rivets that secure the fan to the mid-web. With the rivets center posts raised, press the rivets through the mid web and into the fan. Press down on the center post to snap the rivets into place.
3. Replace any assemblies that were removed for access to the fan.
4. Plug the fan cables into the motherboard.
5. Replace the front frame assembly. Refer to the [“Front Frame”](#) replacement procedure.
6. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

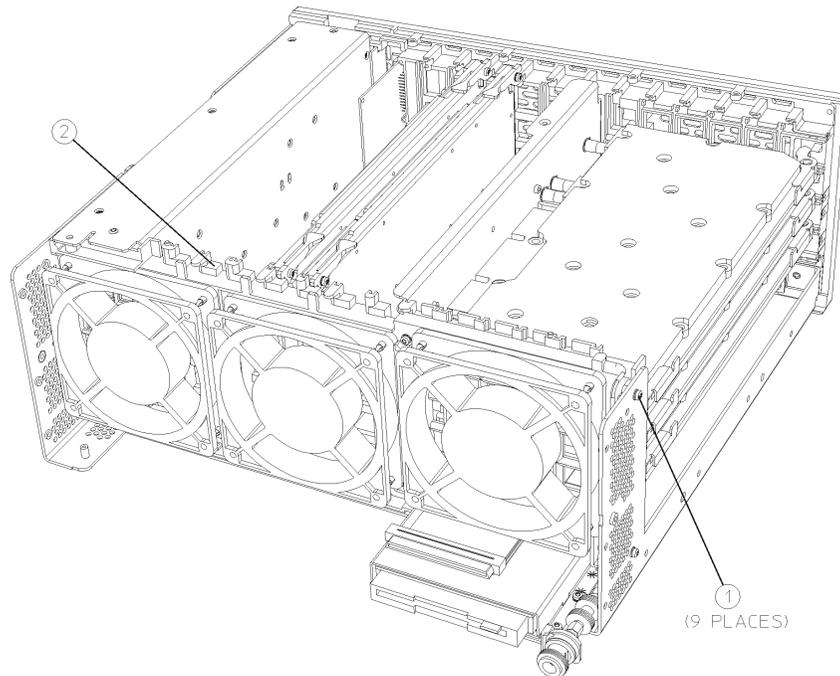
## Mid Web

To completely remove the mid web from the instrument, perform the following steps:

### Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Drop the front frame. Refer to the [“Drop the Front Frame”](#) procedure.
3. Remove the A6 power supply. Refer to the [“A6 Power Supply”](#) removal procedure.
4. Remove the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
5. Remove the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) removal procedure.
6. Remove the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) removal procedure.
7. Disengage the semi-rigid cable from the mid web by removing the RF input bracket from the deck and carefully rotating the cable/bracket assembly up. Refer to the [“RF Input Connector”](#) removal procedure. Using the T-10 driver remove the 2 screws that secure the bracket to the deck.
8. Undress the coaxial cables from the cable guide in the mid-web.
9. Refer to [Figure 4-18](#). Using the T-10 driver, remove the 9 screws (1) that secure the mid-web/fan assembly (2) to the deck. Note this includes 3 screws on the bottom of the instrument. Refer to [Figure 4-20 on page 200](#) and remove the 3 screws (1).
10. Unplug the 3 fan connectors from the motherboard.
11. Lift the mid-web/fan assembly from the deck.

**Figure 4-18 Mid-Web/Fan Assembly Removal**



sa846a

### Replacement

1. Using the T-10 driver, replace the 9 screws that secure the mid-web/fan assembly to the deck. Torque to 9 inch pounds. Be careful to avoid pinching the fan cables.
2. Plug the 3 fan connectors into the motherboard.
3. Carefully rotate the semi-rigid cable down and place the cable under the 2 hooks on the mid web. Using the T-10 driver, secure the RF input bracket to the deck with the 2 screws. Torque to 9 inch pounds.
4. Replace the power supply. Refer to the [“A6 Power Supply”](#) replacement procedure.
5. Replace the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) replacement procedure.
6. Replace the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) replacement procedure.
7. Replace the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) replacement procedure.
8. Redress the coaxial cables in the mid-web.
9. Replace the front frame assembly. Refer to the [“Front Frame”](#) replacement procedure.

10. Replace the instrument top brace. Refer to the “Top Brace” replacement procedure.

## A21 Motherboard

Removing the motherboard requires the removal of all the other assemblies in the instrument. Take care to note the locations of cables and screws for correct placement during reassembly.

---

**CAUTION** Use ESD precautions when performing this replacement procedure.

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**NOTE** The motherboard assembly consists of the A21 motherboard and the MP35 motherboard shield. A replacement motherboard does not include the shield, so when you change a faulty motherboard you must transfer the shield to the new motherboard.

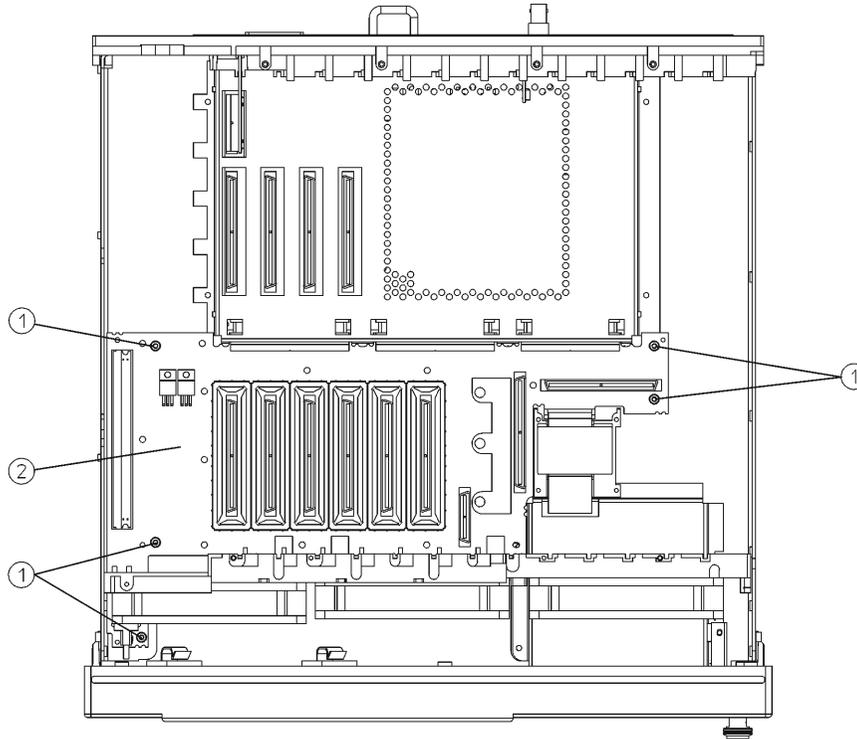
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### Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Remove the front frame. Refer to the [“Front Frame”](#) removal procedure.
3. Remove the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
4. Remove the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) removal procedure.
5. Remove the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) removal procedure.
6. Remove the A6 assembly. Refer to the [“A6 Power Supply”](#) removal procedure.
7. Remove the A22 assembly. Refer to the [“A22 Processor Assembly”](#) removal procedure.
8. Remove the mid-web/fan assembly. Refer to the [“Mid Web/Fans”](#) removal procedure.
9. Remove the A15 daughter board/center-web assembly. Refer to [“Center Web Cables W9, W11, and W12”](#) removal procedure.
10. Remove the W8 front panel ribbon cable from the motherboard. Detach the disk drive cover (refer to [Figure 4-5 on page 178](#)) and remove the W10 disk drive flat flex cable from the motherboard.
11. Using the T-10 driver, remove the 7 screws (2) from the bottom of the instrument as indicated in [Figure 4-20](#).
12. Refer to [Figure 4-19](#). Remove the 5 screws (1) securing the A21

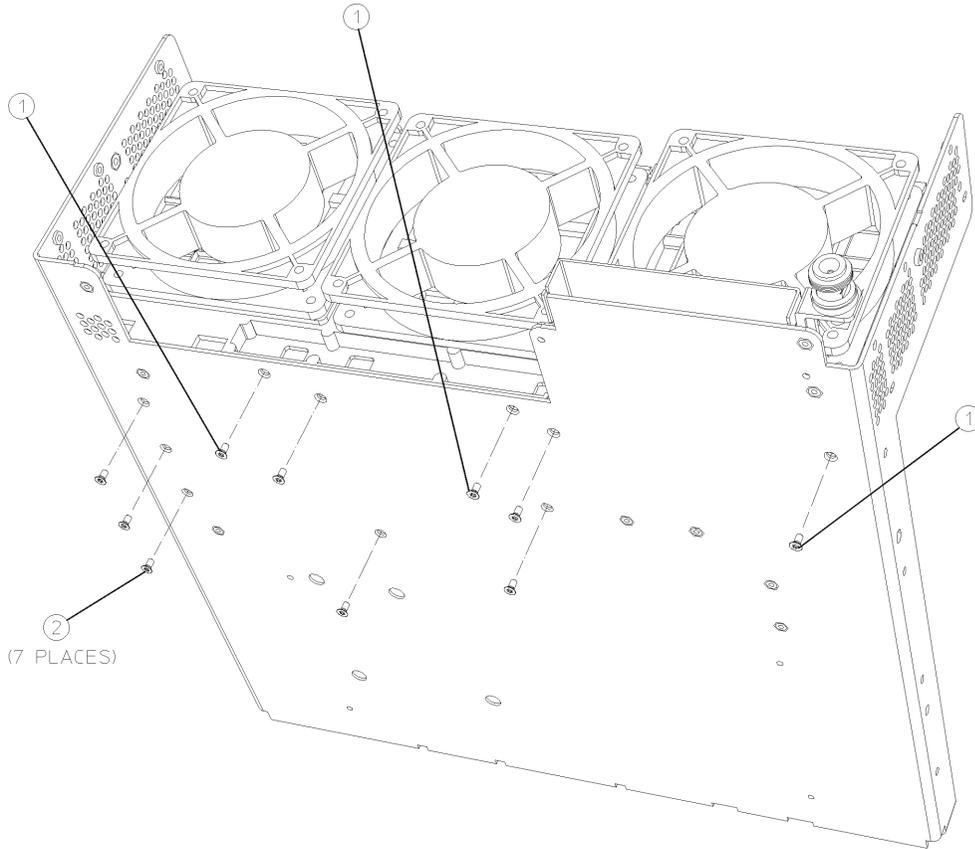
motherboard (2) to the deck. Lift the motherboard out of the deck.  
13. Refer to [Figure 4-21](#). Remove the shield (1) from the motherboard (2) by removing the 13 screws (3) with the T-10 driver.

**Figure 4-19**      **Motherboard Removal**



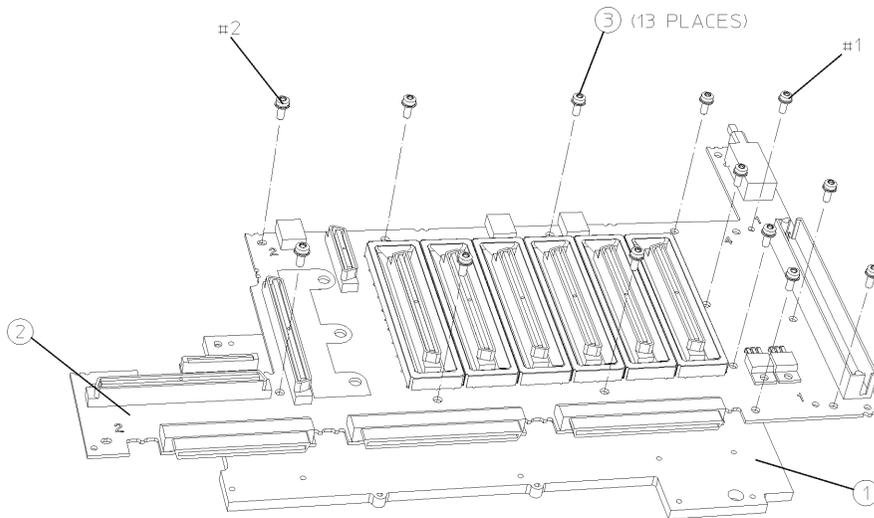
sa816a

**Figure 4-20**      **Bottom Screws**



sa883a

**Figure 4-21**      **Motherboard Shield Removal**



sa843a

## Replacement

1. Using the T-10 driver, assemble the motherboard to the motherboard shield with the 13 screws (1) indicated in [Figure 4-21](#). For alignment purposes, tighten the screws marked on the mother board with a #1 and a #2 first, then tighten the remaining screws. Torque to 9 inch pounds.
2. Refer to [Figure 4-19](#). Place the motherboard into position in the deck. Using the T-10 driver, replace the screws that secure the mother board to the deck. For alignment purposes, tighten the screws in the order marked on the motherboard #1 and #2 first, then tighten the #3, #4, and #5 screws. Torque to 9 inch pounds.
3. Using the T-10 driver, replace the 7 screws on the bottom of the instrument as indicated in [Figure 4-20](#). Torque to 9 inch pounds.
4. Reattach the W10 flat flex cable and W8 ribbon cable to the motherboard.
5. Replace the A15 daughter board/center-web assembly. Refer to the [“A15 Daughter Board”](#) replacement procedure.
6. Replace the mid-web/fan assembly. Refer to the [“Mid Web/Fans”](#) replacement procedure.
7. Replace the A6 assembly. Refer to the [“A6 Power Supply”](#) replacement procedure.
8. Replace the A22 assembly. Refer to the [“A22 Processor Assembly”](#) replacement procedure.
9. Replace the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) replacement procedure.
10. Replace the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) replacement procedure.
11. Replace the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) replacement procedure.
12. Replace the front frame assembly. Refer to the [“Front Frame”](#) replacement procedure.
13. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

## A22 Processor Assembly

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**CAUTION** Use ESD precautions when performing this replacement procedure.

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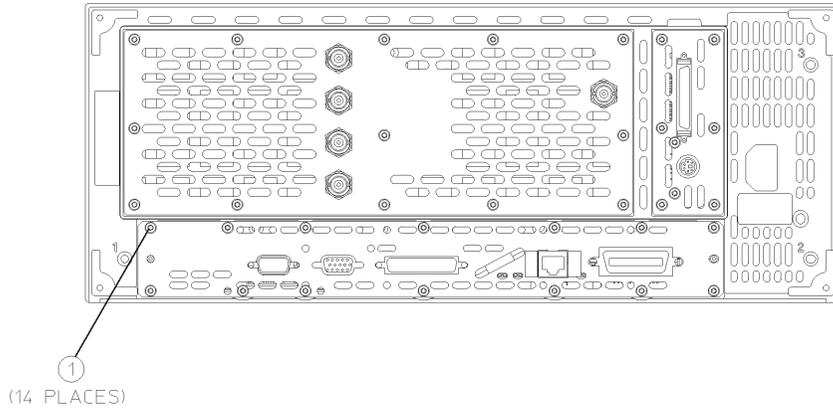
**NOTE** The processor assembly consists of three separate boards: the A22 CPU (processor) board, the A22A1 DRAM board, and the A22A2 Flash board. Earlier instruments (serial prefix US3948 and below) also have an A22A3 GP-IB capacitor board. The Flash memory board contains data that is pertinent to your particular instrument. If you are changing a faulty CPU board, you must transfer the two smaller boards over to the new CPU board. Refer to the “[A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards](#)” removal and replacement procedure. After the boards are installed on the new processor board, refer to the procedure in [Chapter 5](#) for information on transferring data to the new processor.

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### Removal

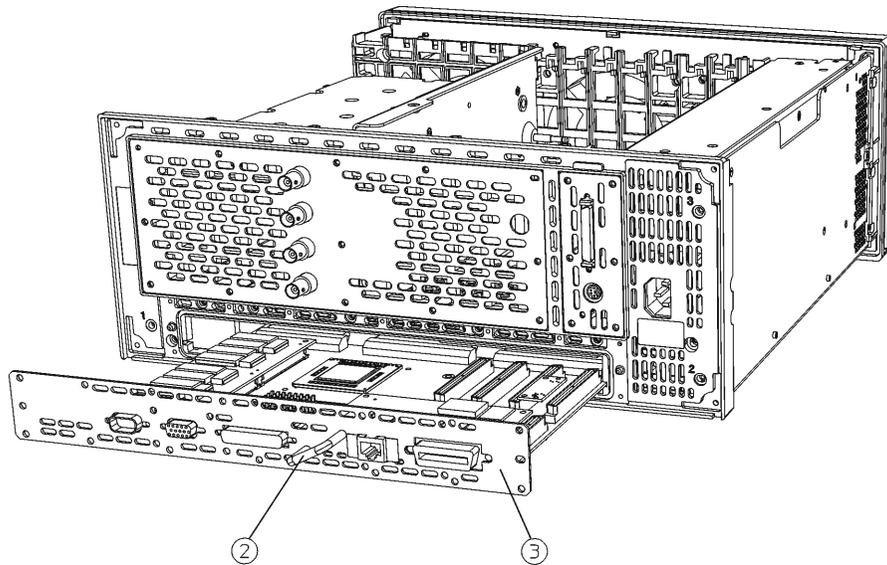
1. Remove the instrument top brace. Refer to the “[Top Brace](#)” removal procedure.
2. Remove the A10 assembly. Refer to the “[A10 Digital IF and A12 Analog IF Assemblies](#)” removal procedure.
3. Remove the A7 assembly (if installed). Refer to the “[A7 Baseband I/Q Assembly \(Option B7C\)](#)” removal procedure.
4. Remove the A25 board. Refer to the “[A25 SCSI Board](#)” removal procedure.
5. Using the T-10 driver, remove the 14 screws (1) from the rear panel as shown in [Figure 4-22](#).
6. Read the **Warning** on the rear dress panel before removing the processor assembly from the deck.
7. Refer to [Figure 4-23](#). Use the handle (2) to slide the A22 assembly (3) out of the deck by pulling towards the rear of the instrument.

**Figure 4-22 Processor Screw Locations**



sa818a

**Figure 4-23 Processor Assembly Removal**



sa817a

## Replacement

1. Secure the A22A1 DRAM and A22A2 Flash assemblies onto the new processor board. Refer to the “[A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards](#)” replacement procedure. The A22A3 GP-IB capacitor board is not required on the new processor board. Discard the A22A3 capacitor board.
2. Slide the A22 processor assembly into the deck. Keep the assembly flat as you slide it into the deck to avoid damage. Fully engage the connectors by pushing on the CPU dress panel.
3. Refer to [Figure 4-22](#). Using the T-10 driver, secure the assembly to the rear frame with the 14 screws (1). Torque to 9 inch pounds.
4. Replace the A25 board. Refer to the “[A25 SCSI Board](#)” replacement procedure.
5. Replace the A10 assembly. Refer to the “[A10 Digital IF and A12 Analog IF Assemblies](#)” replacement procedure.
6. Replace the A7 assembly (if installed). Refer to the “[A7 Baseband I/Q Assembly \(Option B7C\)](#)” replacement procedure.
7. Replace the instrument top brace. Refer to the “[Top Brace](#)” replacement procedure.

## A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards

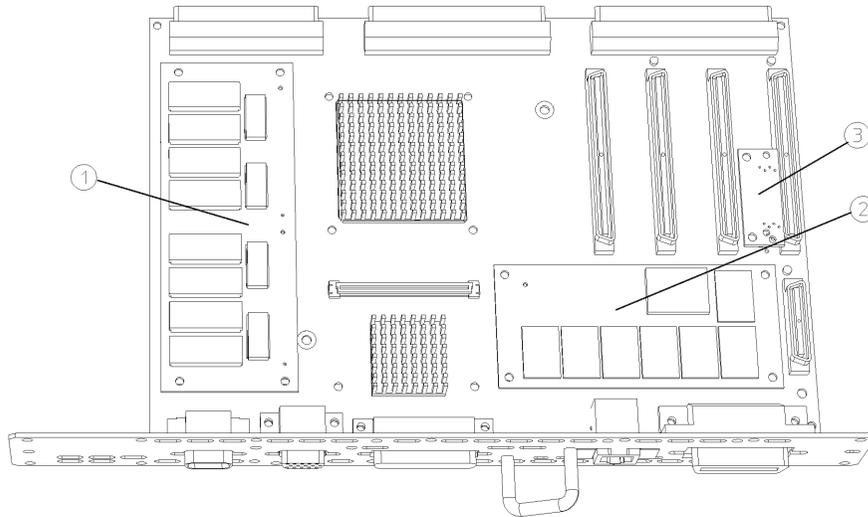
**CAUTION**

Use ESD precautions when performing this replacement procedure.

### Removal

1. Remove the instrument top brace. Refer to the “[Top Brace](#)” removal procedure.
2. Remove the A22 assembly. Refer to the “[A22 Processor Assembly](#)” removal procedure.
3. Refer to [Figure 4-24](#). Pinch the standoffs and carefully pull up on either the A22A1 DRAM board (1), or the A22A2 Flash board (2) to disengage it from the processor assembly.
4. Instruments with serial prefix US3948 and below also have the A22A3 GP-IB capacitor board. To remove the A22A3 GP-IB capacitor board (3) carefully pull up on the board to disengage from the processor board connector.

**Figure 4-24** A22A1, A22A2, and A22A3 Board Removal



sa844a

## Replacement

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**NOTE**

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Replacement DRAM and Flash boards are packaged with replacement standoffs.

1. To replace the DRAM or Flash boards, align the connectors and pins of the board over the holes and press down to seat the board.
2. If you are replacing an earlier A22 CPU assembly with a newer one (E4406-60060), the GP-IB capacitor board is not required. Discard the old A22A3 assembly and proceed to step 3. If you have an earlier A22 CPU assembly, insert the GP-IB capacitor board into the J8 connector on the processor board and press down to seat. Make sure the board is fully seated in the connector to avoid shorting to the deck.
3. Replace the A22 assembly. Refer to the [“A22 Processor Assembly”](#) replacement procedure.
4. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

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## A25 SCSI Board

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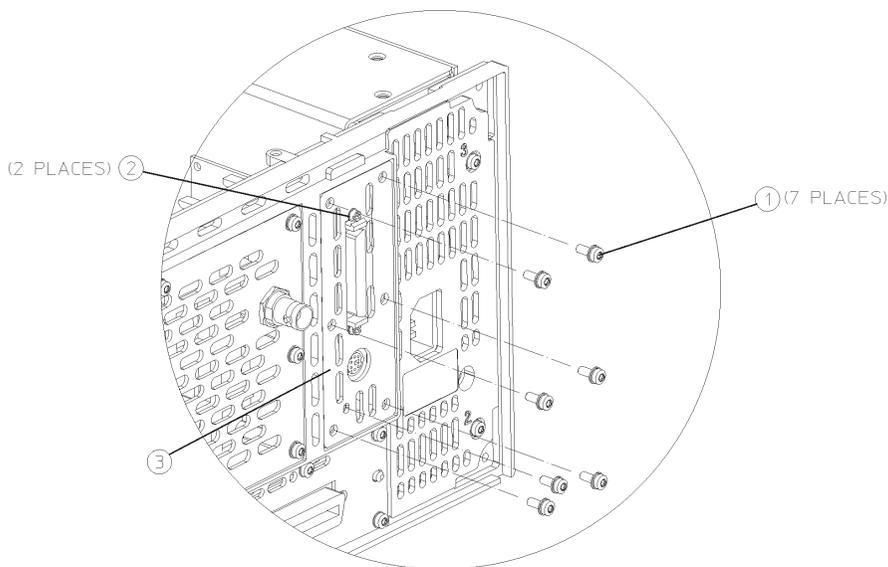
### CAUTION

Use ESD precautions when performing this replacement procedure.

### Removal

1. Refer to [Figure 4-25](#). At the rear of the instrument, use a T-10 driver to remove the 7 screws (1) securing the small panel to the frame.
2. The A25 board can be removed through the rear panel by pulling up on the board to disengage it from the CPU board.
3. If the board hits the rear frame and will not come out, using the flat blade screwdriver, remove the 2 screwlocks (2) that secure the dress panel (3) to the A25 board.

**Figure 4-25** SCSI Board Removal



sa845a

### Replacement

1. Replace the A25 board by inserting it into the opening on the rear frame. Carefully position the board in the CPU board connector and push down to mate.
2. Replace the panel onto the frame by replacing the 7 screws using a T-10 driver. Torque to 9 inch pounds.
3. If the dress panel was removed in step 3 (above), replace the 2 screwlocks to secure the dress panel to the A25 board using the flat blade screwdriver. Torque to 6 inch pounds.

## A27 Rear Panel Connector Board

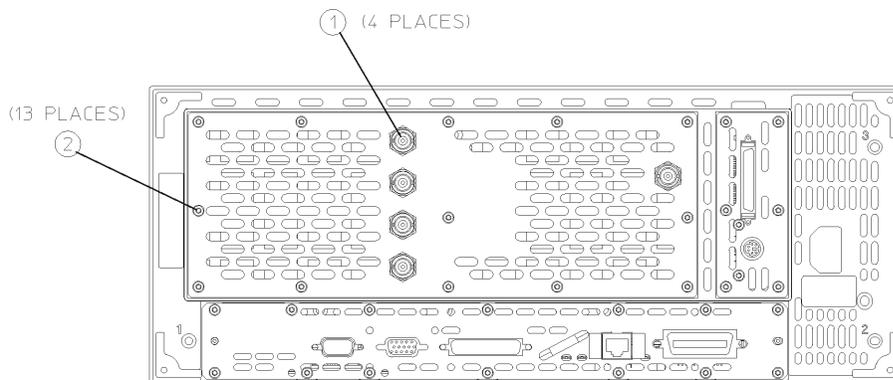
**CAUTION**

Be careful to not scratch the dress panel when removing or replacing this part.

### Removal

1. Remove the instrument outer case. Refer to the “[Instrument Outer Case](#)” removal procedure.
2. Remove the top brace. Refer to the “[Top Brace](#)” removal procedure.
3. Remove the A17, A18, and A19 assemblies. Refer to “[A17 RF, A18 Reference, and A19 Synthesizer Assemblies](#)” removal procedure.
4. Disconnect the ribbon cable from the daughterboard.
5. Refer to [Figure 4-26](#). Using the 9/16 open-end wrench, remove the four nuts (1) that secure the rear panel connectors to the rear frame.
6. Using the T-10 driver, remove the 13 screws (2) to remove the rear dress panel.

**Figure 4-26** Rear Panel Connector Board Removal



sa864a

## Replacement

1. Mount the rear panel connector board to the rear dress panel. Using the 9/16 open-end wrench, replace the four nuts that secure the rear panel connectors to the rear dress panel. Torque to 21 inch pounds.
2. Using the T-10 driver, replace the 13 screws to secure the rear dress panel to the rear frame. For alignment purposes, tighten the screws silkscreened with a #1 and a #2 first. Torque to 9 inch pounds.
3. Reconnect the ribbon cable to the daughterboard.
4. Replace the A17, A18, and A19 assemblies. Refer to “[A17 RF, A18 Reference, and A19 Synthesizer Assemblies](#)” replacement procedure.
5. Replace the top brace. Refer to the “[Top Brace](#)” removal procedure.
6. Replace the instrument outer case. Refer to the “[Instrument Outer Case](#)” removal procedure.

## Rear Frame

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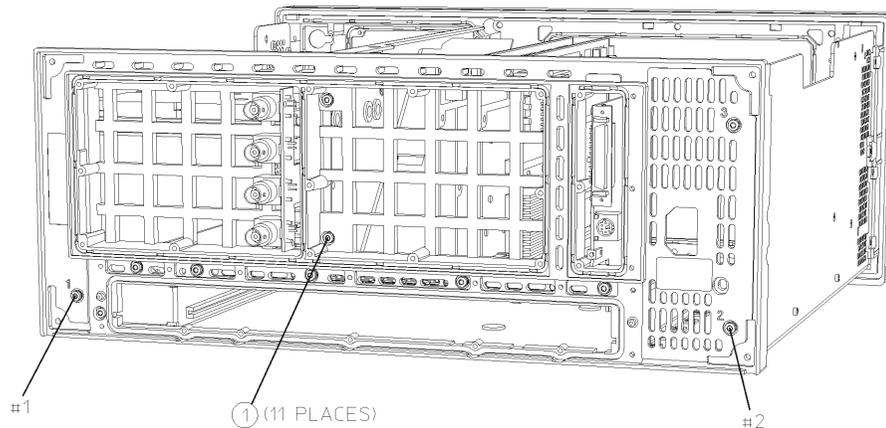
**CAUTION**

Use ESD precautions when performing this replacement procedure.

### Removal

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Remove the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
3. Remove the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) removal procedure.
4. Remove the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) removal procedure.
5. Remove the A25 SCSI board. Refer to the [“A25 SCSI Board”](#) removal procedure.
6. Remove the A22 processor assembly. Refer to the [“A22 Processor Assembly”](#) removal procedure.
7. Detach the flat flex cable from the daughter board.
8. Remove the rear dress panel, which includes the rear panel connector board and the External Trigger Input cable. Using the T-10 driver, remove the 13 screws marked with (2) as shown in [Figure 4-26 on page 208](#).
9. Refer to [Figure 4-27](#). Using a T-10 driver, remove the 11 screws (1) that secure the rear frame to the deck. Remove the rear frame from the deck.

**Figure 4-27 Rear Frame Removal**



sa834a

## Replacement

1. Place the rear frame in position on the deck.
2. Using the T-10 driver, replace the 11 screws to secure the rear frame to the deck. For alignment purposes, tighten the screws marked with a #1 and a #2 in [Figure 4-27](#). Torque to 9 inch pounds.
3. Replace the rear dress panel and reroute the External Trigger Input cable. Using the T-10 driver, replace the 13 screws that secure the dress panel to the rear frame. For alignment purposes, tighten the screws marked with a #1 and a #2 (silkscreened on the dress panel) first. Torque to 9 inch pounds.
4. Re-attach the flat flex cable from the daughter board to the rear panel connector board.
5. Replace the A22 processor assembly. Refer to the [“A22 Processor Assembly”](#) replacement procedure.
6. Replace the A25 SCSI board. Refer to the [“A25 SCSI Board”](#) replacement procedure.
7. Replace the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) replacement procedure.
8. Replace the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) replacement procedure.
9. Replace the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) replacement procedure.
10. Replace the instrument top brace. Refer to the [“Top Brace”](#) replacement procedure.

## Center Web Cables W9, W11, and W12

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**CAUTION** Use ESD precautions when performing this replacement procedure.

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**NOTE** When ordering a replacement center web cable, W9, W11, or W12, it is necessary to also order the cable retainer and snap ring. Refer to [Table 3-6 on page 138](#) for the part numbers.

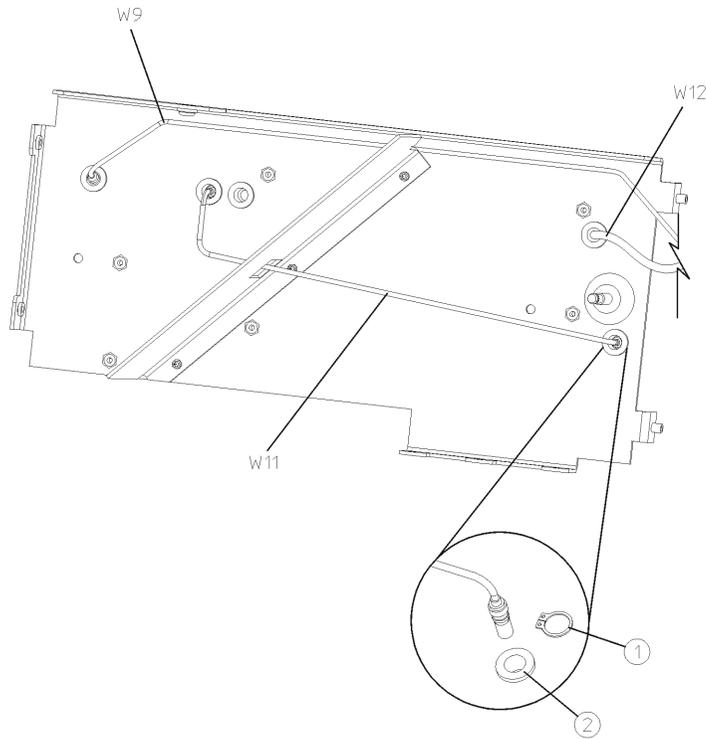
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### Removal and Replacement

1. Remove the instrument top brace. Refer to the [“Top Brace”](#) removal procedure.
2. Remove the A10 and A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) removal procedure.
3. Remove the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) removal procedure.
4. Remove the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) removal procedure.
5. Refer to [Figure 4-28](#). To remove a cable from the center web, it is necessary to first remove the snap ring (1). Use the snap ring tool to separate the snap ring and remove it from the cable retainer.
6. Once the snap ring is removed, the cable and cable retainer (2) can be pulled away from the center web. To remove the 21.4 MHz cable (W12), it is necessary to disconnect the cable from the A10 analog IF assembly. To remove the RF input cable (W9), it is also necessary to disconnect the cable from the input connector/attenuator assembly. Refer to the [“RF Input Connector”](#) removal procedure.
7. When replacing a cable into the center web, first secure the cable retainer in the proper place in the center web with the snap ring. The cable end can now be located in the cable retainer and snapped into place. Refer to [Figure 4-28](#) for the proper placement of cables.
8. Replace the A10 and the A12 assemblies. Refer to the [“A10 Digital IF and A12 Analog IF Assemblies”](#) replacement procedure.
9. Replace the A7 assembly (if installed). Refer to the [“A7 Baseband I/Q Assembly \(Option B7C\)”](#) replacement procedure.
10. Replace the A17, A18, and A19 assemblies. Refer to the [“A17 RF, A18 Reference, and A19 Synthesizer Assemblies”](#) replacement procedure.

11. Replace the instrument top brace. Refer to the “Top Brace” replacement procedure.

**Figure 4-28**      **Center Web Cable Removal**



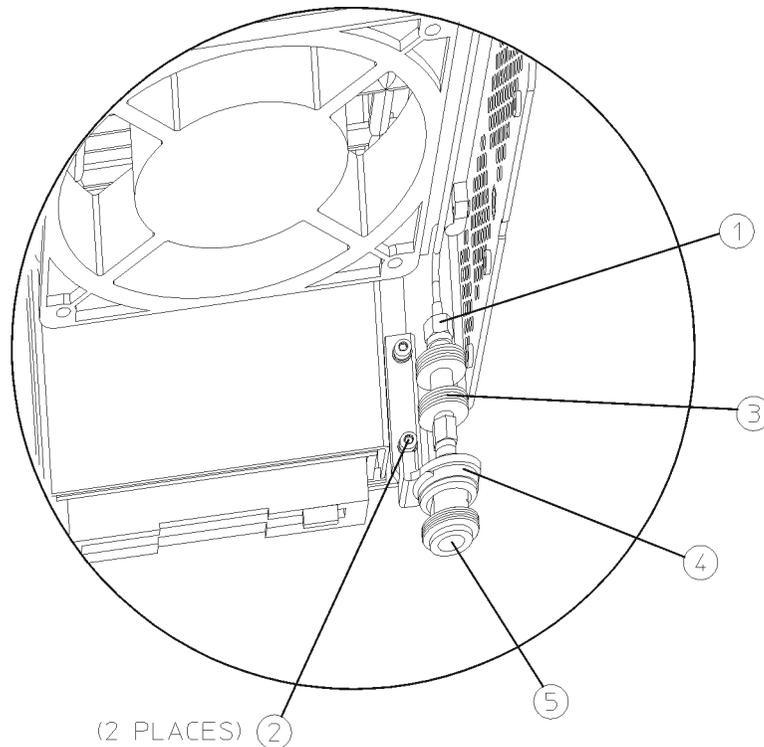
sa888a

## RF Input Connector

### Removal

1. Remove the instrument outer case. Refer to the “[Instrument Outer Case](#)” removal procedure.
2. Remove the front frame. Refer to the “[Front Frame](#)” removal procedure.
3. Refer to [Figure 4-29](#). Using a 5/16 inch wrench, disconnect the semi-rigid cable (1) from the attenuator/connector.
4. Using the T-10 driver, remove the 2 screws (2) that secure the input connector bracket to the deck.
5. Remove the attenuator/connector from the instrument.
6. Separate the attenuator (3) from the input connector (5) using a 5/16 inch wrench.
7. Remove the connector from the bracket (4) using a 9/16 inch wrench.

**Figure 4-29** RF Input Connector



## Replacement

1. Attach the new connector to the bracket. Torque to 120 inch pounds.
2. Attach the attenuator to the input connector. Torque to 10 inch pounds.
3. Replace the attenuator/connector into the instrument.
4. Using the T-10 driver, replace the 2 screws that secure the input connector bracket to the deck. Torque to 9 inch pounds.
5. Using a 5/16 inch wrench, reconnect the semi-rigid cable to the attenuator/connector. To avoid twisting the cable, hold onto it during tightening. Torque to 10 inch pounds.
6. Replace the front frame. Refer to the “[Front Frame](#)” replacement procedure.
7. Replace the instrument outer case. Refer to the “[Instrument Outer Case](#)” removal procedure.

## Front Frame Subassemblies

In order to remove any of the following subassemblies, it is necessary to drop the front frame assembly from the main deck. Refer to the “[Drop the Front Frame](#)” procedure. It will also be necessary to remove the front shield from the front frame assembly. Refer to [Figure 4-30](#).

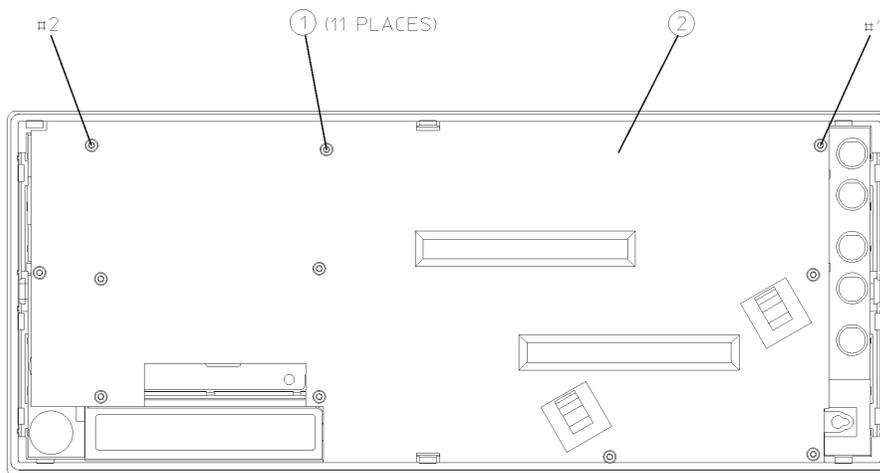
Remove the cables from the cable clamps. Using the T-10 driver, remove the 11 screws (1) securing the front shield (2) to the front frame. Lift the shield from the front frame.

After the subassembly is changed, replace the front shield using the 11 screws removed earlier. For alignment purposes, tighten the screws marked with #1 and #2 first (silkscreened on the shield), then tighten the remaining screws. Torque to 9 inch pounds. Reconnect the front frame to the deck. Refer to the “[Front Frame](#)” replacement procedure.

**CAUTION**

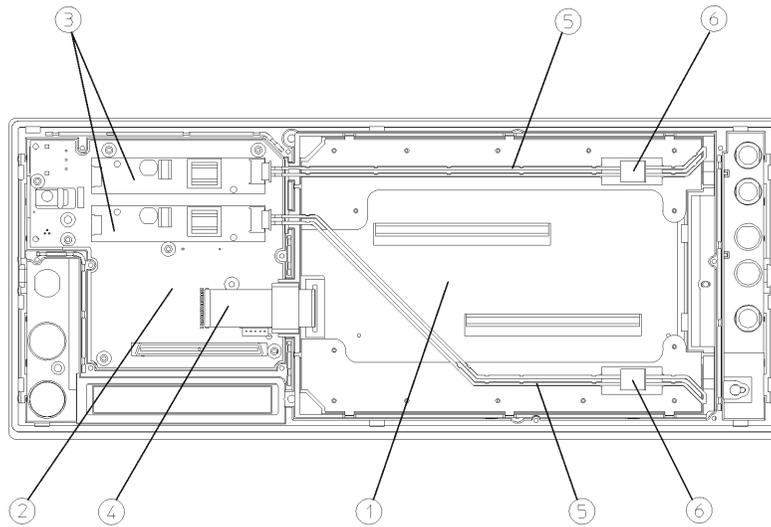
Use ESD precautions when performing the following replacement procedures.

**Figure 4-30 Front Frame Shield**



sa839a

**Figure 4-31 Front Frame Subassemblies**



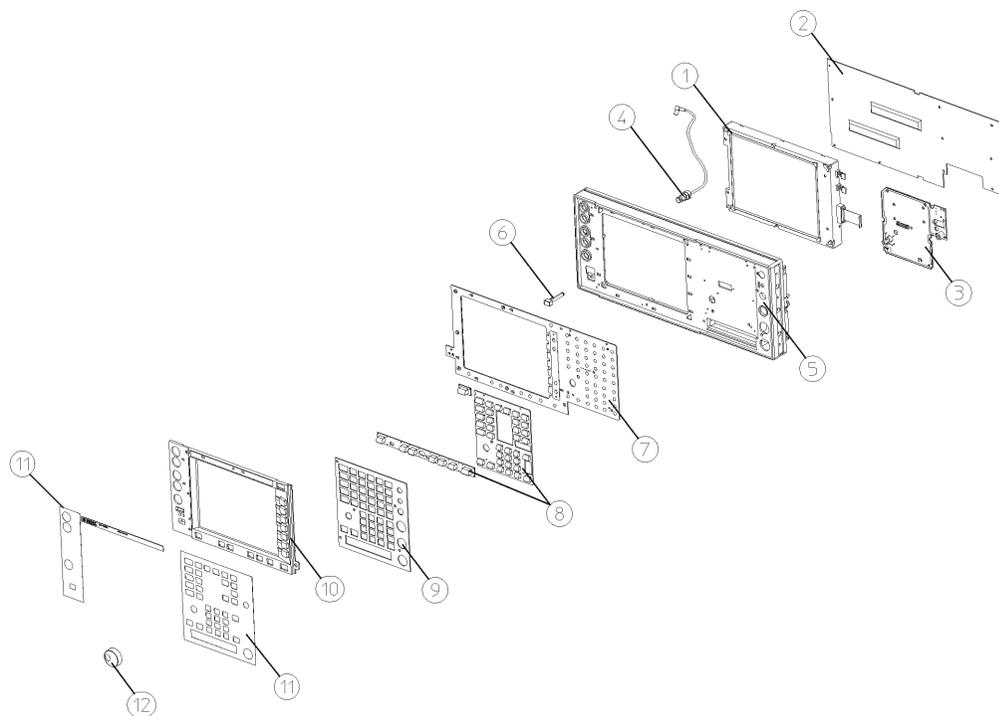
sa840a

The front frame assembly consists of the following sub-assemblies:

<b>Item</b>	<b>Description</b>
1	Display Shield Borad
2	Front Panel Interface Board
3	Inverter Boards
4	Display Ribbon Cable
5	Backlight Extension Cables
6	Backlight Connectors

## Front Frame Exploded View

**Figure 4-32** Front Frame Exploded View

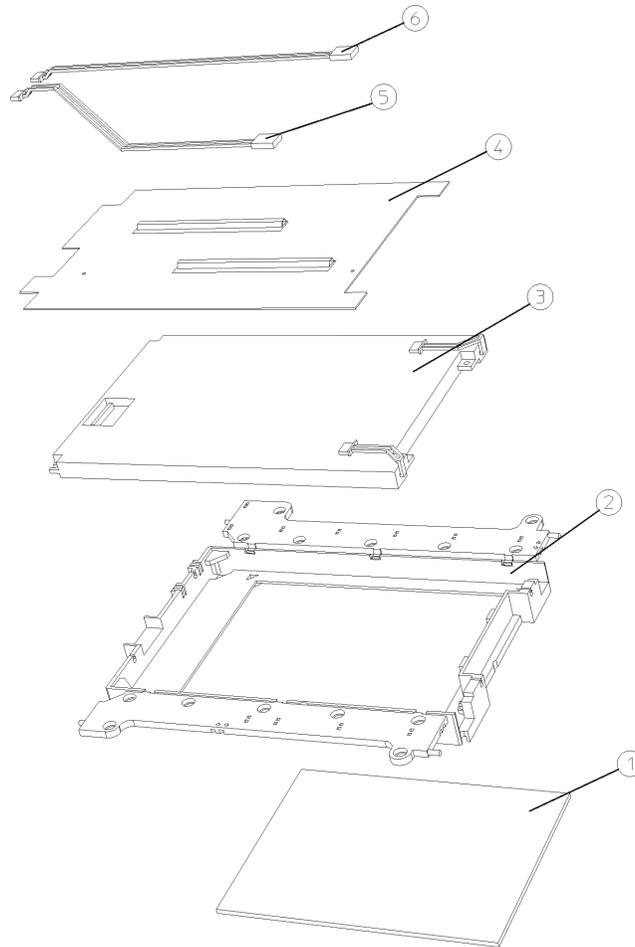


sa882a

Item	Description
1	Display Assembly
2	Front Shield
3	Front Panel Interface Assembly
4	W3 Cable, Coax Ext Trig In, Front Panel
5	Front Frame Assembly
6	Line Key (push rod)
7	Keyboard
8	Keypad
9 and 11	Dress Panel Assembly
10	Display Bezel Assembly (includes E4406-80007
12	RPG Knob
13	Front Panel Overlay, Left
14	Plug, Hole, Nylon
15	Name Plate Overlay

## A2 Display, Backlights, and Filter

**Figure 4-33** Display Parts



sa830a

Refer to [Figure 4-33](#). The display assembly consists of:

Item	Description
1	EMI filter
2	display mount
3	LCD with backlights
4	Display shield board
5	Backlight extension cable, bottom
6	Backlight extension cable, top
7	Backlight

## Display Removal

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**CAUTION**

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The new flat panel display comes with a protective plastic sheet over the glass. Remove this plastic very slowly to avoid damage due to ESD.

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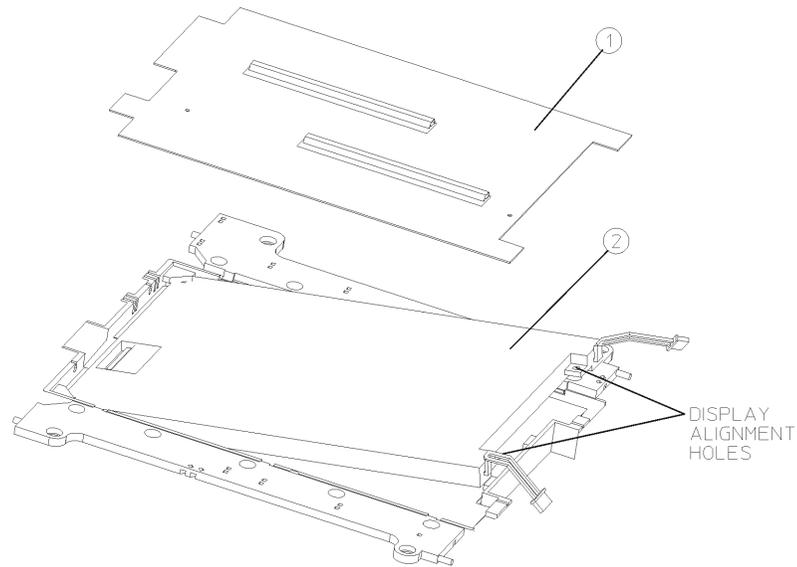
**CAUTION**

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The surface of the display is very easily scratched. Avoid touching it with your bare hands or other objects. Use a blower to remove any dust from the display surface.

1. Refer to [Figure 4-31](#). Unplug the backlight extension cables (5) from the backlight connectors (6), and pull the cables out of the rubber display mount. Carefully lay these cables away from the display.
2. Unplug the display flat flex cable (4) from the display connector. To do this, you must first pull up on both sides of the locking mechanism of the ribbon cable connector.
3. Remove the rubber mount that houses the display assembly from the front frame.
4. Refer to [Figure 4-34](#). Pull open the flaps of the rubber mount.
5. Remove the display shield board (1).
6. Now it is possible to carefully lift up on the display (2) to remove it from the rubber mount.

**Figure 4-34**      **A2 Display Replacement**



sa820a

### **Display Replacement**

1. Carefully slide the display into the rubber mount. Align the pins on the mount with the holes in the display.
2. Replace the display shield.
3. Close the flaps on the rubber mount.
4. Carefully place the display mount into position in the front frame assembly as shown in [Figure 4-31](#).
5. Plug the flat flex cable into the display connector. Push down on both sides of the locking mechanism.
6. Refer to [Figure 4-31](#). Connect the backlight extension cables (5) to the backlight connectors (6). Press the backlight extension cables into the grooves in the rubber flaps. Make sure the white wire of the backlight connector is on top, and the backlight cables are not twisted.
7. Position the display flat flex cable ferrite block in the nest of the rubber mount.

## Backlight Removal/Replacement

There are two backlight assemblies installed in the flat panel display.

---

**NOTE**

The backlight lamps should be replaced as a pair, even if only one lamp is bad. The other one might fail shortly.

1. Refer to [Figure 4-31](#). Unplug the backlight cables (5) from the backlight connectors (6)
2. Lift up on the side of the display mount with the backlight connectors coming out. It is not necessary to completely remove the display mount from the front frame to change the backlights.
3. [Figure 4-35](#) shows how the backlights slide out of the display. Carefully pull on the tab on the backlight assembly (2) to slide the backlight partially out of the display. Once the end of the backlight casing is exposed, you can pull it straight out from the display.

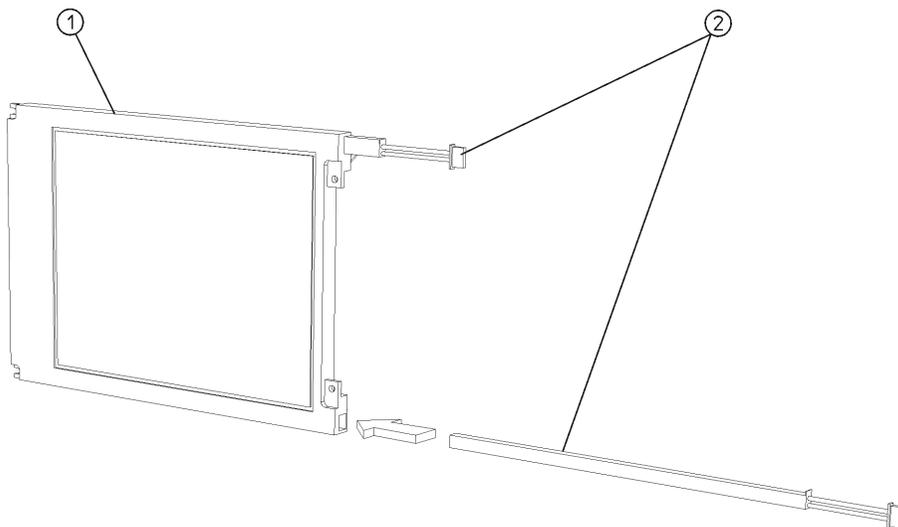
---

**NOTE**

Do not touch the bulb encased in the plastic backlight assembly.

4. Insert the new backlight assembly (2) by sliding it into the display, non-wired end first, taking care not to force it. It is keyed so it will only fit properly one way. Slide it all the way in to the end of the casing.
5. Replace the display mount into the front frame. Connect the backlight cables to the backlight connectors. Press the backlight cables into the grooves in the rubber flaps. Make sure the white wire of the backlight connector is on top, and the backlight cables are not twisted.

**Figure 4-35** Display Backlight Replacement



sa823a

## Display Filter Removal/Replacement

1. Remove the rubber mount containing the display assembly from the front frame. Refer to the “[Display Removal](#)” procedure on [page 220](#).

---

**CAUTION**

Be careful when handling the display/mount assembly outside of the front frame. The individual components are not secured in the mount and could possibly fall out of the mount unless it is held together.

---

2. Flip the display/mount assembly over and place it filter-side up on a flat surface.
3. The display filter can now be removed by pulling back on one of the corner supports (2) and lifting the filter (1) out of the mount as shown in [Figure 4-36](#).
4. When you install a new filter, take care to touch only the outside edges. Install the filter into the mount by sliding under the corner supports.

---

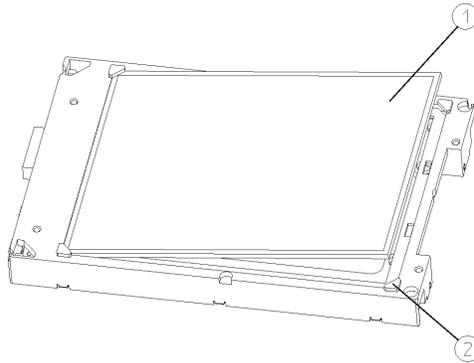
**NOTE**

Make sure the side of the filter with the silver edge is facing up, away from the display.

---

5. The display/mount assembly can now be reinstalled into the front frame. Refer to the “[Display Replacement](#)” procedure on [page 221](#).

**Figure 4-36**      **Display Filter Replacement**



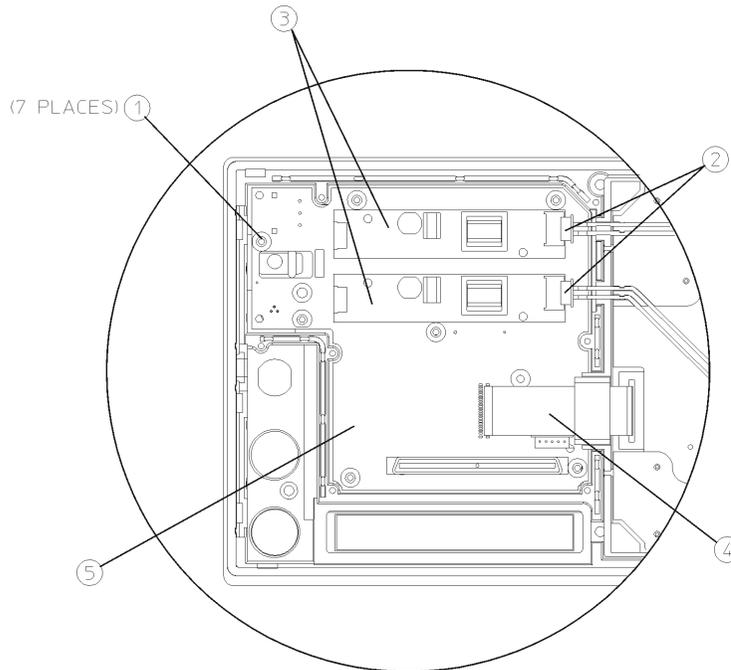
sq841a

## A3 Front Panel Interface Board

### Removal

1. Remove the RPG knob by pulling straight off of the control shaft.
2. Refer to [Figure 4-37](#). Disconnect both of the 2-wire backlight cables (2) from the inverter boards (3).
3. Unplug the display flat flex cable (4) from the front panel interface board. To do this, you must first pull up on both sides of the locking mechanism of the ribbon cable connector. If not carefully inserted, display problems may result.
4. Using the T-10 driver, remove the 7 screws (1) that secure the front panel interface board (5) to the front frame assembly.
5. Lift the front panel interface board from the front frame assembly.

**Figure 4-37**      **A3 Front Panel Interface Board Removal**



sa821a

## **Replacement**

1. Place the front panel interface board into position in the front frame assembly. Mate the connector with the connector in the keyboard.
2. Using the T-10 driver, replace the 7 screws that secure the board to the front frame. Torque to 9 inch pounds.
3. Plug the display flat flex cable into the front panel interface board connector. Push down on both sides of the locking mechanism.
4. Reconnect both of the 2-wire backlight cables.
5. Press the RPG knob onto the control shaft.

## Bezel and Keypad

### Removal

1. Remove the display/rubber mount assembly. Refer to the first section of the “[Display Removal](#)” procedure.
2. Remove the front panel interface board. Refer to the “[A3 Front Panel Interface Board](#)” removal procedure.
3. Refer to [Figure 4-38](#). Using the T-10 driver, remove the 10 screws (1) that secure the bezel and keyboard assembly to the front frame.
4. Refer to [Figure 4-39](#). The 10 screws also attach the dress panel, bezel, subpanel, keypad, and keyboard to the front frame. Take care to keep these parts in the correct order and aligned properly.
5. Lift the front frame off of the keypad/keyboard assembly.
6. The bezel and keyboard can now be separated by pressing on the pin just above the **On/Standby** LEDs on the bezel and sliding apart to unlock the tabs. The flexible keypads can be separated from the keyboard and the bezel by pulling them apart.

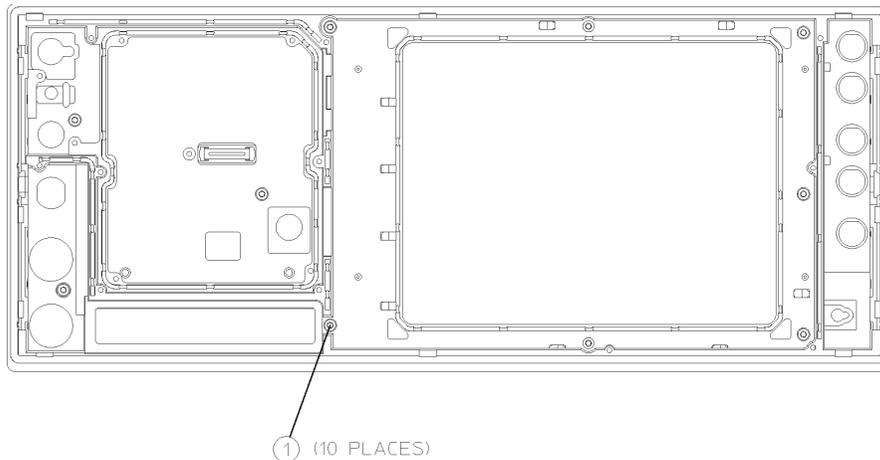
---

**NOTE**

Take care to not touch the contacts on the keypads. Contaminants on the contacts might interfere with the performance of the key.

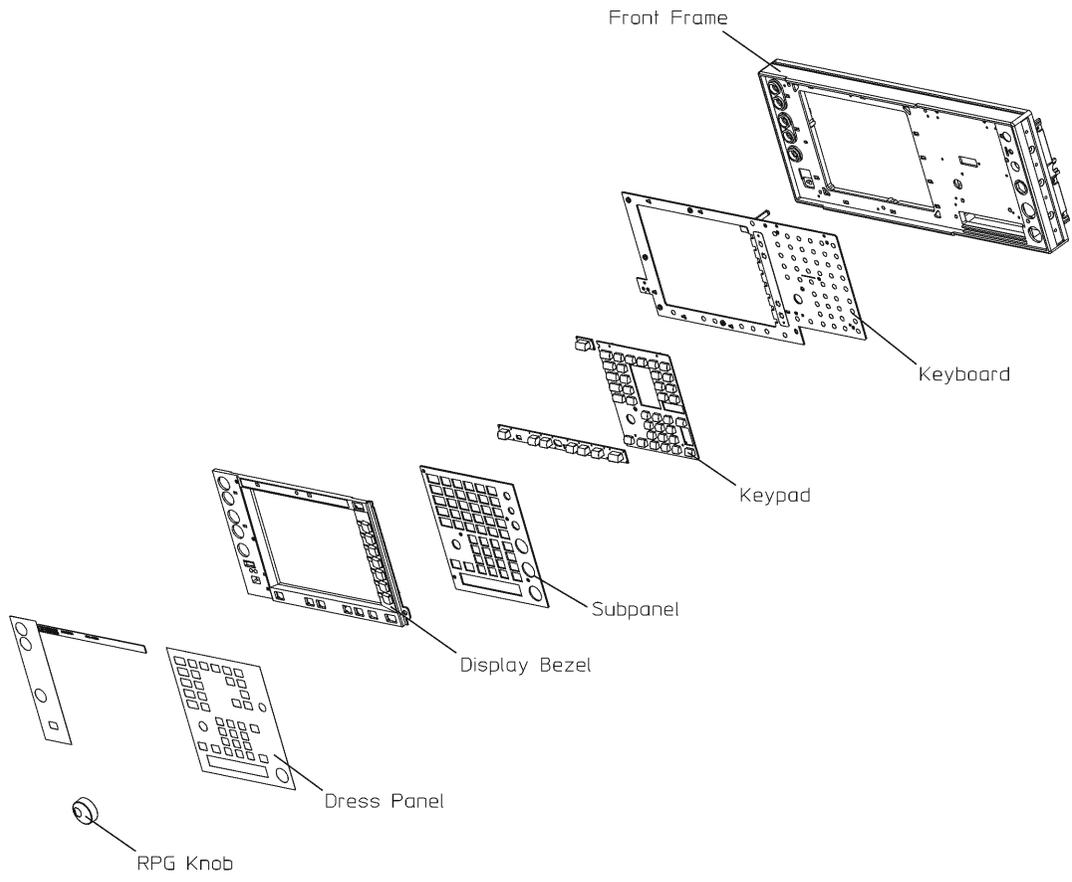
---

**Figure 4-38**      **Keypad Removal**



sa822a

**Figure 4-39**      **Keypad Parts**



sa890a

## Replacement

1. Place the keypad into position in the bezel. Press on the keypad to engage the alignment pins and to seat the keys.
2. Place the keyboard over the bezel alignment pins and carefully slide to lock into place.
3. Refer to [Figure 4-39](#). Place the keyboard/bezel assembly face down on top of the dress panel and subpanel on a flat surface. Install the front frame over the keyboard/bezel assembly. Using the T-10 driver, replace the 10 screws (1) that secure the bezel and keypad to the front frame. Torque to 9 inch pounds.
4. Replace the front panel interface board. Refer to the [“A3 Front Panel Interface Board”](#) replacement procedure.
5. Replace the display/rubber mount assembly. Refer to the last section of the [“Display Replacement”](#) procedure.

## Front Panel RPG

### Removal/Replacement

1. Remove the front panel interface board. Refer to the “[A3 Front Panel Interface Board](#)” removal procedure.
2. Unsolder the RPG, remove the nut and washer, and remove it from the front panel interface board.
3. Place the new RPG in the correct position, tighten the nut and washer, and resolder the leads.
4. Replace the front panel interface board. Refer to the “[A3 Front Panel Interface Board](#)” replacement procedure.

## Front Panel External Trigger Cable

### Removal/Replacement

---

**NOTE** The front panel External Trigger connector/cable must be replaced as an assembly.

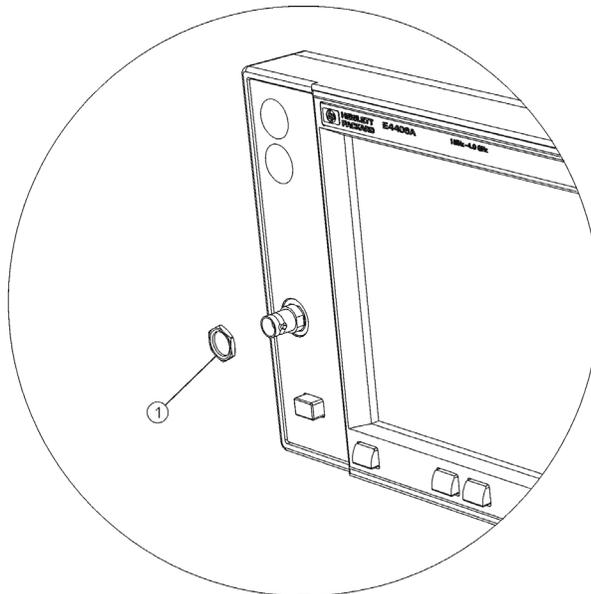
---

**CAUTION** Be careful to not scratch the dress panel when removing or replacing this part.

---

1. Remove the front frame assembly. Refer to the “[Front Frame](#)” removal procedure on [page 175](#).
2. Refer to [Figure 4-40](#). Using the 9/16 socket, remove the nut (1) that secures the connector to the front frame.
3. Disconnect the cable from the A12 analog IF assembly.
4. For replacement, position the connector/cable through the front frame.
5. Using the 9/16 socket, replace the nut to secure the connector to the front frame. Torque to 21 inch pounds.
6. Clip the cable into the cable clamps on the shield.
7. Re-route the cable to avoid interference with the fans or the airflow, and reconnect to the A12 analog IF assembly.
8. Replace the front frame. Refer to the “[Front Frame](#)” replacement procedure.

**Figure 4-40** Front Panel External Trigger Input Connector Removal



sq824a

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## **5 Post-Repair Procedures**

## Introduction

This chapter provides information on the actions you will need to take to return an instrument to full operation following replacement of instrument assemblies. This information includes a list of adjustments, tests, configuration procedures and checks you will need to perform. In addition, you will find procedures for performing manual adjustments, tests, configurations, and checks. The *Agilent N7812A E4406A Calibration Application Software* automates all of the adjustments and tests the instrument to specifications. Never perform adjustments as routine maintenance. Adjustments should be performed after a repair or a performance test failure. For information on which tests to perform, refer to [Table 5-1](#) in this chapter.

The following sections are found in this chapter:

- [“Before You Start” on page 233](#)
- [“Abnormal Indications during Procedure Execution” on page 233](#)
- [“After Assembly Replacement” on page 233](#)
- [“Post-Repair Procedures” on page 234](#)
- [“Test equipment you will need” on page 236](#)
- [“Manual Test, Adjustment, and Configuration Procedures” on page 237](#)
- [“External Keyboard Test” on page 239](#)
- [“Configuring a Replacement CPU Assembly” on page 241](#)
- [“External Keyboard Test” on page 239](#)
- [“Configuring a Replacement Flash Memory Assembly” on page 244](#)
- [“Internal 10 MHz Frequency Reference Adjustment” on page 248](#)
- [“Internal 50 MHz Calibrator Adjustment” on page 250](#)
- [“Burst Trigger Check” on page 254](#)
- [“Baseband I/Q Amplitude Accuracy Test” on page 255](#)
- [“Front Panel Test” on page 259](#)
- [“Automated Adjustments” on page 261](#)

## Safety

Familiarize yourself with the safety symbols marked on the instrument, and read the general safety considerations and the safety note definitions in the front of this guide, **before** you begin the procedures in this chapter.

## Before You Start

There are three things you should do before starting any of the procedures listed or described in this chapter:

- ❑ Check that you are familiar with the safety symbols marked on the UUT, and read the general safety considerations and the symbol definitions given in the front of this service guide.
- ❑ Check that the UUT has been turned on and allowed to warm as described in the instrument specifications (or the software).
- ❑ Read the rest of this section.

## Abnormal Indications during Procedure Execution

If the indications received during a procedure execution do not agree with the normal conditions given in the procedure, a fault exists in your instrument. The fault should be repaired *before* proceeding with any further procedures. Refer to the troubleshooting and repair information in [Chapter 1](#) of this guide.

## After Assembly Replacement

If one or more instrument assemblies has been replaced, related adjustment or configuration procedures **must** be performed prior to verifying that the instrument meets specifications. Refer to [Table 5-1](#) to determine which procedures to perform after replacing an assembly.

## Post-Repair Procedures

Table 5-1 lists the adjustments, tests, configuration procedures, and performance verification tests needed after an assembly replacement. Adjustments and performance verification tests are available in the *Agilent N7812A E4406A Calibration Application Software*.

After an assembly is replaced, find the assembly that has been replaced in the left-hand column, and then perform the adjustment, test, or configuration procedure shown in the adjustment column. After successfully completing the necessary adjustment, test, or configuration procedure, verify that the instrument meets specifications by running the performance verification test or tests listed.

**NOTE** Refer to instrument specifications (or the software) for information on instrument warm-up before performing any of the procedures listed in this chapter.

**Table 5-1 Post-Repair Testing Requirements**

Assembly	Adjustments, Tests, & Configuration	Performance Verification
A1 Keyboard	Front Panel test. Refer to <a href="#">“Internal Front Panel Test”</a> on page 238	None
A2 Flat Panel Display	Ensure that the display quality is satisfactory. There should be no light or dark lines or pixel “triplets”.	None
A3 Front Panel Interface Assembly	Front Panel test. Ensure that the display quality and brightness are satisfactory. Ensure that the green “Power On” LED and yellow “Standby” LED light properly.	None
A4 Disk Drive Assembly	Save data to a disk by: <ol style="list-style-type: none"> <li>1. Inserting a blank DOS formatted disk into the disk drive.</li> <li>2. Press <b>Print Setup</b> key.</li> <li>3. Select print to file.</li> <li>4. Select Print Location Floppy.</li> <li>5. Press <b>Print</b> key and ensure disk drive light comes on indicating that data is being saved to disk.</li> </ol>	None

**Table 5-1 Post-Repair Testing Requirements (Continued)**

Assembly	Adjustments, Tests, & Configuration	Performance Verification
A6 Power Supply Assembly	Verify that the instrument powers up correctly. Check the power supply voltages on any extender board or if external boards are not available, at the probe power connector. Refer to the <a href="#">“Power Supply Check” on page 34</a>	All
A7 Baseband and I/Q Assembly	<a href="#">“Baseband I/Q Amplitude Accuracy Test” on page 255.</a>	None
A10 Digital IF Assembly	Internal Auto-Align	All
A12 Analog IF Assembly	Internal Auto-Align. Check function of the front and rear panel external trigger input. <a href="#">“Burst Trigger Check” on page 254.</a>	“Displayed Average Noise Level (DANL)”, “Spurious Responses”, “Residual FM”, “Amplitude Linearity”, “Residual Responses”, “Phase Noise”
A14 Fan Control Board	Check front panel power switch operation. Check for proper fan operation and direction of rotation (rear exhaust) on power-up. If satisfactory, allow the instrument to warm up. Check probe power connector voltages. Upon warm-up ensure the red LEDs on the board are not turned on. These signal an over temperature condition when lit.	None
A15 Daughter Board	Power instrument up and check for proper operation. Check for presence of the 10 MHz OUT on the rear panel connector. Check the external reference mode operation by connecting an external reference input signal and verifying performance.	None
A17 RF Assembly	<i>Perform in the order listed.</i> “Frequency Response (Flatness) Adjustment”, (Use N7812A software or the manual procedures on <a href="#">page 248</a> and <a href="#">page 250</a> ) “Internal 50 MHz Calibrator Adjustment”, Internal Auto-Align	All

**Table 5-1 Post-Repair Testing Requirements (Continued)**

Assembly	Adjustments, Tests, & Configuration	Performance Verification
A18 Reference Assembly	<i>Perform in the order listed.</i> “Internal 10 MHz Frequency Reference Adjustment”, “Internal 50 MHz Calibrator Adjustment”, (Use N7812A software or the manual procedures on <a href="#">page 248</a> and <a href="#">page 250.</a> ), “Auto-Align Tests” on <a href="#">page 32</a>	“Phase Noise”, “Spurious Responses”, “Internal 10 MHz Frequency Reference”
A19 Synthesizer Assembly	<i>Perform in the order listed.</i> “Synthesizer Adjustment Number Two”, “Synthesizer Adjustment Number One”	“Phase Noise”, “Spurious Responses”, “Residual FM”
A21 MotherBoard	None	None
A22 CPU (processor) Assembly	<a href="#">“Configuring a Replacement CPU Assembly” on page 241</a>	None
A22A1 DRAM Card	None	None
A22A2 Flash Memory Board	<a href="#">“Configuring a Replacement Flash Memory Assembly” on page 244,</a> “Synthesizer Adjustment Number Two”	“Phase Noise”
A25 SCSI Board	<a href="#">“External Keyboard Test” on page 239</a>	None
A27 Rear Panel Connector Board	Check for presence of the 10 MHz OUT on the rear panel connector. Check the external reference mode operation by connecting an external reference input signal and verifying performance.	None
A3A1, A3A2 Inverter Boards	Ensure that the display quality and brightness are satisfactory.	None

**Test equipment you will need**

Refer to [Table 1-2 on page 18](#), for a list of recommended equipment and critical test equipment specifications for the performance verification and adjustments.

## Manual Test, Adjustment, and Configuration Procedures

Each of the following test, adjustment, and configuration procedures includes all of the information required to complete the procedure. The information includes—as applicable—a description of what the procedure does, a list of equipment required for the execution, an illustration of the equipment setup, and the steps necessary to complete the procedure. They are designed to be run on an instrument operating within a temperature range of 20 °C to 30 °C.

The following is a list of the procedures included in this section:

- “Internal Front Panel Test” on page 238
- “External Keyboard Test” on page 239
- “Configuring a Replacement CPU Assembly” on page 241
- “Configuring a Replacement Flash Memory Assembly” on page 244
- “Internal 10 MHz Frequency Reference Adjustment” on page 248
- “Internal 50 MHz Calibrator Adjustment” on page 250
- “Burst Trigger Check” on page 254
- “Baseband I/Q Amplitude Accuracy Test” on page 255
- “Using the Alpha Editor Menu” on page 258
- “Front Panel Test” on page 259

## Internal Front Panel Test

### Description

The front panel test checks the functionality of the instrument front panel keys and the RPG knob.

### Procedure

Press **Mode, More (1 of 2), Service, More (1 of 2), Front Panel Test**. Once the **Front Panel Test** key is pressed you will see a display with three columns appear on the screen. The entries on the left side of each column describe a key. On the right side of each entry you will see a 0.

The front panel test requires you to press each of the front panel keys (in any order, with the exception of the **ESC** key, which *must* be pressed last), and to turn the RPG knob. The first time you press a key a 1 will replace the 0 that originally appeared to the right of the key column. Each additional instance of pressing a given key will result in an increment to the number listed in the column to the right of the key description. For example if you press the **Zoom** key four times, you will see a 4 to the right of the Zoom entry.

Rotating the RPG knob will result in a rapidly incrementing, or decrementing value appearing in the column to the right of the RPG Knob entry. Rotate the RPG knob clockwise and counter-clockwise. You will see negative or positive values appear, in ascending or descending order, depending on the direction you have turned the RPG knob.

Note that the two step keys (the up and down arrow keys) are described as the Rpg Dn and Rpg Up keys.

The **ESC** key must be pressed only after all other keys have been pressed and the RPG knob has been rotated; pressing the **ESC** key will cause the front panel test to be cancelled.

---

## External Keyboard Test

### Description

To test the operation of an external keyboard, you interrupt the boot process and instruct the instrument to use the external keyboard on the next start-up. Then use the external keyboard to verify that the A25 SCSI Assembly has been installed properly and that the instrument can recognize the keyboard by typing command characters on the screen.

---

#### NOTE

The keyboard path may be set to `front_panel` or `PS2`. `front_panel` is the instrument front panel keypad, and `PS2` is an external keyboard. To verify the keyboard path cycle the instrument power and view the boot screen for the keyboard path message.

---

### Procedure

If the keyboard path is shown as `front_panel`, perform the following steps to verify keyboard operation.

1. Connect a PS2 keyboard.
2. Reboot the instrument and watch the instrument display.
3. When the message `To discontinue, press any key within 2 seconds` appears, press any front panel numeric key (0-9).
4. Backspace to clear any characters you may have typed after the prompt `Main Menu: Enter Command>`.
5. From the instrument front panel, enter `52`, and press **Enter**. A message should appear on the instrument screen that tells you that the keyboard path is now `PS2`. The keyboard path change is not effective until the instrument is reset.
6. To confirm the operation of the external keyboard perform the following steps:
  - a. From the instrument front panel, enter `99` and press **Enter**. This will reset—reboot—the instrument.
  - b. When the message `To discontinue, press any key within 2 seconds` appears, press the space bar on the external key board to interrupt the boot process.

## Post-Repair Procedures

### External Keyboard Test

- c. If the external keyboard connection is functioning correctly, the Main Menu: Enter Command> prompt will be displayed. Type **pa key front\_panel** and press **Enter**. The key path will now be restored to front\_panel upon next reset. A message should appear on the instrument screen that tells you that the keyboard path is PS2. This will further confirm that the external keyboard is functional.
7. From the external keyboard, enter **99** and press **Enter**. This will reset the instrument and restore the key path to the front panel key pad.

If the keyboard path is shown as PS2, perform the following steps to verify keyboard operation.

1. Connect a PS2 keyboard.
2. To confirm the operation of the external keyboard perform the following steps:
  - a. Reboot the instrument and watch the instrument display. When the message *To discontinue, press any key within 2 seconds* appears, press the space bar on the external key board to interrupt the boot process.
  - b. If the external keyboard connection is functioning correctly, the Main Menu: Enter Command> prompt will be displayed. Type **pa key front\_panel** and press **Enter**. The key path will now be restored to front\_panel upon next reset. A message should appear on the instrument screen that tells you that the keyboard path is PS2. This will further confirm that the external keyboard is functional.

## Configuring a Replacement CPU Assembly

### Description

When only the main CPU board is replaced, it is necessary to reconfigure it with certain data that is critical for instrument operation. This information includes the IP address, time, date, instrument serial number, and the host name. If possible, it is best to capture this information from the instrument before replacing the main CPU board.

### Procedure

#### Capturing Critical Data for the CPU Board

Ensure that all information is recorded exactly as it is displayed.

1. To view the host name and IP address, press **System** and **Configure I/O**.

---

#### NOTE

The Ethernet Address is embedded in the CPU, and it will change when the CPU is replaced. When the Ethernet Address is changed the Flash Memory board will reset the IP address and host name to the default factory values.

2. To view the instrument serial number, press **System, More** until (2 of 3) is displayed, and **Show System**. Refer to the note below before proceeding.
  - a. Confirm that the serial number on screen matches the number on the rear panel tag.
  - b. If the instrument is not functional, use the serial number on the rear panel tag.

---

#### NOTE

The serial number stored in memory is used to enable all licensed options. If the stored serial number is different from the rear panel serial number sticker, then the instrument has an incorrect CPU board installed or an incorrect serial number was entered into the CPU when it was last replaced. If the two serial numbers do not match, determine the cause and correct the problem.

If you cannot correct the problem, and you use the rear panel serial number on the new CPU board, the keywords associated with the stored serial number will no longer enable the options. In this case, contact Agilent Technologies sales and service office for the correct license numbers for your instrument. To contact the Agilent Technologies sales and service office refer to [“Contacting Agilent Technologies” on page 60](#).

### Replacing the Processor Assembly

There are three boards mounted on the main processor assembly (A22) board: the A22A1 DRAM board, the A22A2 Flash board, and the A22A3 GP-IB capacitor board. These boards must be removed from the defective CPU board and installed on the new CPU board.

The Flash memory board contains the operating system, main firmware, measurement personality firmware, license key words, and synthesizer calibration data. The DRAM memory board and GP-IB capacitor board can be costly to replace. Transferring the Flash memory board from the defective processor board will save time otherwise required to reconfigure. Transferring all three will help keep repair cost low.

Refer to assembly replacement procedure [“A22 Processor Assembly” on page 202](#) for details on replacing the defective main processor board and transferring the two memory boards and the GP-IB capacitor board.

### Entering Configuration Information

After the processor is replaced, restore power to the instrument and enter the necessary configuration information.

---

**CAUTION**

Because the serial number can not be removed once it is entered, ensure that the new processor board corrects the problem before continuing with this procedure.

---

**NOTE**

The **Serial Number** key can only be activated if you have a service password. The password is 7378423.

---

### Entering the Serial Number

1. Press **System, More** until (2 of 3) is displayed, **Show System, Service Password, 7378423**, and **Enter**. The Serial Number softkey that was previously shown as inactive (grayed out) should now be shown as active (black).

---

**CAUTION**

---

You have only one chance to enter the serial number into the replacement processor memory. Ensure that the number you enter matches the number on the serial number tag on the rear panel. Use extreme care when entering the number from the front panel.

2. Press **Serial Number**—alpha editor will be activated—and carefully enter the serial number. If you make an error, press **Backspace**.

For an explanation of the use of the alpha editor, refer to [“Using the Alpha Editor Menu” on page 258](#).

3. Then press **Done** to write the serial number to the instrument memory.

### Entering the Time and Date

1. Press **System, Time/Date, Set Time**, and enter the time in the format hh.mm.ss. For example, 15.25.30 for 15 hours 25 minutes and 30 seconds. Press **Enter**.
2. Press **Set Date** and enter the date in the format mm.dd.yyyy. For example 05.11.1999 for May 11, 1999. Press **Enter**.

### Entering the IP Address and Host Name

To enter the IP Address and Host Name, refer to [“Entering IP Address and Host Name” on page 247](#).

## Configuring a Replacement Flash Memory Assembly

### Description

When the Flash memory board is replaced, it is necessary to reconfigure it with certain data that is critical for instrument operation. The Flash memory board contains the operating system, main firmware, measurement personality firmware, license key number, IP address and host name, and synthesizer calibration data.

The main—core—firmware is the programming that instructs the instrument to be a transmitter tester and the optional measurement personality firmware that determines which personality is available. License key numbers enable the measurement personalities stored in the firmware. All measurement personalities reside in the main firmware, but they cannot be enabled unless the option has been purchased and a license key number has been issued. The synthesizer calibration data—LO tuning constants (MHZ/volt tuning sensitivities)—are obtained by performing “Synthesizer Adjustment Number Two”.

The replacement Flash memory assembly will already have the operating system and firmware installed. The license key numbers for each option must be reloaded to enable the option. If possible, it is best to capture this information from the instrument before replacing the Flash memory board. Refer to [“Capturing Critical Data for the CPU Board” on page 241](#), for additional information.

---

#### NOTE

If the instrument is not functional, contact the owner for the license key numbers. The user’s guide has a table in the getting started section where the end user may have recorded the license key numbers. Also, the end user may have the License Key Certificate that has the license key number on it. Additionally, you may contact Agilent Technologies sales and service office for the information. To contact the Agilent Technologies sales and service office refer to [“Contacting Agilent Technologies” on page 60](#).

---

## Procedure

### Capturing Critical Data

If possible, it is best to capture the critical information described above from the instrument before replacing the Flash memory board. Ensure that all information is recorded exactly as it is displayed.

1. To view the host name and IP address, press **System** and **Configure I/O**.
2. To view the license key number, press **System**, **More** until (3 of 3) is displayed, **Install**, and **Choose Option**. The alpha editor will be activated. For an explanation on the use of the alpha editor, refer to [“Using the Alpha Editor Menu” on page 258](#).

When capturing the license key number, it is very important to copy the number accurately. Since it is a hexadecimal, the letter “O” can not be present, only zeros “0” are used in the license key number.

- a. To determine if the BAC (cdmaOne) option is loaded, type **BAC** and press **Done**. The key number will appear on the License Key.

Then press **Choose Option** to view additional options.

- b. To determine if the BAH (GSM) option is loaded, type **BAH** and press **Done**. The key number will appear on the License Key.

Then press **Choose Option** to view additional options.

---

#### NOTE

If the instrument is not functional, contact the owner for the license key numbers. The user’s guide has a table in the “Getting Started” section where the end user may have recorded the license key numbers. Also, the end user may have the License Key Certificate that has the license key number on it. Additionally, you may contact Agilent Technologies sales and service office for the information. To contact the Agilent Technologies sales and service office, refer to [“Contacting Agilent Technologies” on page 60](#).

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### Replacing the Flash Memory Assembly

If the Flash Memory board has not been replaced already, refer to assembly replacement procedure [“A22A1 DRAM, A22A2 Flash, and A22A3 GP-IB Capacitor Boards” on page 205](#) for details on replacing the defective Flash memory board.

### Enter Option License Key Numbers

The option designation consists of three upper-case letters, as shown in the Option column of the table below.

Available Personality Options	Option
GSM measurement personality	<b>BAH</b>
cdmaOne measurement personality	<b>BAC</b>

To re-install the license key number use the following procedure:

1. Press **System, More** until (3 of 3) is displayed, **Install**, and **Choose Option**. This will activate the alpha editor menu. Use the alpha editor to enter the three-letter option designation, in upper-case, then press the **Done** key. As you enter the option number you will see your entry in the active function area of the display. For more information on the alpha editor, refer to [“Using the Alpha Editor Menu” on page 258](#).
2. Press **License Key**. The license key number is a hexadecimal number that will require entry of both letters and numbers. Use the alpha editor to enter letters. Use the front panel numeric keyboard to enter numerical values. You will see your entry in the active function area. When you have completed entering the license key number, press the **Done** key. For more information on the alpha editor, refer to [“Using the Alpha Editor Menu” on page 258](#)

---

**NOTE**

It is very important to enter the number accurately. Since it is a hexadecimal, the letter “O” can not be present, only zeros “0” are used in the license key number.

3. After you have entered the active license key number and the personality option, press **Install Now**. A **No** softkey and a **Yes** softkey will appear in the **Install Now** menu, and a message will appear in the active function area of the display, which reads Insert disk and power cycle instrument. Press the **No** key only if you wish to cancel the installation process. If you want to proceed with the installation, press the **Yes** key and cycle the instrument off and then on. When the instrument is powered on, the license key number will be read and automatically loaded into your instrument.

---

**NOTE**

Currently, an installation disk is not required. Disregard the Insert disk portion of the message that appears in the active function area when the **Install Now** key is pressed.

### Restoring Synthesizer Calibration Data

Perform “Synthesizer Adjustment Number Two”, using the *Agilent N7812A Calibration Application Software*.

### Entering IP Address and Host Name

---

**NOTE**

If the instrument was not operational when the Flash memory assembly board was replaced, the instrument user will need to re-enter the IP address and host name into the instrument memory. The procedure to reenter this information can be found below and in the “Configuring I/O” section in the user’s guide.

---

1. To enter the IP address, press **System**, **Config I/O**, **IP Address**, enter the numeric IP address, and press **Enter**.
2. To enter the host name, press **System**, **Config I/O**, and **Host Name**. Pressing the **Host Name** key activates the alpha editor, which enables you to change the host name. For an explanation of how to use the alpha editor, refer to [“Using the Alpha Editor Menu” on page 258](#).

---

## Internal 10 MHz Frequency Reference Adjustment

### Adjustment Description

The Internal Frequency Reference adjustment measures an input signal from a standard and adjusts the internal timebase. The source is provided by a frequency standard with an output of 10 MHz. At the RF input to the UUT, the source amplitude must be 0 dBm or less. The internal frequency reference is adjusted to 10 MHz with minimum deviation.

---

**NOTE** This adjustment requires a minimum of a 24 hour warmup time. The UUT must be turned on —**not in standby**— for the entire warmup period.

---

### Required Equipment

The following table lists the test equipment required for the adjustment. The list includes any miscellaneous devices, cables, and adaptors. Refer to [Table 1-2, “Required Test Equipment Summary,”](#) on [page 18](#), for the critical specifications of the test equipment.

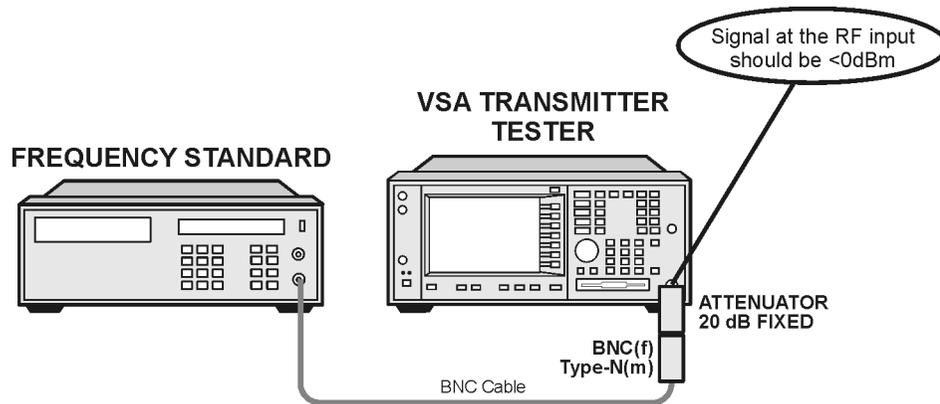
**Table 5-2** Required Test Equipment

Instrument	Recommended Agilent Model Number	Alternative Agilent Model Number
<b>Standards</b>		
Frequency Standard	5071A	
<b>Cables</b>		
BNC	10503A	
<b>Adaptors</b>		
Type-N (m) to BNC (f)	1250-1476	
<b>Attenuator</b>		
20 dB Fixed Attenuator. The attenuation value must provide a power level of less than 0 dBm at the UUT RF input.	8491A Option	

## Test Setup

The following figure illustrates the equipment setup for the adjustment.

**Figure 5-1** Internal 10 MHz Frequency Reference Adjustment Setup



sa877a

## Procedure

1. Press **Preset**.
2. Connect the 10 MHz signal from the frequency standard to the RF input of the UUT as shown in [Figure 5-1](#).
3. Press **MODE** and **Service**.
4. Press **FREQUENCY**, **10**, and **MHz**.
5. Ensure that a 10 MHz signal appears on the display.
6. Press **System**, **More** until (2 of 3) is displayed, **Show System**, **Service Password**, **7378423**, and **Enter**.
7. Press **MEASURE**, **Timebase Frequency**, **AMPLITUDE**, **Scale/Div**, **60**, **mV**, **Meas Setup**, and **Auto Adjust Now**. The Auto Adjust Now does not highlight. An indicator of a proper adjustment is Adjusting 1 displayed in the lower right display window.
8. When the Adjusting 1 indication changes to read Adjusting 0, the adjustment is complete. The adjustment usually takes 30-40 seconds to complete.

---

## Internal 50 MHz Calibrator Adjustment

### Description

The Internal 50 MHz Calibration adjustment measures the amplitude of a calibrated input signal of 50 MHz and adjusts the internal reference oscillator.

The signal source is provided by a synthesized signal generator. A power meter is used to adjust the signal amplitude to a fixed level. The signal is then measured by the UUT. Then the internal 50 MHz reference oscillator amplitude is adjusted to that measured value.

The internal 50 MHz reference oscillator is used when the instrument performs many of the auto alignment measurements.

---

**NOTE** Ensure that the UUT has been warmed up in accordance with the instrument specifications.

---

### Required Equipment

The following table lists the test equipment required for the adjustment. The list includes any miscellaneous devices, cables, and adaptors. Refer to [Table 1-2, “Required Test Equipment Summary,”](#) on [page 18](#), for the critical specifications of the test equipment.

**Table 5-3** Required Test Equipment

Instrument	Recommended Agilent Model Number	Alternative Agilent Model Number
<b>Signal Source</b>		
Synthesized Signal Generator	8663A	8662A or 8648
<b>Meters</b>		
Power Meter	E4419A/B	E4418A or 438
Power Sensor, High sensitivity	8481D	
<b>Attenuators</b>		
30 dB Fixed Attenuator	11708A included with 8481D	
<b>Cables</b>		
Type-N	11500C	

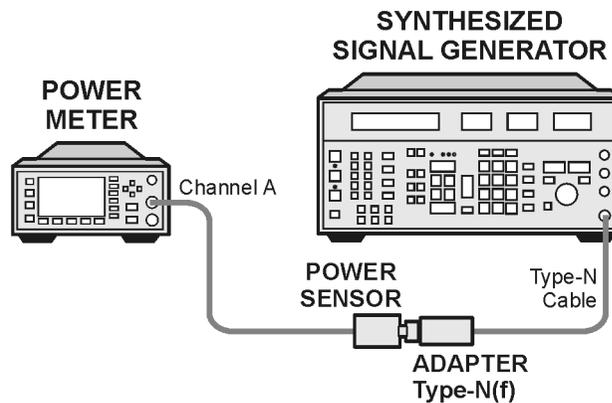
**Table 5-3 Required Test Equipment (Continued)**

Instrument	Recommended Agilent Model Number	Alternative Agilent Model Number
Power Sensor Cable	11730A	

### Test Setup

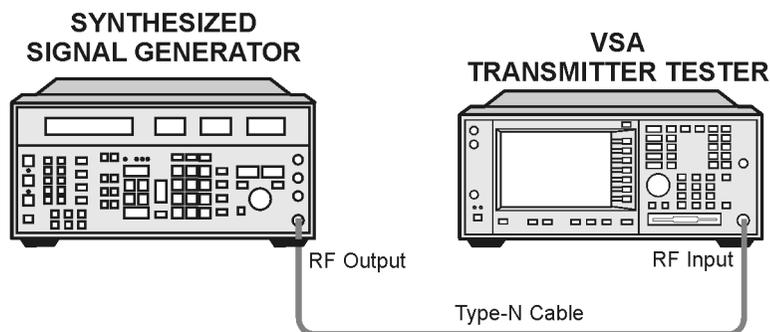
The following figures illustrate the equipment setups for the adjustment.

**Figure 5-2 Source Adjustment Setup**



sa886a

**Figure 5-3 Internal 50 MHz Calibration Adjustment Setup**



sa850a

### Procedure

1. Preset the power meter.

**CAUTION**

When using the 8481D Power Sensor, a 30 dB fixed attenuator must be

Post-Repair Procedures  
Internal 50 MHz Calibrator Adjustment

used between the power sensor and the reference of the power meter. The 0 dBm 50 MHz power reference from the power meter could damage the highly sensitive power sensor.

2. Zero and calibrate the power meter.
3. Configure the source, power meter, and power sensor as shown in [Figure 5-2](#).
4. Preset the signal source and initialize the test equipment parameters as listed in [Table 5-4, “Signal Source Initialization,”](#) on [page 252](#)

**Table 5-4**      **Signal Source Initialization**

Parameter	Setting
Frequency	50 MHz
Amplitude	-25 dBm

5. Adjust the source amplitude until the power meter reads -25 dBm  $\pm\pm 0.2$  dBm.
6. Record the measured value from the power meter.

\_\_\_\_\_ dBm

**NOTE**      Do not readjust the source amplitude during the remainder of the test.

7. Configure equipment as shown in [Figure 5-3, “Internal 50 MHz Calibration Adjustment Setup”](#).
8. Press **Preset**.
9. If the auto alignment for the UUT has not been run within the last hour, run it by pressing **System, Alignments,** and **Align All Now**.
10. Ensure that the instrument passed all test before continuing.

11. Initialize the parameters for the instrument, as listed in [Table 5-5](#), “**UUT Initialization**,” by performing the following steps:
  - a. Press **MODE** and **Service**.
  - b. Press **FREQUENCY**, 50, and **MHz**.

**Table 5-5**

**UUT Initialization**

<b>Parameter</b>		<b>Setting</b>
Mode		Service
Frequency	Center	50 MHz

12. Ensure that a 50 MHz signal with an amplitude of approximately -25 dBm is displayed on the screen.
13. Complete the alignment by performing the following steps:
  - a. Press **System, More** until (2 of 3) is displayed, **Show System, Service Password**, 7378423, and **Enter**.
  - b. Press **System, Alignments, Align Subsystem**, and **Align 50 MHz Reference**.
  - c. Press **RF Inp Lev**, enter the amplitude value recorded from the power meter reading in step 7, and press **dBm**.
  - d. Press **Adjust Now** and wait for the routine to complete.
  - e. Press **Store Abs Amptd to EEROM**.
14. Press **Exit** to complete the adjustment and quit the routine.

## Burst Trigger Check

### Description

The Burst Trigger Check verifies the ability of the instrument to sync on the burst trigger signal. The instrument internal IF Alignment signal is activated and configured to provide a pulse train. The pulses are displayed on the RF Envelope window, and will appear as an unsynchronized signal. When the RF Burst trigger function is activated, the RF train will sync on the burst trigger signal.

### Procedure

1. Press **Preset**.
2. Press **MODE** and **Service**.
3. Press **Input**, **Input Port IF Align**, **IF Align Signal**, **Signal Type**, and **Pulse**. The unsynchronized pulse train will be displayed on the RF Envelope window.
4. Press **Meas Setup**, **Trigger Source**, and **RF Burst**. The pulse train, displayed on the RF Envelope window, will now be synchronized.

## Baseband I/Q Amplitude Accuracy Test

### Description

The amplitude accuracy test measures the absolute amplitude of the baseband I/Q inputs at 100 kHz and 5 MHz. An arbitrary waveform generator or synthesized signal generator is used as the signal source for the test. Most input configurations and ADC voltage ranges for the baseband I/Q signal path are tested.

### Test Limits

Amplitude accuracy results should remain within +/-1 dB of the measured source value for all input connector and impedance settings.

### Procedure

1. Press **Mode**, then **Basic** to select the Basic mode for the UUT.
2. Press **Preset** to preset the UUT.
3. If the auto alignment for the UUT has not been run within the last hour, press **System, Alignment**, then **Align All Now** to activate the alignment.
4. Initialize the parameters for the instrument as listed in [Table 5-6](#) by following these steps:
  - a. Press **Input, Input Port, I only**.
  - b. Press **Input, I/Q Setup, I/Q Input Z, 50 ohms Unbalanced**.
  - c. Press **Meas Setup, Span, 200kHz**.

**Table 5-6 UUT Initialization for 100kHz Test**

Parameter			Setting
Mode			Basic
Measure			Spectrum
Input	Input Port		I only
	I/Q Setup	I/Q Input Z	50 ohms
		I/Q Z Ref	50 ohms
	I/Q Range		1 Volt
Span			200 kHz
Resolution Bandwidth			4 kHz

Post-Repair Procedures  
**Baseband I/Q Amplitude Accuracy Test**

5. Preset the signal source and initialize the test equipment parameters as shown in [Table 5-7](#).

**Table 5-7 Signal Source Initialization**

Parameter	Setting
Frequency	100 kHz
Level	-16 dBm (100mVPP)
Modulation	Off

6. Perform the following steps for each test setup listed in [Table 5-8](#).
  - a. Press **Input**, **Input Port** to configure the input port of the instrument.
  - b. Press **Input**, **I/Q Setup**, **I/Q Input Z** to configure input impedance.
  - c. Press **Input**, **I/Q Range** to select the desired voltage range.
  - d. Connect the signal source to the specified I/Q input connector. For balanced measurements (when the I/Q input Z is 600 ohms balanced or 1 M ohm balanced) connect a 50  $\Omega$  BNC terminator to the complementary input. The complementary input for I is  $\bar{I}$  and for Q is  $\bar{Q}$ .
  - e. Press **Marker**, **Search**.
  - f. Record the measured value in the UUT Measured Amplitude column for 100 kHz in [Table 5-8](#).
  - g. Compare the measured and nominal values to ensure that the measured value is within the 1dB test limit.
7. Press **SPAN**, **5**, then **MHz** to change the span of the UUT.
8. Change the signal source frequency to 5 MHz.
9. Repeat step 6 and record the measured value in the UUT Measured Amplitude column for 5 MHz.

**Table 5-8 Amplitude Accuracy at 100 kHz and 5 MHz**

Input Port	I/Q Input Z	I/Q Range (V)	I/Q Input Connector	UUT Measured Amplitude (dBm)		Nominal Amplitude (dBm)	Test Limits (dB)
				100 kHz	5 MHz		
I only	50 $\Omega$ Unbalanced	1	I input			-16	$\pm 1.0$
I only	50 $\Omega$ Unbalanced	0.25	I input			-16	$\pm 1.0$
I only	50 $\Omega$ Unbalanced	0.125	I input			-16	$\pm 1.0$

**Table 5-8                    Amplitude Accuracy at 100 kHz and 5 MHz**

Input Port	I/Q Input Z	I/Q Range (V)	I/Q Input Connector	UT Measured Amplitude (dBm)		Nominal Amplitude (dBm)	Test Limits (dB)
				100 kHz	5 MHz		
I only	600 Ω Balanced <sup>a</sup>	1	I input			-22	± 1.0
I only	1 MΩ Unbalanced	1	I input			-10	± 1.0
I only	1 MΩ Balanced <sup>a</sup>	1	I input			-10	± 1.0
I only	1 MΩ Balanced <sup>a</sup>	1	$\bar{I}$ input (I bar)			-10	± 1.0
Q only	50 Ω Unbalanced	1	Q input			-16	± 1.0
Q only	50 Ω Unbalanced	0.25	Q input			-16	± 1.0
Q only	50 Ω Unbalanced	0.125	Q input			-16	± 1.0
Q only	600 Ω Balanced <sup>a</sup>	1	Q input			-22	± 1.0
Q only	1 MΩ Unbalanced	1	Q input			-10	± 1.0
Q only	1 MΩ Balanced <sup>a</sup>	1	Q input			-10	± 1.0
Q only	1 MΩ Balanced <sup>a</sup>	1	$\bar{Q}$ input (Q bar)			-10	± 1.0

a. Whenever performing a balanced measurement ensure the complimentary input is terminated (for a balanced input, when the signal source is connected to the I input, the  $\bar{I}$  input must be terminated).

---

## Using the Alpha Editor Menu

The alpha editor enables you to enter text. All text entries are displayed in the active function area.

Level 1 Menu	Level 2 Menu	Level 3 Menu	Example
A B C D E F G	a b c d e f g	() : ; , '	V
H I J K L M N	h i j k l m n	_ ! ? ~	W
O P Q R S T U	o p q r s t u	+ - * / < > =	X
V W X Y Z	v w x y z	\ { } [ ]	Y
Done	Done	@ # \$ % ^ &	Z
Space	Space	Space	
More (1 of 3)	More (2 of 3)	More (3 of 3)	

1. When you access the alpha editor, you will see the menu that is shown in Level 1 Menu of the table above.
2. If you wish to enter a capital letter, press the key which contains the letter you wish to select. For example, if you want to enter an upper case Y, you will press **VWXYZ**. A submenu, as shown in the example column of the table above, is now activated. You will then press the softkey labelled **Y**, and it will appear in the active function area. To access lower case letters, press **More** until (2 of 3) is displayed. To access mathematical symbols and punctuation marks, press **More** until (3 of 3) is displayed.
3. Press **Return** to return to the previous menu without entering characters.
4. To enter a space, press **Space**, which is available on both the letters and the symbols menus.
5. If you need to correct a character you have entered, you can use the backspace key to move the cursor in the active function area to the character you need to correct. Then select the new character.
6. Once you have completed entering all characters, press **Done**.
7. Pressing **ESC** at any time prior to pressing **Done** will clear the new entry and leave the previous entry unchanged.

## Front Panel Test

### Purpose

The front panel test checks the functionality of the instrument front panel keys and the RPG knob.

### Test Setup

Press **Mode, More, Service, More, Front Panel Test**. Once the **Front Panel Test** key is pressed you will see a display with three columns appear on the screen. The entries on the left side of each column describe a key. On the right side of each entry you will see a 0.

The front panel test requires you to press each of the front panel keys (in any order, with the exception of the **ESC** key, which *must* be pressed last), and to turn the RPG knob. The first time you press a key a 1 will replace the 0 that originally appeared to the right of the key column. Each additional instance of pressing a given key will result in an increment to the number listed in the column to the right of the key description. For example if you press the **Zoom** key four times, you will see a 4 to the right of the **Zoom** entry.

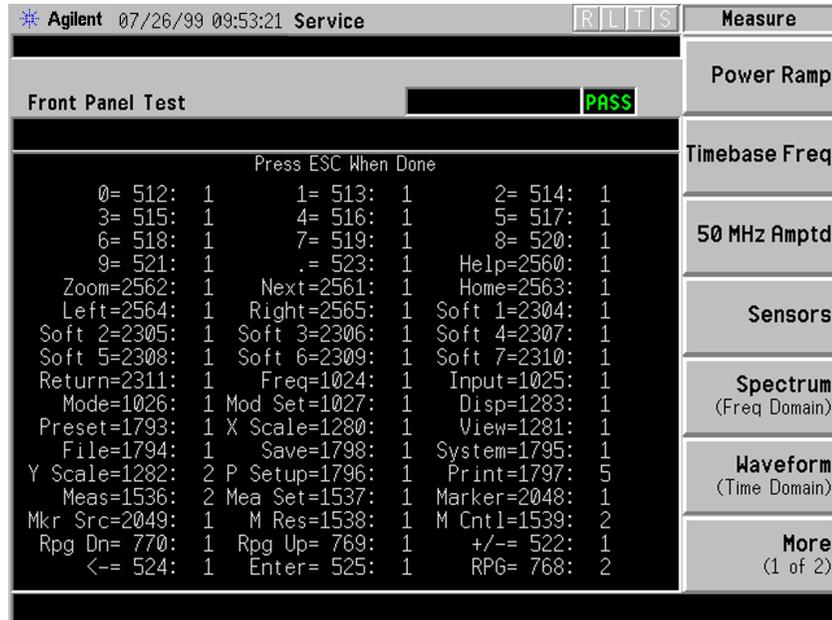
Rotating the RPG knob will result in a rapidly incrementing, or decrementing value appearing in the column to the right of the **RPG Knob** entry. Rotate the RPG knob clockwise and counter-clockwise. You will see negative or positive values appear, in ascending or descending order, depending on the direction you have turned the RPG knob.

Note that the two step keys (the up and down arrow keys) are described as the **Rpg Dn** and **Rpg Up** keys.

The **ESC** key must be pressed only after all other keys have been pressed and the RPG knob has been rotated; pressing the **ESC** key will cause the front panel test to be cancelled.

## Results

The display will show a list of all front panel keys and the RPG knob, followed by a “times-pressed” indicator. You will see a count of the number of times you have pressed a key next to that key on the display, except for the knob, next to which you will see positive or negative numbers in increments of 1.



## Troubleshooting Hints

If the front panel check fails contact the Agilent Technologies instrument support center. See [Table 1-5 on page 61](#).

## **Automated Adjustments**

The *Agilent N7812A Calibration Application Software* performs automated adjustments. Brief descriptions and setups for the automated adjustment procedures is found in the software itself. Details about the computer and test equipment requirements needed to run the software can be found in [Table 1-2 on page 18](#).

Post-Repair Procedures  
**Automated Adjustments**

## Numerics

- 10 MHz frequency reference
  - adjustment
  - test description, 248
- 10 MHz output description, 79
- 10 MHz reference adjustment
  - test description, 248
- 100 MHz VCXO, 50
- 100 MHz VCXO description, 78
- 100 MHz x 3 LO description, 79
- 1st LO, 52
- 21.4 MHz anti-alias filter
  - description, 74
- 21.4 MHz output buffer amplifier
  - description, 72
- 30 MHz sample clock, 56
- 321 MHz amplitude, 33
- 321.4 MHz amplifier description, 71
- 50 MHz calibrator adjustment
  - test description, 250
- 50 MHz calibrator description, 71
- 50 MHz calibrator in description, 79
- 7.5 MHz IF description, 76

## A

- A1 flat panel display
  - parts, 155
- A1 front frame
  - block description, 86
  - connector mnemonics, 106
  - removal, 175
  - troubleshooting
    - see individual sub-assy, 106
- A10 digital IF assembly
  - block description, 76
  - connector mnemonics, 105
  - interconnections, 77
  - part number, 134
  - removal, 185
  - troubleshooting, 47
- A12 analog IF assembly
  - block description, 73
  - connector mnemonics, 104
  - interconnections, 75
  - part number, 134
  - removal, 185
  - troubleshooting, 43
- A14 fan control board
  - block description, 84
  - part number, 134
  - removal, 187
- A15 daughter board
  - block description, 84
  - connector mnemonics, 97

- connector mnemonics (to motherboard), 101
  - part number, 134
  - removal, 189, 212
- A17 RF assembly
    - block description, 70
    - connector mnemonics, 110
    - interconnections, 72
    - part number, 134
    - removal, 191
    - troubleshooting, 39
  - A18 reference assembly
    - block description, 78
    - connector mnemonics, 112
    - interconnections, 79
    - part number, 134
    - removal, 191
    - troubleshooting, 50
  - A19 synthesizer assembly
    - block description, 80
    - connector mnemonics, 114
    - interconnections, 81
    - part number, 134
    - removal, 191
    - troubleshooting, 52
  - A2 flat panel display
    - block description, 86
    - removal, 220
    - troubleshooting, 28
  - A21 fan control board
    - connector mnemonics, 99
  - A21 mother board
    - block description, 84
    - connector mnemonics, 92
    - part number, 134
    - removal, 198
  - A22 processor assembly
    - block description, 82
    - connector mnemonics, 107, 108, 109
    - part number, 134
    - removal, 202
    - troubleshooting, 54
  - A22A1 DRAM board
    - part number, 134
    - removal, 205
  - A22A2 Flash board
    - part number, 134
    - removal, 205
  - A22A3 GP-IB capacitor board
    - part number, 134
    - removal, 205
  - A25 SCSI board
    - block description, 85
    - part number, 134
    - removal, 207
  - A3 front panel interface board

- block description, 86
  - part number, 134
  - removal, 224
- A3A1 and A3A2 inverter boards
    - part number, 134
    - troubleshooting, 28
  - A4 disk drive
    - block description, 86
    - connector mnemonics, 102
    - part number, 134
    - removal, 177
  - A6 power supply
    - block description, 69
    - connector mnemonics, 100
    - part number, 134
    - removal, 180
    - troubleshooting, 34
  - A7 baseband I/Q assembly
    - block description, 83
    - part number, 134
    - removal, 182
  - abbreviations, 130
  - abnormal indications, 233
  - absolute amplitude accuracy test, 59
  - active license key, 246
    - how to locate, 246
  - ADC autorange, 33
  - ADC description, 76, 83
  - ADC dither CF, 32
  - ADC offset DACs, 32
  - ADC RAM gains, 32
  - adjustment software, 14
  - adjustments
    - equipment, 18
    - required test equipment, 18
    - test equipment, 18
  - after repairs
    - see post-repair procedures, 234
  - Agilent Technologies
    - contacting, 60
    - Sales and Service offices, 60
  - alignment, auto, 32
  - Alpha Editor key, 258
  - analog IF assembly, see A12
    - analog IF assembly
  - analog to digital converter
    - see ADC, 76, 83
  - assembly
    - see
      - A1 front frame, 69
      - A10 digital IF assembly, 69
      - A12 analog IF assembly, 69
      - A14 fan control board, 69
      - A15 daughter board, 69
      - A17 RF assembly, 69
      - A18 reference assembly, 69

- A19 synthesizer assembly, 69
- A2 flat panel display, 69
- A21 fan control board, 69
- A22 processor assembly, 69
- A24 SCSI board, 69
- A3 front panel interface board, 69
- A4 disk drive, 69
- A6 power supply assembly, 69
- attenuator steps, 33
- auto align tests, description, 32
- auto alignment routine, 32
- auto boot, 56
  
- B**
- backlight
  - removal, 222
- bandpass filter description, 80
- base band I/Q amplitude accuracy
  - test description, 255
- baseband I/Q assembly, see A7
  - baseband I/Q assembly
- basic functionality,
  - troubleshooting, 31
- basics, troubleshooting, 23
- battery, 56
- bezel, removal, 226
- Block Diagrams, 119
- boot process, 54
- burp mode, 35
- burst trigger
  - test description, 254
- bypass mode, 43
  
- C**
- calibrator adjustment
  - test description, 250
- calibrator oscillator description, 74
- calibrator switch description, 71
- Choose Option key, 246
- clock generator description, 74
- configuration information, 242
- configure a replacement CPU, 241
- configuring I/O, 247
- connector mnemonics
  - see individual assemblies
- contacting Agilent Technologies, 60
- CPU assembly
  - configuring, 241
- CPU assembly, see A22 processor assembly
- critical data, 241
  
- D**
- daughter board, see A15 daughter board
- dead instrument,
  - troubleshooting, 26
- diagnostic check, 32
- digital IF assembly, see A10
  - digital IF assembly
- digital signal processing block, 83
- disk drive, see A4 disk drive
- display
  - see A2 flat panel display
- display filter
  - removal, 223
- down conversion, 39
- DRAM, 54
  - see A22A1 DRAM board, 205
- DRAM board, 242
  
- E**
- editing text, 258
- electrostatic discharge, 15
- entering
  - host name, 247
  - IP address, 247
  - serial number, 243
- entering configuration
  - information, 242
- equipment
  - adjustments, 18
  - performance verification tests, 18
- ESD Information, 15
- Ethernet Addr key, 247
- external keyboard
  - test description, 239
- external monitor, 28
- external trigger
  - front panel connector removal, 230
  
- F**
- fan control board, see A14 fan control board
- fan voltages, 27
- fans
  - removal, 193
- fans, troubleshooting, 27
- firmware updating, 63
- first doubler description, 80
- first LO, 52
- first mixer description, 71
- Flash, 54
  - see A22A2 Flash board, 205
- flash memory board, 242
  - replacement, 245
  
- flat panel display
  - part number, 134
- frequency reference adjustment
  - test description, 248
- front panel interface board, see A3
  - front panel interface board
- Front Panel Test, 238, 259
- front panel, see A1 front frame fuse, 34
  
- G**
- gain range select description, 76
- GPIB Address key, 247
- GP-IB capacitor board, 242
  - see A22A3 GP-IB capacitor board, 205
  
- H**
- Host Name key, 247
- how to order parts, 127
- how to return your analyzer for service, 64
- HSYNC, troubleshooting, 30
  
- I**
- I/O
  - configuring, 247
- I/Q input circuitry, 83
- IF gain curve, 32
- IF image filter, 32
- image filter description, 71
- inoperative instrument,
  - troubleshooting, 26
- inoperative spectrum analyzer, 26
- input attenuator description, 70
- input selector switch description, 76
- Install Now key, 246
- installing measurement personalities, 246
- instrument packaging, 64
- instrument serial number, 62
- internal 10 MHz frequency
  - reference adjustment
  - test description, 248
- internal 50 MHz calibrator
  - adjustment
  - test description, 250
- internal calibrator adjustment
  - test description, 250
- internal frequency reference
  - adjustment
  - test description, 248
- inverter boards
  - see A3A1 and A3A2 inverter boards

IP Address key, 247

## K

keypad, removal, 226

## L

LAN, 55

LC filter mode, 43

LC prefilter narrow, 33

LC prefilter wide, 33

LCD

see A2 flat panel display

LCD clock, troubleshooting, 30

LED

front panel, 23, 24, 25, 34

rear panel, 24, 55

License key, 246

license key number, 241

lock detector description, 80

## M

manuals tests and adjustments,  
237

mid web

removal, 195

mixer (A12 analog IF) description,  
74

mnemonics

see individual assemblies

monitor, external, 28

mother board, see A21 mother  
board

multipliers, 133

## N

N7812A E4406A Calibration  
Application Software, 14

nominal system gain, 33

## O

offset adjust and dither  
description, 77

option connectors

connector mnemonics, 103

ordering parts, 127

original instrument packing, 64

other instrument packing, 65

outer case, removal, 171

over voltage, 35

## P

packaging, 64

parts

how to order, 127

list, 125

replaceable, 134

password, service, 243

performance test software, 14

performance tests

troubleshooting, 58

performance verification tests

equipment, 18

required test equipment, 18

test equipment, 18

phase lock circuitry, 50

post down conversion filter

description, 74

post filters, 44

post-repair procedures, 234

power supply switching frequency

generator description, 75

power supply, see A6 power

supply

power-on process, 54

pre-filter description, 73

prefilter modes, 43

probe power connector, 34

processor assembly, see A22

processor assembly

## R

real time clock, 56

rear frame, removal, 210

rear panel connector board,

removal, 208

rear panel connectors, 54

reference adjustment

test description, 248

reference assembly, see A18

reference assembly

reference designators, 129

reference unlock detector

description, 79

removal procedures, 168

remove

see individual assemblies

replace

see individual assemblies

replaceable parts, 134

replacement procedures, 168

replacement processor, 54

replacing assemblies

see individual assemblies, 168

required test equipment

adjustments, 18

performance verification tests,

18

troubleshooting, 18

returning instrument for service,

64

RF assembly, see A17 RF

assembly

RF input connector

part number, 134

RF input connector, removal, 214

RF input switch description, 70

RPG, removal, 229

## S

Safety Information, 2, 13, 167

Sales and Service offices, 60

sample clock, 56

sample rate oscillator description,

74

SCSI board, see A25 SCSI board

second doubler description, 81

second mixer description, 71

serial number, 62

entering, 243

service password, 243

service tag, 64

service tools, 167

static damage, 15

support URL, 60

support web site, 60

synthesizer assembly, see A19

synthesizer assembly

## T

test descriptions

10 MHz frequency reference

adjustment, 248

10 MHz reference adjustment,

248

50 MHz calibrator adjustment,

250

base band I/Q amplitude

accuracy test, 255

burst trigger check, 254

calibrator adjustment, 250

external keyboard, 239

internal 10 MHz frequency

reference adjustment, 248

internal 50 MHz calibrator

adjustment, 250

internal calibrator adjustment,

250

internal frequency reference

adjustment, 248

reference adjustment, 248

test equipment

adjustments, 18

performance verification tests,

18

post-repair, 236

test software, 14

text

how to enter, 258

thermal shutdown, 27

third LO description, [74](#)  
top brace, removal, [173](#), [182](#)  
trigger delays, [33](#)  
trigger interpolator, [32](#)  
troubleshooting  
  auto align tests, [32](#)  
  basics, [23](#)  
  equipment needed, [18](#)  
  initial checks, [26](#)  
  inoperative instrument, [26](#)  
  performance test failures, [58](#)  
  problems at power-up, [25](#)  
  see individual assemblies  
  symptoms, [24](#)

## U

uninstalling measurement  
  personalities, [246](#)  
unused daughter board  
  connectors, connector  
  mnemonics, [116](#)  
updating firmware, [63](#)  
URL, [23](#), [60](#)

## V

variable gain amplifier  
  description, [73](#)  
VCO, [52](#)  
VCO phase lock loop description,  
  [80](#)  
VCXO, [50](#)  
VGA monitor, [28](#)  
VSYNC, troubleshooting, [30](#)

## W

web site URL, [23](#)

## X

XTAL filter mode, [43](#)  
XTAL prefilter narrow, [33](#)  
XTAL prefilter wide, [33](#)