Keysight N9038A
MXE EMI Receiver

Notice: This document contains references to Agilent. Please note that Agilent's Test and Measurement business has become Keysight Technologies. For more information, go to www.keysight.com.

KEYSIGHT
TECHNOLOGIES

Service Guide

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about these products, including instrument software upgrades, application information, and product information, browse to one of the following URLs, according to the name of your product:

http://www.keysight.com/find/mxe

To receive the latest updates by email, subscribe to Keysight Email Updates at the following URL:

http://www.keysight.com/find/MyKeysight

Information on preventing instrument damage can be found at:

www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

Periodically, Keysight releases software updates to fix known defects and incorporate product enhancements. To search for software updates for your product, go to the Keysight Technical Support website at:

http://www.keysight.com/find/techsupport

Lithium Battery Disposal

The MXE EMI Receiver uses an internal 3.0 VDC battery that contains Lithium/Manganese Dioxide (Li/MnO2). The battery is located on the A4 CPU assembly to power the instrument clock and back up data in SRAM. When the battery is exhausted and ready for disposal, dispose of it according to your country's requirements. The Keysight part number is 1420-0356. The manufacturer's part number is CR2032. You can return the battery to your nearest Keysight Technologies Sales and Service office for disposal, if required. Refer to "Contacting Keysight Technologies" on page 31 for a list of Keysight Technologies Sales and Service offices.

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

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1   Overview

What You Will Find in This Chapter

This chapter provides overview information on your spectrum analyzer.

The following sections are found in this chapter:

KEYSIGHT
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Service Manual Revision History

N9038-90029

- Print Date April 2019

    - Changed part numbers in Replaceable Parts table Table 17-1

    - Minor update in RF Presel chapter

    - Miscellaneous formatting changes

- Print Date March 2016

    - Added support for Option EXM - External Mixing

    - Miscellaneous minor updates

- Print Date September 2015

    - Added support for Option B85 - 85 MHz Analysis Bandwidth

    - Miscellaneous minor updates

- Print Date February 2015

    - Rebrand to Keysight

    - Miscellaneous minor updates and formatting changes

- Print Date December 2014

    - Added support for Option 503 - 20 Hz to 3.6 GHz Frequency Range

    - Incorporate updates from previous revision

- Print Date April 2014

    - Added support for PC4 processor assembly

    - Updated functional tests to include EMI detectors

    - Miscellaneous minor updates

- Print Date October 2013

    - Added support for Option 544 - 20 Hz to 44 GHz Frequency Range

    - Incorporate updates for previous revision

    - Miscellaneous minor updates

N9038-90021

- Print Date June 2013

- Instrument serial number prefix MY/SG5322

— Added support for Option DP2 - High Performance Digital Signal
    Processing

    — New A2 Enhanced Analog IF Assembly

    — New A3 High Performance Digital IF Assembly

    — New A15 Enhanced Front End Control Assembly

— Added support for Option CR3 - Wideband IF Output

— Added support for Option LSN - External LISN Control

— Added support for LED backlit display

— Incorporate updates for previous revision

— Miscellaneous minor updates

N9038-90001

— Print Date May 2011

— Initial revision

Keysight MXE EMI Receiver Overview

The Keysight MXE EMI Receiver measures and monitors complex RF and microwave signals. The receiver integrates traditional spectrum measurements with advanced vector signal analysis to optimize speed, accuracy, and dynamic range. The MXE has a Windows operating system, which expands the usability of the receiver. You will be able to manipulate various file types on your receiver just like your personal computer. Having a Windows based instrument provides many benefits such as easier file management, built-in Windows based programs such as Internet Explorer, and much more.

The Keysight MXE EMI Receiver is readily adaptable to meet changing measurement needs. Optional features, whether hardware or measurement application software, will enable the receiver to be configured as a comprehensive analytical tool to test communications systems and components.

If customer requirements should change or expand, post sale upgrades can be purchased at any time. Most measurement application upgrades require a license key, which is obtained using the Keysight Software Licensing service. If the email delivery option is ordered, the entitlement certificate will be emailed to the customer the same day and the license key can be generated and installed in the signal receiver within minutes (the instrument software may require updating). Once the license key is entered into the receiver, the new option is enabled and fully functional.

The service strategy for the MXE is assembly level repair, not component level.

Hardware upgrades may require installation of optional hardware, and often require readjustment and verification of the hardware option.

Virus Information

Keysight Technologies does not load anti-virus software into the MXE. It is the customers responsibility to install anti-virus software.

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Instrument Option Descriptions

The MXE EMI Receiver has a variety of hardware and measurement application options. Several of these options are "standard" so they are automatically installed on all MXE instruments. All options require license files to be present in instrument memory before the option can be used, or viewed on the System configuration screen.

From the front panel, press **System**, **Show**, **System** to view a list of all installed options.

A current list of all instrument options and retrofit requirements is available on the Keysight web site at:

www.keysight.com/find/mxe

Option	Description	Notes
503	20 Hz to 3.6 GHz Frequency Range	
508	20 Hz to 8.4 GHz Frequency Range	
526	20 Hz to 26.5 GHz Frequency Range	
544	20 Hz to 44 GHz Frequency Range	
B25	25 MHz Analysis Bandwidth	
B85	85 MHz Analysis Bandwidth	
C35	3.5 mm RF Input	
CNF[a]	Type-N Female RF input	Not Licensed
CR3	Wideband IF Output	Included on all units[b]
DP2	High Performance Digital Signal Processing	Included on all units[b]
EDP	Enhanced Display Package	Included on all units
EMC	Software only. Provides EMI detectors and BWs.	Included on all units
EXM	External Mixing	
FSA[a]	Fine Step Attenuator	Included on all units
LSN	External LISN Control	Included on all units[b]
NFE	Noise Floor Extension	Included on all units
PFR	Precision Frequency Reference	Included on all units
P03	Preamp, 100 kHz to 3.6 GHz	Included with Option 503
P08	Preamp, 100 kHz to 8.4 GHz	Included with Option 508

Option	Description	Notes
P26	Preamp, 100 kHz to 26.5 GHz	Included with Option 526
P44	Preamp, 100 kHz to 44 GHz	Included with Option 544
RT1	Real-Time Spectrum Analysis	
TDS	Time Domain Spectrum	
YAS	Y-Axis Screen Video (rear panel Analog Out connector)	

a. Does not appear in option listing of instrument
b. Standard as of Serial Prefix MY/SG5322

Before You Start Troubleshooting

Before troubleshooting, complete the following tasks:

— Familiarize yourself with the safety symbols marked on the instrument and read the general safety considerations in the front of this guide.

— Read the general safety considerations below.

— Read the ESD information below.

— Familiarize yourself with the troubleshooting information in **Chapter 2, "Boot Up and Initialization."**, and how it relates to information on troubleshooting the other assemblies.

General Safety Considerations

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

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

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

WARNING   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.

WARNING   This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a 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.

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

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

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

WARNING   To prevent electrical shock, disconnect the analyzer from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.

Overview
General Safety Considerations

CAUTION   Always position the instrument for easy access to the disconnecting device (detachable power cord).

CAUTION   Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage.

CAUTION   This instrument has an autoranging line voltage input; be sure the supply voltage is within the specified range.

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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 megohm of isolation from ground.

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

Figure 1-1   Example of a Static-Safe Workstation
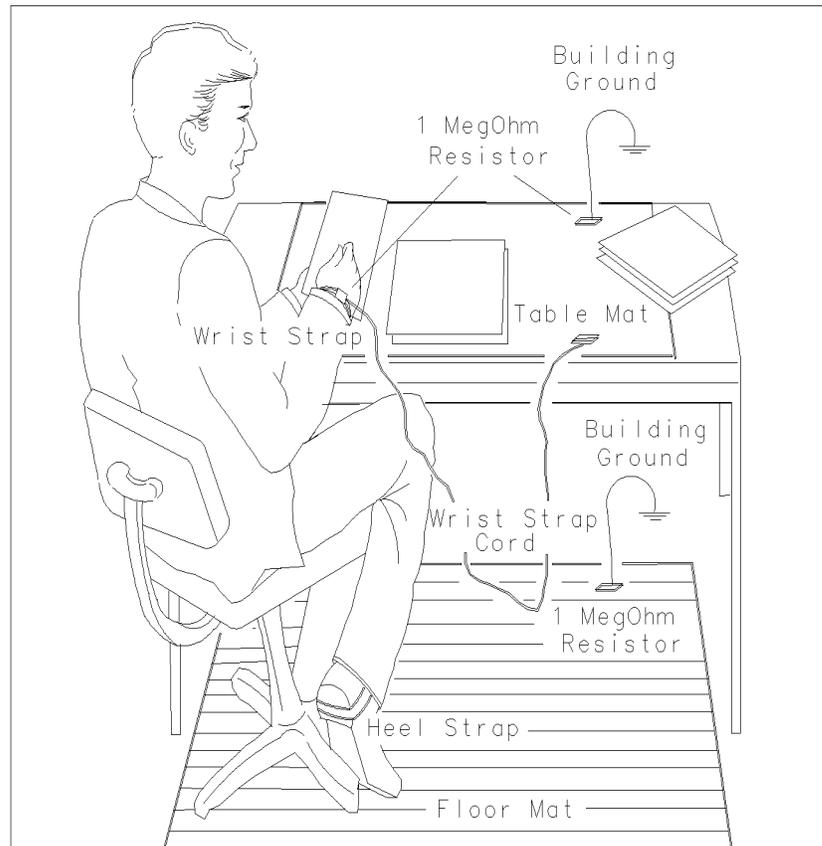
Handling of Electronic Components and ESD

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 paying 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.

CAUTION   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 analyzer connector, momentarily short the center and outer conductors of the cable together.

— Personnel should be grounded with a 1 megohm resistor-isolated wrist-strap before touching the center pin of any connector and before removing any assembly from the analyzer.

— Be sure that all analyzers 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

There are certain things that will be required to troubleshoot, adjust, and test the MXE EMI Receiver. They include the following:

— Calibration Application Software
— Front End Controller Troubleshooting Kit
— USB Keyboard and Mouse
— USB Storage Device
— Test Equipment

Tools you will need

Figure 1-2   TORX Tool
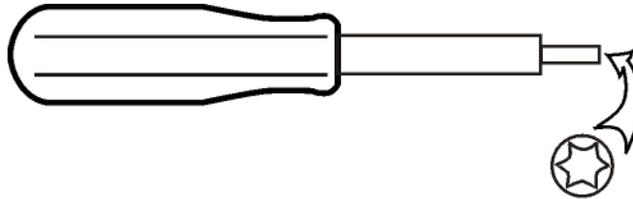
sl736a

Hand Tool	Size
Cable Puller (5021-6773)	
Nut Driver	3/16 inch
Nut Driver	5/16 inch
Nut Driver	9/16 inch
Open-End Wrench	5/16 inch
Torque Driver - Adjustable	Multi Bit
Torque Wrench - 10 inch-lbs	5/16 inch
TORX Driver	T-6
TORX Driver	T-8
TORX Driver	T-10
TORX Driver	T-20

Calibration Application Software

Information regarding the Keysight MXE EMI Receiver Calibration Application Software can be found at the following web site:

www.keysight.com/find/calibrationsoftware

Front End Controller Troubleshooting Kit

The Front End Troubleshooting kit contains a PC board, required cables, and installation instructions to verify the switch control logic from the A15 Front End Control board to the lower level front end components is correct. Oftentimes when troubleshooting an RF front end problem, the logic needs to be verified before one of the front end components is changed. This troubleshooting kit will help identify the defective area in a timely manner. In order to effectively isolate A15 Front End Control board problems from front end component problems, it is highly recommended that the N9020-60005 Front End Troubleshooting kit is purchased.

The Front End Troubleshooting kit lower level items can be purchased individually or as a complete kit with instructions. The complete listing of kit components, descriptions, and part numbers can be found below.

Keysight Part	Keysight Part Number	Notes
Front End Troubleshooting kit	N9020-60005	
Front End Troubleshooting board	E4410-60115	Part of N9020-60005 Troubleshooting kit
Cable, Low Band switch	E4410-60160	Part of N9020-60005 Troubleshooting kit
Cable, RF Downconverter	E4410-60156	Part of N9020-60005 Troubleshooting kit
Cable, YTF Preselector	E4410-60158	Part of N9020-60005 Troubleshooting kit
Cable, Input Attenuators	E4410-60157	Part of N9020-60005 Troubleshooting kit
Cable, Troubleshooting	8121-1400	Right-angle sma (m) to right-angle mmcx (m) (must be ordered separately)
Adapter, MMCX (f) to SMA (f)	n/a	www.hubersuhner.com item number: 31_MMCX-SMZ-50-1/111_OE (must be ordered separately)
Adapter, 2.4 mm (m) to 3.5 mm (f)	11901-60003	Needed for troubleshooting instruments with Option 544 only

Type-M Troubleshooting Cable

In order to directly measure the output of the A22 Radiated Filter board or inject a signal into the input of the A21 RF Presel Input board, a special Type-M connector is needed. A short Type-M male to BNC male cable has been created for this purpose, It is recommended that two of these be available for troubleshooting the instrument. The part number of this cable is N9039-60034.

After an Instrument Repair

If any instrument assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. Most of these tests are done using the N7818A Keysight MXE EMI Receiver Calibration Application Software. Refer to Chapter 19, "Post-Repair Procedures" for a list of post-repair adjustments and performance tests based on which hardware has been changed.

Information regarding the N7818A Keysight MXE EMI Receiver Calibration Application Software can be found at

http://www.keysight.com/find/calibrationsoftware

Contacting Keysight Technologies

If you have a problem with your instrument, see Chapter 2, "Boot Up and Initialization". This section contains a checklist that will help identify some of the most common problems.

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

http://www.keysight.com/find/mxe_support

FAQs, instrument software updates, documentation, and other support information can be accessed from this site.

To obtain servicing information or to order replacement parts, contact the nearest Keysight office listed in Table 1-1. In any correspondence or telephone conversations, refer to the instrument by its model number (N9038A) and full serial number (ex. MY49250887). With this information, the Keysight 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 1-1   Contacting Keysight

Online assistance: www.keysight.com/find/contactus

Americas

Country	Phone Number
Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	1 800 829-4444

Asia Pacific

Country	Phone Number
Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe and Middle

Country	Phone Number
Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100

Europe and Middle

Country	Phone Number
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353 Opt. 1 (DE) Opt. 2 (FR) Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus

Instrument Serial Numbers

Keysight makes frequent improvements to its products enhancing performance, usability, or reliability. Keysight 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 Keysight 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 the following figure.

Figure 1-3   Example Serial Number
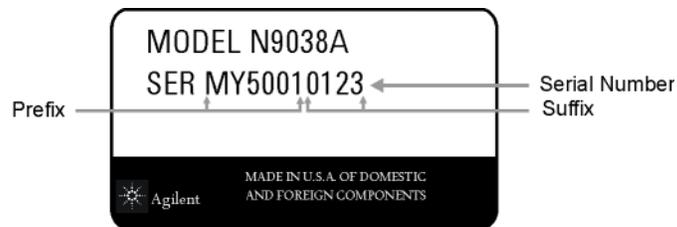
The first two letters of the prefix identify the country in which the unit was manufactured. The remaining four numbers of the prefix identify the date of the last major design change incorporated in your instrument. The four digit suffix is a sequential number and, coupled with the prefix, provides 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.

The serial number is located on the rear panel serial sticker or when the analyzer is power up, press **System**, **Show, System**. The system information can be very useful for updates and post-sale upgrades.

How to Return Your Instrument for Service

Service Order Number

If an instrument is being returned to Keysight for servicing, the phone numbers are mentioned in . In order for Keysight to expedite the repair please be as specific as possible about the nature of the failure.

Helpful failure descriptions:

— Signal level measures 10 dB too low at 1 GHz

— LO Unlock error message appears on screen in spans < 10 MHz

— Analyzer will not complete boot up sequence to signal analyzer mode

Failure descriptions that will most likely increase repair time:

— Analyzer broken

— Analyzer will not make accurate measurements

— Signal drifts

If you have recorded any error messages that appeared on the analyzer display, or have completed a Functional Test or Performance Verification Test, or have any other specific data on the performance of the instrument, please send a copy of this information with the instrument.

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

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. Protect the control panel with cardboard.

2. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.

3. 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.

4. 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.

5. Seal the shipping container securely with strong nylon adhesive tape.

6. Mark the shipping container "FRAGILE, HANDLE WITH CARE" to assure careful handling.

7. Retain copies of all shipping papers.

Keysight Technologies X-Series Signal Analyzers
N9038A MXE Signal Analyzer

Service Guide

2 Boot Up and Initialization

What You Will Find in This Chapter

This chapter provides information that is useful when starting to troubleshoot a spectrum analyzer. It includes procedures for troubleshooting common failures and provides information on isolating problems in the analyzer.

The following sections are found in this chapter:

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Check the Basics

Before calling Keysight Technologies or returning the instrument for service, please make the following checks:

1. Is there power at the power outlet? At the power receptacle on the instrument?

2. Is the instrument turned on? Check to see if the front panel LED is green, which 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.

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 **Mode 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 Guide for specifications.

7. In order to meet specifications, the instrument must be aligned. Press **System**, **Alignments**, **Align Now**, **All**. The diagnostic tests should all pass. If the instrument displays a failure during these tests, refer to "Fails an Initial Alignment" on page 59.

8. Check to see if the instrument has the latest software before starting the troubleshooting procedure. Press **System, Show, System**. The software revision is listed under **Instrument S/W Revision**. For more information, refer to Chapter 20, "Instrument Software", on page 659.

9. Is the instrument displaying an error message? If so, refer to Chapter 3, "Instrument Messages", on page 67 for more information.

10. If the necessary test equipment is available, perform the functional checks in Chapter 22, "Tests", on page 665.

MXE Instrument Boot Up Process

This section describes the N9038A EMI Receiver boot up process from initial AC power to a normal analyzer sweep. The boot process time from start to finish will take 6 to 8 minutes. This boot time will vary slightly depending on the analyzer hardware configuration, installed options and the number of measurement applications.

By default, the measurement applications will preload before the EMI Receiver application is fully booted. The analyzer boot time can be shortened if needed by turning off the preload process for applications that are not going to be used. If this is done, the preload process will be bypassed during the application boot up. If a certain measurement mode is selected that did not preload during the original boot, that measurement application will preload at that time. When this occurs the mode switching time will take longer. Once the application is loaded all subsequent mode switches will be much faster.

If the user does not want the measurement applications to preload during the application boot process, select the Configure Applications icon on the desktop. This will bring up a window as shown in Figure 2-1 that shows the various applications and what is selected to preload. By default all applications are checked and therefore, will preload when the MXE application is launched. Uncheck any applications to bypass the preloading process, select Apply, and then OK to close the Configure Applications window when finished.

Figure 2-1   Configure Application
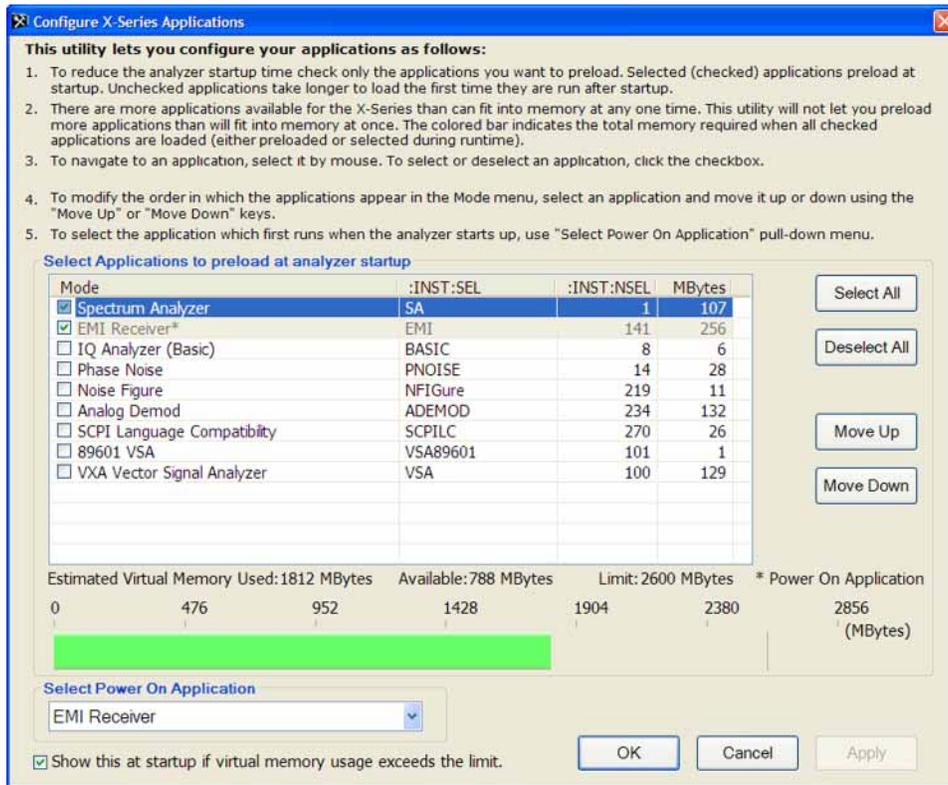
Typical instrument boot-up process flow

1. Plug in the AC power cord from a known good AC power source into the rear panel of the analyzer.

2. The yellow standby LED illuminates on the analyzer front panel to the left-hand side of the On/Off button. If the yellow Standby LED is not illuminating refer to the "Yellow Standby LED Does Not Illuminate" section in this chapter.

3. To turn the analyzer on, press the On/Off button. The yellow Standby LED should turn off and the green Power On LED should illuminate. A green Power On LED indicates that the power supply has received an "On" command from the A4 CPU assembly. If the green Power On LED is not illuminating refer to the "Green Power On LED Does Not Illuminate" section in this chapter.

NOTE If the analyzer AC power source was removed by the operator by pulling the power cord or by turning off the analyzer via a power main switch on a test rack, the analyzer will automatically power on without having to press the On/Off button on the front panel.

4. The instrument fans should start running. The fans are mounted on the left-hand side of the analyzer and draw air into the instrument to cool the internal circuitry. If a fan is not running refer to the "Fan(s) Are Not Operating" section in this chapter.

5. The Keysight Technologies splash screen is displayed in white font on a dark background for ~5-10 seconds after the analyzer is turned on. If the Keysight Technologies logo is not displayed refer to the "No Keysight Splash Screen Displayed" section in this chapter. If the instrument hangs at the Keysight Technologies splash screen refer to the "Instrument Hangs at the Keysight Splash Screen" section in this chapter.

6. Verify text is displayed on screen where the user has the option of booting Windows or running the Instrument Image Recovery System. The default selection is to boot Windows. If a recovery is required, press the Down Arrow key on the front panel of the analyzer within 5 seconds to highlight "Instrument Image Recovery System" and press the Enter key on the analyzer, otherwise Windows will begin to boot. If the Windows boot screen is not displayed within a few seconds refer to the "Instrument Cannot Completely Load or Run the Operating System" section in this chapter.

7. If the recovery system is not selected the Windows operating system will begin to boot up. This will take ~20-30 seconds.

NOTE

If a recovery was selected follow the on-screen instructions and perform a system recovery. Additional information about performing a system recovery can be found in Chapter 11, "CPU & Disk Drive", on page 355 in this manual.

8. The Keysight Technologies logo is displayed in white font on a blue background while Windows finishes loading user preferences. This can take up to 4 minutes. If this does not occur refer to the "Instrument Cannot Completely Load or Run the Operating System" section in this chapter.

9. By default, the initialization process of the MXE EMI Receiver application begins loading. The splash screen appears. This screen remains for slightly over 1 minute. If any of the initializing processes do not complete, refer to the "Initializations Did Not Complete" section in this chapter.

10. While the application software is loading the instrument will perform a number of internal alignments before the analyzer begins to sweep. A screen with a black background appears and the alignment progress is shown in a yellow box. The number of alignments is dependent on which hardware options are present. If an alignment fails, refer to the "Fails an Initial Alignment" section in this chapter.

11. If any of the initial alignments fail, check the alignment history for troubleshooting hints.

The instrument alignment history can be found at:

E:\AlignDataStorage\AlignmentHistory.txt

Look for any failed status for the various internal hardware items listed in this file.

Once the MXE application is fully initialized and aligned, the display should resemble Figure 2-2 when delivered from the factory. This completes the boot process from initial AC power to the spectrum analyzer application.

IMPORTANT   If the power up state has been changed from the factory power on state by the user, the analyzer will boot to that state.

Figure 2-2   Typical Instrument State at Power-up

Potential Problems During Boot Process

This section describes potential problems that may occur if there is an internal hardware issue that prohibits the instrument from completing a full boot up to the spectrum analyzer application.

Yellow Standby LED Does Not Illuminate

Control of the yellow front panel Standby LED comes from the A4 Processor board assembly. This signal is routed through the A7 Midplane board and is then buffered on the A8 Motherboard before being sent to the A1A2 Front Panel Interface board through W8. Of course, the power for this all originates with the A6 Power Supply Assembly. When the Standby LED does not come on it could be due to any one of these assemblies. This procedure will help to determine which one is the cause.

If the instrument turns on and operates properly but the yellow Standby LED does not work then all that will need to be done is to trace where the control signal for the LED is being lost using the routing information in the preceding paragraph.

1. The Standby LED will only turn on when the instrument is connected to an AC power source that has a voltage level and frequency of that specified for the instrument. Before proceeding verify that these requirements are being met. Refer to the instrument rear panel for these requirements.

2. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. Referring to Figure 2-3, verify the +5.1VSB LED on the A7 Midplane board is on (green).

Figure 2-3   A7 Midplane Board +5.1VSB LED
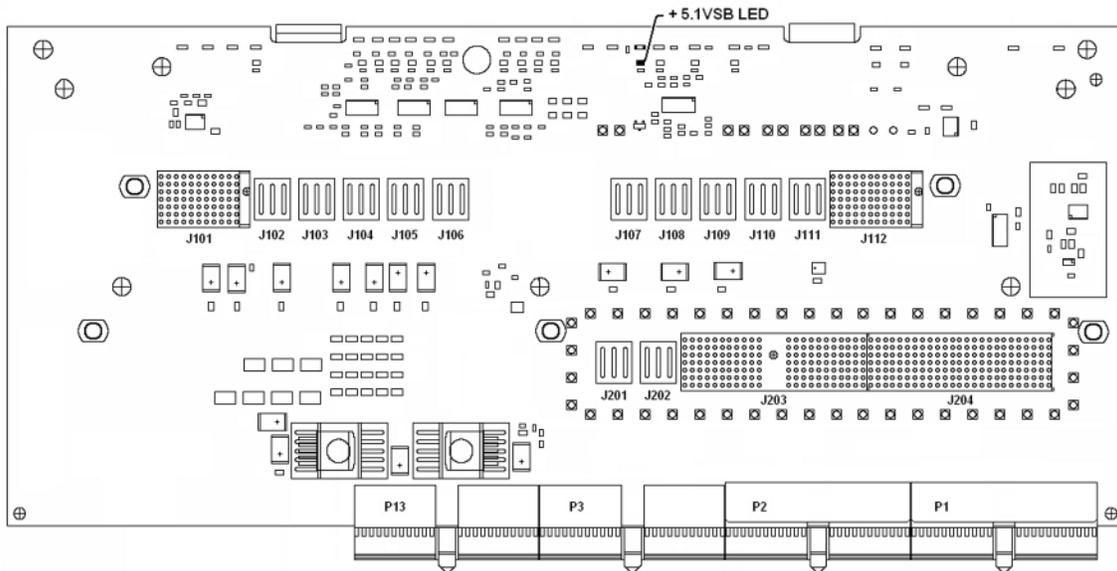
> **NOTE**
>
> Most DC power supplies come from the A6 Power Supply assembly. However, the most convenient measurement location for all the DC supplies is the A7 Midplane. All power supply LED's are accessible once the instrument cover has been removed.

Is the +5.1VSB LED on the A7 Midplane board on?

If yes:

After verifying that the connections from the yellow front panel Standby LED back to the A4 Processor board are not at fault, replace the A4 Processor board.

If not:

Replace the A6 Power Supply assembly.

> **NOTE**
>
> Before replacing the power supply, verify the midplane and motherboard interconnects are mechanically secure.

Green Power On LED Does Not Illuminate

Control of the green front panel Power On LED comes from the A4 Processor board assembly. This signal is routed through the A7 Midplane board and is then buffered on the A8 Motherboard before being sent to the A1A2 Front Panel Interface board through W8. Of course, the power for this all originates with the A6 Power Supply Assembly. When the Power On LED does not come on it could be due to any one of these assemblies. This procedure will help to determine which one is the cause.

This procedure assumes that the yellow Standby LED does turn on when the AC power is connected to the rear panel of the instrument. If it doesn't, refer to the "Yellow Standby LED Does Not Illuminate" section before proceeding.

If the instrument turns on and operates properly but the green Power On LED does not work then all that will need to be done is to trace where the control signal for the LED is being lost using the routing information in the preceding paragraph.

1. The Power On LED will only turn on when the instrument is connected to an AC power source that has a voltage level and frequency of that specified for the instrument and the front panel On/Off button has been pressed. Before proceeding verify that these requirements are being met. Refer to the instrument rear panel for these requirements.

2. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. Remove the Top Brace. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

4. With AC power connected to the rear of the instrument but without turning it on, leaving it in standby mode, measure the voltage at Test Point 518 (POWER_ON_L) of the A7 Midplane board assembly. See Figure 2-4 for Test Point 518 location.

   Does the voltage at Test Point 518 measure 5 VDC?

   If yes:

   Proceed to step 5.

   If not:

   Replace the A6 Power Supply assembly.

NOTE   Before replacing the power supply, verify the midplane and motherboard interconnects are mechanically secure.

Figure 2-4 A7 Midplane Board – Test Point 518/POWER_ON_L LED
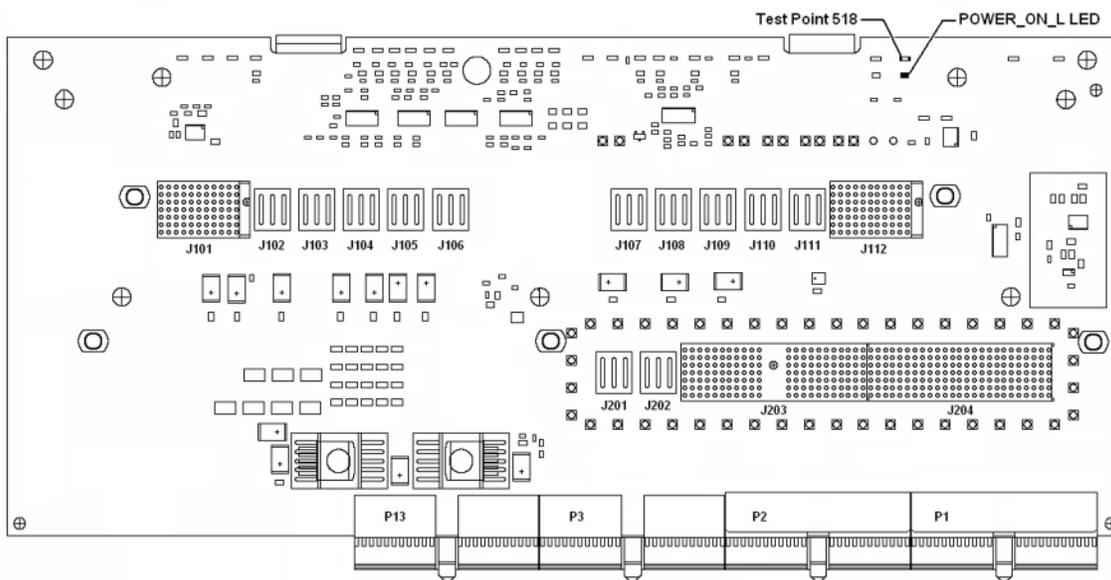
5. Turn the instrument power on from the front panel On/Off button and view the status of the POWER_ON_L LED, as shown in Figure 2-4.

   Does the POWER_ON_L LED come on? (Test Point 518 should also go to 0 VDC)

   If yes:

   > Proceed to step 6.

   If not:

   > Verify the connection between the front panel On/Off switch and the A4 Processor assembly by checking the status of the POWER_SW_L control line when the front panel On/Off button is both pressed and released. This can be monitored by measuring the voltage at Test Point 520, as shown in Figure 2-5.

   > With the On/Off button released this should measure a TTL high level, and with the button pressed it should measure a TTL low level. The A4 Processor board assembly provides the voltage and the switch on the front panel pulls it low when it is pressed.

Measure the voltage at Test Point 520 and compare the results to that in Table 2-1.

Table 2-1   Test Point 520 Verification

Front Panel Switch		Most Probably Cause
Released	Pressed	
High	Low	A4 Processor
High	High	Front Panel Switch
Low	Low	A4 Processor

Figure 2-5 A7 Midplane Board - Test Point 520/POWER_SW_L
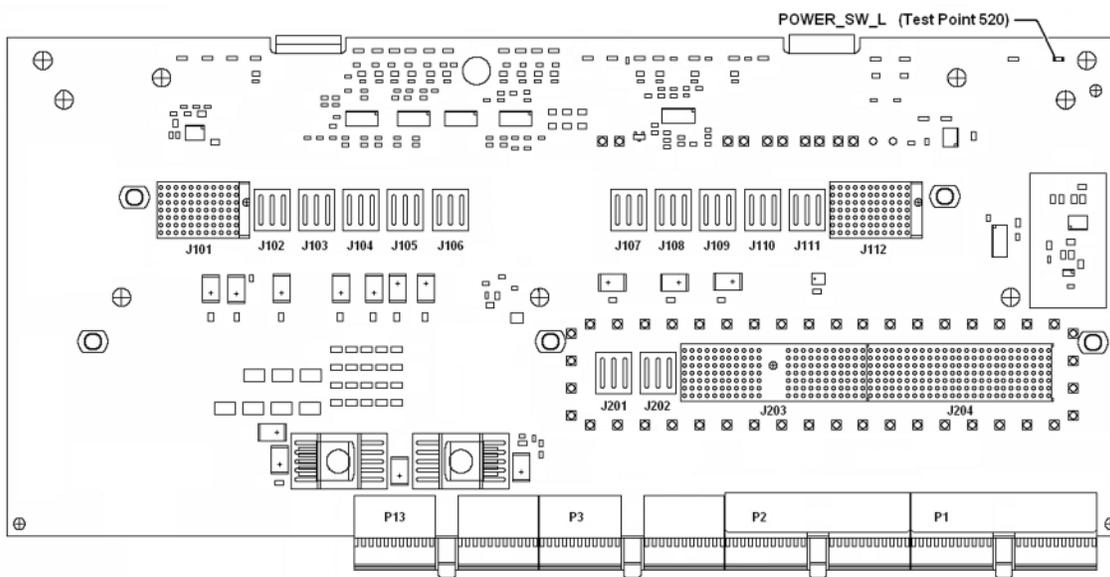
6. Do all of the red power supply LEDs along the top of the A7 Midplane board go off when the power is turned on?

If yes:

Replace the A4 Processor board.

If not:

Proceed to step 7.

7. To verify that the A6 Power Supply is not in an over current condition, check the status of the FAULT_L status line by measuring the voltage level at Test Point 508 or viewing the FAULT_L LED, as shown in Figure 2-6.

It should be noted that the FAULT_L status line can also be triggered by an over voltage or an over temperature condition in the A6 Power Supply assembly.

Is the FAULT_L LED on? (Test Point 508 at a TTL low level)

If not:

Replace the A6 Power Supply assembly.

If yes:

Remove different assemblies from the instrument one at a time to see if one of them can be identified as overloading the A6 Power Supply assembly.

If, when a particular assembly is removed, the power supplies will now come on, replace that assembly.

If no assembly can be found that is causing the overcurrent condition, replace the A6 Power Supply assembly.

Figure 2-6 A7 Midplane Board – Test Point 508/FAULT_L LED
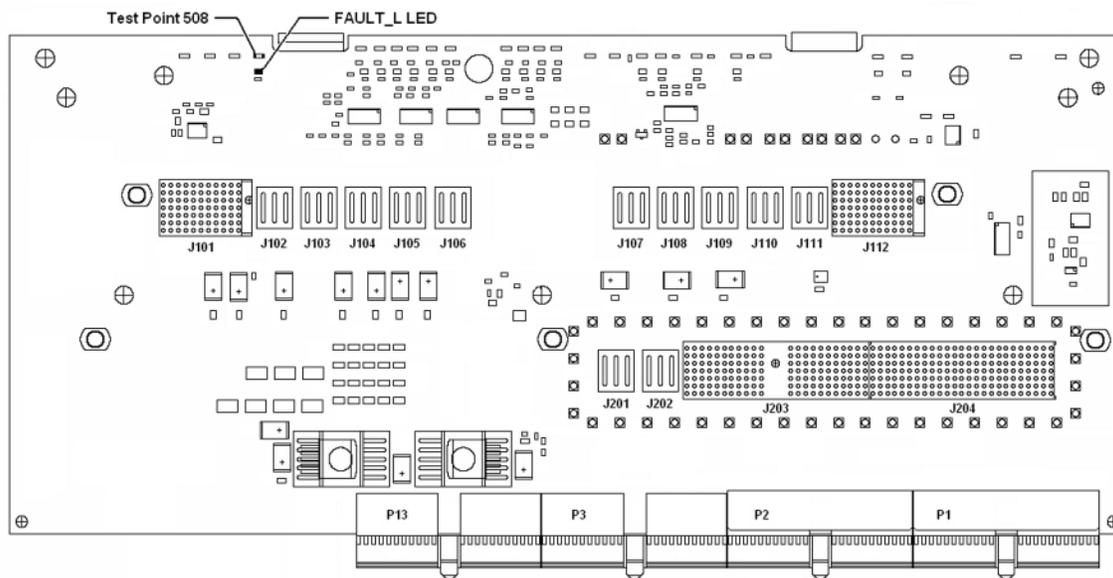
Fan(s) Are Not Operating

Control of the instrument fans comes from the A6 Power Supply assembly. This signal is routed from the A6 Power Supply through the A7 Midplane board, where there is a test point and LED to monitor the level, and is then routed to the A8 Motherboard where it is filtered before being sent to the Fans. When the Fans do not come on it could be due to any one of these assemblies. This procedure will help to determine which one is the cause.

This procedure assumes that the green Power On LED on the front panel does turn on when the instrument is turned on. If it doesn't, refer to the "Green Power On LED Does Not Illuminate" section before proceeding.

1. The instrument fans will only turn on when the instrument is connected to an AC power source that has a voltage level and frequency of that specified for the instrument and the front panel On/Off button has been pressed. Before proceeding verify that these requirements are being met. Refer to the instrument rear panel for these requirements.

2. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. Are all three fans not spinning?

    If yes:

    Proceed to step 4.

    If not:

    Proceed to step 6.

4. Remove the Top Brace. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

5. Referring to Figure 2-7, verify that the Fan_P Failure LED on the A7 Midplane board is off.

Is the Fan_P LED off?

>**If yes:**

>>Measure the voltage level at Test Point 522 on the A7 Midplane board.

>>Is the Test Point 522 voltage between +7 and +15 VDC?

>>>**If yes:**

>>>>Proceed to step 6.

>>>**If not:**

>>>>Replace the A6 Power Supply assembly.

>**If not:**

>>Replace the A6 Power Supply assembly.

NOTE	Before replacing the power supply, verify the midplane and motherboard interconnects are mechanically secure.

Figure 2-7   A7 Midplane Board - Fan_P Failure LED / Test Point 522
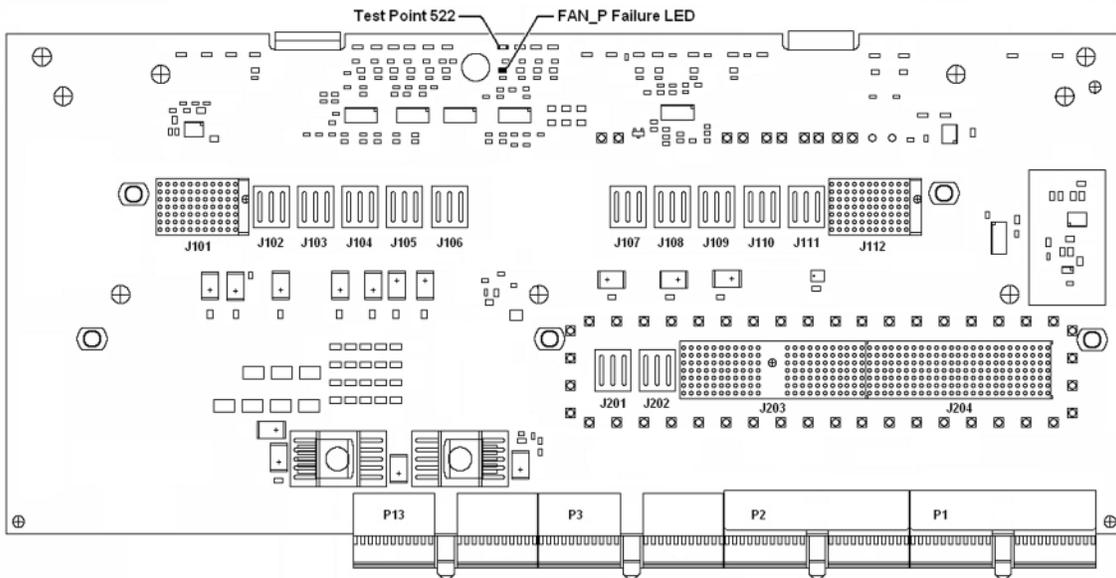
6. With the instrument turned off, and the AC power cord removed, remove the Fan Assembly including unplugging all fans from the A8 Motherboard. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

7. Turn the instrument power back on and measure the fan voltage at all three of the fan connectors (J6, J7, & J8) on the A8 Motherboard.

Each connector has three pins. The outer conductors on all connectors are the FAN_P supply and the center conductors are FAN_N. The voltage between FAN_P and chassis ground should be between +7 and +15 VDC on all three connectors.

Does the A8 Motherboard fan connector for the fan(s) that do not work have the required voltage level?

      If yes:

            Replace the fan(s) that is not working

      If not:

            After verifying that the connections between the A7 Midplane board and the A8 Motherboard are mechanically and electrically secure replace the A8 Motherboard.

No Keysight Splash Screen Displayed

(Black background with white "Keysight Technologies" text)

A problem of not displaying the Keysight splash screen could be caused by many different things. It could be due to a down power supply, a processor hardware problem, an instrument boot-up process error, a display section failure, etc.

This procedure assumes that the green Power On LED on the front panel does turn on when the instrument is turned on. If it doesn't, refer to the "Green Power On LED Does Not Illuminate" section before proceeding.

1. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

2. Remove the Top Brace. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. With the AC power applied and the On/Off button turned on, verify that all of the power supply voltages are at their proper level. This can easily be done by viewing the power supply LEDs on the back side of the A7 Midplane board. Refer to the Chapter 12, "Power Supply & Midplane", on page 367.

    Are all of the power supply voltages at the proper level?

    If yes:

    > Proceed to step 4.

    If not:

    > After verifying that the connections between the A6 Power Supply, the A7 Midplane board, and the A8 Motherboard are all mechanically and electrically secure, replace the A6 Power Supply assembly.

4. Connect an external VGA monitor to the rear panel display output.

    Does the external monitor display the correct information?

    If yes:

    > Proceed to the "Troubleshooting a Blank Display" section in this chapter.

    If not:

    > Replace the A4 Processor Board assembly.

Instrument Hangs at the Keysight Splash Screen

A problem of the instrument hanging at the Keysight splash screen could be caused by many different things. It could be due to a down power supply, a processor hardware problem, an instrument boot-up process error, etc.

1. Remove the AC power cord and then remove the instrument cover. Refer toChapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

2. Remove the Top Brace. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. With the AC power applied and the On/Off button turned on, verify that all of the power supply voltages are at their proper level. This can easily be done by viewing the power supply LEDs on the back side of the A7 Midplane board. See the Chapter 12, "Power Supply & Midplane", on page 367.

   Are all of the power supply voltages at the proper level?

   If yes:

   > After verifying that the connections from the A7 Midplane board to the A4 Processor board are not at fault, replace the A4 Processor board.

   If not:

   > After verifying that the connections between the A6 Power Supply, the A7 Midplane board, and the A8 Motherboard are all mechanically and electrically secure, replace the A6 Power Supply assembly.

Instrument Cannot Completely Load or Run the Operating System

A problem of the instrument not loading the operating system can be caused by a few different things. It could be due to a down power supply, a processor hardware problem, an instrument boot-up process error, corrupt disk drive, etc.

This procedure assumes that the instrument can get past the Keysight splash screen at power on. If it doesn't, refer to the "Instrument Hangs at the Keysight Splash Screen" section before proceeding.

1. Verify that there are no external USB storage devices connected to the instrument.

2. Does the instrument get far enough along in the boot process to run the "Instrument Image Recovery System"?

   If yes:

   Run the Instrument Image Recovery System by referring to the "Disk Drive Recovery Process" on page 364. If this does not correct the problem replace the A5 Disk Drive.

   If not:

   Replace the A5 Disk Drive.

Troubleshooting a Blank Display

This section is intended to troubleshoot a display system problem that would cause the internal LCD to be blank. It is assumed that the rest of the instrument is booting up and functioning properly. To determine if the problem is an internal display issue only, connect an external VGA monitor to the rear panel display output. If the rear panel display output is also not working go to the "No Keysight Splash Screen Displayed" section in this chapter.

Once it has been determined that the rest of the instrument appears to be functioning properly there are a few possible problems that could be causing the display to be blank. They are:

— An LCD Backlight inverter problem

— A video signal path integrity problem

— A video controller / LCD problem

Verify LCD Backlight Functionality

Considering the fact that the expected life span of the backlights is much longer than the LCD itself, it is not very likely that the backlights would cause a completely blank display.

To determine if a blank display problem is backlight related:

1. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

2. Remove the Top Brace. Refer to Chapter 18, "Assembly Replacement Procedures", on page 527 in this manual.

3. Turn the instrument on and allow enough time for it to completely boot-up.

4. Shine a bright light at the display and look closely for the expected information (a large flashlight should work). Since most of the display section of the screen has a black background you will need to look at either the area next to the softkeys or the area across the top of the screen, since these sections will have the largest areas of lighter information in them.

5. Can the expected display information now be seen?

    If yes:

    The problem is backlight related. Proceed to step 6.

    If not:

    The problem is not backlight related. Skip to "Verify Video Signal Path Integrity".

6. Referring to Figure 2-8, verify that the red +12VD LED is off.

Figure 2-8   A7 Midplane Board +12VD LED/Test Point 503
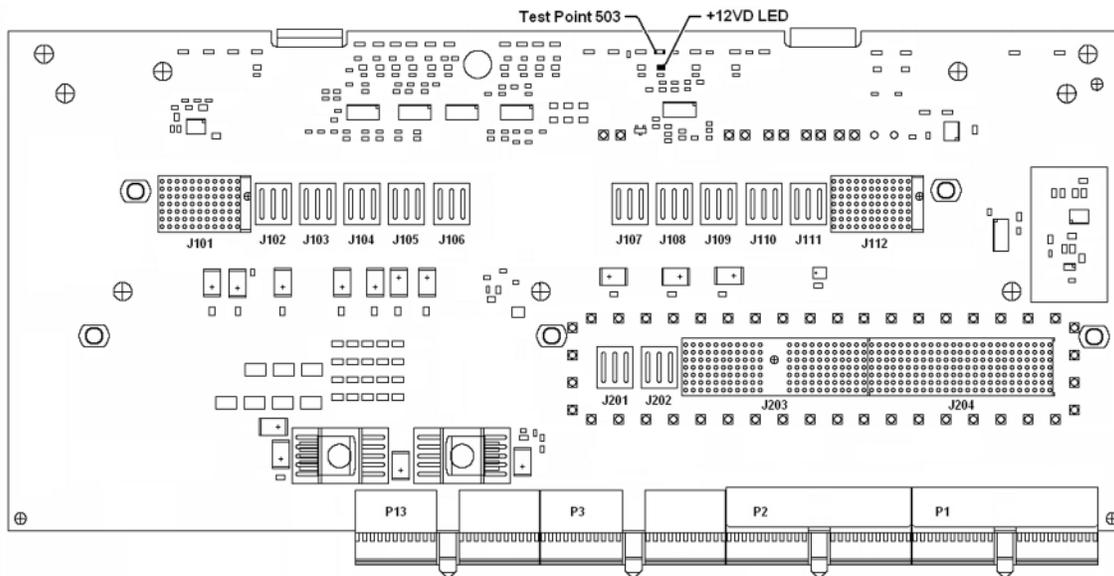
Is the red +12VD backlight supply voltage fault LED off?

If yes:

Proceed to step 7.

If not:

Replace the A6 Power Supply assembly.

7. With the instrument turned off remove the screws that attach the front panel assembly to the instrument chassis.

8. While carefully pulling the front panel assembly away from the instrument, remove W6 from the A23 Limiter assembly, as shown in Figure 4-16.

9. Remove the A1MP19 Front Panel Interface Shield as shown in Figure 18-73.

10. Carefully lay the front panel assembly face down on the work surface.

11. Referring to Figure 2-9, verify the 3 voltage levels listed in Table 2-2 are correct.

NOTE

The instrument does have a screen saver which can disable the display backlight after a predefined period of time. If there is any question as to whether or not this has been set by the user prior to the current failure, and the "Backlight Enable" voltage measures too low, press a front panel key and see if the voltage level increases to the expected level.

Figure 2-9   A1A2 Front Panel Interface Board LCD Backlight Control Voltages
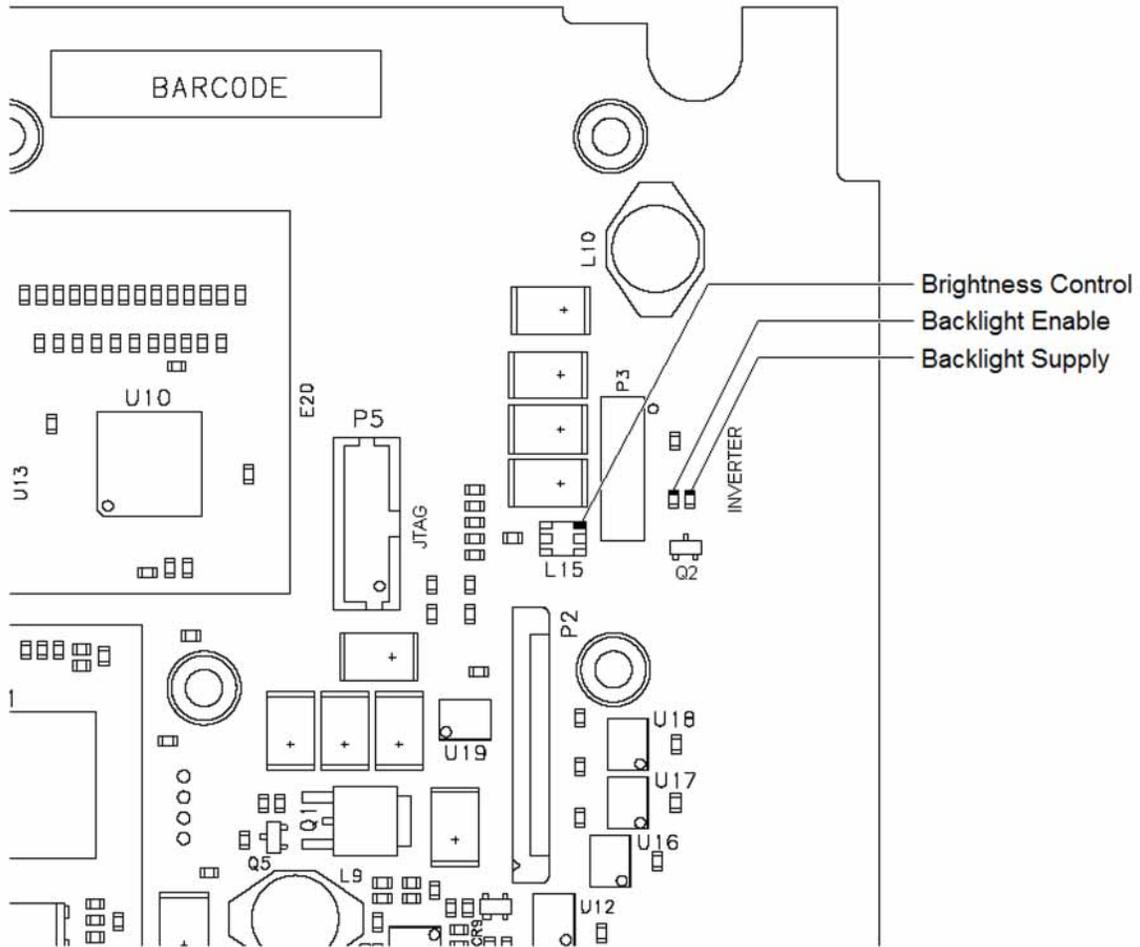
Table 2-2   Expected Backlight Inverter Control Voltage Levels

Signal	Expected Voltage
Brightness Control	0 to 3 VDC
Backlight Enable	>6 VDC
Backlight Supply	+12 VDC

12. Are all of the 3 voltage levels within their expected ranges?

> **If yes:**
>
> > Replace the A1A4 Display Backlight Power Supply.
>
> **If not:**
>
> > Replace the A1A2 Front Panel Interface board.

Verify Video Signal Path Integrity

The video controller is located on the A4 Processor assembly and is routed to the front panel LCD through a few interconnections. These interconnections are:

— A4 Processor assembly to A7 Midplane Board

— A7 Midplane Board to A8 Motherboard assembly

— A8 Motherboard assembly to A1A2 Front Panel Interface assembly via W8 ribbon cable

— A1A2 Front Panel Interface to A1A3 LCD via A1W1 flex-circuit

If all of these connections are properly made and none of the cables are damaged proceed to **"Video Controller / LCD Troubleshooting"**.

Video Controller / LCD Troubleshooting

The video controller is located on the A4 Processor assembly. The video signals that the controller outputs are LVDS. As described above, these signals are routed to the LCD via the A7 Midplane Board, A8 Motherboard, and A1A2 Front Panel Interface board.

On the A1A2 Front Panel Interface board the LVDS signals are buffered and then sent to the LCD via the A1W1 Flex circuit.

The most likely cause for a video problem is the A4 Processor assembly; however it could be the result of a defective LCD.

Initializations Did Not Complete

During the initialization of the MXE EMI Receiver Application the following messages will be displayed on the application splash screen:

— Checking for required services (1 of 7)
— Initializing License Services (2 of 7)
— Initializing Message Services (3 of 7)
— Initializing Hardware (4 of 7)
— Initializing Data Services (5 of 7)
— Initializing SCPI Services (6 of 7)
— Initializing Front Panel EEPROM Services (7 of 7)

If there is a problem with any of these initializations not completing or causing an error message to be displayed refer to the instrument Event Log. This can be accessed by using an external USB keyboard and mouse and selecting Start, Run, enter Eventvwr.exe, and select OK.

Once the Event Viewer comes up, look under SA for the latest error entries. Double-click on the entries to view further details, which should give you some idea of what the problem is.

Fails an Initial Alignment

Troubleshooting Alignment Failures Using the Alignment History Screen

At instrument power on, an initial alignment is automatically performed. It is also possible to manually trigger an alignment by pressing **System**, **Alignments**, **Align Now**, **All**. The power on alignment performs a few more alignments than the manual Align Now All routine.

The number of alignments depends on the hardware options present in the instrument.

Using an external USB keyboard and mouse, access the alignment history, which can be found in a text file at:

E:AlignDataStorage\AlignmentHistory.txt

You will find the most current alignment information at the bottom of this file. Look for the failed alignments. From the windows task bar you can select Edit, Find and type in FAILED and search for a failure.

Note that the information in the history file usually shows that multiple measurements are made for a given alignment routine, and measured values with upper and lower limits are given. For example, the Mechanical Attenuator Algorithm measures and displays all of the attenuator step values. In this case, you can view which steps fail, and by how much. Then based on the input attenuator drawing on the MXE RF Block Diagram, you can determine which

attenuator steps are available on each of the two input attenuators. Then you can view the troubleshooting information for the Front End Controller or deduce from the attenuator steps that fail, which attenuator is faulty.

WARNING Assure there is no 50 MHz signal above 0 dBm applied to the instrument input when the alignment routine is performed. This can cause errors.

Table 2-3   Alignment History Contents

Alignment	Most Probably Cause	Additional Information
PretuneDAC	A14 LO Synthesizer	A16 Reference board provides 4.8 GHz Calibrator signal
VCXOTuningCurve	A16 Reference	
VCXOLoopBandwidth	A16 Reference	
SecondLOTuningCurve	A16 Reference	
SecondLOLoopBandwidth	A16 Reference	
DitherLevelAlgorithm	A3 Digital IF	
AifLCWidePrefilterPassbandTuningAlgorithm	A2 Analog IF	
AifLCWidePrefilterPassbandFineTuningAlgorithm	A2 Analog IF	
AifLCNarrowPrefilterPassbandTuningAlgorithm	A2 Analog IF	
AifLCNarrowPrefilterPassbandFineTuningAlgorithm	A2 Analog IF	
AifXtalWidePrefilterPassbandTuningAlgorithm	A2 Analog IF	
AifXtalNarrowPrefilterPassbandTuningAlgorithm	A2 Analog IF	
AifVariableGainAlgorithm	A2 Analog IF	
AifStepGainAlgorithm	A2 Analog IF	
Aif140VariableGainAlignmentAlgorithm	A25 Wideband Analog IF	
LOPowerAlignmentAlgorithm	A13 Front End A15 Front End Control	
AifVariableAttenuatorAlgorithm	A2 Analog IF	
MechanicalAttenuatorAlgorithm	A9 RF Attenuator A A10 RF Attenuator B	A16 Reference provides 50 MHz Calibrator signal
ElectricalAttenuatorAlgorithm	A13 Front End	A16 Reference provides 50 MHz calibrator Control signals from A15 Front End Controller

Table 2-3　　　　　　　　Alignment History Contents

Alignment	Most Probably Cause	Additional Information
ElectricalAttenuatorTailAlgorithm	A13 Front End	A16 Reference provides 50 MHz calibrator Control signals from A15 Front End Controller
Aif140VariableAttenuatorAlgorithm	A25 Wideband Analog IF	
Dif40VariableAttenuatorAlgorithm	A3 Digital IF	
NarrowbandStepCalAdjustmentAlignmentAlgorithm	A3 Digital IF	Alignment signal originates on A3 Digital IF, routes through A16 Reference, A13 Front End, A2 Analog IF, back to A3 Digital IF
NarrowbandStepCalAlignmentAlgorithm	A3 Digital IF	Alignment signal originates on A3 Digital IF, routes through A16 Reference, A13 Front End, A2 Analog IF, back to A3 Digital IF
DIF40StepCalAdjustmentAlignmentAlgorithm	A15 Front End Control	Uses Wideband 322.5 MHz IF from A15 Front End Control J7901
DIF40StepCalAlignmentAlgorithm	A15 Front End Control	Uses Wideband 322.5 MHz IF from A15 Front End Control J7901
Aif140StepCalAdjustmentAlignmentAlgorithm	A25 Wideband Analog IF	
RFPreselMechanicalAttenuatorAlgorithm	A21 RF Presel Input	A16 Reference provides 50 MHz Calibrator signal
Aif140StepCalAlignmentAlgorithm	A25 Wideband Analog IF	
ECalPathSystemGainAlgorithm	A13 Front End A16 Reference	A16 Reference provides 50 MHz E-Cal signal
LowBandNominalPathSystemGainAlgorithm	A13 Front End	A16 Reference provides 50 MHz Calibrator signal
LowBandPreampPathSystemGainAlgorithm	A13 Front End	A16 Reference provides 50 MHz Calibrator signal
LowBandElecAttenPathSystemGainAlgorithm	A13 Front End	A16 Reference provides 50 MHz Calibrator signal
PreselectorTwoPointTuningAlgorithm	A12 YTF Preselector A15 Front End Control	Controlled by A15 Front End Control

Table 2-3   Alignment History Contents

Alignment	Most Probably Cause	Additional Information
HighBandNominalPathSystemGainAlgorithm	Anything in high band path	A16 Reference board provides 4.8 GHz Calibrator signal
HighBandPreampPathSystemGainAlgorithm	A11 RF Switch / High Band Preamp	Controlled by A15 Front End Control
RFPreselLowBandNominalPathSystemGainAlgorithm	A21 RF Presel Input	
BurstCarrierTriggerCurveFitAlignmentAlgorithm	A2 Analog IF	
DIF25PulseStretcherAlignmentAlgorithm	A3 Digital IF	
DIF40PulseStretcherAlignmentAlgorithm	A3 Digital IF	
ConductedPreampAmplitudeAlgorithm	A21 RF Presel Input	
ConductedAmplitudeAlgorithm	A24 Conducted Filter	
RadiatedPreampAmplitudeAlgorithm	A21 RF Presel Input	
RadiatedAmplitudeAlgorithm	A22 Radiated Filter	
WBDIFPulseStretcherAlignmentAlgorithm	A26 Wideband Digital IF	

Signal Level Verification

Frequencies Less Than 3.6 GHz

The basic functionality of the instrument below 3.6 GHz can be quickly verified with the use of the internal 50 MHz calibrator signal. However, if there are suspected problems at other frequencies an external signal generator will also be needed:

1. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

2. Turn on the internal 50 MHz Calibrator signal by pressing **Input / Output**, **RF Calibrator**, **50 MHz**.

3. Tune the instrument to 50 MHz with a span of 10 MHz by pressing **Freq**, **50 MHz**, **Span**, **10 MHz**.

4. Place the marker on the peak of the calibrator signal by pressing **Peak Search**.

5. Verify that the on screen of the 50 MHz Calibrator signal is −25 dBm (+/-2 dB), as shown in Figure 2-10.

Figure 2-10   50 MHz Calibrator Signal
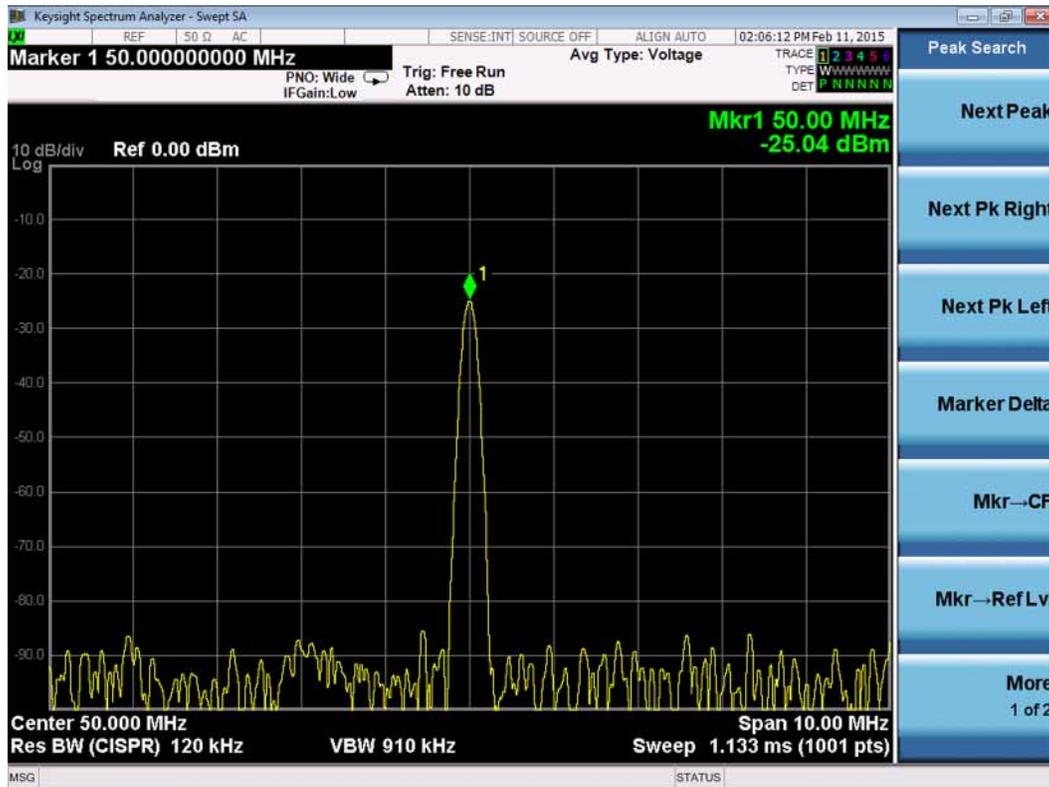
Boot Up and Initialization
Potential Problems During Boot Process

6. If the signal level is not correct refer to Chapter 5, "RF Preselector Section." Chapter 6, "RF Downconverter Section." and Chapter 15, "Block Diagrams." for further troubleshooting information.

Frequencies Greater Than 3.6 GHz

The basic functionality of the instrument above 3.6 GHz can be quickly verified with the use of the internal 4.8 GHz calibrator signal. However, if there are suspected problems at other frequencies an external signal generator will also be needed:

1. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

2. Turn on the internal 4.8 GHz Calibrator signal by pressing **Input / Output**, **RF Calibrator**, **4.8 GHz**.

3. Tune the instrument to 4.8 GHz with a span of 100 MHz by pressing **Span**, **100 MHz**, **Freq**, **4.8 GHz**.

4. Place the marker on the peak of the calibrator signal by pressing **Peak Search**.

5. Center the preselector filter by pressing **Amptd**, **Presel Center**.

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6. Verify that the on screen of the 4.8 GHz Calibrator signal is −28 dBm (+/-2 dB), as shown in Figure 2-11.

Figure 2-11   4.8 GHz Calibrator Signal

7. If the signal level is not correct refer to Chapter 5, "RF Preselector Section." Chapter 6, "RF Downconverter Section." and Chapter 15, "Block Diagrams." for further troubleshooting information.

3   Instrument Messages

Introduction

The Error and Status messaging system of the instrument reports events and conditions in a consistent fashion, as well as logging and reporting event history.

Event vs. Condition Messages

— An Event is simply a message indicating that something has happened. Events are sub-divided according to their severity, into Error, Warning or Advisory categories. The sub-divisions are described in more detail in the section "Event and Condition Categories" on page 68.

Event messages appear in the Message Line at the bottom left of the instrument's display window, as shown in Figure 3-1 below.

— A Condition is a state of the instrument, which is characterized by a Detection event and a Clearing event. Conditions may be Errors or Warnings.

Condition messages appear in the Status Panel at the bottom right of the instrument's display screen, as shown in Figure 3-1 below.

Figure 3-1   Instrument Message Line & Status Panel
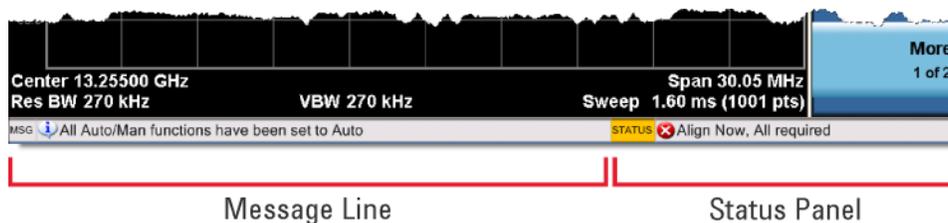
Event and Condition Categories

The three categories of severity are described below, for both Events and Conditions.

Errors

Error messages appear when a requested operation has failed. (For example, "Detector not available", "File not saved".) Error messages are often generated during remote operation when an invalid programming command has been entered. (For example, "Undefined header".)

Some errors are conditions rather than single events. They exist for a period of time, so they have associated "Detected" and "Cleared" events. (For example, "LO Unlocked" or "External reference out of range".)

Error messages appear in the Status Panel at the bottom of the display. A message remains until you press a key, or another message is displayed in its place.

Error messages are logged in the error queues. If the error is a condition, both the Detected and Cleared events are logged.

Warnings

Warning messages appear when a requested operation has completed successfully, but there are modifications and/or side effects. (For example, if you requested too high a stop frequency, then "Data out of range" is displayed and the analyzer sets itself to the highest available stop frequency.)

Some warnings are conditions rather than single events. They exist for a period of time, so they have a "Detected" event and a "Cleared" event. (For example, if you set the sweep time too fast for a measurement to meet the instrument specifications then the "Meas Uncal" message is displayed until you slow down the sweep time.)

Warning messages appear in the Status Panel at the bottom of the display. The message remains until you press a key, or another message is displayed in its place.

Warnings are logged in the error queues. If the warning is a condition, both the Detected and Cleared event messages are logged.

Advisories   Advisory messages tell the front panel user some useful information. (For example, "File saved successfully" or "Measuring the fundamental".)

Advisory messages appear in the Status Panel at the bottom of the display. The message remains until you press a key, or another message is displayed in its place.

Advisory messages are not logged in the error queues.

Grayout messages are a special type of Advisory, which appear when you attempt to access a function that is not available. This could be a grayed out front panel key, or an inappropriate SCPI command. There are two types of grayout messages: Benign and Forced.

1. **Benign**: the requested function is not available because it does not make sense with the current instrument settings. Changing it does not affect the current measurement. (For example, setting the number of FFTs/Span when you are not in the FFT mode.)

   A benign grayout gives an Advisory type of message only when the front panel key is pressed.

   The requested function cannot be changed from the front panel, but it can be changed remotely.

2. **Forced**: the requested function is not available either because changing it would cause an invalid measurement, or because of hardware limitations, or because the selection conflicts with other settings. (For example, selecting the electrical attenuator when the frequency span includes frequencies above 3.6 GHz.)

   A forced grayout function cannot be changed either from the front panel or remotely. It generates a special type of Advisory message. It also only appears on the front panel when the key is pressed. Remotely, the message will appear in the event queue as a warning "-221, Settings conflict; <conflict description>".

Event Message Format

The event messages are listed in numerical order according to their message number. Advisory messages do not have numbers, and are listed in alphabetical order.

An explanation is included with each error to further clarify its meaning. Some errors are specified in industry standards, and may include references to Section 21.8 of the 1999 SCPI Syntax & Style Standard.

Figure 3-2   Error Message Example

Error Number   **Error Message**   **Error Description**
(May be truncated in the display)

−221   Settings conflict;   parameter currently disabled

This parameter is grayed out (unavailable) in the current context. Check the individual parameter help/documentation for more information.

Explanation provided in this chapter
(This is **not** displayed in the instrument)
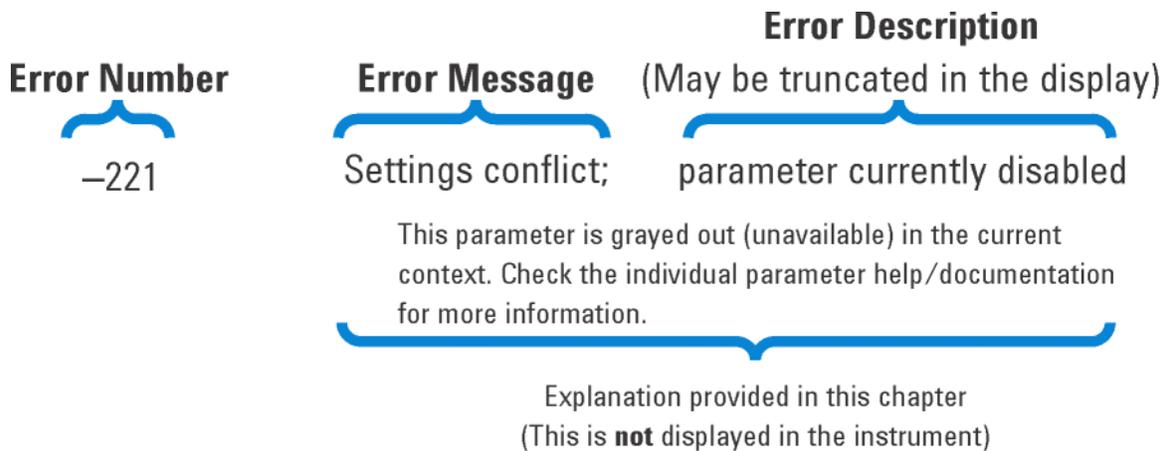
Event Queues

There are several different event queues that are viewed/queried and managed separately. Note that Conditions are logged in the queues as pairs of events: a "Detected" event and a corresponding "Cleared" event.

Table 3-1   Event Queue Types

Front Panel Status	Error messages can be viewed by pressing, **System**, **Show Errors, Status**. The Status screen shows error conditions that currently exist. When an error event is caused by a command sent over a remote interface, the resulting messages are logged in the queue for that interface. For convenience, they are also logged in the front panel queue.
Front Panel History	Error messages can be viewed by pressing, **System**, **Show Errors, History**. The History screen shows all the error events that have occurred since the instrument was turned on, with a maximum of 100 messages. When an error situation is caused by a command sent over a remote interface, the resulting messages are logged in the queue for that interface. For convenience, they are also logged in the front panel queue.
Remote interfaces (GPIB/LAN)	When an error event is caused by a command sent over a remote interface, the resulting messages are output to the queue for that interface. To return an error, you must query the queue for that interface. An error event that is caused by a front panel action is not reported to any remote interface queue. However, a status condition is usually caused by an internal event that is not related to a particular interface, so the Detected/Cleared events for status conditions are reported to all the error queues.

Table 3-2   Characteristics of the Event Queues

Characteristic	Front-Panel Status	Front-Panel History	Remote Interfaces (GPIB/LAN)
Capacity (maximum number of messages)	100	100	100
Overflow Handling	Circular (rotating). Drops oldest error as new error comes in.	Circular (rotating). Drops oldest error as new error comes in.	Linear, first-in/first-out. Replaces newest error with: −350, Queue overflow
Viewing Entries	Press: **System**, **Show Errors**, **Status**	Press: **System**, **Show Errors**, **History**	Send SCPI query to the desired interface. SYSTem:ERRor?
Clearing the Queue	Press: **System**, **Show Errors**, **Clear Error Queue** Clears the errors in all the queues.	Press: **System**, **Show Errors**, **Clear Error Queue** Clears the errors in all the queues.	Send *CLS command to the desired interface. Clears errors in the queue for this particular interface only.

Table 3-3   Summary of Event Reporting Modes

Event Type	SCPI Error Queues	Front Panel History Queue	Status Panel Display
Error Event	Logged	Logged	Displayed in Message Line
Warning Event	Logged	Logged	Displayed in Message Line
Advisory Event	Logged	Logged	Displayed in Message Line
Error Condition Detected	Logged	Logged	Displayed in Status Line
Error Condition Cleared	Logged		
Warning Condition Detected	Logged	Logged	Displayed in Status Line
Warning Condition Cleared	Logged		
Grayout Advisory (Benign)	Not logged	Logged	Displayed in Message Line
Grayout Advisory (Forced)	See note[a]	Logged	Displayed in Message Line

a. Not logged, unless the cause of the Advisory was remotely generated, in which case a Warning message, type −221, is logged.

Advisory Messages

An advisory is simply a message that lets you know something useful; for example "File saved successfully" or "Measuring fundamental." Operation completion and running status indications are common types of advisories. Advisories have no number and are not logged in the error queue.

Advisories include gray-out "settings conflict" errors. These gray-outs are benign (that is, changing them has no impact on the current measurement).

Advisories are event-type errors only. They are never conditions.

Message	Description/Correction Information
All Auto/Man functions have been set to Auto	Message generated by pressing the Auto Couple front-panel key
Allowable Center Frequency exceeded for the current span	When rotating the knob or step up/down keys to change the Center frequency, the value of the Span is kept constant. Therefore, the center frequency is limited by the frequency range of the instrument
Allowable Span exceeded for the current center frequency	When rotating the knob or step up/down keys to change the Span, the value of the Center frequency is kept constant. Therefore, the span is limited by the frequency range of the instrument
Allowable Start Frequency exceeded for the current span	When rotating the knob or step up/down keys to change the Start frequency, the value of the Span is kept constant. Therefore, the start frequency is limited by the frequency range of the instrument
Allowable Stop frequency exceeded for the current span	When rotating the knob or step up/down keys to change the Stop frequency, the value of the Span is kept constant. Therefore, the stop frequency is limited by the frequency range of the instrument
Already in Single, press Restart to initiate a new sweep or sequence	The instrument is already in the single state. If you want to start a new sweep or sequence, press the **Restart** key instead
Auto sweep time rules do not apply in FFT sweeps	FFT sweeps do not use the auto sweep time rules, so the rules setting cannot be changed from the front panel. The setting can be changed remotely and it will have no effect on the current operation unless the analyzer is switched out of FFT sweeps
Band Adjust has no effect on a Fixed marker	If a Marker is a Fixed type marker, the marker's value does not change from when it first became fixed. So you cannot change the band of a fixed marker
Band Adjust has no effect with Mkr Function Off	If Marker Function is off, changing the band has no effect
Band-pass filter set to OFF	Turning on any high-pass or low-pass filter turns off band pass filters
Cal Cancelled; Calibration data cleared	User has canceled the cal either directly or indirectly by changing the setup parameters. The current cal data has been erased. Perform a new user cal to obtain calibrated results again

Message	Description/Correction Information
`Cal Invalid: meas freq pt(s) > 3.6GHz are > 50MHz from existing Cal pts`	When freq points being measured are above 3.6 GHz and a calibration has been successfully performed, and the number of points are changed, the new points are required to be within 50 MHz of the current cal points or the preselector optimize frequencies become inaccurate and the whole cal needs to be invalidated. Interpolation of the cal can only be performed if the new freq points are within 50 MHz of the cal points. To overcome this problem, change the number of freq points back to match cal points or perform another user cal
`Carrier power is too low for optimum dynamic range.`	For better dynamic range, transmit band spur measurements require >10 dBm signal power at the RF input port
`Connecting to source…`	The External Signal Generator is being interrogated via SCPI, to see whether it is suitable for the instrument to control. Please wait until complete before pressing any buttons
`Demod Time is not available in Zero Span`	The Demod Time function is not available in zero span because in zero span we are **always** demodulating
`Detector <X> changed due to physical constraints`	You have selected more detectors than the instrument hardware can implement. An existing detector selection has been changed to allow the current detector choice to be selected. <X> indicates the trace number for which the detector was changed
`Dynamic range is not optimum. Set AUTO RF input.`	
`Exp. Averaging not available when AUTO PhNoise is active.`	
`FFT Width is not settable unless Sweep Type is set to FFT`	You must select the FFT sweep type before you can set the FFT Width
`File <filename> saved`	The file save operation executed successfully
`Filter BW function is only available for Gaussian filter type`	Flattop and CISPR/MIL filters have defined shapes that cannot be altered. Only the Gaussian filter type allows filter bandwidth definition changes
`Fixed LO freq should be greater than RF Stop freq`	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO fixed freq should be greater than the RF freq's for an LSB or DSB (for DSB measurements the setup uses LSB values) downconverter setup. Use the graph icon on the DUT setup form to clarify the setup required
`Freq Scale Type=Log is not available in Zero Span`	Logarithmic scaling cannot be used for time domain sweeps (0 Hz span)

Message	Description/Correction Information
Frequency Hopping enabled, waiting for valid burst	The demodulated burst type has not been found in the originally demodulated slot location within the frame
Frequency menu has changed to reflect frequency context switch	The frequency context parameter has been changed either by the user or the system. The frequency menu will now contain the frequencies for the new context. No action required
Gate required for valid results	
High-pass and Low-pass filters set to OFF	Turning on any band pass filter will turn off high-pass and low-pass filters
High-pass filter set to OFF	Turning on any band pass filter will turn off high-pass filters
IF Fixed freq should be greater than LO Stop freq	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The IF fixed freq should be greater than the LO Stop freq for a USB upconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
IF Fixed freq should be greater than RF Stop freq	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The IF fixed freq should be greater than the RF Stop freq for an upconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
IF Start freq should be greater than LO Fixed freq	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The IF start freq should be greater than the LO fixed freq for an USB upconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
IF Start freq should be greater than RF Start freq	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The IF start freq should be greater than the RF Start freq for an upconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
Input is internal	The instrument's input is set to internal (the internal amplitude reference signal). So any signals connected to the front/rear panel inputs cannot be measured
LO Fixed freq should be greater than IF Stop freq	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO fixed freq should be greater than the IF Stop freq for an LSB upconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required

Message	Description/Correction Information
`LO Fixed freq should be greater than RF Stop freq`	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO fixed freq should be greater than the RF Stop freq's for an LSB or DSB (for DSB measurements the setup uses LSB values) downconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
`LO Start freq should be greater than IF Fixed freq`	The setup frequencies break the rules for an upconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO Start freq should be greater than the IF fixed freq for an LSB upconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
`LO Start freq should be greater than RF Start freq`	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO start freq should be greater than the RF Start freq's for an LSB downconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
`LO Stop freq should be greater than RF Stop freq`	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The LO Stop freq should be greater than the RF Stop freq's for a DSB (for DSB measurements the setup uses LSB values) downconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
`Low-pass filter set to OFF`	Turning on any band pass filter will turn off low-pass filters
`No spurs have been found`	You started a measurement in examine meas type in single or continual sweep mode, or full meas type in single sweep mode, but no spurs were found
`Preparing Calculation…`	
`Preselector is centered`	The preselector has been successfully centered
`Preselector not used in this frequency range.`	You cannot center or adjust the preselector because it is not used at all at the current marker frequency or between the current start and stop frequencies
`Probe connected, cal data is being reapplied; <port>; <probe>`	A probe has been connected, calibration data is being reapplied
`Probe connected, no probe cal; using cable cal data; <port>; <probe>`	A probe has been connected and no probe calibration data is available. The latest cable calibration data will be used
`Probe disconnected, reverting to cable calibration data; <port>`	A probe has been disconnected, calibration data reverting to the last cable calibration data
`Reading SNS data…`	The Keysight Smart Noise Source has been connected and the application is reading the device EEPROM data. Please wait until complete before continuing
`Recalled File <filename>`	A file recall (open/load) was successfully completed

Message	Description/Correction Information
Refer to online help for assistance with DSB measurements	The Double Side Band measurement requires careful setup to obtain valid results. Please refer to the manuals for help with this setup
Requested timeslot number is not present.	The selected timeslot is not on. (Timeslot is referenced to the trigger point)
RF Start freq should be greater than IF Fixed freq	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The RF Start freq should be greater than the IF Fixed freq for a DSB (for DSB measurements the setup uses LSB values) downconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
RF Start freq should be greater than IF start freq	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The RF start freq should be greater than the IF Start freq's for an LSB downconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
RF Start freq should be greater than LO fixed freq	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The RF start freq should be greater than the LO fixed freq's for an USB downconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
RF Start freq should be greater than LO Start freq	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The RF start freq should be greater than the LO Start freq's for an USB downconverter swept LO setup. Use the graph icon on the DUT setup form to clarify the setup required
RF Stop freq should be greater than IF Stop freq	The setup frequencies break the rules for a downconverter measurement. The measurement will still run, but check setup frequencies are correct before continuing. The RF Stop freq should be greater than the IF Stop freq's for an USB or DSB (for DSB measurements the setup uses LSB values) downconverter fixed LO setup. Use the graph icon on the DUT setup form to clarify the setup required
Scale/Div only applies in Log Y Scale	Setting the Scale/Division only makes sense when you are using a logarithmic Y scale
Signal Track is turned off when Zero Span is selected	Signal Track is not available when you have selected Zero Span. So if Zero Span is entered while in Signal Track is On, Signal Track is turned off
Signals deleted	The signals in the signal list were successfully deleted
Sweep Points/Span is < minimum. Results may be inaccurate.	The sweep point to span ratio is below the minimum required to ensure the bucket ratio is large enough to test DVB-T masks
Sweep Setup is not available in Zero Span	Zero span is a display at a single frequency, so there is no "sweeping" to set up

Message	Description/Correction Information
Sync is RF Ampl (not Training Sequence). Bits are not accurate.	
Trace file saved.	The trace saving operation was successful
Use Gate View Sweep Time in the Gate menu.	When in Gate View you use Gate View Sweep Time, rather than Sweep Time, to control the Gate View window
User Cal valid. Apply Cal from Meas Setup menu	The measurement setup has changed such that the current cal data can be applied to the results. To apply the cal, press Meas Setup/Cal Setup/Apply Calibration. A new cal can be performed if required

Event Messages

Event messages are displayed in the MSG area in the bottom left of the instrument display. Event messages and message numbers are defined by the SCPI standard.

In the X-Series, sub-messages are often attached to add additional information, to help you better understand the event being reported. For example, error –221 is defined as Settings Conflict, but in the X-Series you will often see a longer message appended to error –221, such as Settings Conflict; Function not available in Zero Span. This helps you understand the exact cause of the Settings Conflict error.

–800, Operation Complete Event

Err#	Message	Verbose/Correction Information
–800	Operation complete	The instrument has completed all selected pending operations in accordance with the IEEE 488.2, 12.5.2 synchronization protocol

–700, Request Control Event

Err#	Message	Verbose/Correction Information
–700	Request control	The instrument requested to become the active IEEE 4881 controller-in-charge

–600, User Request Event

Err#	Message	Verbose/Correction Information
–600	User request	The instrument has detected the activation of a user request local control

–500, Power on Event

Err#	Message	Verbose/Correction Information
–500	Power on	The instrument has detected an off to on transition in its power supply

–400 to –499, Query Errors

Err#	Message	Verbose/Correction Information
–400	Query Error	There was a problem with a query command. The exact problem cannot be specifically identified
–410	Query INTERRUPTED	Some condition caused an INTERRUPTED query to occur. For example, a query was followed by DAB or GET before a response was completely sent
–420	Query UNTERMINATED	Some condition caused an UNTERMINATED query to occur. For example, the device was addressed to talk and an incomplete program message was received
–430	Query DEADLOCKED	Some condition caused a DEADLOCKED query to occur. For example, both the input buffer and the output buffer are full and the analyzer cannot continue. The analyzer automatically discards output to correct the deadlock
–440	Query UNTERMINATED after indefinite response	A query was received in the same program message after a query requesting an indefinite response was executed

−300 to −399, Device-Specific Errors

Err#	Message	Verbose/Correction Information
−300	`Device-specific error`	An instrument error occurred and the exact problem cannot be specifically identified. Report this error to the nearest Keysight Technologies sales or service office
−310	`System error;`	An internal system-type error has occurred. The exact problem cannot be specifically identified. Report this error to the nearest Keysight Technologies sales or service office
−310	`System error; A license will soon expire;<feature code> will expire in <time>`	The indicated feature/software will expire in the specified time. Contact Keysight Technologies to purchase continued use of this functionality
−310	`System Error; enable GPIB controller mode`	Press **System, I/O Config, GPIB** and set GPIB Controller to Enabled so that the analyzer can control the source over GPIB
−310	`System error; Error transmitting a LAN event to the network.`	Communication with the network driver failed
−310	`System error; Failed to initialize the PTP clock to current time.`	Failure communicating with the DMC libraries' PTP controller
−310	`System error; Failed to instantiate the PTP ordinary clock.`	Failure in the starting up the DMC libraries' PTP controller
−310	`System error; feature <feature code> not licensed`	The specified feature, for example "N9073A-TR2", is not licensed. The license may have expired. You cannot use it until you obtain a license
−310	`System error; Feature expired; <feature code>`	The specified feature has expired. The license is no longer valid
−310	`System error; License installation failed;<feature code>`	The license installation of the specified feature, for example "N9073A-TR2", has failed. You should refer to the event log in the control panel for more details
−310	`System error; License removal failed; <feature code>`	The license removal of the specified feature, for example "N9073A-TR2" has failed. You should refer to the event log in the control panel for more details
−310	`System error; No license; <feature code> will terminate in <time>`	The specified feature will stop working in the specified time due to the license expiration You will be prompted to save results and exit

Err#	Message	Verbose/Correction Information
–310	System Error; No supported source found	Signal source at given IP address is not responding / IP does not belong to a source. Check IP address and network connection
–310	System Error; source connection lost, check interface connection	Signal source at given IP address is not responding / IP does not belong to a source. Check IP address and network connection
–310	System error; The configured PTP hardware driver could not be instantiated.	The PTP driver failed on initialization
–310	System error; The PTP hardware driver reported a configuration error.	Failure in the execution of the PTP driver. The most likely cause of this error is a mismatch between versions of the PTP driver and the LXI middleware
–310	System error; The PTP ordinary clock reported a configuration error.	Failure in execution of the DMC libraries' PTP controller
–310	System error; The Trigger alarm delayed LAN event was not scheduled due to an existing pending event.	Delayed LAN events cannot occur too close together (within 20 ms)
–310	System error; The Trigger alarm delayed LAN event was not scheduled due to a conflict with an existing scheduled alarm.	Delayed LAN events cannot occur too close to a scheduled Alarm (within 20 ms)
–310	System error; The Trigger alarm was not scheduled due to a conflict with an existing scheduled alarm.	Alarms cannot be scheduled to happen too close together (within 20 ms)
–311	Memory error	There is a physical problem with the instrument memory, such as a parity error
–312	PUD memory lost	Protected user data saved by the *PUD command has been lost
–313	Calibration memory lost	The nonvolatile calibration data used by the *CAL? command has been lost

Err#	Message	Verbose/Correction Information
–314	`Save/recall memory lost`	The nonvolatile data saved by the *SAV? command has been lost
–315	`Configuration memory lost`	The nonvolatile configuration data saved by the instrument has been lost
–320	`Storage fault;`	A problem was found while using data storage. The error is not an indication of physical damage or failure of any mass storage element
–321	`Out of memory`	An internal operation needed more memory than was available. Report this error to the nearest Keysight Technologies sales or service office
–330	`Self-test failed`	A self-test failure occurred. Report this error to the nearest Keysight Technologies sales or service office
–340	`Calibration failed`	The instrument requires an Align All Now. Restore the alignment by pressing **System, Alignments, Align All Now**
–340	`Calibration failed; <failure msg> <port>`	The calibration for one of the I-Q ports did not succeed. The information in the "failure msg" field can be used to troubleshoot this problem. Contact Keysight technical support
–350	`Queue overflow`	An error occurred that did not get put in the error queue because the queue was full
–360	`Communication error`	There was a problem with instrument remote communications. The exact problem cannot be specifically identified
–360	`Communication error; SNS data read failure. Disconnect then reconnect SNS`	The Keysight Smart Noise Source connected to the instrument has failed to be read by the application. Please disconnect and reconnect the SNS. If this continues to fail, then the SNS may have had its EEPROM corrupted or another hardware fault exists. Check SNS on another instrument, NFA and ESA are also SNS compatible instruments. Check that the device is not an Keysight power sensor which uses the same cable interface
–360	`Communication error; SNS is not connected`	The Keysight Smart Noise Source connected to the instrument has failed to be read by the application. Please disconnect and reconnect the SNS. If this continues to fail, then the SNS may have had its EEPROM corrupted or another hardware fault exists. Check SNS on another instrument, NFA and ESA are also SNS compatible instruments. Check that the device is not an Keysight power sensor which uses the same cable interface
–361	`Parity error in program message`	A parity bit was not correct when the data was received. For example, on a parallel port
–362	`Framing error in program message`	A stop bit was not detected when data was received. For example, on a remote bus port
–363	`Input buffer overrun`	A software or hardware input buffer on a port overflowed with data because of improper or nonexistent pacing
–365	`Time out error`	There was a time-out problem in the instrument. The exact problem cannot be specifically identified

−221 Settings Conflict Errors

This is one of the errors in the standard SCPI error range −200 to −299. For all other errors in this range, see "−200 to −299, Execution Errors" on page 95.

Err#	Message	Verbose/Correction Information
−221	De-emphasis only available in FM	The de-emphasis function is only available if FM demod is selected
−221	Function not available in Zero Span	The function you are trying to access is not available in zero span
−221	Setting conflict; <trigger source> trigger is not available while input is <input port>	The trigger source (Video, RF Burst, I/Q Mag, etc.) is not available with the current input port (RF, IQ, etc.)
−221	Setting conflict; Differential setting determined by probe type	A probe is connected that has a built in Differential setting. The setting cannot be changed manually
−221	Setting conflict; Input Z unavailable when probe sensed	A probe is connected and the Input Z is set based on the probe type. It cannot be changed manually
−221	Settings conflict;	A legal command was received but it could not be executed due to the current device state
−221	Settings conflict; *.CSV file format is not available in this measurement.	You cannot load or save base instrument traces, as this is not supported by the Log Plot measurement
−221	Settings conflict; <Q Param> cannot be changed when Q same as I	When the **Q Same as I** parameter is set to Yes, the I parameter value is copied to <Q Param> and the <Q Param> value cannot be changed. Set **Q Same as I** to No to enable explicit control of the <Q Param> value
−221	Settings conflict; A Valid User Cal is required. Optimize aborted	Optimize Preselector can only be performed if a valid user cal exists and is applied to current results. Perform a user cal first or apply existing cal
−221	Settings conflict; Auto Tune not available in Tracking Source mode	The Auto Tune feature cannot be used when you are using a Tracking Source
−221	Settings conflict; BTS gain is not available in this Mode	Base Transceiver Station gain correction is not available in some Modes, or in some measurements (for example, the SA measurement)

Err#	Message	Verbose/Correction Information
−221	Settings conflict; Cal only available when Source Mode is Tracking	You must be in Tracking Source mode to use the Cal functions under Normalize. Press Source, Source Mode and set it to Tracking
−221	Settings conflict; Calibration cannot be performed without valid ENR data	The cal ENR table has no values in it, and hence the cal cannot be performed. Correct by either populating the cal ENR table, set ENR mode to Spot, or set the 'Use Meas Table Data for Cal' to 'On'
−221	Settings conflict; Cancellation is not available while measuring DANL floor.	Phase Noise cancellation does not make sense when measuring the DANL Floor, so for this reason it has been disabled
−221	Settings conflict; Cancellation Ref trace has no data.	When performing phase noise cancellation, you need to supply a reference trace that will be used to cancel out the background noise of the analyzer. The reference trace must be in Reference (View) mode, and selected by the Ref Trace parameter under the Cancellation menu
−221	Settings Conflict; Cancellation trace has different X-Scale	Reference trace for the cancellation has a different range of X-axis against the target trace
−221	Settings conflict; Cannot optimize while user cal in progress	Optimize Preselector cannot be performed while a user cal is in progress. The user cal performs an optimize preselector prior to taking the noise source on/off level results for the cal data
−221	Settings conflict; Can't Auto-Couple Res BW in Zero Span	The resolution bandwidth cannot be set to auto while you are in zero span (time domain)
−221	Settings conflict; Carrier freq not allowed with BMT. (Bottom/Middle/Top only)	The transmit band spur measurement only allows bottom (B), middle (M), and top (T) channel frequencies for each supported frequency band. The carrier frequency must be set to the bottom, middle or top frequency of the current frequency band
−221	Settings Conflict; Code channel duplication	This error is reported when the given code channel overlaps other code channel
−221	Settings conflict; Continuous Peak is not available with Fixed marker	The continuous peak feature cannot be used with a marker that is fixed. By definition that marker value cannot change
−221	Settings conflict; Continuous Peak is not available with Signal Track on	The continuous peak feature cannot be used while you are also using the signal tracking function

Err#	Message	Verbose/Correction Information
−221	Settings conflict; Destination trace for Trace Math cannot be a trace operand	The resulting trace data (from doing a trace math function) cannot be put into the any of the traces that are being used by the math operation
−221	Settings conflict; Downconv only available when DUT is Amplifier	SCPI only message. The System Downconverter can only be set to 'On' when the DUT type is amplifier. Change DUT type to Amplifier if the System Downconverter is required
−221	Settings conflict; EDGE EVM only supports EDGE TCH burst type.	
−221	Settings conflict; Electronic attenuator is disabled	You are using the mechanical attenuator, and have not enabled the electronic attenuator. You cannot set the value of the electronic attenuator because it automatically sets/changes when enabled
−221	Settings conflict; Electronic attenuator is not available above 3.6 GHz	The maximum frequency of the electronic attenuator is 3.6 GHz. This is because of switching capacitance
−221	Settings conflict; Electronic attenuator unavailable in current state	
−221	Settings conflict; Electronic attenuator unavailable with Preamp on	The internal preamp is on. Electronic attenuator cannot be used while you are using the internal preamp
−221	Settings conflict; EMI Detectors are not available in FFT sweep	QPD, EMI Average, EMI Peak, and MIL Peak are not allowed when in the manually selected FFT sweep mode
−221	Settings conflict; External Mixer not available	A command has been sent to reference the External Mixer in a model that does not contain it
−221	Settings Conflict; FAST method can only be used while Radio Std is W-CDMA	
−221	Settings conflict; Feature not available in this View	Some functionality is available in one View, but not in another. (See the Views under the **View/Display** key.) This error occurs if you send a SCPI command or push a grayed-out key that is not available in the current selected View

Err#	Message	Verbose/Correction Information
–221	Settings conflict; Feature not supported for selected source	You have selected a feature that the selected source does not support
–221	Settings conflict; Feature not supported for this Input.	Some functionality is not available when certain Inputs are selected. For example, Trigger Holdoff is not available for the BBIQ input
–221	Settings conflict; Feature not supported for this measurement.	Some functionality is available in one measurement, but not in another. (See the measurements under the **Meas** key.) This error occurs if you send a SCPI command or push a grayed-out key that is not available in the current selected measurement
–221	Settings conflict; Feature not supported for this model number	This functionality is not a part of the instrument you are using, but may be found in other models in the X-Series
–221	Settings conflict; FFT IF Gain High not available when Swept IF Gain = Manual Low	When Swept IF Gain is manually set to Low, you cannot set the FFT IF Gain to High because that would make the Reference Level couplings wrong in FFT mode
–221	Settings conflict; FFT method is unavailable for level gating	If you are using level gating, you cannot select the FFT Gate Method
–221	Settings conflict; FFT sweep type is not available while in Gated LO	The gated LO function turns the LO on and off as it sweeps, so the FFT sweep type is not available if you have selected gated LO
–221	Settings conflict; FFT sweep type is not available while in Gated Video	The FFT sweep type is not available if you have selected the gated video function
–221	Settings conflict; FFT Sweeps unavailable in Tracking Source mode	Since FFTs do not sweep, you cannot use a Tracking Source while doing FFTs
–221	Settings conflict; Fixed marker adjust not available while Marker Function is on	If a Marker Function is on for a Fixed marker, the marker's reported value is derived from the function. Therefore, you cannot directly set the X or Y value of a Fixed marker that has a marker function turned on
–221	Settings conflict; Fixed Marker Y value is not adjustable with Normalize On	If Normalize is on the Amplitude scale is in dB units, so adjusting the Y value of a Fixed marker is not possible

Err#	Message	Verbose/Correction Information
–221	Settings conflict; Freq > 3.6 GHz unavailable while electronic attenuator enabled	The electronic attenuator does not function above 3.6 GHz, so if you have that attenuator enabled, you cannot change the center frequency so that frequencies above 3.6 GHz are displayed/measured
–221	Settings conflict; Function not available in External Mixing	The frequency offset feature cannot be used when you have selected a log scale for the frequency axis
–221	Settings conflict; Function not available in Tracking Source mode	The feature cannot be used when you are using a Tracking Source
–221	Settings conflict; Function only available in Tracking Source mode	The feature cannot be used unless you are using a Tracking Source
–221	Settings conflict; Function unavailable with MW Presel off	You cannot center or adjust the preselector because the Microwave Preselector is currently off
–221	Settings conflict; Gate control is Edge for Gated FFT	You cannot use level triggering to control the gate if you are using the FFT gating method
–221	Settings conflict; Gate control must be Edge for this Gate Source	You cannot use level triggering to control the gate when you are using the currently selected gate source
–221	Settings conflict; Gate is not available when Marker Count on	The gate function cannot be used while you have marker count turned on
–221	Settings conflict; Gate Length is not settable in FFT sweeps	The sweep time for FFT sweeps is set by the calculations, so sweep time settings cannot be adjusted
–221	Settings conflict; Gate Length is not settable in FFT sweeps	The sweep time for FFT sweeps is set by the calculations, so sweep time settings cannot be adjusted
–221	Settings conflict; Gate Method is not compatible with current Sweep Type setting	If the Gate is On and you have the FFT Sweep Type manually selected, then the Gate Method cannot be selected

Err#	Message	Verbose/Correction Information
–221	Settings conflict; Gate not available with external Tracking Source	The Gate functions are unavailable when Source Mode is Tracking with an external source. This is because the Gate circuitry is used to sync the external source
–221	Settings conflict; Gate not available with Tracking Generator	If the Source Type is Tracking Generator, the Gate circuitry is used for TG sync and is not available for gating
–221	Settings conflict; Gated FFT is not available while Sweep Type is set to Swept	The gated FFT function is not available if you have selected the swept type of sweep. You must be in the FFT sweep type
–221	Settings conflict; Gated LO is not available while Sweep Type is set to FFT	The FFT sweep type moves the LO frequency in steps. So the gated LO function is not available if you have selected FFT sweep
–221	Settings conflict; Gated Video is not available while Sweep Type is set to FFT	The gated video function is not available if you have selected the FFT sweep type
–221	Settings conflict; Incorrect RBW for demod. Change RBW	
–221	Settings conflict; Ind I/Q is not available for this measurement	The Independent I and Q setting is not available for the current measurement. Only some measurements (initially, only VXA) support this setting
–221	Settings conflict; Invalid trace number	The subopcode used to specify the trace number is invalid for this measurement or query
–221	Settings conflict; Knob is not available to modify this function	You should select a specific value for this function. Scrolling through values with the knob is not allowed
–221	Settings conflict; LO Phase Noise Adj not available	For instruments without the Dual-Loop LO, this feature is not available
–221	Settings conflict; Marker 1 Trace Update=off turns off Signal Track	Signal Track not available unless the trace containing Marker 1 is updating
–221	Settings conflict; Marker cannot be relative to itself	A marker must be set relative to another marker, not to itself

Err#	Message	Verbose/Correction Information
−221	Settings conflict; Marker Count is not available when Gate on	The marker count function cannot be used while you have gating turned on
−221	Settings conflict; Marker Function is not available for a Fixed marker	If a Marker is a Fixed type marker, the marker's value does not change from when it first became fixed. You cannot turn on or change a Marker Function because there is no ongoing measurement data to use for the marker function calculation
−221	Settings conflict; Marker type must be delta	Mkr?->Span and Mkr?->CF require that the selected marker be a delta marker
−221	Settings conflict; Marker-> function is not available in zero span	Most of the **Marker To** functions are not available if you are in zero span (span = 0 Hz, or time domain), so you cannot send the commands for these functions
−221	Settings conflict; Mask unavailable for current Span. Increase to display mask.	The current span setting is either narrower than the mask width or so wide that there are too few display points to allow the mask to be drawn. Increase or decrease the span to display the mask
−221	Settings conflict; Meas Type was changed to Examine for Exp Avg Mode.	Average Mode has been changed to Exponential. Full Meas Type is not available for Exponential Average Mode, therefore Meas Type has been changed to Examine
−221	Settings conflict; Meas Type was changed to Full for Repeat Avg Mode	Average Mode has been changed to Repeat. Examine Meas Type is not available for Repeat Average Mode therefore Meas Type has been changed to Full
−221	Settings Conflict; MinPts/RBW limit not met	
−221	Settings conflict; Mkr -> CF is not available when the x-axis is time domain	The marker to center frequency functionality does not work when the X-axis is in the time domain
−221	Settings conflict; Mod Scheme AutoDet unavailable when Burst Sync=RF Amptd	The modulation scheme auto detection is unavailable when the burst sync is set to RF Amptd (GSM/EDGE)
−221	Settings conflict; MS gain is not available in this Mode	Mobile Station gain correction is not available in some Modes, or in some measurements (for example, the SA measurement)

Err#	Message	Verbose/Correction Information
–221	Settings conflict; Must apply Amplitude Correction to make this unit available	These special units only apply when you are doing antenna measurements, so you must have a correction that includes Antenna Units enabled
–221	Settings conflict; No meas frequencies are above 3.6 GHz	Optimize Preselector can only be performed on frequencies in high band, that is, above 3.6 GHz. The current setup does not have input frequencies (IF) in this range so an Optimize Preselector cannot be performed
–221	Settings conflict; no source selected	You must select a source using Select Source before you can do this
–221	Settings conflict; Normalize is not available when Scale Type = Lin	Normalize does not support Linear amplitude scale, since the results are always presented as a dB ratio
–221	Settings conflict; Normalize is not available while Demod View is on	The normalization (correction) function cannot be used if you are using the Demod View
–221	Settings conflict; Normalize is not available while Trace Math is on	The Normalize function works by doing trace manipulation, so if trace math is on you cannot turn on normalization
–221	Settings conflict; Only active Antenna Unit available; no other Y axis units	When a correction with antenna units is turned on, the only Y-axis units you can have are those that match the Antenna Unit. Turn off the Correction or the Antenna Unit under Input/Output, Corrections
–221	Settings conflict; Option not available	You have attempted to perform an action for which a required option is not installed
–221	Settings conflict; Param only available when DUT is a freq converter	SCPI only message. The sideband and freq context parameters are only available when a freq conversion setup is in use. Change setup to contain a freq conversion to use these parameters
–221	Settings conflict; Param only available when External LO Mode is Swept	SCPI only message. This parameter is only available when the LO mode is set to Swept. Change the LO Mode to Swept
–221	Settings conflict; Param only available when External LO Mode is Fixed	SCPI only message. This parameter is only available when the LO mode is set to Fixed. Change the Freq Mode to Fixed
–221	Settings conflict; Param only available when Frequency Mode is Fixed	SCPI only message. This parameter is only available when the Freq mode is set to Fixed. Change the Freq Mode to Fixed

Err#	Message	Verbose/Correction Information
−221	Settings conflict; Param only available when Frequency Mode is Swept	SCPI only message. This parameter is only available when the Freq mode is set to Swept. Change the Freq Mode to Swept
−221	Settings conflict; Param only available when valid cal data exists	SCPI only message. The 'Apply Calibration' parameter is only available when the stored cal data matches the current setup. Perform a fresh 'Calibrate Now' or change setup such that current cal data is valid
−221	Settings conflict; Preamp gain is not available in this Mode	Preamp gain correction is not available in some Modes or Measurements
−221	Settings conflict; Preamp unavailable with electronic attenuator on	The electronic attenuator is on. Internal preamp cannot be used while you are using the electronic attenuator
−221	Settings conflict; Reference marker must be in same window	A delta marker and its reference must be in the same window. This error occurs when you try to turn on a delta marker for which the reference is in a different window
−221	Settings conflict; Relative Trigger needs hardware support for this meas	To do Relative Triggering in this measurement requires optional hardware that is not present in this analyzer
−221	Settings conflict; Scale Type = Lin is not available when Normalize is on	Only the Log amplitude scale is available in Normalize, since the results are always presented as a dB ratio
−221	Settings conflict; Settings conflict; Pre-trigger is insufficient for demod. Decrease Trig Delay.	
−221	Settings conflict; Signal Track is not available with Continuous Peak	The signal tracking feature cannot be used while you are also using the continuous peak function
−221	Settings conflict; Signal Track is only available in Swept SA measurement	The signal track functionality can be used when making a swept SA measurement. It is not available in the SA measurement when you are using FFT sweeps

Err#	Message	Verbose/Correction Information
–221	Settings conflict; Signal Track is turned off when Zero Span is selected	Signal Track is not available when you have selected Zero Span. So if Zero Span is entered while in Signal Track is On, Signal Track is turned off
–221	Settings Conflict; Span limited to XXX	
–221	Settings conflict; Span Zoom is not available in Zero Span	Span Zoom does not work with a time domain X-axis. You must select a span greater then 0 Hz
–221	Settings conflict; Step keys are not available to modify this function	You should select a specific value for this function. Using the **Up/Down** step keys to scroll through values is not allowed
–221	Settings conflict; Sweep Setup only available in swept measurements	The current measurement uses FFT mode, so does not use the Sweep Setup menu
–221	Settings conflict; Sweep Time cannot be auto-coupled in FFT sweeps	The sweep time for FFT sweeps is set by the calculations. So sweep time settings cannot be adjusted
–221	Settings conflict; Sweep Time cannot be auto-coupled while in Zero Span	You cannot send the remote command to set the sweep time to auto while you are in zero span
–221	Settings conflict; Sweep Time cannot be set while in FFT sweeps	The sweep time for FFT sweeps is set by the calculations. It cannot be manually controlled
–221	Settings conflict; Swept IF Gain High not available when FFT IF Gain = Manual Low	When FFT IF Gain is manually set to Low, you cannot set the Swept IF Gain to High because that would make the Reference Level couplings wrong in swept mode
–221	Settings conflict; Swept LO not available when freq mode is Fixed	SCPI only message. The LO Mode cannot be set to Swept when the freq mode is set to fixed. Change the freq mode away from fixed, or perform the measurement at several fixed frequencies
–221	Settings conflict; Swept Type=Swept is not available while in Gated FFT	If you have selected gated FFT then you are using the FFT sweep type and you cannot select the swept type of sweeping

Err#	Message	Verbose/Correction Information
–221	Settings conflict; System Display Settings, Annotation is Off	This is an override that turns off many of the annotations. This is available as a security feature
–221	Settings conflict; T hot must be greater than T cold	The Tcold value set under **Meas Setup, ENR, Tcold** needs to be lower than the Thot value currently being set. Tcold is often taken as the ambient temperature of the noise source. If using an SNS the Tcold value may be read automatically before every sweep
–221	Settings Conflict; The parameter cannot be changed in FAST mode	
–221	Settings conflict; Trace Math is not available while Normalize is on	The Normalize function works by doing trace manipulation, so trace math is not available while normalization is running
–221	Settings conflict; Tracking Source unavailable in FFT Sweeps	Since FFTs do not sweep, you cannot use a Tracking Source while doing FFTs
–221	Settings conflict; Trigger input in use for source synchronization	If Point Trigger is being used with an external trigger input to synchronize an external source to the analyzer, that trigger input is unavailable for triggering
–221	Settings conflict; Trigger is not available with span > 0 Hz.	
–221	Settings conflict; Tx Band Spur meas does not support this frequency band.	The transmit band spur measurement does not support all of the commercially available frequency bands. You need to change your selection under **Mode Setup, Radio, Band** to one of the supported bands
–221	Settings conflict; Tx Band Spur measurement is not defined for mobiles.	Only base station testing is available
–221	Settings conflict;Administrator privileges required	You must be logged in with administrator privileges to do this. Log out and log back in as the Administrator, then restart the SA application

Err#	Message	Verbose/Correction Information
–221	Settings conflict;Auto Scan Time/Meas Time do not apply in Stepped Scan Type.	The Auto Scan Time/Meas Time are not available when Scan Type =Stepped Scan
–221	Settings conflict;Auto Scan Time/Meas Time do not apply in Stepped Scan Type.	The Auto Scan Time/Meas Time are not available when Scan Type =Stepped Scan
–221	Settings conflict;ClearList & Start not available when ScanSeq = (Re)measure	Cannot perform Clear List & Start during (Re)measure, because we require the frequency information of the peaks in signal list to perform (Re)measure
–221	Settings conflict;EMI Detectors and Average detector can't be used together	You cannot turn on any EMI Detector and Average detector together. They are always mutually exclusive
–221	Settings conflict;Freq > 1 GHz is not available while RF Input 2 enabled	Frequency is limited to 1GHz while RF Input 2 is enabled
–221	Settings conflict;Function not available while measurement is running	Settings change is not allowed while measurement is running. You must stop the current measurement if you wish to change the settings
–221	Settings conflict;function unavailable with this EMC Standard	
–221	Settings conflict;Log Percent Auto Step Rule does not apply in Swept Scan Type.	The Log Percent rule is not available when Scan Type=Swept Scan because we are always doing linear sweep
–221	Settings conflict;QPD + EMI Average + RMS Average is not allowed	You cannot turn on all 3 EMI detectors together. You must turn off one of the EMI Detectors before you turn this on

Err#	Message	Verbose/Correction Information

–221	`Settings`
	`conflict;Range <0> is`
	`turned off as total`
	`range points > 40001`
		Max of Total range points is 400000. Reduce Scan Points or increase Step Size in order to turn on that range

–221	`Settings conflict;RF`
	`Input 2 is not`
	`available above 1GHz`
		If the frequency range is set above 1GHz, you cannot change to RF Input 2

–221	`Settings`
	`conflict;Scan Time &`
	`Points do not apply`
	`in current Step/Time`
	`Control.`
		The Scan Time & Points are not available when Step/Time Control is set to Step & Dwell

–221	`Settings`
	`conflict;Step Size &`
	`Meas Time do not`
	`apply in current`
	`Step/Time Control.`
		The Step Size & Meas Time are not available when Step/Time Control is set to Scan Time&Pts

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–200 to –299, Execution Errors

This section lists all messages in the range *except* –221 error messages. For details of –221 messages, see .

Note that Execution Errors are divided into subclasses, as follows:

–21x   Trigger errors

–22x   Parameter error

–23x   Data corrupt or stale (invalid data)

–24x   Hardware error

–25x   Mass storage error

–26x   Expression data error

–27x   Macro error

–28x   Program error (a downloaded program-related execution error)

–29x   Memory use error

Err#	Message	Verbose/Correction Information
–200	`All ranges are off. Turn on at least a range`	There are no range turn on in scan table. You need to turn on at least a range to initiate a scan
–200	`At Full Zoom`	Marker Zoom is not available as it has reached full zoom
–200	`At Full Zoom`	Marker Zoom is not available as it has reached full zoom
–200	`Execution Error`	A program execution error has occurred. The exact problem cannot be specifically identified
–200	`Execution error; Carrier frequency outside device's transmit band`	The entered channel/carrier frequency is not within the range of your current mode setup selection of standard and device
–200	`Execution error; Invalid GSM burst timing`	A GSM-like burst was acquired, but its timing is not valid. Ensure the correct Burst Type has been selected
–200	`Execution error; Invalid IP address`	The IP address supplied is either not valid or does not belong to a compatible Signal Generator. Please check the IP address and instrument connection and try again
–200	`Execution error; Invalid Marker Trace.`	Cannot place markers on the reference trace, because the reference trace is currently turned off or has no data
–200	`Execution Error; No peak found.`	No signal peak was found within the defined parameters of the search. (Note: for ESA/PSA compatibility, the Swept SA measurement uses 780 for this error number; all other measurements use –220)

Err#	Message	Verbose/Correction Information
–200	Execution error; No ranges are defined. Activate a range.	There are no active ranges in the range table. You will need to activate at least one range
–200	Execution Error; Preselector centering failed	Algorithm failed to center the preselector. This maybe caused by the signal peak being too low in amplitude, or it could be due to excessive CW input signal, alignment error, or hardware failure
–200	Execution Error; Signal not stable enough to track	The signal that you have selected to track is changing too much for the function to track it properly
–200	Execution Error; Store ref trace before turning on Normalize	The Reference trace data must be stored in the Ref trace before you turn on the Normalization function
–200	Execution error; Sync word was not found.	NADC & PDC: In an EVM measurement, the sync word is not found and the synchronization cannot be established when Sync Word is selected in the Burst Sync menu. Flexible Digital Demodulation: The sync word cannot be detected because of inappropriate parameter settings or incorrect signal
–200	Execution error; Trace file contains no compatible traces.	The trace file may have been created by another version of the Phase Noise personality, which uses a different trace format that is incompatible with the version you are running. Please check that you are running the most up-to-date version of the personality
–200	Execution error; Trace file created by incompatible version of Phase Noise App	The trace file may have been created by another version of the Phase Noise personality, which uses a different trace format that is incompatible with the version you are running. Please check that you are running the most up-to-date version of the personality
–200	Function not available before Marker Zoom is performed	Function not available before perform Marker Zoom
–200	Must perform Scan before do Search	Cannot perform Search as the trace data is empty
–200	No marked signal	Cannot perform the selected function because no signal was marked. You must mark the peak of interest before selecting the function
–200	No Measure At Marker Added to Signal List	No signal peak was added into Signal List as there is no valid measure to Marker result. You must perform Measure at Marker before selecting Measure At Marker --> List
–200	No Peak Added to Signal List	No signal peak was added from the Search to Signal List as no signal peaks were found within the defined parameters of the search criteria
–200	Signal List is Empty	Cannot perform the selected function because the signal list contains no data

Err#	Message	Verbose/Correction Information
–200	Signal List is Full	Cannot perform the selected function because the signal list is full. Please clear the list
–200	Signal Selected is not in the Signal List	The signal selected is not the list. You only can perform the operation on signal that is already available in the list
–201	Invalid while in local	The command cannot be executed while the instrument in Local control
–202	Settings lost due to rtl	A "return to local" control was forced and some settings were lost as a result of this
–203	Command protected	The command could not be executed because it is disabled. It was disabled by licensing or password protection
–203	Command protected; feature not licensed	The specified feature, for example "N9073A-TR2" is not licensed. The license may have expired. You cannot use it until you obtain a license
–210	Trigger error	A trigger error has occurred, but the exact problem cannot be specifically identified
–211	Trigger ignored	A GET, *TRG or other triggering signal was received, but was ignored because of timing considerations. For example, maybe the instrument was not ready to respond when the command was received
–212	Arm ignored	An arming signal was received, but it was ignored
–213	Init ignored	An initiate trigger/sweep request was received and ignored, because another measurement was already in progress
–214	Trigger deadlock	The trigger source for the initiation of a measurement is set to GET, and the following measurement query was received. The measurement cannot be started until a GET is received, but the GET would cause an INTERRUPTED error
–215	Arm deadlock	The arm source for the initiation of a measurement is set to GET and the following measurement query is received. The measurement cannot be started until a GET is received and the GET would cause an INTERRUPTED error
–220	Parameter error	A problem was found with a program data element. The exact problem cannot be specifically identified
–221	Settings conflict;	There are many types of settings conflict errors. For full details, see
–222	Data out of range;	A data element was found but the instrument could not be set to that value because it was outside the range defined for the command. A descriptive message may be appended, such as "clipped to upper limit"
–222	Data out of Range; clipped to source max/min	A source parameter has been entered that exceeds the range of the selected source. The parameter has been clipped to match the range of the source

Err#	Message	Verbose/Correction Information
–222	Data out of range; Invalid list data	You tried to use a trace that has a number of sweep points that differs from the current sweep points setting
–222	Data out of range; Two entries already exist at this x-axis value.	When entering values for limit lines, you cannot have more than two Y-axis (amplitude) values entered for a specific X-axis (frequency) value
–223	Too much data	A data element (of block, expression, array type, or string type) had more data then allowed by the command, or by the available memory
–223	Too much data; 200 spurs found. Additional spurs ignored.	There are too many spurs for the table (the limit is 200), and any additional spurs that are found will be ignored
–224	Illegal parameter value	An exact data value (from a list of the allowed values) was required, but not found. See the specific feature description for information about the expected parameter values
–224	Illegal parameter value; <Value> invalid. Fractional values are not allowed.	The seconds parameter of an LXI time may not contain a fractional portion. For example 123456789.0 is valid, but 123456789.1 is not valid
–224	Illegal parameter value; <value> out of range.	The value does not fall within the valid range
–224	Illegal parameter value; Exceeding the max list length	The list parameters have a maximum allowed length. You are trying to set a length longer than the maximum
–224	Illegal parameter value; Gated FFT is not available while Sweep Type is set to Swept	The gated FFT function is not available if you have selected the swept type of sweep. You must select the FFT sweep type
–224	Illegal parameter value; Gated LO is not available while Sweep Type is set to FFT	The FFT sweep type moves the LO frequency in steps, so the gated LO function is not available if you have selected FFT sweep
–224	Illegal parameter value; Gated Video is not available while Sweep Type is set to FFT	The gated video function is not available if you have selected the FFT sweep type

Err#	Message	Verbose/Correction Information
–224	Illegal parameter value; Illegal identifier <identifier>. This value may already be in use.	The value for the LXI LAN identifier parameter must be unique (that is, LAN0 and LAN7 must have different identifier strings)
–224	Illegal parameter value; Index out of range	When querying the LXI Event Log or the Servo Log, an index may be used to look at a specific entry. This error occurs if the index provided does not point to a valid entry
–224	Illegal parameter value; Invalid list length	You are trying to set some list measurement settings, but the multiple lists that you sent had differing lengths. The number of settings must be consistent from list to list
–224	Illegal parameter value; LXI Event <event> already exists.	This error occurs when you try to add an LXI Event that has already been added
–224	Illegal parameter value; LXI Event <event> contains illegal characters.	When a new LXI Event is created, it may not use the comma, semicolon, or newline characters. All other printable ASCII characters are valid
–224	Illegal parameter value; LXI Event <event> does not exist.	The requested event has not been added yet
–224	Illegal parameter value; Measurement not available	You tried to turn on a measurement that is not available in the current mode
–224	Illegal parameter value;This instrument is always DC coupled	You cannot set AC coupling in this instrument
–224	Illegal parameter value;This model is always AC coupled	You cannot set DC coupling in this analyzer
–225	Out of memory	There is not enough memory to perform the requested operation
–225	Out of memory; Insufficient resources to load Mode <mode name>	If you attempt to load a mode via SCPI that will exceed memory capacity, the Mode does not load and this message is returned. "mode name" is the SCPI parameter for the Mode in question (for example, SA for Spectrum Analyzer Mode.) You can free up resources using the **System, Power On, Configure Applications** menu
–225	Out of memory; Memory limit caused Data Acquisition to be truncated	

Err#	Message	Verbose/Correction Information
–226	`List not same length`	You are using the LIST structure, but have individual lists of differing lengths
–230	`Data corrupt or stale;`	A legal data element was found, but it could not be used because the data format or the data structure was not correct. This could occur if a new measurement had been started but had not completed
–230	`Data corrupt or stale; Measurement data is not available`	Measurement data not available. The measurement that you are trying to get data from must be the current active measurement. Maybe you have not initiated the measurement, or it has not completed all the sweeps/averages needed
–230	`Data corrupt or stale; Trace contains no data.`	Trace cannot be displayed because currently there is no data assigned to it. Use the functions under the **Trace/Detector** menu, or load a previously saved trace, to assign data to the trace
–230	`Data corrupt or stale; Unable to load state from file`	There is something wrong with the state data in the desired file. Maybe the file is corrupt, or it is from an instrument/version that is not recognized by the current instrument
–231	`Data questionable`	Indicates that the measurement accuracy is suspect
–232	`Invalid format`	A data element was found but it could not be used because the data format or the data structure was not correct
–232	`Invalid format; Map information not loaded`	Instrument failed to load the burst mapping information from the selected file
–233	`Invalid version`	A legal data element was found but could not be used because the version of the data is incorrect. For example, state data changes as new instrument features are added, so old state files may not work in an instrument with a newer version of software
–240	`Hardware error`	A legal program command or query could not be executed because of a hardware error. The exact problem cannot be specifically identified
–240	`Hardware error; See details in Windows Event Log under SA`	The internal data acquisition system detected a problem at startup and logged the details in the Windows Event Log
–241	`Hardware missing`	The operation could not be performed because of missing hardware; perhaps the optional hardware is not installed
–241	`Hardware missing; Input not available`	The hardware required is not part of this model or the option is not installed
–241	`Hardware missing; Internal preamp not available at all frequency points`	The Internal Preamp is currently turned on, but the measurement is being performed completely or partially outside the range of the preamp. It is recommended that the user turns preamp off to ensure consistent results across the entire measurement
–241	`Hardware missing; not available for this model number`	The hardware required is not part of this model

Err#	Message	Verbose/Correction Information
–241	Hardware missing; Option not installed	The optional hardware is not installed
–250	Mass storage error;	A problem was found with the mass storage device (memory, disk drive, etc.). The exact problem cannot be specifically identified
–250	Mass storage error; Access denied	Access is denied
–250	Mass storage error; Bad path name	The specified path is invalid
–250	Mass storage error; Can only import single trace .csv files	Trace files containing multiple traces can not be imported. However, if you need to recall multiple traces you can use the **Save** and **Recall** functions, rather than the Import and Export functions
–250	Mass storage error; Can only load an Antenna Unit into Correction 1	The only Correction register that supports Antenna Units is number 1. You have attempted to load an Ampcor file that contains antenna units into another register
–250	Mass storage error; Cannot make	The directory or file cannot be created
–250	Mass storage error; Different Antenna Unit already in use	Attempt to import Corrections file with Antenna Unit that differs from an in-use correction
–250	Mass storage error; Directory not found	The system cannot find the path specified
–250	Mass storage error; Failed to Load trace. Bad file format.	The load trace operation could not be completed, as the input file was not in the expected format. You can only load traces that were previously saved using the **Save, Trace** feature
–250	Mass storage error; File <filename> wrong type	Attempt to import a data file that is not the proper type for this operation
–250	Mass storage error; File <filename> and instrument version mismatch	While opening a file, there was a mismatch between file version or model number with instrument version or model number. The import still tried to load as much as possible, but you should check it closely
–250	Mass storage error; File contains incorrect data for this operation	There is a mismatch between the file data type of the file specified and the destination indicated. For example, a correction set cannot be loaded/imported into a limit line
–250	Mass storage error; File empty	Cannot save trace because it contains no data. Check that the trace is turned on and contains some valid data

Err#	Message	Verbose/Correction Information
–250	Mass storage error; Invalid register number for *SAV or *RCL Mass Storage error	You have used the *SAV command to save a state to a non existent state register. Or You have used the *RCL command to recall a state register that wasn't previously saved with the *SAV command
–250	Mass storage error; Lock violation	The process cannot access the file because another process has locked a portion of the file
–250	Mass storage error; Mkr Table must be on to save Mkr Table as Meas Results	You have to have a Marker Table on the screen before you can save it. Turn on the Marker Table and try again
–250	Mass storage error; No file names available	Attempt to use the auto file name generation when all 10,000 file names are taken
–250	Mass storage error; Open failed	The system cannot open the device or file specified. This could be because the storage media is full, or possibly due to a filename error. If using an external storage device, check that the device is properly formatted
–250	Mass storage error; Pk Table must be on to save Pk Table as Meas Results	You must have a Peak Table on the screen before you can save it. Turn on the Peak Table and try again
–250	Mass storage error; Read fault	The system cannot read from the specified device
–250	Mass storage error; Register <number> empty	Attempt to recall a register with nothing in it
–250	Mass storage error; Sharing violation	The process cannot access the file because it is being used by another process
–250	Mass storage error; Spectrogram must be on to save as Meas Results	You must have a Spectrogram on the screen before you can save it. Turn on the Spectrogram and try again
–250	Mass storage error; Too many open files	The system cannot open the file
–250	Mass storage error; Write fault	The system cannot write to the specified device
–252	Missing media	A legal command or query could not be executed because of missing media
–253	Corrupt media	A removable media was found to be bad or incorrectly formatted. Any existing data on the media may have been lost
–254	Media full	A legal command/query could not be executed because the media was full

Err#	Message	Verbose/Correction Information
–255	`Directory full`	A legal command or query could not be executed because the media directory was full
–256	`File name not found;`	A legal command or query could not be executed because the file name was not found in the specified location
–257	`File name error;`	A legal command or query could not be executed because there was an error with the file name on the device media. For example, maybe you tried to copy to a duplicate file name
–257	`File name error; Allowable extension is .csv`	You are using the wrong type of file extension for the current data/file type
–257	`File name error; Allowable extension is .png`	You are using the wrong type of file extension for the current data/file type
–257	`File name error; Allowable extension is .state`	You are using the wrong type of file extension for the current data/file type
–257	`File name error; Invalid file name`	The filename, directory name, or volume label syntax is incorrect
–257	`File name error; name too long`	
–258	`Media protected`	A legal command or query could not be executed because the media was protected. For example, the write-protect was set
–260	`Expression error`	An error was found with an expression type of data element. The exact problem cannot be specifically identified
–261	`Math error in expression`	An expression that has legal syntax could not be executed because of a math error. For example, maybe you are dividing by zero
–270	`Macro error`	Indicates that a macro-related execution error occurred
–271	`Macro syntax error`	Indicates a syntax error within the macro definition
–272	`Macro execution error`	Indicates that a syntactically legal macro program data sequence could not be executed due to some error in the macro definition
–273	`Illegal macro label`	Indicates that the macro label defined in the *DMC command was a legal string syntax, but could not be accepted
–274	`Macro parameter error`	Indicates that the macro definition improperly used a macro parameter placeholder
–275	`Macro definition too long`	Indicates that a syntactically legal macro program data sequence could not be executed because the string or block contents were too long for the device to handle
–276	`Macro recursion error`	Indicates that a syntactically legal macro program data sequence could not be executed because the device found it to be recursive

Err#	Message	Verbose/Correction Information
–277	Macro redefinition\ not allowed	Indicates that a syntactically legal macro label in the *DMC command could not be executed because the macro label was already defined
–278	Macro header not found	Indicates that a syntactically legal macro label in the *GMC? query could not be executed because the header was not previously defined
–280	Program error	There was an execution error in a down-loaded program. The exact problem cannot be specifically identified
–281	Cannot create program	Indicates that an attempt to create a program was unsuccessful. A reason for the failure might include not enough memory
–282	Illegal program name	The name used to reference a program was invalid; for example, redefining an existing program, deleting a nonexistent program, or in general, referencing a nonexistent program
–283	Illegal variable name	An attempt was made to reference a nonexistent variable in a program
–284	Program currently running	Certain operations dealing with programs may be illegal while the program is running; for example, deleting a running program might not be possible
–285	Program syntax error	Indicates that a syntax error appears in a downloaded program. The syntax used when parsing the downloaded program is device-specific
–286	Program runtime error	
–290	Memory use errors	
–291	Out of memory	
–292	Referenced name does not exist	
–293	Referenced name already exists	
–294	Incompatible type	Indicates that the type or structure of a memory item is inadequate

–100 to –199, Command Errors

Err#	Message	Verbose/Correction Information
–100	Command error	There is a problem with the command. The exact problem cannot be specifically identified
–101	Invalid character	An invalid character was found in part of the command
–102	Syntax error	An unrecognized command or data type was found, for example a string was received for a command that doesn't accept strings
–103	Invalid separator	The command was supposed to contain a separator but we found an illegal character. For example, the semicolon was omitted after a command string
–104	Data type error	A data type differed from what was expected. For example, numeric or string data was expected, but block data was found
–105	GET not allowed	A Group Execute Trigger was received within a program message
–108	Parameter not allowed	More parameters were received than were expected for the command. For example, the *ESE common command only accepts one parameter, so sending *ESE 0,1 is not allowed
–109	Missing parameter	Fewer parameters were received than required for this command
–110	Command header error	This is a general error that is generated when a problem is found in a command header, but no more specific information is available
–111	Header separator error	An illegal character was found in a command where a separator was expected
–112	Program mnemonic too long	The command contains a keyword that has more than twelve characters
–113	Undefined header	The command meets the SCPI syntax requirements, but is not valid in the current measurement environment
–114	Header suffix out of range	The value of a numeric suffix that is attached to a program mnemonic makes the header invalid. (A suffix is usually units, like Hz or DB)
–115	Unexpected number of parameters	The number of parameters received does not correspond to the number of parameters expected.
–120	Numeric data error	An error was found in a data element that appears to be numeric. The exact problem cannot be specifically identified
–121	Invalid character in number	A character was found that is not valid for the data type. For example, an alpha in a decimal numeric or a "9" in octal data
–123	Exponent too large	The magnitude of an exponent was greater than 32000
–124	Too many digits	The mantissa of a decimal-numeric contained more than 255 digits, excluding leading zeros
–128	Numeric data not allowed	A legal numeric data element was found, but that is not a valid element at this position in the command

Err#	Message	Verbose/Correction Information
–130	Suffix error	A problem was found in a suffix (units). The exact problem cannot be specifically identified
–131	Invalid suffix	There is a syntax problem with the suffix. You need to use the suffix (units) that are allowed by this command
–134	Suffix too long	The suffix contained more than twelve characters
–138	Suffix not allowed	A suffix was found after a numeric element that does not allow suffixes (units)
–140	Character data error	A problem was found with a character data element. The exact problem cannot be specifically identified
–141	Invalid character data	Either the character data element contains an invalid character or the element itself is not valid for this command
–144	Character data too long	The character data element contains more than twelve characters
–148	Character data not allowed	A character data element that you sent is valid, but it is not allowed at this point in the parsing
–150	String data error	A problem was found with a string data element. The exact problem cannot be specifically identified
–151	Invalid string data	A string type of data element was expected, but it is invalid for some reason. For example, an END message was received before the terminal quote character
–158	String data not allowed	A string data element that you sent is valid, but it is not allowed at this point in the parsing
–160	Block data error	A problem was found with a block data element. The exact problem cannot be specifically identified
–161	Invalid block data	A block data element was expected, but it was invalid. For example, an END message was received before the end length was satisfied
–168	Block data not allowed	A legal block data element was found, but it is not allowed at this point in the parsing
–170	Expression error	A problem was found with an expression data element. The exact problem cannot be specifically identified
–171	Invalid expression	An expression data element is not valid. For example, there may be unmatched parentheses or an illegal character
–178	Expression data not allowed	A legal expression data was found, but it is not allowed at this point in the parsing
–180	Macro error	A problem was found with a macro element. The exact problem cannot be specifically identified
–181	Invalid outside macro definition	Indicates that a macro parameter placeholder was encountered outside of a macro definition

Err#	Message	Verbose/Correction Information
–183	Invalid inside macro definition	Indicates that the program message unit sequence, sent with a *DDT or *DMC command, is syntactically invalid
–184	Macro parameter error	Indicates that a command inside the macro definition had the wrong number or type of parameters

0 Error

Err#	Message	Verbose/Correction Information
0	No error	The queue is empty. Either every error in the queue has been read, or the queue was cleared by power-on or *CLS

Condition Messages

Condition messages are displayed in the STATUS message area in the bottom right of the display. Condition messages are classified as either "Errors" or "Warnings." In the tables in this section, an E in the **Error or Warning** column means that an error is displayed on the front panel and sent out to SCPI when this condition is detected. A W in this column means that a Warning is displayed on the front panel, but nothing is sent to SCPI.

For each Condition Message, there is a corresponding bit in one of the SCPI Status Registers. These bits are listed in the tables below. Some messages exist **only** as status bits; for these messages the **Error or Warning** column entry specifies "status bit only".

Condition errors 1 to 99, Calibration

These errors correspond to the `STATus:QUEStionable:CALibration` register. Since this register is fanned out to three sub-registers, with summary bits in the main `STATus:QUEStionable:CALibration` register, each sub-register has its own range of error numbers.

Condition Errors 6 to 34, Calibration Skipped

This series of errors corresponds to the bits in the `STATus:QUEStionable:CALibration:SKIPped` sub-register. The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

For example, error 6 indicates that the "RF Alignment being skipped" condition has been detected, and error 1006 indicates that failure has been cleared.

This register is summarized as bit 11 of the `STATus:QUEStionable:CALibration` register, as described in section .

Err#	Bit in status register	Message	Error or Warning	More Information
6	0	`Align RF Skipped`	W	
8	1	unused		
10	2	unused		
12	3	unused		
14	4	unused		
16	5	unused		

Err#	Bit in status register	Message	Error or Warning	More Information
18	6	unused		
20	7	unused		
22	8	unused		
24	9	unused		
26	10	unused		
28	11	unused		
30	12	unused		
32	13	unused		
34	14	unused		

Condition Errors 36 to 64, Calibration Needed or Failed

This series of errors corresponds to the bits in the
`STATus:QUEStionable:CALibration` register. The second column in the
table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has
been detected. When the condition is cleared, an event with the error number
plus 1000 is generated. These error numbers can be viewed in the Show Errors
screen, along with the DETECTED and CLEARED indicators.

For example, error 42 indicates that the "RF Alignment Failure" condition has
been detected, and error 1042 indicates that failure has been cleared.

Several bits in this register are "summary bits" for registers at a lower level.
There are no error messages associated with these bits; they exist only as
status bits, which can be read with a `STATus:QUEStionable:CALibration?`
event query or a `STATus:QUEStionable:CALibration:CONDition?` query.

Note that these summary bits summarize the state and history of the event
registers at the lower level. This is true even for bits in the
`STATus:QUEStionable:CALibration` condition register. This means that:

— The summary bits read by the
  `STATus:QUEStionable:CALibration:CONDition?` query are true if any
  event bits are set in any of the :CALibration sub-registers :SKIPped,
  :EXTended:NEEDed or :EXTended:FAILure.

— The summary bits read by the `STATus:QUEStionable:CALibration?`
  event query are true if any event bit has undergone a false-to-true
  transition with the PTRansition filter set, or a true-to-false transition with
  the NTRansition filter set, in any of the :CALibration sub-registers :SKIPped,
  :EXTended:NEEDed or :EXTended:FAILure.

Thus, the summary bits **cannot** be used to determine the current state of a lower level condition bit; only the state and history of the lower level event bits.

This register is itself summarized as bit 8 of the `STATus:QUEStionable` register, as described in the section "Condition Errors 601 to 699, Error Summaries" on page 126.

Err#	Bit in status register	Message	Error or Warning	More Information
36	0	unused		
38	1	unused		
40	2	`TG Alignment Failure`	E	
42	3	`RF Alignment Failure`	E	
44	4	`IF Alignment Failure`	E	
46	5	`LO Alignment Failure`	E	
48	6	`ADC Alignment Failure`	E	
50	7	`FM Demod Alignment Failure`	E	
52	8	`Extended Align Needed Summary`	status bit only	This bit is the summary bit for the STATus:QUEStionable:CALibration:EXTended:NEEDed sub-register.
54	9	`Extended Align Failure Summary`	status bit only	This bit is the summary bit for the STATus:QUEStionable:CALibration:EXTended:FAILure sub-register.
56	10	unused		
58	11	`Align Skipped Sum Summary`	status bit only	This bit is the summary bit for the STATus:QUEStionable:CALibration:SKIPped sub-register.
60	12	`Align Now, RF required`	E	
62	13	unused		
64	14	`Align Now, All required`	E	In PSA, this was error 64

Condition Errors 65 to 92, Calibration Needed (Extended)

This series of errors corresponds to the bits in the
`STATus:QUEStionable:CALibration:EXTended:NEEDed` sub-register.
The second column in the table below shows the corresponding bit in that
register.

An event with the error number shown in the table means the condition has
been detected. When the condition is cleared, an event with the error number
plus 1000 is generated. These error numbers can be viewed in the Show Errors
screen, along with the DETECTED and CLEARED indicators.

For example, error 72 indicates that the "Input Attenuation not calibrated"
condition has been detected, and error 1072 indicates that failure has been
cleared.

This register is summarized as bit 8 of the
`STATus:QUEStionable:CALibration` register, as described in the section
.

Err#	Bit in status register	Message	Error or Warning	More Information
65	0	unused		
66	1	`Align 9kHz–30MHz required`	E	An EMI conducted frequency range alignment is needed.
68	2	`Align 30MHz–1GHz required`	E	An EMI radiated frequency range alignment is needed.
72	4	`Input Attenuation not calibrated`	E	Corrected measurements have been requested and the required RF front-end setting of x dB has not been calibrated.
74	5	unused		
76	6	unused		
78	7	unused		
80	8	unused		
82	9	unused		
84	10	unused		
86	11	unused		
88	12	unused		
90	13	unused		
92	14	unused		

Condition Errors 67 to 95, Calibration Failure (Extended)

This series of errors corresponds to the bits in the
`STATus:QUEStionable:CALibration:EXTended:FAILure` sub-register.
The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has
been detected. When the condition is cleared, an event with the error number
plus 1000 is generated. These error numbers can be viewed in the Show Errors
screen, along with the DETECTED and CLEARED indicators.

For example, error 71 indicates that the Characterize Preselector Failure has
been detected, error 1071 indicates that failure has been cleared.

This register is summarized as bit 9 of the
`STATus:QUEStionable:CALibration` register, as described in the section
.

Err#	Bit in status register	Message	Error or Warning	More Information
67	0	`Align 9kHz to 30MHz failed`	W	In PSA, this was error 13749
69	1	`Align 30MHz to 1GHz failed`	W	In PSA, this was error 13751
71	2	`Characterize Preselector failure`	W	The preselector characterization routine failed.
73	3	unused		
75	4	unused		
77	5	unused		
79	6	unused		
81	7	unused		
83	8	unused		
85	9	unused		
87	10	unused		
89	11	unused		
91	12	unused		
93	13	unused		
95	14	unused		

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Condition Errors 101 to 199, Measurement Integrity

This series of errors corresponds to the bits in the STATus:QUEStionable:INTegrity register. The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

For example, error 141 indicates an Input Overload condition has been detected, error 1129 indicates that failure has been cleared.

Two bits in this register are "summary bits" for registers at a lower level. There are no error messages associated with these bits; they exist only as status bits, which can be read with a STATus:QUEStionable:INTegrity? event query or a STATus:QUEStionable:INTegrity:CONDition? query.

Note that these summary bits summarize the state and history of the event registers at the lower level. This is true even for bits in the STATus:QUEStionable:INTegrity condition register. This means that:

— The summary bits read by the STATus:QUEStionable:INTegrity:CONDition? query are true if any event bits are set in any of the :INTegrity sub-registers :SIGNal or :UNCalibrated.

— The summary bits read by the STATus:QUEStionable:INTegrity? event query are true if any event bit has undergone a false-to-true transition with the PTRansition filter set, or a true-to-false transition with the NTRansition filter set, in any of the :INTegrity sub-registers :SIGNal or :UNCalibrated

Thus, the summary bits **cannot** be used to determine the current state of a lower level condition bit; only the state and history of the lower level event bits.

This register is itself summarized as bit 9 of the STATus:QUEStionable register, as described in the section .

Err#	Bit in status register	Message	Error or Warning	More Information
133	0	**Signal Summary**	status bit only	This bit is the summary bit for the STATus:QUEStionable:INTegrity:SIGNal sub-register.
135	1	**No Result**	E	
135	1	**No Result;Turn on MCE**	E	To calculate Timing and Phase results in the Code Domain Power view of Mod Accuracy, the "Multi Channel Estimator" must be set to ON. Otherwise these results are invalid.

Err#	Bit in status register	Message	Error or Warning	More Information
135	1	No Result; Meas invalid with I/Q inputs	E	The current measurement does not support I/Q input; switch to the RF or another input or select a different measurement
137	2	unused		
139	3	Uncalibrated Summary	status bit only	This bit is the summary bit for the STATus:QUEStionable:INTegrity:UNCalibrated sub-register.
141	4	Input Overload	E[a]	
141	4	Input Overload;ADC over range	E[a]	The signal at the input to the IF section is too high. You should increase the attenuation or lower the signal level.
141	4	Input Overload;I/Q ADC over range	E[a]	The I or Q input exceeds the ADC upper limit.
141	4	Input Overload;I/Q Voltage over range	E[a]	The input voltage on the I or Q channel exceeds the channel limit. In differential mode the over voltage may occur without causing an ADC overload, for example, if I is at +5.01 V and I-bar is at +5.0 the ADC will be in range but both I and I-bar will exceed the voltage limit.
141	4	Input Overload; RF Preselector Overload	E[a]	The level at the input of the MXE RF Preselector has exceeded tolerances, reduce the input level
143	5	unused		
145	6	unused		
147	7	Insufficient Data	E	
147	7	Insufficient Data; Incr. Demod Time	E	There is insufficient acquisition data to provide accurate metrics. You should increase the Demod Time to acquire enough data.
147	7	Insufficient Data; frequency list empty	E	A measurement was attempted with List frequency mode or a SCPI query of the frequency list table was made and the frequency list table is empty.
147	7	Insufficient Data; ENR table empty	E	A measurement was attempted or a SCPI query of an ENR table was made and there were no entries in the relevant ENR table (Common, Meas or Cal).
147	7	Insufficient Data; Loss table empty	E	A measurement is attempted or a SCPI query of a before or after loss table is made and there are no entries in the relevant loss table

Err#	Bit in status register	Message	Error or Warning	More Information
149	8	`Meas Error`		
151	9	`Memory Error`	E	
151	9	`Memory Error;Shorten capture interval`	E	A shortage of free memory related to longer capture intervals has occurred. The measurement is aborted and all results return invalid values
153	10	`I/O Error`	E	
153	10	`I/O Error; Ext Source needs IP Addr`	E	No IP address entered for external source and external LO control is ON.
155	11	`Trig Error`	E	
157	12	`Invalid Data`	Status bit only	This is the "invalid data indicator", same as the "*" in the upper right corner of the screen. It means that the on-screen annotation does not match the on-screen data, usually because a measurement is pending after a settings change. There is no message in the status line and nothing in the history queue, but there IS an on-screen indication and a status bit.
159	13	`Settings Alert`	W	
159	13	`Settings Alert;LO may overload IF`	W	If the sweep type is Swept, the start frequency of the instrument is less than 10 MHz, and you put Swept IF Gain in Manual High, then a warning condition is generated and remains in effect as long as this condition exists. In some older analyzers this was error 1109.
159	13	`Settings Alert; Diff probe mismatch; <I|Q|I,Q>`	W	The attenuation values of the two probes on the I and/or Q channels differ by too much for a valid differential reading.
159	13	`Settings Alert; Acquisition truncated`	W	In the Analog Demod mode, certain extreme settings combinations will result in a required acquisition length in excess of the capacity of the analyzer. Increase the AF Spectrum RBW or the RF Spectrum RBW, decrease the Channel BW, and/or decrease the Demod Waveform Sweep Time.

Err#	Bit in status register	Message	Error or Warning	More Information
159	13	`Settings Alert; Analog Out settings conflict`	W	The user has manually set the Analog Output under the Input/Output menu to a setting that conflicts with the current measurement. There will be no output on the Analog Out port until this conflict is resolved. In most cases, simply set Analog Out to Auto for the optimal setting.
159	13	`Settings Alert;I/Q mismatch:<Differential|Input Z|Attenuation>`	W	The impedance, differential, or attenuation settings for the I and Q channels do not match. For valid I+jQ measurements the impedance and differential settings should be the same on both channels and the attenuation should match within 1 dB
159	13	`Settings Alert;Parm/data mismatch`	W	For *Bluetooth*, the detected parameters did not match the data
159	13	`Settings Alert; Src pwr ramp>ALC range`	W	You have selected a Power Sweep range that exceeds the ability of the external Source to follow without changing mechanical attenuation. Lower the Power Sweep range.
159	13	`Settings Alert; Sweep Rate Unavailable`	W	The auto coupled sweep time exceeds the maximum allowed. Therefore, full amplitude accuracy cannot be attained. Please increase the RBW or reduce the span.
159	13	`Settings Alert; Span:RBW Ratio too big`	W	The chosen large ratio of span to RBW is not possible. Please reduce the span or increase the RBW and/or FFT Width.
161	14	`Setting Modified`	E	
161	14	`Setting Modified; Filter not applied`	E	The filter you have selected is larger than the sampling frequency. You should select a different filter.

a. The Input Overload error is not reported to the SCPI queue unless the :SYSTem:ERRor:OVERload ON command has been issued, however it always sets the status bit. For details of the `:SYS-Tem:ERRor:OVERload` command, see the X-Series User's & Programmer's Reference.

Condition Errors 201 to 299, Signal Integrity

This series of errors corresponds to the bits in the `STATus:QUEStionable:INTegrity:SIGNal` sub-register. The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

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For example, error 207 indicates a Burst Not Found condition has been detected, error 1207 indicates that failure has been cleared.

This register is summarized as bit 0 of the STATus:QUEStionable:INTegrity register, as described in the section "Condition Errors 101 to 199, Measurement Integrity" on page 113.

Err#	Bit in status register	Message	Error or Warning	More Information
203	0	unused	E	
205	1	unused	E	
207	2	Burst Not Found	E	The burst signal cannot be detected because of inappropriate parameter settings or incorrect signal.
				An in appropriate parameter setting could cause the signal to be partially, rather than fully, on the display, Burst Search Threshold and/or Burst Search Length may need to be adjusted.
				An incorrect signal could have either insufficient power, the rising or falling edges cannot be detected, or the burst is less than 126 microseconds.
				Carrier signal is not actually bursted.
				W-CDMA: Either the signal being analyzed has insufficient power, the rising or falling edges cannot be detected, or the burst is less than 126 microseconds.
				W-CDMA: Cannot synchronize measurement with PRACH channel for Power Control measurement, because the signal cannot be found. Make sure PRACH is present in the W-CDMA uplink signal, and that the preamble signature and scramble code are set correctly.
				GSM: Data was acquired but a GSM burst was not found, with the timeslot mode disabled.
				NADC, PDC: A valid burst is not found when the Device is MS.
				1xEV-DO: Data was acquired but a 1xEV burst was not found, with the timeslot mode disabled.
				Bluetooth: The burst that has been found does not correspond to the currently selected *Bluetooth* packet type (the burst length may be too short).
				WLAN: The instrument cannot find a valid WLAN burst. You may need to extend the search length.
				In PSA, this error was reported as one of the following error numbers: 10772, 13104, 10160, 10286, 10420, 10454, 10614, 10904, 10928, 13074, 10287

Err#	Bit in status register	Message	Error or Warning	More Information
207	2	`Burst not found;with selected Time Slot`	E	The selected timeslot does not contain the expected burst.
209	3	`Timing Error`	E	
209	3	`Timing Error:No time ref pilot burst`	E	The pilot burst used for time reference is not active.
211	4	`Carrier(s) incorrect or missing`	E	In PSA, this error was reported as one of the following error numbers: 10165, 10173, 10178, 10419, 10421, 10535, 10560, 10642, 10648, 10650, 10960
213	5	`Freq Out of Range`	E	
213	5	`Freq Out of Range; System input (IF)`	E	One or more system input frequencies are out of range. If using a frequency list, check that all entries are valid for current measurement mode.
213	5	`Freq Out of Range; External LO`	E	One or more external LO frequencies are out of range. Check that the LO frequency limits are set correctly and check the entered measurement frequencies and measurement mode.
215	6	`Sync Error`	E	W-CDMA: Cannot sync DPCCH pilot. Cannot synchronize measurement with DPCCH pilot for Power Control measurement, because the pilot signal cannot be found. Make sure DPCCH is present in the W-CDMA uplink signal, and that the slot format and scramble code are set correctly.
215	6	`Sync Error;No pilot burst`	E	There is no Pilot burst detected.
215	6	`Sync Error;Sync code not found`	E	Synchronization code is not found in the measured time slot.
215	6	`Sync Error;No freq ref pilot burst`	E	The pilot burst used for frequency reference is not active.
215	6	`Sync Error;Midamble sync fail`	E	Failed to find the uplink slot, which caused the synchronization with the Midamble to fail.
215	6	`Sync Error;Preamble length zero`	E	Burst type is "Data" or "Preamble" and the measurement cannot find a Preamble

Err#	Bit in status register	Message	Error or Warning	More Information
217	7	`Demod Error`	E	This error is normally generated because of one of the following reasons: 1. There is no carrier signal. 2. Walsh channels other than the pilot are active. 3. There is some other modulation problem that will prevent the measurement from being made. This problem must be corrected before the measurement can continue. cdma 2000 & W-CDMA: Cannot correlate to the input signal and no active channel is found. (from composite EVM measurement) An active channel must meet the default threshold criteria that it is within 20 dB of the highest power code channel. The threshold can be changed using the active set threshold function in the Meas Setup menu. cdmaOne: A correlation failure with the pilot CDMA channel occurred during synchronous demodulation. 1xEV-DO: Cannot correlate to the input signal and no active channel is found. (from composite EVM measurement) An active channel must meet the default threshold criteria that it is within 20 dB of the highest power code channel. The threshold can be changed using the active set threshold function in the Meas Setup menu. In PSA, this error was reported as one of the following error numbers: 10872, 10962, 13070, 10228, 10768
217	7	`Demod Error;Can't correlate`	E	Cannot correlate to the input signal and no active channel is found. (from composite EVM measurement) An active channel must meet the default threshold criteria that it is within 20 dB of the highest power code channel. The threshold can be changed using the active set threshold function in the Meas Setup menu.
217	7	`Demod Error;Data interval too short`	E	There are not enough input I/Q pairs for the measurement calculation. This may be caused by an incorrect data capture.
217	7	`Demod Error;No active channel`	E	There is no active channel detected.
217	7	`Demod Error;Not an active slot`	E	There is no active slot detected.

Err#	Bit in status register	Message	Error or Warning	More Information
217	7	`Demod Error;No full subframe found`	E	No sub-frame or only part of one sub-frame is detected.
217	7	`Demod Error;Muxed bits not found`	E	Multiplexed Data Demod Bits are not generated even though Data channel is selected, because all 16 data code channels are not active
217	7	`Demod Error;Acq Time too short`	E	For *Bluetooth*, the detected packet type doesn't match the captured packet type because the payload start, end or data could not be found.
219	8	`Signal Too Noisy`	E	NADC & PDC: The valid EVM measurement cannot be performed, because the input signal is too noisy.

GSM & EDGE: In a GSM measurement, indicates that a burst could not be found in a signal that appears noisy.

In PSA, this error was reported as one of the following error numbers: 10702, 10824, 10906, 10930, 13024, 10626, 111 |
221	9	`Slot Error`	E	
221	9	`Slot error;No active slot found`	E	No valid active slot found in captured data, or no active slot found in captured interval. Synchronization may succeed and pilot found when this message is issued, but no results are included in peak/average calculation.
221	9	`Slot Error; No idle slot found`	E	No valid idle slot found in captured data, or no idle slot found in captured interval. Synchronization may succeed and pilot found when this message is issued, but no results are included in peak/average calculation.
223	10	unused	E	
225	11	unused	E	
227	12	unused	E	
229	13	unused	E	
231	14	unused	E	

Condition Errors 301 to 399, Uncalibrated Integrity

This series of errors corresponds to the bits in the
`STATus:QUEStionable:INTegrity:UNCalibrated` sub-register. The
second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

For example, error 301 indicates a Meas Uncal condition has been detected, error 1301 indicates that failure has been cleared.

This register is summarized as bit 3 of the STATus:QUEStionable:INTegrity register, as described in the section "Condition Errors 101 to 199, Measurement Integrity" on page 113.

Err#	Bit in status register	Message	Error or Warning	More Information
301	0	Meas Uncal	W	
303	1	Signal ID on	W	
305	2	No Long Code Phase	W	
307	3	AC coupled: Accy unspec'd <10 MHz	W	AC input coupling will function at lower frequencies, but the performance is not specified below 10 MHz.
309	4	User cal	W	

Err#	Bit in status register	Message	Error or Warning	More Information
309	4	`User Cal; Cal invalidated`	E,W	The existing user cal has been invalidated for one of the following reasons:
				Frequency: Setting the frequency outside the current valid user cal set (for example: If the current sweep range is 2 to 3GHz, then setting the start frequency to 1.9 GHz will invalidate the current user cal. Other frequency changes that will invalidate the user cal are:
				· If the cal was performed at a fixed frequency and you change this frequency.
				· If you are in "Freq List" mode and you change it to extend beyond the current user cal range. In this case you will see an error message.
				DUT Type: If the DUT Type parameter changes, causing the measurement frequencies to be pushed outside the current cal.
				Attenuation: If an attenuation setting is selected but has not been calibrated.
				Preamp: If set to condition different from current cal settings, for example: if calibrated with the preamp on, turning it off will invalidate the cal.
				Points: Changing the number of measured frequency points can make the stored preselector offsets become inaccurate and hence invalidate the calibration. This occurs when the following conditions exist:
				· A successful calibration has been performed.
				· Some measured freq points are > 3.6 GHz.
				· The new points > 3.6 GHz are located more than 50 MHz away from the current calibration points.
309	4	`User Cal; Freq outside cal range`	E	The existing user cal has been invalidated because the current measurement frequencies lie partially or wholly outside the range of frequencies used for user-cal. (UNCAL)
309	4	`User Cal; Cal will be interpolated`	W	The measurement frequency range has been changed such that it is a subset of the calibrated range. (~CAL)

Err#	Bit in status register	Message	Error or Warning	More Information
309	4	`User Cal; Adjusted for new RBW`	W	The measurement RBW has been changed since the last calibration (~CAL)
311	5	`Calibration`	W	
311	5	`Calibration; ENR table extrapolated`	W	One or more calibration or measurement frequency points exceed the currently loaded Cal or Meas ENR Table frequency ranges. The corresponding ENR table's lowest frequency ENR value will be re-used for frequencies less than the table range, and the highest frequency ENR value will be re-used for frequencies greater than the table range. (~ENR)
311	5	`Calibration; No ENR data present`	W	No ENR Data (ENR)
313	6	`Source Uncal`	W	
313	6	`Source Uncal;adj Start Freq or RBW`	W	While using a Tracking Source, you must make sure the Start Frequency is high enough to avoid capturing LO feedthrough in the trace. This depends on both Start Freq and RBW. If you get this message, increase the Start Freq or narrow the RBW.
315	7	`Preamp: Accy unspec'd <XX kHz`	W	Preamp will function at lower frequencies, but the performance is not specified below XX kHz (XX is model number specific).
317	8	unused	W	
319	9	unused	W	
321	10	unused	W	
323	11	unused	W	
325	12	unused	W	
327	13	unused	W	
329	14	unused	W	

Condition Errors 401 to 499, Power

This series of errors corresponds to the bits in the
`STATus:QUEStionable:POWer` register. The second column in the table
shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has
been detected. When the condition is cleared, an event with the error number
plus 1000 is generated. These error numbers can be viewed in the Show Errors
screen, along with the DETECTED and CLEARED indicators.

For example, error 409 indicates a 50 MHz Oscillator Unleveled condition has
been detected, error 1409 indicates that failure has been cleared.

This register is summarized as bit 3 of the `STATus:QUEStionable` register, as
described in the section
.

Err#	Bit in status register	Message	Error or Warning	More Information
401	0	`RPP Tripped`	W	(not currently in use)
403	1	`Source Unleveled`	W	
405	2	`Source LO Unleveled`	E	(not currently in use)
407	3	`LO Unleveled`	E	(not currently in use)
409	4	unused		
411	5	unused		
413	6	unused		
415	7	unused		
417	8	unused		
419	9	unused		
421	10	unused		
423	11	unused		
425	12	unused		
427	13	unused		
429	14	unused		

Condition Errors 501 to 599, Frequency

This series of errors corresponds to the bits in the STATus:QUEStionable:FREQuency register. The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

For example, error 503 indicates a Frequency Reference Unlocked condition has been detected, error 1503 indicates that failure has been cleared.

This register is summarized as bit 5 of the STATus:QUEStionable register, as described in the section .

Err#	Bit in status register	Message	Error or Warning	More Information
501	0	Source Synth Unlocked	E	
503	1	Frequency Reference Unlocked	E	
505	2	2nd LO Unlocked	E	
507	3	unused		
509	4	LO Unlocked	E	
511	5	unused		
513	6	IF Synthesizer Unlocked	E	
515	7	Calibration Oscillator Unlocked	E	
517	8	unused		
519	9	Demodulation	E	
521	10	Ref missing or out of range	E	
521	10	Ref missing or out of range; External	E	The external frequency reference signal is missing or is not within the proper amplitude range. In PSA, this error was reported as error 622
521	10	Ref missing or out of range; Pulse	E	The pulse reference signal is missing or is not within the correct amplitude range.

Err#	Bit in status register	Message	Error or Warning	More Information
523	11	unused		
525	12	unused		
527	13	unused		
529	14	unused		

Condition Errors 601 to 699, Error Summaries

This series of errors corresponds to the bits in the `STATus:QUEStionable` register, read with a `STATus:QUEStionable?` event query or a `STATus:QUEStionable:CONDition?` query.

The second column in the table shows the corresponding bit in the status register. These bits do not have any corresponding error messages, although error numbers have been reserved for them as seen in the Err# column; they are status bits only.

The bits in the `STATus:QUEStionable` register are "summary bits" for registers at a lower level. Note that these summary bits summarize the state and history of the event registers at the lower level. This is true even for bits in the `STATus:QUEStionable` condition register. This means that:

— The summary bits read by the `STATus:QUEStionable: CONDition?` query are true if any event bits are set in any of the :QUEStionable sub-registers :POWer, :TEMPerature, FREQuency, CALibration or :INTegrity.

— The summary bits read by the `STATus:QUEStionable?` event query are true if any event bit has undergone a false-to-true transition with the PTRansition filter set, or a true-to-false transition with the NTRansition filter set, in any of the :QUEStionable sub-registers :POWer, :TEMPerature, FREQuency, CALibration or :INTegrity.

Thus, the summary bits **cannot** be used to determine the current state of a lower level condition bit; only the state and history of the lower level event bits.

Err#	Bit in status register	Message	Error or Warning	More Information
601	0	unused		
603	1	unused		
605	2	unused		
607	3	**Power**	status bit only	This bit is the summary bit for the STATus:QUEStionable:POWer sub-register.

Err#	Bit in status register	Message	Error or Warning	More Information
609	4	`Temperature`	status bit only	This bit is the summary bit for the STATus:QUEStionable:TEMPerature sub-register.
611	5	`Frequency`	status bit only	This bit is the summary bit for the STATus:QUEStionable:FREQuency sub-register.
613	6	unused		
615	7	unused		
617	8	`Calibration`	status bit only	This bit is the summary bit for the STATus:QUEStionable:CALibration sub-register.
619	9	`Integrity`	status bit only	This bit is the summary bit for the STATus:QUEStionable:INTegrity sub-register.
621	10	unused		
623	11	unused		
625	12	unused		
627	13	unused		
629	14	unused		

Condition Errors 701 to 799, Operation

This series of errors corresponds to the bits in the `STATus:OPERation` register, which can be read with a `STATus:OPERation?` event query or a `STATus:OPERation:CONDition?` query.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated.

For example, error 721 indicates that the DC Coupled condition has been detected; error 1721 indicates that condition has been cleared.

Unless otherwise noted in the **Error or Warning** column below, these are status bits only, with no corresponding error message or number

Err#	Bit in status register	Message	Error or Warning	More Information
701	0	`Calibrating`	status bit only	
703	1	`Settling`	status bit only	

Err#	Bit in status register	Message	Error or Warning	More Information
705	2	unused		
707	3	Sweeping	status bit only	
709	4	Measuring	status bit only	
711	5	Waiting for Trigger	status bit only	
713	6	Waiting for Arm	status bit only	
715	7	unused		
717	8	Paused	status bit only	
719	9	Source Sweeping	status bit only	The "Source Sweeping" bit is used to indicate various conditions, depending on the Mode of operation: In the List Sequencer mode, it is used to indicate that the sequencer is running. In the EMI Receiver mode, it is used to indicate that scan results are available from the Frequency Scan measurement
721	10	DC Coupled	W	
723	11	unused		
725	12	Source Waiting for Trigger	status bit only	
727	13	unused		
729	14	unused		

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Condition Errors 801 to 899, Temperature

This series of errors corresponds to the bits in the STATus:QUEStionable:TEMPerature register. The second column in the table shows the corresponding bit in that register.

An event with the error number shown in the table means the condition has been detected. When the condition is cleared, an event with the error number plus 1000 is generated. These error numbers can be viewed in the Show Errors screen, along with the DETECTED and CLEARED indicators.

For example, error 801 indicates that the Ref Osc Oven Cold condition has been detected; error 1801 indicates that condition has been cleared.

This register is summarized as bit 4 of the STATus:QUEStionable register, as described in the section .

Err#	Bit in status register	Message	Error or Warning	More Information
801	0	Reference Oscillator Oven Cold	W	(not currently in use)
803	1	unused		
805	2	unused		
807	3	unused		
809	4	unused		
811	5	unused		
813	6	unused		
815	7	unused		
817	8	unused		
819	9	unused		
821	10	unused		
823	11	unused		
825	12	unused		
827	13	unused		
829	14	unused		

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4 Input Selection & Level Control

What You Will Find in This Chapter

The following information is found in this chapter:

1. Theory of operation of the Input Selection and Level Control section.
2. Isolating the cause of an hardware problem by verifying the functionality of assemblies in the Input Selection and Level Control section signal path.

NOTE Each section describes how the assembly works and gives information to help you troubleshoot the assembly. Each description covers the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following descriptions are found in this chapter:

KEYSIGHT
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Input Selection & Level Control Section Purpose

Input Selection & Level Control Section Purpose

The assemblies covered in this section are responsible for the routing of the signal being measured by the instrument, whether it is from one of the two front panel inputs or one of the internal calibration signals, to the RF Downconverter section of the instrument. There are also two input attenuators that are used to optimize the signal level applied to the downconverter section.

This section also contains a limiter assembly that will protect the Front End of the instrument from transient signals that are often present when performing conducted emissions testing.

Input Selection & Level Control Section Description

NOTE

Refer to Chapter 15, "Block Diagrams.".

The components discussed in this chapter are:

— A9 Input Attenuator A

— A10 Input Attenuator B

— A23 Limiter Assembly

— SW1 Cal Switch

— SW2 Transfer Switch

Input Selection & Level Control Assembly Descriptions

A9 Input Attenuator A

There are two different A9 Input Attenuator A assemblies used in the N9038A. One is used in instruments with Option 503, 508, and 526 and the other with Option 544.

Option 503, 508, and 526

This assembly has two 2 dB attenuator sections, a DC block, and a second RF input port.

With the DC block switched in (AC coupled mode), the low end minimum frequency range increases from 20 Hz to 10 MHz due to capacitive effects.

Option 544

This assembly has a total 10 dB of attenuation. There are two 2 dB attenuator sections, and a 6 dB attenuator section. It also has a second RF input port.

Unlike the Option 503, 508, and 526 A9 Input Attenuator A, this does not have a switchable DC block – it is always DC coupled. Because of this the low end minimum frequency range is always 20 Hz.

Control for this assembly comes from the A15 Front End Controller assembly.

A10 Input Attenuator B

There are two different A10 Input Attenuator B assemblies used in the N9038A. One is used in instruments with Option 503, 508, and 526 and the other with Option 544.

Option 503, 508, and 526

This assembly has a total of 66 dB of attenuation. There is a 30 dB, 20 dB, 6 dB, and 10 dB section in the A10 assembly, in that order.

Option 544

This assembly has a total 60 dB of attenuation. There is a 20 dB, 30 dB, and 10 dB section in the A10 assembly, in that order.

Control for this assembly comes from the A15 Front End Controller assembly.

Total input attenuation of the A9 and A10 assemblies combined is 70 dB in 2 dB steps.

A23 Limiter Assembly

This assembly is used to protect the rest of the instrument from large transient signals that are often produced by Line Impedance Stabilization Networks (LISN) which are used for making conducted emissions measurements.

Control for this assembly comes from the A21 RF Preselector Input assembly.

A23 Limiter Assembly Connections

The connections to and from the A23 Limiter assembly are as listed in Table 4-1 and as illustrated in Figure 4-1 below.

Table 4-1　　　　　　　A23 Limiter Assembly Signals

Port	Description	To/From	Cable
J102	IF Input	RF Input J2	W26
J103	RF Output	SW1 Cal Switch P1	W27
J108	JTAG Programming	A21 RF Preselector Input Assembly J602	W1
P2	RF Input LED Control	A1A5J1 & A1A6J1	W6

Figure 4-1　　　　A23 Limiter Assembly Connections
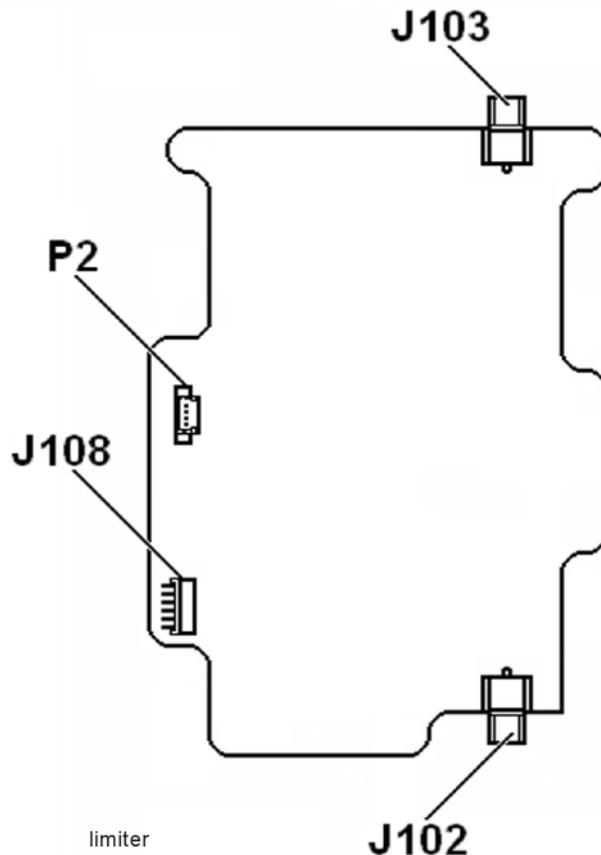
SW1 Cal Switch

This assembly is used to switch the internal 50 MHz and 4.8 GHz calibrator signals from the A16 Reference assembly into the signal path in front of the input attenuators.

Control for this assembly comes from the A21 RF Preselector Input assembly.

SW2 Transfer Switch

This assembly is used to select whether or not to divert the input signal through the RF Preselector section of the instrument or not.

Control for this assembly comes from the A21 RF Preselector Input assembly.

Input Selection & Level Control Section Troubleshooting

NOTE Refer to **Chapter 15, "Block Diagrams."**.

This section will describe how to verify the performance of the following assemblies:

— A9 Attenuator A

— A10 Attenuator B

— A23 Limiter Assembly

— SW1 Cal Switch

— SW2 Transfer Switch

A9 Attenuator A

There are two different A9 Attenuator A assemblies used in the N9038A; one for the Option 503, 508, and 526 instruments and one for the Option 544 instruments. While the overall amount of attenuation is the same for all instruments, the distribution of the attenuator sections within the attenuators is not quite the same. The Option 503, 508, and 526 A9 Attenuator A has a total of only 4 dB of attenuation, while the Option 544 attenuator has 10 dB. Also, the Option 544 attenuator does not have the AC/DC coupling selection that the one for Option 503, 508, and 526 does.

Option 503, 508, & 526

There are three different functions that the A9 Attenuator A assembly provides, as shown in **Figure 4-2**. These functions will be verified with the procedure in this section. They are:

1. AC / DC Coupling Selection

2. RF Input Selection

3. Attenuation Selection (0 to 4 dB in 2 dB steps)

Figure 4-2   A9 Attenuator A Functions - Option 503, 508, & 526
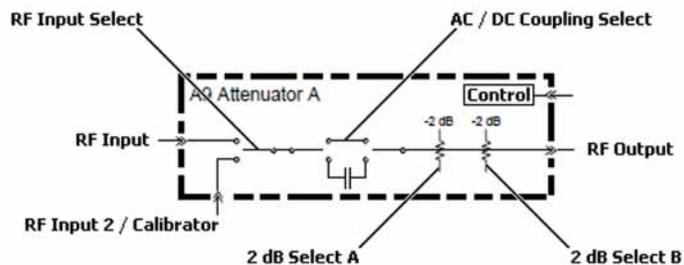
Option 544

There are two different functions that the A9 Attenuator A assembly provides, as shown in Figure 4-3. These functions will be verified with the procedure in this section. They are:

1. RF Input Selection

2. Attenuation Selection (0 to 10 dB in 2 dB steps)

Figure 4-3   A9 Attenuator A Functions - Option 544
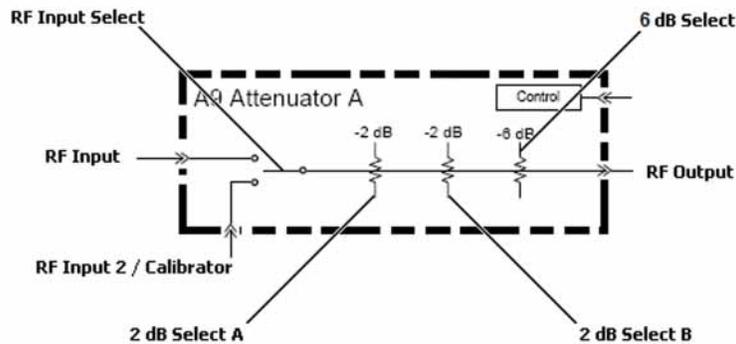
Verifying The A9 Attenuator A Functionality:

1. Remove the instrument dress cover (MP24), top brace (MP10), and right side outer (MP5). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Referring to Figure 4-4 or Figure 4-5, remove W25, W28, and W29 from A9 Attenuator A.

Figure 4-4   A9 & A10 Cable Identification - Option 503, 508, and 526
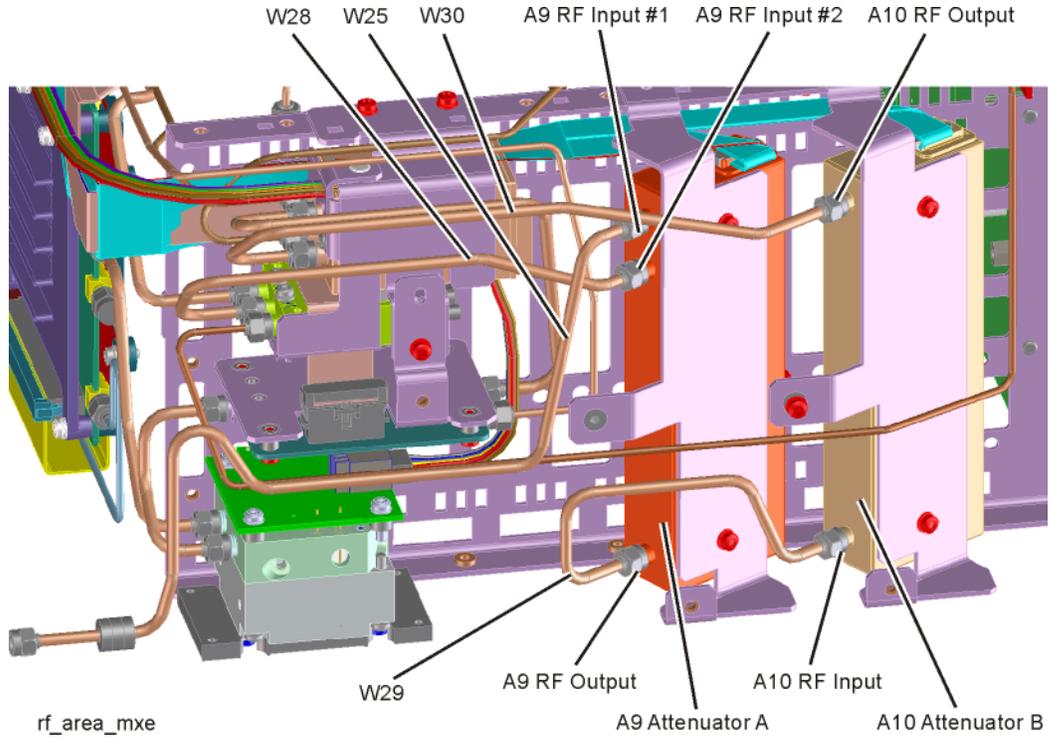
Figure 4-5   A9 & A10 Cable Identification - Option 544
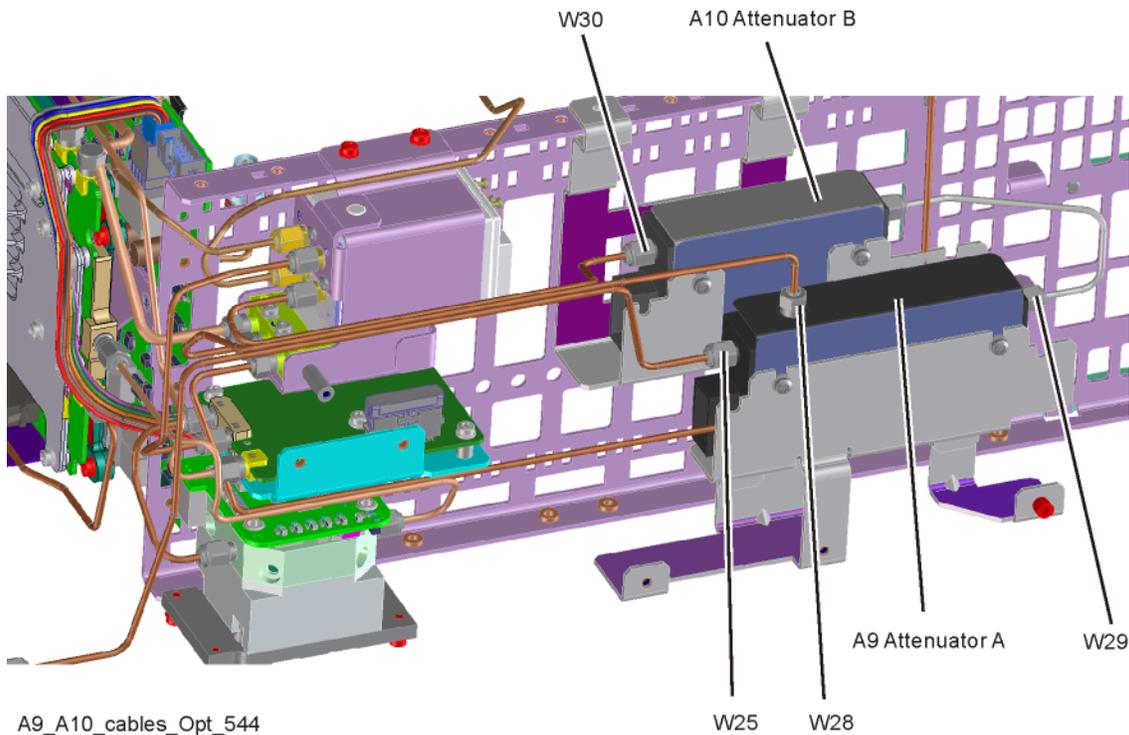
A9_A10_cables_Opt_544

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

AC / DC Coupling Selection - Option 503, 508, and 526 only

5. If the instrument has Option 544 skip to step 16 - .

6. Tune the instrument to a span of 0 Hz by pressing **SPAN**, **Zero Span**.

7. Connect a signal generator to the A9 Attenuator A RF Input #2. Refer to Figure 4-4.

8. Tune the signal generator to 1 MHz with an amplitude of −20 dBm.

9. Connect a spectrum analyzer to the A9 Attenuator A RF Output. Refer to Figure 4-4.

10. Tune the spectrum analyzer to 1 MHz with a span of 1 MHz

11. Change the instrument input coupling to DC by pressing **Input / Output**, **RF Input**, **RF Coupling DC**.

12. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-6, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-6   A9 Attenuator A AC/DC Input Coupling
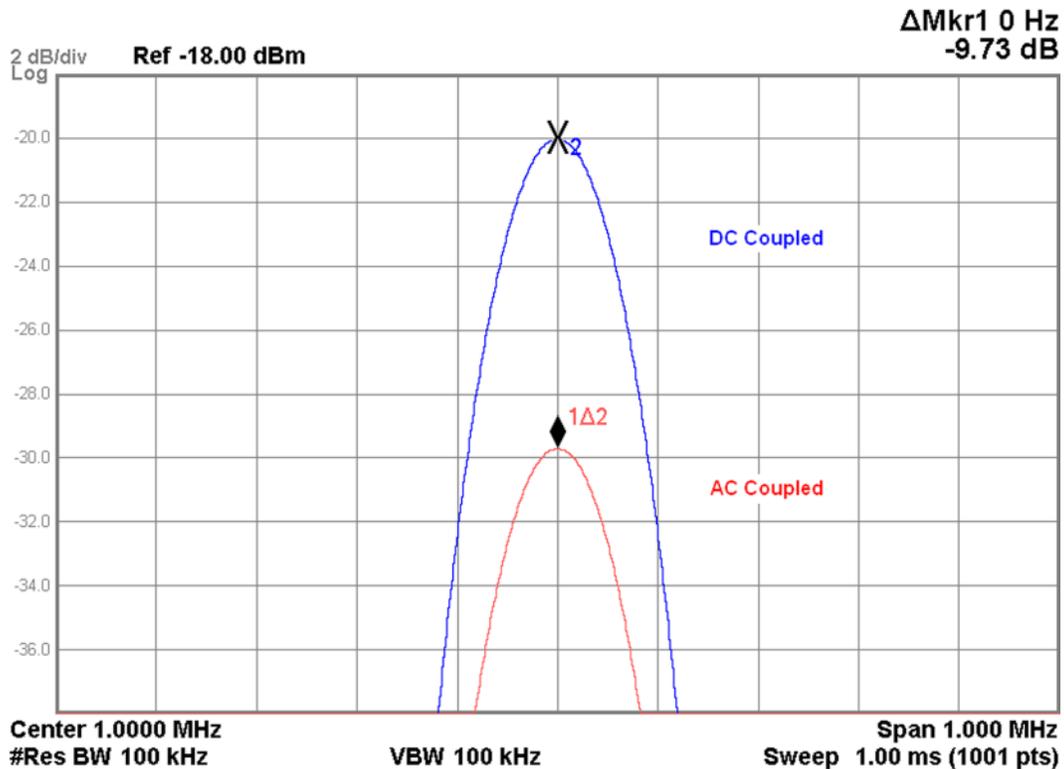
13. Turn on the Marker Delta function of the spectrum analyzer being used.

14. Change the instrument input coupling to AC by pressing **Input / Output**, **RF Input**, **RF Coupling AC**.

15. Verify that the signal level on the spectrum analyzer drops by at least 5 dB from where it was when the RF Coupling was set to DC, as shown in Figure 4-6.

If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

RF Input Selection

16. Move the signal generator to the A9 Attenuator A RF Input #1. Refer to Figure 4-4 or Figure 4-5.

17. Tune the signal generator to 1 GHz with an amplitude of −20 dBm.

18. Tune the spectrum analyzer to 1 GHz with a span of 1 MHz.

NOTE   If there is a particular frequency of interest use that instead of the 1 GHz used in this example.

19. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-7, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-7   A9 Attenuator A RF Input #1
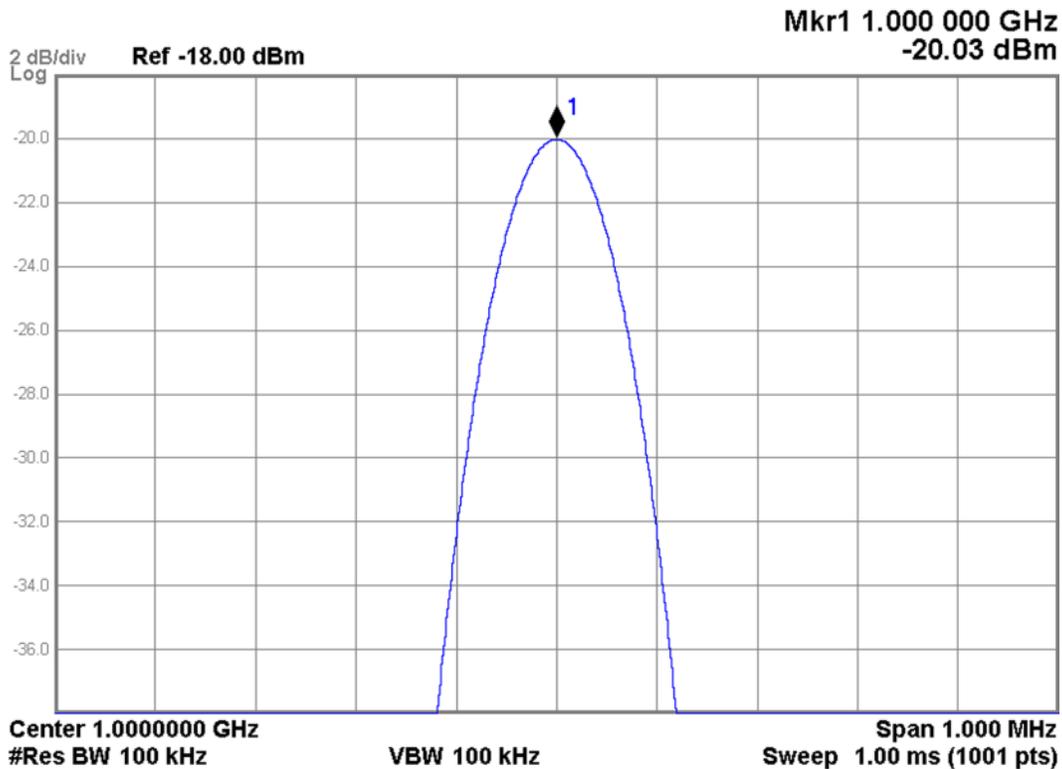
Attenuation Selection

20. Turn on the Marker Delta function of the spectrum analyzer being used.

21. Change the A9 Attenuator A setting to 2 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **2 dB**.

22. Verify that the signal level on the spectrum analyzer drops by 2 dB from where it was, as shown in Figure 4-8.

If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-8   A9 Attenuator A −2 dB
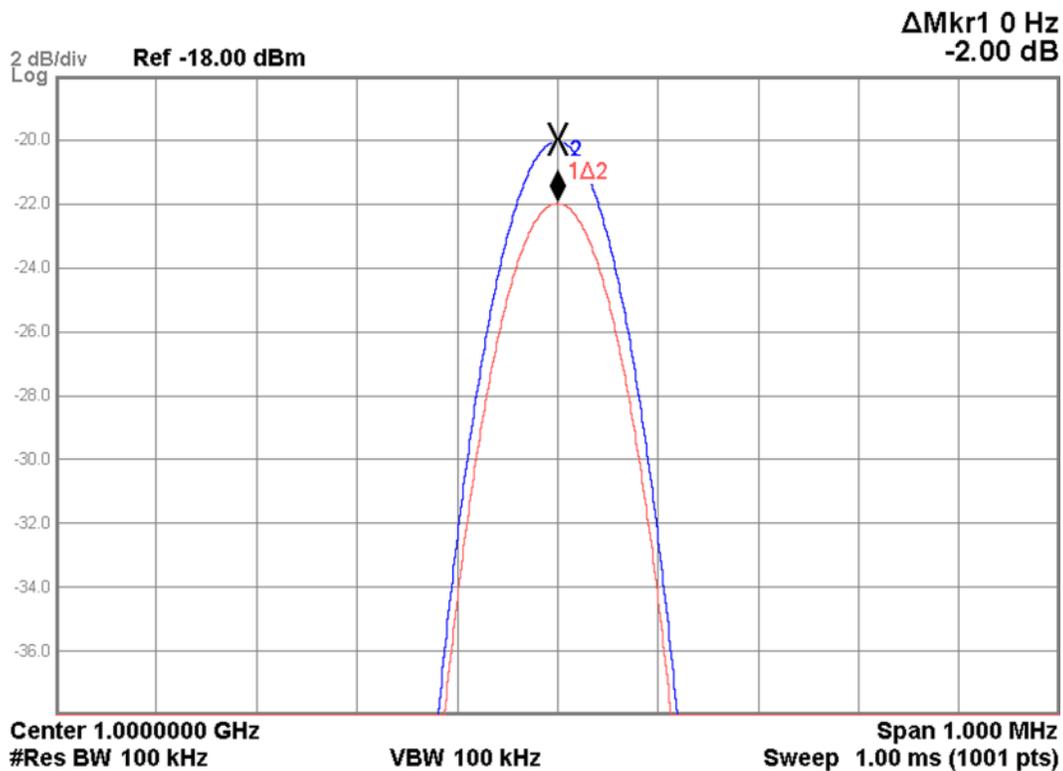
23. Change the A9 Attenuator A setting to 4 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **4 dB**.

24. Verify that the signal level on the spectrum analyzer drops by 4 dB from where it was, as shown in Figure 4-9.

If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-9   A9 Attenuator A −4 dB
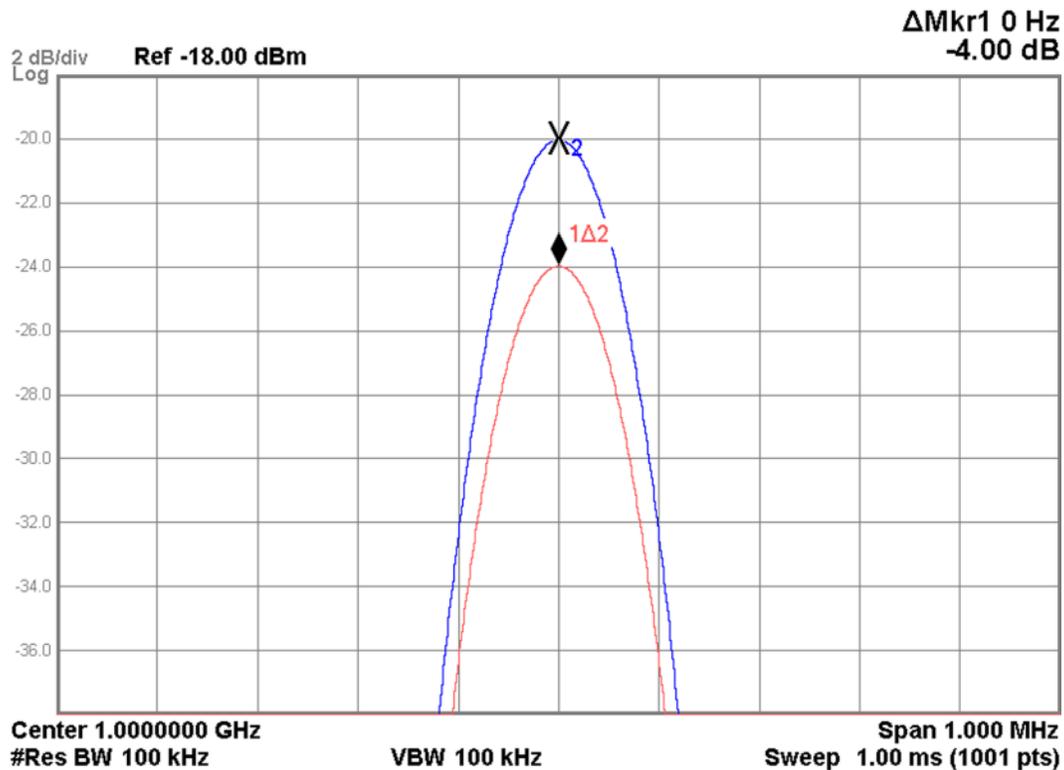
25. If the instrument has Option 503, 508, or 526 skip to step 28.

26. Change the A9 Attenuator A setting to 6 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **6 dB**.

27. Verify that the signal level on the spectrum analyzer drops by 6 dB from where it was, as shown in Figure 4-10.

   If the signal level is incorrect the most likely cause of the problem is the A9 Attenuator A assembly itself. However, before replacing an A9 Attenuator A assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-10   A9 Attenuator A −6 dB - Option 544 only
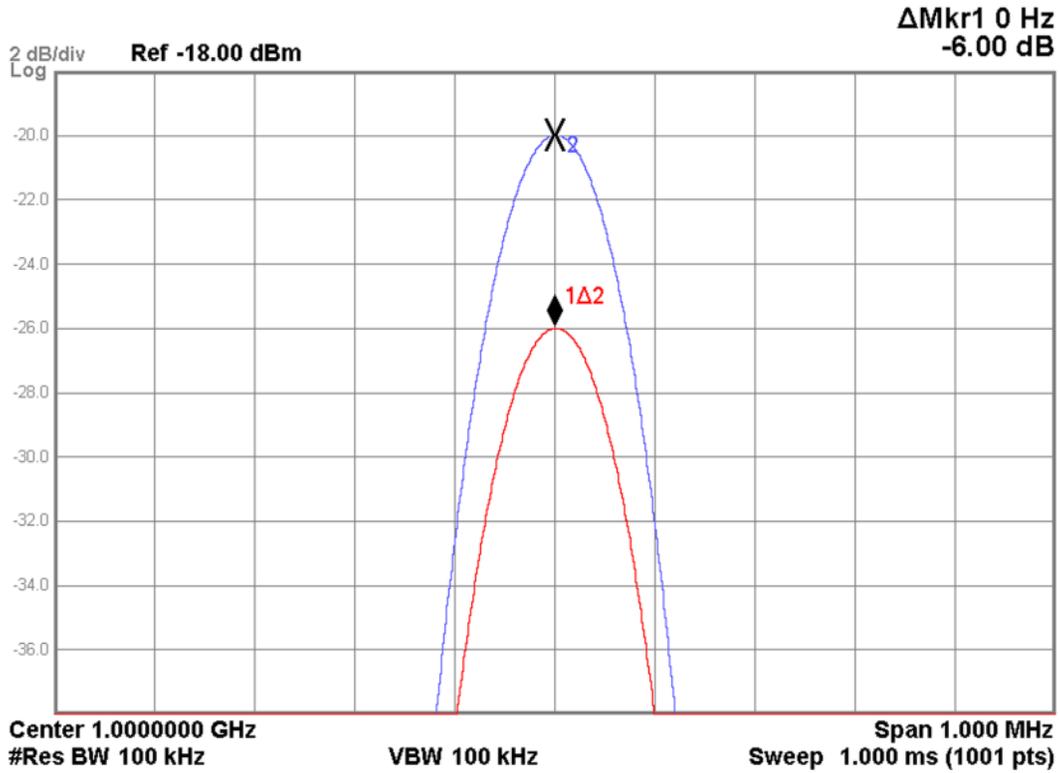
28. If no problem has been found with the functionality of the A9 Attenuator A assembly carefully reconnect W25, W28, and W29 to the A9 Attenuator A as shown if Figure 4-4. Torque all cable connections to 10 in-lbs.

A10 Attenuator B

There are two different A10 Attenuator B assemblies used in the N9038A; one for the Option 503, 508, and 526 instruments and one for the Option 544 instruments. While the overall amount of attenuation is the same for all instruments, the distribution of the attenuator sections within the attenuators is not quite the same. The Option 503, 508, and 526 A10 Attenuator B has a total of 66 dB of attenuation, while the Option 544 attenuator has only 60 dB.

Unlike the A9 Attenuator A, the A10 Attenuator B assembly has just one function, that of a variable attenuator, as seen in Figure 4-11 and Figure 4-12. This functionality will be verified with the procedure in this section.

Figure 4-11   A10 Attenuator B - Option 503, 508, and 526
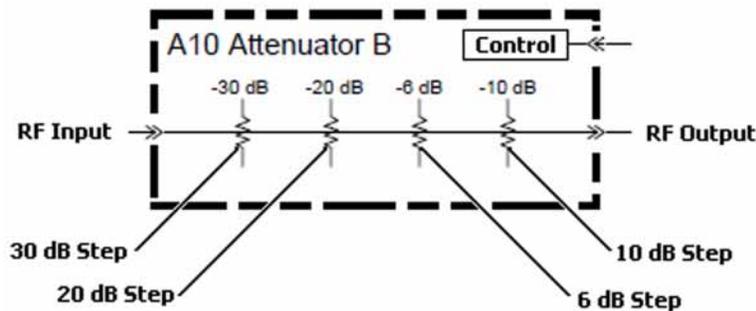
Figure 4-12   A10 Attenuator B - Option 544
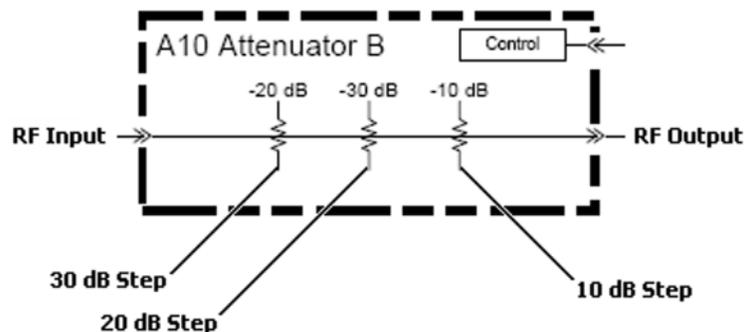
Verifying The A10 Attenuator B Functionality:

1. Remove the instrument dress cover (MP24), top brace (MP10), and right side outer (MP5). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Referring to Figure 4-4 or Figure 4-5, remove W29 and W30 from A10 Attenuator B.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Tune the instrument to a span of 0 Hz by pressing **SPAN**, **Zero Span**.

6. Connect a signal generator to the A10 Attenuator B RF Input. Refer to Figure 4-4 or Figure 4-5.

7. Tune the signal generator to 1 GHz with an amplitude of −20 dBm.

8. Connect a spectrum analyzer to the A10 Attenuator B RF Output. Refer to Figure 4-4 or Figure 4-5.

9. Tune the spectrum analyzer to 1 GHz with a span of 1 MHz.

10. Change the A10 Attenuator B setting to 0 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **0 dB**.

11. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-13, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the A10 Attenuator B assembly itself. However, before replacing an A10 Attenuator B assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-13   A10 Attenuator B −0 dB
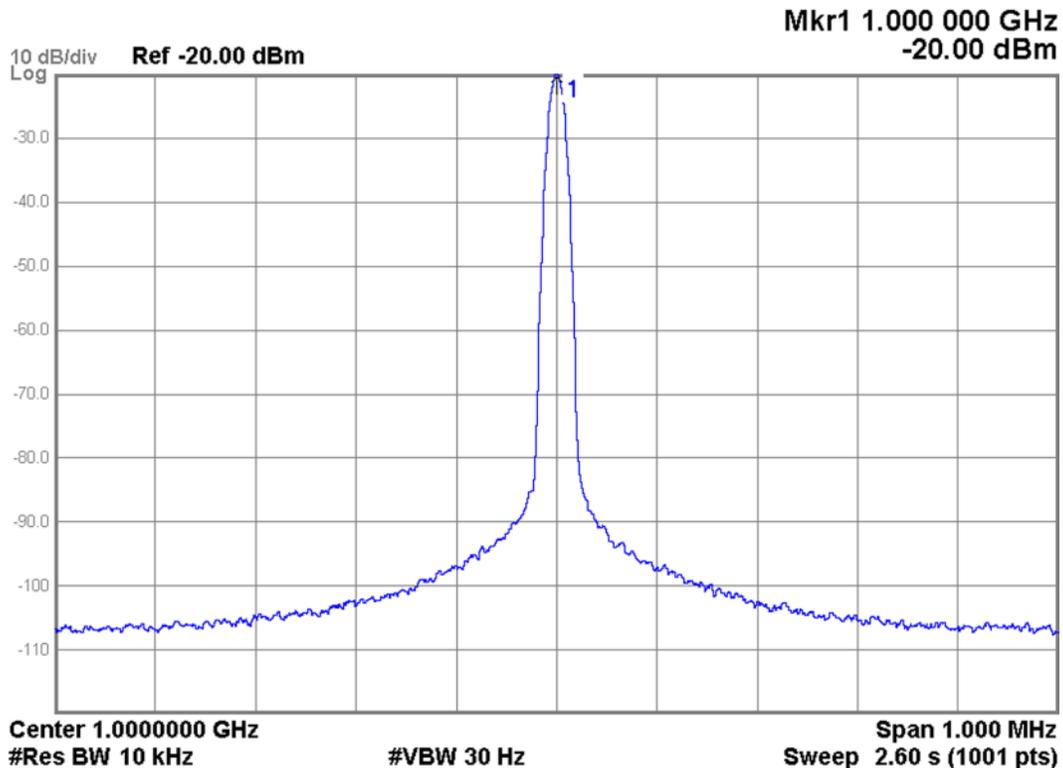
12. Turn on the Marker Delta function of the spectrum analyzer being used.

13. Change the A10 Attenuator B setting to 10 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **10 dB**.

14. Verify that the signal level on the spectrum analyzer drops by 10 dB (±0.25 dB) from where it was, as shown in Figure 4-14.

If the signal level is incorrect the most likely cause of the problem is the A10 Attenuator B assembly itself. However, before replacing an A10 Attenuator B assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Figure 4-14   A10 Attenuator B −10 dB
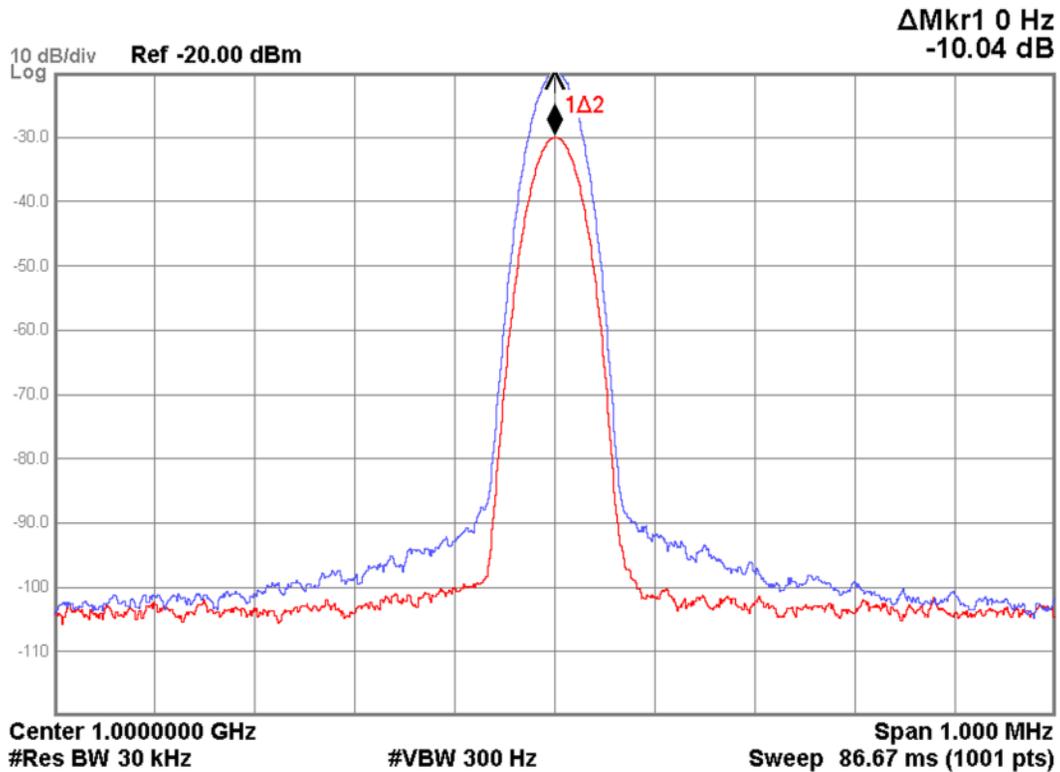
15. Repeat step 13 and step 14 with the rest of the attenuation setting found in Table 4-2.

Table 4-2   A10 Attenuator B Settings

Attenuation	Section Used			
	6 dB	**10 dB**	**20 dB**	**30 dB**
0 dB	No	No	No	No
6 dB[a]	Yes	No	No	No
10 dB	No	Yes	No	No
20 dB	No	No	Yes	No
30 dB	No	No	No	Yes
40 dB	No	Yes	No	Yes
50 dB	No	No	Yes	Yes
60 dB	No	Yes	Yes	Yes
66 dB[a]	Yes	Yes	Yes	Yes

a. Option 503, 508, and 526 only

16. If no problem has been found with the functionality of the A10 Attenuator B assembly carefully reconnect W29 and W30 to the A10 Attenuator B as shown in Figure 4-4. Torque all cable connections to 10 in-lbs.

A23 Limiter Assembly

NOTE

Refer to Chapter 15, "Block Diagrams.".

There are two functions of the A23 Limiter assembly that need to be verified, the signal path loss and the control for the front panel input selection LEDs, as seen in Figure 4-15.

Figure 4-15   A23 Limiter Assembly
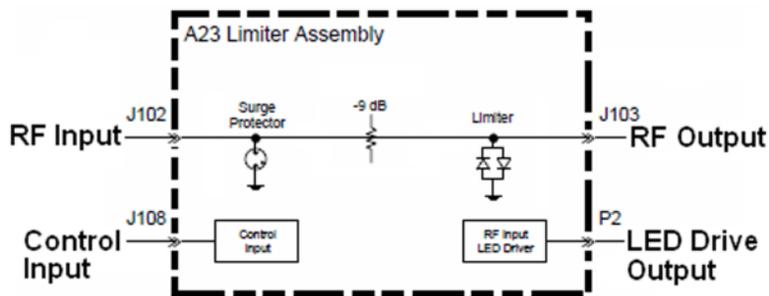
Verifying Signal Path Loss

NOTE

If there is a particular frequency of interest use that instead of the 100 MHz used in this example

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 4-16, disconnect W27 from the A23 Limiter assembly Output (J103).

Figure 4-16   A23 Limiter Assembly Connections
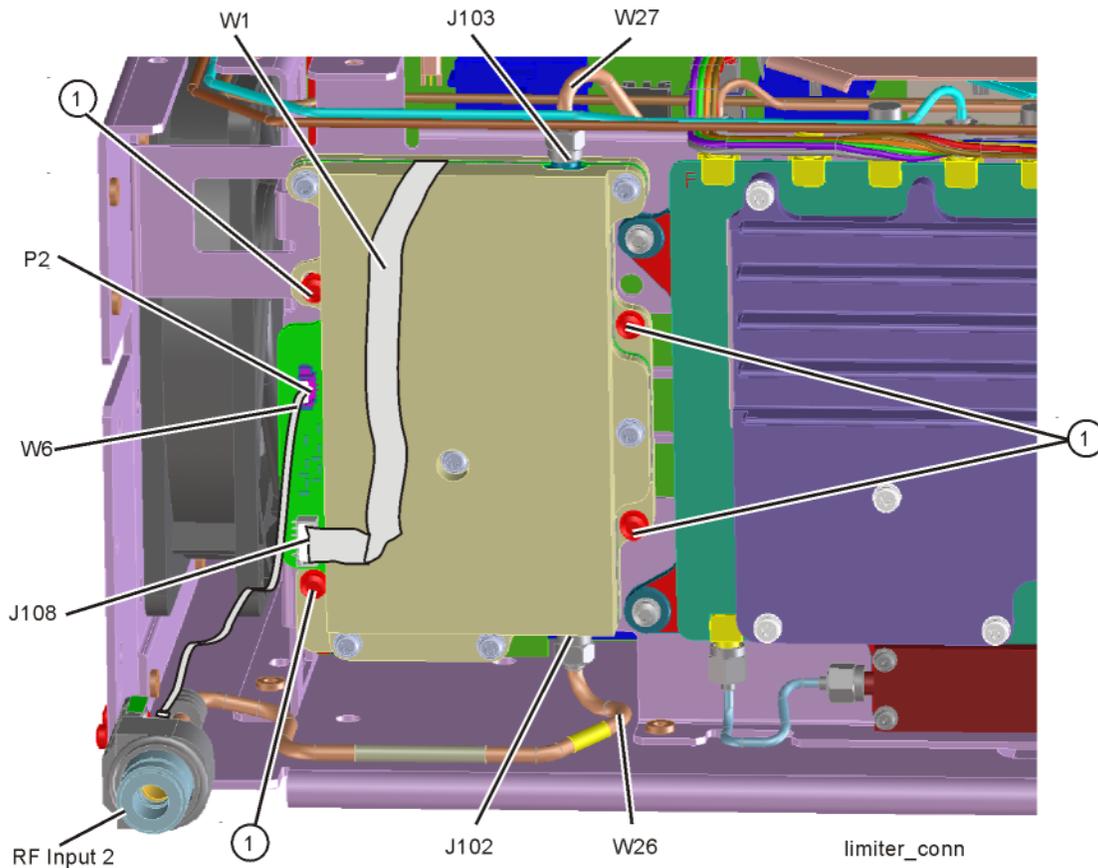
4. Referring to Figure 4-16, disconnect W6 from the A23 Limiter assembly LED Drive Output (P2).

5. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

6. Connect a signal generator to the instrument RF Input 2, as shown in Figure 4-16.

7. Tune the signal generator to 100 MHz with an amplitude of −20 dBm.

8. Connect a spectrum analyzer to the A23 Limiter assembly Output (J103), as shown in Figure 4-16.

9. Tune the spectrum analyzer to a frequency of 100 MHz with a span of 10 MHz.

10. Verify that the signal level on the spectrum analyzer is at −29 dBm (±1.5 dB), as shown in Figure 4-17, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A23 Limiter assembly itself. However, before replacing the A23 Limiter assembly be sure to verify that the control voltages to the assembly are of the correct level. This can be verified in the A21 RF Input Assembly section of the chapter.

Figure 4-17 A23 Limiter Assembly - Signal Path Loss
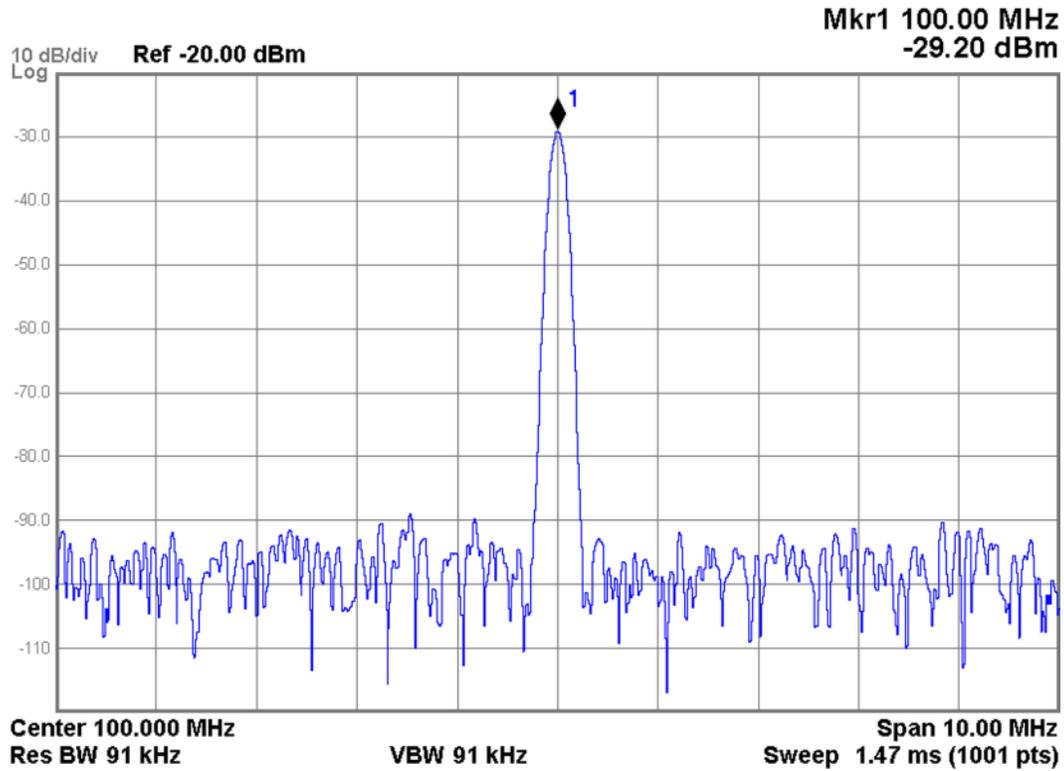
Verifying Input Selection LED Control

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 4-16, disconnect W6 from the A23 Limiter assembly LED Drive Output (P2).

4. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

5. Tune the instrument to a frequency of 10 MHz with a span of 0 Hz by pressing **FREQ**, **100 MHz**, and **SPAN**, **Zero Span**.

6. Switch the instrument to the primary RF Input by pressing **Input / Output, RF Input**, **RF Input Port**, **RF Input**.

7. Referring to Figure 4-18, verify that the DC voltage levels on the 4 pins of the A23 Limiter assembly front panel LED Drive Output (P2) are as outlined in Table 4-3 when the RF Input Port is RF Input.

   If the voltage levels are incorrect verify that the A23 Limiter control voltages coming from the A21 RF Preselector Input assembly are correct before replacing the A23 Limiter assembly. This can be verified in the A21 RF Input Assembly section of this chapter.

Figure 4-18   A23 Limiter Assembly - P2 Pinout

limiter_p2_pinout
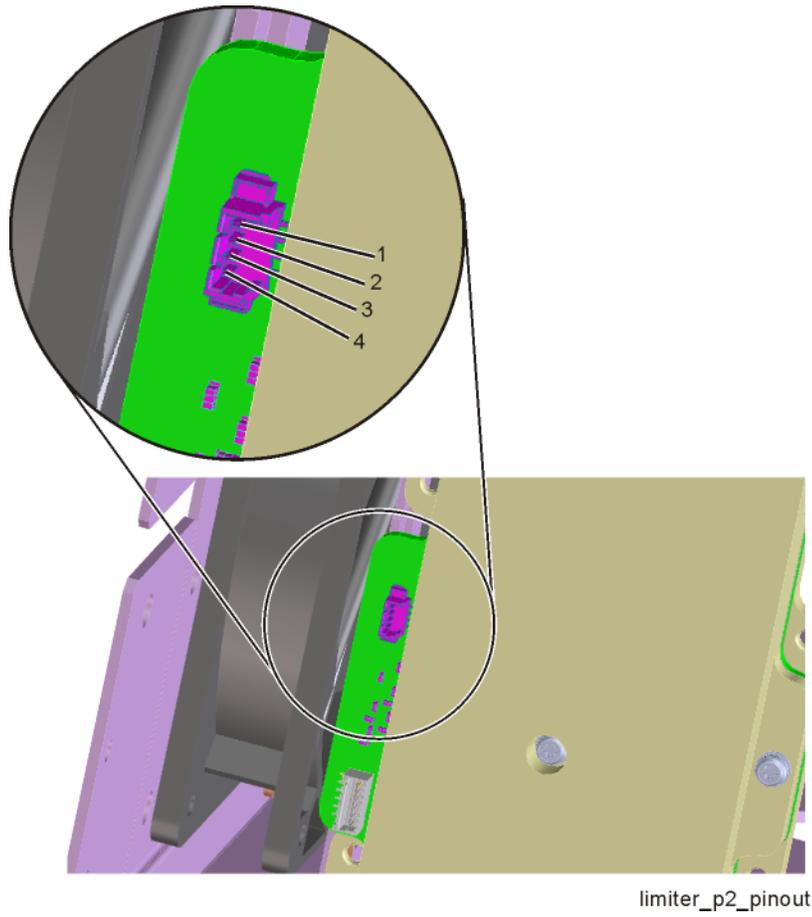
Table 4-3   A23 Limiter Assembly - LED Control Voltage Levels

RF Input Port	P2 Pin #			
	1	2	3	4
RF Input	0.7 V	0 V	5.0 V	0 V
RF Input 2	5.0 V	0 V	0.7 V	0 V

8. Switch the instrument to RF Input 2 by pressing **Input / Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

9. Referring to Figure 4-18, verify that the DC voltage levels on the 4 pins of the A23 Limiter assembly front panel LED Drive Output (P2) are as outlined in Table 4-3 when the RF Input Port is RF Input 2.

   If the voltage levels are incorrect verify that the A23 Limiter control voltages coming from the A21 RF Preselector Input assembly are correct before replacing the A23 Limiter assembly. This can be verified in the A21 RF Input Assembly section of this chapter.

SW1 Cal Switch

The SW1 Cal Switch is a single pole double throw (SPDT) coaxial switch with only two signal paths that will need to be verified, as shown in Figure 4-19.

Figure 4-19   **SW1 Cal Switch**
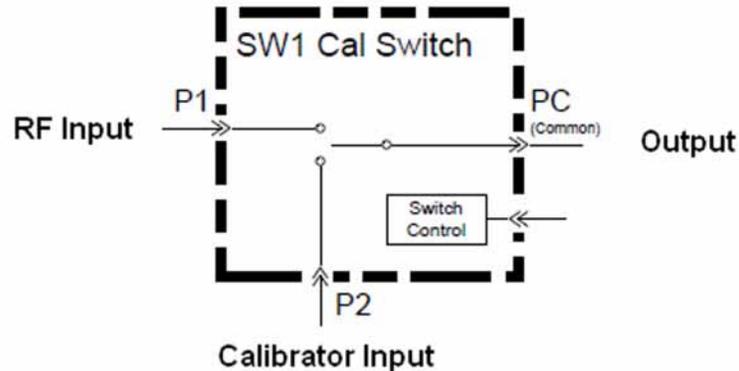
Verifying The SW1 Cal Switch Functionality

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly, or W1 which connects to the A23 Limiter assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 4-20, disconnect W27, W28, and W43 from the SW1 Cal Switch.

Figure 4-20   SW1 Cal Switch and SW2 Transfer Switch Connections - Typical
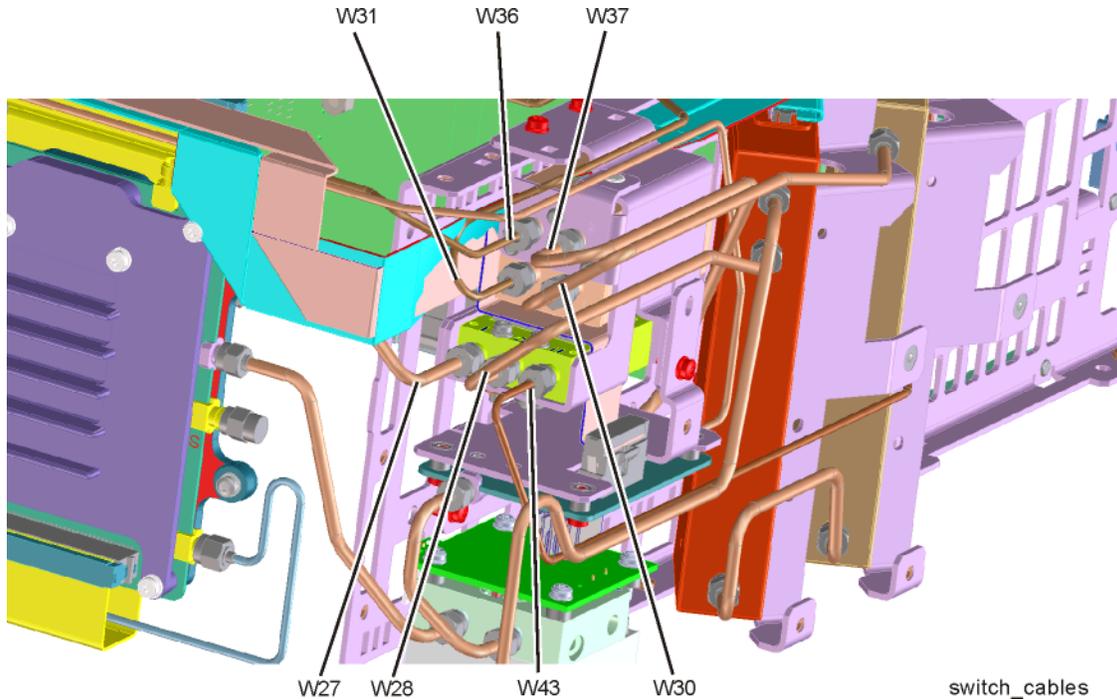
4. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

5. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

6. Connect a signal generator to the SW1 Cal Switch RF Input (P1), as shown in Figure 4-21.

7. Tune the signal generator to 100 MHz with an amplitude of −20 dBm.

8. Connect a spectrum analyzer to the SW1 Cal Switch Output (PC), as shown in Figure 4-21.

9. Tune the spectrum analyzer to 100 MHz with a span of 1 MHz.

NOTE   If there is a particular frequency of interest use that instead of the 100 MHz used in this example. The maximum frequency for the SW1 Cal Switch signal path is 1 GHz.

Figure 4-21   SW1 Cal Switch and SW2 Transfer Switch Port Locations
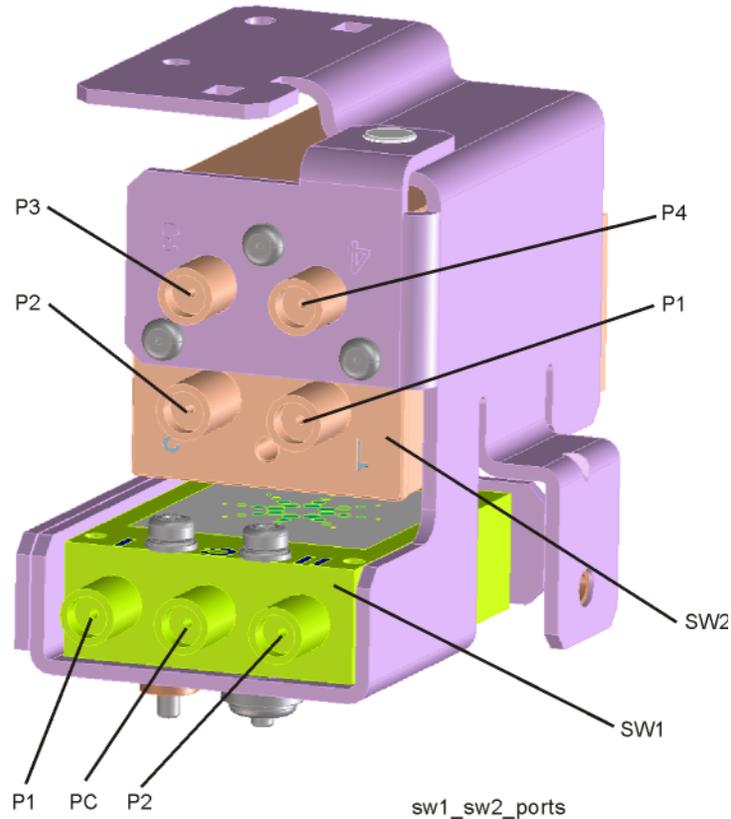
10. Switch the instrument to use the front panel RF Input 2, which will connect the SW1 Cal Switch RF Input (P1) to the Output (PC), by pressing **Input / Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

11. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-22, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the SW1 Cal Switch itself. However, before replacing an SW1 Cal Switch for any failure, refer to the "A21 RF Preselector Input Assembly" section on page 175 for information on how to verify the control signals to it.

Figure 4-22   SW1 Cal Switch Signal Level
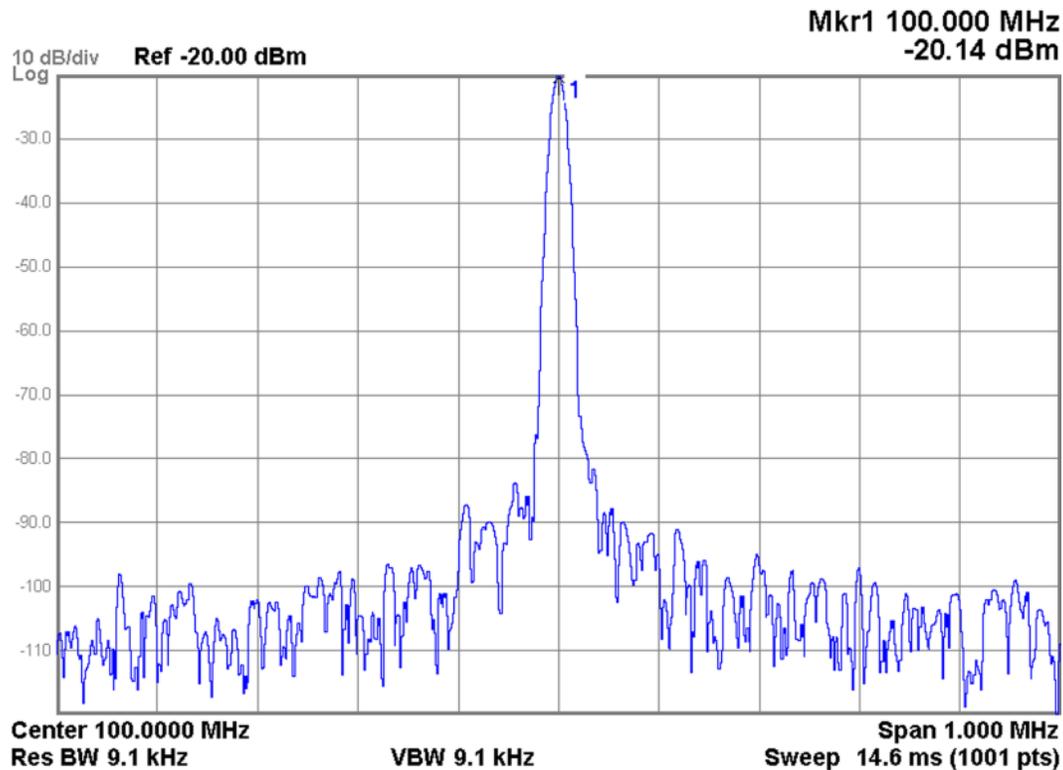
12. Move the signal generator to the SW1 Cal Switch Calibrator Input (P2), as shown in Figure 4-21.

13. Switch the instrument to use the 50 MHz calibrator signal, which will connect the SW1 Cal Switch Calibrator Input (P2) to the Output (PC), by pressing **Input / Output**, **RF Calibrator**, **50 MHz**.

14. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-22, allowing for any additional test cable loss.

    If the signal level is incorrect the most likely cause of the problem is the SW1 Cal Switch itself. However, before replacing an SW1 Cal Switch for any failure, refer to the "A21 RF Preselector Input Assembly" on page 175 for information on how to verify the control signals to it.

15. If no problem has been found with the functionality of the SW1 Cal Switch carefully reconnect W27, W28, and W43 to the SW1 Cal Switch as shown if Figure 4-20. Torque all cable connections to 10 in-lbs.

SW2 Transfer Switch

The SW2 Transfer Switch is a four port coaxial switch with three signal paths that will need to be verified, as shown in Figure 4-23. They are:

1. Bypass Path (P1 to P4)

2. Transfer Out Path (P1 to P2)

3. Transfer In Path (P3 to P4)

Figure 4-23   SW2 Transfer Switch
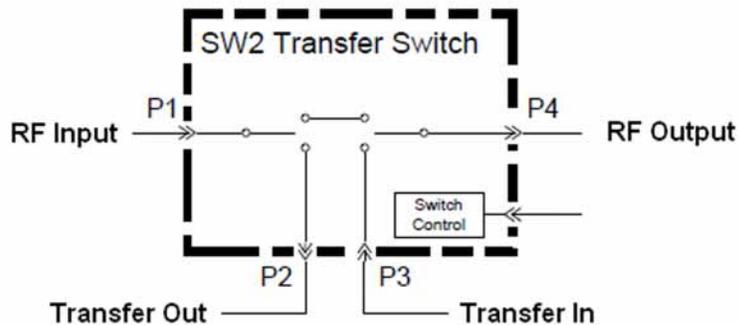
The state of the three signal paths versus the state of the instrument RF Preselector setting can be seen in Table 4-4.

Table 4-4   SW2 Transfer Switch Signal Path State versus RF Preselector Setting

RF Preselector	Signal Path		
	Bypass Path (P1 to P4)	Transfer Out Path (P1 to P2)	Transfer In Path (P3 to P4)
On	Open	Closed	Closed
Off	Closed	Open	Open

Verifying The SW2 Transfer Switch Functionality

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly, or W1 which connects to the A23 Limiter assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 4-20, disconnect W30, W31, W36, and W37 from the SW2 Transfer Switch.

NOTE

In order to not bend the semi-rigid cables it may be necessary to remove some of them from the other end as well.

4. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

5. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

6. Connect a signal generator to the SW2 Transfer Switch RF Input (P1), as shown in Figure 4-21.

7. Tune the signal generator to 100 MHz with an amplitude of −20 dBm.

8. Connect a spectrum analyzer to the SW2 Transfer Switch RF Output (P4), as shown in Figure 4-21.

9. Tune the spectrum analyzer to 100 MHz with a span of 1 MHz.

NOTE

If there is a particular frequency of interest use that instead of the 100 MHz used in this example.

10. Switch the instrument to bypass the RF preselector, which will connect the SW2 Transfer Switch RF Input (P1) to the RF Output (P4), by pressing **Input / Output**, **RF Input**, **RF Preselector Off**.

11. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-24, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the SW2 Transfer Switch itself. However, before replacing an SW2 Transfer Switch for any failure, refer to the "A21 RF Preselector Input Assembly" section on page 175 for information on how to verify the control signals to it.

Figure 4-24   SW2 Transfer Switch Signal Level
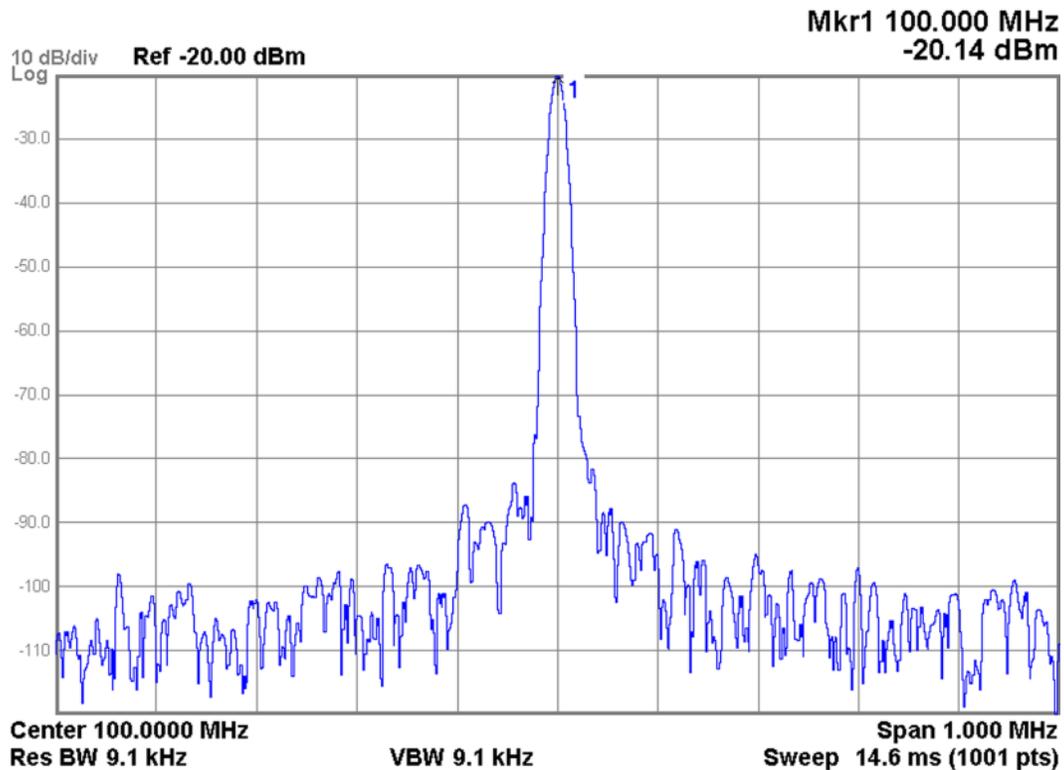
12. Move the spectrum analyzer to the SW2 Transfer Switch Transfer Out (P2) port, as shown in Figure 4-21.

13. Switch the instrument to use the RF preselector, which will connect the SW2 Transfer Switch RF Input (P1) to the Transfer Out (P2) port, by pressing **Input / Output**, **RF Input**, **RF Preselector On**.

14. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-24, allowing for any additional test cable loss.

    If the signal level is incorrect the most likely cause of the problem is the SW2 Transfer Switch itself. However, before replacing an SW2 Transfer Switch for any failure, refer to the "A21 RF Preselector Input Assembly" section on page 175 for information on how to verify the control signals to it.

15. Move the signal generator to the SW2 Transfer Switch Transfer In (P3) port, as shown in Figure 4-21.

16. Move the spectrum analyzer to the SW2 Transfer Switch RF Output (P4), as shown in Figure 4-21.

17. Verify that the signal level on the spectrum analyzer is at −20 dBm (±0.25 dB), as shown in Figure 4-24, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the SW2 Transfer Switch itself. However, before replacing an SW2 Transfer Switch for any failure, refer to the "A21 RF Preselector Input Assembly" section on page 175 for information on how to verify the control signals to it.

18. If no problem has been found with the functionality of the SW2 Transfer Switch carefully reconnect W30, W31, W36, and W37 to the SW2 Transfer Switch as shown in Figure 4-20. Torque all cable connections to 10 in-lbs.

5   RF Preselector Section

What You Will Find in This Chapter

The following information is found in this chapter:

1. Theory of operation of the RF Preselection section.
2. Isolating the cause of an hardware problem by verifying the functionality of assemblies in the RF Preselector section signal path.

NOTE
Each section describes how the assembly works and gives information to help you troubleshoot the assembly. Each description covers the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following descriptions are found in this chapter:

KEYSIGHT
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RF Preselector Section Purpose

The assemblies covered in this section are responsible for preselecting input signals below 3.6 GHz. This is required for the accurate measurement of electromagnetic emissions according to many of the standards prescribed for this type of testing. Without this preselection of the input signal the presence of broadband signals could overload the 1st mixer of the instrument making it impossible to accurately measure low level signals.

RF Preselector Section Description

NOTE
Refer to Chapter 15, "Block Diagrams.".

There are two different signal paths that the user can select through this section of the instrument:

— Conducted Filter Path - 20 Hz to 30 MHz

— Radiated Filter Path - 30 MHz to 3.6 GHz

The components of the RF Preselector section discussed in this chapter are:

— A21 RF Preselector Input Assembly

— A22 Radiated Filter Assembly

— A24 Conducted Filter Assembly

RF Preselector Section Signal Paths

NOTE
Refer to Chapter 15, "Block Diagrams.".

Conducted Filter Path - 20 Hz to 30 MHz

The input signal is routed to the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it.

When routed through the RF Preselector section the input signal first goes to the A21 RF Preselector Input assembly where it is sent through a low pass filter before it is routed to the A24 Conducted Filter assembly.

In the A24 Conducted Filter assembly the signal is then routed through the fixed bandpass filter that corresponds to the tuned frequency of the instrument. Once the signal is filtered it is routed back to the A21 RF Preselector Input assembly. If the user selects to use it, the signal is then amplified before it reaches an overload detector.

The signal then leaves the A21 RF Preselector Input assembly and is routed back to the SW2 Transfer switch.

Radiated Filter Path - 30 MHz to 3.6 GHz

The input signal is routed to the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it.

When routed through the RF Preselector section the input signal first goes to the A21 RF Preselector Input assembly where it is sent through both a low pass filter and a high pass filter before it is routed to the A22 Radiated Filter assembly.

In the A22 Radiated Filter assembly the signal is then routed through a tunable bandpass filter that corresponds to the tuned frequency of the instrument for signals less than 2 GHz. Signals greater than 2 GHz are routed through a fixed high pass filter. Once the signal is filtered it is routed back to the A21 RF Preselector Input assembly. If the user selects to use it, the signal is then amplified before it reaches an overload detector.

The signal then leaves the A21 RF Preselector Input assembly and is routed back to the SW2 Transfer switch.

RF Preselector Section Assembly Descriptions

A21 RF Preselector Input Assembly

NOTE

Refer to Chapter 15, "Block Diagrams.".

The main functions of the A21 RF Preselector Input assembly are to provide:

— Signal path switching

— Input protection

— Prefilters for both the conducted and radiated filter paths

— Preamplifiers for both the conducted and radiated filter paths

— Overload detection for both the conducted and radiated filter paths

— A23 Limiter Assembly control

— SW1 & SW2 control

— Alignment signals

Signal Path Switching

When the receiver is switched to one of the RF Preselector filter paths, signals will enter A21 RF Preselector Input assembly first before being switched into either the A24 Conducted Filter assembly or the A22 Radiated Filter assembly. Output signals from both the A24 Conducted Filter assembly and the A22 Radiated Filter assembly are routed back through the A21 RF Preselector Input assembly before being routed to the down-converter section of the instrument.

Input Protection

The purpose of the limiter is to provide overvoltage protection to the filter boards which is useful while making electromagnetic emissions measurements where the signals are often impulsive in nature. The input signals will encounter the limiter circuit before being routed to either of the filter assemblies.

Conducted Filter Path Prefilter

This is a lowpass filter to reduce the high frequency components of the input signals before going to A24 Conducted Filter assembly. It is designed with a 3 dB roll-off at around 55 MHz. The purpose of this filter is to only allow input signals within the operating frequency range of the A24 Conducted Filter assembly to be sent to it.

Radiated Filter Path Prefilter

This circuit consists of two filters, a lowpass filter and a highpass filter. The lowpass filter has a 3 dB roll-off at 4.4GHz. The highpass filter has a 3 dB roll-off at 2 MHz.

Besides limiting the frequency range of the input signals within operating range of A22 Radiated Filter assembly, the secondary function of the circuit is to act as a DC block to reject low frequency signals which are mostly impulsive in electromagnetic emissions measurements. This will provide further protection to the A22 Radiated Filter assembly.

Preamplifiers

There is an individual preamplifier for both the conducted filter band and the radiated filter band on the A21 RF Preselector Input assembly. These preamplifiers are in the signal path after all of the filtering has been done. The gain of each of these preamplifiers is nominally 20 db. The user has the ability to turn these preamplifiers on and off as their measurements conditions require.

Overload Detection

Because of the frequency range differences between the two different filter paths there are two different overload detector designs used. However, both detectors serve the same purpose and operate in the same basic manner. They detect input signal levels that will cause an overload condition in the instrument Front End.

A23 Limiter Assembly Control

Since the A23 Limiter assembly is not able to communicate directly with the instrument local bus (ILB) or PCI interface its control is implemented through A21 RF Preselector Input assembly. There is not much to control on the A23 Limiter assembly, but there are required bias voltages and control lines, the most obvious of which is the control it provides for the front panel Input selection LEDs.

SW1 & SW2 Control

Both the SW1 Cal Switch and the SW2 Transfer switch are controlled by the A21 RF Preselector Input assembly.

Alignment Signals

There are two different alignment signal sources on the A21 RF Preselector Input assembly, a Direct Digital Synthesizer (DDS) and a broadband noise source.

The Direct Digital Synthesizer provides a CW signal up to 50 MHz which is used by the system alignment routine to adjust the amplitude accuracy of the conducted filter path.

The broadband noise source is used by the system alignment routine to adjust the amplitude accuracy of the Radiated filter path. If it also used to alignment the adjustable bandpass filters located on the A22 Radiated Filter assembly. This broadband noise source generates a near white noise signal which is relatively flat from 10 MHz to 4 GHz.

A21 RF Preselector Input Assembly Connections

The connections to and from the A21 RF Preselector Input assembly are as listed in Table 5-1 and as illustrated in Figure 5-1 below.

Table 5-1   A21 RF Preselector Input Assembly Signals

Port	Description	To/From	Cable
J100	IF Input	SW2 Transfer Switch P2	W31
J101	RF Output	SW2 Transfer Switch P3	W36
J102	Radiated Path Output	A22 Radiated Filter Assembly J100	W34
J103	Conducted Path Output	A24 Conducted Filter Assembly J402	W32
J200	Conducted Path Input	A24 Conducted Filter Assembly J401	W33
J306	Radiated Path Input	A22 Radiated Filter Assembly J300	W35
J500	JTAG Programming	n/a	n/a
J600	Bias and Control	A8 Motherboard J71	n/a
J602	Limiter Assembly Control	A23 Limiter Assembly J108	W1
P600	SW1 & SW2 Control	SW1 Cal Switch & SW2 Transfer Switch	W2

Figure 5-1   A21 RF Preselector Input Assembly Connections
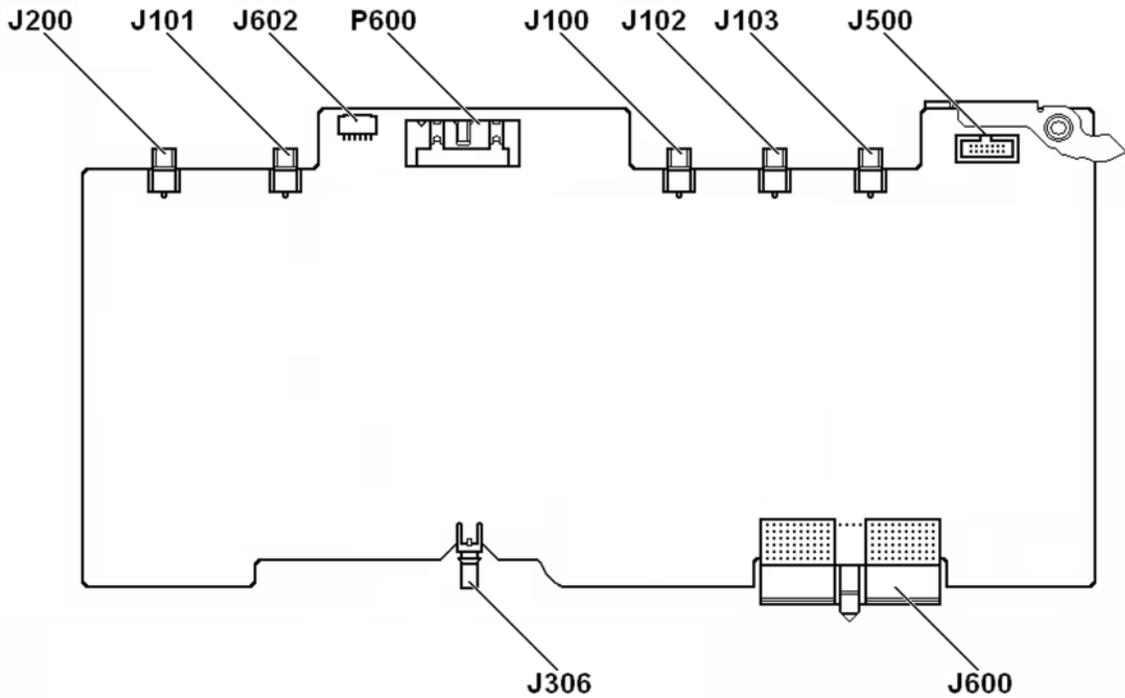
A22 Radiated Filter Assembly

NOTE

Refer to **Chapter 15, "Block Diagrams."**.

The A22 Radiated Filter assembly provides the preselector filters that are required in the frequency range of 30 MHz to 3.6 GHz.

There are a total of eight different signal paths through the A22 Radiated Filter assembly which are broken up into two main sections. These two sections are the Tunable Filters and the Fixed Filters.

Tunable Filters

The 30 MHz to 2 GHz frequency range of the tunable filters is broken up into 6 different bands. They are:

— Band 0 - 30 MHz to 70 MHz

— Band 1 - 70 MHz to 150 MHz

— Band 2 - 150 MHz to 300 MHz

— Band 3 - 300 MHz to 600 MHz

— Band 4 - 600 MHz to 1000 MHz

— Band 5 - 1 GHz to 2 GHz

Bands 0 through 3 each have a lowpass prefilter to reject image signals that are above their frequency range.

All of the tunable filters are adjusted at the factory and can be readjusted in the field by use of the Service Menu. For detailed information on the Service Menu see **Chapter 16, "Service and Diagnostics Menus"**.

The outputs of the six different tunable filter paths are separated into 2 different signal paths. Each of these two signal paths has its own limiter and amplifier.

Fixed Filters

The fixed filter section covers a frequency range of 2 GHz to 3.6 GHz and consists of two different signal paths. They are:

— Band 6 - 2 GHz to 3.6 GHz

— Through Path - 30 MHz to 3.6 GHz

The Band 6 filter path consists of a fixed highpass filter.

The through path has no filtering and is only used during the instrument alignment and calibration.

There is a limiter and amplifier at the output of the fixed filter path section.

Amplifiers

There are three different amplifiers used to cover the 30 MHz to 3.6 GHz frequency range of the A22 Radiated Filter assembly, two for the tunable filter paths and one for the fixed filter paths.

These amplifiers are designed to compensate for the filter loss as well as the overall RF Preselector section loss. Since this is the only gain stage for loss compensation in the RF Preselection path, the gain of these amplifiers will be greater than any loss on the A22 Radiated Filter assembly. This means that there will be an overall gain through the A22 Radiated Filter assembly.

A22 Radiated Filter Assembly Connections

The connections to and from the A22 Radiated Filter Input assembly are as listed in Table 5-2 and as illustrated in Figure 5-2 below.

Table 5-2   A22 Radiated Filter Assembly Signals

Port	Description	To/From	Cable
J100	IF Input	A21 RF Preselector Input Assembly J102	W34
J300	RF Output	A21 RF Preselector Input Assembly J306	W35
J400	JTAG Programming	n/a	n/a
J500	Bias and Control	A8 Motherboard J81	n/a

Figure 5-2   A22 Radiated Filter Assembly Connections
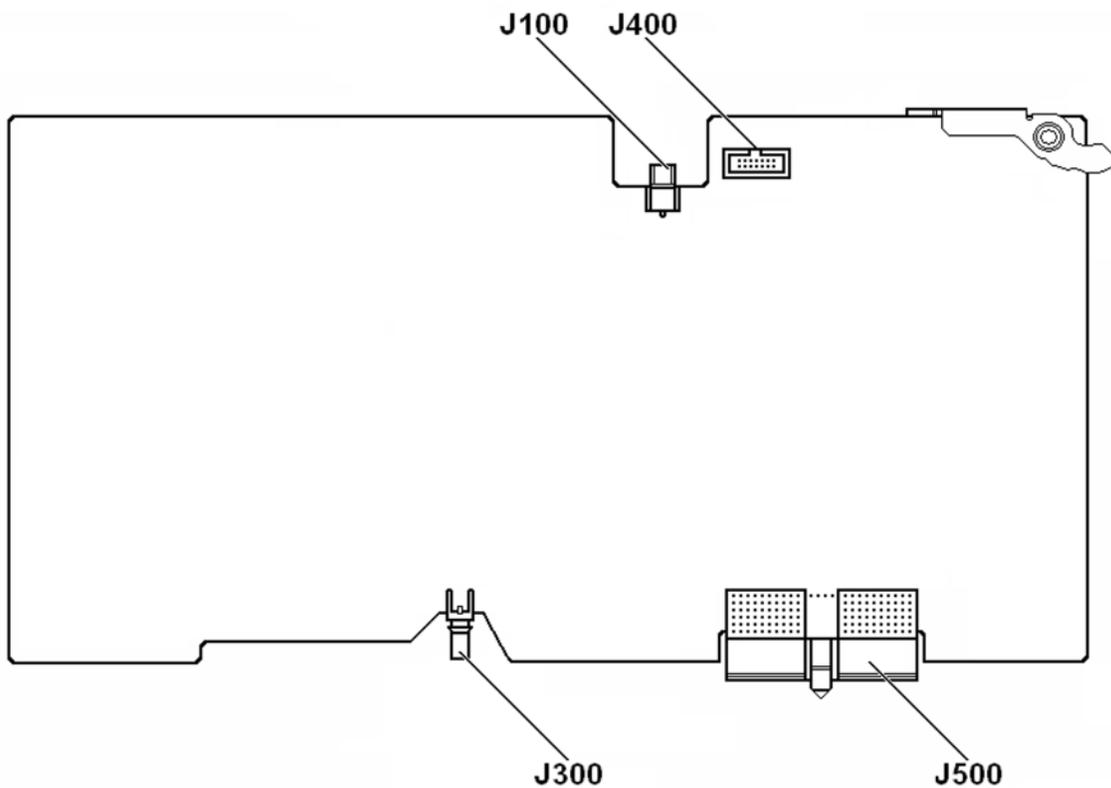
A24 Conducted Filter Assembly

NOTE

Refer to Chapter 15, "Block Diagrams.".

The A24 Conducted Filter assembly provides the preselector filters that are required in the frequency range of 20 Hz to 30 MHz.

There are a total of fifteen different signal paths through the A24 Conducted Filter assembly which are broken up into two main sections. These two sections are the Low Band Filters and the High Band Filters. All of the filters on the A24 Conducted Filter assembly are fixed frequency filters and no tuning or adjustments are required.

Low Band Filters

The low band filter section covers a frequency range of 20 Hz to 2 MHz and is broken up into 5 different bands. They are:

— Band 0 - 20 Hz to 40 kHz

— Band 1 - 20 Hz to 150 kHz

— Band 2 - 150 kHz to 1 MHz

— Band 3 - 1 MHz to 2 MHz

— Through Path - 20 Hz to 2 MHz

Bands 0 and 1 use lowpass filters while bands 2 and 3 use bandpass filters. Band 0 is not used during normal instrument operation.

The through path has no filtering and is only used during the instrument alignment and calibration.

High Band Filters

The high band filter section covers a frequency range of 2 MHz to 32 MHz and is broken into 10 different bands. They are:

— Band 4 - 2 MHz to 5 MHz

— Band 5 - 5 MHz to 8 MHz

— Band 6 - 8 MHz to 11 MHz

— Band 7 - 11 MHz to 14 MHz

— Band 8 - 14 MHz to 17 MHz

— Band 9 - 17 MHz to 20 MHz

— Band 10 - 20 MHz to 24 MHz

— Band 11 - 24 MHz to 28 MHz

— Band 12 - 28 MHz to 32 MHz

— Through Path - 2 MHz to 32 MHz

All of the filter bands in the high band filter section use fixed bandpass filters.

The through path has no filtering and is only used during the instrument alignment and calibration.

High Band Amplifier

There is also a limiter and amplifier on the high band filter section output. The amplifier is used to compensate for the losses contributed by the switches, the filter insertion loss, and general signal path loss.

A24 Conducted Filter Assembly Connections

The connections to and from the A24 Conducted Filter assembly are as listed in Table 5-3 and as illustrated in Figure 5-3 below.

Table 5-3   A24 Conducted Filter Assembly Signals

Port	Description	To/From	Cable
J102	JTAG Programming	n/a	n/a
J400	Bias & Control	A8 Motherboard J61	n/a
J401	RF Output	A21 RF Preselector Input Assembly J200	W33
J402	RF Input	A21 RF Preselector Input Assembly J103	W32

Figure 5-3   A24 Conducted Filter Assembly Connections
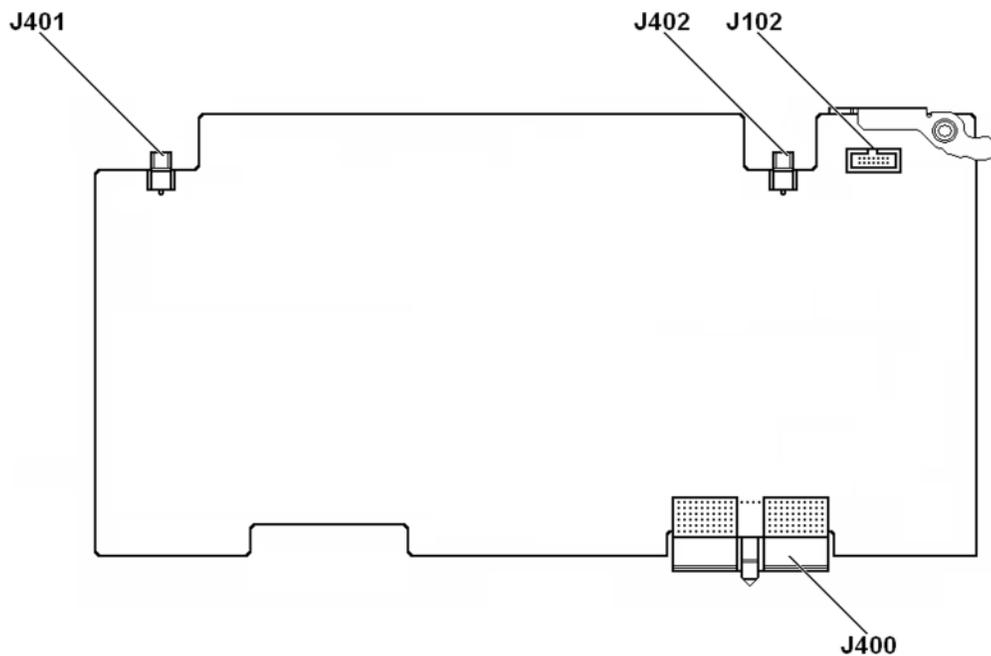
RF Preselector Section Troubleshooting

NOTE

Refer to **Chapter 15, "Block Diagrams."**.

This section will describe how to verify the performance of the following assemblies:

— A21 RF Preselector Input Assembly

— A22 Radiated Filter Assembly

— A24 Conducted Filter Assembly

A21 RF Preselector Input Assembly

NOTE

Refer to **Chapter 15, "Block Diagrams."**.

Since the A21 RF Preselector Input assembly is responsible for the routing of the input signal to either the A24 Conducted Filter assembly or the A22 Radiated Filter assembly, control of both SW1 Cal Switch and SW2 Transfer Switch, control of the A23 Limiter assembly, preamplification of the input signal in both the conducted and radiated filter paths, as well as providing alignment signals for the RF preselector filters, there are quite a few different things that will need to be checked to verify that it is functioning properly. They are:

1. Assembly Initialization

2. SW1 Cal Switch and SW2 Transfer Switch Control

3. A23 Limiter Assembly Control

4. Input Signal Routing and Pre-Filtering

5. Output Signal Routing and Preamplifiers

6. Alignment Signal Generation

7. Through Path

Assembly Initialization

Before the A21 RF Preselector Input assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A21 RF Preselector Input assembly should identify itself on this list as RF Presel Input. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— An instrument power supply voltage is not operating properly

Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A21 RF Preselector Input assembly is defective

Solution: Replace the A21 RF Preselector Input assembly

SW1 Cal Switch and SW2 Transfer Switch Control

Both the SW1 Cal Switch and the SW2 Transfer Switch are controlled by a single ribbon cable (W2) that comes from P600 on the A21 RF Preselector Input assembly, as seen in Figure 5-4.

Figure 5-4   A21 RF Preselector Input Assembly Connections
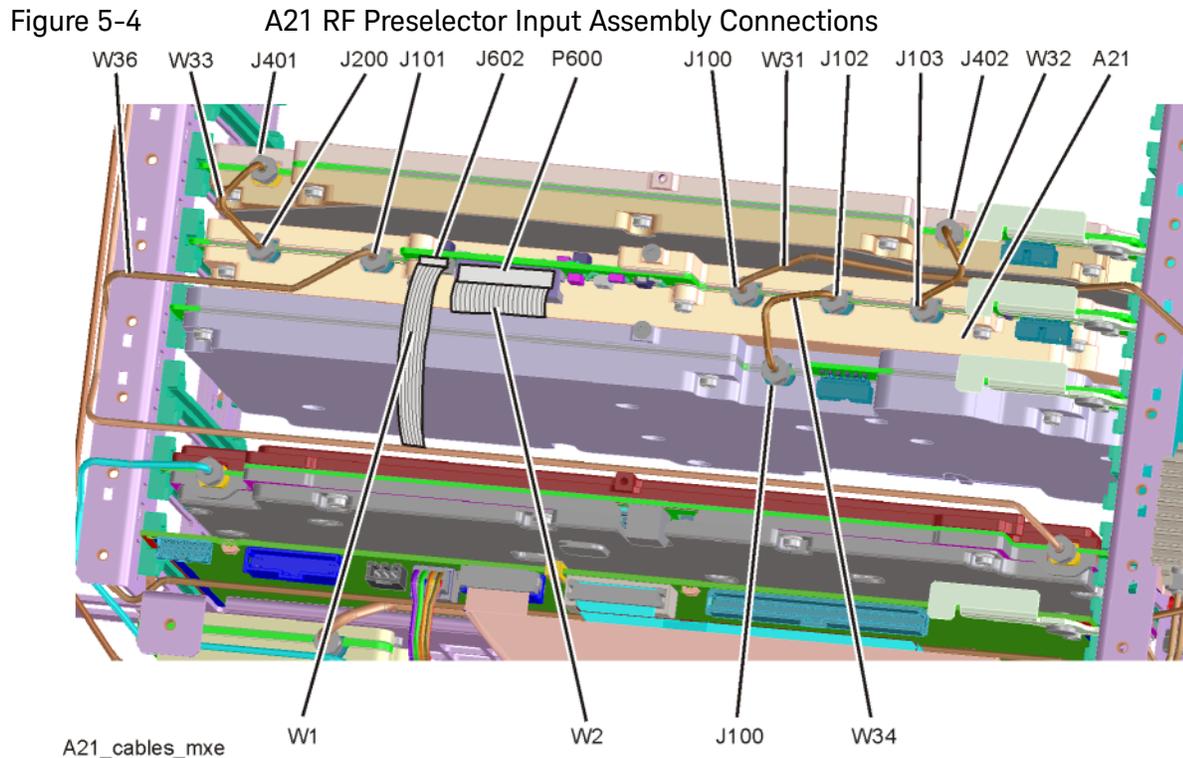
Figure 5-5   A21 RF Preselector Input Assembly Connections - Bottom Side

A21 J306   W35   A22J300   w35_bottom_mxe
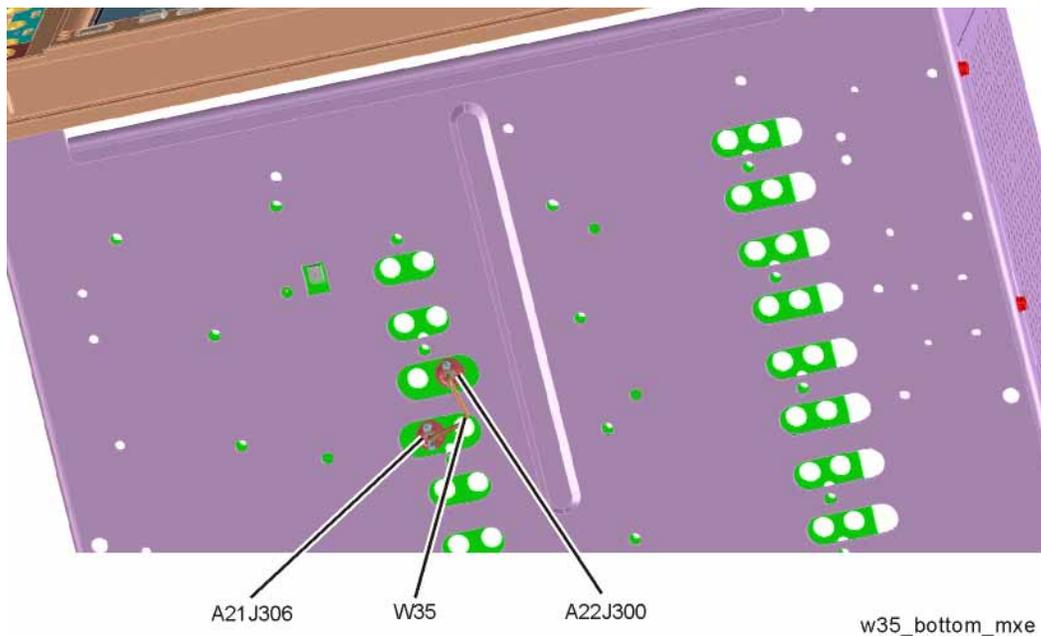
Verifying Control for The SW1 Cal Switch And The SW2 Transfer Switch

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W2 from A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

SW1 Cal Switch Control

5. Switch the instrument input to RF Input 2 by pressing **Input / Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

6. Verify that the RF Calibrator signal is turned off by pressing **Input / Output**, **RF Calibrator**, **Off**.

7. Measure the DC voltages on pins 11 through 20 on P600 of the A21 RF Preselector Input assembly, as shown in Figure 5-6, and verify that they are what is expected for the RF Calibrator Off as shown in Table 5-4.

   If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-6   A21 RF Preselector Input Assembly - P600 Pinout

A21 P600_conn_pins
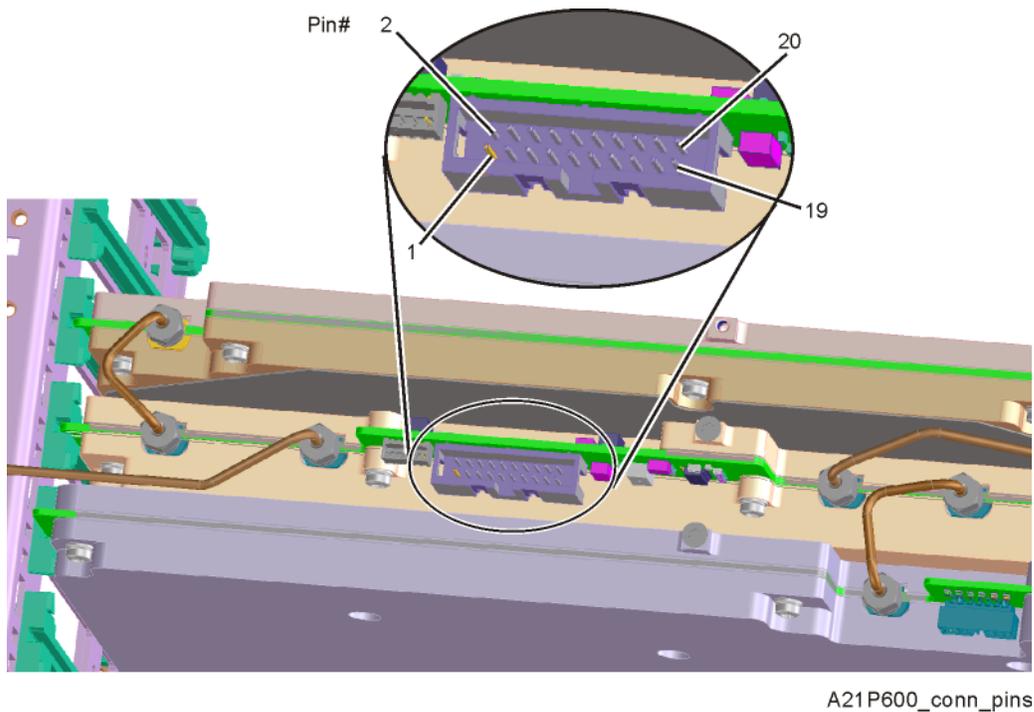
Table 5-4   SW1 Cal Switch Control Voltages

RF Calibrator	P600 Pin #									
	11	12	13	14	15	16	17	18	19	20
Off	0V	0V	N/C	+5V	0V	+5V	+5V	0V	+15V	N/C
50 MHz	0V	0V	N/C	+5V	+5V	+5V	0V	0V	+15V	N/C

8. Change the state of the SW1 Cal Switch control voltages by turning the RF Calibrator signal on, by pressing **Input / Output**, **RF Calibrator**, **50 MHz**.

9. Measure the DC voltages on pins 11 through 20 on P600 of the A21 RF Preselector Input assembly, as shown in Figure 5-6 and verify that they are what is expected for the RF Calibrator set to 50 MHz as shown in Table 5-4.

If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

SW2 Transfer Switch Control

10. Verify that the RF Preselector is turned off by pressing **Input / Output**, **RF Input**, **RF Preselector Off**.

11. Measure the DC voltages on pins 1 through 10 on P600 of the A21 RF Preselector Input assembly, as shown in Figure 5-6, and verify that they are what is expected for the RF Preselector Off as shown in Table 5-5.

If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Table 5-5   SW2 Transfer Switch Control Voltages

RF Preselector	P600 Pin #									
	1	2	3	4	5	6	7	8	9	10
Off	+25V	+5V	N/C	0V	N/C	0V	0V	+5V	0V	N/C
On	+25V	+5V	N/C	0V	N/C	0V	+5V	0V	0V	N/C

12. Turn the RF Preselector on by pressing **Input / Output**, **RF Input**, **RF Preselector On**.

13. Measure the DC voltages on pins 1 through 10 on P600 of the A21 RF Preselector Input assembly, as shown in Figure 5-6, and verify that they are what is expected for the RF Preselector On as shown in Table 5-5.

If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

A23 Limiter Assembly Control

The A23 Limiter Assembly is controlled by a single ribbon cable (W1) that comes from J602 on the A21 RF Preselector Input assembly, as seen in Figure 5-4.

Verifying Control For the A23 Limiter Assembly

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W1 from A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Verify that the RF Input Port selected is RF Input by pressing **Input / Output**, **RF Input**, **RF Input Port**, **RF Input**.

6. Measure the DC voltages on pins 1 through 6 on J602 of the A21 RF Preselector Input assembly, as shown in Figure 5-7, and verify that they are what is expected for the RF Input Port being RF Input as shown in Table 5-6.

If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-7   A21 RF Preselector Input Assembly - J602 Pinout
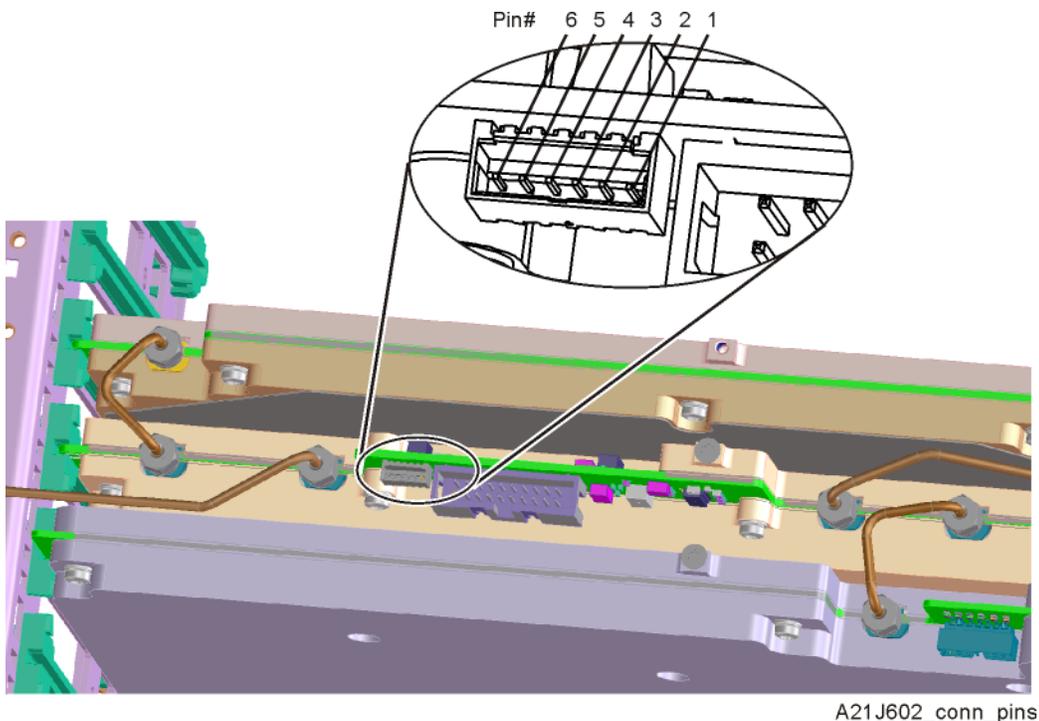
A21J602_conn_pins

Table 5-6   A23 Limiter Assembly Control Voltages

RF Input Port	P602 Pin #					
	1	2	3	4	5	6
RF Input	+15V	0V	+3V	0V	0V	0V
RF Input 2	+15V	0V	+3V	0V	+3V	0V

7. Change the RF Input Port selection to RF Input 2 by pressing **Input / Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

8. Measure the DC voltages on pins 1 through 6 on J602 of the A21 RF Preselector Input assembly, as shown in Figure 5-7, and verify that they are what is expected for the RF Input Port being RF Input 2 as shown in Table 5-6.

If the voltage levels are incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Input Signal Routing and Pre-Filtering

There are two different pre-filter paths through the input routing of the A21 RF Preselector Input assembly to be verified, as seen in Figure 5-8.

Figure 5-8   A21 RF Preselector Input Assembly Input Pre-Filters
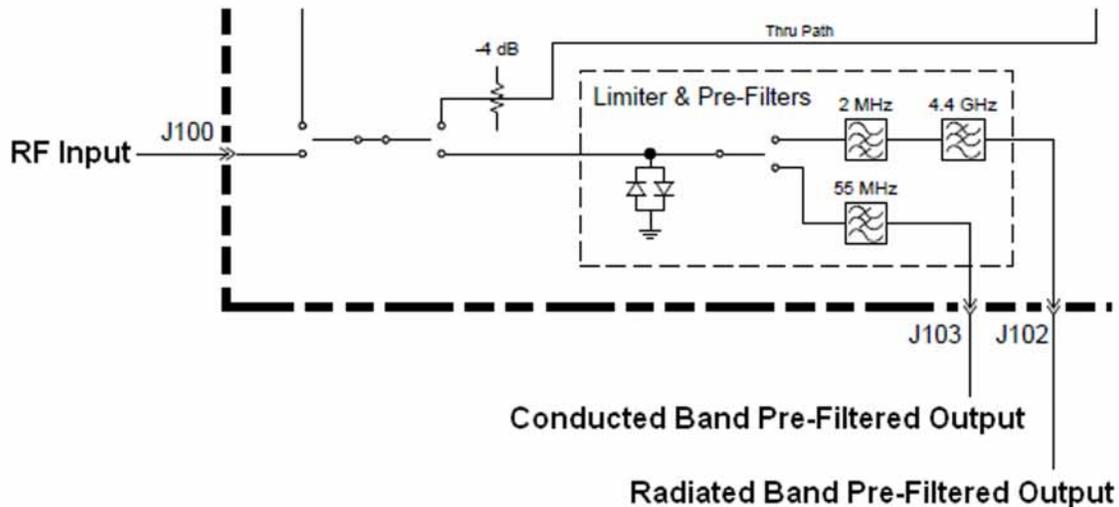
Verifying Input Signal Routing and Pre-Filter Shape

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W31, W32, and W34 from the A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Input Signal Routing Verification - Conducted Band

5. Connect a signal generator to the A21 RF Preselector Input assembly RF Input (J100), as shown in Figure 5-4.

6. Tune the signal generator to 10 MHz with an amplitude of −20 dBm.

7. Connect a spectrum analyzer to the A21 RF Preselector Input assembly Conducted Band Pre-Filtered Output (J103), as shown in Figure 5-4.

8. Tune the spectrum analyzer to a frequency of 50.5 MHz with a span of 100 MHz.

9. Tune the instrument to a frequency of 10 MHz with a span of 0 Hz by pressing **FREQ**, **10 MHz**, and **SPAN**, **Zero Span**.

10. Verify that the signal level on the spectrum analyzer is at −20 dBm (±1.5 dB), as shown in Figure 5-9, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-9   A21 RF Preselector Input Assembly - Conducted Band Pre-Filter
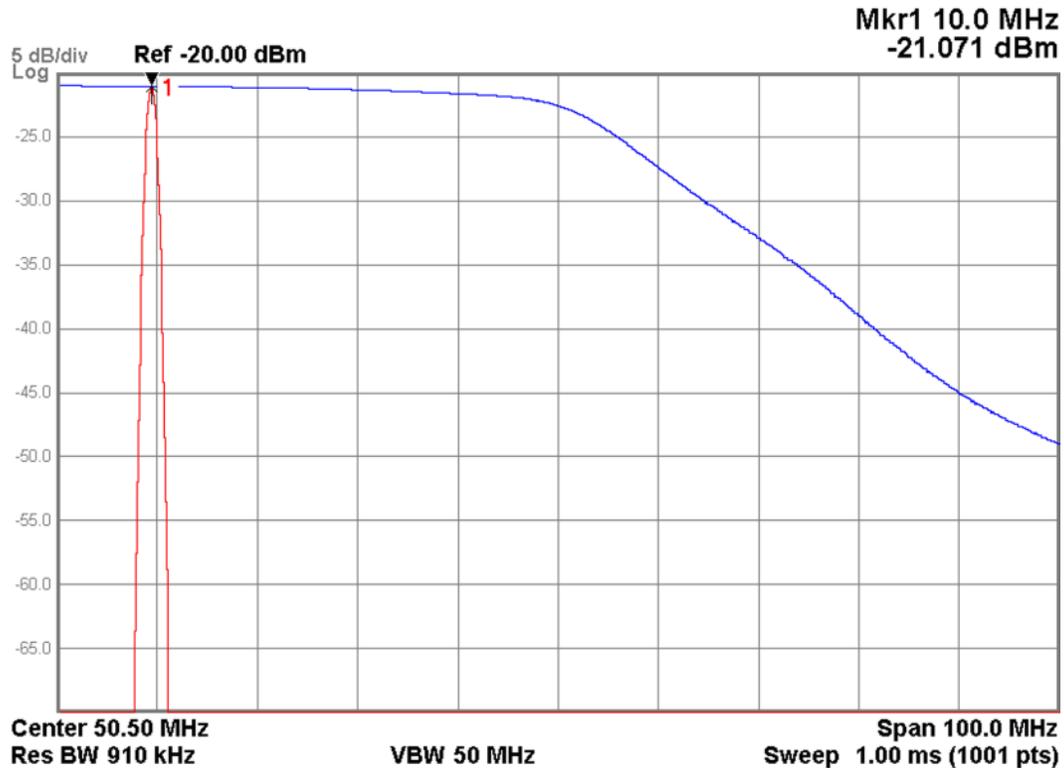
Pre-Filter Shape Verification - Conducted Band

11. Placing one of the active traces on the spectrum analyzer into its Max Hold function.

12. Slowly vary the frequency of the signal generator between 500 kHz and 100.5 MHz to draw out the shape of the conducted band pre-filter on the spectrum analyzer display, as shown in Figure 5-9.

13. Verify that the filter shape on the spectrum analyzer display is similar to that shown in Figure 5-9.

If the filter shape is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Input Signal Routing Verification - Radiated Band

14. Tune the signal generator to 1 GHz with an amplitude of −20 dBm.

15. Move the spectrum analyzer to the A21 RF Preselector Input assembly Radiated Band Pre-Filtered Output (J102), as shown in Figure 5-4.

16. Tune the spectrum analyzer to a start frequency of 1 MHz and a stop frequency of 6 GHz.

17. Tune the instrument to a frequency of 1 GHz with a span of 0 Hz by pressing **FREQ**, **1 GHz**, and **SPAN**, **Zero Span**.

18. Verify that the signal level on the spectrum analyzer is at −20 dBm (±2 dB), as shown in Figure 5-10, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-10   A21 RF Preselector Input Assembly - Radiated Band Pre-Filter
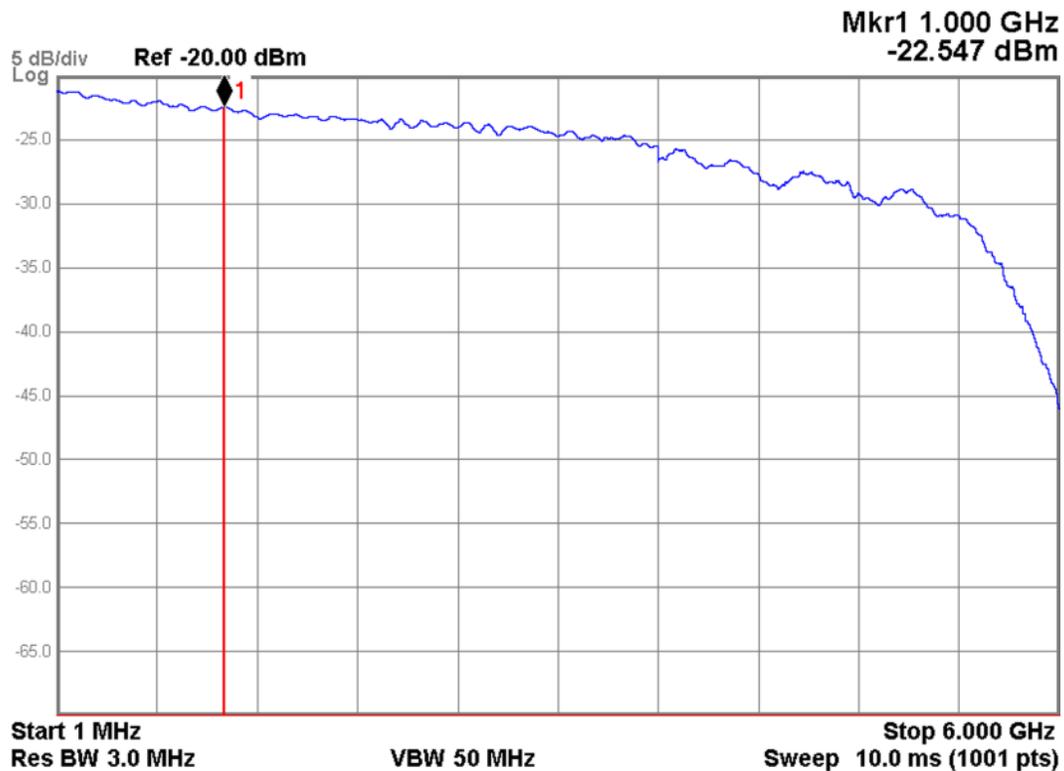
Pre-Filter Shape Verification - Radiated Band

19. Placing one of the active traces on the spectrum analyzer into its Max Hold function.

20. Slowly vary the frequency of the signal generator between 1 MHz and 6 GHz to draw out the shape of the radiated band pre-filter on the spectrum analyzer display, as shown in Figure 5-10.

21. Verify that the filter shape on the spectrum analyzer display is similar to that shown in Figure 5-10.

If the filter shape is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Output Signal Routing and Preamplifiers

There are two main signal paths through the output routing of the A21 RF Preselector Input assembly, and a preamplifier for each, to be verified, as seen in Figure 5-11.

Figure 5-11   A21 RF Preselector Input Assembly Output Switching
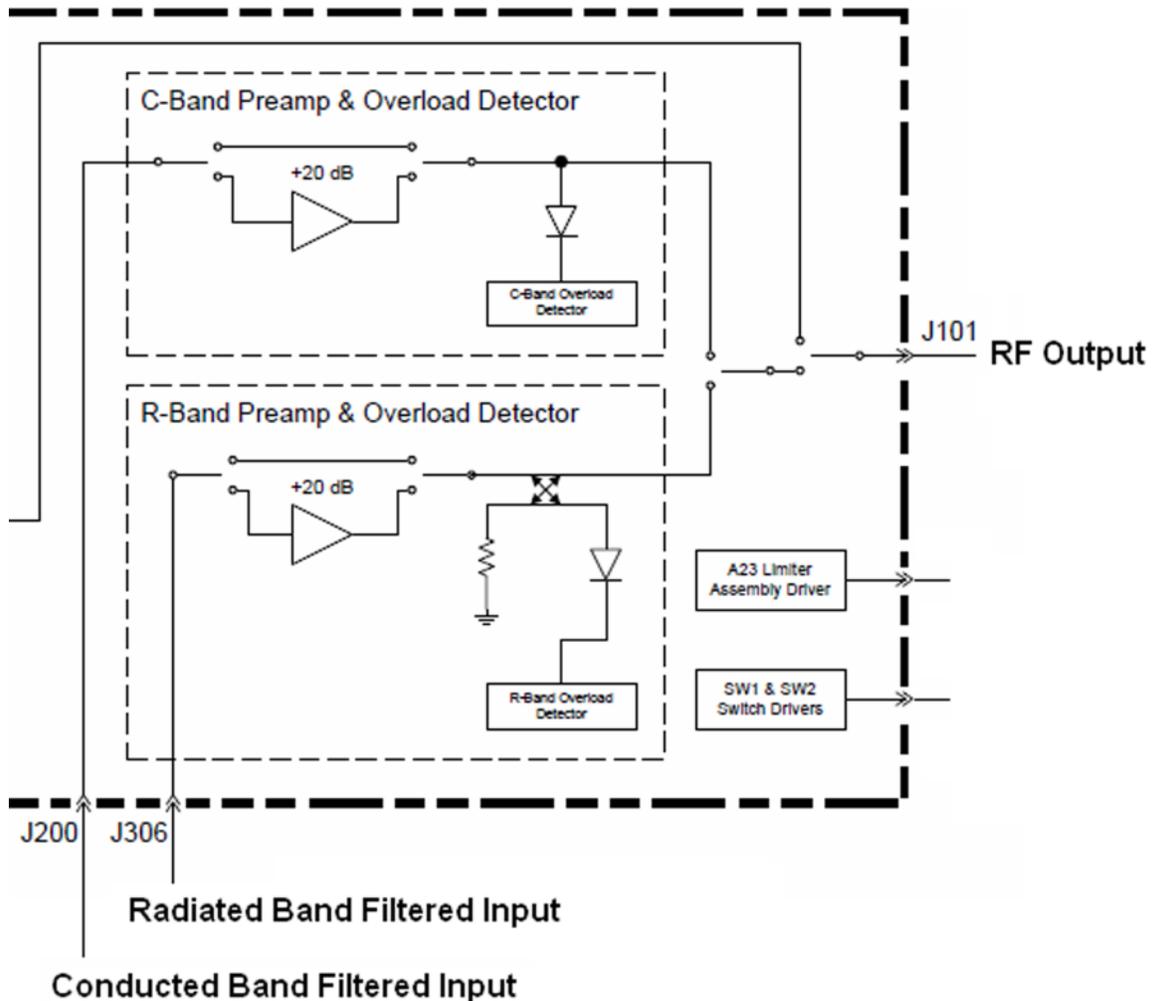
Verifying Output Signal Routing and Preamplifier Gain

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4 and Figure 5-5, remove W33, W35, and W36 from the A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Output Signal Routing Verification - Conducted Band

5. Connect a signal generator to the A21 RF Preselector Input assembly Conducted Band Filtered Input (J200), as shown in Figure 5-4.

6. Tune the signal generator to 10 MHz with an amplitude of −20 dBm.

7. Connect a spectrum analyzer to the A21 RF Preselector Input assembly RF Output (J101), as shown in Figure 5-4.

8. Tune the spectrum analyzer to a frequency of 10 MHz with a span of 10 MHz.

9. Tune the instrument to a frequency of 10 MHz with a span of 0 Hz by pressing **FREQ**, **10 MHz**, and **SPAN**, **Zero Span**.

10. Verify that the signal level on the spectrum analyzer is at −20 dBm (±3 dB), as shown in Figure 5-12, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-12   A21 RF Preselector Input Assembly - Conducted Band Output
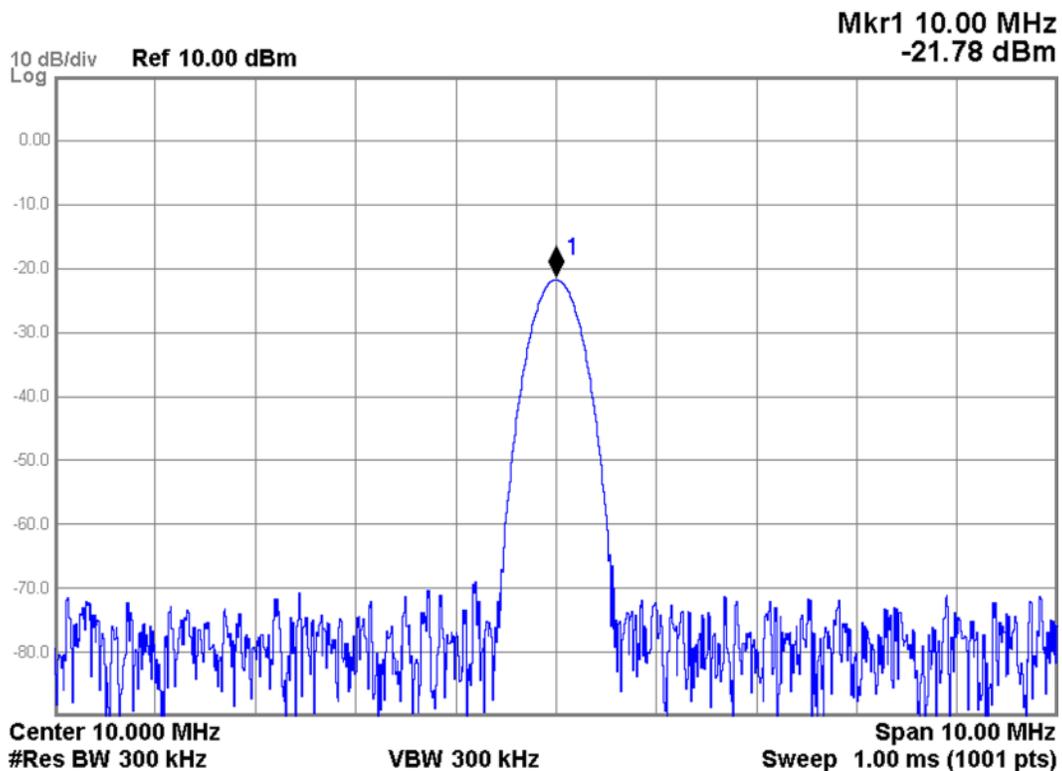
11. Turn on the Marker Delta function of the spectrum analyzer being used.

12. Turn the instrument Preamp on by pressing **AMPTD**, **More**, **Internal Preamp**, **Low Band**.

13. Verify that the signal level on the spectrum analyzer increases by at least 20 dB from where it was, as shown in Figure 5-13.

If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself. However, if there is no RF Preselector alignment data the signal level when the preamplifier is turned on could also be low. Before replacing the A21 RF Preselector Input assembly for a low preamplifier level try running the alignment routine by pressing **System**, **Alignments**, **More**, **RF Preselector**, **Align Now**, **20 Hz to 30 MHz**. Once the alignment is completed check the level again.

Figure 5-13   A21 RF Preselector Input Assembly - Conducted Band Preamp
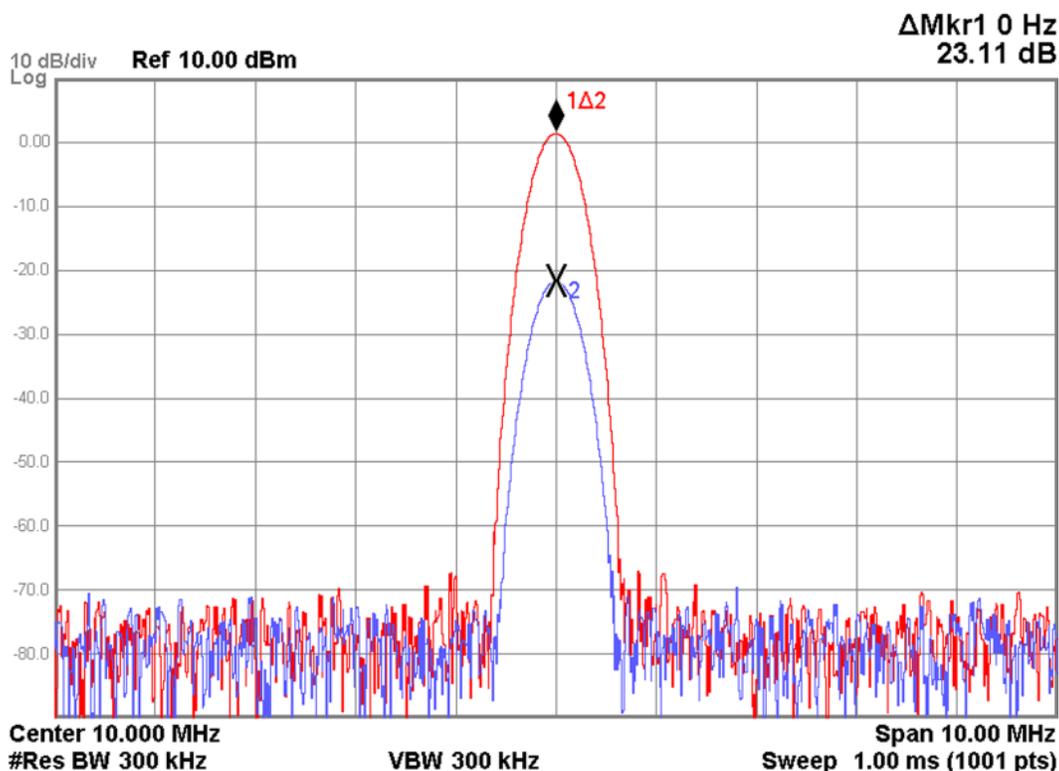
14. Turn the instrument Preamp off by pressing **AMPTD**, **More**, **Internal Preamp**, **Off**.

Output Signal Routing Verification - Radiated Band

NOTE   If there is a particular frequency of interest use that instead of the 100 MHz used in this example

15. Connect a signal generator to the A21 RF Preselector Input assembly Radiated Band Filtered Input (J306), as shown in Figure 5-4.

NOTE Connection to A21J306 will require the use of a Type-M adapter or a Type-M to BNC cable, part number N9039-60034.

16. Tune the signal generator to 100 MHz with an amplitude of −20 dBm.

17. Tune the spectrum analyzer to a frequency of 100 MHz with a span of 10 MHz.

18. Tune the instrument to a frequency of 100 MHz with a span of 0 Hz by pressing **FREQ**, **100 MHz**, and **SPAN**, **Zero Span**.

19. Verify that the signal level on the spectrum analyzer is at −20 dBm (±3 dB), as shown in Figure 5-14, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-14   A21 RF Preselector Input Assembly - Radiated Band Output
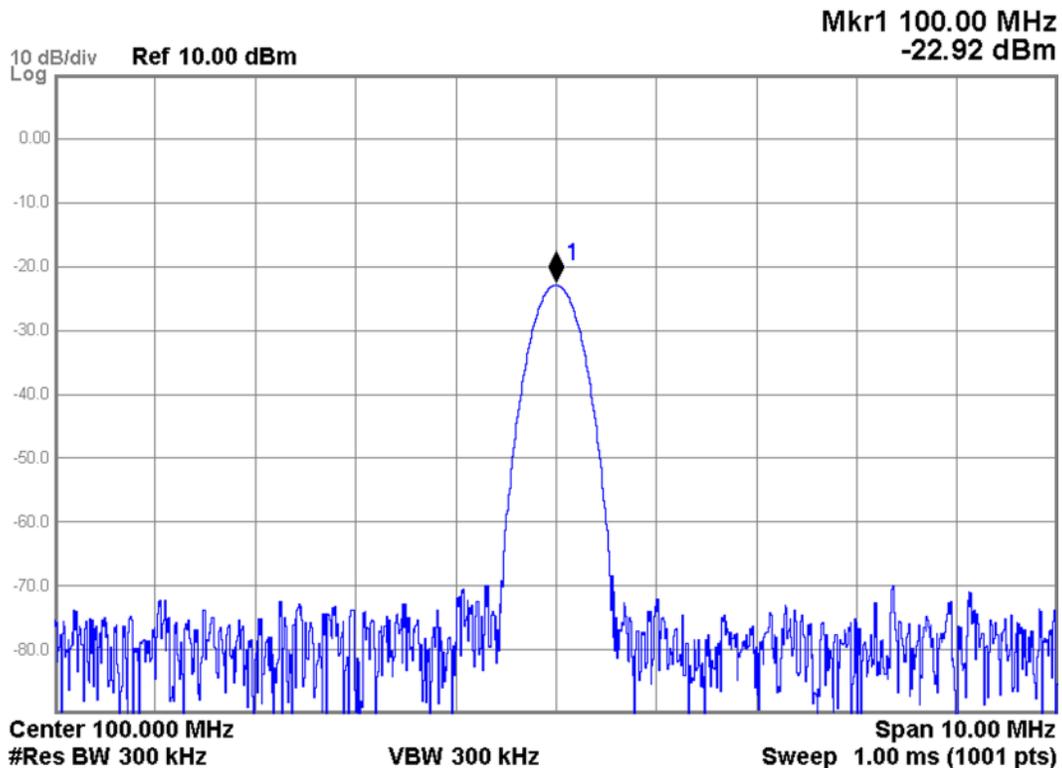
20. Turn on the Marker Delta function of the spectrum analyzer being used.

21. Turn the instrument Preamp on by pressing **AMPTD**, **More**, **Internal Preamp**, **Low Band**.

22. Verify that the signal level on the spectrum analyzer increases by at least 20 dB from where it was, as shown in Figure 5-15.

If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself. However, if there is no RF Preselector alignment data the signal level when the preamplifier is turned on could also be low. Before replacing the A21 RF Preselector Input assembly for a low preamplifier level try running the alignment routine by pressing **System**, **Alignments**, **More**, **RF Preselector**, **Align Now**, **30 MHz to 3.6 GHz**. Once the alignment is completed check the level again.

Figure 5-15   A21 RF Preselector Input Assembly - Radiated Band Preamp
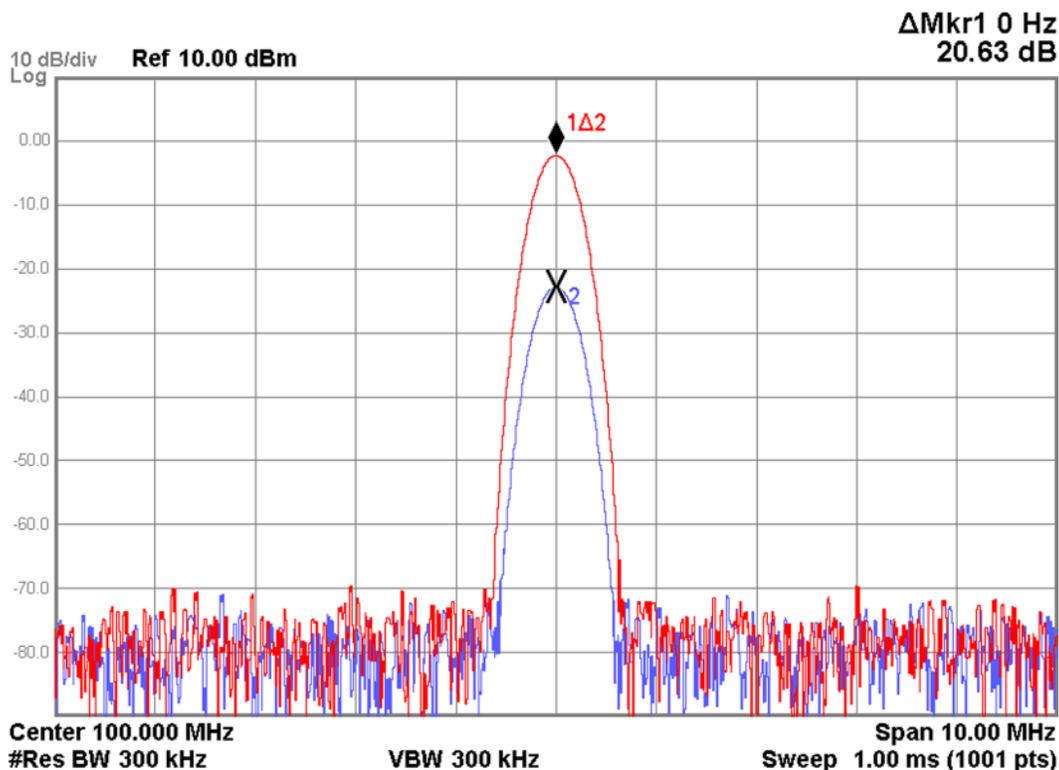
Alignment Signal Generation

There are two alignment signals generated on the A21 RF Preselector Input assembly to be verified, a Direct Digital Synthesizer and a Broad Band Noise Source, as seen in Figure 5-16.

Figure 5-16   A21 RF Preselector Input Assembly - Alignment Signals
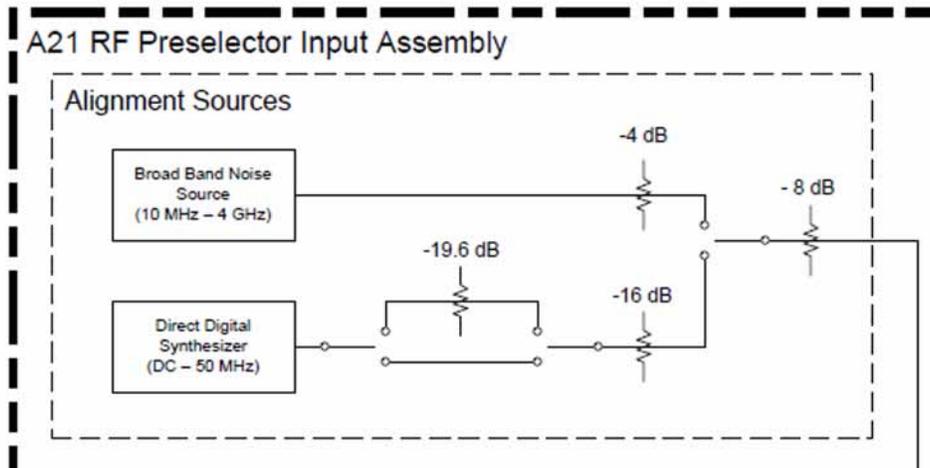
Verifying Alignment Signal Generation

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W32 and W34 from the A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self–alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Direct Digital Synthesizer Verification - Conducted Band

5. Connect a spectrum analyzer to the A21 RF Preselector Input assembly Conducted Band Pre-Filtered Output (J103), as shown in Figure 5-4.

6. Tune the spectrum analyzer to a start frequency of 10 MHz and a stop frequency of 65 MHz.

7. Tune the instrument to a frequency of 10 MHz with a span of 0 Hz by pressing **FREQ**, **10 MHz**, and **SPAN**, **Zero Span**.

8. Turn the Direct Digital Synthesizer on and tune it to 5 MHz by entering the Service menu and pressing **More**, **RF Preselector**, **Calibrator**, **DDS Freq**, **5 MHz**.

NOTE   For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus.".

9. Verify that the signal level on the spectrum analyzer is greater than
−35 dBm, as shown in Figure 5-17, allowing for any additional test cable
loss.

If the signal level is incorrect the most likely cause of the problem is the
A21 RF Preselector Input assembly itself.

Figure 5-17   A21 RF Preselector Input Assembly - DDS Output
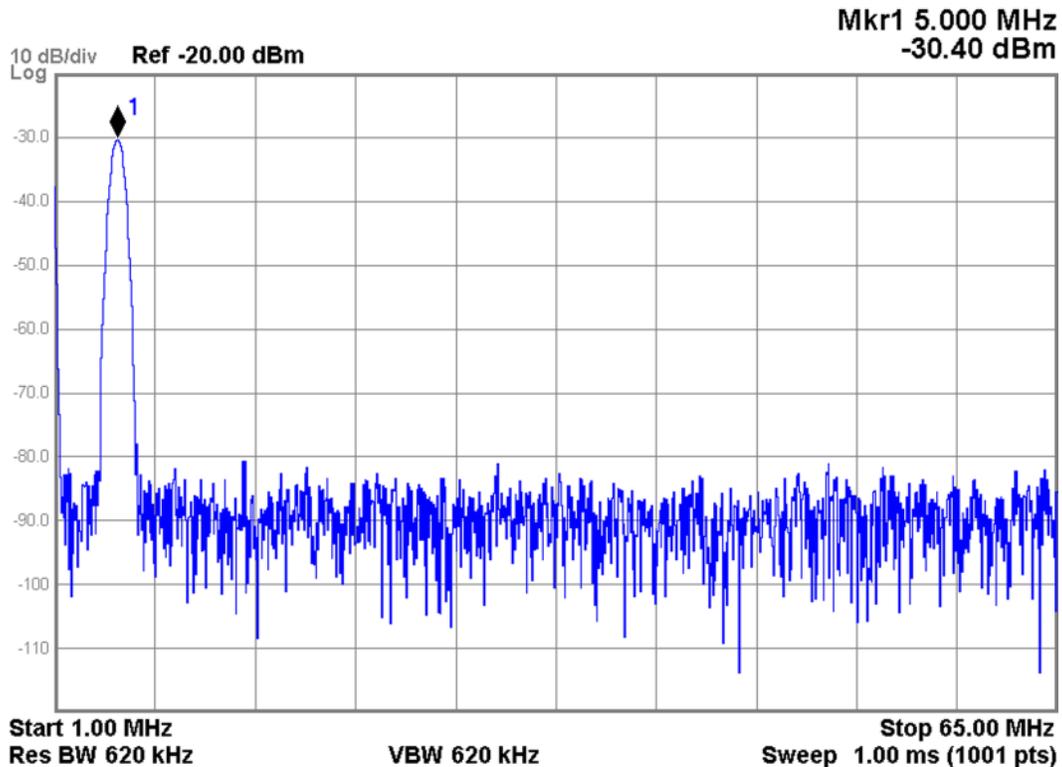
10. Vary the frequency of the Direct Digital Synthesizer alignment signal
across its frequency range and verify that the signal level remains greater
than −35 dBm up to 40 MHz. Above 40 MHz the signal level should remain
greater than −40 dBm.

Broad Band Noise Source - Radiated Band

11. Move the spectrum analyzer to the A21 RF Preselector Input assembly
Radiated Band Pre-Filtered Output (J102), as shown in Figure 5-4.

12. Tune the spectrum analyzer to a start frequency of 10 MHz and a stop
frequency of 4 GHz.

13. Tune the instrument to a frequency of 100 MHz with a span of 0 Hz by
pressing **FREQ**, **100 MHz**, and **SPAN**, **Zero Span**.

14. Turn the Broad Band Noise Source alignment signal on by entering the Service menu and pressing **More**, **RF Preselector**, **Calibrator**, **Noise Source**.

> **NOTE**
>
> For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus."

15. Verify that the signal level on the spectrum analyzer is similar to that shown in Figure 5-18, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-18   A21 RF Preselector Input Assembly - Noise Source Output
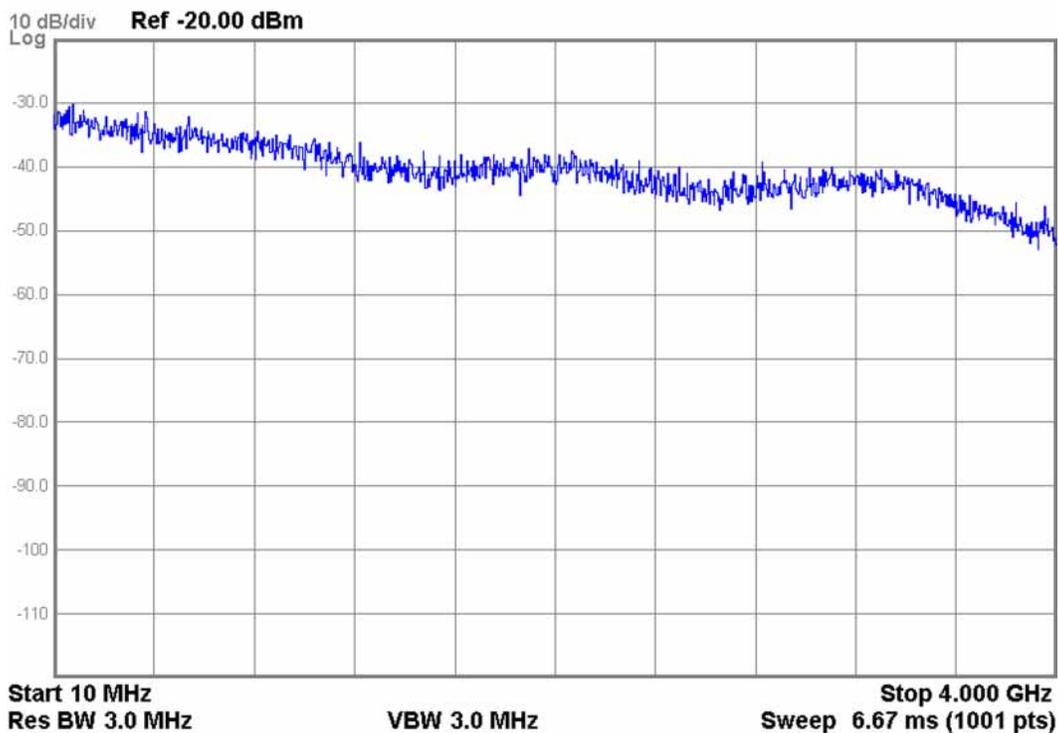
Through Path

While it is not used during normal instrument operation, there is a signal through path on the A21 RF Preselector Input assembly, which will be verified in this section.

Verifying Signal Through Path

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 16, "Service and Diagnostics Menus" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W31 and W36 from the A21 RF Preselector Input assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Connect a signal generator to the A21 RF Preselector Input assembly RF Input (J100), as shown in Figure 5-4.

6. Set the signal generator to an amplitude of −20 dBm.

> **NOTE**
>
> For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus.".

7. Connect a spectrum analyzer to the A21 RF Preselector Input assembly RF Output (J101), as shown in Figure 5-4.

8. Tune the spectrum analyzer to a start frequency of 0 Hz and a stop frequency of 3.6 GHz.

9. Tune the A21 RF Preselector Input assembly to the through path by entering the Service menu and pressing **More**, **RF Preselector**, **Band Lock**, **Through**, **Band 3**.

10. Place one of the active traces on the spectrum analyzer into its Max Hold function.

11. Slowly vary the frequency of the signal generator between 0 Hz and 3.6 GHz to verify the frequency response of the through path on the spectrum analyzer display, as shown in Figure 5-19.

12. Verify that the signal level on the spectrum analyzer is between −25 dBm and −30 dBm (±3 dB) across the frequency range, as shown in Figure 5-19, allowing for any additional test cable loss.

   If the signal level is incorrect the most likely cause of the problem is the A21 RF Preselector Input assembly itself.

Figure 5-19   A21 RF Preselector Input Assembly - Through Path
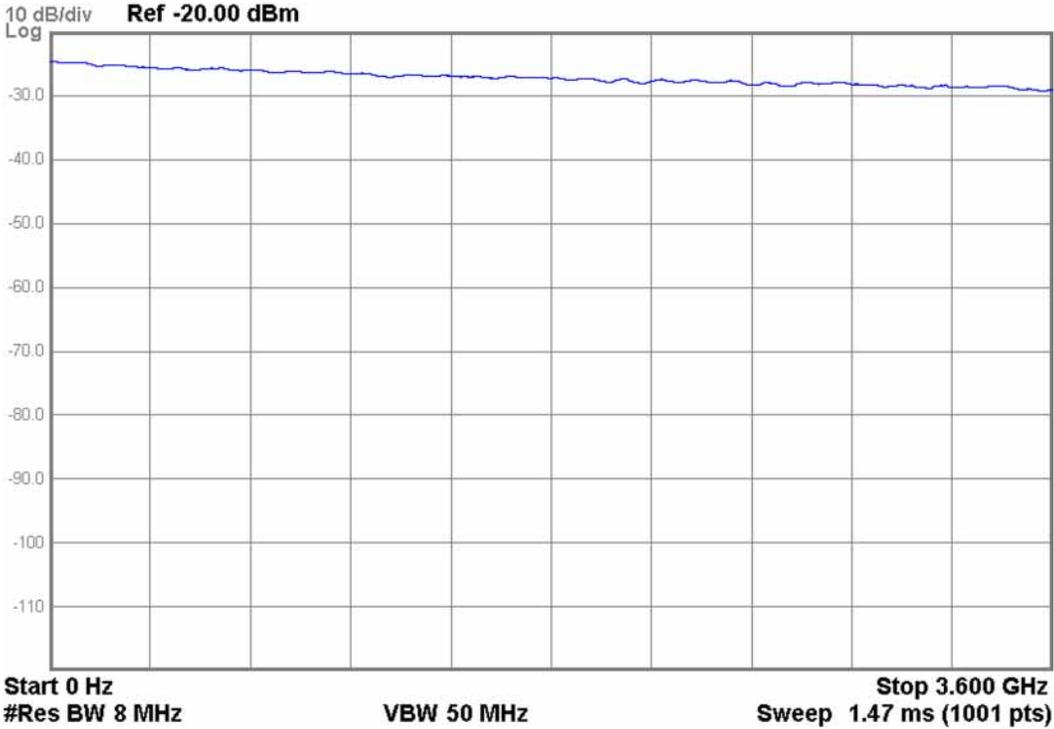
A22 Radiated Filter Assembly

NOTE

Refer to Chapter 15, "Block Diagrams.".

The A22 Radiated Filter assembly is responsible for providing the RF preselector filtering for frequencies between 30 MHz and 3.6 GHz. Each of the filter paths, as well as any through paths, will be verified in this section. However, before verifying the operation of any of the filter paths the assembly initialization will need to be verified.

There are also a number of status LEDs that can be monitored to get an indication of the status of the assembly.

Assembly Initialization

Before the A22 Radiated Filter assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A22 Radiated Filter assembly should identify itself on this list as RF Presel Radiated Filter. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

> Solution: Reload the FPGA code. See "FPGA Synchronization" in Chapter 19, "Post-Repair Procedures".

— An instrument power supply voltage is not operating properly

> Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A22 Radiated Filter assembly is defective

> Solution: Replace the A22 Radiated Filter assembly

Assembly Status LEDs

There are six diagnostics LEDs visible on the A22 Radiated Filter Assembly, as shown in Figure 5-20. Table 5-7 lists the diagnostic LEDs and what their status indicates.

Figure 5-20   A22 Radiated Filter Assembly LEDs
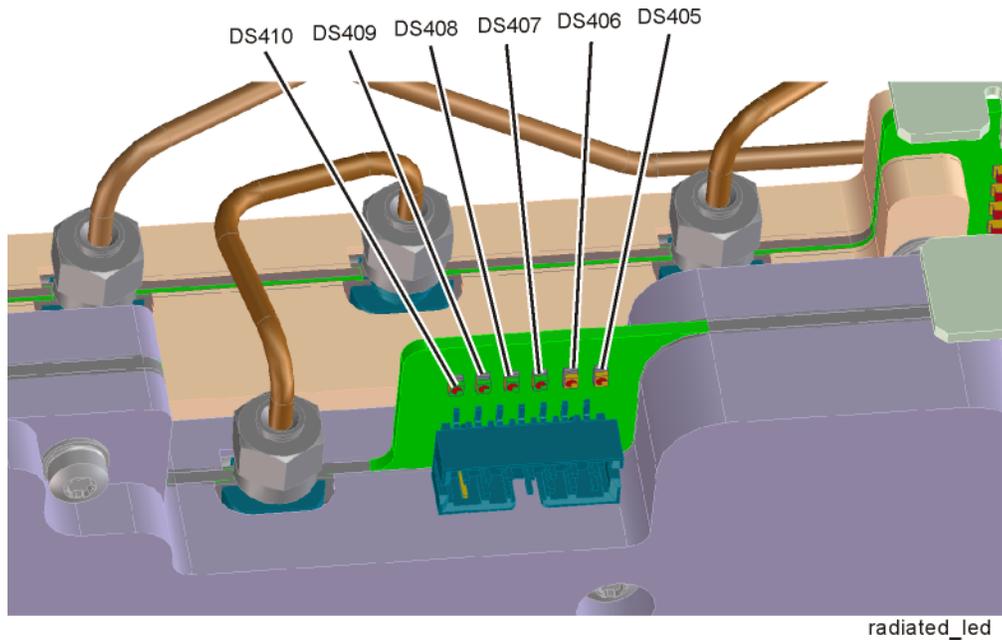
radiated_led

Table 5-7   A22 Radiated Filter Assembly Status LEDs

LED	LED Color	Description	Status
A22DS410	Green	Heartbeat	Blinking = Normal Operation On = FPGA Reference Problem Off = FPGA Programming Problem
A22DS409	Green	Fixed Frequency Mode	On = Enabled Off = Disabled
A22DS408	Green	Swept Mode	On = Enabled Off = Disabled
A22DS407	Green	Stepped Mode	On = Enabled Off = Disabled
A22DS406	Yellow	Not Used	On = N/A Off = Normal Operation
A22DS405	Yellow	Not Used	On = N/A Off = Normal Operation

Radiated Filter Board Heartbeat

This LED should start blinking just a few seconds after the instrument power is turned on. If it does not come on at all there is either a problem with an instrument power supply voltage or the FPGA chip on the A22 Radiated Filter assembly is not getting programmed properly. To verify the instrument power supply voltages see Chapter 12, "Power Supply & Midplane". If the instrument power supply voltages are all correct try reload the FPGA code. See FPGA

Synchronization in Chapter 19, "Post-Repair Procedures". If this LED is always on there is most likely a problem with the 10 MHz reference signal to the FPGA chip.

Fixed Frequency Mode

This LED should be on whenever the RF Preselector is turned on and the instrument span is set to 0 Hz.

Swept Mode

This LED should be on whenever the RF Preselector is turned on and the instrument span is greater than 0 Hz.

Stepped Mode

This LED should be on whenever the RF Preselector is turned on and the instrument is in stepped mode. The only way to place the instrument in stepped mode is with the use of the EMI Receiver mode. This is accessed by pressing **Mode**, **EMI Receiver**, **Meas Setup**, **More**, **Scan Type**, **Discrete**, then press **Restart** to start the stepped mode.

NOTE   Only one of the Fixed Frequency Mode, Swept Mode, and Stepped Mode LEDs should ever be on at the same time.

Signal Path Verification

There are seven different filtered signal paths and one through path on the A22 Radiated Filter assembly, all of which can be selected with the use of the instrument's Service Menu. This section will describe how to verify the functionality of all eight signal paths.

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4 and Figure 5-5, remove W34 and W35 from the A22 Radiated Filter assembly.

   To remove W35 pinch the retainer clips on both ends of the cable and slide the retainers away from the connection as shown in Figure 5-21.

Figure 5-21   Removal of W35
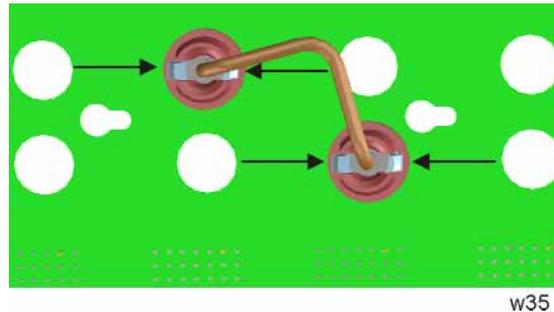
w35

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Connect a signal generator to the A22 Radiated Filter assembly RF Input (J100), as shown in Figure 5-4.

6. Set the power level of the signal generator to −20 dBm.

7. Connect a spectrum analyzer to the A22 Radiated Filter assembly RF Output (J300), as shown in Figure 5-5.

NOTE

Connection to A22J300 will require the use of a Type-M adapter or a Type-M to BNC cable, part number N9039-60034.

Filter Path Verification

8. Tune the spectrum analyzer to a center frequency and span equal to that shown in Table 5-8 for Band 0.

9. Tune the A22 Radiated Filter assembly to the Band 0 filter path by entering the Service menu and pressing **More**, **RF Preselector**, **Band Lock**, **Radiated**, **Band 0**.

**NOTE**

For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus."

10. Tune the filter passband center frequency by pressing **Tuned Frequency** and entering the Center Frequency value found in Table 5-8 for the filter band selected, while in the Radiated band selection area of the Service menu.

11. Tune the signal generator to the Center Frequency listed in Table 5-8 for Band 0.

12. Place one of the active traces on the spectrum analyzer into its Max Hold function.

13. Slowly vary the frequency of the signal generator above and below the Center Frequency listed in Table 5-8 to draw out the shape of the selected filter on the spectrum analyzer display, as shown in Figure 5-22.

14. Verify that the passband gain or loss is equal to the Typical Passband Gain/Loss shown in Table 5-8 for Band 0, and that the filter shape is similar to that shown in Figure 5-22.

If either the passband gain/loss or filter shape is incorrect the most likely cause of the problem is the A22 Radiated Filter assembly itself. However, before replacing the A22 Radiated Filter assembly be sure to perform the Characterize Preselector routine for the band exhibiting an alignment problem. The Characterize Preselector routine can be found in the instrument Service Menu under **System**, **Service**, **RF Preselector**, **Characterize RF Preselector**, **All Bands**. See Chapter 16, "Service and Diagnostics Menus" for details.

15. Repeat step 8 through step 14 for the remained of the A22 Radiated Filter assembly filter bands shown in Table 5-8, using the Center Frequency, Span, and Typical Passband Gain/Loss shown in Table 5-8 for each band.

Table 5-8   A24 Conducted Filter Assembly - Filtered Signal Paths

Service Menu Selection	Frequency Range	Center Frequency	Span	Typical Passband Gain/Loss
Band 0	30 MHz to 70 MHz	50 MHz	30 MHz	+4.0 dB
Band 1	70 MHz to 150 MHz	100 MHz	50 MHz	+4.0 dB
Band 2	150 MHz to 300 MHz	200 MHz	100 MHz	+4.0 dB
Band 3	300 MHz to 600 MHz	500 MHz	200 MHz	+6.0 dB
Band 4	600 MHz to 1 GHz	800 MHz	200 MHz	+6.0 dB
Band 5	1 GHz to 2 GHz	1.5 GHz	300 MHz	+6.0 dB
Band 6	2 GHz to 3.6 GHz	2.55 GHz	2.1 GHz	+10.0 dB

Through Path Verification

16. Tune the spectrum analyzer to a start and stop frequency equal to that shown in Table 5-9 for Band 0.

17. Tune the A22 Radiated Filter assembly to the Band 2 through path by entering the Service menu and pressing **More**, **RF Preselector**, **Band Lock**, **Through**, **Band 2**.

NOTE

For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus.".

18. Tune the signal generator to the Verification Start Frequency listed in Table 5-9 for Band 2.

19. Place one of the active traces on the spectrum analyzer into its Max Hold function.

20. Slowly vary the frequency of the signal generator between the Verification Start Frequency and the Verification Stop Frequency listed in Table 5-9 to draw out the Band 0 through path shape.

21. Verify that the through path gain or loss is equal to the Typical Path Gain/Loss shown in Table 5-9 for Band 2, and that the frequency response shape is similar to that shown in Figure 5-29.

If either the path loss or frequency response shape is incorrect the most likely cause of the problem is the A22 Radiated Filter assembly itself.

Table 5-9   A24 Conducted Filter Assembly - Through Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 2[a]	30 MHz to 3.6 GHz	0 Hz	100 MHz	+10.0 dB

a. Not used during normal instrument operation.

Figure 5-22   A22 Radiated Filter Assembly – Band 0 Filter Path
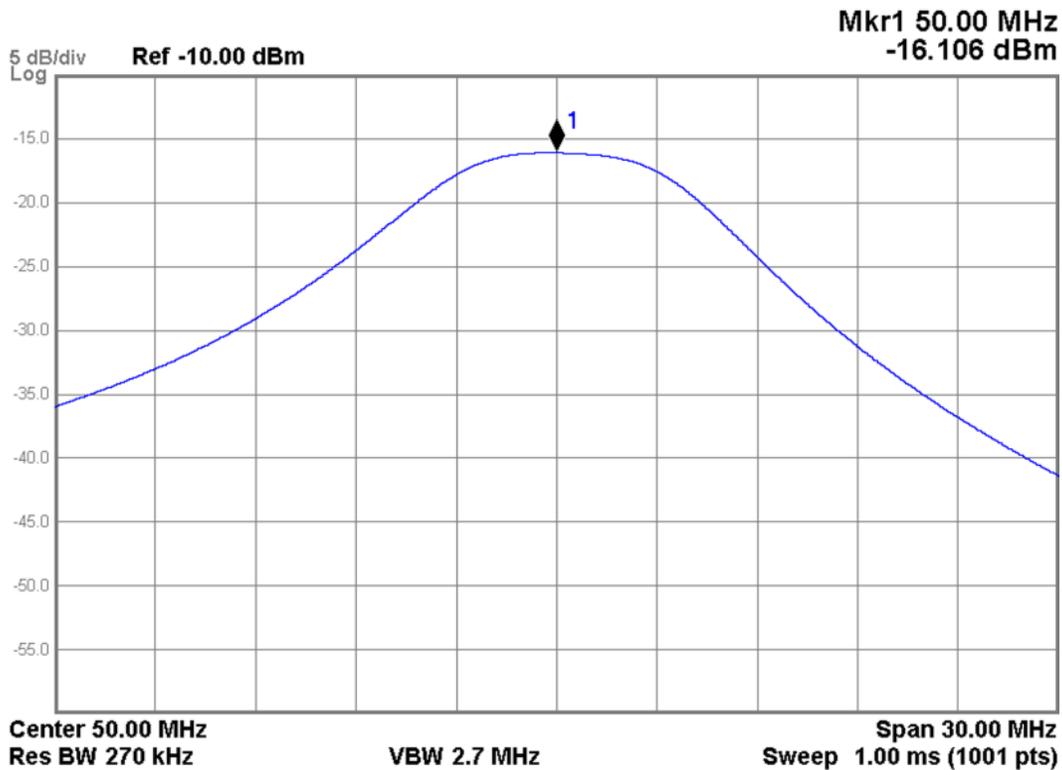
Figure 5-23   A22 Radiated Filter Assembly – Band 1 Filter Path
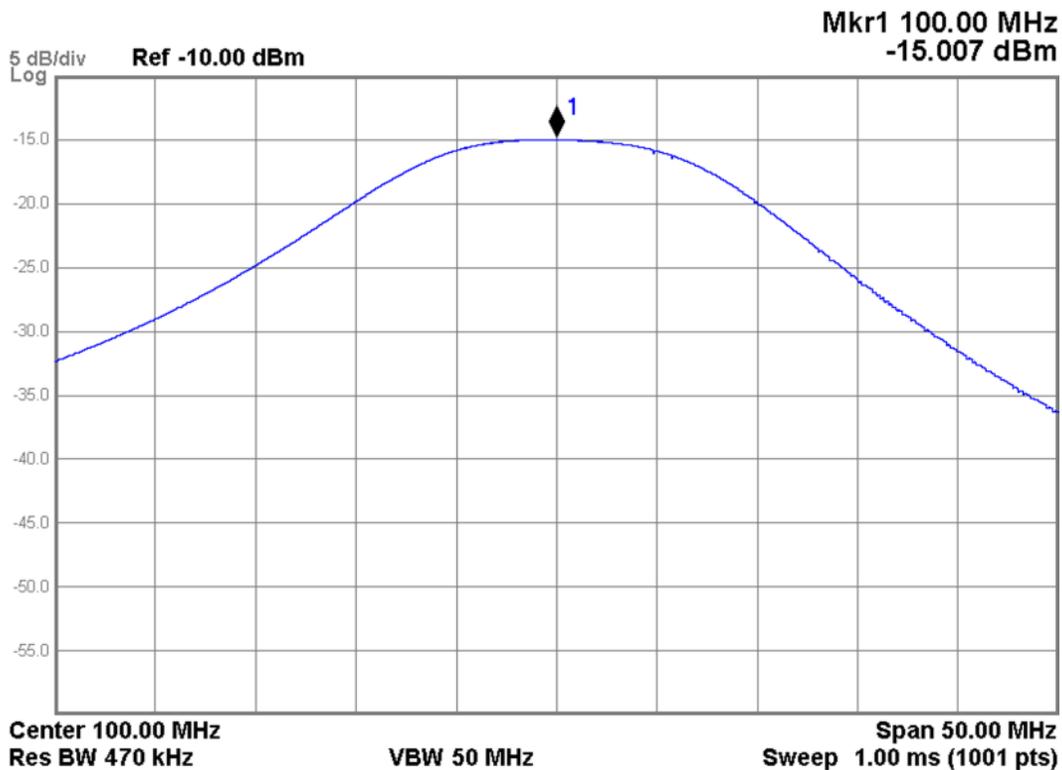
Figure 5-24   A22 Radiated Filter Assembly - Band 2 Filter Path
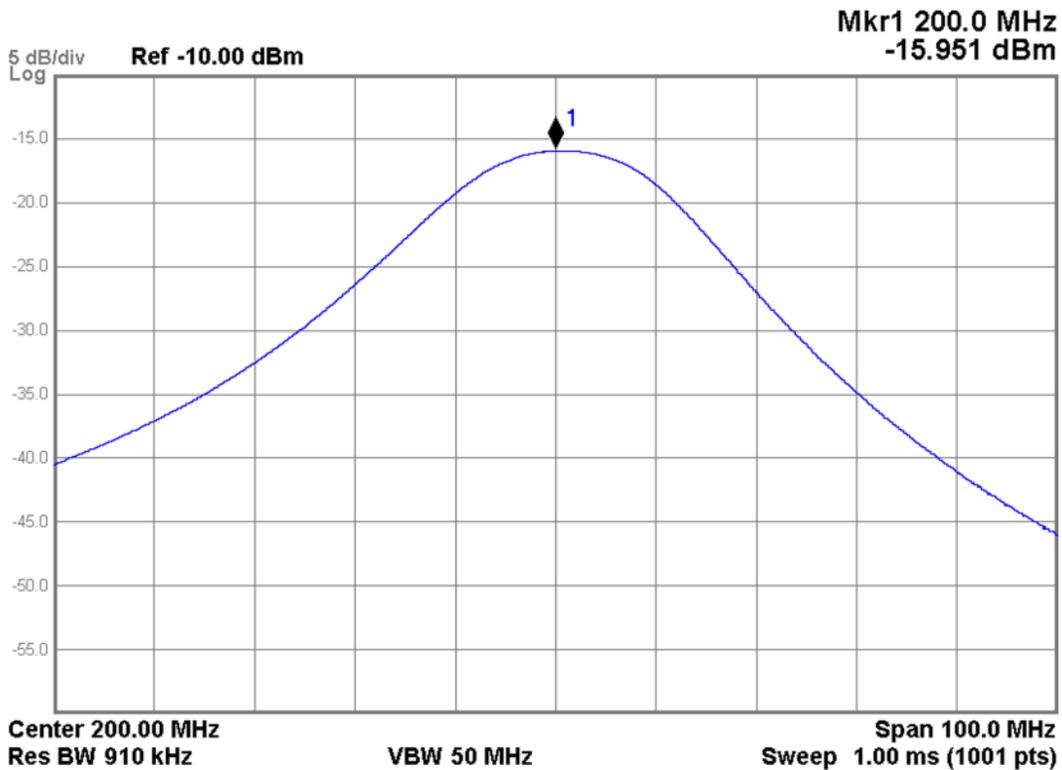
Figure 5-25   A22 Radiated Filter Assembly - Band 3 Filter Path
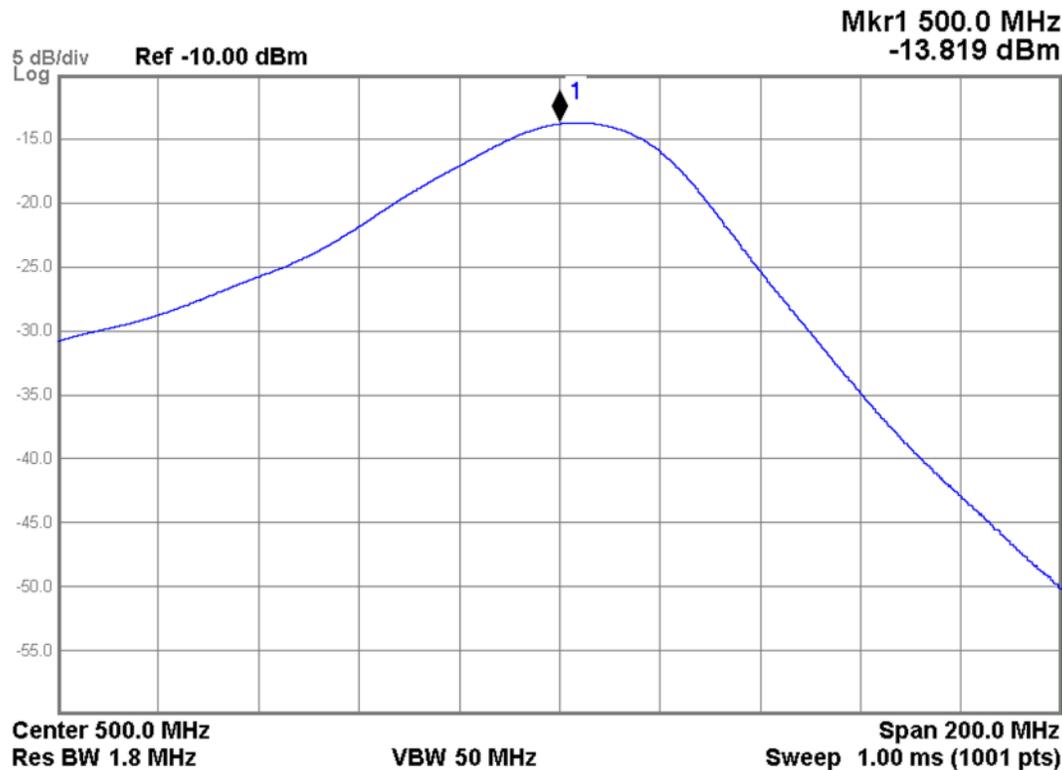
Figure 5-26   A22 Radiated Filter Assembly – Band 4 Filter Path
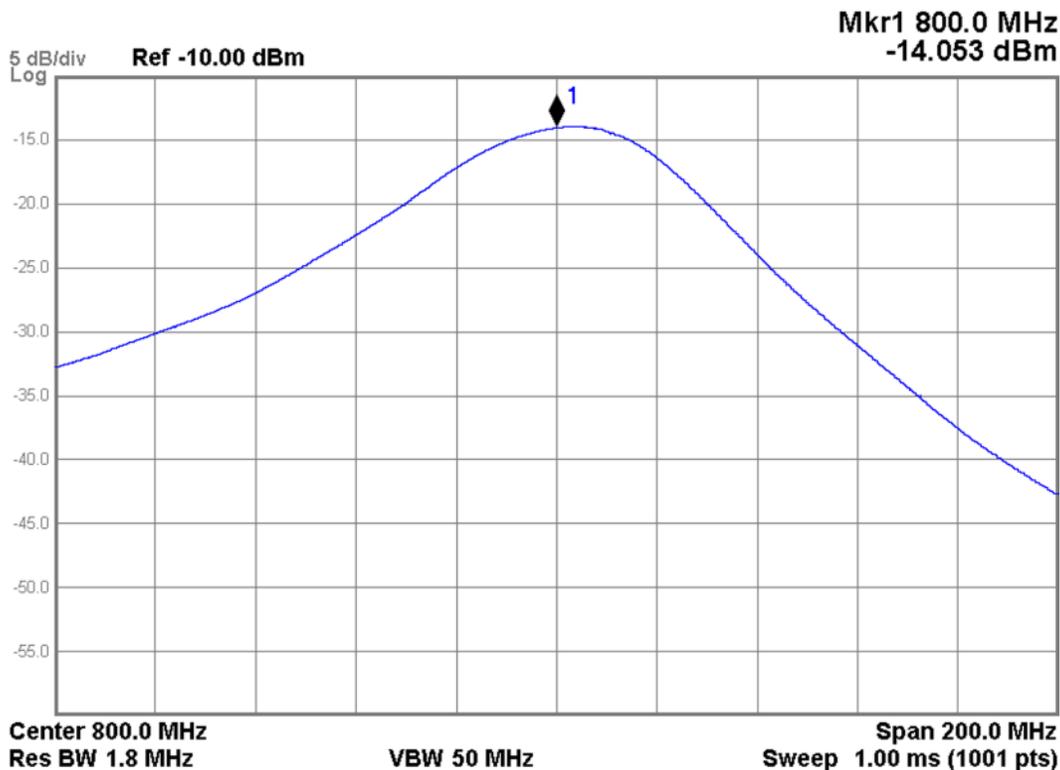
Figure 5-27   A22 Radiated Filter Assembly – Band 5 Filter Path
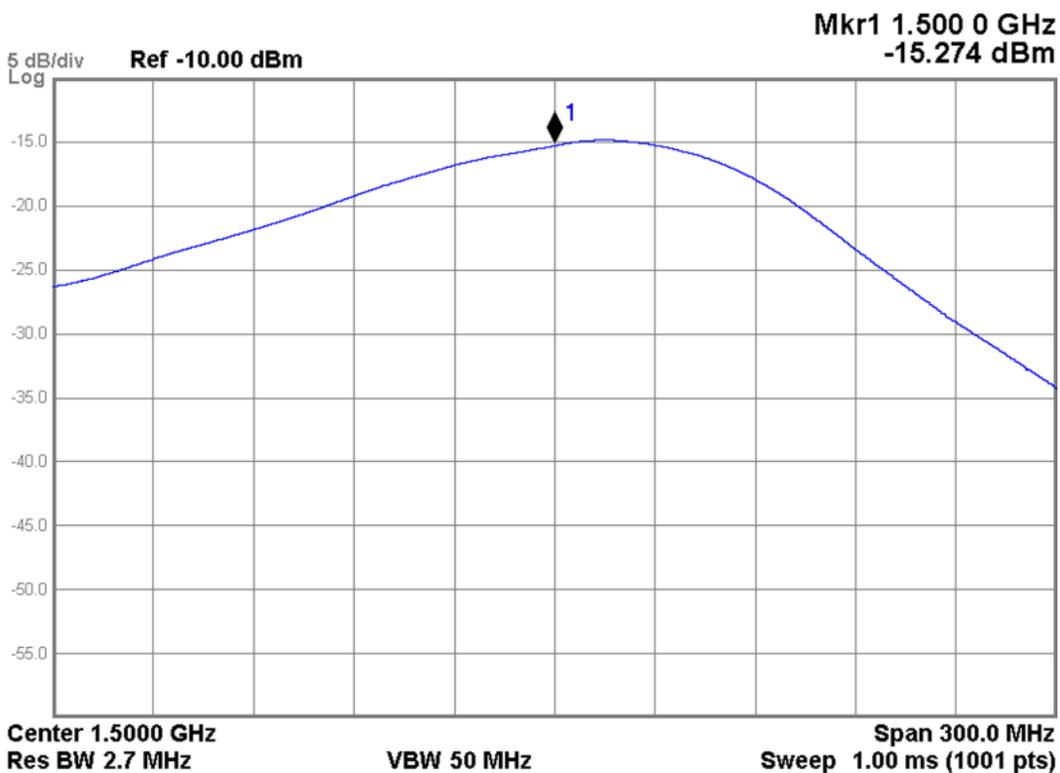
Figure 5-28   A22 Radiated Filter Assembly - Band 6 Filter Path
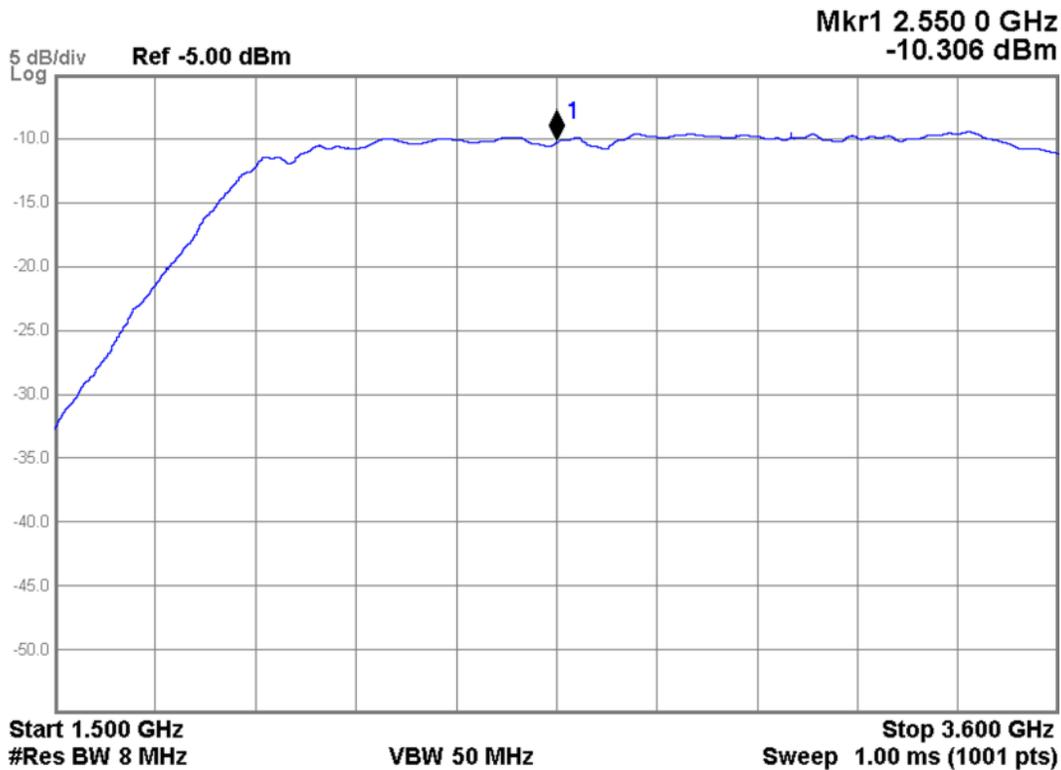
Figure 5-29   A22 Radiated Filter Assembly - Band 2 Through Path
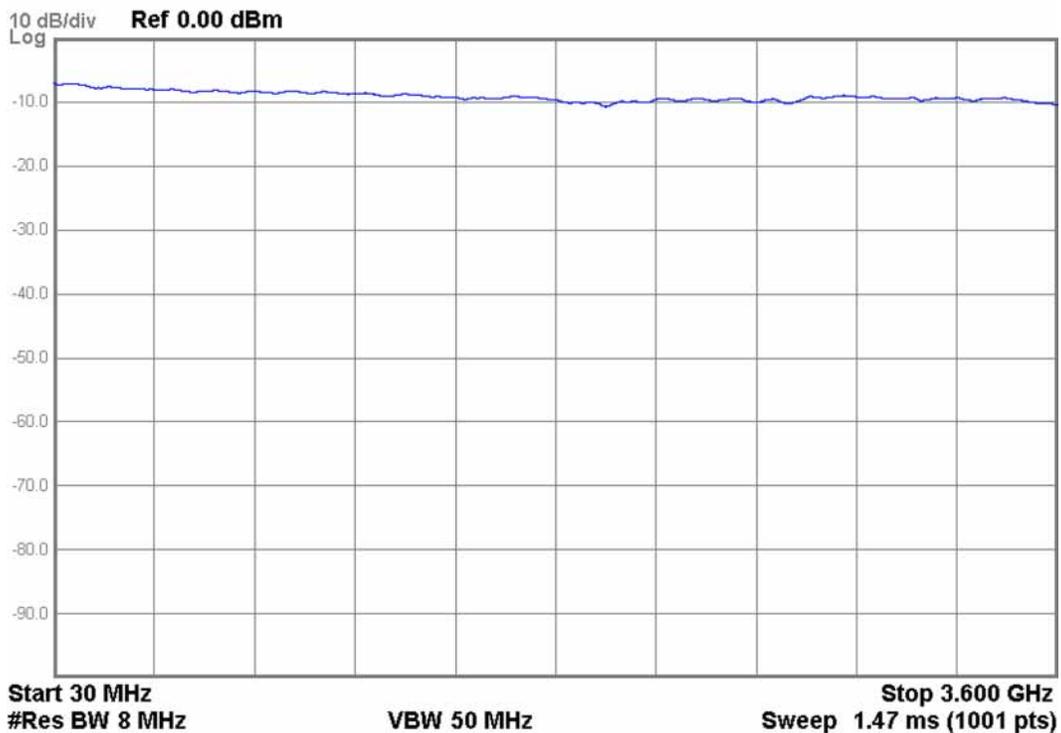
A24 Conducted Filter Assembly

NOTE   Refer to **Chapter 15, "Block Diagrams."**.

The A24 Conducted Filter assembly is responsible for providing the RF preselector filtering for frequencies below 30 MHz. Each of the filter paths, as well as any through paths, will be verified in this section. However, before verifying the operation of any of the filter paths the assembly initialization will need to be verified.

Assembly Initialization

Before the A24 Conducted Filter assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A24 Conducted Filter assembly should identify itself on this list as RF Presel Conducted Filter. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— An instrument power supply voltage is not operating properly

> Solution: Verify all instrument power supply voltages. See **Chapter 12, "Power Supply & Midplane"**.

— A24 Conducted Filter assembly is defective

> Solution: Replace the A24 Conducted Filter assembly

Signal Path Verification

While there are fifteen different signal paths through the A24 Conducted Filter assembly, all of which can be selected with the use of the instrument's Service Menu, only twelve of them are used during normal instrument operation. This section will describe how to verify the functionality of all fifteen signal paths.

1. Remove the instrument dress cover (MP24) and the top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Referring to Figure 5-4, remove W32 and W33 from the A24 Conducted Filter assembly.

3. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.

4. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Connect a signal generator to the A24 Conducted Filter assembly RF Input (J402), as shown in Figure 5-4.

6. Set the power level of the signal generator to −20 dBm.

7. Connect a spectrum analyzer to the A24 Conducted Filter assembly RF Output (J401), as shown in Figure 5-4.

Filter Path Verification

8. Tune the spectrum analyzer to a start and stop frequency equal to that shown in Table 5-10 for Band 0.

9. Tune the A24 Conducted Filter assembly to the Band 0 filter path by entering the Service menu and pressing **More**, **RF Preselector**, **Band Lock**, **Conducted**, **Band 0**.

NOTE
For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus.".

10. Tune the signal generator to the Verification Start Frequency listed in Table 5-10 for Band 0.

11. Place one of the active traces on the spectrum analyzer into its Max Hold function.

12. Slowly vary the frequency of the signal generator between the Verification Start Frequency and the Verification Stop Frequency listed in Table 5-10 to draw out the Band 0 filter shape.

13. Verify that the passband gain or loss is equal to the Typical Passband Gain/Loss shown in Table 5-10 for Band 0, and that the filter shape is similar to that shown in Figure 5-30.

   If either the passband gain/loss or filter shape is incorrect the most likely cause of the problem is the A24 Conducted Filter assembly itself.

14. Repeat step 8 through step 13 for the remained of the A24 Conducted Filter assembly filter bands shown in Table 5-10, using the Verification Start Frequency, Verification Stop Frequency, and Typical Passband Gain/Loss shown in Table 5-10 for each band.

   Verify that the passband for each additional filter band is similar to that shown in the corresponding examples shown in Figure 5-31 through Figure 5-42.

Table 5-10   A24 Conducted Filter Assembly - Filtered Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 0[a]	20 Hz to 40 kHz	0 Hz	100 kHz	−1.5 dB
Band 1	20 Hz to 150 kHz	0 Hz	500 kHz	−1.5 dB
Band 2	150 kHz to 1 MHz	0 Hz	3 MHz	−1.0 dB
Band 3	1 MHz to 2 MHz	0 Hz	5 MHz	−1.0 dB
Band 4	2 MHz to 5 MHz	0 Hz	15 MHz	+3.0 dB
Band 5	5 MHz to 8 MHz	0 Hz	20 MHz	+3.0 dB
Band 6	8 MHz to 11 MHz	1 MHz	25 MHz	+3.0 dB
Band 7	11 MHz to 14 MHz	5 MHz	25 MHz	+3.0 dB
Band 8	14 MHz to 17MHz	10 MHz	25 MHz	+3.0 dB
Band 9	17 MHz to 20 MHz	10 MHz	30 MHz	+2.5 dB
Band 10	20 MHz to 24 MHz	15 MHz	30 MHz	+2.0 dB
Band 11	24 MHz to 28 MHz	20 MHz	35 MHz	+2.0 dB
Band 12	28 MHz to 32 MHz	25 MHz	40 MHz	+1.5 dB

a. Not used during normal instrument operation

Through Path Verification

15. Tune the spectrum analyzer to a start and stop frequency equal to that shown in Table 5-11 for Band 0.

16. 16.Tune the A24 Conducted Filter assembly to the Band 0 through path by entering the Service menu and pressing **More**, **RF Preselector**, **Band Lock**, **Through**, **Band 0**.

NOTE

For information on how to access the instrument's Service menu see Chapter 16, "Service and Diagnostics Menus."

17. Tune the signal generator to the Verification Start Frequency listed in Table 5-11 for Band 0.

18. Place one of the active traces on the spectrum analyzer into its Max Hold function.

19. Slowly vary the frequency of the signal generator between the Verification Start Frequency and the Verification Stop Frequency listed in Table 5-11 to draw out the Band 0 through path shape.

20. Verify that the through path gain or loss is equal to the Typical Path Gain/Loss shown in Table 5-11 for Band 0, and that the frequency response shape is similar to that shown in Figure 5-43.

If either the path loss or frequency response shape is incorrect the most likely cause of the problem is the A24 Conducted Filter assembly itself.

21. Repeat step 15 through step 20 for the Band 1 through path, using the Verification Start Frequency, Verification Stop Frequency, and Typical Passband Gain/Loss shown in Table 5-11 for Band 1.

Verify that the path gain for band 1 is similar to that shown in Figure 5-44.

Table 5-11   A24 Conducted Filter Assembly - Through Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 0[a]	20 Hz to 2 MHz	0 Hz	30 MHz	−1.00 dB
Band 1[a]	2 MHz to 30 MHz	0 Hz	100 MHz	+3.0 dB

a. Not used during normal instrument operation.

Figure 5-30   A24 Conducted Filter Assembly - Band 0 Filter Path
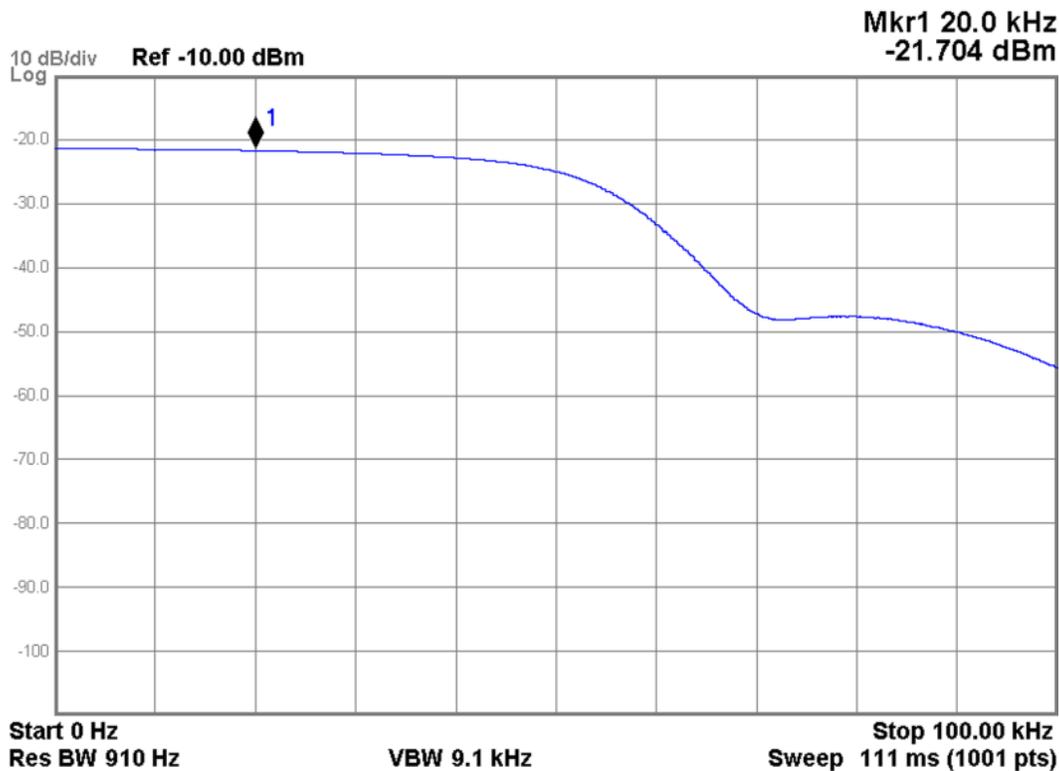
Figure 5-31   A24 Conducted Filter Assembly – Band 1 Filter Path
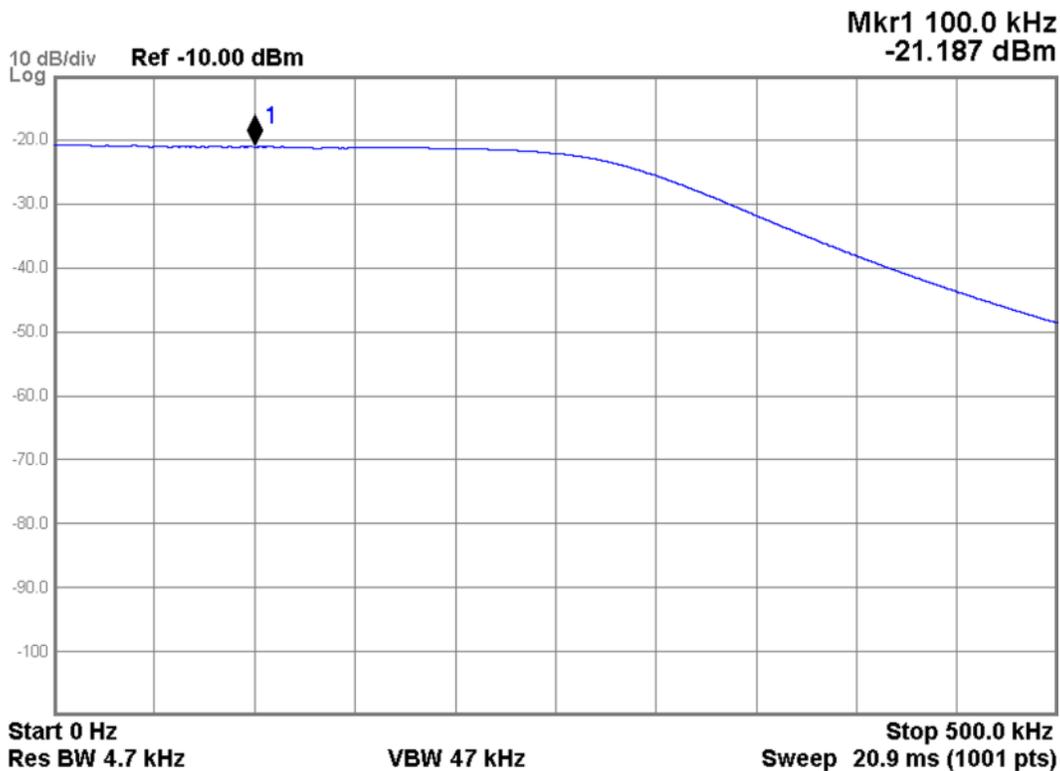
Figure 5-32   A24 Conducted Filter Assembly – Band 2 Filter Path
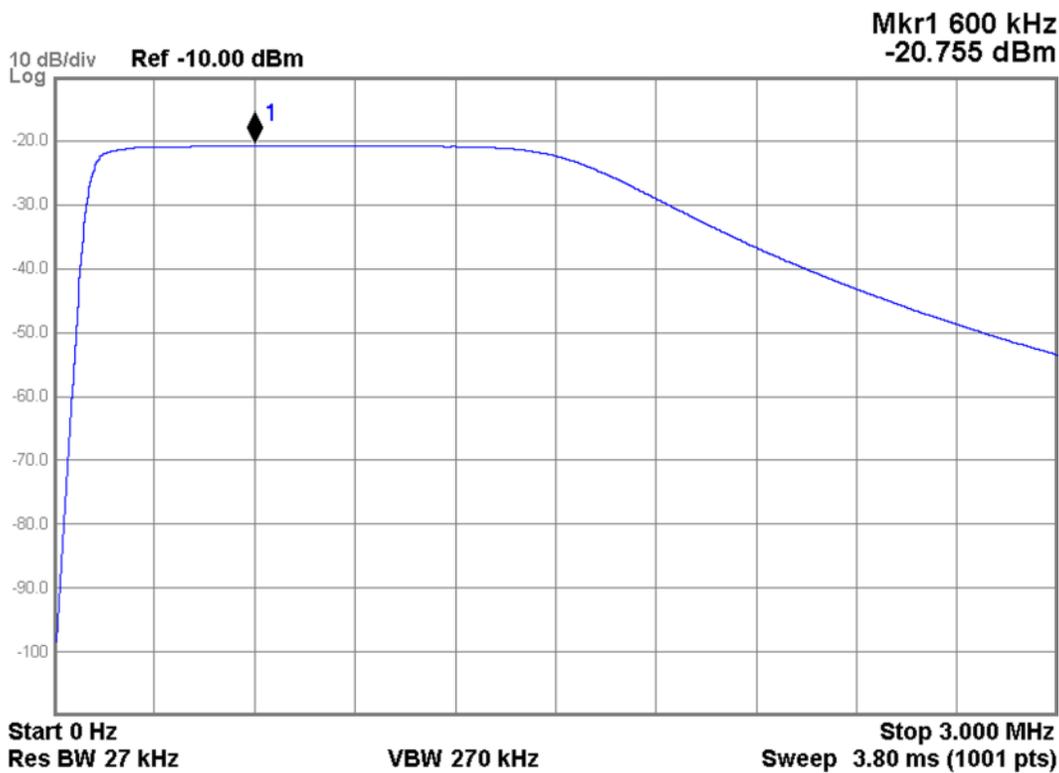
Figure 5-33   A24 Conducted Filter Assembly - Band 3 Filter Path
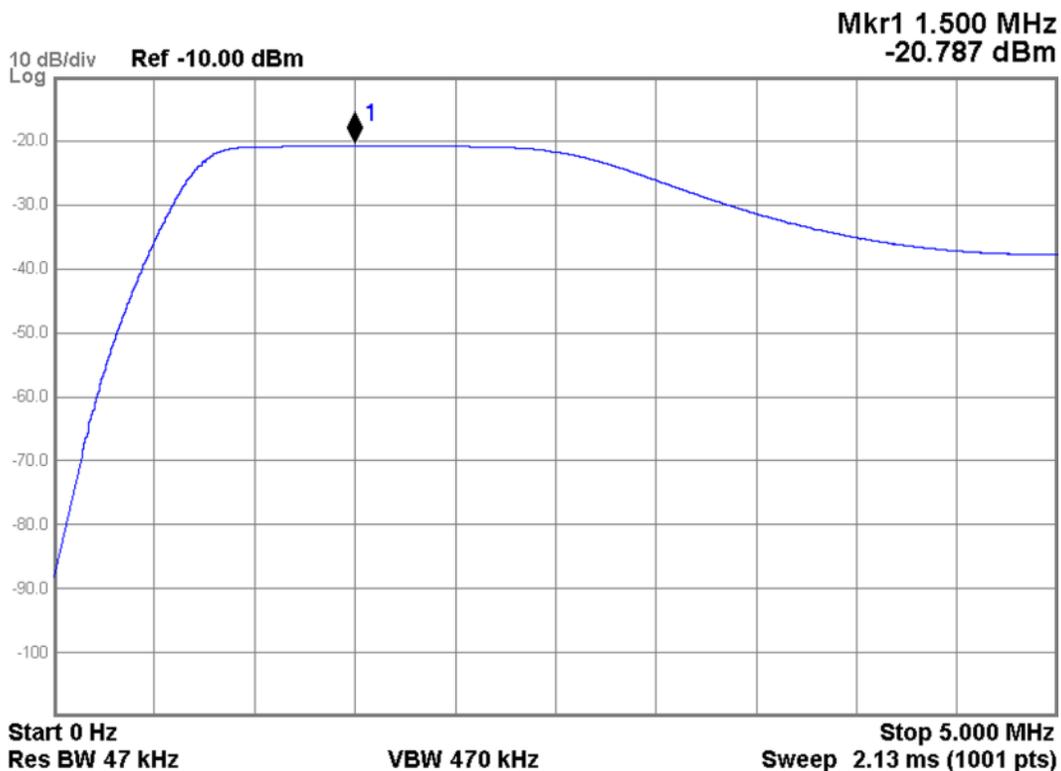
Figure 5-34   A24 Conducted Filter Assembly - Band 4 Filter Path
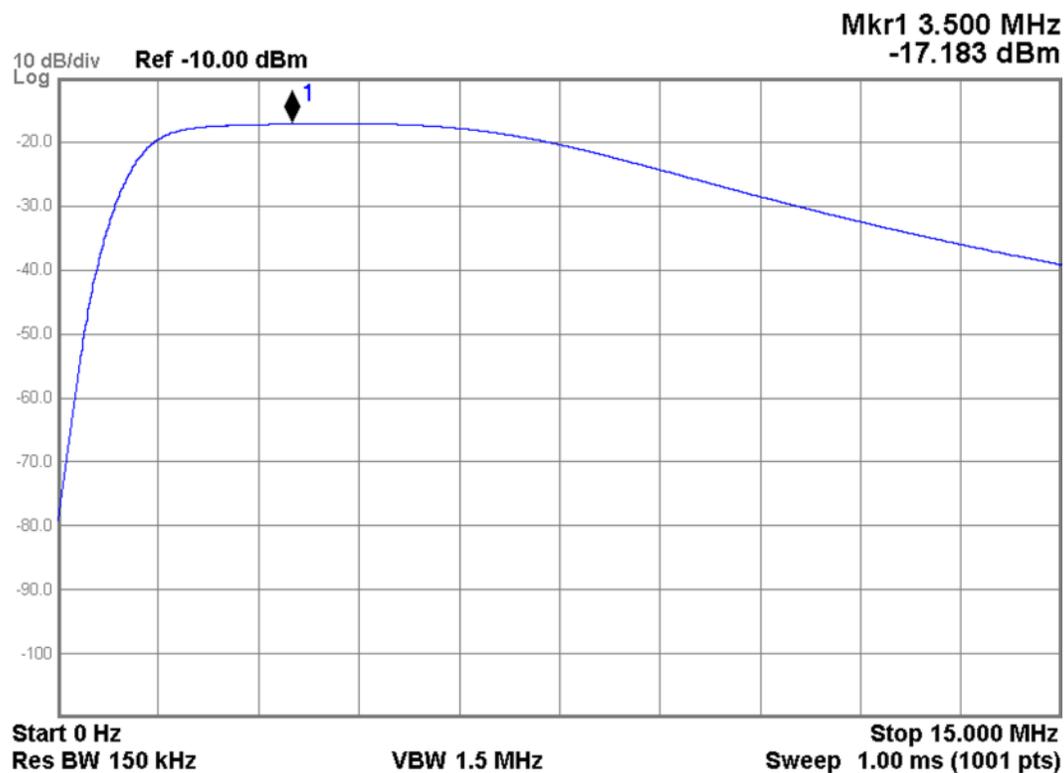
Figure 5-35   A24 Conducted Filter Assembly - Band 5 Filter Path
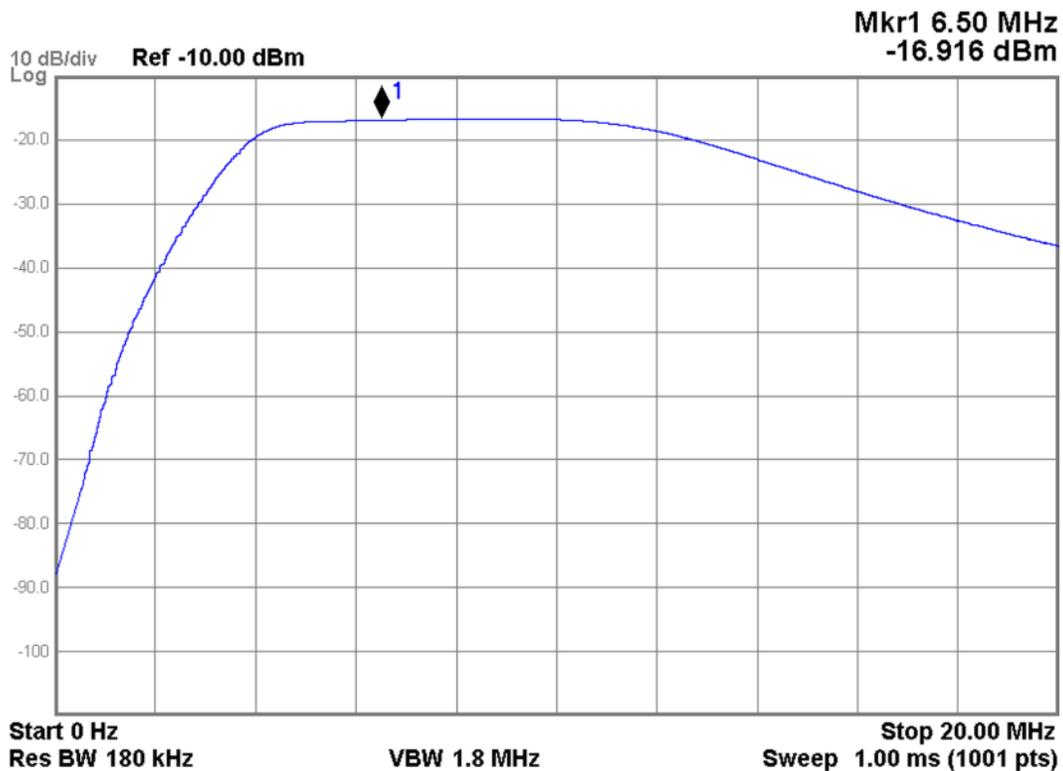
Figure 5-36   A24 Conducted Filter Assembly - Band 6 Filter Path
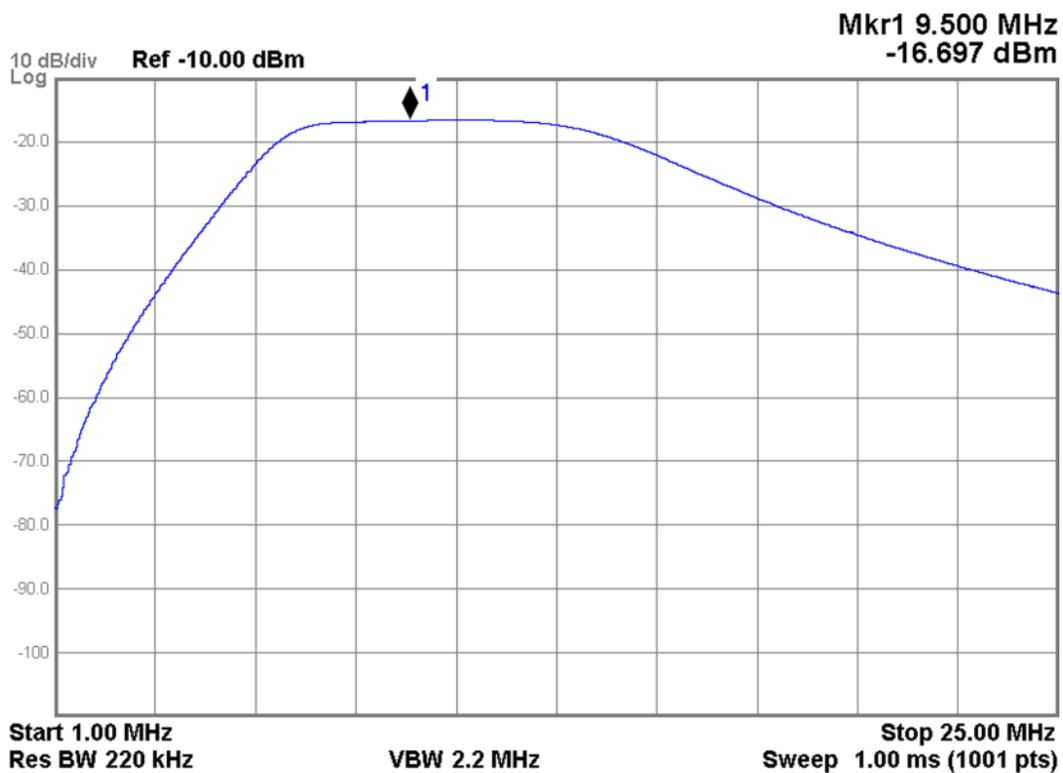
Figure 5-37 A24 Conducted Filter Assembly - Band 7 Filter Path
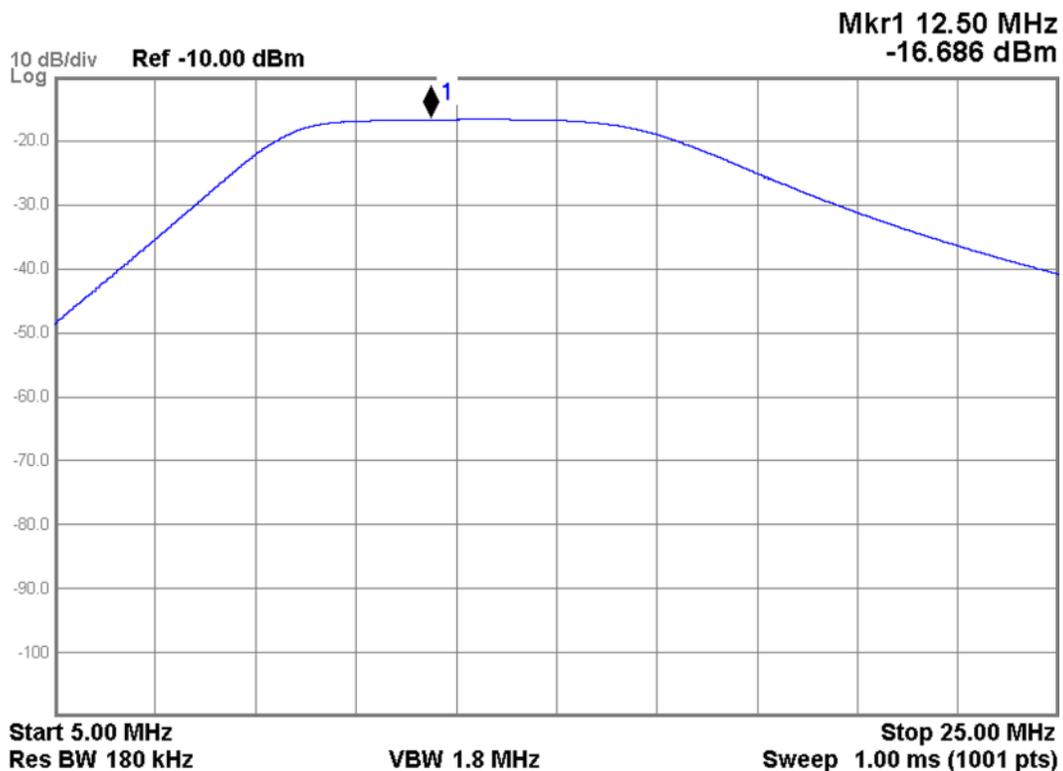
Figure 5-38 A24 Conducted Filter Assembly - Band 8 Filter Path
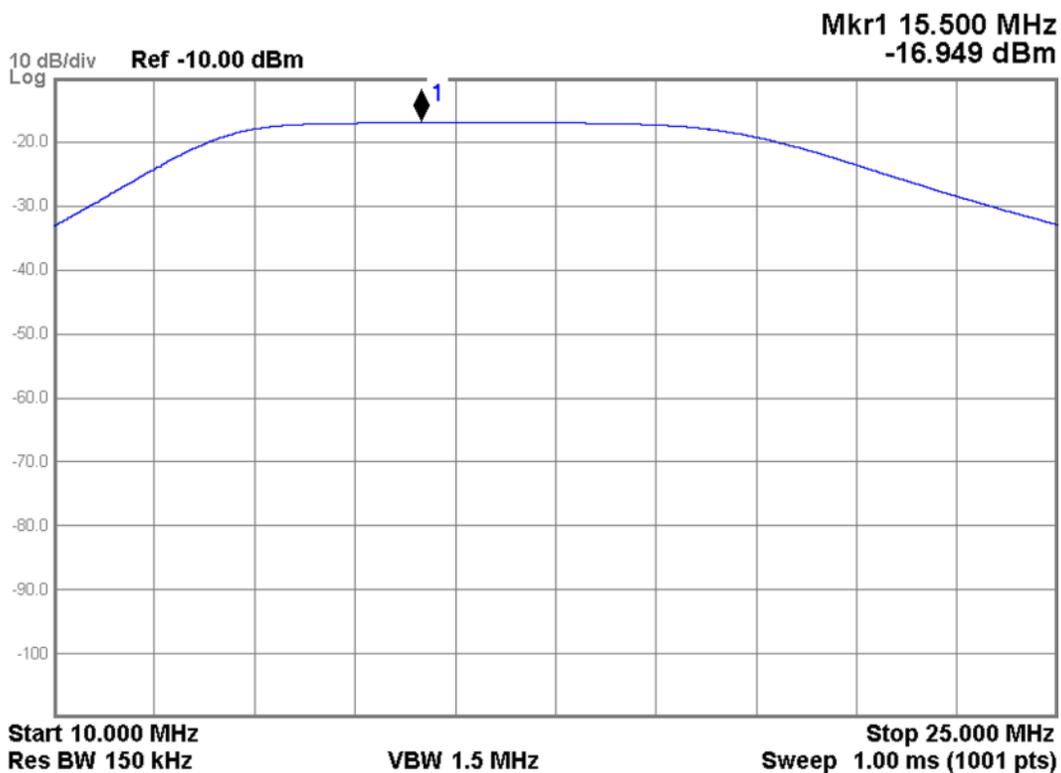
Figure 5-39   A24 Conducted Filter Assembly - Band 9 Filter Path
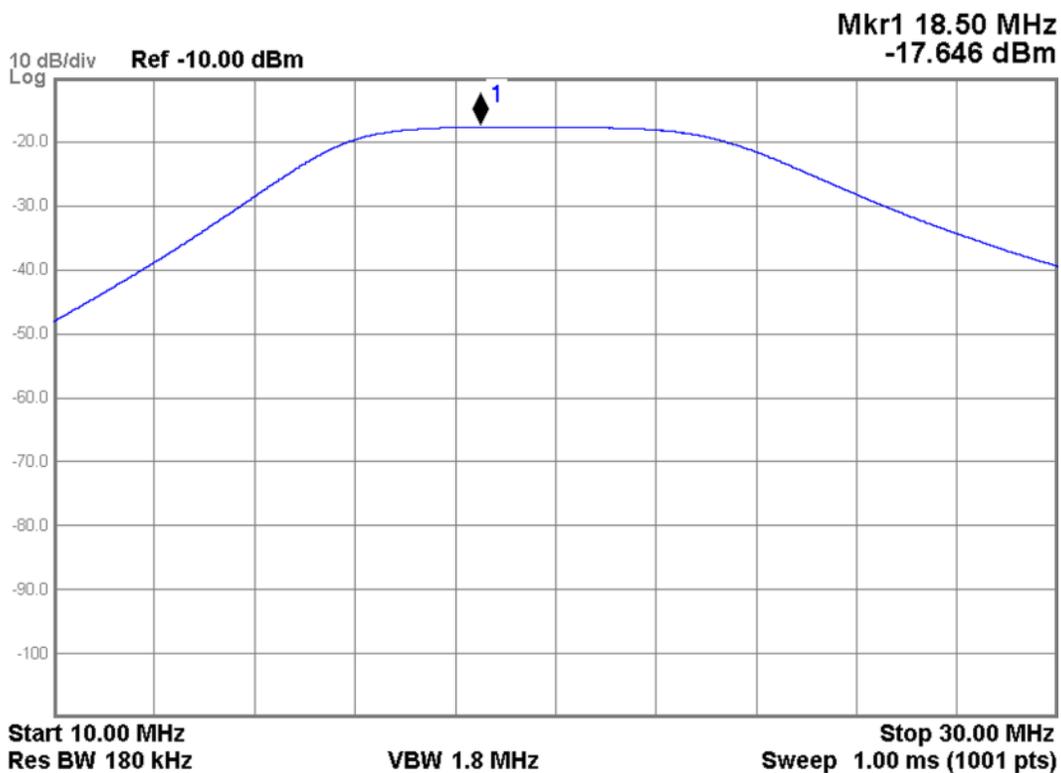
Figure 5-40   A24 Conducted Filter Assembly - Band 10 Filter Path
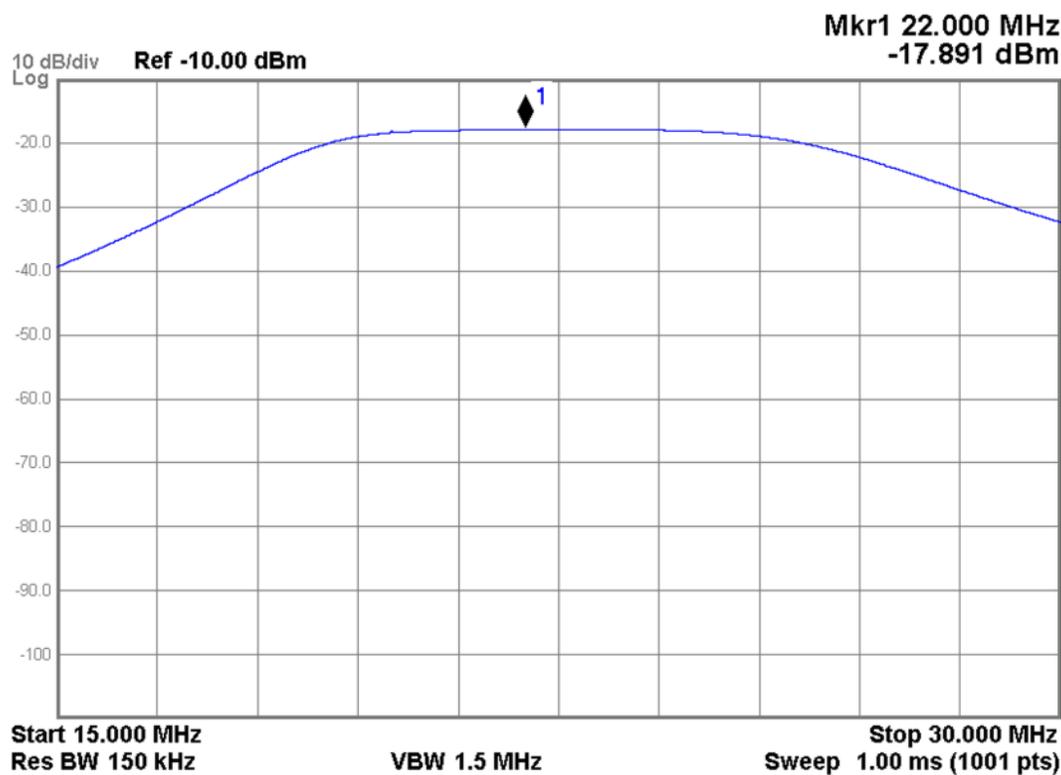
Figure 5-41   A24 Conducted Filter Assembly - Band 11 Filter Path
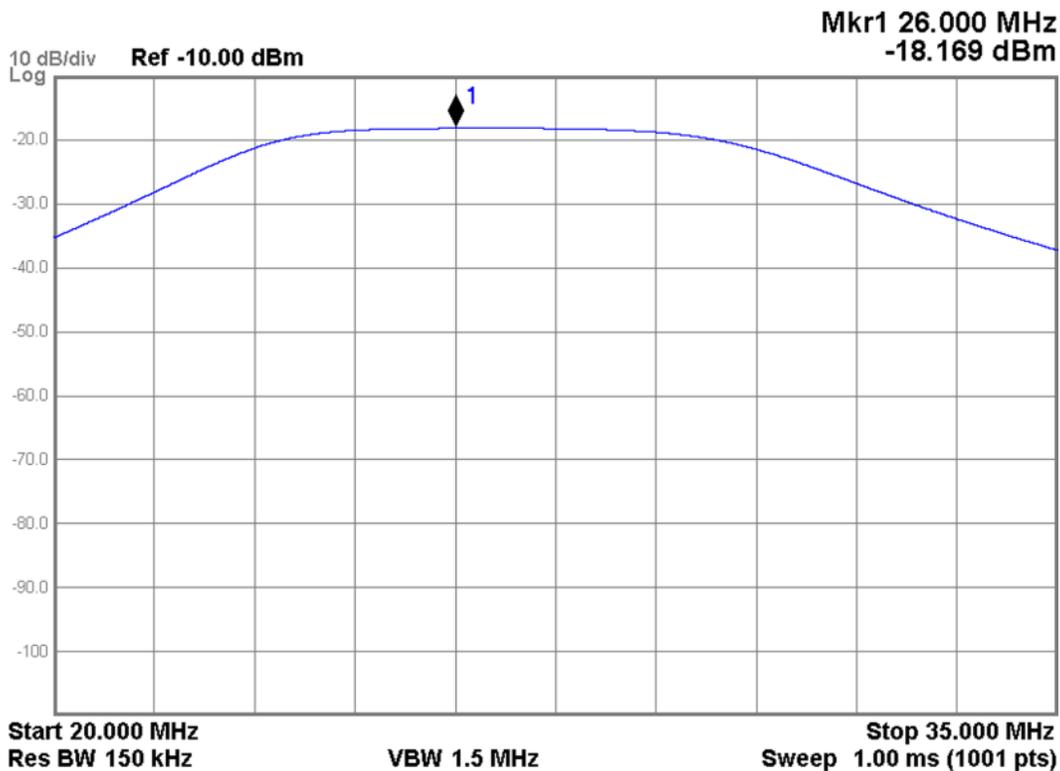
Figure 5-42   A24 Conducted Filter Assembly - Band 12 Filter Path
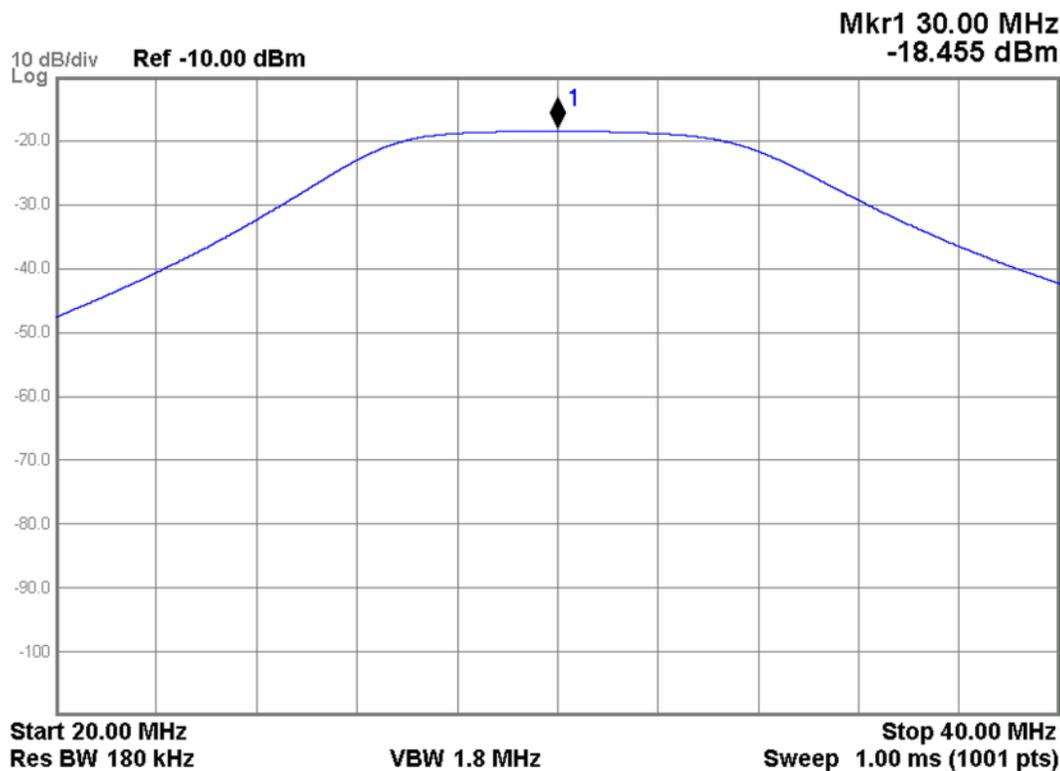
Figure 5-43   A24 Conducted Filter Assembly - Band 0 Through Path
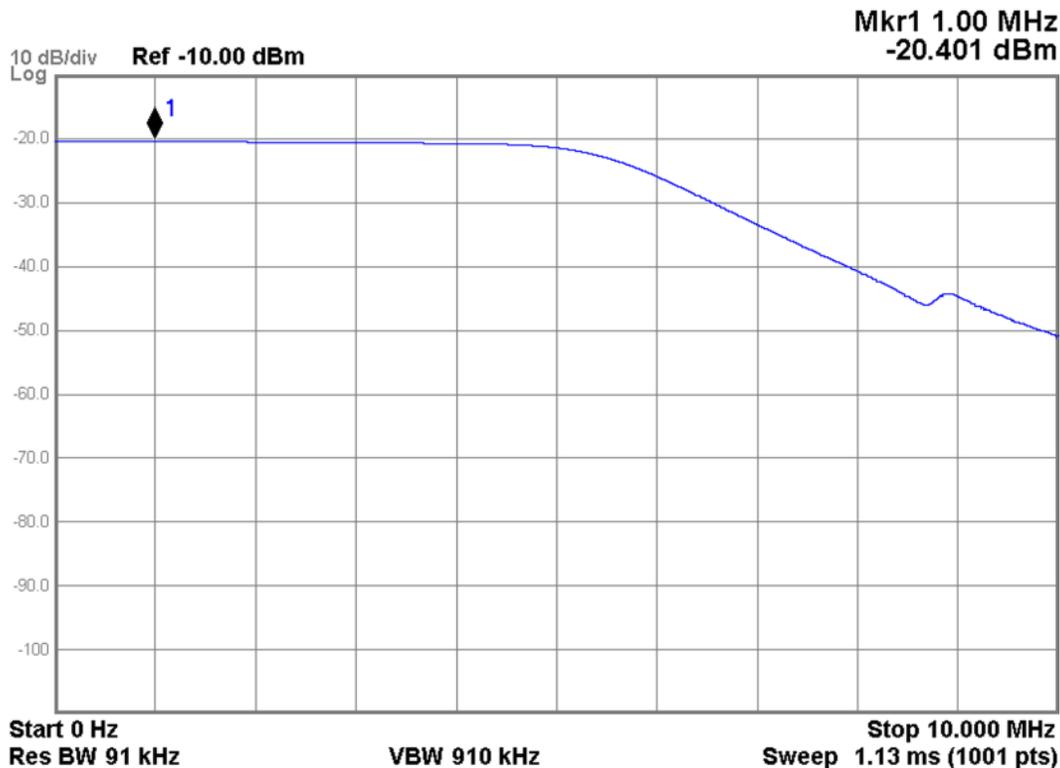
Figure 5-44   A24 Conducted Filter Assembly - Band 1 Through Path
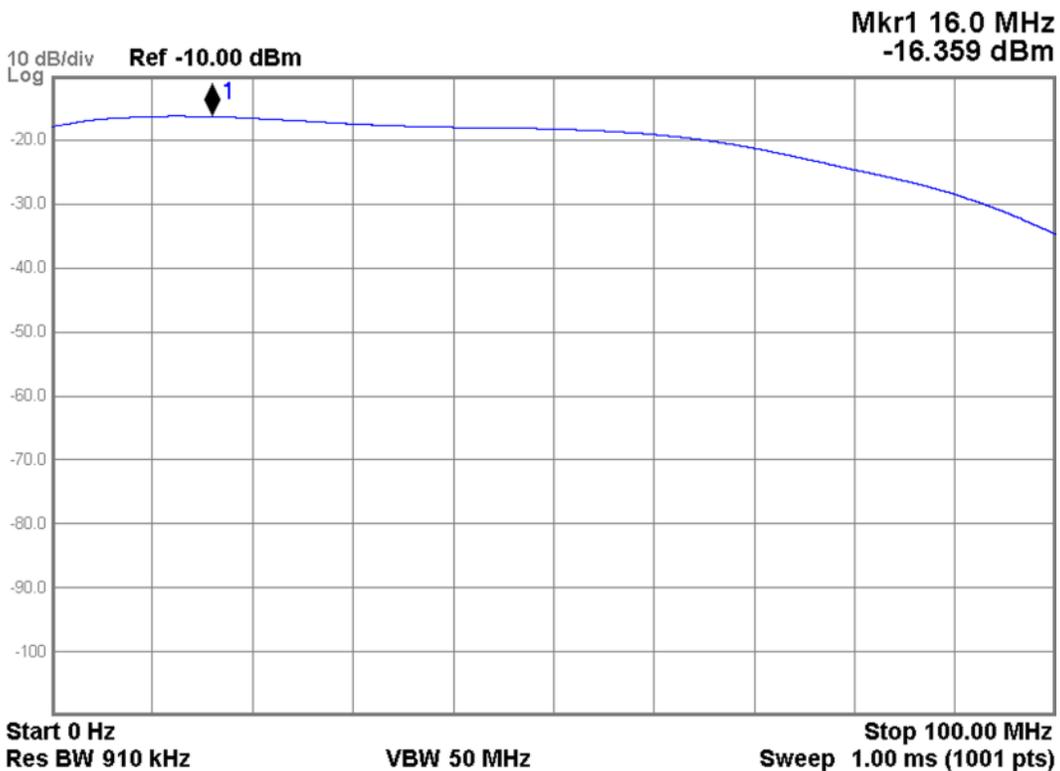
6   RF Downconverter Section

What You Will Find in This Chapter

The following information is found in this chapter:

1. **Theory of operation of the RF section.**
2. **Isolating the cause of an hardware problem by verifying the functionality of assemblies in the RF section signal path.**

NOTE   Each section describes how the assembly works and gives information to help you troubleshoot the assembly. Each description covers the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following descriptions are found in this chapter:

KEYSIGHT
TECHNOLOGIES

RF Downconverter Section Description

RF Section Purpose

The assemblies covered in this section are responsible for filtering and down-converting the full range of frequencies input to either of the instrument's front panel inputs to a 322.5 MHz intermediate frequency (IF) for further processing by the A2 Analog IF & A3 Digital IF assemblies.

There are three different frequency range options that can be ordered with the N9038A EMI Receiver.

— Option 503, 3.6 GHz Maximum Frequency
— Option 508, 8.4 GHz Maximum Frequency
— Option 526, 26.5 GHz Maximum Frequency
— Option 544, 44.0 GHz Maximum Frequency

There are multiple signal paths through the front end of the instrument. The number of different signal paths that an instrument uses will depend on the frequency range of the instrument. In addition to signal paths there are also different 1st LO mixing modes used within certain signal paths, resulting in multiple bands for each frequency range option. These bands are defined in Table 6-1 below.

Table 6-1   RF Downconverter Band Frequency Ranges

Band	Frequency Range Option			
	503	**508**	**526**	**544**
0	20 Hz to 3.6 GHz	20 Hz to 3.6 GHz	20 Hz to 3.6 GHz	20 Hz to 3.6 GHz
1	n/a	3.5 GHz to 8.4 GHz	3.5 GHz to 8.4 GHz	3.5 GHz to 8.4 GHz
2	n/a	n/a	8.3 GHz to 13.6 GHz	8.3 GHz to 13.6 GHz
3	n/a	n/a	13.5 GHz to 17.1 GHz	13.5 GHz to 17.1 GHz
4	n/a	n/a	17.0 GHz to 26.5 GHz	17.0 GHz to 26.5 GHz
5	n/a	n/a	n/a	26.4 GHz to 34.5 GHz
6	n/a	n/a	n/a	34.4 GHz to 44.0 GHz

The RF section is designed to convert all input signals to an intermediate frequency of 322.5 MHz. The components of the RF section discussed in this chapter are:

— A11 RF Switch / High Band Preamp
— A12 YTF Preselector
— A13 RF Front End Assembly

While all of these assemblies are used for all of the different frequency range options, the Option 544 instruments use a different part number assembly than the Option 503, 508, and 526 instruments for each.

RF Section Signal Paths

NOTE   Refer to Chapter 15, "Block Diagrams."

Band 0 Signal Path - Input Frequencies ≤ 3.6 GHz (Option 503, 508, 526, 544)

RF input frequencies ≤ 3.6 GHz route through the low band path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument by either of the two front panel input connectors is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly where it is then directed to the A13 RF Front End assembly.

There are two different signal paths at the band 0 input of the A13 RF Front End assembly that the signal can be routed through, either through the low band preamp and then to the low band 1st mixer, or around it and directly to the mixer. The low band preamp has a gain of approximately 20 dB.

The RF input signal is then mixed with the 1st LO from the A14 LO Synthesizer assembly to generate a 1st IF of 5122.5 MHz.

$$\text{1st IF} = \text{RF} + \text{1st LO} = 5122.5 \text{ MHz}$$

Since the RF input signal is < 3600 MHz for band 0, the RF input signal is up-converted in the 1st mixer to the 1st IF. The 1st IF signal is then down-converted using the 4800 MHz 2nd LO generated on the A16 Reference assembly to generate a 2nd IF of 322.5 MHz.

$$\text{2nd IF} = \text{1st IF} - \text{2nd LO}$$

$$\text{2nd IF} = 5122.5 \text{ MHz} - 4800 \text{ MHz} = 322.5 \text{ MHz}$$

The 322.5 MHz 2nd IF output exits the A13 RF Front End assembly at J7.

Band 1 Signal Path - Input Frequencies from 3.5 to 8.4 GHz (Option 508, 526, 544)

RF input frequencies from 3.5 to 8.4 GHz go through the band 1 path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument through the RF input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the A13 RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the 1st LO from the A14 LO Synthesizer Assembly to a 1st IF of 322.5 MHz.

$$1st\ IF = 1st\ LO - RF = 322.5\ MHz$$

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

Band 2 Signal Path - Input Frequencies from 8.3 to 13.6 GHz (Option 526, 544)

RF input frequencies from 8.3 to 13.6 GHz go through the band 2 path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument through the RF Input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the A13 RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the 1st LO from the A14 LO Synthesizer assembly after it has been doubled in frequency on the A13 RF Front End assembly to generate a 1st IF of 322.5 MHz.

1st IF = 1st LO − RF = 322.5 MHz

In this case the input signal is mixed with 2 times the output frequency of the A14 LO Synthesizer assembly to generate the 322.5 MHz 1st IF.

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

Band 3 Signal Path - Input Frequencies from 13.5 to 17.1 GHz (Option 526, 544)

RF input frequencies from 13.5 to 17.1 GHz go through the band 3 path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument through the RF Input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the A13 RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the second harmonic of the 1st LO from the A14 LO Synthesizer assembly to generate a 1st IF of 322.5 MHz.

1st IF = (1st LO x 2) - RF = 322.5 MHz

In this case the input signal is mixed with 2 times the output frequency of the A14 LO Synthesizer assembly to generate the 322.5 MHz 1st IF.

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

Band 4 Signal Path - Input Frequencies from 17.0 to 26.5 GHz (Option 526, 544)

RF input frequencies from 17.0 to 26.5 GHz go through the band 4 path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument through the RF Input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it.

However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the A13 RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the second harmonic of the 1st LO from the A14 LO Synthesizer assembly after it has been doubled in frequency on the A13 RF Front End assembly to generate a 1st IF of 322.5 MHz.

$$\text{1st IF} = (\text{1st LO} \times 2) - \text{RF} = 322.5 \text{ MHz}$$

In this case the input signal is mixed with 4 times the output frequency of the A14 LO Synthesizer assembly to generate the 322.5 MHz 1st IF.

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

Band 5 Signal Path – Input Frequencies from 26.4 to 34.5 GHz (Option 544)

RF input frequencies from 26.4 to 34.5 GHz go through the band 5 path. Refer to **Chapter 15, "Block Diagrams."** for details.

The RF input signal entering the instrument through the RF Input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the second harmonic of the 1st LO from the A14 LO Synthesizer assembly after it has been doubled in frequency on the A13 RF Front End assembly to generate a 1st IF of 322.5 MHz.

$$\text{1st IF} = (\text{1st LO} \times 2) - \text{RF} = 322.5 \text{ MHz}$$

In this case the input signal is mixed with 4 times the output frequency of the A14 LO Synthesizer assembly to generate the 322.5 MHz 1st IF.

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

Band 6 Signal Path – Input Frequencies from 34.4 to 44.0 GHz (Option 544)

RF input frequencies from 34.4 to 44.0 GHz go through the band 6 path. Refer to Chapter 15, "Block Diagrams." for details.

The RF input signal entering the instrument through the RF Input connector is routed through both of the instrument's input attenuators (A9 & A10). The signal is then routed through the SW2 Transfer switch, where it could either be directed through the RF Preselector section of the instrument or bypass it. However, Since the RF Preselector only operates up to 3.6 GHz, frequencies in this range will always be bypassed. The output of the transfer switch is then routed to the A11 RF Switch / High Band Preamp assembly.

There are two different signal paths in the A11 RF Switch / High Band Preamp that the signal can be routed through, either through the high band preamp or around it. The high band preamp has a gain of approximately +30 dB. The signal is then routed to the A12 YTF Preselector.

After passing through the A12 YTF Preselector the signal is then routed to the A13 RF Front End assembly. The input switch in the A13 RF Front End assembly routes the RF input signal to the correct 1st mixer for the current tuned frequency.

The RF input signal is then mixed with the fourth harmonic of the 1st LO from the A14 LO Synthesizer assembly after it has been doubled in frequency on the A13 RF Front End assembly to generate a 1st IF of 322.5 MHz.

$$1st\ IF = (1st\ LO \times 4) - RF = 322.5\ MHz$$

In this case the input signal is mixed with 8 times the output frequency of the A14 LO Synthesizer assembly to generate the 322.5 MHz 1st IF.

The 322.5 MHz 1st IF output exits the A13 RF Front End assembly at J7.

RF Section Assembly Descriptions

A11 RF Switch / High Band Preamp

This assembly has 3 main functions:

— Switch RF input frequencies from 20 Hz to 3.59 GHz directly to the low band input of the A13 RF Front End assembly.

— Switch RF input frequencies from 3.6 GHz and above to the A12 YTF Preselector before it goes to the high band input of the A13 RF Front End assembly.

— High band preamplifier, which has a typical gain of +30 dB and a noise figure of approximately 9 dB up to 18 GHz, 12 dB up to 30 GHz, and 15 dB up to 44 GHz.

Control for this assembly comes from the A15 Front End Controller assembly.

There are two different A11 RF Switch / High Band Preamp assemblies used in the N9038A – one for instruments with Option 503, 508, or 526 and one for instruments with Option 544.

The connections to and from the A11 RF Switch / High Band Preamp Control assembly are as listed in Table 6-2 and as illustrated in Figure 6-1 and Figure 6-2.

Table 6-2   A11 RF Switch / High Band Preamp Assembly Signals

Port	Description	To/From	Cable	Frequency
J1	Input	SW2 Transfer Switch P4	W37	20 Hz to Max Instrument Freq
J2	Low Band Output	A13 RF Front End J2	W38	20 Hz to 3.6 GHz
J3	High Band Output	A12 YTF Preselector Input	W39	3.6 GHz to Max Instrument Freq
J4	Bias & Control	A15 Front End Controller J700	W4	N/A

Figure 6-1   A11 RF Switch / High Band Preamp Assembly Connections -
                      Option 503, 508, & 526
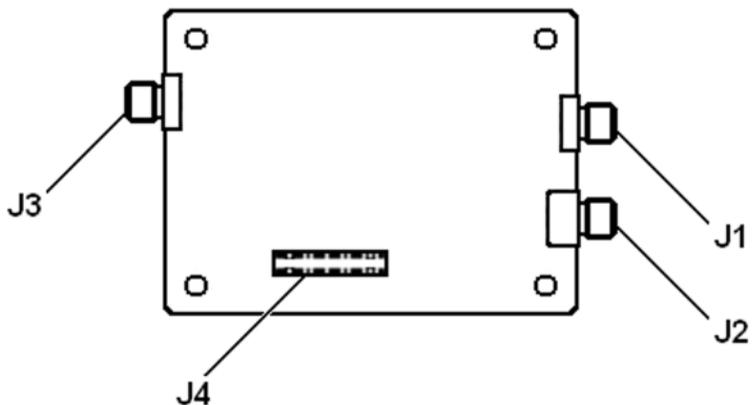
Figure 6-2   A11 RF Switch / High Band Preamp Assembly Connections - Option 544
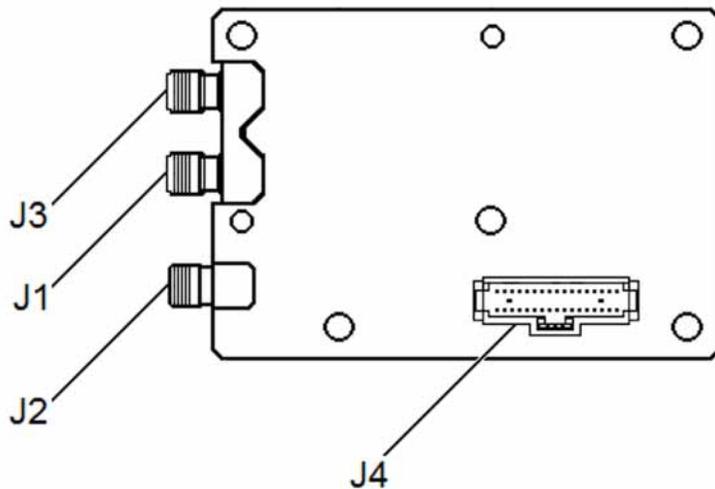
A12 YTF Preselector

The YTF Preselector is used for input frequencies of 3.6 GHz and higher. The YTF Preselector is a YIG tuned bandpass filter whose main purpose is to eliminate unwanted mixing products. When the YTF is properly aligned, the tunable bandpass filter will track the instrument's current input frequency. The YTF Preselector has a 3 dB bandwidth greater than 40 MHz and an insertion loss of approximately 6.5 dB.

Control for this assembly comes from the A15 Front End Controller assembly.

There are two different A12 YTF Preselector assemblies used in the N9038A – one for instruments with Option 503, 508, or 526 and one for instruments with Option 544.

The connections to and from the A12 YTF Preselector assembly are as listed in Table 6-3 and as illustrated in Figure 6-3 and Figure 6-4.

Table 6-3   A12 YTF Preselector Assembly Signals

Port	Description	To/From	Cable
Input	Input	A11 RF Switch / High Band Preamp J3	W39
Output	Output	A13 RF Front End J9	W40
J1	Bias & Control	A15 Front End Controller J300	W12

Figure 6-3   A12 YTF Preselector Assembly Connections - Option 503, 508, & 526
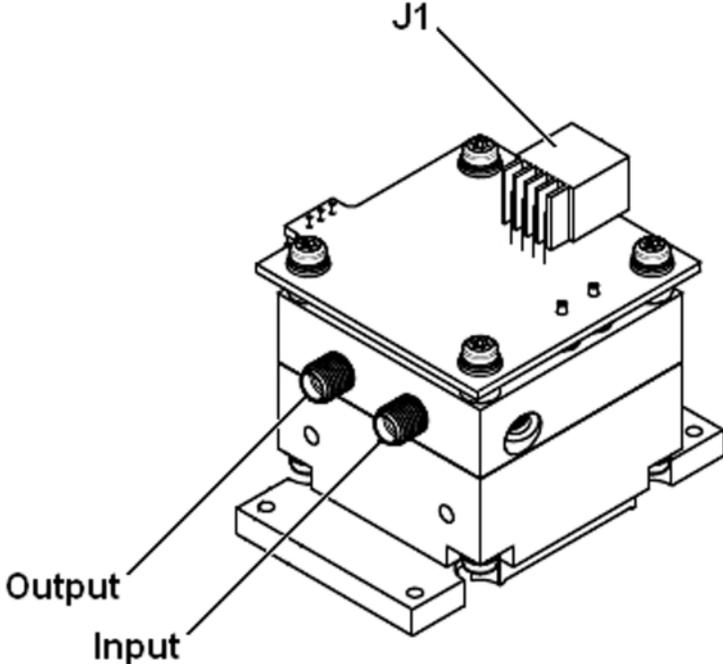
Figure 6-4   A12 YTF Preselector Assembly Connections - Option 544
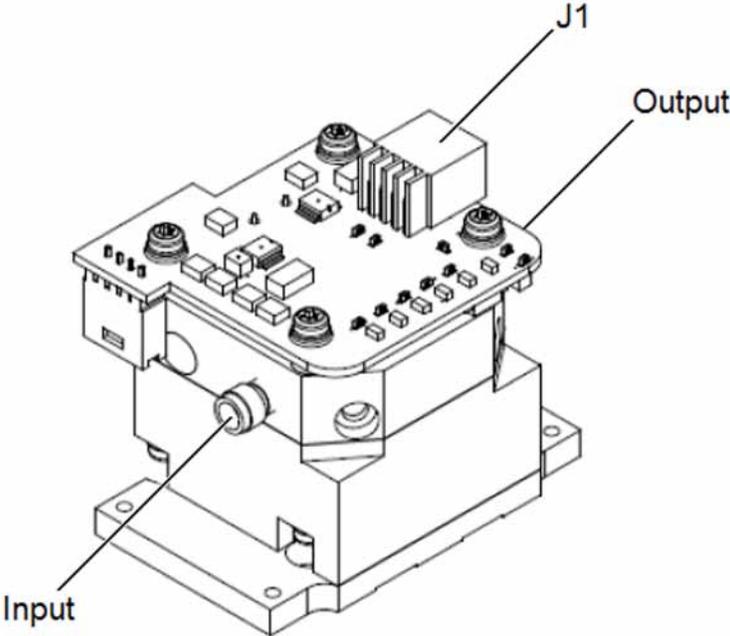
A13 RF Front End Assembly

This assembly contains the following circuits:

— 1st LO Distribution

  — Auxiliary outputs for possible future use

  — oFrequency doubler for certain mixing modes

— Low Band Path

  — 3.6 GHz low pass filter

  — Switchable preamplifier

  — 1st mixer

  — 1st IF amplifier

  — A13A1 1st IF 5122.5 MHz band pass filter

  — 2nd mixer

— High Band Path

  — Input amplifier

  — 1st mixers

— 322.5 MHz IF amplifier

Control for this assembly comes from the A15 Front End Controller assembly.

The connections to and from the A15 Front End Control assembly are as listed in Table 6-4 and Table 6-5 and as illustrated in Figure 6-5 and Figure 6-6.

Table 6-4   A13 Front End Assembly Signals - Option 503, 508, & 526

Port	Description	To/From	Cable	Frequency
J1	Low Band 2nd LO Input	A16 Reference J702	W42	4.8 GHz
J2	Low Band Input	A11 RF Switch J2	W38	20 Hz to 3.6 GHz
J3	Aux. LO Output	Terminated into 50 Ω	N/A	3.8 to 8.7 GHz
J4	1st LO Input	A14 LO Synthesizer J740	W44	3.8 to 8.7 GHz
J5	Aux. LO Output	Terminated into 50 Ω	N/A	3.8 to 8.7 GHz
J6	Calibrator Input	A16 Reference J705	W18	50 MHz
J7	IF Output	A15 Front End Control J902	W14	322.5 MHz
	Serial Prefix < MY/SG5322	A2 Analog IF J100	W16	322.5 MHz
J8	EXT Mixer LO Output	Terminated into 50 Ω	N/A	3.8 to 14.0 GHz
J9	High Band Input	A12 YTF Output	W40	3.6 to 26.5 GHz
J10	Low Band 1st IF Output	A13A1 BPF Input	A13W1	5122.5 MHz
J11	Low Band 1st IF Input	A13A1 BPF Output	A13W2	5122.5 MHz
J12	Bias & Control	A15 Front End Controller J102	W5	n/a
	Serial Prefix < MY/SG5322	A15 Front End Controller J104	W5	n/a
J13	Ext. IF Output	no used	n/a	n/a

Figure 6-5   A13 Front End Assembly Connections - Option 503, 508, & 526
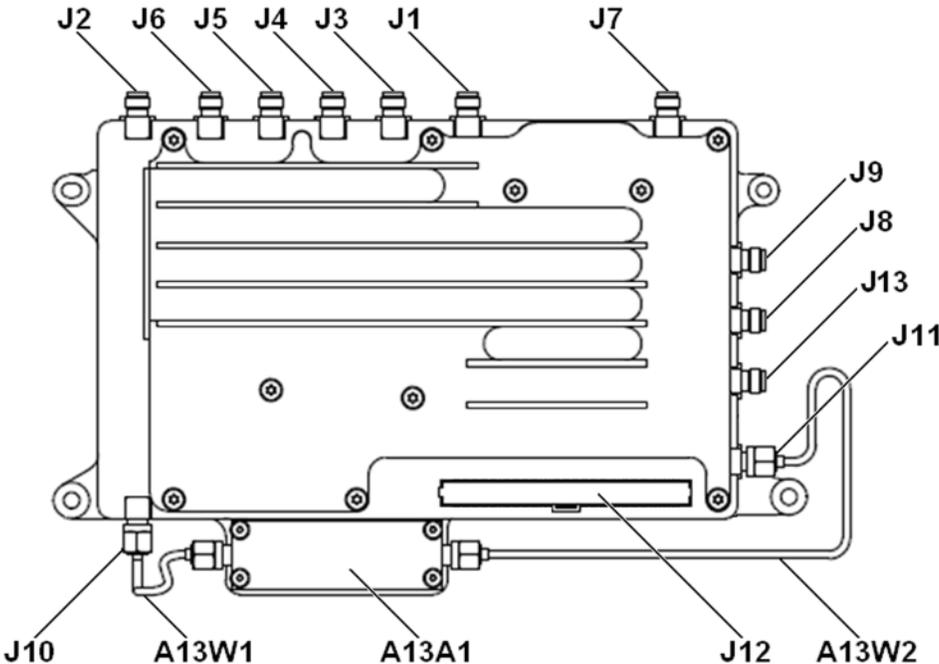
Table 6-5   A13 Front End Assembly Signals - Option 544

Port	Description	To/From	Cable	Frequency
J1	Low Band 2nd LO Input	A16 Reference J702	W42	4.8 GHz
J2	Low Band Input	A11 RF Switch J2	W38	20 Hz to 3.6 GHz
J3	Aux. LO Output	Terminated into 50 Ω	N/A	3.8 to 8.7 GHz
J4	1st LO Input	A14 LO Synthesizer J740	W44	3.8 to 8.7 GHz
J5	Aux. LO Output	Terminated into 50 Ω	N/A	3.8 to 8.7 GHz
J6	Calibrator Input	A16 Reference J705	W18	50 MHz
J7	IF Output	A15 Front End Control J902	W14	322.5 MHz
J8	EXT Mixer LO Output	Terminated into 50 Ω	N/A	3.8 to 17.5 GHz
J9	High Band Input	A12 YTF Output	W40	3.6 to 44.0 GHz
J10	Low Band 1st IF Output	A13A1 BPF Input	A13W1	5122.5 MHz
J11	Low Band 1st IF Input	A13A1 BPF Output	A13W2	5122.5 MHz
J12	Bias & Control	A15 Front End Control J102	W5	N/A
J13	External IF Output	Terminated into 50 Ω	N/A	N/A

Figure 6-6   A13 Front End Assembly Connections - Option 544
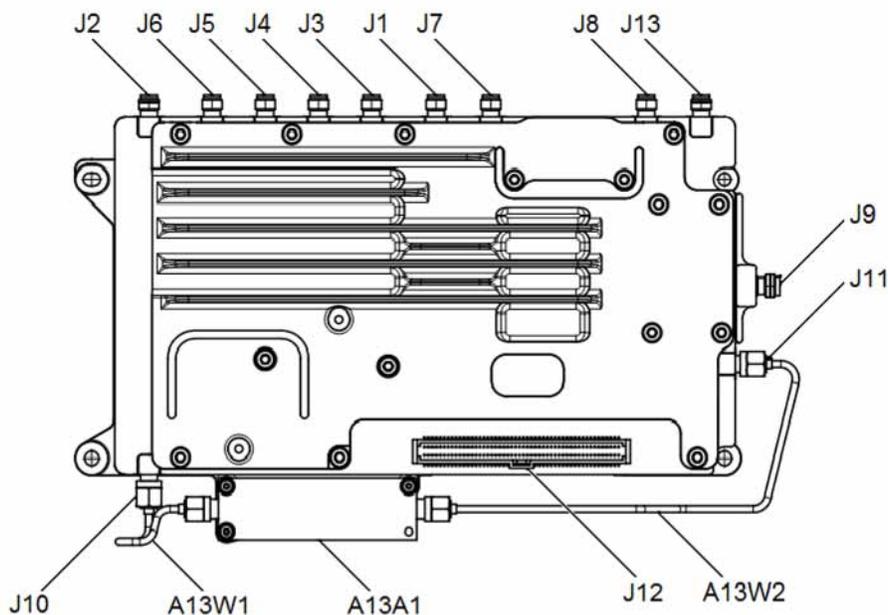
RF Downconverter Section Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams.".

There are three assemblies that are contained in what is considered the RF Section of this instrument, and this section will describe how to verify the performance of each of these. These assemblies are:

— A11 RF Switch / High Band Preamp

— A12 YTF Preselector

— A13 RF Front End Assembly

A11 RF Switch / High Band Preamp

There are two different A11 RF Switch / High Band Preamp assemblies used in the N9038A – one for instruments with Option 503, 508, or 526 and one for instruments with Option 544.

There are 4 different aspects of the A11 RF Switch / High Band Preamp assembly functionality that can be verified with the procedures in this section. They are:

1. Assembly Initialization

2. Low Band Signal Path

3. High Band Thru Signal Path

4. High Band Preamp Signal Path

Assembly Initialization

Before the A11 RF Switch / High Band Preamp assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. To verify that this has happened look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A11 RF Switch / High Band Preamp assembly should identify itself on this list as **Low Band Switch**. If this assembly does not identify itself the cause for this will need to be determined

before any other troubleshooting is performed. The most probable causes for this type of a problem would be that the A11 RF Switch / High Band Preamp assembly itself is defective.

NOTE

Since the instrument communicates with the A11 RF Switch / High Band Preamp assembly through the A15 Front End Control assembly, be sure that the A15 Front End Control assembly is initializing properly before replacing an A11 RF Switch / High Band Switch assembly for not initializing properly.

Signal Path Verification

There are three different signal paths through the A11 RF Switch / High Band Preamp, each of which will be verified in this section. The frequency range of each signal path and the expected signal loss or gain for each path is listed in Table 6-6 and Table 6-7.

Table 6-6   A11 RF Switch / High Band Preamp Signal Paths - Option 508 & 526

Signal Path	Frequency Range	Loss / Gain	
		Value	**Condition**
Low Band	20 Hz to 3.6 GHz	−1.2 dB	20 Hz to 2.5 GHz
		−1.4 dB	2.5 GHz to 3.6 GHz
High Band Thru[a]	3.6 GHz to 26.5 GHz	−8.0 dB	3.6 GHz to 22 GHz
		−12.0 dB	22 GHz to 26.5 GHz
High Band Preamp[a]	3.6 GHz to 26.5 GHz	+30.0 dB[b]	3.6 GHz to 26.5 GHz

a. Option 508 and 526 only
b. Relative to thru path

Table 6-7   A11 RF Switch / High Band Preamp Signal Paths - Option 544

Signal Path	Frequency Range	Loss / Gain	
		Value	**Condition**
Low Band	20 Hz to 3.6 GHz	−1.0 dB	20 Hz to 0.5 GHz
		−1.6 dB	0.5 GHz to 3.6 GHz
High Band Thru	3.6 GHz to 44.0 GHz	−7.0 dB	3.6 GHz to 15 GHz
		−5.0 dB	15 GHz to 35 GHz
		−7.0 dB	35 GHz to 44 GHz

Table 6-7   A11 RF Switch / High Band Preamp Signal Paths - Option 544

Signal Path	Frequency Range	Loss / Gain	
		Value	Condition
High Band Preamp	3.6 GHz to 44.0 GHz	+37.0 dB[a]	3.6 GHz to 15 GHz
		+34.0 dB[a]	15 GHz to 30 GHz
		+29.0 dB[a]	30 GHz to 44 GHz

a. Relative to thru path

Low Band Signal Path

1. Remove the instrument dress cover (MP24), top brace (MP10), and right side outer (MP5). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Refer to Figure 6-7 or Figure 6-8. Disconnect W38 from the A11 RF Switch / High Band Preamp assembly Output **(J2)**.

4. Referring to Figure 6-7 or Figure 6-8, remove W37 by disconnecting it from the A11 RF Switch / High Band Preamp assembly Input **(J1)** and the SW2 Output (P4).

5. Turn the instrument on and allow it to complete its boot up process.

Figure 6-7   A11 RF Switch / High Band Preamp Connections - Option 503, 508, & 526
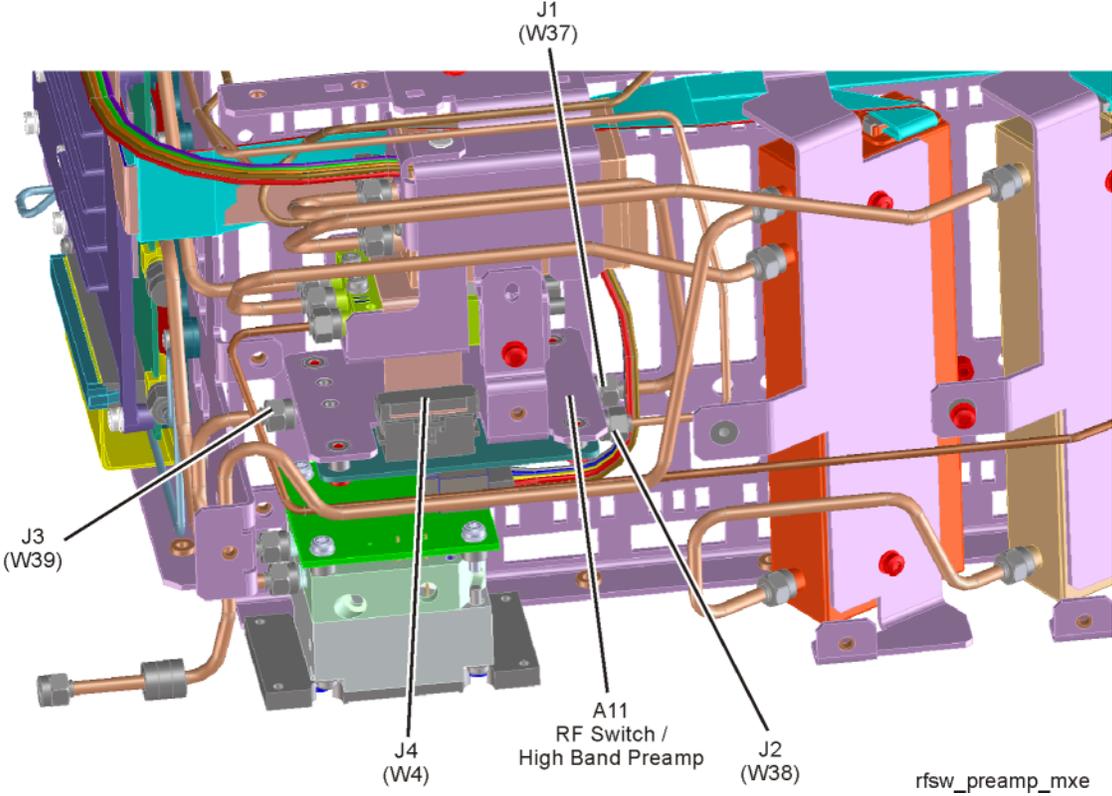
Figure 6-8   A11 RF Switch / High Band Preamp Connections - Option 544

rfsw_preamp_mxe544
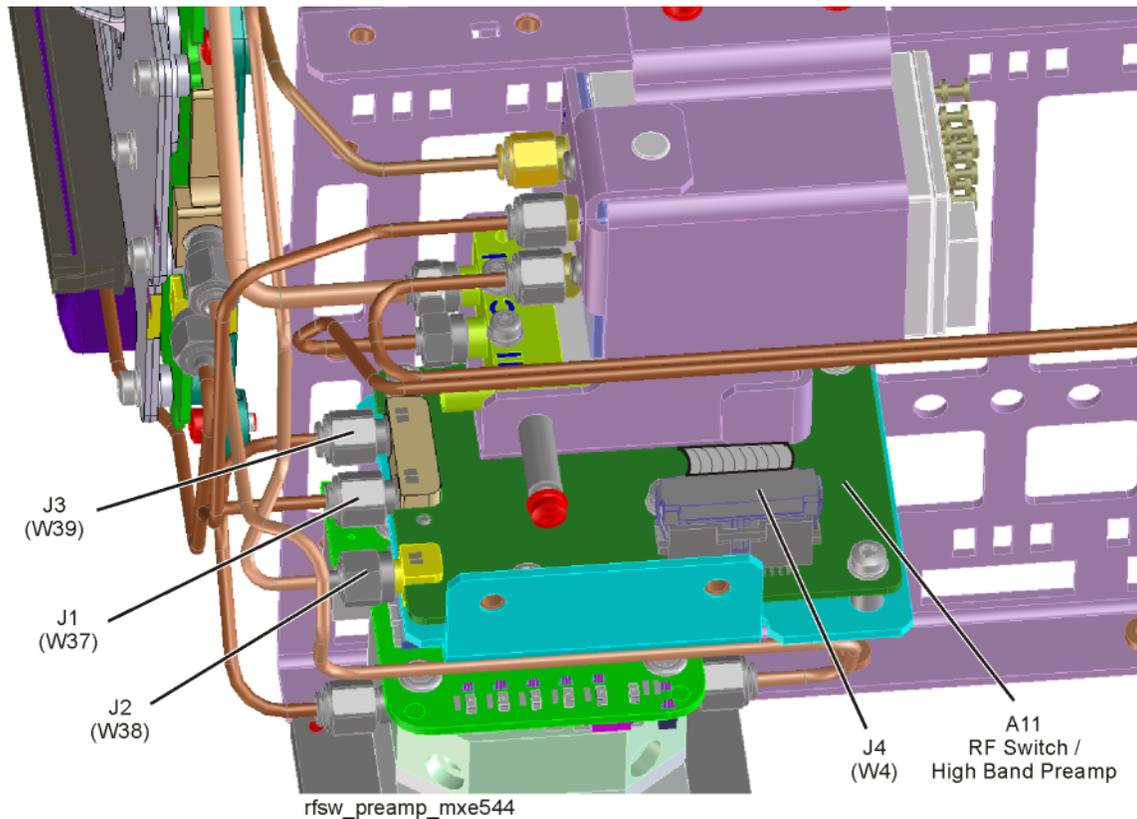
6. Connect a signal generator to the A11 RF switch / High Band Preamp assembly Input **(J1)**.

7. Tune the signal generator to 100 MHz with an amplitude of -20 dBm.

8. Connect a spectrum analyzer to the A11 RF switch / High Band Preamp assembly Low Band Output **(J2)**.

9. Tune the spectrum analyzer to 100 MHz with a span of 1 MHz.

10. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

11. Switch the A11 RF switch / High Band Preamp assembly to the low band signal path by pressing **FREQ**, **50 MHz** and **SPAN**, **Zero Span**.

12. Verify that the signal amplitude on the spectrum analyzer display is approximately what is expected, as outlined in Table 6-6 or Table 6-7, allowing for any additional test cable loss, as seen in Figure 6-9.

Figure 6-9   A11 RF Switch / High Band Preamp - Low Band Signal Path
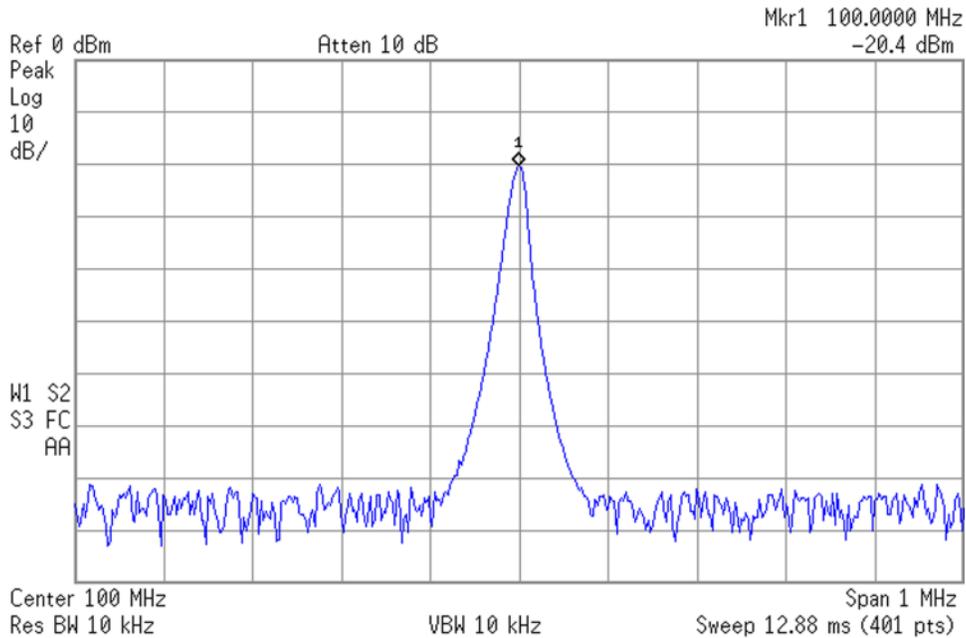
NOTE   The isolation from the input port to the low band output port of the A11 RF Switch / High Band Preamp when the input is switched to either of the high band paths is less than 20 dB. Because of this, if the signal path appears to be less than 20 dB too low it could be that the switch control lines from the A15 Front End Control assembly are at fault.

If the signal is:

– The correct level

> Proceed to the next step

– Lower than expected

> Switch the A11 RF Switch / High Band Preamp assembly to the high band signal path by pressing **FREQ**, **6 GHz**.

> If the signal level decreases further, the most probable cause is a bad A11 RF Switch / High Band Switch assembly.

> If the signal does not decrease any further, verify that the switch control lines from the A15 Front End Control assembly are working properly. Refer to Chapter 8, "Front End Control." for instructions on how to verify the control lines.

13. Tune the signal generator and spectrum analyzer to any other frequency up to 3.6 GHz and verify that the loss through the low band signal path remains within a few dB of the values outlined in Table 6-6 or Table 6-7.

14. If the low band signal path loss continues to be within the expected values, proceed to the High Band Thru Path verification.

High Band Thru Signal Path

15. Referring to Figure 6-7 or Figure 6-8, remove W39 by disconnecting it from the A11 RF Switch / High Band Preamp assembly high band output **(J3)** and the A12 YTF input port.

16. Tune the signal generator to 6 GHz with an amplitude of -20 dBm.

17. Connect a spectrum analyzer to the A11 RF switch / High Band Preamp assembly High Band Output **(J3)**.

18. Tune the spectrum analyzer to 6 GHz with a span of 1 MHz.

19. Switch the A11 RF Switch / High Band Preamp assembly to the high band signal path by pressing **FREQ**, **6 GHz**.

20. Verify that the signal amplitude on the spectrum analyzer display is approximately what is expected, as outlined in Table 6-6 or Table 6-7, allowing for any additional test cable loss, as seen in Figure 6-10.

Figure 6-10   A11 RF Switch / High Band Preamp - High Band Thru Signal Path
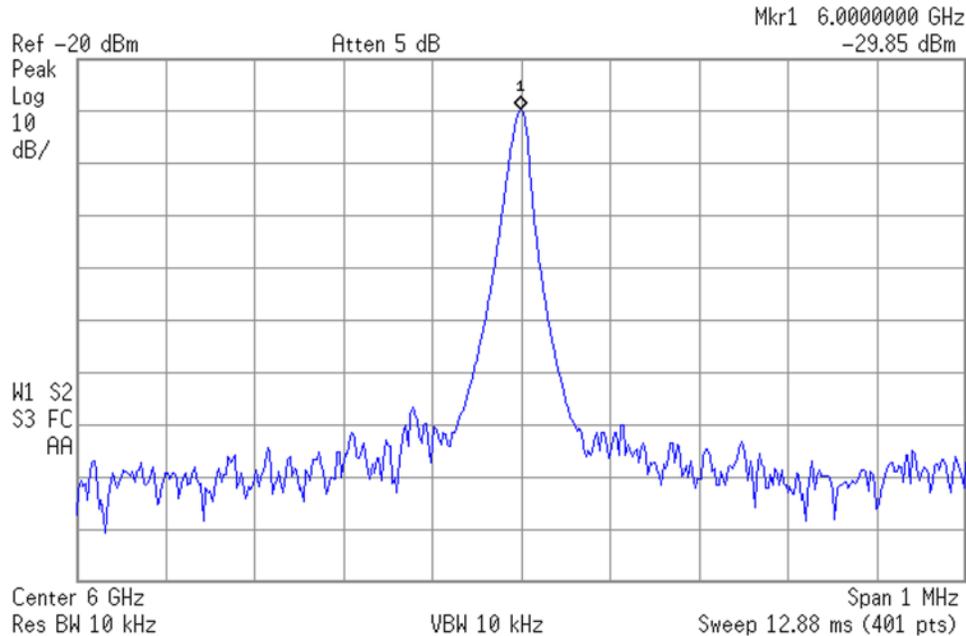
NOTE   The isolation from the input port to the high band output port of the A11 RF Switch / High Band Preamp when the input is switched to the low band path is less than 40 dB. Because of this, if the signal path appears to be less than 40 dB too low it could be that the switch control lines from the A15 Front End Control assembly are at fault.

If the signal is:

- The correct level

  Proceed to the next step

- Lower than expected

  Switch the A11 RF Switch / High Band Preamp assembly to the low band signal path by pressing **FREQ**, **50 MHz**.

  If the signal level decreases further, the most probable cause is a bad A11 RF Switch / High Band Switch assembly.

  If the signal does not decrease any further, verify that the switch control lines from the A15 Front End Control assembly are working properly. Refer to Chapter 8, "Front End Control." for instructions on how to verify the control lines.

21. Tune the signal generator and spectrum analyzer to any other frequency above 3.6 GHz and verify that the loss through the high band signal path remains within a few dB of the values outlined in Table 6-6 or Table 6-7.

22. If the high band thru signal path loss continues to be within the expected values, proceed to the High Band Preamp Path verification.

High Band Preamp Signal Path

23. Tune the signal generator to 6 GHz with an amplitude of –20 dBm.

24. Tune the spectrum analyzer to 6 GHz with a span of 1 MHz.

25. Switch the A11 RF Switch / High Band Preamp assembly to the high band signal path by pressing **FREQ**, **6 GHz**.

26. Verify that the signal amplitude on the spectrum analyzer display is approximately what is expected, as outlined in Table 6-6 or Table 6-7, allowing for any additional test cable loss, as seen in Figure 6-10.

27. Set the spectrum analyzer marker at the peak of the signal and then turn on its marker delta function.

28. Switch the A11 RF Switch / High Band Preamp assembly to the high band preamp signal path by pressing **AMPTD**, **More**, **Internal Preamp**, **Full Range**.

29. Verify that the signal amplitude increases by approximately what is expected, as outlined in Table 6-6 or Table 6-7, as shown in Figure 6-11.

Figure 6-11   A11 RF Switch / High Band Preamp - High Band Preamp Signal Path
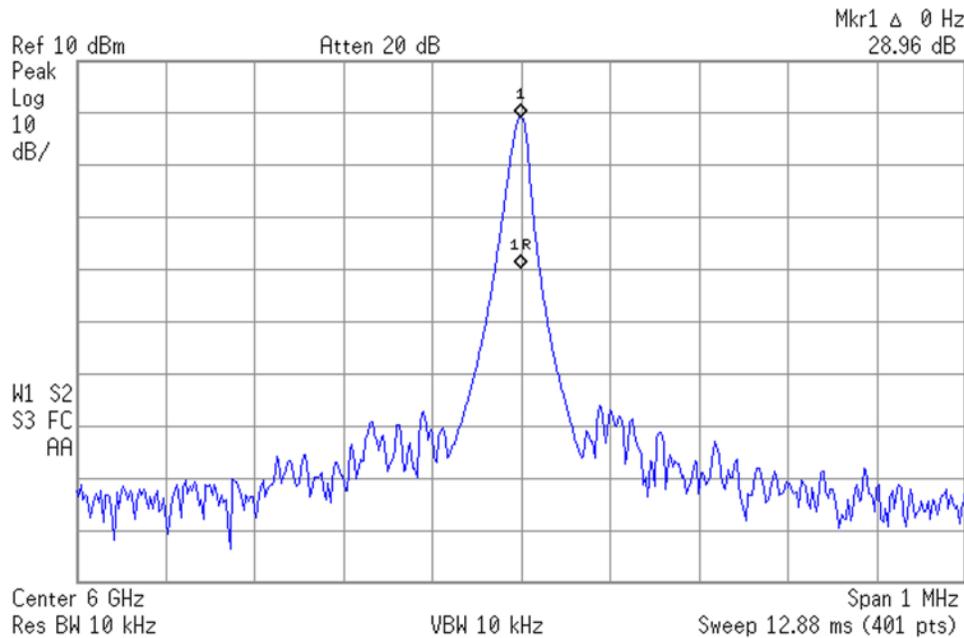
If the change in the signal level is:

— The correct level

Proceed to the next step

— Lower than expected

The most probable cause for the failure is a bad A11 RF Switch / High Band Switch

— There is no change

Verify that the switch control lines from the A15 Front End Control assembly are working properly. Refer to Chapter 8, "Front End Control." for instructions on how to verify the control lines.

30. Switch the A11 RF Switch / High Band Preamp assembly back to the high band thru signal path by pressing **AMPTD**, **More**, **Internal Preamp**, **Off**.

31. Tune the signal generator and spectrum analyzer to any other frequency above 3.6 GHz and repeat step 25 through step 29.

32. If the high band preamp signal path gain continues to be within the expected values, the A11 RF Switch / High Band Preamp is functioning properly.

33. Reconnect W37, W38, and W39 as shown in Figure 6-7 or Figure 6-8.

A12 YTF Preselector

There are two different A12 YTF Preselector assemblies used in the N9038A – one for instruments with Option 503, 508, or 526 and one for instruments with Option 544.

There are 7 different aspects of the A12 YTF Preselector functionality that can be verified with the procedures in this section. They are:

1. Assembly Initialization

2. Status LEDs

3. Supply Voltage

4. Tune Voltage

5. Passband Insertion Loss

6. Passband Filter Shape

7. Passband Centering

Due to a lack of access to certain A12 YTF Preselector test points in Option 544 instruments it is not possible to measure all of the control voltages on these instruments as can be done with the Option 503, 508, and 526 instruments. However, there are extra LEDs on the Option 544 instruments that can be monitored. Because of this not all procedures in this section apply to all instruments.

Assembly Initialization

Before the A12 YTF Preselector assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. To verify that this has happened look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A12 YTF Preselector assembly should identify itself on this list as **YIG Tuned Filter**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be that the A12 YTF Preselector assembly itself is defective, however, be sure to verify the supply voltage to the assembly before replacing it.

NOTE

Since the instrument communicates with the A12 YTF Preselector assembly through the A15 Front End Control assembly, be sure that the A15 Front End Control assembly is initializing properly before replacing an A12 YTF Preselector assembly for not initializing properly.

Instruments with Option 544 also have a series of status LEDs that can be monitored at instrument boot up to verify that the A12 YTF Preselector is initializing and working properly. Information on how to interpret these is covered in the following section.

Status LEDs - Option 544 Only

There is a series of status LEDs on the top of the A12 YTF Preselector assembly. These can be used to verify that the assembly has powered on correctly and what state it is in. Information on these status LEDs as well as what their state should be when an instrument is functioning properly is listed in Table 5-8 and their location on the A12 YTF Preselector assembly is shown in Figure 5-12.

Table 6-8

LED	Description	Normal Operation	During Boot Up
DS1	+3.3 V Regulated	On	On
DS2	EEROM Select	Off	On
DS3	Heater Control Select	On	Off
DS4	Temp Sensor Select	Off	Off
DS5	Heater On	Blinking	Off
DS6	Thermistor Select	Off	Off

Figure 6-12   A12 YTF Preselector Status LED Locations
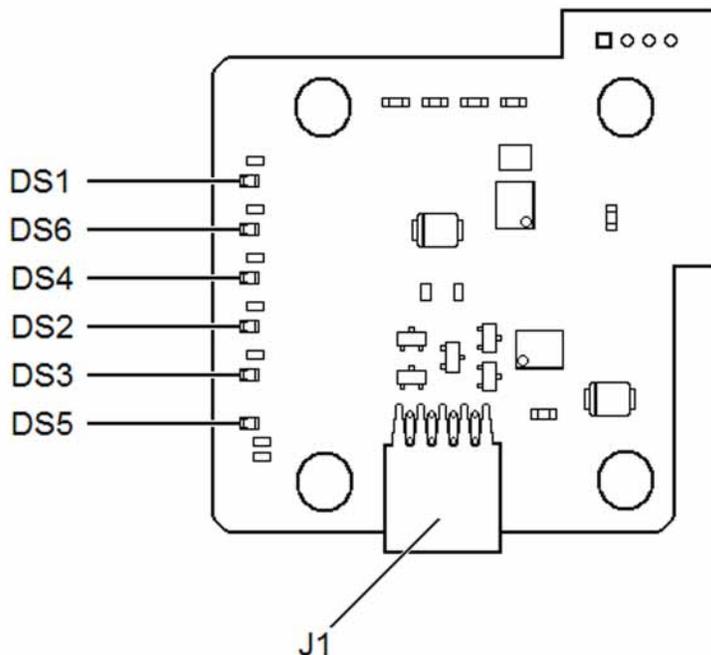
When the instrument is first turned on the only LEDs that should be on are DS1 and DS2. DS1 should be on whenever the instrument is turned on; as this indicates that the voltage regulator on the YTF is working. DS2 will remain on until the assembly has been initialized, which occurs during the time the instrument application initializes the hardware. After that, DS2 will turn off and DS3 will turn on. At the same time that DS3 turns on DS5 will start to blink. It

will blink whenever the heater is turned on, which will be more frequent for lower frequencies – when the current through the YTF main coil is lower. It will continue blinking even when the instrument is tuned below 3.6 GHz, where the YTF is not being used, so that it always remains warm.

Both DS4 and DS6 will turn on during the time that the instrument application initializes the hardware, but this will happen so fast that it may only be possible to see them change by measuring the voltage across them with an oscilloscope. They will also be turned on periodically as the instrument is running, but again for only a very brief period of time – tens of milliseconds.

Supply Voltage Verification

The A12 YTF Preselector can also have a problem initializing if the power supply voltage to it is not correct or if the voltage regulator on the assembly is faulty. To verify these voltages:

1. View the status of the LED DS1 on the A12 YTF Preselector assembly, as shown in Figure 6-12.

   If DS1 is on the +30 volt DC supply to the assembly as well as the +3.3 volt regulator are both fine.

   If DS1 is not on and the instrument has either Option 508 or 526 proceed to Step 2. Otherwise, the cause for the low voltage level will need to be determined. While this could be caused by a faulty voltage regulator on the A12 YTF Preselector itself or by a faulty W4 YTF Control cable, it could also be a problem with the A15 Front End Control assembly or the A6 Power Supply assembly. See the associated chapters in this manual to verify the functionality of these two other assemblies.

2. (Option 503, 508, or 526 Only) Using a volt meter, check the status of the +30 volt supply voltage to the A12 YTF Preselector assembly by measuring from J3 to chassis ground, as shown in Figure 6-13.

   If the voltage is between +28 and +32 volts yet DS1 is not on the most probable cause for the failure is the A12 YTF Preselector.

   If the voltage is less than +28 volts the A12 YTF Preselector is most likely not the source of the failure, the cause for the low voltage level will need to be determined, which will most likely be caused by either the A6 Power Supply assembly or the A15 Front End Control assembly.

Figure 6-13   A12 YTF Preselector Connector Locations - Option 503, 508, & 526
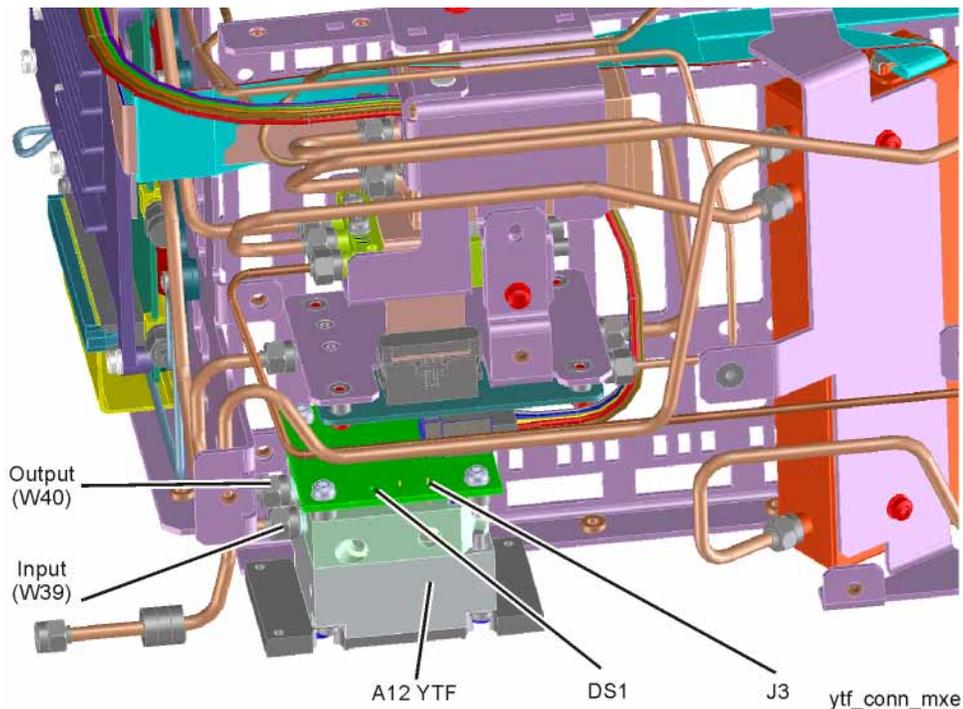
Figure 6-14   A12 YTF Preselector Connector Locations - Option 544
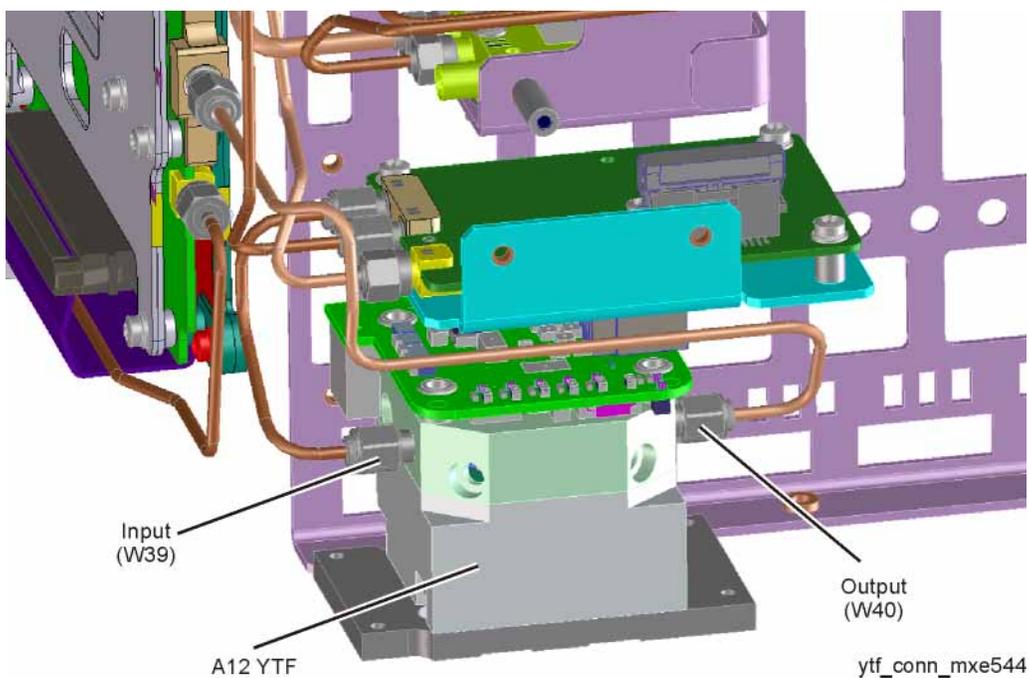
Tune Voltage Verification – Option 508 & 526 Only

The A12 YTF Preselector assembly receives its tune current from the A15 Front End Control assembly. The controller provides a constant +30 volt DC supply as a reference to the main tuning coil and a variable tune voltage. By measuring these voltages the coarse tuning provided to the A12 YTF Preselector can be verified. The following procedure will outline how to do this, while also verifying that the filter is tuned to the test frequencies.

1. Remove the instrument dress cover (MP24), top brace (MP10), and right side outer (MP5). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 6-13, remove W39 by disconnecting it from the A11 RF Switch / High Band Preamp assembly Output (J3) and the A12 YTF Preselector assembly Input.

4. Referring to Figure 6-13, remove W40 by disconnecting it from the A12 YTF Preselector assembly Output and the A13 RF Front End assembly Input (J9).

5. Turn the instrument on and allow it to complete its boot up process.

6. Referring to Figure 6-15, use a volt meter to measure the +30 volt DC reference on pin 2 of J2 on the A12 YTF Preselector control board (this voltage is referenced to chassis ground). If this voltage is not +30 volts ±0.5 there is most likely a problem with the A15 Front End Control assembly. See Chapter 8, "Front End Control." to determine the cause of this failure.

Figure 6-15   A12 YTF Preselector Control Board
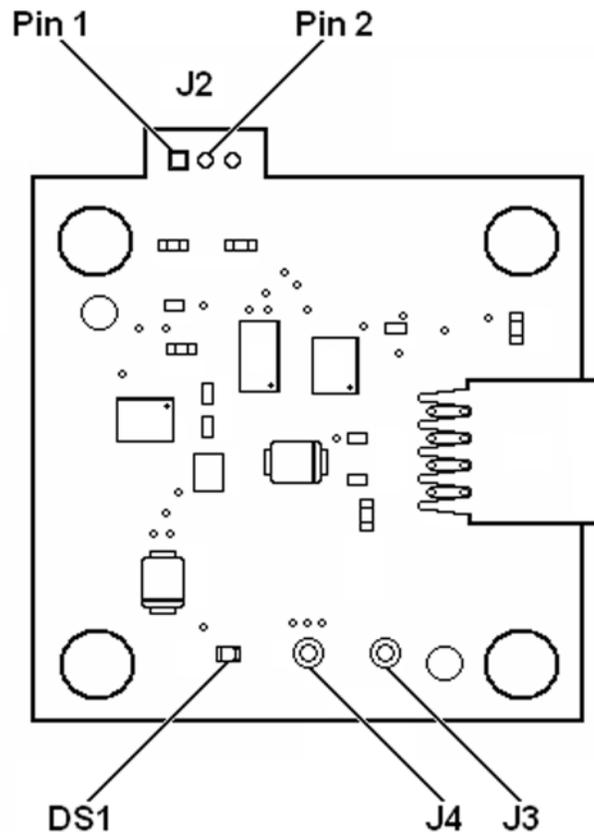
7. Connect a signal generator to the A12 YTF Preselector assembly Input, using a cable rated for high frequency operation.

8. Tune the signal generator to 3.65 GHz with an amplitude of -10 dBm.

9. Connect a spectrum analyzer to the A12 YTF Preselector assembly Output, using a cable rated for high frequency operation.

10. Tune the spectrum analyzer to 3.65 GHz with a span of 100 MHz.

11. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

12. Tune the instrument to 3.65 GHz with a span of 0 Hz by pressing **FREQ**, **3.65 GHz** and **SPAN**, **Zero Span**.

13. Verify that there is a signal at the center of the spectrum analyzer display. The exact level is not important at this point, but it should be greater than -20 dBm, accounting for the loss of the cables being used.

14. Referring to Figure 6-15, use a volt meter to measure the DC voltage on pin 1 of J2 on the A12 YTF Preselector control board (this voltage is referenced to chassis ground).

15. Verify that the control voltage measured roughly equals that expected in Table 6-9 for the current tune frequency.

Table 6-9   A12 YTF Tune Frequency versus Control Voltage

Tune Frequency	Expected Control Voltage at J2 Pin 1 (DC)	Voltage Across YTF Tune Coil (Reference - Control) (DC)
3.65 GHz	+29.6 Volts	0.4 Volts
10 GHz	+25.2 Volts	4.8 Volts
15 GHz	+21.7 Volts	8.3 Volts
20 GHz	+18.1 Volts	11.9 Volts
26.5 GHz	+13.3 Volts	16.7 Volts

NOTE

The exact voltages measured are not expected to match what is listed in Table 6-9 with any given tolerance. This is due to the fact that these voltages will vary to some degree between A12 YTF Preselector assemblies. What needs to be looked for is a trend of the tune voltage and that the increase from one tune frequency to the next follows a relatively linear progression.

16. If the tune voltage increases with frequency similar to what is shown in Table 6-9 yet the filter is not tuning properly than the most likely cause of the failure is the A12 YTF Preselector assembly.

17. If the tune voltage is not increasing in frequency similar to what is shown in Table 6-9 the drive circuitry to the A12 YTF Preselector assembly needs to be verified. See Chapter 8, "Front End Control." to determine the cause of this failure.

Signal Path Verification

There are three different aspects of the A12 YTF Preselector performance that needs to be considered and verified. They are:

— Passband Insertion Loss

— Passband Filter Shape

— Passband Centering

A failure of the A12 YTF Preselector, causing excessive signal path loss, could be caused by any one of the three aspects mentioned. While a failure due to either excessive passband insertion loss or a distorted passband filter shape may require the replacement of the assembly, a problem with the passband centering will most often be solved by running an instrument level adjustment.

NOTE   If there is a particular frequency of interest use that instead of the 6 GHz used in this example

1. Remove the instrument dress cover (MP24), top brace (MP10), and right side outer (MP5). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 6-13 or Figure 6-14, remove W39 by disconnecting it from the A11 RF Switch / High Band Preamp assembly **Output (J3)** and the A12 YTF Preselector assembly Input.

4. Referring to Figure 6-13 or Figure 6-14, remove W40 by disconnecting it from the A12 YTF Preselector assembly Output and the A13 RF Front End assembly **Input (J9)**.

5. Turn the instrument on and allow it to complete its boot up process.

6. Connect a signal generator to the A12 YTF Preselector assembly Input, using a cable rated for high frequency operation.

7. Tune the signal generator to 6 GHz with an amplitude of -10 dBm.

8. Connect a spectrum analyzer to the A12 YTF Preselector assembly Output, using a cable rated for high frequency operation.

9. Tune the spectrum analyzer to 6 GHz with a span of 100 MHz.

10. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

11. Tune the instrument to 6 GHz with a span of 0 Hz by pressing **FREQ**, **6 GHz** and **SPAN**, **Zero Span**.

Passband Insertion Loss

The insertion loss of the A12 YTF Preselector assembly at this frequency, with the current filter tuning, can now be determined by calculating the difference of what is read from the spectrum analyzer display and the –10 dBm signal level being output by the signal generator (be sure to also account for the test cable loss as well, which can be significant at the frequencies that this assembly operates at).

The passband insertion loss of the A12 YTF Preselector itself should not be greater than 10 dB, when properly tuned.

If the passband insertion loss is greater than expected, the cause for this will need to be determined. It could be due to a greater loss than normal, distorted passband filter shape, or incorrect passband centering.

Passband Filter Shape

12. Set the amplitude scale per division setting on the spectrum analyzer to 3 dB.

13. Turn on trace 2 of the spectrum analyzer and set it to use the Maxhold function.

14. Slowly vary the frequency of the signal generator between 5.95 GHz and 6.05 GHz until the spectrum analyzer display looks like that of Figure 6-16.

Figure 6-16   A12 YTF Preselector Passband Filter Shape
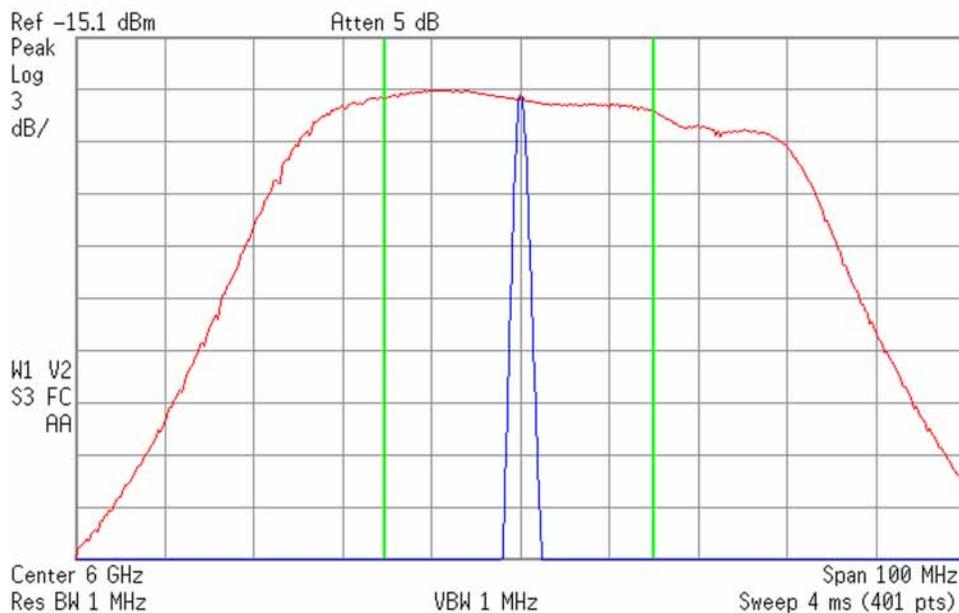
The passband filter shape should have no more than 3 dB of peak-to-peak variation within ±15 MHz of the tuned frequency.

If the peak-to-peak variation within the ±15 MHz area is greater than expected, but the filter passband is not centered in the display, causing the variation to be greater than expected, the passband centering will need to be adjusted. See Chapter 19, "Post-Repair Procedures." for instructions on how this is done.

If the peak-to-peak variation within the ±15 MHz area is greater than expected, and the filter passband is centered in the display, the A12 YTF Preselector will need to be replaced.

Passband Centering

If the passband centering is not aligned properly it can be manually tuned ±500 MHz, which will help to verify that an adjustment of the filter centering will correct the alignment. This can be done by pressing **AMPTD**, **Presel Adjust** and entering either a positive or negative number to adjust the passband centering by. Once an adjustment of this value is made step 14 can be repeated to display the change in the passband centering. However, any changes made with this manual adjustment will not persist; it will go back to 0 Hz once the instrument is preset.

The passband centering can be adjusted by running the Characterize Preselector routine that is found on the **System**, **Alignments**, **More**, **Advanced** menu. This routine should take less than 5 minutes to run. This routine needs to be run whenever the A12 YTF Preselector or A15 Front End Control assembly is replaced, and can be run if the alignment of the passband centering needs to be adjusted.

A13 RF Front End Assembly

NOTE Refer to Chapter 15, "Block Diagrams.".

There are two different A13 RF Front End assemblies used in the N9038A – one for instruments with Option 503, 508, or 526 and one for instruments with Option 544. There are also multiple frequency bands for each instrument, the number of which will depend on the frequency range option the instrument has. Information on the number of bands for the different frequency range options as well as the frequency range covered by each of these bands can be seen in Table 6-1.

There are 3 different aspects of the A13 RF Front End assembly functionality that can be verified with the procedures in this section. They are:

1. Assembly Initialization

2. Low Band Signal Path (20 Hz to 3.6 GHz)

3. High Band Signal Path (3.6 GHz and higher)

Assembly Initialization

Before the A13 RF Front End assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. To verify that this has happened look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A13 RF Front End assembly should identify itself on this list as **Front End**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be that the A13 RF Front End assembly itself is defective.

NOTE Since the instrument communicates with the A13 RF Front End assembly through the A15 Front End Control assembly, be sure that the A15 Front End Control assembly is initializing properly before replacing an A13 RF Front End assembly for not initializing properly.

Signal Path Verification

NOTE

Before verifying the functionality of the A13 RF Front End assembly make sure that the 1st LO signal from the A14 LO Synthesizer assembly as well as the 4800 MHz 2nd LO signal from the A16 Reference assembly are both of the correct frequency and amplitude. Refer to Chapter 7, "L.O. Synthesizer." and Chapter 9, "Reference Assembly." for detailed information on how to verify these signals.

Low Band Signal Path (20 Hz to 3.6 GHz)

NOTE

If there is a particular frequency of interest use that instead of the 100 MHz used in this example. Be aware that the gain at higher frequencies in low band will have a slightly lower gain than that shown in this example.

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 6-17 or Figure 6-18, disconnect W14 from the A13 RF Front End assembly Output (J7).

Figure 6-17 A13 RF Front End Assembly Connections – Option 503, 508, & 526
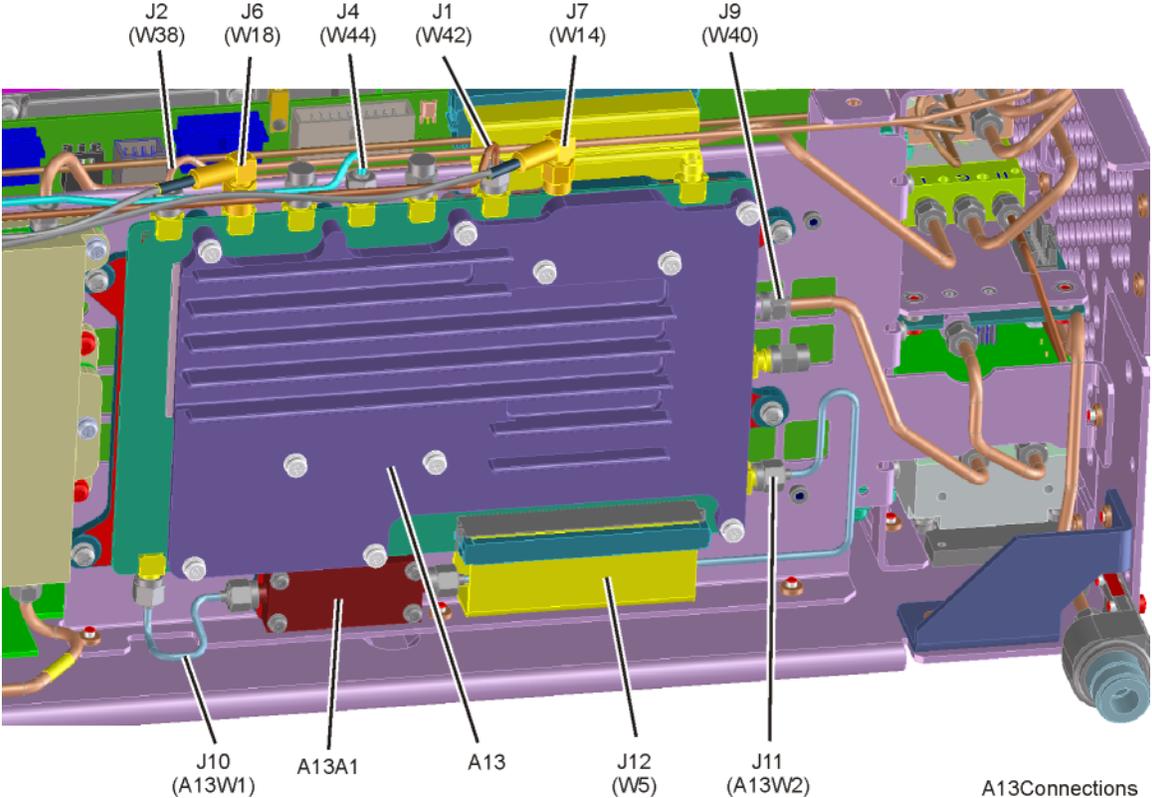
Figure 6-18 A13 RF Front End Assembly Connections - Option 544
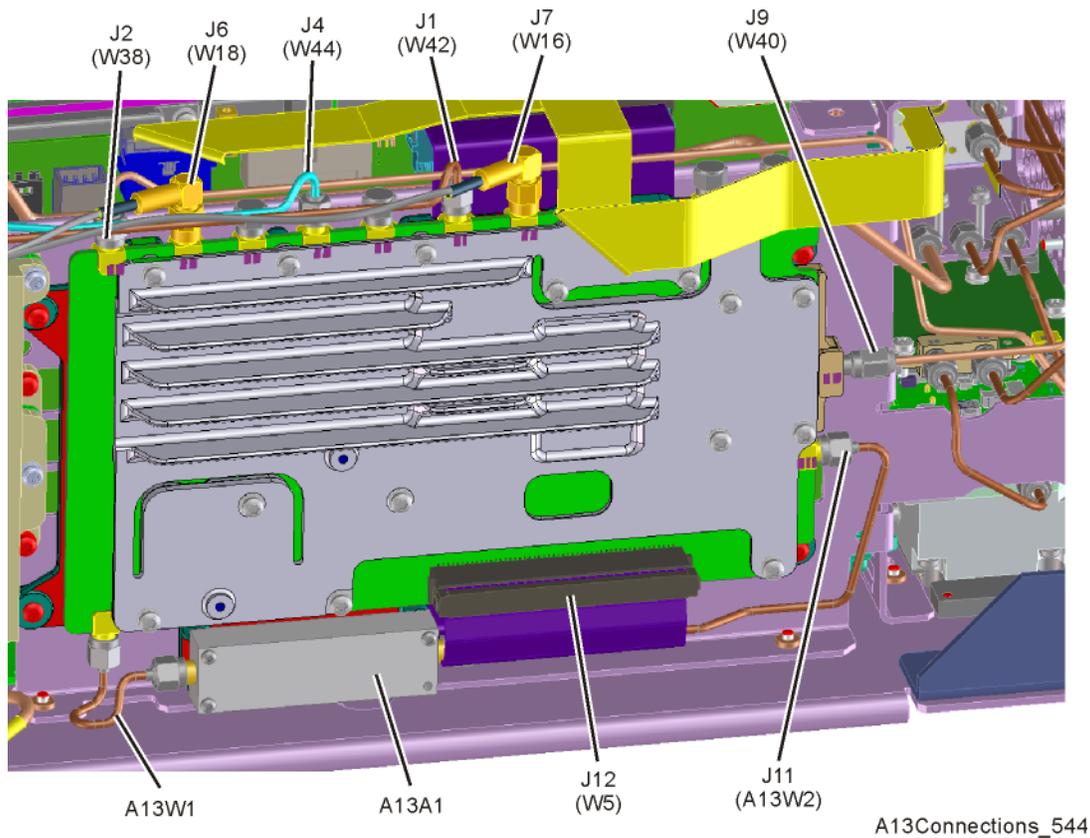
4. Connect a spectrum analyzer to the A13 RF Front End assembly Output (J7).

5. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.

6. Turn the instrument on and allow it to complete its boot up process.

7. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

8. Tune the instrument to 100 MHz with a span of 0 Hz by pressing **FREQ**, **100 MHz** and **SPAN**, **Zero Span**.

9. Referring to Figure 6-17 or Figure 6-18, disconnect W38 from the A13 RF Front End assembly low band Input (J2).

10. Connect a signal generator to the A13 RF Front End assembly low band Input (J2).

11. Tune the signal generator to 100 MHz with an amplitude of -30 dBm.

12. Verify that the signal amplitude on the spectrum analyzer display is approximately -25 dBm (5 dB gain), allowing for any additional test cable loss, as seen in Figure 6-19.

Figure 6-19   A13 RF Front End Low Band Signal Path
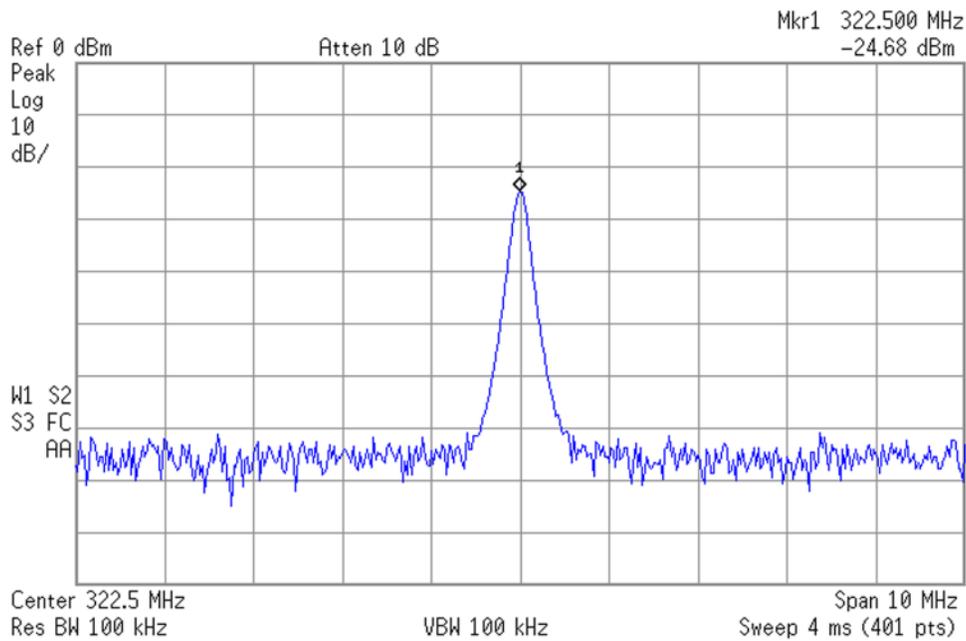
13. If the signal level is incorrect the most likely cause of the problem is the A13 RF Front End assembly itself. If the signal is correct proceed to step 1.

A13A1 Bandpass Filter Verification

A low signal level in the low band signal path could also be caused by a problem with the A13A1 Bandpass Filter. The performance of the A13A1 Bandpass Filter can be verified with the following procedure:

a. Referring to Figure 6-17 or Figure 6-18, remove A13W1 and A13W2 from the A13 RF Front End and A13A1 Bandpass Filter assemblies.

b. Connect a signal generator to the A13A1 Bandpass Filter Input (A13W1 end).

c. Connect a spectrum analyzer to the A13A1 Bandpass Filter Output (A13W2 end).

d. Tune the signal generator to 5.1 GHz with an amplitude of -20 dBm.

e. Tune the spectrum analyzer to a center frequency of 5.1 GHz with a span of 200 MHz.

f. Set the amplitude scale per division setting on the spectrum analyzer to 3 dB.

g. Turn on trace 2 of the spectrum analyzer and set it to use the Maxhold function.

h. Slowly vary the frequency of the signal generator between 5.0 GHz and 5.2 GHz until the spectrum analyzer display looks like that of Figure 6-20.

Figure 6-20   A13A1 Bandpass Filter Shape
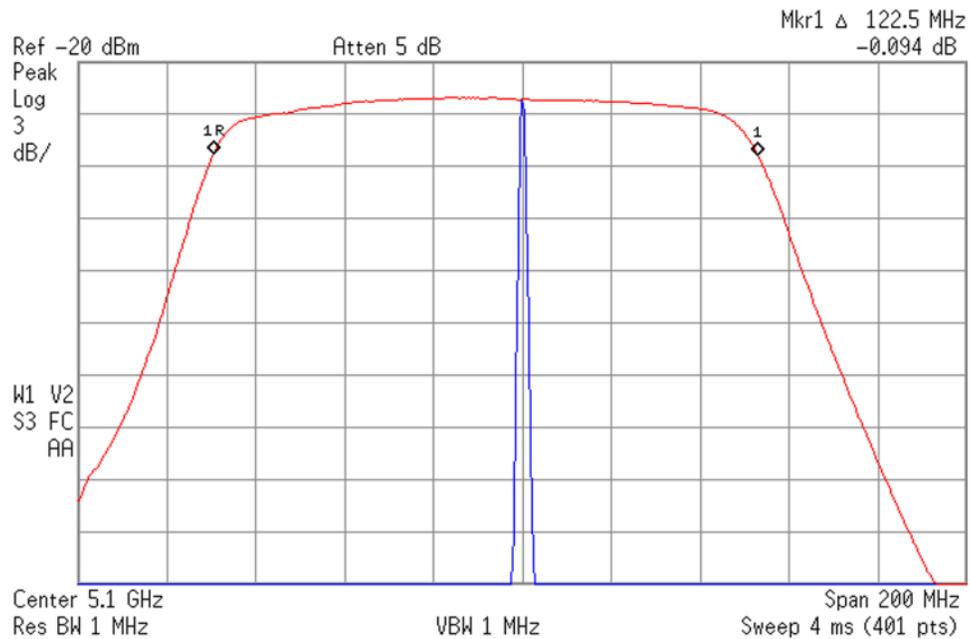
i. Verify that the A13A1 Bandpass Filter insertion loss at 5.1 GHz is approximately 2 dB, allowing for any additional test cable loss, and the 3 dB bandwidth is at least 100 MHz, as shown in Figure 6-20.

Replace the A13A1 Bandpass Filter if its shape or insertion loss does not meet these requirements.

NOTE   Before replacing an A13 RF Front End assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

Low Band Preamp Signal Path (20 Hz to 3.6 GHz)

1. Turn the instrument low band preamp on by pressing **AMPTD**, **More**, **Internal Preamp**, **Low Band**.

2. Verify that the signal amplitude on the spectrum analyzer display is approximately -8 dBm (22 dB gain), allowing for any additional test cable loss, as seen in Figure 6-21.

Figure 6-21   A13 RF Front End Low Band Preamp Signal Path
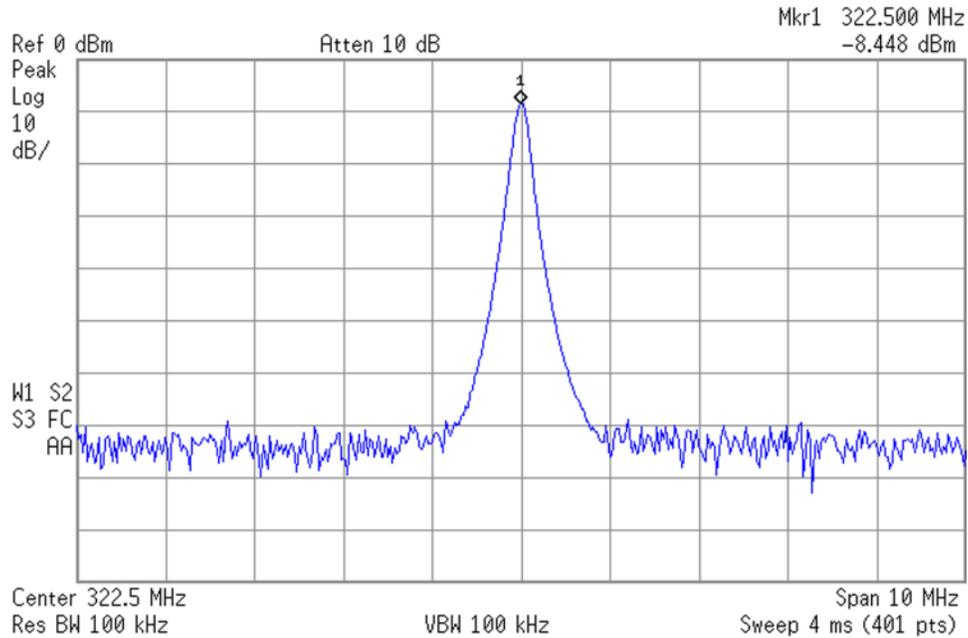
3. If the signal level is incorrect the most likely cause of the problem is the A13 RF Front End assembly itself.

NOTE

Before replacing an A13 RF Front End assembly for any failure, refer to Chapter 8, "Front End Control." for information on how to verify the control signals to it.

High Band Signal Path (3.6 GHz and Higher)

There are multiple frequency bands in the high band signal path. These can be seen in Table 6-1 as well as in the series of block diagrams found in Chapter 15, "Block Diagrams.".

NOTE   If there is a particular frequency of interest use that instead of the 10 GHz used in this example. Be aware that the gain at higher frequencies in low band will have a slightly lower gain than that shown in this example.

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Remove the hardware that attaches the front frame assembly to the chassis and slide it away from the rest of the instrument, but do not disconnect W8 which connects it to the A8 Motherboard assembly. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing the front frame assembly.

3. Referring to Figure 6-17 or Figure 6-18, disconnect W14 from the A13 RF Front End assembly Output (J7).

4. Connect a spectrum analyzer to the A13 RF Front End assembly Output (J7).

5. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.

6. Referring to Figure 6-17 or Figure 6-18, disconnect W40 from the A13 RF Front End assembly high band Input (J9).

7. Connect a signal generator to the A13 RF Front End assembly high band Input (J9), using a cable designed for use at this frequency.

8. Tune the signal generator to 10 GHz with an amplitude of -30 dBm.

9. Turn the instrument on and allow it to complete its boot up process.

10. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

11. Tune the instrument to 10 GHz with a span of 0 Hz by pressing **FREQ**, **10 GHz** and **SPAN**, **Zero Span**.

12. Verify that the signal amplitude on the spectrum analyzer display is at least -10 dBm (15 dB gain), allowing for any additional test cable loss, as seen in Figure 6-22.

Figure 6-22   A13 RF Front End High Band Signal Path
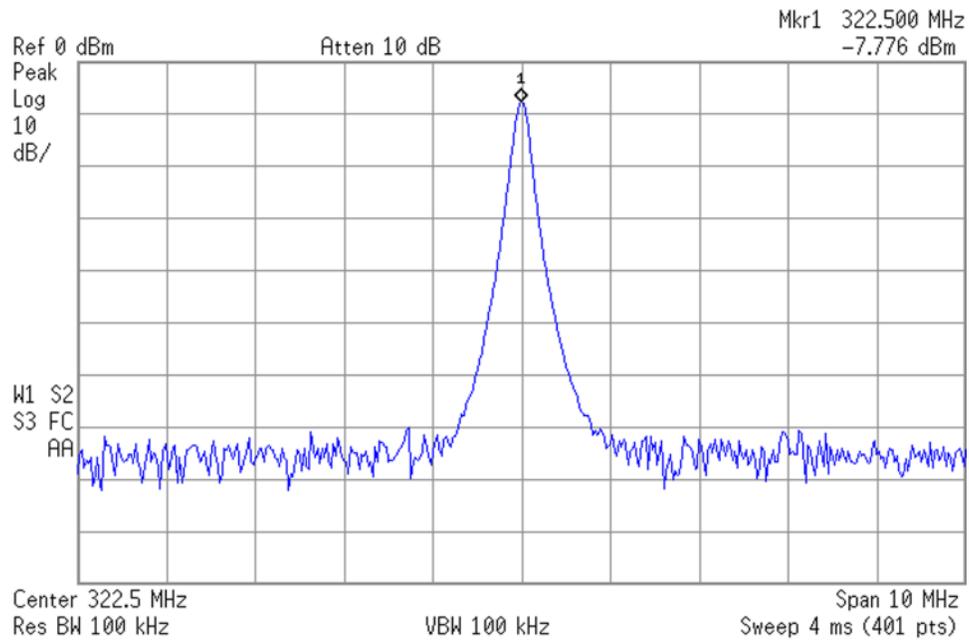
13.If the signal level is incorrect the most likely cause of the problem is the
   A13 RF Front End assembly itself.

NOTE   Before replacing an A13 RF Front End assembly for any failure, refer to Chapter 8, "Front End
           Control." for information on how to verify the control signals to it.

7　L.O. Synthesizer

What You Will Find in This Chapter

The following information is found in this chapter:

![KEYSIGHT TECHNOLOGIES]

A14 L.O. Synthesizer Assembly Description

A14 L.O. Synthesizer Purpose

The A14 LO Synthesizer assembly has only one purpose and one output signal, the 1st Local Oscillator (LO) for the A13 RF Front End assembly.

A14 L.O. Synthesizer Description

NOTE   Refer to Chapter 15, "Block Diagrams".

The main oscillator on the LO Synthesizer assembly is a Voltage Controlled Oscillator (VCO) that has a frequency range from 570 MHz to 1150 MHz. This VCO is then multiplied to the desired 1st LO frequency range required by the A13 Front End assembly.

This VCO/Multiplier technology uses band pass filters after each multiplier stage to suppress the undesired harmonics.

The LO Synthesizer assembly phase locks the 1st LO to the 4800 MHz reference signal that is generated and phase locked to the 10 MHz reference on the A16 Reference Assembly.

The quality of the 4800 MHz reference signal phase lock loop, the 1st LO phase lock loop, as well as the 10 MHz internal reference signal all have a direct bearing on the overall frequency stability of the instrument. Users can also provide their own external reference signal to be used instead of the internal 10 MHz reference, which will also have a direct bearing on the overall stability of the instrument.

After the different multiplier sections and amplifiers, the resultant frequency range of the 1st LO provided to the A13 Front End assembly is 3.8 to 8.7 GHz with an output power from +13 to +18 dBm.

The A14 LO Synthesizer assembly also contains a Field Programmable Gate Array (FPGA) chip that is programmed from an onboard PROM chip when the instrument is powered on. This code is updated if necessary when the instrument software is updated.

A14 L.O. Synthesizer Assembly Connections

The connections to and from the A14 LO Synthesizer assembly are as listed in Table 7-1 and as illustrated in Figure 7-1.

Table 7-1   A14 L.O. Synthesizer Assembly Signals

Port	Description	To/From	Cable
J10	Not Used	n/a	n/a
J100	Bias & Control	A8 Motherboard J101	n/a
J200	4800 MHz Reference Signal	A16 Reference J703	W41
J740	1st LO Output	A13 Front End J4	W44
J741	JTAG Programming	n/a	n/a

Figure 7-1   A14 L.O. Synthesizer Assembly Connections
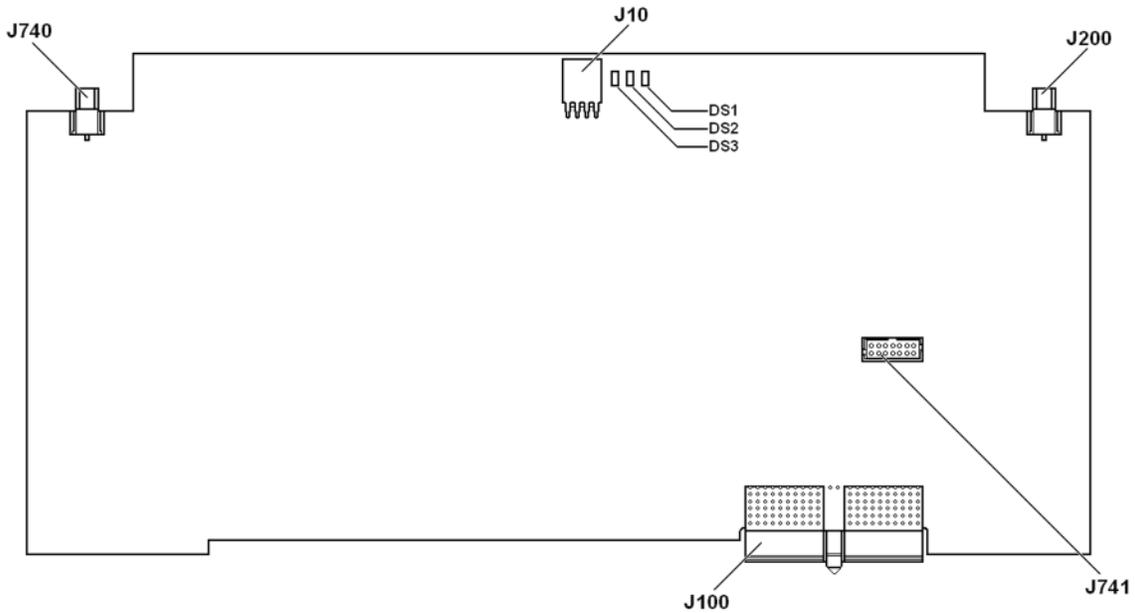
A14 L.O. Synthesizer Assembly Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams".

Since the A14 LO Synthesizer assembly has only one main function there are only a few things that will need to be checked to verify that it is functioning properly. They are:

1. Assembly Initialization

2. Assembly Status LEDs

3. Frequency and Amplitude of the 1st LO Output

Assembly Initialization

Before the A14 LO Synthesizer assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A14 LO Synthesizer assembly should identify itself on this list as **LO Synthesizer**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

   Solution: Reload the FPGA code. See FPGA Synchronization in Chapter 19, "Post-Repair Procedures".

— An instrument power supply voltage is not operating properly

   Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A14 LO Synthesizer assembly is defective

   Solution: Replace the A14 LO Synthesizer assembly

Assembly Status LEDs

There are three assembly status indicating LEDs on the A14 LO Synthesizer assembly, the location of which are shown in Figure 7-1. When the instrument is functioning properly all of these LEDs should be off.

To put the instrument into a known state in which all LEDs should be off tune the instrument to a Center Frequency of 50 MHz and set the Span to 0 Hz. At this point all of the LEDs should be off. If any of the LEDs are on see Table 7-2 for a possible cause.

Table 7-2   A14 L.O. Synthesizer Assembly Status LEDs

LED	Description	Cause for Fault
DS1	FPGA Programming Done	FPGA code is not uploading from assembly EEROM. Try reprogramming FPGA by using the "FPGA Synchronization" instructions in Chapter 19, "Post-Repair Procedures.". If this LED is on the state of all other LEDs can be ignored
DS2	Cycle Slipped	If DS3 is also on at the same time the status of this Led can be ignored and troubleshoot the DS3 LED. If this LED is intermittently on by itself it may not be a problem.
DS3	Frequency Unlocked	Verify that the 4800 MHz reference signal from the A16 Reference assembly is of the correct frequency and power level (See Chapter 9, "Reference Assembly.".)

Frequency and Amplitude of the 1st LO Output

NOTE   Before verifying the functionality of the A14 LO Synthesizer assembly make sure that the 4800 MHz Reference signal from the A16 Reference assembly is of the correct frequency and amplitude. Refer to Chapter 9, "Reference Assembly".

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

2. Disconnect cable W44 from A14J740 as shown in Figure 7-2.

Figure 7-2   A14 LO Synthesizer Connections
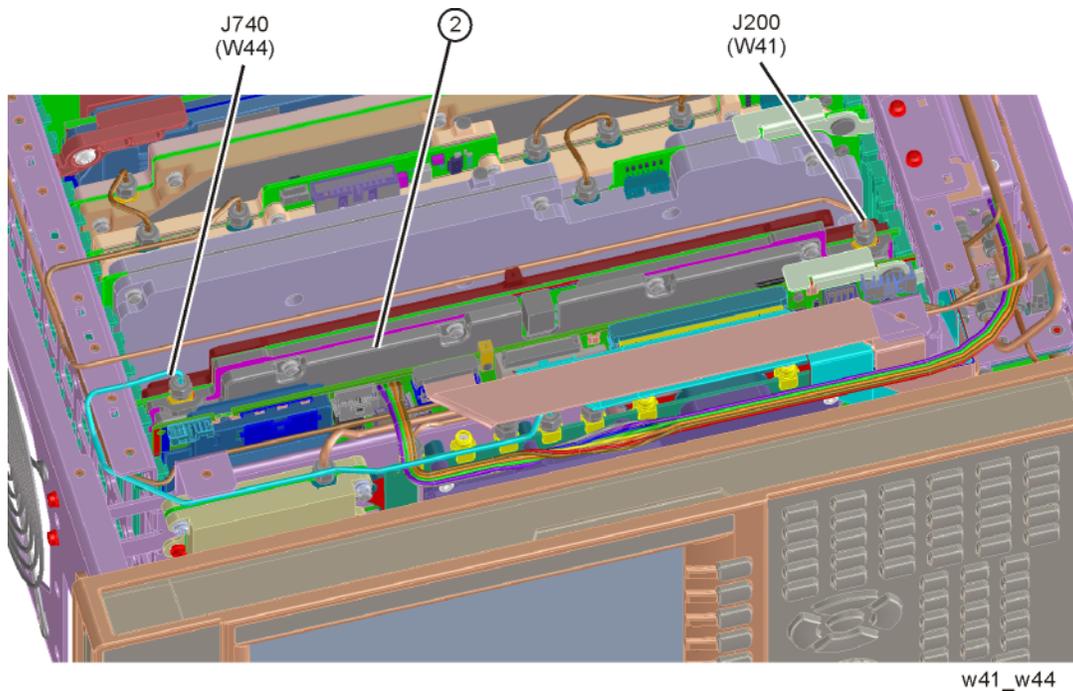
3. Connect a spectrum analyzer to J740 for signal frequency and amplitude verification.

4. Turn the instrument on and allow it to complete its boot up process.

5. Tune the instrument to a Center Frequency of 50 MHz with a Span of 0 Hz by pressing **Freq**, **50 MHz** and **SPAN**, **Zero Span**.

6. Verify that the frequency of the 1st LO signal at J740 is 5172.5 MHz and that the amplitude is between +13 and +18 dBm as shown in Figure 7-3.

Figure 7-3   1st LO Frequency and Amplitude
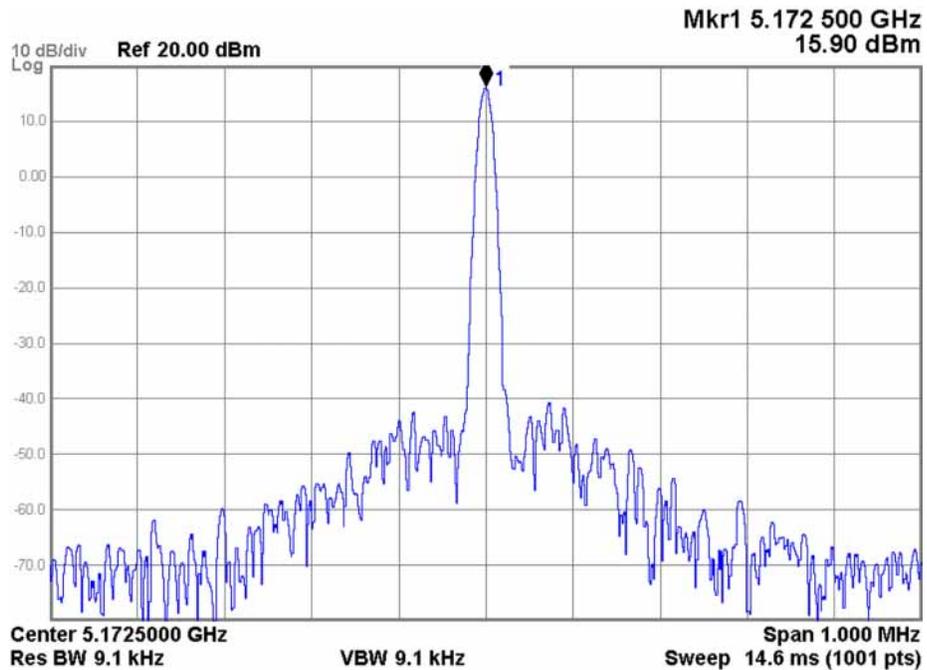
NOTE

If there is a problem with the frequency or amplitude of the 1st LO output signal, and the 4800 MHz Reference input signal is known to be good (See Chapter 9, "Reference Assembly"), the A14 LO Synthesizer board itself is most likely at fault.

7. Continue to change the instrument input frequency according to Table 7-3 to verify the 1st LO frequency and amplitude level across its tuning range.

Table 7-3   Instrument Input versus 1st LO Tune Frequency

Instrument Input Frequency	1st LO Frequency
50 MHz	5,172.5 MHz
3.5 GHz	8,622.5 MHz
3.65 GHz	3,922.5 MHz

Keysight N9038A MXE Service Guide

8   Front End Control

What You Will Find in This Chapter

The following information is found in this chapter:

1. Theory of operation for the Front End Controller Assembly at the assembly level.
2. Interconnections between assemblies.
3. Isolating the cause of a hardware problem by verifying the assembly functionality.

NOTE

Each section describes how the assembly works and gives information to help you troubleshoot the assembly. Each description covers the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following descriptions are found in this chapter:

KEYSIGHT
TECHNOLOGIES

A15 Front End Control Description

As of serial prefix MY/SG5322 all instruments are originally equipped with the Enhanced Front End Control assembly, which includes routing of the A13 IF output.

A15 Front End Control Purpose

The Front End Control assembly provides the necessary switch logic and bias voltages to many of the major RF assemblies in the instrument. These signals are routed from the A15 Front End Control assembly to the RF assemblies via ribbon cables and wiring harnesses.

The Front End Control assembly also has the ability to route the A13 IF output signal to either the A2 Analog IF assembly or the A3 Digital IF assembly (A25 Wideband Analog IF if Option B85 is installed). It also provides the switching of the IF to the rear panel AUX IF OUT connector. (Option CR3 only)

A15 Front End Control Assembly Description

NOTE   Refer to Chapter 15, "Block Diagrams.".

The following RF assemblies are controlled by the A15 Front End Control assembly:

— A9 Input Attenuator A

— A10 Input Attenuator B

— A11 RF Switch / High Band Preamp

— A12 YTF Preselector

— A13 RF Front End Assembly

The A15 Front End Control assembly also contains a Field Programmable Gate Array (FPGA) chip that is programmed from an onboard PROM chip when the instrument is powered on. This code is updated if necessary when the instrument software is updated.

A15 Front End Control Assembly Connections

The connections to and from the A15 Front End Control assembly are as listed in Table 8-1 and as illustrated in Figure 8-1. This same information can be found for instrument produced prior to serial prefix MY/SG5322 in Table 8-2 and illustrated in Figure 8-2.

Table 8-1   **A15 Enhanced Front End Controller Assembly Signals**

Port	Description	To/From	Cable
J100	Bias & Control	A8 Motherboard J111	n/a
J102	Front End Assembly Control	A13 Front End J12	W5
J300	YTF Preselector Control	A12 YTF J1	W12
J301	Not Used	n/a	n/a
J302	Not Used	n/a	n/a
J700	RF Switch / High Band Preamp Control	A11 RF Switch J4	W4
J800	Attenuator Control	A9 & A10 Control	W3
J801	Not Used	n/a	n/a
J802	Not Used	n/a	n/a
J900	Narrowband IF Output	A2 Analog IF J100	W16
J901	Wideband IF Output	A3 Digital IF J15	W15
		A25 Wideband Analog IF J101 (Option B85)	W52
J902	IF Input	A13 Front End J7	W14
J903	EXT IF IN	A13 Front End J13	W24
J1100	AUX IF Output	Rear Panel AUX IF OUT	W22
J1300	Not Used	n/a	n/a

Figure 8-1   A15 Enhanced Front End Control Assembly Connections
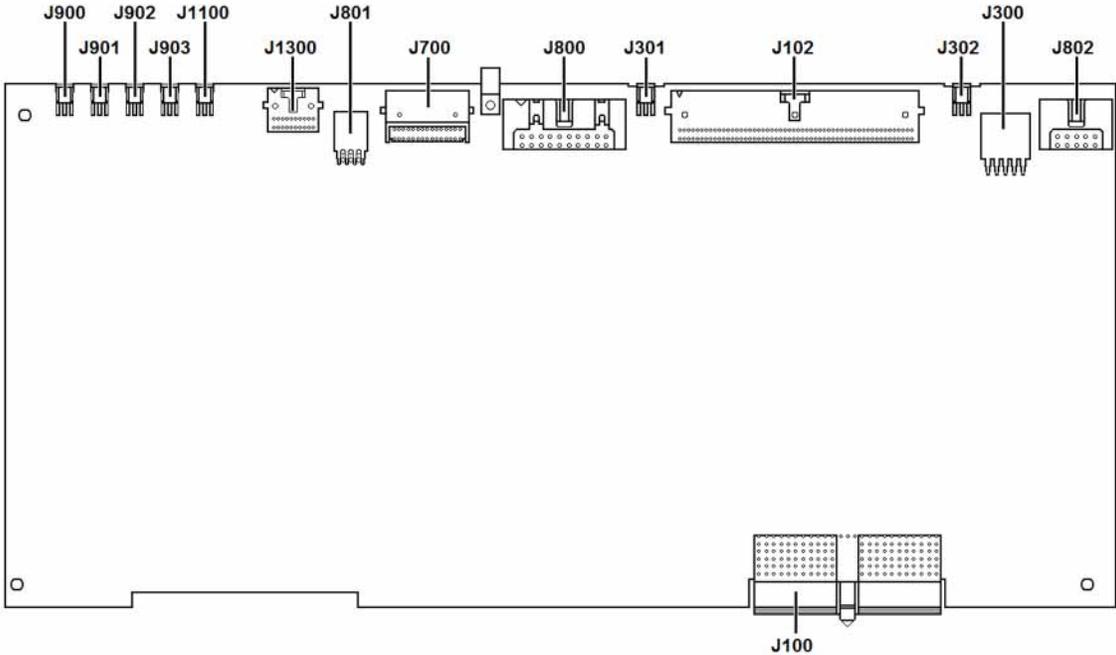
Table 8-2   A15 Front End Control Assembly Signals (Serial Prefix < MY/SG5322)

Port	Description	To/From	Cable
J100	Bias & Control	A8 Motherboard J111	n/a
J103	RF Switch / High Band Preamp Control	A11 RF Switch J4	W4
J104	Front End Assembly Control	A13 Front End J12	W5
J200	JTAG Programming	n/a	n/a
J300	Not Used	n/a	n/a
J301	YTF Preselector Control	A12 YTF J1	W12
J302	Not Used	n/a	n/a
J800	Not Used	n/a	n/a
J801	Attenuator Control	A9 & A10 Control	W3

Figure 8-2   A15 Front End Control Assembly Connections
(Serial Prefix < MY/SG5322)
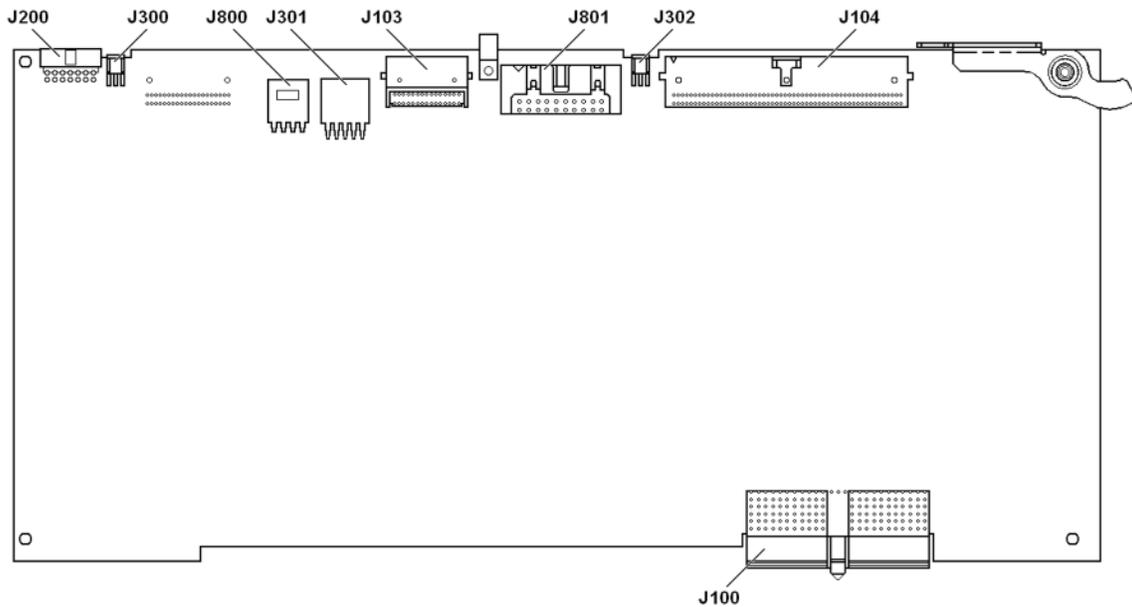
A15 Front End Control Assembly Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams.".

Since the A15 Front End Control assembly is responsible for the control of many different components in the front end of the instrument there are quite a few different things that will need to be checked to verify that it is functioning properly. They are:

— Assembly Initialization
— A9 Input Attenuator A Control*
— A10 Input Attenuator B Control*
— A11 RF Switch / High Band Preamp Control*
— A12 YTF Preselector Control*
— A12 YTF Preselector Alignment
— A13 RF Front End Assembly Control*
— IF Switching
— AUX IF Output (Option CR3)

* Can only be verified in instruments with Option 503, 508, or 526.

Assembly Initialization

Before the A15 Front End Control assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A15 Front End Control assembly should identify itself on this list as **Front End Controller**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

> Solution: Reload the FPGA code. See Chapter 19, "Post-Repair Procedures.".

— An instrument power supply voltage is not operating properly

> Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane.".

— A15 Front End Control assembly is defective

> Solution: Replace the A15 Front End Control assembly

Assembly Control Verification – (Option 503, 508, & 526 only)

In order to verify the different control signals that the A15 Front End Control assembly provides to the Front End components of the instrument a test board is required and has been made available. A kit containing this test board and the required cables can be purchased as part number N9020-60005 from http://www.keysight.com/find/parts. The contents of this kit are contained in Table 8-3.

NOTE

This test board is only intended for use with instruments that have either Option 503, 508, or 526; it will not work with instruments that have Option 544 due to the differences in the front end assemblies used.

Table 8-3   Contents of Kit Part Number N9020-60005

Keysight Part Number	Description
E4410-60115	Front End Control Test Board Assembly
E4410-60156	A13 Front End Assembly Control Cable
E4410-60157	A9 / A10 Input Attenuator Control Cable
E4410-60158	A12 YTF Preselector Control Cable
E4410-60160	A11 RF Switch / High Band Preamp Control Cable

The connections to the test board and the associated circuitry for the verification of the different assemblies can be seen in Figure 8-3. This will also be further explained in the procedures that follow.

The following procedures will describe how to use this board to determine if the control circuitry on the A15 Front End Control assembly is working properly. It is recommended that this be done prior to the replacement of any of the assemblies that the A15 Front End Control assembly controls.

WARNING

When being used to verify the control signals to the A13 RF Front End assembly there are many resistors on the Front End Test board that can get VERY HOT. Be careful not to touch them or place any combustible objects in contact with them. Also, do not leave the instrument unattended while powered on with the Front End Test board connected in this manner.

WARNING

When making Main Coil Current measurements R119, R120, and R121 on the Front End Control Test board can get VERY HOT. Be careful not to touch them or place any combustible objects in contact with them. Also, do not clip test leads to P8 and leave the instrument unattended while powered on.

NOTE

Do not connect or disconnect the Front End control test board assembly to or from the instrument while it is turned on. This can cause damage to either the A15 Front End Control assembly or the assemblies that it controls. Be sure to always turn the instrument power before any connections are made or broken.

Figure 8-3   Front End Control Test Board
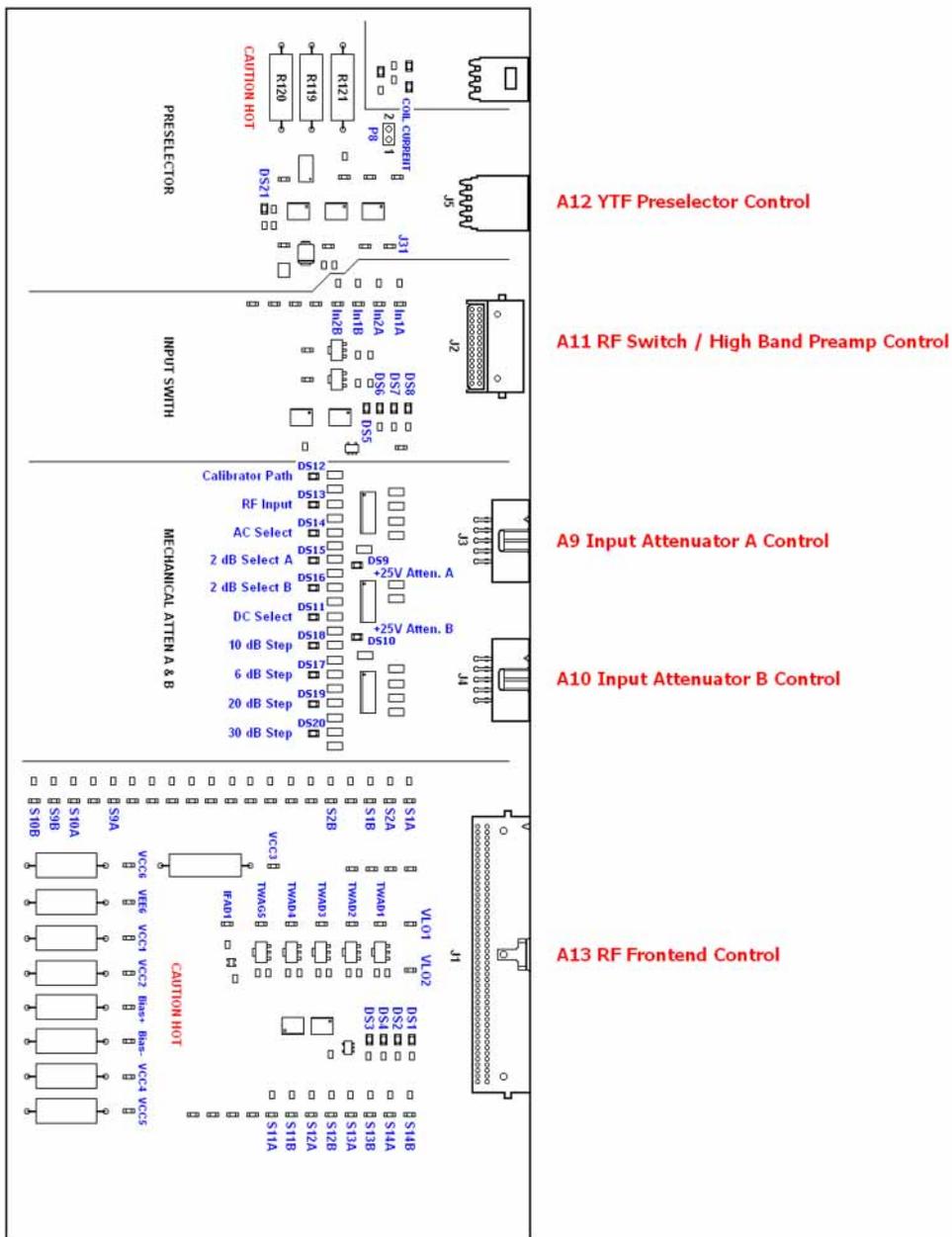
A9 Input Attenuator A Control – (Option 503, 508, & 526 only)

A problem with the A9 Input Attenuator A could be caused by either a failure of the attenuator itself, the control logic sent to it, or damage to the cable between the two. This section will verify the functionality of the control logic coming from the A15 Front End Control assembly. If after verifying that the control logic in working properly refer to **Chapter 5, "RF Preselector Section."** for further troubleshooting information on the A9 Input Attenuator A itself.

This section will verify the control signals from the A15 Front End Control assembly to the A9 Input Attenuator A. As can be seen in **Figure 8-4** there are four different controls for the A9 Input Attenuator A:

1. RF Input / Calibrator Select

2. AC / DC Coupling Select

3. 2 dB Select A

4. 2 dB Select B

The status of these controls is displayed on the Front End Control Test board assembly with the use of six different LEDs, plus one for the status of the +25V power supply, as can be seen in **Figure 8-5**.

Figure 8-4   A9 Input Attenuator A Diagram
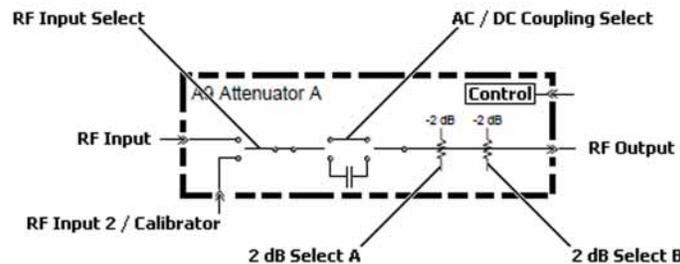
Figure 8-5   A9 Input Attenuator A Control Front End Test Board LEDs
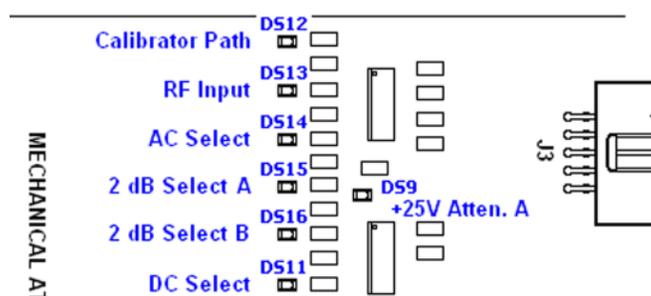
Verifying the Control for the A9 Input Attenuator A

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Disconnect cable W3 from J801 as shown in Figure 8-6.

Figure 8-6   A15 Front End Control Assembly Cable Locations

3. Connect the A9 / A10 Input Attenuator Control cable from J801 to the Front End Control Test board J3 & J4 as shown in Figure 8-3.

NOTE   The 10 pin connector of the A9 / A10 Input Attenuator Control cable with the RED stripe on the cable goes to J3 on the Front End Control Test board.

4. Place the Front End Control Test board on a non-conductive surface.

5. Turn the instrument on and allow it to complete its boot up process, ignoring any alignment failures.

6. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Tune the instrument to a Center Frequency of 50 MHz with a Span of 0 Hz by pressing **FREQ**, **50 MHz** and **SPAN**, **Zero Span**.

8. Verify that the status of the A9 Input Attenuator A LEDs on the Front End Control Test board are as shown in Table 8-4 for the **Mode Preset** instrument setting.

If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

Table 8-4   A9 Input Attenuator A Control Logic

Instrument Setting	Calibrator Path	RF Input	AC Selected	2 dB Select A	2 dB Select B	DC Select	+25V Atten A
	DS12	DS13	DS14	DS15	DS16	DS11	DS9
Mode Preset	Off	On	On	Off	Off	Off	On
RF Calibrator - 50 MHz	On	Off	On	Off	Off	Off	On
RF Coupling - DC	On	Off	Off	Off	Off	On	On
Mechanical Attenuator - 2 dB	On	Off	Off	On	Off	On	On
Mechanical Attenuator - 4 dB	On	Off	Off	On	On	On	On

9. Turn the internal 50 MHz RF Calibrator signal on by pressing **Input / Output, RF Calibrator**, **50 MHz**.

10. Verify that the status of the A9 Input Attenuator A LEDs on the Front End Control Test board are as shown in Table 8-4 for the **RF Calibrator - 50 MHz** instrument setting.

If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

11. Change the RF Coupling to DC by pressing **Input / Output, RF Input**, **RF Coupling DC**.

12. Verify that the status of the A9 Input Attenuator A LEDs on the Front End Control Test board are as shown in Table 8-4 for the **RF Coupling - DC** instrument setting.

If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

13. Change the Mechanical Attenuator setting to 2 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **2 dB**.

14. Verify that the status of the A9 Input Attenuator A LEDs on the Front End Control Test board are as shown in Table 8-4 for the **Mechanical Attenuator - 2 dB** instrument setting.

If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

15. Change the Mechanical Attenuator setting to 4 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **4 dB**.

16. Verify that the status of the A9 Input Attenuator A LEDs on the Front End Control Test board are as shown in Table 8-4 for the **Mechanical Attenuator - 4 dB** instrument setting.

   If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

17. If no trouble has been found with the control logic coming from the A15 Front End Control assembly, yet there is still a problem with the A9 Input Attenuator A, refer to Chapter 5, "RF Preselector Section." for further troubleshooting information on the A9 Input Attenuator A itself.

A10 Input Attenuator B Control – (Option 503, 508, & 526 only)

A problem with the A10 Input Attenuator B could be caused by either a failure of the attenuator itself, the control logic sent to it, or damage to the cable between the two. This section will verify the functionality of the control logic coming from the A15 Front End Control assembly. If after verifying that the control logic in working properly refer to **Chapter 5, "RF Preselector Section."** for further troubleshooting information on the A10 Input Attenuator B itself.

This section will verify the control signals from the A15 Front End Control assembly to the A10 Input Attenuator B. As can be seen in **Figure 8-7** there are four different controls for the A10 Input Attenuator:

1. 6 dB Step

2. 10 dB Step

3. 20 dB Step

4. 30 dB Step

The status of these controls is displayed on the Front End Control Test board assembly with the use of four different LEDs, plus one for the status of the +25V power supply, as can be seen in **Figure 8-8**.

Figure 8-7   A10 Input Attenuator B Diagram
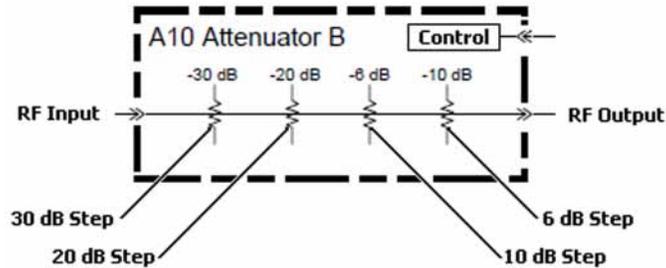
Figure 8-8   A10 Input Attenuator B Control Front End Test Board LEDs
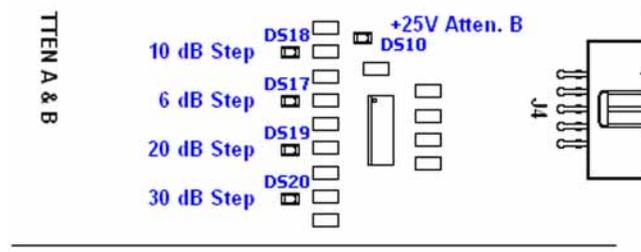
Verifying the Control for the A10 Input Attenuator B

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Disconnect cable W3 from J801 as shown in Figure 8-6.

3. Connect the A9 / A10 Input Attenuator Control cable from J801 to the Front End Control Test board J3 & J4 as shown in Figure 8-3.

NOTE   The 10 pin connector of the A9 / A10 Input Attenuator Control cable with the RED stripe on the cable goes to J3 on the Front End Control Test board.

4. Place the Front End Control Test board on a non-conductive surface.

5. Turn the instrument on and allow it to complete its boot up process, ignoring any alignment failures.

6. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Tune the instrument to a Center Frequency of 50 MHz with a Span of 0 Hz by pressing **FREQ**, **50 MHz** and **SPAN**, **Zero Span**.

8. Verify that the status of the A10 Input Attenuator B LEDs on the Front End Control Test board are as shown in Table 8-5 for the **Mode Preset** instrument setting.

   If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

Table 8-5   A10 Input Attenuator B Control Logic

Instrument Setting	10 dB Step	6 dB Step	20 dB Step	30 dB Step	+25V Atten B
	DS18	DS17	DS19	DS20	DS10
Mode Preset	On	Off	Off	Off	On
Mechanical Attenuator - 6 dB	Off	On	Off	Off	On
Mechanical Attenuator - 10 dB	On	Off	Off	Off	On
Mechanical Attenuator - 20 dB	Off	Off	On	Off	On
Mechanical Attenuator - 30 dB	Off	Off	Off	On	On
Mechanical Attenuator - 66 dB	On	On	On	On	On

9. Change the Mechanical Attenuator setting to 6 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **6 dB**.

10. Verify that the status of the A10 Input Attenuator B LEDs on the Front End Control Test board are as shown in Table 8-5 for the **Mechanical Attenuator - 6 dB** instrument setting.

    If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

11. Change the Mechanical Attenuator setting to 20 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **20 dB**.

12. Verify that the status of the A10 Input Attenuator B LEDs on the Front End Control Test board are as shown in Table 8-5 for the **Mechanical Attenuator - 20 dB** instrument setting.

    If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

13. Change the Mechanical Attenuator setting to 30 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **30 dB**.

14. Verify that the status of the A10 Input Attenuator B LEDs on the Front End Control Test board are as shown in Table 8-5 for the **Mechanical Attenuator - 30 dB** instrument setting.

    If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly

15. Change the Mechanical Attenuator setting to 66 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **66 dB**.

16. Verify that the status of the A10 Input Attenuator B LEDs on the Front End Control Test board are as shown in Table 8-5 for the **Mechanical Attenuator - 66 dB** instrument setting.

    If the state of the status LEDs is correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

17. If no trouble has been found with the control logic coming from the A15 Front End Control assembly, yet there is still a problem with the A10 Input Attenuator B, refer to Chapter 5, "RF Preselector Section." for further troubleshooting information on the A10 Input Attenuator B itself.

A11 RF Switch / High Band Preamp Control – (Option 503, 508, & 526 only)

A problem with the A11 RF Switch / High Band Preamp assembly could be caused by either a failure of the assembly itself, the control logic sent to it, or damage to the cable between the two. This section will verify the functionality of the control logic coming from the A15 Front End Control assembly. If after verifying that the control logic in working properly refer to Chapter 6, "RF Downconverter Section." for further troubleshooting information on the A11 RF Switch / High Band Preamp assembly itself.

This section will verify the control signals from the A15 Front End Control assembly to the A11 RF Switch / High Band Preamp assembly. As can be seen in Figure 8-9, in addition to the bias and control signals there are also two controls for the A11 RF Switch / High Band Preamp assembly:

1. Supply Voltages

2. Serial Communication for Assembly Identification

3. Band Switch Control

4. High Band Preamp Switch Control

The status of these controls can be measured on the Front End Control Test board assembly with the use of four test points, In1A, In2A, In1B, and In2B, as can be seen in Figure 8-10.

Figure 8-9   A11 RF Switch / High Band Preamp Diagram
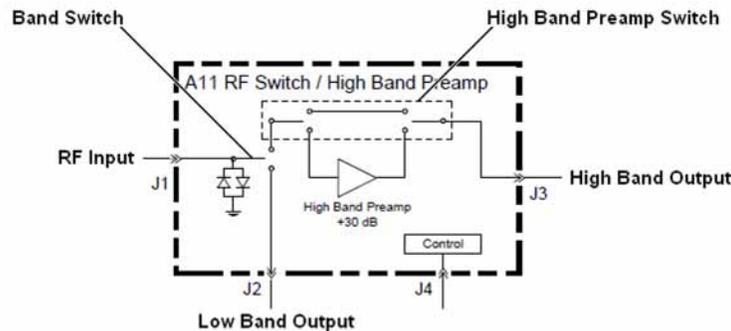
Figure 8-10   A11 RF Switch / High Band Preamp Control Front End Test Board
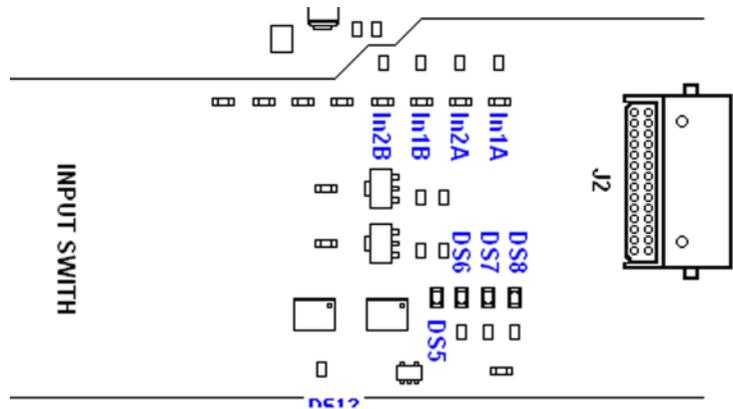
Verifying the Control for the A11 RF Switch / High Band Preamp

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Disconnect cable W4 from J103 as shown in Figure 8-6.

3. Connect the A11 RF Switch / High Band Preamp Control cable from J103 to the Front End Control Test board J2, as shown in Figure 8-3.

4. Place the Front End Control Test board on a non-conductive surface.

5. Turn the instrument on and allow it to complete its boot up process, ignoring any alignment failures.

6. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Referring to Figure 8-10, verify that all four of the power supply voltage LEDs on the Front End Test board for the A11 RF Switch / High Band Preamp assembly are on. If one or more of the power supplies is not on verify the A6 Power Supply output voltages before replacing the A15 Front End Control assembly. For information on verifying the A6 power supply output voltages see Chapter 12, "Power Supply & Midplane.".

The value for each of the power supply LEDs is shown in Table 8-6.

Table 8-6   A11 RF Switch / High Band Switch Power Supply Front End Test Board LEDs

LED	Power Supply Voltage
DS5	+15V
DS6	+9V
DS7	+5.2V
DS8	−15V

8. Verify that the serial communication interface for the A11 RF Switch / High Band Preamp assembly identification on the A15 Front End Control assembly is working properly by pressing **System**, **Show**, **Hardware**.

NOTE

The Front End Control Test board has the circuitry on it to simulate the presence of an A11 RF Switch / High Band Preamp assembly. When the instrument is booted up with the test board connected it will return, via the serial communications interface, similar information to an actual A11 RF Switch / High Band Preamp assembly. This information can then be viewed on the instrument Hardware Information screen.

If there is a **Low Band Switch** entry on the Hardware Information screen proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

9. Tune the instrument to a frequency of 1 GHz with a span of 0 Hz by pressing **FREQ**, **1 GHz**, and **SPAN**, **Zero Span**.

10. Verify that the voltage levels of test points In1A, In1B, In2A, and In2B match what is outlined in Table 8-7 for a Frequency of **1 GHz** (±0.5V).

If the test point voltages are correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

Table 8-7   A11 RF Switch / High Band Preamp Control Voltage

Frequency	In1A	In2A	In1B	In2B
1 GHz	−10V	−10V	+10V	+10V
4 GHz	+10V	−10V	−10V	+10V
4 GHz w/ Preamp	+10V	+10V	−10V	−10V

11. Tune the instrument to a frequency of 4 GHz by pressing **FREQ**, **4 GHz**.

12. Verify that the voltage levels of test points In1A, In1B, In2A, and In2B match what is outlined in Table 8-7 for a Frequency of **4 GHz** (±0.5V).

If the test point voltages are correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

13. Turn off the RF Preselector by pressing **Input/Output**, **RF Input**, **RF Preselector**, **Off**.

14. Turn the High Band Preamp on by pressing **AMPTD**, **More**, **Internal Preamp**, **Full Range**.

15. Verify that the voltage levels of test points In1A, In1B, In2A, and In2B match what is outlined in Table 8-7 for a Frequency of **4 GHz w/ Preamp** (±0.5V).

If the test point voltages are correct proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

16. If no trouble has been found with the control logic coming from the A15 Front End Control assembly, yet there is still a problem with the A11 RF Switch / High Band Preamp assembly, refer to Chapter 6, "RF Downconverter Section." for further troubleshooting information on the A11 RF Switch / High Band Preamp assembly itself.

A12 YTF Preselector Control – (Option 508 & 526 only)

A problem with the A12 YTF Preselector assembly could be caused by either a failure of the assembly itself, the control logic sent to it, or damage to the cable between the two. This section will verify the functionality of the control logic coming from the A15 Front End Control assembly. If after verifying that the control logic in working properly refer to **Chapter 6, "RF Downconverter Section."** for further troubleshooting information on the A12 YTF Preselector assembly itself.

This section will verify the control signals from the A15 Front End Control assembly to the A12 YTF Preselector assembly. There are only three controls for the A12 YTF Preselector:

1. Serial Communication for Assembly Identification

2. Supply Voltage for Serial Communications

3. Main Coil Current

The status of the supply voltage and main coil current can be measured on the Front End Control Test board assembly with the use of three test points, J31, P8 Pin 1, and P8 Pin 2, as seen in **Figure 8-11**.

WARNING

When making Main Coil Current measurements R119, R120, and R121 on the Front End Control Test board can get VERY HOT. Be careful not to touch them or place any combustible objects in contact with them. Also, do not clip test leads to P8 and leave the instrument unattended while powered on.

Figure 8-11   A12 YTF Preselector Control Front End Test Board
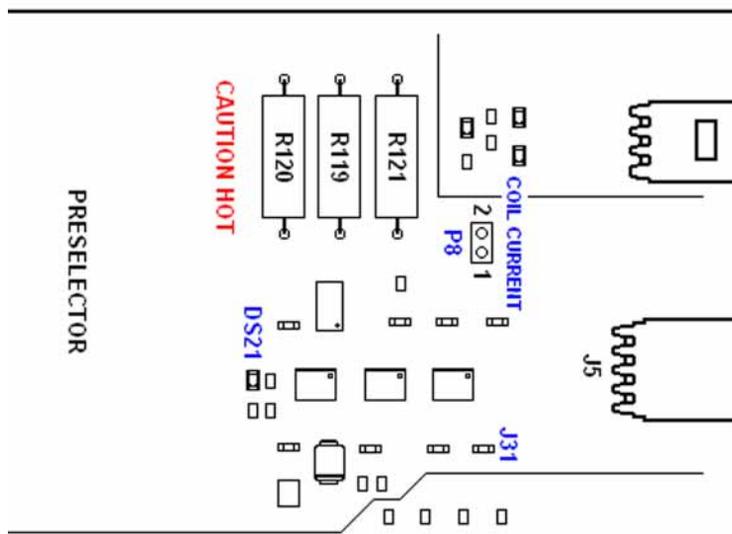
Verifying the Control for the A12 YTF Preselector

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Disconnect cable W12 from J301 as shown in Figure 8-6.

3. Connect the A12 YTF Preselector Control cable from J301 to the Front End Control Test board J5 as shown in Figure 8-3.

4. Place the Front End Control Test board on a non-conductive surface.

5. Turn the instrument on and allow it to complete its boot up process, ignoring any alignment failures.

6. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Verify that the serial communication interface for the A12 YTF Preselector assembly identification on the A15 Front End Control assembly is working properly by pressing **System**, **Show**, **Hardware**.

NOTE

The Front End Control Test board has the circuitry on it to simulate the presence of an A12 YTF Preselector assembly. When the instrument is booted up with the test board connected it will return, via the serial communications interface, similar information to an actual A12 YTF Preselector assembly. This information can then be viewed on the instrument Hardware Information screen.

If there is a **YIG Tuned Filter** entry on the Hardware Information screen proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

8. Measure the serial communication supply voltage from the A15 Front End Control assembly at J31 on the Front End Control Test board, as shown in Figure 8-11.

If the test point voltage measures +29.5V (±0.5V) proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

While LED DS21 on the Front End Control Test board is only an indication that the voltage regulator for the serial communication on the test board is working, the supply to the voltage regulator is the same +29.5V supply that is being measured in this step. So if this LED is on this is also a good indication that the +29.5V supply is working.

9. Tune the instrument to a frequency of 4 GHz with a span of 0 Hz by pressing **FREQ**, **4 GHz** and **SPAN**, **Zero Span**.

WARNING

When making Main Coil Current measurements R119, R120, and R121 on the Front End Control Test board can get VERY HOT. Be careful not to touch them or place any combustible objects in contact with them. Also, do not clip test leads to P8 and leave the instrument unattended while powered on.

10. With the use of an ammeter measure the Main Coil Current being output from the A15 Front End Control assembly by placing the two ammeter probes across pins #1 and #2 of P8 on the Front End Control Test board, as shown in Figure 8-11.

CAUTION   Be sure that the ammeter being used can handle the expected current level and that its range is set properly prior to connecting it across the test points being measured.

11. Verify that the current measured matches what is outlined in Table 8-8 for the Frequency the instrument is tuned to.

If the measured current is correct proceed to the next step. If not, there is most likely either a problem with the A12 YTF Preselector alignment or a problem with the A15 Front End Control assembly. Perform the "A12 YTF Preselector Alignment" routine as outlined below and then re-check the main coil current levels.

Table 8-8   A12 YTF Preselector Main Coil Tune Current Measurements

Frequency	Main Coil Current	Tolerance
4.0 GHz	85 mA	±20 mA
5.0 GHz	105 mA	±20 mA
8.0 GHz	165 mA	±25 mA
10.0 GHz[a]	215 mA	±25 mA
15.0 GHz[a]	325 mA	±30 mA
20.0 GHz[a]	430 mA	±40 mA
26.5 GHz[a]	560 mA	±50 mA

a. Option 526 Only

12. Repeat step 9 through step 11 for the rest of the Frequency values listed in Table 8-8.

13. If no trouble has been found with the main coil current coming from the A15 Front End Control assembly, yet there is still a problem with the A12 YTF Preselector assembly, refer to Chapter 6, "RF Downconverter Section." for further troubleshooting information on the A12 YTF Preselector assembly itself.

A12 YTF Preselector Alignment

The alignment of the A12 YTF Preselector is performed by the use of an internal instrument routine and requires no additional test equipment. Use the following procedure to perform the A12 YTF Preselector alignment routine:

1. If the Front End Control Test board was being used just prior to the running of this routine turn the instrument off, disconnect the Front End Control Test board from the instrument, and plug all of the instrument internal cables back into the A15 Front End Control assembly.

2. Then turn the instrument on and allow it to complete its boot up process.

3. Run the A12 YTF Preselector alignment routine by pressing **System**, **Alignments**, **More**, **Advanced**, **Characterize Preselector**.

A13 RF Front End Assembly Control – (Option 503, 508, & 526 only)

A problem with the A13 RF Front End assembly could be caused by either a failure of the assembly itself, the control logic sent to it, or damage to the cable between the two. This section will verify the functionality of the control logic coming from the A15 Front End Control assembly. If after verifying that the control logic in working properly refer to **Chapter 6, "RF Downconverter Section."** for further troubleshooting information on the A13 RF Front End assembly itself.

This section will verify the control signals from the A15 Front End Control assembly to the A13 RF Front End assembly. There are five controls for the A13 RF Front End assembly:

1. Supply Voltages

2. Serial Communication for Assembly Identification

3. Low Band Preamp Control

4. Frequency Band Selection

5. Amplifier Bias

The status of the control lines for A13 RF Front End assembly can be measured on the Front End Control Test board assembly, as seen in **Figure 8-12**.

WARNING

When being used to verify the control signals to the A13 RF Front End assembly there are many resistors on the Front End Test board that can get VERY HOT. Be careful not to touch them or place any combustible objects in contact with them. Also, do not leave the instrument unattended while powered on with the Front End Test board connected in this manner.

Figure 8-12   A13 RF Front End Assembly Control Front End Test Board
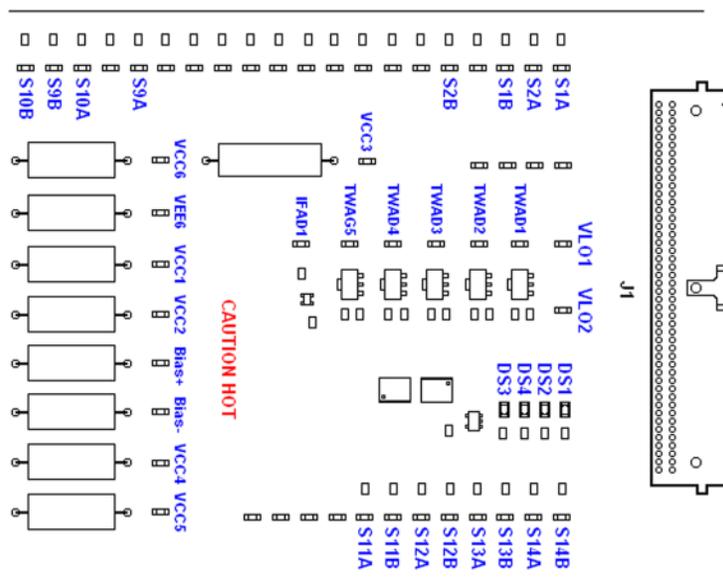
Verifying the Control for the A13 RF Front End Assembly

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Disconnect cable W5 from J104 as shown in Figure 8-6.

3. Connect the A13 RF Front End Assembly Control cable from J104 to the Front End Control Test board J1 as shown in Figure 8-3.

4. Place the Front End Control Test board on a non-conductive surface.

5. Turn the instrument on and allow it to complete its boot up process, ignoring any alignment failures.

6. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Referring to Figure 8-12, verify that all four of the power supply voltage LEDs on the Front End Test board for the A13 RF Front End assembly are on. If one or more of the power supplies is not on verify the A6 Power Supply output voltages before replacing the A15 Front End Control assembly. For information on verifying the A6 power supply output voltages see Chapter 12, "Power Supply & Midplane.".

The value for each of the power supply LEDs is shown in Table 8-9.

Table 8-9   A13 RF Front End Assembly Front End Test Board LEDs

LED	Power Supply Voltage
DS1	−15V
DS2	+5.2V
DS3	+15V
DS4	+9V

8. Verify that the serial communication interface for the A13 RF Front End assembly identification on the A15 Front End Control assembly is working properly by pressing **System**, **Show**, **Hardware**.

NOTE

The Front End Control Test board has the circuitry on it to simulate the presence of an A13 RF Front End assembly. When the instrument is booted up with the test board connected it will return, via the serial communications interface, similar information to an actual A13 RF Front End assembly. This information can then be viewed on the instrument Hardware Information screen.

If there is a **Front End** entry on the Hardware Information screen proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

9. Tune the instrument to a frequency of 50 MHz with a span of 0 Hz by pressing **FREQ**, **50 MHz** and **SPAN**, **Zero Span**.

10. Turn off the RF Preselector by pressing **Input/Output**, **RF Input**, **RF Preselector Off**.

11. Measure the voltage level of the Test Points listed in Table 8-10 for the Internal Preamp **Off** condition.

If the test point voltages are correct (±0.5V) proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

NOTE

If neither the A11 RF Switch / High Band Preamp assembly nor the Front End Test board is connected to the A15 Front End Control assembly J103 the test point voltages for the A13 RF Front End assembly will not be correct.

Table 8-10   A13 RF Front End Assembly Preamp Control Voltages

Internal Preamp	Test Points							
	S1A	S1B	S2A	S2B	S9A	S9B	S10A	S10B
Off	−10V	+10V	+10V	−10V	−10V	+10V	+10V	−10V
Low Band	−10V	+10V	−10V	+10V	+10V	−10V	−10V	+10V

12. Turn the internal low band preamp on by pressing **AMPTD**, **More**, **Internal Preamp**, **Low Band**.

13. Measure the voltage level of the Test Points listed in Table 8-10 for the Internal Preamp **Low Band** condition.

If the test point voltages are correct (±0.5V) proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

14. Turn the internal low band preamp off by pressing **AMPTD**, **More**, **Internal Preamp**, **Off**.

15. Tune the instrument to a frequency of 1 GHz by pressing **FREQ**, **1 GHz**.

16. Measure the voltage level of the Test Points listed in Table 8-11 for a Frequency of **1 GHz**.

If the test point voltages are correct (±0.5V) proceed to the next step. If not, there is most likely a problem with the A15 Front End Control assembly.

Table 8-11   A13 RF Front End Assembly Frequency Band Control Voltages

Frequency	Test Points							
	S11A	S11B	S12A	S12B	S13A	S13B	S14A	S14B
1 GHz	+10V	−10V	−10V	+10V	−10V	+10V	+10V	−10V
5 GHz	−10V	+10V	−10V	+10V	−10V	+10V	−10V	+10V
10 GHz[a]	−10V	+10V	+10V	−10V	−10V	+10V	−10V	+10V
15 GHz[a]	−10V	+10V	−10V	+10V	+10V	−10V	+10V	−10V
20 GHz[a]	−10V	+10V	+10V	−10V	+10V	−10V	+10V	−10V

a. Option 526 only.

17. Repeat step 15 and step 16 for the rest of the Frequency values listed in Table 8-11.

18. Tune the instrument to a frequency of 20 GHz (1 GHz for Option 503 and 508) by pressing **FREQ**, **20 GHz**.

19. Measure the Bias voltage Test Points listed in Table 8-12 (Bias + and Bias - values will only be correct when tuned above 13.6 GHz).

Table 8-12   A13 RF Front End Assembly Bias Voltages

Test Point	Descriptions	Voltage	Tolerance
VCC1	LO Amp Bias	+5.0V	±0.5V
VCC2	LO Amp Bias	+5.0V	±0.5V
VCC3	Low Band Preamp Bias	+8.0V	±0.5V
VCC4	LO Amp Bias	+5.0V	±0.5V
VCC5	Output IF Amp Bias	+5.0V	±0.5V
VCC6	Aux LO Amp Bias +	Future Use	N/A
VEE6	Aux LO Amp Bias −	Future Use	N/A
VLO1	LO Power Level Control	+3.0 to +5.0V	±0.5V
VLO2	LO Power Level Control	+3.0 to +5.0V	±0.5V
TWAD1	LO Amp Bias	+6.0V	±0.5V
TWAD2	LO Amp Bias	+6.0V	±0.5V
TWAD3	High Band Input Amp Bias	+6.0V	±0.5V
TWAD4	LO Amp Bias	+6.0V	±0.5V
TWAD5	LO Amp Bias	+6.0V	±0.5V
IFAD1	Low Band IF Amp Bias	+4.6V	±0.5V
Bias +	High Band Mixer Bias + (>13.6 GHz) Bias	+12.5V[a]	±1.5V
Bias −	High Band Mixer Bias −(>13.6 GHz) Bias	−12.5V[a]	±1.5V

a. Voltages will only be correct when the instrument is tuned above 13.6 GHz

20. If any of the Bias voltages are incorrect the most likely cause of the problem is the A15 Front End Control assembly.

21. If no trouble has been found with the A13 RF Front End assembly controls coming from the A15 Front End Control assembly, yet there is still a problem with the A13 RF Front End assembly, refer to Chapter 6, "RF Downconverter Section." for further troubleshooting information on the A13 RF Front End assembly itself.

IF Switching

The A15 Enhanced Front End Control assembly has the ability to switch the IF signal output from the A13 Front End Assembly to either the A2 Analog IF assembly or the A3 Digital IF assembly. If an instrument has option B85 installed the signal will be routed to the A25 Wideband Analog IF assembly instead of the A3 Digital IF, which will then route the signal to the A3 Digital IF assembly when needed.

With the current configuration of the MXE there is no time other than during the instrument internal alignments that the instrument uses the signal path to the A3 Digital IF assembly. So this procedure will verify the correct signal routing to the A2 Analog IF output, the A25 Wideband Analog IF output if option B85 is installed, and the rear panel AUX IF output.

When the IF signal is routed to the A2 Analog IF assembly the frequency of the signal is 322.5 MHz, when it is routed to the A3 Digital IF assembly it is 250 MHz, and when it is routed to the A25 Wideband Analog IF assembly it is 300 MHz. The instrument is able to vary the intermediate frequency by offsetting the first local oscillator frequency accordingly.

A2 Analog IF Signal Routing

The 322.5 MHz IF signal routing for the A2 Analog IF output of the A15 Enhanced Front End Control board can be seen in the solid heavy blue line in Figure 8-13.

Figure 8-13   322.5 MHz IF Switching to A2 Analog IF
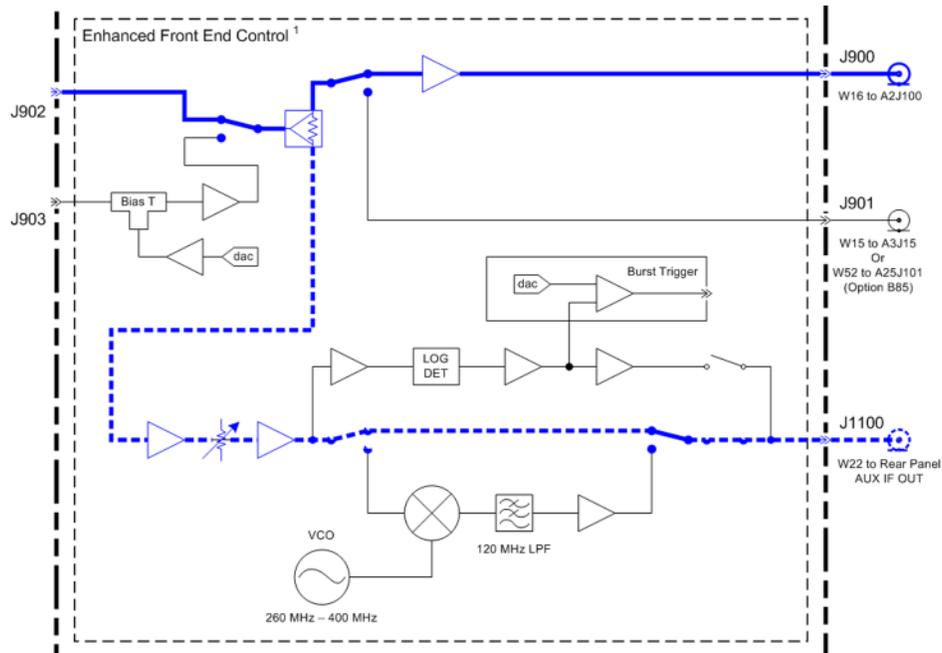
The following procedure will verify the 322.5 MHz IF output switching:

1. Remove the instrument dress cover and internal cover. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Turn the instrument on and allow it to complete its boot up process.

3. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

4. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

5. Turn the 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

6. Tune the instrument to a frequency of 50 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **50 MHz** and **SPAN X Scale**, **Zero Span**.

7. Set the input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

8. Disconnect W16 from A15 J900 as shown in Figure 8-6.

9. Connect a spectrum analyzer to A15 J900.

10. Verify that the amplitude of the 322.5 MHz signal at A15 J900 is equal to that shown in Figure 8-14, +/- 3 dB.

Figure 8-14   A15 Enhanced Front End Control Assembly 322.5 MHz IF Output
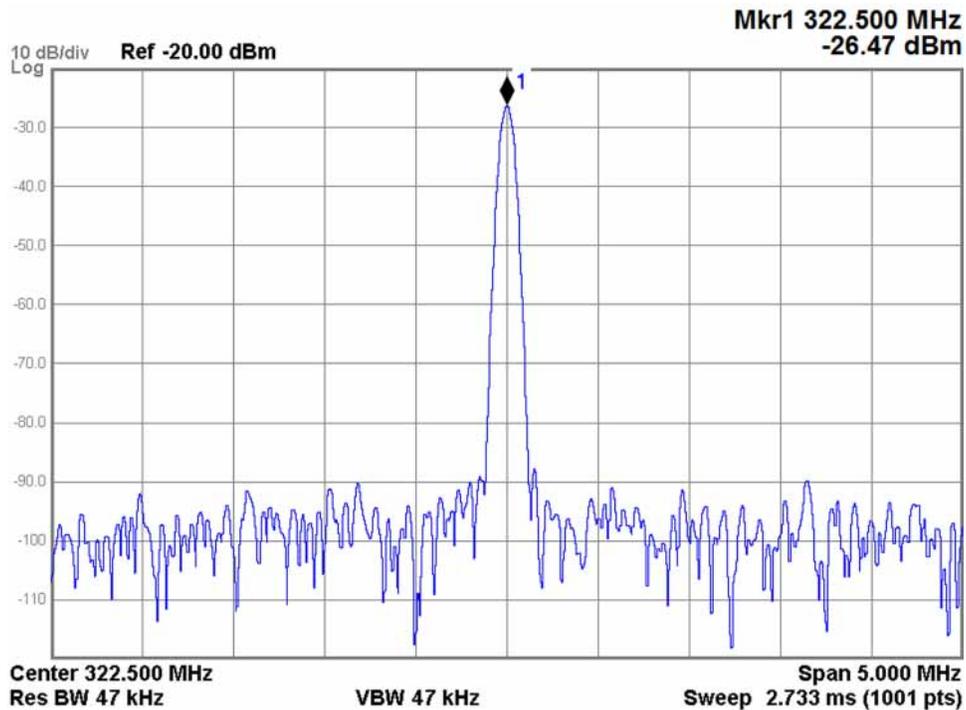
11. If the level is not correct, measure the input signal level coming to A15 J902 out of W14, as shown in Figure 8-6. It should be at approximately the same level shown in Figure 8-14.

If the input signal is at the correct level, and the output is not, the A15 Enhanced Front End Control Assembly has a problem.

If the input signal is not at the correct level see Chapter 6, "RF Downconverter Section." for instructions on how to determine the cause of this problem.

12. Reconnect W16 to A15J 900 as shown in Figure 8-6.

The 300 MHz IF signal routing for the A25 Wideband Analog IF output of the A15 Enhanced Front End Control board can be seen in the solid heavy blue line in Figure 8-15.

Figure 8-15   300 MHz IF Switching to A25 Wideband Analog IF
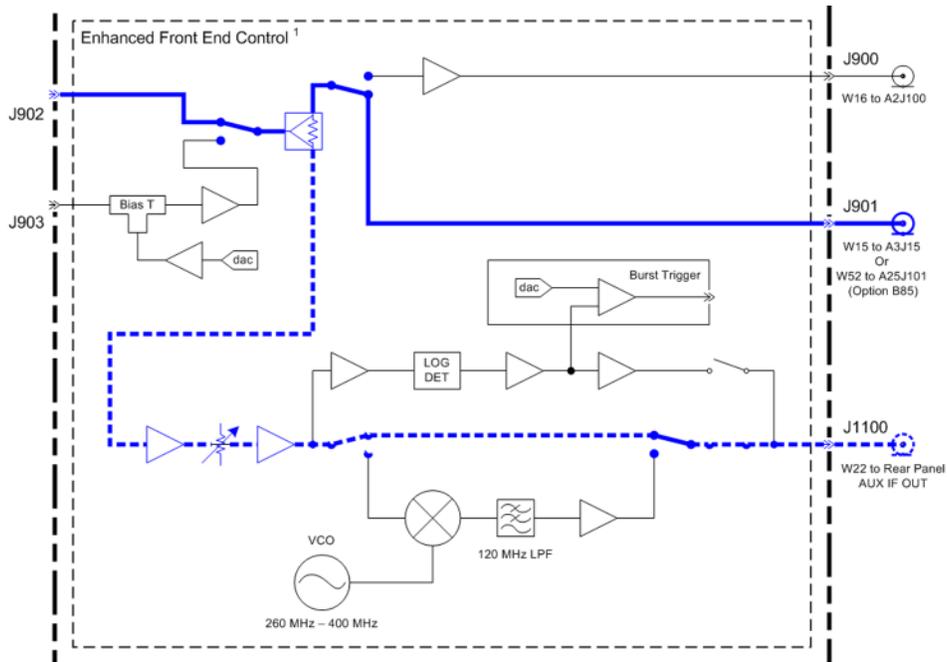
The following procedure will verify the 300 MHz IF output switching:

1. Remove the instrument dress cover and internal cover. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

2. Turn the instrument on and allow it to complete its boot up process.

3. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

4. Turn the RF Preselector off by pressing **Input/Output**, **RF Input**, **RF Preselector Off**.

5. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

6. Switch the instrument into the IQ Analyzer mode by pressing **Mode**, **IQ Analyzer (Basic)**.

7. Turn the 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

8. Tune the instrument to a frequency of 50 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **50 MHz** and **SPAN X Scale**, **Zero Span**.

9. Set the input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

10. Switch to the 85 MHz IF Path by pressing **Mode Setup**, **IF Path**, **85 MHz**.

11. Disconnect W52 from A15 J901 as shown in Figure 8-6.

12. Connect a spectrum analyzer to A15 J901.

13. Verify that the amplitude of the 300 MHz signal at A15 J901 is equal to that shown in Figure 8-16, +/– 3 dB.

Figure 8-16　　A15 Enhanced Front End Control Assembly 300 MHz IF Output
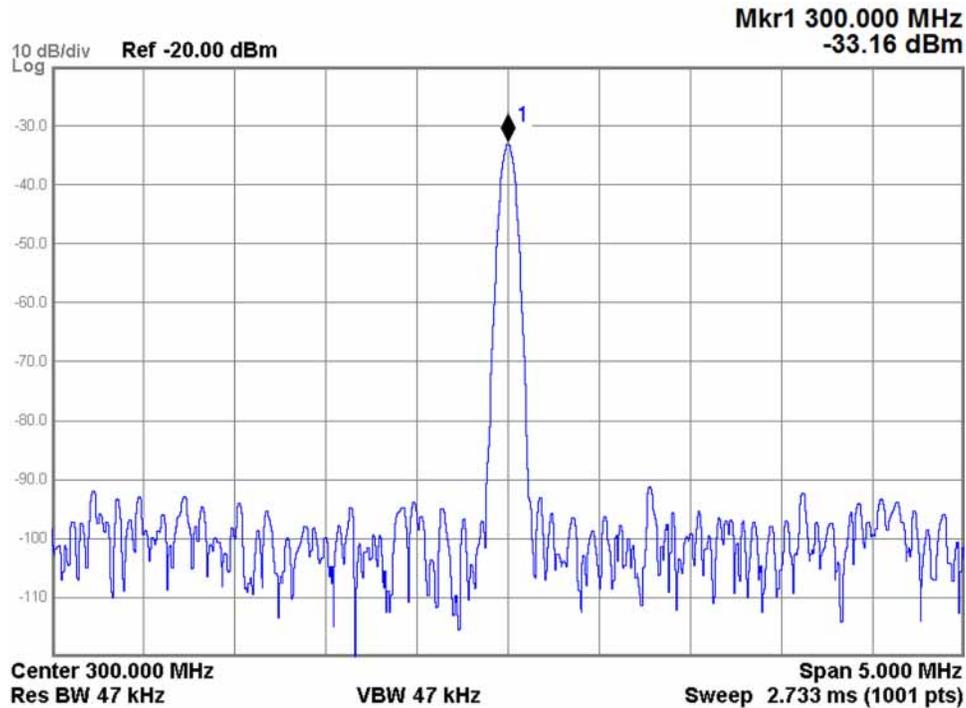
14. If the level is not correct, measure the input signal level coming to A15 J902 out of W14, as shown in Figure 8-6. It should be approximately 6 dB higher than the level shown in Figure 8-16.

If the input signal is at the correct level, and the output is not, the A15 Enhanced Front End Control Assembly has a problem.

If the input signal is not at the correct level see Chapter 6, "RF Downconverter Section." for instructions on how to determine the cause of this problem.

15. Reconnect W52 to A15 J901 as shown in Figure 8-6.

AUX IF Output (Option CR3)

If the instrument is equipped with Option CR3, Auxiliary IF Output, the A15 Enhanced Front End Control assembly will provide the splitting of the IF signal and routing of it to the AUX IF OUT rear panel connector. This optional signal path can be seen in the dashed blue line in Figure 8-13 and Figure 8-15.

The frequency of the Auxiliary IF Output signal will vary depending on the instrument settings. It will typically be 322.5 MHz, unless the instrument has option B85 and it is in a configuration that uses the 85 MHz IF Path. In that case the frequency of the output will be 300 MHz.

The following procedure will verify the AUX IF OUT switching:

1. Turn the instrument on and allow it to complete its boot up process.

2. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

3. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

4. Turn the 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

5. Tune the instrument to a frequency of 50 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **50 MHz** and **SPAN X Scale**, **Zero Span**.

6. Set the input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

7. Turn the Auxiliary IF Output on by pressing **Input/Output**, **Output Config**, **Aux IF Out**, **Second IF (322.5 MHz)**.

8. Connect a spectrum analyzer to the rear panel AUX IF OUT port.

9. Verify that the amplitude of the 322.5 MHz signal at the rear panel AUX IF OUT port is equal to that shown in Figure 8-17, +/- 3 dB.

Figure 8-17   Rear Panel AUX IF OUT
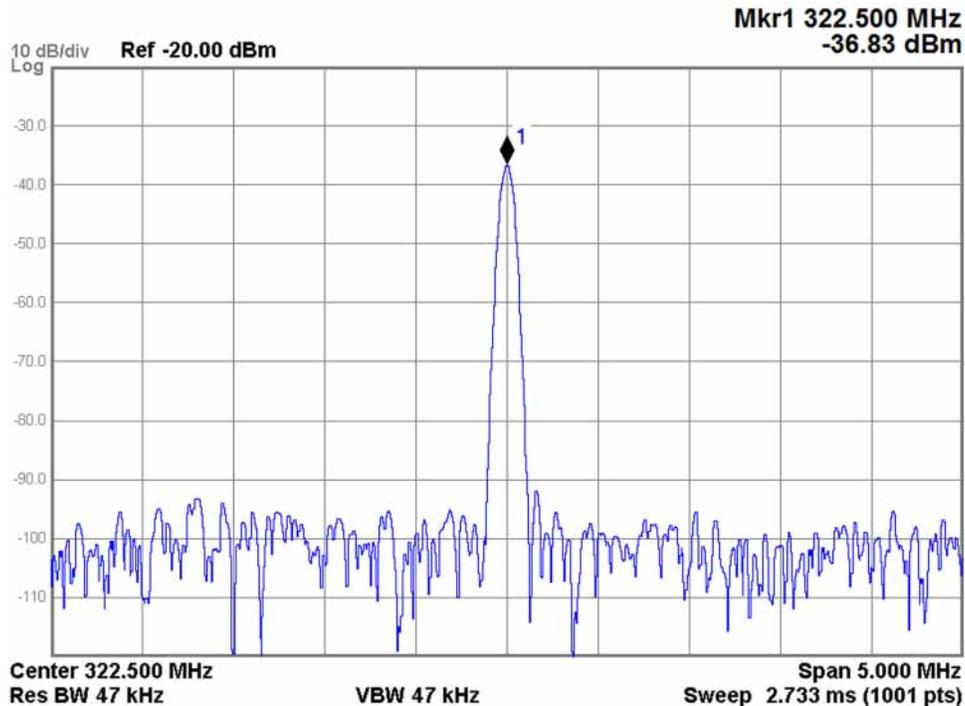
10. IF the level is not correct turn the instrument off and remove the instrument dress cover and internal cover. Refer to Chapter 18, "Assembly Replacement Procedures." for instructions on removing these covers.

11. Turn the instrument on and allow it to complete its boot up process.

12. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

13. Turn the instrument auto alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

14. Turn the 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

15. Tune the instrument to a frequency of 50 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **50 MHz** and **SPAN X Scale**, **Zero Span**.

16. Set the input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

17. Turn the Auxiliary IF Output on by pressing **Input/Output**, **Output Config**, **Aux IF Out**, **Second IF (322.5 MHz)**.

18. Disconnect W22 from A15 J1100 as shown in Figure 8-6.

19. Connect a spectrum analyzer to A15 J1100.

20. Verify that the amplitude of the 322.5 MHz signal at A15 J1100 is equal to that shown in Figure 8-17, +/- 3 dB. If the level is correct at this point replace W22.

21. If the level at A15 J1100 is not correct, measure the input signal level coming to A15 J902 out of W14, as shown in Figure 8-6. It should be approximately 10 dB higher than the level shown in Figure 8-17.

If the input signal is at the correct level, and the output is not, the A15 Enhanced Front End Control Assembly has a problem.

If the input signal is not at the correct level see Chapter 6, "RF Downconverter Section." for instructions on how to determine the cause of this problem.

9 Reference Assembly

What You Will Find in This Chapter

The following information is presented in this chapter:

1. Theory of operation of the Reference section.
2. Isolating the cause of a hardware problem by verifying the functionality of assemblies in the Reference sections.

NOTE

Each of the following sections first describes how the assembly works, then gives information to help you troubleshoot the assembly. Each description explains the purpose of the assembly, describes the main components, and lists external connections to the assembly.

The following information is found in this chapter:

KEYSIGHT
TECHNOLOGIES

A16 Reference Assembly Description

A16 Reference Assembly Purpose

The A16 Reference Assembly provides the fundamental reference signals from which all instrument local oscillator and synchronous timing signals are derived. The reference board also uses these same signals to generate CW and modulated RF calibration signals and a 10 MHz time base signal for the instrument.

A16 Reference Assembly Description

NOTE

Refer to Chapter 15, "Block Diagrams".

Although it is constructed of two boards, the Reference Main board and Reference Daughter board, the A16 Reference assembly must be replaced as a single assembly. These boards are listed individually in the Show Hardware screen, allowing identification of the individual board part numbers comprising the complete assembly.

The reference signals and local oscillators are phase locked to a timebase in one of two ways:

1. The internal 10 MHz reference located on the A16 Main board.

2. An externally provided reference such as a house standard or the reference from another instrument or a base transceiver system. The external reference can be any RF signal in the range of 1 MHz to 50 MHz, −5 dBm to +10 dBm.

If an external reference signal is within 200 Hz of the specified external reference frequency and **Freq Ref In** is set to **Sense**, the analyzer will automatically switch from using the internal reference to an external reference signal.

The phase noise performance of the reference signals establishes the limit on attainable phase noise performance of the LO signals derived from them. Therefore, excellent phase noise of reference signals is required to achieve excellent LO signal phase noise.

Status monitoring is comprehensive. Every PLL is monitored for phase lock and every ALC is monitored for correct leveling. A set of LED's which indicate whether the 100 MHz VCXO PLL and the 2400 MHz CRO PLL is phase locked or unlocked. Each oscillator (10 MHz, 100 MHz, 2400 MHz) is monitored for the presence of RF power (dead/alive status).

A16 Reference Assembly Connections

The connections to and from the A16 Reference assembly are as listed in Table 9-1 and as illustrated in Figure 9-1.

Table 9-1   A16 Reference Assembly Signals

Port	Description	To/From	Cable	Frequency
J100	Bias & Control	A8 Motherboard J21	n/a	n/a
J200	JTAG Programming	n/a	n/a	n/a
J701	Calibrator Signal	SW1 Cal Switch P2	W43	50 MHz or 4.8 GHz
J702	2nd LO Signal	A13 Front End J1	W42	4.8 GHz
J703	1st LO FRAC-N Reference	A14 LO Synthesizer J200	W41	4.8 GHz
J704	External Reference Input	Rear Panel Ext Ref In	W21	1 - 50 MHz
J705	E-Cal Signal	A13 Front End J6	W18	50 MHz
J706	Not Used	n/a	n/a	n/a
J707	Not Used	n/a	n/a	n/a
J710	Digital IF Reference	n/a	n/a	n/a
	Serial Prefix < MY/SG5322	A3 Digital IF J14	W20	10 MHz
J711	3rd LO Signal	A2 Analog IF J300	W19	300 MHz
J714	Not Used	n/a	n/a	n/a
J715	Not Used	n/a	n/a	n/a
J716	Digital IF Reference	A3 High Perf. Digital IF J14	W20	100 MHz
	Serial Prefix < MY/SG5322	n/a	n/a	n/a
J717	Not Used	n/a	n/a	n/a
J718	Wideband IF Reference	A25 Wideband Analog IF J301[a]	W51	2400 MHz
J726	Step Calibrator Input	A3 High Perf. Digital IF J17	W23	Input
		A25 Wideband Analog IF J806[a]	W50	Input
	Serial Prefix < MY/SG5522	n/a	n/a	n/a

a. Only used for instruments with Option B85, 85 MHz Analysis Bandwidth

Figure 9-1   A16 Reference Board Assembly Connections
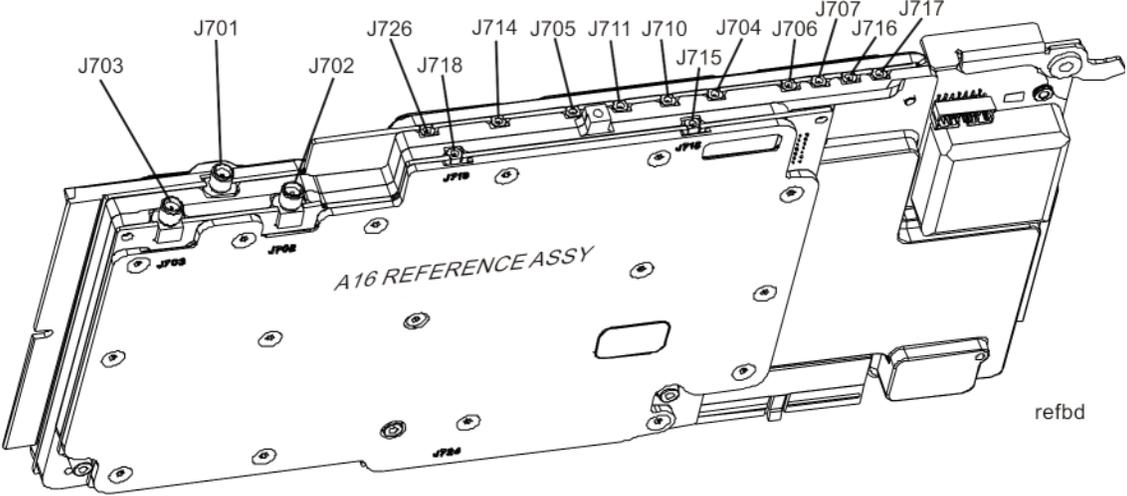
A16 Reference Assembly Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams".

While there are many outputs from the A16 Reference assembly not all are currently used by the instrument and the ones that are will be verified in this section. There are also a number of status LEDs that can be monitored to get an indication of the status of the different functions of the assembly.

Assembly Initialization

Before the A16 Reference assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A16 Reference assembly should identify itself on this list as **Reference**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

Solution: Reload the FPGA code. See"FPGA Synchronization" on page 655.

— An instrument power supply voltage is not operating properly

Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A16 Reference assembly is defective

Solution: Replace the A16 Reference assembly

Assembly Status LEDs

As illustrated in Figure 9-2, there are two sets of diagnostics LEDs on the A16 Reference Assembly. Six LEDs are on the right side of the A16 Reference board and five LEDs are on the A16A1 Reference Daughter board. Table 9-2 lists the diagnostic LEDs and what their status indicates.

A blinking red LED typically indicates that an unleveled condition exists. The number of blinks indicates what circuitry is unleveled, as indicated in Table 9-2.

Figure 9-2   A16 Reference Board Assembly LEDs
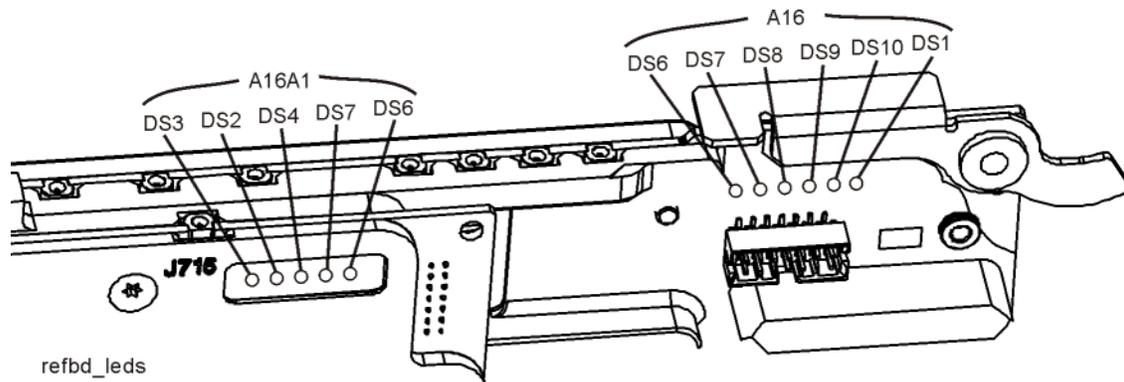
Table 9-2   A16 Reference Assembly Status LEDs

LED	LED Color	Description	Status
A16DS1	Yellow	Program Code is loading	On = Loading Code Off = Ready
A16DS6	Red	100 MHz Unlocked	On = 100 MHz VCXO Unlocked 1 Blink = 4.8 GHz Calibrator Unleveled 2 Blinks = 50 MHz Calibrator Unleveled 3 Blinks = 300 MHz LO Unleveled Off = All Locked
A16DS7	Green	100 MHz PLL Locked	On = Locked Off = Unlocked
A16DS8	Green	100 MHz VCXO Status	On = Yes Off = No
A16DS9	Green	10 MHz OCXO Status	On = On Off = Off
A16DS10	Green	+15V Standby Supply Status	On = On Off = Off
A16A1DS2	Red	Frequency Low	On = Frequency is Low 2 Blinks = 2.4 GHz Ref ALC Unleveled 3 Blinks = 300 MHz Ref ALC Unleveled Off = Normal
A16A1DS3	Red	Frequency High	On = Frequency is High 2 Blinks = 4.8 GHz LO ALC Unleveled 3 Blinks = 2.4 GHz LO ALC Unleveled Off = Normal
A16A1DS4	Green	2.4 GHz Reference Locked	On = Locked Off = Unlocked
A16A1DS5	Green	2.4 GHz VCXO Alive	On = Yes Off = No
A16A1DS6	Yellow	Program Code Loading	On = Loading Code Off = Ready

Assembly Output Signal Frequency & Amplitude Verification

With the use of a spectrum analyzer, verify the frequency and amplitude of the different A16 Reference assembly outputs as outlined in Table 9-3. In order to measure these signals, you will need to remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

The location of the connection for each of the A16 Reference assembly signals can be found in Figure 9-3 and the description, frequency, and amplitude of each can be found in Table 9-3.

Table 9-3   A16 Reference Assembly Outputs

Signal	Signal Location	Frequency (MHz)	Power Level (dBm)
Digital IF Reference	J710	10 MHz	+3 dBm
50 MHz Calibrator	J701	50 MHz	−25 dBm
E-Cal Reference	J705	50 MHz	−27.5 dBm
Digital IF Reference	J716	100 MHz	+13 dBm
3rd LO	J711	300 MHz	+10 dBm
4.8 GHz Calibrator	J701	4800 MHz	−28 dBm
2nd LO (Low Band)	J702	4800 MHz	+11 dBm
1st LO Reference	J703	4800 MHz	+3 dBm
Wideband IF Reference	J718	2400 MHz	+7 dBm

Figure 9-3   A16 Reference Board Assembly Cable Locations
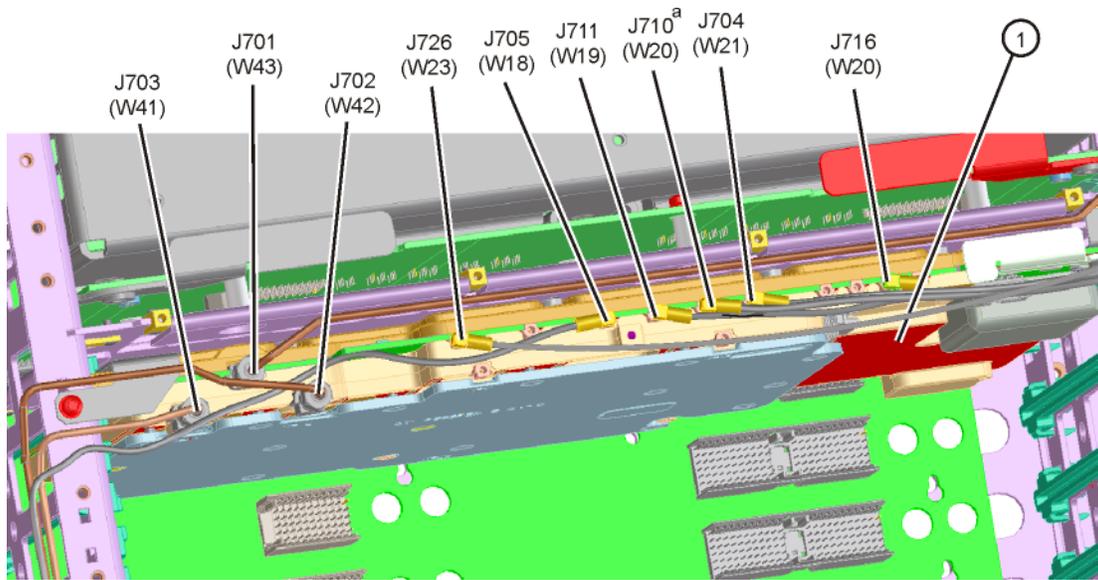
reference_connectors

[a] Serial Prefix < MY/SG5322 only

Digital IF Reference (10 MHz)

1. Disconnect Cable W20 from J710 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the Digital IF Reference signal at J710 is equal to that specified for it in Table 9-3, as shown in Figure 9-4.

Figure 9-4   A16 Reference Assembly Digital IF Reference (10 MHz)
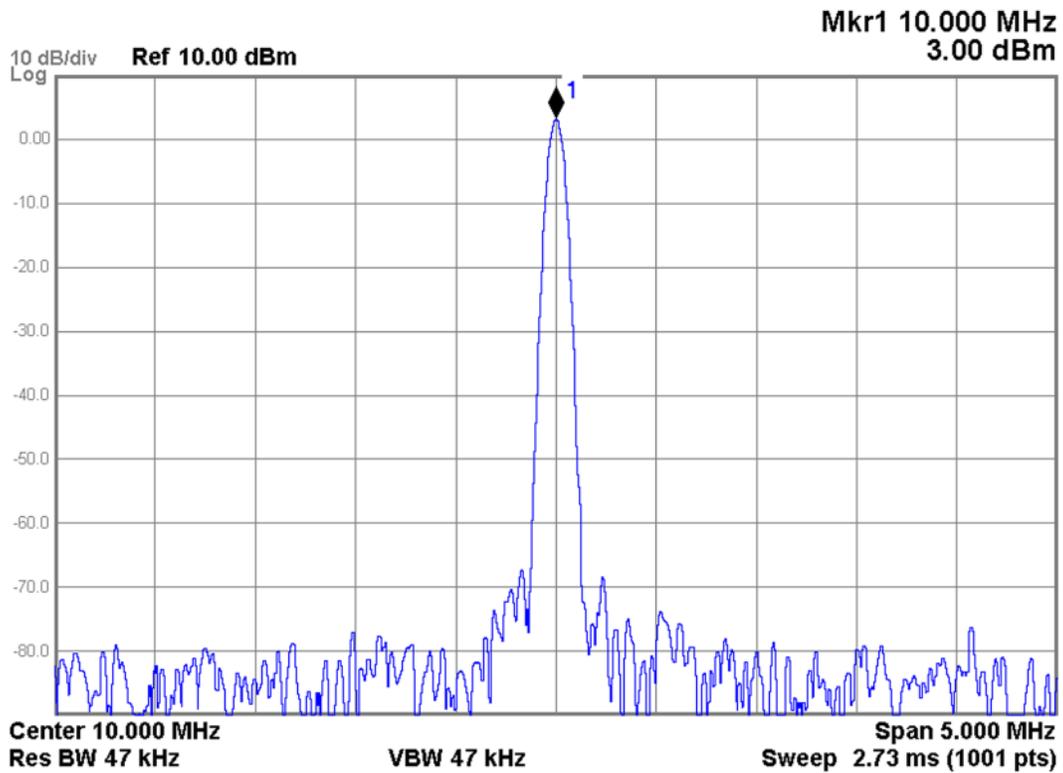
50 MHz Calibrator

1. Disconnect Cable W43 from J701 as shown in Figure 9-3.

2. Turn the 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz** on the instrument.

3. Verify with a spectrum analyzer that the frequency and amplitude of the 50 MHz Calibrator signal at J701 is equal to that specified for it in Table 9-3, as shown in Figure 9-5.

Figure 9-5   A16 Reference Assembly 50 MHz Calibrator
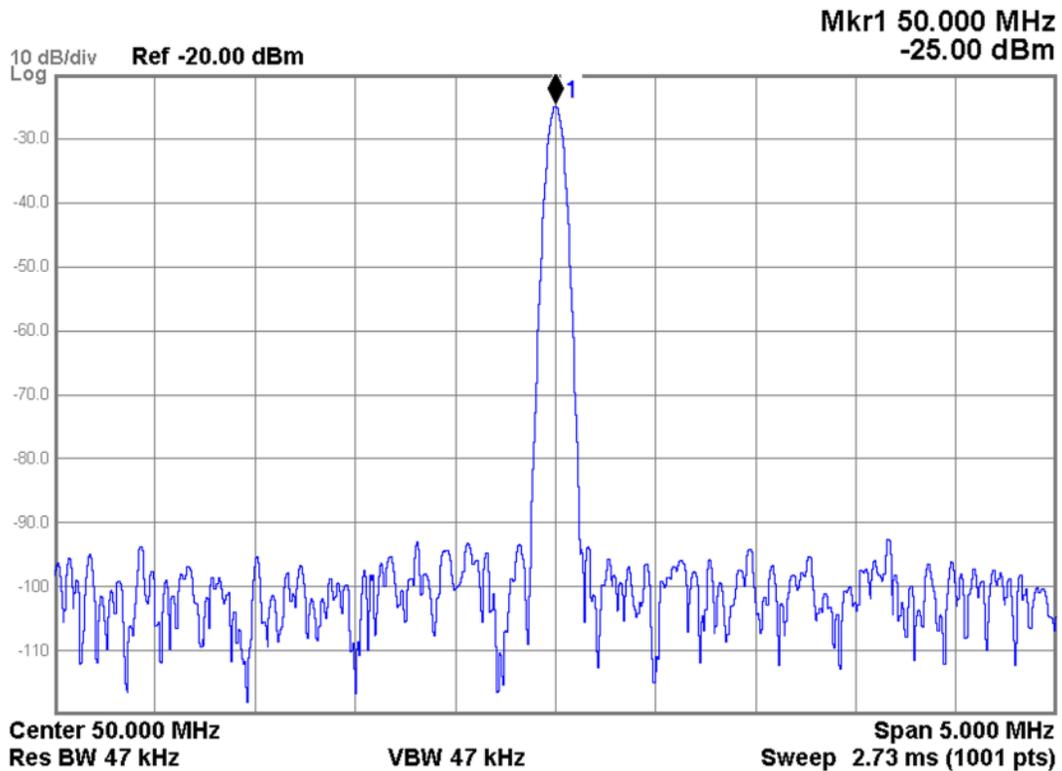
E-Cal Reference

1. Disconnect Cable W18 from J705 as shown in Figure 9-3.

NOTE   The 50 MHz E-Cal signal is only used during an instrument alignment and will not stay on for any length of time. To capture the signal you will need to use the Maxhold function of the spectrum analyzer that you are using to verify the signal.

2. To start the instrument alignment procedure manually so that the E-Cal signal can be captured press **System**, **Alignments**, **Align Now**, **All** on the instrument.

3. Verify with a spectrum analyzer that the frequency and amplitude of the E-Cal Reference signal at J705 is equal to that specified for it in Table 9-3, as shown in Figure 9-6.

Figure 9-6   A16 Reference Assembly E-Cal Reference
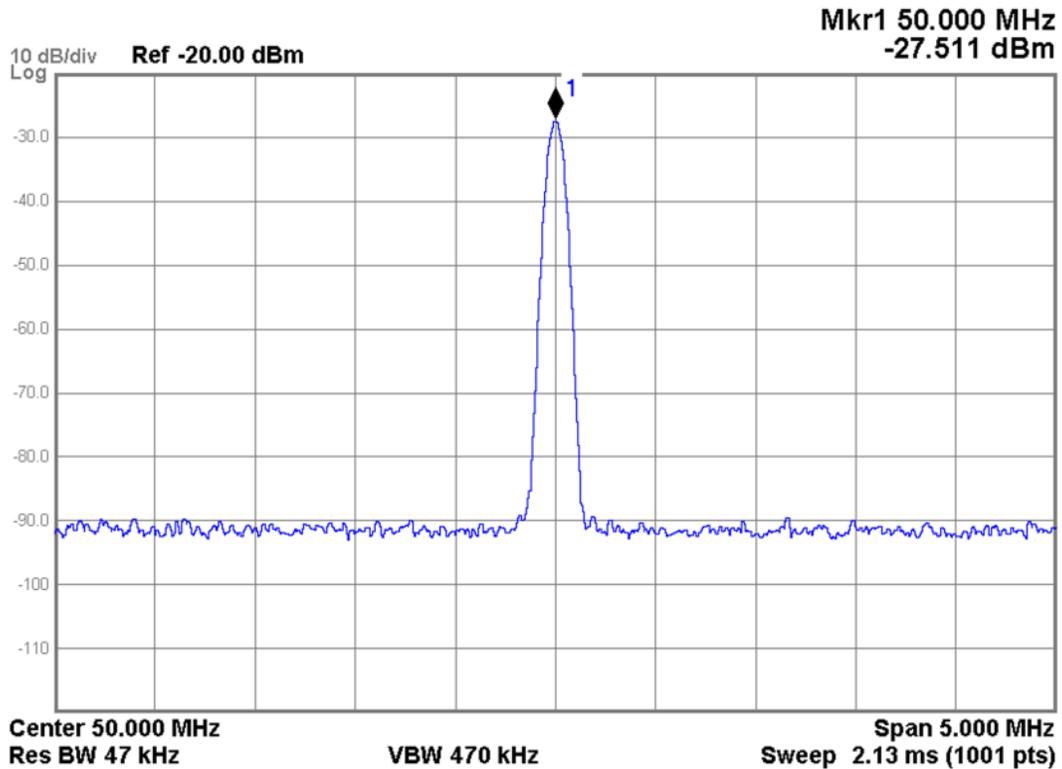
Digital IF Reference (100 MHz)

1. Disconnect Cable W20 from A16J716 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the Digital IF Reference signal at A16J716 is equal to that specified for it in Table 9-3, as shown in Figure 9-7.

Figure 9-7   A16 Reference Assembly Digital IF Reference (100 MHz)
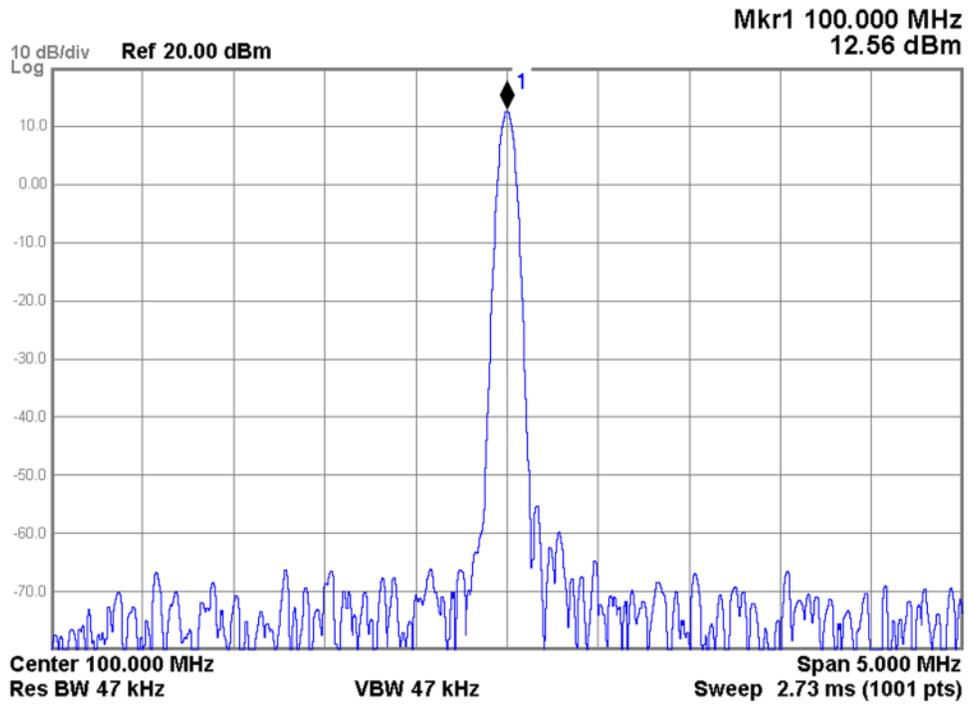
3rd LO

1. Disconnect Cable W19 from J711 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the 3rd LO signal at J711 is equal to that specified for it in Table 9-3, as shown in Figure 9-8.

Figure 9-8   A16 Reference Assembly 3rd LO Output
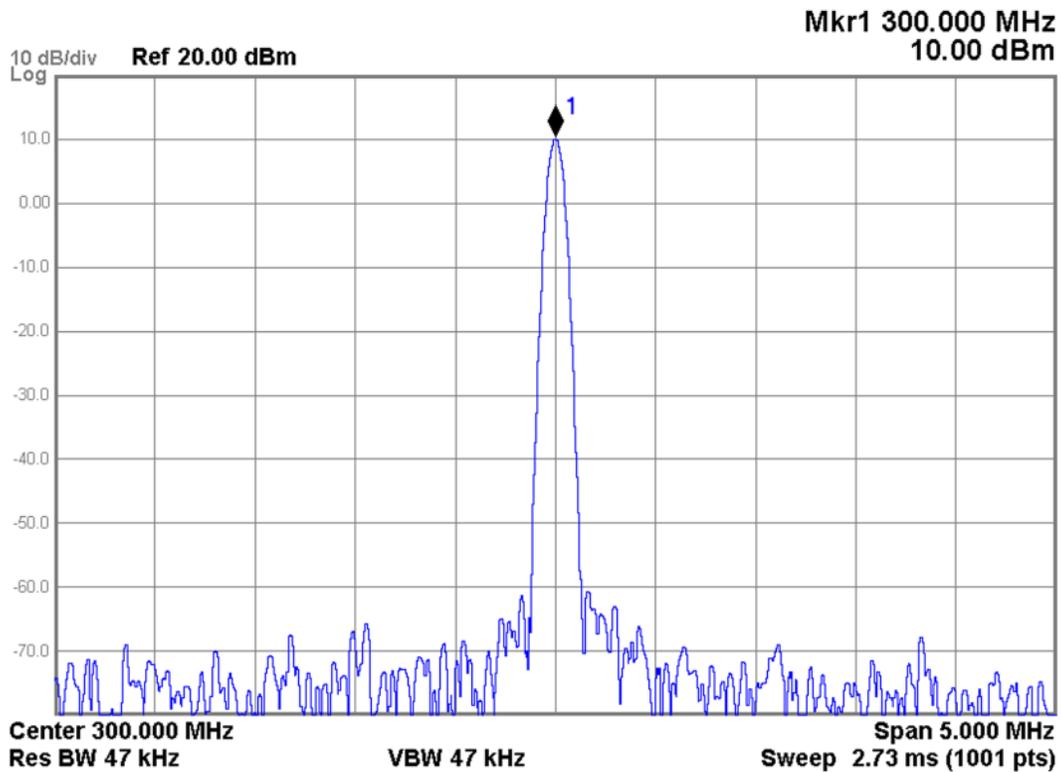
4.8 GHz Calibrator

1. Disconnect Cable W43 from J701 as shown in Figure 9-3.

2. Turn the 4.8 GHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **4.8 GHz** on the instrument.

3. Verify with a spectrum analyzer that the frequency and amplitude of the 4.8 GHz Calibrator signal at J701 is equal to that specified for it in Table 9-3, as shown in Figure 9-9.

Figure 9-9   A16 Reference Assembly 4.8 GHz Calibrator
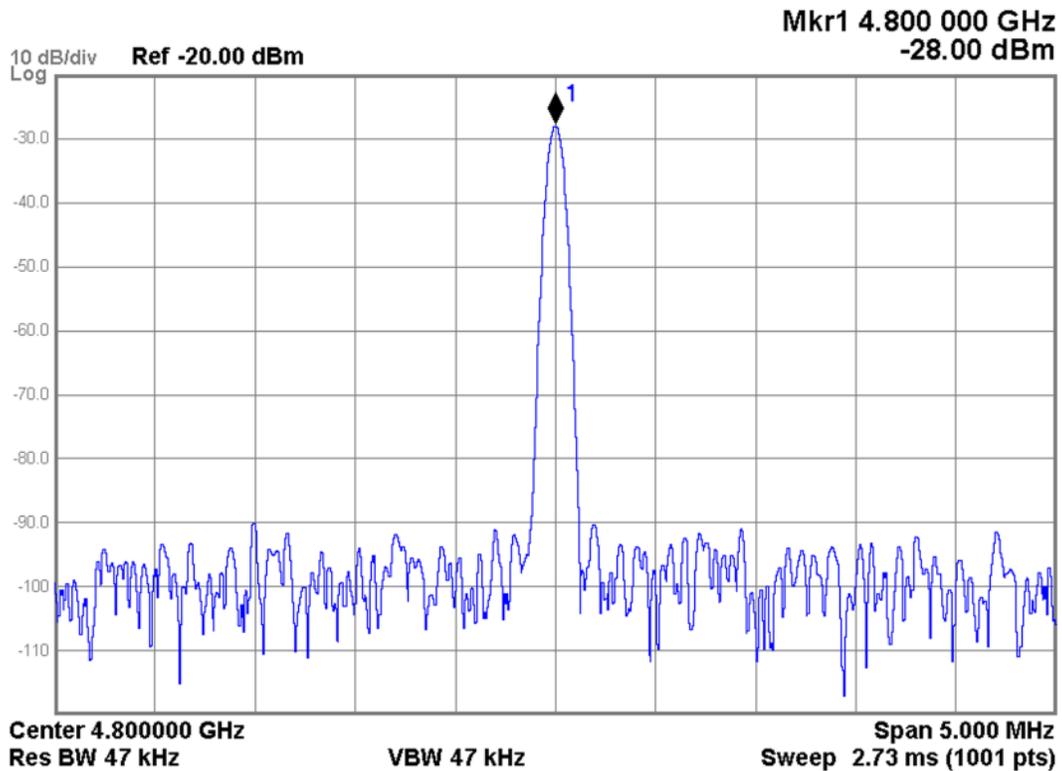
1st LO Reference

1. Disconnect Cable W41 from J703 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the 1st LO Reference signal at J703 is equal to that specified for it in Table 9-3, as shown in Figure 9-10.

Figure 9-10   A16 Reference Assembly 1st LO Reference
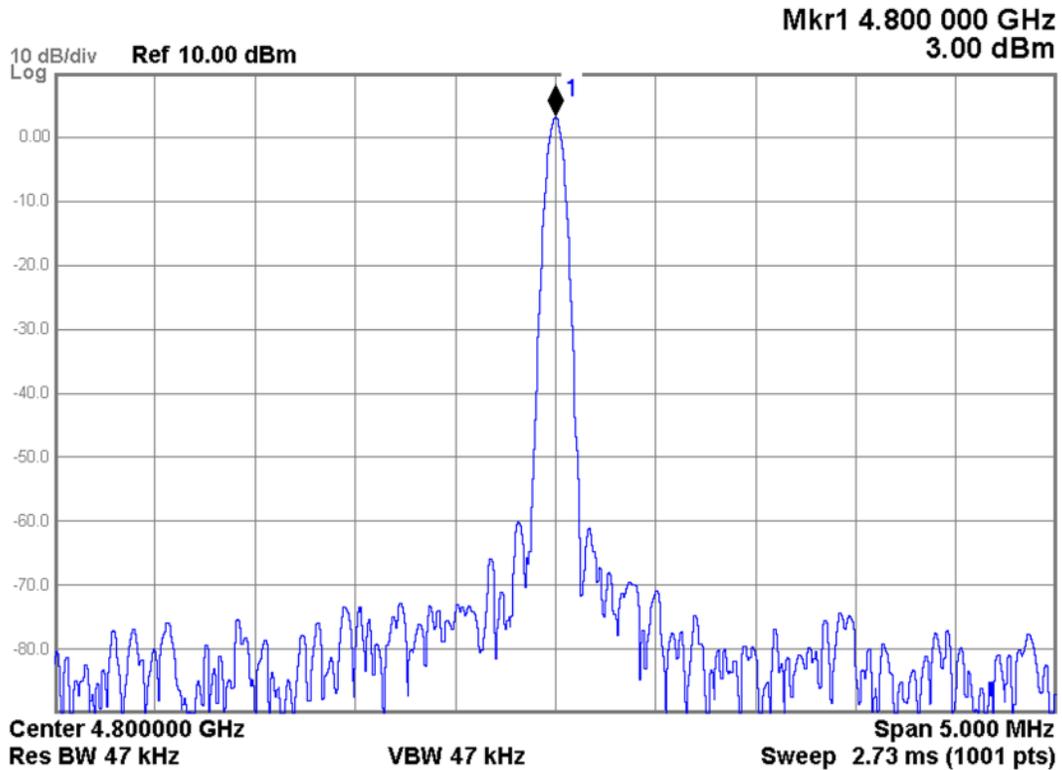
2nd LO (Low Band)

1. Disconnect Cable W42 from J702 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the 2nd LO (Low Band) signal at J702 is equal to that specified for it in Table 9-3, as shown in Figure 9-11.

Figure 9-11   A16 Reference Assembly 2nd LO (Low Band)
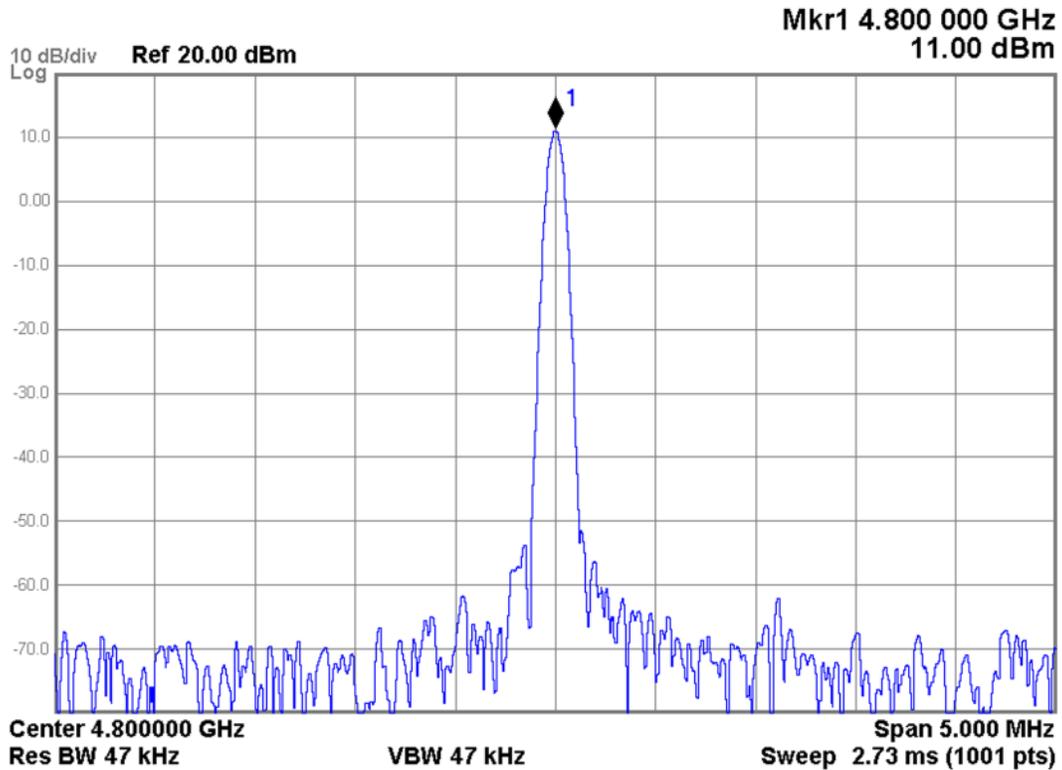
Wideband IF Reference

1. Disconnect Cable W51 from A16J718 as shown in Figure 9-3.

2. Verify with a spectrum analyzer that the frequency and amplitude of the 2nd LO (Low Band) signal at A16J718 is equal to that specified for it in Table 9-3, as shown in Figure 9-12.

Figure 9-12   A16 Reference Assembly 2nd LO (Low Band)
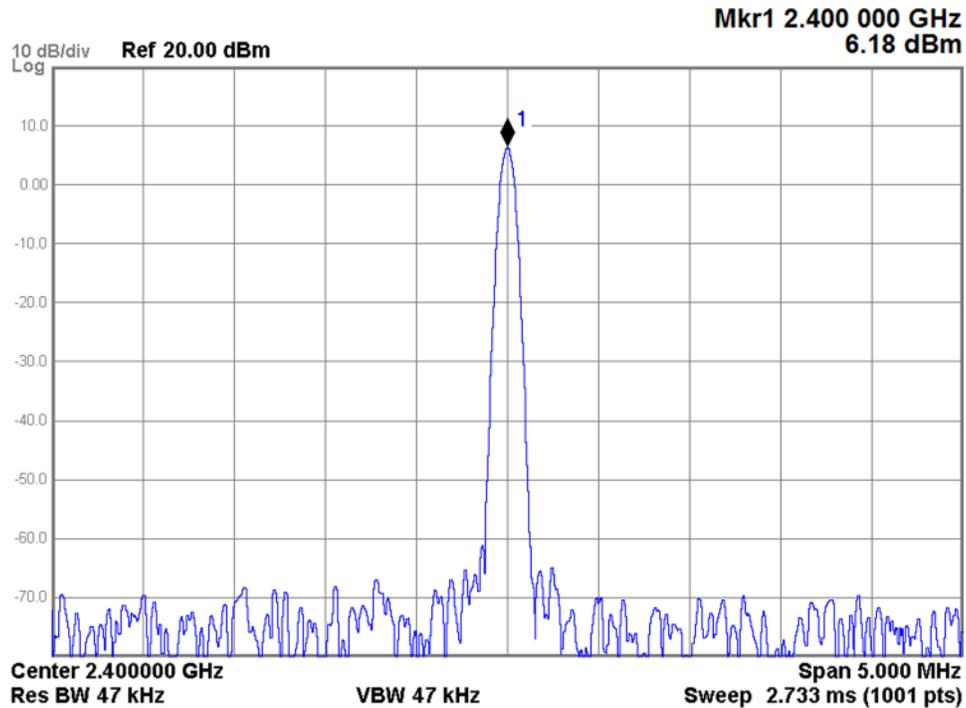
If any of the signals that are generated on the A16 Reference assembly are not of the proper frequency or amplitude the most probable cause of the problem is likely to be the A16 Reference assembly itself, as long as the A6 Power Supply assembly is functioning properly. See Chapter 12, "Power Supply & Midplane" if there are any questions about this.

10   Analog & Digital IF

What You Will Find in This Chapter

The following information is presented in this chapter:

1. Theory of operation of the IF section.
2. Isolating the cause of a hardware problem by verifying the functionality of assemblies in the IF section signal path.

NOTE

Each of the following sections first describes how the assembly works, then gives information to help you troubleshoot the assembly. Each description explains the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following sections are found in this chapter:

KEYSIGHT
TECHNOLOGIES

A2 Analog I.F. Assembly Description

A2 Analog IF Assembly Purpose

The instrument's RF input signal is down converted to a 322.5 MHz intermediate frequency in the A13 RF Front End Assembly. This 322.5 MHz signal is the input to the A2 Analog I.F. Assembly. The Analog I.F. down converts the 322.5 MHz signal to a final 22.5 MHz intermediate frequency. In order to obtain optimal dynamic range and minimize unwanted spurious signals, this signal is filtered, amplified and attenuated throughout this assembly. The final 22.5 MHz signal goes through a series of variable band pass filters each having a specific bandwidth. Three things determine the signal path and which filters are chosen:

— Instrument resolution bandwidth (RBW) setting

— Application used

— Mode applied

This assembly also contains the burst carrier trigger circuitry. The output of the assembly is a filtered 22.5 MHz signal that goes to the A3 Digital I.F. Assembly.

A2 Analog IF Assembly Description

NOTE	Refer to **Chapter 15, "Block Diagrams"**.

A 322.5 MHz input signal is received from the A13 RF Front End assembly. The signal then goes through a band pass filter centered at 322.5 MHz with a 25 MHz bandwidth. A cal comb signal can be automatically switched in at the input of the assembly to calibrate the prefilters.

Step Attenuator and Amplifier

A 1 dB step attenuator follows to compensate for band gain differences. The signal then goes through a high-dynamic range amplifier.

Image Filters

One of three different filter paths will be selected automatically, depending on the analyzer mode.

— The through path is selected in IQ Analyzer Mode and wide-band demod.

— The 12 MHz ceramic bandpass filter is used for normal Signal Analyzer swept and FFT operation.

— The 300 kHz Surface Acoustic Wave (SAW) is used for ACP modes.

Mixer

There are two mixers that reside on this assembly. The first mixer is used to down convert the 322.5 MHz input to the final 22.5 MHz IF. The other mixer is described in the IF Comb Cal section.

3rd LO

The 300 MHz 3rd L.O. signal comes from the A16 Reference assembly and conditions it for use as an LO in the two mixers that reside on this assembly. The third LO power is ~+10 dBm to optimize the conversion efficiency of the mixer.

I.F. Comb Cal

The 2nd mixer on this assembly is used to mix the 300 MHz LO from the A16 Reference assembly with the 22.5 MHz cal comb signal from the A3 Digital IF to allow calibration of the prefilters and overall passband phase and amplitude. The signal is attenuated by 20 dB if necessary. A limiter is used to reduce amplitude variation effects.

Post Down Conversion Amplification and Prefiltering

The 22.5 MHz IF goes through a fixed gain amplifier. Then prefilters are switched in and out. The signal then goes through a variable gain amplifier.

The prefilters provide four single-pole filters to limit the bandwidth of the signal reaching the ADC on the A3 Digital IF assembly. There are five different signal paths for the 22.5 MHz IF when using Signal Analyzer swept mode, as shown in Table 10-1.

Table 10-1   A2 Analog IF Assembly 22.5 MHz Prefilter Signal Paths

Filter Path	Instrument RBW (3 dB)	Filter BW
Through Path	430 kHz to 8 MHz	n/a
LC Wide	180 kHz to 390 kHz	1 MHz
LC Narrow	30 kHz to 160 kHz	300 kHz
Crystal Wide	4.3 kHz to 27 kHz	75 kHz
Crystal Narrow	1 Hz to 3.9 kHz	10 kHz

NOTE

In IQ Analyzer mode or in Spectrum Analyzer mode with Sweep Type of FFT, the analyzer span setting determines the pre-filter settings.

Anti-Alias Filter and Final Amplifier

The anti–alias filters attenuate unwanted out–of–band noise and distortion products. The first anti–alias filter is centered at 22.5 MHz and is 25 MHz wide.

The signal can bypass the second anti–alias filter when the analyzer utilizes either the IQ Analyzer swept, or wide-band demod.

The through path is selected when the image filter is in the 25 MHz mode (for IQ Analyzer swept and wide-band demod)

In all other cases the signal will pass through the second 12 MHz anti–alias filter.

The step gain block provides an additional switchable 10 dB gain to overcome the ADC noise floor and provide an additional 2 dB of sensitivity.

Burst Carrier Trigger

The Burst Carrier Trigger detector provides a binary signal to be used as a trigger based on the presence of an RF input signal or not. The variable gain amplifiers drive a detector and its output drives a comparator which generates the trigger signal.

Overall A2 Analog IF Assembly Resolution Bandwidth

In Spectrum Analyzer mode in the Swept SA measurement, the different filter paths are selected by the instrument when different resolution bandwidths are selected. Table 10-2 outlines what signal paths are used for what resolution bandwidths. The 25 MHz filter path is not used in the Spectrum Analyzer mode. It is used in the IQ Analyzer mode.

Table 10-2   A2 Analog IF Filter Path Selection

Filter Path	Resolution Bandwidth Range
12 MHz	430 kHz to 8 MHz
1 MHz	180 kHz to 390 kHz
300 kHz	30 kHz to 160 kHz
75 kHz	4.3 kHz to 27 kHz
10 kHz	1 Hz to 3.9 kHz

A2 Analog IF Assembly Connections

The connections to and from the A2 Analog IF assembly are as listed in Table 10-3 and as illustrated in Figure 10-1.

Table 10-3   A2 Analog IF Assembly Signals

Port	Description	To/From	Cable	Frequency
J100	IF Input	A15 Front End Control J900	W16	322.5 MHz
J300	LO Input	A16 Reference J711	W19	300 MHz
J401	Not Used	n/a	n/a	n/a
J600	Not Used	n/a	n/a	n/a
J601	IF Output	A3 Digital IF J19	W17	22.5 MHz
J800	JTAG Programming	n/a	n/a	n/a
J810	Not Used	n/a	n/a	n/a
J820	Bias and Control	A3 Digital IF J20	W7	n/a
J850	Not Used	n/a	n/a	n/a

Figure 10-1   A2 Analog IF Assembly Connections
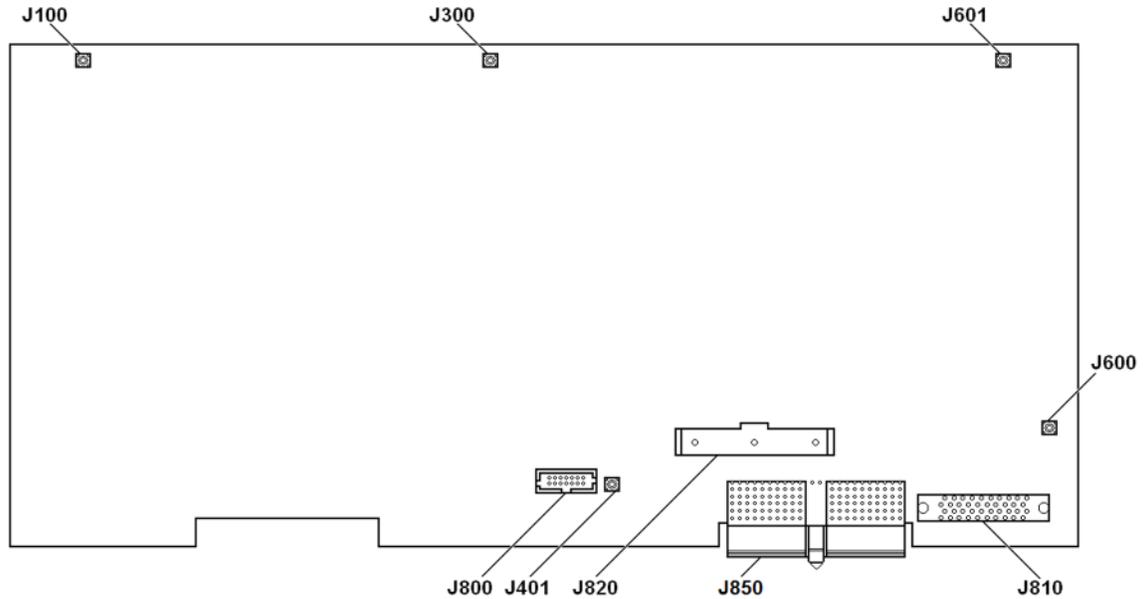
A2 Analog I.F. Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams".

Assembly Initialization

Before the A2 Analog IF assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A2 Analog IF assembly should identify itself on this list as **Analog IF**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

  Solution: Reload the FPGA code. See FPGA Synchronization in Chapter 19, "Post-Repair Procedures".

— An instrument power supply voltage is not operating properly

  Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A2 Analog IF assembly is defective

  Solution: Replace the A2 Analog IF assembly

Signal Path Verification

While this assembly does create the 22.5 MHz IF signal, it does so with two inputs that come from other assemblies. These two input signals are:

— 322.5 MHz IF Input from the A13 RF Front End Assembly

— 300 MHz 3rd LO Signal from the A16 Reference Assembly

Before looking for a fault on the A2 Analog IF assembly be sure to verify that both of these signals are of the correct frequency and amplitude. Refer to Chapter 6, "RF Downconverter Section" and Chapter 9, "Reference Assembly" for detailed information on how to verify the frequency and amplitude of these signals.

As can be seen in the block diagram for the A2 Analog IF assembly (see Chapter 15, "Block Diagrams") there are many different signal paths through this assembly, each of which includes a bandpass filter with a different bandwidth. There is also a step gain amplifier that can be used with any of these filter paths.

The following troubleshooting instructions for the A2 Analog IF assembly are broken up into three sections which can be run independently of each other. They are:

A2 Analog IF Filter Path Switching

This will verify that each filter path is switching in and out properly with the use of the instrument's internal 50 MHz calibrator signal.

A2 Analog IF Filter Path Passband Shape

This will verify the filter shape of each of the filter paths with the use of a signal generator tuned to 50 MHz.

A2 Analog IF 25 MHz Filter Path (Option B25 Only)

This will verify the filter path switching and shape for the 25 MHz filter path with the use of a signal generator tuned to 50 MHz.

A2 Analog IF Filter Path Switching

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

NOTE   Since the A2 Analog IF assembly is not in an easily accessible area of the instrument its 22.5 MHz output will be measured on the other end of the cable coming from this assembly, which is connected to J19 of the A3 Digital IF assembly.

2. Turn the instrument on and allow it to complete its boot up process.

3. Remove W17 from the A3 Digital IF assembly J19 as shown in Figure 10-2.

Figure 10-2   A3 Digital IF Assembly Cable Locations
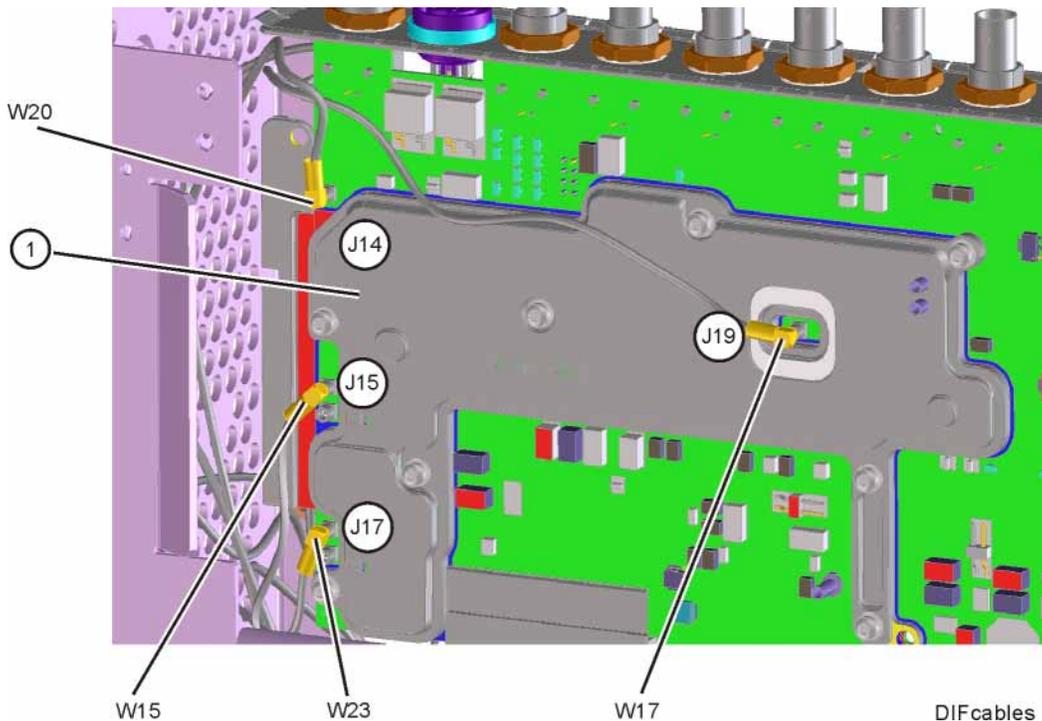
4. Connect the end of W17 to a spectrum analyzer tuned to 22.5 MHz with a span of 5 MHz.

5. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

6. Turn the internal 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

7. Tune the instrument to the calibrator frequency with a span of 0 Hz by pressing **FREQ**, **50 MHz** and **Span**, **Zero Span**.

8. Lock the instrument input attenuation to 10 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **10 dB Man**.

9. Set the instrument resolution bandwidth to 3 MHz by pressing **BW 3 MHz**.

10. Set the step gain to Low by pressing **Meas Setup**, **More**, **Swept IF Gain**, **Low Gain**.

11. Verify that the 22.5 MHz IF output from the A2 Analog IF assembly measures between –21 and –29 dBm as shown in Figure 10-3.

Figure 10-3   A2 Analog IF 22.5 MHz IF Output with Low Gain
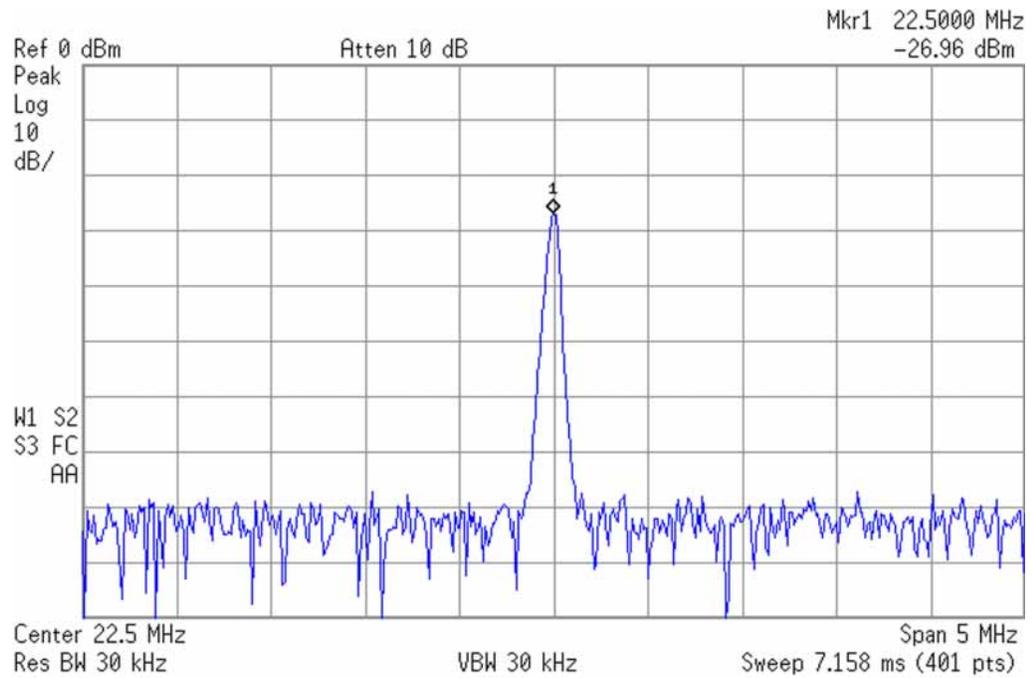
12. Set the step gain to High by pressing **Meas Setup**, **More**, **Swept IF Gain**, **High Gain**.

13. Verify that the 22.5 MHz IF output from the A2 Analog IF assembly measures between -11 and -19 dBm as shown in Figure 10-4.

Figure 10-4   A2 Analog IF 22.5 MHz IF Output with High Gain
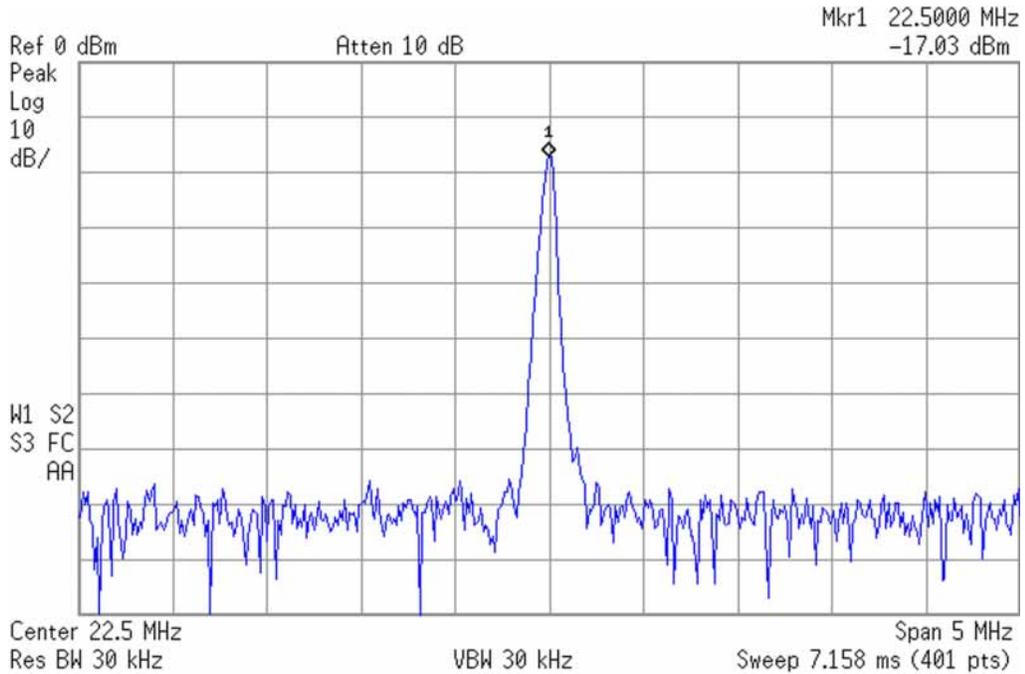
14. Repeat step 9 through step 13 for the remainder of the Filter Paths listed in Table 10-4, using the Resolution Bandwidth values in the table for the setting in step 9.

Table 10-4   A2 Analog IF Filter Path Switching

Filter Path	Resolution Bandwidth
12 MHz	3 MHz
1 MHz	300 kHz
300 kHz	100 kHz
75 kHz	10 kHz
10 kHz	3 kHz

A2 Analog IF Filter Path Passband Shape

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

NOTE

Since the A2 Analog IF assembly is not in an easily accessible area of the instrument its 22.5 MHz output will be measured on the other end of the cable coming from this assembly, which is connected to J19 of the A3 Digital IF assembly.

2. Turn the instrument on and allow it to complete its boot up process.

3. Remove W17 from the A3 Digital IF assembly J19 as shown in Figure 10-2.

4. Connect the end of W17 to a spectrum analyzer tuned to 22.5 MHz.

5. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

6. Tune the instrument to a center frequency 50 MHz and a span of 0 Hz by pressing **FREQ**, **50 MHz** and **Span**, **Zero Span**.

7. Lock the instrument input attenuation to 10 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **10 dB Man**.

8. Connect a sine wave signal generator to the instrument input.

9. Tune the signal generator to 50 MHz with an amplitude of -20 dBm.

10. Set the instrument resolution bandwidth to 3 MHz by pressing **BW 3 MHz**.

11. Set the spectrum analyzer span to 40 MHz

12. Set the spectrum analyzer such that trace 1 is in Clear Write and trace 2 is in Maxhold.

13. Vary the frequency of the signal generator above and below 50 MHz until the resolution bandwidth filter shape has been drawn out on the spectrum analyzer screen as shown in Figure 10-5.

14. Repeat steps 9 through 13 for the remainder of the Filter Paths listed in Table 10-5 with the Resolution Bandwidth and Spectrum Analyzer Span listed in the table.

If any of the resolution bandwidth passband shapes are not correct the A2 Analog IF assembly is most likely at fault.

Table 10-5   A2 Analog IF Filter Path Selection

Filter Path	Resolution Bandwidth	Spectrum Analyzer Span	Expected Filter Shape
12 MHz	3 MHz	40 MHz	Figure 10-5
1 MHz	300 kHz	5 MHz	Figure 10-6
300 kHz	100 kHz	1 MHz	Figure 10-7
75 kHz	10 kHz	500 kHz	Figure 10-8
10 kHz	3 kHz	50 kHz	Figure 10-9

Figure 10-5   A2 Analog IF 12 MHz Filter Path Passband Shape
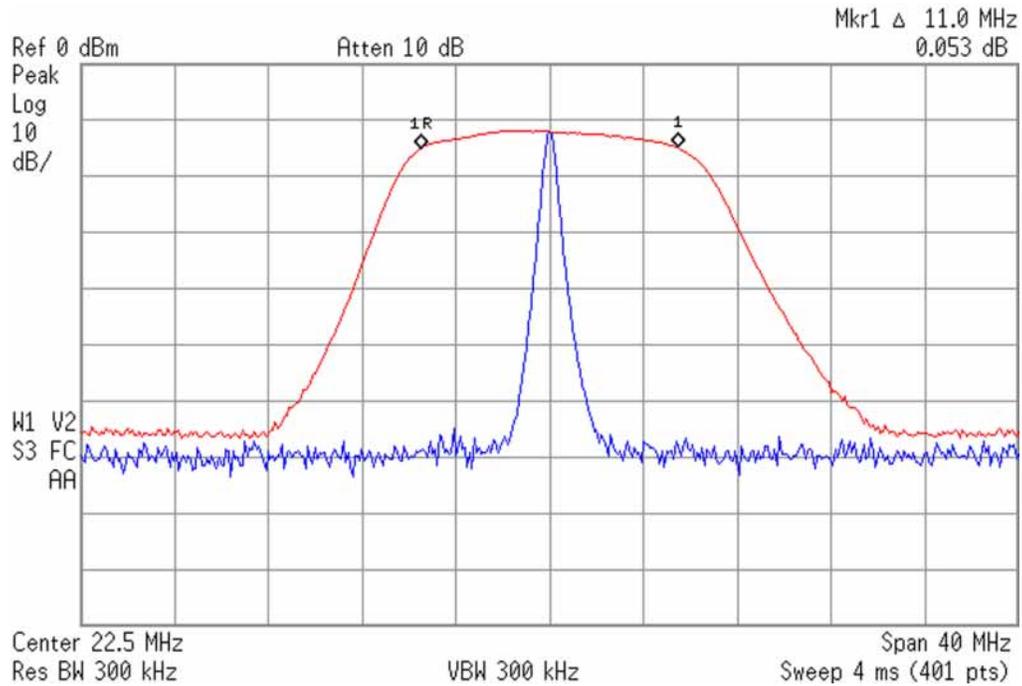
Figure 10-6   A2 Analog IF 1 MHz Filter Path Passband Shape
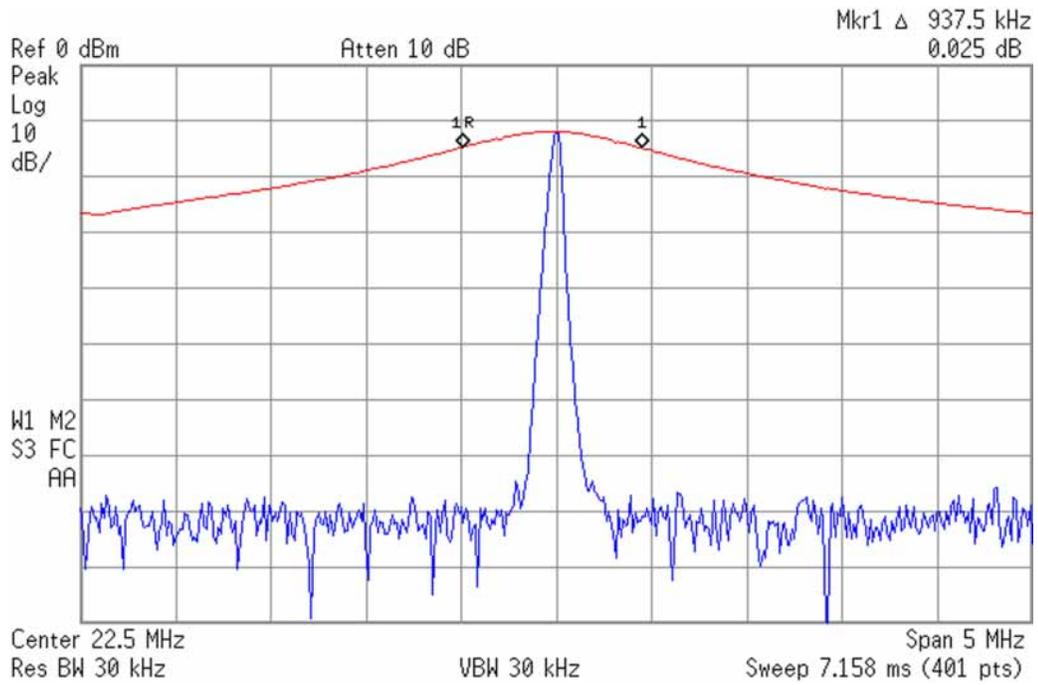
Figure 10-7   A2 Analog IF 300 kHz Filter Path Passband Shape
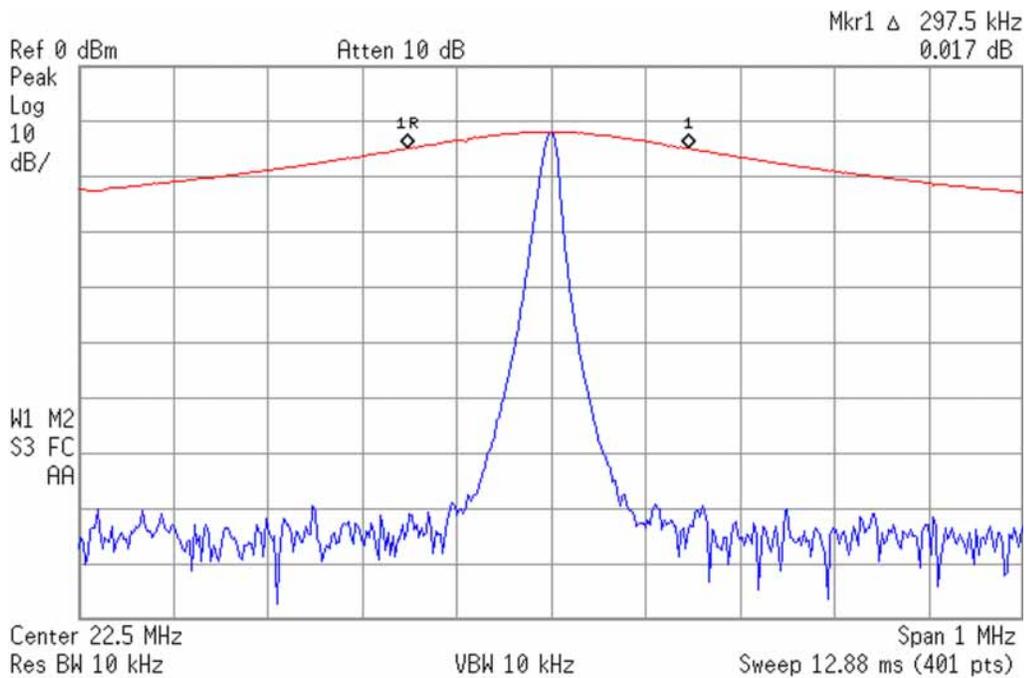
Figure 10-8　　　　A2 Analog IF 75 kHz Filter Path Passband Shape
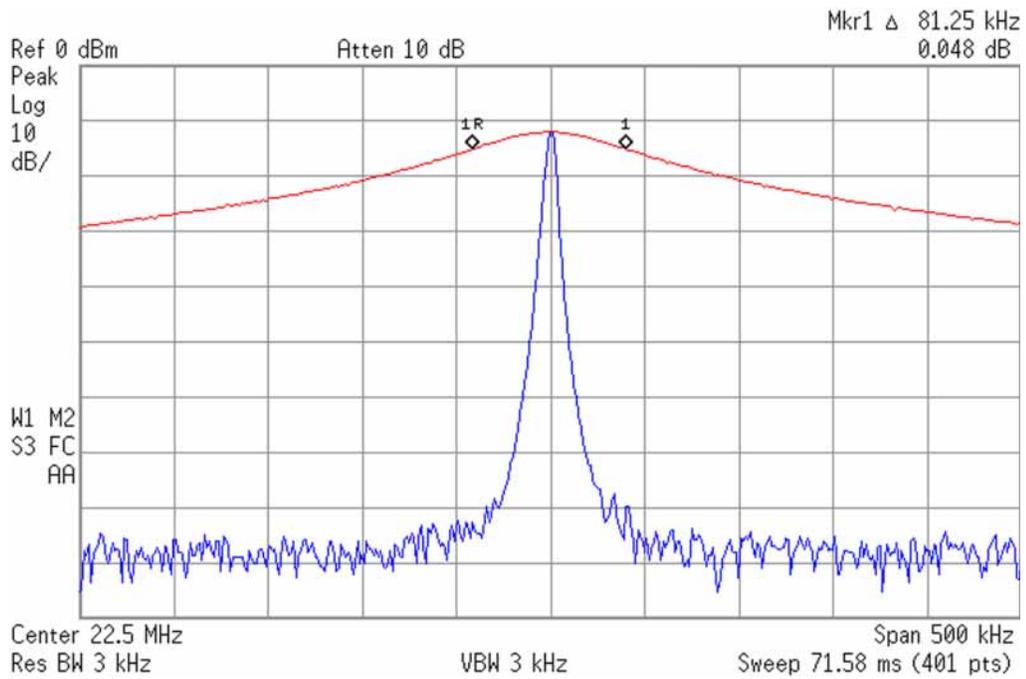
Figure 10-9　　　　A2 Analog IF 10 kHz Filter Path Passband Shape
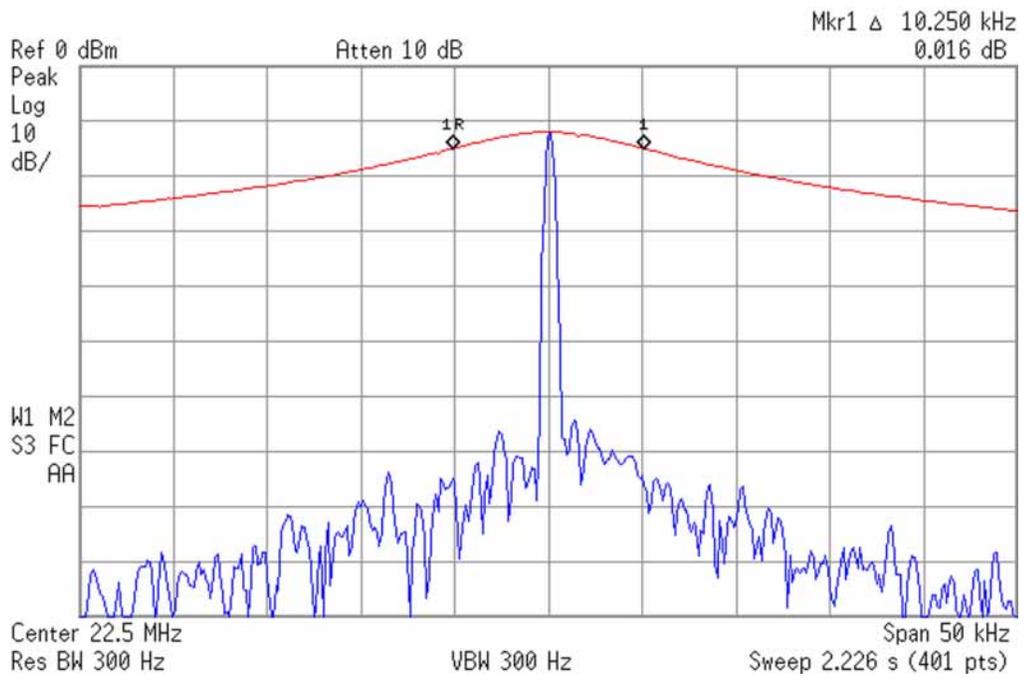
A2 Analog IF 25 MHz Filter Path (Option B25 Only)

This filter is only available with the optional 25 MHz analysis bandwidth, and only when using certain instrument application software. It is not available in either the Spectrum Analyzer or EMI Receiver modes. For this reason this will be verified with the IQ Analyzer mode.

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers.

NOTE

Since the A2 Analog IF assembly is not in an easily accessible area of the instrument its 22.5 MHz output will be measured on the other end of the cable coming from this assembly, which is connected to J19 of the A3 Digital IF assembly.

2. Turn the instrument on and allow it to complete its boot up process.

3. Remove W17 from the A3 Digital IF assembly J19 as shown in Figure 10-2.

4. Connect the end of W17 to a spectrum analyzer tuned to 22.5 MHz.

5. Switch the instrument into the IQ Analyzer mode by pressing **Mode**, **IQ Analyzer**.

6. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

7. Tune the instrument to a center frequency 50 MHz pressing **FREQ**, **50 MHz**.

8. Connect a sine wave signal generator to the instrument input.

9. Tune the signal generator to 50 MHz with an amplitude of -20 dBm.

10. Verify that the instrument resolution bandwidth is set to 25 MHz by pressing **Meas Setup**, **More**, **Advanced**, **Digital IF BW 25 MHz**.

11. Set the spectrum analyzer span to 40 MHz

12. Set the spectrum analyzer such that trace 1 is in Clear Write and trace 2 is in Maxhold.

13. Vary the frequency of the signal generator above and below 50 MHz until the resolution bandwidth filter shape has been drawn out on the spectrum analyzer screen as shown in Figure 10-10.

Figure 10-10   A2 Analog IF 25 MHz Filter Path Passband Shape
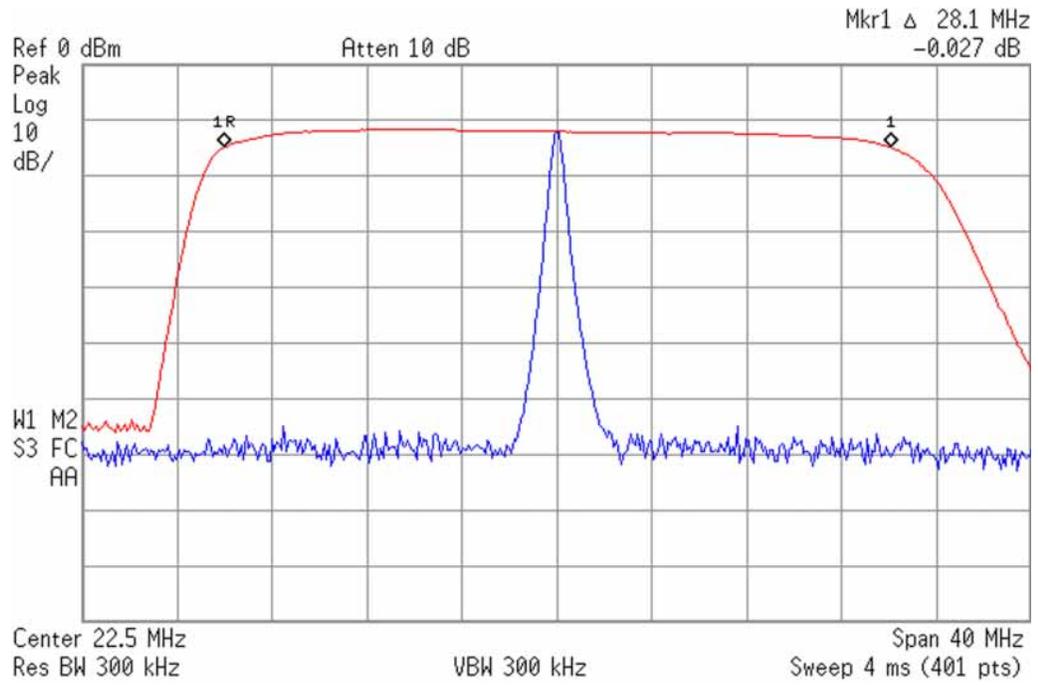
A3 Digital I.F. Assembly Description

A3 Digital IF Assembly Purpose

The A3 Digital IF has circuitry that is needed to analyze complex communication signals that can occupy up to 25 MHz of information bandwidth. It digitizes the final 22.5 MHz IF from the A2 Analog IF board, by processing the time domain continuous data into I/Q (in-phase and quadrature) signals before sending the data to the A4 CPU assembly for further processing and front panel display.

The A3 Digital IF assembly performs the following main functions:

— Digitizes the final 22.5 MHz Intermediate Frequency

— 14 bit ADC with a 90 MHz sample rate

— DSP for standard spectrum analysis

— Capture memory for complex signals

— Noise Source Control

— Dither for final IF

— Provides the alignment sequence generator for wide band alignments

— Provides wide band Comb Calibration Signal

— Trigger interpolation and associated alignment

A3 Digital IF Assembly Description

NOTE

Refer to Chapter 15, "Block Diagrams".

Data Acquisition

The 22.5 MHz IF comes from the A2 Analog IF assembly. The input level to the A3 Digital IF assembly is –25 dBm. The IF input has a 25 MHz bandwidth centered at 22.5 MHz. The analog circuitry leading to the ADC converts the singled ended signal from the Analog IF to differential required by the ADC. Finally, it couples in the dither signal. The ADC is a 14 bit device sampling continuously at 90 Ms/Second.

Rear Panel Triggers

The board has two trigger inputs and two trigger outputs all used via a BNC connector. The trigger inputs are used when an external device has a trigger signal and the user wants to use that external trigger to trigger the instrument. The trigger outputs are used to synchronize other pieces of test equipment to the instrument. These outputs are configurable through the Input/Output menu via the front panel of the instrument.

The trigger inputs each allow trigger levels to be set from –5 to +5 volts using the control DAC. The circuits have relatively high input impedance. The trigger outputs have 50 Ω source impedance with TTL drive levels into no load.

Control DAC

The control DAC is used to set trigger levels and the gain of the reconstruction system. All three outputs can be adjusted from –2.5 to +2.5 volts.

Sample Rate Generator

The 10 MHz reference signal comes from the A16 Reference Assembly. This signal is fairly high power at +10 dBm. The signal goes through a 10 MHz to 30 MHz tripler. A 0 to 5V 10 MHz square wave is generated. Capacitors form a single-pole band pass filter to select the 3rd harmonic, 30 MHz.

The signal then passes through a 30 MHz to 90 MHz tripler. A 0 to 5V 30 MHz square wave is generated. Capacitors form a single-pole band pass filter to select the 3rd harmonic, 90 MHz.

Noise Source Voltage Regulator

Various external noise sources can be connected to the rear panel of the instrument. These noise sources require a very accurate 28 volt DC power supply.

The 28 volt BNC output connector is used with the 346 series noise sources.

The Smart Noise Source (SNS) interface includes power switching for the 28 volt and 15 volt power supply. In addition, it has buffers to interface to the SNS I2C bus for control and read back of ENR data automatically. The SNS connector is used with the SNS series noise sources.

DSP

The signal from the ADC is sent to the Digital Signal Processor.

Digital Bus Common Mode Filtering

The Digital Bus is a real time digital interface. It is sometimes referred to as Messenger or LVDS. The implementation on the Digital IF is unidirectional, meaning it can only source data, not receive it. Common mode filtering is required to translate the digital ground referenced signals to analog ground at the rear panel.

A3 Digital IF Assembly Connections

The connections to and from the A3 Digital IF assembly are as listed in Table 10-6, as illustrated in Figure 10-11 and Figure 10-12.

Table 10-6   A3 Digital IF Assembly Signals

Port	Description	To/From	Cable	Frequency
J4	Digital Bus	Not Available	n/a	n/a
J5	Analog Out	Rear Panel	n/a	n/a
J6	Trigger 2 Out	Rear Panel	n/a	n/a
J7	Trigger 1 Out	Rear Panel	n/a	n/a
J8	Sync	Rear Panel	n/a	n/a
J9	Trigger 2 In	Rear Panel	n/a	n/a
J10	Trigger 1 In	Rear Panel	n/a	n/a
J11	Noise Source	Rear Panel	n/a	n/a
J12	Smart Noise Source	Rear Panel	A3W1	n/a
J13	Reference Out	Rear Panel	n/a	10 MHz
J14	Reference In	A16 Reference J716	W20	100 MHz
J15	IF Input	A15 Front End Control J901[a]	W15	322.5 MHz
J16	Not Used	n/a	n/a	n/a
J17	Step Cal Output	A16 Reference J726	W23	n/a
J18	Not Used	n/a	n/a	n/a
J19	IF Input	A2 Analog IF J601	W17	22.5 MHz

Table 10-6   A3 Digital IF Assembly Signals

Port	Description	To/From	Cable	Frequency
J20	Analog IF Control	A2 Analog IF J820	W7	n/a
J22	JTAG Programming	n/a	n/a	n/a
J23	JTAG Programming	n/a	n/a	n/a
J25	SDRAM Connection	SDRAM DIMM	n/a	n/a
P1	Analog Card Cage	A8 Motherboard J11	n/a	n/a
P2	PCI Card Cage	A8 Motherboard J12	n/a	n/a

a. IF Input comes from A25 Wideband Analog IF J102 if instrument has Option B85

Figure 10-11   A3 Digital IF Assembly Connections - Top
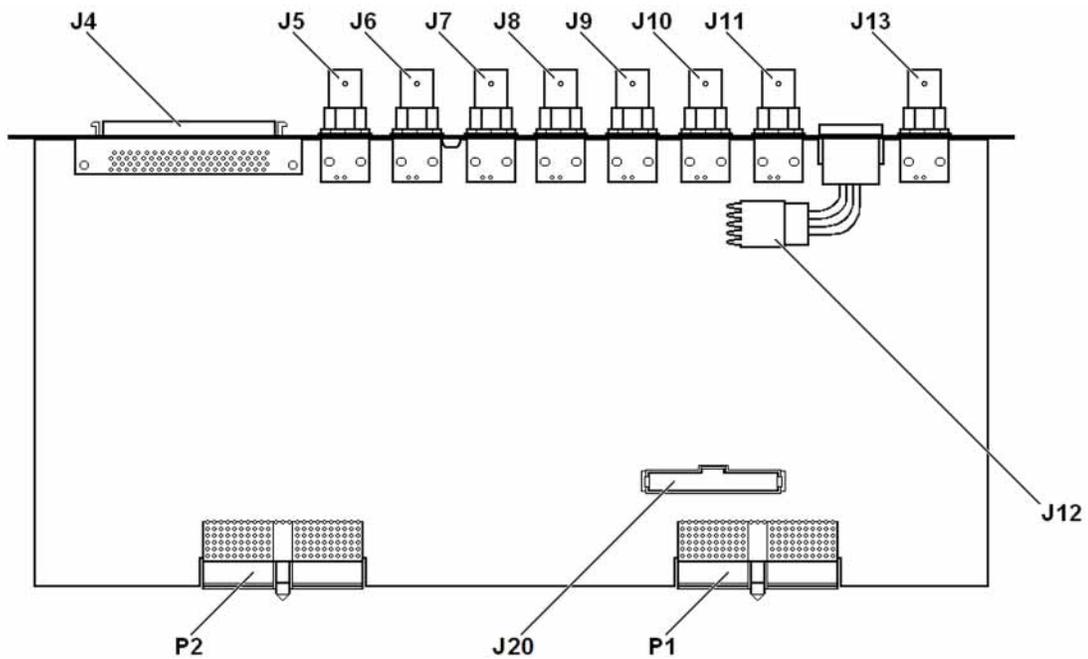
Figure 10-12   A3 Digital IF Assembly Connections - Bottom
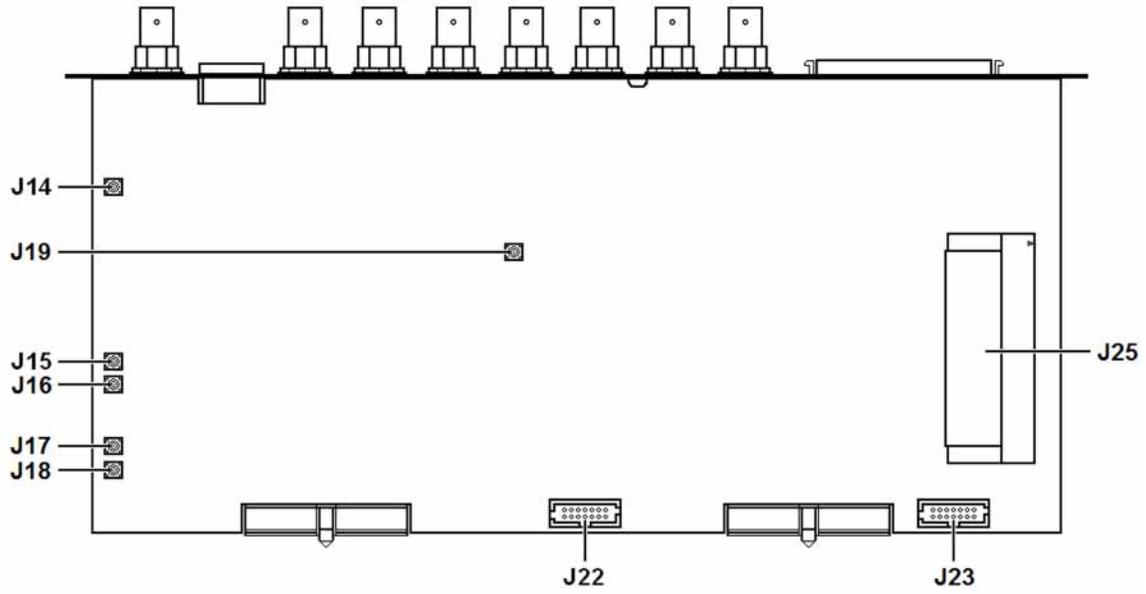
A3 Digital I.F. Troubleshooting

NOTE Refer to Chapter 15, "Block Diagrams".

Assembly Initialization

Before the A3 Digital IF assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A3 Digital IF assembly should identify itself on this list as **Digital IF**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

   Solution: Reload the FPGA code. See FPGA Synchronization in Chapter 19, "Post-Repair Procedures".

— An instrument power supply voltage is not operating properly

   Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A3 Digital IF assembly is defective

   Solution: Replace the A3 Digital IF assembly

Assembly Functionality Verification

In addition to providing the digital signal processing of the 22.5 MHz IF signal, the A3 Digital IF assembly performs many other instrument functions, as well as providing multiple rear panel triggering and reference functions. The functionality of the following functions will be covered in this chapter:

— 22.5 MHz IF Signal Processing

— 10 MHz Reference Output

— Trigger Outputs

— Trigger Inputs

— Analog Output (Option YAS required)

— Noise Source Output (Optional N9069A software required)

— Smart Noise Source Interface (Optional N9069A software required)

Other than the 22.5 MHz IF input signal, these inputs and outputs can be found on the A3 Digital IF rear panel as illustrated in Figure 10-13.

Figure 10-13   A3 Digital IF Assembly Rear Panel Connections
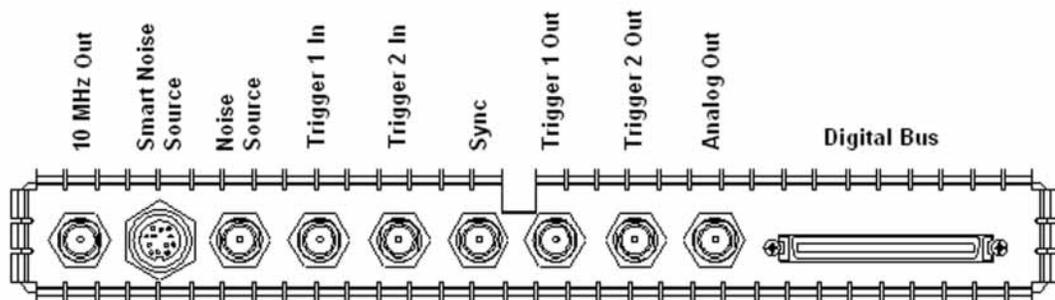
22.5 MHz IF Signal Processing

While this assembly does process the 22.5 MHz IF signal, it does so with two inputs that come from other assemblies. These two input signals are:

— 22.5 MHz IF Input from the A2 Analog IF Assembly

— 10 MHz Reference Signal from the A16 Reference Assembly

Before looking for a fault on the A3 Digital IF assembly be sure to verify that both of these signals are of the correct frequency and amplitude. Refer to the Analog IF section earlier in this chapter and Chapter 9, "Reference Assembly" for detailed information on how to verify the frequency and amplitude of these signals.

If both of these signals are of the correct frequency and amplitude and yet there is still no signal being processed and displayed on the instrument screen then the A3 Digital IF assembly is the most likely cause of the failure.

10 MHz Reference Output

1. Connect a spectrum analyzer to the 10 MHz Out on the rear panel of the instrument as illustrated in Figure 10-13.

2. Tune the spectrum analyzer Center Frequency to 10 MHz with a Span of 10 MHz.

3. Verify that the 10 MHz Reference Output frequency is accurate and that the amplitude is at least 0 dBm, as shown in Figure 10-14.

Figure 10-14   A3 Digital IF 10 MHz Reference Output
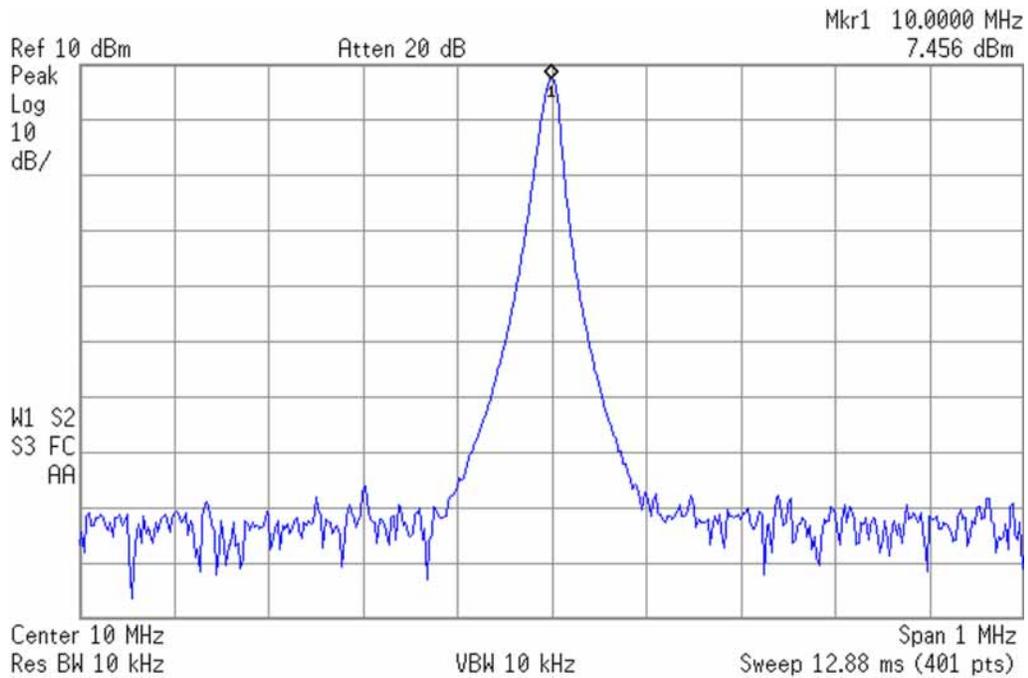
Trigger Outputs

NOTE

This procedure outlines the verification of Trigger 1 Out but it could just as easily be used for Trigger 2 Out if there is a problem reported with that output.

1. Connect an oscilloscope with a 1 M Ω input impedance to the Trigger 1 Out on the rear panel of the instrument as illustrated in Figure 10-13.

2. Tune the oscilloscope to measure 1 Volt per division vertically and 200 µs per division horizontally.

3. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

4. Reduce the instrument span to 100 MHz by pressing **Span**, **100 MHz**.

5. Verify that the Trigger 1 Out is configured for Sweeping by pressing **Input/Output**, **More**, **Output Config**, **Trig 1 Out**, **Sweeping (HSWP)**.

6. Verify that the there is a signal on the oscilloscope screen who's voltage and width resembles that shown in Figure 10-15.

Figure 10-15   A3 Digital IF Trigger Output
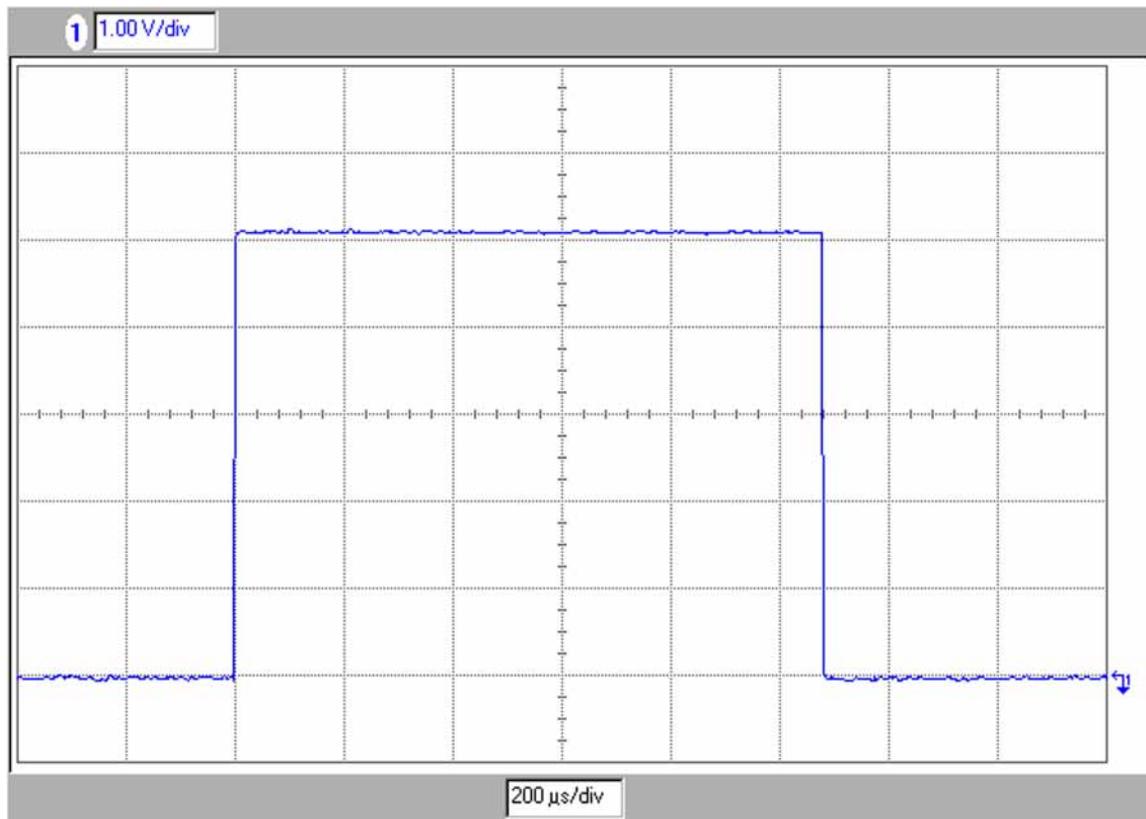
7. When finished, turn the instrument self-alignment routine back on by pressing **System**, **Alignments**, **Auto Align**, **Normal**.

Trigger Inputs

> **NOTE**
>
> This procedure outlines the verification of Trigger 1 In but it could just as easily be used for Trigger 2 In if there is a problem reported with that input.

1. Connect a pulse generator to the Trigger 1 In on the rear panel of the instrument as illustrated in Figure 10-13.

2. Set the pulse generator to output a pulse with TTL levels at a pulse period of 1 sec and a pulse width of 500 µs.

3. Preset the instrument external trigger settings by pressing **Mode Preset**.

4. Tune the instrument to a span of 100 MHz by pressing **Span**, **100 MHz**. (The sweeptime should now be 1 ms)

5. Change the instrument trigger to Trigger 1 In by pressing **Trigger**, **External 1**.

6. Visually verify that the instrument is now sweeping once per second instead of the visually countless sweeps per second when the Trigger is set to Free Run.

Analog Output (Option YAS Only)

1. Connect an oscilloscope with a 1 M Ω input impedance to the Analog Out on the rear panel of the instrument as illustrated in Figure 10-13.

2. Tune the oscilloscope to measure 1 Volt per division vertically and 100 µs per division horizontally.

3. Turn the instrument self-alignment routine off by pressing **System**, **Alignments**, **Auto Align**, **Off**.

4. Turn the internal 50 MHz Calibrator signal on by pressing **Input/Output**, **RF Calibrator**, **50 MHz**.

5. Tune the instrument to the calibrator frequency with a span of 1 MHz by pressing **FREQ**, **50 MHz** and **Span**, **1 MHz**.

6. Bring the calibrator signal to the top of the instrument display by pressing **Peak Search**, **Marker ->**, **Mkr->Ref Lvl**.

7. Change the instrument amplitude scale to linear by pressing **AMPTD**, **Scale Type Lin**.

8. Increase the instrument resolution bandwidth to 300 kHz by pressing **BW**, **300 kHz**.

9. Verify that the on-screen signal resembles that shown in Figure 10-16.

Figure 10-16   A3 Digital IF Analog Output Measurement Setup
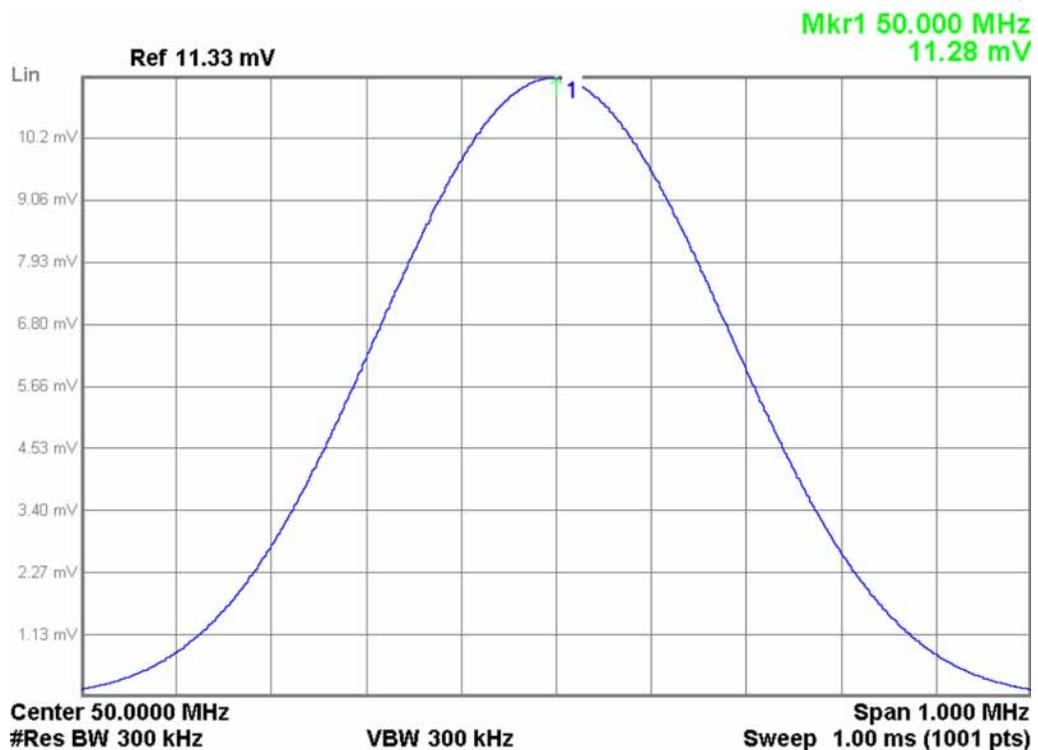
10. Switch the screen video signal to the Analog Out connector by pressing **Input/Output**, **More**, **Output Config**, **Analog Ou**t, **Screen Video**.

11. Verify that the peak of the analog output has an amplitude of approximately +1 volt and resembles that shown in Figure 10-17.

Figure 10-17   A3 Digital IF Analog Output
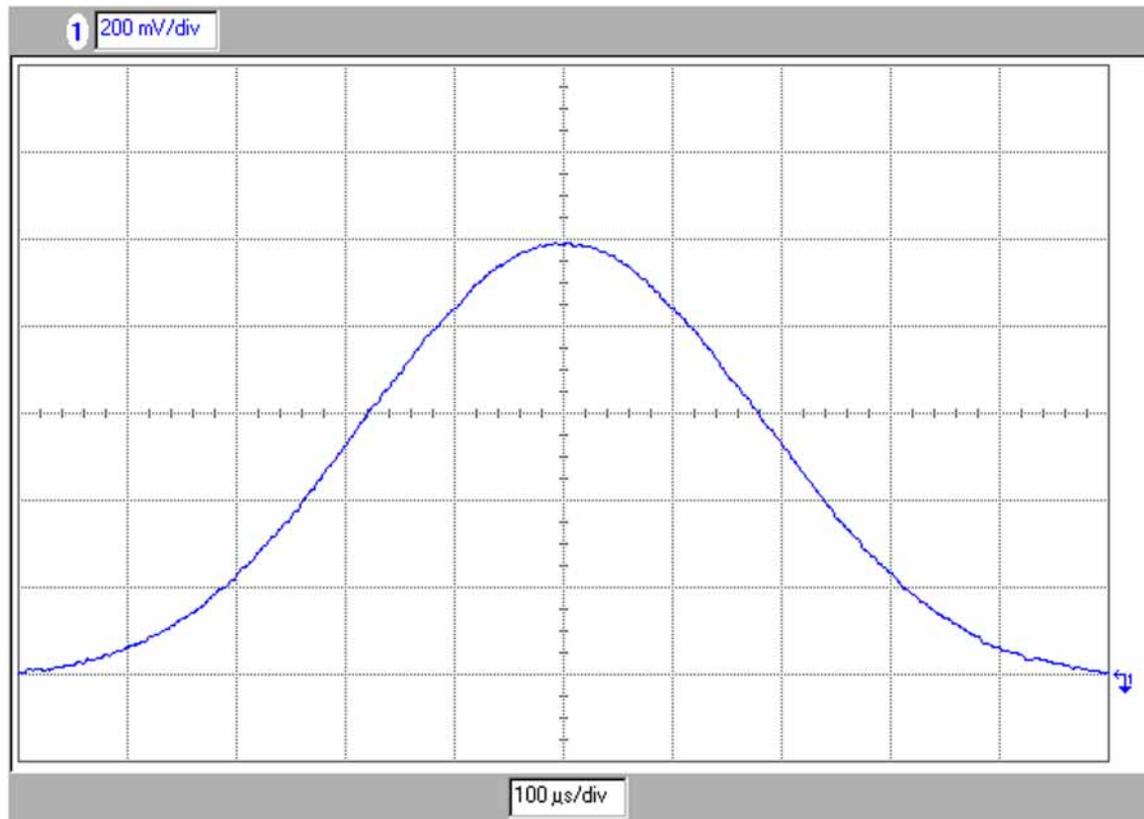
12. When finished, turn the instrument self-alignment routine back on by pressing **System**, **Alignments**, **Auto Align**, **Normal**.

Noise Source Output (Optional N9069A software required)

NOTE	This output will only operate when the optional N9069A Noise Figure measurement personality is installed in the instrument.

1. Connect an oscilloscope with a 1 M Ω input impedance to the Noise Source connector on the rear panel of the instrument as illustrated in Figure 10-13.

2. Tune the oscilloscope to measure 5 Volts per division vertically and 5 ms per division horizontally.

3. Switch the instrument into the Noise Figure measurement personality by pressing **Mode**, **Noise Figure**.

4. Since the Noise Source output will only work when there is nothing connected to the Smart Noise Source output, disconnect anything that might be connected to it, as illustrated in Figure 10-13.

5. Reset the Noise Figure mode to its default settings by pressing **Mode Setup**, **Restore Mode Defaults**.

6. Verify that the there is a signal on the oscilloscope screen who's voltage and pulse width resembles that shown in Figure 10-18. (The pulse width will vary as the instrument sweeps)

Figure 10-18   A3 Digital IF Noise Source Output
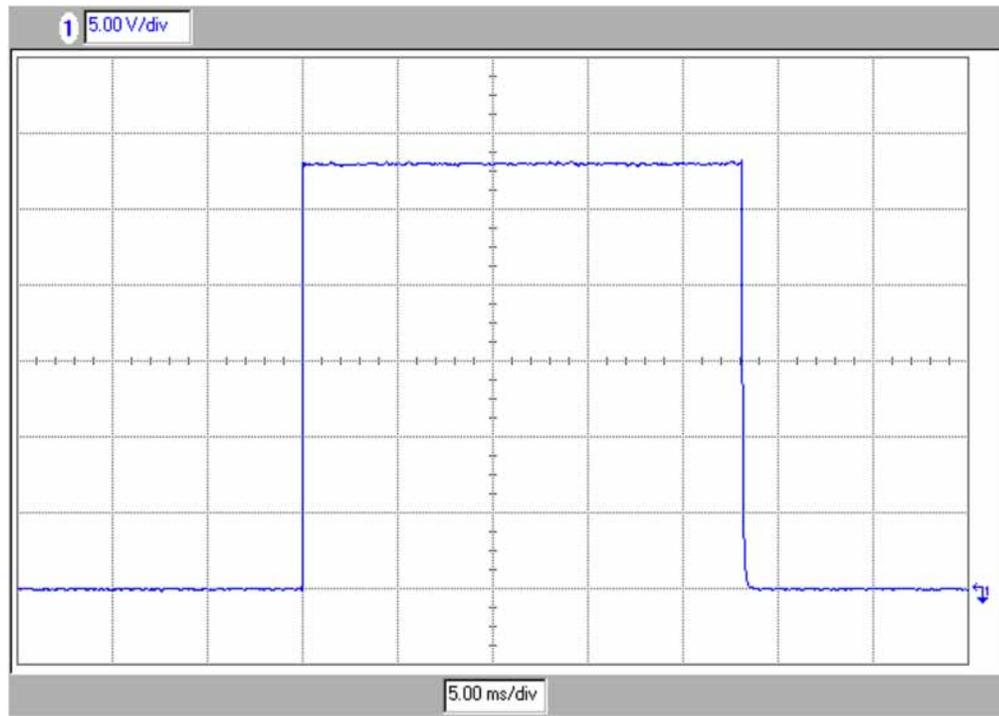
Smart Noise Source Interface
(Optional N9069A software required)

> **NOTE**   This output will only operate when the optional N9069A Noise Figure measurement personality is installed in the instrument.

1. Disconnect anything that might be connected to the Smart Noise Source connector, as illustrated in .

2. Switch the instrument into the Noise Figure measurement personality by pressing **Mode**, **Noise Figure**.

3. Reset the Noise Figure mode to its default settings by pressing **Mode Setup**, **Restore Mode Defaults**.

4. Verify that there is no Smart Noise Model or Serial Number in the instrument by pressing **Meas Setup**, **ENR**, **Meas Table**. The Serial # and Model ID softkey labels should be blank.

5. Verify that the current ENR Meas Table is blank by pressing **Meas Setup**, **ENR**, **Meas Table**, **Edit**.

6. Connect a Smart Noise Source (N4000A, N40001A, or N40002A) and cable to the Smart Noise Source connector.

    The instrument will now automatically load the noise source model number, serial number, and ENR data.

7. Verify that the correct model and serial numbers from the Smart Noise Source used are now displayed on the corresponding instrument softkeys, as shown in Figure 10-19, by pressing **Meas Setup**, **ENR**, **Meas Table**.

Figure 10-19   A3 Digital IF Smart Noise Source – Model and Serial Numbers
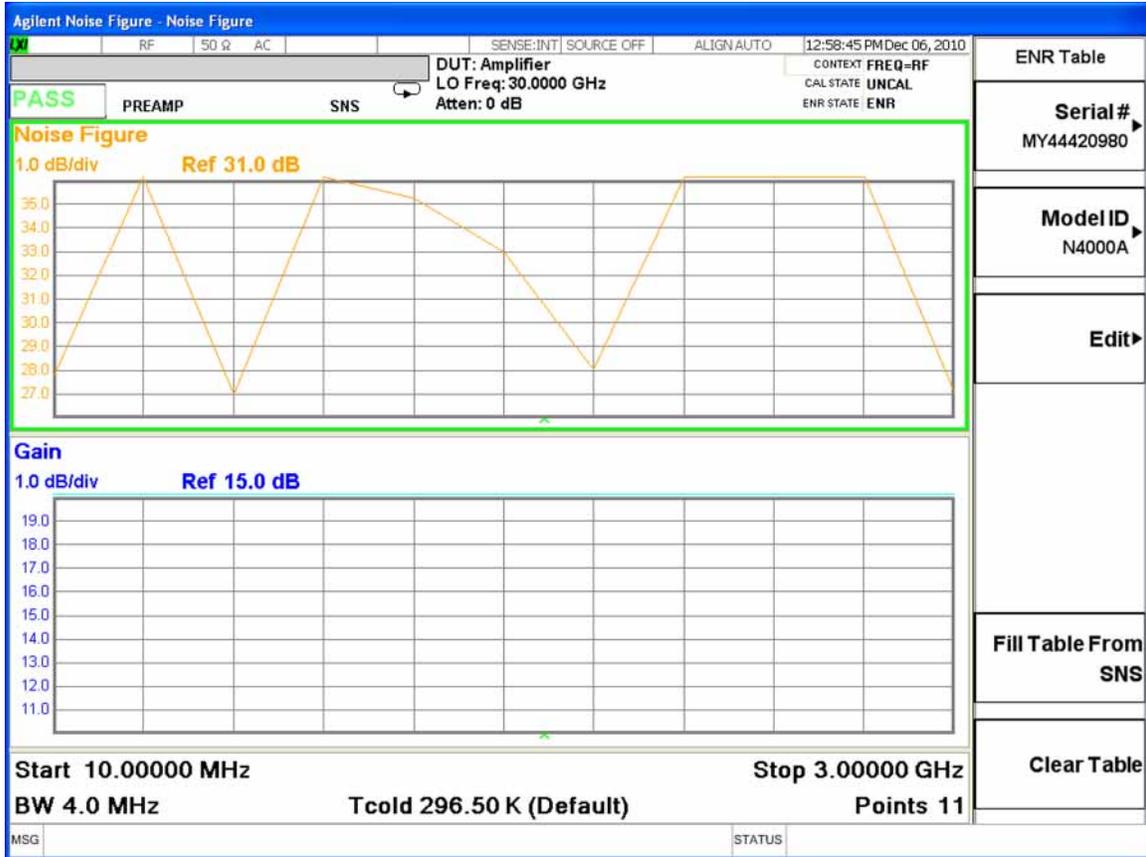
8. Verify that the ENR Meas Table is now populated with the data from the Smart Noise Source, as illustrated in Figure 10-20, by pressing **Meas Setup**, **ENR**, **Meas Table**, **Edit**.

Figure 10-20   A3 Digital IF Smart Noise Source - ENR Data
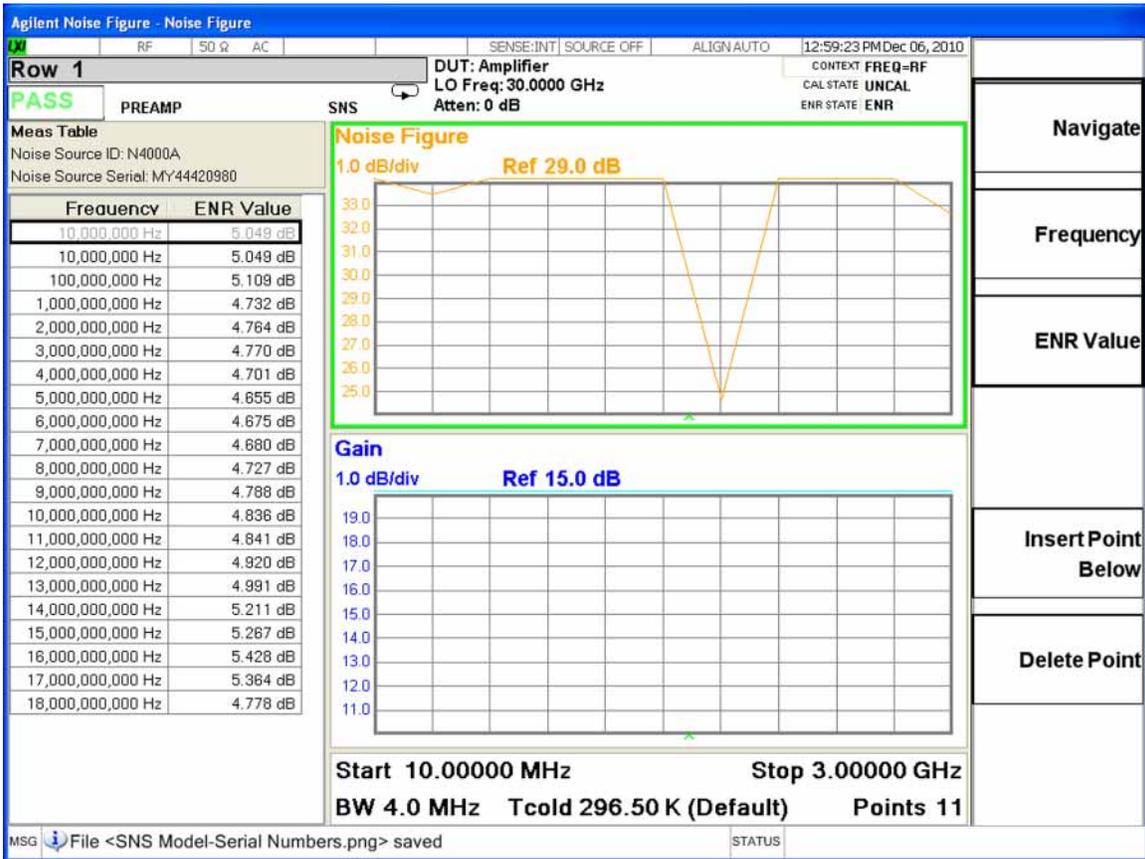
11 CPU & Disk Drive

What You Will Find in This Chapter

The following information is presented in this chapter:

1. Theory of operation of the CPU section.
2. Isolating the cause of a hardware problem by verifying the functionality of assemblies in the CPU section.

NOTE
Each section first describes how the assembly works, then gives information to help you troubleshoot the assembly. Each description explains the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following sections are found in this chapter:

KEYSIGHT
TECHNOLOGIES

A4 Processor Assembly Description

There have been many different A4 Processor assemblies used in the N9038A MXE EMI Receiver over the years. The information in this chapter is for the N9038A-PC6 assembly, which is the current version of this assembly at the time this information was written. While much of this information is similar to older versions of this assembly, not all of it will apply to all versions of this assembly.

If the A4 Processor assembly is suspect in an instrument failure, a full description of the instrument boot process is described in Chapter 2, "Boot Up and Initialization".

Disk Drive

The A5 Disk Drive can easily be removed from the A4 Processor assembly without removing any of the instrument covers. The disk drive is attached to a tray that is accessed from the rear panel by loosening one screw and pulling the drive out of the processor assembly.

If the A4 Processor assembly is replaced, the existing A5 Disk Drive must be transferred from the defective processor assembly to the replacement assembly, there is typically no need to replace them together.

The A5 Disk Drive is field replaceable. See Chapter 17, "Replaceable Parts" for the correct replacement part number.

A4A1 Disk Drive Interface Board

There may be situations where the A5 disk drive must be removed and inserted many times, such as in a security sensitive environment. Therefore, the A4A1 Disk Drive Interface board can be replaced if connector wear is an issue. See Chapter 17, "Replaceable Parts" for the correct replacement part number.

Front Panel Interface

The instrument USB is the electrical interface to the instrument front panel. One of the USB ports on the host controller located on the A4 Processor assembly is routed to the A1A2 Front Panel Interface board for this use. This port is a High Speed USB 2.0 compliant port.

Graphics Controller

The entire graphics subsystem is contained within the instrument system processor chipset. There are multiple outputs of the graphics controller that are used by the instrument. One provides the LVDS video control to drive the internal instrument LCD, one supplies the analog signals to the rear panel VGA output, and one provide the display data to the rear panel DisplayPort connector, which can be used to drive multiple external display types.

Power Supply Control

The power control line from the front panel momentary power switch connects to the A4 Processor assembly. When the front panel power switch is pressed the A4 Processor assembly tells the A6 Power Supply assembly to turn on. Once the +12V D, +5.1V D, and +3.35V D supplies are all on and within specification the A6 Power Supply assembly notifies the A4 Processor assembly, which then comes out of reset and boots-up. Outputs from the A4 Processor assembly also drive the two front panel power state LEDs.

Provisions have also been made to allow the processor board to remember which power state it was in when a power failure occurs. The instrument will return to the same power state after a power failure.

Rear Panel Connectivity

The A4 Processor assembly has direct access to the rear panel of the instrument.

The rear panel connections provided on the A4 Processor assembly are:

— GPIB Interface
— Cabled PCIe x4 Interface
— USB Ports

    — 2 x Super Speed USB 3.0 Host Ports
    — 1 x Super Speed USB 3.0 Device Port
    — 1 x High Speed USB 2.0 Host Port

— Gigabit Ethernet Port (RJ45)
— DisplayPort Video Output
— VGA Output
— SD Memory Card Slot (Accessible only when A5 disk drive is removed)

Figure 11-1   **A4 Processor Assembly Rear Panel Connectivity**
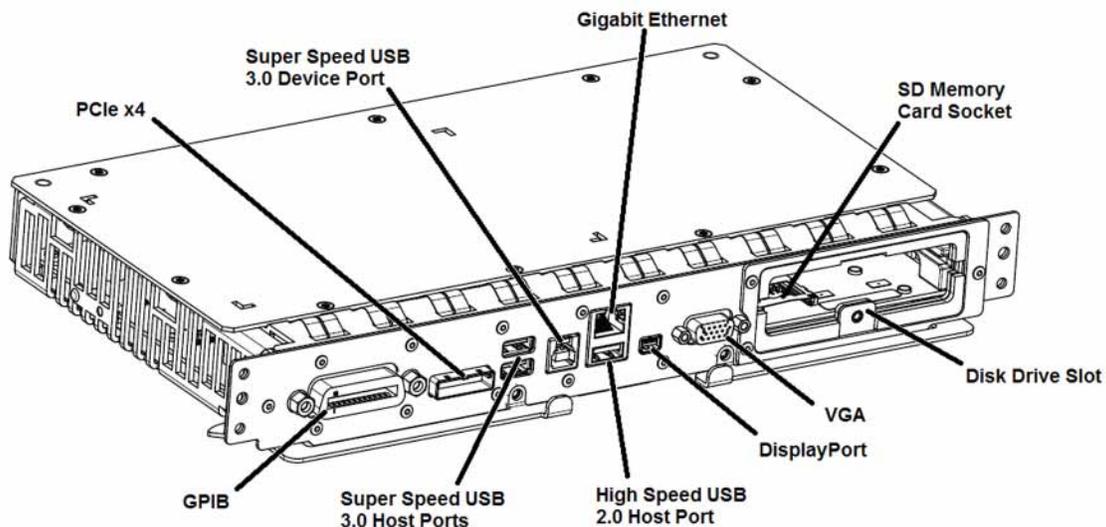
System Memory

The type and amount of system SDRAM in the instrument may vary depending on the age and options installed in an instrument. Current instruments have 16 GB of DDR3 SDRAM in two 204-pin SODIMM memory modules. These memory modules are not field replaceable.

System Processor

The processor used in the instrument may vary depending on the age and options installed in an instrument. Current instruments have a Quad Core Intel i7 processor chipset.

The system processor chipset is not field replaceable.

Processor Battery

The A4BT1 Processor battery used is a lithium manganese dioxide coin battery. It powers the instrument clock and maintains the settings for the CMOS BIOS configuration.

The A4BT1 Processor battery is field replaceable. See Chapter 17, "Replaceable Parts" for the correct replacement part number.

SD Memory Card Slot

The main purpose for the SD memory card is for instrument calibration database backup.

The SD memory card that is shipped with each new instrument is currently a 16 GB SDHC card. It is shipped with a backup of the instrument's factory calibration database. The field adjustment software will also automatically create a backup of the instrument calibration database on the SD memory card each time an adjustment is performed.

The SD memory card can be removed if needed for security or other reasons and the instrument will function as normal. The SD card can also be manually switched to the Lock (read only) position and the instrument will function normally as well.

While the instrument working calibration database is contained on the E: drive, if when the instrument first boots up and finds a newer database on the SD memory card it will prompt the user to select which database to use. This is intended for use when the A5 disk drive assembly has been changed and the calibration database needs to be transferred to it.

The SD memory card is field replaceable. See Chapter 17, "Replaceable Parts" for the correct replacement part number.

A4 Processor Board Assembly Troubleshooting

The A4 Processor board assembly is serviced as an assembly only; no component level repair is supported, other than the A4A1 Disk Drive Interface board.

Boot-Up or Initialization Problems

Typical failures of the A4 Processor board assembly will cause the instrument to not boot-up or initialize properly. Of course, these types of failures can also be caused by a variety of other assemblies as well. In order to determine whether a problem such as this is being caused by a defective A4 Processor board assembly, first see the to eliminate other possibilities.

BIOS Settings

As with other types of PC processor board assemblies the A4 Processor board assembly has a number of settings particular to the hardware on the board. These settings are saved in a separate memory location on the board and accessed by the BIOS (Basic Input Output System) Setup Utility. If these settings are changed from those that the instrument was initially shipped with this could cause a problem with the booting and/or functionality of the instrument.

If the instrument is having a problem booting up, but is functional enough to enter the BIOS Setup Utility you will want to verify that the BIOS settings have not been changed.

Accessing BIOS Setup Utility

To easily navigate the BIOS Setup Utility you will want to have an external USB keyboard connected to the instrument. Then, when the initial Keysight Technologies splash screen is displayed at power-up, press the key on the keyboard specified on the initial boot screen (typically the DEL key). Once this is pressed you will see the main BIOS Setup Utility screen.

Load Defaults

Load the BIOS default values by navigating to the Exit screen and select Restore Defaults or Load Setup Defaults, whichever is present. Once the defaults have been loaded select Save Changes and Exit.

A5 Disk Drive

The standard A5 disk drive is a solid state (FLASH) drive. There may be different drive capacities being used, and due to continual changes being made by the drive manufacturers these will continue to change from time to time.

Failures of this disk drive can be either hardware or software related. The first step in troubleshooting is to determine if the failure is software related. If software is found not to be the issue, the disk drive should be replaced.

NOTE

Before replacing the A5 disk drive it is highly recommended that the factory calibration data be backed up to an external drive if at all possible. If this data is not backed up prior to replacing the disk drive all instrument adjustments and performance verification tests will need to be run after the drive is replaced.

For information on how to backup this data see "Calibration Data Backup and Restore" on page 647.

Overview

The A5 Disk Drive assembly has been divided up into four different partitions. They are:

C. This partition contains the operating system and software installed by Keysight. This is an open system which means you can install additional software, which should be installed on the C: drive. However, only a limited set of software applications are tested for use with the instrument software. The installation and/or use of other software is not warranted, and could interfere with the operation of the instrument software. If the recovery process is ever run, the original version of the C: drive, as shipped from the factory, will be restored. The user will need to reload any other software that was previously installed into the instrument.

Do not save any user data to the C: drive partition, as any data saved in this partition will be lost if the recovery process is run.

D. This partition is reserved for data storage. The User Accounts that are preconfigured by Keysight and their My Documents folder are mapped to the D: drive. This is for the convenience of backing-up the user data. You should always back-up the data on the D: drive. This allows you to restore the data if the A5 Disk Drive assembly ever needs to be replaced.

Data saved in this partition will not be lost if the recovery process is run.

E. This partition is reserved for Keysight's use. The primary use of the E: drive is for storing of the instrument Calibration and Alignment data. Do not change or overwrite the files on this drive. This could cause your instrument to not meet specifications, or even to stop functioning correctly. It is also recommended that you back up the contents of this drive. This allows you to restore the data if the A5 Disk Drive assembly ever needs to be replaced, which could otherwise require that all instrument adjustments be performed.

While data saved in this partition will not be lost if the recovery process is run, do not use this drive for data storage.

In addition, a hidden recovery partition is located on the drive. This partition contains an image of the C: drive as it was when the instrument was shipped from the factory. To restore the C: drive using the image stored in this recovery partition see the section titled "Disk Drive Recovery Process" on page 364.

Troubleshooting software related issues

The C: drive contains the Windows operating system software and the instrument application software. Boot problems can be caused by either a failure of the Windows operating system or the instrument application software. The failure could have occurred due to a failed installation procedure, instrument application software update failure, or a virus.

To correct these issues there are two procedures that can be initiated to resolve a software related issue.

— Reload the instrument application software.

— Use the Recovery Process to reinstall the Windows operating system and instrument application software as it was when it left the factory.

Reloading the Instrument Application Software

The instrument application software contains all the required components for the EMI Receiver application as well as all software options. If the instrument application software has become corrupt the Windows operating system will boot but the instrument application software will fail to start. In these cases go to Chapter 20, "Instrument Software" for information on how to update the instrument application software. This procedure will not affect the instrument's calibration or user files.

If this does not resolve the boot issue, or the instrument never boots the Windows operating system proceed to the "Disk Drive Recovery Process".

Disk Drive Recovery Process

The Instrument Image Recovery System can be used to repair software errors on the instrument's disk drive, or to restore the original factory configuration of the system software. The Instrument Image Recovery System is stored in a separate hidden disk drive partition. Repairing errors on the disk drive may result in loss of data or files. Restoring the original factory system software does not restore any of the following items:

— Windows system configurations that were made after the instrument was shipped from the factory. For example, Windows and Service Pack updates, user accounts, and windows configuration settings. After a recovery, these configurations will have to be redone by the end user.

— Additional software that was installed after the instrument was shipped from the factory. After a recovery, that software will need to be re-installed by the end user.

— Any data or programs saved on the D: or E: drives. This data will be retained on the drive and not altered by the recovery process.

— Any updates that were made to the Keysight measurement application software.

Calibration data is not lost during this process because it resides on the E drive partition.

Instrument Image Recovery System

The instrument disk drive recovery system is stored in a separate disk drive partition. It can be used to attempt to repair errors or restore the original factory instrument system on the disk drive.

Using the Instrument Recovery System

1. Make sure the instrument is turned off.

2. Turn on the instrument.

3. After the "Keysight Technologies" screen is displayed the following screen contents will be displayed for 5 seconds.

Figure 11-2


```
                    Windows Boot Manager

Choose an operating system to start:
(use the arrow keys to highlight your choice, then press ENTER.)

    Microsoft Windows 7                                    >

    Instrument Image Recovery System




To specify an advanced option for this choice, press F8.
Seconds until the highlighted choice will be started automatically: 5




Enter=Choose                                        ESC=Exit
```
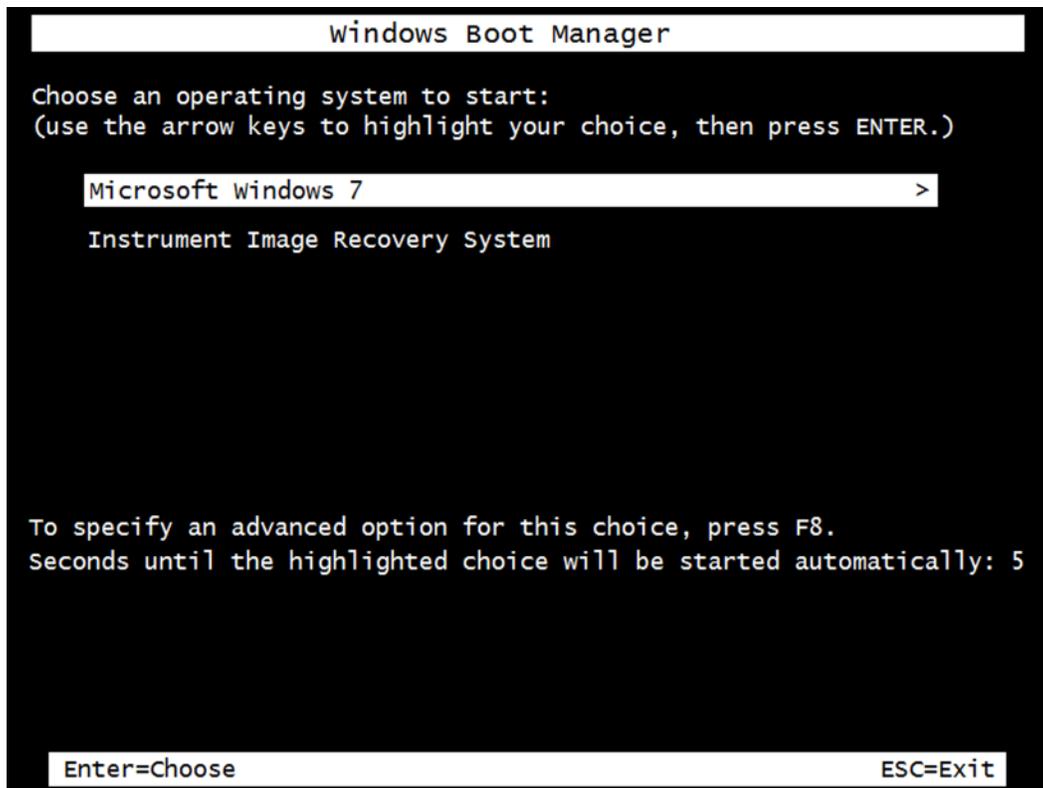
4. Press the down arrow key to move the highlight to "Instrument Image Recovery System", press the **Enter** key.

5. When the Instrument Image Recovery System has booted, follow the on-screen instructions to recover the image of the C drive.

6. After exiting the Instrument Image Recovery System, the instrument will reboot a few times.

7. Update the instrument application software to the latest version by downloading it from the following URL:

   www.keysight.com/find/mxe_software

Replacing the instrument disk drive

If the above two procedures did not resolve the booting issue. The disk drive should be replaced. Refer to the "Disk Drive" replacement section on page 596.

12 Power Supply & Midplane

What You Will Find in This Chapter

The following information is presented in this chapter:

1. Theory of operation of the Power Supply/Midplane section.
2. Isolating the cause of a hardware problem by verifying the functionality of assemblies in the Power Supply and Midplane sections.

NOTE

Each of the following sections first describes how the assembly works, then gives information to help you troubleshoot the assembly. Each description explains the purpose of the assembly, describes the main components, and lists external connections to the assembly.

This following descriptions are found in this chapter:

KEYSIGHT
TECHNOLOGIES

A6 Power Supply Description

A6 Power Supply Purpose

The A6 Power Supply assembly provides most all the necessary DC voltages for the entire instrument to operate correctly. If any of the power supplies are not within their operating voltages, the instrument will not function properly. The power supply outputs provide power to all the printed circuit boards, microcircuit assemblies, front panel display and fans, any of which can cause an over current condition if not operating correctly. The power supply will remain on in an over current state for a minimum of 1 second. The power supply will turn off no later than 5 seconds after the beginning of the over current state. Any one output over current condition will latch the supply off until the line voltage is removed from the rear panel AC power input connector and then reconnected. The power supply assembly plugs into the A7 Midplane Assembly from the rear of the instrument.

A6 Power Supply Description

The A6 Power Supply assembly is serviced as an assembly only; no component level repair is supported.

The A6 Power Supply assembly provides most all of the necessary DC voltages for the instrument. If any of the power supplies are not within their operating voltages, the instrument will not function properly.

The A6 Power Supply assembly is a switching supply that operates at a frequency of ~130 kHz.

The A6 Power Supply assembly is an auto ranging supply, requiring no user selection of the input voltage. The input AC voltage and frequency requirements for the A6 Power Supply assembly are printed on the rear panel of the instruments as well as on the power supply itself.

While there are no test points or status LEDs accessible for troubleshooting on the A6 Power Supply assembly, there are both test points and status LEDs for all of the different power supply voltages, as well as other power supply status lines, on the A7 Midplane Board assembly. See the "A7 Midplane Board Assembly Description" on page 373 for detailed information on the location of each.

Supply Voltages

The following voltage levels are produced by the A6 Power Supply assembly:

Table 12-1

Supply Name	Description	Referenced To
+32VA	+32 Volt Analog Supply	ACOM
+15VA	+15 Volt Analog Supply	ACOM
+15VSB	+15 Volt Standby Supply	ACOM
+9VA	+9 Volt Analog Supply	ACOM
+5.1VA	+5.1 Volt Analog Supply	ACOM
-7VA	-7 Volt Analog Supply	ACOM
-15VA	-15 Volt Analog Supply	ACOM
+12VD	+12 Volt Digital Supply	DCOM
+5.1VD	+5.1 Volt Digital Supply	DCOM
+5.1VSB	+5.1 Volt Standby Supply	DCOM
+3.35VD	+3.35 Volt Digital Supply	DCOM
FAN_P	Fan Positive Supply	FAN_N
FAN_N	Fan Negative Supply	FAN_P

Control Inputs

There are a number of control inputs for the A6 Power Supply assembly. The ones that you will want to be familiar with are:

POWER_ON_L

is a signal that when pulled low tells the A6 Power Supply assembly to turn on all of its outputs. This signal comes from the A4 CPU board assembly and is initiated by pressing the front panel power button.

DITHER

is an AC coupled analog signal going to the supply that is used to frequency modulate the power supply switching frequency for the purpose of lowering any power supply related interference. The DITHER signal is generated on the A7 Midplane board assembly.

Control/Status Outputs

There are a number of control and status outputs for the A6 Power Supply assembly. The ones that you will want to be familiar with are:

POWER_OK

is used to verify that the +12VD, +5.1VD, and +3.35VD are all on and within specification. A TTL high level on this output brings the CPU out of reset and initiates the instrument boot up process.

LINE_TRIGGER

is a TTL level signal that is synchronous to the AC line input. This signal is typically used in spectrum analyzers to trigger an instrument sweep synchronous to the AC power line.

FAULT_L

will be a TTL low level signal to indicate that the supply is experiencing an over voltage, over current, or over temperature condition.

Fuse

The A6 Power Supply has no user replaceable fuse. While there is a fuse internal to the supply this is not meant for field replacement. If the internal fuse is blown, the power supply has experienced a major failure and should be replaced.

Standby Supplies

The A6 Power Supply assembly has two standby supplies that should always be on if the AC input voltage requirements are met. These are the +15VSB and the +5.1VSB supplies. These supplies are used by the instrument to keep certain circuits alive even when the power is turned off.

Over Current Protection

The A6 Power Supply assembly has built in over current protection that will shut down the supply if current draw from the instrument is too great. The power supply will remain on in over current state for a minimum of 1 second. The power supply shall turn off no later than 5 seconds after the beginning of the over current state. The power supply shall remain off until the line voltage is removed and then reconnected or the front panel power switch is cycled. Over current shut down does not apply to the standby supplies, the fan voltage, and the +32VA supply.

Thermal Protection

The A6 Power Supply assembly will protect itself by shutting down if it overheats. It will also reset itself with no user interaction after the temperature is reduced by approximately 10 degrees C.

A6 Power Supply Assembly Troubleshooting

The A6 Power Supply assembly is serviced as an assembly only; no component level repair is supported.

> **NOTE**
>
> The A6 Power Supply has no user replaceable fuse. While there is a fuse internal to the supply this is not meant for field replacement. If the internal fuse is blown, the power supply has experienced a major failure and should be replaced.

If the instrument will not boot up properly, or the display is not turning on, refer to the "MXE Instrument Boot Up Process" on page 39 before further A6 Power Supply troubleshooting to rule out any other assembly as the cause of the failure.

Supply Voltages

While there are no test points or status LEDs accessible for troubleshooting on the A6 Power Supply assembly, there are both test points and status LEDs for all of the different power supply voltages, as well as other power supply status lines, on the A7 Midplane Board assembly. See the A7 Midplane Board Assembly section in this chapter for detailed information on the location of each.

Control Inputs

POWER_ON

POWER_ON is a signal that when pulled low tells the A6 Power Supply assembly to turn on all of its outputs. This signal comes from the A4 Processor board assembly and is initiated by pressing the front panel power button.

If the instrument will not turn on be sure that this line is being pulled low by either measuring the voltage level at Test Point 518 on the A7 Midplane board assembly or by viewing the status of the POWER_ON_L LED. See the "A7 Midplane Board Assembly Troubleshooting" on page 375 for detailed information on the location of this test point and LED as well as the expected status for both when the instrument is operating properly.

Status Outputs

POWER_OK

The POWER_OK status output is an indication of whether or not all of the digital power supply voltages are up to their specified voltage levels or not. If all of these supplies are working properly this output line will be at a TTL high level. If this output is not at a TTL High level the instrument CPU will not come out of its reset state and will not

boot-up. Once this output goes to a TTL high level the instrument CPU will start its boot-up process and the POWER_ON_L line coming from the A4 Processor assembly will go to a TTL low level which will tell the A6 Power Supply assembly to turn on the rest of it output voltages.

If the A6 Power Supply assembly is suspected of causing the instrument to not power on properly the status of this output can be verified by either measuring the voltage level at Test Point 506 on the A7 Midplane board assembly or by viewing the status of the POWER_OK LED. See the A7 Midplane Board Assembly Troubleshooting section in this chapter for detailed information on the location of this test point and LED as well as the expected status for both when the instrument is operating properly.

FAULT_L

The FAULT_L status output is an indication of whether or not there is a fault detected by the A6 Power Supply that is keeping it from powering on properly. If all of the required conditions to turn the A6 Power Supply assembly on properly are being met this status output line will be at a TTL high level. The conditions that could cause this status output line to be at a TTL low level include that of an over current condition, an over voltage condition, and an over temperature condition. However, there is no way to know at the A6 Power Supply assembly level which one of these conditions may be the cause of a TTL low level to be on the FAULT_L status output.

While any over voltage or over temperature conditions will most likely be caused by an A6 Power Supply assembly failure, an over current condition will most likely be caused by another assembly in the instrument demanding too much current.

If this output is not at a TTL high level the A6 Power Supply assembly will not turn its non-standby power supplies on, no matter what the A4 Processor assembly tells it to do.

If the A6 Power Supply assembly is suspected of causing the instrument to not power on properly the status of this output line can be verified by either measuring the voltage level at Test Point 508 on the A7 Midplane board assembly or by viewing the status of the FAULT_L LED. See the A7 Midplane Board AssemblyTroubleshooting section in this chapter for detailed information on the location of this test point and LED as well as the expected status for both when the instrument is operating properly.

A7 Midplane Board Assembly Description

A7 Midplane Assembly Purpose

The A7 Midplane board assembly is used to connect the A4 Processor board assembly and the A6 Power Supply assembly to the A8 Motherboard, and thus the rest of the instrument electrical assemblies.

A7 Midplane Assembly Description

NOTE

Refer to Chapter 15, "Block Diagrams".

In addition to providing instrument assembly interconnections, the A7 Midplane board also provides the following functions:

— Instrument power supply voltage test points and status LEDs

— +3.3V analog linear power supply regulation (+3.3VA)

— –5.2V analog linear power supply regulation (–5.2VA)

— Non-volatile memory for storage of the instrument model number, serial number, and software license keys (Secure Storage).

— Power supply dithering. A triangle wave of approximately 100 Hz is generated and goes directly to the A6 Power Supply assembly. This is used to frequency modulate the power supply switching frequency for the purpose of lowering any power supply related interference.

— Circuitry to phase lock the A4 Processor assembly CPU clock to the instrument reference frequency.

A7 Midplane Assembly Connections

The connections to and from the A7 Midplane assembly are as listed in Table 12-2 and as illustrated in Figure 12-1.

Table 12-2   A7 Midplane Assembly Connections

Connector	Connects To	Connector	Connects To
J101	A6 Power Supply Assembly	J111	A6 Power Supply Assembly
J102	A6 Power Supply Assembly	J112	A6 Power Supply Assembly
J103	A6 Power Supply Assembly	J201	A4 Processor Assembly
J104	A6 Power Supply Assembly	J202	A4 Processor Assembly
J105	A6 Power Supply Assembly	J203	A4 Processor Assembly
J106	A6 Power Supply Assembly	J204	A4 Processor Assembly
J107	A6 Power Supply Assembly	P1	A8 Motherboard Assembly
J108	A6 Power Supply Assembly	P2	A8 Motherboard Assembly
J109	A6 Power Supply Assembly	P3	A8 Motherboard Assembly
J110	A6 Power Supply Assembly	P13	A8 Motherboard Assembly

Figure 12-1   A7 Midplane Board Assembly Connections
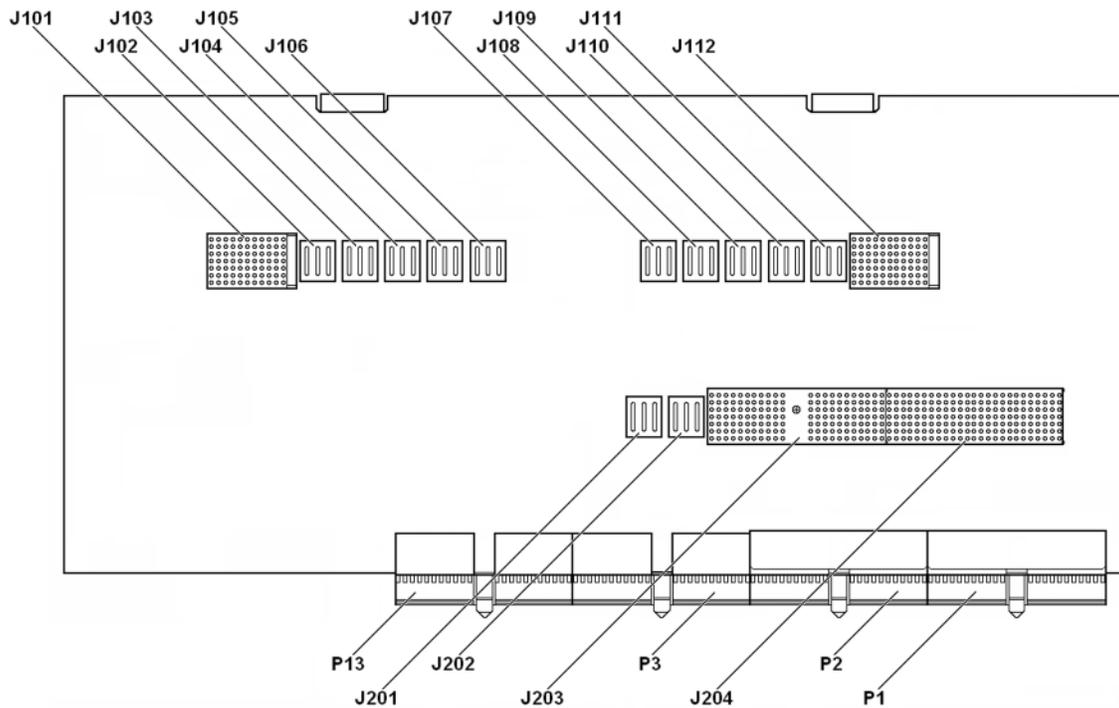
A7 Midplane Board Assembly Troubleshooting

The A7 Midplane board assembly is serviced as an assembly only; no component level repair is supported.

Instrument Power Supply LEDs and Test Points

While the A6 Power Supply assembly has no user accessible LEDs or test points the A7 Midplane board assembly does provide these for all of the different instrument power supplies as well as many of the power supply status lines. A complete list of these can be found in Table 12-3 and the location of each can be seen in Figure 12-2.

Additional Power Supply Regulation

There are two analog power supply regulators on the A7 Midplane board assembly. They are the +3.3VA and –5.2VA supplies.

The +3.3VA supply is regulated down from the instrument +5.1VA supply while the –5.2VA supply is regulated down from the –7VA instrument supply.

Both of these supply voltages have test points and LEDs on the A7 Midplane board assembly as seen in Figure 12-2.

Instrument Secure Storage

This is Non-volatile storage of instrument model number, serial number, and software license keys. While the license keys are also contained on the C: drive of the instrument, the model and serial numbers are only saved in this secure memory. There is no way for the user to access this memory in any way. This is reserved for the factory and field software when needed for instrument initialization, as well as the instrument software when installing an option license key. If for some reason any of these cannot be remembered by the instrument there could be a problem with this memory and the A7 Midplane board assembly would need to be replaced.

Power Supply Dithering

A triangle wave of approximately 100 Hz is generated and goes directly to the A6 Power Supply assembly. This is used to frequency modulate the power supply switching frequency for the purpose of lowering any power supply related interference.

If for some reason the level of the power supply related interference is higher than normal this circuitry, or the A6 Power Supply assembly, could be suspect.

Table 12-3   A7 Midplane Board LEDs and Test Points

Supply/ Signal	Description	Referenced To	Generated On	Expected Status			
				Power Off[a]		Power On	
				LED	Test Point (VDC)	LED	Test Point (VDC)
+32VA	+32 Volt Analog Supply	ACOM	A6	Red	0	Off	+32 ± 2.0
+15VA	+15 Volt Analog Supply	ACOM	A6	Red	0	Off	+15 ± 1.0
+15VSB	+15 Volt Standby Supply	ACOM	A6	Green	+15 ± 1.0	Green	+15 ± 1.0
+9VA	+9 Volt Analog Supply	ACOM	A6	Red	0	Off	+9 ± 1.0
+5.1VA	+5.1 Volt Analog Supply	ACOM	A6	Red	0	Off	+5.1 ± 0.75
-7VA	-7 Volt Analog Supply	ACOM	A6	Red	0	Off	-7 ± 1.0
-15VA	-15 Volt Analog Supply	ACOM	A6	Red	0	Off	-15 ± 1.0
+12VD	+12 Volt Digital Supply	DCOM	A6	Red	0	Off	+12 ± 1.0
+5.1VD	+5.1 Volt Digital Supply	DCOM	A6	Red	0	Off	+5.1 ± 0.75
+5.1VSB	+5.1 Volt Standby Supply	DCOM	A6	Green	+5.1 ± 0.75	Green	+5.1 ± 0.75
+3.35VD	+3.35 Volt Digital Supply	DCOM	A6	Red	0	Off	+3.35 ± 0.75
FAN_P	Fan Positive Voltage	ACOM	A6	Red	0	Off	9.2 - 14.5
+3.3VA	+3.3 Volt Analog Supply	ACOM	A7	Red	0	Off	+3.35 ± 0.75
-5.2VA	-5.2 Volt Analog Supply	ACOM	A7	Red	0	Off	-5.2 ± 0.75
FAULT_L	Power Supply Fault	ACOM	A6	Off	TTL High	Off	TTL High

Table 12-3   A7 Midplane Board LEDs and Test Points

Supply/ Signal	Description	Referenced To	Generated On	Expected Status			
				Power Off[a]		Power On	
				LED	Test Point (VDC)	LED	Test Point (VDC)
POWER_OK	Digital Supplies OK	DCOM	A6	Red	TTL Low	Off	TTL High
POWER_ON_L	Power Supply Enable	DCOM	A4	Off	TTL High	Green	TTL Low
POWER_SW_L	Power Switch Pressed	ACOM	A4	n/a	TTL High	Green	TTL High[b]

a. With AC mains connected to the instrument
b. POWER_SW_L should only be at a TTL Low state when the front panel power switch is being pressed

Figure 12-2   A7 Midplane Board Assembly LEDs and Test Points
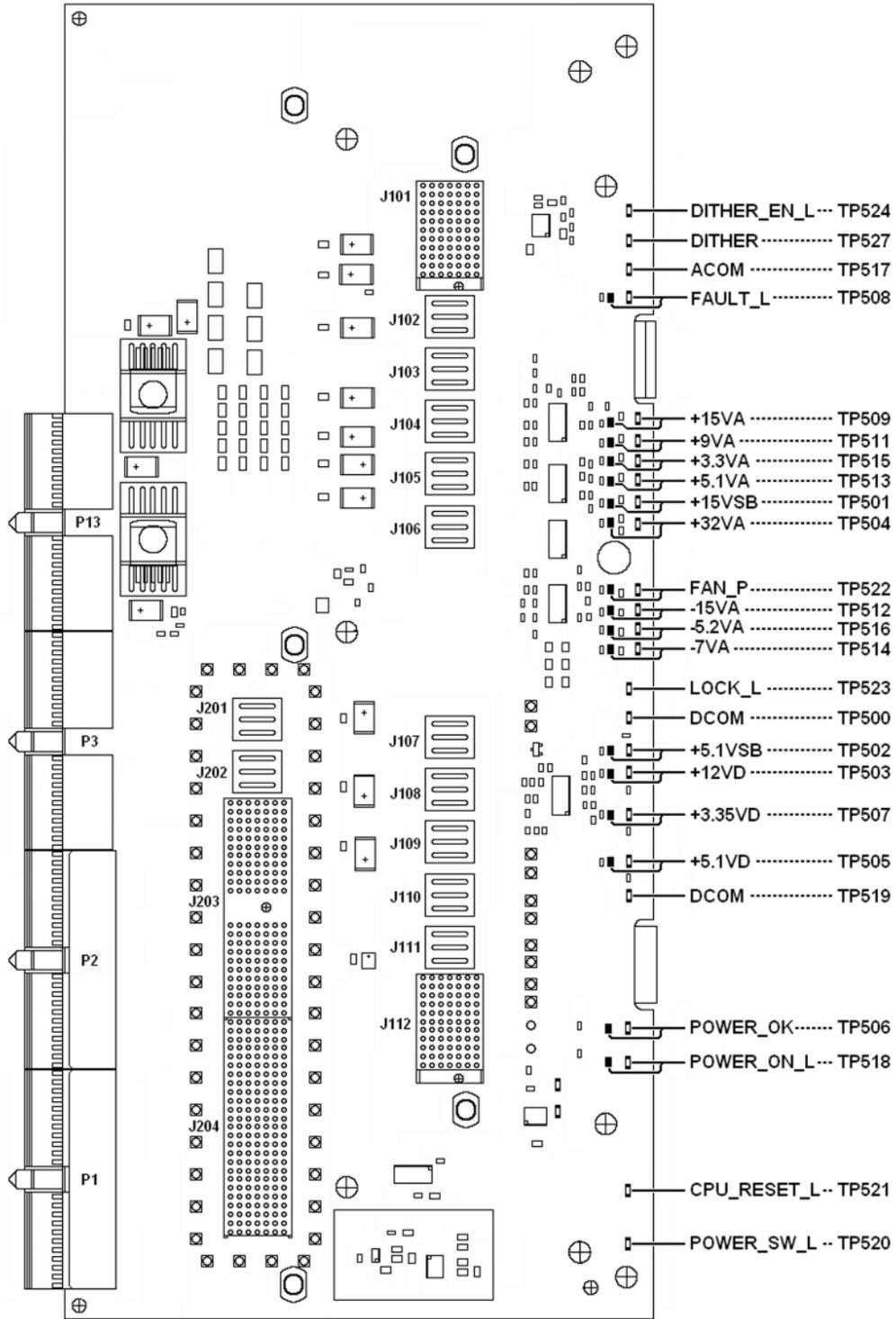
13 Motherboard & Front Panel

What You Will Find in This Chapter

The following information is found in this chapter:

1. Theory of operation of the Motherboard Assembly.
2. Theory of operation of the Front Panel Assembly.
3. Isolating the cause of an hardware problem by verifying the functionality of assemblies.

This following descriptions are found in this chapter:

A8 Motherboard Assembly Description page 380
A1 Front Panel Assembly page 382

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A8 Motherboard Assembly Description

A8 Motherboard Assembly Purpose

The Motherboard is an electrical link between many of the electrical assemblies in the instrument. The main functions of this PC board include:

— Distribute power

— Control and common signals between all the measurement PC boards including the A7 Midplane and the Front Panel Assembly

— Circuitry for fan speed control

— 10 MHz Reference distribution

A8 Motherboard Assembly Connections

The connections to and from the A8 Motherboard assembly are as listed in Table 13-1 and as illustrated in Figure 13-1.

Table 13-1   **A8 Motherboard Assembly Connections**

Connector	Connects to	Connector	Connects to
J2	A7 Midplane P13	J21	A16 Reference J100
J3	A7 Midplane P3	J31/J32	Option Slot
J4	A7 Midplane P2	J41/J42	Option Slot
J5	A7 Midplane P1	J51/J52	A30 LISN Control J3
J6	Chassis Fan - B3	J61/J62	A24 Conducted Filter J400
J7	Chassis Fan - B2	J71/J72	A21 RF Presel Input J600
J8	Chassis Fan - B1	J81/J82	A22 Radiated Filter J500
J9	A1A2 Front Panel P1 (W8)	J91/J92	Option Slot
J11	A3 Digital IF P1	J101	A14 LO Synthesizer J100
J12	A3 Digital IF P2	J111	A15 Front End Controller J100

Figure 13-1   A8 Motherboard Assembly Connectors
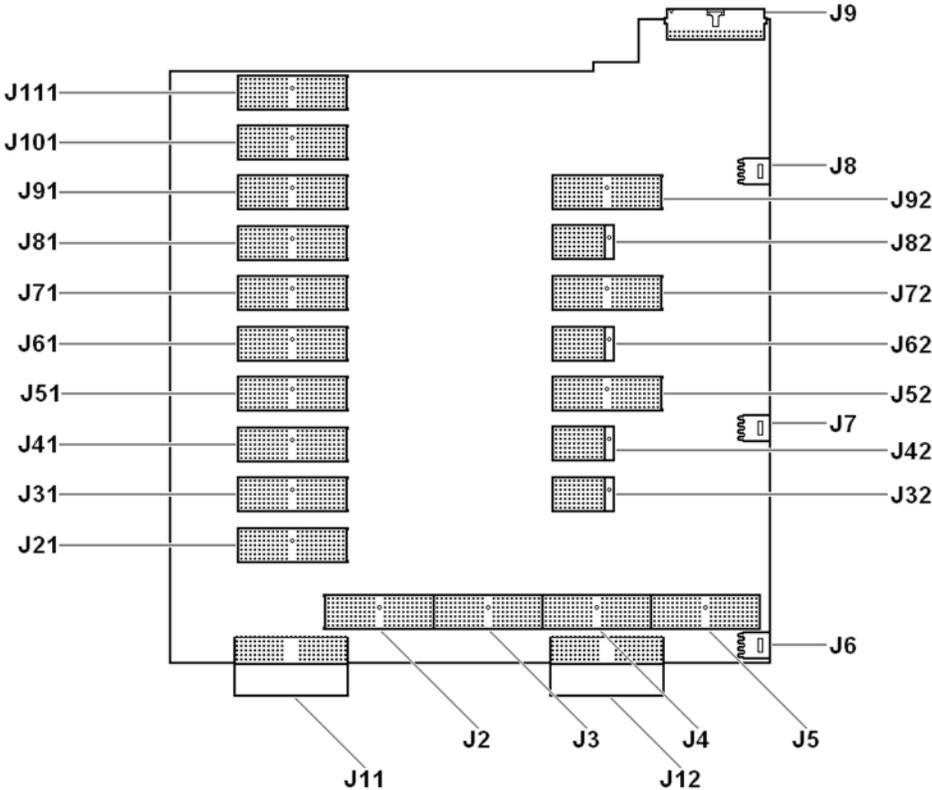
A1 Front Panel Assembly

The major components of the A1 Front Frame Assembly are the A1A2 Front Panel Interface Board, A1A3 LCD, A1A4 Backlight Power Supply Board, and the A1A5 Front Panel Daughter Board, all of which are serviceable as individual components.

The A1 assembly is used to display the measurement results, accept user input via the keyboard, and connect USB peripheral devices.

A1A2 Front Panel Interface Board

The A1A2 Front Panel Interface board is serviced as an assembly only; no component level repair is supported.

The Front Panel Interface Board contains LCD control, backlight drive, audio amplifiers, internal speaker, a 4 port USB hub, and a USB keyboard microcontroller.

The two different front panel rubber keypads attach to the back side of the board, which has the keyboard contacts printed on the reverse side.

The 4 ports from the USB hub contained on this board go to the 2 front panel USB connectors, the keyboard microcontroller, and the fourth port is unused.

A1A3 LCD

The LCD used is an 8.4inch XGA TFT display, which has a resolution of 1024 x 768.

A1A4 Backlight Power Supply

The backlight power supply board provides the voltage required by the LCD backlights.

A1A5 Front Panel Daughter Board

The Front Panel Daughter Board provides the front panel USB connections as well as the headphone jack, probe power, and RF Input 1 LED.

14   Optional Assemblies

What You Will Find in This Chapter

The following information is found in this chapter:

KEYSIGHT
TECHNOLOGIES

A25 Wideband Analog IF Assembly Description

A25 Wideband Analog IF Assembly Purpose

The A25 Wideband Analog IF assembly's primary role is to properly filter and apply attenuation or gain to optimize the level going to the Analog to Digital Converter (ADC) and provide sufficient pre-filtering to reject images that would otherwise interfere with the signals of interest. Precision alignments are used to calibrate the filters, attenuators and gain of this assembly.

A25 Wideband Analog IF Assembly Description

NOTE

Refer to Chapter 15, "Block Diagrams"

The input signal of the instrument is down converted to a 300 MHz intermediate frequency by the A13 Front End assembly and routed through the A15 Front End Controller to the input of the A25 Wideband Analog IF at J101. The signal is then filtered, with attenuation or gain being applied based upon the instrument settings. This signal is then sampled by the ADC and the resultant data is sent to the A26 Wideband Digital IF assembly for processing.

IF Signal Routing

The wideband IF output of the A15 Front End Controller J901 is routed to the A25 Wideband Analog IF via W52. Without the optional 85 MHz analysis bandwidth option (B85) this signal would go directly to the A3 Digital IF assembly. In order to accommodate both the A25 Wideband Analog IF and the A3 Digital IF assemblies the signal is routed to the A25 Wideband Analog IF assembly which can either use the signal itself or route it back out to the A3 Digital IF assembly when needed.

The frequency of the signal input at J101 is 300 MHz when the A25 Wideband Analog IF assembly is going to use it, and it is 250 MHz when it is to be routed back out to the A3 Digital IF assembly.

Clock and Calibrator Signals

Using the 2400 MHz calibration signal coming to J301 from the A16 Reference assembly the A25 Wideband Analog IF assembly generates other needed clock and calibration signals used by both this assembly and others.

RF Burst Trigger

The A25 Wideband Analog IF assembly also generates a built in RF Burst Trigger that is available when the 85 MHz IF path is selected in IQ Analyzer (Basic) mode.

A25 Wideband Analog IF Assembly Connections

The connections to and from the A25 Wideband Analog IF assembly are as listed in Table 14-1 and as illustrated in Figure 14-1.

While the A25 Wideband Analog IF assembly has a connector (J502) that connects to the PCI bus on the A8 Motherboard, none of the signals on this connector are used. The connector is used to give greater stability to the assembly.

Table 14-1   A25 Wideband Analog IF Assembly Connections

Port	Description	To/From	Cable	Frequency
J2	Digital Signal Output	A26 Wideband Digital IF J778	W10	Digital
J101	Wideband IF Input	A15 Front End Controller J901	W52	300 MHz
J102	Wideband IF Output	A3 Digital IF J15	W15	250 MHz
J301	2400 MHz Reference Input	A16 Reference J718	W51	2400 MHz
J302	2400 MHz Reference Output	n/a	n/a	2400 MHz
J502	PCI Bus	A8 Motherboard J32	n/a	n/a
J801	FPGA Diag	n/a	n/a	n/a
J802	Bias and Control	A8 Motherboard J31	n/a	n/a
J803	JTAG Programming	n/a	n/a	n/a
J805	Step Cal Input	A3 Digital IF J17	W23	n/a
J806	Calibrator Output	A16 Reference J726	W50	n/a

Figure 14-1   A25 Wideband Analog IF Connections
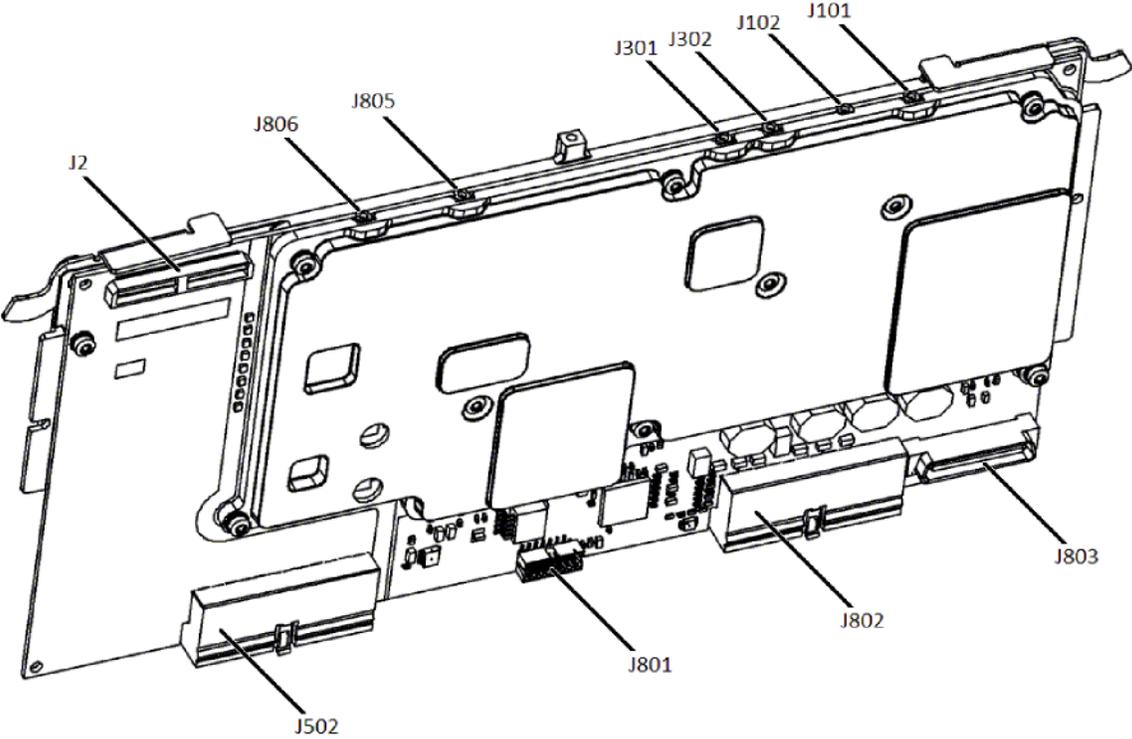
A25 Wideband Analog IF Assembly Troubleshooting

NOTE

Refer to Chapter 15, "Block Diagrams"

Since the A25 Wideband Analog IF assembly output is digital the amount of signal tracing and troubleshooting that can be performed on this assembly is limited. However, there are a few things that can be checked to verify that it is functioning properly. They are:

1. Assembly Initialization

2. Overall Wideband Signal Path Verification

3. 2400 MHz Reference Input Verification

4. Input Signal Level Verification

5. Input Switching Verification

Assembly Initialization

Before the A25 Wideband Analog IF assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A25 Wideband Analog IF assembly should identify itself on this list as WB Analog IF. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

Solution: Reload the FPGA code. See "FPGA Synchronization" in Chapter 19, "Post-Repair Procedures"

— An instrument power supply voltage is not operating properly

Solution: Verify all instrument power supply voltages. See Chapter 12, "Power Supply & Midplane".

— A25 Wideband Analog IF assembly is defective

Solution: Replace the A25 Wideband Analog IF assembly

Overall Wideband Signal Path Verification

Before attributing a fault to the A25 Wideband Analog IF assembly its overall ability to process a signal will need to be verified. However, due to its output being that of the analog to digital converter (ADC) on the assembly the actual output of the assembly itself cannot be verified, only the A25 Wideband Analog IF and A26 Wideband Digital IF assemblies working together can be verified. The following procedure will verify this.

1. Turn the instrument on and allow it to complete its boot up process and initial alignments

2. Make sure that the RF preselector is turned off by pressing **Mode**, **EMI Receiver**, **Input / Output**, **RF Input**, **RF Preselector Off**

3. Turn on the internal 50 MHz calibrator signal by pressing **Input / Output**, **RF Calibrator**, **50 MHz**

4. Switch the instrument to IQ Analyzer mode by pressing **Mode**, **IQ Analyzer (Basic)**

5. Tune the instrument to 50 MHz by pressing **FREQ Channel**, **50 MHz**

6. Switch the instrument IF signal path to go through the A25 Wideband Analog IF assembly by pressing **Mode Setup**, **IF Path**, **85 MHz**

7. Measure the signal level by pressing **Peak Search**. The level of the 50 MHz calibrator should be -25.0 dBm ±0.3 dB, as shown in Figure 14-2.

Figure 14-2   Overall Wideband Signal Path Verification
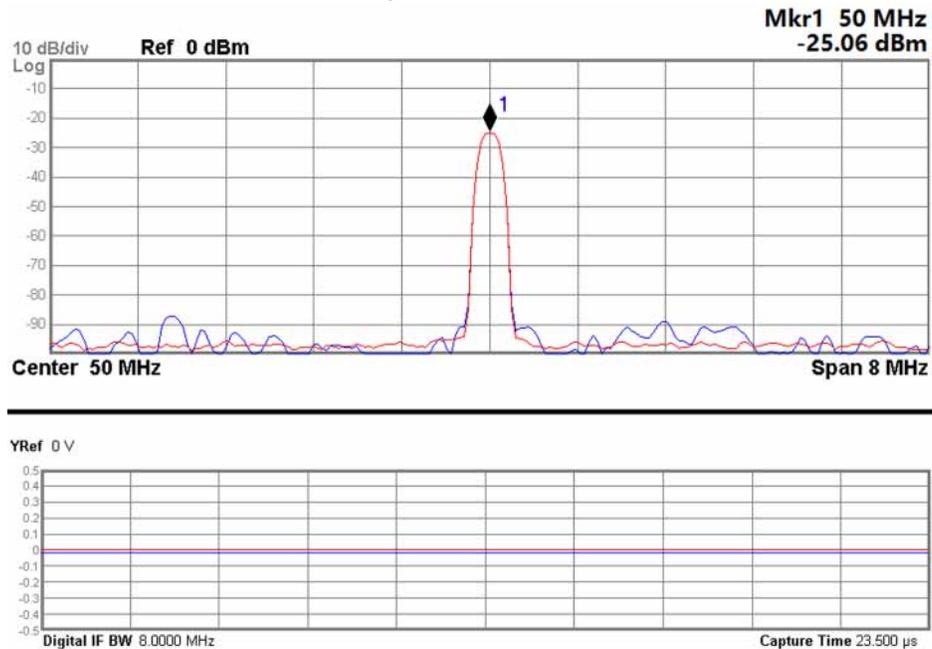
8. If the signal level measured is correct the overall basic functionality of the A25 Wideband Analog IF assembly is working as it should. If not, proceed with the rest of the verification listed in this section.

2400 MHz Reference Input Verification

The A25 Wideband Analog IF assembly uses a 2400 MHz reference signal that comes to J301 via coaxial cable W51 from the A16 Reference assembly J718. Before attributing a fault to the A25 Wideband Analog IF assembly the presence of this reference signal will need to be verified, as the assembly cannot function properly without it. The following procedure will verify this.

1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to Chapter 18, "Assembly Replacement Procedures" for instructions on removing these covers

2. Turn the instrument on and allow it to complete its boot up process and initial alignments

3. Referring to Figure 14-1, disconnect coaxial cable W51 from A25 J301

4. Connect the loose end of W51 to a spectrum analyzer input to verify the signal frequency and amplitude

5. Tune the spectrum analyzer to 2400 MHz with a span of 1 MHz

6. Measure the signal level using the peak search function of the spectrum analyzer. The level of the 2400 MHz signal should be +10.0 dBm, ±4.0 dB, as shown in Figure 14-3.

Figure 14-3   2400 MHz Reference Input Verification
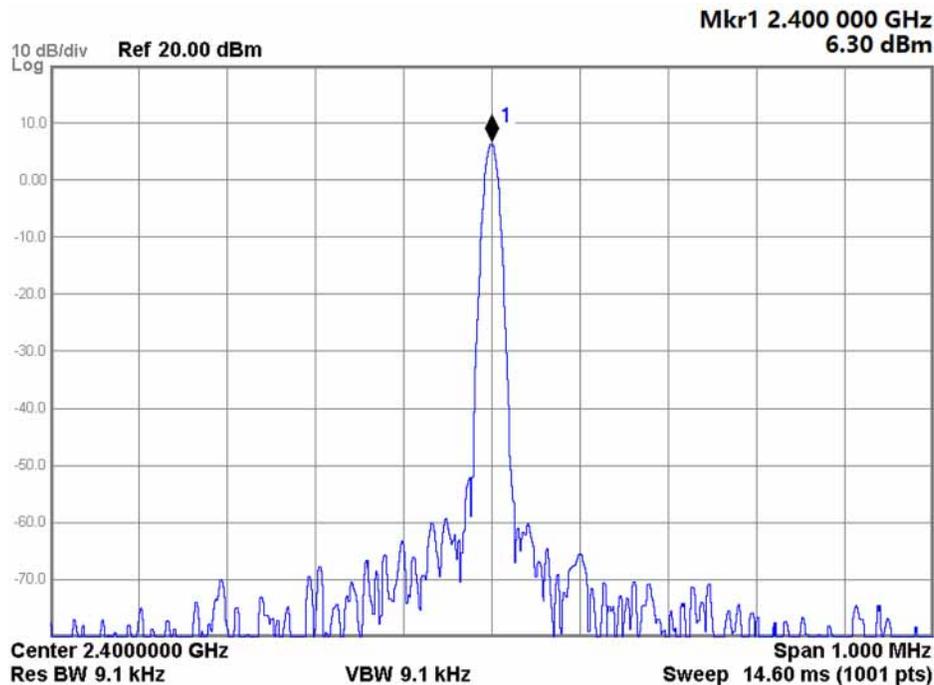
7. If the signal level measured is correct the reference input signal going to the A25 Wideband Analog IF assembly is of the correct level. If not, refer to Chapter 9, "Reference Assembly" and determine why the signal level coming from it is not correct

Input Signal Level Verification

The input signal to the A25 Wideband Analog IF assembly comes to J101 via coaxial cable W52 from the A15 Front End Control assembly J901. When the A25 Wideband Analog IF assembly is going to use this signal itself the frequency of this signal will be 300 MHz. Before attributing a fault to the A25 Wideband Analog IF assembly the input signal to the assembly will need to be verified to be correct. The following procedure will verify the input signal frequency and amplitude level.

1. Turn the instrument internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Off**

2. Referring to Figure 14-1, disconnect coaxial cable W52 from A25 J101

3. Connect the loose end of W52 to a spectrum analyzer input to verify the signal frequency and amplitude

4. Tune the spectrum analyzer to 300 MHz with a span of 1 MHz

5. Measure the signal level using the peak search function of the spectrum analyzer. The level of the 300 MHz signal should be -32.0 dBm, ±3.0 dB, as shown in Figure 14-4.

Figure 14-4   Input Signal Level Verification
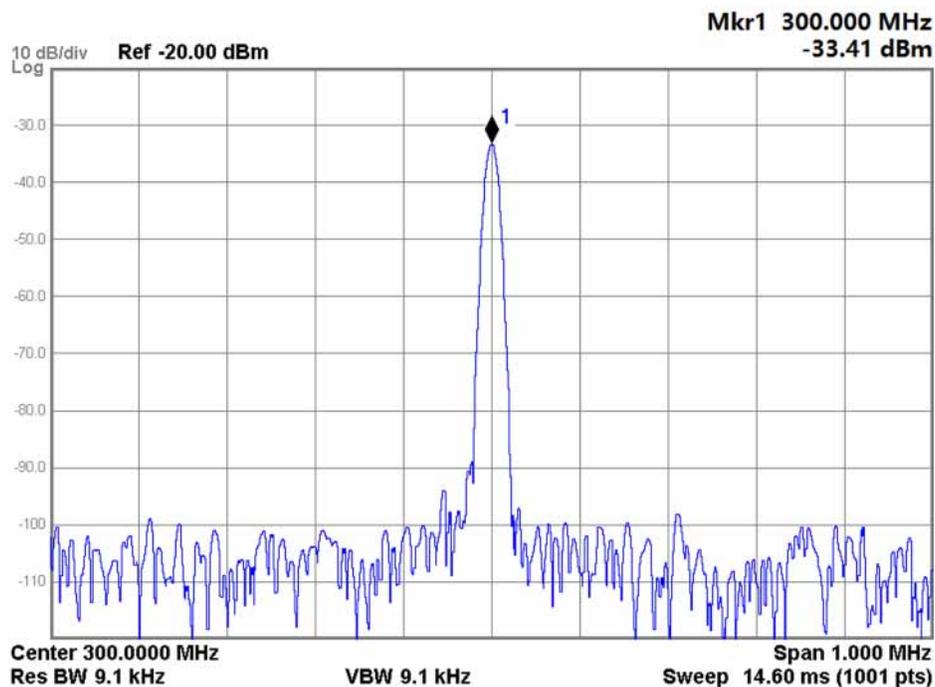
6. If the signal level measured is correct the input signal going to the A25 Wideband Analog IF assembly is of the correct level. If not, refer to Chapter 8, "Front End Control" and determine why the signal level coming from it is not correct.

Input Switching Verification

The input of the A25 Wideband Analog IF assembly is designed such that the input signal presented to it at J101 can be either used by this assembly itself or routed back out of J102 to be used by the A3 Digital IF 40 MHz IF path. However, since the N9038A MXE EMI Receiver does not have an option for a 40 MHz analysis bandwidth there is no time other than during internal alignments that this signal path is used. So there is no way to manually verify that this switching is working properly.

If there is a problem with the input signal switching back out though J102 to the A3 Digital IF assembly the internal alignments will have failures for everything related to either the DIF40 or MediumBandIF.

While the exact levels cannot be verified, the existence of a signal coming out of J101 during an instrument internal alignment can be verified by following this procedure:

1. Referring to Figure 14-1, disconnect coaxial cable W15 from A25 J102

2. Connect a cable from J102 to the input of a spectrum analyzer to verify the presence of a signal

3. Tune the spectrum analyzer to 250 MHz with a span of 1 MHz

4. Set the spectrum analyzer to use Video Trigger with a Trigger Level of –60.0 dBm

5. Set the spectrum analyzer to Single trigger so that it will capture only one signal

6. Run the instrument internal alignment by pressing **System**, **Alignments**, **Align Now**, **RF Only**

7. At some point during the alignment being run the spectrum analyzer should trigger, with a signal that looks something like that seen in Figure 14-5.

Figure 14-5   Input Switching Verification
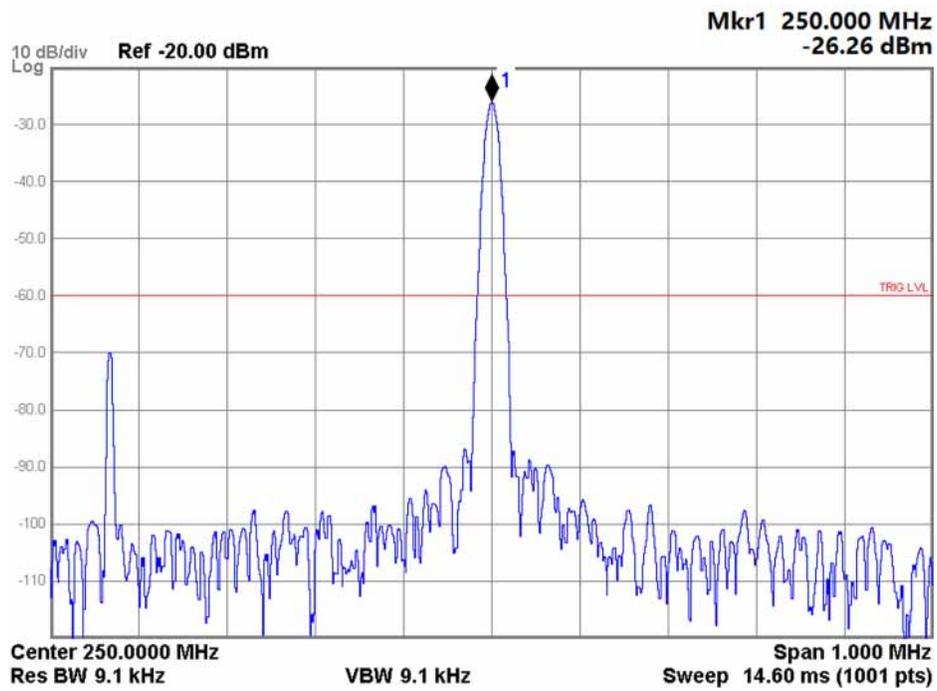
8. If a signal similar to what is seen in Figure 14-5 is seen at some point during the alignment then the input switching circuitry would appear to be working properly.

A26 Wideband Digital IF Assembly Description

A26 Wideband Digital IF Assembly Purpose

The primary role of the A26 Wideband Digital IF assembly is to accept samples from the ADC on the A25 Wideband Analog IF assembly and perform Digital Signal Processor operations on them before either saving them to local memory or host memory. This assembly communicates with and is controlled by the A4 Processor assembly via the instrument 32 bit 33 MHz PCI Bus.

A26 Wideband Digital IF Assembly Description

> **NOTE**
>
> Refer to Chapter 15, "Block Diagrams"

The signal flow through the A26 Wideband Digital IF assembly begins as the ADC samples from the A25 Wideband Analog IF assembly flow into the FPGA. The FPGA can be programmed to route the samples various ways, but the typical setup is that they next flow into the DSP ASIC for processing, and then back into the FPGA where they are processed further before being routed either to the local DDR-2 SDRAM or a PCI bus target such as the Power PC or the A4 Processor assembly.

DSP ASIC

The DSP ASIC provides high speed real-time DSP functionality at sample rates of up to 300 MSmp/s DDR. The ADC samples are routed through the DPS ASIC to allow real-time amplitude and phase corrections, complex down-conversion, arbitrary resampling and decimation, channel filtering, and detection. The input filter is used to correct both for the amplitude and phase characteristics of the instrument. It also does the complex conversion to baseband. The output filter can be used to provide arbitrary channel filters such as Root-Raised Cosine, or Gaussian. The detectors are capable of delivering results as I and Q, magnitude and phase, log of magnitude and phase, and magnitude squared.

FPGA

The FPGA includes the ADC data input as well as interfaces to the DSP ASIC, the 2 GByte DDR-2 SDRAM memory, the PCI bus, and the CPLD. It also provides signal routing, and additional functions such as hardware averaging, data packing.

The FPGA is programmed both at power up as well as on the fly whenever the behavior of the signal processing needs to be altered. Multiple images used for programming the FPGA are stored locally in flash and can be swapped by the Power PC in 20 msec.

Clock Generator

The clock generator takes the 10 MHz reference input from the A8 Motherboard and phase locks a local 100 MHz VCO to it. Phase coherent copies of the 100 MHz reference signal are sent to the DSP ASIC, FPGA, and CPLD. Each copy goes to only one destination and all copies are length matched. There is a separate very low jitter 100 MHz clock that is provided for the PCIe interface.

Power PC

The Power PC serves as the local PCI bus master and controller of the assembly. PCI communication from the A4 Processor host generally comes to the Power PC. The Power PC then controls the local hardware.

The Power PC has two main busses, the PCI bus and the memory bus. The memory bus connects to 128 MB of SDRAM at 100 MHz. The Power PC BootROM is 8 MB of flash memory. The Power PC clocks are derived from the 33 MHz PCI clock. The internal clock runs at 250 MHz.

At power up the Power PC transfers two images from flash memory to the SRAM. Either image can then be written into the FPGA by the CPLD (under Power PC control) over a dedicated 16 bit 100MHz programming bus.

CPLD

The CPLD generates local reset signals, and has a register based interface to the Power PC CPU memory bus.

The Power PC CPU to CPLD interface has two parts. The first is an 8 bit wide interface that is always available and allows for such things as diagnostics, reset control, and FPGA reprogramming control. The second is a 32 bit wide path that allows access to the FPGA Flash and SRAM. This 32 bit path allows setup of FPGA reprogramming and writing/reading of Flash and SRAM contents, and is only available to the Power PC while the FPGA is not being reprogrammed. During FPGA reprogramming the CPLD takes over this bus, isolates it from the CPU and uses it to DMA the SRAM contents into the FPGA.

Non-Transparent PCI to PCI Bridge

The Non-Transparent PCI to PCI Bridge is used to isolate the local PCI bus from the instrument PCI bus, allowing the Power PC to master the local PCI bus. This is important because it allows the Power PC to control and re-enumerate the local PCI bus whenever necessary without causing problems for the rest of the instrument. The local PCI bus connects to the Non-Transparent PCI Bridge, the FPGA, and the PCI to PCIe Bridge. Both PCI busses are 32 bit running at 33 MHz.

Pulse Stretcher

The pulse stretcher is used to get information about when an asynchronous trigger arrives relative to an ADC sample. This is needed since such triggers usually arrive between two samples rather that coincident with one, and the instrument needs to know when they arrive with more precision.

A pulse sent to the pulse stretcher from the FPGA is extended in time and sent back to the FPGA where its new stretched length can be counted using the ADC Sample clock. Typical stretch ratios are approximately seven hundred to one

Prior to interpolating the arrival of triggers, the pulse stretcher must be calibrated so that the slope and offset of its stretching abilities are known. There is an instrument internal alignment for this calibration.

A26 Wideband Digital IF Assembly Connections

The connections to and from the A26 Wideband Digital IF assembly are as listed in Table 14-2 and as illustrated in Figure 14-6.

Table 14-2   A25 Wideband Analog IF Assembly Connections

Port	Description	To/From	Cable	Frequency
J501	Bias & Control	A8 Motherboard J51	n/a	n/a
J502	PCI Bus	A8 Motherboard J52	n/a	n/a
J778	Digital Signal Input	A25 Wideband Analog IF J2	W10	Digital
J9000	PCIe/LVDS	n/a	n/a	n/a

Figure 14-6   A26 Wideband Digital IF Connections
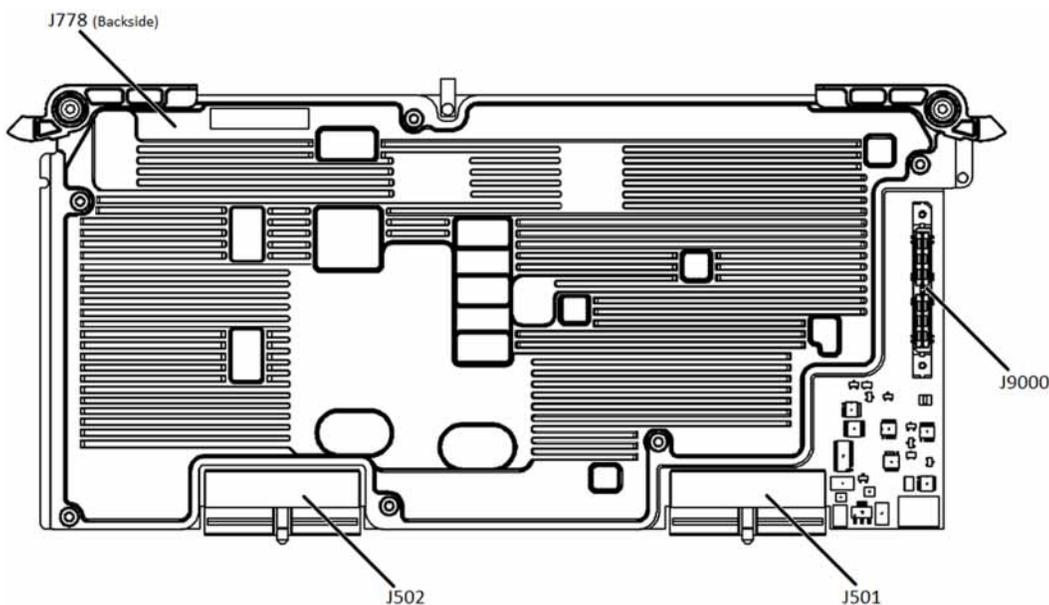
A26 Wideband Digital IF Assembly Troubleshooting

NOTE   Refer to **Chapter 15, "Block Diagrams"**

Since the A26 Wideband Digital IF assembly input and output are both digital no troubleshoot or tracing of a signal can be performed on this assembly. However, there are a few things that can be checked to verify that it is functioning properly. They are:

1. Assembly Initialization

2. Internal Alignment Failures

3. Overall Wideband Signal Path Verification

Assembly Initialization

Before the A26 Wideband Digital IF assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A26 Wideband Digital IF assembly should identify itself on this list as WB Digital IF. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— FPGA Code on the assembly is corrupt

  Solution: Reload the FPGA code. See **"FPGA Synchronization"** in **Chapter 19, "Post-Repair Procedures"**

— An instrument power supply voltage is not operating properly

  Solution: Verify all instrument power supply voltages. See **Chapter 12, "Power Supply & Midplane"**.

— A26 Wideband Digital IF assembly is defective

  Solution: Replace the A26 Wideband Digital IF assembly

Internal Alignment Failures

Failure of this assembly will normally occur when the instrument internal alignments are run, either automatically in the background or manually. To verify if there are alignment errors related to the A26 Wideband Digital IF assembly look in the file named:

E:\AlignDataStore\AlignmentHistrory.txt

If there are failures for items with names or descriptions such as WBDIF, WBIF, or WideBandIF the most likely cause will be either a defective A25 Wideband Analog IF or A26 Wideband Digital IF assembly.

Overall Wideband Signal Path Verification

Before attributing a fault to the A26 Wideband Digital IF assembly its overall ability to process a signal will need to be verified. However, due to its input and output being a digital bus it would be very difficult to isolate and verify the functionality of the assembly itself, only the A25 Wideband Analog IF and A26 Wideband Digital IF assemblies working together can be verified. The following procedure will verify this.

1. Turn the instrument on and allow it to complete its boot up process and initial alignments

2. Make sure that the RF preselector is turned off by pressing **Mode**, **EMI Receiver**, **Input / Output**, **RF Input**, **RF Preselector Off**

3. Turn on the internal 50 MHz calibrator signal by pressing **Input / Output**, **RF Calibrator**, **50 MHz**

4. Switch the instrument to IQ Analyzer mode by pressing **Mode**, **IQ Analyzer (Basic)**

5. Tune the instrument to 50 MHz by pressing **FREQ Channel**, **50 MHz**

6. Switch the instrument IF signal path to go through the A25 Wideband Analog IF assembly by pressing **Mode Setup**, **IF Path**, **85 MHz**

7. Measure the signal level by pressing **Peak Search**. The level of the 50 MHz calibrator should be -25.0 dBm ±0.3 dB, as shown in Figure 14-7.

Figure 14-7   Overall Wideband Signal Path Verification
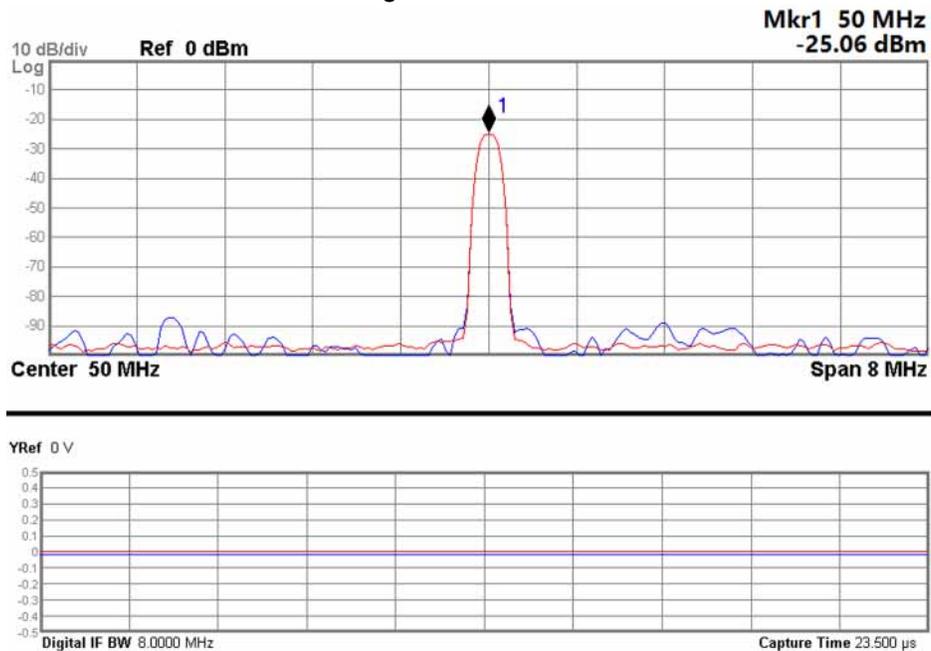
8. If the signal level measured is correct the overall basic functionality of the A26 Wideband Digital IF assembly is working as it should. If not, go to the A25 Wideband Analog IF troubleshooting information in this chapter and verify that the inputs to it are correct. If they are, the problem could be either the A25 Wideband Analog IF assembly or the A26 Wideband Digital IF assembly.

A30 LISN Control Assembly Description

A30 LISN Control Assembly Purpose

The A30 LISN Control assembly has only one purpose, to control an external Line Impedance Stabilization Network (LISN). This is a device used for making conducted emissions measurements.

A30 LISN Control Assembly Description

The output of the A30 LISN Control assembly is an eight bit parallel control bus, as well as two DC voltage supplies. This output (J1) is connected to the AUX I/O port on the instrument rear panel by ribbon cable W9.

The instrument user has control of an external LISN from the EMI Receiver mode under either the Mode Setup or Meas Setup menus. For troubleshooting purposes there is a control menu for this assembly on the Service Menu. See Chapter 16, "Service and Diagnostics Menus" for more information on this.

A30 LISN Control Assembly Connections

The connections to and from the A30 LISN Control assembly are as listed in Table 14-3 and as illustrated in Figure 14-8.

Table 14-3   **A30 LISN Control Assembly Connections**

Port	Description	To/From	Cable
J1	Control Output	Rear Panel AUX I/O	W9
J2	JTAG Programming	n/a	n/a
J3	Bias and Control	A8 Motherboard J51	n/a

Figure 14-8   A30 LISN Control Assembly Connectors
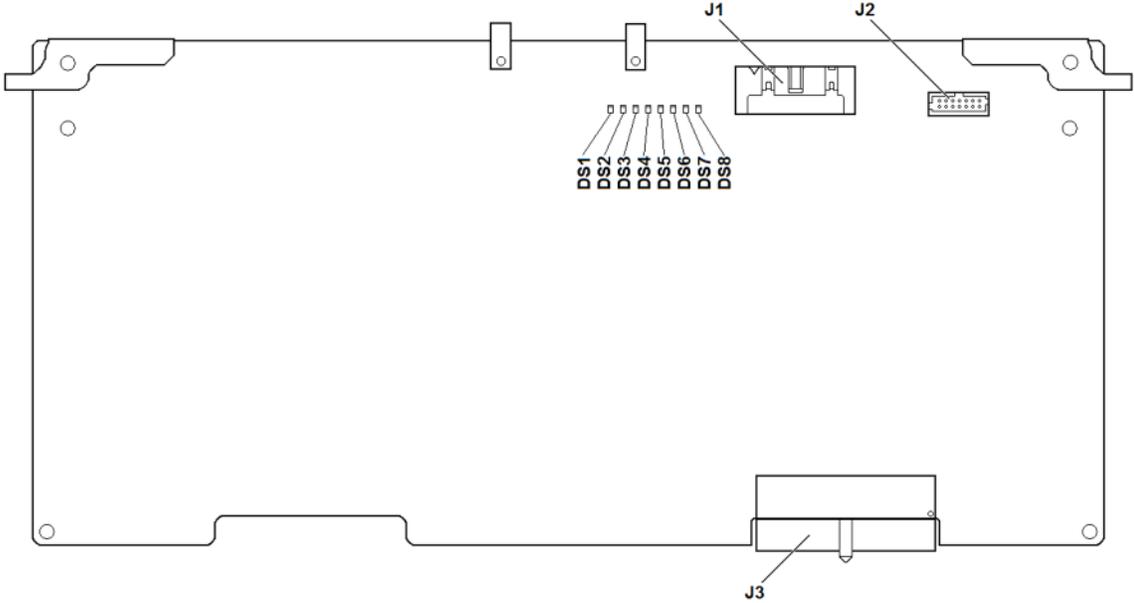
A30 LISN Control Assembly Troubleshooting

Since the A30 LISN Control assembly has only one main function there are only a few things that will need to be checked to verify that it is functioning properly.

They are:

1. Assembly Initialization

2. Option LSN License Key

3. Output Data Line Status LEDs

4. Rear Panel AUX I/O Outputs

Assembly Initialization

Before the A30 LISN Control assembly will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. The first step in verifying that this has happened is to look at the instrument Hardware Information screen. To view this information press **System**, **Show**, **Hardware**. Once you do this you will see a listing of instrument hardware assemblies that are installed. The A30 LISN Control assembly should identify itself on this list as **General Purpose IO Control**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be:

— An instrument power supply voltage is not operating properly

>   Solution: Verify all instrument power supply voltages.
>   See Chapter 12, "Power Supply & Midplane"

— A30 LISN Control assembly is defective

>   Solution: Replace the A30 LISN Control assembly

Option LSN License Key

While the instrument will identify the presence of an A30 LISN Control assembly on the System, Show, Hardware screen without the presence of an Option LSN license key, the assembly will not have the desired menus or functionality without it.

To verify the presence of the Option LSN license key press **System**, **Show**, **System** and look for the presence of **N9038A-LSN LISN Hardware Support**. If there is no entry for this a valid license will need to be obtained and installed.

Output Data Line Status LEDs

There are eight output data line status indicating LEDs on the A30 LISN Control assembly. Their location is shown in Figure 14-8.

NOTE

Before verifying the status of the output data line LEDs be sure to verify that the A30 LISN Control assembly is identified by the instrument and that the Option LSN license key is properly installed. See the "Assembly Initialization" and "Option LSN License Key" section in this chapter for information on how this is done.

In the Spectrum Analyzer mode, or from a Mode Preset state in the EMI Receiver mode, LEDs DS1 through DS5 should be on; DS6 through DS8 should be off, as shown in Table 14-4.

1. Remove the instrument dress cover and top brace. Refer to Chapter 18, "Assembly Replacement Procedures" for removal instructions.

2. Turn the instrument on and allow it to complete its boot up process.

3. Once the instrument completes its boot up process press the Mode Preset key to be sure that the instrument is in a known state. The state of the output data line status LEDs should now be as shown in Table 14-4.

4. If the status of any of the LEDs is not correct verify that all of the instrument power supply voltage levels are correct. For information on how to verify these voltage levels see Chapter 12, "Power Supply & Midplane".

5. If the power supply voltages are all correct and the state of the status LEDs are still not correct replace the A30 LISN Control assembly.

Table 14-4   A30 LISN Control Assembly Status LEDs and AUX I/O Connector Pinout

LED	LED Preset State	Corresponding Data Line	AUX I/O Pin Number	Data Line Preset State
DS1	On	Data 0	14	5 VDC
DS2	On	Data 1	15	5 VDC
DS3	On	Data 2	16	5 VDC
DS4	On	Data 3	17	5 VDC
DS5	On	Data 4	18	5 VDC
DS6	Off	Data 5	19	0 VDC
DS7	Off	Data 6	20	0 VDC
DS8	Off	Data 7	21	0 VDC

Rear Panel AUX I/O Outputs

The rear panel AUX I/O output data lines and DC power supplies from the A30 LISN Control assembly can be measured with the use of the instrument Service Menu and a DC voltmeter.

NOTE

Before verifying the functionality of the AUX I/O outputs be sure to verify that the A30 LISN Control assembly is identified by the instrument and that the Option LSN license key is properly installed. See the "Assembly Initialization" and "Option LSN License Key" section in this chapter for information on how this is done.

1. Refer to Figure 13-2. With the use of a DC voltmeter measure the levels of the +12 VDC and +5 VDC power supplies.

    If the power supply voltages are not correct check the levels of the instrument +15 VA and +5.1 VA voltages. For information on how to verify these voltage levels see Chapter 12, "Power Supply & Midplane".

2. Access the Service Menu and exercise the different data line controls and verify that all data lines will independently toggle between 0 and 5 VDC. For information on how to access the service menu see Chapter 16, "Service and Diagnostics Menus".

    If all of the data lines are changing state properly the A30 LISN Control assembly is working properly. If any of the rear panel AUX I/O data lines are not working properly proceed to step 3 to determine the problem.

3. Remove the instrument dress cover and top brace. Refer to Chapter 18, "Assembly Replacement Procedures" for removal instructions.

4. Refer to Table 14-4. Verify that the output data line status LEDs on the A30 LISN Control assembly are also incorrect. If they are replace the A30 LISN Control assembly. If they are operating correctly replace the W9 ribbon cable assembly.

Figure 14-9   Rear Panel AUX I/O Pinout
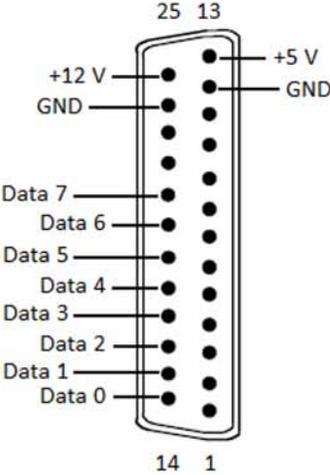
15   Block Diagrams

What You Will Find in This Chapter

The following block diagrams are found in this chapter:

N9038B RF Input Option 503, 508, 526

N9038A RF Input Option 544

N9038A RF Preselector Conducted Band Signal Path

N9038A RF Preselector Radiated Band Signal Path

N9038A RF Section Option 503, 508, and 526 Band 0

N9038A RF Section Option 508, and 526 Band 1

N9038A RF Section Option 526 Band 2

N9038A RF Section Option 526 Band 3

N9038A RF Section Option 526 Band 4

N9038A RF Section Option 544 Band 0

N9038A RF Section Option 544 Band 1

N9038A RF Section Option 544 Band 2

N9038A RF Section Option 544 Band 3

N9038A RF Section Option 544 Band 4

N9038A RF Section Option 544 Band 5

N9038A RF Section Option 544 Band 6

IF System Block Diagram

IF System Block Diagram (Serial Prefix < MY/SG5322)

Wideband IF Section Block Diagram

LO Synthesizer

Reference

MXE Computer

KEYSIGHT
TECHNOLOGIES

Block Diagrams

Graphic Symbols Used On Block Diagrams

Symbol	Description	Symbol	Description	Symbol	Description
	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		
	Inverter Buffer		Switch Open		Slide, Toggle, or Rocker, Switch
	Limiter		Diode		Grounded Coaxial Sheilding
	Variable Integrator	ADC	Analog Digital Convertor		Directional Coupler
		DAC	Digital Analog Convertor		

sa83a

N9038A RF Input Option 503, 508, 526 Block Diagram
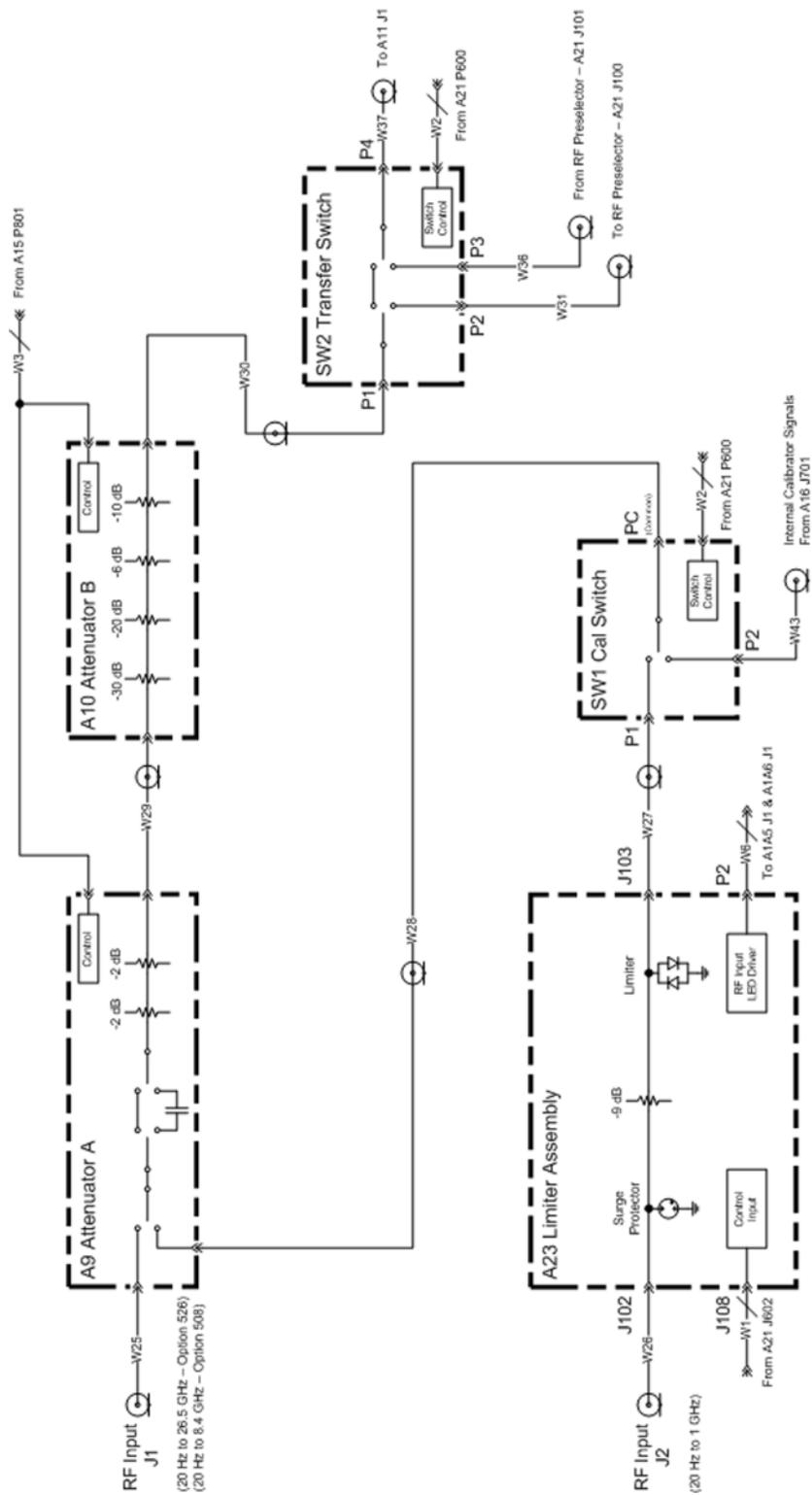
N9038A RF Input Option 544 Block Diagram

N9038A RF Preselector
Conducted Band Signal Path
20 Hz to 30 MHz

A21 RF Preselector Input Assembly

Alignment Sources

Broad Band Noise Source (10 MHz – 4 GHz)

-4 dB

- 8 dB

-19.6 dB

Direct Digital Synthesizer (DC – 50 MHz)

-16 dB

C-Band Preamp & Overload Detector

+20 dB

C-Band Overload Detector

W36

J101

To SW2 P3

-44 dBm

R-Band Preamp & Overload Detector

+20 dB

R-Band Overload Detector

A23 Limiter Assembly Driver

W1

To A23 J108

J602

SW1 & SW2 Switch Drivers

W2

To SW1 & SW2 Control

P600

Thru Path

-4 dB

Limiter & Pre-Filters

2 MHz

4.4 GHz

55 MHz

From SW2 P2

W31

J100

-44 dBm

-45 dBm

J103 J102 J200 J306

W32

W35

(Bottom Side of A8 Motherboard)

A24 Conducted Filter Assembly

Low Band Filters

Low Band Thru Path

40 kHz Low Pass Filter*

20 Hz – 150 kHz Filter Path

150 kHz – 1 MHz Filter Path

1 - 2 MHz Filter Path

Input Switch

Output Switch

W33

W34

A22 Radiated Filter Assembly

Tunable Filters

30 - 70 MHz Filter Path

90 MHz

70 - 150 MHz Filter Path

200 MHz LPF

150 - 300 MHz Filter Path

350 MHz LPF

300 - 600 MHz Filter Path

1.0 GHz LPF

600 MHz – 1 GHz Filter Path

+19 dB

-5 dB

+19 dB

1 - 2 GHz Filter Path

Output Switching

-1.9 dB

+12.5 dB

-3.5 dB

J401

-42 dBm

J402

-3.5 dB

High Band Filters

High Band Thru Path

2 - 5 MHz Filter Path

5 - 8 MHz Filter Path

8 - 11 MHz Filter Path

11 -14 MHz Filter Path

14 - 17 MHz Filter Path

17 - 20 MHz Filter Path

20 - 24 MHz Filter Path

24 - 28 MHz Filter Path

28 - 32 MHz Filter Path

Instrument Settings	
Input Port	RF Input J1
Input Coupling	DC
Input Attenuation	10 dB
RF Preselector	On
Preamp State	Off
Input Frequency	10 MHz
Input Amplitude	-25 dBm
Frequency Span	0 Hz

Fixed Filters

2 – 3.6 GHz Filter Path

+19 dB

Thru Path

J100

J300

N9038A RF Preselector
Radiated Band Signal Path
30 MHz to 3.6 GHz

A21 RF Preselector Input Assembly

Alignment Sources

Broad Band Noise Source (10 MHz – 4 GHz)

-4 dB

- 8 dB

Direct Digital Synthesizer (DC – 50 MHz)

-19.6 dB

-16 dB

C-Band Preamp & Overload Detector

+20 dB

C-Band Overload Detector

W36   To SW2 P3

J101

-35 dBm

R-Band Preamp & Overload Detector

+20 dB

R-Band Overload Detector

A23 Limiter Assembly Driver

W1   To A23 J108

J602

SW1 & SW2 Switch Drivers

W2   To SW1 & SW2 Control

P600

Thru Path

-4 dB

Limiter & Pre-Filters

2 MHz   4.4 GHz

55 MHz

From SW2 P2

W31

J100

-35 dBm

J103   J102   J200   J306

W32

-36 dBm

W35   (Bottom Side of A8 Motherboard)

A24 Conducted Filter Assembly

Low Band Filters

Low Band Thru Path

40 kHz Low Pass Filter*

20 Hz – 150 kHz Filter Path

150 kHz – 1 MHz Filter Path

1 - 2 MHz Filter Path

Input Switch

Output Switch

+12.5 dB   -3.5 dB

W33

W34

J401

J402

-3.5 dB

High Band Filters

High Band Thru Path

2 - 5 MHz Filter Path

5 - 8 MHz Filter Path

8 - 11 MHz Filter Path

11 -14 MHz Filter Path

14 - 17 MHz Filter Path

17 - 20 MHz Filter Path

20 - 24 MHz Filter Path

24 - 28 MHz Filter Path

28 - 32 MHz Filter Path

A22 Radiated Filter Assembly

Tunable Filters

30 - 70 MHz Filter Path

90 MHz

70 - 150 MHz Filter Path

+19 dB   -5 dB

200 MHz LPF

150 - 300 MHz Filter Path

350 MHz LPF

300 - 600 MHz Filter Path

1.0 GHz LPF

600 MHz – 1 GHz Filter Path

+19 dB

1 - 2 GHz Filter Path

Output Switching

-1.9 dB

Fixed Filters

2 – 3.6 GHz Filter Path

+19 dB

J100

Thru Path

J300

-33 dBm

Instrument Settings	
Input Port	Internal Calibrator
Input Coupling	AC
Input Attenuation	10 dB
RF Preselector	On
Preamp State	Off
Input Frequency	50 MHz
Input Amplitude	-25 dBm
Frequency Span	0 Hz

A11 RF Switch / High Band Preamp

From SW2 P4

W37

J1

J2

High Band Preamp +30 dB

Control

J4

J3

3.6 to 26.5 GHz Path

W39

A12 YTF

Control

J1

W12

J300

A15 Front End Control

W3 to A9 & A10

J800

Attenuator Control

YTF Driver

Sweep Ramp Output

Not Used
J301

Ext. µW Preselector Drive

Not Used
J302

µW Preselector Bypass Switch Control

Not Used
J801

Low Noise Path Switch Control

Not Used
J802

Switched IF Filter Control

Not Used
J1300

W40

W4

20 Hz to 3.6 GHz Path

RF Switch / High Band Preamp Control

J700

A13 Front End Assembly

1st Mixer (High Band > 13.6 GHz)

13.6 to 26.5 GHz

J9

3.6 to 13.6 GHz

1st Mixer (High Band < 13.6 GHz)

2nd Mixer (Low Band)

W14

J7

J902

J903

Enhanced Front End Control [1]

J900

W16 to A2J100

Bias T

dac

J901

W15 to A3J15
Or
W52 to A25J101
(Option B85)

1st LO OUT
J8

J13   EXT IF OUT
W24 (Opt EXM)

Burst Trigger

dac

LOG DET

W38

J2

Low Band Preamp

3.6 GHz LPF

+20 dB

1st Mixer (Low Band)

8.3 – 14 GHz BPF

X2

W42

J1   4.8 GHz LO
From A16 J702

9 GHz LPF

VCO

260 MHz – 400 MHz

120 MHz LPF

J1100

W22 to Rear Panel
AUX IF OUT

Mixer Bias
Amplifier Bias
Switch Control

J12

LO Distribution

Front End Assembly Control

J102

[1] Only with serial prefix ≥ MY/SG5322

J6

J5   A13A3
50Ω Load

J3   A13A2
50Ω Load

J4

J10

A13W1

J11

A13W2

W18 from A16 J705

W44 from A14 J740

A13A1 Band Pass Filter

5.1225 GHz

W5

EXT MIXER   J3
(Opt EXM)

W46 (Opt EXM)

W45 (Opt EXM)

N9038A RF Section
Option 503, 508 and 526
Band 0 (20 Hz to 3.6 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-36 dBm
J2
-37 dBm
High Band Preamp +30 dB
Control
J3
J4
3.6 to 26.5 GHz Path
W39

20 Hz to 3.6 GHz Path
W38
W40

A12 YTF
Control
J1
W12

A15 Front End Control
W3 to A9 & A10
J800
Attenuator Control
J300
YTF Driver
W4
J700
RF Switch / High Band Preamp Control

Sweep Ramp Output — Not Used J301
Ext. μW Preselector Drive — Not Used J302
μW Preselector Bypass Switch Control — Not Used J801
Low Noise Path Switch Control — Not Used J802
Switched IF Filter Control — Not Used J1300

A13 Front End Assembly
J9
13.6 to 26.5 GHz
3.6 to 13.6 GHz
1st Mixer (High Band > 13.6 GHz)
1st Mixer (High Band < 13.6 GHz)
x1
2nd Mixer (Low Band)
-31 dBm
W14
J7
322.5 MHz
J902
J903

1st LO OUT J8
J13 EXT IF OUT
W24 (Opt EXM)
8.3 – 14 GHz BPF
X2
+11 dBm
J1
4.8 GHz LO From A16 J702
9 GHz LPF

Low Band Preamp
J2
3.6 GHz LPF
+20 dB
1st Mixer (Low Band)

Mixer Bias Amplifier Bias Switch Control
J12
LO Distribution
W18 from A16 J705
J6   J5   J3   J4   J10
A13A3 50Ω Load
A13A2 50Ω Load
+18 dBm
W44 from A14 J740
5,172.5 MHz

A13W1
A13A1 Band Pass Filter
5.1225 GHz
A13W2

J11
W5

Enhanced Front End Control [1]
-32 dBm J900
W16 to A2J100
322.5 MHz
Bias T
dac
J901
W15 to A3J15 Or W52 to A25J101 (Option B85)
Burst Trigger
dac
LOG DET
J1100
W22 to Rear Panel AUX IF OUT
VCO
260 MHz – 400 MHz
120 MHz LPF
J102
Front End Assembly Control

[1] Only with serial prefix ≥ MY/SG5322

EXT MIXER J3 (Opt EXM)
W46 (Opt EXM)   W45 (Opt EXM)

Signal Path ——————
LO Path - - - - - - - -

Instrument Settings	
Input Port	Internal Calibrator
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	50 MHz
Input Amplitude	-25 dBm

N9038A RF Section
Option 508 and 526
Band 1 (3.5 to 8.4 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-40 dBm

High Band Preamp
+30 dB

Control

J2   J4

J3   -45 dBm

3.6 to 26.5 GHz Path
W39

20 Hz to 3.6 GHz Path

W40

W38

A12 YTF

-50 dBm

Control
J1

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

W12   J300   YTF Driver

W4   J700   RF Switch / High Band Preamp Control

Sweep Ramp Output   Not Used   J301
Ext. µW Preselector Drive   Not Used   J302
µW Preselector Bypass Switch Control   Not Used   J801
Low Noise Path Switch Control   Not Used   J802
Switched IF Filter Control   Not Used   J1300

A13 Front End Assembly

1st Mixer (High Band > 13.6 GHz)

13.6 to 26.5 GHz

J9

3.6 to 13.6 GHz

1st Mixer (High Band < 13.6 GHz)

x1

2nd Mixer (Low Band)

-35 dBm

W14   J7   322.5 MHz

J902   J903

Enhanced Front End Control [1]

-36 dBm
J900
W16 to A2J100
322.5 MHz

Bias T   dac

1st LO OUT   J8

EXT IF OUT   J13
W24 (Opt EXM)

dac   Burst Trigger

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

LOG DET

Low Band Preamp

J2   3.6 GHz LPF   +20 dB

1st Mixer (Low Band)

8.3 – 14 GHz BPF   X2

W42   J1
4.8 GHz LO From A16 J702

9 GHz LPF

VCO
260 MHz – 400 MHz

120 MHz LPF

J1100
W22 to Rear Panel AUX IF OUT

Mixer Bias Amplifier Bias Switch Control

J12

LO Distribution

Front End Assembly Control

J102

[1] Only with serial prefix ≥ MY/SG5322

J6   J5   J3   J4   J10   J11

W18 from A16 J705

A13A3 50Ω Load   A13A2 50Ω Load

A13W1

A13A1 Band Pass Filter

5.1225 GHz

A13W2

+18 dBm

W44 from A14 J740

5,122.5 MHz

W5

EXT MIXER   J3   W46 (Opt EXM)   W45 (Opt EXM)
(Opt EXM)

Instrument Settings	
Input Port	Internal Calibrator
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	4.8 GHz
Input Amplitude	-28 dBm

Signal Path ———
LO Path - - - -

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-23 dBm

High Band Preamp +30 dB

Control

J2   J4

3.6 to 26.5 GHz Path
W39

J3   -30 dBm

-33 dBm

A12 YTF

Control   J1

20 Hz to 3.6 GHz Path

W40

W38

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

Sweep Ramp Output   Not Used J301

Ext. µW Preselector Drive   Not Used J302

W12   J300   YTF Driver

µW Preselector Bypass Switch Control   Not Used J801

Low Noise Path Switch Control   Not Used J802

W4   J700   RF Switch / High Band Preamp Control

Switched IF Filter Control   Not Used J1300

A13 Front End Assembly

1st Mixer (High Band > 13.6 GHz)

13.6 to 26.5 GHz

J9

3.6 to 13.6 GHz

-18 dBm   J900   -19 dBm

1st Mixer (High Band < 13.6 GHz)

W14   J7   J902   W16 to A2J100

322.5 MHz   322.5 MHz

x1

2nd Mixer (Low Band)

1st LO OUT   J8

J13   EXT IF OUT
W24 (Opt EXM)

J903

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

Enhanced Front End Control [1]

Bias T   dac

Burst Trigger   dac

LOG DET

VCO
260 MHz – 400 MHz   120 MHz LPF

J1100
W22 to Rear Panel
AUX IF OUT

Low Band Preamp

3.6 GHz LPF   +20 dB

1st Mixer (Low Band)

J2

8.3 – 14 GHz BPF   X2

W42   J1
4.8 GHz LO From A16 J702

9 GHz LPF

Mixer Bias Amplifier Bias Switch Control   J12

LO Distribution

J6   J5   J3   J4   J10   J11

A13A3 50Ω Load   A13A2 50Ω Load

A13W1   A13W2

Front End Assembly Control   J102

[1] Only with serial prefix ≥ MY/SG5322

+18 dBm

W44 from A14 J740

5,161.25 MHz

W18 from A16 J705

A13A1 Band Pass Filter

5.1225 GHz

W5

EXT MIXER   J3
(Opt EXM)   W46 (Opt EXM)   W45 (Opt EXM)

Signal Path
LO Path

Instrument Settings	
Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	10.0 GHz
Input Amplitude	-10 dBm

N9038A RF Section
Option 526
Band 3 (13.5 to 17.1 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-24 dBm
J2
High Band Preamp +30 dB
Control
J4
J3
-32 dBm
20 Hz to 3.6 GHz Path
W38

3.6 to 26.5 GHz Path
W39
-36 dBm
W40

A12 YTF

Control
J1
W12

A15 Front End Control

W3 to A9 & A10
J800
Attenuator Control
YTF Driver
J300
RF Switch / High Band Preamp Control
J700
W4

Sweep Ramp Output — Not Used J301
Ext. µW Preselector Drive — Not Used J302
µW Preselector Bypass Switch Control — Not Used J801
Low Noise Path Switch Control — Not Used J802
Switched IF Filter Control — Not Used J1300

A13 Front End Assembly

1st Mixer (High Band > 13.6 GHz) X2
13.6 to 26.5 GHz
J9
3.6 to 13.6 GHz
1st Mixer (High Band < 13.6 GHz)
2nd Mixer (Low Band)
-23 dBm
J7
W14
322.5 MHz
J902
J903

+18 dBm
1st LO OUT
J8
7,661.25 MHz
J13 EXT IF OUT
W24 (Opt EXM)

Enhanced Front End Control [1]

-24 dBm
J900
W16 to A2J100
322.5 MHz
Bias T
dac
J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

Burst Trigger
dac
LOG DET
J1100
W22 to Rear Panel
AUX IF OUT
VCO
260 MHz – 400 MHz
120 MHz LPF

[1] Only with serial prefix ≥ MY/SG5322

Low Band Preamp

J2
3.6 GHz LPF
+20 dB
1st Mixer (Low Band)
8.3 – 14 GHz BPF
X2
W42
J1
4.8 GHz LO From A16 J702
9 GHz LPF
Mixer Bias Amplifier Bias Switch Control
J12
LO Distribution
Front End Assembly Control
J102

J6
W18 from A16 J705
J5
A13A3 50Ω Load
J3
A13A2 50Ω Load
J4
J10
A13W1
J11
A13W2

+18 dBm
W44 from A14 J740
7,661.25 MHz

A13A1 Band Pass Filter
5.1225 GHz

W5

EXT MIXER J3 (Opt EXM)
W46 (Opt EXM)
W45 (Opt EXM)

Signal Path ——
LO Path - - - -

Instrument Settings	
Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	15.0 GHz
Input Amplitude	-10 dBm

N9038A RF Section
Option 526
Band 4 (17.0 to 26.5 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-25 dBm

High Band Preamp +30 dB

Control
J2   J4

20 Hz to 3.6 GHz Path

3.6 to 26.5 GHz Path
W39
J3   -35 dBm

A12 YTF

Control   J1

-38 dBm

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

YTF Driver
W12   J300

RF Switch / High Band Preamp Control
W4   J700

Sweep Ramp Output   Not Used   J301
Ext. µW Preselector Drive   Not Used   J302
µW Preselector Bypass Switch Control   Not Used   J801
Low Noise Path Switch Control   Not Used   J802
Switched IF Filter Control   Not Used   J1300

W40

A13 Front End Assembly

1st Mixer (High Band > 13.6 GHz)
x2

13.6 to 26.5 GHz
J9

-26 dBm

3.6 to 13.6 GHz

1st Mixer (High Band < 13.6 GHz)

2nd Mixer (Low Band)

W14
J7

322.5 MHz

Enhanced Front End Control [1]

-27 dBm
J900
W16 to A2J100
322.5 MHz

J902

J903

Bias T   dac

dac   Burst Trigger

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

+18 dBm
1st LO OUT
J8
10,161.25 MHz
J13   EXT IF OUT
W24 (Opt EXM)

Low Band Preamp

3.6 GHz LPF
+20 dB

1st Mixer (Low Band)

8.3 – 14 GHz BPF   X2

9 GHz LPF

LOG DET

VCO
260 MHz – 400 MHz

120 MHz LPF

J1100
W22 to Rear Panel
AUX IF OUT

W42   J1
4.8 GHz LO
From A16 J702

Mixer Bias Amplifier Bias Switch Control
J12

LO Distribution

Front End Assembly Control
J102

[1] Only with serial prefix ≥ MY/SG5322

W38   J2

W18 from A16 J705

J6   J5   J3   J4   J10   J11

A13A3 50Ω Load   A13A2 50Ω Load

+18 dBm
W44 from A14 J740
5,080.625 MHz

A13W1

A13A1 Band Pass Filter

5.1225 GHz

A13W2

W5

EXT MIXER   J3
(Opt EXM)   W46 (Opt EXM)   W45 (Opt EXM)

Signal Path ——————
LO Path — — — — —

Instrument Settings	
Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	20.0 GHz
Input Amplitude	-10 dBm

Block diagram of N9038A RF Section Option 544, including the following labeled sections:

A11 RF Switch / High Band Preamp
- From SW2 P4, W37, J1, J2
- High Band Preamp +30 dB
- Control, J4, J3

A12 YTF
- 3.6 to 44 GHz Path, W39
- Control, J1

A15 Front End Control
- W3 to A9 & A10, J800
- Attenuator Control
- YTF Driver, W12, J300
- Sweep Ramp Output — Not Used J301
- Ext. µW Preselector Drive — Not Used J302
- µW Preselector Bypass Switch Control — Not Used J801
- Low Noise Path Switch Control — Not Used J802
- Switched IF Filter Control — Not Used J1300
- RF Switch / High Band Preamp Control, W4, J700
- Front End Assembly Control, J102

A13 Front End Assembly
- 1st Mixers (High Band): 34.4 to 44 GHz, 17 to 34.5 GHz, 3.6 to 17.1 GHz
- 2nd Mixer (Low Band)
- W40, W14, J9, J7, J902, J903
- 1st LO OUT, J8
- J13 EXT IF OUT, W24 (Opt EXM)
- 14 GHz LPF, 17 GHz LPF, X2
- W42, J1 4.8 GHz LO From A16 J702
- 20 Hz to 3.6 GHz Path, W38, J2
- 3.6 GHz LPF
- Low Band Preamp +20 dB
- 1st Mixer (Low Band)
- LO Distribution
- Mixer Bias Amplifier Bias Switch Control, J12
- J6, J5, J3, J4, J10, J11
- A13A3 50Ω Load, A13A2 50Ω Load
- W18 from A16 J705
- W44 from A14 J740
- A13W1, A13W2

A13A1 Band Pass Filter
- 5.1225 GHz

Right side / IF section
- Bias T, dac, J900, W16 to A2J100
- J901, W15 to A3J15 Or W52 to A25J101 (Option B85)
- Burst Trigger, dac
- LOG DET
- J1100, W22 to Rear Panel AUX IF OUT
- VCO 260 MHz – 400 MHz
- 120 MHz LPF
- W5

EXT MIXER
- J3 (Opt EXM)
- W46 (Opt EXM), W45 (Opt EXM)

N9038A RF Section
Option 544
Band 0 (20 Hz to 3.6 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37 J1
-36 dBm
High Band Preamp +30 dB
Control
J2 J4
-37 dBm

3.6 to 44 GHz Path W39

A12 YTF
Control J1

A15 Front End Control

W3 to A9 & A10 J800 Attenuator Control
W12 J300 YTF Driver

Sweep Ramp Output J301 Not Used
Ext. µW Preselector Drive J302 Not Used
µW Preselector Bypass Switch Control J801 Not Used
Low Noise Path Switch Control J802 Not Used
Switched IF Filter Control J1300 Not Used

W40
20 Hz to 3.6 GHz Path
W4 J700 RF Switch / High Band Preamp Control

W38

A13 Front End Assembly

1st Mixers (High Band)
34.4 to 44 GHz
17 to 34.5 GHz
J9
3.6 to 17.1 GHz
2nd Mixer (Low Band)
X1

-26 dBm
W14 J7 J902
322.5 MHz

-27 dBm
J900
W16 to A2J100
322.5 MHz

Bias T
dac

1st LO OUT J8
J13 EXT IF OUT
W24 (Opt EXM)
J903

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

Low Band Preamp
3.6 GHz LPF
+20 dB
1st Mixer (Low Band)

14 GHz LPF
17 GHz LPF
X2

J2

Mixer Bias Amplifier Bias Switch Control
J12

LO Distribution

J6 J5 J3 J4 J10 J11
A13A3 50Ω Load
A13A2 50Ω Load

A13W1 A13W2

A13A1 Band Pass Filter
5.1225 GHz

+18 dBm
W44 from A14 J740
5,172.5 MHz

+11 dBm
W42 J1
4.8 GHz LO From A16 J702

Burst Trigger
dac
LOG DET

J1100
W22 to Rear Panel AUX IF OUT

VCO
260 MHz – 400 MHz
120 MHz LPF

J102 Front End Assembly Control

W18 from A16 J705

W5

EXT MIXER J3
(Opt EXM)
W46 (Opt EXM) W45 (Opt EXM)

Instrument Settings	
Input Port	Internal Calibrator
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	50 MHz
Input Amplitude	-25 dBm

Signal Path ▬▬▬
LO Path ▬ ▬ ▬

N9038A RF Section

Option 544

Band 1 (3.6 to 8.4 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4

W37

J1

-41 dBm

High Band Preamp +30 dB

Control

J2

J4

J3

-47 dBm

3.6 to 44 GHz Path

W39

20 Hz to 3.6 GHz Path

W40

W38

A12 YTF

-53 dBm

Control

J1

A15 Front End Control

W3 to A9 & A10

J800

Attenuator Control

YTF Driver

W12

J300

RF Switch / High Band Preamp Control

W4

J700

Sweep Ramp Output

Not Used
J301

Ext. µW Preselector Drive

Not Used
J302

µW Preselector Bypass Switch Control

Not Used
J801

Low Noise Path Switch Control

Not Used
J802

Switched IF Filter Control

Not Used
J1300

A13 Front End Assembly

1st Mixers (High Band)

34.4 to 44 GHz

17 to 34.5 GHz

3.6 to 17.1 GHz

2nd Mixer (Low Band)

X1

J9

J7

-35 dBm

W14

322.5 MHz

-36 dBm

J900

W16 to A2J100

322.5 MHz

J902

J903

Bias T

dac

1st LO OUT

J8

J13 EXT IF OUT

W24 (Opt EXM)

J901

W15 to A3J15
Or
W52 to A25J101
(Option B85)

dac

Burst Trigger

LOG DET

VCO

260 MHz – 400 MHz

120 MHz LPF

J1100

W22 to Rear Panel
AUX IF OUT

Low Band Preamp

3.6 GHz LPF

+20 dB

1st Mixer (Low Band)

J2

14 GHz LPF

17 GHz LPF

X2

W42

J1 4.8 GHz LO From A16 J702

LO Distribution

Mixer Bias Amplifier Bias Switch Control

J12

J6

J5

A13A3 50Ω Load

J3

A13A2 50Ω Load

J4

J10

A13W1

J11

A13W2

Front End Assembly Control

J102

W18 from A16 J705

+18 dBm

W44 from A14 J740

5,122.5 MHz

A13A1 Band Pass Filter

5.1225 GHz

W5

EXT MIXER

J3

(Opt EXM)

W46 (Opt EXM)

W45 (Opt EXM)

| Signal Path | ——— |
| LO Path | - - - - |

Instrument Settings

Input Port	Internal Calibrator
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	4.8 GHz
Input Amplitude	-28 dBm

N9038A RF Section
Option 544
Band 2 (8.3 to 13.6 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-23 dBm

High Band Preamp
+30 dB

Control

J2   J4

3.6 to 44 GHz Path
W39

J3   -30 dBm

20 Hz to 3.6 GHz Path

W40

A12 YTF

-35 dBm

Control
J1

A15 Front End Control

W3 to A9 & A10   J800
Attenuator Control

YTF Driver
W12   J300

RF Switch / High Band
Preamp Control
W4   J700

Sweep Ramp Output   Not Used
J301

Ext. µW Preselector Drive   Not Used
J302

µW Preselector Bypass Switch
Control   Not Used
J801

Low Noise Path Switch
Control   Not Used
J802

Switched IF Filter Control   Not Used
J1300

A13 Front End Assembly

1st Mixers
(High Band)

34.4 to 44 GHz

17 to 34.5 GHz

3.6 to 17.1 GHz

X1

2nd Mixer
(Low Band)

J9   J7

-19 dBm
W14   J902
322.5 MHz

-20 dBm
J900
W16 to A2J100

322.5 MHz

1st LO OUT
J8

J13   EXT IF OUT
W24 (Opt EXM)

Bias T
dac

J903

Burst Trigger
dac

LOG
DET

W38

J2

3.6 GHz
LPF

Low Band Preamp

+20 dB

1st Mixer
(Low Band)

14 GHz
LPF

X2

17 GHz
LPF

W42
J1
4.8 GHz LO
From A16 J702

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

J1100
W22 to Rear Panel
AUX IF OUT

VCO
260 MHz – 400 MHz

120 MHz LPF

Mixer Bias
Amplifier Bias
Switch Control
J12

LO Distribution

Front End Assembly Control
J102

J6   J5   J3   J4   J10   J11

A13A3
50Ω Load

A13A2
50Ω Load

+18 dBm

W18 from A16 J705

W44 from A14 J740

5,161.25 MHz

A13W1

A13A1 Band Pass Filter

5.1225 GHz

A13W2

W5

Signal Path
LO Path

EXT MIXER   J3
(Opt EXM)

W46 (Opt EXM)   W45 (Opt EXM)

Instrument Settings	
Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	10.0 GHz
Input Amplitude	-10 dBm

N9038A RF Section

Option 544

Band 3 (13.5 to 17.1 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4

W37

J1

-25 dBm

High Band Preamp +30 dB

Control

J2

J4

J3   -30 dBm

3.6 to 44 GHz Path

W39

20 Hz to 3.6 GHz Path

W38

W40

A12 YTF

-35 dBm

Control

J1

A15 Front End Control

W3 to A9 & A10

J800   Attenuator Control

W12

J300   YTF Driver

W4

J700   RF Switch / High Band Preamp Control

Sweep Ramp Output — Not Used J301

Ext. µW Preselector Drive — Not Used J302

µW Preselector Bypass Switch Control — Not Used J801

Low Noise Path Switch Control — Not Used J802

Switched IF Filter Control — Not Used J1300

A13 Front End Assembly

1st Mixers (High Band)

34.4 to 44 GHz

17 to 34.5 GHz

3.6 to 17.1 GHz

2nd Mixer (Low Band)

X2

J9

J7   322.5 MHz

-19 dBm

W14

J902

J903

Bias T

dac

1st LO OUT

J13   EXT IF OUT
W24 (Opt EXM)

-20 dBm

J900
W16 to A2J100

322.5 MHz

J901
W15 to A3J15
Or
W52 to A25J101
(Option B85)

Burst Trigger

dac

LOG DET

VCO

260 MHz – 400 MHz

120 MHz LPF

J1100
W22 to Rear Panel
AUX IF OUT

Low Band Preamp

3.6 GHz LPF

+20 dB

J2

1st Mixer (Low Band)

14 GHz LPF

17 GHz LPF

X2

W42

J1
4.8 GHz LO From A16 J702

LO Distribution

Mixer Bias Amplifier Bias Switch Control

J12

J6

J5
A13A3 50Ω Load

J3
A13A2 50Ω Load

J4

J10

J11

+18 dBm

W44 from A14 J740

7,661.25 MHz

A13W1

A13A1 Band Pass Filter

5.1225 GHz

A13W2

W18 from A16 J705

Front End Assembly Control

J102

W5

EXT MIXER   J3
(Opt EXM)

W46 (Opt EXM)

W45 (Opt EXM)

| Signal Path | ———— |
| LO Path | - - - - |

Instrument Settings

Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	15.0 GHz
Input Amplitude	-10 dBm

N9038A RF Section
Option 544
Band 4 (17.0 to 26.5 GHz)

A11 RF Switch / High Band Preamp

From SW2 P4
W37
J1
-25 dBm

High Band Preamp +30 dB

Control

J2   J4

3.6 to 44 GHz Path

J3   -31 dBm

W39

20 Hz to 3.6 GHz Path

W40

A12 YTF

-36 dBm

Control   J1

W38

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

W12   J300   YTF Driver

Ext. µW Preselector Drive

µW Preselector Bypass Switch Control

Sweep Ramp Output   Not Used J301

Ext. µW Preselector Drive   Not Used J302

µW Preselector Bypass Switch Control   Not Used J801

Low Noise Path Switch Control   Not Used J802

Switched IF Filter Control   Not Used J1300

W4   J700   RF Switch / High Band Preamp Control

A13 Front End Assembly

1st Mixers (High Band)

34.4 to 44 GHz

17 to 34.5 GHz   x2

3.6 to 17.1 GHz

2nd Mixer (Low Band)

J9

J7   W14   -20 dBm   322.5 MHz

1st LO OUT   J8

J13   EXT IF OUT   W24 (Opt EXM)

Low Band Preamp

3.6 GHz LPF   +20 dB

1st Mixer (Low Band)

J2

W42   J1   4.8 GHz LO From A16 J702

14 GHz LPF

17 GHz LPF   X2

Mixer Bias Amplifier Bias Switch Control

J12

LO Distribution

J6   J5   J3   J4   J10   J11

A13A3 50Ω Load   A13A2 50Ω Load

+18 dBm

W18 from A16 J705

W44 from A14 J740

5,080.625 MHz

A13W1   A13W2

A13A1 Band Pass Filter

5.1225 GHz

J902   J903   Bias T   dac

-21 dBm   J900   W16 to A2J100

322.5 MHz

J901   W15 to A3J15 Or W52 to A25J101 (Option B85)

Burst Trigger   dac

LOG DET

J1100   W22 to Rear Panel AUX IF OUT

VCO   260 MHz – 400 MHz

120 MHz LPF

J102   Front End Assembly Control

EXT MIXER   J3   W46 (Opt EXM)   W45 (Opt EXM)
(Opt EXM)

W5

Signal Path
LO Path

Instrument Settings

Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	20.0 GHz
Input Amplitude	-10 dBm

A11 RF Switch / High Band Preamp

From SW2 P4

W37

J1

-27 dBm

High Band Preamp +30 dB

Control

J2   J4

3.6 to 44 GHz Path

J3   -33 dBm

W39

A12 YTF

-39 dBm

Control   J1   W12   J300

20 Hz to 3.6 GHz Path

W40

W38

W4   J700

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

YTF Driver

RF Switch / High Band Preamp Control

Sweep Ramp Output   Not Used J301

Ext. μW Preselector Drive   Not Used J302

μW Preselector Bypass Switch Control   Not Used J801

Low Noise Path Switch Control   Not Used J802

Switched IF Filter Control   Not Used J1300

A13 Front End Assembly

1st Mixers (High Band)

34.4 to 44 GHz

17 to 34.5 GHz   x2

3.6 to 17.1 GHz

2nd Mixer (Low Band)

J9

-19 dBm

J7   W14   322.5 MHz   J902

322.5 MHz

-20 dBm

J900

W16 to A2J100

J901

W15 to A3J15 Or W52 to A25J101 (Option B85)

Bias T   dac   J903

1st LO OUT   J8

J13   EXT IF OUT   W24 (Opt EXM)

Burst Trigger   dac

LOG DET

VCO   260 MHz – 400 MHz   120 MHz LPF

J1100   W22 to Rear Panel AUX IF OUT

Low Band Preamp

3.6 GHz LPF   +20 dB

J2

1st Mixer (Low Band)

14 GHz LPF

17 GHz LPF   X2

W42   J1   4.8 GHz LO From A16 J702

Mixer Bias Amplifier Bias Switch Control   J12

LO Distribution

J6   J5   J3   J4   J10   J11

A13A3 50Ω Load   A13A2 50Ω Load

+18 dBm

W44 from A14 J740

7,580.625 MHz

W18 from A16 J705

A13W1   A13W2

A13A1 Band Pass Filter

5.1225 GHz

Front End Assembly Control   J102

W5

EXT MIXER   J3 (Opt EXM)   W46 (Opt EXM)   W45 (Opt EXM)

Signal Path ──────
LO Path ─ ─ ─ ─ ─

Instrument Settings	
Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	30.0 GHz
Input Amplitude	-10 dBm

A11 RF Switch / High Band Preamp

From SW2 P4

W37

J1

-28 dBm

High Band Preamp
+30 dB

Control

J2   J4

20 Hz to 3.6 GHz Path

3.6 to 44 GHz Path

J3   -34 dBm

W39

A12 YTF

-40 dBm

Control

J1

W40

A15 Front End Control

W3 to A9 & A10   J800   Attenuator Control

W12   J300   YTF Driver

W4   J700   RF Switch / High Band
Preamp Control

Sweep Ramp Output   Not Used   J301

Ext. µW Preselector Drive   Not Used   J302

µW Preselector Bypass Switch
Control   Not Used   J801

Low Noise Path Switch
Control   Not Used   J802

Switched IF Filter Control   Not Used   J1300

A13 Front End Assembly

1st Mixers
(High Band)

x4

34.4 to 44 GHz

17 to 34.5 GHz

3.6 to 17.1 GHz

2nd Mixer
(Low Band)

J9

J7

-19 dBm

W14

322.5 MHz

+12 dBm
1st LO OUT

J8
10,080.625 MHz

J13   EXT IF OUT
W24 (Opt EXM)

14 GHz
LPF

17 GHz
LPF

X2

W42
J1   4.8 GHz LO
From A16 J702

J902

J903   Bias T   dac

-20 dBm

J900

W16 to A2J100

322.5 MHz

J901

W15 to A3J15
Or
W52 to A25J101
(Option B85)

dac   Burst Trigger

LOG
DET

J1100

W22 to Rear Panel
AUX IF OUT

VCO

260 MHz – 400 MHz

120 MHz LPF

Low Band Preamp

3.6 GHz
LPF

+20 dB

1st Mixer
(Low Band)

W38

J2

Mixer Bias
Amplifier Bias
Switch Control

J12

LO Distribution

J6   J5   J3   J4   J10   J11

A13A3
50Ω Load

A13A2
50Ω Load

W18 from A16 J705

+18 dBm

W44 from A14 J740

5,040.3125 MHz

A13W1

A13W2

J102   Front End Assembly Control

A13A1 Band Pass Filter

5.1225 GHz

W5

EXT MIXER   J3

(Opt EXM)

W46 (Opt EXM)   W45 (Opt EXM)

Signal Path

LO Path

Instrument Settings

Input Port	RF Input J1
RF Preselector	Off
Input Attenuation	10 dB
Internal Preamp	Off
Frequency Span	0 Hz
Auto Alignments	Off
Input Frequency	40.0 GHz
Input Amplitude	-10 dBm

IF SYSTEM BLOCK DIAGRAM

To A16J726
(A25J805 if Option B85)

From A15J901
(A25J102 if Option B85)

IF SYSTEM BLOCK DIAGRAM

blockmxe_if40
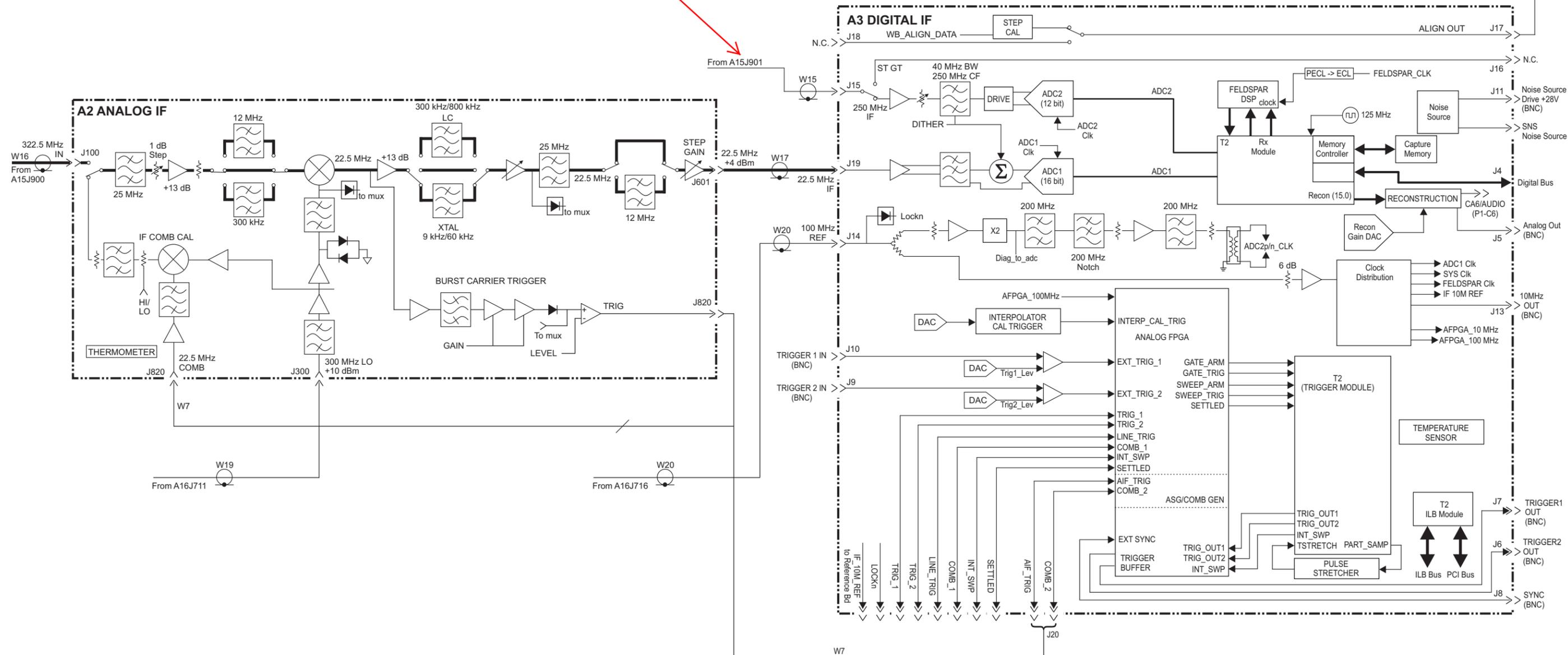
N9038A Wideband IF Section
Option B85

A25 Wideband Analog IF

To A3 J15
250 MHz
W15
J102

From A15 J901[1]
W52
J101

Amplified Bandpass Filter

140 MHz BW
REF Detector 2
ADC
ADC Diag
FPGA
J2
Diag
J803

REF Detector 1
BCT Trigger
Trigger Level

Step Cal
Cal Signal Generator

20 MHz BW
Clock Detector
150 MHz

300 MHz
Step Cal

÷4 ÷2

REF Detector
400 MHz
Clock Generator
Ecal Port Switch
J806 To A16 J726 W50
W23
J805 From A3 J17

From A16 J718
W51
2400 MHz at +10 dBm
J301
2400 MHz

Not Used
J302

10 MHz

Not Used
J502
PCI Card Cage

J801
JTAG Programming

J802
Analog Card Cage

W10

A26 Wideband Digital IF

2 Gbytes DDR-2 SDRAM

J778
ADC Data
FPGA

CPLD
FPGA Image Memory

DSP ASIC

Power PC

Local PCI Bus

Pulse Stretcher

128 MB SDRAM
8 MB BootROM

Non-Transparent PCI to PCI Bridge

Not Used
LVDS
PCIe Bus
J9000
PCI to PCIe Bridge

Instrument PCI Bus

Clock Generator
10 MHz

J501
Analog Card Cage

J502
PCI Card Cage

Footnotes:

1. 250 MHz when 40 MHz path
    300 MHz when 85 MHz path

IF SYSTEM BLOCK DIAGRAM
(Serial Prefix < MY/SG5322)

IF SYSTEM BLOCK DIAGRAM
(Serial Prefix < MY/SG5322)

blockmxe_if
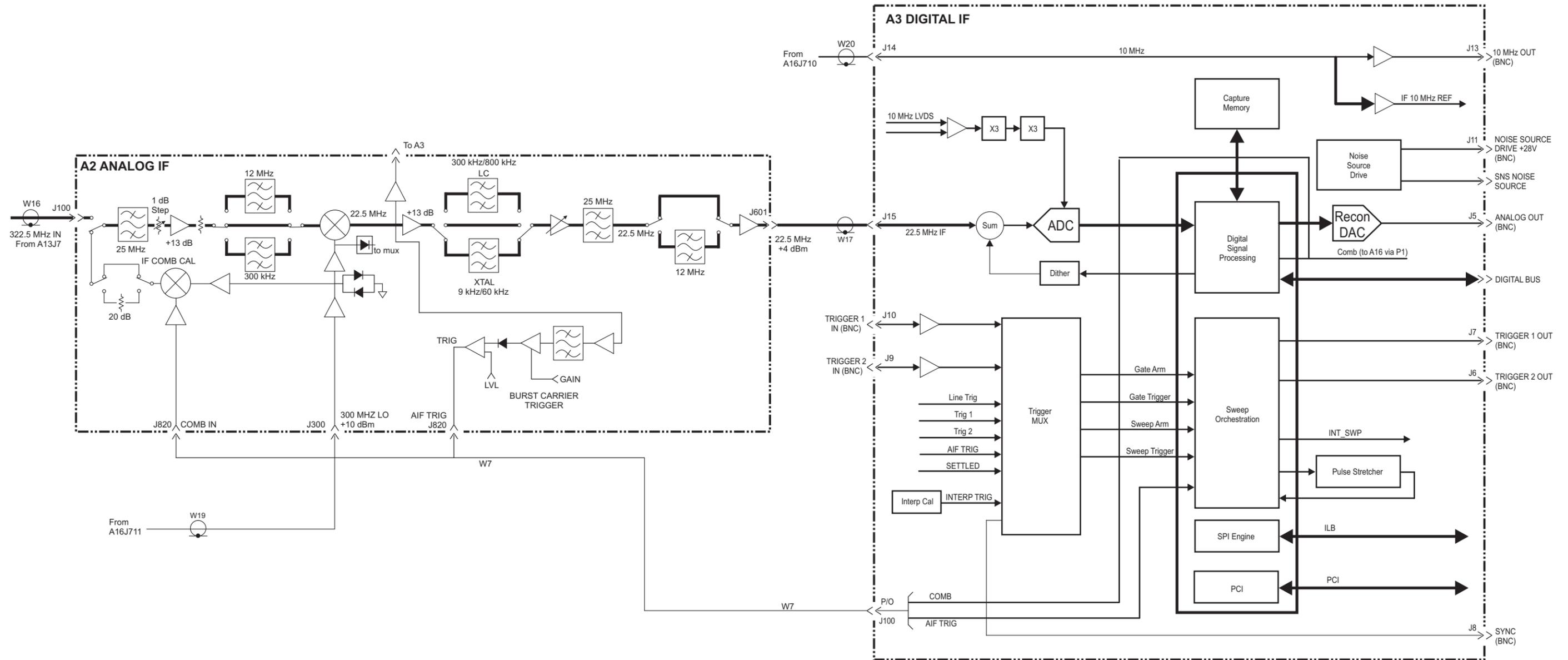
LO Synthesizer Block Diagram

Reference Block Diagram

Keysight N9038A MXE Service Guide
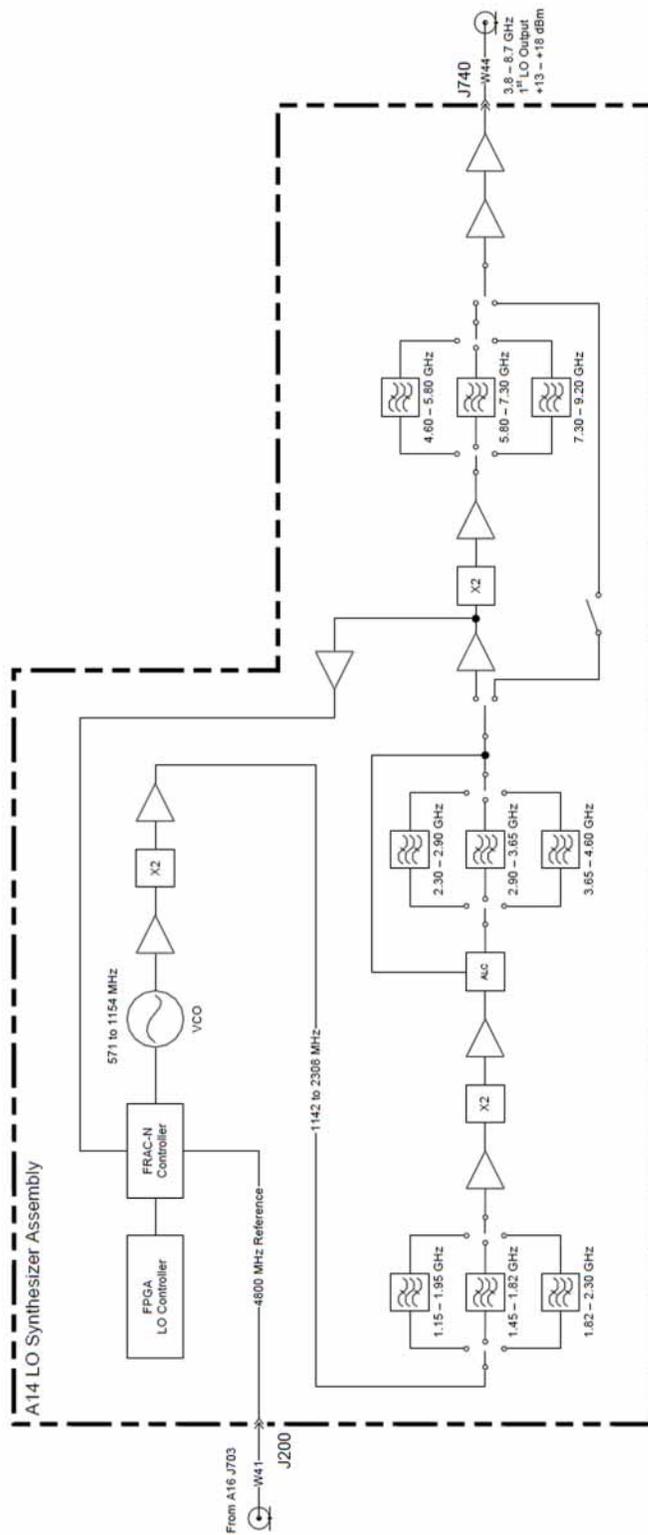
MXE Computer Block Diagram

POWER SUPPLY, CPU, MIDPLANE, MOTHERBOARD, FRONT PANEL BLOCK DIAGRAM
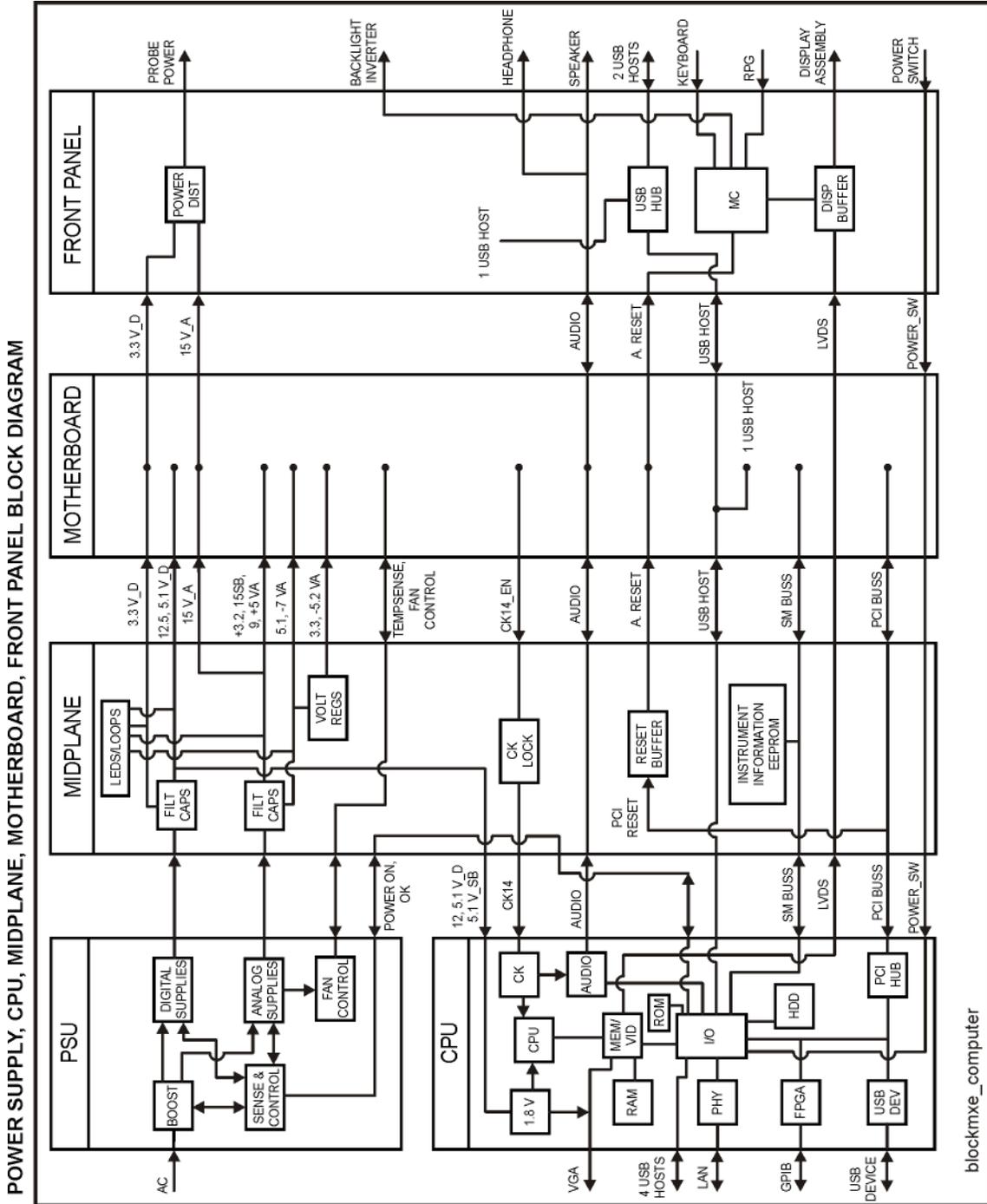
16 Service and Diagnostics Menus

Overview

The Service capabilities described below are accessed via the Service and Diagnostic menus under the System menu. The Service capabilities are intended for field service technicians. These technicians may be at an Keysight Service Center or at a self-maintaining customer site.

There are two types of Service capabilities:

1. **Diagnostics** - These are available to any user and will assist in initial troubleshooting of instrument malfunctions. Examples are the ability to read the mechanical relay cycles.
2. **Service Functions** - These are for use by the factory or field repair technicians and access to these functions is controlled. Examples are the ability to select a specific RF Preselector Filter Path.

Controlling Access

There are two levels of service and diagnostics capabilities:

1. "Unrestricted Access" - Access to the Diagnostics menu is allowed for everyone. Care may be required to use a feature appropriately. This is the "Diagnostics" type of Service capability defined above.

2. "Secure Service Access" - Access to the Service menu is restricted to the service technician. This prevents the casual user from accessing and using these features. The intention is to provide this level of access to Keysight Service Centers as well as any self-maintaining customer who purchases the Service Guide. This is the "Service Functions" type of Service capability defined above.

   Access to secured service capabilities is gained via a specific numeric Service Code. The Service Code is designed to be easily entered via the front panel; an external keyboard or mouse is not required.

Secure service access

Secure service access is gained by accessing by pressing **System**, **More**, **Service**. The following Service Code with then be required to enter the Service Menu:

Service Code: **-2061**

Once access has been gained, it will persist within the current instance of the instrument application. If the user exits the instrument application, the Service Code will need to be entered again in order to gain access to the Service Menu.

Service Menus

Figure 16-1   Service Menu
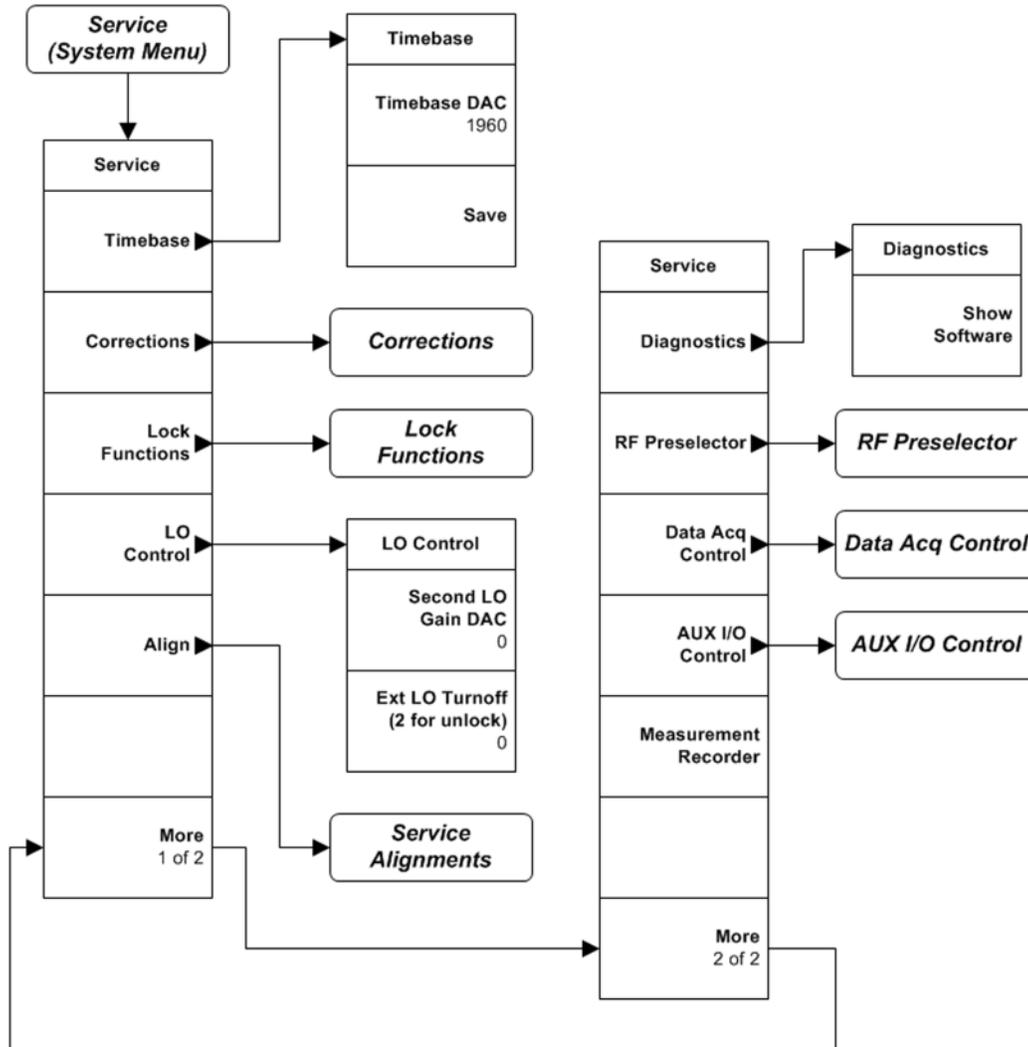
Figure 16-2   Diagnostics Menu
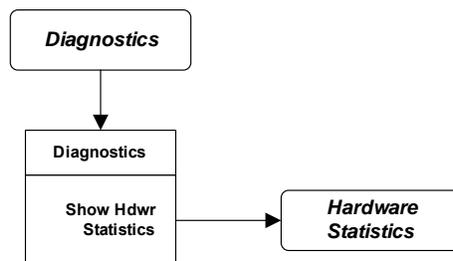
Figure 16-3   Corrections Menu
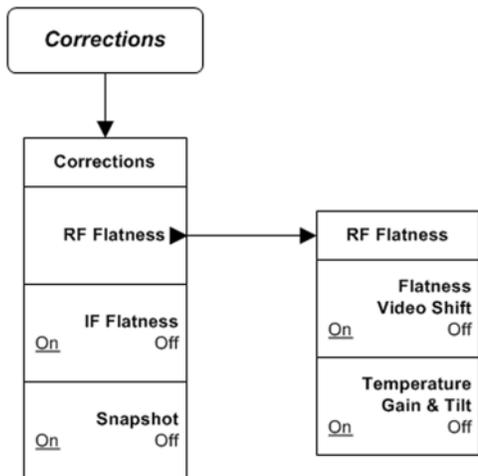
Figure 16-4   Lock Functions Menu
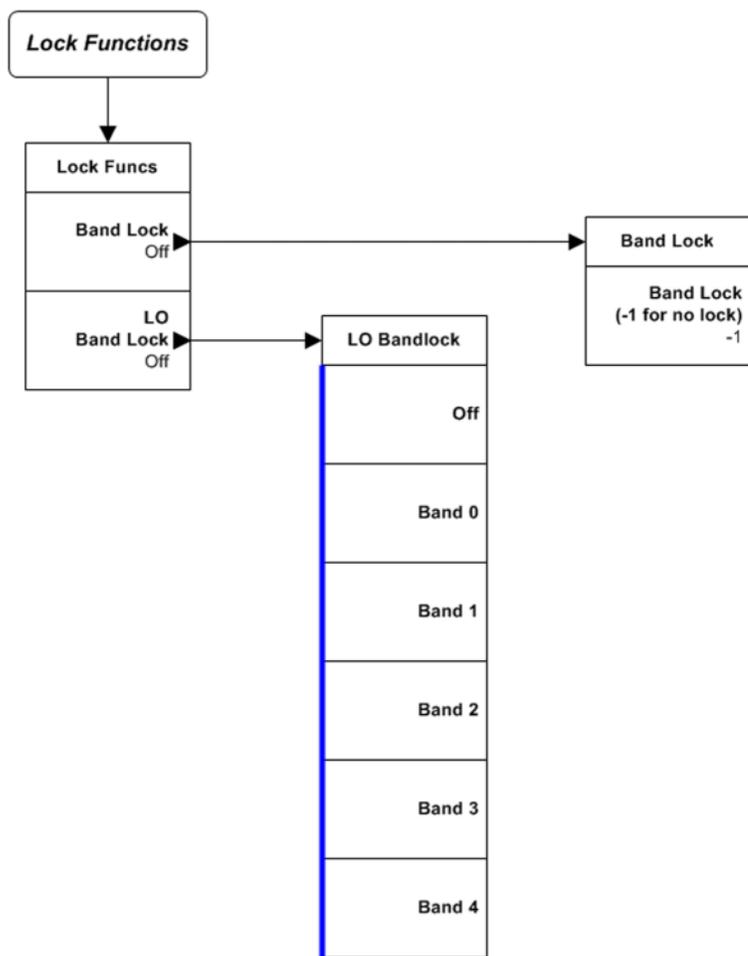
Figure 16-5   Alignments Menu
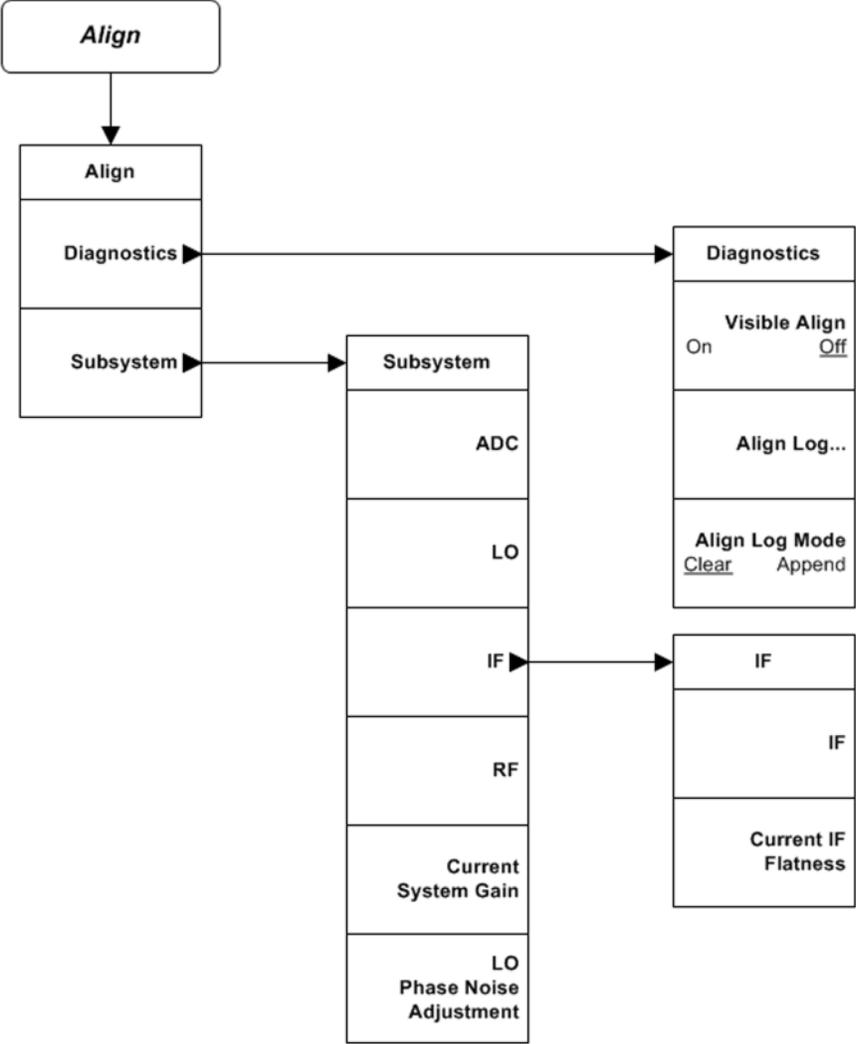
Figure 16-6   RF Preselector Menu
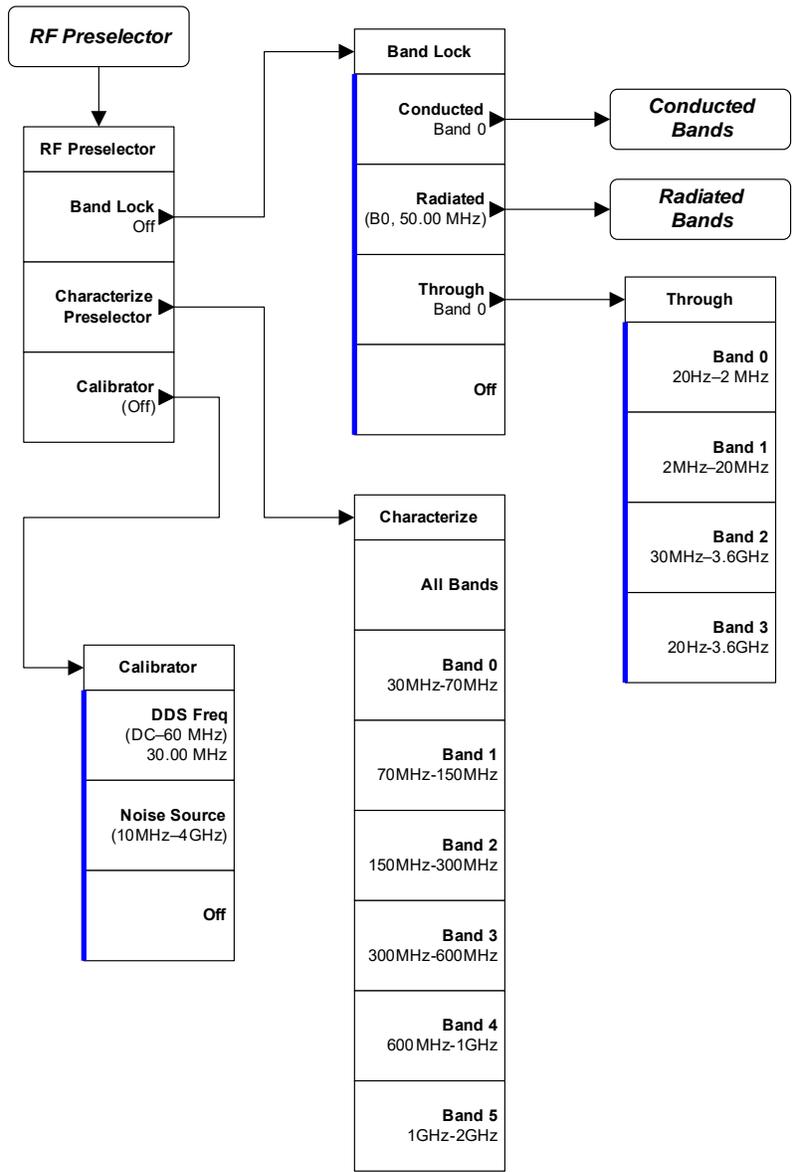
Figure 16-7   Conducted Bands Menu
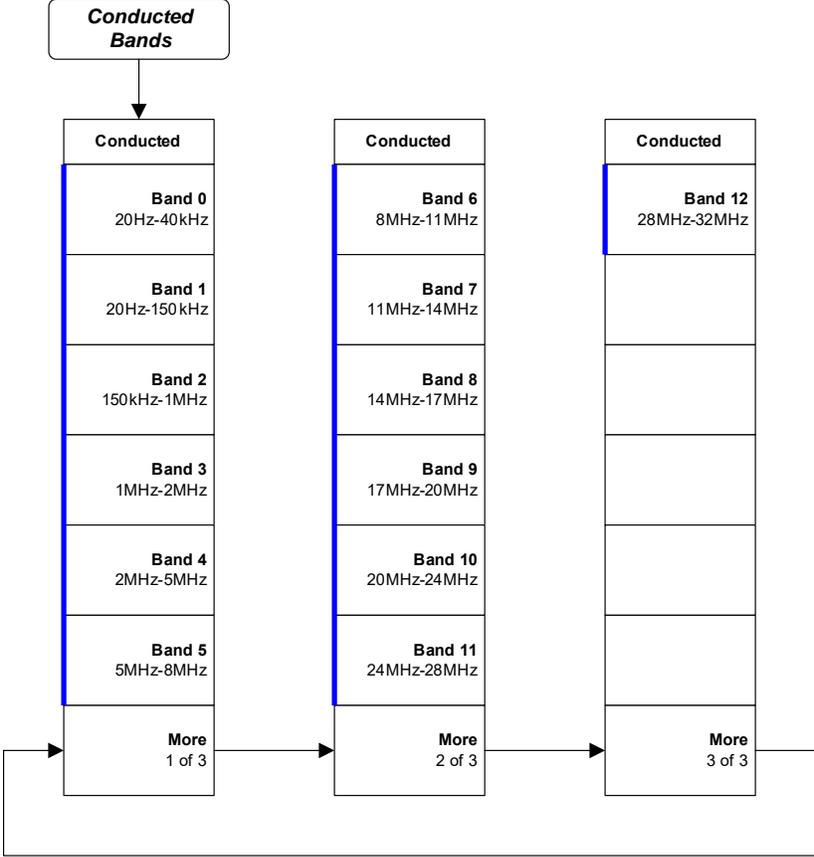
Figure 16-8   Radiated Bands Menu
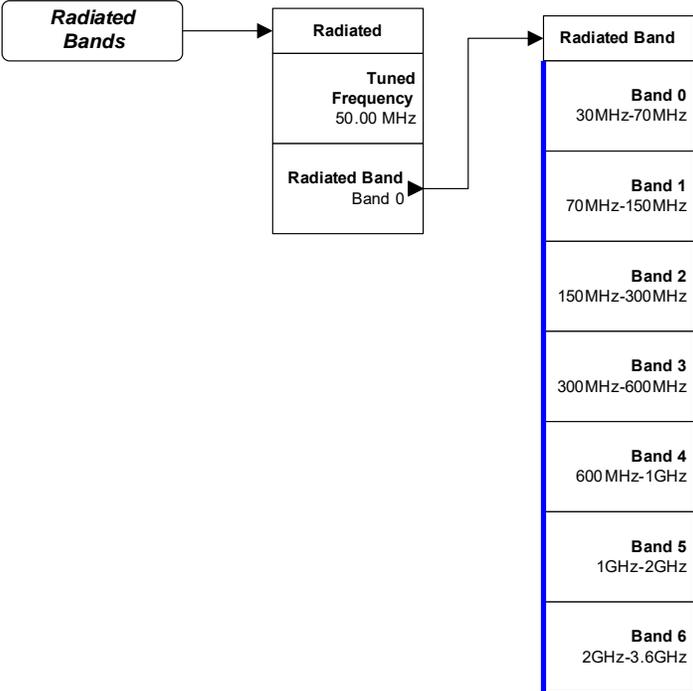
Figure 16-9   Data Acquisition Control Menu
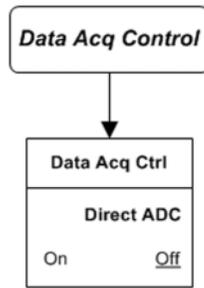
Figure 16-10   AUX I/O Control Menu
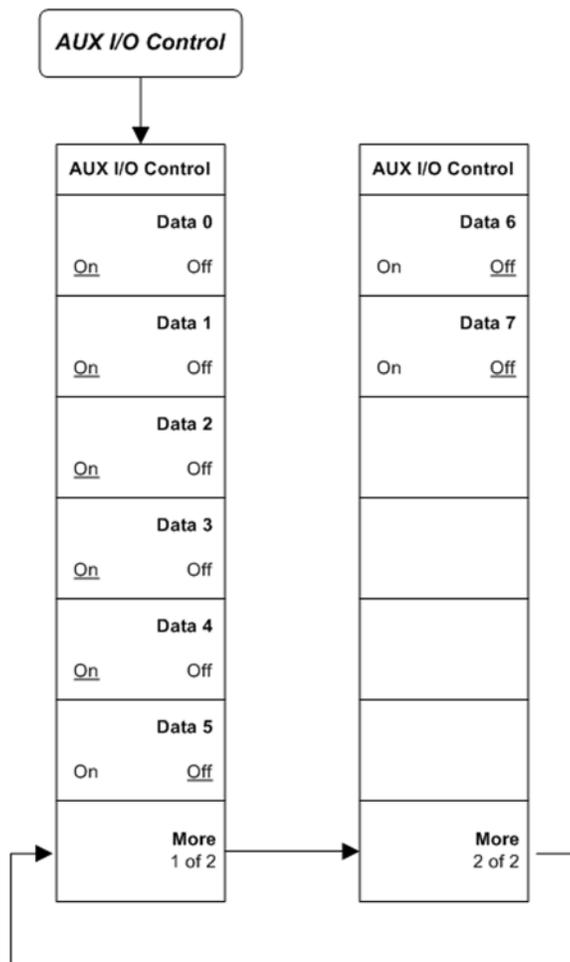
Service Key Descriptions

Service

The first access to the Service Menu after invoking the instrument application will require an authentication, which is to enter the Service Code, as shown in Figure 16-11. Subsequent accesses to the Service Menu are unimpeded.

Figure 16-11   Service Code Entry

You can use the numeric keypad to enter the Service Code, which is -2061, and since "Login" is the default highlighted key, the Enter key can be used to complete the entry.

If an invalid Service Code is entered access will not be granted and you will see the message shown in Figure 16-12. You will need to accept this prompt and press the Service key again to re-enter the Service Code correctly.

Figure 16-12   Incorrect Service Code Entry

Timebase

This menu allows access to manually adjust the 10 MHz reference (timebase).

Timebase DAC

This allows the technician to adjust the 10 MHz reference (timebase). The adjustment is performed by changing the DAC setting controlling the reference.

Once the reference is adjusted to the proper frequency, the DAC value can be saved in non-volatile memory by pressing the Save menu key. If the Timebase DAC value has been changed, but no Save operation performed before exiting this menu, a warning is provided to you that they have not saved their setting, as shown in Figure 16-13.

Figure 16-13   Timebase DAC Changes Warning

Save

Save permanently saves the current Timebase DAC setting to non-volatile memory. When this key is pressed a confirmation prompt, as shown in Figure 16-14, must be accepted in order for the new DAC value to be saved.

Figure 16-14   Timebase DAC Save Confirmation
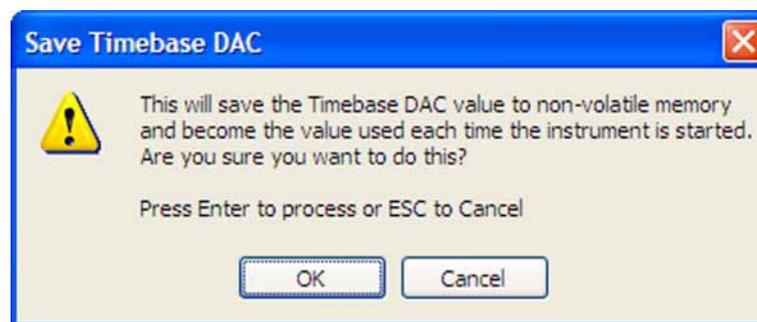
Corrections

This menu allows access to activate and deactivate specific amplitude correction sets. With this capability, the technician can determine if an anomaly is a result of raw hardware performance or incorrect correction data. It also allows the technician the ability to measure the raw hardware performance when all corrections are set to Off.

RF Flatness

This menu allows access to activate and deactivate the corrections unique to the RF flatness of the instrument. RF Flatness corrections consist of two major parts: raw flatness corrections and temperature corrections. These corrections are summed together and applied by using RF gain, IF gain, and/or "video shift" (post-digitized mathematical offset). The selections in this menu allow the corrections to be applied or not applied to facilitate troubleshooting the cause of flatness-related problems.

Flatness Video Shift On/Off

The Flatness Video Shift turns off the corrections for gain vs. frequency. It does not turn off the corrections for changes in the analog IF gain that accompany flatness changes. This function turns both the gain and video shift on or off, but does not affect the temperature corrections. When set to off, it is possible to measure the raw flatness of the spectrum instrument while maintaining the temperature corrections.

When Flatness Video Shift is OFF, the Advisory Event "Flatness Video Shift OFF" will be displayed.

When Flatness Video Shift is ON, the Advisory Event "Flatness Video Shift OFF" will be cleared.

Temperature Gain & Tilt On/Off

This function controls both temperature adjustment mechanisms: overall gain vs. temperature, and the temperature-proportional tilt of the gain vs. frequency.

When Temperature Gain & Tilt is OFF, the Advisory Event "Flatness Temperature Gain & Tilt OFF" will be displayed.

When Temperature Gain & Tilt is ON, the Advisory Event "Flatness Temperature Gain & Tilt OFF" will be cleared.

IF Flatness

This function turns the corrections related to IF flatness on or off.

When IF Flatness is OFF, the Advisory Event "IF Flatness corrections OFF" will be displayed.

When IF Flatness is ON, the Advisory Event "IF Flatness corrections OFF" will be cleared.

Snapshot Alignments On/Off

During normal auto alignment operation, the instrument software will perform an RBW alignment when the instrument RBW state is changed, and every 10 minutes thereafter. These alignments can hinder troubleshooting the instrument since they can change correction factors when the state is changed. Turning snapshot alignments off disables the RBW portion of these alignments for more accurate troubleshooting.

Lock Functions

Band Lock

Provides the ability to tune the analyzer over as large a range as can be accommodated by the specified harmonic number and 1st LO frequency range. As a result, this feature can be used to check performance in the frequency band overlap regions. By definition, multi-band sweeps are not allowed.

When a band lock is selected, the Advisory Event "Band Locked: Band <x>" is displayed, where "x" is a value between 0 and 4.

When band lock is cancelled, the Advisory Event "Band Locked: Band <x>" is cleared.

The individual bands available for selection depends upon the particular frequency range option of the instrument.

> Option 503: Band 0
>
> Option 508: Bands 0 thru 1
>
> Option 526: Bands 0 thru 4

LO Band Lock

Provides the ability to tune the instrument over as large a range as can be accommodated by the specified LO Band. As a result, this feature can be used to check performance in the LO band overlap regions. By definition, multi-band sweeps are not allowed.

LO Band Lock is only available when the Band Lock is active.

When LO band lock is selected, the Advisory Event "LO Band Locked: Band <x>" is displayed, where "x" is a value between 0 and 3.

When LO band lock is cancelled, the Advisory Event "LO Band Locked: Band <x>" is cleared.

Off

Turns LO Band Lock to Off.

Band 0

Locks the instrument to Band 0.

Band 1

Locks the instrument to Band 1.

Band 2

Locks the instrument to Band 2.

Band 3

Locks the instrument to Band 3.

LO Control

Provides keys that allow you to control the LO. This is only present on analyzers equipped with Opt EXM, External Mixing.

2nd LO Gain DAC

This parameter provides the ability to adjust the output gain of the 2nd LO DAC. The range is from 0 to 4095 where 0 is the minimum gain and 4095 is the maximum gain. Setting a value of 4096 or greater returns control to the instrument. In External Mixing, this DAC controls the level of the 1st LO signal at the front panel EXT MIXER connector.

External LO Turnoff

Disconnects the 1st LO path which will minimize the effect of the 1st LO signal at the front panel EXT MIXER connector.

Align

This menu allows access to alignment diagnostic and individual subsystem capabilities of the instrument.

Diagnostic

This menu contains items for controlling the operating behavior of alignment and the alignment reporting capabilities.

Visible Align

This replaces the "Aligning 1 or 10" alignment progress messages with messages that describe the alignment segment being executed.

Align Log...

This will invokes a text editor with the alignment log file loaded. The log can be viewed or saved to an external media or drive.

The text editor can be closed without a mouse or external keyboard by pressing ALT front-panel key, then arrow down to highlight Exit, then press Enter.

Align Log Mode

The alignment system places information about each alignment performed into a log. The log can be configured to operate in clear or append mode.

In Clear mode the log only contains information on the last alignment performed; the log is cleared with each alignment performed.

In Append mode each new alignment appends to the log. In append mode, care must be taken by the operator to not allow the log to grow to a size that would inhibit system operation.

Subsystem

This menu allows invoking individual components of the complete alignments that are available on the System, Alignment, Align Now menu that is accessible to the normal user.

ADC

Immediately executes an alignment of the ADC subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

A failure of ADC will set the Error Condition "Align ADC failed". A failure will not employ new ADC alignment data.

Successful completion of ADC will clear the Error Condition "Align ADC failed".

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

Align ADC can be interrupted by pressing the Cancel (ESC) front-panel key.

LO

Immediately executes an alignment of the LO subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

A failure of LO will set the Error Condition "Align LO failed". A failure will not employ new LO alignment data.

Successful completion of LO will clear the Error Condition "Align LO failed".

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

Align LO can be interrupted by pressing the Cancel (ESC) front-panel key.

When this occurs, no new LO alignment data will be employed.

IF

Accesses a submenu of individual alignments for the IF subsystem.

IF

Immediately executes an alignment of the IF subsystem. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

A failure of IF will set the Error Condition "Align IF failed". A failure will not employ new IF alignment data.

Successful completion of IF will clear the Error Condition "Align IF failed".

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

Align IF can be interrupted by pressing the Cancel (ESC) front-panel key. When this occurs, no new IF alignment data will be employed.

Current IF Flatness

Immediately executes an alignment of the Current IF Flatness. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

Align Current IF Flatness can be interrupted by pressing the Cancel (ESC) front-panel key.

When this occurs, no new Current IF Flatness alignment data will be employed.

RF

This is exactly the same as the customer accessible System, Alignments, Align Now, RF with one exception: the alignment can be invoked even if a previous Align Now, All has not been executed (this key is available not grayed-out if using default alignment data).

Current Gain System

Immediately executes an alignment of the Current System Gain, for the purpose of improving small amplitude variations that occur as resolution bandwidth is switched. This alignment is done by measuring the response of the current system state configuration to the 50 MHz amplitude reference signal. All subsequent measurements are then compensated appropriately for absolute amplitude accuracy. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

Align Current System Gain can be interrupted by pressing the Cancel (ESC) front-panel key. When this occurs, no new Current System Gain alignment data will be employed.

LO Phase Noise Adjustment

Immediately executes an optimization LO for Phase Noise, when the optimization is finished the value is stored in non-volatile memory. The instrument will stop any measurement currently underway, perform the alignment, and then restart the measurement from the beginning.

The Advisory Event "Alignment complete" is displayed when the alignment is complete.

LO Phase Noise Adjustment can be interrupted by pressing the Cancel (ESC) front-panel key. When this occurs, no new LO Phase Noise Adjustment data will be employed.

Diagnostics

This menu allows access to service level diagnostics information

Show Software

This will display the version information for all of the lower level software components in the instrument.

RF Preselector

This menu provides the ability to switch to the particular filter in the Conducted or Radiated Band, to run the Radiated filer alignments, and the turn the RF preselector alignment signals on and off.

Band Lock

Allows access to select either one the conducted, radiated, or through signal paths of the instrument for troubleshooting purposes.

Conducted

This will select the conducted filter path. Once selected, one of the thirteen different conducted path fixed filters can be selected from a submenu. This will allow the viewing of the frequency response of the selected filter.

Band 0

Selects the 20 Hz to 40 kHz filter path

Band 1

Selects the 20 Hz to 150 kHz filter path

Band 2

Selects the 150 kHz to 1 MHz filter path

Band 3

Selects the 1 MHz to 2 MHz filter path.

Band 4

Selects the 2 MHz to 5 MHz filter path

Band 5

Selects the 5 MHz to 8 MHz filter path.

Band 6

Selects the 8 MHz to 11 MHz filter path

Band 7

Selects the 11 MHz to 14 MHz filter path

Band 8

Selects the 14 MHz to 17 MHz filter path

Band 9

Selects the 17 MHz to 20 MHz filter path

Band 10

Selects the 20 MHz to 24 MHz filter path

Band 11

Selects the 24 MHz to 28 MHz filter path

Band 12

Selects the 28 MHz to 32 MHz filter path

Radiated

This will select the radiated filter path. Once selected, one of the seven different radiated filters paths can be selected from a submenu, along with the frequency it will be tuned to. This will allow the viewing of the frequency response of the selected filter.

Tuned Frequency

Since the radiated band filters are all tunable, except Band 6, once a radiated filter band is selected the frequency to which it will be tuned to can then be adjusted with this setting. The minimum and maximum tune frequency for each of the tunable filter is listed in Table 16-1.

Table 16-1   Tunable Radiated Filter Frequencies

Radiated Filter Band	Filter Frequency Range	Allowable Start Tune Frequency	Allowable Stop Tune Frequency
Band 0	30 MHz to 70 MHz	27.34 MHz	74.30 MHz
Band 1	70 MHz to 150 MHz	62.50 MHz	156.3 MHz
Band 2	150 MHz to 300 MHz	140.6 MHz	312.5 MHz
Band 3	300 MHz to 600 MHz	281.3 MHz	625.0 MHz
Band 4	600 MHz to 1 GHz	562.5 MHz	1.063 GHz
Band 5	1 GHz to 2 GHz	937.5 MHz	2.125 GHz

Radiated Band

This will allow access to a menu where the different radiated filter bands can be selected.

Band 0

Selects the 30 MHz to 70 MHz tunable filter path

Band 1

Selects the 70 MHz to 150 MHz tunable filter path

Band 2

Selects the 150 MHz to 300 MHz tunable filter path

Band 3

Selects the 300 MHz to 600 MHz tunable filter path

Band 4

Selects the 600 MHz to 1 GHz tunable filter path

Band 5

Selects the 1 GHz to 2 GHz tunable filter path

Band 6

Selects the 2 GHz to 3.6 GHz fixed filter path

Through

This will select a through path in the RF preselector section. Once selected, one of the four different internal through paths in the RF preselector section of the instrument can then be selected from a submenu. This will allow the viewing of the frequency response of the selected through path. While none of the through paths are used during normal instrument operation, they are used during certain instrument internal alignment routines.

Band 0

Selects the 20 Hz to 2 MHz through path on the A24 Conducted Filter assembly

Band 1

Selects the 2 MHz to 30 MHz through path on the A24 Conducted Filter assembly

Band 2

Selects the 30 MHz to 3.6 GHz through path located on the A22 Radiated Filter assembly

Band 3

Selects the 20 Hz to 3.6 GHz through path located on the A21 RF Preselector Input assembly

Off

This will return the instrument signal path control to the normal settings for the current instrument settings. This will also be accomplished by using the Mode Preset key.

Characterize Preselector

The menu will allow access to the radiated band tunable filters adjustment routines. These routines are used by the factory as well as when an A22 Radiated Filter assembly is replaced. They can also be used whenever it has been determined that the shape of any of the filters needs an adjustment during an instrument servicing. However, it should be noted that once a filter is characterized, the frequency response performance verification test for that signal path will need to be run to guarantee the amplitude accuracy of the instrument is still within advertised specifications. So these routines should only be run when absolutely necessary.

When any of the Characterize Preselector routines are initiated a confirmation window will be seen, as shown in Figure 16-15. Once this has been accepted do not disturb its completion by any means or the system could become corrupted

It is also recommended that the current calibration database be backed up before any of the Characterize Preselector routines are run, just in case an interruption does occur and the database needs to be restored. For information on how to back up the current database see Chapter 19, "Post-Repair Procedures".

Figure 16-15   Characterize Preselector Confirmation
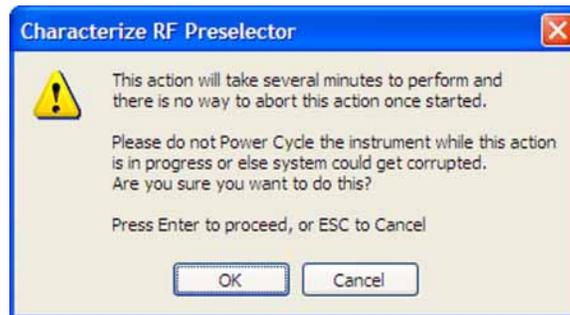
The characterization for Bands 0 through 4 will take approximately five minutes each to complete, while the characterization for Band 5 will take around ten minutes. Running the characterization for All Bands will take approximately 35 minutes.

All Bands

Will align all 6 adjustable radiated filter bands

Band 0

Will align the 30 MHz to 70 MHz radiated filter band

Band 1

Will align the 70 MHz to 150 MHz radiated filter band

Band 2

Will align the 150 MHz to 300 MHz radiated filter band

Band 3

Will align the 300 MHz to 600 MHz radiated filter band

Band 4

Will align the 600 MHz to 1 GHz radiated filter band

Band 5

Will align the 1 GHz to 2 GHz radiated filter band

Calibrator

This menu allows access to the different internal calibrator signals used to align the RF preselector filter shapes and balance the amplitude levels.

DDS Freq

Turns on the DDS (Direct Digital Synthesizer) calibration signal. This calibrator signal is used by the 20 Hz to 30 MHz RF Preselector alignment when balancing the signal levels through the different filter paths of the A24 Conducted Filter assembly.

Once this calibrator signal is selected the frequency of the signal can be set from 20 Hz to 60 MHz.

Noise Source

The Noise Source provides a broadband noise signal from 10 MHz to 4 GHz. This is used to align the tunable filters of the A22 Radiated Filter assembly when a filter Characterization is run. It is also used when a 30 MHz to 3.6 GHz RF Preselector alignment is run.

Off

Turns off whatever calibrator source might be turned on

AUX I/O Control

This menu provides the ability to switch each of the data lines to the 25 pin rear panel AUX I/O connector. This connector is used by the instrument to control an external device via an 8 bit data bus.

The pinout of the 25 pin rear panel AUX I/O connector is as shown in Figure 16-16.

Figure 16-16   **Rear Panel AUX I/O Connector Pinout**
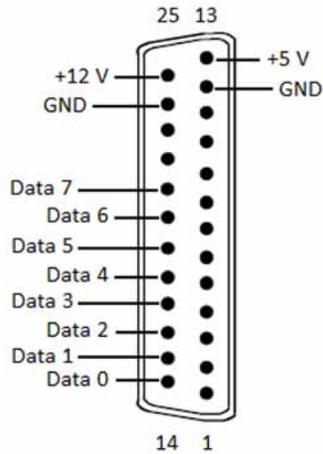
With the use of a voltmeter along with the service menu the operation of each of the individual data lines to the rear panel connector as well as the supply voltages can be verified.

Diagnostics Key Description

Diagnostics

The Diagnostics menu key directly under the System menu will contain system level diagnostics that can be either viewed by any user.

Show Hdwr Statistics

As shown in Figure 16-17, this will display the following instrument hardware statistics:

— Mechanical relay switch counts

— Mechanical attenuator switch counts

— Instrument temperature extremes

— Elapsed instrument on-time

Figure 16-17   Hardware Statistical Information
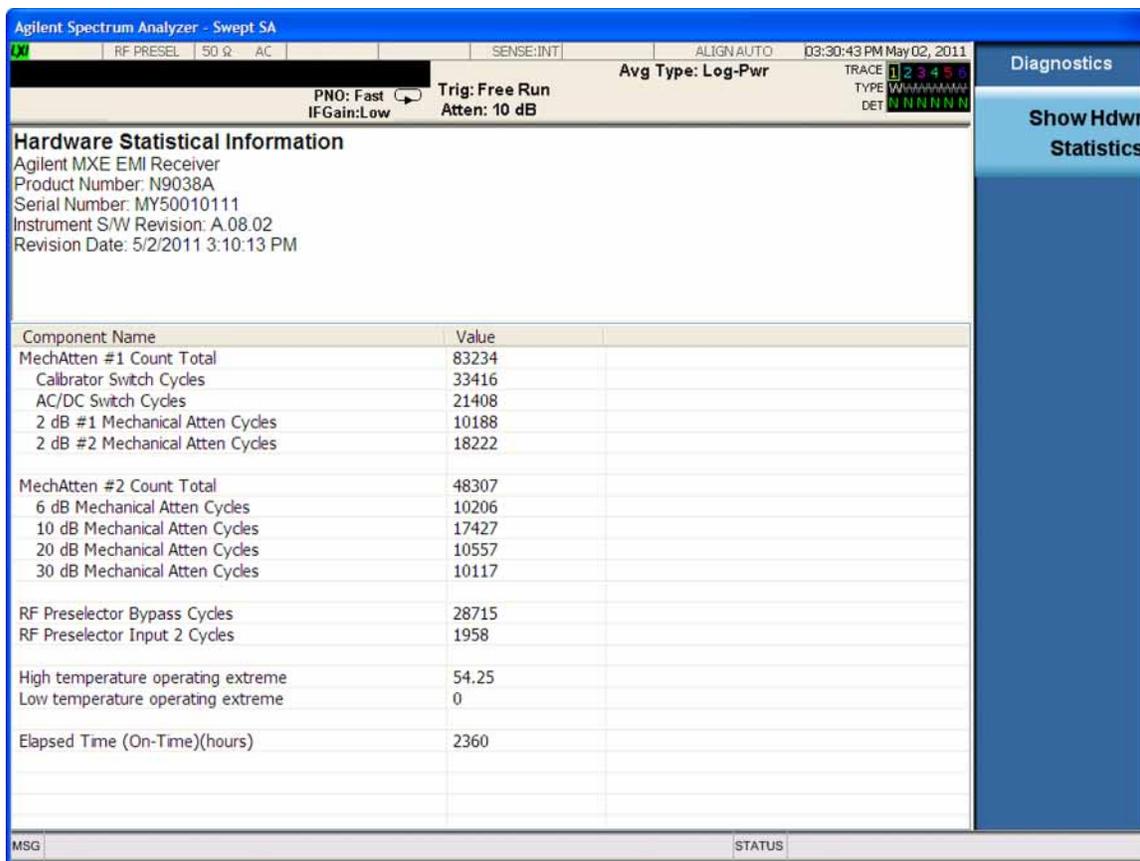
17   Replaceable Parts

What You Will Find in This Chapter

The following information is found in this chapter:

1. Part number tables for assemblies, mechanical parts, cables, front panel connectors, and labels.
2. Part location diagrams for the following:

KEYSIGHT
TECHNOLOGIES

How to Order Parts

To order an assembly or mechanical part listed in this chapter, go to:

http://www.keysight.com/find/parts

If you do not have web access, or the parts you are interested in cannot be found in the parts list provided, contact your local Keysight Technologies sales and service office with the following information:

— Product model number
— Product serial number
— Description of where the part is located, what it looks like, and its function (if known)
— Quantity required

For a list of Keysight Technologies sales and service office locations, refer to "Contacting Keysight Technologies" on page 31.

Replaceable Parts

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
A1A1	Front Frame Assembly Replacement Kit		N9038-60012
A1A1MP1	Front Frame[a]		
A1A1MP2	Overlay, Main Keyboard		N9038-80001
A1A1MP3	Overlay, Input 2		N9038-80002
A1A1MP4	Front Frame Ground Spring		W1312-00021
A1A1MP5	Braided gasket		8160-0660
A1A1MP6	Chromeric Gasket		8160-1104
A1A1MP7	Blank Cover Plate		N9020-00002
A1A1MP8	Top Trim Strip		W1312-40019
A1A1MP9-10	Side Trim Strip		W1312-40005
A1A1MP11-12	Side Trim Strip, Vinyl		5041-9172
A1A2	Front Panel Interface Board	(Serial # ≥ MY/SG52260000)	W1312-60137
		(Serial # < MY/SG52260000)	W1312-63092
A1A2MP1	Speaker		9164-0453
A1A2MP2	Speaker Foam		N9038-40088
A1A3	Liquid Crystal Display	(Serial # ≥ MY/SG52260000)	2090-0997
		(Serial # < MY/SG52260000)	2090-0911
A1A4	Display Backlight Power Supply	(Serial # ≥ MY/SG52260000)	0950-5235
		(Serial # < MY/SG52260000)	0950-4635
A1A5	Front Panel Daughter Board		N9038-63005
A1A6	Input 2 LED Board		N9038-63006
A1MP1	Main Keypad		E4410-40100
A1MP2	Display Keypad		E4410-40101

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
A1MP3	Nameplate Label, 3.6 GHz	(Option 503) (Option 503 & RT1)	N9038-80027 N9038-80023
	Nameplate Label, 8.4 GHz	(Option 508) (Option 508 & RT1)	N9038-80028 N9038-80024
	Nameplate Label, 26.5 GHz	(Option 526) (Option 526 & RT1)	N9038-80029 N9038-80025
	Nameplate Label, 44.0 GHz	(Option 544) (Option 544 & RT1)	N9038-80030 N9038-80026
A1MP6	Grommet, A1W2		0400-0333
A1MP7	LCD Glass Filter		1000-1513
A1MP8	LCD Lens Gasket		W1312-40006
A1MP9	RPG Knob		W1312-40017
A1MP10-13	Cable Clamp		1400-1439
A1MP14	Display Bracket	(Serial # ≥ MY/SG52260000)	W1312-00145
		(Serial # < MY/SG52260000)	W1312-00115
A1MP15	Shield, Inverter Board		W1312-00024
A1MP16	Shield, Inverter Assembly, Top		N9020-00010
A1MP17	Shield, Inverter Assembly, Bottom		N9020-00011
A1MP19	Shield, Front Panel Interface		N9020-00051
A1MP20	Bracket, Input 2 LED Board		N9038-21202
A1W1	Flex Circuit, Front Panel Interface to LCD	(Serial # ≥ MY/SG52260000)	W1312-60122
		(Serial # < MY/SG52260000)	W1312-60010
A1W2	Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	(Serial # ≥ MY/SG52260000)	W1312-60130
		(Serial # < MY/SG52260000)	W1312-60113
A1W3	Cable Assembly, Wire Harness, Backlight Power Supply to LCD		W1312-60131
A2	Analog IF Assembly	(Serial # ≥ MY/SG53220000)	N9020-60011
		(Serial # < MY/SG53220000)	E4410-60104

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
A3	Digital IF Assembly	(Serial # ≥ MY/SG53220000)	N9038-60116
		(Serial # < MY/SG53220000)	N9020-60119
A3MP1	EMI Gasket, Digital Bus		N9038-00004
A3W1	Cable Assembly, Wire Harness, Smart Noise Source	(Serial # ≥ MY/SG53220000)	N9020-60090
		(Serial # < MY/SG53220000)	E4410-60163
A4	CPU Assembly (without A5 disk drive)	(PC6/64 Bit/Windows 7) & (Serial # ≥ MY/SG55260000)	N9038-60212
		(PC4/64 Bit/Windows 7) & (Serial # < MY/SG55260000)	W1312-60196
		(PC2/32 Bit/Windows XP)	W1312-60102
A4A1	Disk Drive Interconnect Board		W1312-63079
A4BT1	Battery, 3V, LI Manganese Dioxide (CR2032)		1420-0356
A5	Solid State Disk Drive	(PC4/64 Bit/Windows 7)	N9020-60202
		(PC2/32 Bit/Windows XP)	N9020-60125
A5MP1	Disk Drive Tray		W1312-40078
A5MP2	Disk Drive Rear Panel		W1312-00103
A5MP3	Disk Drive Handle		1440-0421
A6	Power Supply Assembly		0950-4934
A7	Midplane Assembly		W1312-63095
A8	Motherboard Assembly		N9030-63002
A9	RF Attenuator A (0-4 dB)	(Option 503, 508, and 526)	33360-60008
	RF Attenuator A (0-10 dB)	(Option 544)	33326-60013
A10	RF Attenuator B (0-66 dB)	(Option 503, 508, and 526)	33321-60083
	RF Attenuator B (0-60 dB)	(Option 544)	33325-60020
A11	RF Switch/High Band Preamp Assembly	(Option 503, 508, and 526)	E4410-60170
		(Option 544)	N9020-60051
A12	YIG Tuned Filter (YTF)	(Option 503, 508, and 526)	5087-7382
		(Option 544)	5087-7383
A12MP1	Gap Pad - YTF Mounting		5022-7179

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
A13	Front End Assembly	(Option 503, 508, and 526) & Serial # ≥ MY/SG55260000	N9038-60314
		(Option 503, 508, and 526) & (Serial # < MY/SG55260000)	N9038-60314
		(Option 544)	N9038-60315
A13A1	Bandpass Filter, 5.1225 GHz	(Option 503, 508, and 526) & (Serial # ≥ MY/SG55260000)	0955-2469
		(Option 503, 508, and 526) & (Serial # < MY/SG55260000)	0955-1719
		(Option 544)	0955-2469
A13MP1	Adapter, Filter Mounting	(Option 503, 508, and 526) & (Serial # ≥ MY/SG55260000)	E6607-25005
A13W1	Cable, Semi-Rigid, Front End Assy (A13) J10 to A13A1 Input	(Option 503, 508, and 526) & (Serial # ≥ MY/SG55260000)	E6607-21178
		(Option 503, 508, and 526) & (Serial # < MY/SG55260000)	E4410-20176
		(Option 544)	N9020-20229
A13W2	Cable, Semi-Rigid, A13A1 Output to Front End Assy (A13) J11	(Option 503, 508, and 526) & (Serial # ≥ MY/SG55260000)	E6607-21179
		(Option 503, 508, and 526) & (Serial # < MY/SG55260000)	E4410-20177
		(Option 544)	N9020-20046
A13A2	50 ohm Termination, SMA Male (A13J3)		1810-0118
A13A3	50 ohm Termination, SMA Male (A13J5)		1810-0118
A13A4	50 ohm Termination, SMA Male (A13J8)		1810-0118
A13A5	50 ohm Termination, SMA Male (A13J13)		1810-0118
A14	LO Synthesizer Assembly	(Serial # ≥ MY/SG55260000)	N9020-60118
		(Serial # < MY/SG55260000)	E4410-60188
A15	Front End Control Assembly	(Serial # ≥ MY/SG53220000)	N9020-60172
		(Serial # ≥ MY/SG52130014 & < MY/SG53220000)	N9020-60098
		(Serial # < MY/SG52130014)	E4410-60101
A16	Reference Assembly		N9020-60188

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
A17	Reserved		
A18	Reserved		
A19	Reserved		
A20	Reserved		
A21	RF Preselector Input Assembly		N9038-60003
A22	Radiated Filter Assembly		N9038-60002
A23	Limiter Assembly, Input 2		N9038-60004
A24	Conducted Filter Assembly		N9038-60001
A25	Wideband Analog IF Assembly	(Option B85)	N9020-60044
A26	Wideband Digital IF Assembly	(Option B85)	N9020-60257
A30	LISN Control Assembly		N9038-60027
B1-3	Fan		3160-4199
J1	Type-N Input Connector Assembly	(Standard)	N9038-60021
	3.5 mm Input Connector Assembly	(Option C35)	N9038-60019
	2.4 mm Input Connector Assembly	(Option 544)	N9030-60011
J1MP1	EMI O-Ring 18.75 mm ID		8160-1637
J2	Type-N Input Connector Assembly		N9038-60021
J2MP1	EMI O-Ring 18.75 mm ID		8160-1637
J3	Connector, Front Panel - External Mixing	(Option EXM)	1250-1666
J3MP1	50 ohm Termination, SMA Male (J3)	(Option EXM)	1810-0118
J3MP2	Nut, Hex 1/4 - 36 thread, 0.125 in. thick	(Option EXM)	2950-0223
J3MP3	Washer, lock, internal tooth, 1/4 in, 0.256 in ID	(Option EXM)	2190-0067
MP1	Chassis Base		N9038-00015
MP2	Chassis Side, Left (inner)		W1312-00117
MP3	Chassis Side, Left (outer) - Fan Bracket		W1312-00118

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
MP4	Chassis Side, Right (inner)		W1312-00116
MP5	Chassis Side, Right (outer)		N9020-00014
MP6	Rear Panel	(Serial # ≥ MY/SG53220000)	N9038-00100
		(Serial # < MY/SG53220000)	E4449-00100
		(Option LSN)	N9038-00100
MP7	Chassis, Midplane Bracket		W1312-00048
MP8	Chassis, Front Bracket		N9038-00003
MP9	Bracket, Power Supply		W1312-00131
MP10	Top Brace Assembly		N9030-60005
MP11-14	Vibration Mounts		0460-2725
MP15-17	Fan Guard		3160-0281
MP18	Chassis Gusset, Input Connector		W1312-00093
MP19	Bracket, Attenuator A	(Option 503, 508, and 526)	E4449-00103
	Bracket, Attenuator A and B	(Option 544)	N9038-01202
MP20	Bracket, Attenuator B	(Option 503, 508, and 526)	E4449-00103
MP21	Bracket, RF Switch/High Band Preamp Assembly	(Option 503, 508, and 526)	N9020-00023
		(Option 544)	N9020-00013
MP22	Bracket, SW1 & SW2	(Option 503, 508, and 526)	N9038-01201
		(Option 544)	N9038-01203
MP23	Dress Cover		W1312-00119
MP24	Front Panel Impact Cover		W1312-40025
MP25-26	Strap Handle		E8251-60067
MP27-30	Instrument Rear Feet		5041-9611
MP31-52	Chassis Board Guide		W1312-40001
MP53-54	Retainer, Type-M Cable, Top		N9038-40001
MP55-56	Retainer, Type-M Cable, Bottom		N9038-40007
MP57	Cable Hold Down 1 (158 mm)		5023-1397
MP58	Cable Hold Down 2 (48 mm)		5023-1379
MP59	Label, Blank, (rear panel)		N9020-80057

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
MP60	Shield, Magnetic - Attenuator A	(Option 544)	N9020-00043
MP61	Shield, Magnetic - Attenuator B	(Option 544)	N9020-00044
MP62	Label, EXM warning	(Option EXM)	N9030-80018
SW1	Cal Switch, SPDT Unterminated Latching, 3-Port		N1810-60077
SW2	Transfer Switch, DC-26.5 GHz, 4-Port	(Option 503, 508, and 526)	87222-60026
	Transfer Switch, DC-50.0 GHz, 4-Port	(Option 544)	87222-60036
W1	Cable, Ribbon, RF Presel Input Assy (A21) J602 to Limiter Assy (A23) J108		N9038-60009
W2	Cable, Ribbon, RF Presel Input Assy (A21) P600 to SW1 & SW2 Control		N9038-60010
W3	Cable, Ribbon, Front End Control (A15) J800 to Atten A (A9) & B (A10)		E4410-60157
W4	Cable, Ribbon, Front End Control (A15) J700 to RF Switch/High Band Preamp (A11) J4		E4410-60160
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12		E4410-60156
W6	Cable, Ribbon, Limiter Assy (A23) P2 to A1A5J1 & A1A6J1		N9038-60011
W7	Cable, Ribbon, Digital IF (A3) J100 to Analog IF (A2) J820		E4410-60162
W8	Cable, Ribbon, Front Panel Interface (A1A2) P1 to Motherboard (A8) J9		N9020-60078
W9	Cable, Ribbon, LISN Control (A30) J1 to Rear Panel AUX I/O		N9038-60028
W10	Cable, Ribbon, Wideband Analog IF (A25) J2 to Wideband Digital IF (A26) J778		8121-1854
W11	Reserved		
W12	Cable, Wire Harness, Front End Ctrl (A15) J300 to YTF (A12) J1	(Serial # ≥ MY/SG52130014)	N9020-60059
		(Serial # < MY/SG52130014)	E4410-60158
W13	Reserved		

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
W14	Cable, Coaxial, Front End Assy (A13) J7 to Front End Ctrl (A15) J902		8121-1862
W15	Cable, Coaxial, Front End Ctrl (A15) J901 to Digital IF (A3) J15		8121-1919
	Cable, Coaxial, Wideband Analog IF (A25) J102 to Digital IF (A3) J15	(Option B85)	8121-1401
W16	Cable, Coaxial, Front End Ctrl (A15) J900 to Analog IF (A2) J100	(Serial # ≥ MY/SG53220000)	8121-1865
	Cable, Coaxial, Front End Assy (A13) J7 to Analog IF (A2) J100	(Serial # < MY/SG53220000)	8121-2018
W17	Cable, Coaxial, Analog IF (A2) J601 to Digital IF (A3) J19	(Serial # ≥ MY/SG53220000)	8121-8868
	Cable, Coaxial, Analog IF (A2) J601 to Digital IF (A3) J15	(Serial # < MY/SG53220000)	8121-1411
W18	Cable, Coaxial, Reference Assy (A16) J705 to Front End Assy (A13) J6		8121-1940
W19	Cable, Coaxial, Reference Assy (A16) J711 to Analog IF (A2) J300		8121-1861
W20	Cable, Coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	(Serial # ≥ MY/SG53220000)	8121-1861
	Cable, Coaxial, Reference Assy (A16) J710 to Digital IF (A3) J14	(Serial # < MY/SG53220000)	8121-1861
W21	Cable, Coaxial, Rear Panel EXT REF IN to Reference Assy (A16) J704		8121-1860
W22	Cable, Coaxial, Front End Ctrl (A15) J1100 to Rear Panel AUX IF OUT		8121-1859
W23	Cable, Coaxial, Digital IF (A3) J17 to Reference Assy (A16) J726		8121-1401
	Cable, Coaxial, Digital IF (A3) J17 to Wideband Analog IF (A25) J805	(Option B85)	8121-1401
W24	Cable, Coaxial, Front End Assy (A13) J13 to Front End Ctrl (A15) J903	(Option 503, 508, 526)	8121-2027
		(Option 544)	8121-2025

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
W25	Cable, Semi-Rigid, RF Input 1 (J1) to Atten A (A9) Port 1	(Standard - Type-N)	N9038-21302
		(Option C35 -3.5mm)	N9038-21312
		(Option 544 - 2.4 mm)	N9038-21331
W26	Cable, Semi-Rigid, RF Input 2 (J2) to Limiter Assy (A23) J102		N9038-21300
W27	Cable, Semi-Rigid, Limiter Assy (A23) J103 to Coaxial Switch (SW1) Port 1		N9038-21301
W28	Cable, Semi-Rigid, Coaxial Switch (SW1) Port C to Atten A (A9) Port 2	(Option 503, 508, and 526)	N9038-21303
		(Option 544)	N9038-21332
W29	Cable, Semi-Rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	(Option 503, 508, and 526)	N9020-20025
		(Option 544)	N9038-21337
W30	Cable, Semi-Rigid, Atten B (A10) Port 1 to Transfer Switch (SW2) Port 1	(Option 503, 508, and 526)	N9038-21314
		(Option 544)	N9038-21333
W31	Cable, Semi-Rigid, Transfer Switch (SW2) Port 2 to RF Presel Input Assy (A21) J100	(Option 503, 508, and 526)	N9038-21305
		(Option 544)	N9038-21334
W32	Cable, Semi-Rigid, RF Presel Input Assy (A21) J103 to Conducted Filter Assy (A24) J402		N9038-21310
W33	Cable, Semi-Rigid, Conducted Filter Assy (A24) J401 to RF Presel Input Assy (A21) J200		N9038-21310
W34	Cable, Semi-Rigid, RF Presel Input Assy (A21) J102 to Radiated Filter Assy (A22) J100		N9038-21309
W35	Cable, Semi-Rigid, Radiated Filter Assy (A22) J300 to RF Presel Input Assy (A21) J306		N9038-21308
W36	Cable, Semi-Rigid, RF Presel Input Assy (A21) J101 to Transfer Switch (SW2) Port 3	(Option 503, 508, and 526)	N9038-21307
		(Option 544)	N9038-21335

Table 17-1   All Replaceable Parts

Reference Designator	Description		Part Number
W37	Cable, Semi-Rigid, Transfer Switch (SW2) Port 4 to RF Switch/High Band Preamp (A11) J1	(Option 503, 508, and 526)	N9038-21315
		(Option 544)	N9038-21336
W38	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J2 to Front End Assy (A13) J2	(Option 503, 508, and 526)	N9020-20101
		(Option 544)	N9038-21339
W39	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J3 to YTF (A12) Input	(Option 503, 508, and 526)	N9020-20123
		(Option 544)	N9010-20005
W40	Cable, Semi-Rigid, YTF (A12) Output to Front End Assy (A13) J9	(Option 503, 508, and 526)	N9020-20124
		(Option 544)	N9038-21338
W41	Cable, Semi-Rigid, Reference Assy (A16) J703 to LO Synth Assy (A14) J200		N9038-21306
W42	Cable, Semi-Rigid, Reference Assy (A16) J702 to Front End Assy (A13) J1		N9020-20022
W43	Cable, Semi-Rigid, Reference Assy (A16) J701 to Coaxial Switch (SW1) Port 2		N9038-21304
W44	Cable, Semi-Rigid, LO Synth Assy (A14) J740 to Front End Assy (A13) J4		N9020-20087
W45	Cable, Semi-Rigid, W46 to Front End Assy (A13) J8	(Option EXM Option 503, 508, and 526)	N9020-20132
		(Option EXM Option 544)	N9020-20167
W46	Cable, Semi-Rigid, Front Panel J3 to W46	(Option EXM)	N9020-20166
W50	Cable, Coaxial, Wideband Analog IF (A25) J806 to Reference (A16) J726	(Option B85)	8121-0152
W51	Cable, Coaxial, Reference (A16) J718 to Wideband Analog IF (A25) J301	(Option B85)	8121-0152
W52	Cable, Coaxial, Front End Control (A15) J901 to Wideband Analog IF (A25) J101	(Option B85)	8121-1865
	Hole Plug, Nylon, 0.5 D (BNC)		6960-0149

Replaceable Parts

Table 17-1   All Replaceable Parts

Reference Designator	Description	Part Number
	Hole Plug, Nylon, 0.25 D (SMA)	6960-0076
	Hole Plug, Nylon, 0.875 D (Type-N)	6960-0177
	Edge Protector, Chassis Left and Right	0400-0018
	Spiral Wrap, 0.250 IN OD; 0.160 IN ID, Digital IF cables	0890-0025

a. Not orderable. See A1A1.

Table 17-2   Installation Options

Quantity Required	Description	Part Number
1	Instrument Bottom Feet Kit (Standard)	5000-0913
4	Bottom Feet	5041-9167
4	Bottom Feet Key Lock	5021-2840
1	Rackmount Kit w/o Handles (Option 1CM)	5063-9215
1	Rackmount Kit w/ Handles (Option 1CP)	5063-9222
1	Instrument Front Handles (Option 1CN)	5063-9228

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Analog IF Assembly (A2)	Digital IF Assembly (A3)	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Attenuators (A9 & A10)	Attenuator Brackets (MP19 & MP20)	2 per	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Attenuator Brackets (MP19 & MP20)	Chassis Base (MP1)	1 per	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Sides, Inner (MP2 & MP4)	1 per	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
AUX IF Cable (W22)	Rear Panel (MP6)	1	--	Hex Nut	n/a	5/16" Nut Driver	10 inch-lbs
AUX I/O Cable (W9)	Rear Panel (MP6)	2	0380-1858	Hex Head Standoff	4-40 (.312 in)	3/16" Nut Driver	9 inch-lbs
Display Backlight Inverter Board (A1A4)	Display Bracket (A1MP14)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Display Backlight Inverter Assembly Top Shield (A1MP16)	Display Inverter Assembly Bottom Shield (A1MP17)	8	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Cal Switch (SW1)	SW1 & SW2 Bracket (MP22)	2	0515-1410	Pan Head	M3 X 0.5 (20 mm)	Torx T-10	9 inch-lbs
Chassis Base (MP1)	Chassis Sides, Inner (MP2 & MP4)	12	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 17-3   Attaching Hardware

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Chassis Front Bracket (MP8)	Chassis Base (MP1)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Sides, Inner (MP2 & MP4)	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Fan Bracket (MP3)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Gusset (MP18)	Chassis Base (MP1)	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Side, Fan Bracket (MP3)	Chassis Base (MP1)	5	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Side, Outer (MP5)	Chassis Base (MP1)	5	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Attenuator Brackets (MP19 & MP20)	1 per	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	RF Switch / High Band Preamp Bracket (MP21).	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
CPU Assembly (A4)	Chassis Sides (MP2 & MP4)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	CPU Assembly (A4) - Extractors	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
CPU Top Shield (A4MP1)	CPU Assembly (A4)	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
		19	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
Display (A1A3)	Display Bracket (A1MP14)	4	0515-0367	Pan Head	M2.5 X 0.45 (8 mm)	Torx T-8	5 inch-lbs

Table 17-3   Attaching Hardware

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Display Bracket (A1MP14)	Front Frame (A1A1MP1)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Disk Drive (A5)	Disk Drive Tray (A5MP1)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Disk Drive Handle (A5MP3)	Disk Drive Rear Panel (A5MP2)	2	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
Disk Drive Interconnect (A4A1)	CPU Assembly (A4)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Disk Drive Rear Panel (A5MP2)	Disk Drive Tray (A5MP1)	4	0515-2219	Flat Head	M2.5 X 0.45 (5 mm)	Torx T-8	6 inch-lbs
External Reference Cable (W21)	Rear Panel (MP6)	1	2190-0102	Lock Washer	n/a	n/a	n/a
		1	0590-2332	Hex Nut	n/a	9/16" Nut Driver	21 inch-lbs
Fan (B1-3)	Chassis Side, Fan Bracket (MP3)	4 per	0361-1272	Rivet	n/a	n/a	n/a
Front End Assembly (A13)	Chassis Front Bracket (MP8)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Front Frame Assembly (A1A1MP1)	Chassis Base (MP1)	4	0515-1035	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Sides, Outer (MP3 & MP5)	4	0515-1035	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Front Panel Connector Cover Plate (A1A1MP7)	Front Frame (A1A1MP1)	2	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
Front Panel Daughter Board (A1A5)	Front Frame (A1A1MP1)	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 17-3   Attaching Hardware

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Front Panel Interface Board (A1A2)	Front Frame (A1A1MP1)	13	0515-1521	Flat Head	M3 X 0.5 (5 mm)	Torx T-10	9 inch lbs.
Front Panel Shield (A1MP19)	Front Frame (A1A1MP1)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Input 2 LED Board (A1A6)	Input 2 LED Board Bracket (A1MP20)	2	0515-0365	Pan Head	M2 X 0.4 (4 mm)	Torx T-6	3 inch-lbs
Input 2 LED Board Bracket (A1MP20)	Front Frame (A1A1MP1)	1	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
Input Connector Assemblies (J1 & J2)	Chassis Base (MP1)	2 per	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Limiter Assembly (A23)	Chassis Front Bracket (MP8)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	SW1 & SW2 Bracket (MP22)	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Midplane Assembly (A7)	Midplane Bracket (MP7)	6	0515-0375	Pan Head	M3 X 0.5 (16 mm)	Torx T-10	9 inch-lbs
Midplane Bracket (MP7)	Chassis Sides, Inner (MP2 & MP4)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Motherboard (A8)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Motherboard Assembly (A8)	Chassis Base (MP1)	4	0515-0372	Pan Head	M3 X0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 17-3   Attaching Hardware

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Power Supply Bracket (MP9)	Chassis Sides, Inner (MP2 & MP4)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Sides, Outer (MP3 & MP5)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Power Supply (A6)	3	0515-1227	Flat Head	M3 X0.5 (6 mm)	Torx T-10	9 inch-lbs
Rear Feet (MP27-30)	Rear Panel (MP6)	4	0515-1619	Pan Head	M4 X 0.7 (25 mm)	Torx T-20	21 inch-lbs
		4	3050-0893	Lock Washer	n/a	n/a	n/a
Rear Panel (MP6)	Misc. Items	16	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Reference Assembly (A16)	Chassis Sides, Inner (MP2 & MP4)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
RF Switch / High Band Preamp Assembly (A11).	RF Switch / High Band Preamp Bracket (MP21).	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
RF Switch / High Band Preamp Bracket (MP21)	Chassis Side, Inner (MP4)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Strap Handles (MP25& 26)	Chassis Sides, Outer (MP3 & MP5)	2 per	0515-0710	Flat Head	M5 X 0.8 (18 mm)	Torx T-20	21 inch-lbs
SW1 & SW2 Bracket (MP22)	Chassis Side, Inner (MP4)	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 17-3   Attaching Hardware

Attach	To	Qty	Part Number	Type	Type	Tool	Torque
Top Brace (MP10)	Chassis Sides, Inner (MP2 & MP4)	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Sides, Outer (MP3 & MP5)	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Power Supply Bracket (MP9)	3	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Midplane Bracket (MP7)	4	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Chassis Front Bracket (MP8)	2	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	PCB Assemblies	10[a]	0515-1227	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
Transfer Switch (SW2)	SW1 & SW2 Bracket (MP22)	3	0515-1940	Pan Head	M2.5 X 0.45 (6 mm)	Torx T-8	6 inch-lbs
YIG Tuned Filter Assembly (A12)	Chassis Base (MP1)	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

a. Quantity will vary depending on options installed.

Hardware

Figure 17-1   Major Assemblies

major_assy_mxe
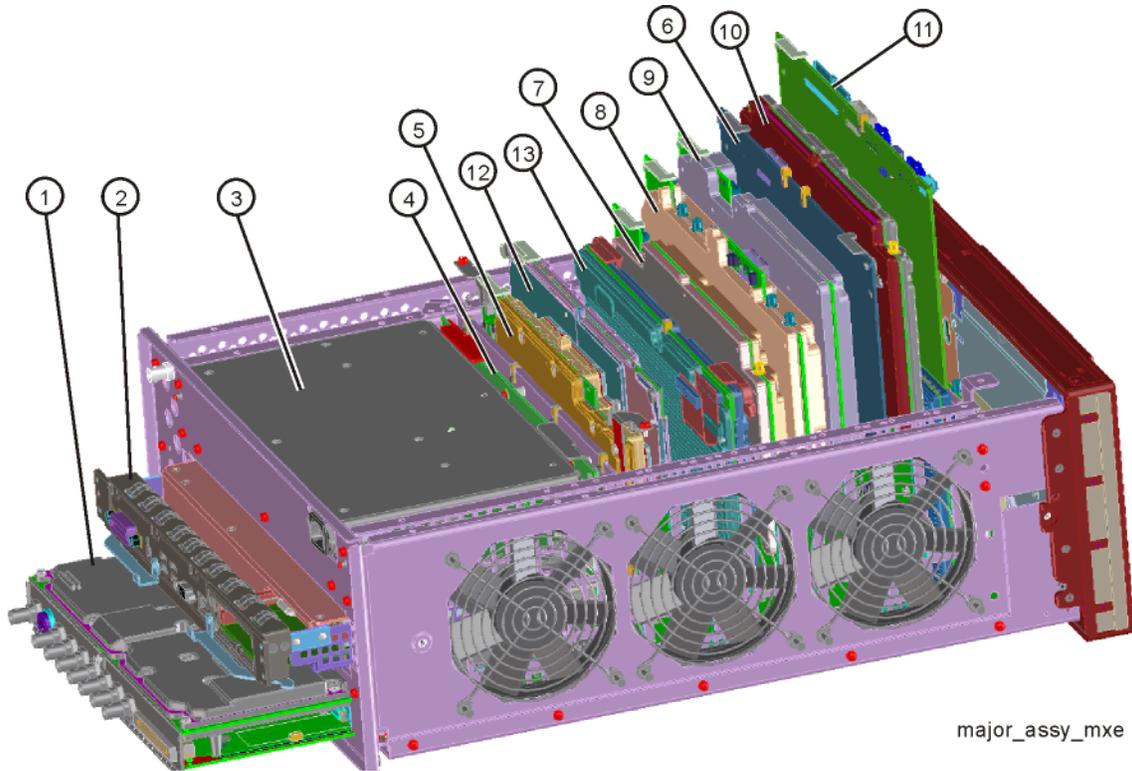
Item	Description	Part Number[a]
1	A2 Analog IF Board A3 Digital IF Board	N9020-60011 N9038-60116
2	A4 CPU Assembly (without A5 disk drive)	N9038-60212
3	A6 Power Supply Assembly	0950-4934
4	A7 Midplane Assembly	W1312-63095
5	A16 Reference Assembly	N9020-60188
6	A30 LISN Control Assembly	N9038-60027
7	A24 Conducted Filter Assembly	N9038-60001
8	A21 RF Preselector Input Assembly	N9038-60003
9	A22 Radiated Filter Assembly	N9038-60002
10	A14 LO Synthesizer Assembly	N9020-60118
11	A15 Front End Control Assembly	N9020-60172
12	A25 Wideband Analog IF Assembly	N9020-60044
13	A26 Wideband Digital IF Assembly	N9020-60257

a. Most current part numbers shown. See Table 17-1 for a complete list of part numbers for
   older instruments.

Figure 17-2   External Hardware

outer_case_pxa
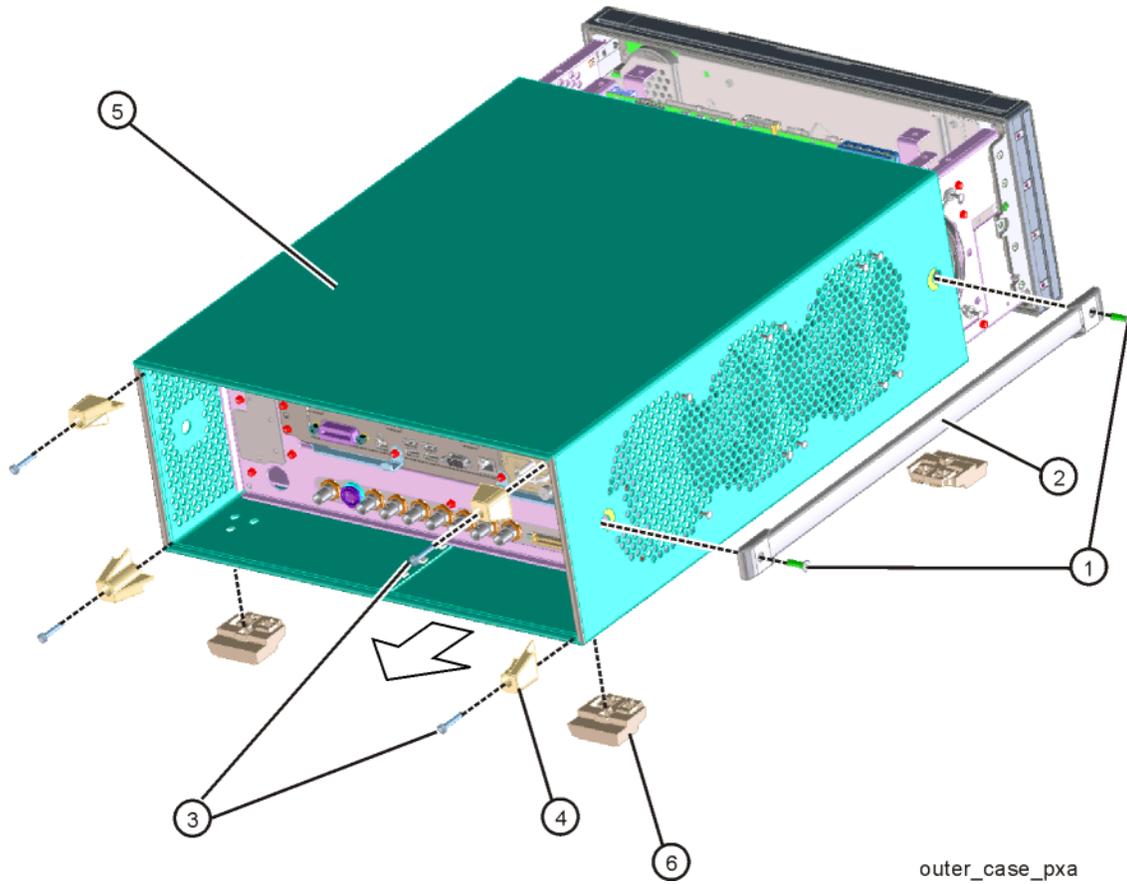
Item	Description	Part Number
1, 2	Strap Handle (includes screws)	E8251-60067
3	Screw M4 X 0.7 (25 mm)	0515-1619
4	Instrument Rear Feet	5041-9611
5	Dress Cover	W1312-00119
6	Bottom Feet	5041-9167
6	Bottom Feet Key Lock	5021-2840

Figure 17-3   Top Brace and Power Supply Bracket
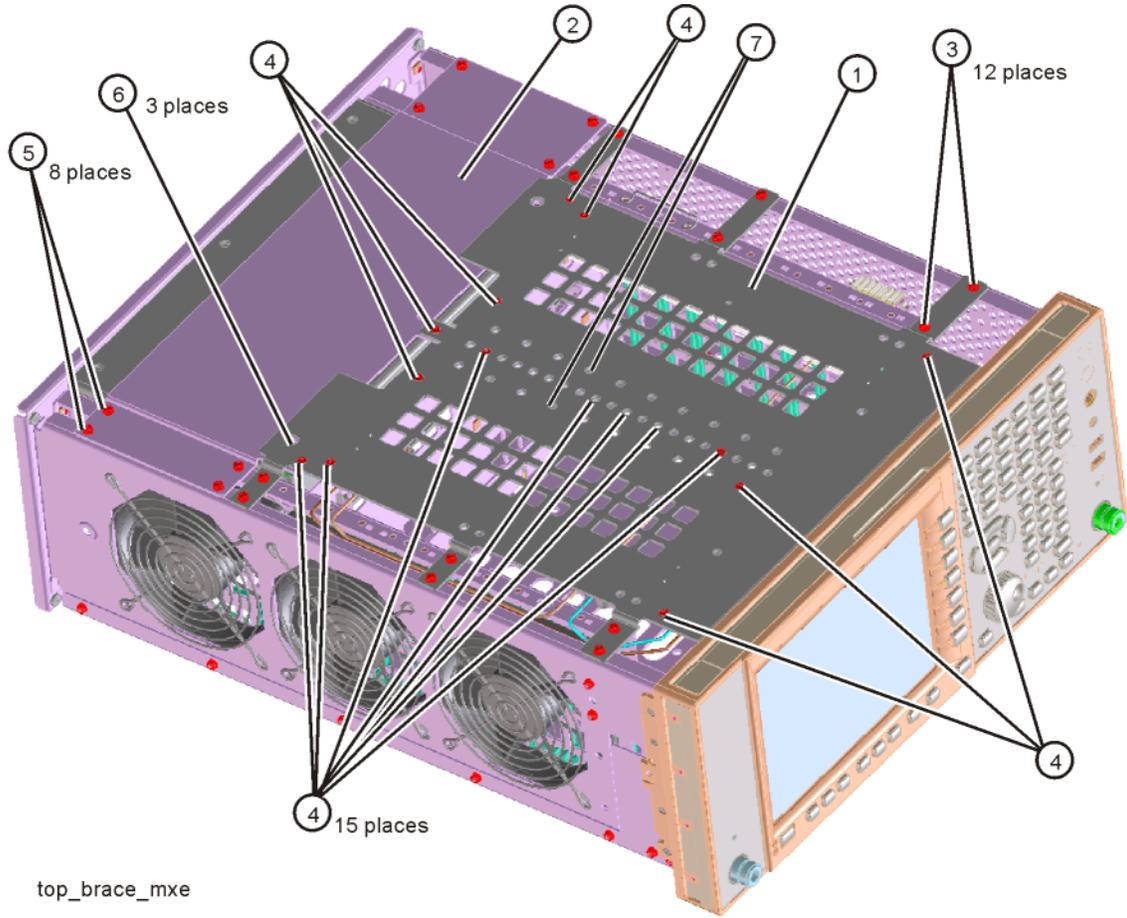
top_brace_mxe

Item	Description	Part Number
1	Top Brace Assembly	N9030-60005
2	Bracket, Power Supply	W1312-00131
3	Screw M3 X 0.5 (8 mm)	0515-0372
4	Screw M3 X 0.5 (6 mm)	0515-1227
5	Screw M3 X 0.5 (8 mm)	0515-0372
6	Screw M3 X 0.5 (6 mm)	0515-1227
7	Screw M3 X 0.5 (6 mm)	0515-1227

Figure 17-4 CPU Assembly

cpu_nocover
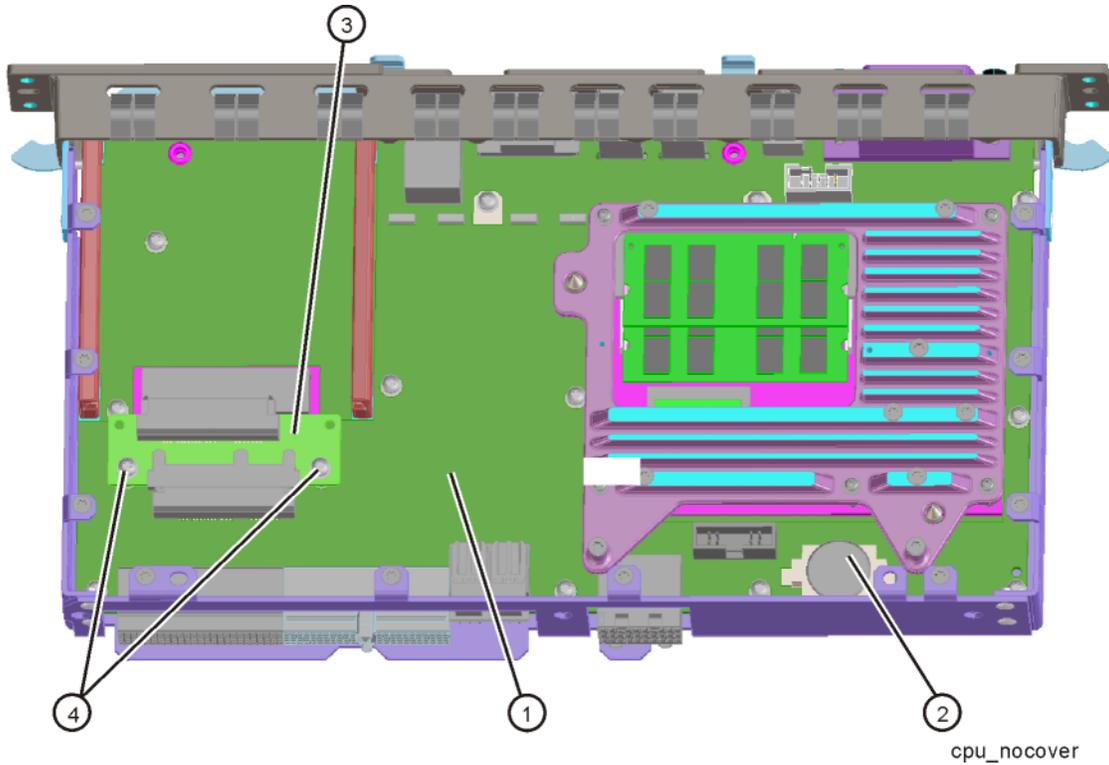
Item	Description	Part Number[a]
1	CPU Replacement Kit	see Table 17-1
2	A4BT1 Battery, 3V, LI Manganese Dioxide (CR2032)	1420-0356
3	A4A1 Disk Drive Interconnect Board	W1312-63079
4	Screw M3 x 0.5 (8 mm)	0515-0372

a. Most current part numbers shown. See Table 17-1 for a complete list of part numbers for older instruments.

Figure 17-5   Disk Drive Tray Assembly


hdtray_explode
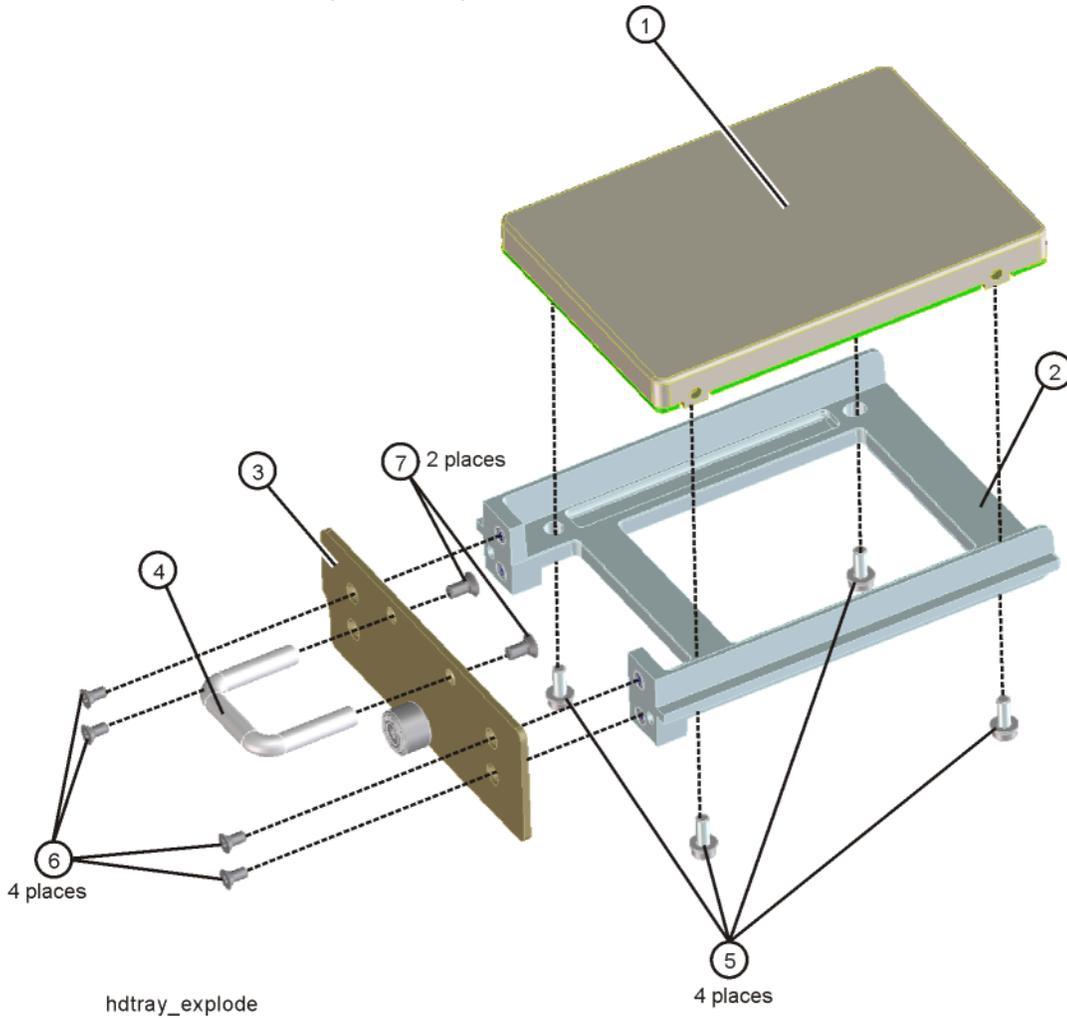
Item	Description	Part Number
1	A5 Solid State Disk Drive	
	(PC4/64 Bit/Windows 7) (PC2/32 Bit/Windows XP)	N9020-60202 N9020-60125
2	A5MP1 Disk Drive Tray	W1312-40078
3	A5MP2 Disk Drive Rear Panel	W1312-00103
4	A5MP3 Disk Drive Assembly Handle	1440-0421
5	Screw M3 x 0.5 (8 mm)	0515-0372
6	Screw M2.5 x 0.45 (5 mm)	0515-2219
7	Screw M3 x 0.5 (6 mm)	0515-1227

Figure 17-6 RF Area - Option 503, 508, & 526

rf_area_parts_mxe
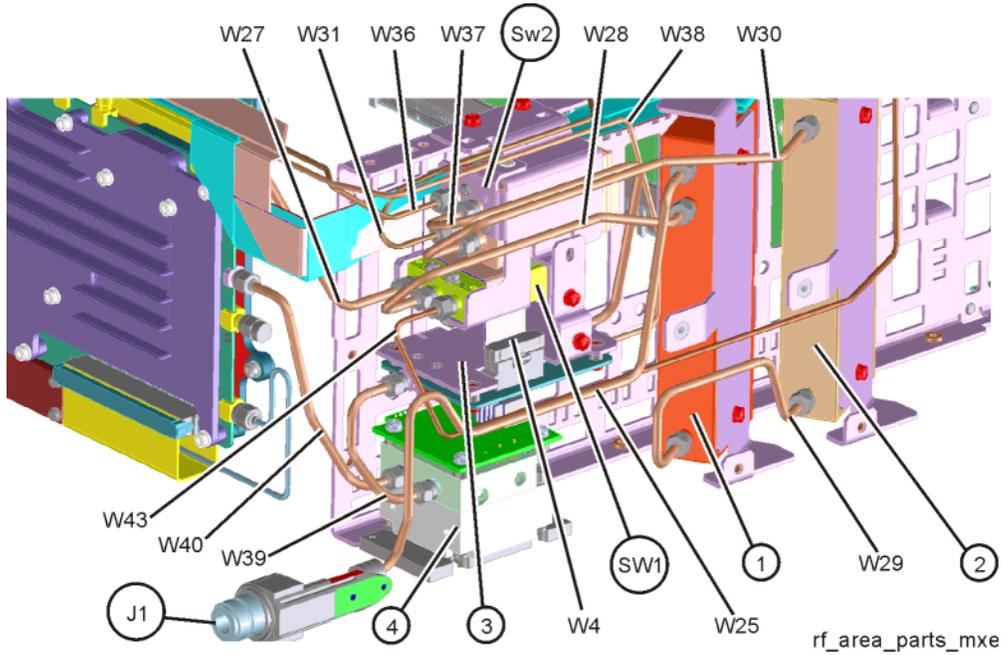
Item	Description	Part Number
1	A9 RF Attenuator	33360-60008
2	A10 RF Attenuator	33321-60083
3	A11 RF Switch/High Band Preamp Assembly	E4410-60170
4	A12 YIG Tuned Filter (YTF)	5087-7382
J1	Type-N Input Connector Assembly (Standard)	N9038-60021
	3.5 mm Input Connector Assembly (Option C35)	N9038-60019
SW1	Cal Switch, SPDT Unterminated Latching, 3-Port	N1810-60077
SW2	Transfer Switch, DC-26.5 GHz, 4-Port	87222-60026
W4	Cable, Ribbon, Front End Control (A15) J700 to RF Switch/High Band Preamp (A11) J4	E4410-60160
W25	Cable, Semi-Rigid, RF Input 1 (J1) to Atten A (A9) Port 1	
	Standard Option C35	N9038-21302 N9038-21312
W27	Cable, Semi-Rigid, Limiter Assy (A23) J103 to Coaxial Switch (SW1) Port 1	N9038-21301
W28	Cable, Semi-Rigid, Coaxial Switch (SW1) Port C to Atten A (A9) Port 2	N9038-21303
W29	Cable, Semi-Rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	N9020-20025

Item	Description	Part Number
W30	Cable, Semi-Rigid, Atten B (A10) Port 1 to Transfer Switch (SW2) Port 1	N9038-21314
W31	Cable, Semi-Rigid, Transfer Switch (SW2) Port 2 to RF Presel Input Assy (A21) J100	N9038-21305
W36	Cable, Semi-Rigid, RF Presel Input Assy (A21) J101 to Transfer Switch (SW2) Port 3	N9038-21307
W37	Cable, Semi-Rigid, Transfer Switch (SW2) Port 4 to RF Switch/High Band Preamp (A11) J1	N9038-21315
W38	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J2 to Front End Assy (A13) J2	N9020-20101
W39	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J3 to YTF (A12) Input	N9020-20123
W40	Cable, Semi-Rigid, YTF (A12) Output to Front End Assy (A13) J9	N9020-20124
W43	Cable, Semi-Rigid, Reference Assy (A16) J701 to Coaxial Switch (SW1) Port 2	N9038-21304

Figure 17-7 RF Area Assemblies and Cables - Option 544
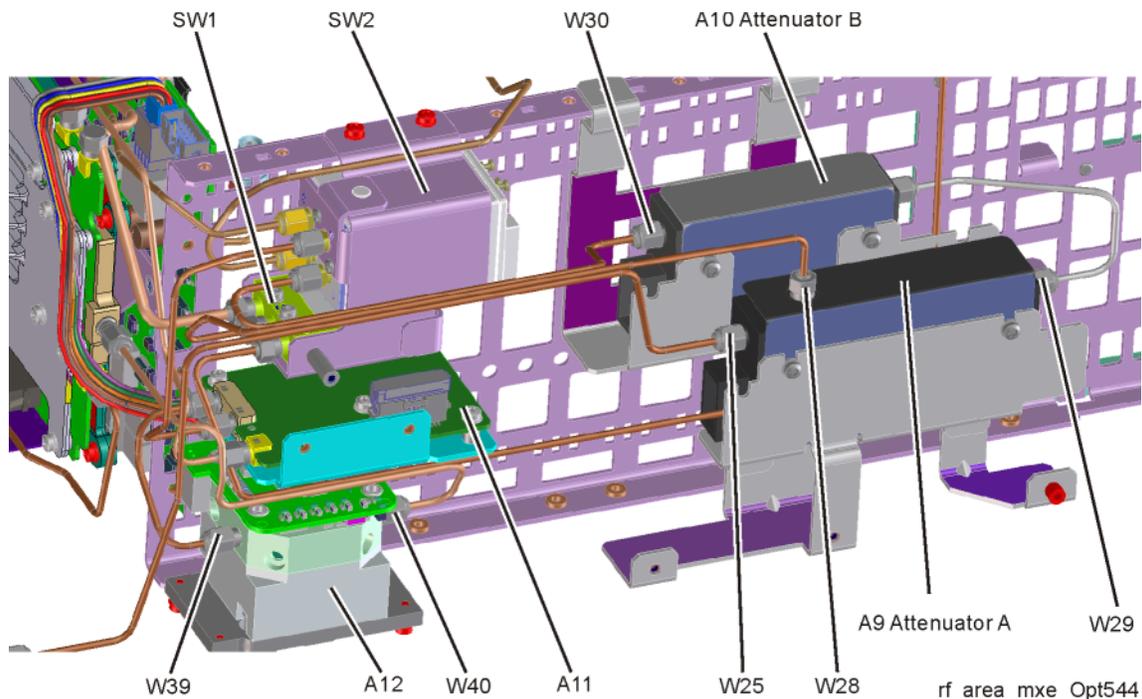
Item	Description	Part Number
A9	RF Attenuator A (0-10 dB)	33326-60013
A10	RF Attenuator B (0-60 dB)	33325-60020
A11	RF Switch/High Band Preamp Assembly	N9020-60051
A12	YIG Tuned Filter (YTF)	5087-7383
SW1	Cal Switch, SPDT Unterminated Latching, 3-Port	N1810-60077
SW2	Transfer Switch, DC-50.0 GHz, 4-Port	87222-60036
W25	Cable, Semi-Rigid, RF Input 1 (J1) to Atten A (A9) Port 1	N9038-21331
W28	Cable, Semi-Rigid, Coaxial Switch (SW1) Port C to Atten A (A9) Port 2	N9038-21332
W29	Cable, Semi-Rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	N9038-21337
W30	Cable, Semi-Rigid, Atten B (A10) Port 1 to Transfer Switch (SW2) Port 1	N9038-21333
W39	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J3 to YTF (A12) Input	N9010-20005
W40	Cable, Semi-Rigid, YTF (A12) Output to Front End Assy (A13) J9	N9038-21338

Figure 17-8   RF Area Cables - Option 544
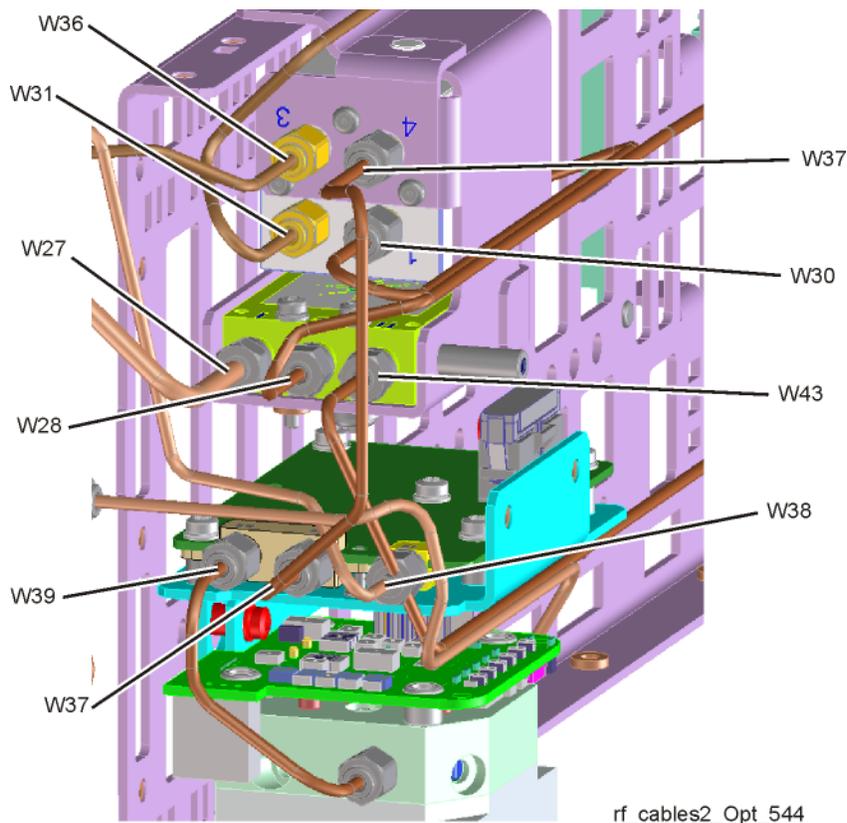
Item	Description	Part Number
W27	Cable, Semi-Rigid, Limiter Assy (A23) J103 to Coaxial Switch (SW1) Port 1	N9038-21301
W28	Cable, Semi-Rigid, Coaxial Switch (SW1) Port C to Atten A (A9) Port 2	N9038-21332
W30	Cable, Semi-Rigid, Atten B (A10) Port 1 to Transfer Switch (SW2) Port 1	N9038-21333
W31	Cable, Semi-Rigid, Transfer Switch (SW2) Port 2 to RF Presel Input Assy (A21) J100	N9038-21334
W36	Cable, Semi-Rigid, RF Presel Input Assy (A21) J101 to Transfer Switch (SW2) Port 3	N9038-21335
W37	Cable, Semi-Rigid, Transfer Switch (SW2) Port 4 to RF Switch/High Band Preamp (A11) J1	N9038-21336
W38	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J2 to Front End Assy (A13) J2	N9038-21339
W39	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J3 to YTF (A12) Input	N9010-20005
W43	Cable, Semi-Rigid, Reference Assy (A16) J701 to Coaxial Switch (SW1) Port 2	N9038-21304

Figure 17-9   Front End Parts - Typical
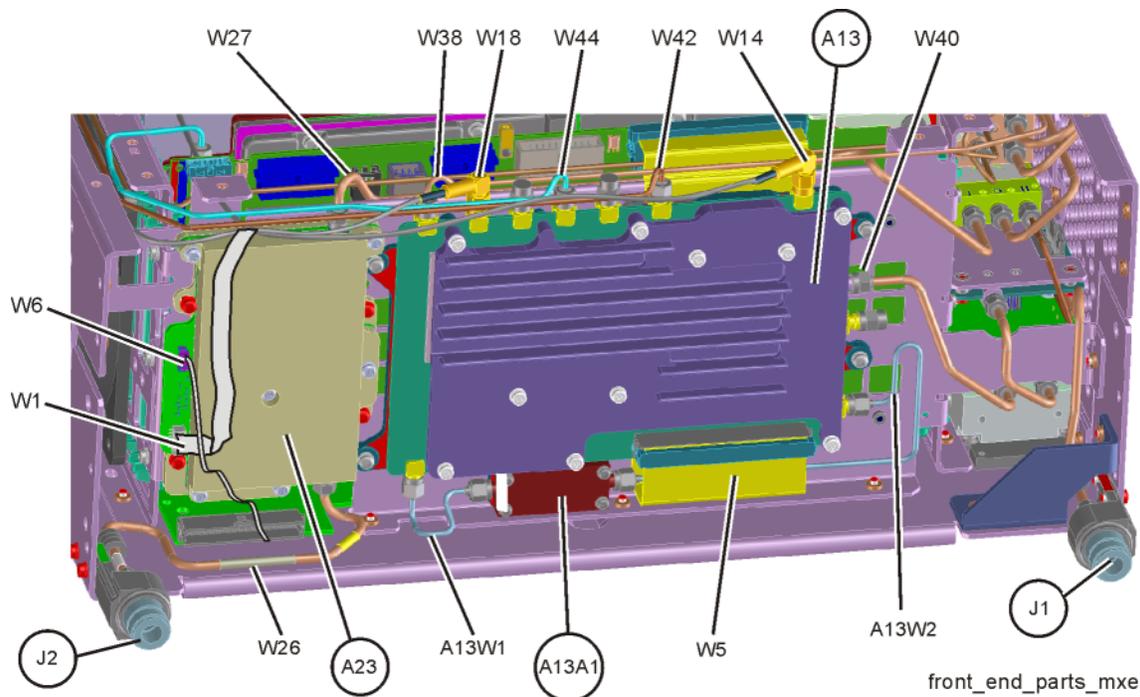
front_end_parts_mxe

Item	Description	Part Number
A13	Front End Assembly	see Table 17-1
A13A1	Bandpass Filter, 5.1225 GHz	see Table 17-1
A13W1	Cable, Semi-Rigid, Front End Assy (A13) J10 to A13A1 Input	see Table 17-1
A13W2	Cable, Semi-Rigid, A13A1 Output to Front End Assy (A13) J11	see Table 17-1
A23	Limiter Assembly, Input 2	N9038-60004
J1	Type-N Input Connector Assembly (Standard)	N9038-60021
	3.5 mm Input Connector Assembly (Option C35)	N9038-60019
	2.4 mm Input Connector Assembly (Option 544)	N9030-60011
J2	Type-N Input Connector Assembly	N9038-60021
W1	Cable, Ribbon, RF Presel Input Assy (A21) J602 to Limiter Assy (A23) J108	N9038-60009
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W6	Cable, Ribbon, Limiter Assy (A23) P2 to A1A5J1 & A1A6J1	N9038-60011

Item	Description	Part Number
W14	Cable, Coaxial, Front End Assy (A13) J7 to Front End Ctrl (A15) J902	8121-1862
W18	Cable, Coaxial, Reference Assy (A16) J705 to Front End Assy (A13) J6	8121-1940
W26	Cable, Semi-Rigid, RF Input 2 (J2) to Limiter Assy (A23) J102	N9038-21300
W27	Cable, Semi-Rigid, Limiter Assy (A23) J103 to Coaxial Switch (SW1) Port 1	N9038-21301
W38	Cable, Semi-Rigid, RF Switch/High Band Preamp (A11) J2 to Front End Assy (A13) J2	
	Option 503, 508, & 526 Option 544	N9020-20101 N9038-21339
W40	Cable, Semi-Rigid, YTF (A12) Output to Front End Assy (A13) J9	
	Option 503, 508, & 526 Option 544	N9020-20124 N9038-21338
W42	Cable, Semi-Rigid, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W44	Cable, Semi-Rigid, LO Synth Assy (A14) J740 to Front End Assy (A13) J4	N9020-20087

Figure 17-10   Front End Control Cables

frontend_control_enhanced
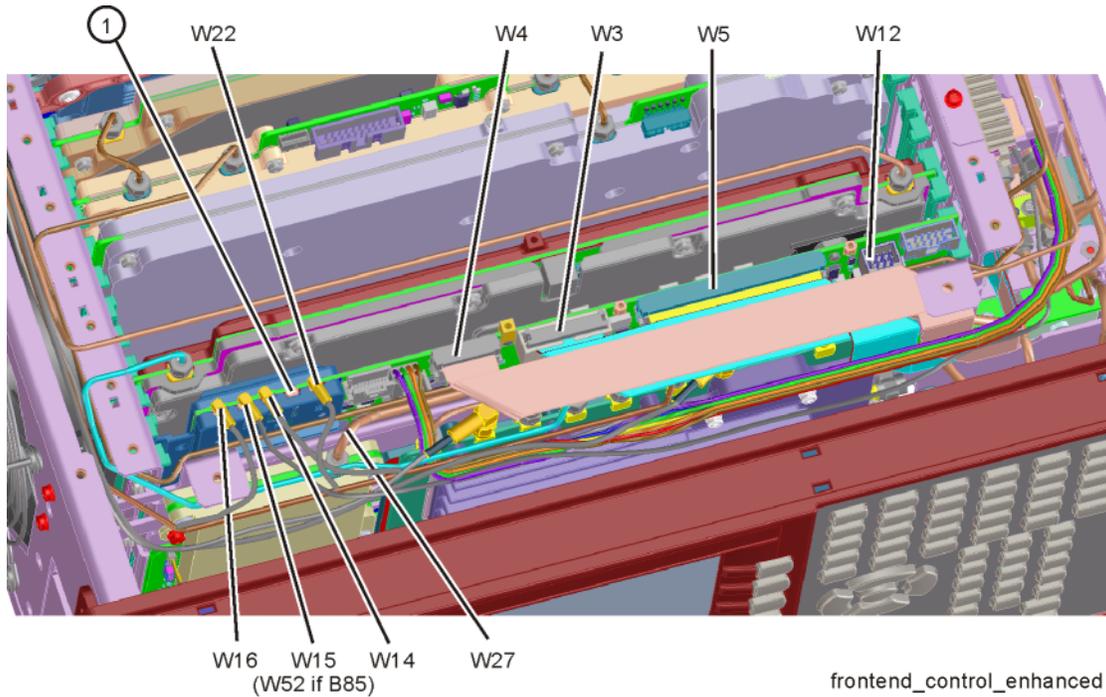
Item	Description	Part Number[a]
1	A15 Front End Control Assembly	N9020-60172
W3	Cable, Ribbon, Front End Control (A15) J800 to Atten A (A9) & B (A10)	E4410-60157
W4	Cable, Ribbon, Front End Control (A15) J700 to RF Switch/High Band Preamp (A11) J4	E4410-60160
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W12	Cable, Wire Harness, Front End Ctrl (A15) J301 to YTF (A12) J1	N9020-60059
W14	Cable, Coaxial, Front End Assy (A13) J7 to Front End Ctrl (A15) J902	8121-1862
W15	Cable, Coaxial, Front End Ctrl (A15) J901 to Digital IF (A3) J15	8121-1919
W16	Cable, Coaxial, Front End Ctrl (A15) J900 to Analog IF (A2) J100	8121-1865
W22	Cable, Coaxial, Digital IF (A3) J17 to Reference Assy (A16) J726	8121-1859
W52	Cable, Coaxial, Front End Control (A15) J901 to Wideband Analog IF (A25) J101	8121-1865

a. Most current part numbers shown. See Table 17-1 for a complete list of part numbers for older instruments.

Figure 17-11   Reference Board Cables
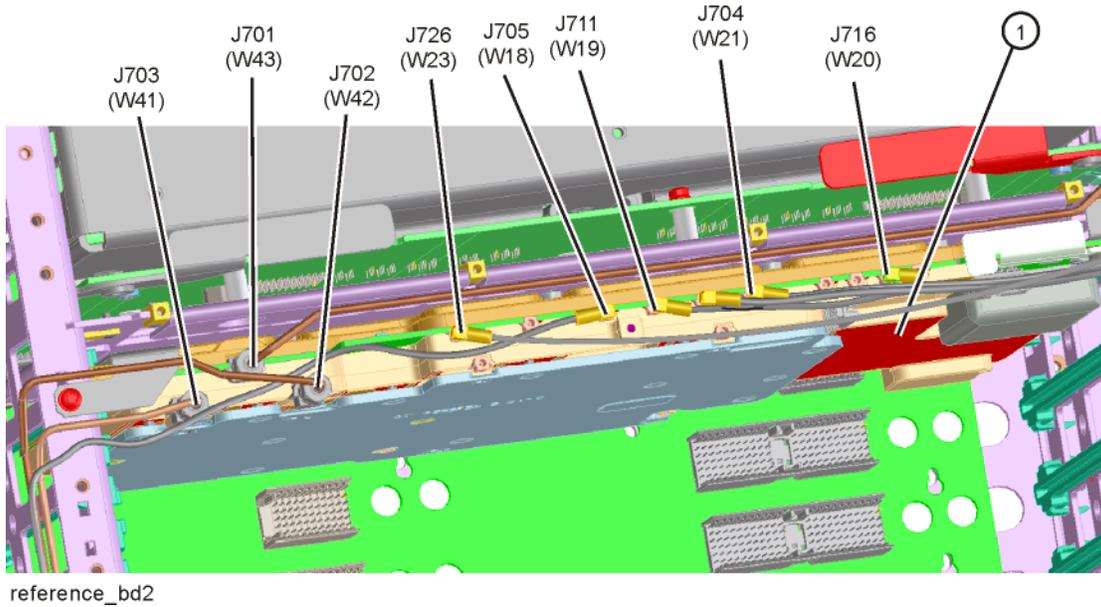
reference_bd2

Item	Description	Part Number
1	A16 Reference Assembly	N9020-60188
W18	Cable, Coaxial, Reference Assy (A16) J705 to Front End Assy (A13) J6	8121-1940
W19	Cable, Coaxial, Reference Assy (A16) J711 to Analog IF (A2) J300	8121-1861
W20	Cable, Coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1861
W21	Cable, Coaxial, Rear Panel EXT REF IN to Reference Assy (A16) J704	8121-1860
W23	Cable, Coaxial, Digital IF (A3) J17 to Reference Assy (A16) J726	8121-1401
W41	Cable, Semi-Rigid, Reference Assy (A16) J703 to LO Synth Assy (A14) J200	N9038-21306
W42	Cable, Semi-Rigid, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W43	Cable, Semi-Rigid, Reference Assy (A16) J701 to Coaxial Switch (SW1) Port 2	N9038-21304

Figure 17-12   Option B85 Cables
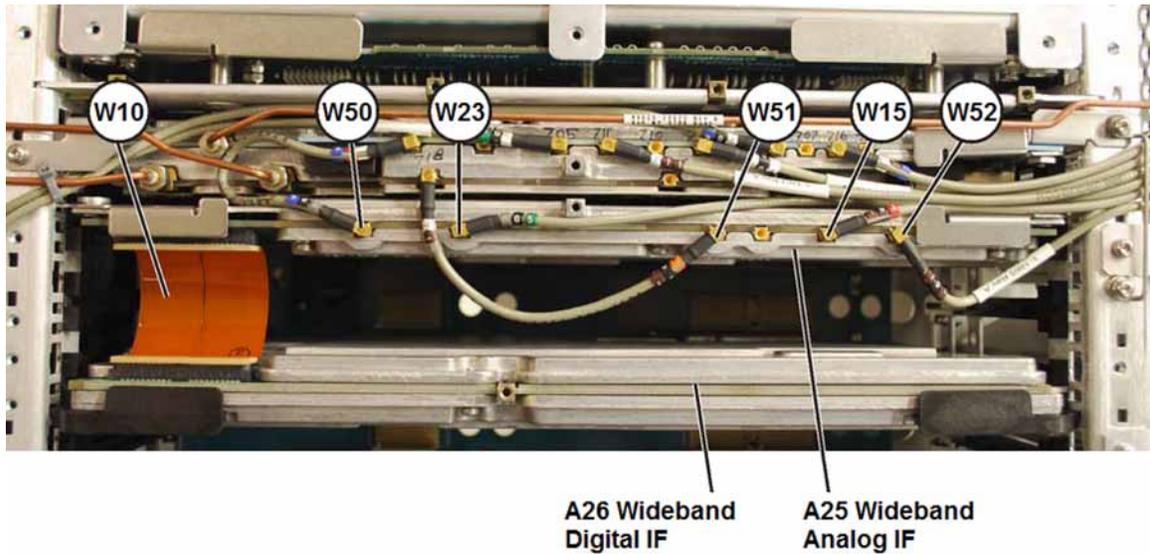
Item	Description	Part Number
W10	Cable, Ribbon, Wideband Analog IF (A25) J2 to Wideband Digital IF (A26) J778	8121-1854
W15	Cable, Coaxial, Wideband Analog IF (A25) J102 to Digital IF (A3) J15	8121-1401
W23	Cable, Coaxial, Digital IF (A3) J17 to Wideband Analog IF (A25) J805	8121-1401
W50	Cable, Coaxial, Wideband Analog IF (A25) J806 to Reference (A16) J726	8121-0152
W51	Cable, Coaxial, Reference (A16) J718 to Wideband Analog IF (A25) J301	8121-0152
W52	Cable, Coaxial, Front End Control (A15) J901 to Wideband Analog IF (A25) J101	8121-1865

Figure 17-13   RF Preselector Boards and Cables
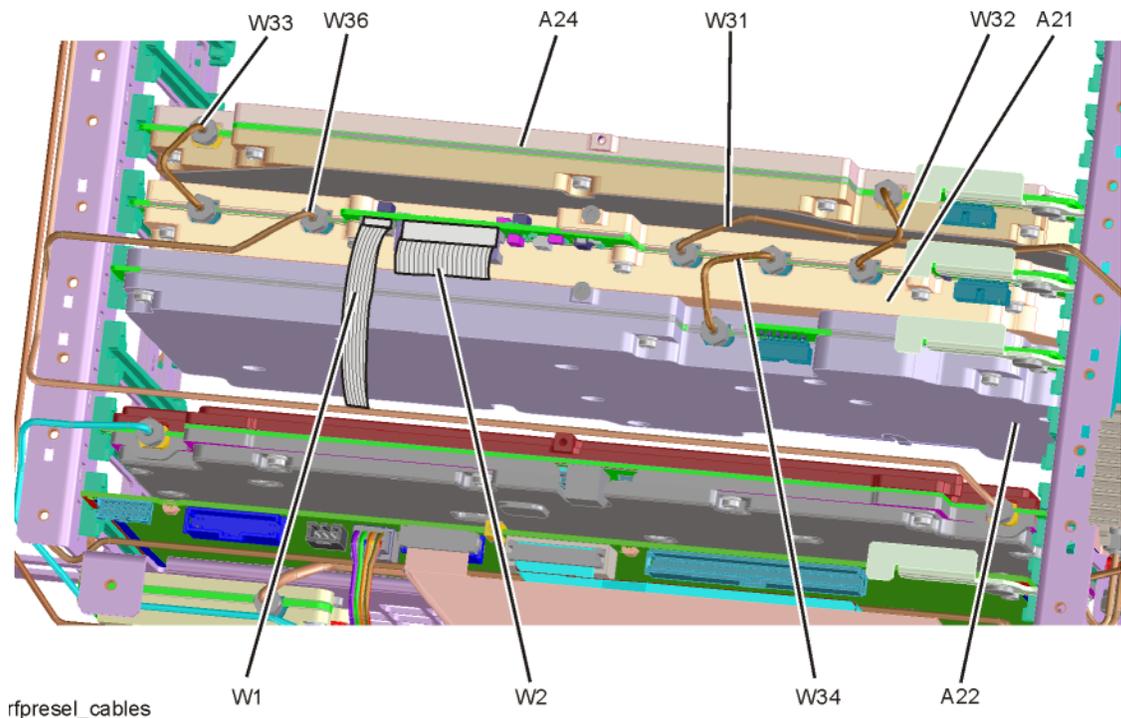
rfpresel_cables

Item	Description	Part Number
A21	RF Preselector Input Assembly	N9038-60003
A22	Radiated Filter Assembly	N9038-60002
A24	Conducted Filter Assembly	N9038-60004
W1	Cable, Ribbon, RF Presel Input Assy (A21) J602 to Limiter Assy (A23) J108	N9038-60009
W2	Cable, Ribbon, RF Presel Input Assy (A21) P600 to SW1 & SW2 Control	N9038-60010
W31	Cable, Semi-Rigid, Transfer Switch (SW2) Port 2 to RF Presel Input Assy (A21) J100	
	Option 503, 508, & 526 Option 544	N9038-21305 N9038-21334
W32	Cable, Semi-Rigid, RF Presel Input Assy (A21) J103 to Conducted Filter Assy (A24) J402	N9038-21310
W33	Cable, Semi-Rigid, Conducted Filter Assy (A24) J401 to RF Presel Input Assy (A21) J200	N9038-21310
W34	Cable, Semi-Rigid, RF Presel Input Assy (A21) J102 to Radiated Filter Assy (A22) J100	N9038-21309
W36	Cable, Semi-Rigid, RF Presel Input Assy (A21) J101 to Transfer Switch (SW2) Port 3	
	Option 503, 508, & 526 Option 544	N9038-21307 N9038-21335

Figure 17-14   AIF/DIF Cables
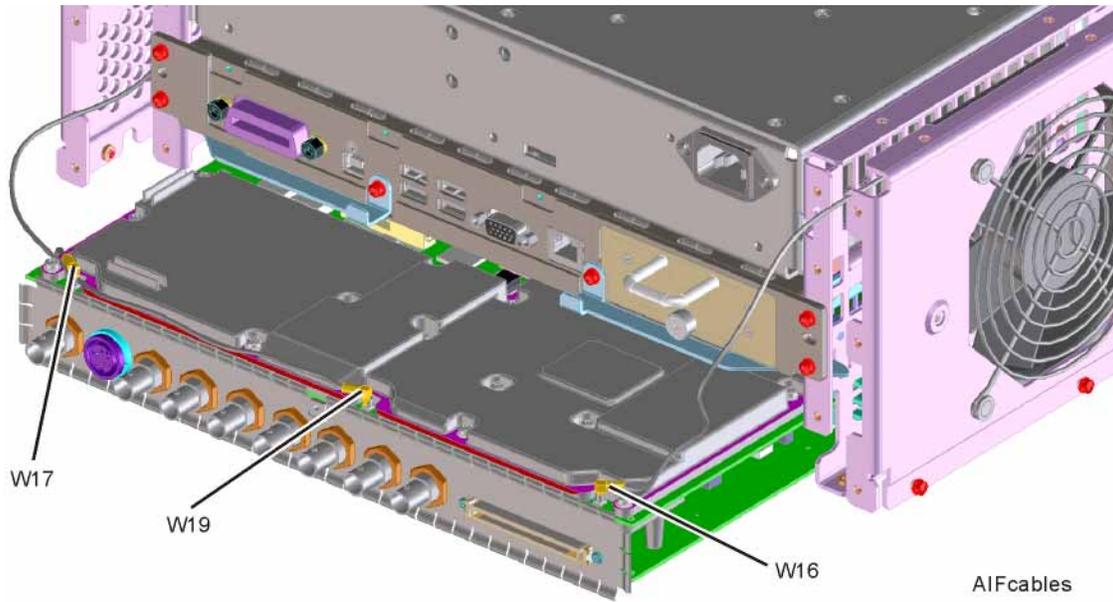
Figure 17-15   AIF/DIF Cables, bottom
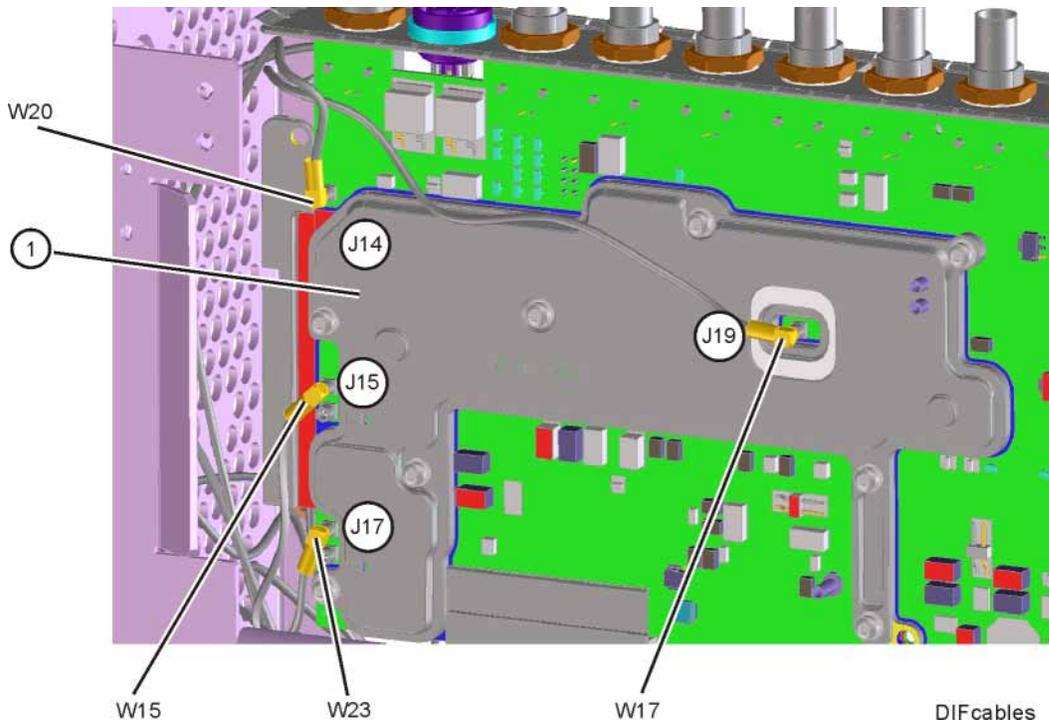
Item	Description	Part Number
W15	Cable, Coaxial, Front End Ctrl (A15) J901 to Digital IF (A3) J15	8121-1919
	Cable, Coaxial, Wideband Analog IF (A25) J102 to Digital IF (A3) J15 - (Option B85)	8121-1401
W16	Cable, Coaxial, Front End Ctrl (A15) J900 to Analog IF (A2) J100	8121-1865
W17	Cable, Coaxial, Analog IF (A2) J601 to Digital IF (A3) J19	8121-8868
W19	Cable, Coaxial, Reference Assy (A16) J711 to Analog IF (A2) J300	8121-1861
W20	Cable, Coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1861
W23	Cable, Coaxial, Digital IF (A3) J17 to Reference Assy (A16) J726	8121-1401

Figure 17-16   AIF/DIF Assemblies
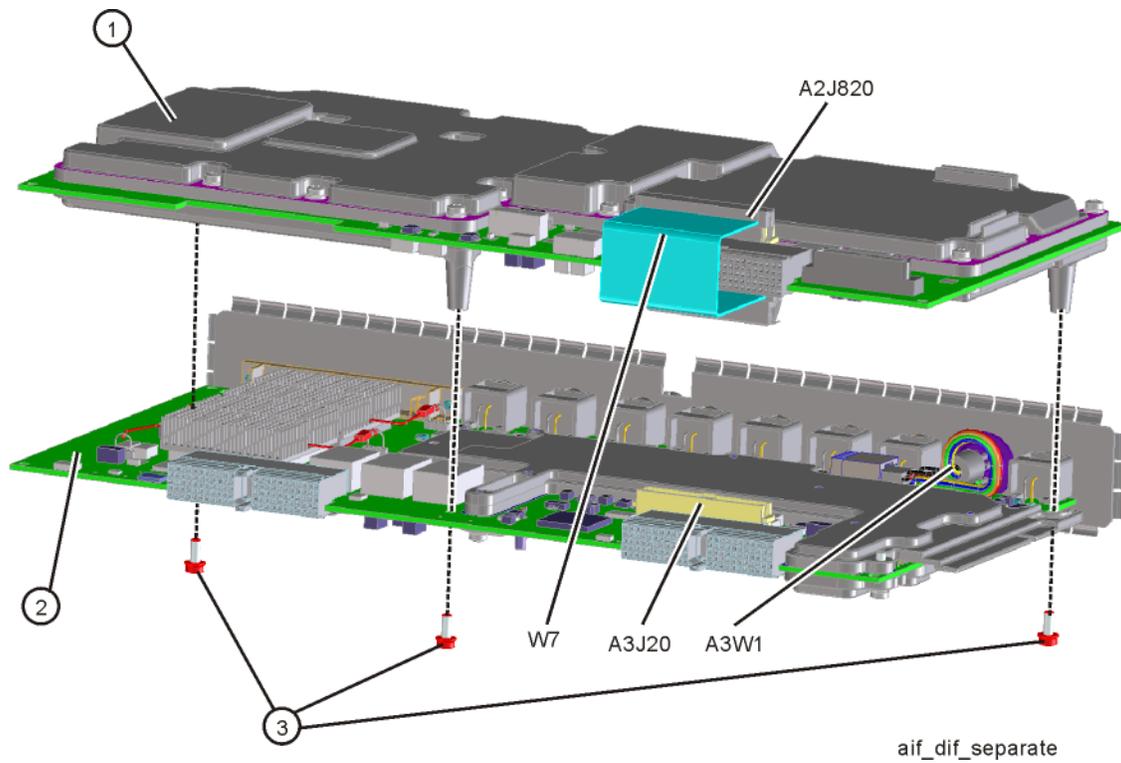
Item	Description	Part Number[a]
1	A2 Analog IF Assembly	N9020-60011
2	A3 Digital IF Assembly	N9038-60116
3	Screw, M3 X 0.5 (8 mm)	0515-0372
W7	Cable, Ribbon, Digital IF (A3) J100 to Analog IF (A2) J820	E4410-60162
A3W1	Cable Assembly, Wire Harness, Smart Noise Source	N9020-60090

a. Most current part numbers shown. See Table 17-1 for complete list of part numbers for older instruments.

Figure 17-17   Chassis
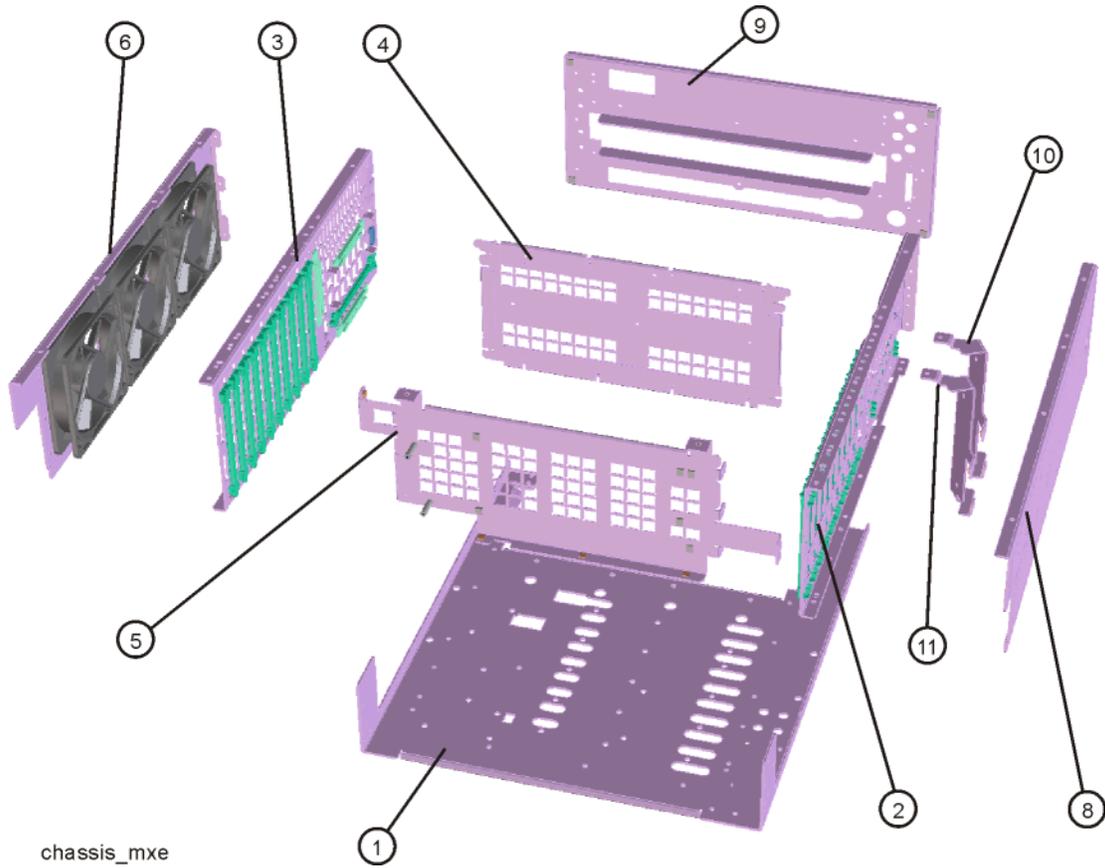
chassis_mxe

Item	Description	Part Number
1	MP1 Chassis Base	N9038-00015
2	MP4 Chassis Side, Right (inner)	W1312-00116
3	MP2 Chassis Side, Left (inner)	W1312-00117
4	MP7 Chassis, Midplane Bracket	W1312-00048
5	MP8 Chassis, Front Bracket	N9038-00003
6	MP3 Chassis Side, Left (outer) – Fan Bracket	W1312-00118
7	MP5 Chassis Side, Right (outer)	N9020-00014
8	MP6 Rear Panel	N9038-00100
9	MP19 Bracket, Attenuator A (Option 503, 508, & 526)	E4449-00103
	MP19 Bracket, Attenuator A and B (Option 544)	N9038-01202
10	MP20 Bracket, Attenuator B (Option 503, 508, & 526)	E4449-00103

Figure 17-18   Cable Hold Downs
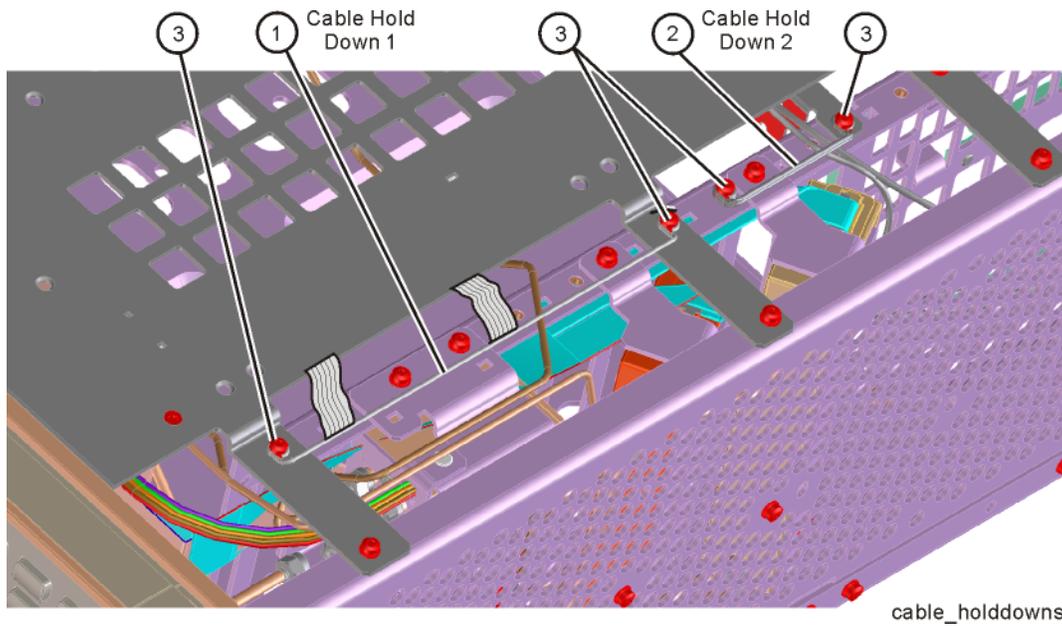
cable_holddowns

Item	Description	Part Number
1	MP57 Cable Hold Down 1 (158 mm)	5023-1397
2	MP58 Cable Hold Down 2 (48 mm)	5023-1379
3	Screw M3 X0.5 (8 mm)	0515-0372

Figure 17-19   Motherboard
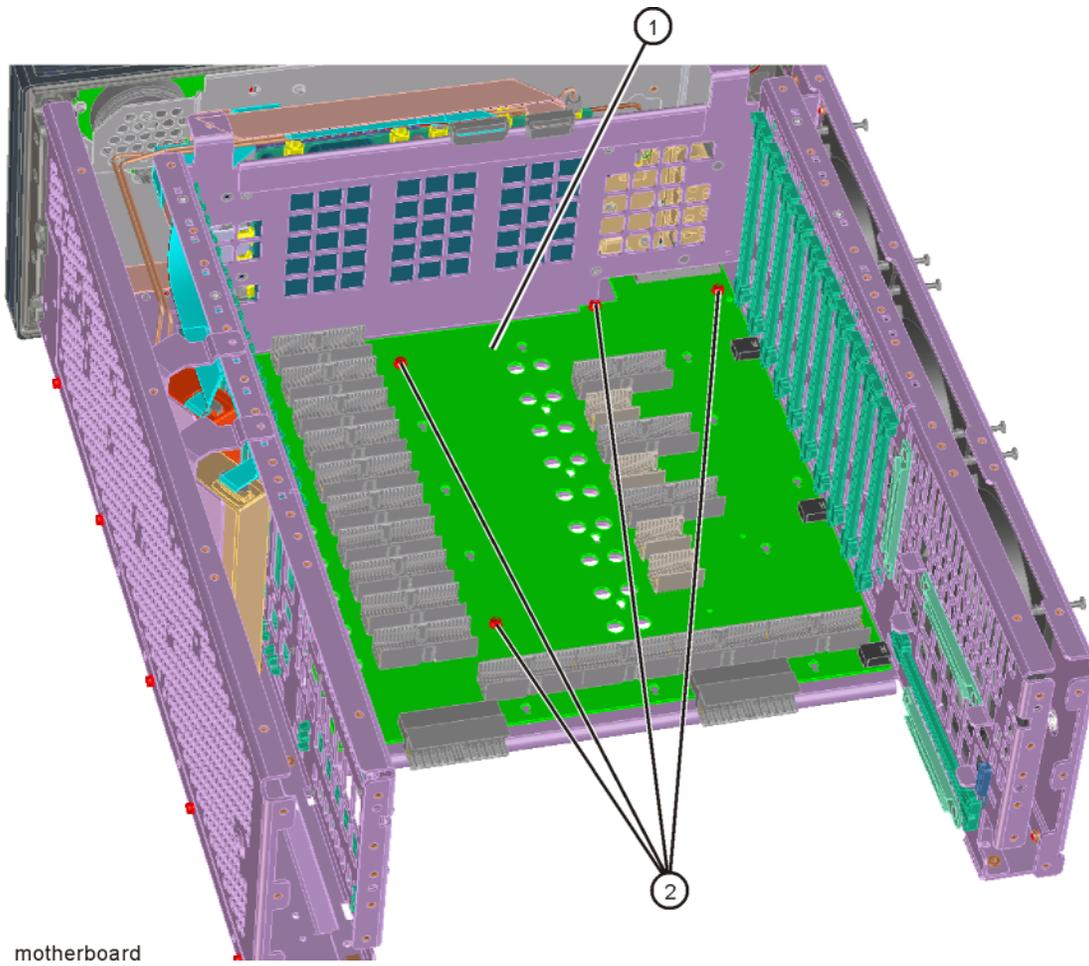
motherboard

Item	Description	Part Number
1	A8 Motherboard Assembly	N9030-63002
2	Screw M3 X0.5 (8 mm)	0515-0372

Figure 17-20   Fan Hardware

Fan orientation:
Arrows point to right and down.
Air flow inward.

fan_replace_pxa
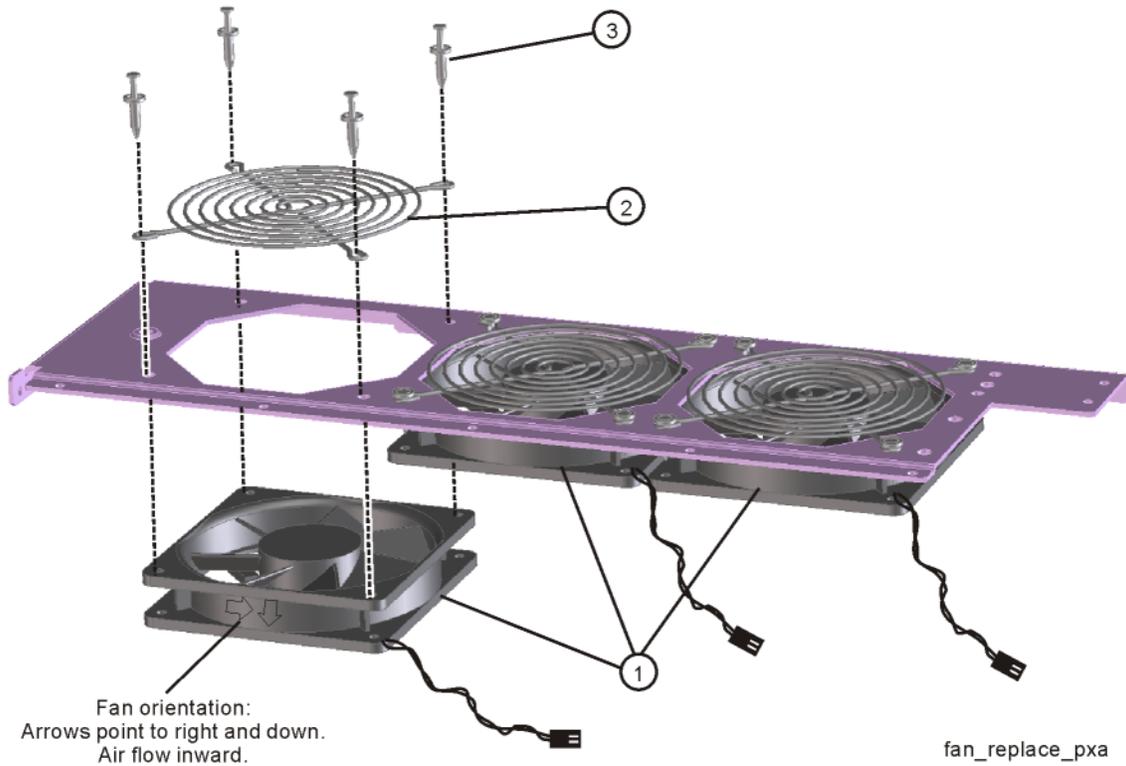
Item	Description	Part Number
1	B1, B2, B3 Fan	3160-4199
2	MP15-17 Fan Guard	3160-0281
3	Rivet, Fan Mounting	0361-1272

Figure 17-21   Input Connector
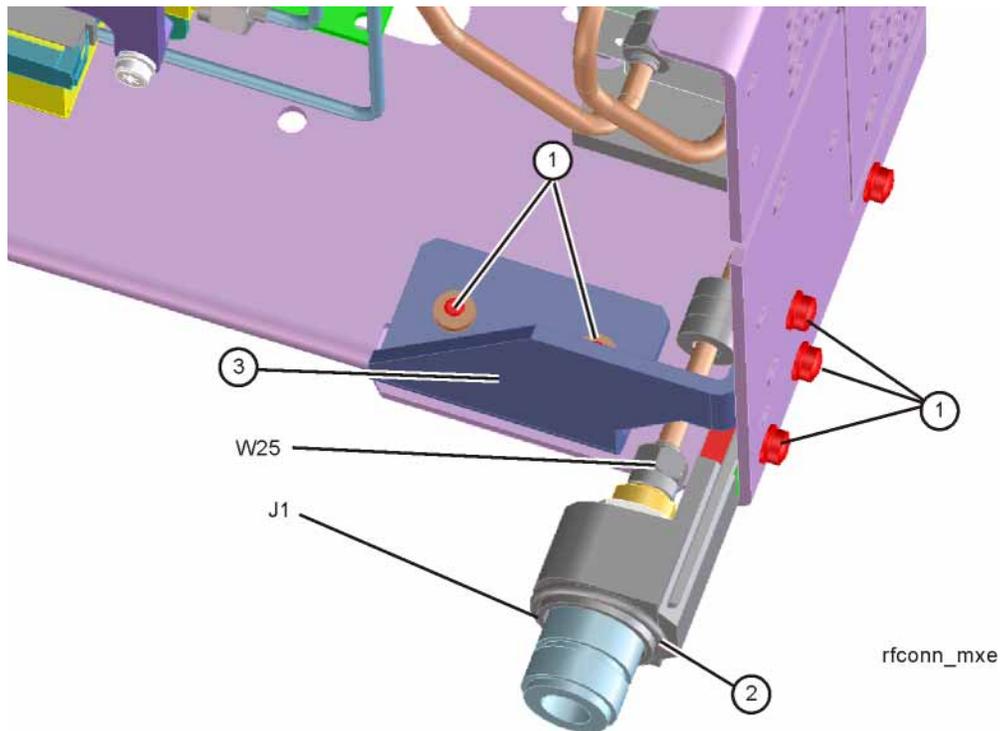
Item	Description	Part Number
1	Screw M3 X 0.5 (8 mm long)	0515-0372
2	J1MP1 EMI O-Ring 18.75 mm ID	8160-1637
3	MP18 Chassis Gusset, Input Connector	W1312-00093
J1	Type-N Input Connector Assembly (Standard)	N9038-60021
	3.5 mm Input Connector Assembly (Option C35)	N9038-60019
	2.4 mm Input Connector Assembly (Option 544)	N9030-60011
W25	Cable, Semi-Rigid, RF Input 1 (J1) to Atten A (A9) Port 1	
	Standard	N9038-21302
	Option C35	N9038-21312
	Option 544	N9038-21331

Figure 17-22   RF 2 Input Connector

rfconn2_mxe
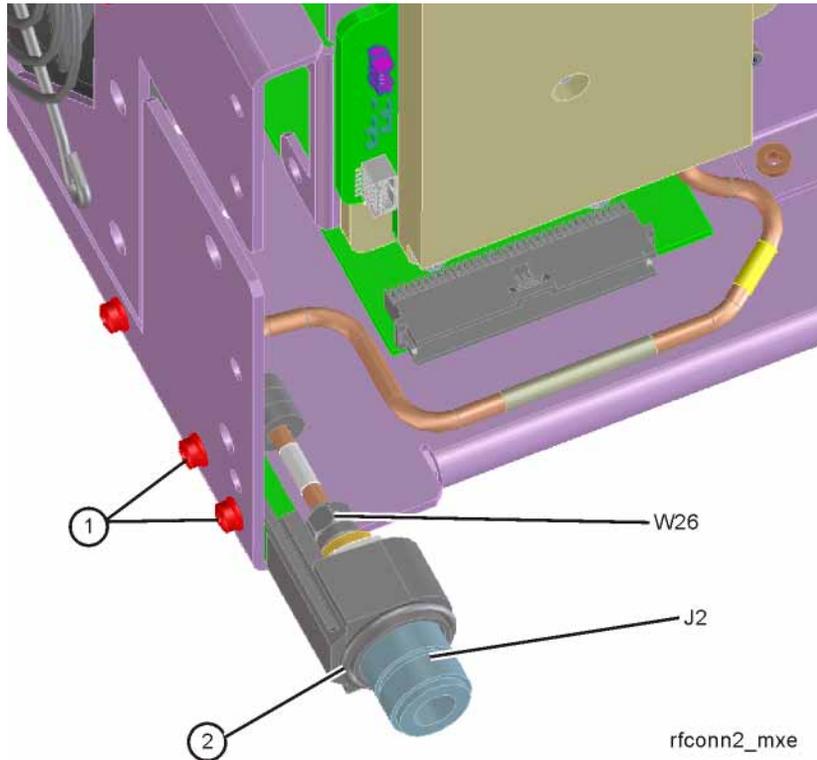
Item	Description	Part Number
1	Screw M3 X 0.5 (8 mm long)	0515-0372
2	J2MP1 EMI O-Ring 18.75 mm ID	8160-1637
J2	Type-N Input Connector Assembly	N9038-60021
W26	Cable, Semi-Rigid, RF Input 2 (J2) to Limiter Assy (A23) J102	N9038-21300

Figure 17-23 Front Frame Exploded View - LED Backlight

ff_xplode_led
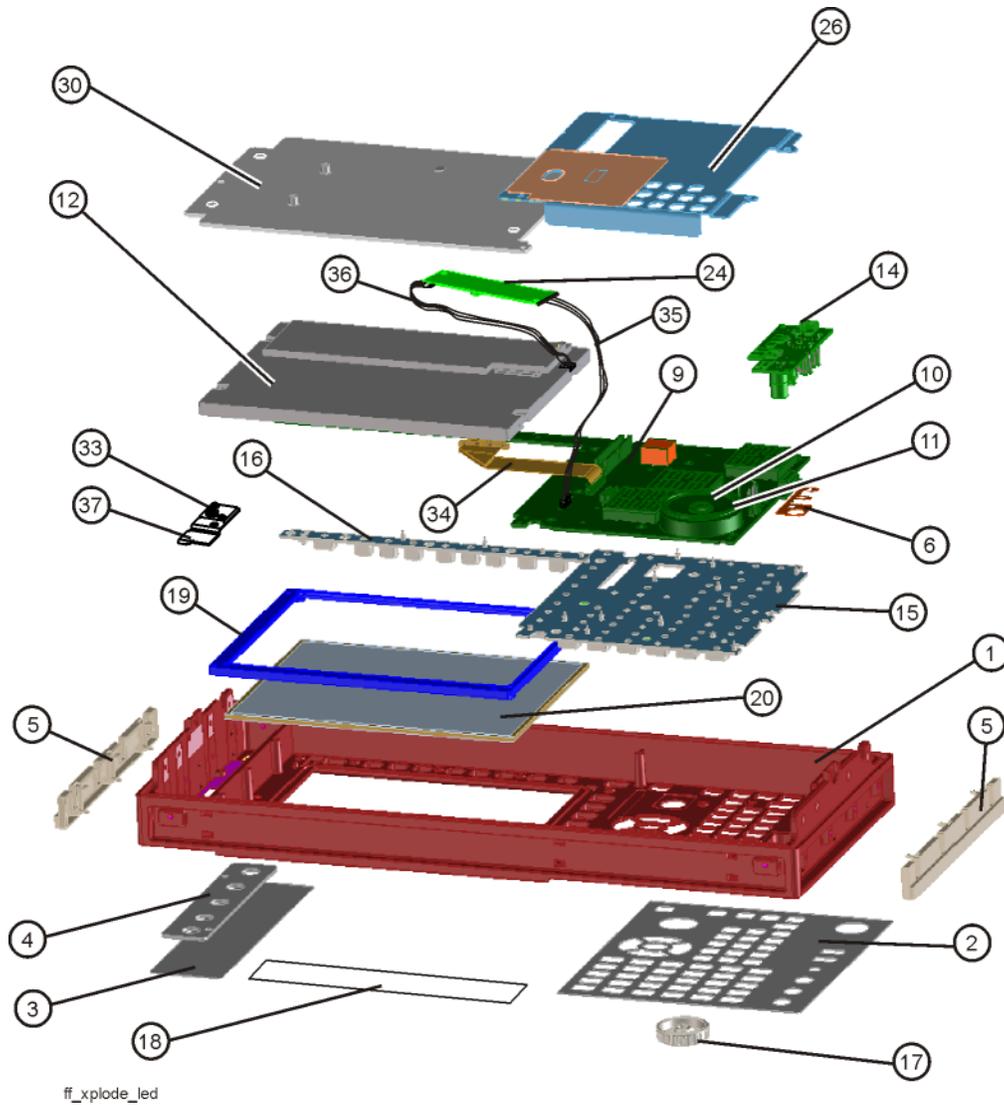
Item	Description	Part Number
1	Front Frame	___[a]
2	A1A1MP2 Overlay, Main Keyboard	N9038-80001
3	A1A1MP3 Overlay, Input 2	N9038-80002
4	A1A1MP7 Blank Cover Plate	N9020-00002
5	A1A1MP9-10 Side Trim Strip	W1312-40005
6	A1A1MP4 Front Frame Ground Spring	W1312-00021
9	A1A2 Front Panel Interface Board	W1312-60137
10	A1A2MP1 Speaker	9164-0453
11	A1A2MP2 Speaker Foam	N9038-40088
12	A1A3 Liquid Crystal Display	2090-0997
13	MP11-14 Vibration Mounts	0460-2725
14	A1A5 Front Panel Daughter Board	N9038-63005
15	A1MP1 Main Keypad	E4410-40100
16	A1MP2 Display Keypad	E4410-40101
17	A1MP9 RPG Knob	W1312-40017
18	A1MP3 Nameplate Label	see Table 17-1
19	A1MP8 LCD Lens Gasket	W1312-40006
20	A1MP7 LCD Glass Filter	1000-1513
24	A1A4 Display Backlight Power Supply	0950-5235
26	A1MP19 Shield, Front Panel Interface	N9020-00051
30	A1MP14 Display Bracket	W1312-00145
33	A1A6 Input 2 LED Board	N9038-63006
34	A1W1 Flex Circuit, Front Panel Interface to LCD	W1312-60122
35	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	W1312-60130
36	A1W3 Cable Assembly, Wire Harness, Backlight Power Supply to LCD	W1312-60131
37	A1MP20 Bracket, Input 2 LED Board	N9038-21202

a. Non-orderable item, see A1A1.

Figure 17-24   Front Frame Parts - LED Backlight
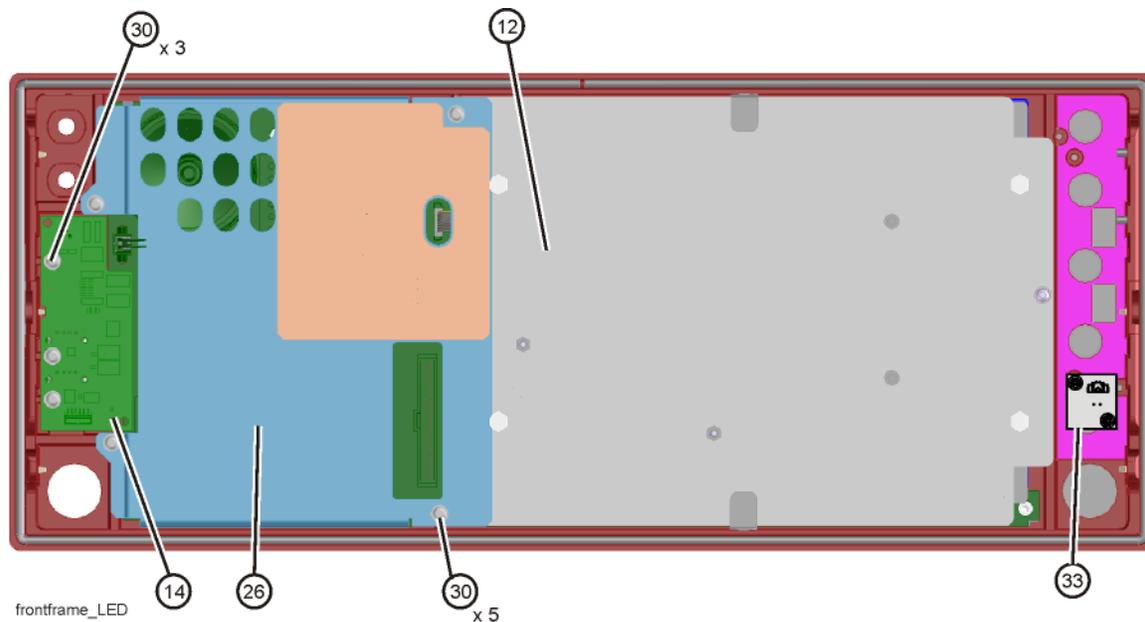
Item	Description	Part Number
12	A1MP14 Display Bracket	W1312-00145
14	A1A5 Front Panel Daughter Board	N9038-63005
26	A1MP19 Shield, Front Panel Interface	N9020-00051
30	Screw, M3 X 0.5 (8 mm)	0515-0372
33	A1A6 Input 2 LED Board	N9038-63006

Figure 17-25   Front Frame Parts (shields off) - LED Backlight

frontframe_LED_2
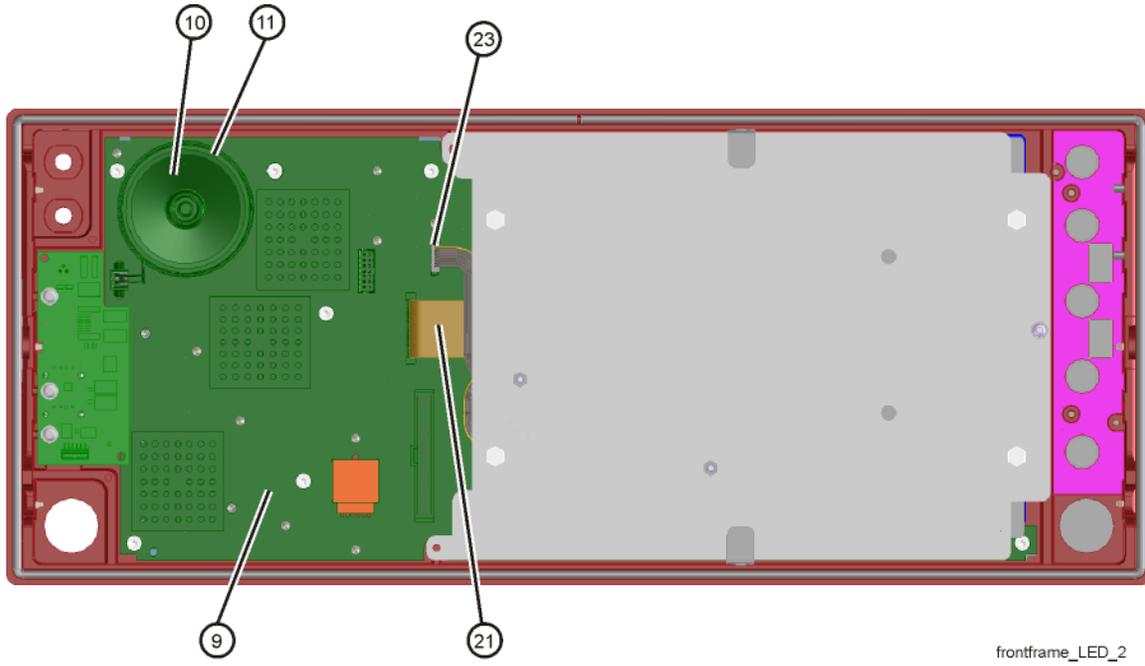
Item	Description	Part Number
9	A1A2 Front Panel Interface Board	W1312-60137
10	A1A2MP1 Speaker	9164-0453
11	A1A2MP2 Speaker Foam	N9038-40088
21	A1W1 Flex Circuit, Front Panel Interface to LCD	W1312-60122
23	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	W1312-60130

Figure 17-26   Front Frame Exploded View - CCFL Backlight

frontframeexplode_mxe
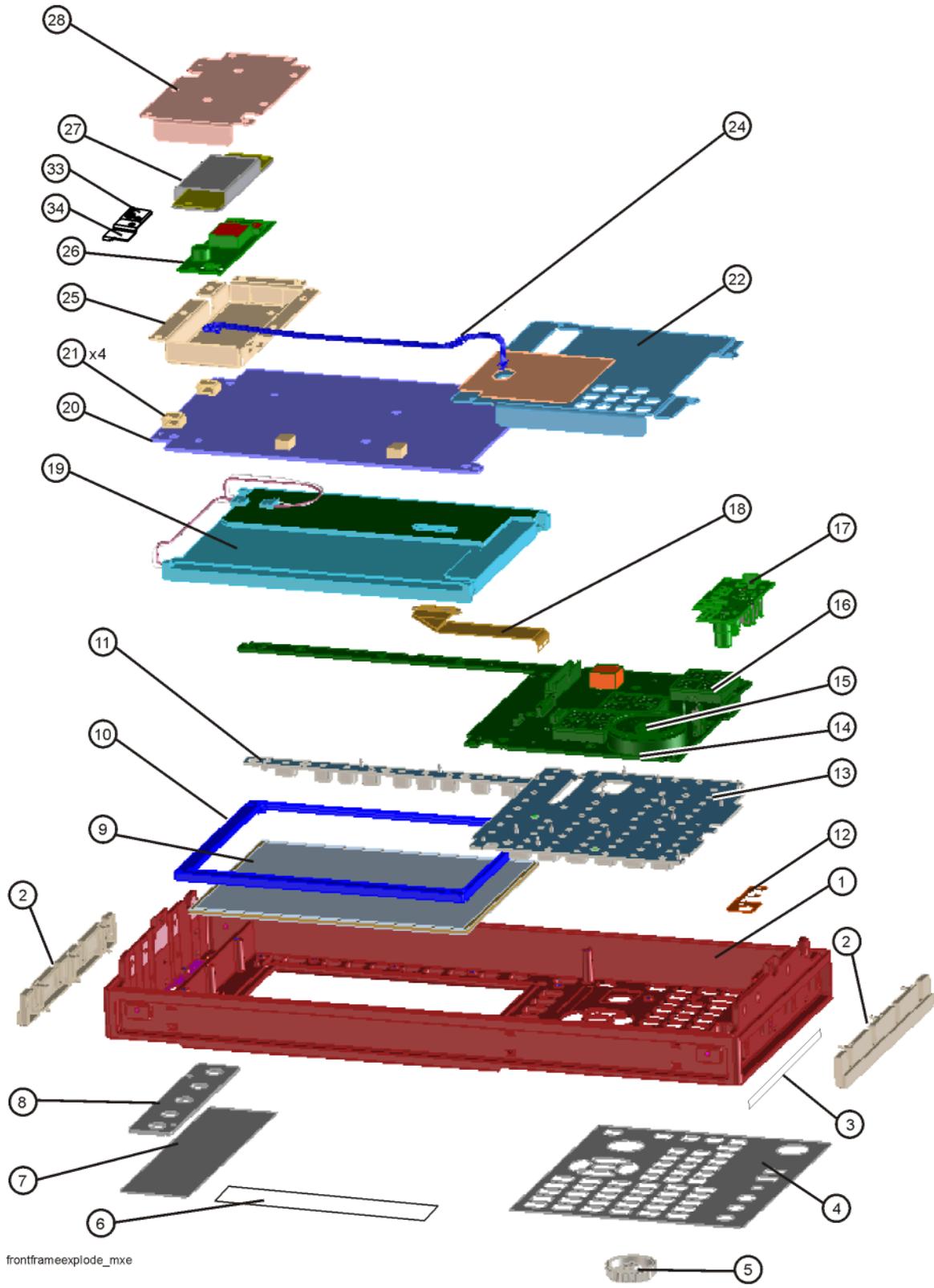
Item	Description	Part Number
1	Front Frame	___a
2	A1A1MP9-10 Side Trim Strip	W1312-40005
3	A1A1MP11-12 Side Trim Strip, Vinyl	5041-9172
4	A1A1MP2 Main Keyboard Overlay	N9038-80001
5	A1MP9 RPG Knob	W1312-40017
6	A1MP3 Nameplate Label	see Table 17-1
7	A1A1MP3 Overlay, Input 2	N9038-80002
8	A1A1MP7 Blank Cover Plate	N9020-00002
9	A1MP7 LCD Glass Filter	1000-1513
10	A1MP8 LCD Lens Gasket	W1312-40006
11	A1MP2 Display Keypad	E4410-40101
12	Front Frame Ground Spring	W1312-00021
13	A1MP1 Main Keypad	E4410-40100
14	A1A2MP2 Speaker Foam	N9038-40088
15	A1A2MP1 Speaker	9164-0453
16	A1A2 Front Panel Interface Board	W1312-63092
17	A1A5 Front Panel Daughter Board	N9038-63005
18	A1W1 Flex Circuit, Front Panel Interface to LCD	W1312-60010
19	A1A3 Liquid Crystal Display	2090-0911
20	A1MP14 Display Bracket	W1312-00115
21	A1MP10-13 Cable Clamp	1400-1439
22	A1MP19 Shield, Front Panel Interface	N9020-00051
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	W1312-60113
25	A1MP17 Shield, Inverter Assembly, Bottom	N9020-00011
26	A1A4 Display Backlight Power Supply	0950-4635
27	A1MP15 Shield, Inverter Board	W1312-00024
28	A1MP16 Shield, Inverter Assembly, Top	N9020-00010
33	A1A6 Input 2 LED Board	N9038-63006
34	A1MP20 Bracket, Input 2 LED Board	N9038-21202

a. Non-orderable item, see A1A1.

Figure 17-27   Front Frame Parts - CCFL Backlight

frontframe_mxe
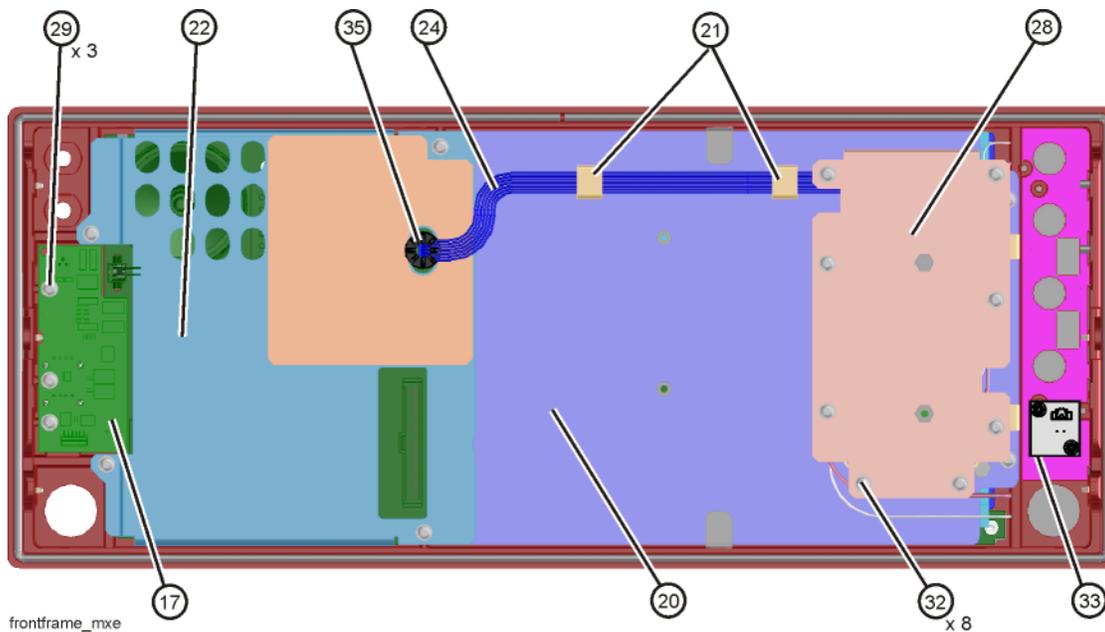
Item	Description	Part Number
17	A1A5 Front Panel Daughter Board	N9038-63005
20	A1MP14 Display Bracket	W1312-00115
21	A1MP10-13 Cable Clamp	1400-1439
22	A1MP19 Shield, Front Panel Interface	N9020-00051
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	W1312-60113
28	A1MP16 Shield, Inverter Assembly, Top	N9020-00010
29	Screw M3 X 0.5 (8 mm)	0515-0372
32	Screw M3 X 0.5 (8 mm)	0515-0372
33	A1A6 Input 2 LED Board	N9038-63006
35	A1MP6 Grommet, A1W2	0400-0333

Figure 17-28   Front Frame Parts (shields off) – CCFL Backlight
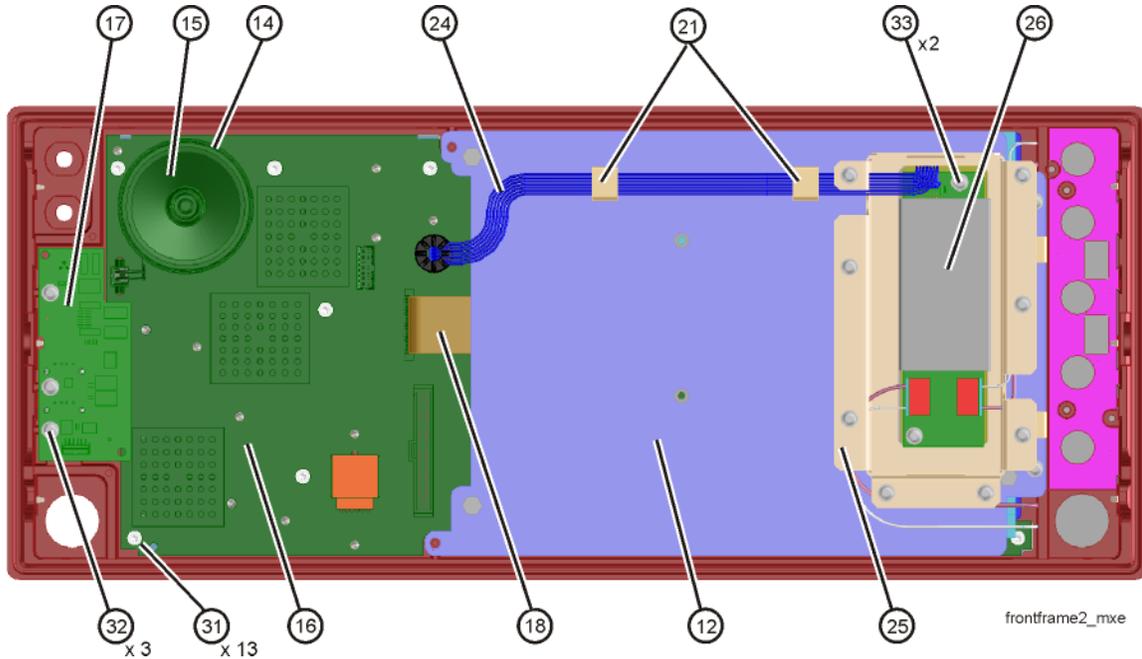
Item	Description	Part Number
12	A1MP14 Display Bracket	W1312-00115
14	A1A2MP2 Speaker Foam	N9038-40088
15	A1A2MP1 Speaker	9164-0453
16	A1A2 Front Panel Interface Board	W1312-63092
17	A1A5 Front Panel Daughter Board	N9038-63005
18	A1W1 Flex Circuit, Front Panel Interface to LCD	W1312-60010
21	A1MP10-13 Cable Clamp	1400-1439
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply	W1312-60113
25	A1MP17 Shield, Inverter Assembly, Bottom	N9020-00011
26	A1A4 Display Backlight Power Supply	0950-4635
31	Screw M3 X 0.5 (5 mm)	0515-1521

18   Assembly Replacement Procedures

What You Will Find in This Chapter

Procedures in this chapter enable you to locate, remove, and replace the following major assemblies in your instrument.

Refer to Chapter 17, "Replaceable Parts" for part numbers, assembly descriptions, and ordering information.

Before Starting

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 26.

Safety

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.

Tools you will need

Figure 18-1   TORX Tool
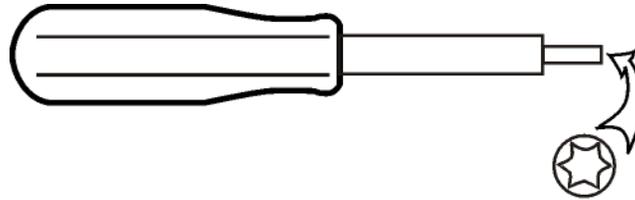
sl736a

Hand Tool	Size
Cable Puller (5021-6773)	
Nut Driver	3/16 inch
Nut Driver	5/16 inch
Nut Driver	9/16 inch
Open-End Wrench	5/16 inch
Torque Driver - Adjustable	Multi Bit
Torque Wrench - 10 inch-lbs	5/16 inch
TORX Driver	T-8
TORX Driver	T-10
TORX Driver	T-20

Adjustments Tests after an instrument repair

Refer to Chapter 19, "Post-Repair Procedures" for information about post-repair procedures. If one or more instrument assemblies have been repaired or replaced, perform the related adjustments and performance verification tests.

Major Assembly Locations

Figure 18-2   Major Assemblies

major_assy_mxe
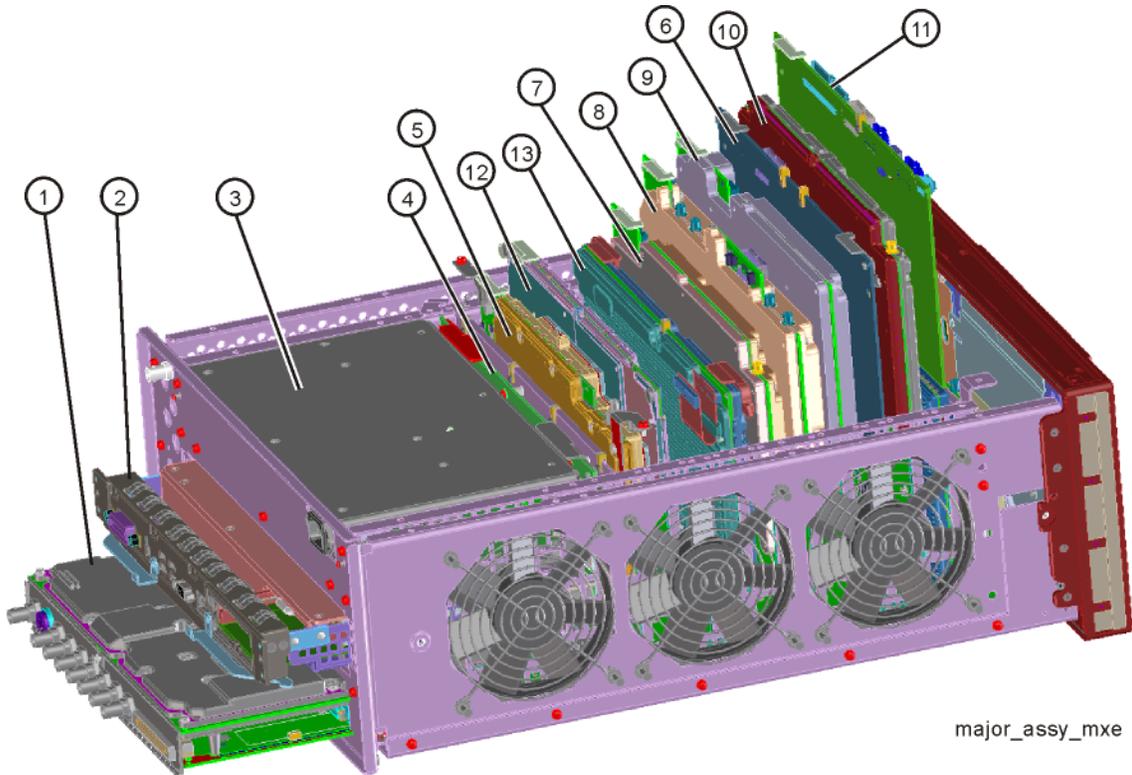
Item	Description
1	A2 Analog IF Assembly and A3 Digital IF Assembly
2	CPU Assembly
3	A6 Power Supply Assembly
4	A7 Midplane Assembly
5	A16 Reference Assembly
6	A30 LISN Control Assembly
7	A24 Conducted Filter Assembly
8	A21 RF Preselector Input Assembly
9	A22 Radiated Filter Assembly
10	A14 LO Synthesizer Assembly
11	A15 Front End Control Assembly
12	A25 Wideband Analog IF Assembly
13	A26 Wideband Digital IF Assembly

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. Refer to Figure 18-3. Using the T-20 driver, remove the four screws (two on each side) **(1)** that attach the handle strap **(2)** on each side of the instrument.

3. Remove the bottom feet and locks **(6)** by lifting the tabs on the feet and sliding to disengage from the outer case.

4. Using the T-20 driver, remove the four screws (including washers) **(3)** that hold the rear feet **(4)** in place.

5. Pull the instrument cover **(5)** off towards the rear of the instrument.

Figure 18-3   Instrument Outer Case Removal

outer_case_pxa
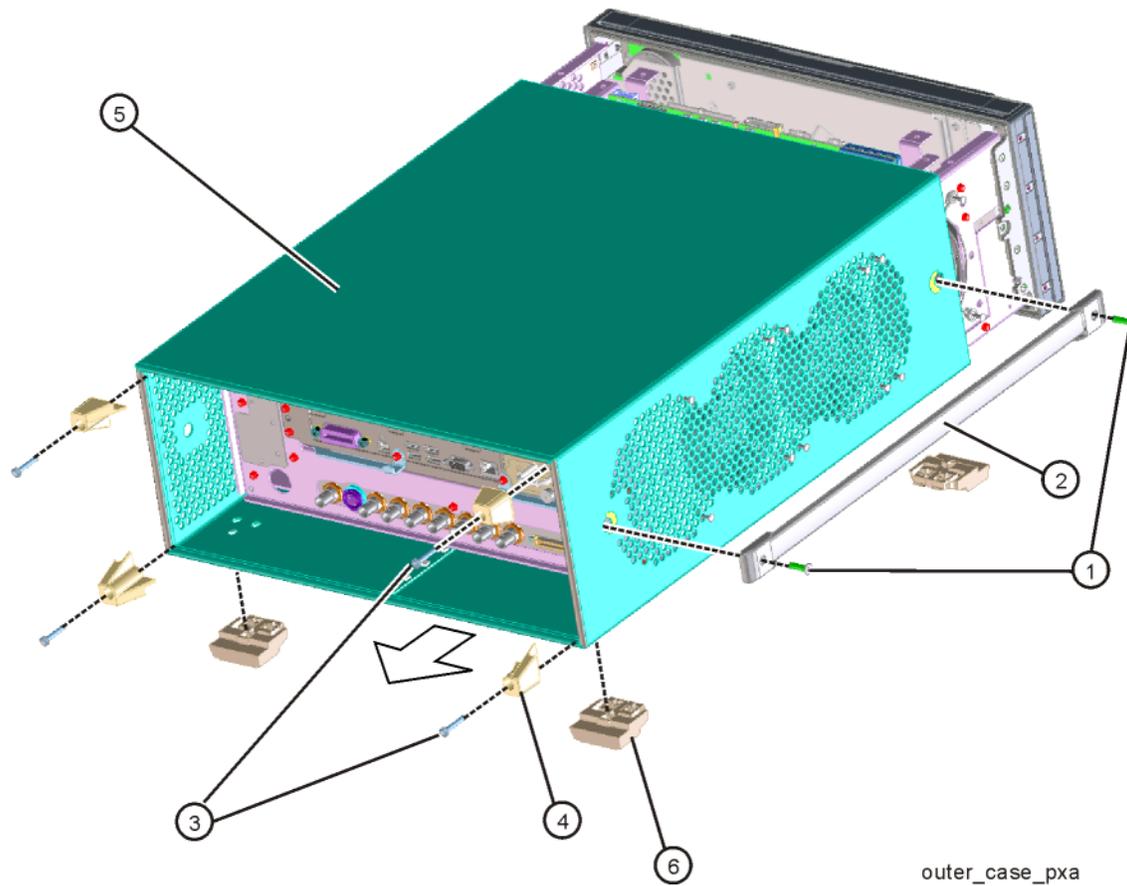
Replacement

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 Assembly.

3. Replace the four rear feet to the rear of the instrument. Torque the rear feet screws (0515-1619 and 3050-0893 washers) to 21 inch pounds.

4. Replace the bottom feet by sliding into place until they snap in. Install the locks by pressing in flat.

5. Replace the handle straps on both sides of the instrument. Torque the handle strap screws to 21 inch pounds.

Top Brace and Power Supply Bracket

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Refer to Figure 18-4. To remove the top brace (1), use the T-10 driver to remove the twelve screws **(3)** (0515-0372) attaching the top brace to the chassis. Remove the wire hold down 1 (as shown in Figure 18-5). Remove the fifteen screws **(4)** (0515-1227) attaching the top brace to the boards.

3. To remove the power supply bracket **(2)**, use the T-10 driver to remove the eight screws **(5)** (0515-0372) attaching the power supply bracket to the instrument and the three screws **(6)** (0515-1227) attaching the power supply bracket to the power supply.

Figure 18-4   Top Brace and Power Supply Bracket Removal

top_brace_mxe
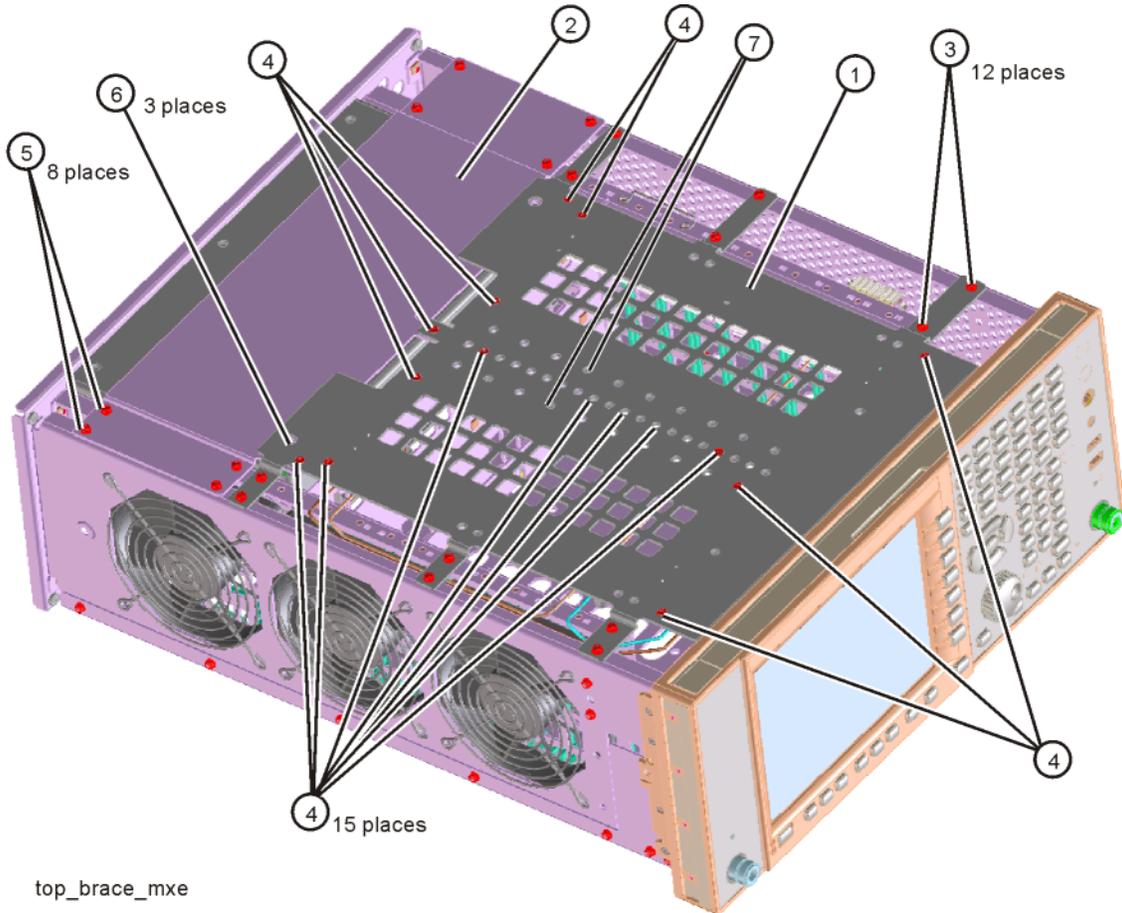
Figure 18-5   Wire Hold Downs
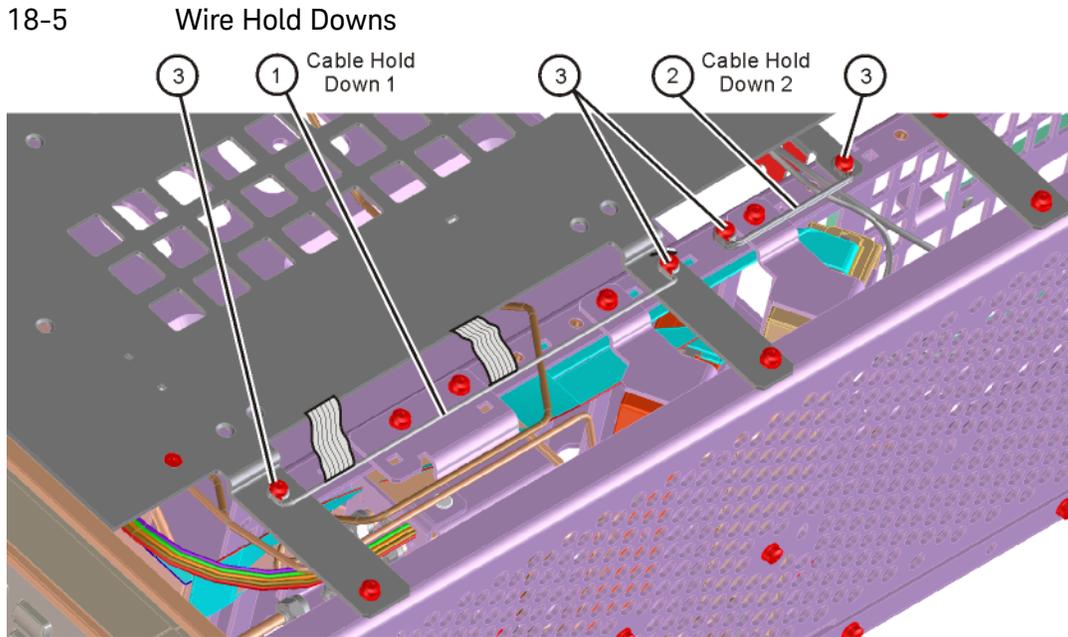
Replacement

1. Refer to Figure 18-4. To replace the top brace or the power supply bracket, place them into the correct position and attach the screws referred to in the removal process. Reinstall wire hold down 1. Torque to 9 inch-pounds.

RF Area – Option 503, 508, & 526

Refer to Figure 18-6. The RF area consists of RF attenuator A **(1)**, RF attenuator B **(2)**, RF Switch/High Band Preamp assembly **(3)**, and YTF **(4)**.

Figure 18-6   **RF Area Components and Cables - Option 503, 508, & 526**
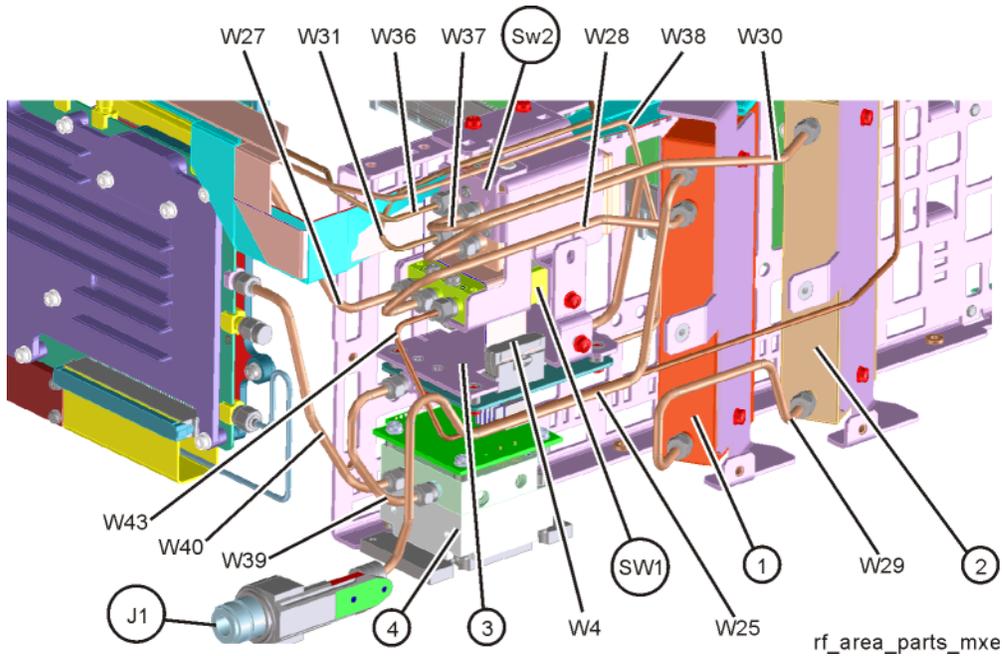
To gain access to the attenuators, RF Switch/High Band Preamp assembly, or YTF for removal, follow these steps:

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the front panel. Refer to the Front Frame Assembly removal procedure.

3. Remove the top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

4. Refer to Figure 18-7. Remove the Chassis Right Side Outer bracket **(1)** by removing the eleven screws **(2)** (0515-0372) using the T–10 driver.

Figure 18-7   Chassis Right Side Outer - Option 503, 508, & 526

chassis_side_mxe
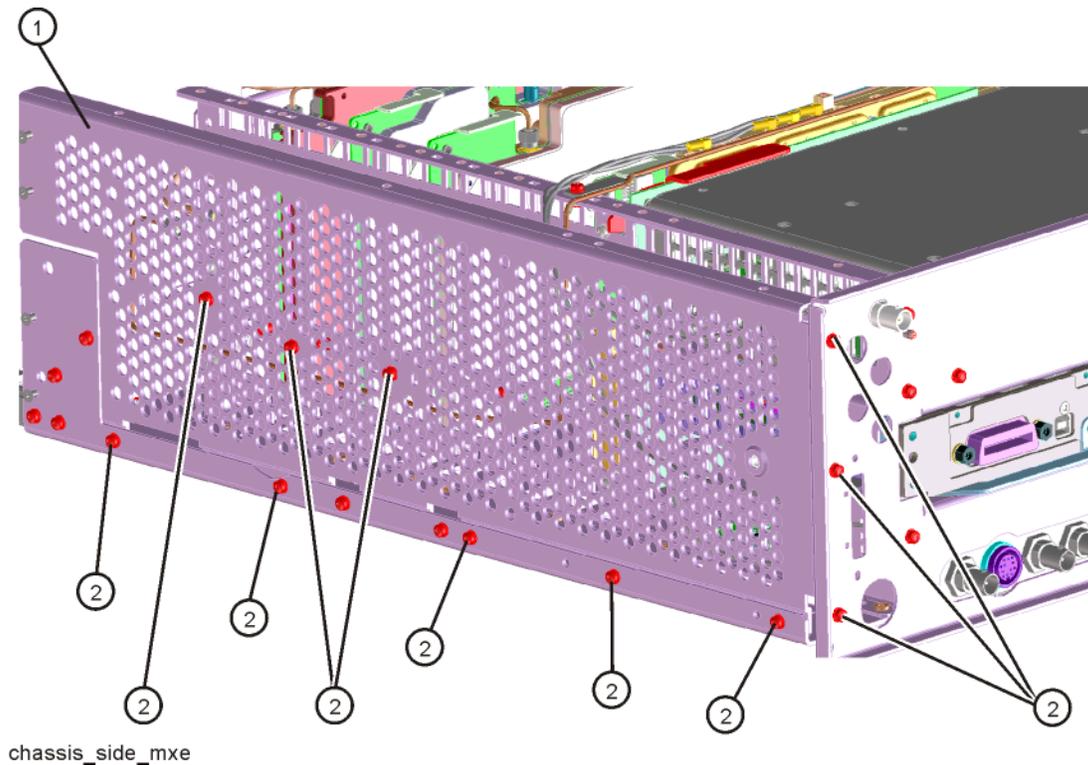
Attenuators – Option 503, 508, & 526

Removal

1. Refer to Figure 18-8. To remove Attenuator A **(1)** or Attenuator B **(2)**, remove the semi-rigid cables W25, W28, W29, W30, and W43 attached to the attenuator using the 5/16 inch wrench.

2. Remove the ribbon cable (W3) attached to the attenuator.

3. Remove the two screws **(3)** or **(4)** (0515-0372) for each attenuator bracket to remove from the chassis using the T-10 driver.

4. Remove the attenuator from the bracket by removing the two screws (0515-0372).

Figure 18-8   Attenuators Removal - Option 503, 508, & 526
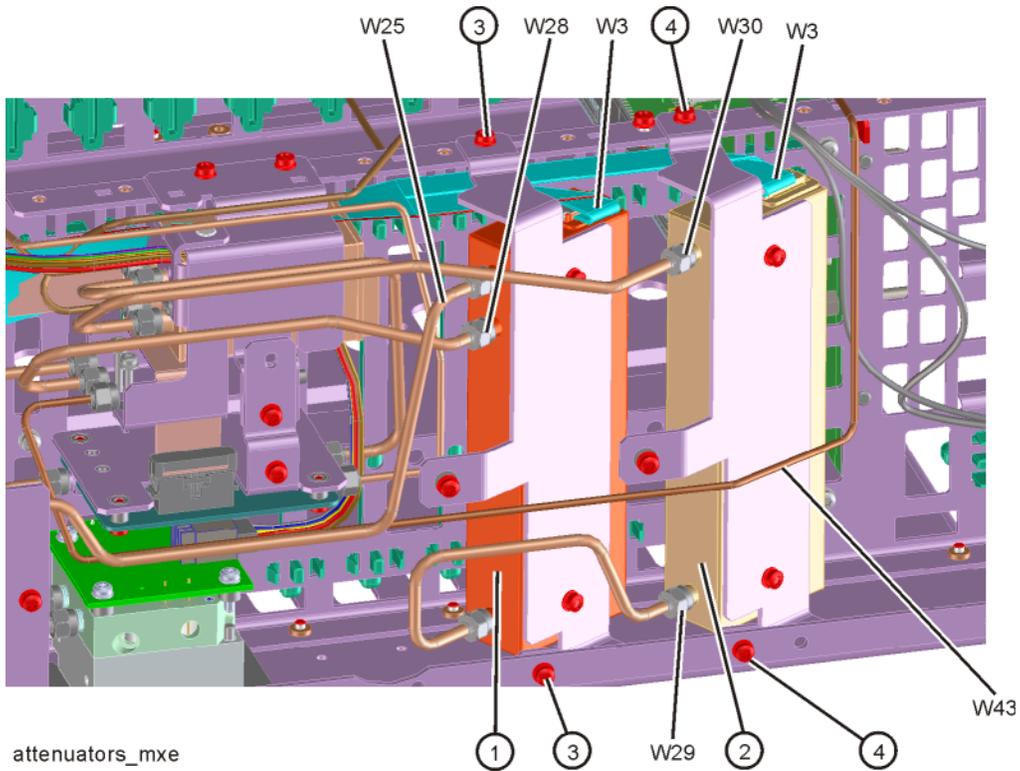
attenuators_mxe

Item	Keysight Part Number
W25	N9038-21302
	N9038-21312 (Option C35)
W28	N9038-21303
W29	N9020-20025
W30	N9038-21314
W43	N9038-21304

Replacement

1. Refer to Figure 18-8. Position the attenuator in the bracket so that the ribbon connector end is "up".

2. Replace the two screws (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.

3. Position the attenuator and bracket into the chassis and attach with the two screws (0515-0372). Torque to 9 inch-pounds.

4. Replace the ribbon cable W3 and semi-rigid cables W25, W28, W29, W30, and W43 to the attenuator. Torque the semi-rigid cables to 10 inch-pounds.

5. Refer to Figure 18-7. Position the Chassis Right Side Outer bracket onto the chassis and replace the eleven screws (0515-0372). Torque to 9 inch-pounds.

6. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

7. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

8. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Switch/High Band Preamp Assembly - Option 503, 508, & 526

Removal

1. Refer to Figure 18-9. Remove the ribbon cable W4.

2. Remove the semi-rigid cables W37, W38, and W39 using the 5/16 inch wrench.

3. Refer to Figure 18-10. Remove the three screws **(2)** (0515-0372) using the T-10 driver. The RF Switch/High Band Preamp assembly **(1)** can now be removed from the chassis.

4. Refer to Figure 18-11. To separate the switch from the bracket, remove the four screws **(3)** (0515-0372) using the T-10 driver.

Figure 18-9   RF Switch/High Band Preamp Assembly Cable Removal - Option 503, 508, & 526
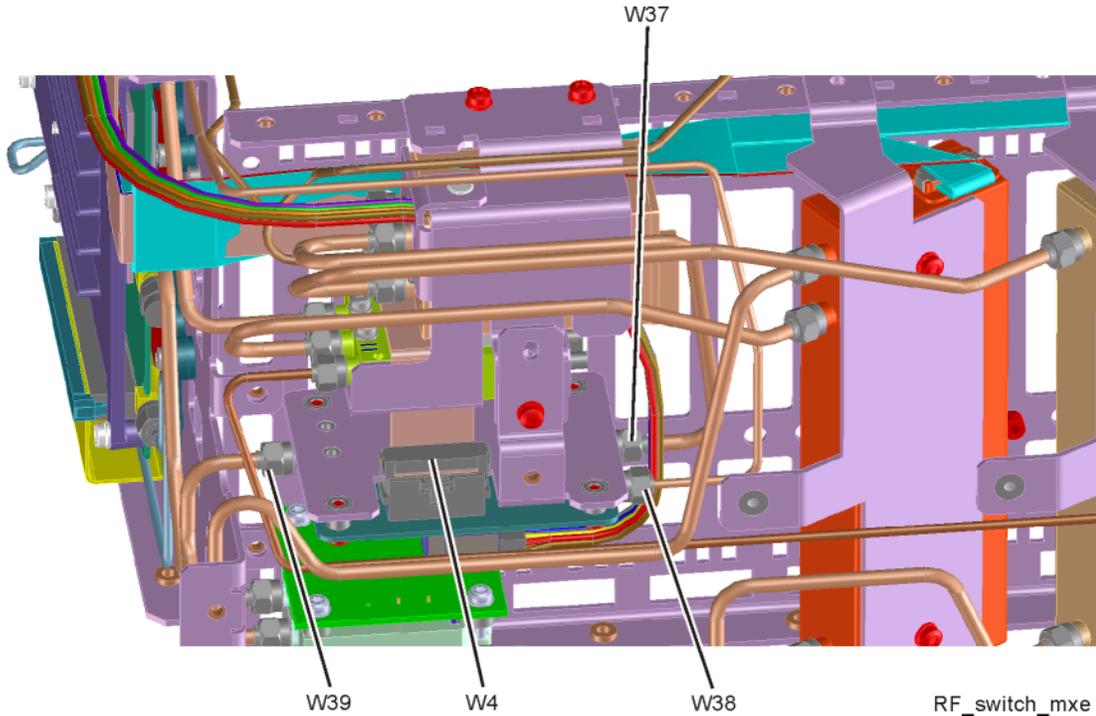
Item	Keysight Part Number
W37	N9038-21315
W38	N9020-20101
W39	N9020-20123

Figure 18-10   RF Switch/High Band Preamp Assembly Bracket Removal –
Option 503, 508, & 526
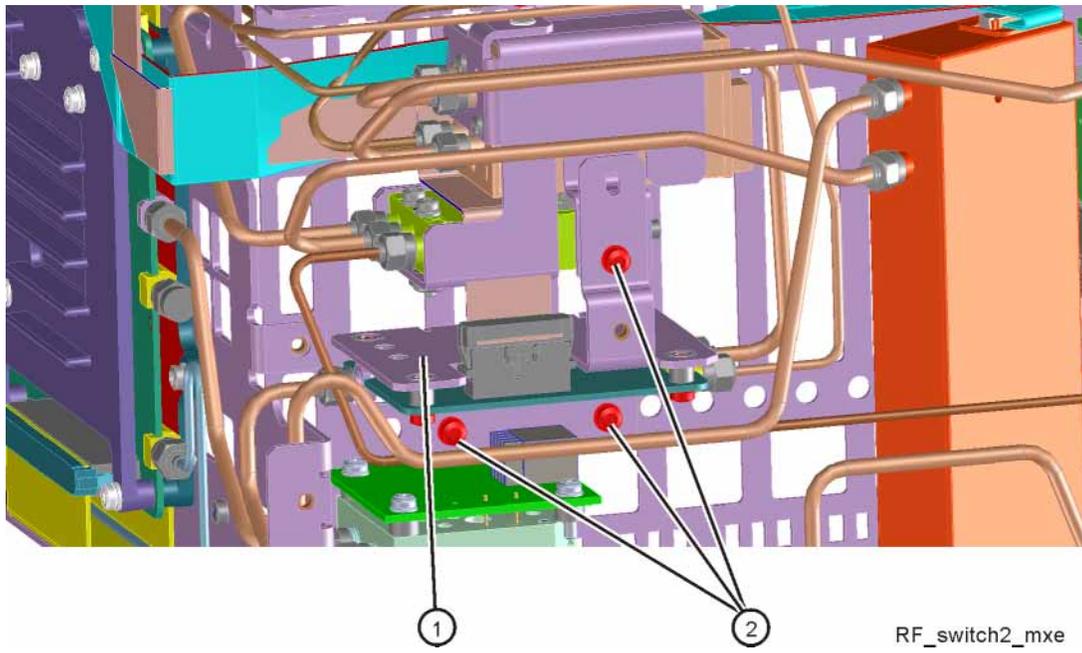
Figure 18-11   RF Switch/High Band Preamp Assembly and Bracket Separation –
Option 503, 508, & 526
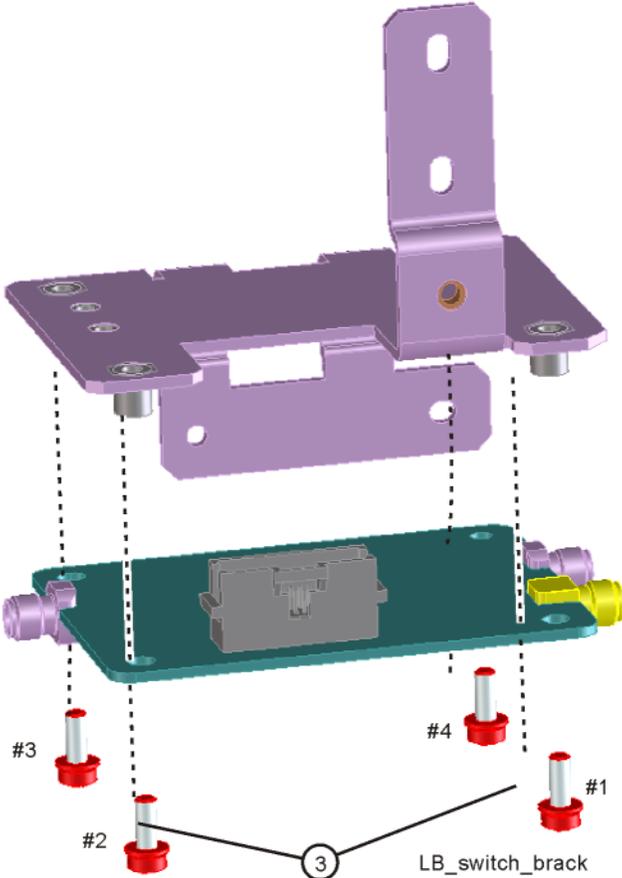
Replacement

1. Refer to Figure 18-11. Place the switch onto the bracket and replace the four screws **(3)** (0515-0372). Torque to 9 inch-pounds in the sequence shown, starting with #1.

2. Place the switch/bracket into place into the chassis and replace the three screws (0515-0372). Torque to 9 inch-pounds starting with the screw closest to the front of the instrument.

3. Refer to Figure 18-9. Replace the semi-rigid cables W37, W38, and W39. Torque to 10 inch-pounds.

4. Replace the ribbon cable W4. Ensure locking tabs on the sides of the connector are engaged.

5. Refer to Figure 18-7. Position the Chassis Right Side Outer bracket onto the chassis and replace the sixteen screws (0515-0372). Torque to 9 inch-pounds.

6. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

7. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

8. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

YTF Preselector - Option 503, 508, & 526

Removal

1. Refer to Figure 18-12. Remove cable W25. Remove cables W39 and W40 from the YTF Preselector **(1)**.

2. Remove W43 from the RF Switch/High Band Preamp assembly.

3. Remove the wire harness W12.

4. Refer to Figure 18-13. From the bottom of the instrument, remove the four screws **(1)** (0515-0372). The YTF Preselector can now be removed from the chassis (may require lifting up slightly on the RF Switch/High Band Preamp assembly).

Figure 18-12   YTF Preselector Removal - Option 503, 508, & 526
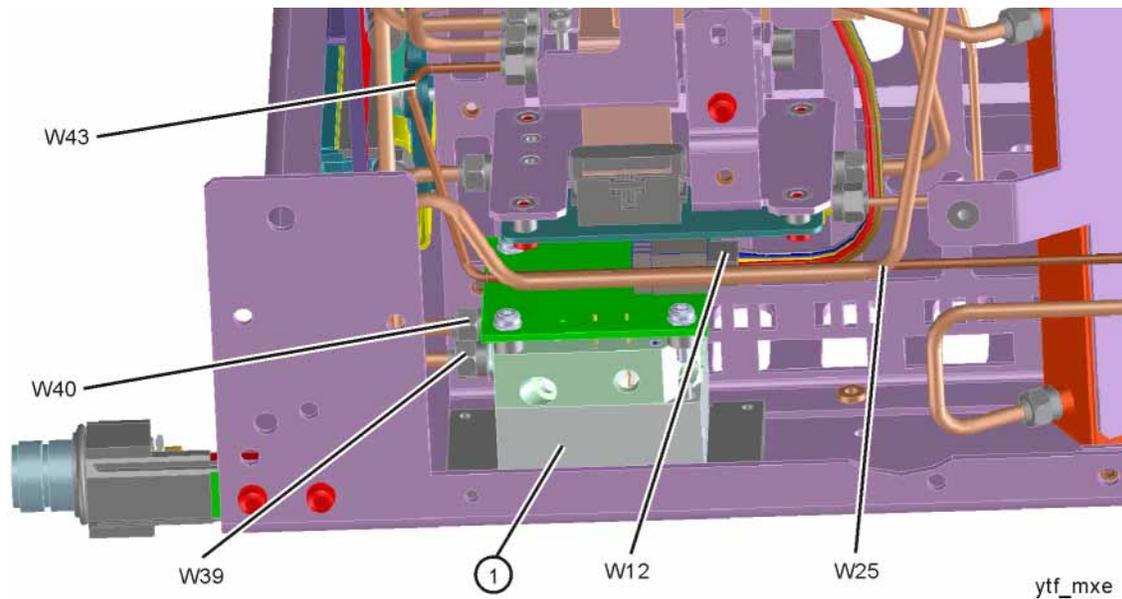
Item	Keysight Part Number
W25	N9038-21302
W39	N9020-20123
W40	N9020-20124
W43	N9038-21304

Figure 18-13   YTF Preselector Screws - Option 503, 508, & 526
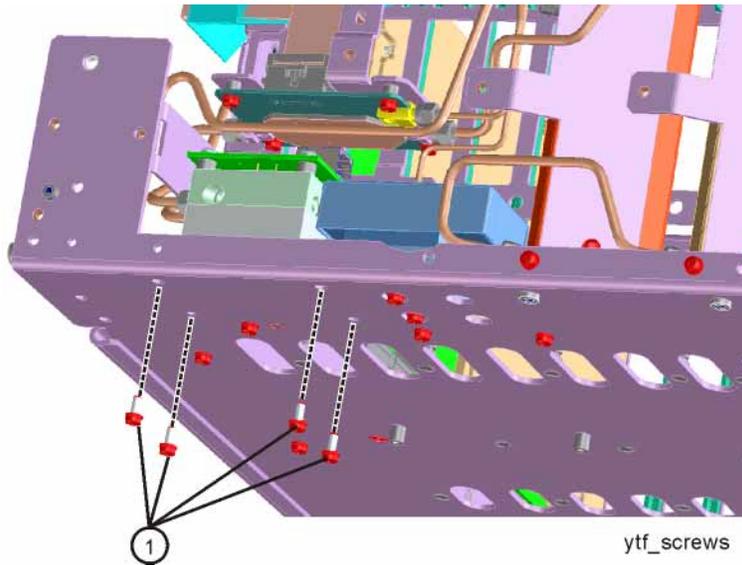
ytf_screws

Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see Figure 18-14, item **(1)**). The gap pad may remain attached to the faulty YTF Preselector.

2. Refer to Figure 18-14. Install the replacement gap pad **(1)** (5022-7179) into the recess in the base of the replacement YTF Preselector **(2)** Refer to A12MP1 in Chapter 17, "Replaceable Parts.". Peel back one corner of the clear plastic backing on the pink side of the gap pad. Remove the blue backing from the other side of the gap pad. Install the gap pad as shown with the pink side exposed. Carefully peel off the clear plastic backing and smooth the gap pad into the recess.

Figure 18-14   Gap Pad Installation

yig_gap_pad
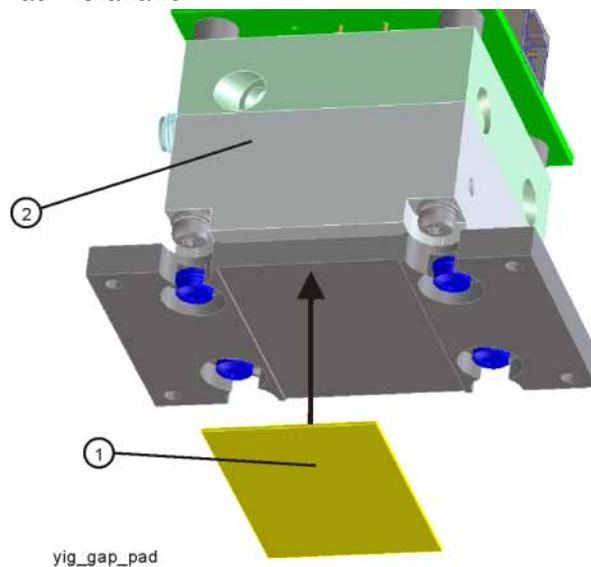
3. Refer to Figure 18-13. Place the YTF Preselector into the chassis with the ports toward the front of the instrument. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.

4. Figure 18-12. Replace the cables W25, W39, W40, and W43. Torque to 10 inch-pounds.

5. Replace the wire harness W12.

6. Refer to Figure 18-7. Position the Chassis Right Side Outer bracket onto the chassis and replace the sixteen screws (0515-0372). Torque to 9 inch-pounds.

7. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

8. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

9. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Cal Switch and Transfer Switch – Option 503, 508, & 526

Removal

1. Refer to Figure 18-15. Remove rigid cables W28, W36, W37, and W43.

Figure 18-15   W28, W36, W37, W43 Cable Removal – Option 503, 508, & 526
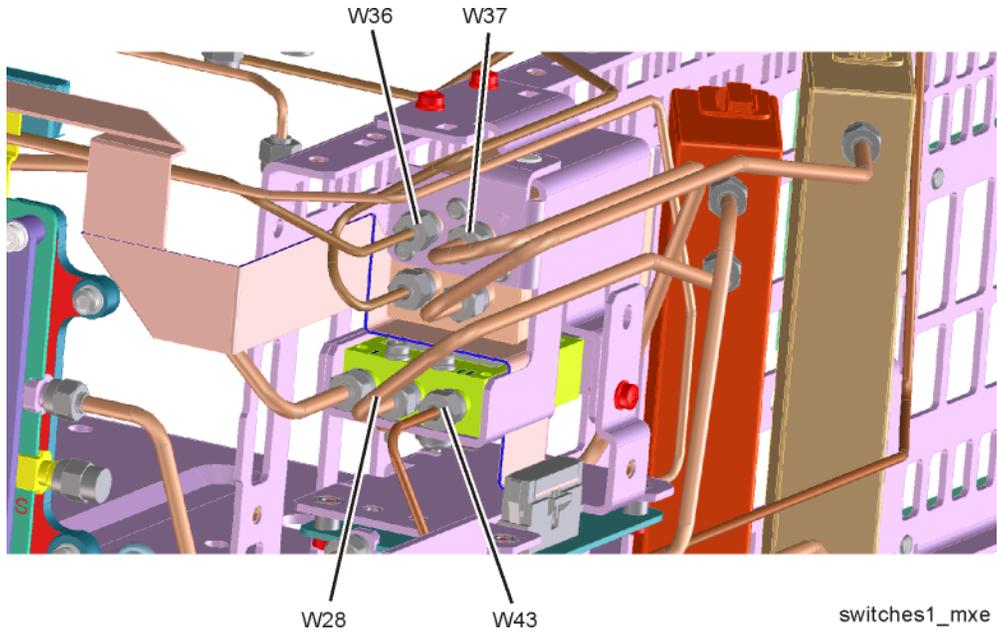
Item	Keysight Part Number
W28	N9038-21303
W36	N9038-21307
W37	N9038-21315
W43	N9038-21304

2. Refer to Figure 18-16. Remove cables W27, W30, and W31.

Figure 18-16   W27, W30, and W31 Cables Removal - Option 503, 508, & 526
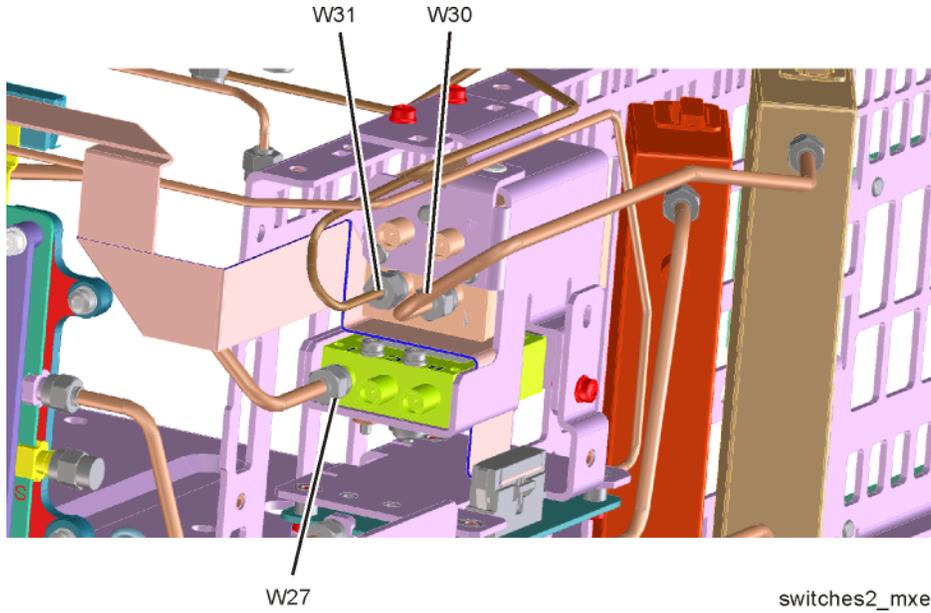
Item	Keysight Part Number
W27	N9038-21301
W30	N9038-21314
W31	N9038-21305

3. Refer to Figure 18-17. Remove the three screws **(1)** and remove the switch/bracket assembly from the chassis. Remove the ribbon cables from the switches.

Figure 18-17 Switches/Bracket Removal - Option 503, 508, & 526

switches3_mxe
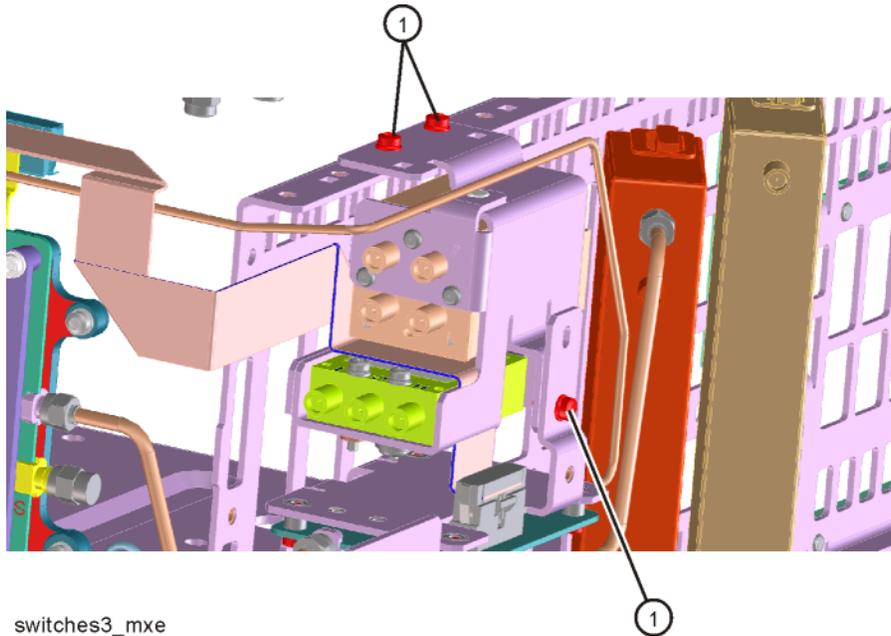
4. To separate the Cal Switch **(1)** from the bracket **(5)** (N9020-80057), remove the two screws **(2)** (0515-1410).

To separate the Transfer Switch **(3)** from the bracket **(5)**, remove the three screws **(4)** (0515-1940).

Figure 18-18   Bracket Mount to Switch – Option 503, 508, & 526
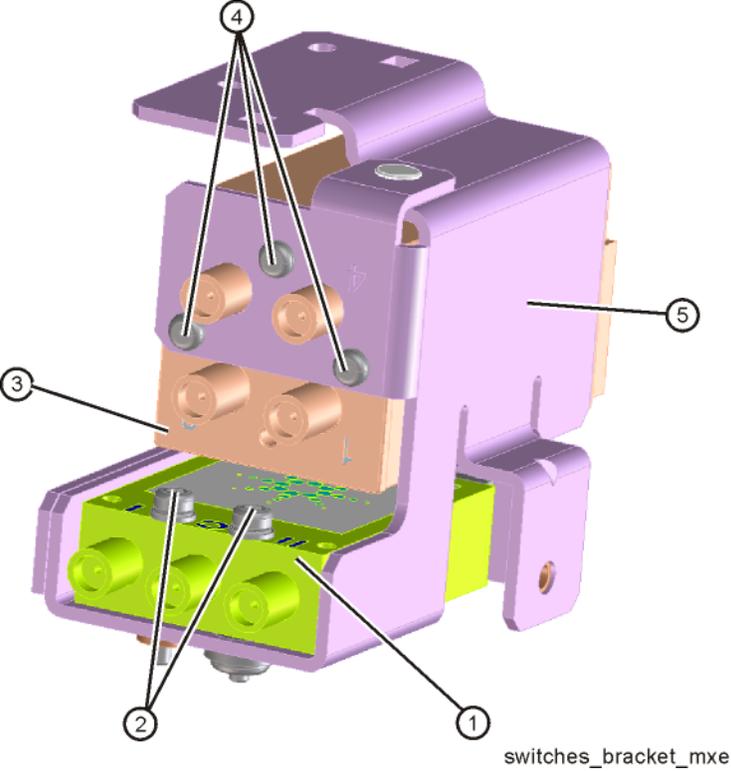
switches_bracket_mxe

Replacement

1. Attach the two ribbon cables to the switches. Torque the SW1 ribbon cable screws to 9 inch-lbs.

2. Refer to Figure 18-19. Place the switch/bracket assembly onto the chassis and use the three screws **(1)** to attach the bracket to the chassis. Torque the screws to 9 inch-lbs.

Figure 18-19   Switches/Bracket Replacement - Option 503, 508, & 526

switches3_mxe
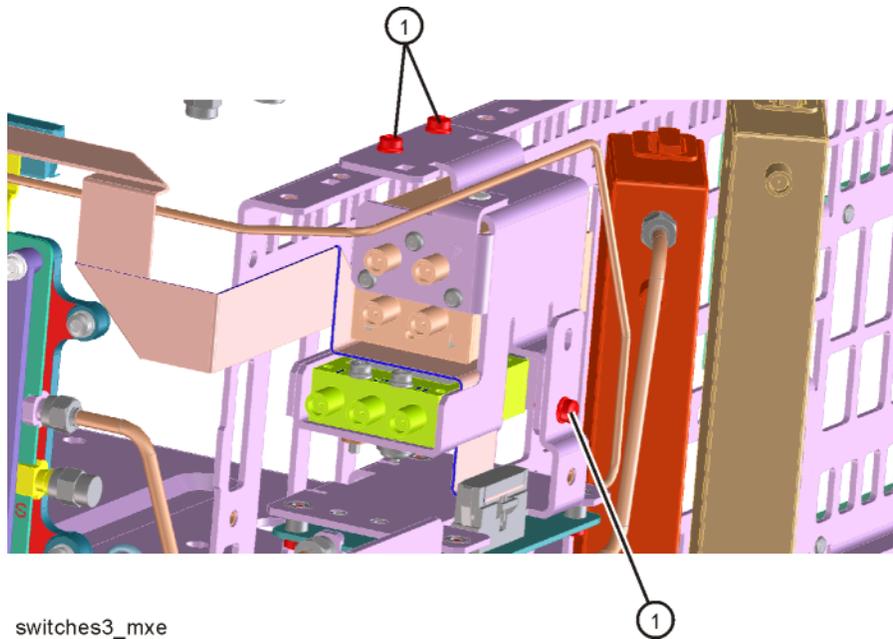
3. Refer to Figure 18-20. Replace cables W27, W30, and W31.Torque to
10 inch-lbs.

Figure 18-20   W27, W30, and W31 Cables Replacement - Option 503, 508, & 526
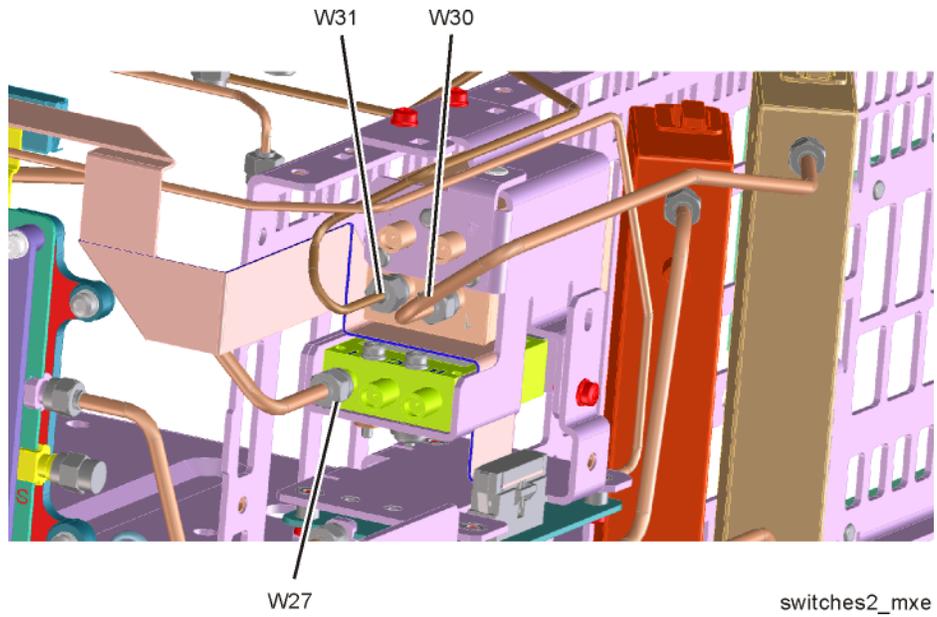
4. Refer to Figure 18-21. Replace cables W28, W36, W37, and W43.Torque to 10 inch-lbs.

Figure 18-21 W28, W36, W37, W43 Cable Removal - Option 503, 508, & 526
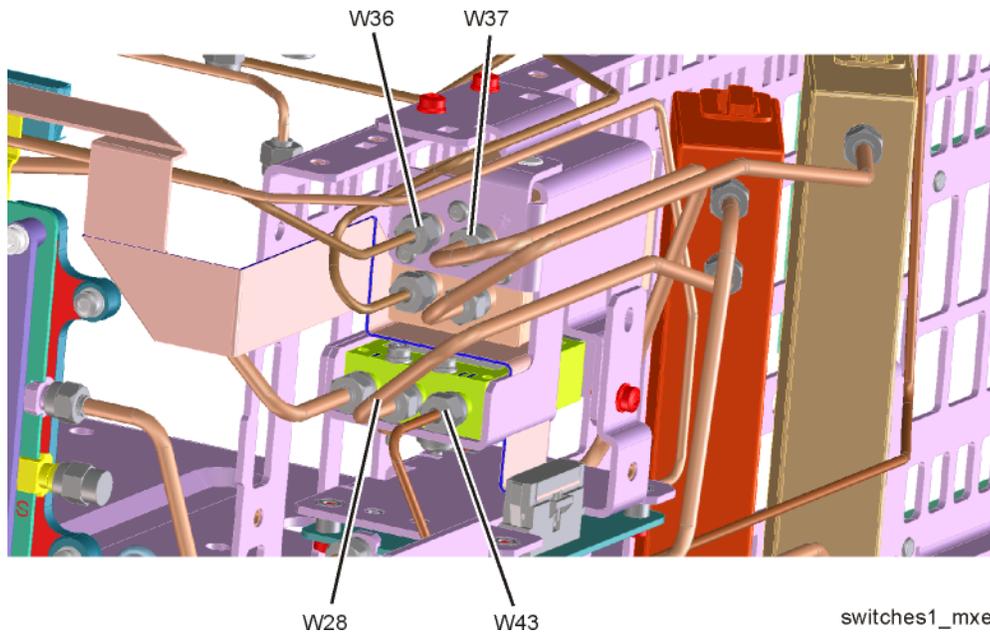
5. Refer to Figure 18-7. Position the Chassis Right Side Outer bracket onto the chassis and replace the sixteen screws (0515-0372). Torque to 9 inch-pounds.

6. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

7. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

8. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Area – Option 544

Refer to Figure 18-22 and Figure 18-23. The RF area consists of A9 Attenuator A, A10 Attenuator B, A11 RF Switch/High Band Preamp assembly, A12 YTF, SW1 Cal Switch, and SW2 Transfer Switch.

Figure 18-22   RF Area Components and Cables - Option 544
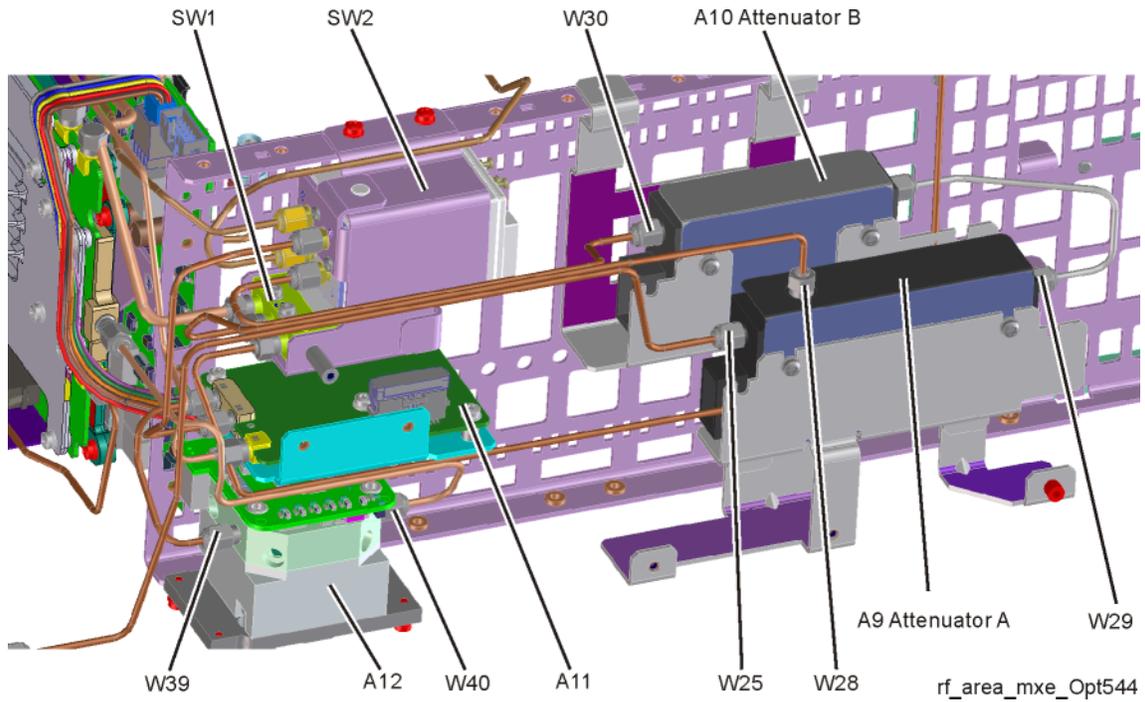
Figure 18-23   RF Area Cables - Option 544
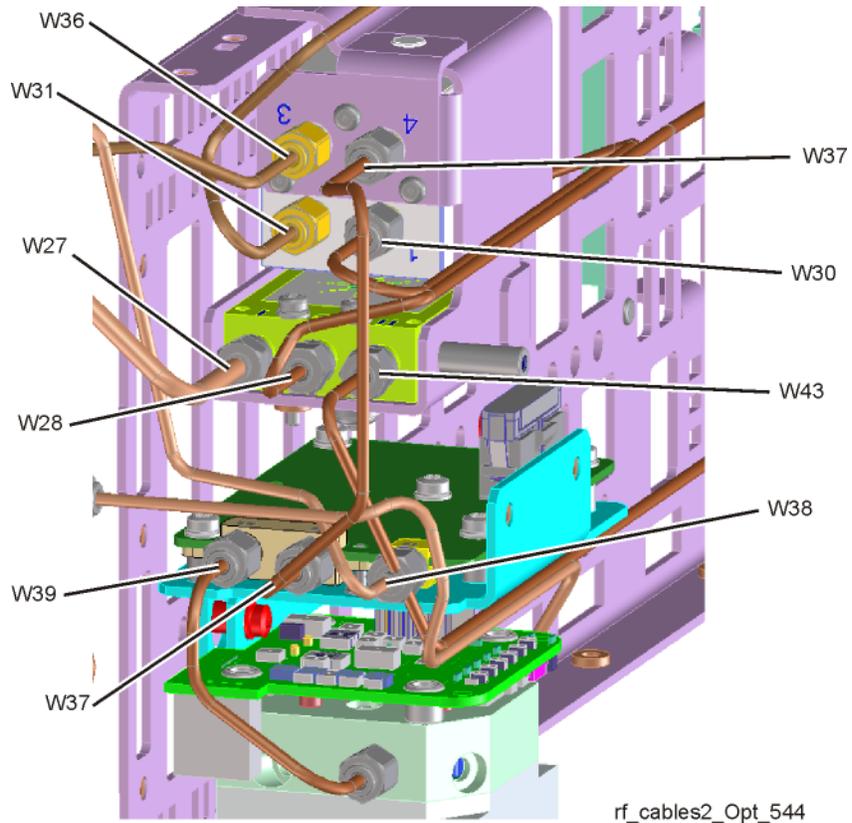
rf_cables2_Opt_544

To gain access to the attenuators, RF Switch/High Band Preamp assembly, or YTF for removal, follow these steps:

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the front panel. Refer to the Front Frame Assembly removal procedure.

3. Remove the top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

4. Refer to Figure 18-24. Remove the Chassis Right Side Outer bracket **(1)** by removing the eleven screws **(2)** (0515-0372) using the T-10 driver.

Figure 18-24   Chassis Right Side Outer - Option 544

chassis_side_mxe544
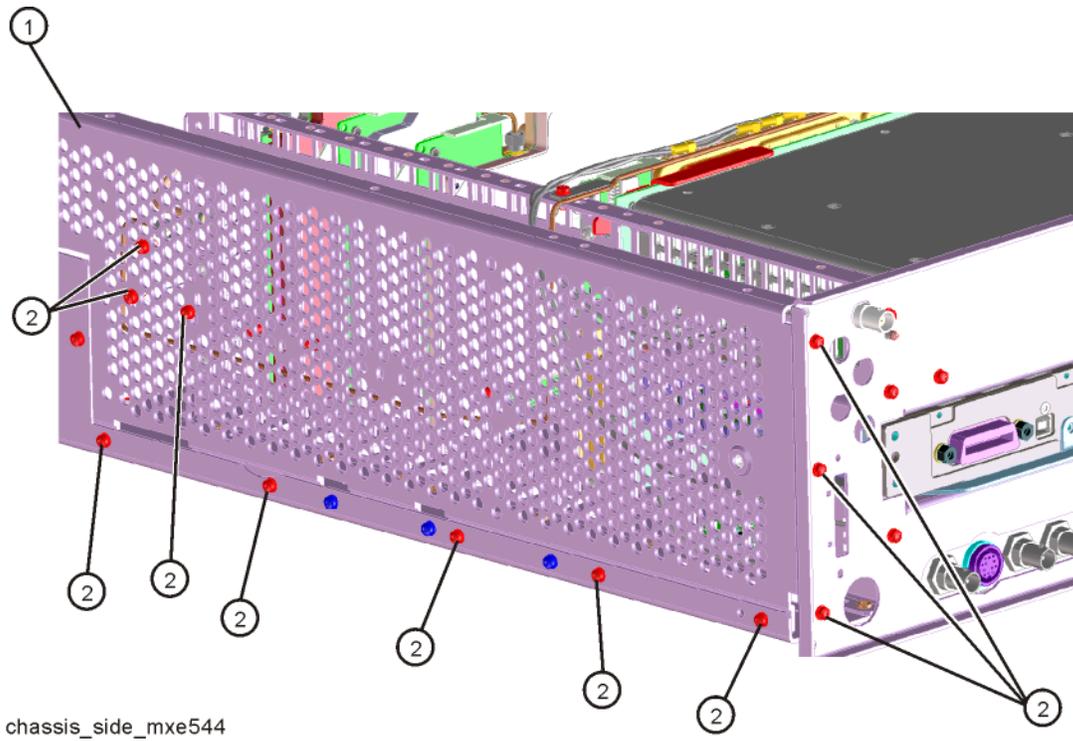
Attenuators – Option 544

Removal

1. Refer to Figure 18-25. To remove Attenuator A **(1)** or Attenuator B **(2)**, remove the semi-rigid cables W25, W28, W29, and W30 attached to the attenuator using the 5/16 inch wrench.

2. Remove the ribbon cable (W3) attached to the attenuator.

3. To remove just the attenuator, remove the two screws **(3)** for each attenuator. The attenuator can now be removed from the instrument.

4. To remove the attenuator bracket, remove the four screws **(4)** (0515-0372). The attenuator bracket can now be removed from the chassis.

Figure 18-25   Attenuators Removal - Option 544
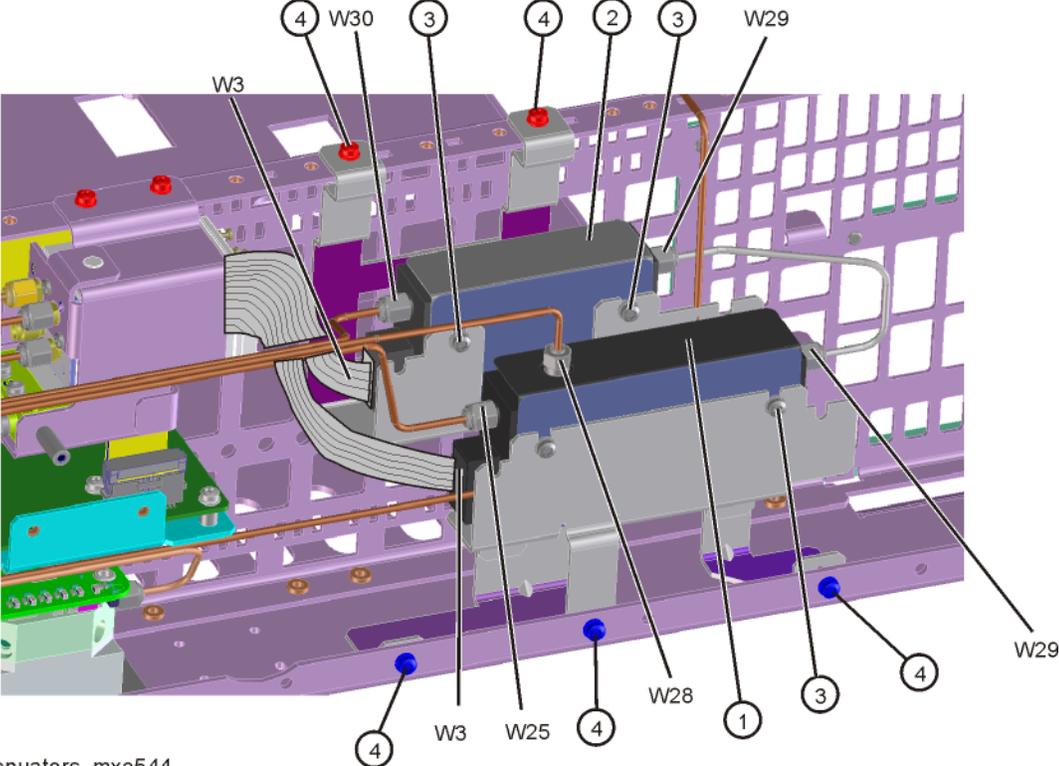
attenuators_mxe544

Item	Keysight Part Number
W25	N9038–21331
W28	N9038–21332
W29	N9038–21337
W30	N9038–21333

Replacement

1. Refer to Figure 18-25. If the attenuator bracket was removed, position it back into the chassis and replace the four screws **(4)** to attach it to the chassis.Torque to 9 inch-pounds.

2. Position the attenuator in the bracket so that the ribbon connector end is toward the front of the instrument.

3. Replace the two screws **(3)** (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.

4. Replace the ribbon cable W3 and semi-rigid cables W25, W28, W29, and W30 to the attenuator. Torque the semi-rigid cables to 10 inch-pounds.

5. Refer to Figure 18-24. Position the Chassis Right Side Outer bracket onto the chassis and replace the eleven screws (0515-0372). Torque to 9 inch-pounds.

6. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

7. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

8. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Switch/High Band Preamp Assembly - Option 544

Removal

1. Refer to Figure 18-26. Remove the ribbon cable W4.

2. Remove the semi-rigid cables W37, W38, and W39 using the 5/16 inch wrench.

3. Refer to Figure 18-27. Remove the two screws **(2)** (0515-0372) using the T-10 driver. The RF Switch/High Band Preamp assembly **(1)** can now be removed from the chassis.

4. Refer to Figure 18-28. To separate the switch from the bracket, remove the five screws **(3)** (0515-0372) using the T-10 driver.

Figure 18-26   RF Switch/High Band Preamp Assembly Cable Removal - Option 544

rfsw_preamp_mxe544
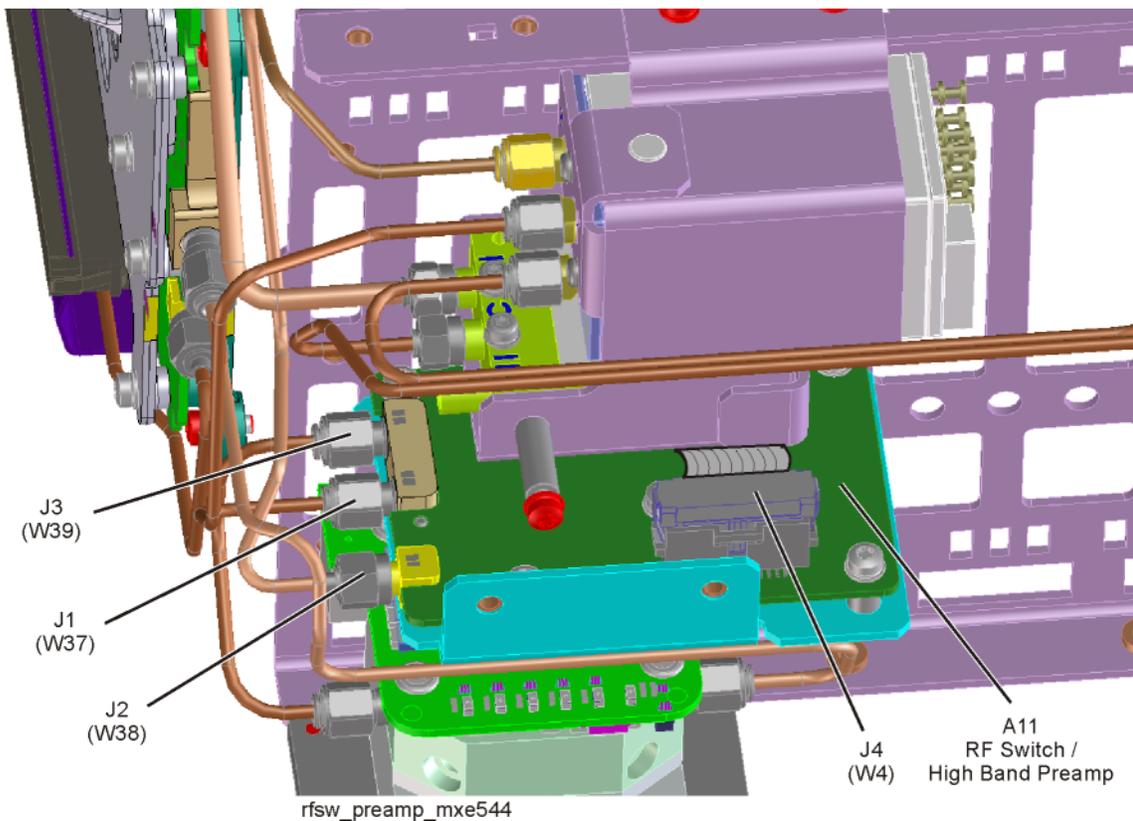
Item	Keysight Part Number
W37	N9038-21336
W38	N9038-21339
W39	N9010-20005

Figure 18-27   RF Switch/High Band Preamp Assembly Bracket Removal - Option 544

RF_switch2_mxe544
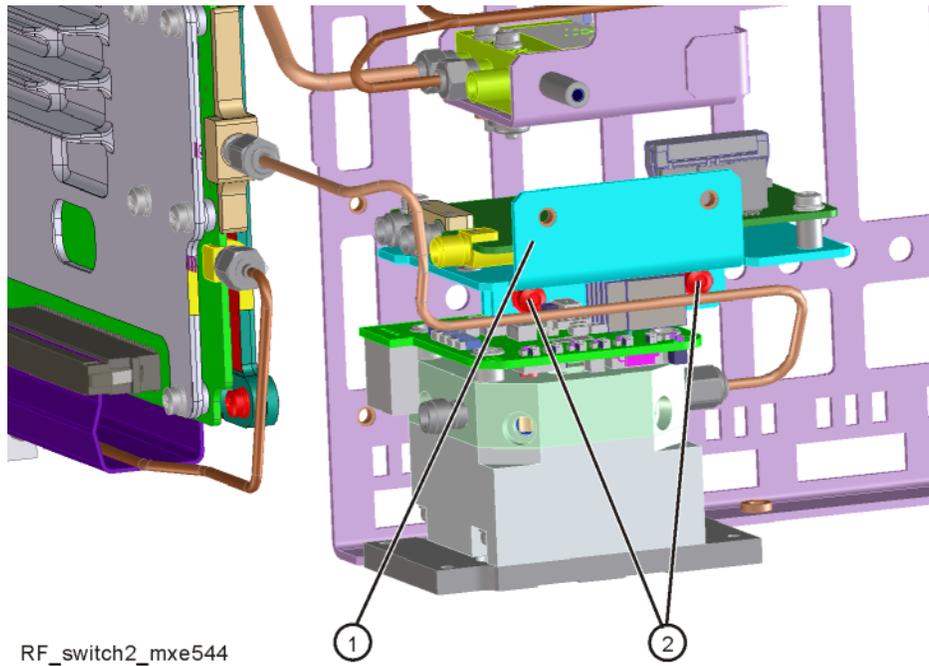
Figure 18-28   RF Switch/High Band Preamp Assembly and Bracket Separation - Option 544
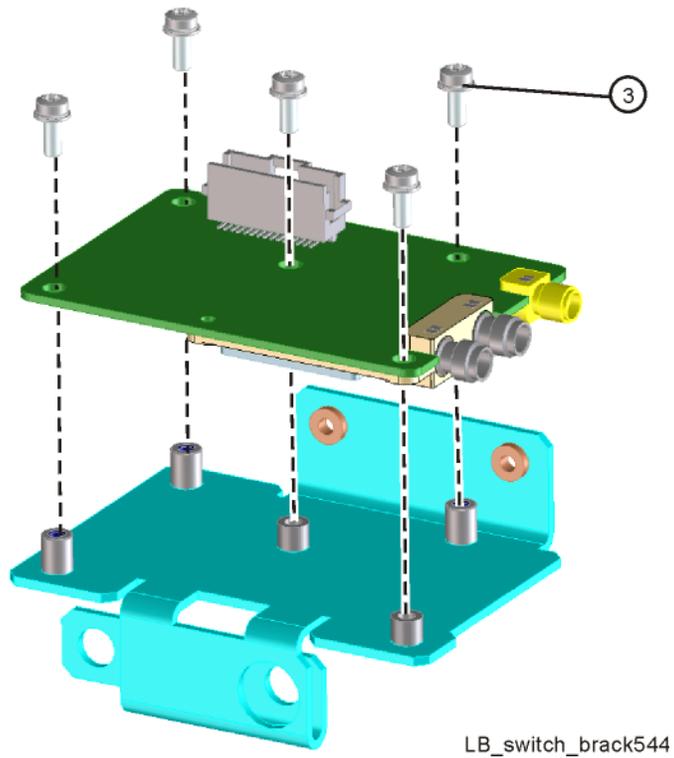
LB_switch_brack544

Replacement

1. Refer to Figure 18-28. Place the switch onto the bracket and replace the five screws **(3)** (0515-0372). Torque to 9 inch-pounds.

2. Refer to Figure 18-27. Place the switch/bracket into place into the chassis and replace the two screws (0515-0372). Torque to 9 inch-pounds starting with the screw closest to the front of the instrument.

3. Refer to Figure 18-26. Replace the semi-rigid cables W37, W38, and W39. Torque to 10 inch-pounds.

4. Replace the ribbon cable W4. Ensure locking tabs on the sides of the connector are engaged.

5. Refer to Figure 18-24. Position the Chassis Right Side Outer bracket onto the chassis and replace the sixteen screws (0515-0372). Torque to 9 inch-pounds.

6. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

7. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

8. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

YTF Preselector - Option 544

Removal

1. Refer to Figure 18-29. Remove cables W39 and W40 from the YTF Preselector **(1)**.

2. Remove the wire harness W12.

3. Refer to Figure 18-30. From the bottom of the instrument, remove the four screws **(1)** (0515-0372). The YTF Preselector can now be removed from the chassis (may require lifting up slightly on the RF Switch/High Band Preamp assembly).

Figure 18-29   YTF Preselector Removal - Option 544
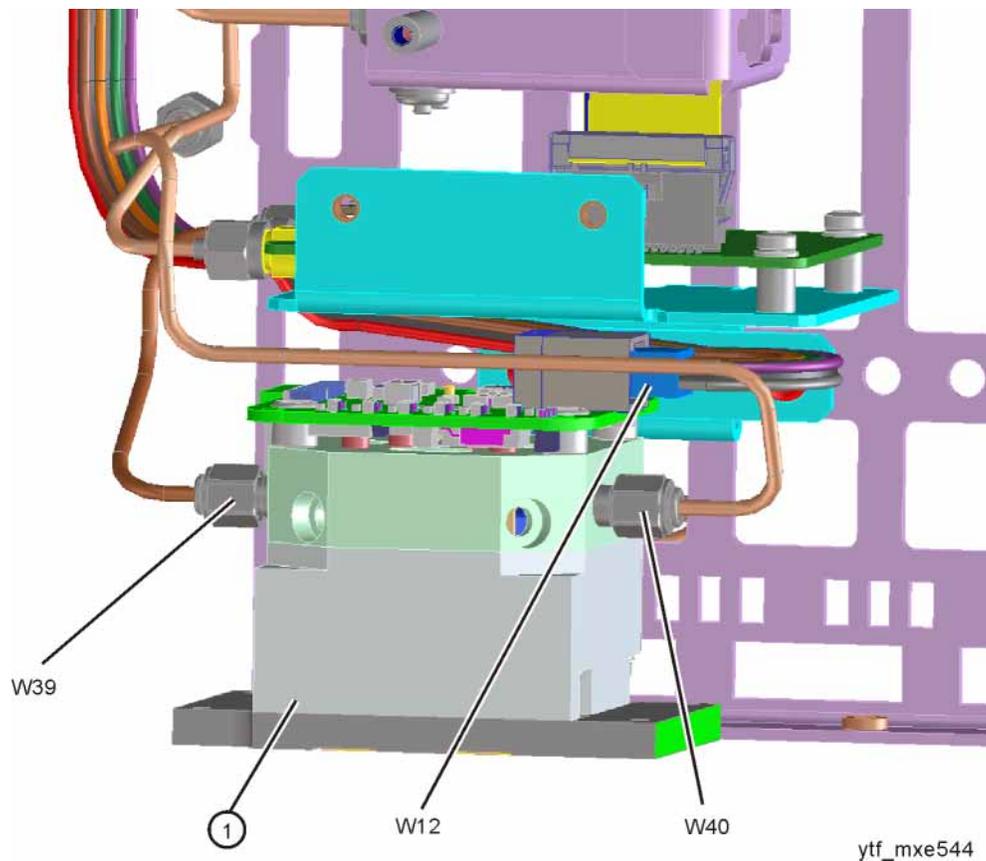
Item	Keysight Part Number
W39	N9010-20005
W40	N9038-21338

Figure 18-30   YTF Preselector Screws
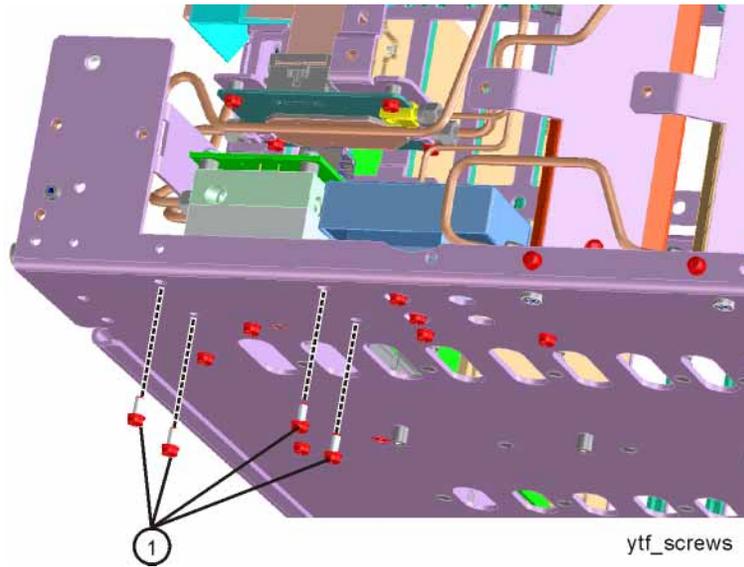
ytf_screws

Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see Figure 18-31, item **(1)**). The gap pad may remain attached to the faulty YTF Preselector.

2. Refer to Figure 18-31. Install the replacement gap pad **(1)** (5022-7179) into the recess in the base of the replacement YTF Preselector **(2)** Refer to A12MP1 in Chapter 17, "Replaceable Parts.". Peel back one corner of the clear plastic backing on the pink side of the gap pad. Remove the blue backing from the other side of the gap pad. Install the gap pad as shown with the pink side exposed. Carefully peel off the clear plastic backing and smooth the gap pad into the recess.

Figure 18-31   Gap Pad Installation

yig_gap_pad544
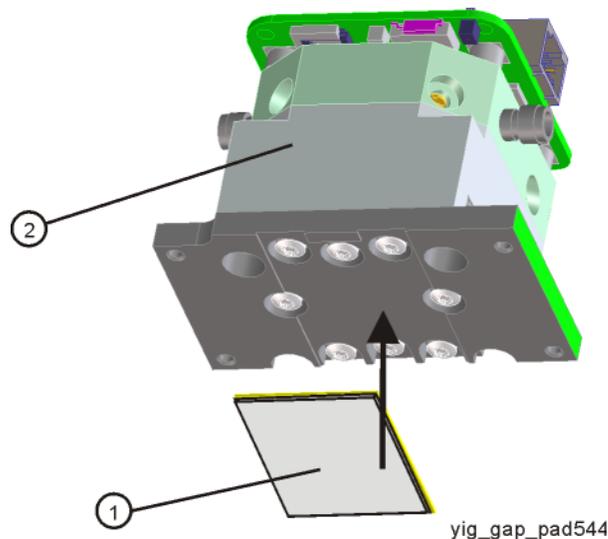
3. Refer to Figure 18-30. Place the YTF Preselector into the chassis. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.

4. Figure 18-29. Replace the cables W39 and W40. Torque to 10 inch-pounds.

5. Replace the wire harness W12.

6. Refer to Figure 18-24. Position the Chassis Right Side Outer bracket onto the chassis and replace the sixteen screws (0515-0372). Torque to 9 inch-pounds.

7. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

8. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

9. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

Cal Switch and Transfer Switch - Option 544

Removal

1. Refer to Figure 18-32. Remove rigid cables W27, W28, W30, W31, W36, W37, W38, W39, and W43.

Figure 18-32   Cal Switch and Transfer Switch Cables - Option 544

rf_cables2_Opt_544
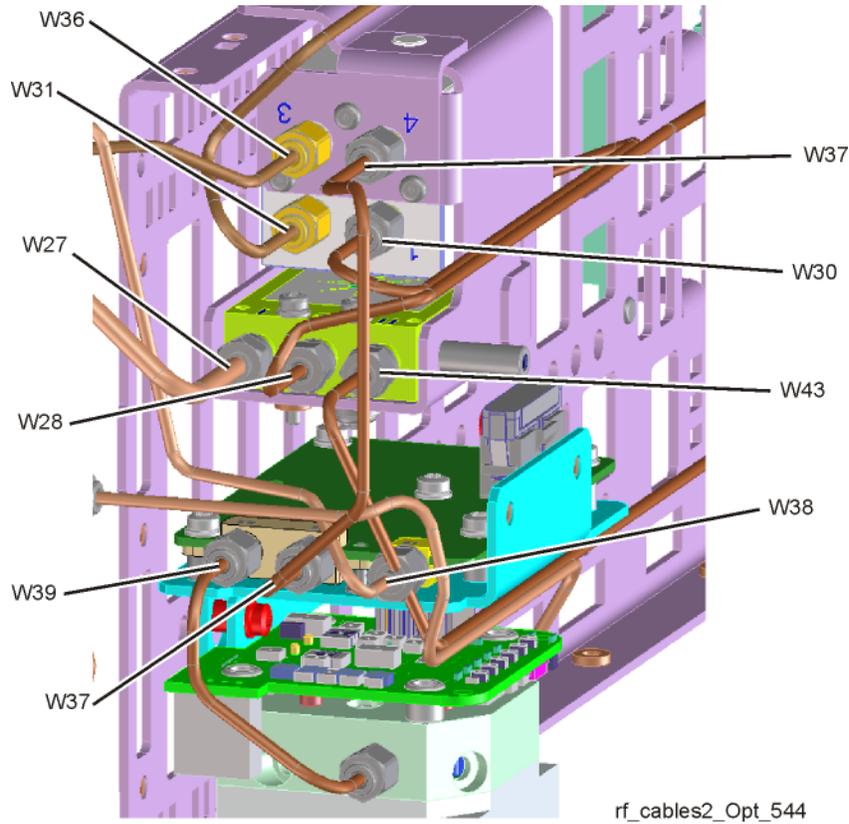
Item	Keysight Part Number
W27	N9038-21301
W28	N9038-21332
W30	N9038-21333
W31	N9038-21334
W36	N9038-21335
W37	N9038-21336
W38	N9038-21339
W39	N9010-20005
W43	N9038-21304

2. Refer to Figure 18-33. Remove the two screws **(1)** and remove the switch/bracket assembly from the chassis. Remove the ribbon cables from the switches.

Figure 18-33   Switches/Bracket Removal - Option 544
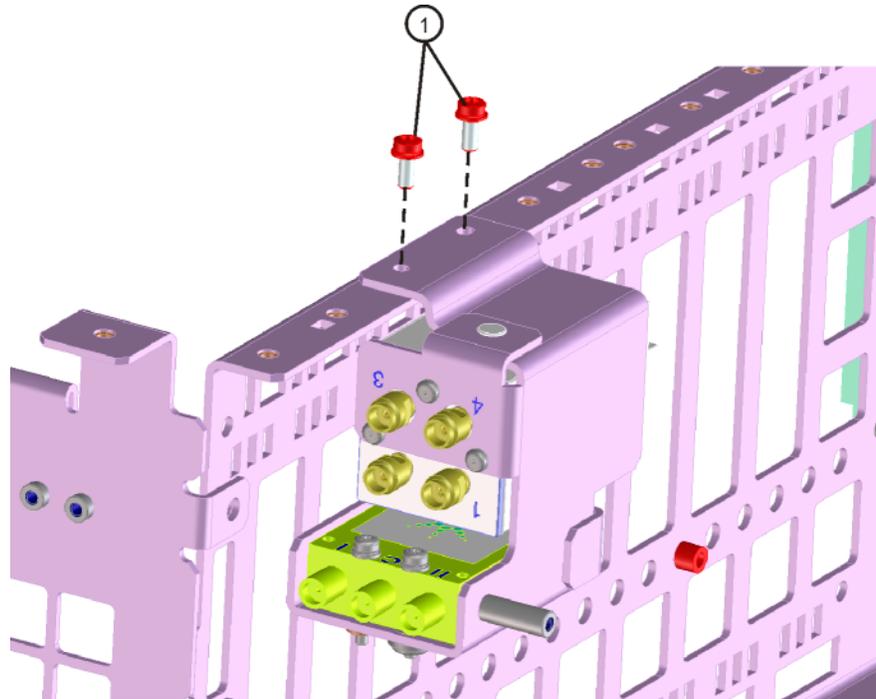
switches3_mxe544

3. To separate the Cal Switch **(1)** from the bracket **(5)** (N9020-80057), remove the two screws **(2)** (0515-1410).

To separate the Transfer Switch **(3)** from the bracket **(5)**, remove the three screws **(4)** (0515-1940).

Figure 18-34   Bracket Mount to Switch - Option 544
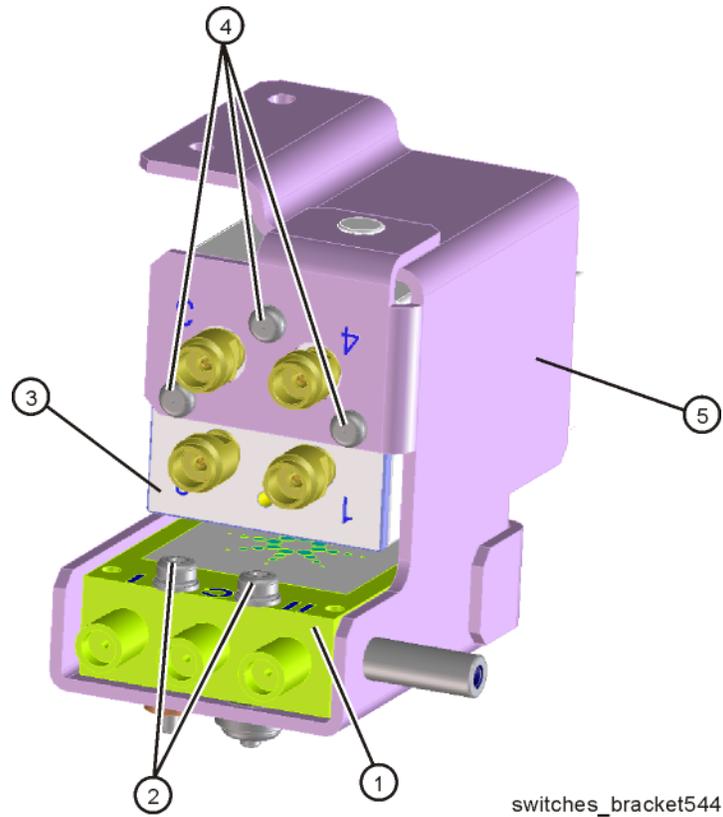
switches_bracket544

Replacement

1. Attach the two ribbon cables to the switches. Torque the SW1 ribbon cable screws to 9 inch-lbs.

2. Refer to Figure 18-33. Place the switch/bracket assembly onto the chassis and use the three screws **(1)** to attach the bracket to the chassis. Torque the screws to 9 inch-lbs.

3. Refer to Figure 18-32. Replace the semi-rigid cables in this order: W39, W31, W36, W38, W27, W30, W28, W37, and W43. Torque all cables to 10 inch-lbs.

4. Refer to Figure 18-24. Position the Chassis Right Side Outer bracket onto the chassis and replace the eleven screws (0515-0372). Torque to 9 inch-pounds.

5. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

6. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

7. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Front End Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the instrument top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

3. Remove the front panel. Refer to the Front Frame Assembly removal procedure.

4. Refer to Figure 18-35 or Figure 18-35. Using the 5/16 inch wrench, remove the cables attached to the RF Front End Assembly, with the exception of A13W1 and A13W2.

5. Remove the W5 ribbon cable from A13J12.

Figure 18-35   RF Front End Assembly Cable Removal – Option 503, 508, & 526
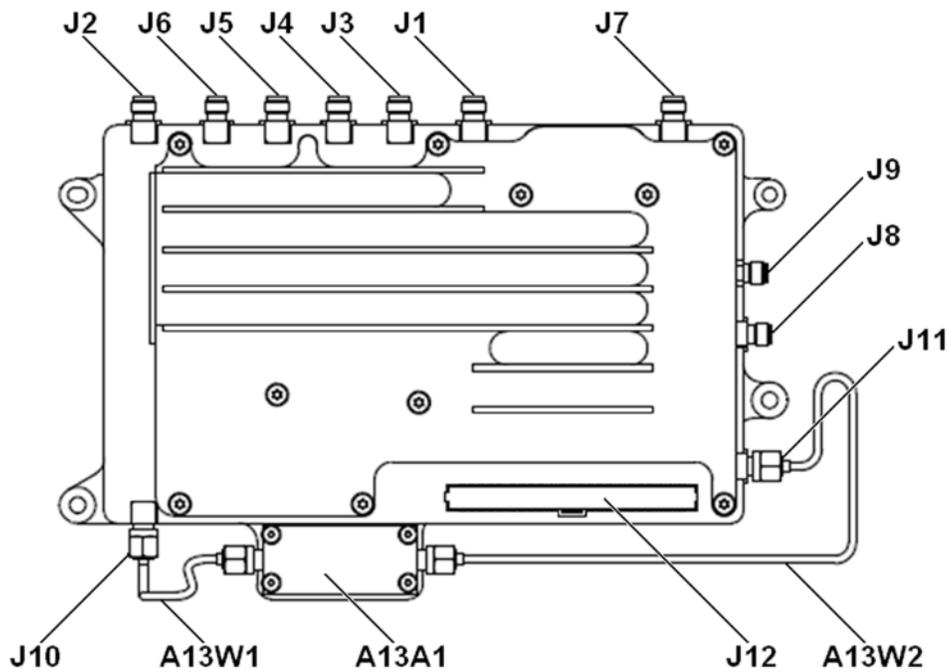
Figure 18-36   RF Front End Assembly Cable Removal – Option 544
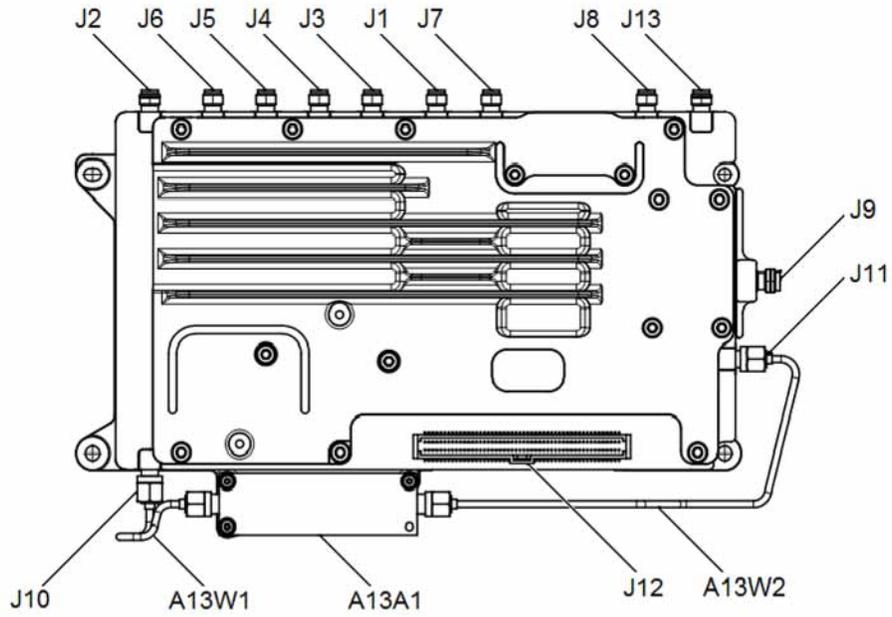
6. Remove the 50 Ω terminators from RF Front End Assembly.

7. Refer to Figure 18-37. Remove the four screws **(1)** (0515-0372) using the T-10 driver. The RF Front End Assembly can now be removed from the chassis.

Figure 18-37   RF Front End Assembly Removal

front_end_remove_mxe
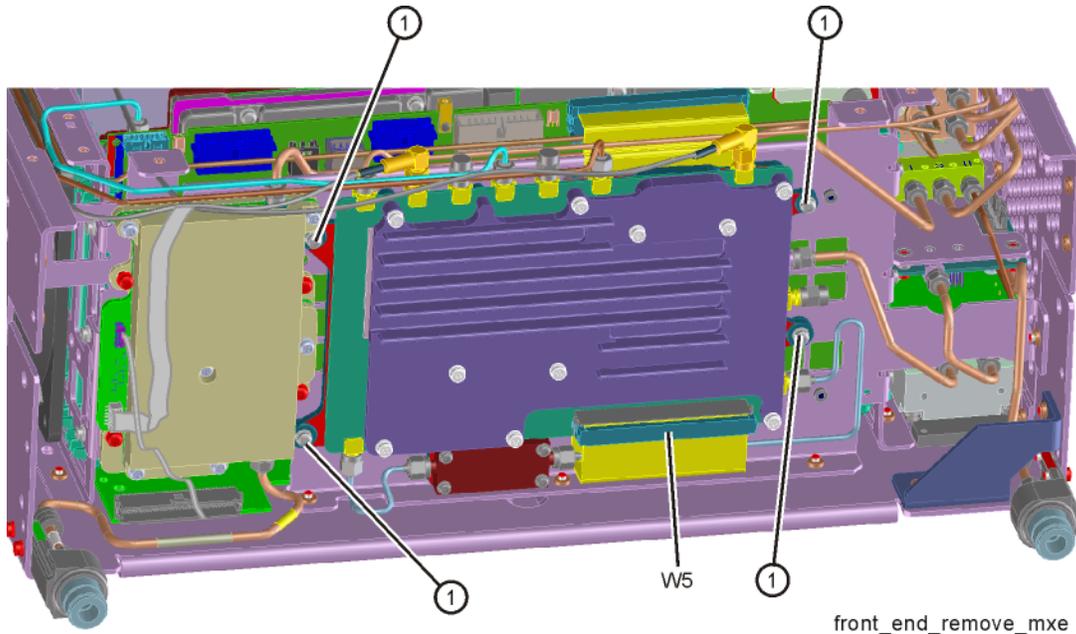
Replacement

1. Refer to Figure 18-37. Attach the W5 ribbon cable to the Front End Assembly first. Route behind the Front End Assembly and ensure the cable is engaged under the tabs, then place the RF Front End Assembly into the chassis. If you are replacing the Front End Assembly make sure to reinstall the 50 ohm loads onto A13J3, A13J5, and A13J8. Torque to 10 inch-pounds.

2. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.

3. Reattach the cables to A13J1, A13J2, A13J4, A13J6, A13J7, A13J9 on the RF Front End Assembly. Torque the semi-rigid cables to 10 inch-pounds.

4. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

5. Replace the instrument top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

6. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Limiter Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the instrument top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

3. Remove the front panel. Refer to the Front Frame Assembly removal procedure.

4. Refer to Figure 18-38. Using the 5/16 inch wrench, remove the cables W1, W6, W26, and W27 attached to the Limiter Assembly.

5. Remove the four screws **(1)** (0515-0372) using the T-10 driver. The Limiter Assembly can now be removed from the chassis.

Figure 18-38   Limiter Assembly Cable Removal
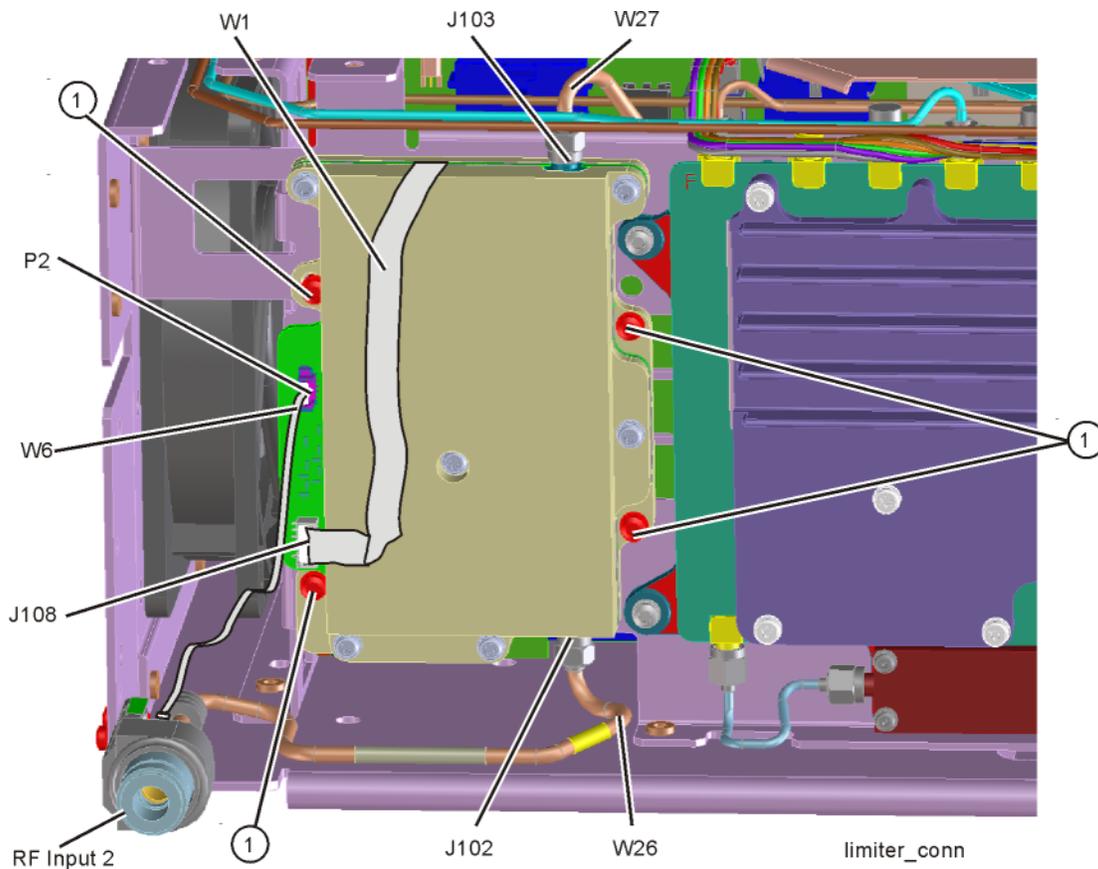
Replacement

1. Refer to Figure 18-38. Place the Limiter Assembly into the chassis. Replace the four screws **(1)** (0515-0372) using the T-10 driver. Torque to 9 inch-pounds.

2. Reattach the cables W1, W6, W26, and W27 to the Limiter Assembly. Torque the semi-rigid cables to 10 inch-pounds.

3. Replace the front panel. Refer to the Front Frame Assembly replacement procedure.

4. Replace the instrument top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

5. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Front End Control Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the instrument top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the Front End Control assembly **(1)**.

Figure 18-39   Assembly Locations

assy_locations_mxe
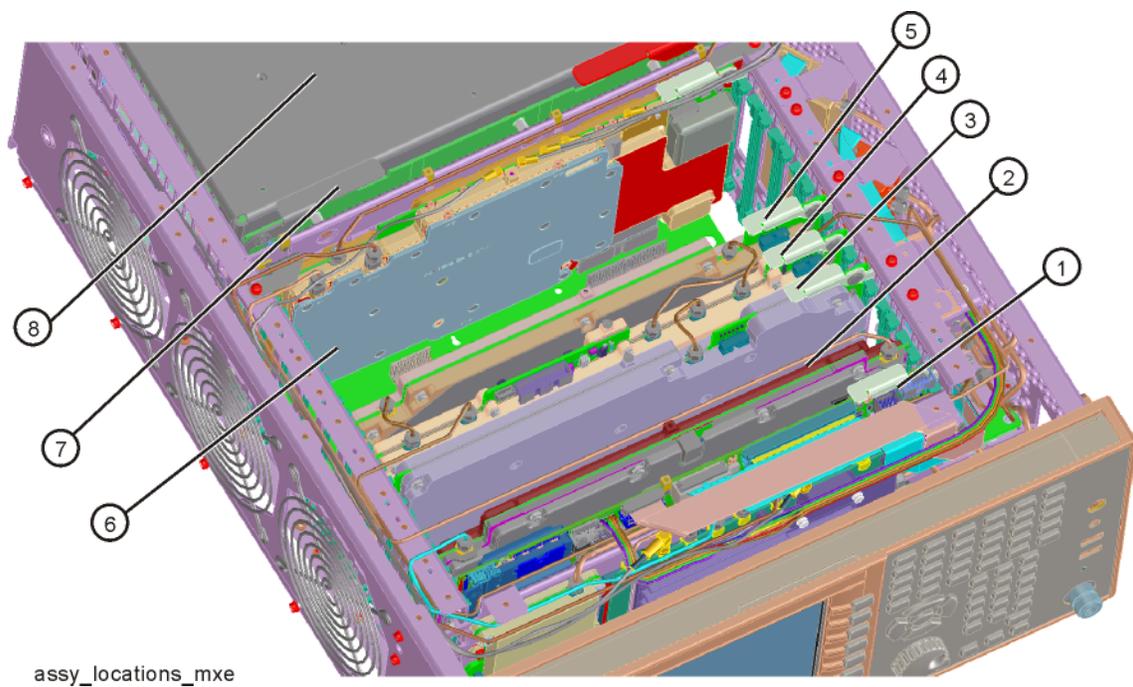
4. Refer to Figure 18-40. Remove the ribbon cables W3, W4, W5, and W12 from the Front End Control assembly **(1)**.

5. Remove the coaxial cables W14, W15, W16, and W22 from the Front End Control Assembly **(1)**.

6. The Front End Control assembly can now be unplugged from the motherboard by using the ejector on the Front End Control assembly to disconnect from the motherboard and lift out of the chassis.

Figure 18-40   Front End Control Cables

frontend_control_enhanced
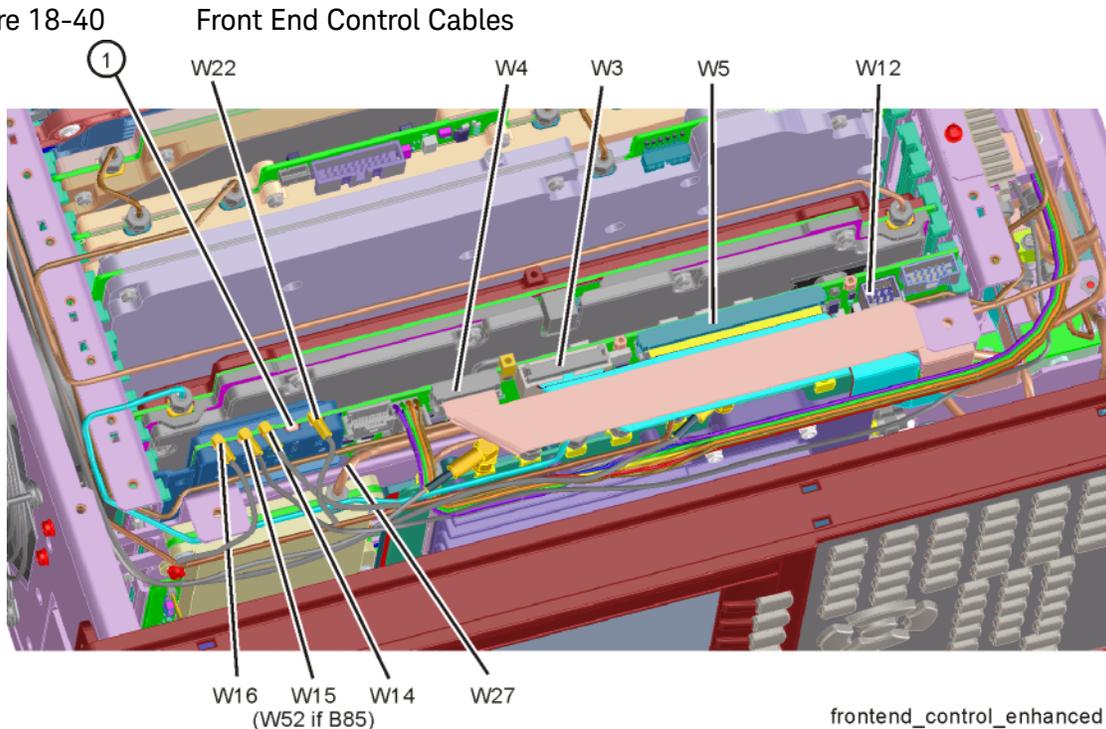
Replacement

1. Refer to Figure 18-40. Install the Front End Control assembly into the correct slot in the chassis. Use the ejector and press down to plug it into the motherboard.

2. Reattach the coaxial cables W14, W15, W16, and W22 to the Front End Control Assembly.

3. Reattach the ribbon cables W3, W4, W5, and W12 to the Front End Control assembly.

4. Replace the instrument top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

5. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

LO Synthesizer Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the instrument top brace. Refer to the Top Brace and Power Supply Bracket removal procedure.

3. Refer to Figure 18-41. Locate the LO Synthesizer assembly **(2)**.

4. Remove the cables W41 and W44 from the LO Synthesizer assembly **(2)** using the 5/16 inch wrench.

5. Pull up on the LO Synthesizer assembly to unplug from the motherboard and lift out of the chassis.

Figure 18-41   LO Synthesizer Assembly Removal
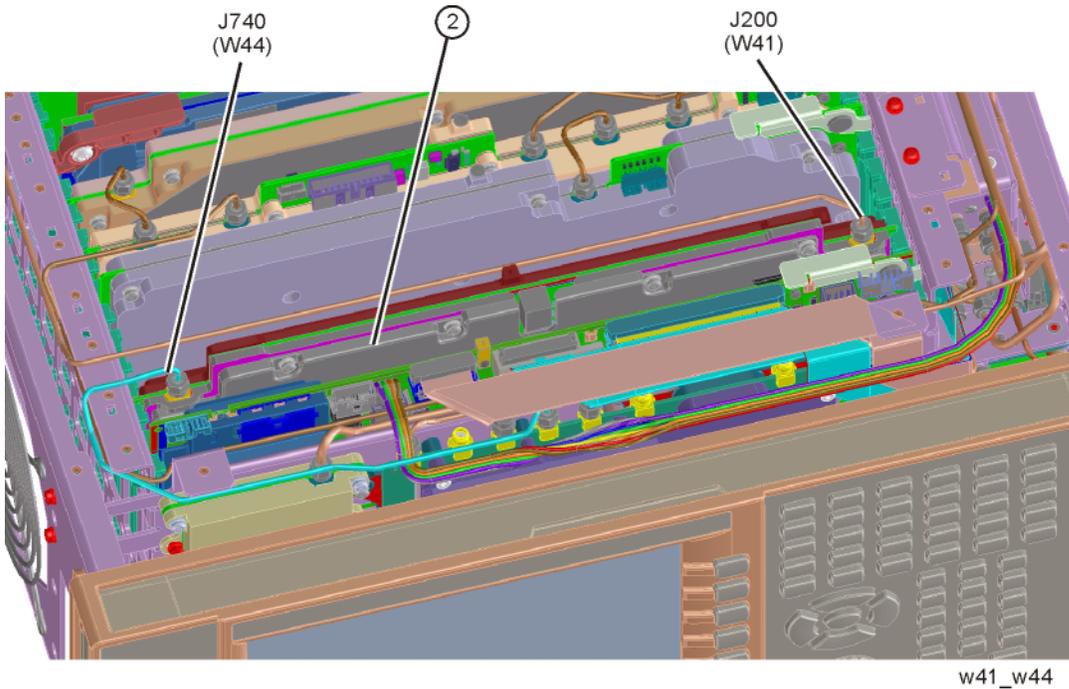
Replacement

1. Refer to Figure 18-41. Install the LO Synthesizer assembly into slot 10 in the chassis and press down to connect to the motherboard.

2. Reattach the cables W41 and W44 to the LO Synthesizer assembly. Torque to 10 inch-pounds.

3. Replace the instrument top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Radiated Filter Assembly

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 and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the Radiated Filter assembly (3).

4. Refer to Figure 18-42. Remove cable W34 using the 5/16-inch wrench.

Figure 18-42   Radiated Filter, RF Preselector Input, and Conducted Filter Cables
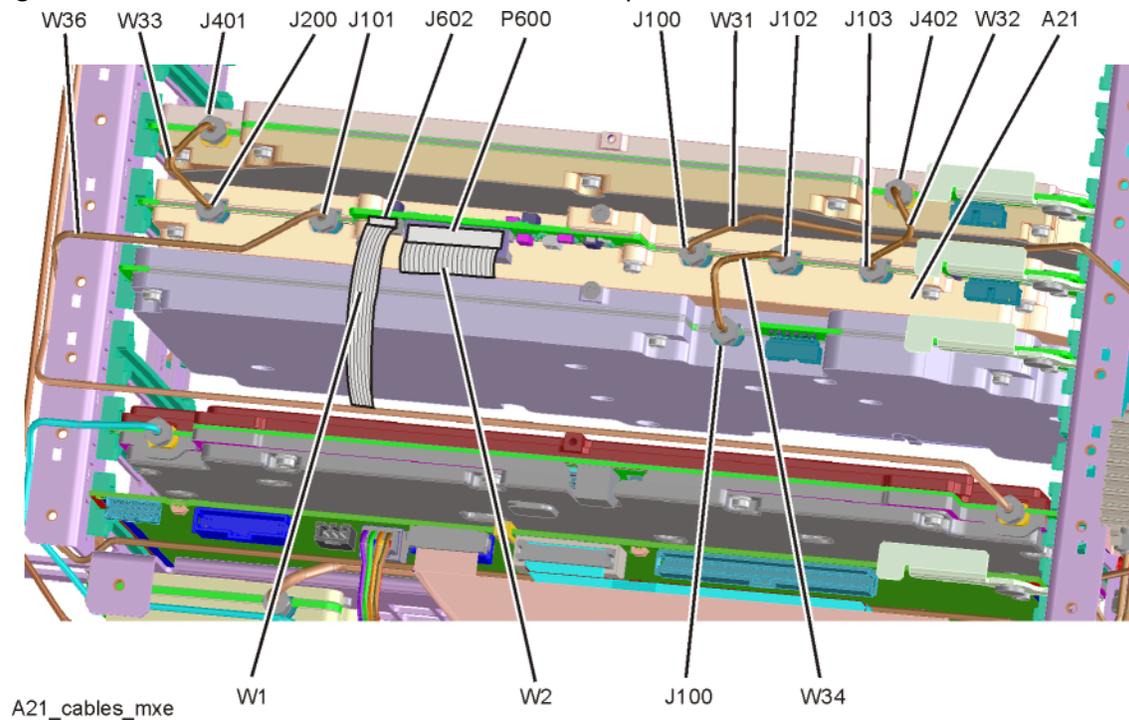
5. The Radiated Filter assembly can now be unplugged from the motherboard by using the ejector on the Radiated Filter assembly to disconnect from the motherboard and lift out of the chassis.

Replacement

1. Slide the Radiated Filter assembly into the chassis and press down to plug it into the motherboard using the ejector to push into place.

2. Refer to Figure 18-42. Replace cable W34. Torque to 10 inch-pounds.

3. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Preselector Input Assembly

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 and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the RF Preselector Input assembly **(4)**.

4. Refer to Figure 18-42. Remove cables W31, W32, W33, W34, and W36 using the 5/16-inch wrench.

5. Remove ribbon cables W1, and W2.

6. The RF Preselector Input assembly can now be unplugged from the motherboard by using the ejector on the RF Preselector Input assembly to disconnect from the motherboard and lift out of the chassis.

Replacement

1. Slide the RF Preselector Input assembly into the chassis and press down to plug it into the motherboard using the ejector to push into place.

2. Refer to Figure 18-42. Replace cables W31, W32, W33, W34, and W36. Torque to 10 inch-pounds.

3. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Conducted Filter Assembly

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 and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the Conducted Filter assembly **(5)**.

4. Refer to Figure 18-42. Remove cables W32 and W33 using the 5/16-inch wrench.

5. The Conducted Filter assembly can now be unplugged from the motherboard by using the ejector on the Conducted Filter assembly to disconnect from the motherboard and lift out of the chassis.

Replacement

1. Slide the Conducted Filter assembly into the chassis and press down to plug it into the motherboard using the ejector to push into place.

2. Refer to Figure 18-42. Replace cables W32 and W33. Torque to 10 inch-pounds.

3. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

LISN Control Assembly

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 and Power Supply Bracket removal procedure.

3. Refer to Figure 18-43. Locate the LISN Control assembly **(2)**.

4. Remove cable W9 from the LISN Control assembly.

5. Using the board extractors, pull up on the LISN Control assembly to unplug from the motherboard and lift out of the chassis.

Figure 18-43   LISN Control Assembly Removal

lisn_remove
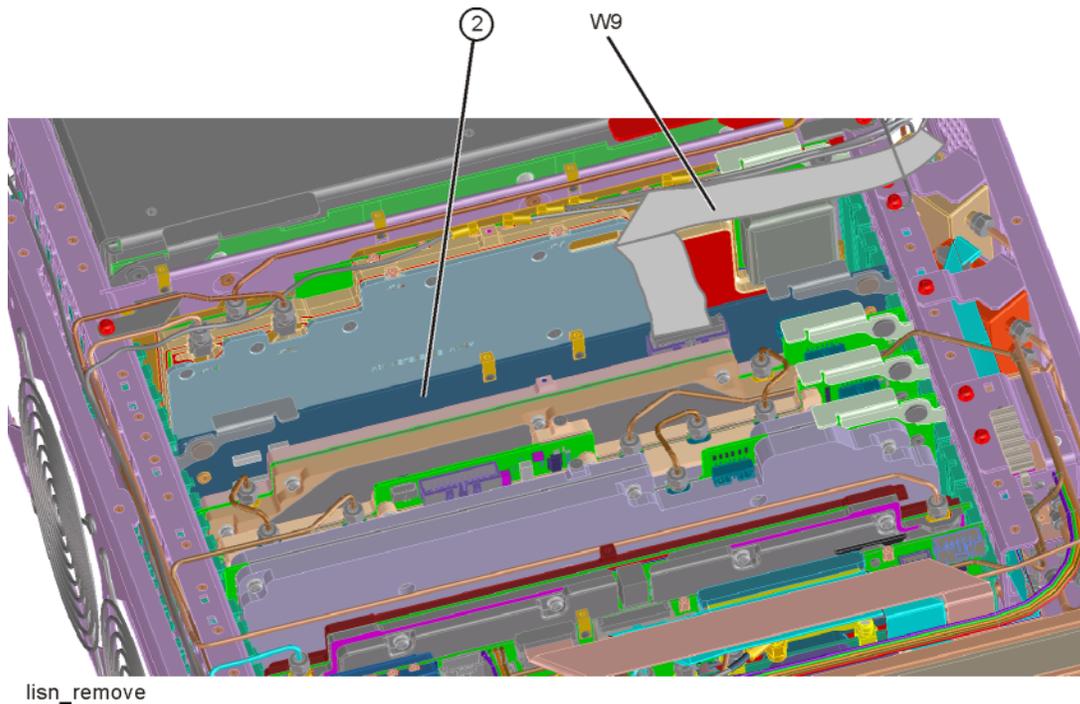
Replacement

1. Refer to Figure 18-43. Lift the board extractors on the LISN Control assembly and insert it into the same slot in the chassis and press down to plug it into the motherboard.

2. Reattach cable W9 to the LISN Control assembly.

3. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Wideband Analog IF and Wideband Digital IF Assemblies

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 and Power Supply Bracket" removal procedure.

3. Refer to Figure 18-44. Locate the A25 Wideband Analog IF and the A26 Digital IF assemblies.

4. Remove cables W15, W23, W50, W51, and W52 from the Wideband Analog IF assembly.

5. Remove ribbon cable W10.

6. The Wideband Analog IF and Wideband Digital IF assemblies can now be removed by pulling up on the ejectors to remove from the chassis.

Figure 18-44   Option B85 Cables
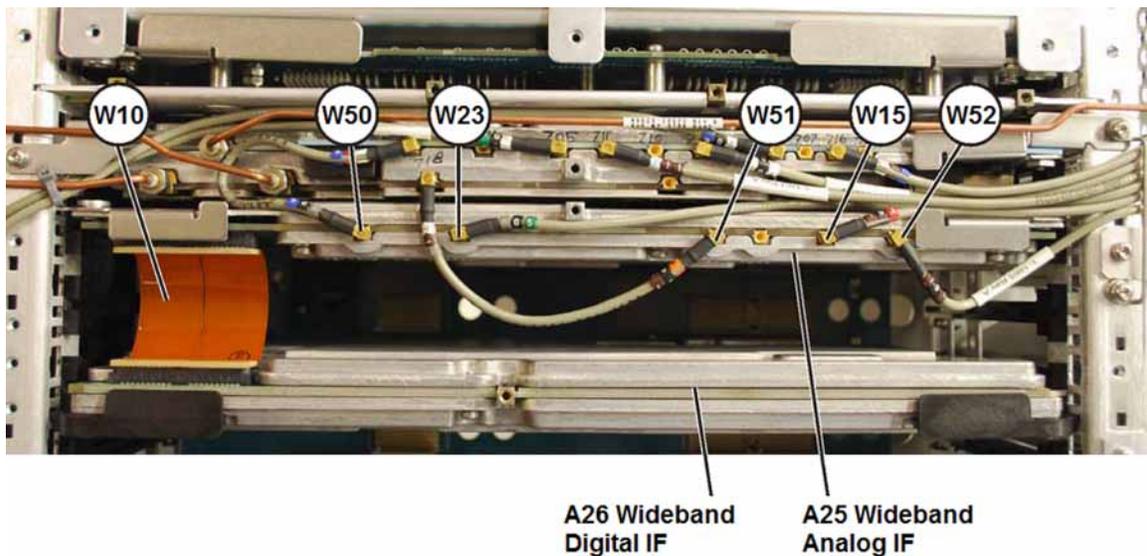
Replacement

1. Slide the Wideband Analog IF assembly into slot 3 in the chassis and use the ejectors to push into place into the motherboard.

2. Slide the Wideband Digital IF assembly into slot 5 in the chassis and use the ejectors to push into place into the motherboard.

3. Refer to Figure 18-44. Reinstall cables W15, W23, W50, W51, and W52 to the Wideband Analog IF assembly.

4. Reattach ribbon cable W10.

5. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

6. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Reference Assembly

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 and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the Reference assembly **(6)**.

4. Refer to Figure 18-45. Remove cables W41, W42, and W43 from the reference assembly using the 5/16-inch wrench.

5. Remove cables W18, W19, W20, W21, and W23 from the Reference assembly **(6)**.

Figure 18-45 Reference Board Cables
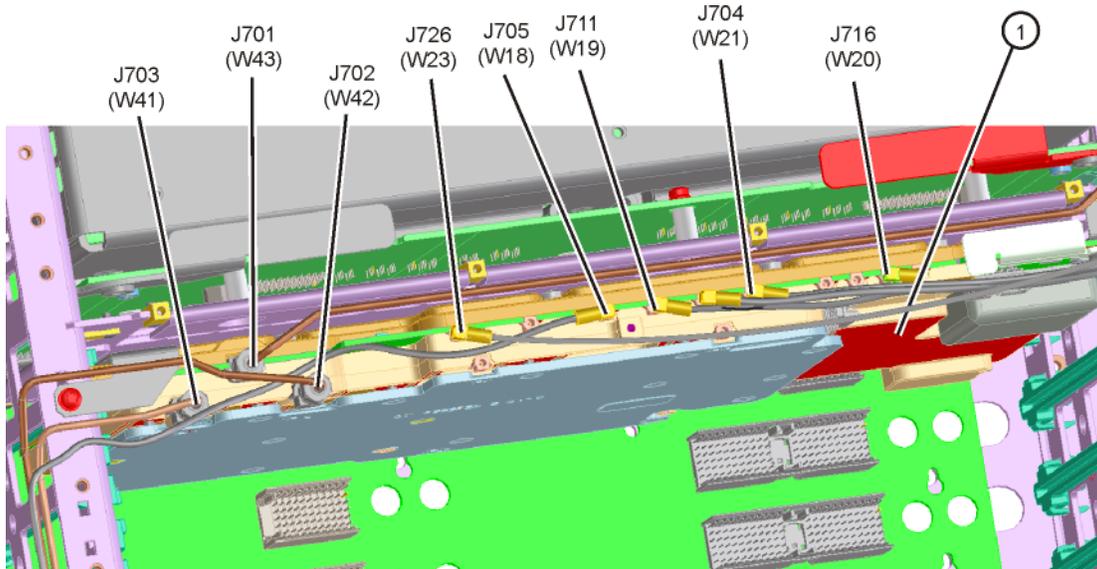
reference_bd2

6. Remove the two screws **(1)**.

7. Remove the Reference board by pulling up to disconnect from the motherboard and pull out of the chassis.

Replacement

1. Slide the reference assembly into the chassis and press down to plug it into the motherboard.

2. Refer to Figure 18-45. Replace the two screws **(1)**. Torque to 9 inch-pounds.

3. Replace cables W41, W42, and W43 to the correct locations. Torque to 10 inch-pounds.

4. Replace cables W18, W19, W20, W21, and W23 to the correct locations.

5. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

6. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Midplane Board Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the top brace and power supply bracket. Refer to the Top Brace and Power Supply Bracket removal procedure.

3. Refer to Figure 18-39. Locate the Midplane Board assembly **(7)**.

4. Remove the processor assembly. Refer to the CPU Assembly removal procedure.

5. Remove the rear panel. Refer to the Rear Panel removal procedure.

6. Remove the power supply assembly. Refer to the Power Supply Assembly removal procedure.

7. Refer to Figure 18-46. Remove the six screws **(2)** (0515-0375) attaching the midplane board assembly **(1)** to the midplane bracket. The midplane board assembly can now be pulled up from the chassis by use of the ejectors.

Figure 18-46   Midplane Board Assembly Removal

midplane_replace_mxe
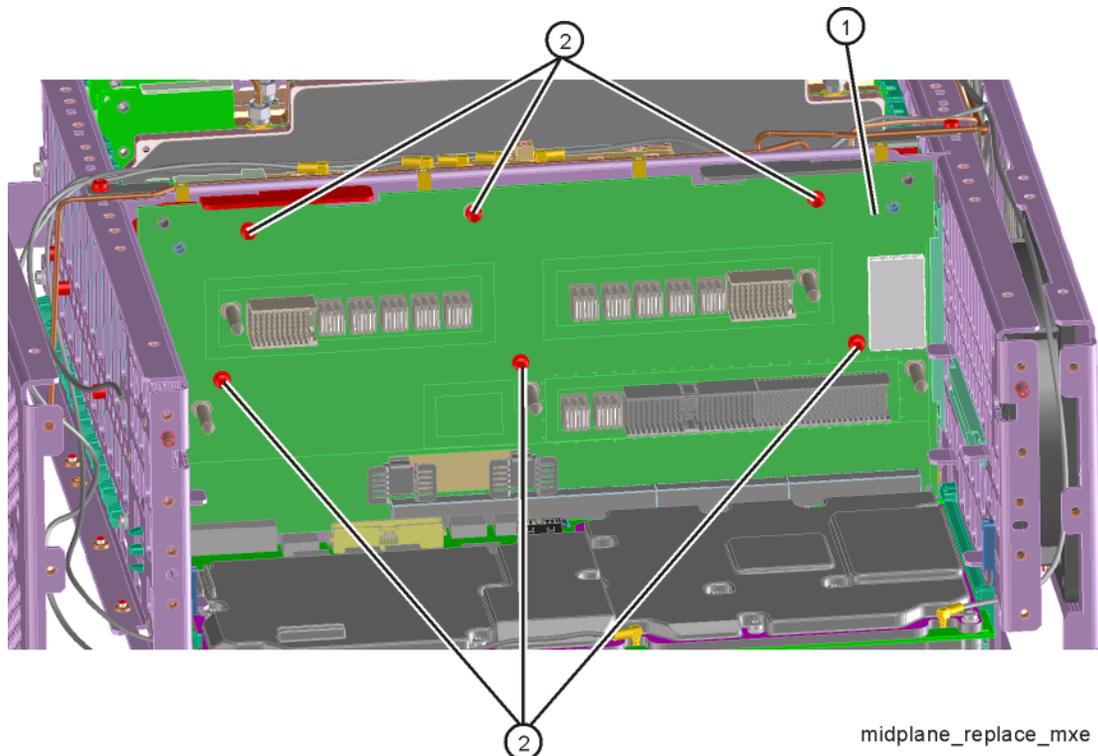
Replacement

1. Refer to Figure 18-46. Install the midplane assembly into the chassis using the ejectors and attach to the midplane bracket using the six screws (0515-0375) removed earlier. Torque to 9 inch-pounds.

2. Replace the power supply assembly. Refer to the Power Supply Assembly replacement procedure.

3. Replace the rear panel. Refer to the Rear Panel replacement procedure.

4. Replace the processor assembly. Refer to the CPU Assembly replacement procedure.

5. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

6. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Rear Panel

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Refer to Figure 18-47. Remove W21 **(2)** cable from the rear panel using the 9/16- inch nut driver.

3. If present, remove W9 **(5)** from the rear panel using the 3/16" nut driver.

4. If present, remove W22 **(3)** from the rear panel using the 5/16" nut driver.

5. Using the T–10 driver, remove the sixteen screws **(4)** (0515-0372) attaching the rear panel **(1)** to the chassis. The rear panel can now be removed.

Figure 18-47   Rear Panel Removal
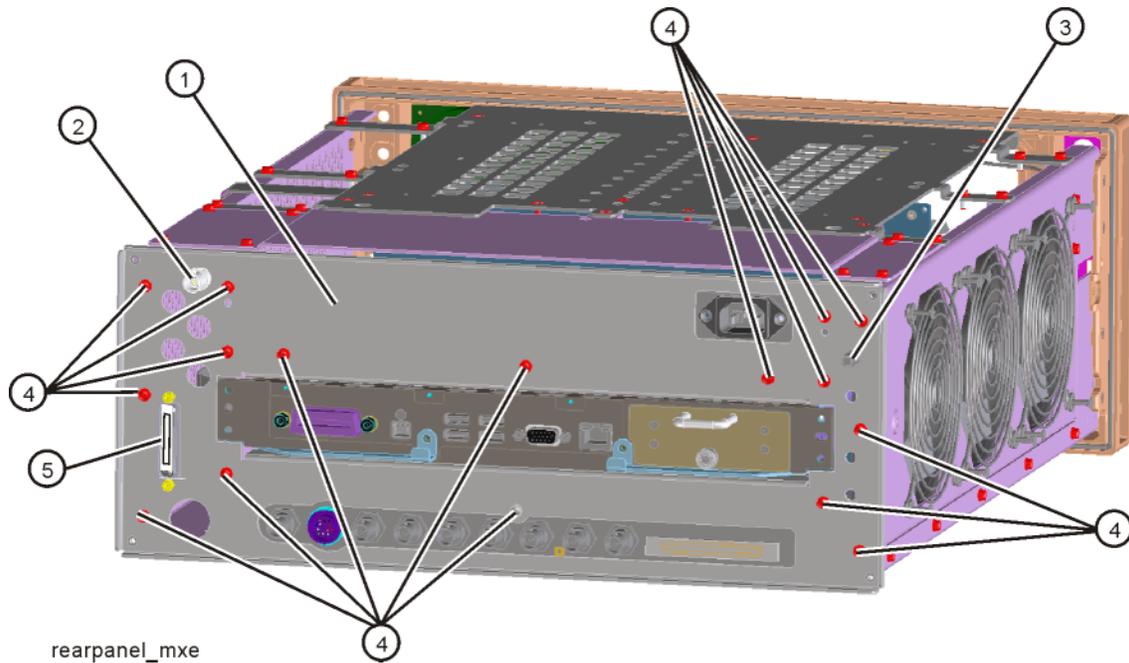
rearpanel_mxe

Replacement

1. Reattach the W21 cable to the rear panel. Torque to 21 inch-pounds using the 9/16-inch nut driver.

2. If present, reattach W9 **(5)** from the rear panel. Torque to 9 inch-pounds using the 3/16" nut driver.

3. If present, reattach W22 **(3)** from the rear panel. Torque to 10 inch-pounds using the 5/16" nut driver.

4. Place the rear panel into position in the chassis. Replace the sixteen screws (0515-0372) to attach the rear panel to the chassis. Torque to 9 inch-pounds.

5. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Power Supply Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the rear panel. Refer to the Rear Panel removal procedure.

3. Refer to Figure 18-48. Remove the three screws **(1)** (0515-1227) attaching the power supply to the chassis.

4. The power supply assembly can be removed from the chassis by pulling straight out the back.

Figure 18-48   Power Supply Assembly Removal
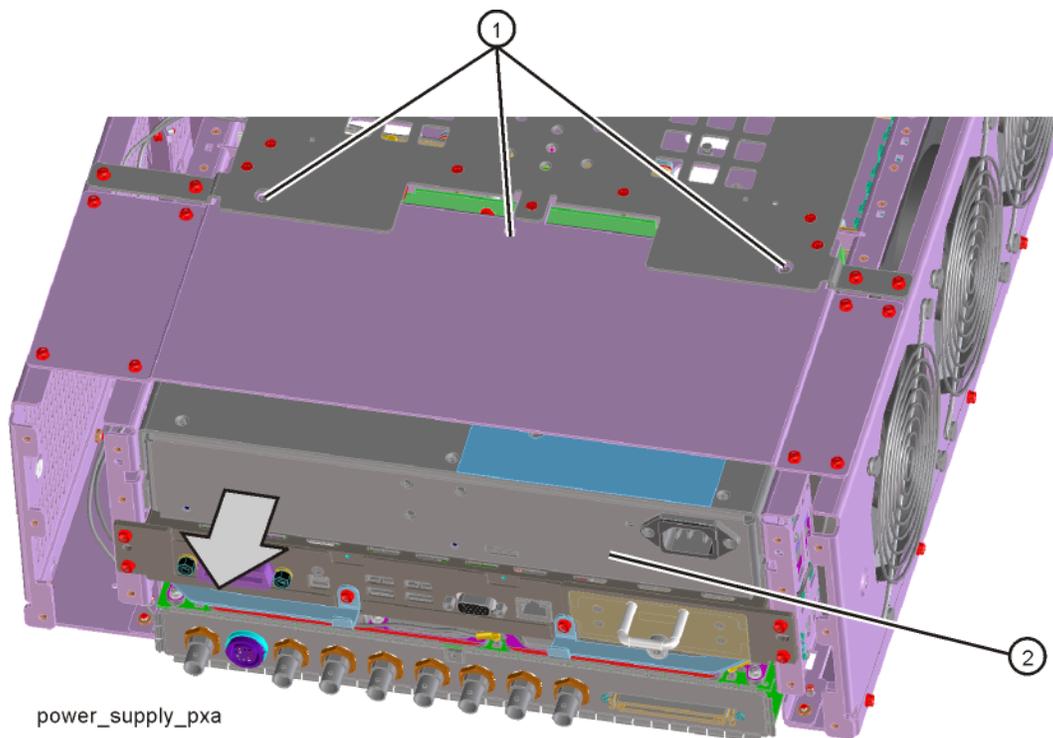
power_supply_pxa

Replacement

1. Slide the power supply assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the midplane assembly.

2. Refer to Figure 18-48. Replace the three screws **(1)** (0515-1227) through the power supply bracket and into the power supply. Torque to 9 inch-pounds.

3. Replace the rear panel. Refer to the Rear Panel replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

CPU Assembly

Removal

1. Refer to Figure 18-49. Remove the six screws **(1)** (0515-0372) attaching the CPU assembly to the chassis.

2. The CPU assembly can be removed from the chassis by pulling straight out the back. Use the two ejectors to pull the CPU assembly out from the chassis.

NOTE   If the A4BT1 CPU board battery is being changed, refer to Chapter 19, "Post-Repair Procedures." for setup instructions.

Figure 18-49   CPU Assembly Removal
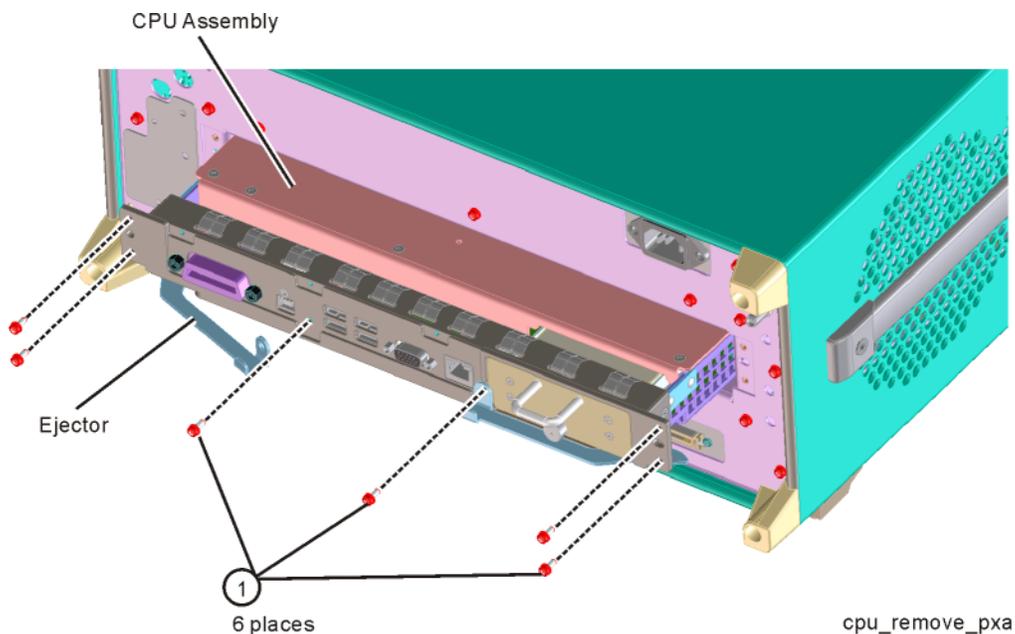
Replacement

1. Slide the CPU assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the midplane assembly. Secure the board with the ejectors.

2. Refer to Figure 18-49. Replace the six screws **(1)** (0515-0372) that attach the CPU assembly to the chassis. Torque to 9 inch-pounds.

Disk Drive

CAUTION   Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Refer to the documentation that pertains to your instrument for information about static-safe workstations and ordering static-safe accessories.

Drive Removal and Replacement

1. Turn the instrument off and remove the AC power cord.

2. Before replacing the A5 disk drive it is highly recommended that the factory calibration data be backed up to an external drive if at all possible. If this data is not backed up prior to replacing the disk drive all instrument adjustments and performance verification tests will need to be run after the drive is replaced.

   For information on how to backup this data see the "Calibration Data Backup and Restore" section in Chapter 19, "Post-Repair Procedures" of this manual.

   If this data cannot be backed up because the instrument will not fully boot, go ahead and change the A5 Disk Drive and perform all adjustments listed in Chapter 19, "Post-Repair Procedures" for the A5 assembly.

3. Refer to Figure 18-50. Locate and remove the existing disk drive carrier assembly **(2)** from the instrument by loosening the rear panel screw **(1)**.

Figure 18-50   Removing the Disk Drive Carrier Assembly
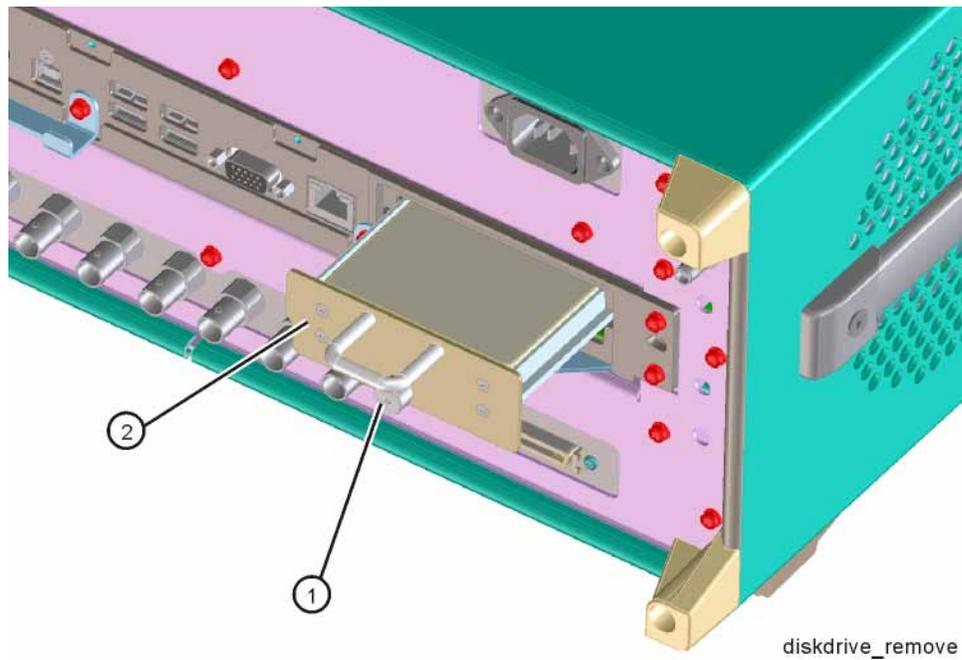
diskdrive_remove

4. Refer to Figure 18-51. Remove the 4 machine screws **(1)** (0515-0372) from the disk drive carrier assembly that secure the drive **(2)**.

Figure 18-51   Disk Drive Screws

diskdrive_explode
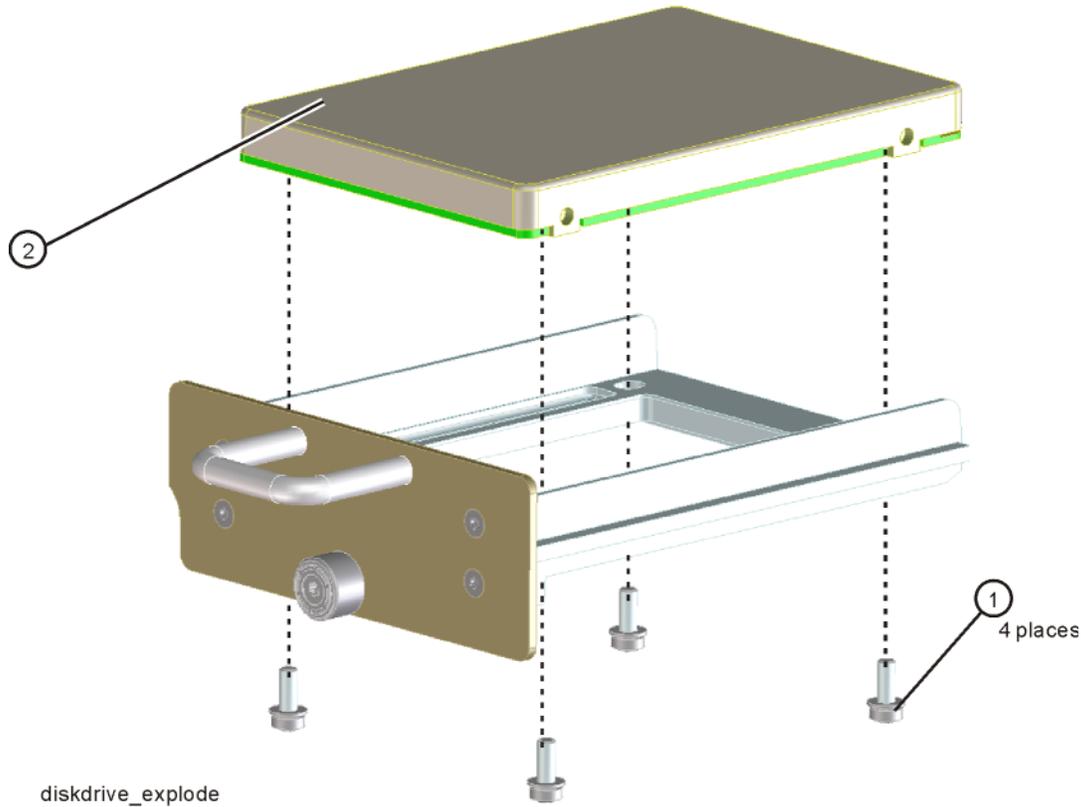
5. Remove the disk drive **(2)** from the carrier assembly.

6. Place the new disk drive onto the carrier assembly and attach with the 4 machine screws **(1)** (0515-0372). Torque to 9 in-pounds.

7. Refer to Figure 18-50. Replace the disk drive carrier assembly **(2)** into the instrument and tighten the screw to 9 in-pounds.

8. Refer to Chapter 19, "Post-Repair Procedures" and perform all of the specified tasks for replacing the A5 Disk Drive assembly.

Disk Drive Interconnect

Removal

1. Remove the A5 Disk Drive assembly for the instrument. Refer to the "Disk Drive" removal procedure.

2. Remove the A4 CPU assembly from the instrument. Refer to the "CPU Assembly" removal procedure.

3. Refer to Figure 18-52. Remove the A4 CPU assembly cover **(1)** by first removing the 19 flat-head screws **(2)** (0515-1227) and 3 pan-head screws **(3)** (0515-0372).

Figure 18-52   A4A1 Disk Drive Interconnect Board Removal

diskdrive_interconn

4. Remove the 2 screws **(4)** (0515-0372) that attached the A4A1 Disk Drive Interconnect board **(5)** to the A4 CPU assembly.

5. Unplug and remove the A4A1 Disk Drive Interconnect board from the A4 CPU assembly by carefully sliding the board out towards the disk drive bay opening **(6)**.

Installation

1. Refer to Figure 18-52. Plug the A4A1 Disk Drive Interconnect board **(5)** into the A4 CPU assembly by carefully sliding it into place from the disk drive bay opening **(6)**.

2. Install the 2 screws **(4)** (0515-0372) that secure the A4A1 Disk Drive Interconnect board to the A4 CPU assembly and torque them to 9 inch-pounds.

3. Replace the A4 CPU assembly cover **(1)** and attach it with the 19 flat-head screws **(2)** (0515-1227) and the 3 pan-head screws **(3)** (0515-0372). Torque all screws to 9 inch-pounds.

4. Re-install the A4 CPU assembly into the instrument. Refer to the CPU Assembly installation procedure.

5. Re-install the A5 Disk Drive assembly into the instrument. Refer to the Disk Drive installation procedure.

AIF/DIF Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the rear panel. Refer to the Rear Panel removal procedure.

3. Refer to Figure 18-53. Remove cable W15, W17, W20, and W23 from the bottom of the DIF assembly.

Figure 18-53   DIF Cables
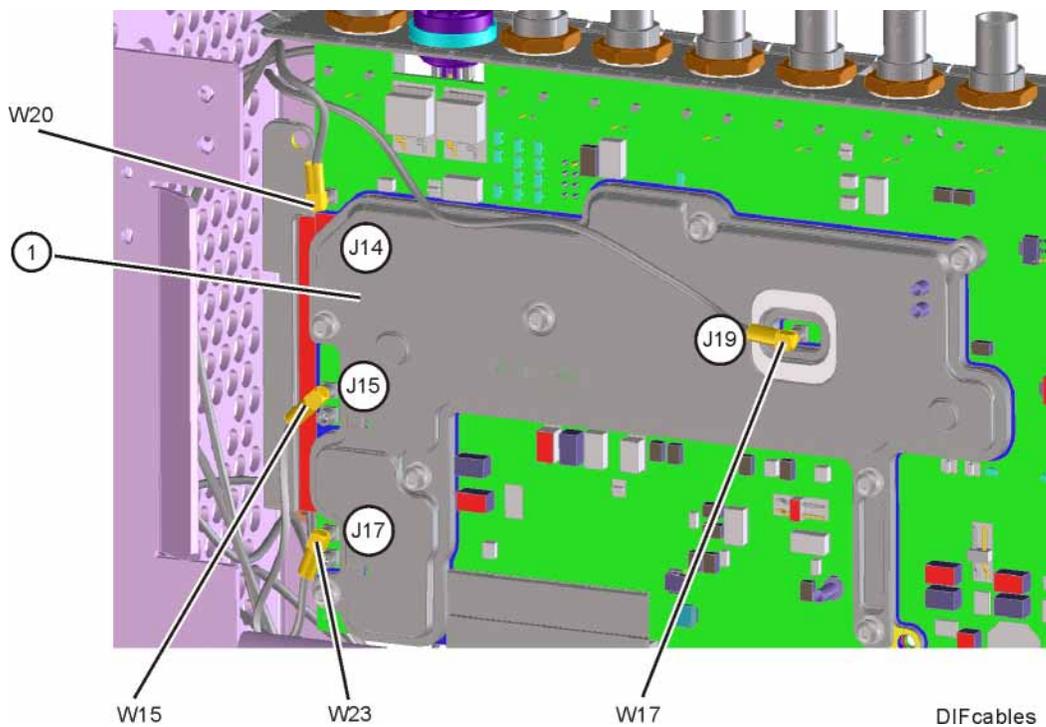
4. Refer to Figure 18-54. Pull the AIF/DIF assembly part way out of the chassis. Remove cables W16, W17, and W19 from the AIF assembly.

Figure 18-54   AIF Cables
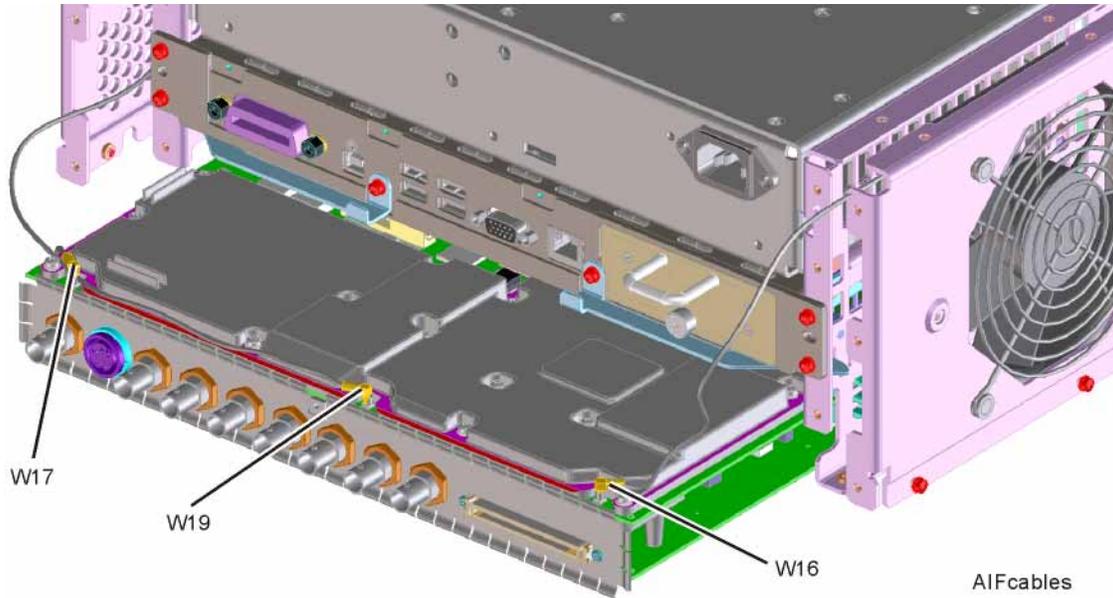
5. The AIF/DIF assembly can be removed from the chassis by pulling straight out the back.

Separate AIF/DIF Assembly

1. To separate the AIF **(1)** from the DIF **(2)**, unplug ribbon cable W7 from the AIF assembly.

2. Refer to Figure 18-55. From underneath the assembly, remove the three screws **(3)** (0515-0372).

Figure 18-55   AIF/DIF Separation

aif_dif_separate
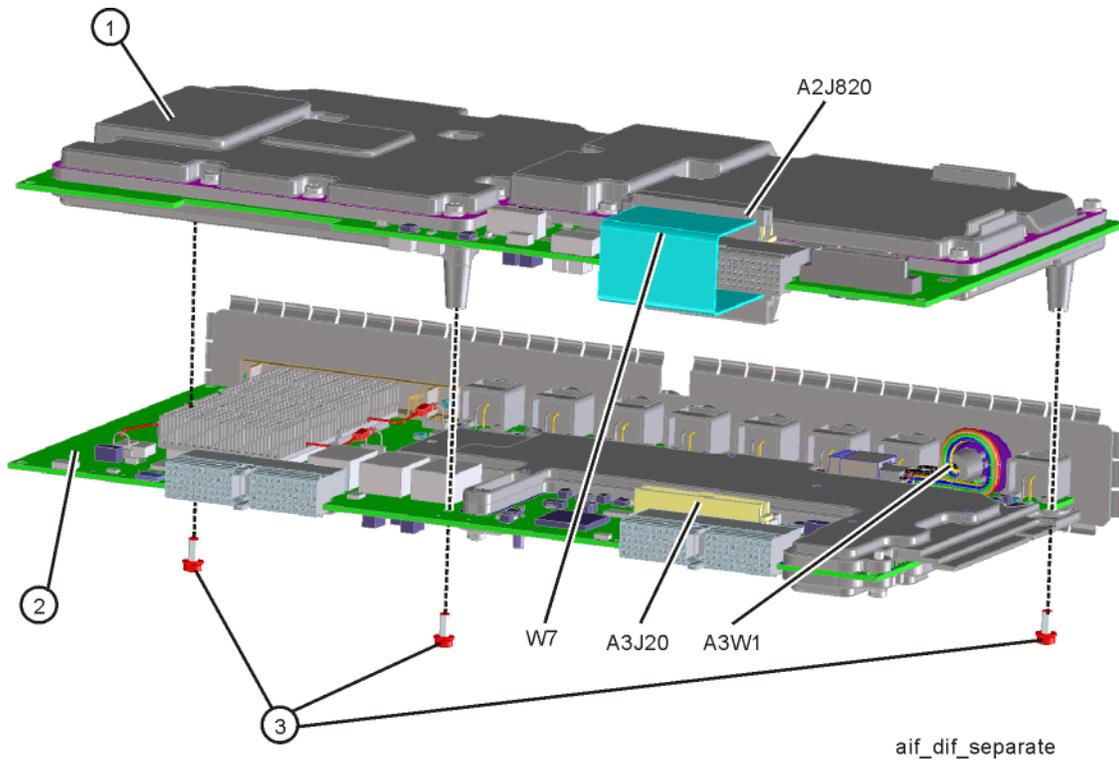
1. To pair the AIF and DIF together again, set the DIF in position over the AIF. Reinstall the three screws (0515-0372) removed before. Torque to 9 inch-pounds, starting with the middle screw.

2. Reconnect the ribbon cable W7.

Replacement

1. Slide the AIF/DIF assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the motherboard assembly.

2. Refer to Figure 18-54. Replace cables W16, W17, and W19 to the AIF assembly.

3. Refer to Figure 18-53. Replace cable W15, W17, W20, and W23 to the bottom of the DIF assembly.

4. Replace the rear panel. Refer to the Rear Panel replacement procedure.

5. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Motherboard Assembly

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the rear panel. Refer to the Rear Panel removal procedure.

3. Remove the top brace and power supply bracket. Refer to the Top Brace and Power Supply Bracket removal procedure.

4. Remove the Front Frame Assembly. Refer to the Front Frame Assembly removal procedure.

5. Remove the CPU assembly. Refer to the CPU Assembly removal procedure.

6. Remove the power supply assembly. Refer to the Power Supply Assembly removal procedure.

7. Remove the AIF/DIF assembly. Refer to the AIF/DIF Assembly removal procedure.

8. Remove the Front End Control assembly. Refer to the Front End Control Assembly removal procedure.

9. Remove the LO Synthesizer assembly. Refer to the LO Synthesizer Assembly removal procedure.

10. Remove the Radiated Filter assembly. Refer to the Radiated Filter Assembly removal procedure.

11. Remove the RF Preselector Input assembly. Refer to the RF Preselector Input Assembly removal procedure.

12. Remove the Conducted Filter assembly. Refer to the Conducted Filter Assembly removal procedure.

13. Remove the LISN Control assembly. Refer to the LISN Control Assembly removal procedure.

14. Remove the Wideband Analog IF and Wideband Digital if assemblies. Refer to the Wideband Analog IF and Wideband Digital IF Assemblies removal procedure.

15. Remove cable W35. Refer to the W35 Removal procedure.

16. Remove the reference assembly. Refer to the Reference Assembly removal procedure.

17. Remove the Midplane assembly. Refer to the Midplane Board Assembly removal procedure.

18. Remove the Chassis Right Side Outer bracket. Refer to Figure 18-7 on page 537.

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Assembly Replacement Procedures
Motherboard Assembly

19. Remove the fan assembly. Refer to the Fan Assembly removal procedure.

20. Refer to Figure 18-56 and Figure 18-57. Remove the midplane bracket **(1)** by removing the eight screws **(2)** (0515-0372) (two on each side and four on the bottom).

Figure 18-56 Midplane Bracket Removal

midplane_bracket_pxa

Keysight N9038A MXE Service Guide   607
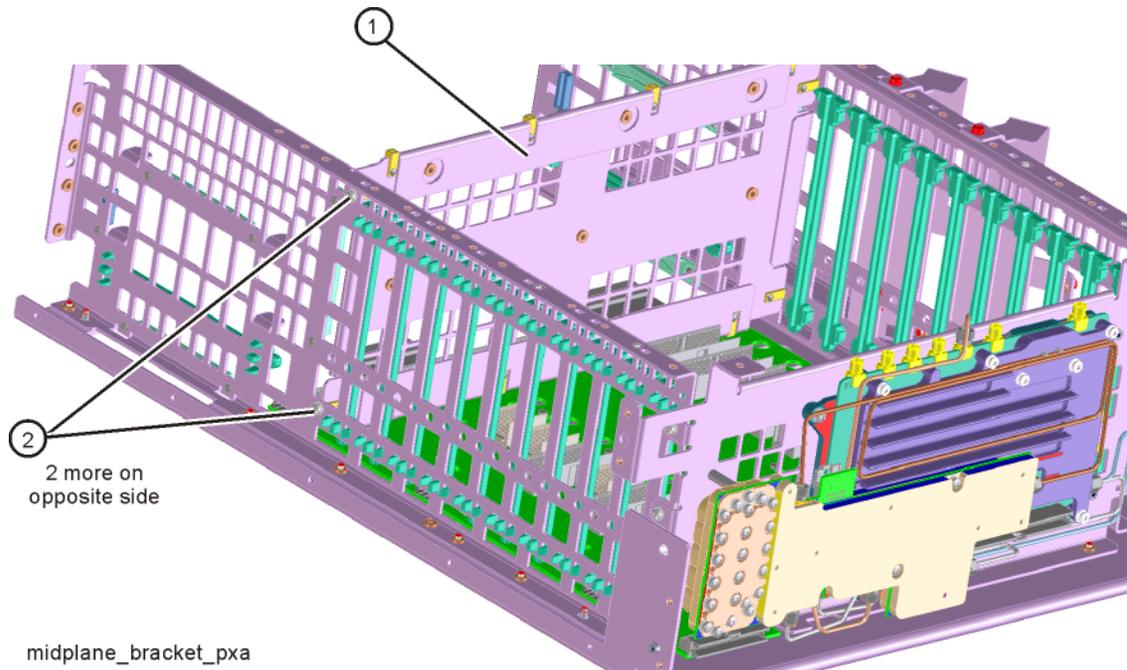
Figure 18-57   Bottom Screws

bottom_screws_pxa
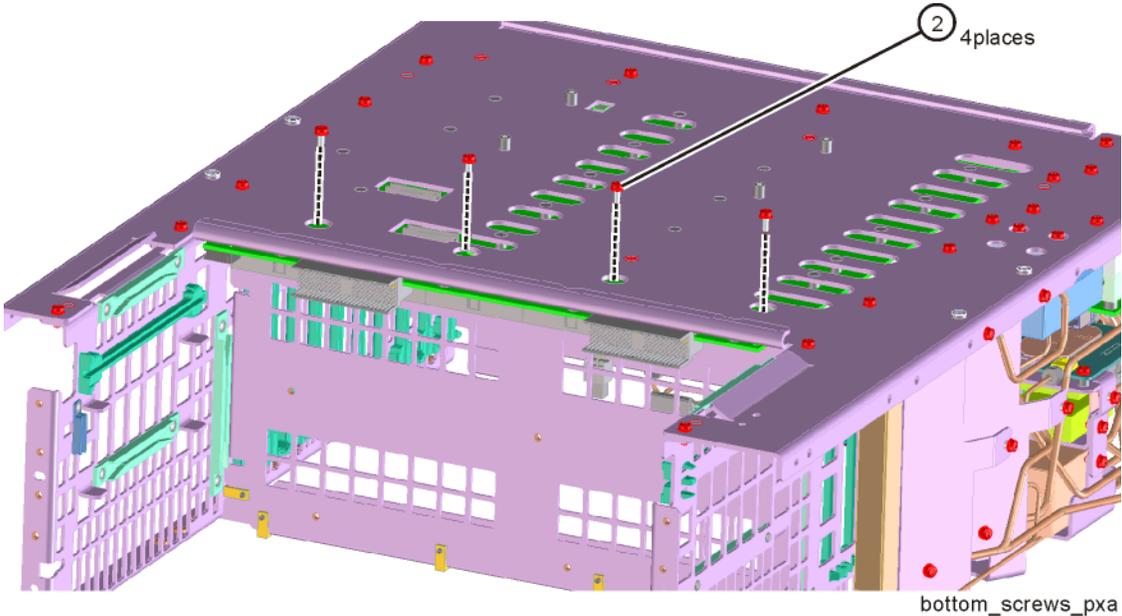
21. Refer to Figure 18-58. Remove the left side chassis **(1)** (same side as the fan) by removing the nine screws **(2)** (0515-0372) (six on the bottom).

Figure 18-58   Chassis Side Removal

chassis_side_pxa
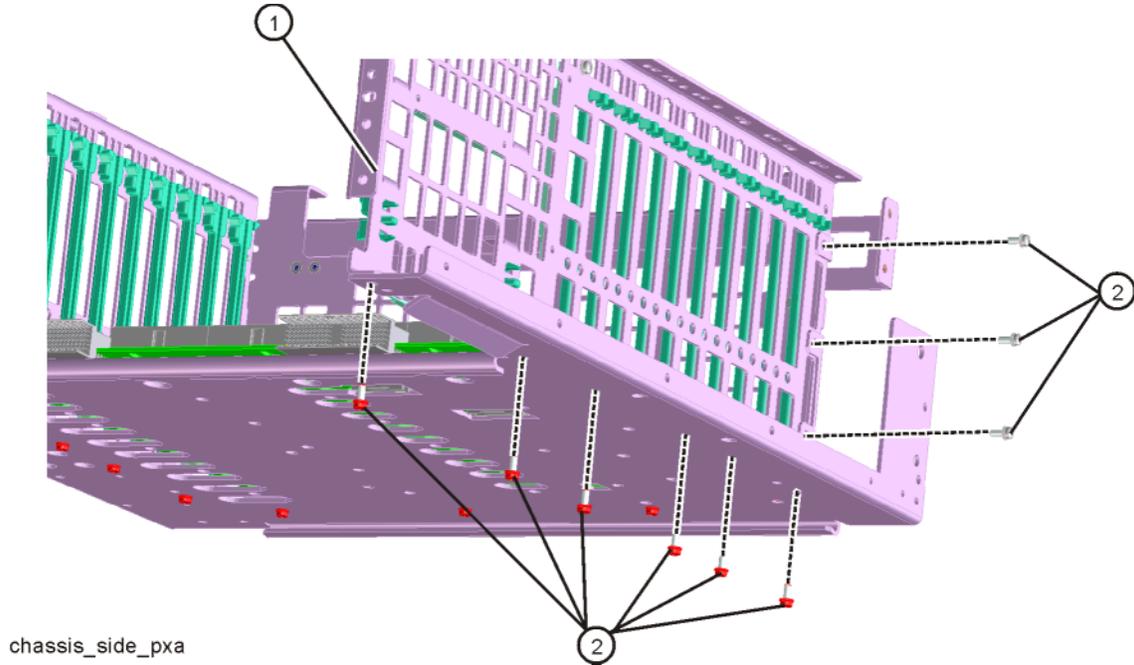
22. Refer to Figure 18-59. Remove the motherboard **(1)** by removing the four screws **(2)** (0515-0372). Slide the motherboard back off the standoffs and lift it up and out.

Figure 18-59   Motherboard Assembly Removal
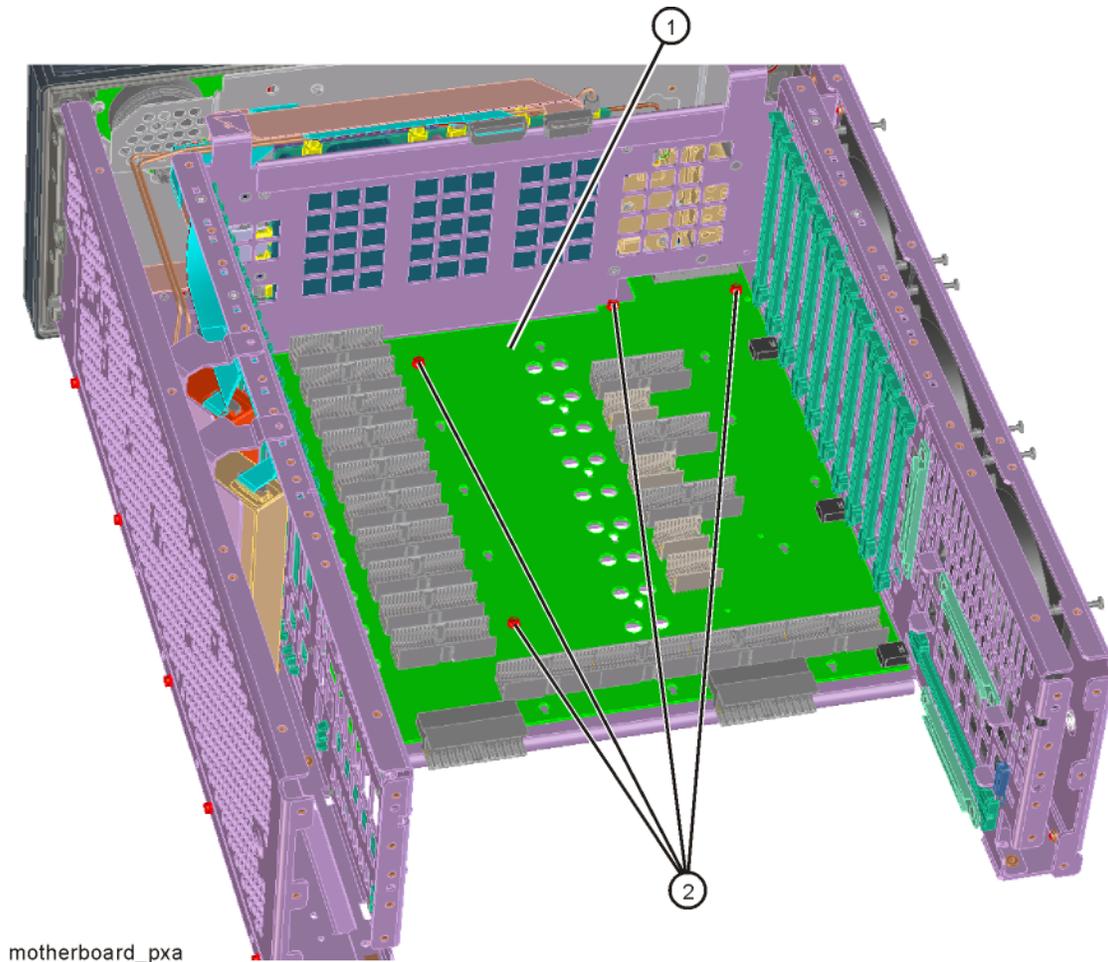
motherboard_pxa

Replacement

1. Refer to Figure 18-59. Place the motherboard **(1)** on standoffs and slide into position in the chassis and replace the four screws **(2)** (0515-0372). Torque to 9 inch-pounds.

2. Refer to Figure 18-58. Replace the left side chassis by replacing the nine screws (0515-0372). Torque to 9 inch-pounds.

3. Refer to Figure 18-56. Replace the midplane bracket **(1)** by replacing the eight screws **(2)** (0515-0372). Torque to 9 inch-pounds.

4. Replace the fan assembly. Refer to the Fan Assembly replacement procedure.

5. Replace the Midplane assembly. Refer to the Midplane Board Assembly replacement procedure.

6. Replace the Front End Control assembly. Refer to the Front End Control Assembly replacement procedure.

7. Replace the LO Synthesizer assembly. Refer to the LO Synthesizer Assembly replacement procedure.

8. Replace the Radiated Filter assembly. Refer to the Radiated Filter Assembly replacement procedure.

9. Replace the RF Preselector Input assembly. Refer to the RF Preselector Input Assembly replacement procedure.

10. Replace the Conducted Filter assembly. Refer to the Conducted Filter Assembly replacement procedure.

11. Replace the LISN Control assembly. Refer to the LISN Control Assembly replacement procedure.

12. Replace cable W35. Refer to the W35 Removal procedure.

13. Replace the Reference assembly. Refer to the Reference Assembly replacement procedure.

14. Replace the Wideband Analog IF and Wideband Digital if assemblies. Refer to the Wideband Analog IF and Wideband Digital IF Assemblies replacement procedure.

15. Replace the AIF/DIF assembly. Refer to the AIF/DIF Assembly replacement procedure.

16. Replace the CPU assembly. Refer to the CPU Assembly replacement procedure.

17. Replace the power supply assembly. Refer to the Power Supply Assembly replacement procedure.

18. Replace the rear panel. Refer to the Rear Panel replacement procedure.

19. Ensure all cables are plugged in or connected and torqued.

20. Replace the Chassis Right Side Outer bracket. Refer to Figure 18-7 on page 537. Torque the screws to 9 inch-pounds.

21. Replace the Front Frame Assembly. Refer to the Front Frame Assembly replacement procedure.

22. Replace the top brace and reference bracket. Refer to the Top Brace and Power Supply Bracket replacement procedure.

23. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

W35 Removal

1. Refer to Figure 18-60. To remove cable W35 pinch the retainer clips on both ends of the cable and slide the retainers away from the connections as shown in Figure 18-61.

2. Replace W35 by pressing into place until the retainers click into place.

Figure 18-60   W35 Location
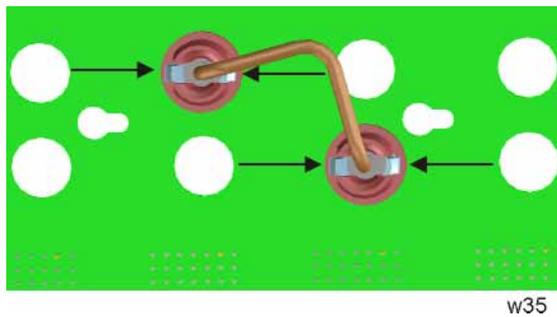
A21J306   W35   A22J300   w35_bottom_mxe

**Figure 18-61**   W35 Removal

w35

Fan Assembly

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 and Power Supply Bracket removal procedure.

3. Remove the Front Frame Assembly. Refer to the Front Frame Assembly removal procedure.

4. Refer to Figure 18-62. Remove the twelve remaining screws **(1)** (0515-0372) that attach the fan assembly to the chassis.

Figure 18-62   Fan Assembly Removal

fan_assy_pxa

1

12 places
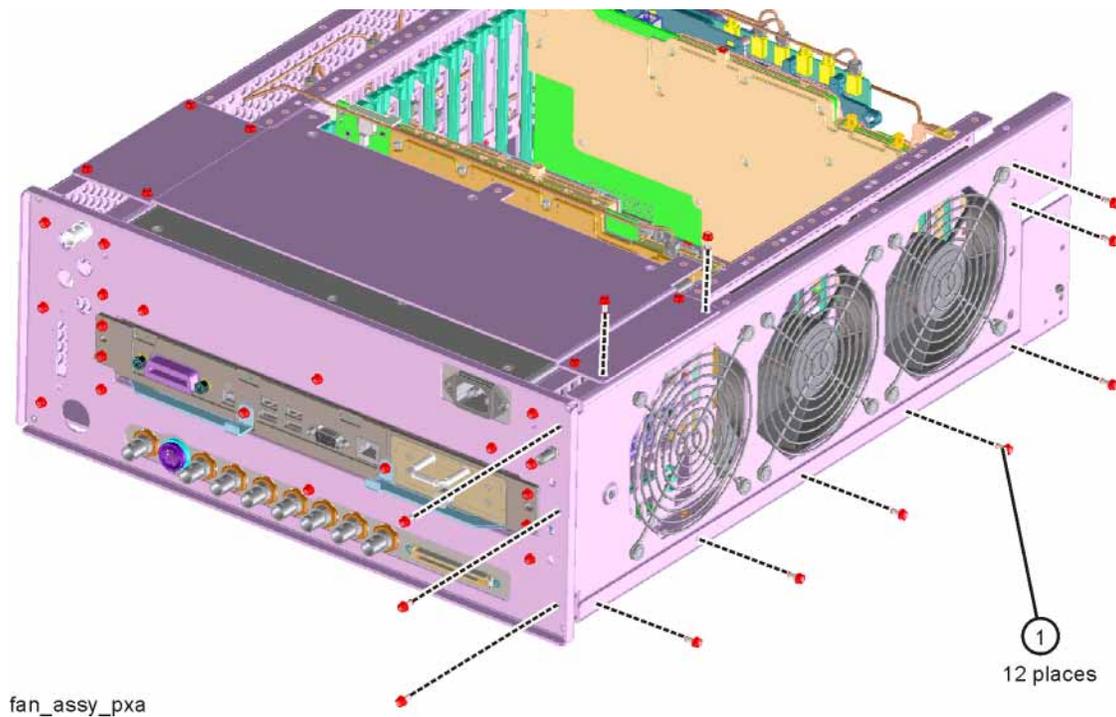
5. Refer to Figure 18-63. Unplug the fan wires from the motherboard. The fan assembly can now be lifted from the chassis.

Figure 18-63   Fan Wires


fan_wires_pxa

Fan Wires
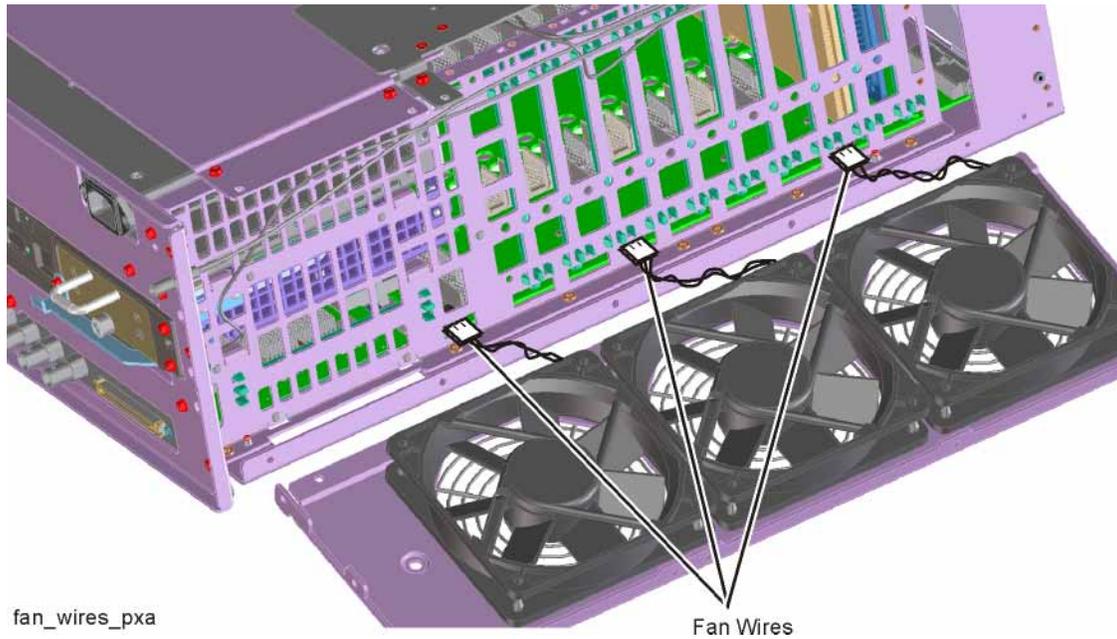
Replacing a Fan

1. Refer to Figure 18-64. To replace a fan, it is necessary to remove the 4 plastic rivets **(3)** that attach the fan **(1)** and guard **(2)** to the fan bracket. To do this use a small screwdriver to unscrew the rivet and remove it from the bracket. The rivets may need to be cut or pushed out from behind. They are not reusable.

Figure 18-64   Fan Replacement

Fan orientation:
Arrows point to right and down.
Air flow inward.

fan_replace_pxa
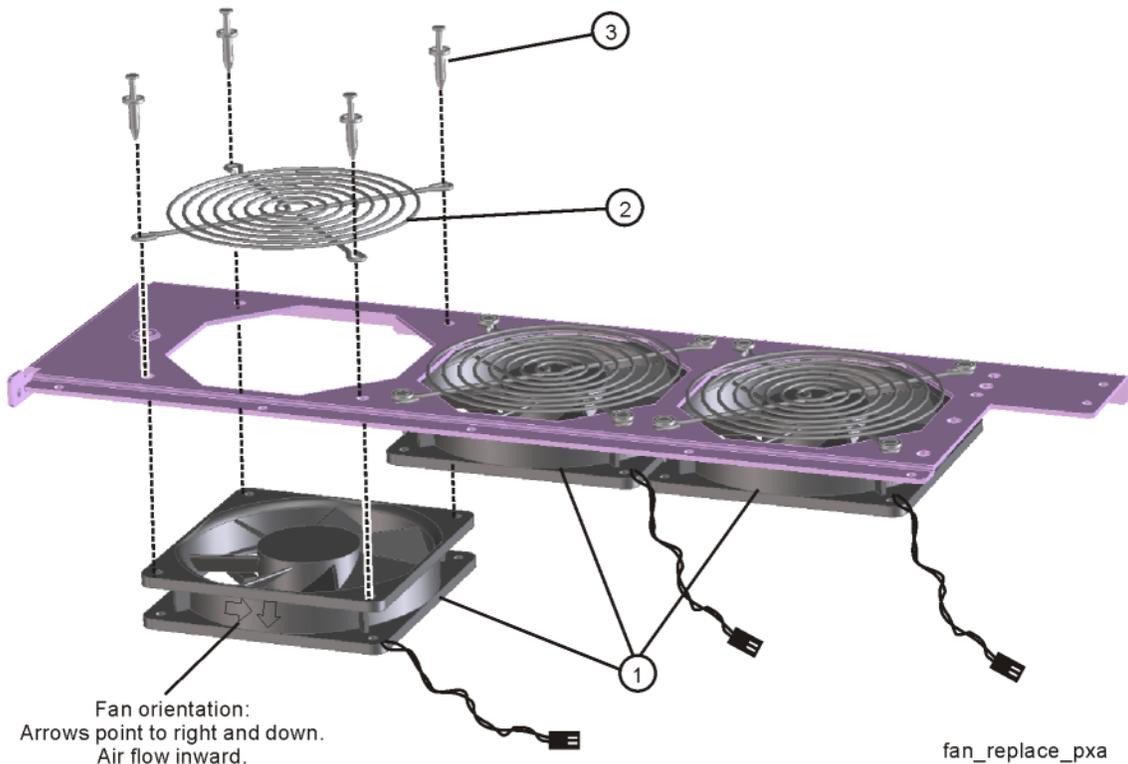
2. Position the new fan on the work surface with the arrows pointing to the right and down.

3. Orient the fan guard so that the rings are on the outside, and that the "V" of the support legs are pointing to the neighboring fan.

4. With the rivets center posts raised, snap the rivets into place through the fan grill and fan bracket and into the fan. Screw the center posts into place. This may require a small hammer or push tool to push the rivets in.

Replacement

1. Plug the fan wires into the motherboard.

2. Refer to Figure 18-62. Place the fan assembly into position in the chassis. Replace the twelve screws **(1)** (0515-0372) to attach the fan assembly to the chassis. Ensure the fan wires are not pinched. Torque to 9 inch-pounds.

3. Replace the Front Frame Assembly. Refer to the Front Frame Assembly replacement procedure.

4. Replace the top brace. Refer to the Top Brace and Power Supply Bracket replacement procedure.

5. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Input Connector Assembly

RF Input 1 Connector

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the Front Frame Assembly. Refer to the Front Frame Assembly removal procedure.

3. Refer to Figure 18-65. Disconnect the semi-rigid cable W25 from the J1 Input Connector Assembly.

Figure 18-65   RF 1 Input Connector Assembly Removal
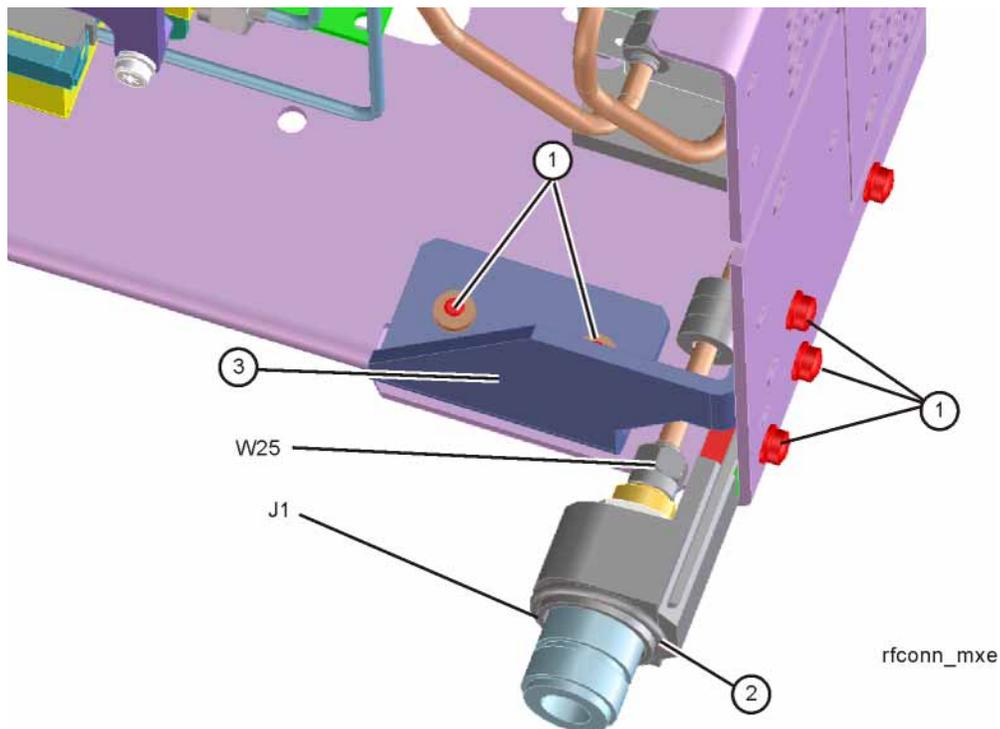
4. Remove the two screws **(1)** (0515-0372) that attach the Input Connector Assembly to the chassis. The connector assembly can now be lifted from the chassis.

Replacement

1. Refer to Figure 18-65. Place the Input Connector Assembly into position in the chassis. Replace the two screws **(1)** (0515-0372) to attach the Input Connector Assembly to the chassis. Torque to 9 inch-pounds.

2. Reconnect the semi-rigid cable W25 to the Input Connector Assembly. Torque to 10 inch-pounds.

3. Replace the Front Frame Assembly. Refer to the Front Frame Assembly replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

RF Input 2 Connector

Removal

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. Remove the Front Frame Assembly. Refer to the Front Frame Assembly removal procedure.

3. Refer to Figure 18-66. Disconnect the semi-rigid cable W26 from the J2 Input Connector Assembly.

Figure 18-66   RF 2 Input Connector Assembly Removal
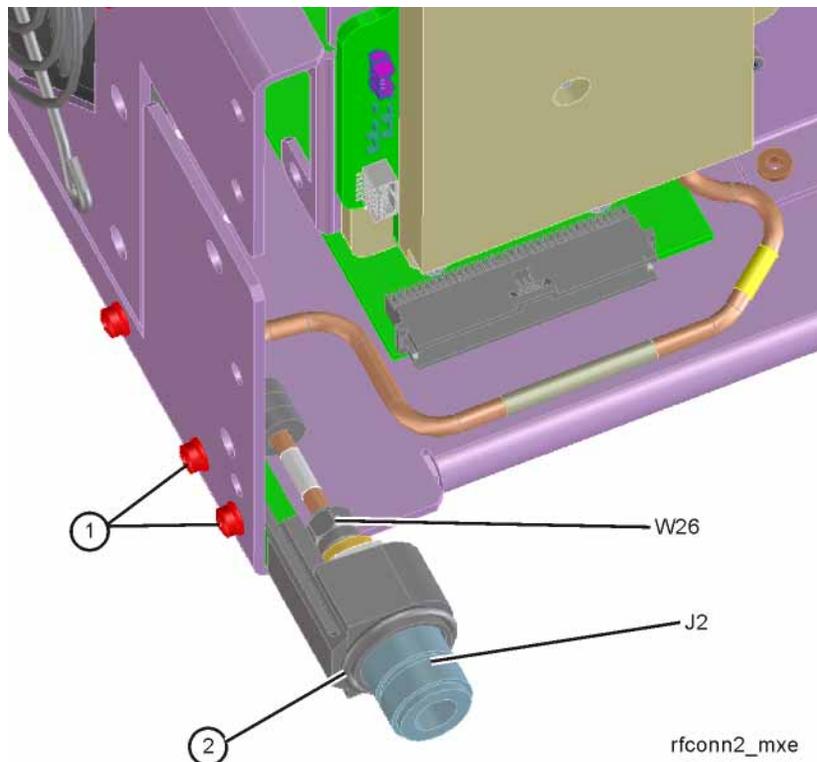
4. Remove the two screws **(1)** (0515-0372) that attach the Input Connector Assembly to the chassis. The connector assembly can now be lifted from the chassis.

Replacement

1. Refer to Figure 18-66. Place the Input Connector Assembly into position in the chassis. Replace the two screws **(1)** (0515-0372) to attach the Input Connector Assembly to the chassis. Torque to 9 inch-pounds.

2. Reconnect the semi-rigid cable W25 to the Input Connector Assembly. Torque to 10 inch-pounds.

3. Replace the Front Frame Assembly. Refer to the Front Frame Assembly replacement procedure.

4. Replace the instrument outer case. Refer to the Instrument Outer Case replacement procedure.

Front Frame Assembly

Removal

NOTE	Make sure any connectors on the front panel are removed.

1. Remove the instrument outer case. Refer to the Instrument Outer Case removal procedure.

2. If Option EXM, External Mixing is installed, disconnect the semi-rigid cable connection **(1)** as shown in Figure 18-67.

3. Refer to Figure 18-67. Using the T–10 driver, remove the eight screws **(2)** (0515-1035), four on each side, to detach the Front Frame Assembly from the chassis.

4. Refer to Figure 18-68. Pull the Front Frame Assembly carefully away from the chassis. Remove the ribbon cable W8 from the motherboard. The cable has locking tabs on each side, pinch and pull to release.

5. Refer to Figure 18-68. Remove W6 from the A23 Limiter Assembly.

Figure 18-67   Front Frame Assembly Removal

ffrane_remove_pxa
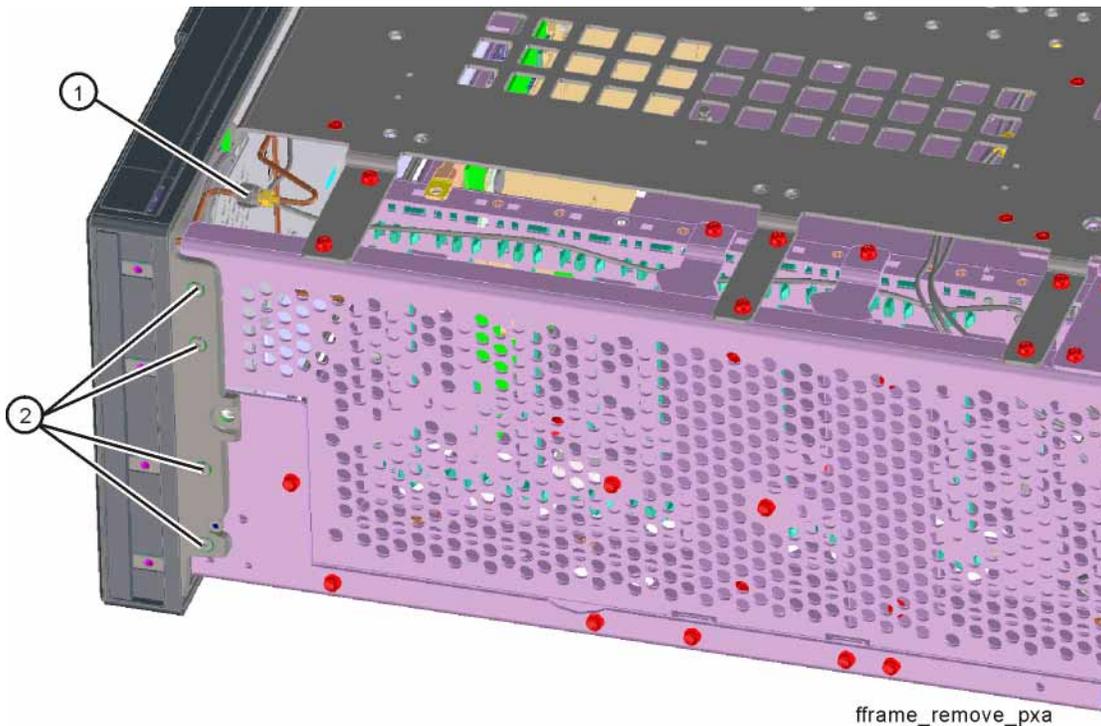
Figure 18-68   Front Panel Cable

fframe_cable_mxe
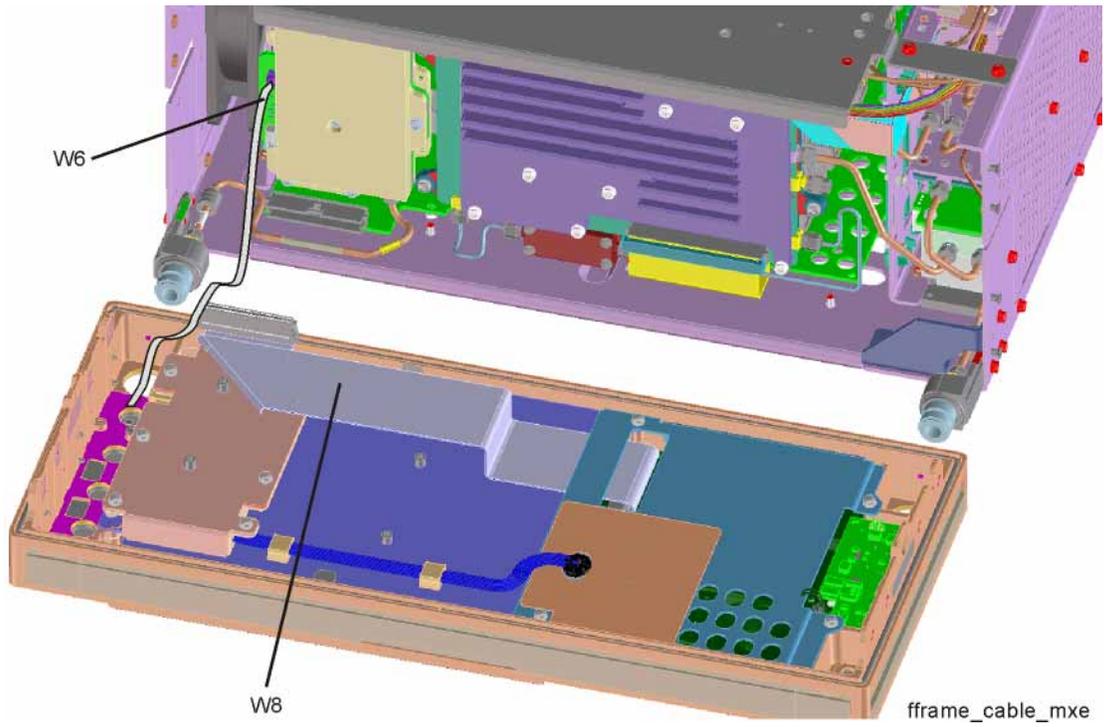
Replacement

1. Reattach the ribbon cable W6.

2. Reattach the ribbon cable W8. Ensure the locking tabs are engaged.

3. Refer to Figure 18-67. Carefully position the Front Frame Assembly onto the chassis. Ensure no cables are crushed. Replace the eight screws **(2)** (0515-1035), four on each side of the chassis. Torque to 9 inch pounds.

4. If Option EXM is installed, reconnect the semi-rigid cables **(1)** as shown in Figure 18-69.

> **NOTE**   Be sure to hold the connector on the end of W45 still when tightening this connection. Only rotate the connector on W46 to tighten. Doing otherwise will damage W45.

Figure 18-69   EXM Cables
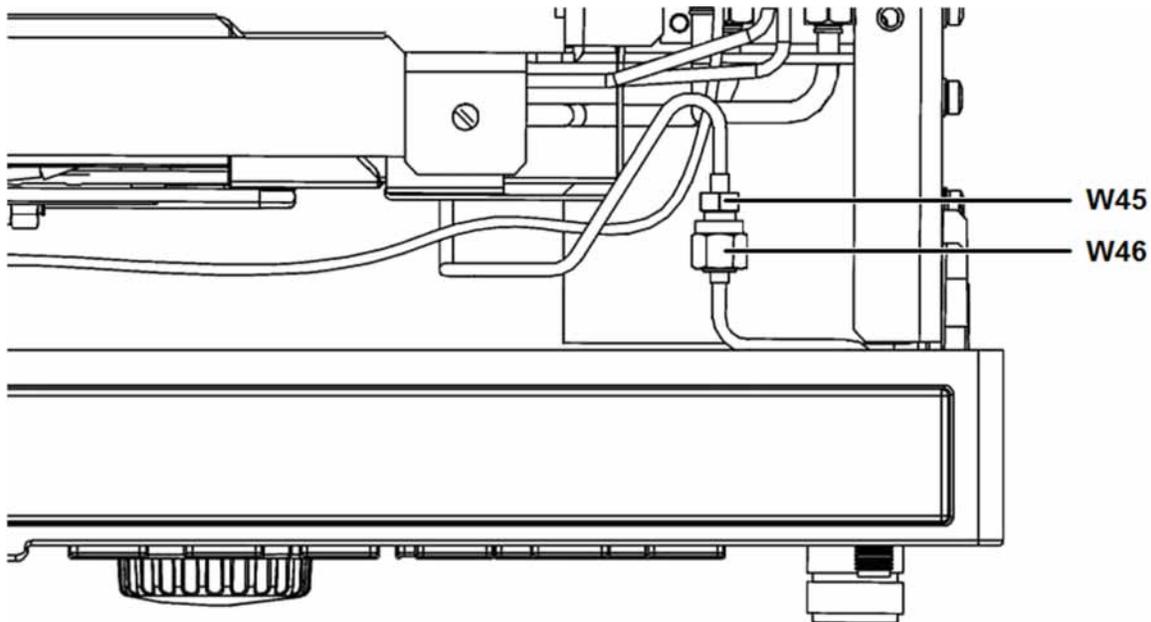
5. Replace the outer case. Refer to the Instrument Outer Case replacement procedure.

## Front Frame Assembly Components - LED

NOTE
Access to any of the Front Frame assemblies requires removal of the Front Frame Assembly from the chassis.

Figure 18-70   Front Frame Parts - LED
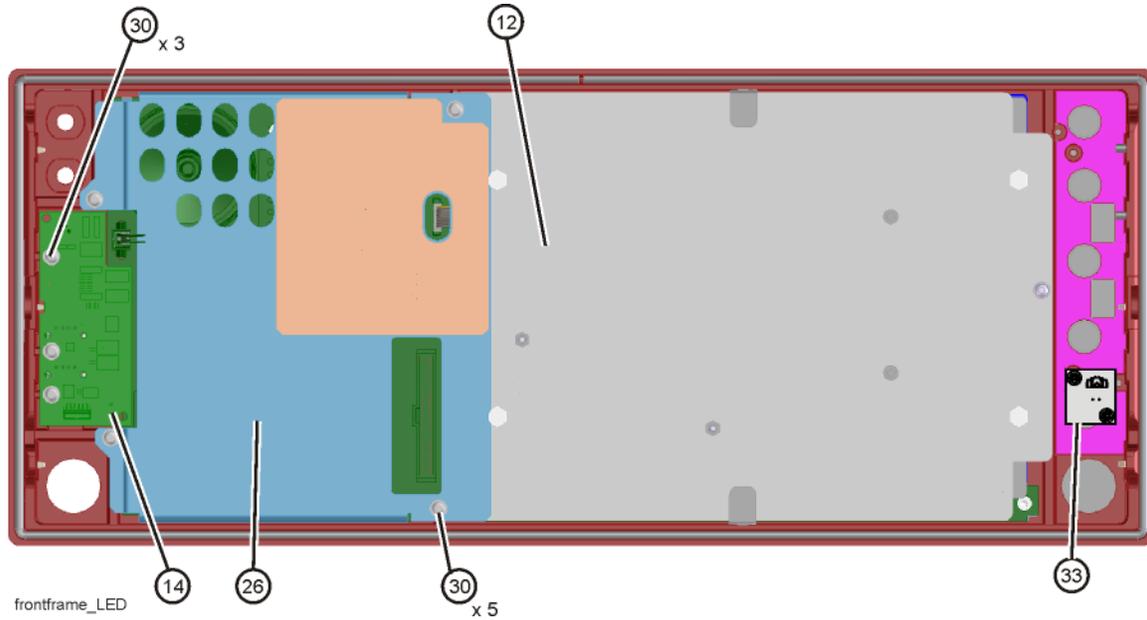
frontframe_LED

Item	Description
12	A1MP14 Display Bracket
14	A1A5 Front Panel Daughter Board
26	A1MP19 Shield, Front Panel Interface
33	A1A6 Input 2 LED Board

Figure 18-71   Front Frame Parts (shields off) - LED
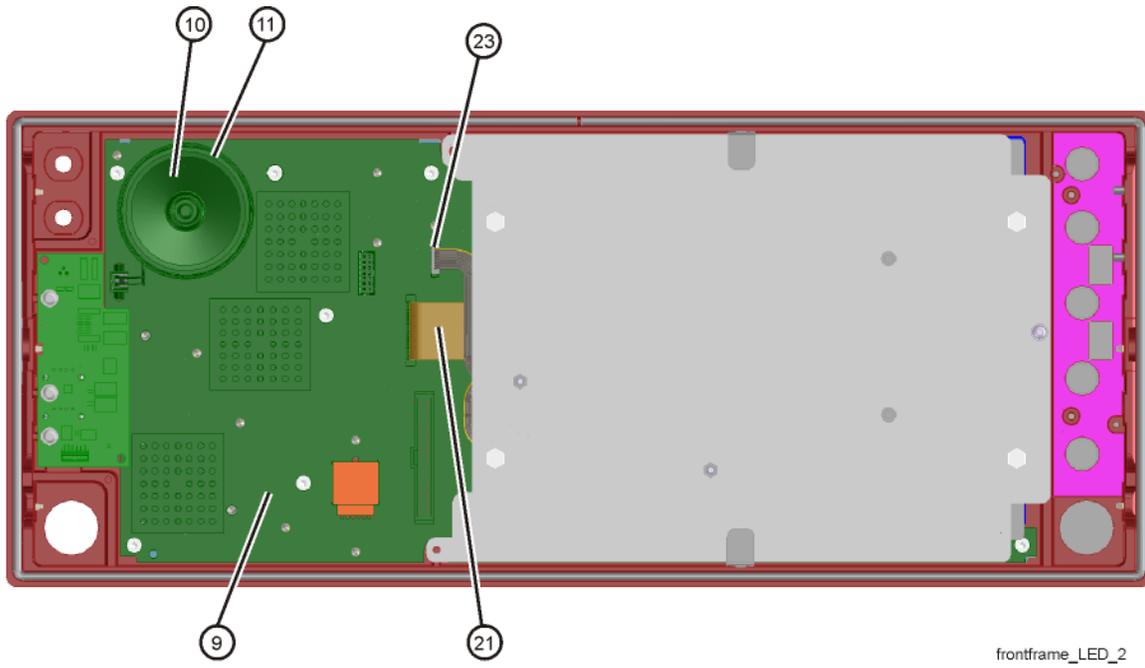
frontframe_LED_2

Item	Description
9	A1A2 Front Panel Interface Board
10	A1A2MP1 Speaker
11	A1A2MP2 Speaker Foam
21	A1W1 Flex Circuit, Front Panel Interface to LCD
23	A1W2 Cable Assembly, Wire Harness, Backlight Power Supply to LCD

Figure 18-72   Front Frame Exploded View - LED

ff_xplode_led
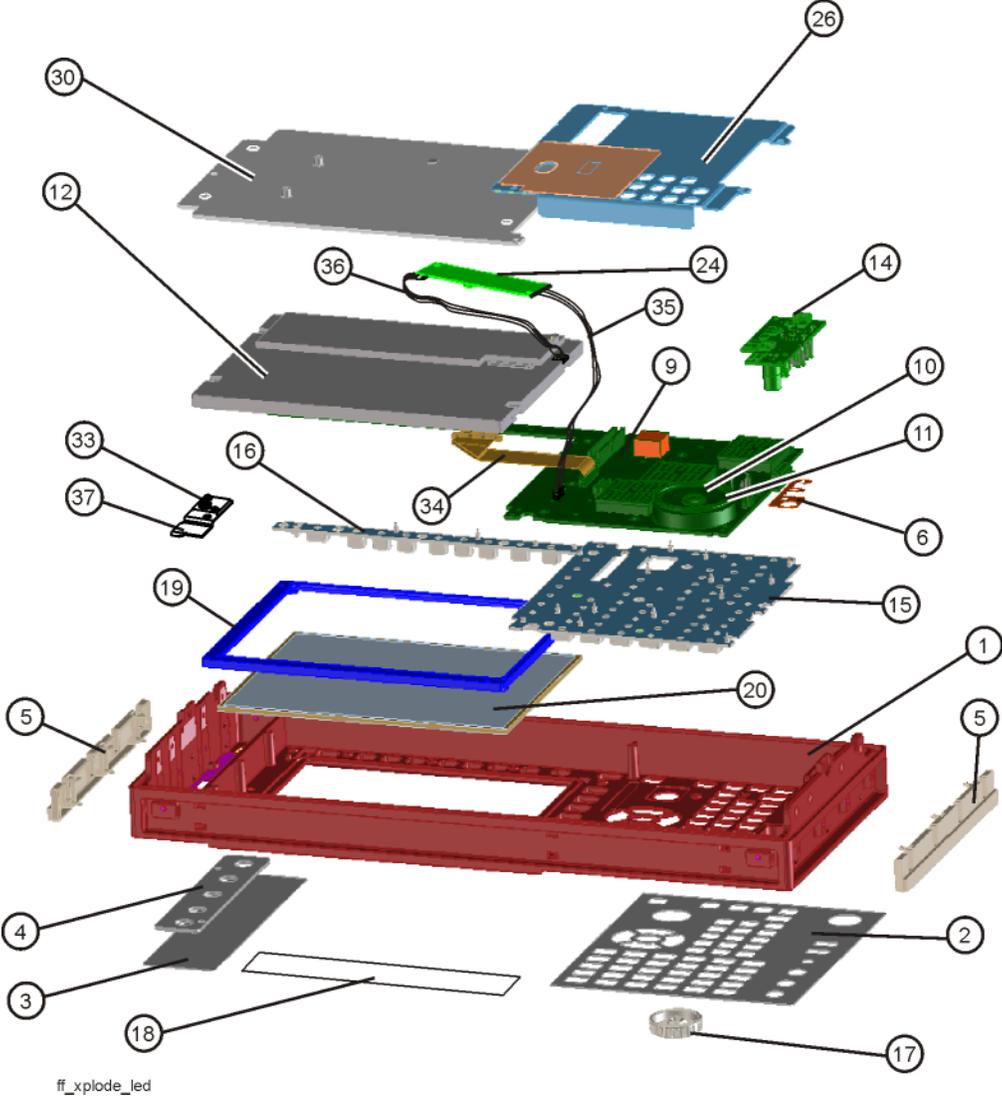
| Item	Description
1	Front Frame
2	Main Keyboard Overlay
3	Overlay, Left Display
4	Cover Plate
5	Front Frame Side Trim Strip (plastic)
6	Front Frame Ground Spring
9	A1A2 Front Panel Interface Board
10	A1A2MP1 Speaker
11	A1A2MP2 Speaker Foam
12	A1A3 Liquid Crystal Display (LED backlight)
14	A1A5 Front Panel Daughter Board
15	A1MP1 Main Keypad
16	A1MP2 Display Keypad
17	A1MP9 RPG Knob
18	A1MP3 Nameplate Label, 8.4 GHz or 26.5 GHz
19	A1MP8 LCD Lens Gasket
20	A1MP7 LCD Glass Filter
24	A1A4 Display Backlight Power Supply
26	A1MP19 Shield, Front Panel Interface
30	A1MP14 Display Bracket
33	A1A6 Input 2 LED Board
37	A1MP20 Bracket, Input 2 LED Board

Figure 18-73   Front Frame Assembly Shields - LED

frontframe_shield_LED
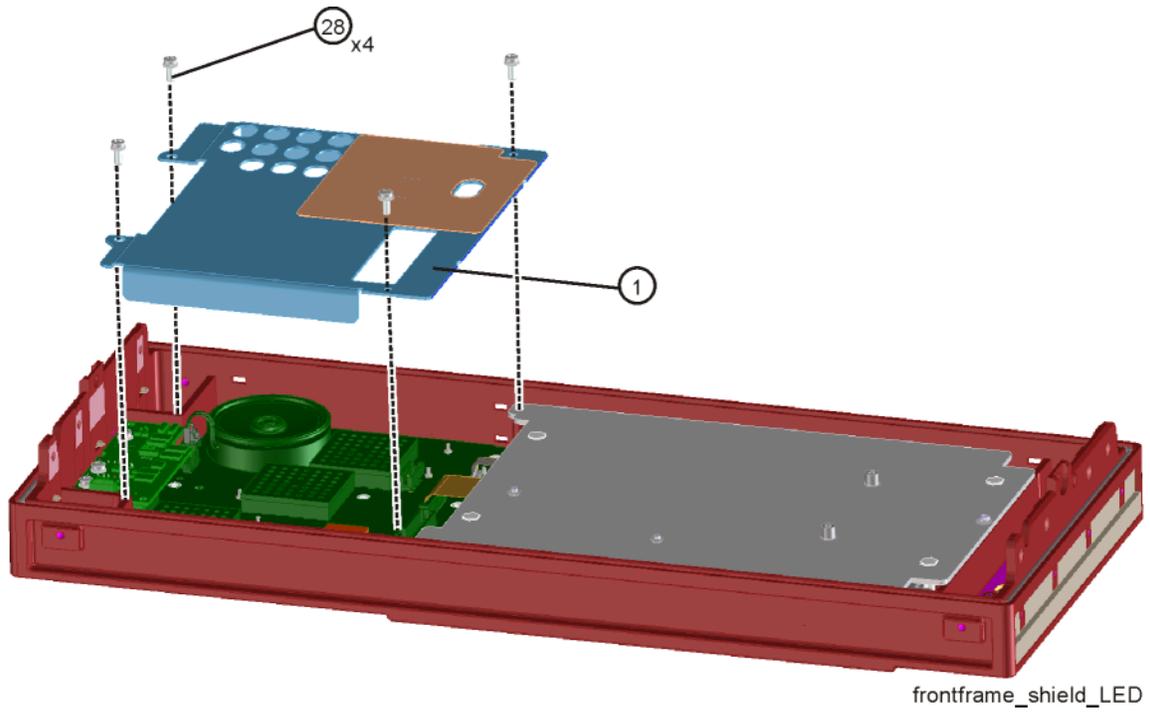
Item	Description
1	A1MP19 Shield, Front Panel Interface
28	Screw M3 X 0.5 (5 mm) (0515-0372)

Display Assembly - LED

Removal

1. Refer to Figure 18-73. Remove the front panel shield by removing the four screws **(28)** (0515-0372).

2. Refer to Figure 18-74. Disconnect the flex circuit A1W1 **(1)** and A1W3 **(2)** from the front panel interface board **(4)**.

Figure 18-74   Display Removal - LED

display_LED
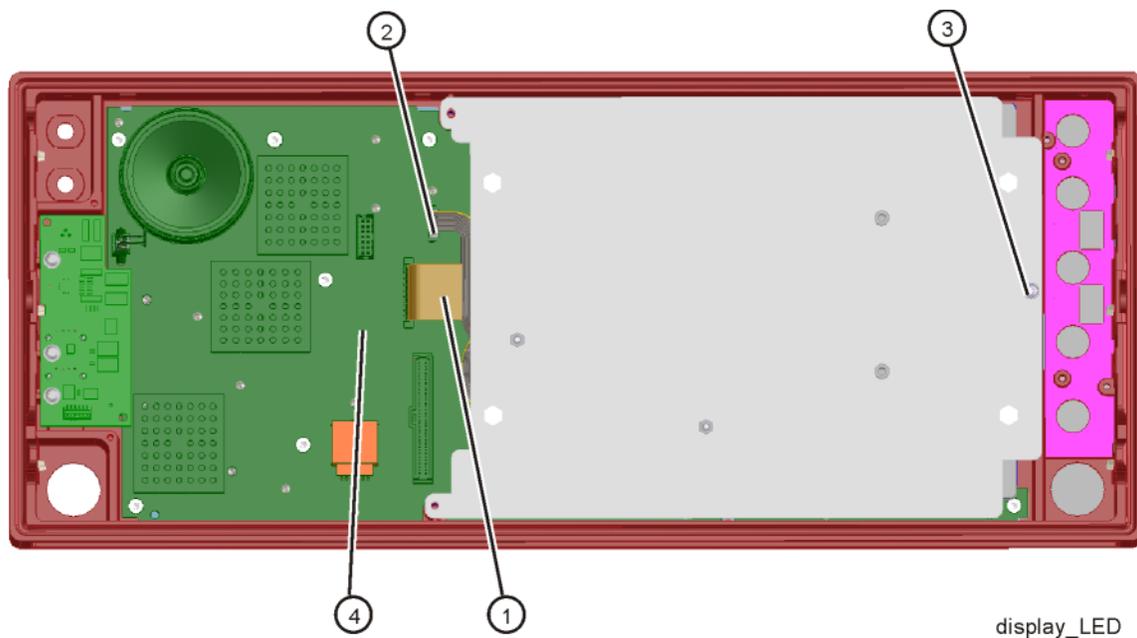
3. Remove the screw **(3)** (0515-0372) securing the display bracket to the Front Frame Assembly. The display can now be removed from the Front Frame Assembly.

CAUTION   Once the display assembly has been removed from the Front Frame Assembly, the glass filter is no longer secured. DO NOT tip the assembly in such a manner that would cause it to fall out of place, as this may cause injury and/or damage to the glass.

4. Refer to Figure 18-75. To separate the LCD **(2)** from the display bracket **(1)**, remove the four screws **(3)** (0515-0367). When reassembling, torque the four screws to 5 inch-pounds.

5. To separate the DC to DC Converter **(4)** from the display bracket **(1)**, remove the two screws **(5)**. When reassembling, torque the two screws to 9 inch-pounds.

Figure 18-75   LED and Display Bracket Separation

display2_LED
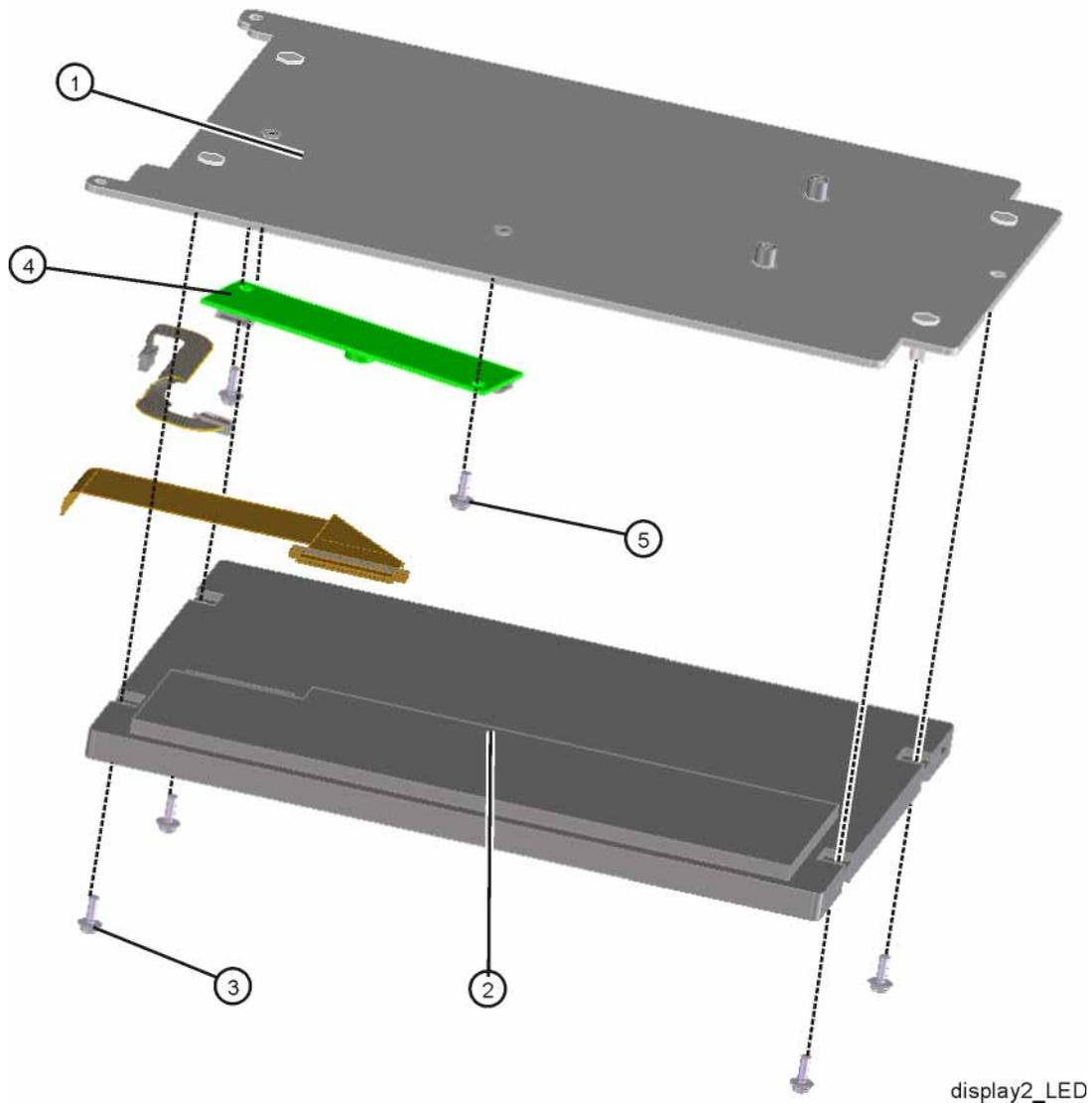
Replacement

1. Refer to Figure 18-74. Place the display bracket into position in the Front Frame Assembly. Reconnect the flex circuit A1W1 **(1)** and A1W3 **(2)** to the front panel interface board **(4)**.

2. Replace the screw **(3)** (0515-0372) that secures the display bracket to the Front Frame Assembly. Torque to 9 inch pounds.

3. Replace the front panel shield.

Daughter Board, Interface Board and Keypad

Removal

1. Refer to Figure 18-72. Remove the RPG knob **(17)** by carefully pulling it off.

2. Remove the display. Refer to the Display Assembly - LED removal procedure.

3. Refer to Figure 18-70. Remove the A1A5 Front Panel Daughter board **(14)** by removing the three screws **(30)** (0515-0372) and unplugging it from the front panel interface board.

4. Remove the thirteen screws **(30)** (0515-1521) securing the A1A2 Front Panel Interface board to the Front Frame Assembly. The Front Panel Interface board with the keypad attached can now be lifted from the Front Frame Assembly.

5. To separate the keypad from the Front Panel Interface board, use a push tool or pliers to carefully separate the pull through tabs.

Replacement

1. Install the keypad onto the Front Panel Interface board using the pull through tabs and alignment holes. Use a push tool or pliers to ensure that all of the pull through tabs are properly captive on the board.

2. Install the A1A2 Front Panel Interface board/keypad assembly into the Front Frame Assembly, and replace the thirteen screws **(30)** (0515-1521) to secure. Torque to 9 inch pounds.

3. Replace the A1A5 Front Panel Daughter board **(14)** by plugging it into the Front Panel Interface board using the board to board connectors and secure it with the three screws **(30)** (0515-0372). Torque to 9 inch-pounds.

4. Replace the display. Refer to the Display Assembly - LED replacement procedure.

5. Replace the RPG knob by firmly pressing it on.

Front Frame Assembly Components - CCFL Backlight

NOTE   Access to any of the Front Frame assemblies requires removal of the Front Frame Assembly from the chassis.

Figure 18-76   Front Frame Parts

frontframe_mxe
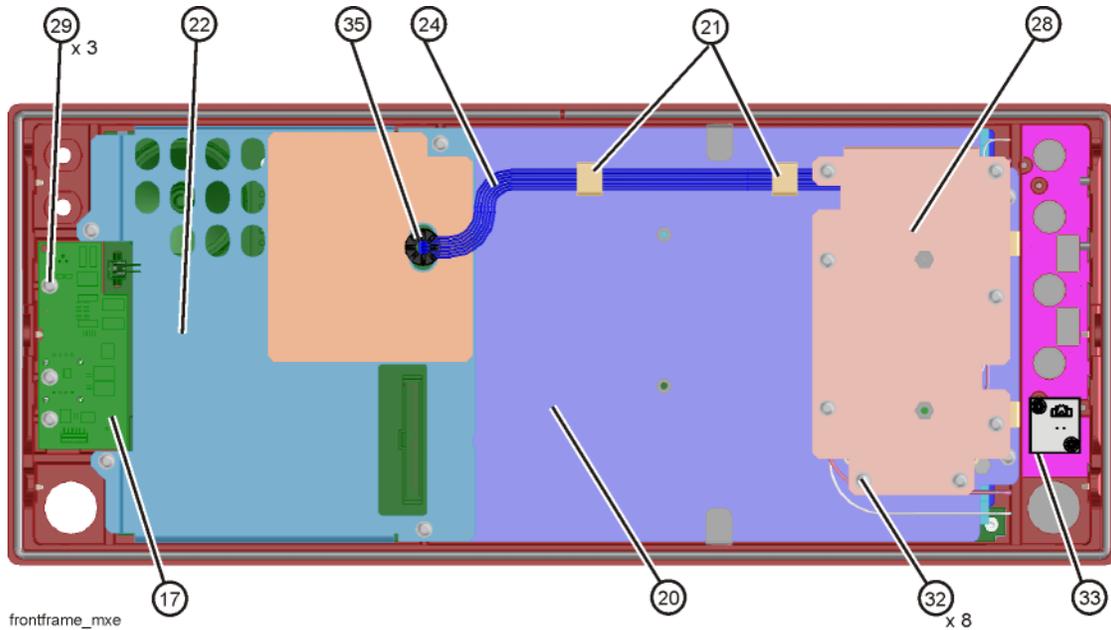
Item	Description
17	A1A5 Front Panel Daughter Board
20	A1MP14 Display Bracket
21	A1MP10-13 Cable Clamp
22	A1MP19 Shield, Front Panel Interface
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply
28	A1MP16 Shield, Inverter Assembly, Top
29	Screw M3 X 0.5 (8 mm) (0515-0372)
32	Screw M3 X 0.5 (8 mm) (0515-0372)
33	A1A6 Input 2 LED Board
35	A1MP6 Grommet, A1W2

Figure 18-77   Front Frame Parts (shields off) - CCFL Backlight
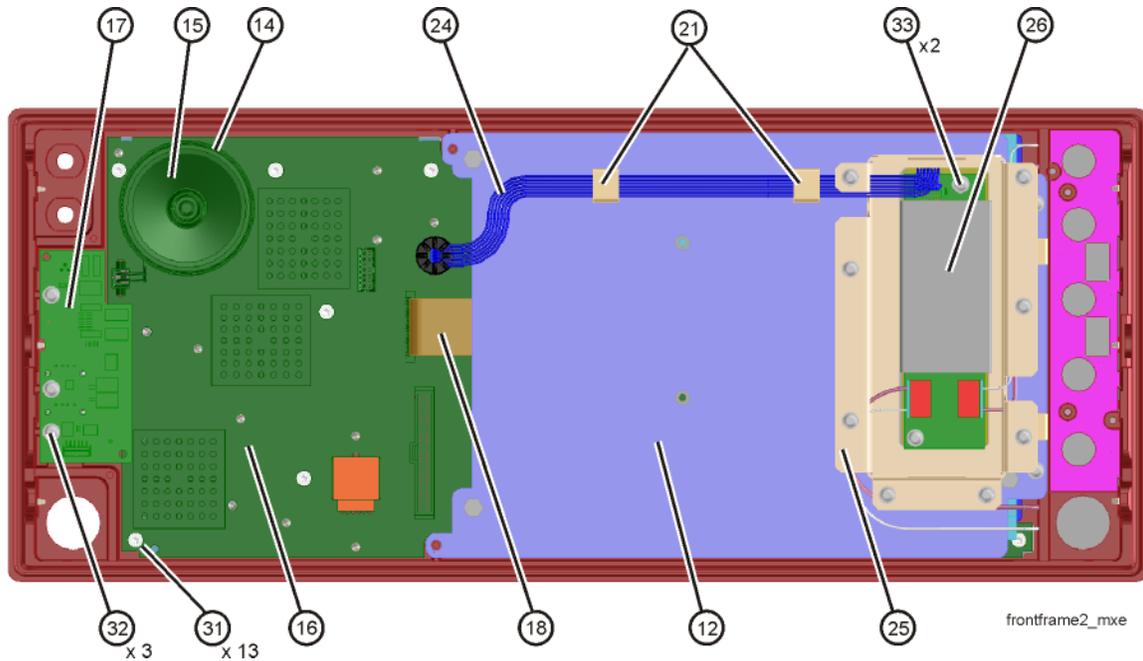
| Item	Description
12	A1MP14 Display Bracket
14	A1A2MP2 Speaker Foam
15	A1A2MP1 Speaker
16	A1A2 Front Panel Interface Board
17	A1A5 Front Panel Daughter Board
18	A1W1 Flex Circuit, Front Panel Interface to LCD
21	A1MP10-13 Cable Clamp
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply
25	A1MP17 Shield, Inverter Assembly, Bottom
26	A1A4 Display Backlight Power Supply
31	Screw M3 X 0.5 (5 mm) (0515-1521)
33	Screw M3 X 0.5 (8 mm) (0515-0372)

Figure 18-78   Front Frame Exploded View - CCFL Backlight

frontframeexplode_mxe
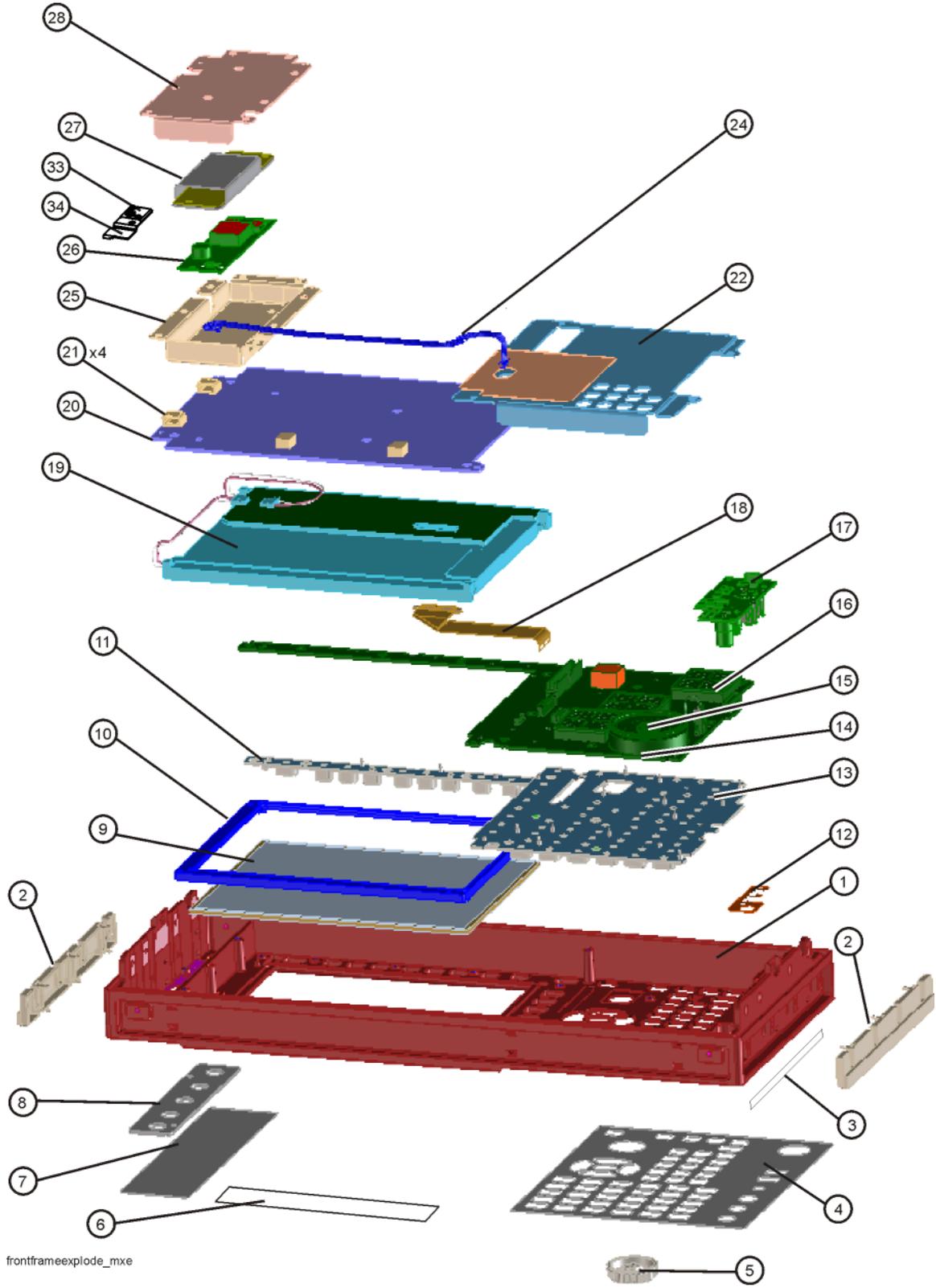
Item	Description
1	Front Frame
2	Front Frame Side Trim Strip (plastic)
3	Front Frame Side Trim Strip (vinyl)
4	Main Keyboard Overlay
5	**A1MP9 RPG Knob**
6	**A1MP3** Nameplate Label
7	Overlay, Left Display
8	Cover Plate
9	**A1MP7 LCD Glass Filter**
10	**A1MP8 LCD Lens Gasket**
11	**A1MP2 Display Keypad**
12	Front Frame Ground Spring
13	**A1MP1 Main Keypad**
14	**A1A2MP2 Speaker Foam**
15	**A1A2MP1 Speaker**
16	A1A2 Front Panel Interface Board
17	**A1A5 Front Panel Daughter Board**
18	A1W1 Flex Circuit, Front Panel Interface to LCD
19	A1A3 Liquid Crystal Display
20	A1MP14 Display Bracket
21	**A1MP10-13 Cable Clamp**
22	**A1MP19 Shield, Front Panel Interface**
24	A1W2 Cable Assembly, Wire Harness, Front Panel Interface to Backlight Power Supply
25	**A1MP17 Shield, Inverter Assembly, Bottom**
26	A1A4 Display Backlight Power Supply
27	**A1MP15 Shield, Inverter Board**
28	**A1MP16 Shield, Inverter Assembly, Top**
33	A1A6 Input 2 LED Board
34	A1MP20 Input 2 LED Board Bracket

Figure 18-79   Front Frame Assembly Shields - CCFL Backlight
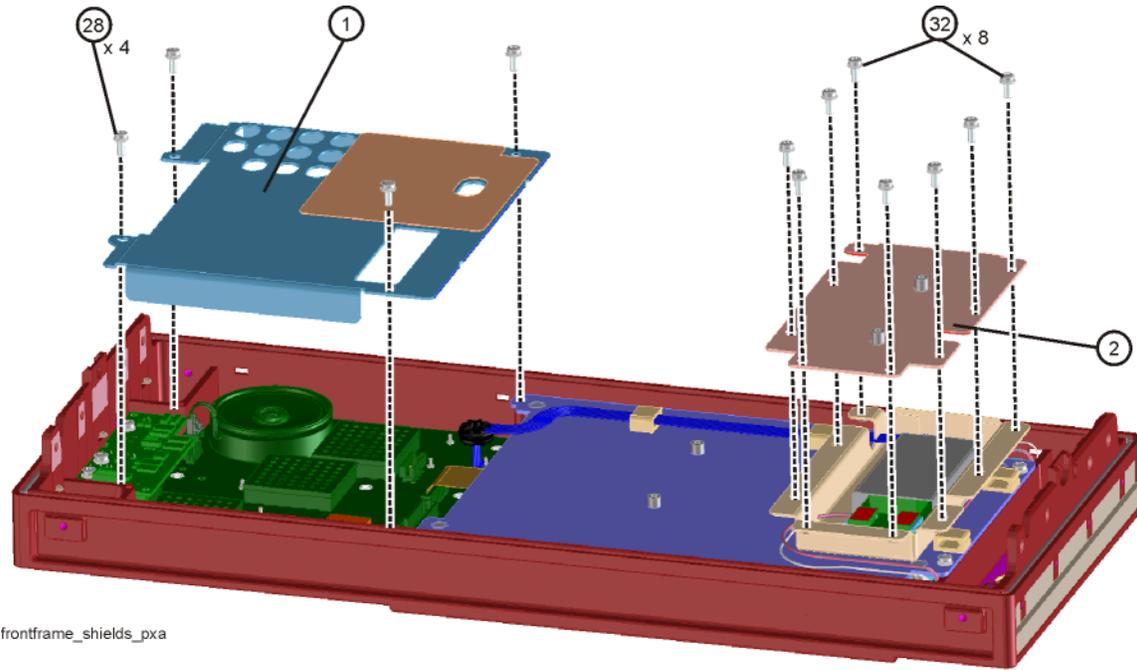
frontframe_shields_pxa

Item	Description
28	Screw M3 X 0.5 (5 mm) (0515-0372)
32	Screw M3 X 0.5 (8 mm) (0515-0372)

Inverter Board Assembly - CCFL Backlight

Removal

1. Refer to Figure 18-79. Remove the eight screws **(32)** (0515-0372) and the inverter top shield.

2. Disconnect the wires **(1)** from the Inverter board **(3)**.

3. Remove the two screws **(2)** (0515-0372) securing the Inverter board **(3)**. The Inverter board and inverter bottom shield can now be removed.

Figure 18-80 Inverter Board Removal - CCFL Backlight
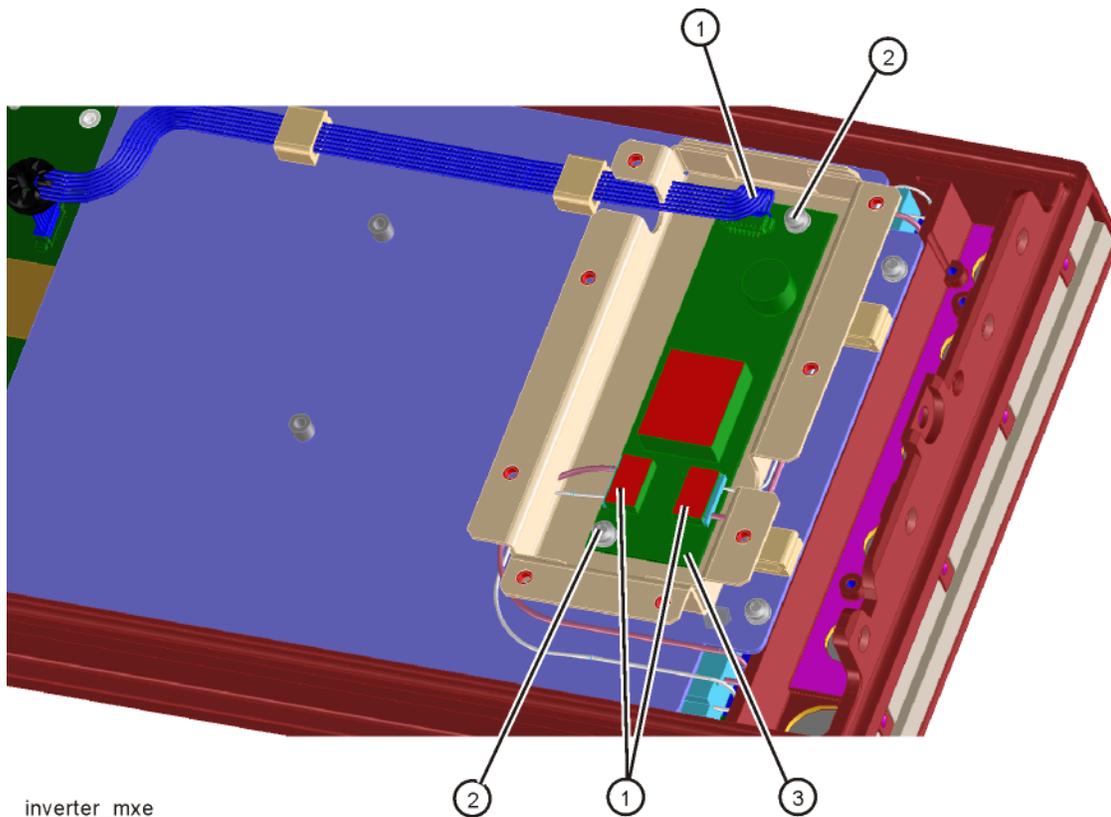

inverter_mxe

Replacement

1. Place the Inverter board into the inverter bottom shield and position onto the display bracket. Replace the two screws (0515-0372). Torque to 9 inch pounds.

2. Reattach the wires to their correct locations.

3. Place the inverter top shield into position. Replace the eight screws **(32)** (0515-0372) as shown in Figure 18-79. Torque to 9 inch pounds.

Display Assembly - CCFL Backlight

Removal

1. Remove the Inverter board and shields.

2. Refer to Figure 18-79. Remove the front panel shield by removing the four screws **(28)** (0515-0372).

3. Disconnect the cable A1W2 **(25)** from the LCD Inverter board **(13)** and unclip the cable from the cable clamps.

4. Refer to Figure 18-81. Disconnect the flex circuit A1W1 **(1)** from the front panel interface board **(4)**.

Figure 18-81   Display Removal - CCFL Backlight

display_mxe
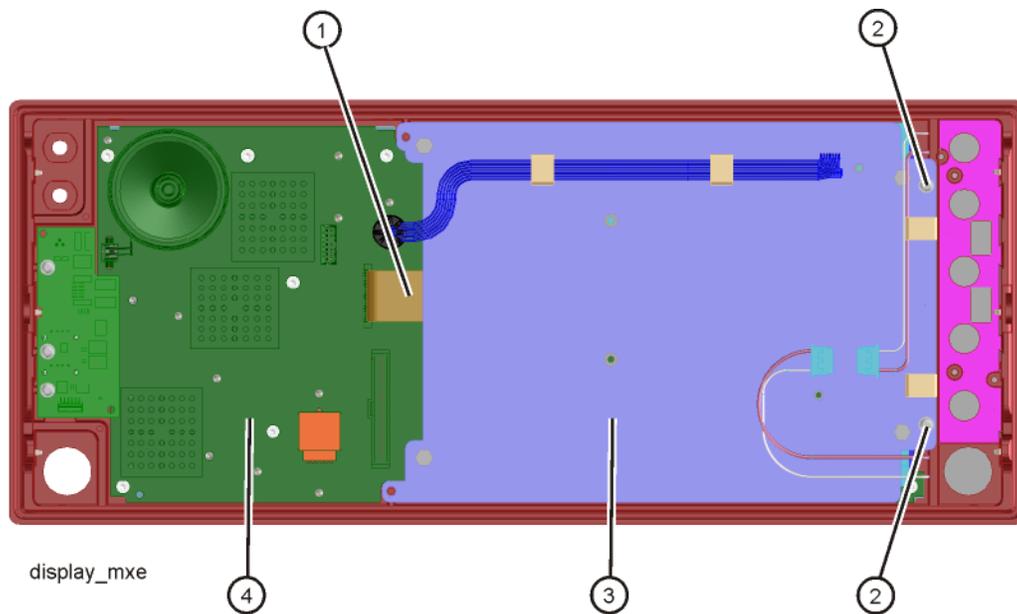
5. Remove the two screws **(2)** (0515-0372) securing the display bracket **(3)** to the Front Frame Assembly. The display can now be removed from the Front Frame Assembly.

CAUTION   Once the display assembly has been removed from the Front Frame Assembly, the glass filter is no longer secured. DO NOT tip the assembly in such a manner that would cause it to fall out of place, as this may cause injury and/or damage to the glass.

6. Refer to Figure 18-82. To separate the LCD **(1)** from the display bracket **(2)**, remove the four screws **(3)** (0515-0367). When reassembling, torque the four screws to 5 inch-pounds.

Figure 18-82   LCD and Display Bracket Separation - CCFL Backlight

display2_pxa
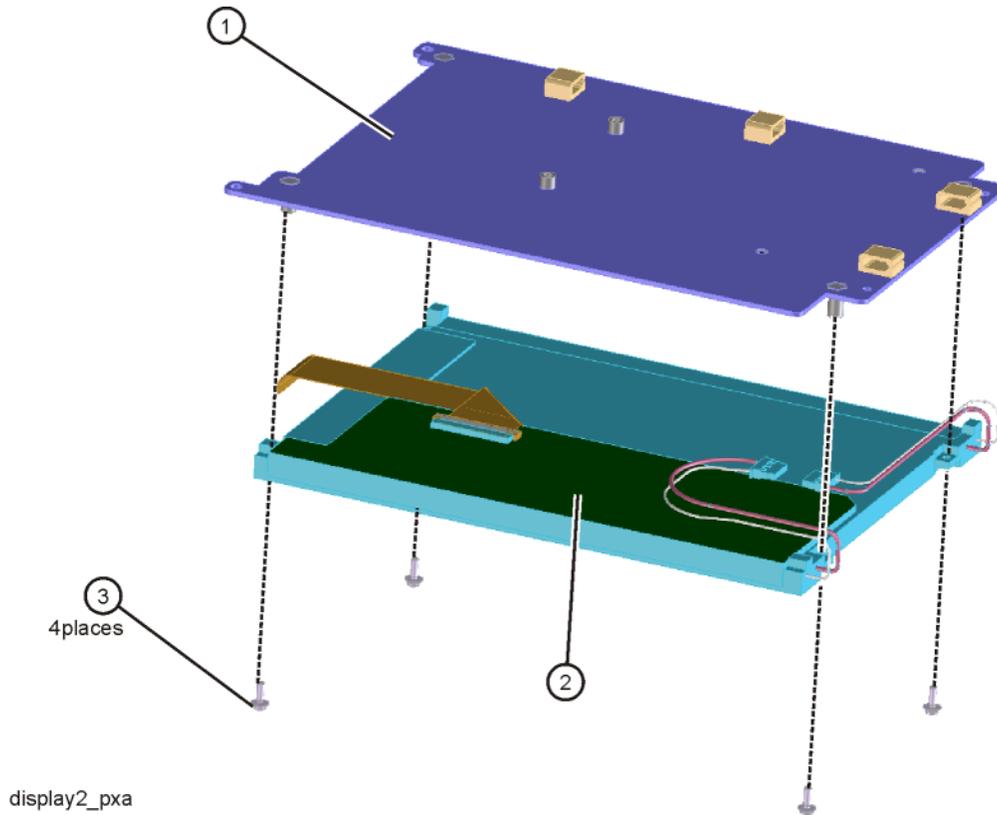
Replacement

1. Refer to Figure 18-81. Place the display bracket into position in the Front Frame Assembly. Reconnect the flex circuit A1W1 **(2)** to the front panel interface board **(4)**.

2. Replace the two screws **(2)** (0515-0372) that secure the display bracket to the Front Frame Assembly. Torque to 9 inch pounds.

3. Replace the Inverter board.

Daughter Board, Interface Board and Keypad – CCFL Backlight

Removal

1. Refer to Figure 18-78. Remove the RPG knob **(5)** by carefully pulling it off.

2. Remove the display. Refer to the Display Assembly – CCFL Backlight removal procedure.

3. Refer to Figure 18-77. Remove the A1A5 Front Panel Daughter board **(17)** by removing the three screws **(32)** (0515-0372) and unplugging it from the front panel interface board.

4. Remove the thirteen screws **(31)** (0515-1521) securing the A1A2 Front Panel Interface board to the Front Frame Assembly. The Front Panel Interface board with the keypad attached can now be lifted from the Front Frame Assembly.

5. To separate the keypad from the Front Panel Interface board, use a push tool or pliers to carefully separate the pull through tabs.

Replacement

1. Install the keypad onto the Front Panel Interface board using the pull through tabs and alignment holes. Use a push tool or pliers to ensure that all of the pull through tabs are properly captive on the board.

2. Install the A1A2 Front Panel Interface board/keypad assembly into the Front Frame Assembly, and replace the thirteen screws **(31)** (0515-1521) to secure. Torque to 9 inch pounds.

3. Replace the A1A5 Front Panel Daughter board **(17)** by plugging it into the Front Panel Interface board using the board to board connectors and secure it with the three screws **(32)** (0515-0372). Torque to 9 inch pounds.

4. Replace the display. Refer to the Display Assembly – CCFL Backlight replacement procedure.

5. Replace the RPG knob by firmly pressing it on.

Input 2 LED Board

Removal

1. Refer to Figure 18-83. Remove the Input 2 LED board **(2)** by removing the two screws **(1)** (0515-0365).

2. Remove the LED bracket **(4)** by removing the single screw **(3)** from the front frame.

Figure 18-83   LED 2 Board Removal
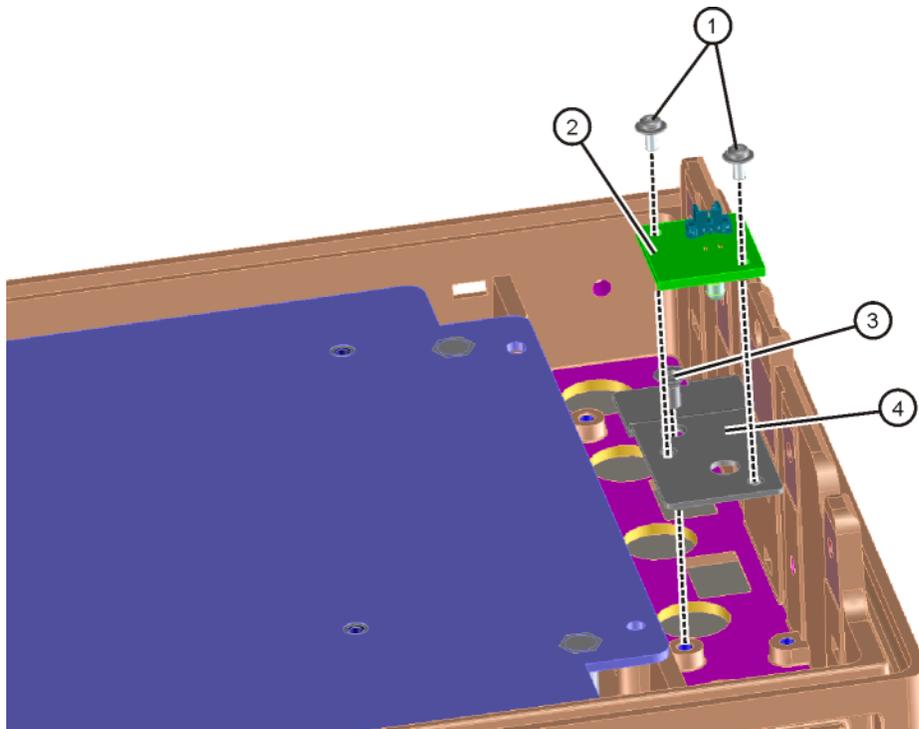
LED2_remove

Replacement

1. Refer to Figure 18-83. Place the LED board bracket **(4)** into position in the Front Frame Assembly. Secure it with the single screw **(3)**, Torque to 9 inch-pounds.

2. Place the LED board **(2)** onto the bracket and secure with two screws **(1)** (0515-0372). Torque to 3 inch-pounds.

Keysight N9038A MXE Service Guide

19   Post–Repair Procedures

What You Will Find in This Chapter

This chapter provides information that will enable you to return an instrument to full operation following the replacement of any instrument assembly. This information includes a table that shows which adjustments and/or performance tests must be executed after replacing an assembly.

Before Starting

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

— Familiarize yourself with the safety symbols, 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.

— Check that the instrument has been turned on and allowed to warm up.

— Ensure that the instrument is operating within a temperature range of 20 °C to 30 °C.

Post-Repair Procedures

The following table lists the adjustments and performance verification tests needed after an assembly replacement.

After an assembly is replaced, find the assembly that has been replaced in the left-hand column, and then perform the recommended adjustment and/or performance verification test. Making the recommended adjustments and/or performance verification tests doesn't guarantee all published specifications are being met. Only a full instrument calibration will do this.

NOTE   Refer to the instrument user's guide for information on instrument warm-up before performing any of the procedures listed in this chapter.

The following procedures are also included in the "Calibration Data Backup and Restore" on page 647.

"Calibration Data Backup and Restore" on page 647

"BIOS Settings Verification" on page 651

"Operating System Initialization" on page 652

"FPGA Synchronization" on page 655

"Programming Model and Serial Numbers" on page 657

Post Repair Procedures	A1A2 Front Panel Interface	A1A3 Display Panel	A2 Analog IF Assembly	A3 Digital IF Assembly	A4 CPU Assembly	A4BT1 Battery	A5 Disk Drive[d]	A6 Power Supply Assembly	A7 Midplane Board	A8 Motherboard	A9 Input Attenuator A	A10 Input Attenuator B	A11 RF Switch / High Band Preamp	A12 YIG Tuned Filter	A13 Front End Assembly	A14 LO Synthesizer Assembly	A15 Front End Control Assembly	A16 Reference Assembly	A21 RF Preselector Input Assembly	A22 Radiated Filter Assembly	A23 Limiter Assembly	A24 Conducted Filter Assembly	A25 Wideband Analog IF Assembly	A26 Wideband Digital IF Assembly	SW1 Cal Switch	SW2 Transfer Switch
Additional Tasks[b]																										
BIOS Settings Verification					X	X																				
Operating System Initialization							X																			
Set Time and Date[c]					X	X																				
Program Model and Serial Numbers										X																
FPGA Synchronization				X												X	X	X	X						X	X
Characterize RF Preselector[g]																			X							
Update Instrument Software[e]							X																			
Calibration Data Backup and Restore							X																			
Characterize Preselector (System, Alignments, Advanced)															X		X									
Time Domain Scan Alignment (System, Alignments, Advanced)[h]							*													X						
Utilities[a]																										
Memory Initialization											X	X													X	X
Attenuator Slope Check																										
Adjustments[a]																										
10 MHz Internal Reference							*											X								
50 MHz Calibrator Amplitude							*				X	X	X		X			X							X	X
RF2 Amplitude Offset							*				X												X		X	
Frequency Response Below 3.6 GHz							*				X	X	X		X				X	X	X	X			X	X
Frequency Response Above 3.6 GHz (Preamp Off)							*				X	X	X	X	X											X
Frequency Response Above 3.6 GHz (Preamp On)							*				X	X	X	X	X											X
Attenuator Slope							*				X	X	X	X					X	X	X	X			X	X
Frequency Response AC Coupled[i]							*				X	X	X	X	X				X	X	X	X			X	X
IF Frequency Response							*																		X	X
Effective DANL							*				X	X	X	X					X	X	X	X				
Overload Detector							*												X	X	X	X				
Front End Controller Attenuator Adjustment[f]							*						X		X		X									
Performance Verification[a]																										
Internal Alignment	X	X	X	X	X		*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Frequency Reference Accuracy							*				X							X								
Power Bandwidth Accuracy			X	X			*				X															
Resolution Bandwidth Switching Uncertainty			X	X			*				X															
Residual Response	X	X	X	X	X		*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Displayed Average Noise Level	X	X	X	X	X		*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Effective DANL (Option NFE)							*				X	X	X	X	X	X			X	X	X	X				
Frequency Readout Accuracy							*				X								X							
Frequency Span Accuracy							*				X					X										
Count Accuracy							*				X								X							
IF Frequency Response			X	X			*				X														X	X
RBW Selectivity CISPR Bands			X	X			*				X															
Phase Noise							*				X					X		X								
Absolute Amplitude Accuracy at 50 MHz			X	X			*				X	X	X		X			X	X	X	X	X			X	X
Input Attenuation Switching Uncertainty							*				X															
Display Scale Fidelity			X	X			*				X															
Frequency Response Above 3.6 GHz (Preamp On)							*				X	X	X	X	X	X	X									X
Spurious Response							*	X			X	X	X	X	X	X	X		X	X	X	X			X	X
Frequency Response Above 3.6 GHz (Preamp Off)							*				X	X	X	X	X	X	X									X
Second Harmonic Intercept							*				X				X	X										
Gain Compression							*				X					X										
Third Order Intermodulation Distortion							*				X				X	X	X									
Responses to Pulses (Peak, Ave, RMS) Band E			X	X			*				X															
Variation with Pulse Repetition Freq (Ave, RMS)			X	X			*				X															
Responses to Intermittent Disturbances (Ave, RMS)			X	X			*				X															
Radiated Band Sine Wave Accuracy							*				X									X						
Frequency Response 50 MHz to 3.6 GHz							*				X	X	X		X			X	X	X	X				X	X
Frequency Response 9 kHz to 50 MHz							*				X	X	X		X			X	X	X	X	X			X	X
Conducted Band Sine Wave Accuracy							*				X											X				
Frequency Response Below 300 kHz							*				X	X	X		X			X	X		X	X			X	X
Q-P Detector Absolute Calibration			X	X			*				X										X		X			
Q-P Detector Variation with Pulse Repetition Freq			X	X			*				X										X		X			
Q-P Detector Relative Responses to Pulses			X	X			*				X															
Response to Pulses (Peak, Ave, RMS) Bands A/B/C/D			X	X			*				X															
Conducted Band VSWR							*				X	X	X						X		X	X			X	X
Radiated Band VSWR							*				X	X	X						X		X	X			X	X

[a] Calibration Software required for all performance tests, adjustments and utilities. For details see http://www.keysight.com/find/calibrationsoftware

[b] See the "Additional Tasks" section in this chapter for detailed instructions on these tasks

[c] To set the instrument time and date select **Start, Control Panel, Date Time Language and Regional Options, Date and Time**

[d] Before replacing the A5 Disk Drive, see the "Calibration Data Backup and Restore" section in this chapter for details

[e] See Chapter 19, "Instrument Software" for instructions on updating the instrument software to the latest version

[f] Only if option CR3 is installed

[g] Found in instrument Service Menu under **System, Service, RF Preselector, Characterize RF Preselector, All Bands**. See Chapter 16 - Service & Diagnostics Menu for details.

[h] Only if option TDS is installed

[i] Not applicable for option 544 instruments

X = Must Perform in the order listed

* = Must Perform if calibration file cannot be transferred to new disk drive

Calibration Data Backup and Restore

In order for the instrument being repaired to not need all of the instrument adjustments and performance verification tests to be run after the A5 Disk Drive is replaced the calibration data will need to be backed up onto an external drive prior to removing the existing disk drive.

NOTE

While the backing up and restoring of the calibration data to the new disk drive will return the instrument performance to the state that it was prior to a repair this does not guarantee that all instrument performance parameters meet their specified values. A full instrument calibration would be required to verify this.

Data Backup

There are two different backup procedures that might need to be followed. Which backup procedure to be run will depend on whether the software will run or not.

If the Instrument Software Application Will Run

1. Connect a USB keyboard and mouse to two of the instrument rear panel USB ports

2. Connect a USB FLASH drive to one of the front panel USB port.

3. Press **System**, **Alignments**, **Backup or Restore Align Data**.

4. The Alignment Data Wizard window as shown in Figure 19-1 will appear.

Figure 19-1   Alignment Data Wizard
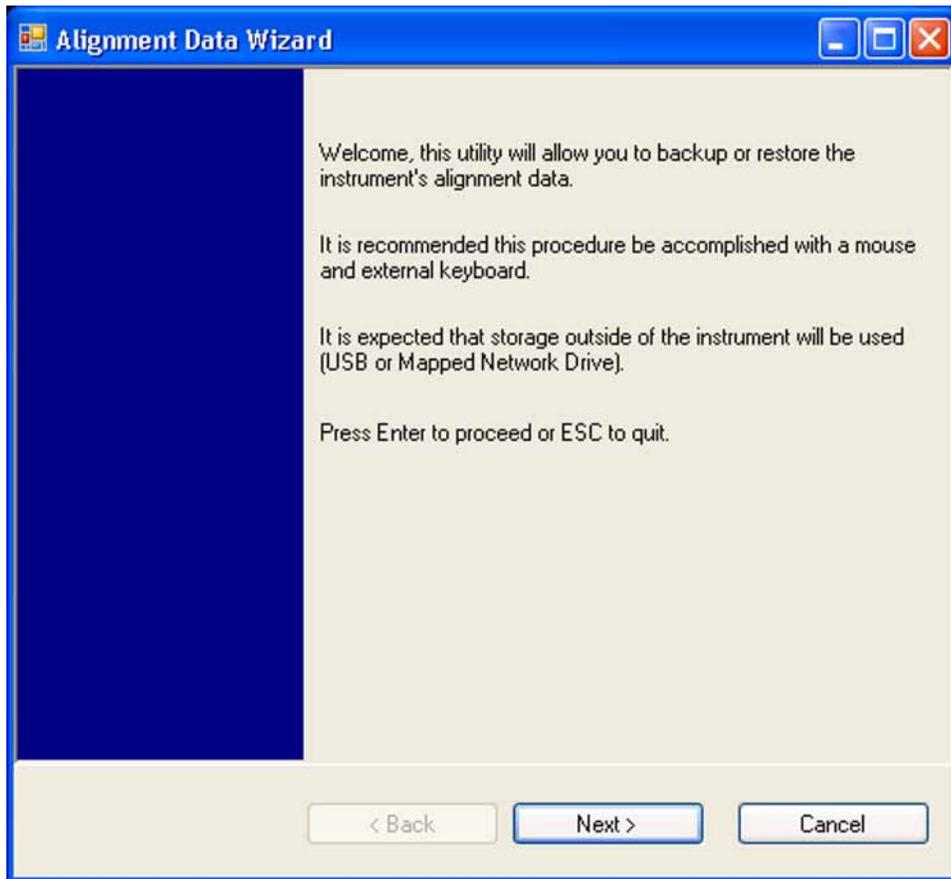
5. Follow the on-screen instruction to backup the calibration data to the USB FLASH drive.

If the Instrument Software Application Will Not Run

1. Connect a USB mouse to one of the instrument front panel USB ports.

2. Connect a USB FLASH drive to the other front panel USB port.

3. Using the mouse go to Start, Computer, and navigate to the following folder:

   C:\Program Files\Agilent\SignalAnalysis\Infrastructure

4. Double-click on BackupRestoreAlignDataWizard and the window shown in Figure 19-1 will appear.

5. Follow the on-screen instructions to backup the calibration data to the USB FLASH drive.

Data Restore

1. Connect a USB mouse to one of the instrument front panel USB ports.

2. Locate the USB FLASH drive that was earlier used to backup the instrument calibration file and insert it into one of the instrument front panel USB ports.

3. Restore the instrument calibration data by pressing: **System**, **Alignments**, **Backup or Restore Align Data...** The Alignment Data Wizard window as shown in Figure 19-1 will appear.

4. Follow the on-screen instruction to restore the previously saved calibration data from the USB FLASH drive.

BIOS Settings Verification

Whenever either the A4 CPU assembly or the A4BT1 CPU Battery is changed there are certain BIOS settings that need to be verified. If these are not set correctly the instrument may not boot up or operate correctly.

Default BIOS Settings

1. Connect an external USB keyboard to one of the front panel USB ports.

2. Turn on instrument power.

3. Confirm Keysight Technologies splash screen comes up within a few seconds.

4. Press the key on the keyboard specified on the initial boot screen to enter the setup utility.

5. Navigate to the Exit screen and select "Restore Defaults" or "Load Setup Defaults", whichever is present.

6. Once the defaults have been loaded select "Save Changed" and "Exit".

Operating System Initialization

When a new disk drive is powered on for the first time the operating system will need to initialize itself before the instrument can be used. This will take just a few minutes to complete and will require very little user interaction.

Initialization

1. With the new disk drive installed power the instrument on.

2. Within a few seconds you will see the initial Keysight Technologies splash screen, and then the boot selection menu as seen in Figure 19-2.

3. Allow the instrument to boot the Windows operating system. (This will happen automatically after 5 seconds if the instrument is left alone).

Figure 19-2   Boot Selection Screen
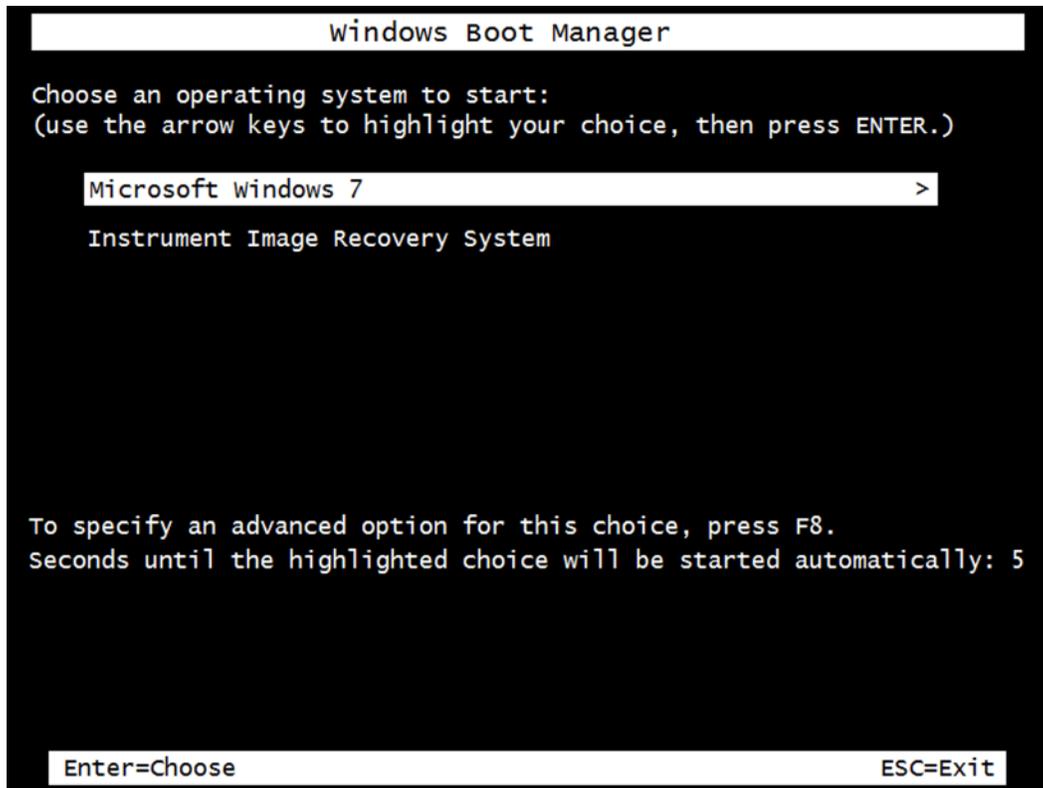
4. After a few moments the License Agreement message window will appear, as shown in Figure 19-3.

Figure 19-3   License Agreement Window
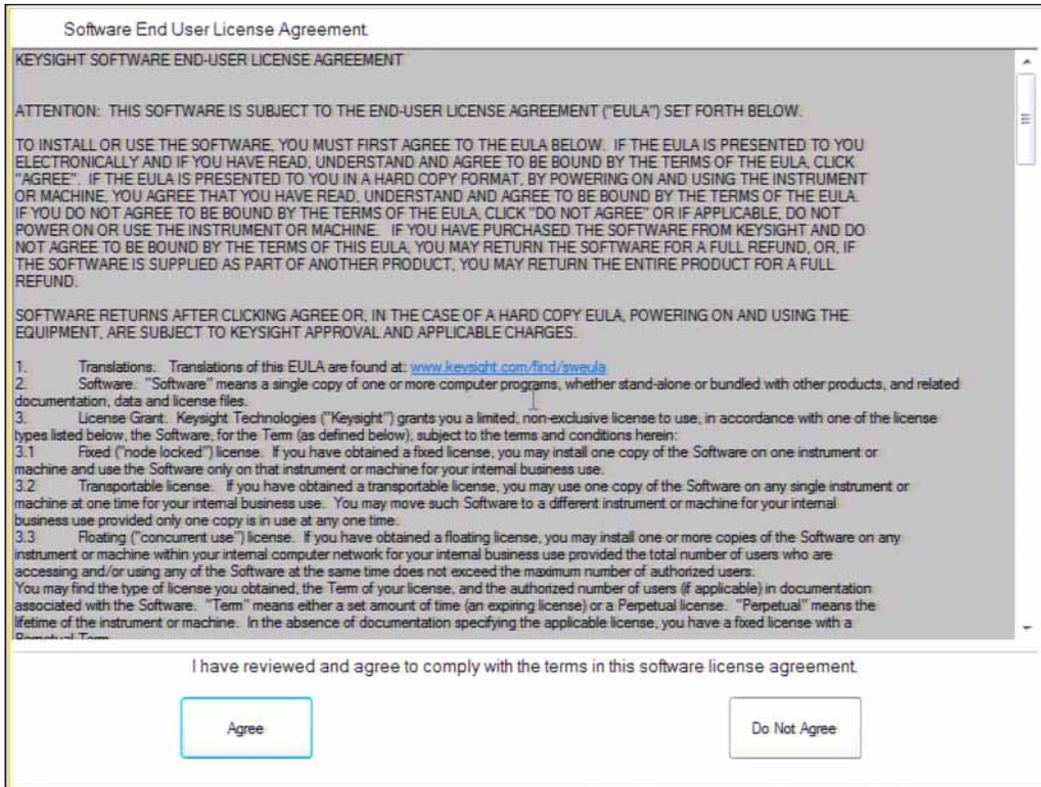
5. Select "Agree" to continue with the operating system initialization.

NOTE   If the initialization process would like to be postponed select "Do Not Agree" at this time to safely shut the instrument off. The next time this disk drive is powered on this process will be restarted.

6. The instrument will now reboot and complete the initialization process. Once this process has completed the Anti-Virus Message will appear, as shown in Figure 19-4. At this point the operating system initialization process will be completed and either selection can be made, or the instrument can be powered off.

Figure 19-4   Anti-Virus Message

7. The disk drive in use is now ready for further configuration.

FPGA Synchronization

There is FPGA (Field-Programmable Gate Array) program code on many different assemblies inside of the instrument, and all of these must be of a compatible version with the instrument software revision. In order to ensure that this requirement is met when either an assembly is replaced that contains FPGA code on it, or if the A5 Disk Drive is replaced with a drive that has a different version of software than the previous drive, you will need to take certain steps to ensure that the instrument operates properly.

NOTE
Even if an instrument appears to work properly when an assembly with FPGA code is replaced, that does not mean that the FPGA code is completely compatible with the software version installed in the instrument. There could be incompatibilities that will only be seen under certain measurement conditions.

Updating the Instrument FPGA Code

All instruments have a utility included in them that will update the FPGA code on all of the different assemblies in the instrument that have it. When this utility is run it will detect the assemblies that need to be updated and will update them to the correct revision.

NOTE
Once you start the FPGA programming process you MUST NOT interrupt the process for any reason. This would include turning the instrument off or unplugging the power cord to the instrument. Doing so will result in an inoperative instrument, requiring the affected assembly to be replaced.

1. Close the instrument application software by pressing **File**, **Exit**, **Enter** using the front panel keys.

2. Connect a USB mouse to one of the instrument front panel USB ports.

3. Using the mouse go to Start, Computer and navigate to the following folder:

   C:\Program Files\Agilent\SignalAnalysis\Physics

4. In this folder find and execute the file named:

   FPGA_Prog.bat

5. The FPGA Programming Utility will start and a window as shown in Figure 19-5 will appear.

Figure 19-5   FPGA Programming Utility
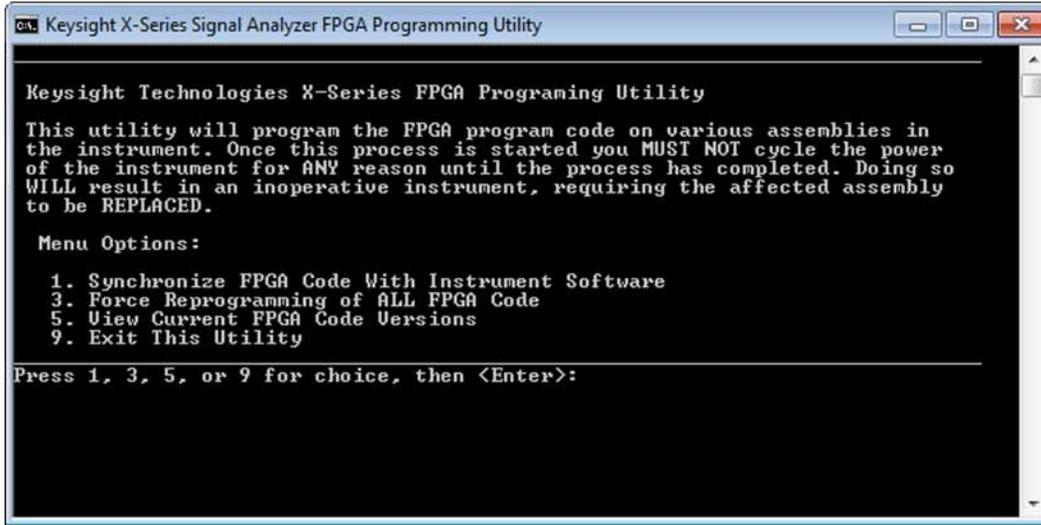
6. To program the FPGA code enter **1** and press **Enter**. You will need to confirm this selection by pressing **1** and **Enter** one more time.

7. The programming of the FPGA code could take a few minutes to complete. Once it has finished the instrument will reboot itself to use the new code and this process will then be completed.

Programming Model and Serial Numbers

Since the instrument model and serial numbers are stored only on the A7 Midplane board assembly, this information will be lost when this board assembly is replaced. Until the instrument model and serial numbers are restored the instrument application software will not allow any user measurements to be made, due to the fact that all previously installed license keys will not be accepted. However, the license files will not be automatically deleted. Once the model and serial numbers are restore the license files will then be recognized and accepted, returning the instrument to the capability that was available prior to the A7 Midplane board assembly replacement.

To program the model and serial numbers into a replacement A7 Midplane board assembly the N7818A Keysight MXE EMI Receiver Calibration Application Software will be required.

Information regarding N7818A Keysight MXE EMI Receiver Calibration Application Software can be found at:

http://www.keysight.com/find/calibrationsoftware

When the calibration software first detects the instrument it will recognize that it does not have a valid model and serial number and will prompt the user to enter the correct values.

NOTE   Be very careful when entering the instrument serial number into the software, because once it has been written it can no longer be changed.

Since the instrument model and serial numbers are stored on the A7 Midplane board assembly, this should only be required when this assembly has been replaced with a new one.

20   Instrument Software

What You Will Find in This Chapter

KEYSIGHT
TECHNOLOGIES

Instrument Software Overview

The instrument software, installed in every instrument, contains not only the EMI Receiver measurement application, but also all of the other currently available measurement applications. However, only the licensed applications will be seen and available for use.

To view the currently licensed measurement applications press **System**, **Show**, **System**. In addition to listing the application model number and description you will also see the revision of each. However, the complete package itself also has a revision associated with it, which can also be found on this screen as the "Instrument S/W Revision".

Since the instrument application software is distributed in one complete package, when an update is installed they are all updated at the same time. One of the benefits of this is that you cannot have revisions that are incompatible with each other installed in an instrument.

Software Licensing

All application software needs to have a valid license in order to be available for use. This also includes the spectrum analyzer application (N9060B).

Software Updates

Instrument Measurement Application Software

Updates are installed much like most other types of commercial software packages. The latest revision of the software, along with complete installation instructions, can be downloaded from:

www.keysight.com/find/mxe_software

21 Performance Verification and Adjustment Software

Test Software Overview

The N9038A MXE EMI Receiver can be fully tested and adjusted with the use of the N7818A MXE EMI Receiver Calibration Application software.

To download a copy of the Performance Verification & Adjustment software as well as find information on software licensing, visit the Keysight Calibration & Adjustment Software web site at:

http://www.keysight.com/find/calibrationsoftware

Performance Verification Tests

Performance verification tests are tests designed to provide the highest level of confidence that the instrument being tested conforms to published, factory-set specifications. The tests are supplied in an automated test software package. The automatic execution of the full set of performance tests will take between six and eight hours to complete. Performance tests are designed to test an instrument operating within the operational temperature range defined by the instrument specifications.

A complete list of the performance verification tests can be found at:

http://cal.software.keysight.com/

Adjustments

Adjustments are procedures designed to reset various circuit parameters or calculate correction values associated with certain measurements. The adjustments are supplied in an automated test software package. The software is designed to adjust an instrument operating within the operational temperature range defined by the instrument specifications.

Never perform adjustments as routine maintenance. Adjustments should be performed only after a repair or a performance test failure.

A complete list of the adjustments can be found at:

http://cal.software.keysight.com/

KEYSIGHT
TECHNOLOGIES

Required Test Equipment

A complete list of test equipment required to perform both the performance verification testing as well as all adjustments can be found at:

http://cal.software.keysight.com/

22 Tests

What You Will Find in This Chapter

The following information is found in this chapter:

KEYSIGHT
TECHNOLOGIES

Functional Test Versus Performance Verification

Functional tests use a minimum set of test equipment to check a much smaller range of parameters (and a limited number of data points for each parameter) than do performance verification tests. Functional tests use limits that are wider than the published specifications; measurement uncertainty analysis is **not** available for functional tests.

NOTE	If a functional test does not pass, you must run performance verification tests to determine whether a problem exists.

Performance verification tests span a wide range of instrument parameters and provide the highest level of confidence that the instrument conforms to published specifications. These tests can be time consuming and require extensive test equipment.

Before Performing a Functional Test

1. Ensure that you have the proper test equipment.

2. Switch on the unit under test (UUT) and let it warm up (in accordance with warm-up requirements in the instrument specifications).

3. Allow sufficient warm-up time for the required test equipment (refer to individual instrument documentation for warm-up specifications).

4. Ensure that the analyzer's frequency reference is set to Internal:

    a. Press the **Input/Output**, More, **Freq Ref In** keys.

    b. If the **Freq Ref In** softkey does **not** show Internal, press the **Freq Ref In** softkey and select Internal.

5. Following instrument warm-up, perform the auto align routine:

    Press **System**, **Alignments**, **Align Now, All**.

6. Run the EMI receiver internal RF preselector alignments by pressing **System**, **Alignments**, **More**, **RF Preselector**, **Align Now**, **20 Hz to 3.6 GHz**.

> **NOTE**   Functional test accuracy depends on the precision of the test equipment used. Ensure that all of the test equipment is calibrated before running a functional test.

Test Equipment

The table below summarizes the test equipment needed to perform all of the functional tests. Alternate equipment model numbers are given in case the recommended equipment is not available. If neither the recommended nor the alternative test equipment are available, substitute equipment that meets or exceeds the critical specifications listed.

Table 22-1   Required Test Equipment

Item	Quantity	Critical Specifications	Recommended Keysight Model
Adapters			
Adapter BNC (f) to SMA (m)	1	Frequency: 40 MHz to 80 MHz	1250-1200
Adapter Type N (m) to 3.5 mm (m)	1	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743
Adapter Type N (m) to 3.5 mm (f)	1	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	1250-1744
Adapter Type N (m) to BNC (f)	1	Frequency: 10 MHz to 80 MHz VSWR: < 1.05:1	1250-1476
Adapter 3.5 mm (f) to 3.5mm (f)	1[a]	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Adapter 2.4 mm (f) to 3.5mm (f)	1[b]	Frequency: 10 MHz to 50 GHz VSWR: < 1.1:1	11901B
Adapter 2.4 mm (f) to 3.5mm (m)	1[b]	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	11901D
Attenuators			
Attenuator, 10 dB 3.5 mm (m) to 3.5 mm (f))	2	Frequency:50 MHz VSWR: < 1.2:1	8493C Option 010
Attenuator, 10 dB Step 3.5 mm (f) to 3.5 mm (f))	1	Range: 0 to 50 dB Frequency: 50 MHz Accuracy: ±0.25 dB	8495A Option 004
Attenuator, 30 dB Type-N (m) to Type-N (f)	1	Accuracy: < 0.5 dB @ 50 MHz	11708A
Attenuator, 30 dB 3.5 mm (m) to 3.5 mm (f))	1[c]	Accuracy: < 0.5 dB @ 50 MHz	8493C Option 030

Table 22-1   Required Test Equipment

Item	Quantity	Critical Specifications	Recommended Keysight Model
Cables			
Cable, 1 meter 2.4 mm (m) to 2.4 mm (m)	1[b]	Frequency:50 MHz to 44 GHz VSWR< 1.55:1	8120-6164
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	2	Frequency:10 MHz to 26.5 GHz VSWR< 1.4:1	11500E
Cable, 120 cm BNC (m) to BNC (m)	2	Frequency:10 MHz	10503A
Power Meters/Sensors			
Power Meter	1	Compatible with power sensor	E4418B
Power Sensor	1	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: −25 dBm to 10 dBm	8485A
Power Sensor	1	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: −65 to −55 dBm	8485D
Power Sensor	1[b]	Frequency Range: 50 MHz to 44 GHz Amplitude Range: −30 to 20 dBm	8487A
Power Sensor	1[b]	Frequency Range: 50 MHz to 44 GHz Amplitude Range: −65 to −55 dBm	8487D
Power Sensor	1	Frequency Range: 9 kHz to 1 GHz Amplitude Range: −60 to 0 dBm	E9304A
Signal Source			
Signal Generator	1	Frequency: 50 MHz to 26.5 GHz Output Level Accuracy: 0 to −15 dBm: ±1.0 dB Spectral Purity: Better than −20 dBc Typical Temperature Stability: 0.01 dBc/°C	PSG
EMI Calibration Pulse Generator	1	Pulse Area meets CISPR 16-1-1 specification	Schwarzbeck IGUU 2916
Miscellaneous Equipment			
Filter, 50 MHz Low Pass BNC (m) to BNC (f)	1	Cutoff Frequency: 50 MHz Rejection at 65 MHz: > 40 dB Rejection at 75 MHz: > 60 dB	0955-0306
Power Splitter 3.5 mm (f)	1	Frequency Range: 50 MHz to 26.5 GHz Tracking Between Ports: < 0.25 dB	11667B

Table 22-1   Required Test Equipment

Item	Quantity	Critical Specifications	Recommended Keysight Model
Power Splitter 2.4 mm (f)	1[b]	Frequency Range: 50 MHz to 44 GHz Tracking Between Ports: < 0.4 dB	11667C
Termination, 50 Ω Type-N (m)	1	Frequency: DC to 18 GHz	909A Option 012
Termination, 50 Ω 3.5 mm (f)	1[c]	Frequency: DC to 26 GHz	909A Option 011
Termination, 50 Ω 2.4 mm (f)	1[b]	Frequency: DC to 50 GHz	85138B

a. Quantity of 2 required for Option C35 (3.5 mm RF Input 1)
b. Required for Option 544 (44 GHz Frequency Range)
c. Only required for Option C35 (3.5 mm RF Input 1)

Displayed Average Noise Level (DANL)

Test Limits

See test limits in Table 22-3 and Table 22-4.

Overview

The Displayed Average Noise Level (DANL) of the EMI receiver is measured across a 10 kHz frequency span at several center frequencies. The receiver input is terminated into a 50 Ω load. A test is performed to assure the measurement is not performed in the presence of a residual response. The measurement is then averaged, and the result is normalized to a 1 Hz bandwidth.

This measurement is performed for both RF inputs.

Table 22-2   Displayed Average Noise Level (DANL) - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Termination, 50 Ω Type-N (m)	Frequency: DC to 18 GHz	909A Option 012
Termination, 50 Ω [a] 3.5 mm (f)	Frequency: DC to 26 GHz	909D Option 011
Termination, 50 Ω [b] 2.4 mm (f)	Frequency: DC to 50 GHz	85138B

a. Only required for Option C35 (3.5 mm RF Input 1)
b. Only required for Option 544 (44 GHz Frequency Range)

Figure 22-1   DANL Test Setup
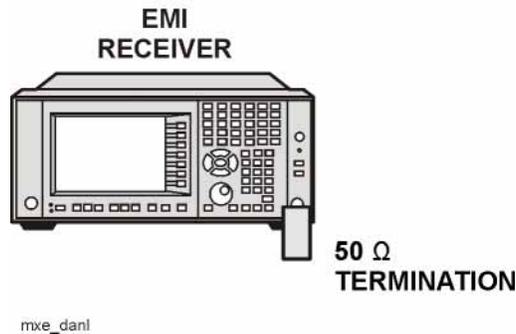
Procedure

1. Configure the equipment as shown in Figure 22-1.

2. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input**.

3. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

4. Set up the receiver by pressing:

> **Mode Setup**, **EMC Standard**, **None**
> **FREQ Channel**, **Center Freq**, **10**, **MHz**
> **Input/Output**, **RF Input**, **RF Coupling DC** (if available)
> **SPAN X Scale**, **Span**, **10 kHz**
> **AMPTD Y Scale**, **−70 dBm**
> **AMPTD Y Scale**, **Attenuation**, **MechAtten**, **0 dB**
> **BW**, **Res BW**, **1 kHz**
> **BW**, **Video BW**, **100 Hz**
> **Meas Setup**, **Average/Hold**, **Number**, **20**, **Enter**
> **Trace/Detector**, **Trace Average**
> **Single**

5. Perform the following steps for each row listed in Table 22-3 that applies to the frequency range of the instrument being tested:

   a. Set the receiver center frequency to the value listed in the Center Frequency column in Table 22-3 by pressing **FREQ Channel**, **Center Freq**, [Value].

   b. On the receiver, press **Restart**.

   c. Wait for the receiver to finish averaging.

   d. On the receiver, press **View/Display**, **Display**, **Display Line On**.

   e. Rotate the knob and set the display line at the average amplitude of the displayed noise floor by visual inspection.

   f. Confirm that the measurement is performed on the analyzer noise floor and not on a residual response within the displayed 10 kHz span.

NOTE

Ignore the residual response if one appears when taking the measurement.

   g. Enter the value of the display line as the Measured Average Noise Level in Table 22-3.

h. Normalize the measured value to a 1 Hz BW by adding –30 dB to the measured value.

NOTE The –30 dB value is added because the formula used to calculate the value of the noise power in a 1 Hz BW when measured with a 1 kHz BW is:

Normalized Noise = 10 Log (BW 2/BW 1) where BW 2 is the 1 kHz BW we measure and BW 1 is 1 Hz BW to which we want to normalize.

Therefore, 10 Log (1000) = 30 dB, so the noise floor will be 30 dB lower in a 1 Hz BW.

i. Enter the Normalized Average Noise Level value in Table 22-3.

j. The value of the normalized displayed average noise should be less than the specification value.

Table 22-3   Displayed Average Noise Level (DANL) Results - RF Input 1

Center Frequency	Measured Average Noise Level (dBm)	Normalized Average Noise Level/ (1 Hz BW) (dBm)	Test Limits (dBm)
10 MHz			–150
2 GHz			–150
6 GHz			–145
13 GHz[a]			–147
20 GHz[a]			–142
26.5 GHz[a]			–135
30 GHz[b]			–141
44 GHz[b]			–135

a. Option 526 and 544 only.
b. Option 544 only.

6. Attach a 50 Ω termination to RF Input 2.

7. Select RF Input 2 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

8. Tune the receiver to 10 MHz by pressing **Freq Channel**, **Center Freq**, **10 MHz**.

9. Perform the following steps for each row listed in Table 22-4.

    a. Set the receiver center frequency to the value listed in the Center Frequency column in Table 22-4 by pressing **FREQ Channel**, **Center Freq**, [Value].

    b. On the receiver, press **Restart**.

    c. Wait for the receiver to finish averaging.

    d. On the receiver, press **View/Display**, **Display**, **Display Line On**.

    e. Rotate the knob and set the display line at the average amplitude of the displayed noise floor by visual inspection.

    f. Confirm that the measurement is performed on the analyzer noise floor and not on a residual response within the displayed 10 kHz span.

    g. Enter the value of the display line as the **Measured Average Noise Level** in Table 22-4.

    h. Normalize the measured value to a 1 Hz BW by adding –30 dB to the measured value.

    i. Enter the Normalized Average Noise Level value in Table 22-4.

    j. The value of the normalized displayed average noise should be less than the specification value.

Table 22-4   Displayed Average Noise Level (DANL) Results - RF Input 2

Center Frequency	Measured Average Noise Level (dBm)	Normalized Average Noise Level /(1 Hz BW) (dBm)	Test Limits (dBm)
10 MHz			–139
100 MHz			–140
500 MHz			–142
1 GHz			–140

Frequency Readout Accuracy

Test Limits

Frequency Readout Accuracy is equivalent to the following equation:

$$\pm(\mathbf{0.25\%} \times span + \mathbf{5\%} \times RBW + \mathbf{2}\ Hz + \mathbf{0.5} \times horizontal\ resolution)$$

See Table 22-6 for actual limits used.

Overview

The frequency readout accuracy is measured in several spans and center frequencies that allow both internal receiver synthesizer modes and prefilter bandwidths to be tested. Frequency reference error is eliminated by using the same frequency standard for the receiver and signal source.

This measurement is performed on RF Input 1 only.

Table 22-5   Frequency Readout Accuracy - Required Equipment

Item	Critical Specification (for this test)	Recommended Keysight Model
Adapter Type-N (m) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	1250-1744
Adapter[a] 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	83059B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.4:1	11500E
Cable, 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Signal Generator	Frequency: 10 MHz to 1.51 GHz	PSG
Adapter[b] 2.4 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.4:1	11901B

a. Quantity of 2 required for Option C35 (3.5 mm RF Input 1)
b. Required for Option 544 (44 GHz Frequency Range)

Figure 22-2   Frequency Readout Accuracy Test Setup
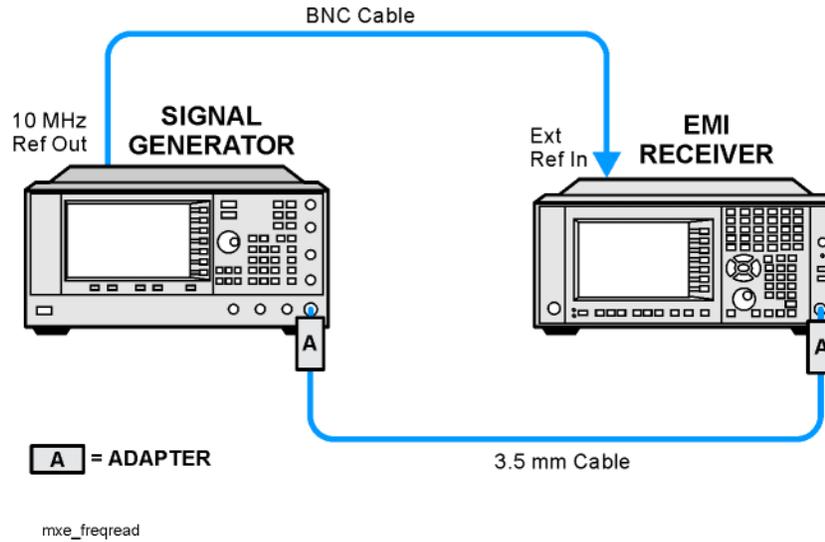
Procedure

1. Configure the equipment as shown in .

2. If the auto alignment for the analyzer has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now**, **All** to perform the auto alignment routine.

3. On the signal generator, press **PRESET**, then set the controls as follows:

   > **FREQUENCY**, **1505**, **MHz**
   > **POWER LEVEL**, **–10**, **dBm**
   > **RF, On**

4. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input**.

5. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset.**

6. Set up the receiver by pressing:

   > **Mode Setup, EMC Standard, None**
   > **Input/Output, More, Freq Ref In, External**
   > **FREQ Channel, Center Freq, 1505, MHz**
   > **SPAN X Scale, Span, 2990, MHz**
   > **Trace/Detector, More, Detector, Sample**
   > **Single**

7. Perform the following steps for each row listed in Table 22-6:

    a. Set the signal generator frequency to the value listed in the Center Frequency column in Table 22-6.

    b. Set the receiver center frequency to the value listed in the Center Frequency column in Table 22-6 by pressing **FREQ Channel**, **Center Freq**, [Value].

    c. Set the receiver span to the value listed in the Span column of Table 22-6 by pressing **SPAN X Scale**, **Span**, [Value].

    d. On the receiver, press **Restart**.

    e. On the receiver, press **Peak Search**.

    f. Record the marker value in the Marker Frequency Readout column in Table 22-6.

Table 22-6   Frequency Readout Accuracy Results

Center Frequency (MHz)	Span (MHz)	Test Limit Minimum	Marker Frequency Readout	Test Limit Maximum
1505	2990	1495.9 MHz		1514.1 MHz
1505	127.2	1504.56 MHz		1505.44 MHz
1505	54.1	1504.8122 MHz		1505.1878 MHz
1505	7.95	1504.97240 MHz		1505.0276 MHz
1505	0.106	1504.999630 MHz		1505.000370 MHz
517.59	1.98	517.58316 MHz		517.59684 MHz
832.50	1.98	832.49316 MHz		832.50684 MHz

Second Harmonic Distortion (SHD)

Test Limits

Table 22-7 Second Harmonic Distortion Test Limits

Applied Frequency	Mixer Level[a]	Distortion
40 MHz	–15 dBm	< –55 dBc

a. Mixer Level = Input Level – RF Attenuation

Overview

This test checks the second harmonic distortion of the EMI receiver by tuning to twice the input frequency and examining the level of the distortion product. A low pass filter is inserted between the source and the receiver to prevent the source second harmonic from artificially raising the second harmonic product displayed on the receiver.

This measurement is performed on RF Input 1 only.

Table 22-8 Second Harmonic Distortion - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type-N (m) to BNC (f)	Frequency: 40 to 80 MHz VSWR: < 1.05:1	1250-1476
Adapter[a] BNC (f) to SMA (m)	Frequency: 40 to 80 MHz	1250-1200
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 40 to 80 MHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 40 to 80 MHz VSWR: < 1.1:1	11901B
Cable, 120 cm BNC (m) to BNC (m) (2 required)	Frequency: 10 to 80 MHz	10503A
Filter, 50 MHz Low Pass	Cutoff Frequency: 50 MHz Rejection at 65 MHz: > 40 dB Rejection at 75 MHz: > 60 dB	0955-0306
Signal Generator	Frequency: 50 MHz Spectral Purity: Better than –30 dBc	PSG

a. Quantity 2 required for Option C35 (3.5 mm RF Input 1) or Option 544 (44 GHz Frequency Range)

b. Quantity 2 required for Option C35 (3.5 mm RF Input 1)

c. Required for Option 544 (44 GHz Frequency Range)

Figure 22-3   Second Harmonic Distortion Test Setup
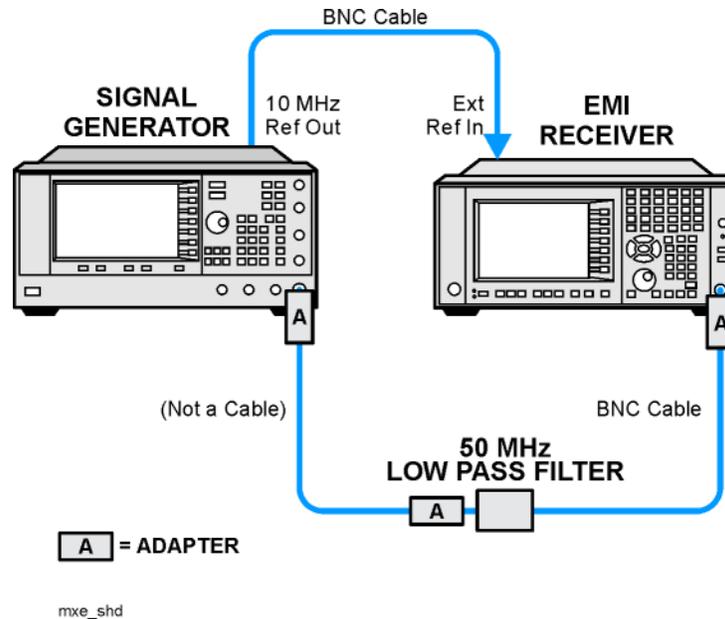
Procedure

1. Configure the equipment as shown in Figure 22-3.

2. On the signal generator, press **PRESET**, then set the controls as follows:

   > **Frequency**, **40**, **MHz**
   > **Amplitude**, **–5**, **dBm**
   > **RF**, **On**

3. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input**.

4. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

5. Set up the receiver by pressing:

   > **Mode Setup**, **EMC Standard**, **None**
   > **Input/Output**, **More**, **Freq Ref In**, **External**
   > **FREQ Channel**, **Center Freq**, **40**, **MHz**
   > **SPAN X Scale**, **Span**, **1**, **MHz**
   > **AMPTD Y Scale**, **Attenuation**, **Mech Atten**, **10**, **dB**

6. On the receiver, press **Peak Search**.

7. Adjust the signal generator amplitude for a instrument display of –5 dBm ±0.1 dB.

8. On the receiver, activate the marker delta function by pressing the **Marker** and **Delta** keys.

9. On the receiver, press:

   FREQ Channel, **Center Freq**, **80, MHz**
   Meas Setup, **Average/Hold Number**, **20**, **Enter**
   Trace/Detector, Trace Average
   Single

10. Press **Peak Search**. Enter the displayed value under the Measured Second Harmonic Distortion (dBc) heading in Table 22-9.

Table 22-9   Second Harmonic Distortion Results

Applied Frequency (MHz)	Mixer Level (dBm)	Measured Second Harmonic Distortion (dBc)	Specification (dBc)
40	–15		–55

Amplitude Accuracy at 50 MHz

Test Limits

See test limits in the test result Table 22-11 and Table 22-12.

Overview

A signal generator is used as the signal source for the test. The source amplitude is varied using the signal source amplitude control. The attenuation and resolution bandwidth are varied on the EMI receiver. The source amplitude is measured by the power meter and receiver at each setting, and the values compared. The difference between each pair of measurements indicates the amplitude accuracy.

This measurement is performed for both RF inputs.

Table 22-10   Absolute Amplitude Accuracy - Required Equipment

Item	Critical Specifications	Recommended Keysight Model
Adapter Type-N (m), to 3.5 mm (m)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743
Adapter 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Adapter[a] 2.4 mm (f) to 3.5 mm (m)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	11901D
Cable 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.4:1	11500E
Cable 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 50 MHz Amplitude Range: −25 dBm to 10 dBm	8485A
Power Splitter 3.5 mm (f)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Signal Generator	Typical Temperature Stability: 0.01 dBc/°C	PSG

a. Required for Option 544 (44 GHz Frequency Range)

Figure 22-4   Absolute Amplitude Accuracy Test Setup

mxe_ampaccy
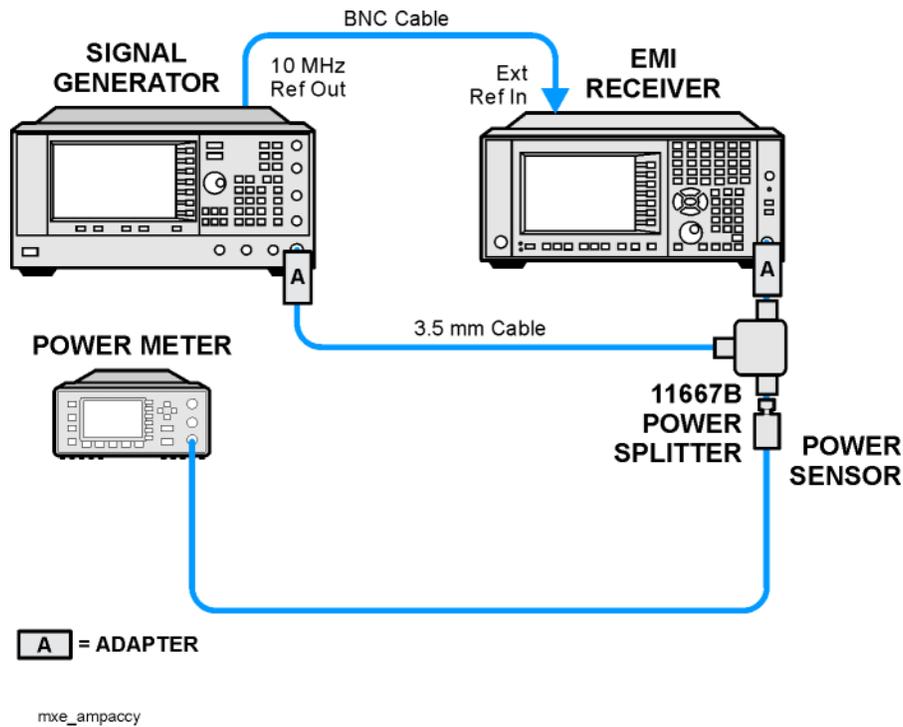
Procedure

1. Zero and calibrate the power meter.

2. Configure equipment as shown in Figure 22-4, with the power splitter connected directly to the receiver RF Input with an adapter when needed.

> **CAUTION**
> To minimize stress on the test equipment connections, support the power sensor.

RF Input 1

3. If the auto alignment for the receiver has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now, All** to perform the auto alignment routine.

4. On the signal generator, press **PRESET**, then set the controls as follows:

   FREQUENCY, **50**, **MHz**
   Power Level, **−4**, **dBm**
   RF On

5. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

7. Set up the receiver by pressing:

> **Mode Setup**, **EMC Standard**, **None**
> **Input/Output**, **More**, **Freq Ref In**, **External**
> **FREQ Channel**, **Center Freq**, **50**, **MHz**
> **SPAN X Scale**, **2**, **MHz**
> **AMPTD Y Scale**, **Attenuation**, **Mech Atten**, **10**, **dB**
> **Sweep/Control**, **Sweep Setup**, **Swp Time Rules**, **SA - Accuracy**
> **Meas Setup**, **Average/Hold Number**, **20**, **Enter**
> **Trace/Detector**, **Trace Average**
> **Single**

8. Perform the following steps for each row listed in Table 22-11:

> **a.** Set the signal generator amplitude to the value listed in the Nominal Source Amplitude column in Table 22-11.
>
> **b.** Set the receiver input attenuator as indicated in the Attenuation column in Table 22-11 by pressing **AMTD Y Scale**, **Attenuation**, **Mech Atten**, [Value].
>
> **c.** Set the receiver span as listed in the Span column of Table 22-11 by pressing **SPAN X Scale**, **Span**, [Value].
>
> **d.** Record the signal generator amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-11.
>
> **e.** On the receiver, press **Restart**.
>
> **f.** Wait for the instrument to finish averaging.
>
> **g.** On the receiver press Peak Search.
>
> **h.** Record the signal amplitude, as measured by the receiver in the Measured Amplitude column of Table 22-11.
>
> **i.** Calculate the signal amplitude accuracy error using the following equation, and record the results under the Amplitude Accuracy Error column of Table 22-11:

$$\text{Amplitude Accuracy Error} = \text{Meas\_Amp} - \text{Power\_Meter}$$

Table 22-11   Amplitude Accuracy Results (RF Input 1 - Preamp Off)

Nominal Source Amplitude (dBm)	Attenuation (dB)	Span	Measured Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Amplitude Accuracy Error (dB)	Test Limit (dB)
−4	10	2 MHz				±1.13 dB
−9	10	1 MHz				±1.13 dB
−14	10	500 kHz				±1.13 dB

Table 22-11   Amplitude Accuracy Results (RF Input 1 - Preamp Off)

Nominal Source Amplitude (dBm)	Attenuation (dB)	Span	Measured Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Amplitude Accuracy Error (dB)	Test Limit (dB)
−4	20	100 kHz				±1.13 dB
−14	20	100 kHz				±1.13 dB
−4	30	100 kHz				±1.13 dB
−14	30	100 kHz				±1.13 dB

RF Input 2

9. Move the power splitter from RF Input 1 to RF Input 2.

10. Select RF Input 2 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

11. Perform the following steps for each row listed in Table 22-12:

    a. Set the signal generator amplitude to the value listed in the Nominal Source Amplitude column in Table 22-12.

    b. Set the receiver input attenuator as indicated in the Attenuation column in Table 22-12 by pressing **AMTD Y Scale**, **Attenuation**, **Mech Atten**, [Value].

    c. Set the receiver span as listed in the Span column of Table 22-12 by pressing **SPAN X Scale**, **Span**, [Value].

    d. Record the signal generator amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-12.

    e. On the receiver, press **Restart**.

    f. Wait for the instrument to finish averaging.

    g. On the receiver press Peak Search.

    h. Record the signal amplitude, as measured by the receiver in the Measured Amplitude column of Table 22-12.

    i. Calculate the signal amplitude accuracy error using the following equation, and record the results under the Amplitude Accuracy Error column:

$$\text{Amplitude Accuracy Error} = \text{Meas\_Amp} - \text{Power\_Meter}$$

Table 22-12   Amplitude Accuracy Results (RF Input 2 - Preamp Off)

Nominal Source Amplitude (dBm)	Attenuation (dB)	Span	Measured Amplitude (dBm) Meas_amp	Power Meter Amplitude (dBm) Power_meter	Amplitude Accuracy Error (dB)	Test Limit (dB)
−4	10	2 MHz				±1.16 dB
−9	10	1 MHz				±1.16 dB
−14	10	500 kHz				±1.16 dB
−4	20	100 kHz				±1.16 dB
−14	20	100 kHz				±1.16 dB
−4	30	100 kHz				±1.16 dB
−14	30	100 kHz				±1.16 dB

Amplitude Accuracy – Preamp On

Test Limits

See test limits in the test result Table 22-14 and Table 22-15.

Overview

A signal generator is used as the signal source for the test. The source amplitude is varied using the signal source amplitude control. The attenuation and resolution bandwidth are varied on the EMI receiver. The source amplitude is measured by the power meter and receiver at each setting, and the values compared. The difference between each pair of measurements indicates the amplitude accuracy.

This measurement is performed for both RF inputs.

Table 22-13   Absolute Amplitude Accuracy - Preamp On - Required Equipment

Item	Critical Specifications	Recommended Keysight Model
Adapter Type-N (m), to 3.5 mm (m)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743
Adapter 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Adapter[a] 2.4 mm (f) to 3.5 mm (m)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	11901D
Attenuator, 30 dB Type-N (m) to Type-N (f)	Accuracy: < 0.5 dB at 50 MHz	11708A
Attenuator, 30 dB[b] 3.5 mm (m) to 3.5 mm (f)	Accuracy: < 0.5 dB at 50 MHz	8493C Option 030
Cable 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 1.515 GHz VSWR: < 1.4:1	11500E
Cable 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 50 MHz Amplitude Range: –25 dBm to 10 dBm	8485A
Power Splitter 3.5 mm (f)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Signal Generator	Typical Temperature Stability: 0.01 dBc/°C	PSG

a. Only required for Option 544 (44 GHz Frequency Range)
b. Only required for Option C35 (3.5 mm RF Input 1) or Option 544 (44 GHz Frequency Range)

Figure 22-5   Absolute Amplitude Accuracy - Preamp On Test Setup
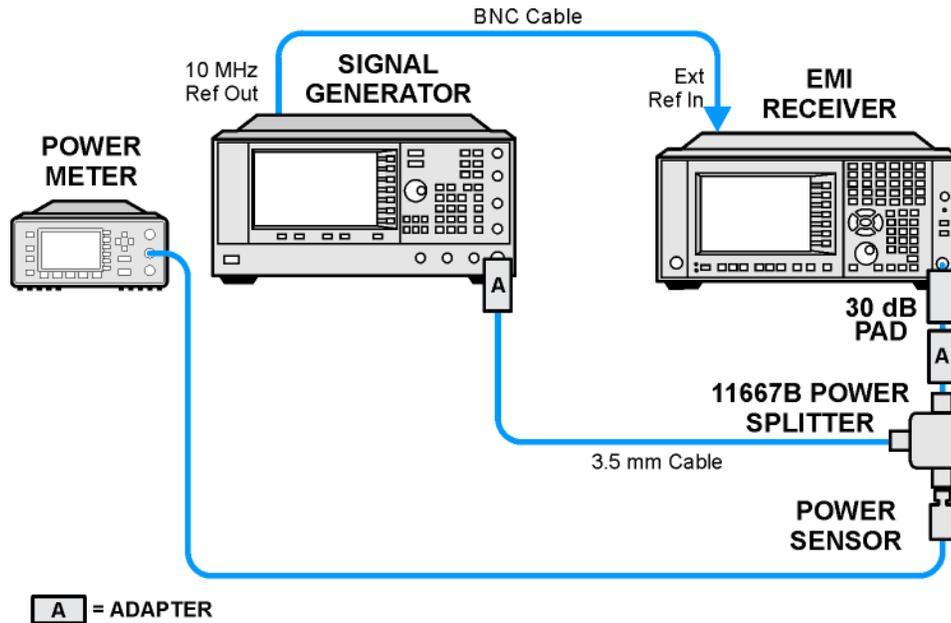
mxe_ampaccy_preamp

Procedure

1. Zero and calibrate the power meter.

2. Configure equipment as shown in Figure 22-5, with the power splitter connected directly to the receiver RF Input with an adapter when needed.

CAUTION   To minimize stress on the test equipment connections, support the power sensor.

RF Input 1 - Preamp On

3. If the auto alignment for the receiver has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now, All** to perform the auto alignment routine.

4. On the signal generator, press **PRESET**, then set the controls as follows:

   FREQUENCY, **50**, **MHz**
   Power Level, −**13**, **dBm**
   RF On

5. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

7. Set up the receiver by pressing:

> **Mode Setup**, **EMC Standard**, **None**
> **Input/Output**, **More**, **Freq Ref In**, **External**
> **FREQ Channel**, **Center Freq**, **50**, **MHz**
> **SPAN X Scale**, **Span**, **106 kHz**
> **AMPTD Y Scale**, **More**, **Internal Preamp**, **Low Band**
> **AMPTD Y Scale**, **Attenuation**, **Mech Atten**, **0 dB**
> **Sweep/Control**, **Sweep Setup**, **Swp Time Rules**, **SA - Accuracy**
> **Meas Setup**, **Average/Hold Number**, **20**, **Enter**
> **Trace/Detector**, **Trace Average**
> **Single**

8. Record the signal generator amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-14.

9. On the receiver, press **Restart**.

10. Wait for the instrument to finish averaging.

11. On the receiver press Peak Search.

12. Record the signal amplitude, as measured by the receiver in the Measured Amplitude column of Table 22-14.

13. Calculate the signal amplitude accuracy error using the following equation, and record the results under the Amplitude Accuracy Error column:

> Amplitude Accuracy Error = Meas_Amp + 30 dB – Power_Meter

14. Perform the following steps for each row listed in Table 22-14:

Table 22-14   Amplitude Accuracy Results (RF Input 1 - Preamp Off)

Nominal Source Amplitude (dBm)	Measured Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Amplitude Accuracy Error (dB)	Test Limit (dB)
−13				±1.30 dB

RF Input 2 - Preamp On

15. Move the power splitter from RF Input 1 to RF Input 2.

16. Select RF Input 2 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

17. Record the signal generator amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-15.

18. On the receiver, press **Restart**.

19. Wait for the instrument to finish averaging.

20. On the receiver press Peak Search.

21. Record the signal amplitude, as measured by the receiver in the Measured Amplitude column of Table 22-15.

22. Calculate the signal amplitude accuracy error using the following equation, and record the results under the Amplitude Accuracy Error column of Table 22-15:

$$\text{Amplitude Accuracy Error} = \text{Meas\_Amp} + 30 \text{ dB} - \text{Power\_Meter}$$

Table 22-15 Amplitude Accuracy Results (RF Input 2 - Preamp Off)

Nominal Source Amplitude (dBm)	Measured Amplitude (dBm) Meas_amp	Power Meter Amplitude (dBm) Power_meter	Amplitude Accuracy Error (dB)	Test Limit (dB)
−13				±1.33 dB

Frequency Response (Flatness)

Test Limits

See test limits in the test result Table 22-17 and Table 22-18.

Overview

The frequency response test measures the EMI receiver's amplitude error as a function of the tuned frequency. Measurements are made ranging from 50 MHz to the maximum frequency range of the receiver under test. The signal source amplitude is measured with a power meter to eliminate error due to source flatness. The measured value is normalized to 50 MHz.

This measurement is performed for both RF inputs.

Table 22-16   Frequency Response - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type N (m) to 3.5 mm (m)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743
Adapter, 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Cable, 1 meter[a] 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1	11500E
Cable, 1 meter[b] 2.4 mm (m) to 2.4 mm (m)	Frequency: 50 MHz to 44 GHz VSWR: < 1.55:1	8120-6164
Cable, 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: −25 dBm to 10 dBm	8485A
Power Sensor	Frequency Range: 50 MHz to 44 GHz Amplitude Range: −30 dBm to 20 dBm	8487A
Power Splitter[a] 3.5 mm (f)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Power Splitter[b] 2.4 mm (f)	Frequency Range: 50 MHz to 44 GHz Tracking between ports: < 0.4 dB	11667C
Signal Generator	Frequency Range: 50 MHz to 26 GHz	PSG

a. Required for Option 503, 508, and 526
b. Required for Option 544 (44 GHz Frequency Range)

Figure 22-6   Frequency Response Test Setup
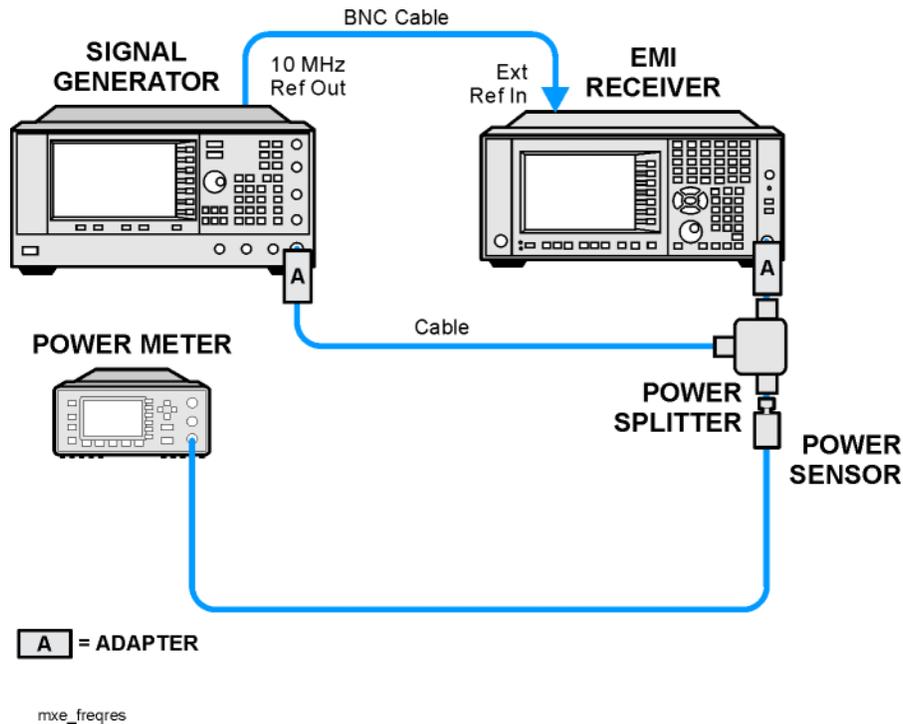
mxe_freqres

Procedure

1. Zero and calibrate the power meter.

2. Configure the equipment as shown in Figure 22-6.

NOTE

Connect the power splitter to the receiver input directly, with an adapter if needed. Do not use a cable. To minimize stress on the test equipment connections, support the power sensor.

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3. If the auto alignment for the receiver has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now**, **All** to perform the auto alignment routine.

4. On the signal generator, press **PRESET**, then set the controls as follows:

> **FREQUENCY, 50, MHz**
> **Power level, –4, dBm**
> **RF, On**

RF Input 1

5. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

7. Set up the receiver by pressing:

> **Mode Setup**, **EMC Standard**, **None**
> **Input/Output**, **More**, **Freq Ref In**, **External**
> **FREQ Channel**, **Center Freq**, **50**, **MHz**
> **SPAN X Scale**, **Span**, **50**, **kHz**
> **AMPTD Y Scale**, **Ref Level**, **0**, **dBm**
> **Single**

8. Perform the following steps for each row listed in Table 22-17 that applies to the frequency range of the instrument being tested:

   a. Tune the receiver center frequency to the value listed in the Center Frequency column of Table 22-17 by pressing **FREQ Channel**, **Center Freq**, [Value].

   b. Tune the signal generator frequency to the value listed in the Center Frequency column of Table 22-17.

   c. Enter the power sensor calibration factor into the power meter for the signal generator frequency.

   d. Adjust the signal generator output power for a power meter reading of −10 dBm ± 0.1 dB.

   e. Enter the power meter amplitude value into the Power Meter Amplitude column of Table 22-17.

   f. If the Center Frequency is greater than 3.6 GHz center the preselector by pressing **Cont**, **Peak Search**, **AMPTD X Scale**, **Presel Center**, then press **Single** on the receiver.

   g. On the receiver, press **Restart**.

   h. On the receiver press **Peak Search** to position the marker on the peak of the signal.

   i. Enter the receiver marker amplitude value into the Receiver Amplitude column of Table 22-17.

   j. Calculate the measurement error using the following equation, and record the results under the Measurement Error column in Table 22-17:

   $$\text{Measurement Error} = \text{Meas\_Amp} - \text{Power\_Meter}$$

   k. Calculate the frequency response error normalized to 50 MHz using the following equation, and record the results under the Flatness Normalized the 50 MHz column in Table 22-17:

   $$\text{Normalized to 50 MHz} = \text{Meas\_Error} - \text{Meas\_Error @ 50 MHz}$$

Table 22-17   Frequency Response Results - RF Input 1

Center Frequency	Receiver Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Measurement Error (dB) Meas_Error	Normalized to 50 MHz (dB)	Normalized Test Limit (dB)
50 MHz				0	Ref
1.0 GHz					±1.75 dB
2.0 GHz					±1.75 dB
3.0 GHz					±1.75 dB
4.0 GHz					±2.5 dB
6.0 GHz					±2.5 dB
8.0 GHz					±2.5 dB
9.0 GHz					±2.5 dB
11 GHz					±2.5 dB
13 GHz					±2.5 dB
14 GHz					±2.5 dB
17 GHz					±2.5 dB
20 GHz					±3.0 dB
23 GHz					±3.0 dB
26 GHz					±3.0 dB
29 GHz					±3.5 dB
32 GHz					±3.5 dB
35 GHz					±4.5 dB
38 GHz					±4.5 dB
41 GHz					±4.5 dB
44 GHz					±4.5 dB

RF Input 2

9. Move the power splitter from RF Input 1 to RF Input 2.

10. Select RF Input 2 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

11. Tune the receiver to a center frequency of 50 MHz by pressing **FREQ Channel, Center Freq**, **50 MHz**.

12. On the receiver, press **Restart**.

13. Set the signal generator output power to **-4 dBm**.

14. Perform the following steps for each row listed in Table 22-18:

    a. Tune the receiver center frequency to the value listed in the Center Frequency column of Table 22-18 by pressing **FREQ Channel**, **Center Freq**, [Value]

    b. Tune the signal generator frequency to the value listed in the Center Frequency column of Table 22-18.

    c. Enter the power sensor calibration factor into the power meter for the signal generator frequency.

    d. Adjust the signal generator output power for a power meter reading of -10 dBm ±0.1 dB.

    e. Enter the power meter amplitude value into the Power Meter Amplitude column of Table 22-18.

    f. On the receiver, press **Restart**.

    g. On the receiver, press **Peak Search** to position the marker on the peak of the signal.

    h. Enter the receiver marker amplitude value into the Receiver Amplitude column of Table 22-18.

    i. Calculate the measurement error using the following equation, and record the results under the Measurement Error column in Table 22-18:

$$\text{Measurement Error} = \text{Meas\_Amp} - \text{Power\_Meter}$$

    j. Calculate the frequency response error normalized to 50 MHz using the following equation, and record the results under the Normalized to 50 MHz column in Table 22-18:

$$\text{Normalized to 50 MHz} = \text{Meas\_Error} - \text{Meas\_Error @ 50 MHz}$$

Table 22-18   Frequency Response Results - RF Input 2

Center Frequency	Receiver Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Measurement Error (dB) Meas_Error	Normalized to 50 MHz (dB)	Normalized Test Limit (dB)
50 MHz				0	Ref
300 MHz					±1.75 dB
600 MHz					±1.75 dB
1.0 GHz					±1.75 dB

Frequency Response (Flatness) – Preamp On

Test Limits

See test limits in the test result Table 22-20 and Table 22-21.

Overview

The frequency response test measures the EMI receiver's amplitude error as a function of the tuned frequency with the internal preamp turned on. Measurements are made ranging from 50 MHz to the maximum frequency range of the receiver under test. The signal source amplitude is measured with a power meter to eliminate error due to source flatness. The measured value is normalized to 50 MHz.

This measurement is performed for both RF inputs.

Table 22-19   Frequency Response - Preamp On - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type N (m) to 3.5 mm (m)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743
Adapter, 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Cable, 1 meter[a] 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1	11500E
Cable, 1 meter[b] 2.4 mm (m) to 2.4 mm (m)	Frequency: 50 MHz to 44 GHz VSWR: < 1.55:1	8120-6164
Cable, 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: −65 dBm to −55 dBm	8485D
Power Sensor[b]	Frequency Range: 50 MHz to 44 GHz Amplitude Range: −65 dBm to −55 dBm	8487D
Power Splitter[a] 3.5 mm (f)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Power Splitter[b] 2.4 mm (f)	Frequency Range: 50 MHz to 44 GHz Tracking between ports: < 0.4 dB	11667C
Signal Generator	Frequency Range: 50 MHz to maximum frequency of MXE	PSG

a. Required for Option 503, 508, and 526

b. Required for Option 544 (44 GHz Frequency Range)

Figure 22-7   Frequency Response - Preamp On Test Setup
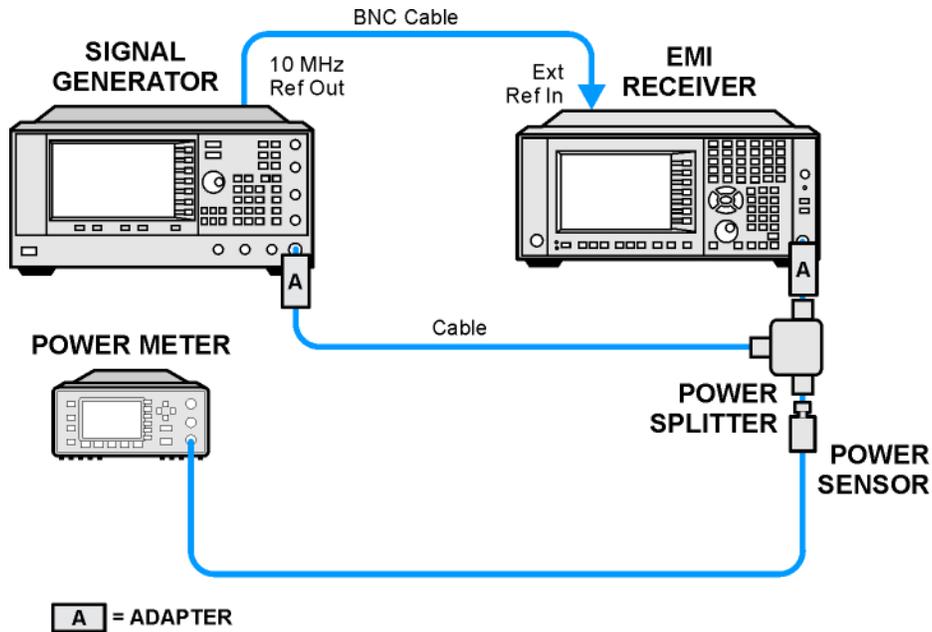
mxe_freqres_preamp

Procedure

1. Zero and calibrate the power meter.

2. Configure the equipment as shown in Figure 22-7.

NOTE   Connect the power splitter to the receiver input directly, with an adapter if needed. Do not use a cable. To minimize stress on the test equipment connections, support the power sensor.

3. If the auto alignment for the receiver has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now**, **All** to perform the auto alignment routine.

4. On the signal generator, press **PRESET**, then set the controls as follows:

> **FREQUENCY, 50, MHz**
> **Power level**, **–54**, **dBm**
> **RF**, **On**

RF Input 1

5. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode**, **Spectrum Analyzer**, **Mode Preset**.

7. Set up the receiver by pressing:

> **Mode Setup**, **EMC Standard**, **None**
> **Input/Output**, **More**, **Freq Ref In**, **External**
> **FREQ Channel**, **Center Freq**, **50**, **MHz**
> **SPAN X Scale**, **Span**, **50**, **kHz**
> **AMPTD Y Scale**, **More**, **Internal Preamp Full Range**
> **AMPTD Y Scale**, **Attenuation**, **Mech Atten**, **0 dB**
> **AMPTD Y Scale**, **Ref Level**, **−55, dBm**

8. Perform the following steps for each row listed in Table 22-20 that applies to the frequency range of the instrument being tested:

   a. Tune the receiver center frequency to the value listed in the Center Frequency column of Table 22-20 by pressing **FREQ Channel**, **Center Freq**, [Value].

   b. Tune the signal generator frequency to the value listed in the Center Frequency column of Table 22-20.

   c. Enter the power sensor calibration factor into the power meter for the signal generator frequency.

   d. Adjust the signal generator output power for a power meter reading of −60 dBm ± 0.1 dB.

   e. Enter the power meter amplitude value into the Power Meter Amplitude column of Table 22-20.

   f. If the Center Frequency is greater than 3.6 GHz center the preselector by pressing **Peak Search**, **AMPTD X Scale**, **Presel Center**.

   g. On the receiver press **Peak Search** to position the marker on the peak of the signal.

   h. Enter the receiver marker amplitude value into the Receiver Amplitude column of Table 22-20.

   i. Calculate the measurement error using the following equation, and record the results under the Measurement Error column in Table 22-20:

   > Measurement Error = Meas_Amp − Power_Meter

j. Calculate the frequency response error normalized to 50 MHz using the following equation, and record the results under the Normalized to 50 MHz column in Table 22-20:

$$\text{Normalized to 50 MHz} = \text{Meas\_Error} - \text{Meas\_Error @ 50 MHz}$$

Table 22-20   Frequency Response Results - Preamp On - RF Input 1

Center Frequency	Receiver Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Measurement Error (dB) Meas_Error	Normalized to 50 MHz (dB)	Normalized Test Limit (dB)
50 MHz				0	Ref
1.0 GHz					±2.0 dB
2.0 GHz					±2.0 dB
3.0 GHz					±2.0 dB
4.0 GHz					±3.0 dB
6.0 GHz					±3.0 dB
8.0 GHz					±3.0 dB
9.0 GHz					±3.0 dB
11 GHz					±3.0 dB
13 GHz					±3.0 dB
14 GHz					±3.0 dB
17 GHz					±3.0 dB
20 GHz					±3.5 dB
23 GHz					±3.5 dB
26 GHz					±3.5 dB
29 GHz					±4.0 dB
32 GHz					±4.0 dB
35 GHz					±4.0 dB
38 GHz					±5.5 dB
41 GHz					±5.5 dB
44 GHz					±5.5 dB

RF Input 2

9. Move the power splitter from RF Input 1 to RF Input 2.

10. Select RF Input 2 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input 2**.

11. Tune the receiver to a center frequency of 50 MHz by pressing **FREQ Channel, Center Freq**, **50 MHz**.

12. Tune the signal generator to **50 MHz** and set the output power to −**54 dBm**.

13. Perform the following steps for each row listed in Table 22-21:

    a. Tune the receiver center frequency to the value listed in the Center Frequency column of Table 22-21 by pressing **FREQ Channel**, **Center Freq**, [Value]

    b. Tune the signal generator frequency to the value listed in the Center Frequency column of Table 22-21.

    c. Enter the power sensor calibration factor into the power meter for the signal generator frequency.

    d. Adjust the signal generator output power for a power meter reading of −60 dBm ± 0.1 dB.

    e. Enter the power meter amplitude value into the Power Meter Amplitude column of Table 22-21.

    f. On the receiver, press **Peak Search** to position the marker on the peak of the signal.

    g. Enter the receiver marker amplitude value into the Receiver Amplitude column of Table 22-21.

    h. Calculate the measurement error using the following equation, and record the results under the Measurement Error column in Table 22-21:

$$\text{Measurement Error} = \text{Meas\_Amp} - \text{Power\_Meter}$$

    i. Calculate the frequency response error normalized to 50 MHz using the following equation, and record the results under the Normalized to 50 MHz column in Table 22-21:

$$\text{Normalized to 50 MHz} = \text{Meas\_Error} - \text{Meas\_Error @ 50 MHz}$$

Table 22-21   Frequency Response Results - RF Input 2

Center Frequency	Receiver Amplitude (dBm) Meas_Amp	Power Meter Amplitude (dBm) Power_Meter	Measurement Error (dB) Meas_Error	Normalized to 50 MHz (dB)	Normalized Test Limit (dB)
50 MHz				0	Ref
300 MHz					±2.0 dB
600 MHz					±2.0 dB
1.0 GHz					±2.0 dB

Scale Fidelity

Test Limits

The scale fidelity error test limit is ±1.0 dB.

Overview

This test checks the scale fidelity of the receiver by maintaining a constant reference level and measuring signals of different amplitudes over most of the display range. This test sets the input attenuator to 10 dB and the Reference Level to 0 dBm. The external attenuator is set to 0 dB, and the amplitude of the source is adjusted to set the displayed signal at the reference level.

The receiver's internal marker is used to measure the reference amplitude. The Marker Delta function is activated and the RF input is reduced using the external precision step attenuator. Signal input levels from 0 dBm to –50 dBm are measured.

This measurement is performed on RF Input 1 only.

Table 22-22   **Scale Fidelity - Required Equipment**

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 50 MHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 50 MHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 50 MHz VSWR: < 1.1:1	11901B
Attenuator, 10 dB[d] 3.5 mm (m) to 3.5 mm (f)	Frequency: 50 MHz VSWR: < 1.2:1	8493C, Option 010
Attenuator, 10 dB Step 3.5 mm (f) to 3.5 mm (f)	Range: 0-50 dB Frequency: 50 MHz Accuracy: ±0.25 dB	8495A Option 004
Cable, 1 meter[d] 3.5 mm (m) to 3.5 mm (m)	Frequency: 50 MHz VSWR: < 1.4:1	11500E
Cable, 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Signal Generator	Frequency: 50 MHz Output Level Accuracy: 0 to –15 dBm: ±1.0 dB	PSG

a. Required for Option CNF (Type-N RF Input 1)
b. Quantity of 2 required for Option C35 (3.5 mm RF Input 1)
c. Required for Option 544 (44 GHz Frequency Range)
d. Quantity of 2 required

Figure 22-8   Scale Fidelity Setup
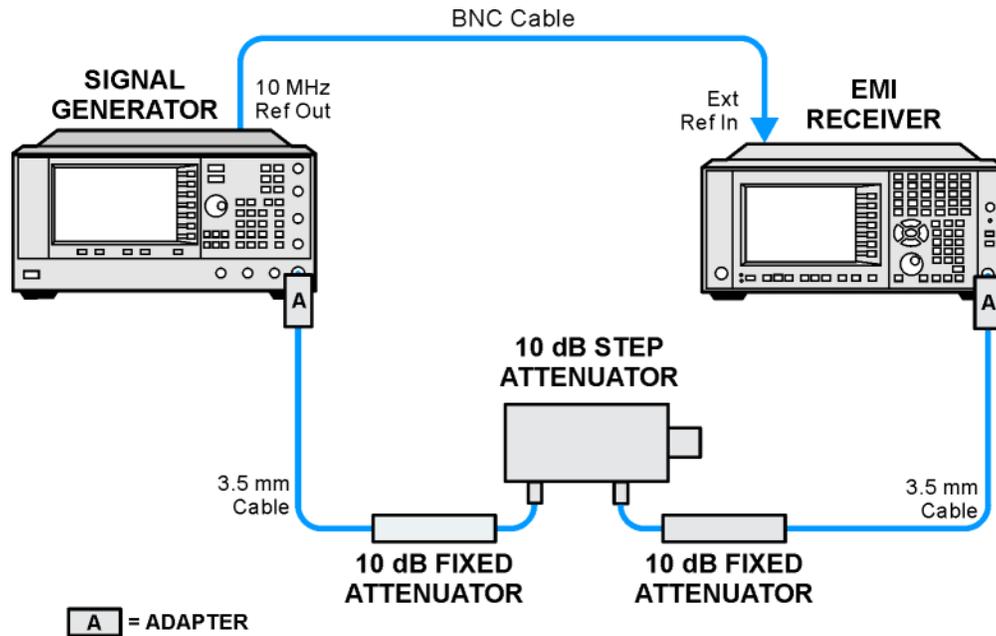
mxe_scalefid

Procedure

1. Configure the equipment as shown in Figure 22-8.

2. If the auto alignment for the analyzer has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now**, **All** to perform the auto alignment routine.

3. On the signal generator, press **PRESET**, then set the controls as follows:

   Frequency, **50**, **MHz**
   Amplitude, **+5**, **dBm**
   RF, **On**

4. Select RF Input 1 on the receiver by pressing **Input/Output**, **RF Input**, **RF Input Port**, **RF Input**.

5. Preset the receiver by pressing **Mode**, **Spectrum Analyzer, Mode Preset**.

6. Set up the receiver by pressing:

   Mode Setup, **EMC Standard**, **None**
   Input/Output, **More**, **Freq Ref In**, **External**
   FREQ Channel, **Center Freq**, **50**, **MHz**
   SPAN X Scale, **Span**, **1**, **MHz**
   AMPTD Y Scale, **Ref Level**, **0**, **dBm**
   Meas Setup, **Average/Hold Number**, **10**, **Enter**

Trace/Detector, Trace Average
Peak Search

7. Set the external 10 dB step attenuator to 0 dB.

8. Adjust the amplitude on the signal generator until the marker amplitude on the receiver reads –15 dBm ± 0.2 dB.

9. On the receiver, press the **Single**, **Restart** to trigger a 10 sweep average.

10. On the receiver, activate the Marker Delta function by pressing **Peak Search**, **Marker Delta**.

11. Perform the following steps for each attenuator setting listed in the Table 22-23:

    a. Set the external 10 dB step attenuator to the value listed in the External Attenuator Setting column of Table 22-23.

    b. On the receiver, press **Restart**.

    c. Record the delta marker amplitude value into the Marker Delta Value column of Table 22-23.

Table 22-23   Scale Fidelity Results

External Attenuator Setting (dB)	Minimum (dB)	Marker Delta Value (dB)	Maximum (dB)
0	N/A	Reference	N/A
10	–11.0		–9.0
20	–21.0		–19.0
30	–31.0		–29.0
40	–41.0		–39.0
50	–51.0		–49.0

CISPR Resolution Bandwidth Shape Accuracy

Test Limits

See the test limits in Table 22-31.

Overview

The CISPR resolution bandwidth shape accuracy is measured for all four of the CISPR specified resolution bandwidths - 200 Hz, 9 kHz, 120 kHz, and 1 MHz. The CISPR 16-1-1 standard provides masks that each of these resolution bandwidths must fall within. This test will verify that the resolution bandwidth shapes fall within the individual frequency offset points in the standard.

This measurement is performed on RF Input 1 only.

Table 22-24   CISPR Resolution Bandwidth Shape Accuracy - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type-N (m) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	1250-1744
Adapter[a] 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	83059B
Adapter[b] 2.4 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.4:1	11500E
Cable, 120 cm BNC (m) to BNC (m)	Frequency: 10 MHz	10503A
Signal Generator	Frequency: 10 MHz to 1.51 GHz	PSG

a. Quantity of 2 required for Option C35 (3.5 mm RF Input 1)
b. Required for Option 544 (44 GHz Frequency Range)

Figure 22-9   CISPR Resolution Bandwidth Shape Accuracy

mxe_freqread
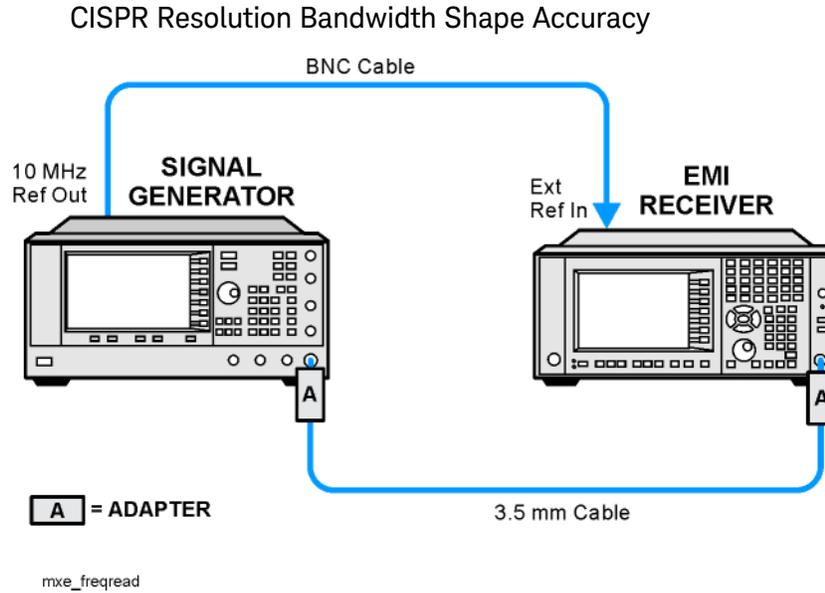
Procedure

1. Configure the equipment as shown in Figure 22-9.

2. If the auto alignment for the analyzer has not been performed within the past 24 hours, press **System**, **Alignments**, **Align Now**, **All** to perform the auto alignment routine.

3. On the signal generator, press **PRESET**, then set the controls as follows:

   FREQUENCY, **100**, **kHz**
   POWER LEVEL, **-10**, **dBm**
   RF, **On**

4. Preset the receiver by pressing **Mode**, **Spectrum Analyzer, Mode Preset**.

5. Set up the receiver by pressing:

   Input/Output, **RF Input**, **RF Input Port**, **RF Input**
   Input/Output, **RF Input**, **RF Coupling**, **DC** (if available)
   Input/Output, **More**, **Freq Ref In**, **External**
   Mode Setup, **EMC Standard**, **CISPR**
   AMPTD Y Scale, Ref Level, **-10**, **dBm**
   AMPTD Y Scale, **Scale/Div**, **3 dB**
   Sweep/Control, **Sweep Setup**, **Swp Time Rules**, **SA-Accuracy**

6. Perform the following steps for each Resolution Bandwidth listed in Table 22-25:

   a. Set the signal generator frequency to the value listed in the Center Frequency column in Table 22-25.

b. Set the receiver center frequency to the value listed in the Center Frequency column in Table 22-25 by pressing **FREQ Channel**, **Center Freq**, [Value].

c. Set the receiver span to the value listed in the Span column of Table 22-25 by pressing **SPAN X Scale**, **Span**, [Value].

d. Adjust the signal generator amplitude as necessary to place the signal in the middle of the top graticule on the receiver display.

e. Turn on trace averaging by pressing **Trace/Detector**, **Trace Averaging**.

f. Set the receiver N dB Points to the value listed in the N dB Points column of Table 22-25 by pressing **Meas Setup**, **N dB Points**, [Value].

g. Record the measured N dB Points value in the Measurement Results column in Table 22-25.

h. Repeat step f and step g for each N dB Points value in Table 22-25 for the Resolution Bandwidth being measured.

i. Turn off the N dB Points function by pressing **Marker**, **Off**.

j. Turn off trace averaging by pressing **Trace/Detector**, **Clear Write**.

Table 22-25   CISPR Resolution Bandwidth Shape Accuracy Results

Resolution Bandwidth	Center Frequency	Span	N dB Points	Test Limit Minimum	Measurement Results	Test Limit Maximum
200 Hz	100 kHz	440 Hz	-1.5 dB	90 Hz		220 Hz
			-6.0 dB	180 Hz		220 Hz
			-20 dB	180 Hz		440 Hz
9 kHz	10 MHz	20 kHz	-1.0 dB	2 kHz		10 kHz
			-1.5 dB	4 kHz		10 kHz
			-6.0 dB	8 kHz		10 kHz
			-20.0 dB	8 kHz		20 kHz
120 kHz	100 MHz	280 kHz	-1.0 dB	20 kHz		140 kHz
			-1.5 dB	40 kHz		140 kHz
			-6.0 dB	100 kHz		140 kHz
			-20 dB	100 kHz		280 kHz
1.0 MHz	1.2 GHz	2.70 MHz	-3.0 dB	500 kHz		1.1 MHz
			-6.0 dB	750 kHz		1.1 MHz
			-9.0 dB	900 kHz		2 MHz
			-20.0 dB	900 kHz		2.7 MHz

Quasi-Peak Detector Accuracy

Test Limits

See test limits in test results Table 22-27 through Table 22-37.

Overview

This test will verify the performance of the Quasi-Peak detector of the EMI receiver according to section 4 of the CISPR 16-1-1 :2010 standard. This includes testing for the following subsections:

4.3 Sine-wave voltage accuracy

4.4 Response to pulses

4.4.1 Amplitude relationship (absolute calibration)

4.4.2 Variation with repetition frequency (relative calibration)

Table 22-26   Quasi-Peak Detector - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 100 kHz to 1.51 GHz VSWR: < 1.4:1	11500E
EMI Calibration Pulse Generator	CISPR Specified Pulse Area	Schwarzbeck IGUU 2916
Power Meter	Compatible with power sensor	E4418A
Power Sensor	Frequency Range: 100 MHz Amplitude Range: –60 to 0 dBm	E9304A

a. Quantity of 2 required for Option CNF (Type-N RF Input)
b. Only required for Option C35 (3.5 mm RF Input 1)
c. Required for Option 544 (44 GHz Frequency Range)

Figure 22-10   Typical Equipment Setup
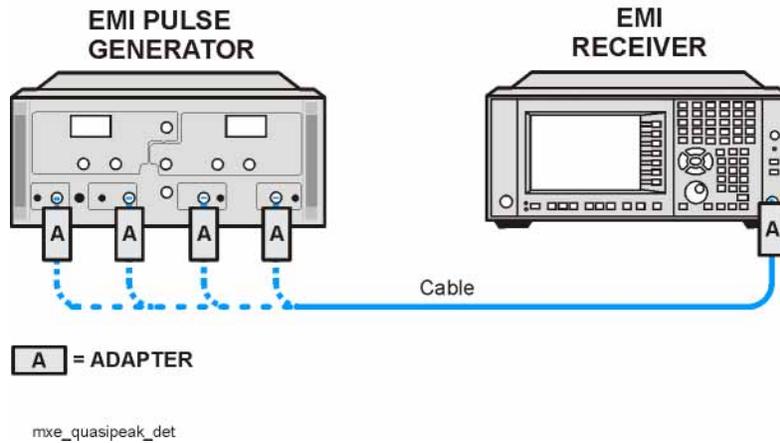
mxe_quasipeak_det

Sine Wave Generator Characterization

1. Zero and calibrate the power meter.

2. Connect the power meter to the Output Sine Wave Generator of the IGUU 2916 EMI pulse generator as shown in Figure 22-11.

Figure 22-11   Sine Wave Generator Characterization
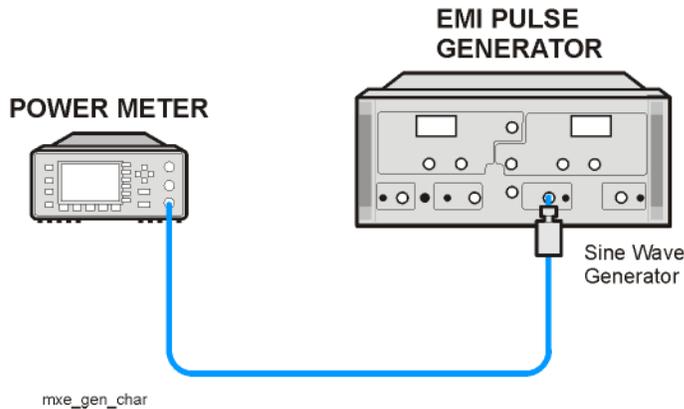
mxe_gen_char

3. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

4. After allowing the power meter to settle, record the reading in Table 22-27 under the Power Meter column.

5. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

6. After allowing the power meter to settle, record the reading in Table 22-30 under the Power Meter column.

7. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

8. After allowing the power meter to settle, record the reading in Table 22-27under the Power Meter column.

Initial Setup

1. Setup the equipment as shown in Figure 22-10.

2. Make sure that the EMI receiver is in the spectrum analyzer mode by pressing **Mode**, **Spectrum Analyzer**.

3. Make sure that the auto alignment routine in the EMI receiver is on by pressing **System**, **Alignments**, **Auto Align**, **Normal**.

4. Put the instrument in a known state by pressing **Mode**, **Spectrum Analyzer**, **Mode Setup**, **More**, **Restore Mode Defaults**, **OK**.

5. Set all input / output setting to their default state by pressing **System**, **Restore Defaults**, **Input / Output Settings**, **OK**.

Band A Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 kHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **100 kHz** then **SPAN X Scale**, **Zero Span**.

5. Set the Sweeptime to 2 seconds by pressing **Sweep / Control**, **2 s**.

6. Set the RF Coupling to DC by pressing **Input / Output**, **RF Input**, **RF Coupling DC** (instruments with Option 544 are always DC coupled so this step is skipped for them.)

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale**, **More**, **Y Axis Unit**, **More**, **dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale**, **80 dBμV**.

9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace / Detector**, **More**, **Detector**, **More**, **Quasi Peak**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-27 as the Measured value for Band A.

12. Calculate the Error with the following formula and enter the value in Table 22-27

Error = Measured - (Power Meter + 106.99)

Table 22-27   Quasi-Peak Sine-Wave Voltage Accuracy Band A - CISPR 16-1-1: 2010 Section 4.3

Sine Wave Frequency (kHz)	Band A				
	Power Meter (dBm)	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			−2.5		+2.5

13. Set the EMI receiver input attenuator to 20 dB by pressing **AMPTD Y Scale**, **Attenuation**, **20 dB**.

14. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Main Generator: **Band A**

    b. Pulse Frequency: **25 Hz**

    c. Amplitude: **60 dBμV**

15. Connect the IGUU 2916 EMI pulse generator Output Main Generator Band A/B to the EMI receiver RF Input.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

19. Record the marker value in Table 22-28 as the Measured value for the Band A reference PRF.

20. Calculate the Error with the following formula and enter the value in Table 22-28.

Error = Measured - 60 dBμV - Error (Table 22-27)

Table 22-28   Quasi-Peak Absolute Calibration Band A - CISPR 16-1-1: 2010 Section 4.4.1

Pulse Frequency (Hz)	Band A			
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
25		−2.0		+2.0

21. Put the marker in Delta mode by pressing **Marker**, **Delta**.

22. Turn on the continuous peak function by pressing **Peak Search**, **More**, **Continuous Peak Search On**.

23. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

24. Take a single sweep on the EMI receiver by pressing **Restart**.

25. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency being measured in Table 22-29.

26. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator to the other values in the Table 22-29 and repeat step 24 and step 25 for each.

Table 22-29   Quasi-Peak Relative Response Band A - CISPR 16-1-1: 2010 Section 4.4.2

Pulse Frequency (Hz)	Band A		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
100	2.5		5.5
60	1.5		4.5
25	0	Reference	0
10	−5.5		−2.5
5	−9.0		−6.0
2	−15.5		−10.5
1	−19.5		−14.5
Isolated (0.1 Hz)[a]	−21.5		−16.5

a. Due to the slow pulse rate you may need to take multiple sweeps to capture a complete pulse.

Band B Testing

1. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 10 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **10 MHz** then **SPAN X Scale**, **Zero Span**.

5. Set the Sweeptime to 2 seconds by pressing **Sweep / Control**, **2 s**.

6. Set the RF Coupling to DC by pressing **Input / Output**, **RF Input**, **RF Coupling DC** (instruments with Option 544 are always DC coupled so this step is skipped for them.)

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale**, **More**, **Y Axis Unit**, **More**, **dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale**, **80 dBμV**.

9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace / Detector**, **More**, **Detector**, **More**, **Quasi Peak**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-30 as the Measured value for Band B.

12. Calculate the Error with the following formula and enter the value in Table 22-30

Error = Measured - (Power Meter + 106.99)

Table 22-30   Quasi-Peak Sine-Wave Voltage Accuracy Band B - CISPR 16-1-1: 2010 Section 4.3

| Sine Wave Frequency (MHz) | Band B | | | | |
	Power Meter (dBm)	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
10			−2.5		+2.5

13. Set the EMI receiver input attenuator to 18 dB by pressing **AMPTD Y Scale**, **Attenuation**, **18 dB**.

14. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Main Generator: **Band B**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **60 dBμV**

15. Connect the IGUU 2916 EMI pulse generator Output Main Generator Band A/B to the EMI receiver RF Input.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

19. Record the marker value in Table 22-31 as the Measured value for the Band B reference PRF.

20. Calculate the Error with the following formula and enter the value in Table 22-31.

Error = Measured - 60 dBμV - Error (Table 22-30)

Table 22-31   Quasi-Peak Absolute Calibration Band B - CISPR 16-1-1: 2010 Section 4.4.1

Pulse Frequency (Hz)	Band B			
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100		−2.0		+2.0

21. Put the marker in Delta mode by pressing **Marker**, **Delta**.

22. Turn on the continuous peak function by pressing **Peak Search**, **More**, **Continuous Peak Search On**.

23. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **20 Hz**.

24. Take a single sweep on the EMI receiver by pressing **Restart**.

25. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency being measured in Table 22-32.

26. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator to the other values in the Table 22-32 (except for 1000 Hz) and repeat step 24 and step 25 for each.

Table 22-32   Quasi-Peak Relative Response Band A - CISPR 16-1-1: 2010 Section 4.4.2

Pulse Frequency (Hz)	Band B		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
1000	3.0		6.0
100	0	Reference	0
20	−8.0		−5.0
10	−12.0		−8.0
2	−23.0		−18.0
1	−25.0		−20.0
Isolated (0.1 Hz)[a]	−26.0		−21.0

a. Due to the slow pulse rate you may need to take multiple sweeps to capture a complete pulse.

27. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band B**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **40 dBμV**

28. Move the cable on the IGUU 2916 EMI pulse generator to Output Auxiliary Generator Band A/B/C/D.

29. Change the EMI receiver input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

30. Take a single sweep on the EMI receiver by pressing **Restart**.

31. Reset the delta marker by pressing **Marker**, **Delta**.

32. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

33. Take a single sweep on the EMI receiver by pressing **Restart**.

34. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency of 1000 Hz in Table 22-32.

Band C Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **100 MHz** then **SPAN X Scale**, **Zero Span**.

5. Set the Sweeptime to 2 seconds by pressing **Sweep / Control**, **2 s**.

6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale**, **More**, **Y Axis Unit**, **More**, **dBμV**.

7. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale**, **80 dBμV**.

8. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace / Detector**, **More**, **Detector**, **More**, **Quasi Peak**.

9. Turn on the marker by pressing **Marker**.

10. Record the marker value in Table 22-33 as the Measured value for Band C.

11. Calculate the Error with the following formula and enter the value in Table 22-33

Error = Measured - (Power Meter + 106.99)

Table 22-33   Quasi-Peak Sine-Wave Voltage Accuracy Band C - CISPR 16-1-1: 2010 Section 4.3

Sine Wave Frequency (MHz)	Band C				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			−2.5		+2.5

12. Set the EMI receiver input attenuator to 18 dB by pressing **AMPTD Y Scale**, **Attenuation**, **18 dB**.

13. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Main Generator: **Band C/D**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **60 dBµV**

14. Connect the IGUU 2916 EMI pulse generator Output Main Generator Band C/D to the EMI receiver RF Input.

15. Put the EMI receiver in single sweep operation by pressing **Single**.

16. Take a single sweep on the EMI receiver by pressing **Restart**.

17. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

18. Record the marker value in Table 22-34 as the Measured value for the Band A reference PRF.

19. Calculate the Error with the following formula and enter the value in Table 22-34.

Error = Measured - 60 dBµV - Error (Table 22-33)

Table 22-34   Quasi-Peak Absolute Calibration Band C - CISPR 16-1-1: 2010 Section 4.4.1

Pulse Frequency (Hz)	Band C			
	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100		−2.0		+2.0

20. Put the marker in Delta mode by pressing **Marker**, **Delta**.

21. Turn on the continuous peak function by pressing **Peak Search**, **More**, **Continuous Peak Search On**.

22. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **20 Hz**.

23. Take a single sweep on the EMI receiver by pressing **Restart**.

24. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency being measured in Table 22-35.

25. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator to the other values in the Table 22-35 (except 1000 Hz and Isolated) and repeat step 23 and step 24 for each.

Table 22-35   Quasi-Peak Relative Response Band C - CISPR 16-1-1: 2010 Section 4.4.2

Pulse Frequency (Hz)	Band C		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
1000	6.5		9.5
100	0	Reference	0
20	−10.5		−7.5
10	−16.0		−12.0
2	−28.5		−23.5
1	−31.0		−26.0
Isolated (0.1 Hz)[a]	−34.0		−29.0

a. Due to the slow pulse rate you may need to take multiple sweeps to capture a complete pulse.

26. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **0.1 Hz**.

27. Turn noise floor extension on by pressing **Mode Setup**, **Noise Reduction**, **Noise Floor Extension On**.

28. Take a single sweep on the EMI receiver by pressing **Restart** (due to the slow pulse rate a number of Restarts may be required to capture a complete pulse).

29. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency of Isolated in Table 22-35.

30. Turn noise floor extension off by pressing **Mode Setup**, **Noise Reduction**, **Noise Floor Extension Off**.

31. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band C/D**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **40 dBμV**

32. Move the cable on the IGUU 2916 EMI pulse generator to Output Auxiliary Generator Band A/B/C/D.

33. Change the EMI receiver input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

34. Take a single sweep on the EMI receiver by pressing **Restart**.

35. Reset the delta marker by pressing **Marker**, **Delta**.

36. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

37. Take a single sweep on the EMI receiver by pressing **Restart**.

38. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency of 1000 Hz in Table 22-35.

Band D Testing

1. Set the IGUU 2916 EMI pulse generator as follows:

    a. Main Generator: **Band C/D**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **60 dBμV**

2. Connect the IGUU 2916 EMI pulse generator Output Main Generator Band C/D to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 500 MHz with a span of 0 Hz by pressing **FREQ Channel**, **Center Freq**, **500 MHz** then **SPAN X Scale**, **Zero Span**.

5. Set the Sweeptime to 2 seconds by pressing **Sweep / Control**, **2 s**.

6. Set the EMI receiver input attenuator to 18 dB by pressing **AMPTD Y Scale**, **Attenuation**, **18 dB**.

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale**, **More**, **Y Axis Unit**, **More**, **dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale**, **80 dBμV**.

9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace / Detector**, **More**, **Detector**, **More**, **Quasi Peak**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

13. Record the marker value in Table 22-36 as the Measured value for the Band D reference PRF.

Table 22-36   Quasi-Peak Sine-Wave Voltage Accuracy Band D - CISPR 16-1-1: 2010 Section 4.3

Pulse Frequency (Hz)	Band D		
	Lower Limit (dBμV)	Measured (dBμV)	Upper Limit (dBμV)
100	58.0		62.0

14. Put the marker in Delta mode by pressing **Marker**, **Delta**.

15. Turn on the continuous peak function by pressing **Peak Search**, **More**, **Continuous Peak Search On**.

16. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **20 Hz**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency being measured in Table 22-37.

19. Without changing any other setting on the EMI receiver or the IGUU 2916
EMI pulse generator change the Pulse Frequency on the pulse generator
to the other values in the Table 22-37 (except 1000 Hz and Isolated) and
repeat step 17 and step 18 for each.

Table 22-37   Quasi-Peak Relative Response Band D - CISPR 16-1-1: 2010 Section 4.4.2

Pulse Frequency (Hz)	Band D		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
1000	6.5		9.5
100	0	Reference	0
20	−10.5		−7.5
10	−16.0		−12.0
2	−28.5[a]		−23.5[a]
1	−31.0[a]		−26.0[a]
Isolated (0.1 Hz)[b]	−34.0[a]		−29.0[a]

a. These measurements are optional and are not required.
b. Due to the slow pulse rate you may need to take multiple sweeps to capture a complete pulse.

20. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **0.1 Hz**.

21. Turn noise floor extension on by pressing **Mode Setup**, **Noise Reduction**, **Noise Floor Extension On**.

22. Take a single sweep on the EMI receiver by pressing **Restart** (due to the slow pulse rate a number of Restarts may be required to capture a complete pulse).

23. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency of Isolated in Table 22-37.

24. Turn noise floor extension off by pressing **Mode Setup**, **Noise Reduction**, **Noise Floor Extension Off**.

25. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band C/D**

    b. Pulse Frequency: **100 Hz**

    c. Amplitude: **40 dBμV**

26. Move the cable on the IGUU 2916 EMI pulse generator to Output Auxiliary Generator Band A/B/C/D.

27. Change the EMI receiver input attenuation to 10 dB by pressing **AMPTD Y Scale**, **Attenuation**, **10 dB**.

28. Take a single sweep on the EMI receiver by pressing **Restart**.

29. Reset the delta marker by pressing **Marker**, **Delta**.

30. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

31. Take a single sweep on the EMI receiver by pressing **Restart**.

32. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency of 1000 Hz in Table 22-37.

Peak Detector Accuracy

Test Limits

See test limits in test results Table 22-39 through Table 22-45.

Overview

This test will verify the performance of the Peak detector of the EMI receiver according to section 5 of the CISPR 16-1-1 :2010 standard. This includes testing for the following subsections:

5.3 Sine-wave voltage accuracy

5.4 Response to pulses

Table 22-38   Peak Detector - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.4:1	11500E
EMI Calibration Pulse Generator	CISPR Specified Pulse Area	Schwarzbeck IGUU 2916
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 100 kHz to 100 MHz Amplitude Range: -60 to 0 dBm	E9304A

a. Quantity 2 required for Option CNF (Type-N RF Input)
b. Only required for Option C35 (3.5 mm RF Input)
c. Only required for Option 544 (44.0 GHz Frequency Range)

Figure 22-12   Typical Equipment Setup
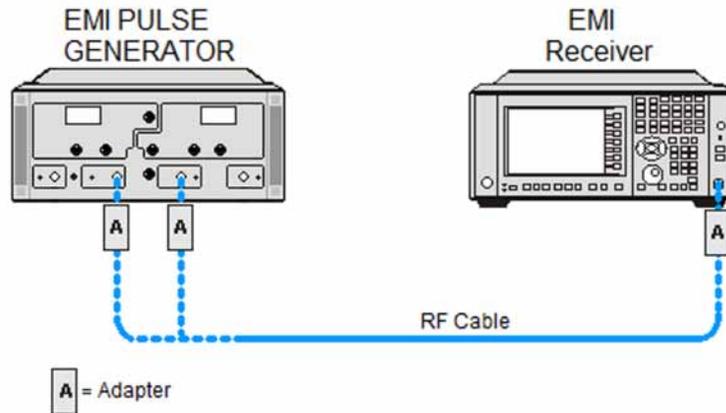
Sine Wave Generator Characterization

1. Zero and calibrate the power meter.

2. Connect the power meter to the Output Sine Wave Generator of the IGUU 2916 EMI pulse generator as shown in Figure 22-13.

Figure 22-13   Sine Wave Generator Characterization
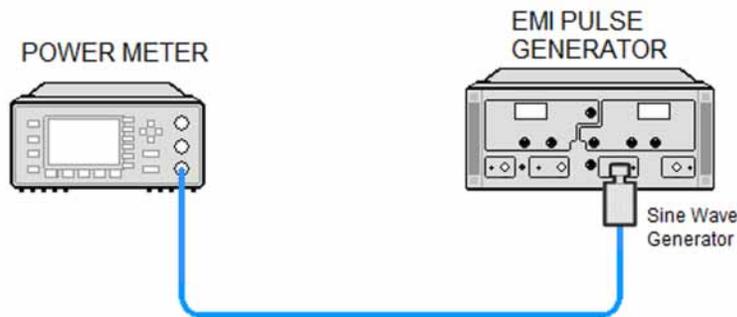
3. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

4. After allowing the power meter to settle, record the reading in Table 22-39 under the Power Meter column.

5. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

6. After allowing the power meter to settle, record the reading in Table 22-41 under the Power Meter column.

7. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

8. After allowing the power meter to settle, record the reading in Table 22-43 under the Power Meter column.

Initial Setup

1. Setup the equipment as shown in Figure 22-12.

2. Make sure that the EMI receiver is in the spectrum analyzer mode by pressing **Mode, Spectrum Analyzer**.

3. Make sure that the auto alignment routine in the EMI receiver is on by pressing **System, Alignments, Auto Align, Normal**.

4. Put the instrument in a known state by pressing **Mode, Spectrum Analyzer, Mode Setup, More, Restore Mode Defaults, OK**.

5. Set all input / output setting to their default state by pressing **System, Restore Defaults, Input / Output Settings, OK**.

Band A Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the EMI receiver to 100 kHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 kHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 100 milliseconds by pressing **Sweep / Control, 100 ms**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

9. Change the detector used by the EMI receiver to Peak by pressing **Trace / Detector, More, Detector, Peak**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-39 as the Measured value for Band A.

12. Calculate the Error with the following formula and enter the value in Table 22-39.

Error = Measured − (Power Meter + 106.99)

Table 22-39   Peak Sine-Wave Voltage Accuracy Band A – CISPR 16-1-1 :2010 Section 5.3

Sine Wave Frequency (kHz)	Band A				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

13. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

14. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band A**

    b. Pulse Frequency: **190 Hz**

    c. Amplitude: **40 dBµV**

15. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

18. Take a single sweep on the EMI receiver by pressing **Restart**.

19. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Measured value for the pulse frequency being measured in Table 22-40.

20. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator and the Sweeptime of the EMI receiver to the other values listed in Table 22-40 and repeat steps 18 and 19 for each.

Table 22-40   Peak Response to Pulses Band A – CISPR 16-1-1 :2010 Section 5.4

Pulse Frequency (Hz)	Sweeptime (sec)	Band A			
		Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
190	0.1		-2.0		+2.0
150	0.1		-2.0		+2.0
100	0.1		-2.0		+2.0
50	0.1		-2.0		+2.0
10	2.0		-2.0		+2.0
1	2.0		-2.0		+2.0

21. Calculate the Error for each of the Measured values in Table 22-40 with the following formula and enter the value in Table 22-40.

Error = Measured – 40 dBμV – 6.61 dB – Error (Table 22-39)

Band B Testing

1. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the EMI receiver to 10 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 10 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 100 milliseconds by pressing **Sweep / Control, 100 ms**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

9. Change the detector used by the EMI receiver to Peak by pressing **Trace / Detector, More, Detector, Peak**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-41 as the Measured value for Band B.

12. Calculate the Error with the following formula and enter the value in Table 22-41.

Error = Measured – (Power Meter + 106.99)

Table 22-41   Peak Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 :2010 Section 5.3

Sine Wave Frequency (MHz)	Band B				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
10			-2.5		+2.5

13. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

14. Setup the IGUU 2916 EMI pulse generator as follows:

     a. Aux. Generator: **Band B**

     b. Pulse Frequency: **5000 Hz**

     c. Amplitude: **40 dBµV**

15. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

16. Set the Sweeptime to 2 milliseconds by pressing **Sweep / Control, 2 ms**.

17. Put the EMI receiver in single sweep operation by pressing **Single**.

18. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

19. Take a single sweep on the EMI receiver by pressing **Restart**.

20. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Measured value for the pulse frequency being measured in Table 22-42.

21. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator and the Sweeptime of the EMI receiver to the other values listed in Table 22-42 and repeat steps 19 and 20 for each.

Table 22-42   Peak Response to Pulses Band B – CISPR 16-1-1 :2010 Section 5.4

Pulse Frequency (Hz)	Sweeptime (sec)	Band B			
		Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
5000	0.002		-2.0		+2.0
1000	0.02		-2.0		+2.0
500	0.02		-2.0		+2.0
100	0.1		-2.0		+2.0
50	0.1		-2.0		+2.0
10	2.0		-2.0		+2.0
1	2.0		-2.0		+2.0

22. Calculate the Error for each of the Measured values in Table 22-42 with the following formula and enter the value in Table 22-42.

Error = Measured – 40 dBµV – 6.33 dB – Error (Table 22-41)

Band C Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the EMI receiver to 100 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 100 milliseconds by pressing **Sweep / Control, 100 ms.**

6. Set the amplitude units to dBµV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBµV**.

7. Set the reference level to 80 dBµV by pressing **AMPTD Y Scale, 80 dBµV**.

8. Change the detector used by the EMI receiver to Peak by pressing **Trace / Detector, More, Detector, Peak**.

9. Turn on the marker by pressing **Marker**.

10. Record the marker value in Table 22-43 as the Measured value for Band C.

11. Calculate the Error with the following formula and enter the value in Table 22-43.

Error = Measured – (Power Meter + 106.99)

Table 22-43   Peak Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 :2010 Section 5.3

Sine Wave Frequency (MHz)	Band C				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

12. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

13. Setup the IGUU 2916 EMI pulse generator as follows:

     a. Aux. Generator: **Band C/D**

     b. Pulse Frequency: **20 kHz**

     c. Amplitude: **40 dBµV**

14. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

15. Set the Sweeptime to 1 milliseconds by pressing **Sweep / Control, 1 ms**.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

18. Take a single sweep on the EMI receiver by pressing **Restart**.

19. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Measured value for the pulse frequency being measured in Table 22-44.

20. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator and the Sweeptime of the EMI receiver to the other values listed in Table 22-44 and repeat steps 18 and 19 for each.

Table 22-44   Peak Response to Pulses Band C – CISPR 16-1-1 :2010 Section 5.4

Pulse Frequency (Hz)	Sweeptime (sec)	Band C			
		Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
20000	0.001		-2.0		+2.0
10000	0.001		-2.0		+2.0
5000	0.002		-2.0		+2.0
1000	0.02		-2.0		+2.0
500	0.02		-2.0		+2.0
100	0.1		-2.0		+2.0
50	0.1		-2.0		+2.0
10	2.0		-2.0		+2.0
1	2.0		-2.0		+2.0

21. Calculate the Error for each of the Measured values in Table 22-44 with the following formula and enter the value in Table 22-44.

Error = Measured – 40 dBµV – 12.61 dB – Error (Table 22-43)

Band D Testing

1. Setup the IGUU 2916 EMI pulse generator as follows:

   a. Aux. Generator: **Band C/D**

   b. b.Pulse Frequency: **20 kHz**

   c. Amplitude: **40 dBµV**

2. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the EMI receiver to 500 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 500 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 milliseconds by pressing **Sweep / Control, 1 ms**.

6. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

7. Set the amplitude units to dBµV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBµV**.

8. Set the reference level to 80 dBµV by pressing **AMPTD Y Scale, 80 dBµV**.

9. Change the detector used by the EMI receiver to Peak by pressing **Trace / Detector, More, Detector, Peak**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

12. Take a single sweep on the EMI receiver by pressing **Restart.**

13. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Measured value for the pulse frequency being measured in Table 22-45.

14. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator and the Sweeptime of the EMI receiver to the other values listed in Table 22-45 and repeat steps 12 and 13 for each.

Table 22-45   Peak Response to Pulses Band D – CISPR 16-1-1 :2010 Section 5.4

| Pulse Frequency (Hz) | Sweeptime (sec) | Band D | | | |
		Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
20000	0.001		-2.0		+2.0
10000	0.001		-2.0		+2.0
5000	0.002		-2.0		+2.0
1000	0.02		-2.0		+2.0
500	0.02		-2.0		+2.0
100	0.1		-2.0		+2.0
50	0.1		-2.0		+2.0
10	2.0		-2.0		+2.0
1	2.0		-2.0		+2.0

15. Calculate the Error for each of the Measured values in Table 22-45 with the following formula and enter the value in Table 22-45.

Error = Measured – 40 dBµV – 12.61 dB

EMI Average Detector Accuracy

Test Limits

See test limits in test results Table 22-47 through Table 22-57.

Overview

This test will verify the performance of the EMI Average detector of the EMI receiver according to section 6 of the CISPR 16-1-1 :2010 standard. This includes testing for the following subsections:

6.4 Sine-wave voltage accuracy

6.5 Response to pulses

6.5.2 Amplitude relationship

6.5.3 Variation with repetition frequency

Table 22-46   EMI Average - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 100 kHz to 1.51 GHz VSWR: < 1.4:1	11500E
EMI Calibration Pulse Generator	CISPR Specified Pulse Area	Schwarzbeck IGUU 2916
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 100 MHz Amplitude Range: -60 to 0 dBm	E9304A

a. Quantity 2 required for Option CNF (Type-N RF Input)
b. Only required for Option C35 (3.5 mm RF Input)
c. Only required for Option 544 (44 GHz RF Frequency Range)

Figure 22-14   Typical Equipment Setup
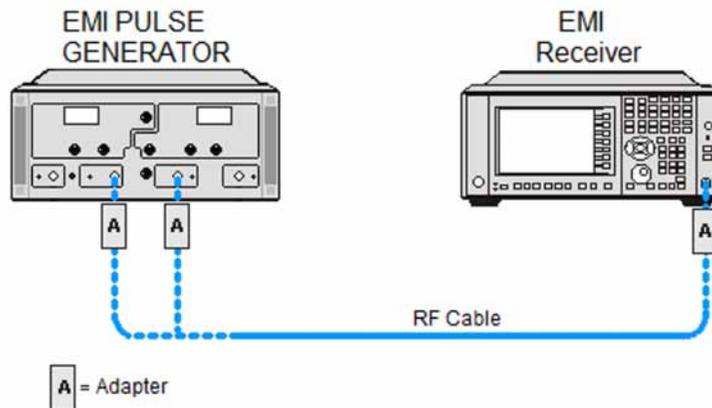
Sine Wave Generator Characterization

1. Zero and calibrate the power meter.

2. Connect the power meter to the Output Sine Wave Generator of the IGUU 2916 EMI pulse generator as shown in Figure 22-15.

Figure 22-15   Sine Wave Generator Characterization
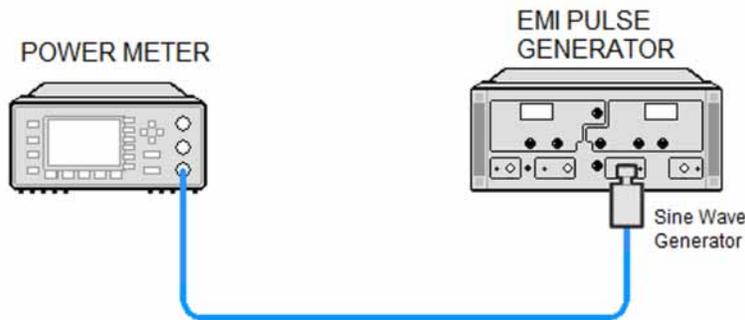
3. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

4. After allowing the power meter to settle, record the reading in Table 22-47 under the Power Meter column.

5. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

6. After allowing the power meter to settle, record the reading in Table 22-50 under the Power Meter column.

7. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

8. After allowing the power meter to settle, record the reading in Table 22-53 under the Power Meter column.

Initial Setup

1. Setup the equipment as shown in Figure 22-14.

2. Make sure that the EMI receiver is in the spectrum analyzer mode by pressing **Mode, Spectrum Analyzer**.

3. Make sure that the auto alignment routine in the EMI receiver is on by pressing **System, Alignments, Auto Align, Normal**.

4. Put the instrument in a known state by pressing **Mode, Spectrum Analyzer, Mode Setup, More, Restore Mode Defaults, OK**.

5. Set all input / output setting to their default state by pressing **System, Restore Defaults, Input / Output Settings, OK**.

Band A Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 kHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 kHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

9. Change the detector used by the EMI receiver to EMI Average by pressing **Trace / Detector, More, Detector, More, EMI Average**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-47 as the Measured value for Band A.

12. Calculate the Error with the following formula and enter the value in Table 22-47.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-47   EMI Average Sine-Wave Voltage Accuracy Band A – CISPR 16-1-1 :2010 Section 6.4

Sine Wave Frequency (kHz)	Band A				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

13. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band A**

    b. Pulse Frequency: **25 Hz**

    c. Amplitude: **40 dBµV**

14. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

15. Set the EMI receiver input attenuator to 6 dB by pressing **AMPTD Y Scale, Attenuation, 6 dB**.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

19. Record the marker value in Table 22-48 as the Measured value for the Band A reference PRF.

20. Calculate the Error with the following formula and enter the value in Table 22-48.

    $$\text{Error} = \text{Measured} - 40 \text{ dBµV} + 12.36 \text{ dB} - \text{Error (Table 22-47)}$$

Table 22-48   EMI Average Amplitude Relationship Band A – CISPR 16-1-1 :2010 Section 6.5.2

Pulse Frequency (Hz)	Band A			
	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
25		-2.0		+2.0

21. Put the marker in Delta mode by pressing **Marker, Delta**.

22. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

23. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

24. Take a single sweep on the EMI receiver by pressing **Restart**.

25. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 100 Hz pulse frequency in Table 22-56.

26. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10 Hz**.

27. Take a single sweep on the EMI receiver by pressing **Restart**.

28. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10 Hz pulse frequency in Table 22-56.

Table 22-49　　　　　EMI Average Variation with Repetition Frequency
　　　　　　　　　　Band A – CISPR 16-1-1 :2010 Section 6.5.3

Pulse Frequency (Hz)	Band A		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
100	15.5		10.5
25	0	Reference	0
10	-9.5		-4.5

Band B Testing

1. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 10 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 10 MHz then SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

9. Change the detector used by the EMI receiver to EMI Average by pressing **Trace / Detector, More, Detector, More, EMI Average**.

10. Turn on the marker by pressing **Marker**.

11. Record the marker value in Table 22-50 as the Measured value for Band B.

12. Calculate the Error with the following formula and enter the value in Table 22-50.

    Error = Measured – (Power Meter + 106.99)

Table 22-50   EMI Average Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 :2010 Section 6.4

Sine Wave Frequency (MHz)	Band B				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
10			-2.5		+2.5

13. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band B**

    b. Pulse Frequency: **500 Hz**

    c. Amplitude: **40 dBµV**

14. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

15. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

16. Put the EMI receiver in single sweep operation by pressing **Single**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

19. Record the marker value in Table 22-51 as the Measured value for the Band B reference PRF.

20. Calculate the Error with the following formula and enter the value in Table 22-51.

Error = Measured − 40 dBμV + 18.95 dB - Error (Table 22-50)

Table 22-51   EMI Average Amplitude Relationship Band B – CISPR 16-1-1 :2010 Section 6.5.2

Pulse Frequency (Hz)	Band B			
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
500		-2.0		+2.0

21. Put the marker in Delta mode by pressing **Marker, Delta**.

22. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

23. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

24. Take a single sweep on the EMI receiver by pressing **Restart**.

25. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 1000 Hz pulse frequency Table 22-52.

26. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

27. Take a single sweep on the EMI receiver by pressing **Restart**.

28. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 100 Hz pulse frequency in Table 22-52.

Table 22-52   EMI Average Variation with Repetition Frequency Band B CISPR 16-1-1 :2010 Section 6.5.3

Pulse Frequency (Hz)	Band B		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
1000	4.5		9.5
500	0	Reference	0
100	-15.5		-10.5

Band C Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

7. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

8. Change the detector used by the EMI receiver to EMI Average by pressing **Trace / Detector, More, Detector, More, EMI Average**.

9. Turn on the marker by pressing **Marker**.

10. Record the marker value in Table 22-53 as the Measured value for Band C.

11. Calculate the Error with the following formula and enter the value in Table 22-53.

    Error = Measured – (Power Meter + 106.99)

Table 22-53   EMI Average Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 :2010 Section 6.4

Sine Wave Frequency (MHz)	Band C				
	Power Meter (dBm)	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

12. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band C/D**

    b. Pulse Frequency: **5000 Hz**

    c. Amplitude: **40 dBμV**

13. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

14. Set the EMI receiver input attenuator to 0 dB by pressing **AMPTD Y Scale, Attenuation, 0 dB**.

15. Put the EMI receiver in single sweep operation by pressing **Single**.

16. Take a single sweep on the EMI receiver by pressing **Restart**.

17. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

18. Record the marker value in Table 22-54 as the Measured value for the Band C reference PRF.

19. Calculate the Error with the following formula and enter the value in Table 22-54.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 16.07 \text{ dB} - \text{Error (Table 22-53)}$$

Table 22-54   EMI Average Amplitude Relationship Band C – CISPR 16-1-1 :2010 Section 6.5.2

Pulse Frequency (Hz)	Band C			
	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
5000		-2.0		+2.0

20. Put the marker in Delta mode by pressing **Marker, Delta**.

21. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

22. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10000 Hz**.

23. Take a single sweep on the EMI receiver by pressing **Restart**.

24. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10000 Hz pulse frequency in Table 22-55.

25. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

26. Take a single sweep on the EMI receiver by pressing **Restart**.

27. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 1000 Hz pulse frequency in Table 22-55.

Table 22-55   EMI Average Variation with Repetition Frequency Band C – CISPR 16-1-1 :2010 Section 6.5.3

Pulse Frequency (Hz)	Band C		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
10000	4.5		9.5
5000	0	Reference	0
1000	-15.5		-10.5

Band D Testing

1. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band C/D**

    b. Pulse Frequency: **5000 Hz**

    c. Amplitude: **40 dBμV**

2. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 500 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 500 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

7. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

8. Change the detector used by the EMI receiver to EMI Average by pressing **Trace / Detector, More, Detector, More, EMI Average**.

9. Set the EMI receiver input attenuator to 0 dB by pressing **AMPTD Y Scale, Attenuation, 0 dB**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

13. Record the marker value in Table 22-56 as the Measured value for the Band D reference PRF.

14. Calculate the Error with the following formula and enter the value in Table 22-56.

    Error = Measured − 40 dBμV + 16.07 dB

Table 22-56   EMI Average Amplitude Relationship Band D − CISPR 16-1-1 :2010 Section 6.5.2

Pulse Frequency (Hz)	Band D			
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
5000		-2.0		+2.0

15. Put the marker in Delta mode by pressing **Marker, Delta**.

16. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

17. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10000 Hz**.

18. Take a single sweep on the EMI receiver by pressing **Restart**.

19. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10000 Hz pulse frequency in Table 22-57.

20. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **1000 Hz**.

21. Take a single sweep on the EMI receiver by pressing **Restart**.

22. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 1000 Hz pulse frequency in Table 22-57.

Table 22-57   EMI Average Variation with Repetition Frequency Band D – CISPR 16-1-1 :2010 Section 6.5.3

Pulse Frequency (Hz)	Band D		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
10000	4.5		9.5
5000	0	Reference	0
1000	-15.5		-10.5

RMS Average Detector Accuracy

Test Limits

See test limits in test results Table 22-59 through Table 22-69.

Overview

This test will verify the performance of the RMS Average detector of the EMI receiver according to section 7 of the CISPR 16-1-1 :2010 standard. This includes testing for the following subsections:

7.4 Sine-wave voltage accuracy

7.5 Response to pulses

7.5.2 Amplitude relationship

7.5.3 Variation with repetition frequency

Table 22-58   RMS Average Detector- Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 10 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 100 kHz to 1.51 GHz VSWR: < 1.4:1	11500E
EMI Calibration Pulse Generator	CISPR Specified Pulse Area	Schwarzbeck IGUU 2916
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency Range: 100 MHz Amplitude Range: -60 to 0 dBm	E9304A

a. Quantity 2 required for Option CNF (Type-N RF Input)
b. Only required for Option C35 (3.5 mm RF Input)
c. Only required for Option 544 (44 GHz Frequency Range)

Figure 22-16   Typical Equipment Setup
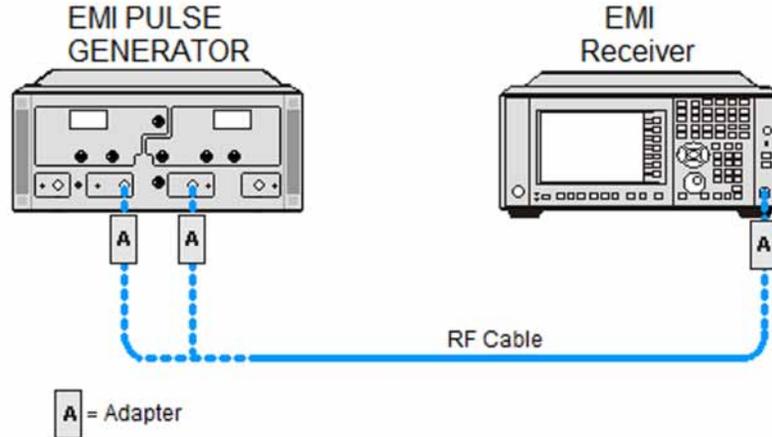
Sine Wave Generator Characterization

1. Zero and calibrate the power meter.

2. Connect the power meter to the Output Sine Wave Generator of the IGUU 2916 EMI pulse generator as shown in Figure 22-17.

Figure 22-17   Sine Wave Generator Characterization
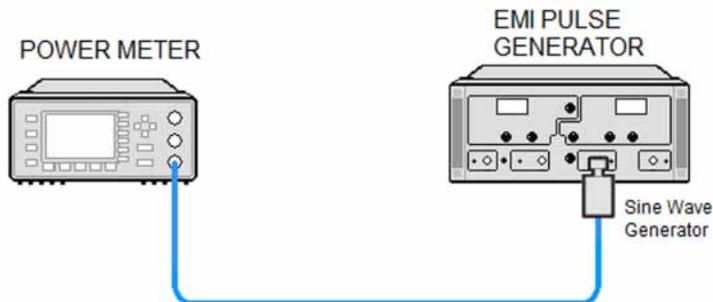
3. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

4. After allowing the power meter to settle, record the reading in Table 22-59 under the Power Meter column.

5. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

6. After allowing the power meter to settle, record the reading in Table 22-69 under the Power Meter column.

7. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

8. After allowing the power meter to settle, record the reading in Table 22-72 under the Power Meter column.

Initial Setup

1. Setup the equipment as shown in Figure 22-12.

2. Make sure that the EMI receiver is in the spectrum analyzer mode by pressing **Mode, Spectrum Analyzer**.

3. Make sure that the auto alignment routine in the EMI receiver is on by pressing **System, Alignments, Auto Align, Normal**.

4. Put the instrument in a known state by pressing **Mode, Spectrum Analyzer, Mode Setup, More, Restore Mode Defaults, OK**.

5. Set all input / output setting to their default state by pressing **System, Restore Defaults, Input / Output Settings, OK**.

Band A Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 kHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 kHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 kHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

8. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

9. Change the detector used by the EMI receiver to RMS Average by pressing **Trace / Detector, More, Detector, More, RMS Average**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Turn on the marker by pressing **Marker.**

13. Record the marker value in Table 22-59 as the Measured value for Band A.

14. Calculate the Error with the following formula and enter the value in Table 22-59.

Error = Measured − (Power Meter + 106.99)

Table 22-59   RMS Average Sine-Wave Voltage Accuracy Band A – CISPR 16-1-1 :2010 Section 7.4

Sine Wave Frequency (kHz)	Band A				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

15. Setup the IGUU 2916 EMI pulse generator as follows:

  – Aux. Generator: **Band A**

  – Pulse Frequency: **25 Hz**

  – Amplitude: **40 dBµV**

16. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

17. Set the EMI receiver input attenuator to 6 dB by pressing **AMPTD Y Scale, Attenuation, 6 dB**.

18. Take a single sweep on the EMI receiver by pressing **Restart**.

19. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

20. Record the marker value in Table 22-60 as the Measured value for the Band A reference PRF.

21. Calculate the Error with the following formula and enter the value in Table 22-60.

Error = Measured − 40 dBµV + 5.13 dB - Error (Table 22-59)

Table 22-60   RMS Average Amplitude Relationship Band A – CISPR 16-1-1 :2010 Section 7.5.2

Pulse Frequency (Hz)	Band A			
	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
25		-2.0		+2.0

22. Put the marker in Delta mode by pressing **Marker, Delta**.

23. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

24. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

25. Take a single sweep on the EMI receiver by pressing **Restart**.

26. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 100 Hz pulse frequency in Table 22-61.

27. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10 Hz**.

28. Take a single sweep on the EMI receiver by pressing **Restart**.

29. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10 Hz pulse frequency in Table 22-61.

30. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **5 Hz**.

31. Take a single sweep on the EMI receiver by pressing **Restart**.

32. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 5 Hz pulse frequency in Table 22-61.

Table 22-61   RMS Average Variation with Repetition Frequency
                     Band A – CISPR 16-1-1 :2010 Section 7.5.3

Pulse Frequency (Hz)	Band A		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
100	4.9		7.1
25	0	Reference	0
10	-4.9		-3.1
5	-10.2		-7.8

Band B Testing

1. Set the IGUU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 10 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 10 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the amplitude units to dBµV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBµV**.

8. Set the reference level to 80 dBµV by pressing **AMPTD Y Scale, 80 dBµV**.

9. Change the detector used by the EMI receiver to RMS Average by pressing **Trace / Detector, More, Detector, More, RMS Average**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Turn on the marker by pressing **Marker**.

13. Record the marker value in Table 22-62 as the Measured value for Band B.

14. Calculate the Error with the following formula and enter the value in Table 22-62.

Error = Measured – (Power Meter + 106.99)

Table 22-62   RMS Average Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 :2010 Section 7.4

Sine Wave Frequency (MHz)	Band B				
	Power Meter (dBm)	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
10			-2.5		+2.5

15. Setup the IGUU 2916 EMI pulse generator as follows:

    a. Aux. Generator: **Band B**

    b. Pulse Frequency: **1000 Hz**

    c. Amplitude: **40 dBµV**

16. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

17. Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.

18. Take a single sweep on the EMI receiver by pressing **Restart.**

19. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

20. Record the marker value in Table 22-63 as the Measured value for the Band B reference PRF.

21. Calculate the Error with the following formula and enter the value in Table 22-63.

Error = Measured – 40 dBμV + 4.55 dB - Error (Table 22-62)

Table 22-63   RMS Average Amplitude Relationship Band B – CISPR 16-1-1 :2010 Section 7.5.2

Pulse Frequency (Hz)	Band B			
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
1000		-2.0		+2.0

22. Put the marker in Delta mode by pressing **Marker, Delta**.

23. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

24. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

25. Take a single sweep on the EMI receiver by pressing **Restart**.

26. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the pulse frequency being measured in Table 22-64.

27. Without changing any other setting on the EMI receiver or the IGUU 2916 EMI pulse generator change the Pulse Frequency on the pulse generator to the other values in the Table 22-64 and repeat steps 25 and 26 for each.

Table 22-64   RMS Average Variation with Repetition Frequency
Band B – CISPR 16-1-1 :2010 Section 7.5.3

Pulse Frequency (Hz)	Band B		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
1000	0	Reference	0
100	-11.5		-8.5
25	-18.1		-13.9
10	-22.5		-17.5
5	-27.8		-22.2

Band C Testing

1. Set the IGUU 2916 EMI pulse generator to output a 100 MHz Sine Wave signal.

2. Connect the IGUU 2916 EMI pulse generator Output Sine Wave Generator to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 100 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 100 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

7. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

8. Change the detector used by the EMI receiver to RMS Average by pressing **Trace / Detector, More, Detector, More, RMS Average**.

9. Put the EMI receiver in single sweep operation by pressing **Single**.

10. Take a single sweep on the EMI receiver by pressing **Restart**.

11. Turn on the marker by pressing **Marker**.

12. Record the marker value in Table 22-65 as the Measured value for Band C.

13. Calculate the Error with the following formula and enter the value in Table 22-65.

Error = Measured – (Power Meter + 106.99)

Table 22-65   RMS Average Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 :2010 Section 7.4

Sine Wave Frequency (MHz)	Band C				
	Power Meter (dBm)	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
100			-2.5		+2.5

14. Setup the IGUU 2916 EMI pulse generator as follows:

   a. Aux. Generator: **Band C/D**

   b. Pulse Frequency: **1000 Hz**

   c. Amplitude: **40 dBμV**

15. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

16. Set the EMI receiver input attenuator to 0 dB by pressing **AMPTD Y Scale, Attenuation, 0 dB**.

17. Take a single sweep on the EMI receiver by pressing **Restart**.

18. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

19. Record the marker value in Table 22-66 as the Measured value for the Band C reference PRF.

20. Calculate the Error with the following formula and enter the value in Table 22-66.

Error = Measured – 40 dBµV + 10.41 dB - Error (Table 22-65)

Table 22-66   RMS Average Amplitude Relationship Band C – CISPR 16-1-1 :2010 Section 7.5.2

| Pulse Frequency (Hz) | Band C | | | |
	Measured (dBµV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
1000		-2.0		+2.0

21. Put the marker in Delta mode by pressing **Marker, Delta**.

22. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

23. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10000 Hz**.

24. Take a single sweep on the EMI receiver by pressing **Restart**.

25. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10000 Hz pulse frequency in Table 22-67.

26. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz**.

27. Take a single sweep on the EMI receiver by pressing **Restart**.

28. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 100 Hz pulse frequency in Table 22-67.

Table 22-67   RMS Average Variation with Repetition Frequency Band C – CISPR 16-1-1 :2010 Section 7.5.3

| Pulse Frequency (Hz) | Band C | | |
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
10000	8.5		11.5
1000	0	Reference	0
100	-11.5		-8.5

Band D Testing

1. Setup the IGUU 2916 EMI pulse generator as follows:

   a. Aux. Generator: **Band C/D**

   b. Pulse Frequency: **1000 Hz**

   c. Amplitude: **40 dBμV**

2. Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.

3. Preset the EMI receiver by pressing **Mode Preset**.

4. Tune the receiver to 500 MHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 500 MHz** then **SPAN X Scale, Zero Span**.

5. Set the Sweeptime to 1 second by pressing **Sweep / Control, 1 s**.

6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, More, Y Axis Unit, More, dBμV**.

7. Set the reference level to 80 dBμV by pressing **AMPTD Y Scale, 80 dBμV**.

8. Change the detector used by the EMI receiver to RMS Average by pressing **Trace / Detector, More, Detector, More, RMS Average**.

9. Set the EMI receiver input attenuator to 0 dB by pressing **AMPTD Y Scale, Attenuation, 0 dB**.

10. Put the EMI receiver in single sweep operation by pressing **Single**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Once the sweep has completed find the peak of the detector output by pressing **Peak Search**.

13. Record the marker value in Table 22-68 as the Measured value for the Band D reference PRF.

14. Calculate the Error with the following formula and enter the value in Table 22-68.

    Error = Measured – 40 dBμV + 10.41 dB

Table 22-68   RMS Average Amplitude Relationship Band D – CISPR 16-1-1 :2010 Section 7.5.2

| Pulse Frequency (Hz) | Band D | | | |
	Measured (dBμV)	Lower Limit (dB)	Error (dB)	Upper Limit (dB)
5000		-2.0		+2.0

15. Put the marker in Delta mode by pressing **Marker, Delta**.

16. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

17. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **10000 Hz**.

18. Take a single sweep on the EMI receiver by pressing **Restart**.

19. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 10000 Hz pulse frequency in Table 22-69.

20. Change the Pulse Frequency on the IGUU 2916 EMI pulse generator to **100 Hz.**

21. Take a single sweep on the EMI receiver by pressing **Restart**.

22. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker delta amplitude value for the 100 Hz pulse frequency in Table 22-69.

Table 22-69   RMS Average Variation with Repetition Frequency
                   Band D – CISPR 16-1-1 :2010 Section 7.5.3

Pulse Frequency (Hz)	Band D		
	Lower Limit (dB)	Measured (dB)	Upper Limit (dB)
10000	8.5		11.5
1000	0	Reference	0
100	-11.5		-8.5

Intermittent, Unsteady, Drifting Disturbances

Test Limits

See test limits in test results Table 22-71 and Table 22-72.

Overview

This test will verify the response of the EMI Average and RMS Average detectors of the EMI receiver according to CISPR 16-1-1 :2010 standard to intermittent, unsteady, and drifting narrowband disturbances. This includes testing for the following subsections:

6.5.4 Response to intermittent, unsteady, and drifting narrowband disturbances

7.5.4 Response to intermittent, unsteady, and drifting narrowband disturbances

Table 22-70   Intermittent, Unsteady, Drifting Disturbances - Required Equipment

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter[a] Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter[b] 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter[c] 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	11901B
Cable, 1 meter 3.5 mm (m) to 3.5 mm (m)	Frequency: 10 kHz to 1.51 GHz VSWR: < 1.4:1	11500E
Signal Generator	Frequency Range: 100 kHz to 1.5 GHz Amplitude Range: -40 to 0 dBm Narrow Pulse Modulation	PSG w/Option UNW

a. Quantity 2 required for Option CNF (Type-N RF Input)
b. Only required for Option C35 (3.5 mm RF Input)
c. Only required for Option 544 (44 GHz Frequency Range)

Figure 22-18   Equipment Setup
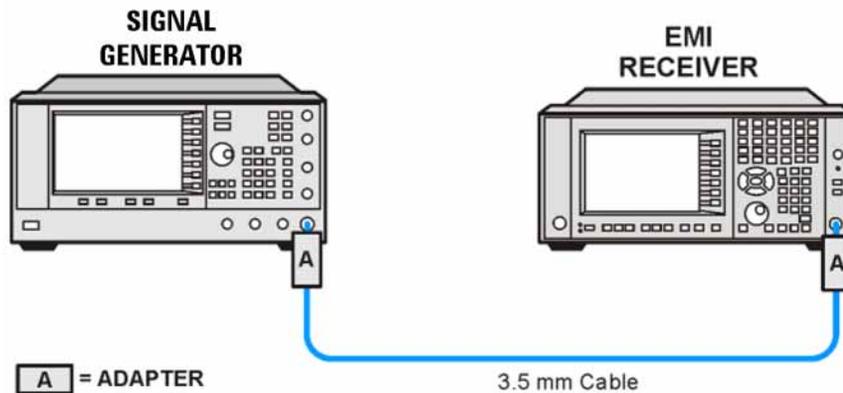
Initial Setup

1. Setup the equipment as shown in Figure 22-18.

2. Make sure that the EMI receiver is in the spectrum analyzer mode by **pressing Mode, Spectrum Analyzer.**

3. Make sure that the auto alignment routine in the EMI receiver is on by pressing **System, Alignments, Auto Align, Normal**.

4. Put the instrument in a known state by pressing **Mode, Spectrum Analyzer, Mode Setup, More, Restore Mode Defaults, OK**.

5. Set all input / output setting to their default state by pressing **System, Restore Defaults, Input / Output Settings, OK**.

EMI Average Detector Testing

1. Preset the Signal Generator by pressing **Preset.**

2. Set the Synthesizer Sweeper as follows:

   a. Output: **Sine Wave**

   b. Frequency: **125 kHz**

   c. Amplitude: **-20 dBm**

   d. Pulse Period: **1.6 seconds**

   e. Pulse Width: **0.16 seconds**

   f. Pulse: **On**

   g. RF Output: **On**

   h. Modulation: **Off**

3. Connect the Signal Generator output to the EMI receiver RF Input.

4. Preset the EMI receiver by pressing **Mode Preset**.

5. Tune the EMI receiver to 125 kHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 125 kHz** then **SPAN X Scale, Zero Span**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the Sweeptime to 3 seconds by pressing **Sweep / Control, 3 s**.

8. Change the detector used by the EMI receiver to EMI Average by pressing **Trace / Detector, More, Detector, More, EMI Average**.

9. Put the EMI receiver in single sweep operation by pressing **Single**.

10. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Sine Wave Measured value for the frequency being measured in Table 22-71.

13. On the signal generator turn the modulation **On**.

14. Take a single sweep on the EMI receiver by pressing **Restart**.

15. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Pulsed RF Measured value for the frequency being measured in Table 22-71.

16. Calculate the Delta between the Sine Wave and Pulsed RF measurements with the following formula and enter the value in Table 22-71 for the frequency being measured.

    Delta = Pulsed RF Measured – Sine Wave Measured

Table 22-71   EMI Average – CISPR 16-1-1 :2010 Section 6.5.4

Frequency (MHz)	Pulse Width (sec)	Sine Wave Measured (dBm)	Pulsed RF Measured (dBm)	Lower Limit (dB)	Delta (dB)	Upper Limit (dB)
0.125	0.16			-10.5		-7.5
10	0.16			-10.5		-7.5
100	0.10			-10.5		-7.5
500	0.10			-10.5		-7.5
1100	0.10			-10.5		-7.5

17. On the signal generator turn the modulation **Off**.

18. Changing the frequency on the EMI receiver and the signal generator to the next value listed in Table 22-71.

19. Change the Pulse Width on the signal generator to the corresponding value for the Frequency being tested listed in Table 22-71.

20. Repeat steps 11 through 19 for the rest of the frequencies in Table 22-71.

RMS Average Detector Testing

1. Preset the signal generator by pressing **Preset**.

2. Set the Synthesizer Sweeper as follows:

   a. Output: **Sine Wave**

   b. Frequency: **125 kHz**

   c. Amplitude: **-20 dBm**

   d. Pulse Period: **1.6 seconds**

   e. Pulse Width: **0.16 seconds**

   f. Pulse: **On**

   g. RF Output: **On**

   h. Modulation: **Off**

3. Connect the signal generator output to the EMI receiver RF Input.

4. Preset the EMI receiver by pressing **Mode Preset.**

5. Tune the EMI receiver to 125 kHz with a span of 0 Hz by pressing **FREQ Channel, Center Freq, 125 kHz** then **SPAN X Scale, Zero Span**.

6. Set the RF Coupling to DC by pressing **Input / Output, RF Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).

7. Set the Sweeptime to 3 seconds by pressing **Sweep / Control, 3 s**.

8. Change the detector used by the EMI receiver to RMS Average by pressing **Trace / Detector, More, Detector, More, RMS Average**.

9. Put the EMI receiver in single sweep operation by pressing **Single**.

10. Turn on the continuous peak function by pressing **Peak Search, More, Continuous Peak Search On**.

11. Take a single sweep on the EMI receiver by pressing **Restart**.

12. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Sine Wave Measured value for the frequency being measured in Table 22-72.

13. On the signal generator turn the modulation **On**.

14. Take a single sweep on the EMI receiver by pressing **Restart**.

15. Once the sweep on the EMI receiver has completed and the auto peak value is found record the marker amplitude as the Pulsed RF Measured value for the frequency being measured in Table 22-72.Calculate the Delta between the Sine Wave and Pulsed RF measurements with the following formula and enter the value in Table 22-72 for the frequency being measured.

Delta = Pulsed RF Measured – Sine Wave Measured

Table 22-72   RMS Average – CISPR 16-1-1 :2010 Section 7.5.4

Frequency (MHz)	Pulse Width (sec)	Sine Wave Measured (dBm)	Pulsed RF Measured (dBm)	Lower Limit (dB)	Delta (dB)	Upper Limit (dB)
0.125	0.16			-9.4		-6.4
10	0.16			-9.4		-6.4
100	0.10			-10.5		-7.5
500	0.10			-10.5		-7.5
1100	0.10			-10.5		-7.5

16. On the signal generator turn the modulation **Off**.

17. Changing the frequency on the EMI receiver and the signal generator to the next value listed in Table 22-72.

18. Change the Pulse Width on the signal generator to the corresponding value for the Frequency being tested listed in Table 22-72.

19. Repeat steps 11 through 19 for the rest of the frequencies in Table 22-72.

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