
Keysight N9048B PXE EMI Receiver

N9048B Option 503 (1 Hz - 3.6 GHz)

N9048B Option 508 (1 Hz - 8.4 GHz)

N9048B Option 526 (1 Hz - 26.5 GHz)

N9048B Option 544 (1 Hz - 44 GHz)

Notices

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CAUTION

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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/pxe>

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/PreventingInstrumentDamage

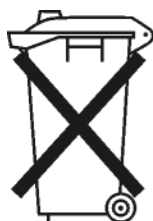
Is your product software up-to-date?

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 PXE 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 28** for a list of Keysight Technologies Sales and Service offices.



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

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.

Product and Solution Cybersecurity

Keysight complies with multinational regulations for the cybersecurity of its own products and is committed to providing information to assist you in protecting your products and solutions from external cyber threats. For more information, see:

<https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security.html>

Keysight also recommends that you secure your IT environments using appropriate third-party tools. For instruments that run the Microsoft Windows operating system, Keysight concurs with Microsoft's recommendations for ensuring that the instrument is protected:

- Get the latest critical Windows updates
- For network-connected instruments, use an Internet firewall (in Keysight instruments, Windows Firewall is enabled by default)
- For network-connected instruments, use up-to-date antivirus and anti-spyware software

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<https://www.keysight.com/us/en/contact/responsible-disclosure-program.html>

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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 PXE EMI Receiver Overview on page 17

Instrument Option Descriptions on page 18

Before You Start Troubleshooting on page 20

ESD Information on page 23

Service Equipment You Will Need on page 26

Contacting Keysight Technologies on page 28

How to Return Your Instrument for Service on page 32

Service Manual Revision History

N9048-90011

- Print Date February 2023
 - Initial publication.
 - Added support for WF1 Wideband Digital IF
 - Added support for latest shipping hardware

Keysight PXE EMI Receiver Overview

The Keysight PXE 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 PXE 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 and much more.

The Keysight PXE 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 PXE 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 PXE. It is the customers responsibility to install anti-virus software.

Instrument Option Descriptions

The PXE EMI Receiver has a variety of hardware and measurement application options. Several of these options are “standard” so they are automatically installed on all PXE 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 website at:

<http://www.keysight.com/find/pxe>

Option	Description	Notes
503	1 Hz to 3.6 GHz Frequency Range	
508	1 Hz to 8.4 GHz Frequency Range	
526	1 Hz to 26.5 GHz Frequency Range	
544	1 Hz to 44 GHz Frequency Range	
B25	25 MHz Analysis Bandwidth	
B40	40 MHz Analysis Bandwidth	
C35	3.5 mm RF Input	
CNF^a	Type-N Female RF input	No license needed
CR3	Wideband IF Output	
EMC	Software only. Provides EMI detectors and BWs.	Included on all units
EXM	External Mixing	
LSN	External LISN Control	Included on all units
N9048CKB	Multi-Channel Click (requires WF1)	
N9048WT1B	Wideband Time Domain Scan (Basic detection, requires WF1)	
N9048WT2B	Wideband Time Domain Scan (Optimum detection, requires WF1 and TDSB))	
N9048TDSB	Time Domain Scan (requires WF1)	
NF2	Noise Floor Extension	Included on all units

Overview
Instrument Option Descriptions

Option	Description	Notes
PFR	Precision Frequency Reference	
P03	Preamp, 100 kHz to 3.6 GHz	
P08	Preamp, 100 kHz to 8.4 GHz	
P26	Preamp, 100 kHz to 26.5 GHz	
P44	Preamp, 100 kHz to 44 GHz	
WF1	Wideband Digital IF	
YAS	Y-Axis Screen Video (rear panel Analog Out connector)	

- a. Does not appear in option listing of instrument

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 its 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.

WARNING

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

CAUTION

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 its 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.

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.

NOTE

Cleaning connectors with alcohol should only be done with the instrument's power cord removed, and in a well ventilated area. Allow all residual alcohol moisture to evaporate and the fumes to dissipate prior to energizing the instrument.

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.

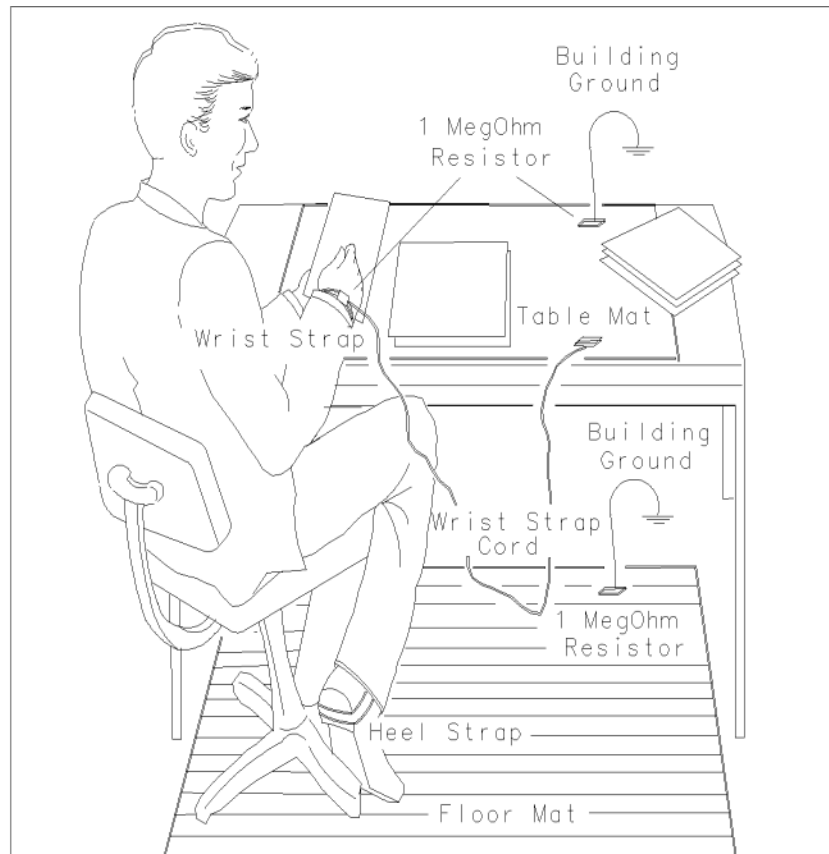
Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 megohm of isolation from ground.

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).

Instrument Maintenance

Cleaning the instrument

WARNING

To prevent electrical shock, disconnect the receiver 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.

Cleaning Connectors

Cleaning connectors with alcohol shall only be done with the instrument power cord removed, and in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

WARNING

Keep isopropyl alcohol away from heat, sparks, and flame. Store in a tightly closed container. It is extremely flammable. In case of fire, use alcohol foam, dry chemical, or carbon dioxide; water may be ineffective.

Use isopropyl alcohol with adequate ventilation and avoid contact with eyes, skin, and clothing. It causes skin irritation, may cause eye damage, and is harmful if swallowed or inhaled. It may be harmful if absorbed through the skin. Wash thoroughly after handling.

In case of spill, soak up with sand or earth. Flush spill area with water.

Dispose of isopropyl alcohol in accordance with all applicable federal, state, and local environmental regulations.

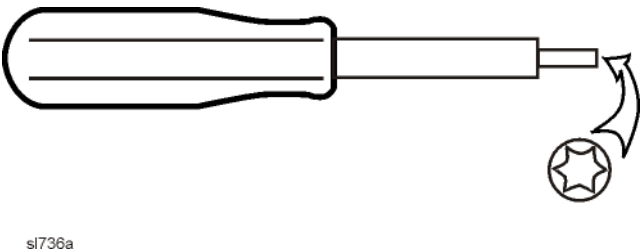
Service Equipment You Will Need

There are certain things that will be required to troubleshoot, adjust, and test the PXE 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



Description	Keysight Part Number
TORX Driver - Size T-8	8710-1614
TORX Driver - Size T-10	8710-1623
TORX Driver - Size T-20	8710-1615
9/16-inch Nut Driver	8720-0008
1/4-inch Nut Driver	source locally
5/16-inch Open-End Wrench	source locally
1/4-inch Open-End Wrench	source locally
1/4-inch socket on 4-lb torque wrench	source locally

Calibration Application Software

Information regarding the Keysight X-Series Signal Analyzer 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)

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 PXE 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 PXE 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/pxe_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 (N9048B) and full serial number (ex. MY584800000). 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 **Table 1-1 on page 29**. 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” on page 33**.

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.

Overview
How to Return Your Instrument for Service

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:

[Check the Basics on page 36](#)

[PXE Instrument Boot Up Process on page 37](#)

[Typical instrument boot-up process flow on page 39](#)

[Potential Problems During Boot Process on page 42](#)

[Yellow Standby LED Does Not Illuminate on page 42](#)

[Green Power On LED Does Not Illuminate on page 44](#)

[Fan\(s\) Are Not Operating on page 48](#)

[No Keysight Splash Screen Displayed on page 51](#)

[Instrument Hangs at the Keysight Splash Screen on page 52](#)

[Instrument Cannot Completely Load or Run the Operating System on page 53](#)

[Troubleshooting a Blank Display on page 53](#)

[Verify LCD Backlight Functionality on page 54](#)

[Initializations Did Not Complete on page 58](#)

[Fails an Initial Alignment on page 58](#)

[Fails an Initial Alignment on page 58](#)

[Frequencies Less Than 3.6 GHz on page 64](#)

[Frequencies Greater Than 3.6 GHz on page 65](#)

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 58**.
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 531**.
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 537**.

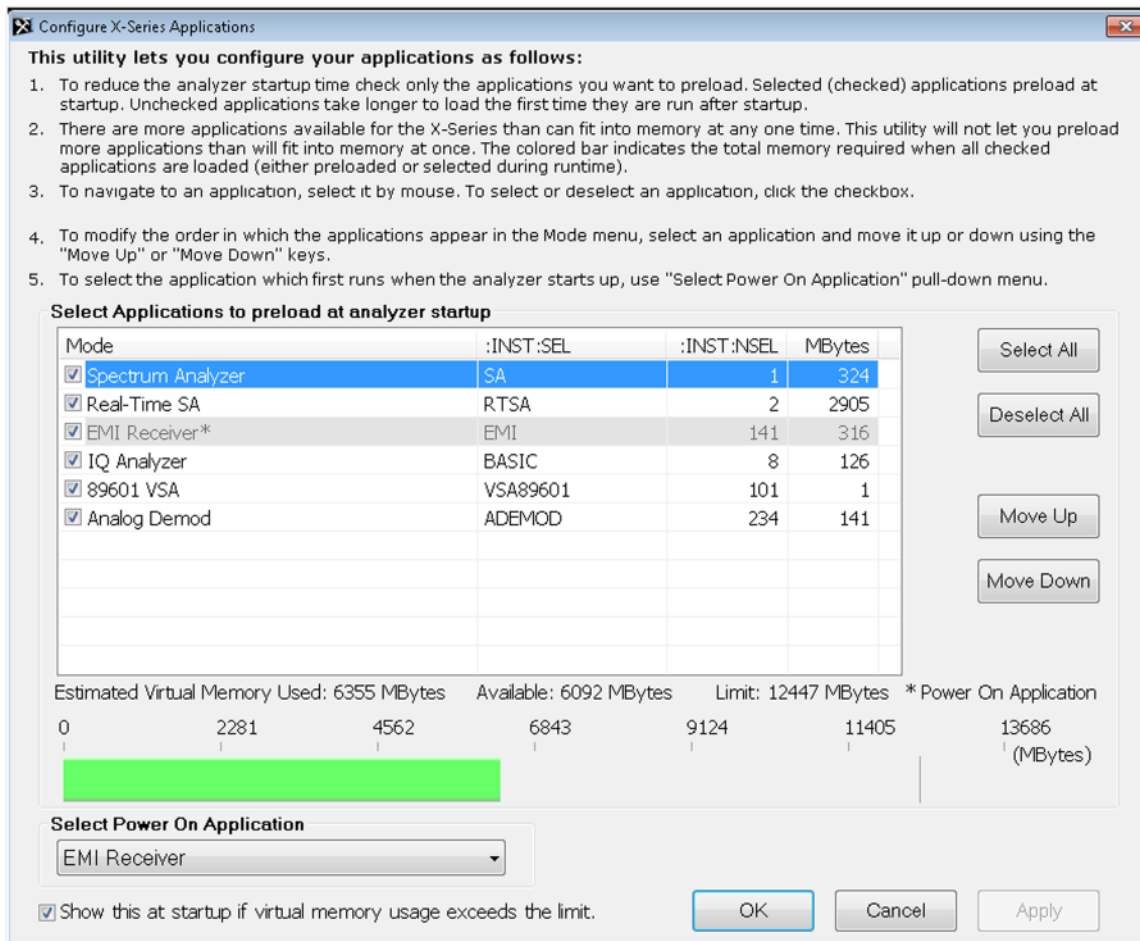
PXE Instrument Boot Up Process

This section describes the N9048B 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 PXE 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 301** 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 PXE 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 PXE 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

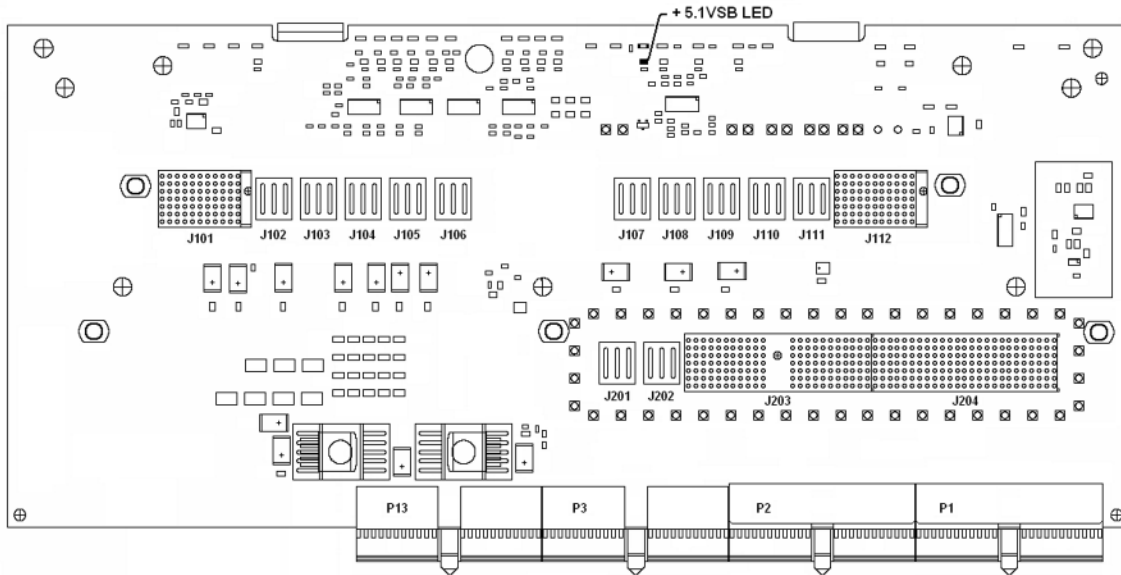
Control of the yellow front panel Standby LED comes from the A4 Processor board assembly. This signal is routed through the A7 Midplane board and is then buffered on the A8 Motherboard before being sent to the A1A2 Front Panel Interface board through W8. Of course, the power for this all originates with 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 423](#) 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 423** in this manual.
3. Remove the Top Brace. Refer to **Chapter 18, "Assembly Replacement Procedures", on page 423** 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**.

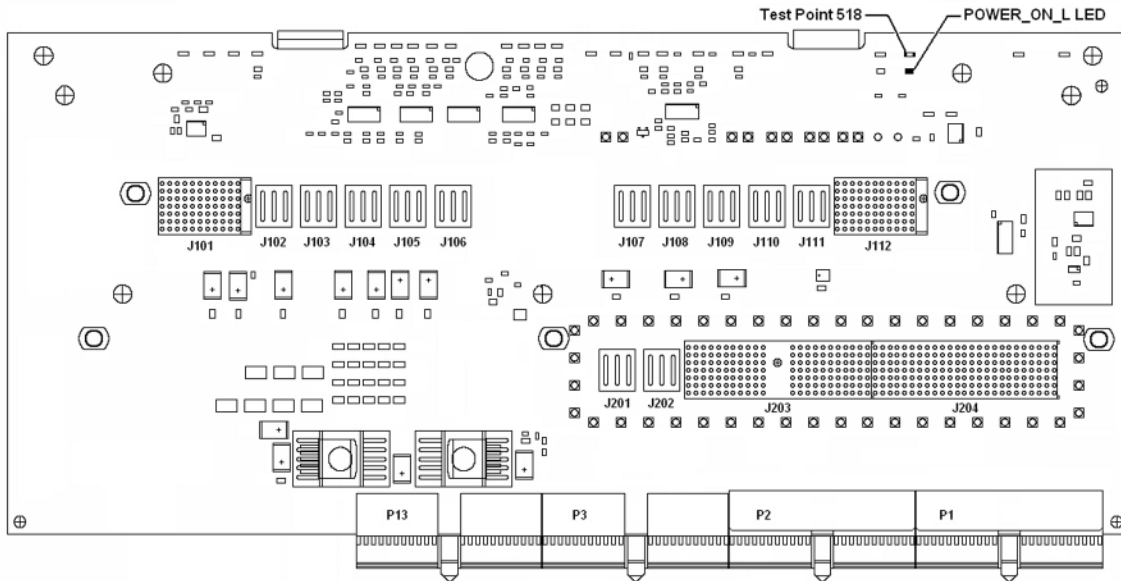
If not:

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:

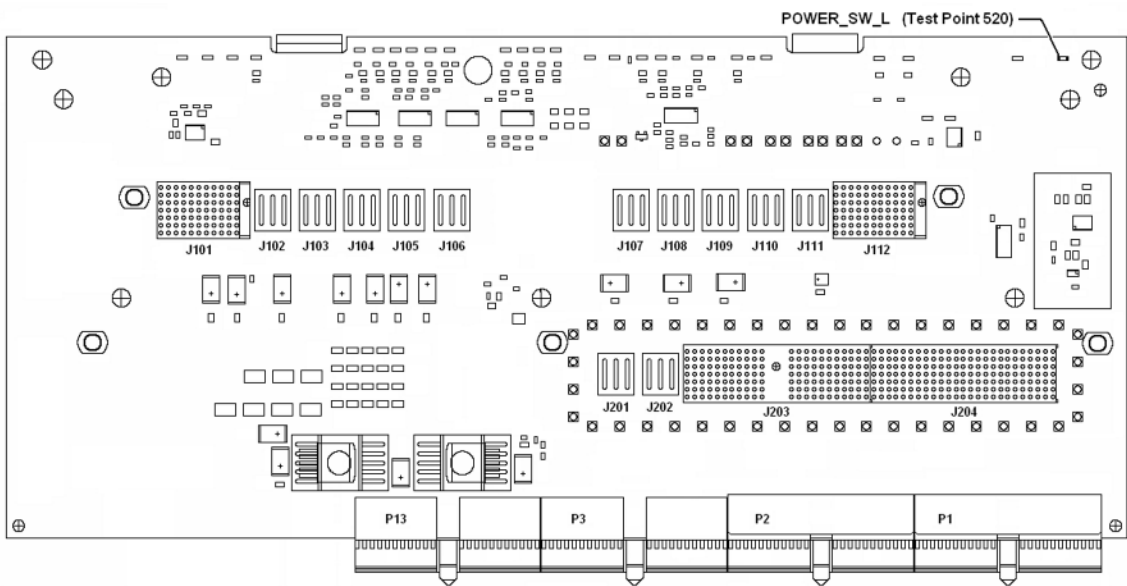
Verify the connection between the front panel On/Off switch and the A4 Processor assembly by checking the status of the POWER_SW_L control line when the front panel On/Off button is both pressed and released. This can be monitored by measuring the voltage at Test Point 520, as shown in **Figure 2-5**.

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.

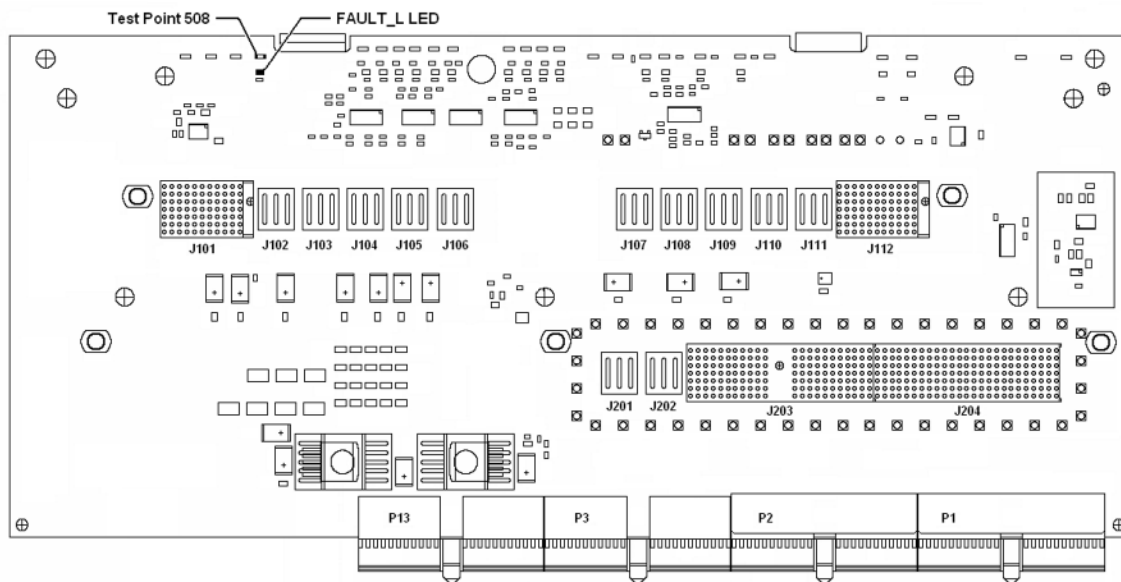
If yes:

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 423** 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 423** 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.

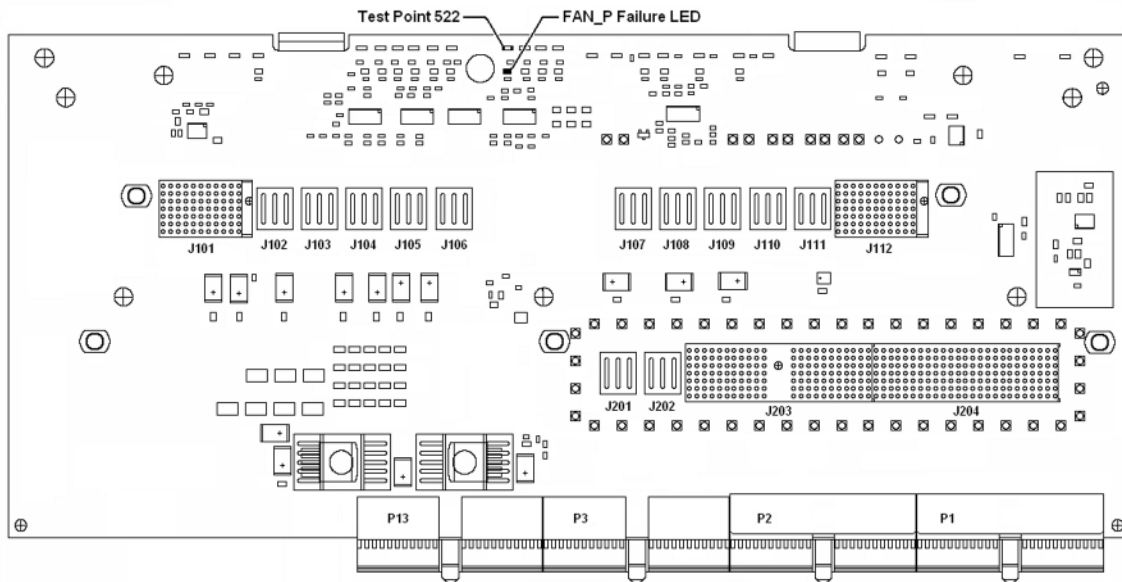
If not:

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 423** 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 423** in this manual.
2. Remove the Top Brace. Refer to **Chapter 18, “Assembly Replacement Procedures”, on page 423** 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 313**.

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 to [Chapter 18, “Assembly Replacement Procedures”, on page 423](#) in this manual.
2. Remove the Top Brace. Refer to [Chapter 18, “Assembly Replacement Procedures”, on page 423](#) 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 313](#).

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 310**. 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 423** in this manual.
2. Remove the Top Brace. Refer to **Chapter 18, “Assembly Replacement Procedures”, on page 423** 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:

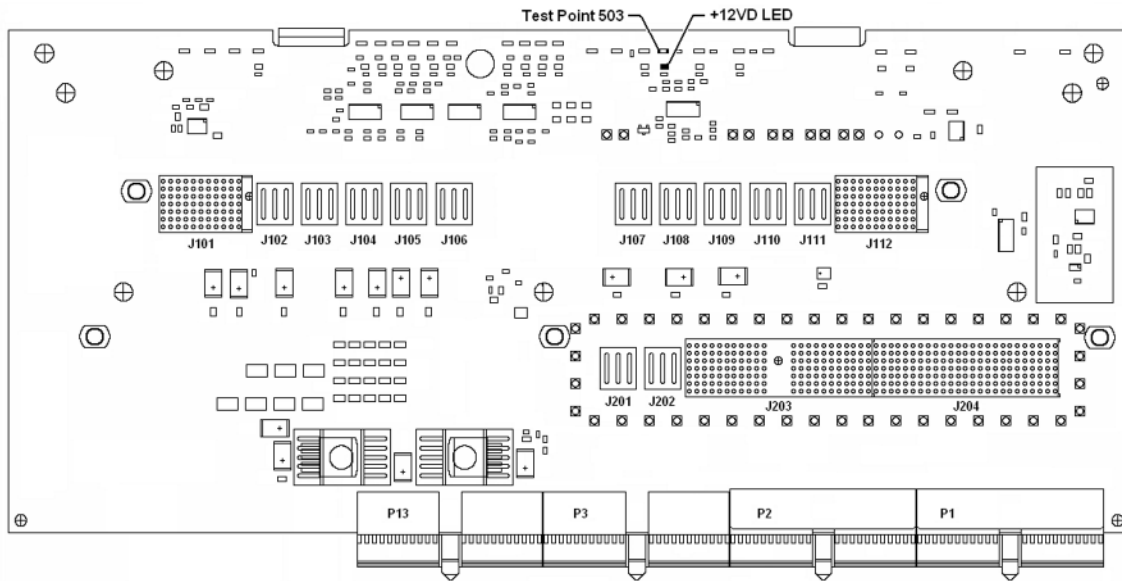
The problem is backlight related. Proceed to **step 6**.

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. Remove the Front Panel Shield as shown in **Figure 18-60**.
9. Carefully lay the front panel assembly face down on the work surface.
10. 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

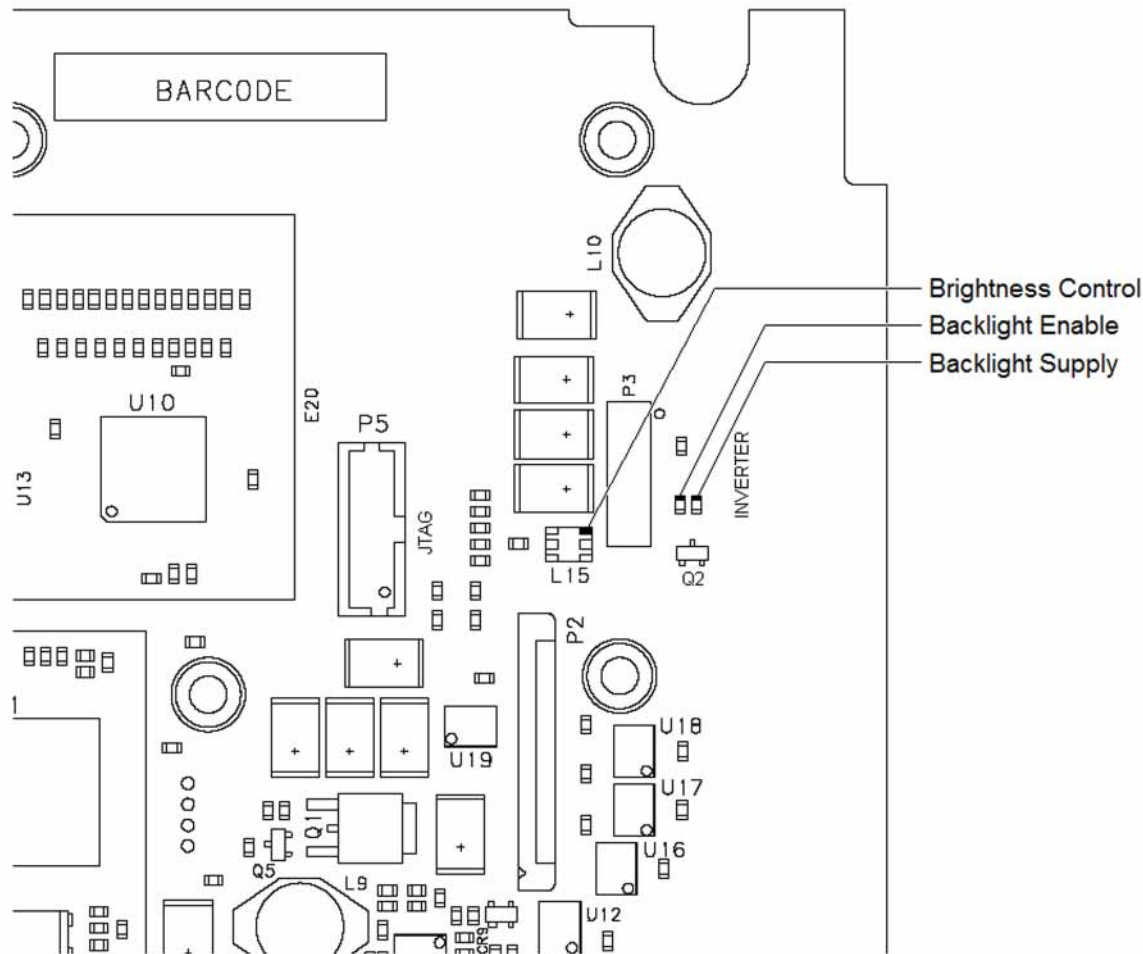


Table 2-2 Expected Backlight Inverter Control Voltage Levels

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

11.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 PXE 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 PXE 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 is not providing correct 100 MHz or 4.8 GHz signals. A20 YTO output power low.
VCXOTuningCurve Measures the tuning voltage for the 100 MHz VCO at a number of different frequencies. Uses internal 10 MHz time base.	A16 Reference	A16 Reference board is not providing correct 100 MHz or 4.8 GHz signals.
VCXOLoopBandwidth Adjusts gain of the PLL loop amplifier. Uses the 10 MHz internal reference.	A16 Reference	
ScarletFeldsparRxDataAlignment	A26 Wideband Digital IF	
DitherLevelAlgorithm 4 measurements	A3 Digital IF	
AifLCWidePrefilterPassbandTuningAlgorithm Adjusts the LC prefilter centering with the prefilter BW set to about 1.12 MHz. Uses 322.5 MHz Comb Calibrator on the A-IF.	A2 Analog IF	
AifLCWidePrefilterPassbandFineTuningAlgorithm	A2 Analog IF	
AifLCNarrowPrefilterPassbandTuningAlgorithm Adjusts the LC prefilter centering with the prefilter BW set to about 413 kHz. Uses 322.5 MHz Comb Calibrator on the A-IF.	A2 Analog IF	
AifLCNarrowPrefilterPassbandFineTuningAlgorithm	A2 Analog IF	
AifXtalWidePrefilterPassbandTuningAlgorithm Adjusts Centering, symmetry and dip of the crystal prefilter BW set to about 80 kHz. Uses 322.5 MHz Comb Calibrator on the A-IF.	A2 Analog IF	A3 Digital IF or A16 Reference
AifXtalNarrowPrefilterPassbandTuningAlgorithm Adjusts Centering, symmetry and dip of the crystal prefilter BW set to about 13 kHz. Uses 322.5 MHz Comb Calibrator on the A-IF.	A2 Analog IF	

Table 2-3 Alignment History Contents

Alignment	Most Probably Cause	Additional Information
AifVariableGainAlgorithm The Gain of the Analog IF System is measured and compared with the ideal gain value. Several conditions are tested, Dither on/ dither off, A-IF prefilter in and bypassed, alias filter set wide and narrow. Uses 322.5 MHz Comb Calibrator on the A-IF.	A2 Analog IF	
AifStepGainAlgorithm Measures the relative gain of the IF for high gain (10 dB) verses the low gain (0 dB) paths. In normal instrument operation these two states can be controlled by the user interface key called "Swept IF Gain". Uses the Comb calibrator on the A-IF.	A2 Analog IF	
LOPowerAlignmentAlgorithm Measure max LO power then backs off for each band.	A13 Front End A15 Front End Control	
LNAControlRouteAlignmentAlgorithm	A11 Dual Pre-Amp Module, LNA and EMC Band Switch	
AifVariableAttenuatorAlgorithm Measures the gain in all settings of the A-IF 1 dB step attenuator. A reference power is measured with atten 4 dB. The Comb calibrator on A-IF is used to provide a CW signal.	A2 Analog IF	
MechanicalAttenuatorAlgorithm Measures the attenuation of all DC coupled, and one AC coupled (10 dB) settings of the RF input attenuators. Reference atten setting is 10 dB.	A9 RF Attenuator A A10 RF Attenuator B	A16 Reference provides 50 MHz Calibrator signal
ElectricalAttenuatorAlgorithm Each setting from 0 to 24 dB in steps of 1 dB is measured. The reference condition is electrical attenuator set to 0 dB and RF input attenuators set to 10 dB. (Option EA3).	A13 Front End	A16 Reference provides 50 MHz calibrator Control signals from A15 Front End Controller
LONullingFullAlignmentAlgorithm Looks for optimum I and Q over large range.	A13 Front End	
LONullingMinAlignmentAlgorithm Looks for optimum I and Q over small range.	A13 Front End	
LONullingSimplexMBAAlignmentAlgorithm MB = medium bandwidth	A13 Front End	

Table 2-3 Alignment History Contents

Alignment	Most Probably Cause	Additional Information
NarrowbandStepCalAdjustmentAlignmentAlgorithm	Alignment signal originates on A3 D-IF, then goes through A16 Reference through the input attenuators, through A13 Front End, through A2 Analog IF, and back to A3 Digital IF.	
NarrowbandStepCalAlignmentAlgorithm	See above.	
DIF40StepCalAdjustmentAlignmentAlgorithm	Since this is wide band alignment for 40 MHz BW signal path, A2 Analog IF is not included in the signal path.	
DIF40StepCalAlignmentAlgorithm	See above.	
RFPreselMechanicalAttenuatorAlgorithm	A21 RF Presel Input	A16 Reference provides 50 MHz Calibrator signal
Dif40VariableAttenuatorAlgorithm	A3 Digital IF	
AifScarlettWBVariableAttenuatorAlgorithm	A26 Wideband Digital IF	
AifScarlettWBAlternateVariableAttenuatorAlgorithm	A26 Wideband Digital IF	
AifScarlettDirectVariableAttenuatorAlgorithm	A26 Wideband Digital IF	Presel 1 provides Calibrator Signal LPF
RFPresselectorDCOffsetAlignmentAlgorithm	A21 RF Presel Input	The alignment is to remove the DC voltage of Presel 1 direct path.
RFPresselectorDCOffsetDirectIfAlignmentAlgorithm	A21 RF Presel Input	The alignment is to remove the DC voltage of Presel 1 direct path.
ScarletWidebandIFAlignmentAlgorithm	A26 Wideband Digital IF	
ScarletDirectPathFlatnessAlignmentAlgorithm	A26 Wideband Digital IF	
ScarletDualWBdifPhaseAlignmentAlgorithm	A26 Wideband Digital IF	4800 MHz calibrator on A16 Reference
ECalPathSystemGainAlgorithm Measures the amplitude error of the low band signal path by injecting the 50 MHz E-Cal signal into the A13 Front End assembly. The E-Cal signal originates on the A16 Reference assembly.	Signal path from A13 Front End to A3 Digital IF	A16 Reference may not be providing 50 MHz E-Cal

Table 2-3 Alignment History Contents

Alignment	Most Probably Cause	Additional Information
LowBandNominalPathSystemGainAlgorithm Aligns low band (3 Hz to 3.6 GHz path) with preamp and electronic attenuator OFF. Dependent on successful E-Cal alignment. Input attenuators set to 10 dB and DC coupled.	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators.
LowBandLowNoisePreampPathSystemGainAlgorithm	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators.
LowBandPreampPathSystemGainAlgorithm Aligns low band (3 Hz to 3.6 GHz path) with preamp ON. Input attenuator set to 20 dB. (Options P03, P08, P26, P44).	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators.
LowBandElecAttenPathSystemGainAlgorithm Aligns low band with electronic attenuator in the signal path and set to 0 dB. (Option EA3)	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators.
PreselectorTwoPointTuningAlgorithm Aligns the YTF preselector centering near the maximum and minimum frequency points of the YTF. Uses the high band preamp noise as stimulus signal.	A12 YTF Preselector A15 Front End Control or All Low Band	A13 Front End
HighBandNominalPathSystemGainAlgorithm	Anything in high band path	4800 MHz calibrator on A16 Reference
RFPreselHighBandPreampPathSystemGainAlgorithm	A11 Dual Pre-Amp Module, LNA and EMC Band Switch	Controlled by A15 Front End Control. This is purely HB preamp and should be the same as HBNominal (4800 MHz calibrator on A16 Reference).
HighBandLowNoisePreampPathSystemGainAlgorithm	A11 Dual Pre-Amp Module, LNA and EMC Band Switch	This is purely HB preamp and should be the same as HBNominal (4800 MHz calibrator on A16 Reference).
RFPreselLowBandNominalPathSystemGainAlgorithm	A11 Dual Pre-Amp Module, LNA and EMC Band Switch	This is purely LBNominal and should be the same as LBNominal (50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators.

Table 2-3 Alignment History Contents

Alignment	Most Probably Cause	Additional Information
RFPreselLowBandLowNoisePreampPathSystemGainAlgorithm	A11 Dual Pre-Amp Module, LNA and EMC Band Switch	This is purely LB LNA and should be the same as LB LNA (50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators
BurstCarrierTriggerCurveFitAlignmentAlgorithm Detects the level of the signal envelope before filtering at the 22.5 MHz IF, and compares that detected level against the trigger threshold DC level.	A2 Analog IF	
DIF25PulseStretcherAlignmentAlgorithm	A3 Digital IF	
DIF40PulseStretcherAlignmentAlgorithm Adjusts time between trigger and clock signal.	A3 Digital IF	
ConductedAmplitudeAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.
ConductedPreampAmplitudeAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.
ConductedAmplitudeDirectPathAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.
ConductedPreampAmplitudeDirectPathAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.
RadiatedAmplitudeAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.
RadiatedPreampAmplitudeAlgorithmRev4	A21 RF Presel Input	Presel 1 provides Calibrator Signal.

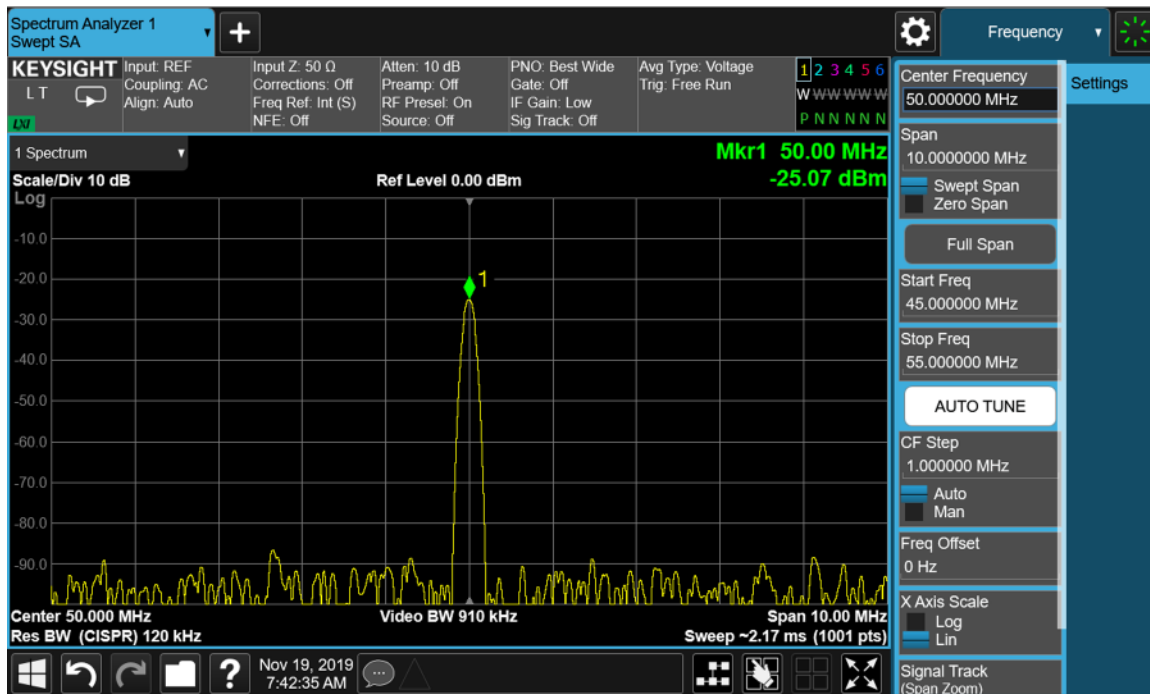
Signal Level Verification

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



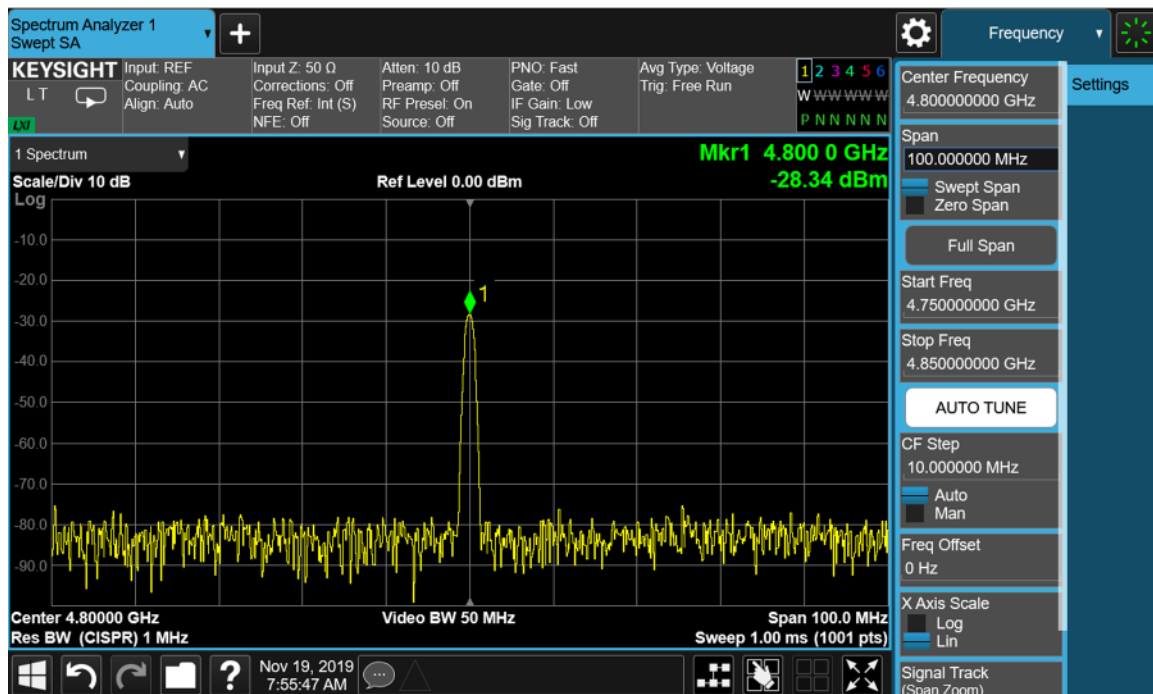
6. If the signal level is not correct refer to [Chapter 5, “RF Preselector Section.”](#) [Chapter 6, “RF Downconverter Section.”](#) and [Chapter 15, “Block Diagrams.”](#) for further troubleshooting information.

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, Signal Path, Presel Center**.
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.

Boot Up and Initialization
Potential Problems During Boot Process

3 Instrument Messages

Introduction

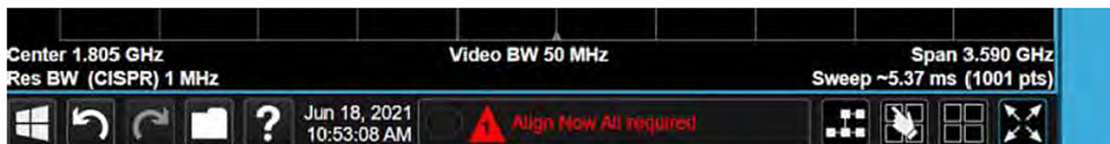
The Error and Status messaging system of the instrument reports events and conditions in a consistent fashion, as well as logging and reporting event history.

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**.
- 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.

Event and Condition messages appear in the Status Panel at the bottom 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.)

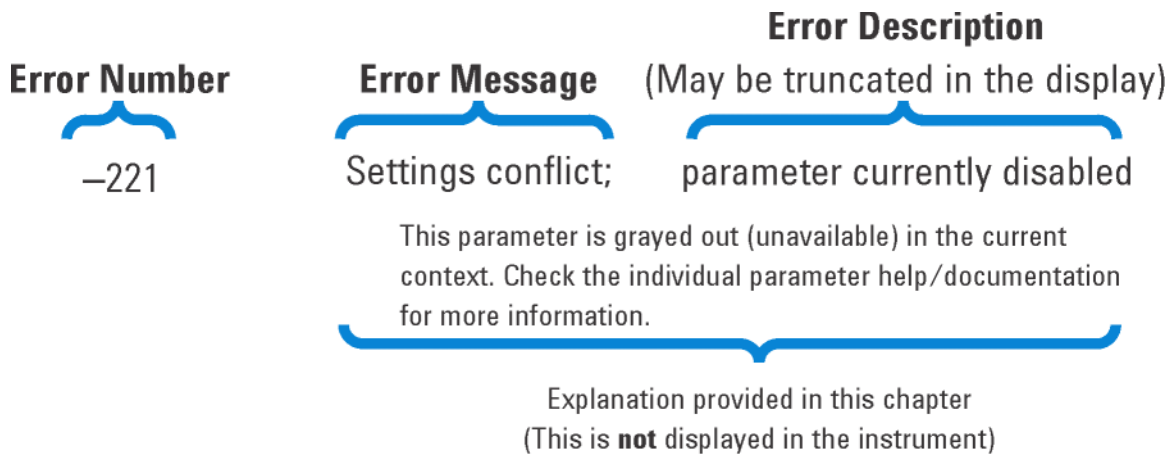
A forced grayout function cannot be changed either from the front panel or remotely. It generates a special type of Advisory message. It also only appears on the front panel when the key is pressed. Remotely, the message will appear in the event queue as a warning “-221, Settings conflict; <conflict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



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.

Instrument Messages
Event Messages

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 than 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;Administrat or 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.

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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.

-200 to -299, Execution Errors

This section lists all messages in the range *except* -221 error messages. For details of -221 messages, see “**-221 Settings Conflict Errors**” on page 82.

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 "-221 Settings Conflict Errors" on page 82 .
-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 than 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.

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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.

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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.

Instrument Messages
Event Messages

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 **“Condition Errors 36 to 64, Calibration Needed or Failed” on page 109.**

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 **“Condition Errors 36 to 64, Calibration Needed or Failed” on page 109.**

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 **“Condition Errors 36 to 64, Calibration Needed or Failed” on page 109**.

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		

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 **“Condition Errors 601 to 699, Error Summaries” on page 126**.

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 PXE 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.

Instrument Messages
Condition Messages

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 <i>Bluetooth</i> , 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 **:SYSTEM: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.

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. <i>Bluetooth</i>: The burst that has been found does not correspond to the currently selected <i>Bluetooth</i> 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.

Instrument Messages
Condition Messages

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 <i>Bluetooth</i> , 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.

Instrument Messages
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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. Preamplifier: 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).

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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 **“Condition Errors 601 to 699, Error Summaries” on page 126.**

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 **“Condition Errors 601 to 699, Error Summaries” on page 126**.

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	2 nd 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	

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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		

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 **“Condition Errors 601 to 699, Error Summaries” on page 126.**

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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Condition Messages

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:

[Input Selection & Level Control Section on page 132](#)

[Input Selection & Level Control Section Troubleshooting on page 137](#)

[A9 Attenuator A on page 137](#)

[A10 Attenuator B on page 146](#)

[A23 Limiter Pre-Filter Board on page 150](#)

[A11 Dual Pre-Amp Module, LNA, and EMC Band Switch on page 155](#)

Input Selection & Level Control Section

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 or the preselector for signals less than 3.6 GHz. There are also two input attenuators, an LNA and Preamplifier 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 using the PXE RF2 Input.

Input Selection & Level Control Assembly Descriptions

NOTE

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

A9 Input Attenuator A

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 1 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 1 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 N9048B. 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.

A11 Dual Pre-Amp Module, Low Noise Amplifier (LNA), & EMC Band Switch

Provides RF-uW input switching (DC up to 50 GHz).

There is no low band limiter in this module, and it is able to pass EMC CISPR pulses with amplitudes up to +/-60 Volts.

Provides a bypass-able (solid-state bypass) microwave preamp and provides necessary ESD/Overpower protection.

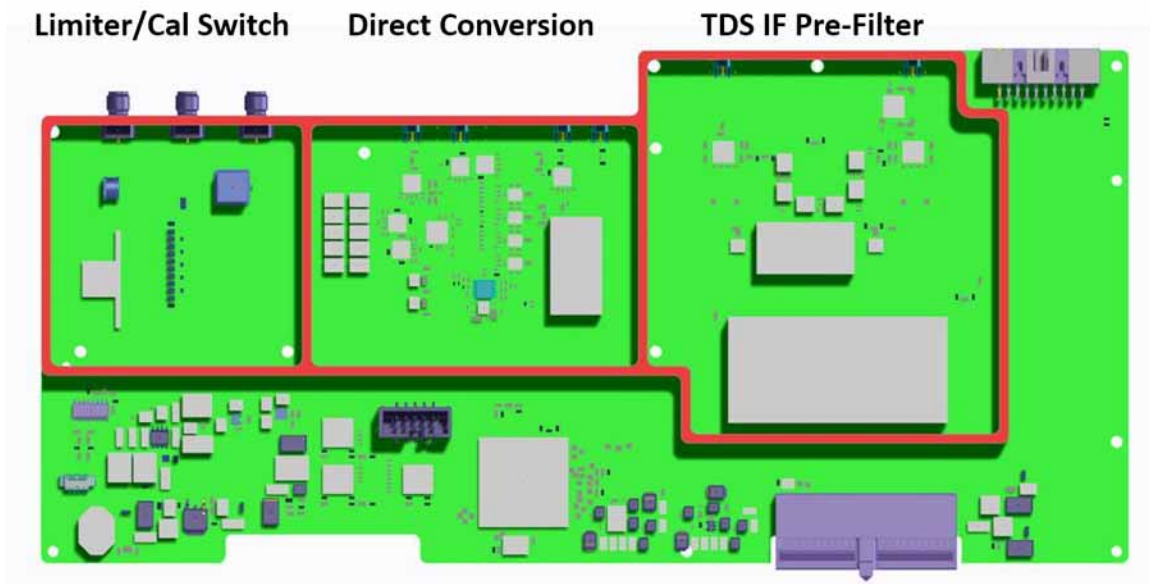
The preamp provides sufficient output excess-noise-ratio (ENR) that it can be used for YTF peaking and/or alignment.

Includes a new Low Noise Amplifier (LNA) path for competitive DANL. The LNA path is switched in/out with an Electro-Mechanical Transfer switch (4-port switch) placed after Attenuator B.

A23 Limiter and Pre-Filter Board (LPF)

This assembly is actually a combination of multiple assemblies:

Figure 4-1 LPF Board Sections

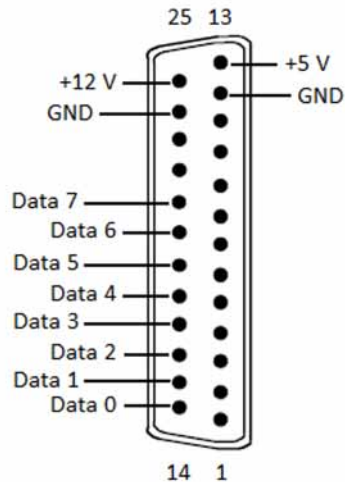


- **Limiter** - used to protect the rest of the instrument from large transient signals that are often produced by Line Impedance Stabilization Networks (LISN) which are used for making conducted emissions measurements.
- **Cal switch** - The new LPF board also contains the Cal switch internally.
- **Direct conversion filter path** - contained in here for wideband TDS capture. Only for use with WBDIF/TDS measurement capability.
- **TDS IF prefilter path** - used for TDS IF pre-filtering. Only for use with WBDIF/TDS measurement capability.

- **LISN control** - This section is an eight bit parallel control bus, as well as two DC voltage supplies. The output (J10) is connected to the AUX I/O port on the instrument rear panel by ribbon cable. The instrument user has control of an external LISN from the EMI Receiver mode under Meas Setup, Advanced menu.

Below is the Pin Out of the rear panel Aux I/O connector.

Figure 4-2 Rear Panel AUX I/O Pinout



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 Pre-filter Board (LPF)
- A11 Dual Pre-Amp, LNA, & EMC Band Switch

A9 Attenuator A

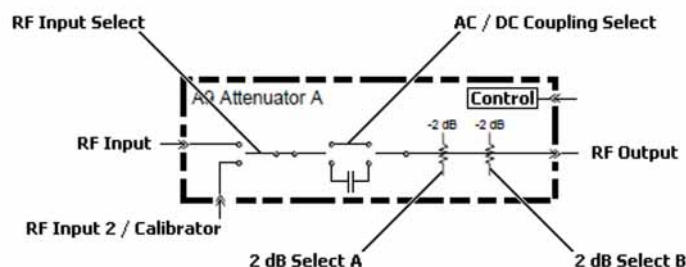
There are two different A9 Attenuator A assemblies used in the N9048B; one for the Option 503, 508, and 526 instruments and one for the Option 544 instruments. While the overall amount of attenuation is the same for all instruments, the distribution of the attenuator sections within the attenuators is 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 4-3**. 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 4-3 A9 Attenuator A Functions - Option 503, 508, & 526

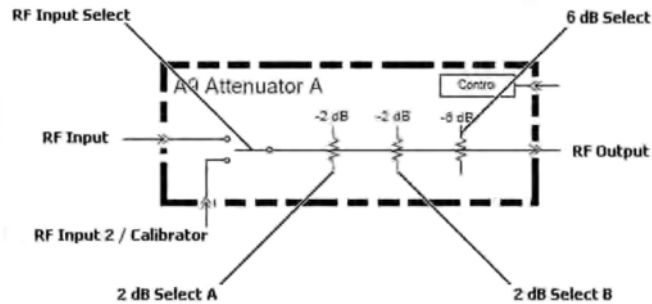


Option 544

There are two different functions that the A9 Attenuator A assembly provides, as shown in **Figure 4-4**. 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 4-4 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 4-5](#) or [Figure 4-6](#), remove the RF Input W25 and RF Output W28 cables from Attenuator A9 (Attenuator A).

Figure 4-5 Attenuator A9 Cable Identification - Option 503, 508, and 526

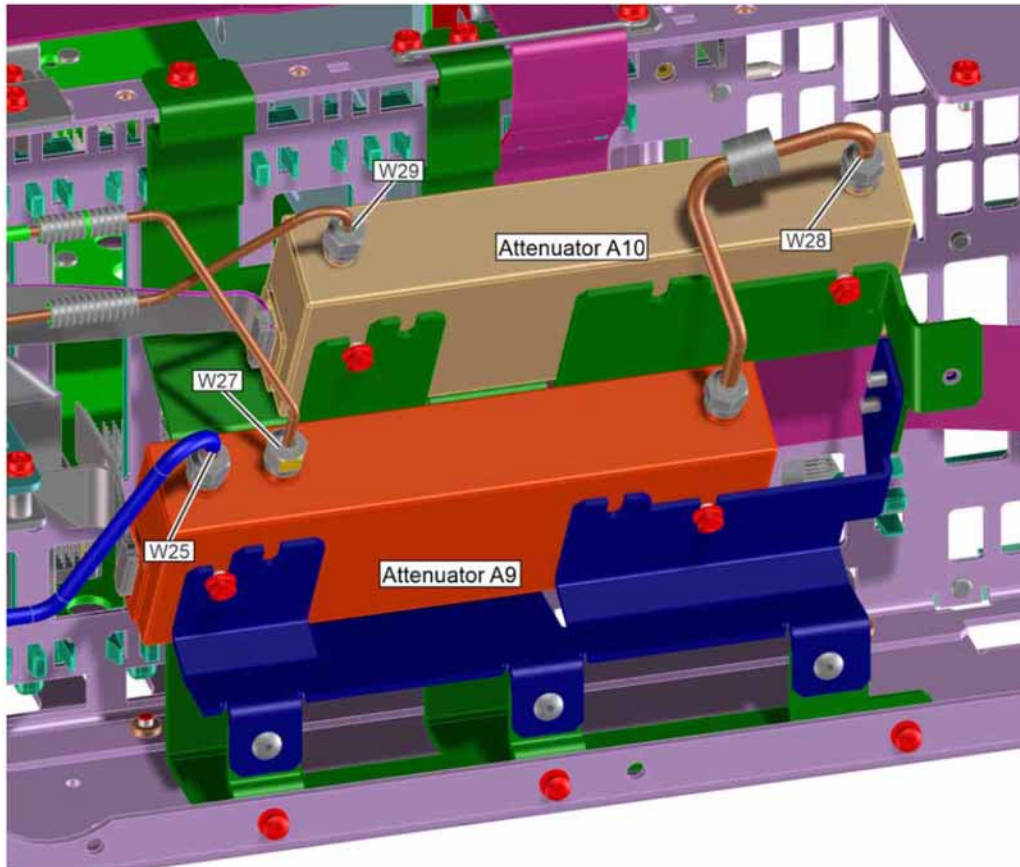
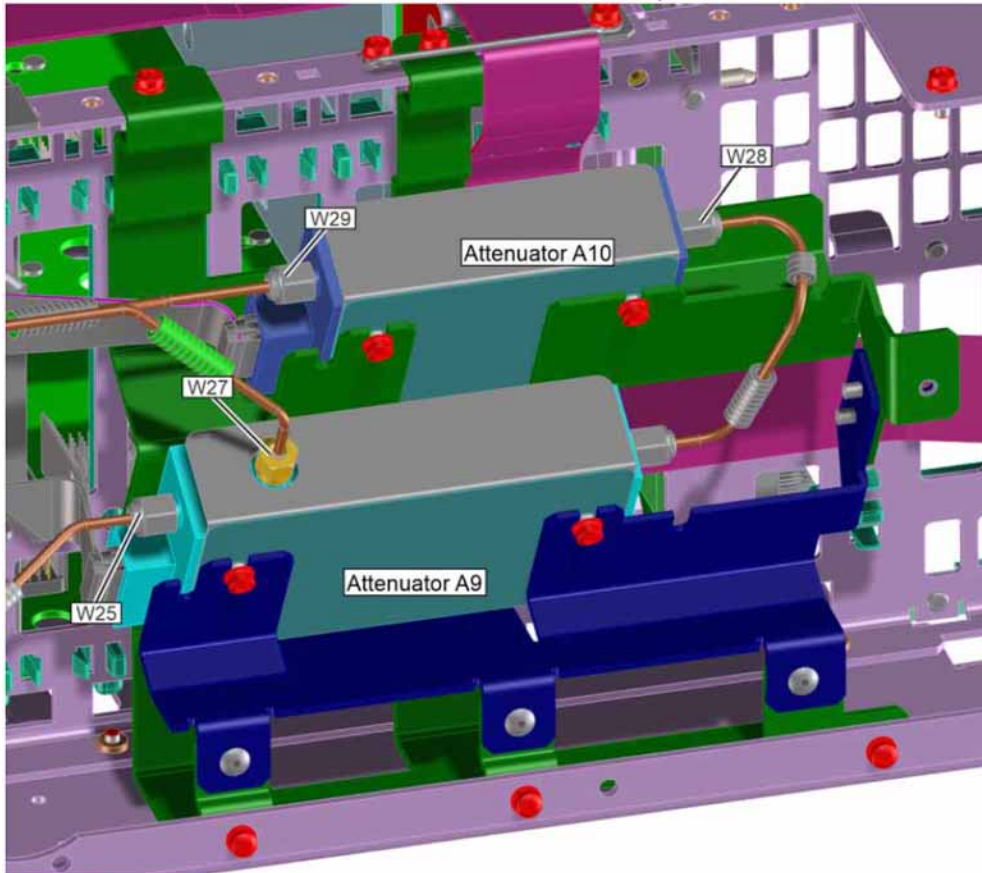


Figure 4-6 Attenuator A9 and A10 Cable Identification - Option 544



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**.

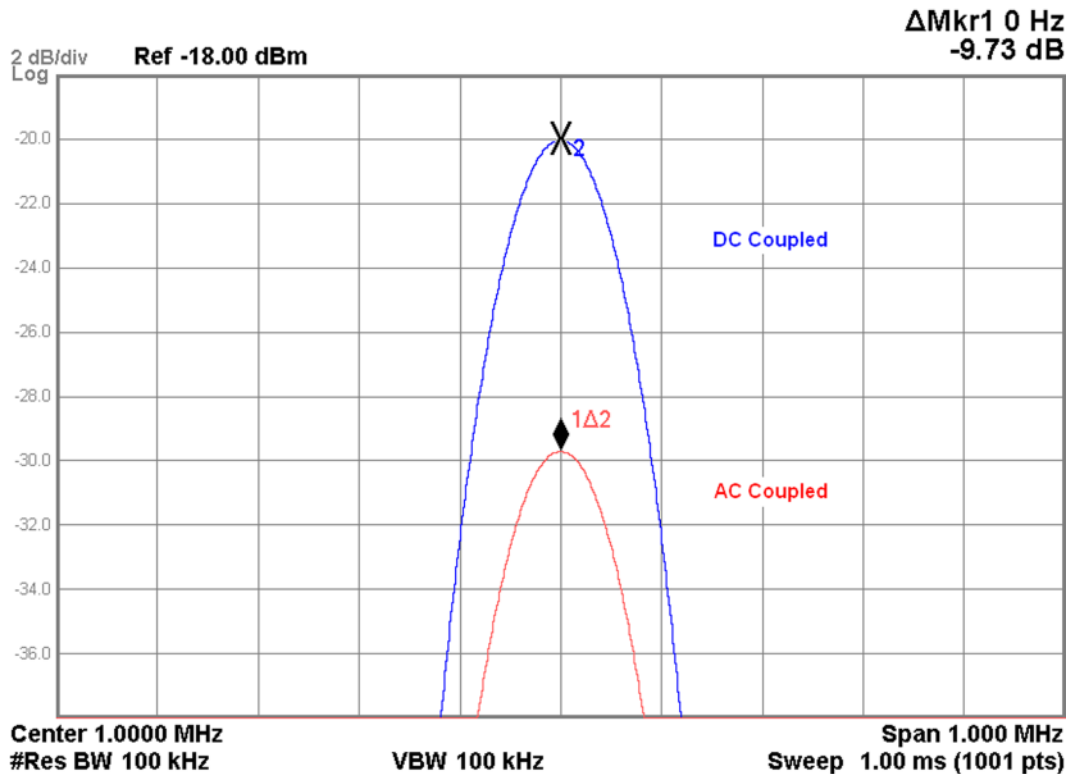
AC / DC Coupling Selection - Option 503, 508, and 526 only

5. If the instrument has Option 544 skip to **step 16**.
6. Tune the instrument to a span of 0 Hz by pressing **FREQ Channel, SPAN, Zero Span**.
7. Connect a signal generator to the A9 Attenuator A RF Input (W25). Refer to **Figure 4-5**.
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 (W28). Refer to **Figure 4-5**.
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 4-7**, 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 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 4-7**.

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. Refer to [Figure 4-5](#) or [Figure 4-6](#).
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.

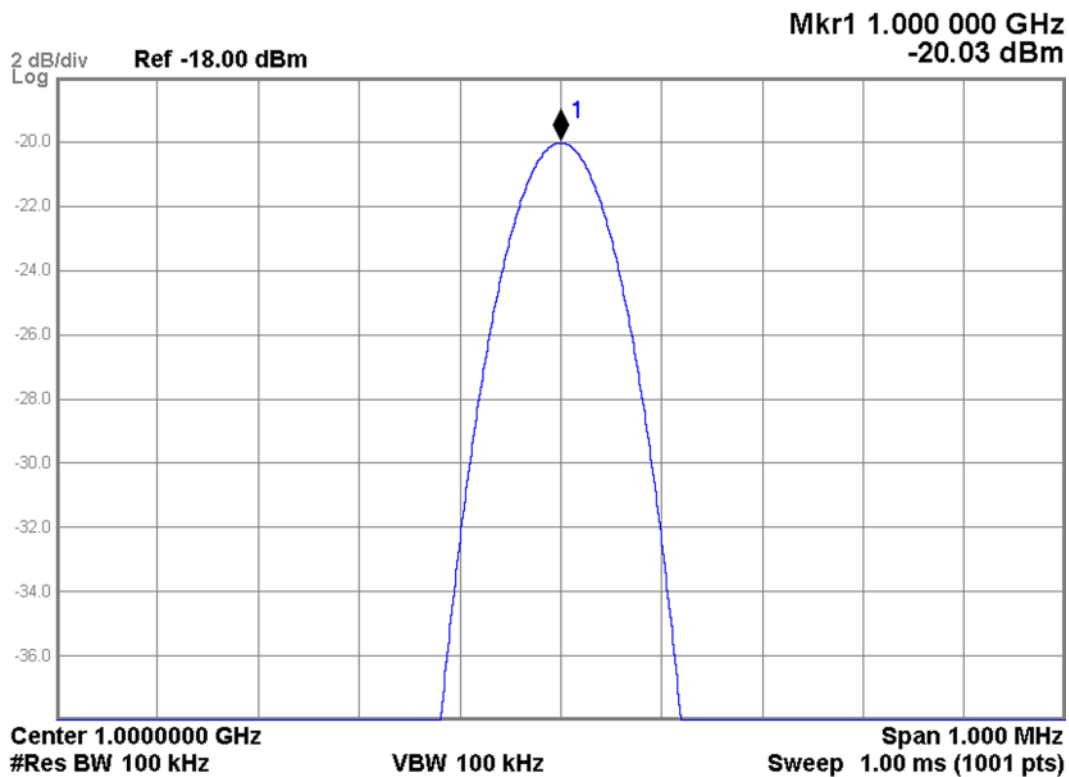
NOTE

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 4-8](#), 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 4-8 A9 Attenuator A RF Input



Attenuation Selection

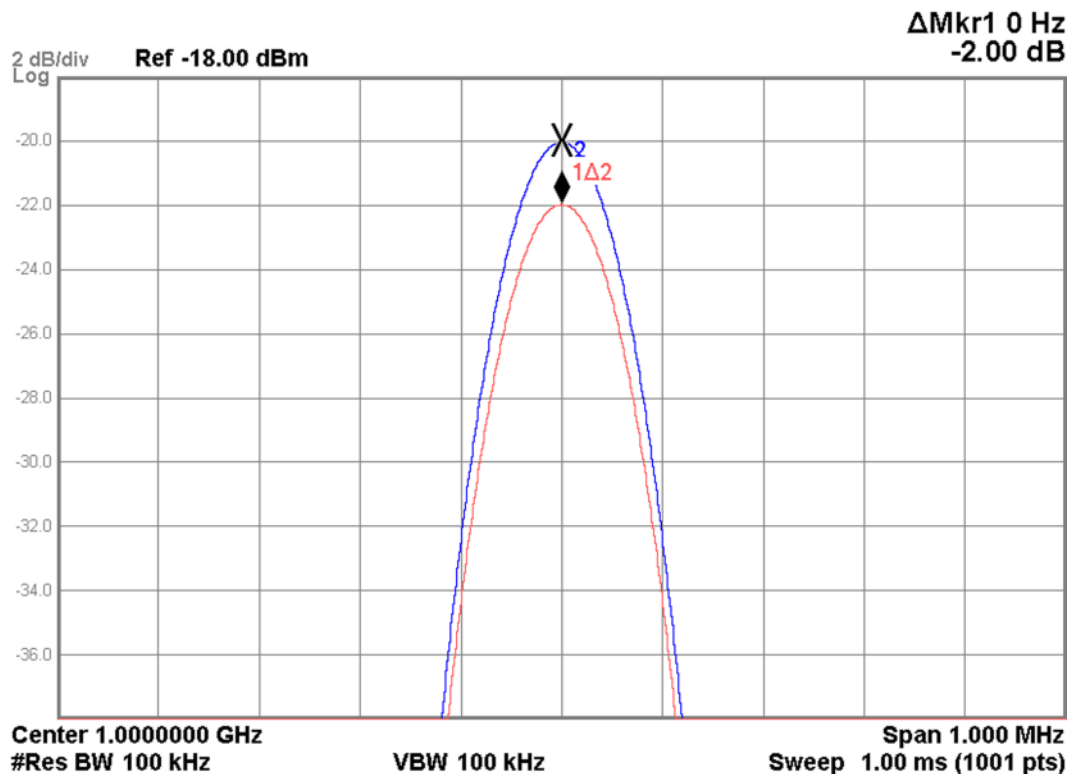
20. Turn on the Marker Delta function of the spectrum analyzer being used.

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 4-9**.

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 –2 dB

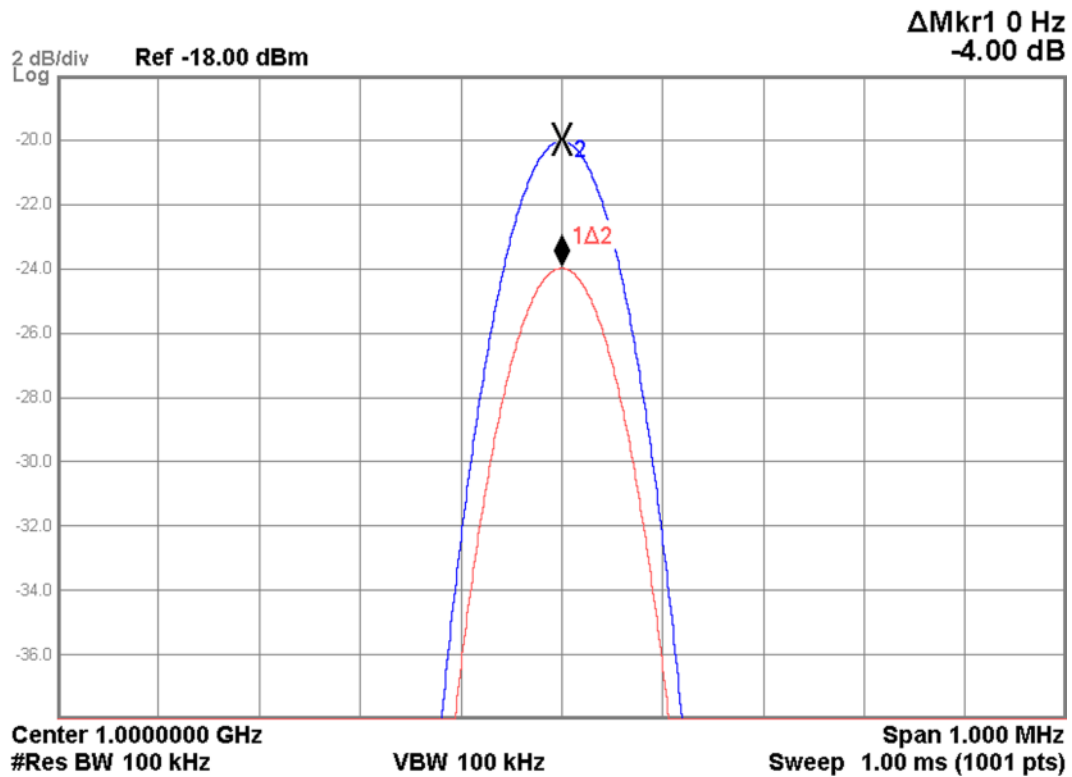


23. Change the A9 Attenuator A setting to 4 dB by pressing **AMPTD**, **Attenuation**, **Mech Atten**, **4 dB**.

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

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.

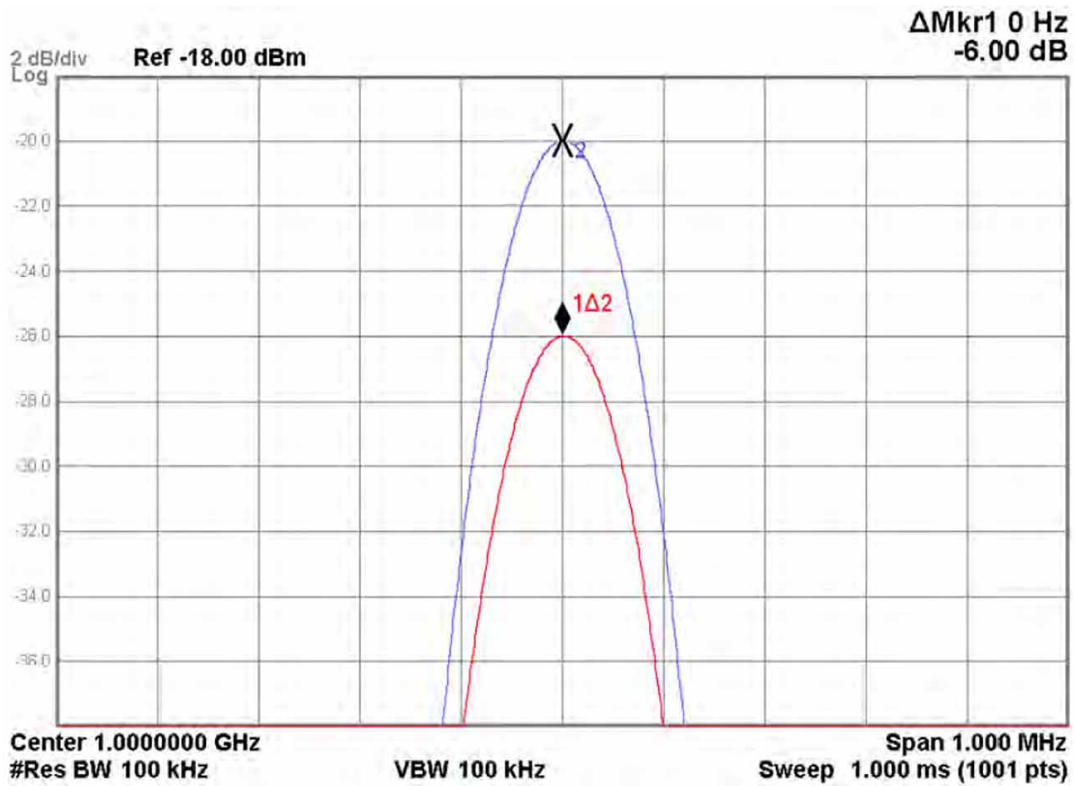
Figure 4-10 A9 Attenuator A –4 dB



- 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 4-11**.

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 4-11 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 the three semi-rigid cables to the A9 Attenuator A as shown in [Figure 4-5](#). Torque all cable connections to 10 in-lbs.

A10 Attenuator B

There are two different A10 Attenuator B assemblies used in the N9048B; 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 4-12](#) and [Figure 4-13](#). This functionality will be verified with the procedure in this section.

Figure 4-12 A10 Attenuator B - Option 503, 508, and 526

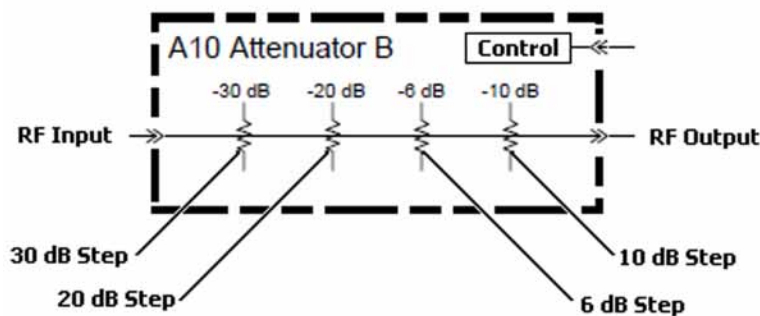
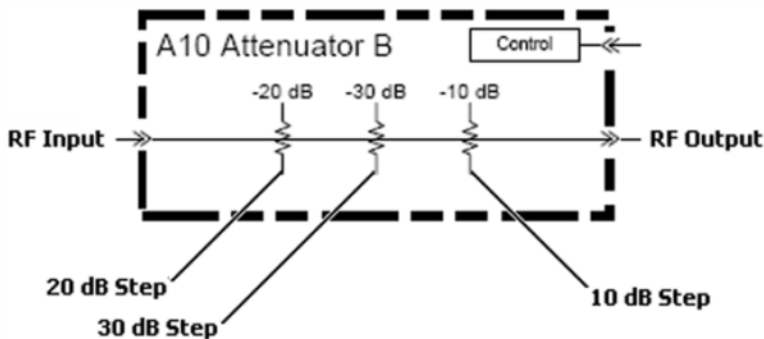


Figure 4-13 A10 Attenuator B - Option 544



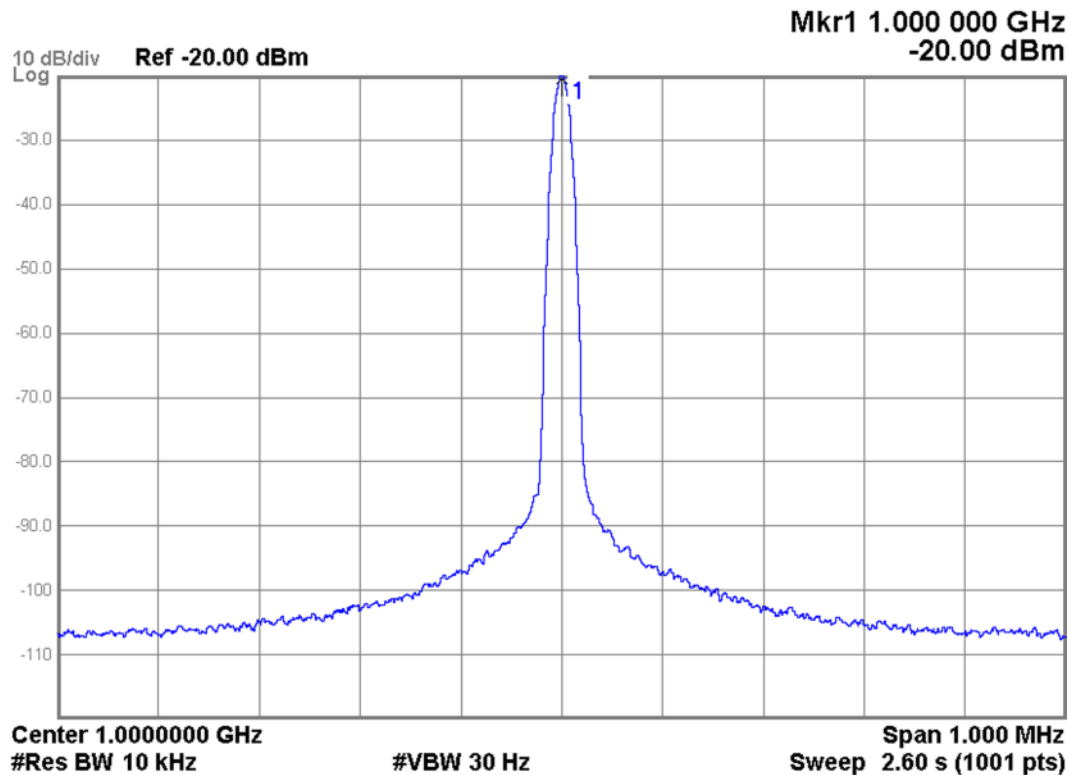
Verifying the A10 Attenuator B Functionality

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 4-5](#) and [Figure 4-6](#), remove the RF Input and RF Output cables 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 4-5](#) or [Figure 4-6](#).
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 4-5](#) or [Figure 4-6](#).
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 4-14](#), 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 4-14 A10 Attenuator B -0 dB



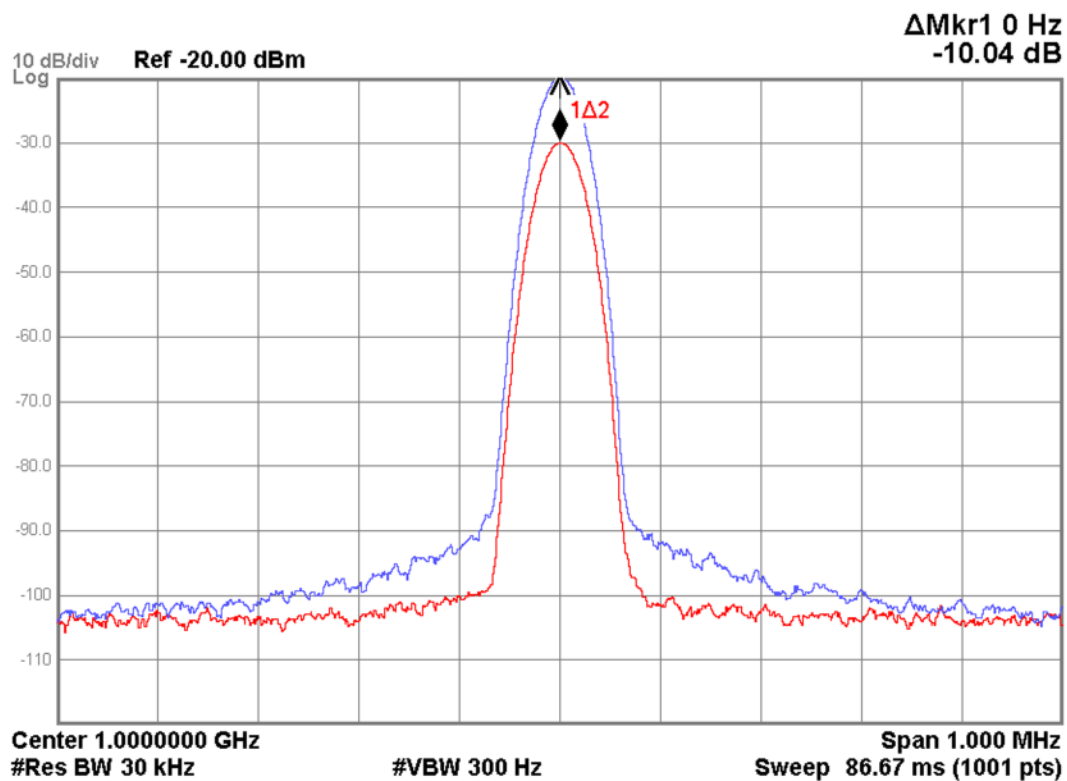
12. Turn on the Marker Delta function of the spectrum analyzer being used.

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 4-15**.

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 4-15 A10 Attenuator B –10 dB



15. Repeat **step 13** and **step 14** with the rest of the attenuation setting found in **Table 4-1**.

Table 4-1 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 4-5**. Torque all cable connections to 10 in-lbs.

A23 Limiter Pre-Filter Board

Figure 4-16 Limiter Pre-Filter Board Schematic

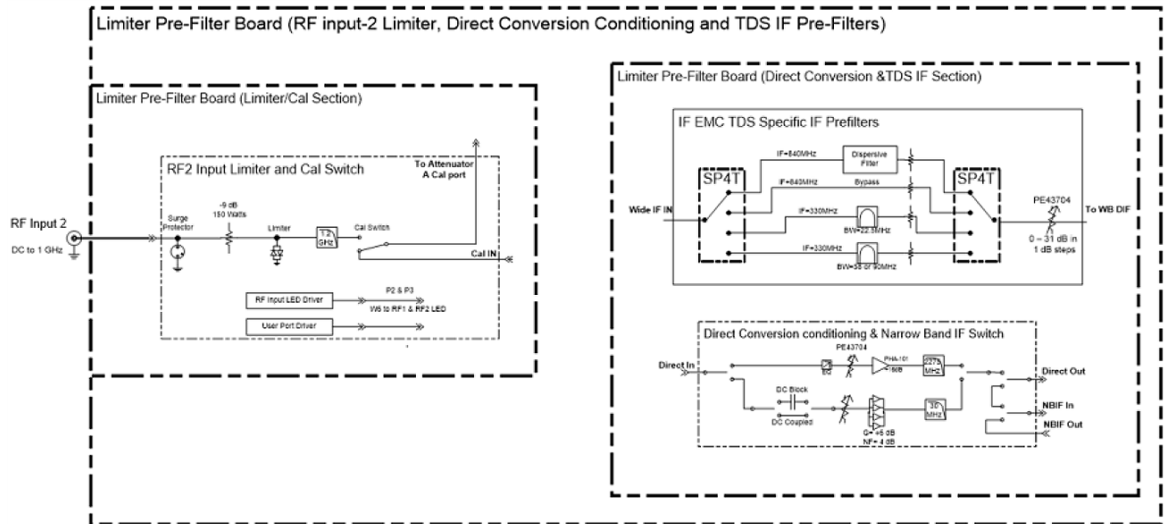
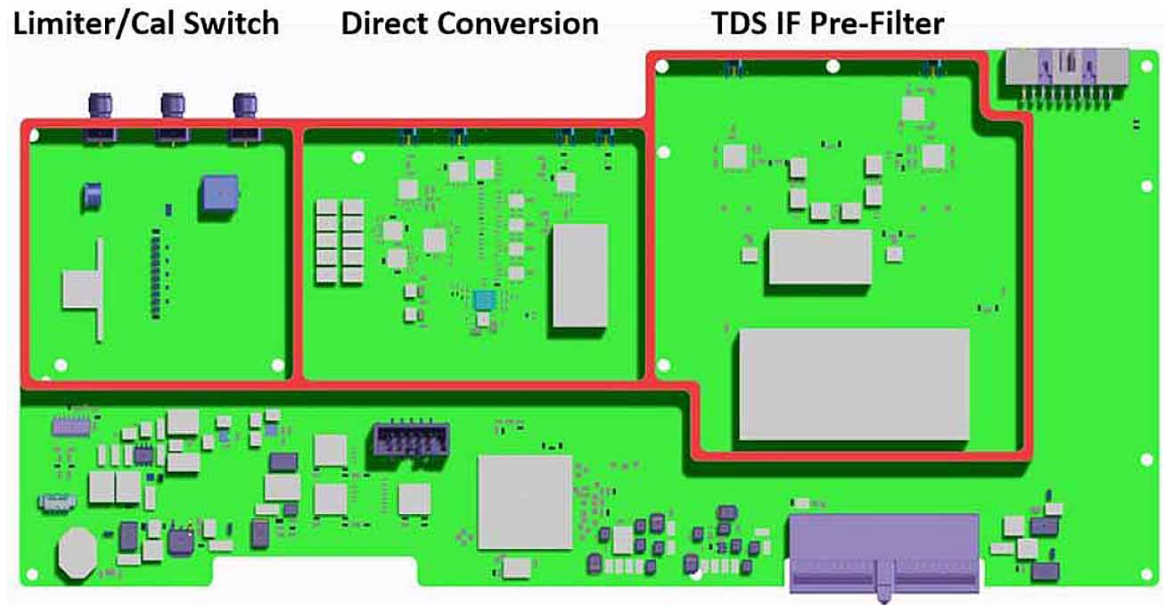


Figure 4-17 LPF Board Sections



There are 4 main sections of this board:

- Limiter/Cal switch
- Direct Conversion Path
- IF Pre-filter
- LISN Control

Only the Limiter/Cal Switch section of the LPF board is tested in this section.

Section 1, the limiter is slightly enhanced with different spec components, but the overall spec is the same and it also contains a Cal switch allowing the removal of the external cal switch.

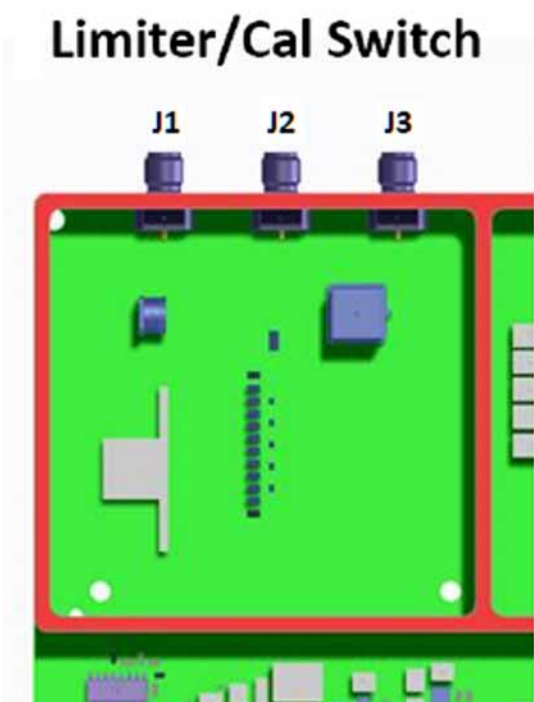
Section 2 and 3 are only for use with the WBDIF / TDS Measurement capability.

Section 4 is General Purpose I/O Control.

Table 4-2 LPF Board Connectivity

Port	Connector	Description
RF Input	J1	RF Input 2 (IN)
Cal Input	J2	Cal Signal (IN)
RF Output	J3	RF Output

Figure 4-18 A23 Limiter Pre-Filter Board Connectivity



Calibration Switch on LPF Board

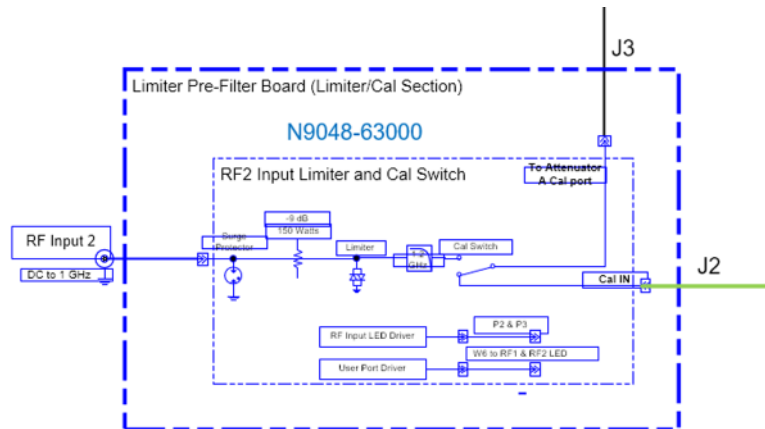
NOTE

The Calibration Path Switch comes with the Limiter Pre-filter (LPF) assembly.

The 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

Calibration Switch in LPF Board



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. Refer to **Chapter 18, "Assembly Replacement Procedures."** for instructions on removing the front frame assembly.
3. Referring to **Figure 4-20**, disconnect the RF cables connected to the Calibration Switch at J2.

Figure 4-20 Cal Switch Connections Limiter Pre-Filter Board

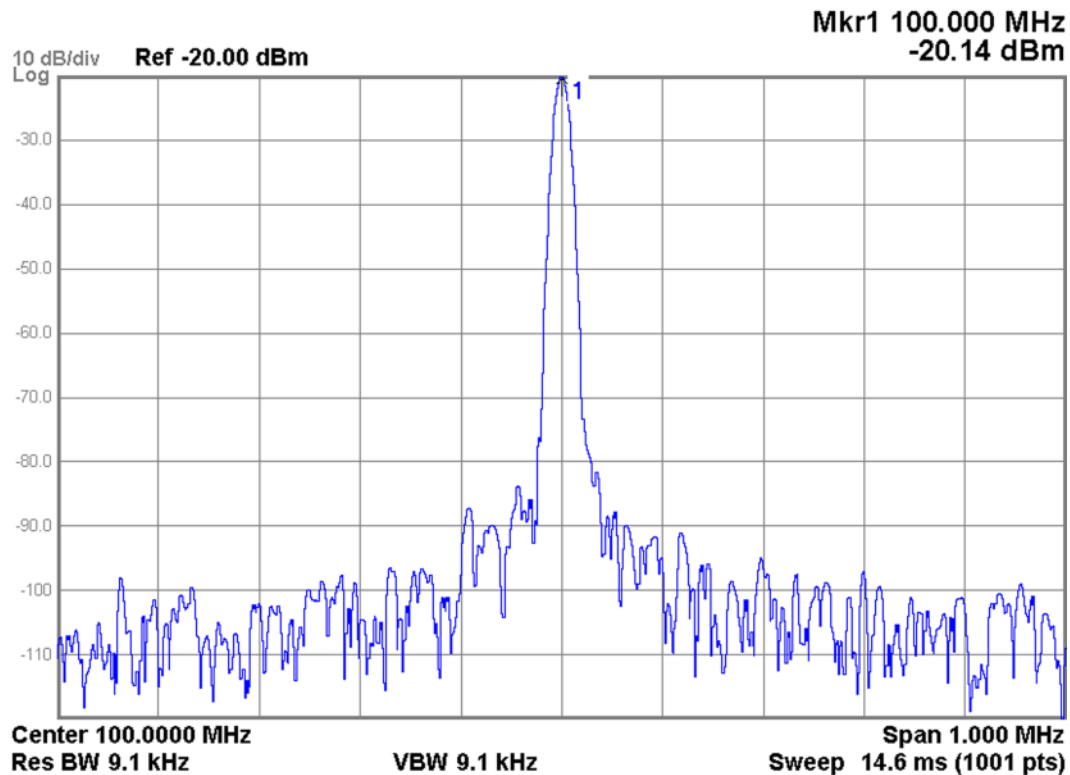


4. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.
5. Turn the instrument self-alignment routine off by pressing **System, Alignments, Auto Align, Off**.
6. Connect a signal generator to the LPF board Cal Switch RF Input (J2) as shown in **Figure 4-20**.
7. Tune the signal generator to 100 MHz with an amplitude of -20 dBm.
8. Connect a spectrum analyzer to the LPF board RF Output (J3) as shown in **Figure 4-20**.
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 LPF Board Calibration Switch Signal Level



10. Switch the instrument to use the 50 MHz calibrator signal, which will connect the Cal Switch Calibrator Input (J2) to the Output (J3), by pressing **Input / Output, RF Calibrator, 50 MHz**.
11. Verify that the signal level on the spectrum analyzer is at -20 dBm (± 0.25 dB), as shown in **Figure 4-21**, allowing for any additional test cable loss.

If the signal level is incorrect the most likely cause of the problem is the Cal Switch on the LPF board. This assembly will have to be replaced.

12. If no problem has been found with the functionality of the Cal Switch carefully reconnect the RF cables to the Cal Switch as shown in **Figure 4-20**. Torque all cable connections to 10 in-lbs.

A11 Dual Pre-Amp Module, LNA, and EMC Band Switch

This section will validate the path switching and functions of the LNA and Pre-Amplifier module paths. This will be a basic functional check of the path selection for both paths of the preamp low band with Preselector On and Off and Pre-amp High Band, then the main LNA which can be used across the whole frequency range as per the block diagram segment and connectivity diagram shown below.

Figure 4-22 Connectivity Diagram

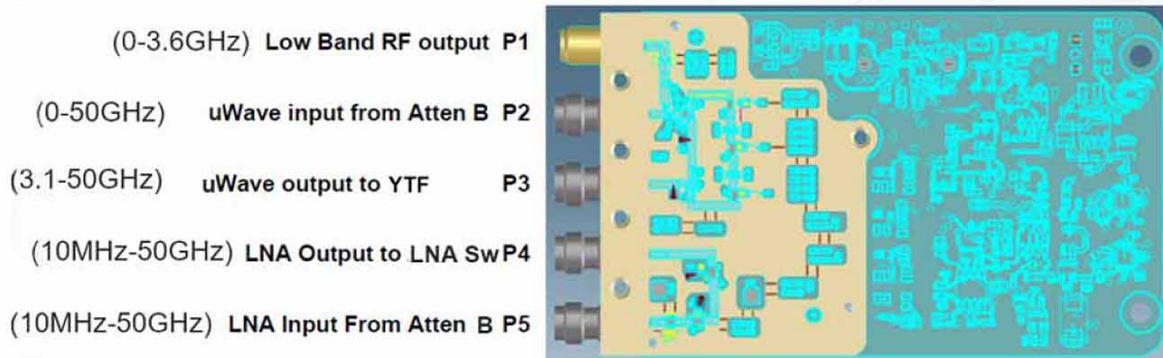
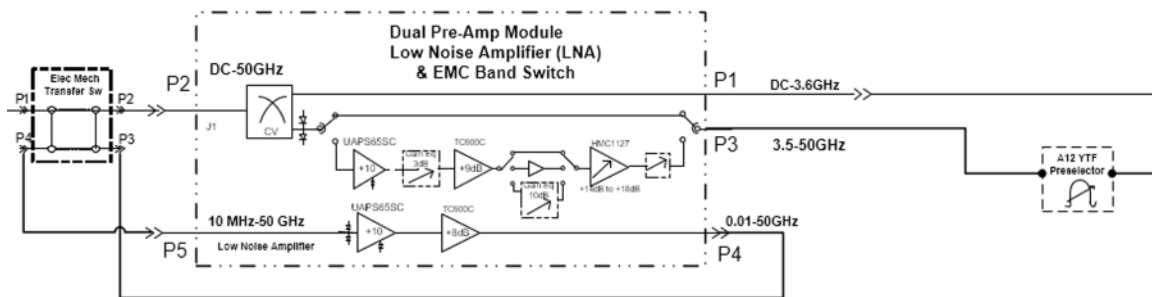


Figure 4-23 Block Diagram



There are four main paths in this module:

- Preamp ON
- LNA- Low Gain Setting
- LNA - High Gain Setting
- YTF Alignment Setting - this tests the P2 to P3 Bypass Path (switch)

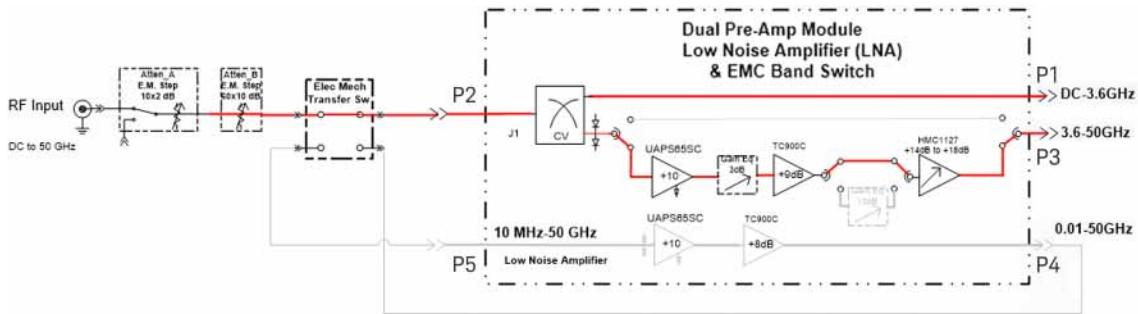
Pre-Amp On Setting

PA = Standard

Band 0, 100 kHz to 3.6 GHz: Use Front End Assembly Preamp

Band 1 and up: Use Standard Legacy Path of the Dual Pre-Amp module

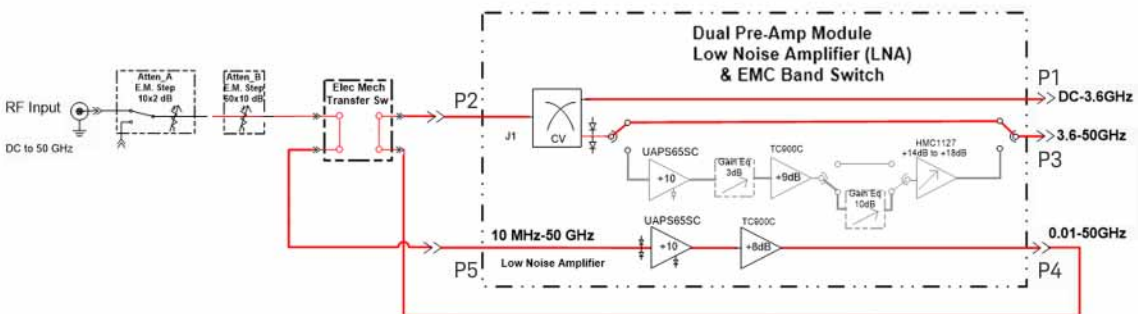
Figure 4-24 Pre-Amp On Setting



LNA - Low Gain Setting

Band 0 and up: Use LNA ONLY (turn off Microwave Front End in Band 0)

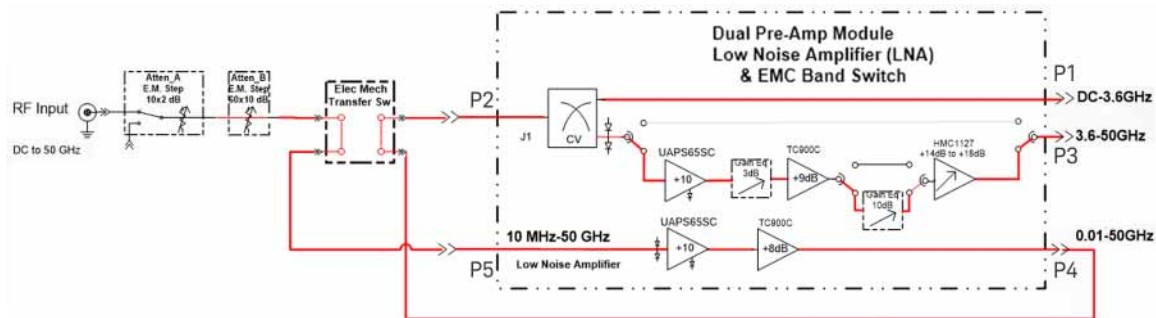
Figure 4-25 LNA - Low Gain Setting



LNA - High Gain Setting (both LNA and PA on)

Band 0: Use LNA ONLY (turn off Front End Assembly Preamplifier in Band 0)
 Band 1 and up: Use both LNA and Legacy Power Amplifier but switch in 10 dB Gain equalizer

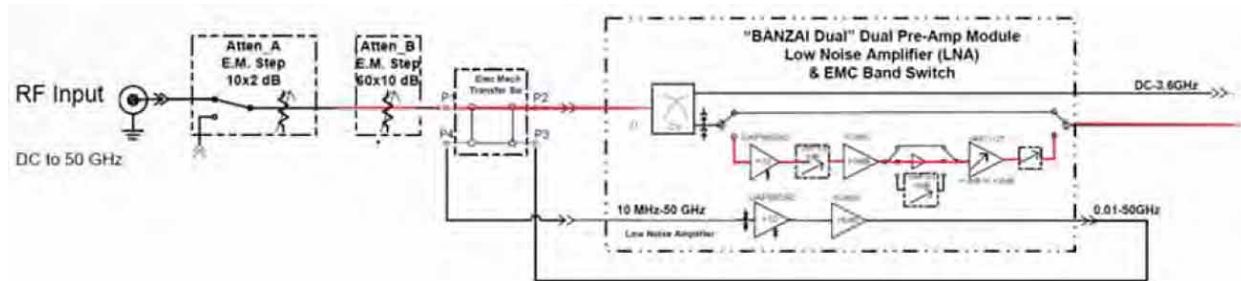
Figure 4-26 LNA - High Gain Setting



YTF Alignment Setting

Attenuator set to Calibration (Max isolation to input)
 Attenuators A & B both set to maximum attenuation value
 Dual Pre-Amp module input switch set to Isolation setting
 Amplifiers set to Excess Noise Ratio (ENR) setting
 LNA amplifier is not used during the YTF Alignment

Figure 4-27 YTF Alignment Setting



LNA and Preamp Path Switching and Function Check

The basic interconnectivity and function of the Preamp and LNA switching can be checked using the internal 50 MHz and 4.8 GHz calibrator signals.

50 MHz Calibrator

1. Access the Spectrum Analyzer mode and select **Mode Preset**. Set the **Center Frequency** to 57.8 MHz. Set the **Span** to 40 MHz. Set the **RF Presel** to **Off**. This will allow menu settings to be toggled on and off and make it possible to view the noise floor and the actual calibrator signal at the same time.
2. Press **Input/Output, RF Calibrator, 50 MHz**. This will set the Internal Calibration Cal signal to ON and allow the instrument to use the 50 MHz calibrator signal.
3. Refer to [Figure 4-28](#). Verify that the noise floor level is at approximately -95 to -100 dBm. Use the marker to ensure that the 50 MHz calibrator signal is at approximately -25 dBm.

Figure 4-28 50 MHz Calibration Signal, Preamp Off

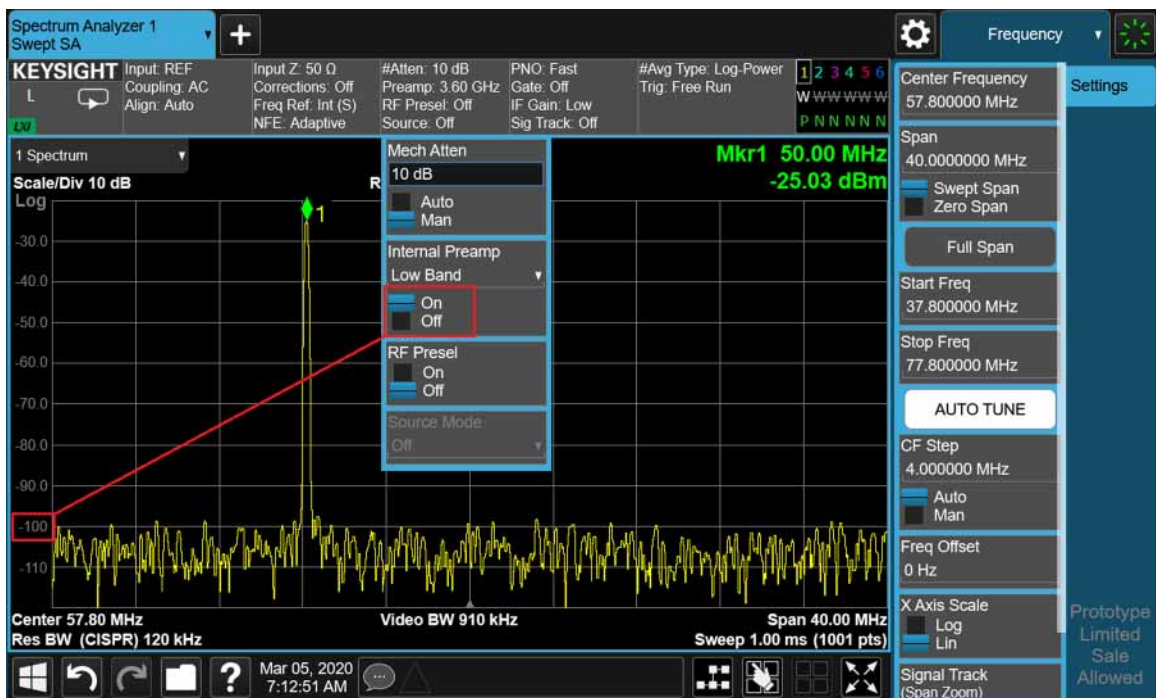


4. Refer to **Figure 4-29**. Switch the **Internal Preamp (Low Band)** to **ON** with the Mechanical Attenuator set to 10 dB and confirm that the noise floor lowers by approximately 10 dB.

IMPORTANT

This check verifies the switch path and connectivity in the Dual Pre-Amp Module, LNA, and EMC Band Switch as well as the Preamplifier in Band 0 (located on the Front End assembly). It also checks the RF Preselector assemblies when RF Preselector = ON.

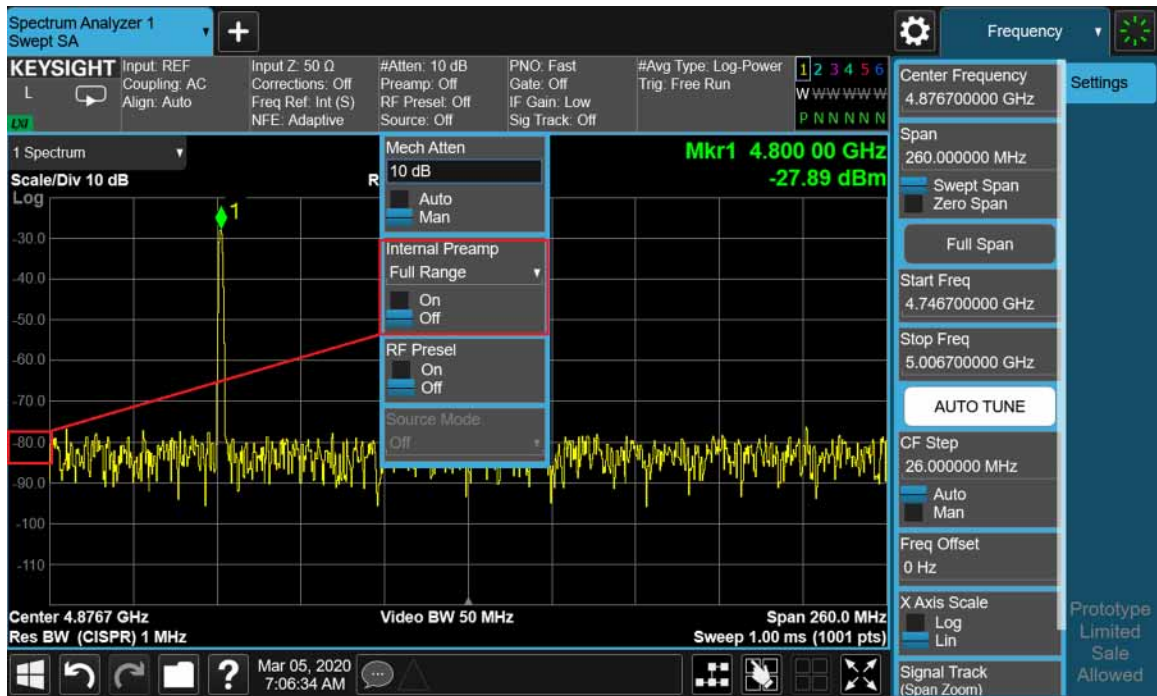
Figure 4-29 50 MHz Calibration Signal, Preamp On



4.8 GHz Calibrator

5. The interconnectivity and function for the Preamp and LNA switching can be checked using the internal 4.8 GHz calibrator signal to confirm the high band functionality. Access the Spectrum Analyzer mode and select **Mode Preset**. Set the **Center Frequency** to 4.87 GHz. Set the **Span** to 260 MHz. This will allow menu settings to be toggled on and off and make it possible to view the noise floor and the actual calibrator signal at the same time.
6. Press **Input/Output, RF Calibrator, 4.8 GHz**. This will set the Internal Calibration Cal signal to ON and allow the instrument to use the 4.8 GHz calibrator signal.
7. Refer to **Figure 4-30**. Verify that the noise floor level is at approximately -80 to -90 dBm. Use the marker to ensure that the 4.8 GHz calibrator signal is at approximately -28 dBm.

Figure 4-30 4.8 GHz Calibration Signal, Preamp Off



8. Refer to **Figure 4-31**. Switch the **Internal Preamp (Full Range)** to **ON** with the Mechanical Attenuator set to 10 dB and confirm that the noise floor lowers by approximately 10 dB.

Figure 4-31 4.8 GHz Calibration Signal, Preamp On



LNA and Preamp Check

9. The interconnectivity and function for the Preamp and LNA switching can also be checked using the Spectrum Analyzer mode to measure the noise floor as needed. Access the Spectrum Analyzer mode and select **Mode Preset** Set the **Center Frequency** to 1.85 GHz with a Swept span. This check can be done at either a low frequency or a high frequency of your choice to also double check if the high band path of these same amplifiers is functioning correctly. This test setup will allow menu settings to be toggled on and off for both the LNA and the full range preamp and make it possible to view the noise floor changes.
10. Refer to [Figure 4-32](#). Press **Amplitude** to access the Signal Path menu. In this menu, you can toggle the LNA **On** or **Off** and the preamp **On** or **Off** and watch the noise floor lower.
11. Verify that the noise floor level is at approximately -80 dBm. Then toggle the **Internal Preamp Low Band** to **On** and confirm that this moves the noise floor approximately 10 db lower to -90 dBm.

Figure 4-32 Internal Preamp Low Band Noise Floor Check



12. Refer to **Figure 4-33**. Set the **Internal Preamp Low Band** to **Off**. Verify that the noise floor level is at approximately -80 dBm. Then toggle the **LNA** to **On** and verify that this moves the noise floor approximately 10 dB lower to -90 dBm.

Figure 4-33 LNA Noise Floor Check



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 a 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:

RF Preselector Section Purpose

RF Preselector Section Description

A21A1 Presel 1 Board

A21A2 Presel 2 Board

RF Preselector Section Troubleshooting

A21A1 Presel 1 Board

A21A2 Presel 2 Board

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.”**

Signal Paths

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

- Preselector Bypass - DC to 3.6 GHz directly to A13 RF Front End
- Conducted Filter Path - 9 kHz to 30 MHz (Bands A & B)
- Radiated Filter Path - 30 MHz to 3.6 GHz (Bands C, D, & E)

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

- A21A1 Presel 1 Board Conducted Filter Section
- A21A2 Presel 2 Board Radiated Filter Section
- A21A1 Presel 1 Output path and Overload Detection Section

Preselector Bypass Path - DC to 3.6 GHz

The input signal is routed to the preselector J101 Input, where it could either be directed through the RF Preselector section of the instrument or bypass it.

Conducted Filter Path - 9 kHz to 30 MHz (Bands A & B)

The input signal is routed to the preselector J101 input and for signal of frequency range DC - 30 MHz, it will be routed through the low pass filter arm of a duplexer and subsequently into the Band A and Band B pre-selection filter circuit section.

The input signal is incident to a 5 Watt limiter before passed into the Band A or B filter section as selected. The signal then passes through an appropriate pre-amp / buffer before being sent through a conducted band overload detection circuit and low pass filtered before being sent to the A13 Front End assembly for further processing or, if selected, through the direct conversion path to the WBDIF for FFT measurement.

Radiated Filter Path - 30 MHz to 3.6 GHz (Bands C, D, & E)

The input signal is routed to the A21A1 Presel 1 Board J101 input and for a signal in the range of 30 MHz to 3.6 GHz, it will be routed to the high pass filter arm of the Duplexer and subsequently to the RF output connector J103 into A21A2 Presel 2 Board.

RF Preselector Section
RF Preselector Section Description

The signal will pass into a different filter section for band C, D, or E and then pass through the appropriate pre-amp or buffer before being sent back through a radiated band overload detection circuit in the A21A1 Presel 1 assembly. The signal is then sent to the A13 Front End assembly for further processing or, if selected, through the direct conversion path to the WBDIF for FFT measurement.

Both the output signals, from Conducted Band filters in A21A1 Presel 1 Board, and from Radiated Band filters in A21A2 Presel 2 Board, are tapped, through resistive coupling, into 2 overload detectors for each Conducted Band and Radiated Band, right before they are routed to output switches. These detector circuits are used to detect amplitude overload at the RF pre-selectors so that the front-end mechanical step attenuators in the PXE instrument system will be adjusted accordingly, to avoid overload error, and thus preventing any signal distortion caused by non-linearities of the front-end and back-end circuits.

A21A1 Presel 1 Board

The N9048-63001 Presel 1 board is a PCA that contains preselection filters required for the measurement of Conducted Band frequencies from 9 kHz to 30 MHz, overload detection, alignment sources, and pre-selector bypass path.

The main functions of the A21A1 Presel 1 board are:

- Provides preselection filters for Band A and B EMI Compliance measurements from 9 kHz to 30 MHz
 - 1 low pass filter for Band A (DC to 150 kHz)
 - 1 band pass filter for Band B (150 kHz to 30 MHz)
- Buffer amplifiers and Preamplifiers for the filter paths
- PIN diode-driven diplexer circuit to switch RF input to either Conducted Band filters in A21A1 Presel 1 Board (DC to 30 MHz) or Radiated Band filters in A21A2 Presel 2 Board (30 MHz to 3.6 GHz)
- Pre-selector filters bypass path from Dual Pre-Amp Module, LNA and EMC band Switch directly to the Front End Assembly Preamp input
- Conducted Band and Radiated Band overload detectors
- RF Pre-Selector alignment sources
 - Direct Digital Synthesizer 9 kHz to 30 MHz
 - Wideband Synthesizer 30 MHz to 3.6 GHz
- Routes motherboard's supplies and communication to A21A2 Presel 2 board through an inter-board connector.

Input Path

Input signals of frequency range DC to 3.6 GHz from the RF Input connector will go through various switches which will switch to different signal paths. All input signal paths in A21A1 Presel 1 board are listed below:

- 1. Pre-selector bypass path, DC - 3.6 GHz**
- 2. Conducted Band filters path, DC - 30 MHz**
- 3. Radiated Band filters path, 30 MHz - 3.6 GHz**

From RF input J101, the input RF path is first split into 2 paths. First path is bypass path with only a single limiter. This path is used to bypass all EMC Pre-selection filters in both A21A1 Presel 1 board and A21A2 Presel 2 board.

The second path will be preselector path which will be further split into Conducted filter path and Radiated filter path (A21A2 Presel 2 board) which will then route to overload detection circuit 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 conducted filter path which is useful while making electromagnetic emissions measurements where the signals are often impulsive in nature.

Conducted Filter Path Prefilter

There is a low pass filter that covers Band A (DC to 150 kHz) and a band pass filter to cover Band B (150 kHz to 30 MHz).

The most critical requirement for the filters is the impulse bandwidth of each filter. The impulse bandwidth determines how much energy is coming out of the passband of each filter when we are applying narrow pulses like CISPR generator pulses to the receiver.

If the impulse bandwidth is too wide, the pulse energy out of the filter will cause compression of the system after RF preselection filters. If the impulse bandwidth is too narrow, we might need more filters to cover the frequency range of 150 kHz to 30 MHz. For Band B bass pass filter response, the maximum allowable impulse bandwidth, BW_i, is 33 MHz.

Buffer Amplifiers and Preamplifiers

The purpose of the buffer amplifier is to provide some gain to compensate path losses from filters, switches, and traces. They could also provide some isolation between filters and output of the amplifiers.

There is only one buffer amplifier caters for both Band A and Band B filters as outputs from these filters will be switch-selected to the input of the buffer amplifier.

There are also switchable high gain amplifiers, or preamplifiers, for each Band A and B signal paths. The preamplifier is applied when more sensitivity is required during measurements.

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. These detector circuits are used to detect amplitude overload at the RF pre-selectors so that the front-end mechanical step attenuators in the PXE instrument system will be adjusted accordingly, to avoid overload error, and thus preventing any signal distortion caused by non-linearities of the front-end and back-end circuits.

Alignment Sources

There are two alignment sources on the A21 Presel 1 Assembly, a Digital Direct Synthesizer (DDS) and a Wideband Synthesizer.

The DDS is used to synthesize a CW of 9 kHz to 30 MHz for Conducted Band filter paths alignment while the Wideband Synthesizer generates 30 MHz to 3.6 GHz CW for Radiated band filter paths alignment.

A21A1 Board Connections

Figure 5-1 A21A1 Board Connections

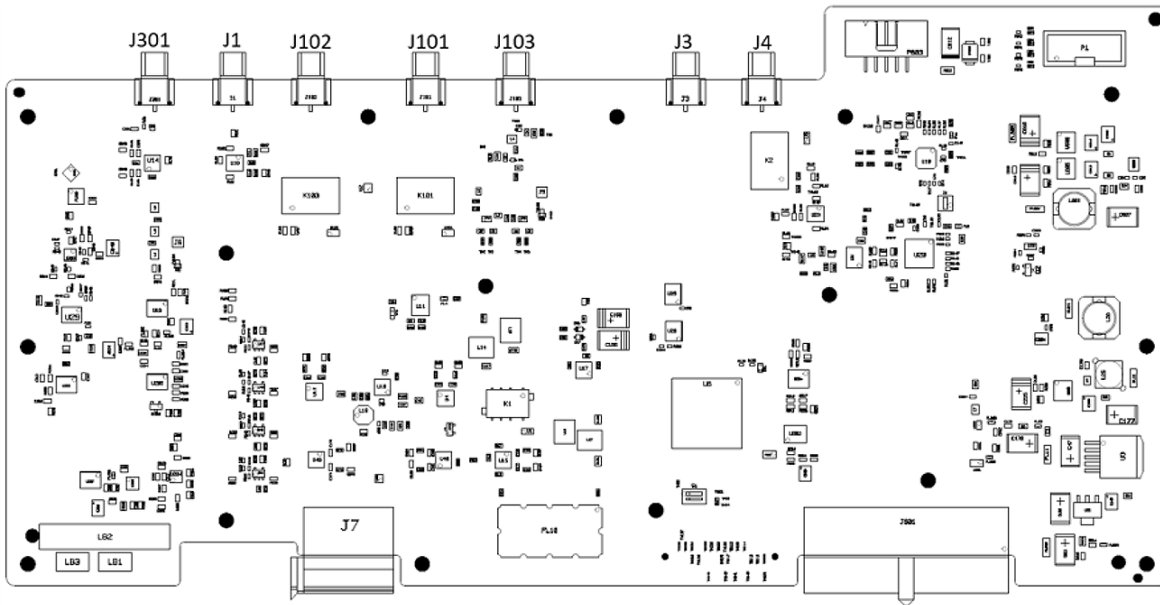


Table 5-1 A21 RF Preselector Input Assembly Signals

Port	Description	To/From	Cable
J101	RF Input	SMA to Low Band RF Output	N9048-21337
J102	RF Output	SMA to Band 0 Input of Front End	N9048-21329
J103	Radiated Band Output	SMA to RF Input of A21A2 Presel 2 board	N9048-20307
J1	Direct Conversion Output	Output to LPF board Direct in	N9048-21336
J301	Radiated Band Input	SMA to RF Output of A21A2 Presel 2 board	N9048-21307
J3	Alignment Signal Output	SMA to A23 Limiter Pre-Filter	N9048-21330
J4	Reference Signal Input	SMA to FE Calibrator output for 50 MHz and 4.8 GHz source	N9048-21310

A21A2 Presel 2 Board

The A21A2 Presel 2 board is a PCA that contains all preselection filters required for the measurement of Radiated Band frequencies from 30 MHz to 3.6 GHz.

There are a total of 18 different fixed filters in the A21A2 Presel 2 board which are broken up into four main sections.

Section 1

Narrowband BandPass Filter Band C

The Band C 30 MHz to 300 MHz frequency range has 7 filter paths:

- 30 MHz to 52 MHz
- 52 MHz to 75 MHz
- 75 MHz to 120 MHz
- 120 MHz to 165 MHz
- 165 MHz to 210 MHz
- 210 MHz to 255 MHz
- 255 MHz to 300 MHz

Section 2

Narrowband BandPass Filter Band D

The Band D 300 MHz to 1 GHz frequency range has 4 Narrow Bandwidth filter paths:

- 300 MHz to 475 MHz
- 475 MHz to 650 MHz
- 650 MHz to 825 MHz
- 825 MHz to 1000 MHz

Section 3

Bandpass Filters Band E

The Band E 1 GHz to 3.6 GHz frequency range has 3 Highpass filter paths:

- 1 GHz to 1.7 GHz
- 1.7 GHz to 2.9 GHz
- 2.9 GHz to 3.6 GHz

Section 4 Wide Bandwidth BandPass Filter Band C

This Wideband filter is only used in boxes which also have the A26 WBDIF hardware installed.

300 MHz to 300 MHz

2.4 GHz Notch Filter Band E

This notch filter is only used in boxes which also have the A26 WBDIF hardware installed.

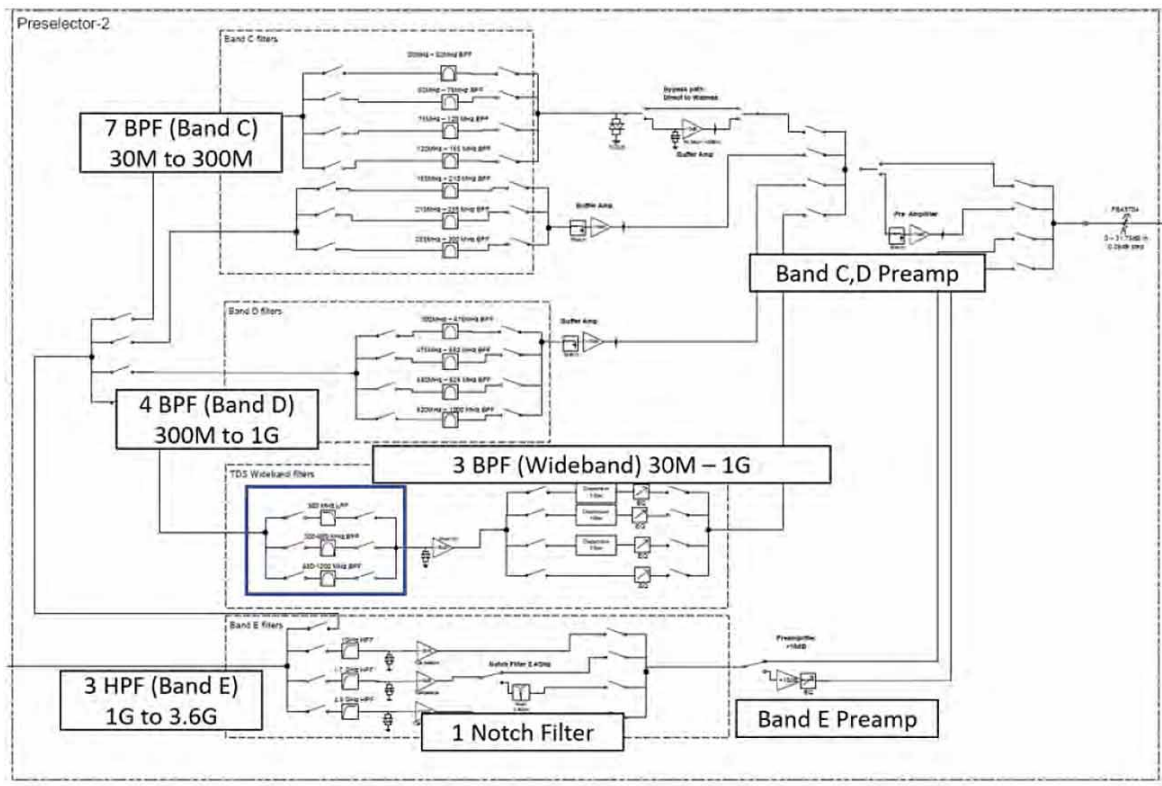
Band E also contains a 2.4 GHz Notch Filter Path for Wi-Fi signal blocking.

Amplifiers

There are multiple amplifiers used to cover the 30 MHz to 3.6 GHz frequency range of the A21A2 Presel 2 Board, one for the band C&D filter paths and the other for the Band E 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 A21A2 Presel 2 Board. This means that there will be an overall gain through the A21A2 Presel 2 Board.

Figure 5-2 A21A2



A21A2 Presel Board Connections

The connections to and from the A21A2 Presel 2 board are as listed in Table 5-2 and are illustrated in **Figure 5-3** & **Figure 5-4** below.

Table 5-2 A21 RF Preselector Input Assembly Signals

Port	Description	To/From	Cable
J3	RF Input	A21A1 Presel 1 Board J103	N9048-21307
J4	RF Output	A21A1 Presel 1 Board J301	N9048-21307
Bottom Side			
P1	Bias, Control + JTAG	A21A1 Presel 1 Board	

Figure 5-3 A21A2 Presel Board Connections Top Side

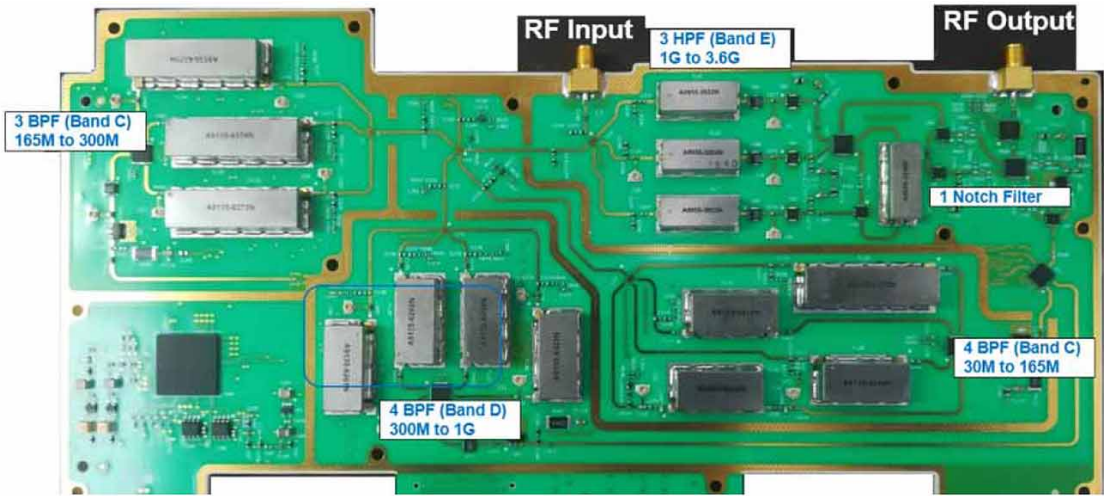
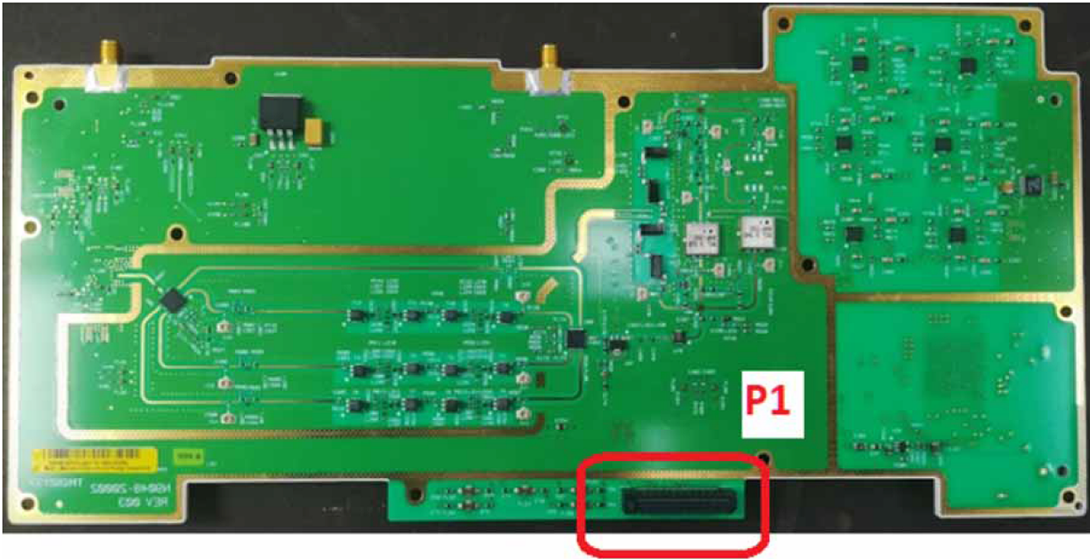


Figure 5-4 A21A2 Presel Board Connections Bottom Side



RF Preselector Section Troubleshooting

NOTE

Refer to **Chapter 15, “Block Diagrams.”**

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

- A21A1 Presel 1 Board
- A21A2 Presel 2 Board

A21A1 Presel 1 Board

The A21A1 Presel 1 board 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 A21A1 Presel 1 board 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 A21A1 Presel 1 board should identify itself on this list as Preselector 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:

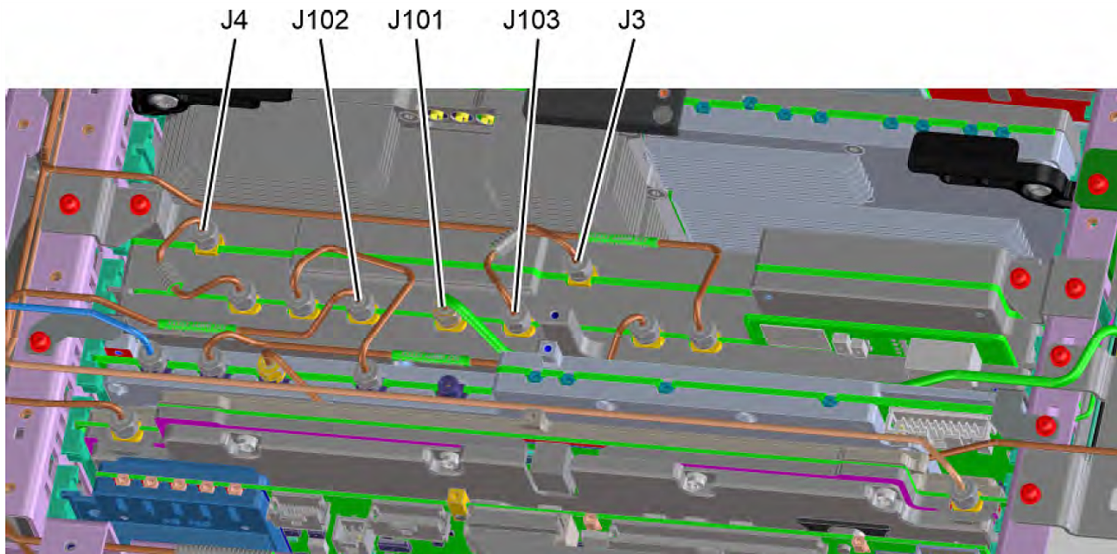
- FPGA Code on the assembly is corrupt.
Solution: Reload the FPGA code. See **Chapter 19, “Post-Repair Procedures”**
- An instrument power supply voltage is not operating properly.
Solution: Verify all instrument power supply voltages. See **Chapter 12, “Power Supply & Midplane”**
- A21A1 Presel 1 board is defective.
Solution: Replace the A21 RF Preselector Input assembly.

Signal Path Verification

While there are two different signal paths through the A21A1 Presel 1 board, 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 these two 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. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.
3. Turn the instrument self-alignment routine off by pressing **System, Alignments, Auto Align, Off**.
4. Connect a signal generator to the A21A1 Presel 1 board RF Input (J101) as shown in **Figure 5-5**.

Figure 5-5 A21 RF Preselector Input Assembly Connectors



5. Set the power level of the signal generator to -20 dBm.
6. Connect a spectrum analyzer to the A21A1 Presel 1 board RF output (J102) as shown in **Figure 5-5**.
7. Tune the spectrum analyzer to a start and stop frequency equal to that shown in **Table 5-3** for Band 0.
8. Tune the A21A1 Presel 1 board to the Band 0 filter path by entering the Service menu and pressing **RF Preselector, LO Band Lock, Conducted Band, Band 0**.
9. Tune the signal generator to the **Verification Start Frequency** listed in **Table 5-3** for Band 0.
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 the **Verification Start Frequency** and the **Verification Stop Frequency** listed in **Table 5-3** to draw out the Band 0 filter shape.
12. Verify that the passband gain or loss is equal to the Typical Passband Gain/Loss shown in **Table 5-3** for Band 0, and that the filter shape is similar to that shown in **Figure 5-6**. If either the passband gain/loss or filter shape is incorrect the most likely cause of the problem is the A21A1 Presel 1 board itself.
13. Repeat **step 8** through **step 13** for Band 1 of A21A1 Presel 1 board filter bands shown in **Table 5-3**, using the **Verification Start Frequency**, **Verification Stop Frequency**, and **Typical Passband Gain/Loss** shown in **Table 5-3** for each band. Verify that the passband for each additional filter band is similar to that shown in the corresponding examples shown in **Figure 5-7**.

Table 5-3 A21A1 Presel 1 Board - Filtered Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 0	DC to 150 kHz	0 Hz	500 kHz	-6 dB
Band 1	150 kHz to 30 MHz	100 kHz	50 MHz	-1 dB

Figure 5-6 Band 0 Filter Shape



Figure 5-7 Band 1 Filter Shape



A21A2 Presel 2 Board

The A21A2 Presel 2 board 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.

Assembly Initialization

Before the A21A2 Presel 2 board 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 A21A2 Presel 2 board should identify itself on this list as Preselector 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 **Chapter 19, “Post-Repair Procedures”**.

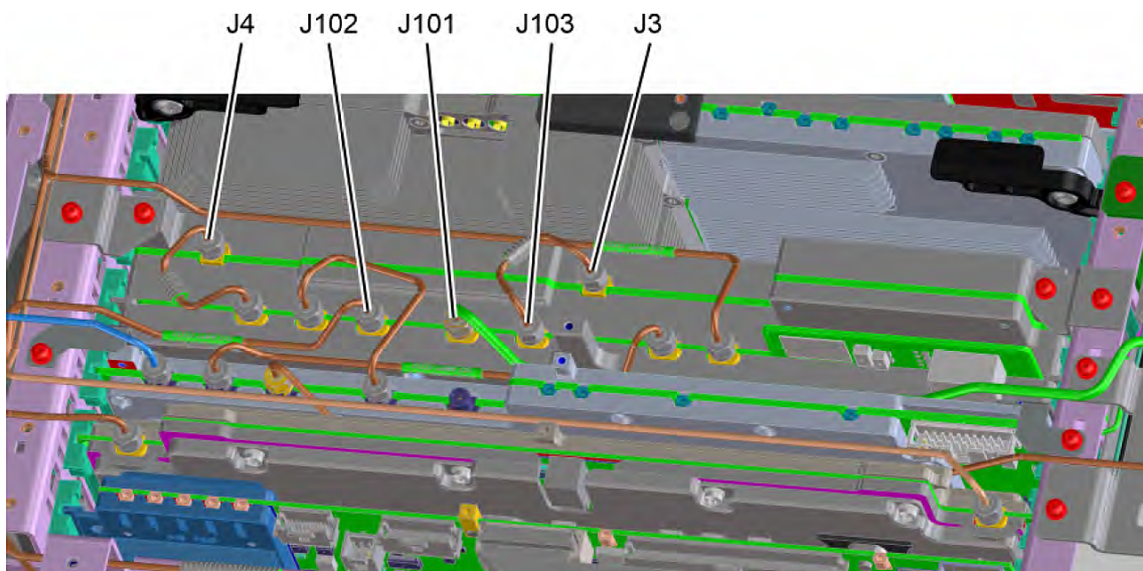
- An instrument power supply voltage is not operating properly
Solution: Verify all instrument power supply voltages. See **Chapter 12, “Power Supply & Midplane”**.
- A21A2 Presel 2 board is defective
Solution: Replace the A21 RF Preselector Input assembly

Signal Path Verification

There are 14 different filtered signal paths for Band C, D, and E on the A21A2 Presel 2 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 14 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. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.
3. Turn the instrument self-alignment routine off by pressing **System, Alignments, Auto Align, Off**.
4. Connect a signal generator to the A21A2 Presel 2 board RF Input (J3), as shown in **Figure 5-8**.

Figure 5-8 A21 RF Preselector Input Assembly Connectors



5. Set the power level of the signal generator to -20 dBm.
6. Connect a spectrum analyzer to the A21A2 Presel 2 board RF Input (J4), as shown in **Figure 5-8**.
7. Tune the spectrum analyzer to a start and stop frequency equal to that shown in **Table 5-4** for Band 0.

8. Tune the A21A2 Presel 2 board to the Band 0 filter path by entering the Service menu and pressing **RF Preselector, LO Band Lock, Radiated Band, Band 0**.
9. Tune the signal generator to the **Verification Start Frequency** listed in **Table 5-4** for Band 0.
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 the **Verification Start Frequency** and the **Verification Stop Frequency** listed in **Table 5-4** to draw out the Band 0 filter shape.
12. Verify that the passband gain or loss is equal to the **Typical Passband Gain/Loss** shown in **Table 5-4** for Band 0, and that the filter shape is similar to that shown in **Figure 5-9**.

If either the passband gain/loss or filter shape is incorrect the most likely cause of the problem is the A21A2 Presel 2 board itself.
13. Repeat step 8 through step 13 for the remained of the A21A2 Presel 2 board filter bands shown in **Table 5-4**, using the **Verification Start Frequency, Verification Stop Frequency, and Typical Passband Gain/Loss** shown in **Table 5-4** for each band.

Verify that the passband for each additional filter band is similar to that shown in the corresponding examples shown in **Figure 5-10** to **Figure 5-23**.

Table 5-4 A21A2 Presel 2 Board - Filtered Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 0	30 MHz to 52 MHz	20 MHz	65 MHz	+5 dB
Band 1	52 MHz to 75 MHz	30 MHz	90 MHz	+4 dB
Band 2	75 MHz to 120 MHz	50 MHz	140 MHz	+4 dB
Band 3	120 MHz to 165 MHz	100 MHz	190 MHz	+4 dB
Band 4	165 MHz to 210 MHz	140 MHz	230 MHz	+4 dB
Band 5	210 MHz to 255 MHz	190 MHz	280 MHz	+4 dB
Band 6	255 MHz to 300 MHz	230 MHz	330 MHz	+4 dB
Band 7	300 MHz to 475 MHz	250 MHz	540 MHz	+4 dB
Band 8	475 MHz to 650 MHz	400 MHz	700 MHz	+3 dB
Band 9	650 MHz to 825 MHz	600 MHz	900 MHz	+3 dB
Band 10	826 MHz to 1 GHz	750 MHz	1100 MHz	+3 dB
Band 11	1 GHz to 1.7 GHz	900 MHz	1900 MHz	+6 dB

Table 5-4 A21A2 Presel 2 Board - Filtered Signal Paths

Service Menu Selection	Frequency Range	Verification Start Frequency	Verification Stop Frequency	Typical Passband Gain/Loss
Band 12	1.7 GHz to 2.9 GHz	1.5 GHz	3.1 GHz	+5 dB
Notch Band 12	2.3 GHz to 2.6 GHz	2 GHz	3 GHz	-15 dB
Band 13	2.9 GHz to 3.6 GHz	2 GHz	3.6 GHz	+5 dB

Figure 5-9 Band 0 Filter Shape



Figure 5-10 Band 1 Filter Shape



Figure 5-11 Band 2 Filter Shape



Figure 5-12 Band 3 Filter Shape



Figure 5-13 Band 4 Filter Shape



Figure 5-14 Band 5 Filter Shape



Figure 5-15 Band 6 Filter Shape



Figure 5-16 Band 7 Filter Shape



Figure 5-17 Band 8 Filter Shape



Figure 5-18 Band 9 Filter Shape



Figure 5-19 Band 10 Filter Shape



Figure 5-20 Band 11 Filter Shape



Figure 5-21 Band 12 Filter Shape



Figure 5-22 Notch Band 12 Filter Shape

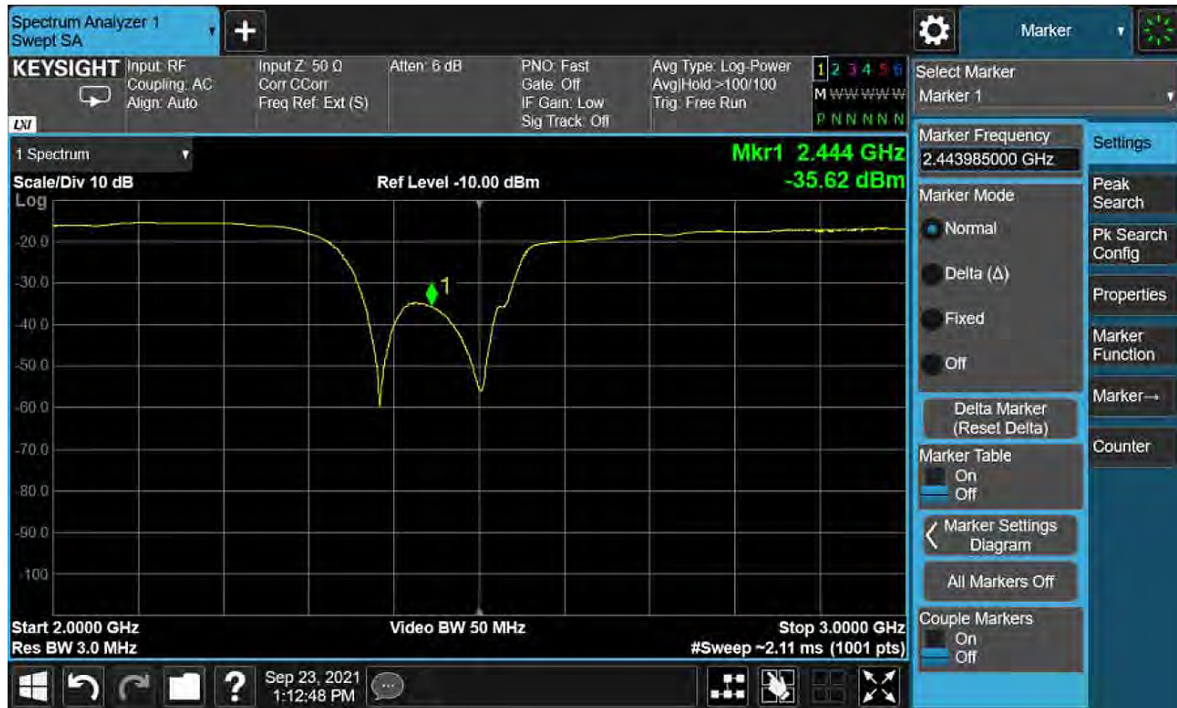


Figure 5-23 Band 13 Filter Shape

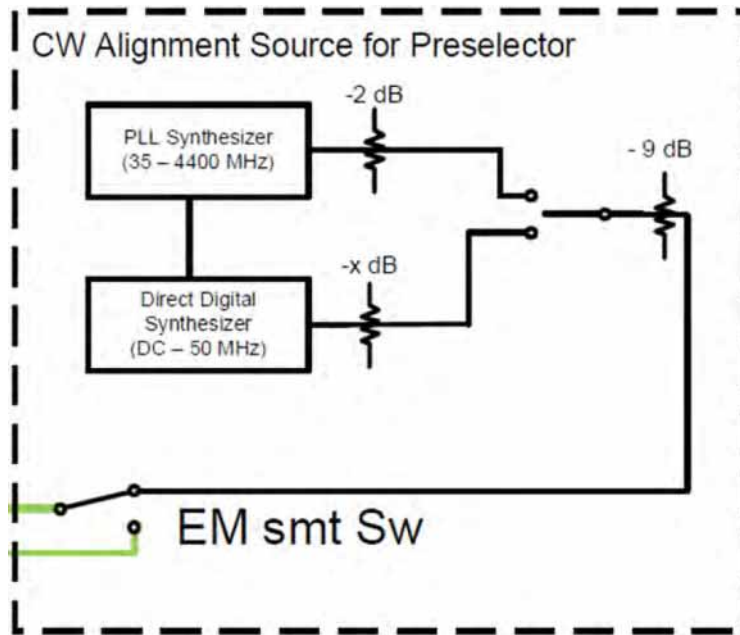


Alignment Signal Generation

There are two alignment signals generated on the A21 RF Preselector Input assembly to be verified, a Direct Digital Synthesizer and a Wideband Synthesizer, as seen in [Figure 5-24](#).

Figure 5-24

A21 RF Preselector Input Assembly - Alignment Signals



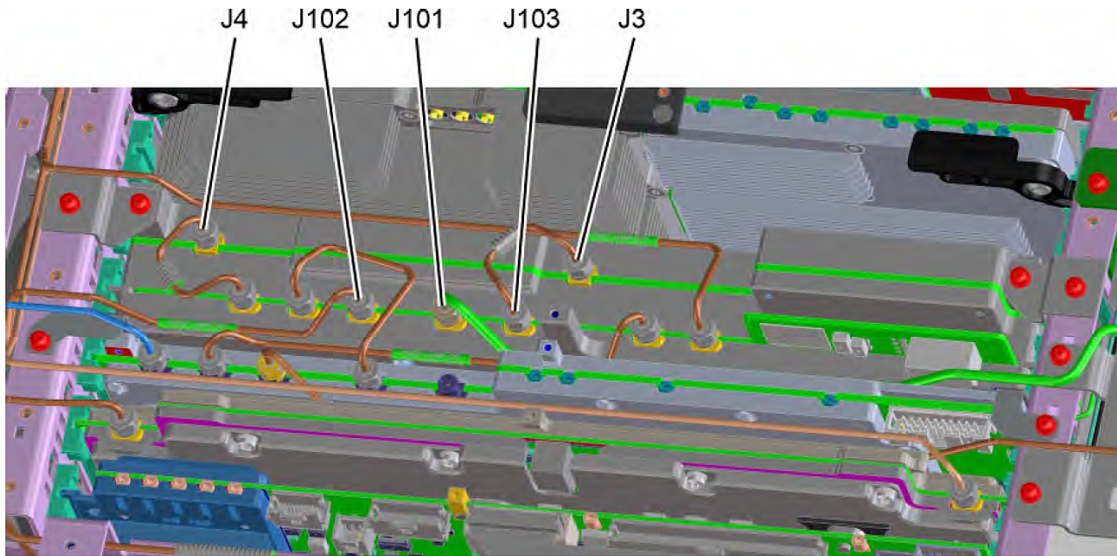
Verifying Alignment Signal Generation

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. Turn the instrument on and allow it to complete its boot up process, ignoring any error messages.
3. Turn the instrument self-alignment routine off by pressing **System, Alignments, Auto Align, Off**.

Direct Digital Synthesizer Verification - Conducted Band

4. Connect a spectrum analyzer to the A21 RF Preselector Input assembly Conducted Band Pre-Filtered Output (J103), as shown in [Figure 5-25](#).

Figure 5-25 A21 RF Preselector Input Assembly Connectors



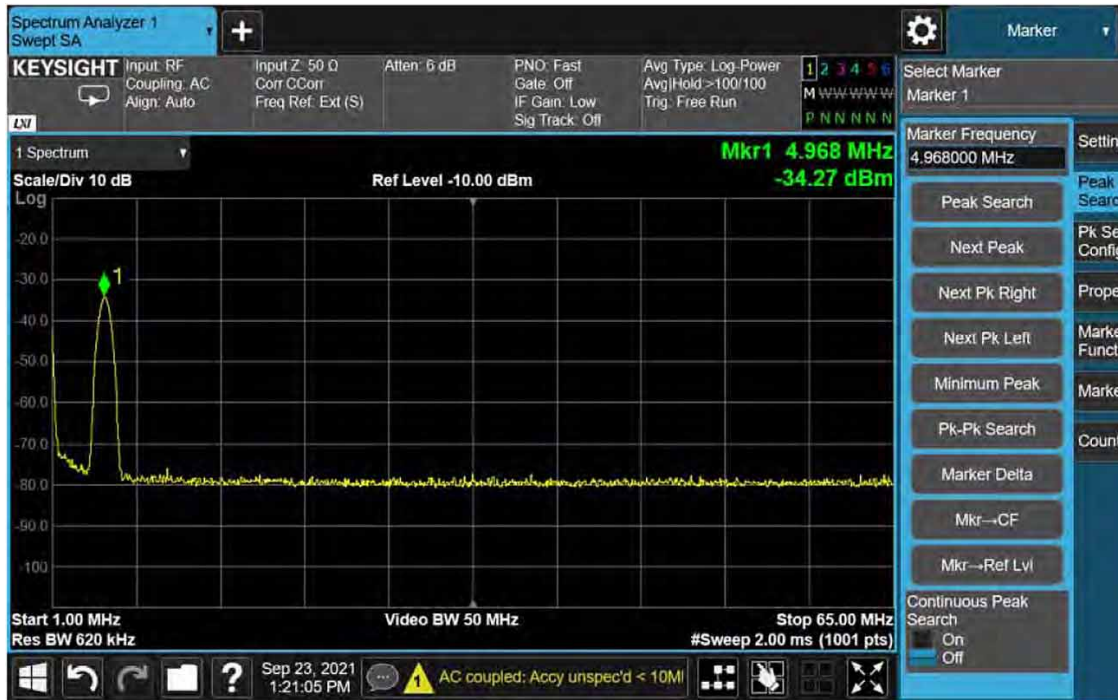
5. Tune the spectrum analyzer to a start frequency of 1 MHz and a stop frequency of 65 MHz.
6. Tune the instrument to a frequency of 10 MHz with a span of 0 Hz by pressing **FREQ**, **10 MHz**, and **SPAN**, **Zero Span**.
7. Turn the Direct Digital Synthesizer on and tune it to 5 MHz by entering the Service menu and pressing **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."](#)

8. Verify that the signal level on the spectrum analyzer is greater than -40 dBm, as shown in **Figure 5-26**, 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 5-26 A21 RF Preselector Input Assembly - DDS Output



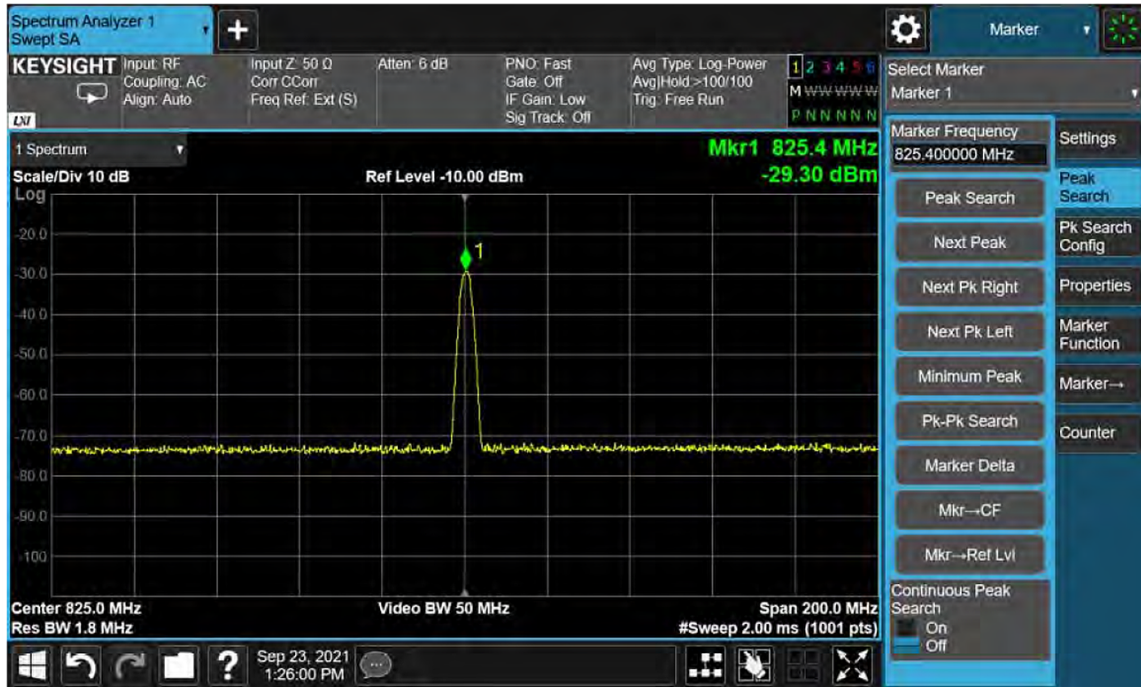
9. Vary the frequency of the Direct Digital Synthesizer alignment signal across its frequency range and verify that the signal level remains greater than -40 dBm up to 40 MHz.

Wideband Synthesizer - Radiated Band

10. Tune the spectrum analyzer to a center frequency of 825.4 MHz.
11. Tune the instrument to a frequency of 100 MHz with a span of 0 Hz by pressing **FREQ, 100 MHz, and SPAN, Zero Span**.
12. Turn the Wideband Synthesizer Source alignment signal on by entering the Service menu and pressing **RF Preselector, Calibrator, Wideband Synthesizer**.

13. Verify that the signal level on the spectrum analyzer is similar to that shown in **Figure 5-27**, 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 5-27 A21 RF Preselector Input Assembly - Wideband Synthesizer Output



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 a 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:

RF Downconverter Section Description

RF Section Purpose

RF Section Signal Paths

RF Section Assembly Descriptions

RF Downconverter Section Troubleshooting

A12 YTF Preselector

A13 RF Front End Assembly

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 four different frequency range options that can be ordered with the N9048B 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	1 Hz to 3.6 GHz	1 Hz to 3.6 GHz	1 Hz to 3.6 GHz	1 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:

- A12 YTF Preselector
- A13 RF Front End Assembly - shown on the block diagram as A13A1 and A13A2, however the entire A13 assembly must be replaced.

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 A11 Dual Pre-Amp Module, LNA, and EMC Band Switch, where it could either be directed through the RF Preselector section of the instrument or bypass it in A21A1 Presel 1 assembly. 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.

$$1\text{st IF} = \text{RF} + 1\text{st LO} = 5122.5 \text{ MHz}$$

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.

$$2\text{nd IF} = 1\text{st IF} - 2\text{nd LO}$$

$$2\text{nd IF} = 5122.5 \text{ MHz} - 4800 \text{ MHz} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 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.

$$1\text{st IF} = 1\text{st LO} - \text{RF} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 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.

$$1\text{st IF} = 1\text{st LO} - \text{RF} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 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.

$$1\text{st IF} = (1\text{st LO} \times 2) - \text{RF} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 routed to the A12 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.

$$1\text{st IF} = (1\text{st LO} \times 2) - \text{RF} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 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.

$$1\text{st IF} = (1\text{st LO} \times 2) - \text{RF} = 322.5 \text{ MHz}$$

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 A11 Dual Pre-Amp, LNA, and EMC Band 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 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.

RF Downconverter Section
RF Downconverter Section Description

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.

$$1\text{st IF} = (1\text{st LO} \times 4) - \text{RF} = 322.5 \text{ MHz}$$

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

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 N9048B – 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 6-2** and as illustrated in **Figure 6-1** and **Figure 6-2**.

Table 6-2 **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 6-1 A12 YTF Preselector Assembly Connections - Option 503, 508, & 526

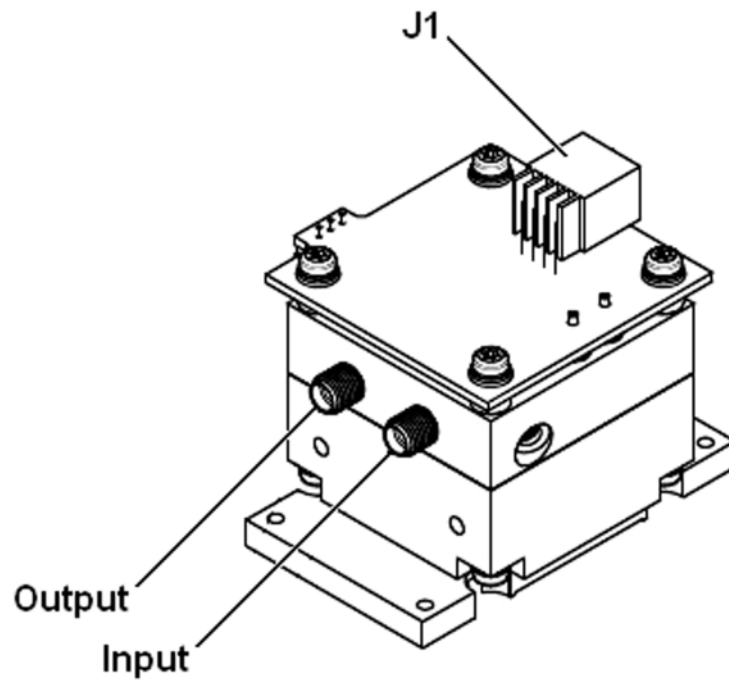
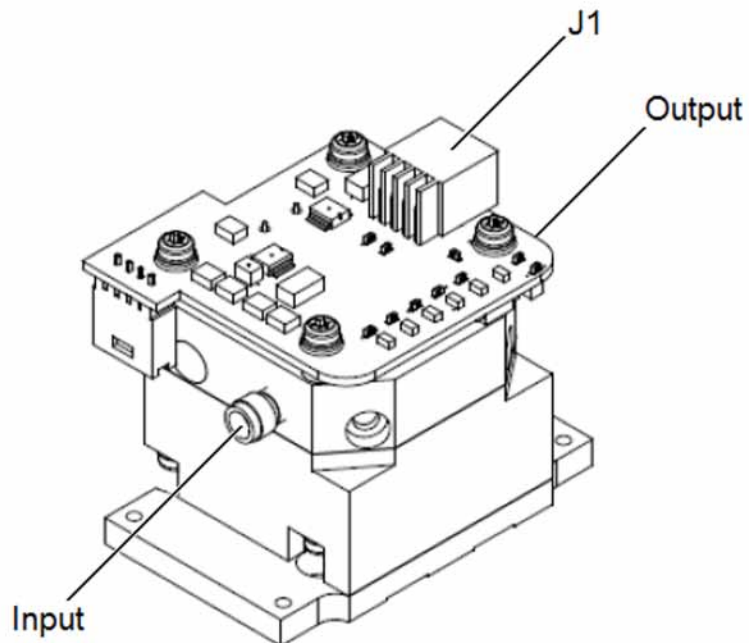


Figure 6-2 A12 YTF Preselector Assembly Connections - Option 544



A13 RF Front End Assembly

This assembly consists of two circuit boards. A13A1 contains the major front end conversion components. A13A2 contains the switched filters and LO and IM nulling circuits. A13A1 and A13A2 are not separately replaceable. The entire A13 assembly must be replaced.

A13A1:

- 1st LO Distribution
 - Auxiliary outputs for possible future use
 - Frequency 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

A13A2:

- Switched Filter
- IM and LO Nulling Circuit

Table 6-3 A13 Front End Assembly Signals - Option 503, 508, & 526

Port	Description	To/From	Cable	Frequency
A13A1J1	Low Band 2nd LO Input	A16 Reference J702	N9020-20022	4.8 GHz
A13A1J2	Low Band In	A21A1 Presel 1 J102	N9048-21329	
A13A1J3	Aux. LO Out			
A13A1J4	First LO Input	A14 LO Synthesizer J740	N9020-20156	
A13A1J5	Aux. LO Output	Terminated into 50 Ω	N/A	
A13A1J6	Calibrator Input	A16 Reference J705	8121-1940	50 MHz
A13A1J7	IF Output	A15 Front End Control J902	9121-1862	
A13A1J8	EXT Mixer LO Output	Terminated into 50 Ω		
A13A1J9	High Band Input	A12 YTF Output	N9048-21337	3.6 to 26.5 GHz
A13A1J13	Ext. IF Out			

Figure 6-3 A13 Front End Assembly Connections - Option 503, 508, & 526

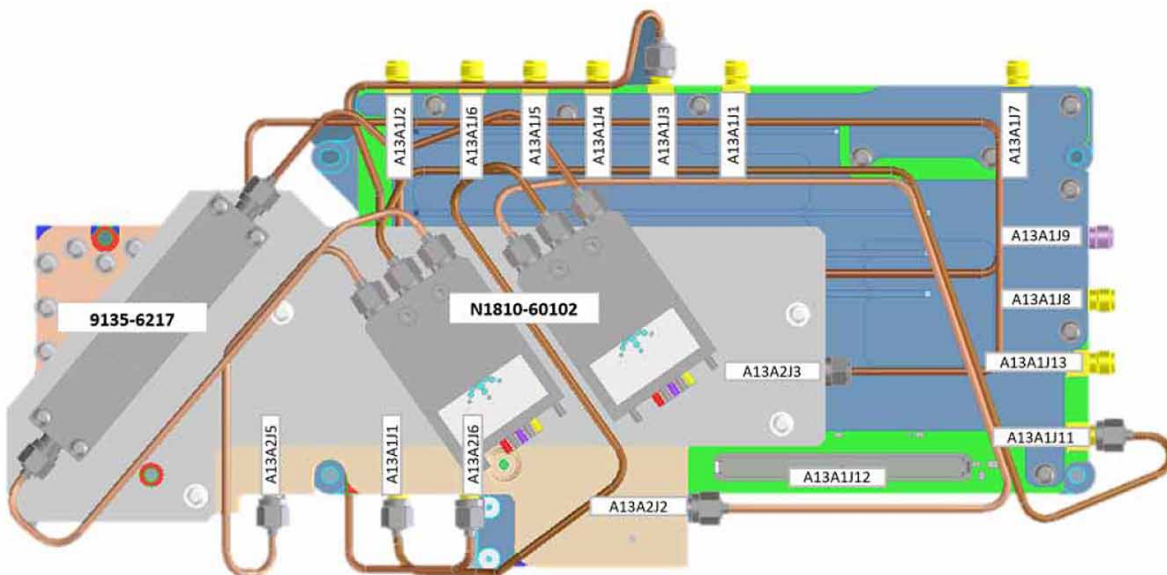
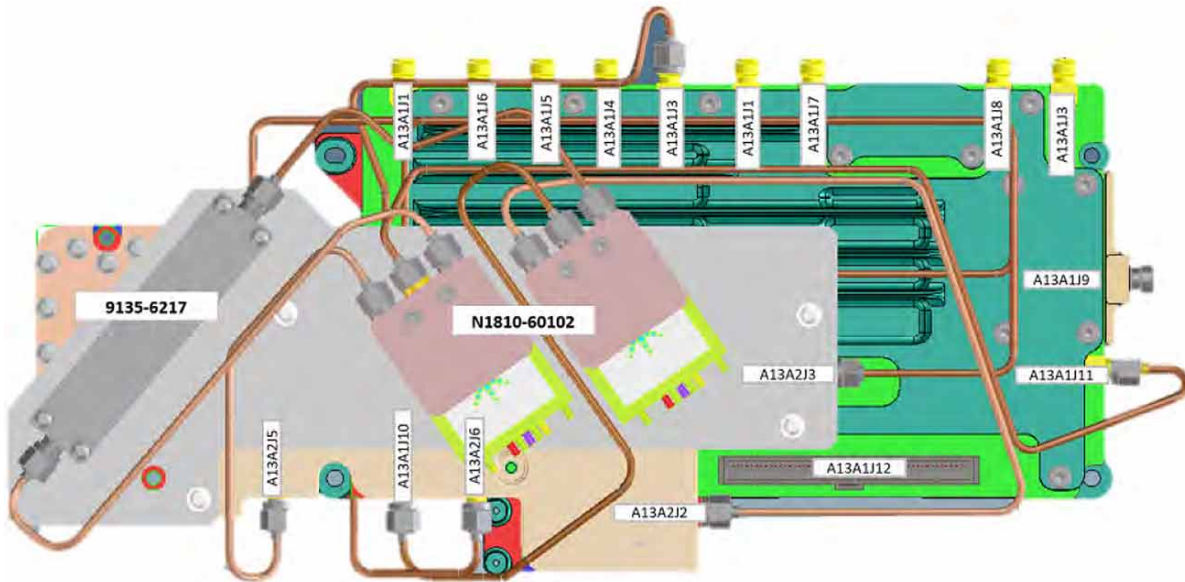


Table 6-4 A13 Front End Assembly Signals - Option 544

Port	Description	To/From	Cable	Frequency
A13A1J1	Low Band 2nd LO Input	A16 Reference J702	N9020-20022	4.8 GHz
A13A1J2	Low Band In	A21A1 Presel 1 J102	N9048-21329	
A13A1J3	Aux. LO Out			
A13A1J4	First LO Input	A14 LO Synthesizer J740	N9020-20156	
A13A1J5	Aux. LO Output	Terminated into 50 Ω	N/A	
A13A1J6	Calibrator Input	A16 Reference J705	8121-1940	50 MHz
A13A1J7	IF Output	A15 Front End Control J902	9121-1862	
A13A1J8	EXT Mixer LO Output	Terminated into 50 Ω		
A13A1J9	High Band Input	A12 YTF Output	N9048-21322	3.6 to 44 GHz
A13A1J13	Ext. IF Out			

Figure 6-4 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:

- A12 YTF Preselector
- A13 RF Front End Assembly

A12 YTF Preselector

There are two different A12 YTF Preselector assemblies used in the N9048B – 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

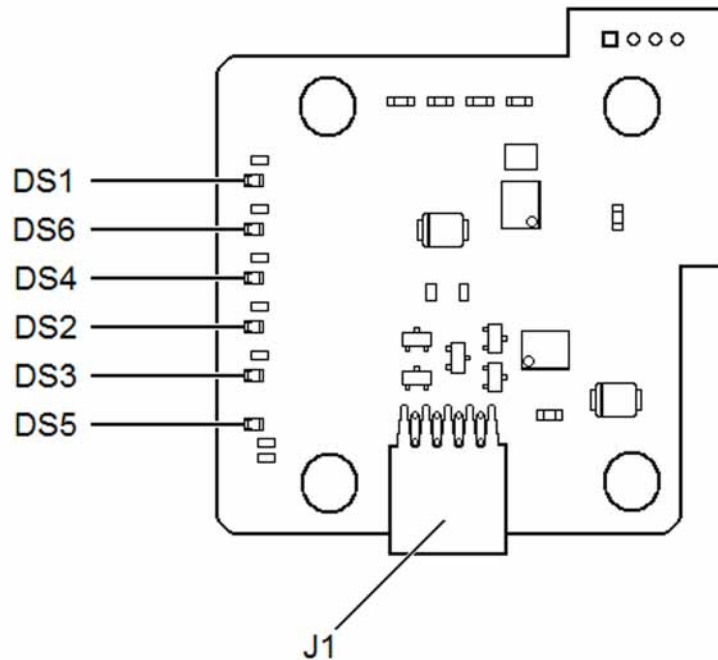
There is a series of status LEDs on the top of the A12 YTF Preselector assembly. These can be used to verify that the assembly has powered on correctly and what state it is in. Information on these status LEDs as well as what their state should be when an instrument is functioning properly is listed in [Table 6-5](#) and their location on the A12 YTF Preselector assembly is shown in [Figure 6-5](#).

Table 6-5

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 6-5

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 6-5](#).

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 6-6](#).

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 6-6 A12 YTF Preselector Connector Locations - Option 503, 508, & 526

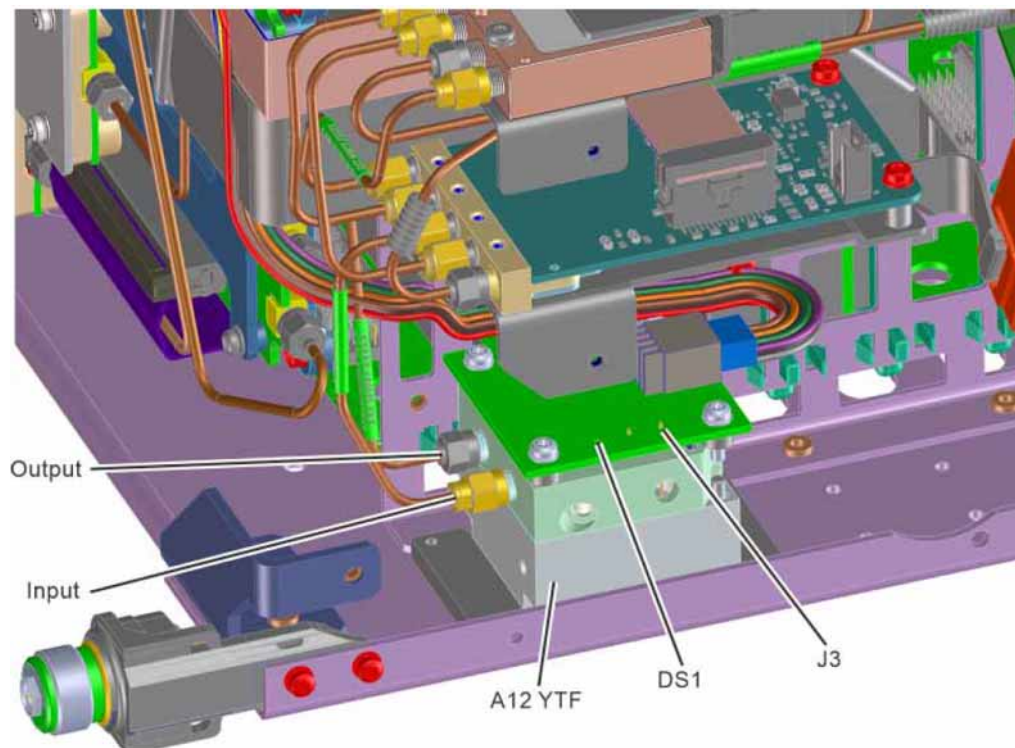
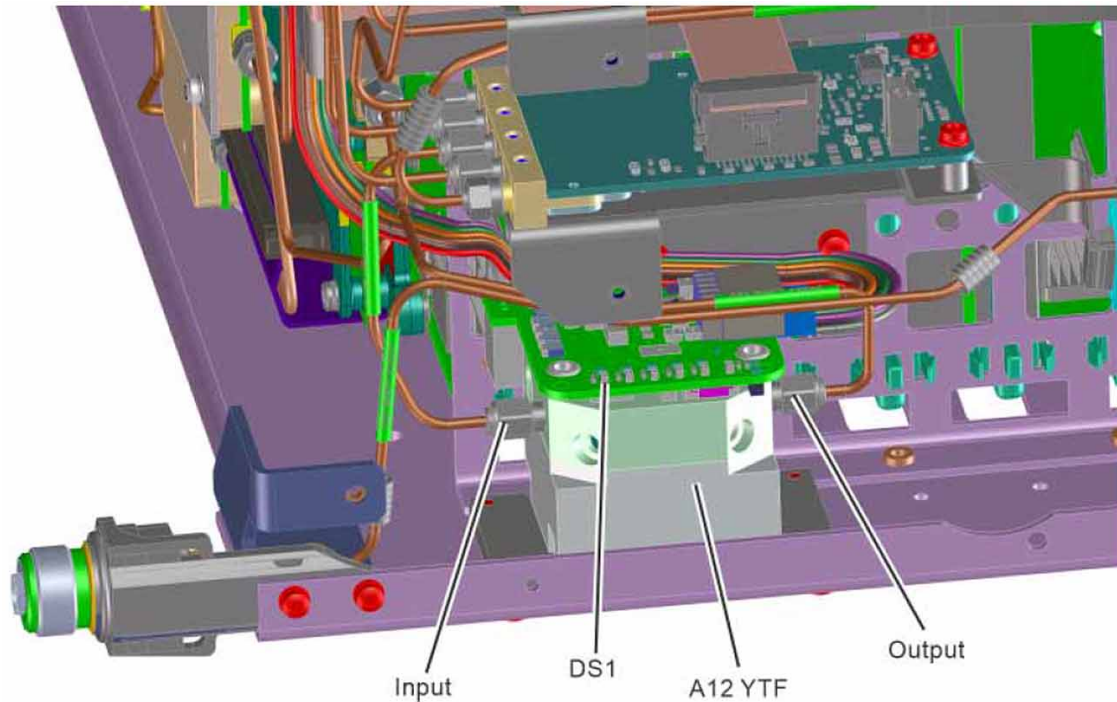


Figure 6-7 A12 YTF Preselector Connector Locations - Option 544



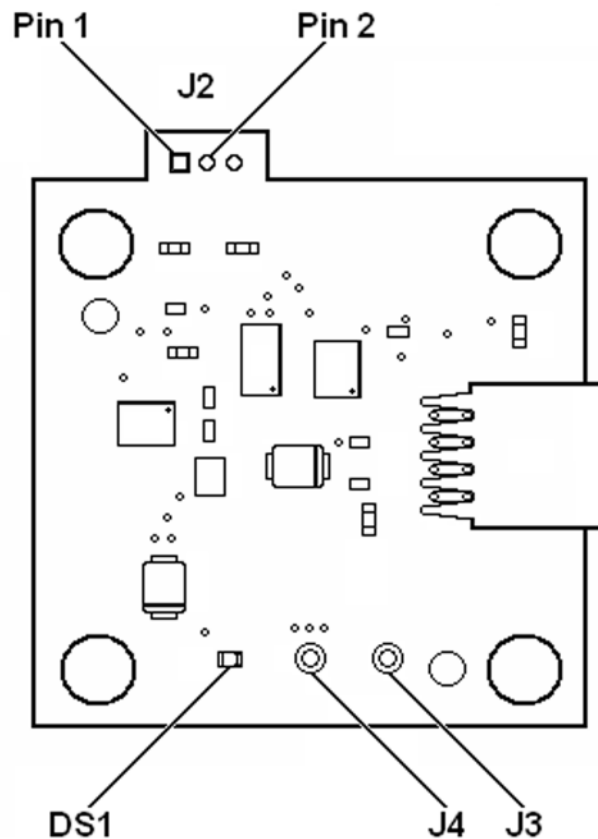
Tune Voltage Verification - Option 508 & 526 Only

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 6-6](#), remove W39 by disconnecting it from the A11 Dual Pre-Amp, LNA, and EMC Band Switch assembly Output (J3) and the A12 YTF Preselector assembly Input.
4. Referring to [Figure 6-6](#), 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 6-8**, 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 6-8 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 6-8**, 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 6-6** for the current tune frequency.

Table 6-6 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 6-6** 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 6-6** 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 6-6** 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 6-6](#) or [Figure 6-7](#), remove W39 by disconnecting it from the A11 Dual Pre-Amp, LNA, and EMC Band Switch assembly Output (J3) and the A12 YTF Preselector assembly Input.
4. Referring to [Figure 6-6](#) or [Figure 6-7](#), 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).

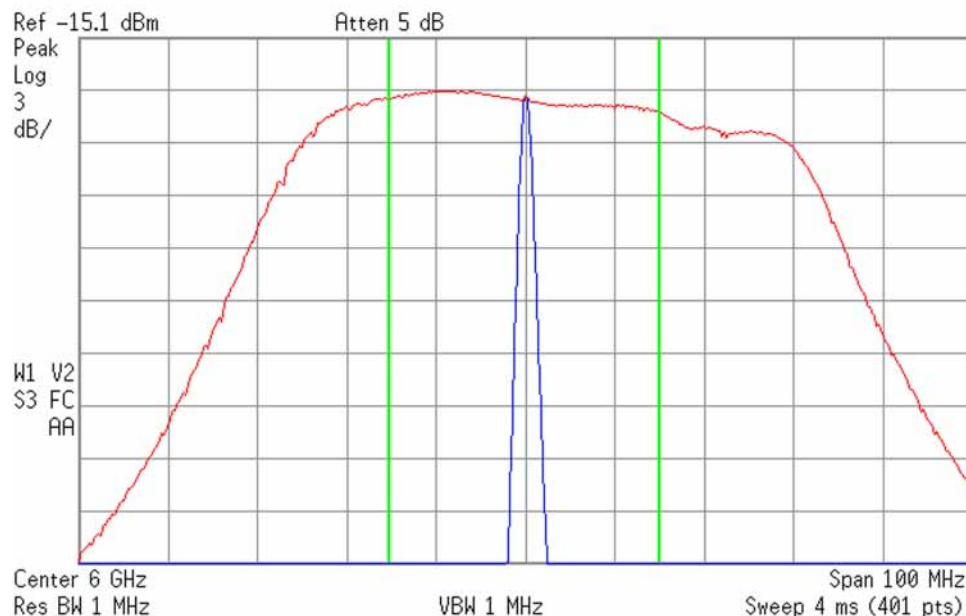
The passband insertion loss of the A12 YTF Preselector itself should not be greater than 10 dB, when properly tuned.

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 6-9**.

Figure 6-9 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, Signal Path, 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, 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 N9048B – 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 6-10](#) or [Figure 6-11](#), disconnect W14 from the A13 RF Front End assembly Output (J7).

Figure 6-10 A13 RF Front End Assembly Connections - Option 503, 508, & 526

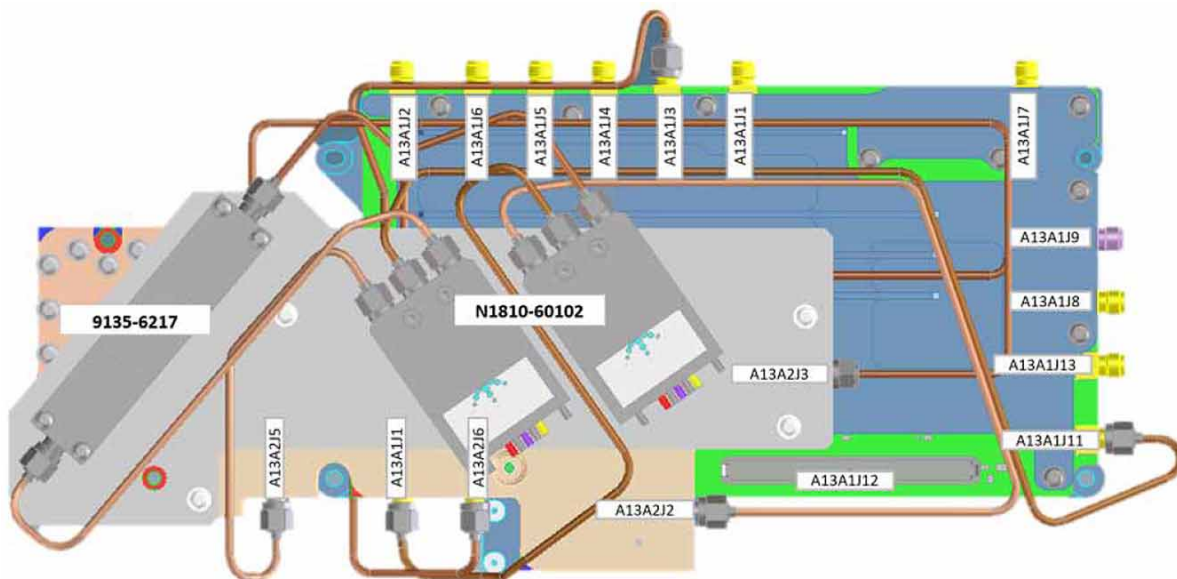
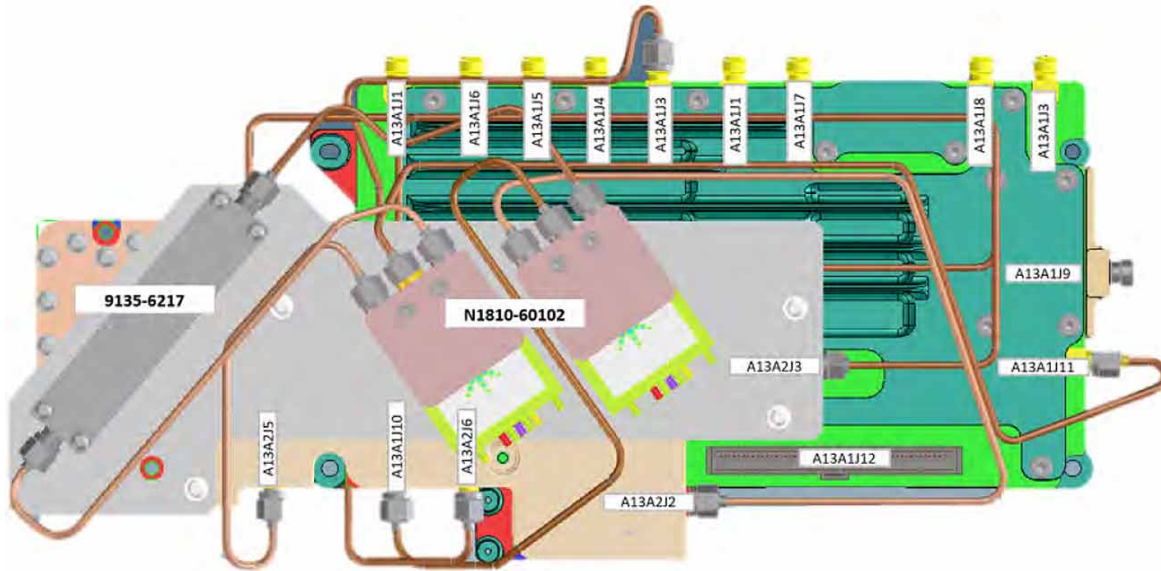
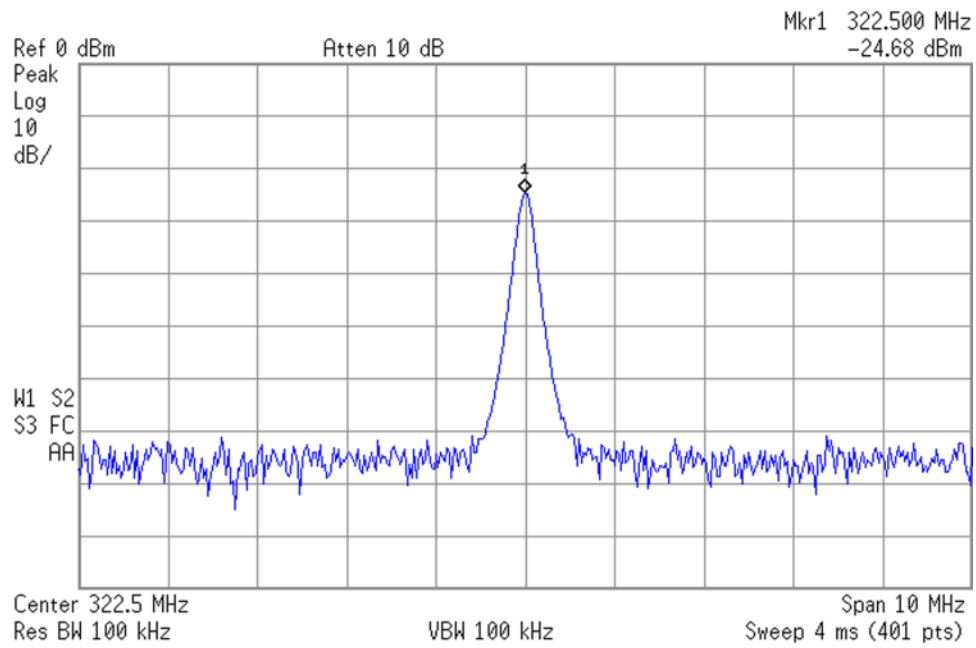


Figure 6-11 A13 RF Front End Assembly Connections - Option 544



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 6-10](#) or [Figure 6-11](#), 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 6-12](#).

Figure 6-12 A13 RF Front End Low Band Signal Path

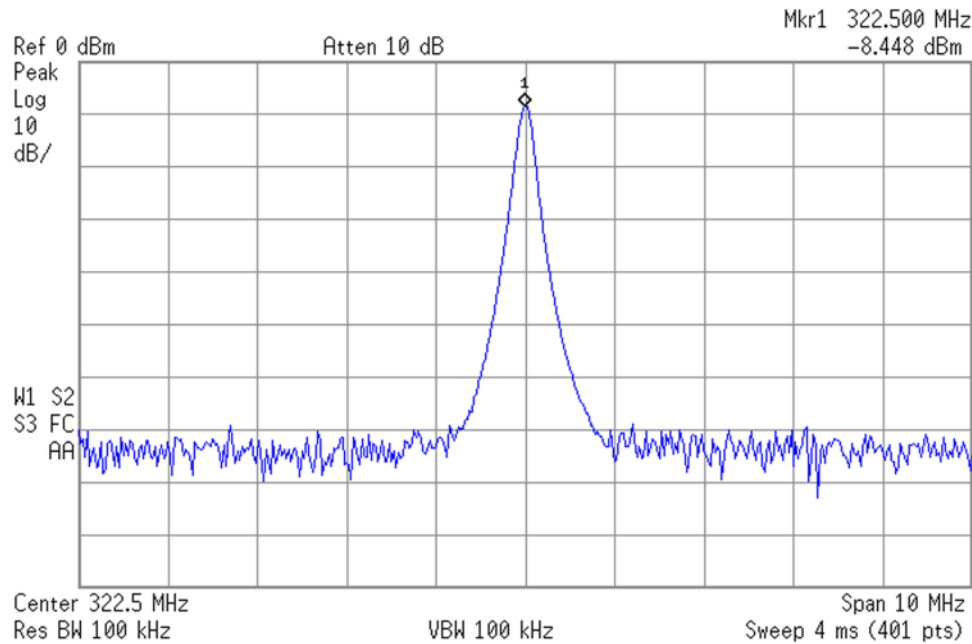


13. If the signal level is incorrect the most likely cause of the problem is the A13 RF Front End assembly itself. If the signal is correct proceed to **step 1**.

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 6-13**.

Figure 6-13 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)

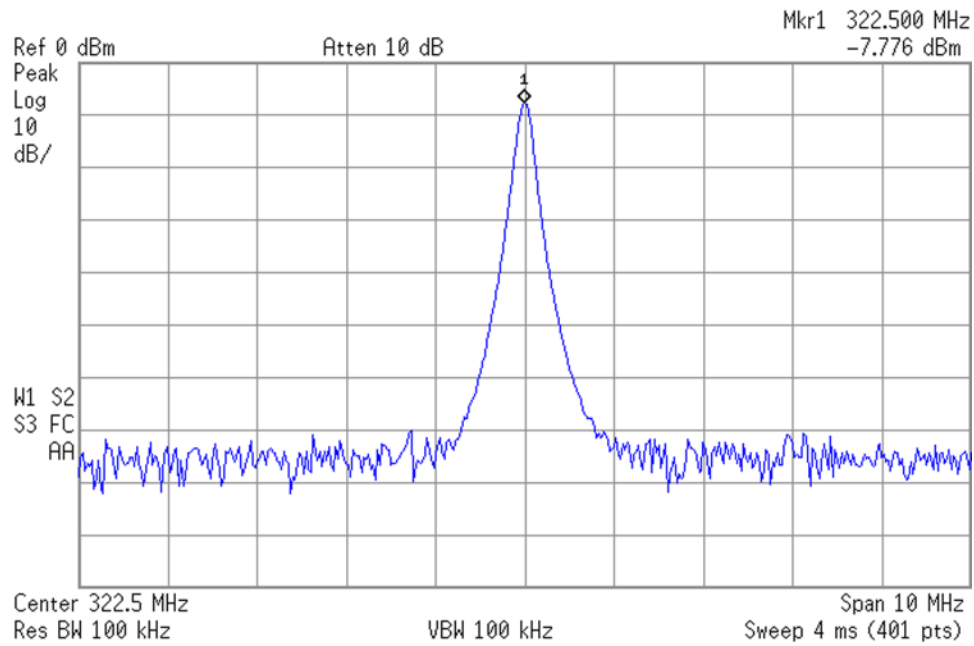
There are multiple frequency bands in the high band signal path. These can be seen in [Table 6-1](#) as well as in the series of block diagrams found in [Chapter 15, “Block Diagrams.”](#)

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 6-10](#) or [Figure 6-11](#), 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 6-10](#) or [Figure 6-11](#), 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 6-14](#).

Figure 6-14 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:

A14 L.O. Synthesizer Assembly Description

A14 L.O. Synthesizer Purpose

A14 L.O. Synthesizer Description

A14 L.O. Synthesizer Assembly Connections

A14 L.O. Synthesizer Assembly Troubleshooting

Assembly Status LEDs

Frequency and Amplitude of the 1st LO Output

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.

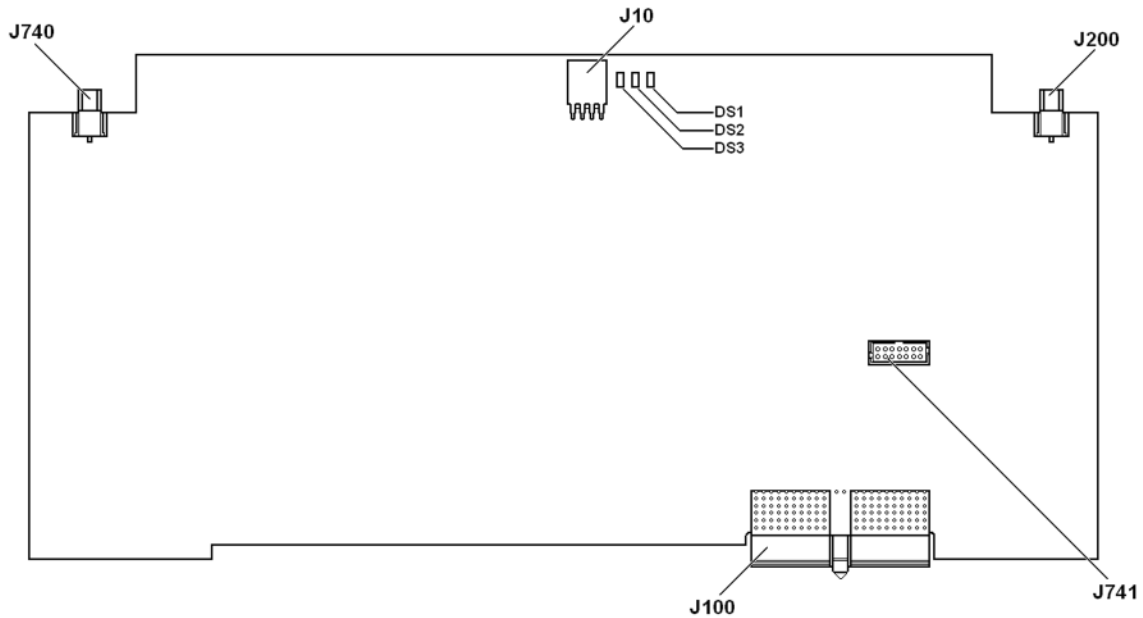
A14 L.O. Synthesizer Assembly Connections

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	W39
J740	1st LO Output	A13 Front End J4	W38
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.")

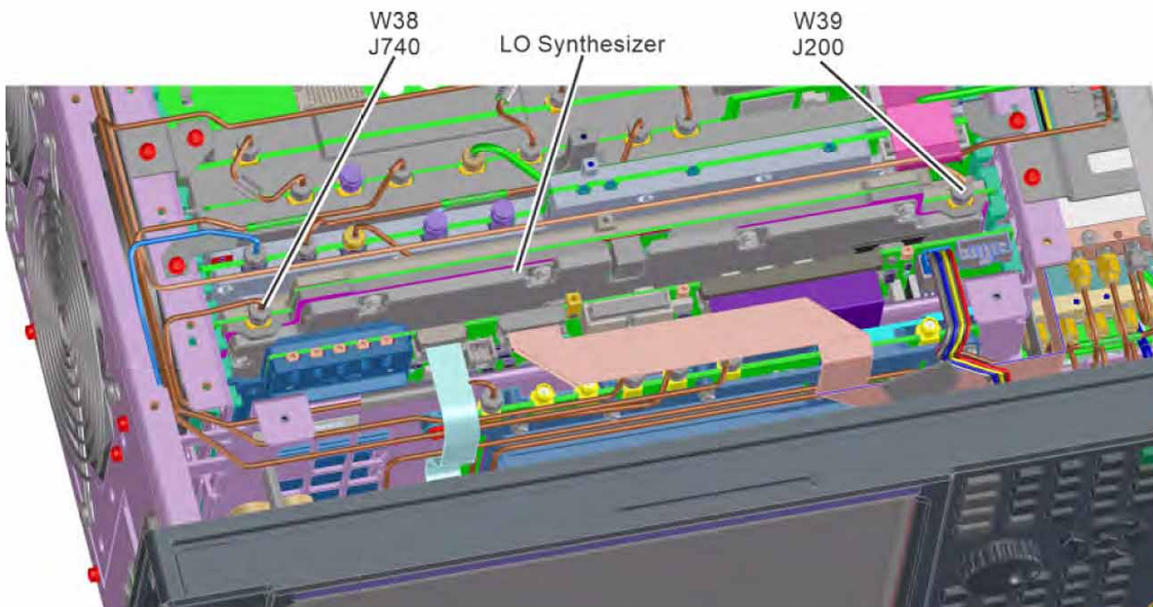
Frequency and Amplitude of the 1st LO Output

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."](#)

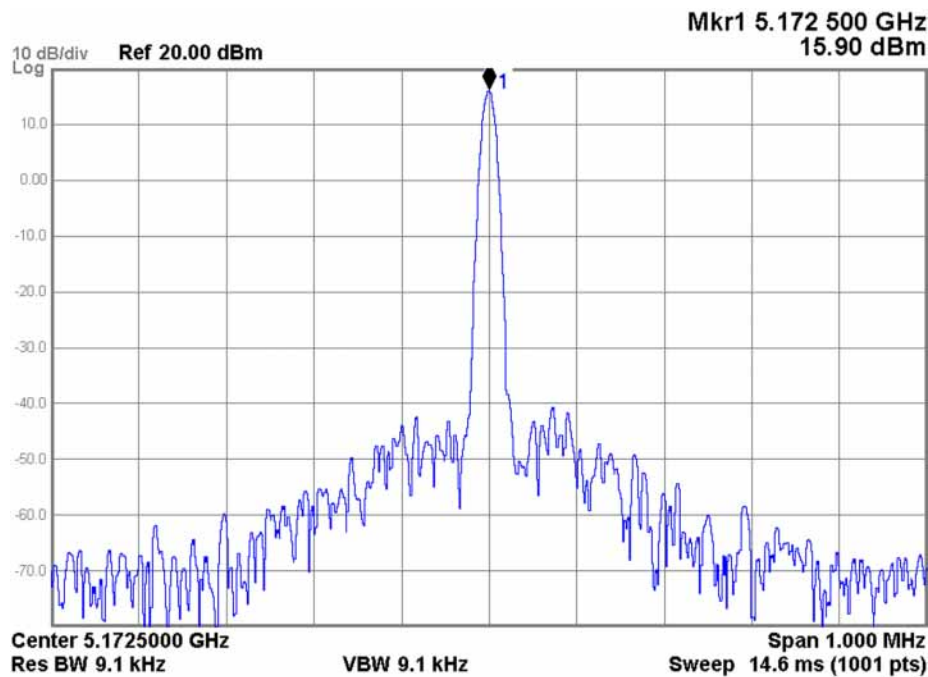
1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to [Chapter 18, "Assembly Replacement Procedures."](#) for instructions on removing these covers.
2. Disconnect cable W38 from A14J740 as shown in [Figure 7-2](#).

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

L.O. Synthesizer
A14 L.O. Synthesizer Assembly Troubleshooting

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.
2. 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.

The following descriptions are found in this chapter:

[A15 Front End Control Description](#)

[A15 Front End Control Assembly Troubleshooting](#)

A15 Front End Control Description

A15 Front End Control Purpose

The A15 Front End Controller board functionality can be broken down into (3) main categories:

- 1. Provides switch control logic and bias voltages to the major RF front end assemblies in the N9048B EMI Receiver.**
- 2. Contains on board circuitry providing various signal outputs to other locations within the EMI Receiver.**
- 3. Provides control logic for various instrument options within the EMI receiver.**

These signals are routed to and from the A15 via ribbon cables, wiring harnesses and coaxial cables. The RF front end assemblies require the correct control logic and bias in order to function properly. If the voltages from the A15 are not correct, the RF input signals will most likely be displayed at an incorrect power level if they even get displayed at all.

NOTE

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

Standard RF assemblies controlled by the A15 Front End Control assembly:

- A9 Input Attenuator A (4 dB total for Opt 503, 508, 526; 10 dB total for Opt 544)
- A10 Input Attenuator B (66 dB total for Opt 503, 508, 526; 60 dB total for Opt 544)
- A11 Dual Pre-Amp Module, LNA and EMC Band switch
- A12 YIG Tuned Filter
- A13 RF Front End Assembly

A15 On Board Circuits:

- RF Burst Trigger (When set to Relative Trigger or when start frequency is > 300 MHz.)
- Switched IF Filter Control
- 1st L.O. Optimization
- YTF Tune Ramp
- Preselector Tune Out (Provides output voltage, not specified, reserved for future use)
- Mixer Bias
- Amplifier Bias
- Switch Control
- Sweep Ramp (reserved for future use)

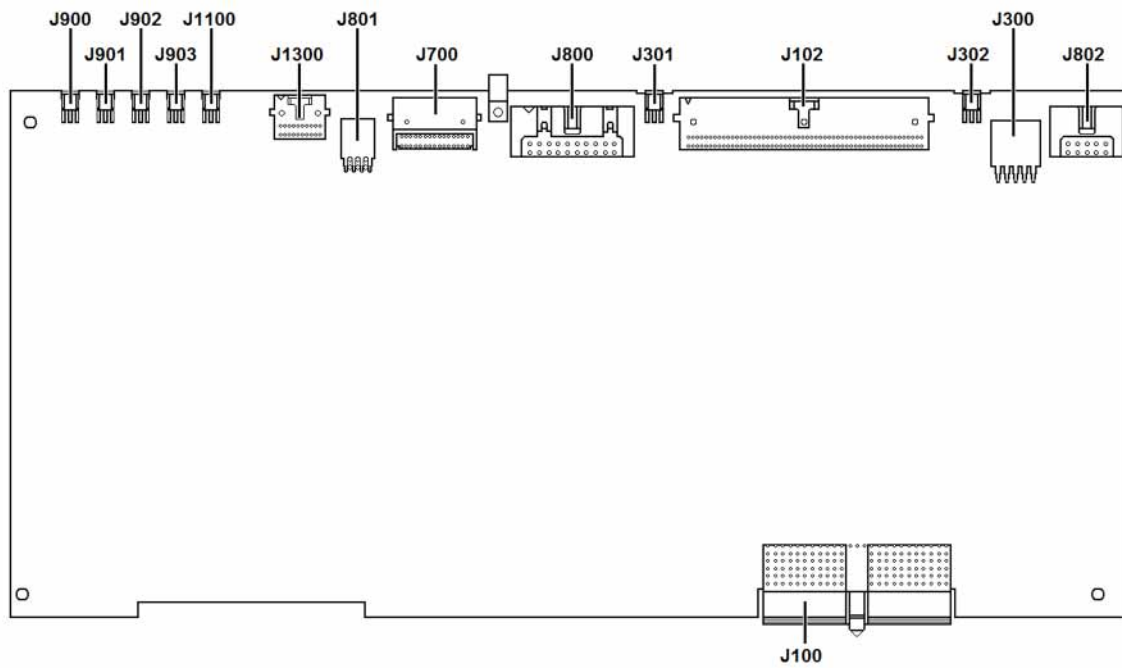
A15 Front End Control Assembly Connections

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**.

Table 8-1 A15 Enhanced Front End Controller Assembly Signals

Port	Description	To/From
J100	Bias & Control	A8 Motherboard J111
J102	Front End Assembly Control	A13 Front End J12
J300	YTF Preselector Control	A12 YTF J1
J301	Sweep Out	Reserved for future use
J302	Preselector Tune Out	n/a (test point only)
J700	A11 Dual Pre-amp, LNA & EMC Band switch Logic Out	To A11 Dual Pre-amp, LNA & EMC Band switch J2
J800	Attenuator Control	A9 & A10 Control
J801	4 Port Terminated Switch Control	4 Port Terminated Switch
J802	Not Used	n/a
J900	Narrowband IF Output	A2 Analog IF J100
J901	Wideband IF Output	A3 Digital IF J15
		A23 Limiter Prefilter J8 (Option WF1)
J902	IF Input	A13 Front End J7
J903	EXT IF IN	A13 Front End J13
J1100	AUX IF Output	Rear Panel AUX IF OUT
J1300	Switched I.F. Filter Out	To A13A2

Figure 8-1 A15 Enhanced Front End Control Assembly Connections



A15 Front End Control Assembly Troubleshooting

NOTE

Refer to [Chapter 15, “Block Diagrams.”](#).

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

Troubleshooting

The N9020A, MXA Signal Analyzer utilizes an RF front end troubleshooting board that can be used to verify some, but not all of the control circuitry on the N9048B, EMI Receiver due to the additions of front end assemblies. The troubleshooting board kit part number is N9020-60005 and includes the troubleshooting board and required interconnect cables. If you have the interconnect cables, you can order the board by itself using part number E4410-60115. When using the troubleshooting board and cables on a PXE the control logic for Input Attenuator A, Input Attenuator B, and some of the power supplies can be verified. The remaining control voltages and RF signals can be measured directly with a voltmeter, oscilloscope or functioning spectrum analyzer.

In order to verify the wide bandwidth I.F.'s and Aux I.F. output frequencies and power levels the following specialty cables and connector will be needed:

MMCX (m) to SMB (f) cable, p/n 8121-0655

MMCX (f) to MMCX (f) barrel. Huber & Suhner 31_mmcx-50-0-1/111_0E

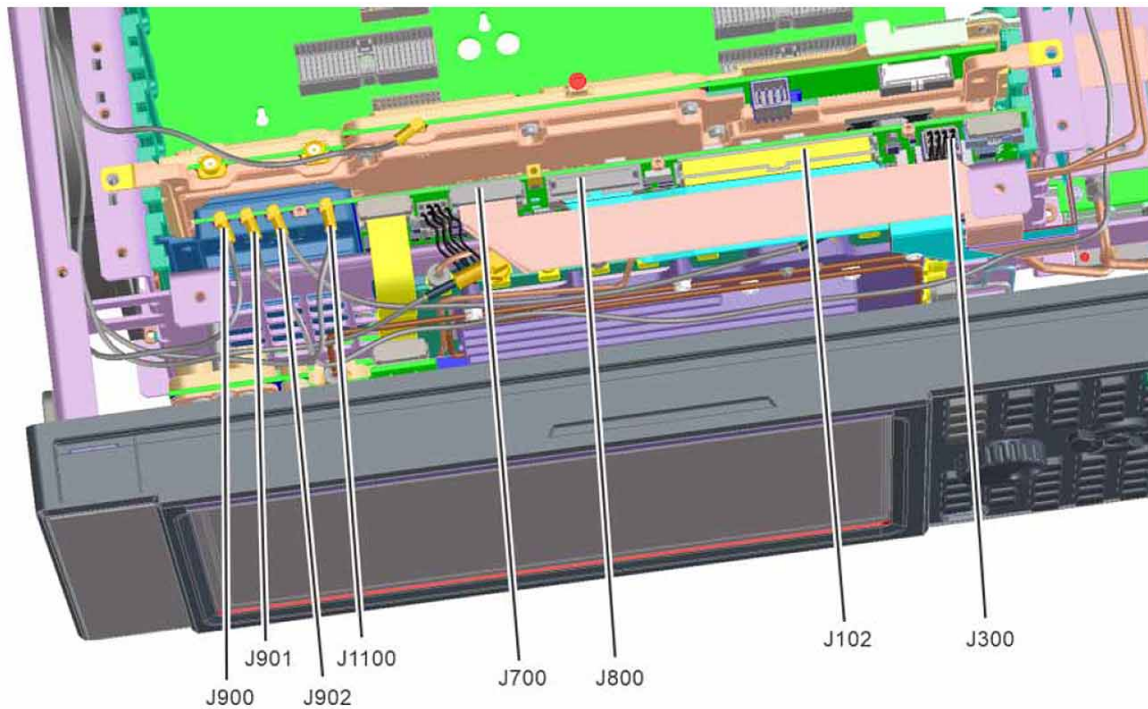
Visit: <https://www.hubersuhner.com/en>

Other standard cables and connectors need to be used to adapt to the voltmeter or the RF input of the functioning spectrum analyzer.

Verifying Input Attenuator A, Input Attenuator B, and Power Supplies

1. Turn off the instrument.
2. Disconnect ribbon cables from A15J700 and A15J800 as shown **Figure 8-2**.

Figure 8-2 Front End Cables

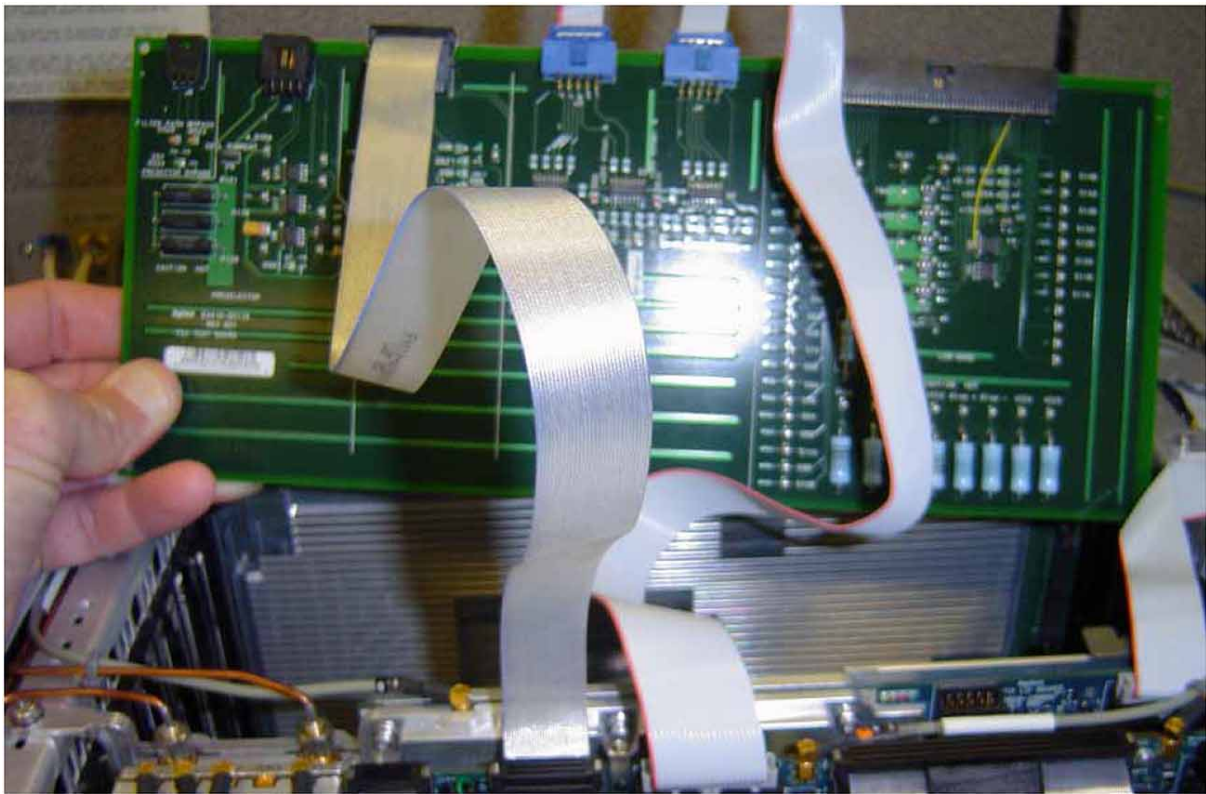


3. Connect the E4410-60115 RF Front End Troubleshooting board to the A15 Front End Control board using the E4410-60157 attenuator control cable. When connecting the attenuator control cable, E4410-60157, note that one end has two 10-pin connectors with one connector extending beyond the other. The shorter connector is marked with a red stripe. Connect the end with the 20-pin connector to A15J800. Connect the two 10-pin connectors to either J3 or J4 of the RF Front End Troubleshooting board based upon the PXE's frequency range as described below:

Table 8-2 PXE Frequency Range

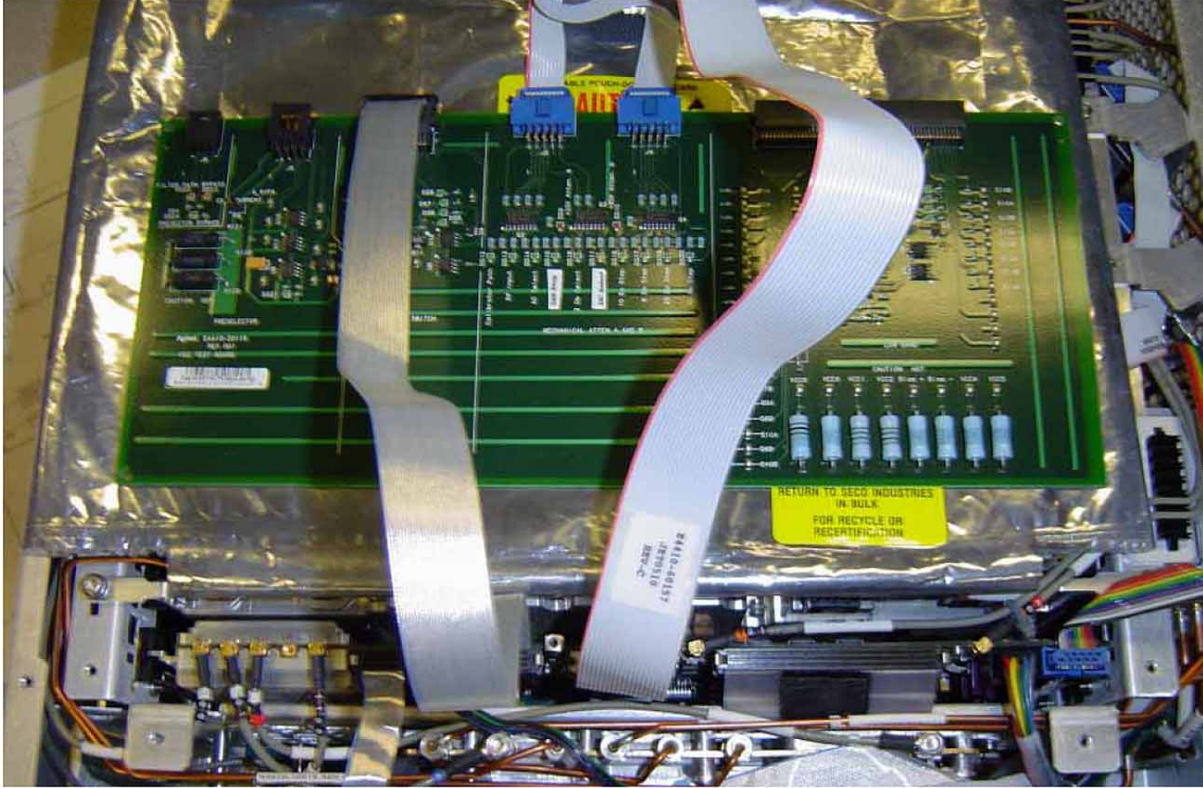
Frequency Range Option	Shorter 10-pin connector (marked with red stripe)	Longer 10-pin connector
503, 508, or 526	J3	J4
544	J4	J3

Figure 8-3 RF Front End Troubleshooting Board



4. Place the RF front end troubleshooting board on an ESD safe bag or foam to ensure nothing shorts out. See [Figure 8-4](#).

Figure 8-4 RF Front End Troubleshooting Board Placement



5. Turn the instrument on and allow it to complete its full boot up process to the Spectrum Analyzer application.

NOTE

You may notice an Align Now, All required message on the analyzer display. This can occur when the test board is connected.

6. Turn Auto Align off by pressing System, Alignments, Auto Align, Off on the analyzer.

CAUTION

Resistors on the test board can get very hot. Handle with care.

Power Supply Verification

Looking at the test board, verify power supply green LED's DS5, DS6, DS7 and DS8 located under the J2 connector are turned on. Additionally red LED's DS9 and DS10 should also be on. The power supply voltages are listed in the table below.

Table 8-3 Power Supply Voltages

LED	Power Supply
DS5	+15 VDC
DS6	+9.0 VDC
DS7	+5.2 VDC
DS8	-15 VDC
DS9	+25 VDC
DS10	+25 VDC

If any of the power supply LED's are not turned on, see [Chapter 2, “Boot Up and Initialization”](#)

Input Attenuator A Control Logic Verification (Option 503, 508, 526)

Press **AMPTD, Attenuation 0 dB** on the analyzer.

Attenuation LED's DS15-20 on the test board should be off.

When the input attenuation is changed from 0 dB to 2 dB, the 2 dB Step LED DS15 should illuminate. When the input attenuation is changed from 2 dB to 4 dB, DS15 and DS16 should be illuminated as per [Table 8-4](#).

Table 8-4 Input Attenuator A LED's

Attenuator Setting (dB)	DS15	DS16
0	OFF	OFF
2	ON	OFF
4	ON	ON

If this is incorrect, the most probable cause is the A15, Front End Control assembly.

The analyzer default setting for RF Coupling is AC mode. Verify the AC Select LED DS14 is illuminated at this time. Press **Input/Output, Input, RF Coupling, AC/DC** to DC on the analyzer. DS14 should turn off and DS11, DC Select LED should illuminate. Switch the RF Coupling back to AC. If the LED's do not illuminate correctly, the most probable cause is the A15 Front End Control Assembly.

Input Attenuator A Control Logic Verification (Option 544)

NOTE

Ignore DS11 in this procedure.

Press **System, Show, Hardware**. Look for an entry for the Low Band Switch and verify that the HW ID is 45. If the HW ID is something other than 45 (for example, 10) or there is no entry for the Low Band Switch, the analyzer will control the attenuators as if they are 26.5 GHz attenuators, not the 50 GHz attenuators that are actually installed. If this occurs, skip this procedure and troubleshoot the Low Band Switch.

Press **AMPTD, Attenuation 0 dB** on the analyzer.

Attenuation LEDs DS14 through DS20 should be off.

When the input attenuation is changed from 0 to 8 dB in 2 dB steps, LEDs DS14 through DS16 should be illuminated as per [Table 8-5](#). When the input attenuation is set to 70 dB, LEDs DS14 through DS16 should all be illuminated.

Table 8-5 Input Attenuator A LED's (Opt 544)

Attenuator Setting (dB)	DS14	DS15	DS16
0	OFF	OFF	OFF
2	OFF	ON	OFF
4	ON	ON	OFF
6	OFF	OFF	ON
8	OFF	ON	ON
70	ON	ON	ON

If this is incorrect, the most probable cause is the A15 Front End Control Assembly.

Input Attenuator B Control Logic Verification (Option 503, 508, 526)

Press **AMPTD, Attenuation 6 dB** on the analyzer and verify the 6 dB Step LED DS17 is illuminated. Change to the input attenuation settings found in **Table 8-6** and verify the proper LED's illuminate on the Front End Troubleshooting board according to **Table 8-6**.

Table 8-6 Input Attenuator B LED's

Attenuator Setting (dB)	DS20 30 dB Step LED	DS19 20 dB Step LED	DS18 10 dB Step LED	DS17 6 dB Step LED
10	OFF	OFF	ON	OFF
16	OFF	OFF	ON	ON
20	OFF	ON	OFF	OFF
30	ON	OFF	OFF	OFF
40	ON	OFF	ON	OFF
50	ON	ON	OFF	OFF
60	ON	ON	ON	OFF
66	ON	ON	ON	ON

If the LED's illuminate correctly, the switch control logic for the input attenuators from the A15 Front End Control Assembly is correct. If the LED's are not illuminating as expected, the most probable cause is the A15 Front End Control Assembly.

Set the input attenuator back to 10 dB by pressing **AMPTD, Attenuation, 10 dB** on the analyzer.

Input Attenuator B Control Logic Verification (Option 544)

Press **AMPTD, Attenuation 10 dB** on the analyzer and verify that the 10 dB Step LED DS18 is illuminated.

Table 8-7 Input Attenuator B LED's (Opt 544)

Attenuator Setting (dB)	DS17	DS18	DS19
10	OFF	ON	OFF
20	OFF	OFF	ON
30	ON	OFF	OFF
40	ON	ON	OFF
50	ON	OFF	ON
60	ON	ON	ON
70	ON	ON	ON

If the LEDs illuminate correctly, the switch control logic for the input attenuators from the A15 Front End Control assembly is correct. If the LEDs are not illuminating as expected, the most probable cause is the A15 Front End Control Assembly.

Set the input attenuator back to 10 dB by pressing **AMPTD, Attenuation, 10 dB** on the analyzer.

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 is 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:

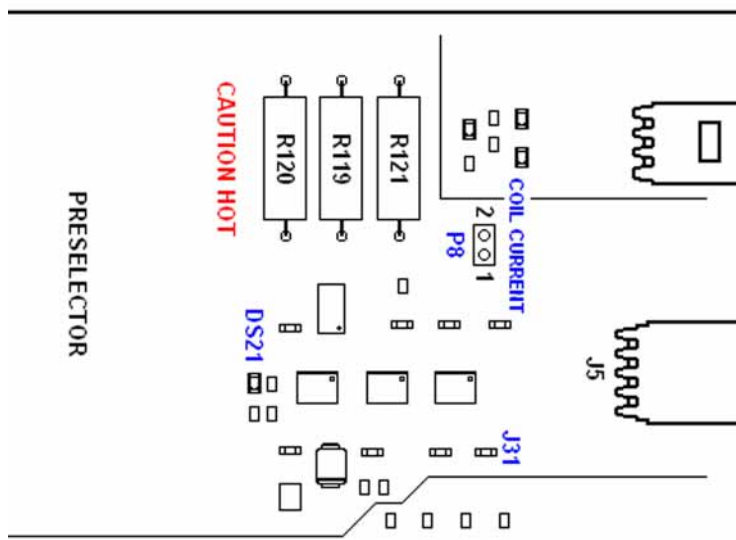
1. Serial Communication for Assembly Identification
2. Supply Voltage for Serial Communications
3. Main Coil Current

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 8-5**.

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 8-5 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 J300 as shown in [Figure 8-2](#).
3. Connect the A12 YTF Preselector Control cable from J300 to the Front End Control Test board J5 as shown in [Figure 8-5](#).
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 8-5](#).

If the test point voltage measures +29.5V ($\pm 0.5V$) 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 8-5](#).

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 is 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:

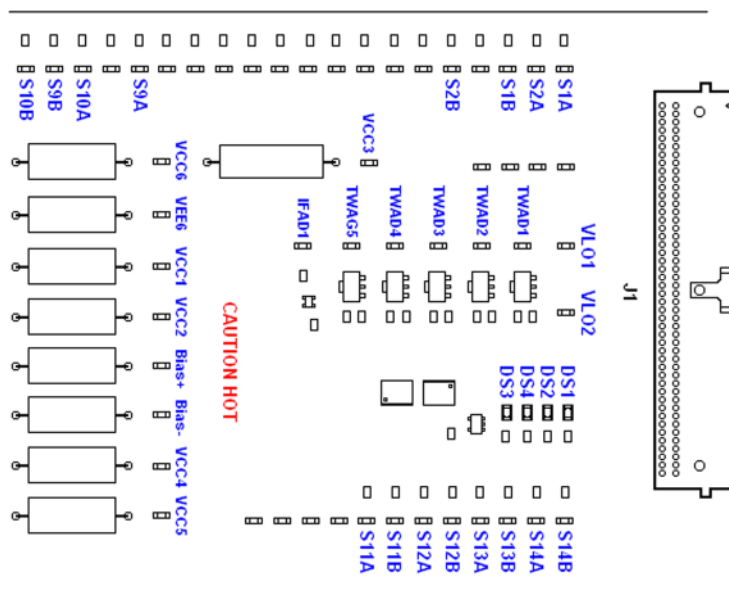
1. Supply Voltages
2. Serial Communication for Assembly Identification
3. Low Band Preamp Control
4. Frequency Band Selection
5. Amplifier Bias

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 8-6**.

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 8-6 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 J102 as shown in **Figure 8-2**.
3. Connect the A13 RF Front End Assembly Control cable from J102 to the Front End Control Test board J1 as shown in **Figure 8-6**.
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 8-6**, 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 ($\pm 0.5V$) 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, Signal Path, 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 ($\pm 0.5V$) 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, Signal Path, 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 ($\pm 0.5V$) 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 Preamplifier 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.

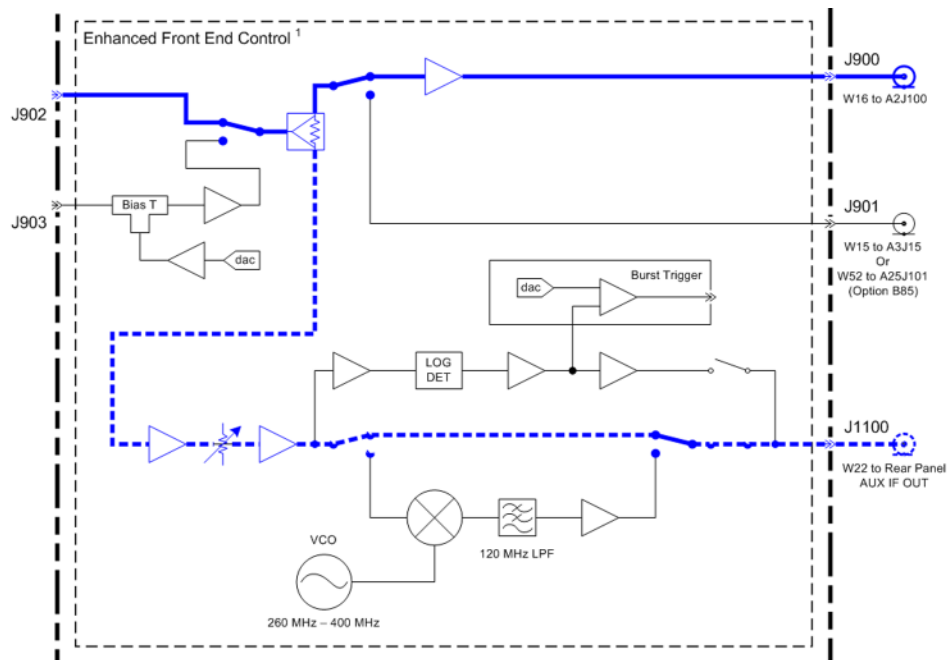
With the current configuration of the PXE there is no time other than during the instrument internal alignments that the instrument uses the signal path to the A3 Digital IF assembly. So this procedure will verify the correct signal routing to the A2 Analog IF output and the rear panel AUX IF output.

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. 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 8-7**.

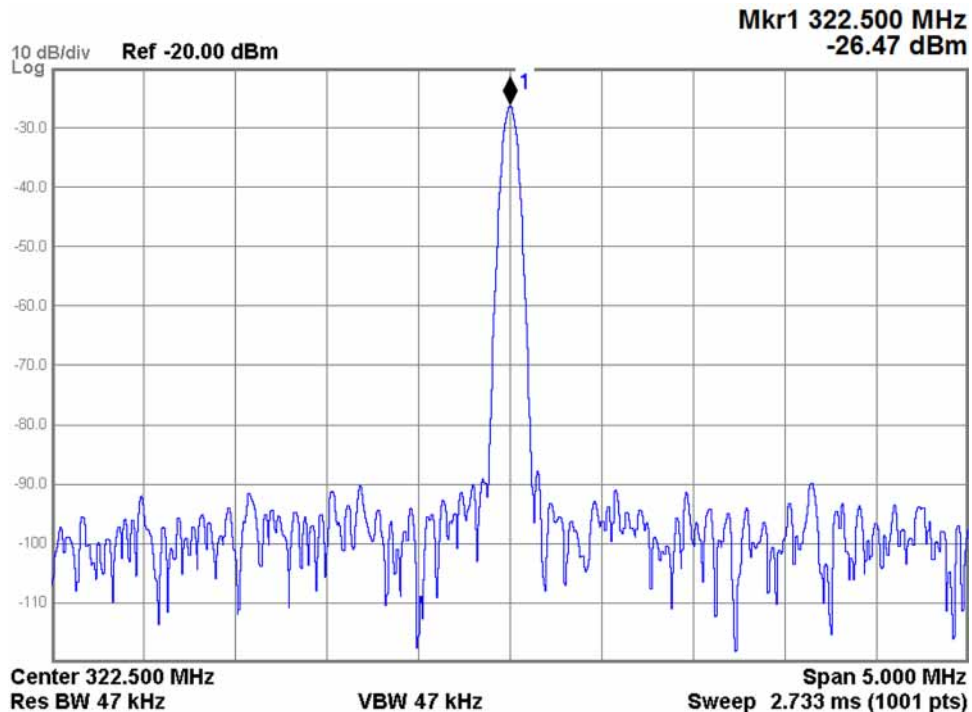
Figure 8-7 322.5 MHz IF Switching to A2 Analog IF



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 8-2**.
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 8-8**, +/- 3 dB.

Figure 8-8 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 8-2](#). It should be at approximately the same level shown in [Figure 8-8](#).

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.

AUX IF Output (Option CR3)

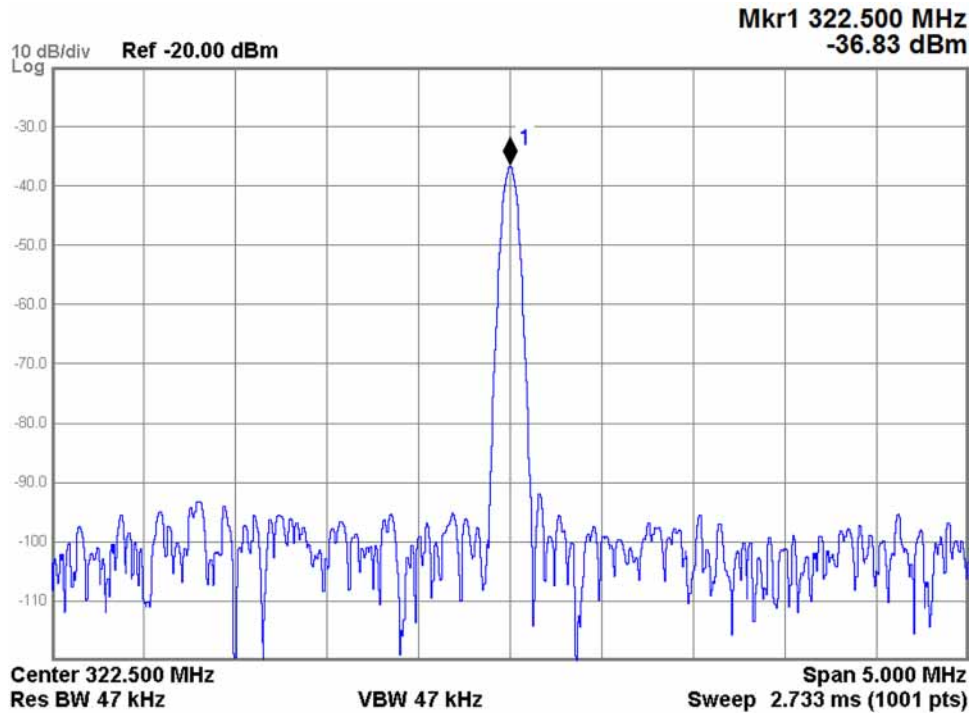
If the instrument is equipped with Option CR3, Auxiliary IF Output, the A15 Enhanced Front End Control assembly will provide the splitting of the IF signal and routing of it to the AUX IF OUT rear panel connector. This optional signal path can be seen in the dashed blue line in **Figure 8-7**.

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, Aux IF Out, Second IF**.
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 8-9**, +/- 3 dB.

Figure 8-9 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, Aux IF Out, Second IF**.
18. Disconnect W22 from A15 J1100 as shown in **Figure 8-2**.

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 8-9**, +/- 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 8-2**. It should be approximately 10 dB higher than the level shown in **Figure 8-9**.

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.

Front End Control
A15 Front End Control Assembly Troubleshooting

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:

A16 Reference Description

A16 Reference Troubleshooting

A16 Reference Description

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.

The Reference assembly must be replaced as a single assembly, although it is constructed of two boards, the A16 Reference Main board and A16A1 Reference Daughter board. 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 SENSE:INT to SENSE:EXT.

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 reference signals phase noise 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).

Table 9-1 lists all the reference signals provided by the A16 Reference Assembly.

Table 9-1 A16 Reference Assembly Signals

Signal Description	From Location	Originates From	To Location	Purpose
External Reference Input (1 to 50 MHz, -5 dBm to +10 dBm)	Input from User	n/a	A16704	Phase Lock analyzer with user-provided reference.
10 MHz Out DIF	A16J710	10 MHz Reference	Not used	Reserved for future use
50 MHz Align Signal	A16J701	100 MHz VCXO/2	A21A1J4	50 MHz Low band alignment signal
4800 MHz Align Signal	A16J701	2.4 GHz VCXO x 2	A21A1J4	4.8 GHz High band alignment signal
50 MHz Ecal/300 MHz Comb Output	A16J705	100 MHz VCXO/2, 100 MHz VCXO x 3	A13J6	50 MHz Cal Signal or 300 MHz Comb for wideband IF phase linearity
100 MHz LO Synth	A16J706	100 MHz VCXO	Not used	Reserved for future use
100 MHz Ref A	A16J707	100 MHz VCXO	Not used	Reserved for future use
100 MHz Ref B	A16J716	100 MHz VCXO	A3J14	Frequency reference for A3 Digital IF (DIF) assembly. Divided by 10 on DIF to provide 10 MHz OUT on rear panel.
100 MHz Ref C	A16J717	100 MHz VCXO	Not used	Reserved for future use
300 MHz LO AIF	A16J711	100 MHz VCXO x 3	A2J300	Used as 3rd LO on A2 Analog IF (AIF) assembly
2.4 GHz Ref	A16J718	2.4 GHz VCXO	A26J1	Reference for A26 Wideband Digital IF (WDIF)
4.8 GHz 2nd LO	A16J702	2.4 GHz VCXO x 2	A13J1	2nd LO for A13 Front End assembly, downconvert low band 1st IF to 322.5 MHz 2nd IF
4.8 GHz 1st LO Ref	A16J703	2.4 GHz VCXO x 2	A14J200	4.8 GHz reference for FRAC-N

A16 Reference Troubleshooting

If the A16 Reference assembly is suspect, verify the reference signals, local oscillator output frequencies, and power levels as per **Table 9-3** using a functioning spectrum analyzer. In order to measure the signals, you will need to remove the top brace. Refer to the **“Top Brace and Power Supply Bracket”** replacement procedure for details.

Figure 9-1 identifies the input and output connectors on the A16 Reference Assembly.

Table 9-3 lists the expected frequency and power levels of signals at the A16 Reference assembly output connectors.

If the outputs measure correctly, the A16 Reference Assembly is functioning correctly. If not, the Reference Assembly is the most probable cause provided the power supply is operating correctly. Refer to **“A7 Midplane Board Assembly Troubleshooting”** if the power supplies are suspect.

Figure 9-1 A16 Reference Assembly

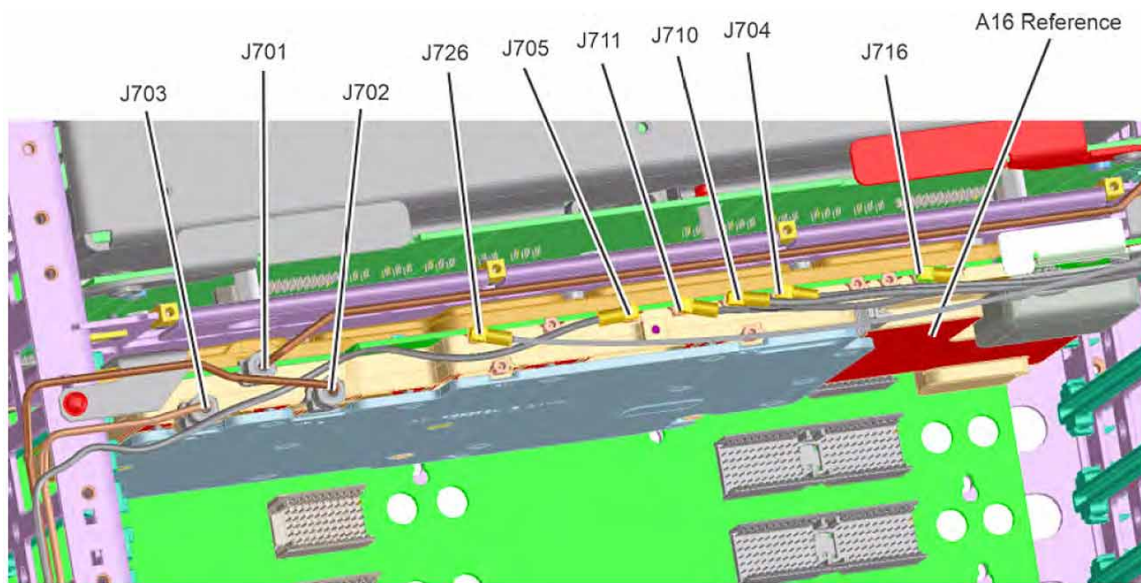


Table 9-2 A16 Reference Assembly Signals Measurement Details

Signal Description	Signal Location	Expected Frequency (MHz)	Expected Power Level (dBm)	Special Instrument Conditions	Figure
50 MHz Ecal Out	A16J705	50 MHz	–26 to –29 dBm typical	While monitoring A16J705 output, place functioning spectrum analyzer in Max Hold. Press System, Alignments, Align Now, All on PXE.	Figure 9-2
4.8 GHz 2nd LO Out	A16J702	4800 MHz	+11 dBm	Press Freq, 1 GHz, Span, Zero Span on PXE	Figure 9-3
4.8 MHz 1st LO Ref Out	A16J703	4800 MHz	+3 dBm	Press Freq, 50 MHz, Span, Zero Span, Meas Setup, Advanced, PhNoise Opt, Best Close in PNoise on PXE	Figure 9-4
50 MHz Ref Out	A16J701	50 MHz	–25 dBm	Press Input/Output, RF Calibrator, 50 MHz on PXE	Figure 9-5
4.8 GHz Ref Out	A16J701	4800 MHz	–28 dBm	Press Input/Output, RF Calibrator, 4.8 GHz on PXE	Figure 9-6
2.4 GHz Ref Out	A16J718	2400 MHz	+10 dBm		Figure 9-7
300 MHz LO AIF	A16J711	300 MHz	+10 dBm		Figure 9-8
100 MHz Ref Output	A16J706	100 MHz	+13 dBm		Figure 9-9
100 MHz Ref B Out	A16J716	100 MHz	+13 dBm		Figure 9-10

Figure 9-2 50 MHz Ecal Out

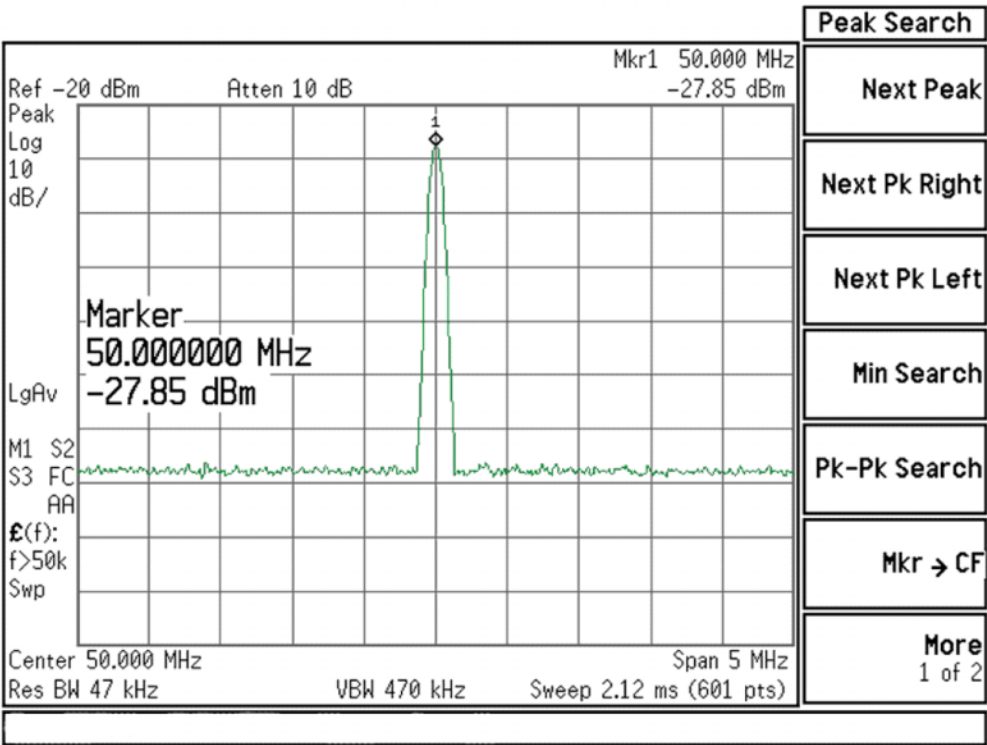


Figure 9-3 4.8 GHz 2nd LO Out

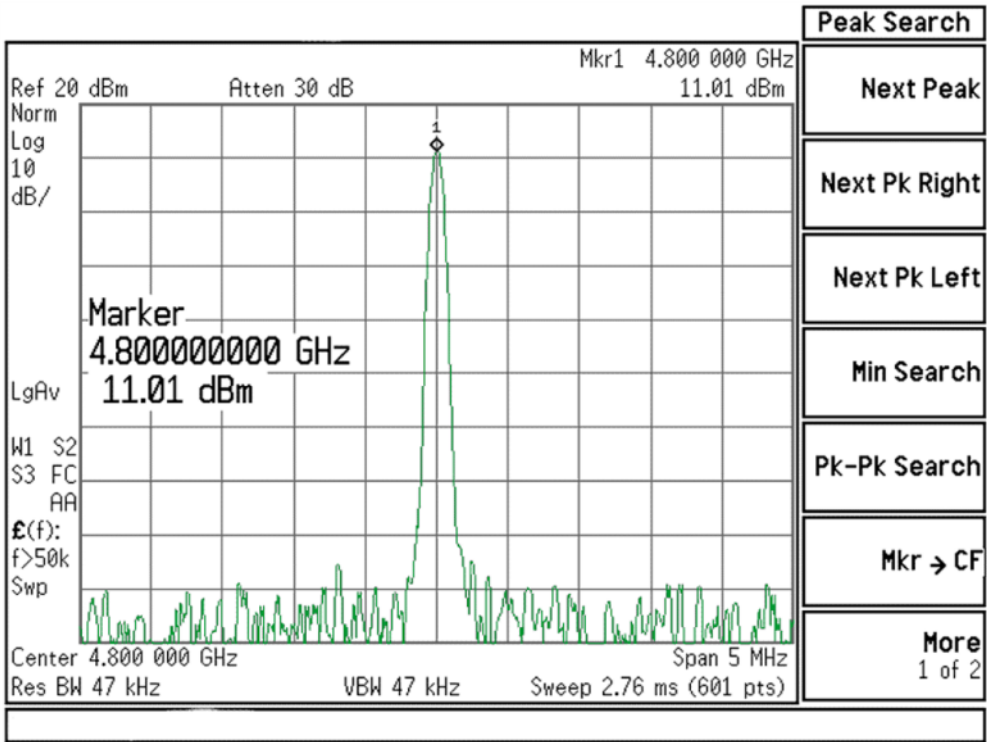


Figure 9-4 4.8 GHz 1st LO Ref Out

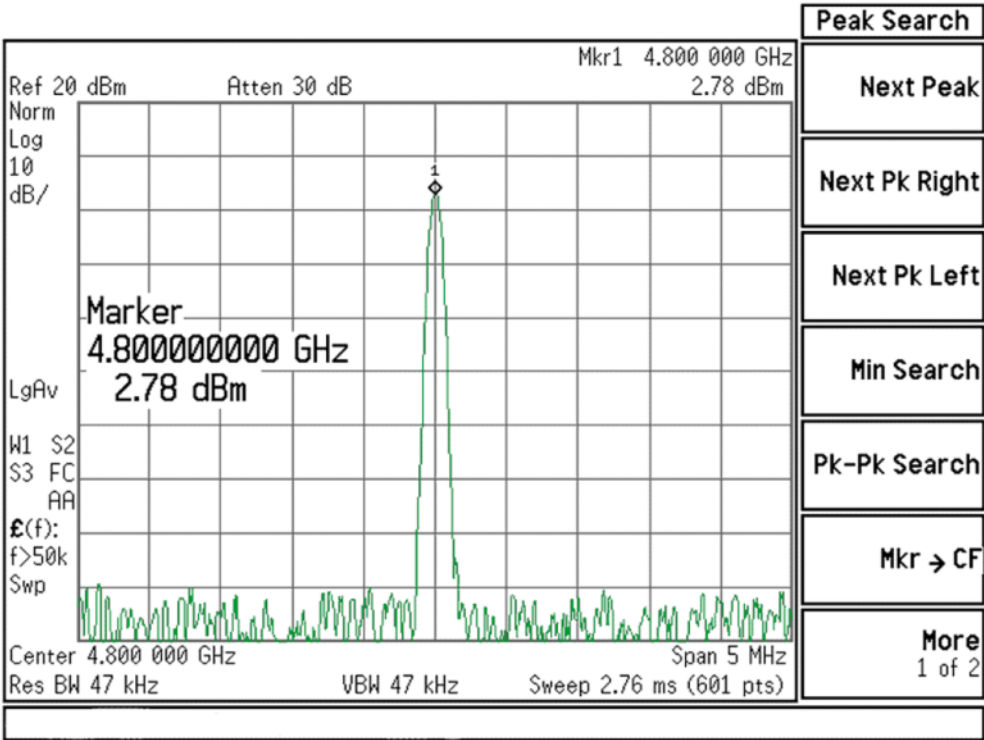


Figure 9-5 50 MHz Ref Out

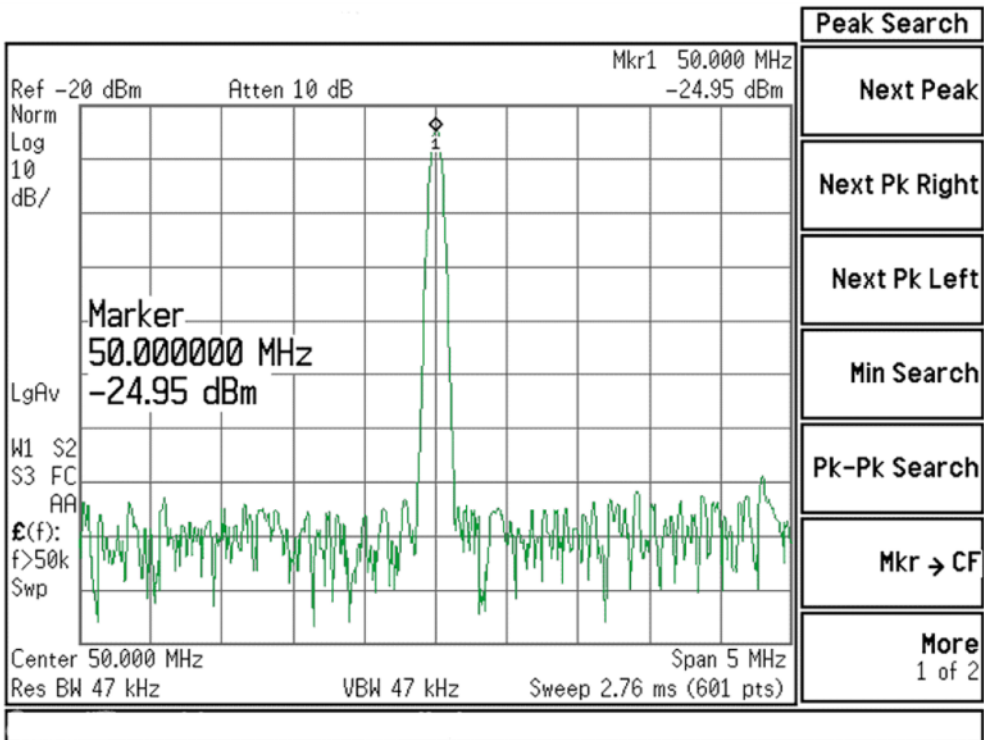


Figure 9-6 4.8 GHz Ref Out

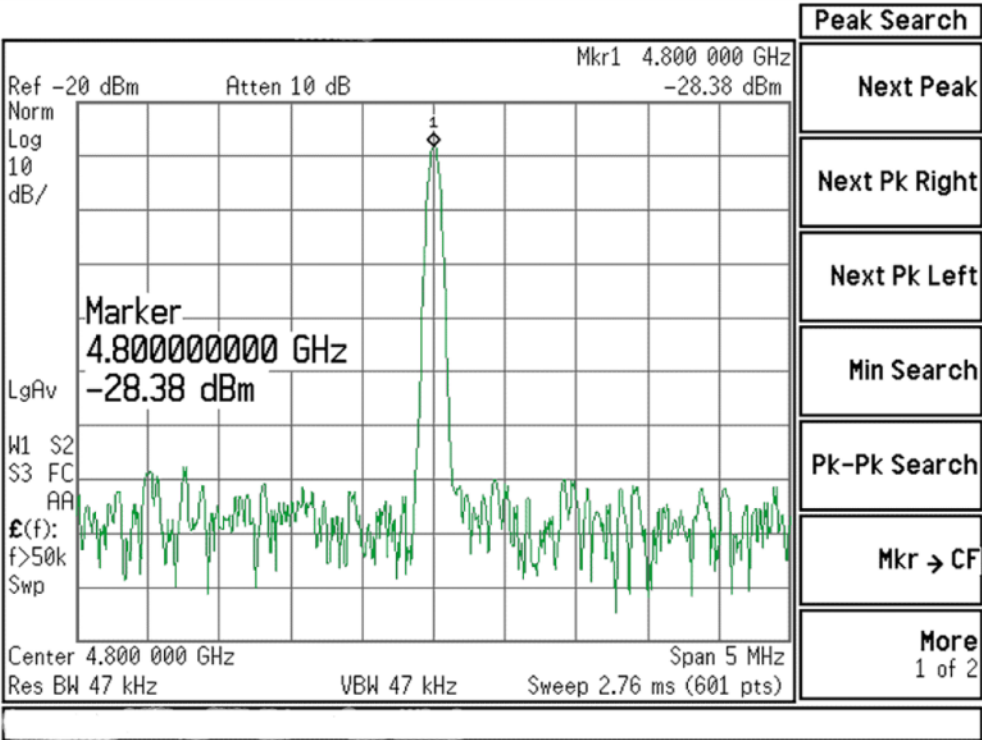


Figure 9-7 2.4 GHz Ref Output

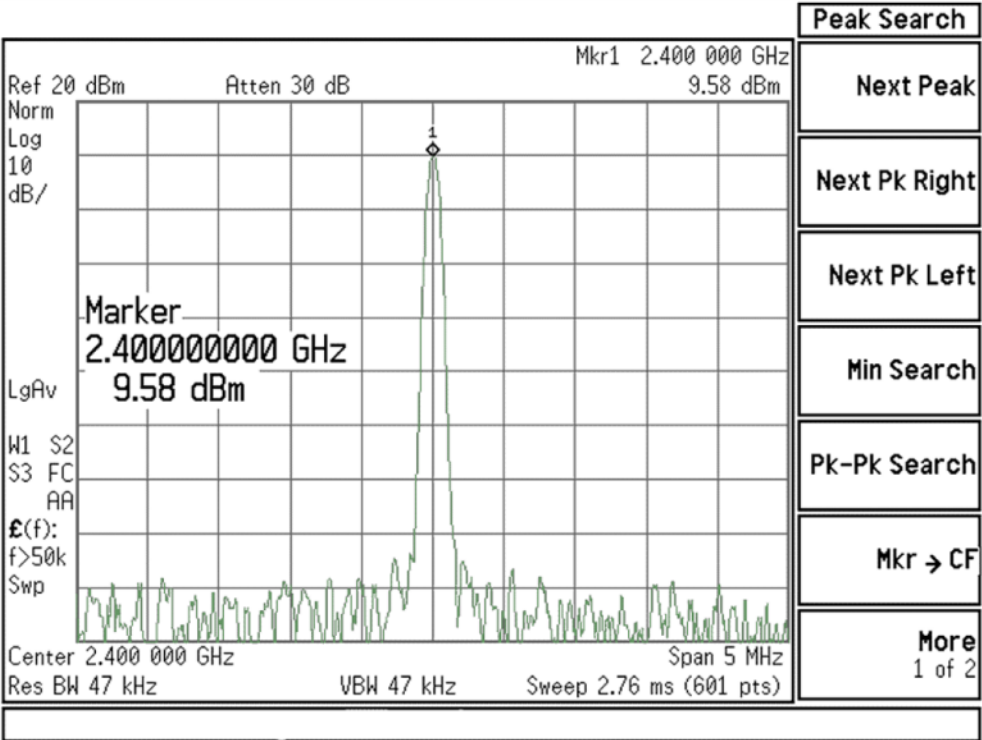


Figure 9-8 300 MHz LO AIF

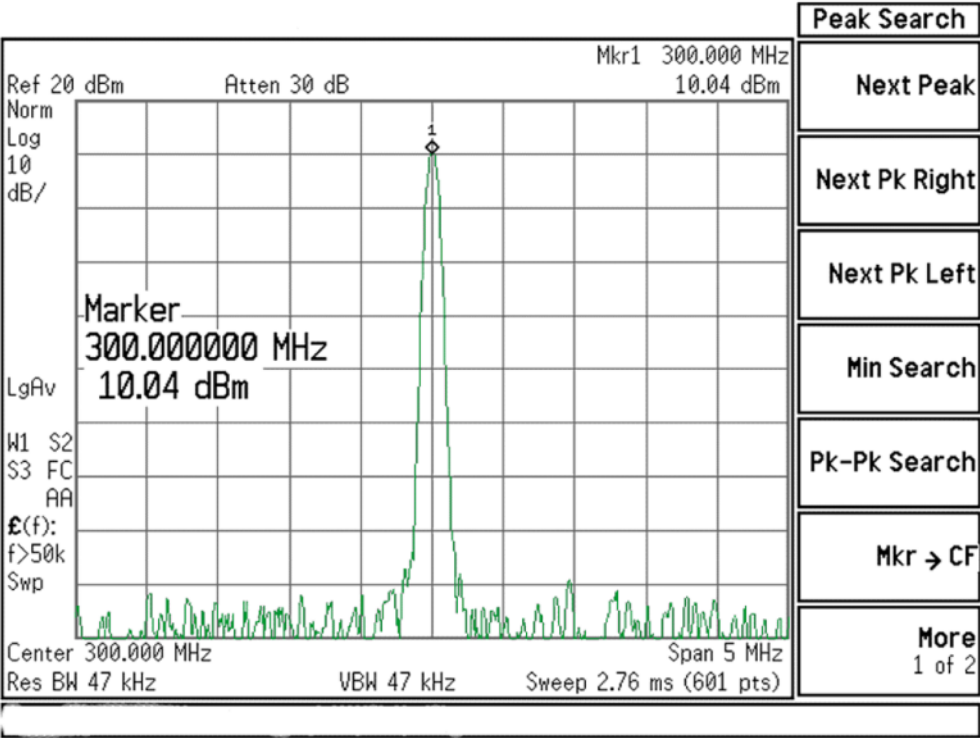


Figure 9-9 100 MHz Ref Out

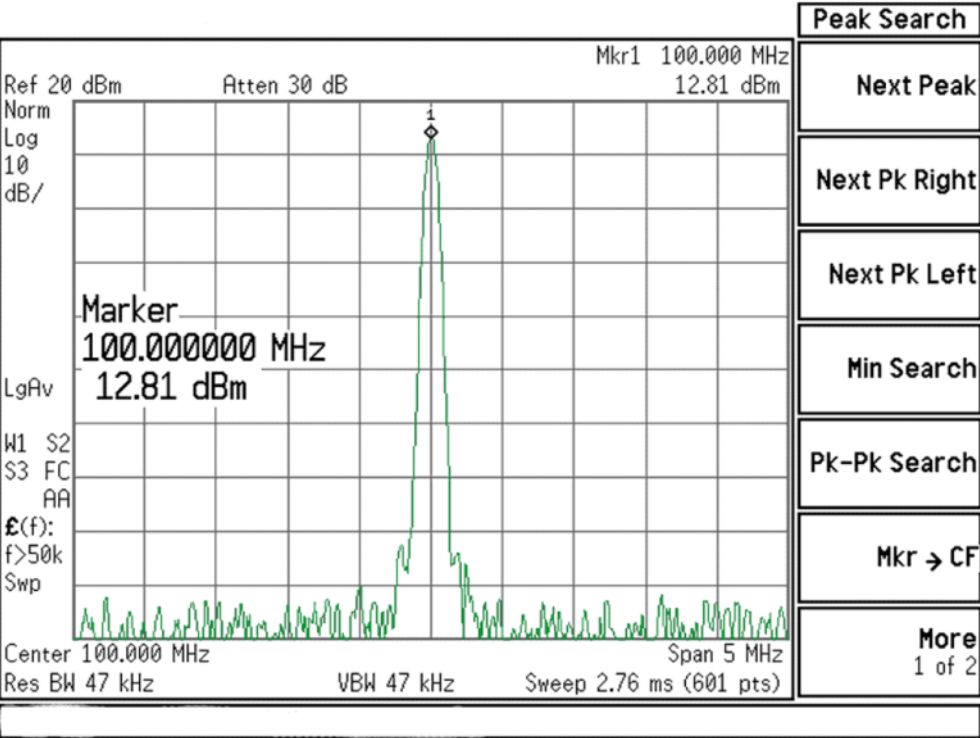
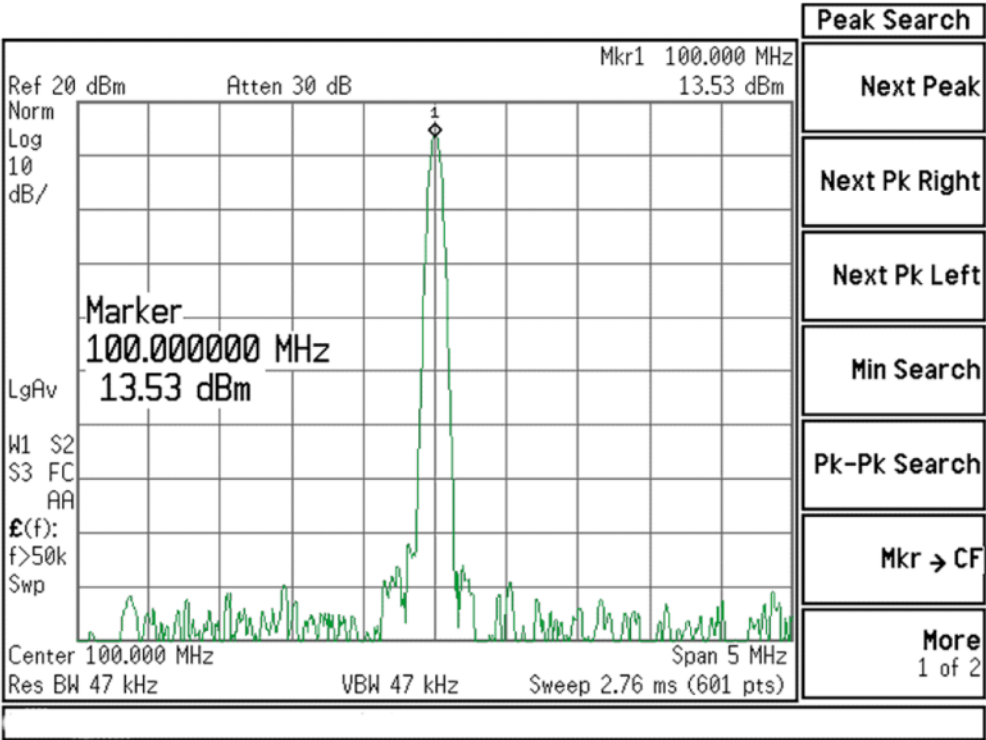


Figure 9-10 100 MHz Ref B Out



A16 Reference Diagnostic LEDs

There are two sets of diagnostics LEDs on the A16 Reference Assembly. Six LEDs are on the right side of the A16 Reference Main board and four LEDs are on the A16A1 Reference Daughter board. Refer to **Figure 9-11**.

Figure 9-11 A16 Reference LEDs

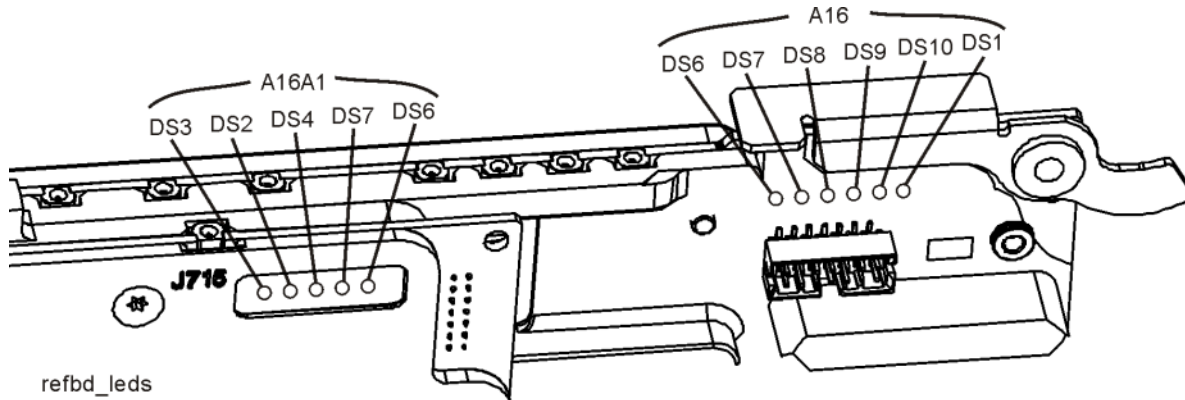


Table 9-3 lists the diagnostic LEDs and what their status indicates. A blinking red LED typically indicates that an unlevelled condition exists. The number of blinks indicates what circuitry is unlevelled.

Table 9-3 A16 Reference Assembly Diagnostic LEDs

LED Number	Color	Description	Status
A16DS1	Yellow	When Program Code is loading	On = Loading code from EEPROM 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_AIF Unleveled Off = Normal (Locked)
A16DS7	Green	Is the 100 MHz PLL Unlocked?	On=Normal (locked) Off=Fault (unlocked)
A16DS8	Green	Is the 100 MHz VCXO working?	On=Yes (alive) Off=Fault (not alive)
A16DS9	Green	Is Internal 10 MHz Reference On?	On=Yes (enabled) Off=No (disabled; Ext Ref Mode)
A16DS10	Green	Is the +15V Standby supply working?	On=Yes (+15V Standby supply is on) Off=No
A16A1DS2	Red	Is 2.4 GHz Ref Signal Unlevel?	On=2.4 GHz Ref Signal Unlevel Off=Normal

Table 9-3 A16 Reference Assembly Diagnostic LEDs

LED Number	Color	Description	Status
A16A1DS4	Red	Is 4.8 GHz LO Unlevel?	On=4.8 GHz LO Unlevel Off=Normal
A16A1DS5	Green	Is the 2.4 GHz VCXO working?	On=Yes (alive) Off=Fault (not alive)
A16A1DS6	Yellow	When Program Code is loading	On=Loading code from EEPROM Off=Ready

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.

The following sections are found in this chapter:

- A2 Analog IF Assembly Description on page 274**
- A2 Analog IF Troubleshooting on page 279**
- A3 Digital IF Assembly Description on page 290**
- A3 Digital IF Assembly Theory of Operation on page 291**
- A3 Digital IF Troubleshooting on page 293**

A2 Analog IF 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 IF Assembly. The Analog IF 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 contains one of the two burst carrier trigger (BCT) circuits for performing mobile communication measurements. The BCT on the A2 assembly is relatively narrowband. The other BCT circuit is part of the IF MUX on the A15 Front End Control Assembly and has a much wider bandwidth. The output of the A2 assembly is a filtered 22.5 MHz signal that goes to one of the two ADCs on the A3 Digital IF Assembly.

Inputs to the A2

- 322.5 MHz signal (from A15 Front End Control Assembly)
- LO Input (300 MHz signal from A16 Reference Assembly)
- 22.5 MHz Cal Comb Signal (from the A3 Digital IF Assembly)

Outputs from the A2

- 22.5 MHz signal (to A3 Digital IF Assembly)
- RF Trigger Detector (to A3 Digital IF 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.

IF 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

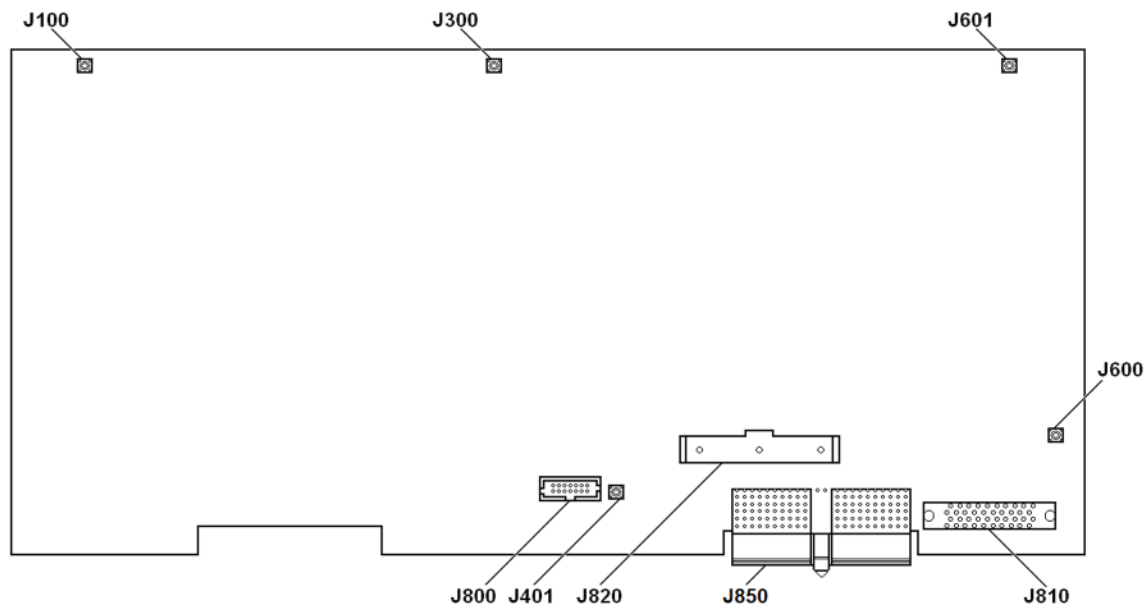
A2 Analog IF Assembly Connections

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 IF 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.

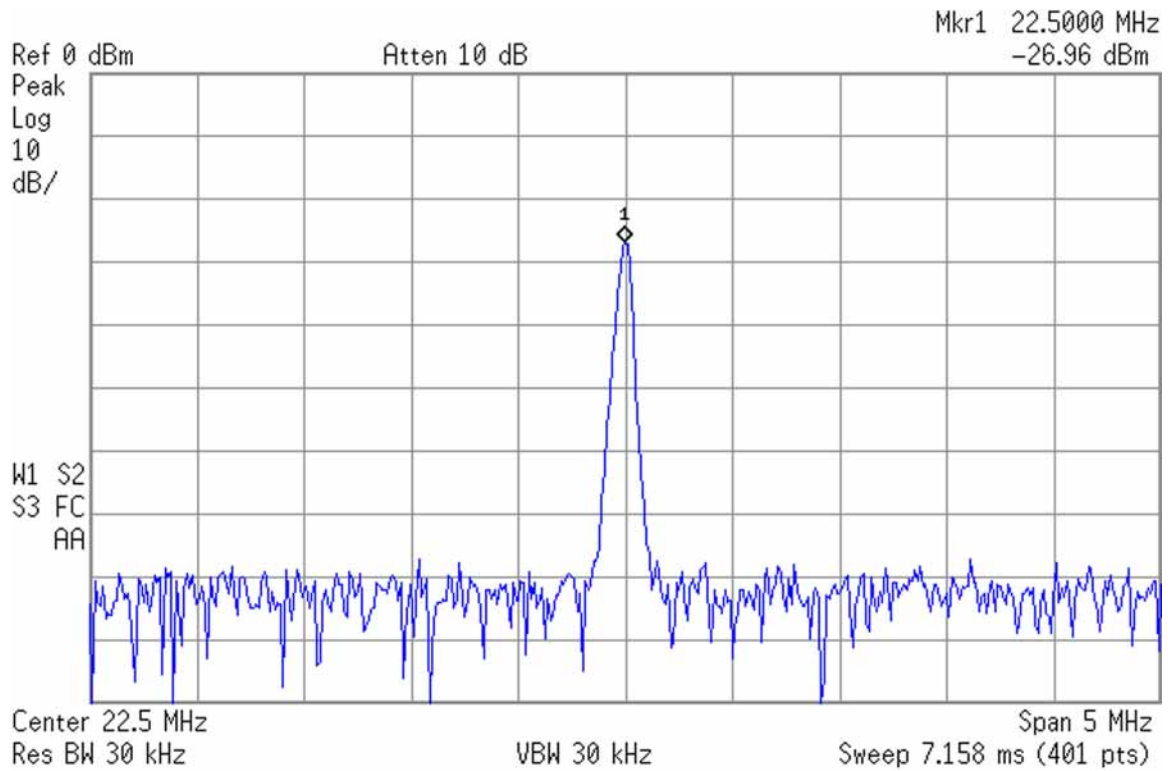
-
2. Turn the instrument on and allow it to complete its boot up process.
 3. Remove W17 from the A3 Digital IF assembly J19 as shown in [Figure 10-2](#).

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, Advanced, 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](#).

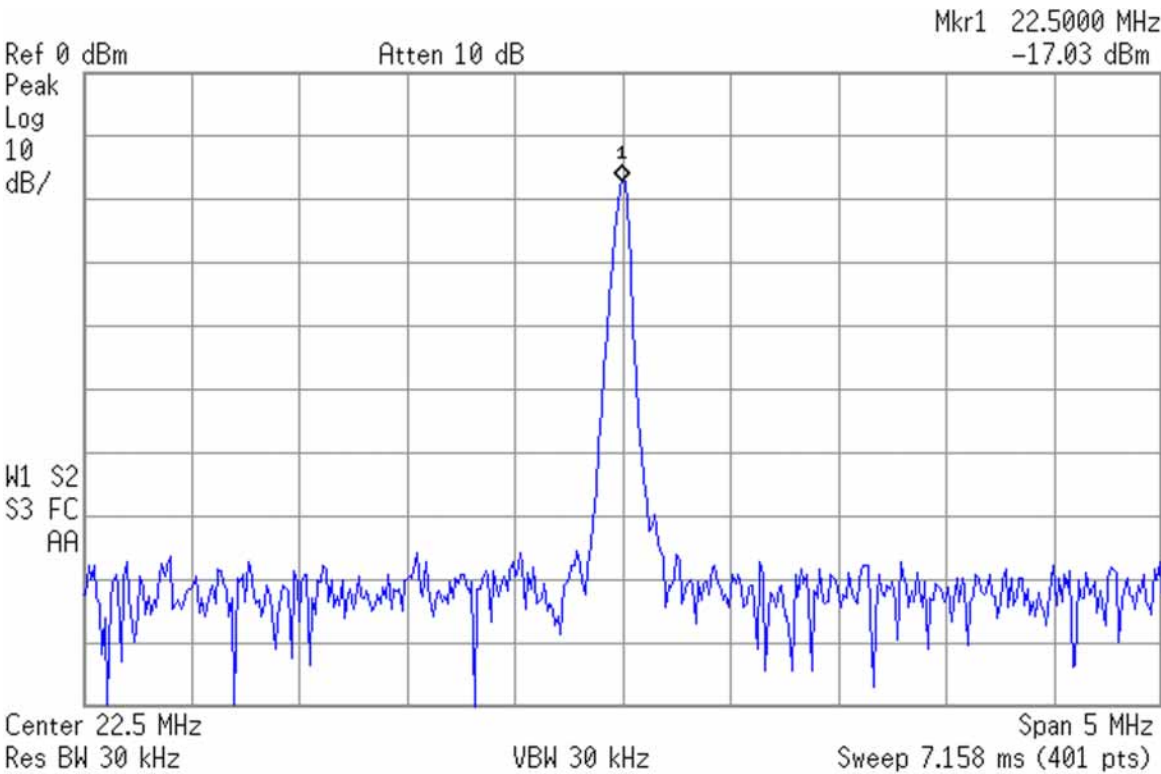
Figure 10-3 A2 Analog IF 22.5 MHz IF Output with Low Gain



12.Set the step gain to High by pressing **Meas Setup, Advanced, 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

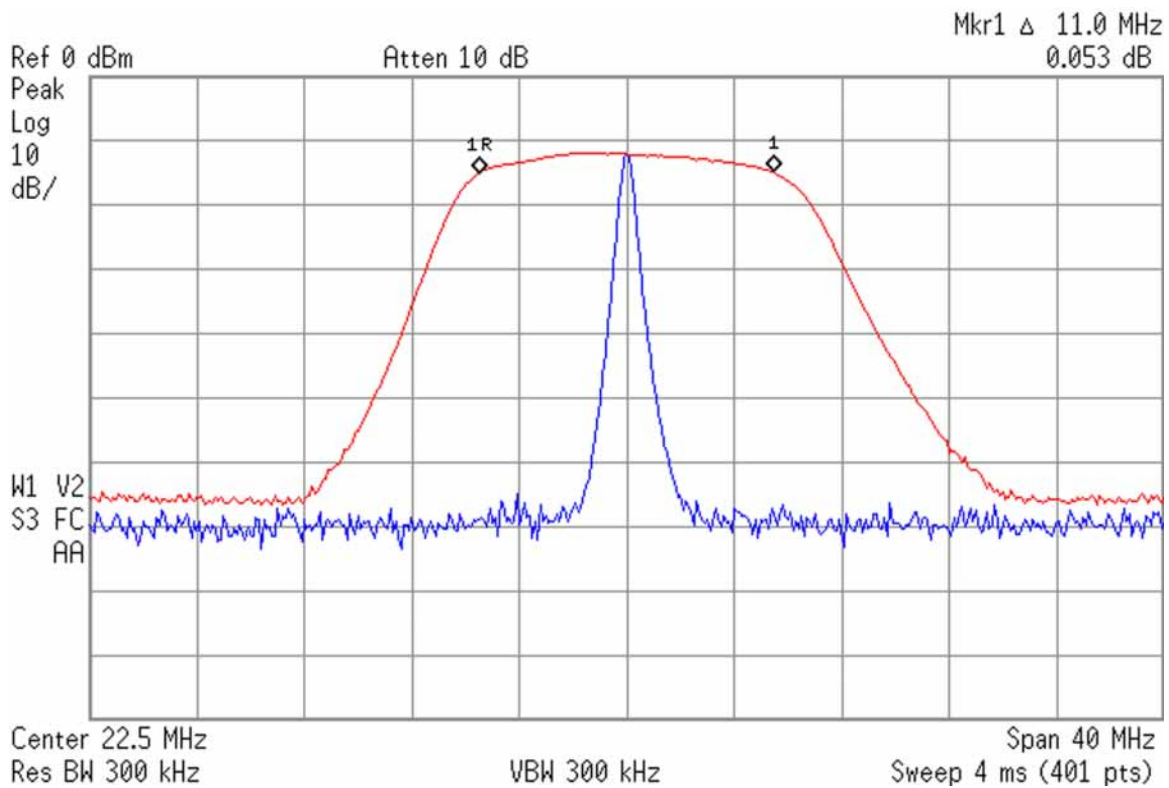


Figure 10-6 A2 Analog IF 1 MHz Filter Path Passband Shape

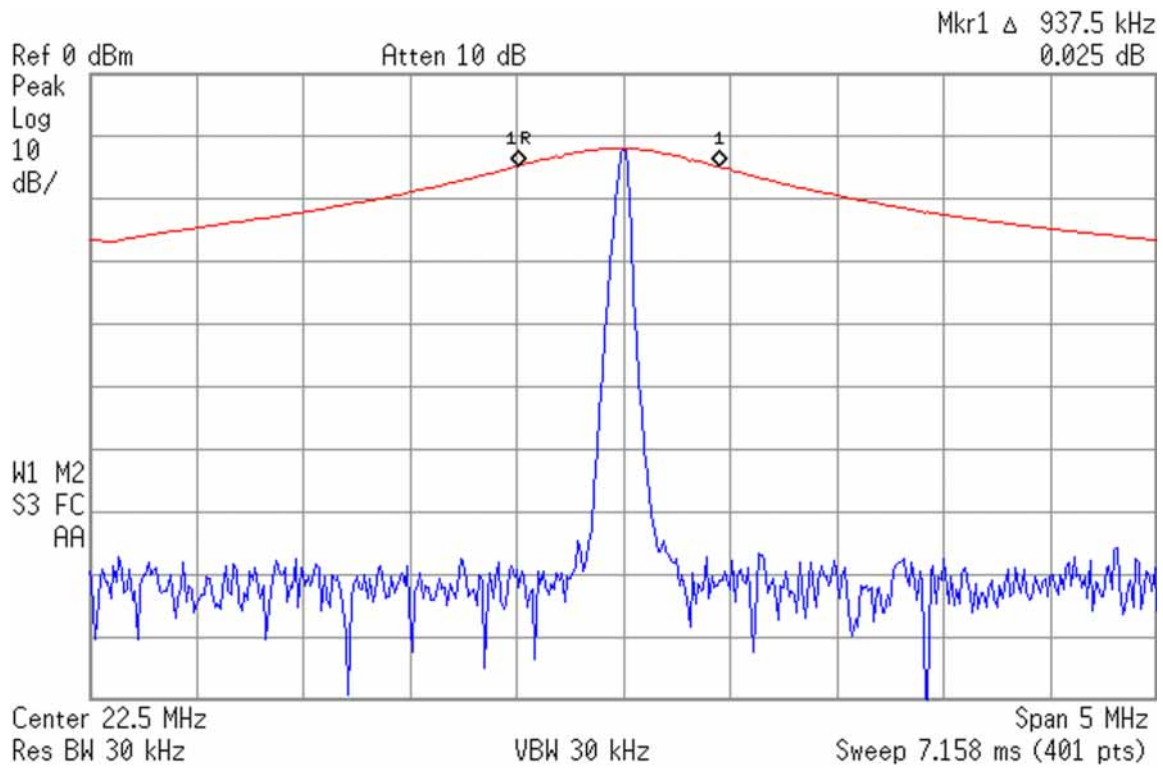


Figure 10-7 A2 Analog IF 300 kHz Filter Path Passband Shape

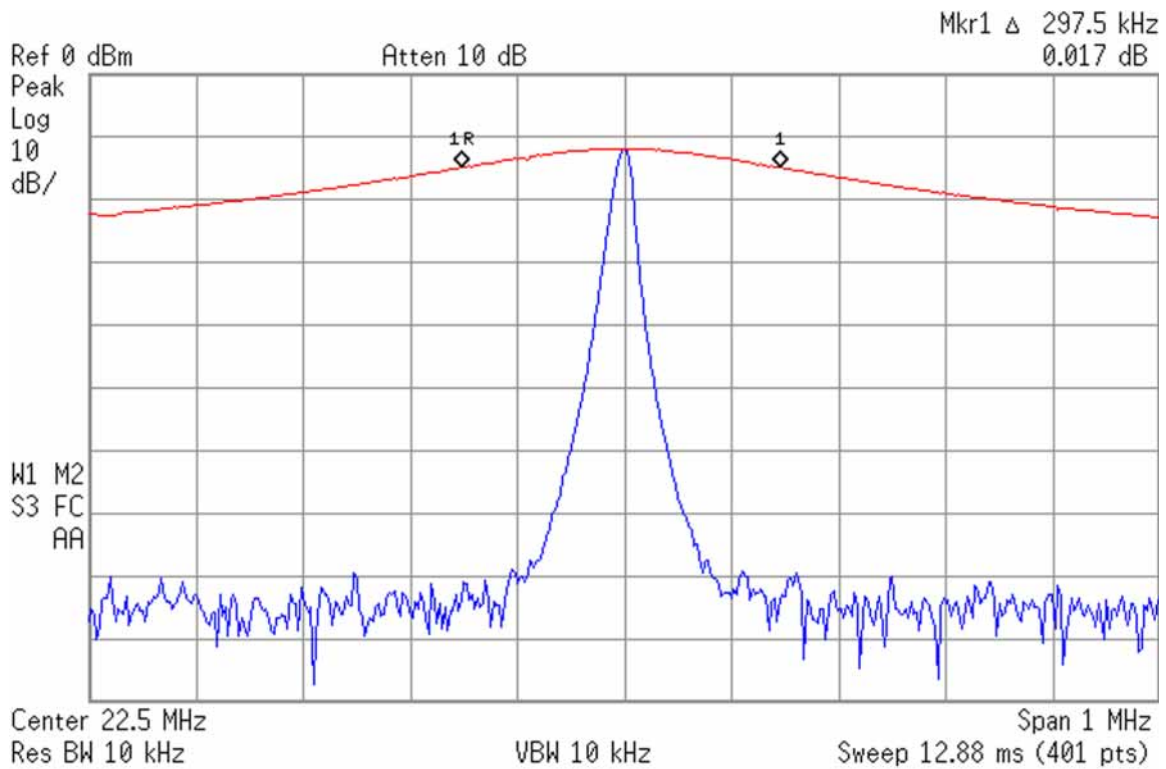


Figure 10-8 A2 Analog IF 75 kHz Filter Path Passband Shape

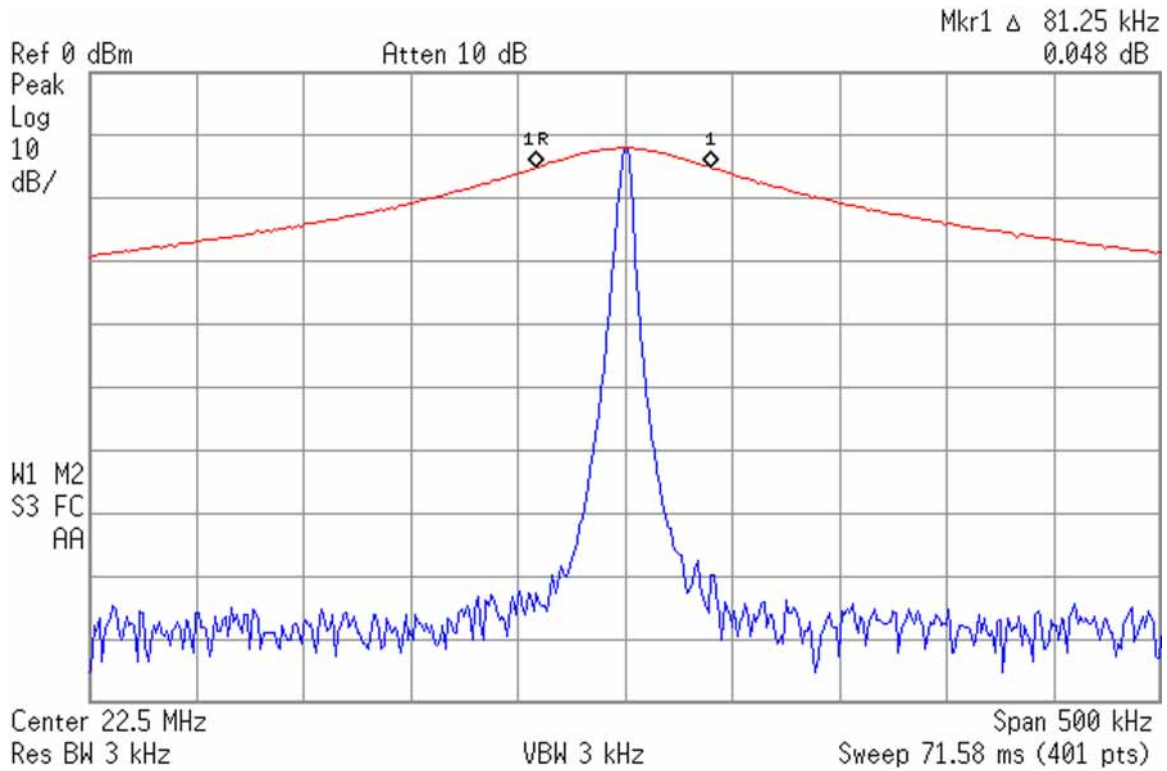
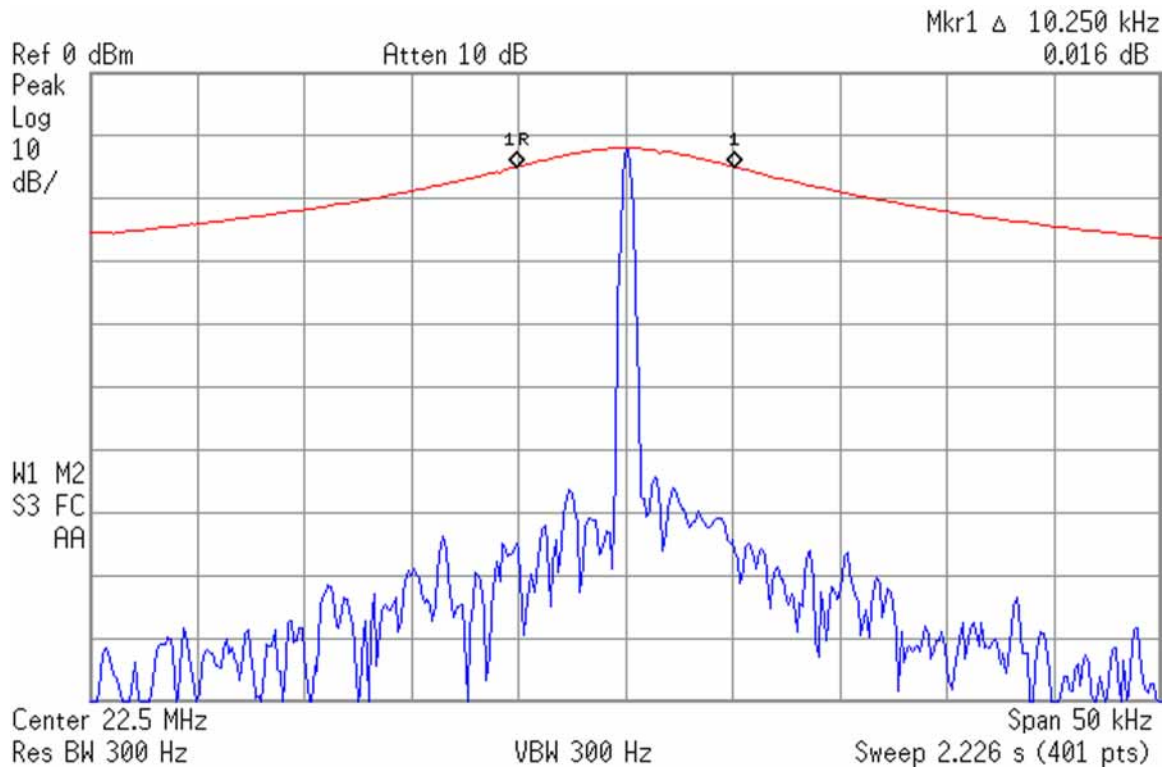


Figure 10-9 A2 Analog IF 10 kHz Filter Path Passband Shape



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.

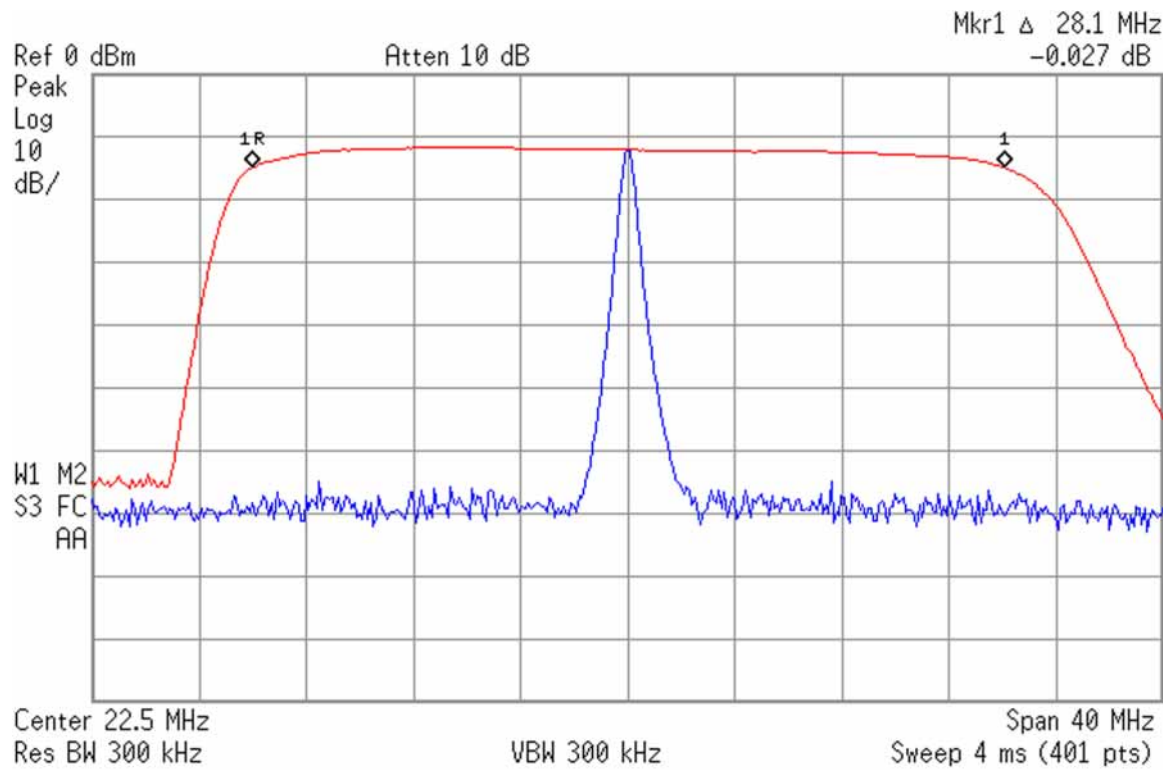
1. Remove the instrument dress cover (MP24) and top brace (MP10). Refer to **Chapter 18, "Assembly Replacement Procedures."** for instructions on removing these covers.

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, Filter, 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 IF Assembly Description

The A3 Digital IF has circuitry that is needed to analyze complex communication signals that can occupy up to 40 MHz of information bandwidth. The assembly has two inputs:

- 1. The final 22.5 MHz IF from the A2 Analog IF for IF bandwidth paths up to 25 MHz wide. This input is used for swept and FFT spectrum analysis.**
- 2. The 250 MHz IF from the A15 Front End Control Assembly for IF bandwidth of 40 MHz.**

Each input has a separate ADC that processes 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 Digital IF has the following main functions:

- Digitizes the 22.5 MHz and the 250 MHz IF signals
 - 16 bit ADC with a 100 MHz sample rate to digitize the 22.5 MHz IF
 - 12 bit ADC with a 200 MHz sample rate to digitize the 250 MHz IF
- 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 Theory of Operation

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 when observing the 50 MHz calibrator signal. 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. In addition, it is part of a filter, part of which is on the AIF, which improves distortion. Finally, it couples in the dither signal. The ADC is a 16 bit device sampling continuously at 100 Ms/second.

The 250 MHz IF comes from the A15 Front End Control assembly. The input level is approximately –25 dBm when observing the 50 MHz calibrator signal. The IF input has a 40 MHz bandwidth centered at 250 MHz. The analog circuitry leading to the ADC converts the single-ended signal from the Front End Control to differential required by the ADC. Finally, it couples in the dither signal. The ADC is a 12-bit device sampling continuously at 200 Ms/second.

Rear Panel Triggers

The board has two trigger inputs and two trigger outputs all used via BNC connectors on the rear panel. 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 signal analyzer. The trigger outputs are used to synchronize other pieces of test equipment to the PXE. 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 PXE EMI Receiver. 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 Troubleshooting

Verifying the 22.5 MHz Input Power

1. Perform an instrument shutdown.
2. Remove the cover of the PXE EMI Receiver. Refer to **Chapter 18, "Assembly Replacement Procedures."** in this service guide.
3. Turn the instrument over so that the bottom side of the analyzer is facing up.
4. Turn on the PXE EMI Receiver and wait for the instrument to complete the boot up process. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode, Spectrum Analyzer**.
5. Press **System, Alignments, Auto Align, Off**.
6. Press **Input/Output, RF Calibrator, 50 MHz**.
7. Verify the 50 MHz signal is at -25 dBm by pressing **FREQ, 50 MHz, SPAN, 1 MHz, Peak Search** on the analyzer. The marker readout should be 50 MHz at -25 dBm $\pm$ 3 dB.
8. To continue verifying press **SPAN, Zero Span**. Verify the input attenuator on the PXE is set to 10 dB. Look near the top of the display near the center and verify **Atten: 10 dB** is visible. If needed change the input attenuator by pressing **AMPTD, Attenuation, 10 dB** on the analyzer.

9. Referring to **Figure 10-11**, carefully disconnect W17 cable at A3J19.

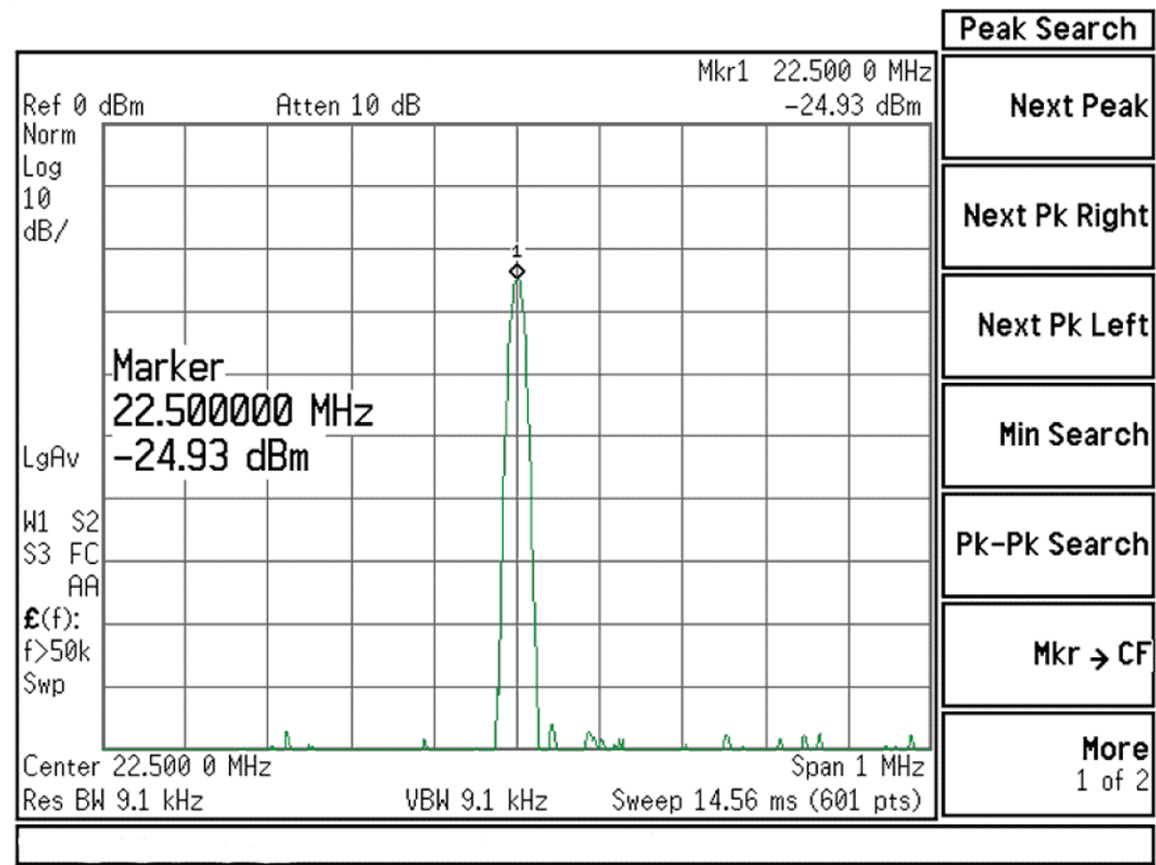
Figure 10-11 A3 Digital IF Cables



10. Connect the W17 cable to the MMCX female to SMA female connector. Use an appropriate cable to go from the SMA connector to the RF input of a functioning spectrum analyzer to verify the 22.5 MHz I.F. signal frequency and amplitude is correct.
11. Press **Freq, 22.5 MHz Span, 1 MHz, Peak Search** on the functioning spectrum analyzer.

12.The analyzer should read 22.5 MHz at -25 dBm ± 4 dB as shown in **Figure 10-12**.

Figure 10-12 22.5 MHz IF Input



13.If the 22.5 MHz signal is not measuring the correct power level, see **"A2 Analog IF Troubleshooting"** in this service guide.

14.If the 22.5 MHz signal is within tolerance, carefully reconnect the W17 cable to A3J19.

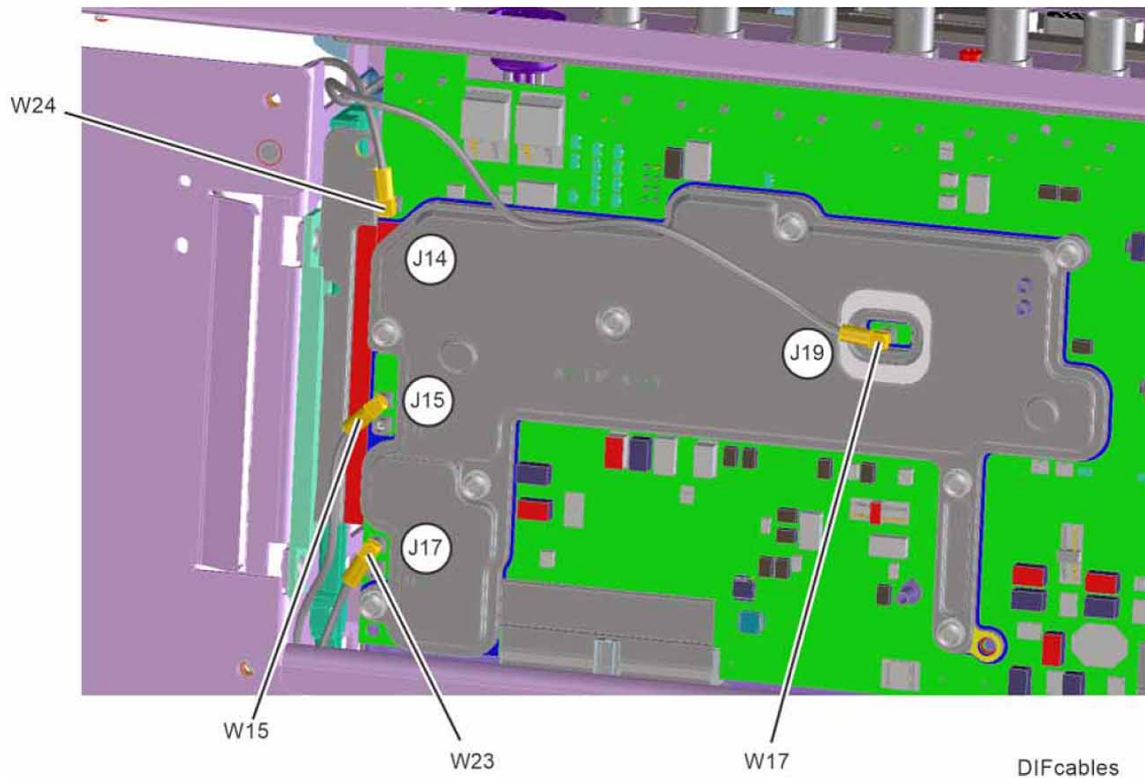
Verifying the 250 MHz IF Input Power (Option B40 only)

NOTE

Perform this procedure only if the analyzer is equipped with Option B40, Analysis Bandwidth, 40 MHz.

1. Perform an instrument shutdown.
2. Remove the cover of the PXE EMI Receiver. Refer to [Chapter 18, "Assembly Replacement Procedures."](#) in this service guide.
3. Turn the instrument over so that the bottom side of the analyzer is facing up.
4. Turn on the PXE EMI Receiver and wait for the instrument to complete the boot up process.
5. Press **Mode, IQ Analyzer (Basic), Meas Setup, IF Path, 40 MHz.**
6. Press **System, Alignments, Auto Align, Off.**
7. Press **Input/Output, RF calibrator, 50 MHz.**
8. Verify the 50 MHz signal is at -25 dBm by pressing **FREQ, 50 MHz, SPAN, 1 MHz, Peak Search** on the analyzer. The marker readout should be 50 MHz at -25 dBm $\pm$ 3 dB.
9. To continue verifying press **Meas, IQ Waveform**. Verify the input attenuator on the PXE is set to 10 dB. Look near the top of the display near the center and verify **Atten: 10 dB** is visible. If needed change the input attenuator by pressing **AMPTD, Attenuation, 10 dB** on the analyzer.
10. Referring to [Figure 10-13](#), carefully disconnect W15 from A3J15.

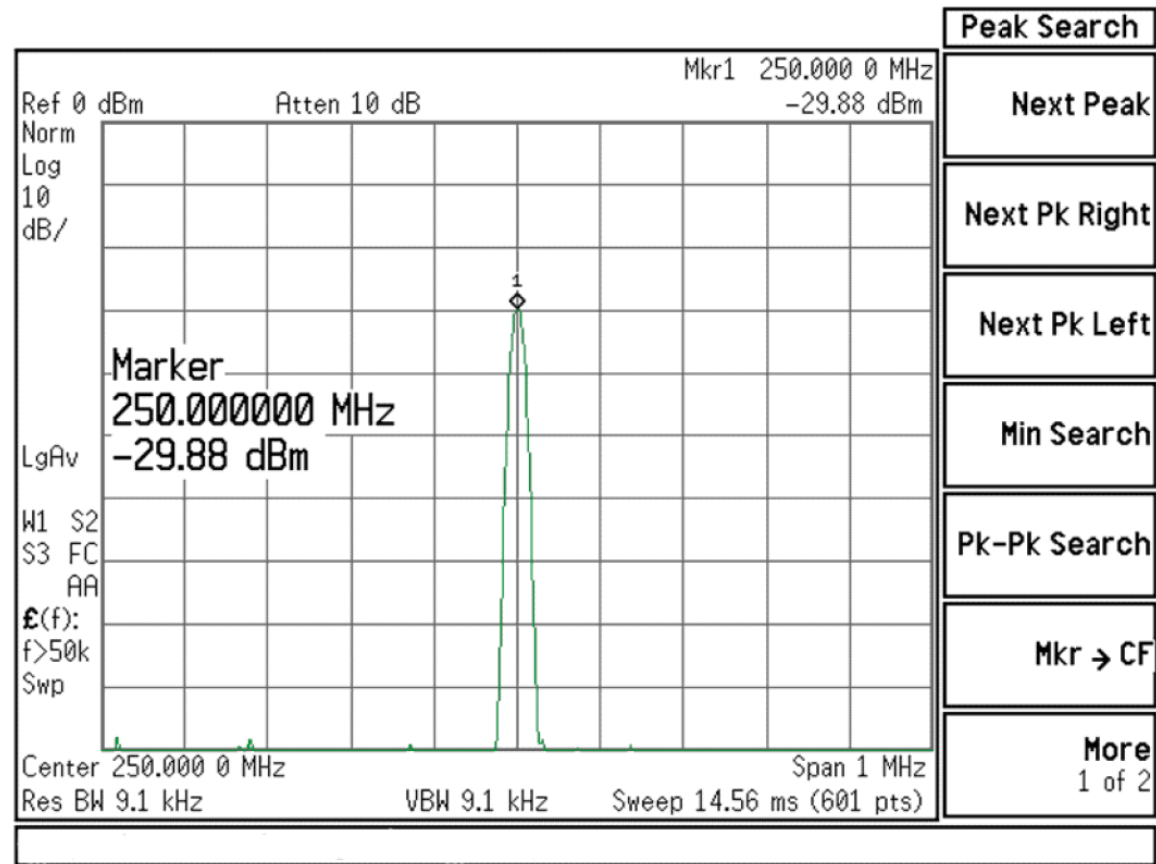
Figure 10-13 A3 Digital IF Cables



11. Connect the W15 cable to the MMCX female to SMA female connector. Use an appropriate cable to go from the SMA connector to the RF input of a functioning spectrum analyzer to verify the 250 MHz I.F. signal frequency and amplitude is correct.
12. Press **Freq, 250 MHz, Span, 1 MHz, Peak Search** on the functioning spectrum analyzer.

13.The analyzer marker should read 250 MHz at -30 dBm $\pm$ 4 dB as shown in Figure 10-14.

Figure 10-14 250 MHz IF Input



14.If the 250 MHz signal is not measuring the correct power level, see “A15 Front End Control Assembly Troubleshooting” in this service guide.

15.If the 250 MHz signal is within tolerance, carefully reconnect the W15 cable to A3J15.

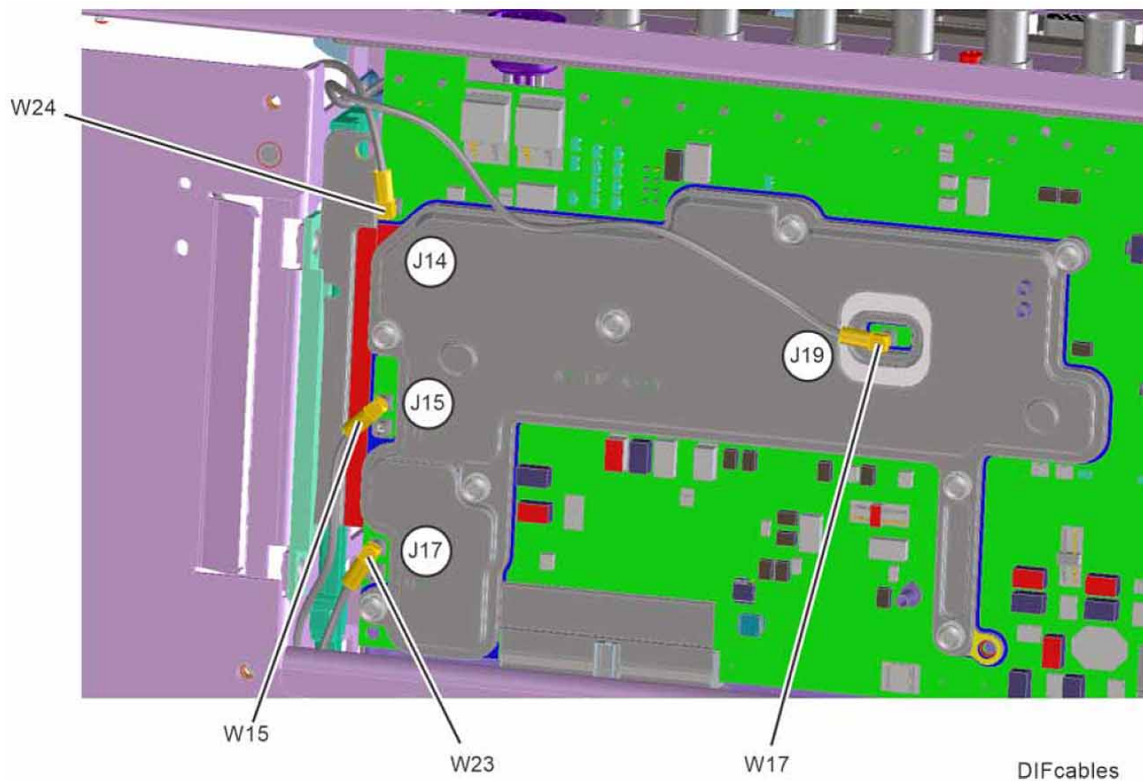
NOTE

You should hear a distinct snap when reconnecting the cable. If this cable is not installed properly, intermittent signal fluctuations may occur on the analyzer display.

Verifying the 100 MHz Reference Input

1. Perform an instrument shutdown.
2. Remove the cover of the PXE EMI Receiver. Refer to **Chapter 18, "Assembly Replacement Procedures."** in this service guide.
3. Turn the instrument over so that the bottom side of the analyzer is facing up.
4. Turn on the PXE EMI Receiver and wait for the instrument to complete the boot up process. Switch the instrument into the Spectrum Analyzer mode by pressing **Mode, Spectrum Analyzer**.
5. Press **System, Alignments, Auto Align, Off**.
6. Press **Input/Output, RF calibrator, 50 MHz**.
7. Referring to **Figure 10-15**, carefully disconnect W24 cable at A3J14.

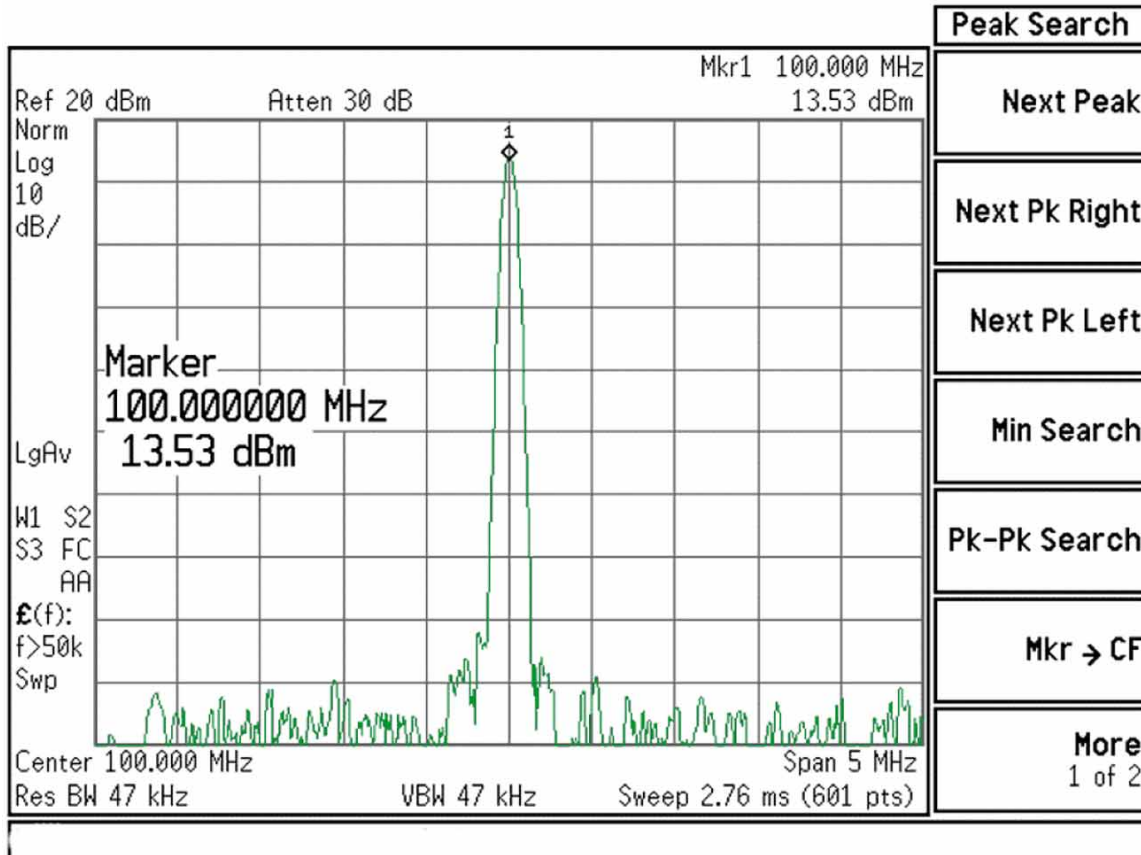
Figure 10-15 A3 Digital IF Cables



8. Connect the W24 cable to the MMCX female to SMA female connector. Use an appropriate cable to go from the SMA connector to the RF input of a functioning spectrum analyzer to verify the 100 MHz reference frequency and amplitude is correct.
9. Press **AMPTD, Ref Level, 20 dBm, Freq, 100 MHz, Span, 1 MHz, Peak Search** on the functioning spectrum analyzer.

10. The analyzer marker should read 100 MHz at +10 dBm $\pm$ 4 dB as shown in Figure 10-16.

Figure 10-16 100 MHz Reference Input



11. If the 100 MHz signal is measuring incorrectly, see “A16 Reference Troubleshooting” in this service guide.

12. If the 22.5 MHz IF, 250 MHz IF (if appropriate) and 100 MHz reference signals measure the correct frequency and amplitude and yet the display is not processing the signal properly, the most probable causes are the A3 Digital IF or the A4 CPU. It is difficult to separate these two assemblies given the architecture of the analyzer. Each assembly will have to be tried to see which one is causing the failure.

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.

The following sections are found in this chapter:

[A4 Processor Assembly Description on page 302](#)

[A4 Processor Board Assembly Troubleshooting on page 305](#)

[A5 Disk Drive on page 306](#)

[Troubleshooting software related issues on page 308](#)

[Reloading the Instrument Application Software on page 309](#)

[Disk Drive Recovery Process on page 310](#)

[Replacing the instrument disk drive on page 311](#)

A4 Processor Assembly Description

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:

- External VGA
- LAN (RJ45) 10/100/1000 based-T Ethernet port
- USB
 - 4 x Type-A ports (USB 2.0 compatible)
 - 1 x Type-B port (USB 2.0 compatible)
 - Instrument behaves like a USB device (client)
- GPIB Interface

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 **“PXE Instrument Boot Up Process” on page 37** 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 520](#).

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 310.**

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.

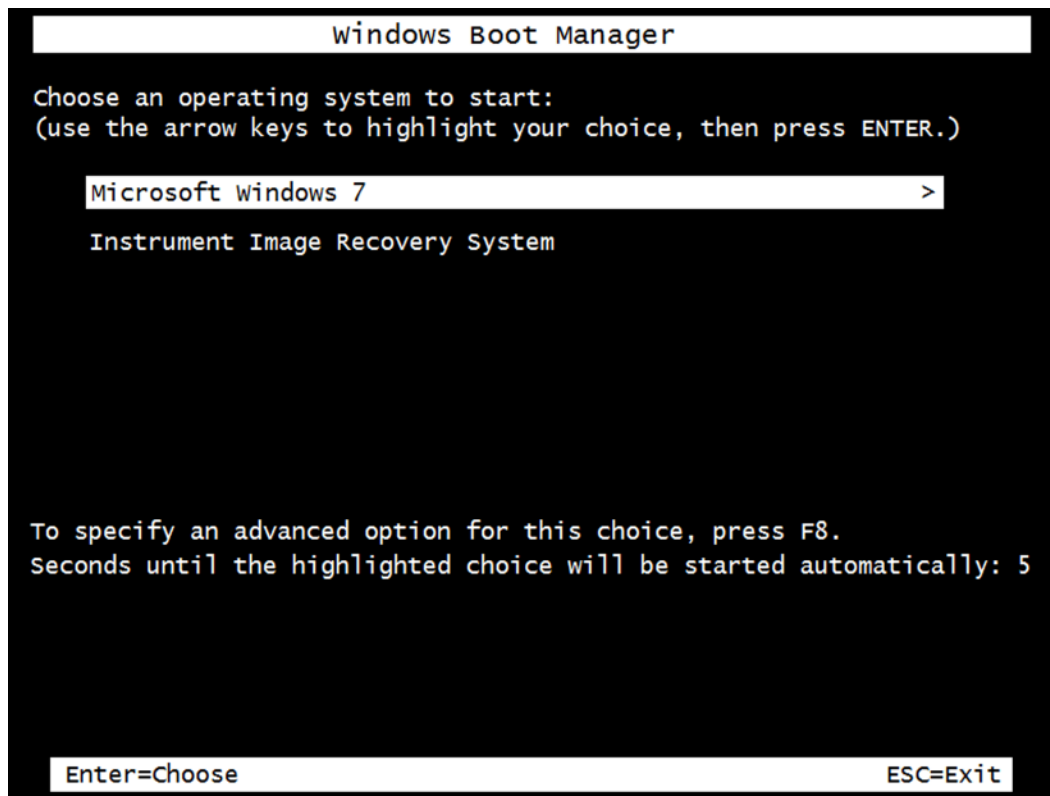
Instrument Image Recovery System

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 11-1



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. www.keysight.com/find/pxe_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 479](#).

CPU & Disk Drive
Disk Drive Recovery Process

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.

The following descriptions are found in this chapter:

A6 Power Supply Description on page 314

A6 Power Supply Assembly Troubleshooting on page 318

A7 Midplane Board Assembly Description on page 320

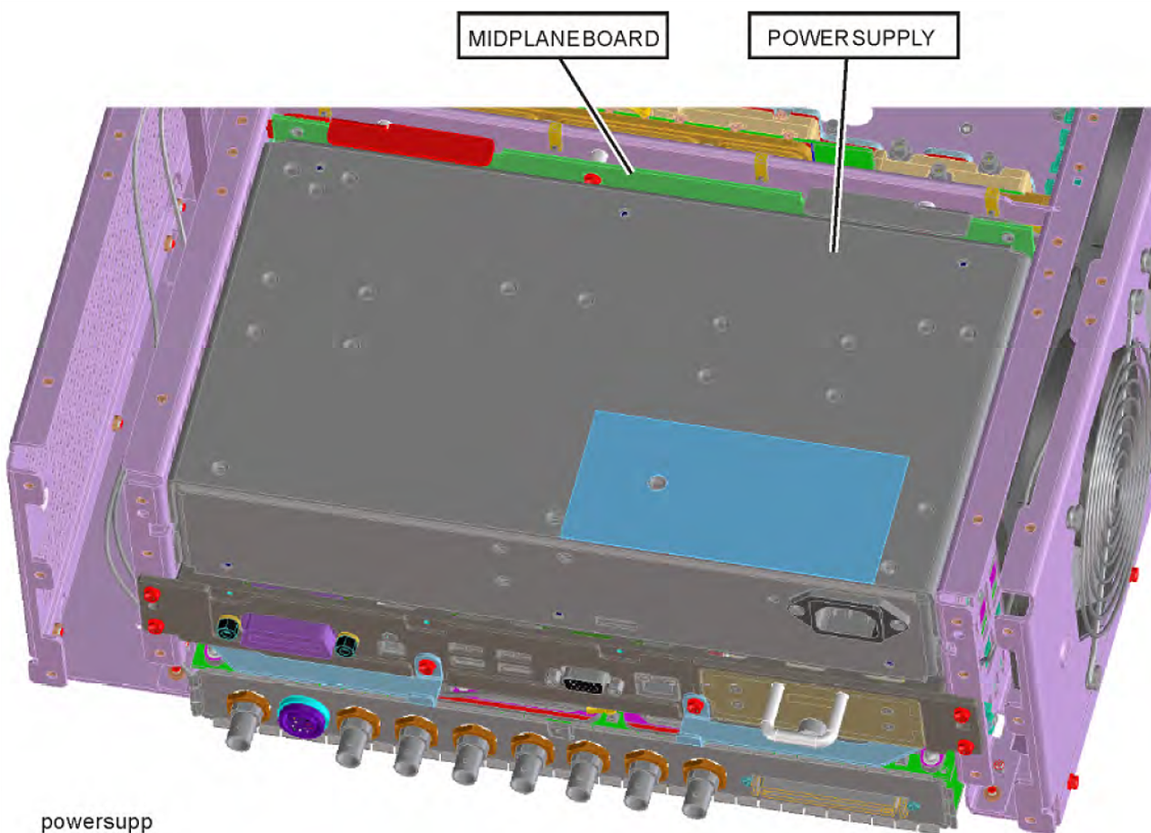
A7 Midplane Board Assembly Troubleshooting on page 323

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.

Figure 12-1 Power Supply and Midplane



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 320** 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 **"PXE Instrument Boot Up Process" on page 37** 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 323** 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 its 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 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.

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.

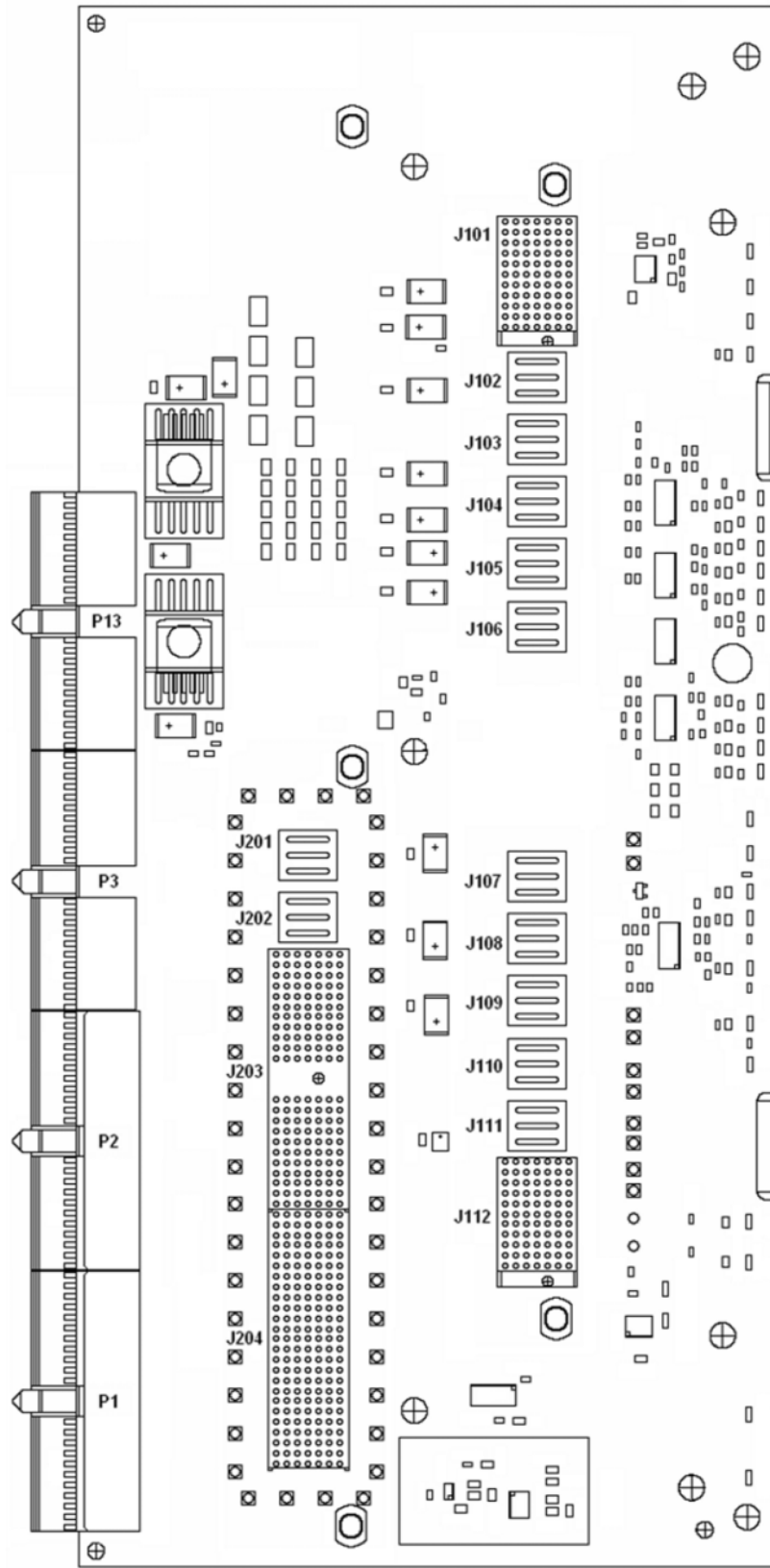
A7 Midplane Assembly Connections

The connections to and from the A7 Midplane assembly are as listed in **Table 12-2** and as illustrated in **Figure 12-2**.

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 12-2 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 12-3**.

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 12-3**.

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

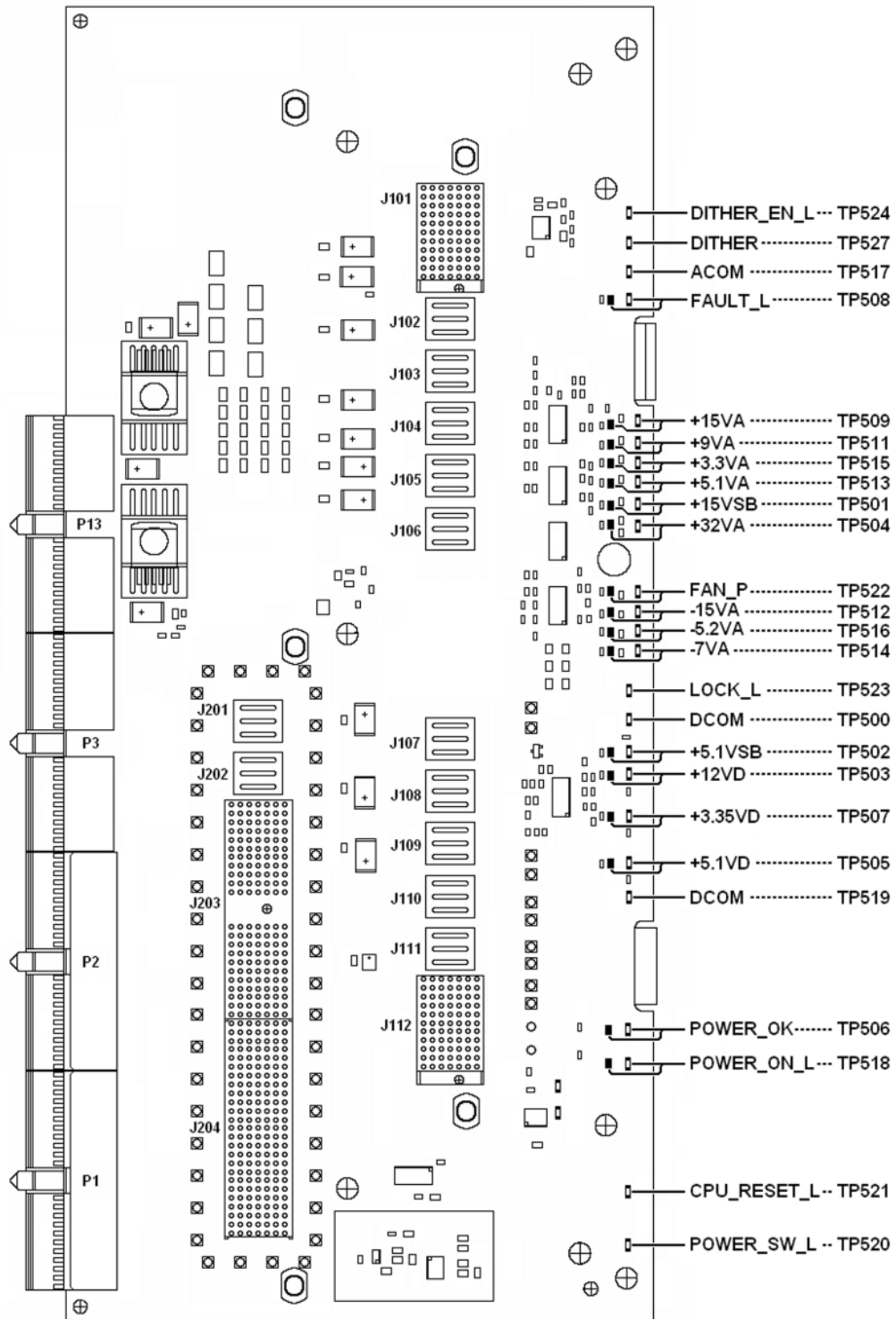
Table 12-3 A7 Midplane Board LEDs and Test Points

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 12-3 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 328

A1 Front Panel Assembly page 330

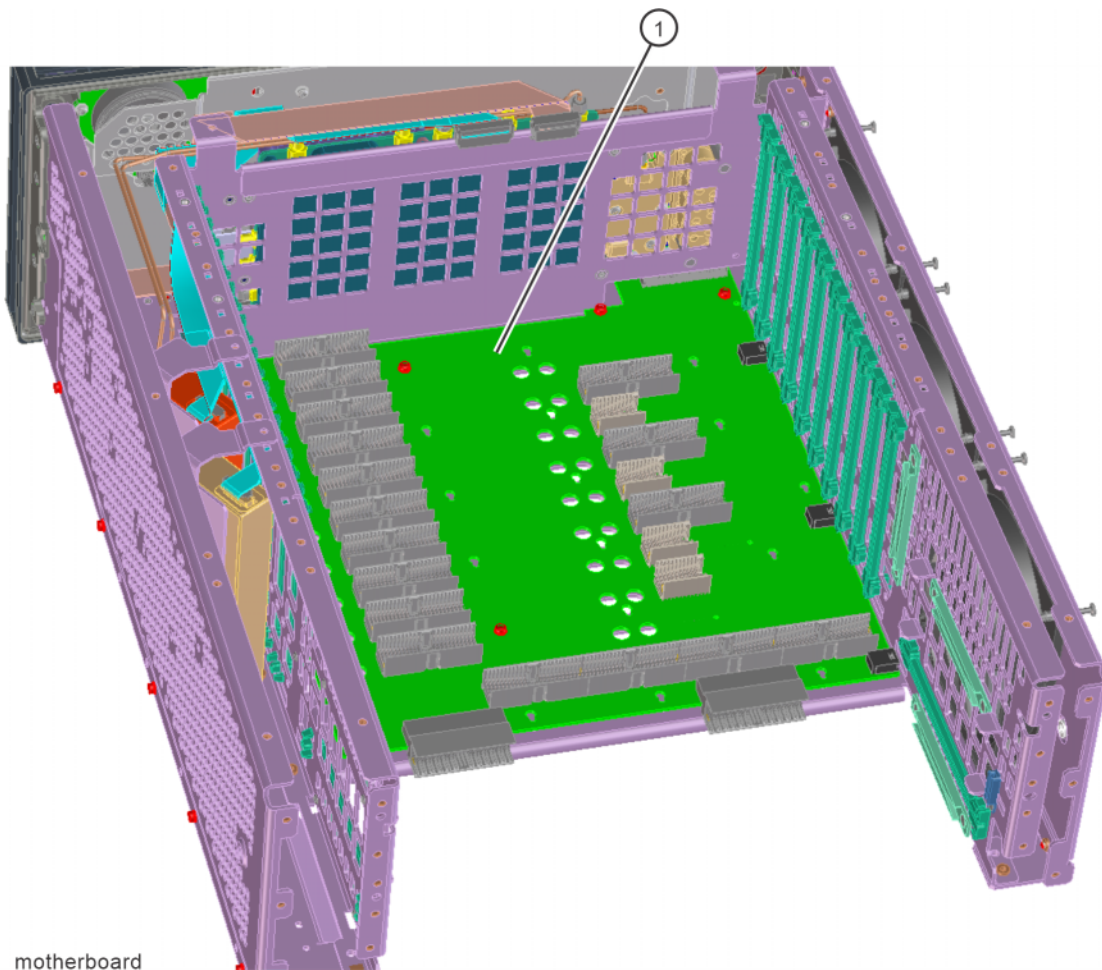
A8 Motherboard Assembly Description

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

Figure 13-1 Motherboard



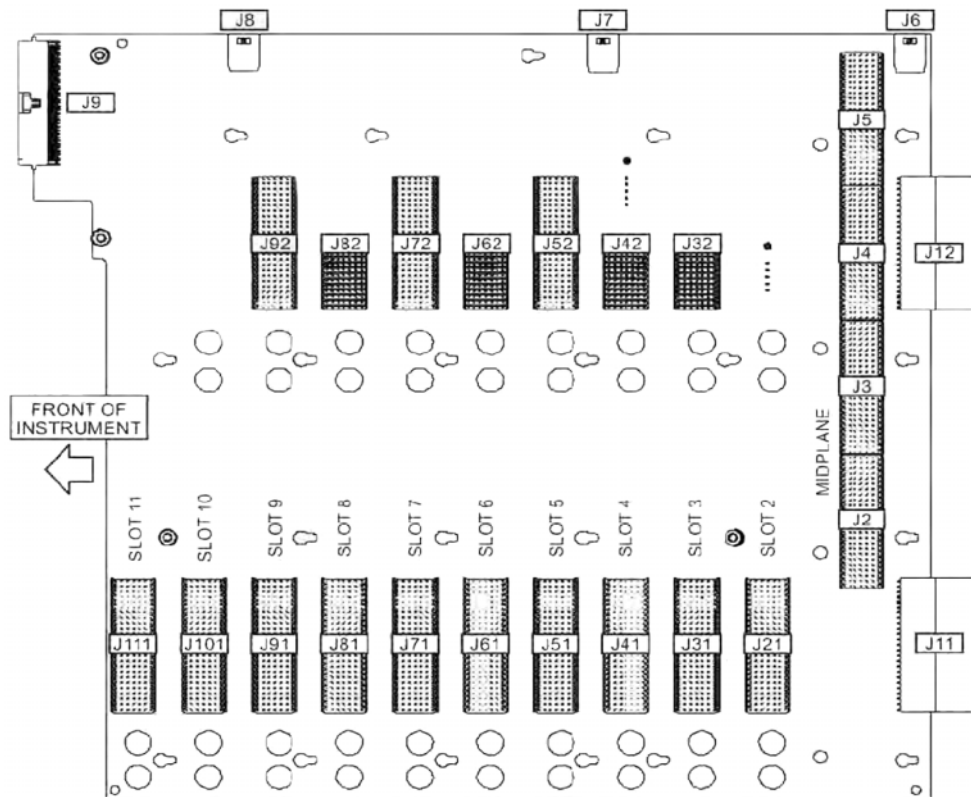
A8 Motherboard Assembly Connections

The connections to and from the A8 Motherboard assembly are as listed in **Table 13-1** and as illustrated in **Figure 13-2**.

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	Option Slot
J6	Chassis Fan - B3	J61/J62	Option Slot
J7	Chassis Fan - B2	J71/J72	A21A2 Presel 2
J8	Chassis Fan - B1	J81/J82	A21A1 Presel 1
J9	A1A2 Front Panel P1 (W8)	J91/J92	A23 Limiter Prefilter Board J12
J11	A3 Digital IF P1	J101	A14 LO Synthesizer J100
J12	A3 Digital IF P2	J111	A15 Front End Controller J100

Figure 13-2 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 DC-DC Converter

The B series X-Series Analyzers use a DC-DC converter to power the LED 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:

Option WF1, Wideband Digital IF Assembly	page 332
Description	page 332
Theory of Operation	page 334
Option WF1 - Wideband Digital IF Troubleshooting	page 334

Option WF1, Wideband Digital IF Assembly

Description

The primary role of the Wideband Digital IF assembly is to replace the existing A26 wideband DIF and AIF160 Assemblies. This new assembly provides Super Fast TDS Capture and measurement with an accelerated TDS measurement bandwidth of up to 350 MHz. It also provides a direct Baseband to 30 MHz acquisition for Band A/B CISPR support. Supporting a real-time acquisition bandwidth of up to 510 MHz.

Figure 14-1 Cable Connections



Table 14-1 Cable Connections

Ref	Type	Name	From	To
J1	MMCX	2.4 GHz_In	Ref Board	
J2	MMCX	Align_Out		
J3	MMCX	Align_In		DIF Board
J4	MMCX	WB_In	LPF	
J5	MMCX	WB_Out		DIF Board
J6	MMCX	BB_OUT		

Optional Assemblies
Option WF1, Wideband Digital IF Assembly

Table 14-1 Cable Connections

Ref	Type	Name	From	To
J7	MMCX	BB_IN	LPF	
J11	MMCX	Trigger_In	Rear Panel	
J12		ACOM JTAG		
J1009		ACOM JTAG		
P1	Hard Metric	DCOM JTAG	Motherboard	
P1000	Hard Metric	Analog Card Cage	Motherboard	

Theory of Operation

Wideband Acquisition

The Wideband Path provides digitization of signals up to about 1 GHz. It has a variety of filters and configurations to serve the needs of the EMC analyzer, provide the functionality of previous IF/Digitizers, and allow for possible future uses.

Baseband Acquisition

The Baseband section of the board provides for whole-band direct digitization of input frequencies from DC to 30 MHz. It also can be used to digitize the output of the Enhanced AIF board (the main swept-signal-path IF in the analyzer).

2400 MHz Reference Clock

The Wideband Digitizer receives a clean 2400 MHz signal from the Reference Board and conditions it for use in synchronizing all the clocked operations on the board.

The 2400 MHz clock signal is split and sent to the ADC and the clock system which provides all the frequencies used on the analog side of the board. It also sends the 2400 MHz across the ground boundary to the digital half of the board.

Option WF1 – Wideband Digital IF Troubleshooting

The Wideband DIF provide the Direct IF conversion for base band signal (below 30 MHz) and Wideband IF processing up to 510MHz bandwidth. This enable TDS and ACC TDS feature to be implemented in PXE.

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 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 Wideband Digital IF assembly should identify itself on this list as Gen 4 DIF 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 **“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 Wideband Digital IF assembly look in the file named:

E:\AlignDataStore\AlignmentHistory.txt

If there are failures for items with names or descriptions such as ScarletWB, ScarletWideband, ScarletDirect and ScarletDual the most likely cause will be a defective Wideband Digital IF assembly.

Overall Wideband Signal Path Verification

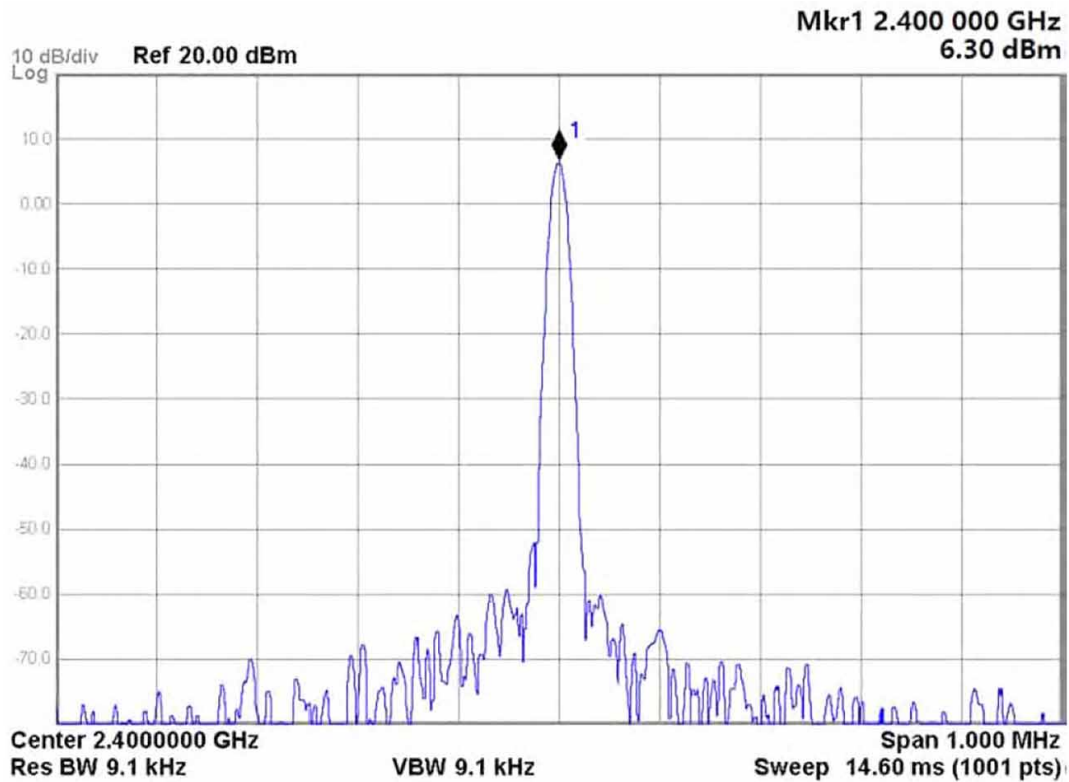
The Wideband Digital IF assembly uses a 2400 MHz reference signal that comes to J1 via MMCX cable from the A16 Reference assembly J718.

Before attributing a fault to the Wideband Digital 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 MMCX cable J1.
4. Connect the loose end of MMCX cable 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 14-2](#).

Figure 14-2 2400 MHz Reference Input Verification



7. If the signal level measured is correct the reference input signal going to the A26 Wideband Digital 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.

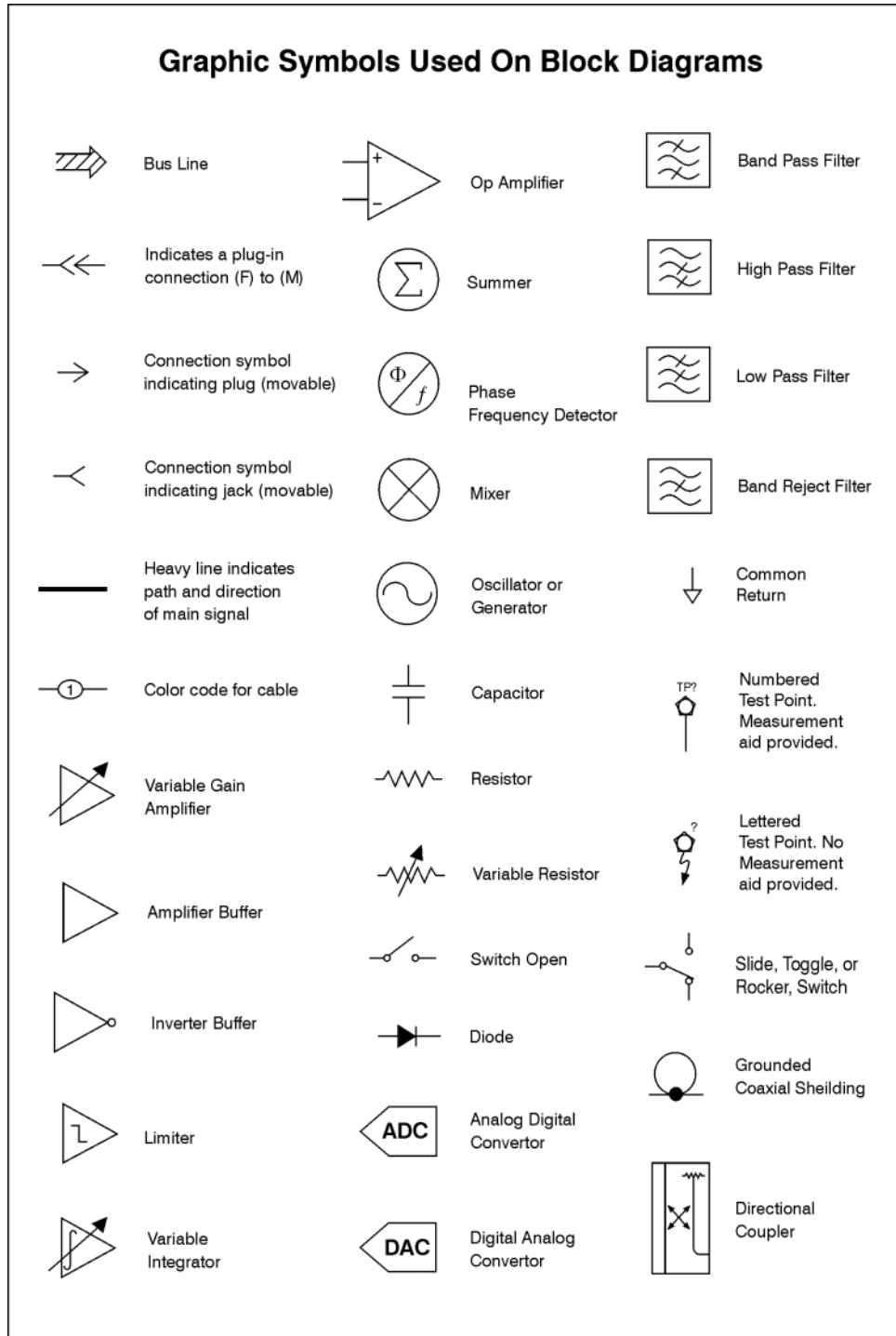
15 Block Diagrams

What You Will Find in This Chapter

The following block diagrams are found in this chapter:

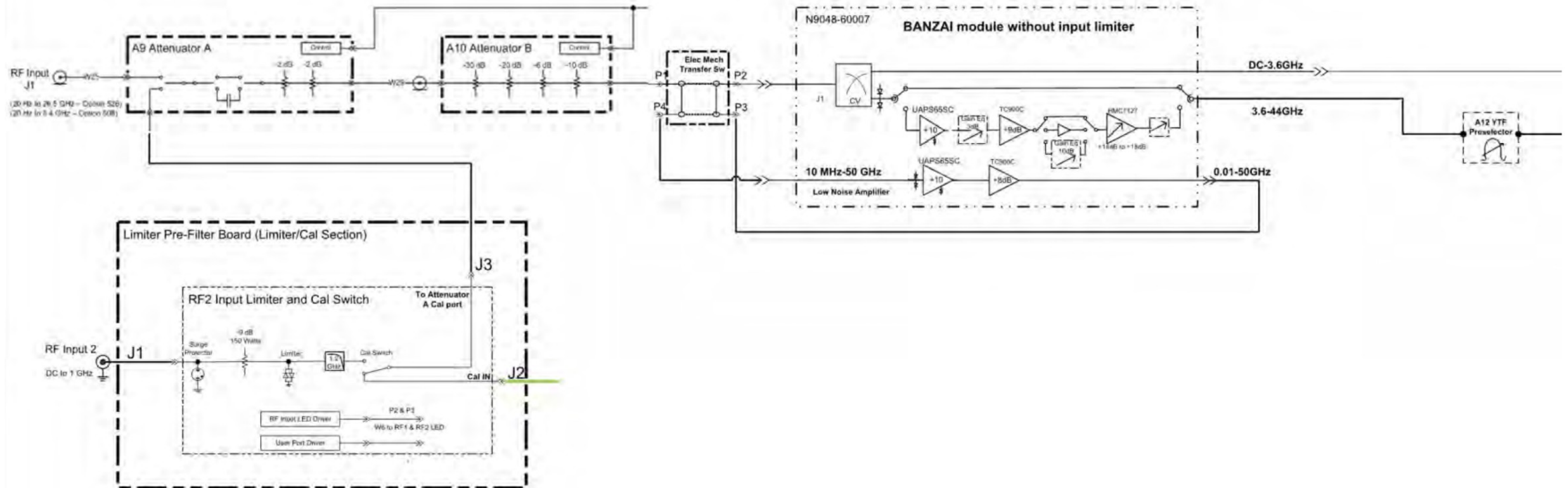
N9048B RF Input Option 503, 508, 526
N9048B RF Input Option 544
N9048B Conducted Band Signal Path
N9048B Radiated Band Signal Path (1)
N9048B Radiated Band Signal Path (2)
N9048B Option 503, 508, and 526 Bypass Narrowband
N9048B Option 544 Bypass Narrowband
N9048B Option 503, 508, and 526 Bypass Narrowband (TDS Path)
N9048B Option 544 Bypass Narrowband (TDS Path)
RF Block Diagram Option 503, 508, & 526 Low Band Path (DC - 3.6 GHz)
RF Block Diagram Option 503, 508, & 526 (Highband Path #1 - Input signals 3.6 to 13.6 GHz)
RF Block Diagram Option 503, 508, & 526 (Highband Path #2 - Input signals 13.6 to 26.5 GHz)
RF Block Diagram Option 544 Low Band Path (DC - 3.6 GHz)
RF Block Diagram Option 544 (Highband Path #1 - Input signals 3.6 to 17.1 GHz)
RF Block Diagram Option 544 (Highband Path #2 - Input signals 17.1 to 34.5 GHz)
RF Block Diagram Option 544 (Highband Path #3 - Input signals 17.1 to 44 GHz)
PXE Reference and Synthesizer Block Diagram
Analog IF Block Diagram
Digital IF Block Diagram
PXE Computer

Block Diagrams

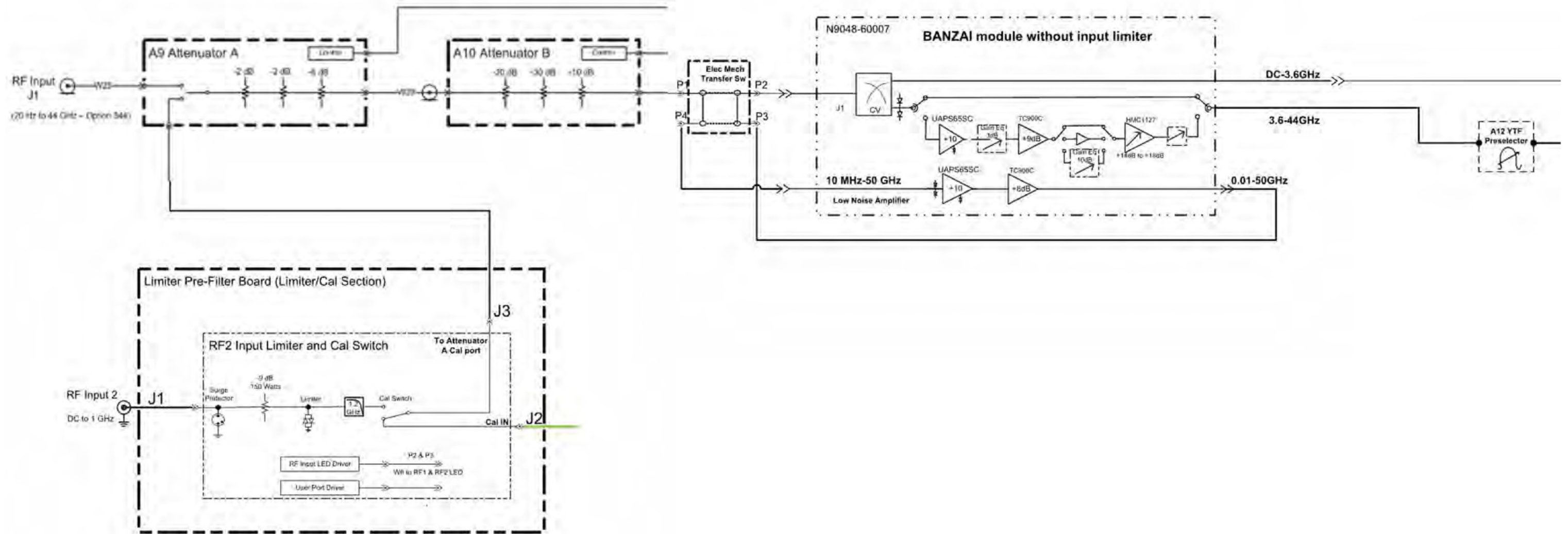


sa83a

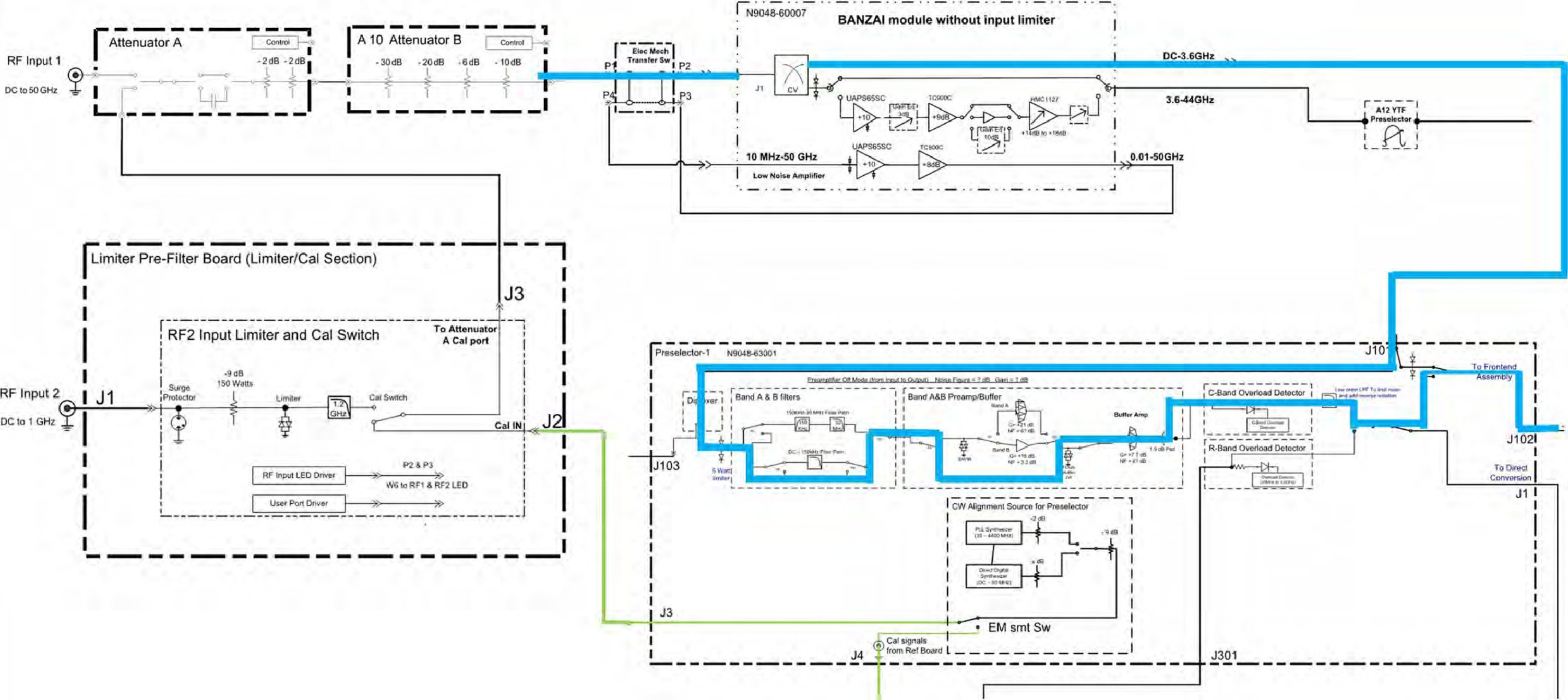
N9048B RF Input option 503, 508, 526 Block Diagram



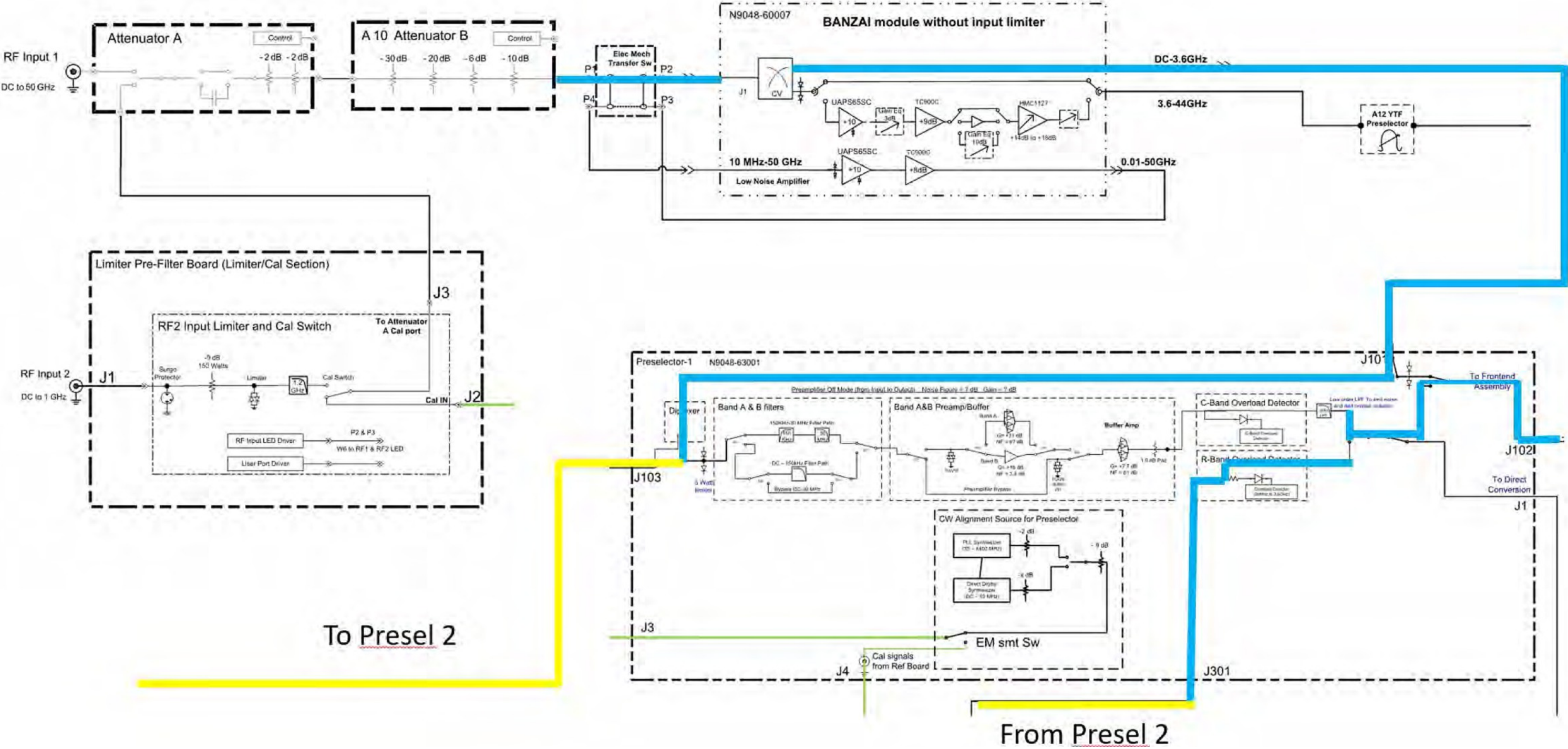
N9048B RF Input option 544 Block Diagram



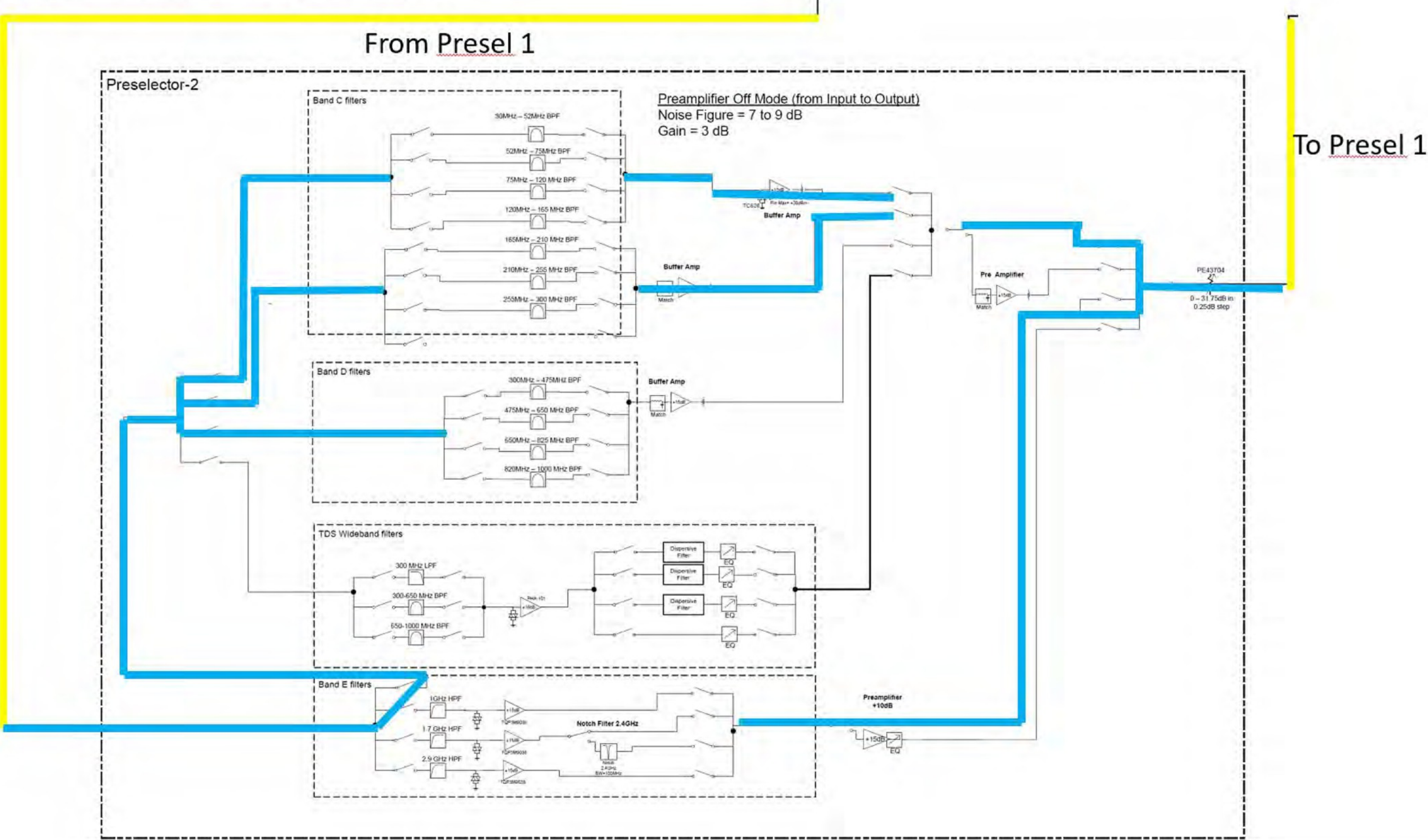
N9048B Conducted Band Signal Path



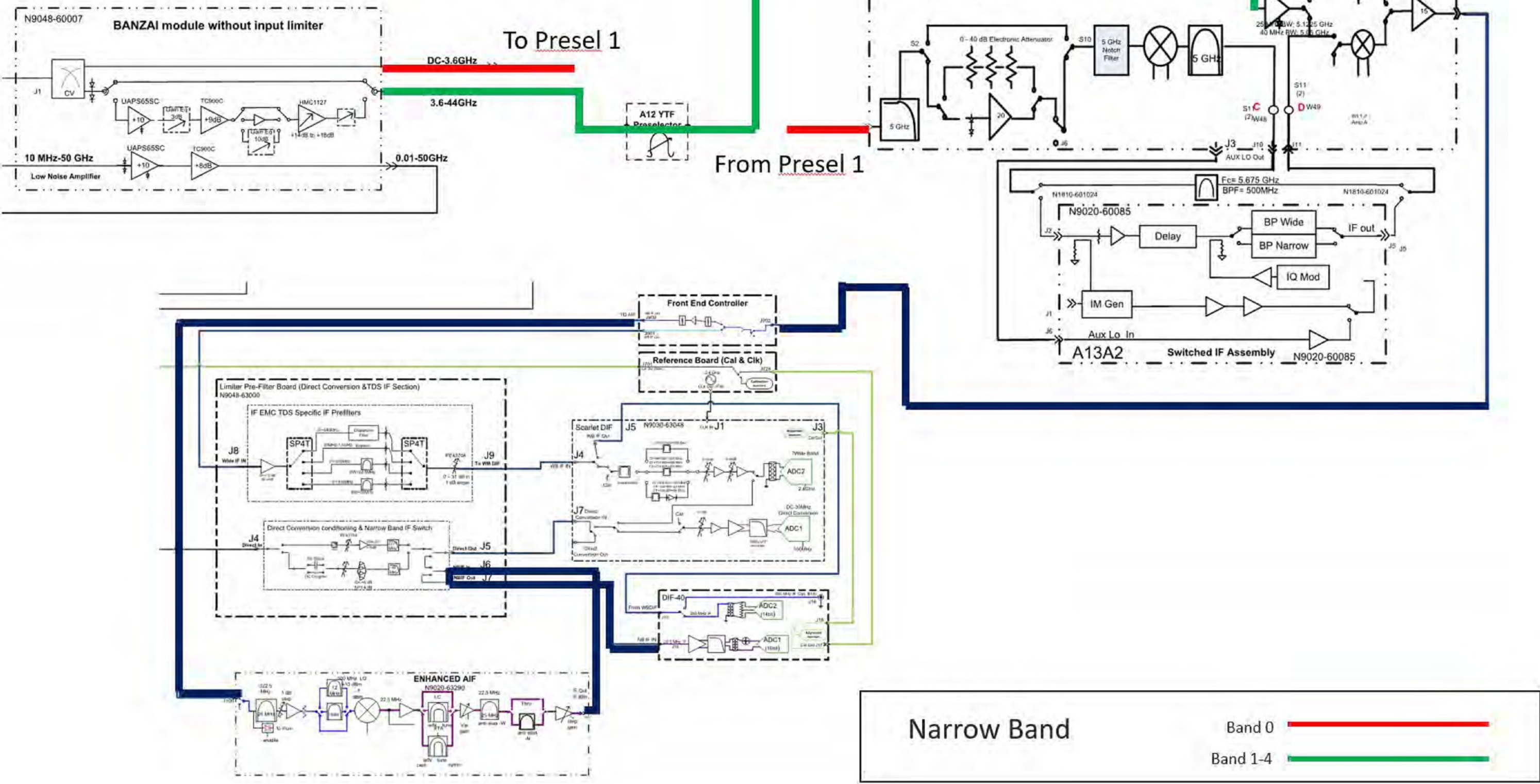
N9048B Radiated Band Signal Path (1)



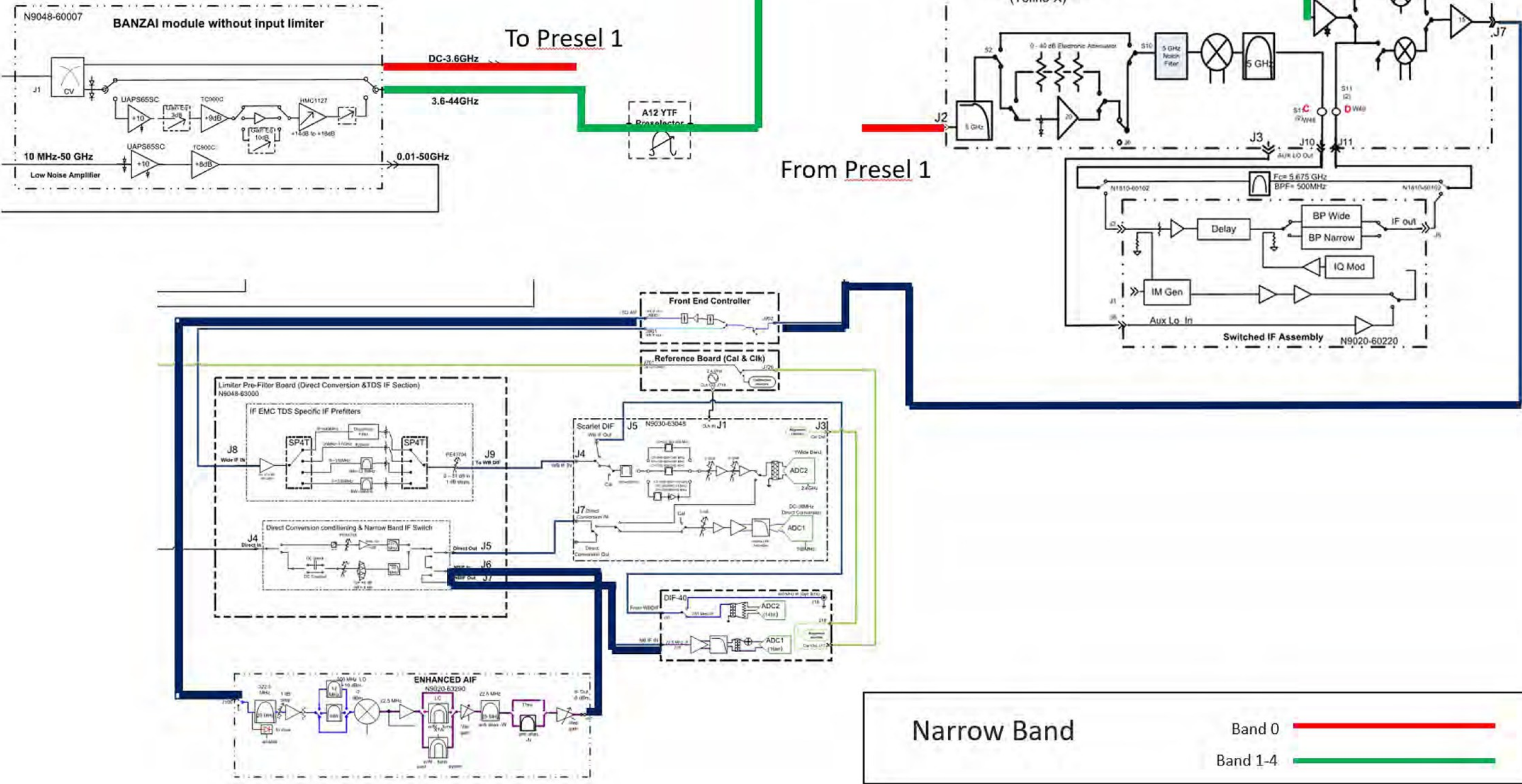
N9048B Radiated Band Signal Path (2)



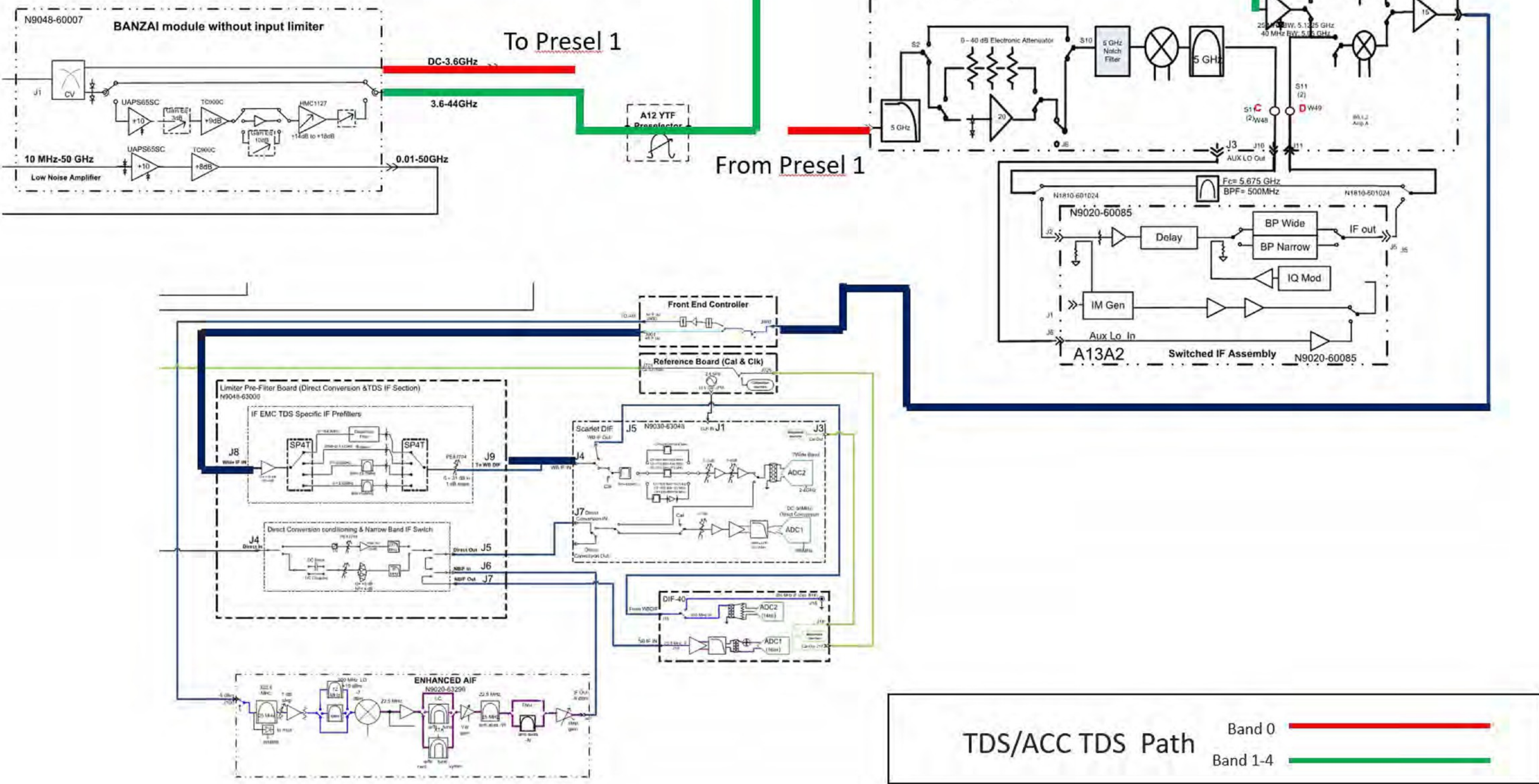
N9048B Option 503, 508, 526 Bypass Narrowband



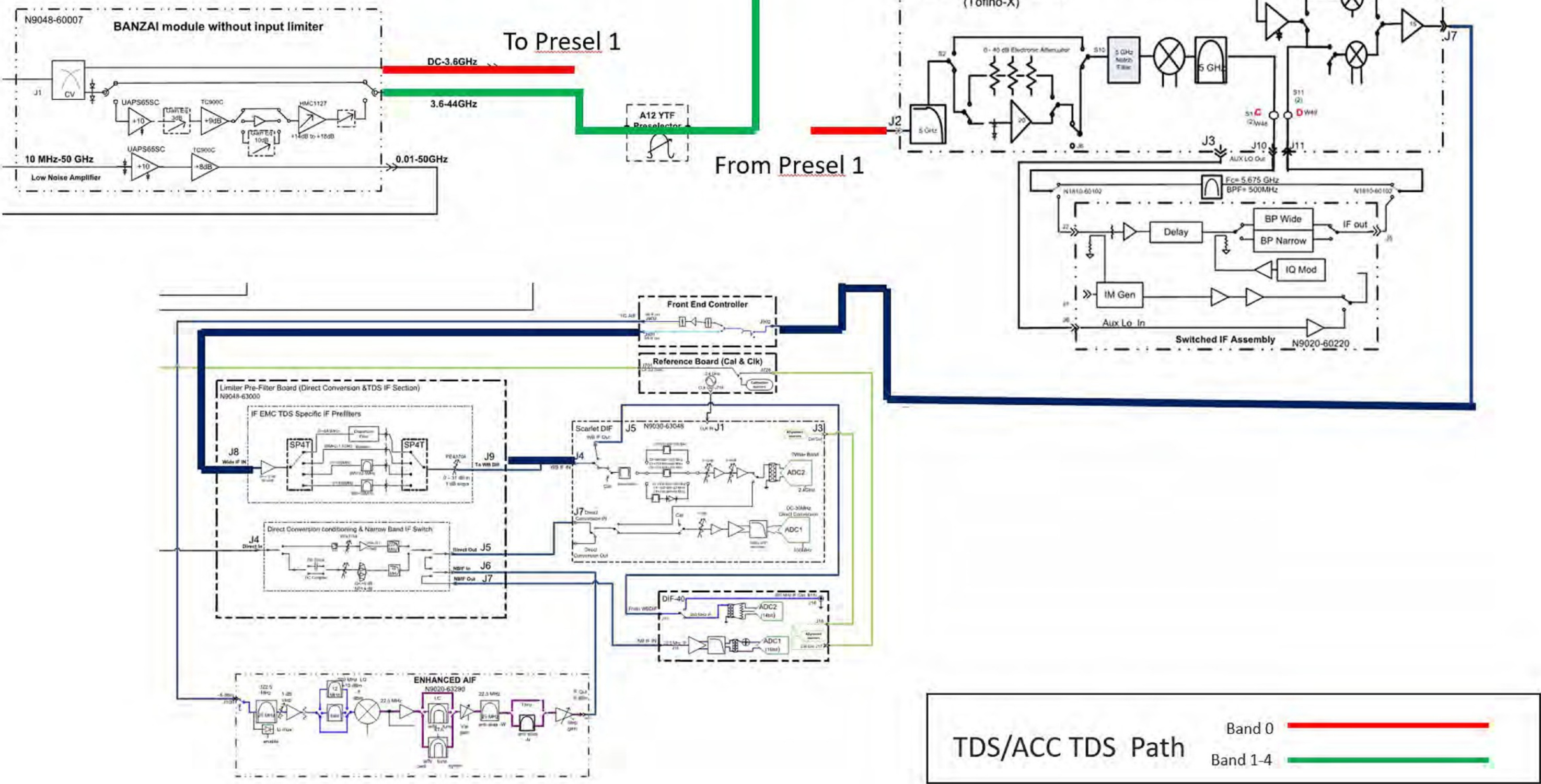
N9048B Option 544 Bypass Narrowband



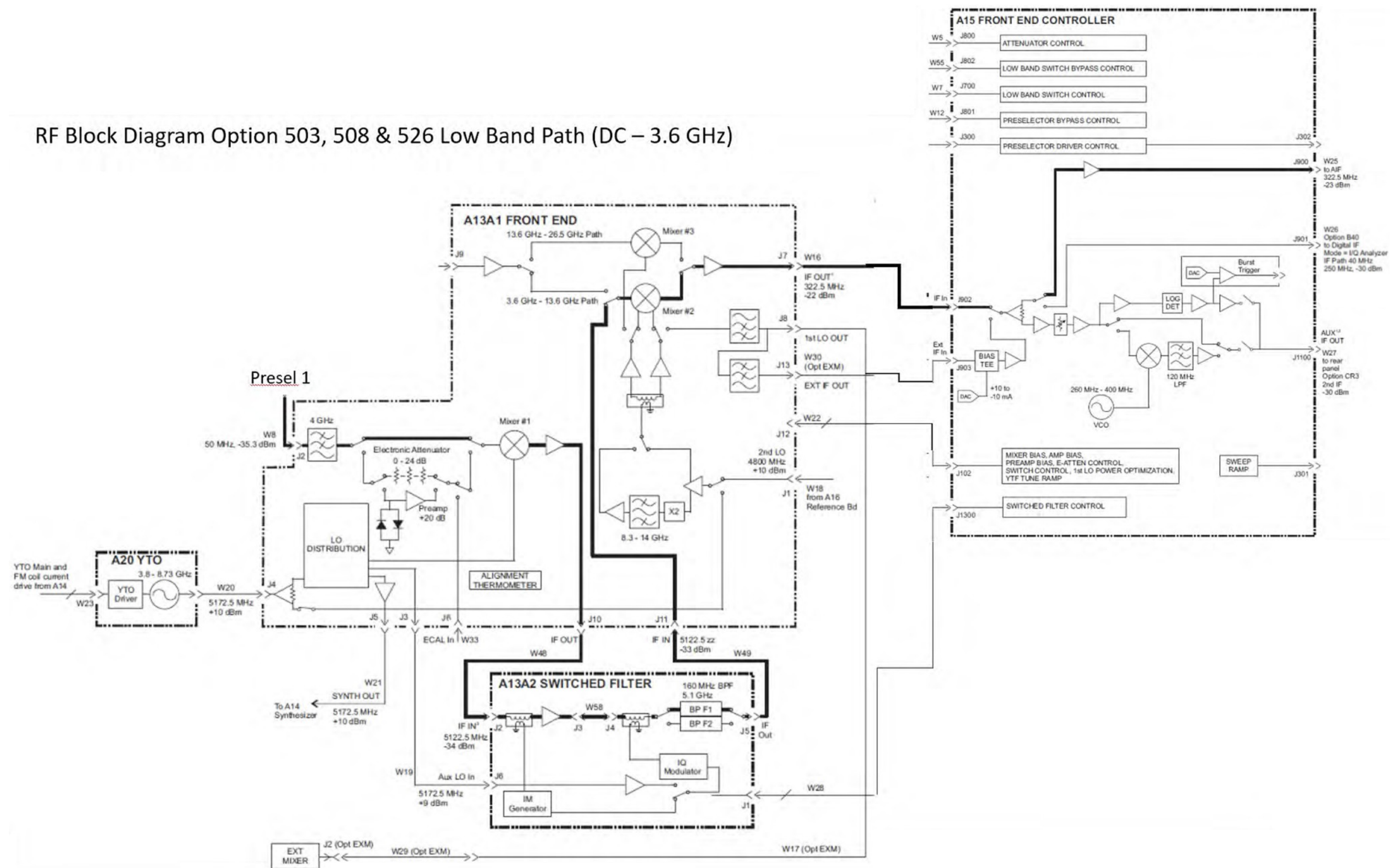
N9048B Option 503, 508, 526 Bypass Narrowband (TDS Path)



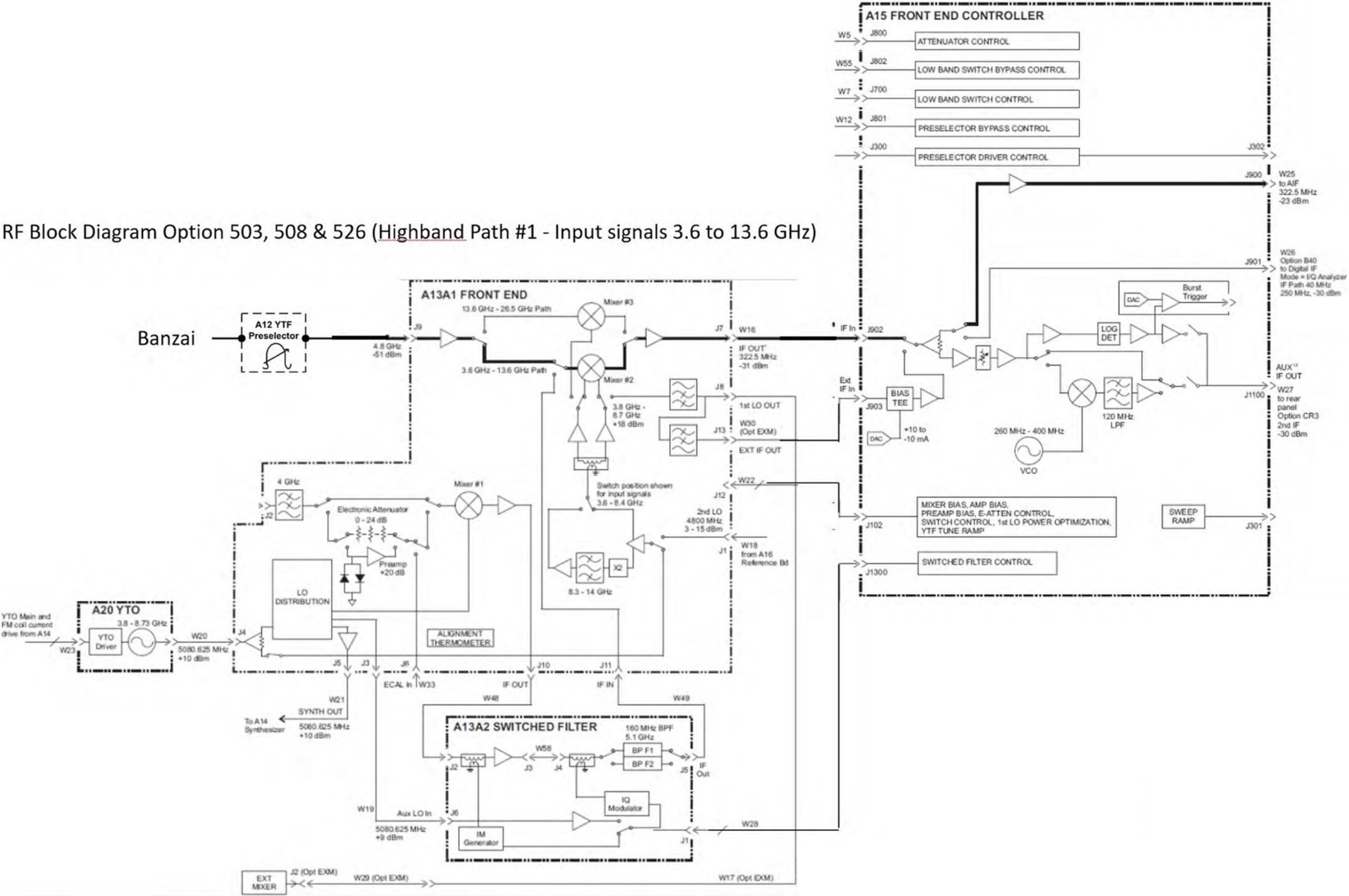
N9048B Option 544 Bypass Narrowband (TDS Path)



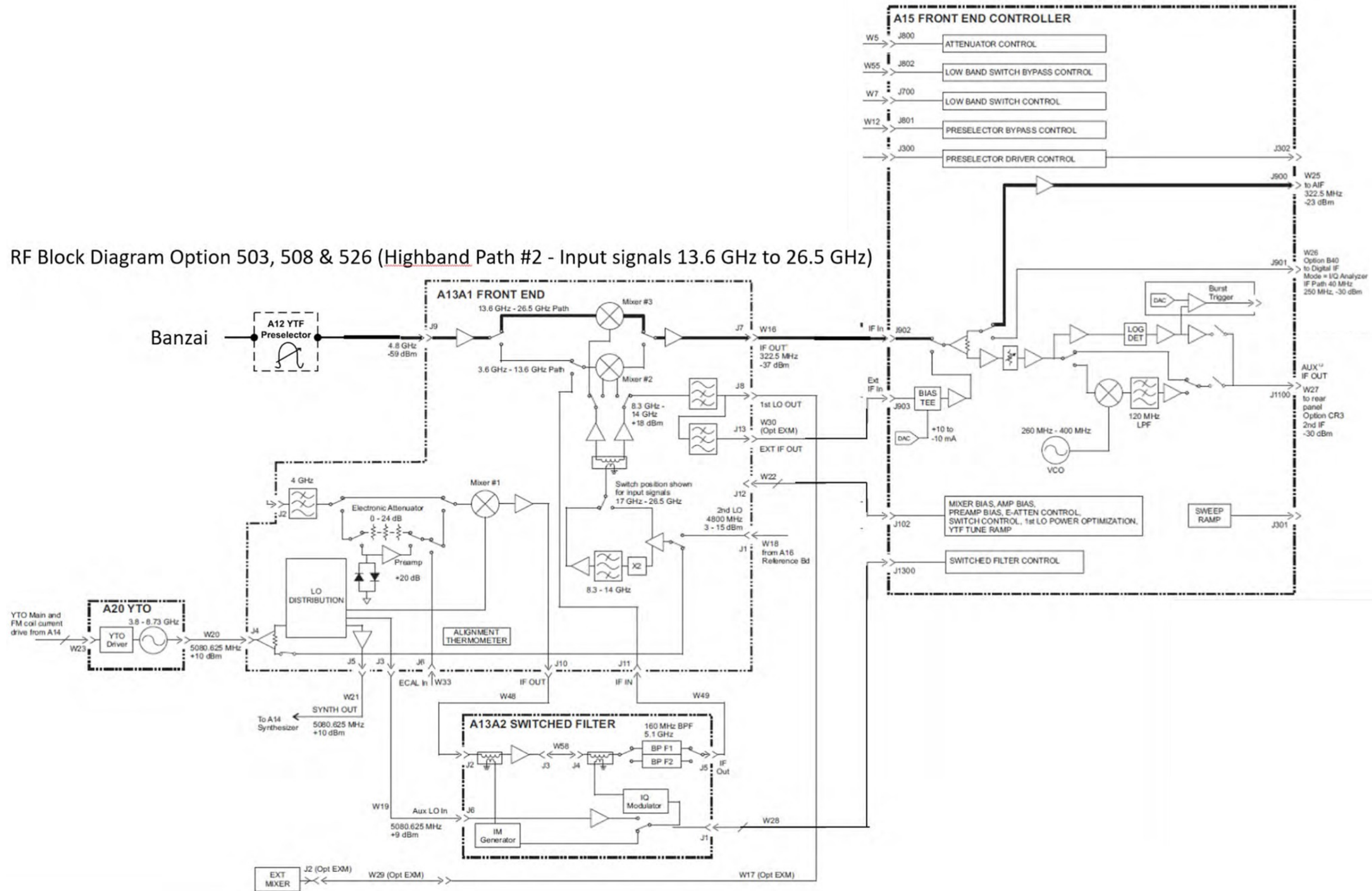
RF Block Diagram Option 503, 508 & 526 Low Band Path (DC – 3.6 GHz)



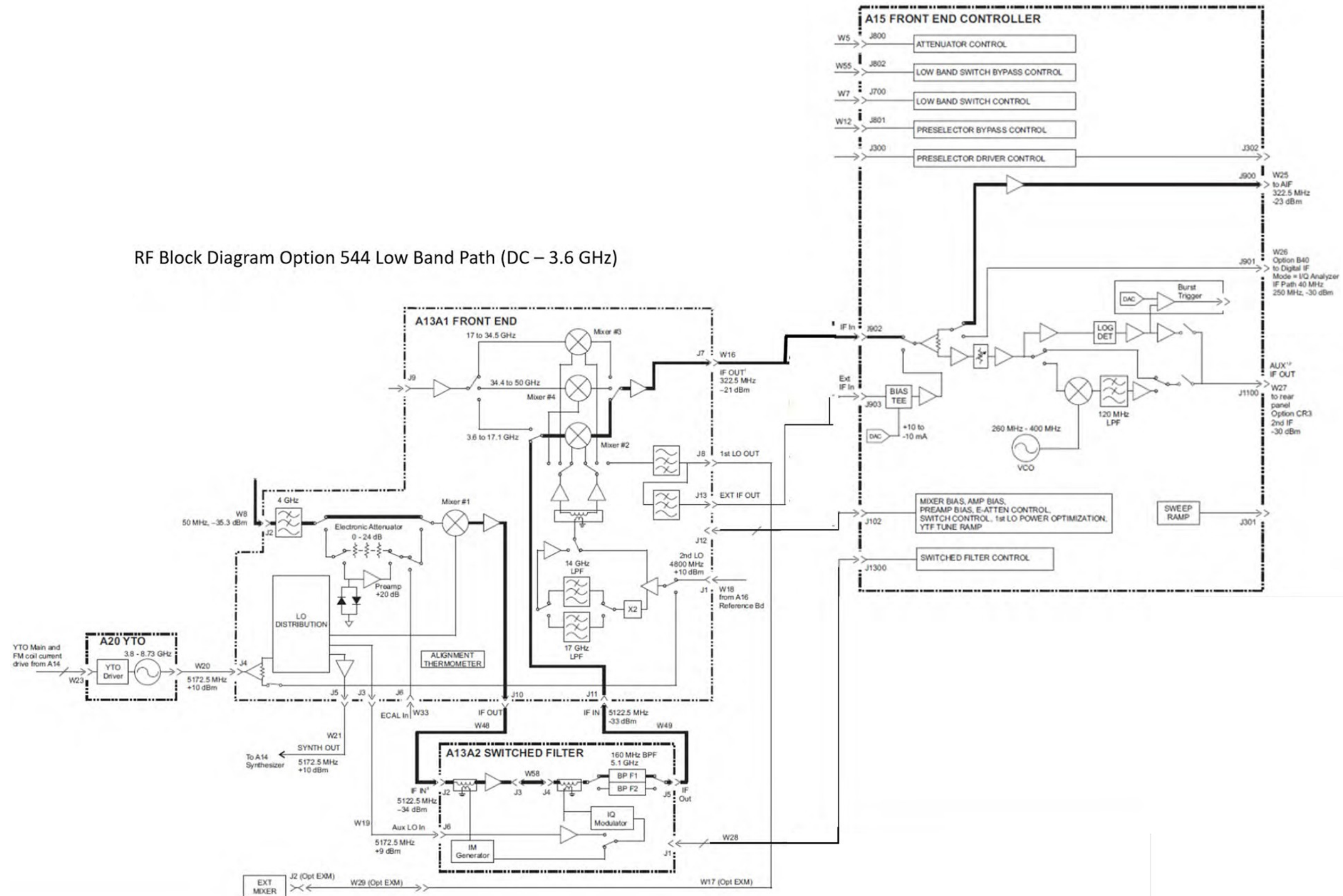
RF Block Diagram Option 503, 508 & 526 (Highband Path #1 - Input signals 3.6 to 13.6 GHz)



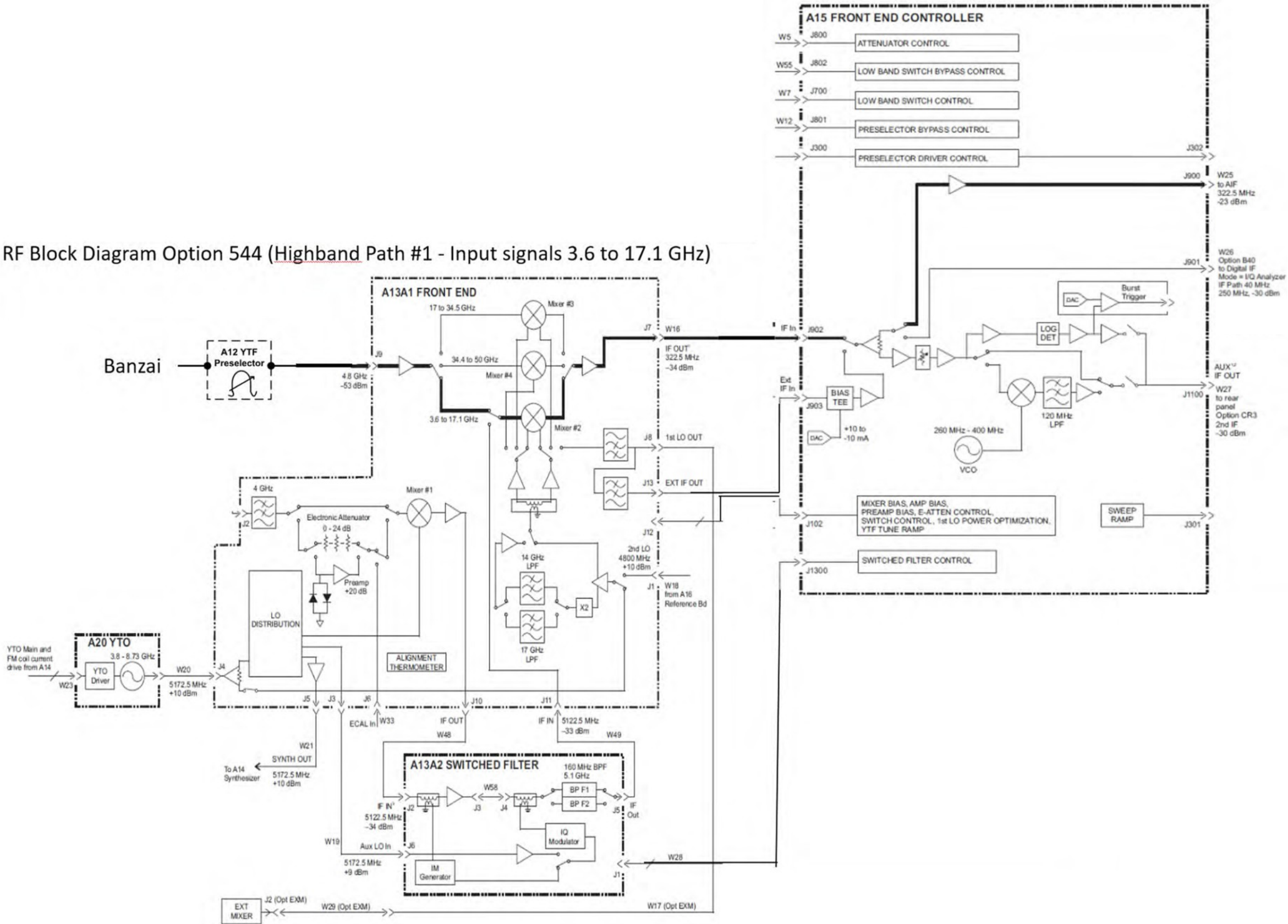
RF Block Diagram Option 503, 508 & 526 (Highband Path #2 - Input signals 13.6 GHz to 26.5 GHz)



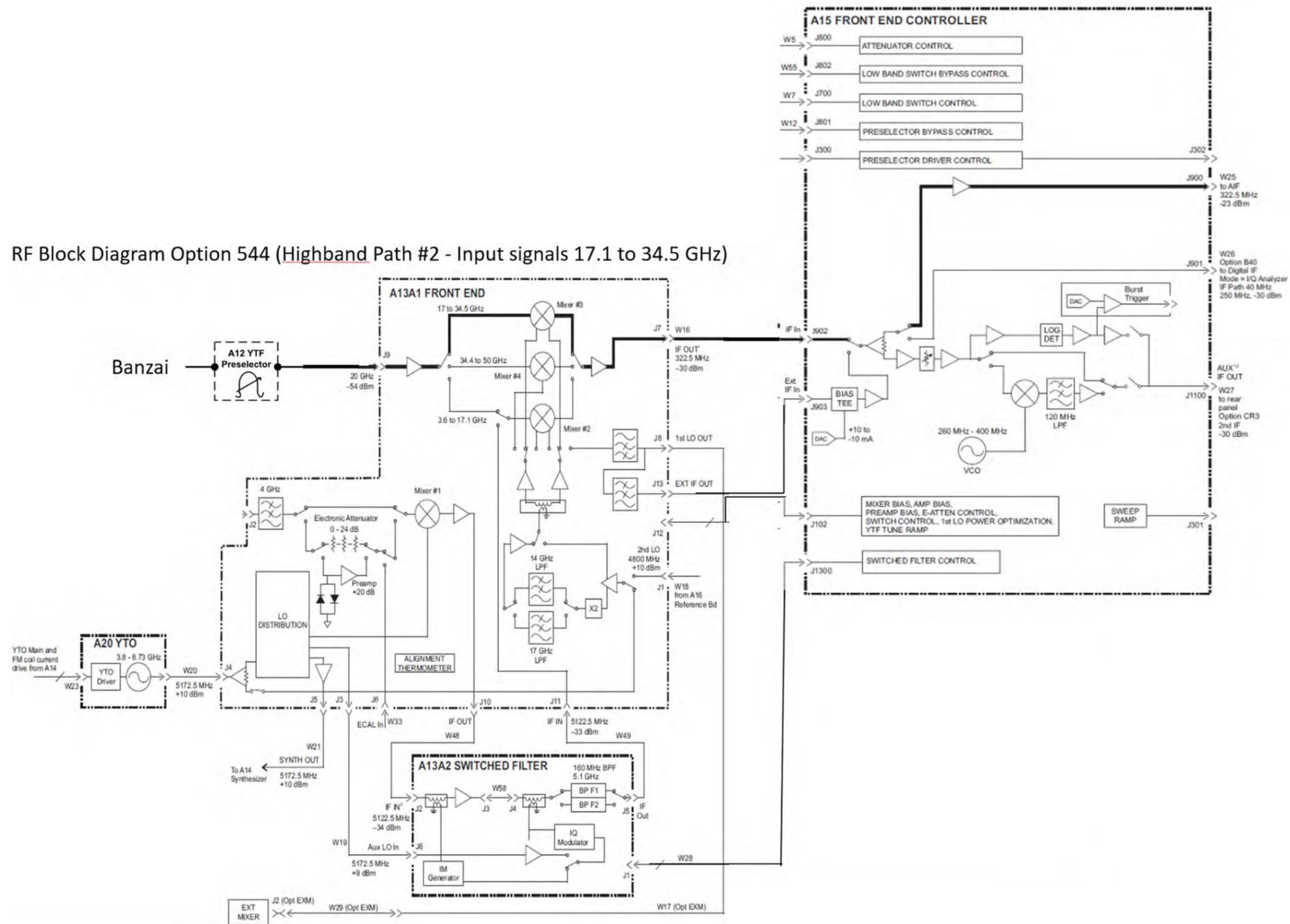
RF Block Diagram Option 544 Low Band Path (DC – 3.6 GHz)



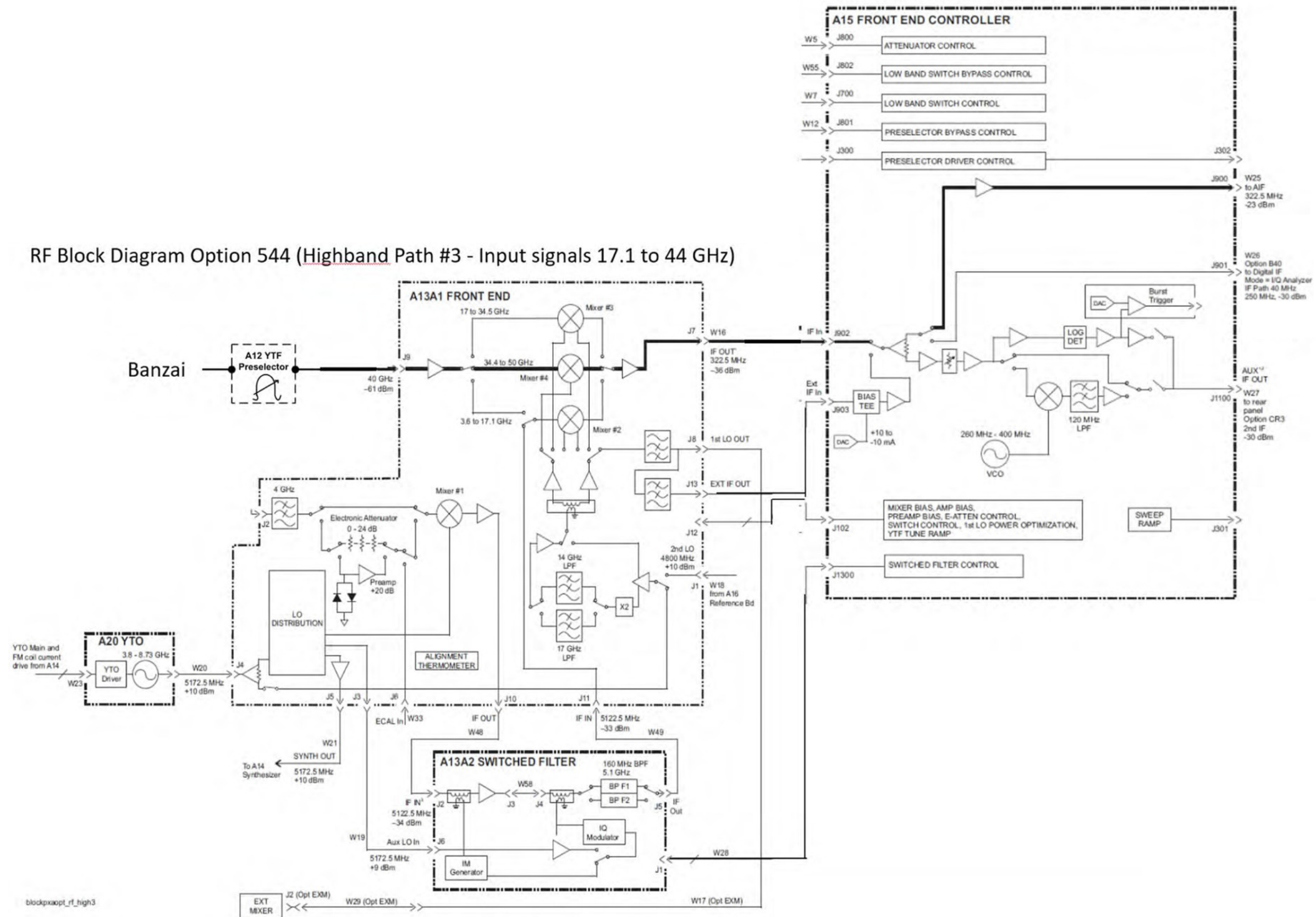
RF Block Diagram Option 544 (Highband Path #1 - Input signals 3.6 to 17.1 GHz)

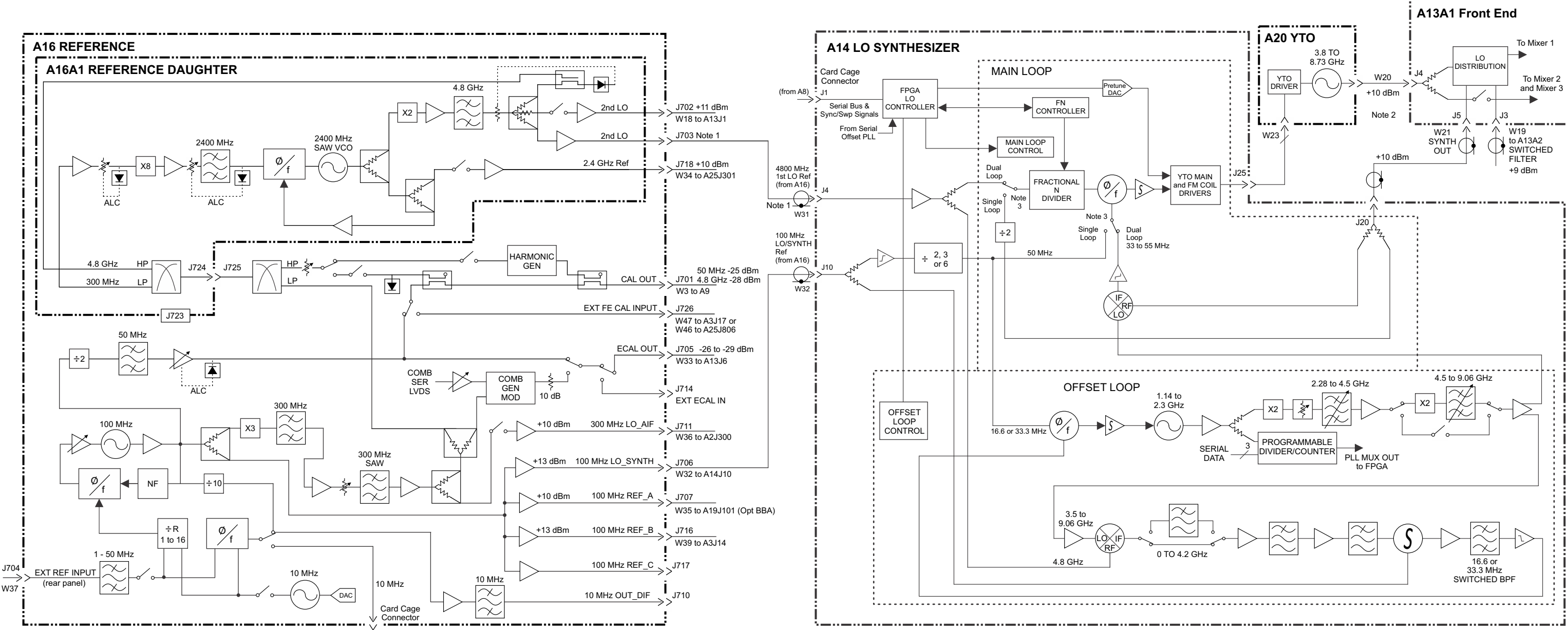


RF Block Diagram Option 544 (Highband Path #2 - Input signals 17.1 to 34.5 GHz)



RF Block Diagram Option 544 (Highband Path #3 - Input signals 17.1 to 44 GHz)





NOTES

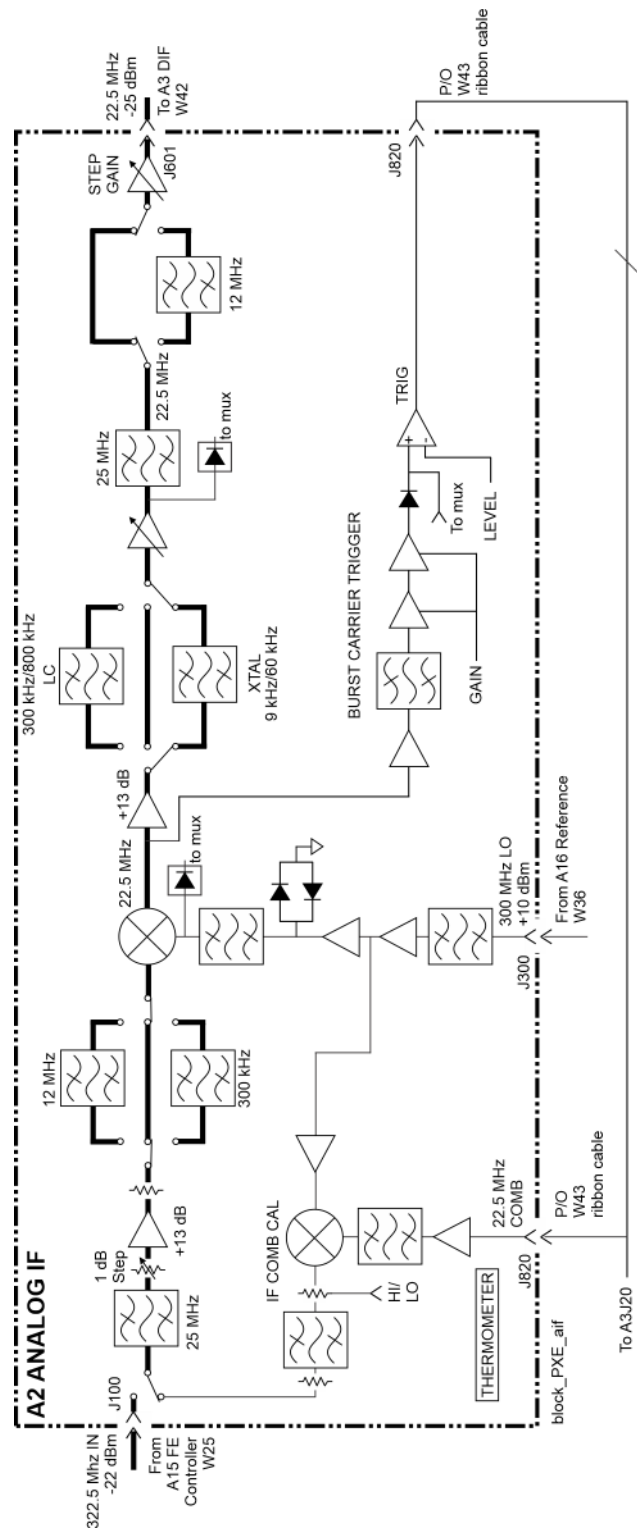
- 1 Power Level is ~ +3 dBm in Dual-Loop mode and ~ -20 dBm in Single-Loop mode.
- 2 The Tuning Equation below shows the relationship between the YTO frequency (1st LO) and the Tuned Frequency.

Band	Tuning Equation
0 - 3.6 GHz	YTO = Tuned Freq + 5.1225 GHz
3.6 - 8.4 GHz	YTO = Tuned Freq + 322.5 GHz
8.4 - 13.6 GHz	YTO = (Tuned Freq + 322.5 MHz) / 2
13.6 - 17.1 GHz	YTO = (Tuned Freq + 322.5 MHz) / 2
17.1 - 26.5 GHz	YTO = (Tuned Freq + 322.5 MHz) / 4
26.4 - 34 GHz	YTO = (Tuned Freq + 322.5 MHz) / 4
34 - 44 GHz	YTO = (Tuned Freq + 322.5 MHz) / 8

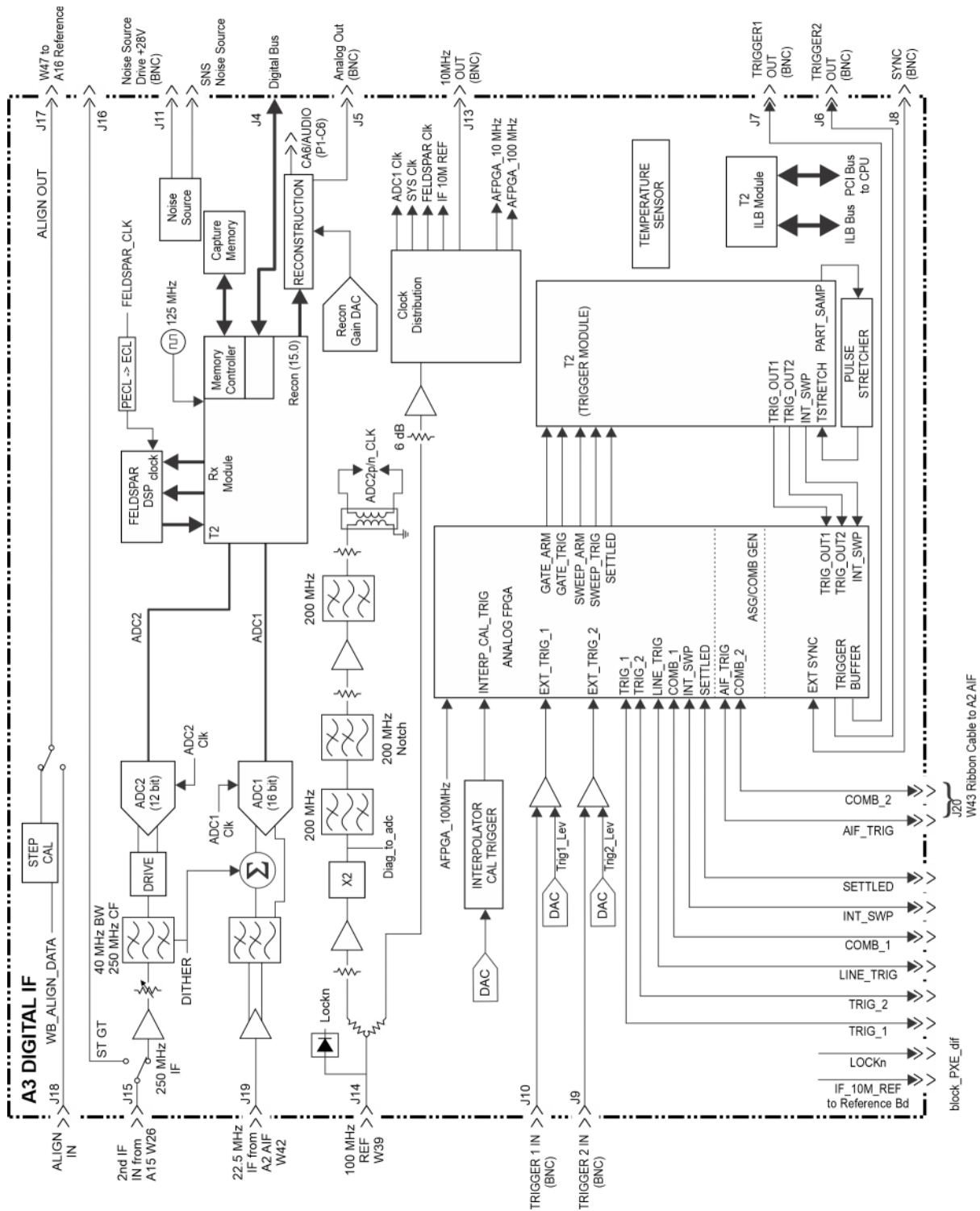
- 3 When autocoupled, spans > 10 MHz are Single-Loop spans and ≤ 10 MHz are Dual-Loop spans.

PXE REFERENCE and SYNTHESIZER BLOCK DIAGRAM

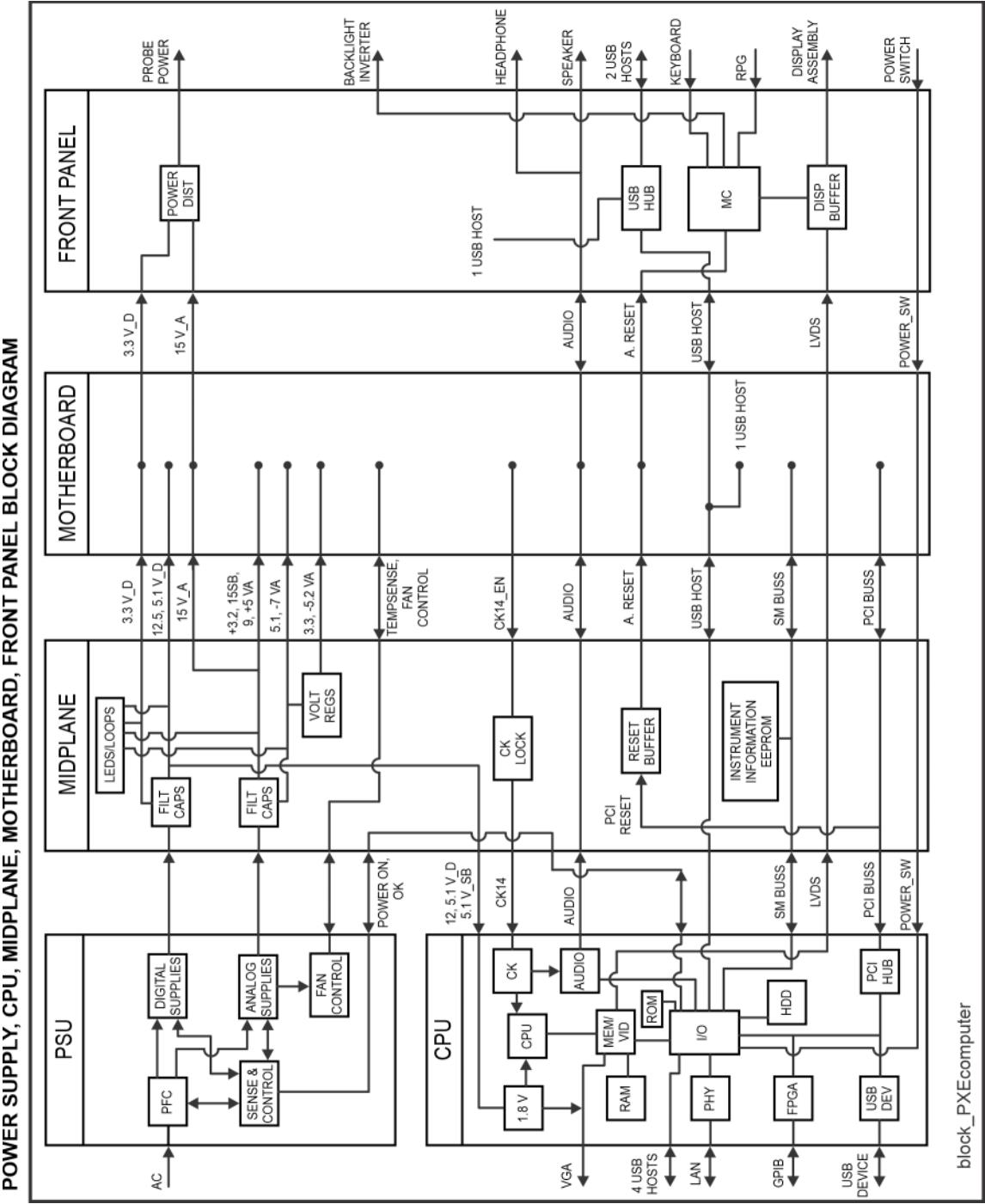
Analog IF Block Diagram



Digital IF Block Diagram



PXE Computer Block Diagram



Block Diagrams
Block Diagrams

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.

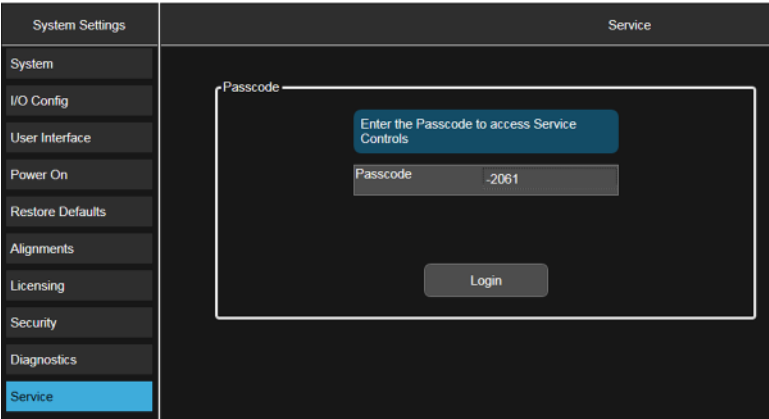
Access to secured service capabilities is gained via a specific numeric Service Code. The Service Code is designed to be easily entered via the front panel; an external keyboard or mouse is not required.

Secure service access

To access the secure service capabilities press **System, Service** with the instrument application running. At this point you will see the window shown in **Figure 16-1**. Enter the Service Code and press **Login**.

The Service Code is: -2061

Figure 16-1 Service Code Entry



Service Menus

Figure 16-2 Secure Service Menu

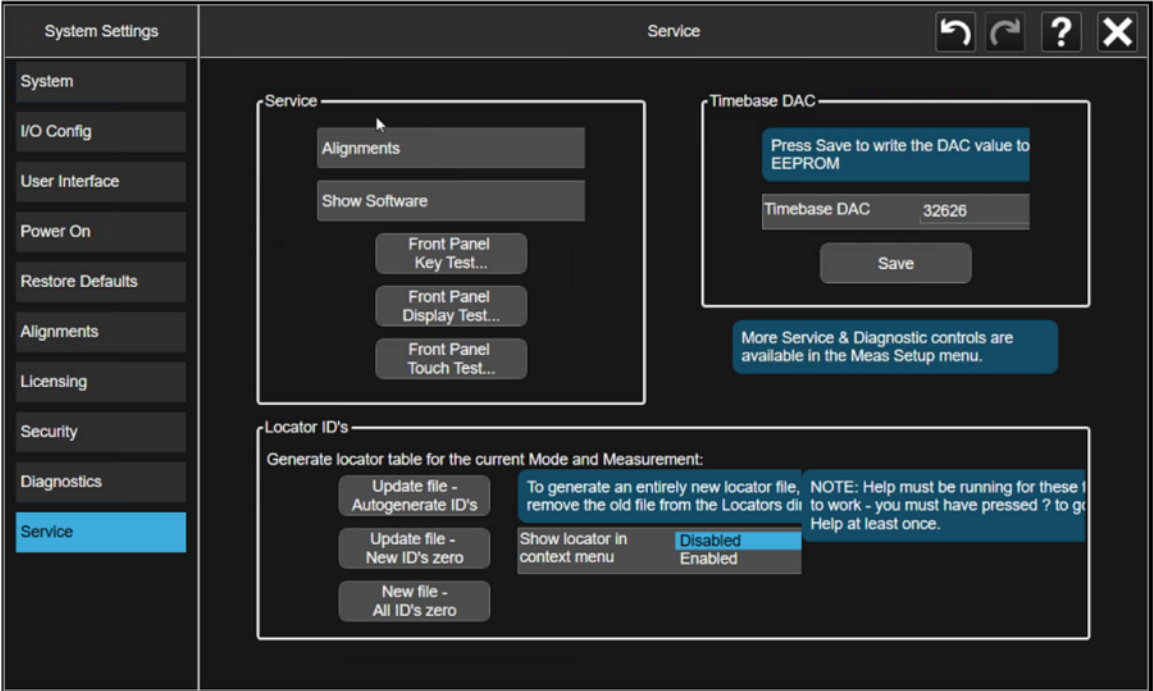


Figure 16-3 Lock and LO Menu
(accessed via Spectrum Analyzer Mode --> Meas Setup --> Lock & LO)



Figure 16-4 Diagnostics (Hardware Statistics)
(accessed via System --> Diagnostics)

System Settings	< Diagnostics	Hardware Statistics	↶ ↷ ? ✕
System	Keysight PXE	Keysight PXE EMI Receiver	
	Product Number	N9048B	
	Serial Number	MY57000052	
I/O Config	S/W Release Name	2020 Update 2.0	
	Instrument S/W Revision	A.28.07	
	Revision Date	2/2/2021 12:15:28 PM	
User Interface	MechAtten #1 Count Total	17638	
	Calibrator Switch Cycles	2464	
Power On	2 dB #1 Mechanical Atten Cycles	7282	
	2 dB #2 Mechanical Atten Cycles	7892	
Restore Defaults	MechAtten #2 Count Total	24905	
	6 dB Mechanical Atten Cycles	7528	
Alignments	10 dB Mechanical Atten Cycles	2883	
	20 dB Mechanical Atten Cycles	6709	
	30 dB Mechanical Atten Cycles	7785	
Licensing			
	VW MechAtten Count Total	0	
Security	6 dB Mechanical Atten Cycles	0	
	14 dB Mechanical Atten Cycles	0	
Diagnostics	RF Preselector Bypass Cycles	48352	
	RF Preselector Input 2 Cycles	4571	
	RFin 1/2 Switch Cycles	0	
Service			
	High temperature operating extreme	43	
	Low temperature operating extreme	29.25	
	Elapsed Time (On-Time)(Hours)	3820	

Figure 16-5 Service Diagnostics (Corrections Menu)
(accessed via Spectrum Analyzer Mode --> Meas Setup --> Service Diagnostics)

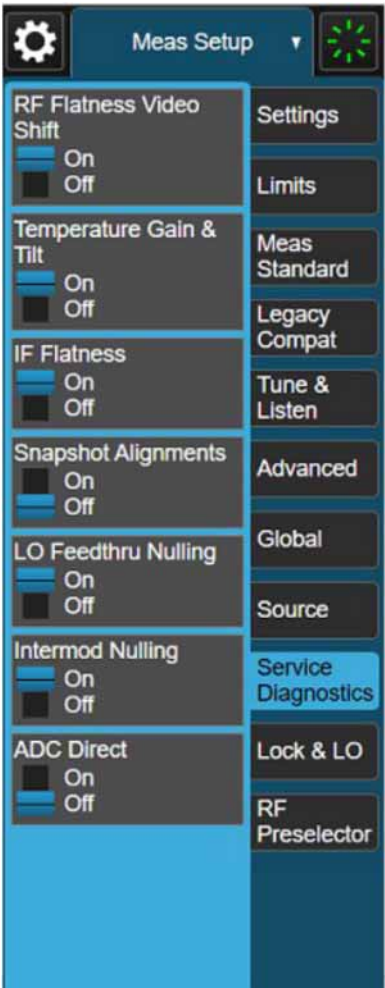
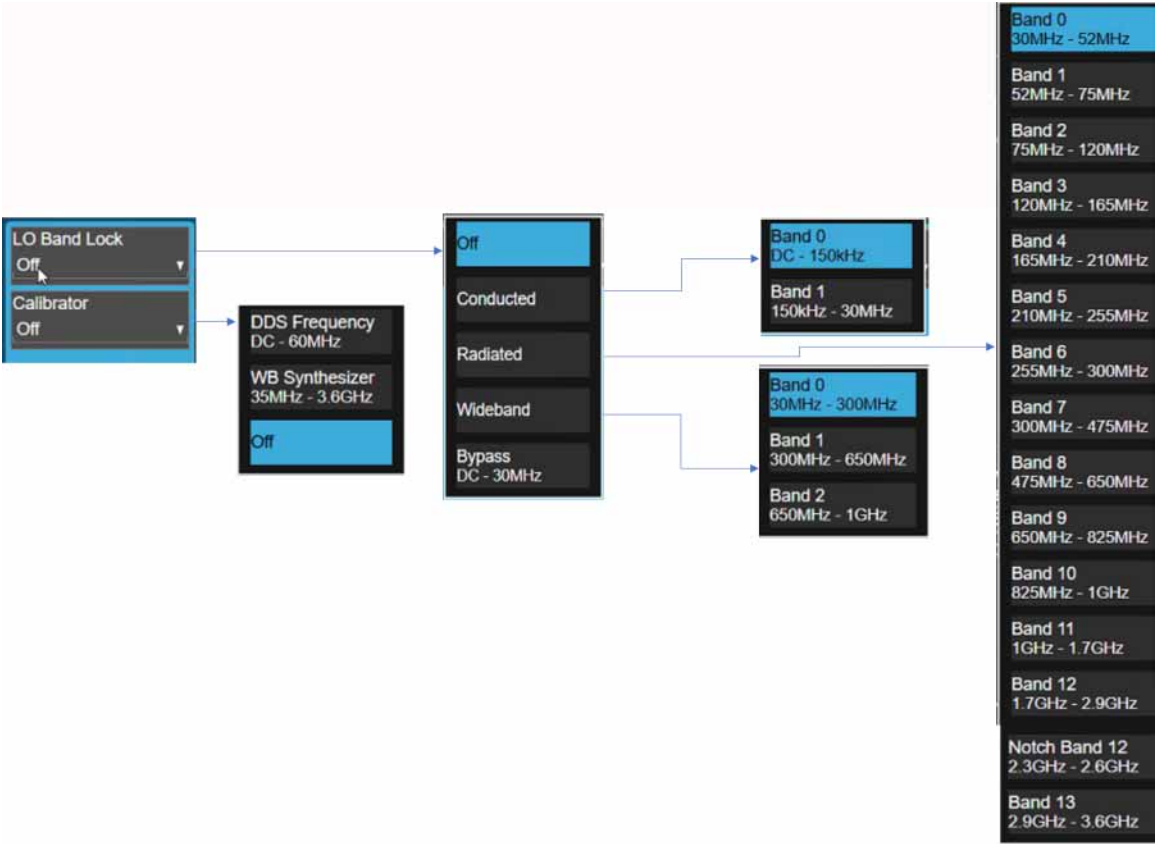


Figure 16-6 RF Preselector Menu
(accessed via Meas Setup --> RF Preselector)



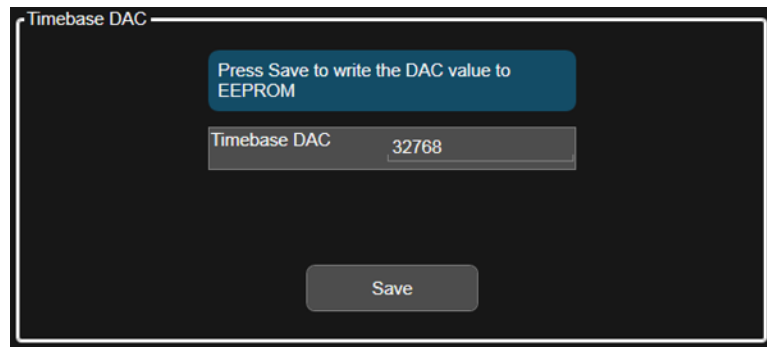
Service Key Descriptions

Timebase

Allows the technician to adjust the 10 MHz reference (“timebase”) manually.

Timebase DAC

Allows the technician the ability 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.



Corrections

The Corrections menu for the multi-touch display in UXA is labeled the Service Diagnostics menu under the Spectrum Analyzer Mode, Measure Setup menu. It allows the technician 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.

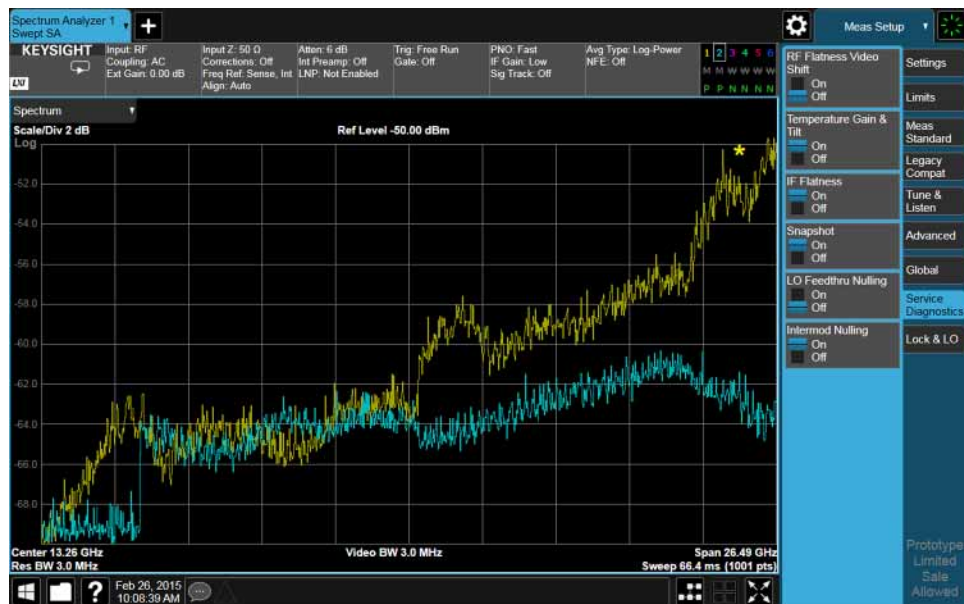
RF Flatness Video Shift On/Off

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 analyzer 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.

The example spectrum below shows the effect of turning off RF Flatness Video. The yellow trace shows RF Flatness Video shift on, and the Blue trace shows RF Flatness Video shift off.



Temperature Gain & Tilt

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 firmware will perform an RBW and IQ alignment when the analyzer RBW state is changed, and every 10 minutes thereafter. These alignments can hinder troubleshooting the analyzer 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. (Use **IF Flatness ON/OFF** to control the IQ alignment.)

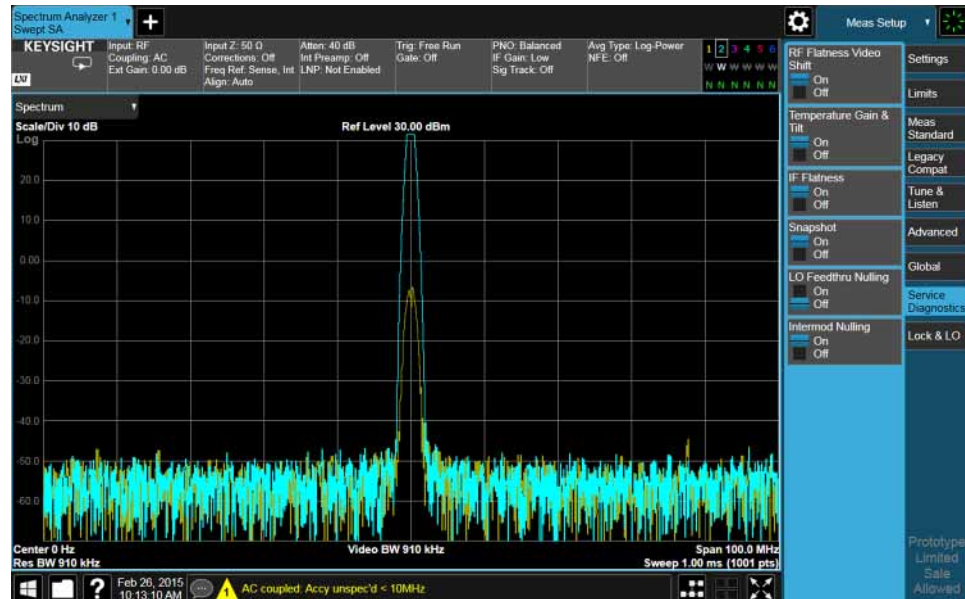
When **Snapshot Alignments** are **OFF**, the Advisory Event “Snapshot OFF” will be displayed.

When **Snapshot Alignments** are **ON**, the Advisory Event “Snapshot OFF” will be cleared.

LO Feedthru Nulling

Control is available to set the state of LO Feedthru nulling ON or OFF. In the ON state, the software will determine when it is appropriate to null the LO Feedthru. LO nulling is only available in low band.

An example spectrum demonstrating the difference between LO Feed through nulling turned on/off is shown below. The yellow trace is with feed through nulling turned on, and the blue trace is with feed through nulling turned off.



Intermod Nulling

Control is available to set the state of Intermod Nulling On or OFF. In the ON state, the software will determine when it is appropriate to null the intermodulation products. IM nulling is only available in low band.

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

Option 544: Bands 0 thru 6

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.

Alignments

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...

Invokes Notepad with the Alignment Log loaded. The log can be viewed or saved to an external media or drive. Notepad can be closed without a mouse or external keyboard by pressing **ALT** front-panel key, then arrow down to highlight **Exit**, then press **Enter**.

This file can also be accessed directly on the instrument hard drive as:

E:\AlignDataStorage\AlignmentHistory.txt

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.

Immediate Actions

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.

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

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

The Show Software screen displays revision information for Keysight internal software that comprises the embedded application and programmable hardware devices (FPGAs and PLDs).

(The Show Software screen is **not** implemented in A.15.xx software)

Figure 16-7 Show Software Screen

System Settings	Service Show Software		   
System	Software Assembly Name	Version	
	Accessibility	4.0.0.0	
I/O Config	ADemodApplication	1.3.54511.15979	
	Agilent.Cdf.Api	4.6.19518.11236	
User Interface	Agilent.Cdf.Api.ApplicationFramework	4.6.19518.11236	
	Agilent.Cdf.Api.Licensing	4.6.19518.11236	
Power On	Agilent.Cdf.Api.Lxi	4.6.19518.11236	
	Agilent.Cdf.Api.Lxi.ScpiCommands	4.6.19518.11236	
Restore Defaults	Agilent.Cdf.Api.Security	4.6.19518.11236	
	Agilent.Cdf.Api.SystemManagement	4.6.19518.11236	
Alignments	Agilent.Cdf.Api.SystemManagement.ScpiCommands	4.6.19518.11236	
	Agilent.Cdf.Api.Ui.Scpi	4.6.19518.11236	
Licensing	Agilent.Cdf.Core.Lxi.Web.ComServer.Interop	1.0.0.0	
	Agilent.Cdf.DataAccess	2.2.9815.12243	
Security	Agilent.CommonBaseband.HWControl	24.13.3.0	
Diagnostics	Agilent.Dca.Hooks	4.6.19518.11236	
	Agilent.Physics	24.13.0.0	
Service	Agilent.Physics.AbortHandler	24.13.3.0	
	Agilent.Physics.ExternalMixerUSBMonitor	1.0.0.0	
	Agilent.Physics.HardwareManagerWrapper	24.13.3.0	
	Agilent.Physics.LogicalHardware	1.0.0.0	
	Agilent.Physics.NativeWrapper	1.0.0.0	
	Agilent.Physics.RFModel	1.0.0.0	
	Agilent.Physics.SAHardwareControl	24.13.3.0	
	Agilent.PhysicsDSPServices	0.20.1.0	
	Agilent.PhysicsServer	24.13.3.0	
	Agilent.PhysicsServices	0.20.2.0	
	Agilent.SA.Api	1.3.54511.15979	
	Agilent.SA.Application.ResourceCatalog	1.3.54511.15979	

RF Preselector

This Menu Provides the ability to switch to the particular filter in the Conducted or Radiated Band and turn the RF preselector alignment signals in and off.

Band Lock

Allow access to select to select either conducted, radiated, Bypass (DC to 30 MHz) or wideband signal paths of the instrument for troubleshooting purposes.

Bypass

This will select the bypass path (DC-30 MHz) in Presel 1 assembly.

Conducted

This will select the conducted filter path. Once selected two conducted paths can be selected from a submenu. This will allow the viewing of the frequency response of the selected filter.

Band 0

Selects the DC to 150 kHz filter path

Band 1

Selects the 150 kHz to 30 MHz filter path

Radiated

This will select the radiated filter path. Once selected, one of the fifteen different radiated filters paths can be selected from a submenu. This will allow the viewing of the frequency response of the selected filter.

Band 0

Selects the 30 MHz to 52 MHz filter path

Band 1

Selects the 52 MHz to 75 MHz filter path

Band 2

Selects the 75 MHz to 120 MHz filter path

Band 3

Selects the 120 MHz to 165 MHz filter path

Band 4

Selects the 165 MHz to 210 MHz filter path

Band 5

Selects the 210 MHz to 255 MHz filter path

Band 6

Selects the 255 MHz to 300 MHz filter path

Band 7

Selects the 300 MHz to 475 MHz path

Band 8

Selects the 475 MHz to 650 MHz fixed filter path

Band 9

Selects the 650 MHz to 825 MHz filter path

Band 10

Selects the 825 MHz to 1 GHz filter path

Band 11

Selects the 1 GHz to 1.7 GHz filter path

Band 12

Selects the 1.7 GHz to 2.9 GHz filter path

Notch Band 12

Selects the 2.3 GHz to 2.6 GHz notch filter path

Band 13

Selects the 2.9 GHz to 3.6 GHz filter path

Wideband

This will select the wideband filter path. Once selected, one of the three different filters paths can be selected from a submenu.

Band 0

Selects the 30 MHz to 300 MHz filter path

Band 1

Selects the 300 MHz to 650 MHz filter path

Band 2

Selects the 650 MHz to 1 GHz filter path

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 Presel 1 assembly.

Once this calibrator signal is selected the frequency of the signal can be set from DC to 60 MHz.

Wideband Synthesizer

The Wideband Synthesizer provides a broadband noise signal from 30 MHz to 3.6 GHz. It is used when a 30 MHz to 3.6 GHz RF Preselector alignment is run.

Off

Turns off whatever calibrator source might be turned on

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 Hdw Statistics

As shown in **Figure 16-8**, this will display the following instrument hardware statistics:

- Mechanical relay switch counts
- Mechanical attenuator switch counts
- Instrument temperature extremes
- Elapsed instrument on-time

Figure 16-8 Hardware Statistical Information

System Settings	Diagnostics		Hardware Statistics	↶ ↷ ? ✕			
System	Keysight PXE	Keysight PXE EMI Receiver					
	Product Number	N9048B					
	Serial Number	MY57000052					
I/O Config	S/W Release Name	2020 Update 2.0					
	Instrument S/W Revision	A.28.07					
	Revision Date	2/2/2021 12:15:28 PM					
User Interface	MechAtten #1 Count Total	17638					
	Calibrator Switch Cycles	2464					
Power On	2 dB #1 Mechanical Atten Cycles	7282					
	2 dB #2 Mechanical Atten Cycles	7892					
Restore Defaults	MechAtten #2 Count Total	24905					
	6 dB Mechanical Atten Cycles	7528					
Alignments	10 dB Mechanical Atten Cycles	2883					
	20 dB Mechanical Atten Cycles	6709					
	30 dB Mechanical Atten Cycles	7785					
Licensing	VW MechAtten Count Total	0					
	6 dB Mechanical Atten Cycles	0					
Security	14 dB Mechanical Atten Cycles	0					
Diagnostics	RF Preselector Bypass Cycles	48352					
	RF Preselector Input 2 Cycles	4571					
	RFin 1/2 Switch Cycles	0					
Service	High temperature operating extreme	43					
	Low temperature operating extreme	29.25					
	Elapsed Time (On-Time)(Hours)	3820					

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:

Figure 17-1, “Major Assemblies”	page 395
Figure 17-2, “External Hardware”	page 396
Figure 17-3, “Top Brace and Power Supply Bracket”	page 397
Figure 17-4, “CPU Assembly”	page 398
Figure 17-5, “Disk Drive Tray Assembly”	page 399
Figure 17-6, “RF Area - Option 503, 508, & 526”	page 400
Figure 17-7, “RF Area Assemblies and Cables - Option 544”	page 402
Figure 17-8, “Front End Parts - Option 503, 508, 513”	page 404
Figure 17-9, “Front End Parts - Option 544”	page 404
Figure 17-10, “Front End Control Cables”	page 406
Figure 17-11, “LO Synthesizer, RF Preselector, and Limiter Prefilter Cables”	page 407
Figure 17-12, “Reference Board Cables”	page 408
Figure 17-13, “Option WF1 Cables”	page 409
Figure 17-14, “AIF/DIF Cables”	page 411
Figure 17-15, “AIF/DIF Cables, bottom”	page 411
Figure 17-16, “AIF/DIF Assemblies”	page 413
Figure 17-17, “Chassis”	page 414
Figure 17-18, “Motherboard”	page 415
Figure 17-19, “Fan Hardware”	page 416

Figure 17-20, “Input Connector”	page 417
Figure 17-21, “RF 2 Input Connector”	page 419
Figure 17-22, “Front Frame Exploded View”	page 420

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 28.**

Replaceable Parts

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1A1	Front Frame Assembly Replacement Kit	N9048-60299
A1A1MP1	Front Frame ^a	
A1A1MP2	Overlay, Main Keyboard	N9048-80004
A1A1MP3	Overlay, Input 2	N9048-80015
A1A1MP4	Front Frame Ground Spring	N9020-20258
A1A1MP5	Braided gasket	8160-0660
A1A1MP6	Gasket - EMI Shielding	8160-1997
A1A1MP7	Blank Cover Plate	N9020-00002
A1A1MP8	Top Trim Strip	N9020-40005
A1A1MP9-10	Side Trim Strip	N9020-40018
A1A1MP11-12	Side Trim Strip, Vinyl	5041-7905
A1A1MP13	Display Boot	N9020-40002
A1A2	Front Panel Control Board	
	Serial # > MY/SG63070100	N9020-63296
	Serial # < MY/SG63070100	N9020-63294
A1A2MP1	Speaker	W1312-60073
A1A2MP2	Speaker Foam	W1312-40088
A1A3	Liquid Crystal Display	2090-1103
A1A5	Keyboard, PCA	N9020-63275
A1A6	Input 2 LED Board	N9038-63006
A1MP1	Main Keypad	N9020-40001
A1MP3	Nameplate Label, 3.6 GHz (Option 503)	N9048-80005
	Nameplate Label, 8.4 GHz (Option 508)	N9048-80006
	Nameplate Label, 26.5 GHz (Option 526)	N9048-80001
	Nameplate Label, 44.0 GHz (Option 544)	N9048-80002
A1MP9	RPG Knob	W1312-40179
A1MP10-13	Cable Clamp	1400-2219

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1MP14	Display Bracket	N9020-00078
A1MP15	Front Panel Shield Bracket	N9020-00064
A1MP16	Display hold down (compression pad)	N9020-40003
A1MP19	Shield, Front Panel	N9020-00066
A1MP20	Bracket, Input 2 LED Board	N9048-00007
A1W1	Flex Circuit, Display to Front Panel Control Board	N9020-60273
A1W2	Cable Assembly, ribbon, 68 pin Motherboard Keyboard	N9020-60216
A1W3	Cable Assembly, Touch/Backlight	N9020-60217
A1W4	Cable Assembly, LED Board	N9048-60011
A2	Analog IF Assembly	N9020-60290
A3	Digital IF Assembly	N9038-60116
A3MP1	EMI Gasket, Digital Bus	N9038-00004
A3W1	Cable Assembly, Wire Harness, Smart Noise Source	N9020-60090
A4	CPU Assembly (without A5 disk drive)	
	PC8/64 Bit/Windows 10 (serial # > MY/SG61390000)	N9048-60524
	PC6/64 Bit/Windows 10 (serial # ≤ MY/SG61390000)	N9038-60212
A4A1	Disk Drive Interconnect Board	W1312-63377
A4BT1	Battery, 3V, LI Manganese Dioxide (CR2032)	1420-0356
A5	Solid State Disk Drive	N9020-60202
	PC8/64 Bit Windows 10	N9032-60016
	PC6/64 Bit Windows 10	N9020-60356
A5MP1	Disk Drive Tray	W1312-40078
A5MP2	Disk Drive Rear Panel	W1312-00103
A5MP3	Disk Drive Handle	1440-0421
A6	Power Supply Assembly	0950-5748
A7	Midplane Assembly	W1312-63310
A8	Motherboard Assembly	N9030-63002

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
A9	RF Attenuator A (0-4 dB) (Option 503, 508, and 526)	
	Serial # > MY/SG63070100	33360-60011
	Serial # < MY/SG63070100	33360-60008
	RF Attenuator A (0-10 dB) (Option 544)	33326-60013
A10	RF Attenuator B (0-66 dB) (Option 503, 508, 526)	
	Serial # > MY/SG63070100	33321-60085
	Serial # < MY/SG63070100	33321-60083
	RF Attenuator B (0-60 dB) (Option 544)	33325-60020
A11	Dual Pre-Amp Module, LNA, and EMC Band Switch	N9048-60007
A12	YIG Tuned Filter (YTF)	
	(Option 503, 508, 526)	5087-7382
	(Option 544)	5087-7383
A12MP1	Gap Pad - YTF Mounting	5022-7179
A13	Front End Assembly	
	(Option 503, 508, 526)	N9020-60328
	(Option 544)	N9020-60337
A14	LO Synthesizer Assembly	N9020-60118
A15	Front End Control Assembly	N9020-60295
A16	Reference Assembly	N9020-60188
A17	Reserved	
A18	Reserved	
A19	Reserved	
A20	Reserved	
A21	RF Preselector Input Assembly	N9048-60002
A23	Limiter Prefilter Board (LPF) Assembly	N9048-60000
A26	Wideband Digital IF Assembly (Option WF1)	N9030-60048
B1-3	Fan	3160-4199

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
J1	Type-N Input Connector Assembly	
	Serial # <MY/SG62030000	N9038-60021
	Serial # >MY/SG62030000	N9048-60121
	3.5 mm Input Connector Assembly (Option C35)	
	Serial # <MY/SG62030000	N9038-60019
	Serial # >MY/SG62030000	N9048-60119
	2.4 mm Input Connector Assembly (Option 544)	
J1MP1	Serial # >MY/SG62030000	N9030-60011
	Serial # >MY/SG62030000	N9048-60111
J1MP1	EMI O-Ring 18.75 mm ID	8160-1637
J2	Type-N Input Connector Assembly	
	Serial # <MY/SG62030000	N9038-60021
	Serial # >MY/SG62030000	N9048-60121
J2MP1	EMI O-Ring 18.75 mm ID	8160-1637
MP1	Chassis Base	
	Serial # < MY/SG62030000	N9038-00015
	Serial # > MY/SG62030000)	N9048-00020
MP2	Chassis Side, Left (inner)	W1312-00117
MP3	Chassis Side, Left (outer) - Fan Bracket	W1312-00118
MP4	Chassis Side, Right (inner)	W1312-00116
MP5	Chassis Side, Right (outer)	N9048-00016
MP6	Rear Panel	N9048-00008
MP7	Chassis, Midplane Bracket	W1312-00048
MP8	Chassis, Front Bracket	N9048-00019
MP9	Bracket, Power Supply	W1312-00131
MP10	Top Brace Assembly	N9048-00014
MP11-14	Vibration Mounts	0460-2725
MP15-17	Fan Guard	3160-0281

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
MP18	Chassis Gusset, Input Connector	
	Serial # <MY/SG62030000	W1312-00224
	Serial # >MY/SG62030000	N9048-20618
MP19	Bracket, Attenuator A and B	N9048-00018
MP21	Bracket, Dual Pre-Amp Module, LNA, and EMC Band Switch	N9048-00011
MP22	Bracket, 4 Port Switch	N9048-00012
MP23	Dress Cover	N9020-00069
MP25-26	Strap Handle	N9048-60020
MP27-30	Instrument Rear Feet	5041-7903
MP31-52	Chassis Board Guide	W1312-40001
MP57	Cable Hold Down 1 (158 mm)	5023-1397
MP58	Cable Hold Down 2 (48 mm)	5023-1379
MP60	Shield, Magnetic - Attenuator A (Option 544)	N9020-00043
MP61	Shield, Magnetic - Attenuator B (Option 544)	N9020-00044
SW1	4 Port Terminated Switch (Option 503, 508, and 526)	N9048-60004
	4 Port Terminated Switch (Option 544)	N9048-60005
W1	Cable, Ribbon, Front Panel Interface P1 to Motherboard	N9020-60216
W3	Cable, Ribbon, Front End Control (A15) J800 to Atten A (A9) & B (A10)	E4410-60157
W4	Cable, Ribbon, Digital IF (A3) J100 to Analog IF (A2) J820	N9020-60046
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W6	Cable, Wire Harness, 4 Port Terminated Switch (SW1), Front End Ctrl (A15) J801	N9048-60013
W7	Cable, ribbon, Dual Pre-Amp Module, LNA, and EMC Band Switch to Front End Ctrl (A15) J700	N9020-60092
W8	Cable, ribbon, Switched Filter control, Front End Ctrl (A15) J1300 to Switched Filter J1	N9020-60064
W9	Cable, ribbon, LPF board (A23) J10 to Rear Panel	N9038-60028
W10	Reserved	
W11	Reserved	

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
W12	Cable, Wire Harness, Front End Ctrl (A15) J300 to YTF (A12) J1	N9020-60059
W13	Cable, coaxial, Digital IF (A3) J15 to Wideband Digital IF Assy (A26) J5 (Option WF1)	8121-2292
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, Front End Ctrl (A15) J901 to LPF Board (A23) J8 (Option WF1)	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	8120-8868
	Cable, Coaxial, Analog IF (A2) J601 to LPF Board (A23) J6 (Option WF1)	8121-2291
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, Digital IF (A3) J19 to LPF Board (A23) J7 (Option WF1)	8121-1919
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
W24	Cable, coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1401
W25	Cable, semi-rigid, RF Input 1 (J1) to Atten A (A9) Port 1	
	(Standard - Type-N)	N9048-21300
	(Option C35 - 3.5mm)	N9048-21326
	(Option 544 - 2.4 mm)	N9048-21319
W26	Cable, semi-rigid, RF Input 2 (J2) to Limiter Assy (A23) J1	N9048-21332
W27	Cable, semi-rigid, LPF Board (A23) J3 to Atten A (A9) Port 2	
	(Option 503, 508, 526)	N9048-21328
	(Option 544)	N9048-21318
W28	Cable, semi-rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	
	(Option 503, 508, 526)	N9048-21302
	(Option 544)	N9048-21317
W29	Cable, semi-rigid, Atten B (A10) Port 1 to 4 Port Terminated Switch (SW1) Port 3	
	(Option 503, 508, 526)	N9048-21331
	(Option 544)	N9048-21320

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
W30	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 1 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 4	
	(Option 503, 508, 526)	N9048-21333
	(Option 544)	N9048-21323
W31	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 2 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 2	
	(Option 503, 508, 526)	N9048-21334
	(Option 544)	N9048-21324
W32	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 4 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 5	
	(Option 503, 508, 526)	N9048-21308
	(Option 544)	N9048-21325
W33	Cable, semi-rigid, RF Preselector Input Assembly (A21A1) J101 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) P1	N9048-21327
W34	Cable, semi-rigid, A12 YTF P2 Preselector to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) P3	
	(Option 503, 508, 526)	N9048-21335
	(Option 544)	N9048-21321
W35	Cable, semi-rigid, YTF Preselector (A12) P1 to Front End (A13) J9	
	(Option 503, 508, 526)	N9048-21337
	(Option 544)	N9048-21322
W36	Cable, semi-rigid, 2nd LO In, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W37	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J102 to Front End Assy (A13) J2	N9048-21329
W38	Cable, semi-rigid, Synthesizer Assy (A14) J740 to Front End Assy (A13) J4	N9020-20156
W39	Cable, semi-rigid, Synthesizer Assy (A14) J200 to Reference Assy (A16) J703	N9038-21306
W40	Cable, semi-rigid, LPF Board (A23) J2 to RF Preselector Input Assy (A21A1) J3	N9048-21330
W41	Cable, semi-rigid, LPF Board (A23) J4 to RF Preselector Input Assy (A21A1) J1 (Option WF1)	N9048-21336
W42	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J301 to RF Preselector Input Assy (A21A2) J4	N9048-21307
W43	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J103 to RF Preselector Input Assy (A21A2) J3	N9048-21307

Table 17-1 All Replaceable Parts

Reference Designator	Description	Part Number
W44	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J4 to Reference Assy (A16) J701	N9048-21310
W45	Cable, semi-rigid, W46 to Front End Assy (A13) J8 (Option EXM) (Option 503, 508, 526) (Option 544)	N9020-20132 N9020-20167
W46	Cable, semi-rigid, Front Panel J3 to W46 (Option EXM)	N9020-20166
W49	Cable, coaxial, Wideband Digital IF Assy (A26) J3 to Digital IF (A3) J18 (Option WF1)	8121-2292
W50	Cable, coaxial, Wideband Digital IF Assy (A26) J1 to Reference Assy (A16) J718 (Option WF1)	8121-0152
W51	Cable, coaxial, Wideband Digital IF Assy (A26) J4 to LPF Board (A23) J9 (Option WF1)	8121-0152
W52	Cable, coaxial, Wideband Digital IF Assy (A26) J7 to LPF Board (A23) J5 (Option WF1)	8121-1940
	Hole Plug, Nylon, 0.5 D (BNC)	6960-0149
	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.

Replaceable Parts
Replaceable Parts

Quantity Required	Description	Part Number
4	Bottom Feet	5041-7906
4	Bottom Feet Key Lock	5041-2840
1	Rackmount Kit w/o Handles (Option 1CM)	5022-9639
1	Rackmount Kit w/ Handles (Option 1CP)	5022-9635
1	Instrument Front Handles (Option 1CN)	5063-1547

Table 17-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Analog IF Assembly	Digital IF Assembly	3	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Attenuators	Attenuator Bracket	2 per	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Attenuator Bracket	Chassis	5	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
AUX I/O Cable	Rear Panel	2	0380-1858	4-40 0.312 in	3/16" Nut Driver	9 inch-lbs
Backlight Inverter Board	Inverter Bracket	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Backlight Inverter Assembly Top Shield	Inverter Assembly Bottom Shield	8	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Chassis Bottom	Chassis Front and Side Brackets	15	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Chassis Front Bracket	Chassis	10	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Chassis Gusset	Chassis	3	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Chassis Side, Right Outside	Chassis	8	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
CPU Assembly	Chassis	6	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
CPU Top Shield	CPU Assembly	3	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
		19	0515-1227	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
Display	Display Bracket	4	0515-0367	M2.5 X 0.45, 8 mm	Torx T-8	5 inch-lbs
Display Bracket	Front Frame	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Disk Drive	Disk Drive Tray	4	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Disk Drive Handle	Disk Drive Rear Panel	2	0515-1227	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
Disk Drive Interconnect	CPU Assembly	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Disk Drive Rear Panel	Disk Drive Tray	4	0515-2219	M2.5 X 0.45, 5 mm	Torx T-8	6 inch-lbs

Table 17-2 Attaching Hardware

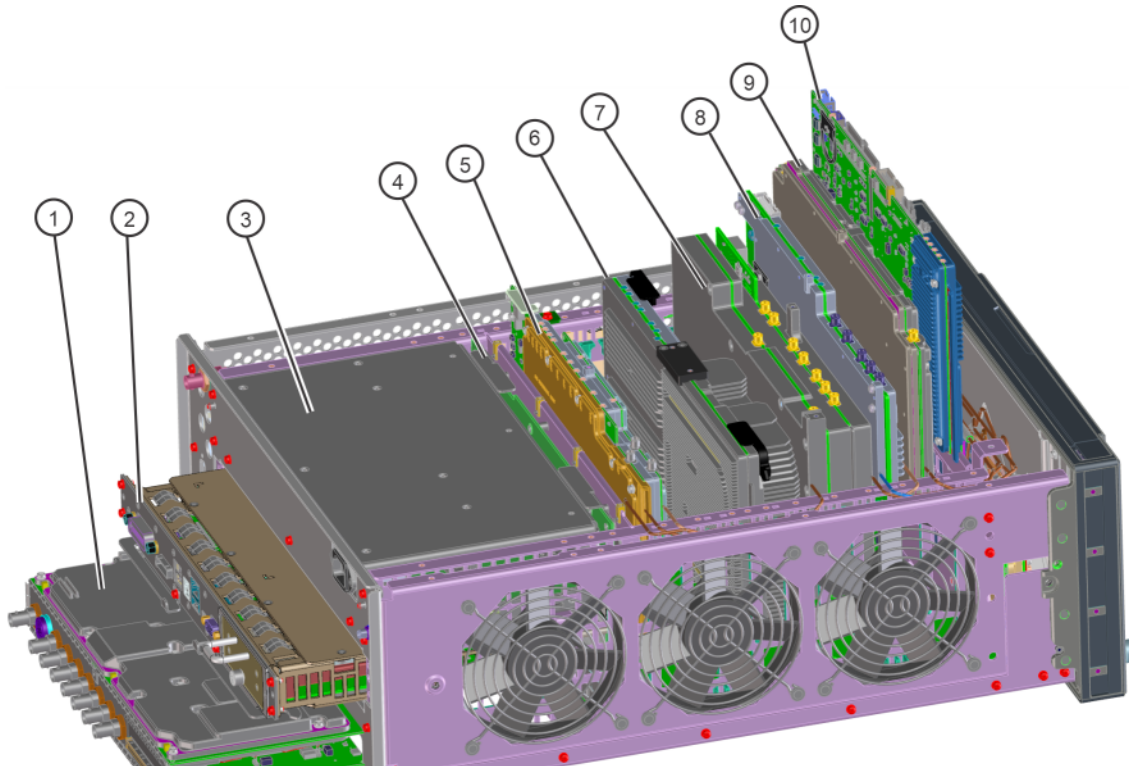
Attach	To	Qty	Part Number	Type	Tool	Torque
Dual Pre-Amp Module, LNA, and EMC Band Switch	Dual Pre-Amp Module, LNA, and EMC Band Switch Bracket	5	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Dual Pre-Amp Module, LNA, and EMC Band Switch Bracket	Chassis	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
External Reference Cable	Rear Panel	1	2190-0102	n/a	n/a	n/a
		1	0590-2332	n/a	9/16" Nut Driver	21 inch-lbs
Fan	Fan Bracket	4 per	0361-1272	n/a	n/a	n/a
Fan Assembly	Chassis	7	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Front Frame Assembly	Chassis	5	0515-2032	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
Front Panel Connector Cover Plate	Front Frame	2	0515-1227	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
Front Panel Daughter Board	Front Frame	3	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Front Panel Interface Board	Front Frame	13	0515-1521	M3 X 0.5, 5 mm	Torx T-10	9 inch lbs.
Front Panel Shield	Front Frame	4	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Input 2 LED Board	Input 2 LED Board Bracket	2	0515-0658	M2 X 0.4, 6 mm	Torx T-6	3 inch-lbs
Input 2 LED Board Bracket	Front Frame	1	0515-1227	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
LO Synthesizer Assembly	Chassis Front Bracket	2	0515-2032	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
LPF Assembly	Chassis	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Midplane Assembly	Midplane Bracket	6	0515-0375	M3 X 0.5, 16 mm	Torx T-10	9 inch-lbs

Table 17-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Midplane Bracket	Chassis Sides	4	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
	Motherboard	4	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Motherboard Assembly	Chassis Bottom	4	0515-0372	M3 X0.5, 8 mm	Torx T-10	9 inch-lbs
Power Supply Bracket	Chassis Sides	8	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
	Power Supply	3	0515-1946	M3 X0.5, 8 mm	Torx T-10	9 inch-lbs
Rear Feet	Rear Panel	4	0515-1619	M4 X 0.7, 25 mm	Torx T-20	21 inch-lbs
		4	3050-0893	n/a	n/a	n/a
Rear Frame	Chassis	5	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Rear Frame Hole Cover	Rear Frame Inner Hole Cover	16	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Reference Assembly	Chassis	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
RF Front End Assembly	Chassis	6	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
RF Preselector Input Assembly	RF Preselector Input Assembly Bracket	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
RF Preselector Input Assembly Bracket	Chassis	2	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
RF Input Connector	Chassis	2 per	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
RF Input Gusset	Chassis	3	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
Strap Handles	Chassis Sides	2 per	0515-0710	M5 X 0.8, 18 mm	Torx T-20	21 inch-lbs
Top Brace	Chassis	12	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs
	Chassis & PCB Assemblies	12	0515-1946	M3 X 0.5, 6 mm	Torx T-10	9 inch-lbs
YIG Tuned Filter Assembly	Chassis	4	0515-0372	M3 X 0.5, 8 mm	Torx T-10	9 inch-lbs

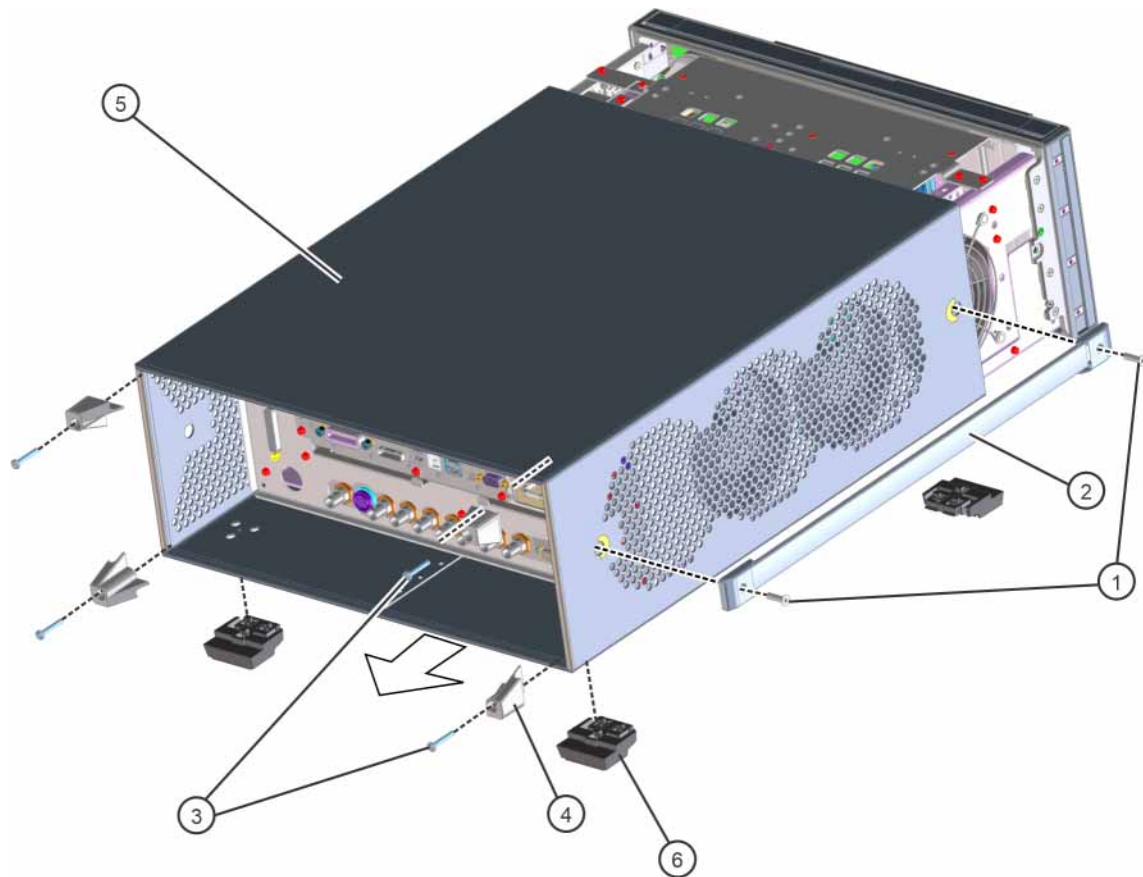
Hardware

Figure 17-1 Major Assemblies



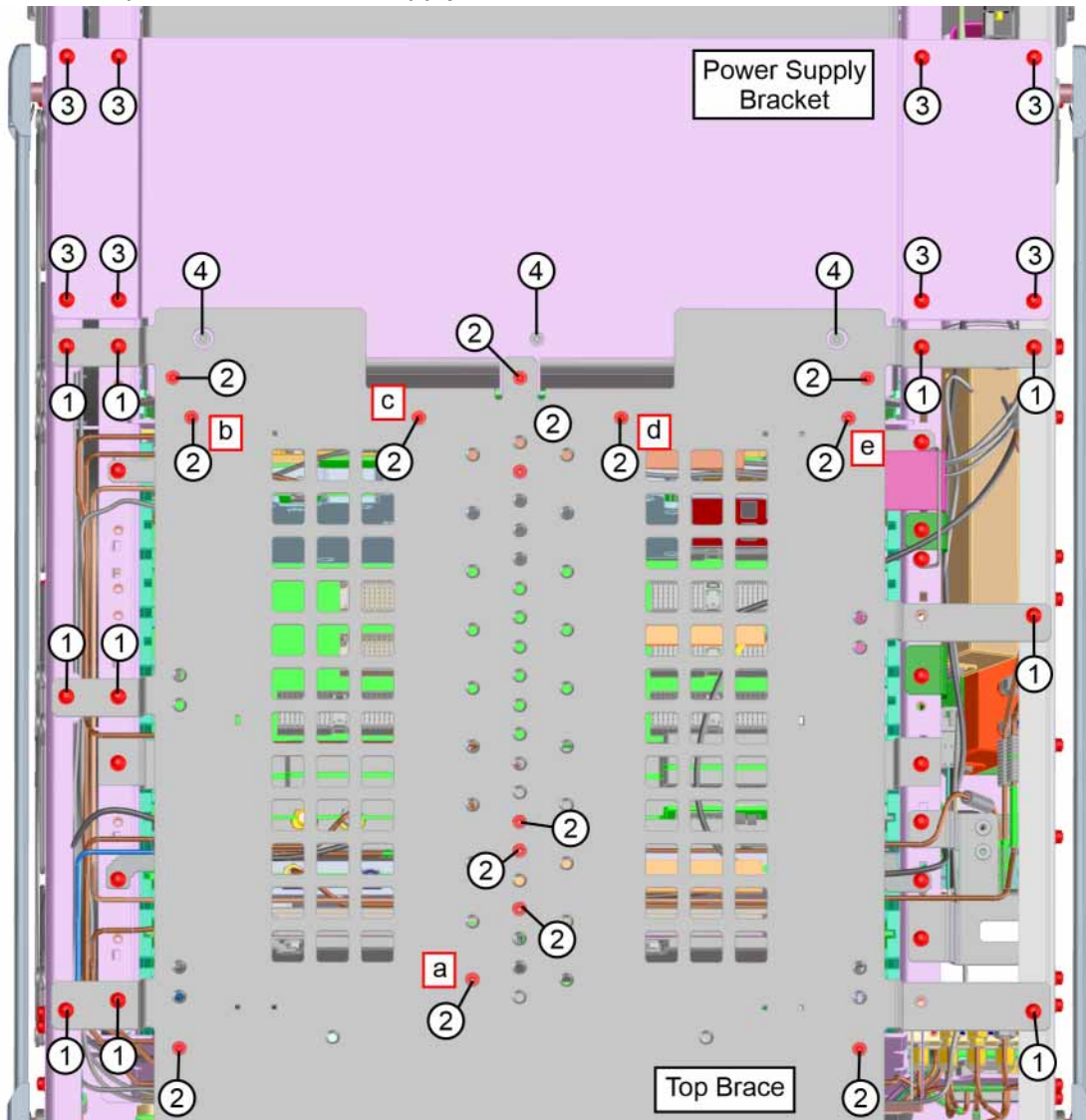
Item	Description	Part Number
1	A2 Analog IF Board A3 Digital IF Board	N9020-60290 N9038-60116
2	A4 CPU Assembly (without A5 disk drive) PC8/64 Bit/Windows 10 (serial # > MY/SG61390000) PC6/64 Bit/Windows 10 (serial # ≤ MY/SG61390000)	N9048-60524 N9038-60212
3	A6 Power Supply Assembly	0950-5748
4	A7 Midplane Assembly	W1312-63310
5	A16 Reference Assembly	N9020-60188
6	A26 Wideband Digital IF Assembly (Option WF1)	N9030-60048
7	A21 RF Preselector Input Assembly	N9048-60002
8	A23 Limiter Prefilter Board (LPF) Assembly	N9048-60000
9	A14 LO Synthesizer Assembly	N9020-60118
10	A15 Front End Control Assembly	N9020-60295

Figure 17-2 External Hardware



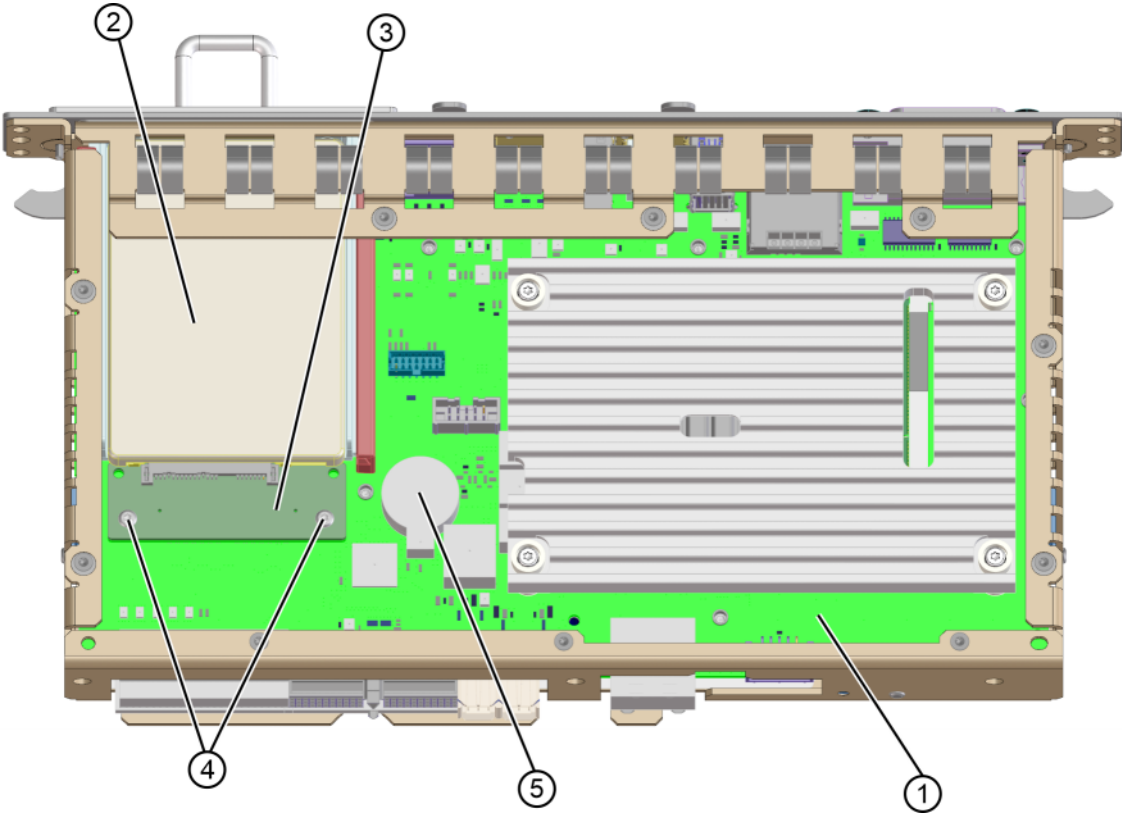
Item	Description	Part Number
1, 2	MP25-26 Strap Handle (includes screws)	N9048-60020
3	Screw	0515-1619
4	MP27-30 Instrument Rear Feet	5041-7903
5	MP23 Dress Cover	N9020-00069
6	Bottom Feet	5041-7906
6	Bottom Feet Key Lock	5041-2840

Figure 17-3 Top Brace and Power Supply Bracket



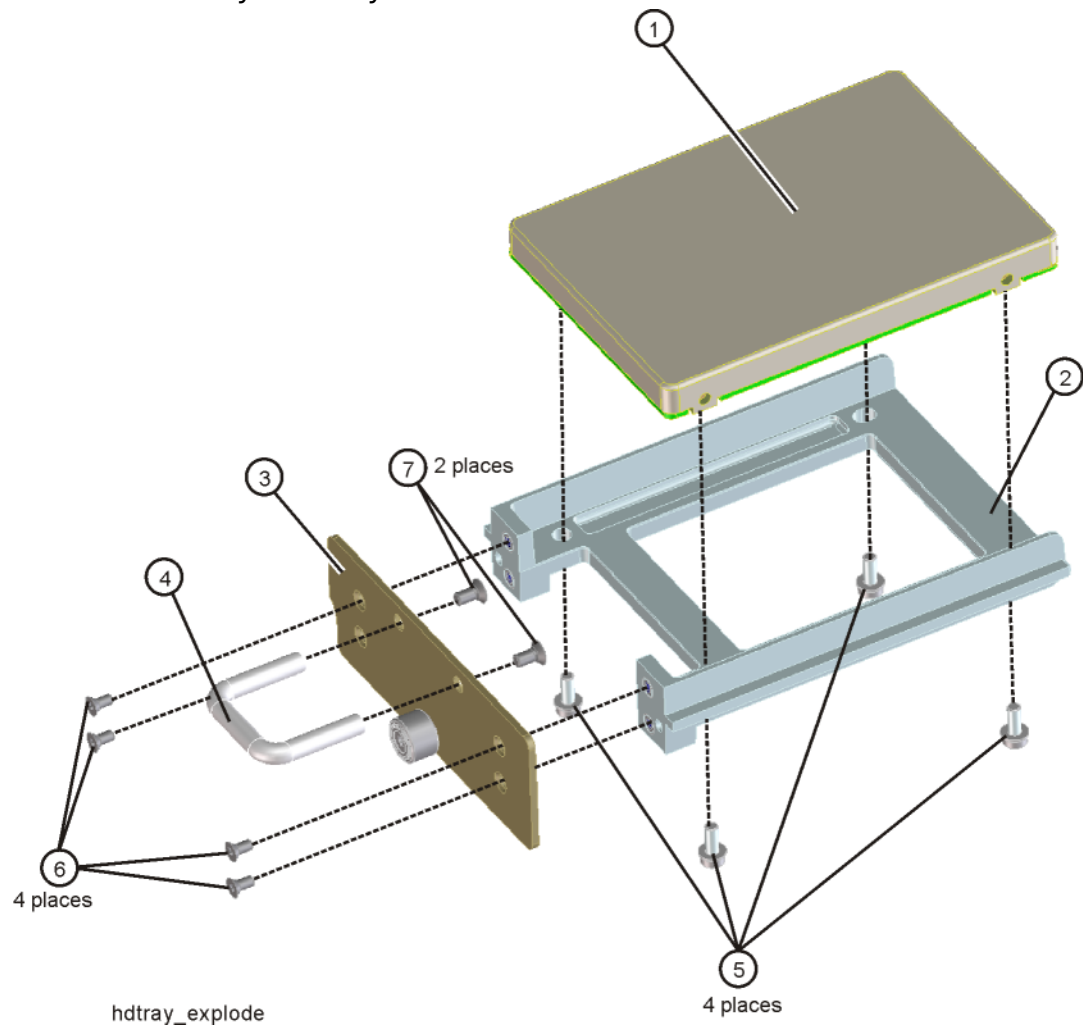
Item	Description	Part Number
	MP10 Top Brace Assembly	N9048-00014
	MP9 Bracket, Power Supply	W1312-00131
1	Screw	0515-0372
2	Screw	0515-1946
3	Screw	0515-0372
4	Screw	0515-1946

Figure 17-4 CPU Assembly



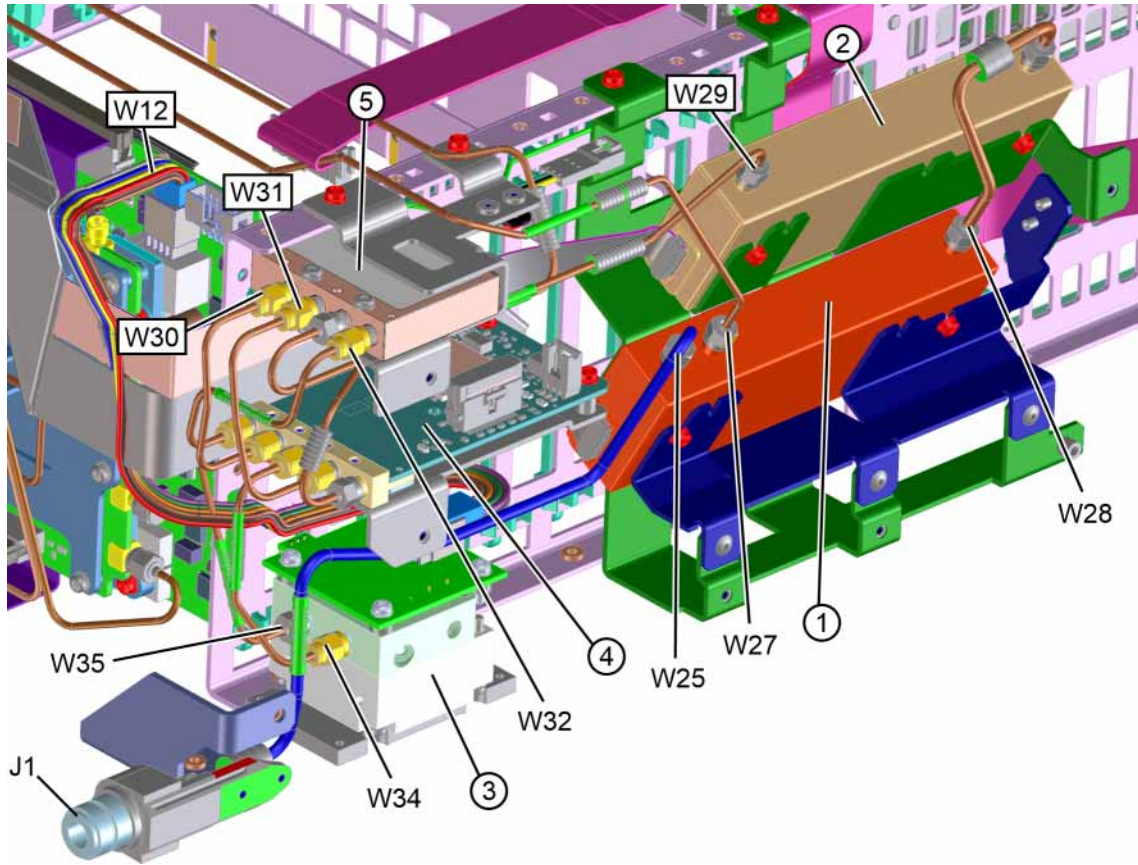
Item	Description	Part Number
1	A4 CPU Assembly (without A5 disk drive) PC8/64 Bit/Windows 10 (serial # > MY/SG61390000) PC6/64 Bit/Windows 10 (serial # ≤ MY/SG61390000)	 N9048-60524 N9038-60212
2	A5 Solid State Disk Drive PC8/64 Bit Windows 10 PC6/64 Bit Windows 10	 N9032-60016 N9020-60356
3	A4A1 Disk Drive Interconnect Board	W1312-63377
4	Screw	0515-0372
5	A4BT1 Battery, 3V, LI Manganese Dioxide (CR2032)	1420-0356

Figure 17-5 Disk Drive Tray Assembly



Item	Description	Part Number
1	A5 Solid State Disk Drive	
	PC8/64 Bit Windows 10	N9032-60016
	PC6/64 Bit Windows 10	N9020-60356
2	A5MP1 Disk Drive Tray	W1312-40078
3	A5MP2 Disk Drive Rear Panel	W1312-00103
4	A5MP3 Disk Drive Handle	1440-0421
5	Screw	0515-0372
6	Screw	0515-2219
7	Screw	0515-1227

Figure 17-6 RF Area - Option 503, 508, & 526

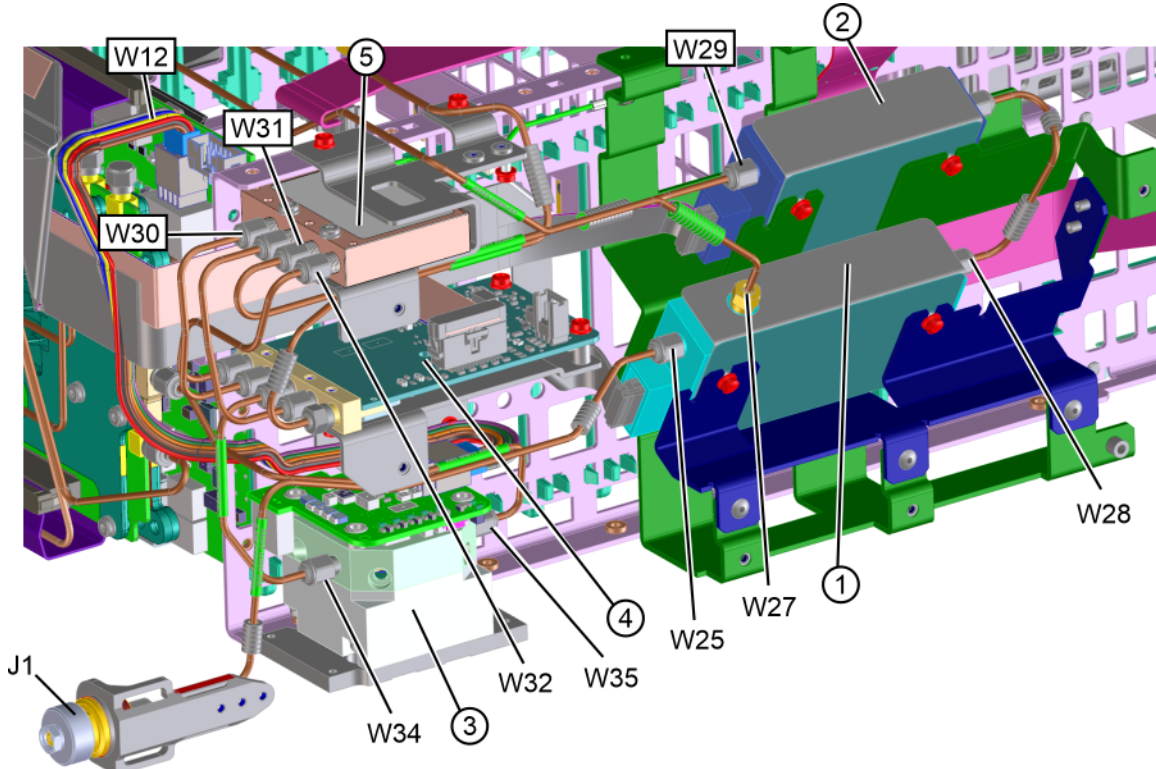


Item	Description	Part Number
1	A9 RF Attenuator A (0-4 dB) (Option 503, 508, and 526) Serial # > MY/SG63070100 Serial # < MY/SG63070100	33360-60011 33360-60008
2	A10 RF Attenuator B (0-66 dB) (Option 503, 508, 526) Serial # > MY/SG63070100 Serial # < MY/SG63070100	33321-60083 33321-60083
3	A12 YIG Tuned Filter (YTF)	5087-7382
4	A11 Dual Pre-Amp Module, LNA, and EMC Band Switch	N9048-60007
5	SW1 4 Port Terminated Switch (Option 503, 508, and 526)	N9048-60004

Replaceable Parts
Hardware

Item	Description	Part Number
J1	Type-N Input Connector Assembly	
	Serial # <MY/SG62030000	N9038-60021
	Serial # >MY/SG62030000	N9048-60121
	3.5 mm Input Connector Assembly (Option C35)	
	Serial # <MY/SG62030000	N9038-60019
	Serial # >MY/SG62030000	N9048-60119
W12	Cable, Wire Harness, Front End Ctrl (A15) J300 to YTF (A12) J1	N9020-60059
W25	Cable, semi-rigid, RF Input 1 (J1) to Atten A (A9) Port 1	
	(Standard - Type-N)	N9048-21300
	(Option C35 -3.5mm)	N9048-21326
W27	Cable, semi-rigid, LPF Board (A23) J3 to Atten A (A9) Port 2	N9048-21328
W28	Cable, semi-rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	N9048-21302
W29	Cable, semi-rigid, Atten B (A10) Port 1 to 4 Port Terminated Switch (SW1) Port 3	N9048-21331
W30	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 1 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 4	N9048-21333
W31	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 2 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 2	N9048-21334
W32	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 4 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 5	N9048-21308
W34	Cable, semi-rigid, A12 YTF P2 Preselector to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) P3	N9048-21335
W35	Cable, semi-rigid, YTF Preselector (A12) P1 to Front End (A13) J9	N9048-21337

Figure 17-7 RF Area Assemblies and Cables - Option 544

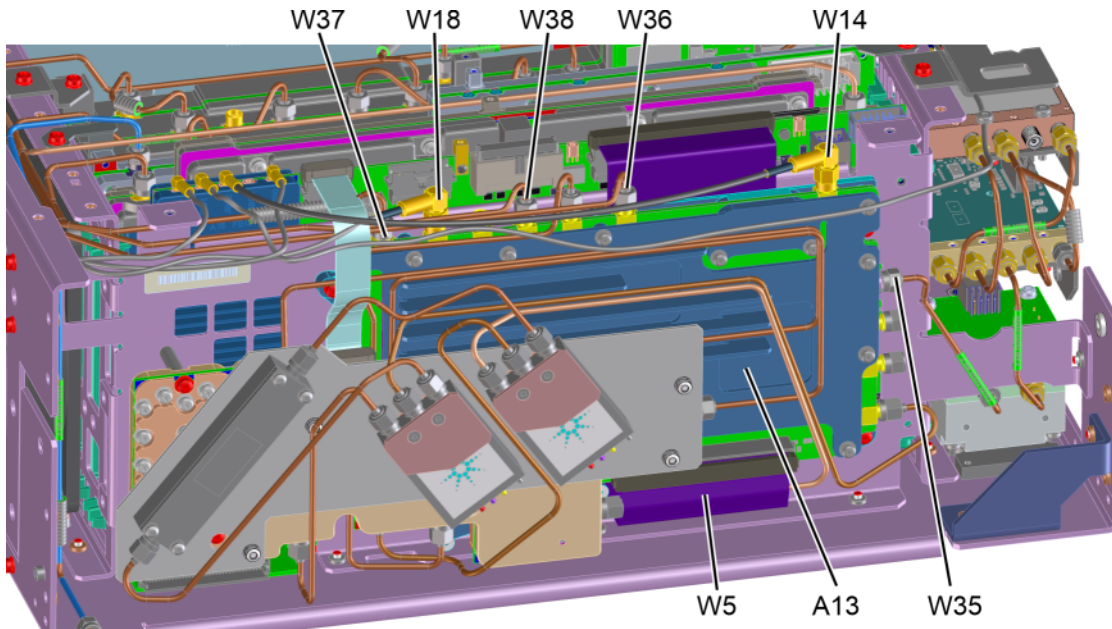


Item	Description	Part Number
1	A9 RF Attenuator A (0-10 dB) (Option 544)	33326-60013
2	A10 RF Attenuator B (0-60 dB) (Option 544)	33325-60020
3	A12 YIG Tuned Filter (YTF)	5087-7383
4	A11 Dual Pre-Amp Module, LNA, and EMC Band Switch	N9048-60007
5	SW1 4 Port Terminated Switch (Option 544)	N9048-60005
J1	2.4 mm Input Connector Assembly (Option 544)	
	Serial # >MY/SG62030000	N9030-60011
	Serial # >MY/SG62030000	N9048-60111
W12	Cable, Wire Harness, Front End Ctrl (A15) J300 to YTF (A12) J1	N9020-60059
W25	Cable, semi-rigid, RF Input 1 (J1) to Atten A (A9) Port 1 (Option 544 - 2.4 mm)	N9048-21319
W27	Cable, semi-rigid, LPF Board (A23) J3 to Atten A (A9) Port 2	N9048-21318
W28	Cable, semi-rigid, Atten A (A9) Port 3 to Atten B (A10) Port 2	N9048-21317
W29	Cable, semi-rigid, Atten B (A10) Port 1 to 4 Port Terminated Switch (SW1) Port 3	N9048-21320

Replaceable Parts
Hardware

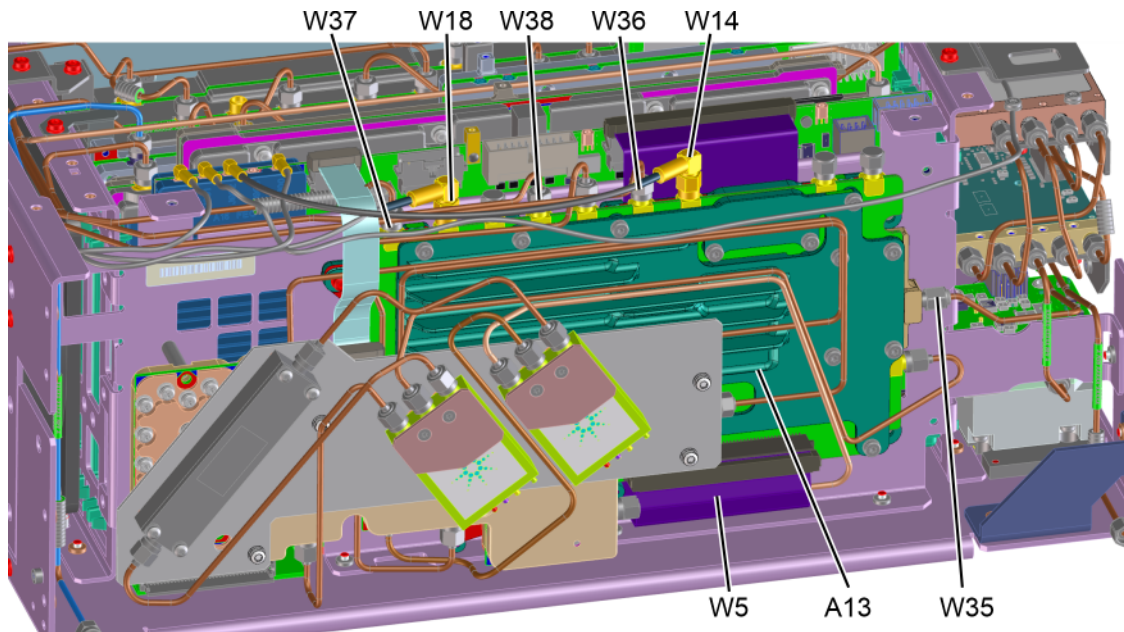
Item	Description	Part Number
W30	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 1 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 4	N9048-21323
W31	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 2 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 2	N9048-21324
W32	Cable, semi-rigid, 4 Port Terminated Switch (SW1) Port 4 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) Port 5	N9048-21325
W34	Cable, semi-rigid, A12 YTF P2 Preselector to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) P3	N9048-21321
W35	Cable, semi-rigid, YTF Preselector (A12) P1 to Front End (A13) J9	N9048-21322

Figure 17-8 Front End Parts - Option 503, 508, 513



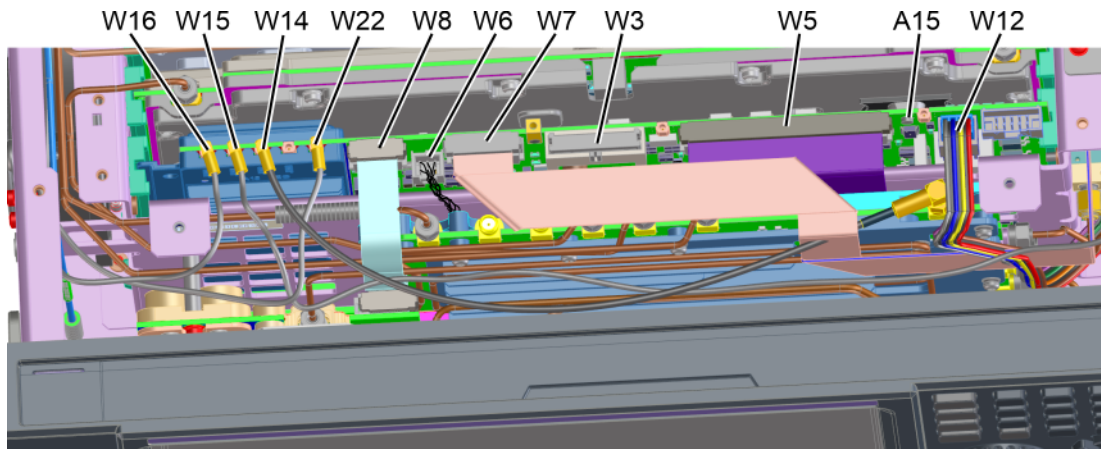
Item	Description	Part Number
A13	Front End Assembly	N9020-60328
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W14	Cable, Coaxial, Front End Assy (A13) J7 to Front End Ctrl (A15) J902	8121-1862
W18	Cable, Coaxial, Reference Assy (A16) J705 to Front End Assy (A13) J6	8121-1940
W35	Cable, semi-rigid, YTF Preselector (A12) P1 to Front End (A13) J9	N9048-21337
W36	Cable, semi-rigid, 2nd LO In, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W37	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J102 to Front End Assy (A13) J2	N9048-21329
W38	Cable, semi-rigid, Synthesizer Assy (A14) J740 to Front End Assy (A13) J4	N9020-20156

Figure 17-9 Front End Parts - Option 544



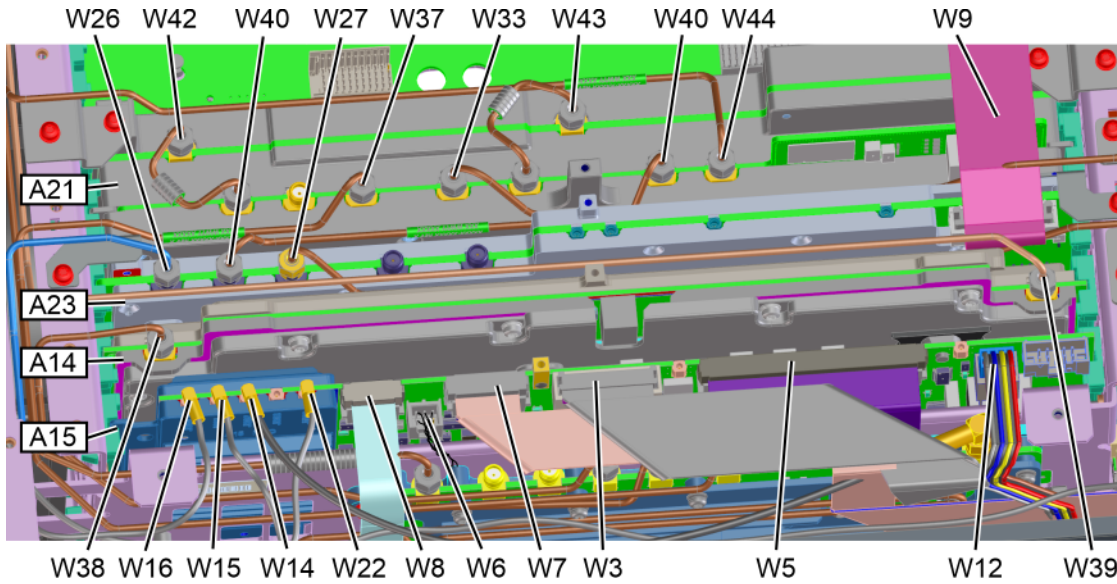
Item	Description	Part Number
A13	Front End Assembly	N9020-60337
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W14	Cable, Coaxial, Front End Assy (A13) J7 to Front End Ctrl (A15) J902	8121-1862
W18	Cable, Coaxial, Reference Assy (A16) J705 to Front End Assy (A13) J6	8121-1940
W35	Cable, semi-rigid, YTF Preselector (A12) P1 to Front End (A13) J9	N9048-21322
W36	Cable, semi-rigid, 2nd LO In, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W37	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J102 to Front End Assy (A13) J2	N9048-21329
W38	Cable, semi-rigid, Synthesizer Assy (A14) J740 to Front End Assy (A13) J4	N9020-20156

Figure 17-10 Front End Control Cables



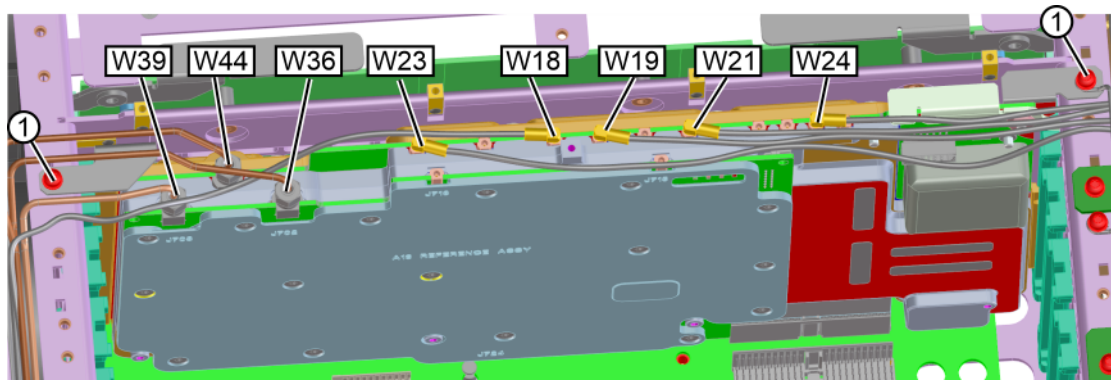
Item	Description	Part Number
A15	Front End Control Assembly	N9020-60295
W3	Cable, Ribbon, Front End Control (A15) J800 to Atten A (A9) & B (A10)	E4410-60157
W5	Cable, Ribbon, Front End Control (A15) J102 to Front End Assy (A13) J12	E4410-60156
W6	Cable, Wire Harness, 4 Port Terminated Switch (SW1), Front End Ctrl (A15) J801	N9048-60013
W7	Cable, ribbon, Dual Pre-Amp Module, LNA, and EMC Band Switch to Front End Ctrl (A15) J700	N9020-60092
W8	Cable, ribbon, Switched Filter control, Front End Ctrl (A15) J1300 to Switched Filter J1	N9020-60064
W12	Cable, Wire Harness, Front End Ctrl (A15) J300 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, Front End Ctrl (A15) J1100 to Rear Panel AUX IF OUT	8121-1859

Figure 17-11 LO Synthesizer, RF Preselector, and Limiter Prefilter Cables



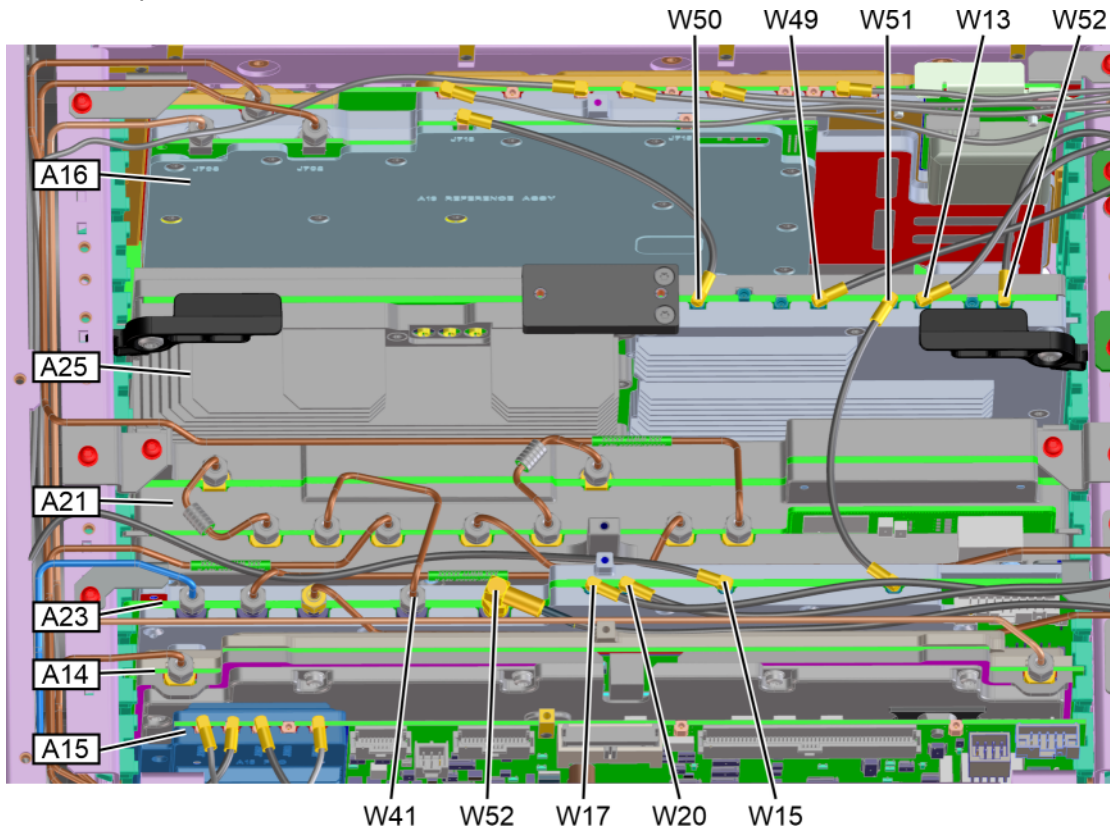
Item	Description	Part Number
A14	LO Synthesizer Assembly	N9020-60118
A15	Front End Control Assembly	N9020-60295
A21	RF Preselector Input Assembly	N9048-60002
A23	Limiter Prefilter Board (LPF) Assembly	N9048-60000
W9	Cable, ribbon, LPF board (A23) J10 to Rear Panel	N9038-60028
W26	Cable, semi-rigid, RF Input 2 (J2) to Limiter Assy (A23) J1	N9048-21332
W27	Cable, semi-rigid, LPF Board (A23) J3 to Atten A (A9) Port 2	
	(Option 503, 508, 526)	N9048-21328
	(Option 544)	N9048-21318
W33	Cable, semi-rigid, RF Preselector Input Assembly (A21A1) J101 to Dual Pre-Amp Module, LNA, and EMC Band Switch (A11) P1	N9048-21327
W37	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J102 to Front End Assy (A13) J2	N9048-21329
W38	Cable, semi-rigid, Synthesizer Assy (A14) J740 to Front End Assy (A13) J4	N9020-20156
W39	Cable, semi-rigid, Synthesizer Assy (A14) J200 to Reference Assy (A16) J703	N9038-21306
W40	Cable, semi-rigid, LPF Board (A23) J2 to RF Preselector Input Assy (A21A1) J3	N9048-21330
W42	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J301 to RF Preselector Input Assy (A21A2) J4	N9048-21307
W43	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J103 to RF Preselector Input Assy (A21A2) J3	N9048-21307
W44	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J4 to Reference Assy (A16) J701	N9048-21310

Figure 17-12 Reference Board Cables



Item	Description	Part Number
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
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
W24	Cable, coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1940
W36	Cable, semi-rigid, 2nd LO In, Reference Assy (A16) J702 to Front End Assy (A13) J1	N9020-20022
W39	Cable, semi-rigid, Synthesizer Assy (A14) J200 to Reference Assy (A16) J703	N9038-21306
W44	Cable, semi-rigid, RF Preselector Input Assy (A21A1) J4 to Reference Assy (A16) J701	N9048-21310

Figure 17-13 Option WF1 Cables



Item	Description	Part Number
A14	LO Synthesizer Assembly	N9020-60118
A15	Front End Control Assembly	N9020-60295
A16	Reference Assembly	N9020-60188
A21	RF Preselector Input Assembly	N9048-60002
A23	Limiter Prefilter Board (LPF) Assembly	N9048-60000
A26	Wideband Digital IF Assembly (Option WF1)	N9030-60048
W13	Cable, coaxial, Digital IF (A3) J15 to Wideband Digital IF Assy (A26) J5 (Option WF1)	8121-2292
W15	Cable, Coaxial, Front End Ctrl (A15) J901 to LPF Board (A23) J8 (Option WF1)	8121-1401
W17	Cable, Coaxial, Analog IF (A2) J601 to LPF Board (A23) J6 (Option WF1)	8121-2291
W20	Cable, coaxial, Digital IF (A3) J19 to LPF Board (A23) J7 (Option WF1)	8121-1919
W24	Cable, coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1401
W41	Cable, semi-rigid, LPF Board (A23) J4 to RF Preselector Input Assy (A21A1) J1 (Option WF1)	N9048-21336
W49	Cable, coaxial, Wideband Digital IF Assy (A26) J3 to Digital IF (A3) J18 (Option WF1)	8121-2292

Replaceable Parts
Hardware

Item	Description	Part Number
W50	Cable, coaxial, Wideband Digital IF Assy (A26) J1 to Reference Assy (A16) J718 (Option WF1)	8121-0152
W51	Cable, coaxial, Wideband Digital IF Assy (A26) J4 to LPF Board (A23) J9 (Option WF1)	8121-0152
W52	Cable, coaxial, Wideband Digital IF Assy (A26) J7 to LPF Board (A23) J5 (Option WF1)	8121-1940

Figure 17-14 AIF/DIF Cables

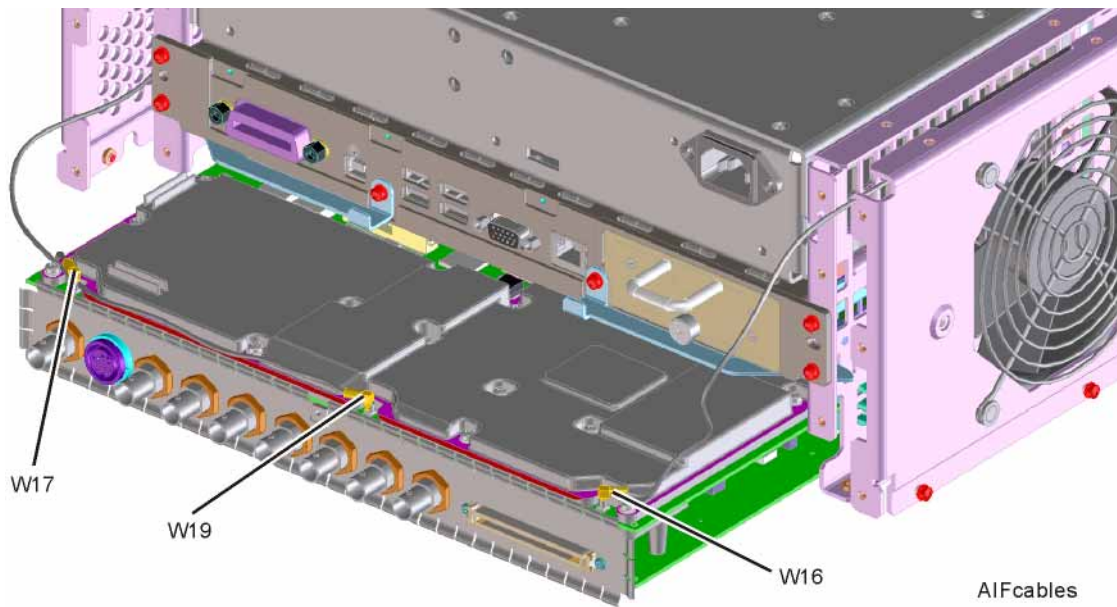
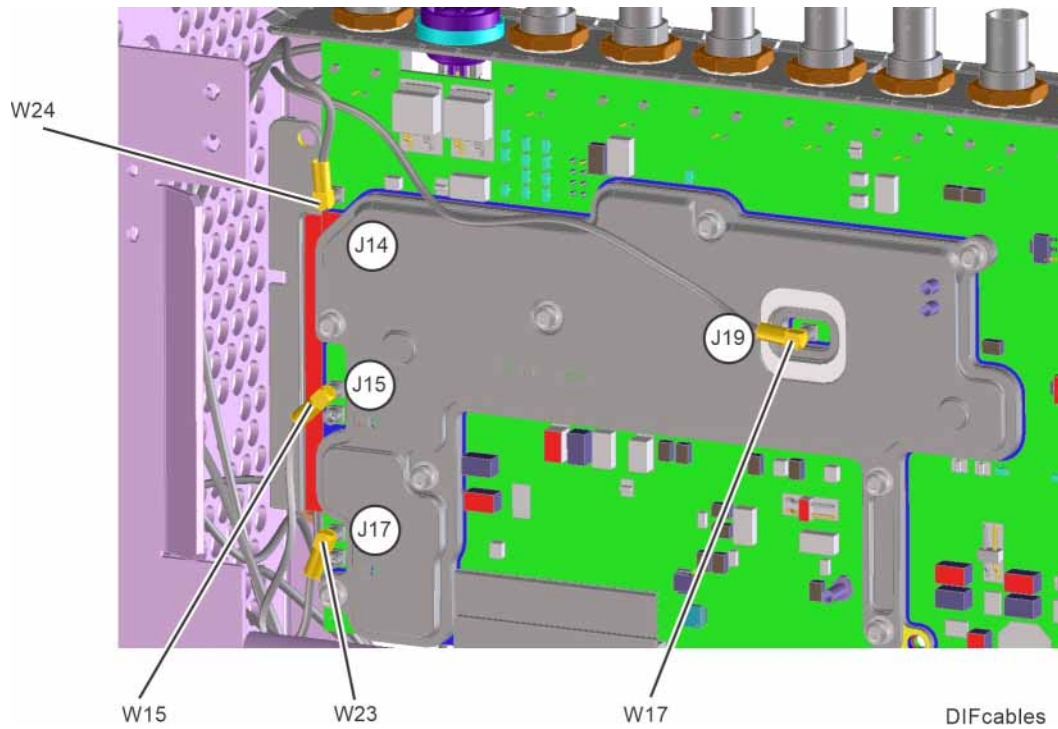


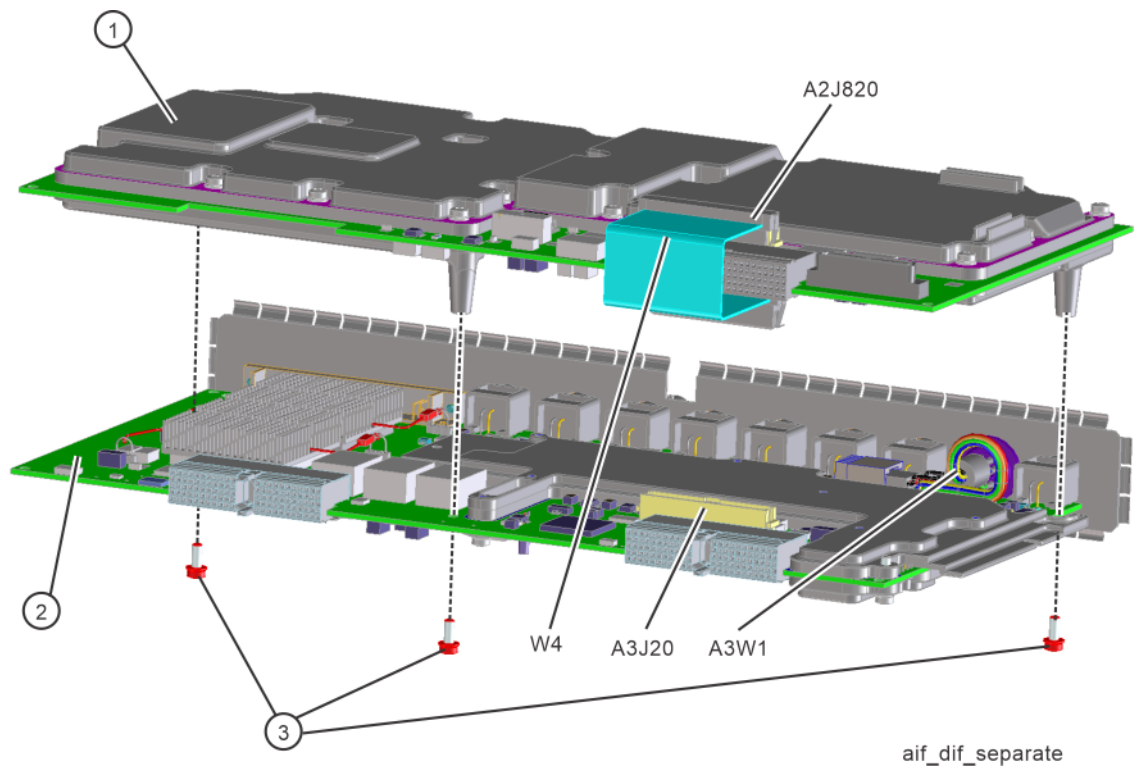
Figure 17-15 AIF/DIF Cables, bottom



Replaceable Parts
Hardware

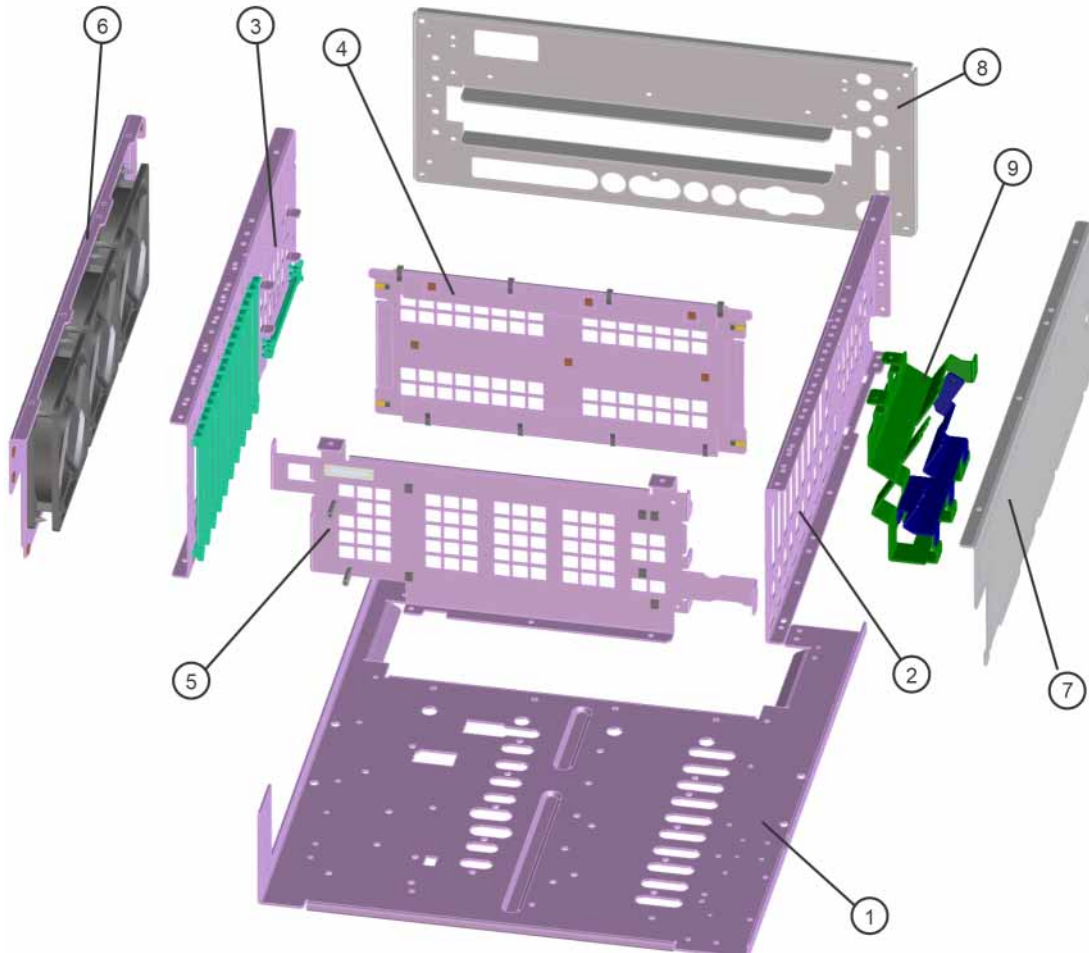
Item	Description	Part Number
W15	Cable, Coaxial, Front End Ctrl (A15) J901 to Digital IF (A3) J15	8121-1919
W16	Cable, Coaxial, Front End Ctrl (A15) J900 to Analog IF (A2) J100	8121-1865
W17	Cable, Coaxial, Analog IF (A2) J601 to Digital IF (A3) J19	8120-8868
W19	Cable, Coaxial, Reference Assy (A16) J711 to Analog IF (A2) J300	8121-1861
W23	Cable, Coaxial, Digital IF (A3) J17 to Reference Assy (A16) J726	8121-1401
W24	Cable, coaxial, Reference Assy (A16) J716 to Digital IF (A3) J14	8121-1401

Figure 17-16 AIF/DIF Assemblies



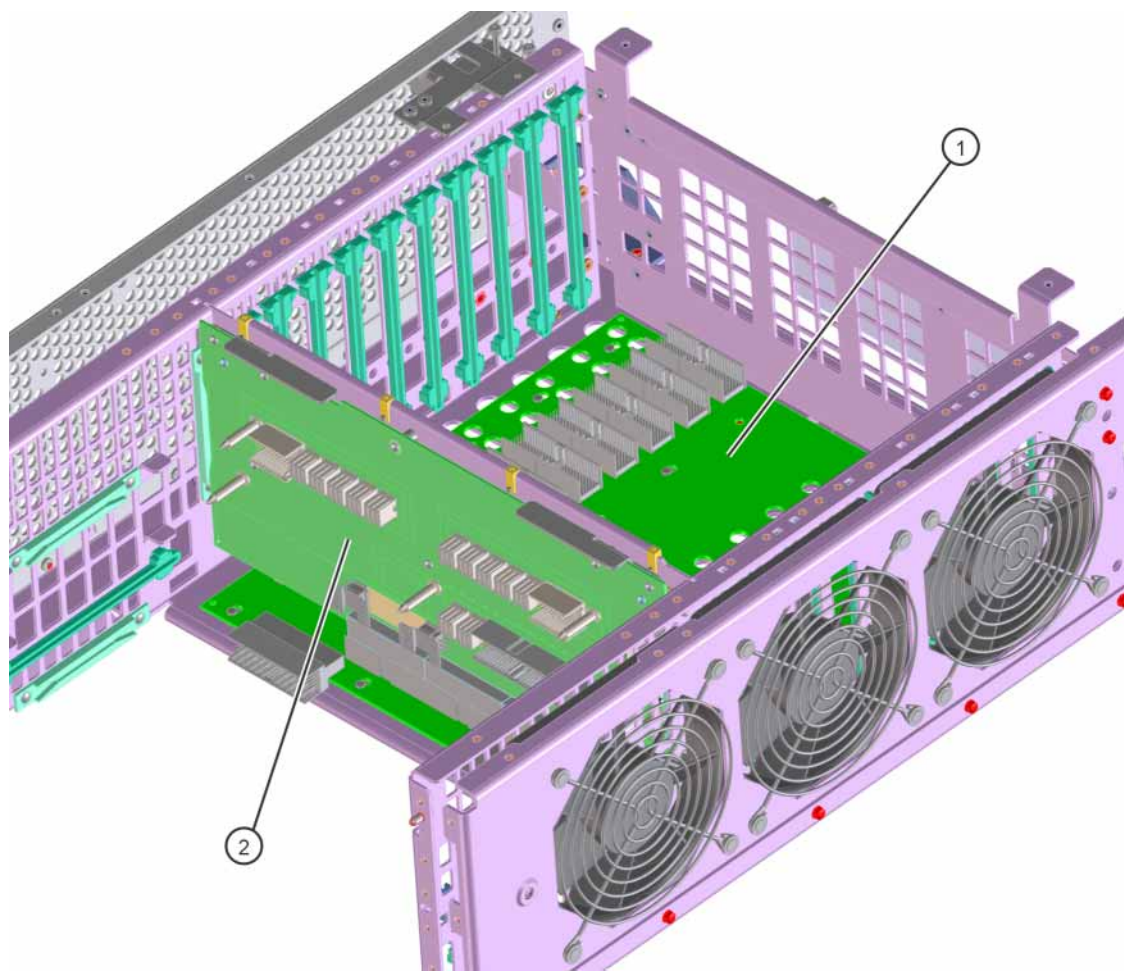
Item	Description	Part Number
1	A2 Analog IF Board	N9020-60290
2	A3 Digital IF Board	N9038-60116
3	Screw	0515-0372
W4	Cable, Ribbon, Digital IF (A3) J100 to Analog IF (A2) J820	N9020-60046
A3W1	Cable Assembly, Wire Harness, Smart Noise Source	N9020-60090

Figure 17-17 Chassis



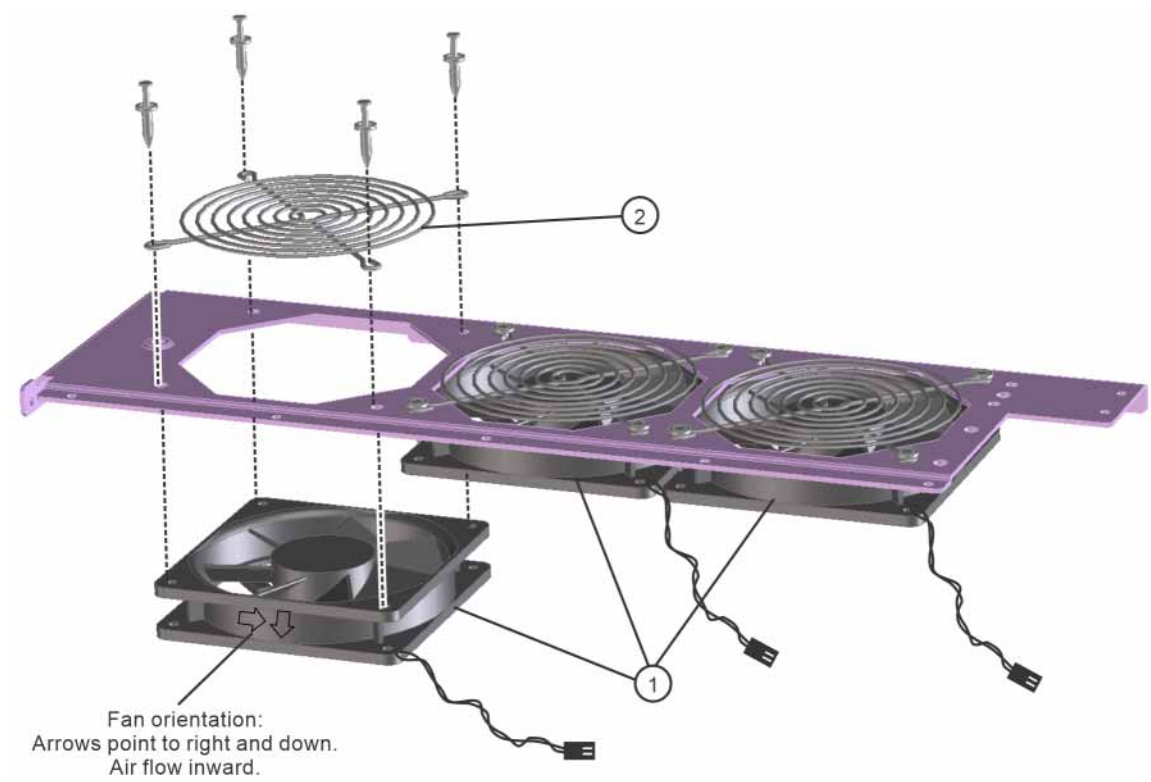
Item	Description	Part Number
1	MP1 Chassis Base Serial # < MY/SG62030000 Serial # > MY/SG62030000)	N9038-00015 N9048-00020
2	MP4 Chassis Side, Right (inner)	W1312-00116
3	MP2 Chassis Side, Left (inner)	W1312-00117
4	MP7 Chassis, Midplane Bracket	W1312-00048
5	MP8 Chassis, Front Bracket	N9048-00019
6	MP3 Chassis Side, Left (outer) - Fan Bracket	W1312-00118
7	MP5 Chassis Side, Right (outer)	N9048-00016
8	MP6 Rear Panel	N9048-00008
9	MP19 Bracket, Attenuator A and B	N9048-00018

Figure 17-18 Motherboard



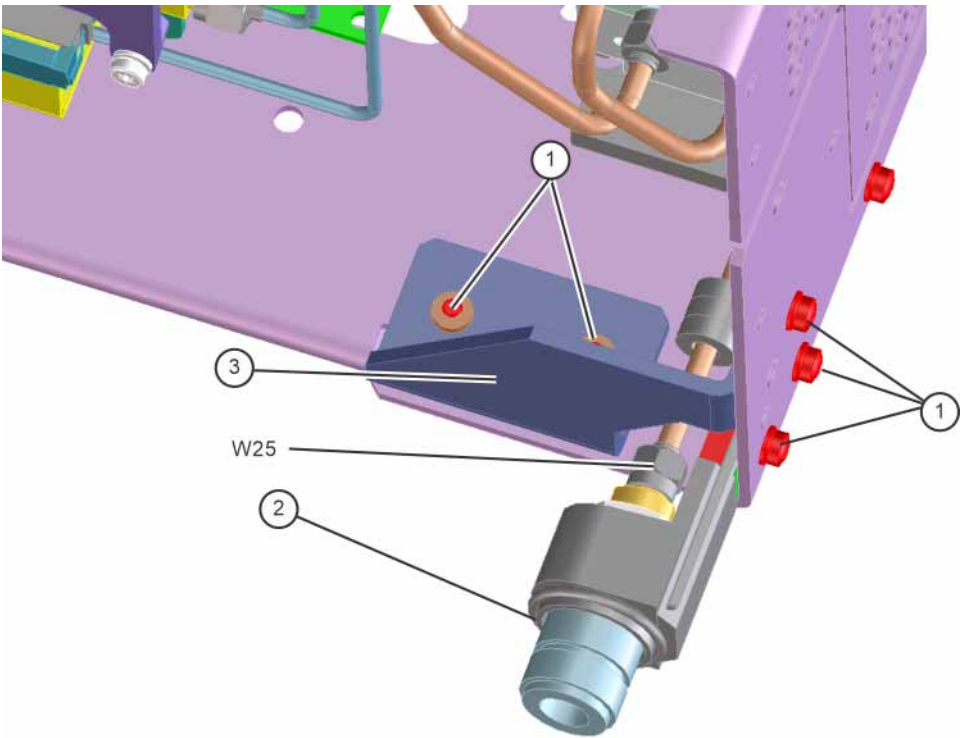
Item	Description	Part Number
1	A8 Motherboard Assembly	N9030-63002
2	A7 Midplane Assembly	W1312-63310

Figure 17-19 Fan Hardware



Item	Description	Part Number
1	B1-3 Fan	3160-4199
2	MP15-17 Fan Guard	3160-0281

Figure 17-20 Input Connector

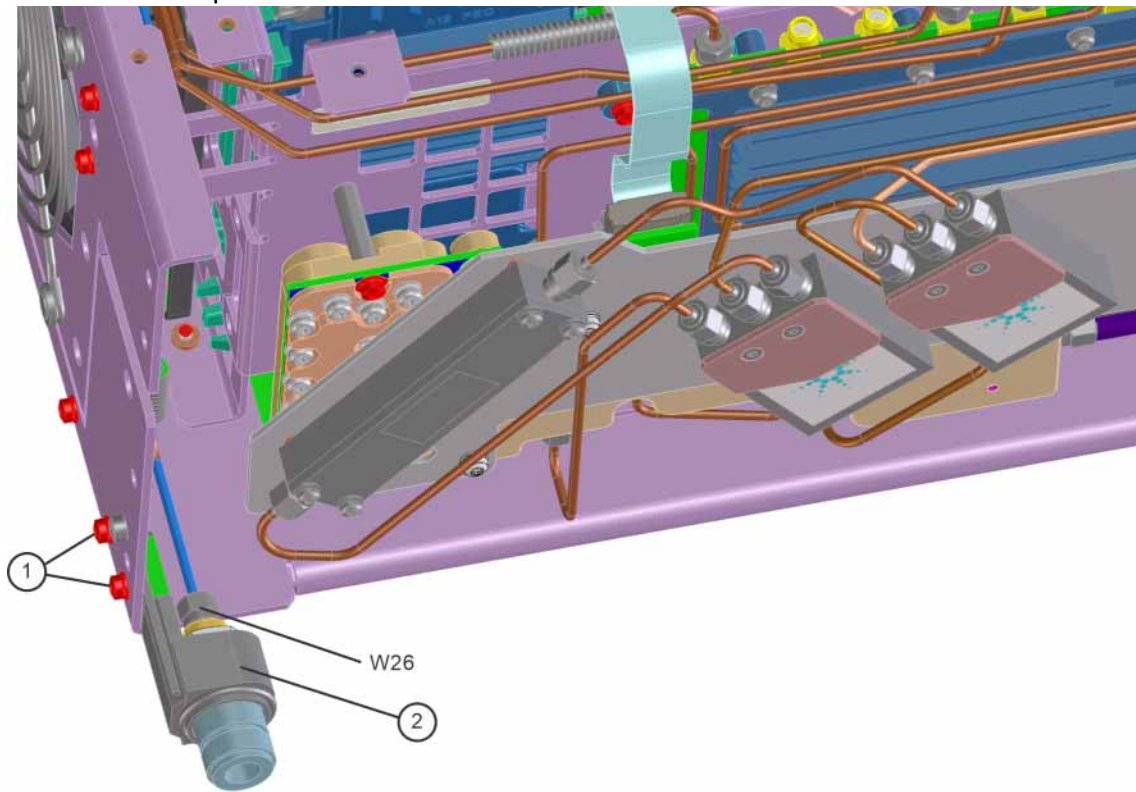


Item	Description	Part Number
1	Screw	0515-0372
2	J1 Type-N Input Connector Assembly	
	Serial # <MY/SG62030000	N9038-60021
	Serial # >MY/SG62030000	N9048-60121
	3.5 mm Input Connector Assembly (Option C35)	
	Serial # <MY/SG62030000	N9038-60019
	Serial # >MY/SG62030000	N9048-60119
	2.4 mm Input Connector Assembly (Option 544)	
	Serial # >MY/SG62030000	N9030-60011
	Serial # >MY/SG62030000	N9048-60111
3	MP18 Chassis Gusset, Input Connector	
	Serial # <MY/SG62030000	W1312-00224
	Serial # >MY/SG62030000	N9048-20618

Replaceable Parts
Hardware

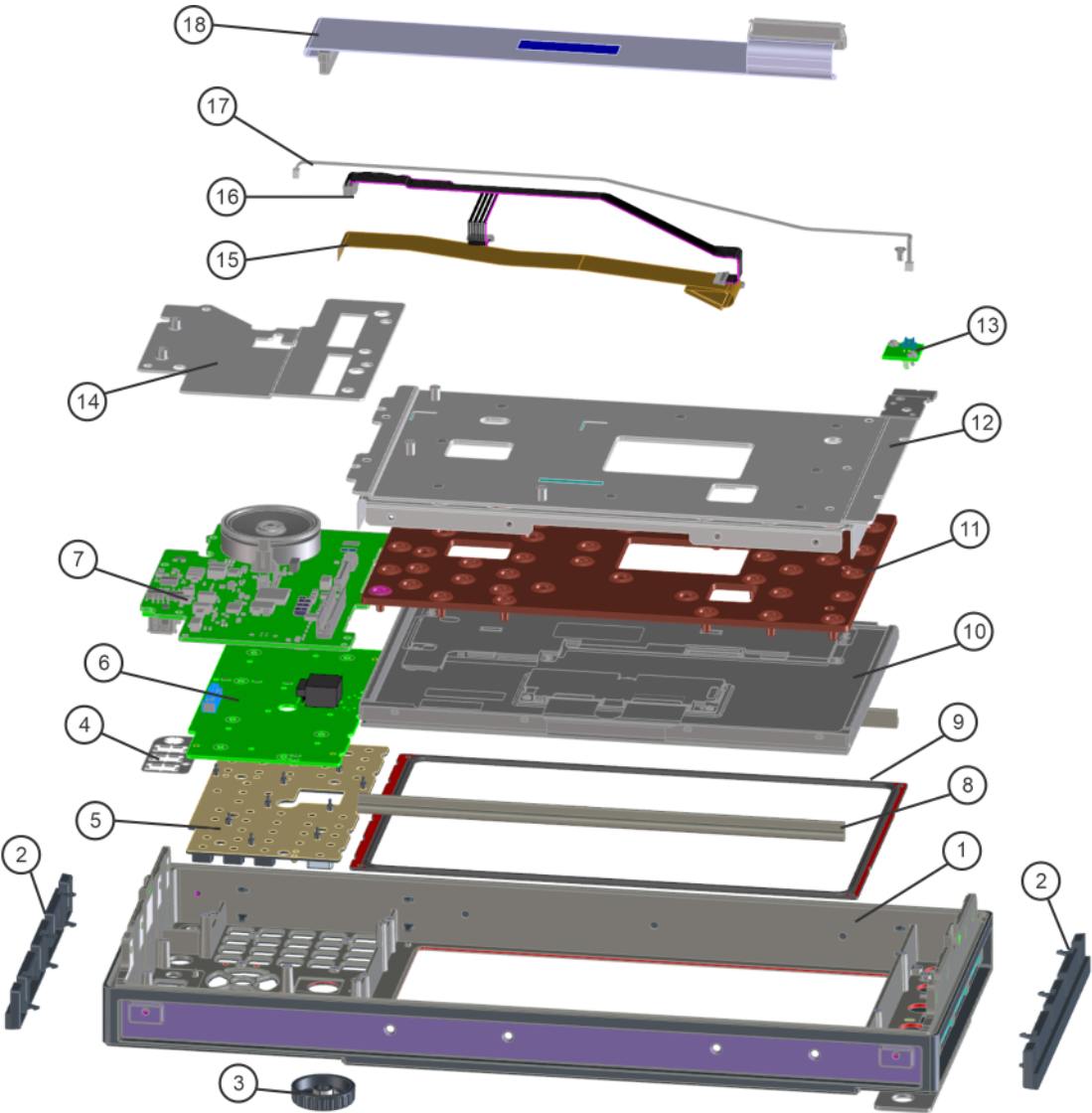
Item	Description	Part Number
W25	Cable, semi-rigid, RF Input 1 (J1) to Atten A (A9) Port 1	
	(Standard - Type-N)	N9048-21300
	(Option C35 -3.5mm)	N9048-21326
	(Option 544 - 2.4 mm)	N9048-21319

Figure 17-21 RF 2 Input Connector



Item	Description	Part Number
1	Screw	0515-0372
2	J2 Type-N Input Connector Assembly	
	Serial # <MY/SG62030000	N9038-60021
	Serial # >MY/SG62030000	N9048-60121
W26	Cable, semi-rigid, RF Input 2 (J2) to Limiter Assy (A23) J1	N9048-21332

Figure 17-22 Front Frame Exploded View



Replaceable Parts
Hardware

Item	Description	Part Number
1	A1A1MP1 Front Frame	a
2	A1A1MP9-10 Side Trim Strip	N9020-40018
3	A1MP9 RPG Knob	W1312-40179
4	A1A1MP4 Front Frame Ground Spring	N9020-20258
5	A1MP1 Main Keypad	N9020-40001
6	A1A5 Keyboard, PCA	N9020-63275
7	A1A2 Front Panel Control Board	
	Serial # > MY/SG63070100	N9020-63296
	Serial # < MY/SG63070100	N9020-63294
8	A1A1MP6 Gasket - EMI Shielding	8160-1997
9	A1A1MP13 Display Boot	N9020-40002
10	A1A3 Liquid Crystal Display	2090-1103
11	A1MP16 Display hold down (compression pad)	N9020-40003
12	A1MP14 Display Bracket	N9020-00078
13	A1A6 Input 2 LED Board	N9038-63006
14	A1MP15 Front Panel Shield Bracket	N9020-00064
15	A1W1 Flex Circuit, Display to Front Panel Control Board	N9020-60273
16	A1W3 Cable Assembly, Touch/Backlight	N9020-60217
17	A1W4 Cable Assembly, LED Board	N9048-60011
18	A1W2 Cable Assembly, ribbon, 68 pin Motherboard Keyboard	N9020-60216

a. Non-orderable item, see A1A1

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.

- Instrument Outer Case on page 427
- Top Brace and Power Supply Bracket on page 429
- RF Area - Option 503, 508, & 526 on page 431
- RF Area - Option 544 on page 446
- RF Front End Assembly on page 460
- Front End Control Assembly on page 463
- LO Synthesizer Assembly on page 465
- LPF Assembly on page 467
- RF Preselector Input Assembly on page 469
- Reference Assembly on page 470
- Midplane Board Assembly on page 472
- Rear Panel on page 474
- Power Supply Assembly on page 476
- CPU Assembly on page 478
- Disk Drive on page 479
- AIF/DIF Assembly on page 485
- Wideband Digital IF Assembly (Option WF1) on page 489
- Motherboard Assembly on page 491
- Fan Assembly on page 497
- Input Connector Assembly on page 501
- Front Frame Assembly on page 505
- Front Frame Assembly Components on page 508
- Input 2 LED Board on page 516

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 23**.

Safety

WARNING

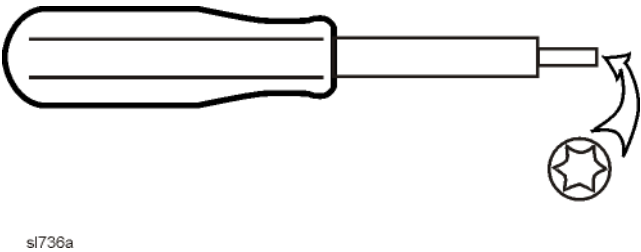
The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

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



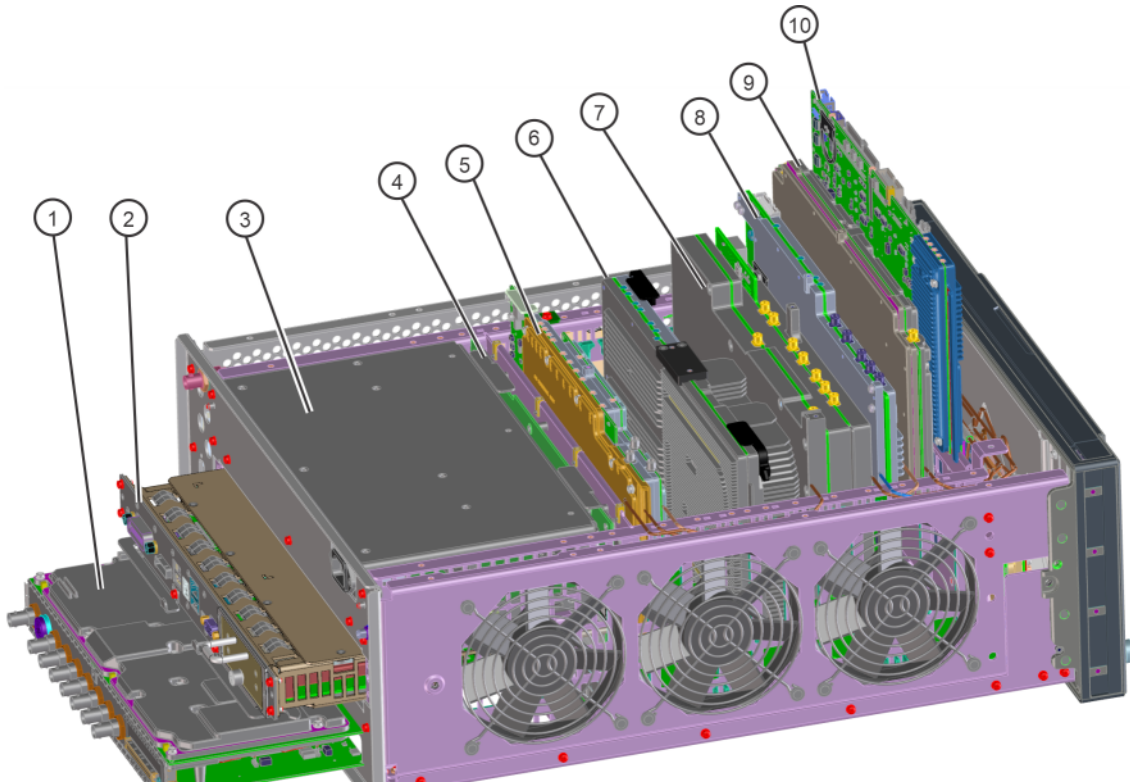
Hand Tool	Size
Cable Puller (5021-6773)	
Nut Driver	3/16 inch
Nut Driver	5/16 inch
Nut Driver	9/16 inch
Open-End Wrench	5/16 inch
Torque Driver - Adjustable	Multi Bit
Torque Wrench - 10 inch-lbs	5/16 inch
TORX Driver	T-8
TORX Driver	T-10
TORX Driver	T-20

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



Item	Description
1	A2 Analog IF Assembly and A3 Digital IF Assembly
2	A4 CPU Assembly (without A5 disk drive)
3	A6 Power Supply Assembly
4	A7 Midplane Assembly
5	A16 Reference Assembly
6	A26 Wideband Digital IF Assembly (Option WF1)
7	A21 RF Preselector Input Assembly
8	A23 Limiter Prefilter Board (LPF) Assembly
9	A14 LO Synthesizer Assembly
10	A15 Front End Control Assembly

Instrument Outer Case

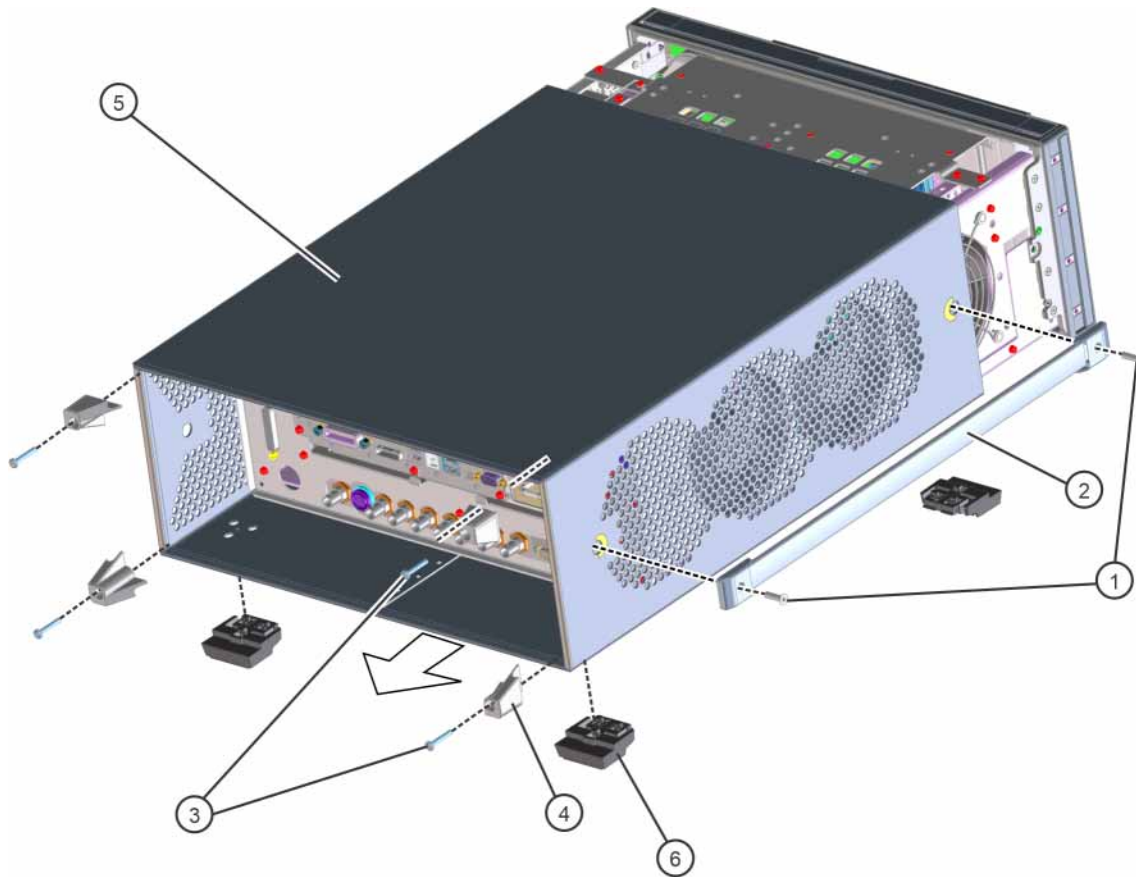
CAUTION

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



Replacement

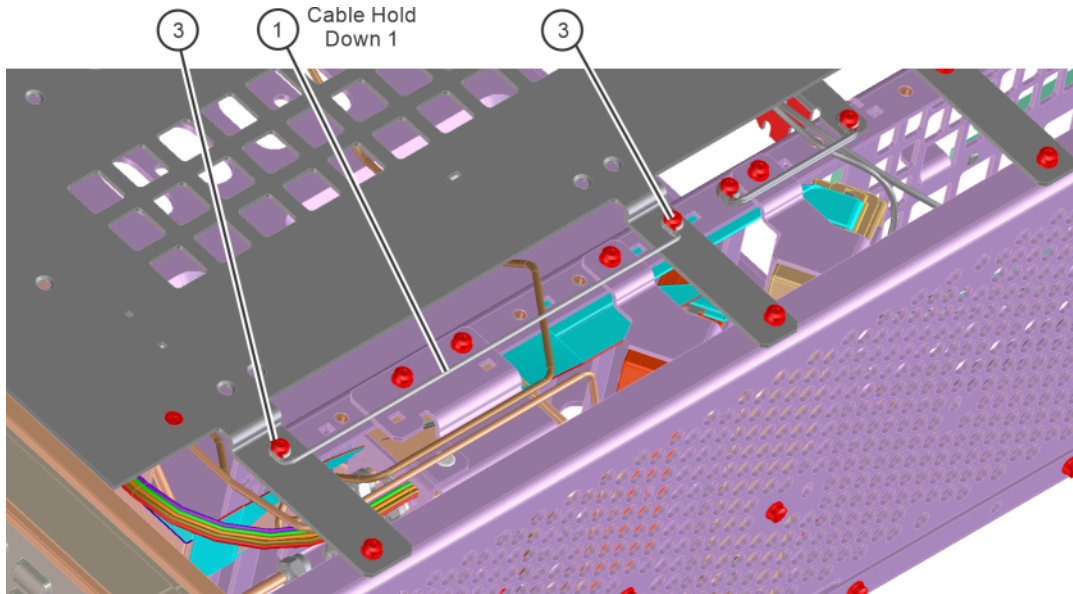
1. Disconnect the instrument from ac power.
2. Slide the instrument cover back onto the deck from the rear. The seam on the cover should be on the bottom. Be sure the cover seats into the gasket groove in the Front Frame Assembly.
3. Replace the four rear feet to the rear of the instrument. Torque the 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

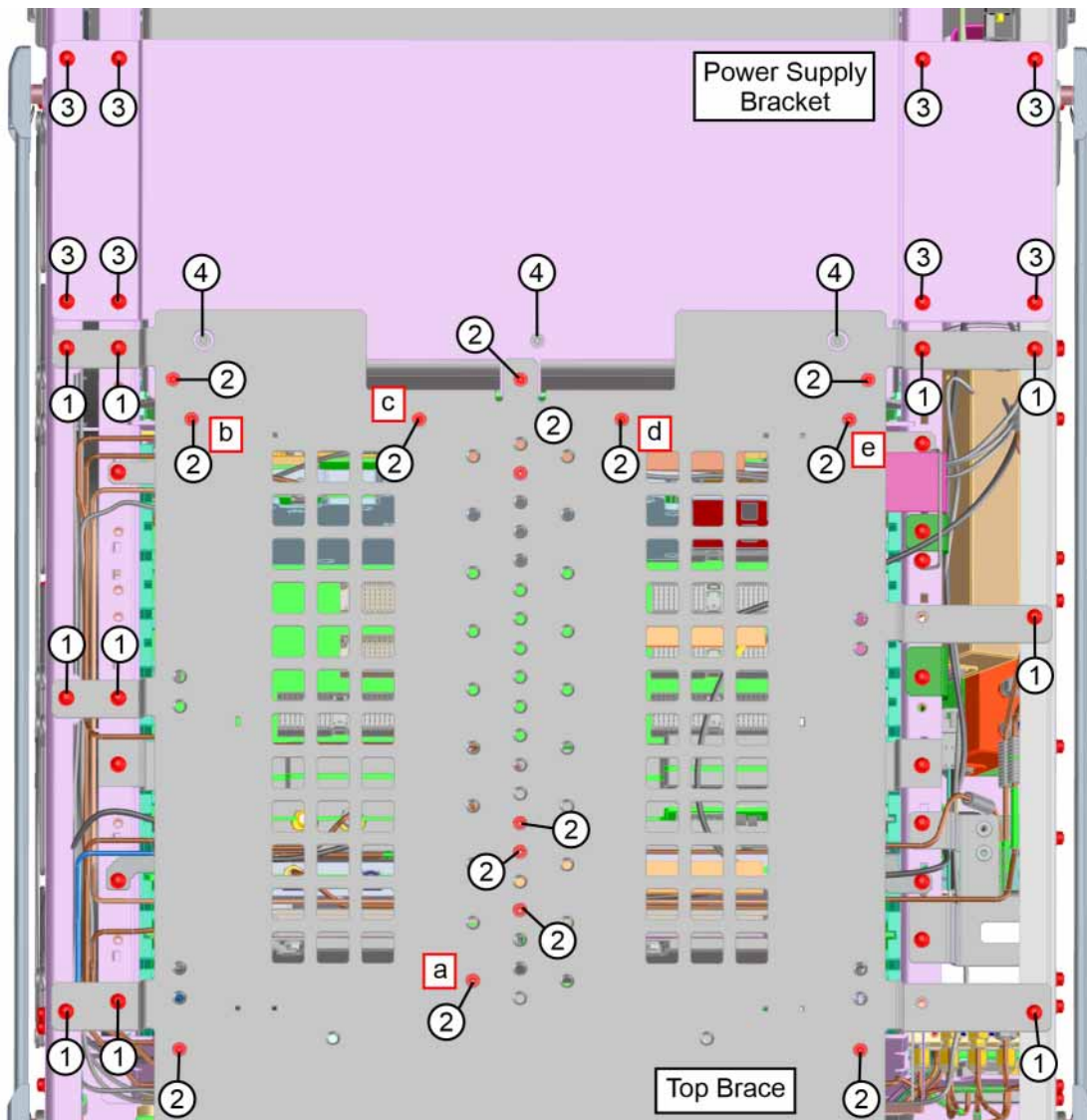
1. Remove the instrument outer case. Refer to the **“Instrument Outer Case”** removal procedure.
2. Refer to **Figure 18-4**. Use the T-10 driver to remove the cable hold down **(1)**.

Figure 18-4 Cable Hold Down



3. Refer to **Figure 18-5**. To remove the top brace, use the T-10 driver to remove the ten screws **(1)** (0515-0372) attaching the top brace to the chassis. Remove the fourteen screws **(2)** (0515-1946) (additional two screws with Option WF1) attaching the top brace to the boards.
4. To remove the power supply bracket, use the T-10 driver to remove the eight screws **(3)** (0515-0372) attaching the power supply bracket to the instrument. Remove the three screws **(4)** (0515-1946) attaching the power supply bracket to the power supply.

Figure 18-5 Top Brace and Power Supply Bracket Removal



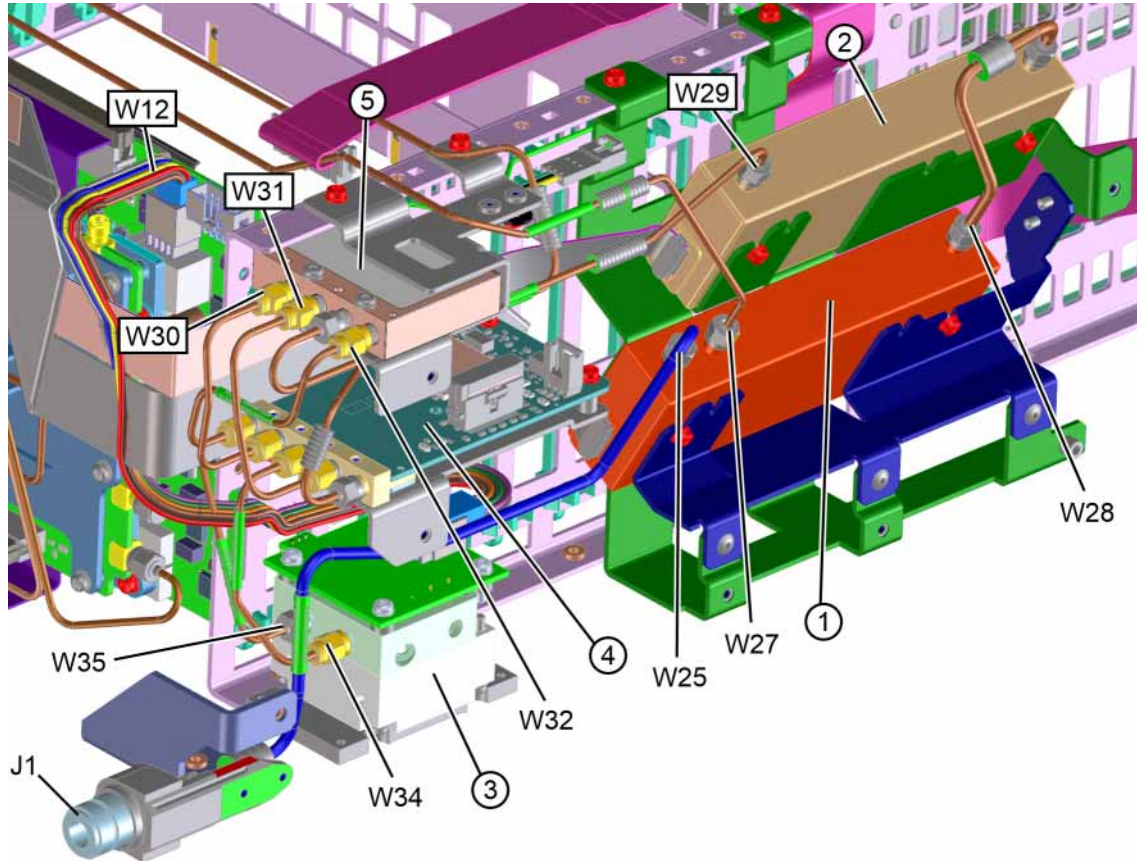
Replacement

1. Refer to **Figure 18-5**. 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. For the top brace, install screws marked a, b, c, d, e in that order first, then followed by the remaining screws. Reinstall wire hold down 1. Torque all screws to 9 inch-pounds.

RF Area - Option 503, 508, & 526

Refer to **Figure 18-6**. The RF area consists of A9 RF attenuator A (1), A10 RF attenuator B (2), A11 Dual Pre-Amp Module, LNA, and EMC Band Switch (3), A12 YTF (4), and SW1 4-Port Terminated Switch assembly (5).

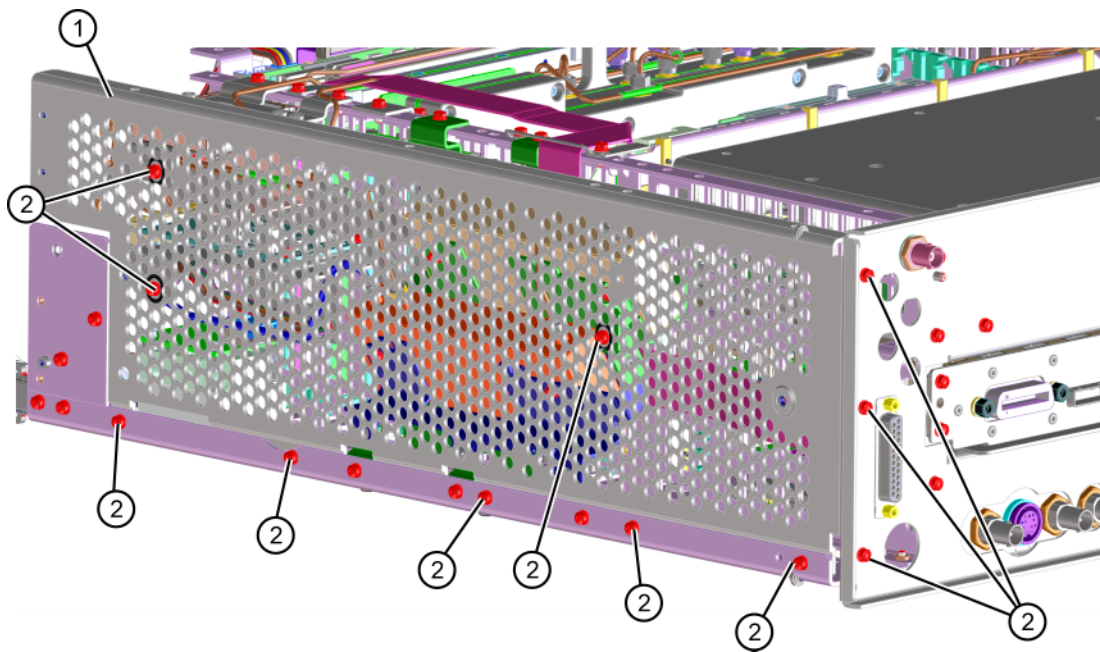
Figure 18-6 RF Area Components and Cables - Option 503, 508, & 526



To gain access to the attenuators, Dual Pre-Amp Module, LNA, and EMC Band Switch, 4-Port Terminated Switch, 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

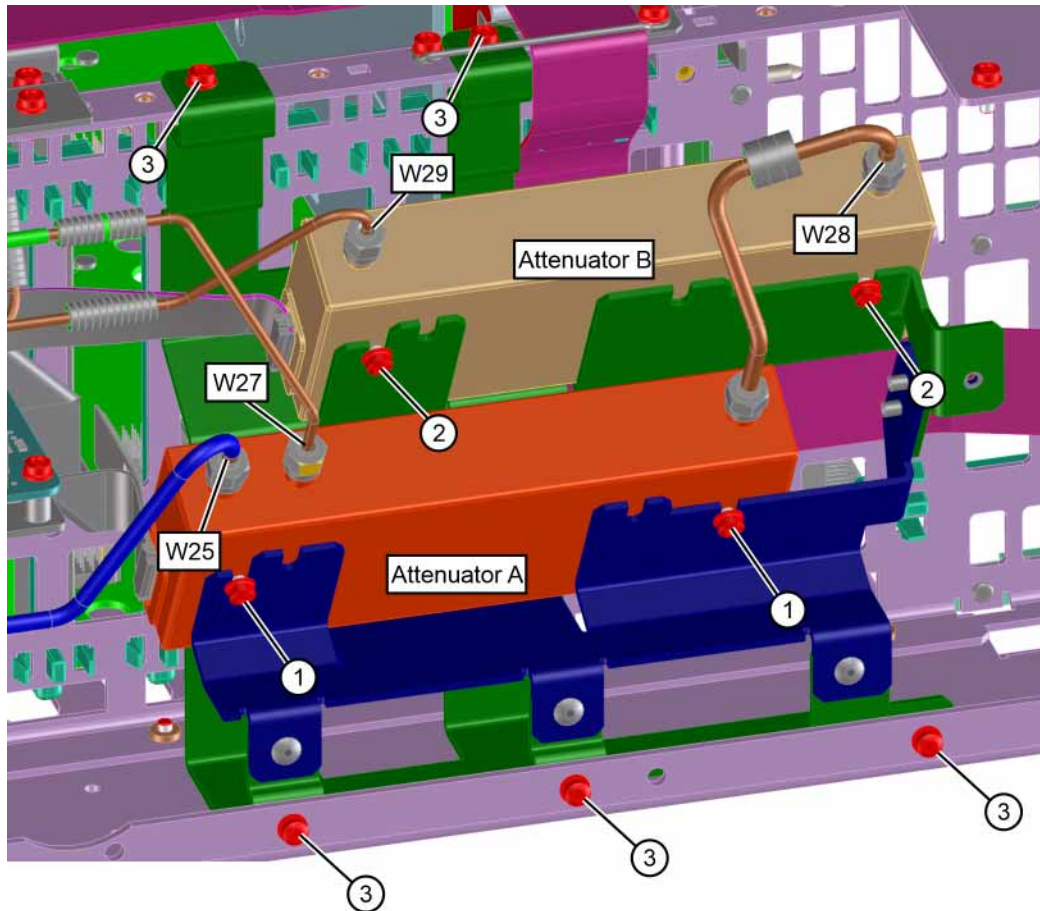


Attenuators - Option 503, 508, & 526

Removal

1. Refer to **Figure 18-8**. To remove Attenuator A or Attenuator B, remove the semi-rigid cables W25, W27, W28, and W29 attached to the attenuator using the 5/16 inch wrench.
2. Remove the ribbon cable attached to the attenuator.
3. To remove either attenuator, remove the two screws **(1)** or **(2)** **(0515-0372)** for the appropriate attenuator to remove it from the bracket using the T-10 driver.
4. To remove the entire bracket from the chassis, remove the five screws **(3)** **(0515-0372)**.

Figure 18-8 Attenuators Removal - Option 503, 508, & 526



Item	Keysight Part Number
W25	N9048-21300
	N9048-21326 (Option C35)
W27	N9048-21328
W28	N9048-21302
W29	N9048-21331

Replacement

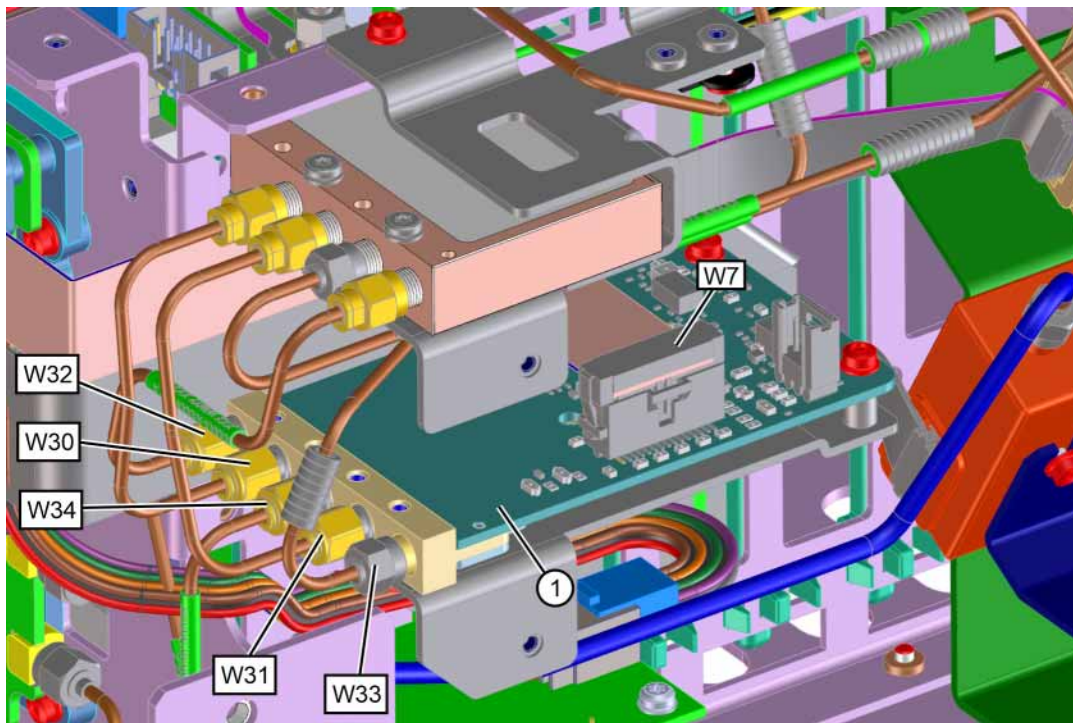
1. Refer to **Figure 18-8**. Position the attenuator in the bracket so that the ribbon connector end is facing the front of the instrument. Replace the two screws (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
2. Replace the ribbon cable and semi-rigid cables W25, W27, W28, and W29 to the attenuator. Torque the semi-rigid cables to 10 inch-pounds.
3. 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.
4. Replace the top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
5. Replace the front panel. Refer to the **Front Frame Assembly** replacement procedure.
6. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Dual Pre-Amp Module, LNA, and EMC Band Switch - Option 503, 508, & 526

Removal

1. Refer to **Figure 18-9**. Remove the ribbon cable W7.
2. Remove the semi-rigid cables W30, W31, W32, W33, and W34 using the 5/16 inch wrench.

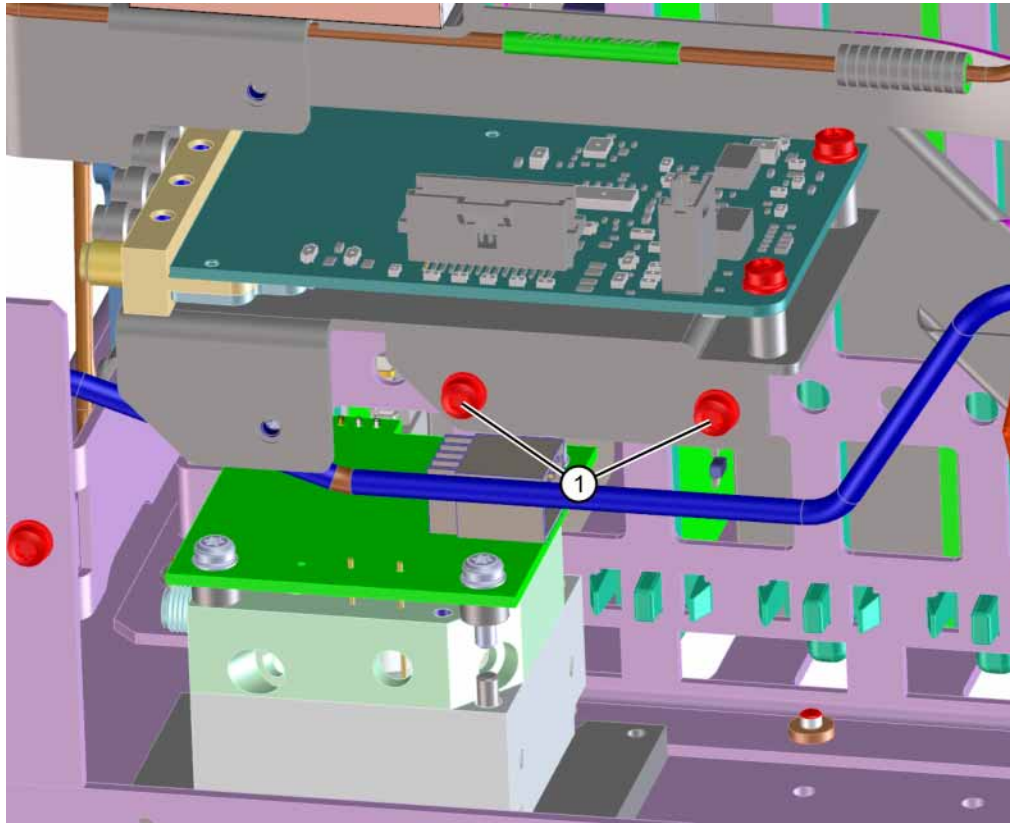
Figure 18-9 Dual Pre-Amp Module, LNA, and EMC Band Switch Cable Removal - Option 503, 508, & 526



Item	Keysight Part Number
W30	N9048-21333
W31	N9048-21334
W32	N9048-21308
W33	N9048-21327
W34	N9048-21335

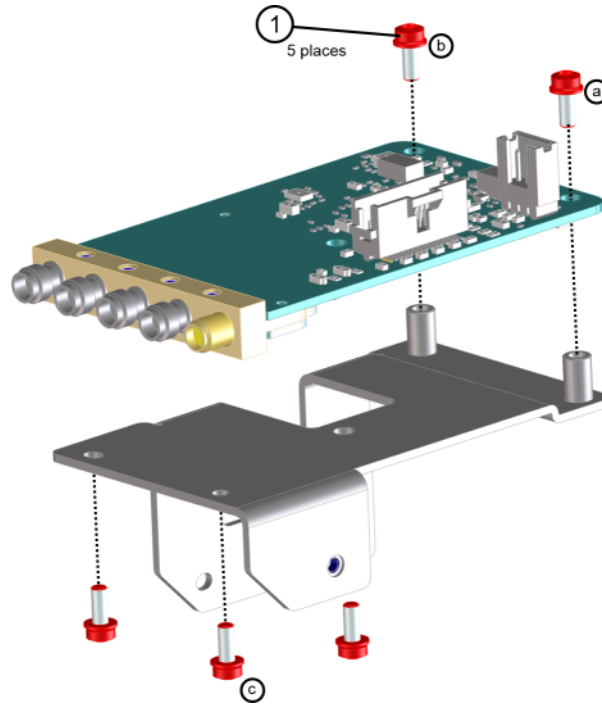
3. Refer to **Figure 18-10**. Remove the two screws **(1)** (0515-0372) using the T-10 driver. The Dual Pre-Amp Module, LNA, and EMC Band Switch and bracket can now be removed from the chassis.

Figure 18-10 Dual Pre-Amp Module, LNA, and EMC Band Switch Bracket Removal -
Option 503, 508, & 526



4. Refer to **Figure 18-11**. To separate the assembly from the bracket, remove the five screws **(1)** (0515-0372) using the T-10 driver.

Figure 18-11 Dual Pre-Amp Module, LNA, and EMC Band Switch/Bracket Separation - Option 503, 508, & 526



Replacement

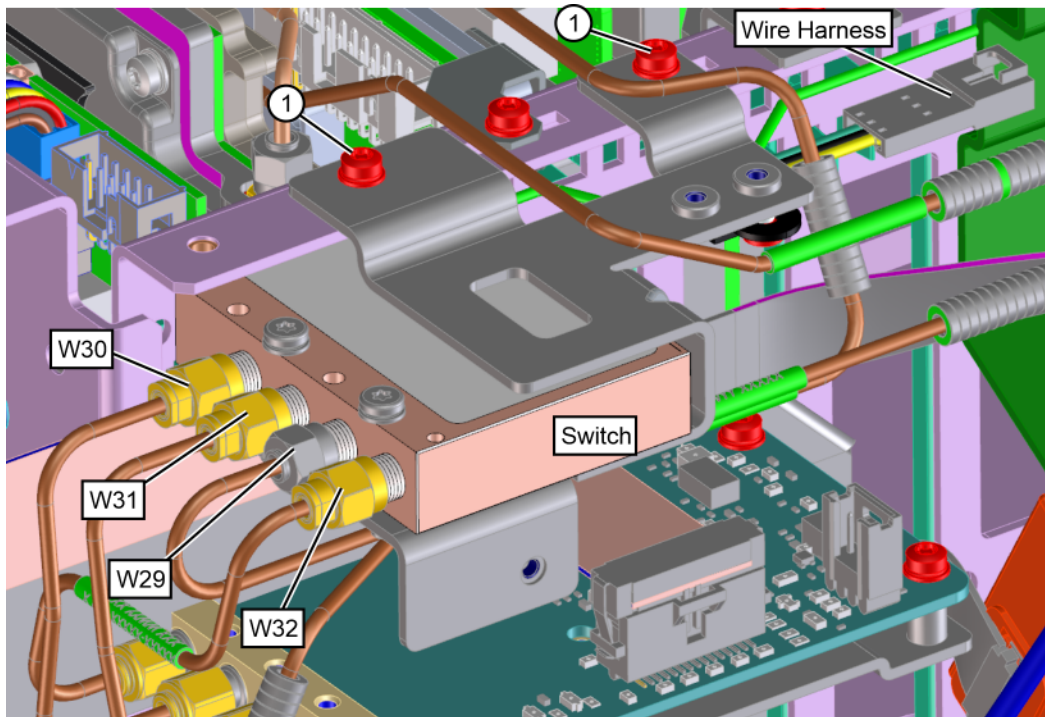
1. Refer to **Figure 18-11**. Place the assembly onto the bracket and replace the five screws **(1)** (0515-0372). Torque to 9 inch-pounds in the sequence a, b, c, 1, 1.
2. Refer to **Figure 18-10**. Place the assembly/bracket into place into the chassis and replace the three screws (0515-0372). Torque 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 W30, W31, W32, W33, and W34. Torque to 10 inch-pounds.
4. Replace the ribbon cable W7. 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.

4-Port Terminated Switch - Option 503, 508, & 526

Removal

1. Refer to **Figure 18-12**. Remove the semi-rigid cables W29, W30, W31, and W32 using the 5/16 inch wrench.
2. Disconnect the wire harness connector.
3. Remove the two screws (1) (0515-0372) to remove the switch/bracket from the chassis using the T-10 driver.

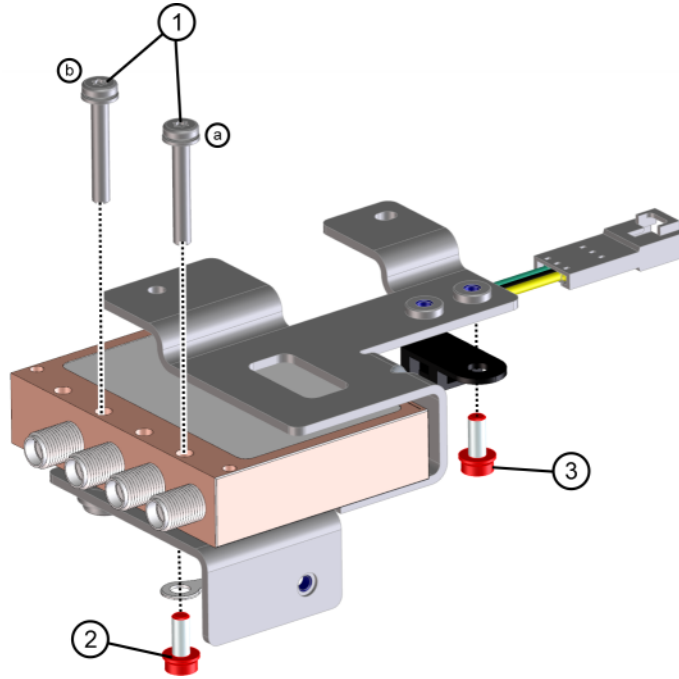
Figure 18-12 4-Port Terminated Switch Removal - Option 503, 508, & 526



Item	Keysight Part Number
W29	N9048-21331
W30	N9048-21333
W31	N9048-21334
W32	N9048-21308

4. Refer to **Figure 18-13**. To separate the switch from the bracket, remove the two screws **(1)** (0515-1410). Remove the screw **(2)** (0515-0372) that attaches the grounding wire to the bracket. Remove the screw **(3)** (0515-0430) that attaches the wire clip to the bracket.

Figure 18-13 4-Port Terminated Switch/Bracket Separation - Option 503, 508, & 526



Replacement

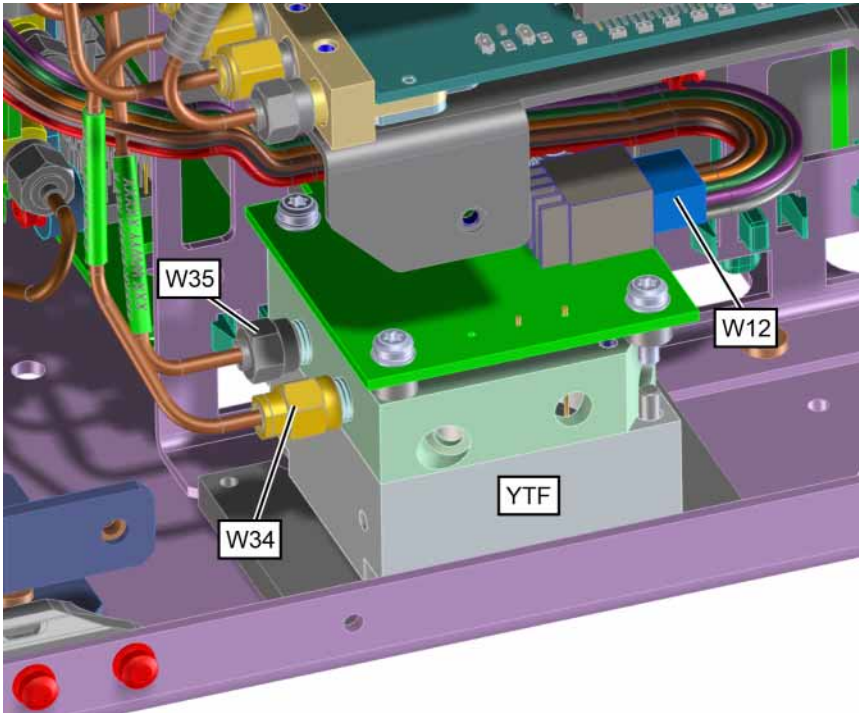
1. Refer to **Figure 18-13**. Position the switch in the bracket. Replace the two screws **(1)** (0515-1410). Torque to 9 inch-pounds in the sequence (a) - (b).
2. Reattach the switch grounding wire to the bottom of the bracket using the single screw **(2)** (0515-0372). Reattach the wire clip to the bottom of the bracket using the single screw **(3)** (0515-0430). Torque screws to 9 inch-pounds.
3. Refer to **Figure 18-12**. Position the switch/bracket onto the chassis. Replace the two screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. Replace the semi-rigid cables W29, W30, W31, and W32. Torque to 10 inch-pounds.
5. Reconnect the wire harness.
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.

YTF Preselector - Option 503, 508, & 526

Removal

- 1. Refer to **Figure 18-14**. Remove wire harness cable W12.
- 2. Remove cables W34 and W35 from the YTF Preselector.

Figure 18-14 YTF Preselector Removal - Option 503, 508, & 526

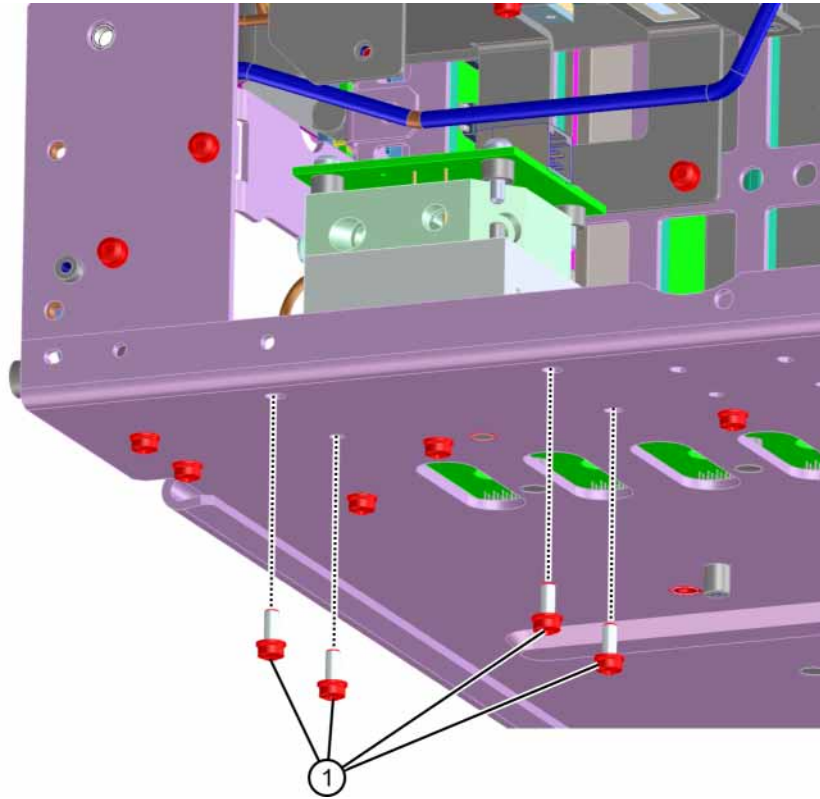


Item	Keysight Part Number
W34	N9048-21335
W35	N9048-21337

3. Refer to **Figure 18-15**. From the bottom of the instrument, remove the four screws (**1**) (0515-0372). The YTF Preselector can now be removed from the chassis.

Figure 18-15

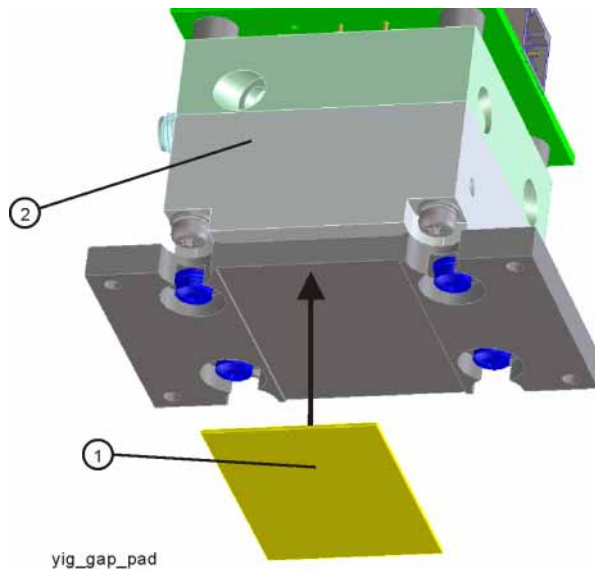
YTF Preselector Screws - Option 503, 508, & 526



Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see **Figure 18-16**, item **(1)**). The gap pad may remain attached to the faulty YTF Preselector.
2. Refer to **Figure 18-16**. 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 18-16 Gap Pad Installation

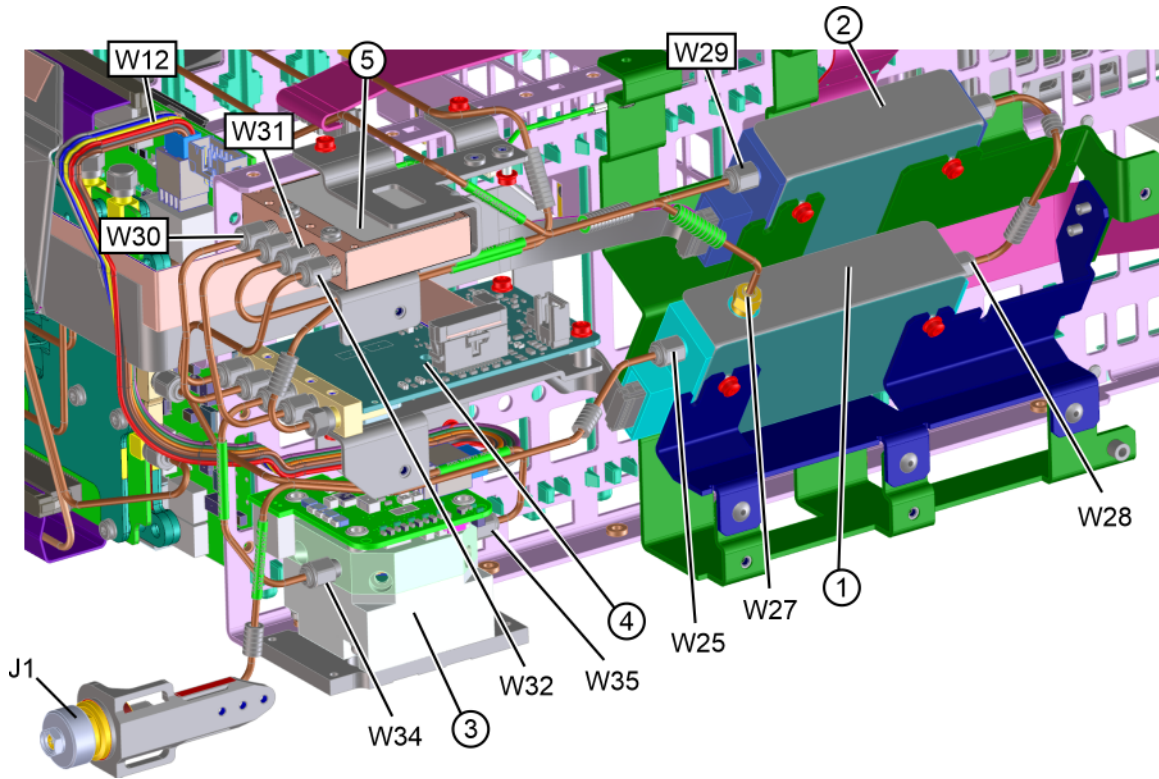


3. Refer to **Figure 18-15**. Place the YTF Preselector into the chassis with the ports toward the front of the instrument. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. **Figure 18-14**. Replace the cables W34 and W35. Torque to 10 inch-pounds.
5. Replace the wire harness 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.

RF Area - Option 544

Refer to **Figure 18-17**. The RF area consists of A9 Attenuator A **(1)**, A10 Attenuator B **(2)**, A11 Dual Pre-Amp Module, LNA, and EMC Band Switch **(3)**, A12 YTF **(4)**, and SW1 4-Port Terminated Switch assembly **(5)**.

Figure 18-17 RF Area Components and Cables - Option 544

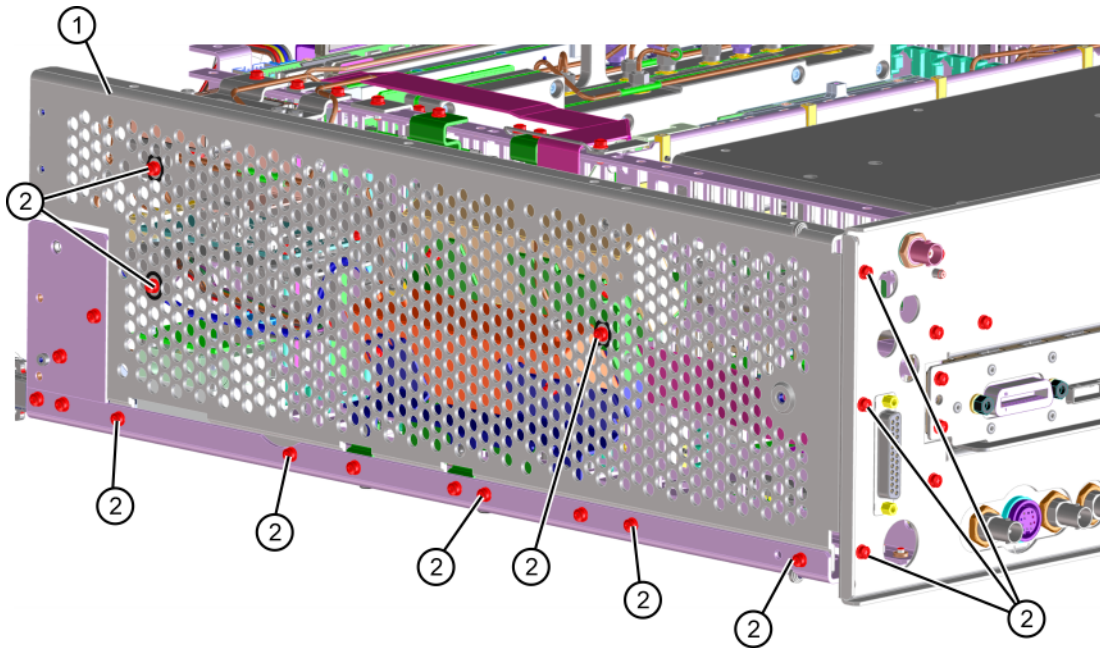


To gain access to the attenuators, Dual Pre-Amp Module, LNA, and EMC Band Switch, 4-Port Terminated Switch, or YTF for removal, follow these steps:

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 18-18**. Remove the Chassis Right Side Outer bracket (**1**) by removing the eleven screws (**2**) (0515-0372) using the T-10 driver.

Figure 18-18 Chassis Right Side Outer - Option 544

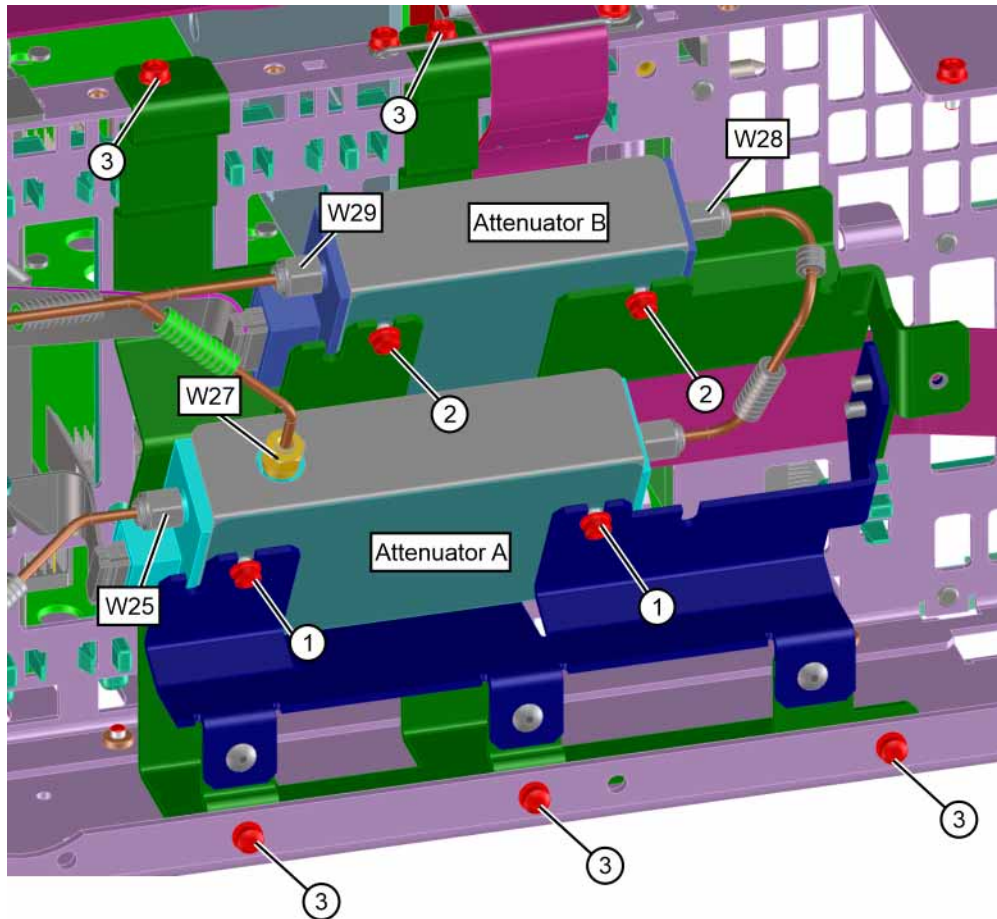


Attenuators - Option 544

Removal

1. Refer to **Figure 18-19**. To remove Attenuator A or Attenuator B, remove the semi-rigid cables W25, W27, W28, and W29 attached to the attenuator using the 5/16 inch wrench.
2. Remove the ribbon cable attached to the attenuator.
3. To remove either attenuator, remove the two screws **(1)** or **(2)** for the appropriate attenuator to remove it from the bracket using the T-10 driver.
4. To remove the entire bracket from the chassis, remove the five screws **(3)** (0515-0372).

Figure 18-19 Attenuators Removal - Option 544



Item	Keysight Part Number
W25	N9048-21319
W27	N9048-21318
W28	N9048-21317
W29	N9048-21320

Replacement

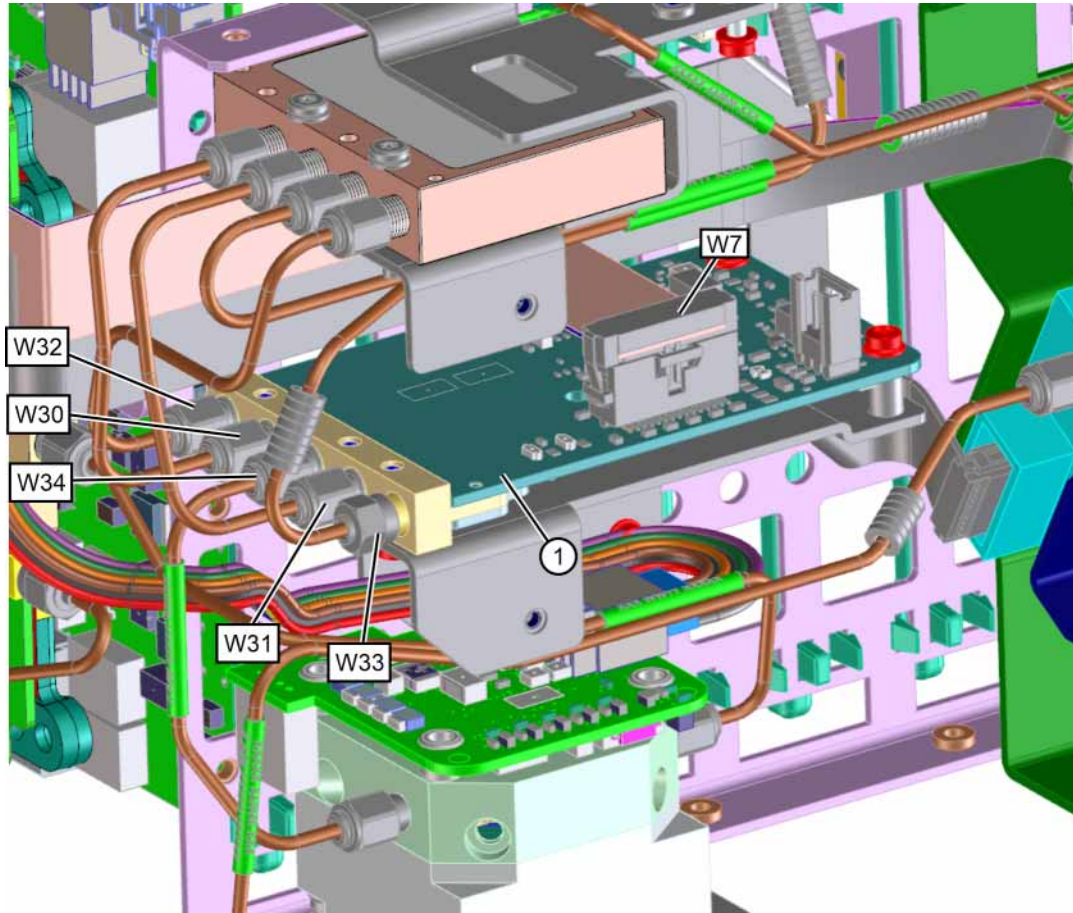
1. Refer to **Figure 18-19**. Position the attenuator in the bracket so that the ribbon connector end is facing the front of the instrument. Replace the two screws (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
2. Replace the ribbon cable and semi-rigid cables W25, W27, W28, and W29 to the attenuator. Torque the semi-rigid cables to 10 inch-pounds.
3. Refer to **Figure 18-18**. Position the Chassis Right Side Outer bracket onto the chassis and replace the eleven screws (0515-0372). Torque to 9 inch-pounds.
4. Replace the top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
5. Replace the front panel. Refer to the **Front Frame Assembly** replacement procedure.
6. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Dual Pre-Amp Module, LNA, and EMC Band Switch - Option 544

Removal

1. Refer to **Figure 18-20**. Remove the ribbon cable W7.
2. Remove the semi-rigid cables W30, W31, W32, W33, and W34 using the 5/16 inch wrench.

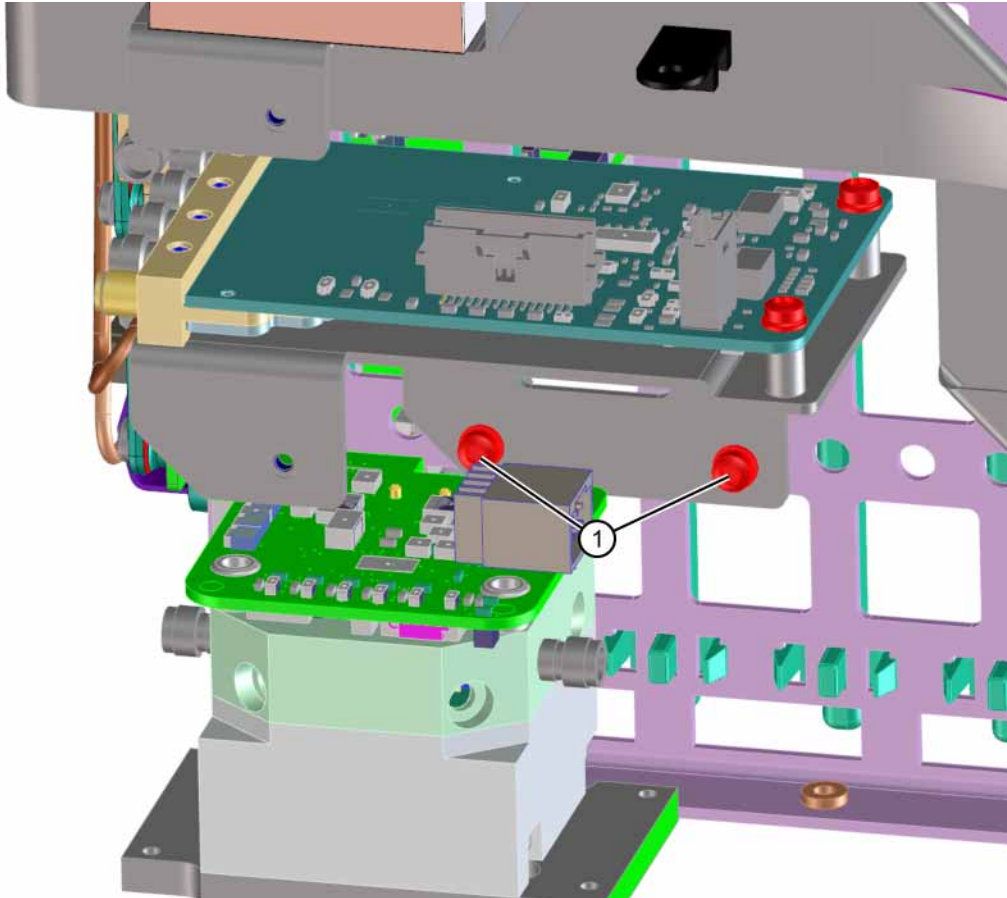
Figure 18-20 Dual Pre-Amp Module, LNA, and EMC Band Switch Cable Removal - Option 544



Item	Keysight Part Number
W30	N9048-21323
W31	N9048-21324
W32	N9048-21325
W33	N9048-21327
W34	N9048-21321

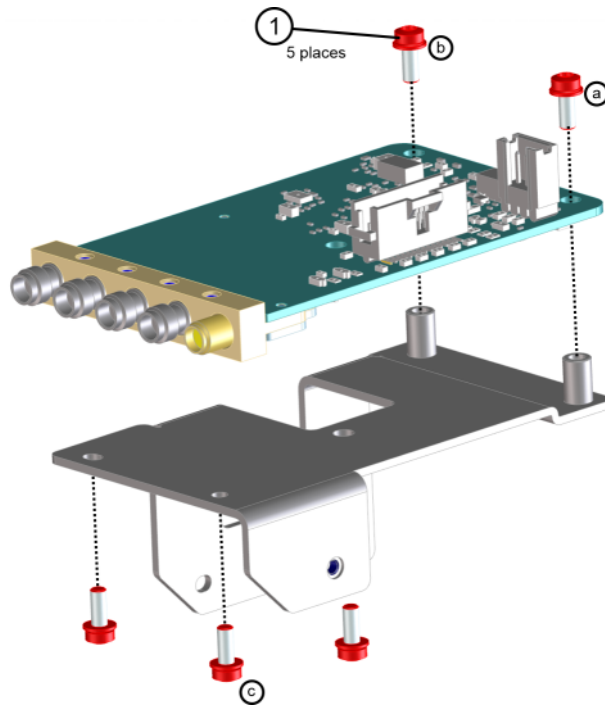
3. Refer to **Figure 18-21**. Remove the two screws **(2)** (0515-0372) using the T-10 driver. The Dual Pre-Amp Module, LNA, and EMC Band Switch **(1)** can now be removed from the chassis.

Figure 18-21 Dual Pre-Amp Module, LNA, and EMC Band Switch Bracket Removal - Option 544



4. Refer to **Figure 18-22**. To separate the switch from the bracket, remove the five screws **(1)** (0515-0372) using the T-10 driver.

Figure 18-22 Dual Pre-Amp Module, LNA, and EMC Band Switch/Bracket Separation - Option 544



Replacement

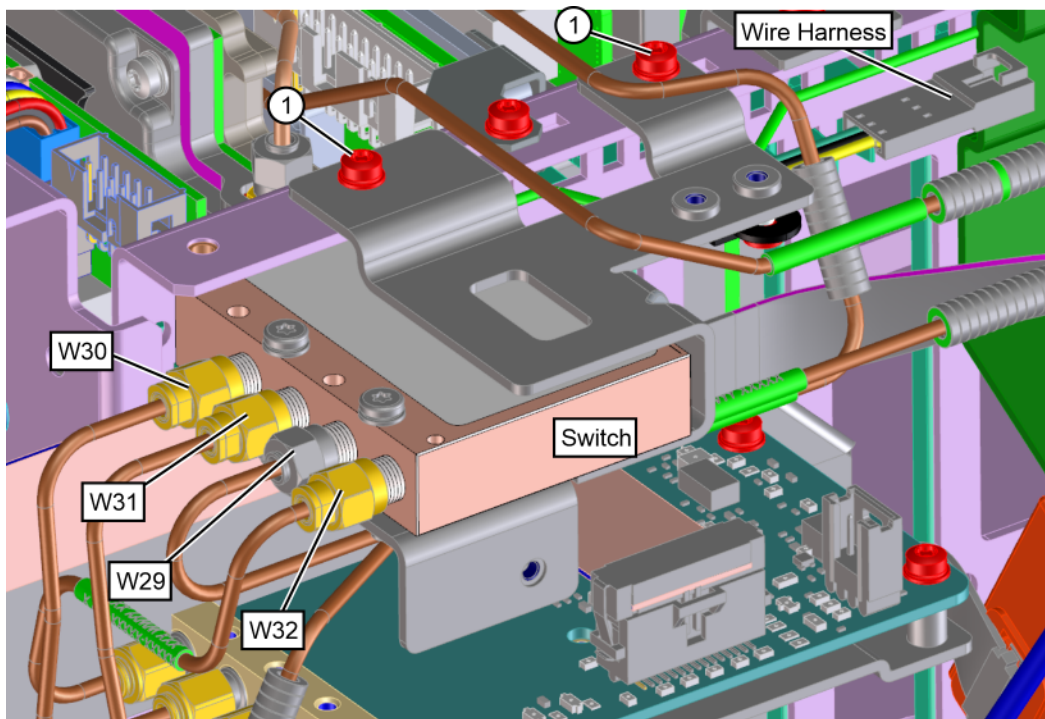
1. Refer to **Figure 18-22**. Place the switch onto the bracket and replace the five screws (**1**) (0515-0372). Torque to 9 inch-pounds in the sequence, a, b, c, 1, 1.
2. Refer to **Figure 18-21**. Place the switch/bracket into place into the chassis and replace the two screws (0515-0372). Torque to 9 inch-pounds starting with the screw closest to the front of the instrument.
3. Refer to **Figure 18-20**. Replace the semi-rigid cables W30, W31, W32, W33, and W34. Torque to 10 inch-pounds.
4. Replace the ribbon cable W7. Ensure locking tabs on the sides of the connector are engaged.
5. Refer to **Figure 18-18**. 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.

4-Port Terminated Switch - Option 544

Removal

1. Refer to **Figure 18-23**. Remove the semi-rigid cables W29, W30, W31, and W32 using the 5/16 inch wrench.
2. Disconnect the wire harness connector.
3. Remove the two screws (1) (0515-0372) to remove the switch/bracket from the chassis using the T-10 driver.

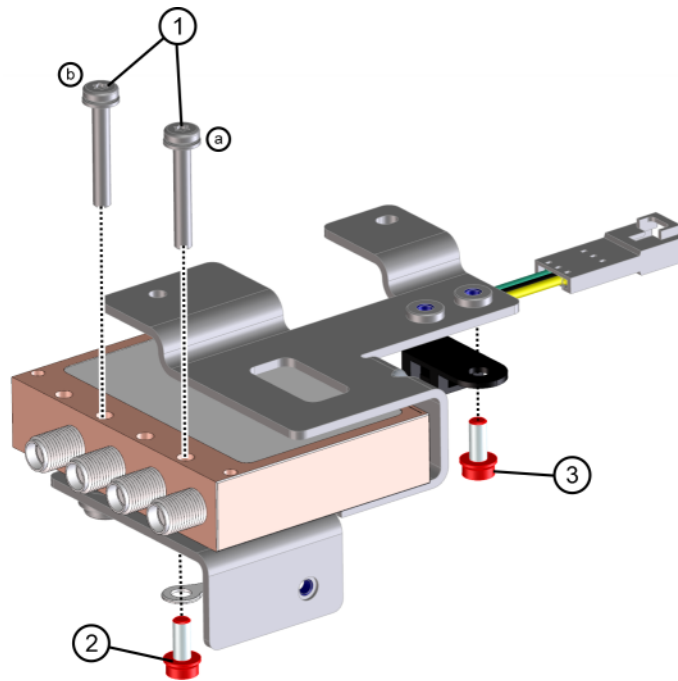
Figure 18-23 4-Port Terminated Switch Removal - Option 544



Item	Keysight Part Number
W29	N9048-21320
W30	N9048-21323
W31	N9048-21324
W32	N9048-21325

4. Refer to **Figure 18-24**. To separate the switch from the bracket, remove the two screws **(1)** (0515-1410). Remove the screw **(2)** (0515-0372) that attaches the grounding wire to the bracket. Remove the screw **(3)** (0515-0430) that attaches the wire clip to the bracket.

Figure 18-24 4-Port Terminated Switch/Bracket Separation - Option 544



Replacement

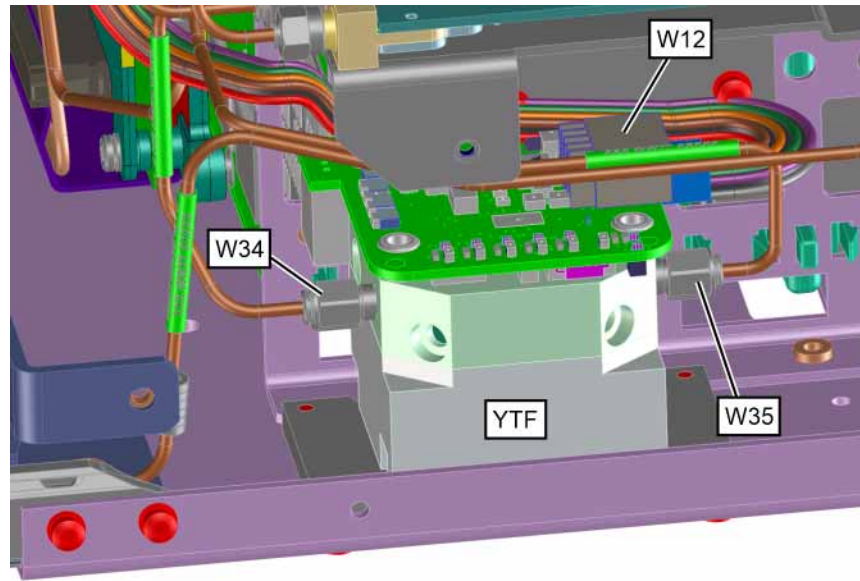
1. Refer to **Figure 18-24**. Position the switch in the bracket. Replace the two screws **(1)** (0515-1410). Torque the screws to 9 inch-lbs.
2. Reattach the switch grounding wire to the bottom of the bracket using the single screw **(2)** (0515-0372). Reattach the wire clip to the bottom of the bracket using the single screw **(3)** (0515-0430). Torque screws to 9 inch-pounds.
3. Refer to **Figure 18-23**. Position the switch/bracket onto the chassis. Replace the two screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. Replace the semi-rigid cables in this order: W29, W30, W31, and W32. Torque all cables to 10 inch-lbs.
5. Reconnect the wire harness.
6. Refer to **Figure 18-18**. Position the Chassis Right Side Outer bracket onto the chassis and replace the eleven 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.

YTF Preselector - Option 544

Removal

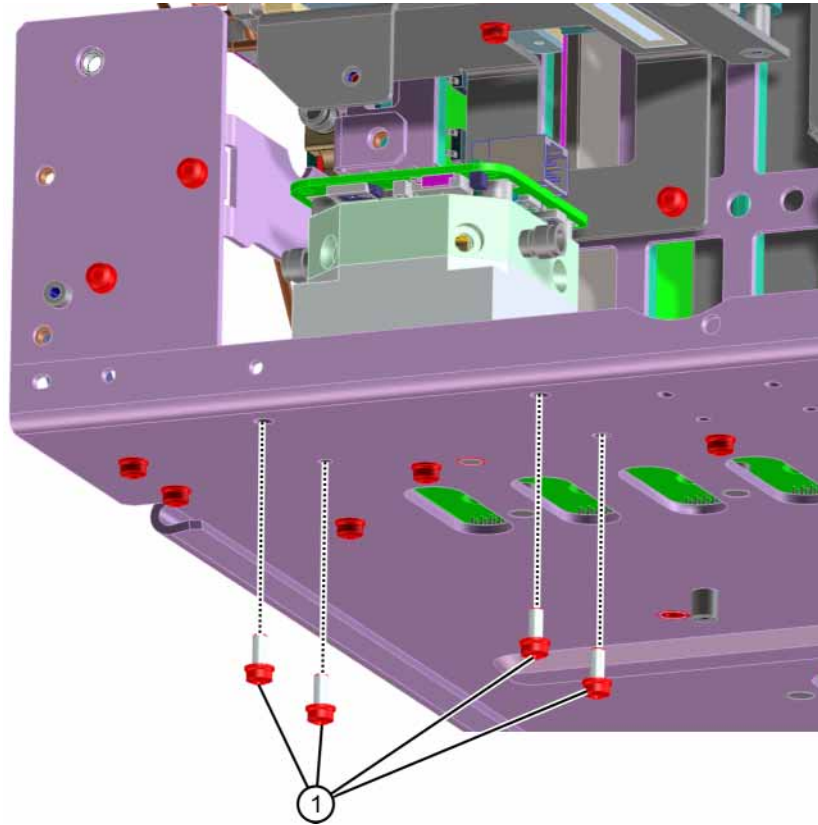
1. Refer to **Figure 18-25**. Remove cables W39 and W40 from the YTF Preselector **(1)**.
2. Remove the wire harness W12.
3. Refer to **Figure 18-26**. From the bottom of the instrument, remove the four screws **(1)** (0515-0372). The YTF Preselector can now be removed from the chassis (may require lifting up slightly on the Dual Pre-Amp Module, LNA, and EMC Band Switch).

Figure 18-25 YTF Preselector Removal - Option 544



Item	Keysight Part Number
W34	N9048-21321
W35	N9048-21322

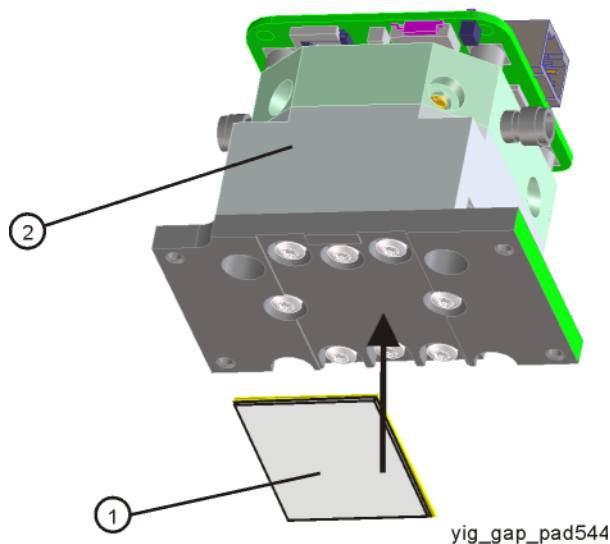
Figure 18-26 YTF Preselector Screws



Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see **Figure 18-27**, item **(1)**). The gap pad may remain attached to the faulty YTF Preselector.
2. Refer to **Figure 18-27**. 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 18-27 Gap Pad Installation



3. Refer to **Figure 18-26**. Place the YTF Preselector into the chassis. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. **Figure 18-25**. Replace the cables W39 and W40. Torque to 10 inch-pounds.
5. Replace the wire harness W12.
6. Refer to **Figure 18-18**. 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.

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 18-28** or **Figure 18-29**. Using the 5/16 inch wrench, remove any cables connected to the connectors indicated, A13A1J1, J2, J4, J5, J6, J7, and J9. If the instrument has Option EXM, remove the cables connected to A13A1J8 and J13 also.

Figure 18-28 RF Front End Assembly Cable Removal - Option 503, 508, & 526

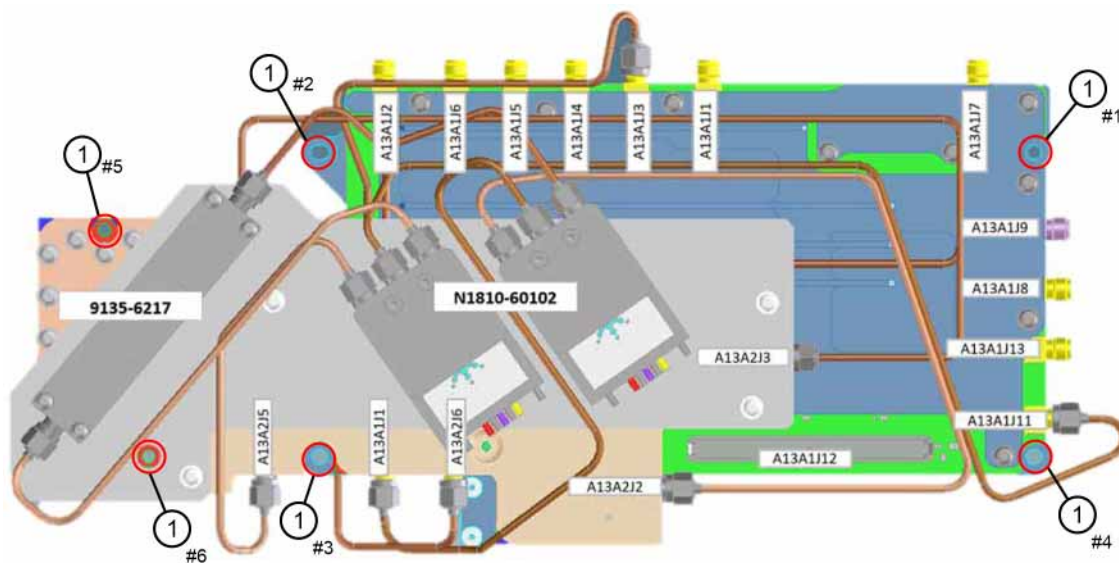
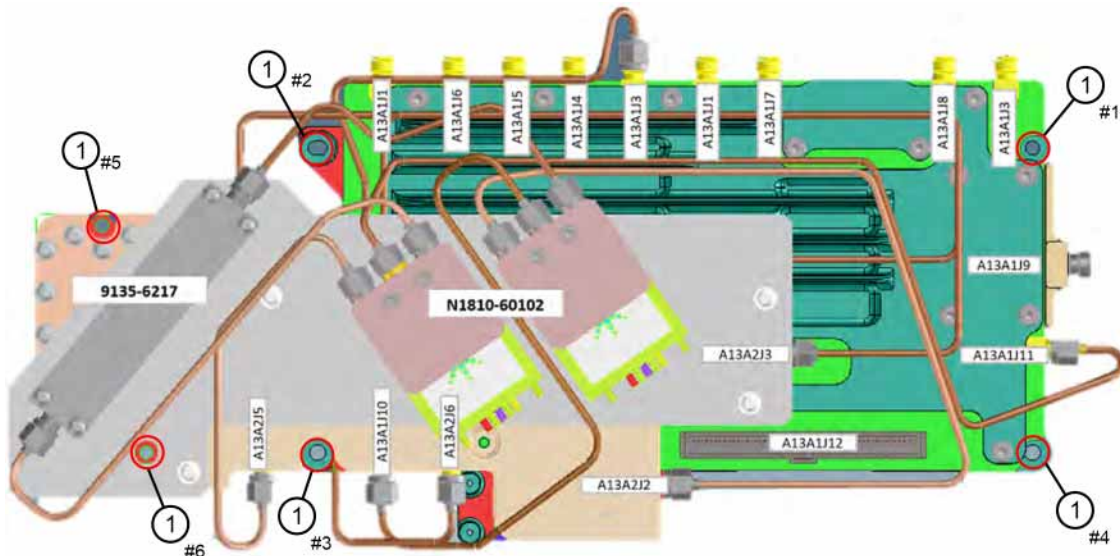
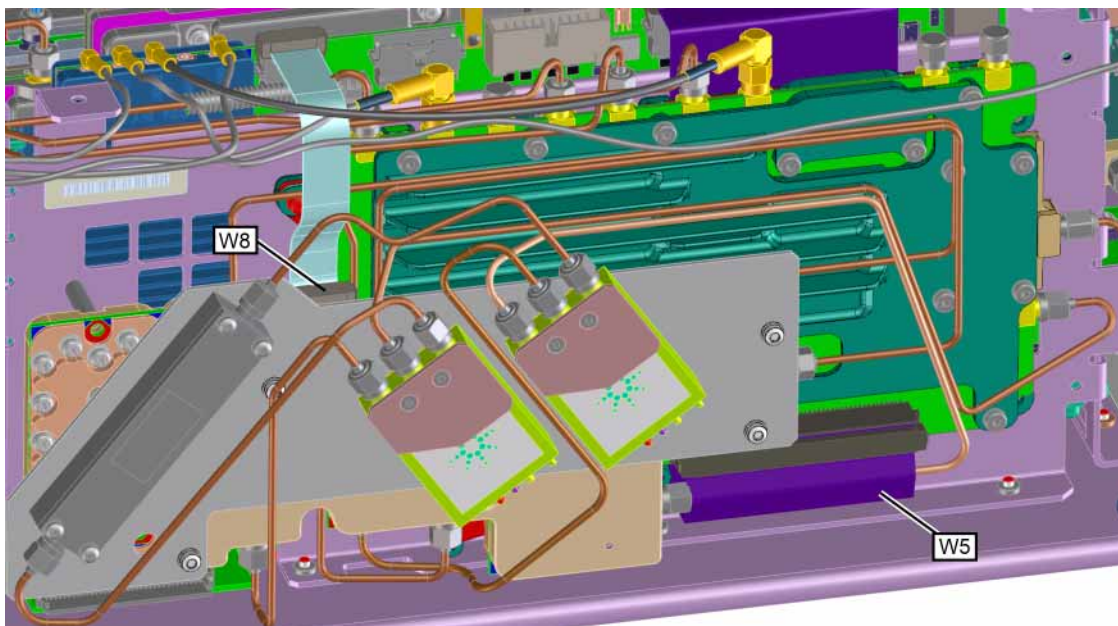


Figure 18-29 RF Front End Assembly Cable Removal - Option 544



5. Refer to **Figure 18-30**. Remove the W5 and W8 ribbon cables from the connectors as indicated.

Figure 18-30 RF Front End Assembly Ribbon Cable Removal



6. Remove the 50 Ω terminators from RF Front End Assembly.

7. Refer to **Figure 18-28** or **Figure 18-29**. Remove the six screws **(1)** (0515-0372) using the T-10 driver. The RF Front End Assembly can now be removed from the chassis.

Replacement

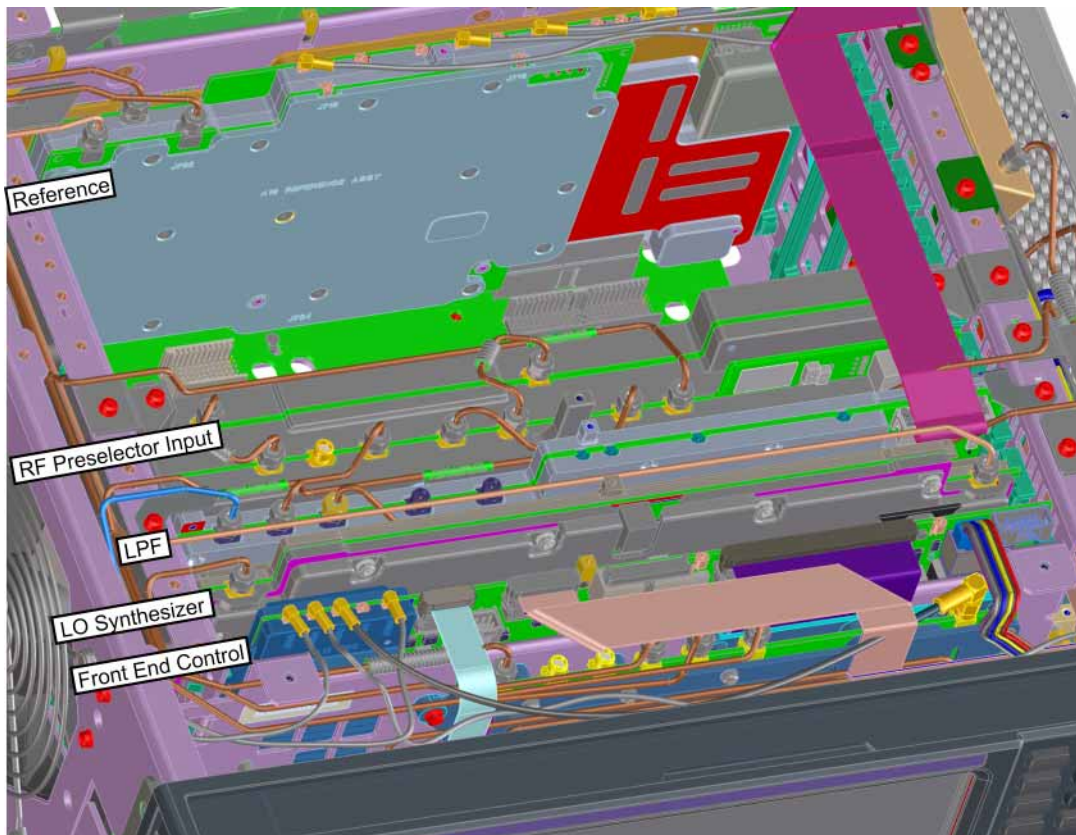
1. Refer to **Figure 18-30**. Attach the W5 ribbon cable to the Front End Assembly first. Route behind the Front End Assembly and ensure the cable is engaged under the tabs, then place the RF Front End Assembly into the chassis. Reattach the W8 ribbon cable.
2. Refer to **Figure 18-28** or **Figure 18-29**. Replace the six screws **(1)** (0515-0372). Torque to 9 inch-pounds in the sequence #1 to #6.
3. Reattach the cables to A13J1, J2, J4, J5, J6, J7, and J9. If the instrument has Option EXM, reattach the cables to A13A1J8 and J13 also. 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.

Front End Control Assembly

Removal

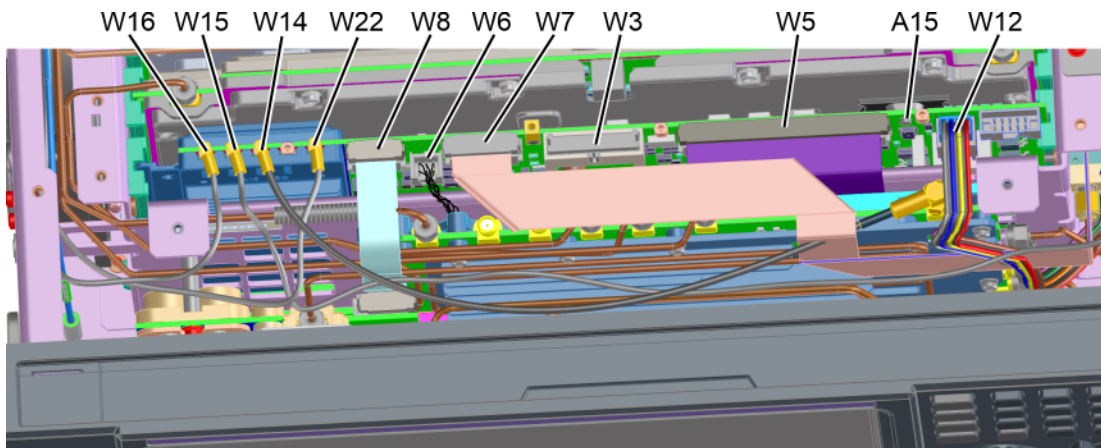
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the instrument top brace. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
3. Refer to **Figure 18-31**. Locate the Front End Control assembly.

Figure 18-31 Assembly Locations



4. Refer to **Figure 18-32**. Remove the ribbon cables W3, W5, W6, W7, W8, and W12 from the Front End Control assembly.
5. Remove the coaxial cables W14, W15, W16, and W22 from the Front End Control Assembly.
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 18-32 Front End Control Cables



Replacement

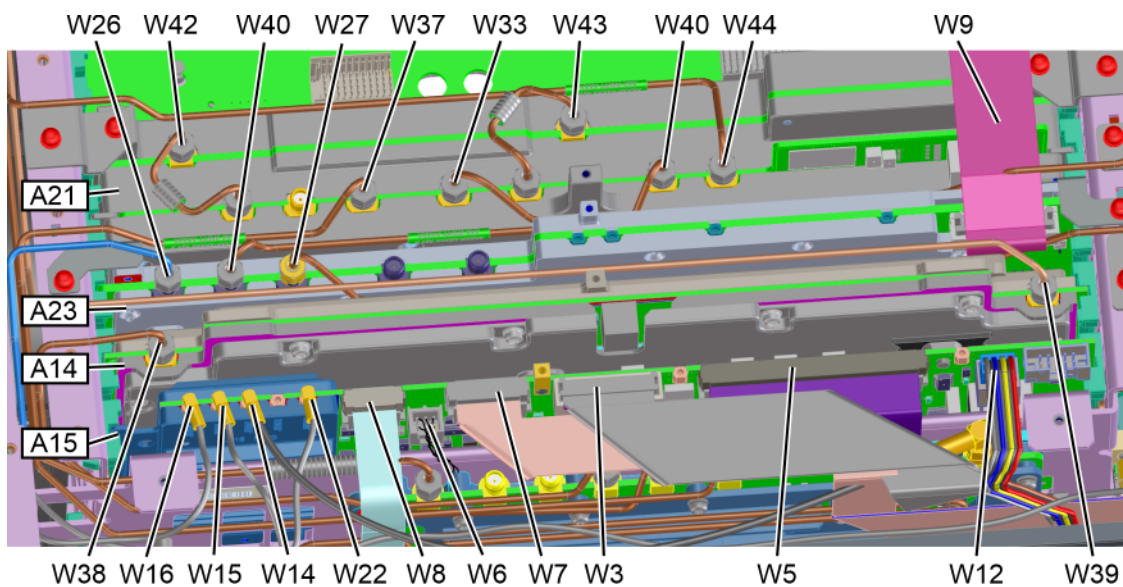
1. Refer to **Figure 18-32**. Install the Front End Control assembly into the correct slot in the chassis. Use the ejector and press down to plug it into the motherboard.
2. Reattach the coaxial cables W14, W15, W16, and W22 to the Front End Control Assembly.
3. Reattach the ribbon cables W3, W5, W5, W7, W8, 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 18-31**. Locate the LO Synthesizer assembly.
4. Refer to **Figure 18-33**. Remove the cables W38 and W39 from the A14 LO Synthesizer assembly using the 5/16 inch wrench.

Figure 18-33 LO Synthesizer Cables



5. Pull up on the LO Synthesizer assembly to unplug from the motherboard and lift out of the chassis.

Replacement

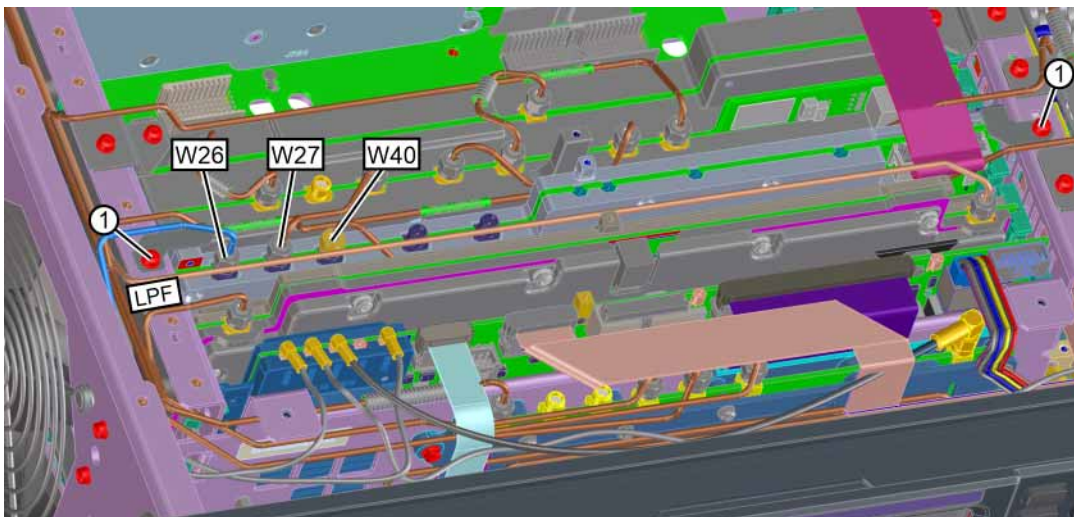
1. Refer to **Figure 18-33**. Install the LO Synthesizer assembly into slot 10 in the chassis and press down to connect to the motherboard.
2. Reattach the cables W38 and W39 to the LO Synthesizer assembly. Torque to 10 inch-pounds.
3. Replace the instrument top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
4. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

LPF 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 18-31**. Locate the LPF assembly.
4. Refer to **Figure 18-34**. Remove cables W26, W27, and W40 from the LPF assembly using the 5/16-inch wrench.

Figure 18-34 LPF Assembly Cables



5. Remove the ribbon cable.
6. Remove the two screws (0515-0372) (1) using the T-10 driver. Pull up on the LPF assembly to unplug from the motherboard and lift out of the chassis.

Replacement

1. Refer to **Figure 18-34**. Install the LPF assembly into slot 10 in the chassis and press down to connect to the motherboard.
2. Replace the two screws (0515-0372) **(1)** using the T-10 driver. Torque to 9 inch-pounds.
3. Replace cables W26, W27, and W40 to the LPF assembly. Torque to 10 inch-pounds.
4. Reattach ribbon cable.
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.

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 18-31](#). Locate the RF Preselector Input assembly.
4. Refer to [Figure 18-35](#). Remove cables W33, W37, W40, and W44 using the 5/16-inch wrench.

Figure 18-35 RF Preselector Cables



5. Remove the two screws (0515-0372) (1) using the T-10 driver.
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

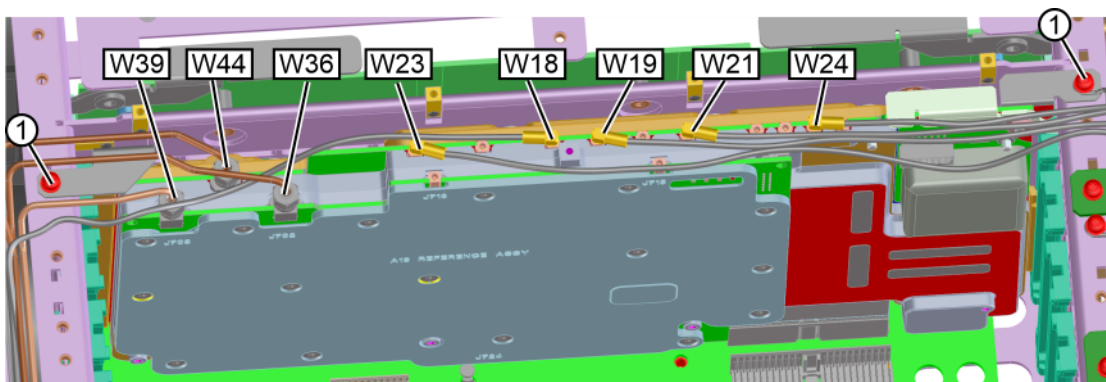
1. Slide the RF Preselector Input assembly into the chassis and press down to plug it into the motherboard using the ejector to push into place.
2. Refer to [Figure 18-35](#). Replace the two screws (0515-0372) (1) using the T-10 driver. Torque to 9 inch-pounds.
3. Replace cables W33, W37, W40, and W44. Torque to 10 inch-pounds.
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.

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 18-31**. Locate the Reference assembly.
4. Refer to **Figure 18-36**. Remove cables W36, W39, and W44 from the reference assembly using the 5/16-inch wrench.
5. Remove cables W18, W19, W21, W23, and W24 from the Reference assembly.

Figure 18-36 Reference Board Cables



6. Remove the two screws (0515-0372) (1) using the T-10 driver.
7. Remove the Reference board by pulling up to disconnect from the motherboard and pull out of the chassis.

Replacement

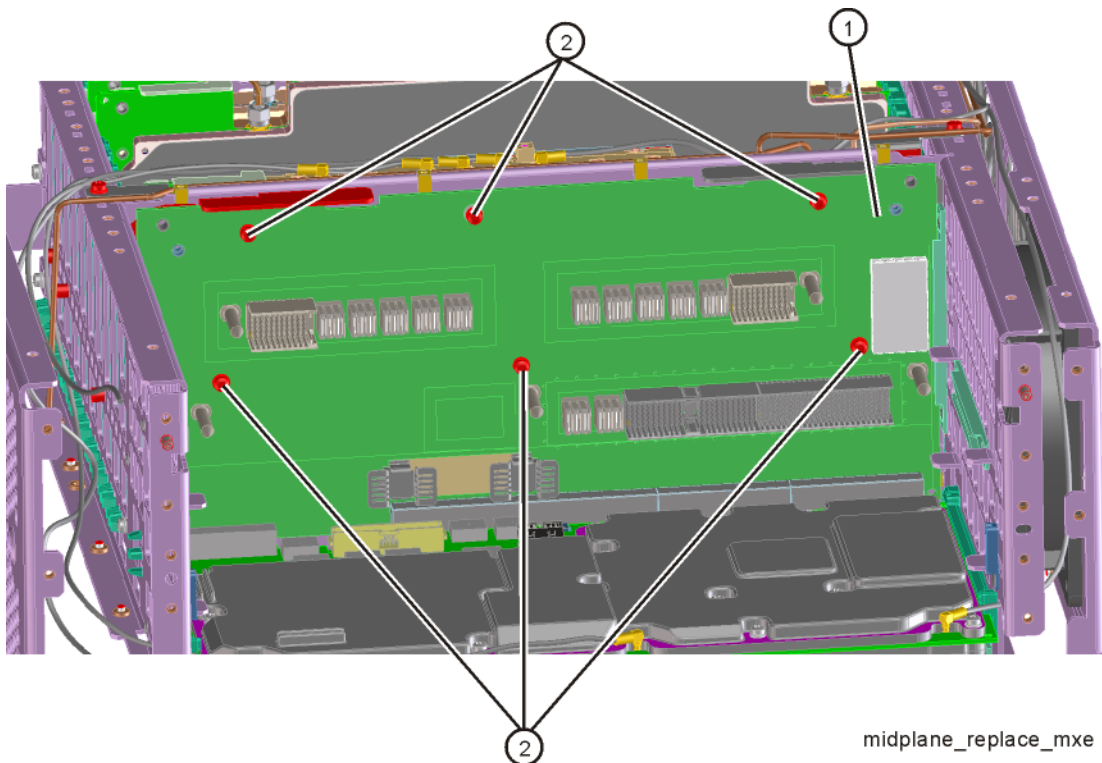
1. Slide the reference assembly into the chassis and press down to plug it into the motherboard.
2. Refer to **Figure 18-36**. Replace the two screws (1). Torque to 9 inch-pounds.
3. Replace cables W36, W39, and W44 to the correct locations. Torque to 10 inch-pounds.
4. Replace cables W18, W19, W21, W23, and W24 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. Remove the processor assembly. Refer to the **CPU Assembly** removal procedure.
4. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
5. Remove the power supply assembly. Refer to the **Power Supply Assembly** removal procedure.
6. Refer to **Figure 18-37**. 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 18-37 Midplane Board Assembly Removal



Replacement

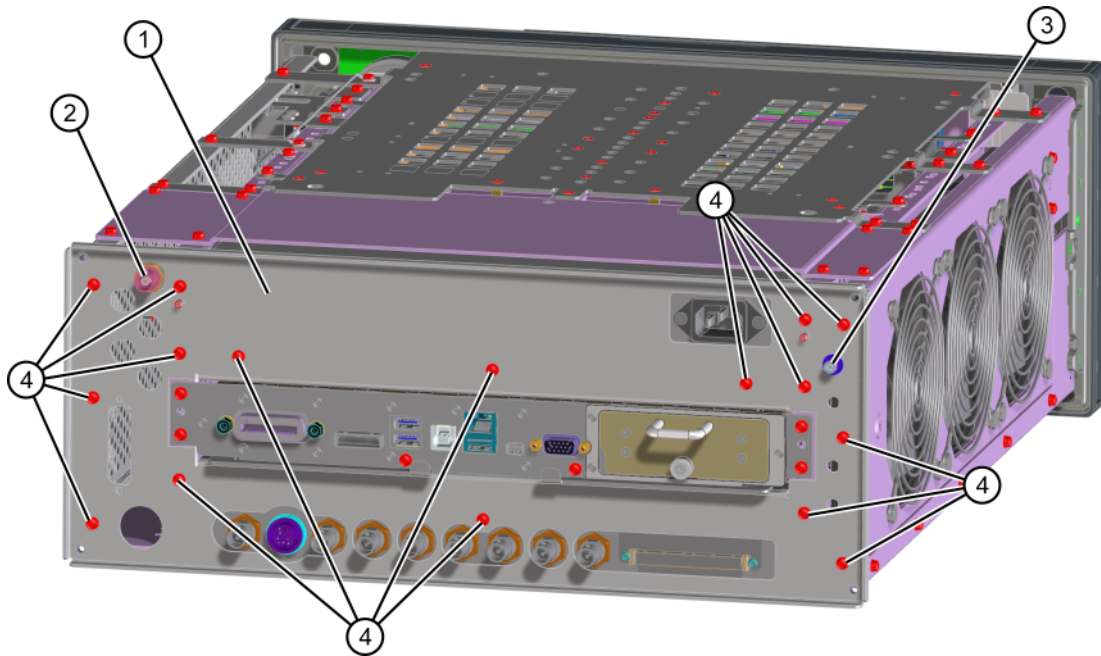
1. Refer to **Figure 18-37**. Install the midplane assembly into the chassis using the ejectors and attach to the midplane bracket using the six screws (**0515-0375**) removed earlier. Torque to 9 inch-pounds.
2. Replace the power supply assembly. Refer to the **Power Supply Assembly** replacement procedure.
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 18-38**. Remove W21 (2) cable from the rear panel using the 9/16- inch nut driver.
3. If present, remove W9 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 18-38 Rear Panel Removal



Replacement

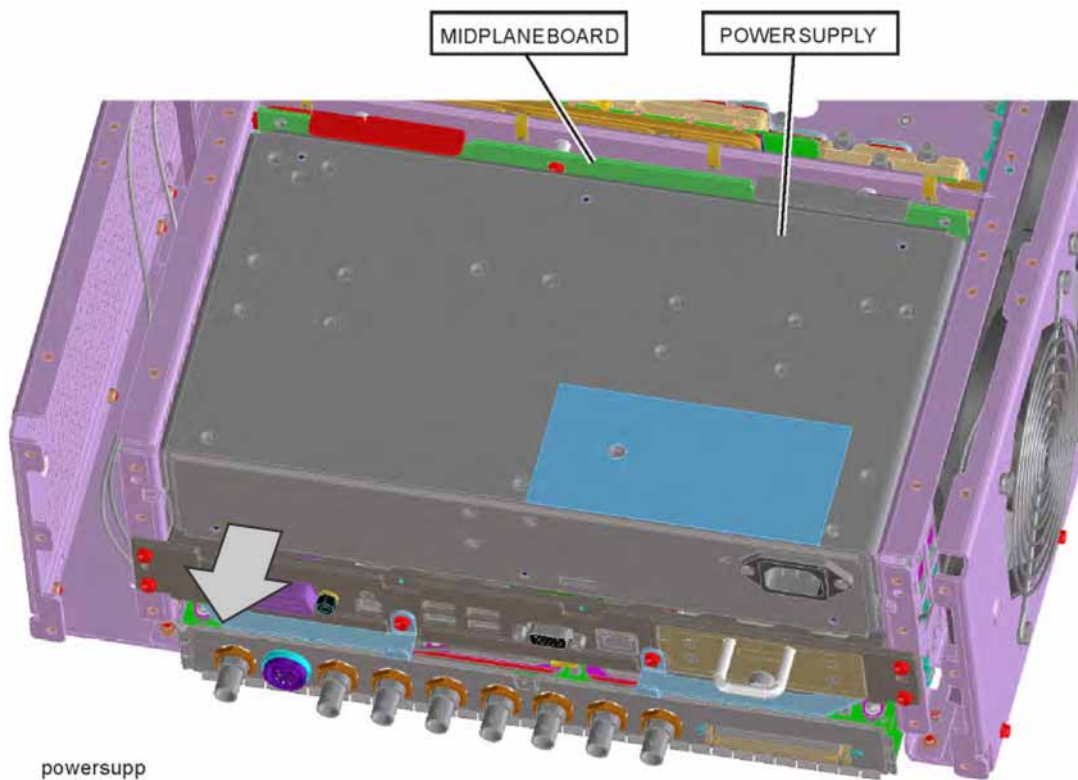
1. Reattach the W21 cable to the rear panel. Torque to 21 inch-pounds using the 9/16-inch nut driver.
2. If present, reattach W9 from the rear panel. Torque to 9 inch-pounds using the 3/16" nut driver.
3. If present, reattach W22 (3) from the rear panel. Torque to 10 inch-pounds using the 5/16" nut driver.
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 top brace and power supply bracket. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
3. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
4. The power supply assembly can be removed from the chassis by pulling straight out the back.

Figure 18-39 Power Supply Assembly Removal



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. Replace the rear panel. Refer to the **Rear Panel** replacement procedure.
3. Replace the top brace and power supply bracket. 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.

CPU Assembly

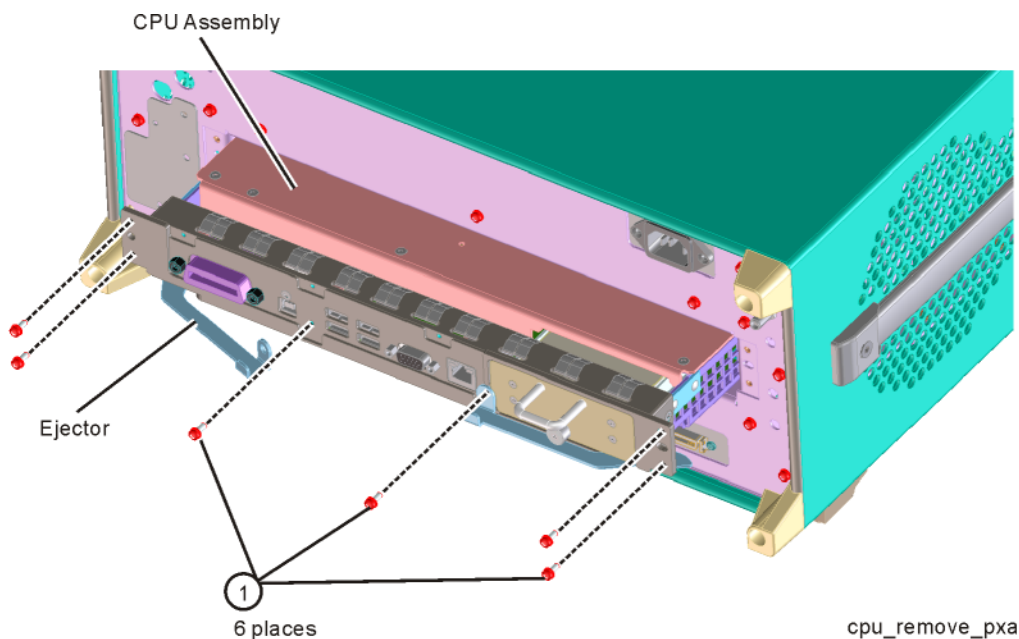
Removal

1. Refer to **Figure 18-40**. 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 18-40 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 18-40**. 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

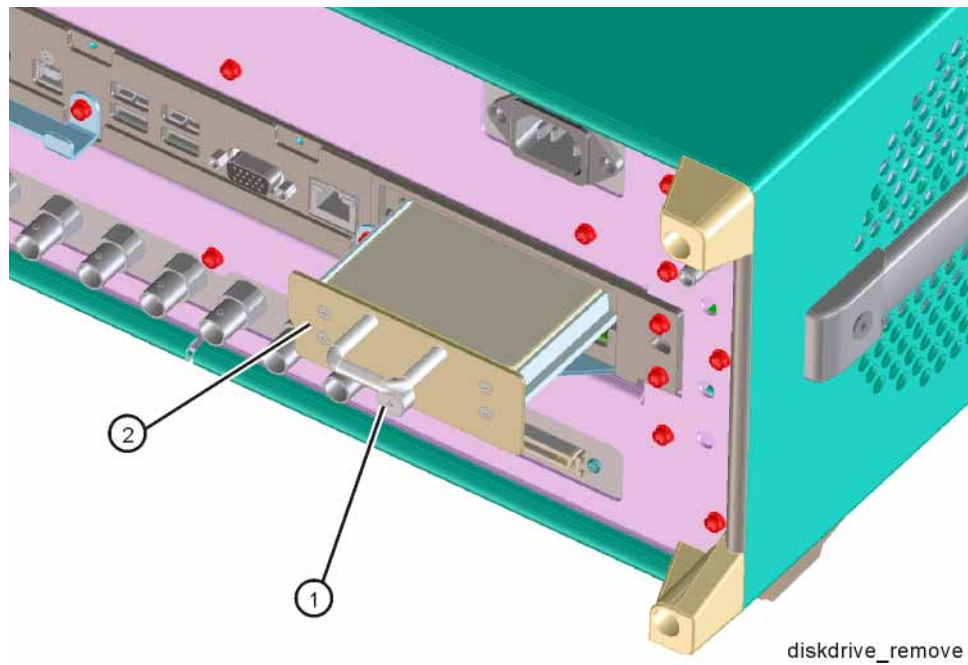
1. Turn the instrument off and remove the AC power cord.
2. Before replacing the A5 disk drive it is highly recommended that the factory calibration data be backed up to an external drive if at all possible. If this data is not backed up prior to replacing the disk drive all instrument adjustments and 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.

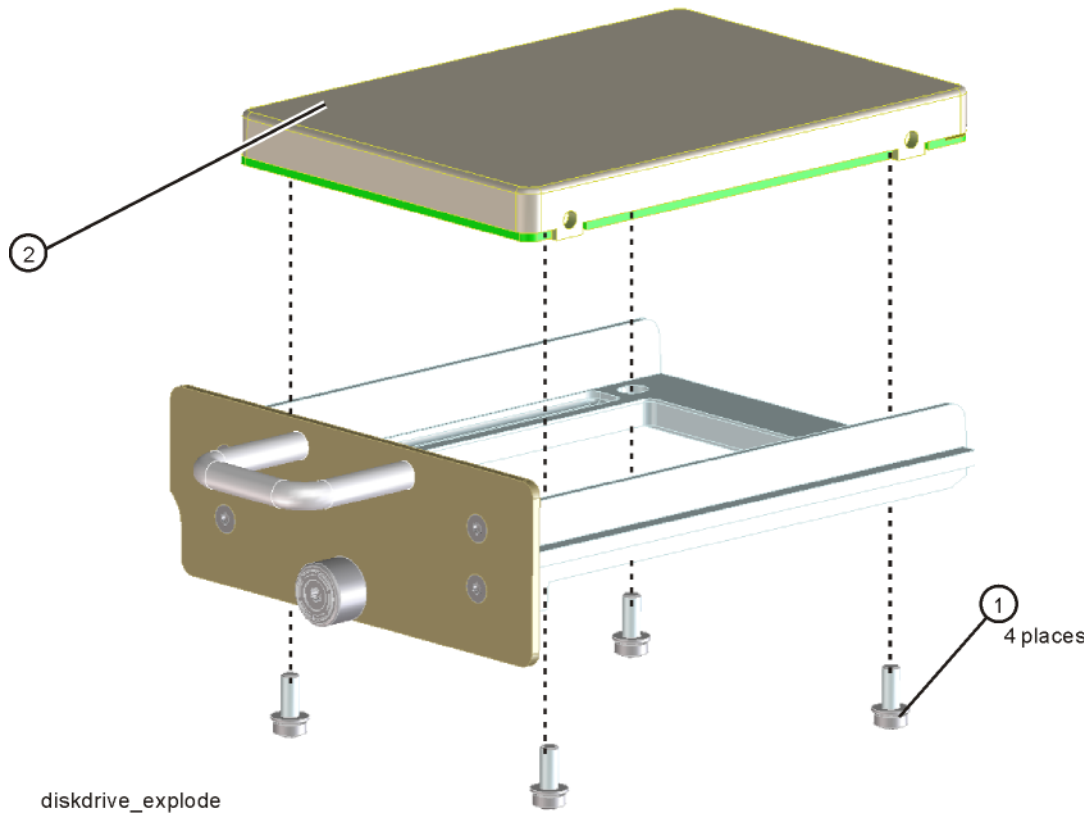
3. Refer to **Figure 18-41**. Locate and remove the existing disk drive carrier assembly (2) from the instrument by loosening the rear panel screw (1).

Figure 18-41 Removing the Disk Drive Carrier Assembly



4. Refer to **Figure 18-42**. Remove the 4 machine screws (1) (0515-0372) from the disk drive carrier assembly that secure the drive (2).

Figure 18-42 Disk Drive Screws



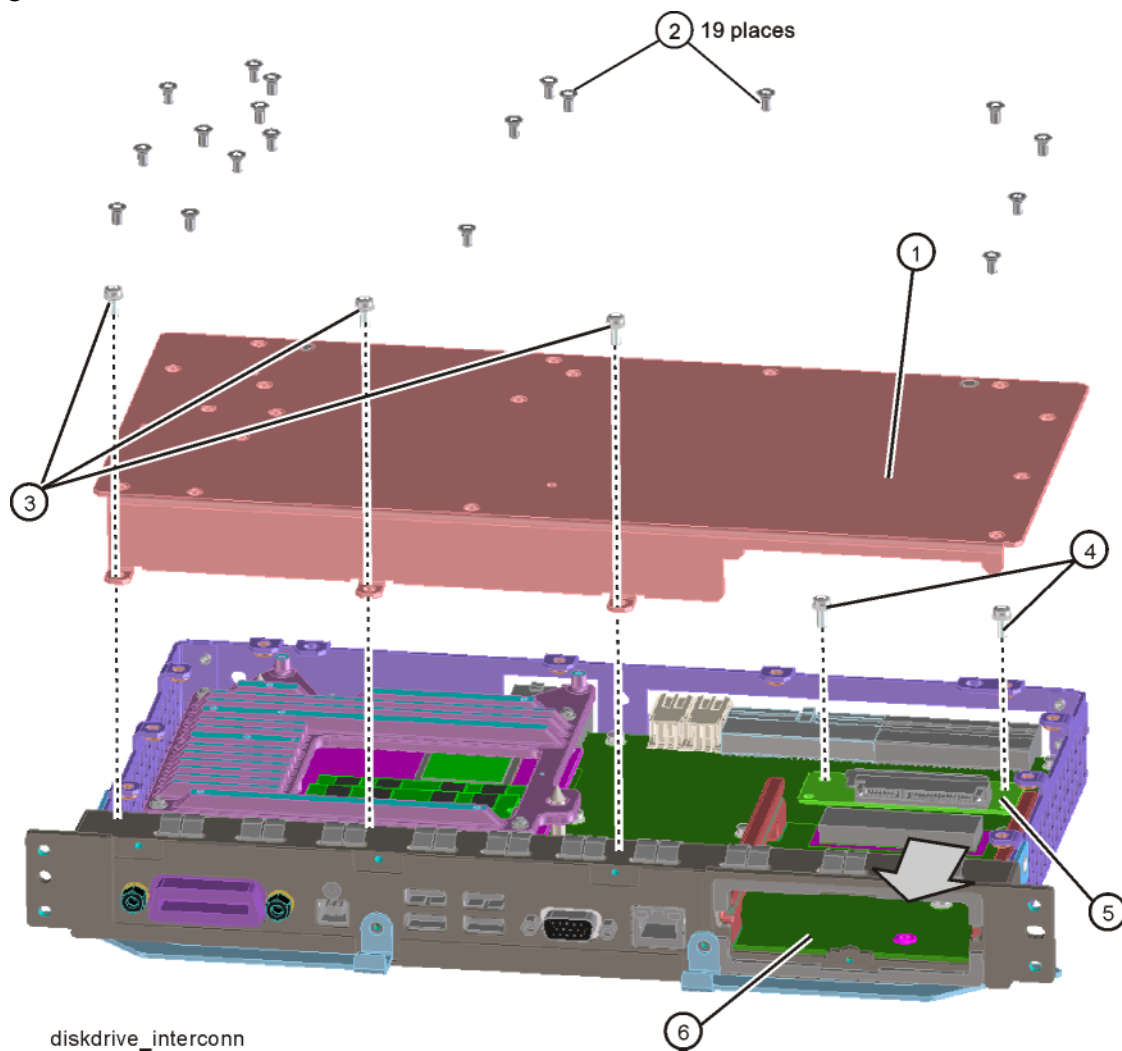
5. Remove the disk drive **(2)** from the carrier assembly.
6. Place the new disk drive onto the carrier assembly and attach with the 4 machine screws **(1)** (0515-0372). Torque to 9 in-pounds.
7. Refer to **Figure 18-41**. Replace the disk drive carrier assembly **(2)** into the instrument and tighten 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 18-43**. 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 18-43 A4A1 Disk Drive Interconnect Board Removal



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

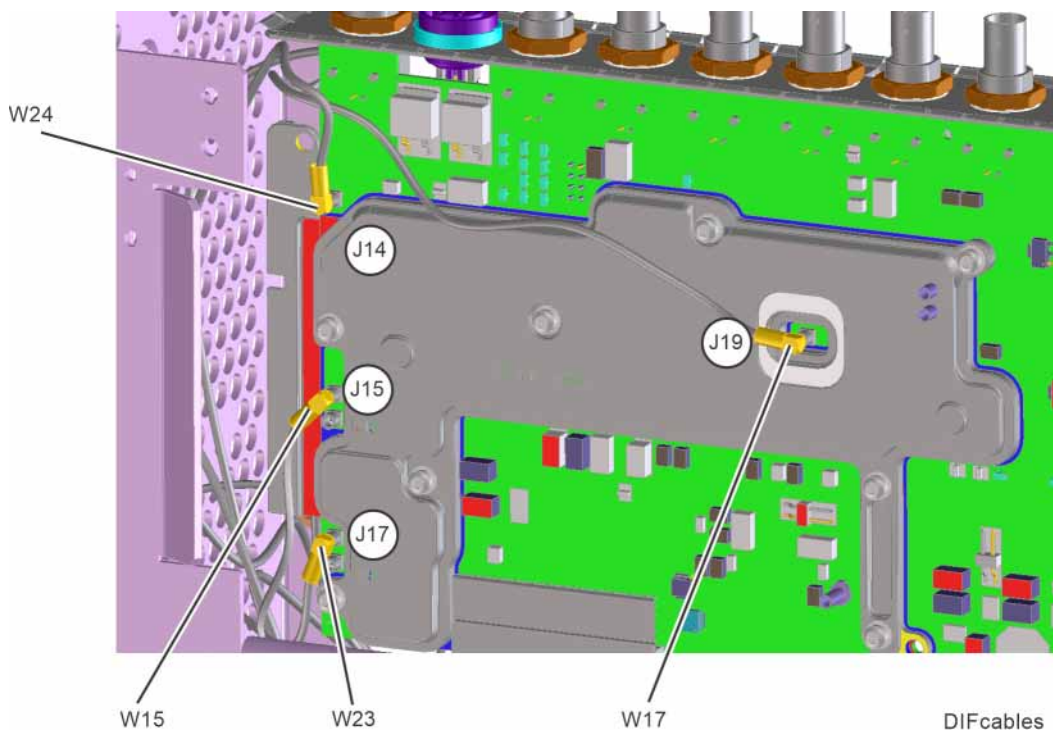
1. Refer to **Figure 18-43**. Plug the A4A1 Disk Drive Interconnect board **(5)** into the A4 CPU assembly by carefully sliding it into place from the disk drive bay opening **(6)**.
2. Install the 2 screws **(4)** (0515-0372) that secure the A4A1 Disk Drive Interconnect board to the A4 CPU assembly 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

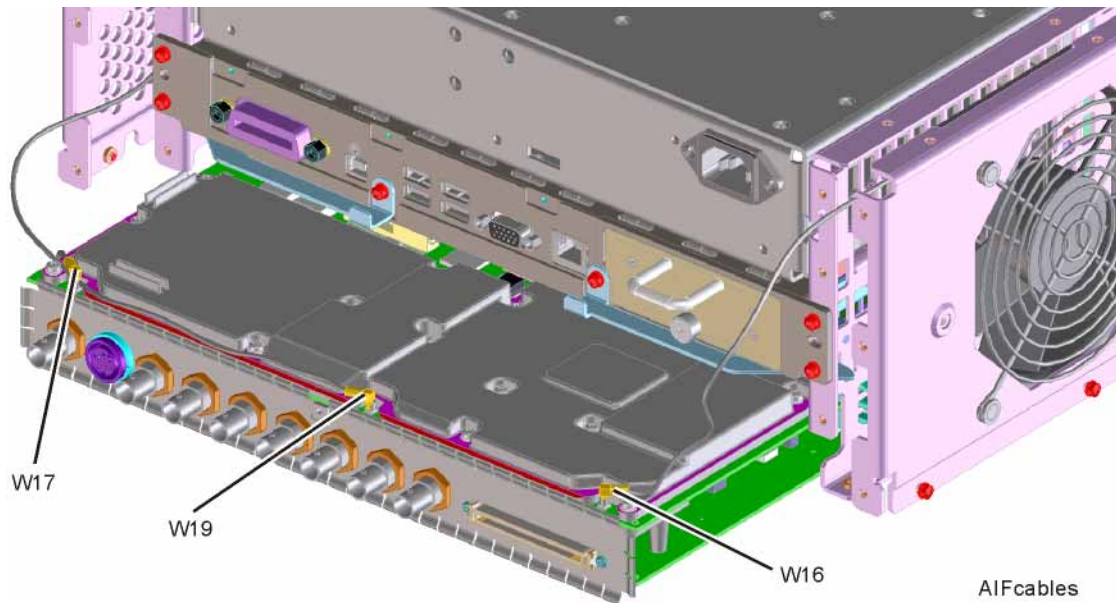
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
3. Refer to **Figure 18-44**. Remove cable W15, W17, W23, and W24 from the bottom of the DIF assembly.

Figure 18-44 DIF Cables



4. Refer to **Figure 18-45**. Pull the AIF/DIF assembly part way out of the chassis. Remove cables W16, W17, and W19 from the AIF assembly.

Figure 18-45 AIF Cables

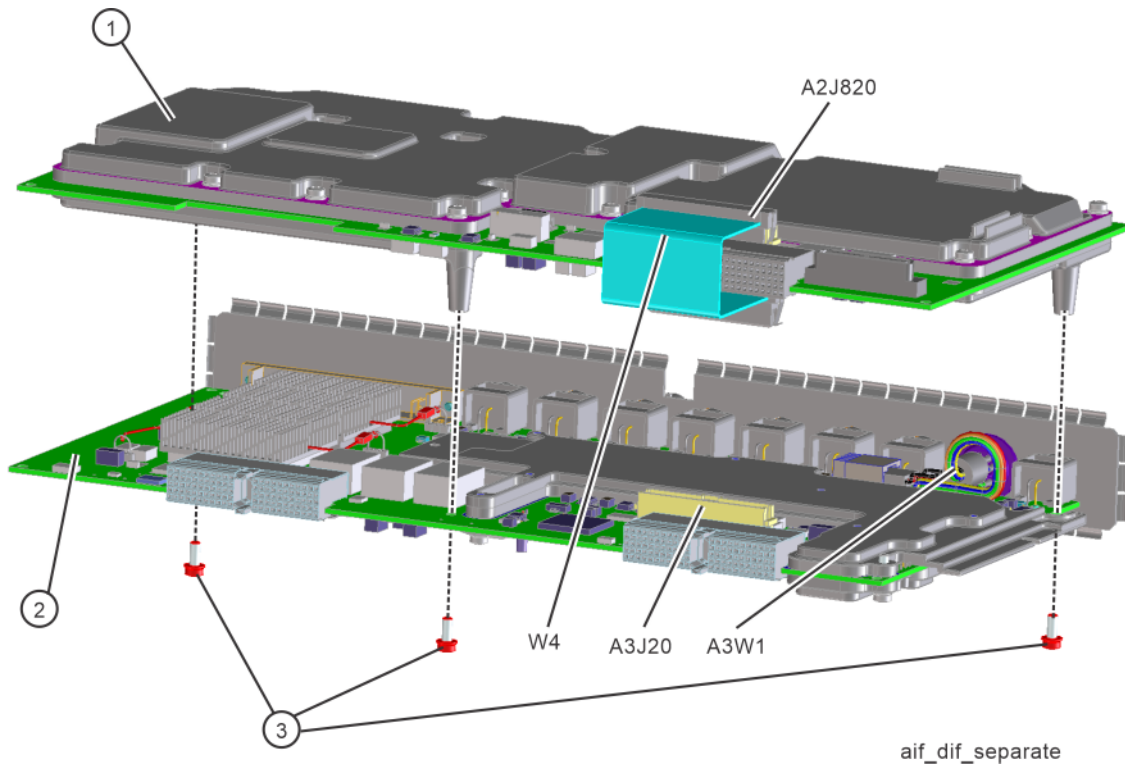


5. The AIF/DIF assembly can be removed from the chassis by pulling straight out the back.

Separate AIF/DIF Assembly

1. To separate the AIF (1) from the DIF (2), unplug ribbon cable W4 from the AIF assembly.
2. Refer to **Figure 18-46**. From underneath the assembly, remove the three screws (3) (0515-0372).

Figure 18-46 AIF/DIF Separation



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 W4.

Replacement

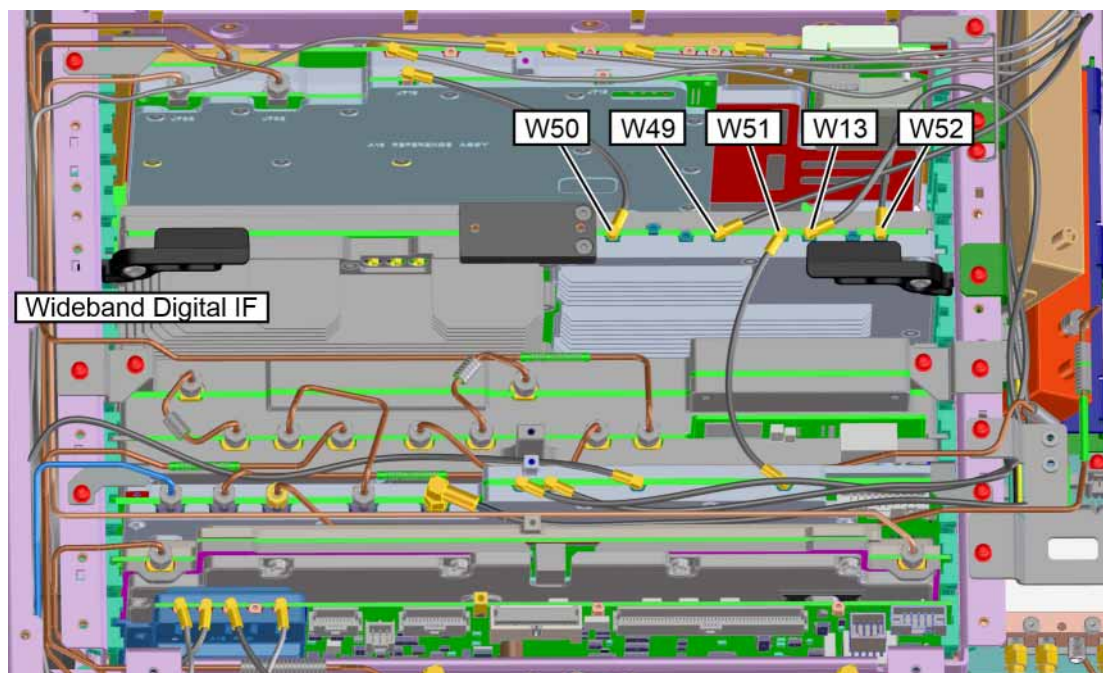
1. Slide the AIF/DIF assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the motherboard assembly.
2. Refer to **Figure 18-45**. Replace cables W16, W17, and W19 to the AIF assembly.
3. Refer to **Figure 18-44**. Replace cable W15, W17, W23, and W24 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.

Wideband Digital IF Assembly (Option WF1)

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 18-47**. Locate the Wideband Digital IF assembly.

Figure 18-47 Wideband Digital IF Cables



4. Remove cables W13, W49, W50, W51, and W52 from the Wideband Digital IF assembly.
5. The Wideband Digital IF assembly can now be removed by pulling up on the ejectors to remove from the chassis.

Replacement

1. Slide the Wideband Digital IF assembly into the chassis and use the ejectors to push into place into the motherboard.
2. Refer to **Figure 18-47**. Replace cables W13, W49, W50, W51, and W52
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.

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 RF Preselector Input assembly. Refer to the **RF Preselector Input Assembly** removal procedure.
11. Remove the Limiter Pre-Filter assembly. Refer to the **LPF Assembly** removal procedure.
12. If the instrument has Option WF1 installed, remove the Wideband Digital IF assembly. Refer to the **Wideband Digital IF Assembly (Option WF1)** removal procedure.
13. Remove the Reference assembly. Refer to the **Reference Assembly** removal procedure.
14. Remove the Midplane assembly. Refer to the **Midplane Board Assembly** removal procedure.
15. Remove the Chassis Right Side Outer bracket. Refer to **Figure 18-7 on page 432**.

16. Remove the fan assembly. Refer to the [Fan Assembly](#) removal procedure.

17. Refer to [Figure 18-48](#) and [Figure 18-49](#). Remove the midplane bracket (1) by removing the eight screws (2) (0515-0372) (two on each side and four on the bottom).

Figure 18-48 Midplane Bracket Removal

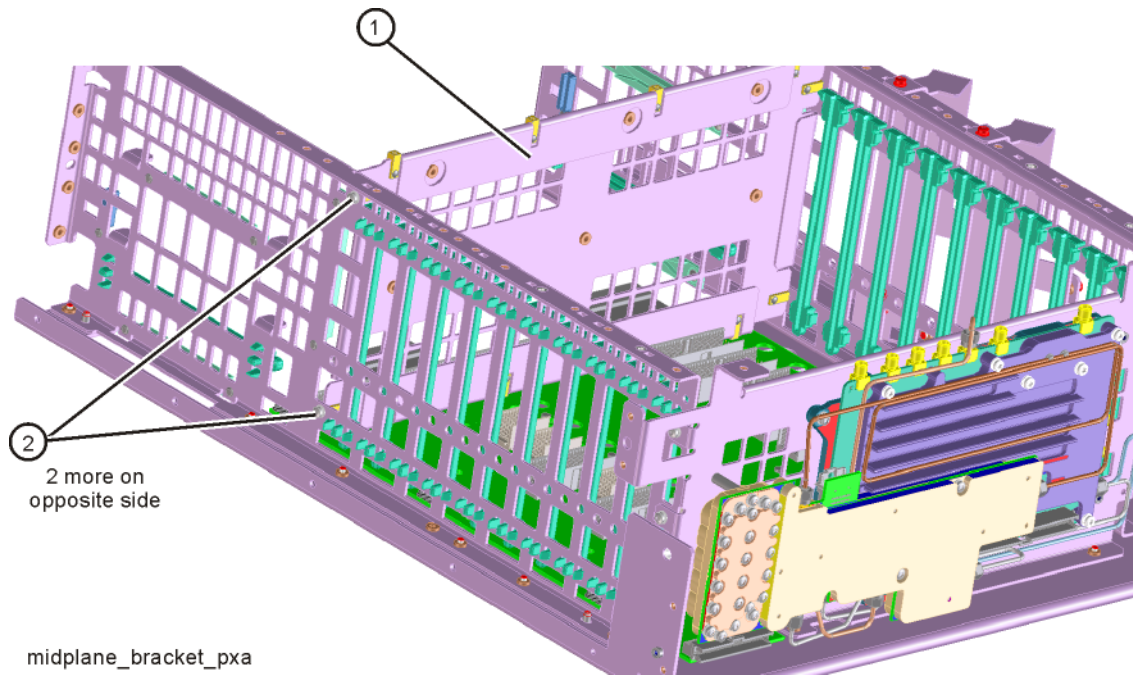
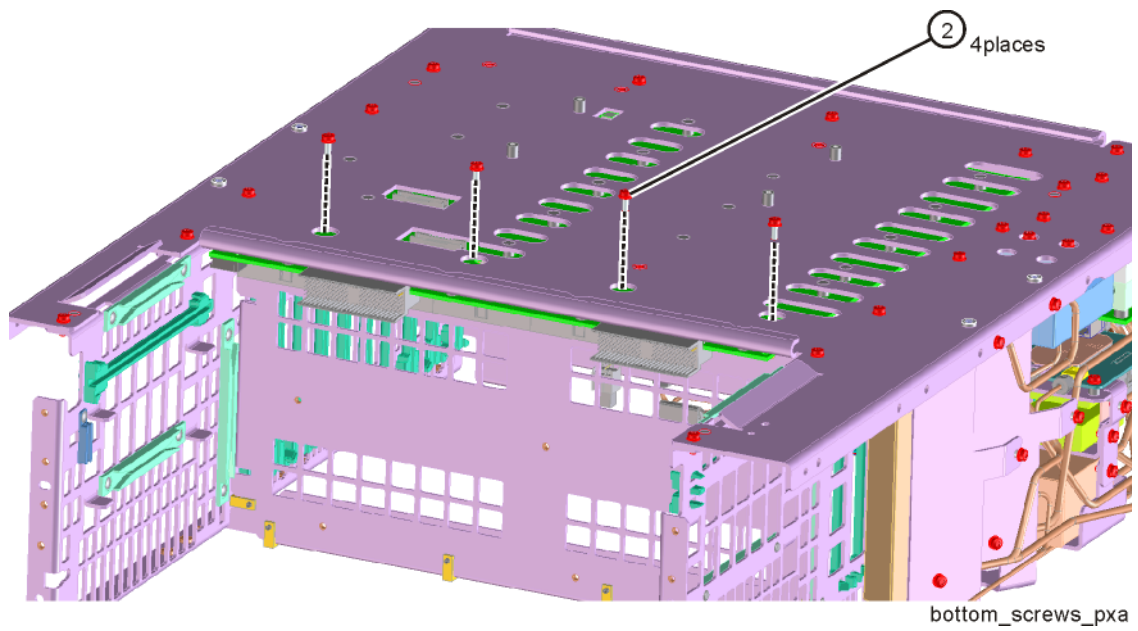
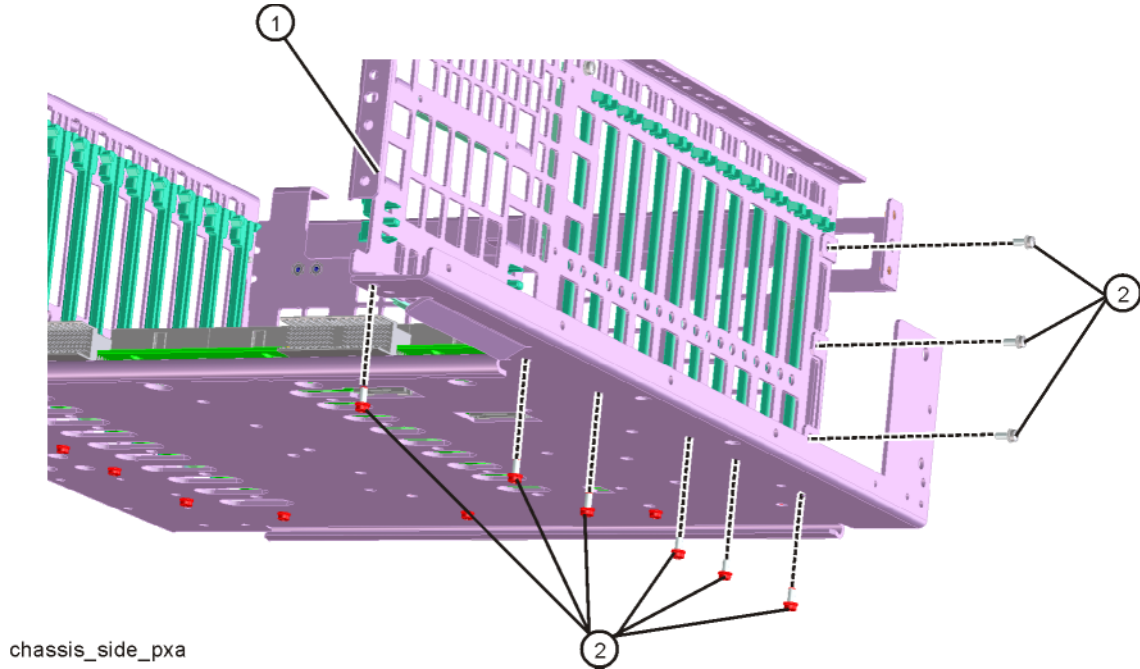


Figure 18-49 Bottom Screws



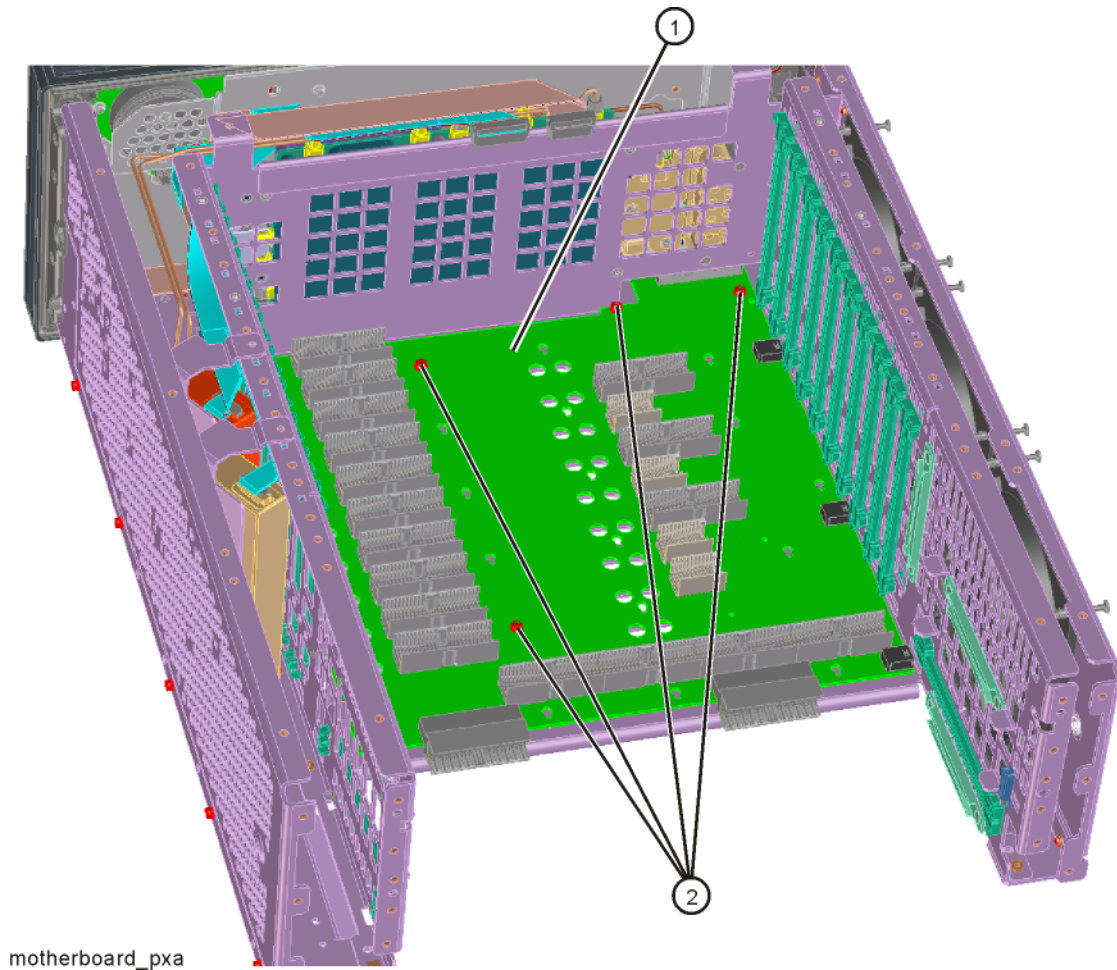
18. Refer to **Figure 18-50**. Remove the left side chassis **(1)** (same side as the fan) by removing the nine screws **(2)** (0515-0372) (six on the bottom).

Figure 18-50 Chassis Side Removal



19. Refer to **Figure 18-51**. 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 18-51 Motherboard Assembly Removal



Replacement

1. Refer to **Figure 18-51**. 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 18-50**. Replace the left side chassis by replacing the nine screws (0515-0372). Torque to 9 inch-pounds.
3. Refer to **Figure 18-48**. 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.

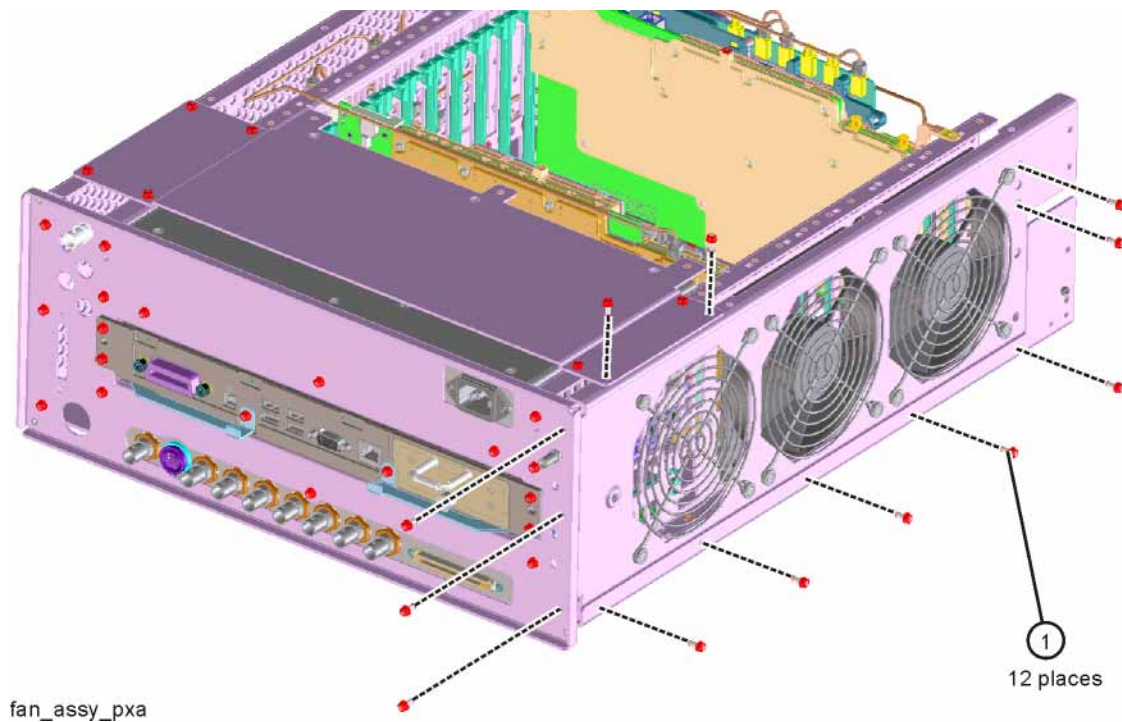
5. Replace the Midplane assembly. Refer to the **Midplane Board Assembly** replacement procedure.
6. Replace the Front End Control assembly. Refer to the **Front End Control Assembly** replacement procedure.
7. Replace the LO Synthesizer assembly. Refer to the **LO Synthesizer Assembly** replacement procedure.
8. Replace the RF Preselector Input assembly. Refer to the **RF Preselector Input Assembly** replacement procedure.
9. Replace the Limiter Pre-Filter assembly. Refer to the **LPF Assembly** replacement procedure.
10. If the instrument has Option WF1, replace the Wideband Digital IF assembly. Refer to the **Wideband Digital IF Assembly (Option WF1)** replacement procedure.
11. Replace the Reference assembly. Refer to the **Reference Assembly** replacement procedure.
12. Replace the AIF/DIF assembly. Refer to the **AIF/DIF Assembly** replacement procedure.
13. Replace the CPU assembly. Refer to the **CPU Assembly** replacement procedure.
14. Replace the power supply assembly. Refer to the **Power Supply Assembly** replacement procedure.
15. Replace the rear panel. Refer to the **Rear Panel** replacement procedure.
16. Ensure all cables are plugged in or connected and torqued.
17. Replace the Chassis Right Side Outer bracket. Refer to **Figure 18-7 on page 432**. Torque the screws to 9 inch-pounds.
18. Replace the Front Frame Assembly. Refer to the **Front Frame Assembly** replacement procedure.
19. Replace the top brace and reference bracket. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
20. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Fan Assembly

Removal

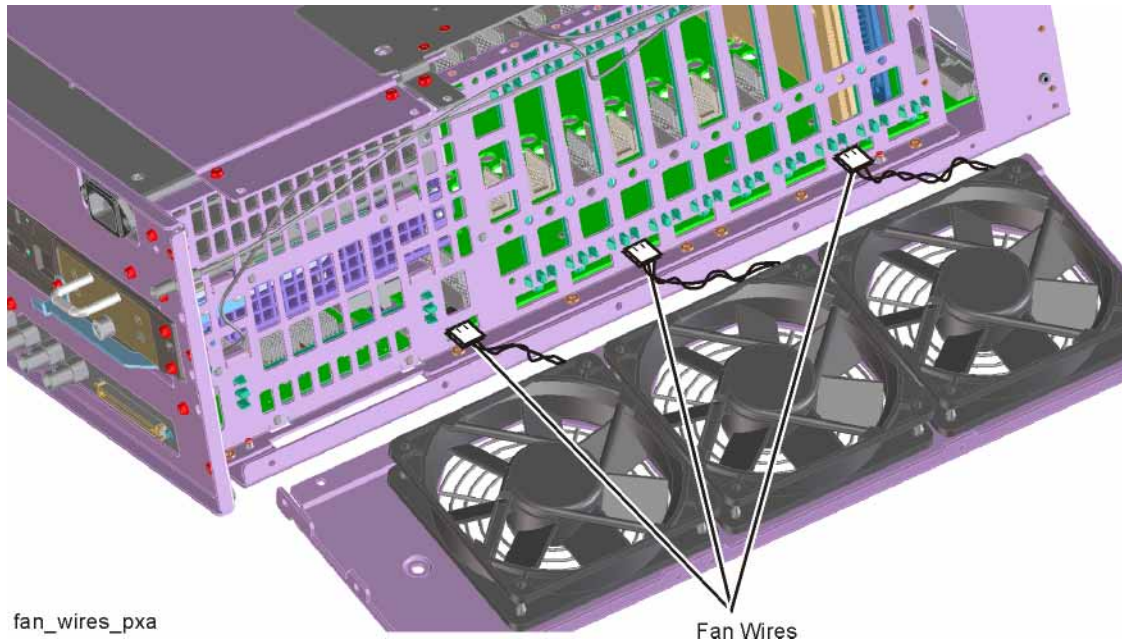
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the top brace. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
3. Remove the Front Frame Assembly. Refer to the **Front Frame Assembly** removal procedure.
4. Refer to **Figure 18-52**. Remove the twelve remaining screws (1) (0515-0372) that attach the fan assembly to the chassis.

Figure 18-52 Fan Assembly Removal



5. Refer to **Figure 18-53**. Unplug the fan wires from the motherboard. The fan assembly can now be lifted from the chassis.

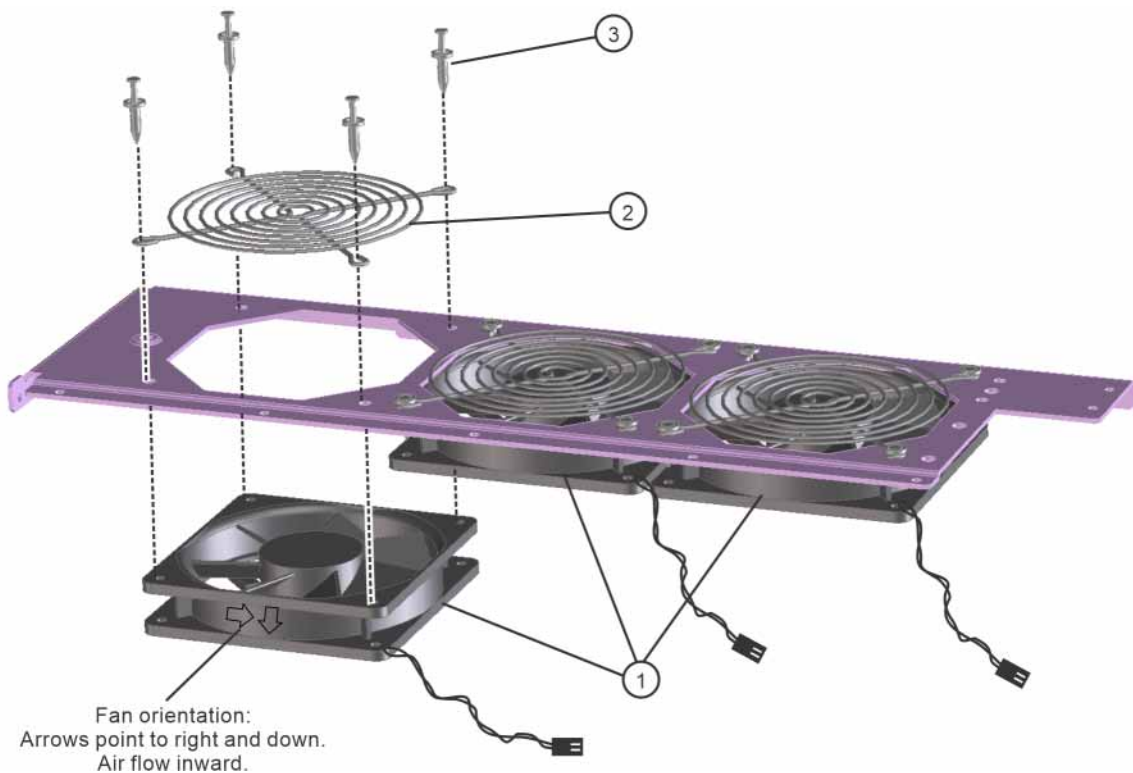
Figure 18-53 Fan Wires



Replacing a Fan

1. Refer to **Figure 18-54**. 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 18-54 Fan Replacement



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 18-52**. 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.

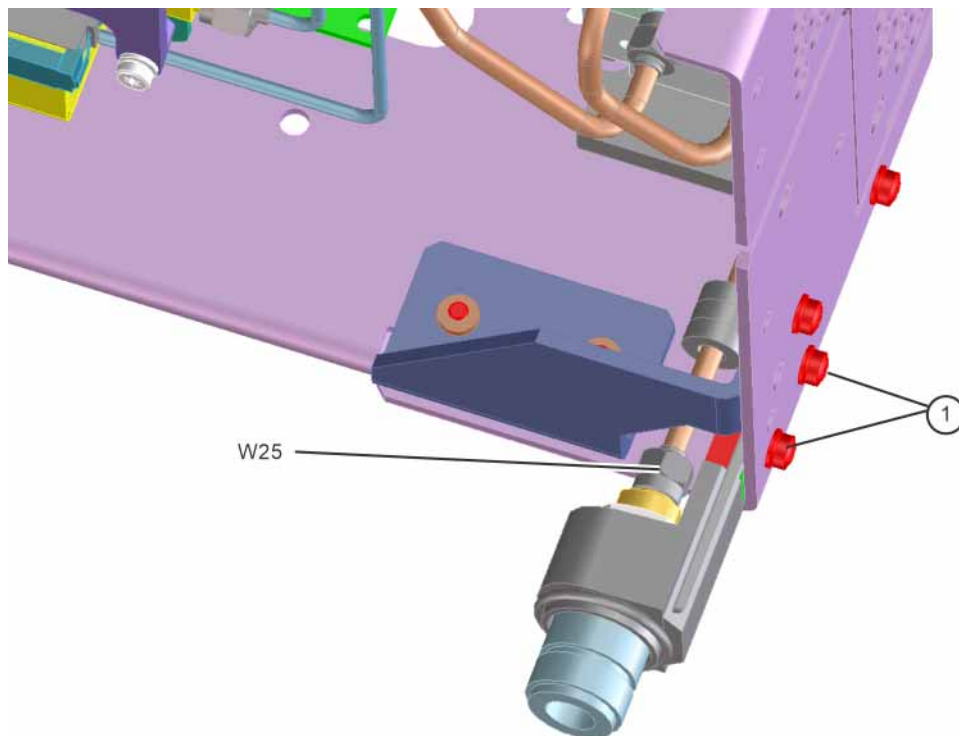
Input Connector Assembly

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 18-55**. Disconnect the semi-rigid cable W25 from the J1 Input Connector Assembly.

Figure 18-55 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

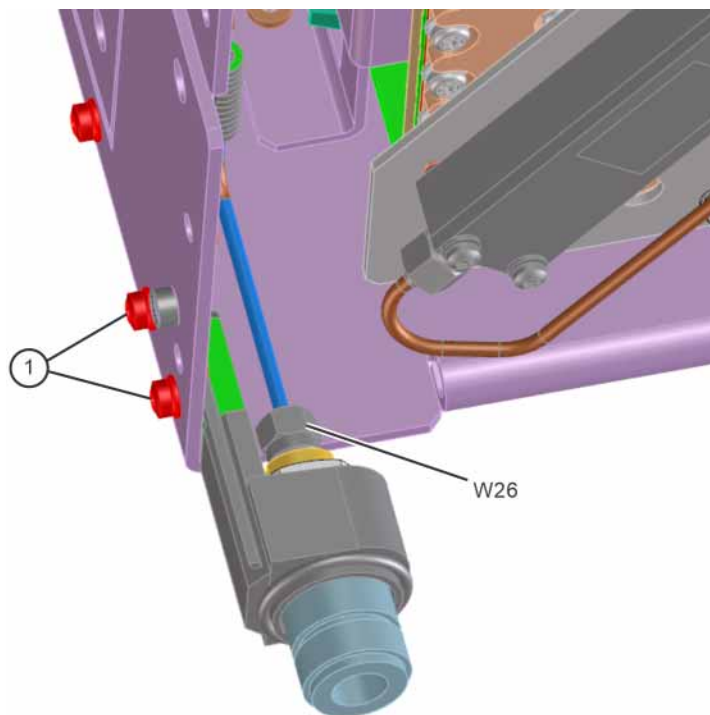
1. Refer to **Figure 18-55**. Place the Input Connector Assembly into position in the chassis. Replace the two screws **(1)** (0515-0372) to attach the Input Connector Assembly to the chassis. Torque to 9 inch-pounds.
2. Reconnect the semi-rigid cable W25 to the Input Connector Assembly. Torque to 10 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 18-56](#). Disconnect the semi-rigid cable W26 from the J2 Input Connector Assembly.

Figure 18-56 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 18-56**. 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 18-57](#).
3. Refer to [Figure 18-57](#). 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 18-58](#). Pull the Front Frame Assembly carefully away from the chassis. Remove the ribbon cable W1 from the motherboard. The cable has locking tabs on each side, pinch and pull to release.

Figure 18-57 Front Frame Assembly Removal

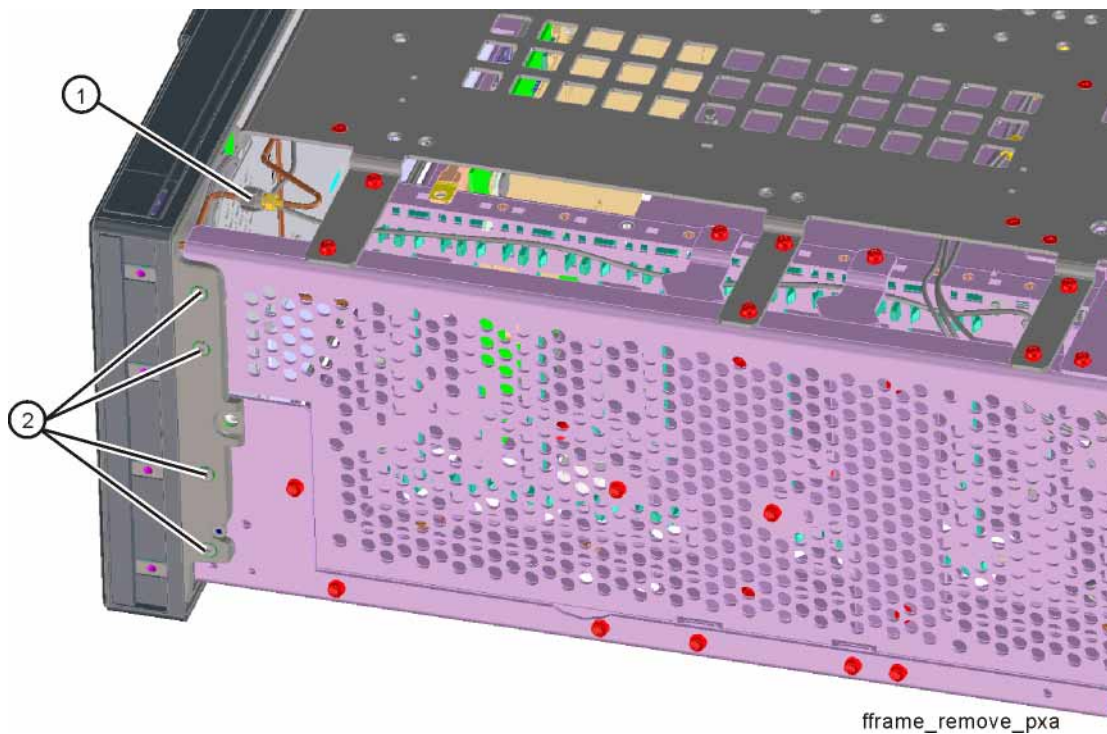
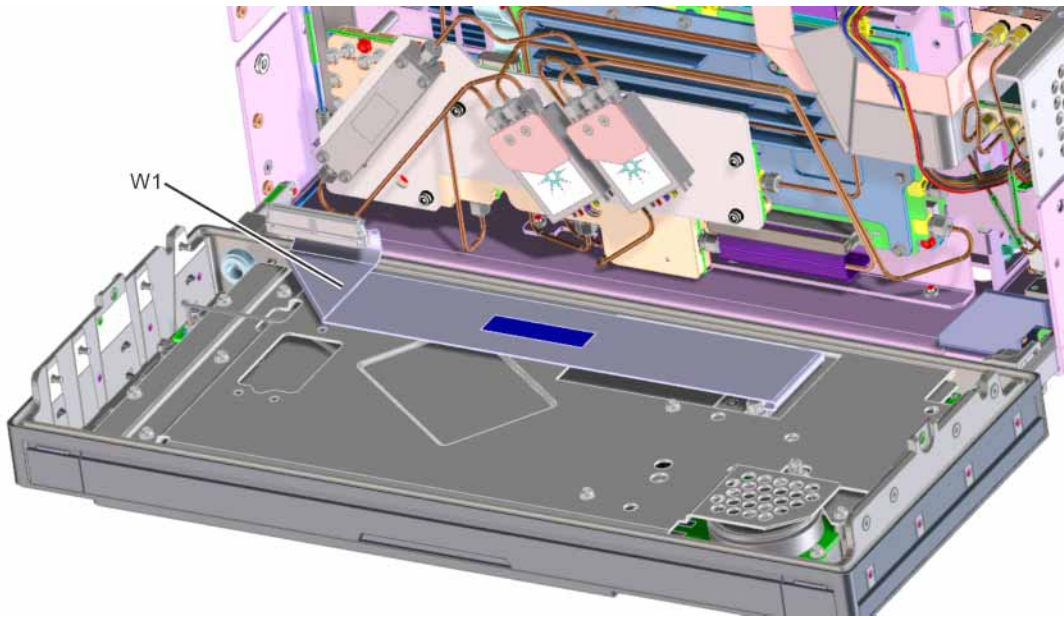


Figure 18-58 Front Panel Cable



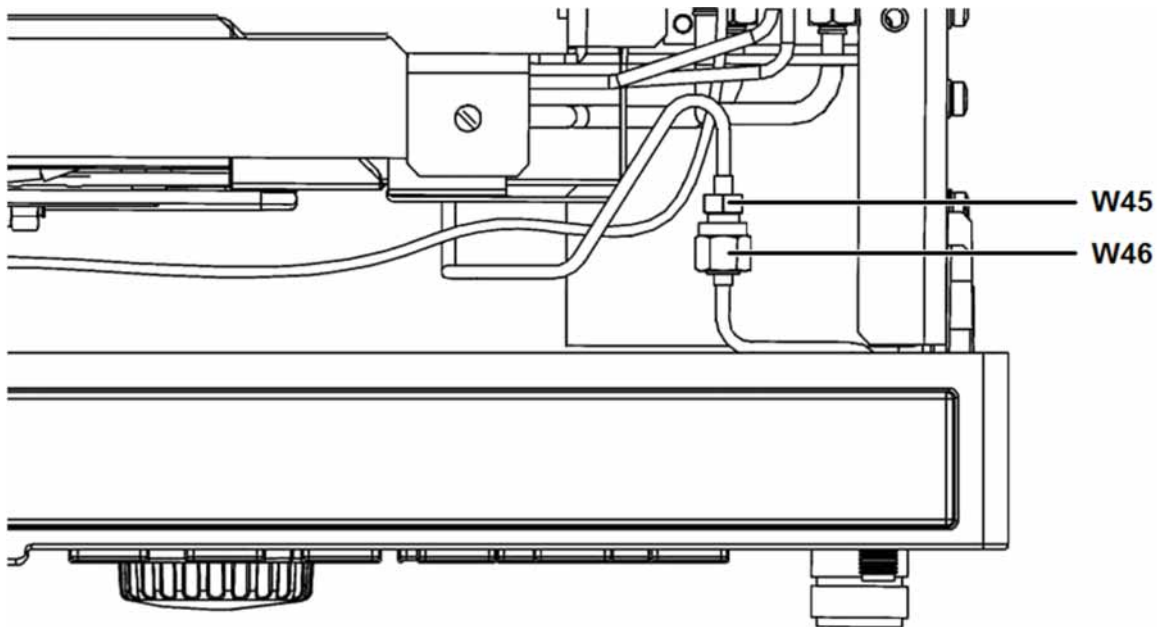
Replacement

1. Reattach the ribbon cable W6.
2. Reattach the ribbon cable W1. Ensure the locking tabs are engaged.
3. Refer to [Figure 18-57](#). 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 18-59](#).

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 18-59 EXM Cables



5. Replace the outer case. Refer to the [Instrument Outer Case](#) replacement procedure.

Front Frame Assembly Components

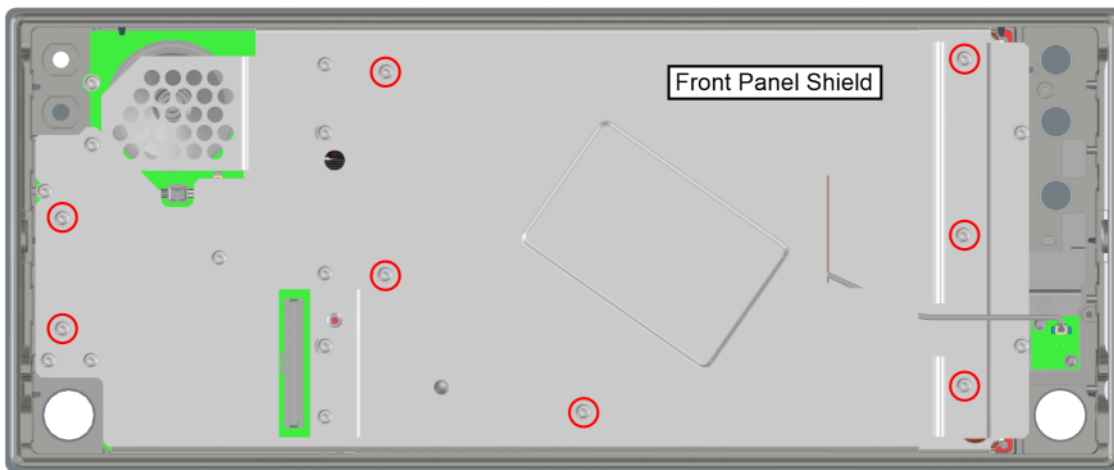
NOTE

Access to any of the Front Frame assemblies requires removal of the Front Frame Assembly from the chassis.

Remove Front Panel Shield

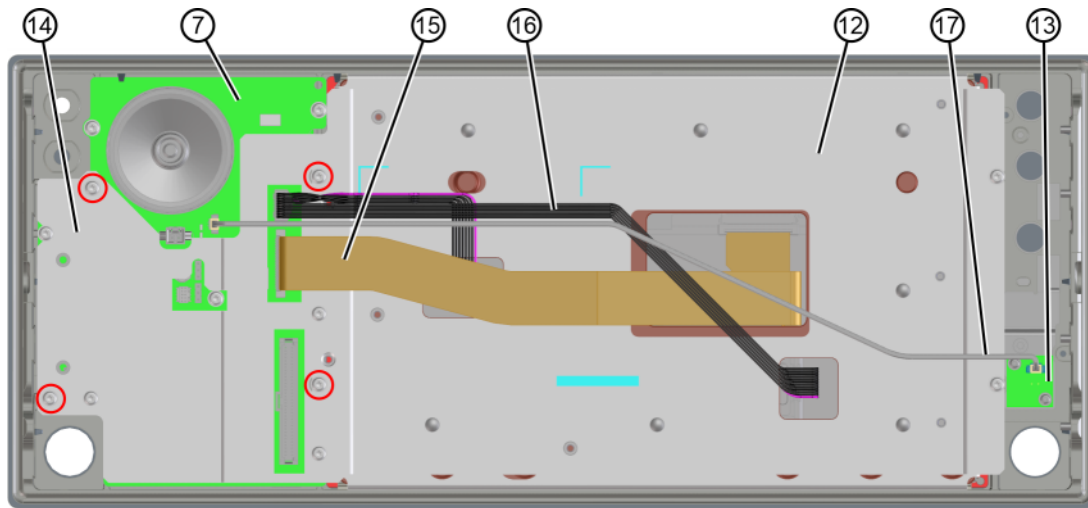
1. Refer to **Figure 18-60**. Remove the front panel shield by removing the eight screws indicated (0515-0372).

Figure 18-60 Front Panel Shield Removal



2. When replacing the shield, torque the screws to 9 inch-pounds.

Figure 18-61 Front Frame Parts

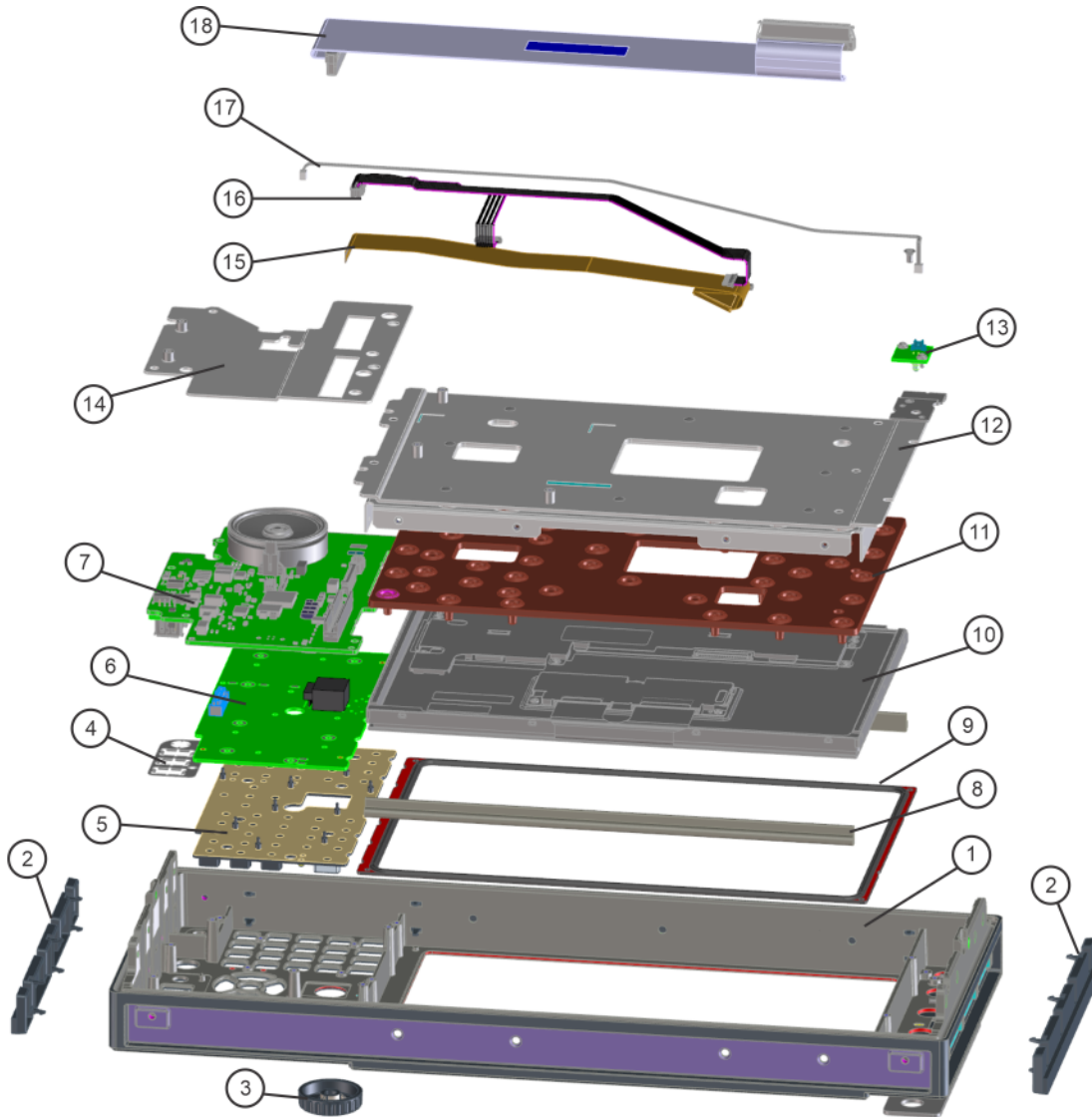


Item	Description
7	A1A2 Front Panel Control Board
12	A1MP14 Display Bracket
13	A1A6 Input 2 LED Board
14	A1MP15 Front Panel Shield Bracket
15	A1W1 Flex Circuit, Display to Front Panel Control Board
16	A1W3 Cable Assembly, Touch/Backlight
17	A1W4 Cable Assembly, LED Board

Remove Front Panel Shield Bracket

1. Refer to **Figure 18-61**. Unplug the cables from the Front Panel Control Board.
2. Remove the front panel shield bracket by removing the four screws indicated (0515-0372).
3. When replacing the bracket, torque the screws to 9 inch-pounds.

Figure 18-62 Front Frame Exploded View - LED



Assembly Replacement Procedures
Front Frame Assembly

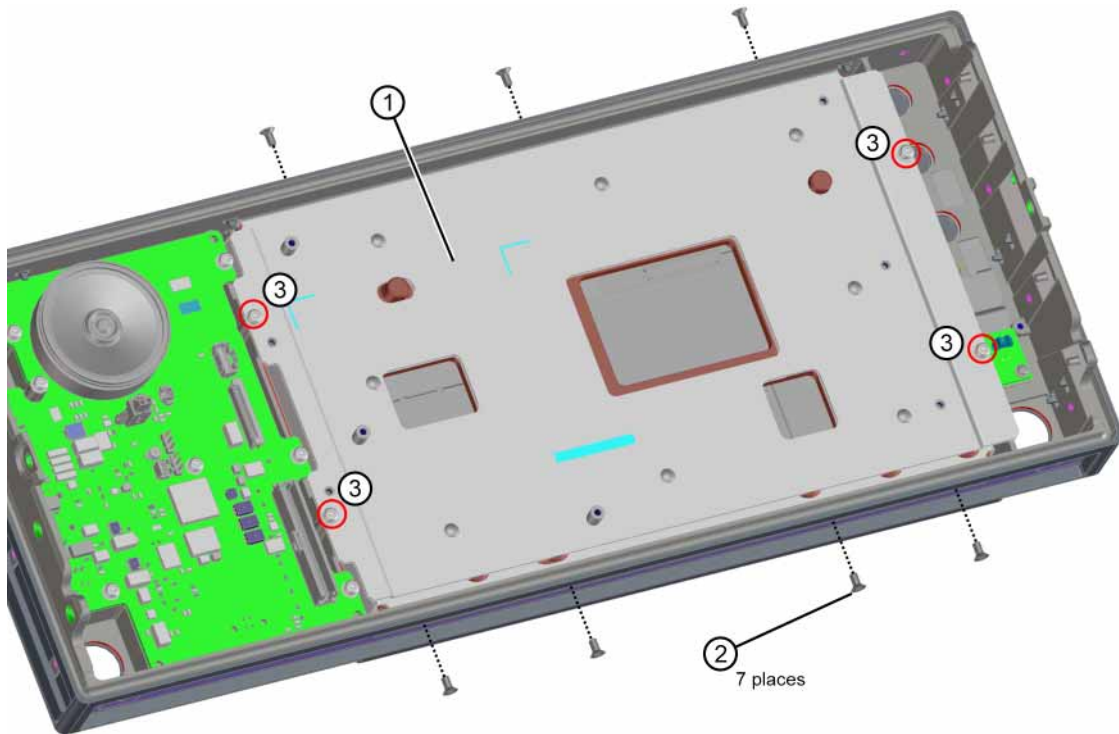
Item	Description
1	A1A1MP1 Front Frame
2	A1A1MP9-10 Side Trim Strip
3	A1MP9 RPG Knob
4	A1A1MP4 Front Frame Ground Spring
5	A1MP1 Main Keypad
6	A1A5 Keyboard, PCA
7	A1A2 Front Panel Control Board
8	A1A1MP6 Gasket - EMI Shielding
9	A1A1MP13 Display Boot
10	A1A3 Liquid Crystal Display
11	A1MP16 Display hold down (compression pad)
12	A1MP14 Display Bracket
13	A1A6 Input 2 LED Board
14	A1MP15 Front Panel Shield Bracket
15	A1W1 Flex Circuit, Display to Front Panel Control Board
16	A1W3 Cable Assembly, Touch/Backlight
17	A1W4 Cable Assembly, LED Board
18	A1W2 Cable Assembly, ribbon, 68 pin Motherboard Keyboard

Display Assembly

Removal

1. Remove the front panel shield and shield bracket as described previously.
2. Refer to **Figure 18-63**. To remove the display (1), remove the seven screws (2) (0515-1946) securing the display bracket to the Front Frame Assembly. Remove the four screws indicated (3) (0515-0372). The display can now be removed from the Front Frame Assembly.

Figure 18-63 Display Removal

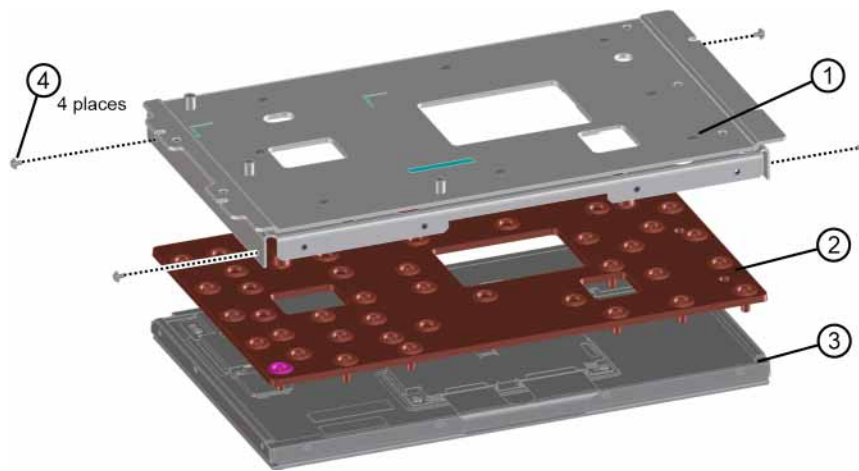


CAUTION

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.

3. Refer to **Figure 18-64**. To separate the display (3) from the display hold down (2) and display bracket (1), remove the four screws (4) (0515-0365). When reassembling, torque the four screws to 5 inch-pounds.

Figure 18-64 Display and Display Bracket Separation



Replacement

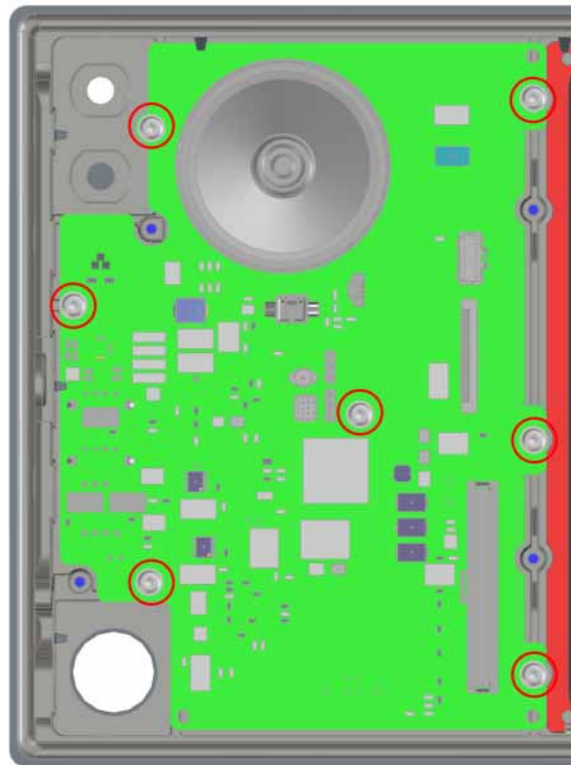
1. Refer to **Figure 18-63**. Place the display bracket into position in the Front Frame Assembly. Replace the four screws **(3)** (0515-0372) and the seven screws **(2)** (0515-1946). Torque all screws to 9 inch-pounds.
2. Replace the front panel shield bracket as described previously. Reconnect the flex circuit, wire harness, and LED cable to the Front Panel Control board.
3. Replace the front panel shield.

Front Panel Control Board

Removal

1. Remove the RPG knob by carefully pulling it off.
2. Remove the display. Refer to the **Display Assembly** removal procedure.
3. Refer to **Figure 18-65**. Remove the seven screws indicated (0515-0372) securing the Front Panel Control board to the Front Frame Assembly.
4. Pull up on the Front Panel Control board to disengage the connector from the keyboard. The Front Panel Control board can now be lifted from the Front Frame Assembly.

Figure 18-65 Front Panel Control Board Removal



Replacement

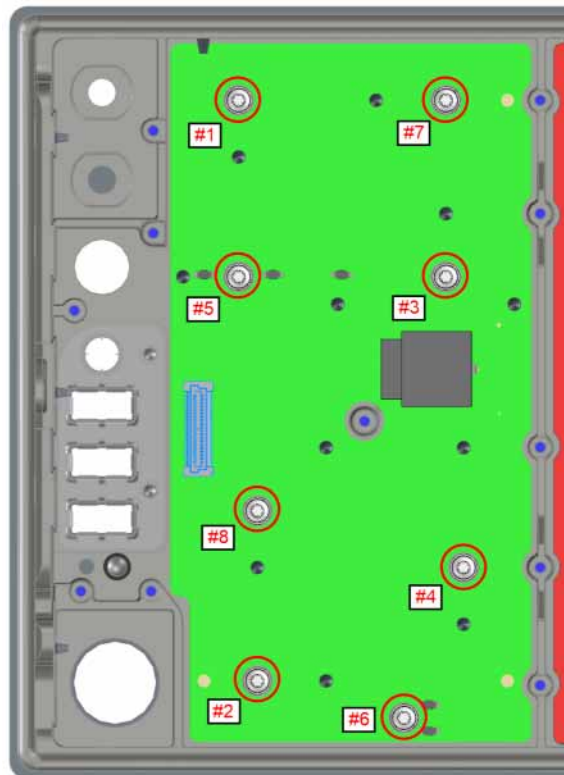
1. Install the Front Panel Interface board/keypad assembly into the Front Frame Assembly and press down to engage the connector to the keyboard. Replace the seven screws (0515-0372). Torque to 9 inch-pounds.
2. Replace the display. Refer to the **Display Assembly** replacement procedure.
3. Replace the RPG knob by firmly pressing it on.

Keyboard and Keypad

Removal

1. Refer to **Figure 18-66**. After the Front Panel Control board is removed, remove the eight screws indicated (0515-0430) securing the Keyboard to the Front Frame Assembly.

Figure 18-66 Keyboard and Keypad Removal



2. To separate the keypad from the Keyboard, use a push tool or pliers to carefully separate the pull through tabs.

Replacement

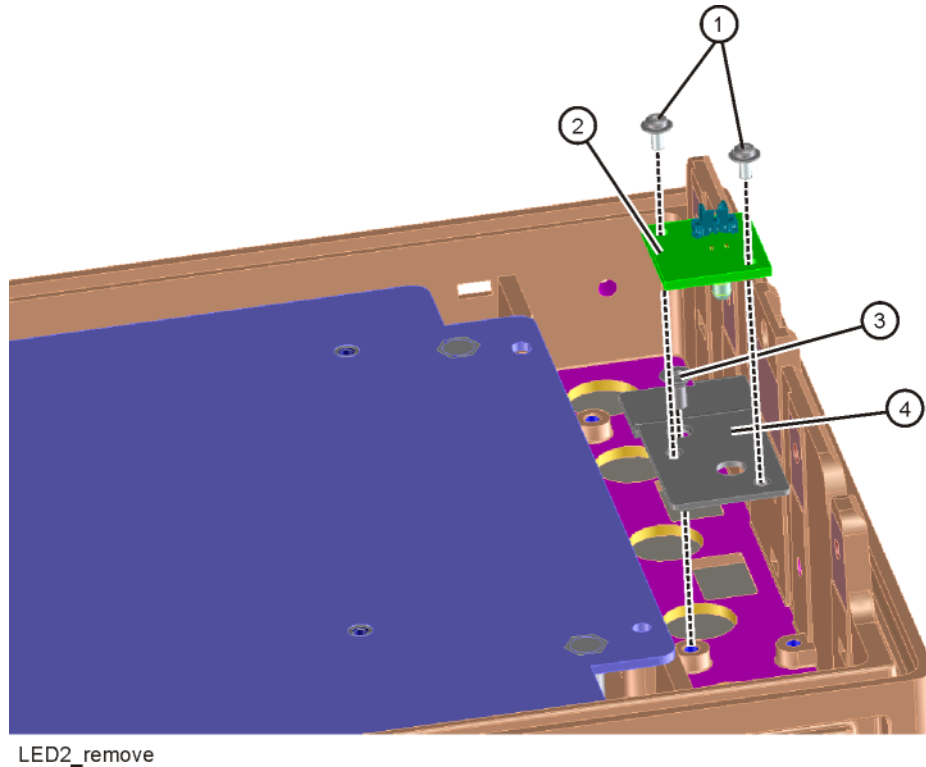
1. Install the keypad onto the Keyboard using the pull through tabs and alignment holes. Use a push tool or pliers to ensure that all of the pull through tabs are properly captive on the board.
2. Install the Keyboard/keypad assembly into the Front Frame Assembly, and replace the eight screws (0515-0430) to secure. Torque to 9 inch-pounds in the sequence shown in **Figure 18-66** #1 to #8.

Input 2 LED Board

Removal

1. Refer to **Figure 18-67**. Remove the Input 2 LED board (2) by removing the two screws (1) (0515-0658).
2. Remove the LED bracket (4) by removing the single screw (3) from the front frame.

Figure 18-67 LED 2 Board Removal



Replacement

1. Refer to **Figure 18-67**. 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) (0515-0658). Torque to 3 inch-pounds.

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 520**.

"Calibration Data Backup and Restore" on page 520

"BIOS Settings Verification" on page 525

"Operating System Initialization" on page 526

"FPGA Synchronization" on page 528

"Programming Model and Serial Numbers" on page 530

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 Dual Pre-Amp Module, LNA, and EM
	A12 YIG Tune Filter
	A13 Front End Assembly
	A14 LO Synthesizer Assembly
	A15 Front End Control Assembly
	A16 Reference Assembly
	A21 RF Preselector Input Assembly
	A23 Limiter Prefilter Board (LPF) Assembly
	A26 Wideband Digital IF Assembly
	SW1 4 Port Terminated Switch

Additional Tasks^b[illegible]

Utilities^a

[illegible]Adjustments^a

10 MHz Internal Reference							*										X				
50 MHz Calibrator Amplitude							*				X	X	X		X		X	X	X		X
4800 MHz Calibrator Amplitude							*				X	X	X	X	X		X	X	X		X
RF2 Amplitude Offset							*				X								X		
Frequency Response Below 3.6 GHz (Preamp Off)							*				X	X	X		X			X	X		X
Frequency Response Below 3.6 GHz (Preamp On)							*				X	X	X		X			X	X		X
Frequency Response Above 3.6 GHz (Preamp Off)							*				X	X	X	X	X				X		X
Frequency Response Above 3.6 GHz (Preamp On)							*				X	X	X	X	X				X		X
Freq Resp Notch Filter Path (Preamp Off)							*				X	X	X		X			X	X		X
Freq Resp Notch Filter Path (Preamp On)							*				X	X	X		X			X	X		X
Freq Resp Wideband Filter Path (Preamp Off) ^h							*				X	X	X		X			X	X	X	X
Freq Resp Wideband Filter Path (Preamp On) ^h							*				X	X	X		X			X	X	X	X
Attenuator Slope							*				X	X	X	X	X			X	X		X
Attenuator Slope, Preamp On							*				X	X	X	X	X			X	X		X
Frequency Response AC Coupled ⁱ							*				X	X	X	X	X			X	X		X
IF Frequency Response			X	X			*				X	X		X	X					X	X
Overload Detector							*											X	X		
IF Output Attenuator Adjustment ^f							*						X		X		X				
Third Order Intermodulation							*						X		X		X				
IF Input Gain Option EXM ^j															X		X				
LO Output Power Option EXM ^j															X		X				
															X		X				

Performance Verification^a[illegible]

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.

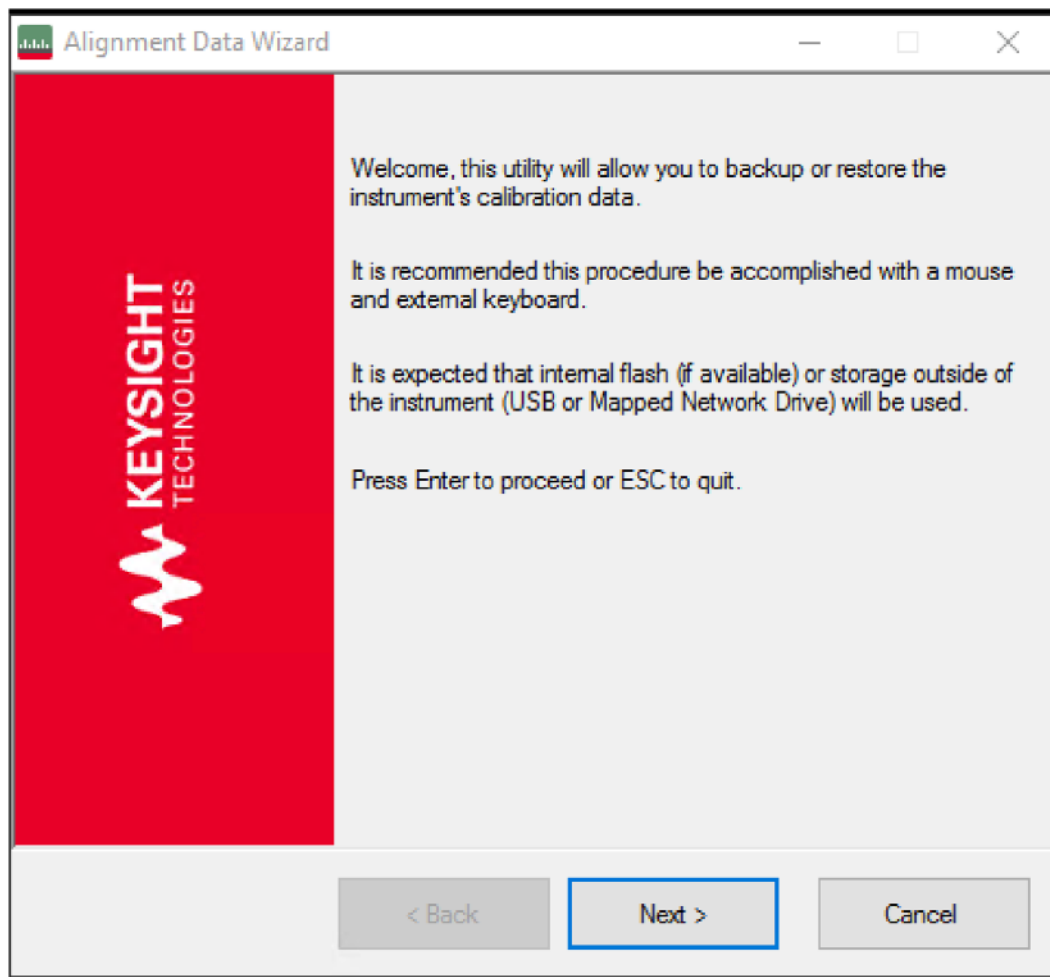
Data Backup

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 double-click on the Windows Explorer link on the desktop and navigate to the following folder:

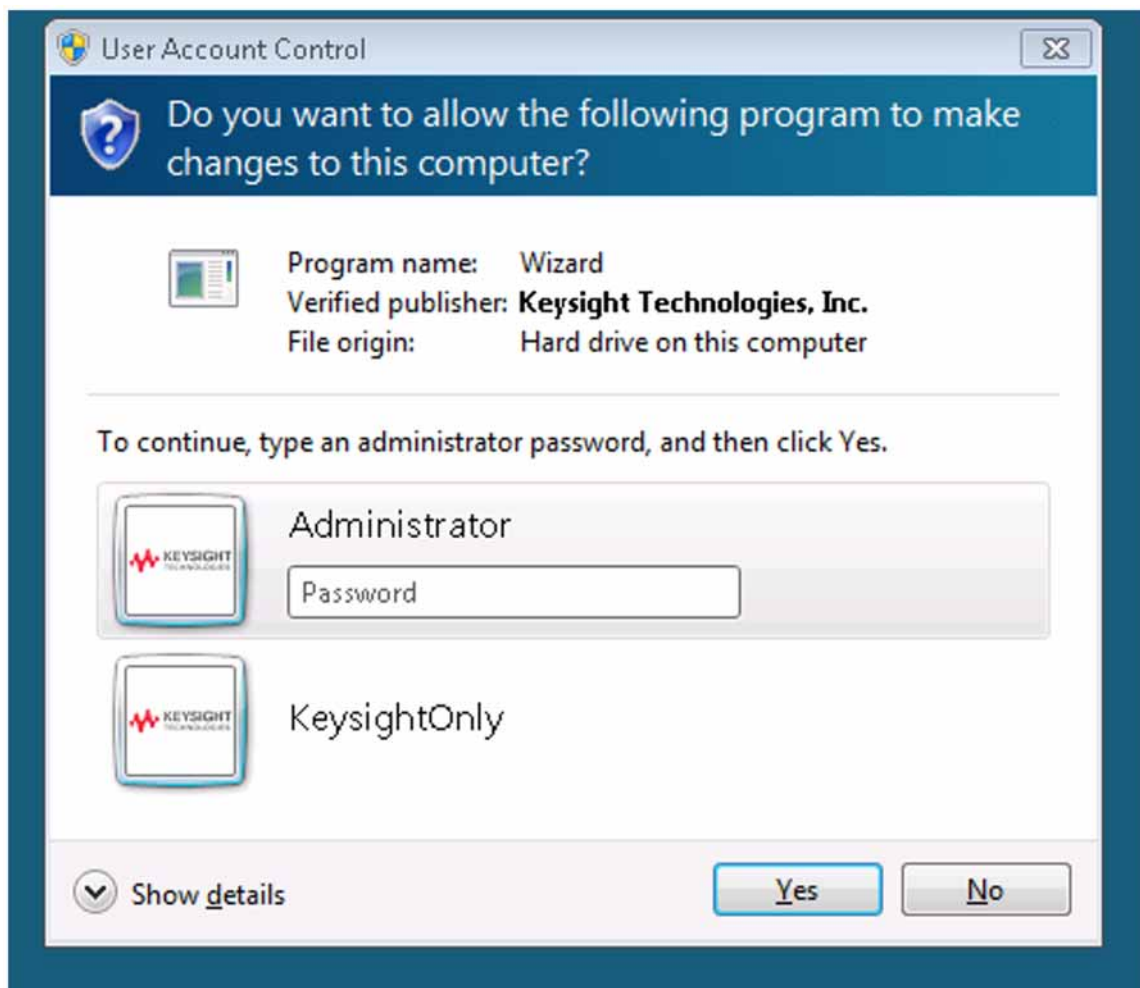
C:\Program Files\Agilent\SignalAnalysis\Infrastructure

4. Scroll down and double-click on BackupRestoreAlignDataWizard.exe.

If BackupRestoreAlignDataWizard.exe does not appear, the instrument software is an early version, and you need to continue at "BackupRestoreAlignDataWizard.exe not available" below.

5. The window shown in **Figure 19-2** appears. Enter the administrator password "Keysight4u!" and press **Yes**.

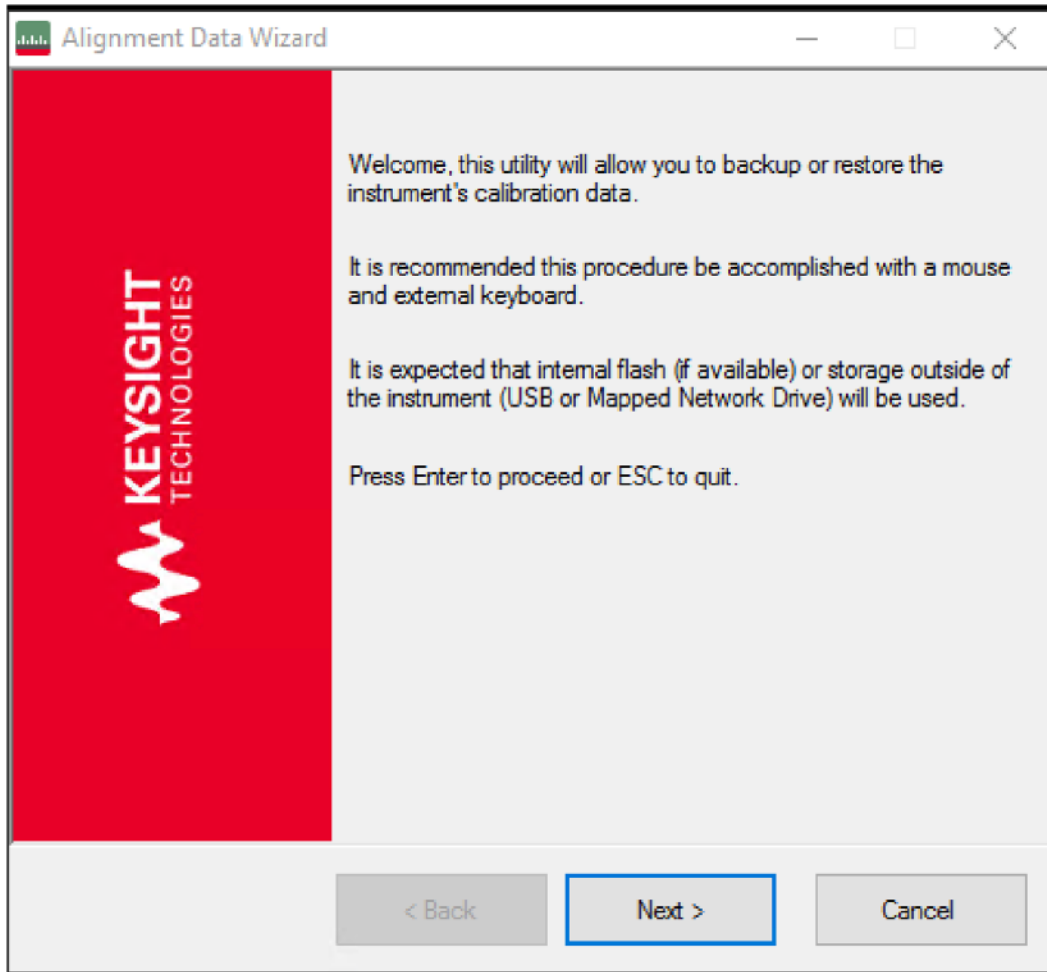
Figure 19-2 User Account Control



6. On the next screen select **Backup** and press **Next**.

7. On the screen shown in **Figure 19-3**, select a storage location. The default is the on-board CPU memory (SD card, F: drive). Press **Next** and then **Save**, to back up to this internal memory, or see **step 8**.

Figure 19-3 Alignment Data Wizard



8. If you want to save the alignment data to a USB FLASH drive, press **Browse** and navigate to the USB drive. Press **Save**, then **Next**.
9. A message will appear that the Alignment data backed up successfully. Press **Finish**.

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”.

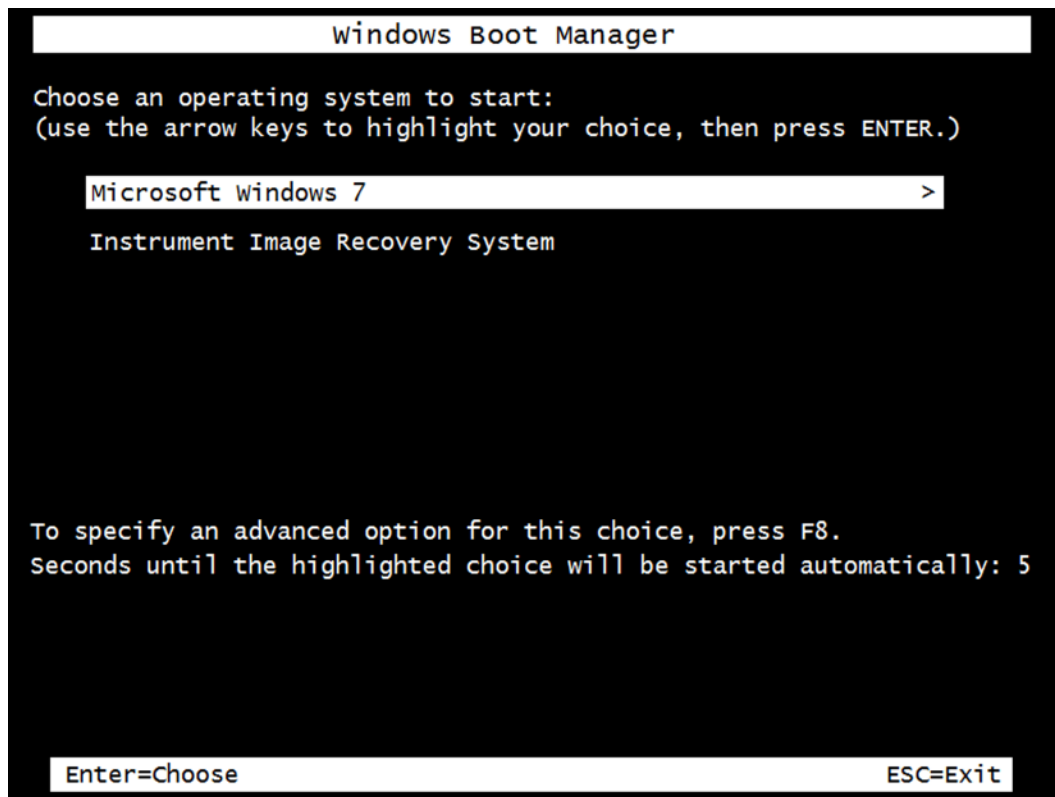
Operating System Initialization

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

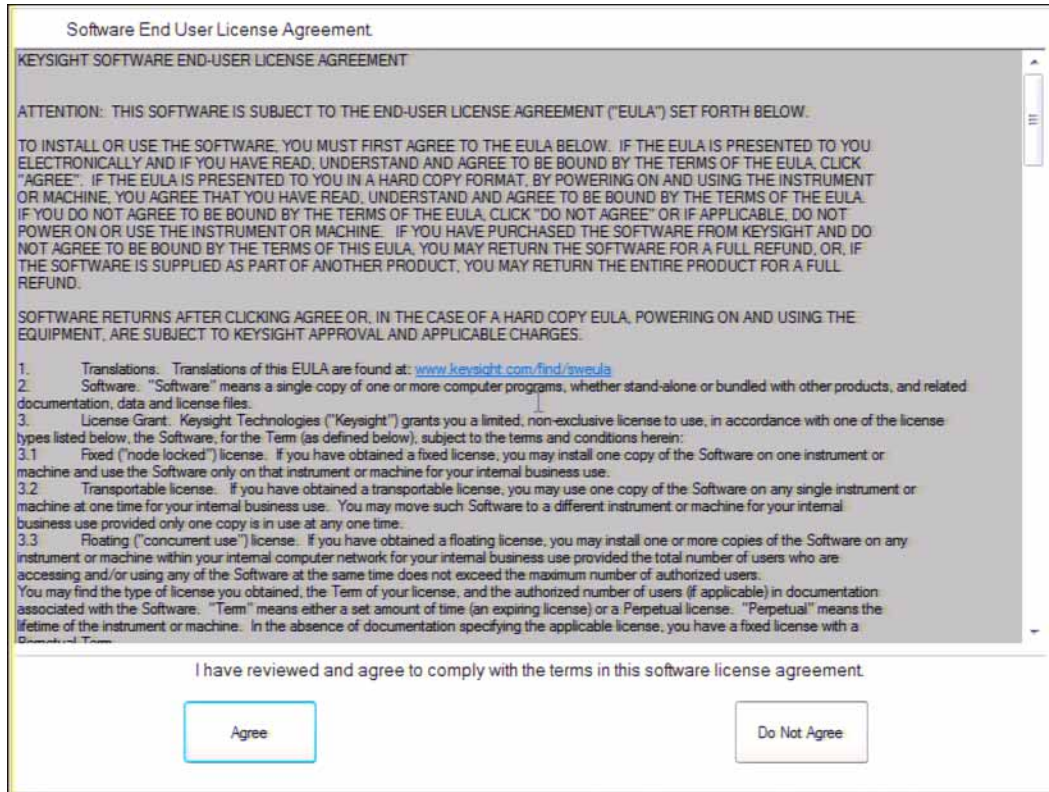
1. With the new disk drive installed power the instrument on.
2. Within a few seconds you will see the initial Keysight Technologies splash screen, and then the boot selection menu as seen in [Figure 19-4](#).
3. Allow the instrument to boot the Windows operating system. (This will happen automatically after 5 seconds if the instrument is left alone).

Figure 19-4 Boot Selection Screen



4. After a few moments the License Agreement message window will appear, as shown in **Figure 19-5**.

Figure 19-5 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 may appear. At this point the operating system initialization process will be completed and either selection can be made, or the instrument can be powered off.

NOTE

Keysight Technologies does not load anti-virus software into the signal analyzer. It is the customer’s responsibility to install anti-virus software.

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:

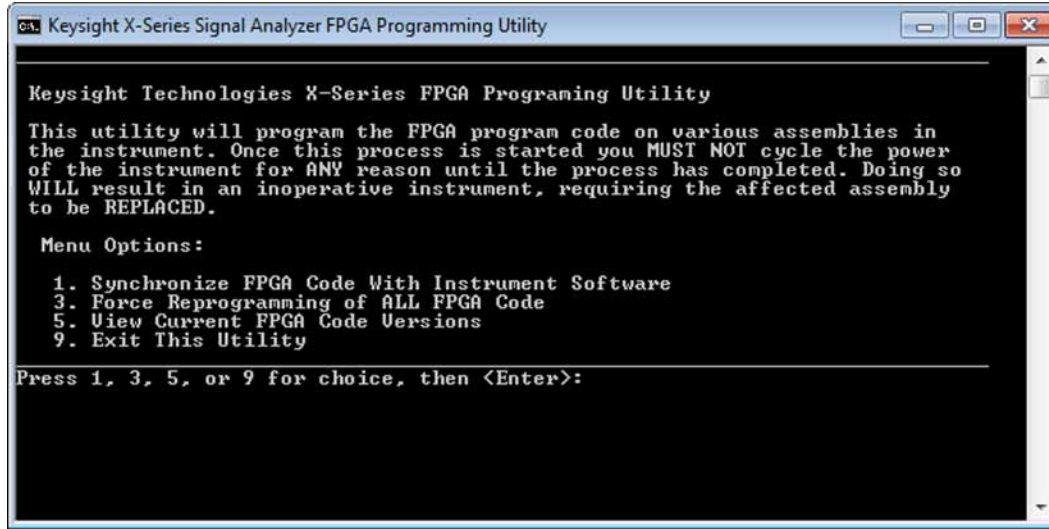
C:\Program Files\Agilent\SignalAnalysis\Physics

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 19-6** will appear.

Figure 19-6 **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 restored 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 PXE EMI Receiver Calibration Application Software will be required.

Information regarding N7818A Keysight PXE 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

[Instrument Software Overview on page 532](#)

[Software Licensing on page 532](#)

[Software Updates on page 533](#)

[Instrument Measurement Application Software on page 533](#)

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/pxe_software

21 Performance Verification and Adjustment Software

Test Software Overview

The N9048B PXE EMI Receiver can be fully tested and adjusted with the use of the N7818A PXE 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/>

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:

Functional Test Versus Performance Verification on page 538

Before Performing a Functional Test on page 539

Test Equipment on page 540

Functional Tests:

Displayed Average Noise Level (DANL) on page 543

Frequency Readout Accuracy on page 547

Second Harmonic Distortion (SHD) on page 550

Amplitude Accuracy at 50 MHz on page 553

Amplitude Accuracy - Preamp On on page 558

Frequency Response (Flatness) on page 562

Frequency Response (Flatness) - Preamp On on page 568

Scale Fidelity on page 574

CISPR Resolution Bandwidth Shape Accuracy on page 577

Quasi-Peak Detector Accuracy on page 581

Peak Detector Accuracy on page 595

EMI Average Detector Accuracy on page 605

RMS Average Detector Accuracy on page 616

Intermittent, Unsteady, Drifting Disturbances on page 627

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**, **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**, **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.

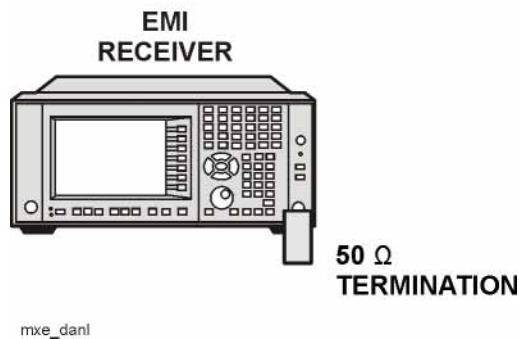
This measurement is performed for both RF inputs.

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, Input, RF Input Port, RF Input**.
3. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.
4. Set up the receiver by pressing:
 - Meas 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, Ref Level -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, Trace Control, 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 **Display, Meas 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, **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 **Display, Meas 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:

$$\pm(0.25\% \times \text{span} + 5\% \times \text{RBW} + 2 \text{ Hz} + 0.5 \times \text{horizontal resolution})$$

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.

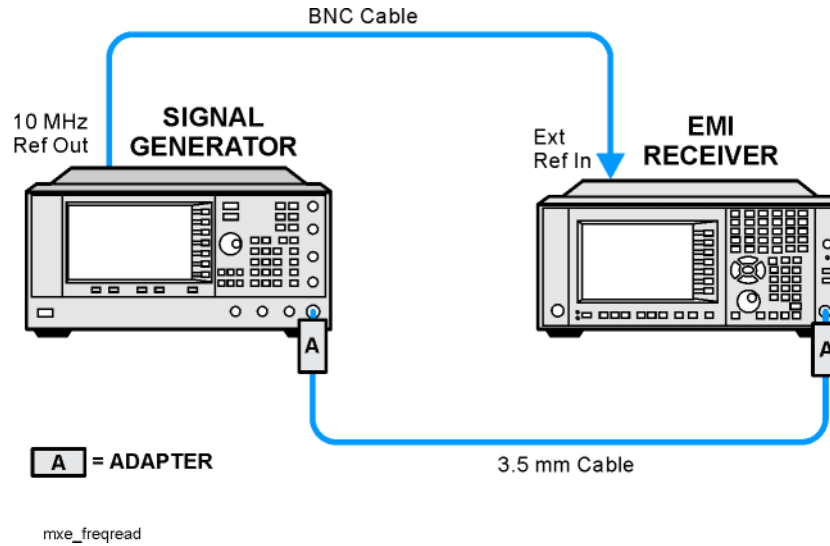
Table 22-5 Frequency Readout Accuracy - Required Equipment

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 [Figure 22-2](#).
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, Input, RF Input Port, RF Input**.
5. Preset the receiver by pressing **Mode/Meas, Spectrum Analyzer, Mode Preset**.
6. Set up the receiver by pressing:
Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, External
FREQ Channel, Center Freq, 1505, MHz
FREQ Channel, Span, 2990, MHz
Trace, 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 **FREQ Channel, 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.

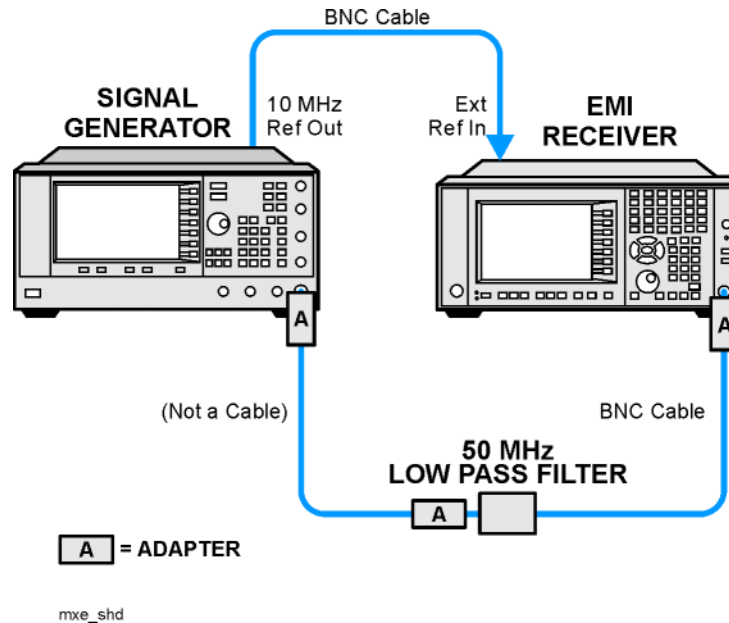
Table 22-8 Second Harmonic Distortion - Required Equipment

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, Input, RF Input Port, RF Input**.
4. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.
5. Set up the receiver by pressing:
 - Meas Setup, Meas Standard, EMC Standard, None**
 - Input/Output, Freq Ref Input, Freq Ref Input, External**
 - FREQ Channel, Center Freq, 40, MHz**
 - FREQ Channel, Span, 1, MHz**
 - AMPTD Y Scale, Attenuation, Mech Atten, 10, dB**
6. On the receiver, press **Peak Search**.

Tests
Second Harmonic Distortion (SHD)

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, 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.

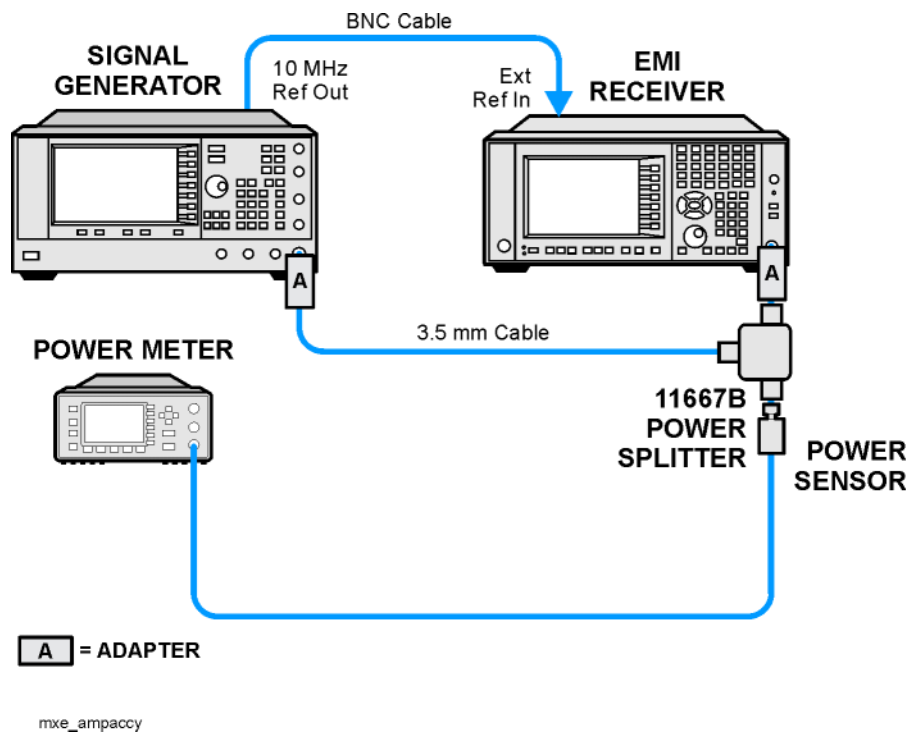
This measurement is performed for both RF inputs.

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



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, Input, RF Input Port, RF Input**.
6. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.

7. Set up the receiver by pressing:

**Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, External
FREQ Channel, Center Freq, 50, MHz
SPAN X Scale, 2, MHz
AMPTD Y Scale, Attenuation, Mech Atten, 10, dB
Sweep, Sweep Config, Swp Time Rules, SA - Accuracy
Meas Setup, Average/Hold Number, 20, Enter
Trace, 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 **FREQ Channel, 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

Tests
Amplitude Accuracy at 50 MHz

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, 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 **FREQ Channel, 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.

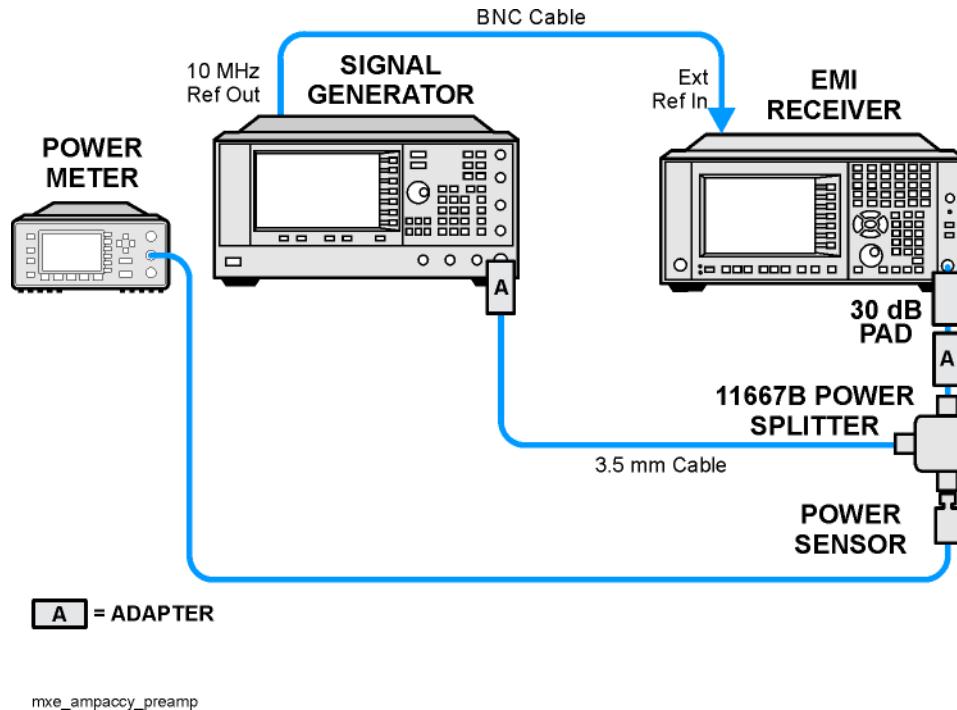
Table 22-13 Absolute Amplitude Accuracy - Preamp On - Required Equipment

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



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, Input, RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.
7. Set up the receiver by pressing:

**Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, External
FREQ Channel, Center Freq, 50, MHz
SPAN X Scale, Span, 106 kHz
AMPTD Y Scale, Signal Path, Internal Preamp, Low Band
AMPTD Y Scale, Attenuation, Mech Atten, 0 dB
Sweep, Sweep Config, Swp Time Rules, SA - Accuracy
Meas Setup, Average/Hold Number, 20, Enter
Trace, 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:

$$\text{Amplitude Accuracy Error} = \text{Meas_Amp} + 30 \text{ dB} - \text{Power_Meter}$$

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, 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.

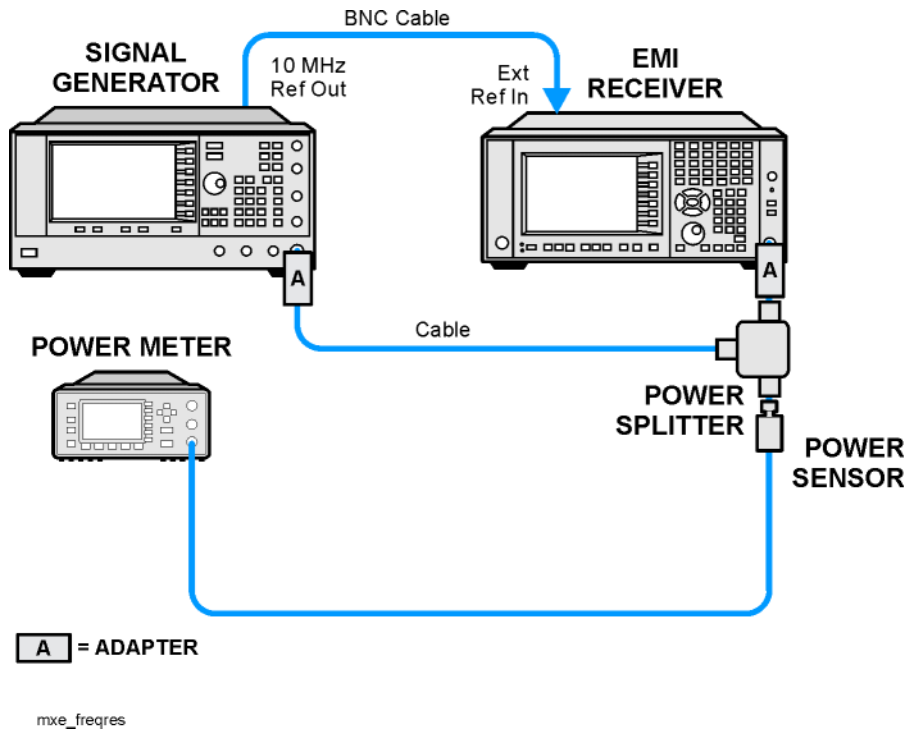
Table 22-16 Frequency Response - Required Equipment

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



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.

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, Input, RF Input Port, RF Input**.
6. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.

7. Set up the receiver by pressing:

**Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, 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 $-10 \text{ dBm} \pm 0.1 \text{ dB}$.
- 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, Signal Path**, 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**:

$$\text{Normalized to 50 MHz} = \text{Meas_Error} - \text{Meas_Error @ 50 MHz}$$

Tests
Frequency Response (Flatness)

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, 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 $-10 \text{ dBm} \pm 0.1 \text{ dB}$.
 - 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**:

$$\text{Normalized to 50 MHz} = \text{Meas_Error} - \text{Meas_Error @ 50 MHz}$$

Tests
Frequency Response (Flatness)

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.

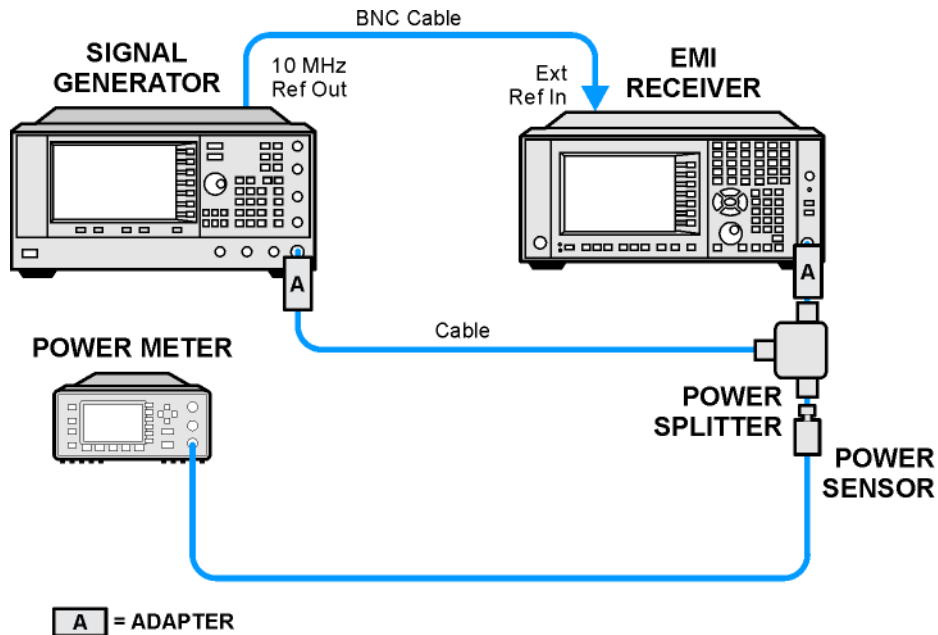
Table 22-19 Frequency Response – Preamp On – Required Equipment

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 PXE	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, Input, RF Input Port, RF Input**.

6. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.

7. Set up the receiver by pressing:

Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, External
FREQ Channel, Center Freq, 50, MHz
SPAN X Scale, Span, 50, kHz
AMPTD Y Scale, Signal Path, 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 $-60 \text{ dBm} \pm 0.1 \text{ dB}$.
- 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, Signal Path**.
- 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**:

$$\text{Measurement Error} = \text{Meas_Amp} - \text{Power_Meter}$$

- 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 22-20**:

$$\text{Normalized to 50 MHz} = \text{Meas_Error} - \text{Meas_Error @ 50 MHz}$$

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, 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 $-60 \text{ dBm} \pm 0.1 \text{ dB}$.
 - 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**:

$$\text{Normalized to 50 MHz} = \text{Meas_Error} - \text{Meas_Error @ 50 MHz}$$

Tests
Frequency Response (Flatness) - Preamp On

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.

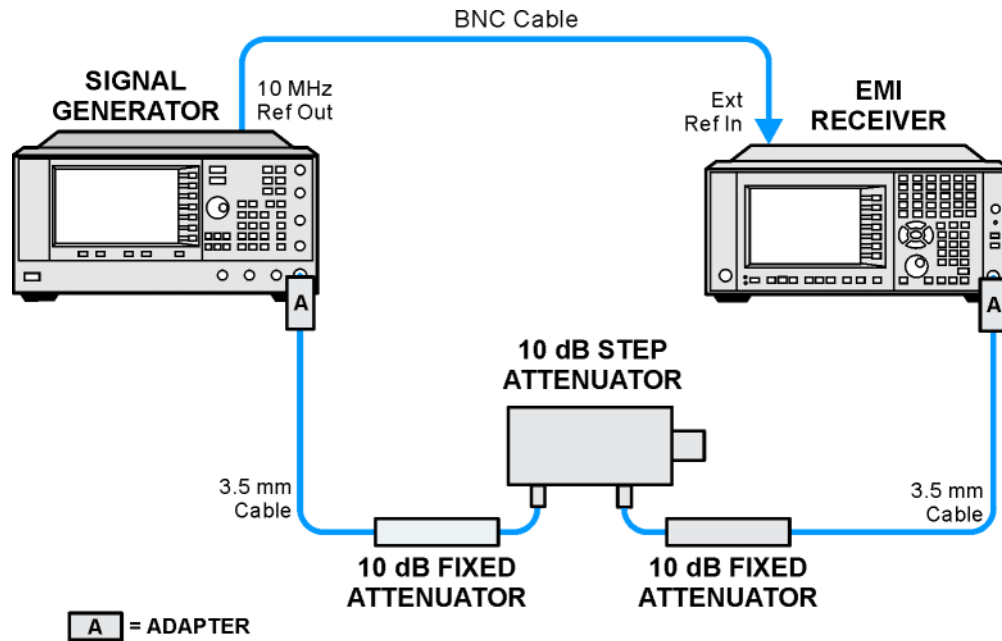
This measurement is performed on RF Input 1 only.

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, Input, RF Input Port, RF Input**.
5. Preset the receiver by pressing **Mode, Spectrum Analyzer, Mode Preset**.
6. Set up the receiver by pressing:
Meas Setup, Meas Standard, EMC Standard, None
Input/Output, Freq Ref Input, Freq Ref Input, 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, 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 $-15 \text{ dBm} \pm 0.2 \text{ dB}$.
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.

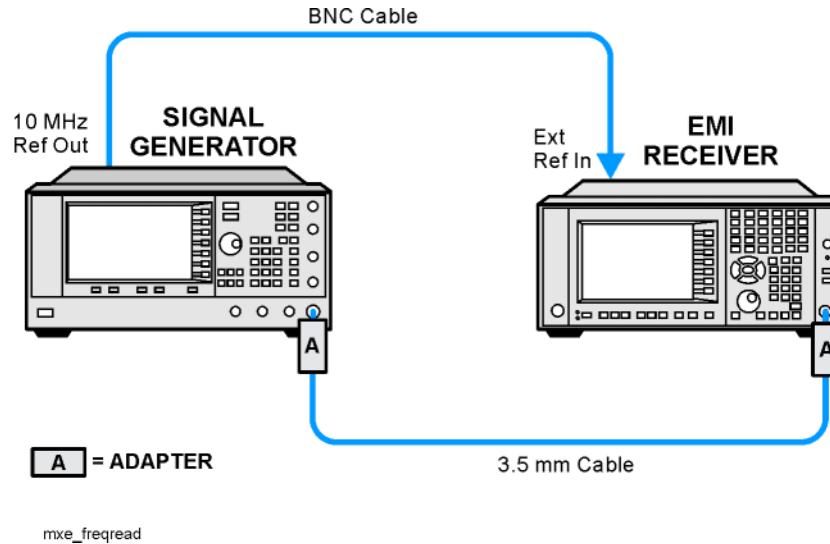
Table 22-24 CISPR Resolution Bandwidth Shape Accuracy – Required Equipment

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



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, Input, RF Input Port, RF Input**
 - Input/Output, Input, RF Coupling, DC (if available)**
 - Input/Output, Freq Ref Input, Freq Ref Input, External**
 - Meas Setup, Meas Standard, EMC Standard, CISPR**
 - AMPTD Y Scale, Ref Level, -10, dBm**
 - AMPTD Y Scale, Scale/Div, 3 dB**
 - Sweep, Sweep Config, 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 **FREQ Channel, 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, 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 **Marker, Marker Function, 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, 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 5 of the CISPR 16-1-1 standard. This includes testing for the following subsections:

4.3 Sine-wave voltage accuracy

5.2 Response to pulses

5.2.1 Amplitude relationship (absolute calibration)

5.2.2 Variation with repetition frequency (relative calibration)

Table 22-26 **Quasi-Peak Detector - Required Equipment**

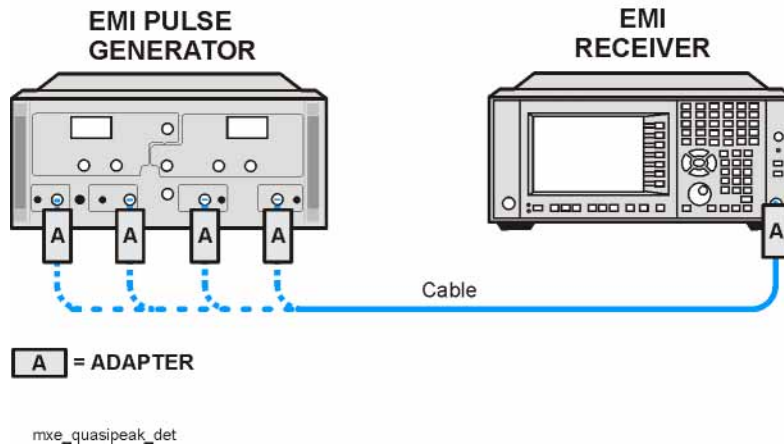
Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter ^a Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter ^b 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter ^c 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz 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)

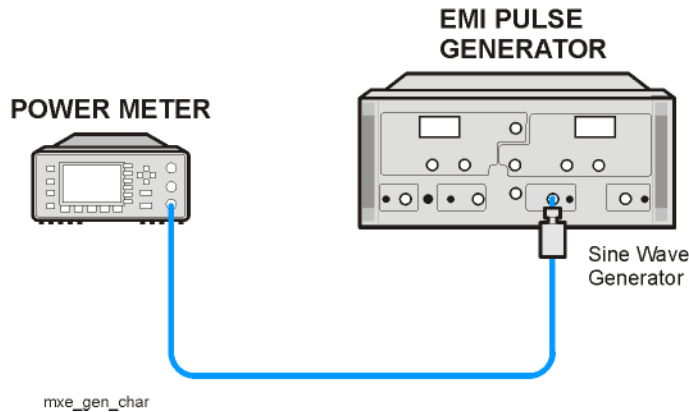
Figure 22-10 Typical Equipment Setup



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



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 22-27](#) under 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, 2 s**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace, Detector, 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](#)

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-27 Quasi-Peak Sine-Wave Voltage Accuracy Band A - CISPR 16-1-1 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**.

$$\text{Error} = \text{Measured} - 60 \text{ dB}\mu\text{V} - \text{Error (Table 22-27)}$$

Table 22-28 Quasi-Peak Absolute Calibration Band A - CISPR 16-1-1 Section 5.2.1

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, 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 IGU 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 Section 5.2.2

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 IGU 2916 EMI pulse generator to output a 10 MHz Sine Wave signal.
2. Connect the IGU 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 Sweptime to 2 seconds by pressing **Sweep, 2 s**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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, Y Axis Unit, dBμV**.

8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace, Detector, 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**

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-30

Quasi-Peak Sine-Wave Voltage Accuracy Band B - CISPR 16-1-1 Section 4.3

Sine Wave Frequency (MHz)	Band B				
	Power Meter (dBm)	Measured (dB μ V)	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 dB μ V**
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**.

$$\text{Error} = \text{Measured} - 60 \text{ dB}\mu\text{V} - \text{Error (Table 22-30)}$$

Table 22-31 Quasi-Peak Absolute Calibration Band B - CISPR 16-1-1 Section 5.2.1

Pulse Frequency (Hz)	Band B			
	Measured (dB μ V)	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, 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 Section 5.2.2

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 dB μ V**

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, 2 s**.
- 6. Set the amplitude units to dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
- 7. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
- 8. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace, Detector, 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](#)

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-33 Quasi-Peak Sine-Wave Voltage Accuracy Band C - CISPR 16-1-1 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**.

$$\text{Error} = \text{Measured} - 60 \text{ dB}\mu\text{V} - \text{Error (Table 22-33)}$$

Table 22-34 Quasi-Peak Absolute Calibration Band C - CISPR 16-1-1 Section 5.2.1

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, 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 Section 5.2.2

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 **Meas Setup, Advance, Noise Floor Extension Full**.
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 **Meas Setup, Advance, 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 dB μ V**
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 dB μ V**
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, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to Quasi-Peak by pressing **Trace, Detector, 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 Section 4.3

Pulse Frequency (Hz)	Band D		
	Lower Limit (dB μ V)	Measured (dB μ V)	Upper Limit (dB μ V)
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, Continuous Peak Search On**.
16. Change the Pulse Frequency on the IGU 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 Section 5.2.2

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 **Meas Setup, Advance, Noise Floor Extension Full**.

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 **Meas Setup, Advance, 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 6 of the CISPR 16-1-1 standard. This includes testing for the following subsections:

4.3 Sine-wave voltage accuracy

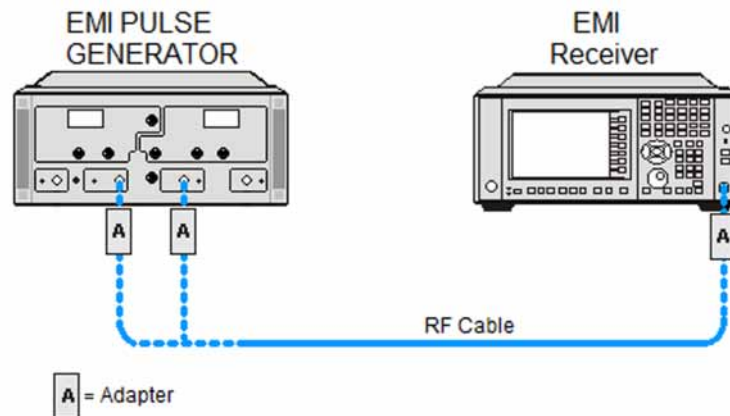
6.4 Response to pulses

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)

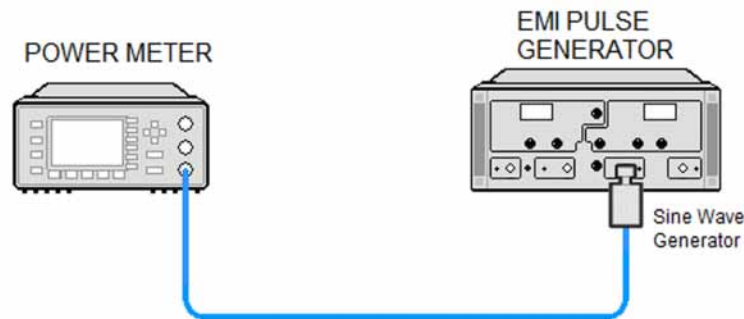
Figure 22-12 Typical Equipment Setup



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, 100 ms**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to Peak by pressing **Trace, 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](#).

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-39 Peak Sine-Wave Voltage Accuracy Band A – CISPR 16-1-1 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 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, 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 Section 6.4

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.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} - 6.61 \text{ dB} - \text{Error (Table 22-39)}$$

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, 100 ms**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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, Y Axis Unit, 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, 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**.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-41

Peak Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 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 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, 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 Section 6.4

Pulse Frequency (Hz)	Sweptime (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.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} - 6.33 \text{ dB} - \text{Error (Table 22-41)}$$

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 Sweptime to 100 milliseconds by pressing **Sweep, 100 ms**.
6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, 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, 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**.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-43

Peak Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 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 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 Sweptime to 1 milliseconds by pressing **Sweep, 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 Sweptime 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 Section 6.4

Pulse Frequency (Hz)	Sweptime (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.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} - 12.61 \text{ dB} - \text{Error (Table 22-43)}$$

Band D Testing

- Setup the IGUU 2916 EMI pulse generator as follows:
 - Aux. Generator: **Band C/D**
 - b.Pulse Frequency: **20 kHz**
 - Amplitude: **40 dBμV**
- Connect the IGUU 2916 EMI pulse generator Output Auxiliary Generator Band A/B/C/D to the EMI receiver RF Input.
- Preset the EMI receiver by pressing **Mode Preset**.
- 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**.
- Set the Sweptime to 1 milliseconds by pressing **Sweep, 1 ms**.
- Set the EMI receiver input attenuator to 10 dB by pressing **AMPTD Y Scale, Attenuation, 10 dB**.
- Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, dBμV**.
- 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, Peak**.
10. Put the EMI receiver in single sweep operation by pressing **Single**.
11. Turn on the continuous peak function by pressing **Peak Search, 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 IGU 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 Section 6.4

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**.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} - 12.61 \text{ dB}$$

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 7 of the CISPR 16-1-1 standard. This includes testing for the following subsections:

4.3 Sine-wave voltage accuracy

7.3 Response to pulses

7.3.1 Amplitude relationship

7.3.2 Variation with repetition frequency

Table 22-46 EMI Average - Required Equipment

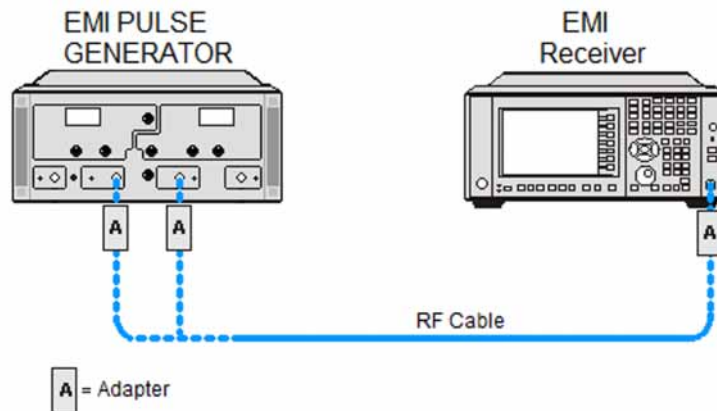
Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter ^a Type-N (m) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter ^b 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter ^c 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz 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)

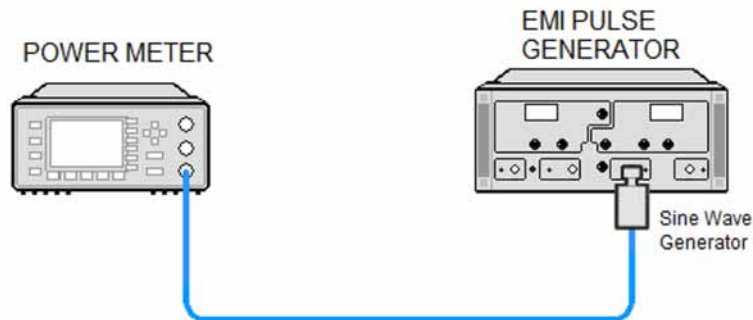
Figure 22-14 Typical Equipment Setup



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 Sweptime to 1 second by pressing **Sweep, 1 s**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to EMI Average by pressing **Trace, Detector, 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 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. 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**.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 12.36 \text{ dB} - \text{Error (Table 22-47)}$$

Table 22-48 EMI Average Amplitude Relationship Band A – CISPR 16-1-1 Section 7.3.1

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, 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 Section 7.3.2

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, 1 s**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.

9. Change the detector used by the EMI receiver to EMI Average by pressing **Trace, Detector, 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**.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-50 EMI Average Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 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. 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**.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 18.95 \text{ dB} - \text{Error (Table 22-50)}$$

Table 22-51 EMI Average Amplitude Relationship Band B – CISPR 16-1-1 Section 7.3.1

Pulse Frequency (Hz)	Band B		
	Measured (dB μ V)	Lower Limit (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, 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 Section 7.3.2

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, 1 s**.
6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, 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, 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**.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-53 EMI Average Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 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. 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 Section 7.3.1

Pulse Frequency (Hz)	Band C		
	Measured (dB μ V)	Lower Limit (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, 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 Section 7.3.2

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, 1 s**.
6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, 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, 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](#).

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 16.07 \text{ dB}$$

Table 22-56

EMI Average Amplitude Relationship Band D – CISPR 16-1-1 Section 4.3

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, 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 Section 7.3.2

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 8 of the CISPR 16-1-1 standard. This includes testing for the following subsections:

4.3 Sine-wave voltage accuracy

8.3 Response to pulses

8.3.2 Amplitude relationship

8.3.3 Variation with repetition frequency

Table 22-58 **RMS Average Detector- Required Equipment**

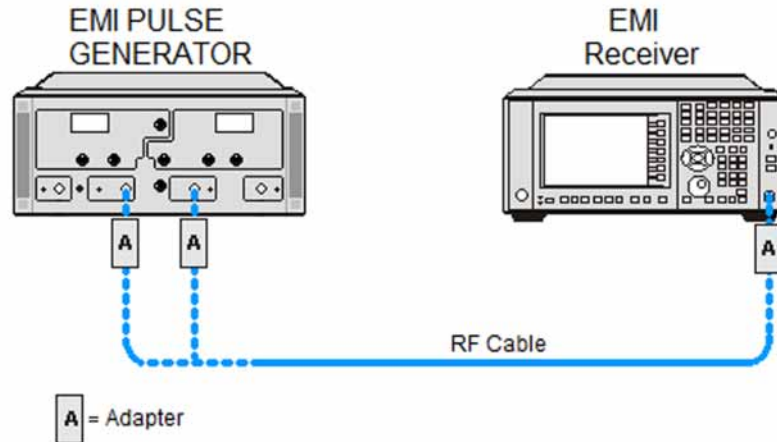
Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter ^a Type-N (m) to 3.5 mm (f)	Frequency: 10 kHz to 1.0 GHz VSWR: < 1.1:1	1250-1744
Adapter ^b 3.5 mm (f) to 3.5 mm (f)	Frequency: 100 kHz to 1.0 GHz VSWR: < 1.1:1	83059B
Adapter ^c 2.4 mm (f) to 3.5 mm (f)	Frequency: 100 kHz 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)

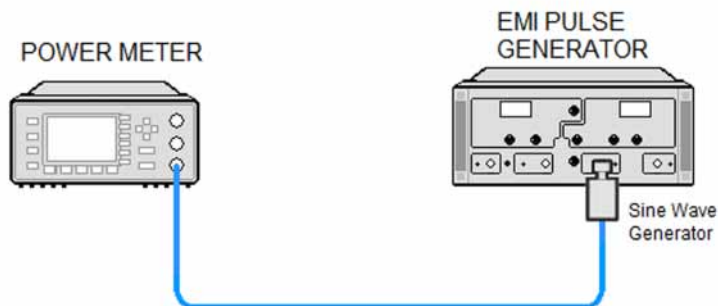
Figure 22-16 Typical Equipment Setup



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, 1 s**.
6. Set the RF Coupling to DC by pressing **Input / Output, 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 dB μ V by pressing **AMPTD Y Scale, Y Axis Unit, dB μ V**.
8. Set the reference level to 80 dB μ V by pressing **AMPTD Y Scale, 80 dB μ V**.
9. Change the detector used by the EMI receiver to RMS Average by pressing **Trace, Detector, 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**.

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-59 RMS Average Sine-Wave Voltage Accuracy Band A – CISPR 16-1-1 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

15. Setup the IGU 2916 EMI pulse generator as follows:

- Aux. Generator: **Band A**
- Pulse Frequency: **25 Hz**
- Amplitude: **40 dBμV**

16. Connect the IGU 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**.

$$\text{Error} = \text{Measured} - 40 \text{ dBμV} + 5.13 \text{ dB} - \text{Error (Table 22-59)}$$

Table 22-60 RMS Average Amplitude Relationship Band A – CISPR 16-1-1 Section 8.3.2

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, 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 Section 8.3.3

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, 1 s**.

6. Set the RF Coupling to DC by pressing **Input / Output, 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, Y Axis Unit, 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, 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**.
$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-62 RMS Average Sine-Wave Voltage Accuracy Band B – CISPR 16-1-1 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

15. Setup the IGU 2916 EMI pulse generator as follows:
 - a. Aux. Generator: **Band B**
 - b. Pulse Frequency: **1000 Hz**
 - c. Amplitude: **40 dBμV**
16. Connect the IGU 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**.

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 4.55 \text{ dB} - \text{Error (Table 22-62)}$$

Table 22-63 RMS Average Amplitude Relationship Band B – CISPR 16-1-1 Section 8.3.2

Pulse Frequency (Hz)	Band B			
	Measured (dB μ V)	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, 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 Section 8.3.3

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, 1 s**.
6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, 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, 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](#).

$$\text{Error} = \text{Measured} - (\text{Power Meter} + 106.99)$$

Table 22-65 RMS Average Sine-Wave Voltage Accuracy Band C – CISPR 16-1-1 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

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](#).

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 10.41 \text{ dB} - \text{Error (Table 22-65)}$$

Table 22-66 RMS Average Amplitude Relationship Band C – CISPR 16-1-1 Section 8.3.2

Pulse Frequency (Hz)	Band C			
	Measured (dB μ V)	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, 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 Section 8.3.3

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, 1 s**.
6. Set the amplitude units to dBμV by pressing **AMPTD Y Scale, Y Axis Unit, 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, 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](#).

$$\text{Error} = \text{Measured} - 40 \text{ dB}\mu\text{V} + 10.41 \text{ dB}$$

Table 22-68

RMS Average Amplitude Relationship Band D – CISPR 16-1-1 Section 8.3.2

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, 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 Section 8.3.3

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 standard to intermittent, unsteady, and drifting narrowband disturbances. This includes testing for the following subsections:

7.3.3 Response to intermittent, unsteady, and drifting narrowband disturbances

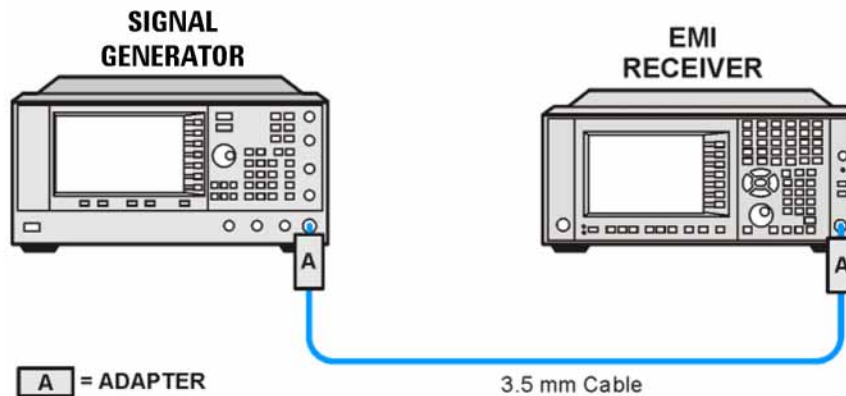
8.3.4 Response to intermittent, unsteady, and drifting narrowband disturbances

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, Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).
7. Set the Sweptime to 3 seconds by pressing **Sweep, 3 s**.
8. Change the detector used by the EMI receiver to EMI Average by pressing **Trace, Detector, 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, 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.

$$\text{Delta} = \text{Pulsed RF Measured} - \text{Sine Wave Measured}$$

Table 22-71 EMI Average – CISPR 16-1-1 Section 7.3.3

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, Input, RF Coupling DC** (instruments with option 544 are always DC coupled so this step is skipped for them).
7. Set the Sweep time to 3 seconds by pressing **Sweep, 3 s**.
8. Change the detector used by the EMI receiver to RMS Average by pressing **Trace, Detector, 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, 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.

$$\text{Delta} = \text{Pulsed RF Measured} - \text{Sine Wave Measured}$$

Table 22-72 RMS Average – CISPR 16-1-1 Section 8.3.4

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**.

