Keysight Technologies
N9040B UXA Signal Analyzer

KEYSIGHT

SERVICE GUIDE

Notices

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Where to Find the Latest Information

Documentation is updated periodically. For the latest information about this instrument, including firmware upgrades, application information, and product information, click the website link below.

https://www.keysight.com/find/uxa

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

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

Information on preventing instrument damage can be found at:

https://www.keysight.com/find/PreventingInstrumentRepair

Is your product software up-to-date?

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

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

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

Responsible Disclosure Program

Keysight recommends that security researchers share the details of any suspected vulnerabilities across any asset owned, controlled, or operated by Keysight (or that would reasonably impact the security of Keysight and our users) using this form:

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

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https://www.keysight.com/us/en/about/quality-and-security/security/product-and-solution-cyber-security/report-a-product-cybersecurity-issue

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Keysight Technologies
N9040B UXA Signal Analyzer

Service Guide

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 UXA Signal Analyzer Overview on page 16

Instrument Option Descriptions on page 17

Before You Start Troubleshooting on page 19

ESD Information on page 21

Instrument Maintenance on page 23

Service Equipment You Will Need on page 25

After an Instrument Repair on page 28

Contacting Keysight Technologies on page 29

How to Return Your Instrument for Service on page 31

Keysight UXA Signal Analyzer Overview

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

The Keysight UXA signal analyzer is readily adaptable to meet changing measurement needs. Optional features, whether hardware or measurement application software, will enable the analyzer 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 user the same day and the license key can be generated and installed in the signal analyzer within minutes (the instrument software may require updating). Once the license key is entered into the analyzer, the new option is enabled and fully functional.

The service strategy for the UXA 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 signal analyzer. It is the customer’s responsibility to install anti-virus software.

Instrument Option Descriptions

The UXA has a variety of hardware and measurement application options. Several of these options are “standard” so they are automatically installed on all UXA analyzers. All options require license files to be present in instrument memory before the option can be used, or viewed on the Show, System screen.

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

A current list of all instrument options and retrofit requirements is available on the Keysight web site for the UXA signal analyzer.

Table 1-1

Option	Description	Notes
508	2 Hz to 8.4 GHz frequency range	
513	2 Hz to 13.6 GHz frequency range	
526	2 Hz to 26.5 GHz frequency range	
544	2 Hz to 44 GHz frequency range	
550	2 Hz to 50 GHz frequency range	
ALV	Auxiliary Log Video	
B25	25 MHz analysis bandwidth	Standard
B40	40 MHz analysis bandwidth	
B2X	255 MHz analysis bandwidth	
B5X	510 MHz analysis bandwidth	
H1G	1 GHz analysis bandwidth	Requires Option 550
CRP	Arbitrary IF Output	
CR3	2nd IF Out	Standard
C35	APC 3.5 mm Connector	Requires Option 526
DP2	Deep Capture Memory for IQ data capture	Standard
DP4	4 GB Capture Memory	Included with Options B2X, B5X, H1G
EA3	Electronic Attenuator	
EP0	Enhanced Phase Noise Performance	Standard
EXM	External Mixing	Standard
FBP	Full Bypass Path	Included with Options B2X, B5X, H1G
FSA	Fine Step Attenuator	Standard

Table 1-1

Option	Description	Notes
FS1	Fast Sweep	Standard
FS2	Enhanced Fast Sweep Speed	Standard
LFE	Low Frequency Enabled	Standard
LNP	Low Noise Path	Standard
MPB	Preselector Bypass	Standard
NF2	Noise Floor Extension	Standard
NUL	IM Nulling	Standard
PFR	Precision Frequency Reference	Standard
P08	Preamp, 100 kHz to 8.4 GHz	
P13	Preamp, 100 kHz to 13.6 GHz	
P26	Preamp, 100 kHz to 26.5 GHz	
P44	Preamp, 100 kHz to 44 GHz	Requires Option 544
P50	Preamp, 100 kHz to 50 GHz	Requires Option 550
RTL	Real Time Data Link	Standard
RTS	Real-Time I/Q Data Streaming	Requires B2X or B5X
SF1	Security Features, exclude launch programs	
SF2	Security Features, prohibit saving results	
YAV	Screen Video (rear panel Analog Out connector)	

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 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.

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 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 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).

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

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.

WARNING

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

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.

ESD Information

Protection from Electrostatic Discharge

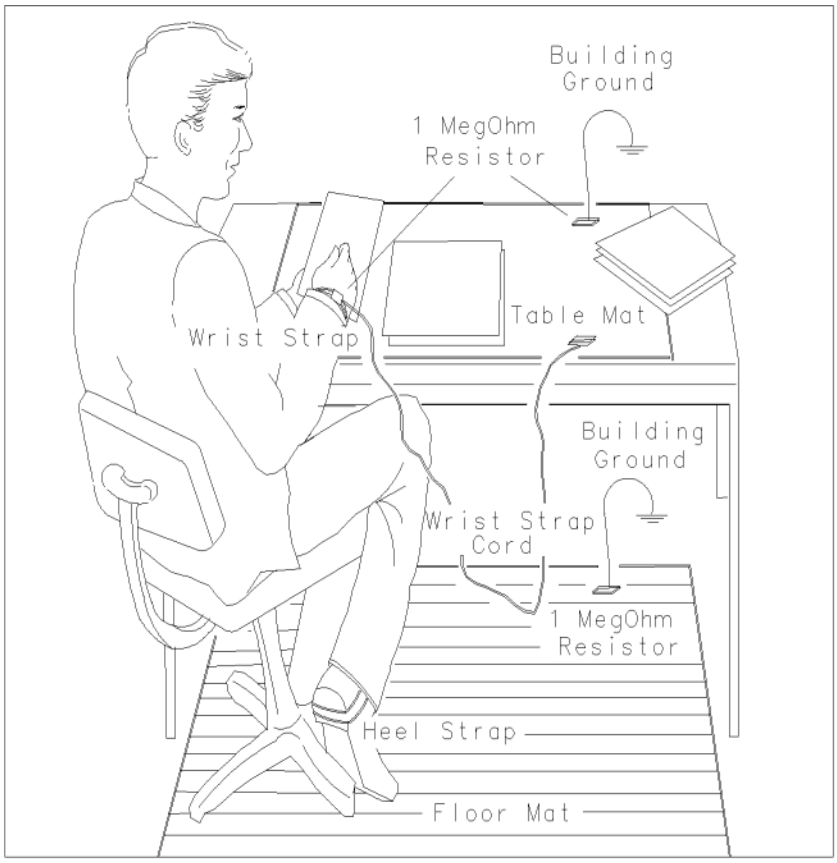
Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Figure 1-1 shows an example of a static-safe workstation using two types of ESD protection:

- 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).

Static Safe Accessories

9300-1367	Wrist-strap, color black, stainless steel. Four adjustable links and a 7 mm post-type connection.
9300-0980	Wrist-strap cord 1.5 m (5 ft.)
9300-0797	2 ft by 4 ft conductive mat with 15 ft grounding wire

Instrument Maintenance

Cleaning the Instrument

WARNING

To prevent electrical shock, disconnect the signal 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.

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.

Battery Information

The analyzer uses a lithium battery located on the CPU board. This is not an operator replaceable part. See "How to Return Your Instrument for Service" on page 31. Replaceable parts must be approved or supplied by Keysight Technologies.

WARNING

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

Do not throw batteries away but collect as small chemical waste.

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

Service Equipment You Will Need

There are certain things that will be required to troubleshoot, adjust, and test the UXA Signal Analyzer. 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

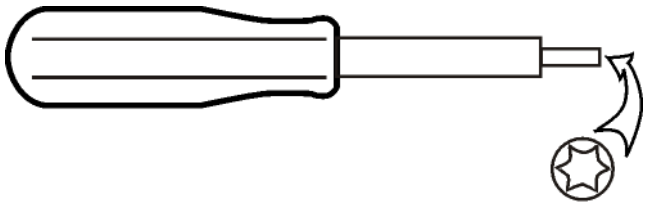


Table 1-2

Description	Keysight Part Number
TORX Hand Driver - Size T-8	source locally
TORX Hand Driver - Size T-10	source locally
TORX Hand Driver - Size T-20	source locally
9/16 inch nut driver	source locally
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
cable puller	5021-6773

Calibration Application Software

Information regarding the Keysight X-Series Signal Analyzer Calibration Application Software can be found at the following web site:

https://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.

Table 1-3

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)
Connector, MMCX (f) to SMA (f)	n/a	www.hubersuhner.com item number: 31_MMCX-SMZ-50-1/111_OE (must be ordered separately)

USB Keyboard and Mouse

A USB keyboard and mouse will be needed to accomplish many of the different troubleshooting tasks, as well as updating the instrument software. Any standard USB keyboard and mouse should work.

USB Storage Device

The main reason why a USB storage device will be needed is to download instrument software and backup calibration data when the hard drive in an instrument needs to be replaced. The instrument software is about 3 GB. The calibration files are around 30 megabytes.

After an Instrument Repair

If any instrument assemblies have been repaired or replaced, perform the related adjustments and performance verification tests. These tests are done using the N7800A Keysight Calibration Application Software. Refer to Chapter 21, “Post-Repair Procedures,” for a list of post-repair adjustments and performance tests based on which hardware has been changed.

https://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:

https://www.keysight.com/find/uxa_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 using the link below. In any correspondence or telephone conversations, refer to the instrument by its model number (N9040B) and full serial number (ex. MY49250887). With this information, the Keysight representative can quickly determine whether your unit is still within its warranty period.

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

https://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 appropriate contact information can be found using the link in the section titled "Contacting Keysight Technologies". 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 32.

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.

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 34

Instrument Boot Up Process on page 35

Typical instrument boot-up process flow on page 36

Potential Problems During Boot Process on page 39

Yellow Standby LED Does Not Turn On on page 43

Green Power On LED Does Not Turn On on page 47

Fan(s) Are Not Operating on page 49

No Keysight Splash Screen Displayed on page 53

Instrument Hangs at the Keysight Splash Screen on page 56

Instrument Cannot Completely Load or Run the Operating System on page 57

Initializations Did Not Complete on page 65

Fails an Initial Alignment on page 65

Troubleshooting a Blank Display on page 58

Signal Level Verification on page 66

Signal Level Problem with Input Frequencies < 3.6 GHz on page 66

Signal Level Problem with Input Frequencies > 3.6 GHz on page 67

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 65.
8. Check to see if the instrument has the latest firmware before starting the troubleshooting procedure. Press **System**, **Show, System**. The firmware revision is listed under **Firmware Revision**. For more information, refer to Chapter 23, "Instrument Software and FPGAs.".
9. Is the instrument displaying an error message? If so, refer to "Error Messages" for more information.
10. If the necessary test equipment is available, perform the functional checks in Chapter 22, "Functional Tests.".

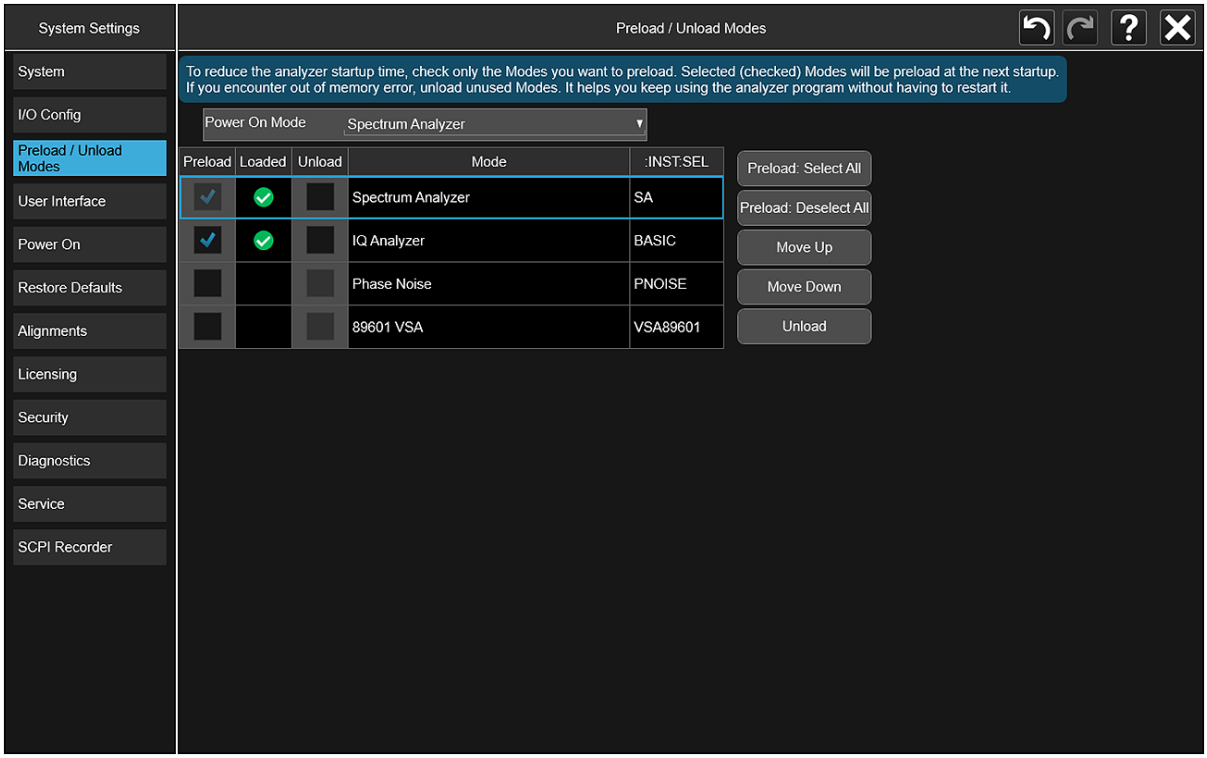
Instrument Boot Up Process

This section describes the instrument 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 spectrum analyzer 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, they can go to the **Preload / Unload Modes** screen and configure them as they would like, as seen in Figure 2-1. By default all applications are checked and therefore, will preload when the instrument application is launched. Uncheck any applications to bypass the preloading process.

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 Turn On" 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 instrument does not turn on refer to the "Instrument Does Not Turn On" section in this chapter. If the instrument turns on, but the green Power On LED does not turn on refer to the "Green Power On LED Does Not Turn On" 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 Microsoft Windows or running the Instrument Image Recovery System. The default selection is to boot Microsoft 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 Microsoft Windows will begin to boot. If the Microsoft 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 Microsoft 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 13, "System Processor and Disk Drive" in this manual.

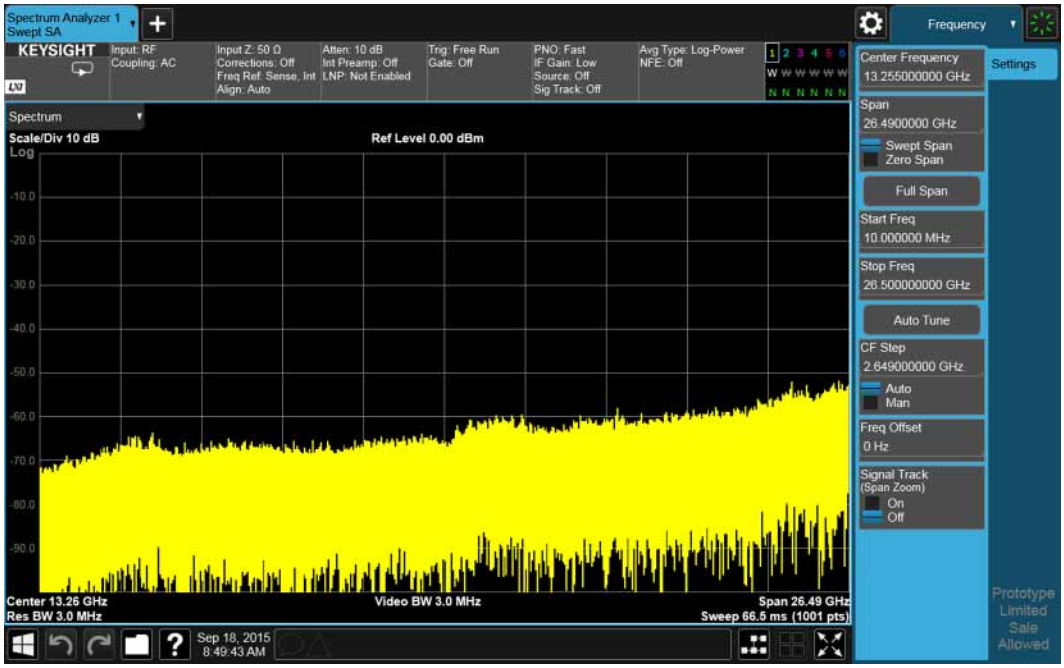
8. The Keysight Technologies logo is displayed in white font on a blue background while Windows finishes loading user preferences. This can take up to 4 minutes. If this does not occur refer to the "Instrument Cannot Completely Load or Run the Operating System" section in this chapter.
9. By default, the initialization process of the spectrum analyzer application begins loading. The signal analyzer 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 it begins to sweep. 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.

Once the instrument application is fully initialized and aligned, the sweep 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 Sweep 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.

Instrument Does Not Turn On

The control for the instrument turning on comes from the A4 Processor board assembly. However, there are other assemblies that can cause this process to be interrupted due to many factors. If all the standby power supplies are working, when the front panel power button is pressed the A4 Processor assembly receives this signal and tells the A6 Power Supply assembly to turn on. It also turns off the yellow standby LED and turns the Green on LED on. These signals are routed through the A7 Midplane board and sent to and from the A1A2 Front Panel Controller board through W1. The instrument could also not turn on if there is excessive current being drawn by any one of the assemblies in the instrument. Of course, the power for this all originates with the A6 Power Supply Assembly. When the instrument will not power 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 Turn On" section before proceeding.

If the instrument turns on and operates properly but the green Power On LED does not work, see the "Green Power On LED Does Not Turn On" section in this chapter.

1. The instrument power 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 20, "Assembly Replacement Procedures," in this manual.
3. Remove the Top Brace. Refer to Chapter 20, "Assembly Replacement Procedures," in this manual.
4. Connect the AC power cord to the instrument, but do not try to turn it on, leave it in standby mode.
5. Press S1 on the A7 Midplane board, as seen in Figure 2-3.

   Does the instrument turn on?

   If yes:

   Refer to the "Front Panel Power Switch Is Not Working" section in this chapter.

If no:

Proceed to the next step.

NOTE

If the instrument tries to turn on, but then quickly shuts down, there is most likely an assembly that is overloading the power supply and causing it to shut down. In this case, remove or disconnect assemblies to isolate the one that is overloading the power supply. This could also be caused by a faulty A6 Power Supply as well.

Figure 2-3 A7 Midplane Board S1 Location

6. Use a voltmeter to measure the DC voltage on pin #2 of S1 on the A7 Midplane board, as seen in Figure 2-3.

   Does pin #2 measure at least +3.0 VDC?

   If yes:

   Replace the A4 System Processor Assembly.

   If no:

   Replace the A6 Power Supply Assembly.

Front Panel Power Switch Is Not Working

Since the instrument will turn on when S1 on the A7 Midplane board is pressed, and S1 pulls down the same control line that the front panel power switch does, the problem must be in the connections between pin #2 of S1 and the front panel power switch. Use the following procedure to determine where the problem is located.

1. With the instrument power turn off and the AC power cord removed from the instrument, remove the A1 Front Panel assembly. Refer to Chapter 20, "Assembly Replacement Procedures," in this manual.
2. Referring to Figure 2-4, remove W1 from J11 of the A1A5 Front Panel Controller board and measure the resistance from pin #68 of J11 to ground while holding down the front panel power switch.

   Does the resistance from Pin #68 to ground measure approximately 1k ohms?

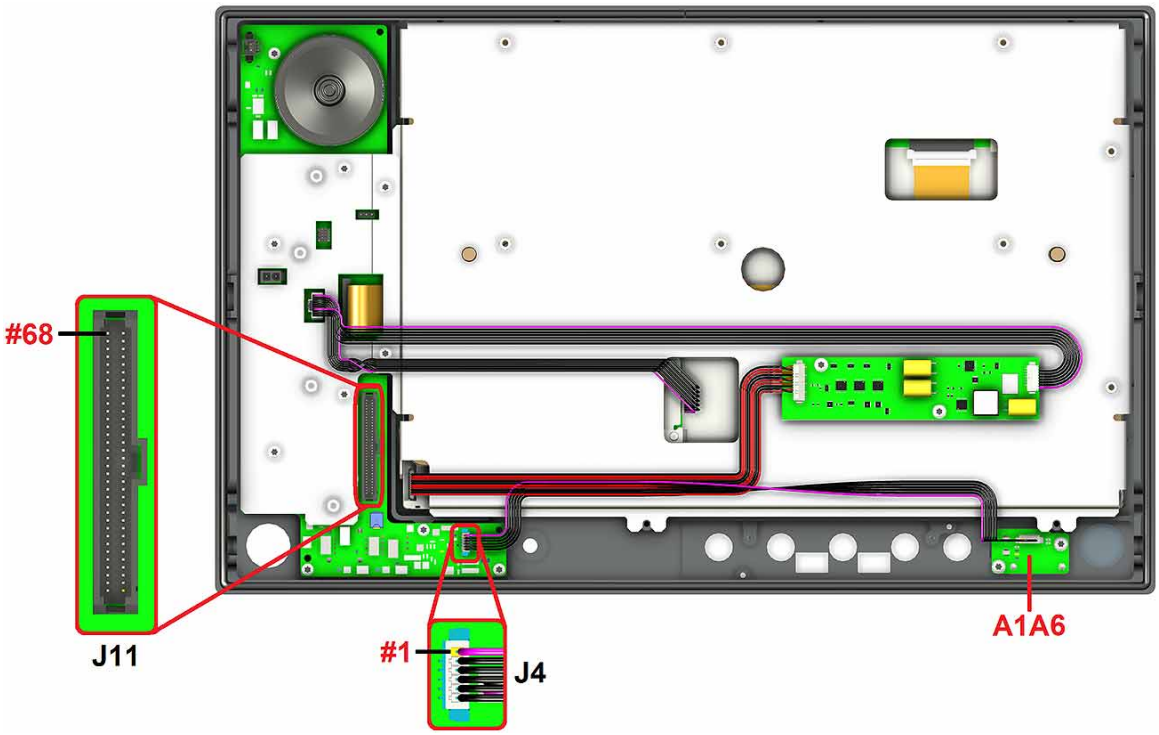
   If yes:

   Replace ribbon cable W1 that connects the front panel assembly to the A7 Midplane board and verify that the instrument can now be turned on using the front panel power switch.

   If no:

   Proceed to the next step.

Figure 2-4 A1 Front Panel Power Switch Troubleshooting



3. Referring to Figure 2-4, measure the resistance from pin #1 of J4 on the A1A2 Front Panel Controller board to ground while holding down the front panel power switch.

   Does the resistance from pin #1 to ground measure approximately 1k ohms?

   If yes:

   Replace the A1A5 Front Panel Controller board and verify that the instrument can now be turned on using the front panel power switch.

   If no:

   Proceed to the next step.

4. Inspect the wire harness A1W4 that goes from the A1A5 Front Panel Controller J4 to the A1A6 Front Panel Power Switch Keyboard for any pinched, bare, or loose wires, and replace it if needed.

   If A1W4 is not damaged, replace the A1A6 Front Panel Power Switch Keyboard.

Yellow Standby LED Does Not Turn On

Control of the yellow front panel Standby LED comes from the A4 Processor board assembly. This signal is routed through the A7 Midplane board before being sent to the A1A5 Front Panel Controller board through W1. 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 between the A7 Midplane board and the A1A6 Front Panel Power Switch Keyboard.

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 20, “Assembly Replacement Procedures,” in this manual.
3. Reconnect the AC power cord to the instrument, but do not turn it on.
4. Referring to Figure 2-5, verify that both the +5.1V STBY and +15 STBY LEDs on the A7 Midplane board are on (green).

   Are both standby LEDs on?

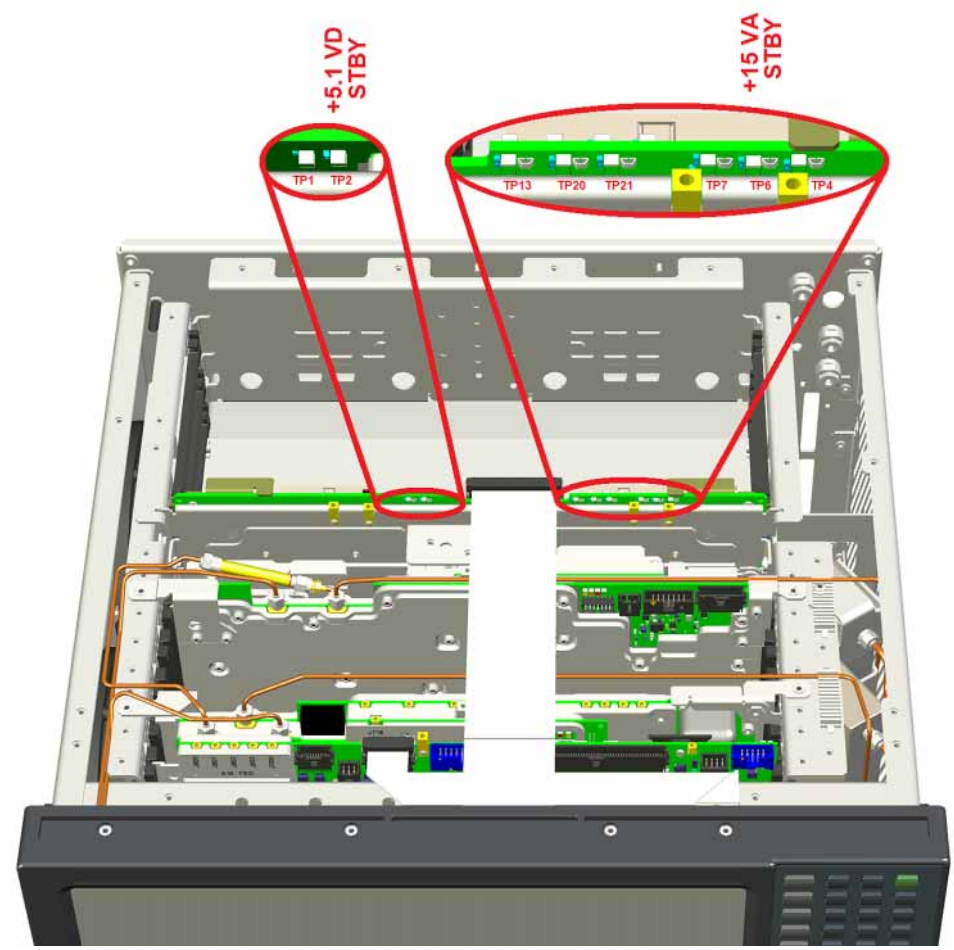
   If yes:

   Proceed to the next step.

   If no:

   Replace the A6 Power Supply assembly.

Figure 2-5 A7 Midplane Board Standby Supplies



5. Remove the AC power cord from the instrument.
6. Referring to Figure 2-6, remove W1 from J32 of the A7 Midplane board.
7. Reconnect the AC power cord to the instrument, but do not turn it on.
8. Referring to Figure 2-6, measure the DC voltage from pin #64 of J32 on the A7 Midplane board to ground.

   Does the DC voltage from pin #64 to ground measure approximately +5 VDC?

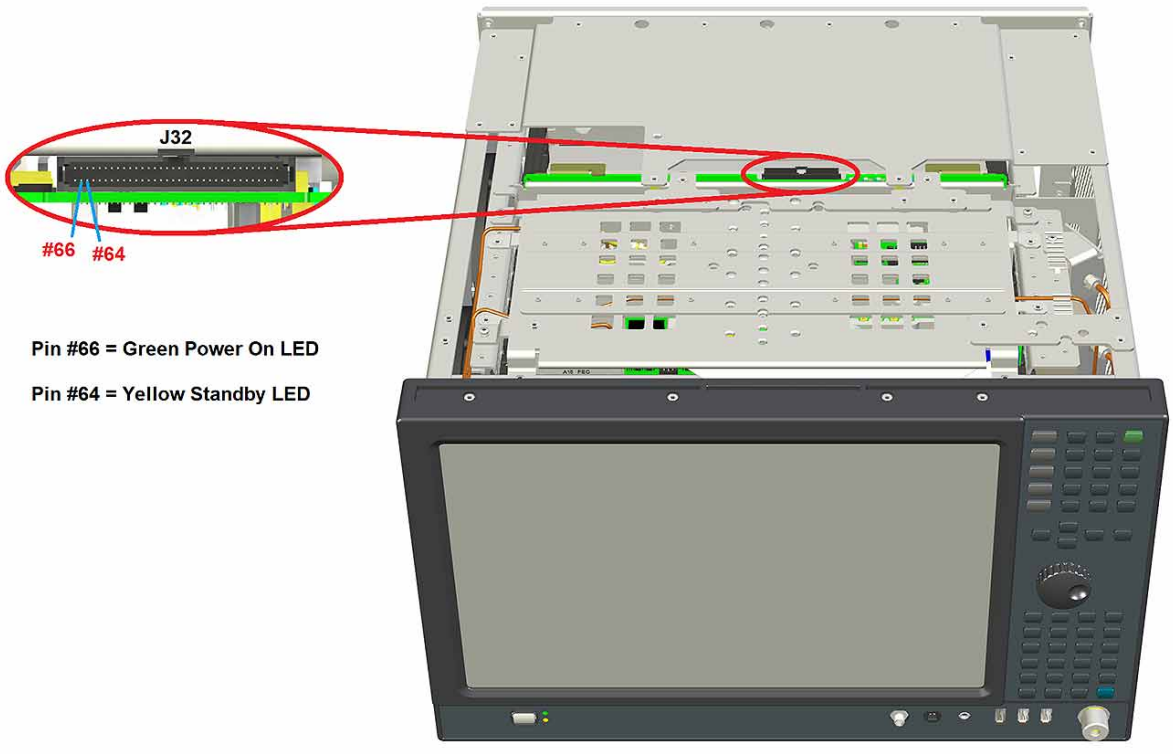
   If yes:

   Proceed to the next step.

   If no:

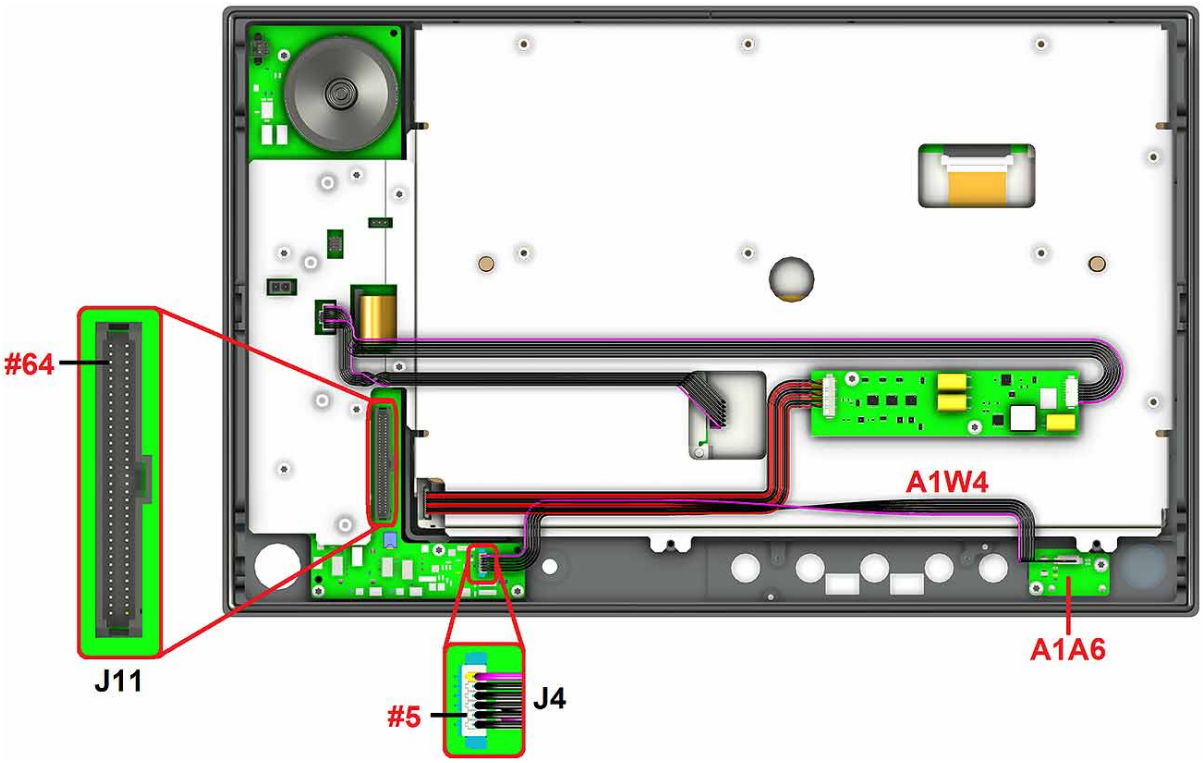
   Replace the A4 System Processor Assembly.

Figure 2-6 A7 Midplane Board J32 Front Panel Power LED Control Lines



9. With the instrument power turned off and the AC power cord removed from the instrument, remove the A1 Front Panel assembly. Refer to Chapter 20, “Assembly Replacement Procedures,” in this manual.
10. Referring to Figure 2-7, remove W1 from J11 of the A1A5 Front Panel Controller board and inspect the cable for any damage, and replace it if needed.

Figure 2-7 Front Panel Standby LED Connections



11. Referring to Figure 2-7, measure the resistance from J11 pin #64 to J4 pin #5 an the A1A5 Front Panel Controller board.

Does the resistance from J11 pin #64 to J4 pin #5 measure approximately 0 ohms?

If yes:

Proceed to the next step.

If no:

Replace the A1A5 Front Panel Controller board.

12. Inspect the wire harness A1W4 that goes from the A1A5 Front Panel Controller J4 to the A1A6 Front Panel Power Switch Keyboard for any pinched, bare, or loose wires, and replace it if needed.

If A1W4 is not damaged, replace the A1A6 Front Panel Power Switch Keyboard.

Green Power On LED Does Not Turn On

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 before being sent to the A1A2 Front Panel Controller board through W1. 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 Turn On" section before proceeding. It also assumes that the instrument will turn on when the front panel power button is pressed. If it doesn't, refer to the "Instrument Does Not Turn On" 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.

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 20, "Assembly Replacement Procedures," in this manual.
3. Referring to Figure 2-6, remove W1 from J32 of the A7 Midplane board.
4. Reconnect the AC power cord to the instrument and turn it back on by pressing S1 on the A7 Midplane board, as seen in Figure 2-3.
5. Referring to Figure 2-6, measure the DC voltage from pin #66 of J32 on the A7 Midplane board to ground.

   Does the DC voltage from pin #66 to ground measure approximately +5 VDC?

   If yes:

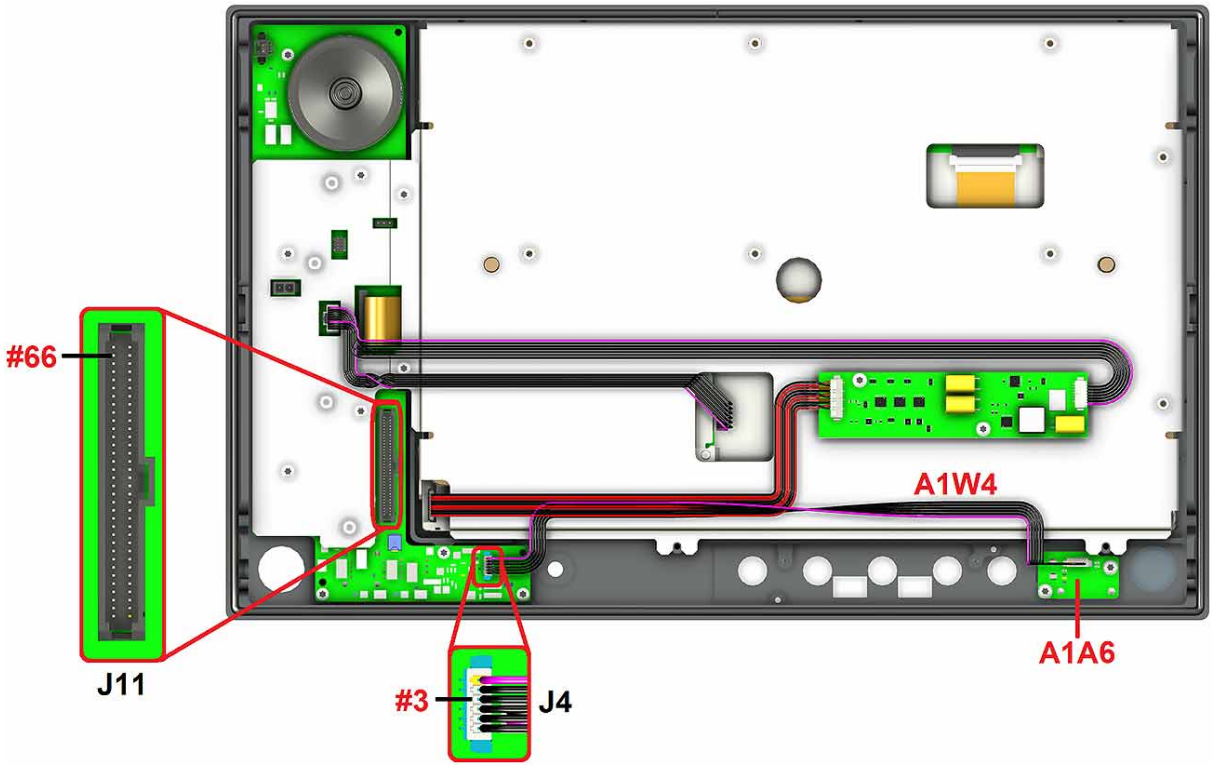
   Proceed to the next step.

   If no:

   Replace the A4 System Processor Assembly.
6. Turn the instrument off using S1 on the A7 Midplane board and remove the power cord from the instrument.
7. Remove the A1 Front Panel assembly. Refer to Chapter 20, "Assembly Replacement Procedures," in this manual.

8. Referring to Figure 2-8, remove W1 from J11 of the A1A5 Front Panel Controller board and inspect the cable for any damage, and replace it if needed.

Figure 2-8 Front Panel Power On LED Connections



9. Referring to Figure 2-8, measure the resistance from J11 pin #66 to J4 pin #3 an the A1A5 Front Panel Controller board.

   Does the resistance from J11 pin #66 to J4 pin #3 measure approximately 0 ohms?

   If yes:

   Proceed to the next step.

   If no:

   Replace the A1A5 Front Panel Controller board.

10. Inspect the wire harness A1W4 that goes from the A1A5 Front Panel Controller J4 to the A1A6 Front Panel Power Switch Keyboard for any pinched, bare, or loose wires, and replace it if needed.

    If A1W4 is not damaged, replace the A1A6 Front Panel Power Switch Keyboard.

Fan(s) Are Not Operating

The instrument cooling fans are on the left side of the instrument. They should all come on as soon as the instrument is turned on and draw air into the instrument.

The procedure in this section 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 Turn On" section before proceeding.

CAUTION If a fan is not running, assemblies in the instrument could overheat and be damaged if it is powered on for a long period of time.

NOTE 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.

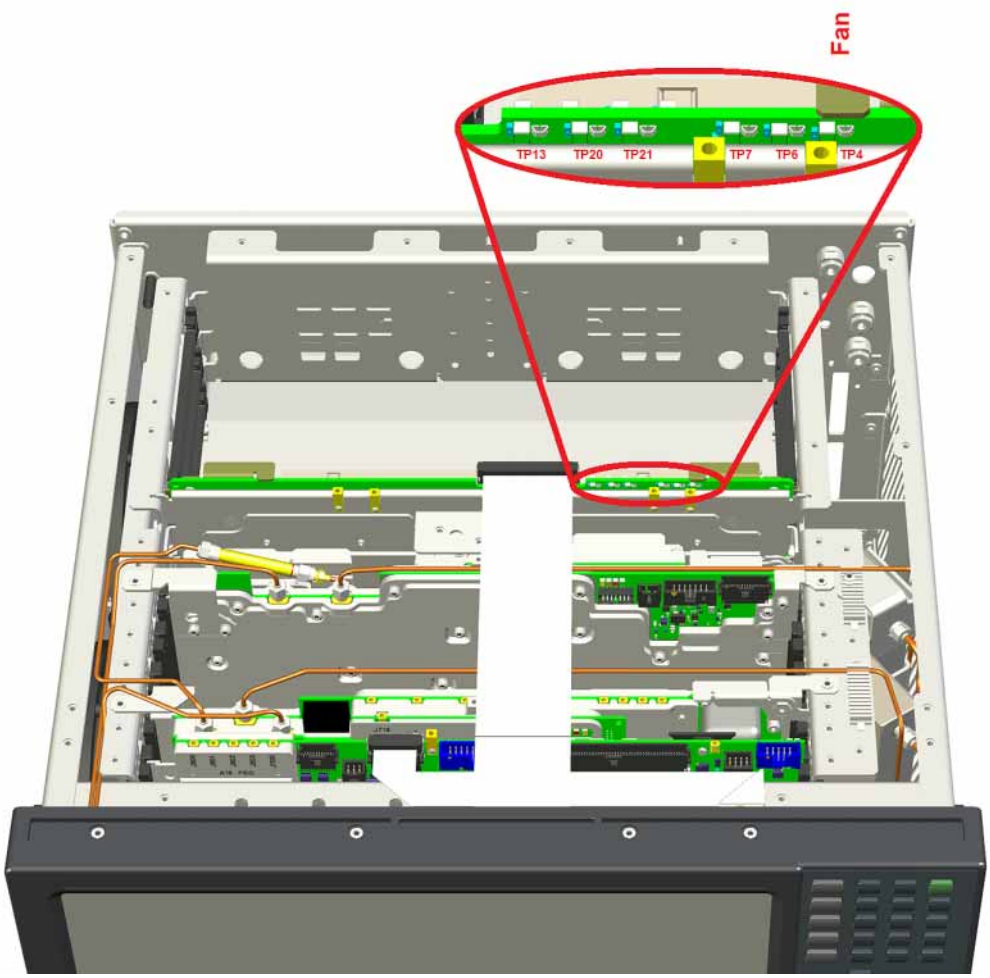
There is a temperature sensor on the A7 Midplane board that feeds information back to the A6 Power Supply, which regulates the speed of the two large cooling fans. When these fans do not come on it could be due to either one of these assemblies. This procedure will help to determine which one is the cause.

1. Remove the AC power cord and then remove the instrument cover. Refer to Chapter 20, "Assembly Replacement Procedures," in this manual.
2. Plug the AC power cord back into the instrument and turn it on.
3. If either of the fans (B1 or B2) are not spinning, verify that the FAN control voltage is correct by measuring the DC voltage at TP4 on the A7 Midplane board, as seen in Figure 2-9.

   If the voltage at TP4 measures at least +7 VDC, proceed to next step.

   If the voltage at TP4 does not measure at least +7 VDC, replace the A6 Power Supply assembly.

Figure 2-9 A7 Midplane Board Fan Control Voltages



4. Turn the instrument off and remove the AC power cord from the rear panel of the instrument.
5. Remove the left side chassis outer bracket that the fans are attached to and verify that the wire harness for both fans are securely plugged into the A7 Midplane board and that none of the wires are damaged.

   If there are any disconnected or damaged connections, make the needed repairs and verify the functionality.

   If nothing wrong is found with the wiring harnesses, proceed to the next step.
6. Disconnect both fan wire harnesses from the A7 Midplane board.

7. Reconnect the AC power cord to the instrument and turn it back on. When the display shows the choice to either boot Microsoft Windows or to run the Instrument Image Recovery System press the front panel up or down key to stop the instrument from going any farther in the boot up process.

CAUTION

Extreme caution needs to be taken when making the following fan control voltage measurements, as it would be very easy to accidentally short the control lines being measured to the chassis ground when probing them, which could cause further damage to the instrument. To help avoid this, use a probe that is insulated up to the tip.

8. Use a multimeter to measure the DC voltages from pin #1 and pin #3 of both J30 and J31 to chassis ground, as seen in Figure 2-10.

Figure 2-10 Fan Power Connector Locations

NOTE

When the instrument is first turned on the voltage level measured should be at the maximum level that the fans would expect to see.

Table 2-1 Expected DC Voltage Levels

Connector	Pin #	Referenced To	Expected DC Voltage
J30	1	Chassis	~+8 VDC
J30	3	Chassis	~0 VDC
J31	1	Chassis	~+8 VDC
J31	3	Chassis	~0 VDC

If all the DC voltage measurements match the expected values shown in Table 2-1, replace the fans that are not working.

If all the DC voltage measurements do not match the expected values, replace the A7 Midplane board.

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 instrument is turning on, as evidenced by the green Power On LED on the front panel turning on as well as the instrument fans. If this instrument is not turning on, refer to the “Instrument Does Not Turn On” section in this chapter before proceeding.

1. Turn the instrument on and connect an external monitor the rear panel VGA port or DisplayPort connector.

   Does the external monitor display the correct information?

   If yes:

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

   If no:

   Proceed to the next step.

2. Remove the AC power cord and the instrument cover. Refer to Chapter 20, “Assembly Replacement Procedures,” in this manual.

3. Reconnect the AC power cord and turn the instrument on.

4. Referring to Figure 2-11 and Figure 2-12, verify that all the power supply voltage LEDs along both sides of the A7 Midplane board are on. If there are any questions as to whether a power supply is at the correct level, see the “A6 Power Supply” section in Chapter 14, “Power Supply and Cooling Fans,” of this manual.

   Are all the power supply LEDs on?

   If yes:

   Verify that ribbon cable W1 is undamaged and properly connected from the A7 Midplane board to the A1A5 Front Panel Controller board. If there is nothing wrong with W1, replace the A4 System Processor assembly.

   If no:

   Replace the A6 Power Supply assembly.

Figure 2-11 A7 Midplane Board Power Supply LEDs - Rear

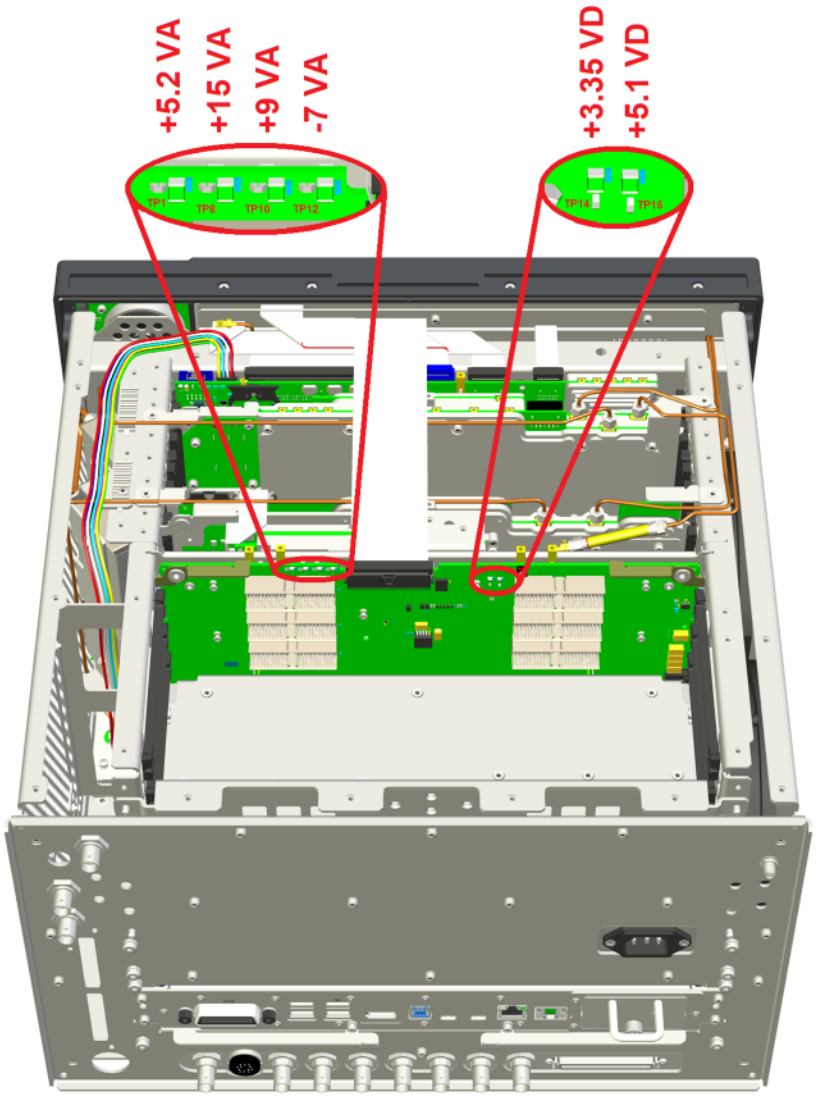
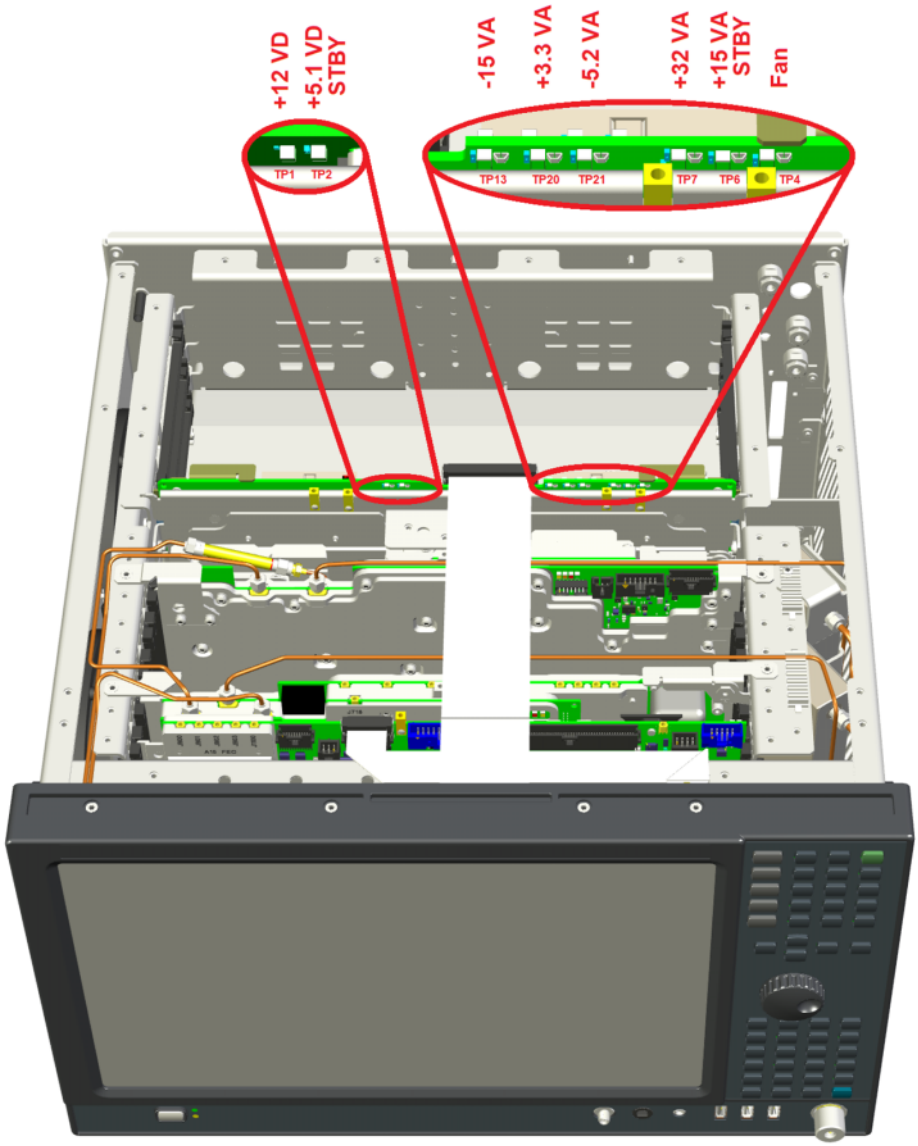


Figure 2-12 A7 Midplane Board Power Supply LEDs - Front



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 20, “Assembly Replacement Procedures”, on page 447 in this manual.
2. Remove the Top Brace. Refer to Chapter 20, “Assembly Replacement Procedures”, on page 447 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 both sides of the A7 Midplane board. See the “Power Supply Verification” section in Chapter 5, “First-Look Troubleshooting.”

   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 "Keysight Recovery System"?

If yes:

Run the Instrument Recovery System by referring to the "Instrument Image Recovery System" in Chapter 13, "System Processor and Disk Drive.". 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.

It is also assumed that there is a normal video signal at the rear panel DisplayPort. 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, use the following procedure to determine the most likely cause of the blank display.

1. Turn the instrument on and allow it a few minutes to complete its power on process.
2. Shine a bright light onto the blank display.

   Can the instrument application be seen at all when the light is directed on the display?

   If yes:

   Proceed to the "Display Backlight Is Not Working" section in this chapter.

   If no:

   Proceed to the next step.
3. Check the video signal path connections for any irregularities from the video controller on the A4 Processor assembly to the A1A3 Touch Screen Display:

   A4 Processor assembly to A7 Midplane board

   A7 Midplane board to the A1A5 Front Panel Controller board via ribbon cable W1

   A1A5 Front Panel Controller board to A1A3 Touch Screen Display via flex-circuit A1W1

   If all these connections are properly made and none of the cables are damaged proceed to the next step
4. At this point, the most likely cause for a video problem is the A4 System Processor assembly; however, it could be the result of a defective Touch Screen Display.

Display Backlight Is Not Working

This section is intended to troubleshoot a display backlight issue that would cause a functioning instrument display to be blank. It is assumed that it has already been verified that the instrument application can be seen on the blank display with the use of a bright light pointed at the display, indicating that the display is able to display information, only the backlight is not on. This procedure will assist in determining why the backlight is not on.

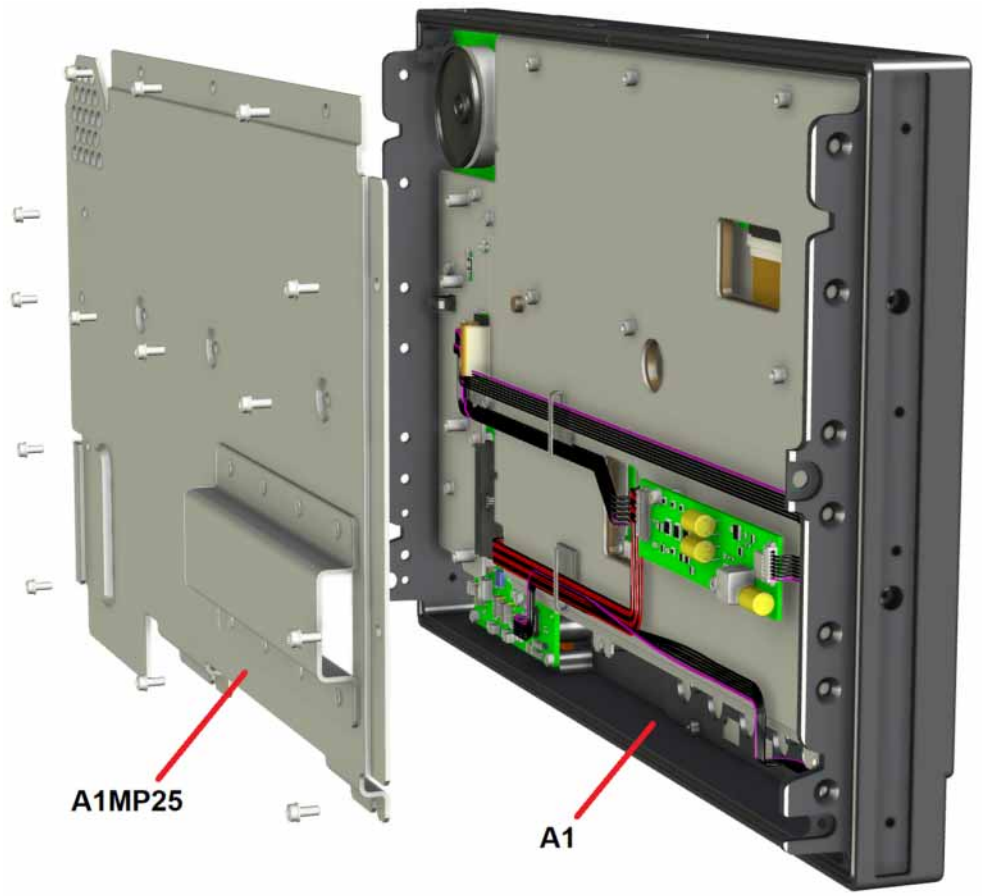
NOTE While there is a backlight intensity adjustment in the user settings, it does not work, as there is no control line for this going to the A1A4 DC to DC Converter backlight control board.

Beginning with serial prefix MY/SG/US6442 instruments no longer have a separate A1A4 DC to DC converter to power the display backlight, rather, this functionality is built into the newer A1A3 Touch Screen Displays. Because of this there are two different procedures to troubleshoot a display backlight that is not working. Follow the procedure below for the revision of the instrument that is being diagnosed.

All Instruments

1. Remove the AC power cord and the instrument cover. Refer to Chapter 20, “Assembly Replacement Procedures,” in this manual.
2. Remove the A1 Front Panel assembly along with the connecting ribbon cables. Refer to Chapter 20, “Assembly Replacement Procedures,” in this manual.
3. Remove the A1MP25 Front Panel Shield from the A1 Front Panel assembly, as seen in Figure 2-13.

Figure 2-13 Front Panel Shield Removal



4. Reconnect the W1 ribbon cable from the A7 Midplane board to the A1A5 Front Panel Controller board J11.
5. Reconnect the AC power cord and turn the instrument on.

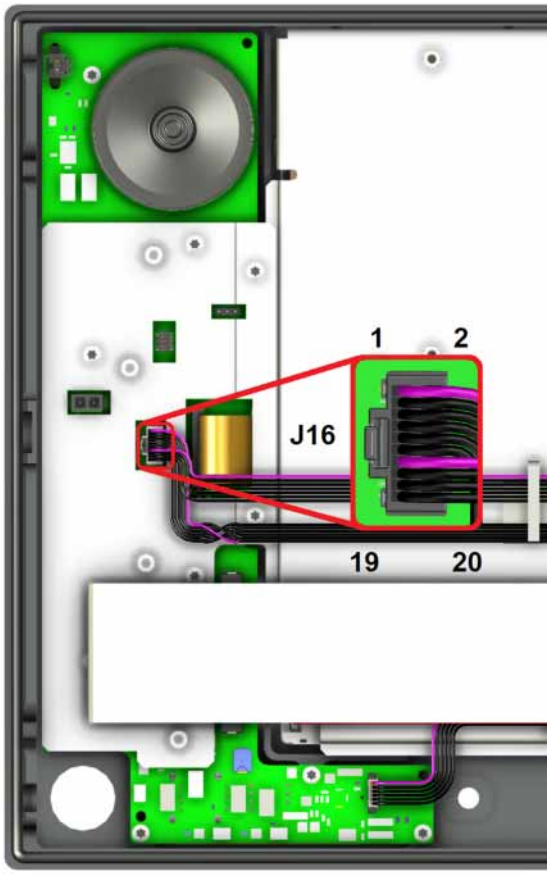
Instruments without an A1A4 DC to DC Converter Board

1. Referring to Figure 2-14, measure the DC voltage from pins #13 and 15 of J16 to ground. This is the power supply for the display backlight.

   If the DC voltage on pins #13 and 15 both measure approximately +11 VDC, proceed to the next step.

   If the DC voltage on pins #13 and 15 do not both measure approximately +11 VDC, replace the A1A5 Front Panel Controller board.

Figure 2-14 Backlight Control Voltage Verification



2. Referring to Figure 2-14, measure the DC voltage from pin #19 of J16 to ground. This is the backlight enable control line.

   If the DC voltage on pin #19 measures at least +3 VDC, proceed to the next step.

   If the DC voltage on pin #19 does not measure at least +3 VDC, replace the A1A5 Front Panel Controller board.

3. Referring to Figure 2-14, measure the DC voltage from pin #20 of J16 to ground. This is the backlight intensity control line.

If the DC voltage on pin #20 measures at least +0.5 VDC, and yet the display cannot be seen, inspect wire harness A1W3 for any damage and replace it if necessary. If the wire harness is fine, replace the A1A3 Touch Screen Display.

If the DC voltage on pin #20 does not measure at least +0.5 VDC, replace the A1A5 Front Panel Controller board.

Instruments with an A1A4 DC to DC Converter Board

1. Referring to Figure 2-15, measure the DC voltage from pin #1 of J1 on the A1A4 DC to DC Converter board to ground. This is the power supply for the backlight converter board.

   Does the DC voltage from pin #1 to ground measure approximately +11 VDC?

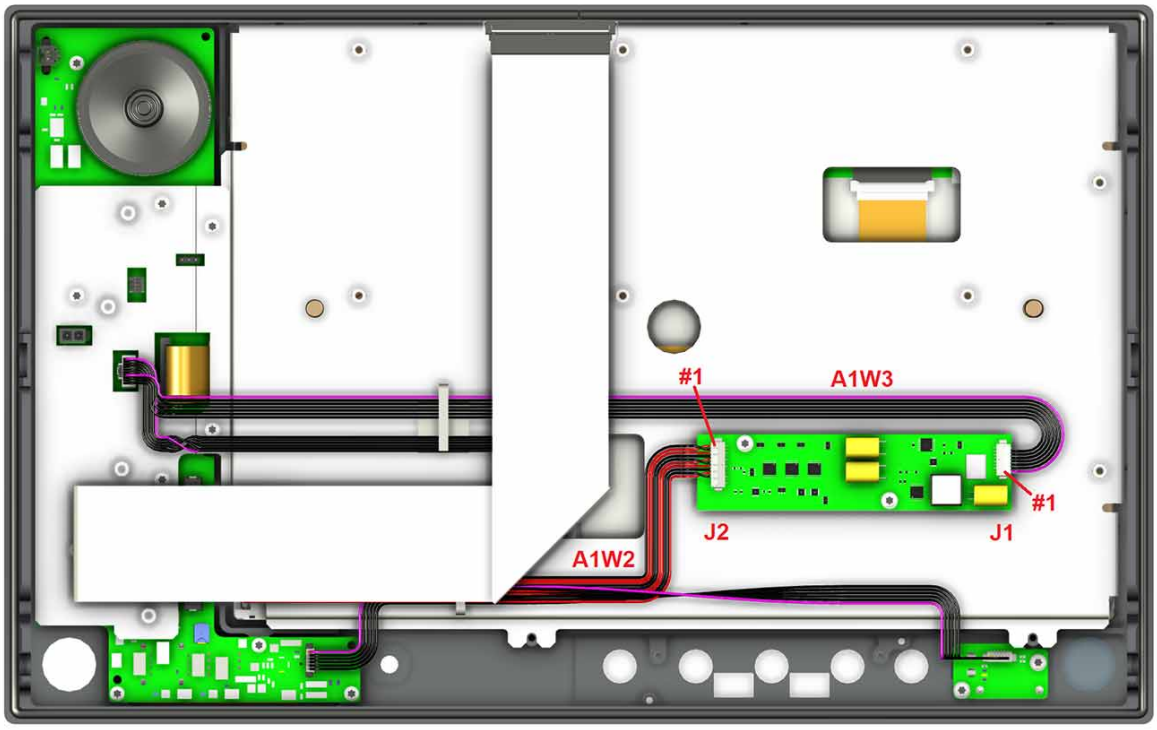
   If yes:

   Proceed to the next step.

   If no:

   Inspect wire harness A1W2 for any damage and replace it if necessary. If the wire harness is fine, replace the A1A5 Front Panel Controller board.

Figure 2-15 Backlight Control Voltage Verification



2. Referring to Figure 2-15, measure the DC voltage from pin #7 of J1 on the A1A4 DC to DC Converter board to ground. This is the backlight enable control line for the backlight converter board.

   Does the DC voltage from pin #7 to ground measure at least +3 VDC?

   If yes:

   Proceed to the next step.

If no:

Inspect wire harness A1W2 for any damage and replace it if necessary. If the wire harness is fine, replace the A1A5 Front Panel Controller board.

3. Referring to Figure 2-15, measure the DC voltage from pin #2 of J2 on the A1A4 DC to DC Converter board to ground. This is one of the backlight converter board output control voltages to drive the LED backlight of the display.

   Does the DC voltage from pin #2 to ground measure at least +25 VDC?

   If yes:

   Replace the A1A3 Touch Screen Display.

   If no:

   Replace the A1A4 DC to DC Converter board.

Initializations Did Not Complete

During the initialization of the UXA Signal Analyzer 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 Hardware (3 of 7)
- Initializing Data Services (4 of 7)
- Initializing SCPI Services (5 of 7)
- Initializing Message 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

If the instrument fails an initial alignment at boot up, see the "When an Alignment Fails" section in Chapter 4, "Internal Alignments," for assistance in determining the cause.

Error Messages

If there are any error messages displayed at the bottom of the instrument screen once it completes the boot up process, refer to the X-Series Instrument Messages Guide for a description of the message.

X-Series Instrument Messages Guide

Signal Level Verification

Signal Level Problem with Input Frequencies < 3.6 GHz

Measure the 50 MHz RF calibrator signal level by pressing **Input/Output**, **RF Calibrator**, **50 MHz**. Now press **Freq** and input **50 MHz**. Press **SPAN**, **1 MHz**, and **Peak Search**. If the analyzer is functioning correctly in low band, the 50 MHz calibrator level should be –25 dBm ± 2 dB. See the figure below.

Is the signal level correct?

If yes:

The analyzer low band path is functioning properly at least at 50 MHz.

If no:

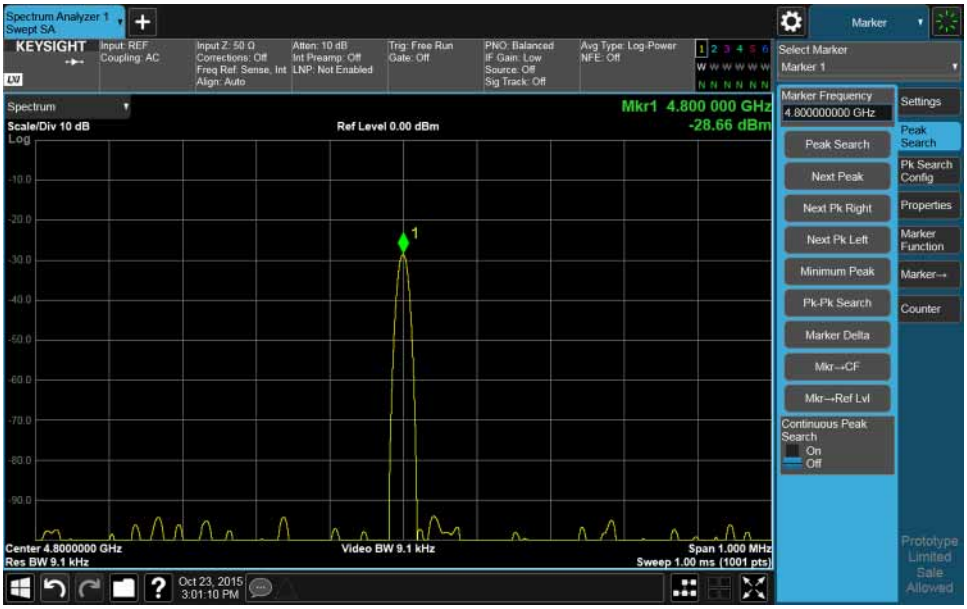
Refer to Chapter 7, “RF Section (RF/Microwave)” in this manual.

NOTE

It is possible that other input frequencies < 3.6 GHz could have an amplitude problem even though the 50 MHz calibrator is within tolerance. Using the internal RF calibrator provides a quick check of the low band path.

Signal Level Problem with Input Frequencies > 3.6 GHz

Measure the 4.8 GHz RF calibrator signal level by pressing **Input/Output**, **RF Calibrator**, **4.8 GHz**. Now press **Freq** and input **4.8 GHz**. Press **SPAN**, **1 MHz**, and **Peak Search**. If the analyzer is functioning correctly in high band, the 4.8 GHz calibrator level should be –28 dBm ± 2 dB. See the figure below.



Is the signal level correct?

If yes:

The analyzer high band path is functioning properly at least at 4.8 GHz.

If no:

Press **Amplitude**, **Y-Scale**, **Preselector Center** to manually center the preselector. Refer to Chapter 7, “RF Section (RF/Microwave)” in this manual.

NOTE

It is possible that other input frequencies > 3.6 GHz could have an amplitude problem even though the 4.8 GHz calibrator is within tolerance. Using the internal RF calibrator provides a quick check of the high band path.

3 Instrument Information and Calibration Data

What You Will Find in This Chapter

This chapter provides information on the following:

Instrument Model Number on page 70

Instrument Serial Number on page 71

Instrument Licenses on page 72

License Installation on page 73

Instrument Calibration Database on page 74

Alignment Data Wizard on page 74

Instrument Model Number

The instrument model number is programmed at the factory into secure memory on the A7 Midplane board. The instrument model number is part of the instrument HostID, which is what all instrument licenses are validated against. So, if the model number is not correct, none of the instrument's licensed functionality will be enabled when the instrument application validates licenses at runtime.

When the A7 Midplane board is replaced both the model and serial number will need to be reprogrammed into the instrument. This is done with the use of the N7814A X-Series Signal Analyzer Calibration Application software. If this information is missing from the instrument when the software makes first contact with it, the software will allow programming of the missing information.

NOTE The N7814A software will only allow the programming of this information into the instrument once. If incorrect information is entered and programmed into the instrument, factory support will need to be contacted to clear the model and serial number from the instrument so that the correct information can then be entered.

The model number of the instrument can be found on the instrument in three places. It is on the front panel nameplate, the rear panel label, and on the System Information screen in the instrument application software, as seen in Figure 3-1.

Figure 3-1 System Information Screen

Keysight Technologies	
Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2023
Instrument S/W Revision	A.33.05
Revision Date	8/4/2022 3:29:42 PM
Computer System	Windows 10
Computer Name	K-N9040B-21234
IP Address	141.121.100.208
IPv6 Address	
Link-Local IPv6 Address	fe80::f081:1c0c:45a0:1f0a%6
Host ID	N9040B,US60421234
mDNS Enabled	Yes
mDNS Host Name	K-N9042B-21234
mDNS Service Name	Keysight N9040B Signal Analyzer - US60421234

Instrument Serial Number

The instrument serial number is programmed at the factory into secure memory on the A7 Midplane board. The instrument serial number is part of the instrument HostID, which is what all instrument licenses are validated against. So, if the serial number is not correct, none of the instrument's licensed functionality will be enabled when the instrument application validates licenses at runtime.

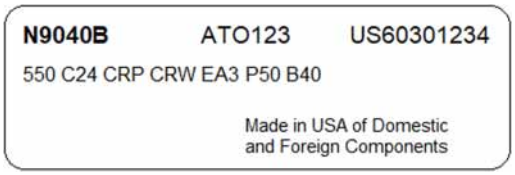
When the A7 Midplane board is replaced both the model and serial number will need to be reprogrammed into the instrument. This is done with the use of the N7814A X-Series Signal Analyzer Calibration Application software. If this information is missing from the instrument when the software makes first contact with it, the software will allow programming of the missing information.

NOTE

The N7814A software will only allow the programming of this information into the instrument once. If incorrect information is entered and programmed into the instrument, factory support will need to be contacted to clear the model and serial number from the instrument so that the correct information can then be entered.

The instrument serial number is made up of three parts, (1) the country of origin, (2) the serial prefix, (3) sequential serial number, as shown in Figure 3-2.

Figure 3-2 Example Serial Number Label



The first two letters designate the country that the instrument was manufactured in:

MY = Malaysia

SG = Singapore

US = United States

The next four numbers are the serial prefix. This is used to designate different factory production runs.

The last four digits are the sequential serial number for the instrument. This number is typically reset whenever the serial prefix changes.

The combination of the country of origin, serial prefix, and sequential serial number provides a unique serial number identifier for each instrument produced.

The serial number of the instrument can be found on the instrument in two places. It is on the rear panel label, and on the System Information screen in the instrument application software, as seen in Figure 3-1.

Instrument Licenses

Instrument licenses are what enable both the standard and option functionality in the instrument, as listed in Table 1-1. These licenses are stored in two places in the instrument, on the A5 disk drive, and in secure memory on the A7 Midplane board as a backup. If one of these assemblies is replaced, the instrument license service will automatically copy all validated licenses from the remaining assembly to the replacement assembly when the instrument powers up.

When an instrument is powered on, the license service validates the licenses it has against the instrument Host ID, which is made up of the instrument model number and serial number separated by a comma, as seen in Figure 3-1. If the instrument model or serial number is not correct for some reason, the Host ID will also not be correct, and all licenses will not be validated. This will happen when the A7 Midplane board is replaced, which will require the instrument model and serial number be programmed into it.

Installed licenses can be viewed from the instrument front panel by selecting System, Show System. They can also be viewed using the Keysight License Manager either built into the instrument or remotely. This can be run from the instrument by selecting System, Licensing, License Manager.

License files are saved on the A5 disk drive at the following location:

C:\Program Files\Agilent\Licensing

The file extension for these files is .lic and they are setup to be opened with notepad for viewing in the instrument. However, most of these files are hidden, and you would need to select to show hidden files to see them. The licenses that are hidden are non-removable.

CAUTION While the license files can be opened with notepad, there is no valid reason to edit these files, as doing so could easily render them invalid.

As previously mentioned, most all licenses in the instrument are non-removable, except for measurement applications. If for some reason a non-removable license needs to be removed from an instrument, Keysight factory support will need to be contacted for assistance.

License Installation

The typical way to install a license into an instrument is to place the license file in the root directly of a USB memory device and then insert the device into one of the USB ports of the instrument. Within a few seconds the instrument license service will scan the drive for license files and install ones it finds that are valid for the instrument. After installing a new license, the instrument application will need to be restarted for the licensed functionality to be activated.

Licenses can also be installed by dropping them into the C:\Program Files\Agilent\Licensing folder.

Instrument Calibration Database

Preserving the instrument calibration database when servicing an instrument should be considered a very high priority. Without doing so many needless hours could be spent running adjustments to recreate this database.

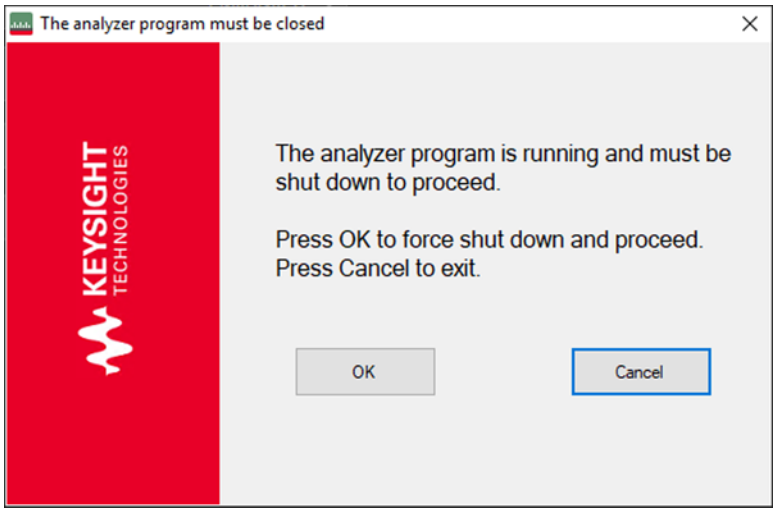
The instrument calibration data is saved in a MariaDB database on the A5 Solid State Drive in the AlignmentDataStorage folder on the E:\ partition. However, manually copying, moving, or backing up these files is not recommended or supported.

There is an Alignment Data Wizard in the instrument that is designed to handle the backing up and restoring of the calibration database. There is also dedicated memory in the A4 Processor assembly for calibration database backups. If a backup is needed to be saved to a location outside of the instrument, the wizard will also allow for that.

Alignment Data Wizard

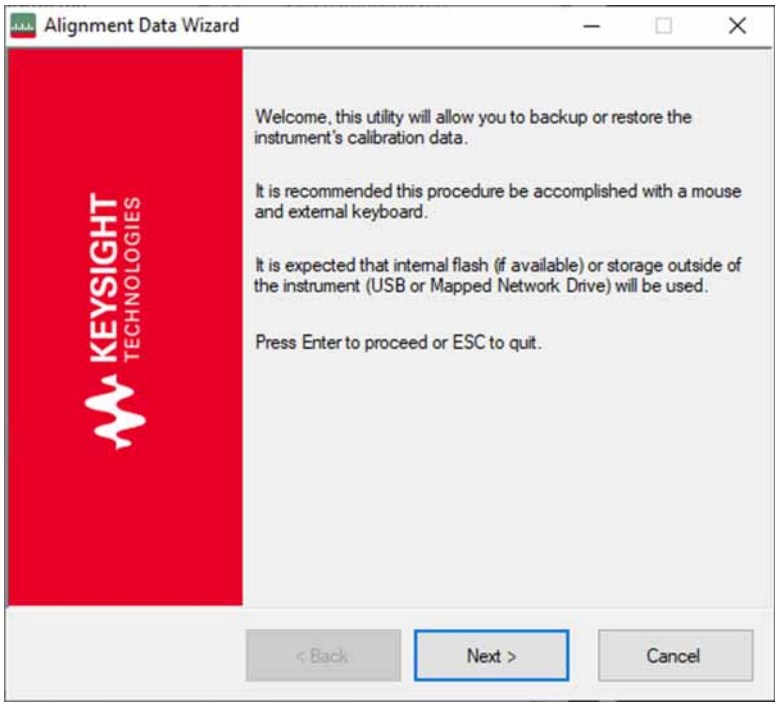
1. To run the Alignment Data Wizard, select **System**, **Alignments**, **Backup / Restore Align Data**...
2. When the Alignment Data Wizard starts, and the instrument application is running, you will see a prompt notifying you that it will first need to shut down the instrument application before it can run, as seen in Figure 3-3. This is so that the instrument application does not try to access the calibration database while it is being backed up or restored. Select **OK** to continue.

Figure 3-3 Alignment Data Wizard - Application Shutdown



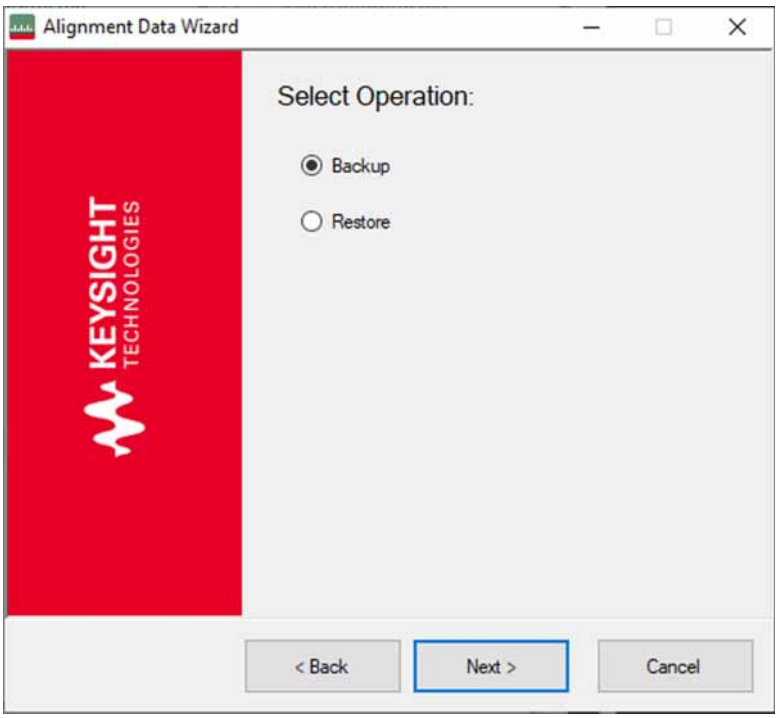
3. Once the instrument application shuts down, the wizard will continue with the prompt seen in Figure 3-4. Select **Next**.

Figure 3-4 Alignment Data Wizard - Welcome



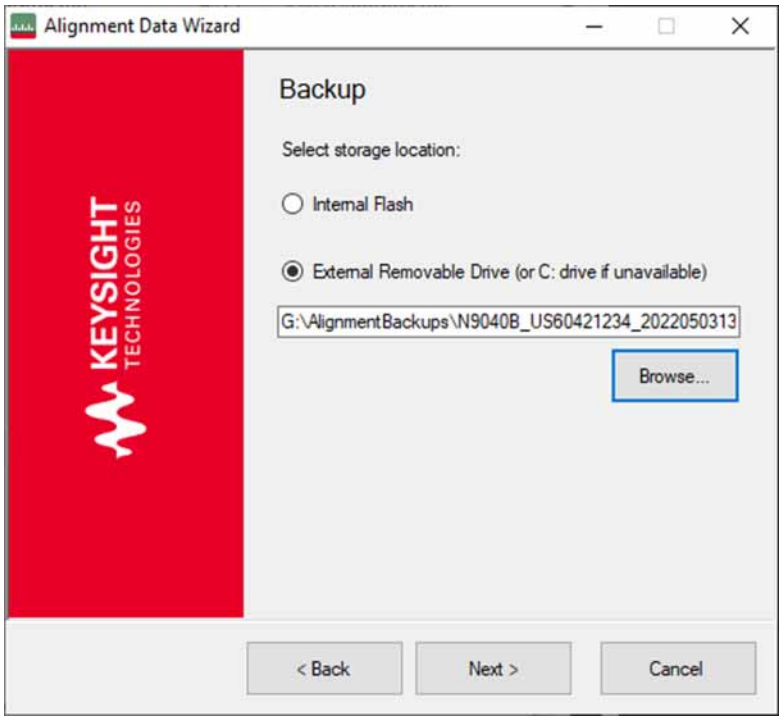
4. You will then be presented with a selection to either Backup or Restore the calibration data, as seen in Figure 3-5. For this exercise select **Backup** and **Next**.

Figure 3-5 Alignment Data Wizard - Select Operation



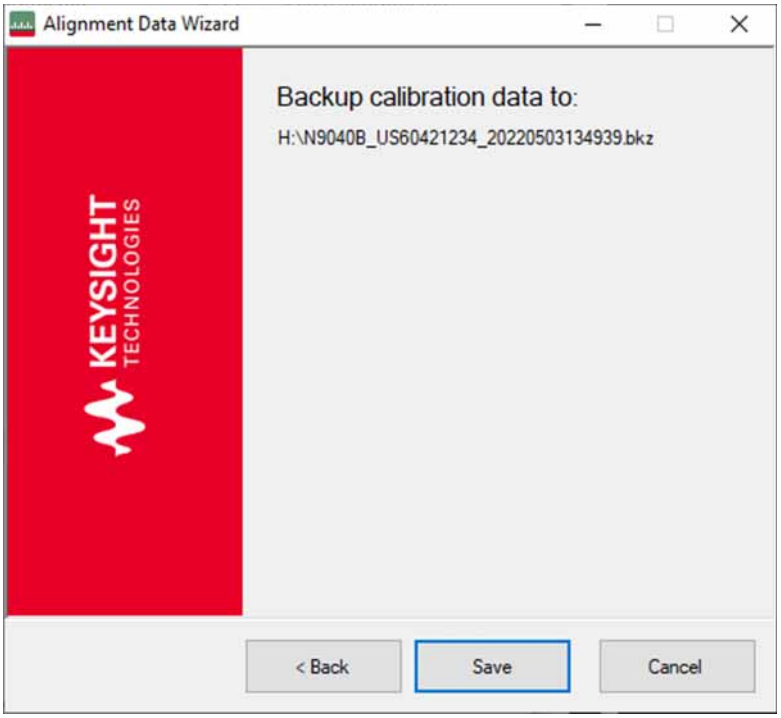
5. You will then need to select a location to backup the calibration database to, as seen in Figure 3-6. If you select Internal Flash, it will backup the database to the dedicated memory on the A4 Processor assembly. If you select External Removable Drive you can then select Browse to select any available location. For this exercise, insert a USB memory device into one of the instrument front panel USB ports, select **External Removable Drive**, Browse to the drive, and select **Save**.

Figure 3-6 Alignment Data Wizard - Backup Location



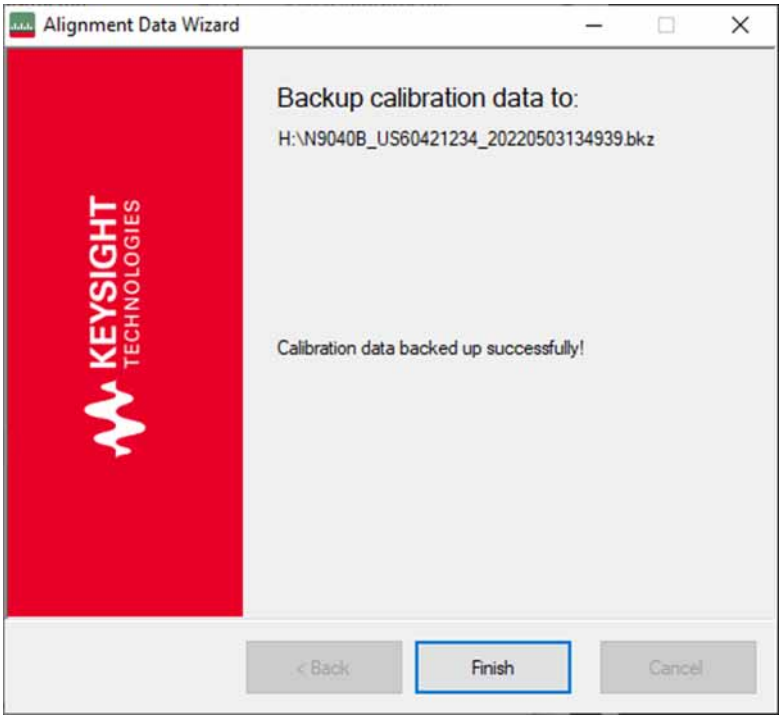
6. You will then need to confirm the Backup operation by selecting **Save**, as seen in Figure 3-7.

Figure 3-7 Alignment Data Wizard - Confirm Save



7. Once the backup of the database is complete select **Finish**, as seen in Figure 3-8.

Figure 3-8 Alignment Data Wizard - Completed



NOTE

If you need to run the Alignment Data Wizard but the instrument application will not run, open windows explorer and navigate to the following folder:

C:\Program Files\Agilent\SignalAnalysis\Infrastructure

and run the following program:

BackupRestoreAlignDataWizard.exe

The calibration database process will create two files, the database backup (.bkz file) and a configuration file (.xml file) that contains current instrument configuration information. Be sure to keep these two files together, as they will both be needed if you want to ever restore the database.

The process for restoring a calibration database is very similar, just follow the on-screen prompts for that.

4 Internal Alignments

What You Will Find in This Chapter

This chapter provides information on the following:

Internal Alignments Overview on page 80

When an Alignment Fails on page 81

Multiple Alignment Failures on page 82

Auto Alignment Descriptions on page 83

Internal Alignments Overview

The instrument has a built-in auto alignment system that is used to keep the accuracy of the instrument within the published specifications. These alignments compensate for circuit drift due to time and temperature changes.

NOTE

While this instrument defaults to the Light setting for Auto Align, the instrument is only guaranteed to meet all its published specifications when it is set to Normal (Auto).

There are approximately 50 alignments that the instrument can perform, depending on installed hardware options. When most alignments are run the results are recorded in the alignment history file, which can be used for diagnostic and troubleshooting purposes.

When running alignment be sure that:

1. There is no RF power applied to the front panel RF input.
2. That the instrument is not using an external frequency reference.

At instrument power on, an initial alignment is automatically performed. It can also be manually run by pressing **System**, **Alignments**, **Align Now**, **Align Now All**.

Each of the alignments has a predetermined time and temperature interval at which they will be run. However, the **Auto Align** setting can either disable them or extend the time and temperature intervals at which they run.

When an Alignment Fails

The first thing that should be done before troubleshooting an alignment failure is to verify that all the instrument power supplies are at the correct level. See the **"Power Supply Verification"** section in **Chapter 5, "First-Look Troubleshooting,"** to verify that all the instrument power supplies are on.

When an alignment fails you can select the alignment message at the bottom of the instrument screen to see the current condition or history, or select the file folder at the bottom of the instrument screen, then File Explorer and navigate to alignment history file at:

E:\AlignDataStorage\AlignmentHistory.txt

Open the file with Notepad and search the file for the word "FAIL". For the most recent alignment history search up from the bottom of the file.

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 saved. For example, the Mechanical Attenuator Algorithm measures and displays all the attenuator step values. In this case, you can view which steps fail, and by how much. Then based on the input attenuator drawing in the 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 A15 Front End Controller or deduce from the attenuator steps that fail, which attenuator is faulty.

Multiple Alignment Failures

Finding the cause of multiple alignment failures can be difficult at times. If this is the case, try using the following procedure:

1. Turn auto alignments of by pressing **System**, **Alignments**, **Auto Align**, **Off**.
2. Default the alignment data by pressing **System**, **Alignments**, **Restore Alignment Defaults**.
3. Run all alignments by pressing **Align Now**, **Align Now All**.
4. Open the alignment history file and focus on the first failure for the alignment that was just run.

NOTE

The limits for many of the alignments are such that certain alignments may never fail, even though the returned results are not as expected. So, when looking at the alignment history for complicated failures it will often help to also look at alignments that passed to see if the data for certain conditions might give further indication of a failure trend.

Auto Alignment Descriptions

The following information can be used to understand the workings of the internal alignments. It can also be used when there are multiple alignment failures to see what common settings or signal paths there may be between the failures.

Table 4-1 Initial Alignments

Alignment Description	Most Probable Hardware Failure	Related Hardware
DDS Synth Fast Port Skew Training	A14 Synthesizer	
DDS Synthesizer YTO Pretune DAC	A14 Synthesizer	A16 Reference board is not providing correct 100 MHz or 4.8 GHz signals. A20 YTO output power low.
VCXO Loop Bandwidth Adjusts gain of the PLL loop amplifier. Uses the 10 MHz internal reference	A16 Reference	
Second LO Loop Bandwidth	A2 Analog IF	
Second LO Saw Peak	A16 Reference	
Ext Mix LO Alignment Algorithm		
AIF 255 ADC Setup Alignment Algorithm	Wide Band Analog IF or Wideband Digital IF.	
AIF 255 ADC Clock Alignment Algorithm		
AIF 255 Flex Circuit Cable Test Algorithm	W56 or W57 Flex circuit cable	
Dither Level Algorithm	A3 Digital IF	
LO Nulling Simplex MB Alignment Algorithm	A13 Front End, Uses narrow BW switched filter.	
LO Nulling Simplex WB Alignment Algorithm	A13 Front End, Uses wide BW switched filter.	
AIF LC Wide Prefilter Passband Tuning Algorithm	A2 Analog IF	
AIF LC Wide Prefilter Passband Fine Tuning Algorithm	A2 Analog IF	
AIF LC Narrow Prefilter Passband Tuning Algorithm	A2 Analog IF	
AIF LC Narrow Prefilter Passband Fine Tuning Algorithm	A2 Analog IF	
AIF Xtal Wide Prefilter Passband Tuning Algorithm	A2 Analog IF	A3 Digital IF or A16 Reference
AIF Xtal Narrow Prefilter Passband Tuning Algorithm	A2 Analog IF	

Table 4-1 Initial Alignments

Alignment Description	Most Probable Hardware Failure	Related Hardware
AIF Variable Gain Algorithm	A2 Analog IF	
AIF Step Gain Algorithm	A2 Analog IF	
LO Power Alignment Algorithm	A13 Front End Assembly or A15 Front End Controller	
AIF Variable Attenuator Algorithm	A2 Analog IF	
Mechanical Attenuator Algorithm	A9 and A10 RF Input Attenuators	50 MHz calibrator on A16 Reference
Electrical Attenuator Algorithm	A13 Front End	50 MHz calibrator on A16 Reference. Control signals from A15 Front End Controller
LO Nulling Full Alignment Algorithm	A13 Front End	
LO Nulling Min Alignment Algorithm	A13 Front End	
LO Nulling Full MB Alignment Algorithm	A13 Front End	
LO Nulling Min MB Alignment Algorithm	A13 Front End	
LO Nulling Full WB Alignment Algorithm	A13 Front End	
LO Nulling Min WB Alignment Algorithm	A13 Front End	
Narrow Band Step Cal Adjustment Alignment Algorithm	Alignment signal originates on A3 D-IF, then goes through A16 Reference, through A13 Front End, through A2 Analog IF, and back to A3 Digital IF. If Option B1X present, A25 WB A-IF switches calibrator signal to A16 Reference.	
Narrow Band Step Cal Alignment Algorithm		
DIF 40 Step Cal Adjustment Alignment Algorithm	Since this is wide band alignment done for 40 MHz BW signal path, A2 Analog IF is not included in the signal path.	
DIF 40 Variable Attenuator Algorithm	A3 Digital IF	
AIF 255 Variable Attenuator Alignment Algorithm	A21 Wide band A-IF	

Table 4-1 Initial Alignments

Alignment Description	Most Probable Hardware Failure	Related Hardware
AIF 510 Variable Attenuator Alignment Algorithm		
DIF 40 Step Cal Alignment Algorithm	see above	
DIF 40 Highband Phase Removal Algorithm	see above	
DIF 25 Highband Phase Removal Algorithm	A3 Digital IF	
AIF 255 RF Band 0 Chirp Cal Adjustment Algorithm	A21 Wideband Analog IF Uses 1.2 GHz internal cal signal (not viewable on screen), and it is possible an external signal at the RF input will interfere. Assure no external signals connected. Band 0 is < 3.6 GHz.	
AIF 255 RF Band 0 Chirp Cal Alignment Algorithm	A21 Wideband Analog IF	
AIF 500 RF Band 0 Chirp Cal Adjustment Algorithm	A21 Wideband Analog IF Could be either WB AIF assemblies. See if AIF 255 Chirp Cal fails also. Uses 1.2 GHz internal cal signal (not viewable on screen), and it is possible an external signal at the RF input will interfere. Assure no external signals connected. Band 0 is < 3.6 GHz	
AIF 500 RF Band 0 Chirp Cal Alignment Algorithm		
AIF 500 Phase Alignment Algorithm		
AIF 255 UW Band 1 Chirp Cal Adjustment Algorithm	A21 Wideband Analog IF Uses 4.8 GHz internal cal signal. Assure 4.8 GHz calibrator is present by viewing the calibrator on screen. Band 1 is > 3.6 GHz, high band path.	

Table 4-1 Initial Alignments

Alignment Description	Most Probable Hardware Failure	Related Hardware
AIF 255 UW Band 1 Chirp Cal Alignment Algorithm	A21 Wideband Analog IF	
AIF 500 UW Band 1 Chirp Cal Adjustment Algorithm	A21 Wideband Analog IF Could be either WB AIF assemblies. See if AIF 510 Chirp Cal fails also. Uses 1.2 GHz internal cal signal (not viewable on screen) and it is possible an external signal at the RF input will interfere. Assure no external signals connected. Band 1 is > 3.6 GHz, high band path.	
AIF 500 UW Band 1 Chirp Cal Alignment Algorithm		
E Cal Path System Gain Algorithm	Signal path from A13 Front End to A3 Digital IF	A16 Reference may not be providing 50 MHz E-Cal
Low Band Nominal Path System Gain Algorithm	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators
Low Band Preamp Path System Gain Algorithm	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators
Low Band Elec Atten Path System Gain Algorithm	A13 Front End	50 MHz calibrator on A16 Reference. A9 and A10 Input attenuators
Preselector Two Point Tuning Algorithm	A12 YTF Preselector or A15 Front End Controller or All Low Band	A13 Front End
High Band Nominal Path System Gain Algorithm	All Front End components	4800 MHz calibrator on A16 Reference

Table 4-1 Initial Alignments

Alignment Description	Most Probable Hardware Failure	Related Hardware
Low Noise Path System Gain Algorithm)	SW3	4800 MHz calibrator on A16 Reference A15 Front End Controller
High Band Preamp Path System Gain Algorithm	A11 Low Band Switch	4800 MHz calibrator on A16 Reference A9 and A10 Input attenuators A15 Front End Controller
High Band Preselector Bypass Path System Gain Algorithm	SW 1 and SW 2, coax switches and cabling	A15 Front End Controller 4800 MHz calibrator on A16 Reference A9 and A10 Input attenuators
High Band Preselector Bypass Preamp Path System Gain Algorithm	A11 Low Band Switch Preselector Bypass Switch(s)	
Burst Carrier Trigger Curve Fit Alignment Algorithm	A2 Analog IF	
DIF 25 Pulse Stretcher Alignment Algorithm	A3 Digital IF	
DIF 40 Pulse Stretcher Alignment Algorithm	A3 Digital IF	
WBDIF Pulse Stretcher Alignment Algorithm	A22 or A23 Wideband Digital IF	

Notes:
NarrowBandIF is the standard 10 MHz IF or the 25 MHz path (B25)
MediumBandIF is the 40 MHz IF path (B40)
WideBandIF is the 255 MHz IF path (B2X)
DualWideBandIF is the 510 MHz IF path (B5X)

5 First-Look Troubleshooting

What You Will Find in This Chapter

This chapter provides information on the following:

Overview on page 90

Front Panel Troubleshooting on page 91

- Overview on page 91
- Initial Configuration Check on page 92
- Mechanical Attenuator Evaluation on page 97
- A12 Yig Tuned Filter Shape Verification on page 100
- µWave Path Functionality on page 102
- Preamplifier Functionality on page 105
- IF Signal Path Isolation on page 108
- IF Flatness Verification on page 110

Power Supply Verification on page 117

Overview

There are many different levels of troubleshooting that can be performed on these instruments. The nature of the failure or issue reported will often dictate how in-depth the troubleshooting needs to be. Access to assemblies and their ports or test points can also limit or dictate what can realistically be measured or verified. However, this chapter will focus on things that can be done to isolate, or at least narrow down the list of possible failed components with minimal troubleshooting effort.

The first section in the chapter, **"Front Panel Troubleshooting"**, will provide direction on gathering information and troubleshooting the instrument without removing any of the covers, using minimal external test equipment.

The second section, **"Power Supply Verification"**, provides information on how to do a quick check of the internal power supplies, which should be the first thing that is done whenever the instrument outer cover is removed.

The troubleshooting information in this chapter is aimed at performance or functional issues with the instrument. If there is a problem with the instrument not turning on, booting up, loading the instrument application software, the display not working, auto alignments failing and such, see **Chapter 2, "Boot Up and Initialization,"** for those issues.

NOTE

The removal of the instrument outer cover, along with various inner sheet panel parts, will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, "Assembly Replacement Procedures."

Front Panel Troubleshooting

Overview

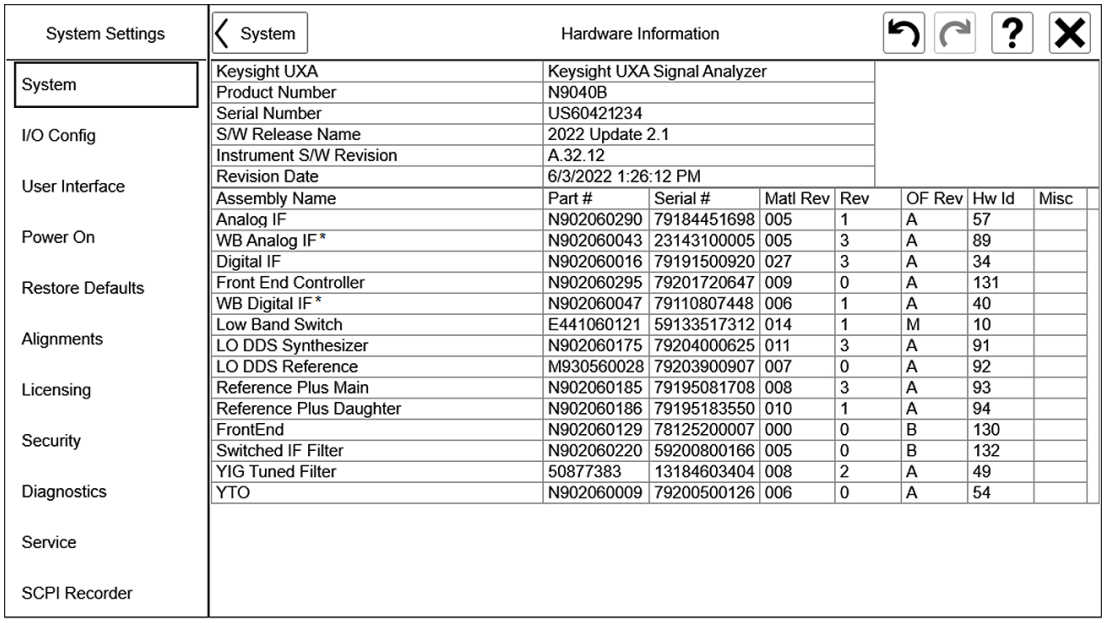
There is much that can be evaluated about the instrument from pressing keys on the front panel, without taking any of the covers off, and without any other test equipment connected to the instrument. The following will be covered in this section:

- Initial Configuration Check
- Mechanical Attenuator Evaluation
- A12 Yig Tuned Filter Shape Verification
- µWave Signal Path Functionality
- Preamplifier Functionality
- IF Signal Path Isolation
- IF Flatness Verification

Initial Configuration Check

The first thing that should be checked when the instrument is not functioning properly is that all the required hardware assemblies in the instrument are being recognized and configured by the instrument software. To do this press **System**, **Show Hardware** and review the list of assemblies that are listed on the Hardware Information screen. The list should include all the assemblies shown in Figure 5-1.

Figure 5-1 Hardware Information Screen Contents



Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2022 Update 2.1
Instrument S/W Revision	A.32.12
Revision Date	6/3/2022 1:26:12 PM

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060290	79184451698	005	1	A	57	
WB Analog IF*	N902060043	23143100005	005	3	A	89	
Digital IF	N902060016	79191500920	027	3	A	34	
Front End Controller	N902060295	79201720647	009	0	A	131	
WB Digital IF*	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	79204000625	011	3	A	91	
LO DDS Reference	M930560028	79203900907	007	0	A	92	
Reference Plus Main	N902060185	79195081708	008	3	A	93	
Reference Plus Daughter	N902060186	79195183550	010	1	A	94	
FrontEnd	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	59200800166	005	0	B	132	
YIG Tuned Filter	50877383	13184603404	008	2	A	49	
YTO	N902060009	79200500126	006	0	A	54	

*Optional Hardware

The only possible exception to the list of installed hardware assemblies would be the optional A21 Wideband Analog IF and the A22/A23 Wideband Digital IF assemblies.

For a definition of the difference assembly names used in the Hardware Information screen as well as dependencies there might be for each assembly, see Table 5-1.

Table 5-1 Hardware Information Definitions and Dependencies

Assembly Name	Reference Designation	Dependant On
Analog IF	A2 25 MHz Analog IF	--
WB Analog IF	A21 Wideband Analog IF	--
Digital IF	A3 40 MHz Digital IF	--
Front End Controller	A15 Front End Controller	--
WB Digital IF	A22/23 Wideband Digital IF	--
Low Band Switch	A11 Band Switch	A15 Front End Controller
LO DDS Synthesizer	A14 DDS LO Synthesizer	--
LO DDS Reference	A14A1 DDS LO Reference	A14 DDS LO Synthesizer
Reference Plus Main	A16 Reference	--
Reference Plus Daughter	A16A1 Reference Daughter	A16 Reference
FrontEnd	A13A1 Downconverter	A15 Front End Controller
Switched IF Filter	A13A2 Switched IF Filter	A15 Front End Controller
YIG Tuned Filter	A12 Yig Tuned Filter	A15 Front End Controller
YTO	A21 Yig Tuned Oscillator	A14 DDS LO Synthesizer

If an assembly is dependent on another assembly, it will not show up on the Hardware Information screen if the assembly it is dependent on is not listed. For example: The A12 Yig Tuned Filter is dependent on the A15 Front End Controller. If the A12 Yig Tuned Filter does not show up in the list, be sure to verify that the A15 Front End Controller is on the list before assuming that the A12 Yig Tuned Filter has the problem.

If any hardware assembly is missing from the list, that will be a good place to start when isolating a problem. See the chapter in this manual that relates to that assembly for more information on determining why it is not being identified.

The instrument System Information screen should also be evaluated. It includes a wide variety of information about the instrument, including the model and serial number the instrument thinks it is, as well as the firmware version, IP address, options installed, etc... Access this screen by pressing **System**, **Show System**. This screen will resemble Figure 5-2.

Figure 5-2 System Information Screen Contents

System Settings

- System
- I/O Config
- User Interface
- Power On
- Restore Defaults
- Alignments
- Licensing
- Security
- Diagnostics
- Service
- SCPI Recorder

System | System Information

Keysight Technologies	
Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2023
Instrument S/W Revision	A.33.03
Revision Date	7/20/2022 5:25:36 PM
Computer System	Windows 10
Computer Name	K-N9040B-21234
IP Address	141.121.100.208
IPv6 Address	
Link-Local IPv6 Address	fe80::f501:1c3c:40a0:1f0a%6
Host ID	N9040B,US60421234
mDNS Enabled	Yes
mDNS Host Name	K-N9040B-21234
mDNS Service Name	Keysight N9040B Signal Analyzer - US60421234

Option	Name / Description	Option Version
N9040B-MTU	Multi-touch user interface	
N9040B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB	
N9040B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS	
N6141EM0E_1FP	EMC Software for X-Series	1.3.63020.31343
N9040B_550	Frequency Range, 50 GHz	- - -
N9040B_ALV	Auxiliary Log Video Output	- - -
N9040B_B25	Analysis bandwidth, 25 MHz	- - -
N9040B_B2X	Analysis bandwidth, 255 MHz	- - -
N9040B_B40	Analysis bandwidth, 40 MHz	- - -
N9040B_CR3	Connector Rear, 2nd IF output	- - -
N9040B_CRP	Connector Rear, Arbitrary IF output	- - -
N9040B_CRW	Connector, IF Out, Wide	- - -
N9040B_DP2	Digital Processor, 2 GB Capture Memory	- - -
N9040B_EA3	Electronic attenuator, 3.6 GHz	- - -

Some of the important things to verify on this screen are the model and serial number to make sure that they match the serial number label on the rear panel of the instrument. If either of these are incorrect there could be a lot of different problems with the instrument, especially with the licensing of all standard and optional hardware and software. If either of these is not correct, see Chapter 3, “Instrument Information and Calibration Data,” for information on how to resolve that issue.

Verify that the Instrument S/W Revision is one that is supported by this model instrument. A list of valid software versions for this instrument can be found in the software revision history file found on the software download web page at:

https://www.keysight.com/find/uxa_software

You will also want to verify that the installed operating system matches the rear panel operating system certificate of authenticity, as the user could have installed something different, which could cause many different issues.

Verify that there are licenses for the options listed on the rear panel serial number label as well as any others that it is entitled to. While all option licenses are important to have configured properly, there are some that are of particular interest, as the instrument will not function at all without them. These would be the following:

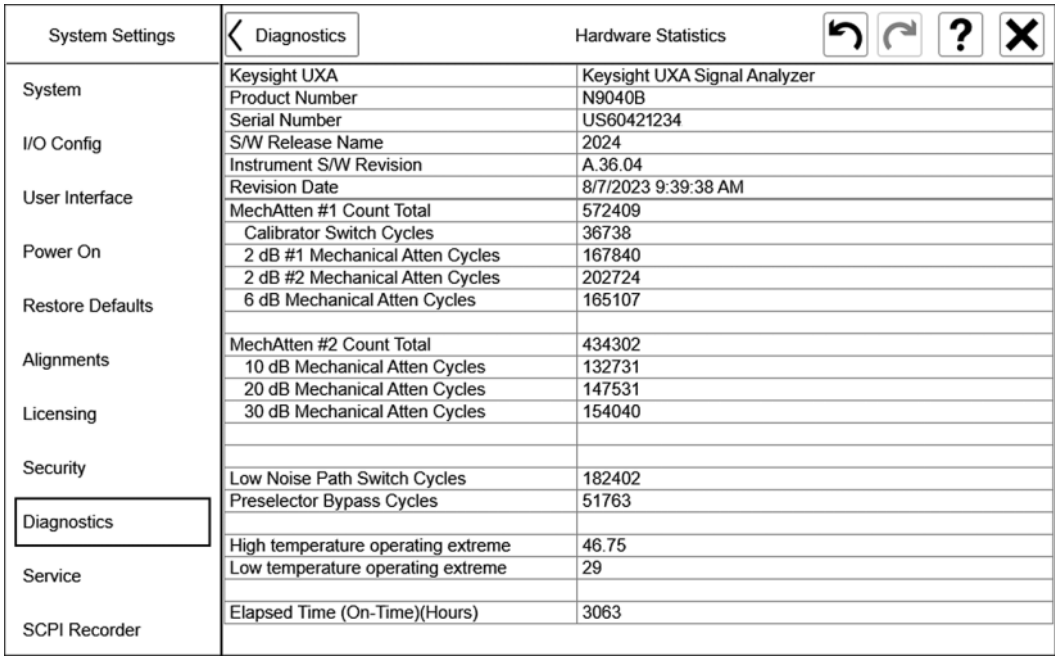
- Frequency Range – 508, 513, 526, 544, or 550
- Analysis Bandwidth – B25, B40, B2X, B5X, or H1G
- Spectrum Analyzer and IQ Analyzer Applications – N9060ES1E

If there is a user complaint about any particular functionality of the instrument you would also want to be sure that any license related to it is also installed. For a complete list of options that are standard in all instruments, see Table 1-1 in Chapter 1, "Overview."

If there are any issues with the configuration of the instrument interface, either from the front panel or remotely, try defaulting the instrument configuration settings from the **System**, **Restore Defaults** menu.

The Hardware Statistics screen should also be looked at to see what kind of use the instrument has seen. This is found by pressing **System**, **Diagnostics**, **Show Hardware Statistics**, as seen in Figure 5-3.

Figure 5-3 Hardware Statistics Screen Contents



Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2024
Instrument S/W Revision	A.36.04
Revision Date	8/7/2023 9:39:38 AM
MechAtten #1 Count Total	572409
Calibrator Switch Cycles	36738
2 dB #1 Mechanical Atten Cycles	167840
2 dB #2 Mechanical Atten Cycles	202724
6 dB Mechanical Atten Cycles	165107
MechAtten #2 Count Total	434302
10 dB Mechanical Atten Cycles	132731
20 dB Mechanical Atten Cycles	147531
30 dB Mechanical Atten Cycles	154040
Low Noise Path Switch Cycles	182402
Preselector Bypass Cycles	51763
High temperature operating extreme	46.75
Low temperature operating extreme	29
Elapsed Time (On-Time)(Hours)	3063

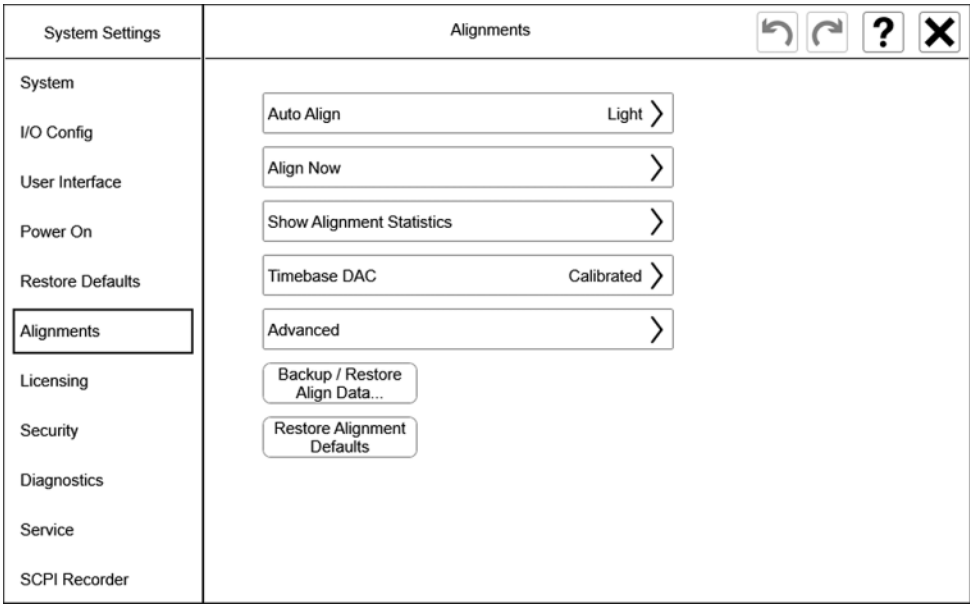
The things to look for on this screen would be the number of mechanical attenuator and switch cycles. Both have a typical life expectancy of 5 million cycles. This would normally take many years for them to reach this under normal use. But no matter if they are used at a normal rate or not, if they are nearing that number, it might be time to change them even if they are not failing.

The temperature operating extremes is also something to take note of. Of course, these are internal temperatures in degrees Celsius. The values for this seen in Figure 5-3 would be typical for normal room temperature operation.

The elapsed time is also something to take note of. An instrument that is powered on eight hours a day, five days a week, fifty-two weeks per year would be on for approximately 2,000 hours per year.

If there is some sort of an alignment data issue it might also be a good idea to either restore a recent alignment data backup, or to default the auto alignment data. Both options can be found on the **System**, **Alignments** screen, as seen in Figure 5-4.

Figure 5-4 Alignments Screen Contents



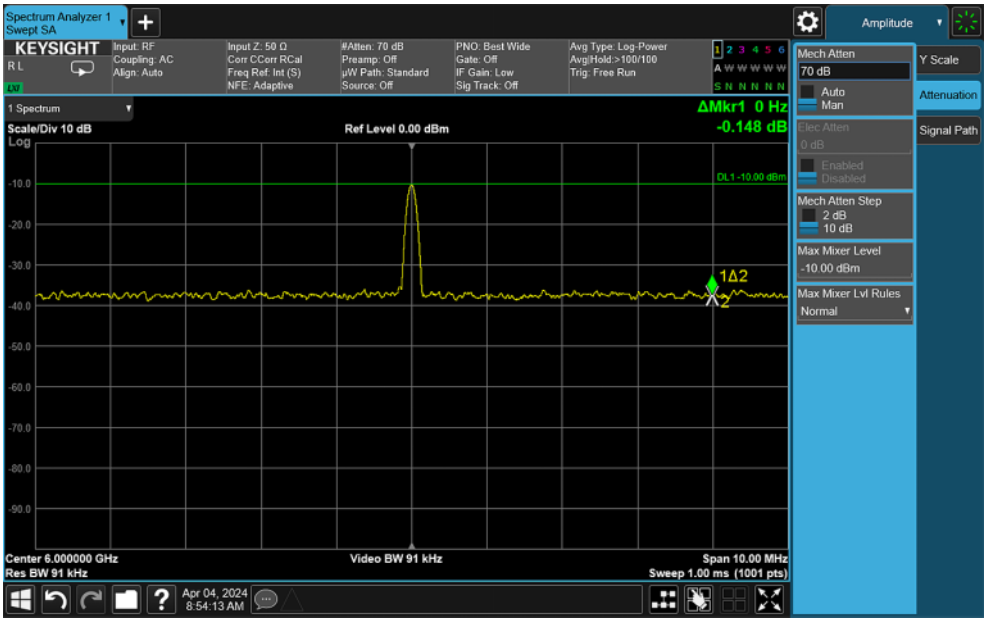
Mechanical Attenuator Evaluation

Whenever one of the mechanical step attenuators changes its attenuation value the power level out of the attenuator should obviously change by the amount of change made. Of course, the user of the instrument does not want to see the onscreen power level of the signal change. This change in signal level is made up for much further along in the signal path. However, when the attenuation value used increases, the signal-to-noise ratio will decrease. This can be used to evaluate the functionality of the attenuator and the corrections applied for it.

This procedure uses a frequency of 6 GHz, but any frequency of interest could be used.

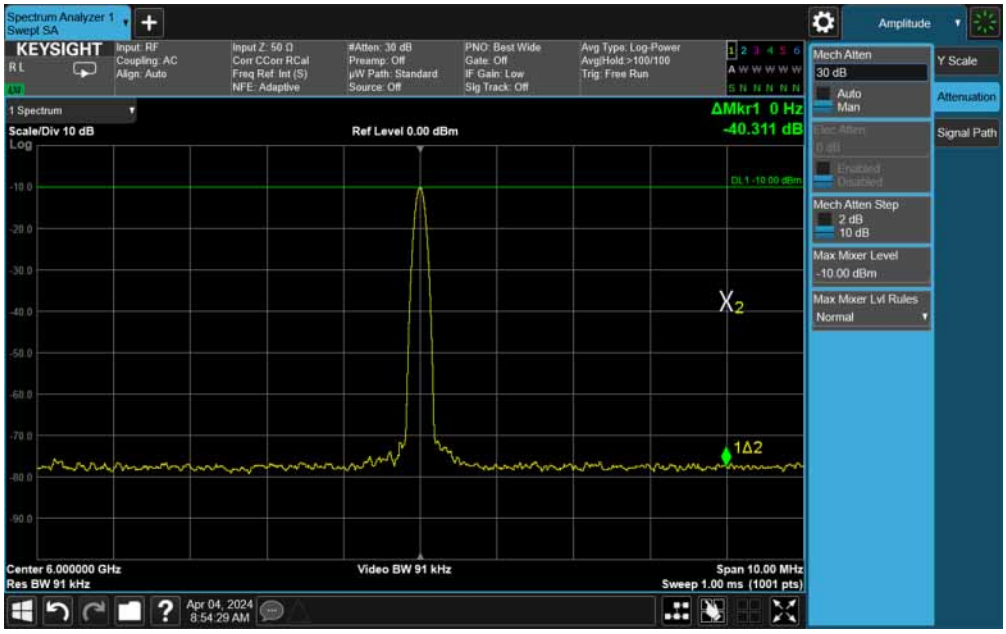
1. Return the instrument to a known state by pressing **Mode Preset.**
2. Connect a signal generator to the instrument input and tune it to 6 GHz with a power level of -10 dBm.
3. Tune the center frequency of the instrument to 6 GHz by pressing **Frequency**, **Center Frequency 6 GHz**.
4. Set the span to 10 MHz by pressing **Span 10 MHz**.
5. There should now be a signal at the center of the display at approximately -10 dBm.
6. Set the mechanical attenuators to 70 dB by pressing **Amplitude**, **Attenuation**, **Mech Atten 70 dB**.
7. Set the attenuator step size to 10 dB by setting **Mech Atten Step** to **10 dB**.
8. Turn on trace averaging by pressing **Trace**, **Trace Type**, **Trace Averaging**.
9. Turn the display line on by pressing **Display**, **Display Line On**.
10. Adjust the **Display Line** level to put the line at the same level as the signal at the center of the screen.
11. Turn the marker on and place it at the first vertical graticule from the right side of the screen by pressing **Marker** and then the **Up Arrow** four times.
12. Activate the marker delta function by pressing **Marker Mode**, **Delta**.
13. Return to the attenuator control menu by pressing **Amplitude**, **Attenuation**.
14. The screen should now look like Figure 5-5.

Figure 5-5 Mechanical Attenuation Evaluation Setup



15. Use the **Down Arrow** key to decrease the **Mech Atten** setting in 10 dB steps and watch the level of the signal to verify that it does not vary from the display line by much, while also monitoring the marker delta level on the noise to see that it changes by approximately the same amount that the attenuator value does, as can be seen for a 40 dB change in Figure 5-6.

Figure 5-6 Mechanical Attenuator – 40 dB Change

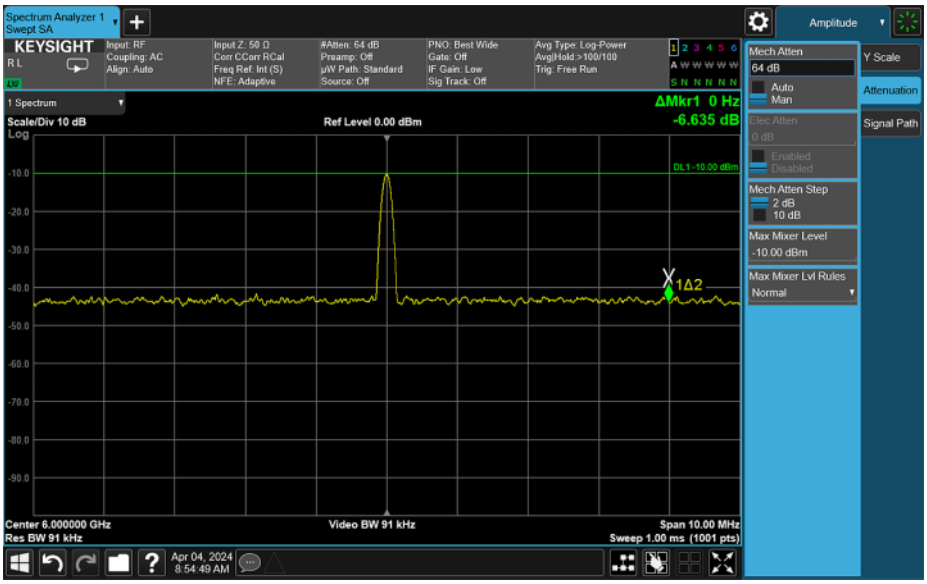


If the signal stays at the same level and the noise floor reduces at the same rate as the attenuation changes, it would indicate that the A10 Step Attenuator is stepping at the correct amount and the corrections are compensating for it accordingly.

NOTE There is no need to go all the way down to 0 dB of attenuation as this will overload the instrument input and the phase noise of the signal will not allow the noise floor to go low enough to see the difference in corrections.

16. Set the attenuator back to 70 dB by pressing **Mech Atten 70 dB**.
17. Change the attenuator step size to 2 dB by setting **Mech Atten Step** to **2 dB**.
18. Use the **Down Arrow** key to decrease the **Mech Atten** setting in 2 dB steps and watch the level of the signal to verify that it does not vary from the display line by much, while also monitoring the marker delta level on the noise to see that it changes by approximately the same amount that the attenuator value does, as can be seen for a 6 dB change in Figure 5-7.

Figure 5-7 Mechanical Attenuator – 6 dB Change



If the signal stays at the same level and the noise floor reduces at the same rate as the attenuation changes, it would indicate that the A9 Step Attenuator is stepping at the correct amount and the corrections are compensating for it accordingly.

19. If there is any problem found with the levels in this attenuator evaluation, see the appropriate RF Section Troubleshooting chapter to determine what the problem is.

A12 Yig Tuned Filter Shape Verification

If the shape of the A12 Yig Tuned Filter has changed for some reason and is no longer as expected, it can cause a variety of issues with the instrument. However, we would not want to replace a suspected detuned filter without knowing for sure that the shape is not correct. The following procedure will display the shape of the filter on the instrument display with no additional equipment needed. This procedure will use a frequency of 6 GHz, but any frequency of interest higher than 3.6 GHz can be used.

1. Switch the instrument to the IQ Analyzer mode by selecting **Mode/Meas**, **IQ Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Connect a signal generator to the instrument input and tune it to 6 GHz with a power level of -10 dBm.
4. Tune the center frequency of the instrument to 6 GHz by pressing **Frequency**, **Center Frequency 6 GHz**.
5. Set the span to 100 MHz by pressing **Span 100 MHz**.
6. Change the reference level to -10 dBm by pressing **Amplitude**, **Ref Value -10 dBm**.
7. Set the scale per division to 3 dB by pressing **Scale/Div 3 dB**.
8. Since the IQ Analyzer will bypass the A12 Yig Tuned Filter by default, press **Signal Path**, **µW Path Control**, **Standard Path** to make sure it is not bypassed.
9. The following error message will appear at the bottom of the display, which can be ignored:

   Settings Alert; Presel/Meas BW conflict

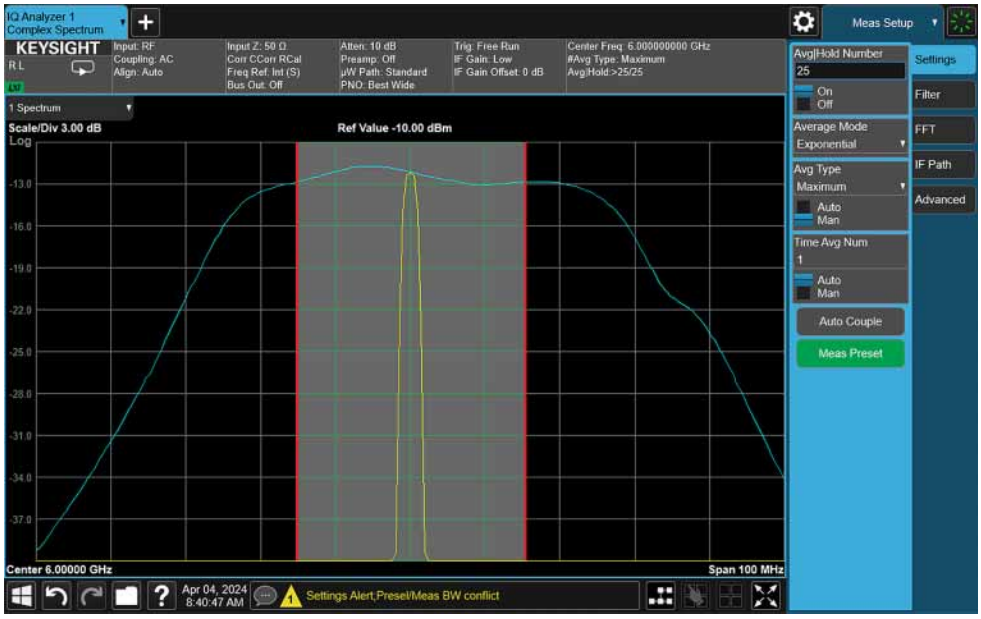
10. Center the filter by pressing **Presel Center**.

    The **Presel Adjust** value that is returned after centering the preselector will give a good indication on how well the preselector characterization is. If it's more than a few MHz the Characterize Preselector routine should be run by pressing **System**, **Alignments**, **Advanced**, **Characterize Preselector**.

11. Change the average type to maximum by pressing **Meas Setup**, **Avg Type Maximum**.
12. Slowly vary the frequency of the signal generator ±50 MHz to draw the A12 YIG Tuned Filter shape on the display, as seen in Figure 5-8.

NOTE The IQ Analyzer application Complex Spectrum measurement has two displays by default – Spectrum and IQ Waveform. Double-tapping in the Spectrum display will maximize that display and hide the IQ Waveform display, making this measurement easier to evaluate, as seen in Figure 5-8.

Figure 5-8 A12 YIG Tuned Filter Shape - 20 GHz



13. The passband filter shape should have no more than 4 dB of peak-to-peak variation within ±15 MHz of the tuned frequency, as seen in the shaded area of Figure 5-8.

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 by pressing **System**, **Alignments**, **Advanced**, **Characterize Preselector**.

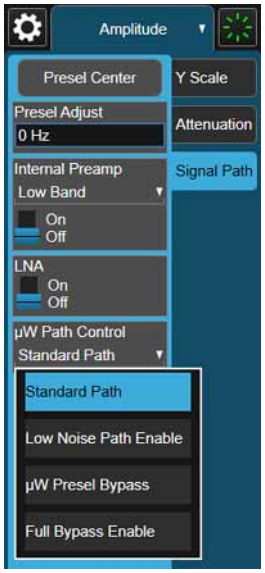
If the peak-to-peak variation within the ±15 MHz area is greater than expected, and the filter passband is centered in the display, the A12 Yig Tuned Filter will need to be replaced.

µWave Path Functionality

There are a few different signal paths through the front end of the instrument. If there is a problem getting a signal through the instrument, switching through the different microwave signal paths could quickly identify which signal paths might have a problem, and help to isolate the problem to an assembly or component. The following procedure will do this at a frequency of 6 GHz, but any frequency higher than 3.6 GHz could be used.

1. Verify that the instrument is using the spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Connect a signal generator to the instrument input and tune it to 6 GHz with a power level of -10 dBm.
4. Tune the center frequency of the instrument to 6 GHz by pressing **Frequency**, **Center Frequency 6 GHz**.
5. Set the span to 10 MHz by pressing **Span 10 MHz**.
6. Make sure that the instrument is using the **Standard** path by pressing **Amplitude**, **Signal Path** and verify that the **µWave Path Control** says **Standard Path**, as seen in Figure 5-9.

Figure 5-9 µWave Path Control - Standard Path

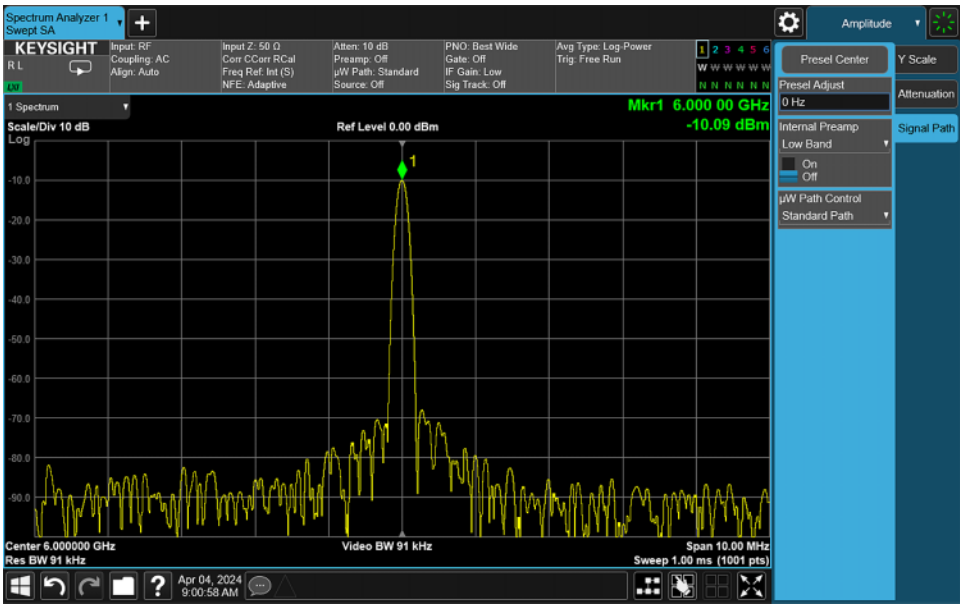


7. There should now be a signal at the center of the display at approximately -10 dBm, as seen in Figure 5-10.

   If the signal is there, but at a lower power level, try centering the A12 Yig Tuned Filter by pressing **Amplitude**, **Signal Path**, **Presel Center**. If the signal level comes up to the expected level, note the **Presel Adjust** value.

If it's more than a few MHz the Characterize Preselector routine should be run by pressing **System**, **Alignments**, **Advanced**, **Characterize Preselector**.

Figure 5-10 µWave Signal Paths - Standard Path



8. Make a note of whether there is a signal at the expected level or not for the Standard path and proceed to the next step.
9. Bypass the A11 Band Switch by pressing **Amplitude**, **Signal Path**, **µWave Path Control**, **Low Noise Path Enable**.
10. There should be a signal at the center of the display at approximately -10 dBm.

    If there was previously no signal seen through the Standard path, but there is now through the Low Noise Path, there is most likely a problem with the A11 Band Switch, or the control of it. See the appropriate RF Section Troubleshooting chapter to determine why there is a problem with the A11 Band Switch.

    If there was previously a signal seen through the Standard path, but now there is no signal through the low noise path, there is most likely a problem with the SW3 LNP Switch, or the control of it. See the appropriate RF Section Troubleshooting chapter to determine why there is a problem with the SW3 LNP Switch.
11. Bypass the A12 Yig Tuned Filter by pressing **Amplitude**, **Signal Path**, **µWave Path Control**, **µW Presel Bypass**.
12. There should be a signal at the center of the display at approximately -10 dBm.

If there was previously no signal seen through the Standard path, but there is now through the µW Presel Bypass path, there is most likely a problem with the A12 Yig Tuned Filter, or the control of it. See the appropriate RF Section Troubleshooting chapter to determine why there is a problem with the A12 Yig Tuned Filter.

If there was previously a signal seen through the Standard path, but now there is no signal through the µW Presel Bypass path, there is most likely a problem with the MPB Switch, or the control of it. See the appropriate RF Section Troubleshooting chapter to determine why there is a problem with the MPB Switch.

13. If it was found that only one of the microwave signal paths has a problem, follow the instructions given to resolve that issue.

If all the microwave signal paths appear the same, either good or bad, see the "IF Signal Path Isolation" section for further fault isolation.

Preamplifier Functionality

There are two different preamplifiers in the instrument, both of which are available with any of the preamplifier options. They are the low band preamplifier on the A13 RF Front End and the high band preamplifier on the A11 Band Switch. Both of these have a specified frequency range that they operate within, as seen in Table 5-2.

Table 5-2 Preamplifier Specified Frequency Ranges and Typical Gain

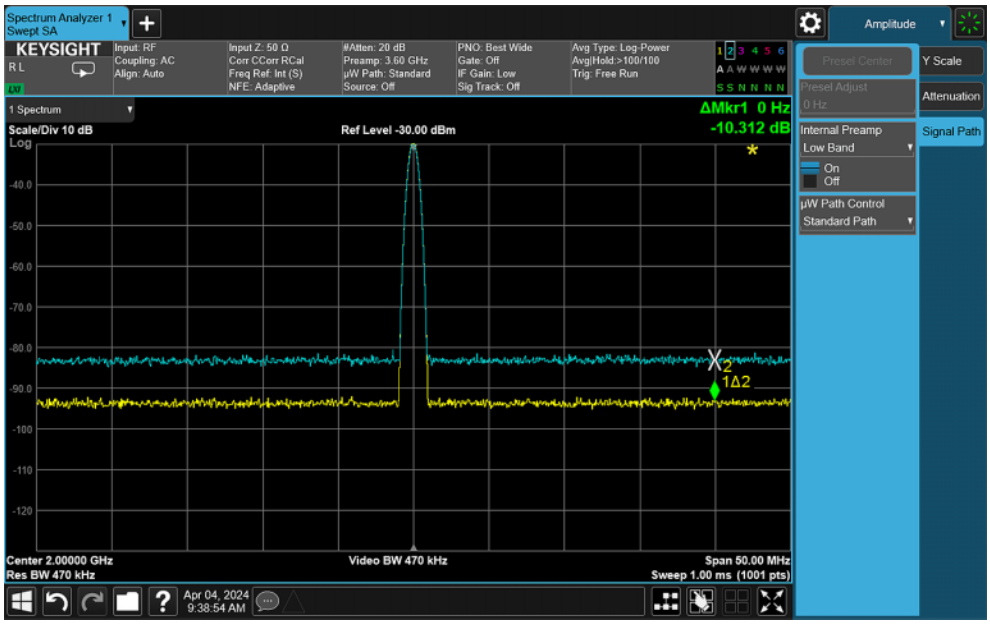
Preamplifier	Specified Frequency Range		Typical Gain
	Minimum	Maximum	
Low Band	100 kHz	3.6 GHz	20 dB
High Band	3.6 GHz	Instrument Max Frequency	30 dB

When one of the preamplifiers is turned on, the signal level on-screen should not change, while the noise floor level should decrease. However, it might not appear this way at first glance, as turning on one of the preamplifiers also increases the input attenuation considerably by default. The following procedure will use two different frequencies to verify the functionality of the preamplifiers, 2 GHz in low band and 6 GHz in high band, but any frequencies of interest could also be used.

1. Verify that the instrument is using the spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Connect a signal generator to the instrument input and tune it to 2 GHz with a power level of -30 dBm.
4. Tune the center frequency of the instrument to 2 GHz by pressing **Frequency**, **Center Frequency 2 GHz**.
5. Set the span to 50 MHz by pressing **Span 50 MHz**.
6. Set the reference level to -30 dBm by pressing **Amplitude**, **Ref Level -10 dBm**.
7. Set the input attenuator to 20 dB by pressing **Attenuation**, **Mech Atten 20 dB**.
8. Change trace 1 to averaging by pressing **Trace**, **Trace Type**, **Trace Average**.
9. Turn trace 2 on by pressing **Select Trace**, **Trace 2**, **Trace Type**, **Trace Average**.
10. Allow the **Avg/Hold** to reach 100 then stop the trace 2 acquisition by pressing **View/Blank**, **View**.

11. Turn the marker on and place it at the first vertical graticule from the right side of the display by pressing **Marker** and then the **Up Arrow** four times.
12. Activate the marker delta function by pressing **Marker Mode**, **Delta**.
13. Turn the low band preamplifier on by pressing **Amplitude**, **Signal Path**, **Internal Preamp**, **Low Band**, **On**.
14. The signal level should remain the same while the noise floor at the marker should drop by approximately 10 dB, as seen in Figure 5-11.

Figure 5-11 Low Band Preamplifier On and Off

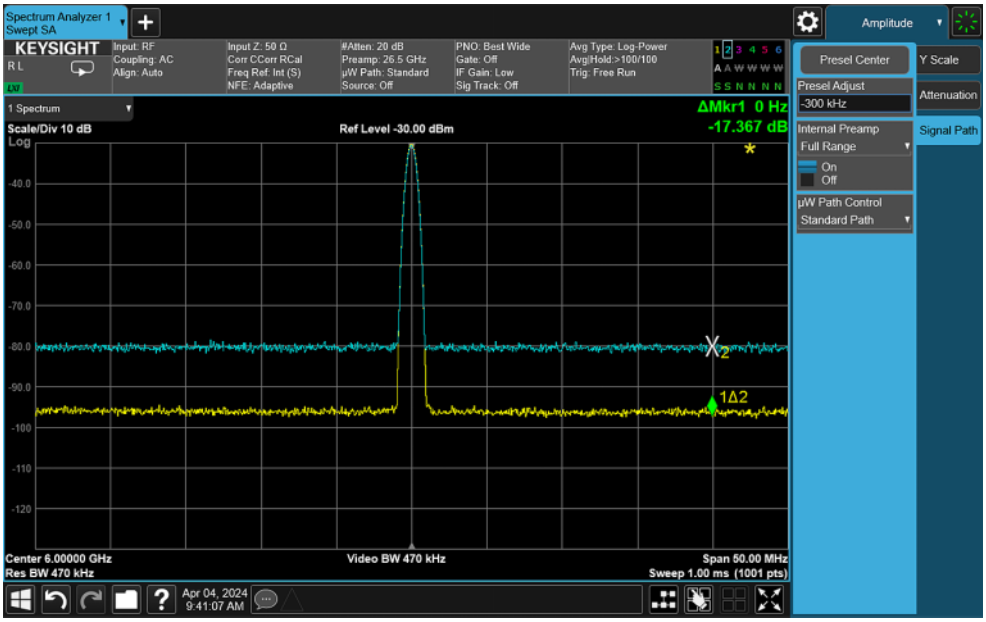


If either the signal level changes or the noise floor does not change as expected, see the appropriate RF Section Troubleshooting chapter to determine why the low band preamplifier is not working properly.

15. Turn the low band preamplifier off by pressing **Internal Preamp**, **Off**.
16. Tune the instrument to 6 GHz by pressing **Frequency**, **Center Frequency 6 GHz**.
17. Tune the signal generator to 6 GHz.
18. Center the A12 Yig Tuned Filter by pressing **Amplitude**, **Signal Path**, **Presel Center**.
19. Reset trace 2 by pressing **Trace**, verify that **Select Trace** is **Trace 2**, and press **View/Blank**, **Active**, wait for **Avg/Hold** to reach 100, then press **View**.
20. Reset the marker by pressing **Marker**, **Marker Mode**, **Off**, then **Normal**, then press the **Up Arrow** four times to move the marker to the first vertical graticule from the right of the display.

21. Activate the marker delta function by pressing **Marker Mode**, **Delta**.
22. Turn the high band preamplifier on by pressing **Amplitude**, **Signal Path**, **Internal Preamp**, **Full Range**, **On**.
23. Allow the **Avg/Hold** to reach 100.
24. The signal level should remain the same while the noise floor at the marker should drop by approximately 18 dB, as seen in Figure 5-12.

Figure 5-12 High Band Preamplifier On and Off



If either the signal level changes or the noise floor does not change as expected, see the "A11 Low Band Switch" section in Chapter 7, "RF Section (RF/Microwave)," to determine why the high band preamplifier is not working properly.

25. Turn the high band preamplifier off by pressing **Internal Preamp**, **Off**.

IF Signal Path Isolation

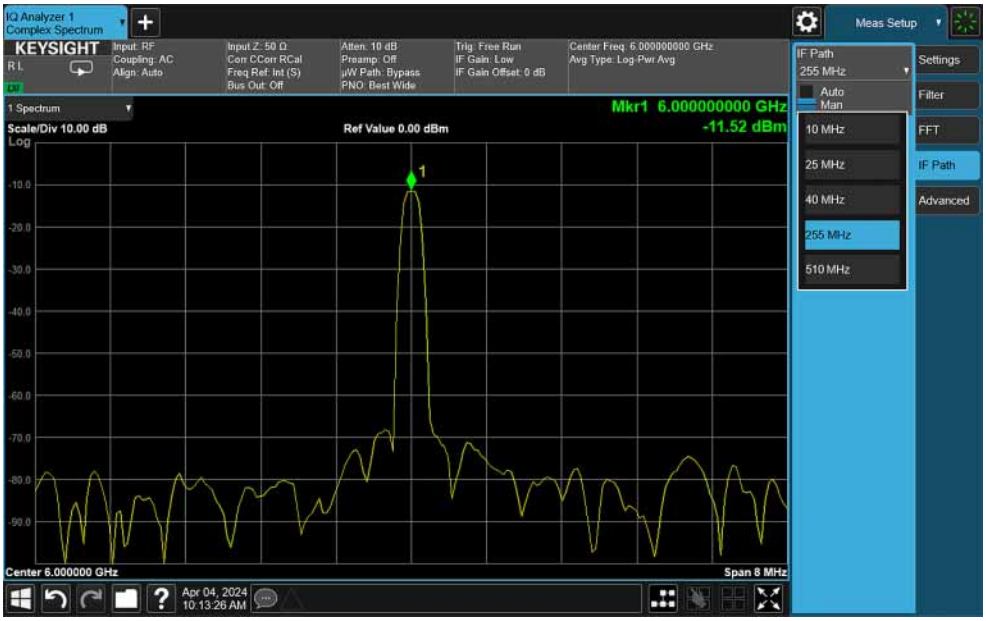
The following procedure can be used to quickly cycle through the different IF signal paths whenever a signal level issue exists. Knowing if the issue only occurs for certain IF paths can help to quickly narrow down the possible suspect assemblies. This procedure uses a frequency of 6 GHz, but any frequency of interest could be used instead.

Table 5-3 IF Path versus IF Assemblies

IF Path	IF Assemblies Used
10 MHz	A2 Analog IF
	A3 Digital IF
25 MHz	A2 Analog IF
	A3 Digital IF
40 MHz	A3 Digital IF
255 MHz	A21 Wideband Analog IF
	A22 Wideband Digital IF
510 MHz	A21 Wideband Analog IF
	A22 Wideband Digital IF
	A23 Wideband Digital IF

1. Switch the instrument to the IQ Analyzer mode by selecting **Mode/Meas**, **IQ Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Connect a signal generator to the instrument input and tune it to 6 GHz with a power level of -10 dBm.
4. Tune the center frequency of the instrument to 6 GHz by pressing **Frequency**, **Center Frequency 6 GHz**.
5. For clarity, turn the average trace off by pressing **Meas Setup**, **Avg/Hold Off**.
6. Put a marker on the signal by pressing **Marker**.
7. Go to the **Meas Setup**, **IF Path** menu.
8. Cycle through the different IF Paths that are available in the IF Path selection, as seen in Figure 5-13, and note any signal level drop-outs.

Figure 5-13 IF Signal Path Isolation



9. If any problems are found after cycling through all the available IF Paths, refer to Table 5-3 to see what assemblies the problem paths have in common and proceed from there.

IF Flatness Verification

There are two types of frequency response corrections that are very important for these instruments. They are the RF Flatness and the IF Flatness. Simply put, the RF flatness data corrects for the frequency response of the front end of the instrument and IF flatness corrects for the frequency response across the width of a given IF bandwidth.

It also needs to be noted that the IF response for a given bandwidth will vary depending on the mixer used. There are up to four different mixers in the A13 Front End assembly, depending on the frequency range of the instrument, and all six IF signal paths use multiple mixers. For example, the 40 MHz IF path can use up to four different mixers depending on the input frequency. Each of these would have a different uncorrected response across the bandwidth, and thus there will be four different sets of IF flatness corrections for the 40 MHz IF signal path alone.

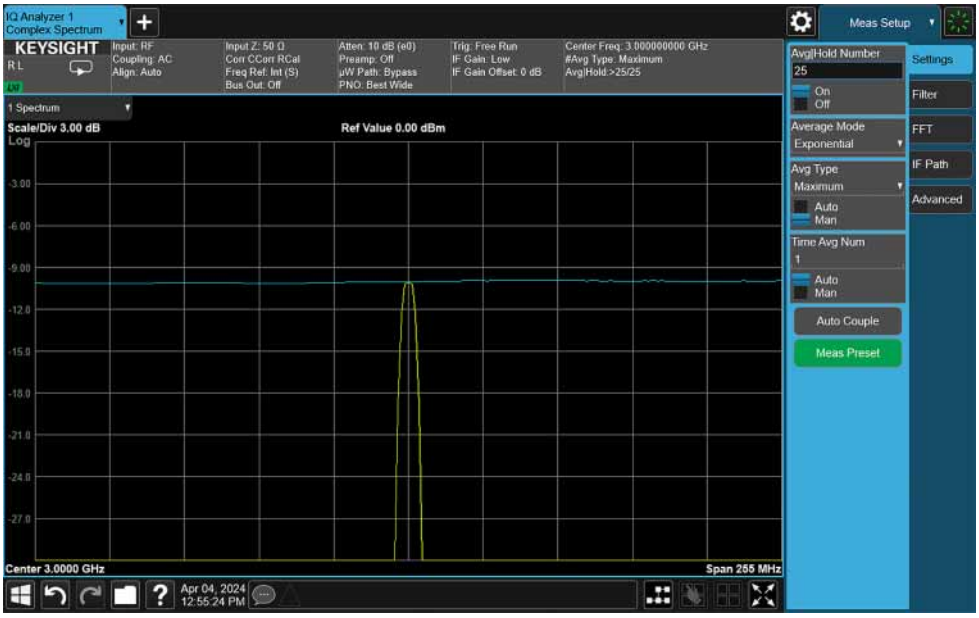
The following procedure can be used to view the IF response both with and without corrections applied for the 255 MHz IF Path for the three mixer variations if the instrument being verified does not have the 255 MHz IF Path enabled, or there is another IF Path of interest that could be used instead.

NOTE

While this procedure operates as though the frequency response of the signal generator used is perfect, it needs to be understood that, while they may be very small, across a wide bandwidth there are frequency response errors associated with the signal generator used itself. This procedure is used to look for obvious issues with the IF flatness, not to confirm performance verification.

1. Enable the service menus. See Chapter 18, “Service Menus,” if instructions for this are needed.
2. Switch the instrument to the IQ Analyzer mode by selecting **Mode/Meas**, **IQ Analyzer**, **OK**.
3. Return the instrument to a known state by pressing **Mode Preset**.
4. Connect a signal generator to the instrument input and tune it to 3 GHz with a power level of -10 dBm.
5. Tune the center frequency of the instrument to 3 GHz by pressing **Frequency**, **Center Frequency 3 GHz**.
6. Set the span to 255 MHz by pressing **Span 255 MHz**.
7. Set the scale per division to 3 dB by pressing **Amplitude**, **Scale/Div 3 dB**.
8. Set the trace average type to maximum by pressing **Meas Setup**, **Avg Type**, **Maximum**.
9. Slowly vary the frequency of the signal generator to draw the corrected IF response using mixers #1 and #2 on the display, as seen in Figure 5-14.

Figure 5-14 255 MHz IF Path Flatness - 3 GHz – IF Flatness On

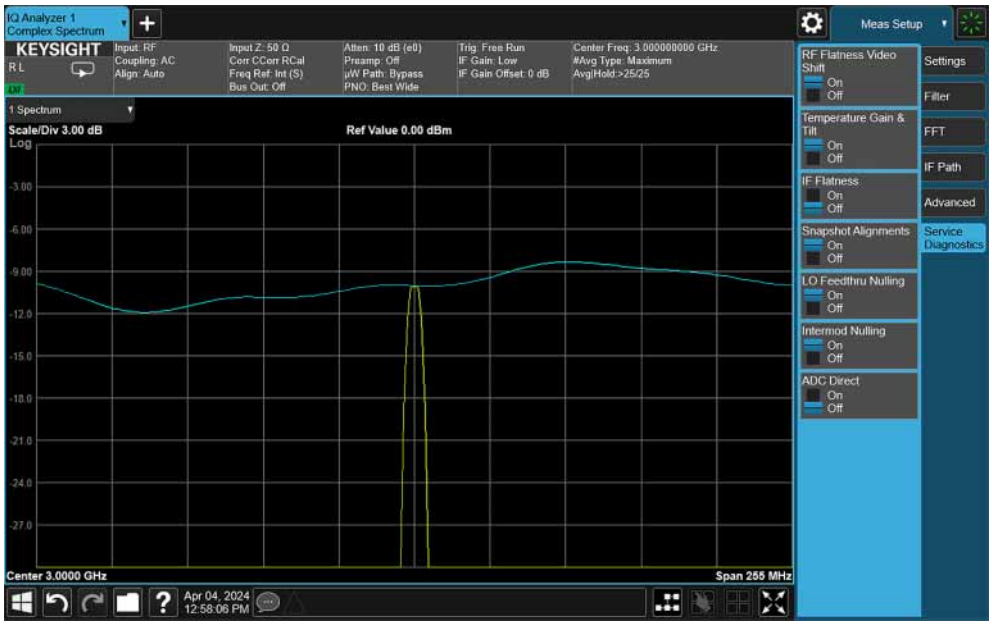


NOTE

The IQ Analyzer application Complex Spectrum measurement has two displays by default – Spectrum and IQ Waveform. Double-tapping in the Spectrum display will maximize that display and hide the IQ Waveform display, making this measurement easier to evaluate, as seen in Figure 5-14.

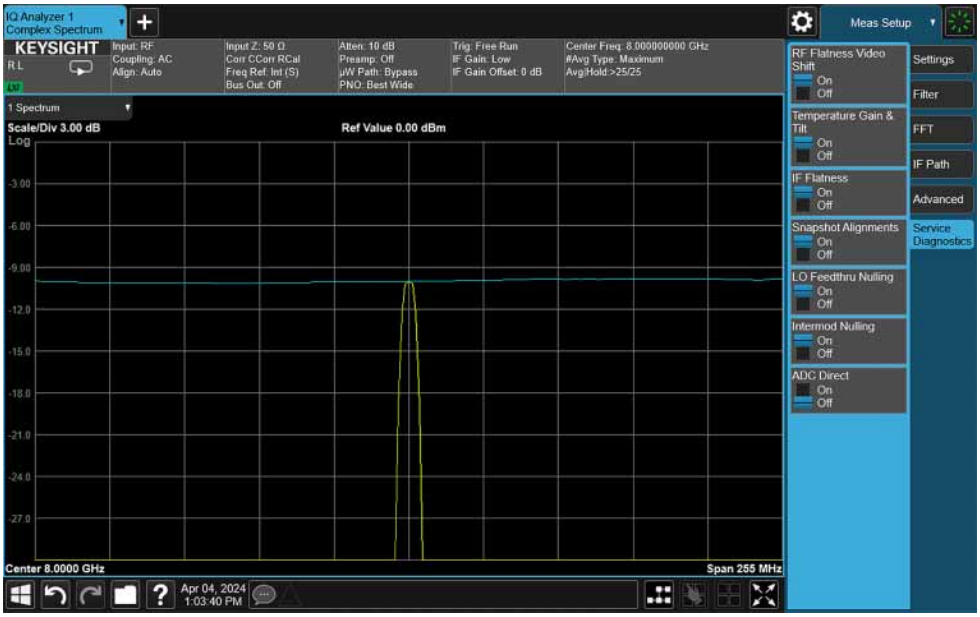
10. If the corrected frequency response error (blue trace) varies by more than ±1 dB from the value at the center of the display, the IF flatness adjustment should probably be run. But before doing so, proceed to the next step and view the uncorrected frequency response to see if there is a larger problem that may need to be fixed before running the adjustment.
11. Turn the IF flatness off by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness Off**.
12. Restart the maximum trace by pressing **Sweep**, **Restart**.
13. Slowly vary the frequency of the signal generator to draw the uncorrected IF response using mixers #1 and #2 on the display, as seen in Figure 5-15.

Figure 5-15 255 MHz IF Path Flatness - 3 GHz – IF Flatness Off



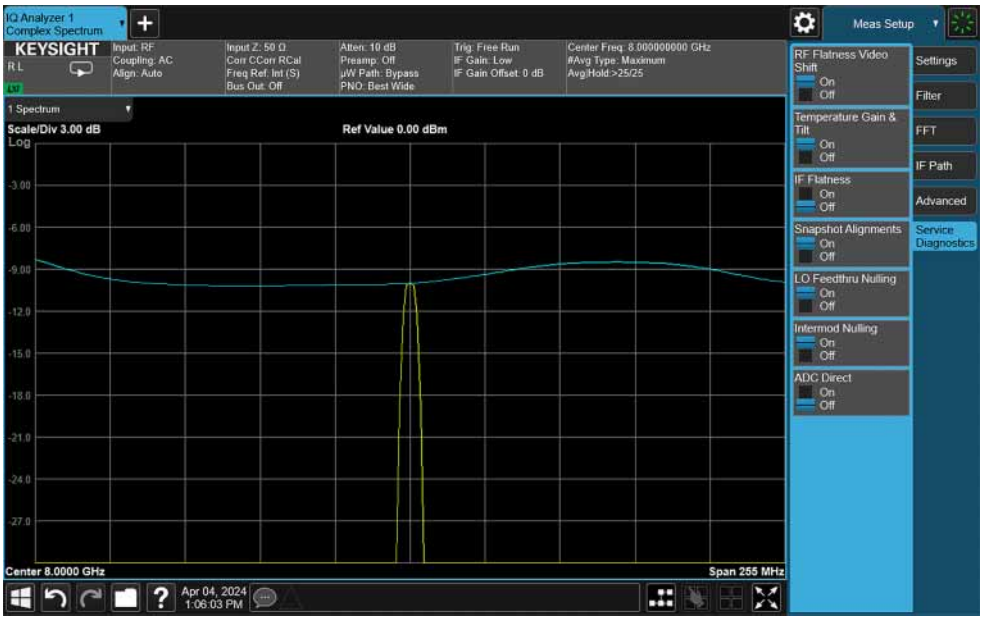
14. The uncorrected frequency response for the 255 MHz IF path at 3 GHz should look similar to that seen in Figure 5-15. If it varies greatly from this, further troubleshooting will be needed to determine why.
15. Tune the center frequency of the instrument to 8 GHz by pressing **Frequency**, **Center Frequency 8 GHz**.
16. Turn the IF flatness on by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness On**.
17. Tune the signal generator to 8 GHz.
18. Slowly vary the frequency of the signal generator to draw the corrected IF response using mixer #2 on the display, as seen in Figure 5-16.

Figure 5-16 255 MHz IF Path Flatness - 8 GHz - IF Flatness On



19. If the corrected frequency response error (blue trace) varies by more than ±1 dB from the value at the center of the display, the IF flatness adjustment should probably be run. But before doing so, proceed to the next step and view the uncorrected frequency response to see if there is a larger problem that may need to be fixed before running the adjustment.
20. Turn the IF flatness off by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness Off**.
21. Restart the maximum trace by pressing **Sweep**, **Restart**.
22. Slowly vary the frequency of the signal generator to draw the uncorrected IF response using mixer #2 on the display, as seen in Figure 5-17.

Figure 5-17 255 MHz IF Path Flatness - 8 GHz - IF Flatness Off



23. The uncorrected frequency response for the 255 MHz IF path at 8 MHz should look similar to that seen in Figure 5-17. If it varies greatly from this, further troubleshooting will be needed to determine why.

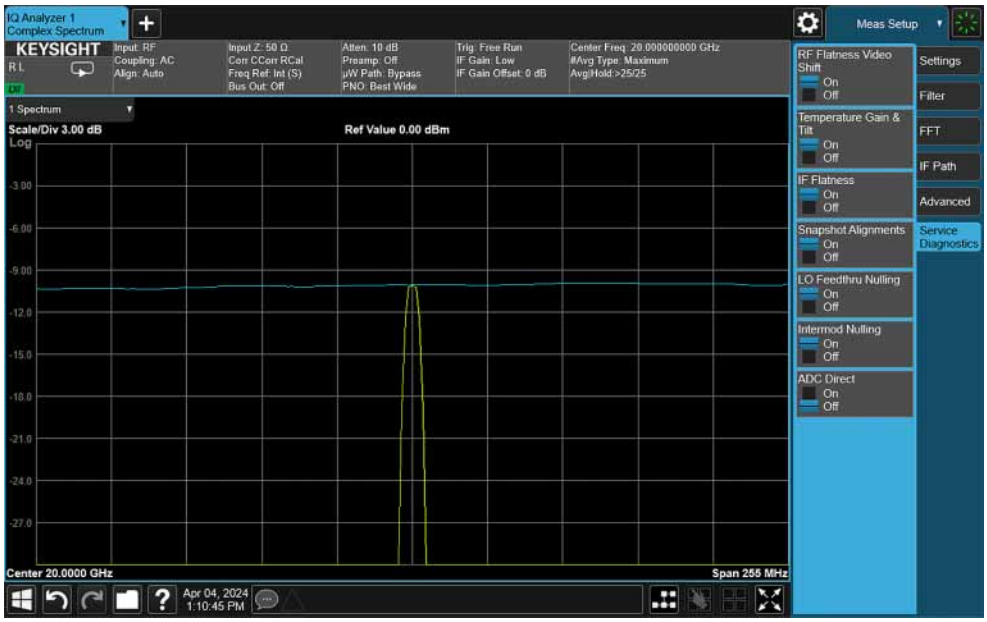
24. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency**, **Center Frequency 20 GHz**.

25. Turn the IF flatness on by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness On**.

26. Tune the signal generator to 20 GHz.

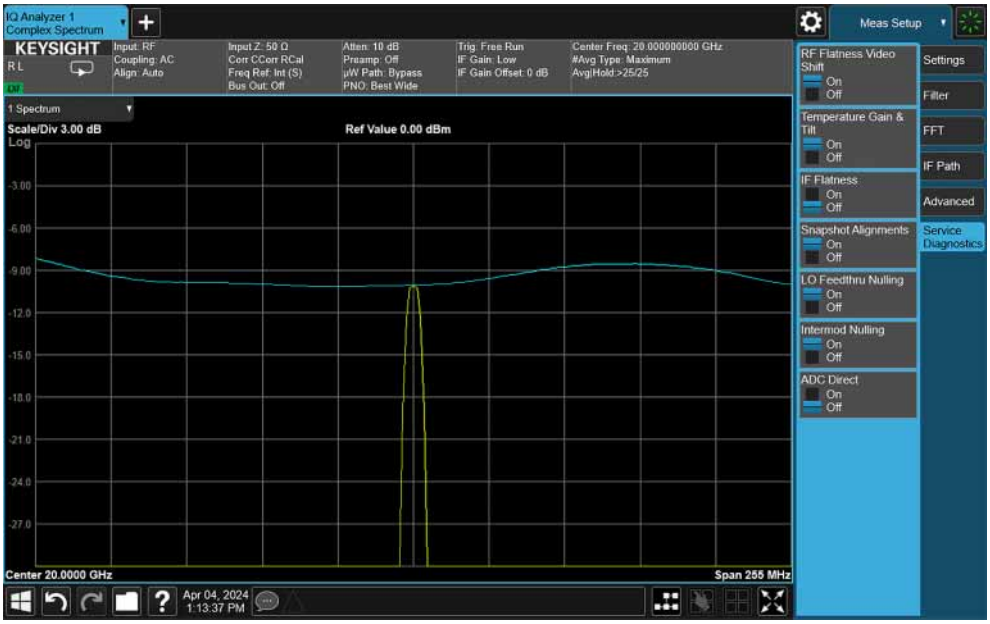
27. Slowly vary the frequency of the signal generator to draw the corrected IF response using mixer #5 on the display, as seen in Figure 5-18.

Figure 5-18 255 MHz IF Path Flatness - 20 GHz - IF Flatness On



28. If the corrected frequency response error (blue trace) varies by more than ±1 dB from the value at the center of the display, the IF flatness adjustment should probably be run. But before doing so, proceed to the next step and view the uncorrected frequency response to see if there is a larger problem that may need to be fixed before running the adjustment.
29. Turn the IF flatness off by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness Off**.
30. Restart the maximum trace by pressing **Sweep**, **Restart**.
31. Slowly vary the frequency of the signal generator to draw the uncorrected IF response using mixer #5 on the display, as seen in Figure 5-19.

Figure 5-19 255 MHz IF Path Flatness - 20 GHz - IF Flatness Off



32. The uncorrected frequency response for the 255 MHz IF path at 20 GHz should look similar to that seen in Figure 5-19. If it varies greatly from this, further troubleshooting will be needed to determine why.

Power Supply Verification

Before replacing any assembly in the instrument, the status of all the power supply voltages should be verified. There is a status LED near the top of the A7 Midplane board for all twelve of the voltages that originate on the A6 Power Supply, along with two other voltages that are regulated on the A7 Midplane board. A list of the voltages can be seen in Table 5-4, and the location of the LEDs for each can be seen in Figure 5-20 and Figure 5-21.

Table 5-4 Power Supply Voltage

Supply Voltage	Regulated On	LED
+3.3 V Analog	A7 Midplane Board	DS13
+3.35 V Digital	A6 Power Supply	DS9
+5.1 V Standby	A6 Power Supply	DS12
+5.1 V Digital	A6 Power Supply	DS10
+5.2 V Analog	A6 Power Supply	DS5
+9 V Analog	A6 Power Supply	DS6
+12 V Digital	A6 Power Supply	DS11
+15 V Standby	A6 Power Supply	DS2
+15 V Analog	A6 Power Supply	DS4
+32 V Analog	A6 Power Supply	DS3
-5.2 V Analog	A7 Midplane Board	DS14
-7 V Analog	A6 Power Supply	DS8
-15 V Analog	A6 Power Supply	DS7
Fan	A6 Power Supply	DS1

Figure 5-20 Power Supply LED Locations – A7 Midplane Board Rear

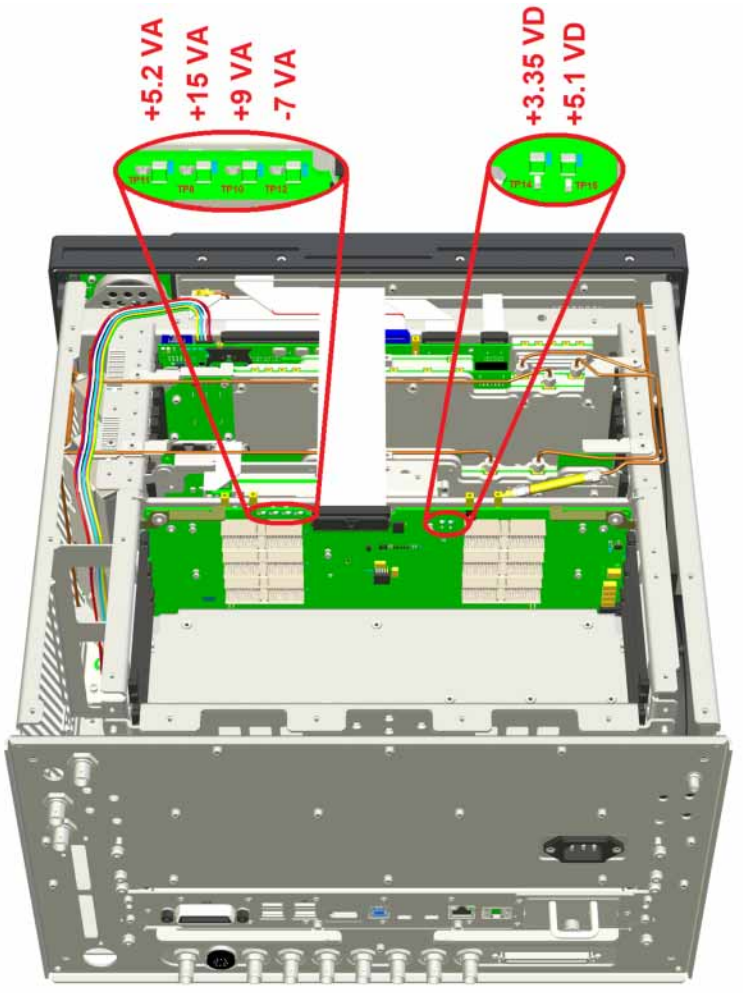
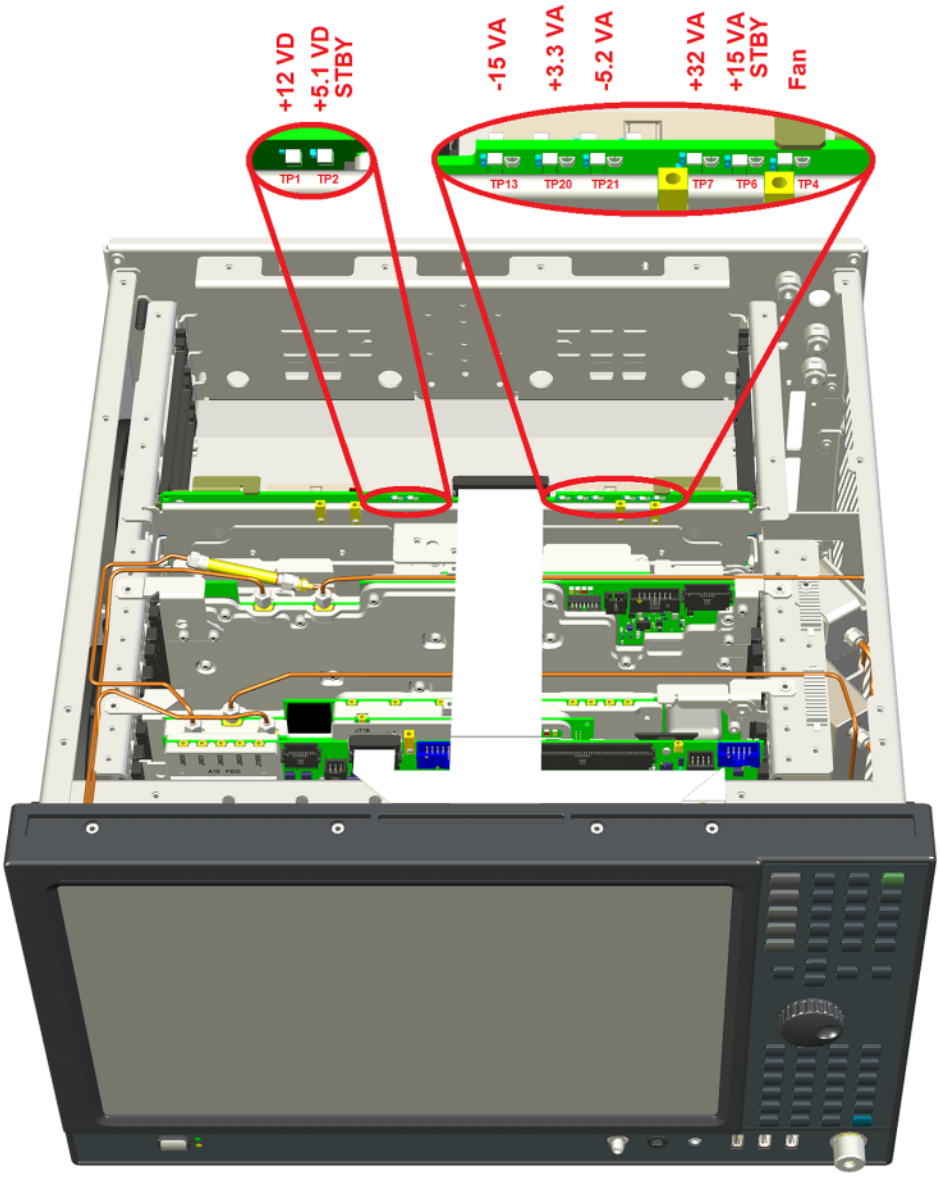


Figure 5-21 Power Supply LED Locations – A7 Midplane Board Front



When the instrument is turned on all fourteen green power supply LEDs should be on. If there is any question as to the actual voltage level of any of these supplies, there is a test point next to each LED that could be measured with a DC voltmeter.

If any of the voltages regulated on the A6 Power Supply are not at the correct level, see Chapter 14, “Power Supply and Cooling Fans,” to determine why.

If either of the two voltages regulated on the A7 Midplane board are not at the correct level, see Chapter 15, “Motherboards,” to determine why.

6 Block Diagrams

What You Will Find in This Chapter

The following block diagrams are found in this chapter:

Option 508, 513, 526

- Full System - Standard
- Swept Spectrum Analyzer
- Full System - Option B2X
- IQ Analyzer - Option B2X
- Full System - Option B5X
- IQ Analyzer - Option B5X

Option 544, 550

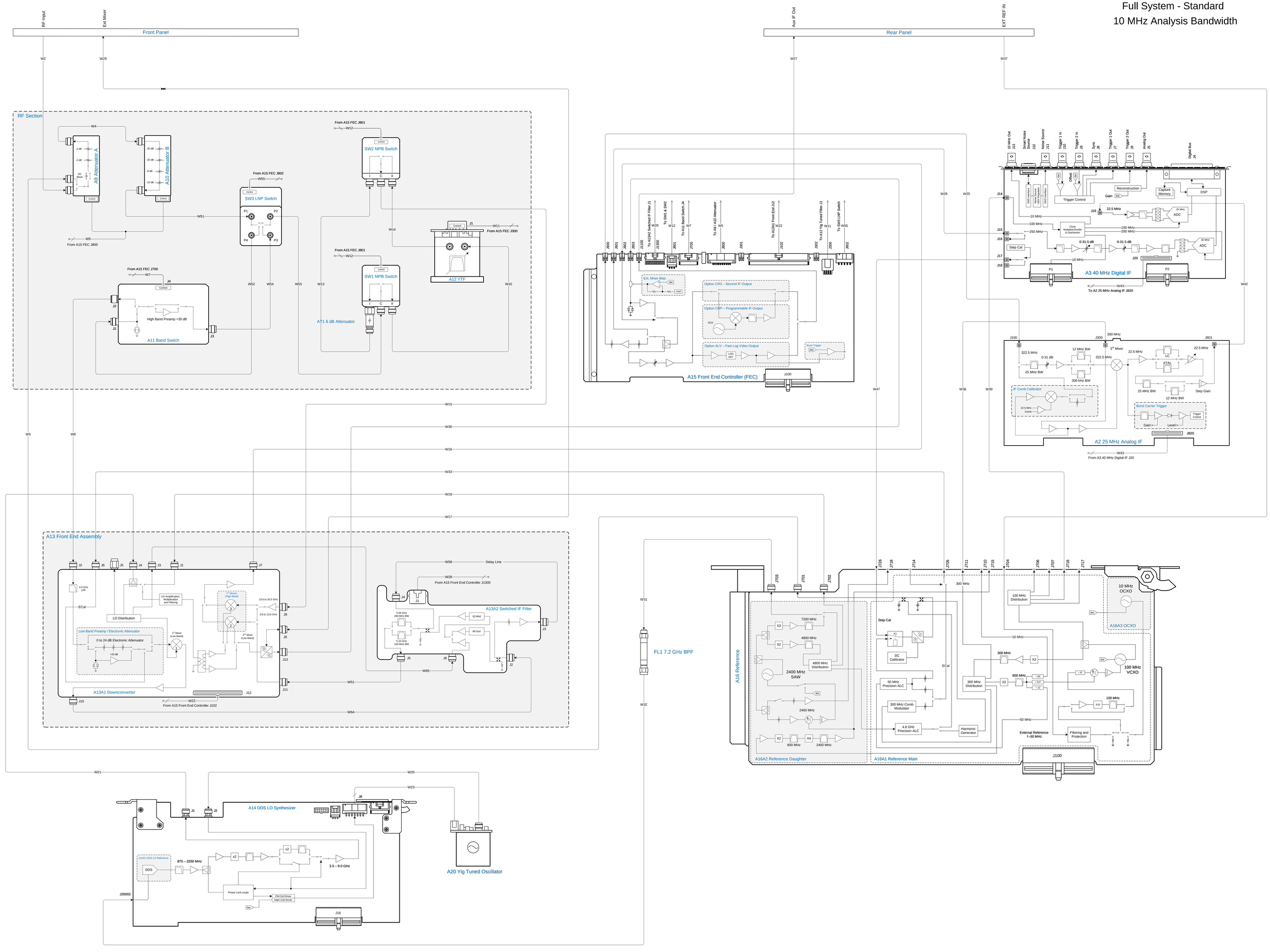
- Full System - Standard
- Swept Spectrum Analyzer
- Full System - Option B2X
- IQ Analyzer - Option B2X
- Full System - Option B5X
- IQ Analyzer - Option B5X

Swept Spectrum Analyzer - External Mixing

N9040B – Option 508, 513, 526

Full System - Standard

10 MHz Analysis Bandwidth



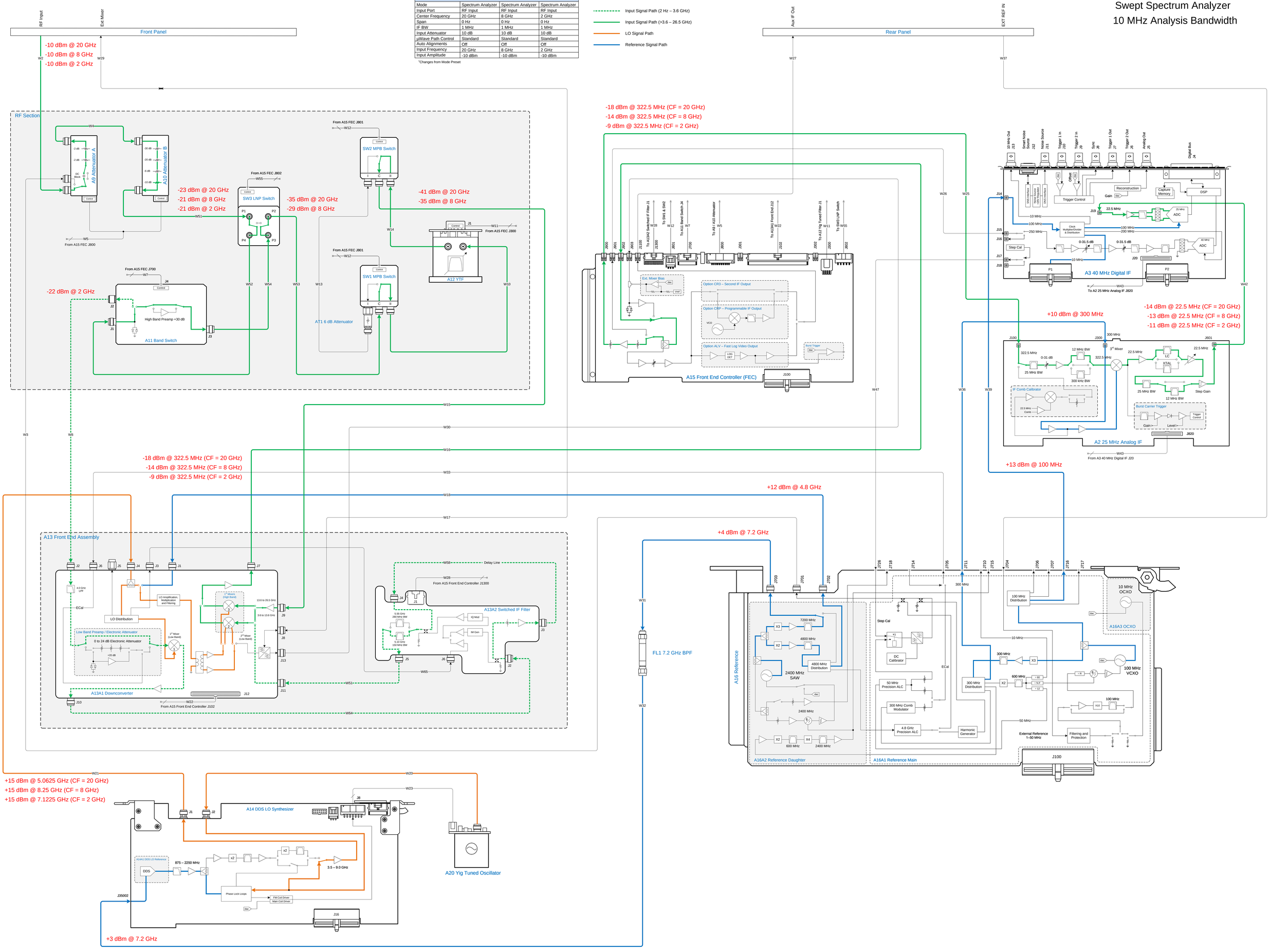
N9040B – Option 508, 513, 526

Swept Spectrum Analyzer

10 MHz Analysis Bandwidth

Instrument Setup[1]			
Mode	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer
Input Port	RF Input	RF Input	RF Input
Center Frequency	20 GHz	8 GHz	2 GHz
Span	0 Hz	0 Hz	0 Hz
IF BW	1 MHz	1 MHz	1 MHz
Input Attenuator	10 dB	10 dB	10 dB
µWave Path Control	Standard	Standard	Standard
Auto Alignments	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

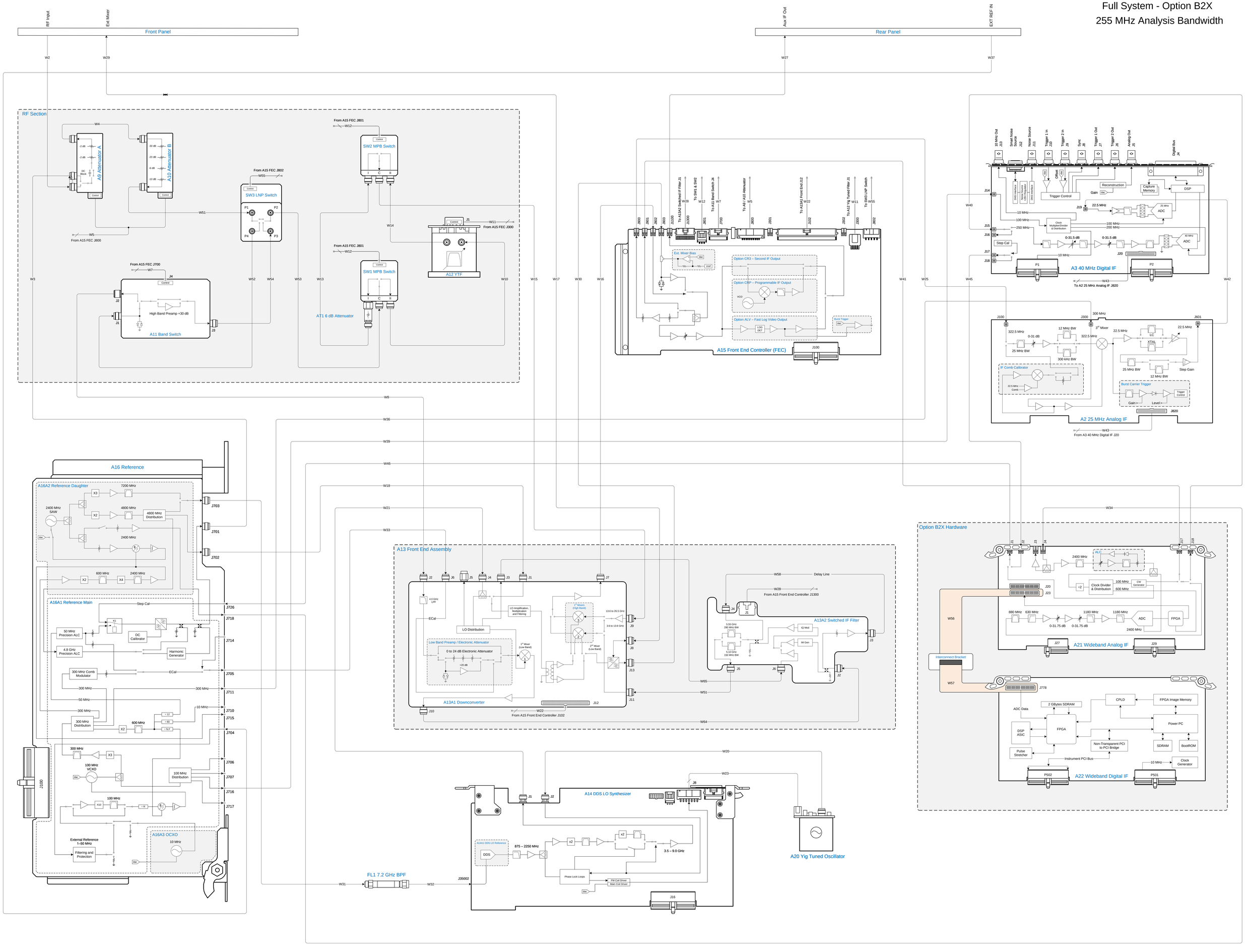
[1]Changes from Mode Preset



N9040B – Option 508, 513, 526

Full System - Option B2X

255 MHz Analysis Bandwidth



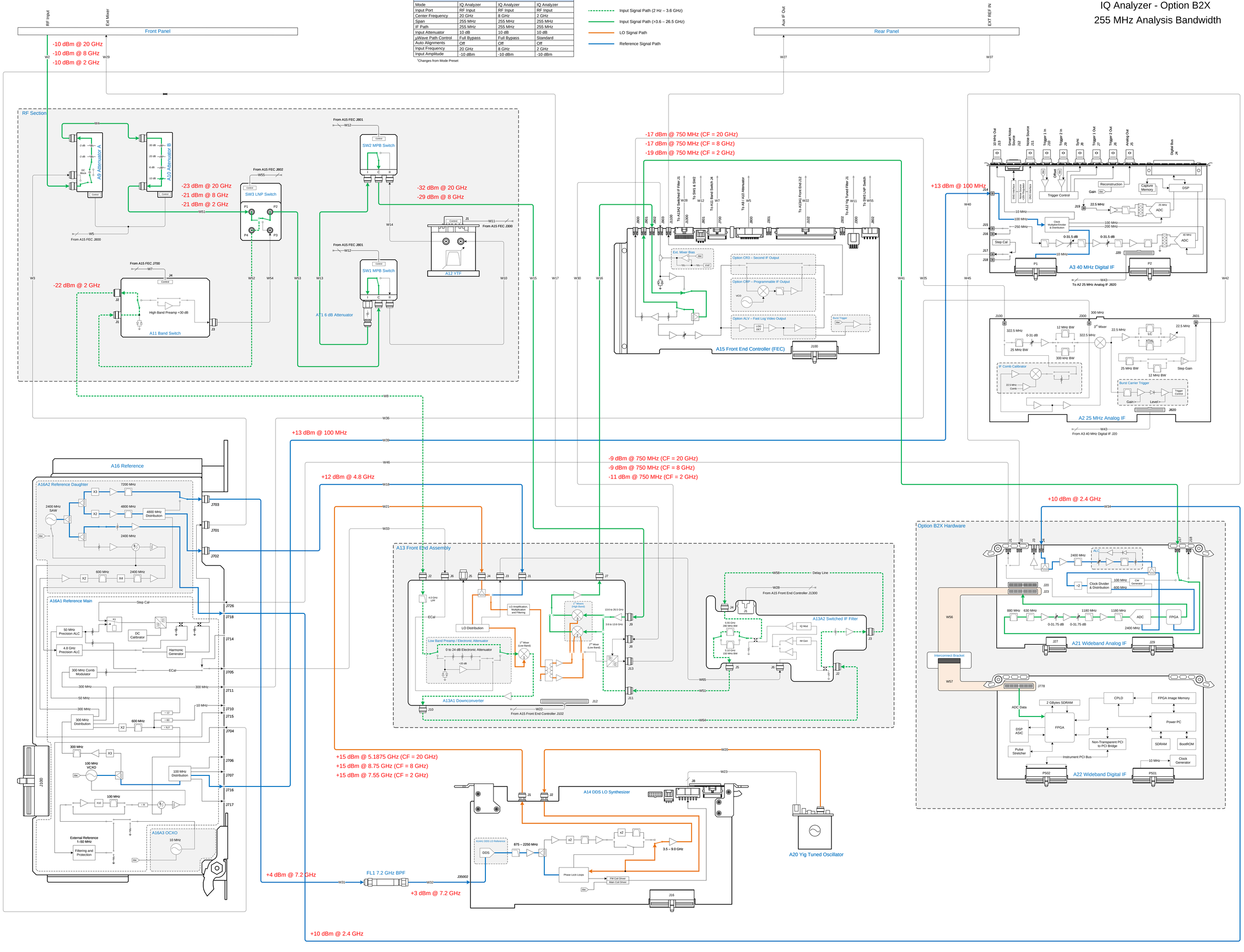
N9040B – Option 508, 513, 526

IQ Analyzer - Option B2X

255 MHz Analysis Bandwidth

Instrument Setup[1]			
Mode	IQ Analyzer	IQ Analyzer	IQ Analyzer
Input Port	RF Input	RF Input	RF Input
Center Frequency	20 GHz	8 GHz	2 GHz
Span	255 MHz	255 MHz	255 MHz
IF Path	255 MHz	255 MHz	255 MHz
Input Attenuator	10 dB	10 dB	10 dB
µWave Path Control	Full Bypass	Full Bypass	Standard
Auto Alignments	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

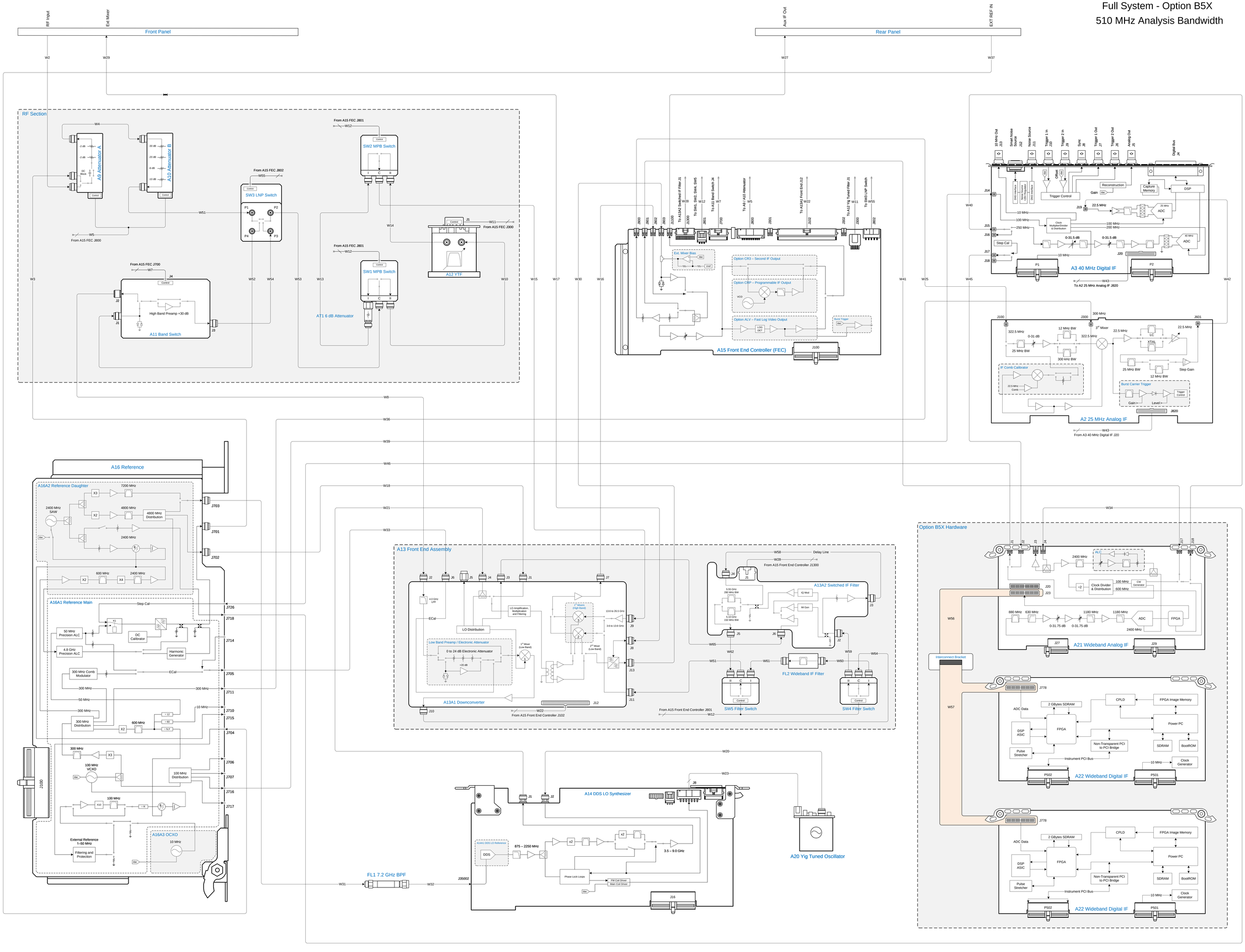
[1]Changes from Mode Preset



N9040B – Option 508, 513, 526

Full System - Option B5X

510 MHz Analysis Bandwidth



N9040B – Option 508, 513, 526

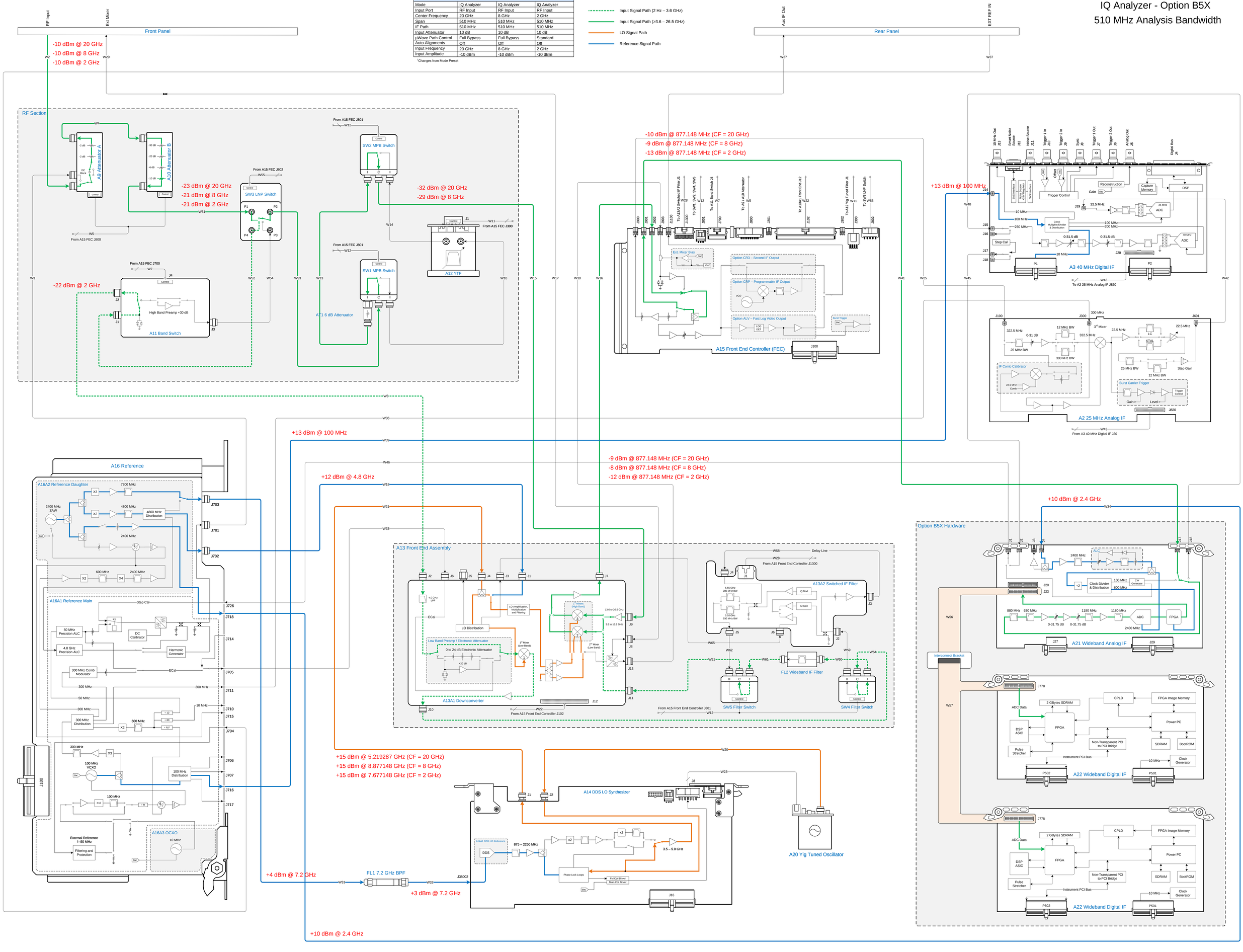
IQ Analyzer - Option B5X

510 MHz Analysis Bandwidth

Instrument Setup[1]			
Mode	IQ Analyzer	IQ Analyzer	IQ Analyzer
Input Port	RF Input	RF Input	RF Input
Center Frequency	20 GHz	8 GHz	2 GHz
Span	510 MHz	510 MHz	510 MHz
IF Path	510 MHz	510 MHz	510 MHz
Input Attenuator	10 dB	10 dB	10 dB
µWave Path Control	Full Bypass	Full Bypass	Standard
Auto Alignments	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

[1]Changes from Mode Preset

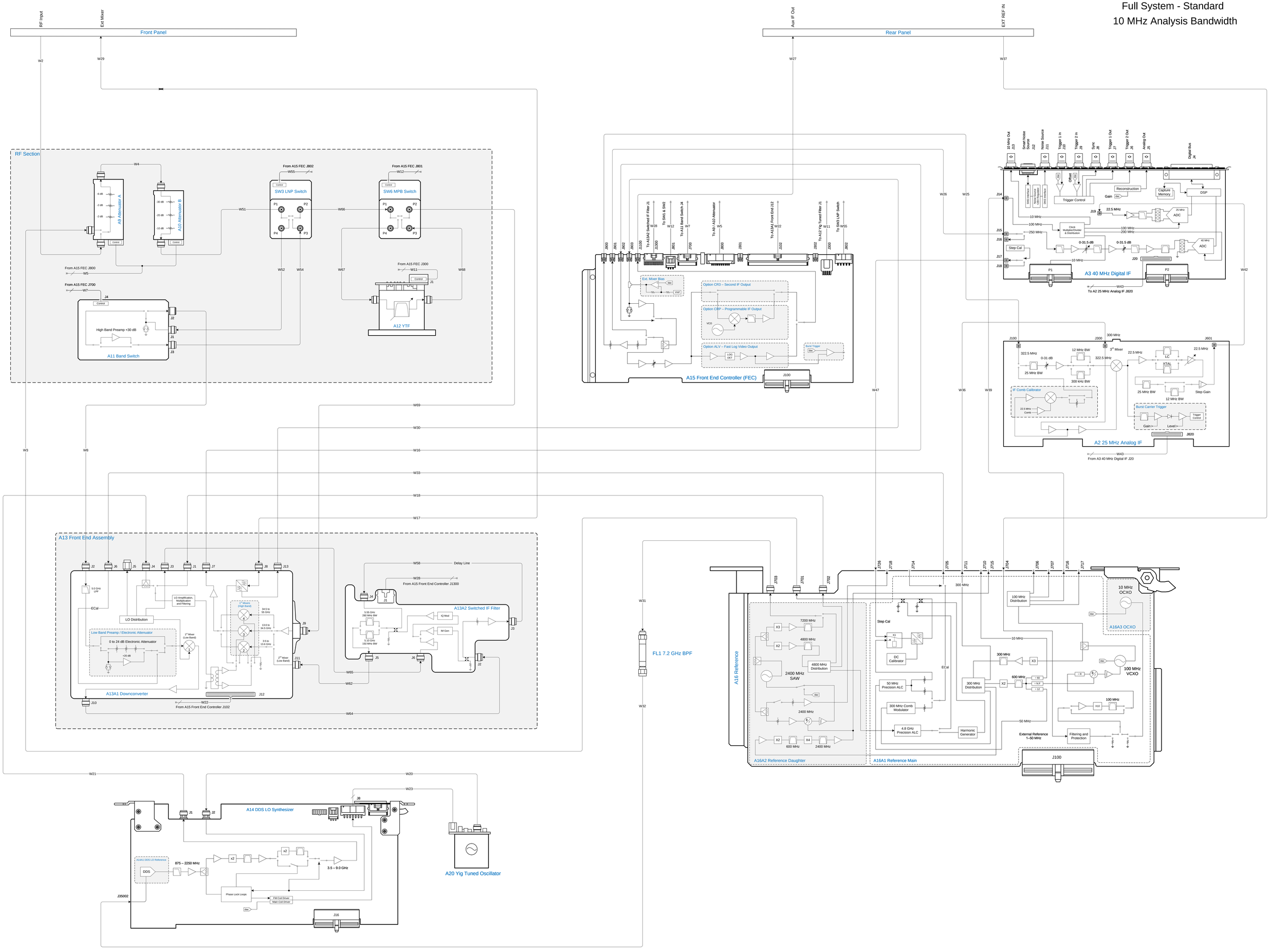
- Input Signal Path (2 Hz – 3.6 GHz)
- Input Signal Path (>3.6 – 26.5 GHz)
- LO Signal Path
- Reference Signal Path



N9040B – Option 544, 550

Full System - Standard

10 MHz Analysis Bandwidth



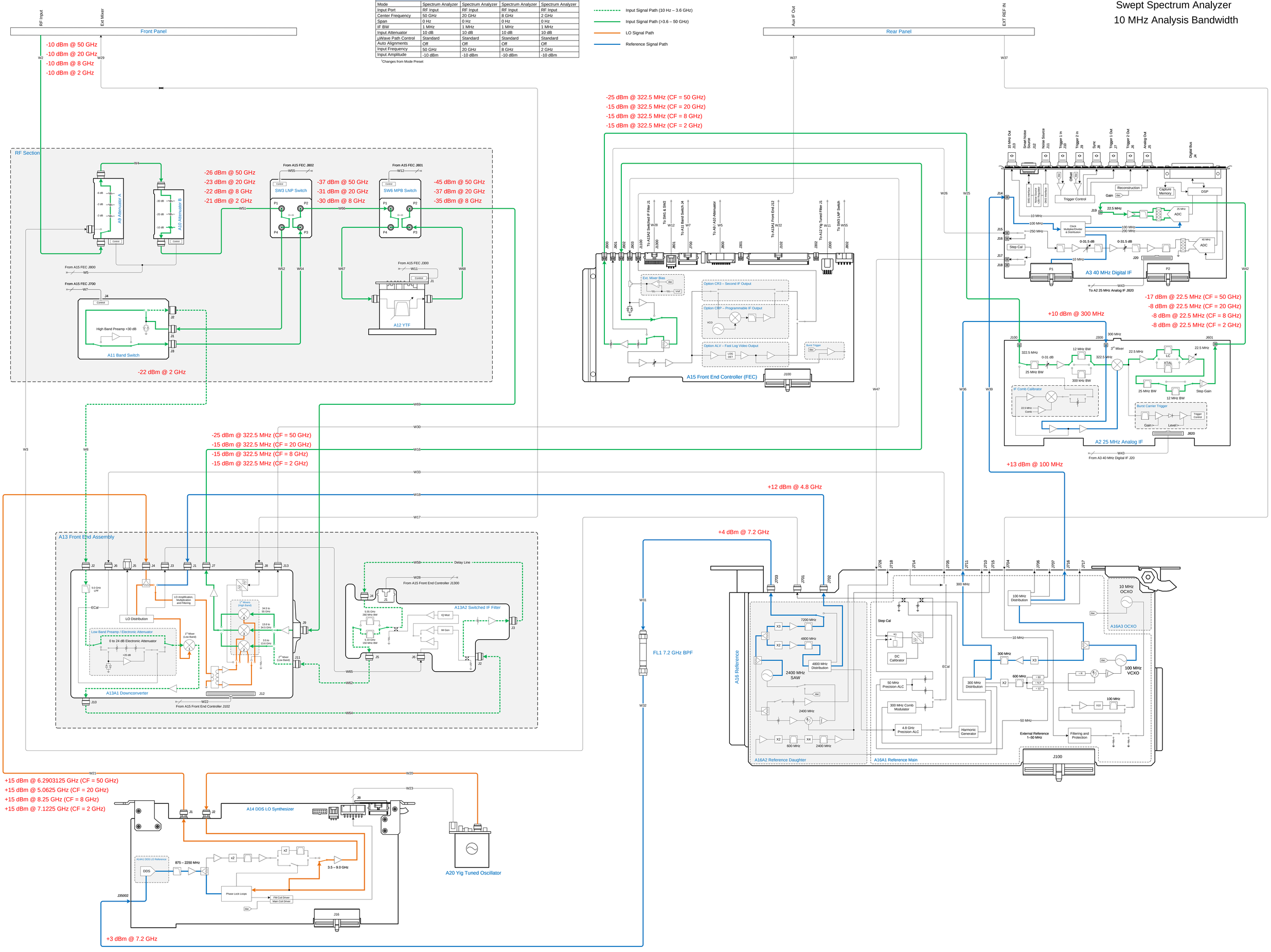
N9040B – Option 544, 550

Swept Spectrum Analyzer

10 MHz Analysis Bandwidth

Instrument Setup[1]				
Mode	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer	Spectrum Analyzer
Input Port	RF Input	RF Input	RF Input	RF Input
Center Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Span	0 Hz	0 Hz	0 Hz	0 Hz
IF BW	1 MHz	1 MHz	1 MHz	1 MHz
Input Attenuator	10 dB	10 dB	10 dB	10 dB
µWave Path Control	Standard	Standard	Standard	Standard
Auto Alignments	Off	Off	Off	Off
Input Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm	-10 dBm

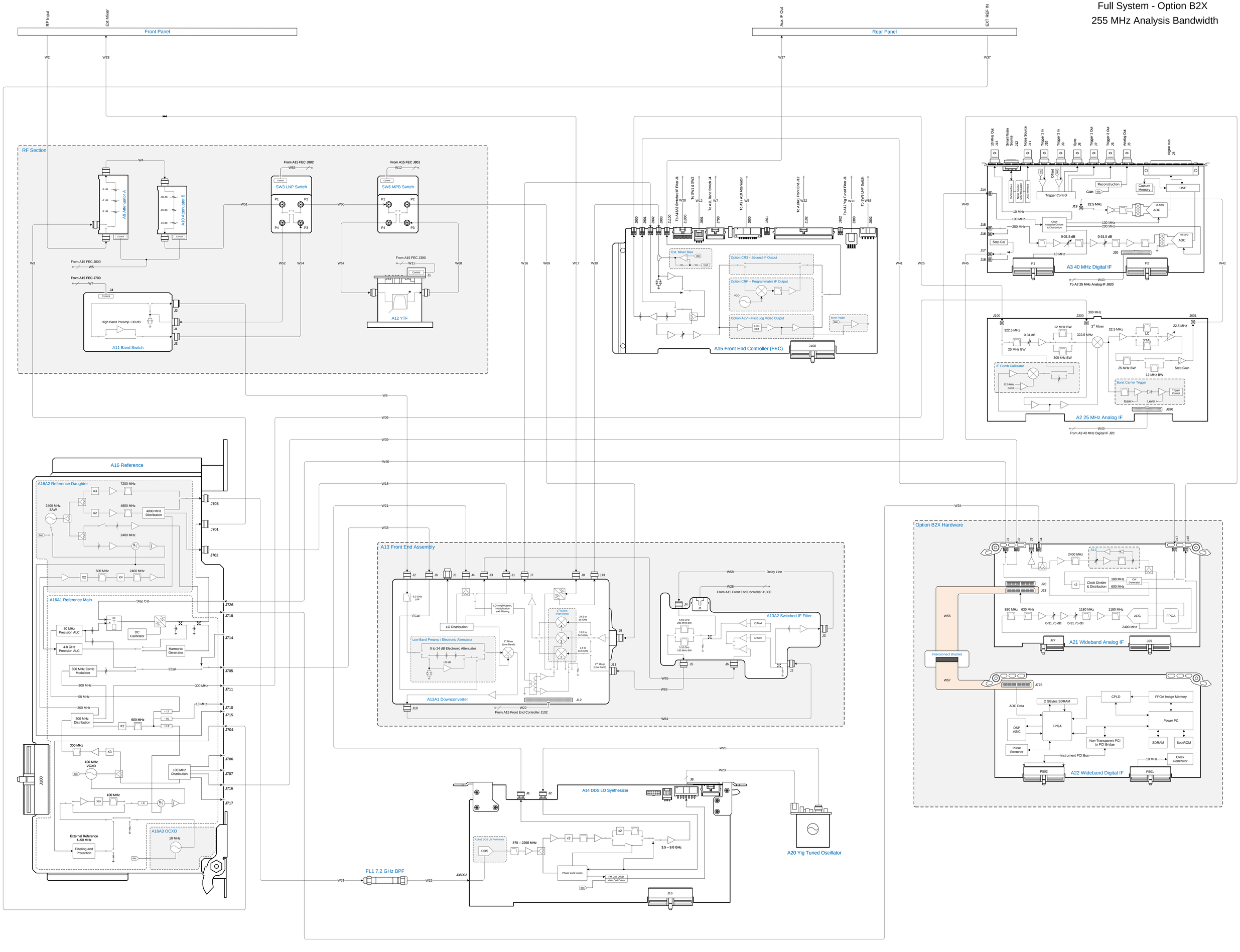
[1]Changes from Mode Preset



N9040B – Option 544, 550

Full System - Option B2X

255 MHz Analysis Bandwidth



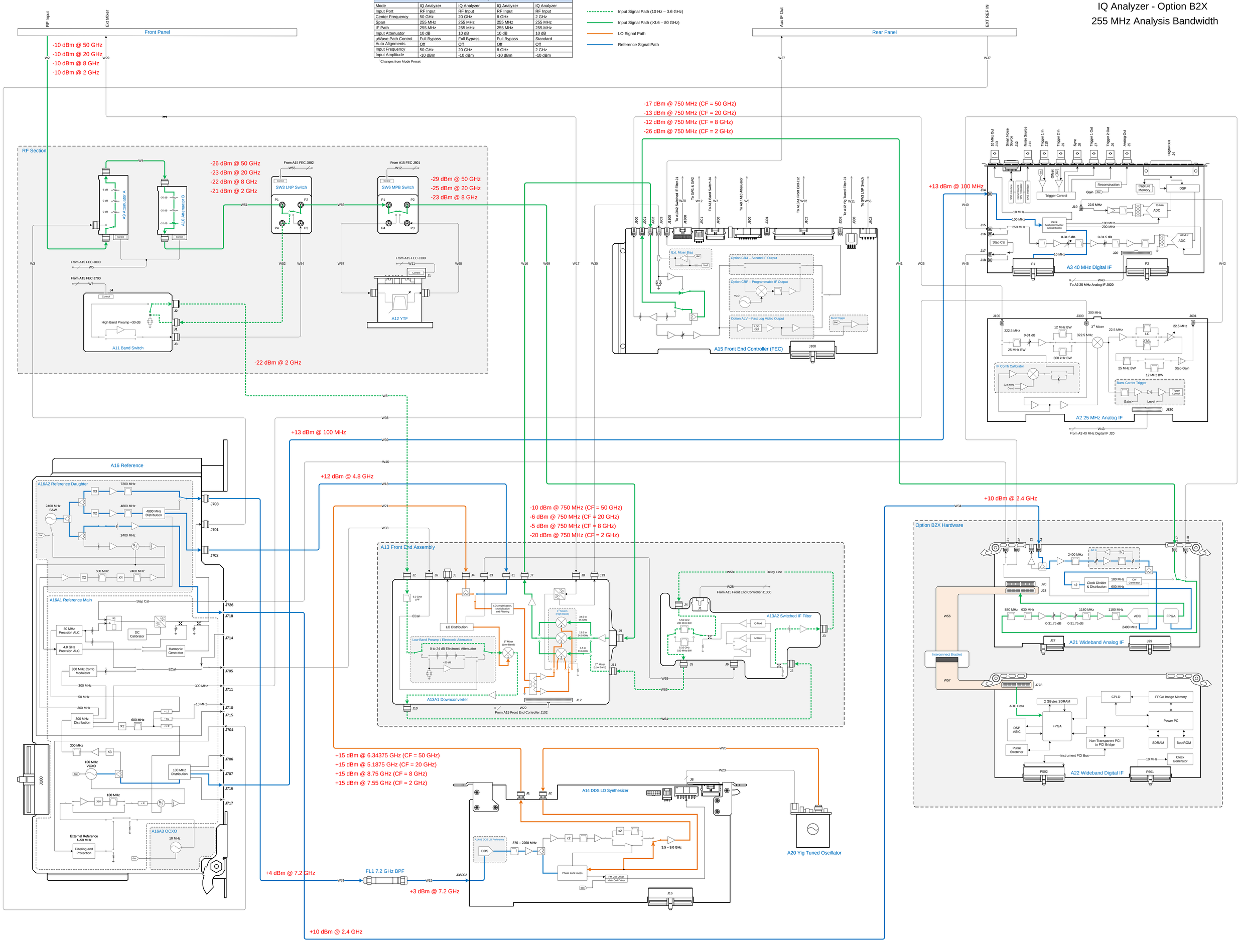
N9040B – Option 544, 550

IQ Analyzer - Option B2X

255 MHz Analysis Bandwidth

Instrument Setup[1]				
Mode	IQ Analyzer	IQ Analyzer	IQ Analyzer	IQ Analyzer
Input Port	RF Input	RF Input	RF Input	RF Input
Center Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Span	255 MHz	255 MHz	255 MHz	255 MHz
IF Path	255 MHz	255 MHz	255 MHz	255 MHz
Input Attenuator	10 dB	10 dB	10 dB	10 dB
µWave Path Control	Full Bypass	Full Bypass	Full Bypass	Standard
Auto Alignments	Off	Off	Off	Off
Input Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm	-10 dBm

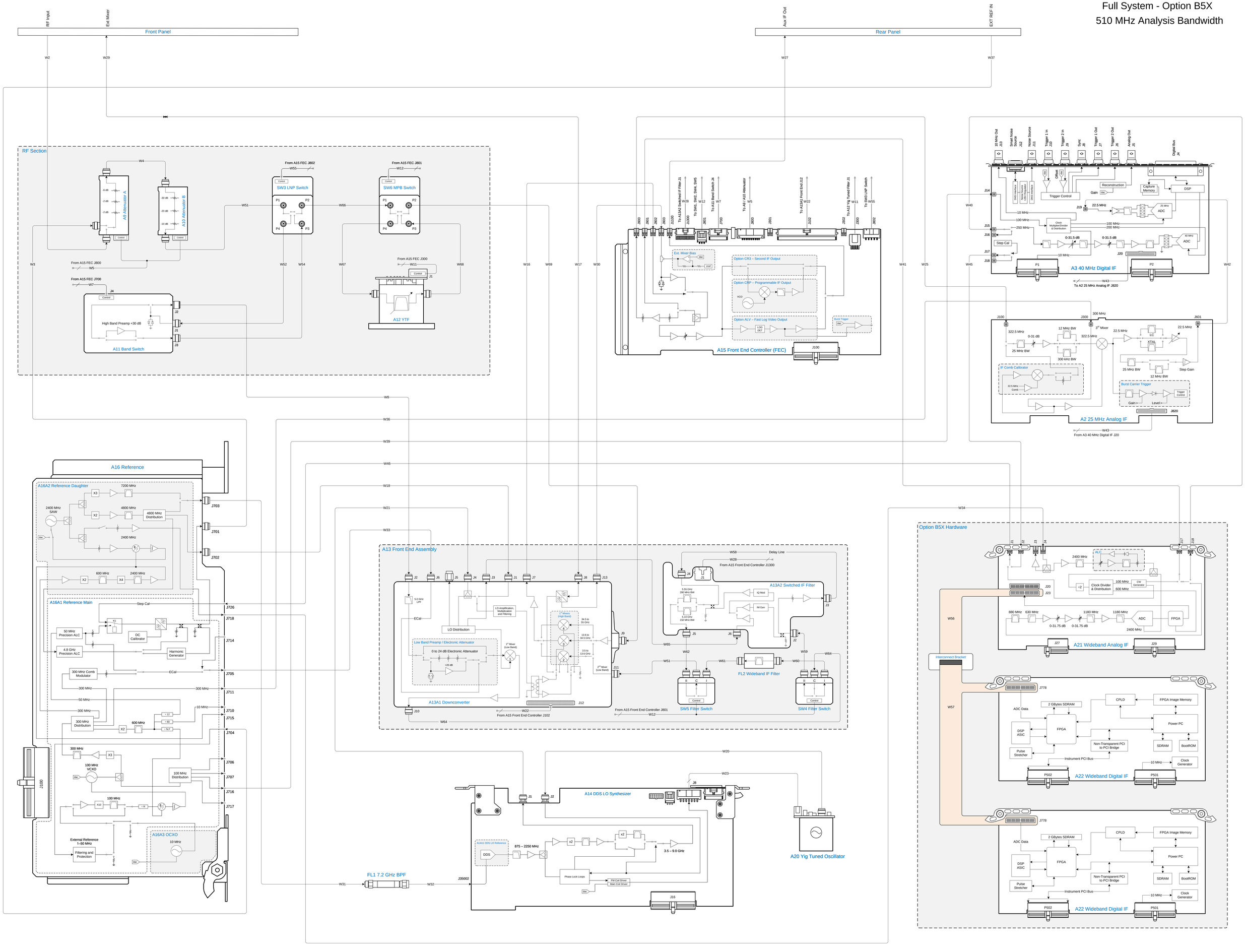
[1]Changes from Mode Preset



N9040B – Option 544, 550

Full System - Option B5X

510 MHz Analysis Bandwidth



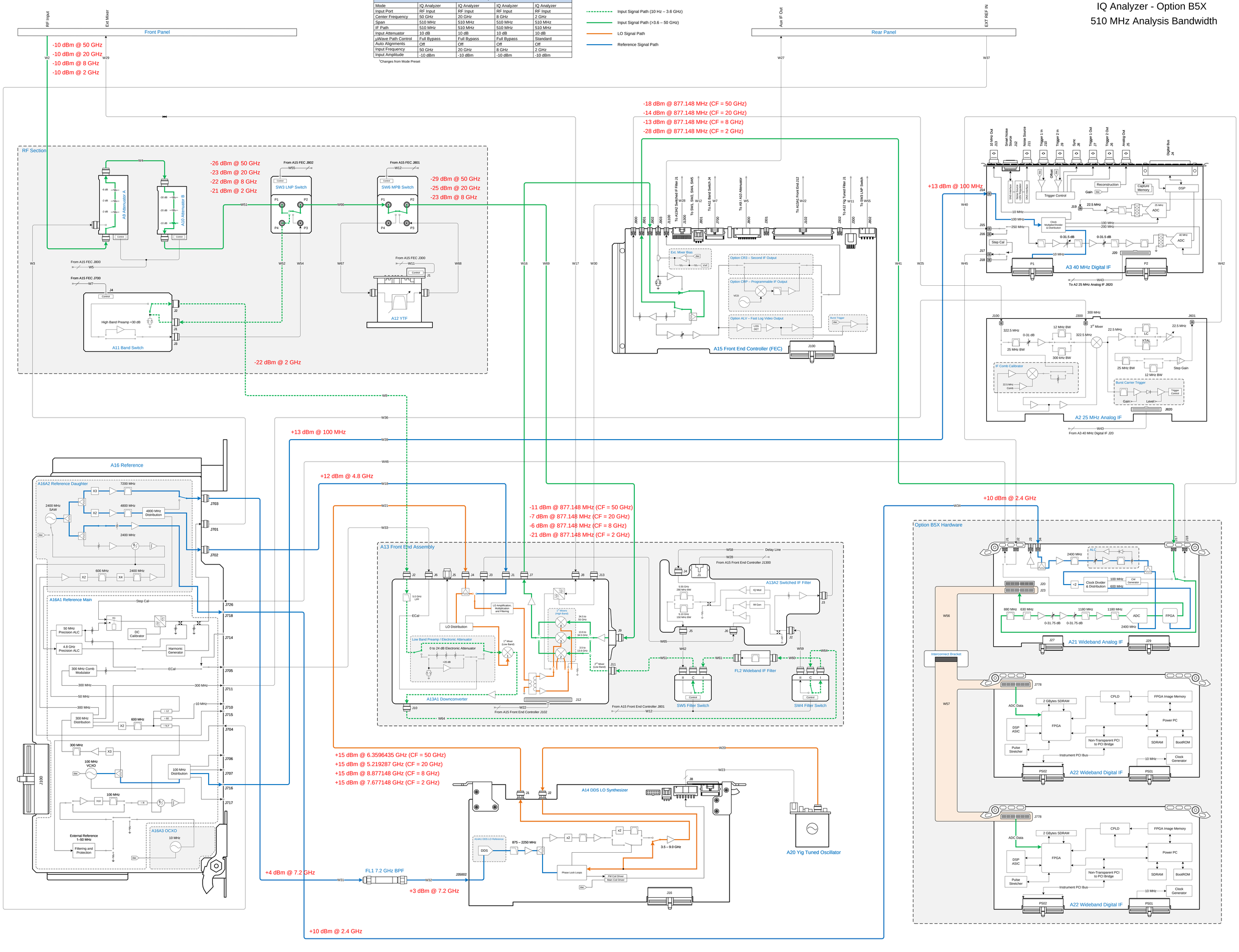
N9040B – Option 544, 550

IQ Analyzer - Option B5X

510 MHz Analysis Bandwidth

Instrument Setup[1]				
Mode	IQ Analyzer	IQ Analyzer	IQ Analyzer	IQ Analyzer
Input Port	RF Input	RF Input	RF Input	RF Input
Center Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Span	510 MHz	510 MHz	510 MHz	510 MHz
IF Path	510 MHz	510 MHz	510 MHz	510 MHz
Input Attenuator	10 dB	10 dB	10 dB	10 dB
µWave Path Control	Full Bypass	Full Bypass	Full Bypass	Standard
Auto Alignments	Off	Off	Off	Off
Input Frequency	50 GHz	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm	-10 dBm

[1]Changes from Mode Preset



N9040B

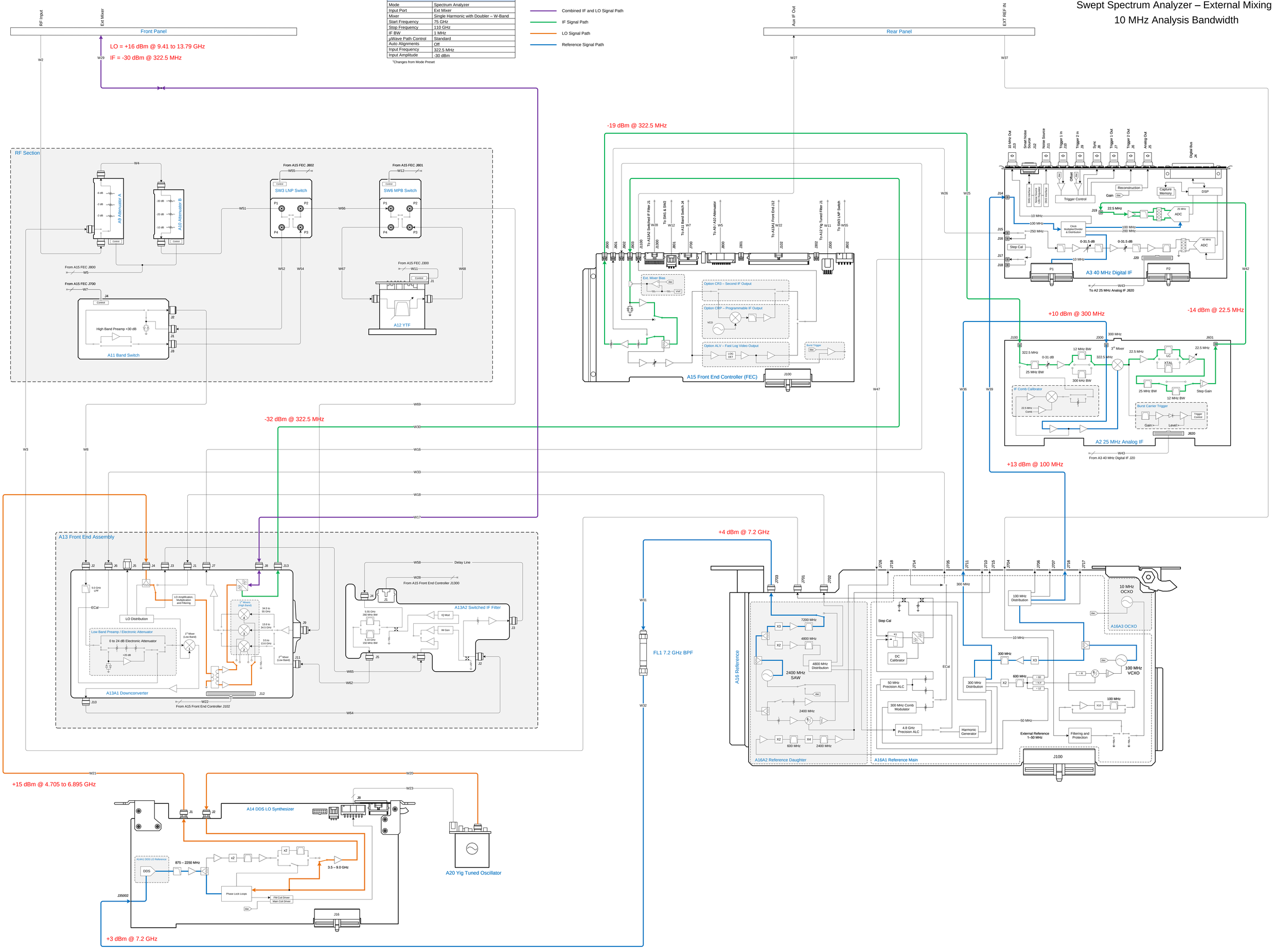
Swept Spectrum Analyzer – External Mixing

10 MHz Analysis Bandwidth

Instrument Setup[1]	
Mode	Spectrum Analyzer
Input Port	Ext Mixer
Mixer	Single Harmonic with Doubler – W-Band
Start Frequency	75 GHz
Stop Frequency	110 GHz
IF BW	1 MHz
µWave Path Control	Standard
Auto Alignments	Off
Input Frequency	322.5 MHz
Input Amplitude	-30 dBm

[1]Changes from Mode Preset

- Combined IF and LO Signal Path
- IF Signal Path
- LO Signal Path
- Reference Signal Path



7 RF Section (RF/Microwave)

What You Will Find in This Chapter

The following information is found in this chapter:

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

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

The following sections are found in this chapter:

RF Section Description on page 136
- A9 Input Attenuator A on page 138
- A10 Input Attenuator B on page 138
- A11 Low Band Switch on page 139
- A12 YTF Preselector on page 139
- A20 YTO Assembly on page 139
- A13 RF Front End Assembly on page 140

Troubleshooting on page 142
- Quick Check to Verify the Low Band Signal Path on page 142
- Troubleshooting a Low Band Problem on page 146
- Quick Check to Verify High Band RF Path on page 153
- Troubleshooting a High Band Problem on page 157

RF Section Description

This section covers only those optional frequency ranges listed below for the N9040B Signal Analyzer.

– Option 508, 8.4 GHz Frequency Range

– Option 513, 13.6 GHz Frequency Range

– Option 526, 26.5 GHz Frequency Range

The RF input signal can be routed through three different front end signal paths. These various paths are switched in and out based on where the signal analyzer center frequency is tuned.

1. **Low band RF path is used when the input frequency is ≤ 3600 MHz**
2. **High band RF path #1 is used when the input frequency is > 3.6 GHz to 13.6 GHz**
3. **High band RF path #2 is used when the input frequency is > 13.6 GHz to 26.5 GHz**

The RF section is designed to convert RF input signals to an intermediate frequency that is present at the RF output of the A13 Front End assembly. This intermediate frequency (IF) depends on installed options and the IF path selected. This chapter will assume the default operation in Spectrum Analyzer mode. Therefore the IF frequency will be 322.5 MHz.

IF Path	IF	Mode
10 MHz (standard)	322.5 MHz	Spectrum Analyzer or IQ Analyzer
25 MHz (Option B25)	322.5 MHz	IQ Analyzer
40 MHz (Option B40)	250 MHz	IQ Analyzer
255 MHz (Option B2X)	750 MHz	IQ Analyzer
510 MHz (Option B5X)	877 MHz	IQ Analyzer

The RF section is comprised of the following major assemblies:

- A9 Input Attenuator A
- A10 Input Attenuator B
- A11 Low Band Switch Assembly
- A12 YTF Preselector
- A20 Yig Tuned Oscillator
- A13 RF Front End Assembly
- A15 Front End Control Assembly
- Low Noise Path
- Microwave Preselector Bypass

Refer to the annotated Option 508, 513, 526 Swept Spectrum Analyzer block diagram in Chapter 6, "Block Diagrams," for the following descriptions of the signal flow.

1. **RF input frequencies < 3600 MHz** route through the low band path.

   The RF input signal level can be optimized by Input Attenuator A and/or Input Attenuator B. The low band switch assembly contains a limiter that offers added protection for the mixer, and routes the input signal to the low band input of the A13 RF Front End assembly. There are (3) different signal paths on the input of the RF Front End assembly that the signal can be routed through depending on installed options and front panel settings.

   - Electronic Attenuator path, 0-24 dB (Option EA3)
   - Low Band Preamplifier path, 20 dB nominal gain
   - Direct to Mixer #1

NOTE The RF input signal can route through the Electronic Attenuator section or the Preamplifier, but not both. All RF input frequencies < 3600 MHz go to Mixer #1.

The RF input signal is then mixed with the 1st LO from the A20 YTO assembly to a 1st intermediate frequency of 5122.5 MHz. Since the RF input signal is < 3600 MHz for low band, this RF input signal is upconverted in Mixer #1 to the 1st IF. This 1st IF signal is then downconverted in Mixer #2 using the 4800 MHz 2nd LO generated on the A16 Reference assembly to a 2nd intermediate frequency of 322.5 MHz (5122.5 MHz (1st IF) – 4800 MHz (2nd LO)). The 2nd IF output is at A13A1J7. This signal path is used for all frequency range options when the RF input frequencies are < 3600 MHz. The control voltages and biasing for these assemblies come from the A15 Front End Control assembly.

2. **RF input frequencies from 3.6 GHz to 13.6 GHz** go through the high band path.

   The input signal level can be optimized by Input Attenuator A and/or Input Attenuator B. The Low Band Switch assembly routes the signal through the A12 YTF Preselector. If one of the optional high band preamps is licensed, the signal can be routed through the preamp. The A15 Front End Controller provides switching signals.

   The Low Band Switch assembly performs the following tasks:

   - Provides a limiter that offers added protection for the mixer and optional preamp.
   - Contains the high band preamp.
   - Routes the input signal to the A12 YTF Preselector.

   The high band input switch in the Front End Assembly routes the RF input signal to Mixer #2, where it mixes with the LO and provides a 1st intermediate frequency of 322.5 MHz. The 322.5 MHz IF output is at A13A1J7. This is the signal path for Option 508, 8.4 GHz Frequency Range, Option 513, 13.6 GHz Frequency Range, and Option 526, 26.5 GHz Frequency Range (up to 13.6 GHz). The control voltages and biasing are provided by the A15 Front End Control Assembly.

3. **RF input frequencies from 13.6 GHz to 26.5 GHz** go through the high band path.

   The signal path for 13.6 GHz to 26.5 GHz operation is almost the same as the 3.6 GHz to 13.6 GHz path. The only difference is that Mixer #3 is used in this path. The LO is doubled at tuned frequencies above 17 GHz.

A9 Input Attenuator A

This assembly has two 2 dB attenuator sections, a DC block and a cal signal input port. With the DC block switched in (AC coupled mode), the low end minimum frequency range increases from 3 Hz to 10 MHz due to capacitive effects.

A10 Input Attenuator B

This assembly has a total of 66 dB of attenuation to control the signal level into the Low Band Switch assembly. There is a 6 dB, 10 dB, 20 dB, and 30 dB section in the A10 assembly. Total input attenuation with the A9 and the A10 combined is 70 dB in 2 dB steps.

A11 Low Band Switch

This assembly operates across the entire frequency range of the analyzer. The switch has 3 main functions:

- Switch RF input frequencies from 3 Hz to 3.59 GHz RF Output to A13 RF Front End Assembly.
- Switch input frequencies from 3.6 GHz to 26.5 GHz Microwave RF Output to A12, YTF Preselector.
- Contains optional high band preamplifier, which has a typical gain of 30 dB and a noise figure from 9 to 12 dB up to 18 GHz.
- Contains protective limiter circuitry.

A12 YTF Preselector

The YTF Preselector is used for input frequencies greater than 3.6 GHz. Signals less than 3.6 GHz bypass the YTF assembly and are routed to the low band input of the A13 RF Front End Assembly. The YTF Preselector is a YIG tunable bandpass filter whose main purpose is to track the input signal and to filter out unwanted spurious or image response signals. The YTF Preselector has a 3 dB bandwidth greater than 40 MHz and an insertion loss of ~ 6.5 dB.

The preselector requires centering for optimum amplitude accuracy. The Auto Align routine will perform a rough centering during the preselector two point tuning algorithm. However, when troubleshooting, press **Amplitude**, **Preselector Center** to manually center the preselector.

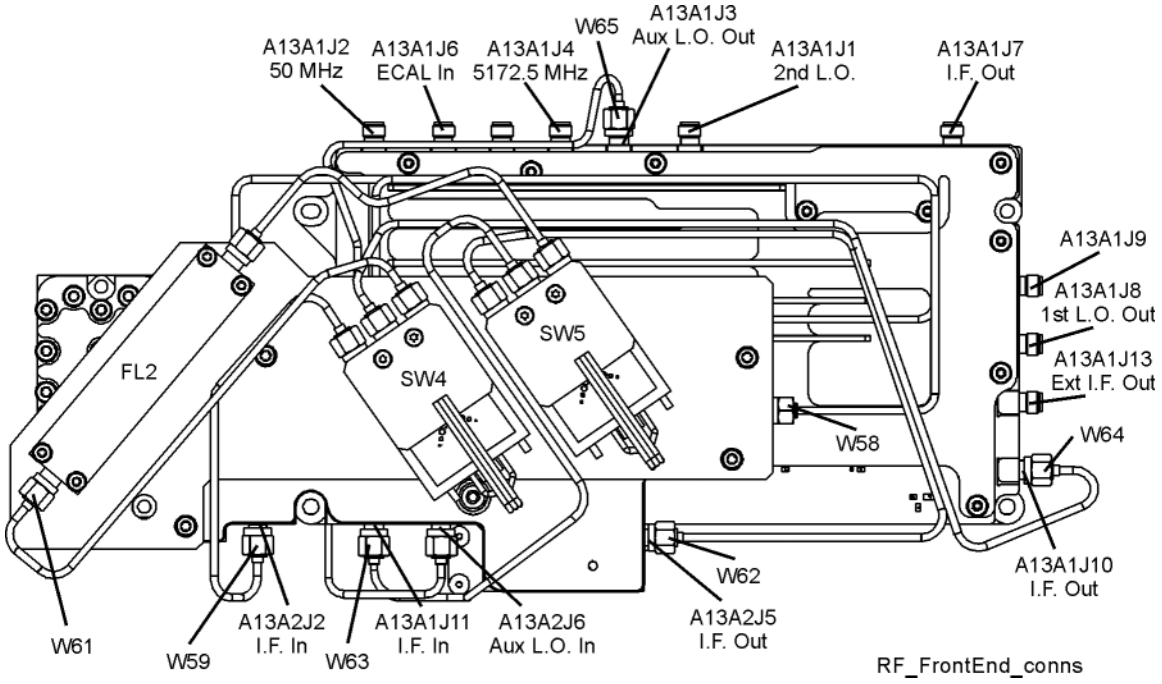
A20 YTO Assembly

Provides the 1st LO signal that is required for the A13 RF Front End Assembly. The 1st LO has a frequency range from 3.50 to 9 GHz. The output power is +13 to +18 dBm. In order to maximize the conversion efficiency and avoid LO unlock, sufficient LO power must be supplied.

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. See Figure 7-1.

Figure 7-1 A13 RF Front End Assembly



This assembly contains the following circuits:

- Input Low-pass filter (RF input signals < 3.6 GHz)
- Optional Low Band Electronic Attenuator (0-24 dB attenuation control)
- Optional Low Band Preamplifier and Limiter
- RF Mixer #1 (RF input signals < 3.6 GHz)
- 1st LO Sub-system (3.8 GHz to 8.7 GHz)
- 1st IF Amplifier
- Switched Filters (A13A2) provides wide BW band pass filter (low band)
- LO and IM nulling (A13A2)
- Mixer #2 (RF input signals 3.6 GHz to 13.599 GHz)
- Microwave Input Amplifier
- Mixer #3 (RF input signals 13.6 GHz to 26.5 GHz)
- LO Doubler
- External Mixing Diplexer

A15 Front End Control Assembly

Provides the correct biasing and switch control logic to the following RF assemblies:

- Input Attenuator A
- Input Attenuator B
- Low Band Switch
- Low Noise Path
- YTF Preselector (Input signals > 3.6 GHz)
- Microwave Preselector Bypass
- Front End Assembly including switched filter
- (Optional) High Band Preamplifier
- (Optional) Low Band Preamplifier
- (Option EA3) Electronic Attenuator (0-24 dB)

NOTE For detailed descriptions & troubleshooting procedures refer to Chapter 9, “Front End Control.”

Troubleshooting

Quick Check to Verify the Low Band Signal Path

The analyzer has an internal 50 MHz amplitude reference signal that is used to verify the low band path. This 50 MHz calibrator is used when the analyzer performs many of the internal alignment routines. Therefore, the functionality of the 50 MHz calibrator and low band path are critical to passing Align All Now.

Equipment needed:

Spectrum Analyzer with frequency range to 8 GHz

Signal source with output power 0 dBm and frequency range to at least 3.6 GHz

Power splitter, 11667B

2 each, quality SMA or 3.5 mm cables

90° SMA (m) to SMA (f) adapter

MMCX (f) to SMA (f) cable or adapter

SMA (f) to SMA (f) adapter

SMA (m) to SMA (m) adapter

NOTE To perform the following checks, it will be necessary to remove the outer cover, top brace, and possibly more brackets. For removal procedures see Chapter 20, "Assembly Replacement Procedures."

Turn the instrument on and allow it to complete its full boot up process to Spectrum Analyzer mode. Use the internal 50 MHz, –25 dBm calibrator signal as a reference for troubleshooting by pressing **Mode Preset**, **Input/Output**, **RF Calibrator**, **50 MHz** on the analyzer. Now press **FREQ (Channel)**, **Center Frequency**, **50 MHz**, **Span**, **1 MHz**, **Peak Search**. The 50 MHz reference signal should measure 50 MHz @ –25 dBm ± 2 dB on the analyzer display. If the power level is within tolerance, the low band path is functioning correctly at 50 MHz. If the power level is incorrect, select the 4.8 GHz RF Calibrator and set the analyzer center frequency to 4.8 GHz. Since several of the same signal path components are shared between low band and high band, determining if the problem appears in both paths is helpful.

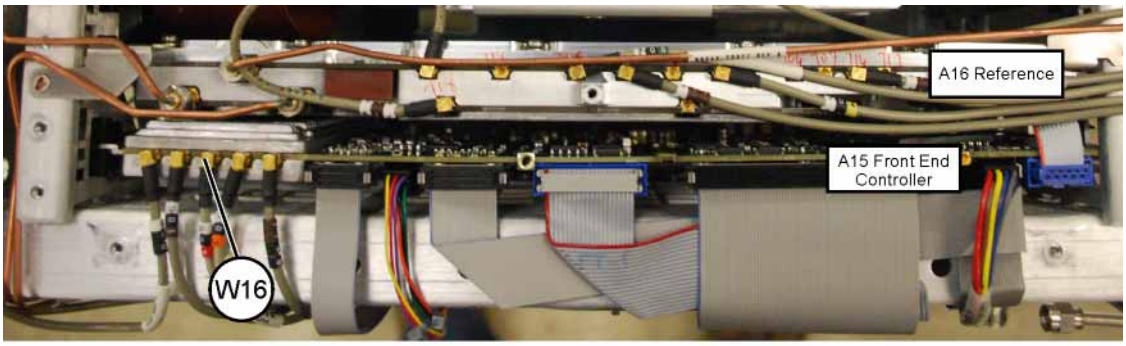
To verify the high band path go to "Quick Check to Verify High Band RF Path" on page 153.

If the power level is not within tolerance, press **FREQ (Channel)**, **Toggle Swept Span to Zero Span**, **AMPTD (Y Scale)**, **Attenuation**, **10 dB**.

IMPORTANT Turn off auto align by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Disconnect the W16 cable from A15J902 on the Front End Controller IF IN. The end of W16 cable is easily accessed from the top of the instrument (See Figure 7-2.

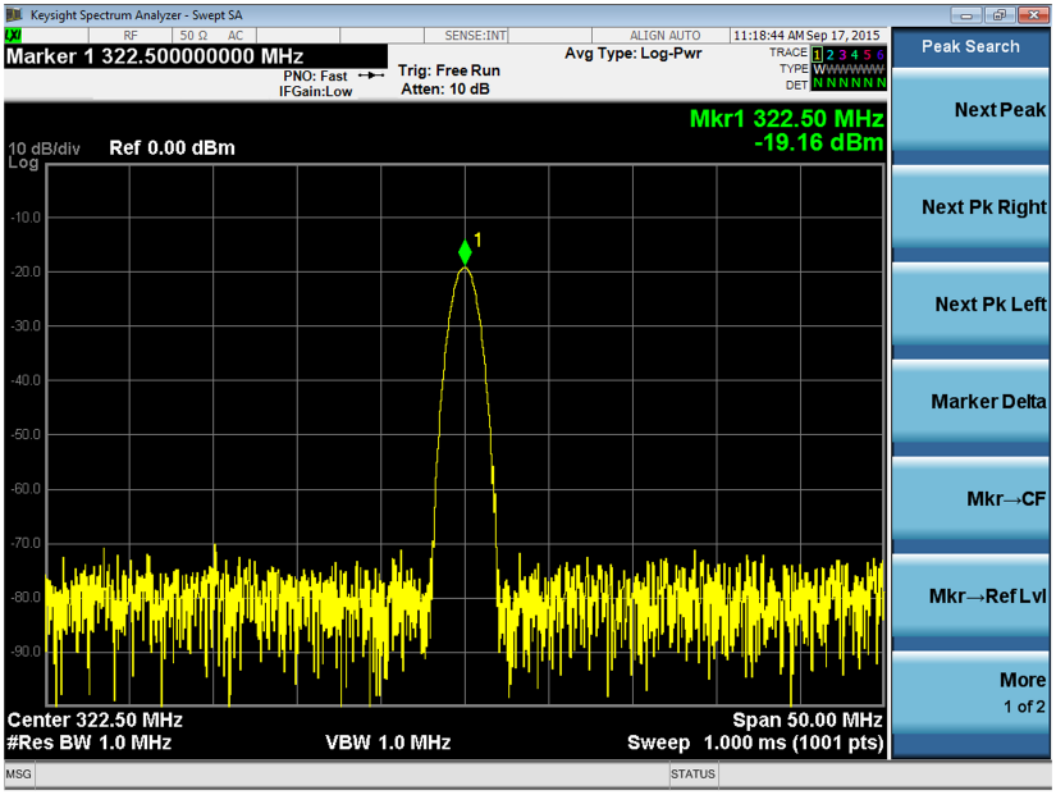
Figure 7-2 W16 at Front End Controller



W16

Connect W16 cable output to a functioning spectrum analyzer and verify the 322.5 MHz intermediate frequency is measuring –20 dBm ± 3 dB using the same analyzer settings as in Figure 7-3.

Figure 7-3 322.5 MHz Intermediate Frequency



If this power level is correct the signal path from the A9 50 MHz Reference signal input port to W16, IF Output is operating correctly using a 50 MHz input calibrator signal. Reconnect the W16 cable to A15J902.

NOTE

Flatness issues or power level problems at other input frequencies below 3600 MHz may exist. This type of problem can be diagnosed using an external source to verify performance

If this power level is incorrect, the following assemblies need to be verified using the 50 MHz internal calibrator signal. Be sure the 50 MHz calibrator is turned on. Press **Input/Output**, **RF Calibrator**, **50 MHz** when verifying the performance.

1. A11 Low Band Switch
2. A10 Input Attenuator B
3. A9 Input Attenuator A
4. A16 Reference Assembly (50 MHz calibrator, 2nd LO)
5. A20 YTO
6. A13 RF Front End Assembly

NOTE

In order to gain access to the front end components, remove the front frame assembly, but leave the ribbon cable connected so you can still control the instrument. Remove the right side chassis. Refer to the removal procedures in Chapter 20, “Assembly Replacement Procedures.”

Troubleshooting a Low Band Problem

To enable the internal 50 MHz, –25 dBm calibrator signal press **Input/Output**, **RF Calibrator**, **50 MHz**.

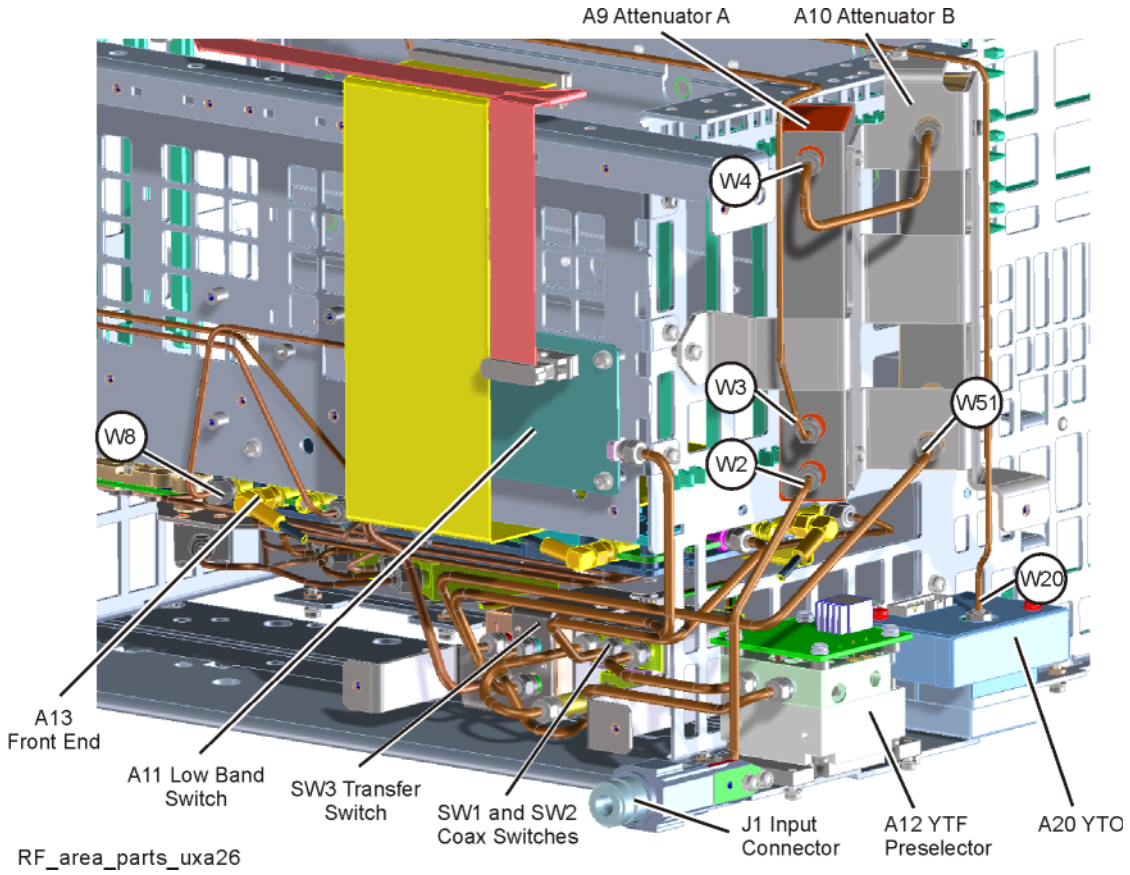
The Low Band signal path (sometimes referred to as Band 0) is used for all signals less than 3.6 GHz when the analyzer is used in normal operation. If the stop frequency is set to 3.6 GHz, the analyzer displays only the Low Band signal path. If the analyzer stop frequency is set above 3.6 GHz and the start frequency is set below 3.6 GHz, the analyzer will sweep up to 3.6 GHz in low band and then automatically switch to the high band path above 3.6 GHz.

A11 Low Band Switch Verification

Disconnect W8 from A13A1J2. See Figure 7-4 for location of connector. Attach a right angle sma adapter to W8 and measure the output of the Low Band Switch with a spectrum analyzer. Expected signal is 50 MHz at –35.3 dBm since the Low Band Switch and Option LNP SW3 have a few tenths of a dB loss.

If the signal level is incorrect, remove A10 Input Attenuator B output cable W51 and measure the output power. Expected signal is 50 MHz at –35 dBm. See Figure 7-4 for location of attenuator. If the attenuator output signal is correct but the Low Band output at W8 is incorrect, suspect the A11 Low Band Switch, the interconnect cables, Switch 3 if Option LNP is present, or the control signals. The control signals are explained in Chapter 9, “Front End Control”, on page 189.

Figure 7-4 RF Section



A9 Input Attenuator and A10 Input Attenuator Verification

Calibrator Switch Test

On the A16 Reference assembly, disconnect semi rigid cable W3 from A16J701 and measure A16J701 with a spectrum analyzer. Expected signal is 50 MHz at –25 dBm ± 0.5 dB. If signal level is incorrect, suspect A16 Reference assembly is faulty, or the 50 MHz calibrator amplitude requires adjustment using the field calibration software.

To verify calibrator switch operation, connect external signal source set to 50 MHz and –25 dBm to the RF input connector of analyzer under test. Press **Input/Output**, **RF Calibrator**, **Off**. If the signal level at the attenuator output is now correct, suspect the A9 Attenuator cal switch or a faulty control signal from the A15 Front End Controller assembly.

Attenuator Check

Set the signal source connected to the analyzer input port to 0 dBm. On the analyzer, press **Amplitude**, **Attenuation**, and change input attenuation to 0 dB. The measuring spectrum analyzer connected to A10 Attenuator output port should indicate a 0 dBm level.

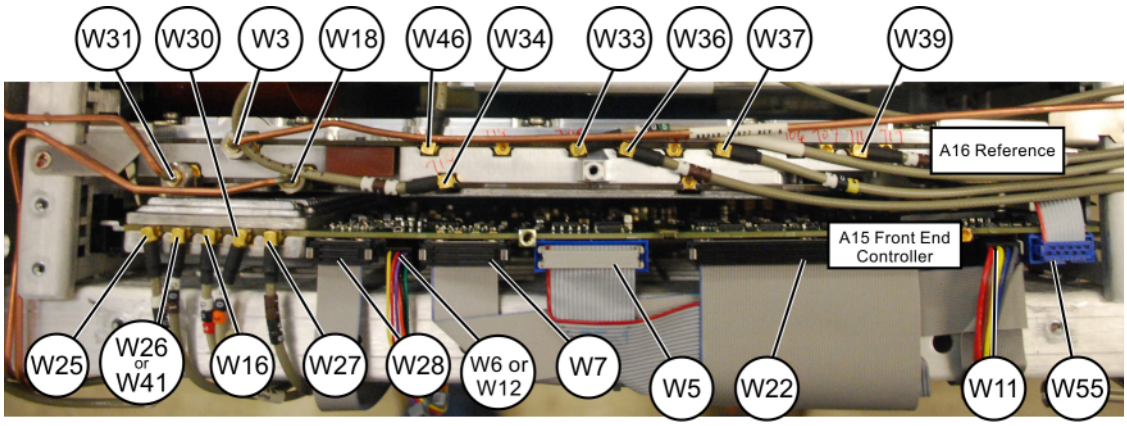
Change the input attenuation on the analyzer under test to 2 dB. See the chart below for expected measurement values at the A10 Attenuator output port.

Analyzer Under Test Attenuator Setting (dB)	Power at A10 Output Port	Input Attenuator Being Tested
0	0 dBm (reference)	Both set to through path
2	–2	A9
4	–4	A9
6	–6	A10
8	–8	A9 set to 2 dB, A10 set to 6 dB
10	–10	A10
20	–20	A10
30	–30	A10
40	–40	A10
50	–50	A10
60	–60	A10
70	–70	A9 set to 4 dB, A10 set to 66 dB

Second LO Level Verification

The second LO signal comes from the A16 Reference Assembly and is only used in Low Band. The second LO signal can be measured by removing the W18 semi-rigid cable from A16J702. Connect the functioning spectrum analyzer to A16J702 connector. This signal goes to A13A1J1 via the W18 cable. Expected signal is 4800 MHz at +10 dBm when a low loss test cable is used and with the measuring spectrum analyzer input attenuator set to at least 20 dB to prevent overload.

Figure 7-5 A16



front_cables_uxa

First LO Level Verification

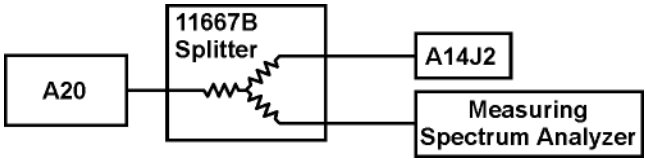
The first LO is the A20 YTO assembly. The first LO is phased locked by the A14 Synthesizer assembly.

To assure the first LO is tuned to the correct frequency and power, measure the A13 Front End assembly at A13A1J3 when the analyzer center frequency is 50 MHz. This test port is chosen because removing cable W19 will not cause the analyzer LO phase lock loop to unlock, which would affect the LO frequency measurement. Analyzer settings should be **FREQ (Channel)**, **Center Frequency**, **50 MHz**, **Span**, **Zero Span**, **System**, **Alignments**, **Auto Align Off**.

The LO signal should measure 5172.5 MHz at 0 dBm ± 3 dB.

If the signal level is incorrect, measure the signal coming from the A20 YTO. In order to measure this signal and avoid an LO Unlock, you will need to install a power splitter. Remove the W20 cable that attaches to A14J2. Connect the input of the splitter to W20 cable using a sma (m) to sma (f) elbow. Connect one arm of the splitter to where the W20 cable was connected. You might want to use a short flexible semi-rigid cable. Connect the measuring spectrum analyzer to the other arm of the splitter. Add the loss through the splitter arm which is 6 dB for the Keysight 11667B splitter.

Figure 7-6 Measuring Setup



The signal should be 5172.5 MHz at +7 dBm ± 3 dB because of the 6 dB loss through the 11667B splitter.

NOTE

The output power from A20 is 5172.5 MHz at +13 dBm.

A13 Front End Assembly Verification

NOTE

The A13 Front End assembly is shown as A13A1 and A13A2 for troubleshooting clarification. However, A13A1 and A13A2 are not separately replaceable. The entire A13 assembly must be replaced.

Many portions of the Front End Assembly have been verified earlier in the Low Band troubleshooting process outlined above.

The input signal level was measured on W8 as part of the A11 Low Band Switch verification.

The output signal level was measured at W16 during the quick check to verify the Low Band Signal Path.

The Second LO input was tested during the Second LO Verification.

The LO input at W21, and the LO outputs were tested when performing the First LO Verification.

Electronic Attenuator Test (Option EA3)

The electronic attenuator is aligned as part of the System Gain internal alignment process. See the description of the initial alignments and the location of the alignment history file in the Boot Up and Initialization Troubleshooting chapter. Viewing the Alignment History file will tell you if other alignment tests failed, and reveal which electronic attenuator steps failed.

To verify the electronic attenuator operation on instruments with Option EA3, set up the analyzer to view the 50 MHz calibrator signal on screen. Press **Input/Output**, **RF Calibrator**, **50 MHz**, **FREQ (Channel)**, **Center Frequency**, **50 MHz**, **Span**, **500 kHz**

Press **Peak Search** to place a marker on the calibrator signal, then press **Marker Delta**

Activate the electronic attenuator. Press **AMPTD**, **Attenuation**, **Elec Atten**, **Enabled**.

Press the up arrow key to step through all attenuator steps while monitoring the marker delta readout. The signal level should not change more than 0.4 dB as indicated by the marker delta readout.

If the attenuator switches slowly, or the signal is not present when the electronic attenuator is switched into the signal path or the signal appears only when the attenuator is switched on, suspect the control signals from the A15 Front End Controller are faulty or the A13 Front End assembly is faulty. If the attenuator switches, but the switching error between attenuator settings is greater than ± 0.4 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. Assure you have evaluated all causes before you replace the Front End assembly.

If you determine the problem is at a frequency other than 50 MHz, perform the low band flatness adjustment before replacing the Front End assembly.

Low Band Preamp (Option P08, P13, P26)

The Preamp is aligned as part of the System Gain internal alignment process. See the description of the initial alignments and the location of the alignment history file in Chapter 2, “Boot Up and Initialization”, on page 33. Viewing the Alignment History file will tell you if other alignment tests failed, and reveal pass or fail information for the preamp.

If any of the preamp options are installed, the Low Band preamp can be verified as follows:

Set up the analyzer to view the 50 MHz calibrator signal on screen

Press **AMPTD**, **Attenuation**, and verify that the Elec Atten is set to Disabled. It is not possible to turn on both the electronic attenuator and preamp at the same time.

To activate the internal preamplifier press **AMPTD**, **Signal Path**, **On**.

The expected operation is the signal level will not change more than ± 0.5 dB and the noise floor will increase due to the fact the input attenuator is automatically increased. If the amplitude error when switching the preamp on and off is greater than 0.5 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. Assure you have evaluated all causes including A15 Front End Controller switching problems, before you replace the Front End assembly.

If you determine the problem is at a frequency other than 50 MHz, perform the low band flatness adjustment before replacing the Front End assembly.

Low Band Mixing Equations

Low Band first mixer:

RF = LO – IF
IF = LO – RF
LO = IF + RF
where RF is the input signal at the signal analyzer

Low Band second mixer:

RF = LO + IF
IF = RF – LO
LO = RF – IF
where RF in this case is the first IF signal (signal at A13A1J11)

Quick Check to Verify High Band RF Path

The High Band signal path (sometimes referred to as Band 1-Band 4) is used for all signals 3.6 GHz and above. If the start frequency is set to 3.6 GHz and above, the analyzer displays only the High Band signal path. If the analyzer start frequency is below 3.6 GHz and the Stop frequency is set above 3.6 GHz, the analyzer will start sweeping in Low Band up to 3.6 GHz, and then automatically switch to the high band path above 3.6 GHz.

Equipment needed:

Spectrum Analyzer with frequency range to 14 GHz

Signal source with output power 0 dBm and frequency range to at least 26 GHz

Power splitter, 11667B

2 each, quality SMA or 3.5 mm cables

90° SMA (m) to SMA (f) adapter

MMCX (f) to SMA (f) cable or adapter

SMA (f) to SMA (f) adapter

SMA (m) to SMA (m) adapter

NOTE To perform the following checks, it will be necessary to remove the outer cover, top brace, and possibly other brackets. For removal procedures see Chapter 20, “Assembly Replacement Procedures.”

Turn the instrument on and allow it to complete its full boot up process to Signal Analyzer mode. Use the internal 4.8 GHz, –28 dBm calibrator signal as a reference for troubleshooting by pressing **Mode Preset**, **Input/Output**, **RF Calibrator**, **4.8 GHz** on the analyzer. Now press **FREQ (Channel)**, **4.8 GHz**, **Span**, **1 MHz**, **Peak Search**.

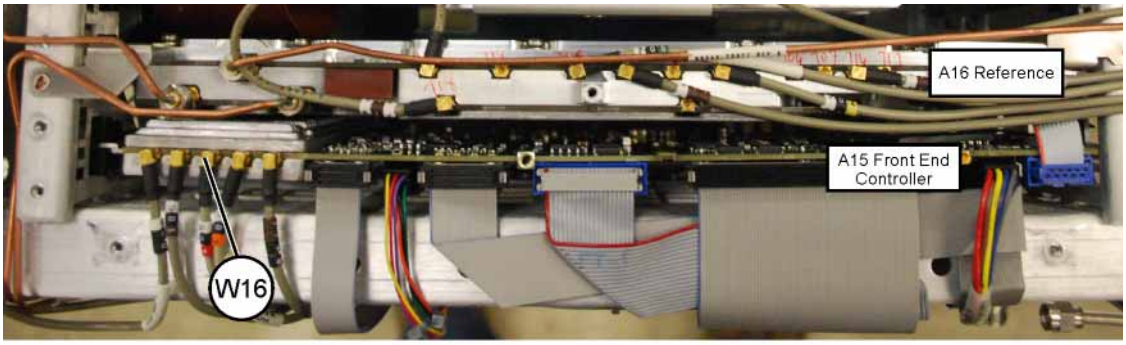
The 4.8 GHz reference signal should measure –28 dBm ± 2 dB on the analyzer display. If the power level is within tolerance, the 3.6 GHz to 13.6 GHz path is functioning correctly at 4.8 GHz.

If the power level is incorrect, select the 50 MHz RF calibrator and set the analyzer center frequency to 50 MHz. Since several of the same signal path components are shared between high band and low band, determining if the problem appears in both paths is helpful

IMPORTANT Turn off auto align by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Disconnect cable W16 at A15J902, 322.5 MHz output on the A15 Front End Controller. See Figure 7-7. Select Span, 0 Hz.

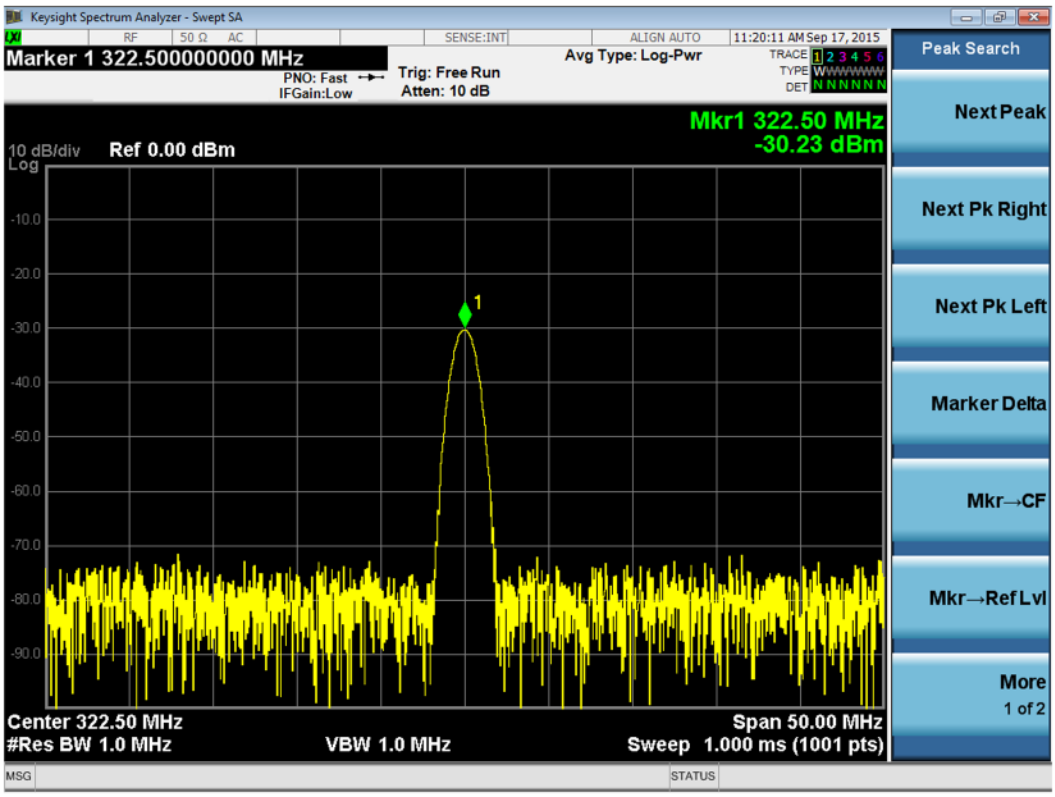
Figure 7-7 A15J902 Location (Options 508, 513, and 526)



W16

Connect W16 output to a functioning spectrum analyzer and verify the 322.5 MHz intermediate frequency is measuring –31 ± 4 dB as shown in Figure 7-8.

Figure 7-8 322.5 MHz Intermediate Frequency



If this power level is correct the Front End assembly is operating correctly in high band. If this power level is incorrect verify the following assemblies using the 4.8 GHz internal calibrator signal.

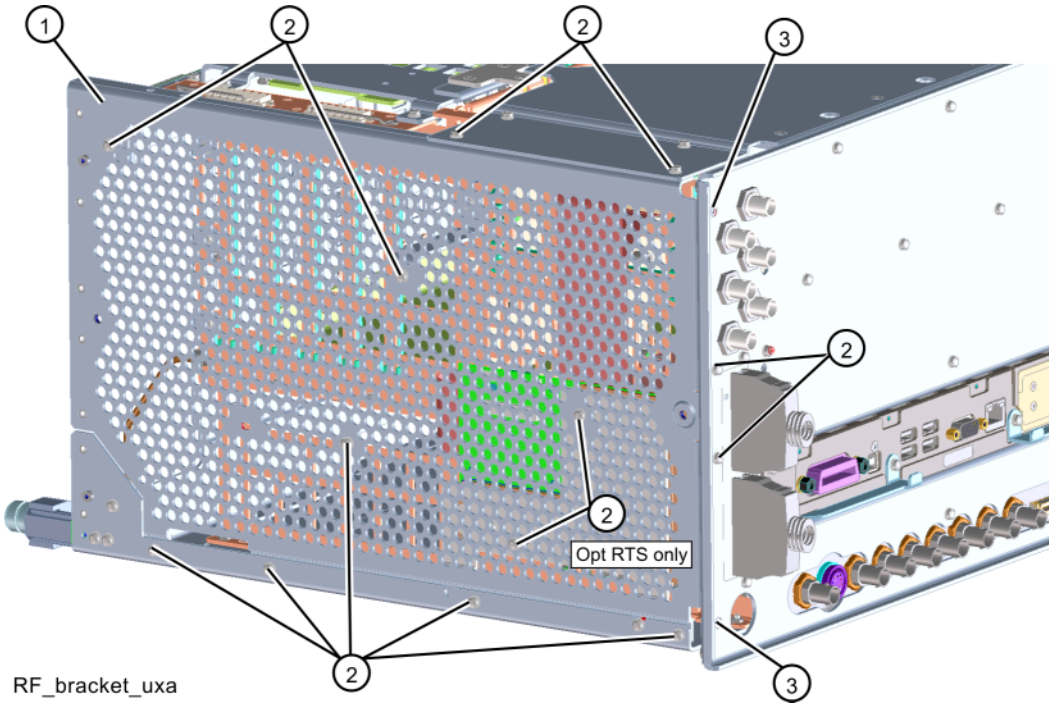
1. A11 Low Band Switch
2. A10 Input Attenuator B
3. A9 Input Attenuator A
4. A16 Reference Assembly (4.8 GHz calibrator)
5. A20 YTO
6. A12 YTF Preselector
7. A13 Front End Assembly

NOTE

High Band #2 signal path utilizes a high band mixer internal to the A13 Front End Assembly for input frequencies from 13.6 GHz to 26.5 GHz. Failures from 13.6 GHz – 26.5 GHz will most likely be caused by the A13 RF Front End Assembly. If the failure is amplitude related, proper adjustments such as frequency response and the YTF Preselector adjust should be performed first before changing the A13 RF Front End Assembly.

In order to gain access to the front end components, remove the side chassis **(1)** by removing the eleven screws **(2)** (0515-0372) and the two screws **(3)** (0515-1946). See Figure 7-9.

Figure 7-9 Remove the Side Chassis



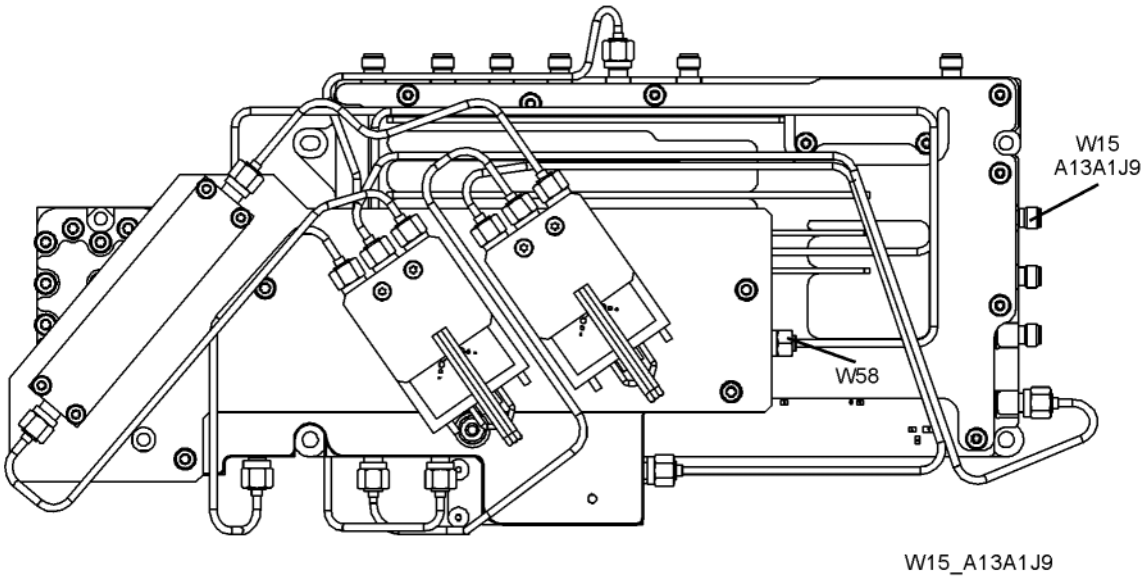
Troubleshooting a High Band Problem

To enable the internal 4.8 GHz, –28 dBm calibrator signal press **Input/Output**, **RF Calibrator**, **4.8 GHz**.

A13 Front End Input Verification

Disconnect W15 from A13A1J9 See Figure 7-10 for location of connector. Loosen the other end of W15 which attaches to SW1to avoid damaging the cable. Attach a right angle sma adapter to W15 and measure the input to the A13 Front End with a spectrum analyzer.

Figure 7-10 A13A1J9 Location

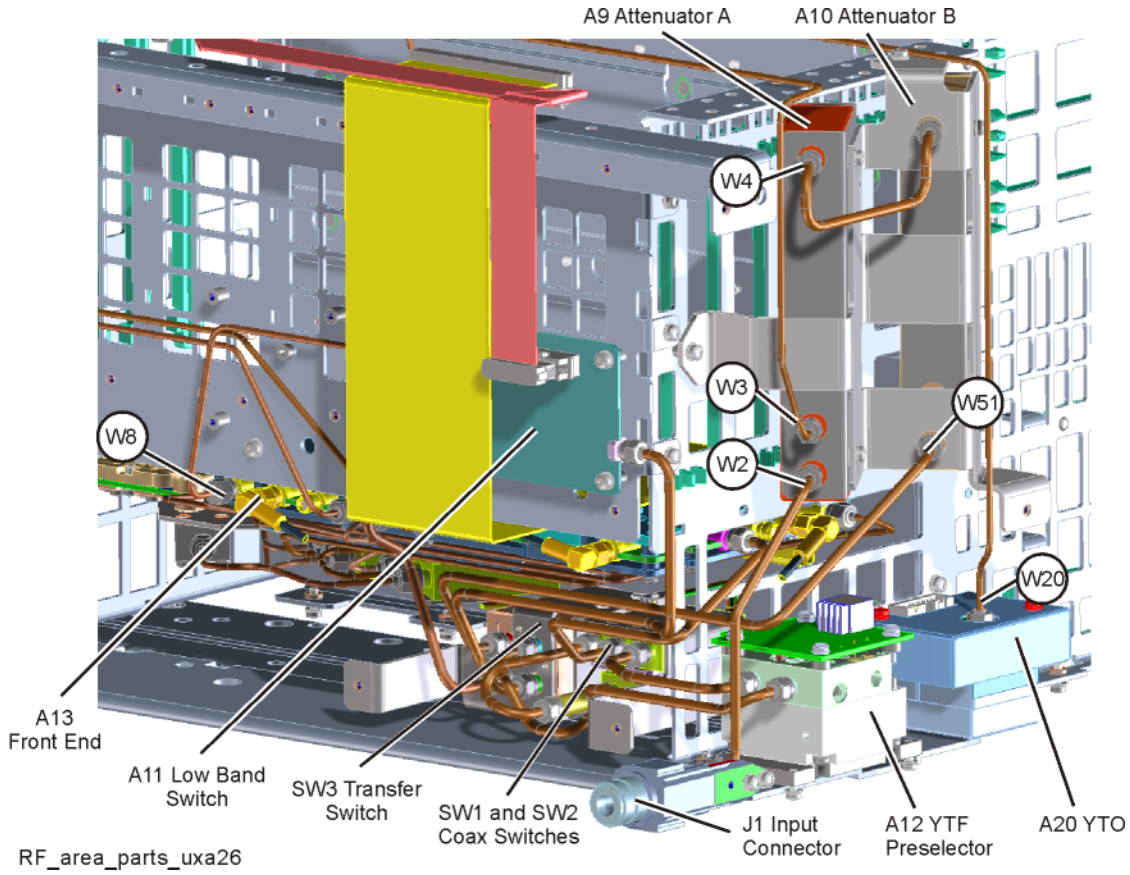


Expected signal is 4.8 GHz at –51 dBm ± 4 dB. The tolerance is large because the A12 YTF (microwave preselector) loss varies between devices, and the YTF may not be perfectly aligned, or the frequency response adjustment may be required.

If the signal level is incorrect, press **AMPTD (Y Scale)**, **Signal Path**, **uWPath Control**, **uW Preselector Bypass**. If the signal level is now –52 dBm, suspect the A12 YTF is out of adjustment or faulty.

To perform the YTF alignment, reconnect W15 cable, and press **System**, **Alignments**, **Advanced**, **Characterize Preselector**. The routine may take several minutes to align the YTF. Display the 4.8 GHz calibrator signal on screen as explained in the quick check section. If the signal level is still incorrect, suspect all assemblies, cables, switches and the A16 Reference calibrator signal between the W15 cable and the input to the A9 Attenuator.

Figure 7-11 RF Section



A9 Input Attenuator A and A10 Input Attenuator B Verification

Calibrator Switch Test

On the A16 Reference assembly, disconnect semi rigid cable W3 from A16J701 and measure A16J701 with a spectrum analyzer. Expected signal is 4.8 GHz at –28 dBm ± 0.5 dB. If signal level is incorrect, suspect A16 Reference Assembly.

To verify calibrator switch operation, connect external signal source set to 4.8 GHz and –25 dBm to the RF input connector of analyzer under test. Press **Input/Output**, **RF Calibrator**, **Off**. If the signal level at the attenuator output is now correct, suspect the A9 Attenuator cal switch or a faulty control signal from the A15 Front End Controller assembly.

Attenuation Check

Set the signal source connected to the analyzer input port to 0 dBm. On the analyzer, press **Amplitude**, **Attenuation**, and change input attenuation to 0 dB. The measuring spectrum analyzer connected to A10 Attenuator output port should indicate a 0 dBm level. Change the input attenuation on the analyzer under test to 2 dB.

See the chart below for expected measurement values at the A10 Attenuator output port.

Analyzer Under Test Attenuator Setting (dB)	Power at A10 Output Port	Input Attenuator Being Tested
0	0 dBm (reference)	Both set to through path
2	–2	A9
4	–4	A9
6	–6	A10
8	–8	A9 set to 2 dB, A10 set to 6 dB
10	–10	A10
20	–20	A10
30	–30	A10
40	–40	A10
50	–50	A10
60	–60	A10
70	–70	A9 set to 4 dB, A10 set to 66 dB

First LO Level Verification

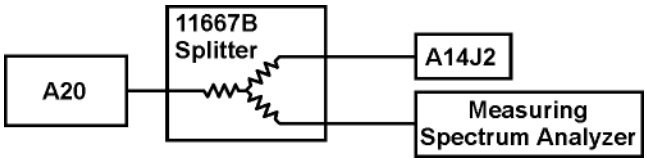
The first LO is the A20 YTO assembly. The first LO is phased locked by the A14 L.O. Synthesizer assembly. Control signals to the A20 YTO come from the A14 L.O. Synthesizer.

To assure the first LO is tuned to the correct frequency and power, measure the A13 Front End assembly at A13A1J3 when the analyzer center frequency is 50 MHz. This test port is chosen because removing cable W19 will not cause the analyzer LO phase lock loop to unlock, which would affect the LO frequency measurement. Analyzer settings should be **FREQ (Channel)**, **Center Frequency**, **4.8 GHz**, **Span**, **Zero Span**, **System**, **Alignments**, **Auto Align Off**.

The LO signal should measure 5122.5 MHz at 0 dBm ± 3 dB.

If the signal level is incorrect, measure the signal coming from the A20 YTO. In order to measure this signal and avoid an LO Unlock, you will need to install a power splitter. Remove the W20 cable that attaches to A14J2. Connect the input of the splitter to W20 cable using a sma (m) to sma (f) elbow. Connect one arm of the splitter to where the W20 cable was connected. You might want to use a short flexible semi-rigid cable. Connect the measuring spectrum analyzer to the other arm of the splitter. Add the loss through the splitter arm which is 6 dB for the Keysight 11667B splitter.

Figure 7-12 Measuring Setup



The signal should be 5122.5 MHz at +7 dBm ± 3 dB because of the 6 dB loss through the 11667B splitter.

NOTE The output power from A20 is 5122.5 MHz at +13 dBm.

A13 Front End Assembly Verification

NOTE The A13 Front End assembly is shown as A13A1 and A13A2 for troubleshooting clarification. However, A13A1 and A13A2 are not separately replaceable. The entire A13 assembly must be replaced.

Many portions of the Front End Assembly have been verified earlier in the High Band troubleshooting process outlined above.

The input signal level was measured on W15 as part of the A13 Front End Input Verification.

The output signal level was measured at the output of W16 cable during the quick check to verify the High Band signal path.

The LO input at W20, and the LO outputs were tested when performing the First LO Verification.

High Band Preamp (Option P08, P13, P26)

If a preamp option listed above is installed, the High Band preamp can be verified as follows:

View the 4.8 GHz calibrator signal on screen. Press **AMPTD Y Scale**. Tap **Signal Path**, **Internal Preamp Low Band**, **Full Range**, **On** to activate the preamp.The expected operation is the signal level will not change more than +/- 0.5 dB and the noise floor will increase due to the fact the input attenuation was automatically increased.

If the amplitude error when switching the preamp on and off is greater than 0.5 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. The amplitude error could be caused by poor frequency response, and performing the high band frequency response adjustment (using the calibration software) will adjust the preamp on, high band path. Assure you have evaluated all causes including A15 Front End Controller switching problems, before you replace the Front End assembly.

High Band Mixing Equations

For input signal frequencies from 3.6 GHz to 8.4 GHz and 13.6 GHz to 17 GHz:

RF = LO x N – IF
IF = LO x N – RF
LO x N = IF + RF
where RF is the input signal at the signal analyzer
where N is the harmonic mixing mode:
N = 1 for 3.5 GHz to 8.4 GHz
N = 2 for 13.5 GHz to 17 GHz

For input signal frequencies above 8.4 GHz to 13.6 GHz and 17 GHz to 26.5 GHz:

RF = LO x 2 x N – IF
IF = LO x 2 x N – RF
LO x 2 x N = RF + IF
where RF is the input signal at the signal analyzer
where N is the harmonic mixing mode:
N = 1 for 8.4 GHz to 13.6 GHz
N = 2 for 17 GHz to 26.5 GHz

Low Noise Path

Allows the Lowband Switch assembly to be bypassed, improving sensitivity in high band path.

Press **AMPTD Y Scale**. Tap **Signal Path**, **uW Path Control**, **Low Noise Path Enable** key. The Low Noise Path will be enabled only after the following conditions are met:

1. The start frequency must be 3.6 GHz or greater.
2. The high band preamp (Option P08, P18, P26) must be Off.

When Switch 3 changes state, you will hear a click. The amplitude of the displayed signal should not change.

Microwave Preselector Bypass

Allows the YTF to be bypassed improving amplitude accuracy.

Assure start frequency is 3.6 GHz or greater. Press **AMPTD Y Scale**. Tap **Signal Path**, **uW Path Control**, **uW Preselector Bypass**.

When the bypass switches Switch 1 and Switch 2 change state you will hear a click. Depending on the signal source connected, you may see many “signals” appear on screen because without preselection, the analyzer will display images and multiples. The real input signal should not change amplitude when you switch the uW Preselector Bypass on and off.

8 RF Section (Millimeter-Wave)

What You Will Find in This Chapter

The following information is found in this chapter:

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

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

The following sections are found in this chapter:

RF Section Description on page 164
- A9 Input Attenuator A on page 166
- A10 Input Attenuator B on page 166
- A11 Low Band Switch on page 167
- A12 YTF Preselector on page 167
- A20 YTO Assembly on page 167
- A13 RF Front End Assembly (Options 544, 550) on page 168

Troubleshooting on page 170
- Quick Check to Verify the Low Band Signal Path on page 170
- Troubleshooting a Low Band Problem on page 173
- Quick Check to Verify High Band RF Path on page 179
- Troubleshooting a High Band Problem on page 183

RF Section Description

This section covers only those optional frequency ranges listed below for the N9040B Signal Analyzer.

– Option 544, 44 GHz Frequency Range

– Option 550, 50 GHz Frequency Range

The RF input signal can be routed through four different front end signal paths. These various paths are switched in and out based on where the signal analyzer center frequency is tuned.

1. Low band RF path is used when the input frequency is ≤ 3600 MHz
2. High band RF path #1 is used when the input frequency is > 3.6 GHz to 17.1 GHz
3. High band RF path #2 is used when the input frequency is > 17 GHz to 34.5 GHz
4. High band RF Path #3 is used when the input frequency is > 34.4 GHz to 50 GHz

The RF section is designed to convert RF input signals to an intermediate frequency that is present at the RF output of the A13 Front End assembly. This intermediate frequency (IF) depends on installed options and the IF path selected. This chapter will assume the default operation in Spectrum Analyzer mode. Therefore the IF frequency will be 322.5 MHz.

IF Path	IF	Mode
10 MHz (standard)	322.5 MHz	Spectrum Analyzer or IQ Analyzer
25 MHz (Option B25)	322.5 MHz	IQ Analyzer
40 MHz (Option B40)	250 MHz	IQ Analyzer
255 MHz (Option B2X)	750 MHz	IQ Analyzer
510 MHz (Option B5X)	877.148 MHz	IQ Analyzer
1 GHz (Option H1G)[a]	750 MHz	IQ Analyzer

a. Requires Option 550, 50 GHz Frequency Range

The RF section is comprised of the following major assemblies:

- A9 Input Attenuator A
- A10 Input Attenuator B
- A11 Low Band Switch Assembly
- A12 YTF Preselector
- A20 Yig Tuned Oscillator
- A13 RF Front End Assembly - shown on the block diagram as A13A1 and A13A2, however the entire A13 assembly must be replaced.
- A15 Front End Control Assembly
- Low Noise Path
- Microwave Preselector Bypass

Refer to the annotated Option 544, 550 Swept Spectrum Analyzer block diagram in Chapter 6, “Block Diagrams,” for the following descriptions of the signal flow.

1. **RF input frequencies < 3600 MHz** route through the low band path.

   The RF input signal level can be optimized by Input Attenuator A and/or Input Attenuator B. The low band switch assembly contains a limiter that offers added protection for the mixer, and routes the input signal to the low band input of the A13 RF Front End assembly. There are (3) different signal paths on the input of the RF Front End assembly that the signal can be routed through depending on installed options and front panel settings.

   - Electronic Attenuator path, 0-24 dB (Option EA3)
   - Low Band Preamplifier path, 20 dB nominal gain (Any preamp option)
   - Direct to Mixer #1

NOTE

The RF input signal can route through the Electronic Attenuator section or the Preamplifier, but not both. All RF input frequencies < 3600 MHz go to Mixer #1.

The RF input signal is then mixed with the 1st LO from the A20 YTO assembly to a 1st intermediate frequency of 5122.5 MHz. Since the RF input signal is <3600 MHz for low band, this RF input signal is upconverted in Mixer #1 to the 1st IF. This 1st IF signal is then downconverted in Mixer #2 using the 4800 MHz 2nd LO generated on the A16 Reference assembly to a 2nd intermediate frequency of 322.5 MHz (5122.5 MHz (1st IF) – 4800 MHz (2nd LO)). The 2nd IF output is at A13A1J7. This signal path is used for all frequency range options when the RF input frequencies are < 3600 MHz. The control voltages and biasing for these assemblies come from the A15 Front End Control assembly.

2. **RF input frequencies from 3.6 GHz to 17.1 GHz** go through the high band path.

   The input signal level can be optimized by Input Attenuator A and/or Input Attenuator B. The Low Band Switch assembly routes the signal through the A12 YTF Preselector. If one of the optional high band preamps is licensed, the signal can be routed through the preamp. The A15 Front End Controller provides switching signals.

   The Low Band Switch assembly performs the following tasks:

   - Provides a limiter that offers added protection for the mixer and optional preamp.
   - Contains the high band preamp.
   - Routes the input signal to either the low band input of the A13 Front End assembly or to the A12 YTF Preselector. If Options LNP or MPB are installed, the signal is routed through switches.

   The high band input switch in the Front End Assembly routes the RF input signal to Mixer #2, where it mixes with the LO and provides a 1st intermediate frequency of 322.5 MHz. The 322.5 MHz IF output is at A13A1J7. The control voltages and biasing are provided by the A15 Front End Control Assembly. The LO is doubled for tuned frequencies > 8.4 GHz in this path.

3. **RF input frequencies from 17.1 GHz to 34.5 GHz** go through the high band path.

   The signal path for 17.1 GHz to 34.5 GHz operation is almost the same as the 3.6 GHz to 17.1 GHz path. The only difference is that Mixer #3 is used in this path. The LO is doubled for all tuned frequencies in this path.

4. **RF input frequencies from 34.5 GHz to 50 GHz** go through the high band path.

   The signal path for 34.5 GHz to 50 GHz operation is almost the same as the 3.6 GHz to 17.1 GHz path. The only difference is that Mixer #4 is used in this path. The LO is doubled for all tuned frequencies in this path.

A9 Input Attenuator A

This assembly has two 2 dB attenuator sections, a 6 dB attenuator section, and a cal signal input port.

A10 Input Attenuator B

This assembly has a total of 60 dB of attenuation to control the signal level into the Low Band Switch assembly. There is a 10 dB, 20 dB, and 30 dB section in the A10 assembly. Total input attenuation with the A9 and the A10 combined is 70 dB in 2 dB steps.

A11 Low Band Switch

This assembly operates across the entire frequency range of the analyzer. The switch has 3 main functions:

- Switch RF input frequencies from 3 Hz to 3.59 GHz RF Output to A13 RF Front End Assembly.
- Switch input frequencies from 3.6 GHz to 50 GHz Millimeter-Wave RF Output to A12, YTF Preselector.
- Contains optional high band preamplifier, which has a typical gain of 35 dB to 40 dB and a noise figure from 9 to 23 dB up to 50 GHz.

A12 YTF Preselector

The YTF Preselector is used for input frequencies greater than 3.6 GHz. Signals less than 3.6 GHz bypass the YTF assembly and are routed to the low band input of the A13 RF Front End Assembly. The YTF Preselector is a YIG tunable bandpass filter whose main purpose is to track the input signal and to filter out unwanted spurious or image response signals. The YTF Preselector has a 3 dB bandwidth greater than 40 MHz and an insertion loss of ~ 6.5 dB.

The preselector requires centering for optimum amplitude accuracy. The Auto Align routine will perform a rough centering during the preselector two point tuning algorithm. However, when troubleshooting, press **Amplitude**, **Preselector Center** to manually center the preselector.

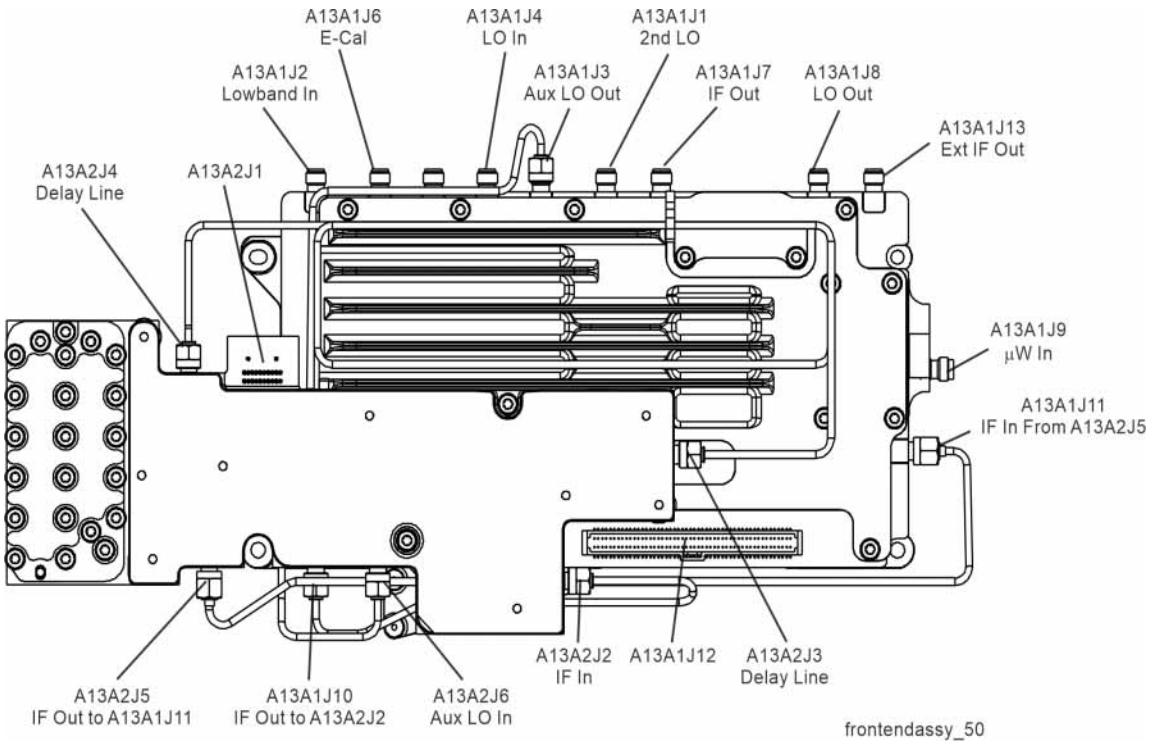
A20 YTO Assembly

Provides the 1st LO signal that is required for the A13 RF Front End Assembly. The 1st LO has a frequency range from 3.80 to 8.73 GHz. The output power is +13 to +18 dBm. In order to maximize the conversion efficiency and avoid LO unlock, sufficient LO power must be supplied.

A13 RF Front End Assembly (Options 544, 550)

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. See Figure 8-1.

Figure 8-1 A13 RF Front End Assembly View from Front Panel



This assembly contains the following circuits:

- Input Low-pass filter (RF input signals < 3.6 GHz)
- Optional Low Band Electronic Attenuator (0-24 dB attenuation control)
- Optional Low Band Preamplifier and Limiter
- RF Mixer #1 (RF input signals < 3.6 GHz)
- 1st LO Sub-system (3.8 GHz to 8.7 GHz)
- 1st IF Amplifier (5122.5 MHz)
- Switched Filters (A13A2) provides wide BW band pass filter (low band)
- LO and IM nulling (A13A2)
- Mixer #2 (RF input signals 3.6 GHz to 17.1 GHz)
- Microwave Input Amplifier
- Mixer #3 (RF input signals 17 GHz to 34.5 GHz)
- Mixer #4 (RF input signals 34.4 GHz to 50 GHz)
- LO Doubler
- External Mixing Diplexer

A15 Front End Control Assembly

Provides the correct biasing and switch control logic to the following RF assemblies:

- Input Attenuator A
- Input Attenuator B
- Low Band Switch
- Low Noise Path
- YTF Preselector (Input signals > 3.6 GHz)
- Microwave Preselector Bypass
- Front End Assembly including switched filter
- (Optional) High Band Preamplifier
- (Optional) Low Band Preamplifier
- (Option EA3) Electronic Attenuator (0-24 dB)

NOTE Refer to Chapter 9, “Front End Control” for detailed descriptions & troubleshooting procedures

Troubleshooting

Quick Check to Verify the Low Band Signal Path

The analyzer has an internal 50 MHz amplitude reference signal that is used to verify the low band path. This 50 MHz calibrator is used when the analyzer performs many of the internal alignment routines. Therefore, the functionality of the 50 MHz calibrator and low band path are critical to passing Align All Now.

Equipment needed:

Spectrum Analyzer with frequency range to 8 GHz

Signal source with output power 0 dBm and frequency range to at least 3.6 GHz

Power splitter, 11667B or 11667C

2 each, quality SMA or 3.5 mm cables

90° SMA (m) to SMA (f) adapter

MMCX (f) to SMA (f) cable

SMA (f) to SMA (f) adapter

SMA (m) to SMA (m) adapter

3.5mm (f) to 2.4mm (m) adapters (2 required)

NOTE

To perform the following checks, it will be necessary to remove the outer cover and the top brace. See Chapter 20, "Assembly Replacement Procedures" for removal procedures.

Turn the instrument on and allow it to complete its full boot up process to Spectrum Analyzer mode. Use the internal 50 MHz, –25 dBm calibrator signal as a reference for troubleshooting by pressing **Mode Preset**, **Input/Output**, **RF Calibrator**, **50 MHz** on the analyzer. Now press **FREQ (Channel)**, **50 MHz**, **SPAN (X Scale)**, **1 MHz**, **Peak Search**. The 50 MHz reference signal should measure 50 MHz @ –25 dBm ± 2 dB on the analyzer display. If the power level is within tolerance, the low band path is functioning correctly at 50 MHz. If the power level is incorrect, select the 4.8 GHz RF Calibrator and set the analyzer center frequency to 4.8 GHz. Since several of the same signal path components are shared between low band and high band, determining if the problem appears in both paths is helpful.

To verify the high band path go to "Quick Check to Verify High Band RF Path" on page 179.

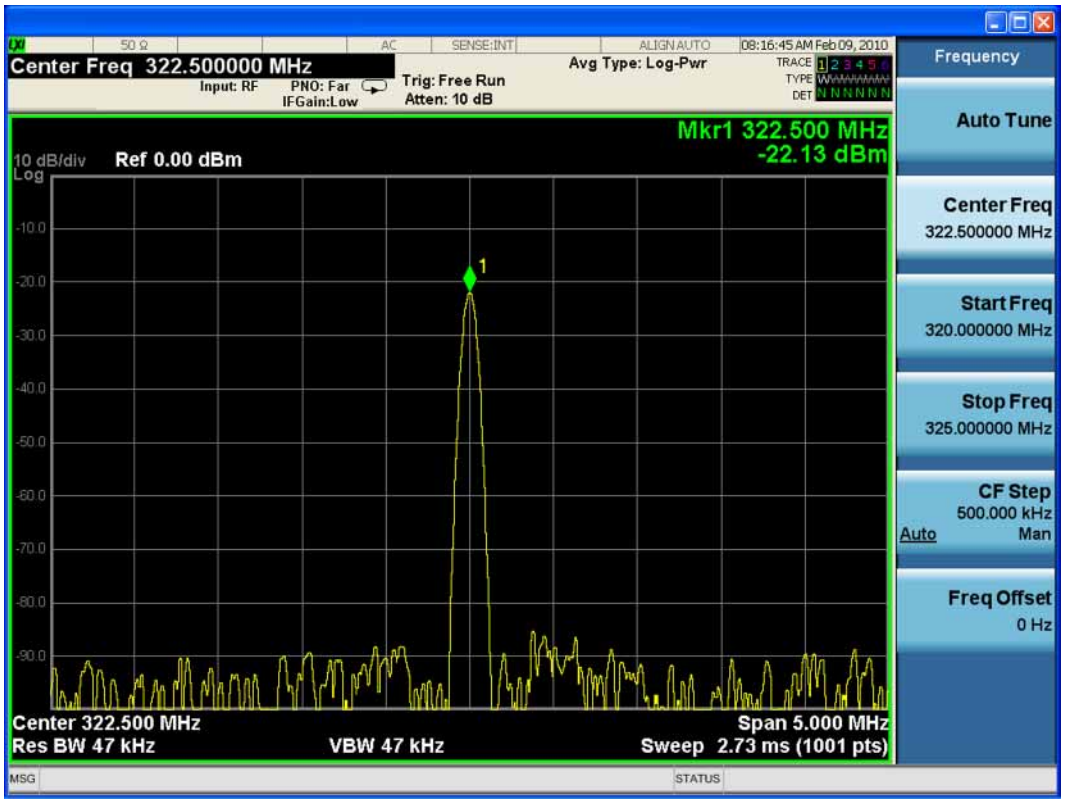
If the power level is not within tolerance, press **SPAN (X Scale)**, **Zero Span**, **AMPTD (Y Scale)**, **Attenuation**, **10 dB**.

IMPORTANT Turn off auto align by pressing **System**, **Alignments**, **Auto Align**, **Off**.

Disconnect the W16 cable from A13A1J7 on the Front End Assembly IF Out. See Figure 8-1.

Connect A13A1J7 output to a functioning spectrum analyzer and verify the 322.5 MHz intermediate frequency is measuring –22 dBm ± 3 dB using the same analyzer settings as in Figure 8-2.

Figure 8-2 322.5 MHz Intermediate Frequency



If this power level is correct the signal path from the A9 50 MHz Reference signal input port to A13A1J7, IF Output is operating correctly using a 50 MHz input calibrator signal. Reconnect the W16 cable to A13A1J7.

NOTE Flatness issues or power level problems at other input frequencies below 3600 MHz may exist. This type of problem can be diagnosed using an external source to verify performance.

If this power level is incorrect, the following assemblies need to be verified using the 50 MHz internal calibrator signal. Be sure the 50 MHz calibrator is turned on. Press **Input/Output**, **RF Calibrator**, **50 MHz** when verifying the performance.

1. A11 Low Band Switch
2. A10 Input Attenuator B
3. A9 Input Attenuator A
4. A16 Reference Assembly (50 MHz calibrator, 2nd LO)
5. A20 YTO
6. A13 RF Front End Assembly

NOTE

In order to gain access to the front end components, remove the front frame assembly, but leave the ribbon cable connected so you can still control the instrument. Remove the right side chassis. Refer to the removal procedures in Chapter 20, “Assembly Replacement Procedures”.

Troubleshooting a Low Band Problem

To enable the internal 50 MHz, –25 dBm calibrator signal press **Input/Output**, **RF Calibrator**, **50 MHz**.

The Low Band signal path (sometimes referred to as Band 0) is used for all signals less than 3.6 GHz when the analyzer is used in normal operation. If the stop frequency is set to 3.6 GHz, the analyzer displays only the Low Band signal path. If the analyzer stop frequency is set above 3.6 GHz and the start frequency is set below 3.6 GHz, the analyzer will sweep up to 3.6 GHz in low band and then automatically switch to the high band path above 3.6 GHz.

A11 Low Band Switch Verification

Disconnect W8 from A13A1J2. See Figure 8-3 for location of connector. Attach a right angle SMA adapter to W8 and measure the output of the Low Band Switch with a spectrum analyzer. Expected signal is 50 MHz at –35.3 dBm since the Low Band Switch and SW3 have a few tenths of a dB loss.

If the signal level is incorrect, remove A10 Input Attenuator B output cable and measure the output power. Expected signal is 50 MHz at –35 dBm. See Figure 8-3 for location of attenuator. If the attenuator output signal is correct but the Low Band output at W8 is incorrect, suspect the A11 Low Band Switch, the interconnect cables, Switch 3, or the control signals. The control signals are explained in Chapter 9, “Front End Control.”

Figure 8-3 RF Section Assembly Locations (Options 544 and 550)

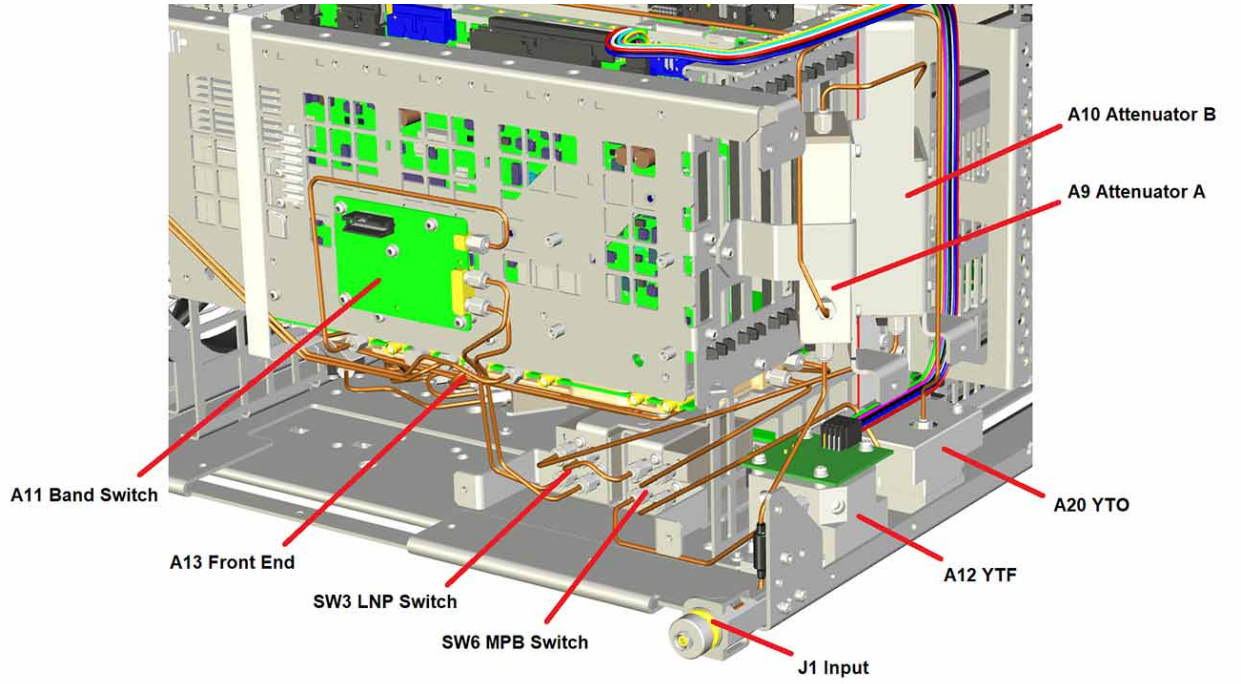
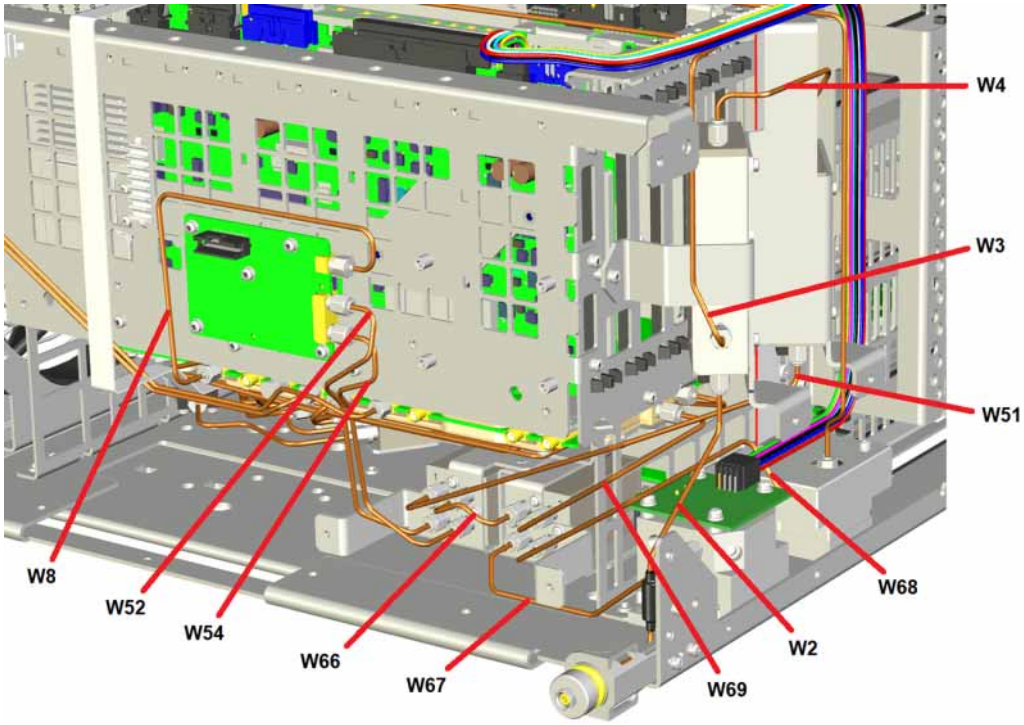


Figure 8-4 RF Section Cable Locations (Options 544 and 550)



A9 Input Attenuator and A10 Input Attenuator Verification

Calibrator Switch Test

On the A16 Reference assembly, disconnect semi rigid cable W3 from A16J701 and measure A16J701 with a spectrum analyzer. Expected signal is 50 MHz at –25 dBm ± 0.5 dB. If signal level is incorrect, suspect A16 Reference assembly is faulty, or the 50 MHz calibrator amplitude requires adjustment using the field calibration software.

To verify calibrator switch operation, connect external signal source set to 50 MHz and –25 dBm to the RF input connector of analyzer under test. Press **Input/Output**, **RF Calibrator**, **Off**. If the signal level at the attenuator output is now correct, suspect the A9 Attenuator cal switch or a faulty control signal from the A15 Front End Controller assembly.

Attenuator Check

Set the signal source connected to the analyzer input port to 0 dBm. On the analyzer, press **Amplitude**, **Attenuation**, and change input attenuation to 0 dB. The measuring spectrum analyzer connected to A10 Attenuator output port should indicate a 0 dBm level.

Change the input attenuation on the analyzer under test to 2 dB. See the chart below for expected measurement values at the A10 Attenuator output port.

Analyzer Under Test Attenuator Setting (dB)	Power at A10 Output Port (dBm)	Input Attenuator Being Tested (Options 544, and 550)
0	0 dBm (reference)	Both set to through path
2	–2	A9
4	–4	A9
6	–6	A9
8	–8	A9
10	–10	A10
20	–20	A10
30	–30	A10
40	–40	A10
50	–50	A10
60	–60	A10
70	–70	A9 set to 10 dB, A10 set to 60 dB

Second LO Level Verification

The second LO signal comes from the A16 Reference Assembly and is only used in Low Band. The second LO signal can be measured on the Front End Assembly at A13A1J1 or the A16 Reference Assembly at A16J702. Expected signal is 4800 MHz at +10 dBm when a low loss test cable is used and with the measuring spectrum analyzer input attenuator set to at least 20 dB to prevent overload.

First LO Level Verification

The first LO is the A20 YTO assembly. The first LO is phased locked by the A14 DDS LO Synthesizer assembly.

To assure the first LO is tuned to the correct frequency and power, measure the A14 DDS LO Synthesizer assembly at A14J1 when the analyzer center frequency is 50 MHz.

The LO signal should measure 5172.5 MHz at +15 dBm ± 3 dB.

A13 Front End Assembly Verification

NOTE

The A13 Front End assembly is shown as A13A1 and A13A2 for troubleshooting clarification. However, A13A1 and A13A2 are not separately replaceable. The entire A13 assembly must be replaced.

Many portions of the Front End Assembly have been verified earlier in the Low Band troubleshooting process outlined above.

The input signal level was measured on W8 as part of the A11 Low Band Switch verification.

The output signal level was measured at A13A1J7 during the quick check to verify the Low Band Signal Path.

The Second LO input was tested during the Second LO Verification.

The LO input at W21 was tested when performing the First LO Verification.

It is possible to measure the W48 input cable to the Switched Filter where it connects to A13A2J2, and the output of the Switched Filter at W49 where it connects to A13A1J11. The A13A2 Switched Filter is not separately replaceable, but being able to determine where the signal level is faulty, can aid in verifying the faulty assembly. See the block diagram for signal levels.

CAUTION

When measuring W48, the analyzer must be powered down and ribbon cable W28 on the Switched Filter removed to gain access to W48. Once the measuring spectrum analyzer is connected to W48, the W28 ribbon cable must be reinstalled, and only then can the analyzer be powered back up. The ribbon cable is fragile so it cannot be bent out of the way to access the cable, and should not be removed and installed with power applied.

Electronic Attenuator Test (Option EA3)

The electronic attenuator is aligned as part of the System Gain internal alignment process. See the description of the initial alignments and the location of the alignment history file in the Boot Up and Initialization Troubleshooting chapter. Viewing the Alignment History file will tell you if other alignment tests failed, and reveal which electronic attenuator steps failed.

To verify the electronic attenuator operation on instruments with Option EA3, set up the analyzer to view the 50 MHz calibrator signal on screen. Press **Input/Output**, **RF Calibrator**, **50 MHz**, **Center Frequency**, **50 MHz**, **Span**, **500 kHz**

Press **Peak Search** to place a marker on the calibrator signal, then press **Marker Delta**

Activate the electronic attenuator. Press **AMPTD**, **Attenuation**, **Enable Elec Atten**. Then press **Elec Atten**.

Press the up arrow key to step through all attenuator steps while monitoring the marker delta readout. The signal level should not change more than 0.4 dB as indicated by the marker delta readout.

If the attenuator switches slowly, or the signal is not present when the electronic attenuator is switched into the signal path or the signal appears only when the attenuator is switched on, suspect the control signals from the A15 Front End Controller are faulty or the A13 Front End assembly is faulty. If the attenuator switches, but the switching error between attenuator settings is greater than
± 0.4 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. Assure you have evaluated all causes before you replace the Front End assembly.

If you determine the problem is at a frequency other than 50 MHz, perform the low band flatness adjustment before replacing the Front End assembly.

Low Band Preamp (Option P03, P08, P13, P26, P43, P44, P50)

The Preamp is aligned as part of the System Gain internal alignment process. See the description of the initial alignments and the location of the alignment history file in Chapter 2, “Boot Up and Initialization.” Viewing the Alignment History file will tell you if other alignment tests failed, and reveal pass or fail information for the preamp.

If any of the preamp options are installed, the Low Band preamp can be verified as follows:

Set up the analyzer to view the 50 MHz calibrator signal on screen

Press **AMPTD**, **Attenuation**, and verify that the Enable Elec Atten key is set to Off. It is not possible to turn on both the electronic attenuator and preamp at the same time.

Press **AMPTD**, **More**, **Internal Preamp**, **Low Band** to activate the preamp.

The expected operation is the signal level will not change more than ± 0.5 dB and the noise floor will increase due to the fact the input attenuator is automatically increased. If the amplitude error when switching the preamp on and off is greater than 0.5 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. Assure you have evaluated all causes including A15 Front End Controller switching problems, before you replace the Front End assembly.

If you determine the problem is at a frequency other than 50 MHz, perform the low band flatness adjustment before replacing the Front End assembly.

Low Band Mixing Equations

Low Band first mixer:

RF = LO – IF
IF = LO – RF
LO = IF + RF
where RF is the input signal at the signal analyzer

Low Band second mixer:

RF = LO + IF
IF = RF – LO
LO = RF – IF
where RF in this case is the first IF signal (signal at A13A1J11)

Quick Check to Verify High Band RF Path

The High Band signal path (sometimes referred to as Band 1-Band 6) is used for all signals 3.6 GHz and above. If the start frequency is set to 3.6 GHz and above, the analyzer displays only the High Band signal path. If the analyzer start frequency is below 3.6 GHz and the Stop frequency is set above 3.6 GHz, the analyzer will start sweeping in Low Band up to 3.6 GHz, and then automatically switch to the high band path above 3.6 GHz.

Equipment needed:

Spectrum Analyzer with frequency range to 14 GHz

Signal source with output power 0 dBm and frequency range to at least the maximum frequency of the PXA

Power splitter, 11667C

2 each, quality 2.4 mm cables

90° SMA (m) to SMA (f) adapter

MMCX (f) to SMA (f) cable

SMA (f) to SMA (f) adapter

SMA (m) to SMA (m) adapter

3.5mm (f) to 2.4 mm (m) adapters (2 required)

3.5 mm (m) to 2.4 mm (f) adapter

NOTE To perform the following checks, it will be necessary to remove the outer cover and the top brace. See Chapter 20, “Assembly Replacement Procedures” for removal procedures.

Turn the instrument on and allow it to complete its full boot up process to Signal Analyzer mode. Use the internal 4.8 GHz, –28 dBm calibrator signal as a reference for troubleshooting by pressing **Mode Preset**, **Input/Output**, **RF Calibrator**, **4.8 GHz** on the analyzer. Now press **FREQ (Channel)**, **4.8 GHz**, **SPAN (X Scale)**, **1 MHz**, **Peak Search)**.

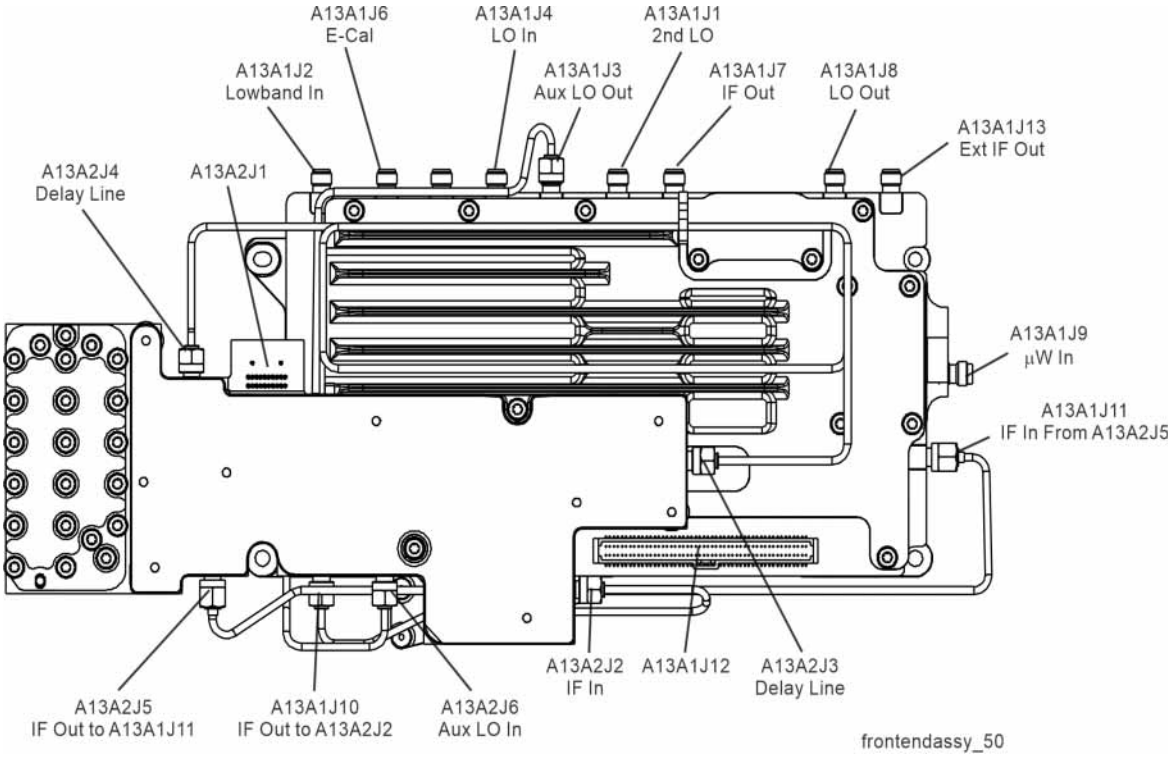
The 4.8 GHz reference signal should measure –28 dBm ± 2 dB on the analyzer display. If the power level is within tolerance, the 3.6 GHz to 17.1 Ghz path is functioning correctly at 4.8 Ghz.

If the power level is incorrect, select the 50 MHz RF calibrator and set the analyzer center frequency to 50 MHz. Since several of the same signal path components are shared between high band and low band, determining if the problem appears in both paths is helpful.

IMPORTANT Turn off auto align by pressing **System, Alignments, Auto Align, Off**.

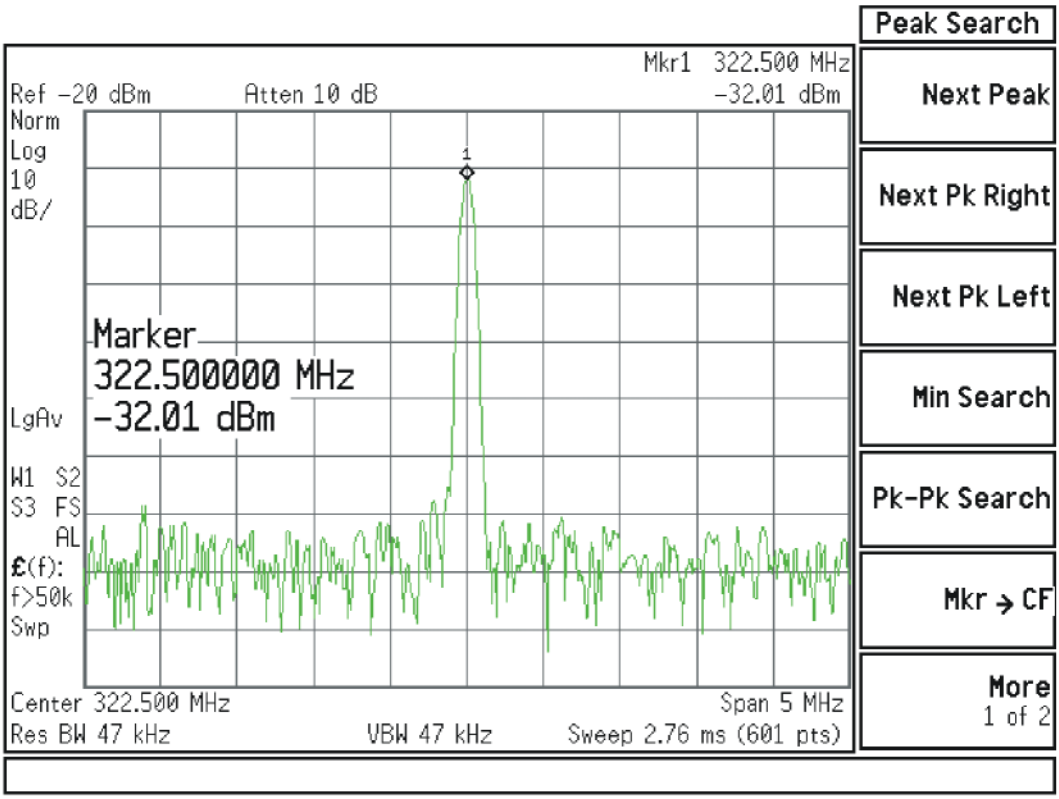
Disconnect cable W16 at A13A1J7, 322.5 MHz output on the Front End Assembly. See Figure 8-5. Select Span, 0 Hz.

Figure 8-5 A13A1J7 Location (Options 544 and 550)



Connect A13J7 output to a functioning spectrum analyzer and verify the 322.5 MHz intermediate frequency is measuring –31 ± 4 dB as shown in Figure 8-6.

Figure 8-6 322.5 MHz Intermediate Frequency



If this power level is correct the Front End assembly is operating correctly in high band. If this power level is incorrect verify the following assemblies using the 4.8 GHz internal calibrator signal.

1. A11 Low Band Switch
2. A10 Input Attenuator B
3. A9 Input Attenuator A
4. A16 Reference Assembly (4.8 GHz calibrator)
5. A20 YTO
6. A12 YTF Preselector
7. A13 Front End Assembly

NOTE

High Band #2 signal path utilizes a high band mixer internal to the A13 Front End Assembly for input frequencies from 17.0 GHz to 34.5 GHz. High Band #3 signal path utilizes a high band mixer internal to the A13 Front End Assembly for input frequencies from 34.4 to 50 GHz. Failures from 3.6 GHz to 50 GHz will most likely be caused by the A13 RF Front End Assembly. If the failure is amplitude related, proper adjustments such as frequency response and the YTF Preselector adjust should be performed first before changing the A13 RF Front End Assembly.

In order to gain access to the front end components, remove the side chassis.

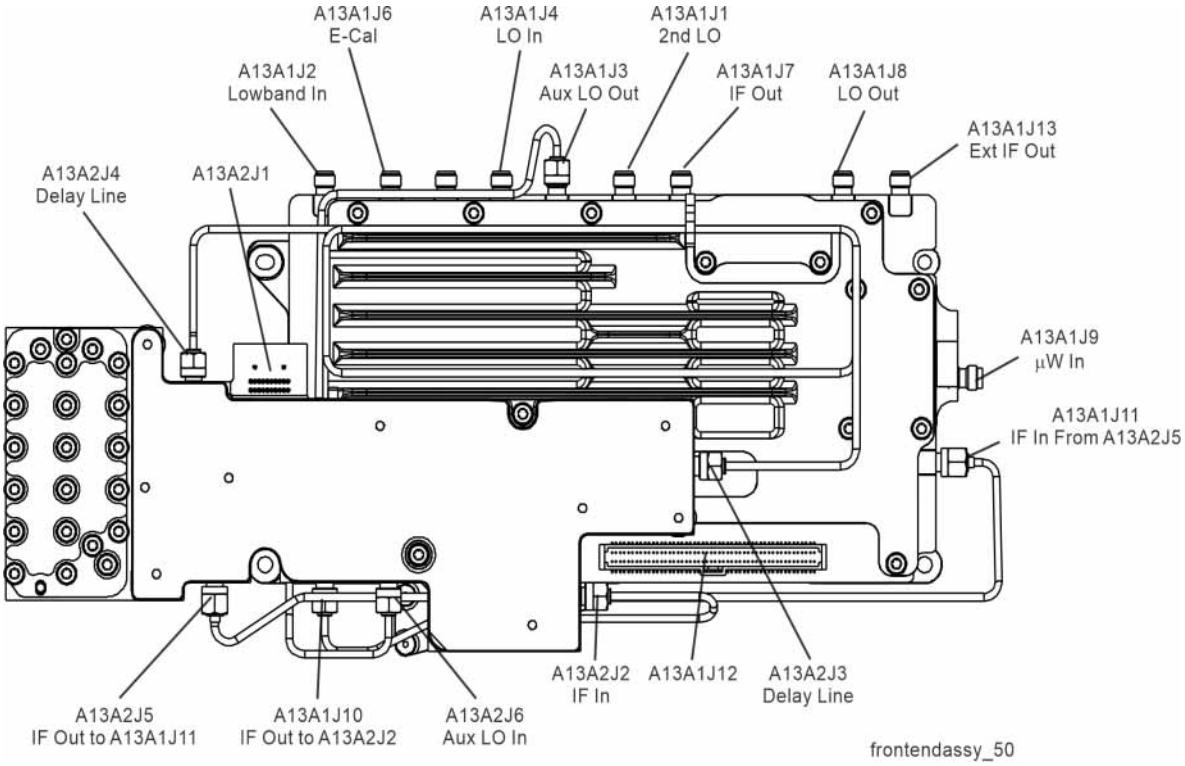
Troubleshooting a High Band Problem

To enable the internal 4.8 GHz, –28 dBm calibrator signal press **Input/Output**, **RF Calibrator**, **4.8 GHz**.

A13 Front End Input Verification

Disconnect W62 from A13A1J9 See Figure 8-7 for location of connector. Loosen the other end of W62 if possible to avoid damaging the cable. Attach a right angle SMA adapter to W62 and measure the input to the A13 Front End with a spectrum analyzer.

Figure 8-7 A13A1J9 Location



Expected signal is 4.8 GHz at –51 dBm ± 4 dB. The tolerance is large because the A12 YTF (microwave preselector) loss varies between devices, and the YTF may not be perfectly aligned, or the frequency response adjustment may be required.

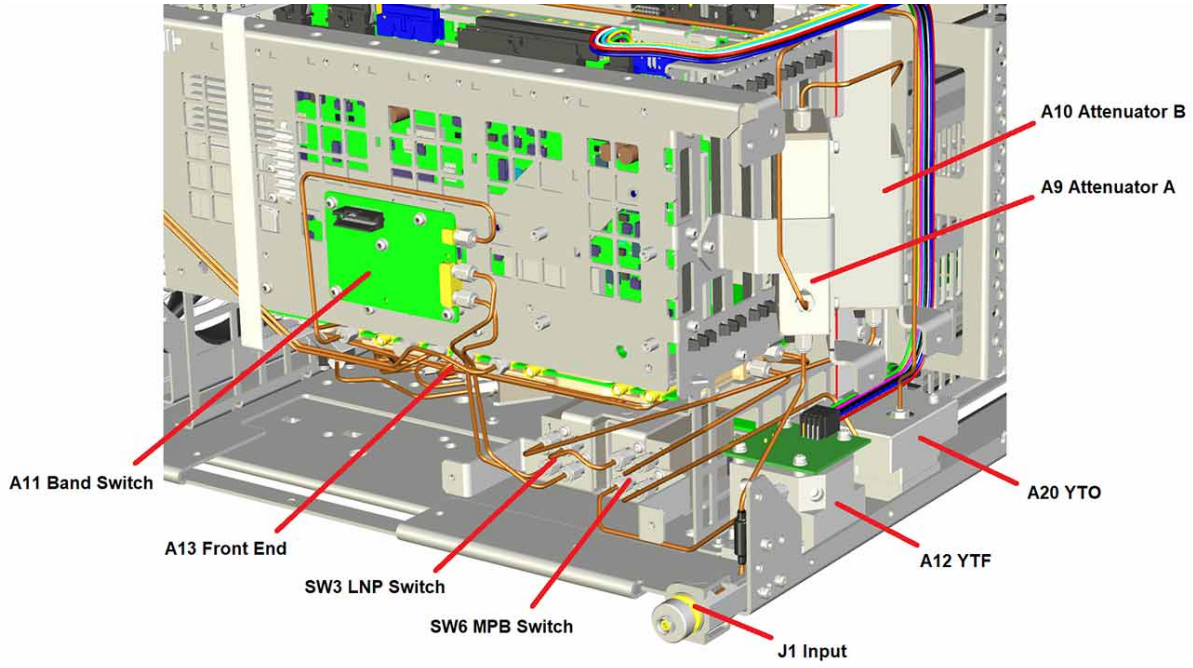
If the signal level is incorrect press **Amplitude**, **More**, **uWPath Control**, **uW Preselector Bypass**. If the signal level is now –52 dBm, suspect the A12 YTF is out of adjustment or faulty.

To perform the YTF alignment, reconnect W62, and press **System, Alignments, More, Advanced, Characterize Preselector**. The routine may take several minutes to align the YTF. Display the 4.8 GHz calibrator signal on

screen as explained in the quick check section. If the signal level is still incorrect, suspect all assemblies, cables, switches and the A15 Reference calibrator signal between the W62 cable and the input to the A9 Attenuator.

Remove A10 Input Attenuator B output cable and measure the output power. Expected signal is 4.8 GHz –38 dBm. See Figure 8-8 for location of attenuator. If the attenuator output signal is correct suspect the A11 Low Band Switch, and suspect switches 3 and 6. Also suspect the switching signals from the A15 Front End controller. The control signals are explained in the Front End Control Troubleshooting section.

Figure 8-8 RF Section



A9 Input Attenuator A and A10 Input Attenuator B Verification

Calibrator Switch Test

On the A16 Reference assembly, disconnect semi rigid cable W3 from A16J701 and measure A16J701 with a spectrum analyzer. Expected signal is 4.8 GHz at –28 dBm ± 0.5 dB. If signal level is incorrect, suspect A16 Reference Assembly.

To verify calibrator switch operation, connect external signal source set to 4.8 GHz and –25 dBm to the RF input connector of analyzer under test. Press **Input/Output**, **RF Calibrator**, **Off**. If the signal level at the attenuator output is now correct, suspect the A9 Attenuator cal switch or a faulty control signal from the A15 Front End Controller assembly.

Attenuation Check

Set the signal source connected to the analyzer input port to 0 dBm. On the analyzer, press **Amplitude**, **Attenuation**, and change input attenuation to 0 dB. The measuring spectrum analyzer connected to A10 Attenuator output port should indicate a 0 dBm level. Change the input attenuation on the analyzer under test to 2 dB.

See the chart below for expected measurement values at the A10 Attenuator output port.

Analyzer Under Test Attenuator Setting (dB)	Power at A10 Output Port (dBm)	Input Attenuator Being Tested
0	0 dBm (reference)	Both set to through path
2	–2	A9
4	–4	A9
6	–6	A9
8	–8	A9
10	–10	A10
20	–20	A10
30	–30	A10
40	–40	A10
50	–50	A10
60	–60	A10
70	–70	A9 set to 10 dB, A10 set to 60 dB

First LO Level Verification

The first LO is the A20 YTO assembly. The first LO is phased locked by the by the A14 DDS LO Synthesizer assembly.

To assure the first LO is tuned to the correct frequency and power, measure the A14 DDS LO Synthesizer assembly at A14J1 when the analyzer center frequency is 4.8 GHz. The LO signal should measure 5122.5 MHz at +15 dBm ± 3 dB.

A13 Front End Assembly Verification

NOTE

The A13 Front End assembly is shown as A13A1 and A13A2 for troubleshooting clarification. However, A13A1 and A13A2 are not separately replaceable. The entire A13 assembly must be replaced.

Many portions of the Front End Assembly have been verified earlier in the High Band troubleshooting process outlined above.

The input signal level was measured on W15 as part of the A13 Front End Input Verification.

The output signal level was measured at A13A1J7 during the quick check to verify the High Band signal path.

The LO input at W21, and the LO outputs were tested when performing the First LO Verification.

High Band Preamp (Option P08, P13, P26, P43, P44, P50)

If a preamp option listed above is installed, the High Band preamp can be verified as follows:

View the 4.8 GHz calibrator signal on screen. Press **AMPTD**, **More**, **Internal Preamp**, **Full Range** to activate the preamp.The expected operation is the signal level will not change more than +/- 0.5 dB and the noise floor will increase due to the fact the input attenuation was automatically increased.

If the amplitude error when switching the preamp on and off is greater than 0.5 dB, assure that any other internal alignment failures are resolved since the System Gain alignment must run before optimum performance is possible. The amplitude error could be caused by poor frequency response, and performing the high band frequency response adjustment (using the calibration software) will adjust the preamp on, high band path. Assure you have evaluated all causes including A15 Front End Controller switching problems, before you replace the Front End assembly.

High Band Mixing Equations

For input signal frequencies from 3.6 GHz to 8.4 GHz:

RF = LO x N – IF
IF = LO x N – RF
LO x N = IF + RF
where RF is the input signal at the signal analyzer
where N is the harmonic mixing mode:
N = 1 for 3.5 GHz to 8.4 GHz

For input signal frequencies above 8.4 GHz to 50 GHz:

RF = LO x 2 x N – IF
IF = LO x 2 x N – RF
LO x 2 x N = RF + IF
where RF is the input signal at the signal analyzer
where N is the harmonic mixing mode:
N = 1 for 8.4 GHz to 17.1 GHz
N = 2 for 17.1 GHz to 34.0 GHz
N = 4 for 34.0 GHz to 50 GHz

Low Noise Path

Allows the Lowband Switch assembly to be bypassed, improving sensitivity in highband path.

Press **Amplitude**, **uW Path Control**, **Low Noise Path Enable** key. The Low Noise Path will be enabled only after the following conditions are met:

1. The start frequency must be 3.6 GHz or greater.
2. The high band preamp (option P08, P18, P26, P43, P44, P50) must be Off.

When Switch 3 changes state, you will hear a click. The amplitude of the displayed signal should not change.

Microwave Preselector Bypass

Allows the YTF to be bypassed improving amplitude accuracy.

Assure start frequency is 3.6 GHz or greater. Press **Amplitude**, **uW Path Control**, **uW Preselector Bypass**. When the bypass switch, Switch 4, changes state you will hear a click. Depending on the signal source connected, you may see many “signals” appear on screen because without preselection, the analyzer will display images and multiples. The real input signal should not change amplitude when you switch the uW Preselector Bypass on and off.

9 Front End Control

What You Will Find in This Chapter

The following information is presented in this chapter:

1. Theory of operation of the Front End Control section.
2. Isolating the cause of a hardware problem by verifying the functionality of assemblies of the Front End Control.

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:

A15 Front End Control Description on page 190

A15 Front End Control Assembly Troubleshooting on page 193

Verifying Input Attenuator A, Input Attenuator B, Low Band Switch Logic and Power Supplies on page 194

Preselector Tune Output on page 200

Verifying SW3 (Option LNP only) on page 201

Verifying SW1 and SW2 (Option MPB) on page 201

RF Signal Tracing on page 202

Verifying Narrowband IF Out (A15J900) on page 202

Verifying Aux IF Out, Rear Panel (Option CR3, CRP, ALV only) on page 202

Standard UXA on page 202

Verifying Option CR3 on page 203

Verifying Option CRP on page 204

Verifying Option ALV on page 205

A15 Front End Control Description

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 N9040B Signal Analyzer.**
2. **Contains on board circuitry providing various signal outputs to other locations within the analyzer.**
3. **Provides control logic for various instrument options within the analyzer.**

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.

Standard RF Assemblies Controlled by the A15:

- A9 Input Attenuator A (4 dB total for Opt 508, 513, 526)
- A10 Input Attenuator B (66 dB total for Opt 508, 513, 526)
- A11 Low Band Switch
- A12 YIG Tuned Filter
- A13 RF Front End Assembly

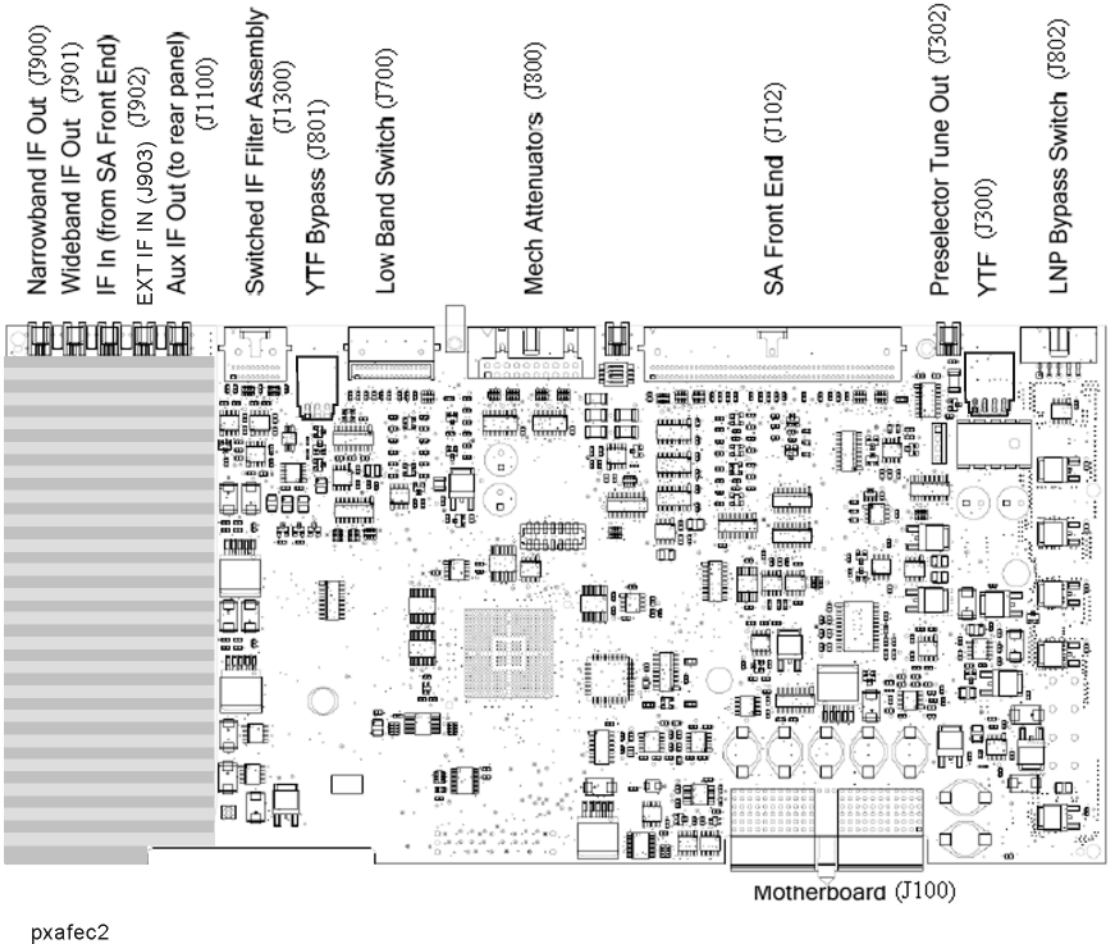
A15 On Board Circuits:

- 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)

Table 9-1 A15 Option Related Control

Option	Description	Physical Location in the Analyzer
P08	100 kHz to 8.4 GHz Internal Preamplifier	A15 to A11 and A13
P13	100 kHz to 13.6 GHz Internal Preamplifier	A15 to A11 and A13
P26	100 kHz to 26.5 GHz Internal Preamplifier	A15 to A11 and A13
ALV	Log Video Out	A15 to Aux IF Output (rear panel)
CRP	Arbitrary I.F. Out	A15 to Aux IF Output (rear panel)
CR3	2nd I.F. Out	A15 to Aux IF Output (rear panel)
LNP	Low Noise Path	A15 to SW3
MPB	Microwave Preselector Bypass	A15 to SW1 and SW2 (Opt 508, 513, or 526)
EA3	Electronic Attenuator	A15 to A13

Figure 9-1 A15 Front View, Physical Connectors



The table below describes the connector location and the final destinations of the RF signal, switch control logic or bias voltage.

Table 9-2 A15 Connectors and Destinations

A15 Connector Designation	Description	Destination
J900	Narrowband I.F. Out	To A2
J901	Wideband I.F. Out	To A2 or A3 (Wide bandwidths)
J902	322.5 MHz I.F. In	From A13 to A15
J903	Ext IF In	From A13 to A15 (Option EXM)
J1100	Aux I.F. Out	To Rear Panel
J1300	Switched I.F. Filter Out	To A13A2
J801	YTF Bypass Out	To SW1 & SW2 (Option MPB with Option 508, 513, or 526)
J700	Low Band Switch Logic Out	To A11
J800	Mechanical Attenuator Logic Out	To A9 & A10
J102	R.F. Front End Logic Out	To A13
J302	Preselector Tune Out	N/A (test point only)
J300	YTF Bias Control Out	To A12
J802	Low Noise Bypass Switch Logic Out	To SW3 (Option LNP)
J100	Motherboard Connector	From A8

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 N9040B, UXA Signal Analyzer 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 UXA the control logic for Input Attenuator A, Input Attenuator B, Low Band Switch 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

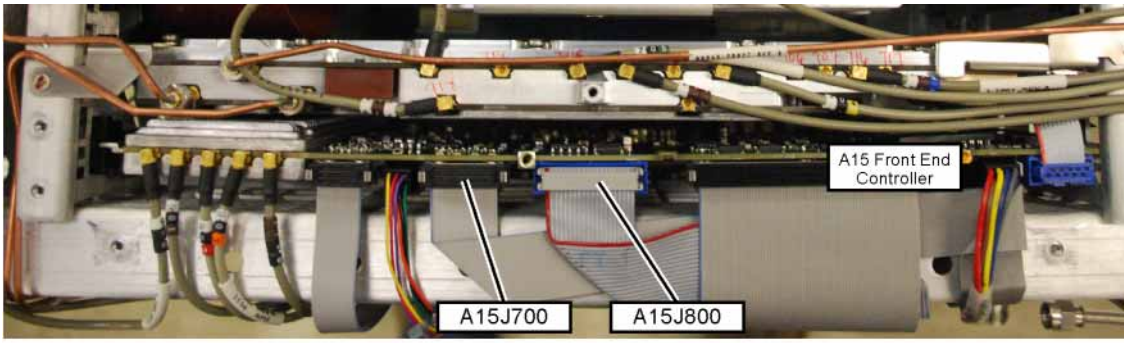
Visit: http://www.hubersuhner.com/de/ie70/hs-index

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, Low Band Switch Logic and Power Supplies

1. Turn off the instrument.
2. Disconnect ribbon cables from A15J700 and A15J800 as shown Figure 9-2.

Figure 9-2 Ribbon Cables at A15J700 and A15J800



fec_cables_ts_uxa

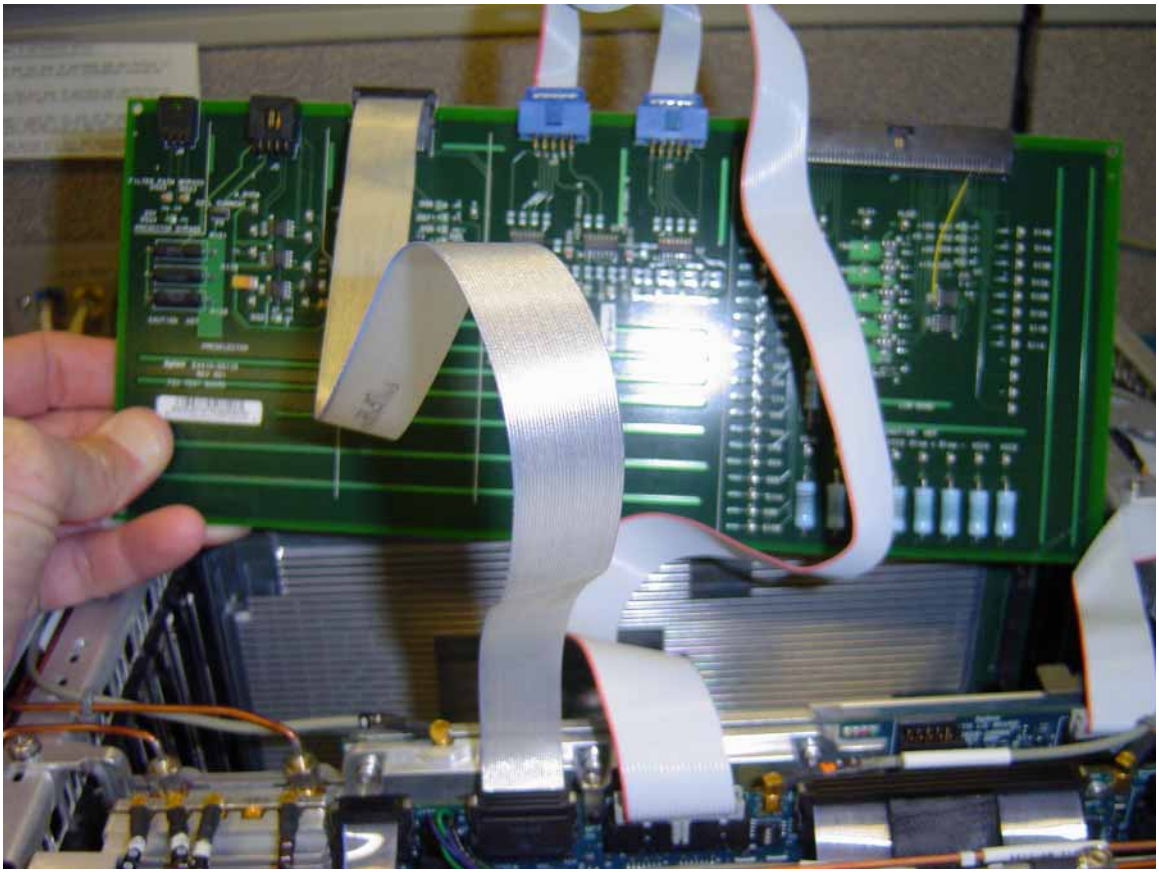
3. Connect the E4410-60115 RF Front End Troubleshooting board to the A15 Front End Control board using the E4410-60157 attenuator control cable. When connecting the attenuator control cable, E4410-60157, note that one end has two 10-pin connectors with one connector extending beyond the other. The shorter 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 UXA's frequency range as described below:

Table 9-3 UXA Frequency Range

Frequency Range Option	Shorter 10-pin connector (marked with red stripe)	Longer 10-pin connector
508, 513, or 526	J3	J4

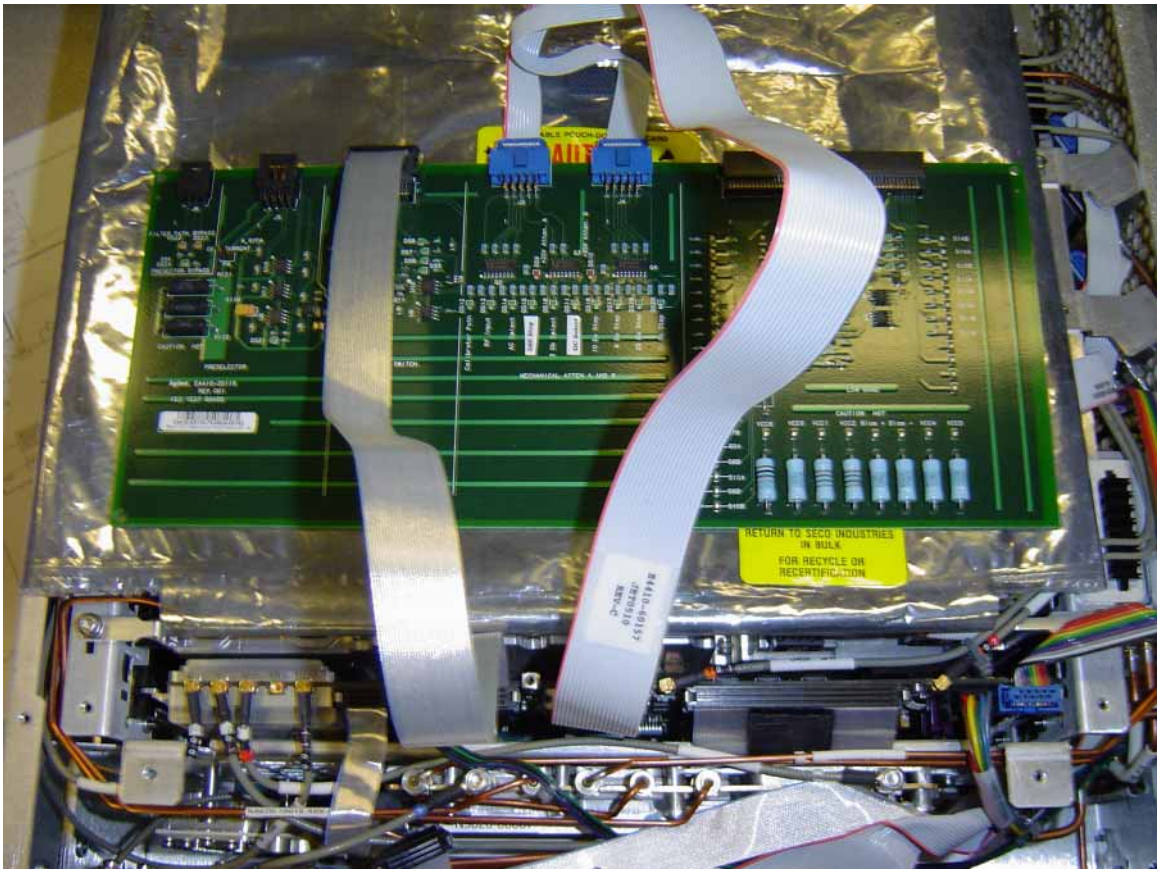
4. If the UXA has frequency range option 508, 513, or 526, also connect the Low Band Switch Control Cable, E4410-60160 between A15J700 and J2 of the RF Front End Troubleshooting board.

Figure 9-3 RF Front End Troubleshooting Board



5. Place the RF front end troubleshooting board on an ESD safe bag or foam to ensure nothing shorts out. See Figure 9-4.

Figure 9-4 RF Front End Troubleshooting Board Placement



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

NOTE You may notice an RF Alignment failure message on the analyzer display. This will occur when the test board is connected.

7. Turn Auto Align off by pressing **System**, **Alignments**, **Auto Align**, choose **Off** from the drop-down menu.

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 (located under the J3 and J4 connector). The power supply voltages are listed in the table below.

Table 9-4 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 508, 513, 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 9-5.

Table 9-5 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**, **RF Coupling**. Toggle the RF Coupling switch to DC (Direct Coupled) and verify DS14 turns off and DS11 turns on. Set the RF Coupling back to AC. If the LED’s are not toggling correctly, the most probably cause is the A15 Front End Controller.

Input Attenuator B Control Logic Verification (Option 508, 513, 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 9-6 and verify the proper LED's illuminate on the Front End Troubleshooting board according to Table 9-6.

Table 9-6 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.

Low Band Switch Control Logic Verification (Option 508, 513, 526 only)

Press **Mode Preset** on the analyzer. Press **FREQ**, **50 MHz**, **SPAN**, **2 MHz** on the analyzer. Make sure the auto alignments are turned off by pressing **System**, **Alignments**, **Auto Align**, **Off**. Connect the voltmeter positive lead to test point listed in the table below and the negative lead to the instrument chassis. These test points are located under the J2 connector. Verify the voltages in Table 9-7.

Table 9-7

Test Board Test Point	Voltage (VDC)
In1A	–10
In2A	–10
In1B	+10.0
In2B	+10.0

Press **FREQ**, **5 GHz** on the analyzer. Verify the voltages in Table 9-8.

Table 9-8

Test Board Test Point	Voltage (VDC)
In1A	+10.0
In2A	–10
In1B	–10.0
In2B	+10.0

If the voltages are not correct, the most probable cause is the A15 Front End Control board.

Disconnect RF Front End Troubleshooting Board

You do not need the RF front end troubleshooting board to test out the remaining front end hardware components. At this point it is advisable to shutdown the analyzer and disconnect the test board and cables. Be sure to reconnect the UXA Low Band switch ribbon cable and the input attenuator ribbon that were originally plugged into the Front End Control board before testing the input attenuator and low band switch logic.

Preselector Tune Output

The J302 connector is a test point used to verify the internal A12, YIG Tuned Filter drive voltage variations with center frequency. The YTF is used in the high band path (3.6 GHz to 26.5 GHz). Connect A15J302, Presel Tune to a voltmeter. Use the MMCX (m) to SMB (f) to connect to J302 on the A15 board and appropriate adaptors to connect to the voltmeter. Refer to Figure 9-1 for J302 location. You may also need a Banana plug to BNC (f) adapter, part number E9637A for the voltmeter. The preselector tune output voltage can be measured to verify this portion of the A15 is functioning.

Press **System**, **Alignments**, **Auto Align**, and choose **Off** from the drop-down menu once it has fully booted to the spectrum analyzer application. Press **Freq**, **Span** and toggle to Zero Span on the analyzer. The preselector tune output voltage in high band should change when the center frequency of the analyzer is changed.

Table 9-9 Preselector Tune Output Voltages (Option 508, 513, 526)

Center Frequency (GHz)	~ Tune Voltage (VDC)	Valid Frequency Range Option
5.0	1.55	508, 513, 526
10.0	3.12	513, 526
15.0	4.7	526
20.0	6.27	526
26.0	8.17	526

Verifying SW3 (Option LNP only)

Since there is a ribbon cable from the A15J802 to SW3, it is not feasible to use a voltmeter or oscilloscope to measure the control voltages. For testing SW3, the “click” test can be used.

Press **Mode Preset** on the analyzer. Press **FREQ**, **5 GHz**, **SPAN**, **1 MHz**. Verify the optional preamplifier is off by pressing **AMPTD**, **Signal Path** and verify the Internal Preamp Low Band toggle is in the Off position. The Internal Preamp toggle must be Off in order to test SW3. Press **AMPTD**, **Signal Path**, **uW Path Control**, **Low Noise Path Enable** on the analyzer. You should hear a distinct “click” noise from SW3 when the low noise path is selected. Now press **uW Path Control** and select **Standard Path**. SW3 will “click” again and return to the standard RF path.

Another way of testing this switch is using an RF signal. This is described in the RF Section Troubleshooting chapter, under the high band troubleshooting section.

Verifying SW1 and SW2 (Option MPB)

SW1 and SW2 can be verified three different ways:

– “Click” Test

– R.F. Signal Tracing

“Click” Test

This test changes between two different path modes. When this is done a distinct “click” noise from SW1 and SW2 can be heard. Since both switches switch at the same time, it is difficult to decipher if one is switching and the other is not.

Press **Mode**, **Preset** on the analyzer. Press **FREQ**, **5 GHz**, **SPAN**, **1 MHz**, **AMPTD**, **Signal Path**, **uW Path Control**. Standard Path is the default. Select uW Preselector Bypass and you should hear a distinct “click” noise if the control logic from the A15 Front End Control board is getting to SW1 and SW2.

RF Signal Tracing

Refer to Chapter 7, "RF Section (RF/Microwave)," for this method of troubleshooting if you are unable to use an Oscilloscope.

Verifying Narrowband IF Out (A15J900)

The outer cover and top shield need to be removed to verify A15J900 I.F. output to the A2 Analog IF assembly. Refer to Chapter 20, "Assembly Replacement Procedures," for the removal procedure. Press **MODE/MEAS**, **Spectrum Analyzer**, **OK**, **Mode Preset** on the analyzer. Press **Input/Output**, **RF Calibrator**, **50 MHz**, **FREQ**, **50 MHz**, **Span** and toggle from Swept Span to Zero Span. Press **Amptd**, **Attenuation**, **10 dB**, **Amptd**, **Signal Path** and verify Internal Preamp Low Band toggle is set to Off. Press **System**, **Alignments**, **Auto Align** and choose **Off** from the drop-down menu. Disconnect the cable marked J900 that plugs into the top of the A15, Front End Controller board and connect a functioning spectrum analyzer where the cable was plugged in. J900's output should be 322.5 MHz at ~-20 dBm on the functioning spectrum analyzer if the Front End Controller board is switching this level correctly. If -20 dBm is not being measured correctly, remove the cable labeled J902 from the Front End Controller board and measure the output of that cable. This should also measure 322.5 MHz at ~-20 dBm. If the output of the J902 cable measures correctly and yet the output of J900 is incorrect, the most probable cause is the A15, Front End Controller board.

Reconnect all cables to their correct location when finished with the measurements.

IMPORTANT When plugging in an mmcx connector, a distinct "snap" should be heard when the cable is seated correctly.

Verifying Aux IF Out, Rear Panel (Option CR3, CRP, ALV only)

The Aux I.F. output connector on the rear panel of the UXA is installed on each instrument; however the actual Aux I.F. output frequency will vary depending on the options installed. These options are all enabled with a license key. The first step in verifying the Aux I.F. output is the make sure the option is licensed by pressing **System**, **Show**, **System** on the analyzer and make sure the option identifies itself in the table.

The I.F. switch path and frequency generation occurs on the A15, Front End Controller board. This troubleshooting procedure provides the instrument setups to verify options CR3, CRP and ALV. Test the Aux I.F. output based on the options installed in the analyzer.

Standard UXA

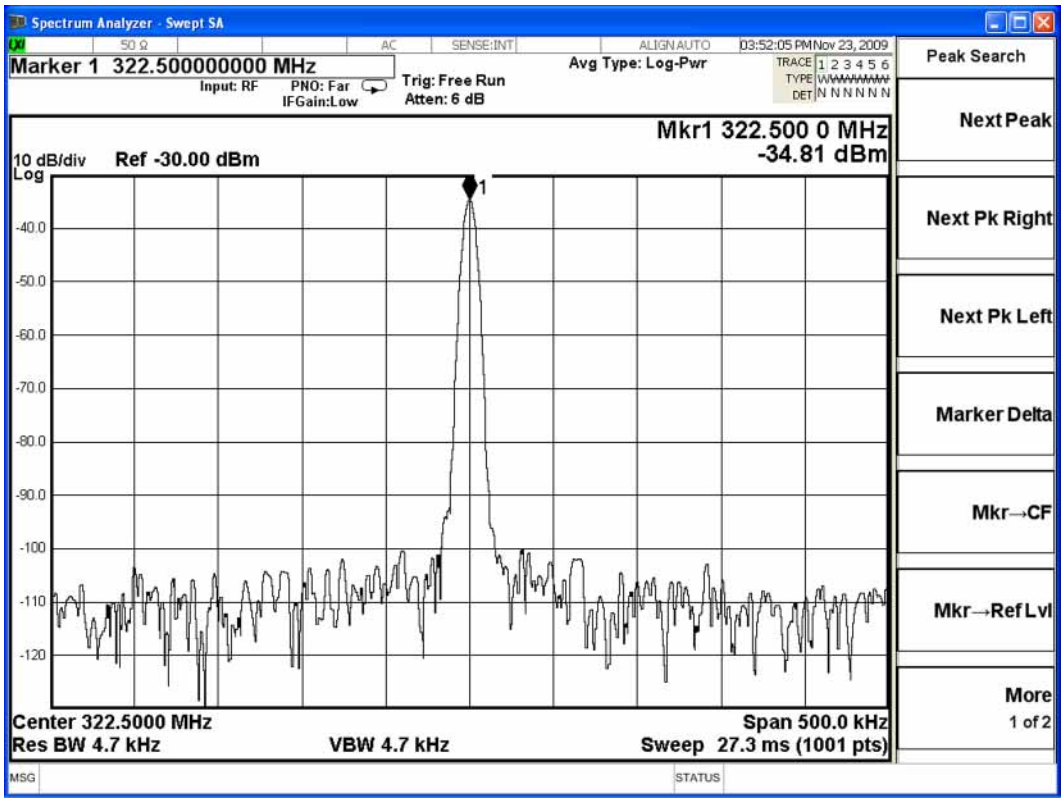
No test to perform.

Verifying Option CR3

Press the following keys on the analyzer:
MODE/MEAS, **Spectrum Analyzer**, **OK**, **Mode Preset**, **Input/Output**, **RF Calibrator**, **50 MHz**, **FREQ**, **50 MHz**, **Span** and toggle switch to Zero Span.
Press **System**, **Alignments**, **Auto Align**, **Off**, **Input/Output**, **Output**, **Aux IF Out** and select **Second IF** from the drop-down menu.

Connect the Aux I.F. Output on the rear panel to the RF Input of a functioning spectrum analyzer. If the A15 Front End Controller is switching the I.F. correctly, you should measure 322.5 MHz at –35 dBm ±3 dB as per Figure 9-5.

Figure 9-5 322.5 MHz

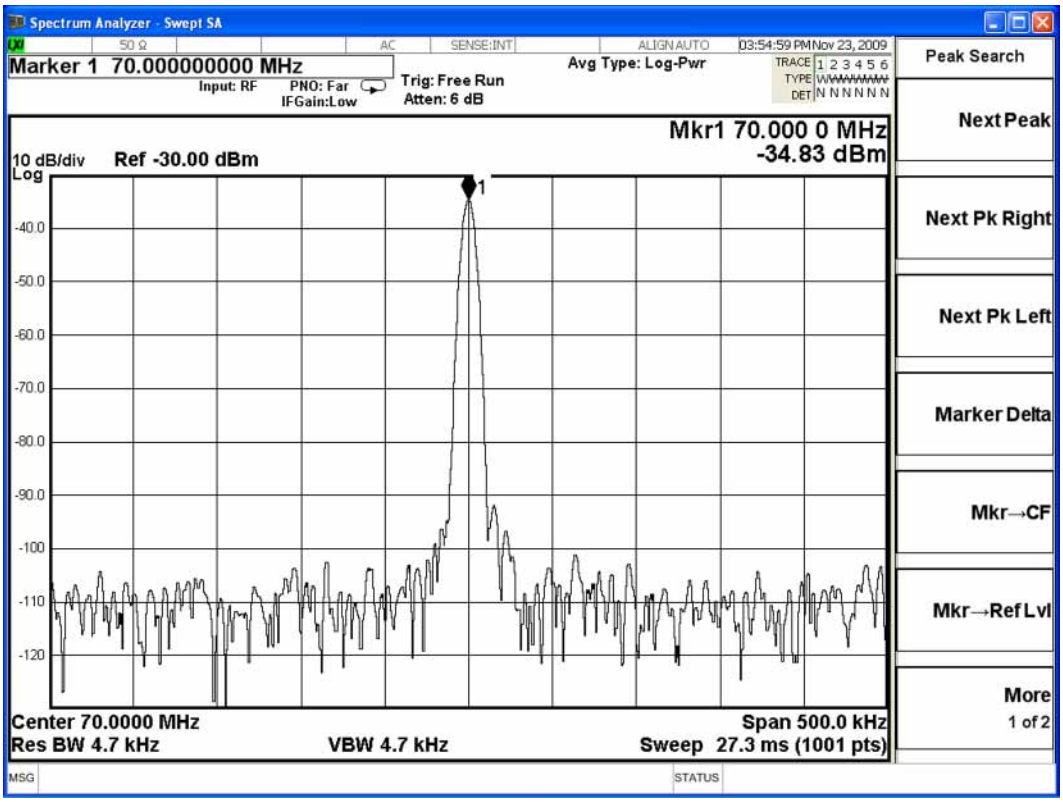


Verifying Option CRP

Press the following keys on the analyzer:
MODE/MEAS, **Spectrum Analyzer**, **OK**, **Mode Preset**, **Input/Output**, **RF Calibrator, 50 MHz**, **FREQ**, **50 MHz**, **Span** and toggle switch to Zero Span.
Press **System**, **Alignments**, **Auto Align**, **Off**, **Input/Output**, **More 1 of 2**, **Output Config**, **Aux IF Out**, **Arbitrary IF**.

The default is 70 MHz, which can be measured on a functioning spectrum analyzer. The amplitude level should be –35 dBm ±3 dB as per Figure 9-6. You can select Arbitrary IF Freq and vary the I.F. from 10 MHz to 70 MHz in 500 kHz steps and measure the Aux IF output. The amplitude level should remain fairly flat across the entire arbitrary IF output range.

Figure 9-6 70 MHz



Verifying Option ALV

Equipment needed:

Volt meter

Adapters and cables to connect the volt meter to the Aux IF Out SMA connector on the spectrum analyzer rear panel.

Signal source

Signal source settings:

Frequency: 1 GHz (CW)

Amplitude: –10 dBm

Press the following keys on the analyzer:
MODE/MEAS, Spectrum Analyzer, Mode Preset, OK, FREQ Channel, and set the center frequency to 1 GHz. Press **Span** and toggle the switch to Zero Span. Press **Input/Output**, **Output**, **Aux IF Out** and choose **Fast Log Video** from the drop-down menu.

Connect the rear panel Aux IF Out of the signal analyzer to a voltmeter set to measure DC volts.

Verify that signal level appears on the analyzer screen positioned 1 division below top graticule line.

Voltmeter should measure approximately 1.5 Vdc.

Reduce source output power to –20 dBm. Signal should now appear one division lower, and voltmeter should measure approximately 1.3 VDC.

Reduce source output power to –30 dBm. Signal should now appear one division lower, and voltmeter should measure approximately 1.0 VDC.

10 Analog and Digital IFs

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 208

Troubleshooting Equipment Required on page 210

A2 25 MHz Analog IF on page 211

- Overview on page 222
- Functional Verification on page 226

A3 40 MHz Digital IF on page 222

- Overview on page 222
- Functional Verification on page 226

A3 40 MHz Digital IF on page 222

- Overview on page 211
- Functional Verification on page 226

Overview

To provide all the possible IF path selections that the instrument has there are multiple IF assemblies in the instrument, both analog and digital. These include the following:

– A2 25 MHz Analog IF

– A3 40 MHz Digital IF

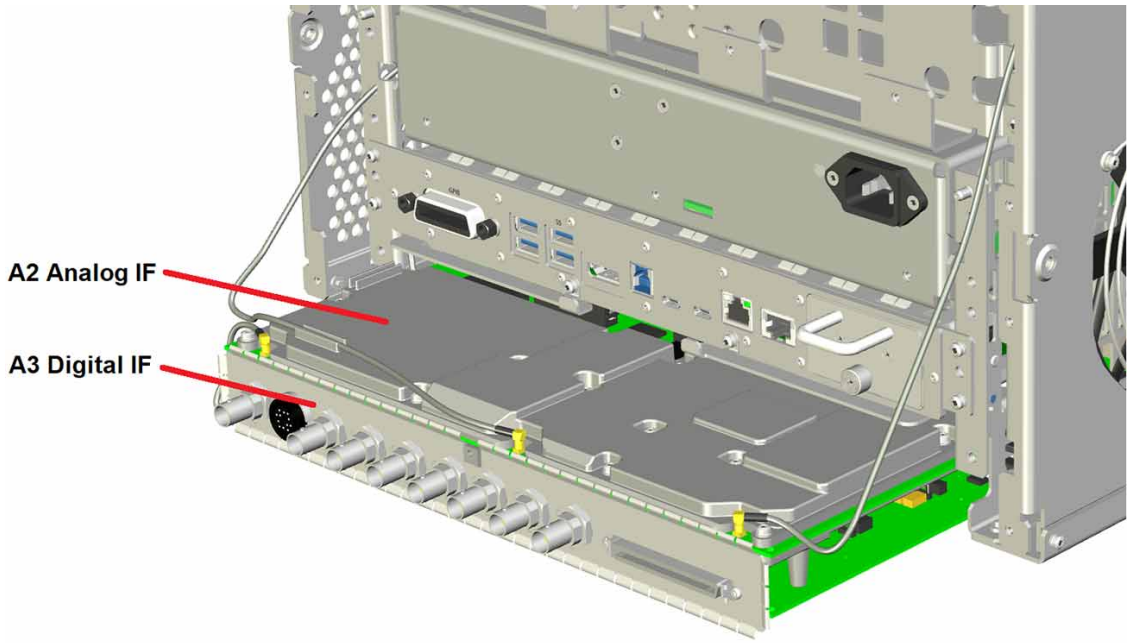
When the instrument uses each of these is outlined in Table 10-1, and the location of each can be seen in Figure 10-1.

Table 10-1 IF Path versus IF Assembly

IF Path	IF Assembly Used	IF Input
10 MHz[a]	A2 25 MHz Analog IF	322.5 MHz
	A3 40 MHz Digital IF	22.5 MHz
25 MHz	A2 25 MHz Analog IF	322.5 MHz
	A3 40 MHz Digital IF	22.5 MHz
40 MHz	A3 40 MHz Digital IF	250 MHz

a. The spectrum analyzer swept SA measurement uses the 10 MHz IF path.

Figure 10-1 IF Assembly Locations



NOTE

The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

Troubleshooting Equipment Required

To perform the troubleshooting and verification outlined in this chapter the following test equipment will be needed:

Spectrum Analyzer

Minimum frequency range: 10 MHz to 26.5 GHz

Signal Generator

Minimum frequency range: 10 MHz to 26.5 GHz

Power Meter

Minimum frequency range: 10 MHz to 26.5 GHz

Minimum power level range: -50 dBm to +20 dBm

Miscellaneous

Oscilloscope: 500 MHz, 1 MΩ input

Multimeter (Voltage and Resistance)

Misc. cables and adapters

A2 25 MHz Analog IF

Overview

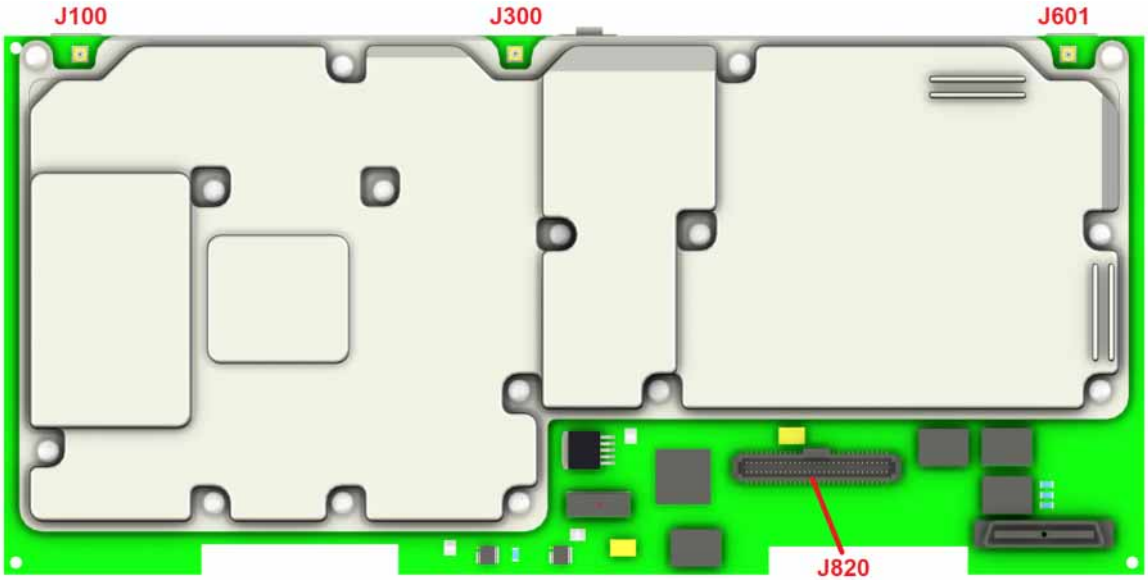
The A2 25 MHz Analog IF is used whenever the IF signal path is 10 MHz or 25 MHz and when any swept measurement is made. This assembly is basically a downconverter with multiple bandwidth filters. The output of this assembly is digitized and processed on the A3 40 MHz Digital IF assembly.

The connections to and from the A2 25 MHz Analog IF are listed in Table 10-2, as seen in Figure 10-2.

Table 10-2 A2 25 MHz Analog IF Connections

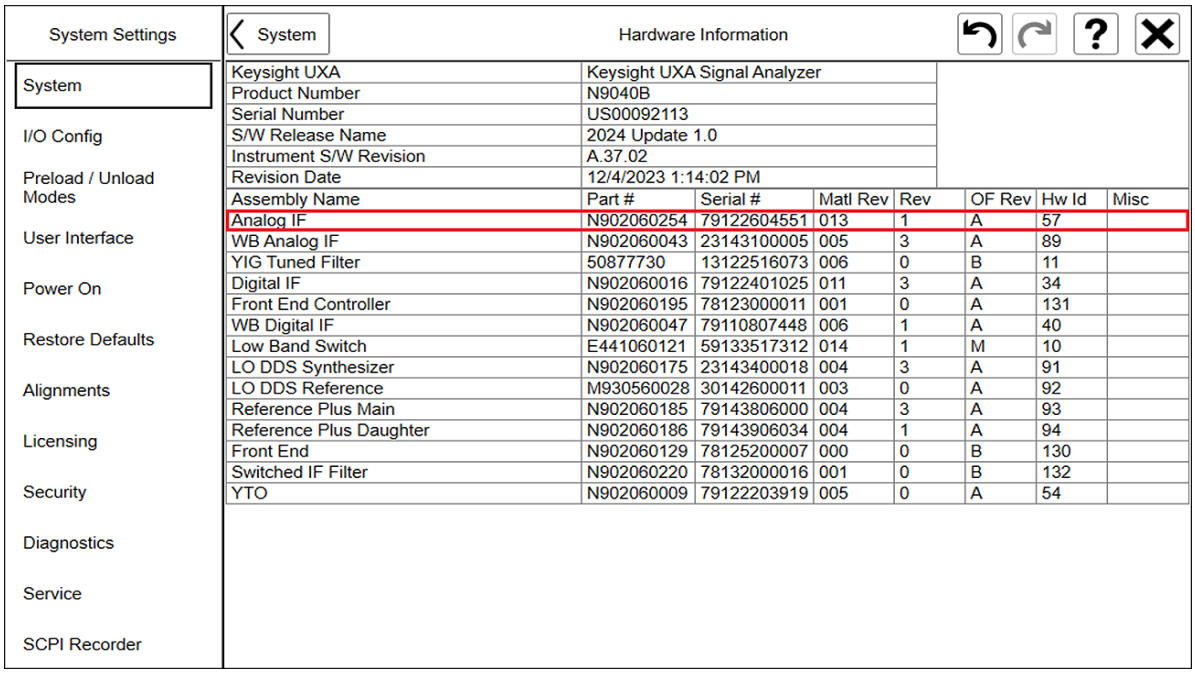
Port	Description	To / From	Cable
J100	322.5 MHz IF Input	From A15 Front End Controller J900	W101
J300	300 MHz LO Input	From A16 Reference J711	W107
J601	22.5 MHz IF Output	To A3 40 MHz Digital IF J19	W100
J820	Bias & Control	From A3 40 MHz Digital IF J20	W11

Figure 10-2 A2 25 MHz Analog IF Connections



The A2 25 MHz Analog IF will identify itself on the instrument Hardware Information screen as the **Analog IF**, as seen in Figure 10-3.

Figure 10-3 Hardware Information Screen – A2 25 MHz Analog IF



Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US00092113
S/W Release Name	2024 Update 1.0
Instrument S/W Revision	A.37.02
Revision Date	12/4/2023 1:14:02 PM

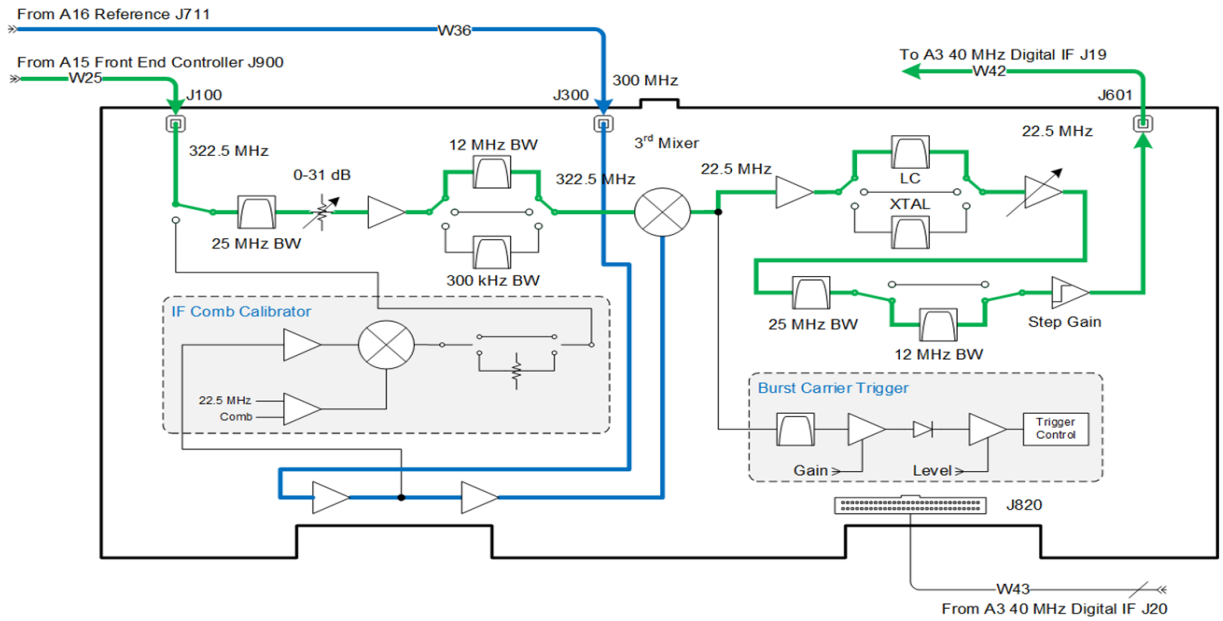
Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060254	79122604551	013	1	A	57	
WB Analog IF	N902060043	23143100005	005	3	A	89	
YIG Tuned Filter	50877730	13122516073	006	0	B	11	
Digital IF	N902060016	79122401025	011	3	A	34	
Front End Controller	N902060195	78123000011	001	0	A	131	
WB Digital IF	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	23143400018	004	3	A	91	
LO DDS Reference	M930560028	30142600011	003	0	A	92	
Reference Plus Main	N902060185	79143806000	004	3	A	93	
Reference Plus Daughter	N902060186	79143906034	004	1	A	94	
Front End	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	78132000016	001	0	B	132	
YTO	N902060009	79122203919	005	0	A	54	

Downconverter Signal Path

When the 10 MHz or 25 MHz IF Path is selected, or when any swept measurement is made, the analyzer's RF input signal is down converted to a 322.5 MHz intermediate frequency in the A13 Front End assembly. This 322.5 MHz signal is then routed through the A15 Front End Controller that will then route it to the A2 25 MHz Analog IF input.

The A2 25 MHz Analog IF down converts the 322.5 MHz signal to a final IF of 22.5 MHz. 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, as seen in the block diagram of Figure 10-4.

Figure 10-4 A2 25 MHz Analog IF Signal Path



The only other RF signal that the A2 25 MHz Analog IF needs to function is a 300 MHz reference signal at J300 that comes from the A16 Reference assembly. This reference signal is used as the LO for the third mixer, as seen in Figure 10-4. It is also mixed with a 22.5 MHz signal to generate a 322.5 MHz calibrator signal.

This assembly also contains one of the burst carrier triggers (BCT). The BCT on the A2 assembly is relatively narrowband. Other BCT circuits have a much wider bandwidth.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A2 25 MHz Analog IF, verify that it is being recognized by the instrument by pressing **System**, **Show Hardware** and verify that there is an **Analog IF** in the list of hardware assemblies, as seen in Figure 10-3. If it is not listed, 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 one of the following:

– An instrument power supply voltage is not operating properly
  Solution: See the **"Power Supply Verification"** section in **Chapter 5, "First-Look Troubleshooting,"** to verify that all the instrument power supplies are on.

– A2 25 MHz Analog IF assembly is defective
  Solution: Replace the A2 25 MHz Analog IF assembly

NOTE

Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting."

Downconverter Signal Path

The following verification procedure for the A2 25 MHz Analog IF will verify the following:

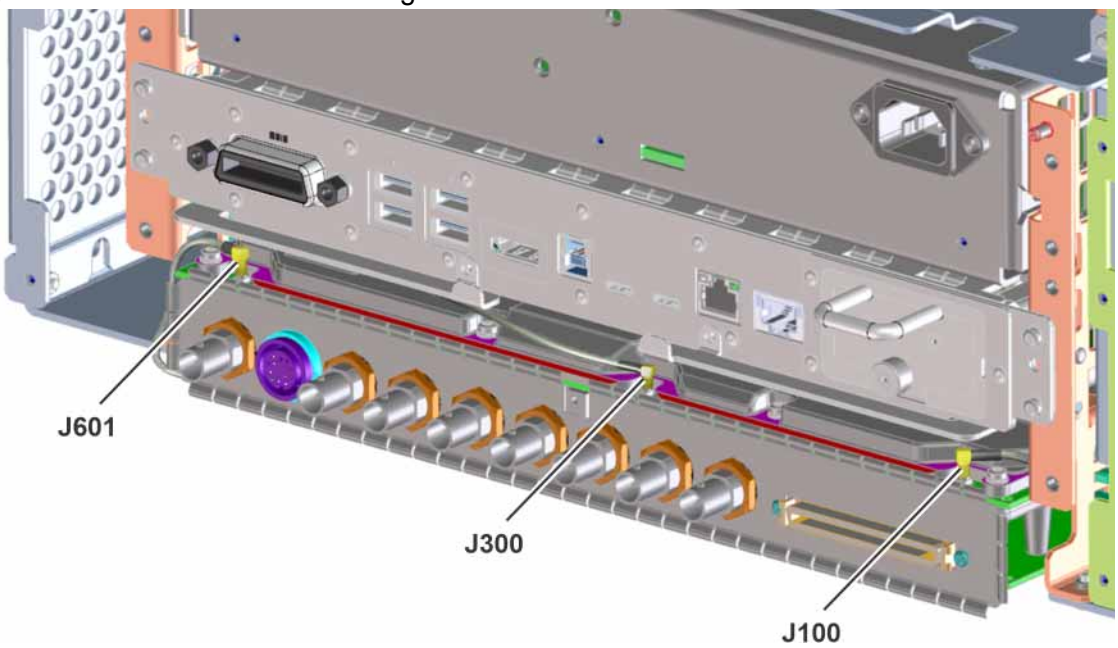
- 300 MHz Reference Signal Input
- Filter Path Switching
- Step Gain Amplifier
- Filter Path Passband Shape

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Tune the instrument to 1 GHz by pressing **Frequency**, **Center Frequency 1 GHz**.
5. Stop the instrument from sweeping by pressing **Zero Span**.

300 MHz Reference

6. Referring to Figure 10-5, remove W36 from J300 of the A2 25 MHz Analog IF.

Figure 10-5 A2 25 MHz Analog IF Connections



7. Connect a spectrum analyzer to the loose end of W36.
8. Tune the spectrum analyzer to 300 MHz with a span of 10 MHz.

9. Verify that there is a 300 MHz signal on the spectrum analyzer display with a power level of +8.0 dBm, ±2.0 dB.

   If there is a signal as expected, proceed to the next step.

   If there is not a signal as expected, see the "Functional Verification" section in Chapter 12, "Reference," to determine why there is not a 300 MHz reference signal at J711.

10. Reconnect W36 to J300.

Filter Path Switching

11. Verify that the swept IF gain is set to low by pressing **Meas Setup**, **Advanced**, **Swept IF Gain**, **Low Gain**.
12. Referring to Figure 10-5, remove W25 from J100 and W42 from J601.
13. Connect a signal generator to the A2 25 MHz Analog IF input at J100.
14. Tune the signal generator to 322.5 MHz with a power level of -20 dBm.
15. Connect a spectrum analyzer to the A2 25 MHz Analog IF output at J601.
16. Tune the spectrum analyzer to 22.5 MHz with a span of 10 MHz.
17. Set the resolution bandwidth of the instrument under test to 10 MHz by pressing **BW**, **Res BW 10 MHz**.
18. Verify that there is a 22.5 MHz signal on the spectrum analyzer display at approximately -20 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A2 25 MHz Analog IF.

19. Repeat steps 17 and 18 for the rest of the resolution bandwidths listed in Table 10-3.

Table 10-3 A2 25 MHz Analog IF Swept Filter Paths

Resolution Bandwidth (3 dB)	Filter Path	Path Description
10 MHz	12 MHz	Through
300 kHz	1 MHz	LC Wide
100 kHz	300 kHz	LC Narrow
10 kHz	75 kHz	Crystal Wide
3 kHz	10 kHz	Crystal Narrow

Step Gain Amplifier

20. Set the resolution bandwidth to 10 MHz by pressing **BW**, **Res BW 10 MHz**.
21. Place a marker on the 22.5 MHz signal on the spectrum analyzer display.

22. Enable the delta marker on the spectrum analyzer and verify that it reads 0 dBm.
23. Set the swept IF gain to high by pressing **Meas Setup**, **Advanced**, **Swept IF Gain**, **High Gain**.
24. Verify that the signal level on the spectrum analyzer display increased by approximately 10 dB.

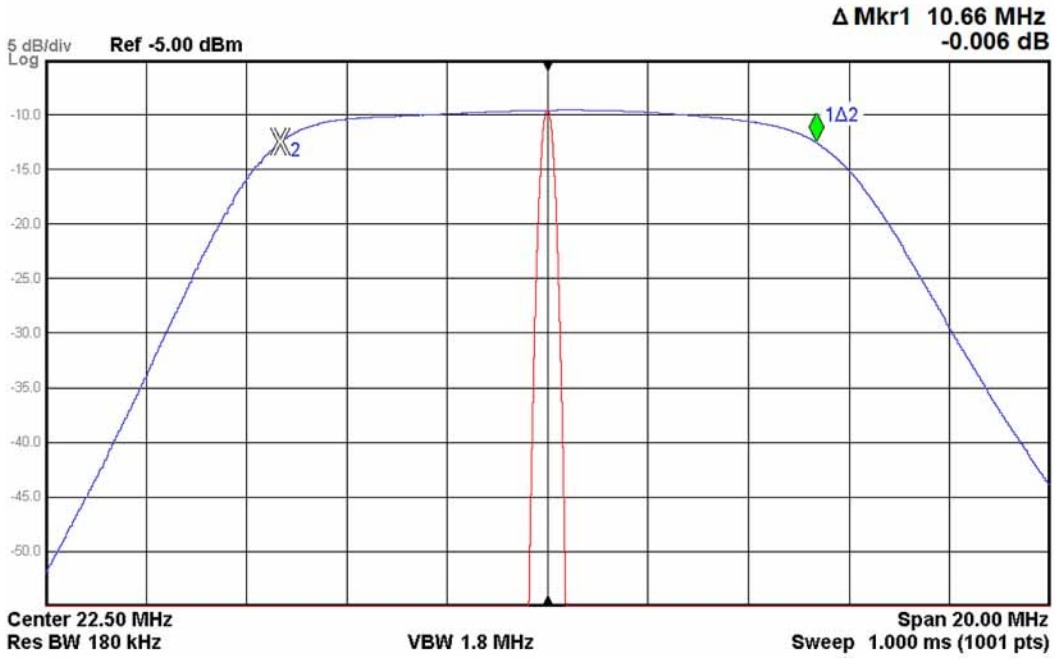
    If the signal level increased as expected, the step gain amplifier is working properly. Proceed to the next step.

    If the signal level did not increase as expected, replace the A2 25 MHz Analog IF.
25. Set the swept IF gain back to low by pressing **Meas Setup**, **Advanced**, **Swept IF Gain**, **Low Gain**.

Filter Path Passband Shape

26. Increase the power level of the signal generator to -10 dBm.
27. Set the reference level of the spectrum analyzer to -5 dBm and the scale per division to 5 dB.
28. Turn on trace two of the spectrum analyzer and set it to max-hold.
29. Set the span of the spectrum analyzer to 20 MHz.
30. Vary the frequency of the signal generator to draw out the shape of the filter on the spectrum analyzer display, as seen in Figure 10-6.

Figure 10-6 A2 25 MHz Analog IF Filter Shape - 12 MHz



31. Repeat steps 29 and 30 for the remaining filter paths in Table 10-4.

Table 10-4 A2 25 MHz Analog IF Filter Path Selections

Filter Path	Resolution Bandwidth	Spectrum Analyzer Span	Expected Filter Shape
12 MHz	10 MHz	20 MHz	Figure 10-6
1 MHz	300 kHz	5 MHz	Figure 10-7
300 kHz	100 kHz	1 MHz	Figure 10-8
75 kHz	10 kHz	500 kHz	Figure 10-9
10 kHz	3 kHz	100 kHz	Figure 10-10

Figure 10-7 A2 25 MHz Analog IF Filter Shape - 1 MHz

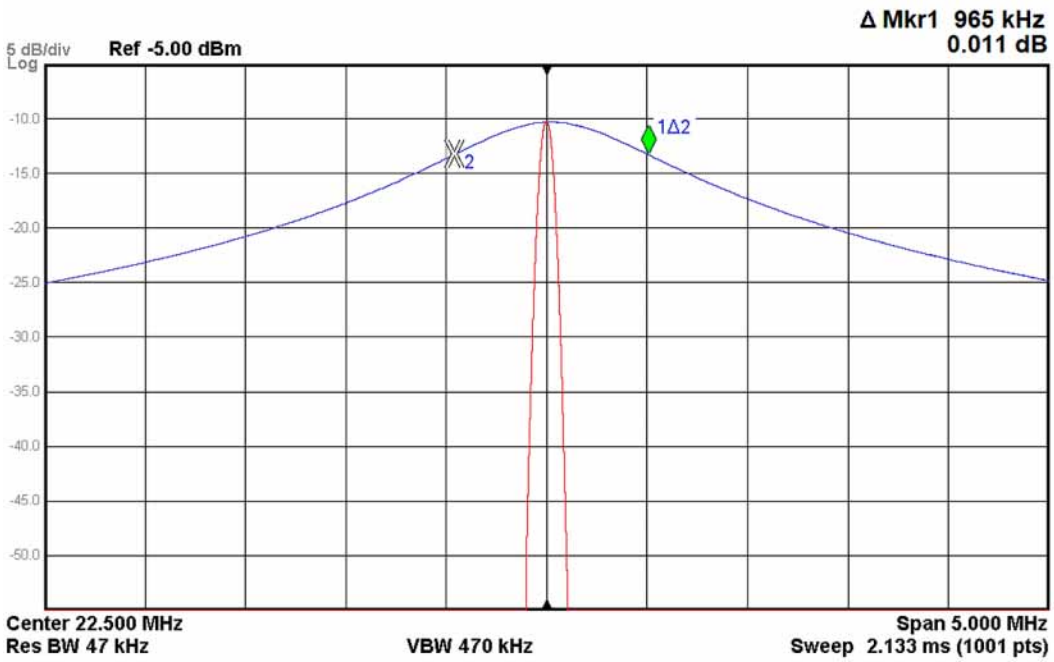


Figure 10-8 A2 25 MHz Analog IF Filter Shape - 300 MHz

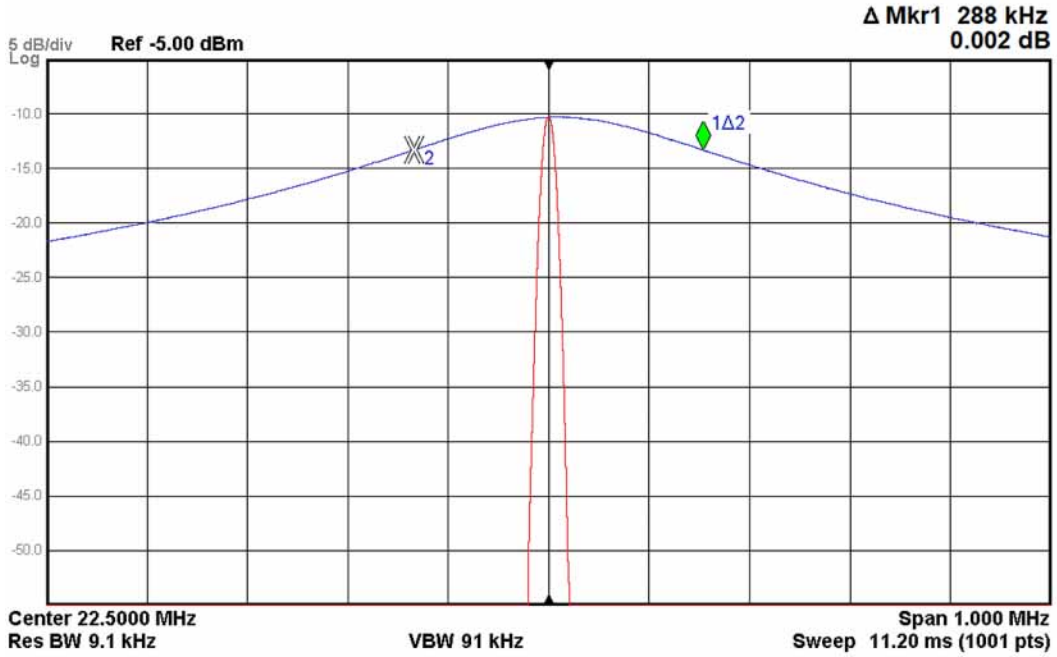


Figure 10-9 A2 25 MHz Analog IF Filter Shape - 75 kHz

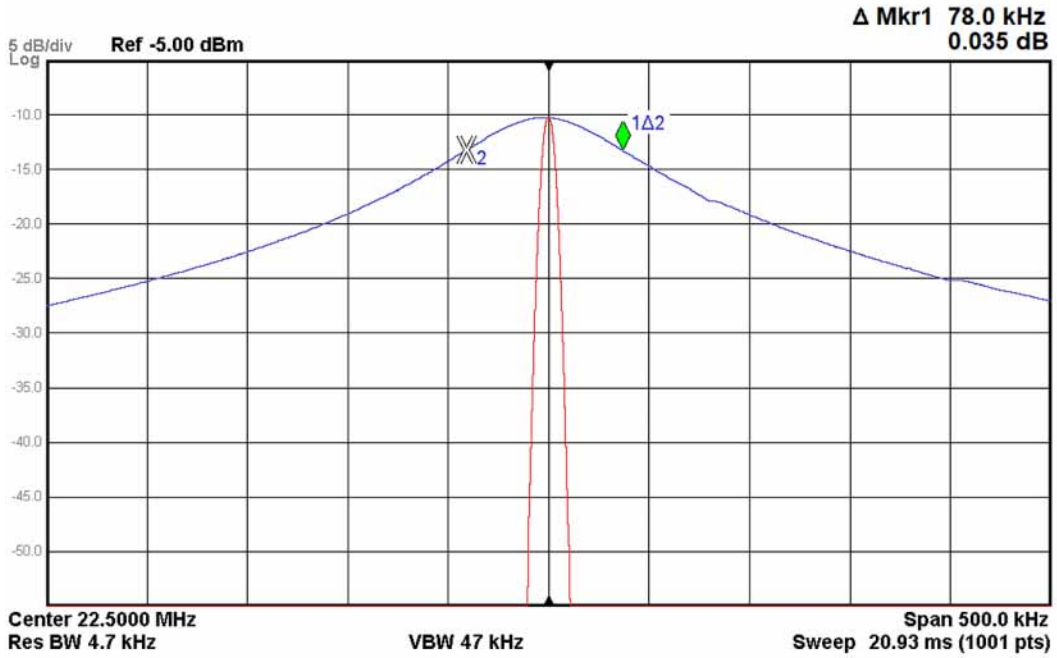
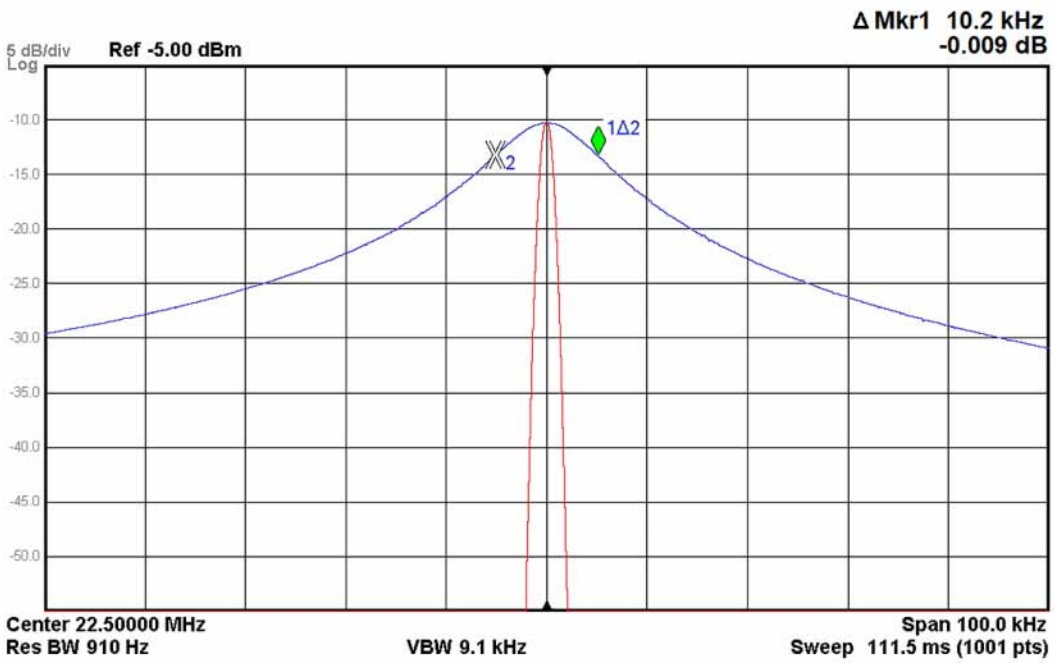


Figure 10-10 A2 25 MHz Analog IF Filter Shape - 10 kHz



32. If any of the filter passband shapes do not match what is expected, replace the A2 25 MHz Analog IF.

33. Switch the instrument mode to IQ analyzer by pressing **Mode/Meas**, **IQ Analyzer**, **OK**.

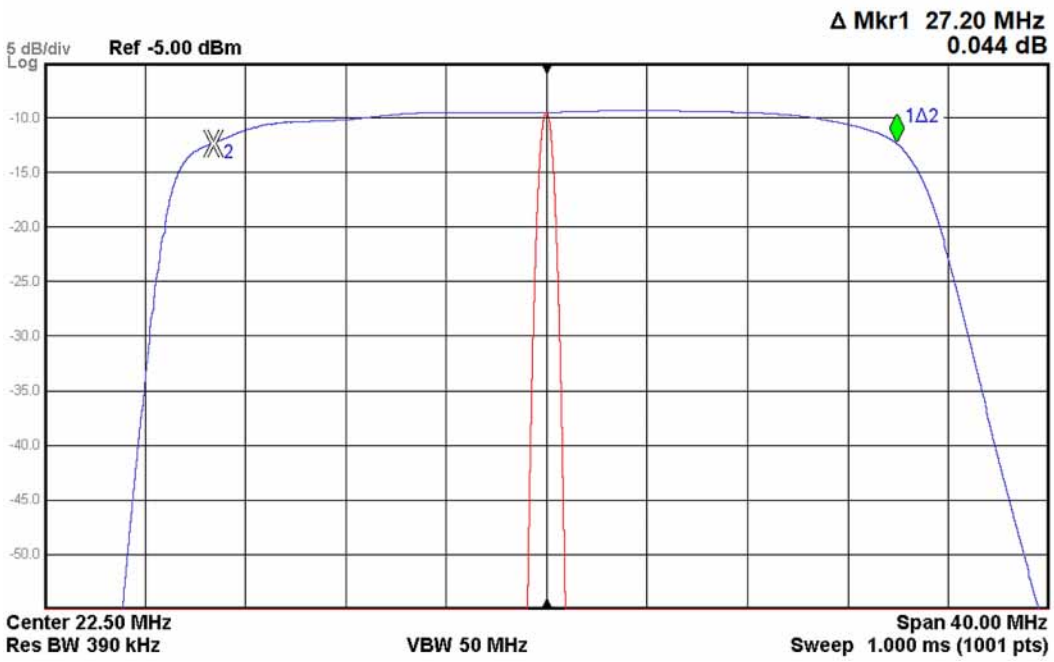
34. Return the instrument to a known state by pressing **Mode Preset**.

35. Set the span to 25 MHz by pressing **Frequency**, **Span 25 MHz**.

36. Set the span on the spectrum analyzer to 40 MHz.

37. Vary the frequency of the signal generator to draw out the shape of the filter on the spectrum analyzer display, as seen in Figure 10-11.

Figure 10-11 A2 25 MHz Analog IF Filter Shape - 25 MHz



38. If the filter bandpass shape does not match what is expected, replace the A2 25 MHz Analog IF.

A3 40 MHz Digital IF

Overview

The A3 40 MHz 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
- Provides step comb calibration signal
- Trigger interpolation and associated alignment

The connections to and from the A3 40 MHz Digital IF are listed in Table 10-5, as seen in Figure 10-12 and Figure 10-13.

Table 10-5 A3 40 MHz Digital IF Connections

Port	Description	To / From	Cable
J4	Digital Bus	Rear Panel	--
J5	Analog Out	Rear Panel	--
J6	Trigger 2 Out	Rear Panel	--
J7	Trigger 1 Out	Rear Panel	--
J8	Sync	Rear Panel	--
J9	Trigger 2 In	Rear Panel	--
J10	Trigger 1 In	Rear Panel	--
J11	Noise Source +28 Volts	Rear Panel	--
J12	Smart Noise Source	Rear Panel	--
J13	10 MHz Out	Rear Panel	--
J14	100 MHz Reference Input	From A16 Reference J716	W108
J15	250 MHz IF Input	From A15 FEC J901	W102
J17	Step Calibrator Output	To A16 Reference J726	W110
J19	22.5 MHz IF Input	From A2 25 MHz Analog IF J601	W100
J20	A2 Power and Control	To A2 25 MHz Analog IF J820	W11
P1	Analog Card Cage Connector	A24 Interconnect Board J3	--
P2	PCI Card Cage Connector	A24 Interconnect Board J4	--

Figure 10-12 A3 40 MHz Digital IF Connections - Bottom

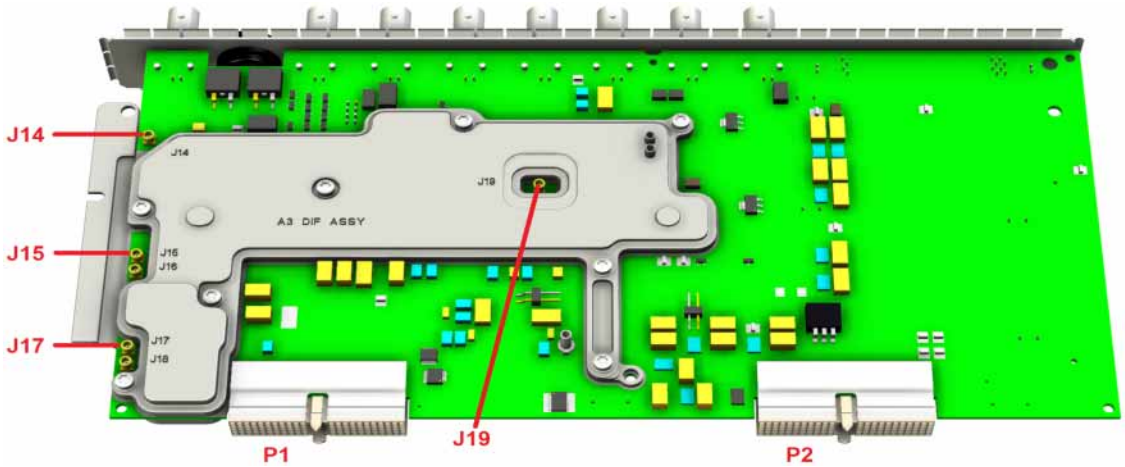
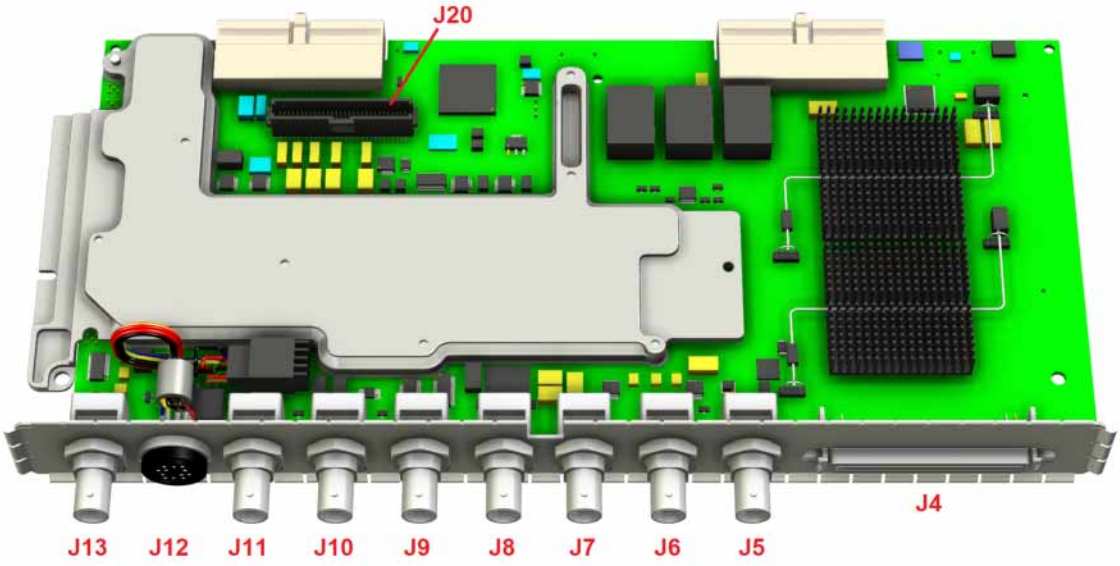
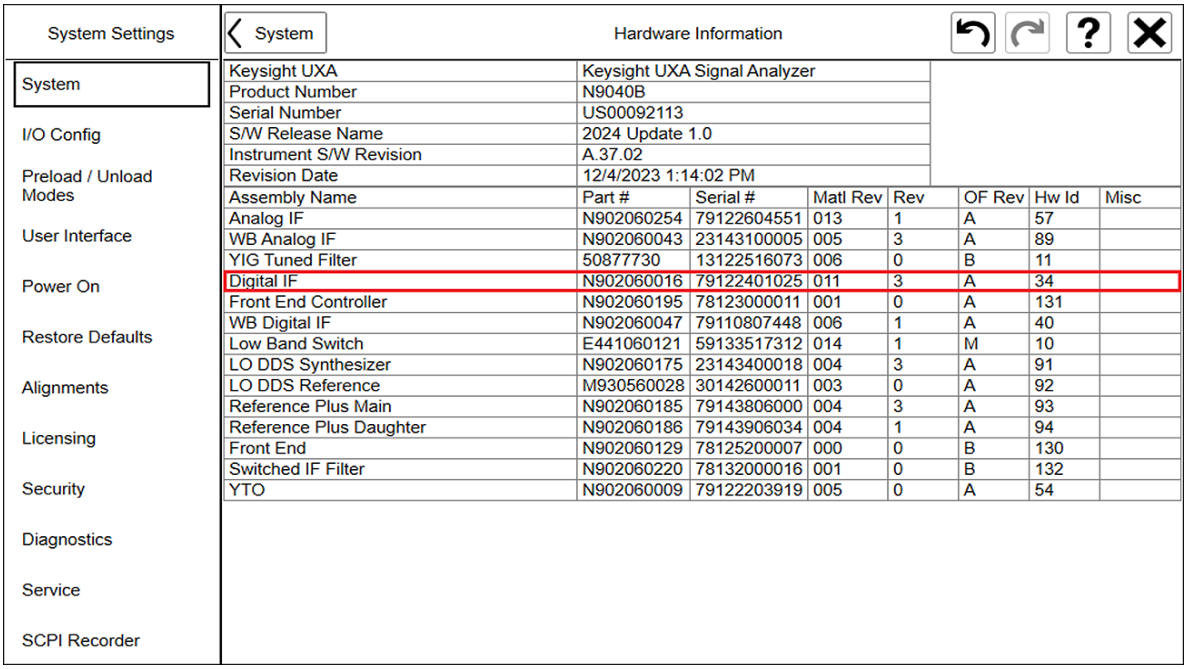


Figure 10-13 A3 40 MHz Digital IF Connections - Top



The A3 40 MHz Digital IF will identify itself on the instrument Hardware Information screen as the **Digital IF**, as seen in Figure 10-14.

Figure 10-14 Hardware Information Screen – A3 40 MHz Digital IF



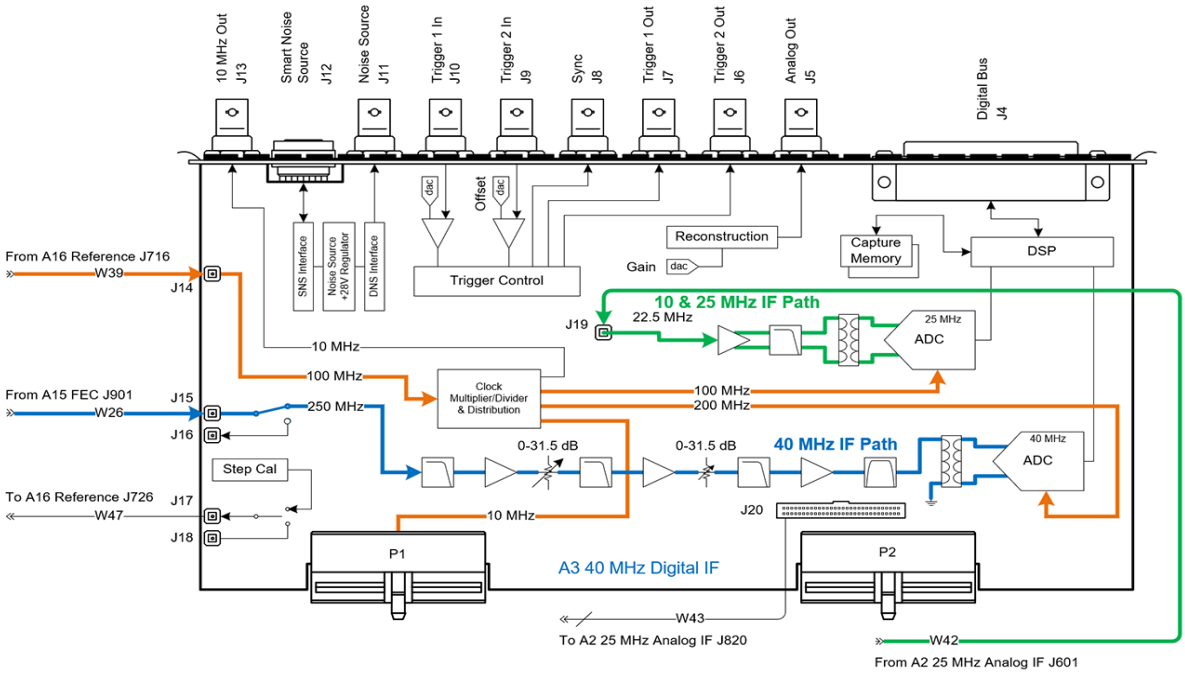
Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US00092113
S/W Release Name	2024 Update 1.0
Instrument S/W Revision	A.37.02
Revision Date	12/4/2023 1:14:02 PM

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060254	79122604551	013	1	A	57	
WB Analog IF	N902060043	23143100005	005	3	A	89	
YIG Tuned Filter	50877730	13122516073	006	0	B	11	
Digital IF	N902060016	79122401025	011	3	A	34	
Front End Controller	N902060195	78123000011	001	0	A	131	
WB Digital IF	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	23143400018	004	3	A	91	
LO DDS Reference	M930560028	30142600011	003	0	A	92	
Reference Plus Main	N902060185	79143806000	004	3	A	93	
Reference Plus Daughter	N902060186	79143906034	004	1	A	94	
Front End	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	78132000016	001	0	B	132	
YTO	N902060009	79122203919	005	0	A	54	

Signal Path

The A3 40 MHz Digital IF is used to digitize IF signal path bandwidths of 10 to 40 MHz. It does this with the use of two different IF signal paths, as seen in the block diagram of Figure 10-15.

Figure 10-15 A3 40 MHz Digital IF Signal Paths



NOTE Refer to the different signal path block diagrams in Chapter 6, "Block Diagrams," for more details on how and when the A3 40 MHz Digital IF is used and what the expected power levels are.

The frequencies of the two different IF inputs to the A3 40 MHz Digital IF are:

- 22.5 MHz for the 10 and 25 MHz IF path
- 250 MHz for the 40 MHz IF path

Each input has a separate ADC that processes the time domain continuous data into I/Q signals before sending the data to the A4 System Processor assembly for further processing and measurement display.

The only other RF signal that the A3 40 MHz Digital IF needs to function is a 100 MHz reference signal at J14 that comes from the A16 Reference assembly. This reference signal is used to clock the 25 MHz ADC, is doubled to provide the clock for the 40 MHz ADC and is divided by 10 to provide the rear panel 10 MHz Reference output, as seen in Figure 10-15.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A3 40 MHz Digital IF, verify that it is being recognized by the instrument by pressing **System**, **Show Hardware** and verify that there is an **Digital IF** in the list of hardware assemblies, as seen in Figure 10-14. If it is not listed, 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 one of the following:

– FPGA Code on the assembly is corrupt
  Solution: See the "Overview" section in Chapter 23, "Instrument Software and FPGAs" to reload the FPGA code.

– An instrument power supply voltage is not operating properly
  Solution: See the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting," to verify that all the instrument power supplies are on.

– A3 40 MHz Digital IF assembly is defective
  Solution: Replace the A3 40 MHz Digital IF assembly

NOTE

Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting."

Signal Path Verification

The procedure in this section can be used to verify that the A3 40 MHz Digital IF inputs are working properly.

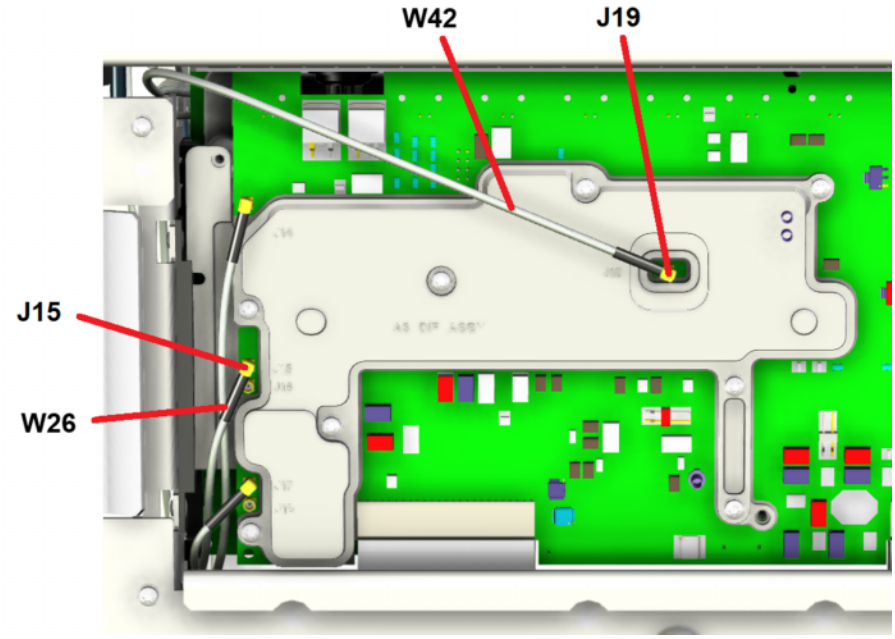
Since the only output of the A3 40 MHz Digital IF is from its digital signal processor to the A4 System Processor, it is not possible to verify the actual output of the assembly. However, the following procedure will verify that the assembly receives known good signals and will then make the best assumptions possible as to the cause of any fault based on the instrument's ability to display the correct overall results.

1. Switch the instrument to the IQ analyzer mode by pressing **Mode/Meas**, **IQ Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Verify that the instrument is tuned to 1.0 GHz by pressing **Frequency**, **Center Frequency 1.0 GHz**.
5. Verify that the IF path is set to 10 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **10 MHz**.
6. Connect a spectrum analyzer to the rear panel 10 MHz REF OUT connector.
7. Tune the spectrum analyzer to 10 MHz with a span of 1 MHz.
8. Verify that there is a 10 MHz signal on the spectrum analyzer display at a power level of at least 0 dBm.

   If there is a signal as expected, proceed to the next step.

   If there is not a signal as expected, see the "100 MHz Reference Verification" section later in this chapter to determine if there is a 100 MHz reference signal at the reference input of the A3 40 MHz Digital IF.
9. Referring to Figure 10-16, remove W42 from the A3 40 MHz Digital IF 10/25 MHz input at J19.

Figure 10-16 A3 40 MHz Digital IF Input Connections



10. Connect a signal generator to J19.
11. Tune the signal generator to 22.5 MHz with a power level of -10 dBm.
12. Verify that there is a signal at the center of the instrument display with a power level of approximately -10 dBm.

    If there is a signal as expected, the 10 MHz IF path through the A3 40 MHz Digital IF is working as expected. Proceed to the next step.

    If there is not a signal as expected, make a note that the 10 MHz IF path through the A3 40 MHz Digital IF is not working as expected. Proceed to the next step.
13. Change the IF path to 25 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **25 MHz**.
14. Verify that there is a signal at the center of the instrument display with a power level of approximately -10 dBm.

    If there is a signal as expected, the 25 MHz IF path through the A3 40 MHz Digital IF is working as expected. Proceed to the next step.

    If there is not a signal as expected, make a note that the 25 MHz IF path through the A3 40 MHz Digital IF is not working as expected. Proceed to the next step.
15. Change the IF path to 40 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **40 MHz**.
16. Remove W26 from the A3 40 MHz Digital IF 40 MHz input at J15.

17. Move the signal generator to J15.
18. Tune the signal generator to 250 MHz with a power level of -20 dBm.
19. Verify that there is a signal at the center of the instrument display with a power level of approximately -12 dBm.

    If there is a signal as expected, the 40 MHz IF path through the A3 40 MHz Digital IF is working as expected. Proceed to the next step.

    If there is not a signal as expected, make a note that the 40 MHz IF path through the A3 40 MHz Digital IF is not working as expected. Proceed to the next step.

Evaluate the Results

If all three of the 10 MHz, 25 MHz, and 40 MHz IF paths are working as expected, the A3 40 MHz Digital IF is working as expected.

If one or two of the IF paths is not working as expected, replace the A3 40 MHz Digital IF.

If all three of the IF paths is not working, proceed to the next step.

20. If the instrument does not have option B2X, B5X, or H1G, the problem could be either the A3 40 MHz Digital IF or the A4 System Processor.

    If the instrument has option B2X, B5X, or H1G, proceed to the next step.
21. Connect the signal generator to the instrument RF input.
22. Tune the signal generator to 1 GHz with a power level of -10 dBm.
23. Change the IF path to 255 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **255 MHz**.
24. Verify that there is a 1 GHz signal at the center of the instrument display at approximately -10 dBm.

    If there is a signal on screen as expected, replace the A3 40 MHz Digital IF.

    If there is not a signal on screen as expected, replace the A4 System Processor assembly.

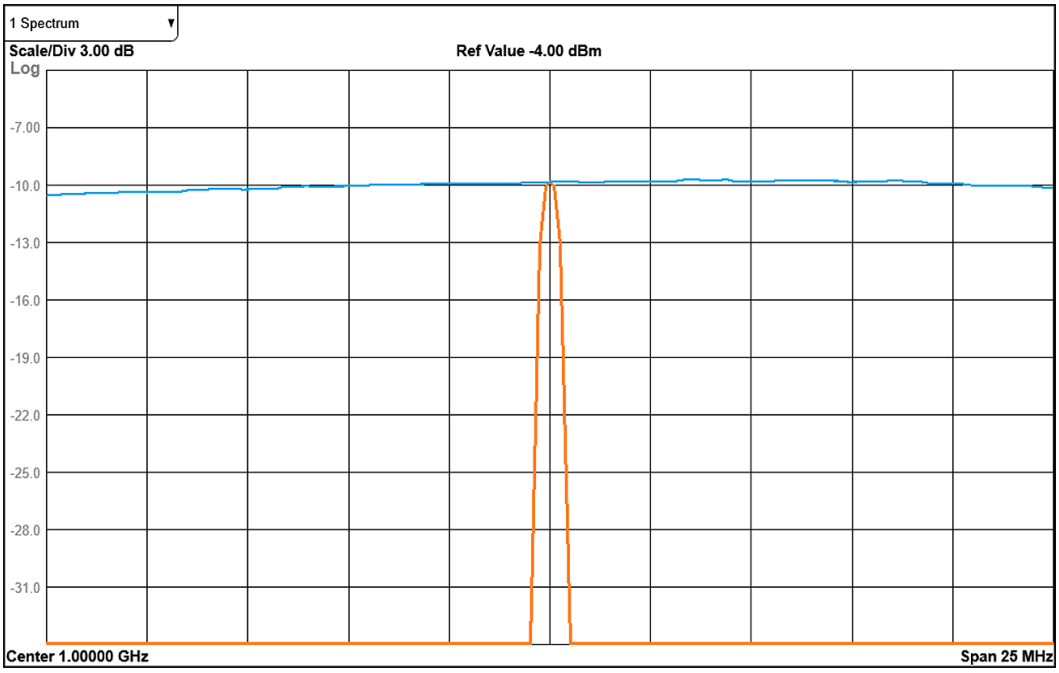
IF Frequency Response

If the instrument fails the IF Frequency Response performance verification test, and an adjustment will not correct it, the problem could be any device from the front panel input connector to the ADC in the IF assembly used. By turning the IF Flatness off under the instrument service menus, the hardware performance can then be evaluated by sweeping the individual assemblies that are suspected. While there are not hard specifications for each assembly in this regard, evaluating each, looking for anything that isn't typical, can help to locate the problem assembly.

If there is a question about the flatness across the IF passband of any of the IF paths that use the A3 40 MHz Digital IF, the following procedure can be used to evaluate its performance.

1. Switch the instrument to the IQ analyzer mode by pressing **Mode/Meas**, **IQ Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Change the IF path to 25 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **25 MHz**.
5. Change the span to 25 MHz by pressing **Frequency**, **Span 25 MHz**.
6. Set the instrument reference level to -4 dBm by pressing **Amplitude**, **Ref Value -4 dBm**.
7. Set the vertical scale per division to 3 dB by pressing **Scale/Div 3 dB**.
8. Activate the service menu. See Chapter 18, "Service Menus," if instructions on how to do this are needed.
9. Turn the IF flatness corrections off by pressing **Meas Setup**, **Service Diagnostics**, **IF Flatness Off**.
10. Referring to Figure 10-16, remove W42 from J19 of the A3 40 MHz Digital IF.
11. Connect a signal generator to J19.
12. Tune the signal generator to 22.5 MHz with a power level of -10 dBm.
13. Adjust the power level of the signal generator until the level of the signal on the screen is -10 dBm, ±0.25 dB.
14. Change the average type to maximum by pressing **Meas Setup**, **Avg Type**, **Maximum**.
15. Vary the frequency of the signal generator between 10 and 35 MHz so that it draws out the IF frequency response of the 25 MHz IF path on the instrument screen, as seen in Figure 10-17.

Figure 10-17 A3 40 MHz Digital IF Typical IF Frequency Response - 25 MHz IF Path



NOTE The IQ Analyzer application Complex Spectrum measurement has two displays by default – Spectrum and IQ Waveform. Double-tapping in the Spectrum display will maximize that display and hide the IQ Waveform display, making this measurement easier to evaluate, as seen in Figure 10-17.

16. Verify that the maximum trace does not vary by more than 3 dB from the center trace point value.

    If the maximum trace is as expected, proceed to the next step to verify the 40 MHz IF path.

    If the maximum trace is not as expected, replace the A3 40 MHz Digital IF.

17. Referring to Figure 10-16, remove W26 from J15 of the A3 40 MHz Digital IF.

18. Move the signal generator to J15.

19. Tune the signal generator to 250 MHz.

20. Adjust the power level of the signal generator to -16 dBm.

21. Change the IF path to 40 MHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **40 MHz**.

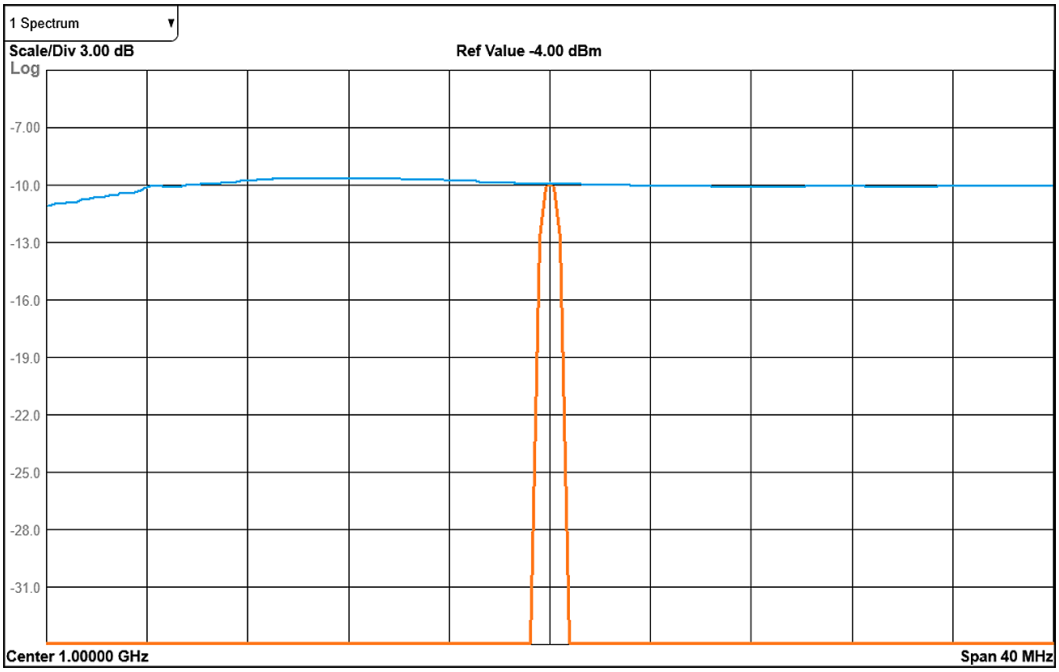
22. Change the span to 40 MHz by pressing **Frequency**, **Span 40 MHz**.

23. Adjust the power level of the signal generator until the level of the signal on the screen is -10 dBm, ±0.25 dB.

24. Restart the maximum trace by pressing **Restart**.

25. Vary the frequency of the signal generator between 230 and 270 MHz so that it draws out the IF frequency response of the 40 MHz IF path on the instrument screen, as seen in Figure 10-18.

Figure 10-18 A3 40 MHz Digital IF Typical IF Frequency Response - 40 MHz IF Path



26. Verify that the maximum trace does not vary by more than 3 dB from the center trace point value.

If the maximum trace is as expected, the IF flatness of the A3 40 MHz Digital IF is as expected.

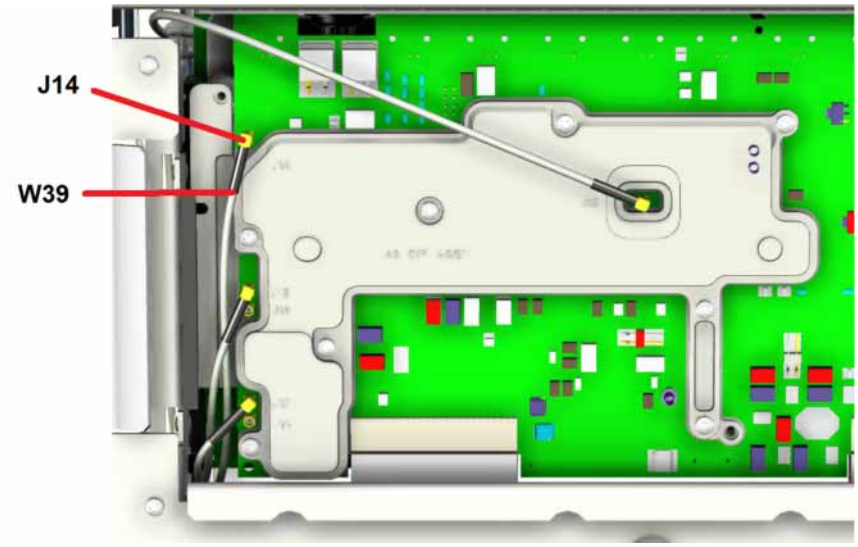
If the maximum trace is not as expected, replace the A3 40 MHz Digital IF.

100 MHz Reference Verification

The 100 MHz reference signal going to the A3 40 MHz Digital IF is used to derive much more than just the clock signals for the ADCs on the A3 40 MHz Digital IF and the 10 MHz reference output on the rear panel of the instrument. If this signal to the A3 40 MHz Digital IF is lost, all data acquisition in the instrument will stop, as will communication to many of the assemblies in the instrument, which will also cause the LO to go unlocked. So, when the following procedure is used to verify that there is a 100 MHz reference signal going to the A3 40 MHz Digital IF the instrument will display a few error messages, and the instrument application will need to be restarted to recover from them.

1. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
2. Referring to Figure 10-19, remove W39 from the A3 40 MHz Digital IF J14.

Figure 10-19 A3 40 MHz Digital IF 100 MHz Reference Input



3. Connect a spectrum analyzer to the loose end of W39.
4. Tune the spectrum analyzer to 100 MHz with a span of 10 MHz.
5. Verify that there is a 100 MHz signal on the spectrum analyzer display at approximately +12 dBm.

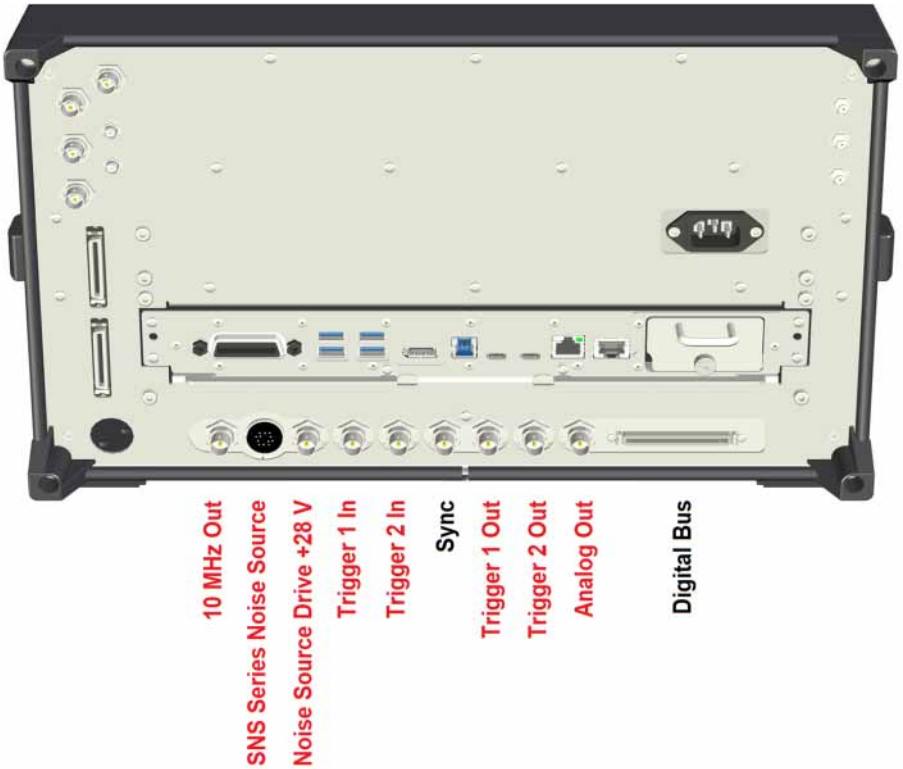
   If there is a signal as expected, proceed to the next step.

   If there is not a signal as expected, see Chapter 12, “Reference,” to determine why there is a problem with the 100 MHz reference coming from J716 of the A16 Reference assembly.
6. Reconnect W39 to J14.
7. Restart the instrument application.

Rear Panel Inputs / Outputs Verification

There are many different rear panel ports that provide different instrument functions. While the performance verification tests do not test the functionality of these, the user may report that one or more of these functions is not working properly. The procedures that follow can be used to verify the functionality of many of these ports. The ports that will be verified in this section are labeled in red in Figure 10-20.

Figure 10-20 A3 40 MHz Digital IF Rear Panel Ports



NOTE The **SNS Series Noise Source** and **Noise Source Drive +28V** ports will only be functional if the N9069EM0E Noise Figure Measurement Application is installed in the instrument.

10 MHz Out

The rear panel 10 MHz out is derived from the 10 MHz reference that the instrument is currently using, whether that is the internal 10 MHz OCXO on the A16 Reference assembly or an external reference that is connected to the rear panel EXT REF IN port.

This output is tested with the Frequency Reference Accuracy test. However, this procedure can be used to manually verify its function. If an exact measurement of the output frequency accuracy is needed, use the performance verification test previously mentioned.

1. Connect a spectrum analyzer to the 10 MHz Out port on the rear panel of the instrument, as seen in Figure 10-20.
2. Verify that there is nothing connected to the rear panel EXT REF IN port.
3. Tune the spectrum analyzer to a frequency of 10 MHz with a Span of 1 MHz.
4. Verify that there is a 10 MHz signal on the spectrum analyzer display with a power level of at least 0 dBm.

   If there is a signal as expected, the 10 MHz Out port is working as expected.

   If there is not a signal as expected, see the “100 MHz Reference Verification” section in this chapter to determine if there is a 100 MHz reference signal at the reference input of the A3 40 MHz Digital IF.

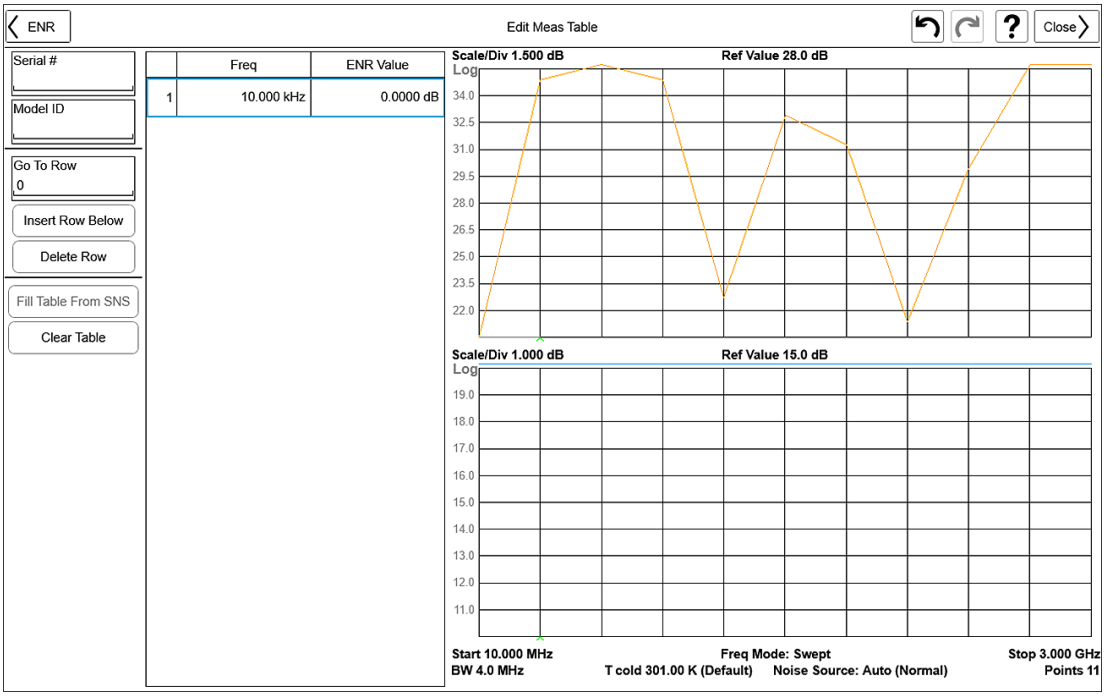
SNS Series Noise Source

The SNS Series Noise Source port will only be functional if the N9069EM0E Noise Figure Measurement Application is installed in the instrument.

This port is designed to control one of the Keysight N4000A, N4001A, N4002A SNS Series Noise Sources. The following procedure will require one of these noise sources to test the communication of this port.

1. Disconnect anything that might be connected to the SNS Series Noise Source port, as seen in Figure 10-20.
2. Switch the instrument into the Noise Figure measurement application by pressing **Mode/Meas**, **Noise Figure**, **OK**.
3. Return the instrument to a known state by pressing **Mode Preset**.
4. Display the noise source information screen by pressing **Meas Setup**, **ENR**, **Edit Meas Table**.
5. Verify that the **Serial #** and **Model ID** fields are blank, as well as the ENR Meas Table, as seen in Figure 10-21.

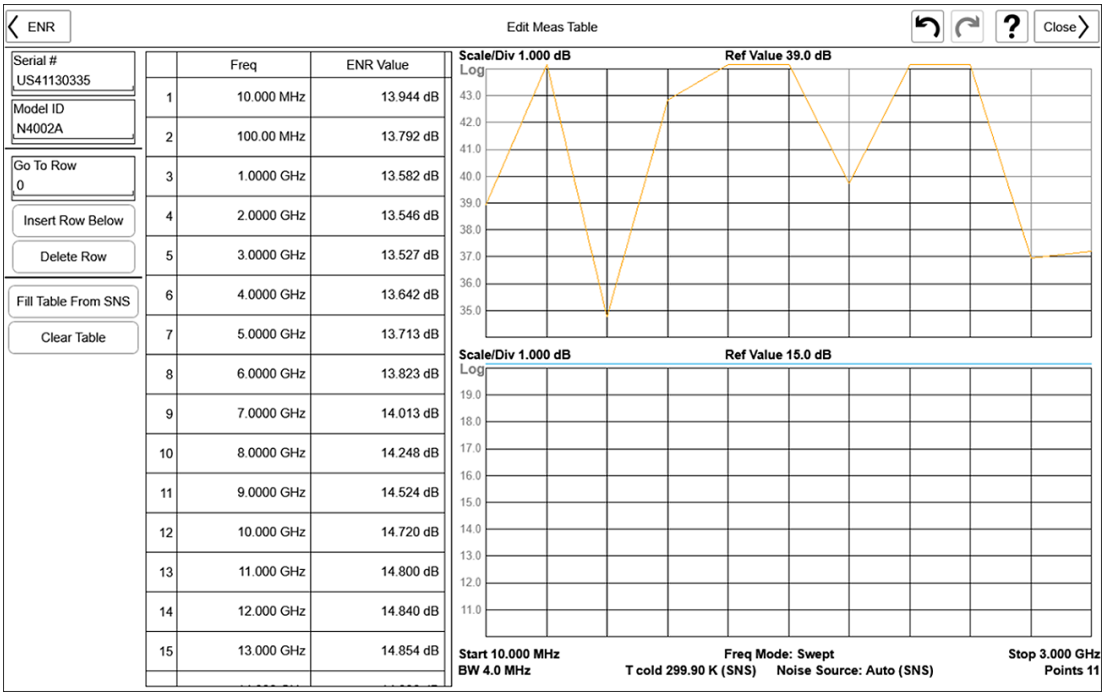
Figure 10-21 SNS Series Noise Source Communication - Not Connected



6. Connect a known working SNS series noise source to the **SNS Series Noise Source** port.
7. The instrument will automatically load the noise source model number, serial number, and ENR data.

8. Verify that the correct model and serial numbers from the noise source used are now displayed in the corresponding fields, and the ENR Meas Table has been populated with the data from the noise source, as displayed in Figure 10-22.

Figure 10-22 SNS Series Noise Source Communication - Connected



If the information from the noise source has been transferred to the instrument, the SNS Series Noise Source port is communicating properly.

If the information from the noise source has not been transferred to the instrument, replace the A3 40 MHz Digital IF.

Noise Source Drive +28 Volts

The Noise Source Drive +28 Volts port will only be functional if the N9069EM0E Noise Figure Measurement Application is installed in the instrument.

This port is designed to control one of the Keysight 346A, 346B, and 346C Noise Sources. However, since this port only provides a switched +28 volt DC supply to activate the noise source, with no communication required, one of these noise sources will not be used to test the functionality of the port.

1. Switch the instrument into the Noise Figure measurement application by pressing **Mode/Meas**, **Noise Figure**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Setup an oscilloscope with the following setting:

   Input Impedance = 1 MΩ

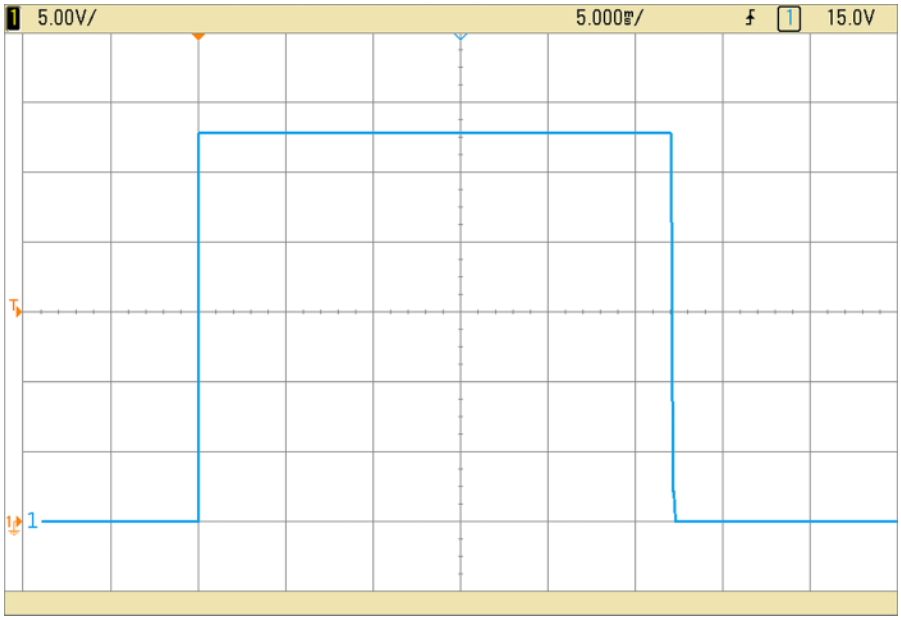
   Y-Scale = 5.0 V / Division

   X-Scale = 5.0 ms / Division

   Trigger = Positive Edge

   Trigger Level = +15 V
4. Connect the oscilloscope to the rear panel **Noise Source Drive +28 V** port, as seen in Figure 10-20.
5. Configure the instrument to use a normal noise source by pressing **Meas Setup**, **Noise Source**, **Noise Source Preference**, **Normal**.
6. Verify that there is a positive going pulse on the oscilloscope screen similar to what is seen in Figure 10-23. (It is normal for the pulse width to vary as the instrument sweeps).

Figure 10-23 Noise Source Drive +28 Volt Output



If there is a positive pulse as expected, the Noise Source Drive +28 Volts is working as expected.

If there is not a positive as expected, replace the A3 40 MHz Digital IF.

Trigger Inputs

The following procedure can be used to verify the functionality of the Trigger 1 In and Trigger 2 In rear panel ports.

1. Verify that the instrument is in the spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Set the instrument span to 100 MHz by pressing **Frequency**, **Span 100 MHz**.
4. Note that the time in-between sweeps is very small.
5. Connect a pulse generator to the Trigger 1 In port on the rear panel of the instrument, as seen in Figure 10-20.
6. Set the pulse generator to output a pulse with TTL levels at a pulse period of 1 sec and a pulse width of 500 µs.
7. Change the instrument trigger to **Trigger 1** In by pressing **Trigger**, **Select Trigger Source**, **External 1**.
8. Verify that the time in-between sweeps is now approximately one second.

   If the instrument is sweeping as expected, the Trigger 1 In port is working as expected. Proceed to the next step to verify the Trigger 2 In port.

   If the instrument is not sweeping as expected, replace the A3 40 MHz Digital IF.
9. Move the pulse generator to the Trigger 2 In port.
10. Change the instrument trigger to Trigger 2 In by pressing **Trigger**, **Select Trigger Source**, **External 2**.
11. Verify that the time in-between sweeps is now approximately one second.

    If the instrument is sweeping as expected, the Trigger 2 In port is working as expected.

    If the instrument is not sweeping as expected, replace the A3 40 MHz Digital IF.

Trigger Outputs

The following procedure can be used to verify the functionality of the Trigger 1 Out and Trigger 2 Out rear panel ports.

1. Verify that the instrument is in the spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Set the instrument span to 100 MHz by pressing **Frequency**, **Span 100 MHz**. The sweeptime should now be 1 ms.
5. Connect an oscilloscope to the Trigger 1 Out port on the rear panel of the instrument, as seen in Figure 10-20.
6. Setup the oscilloscope with the following settings.

   Input Impedance = 1 MΩ

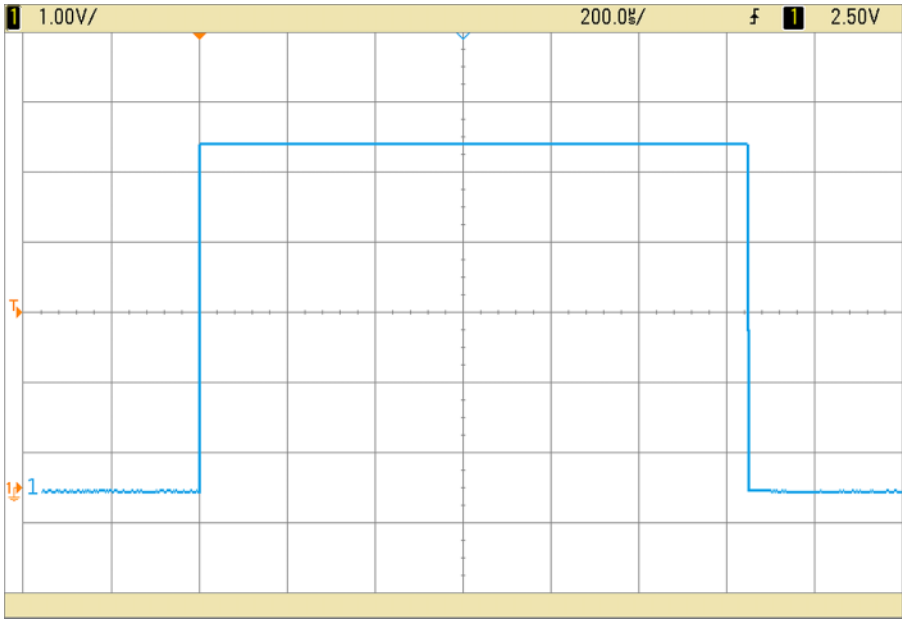
   Y-Scale = 1.0 V / Division

   X-Scale = 200 µs / Division

   Trigger = Positive Edge

   Trigger Level = +2.5 V
7. Set the Trigger 1 Out to be a TTL high level when sweeping by pressing **Input/Output**, **Trigger Output**, **Trig 1 Out**, **Sweeping (HSWP)**.
8. Verify that there is a positive pulse on the oscilloscope screen as seen in Figure 10-24.

Figure 10-24 A3 40 MHz Digital IF - Trigger Out



If there is a pulse as expected, the Trigger 1 Out port is working as expected. Proceed to the next step to verify the Trigger 2 Out port.

If there is not a pulse as expected, replace the A3 40 MHz Digital IF.

9. Move the oscilloscope to the Trigger 2 Out port.
10. Set the Trigger 2 Out to be a TTL high level when sweeping by pressing **Trig 2 Out**, **Sweeping (HSWP)**.
11. Verify that there is a positive pulse on the oscilloscope screen as seen in Figure 10-24.

    If there is a pulse as expected, the Trigger 2 Out port is working as expected.

    If there is not a pulse as expected, replace the A3 40 MHz Digital IF.

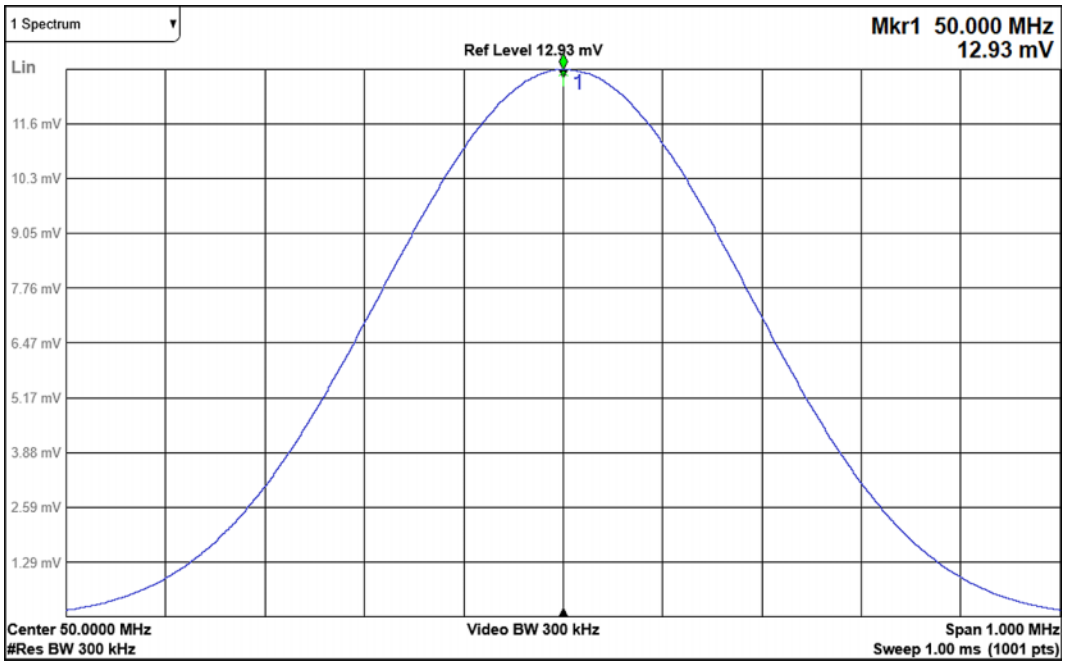
Analog Out

The Analog Out port will only be functional if the Y-Axis Video option (YAV) is installed.

The following procedure can be used to verify the functionality of the Analog Out rear panel port.

1. Verify that the instrument is in the spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Turn on the internal 50 MHz calibrator signal by pressing **Input/Output**, **Calibrator Control**, **Cal Source**, **50 MHz**.
5. Tune the frequency of the instrument to 50 MHz by pressing **Frequency**, **Center Frequency 50 MHz**.
6. Set the span to 1 MHz by pressing **Span 1 MHz**.
7. Set the reference level to -25 dBm by pressing **Amplitude**, **Ref Level -25 dBm**.
8. Set the display scale to linear by pressing **Display Scale**, **Lin**.
9. Set the resolution bandwidth to 300 kHz by pressing **BW**, **Res BW 300 kHz**.
10. Set the peak of the signal to the reference level by pressing **Peak Search**, **Marker ->**, **Mkr->Ref Lvl**.
11. Verify that the signal on the instrument screen looks like that in Figure 10-25.

Figure 10-25 A3 40 MHz Digital IF - Analog Output Setup



12. Setup an oscilloscope with the following settings:

Input Impedance = 1 MΩ

Y-Scale = 200 mV / Division

X-Scale = 100 µs / Division

Trigger = Positive Edge

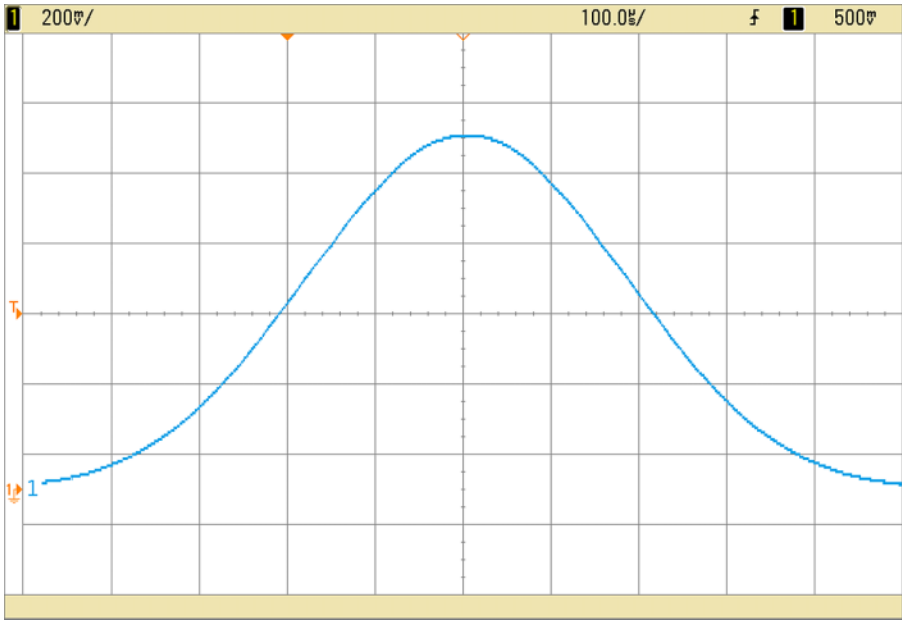
Trigger Level = +0.5 V

13. Connect the oscilloscope to the Analog Out port on the rear panel of the instrument, as seen in Figure 10-20.

14. Send the screen video to the Analog Out port by pressing **Input/Output**, **Output**, **Analog Out**, **Screen Video**.

15. Verify that there is a signal on the oscilloscope display that resembles that of Figure 10-26.

Figure 10-26 A3 40 MHz Digital IF - Analog Output



If there is a signal as expected, the Analog Out port is working as expected.

If there is not a signal as expected, replace the A3 40 MHz Digital IF.

11 LO Synthesizer

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 248

Troubleshooting Equipment Required on page 249

A14 DDS LO Synthesizer on page 250

- Overview on page 250
- Functional Verification on page 256

A20 Yig Tuned Oscillator on page 265

- Overview on page 265
- Functional Verification on page 267

Overview

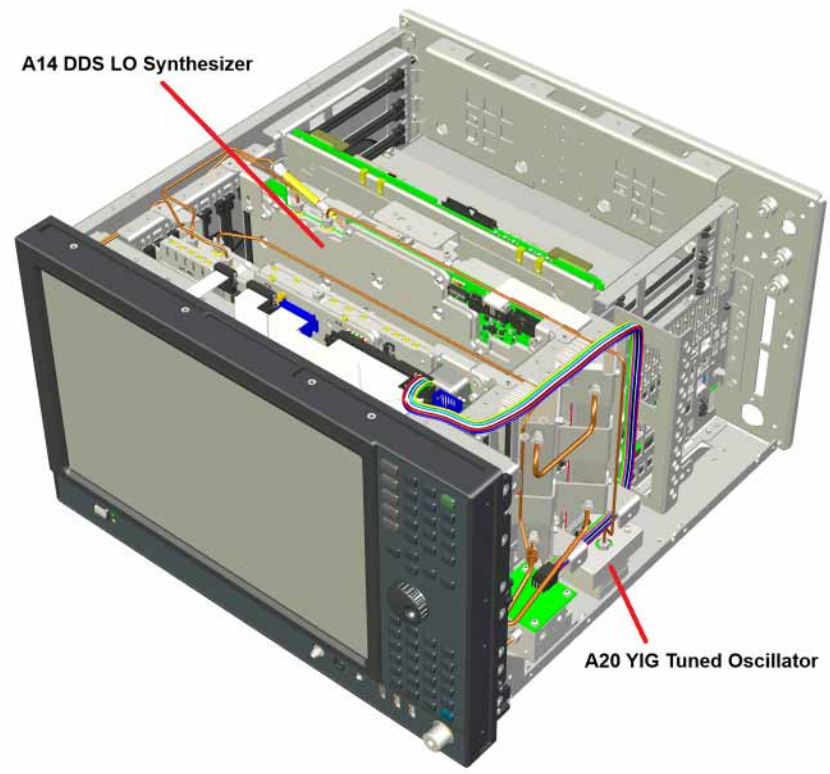
There are two assemblies that are used to generate the synthesizer LO signal required to cover the frequency range of the instrument. They are:

– A14 DDS LO Synthesizer

– A20 YIG Tuned Oscillator

The location of each of these components in the instrument can be seen in Figure 11-1.

Figure 11-1 LO Synthesizer Assemblies Location



The following sections for each of these will describe the components as well as outline how to verify that each one is functioning properly.

NOTE

The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

Troubleshooting Equipment Required

To perform the troubleshooting and verification outlined in this chapter the following test equipment will be needed:

Spectrum Analyzer

Minimum frequency range: 10 MHz to 40 GHz

Power Meter

Minimum frequency range: 10 MHz to 40 GHz

Minimum power level range: -50 dBm to +20 dBm

Miscellaneous

Multimeter (Voltage and Resistance)

Directional Coupler: 3 to 9 GHz

Misc. cables and adapters

A14 DDS LO Synthesizer

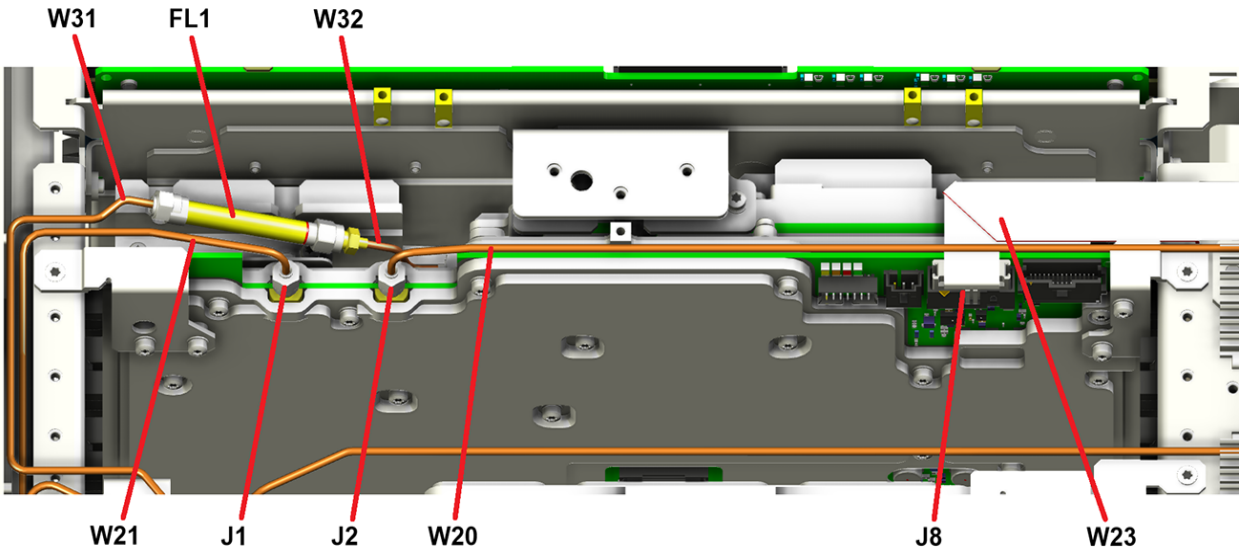
Overview

The A14 DDS LO Synthesizer provides a stable LO signal that the instrument uses to downconvert the RF input signal. It also provides the bias and tune voltage for the A20 Yig Tuned Oscillator. The connections to and from the A14 DDS LO Synthesizer are listed in Table 11-1, as seen in Figure 11-2.

Table 11-1 A14 DDS LO Synthesizer Connections

Port	Description	To/From	Cable
J1	LO Output	To A13A1 Front End	W21
J2	Yig Tuned Oscillator Input	From A20 Yig Tuned Oscillator Output	W20
J8	Yig Tuned Oscillator Control	To A20 Yig Tuned Oscillator Control	W23
J16	Bias and Control	From A8 Motherboard J9	--
FL1 Input	7.2 GHz Reference Input	From A16 Reference J703	W31/W32

Figure 11-2 A14 DDS LO Synthesizer Connections



The A14 DDS LO Synthesizer has two components that will identify themselves on the instrument Hardware Information screen. The A14 DDS LO Synthesizer main assembly will identify as the **LO DDS Synthesizer** and the A14A1 DDS LO Reference will identify as the **LO DDS Reference**, as seen in Figure 11-3.

Figure 11-3 Hardware Information Screen – A14 DDS LO Synthesizer

System Settings

System

I/O Config

Preload / Unload Modes

User Interface

Power On

Restore Defaults

Alignments

Licensing

Security

Diagnostics

Service

SCPI Recorder

System

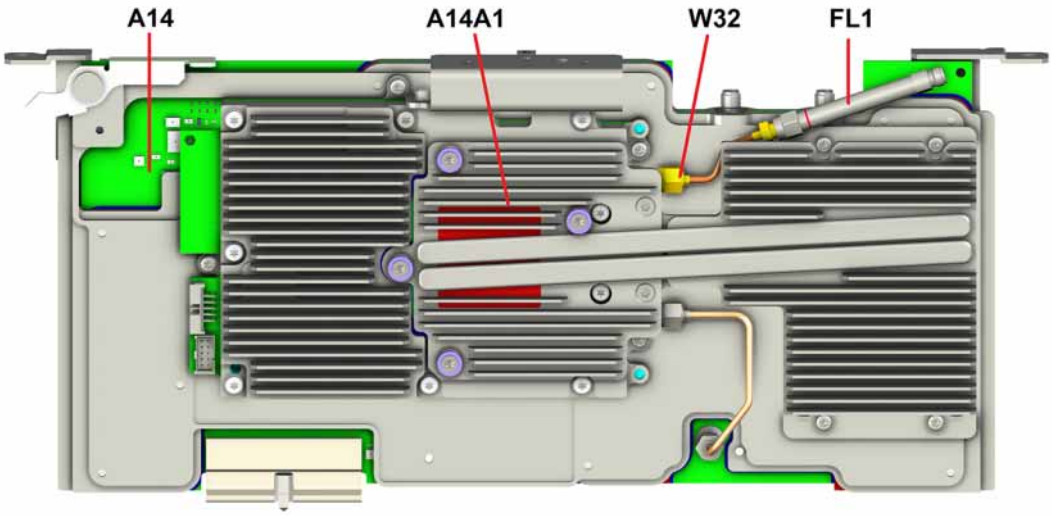
Hardware Information

Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US00092113
S/W Release Name	2024 Update 1.0
Instrument S/W Revision	A.37.02
Revision Date	12/4/2023 1:14:02 PM

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060254	79122604551	013	1	A	57	
WB Analog IF	N902060043	23143100005	005	3	A	89	
YIG Tuned Filter	50877730	13122516073	006	0	B	11	
Digital IF	N902060016	79122401025	011	3	A	34	
Front End Controller	N902060195	78123000011	001	0	A	131	
WB Digital IF	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	23143400018	004	3	A	91	
LO DDS Reference	M930560028	30142600011	003	0	A	92	
Reference Plus Main	N902060185	79143806000	004	3	A	93	
Reference Plus Daughter	N902060186	79143906034	004	1	A	94	
Front End	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	78132000016	001	0	B	132	
YTO	N902060009	79122203919	005	0	A	54	

The different components that make up the A14 DDS LO Synthesizer can be seen in Figure 11-4. A replacement A14 DDS LO Synthesizer includes both the A14 and A14A1, but not FL1 or W32.

Figure 11-4 A14 DDS LO Synthesizer Components



Synthesizer Modes of Operation

There are two LO signal sources that the A14 DDS LO Synthesizer can use for its output. These are the phase locked A20 Yig Tuned Oscillator output, and the A14A1 DDS LO Reference output, as seen in the block diagrams of Figure 11-5 and Figure 11-6. The instrument settings determine which one to use.

Figure 11-5 A14 DDS LO Synthesizer Block Diagram – A20 Output

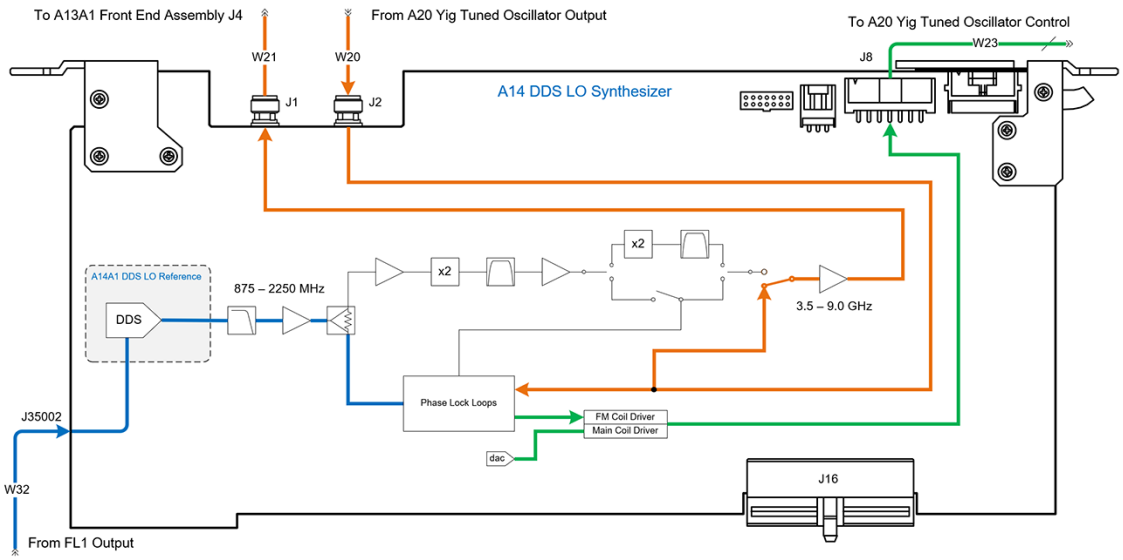
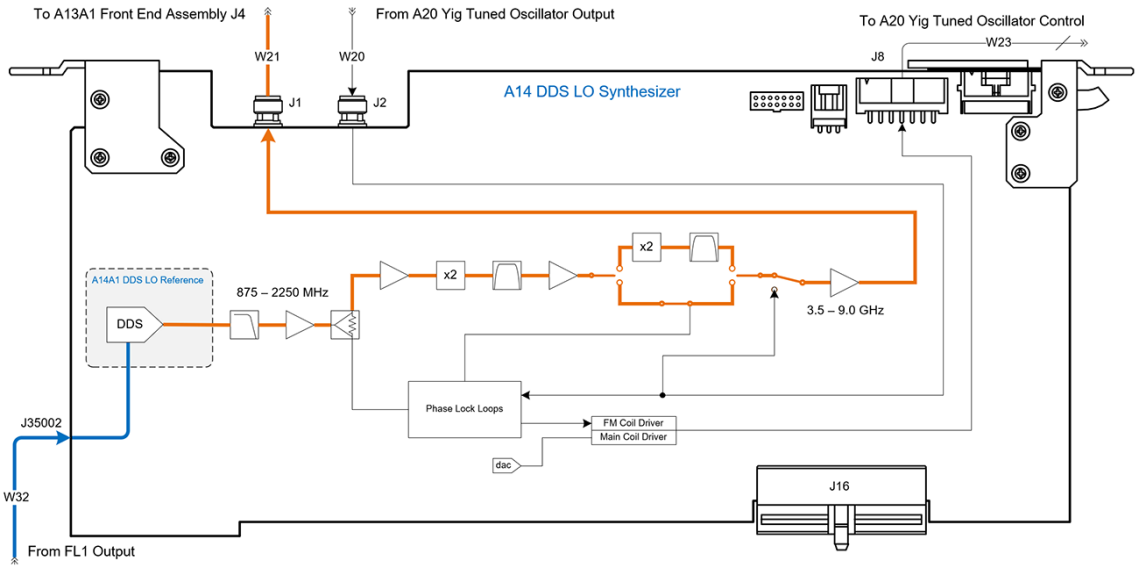


Figure 11-6 A14 DDS LO Synthesizer Block Diagram - A14A1 Output



When the A20 Yig Tuned Oscillator output is used, the A14A1 DDS LO Reference output is used as the reference for the phase lock loops. The phase lock loop settings can also be adjusted to optimize the synthesizer performance for the measurement being made. When the A14A1 DDS LO Reference output is used, the A20 Yig Tuned Oscillator is turned off. The DDS output is a Direct Digital Synthesis signal generated by a DAC on the A14A1 assembly.

Phase Noise Optimization is the main setting that determines which source and loop bandwidth to use. The instrument settings to enable the phase lock loop modes are typically set automatically as a function of the instrument span, or can be manually selected by pressing **Meas Setup**, **Advanced**, **Phase Noise Optimization**. The selections and effects for this setting are:

Best Close-In Phase Noise [offset < 600 kHz]

Best phase noise for offsets <600 kHz

Must be in a span of 100 MHz or less

A14A1 DDS LO output is used

Slightly higher spurs

Balance Noise and Spurs [offset < 600 kHz]

Auto coupled in spans ≤ 4.2 MHz

A14A1 DDS LO output is used for spans <119 kHz

A20 Yig Tuned Oscillator output is used for spans ≥119 kHz

Spurs are minimized

Best Spurs [offset < 600 kHz]

Phase noise performance is not as good <600 kHz

A20 Yig Tuned Oscillator output is used

Best Wide-Offset Phase Noise [offset > 800 kHz]

Best phase noise for offsets >800 kHz

Auto coupled in spans of 4.21 to 83.1 MHz

A16 Reference will narrow its 2.4 GHz phase lock loop bandwidth

A20 Yig Tuned Oscillator output is used

Fast Tuning

Wide loop bandwidth for wide capture range

Spur suppression is as good as the "Best Spurs" setting

Auto Coupled in spans ≥ 83.2 MHz

A20 Yig Tuned Oscillator output is used

Synthesizer Frequency Ranges

The output of the A14 DDS LO Synthesizer has a nominal frequency range of 3.8 to 9.3 GHz. To cover the wide input frequency range of the instrument the LO output is then multiplied in either the A13 Front End assembly or the mixer being used will use a harmonic of the signal internally. But as far as the A14 DDS LO Synthesizer itself is concerned, the frequency range that it will tune to can be seen in Table 11-2 through Table 11-6 for the different IF signal paths.

Table 11-2 LO Frequency Range - Swept SA and 10 / 25 MHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.6 GHz	5.1225 to 8.7225 GHz	x1	5.1225 GHz
3.6 to 8.4 GHz	3.9225 to 8.7225 GHz	x1	322.5 MHz
8.4 to 17.1 GHz	4.36125 to 8.71125 GHz	x2	322.5 MHz
17.1 to 34.5 GHz	4.355625 to 8.705625 GHz	x4	322.5 MHz
34.5 to 50 GHz	4.3528125 to 6.2903125 GHz	x8	322.5 MHz

Table 11-3 LO Frequency Range - 40 MHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.6 GHz	5.05 to 8.65 GHz	x1	5.05 GHz
3.6 to 8.4 GHz	3.85 to 8.65 GHz	x1	250 MHz
8.4 to 17.1 GHz	4.325 to 8.675 GHz	x2	250 MHz
17.1 to 34.5 GHz	4.3375 to 8.6875 GHz	x4	250 MHz
34.5 to 50 GHz	4.34375 to 6.28125 GHz	x8	250 MHz

Table 11-4 LO Frequency Range - 255 MHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.6 GHz	5.55 to 9.150 GHz	x1	5.55 GHz
3.6 to 8.4 GHz	4.350 to 9.150 GHz	x1	750 MHz
8.4 to 17.1 GHz	4.575 to 8.925 GHz	x2	750 MHz
17.1 to 34.5 GHz	4.4625 to 8.8125 GHz	x4	750 MHz
34.5 to 50 GHz	4.40625 to 6.34375 GHz	x8	750 MHz

Table 11-5 LO Frequency Range - 510 MHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.6 GHz	5.677148 to 9.277148 GHz	x1	5.677148 GHz
3.6 to 8.4 GHz	4.477148 to 9.277148 GHz	x1	877.148 MHz
8.4 to 17.1 GHz	4.643574 to 8.988574 GHz	x2	877.148 MHz
17.1 to 34.5 GHz	4.494287 to 8.844287 GHz	x4	877.148 MHz
34.5 to 50 GHz	4.4221435 to 6.3596435 GHz	x8	877.148 MHz

Table 11-6 LO Frequency Range - 1.0 GHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.6 GHz	5.55 to 9.150 GHz	x1	5.55 GHz
3.6 to 8.4 GHz	4.350 to 9.150 GHz	x1	750 MHz
8.4 to 17.1 GHz	4.575 to 8.925 GHzz	x2	750 MHz
17.1 to 34.5 GHz	4.4625 to 8.8125 GHz	x4	750 MHz
34.5 to 50 GHz	4.40625 to 6.34375 GHz	x8	750 MHz

To determine what the A14 DDS LO Synthesizer output frequency should be for any input frequency, use the information in Table 11-2 through Table 11-6 for the IF path being used.

A14 DDS LO Output Frequency = (Input Frequency + First IF) / Total LO Multiplier

References

The A14 DDS LO Synthesizer creates a 50 MHz clock from the 10 MHz system reference clock.

The A14A1 DDS LO Reference creates a 100 MHz clock and a 50 MHz clock from the 10 MHz reference clock from the main Board.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A14 DDS LO Synthesizer, verify that it is being recognized by the instrument by pressing **System**, **Show Hardware** and verify that there is a **LO DDS Synthesizer** and a **LO DDS Reference** in the list of hardware assemblies, as seen in Figure 11-3 If either one is not listed, 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 one of the following:

– FPGA Code on the assembly is corrupt

  Solution: See the "Overview" section in Chapter 23, "Instrument Software and FPGAs," to reload the FPGA code.

– An instrument power supply voltage is not operating properly

  Solution: See the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting," to verify that all the instrument power supplies are on.

– A14 DDS LO Synthesizer assembly is defective

  Solution: Replace the A14 DDS LO Synthesizer assembly

NOTE

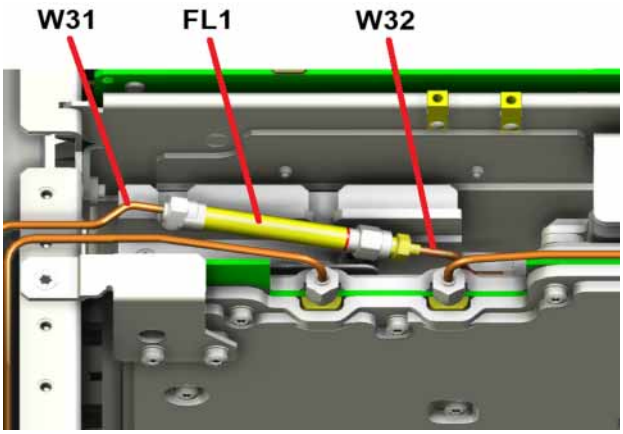
Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting."

7.2 GHz Reference Verification

The 7.2 GHz reference signal going to the A14A1 DDS LO Reference is used to clock the DDS DAC. If this signal is lost the LO will go unlocked. So, when the following procedure is used to verify that this reference signal is present the instrument will display error messages, and the instrument application will need to be restarted to recover from them.

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Set the span to 0 Hz by pressing **Frequency**, **Zero Span**.
5. Referring to Figure 11-7, remove W31 from the input of FL1.

Figure 11-7 A14 DDS LO Synthesizer 7.2 GHz Reference Connections



6. Connect a spectrum analyzer to the loose end of W31.
7. Tune the spectrum analyzer to 7.2 GHz with a span of 10 MHz.
8. Verify that there is a 7.2 GHz signal on the spectrum analyzer display at approximately +4 dBm.

   If there is a signal as expected, proceed to the next step.

   If there is not a signal as expected, see Chapter 12, “Reference,” to determine why there is a problem with the 7.2 GHz reference coming from J703 of the A16 Reference assembly.
9. Reconnect W31 to the input of FL1.
10. Restart the instrument application.

Synthesizer Output Level Verification

The following procedure will verify the output power level of the A14 DDS LO Synthesizer when both the A20 Yig Tuned Oscillator and the A14A1 DDS LO Reference are used to provide the output.

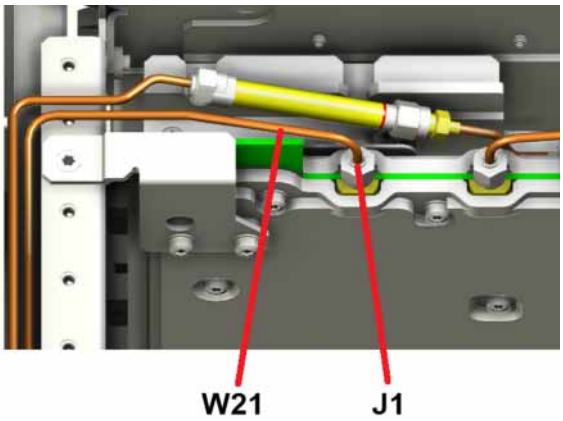
NOTE The following procedure assumes that the 7.2 GHz Reference signal to the A14A1 DDS LO Reference has been verified. If this has not been done, see the "7.2 GHz Reference Verification" section in this chapter before proceeding.

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Tune the instrument start frequency to 3.601 GHz by pressing **Frequency**, **Start Freq 3.601 GHz**.
5. Tune the instrument stop frequency to 8.4 GHz by pressing **Stop Freq 8.4 GHz**.

NOTE As can be seen in Table 11-3, the frequency range selected for this part of the procedure will allow the synthesizer to cover the widest frequency range used by the spectrum analyzer mode.

6. Set the sweep time to 30 seconds by pressing **Sweep**, **Sweep Time 30 sec**.
7. Referring to Figure 11-8, remove W21 from the A14 DDS LO Synthesizer J1.

Figure 11-8 A14 DDS LO Synthesizer Output Connection



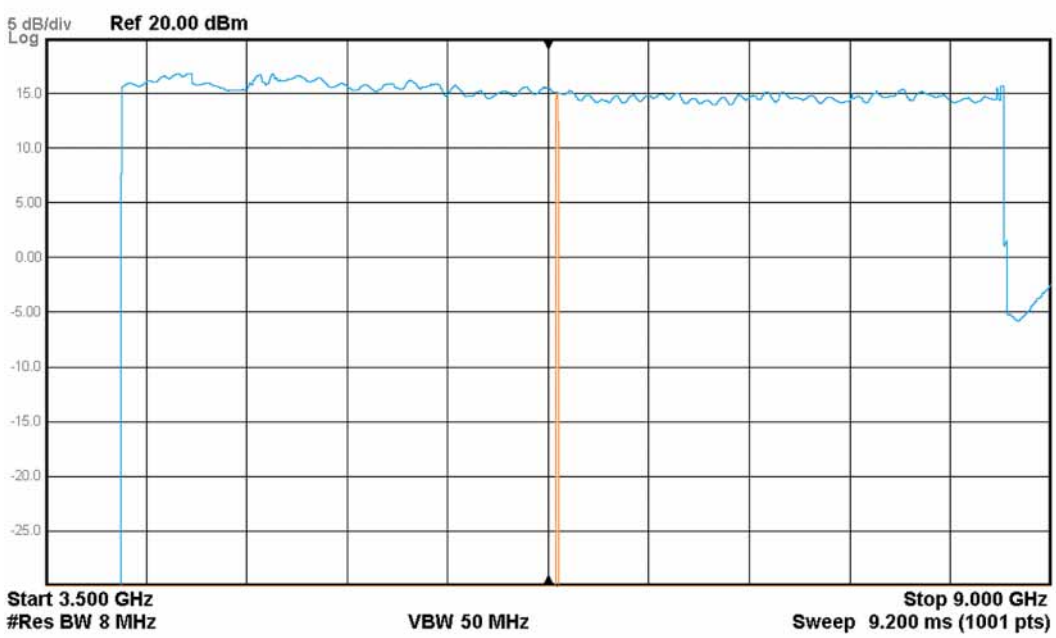
8. Connect a spectrum analyzer to the A14 DDS LO Synthesizer output at J1.
9. Tune the spectrum analyzer to a start frequency of 3.5 GHz and a stop frequency of 9 GHz

10. Set the spectrum analyzer reference level to +20 dBm with a vertical scale of 5 dB per division.
11. Set the spectrum analyzer resolution bandwidth as wide as it will go.
12. Turn the spectrum analyzer trace number two on and set it to maximum hold.

NOTE Be sure to account for the loss of the cable being used when making this measurement. A power meter could also be used if there is any question about the accuracy when using a cable and spectrum analyzer.

13. Let the instrument sweep a few times to fill in the max hold trace on the spectrum analyzer to get a good idea of the power level of the synthesizer output across its tuning range. The power level should be at least +10 dBm across the tuning range, as seen in Figure 11-9.

Figure 11-9 A14 DDS LO Synthesizer Typical Output - A20



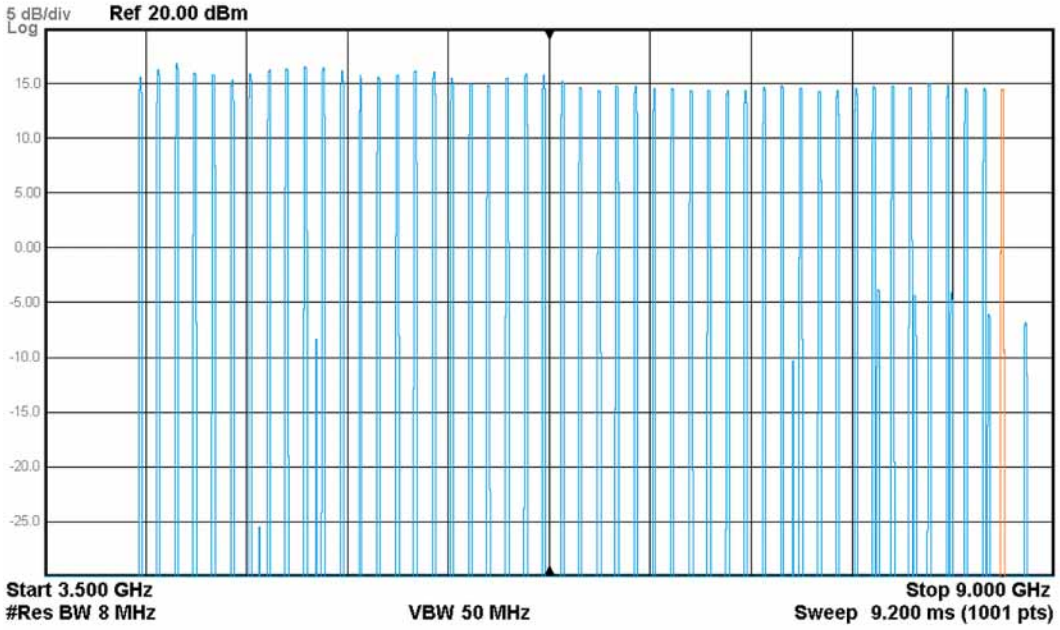
If the power level is as expected, the synthesizer output power level when using the A20 Yig Tuned Oscillator is as expected. Proceed to the next step.

If the power level is not as expected, see the "Output Power Level Verification" section for the A20 Yig Tuned Oscillator later in this chapter to determine if its power level is correct. If it is determined that the power level of the A20 Yig Tuned Oscillator is correct, replace the A14 DDS LO Synthesizer.

NOTE When using the A14A1 DDS LO Reference for the synthesizer output the maximum span that can be used is 100 MHz. So, the power level while using that will be measured at spot frequencies. If there are other frequencies of interest, use them as well.

14. Change the sweep time to auto by pressing **Sweep**, **Sweep Time Auto**.
15. Set the span to 0 Hz by pressing **Frequency**, **Zero Span**.
16. Set the center frequency step size to 100 MHz by pressing **CF Step 100 MHz**.
17. Tune the instrument to 3.7 GHz by pressing **Center Frequency 3.7 GHz**.
18. Restart the spectrum analyzer maximum hold function.
19. Use the **Up Arrow** to step the center frequency of the instrument 100 MHz at a time up to 8.4 GHz.
20. Verify that the synthesizer output using the A14A1 DDS Reference as its source is at least +10 dBm, across the frequency range, as seen in Figure 11-10.

Figure 11-10 A14 DDS LO Synthesizer Typical Output - A14A1 DDS LO Reference



If the power level is as expected, the synthesizer output power level when using the A14A1 DDS LO Reference as expected.

If the power level is not as expected, replace the A14 DDS LO Synthesizer.

LO Unlock Conditions

There are several possible causes for an instrument to display an LO Unlocked error message. The following procedure will go through the process of determining what the cause might be.

1. See the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting," to verify that all the instrument power supply voltages are at the correct level.
2. See the "7.2 GHz Reference Verification" section in this chapter to verify that the A14A1 DDS LO Reference board is receiving the 7.2 GHz reference signal from the A16 Reference assembly.
3. See the "100 MHz Reference Verification" section in Chapter 10, "Analog and Digital IFs," to verify that the A3 40 MHz Digital IF is receiving the 100 MHz reference signal from the A16 Reference assembly.
4. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer, OK**.
5. Return the instrument to a known state by pressing **Mode Preset**.
6. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
7. Tune the instrument to 10 GHz by pressing **Frequency**, **Center Frequency 10 GHz**.
8. Set the span to 0 Hz by pressing **Zero Span**.
9. Set the phase noise optimization to best close-in phase noise by pressing **Meas Setup**, **Advanced**, **Phase Noise Optimization**, **Best Close-In Phase Noise**.

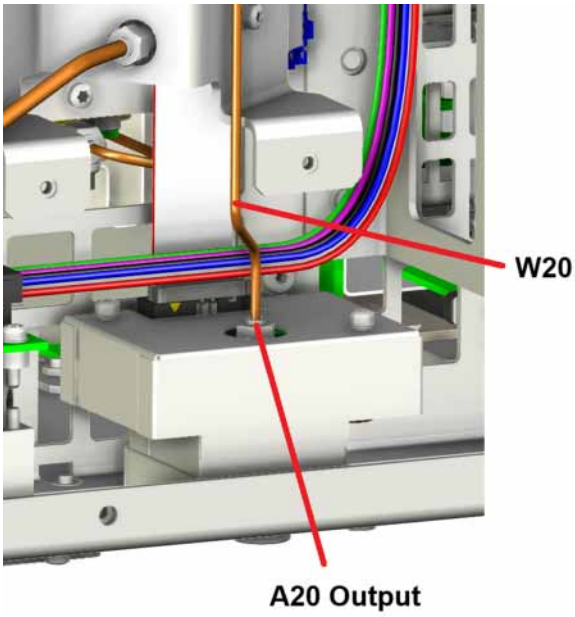
   If the error goes away and the instrument now sweeps, the cause is related to the A20 Yig Tuned Oscillator. It either has a problem itself or there is a problem with the phase lock loops on the A14 DDS LO Synthesizer assembly. Proceed to the next step.

   If the problem does not go away, replace the A14 DDS LO Synthesizer.

NOTE Selecting Best Close-In Phase Noise will turn the A20 Yig Tuned Oscillator off, and the instrument will then use the A14A1 DDS output as its LO.

10. Referring to Figure 11-11, remove W20 from the A20 Yig Tuned Oscillator output.

Figure 11-11 A20 Yig Tuned Oscillator Output



11. Connect a spectrum analyzer to the A20 Yig Tuned Oscillator output.
12. Set the spectrum analyzer start frequency to 2 GHz and the stop frequency to 10 GHz.
13. Set the reference level of the spectrum analyzer to +20 dBm.
14. Turn the A20 Yig Tuned Oscillator back on by pressing **Meas Setup**, **Advanced**, **Phase Noise Optimization**, **Fast Tuning**.
15. Verify that there is a signal somewhere on the spectrum analyzer display at a power level of approximately +15 dBm. Even though the instrument is in zero span, the signal may be wondering around due to the phase lock loop trying to obtain a lock.

    If there is a signal as expected, replace the A14 DDS LO Synthesizer.

    If there is not a signal as expected, replace the A20 Yig Tuned Oscillator.

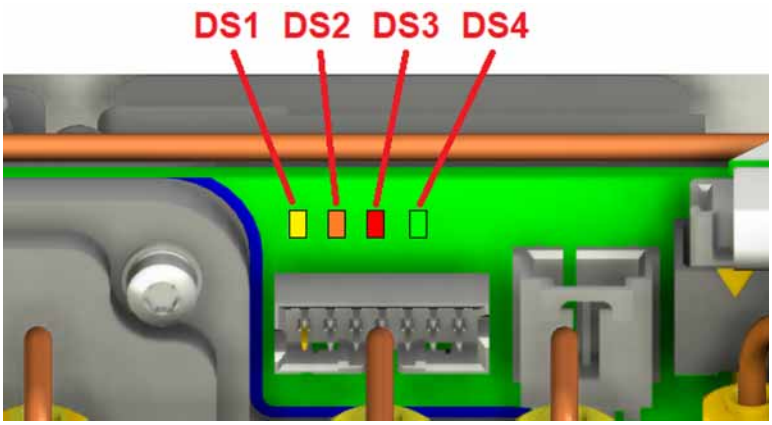
Synthesizer Status LEDs

There are four status LEDs on the A14 DDS LO Synthesizer assembly. A list of each LED can be seen in Table 11-7, and the location of each can be seen in Figure 11-12.

Table 11-7 A14 DDS LO Synthesizer Status LEDs

LED	Description	Color
DS1	Sweep Status	Yellow
DS2	LO Ready	Orange
DS3	LO Unlock	Red
DS4	FPGAs Configured	Green

Figure 11-12 A14 DDS LO Synthesizer Status LED Locations



DS1 - Yellow

This will be on whenever the synthesizer is being tuned. This can be during a measurement or a retrace. When the instrument is preset in the spectrum analyzer mode it will be flashing on and off as the instrument sweeps. It will mostly be on when DS2 is off.

DS2 - Orange

If the synthesizer is not ready to sweep or tune this will be on. When the instrument is preset in the spectrum analyzer mode it will be flashing on and off as the instrument sweeps. It will mostly be on when DS1 is off.

DS3 - Red

Whenever the A20 Yig Tuned Oscillator is unlocked this LED will be one. It will also be on briefly whenever the instrument sweeps across an LO band break and during retrace. If the instrument is in a narrow span with a very fast sweeptime it will appear to be on constantly, while it is actually switching on

and off at such a high rate that it just appears that way. When the instrument is preset in the spectrum analyzer mode it will be flashing on and off as the instrument sweeps.

If the Phase Noise Optimization is set to Best Close-In Phase Noise this LED should never be on, as the A20 Yig Tuned Oscillator will be turned off.

DS4 - Green

Once the FPGAs on the A14 DDS LO Synthesizer have been initiated, DS4 should always be on. If it does not come on, the assembly will not be working correctly and may not be identified by the instrument. If this is the case, see the introductory portion under the "Functional Verification" heading in this section to verify that the assembly is being identified by the instrument and follow the instructions found there if it is not.

Debug Mode

If the A14 DDS LO Synthesizer has a problem with one of its reference signals, LEDs DS1, DS2, and DS3 will go into debug mode. They will flash to indicate what problem exists, as seen in Table 11-8.

Table 11-8 A14 DDS LO Synthesizer LED Debug Mode

Flashes	DS1 - Yellow	DS2 - Orange	DS3 - Red
1	A14A1 10 MHz Error	A14 Main 10 MHz Error	A14 Main 50 MHz Error
2	A14A1 100 MHz Error	A14A1 Thermal Alert	A14A1 Thermal Shut-Down
3	A14A1 300 MHz Error	--	--

A14A1 10 MHz clock comes from the A14 main.

A14A1 100 MHz clock is derived by multiplying the 10 MHz clock times 10 on the A14A1.

A14A1 300 MHz clock comes from dividing the 7.2 GHz reference by 24 on the A14A1.

A14 Main 10 MHz clock comes from the motherboard.

A14 Main 50 MHz clock comes from multiplying the 10 MHz clock times 5 on the A14 main.

A20 Yig Tuned Oscillator

Overview

The A20 Yig tuned Oscillator is used by the instrument as the source for the A14 DDS LO Synthesizer most of the time. The only time that it is not used is when the span is 100 MHz or less and Phase Noise Optimization is set to Best Close-In Phase Noise. For these settings it will use the A14A1 DDS LO Reference instead.

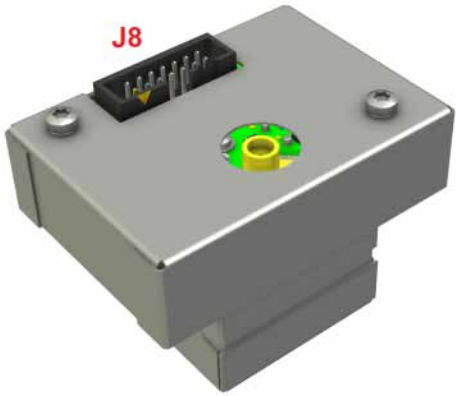
Control of the A20 Yig Tuned Oscillator comes from the A14 DDS LO Synthesizer assembly J8, via ribbon cable W23.

The connections to and from the A20 Yig Tuned Oscillator are listed in Table 11-9 and as seen in Figure 11-13.

Table 11-9 A20 Yig Tuned Oscillator Connections

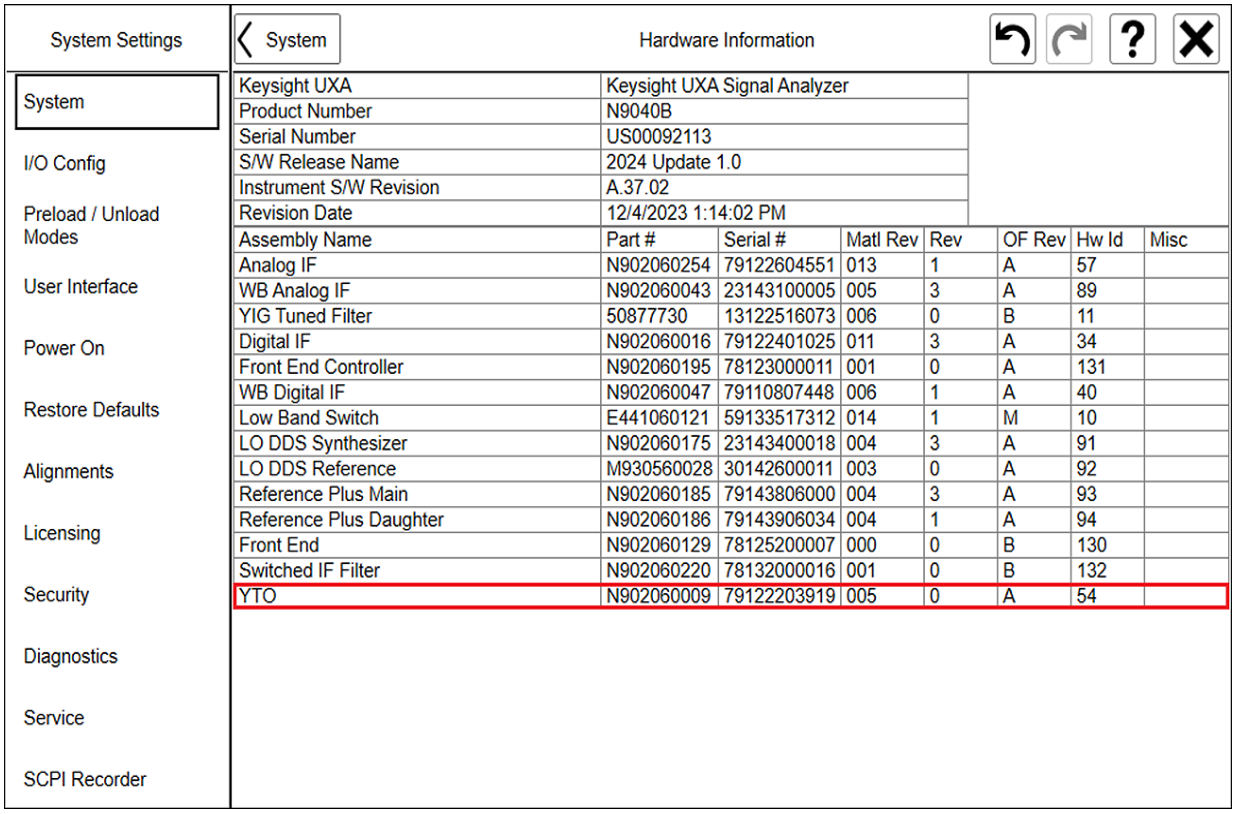
Port	Description	To/From	Cable
J8	Bias & Control	From A14 DDS LO Synthesizer J8	W23
Output	LO Output	To A14 DSS LO Synthesizer J2	W20

Figure 11-13 A20 Yig Tuned Oscillator



The A20 Yig Tune Oscillator will identify itself on the instrument Hardware Information screen as the **YTO**, as seen in Figure 11-14.

Figure 11-14 Hardware Information Screen – A20 Yig Tuned Oscillator



Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US00092113
S/W Release Name	2024 Update 1.0
Instrument S/W Revision	A.37.02
Revision Date	12/4/2023 1:14:02 PM

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060254	79122604551	013	1	A	57	
WB Analog IF	N902060043	23143100005	005	3	A	89	
YIG Tuned Filter	50877730	13122516073	006	0	B	11	
Digital IF	N902060016	79122401025	011	3	A	34	
Front End Controller	N902060195	78123000011	001	0	A	131	
WB Digital IF	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	23143400018	004	3	A	91	
LO DDS Reference	M930560028	30142600011	003	0	A	92	
Reference Plus Main	N902060185	79143806000	004	3	A	93	
Reference Plus Daughter	N902060186	79143906034	004	1	A	94	
Front End	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	78132000016	001	0	B	132	
YTO	N902060009	79122203919	005	0	A	54	

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A20 Yig Tuned Oscillator, verify that it is being recognized by the instrument by pressing **System**, **Show Hardware** and verify that there is a **YTO** in the list of hardware assemblies, as seen in Figure 11-14. If it is not listed, inspect the W10 ribbon cable and verify that it is properly connected between J8 of the assembly and J8 of the A14 DDS LO Synthesizer.

If the ribbon cable is not an issue, and the assembly is still not showing up in the Hardware Information screen, replace the A20 Yig Tuned Oscillator.

NOTE

Since the instrument communicates with the A20 Yig Tuned Oscillator through the A14 DDS LO Synthesizer, be sure that it is initializing properly and being recognized on the Hardware Information screen before replacing an A20 Yig Tuned Oscillator for not initializing properly.

Output Power Level Verification

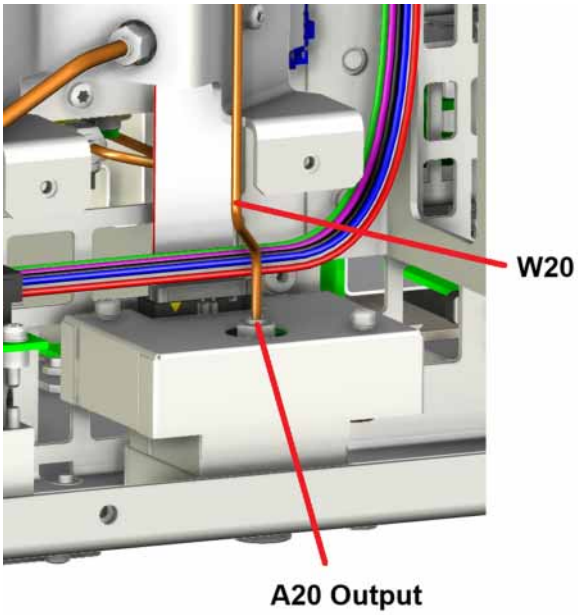
The following procedure will verify the output power level of the A20 Yig Tuned Oscillator.

NOTE

This procedure will use a directional coupler to measure the A20 Yig Tuned Oscillator output while still allowing the A14 DDS LO Synthesizer to continue to operate normally. The directional coupler will need to be able to cover the frequency range of 3 to 9 GHz.

1. Turn the instrument power off.
2. Referring to Figure 11-15, remove W20 from the A20 Yig Tuned Oscillator output and connect a directional coupler input to it. Then either reconnect W20 to the output of the coupler or substitute another high quality cable for it and connect the other end to the A14 DDS LO Synthesizer output at J2.

Figure 11-15 A20 Yig Tuned Oscillator Output Connection



3. Connect a spectrum analyzer to the coupled port of the directional coupler.
4. Turn the instrument back on and allow it to complete its power on process.
5. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
6. Return the instrument to a known state by pressing **Mode Preset**.
7. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.

8. Tune the instrument start frequency to 3.601 GHz by pressing **Frequency**, **Start Freq 3.601 GHz**.
9. Tune the instrument stop frequency to 8.4 GHz by pressing **Stop Freq 8.4 GHz**.

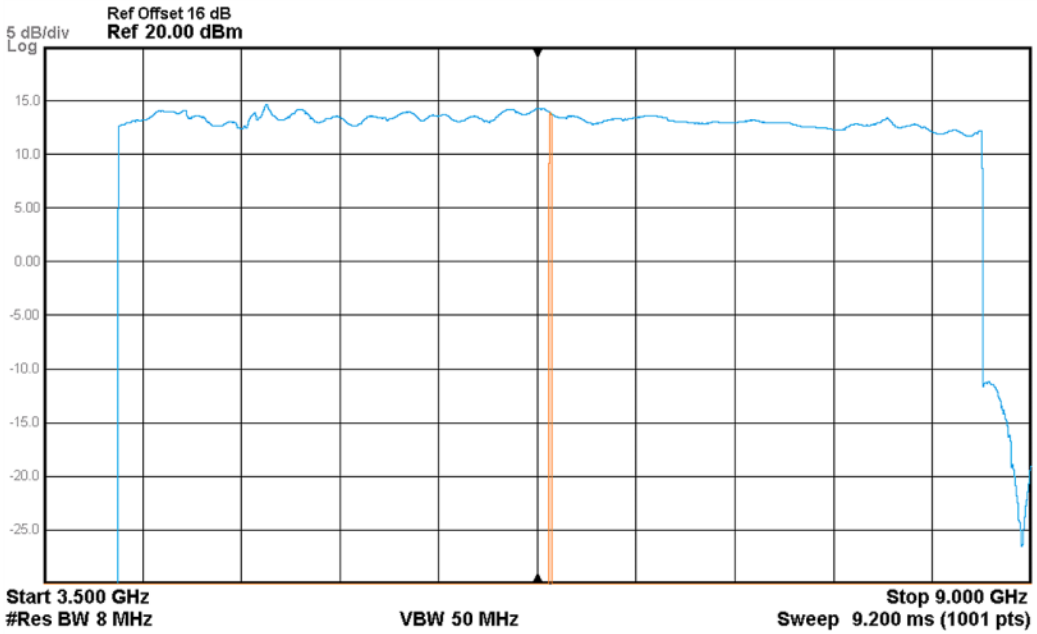
NOTE As can be seen in Table 11-3, the frequency range selected for this part of the procedure will allow the synthesizer to cover the widest frequency range used by the spectrum analyzer mode.

10. Set the sweep time to 30 seconds by pressing **Sweep**, **Sweep Time 30 sec**.
11. Tune the spectrum analyzer to a start frequency of 3.5 GHz and a stop frequency of 9 GHz
12. Set the spectrum analyzer reference level offset to the coupling factor of the directional coupler being used.
13. Set the spectrum analyzer reference level to +20 dBm with a vertical scale of 5 dB per division.
14. Set the spectrum analyzer resolution bandwidth as wide as it will go.
15. Turn the spectrum analyzer trace two on and set it to maximum hold.

NOTE Be sure to account for the loss of the cable being used when making this measurement. A power meter could also be used if there is any question about the accuracy using a cable and spectrum analyzer.

16. Let the instrument sweep a few times to fill in the max hold trace on the spectrum analyzer to get a good idea of the power level of the oscillator output across its tuning range.
17. Verify that the power level across the frequency range covered is at least +8 dBm, as seen in Figure 11-16, with the reference level offset set to equal the coupling factor of the directional coupler used.

Figure 11-16 A20 Yig Tuned Oscillator Typical Output Power



If the power level is as expected, the power level of the A20 Yig Tuned Oscillator is as expected.

If the power level is not as expected, replace the A20 Yig Tuned Oscillator.

12 Reference

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 272

Troubleshooting Equipment Required on page 273

A16 Reference on page 274

Overview on page 274

Functional Verification on page 283

Overview

There are many internal reference and clock signals needed by many of the different instrument assemblies. These need to have a common source so that they are synchronized. The instrument also needs internal calibration signals that it can use to align the different assemblies and signal paths. Most of these signals are provided by the A16 Reference assembly.

NOTE

The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

Troubleshooting Equipment Required

To perform the troubleshooting and verification outlined in this chapter the following test equipment will be needed:

Spectrum Analyzer

Minimum frequency range: 10 MHz to 10 GHz

Power Meter

Minimum frequency range: 10 MHz to 10 GHz

Minimum power level range: -50 dBm to +20 dBm

Miscellaneous

Misc. cables and adapters

A16 Reference

Overview

The A16 Reference provides several stable references that the different assemblies in the instrument require. There are three main sections of the A16 Reference assembly:

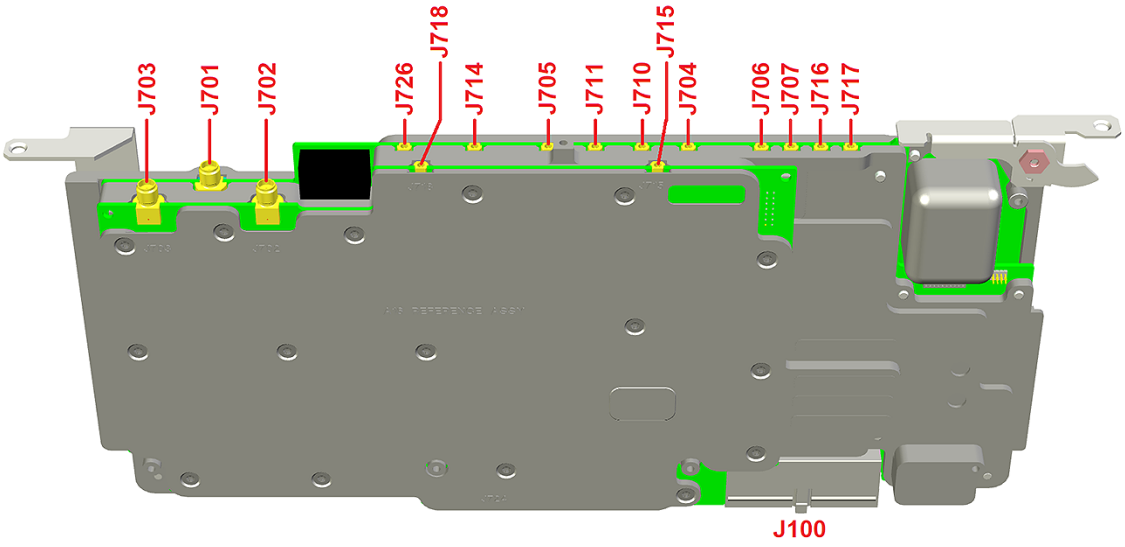
- Low Frequency Reference Signals
- High Frequency Reference Signals
- Calibrator Signals

The connections to and from the A16 Reference are listed in Table 12-1, as seen in Figure 12-1.

Table 12-1 A16 Reference Connections

Port	Description	To/From	Cable
J100	Control	From A8 Motherboard J6	--
J701	Calibrator Output	To A9 Attenuator A Cal Input	W3
J702	4.8 GHz Output	To A13A1 Front End Assembly J1	W18
J703	7.2 GHz Output	To FL1 7.2 GHz BPF Input	W31
J704	External Reference Input	From Rear Panel EXT REF IN	W37
J705	Ecal Output	To A13 Front End Assembly J6	W33
J706	100 MHz Output	Not Used	--
J707	100 MHz Output	Not Used	--
J710	10 MHz Output	Not Used	--
J711	300 MHz Output	To A2 25 MHz Analog IF J300	W36
J714	Alternate Calibrator Input	Not Used	--
J715	2.4 GHz Output	Not Used	--
J716	100 MHz Output	To A3 40 MHz Digital IF J14	W39
J717	100 MHz Output	Not Used	--
J718	2.4 GHz Output	To A21 Wideband Digital IF J4	W34
J726	Step Cal Input	From A3 40 MHz Digital IF J17	W46

Figure 12-1 A16 Reference Connections

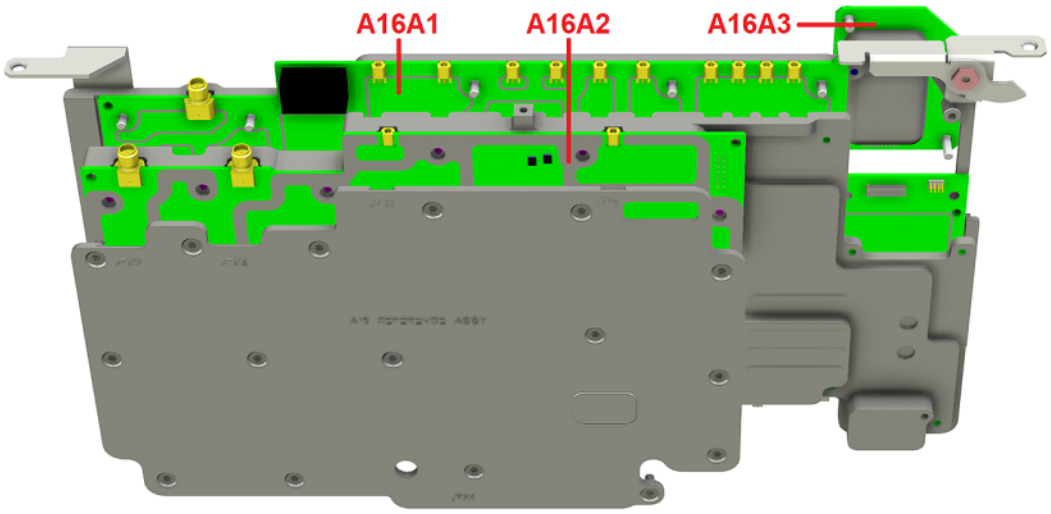


There are three hardware components that make up the A16 Reference assembly. They are:

- A16A1 Reference Main
- A16A2 Reference Daughter
- A16A3 Reference OCXO

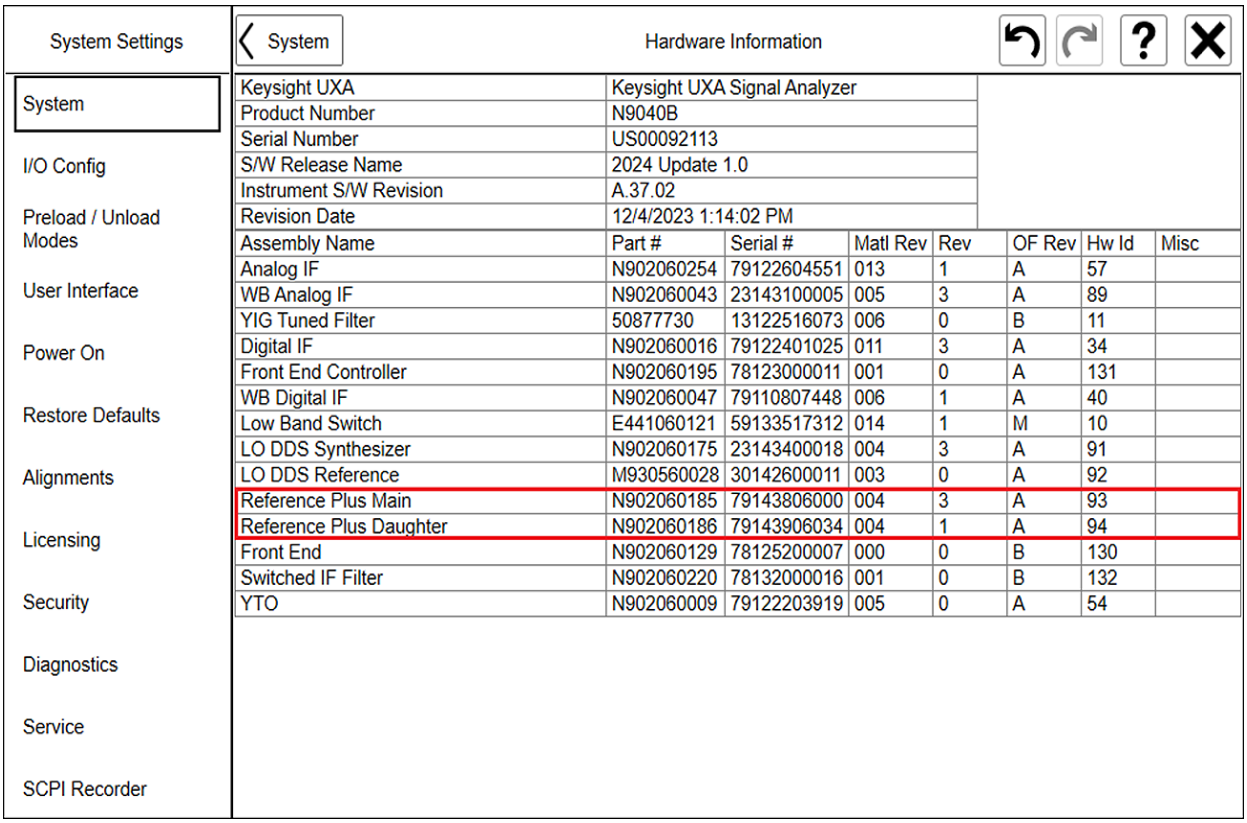
The location of these three components can be seen in Figure 12-2.
The A16A3 Reference OCXO is the only one of these assemblies that can be replaced individually.

Figure 12-2 A16 Reference Components



Two of the components of the A16 Reference assembly will identify themselves on the instrument Hardware Information screen. The A16A1 Reference Main will identify as the **Reference Plus Main** and the A16A2 Reference Daughter will identify as the **Reference Plus Daughter**, as seen in Figure 12-3. The A16A3 Reference OCXO will not identify on the Hardware Information screen.

Figure 12-3 Hardware Information Screen – A16 Reference



Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US00092113
S/W Release Name	2024 Update 1.0
Instrument S/W Revision	A.37.02
Revision Date	12/4/2023 1:14:02 PM

Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Analog IF	N902060254	79122604551	013	1	A	57	
WB Analog IF	N902060043	23143100005	005	3	A	89	
YIG Tuned Filter	50877730	13122516073	006	0	B	11	
Digital IF	N902060016	79122401025	011	3	A	34	
Front End Controller	N902060195	78123000011	001	0	A	131	
WB Digital IF	N902060047	79110807448	006	1	A	40	
Low Band Switch	E441060121	59133517312	014	1	M	10	
LO DDS Synthesizer	N902060175	23143400018	004	3	A	91	
LO DDS Reference	M930560028	30142600011	003	0	A	92	
Reference Plus Main	N902060185	79143806000	004	3	A	93	
Reference Plus Daughter	N902060186	79143906034	004	1	A	94	
Front End	N902060129	78125200007	000	0	B	130	
Switched IF Filter	N902060220	78132000016	001	0	B	132	
YTO	N902060009	79122203919	005	0	A	54	

Low Frequency Reference Signals

The signals generated in the low frequency reference section of the A16 Reference assembly are all derived from the output of a 100 MHz VCXO, that is phase locked to the reference standard that the instrument is currently using. This could be either 10 MHz from the internal A16A3 Reference OCXO or from an external reference connected to the rear panel EXT REF IN port. The external reference can be any frequency from 1 to 50 MHz. A block diagram of the low frequency reference generation section can be seen in Figure 12-4, and the destination of each low frequency reference signal is seen in Table 12-2.

Figure 12-4 A16 Reference – Low Frequency References Block Diagram

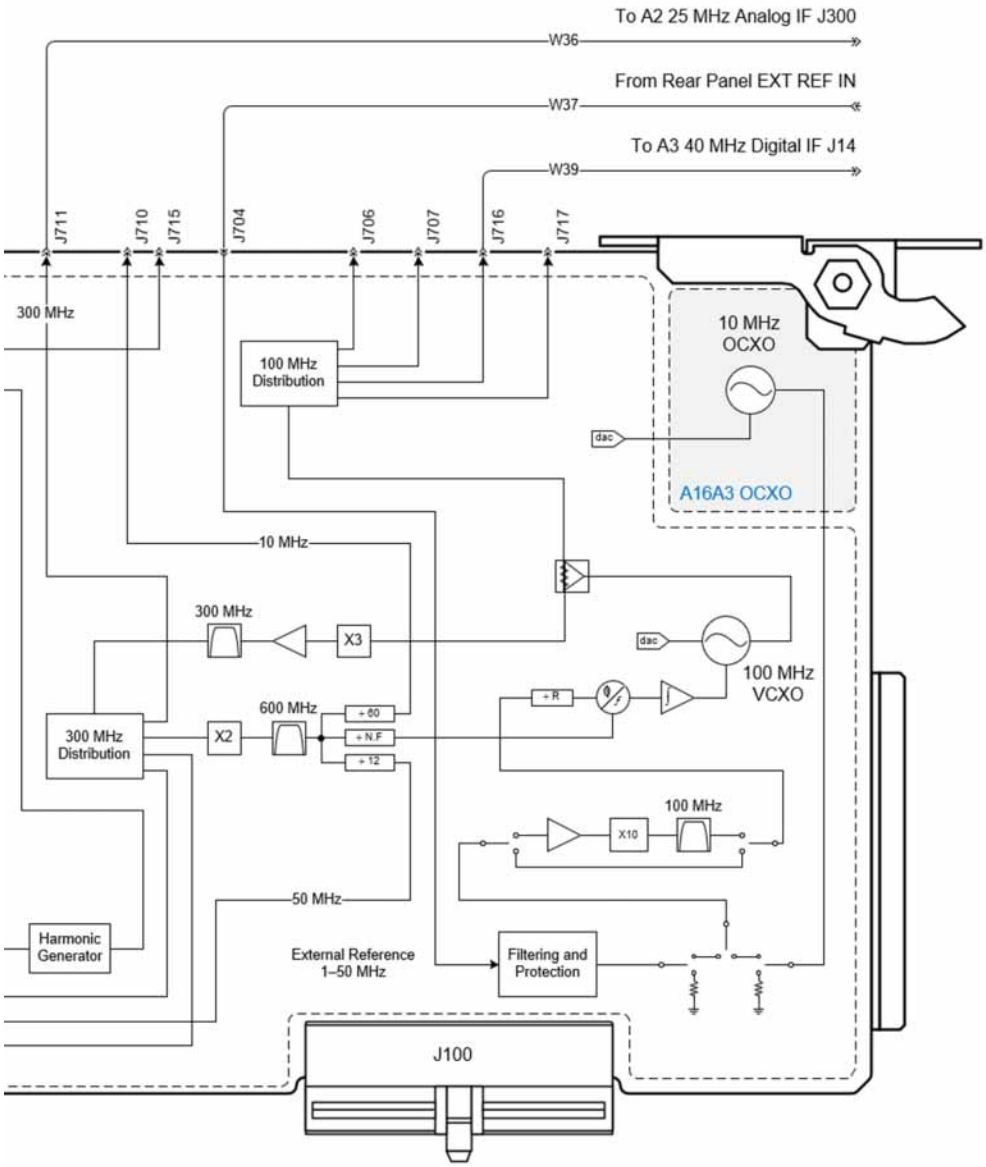


Table 12-2 A16 Low Frequency Reference Signals

Reference Frequency	Sent To	Used For
10 MHz	J710	Not Used
50 MHz	Calibrator Signals	50 MHz Calibrator Signal
100 MHz	J706	Not Used
100 MHz	J707	Not Used
100 MHz	J716	A3 40 MHz Digital IF
100 MHz	J717	Not Used
300 MHz	J711	A2 25 MHz Analog IF 3rd LO
300 MHz	Calibrator Signals	300 MHz Comb Generator
300 MHz	High Frequency Signals	Phase Lock Loop Reference

High Frequency Reference Signals

The high frequency reference signals are all generated on the A16A2 Reference Daughter. These signals are all derived from the output of a 2400 MHz SAW oscillator, that is phase locked to a 300 MHz reference signal from the low frequency reference section. A block diagram of the high frequency reference generation section can be seen in Figure 12-5, and the destination of each high frequency reference signal is seen in Table 12-3.

Figure 12-5 A16 Reference - High Frequency References Block Diagram

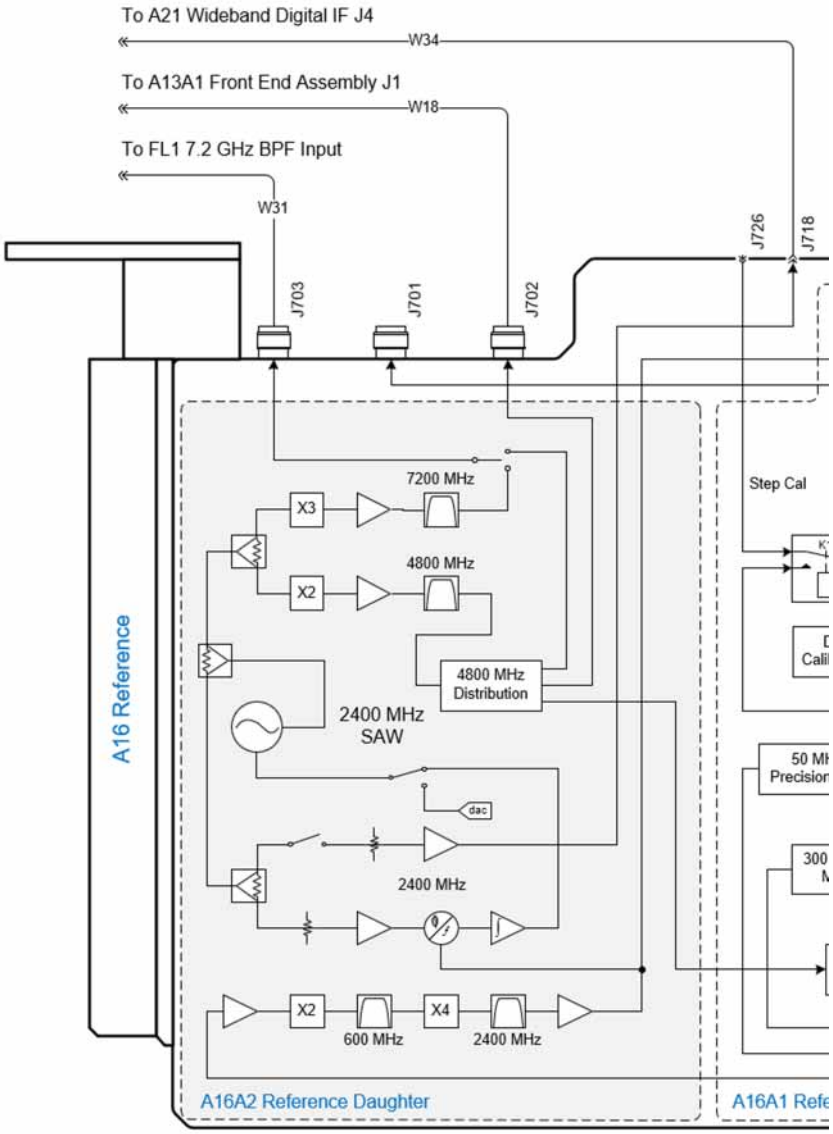


Table 12-3 A16 High Frequency Reference Signals

Reference Frequency	Sent To	Used For
2400 MHz	J718	A21 Wideband Digital IF Clock
4800 MHz	J702	Multiple References and LO
4800 MHz	Calibrator Signals	4.8 GHz Reference Signal
7200 MHz	J703	A14A1 DDS LO Clock

Calibrator Signals

The calibrator signals section takes multiple reference signal inputs and directs them to its two outputs. These signals come from the low frequency reference section, the high frequency reference section, as well as the step calibrator signal from the A3 40 MHz Digital IF. A block diagram of the calibrator signals section can be seen in Figure 12-6, and the signals that can be routed to each of the two calibrator outputs can be seen in Table 12-4.

Figure 12-6 A16 Calibrator Signals

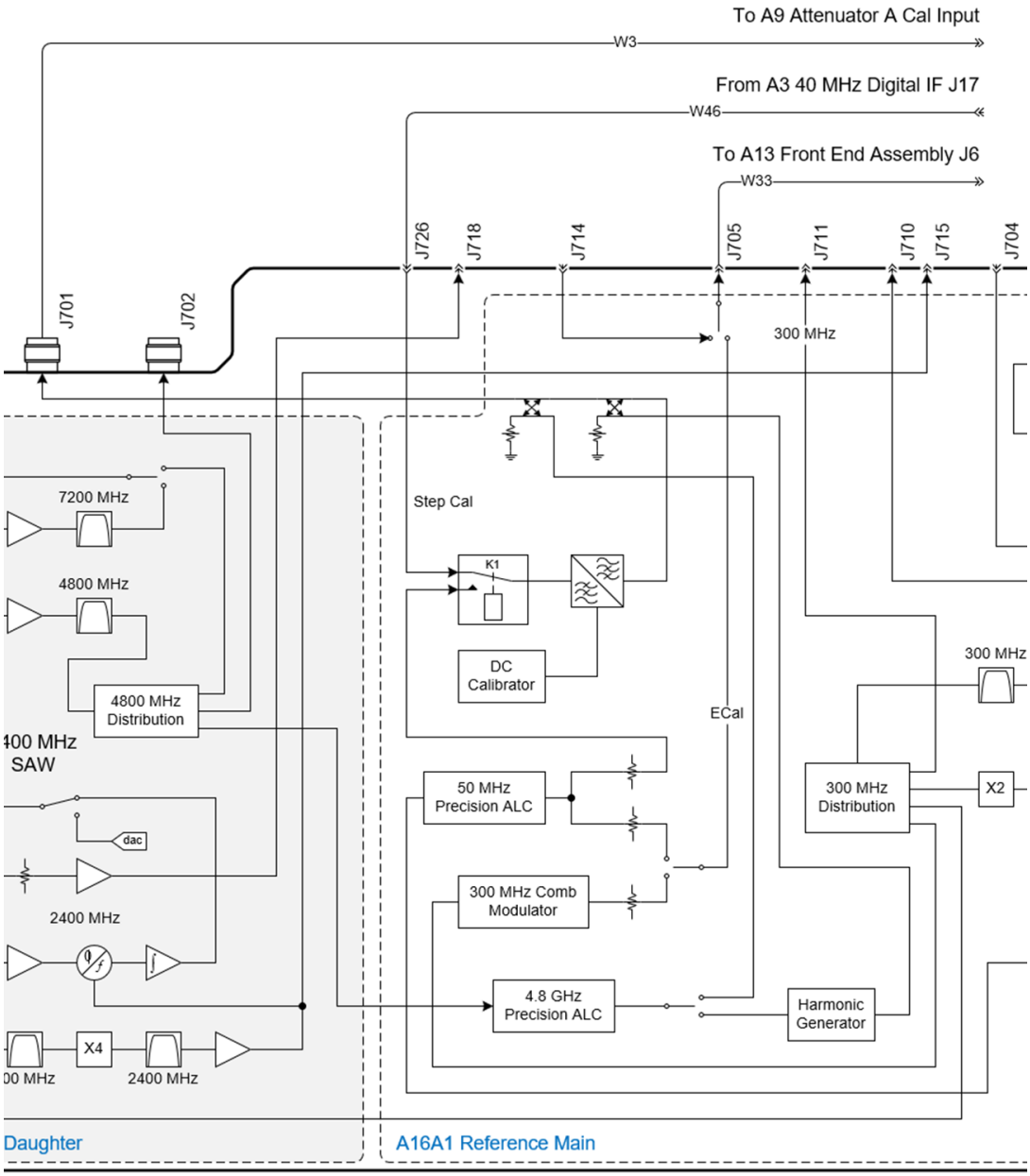


Table 12-4 A16 Calibrator Signal Potential Outputs

Output	Signal
J701	DC Calibrator
	Step Cal
	50 MHz
	4.8 GHz
	4.8 GHz Comb
J705	50 MHz
	300 MHz Comb

The J701 calibrator output is routed to the A9 Step Attenuator when needed.

The J705 calibrator output is routed to the A13 Front End Assembly where it can be switched into the circuit right before the low band 1st mixer.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A16 Reference, verify that it is being recognized by the instrument by pressing **System**, **Show Hardware** and verify that there is a **Reference Plus Main** and a **Reference Plus Daughter** in the list of hardware assemblies, as seen in Figure 12-3. If either one is not listed, 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 one of the following:

– FPGA Code on the assembly is corrupt

  Solution: See the "Overview" section in Chapter 23, "Instrument Software and FPGAs," to reload the FPGA code.

– An instrument power supply voltage is not operating properly

  Solution: See the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting," to verify that all the instrument power supplies are on.

– -A16 Reference assembly is defective

  Solution: Replace the A16 Reference assembly

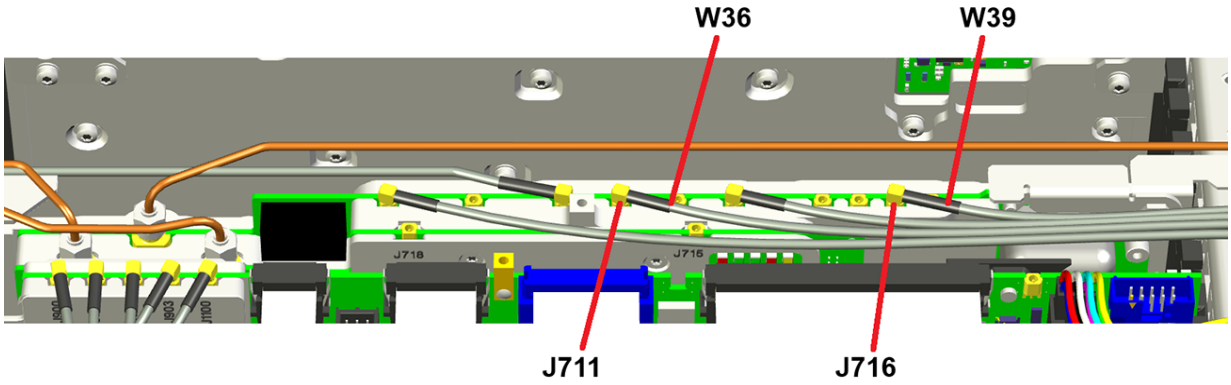
NOTE Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting."

Low Frequency Reference Signals Verification

Some of the low frequency reference signals are used to generate clock signals on other assemblies in the instrument. If these signals are lost the instrument may display errors and stop acquiring data. Because of this the instrument application will need to be restarted to recover at the end of this procedure.

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Set the span to 0 Hz by pressing **Frequency**, **Zero Span**.
5. Verify that there is nothing connected to the rear panel EXT REF IN port.
6. Referring to Figure 12-7, remove W39 from J716 of the A16 reference.

Figure 12-7 A16 Reference Low Frequency Reference Signal Connections



7. Connect a spectrum analyzer to J716 on the A16 Reference.
8. Set the spectrum analyzer reference level to +20 dBm.
9. Tune the spectrum analyzer to 100 MHz with a span of 10 MHz.
10. Verify that there is a 100 MHz signal on the spectrum analyzer display at approximately +12 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.
11. Remove the spectrum analyzer from J716 and reconnect W39 to it.
12. Remove W36 from J711 of the A16 Reference.
13. Connect the spectrum analyzer to J711.
14. Tune the spectrum analyzer to 300 MHz with a span of 10 MHz.

15. Verify that there is a 300 MHz signal on the spectrum analyzer display at approximately +8 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.

16. Remove the spectrum analyzer from J711 and reconnect W36 to it.

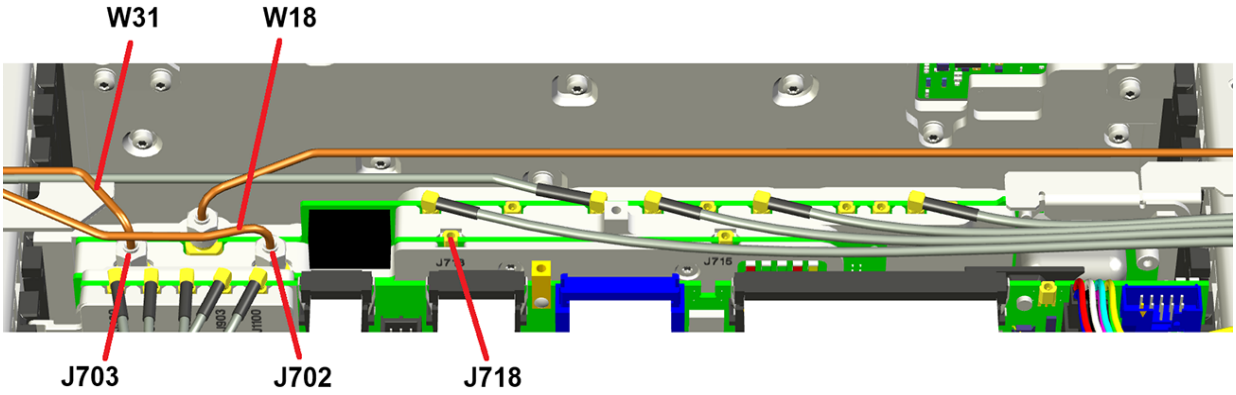
17. Restart the instrument application.

High Frequency Reference Signals Verification

Some of the high frequency reference signals are used to generate clock signals on other assemblies in the instrument. If these signals are lost the instrument may display errors and stop acquiring data. Because of this the instrument application will need to be restarted to recover at the end of this procedure.

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Set the span to 0 Hz by pressing **Frequency**, **Zero Span**.
5. Verify that there is nothing connected to the rear panel EXT REF IN port.
6. Referring to Figure 12-8, remove W18 from J702 of the A16 reference.

Figure 12-8 A16 Reference High Frequency Reference Connections



7. Connect a spectrum analyzer to J702 on the A16 Reference.
8. Set the spectrum analyzer reference level to +20 dBm.
9. Tune the spectrum analyzer to 4.8 GHz with a span of 10 MHz.
10. Verify that there is a 4.8 GHz signal on the spectrum analyzer display at approximately +12 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.
11. Remove the spectrum analyzer from J702 and reconnect W18 to it.
12. Remove W31 from J703 of the A16 Reference.
13. Connect the spectrum analyzer to J703.
14. Tune the spectrum analyzer to 7.2 GHz with a span of 10 MHz.

15. Verify that there is a 7.2 GHz signal on the spectrum analyzer display at approximately +4 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.

NOTE Be sure to account for the loss of the cable being used when making this measurement. A power meter could also be used if there is any question about the accuracy when using a cable and spectrum analyzer.

16. Remove the spectrum analyzer from J703 and reconnect W31 to it.
17. If the instrument has option B2X, B5X, or H1G proceed to the next step. If not, exit this procedure.
18. Remove W34 from J718 of the A16 Reference.
19. Connect the spectrum analyzer to J718.
20. Tune the spectrum analyzer to 2.4 GHz with a span of 10 MHz.
21. Verify that there is a 2.4 GHz signal on the spectrum analyzer display at approximately +10 dBm.

    If there is a signal as expected, proceed to the next step.

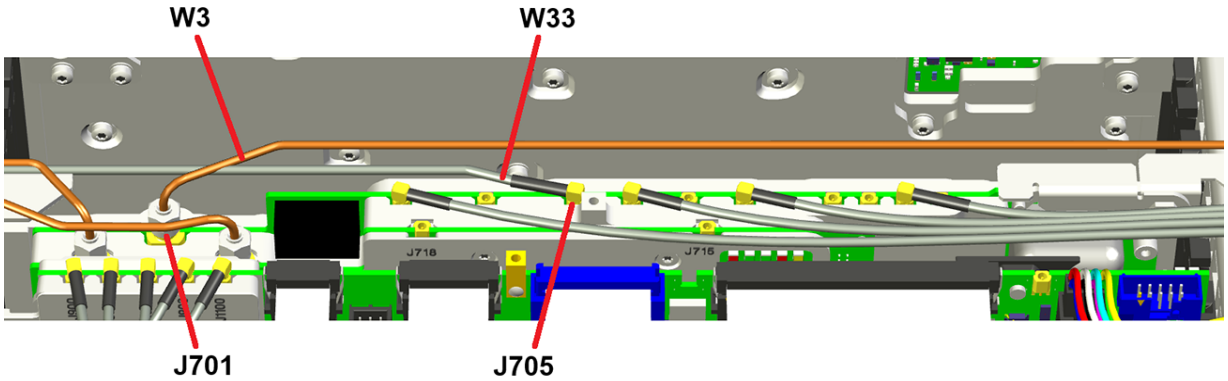
    If there is not a signal as expected, replace the A16 Reference assembly.
22. Remove the spectrum analyzer from J718 and reconnect W34 to it.
23. Restart the instrument application.

Calibrator Signals Verification

Many of the calibrator signals that the A16 Reference outputs can only be turned on and routed to one of its outputs by the instrument's alignment routines. So, it is not possible to measure all of them directly. The following procedure will verify the calibrator outputs that can reasonably be done.

1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas**, **Spectrum Analyzer**, **OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System**, **Alignments**, **Auto Align**, **Auto Align Off**.
4. Set the span to 0 Hz by pressing **Frequency**, **Zero Span**.
5. Referring to Figure 12-9, remove W33 from J705 of the A16 reference.

Figure 12-9 A16 Reference Calibrator Signal Connections

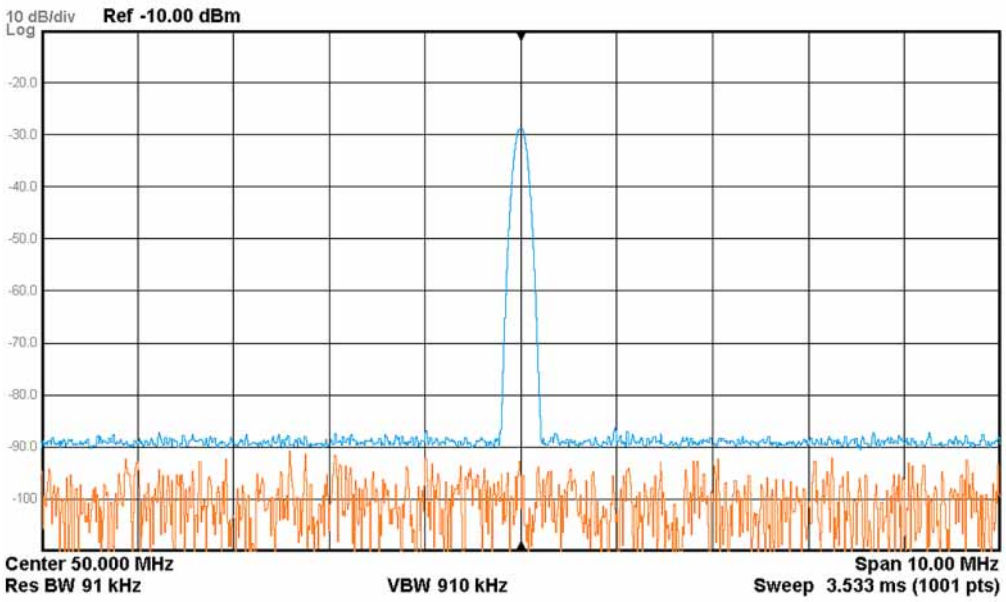


6. Connect a spectrum analyzer to J705 on the A16 Reference.
7. Tune the spectrum analyzer to 50 MHz with a span of 10 MHz.
8. Turn trace two of the spectrum analyzer on and turn the maximum hold function on.
9. Run the instrument RF alignments by pressing **System**, **Alignments**, **Align Now**, **Align Now RF**.

   Near the beginning of the RF alignment routine the 50 MHz calibrator signal will be routed out of the J705 port to run the AifVariableAttenuatorAlgorithm alignment, which should be captured by the maximum hold trace on the spectrum analyzer, as seen in Figure 12-10.

NOTE Once the 50 MHz signal is captured on the spectrum analyzer display the rest of the alignment routine can be aborted by pressing **Cancel (Esc)**.

Figure 12-10 A16 Reference 50 MHz Calibrator Signal - J705



10. Verify that a 50 MHz signal was captured by the spectrum analyzer maximum hold trace, with a power level of approximately -30 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.

11. Remove the spectrum analyzer from J705 and reconnect W33 to it.

12. Run the instrument RF alignments to clear any alignment errors created by pressing **System**, **Alignments**, **Align Now**, **Align Now RF**.

13. Remove W3 from J701 of the A16 Reference.

14. Connect a spectrum analyzer to J701.

15. Turn trace two of the spectrum analyzer off.

16. Turn the 50 MHz calibrator signal on by pressing **Input/Output**, **Calibrator Control**, **Cal Source**, **50 MHz**.

17. Verify that there is a 50 MHz signal on the spectrum analyzer display at approximately -25 dBm.

    If there is a signal as expected, proceed to the next step.

    If there is not a signal as expected, replace the A16 Reference assembly.

18. Tune the spectrum analyzer to 4.8 GHz.

19. Turn the 4.8 GHz calibrator signal on by pressing **Cal Source**, **4.8 GHz**.

20. Verify that there is a 4.8 GHz signal on the spectrum analyzer display at approximately -28 dBm.

If there is a signal as expected, proceed to the next step.

If there is not a signal as expected, replace the A16 Reference assembly.

21. Remove the spectrum analyzer from J701 and reconnect W3 to it.

Status LEDs

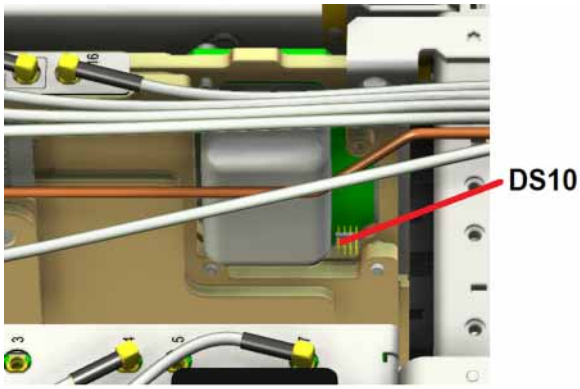
There are status LEDs on all three of the A16 Reference assembly boards, some are visible while others are not.

A16A1 Reference Main

While there are multiple status LEDs on the A16A1 Reference Main, only one of them is viewable when the assembly is in the instrument. However, the status LEDs on the A16A3 Reference OCXO that can be seen are related to A16A1 Reference Main circuits.

The one LED on the A16A1 Reference Main that can be seen is DS10 and it indicates the status of the +15 VSTBY. It should be on (green) whenever the instrument is plugged into the AC mains, even when the instrument is in standby mode. The location of DS10 can be seen in Figure 12-11.

Figure 12-11 A16A1 Reference Main Status LED Location



If DS10 is not on when it should be, see the "Power Supply Verification" section in Chapter 5, "First-Look Troubleshooting." to determine if the A6 Power Supply is having a problem, or if it is due to a problem with the power supply filtering on the A16 Reference assembly.

A16A2 Reference Daughter

There are five LEDs on the A16A2 Reference Daughter that can be seen. A listing of these can be seen in Table 12-5, and the location of each can be seen in Figure 12-12.

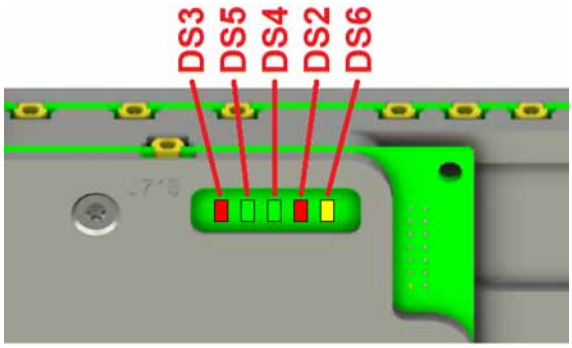
Table 12-5 A16A2 Reference Daughter Status LEDs

LED	Description	Color	Normal State
DS2	2400 MHz Reference Low	Red	Off
DS3	2400 MHz Reference High	Red	Off
DS4	2400 MHz Reference Locked	Green	On
DS5	2400 MHz Reference OK	Green	On

Table 12-5 A16A2 Reference Daughter Status LEDs

LED	Description	Color	Normal State
DS6	FPGA Programming	Yellow	Off

Figure 12-12 A16A2 Reference Daughter Status LED Locations



DS2 - Red

This LED may come on very briefly during the initial instrument power on, then it will go off as DS4 and DS5 come on, indicating that the 2400 MHz SAW oscillator is working properly. If it does stay on this would indicate that the 2400 MHz SAW oscillator phase lock loop is railed low.

DS3 - Red

This LED may come on very briefly during the initial instrument power on, then it will go off as DS4 and DS5 come on, indicating that the 2400 MHz SAW oscillator is working properly. If it does stay on this would indicate that the 2400 MHz SAW oscillator phase lock loop is railed high.

DS4 - Green

This LED should come on very shortly after the instrument power is turned on, as it indicates that the 2400 MHz SAW oscillator phase lock loop is working properly. It does not require that the instrument completes all its hardware initialization before it will come on.

DS5 - Green

This LED should come on very shortly after the instrument power is turned on, as it indicates that the 2400 MHz SAW oscillator is working properly. It does not require that the instrument completes all its hardware initialization before it will come on.

DS6 - Yellow

This LED will be on when the instrument power is first turned on. Once the FPGAs on the A16 Reference Daughter have properly loaded it will go off.

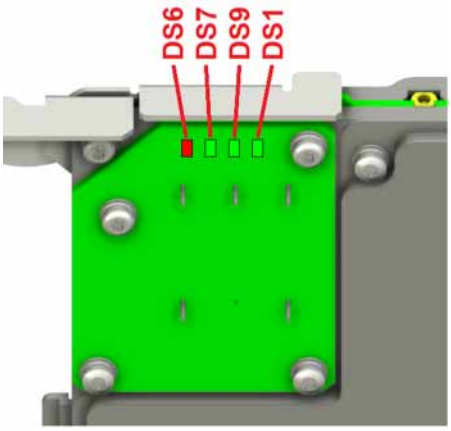
A16A3 Reference OCXO

There are four LEDs on the A16A3 Reference OCXO board. They indicate the status of circuits on the A16A1 Reference Main. A listing of these can be seen in Table 12-6, and the location of each can be seen in Figure 12-13.

Table 12-6 A16A3 Reference OCXO Status LEDs

LED	Description	Color	Normal State
DS1	FPGA Alive	Green	On
DS6	100 MHz Unlocked	Red	Off
DS7	100 MHz Locked	Green	On
DS9	10 MHz On	Green	On

Figure 12-13 A16A3 Reference OCXO Status LEDs



DS1 - Green

This LED should come on very shortly after the instrument power is turned on, as it indicates that the FPGAs on the A16A1 Reference Main have loaded properly and are alive.

DS6 - Red

This LED may come on briefly during the initial instrument turn on, then it should go off as DS7 comes on, indicating that the 100 MHz oscillator phase lock loop is locked.

DS7 - Green

This LED will come on shortly after the instrument power is turned on, as it indicated that the 100 MHz oscillator phase lock loop is locked.

DS9 - Green

This LED should come on very shortly after the instrument power is turned on, as it indicates that the 10 MHz OCXO on the A16A3 Reference OCXO is alive.

13 System Processor and Disk Drive

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 296

A4 System Processor Assembly on page 297

- Overview on page 297
- Processor Battery on page 302
- Boot-Up or Initialization Problems on page 302
- BIOS Settings on page 302

A5 Disk Drive on page 304

- Overview on page 304
- Partitioning on page 305
- Troubleshooting Software Related Issues on page 306
- Instrument Image Recovery System on page 307

Overview

The system processor and disk drive used in these instruments has changed over time and will continue to do so as the PC industry continues to evolve.

Figure 13-1 A4 System Processor and A5 Disk Drive Assembly

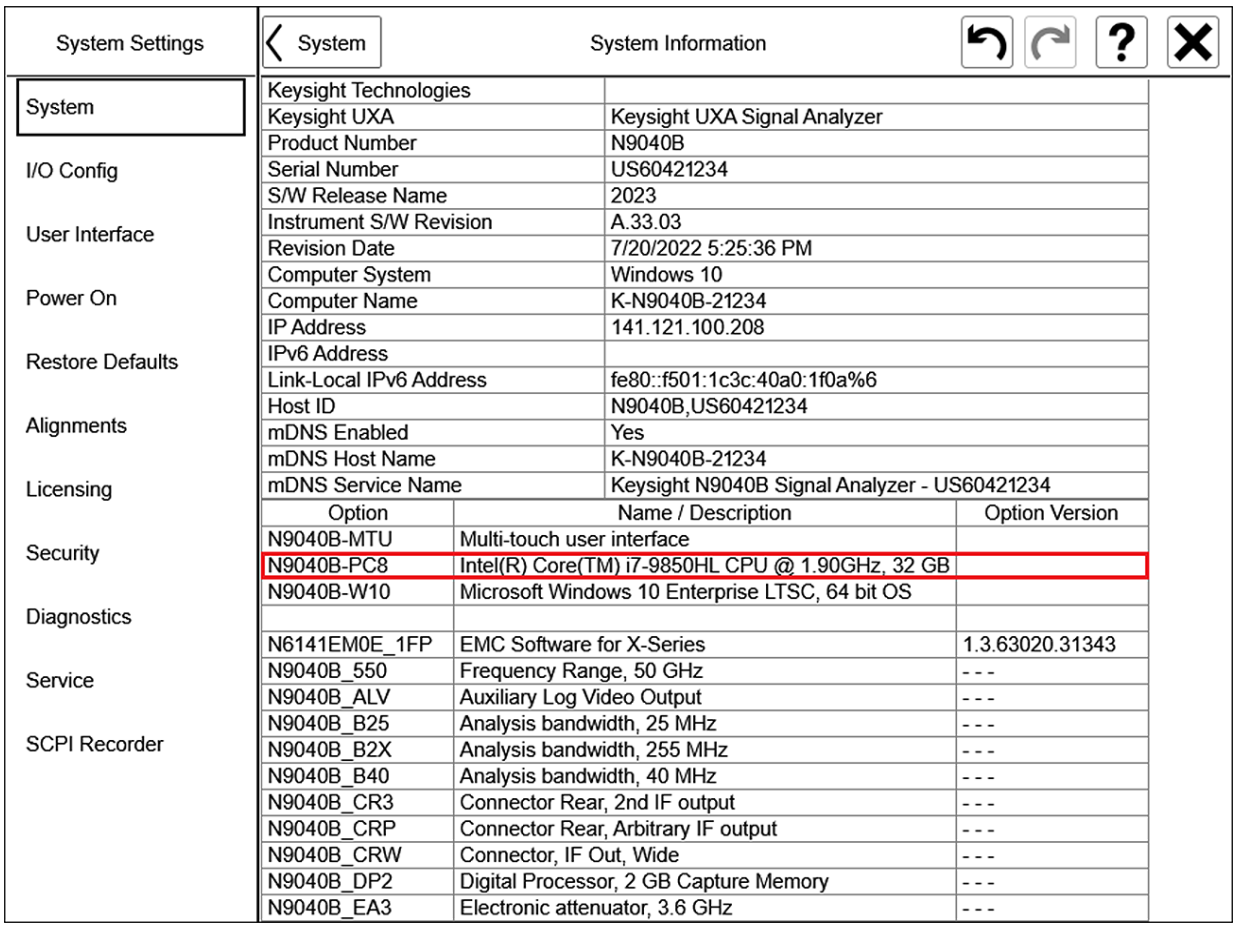
NOTE The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

A4 System Processor Assembly

Overview

There have been a couple of different A4 System Processor assemblies used in these instruments over the years, and they will continue to change as the PC industry continues to evolve. The information in this chapter is for the option PC6, PC8, and PCA system processors. The installed version of the A4 System Processor can be seen on the System Information screen by pressing **System**, **Show System** as seen in Figure 13-2. An example of the rear panel of these A4 System Processor version can be seen in Figure 13-3 and Figure 13-4.

Figure 13-2 A4 System Processor Identification – System Information



Keysight Technologies	
Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2023
Instrument S/W Revision	A.33.03
Revision Date	7/20/2022 5:25:36 PM
Computer System	Windows 10
Computer Name	K-N9040B-21234
IP Address	141.121.100.208
IPv6 Address	
Link-Local IPv6 Address	fe80::f501:1c3c:40a0:1f0a%6
Host ID	N9040B,US60421234
mDNS Enabled	Yes
mDNS Host Name	K-N9040B-21234
mDNS Service Name	Keysight N9040B Signal Analyzer - US60421234

Option	Name / Description	Option Version
N9040B-MTU	Multi-touch user interface	
N9040B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB	
N9040B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS	
N6141EM0E_1FP	EMC Software for X-Series	1.3.63020.31343
N9040B_550	Frequency Range, 50 GHz	- - -
N9040B_ALV	Auxiliary Log Video Output	- - -
N9040B_B25	Analysis bandwidth, 25 MHz	- - -
N9040B_B2X	Analysis bandwidth, 255 MHz	- - -
N9040B_B40	Analysis bandwidth, 40 MHz	- - -
N9040B_CR3	Connector Rear, 2nd IF output	- - -
N9040B_CRP	Connector Rear, Arbitrary IF output	- - -
N9040B_CRW	Connector, IF Out, Wide	- - -
N9040B_DP2	Digital Processor, 2 GB Capture Memory	- - -
N9040B_EA3	Electronic attenuator, 3.6 GHz	- - -

Figure 13-3 A4 System Processor Rear Panel - PC6 and PC8

Figure 13-4 A4 System Processor Rear Panel - PCA

If the A4 System Processor assembly is suspect in an instrument failure, see the Instrument "Instrument Boot Up Process" section in Chapter 2, "Boot Up and Initialization," to determine if the A4 System Processor is the cause.

Disk Drive

The A5 Disk Drive can easily be removed from the A4 System Processor assembly without removing any of the instrument covers. The disk drive is attached to a tray that is accessed on the rear panel by loosening one screw and pulling the drive out of the processor assembly.

If the A4 System Processor assembly is replaced, it should be replaced with the same version if possible, otherwise the A5 disk drive will also need to be replaced.

Front Panel Interface

The instrument USB bus is the electrical interface to the instrument front panel. One of the USB ports on the host controller located on the A4 System Processor assembly is routed to the A1A2 Front Panel Controller 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 display, one supplies the analog signals to the rear panel VGA output (PC8 only), and one provides 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 System Processor assembly. When the front panel power switch is pressed the A4 System Processor assembly tells the A6 Power Supply assembly to turn on. Once the +12 VD, +5.1 VD, and +3.35 VD supplies are all on and within specification the A6 Power Supply assembly notifies the A4 System Processor assembly, which then comes out of reset and boots-up. Outputs from the A4 System 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 rear panel connections provided on the A4 System Processor assembly vary depending on the version of the assembly.

PC6 and PC8 Rear Panel Connections:

- GPIB Interface
- PCIe x4 Interface
- 2 x Super Speed USB 3.0 Type-A Host Ports
- 1 x Super Speed USB 3.0 Type-B Device Port
- 1 x High Speed USB 2.0 Type-A Host Port
- LAN (RJ45) 10/100/1000 based-T Ethernet port
- Mini DisplayPort Video Output
- VGA Video Output
- SD Memory Card Slot (Accessible only when A5 disk drive is removed)

PCA Rear Panel Connections:

- GPIB Interface
- 4 x Super Speed USB 3.0 Type-A Host Ports
- DisplayPort Video Output
- Super Speed USB 3.0 Type-B Device Port
- 2 x Thunderbolt 3 Ports
- LAN (RJ45) 10/100/1000 based-T Ethernet port
- LAN (RJ45) 10 GB Ethernet port

System Memory

The type and amount of system SDRAM in the instrument may vary depending on the age and processor option installed in an instrument. Current instruments have 32 GB of DDR4 SDRAM in two 260-pin SODIMM memory modules.

The system SDRAM memory is 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 Hexa Core Intel i7 processor chipset.

The system processor chipset is not field replaceable.

Dedicated Calibration Data Backup Memory

There is dedicated non-volatile memory on the A4 System Processor that can only be used for backing up and restoring the instrument calibration file. This memory location cannot be seen or cataloged by the operating system user interface. When an instrument is shipped from the factory, or if adjustments are run at a Keysight service center, the latest calibration data is backed up in this location. For information on how to use this memory see the "Instrument Calibration Database" section in Chapter 3, "Instrument Information and Calibration Data."

SD Memory Card Slot

The main purpose for the SD memory card is for instrument calibration database backup. While the SD memory card slot is available on the PC6 and PC8 version of the assembly, it is no longer being used on PCA and newer assemblies.

The SD memory card that was shipped with PC6 and PC8 instruments is 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 need 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.

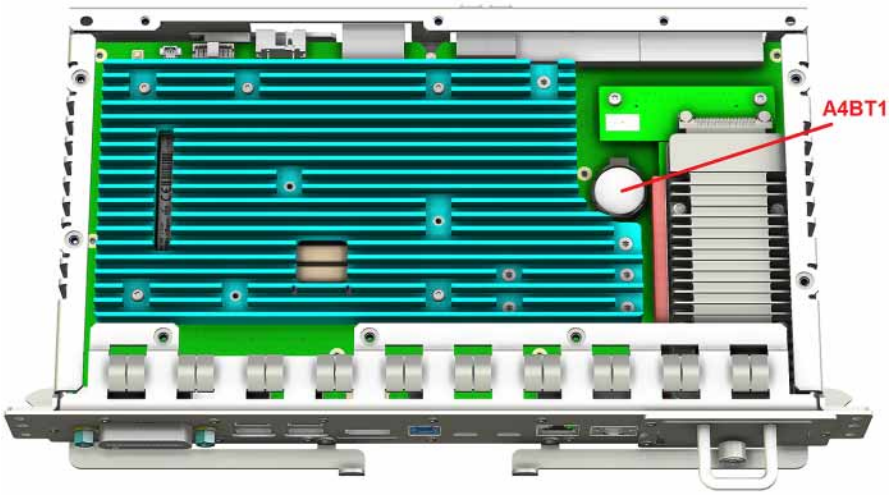
While the instrument working calibration database is contained on the E: drive, if when the instrument first boots up and finds a newer database on the SD memory card it will prompt the user to select which database to use. This is intended for use when the A5 disk drive assembly has been changed and the calibration database needs to be transferred to it.

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.

The typical location for the A4BT1 Processor Battery can be seen in Figure 13-5.

Figure 13-5 A4BT1 Processor Battery Typical Location



Boot-Up or Initialization Problems

Typical failures of the A4 System Processor 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 System Processor assembly, first see the "Instrument Boot Up Process" section in Chapter 2, "Boot Up and Initialization," to eliminate other possibilities.

BIOS Settings

As with other types of PC processor assemblies the A4 System Processor assembly has a number of settings particular to its hardware. These settings are saved in a separate memory location on the assembly 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

Overview

The A5 Disk Drive is a solid state drive. There are different drive capacities and types that have been used, and due to continual changes being made by the drive manufacturers these will continue to change from time to time. While the PC6 and PC8 system processors have a 2.5 inch solid state disk drive, as seen in Figure 13-6, the PCA system processors have an M.2 solid state drive, as seen in Figure 13-7.

Figure 13-6 PC6 and PC8 A4 Disk Drive – 2.5 Inch

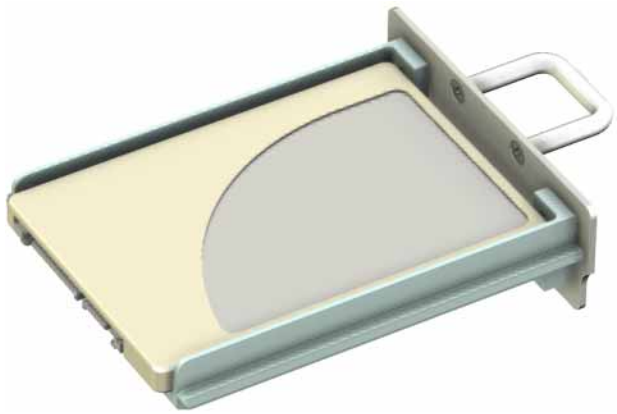
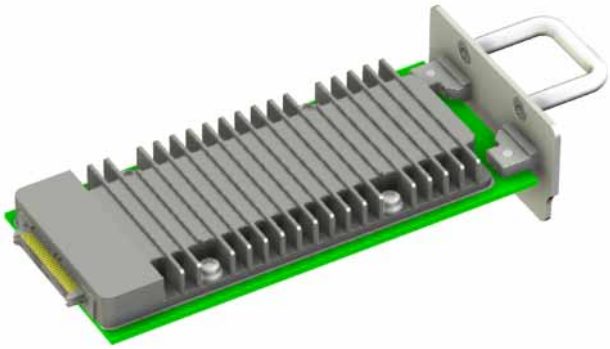


Figure 13-7 PCA A4 Disk Drive - M.2



Failures of the 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 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 section titled "Instrument Calibration Database" in Chapter 3, "Instrument Information and Calibration Data."

Partitioning

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. The user is responsible for backing-up the data on the D: drive. This allows them 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 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 the instrument to not meet specifications, or even to stop functioning correctly. While data saved in this partition will not be lost if the recovery process is run, do not use this drive for data storage.

F.

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 “Instrument Image Recovery System” section later in this chapter.

Troubleshooting Software Related Issues

The C: drive contains the instrument operating system software and the instrument application software. Boot problems can be caused by either a failure of the 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 "Instrument Image Recovery System" to reinstall the operating system and instrument application software as it was when it left the factory.

For information on reloading the instrument software, see Chapter 23, "Instrument Software and FPGAs."

Instrument Image Recovery System

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:

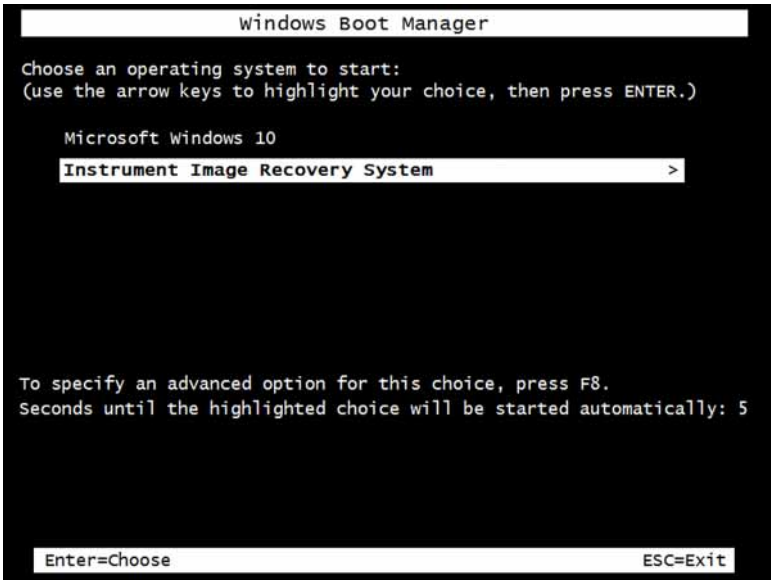
- Operating system configurations that were changed after the instrument was shipped from the factory. For example, service pack updates, user accounts, and windows configuration settings. After a recovery, these configurations will have to be redone by the end user.
- Additional software that was installed 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.

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 windows boot manager screen as seen in Figure 13-8 will be displayed for 5 seconds.**

Figure 13-8 Windows Boot Manager



4. Press the down arrow key to move the highlight to **Instrument Image Recovery System**, then press the **Enter** key.
5. When the Instrument Image Recovery System has booted, follow the on-screen instructions to recover the image of the C: drive.
6. After exiting the Instrument Image Recovery System, the instrument will reboot a few times.
7. Update the instrument application software to the latest version by downloading it from the following location.

   https://www.keysight.com/find/uxa_software

14 Power Supply and Cooling Fans

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 310

A6 Power Supply on page 311

Overview on page 311

Functional Verification on page 315

Instrument Cooling Fans on page 319

Overview on page 319

Troubleshooting on page 321

Overview

This chapter covers the instrument power supply and the fans that keep it, and the rest of the instrument cool.

NOTE

The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

A6 Power Supply

Overview

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 14-1 A6 Power Supply

The power supply outputs and the connections of the A6 Power Supply to the A7 Midplane board are as listed in Table 14-1, and seen in Figure 14-2.

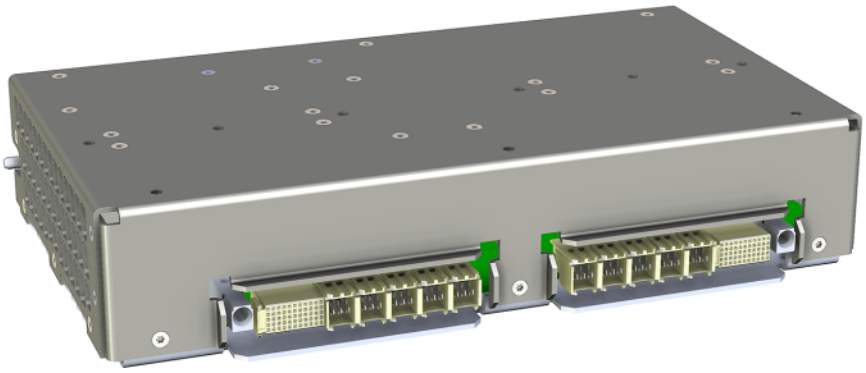
Table 14-1 A6 Power Supply Voltages

Type	Voltage	Reference
Standby	+5.1 V Standby	DCOM
	+15 V Standby	ACOM
Digital	+3.35 V Digital	DCOM
	+5.1 V Digital	DCOM
	+12 V Digital	DCOM
Analog	+5.2 V Analog	ACOM
	+9 V Analog	ACOM

Table 14-1 A6 Power Supply Voltages

Type	Voltage	Reference
	+15 V Analog	ACOM
	+32 V Analog	ACOM
	-7 V Analog	ACOM
	-15 V Analog	ACOM
Misc.	Fan_P	FAN_N

Figure 14-2 A6 Power Supply Outputs



The two standby supplies should always be on if the AC input voltage requirements are met. These are the +15 V Standby and the +5.1 V Standby supplies. These supplies are used by the instrument to keep certain circuits alive even when the power is turned off.

Control Inputs and Outputs

There are several control inputs and outputs to and from the A6 Power Supply. While it is not possible to access test points in the instrument to monitor these, it is good to have a working knowledge of them to understand how the instrument functions.

POWER_ON_L

This is a signal that when pulled low tells the A6 Power Supply assembly to turn on all its outputs. This signal comes from the A4 System Processor assembly and is initiated by pressing the front panel power button.

DITHER

This 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.

POWER_OK

This 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.

FAULT_L

This will be a TTL low level signal to indicate that the supply is experiencing an over voltage, over current, or over temperature condition.

LINE_TRIGGER

This 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.

Built-in Protection

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 will turn off no later than 5 seconds after the beginning of the over current state. The power supply will remain off until the line voltage is removed and then reconnected. 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.

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 must be replaced.

Functional Verification

If there is any problem that appears to be power supply related, first see the Instrument "Instrument Boot Up Process" section in Chapter 2, "Boot Up and Initialization," to determine if there is another assembly in the instrument that is causing the problem before proceeding with troubleshooting of the A6 Power Supply.

WARNING Do not remove the cover from the A6 Power Supply for any reason. There are no internal serviceable parts or fuses that can be replaced during servicing. The A6 Power Supply is replaced as a unit, no lower level part replacement is supported.

Power Supply Voltages and Status LEDs

There are no status LEDs or test points on the A6 Power Supply itself. However, there is a status LED near the top of the A7 Midplane board for all twelve of the voltages that originate on the A6 Power Supply, along with two other voltages that are regulated on the A7 Midplane board. A list of the voltages can be seen in Table 14-2, and the location of the LEDs for each can be seen in Figure 14-3 and Figure 14-4.

Table 14-2 A6 Power Supply Voltages

Supply Voltage	Regulated On	LED	Test Point
+3.3 V Analog	A7 Midplane Board	DS13	TP20
+3.35 V Digital	A6 Power Supply	DS9	TP14
+5.1 V Standby	A6 Power Supply	DS12	TP2
+5.1 V Digital	A6 Power Supply	DS10	TP15
+5.2 V Analog	A6 Power Supply	DS5	TP11
+9 V Analog	A6 Power Supply	DS6	TP10
+12 V Digital	A6 Power Supply	DS11	TP1
+15 V Standby	A6 Power Supply	DS2	TP6
+15 V Analog	A6 Power Supply	DS4	TP8
+32 V Analog	A6 Power Supply	DS3	TP7
-5.2 V Analog	A7 Midplane Board	DS14	TP21
-7 V Analog	A6 Power Supply	DS8	TP12
-15 V Analog	A6 Power Supply	DS7	TP13
Fan	A6 Power Supply	DS1	TP4

Figure 14-3 A7 Midplane Power Supply Status LED and Test Point Location - Front

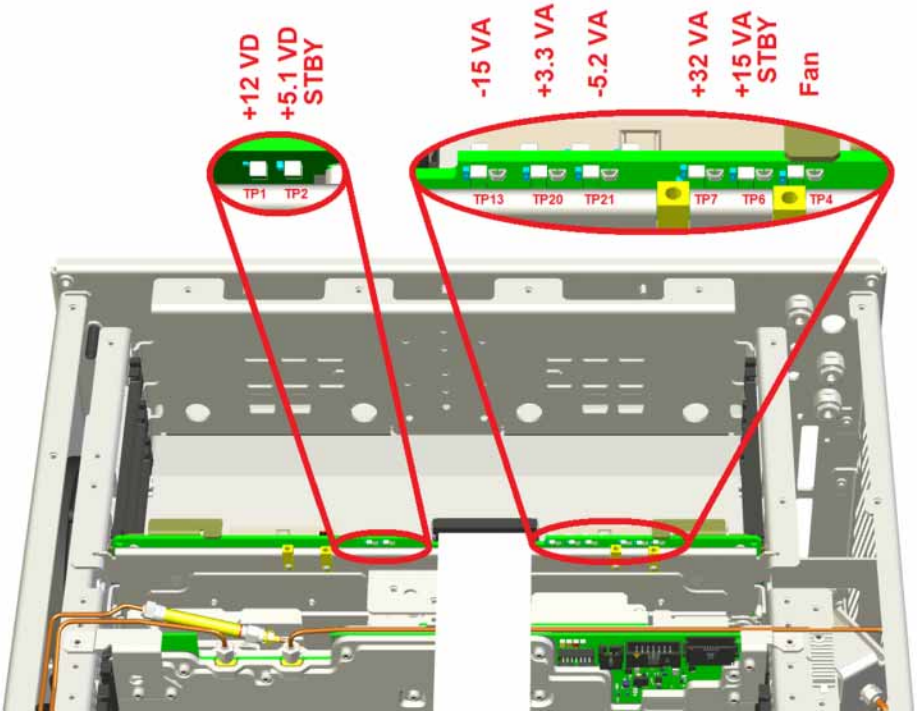
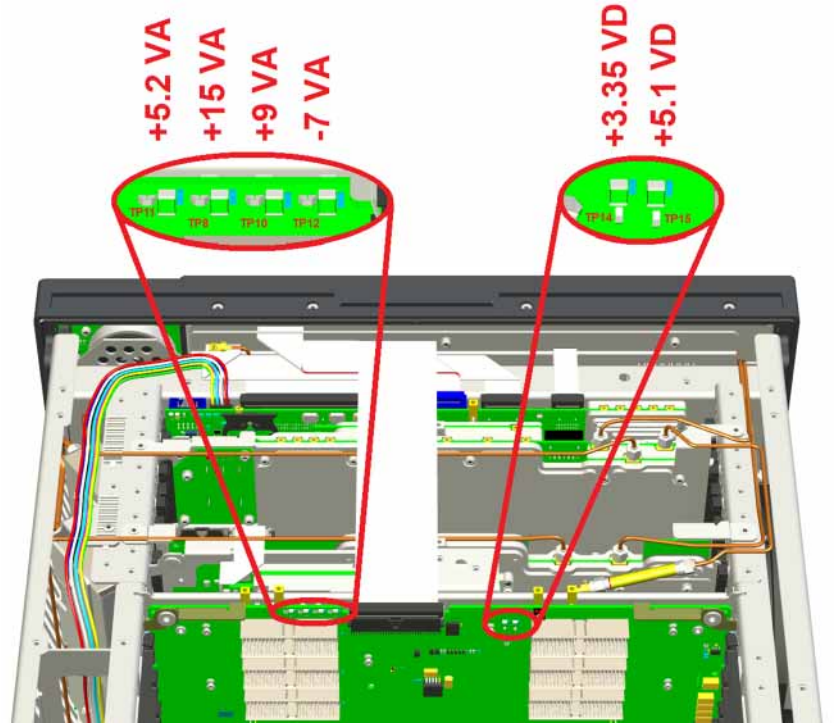


Figure 14-4 A7 Midplane Power Supply Status LED and Test Point Location - Rear



When the instrument is plugged into the proper AC mains the two green standby LEDs should be on.

When the instrument is turned on all fourteen green power supply LEDs should be on. If there is any question as to the actual voltage level of any of these supplies, there is a test point above each LED that could be measured with a DC voltmeter.

If none of the power supply voltages come on when the instrument is turned on, see the "Instrument Boot Up Process" section in Chapter 2, "Boot Up and Initialization," to determine what the cause is.

Additional Power Supply Regulation

The +3.3 V analog power supply is regulated on the A7 Midplane board from the +5.2 V analog supply that comes from the A6 Power Supply. If the +3.3 V is not working, first verify that the +5.2 V is working before replacing the A7 Midplane board.

The -5.2 V analog power supply is regulated on the A7 Midplane board from the -7 V analog supply that comes from the A6 Power Supply. If the -5.2 V is not working, first verify that the -7 V is working before replacing the A7 Midplane board.

Instrument Cooling Fans

Overview

With all the high performance, power consuming assemblies in this instrument it is vital to keep them all running at a controlled temperature. This is achieved using carefully designed and positioned heat sinks, heat pipes, and cooling fans. There are two large cooling fans in the instrument, as seen in Figure 14-5.

Figure 14-5 Cooling Fans

Fan Temperature Sensor and Control

There is a temperature sensor on the A7 Midplane board that feeds information back to the power supply, which regulates the speed of the three large instrument fans.

The connections to the fans from the A7 Midplane board can be seen on Figure 14-6.

Figure 14-6 A7 Midplane board Fan Connector Locations

Troubleshooting

If there are any problems with the running of any of the instrument fans, see the “Fan(s) Are Not Operating” section in Chapter 2, “Boot Up and Initialization,” to determine the cause of the problem.

15 Motherboards

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 324

A7 Midplane on page 325

- Overview on page 325
- Power Supply Voltages and Status LEDs on page 327
- Additional Power Supply Regulation on page 329
- Fan Temperature Sensor and Control on page 329
- Instrument Secure Storage on page 330
- 10 MHz Clock Distribution on page 331
- Power Supply Dithering on page 331

A8 Motherboard on page 332

A24 Interconnect Board on page 333

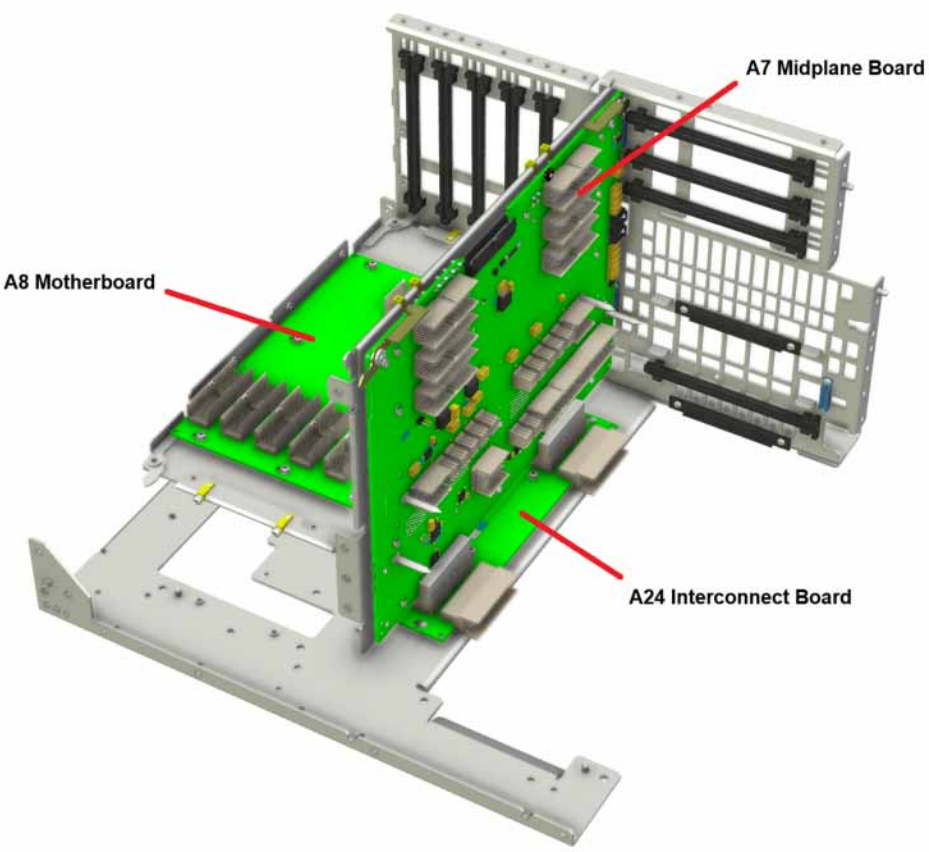
Overview

There three different board assemblies in the instrument that are considered motherboards, as their main function is to provide interconnects for the measurement and system board assemblies in the instrument. These are:

- A7 Midplane Board
- A8 Motherboard
- A24 Interconnect Board

The location of each of these motherboards can be seen in Figure 15-1.

Figure 15-1 Motherboard Locations



None of the motherboards covered in this chapter have memory on them to store its part number or serial number, so none are identified on the Hardware Information screen of the instrument.

NOTE The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

A7 Midplane

Overview

While the A7 Midplane board provides interconnection for many of the instrument measurement and system boards, it also provides many other vital functions, including:

- Power supply voltage test points and status LEDs
- Additional power supply regulation
- Fan temperature sensor and control
- Instrument secure storage
- 10 MHz clock distribution
- Power supply dither
- PCIe repeaters and reference clock buffer

The connections to and from the A7 Midplane board are listed in Table 15-1, as seen in Figure 15-2, and Figure 15-3.

Table 15-1 A7 Midplane Connections

Connector	Connects To	Connector	Connects To
J1	A6 Power Supply	J18	A4 System Processor
J2	A6 Power Supply	J19	A4 System Processor
J3	A6 Power Supply	J22	A8 Motherboard
J4	A6 Power Supply	J23	A8 Motherboard
J5	A6 Power Supply	J24	Optional Hardware
J6	A6 Power Supply	J25	Optional Hardware
J7	A6 Power Supply	J26	Optional Hardware
J8	A6 Power Supply	J27	Optional Hardware
J9	A6 Power Supply	J28	Optional Hardware
J10	A6 Power Supply	J30	B1 Fan Control
J11	A6 Power Supply	J31	B2 Fan Control
J12	A6 Power Supply	J32	A1A2 Front Panel Controller
J13	A4 System Processor	J36	A8 Motherboard
J14	A4 System Processor	J920	A24 Interconnect
J16	A4 System Processor	J921	A24 Interconnect
J17	Optional Hardware	P1	Not used

Figure 15-2 A7 Midplane Connector Locations - Back

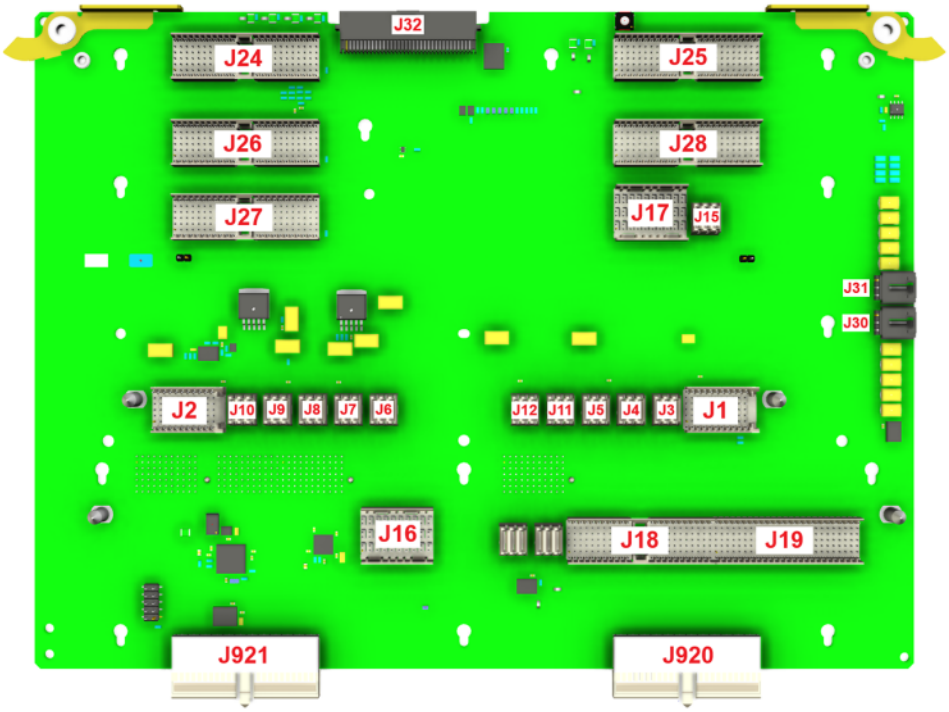
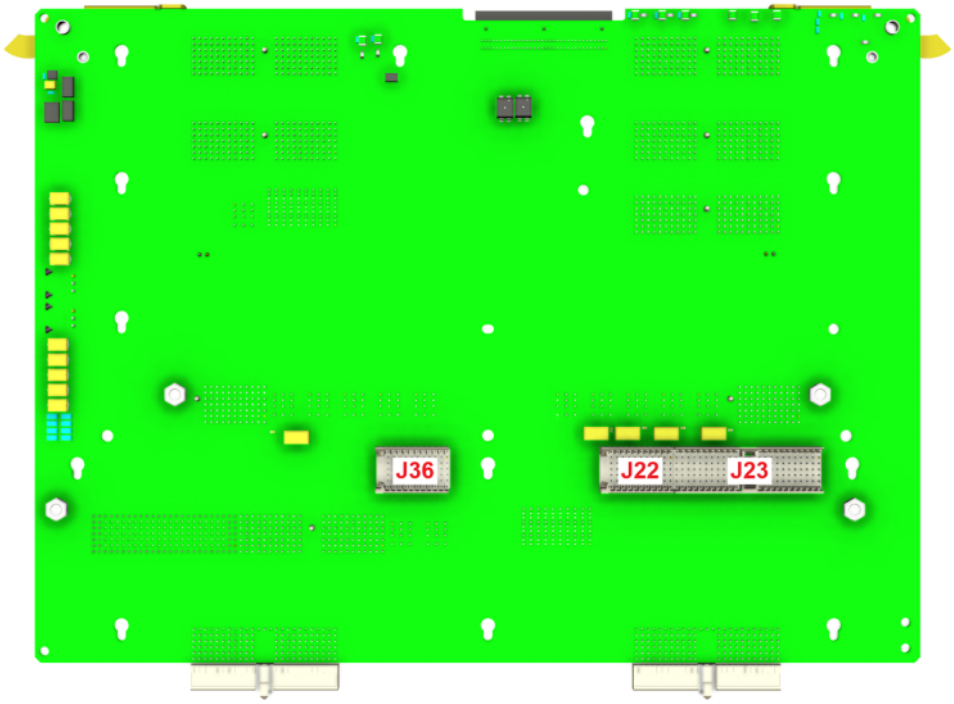


Figure 15-3 A7 Midplane Connector Locations - Front



Power Supply Voltages and Status LEDs

The A7 Midplane board has test points and status LEDs for all the power supply voltages that originate on the A6 Power Supply as well as a couple of voltages that are regulated on the A7 Midplane itself. A list of the voltages and where they originate can be seen in Table 15-2, and their location can be seen in Figure 15-4 and Figure 15-5.

Table 15-2 A7 Midplane Power Supply Voltage Levels and Status LED Designation

Supply Voltage	Regulated On	LED	Test Point	Board Side
+3.3 V Analog	A7 Midplane Board	DS13	TP20	Front
+3.35 V Digital	A6 Power Supply	DS9	TP14	Back
+5.1 V Standby	A6 Power Supply	DS12	TP2	Front
+5.1 V Digital	A6 Power Supply	DS10	TP15	Back
+5.2 V Analog	A6 Power Supply	DS5	TP11	Back
+9 V Analog	A6 Power Supply	DS6	TP10	Back
+12 V Digital	A6 Power Supply	DS11	TP1	Front
+15 V Standby	A6 Power Supply	DS2	TP6	Front
+15 V Analog	A6 Power Supply	DS4	TP8	Back
+32 V Analog	A6 Power Supply	DS3	TP7	Front
-5.2 V Analog	A7 Midplane Board	DS14	TP21	Front
-7 V Analog	A6 Power Supply	DS8	TP12	Back
-15 V Analog	A6 Power Supply	DS7	TP13	Front
Fan	A6 Power Supply	DS1	TP4	Front

Figure 15-4 A7 Midplane Power Supply Status LED and Test Point Location - Back

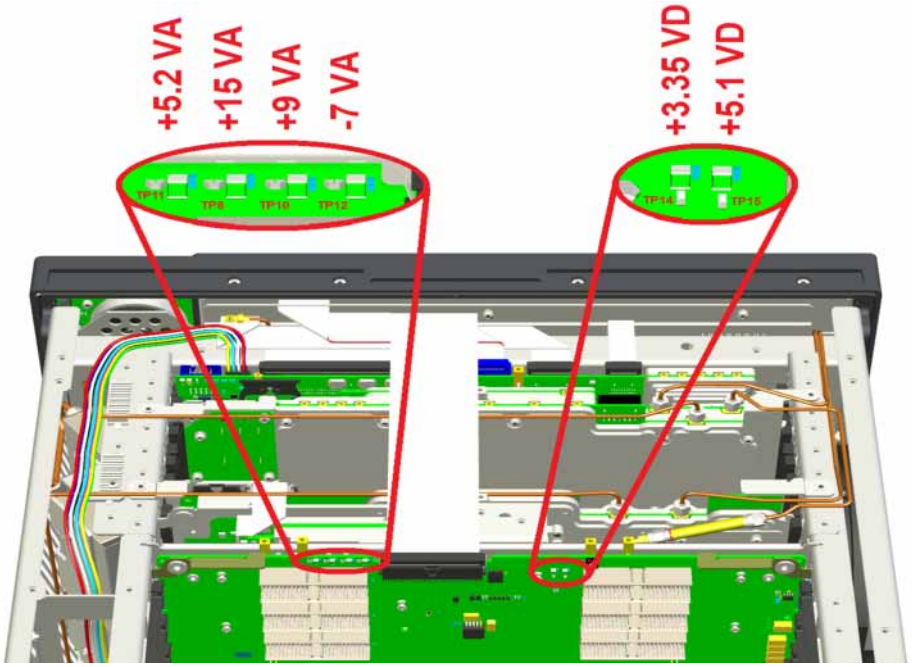
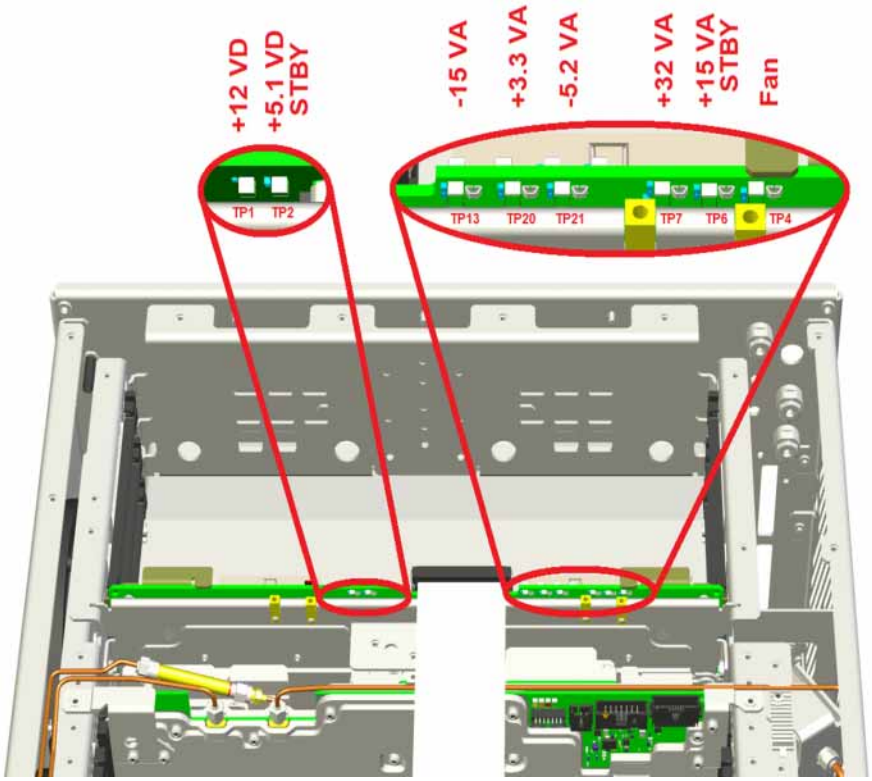


Figure 15-5 A7 Midplane Power Supply Status LED and Test Point Location - Front



When the instrument is plugged into the proper AC mains the two green standby LEDs should be on.

When the instrument is turned on all fourteen green power supply LEDs should be on. If there is any question as to the actual voltage level of any of these supplies, there is a test point next to each LED that can be measured with a DC voltmeter.

If none of the power supply voltages come on when the instrument is turned on, see the "Instrument Does Not Turn On" section in Chapter 2, "Boot Up and Initialization," to determine what the cause is.

Additional Power Supply Regulation

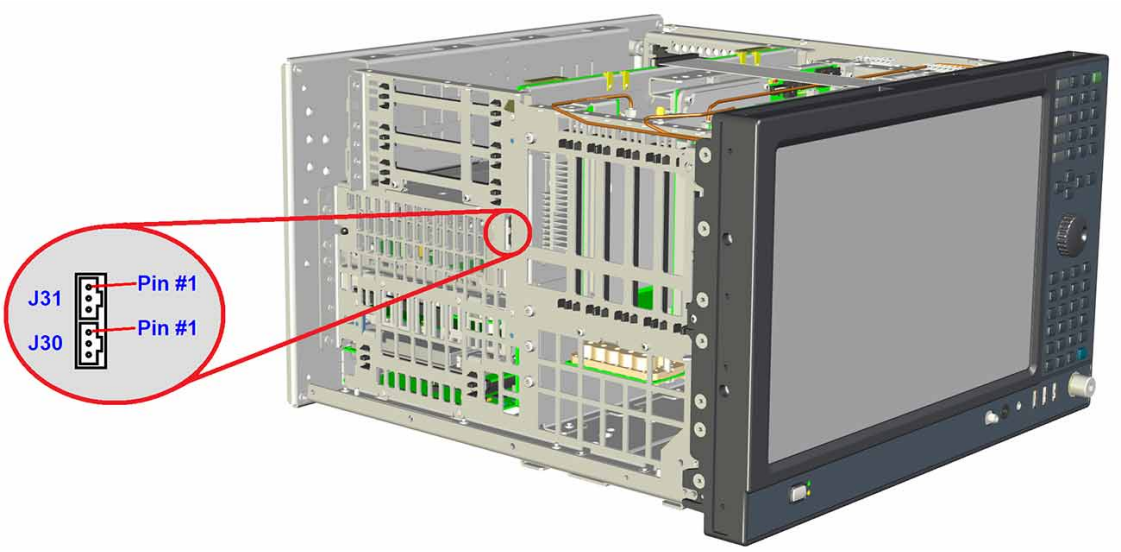
The +3.3 V analog power supply is regulated on the A7 Midplane board from the +5.2 V analog supply that comes from the A6 Power Supply. If the +3.3 V is not working, first verify that the +5.2 V is working before replacing the A7 Midplane board.

The -5.2 V analog power supply is regulated on the A7 Midplane board from the -7 V analog supply that comes from the A6 Power Supply. If the -5.2 V is not working, first verify that the -7 V is working before replacing the A7 Midplane board.

Fan Temperature Sensor and Control

There is a temperature sensor on the A7 Midplane board that feeds information back to the power supply, which regulates the speed of the two large instrument fans. The connections to the fans from the A7 Midplane board can be seen on Figure 15-6.

Figure 15-6 A7 Midplane Board Fan Connector Locations



If there are any problems with the running of any of the instrument fans, see the "Fan(s) Are Not Operating" section in Chapter 2, "Boot Up and Initialization," to determine the cause of the problem.

Jump Start Switch

There is a momentary switch (S1) mounted along the top of the A7 Midplane board that can be used to turn the instrument on and off if needed, as seen in Figure 15-7. This can be used to troubleshoot a front panel power switch problem.

Figure 15-7 A7 Midplane Board Jump Start Switch Location

Instrument Secure Storage

This is non-volatile storage of instrument model number, serial number, and software licenses. While the licenses 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 would need to be replaced.

10 MHz Clock Distribution

A 10 MHz clock signal that is generated on the A3 40 MHz Digital IF by dividing the 100 MHz reference signal that it gets from the A16 Reference is sent to the A7 Midplane board where it is buffered then routed through the motherboards of the instrument to the different measurement assemblies to synchronize data.

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 causing the problem.

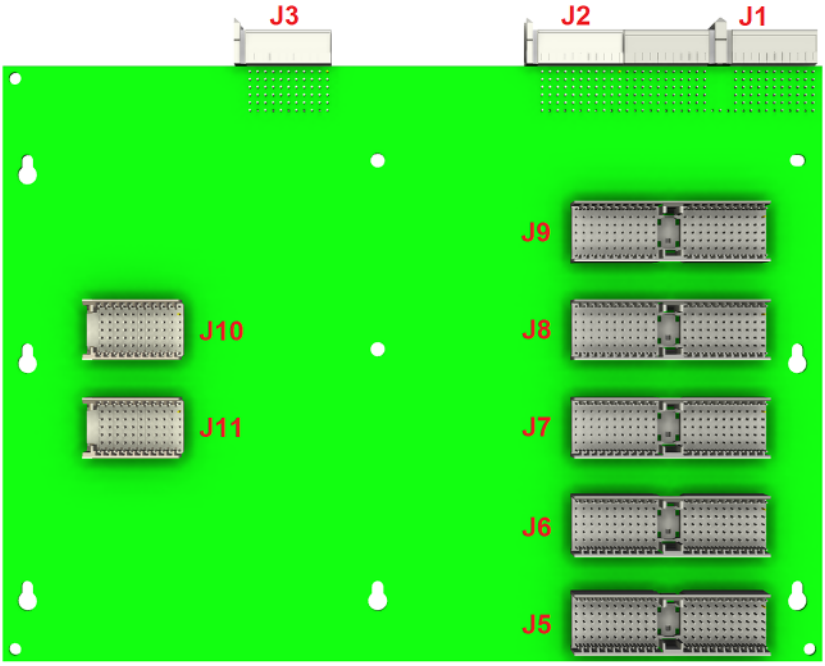
A8 Motherboard

The A8 Motherboard provides nothing more than interconnects for the measurement assemblies in the front card cage of the instrument. The connections to and from the A8 Motherboard are listed in Table 15-3, as seen in Figure 15-8.

Table 15-3 A8 Motherboard Connections

Connector	Connects To
J1	A7 Midplane Board
J2	A7 Midplane Board
J3	A7 Midplane Board
J5	A15 Front End Controller
J6	A16 Reference
J7	Not Used
J8	Optional Hardware
J9	A14 DDS LO Synthesizer
J10	Not Used
J11	Not Used

Figure 15-8 A8 Motherboard Connector Locations



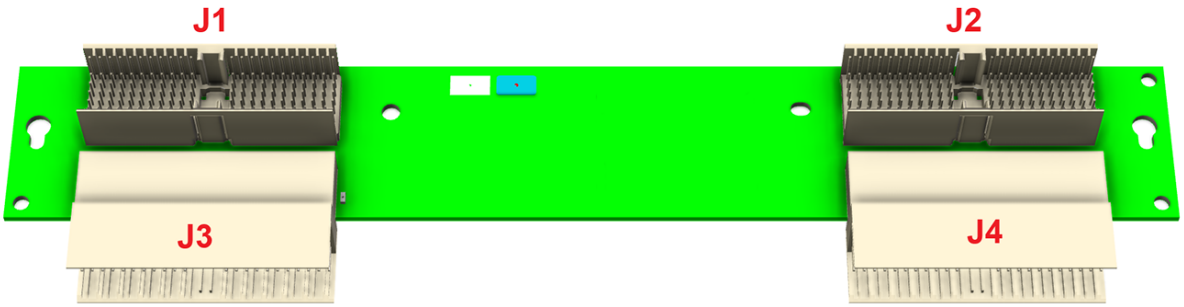
A24 Interconnect Board

The A24 Interconnect board provides nothing more than connection from the instrument to the A3 40 MHz Digital IF assembly. The connections to and from the A24 Interconnect board are listed in Table 15-4, as seen in Figure 15-9.

Table 15-4 A24 Interconnect Board Connections

Connector	Connects To
J1	A7 Midplane Board
J2	A7 Midplane Board
J3	A3 40 MHz Digital IF
J4	A3 40 MHz Digital IF

Figure 15-9 A24 Interconnect Board Connector Locations



16 Front Panel

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 336

A1A5 Front Panel Controller Board on page 339

A1A3 Touch Screen Display on page 341

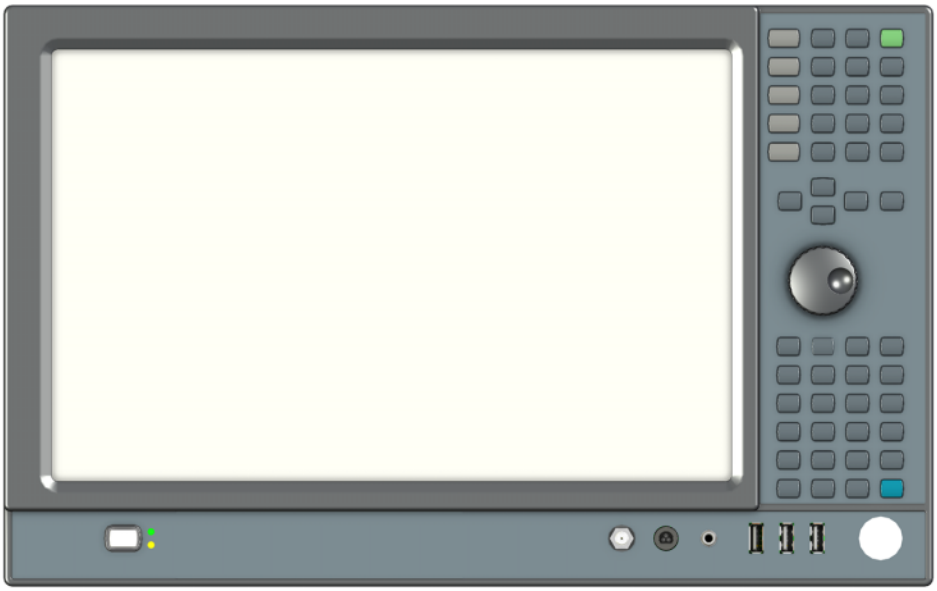
A1A4 DC to DC Converter Board on page 343

Miscellaneous on page 344

Overview

The A1 Front Panel assembly is used to display the measurement results, accept user input via the touch screen display and/or keyboard, and connect USB peripheral devices.

Figure 16-1 A1 Front Panel Assembly



The major components of the A1 Front Panel Assembly are:

- A1A2 Front Panel Keyboard
- A1A3 Touch Screen Display
- A1A4 DC to DC Converter Board
- A1A5 Front Panel Controller Board
- A1A6 Power Switch Board

Each of these components can be replaced individually if needed. The location of each can be seen in Figure 16-2 and Figure 16-3.

Starting with serial prefix MY/SG/US6442 the A1A5 DC to DC Converter board is no longer used. This function has been built into the newer A1A4 Touch Screen Displays.

Figure 16-2 A1 Front Panel Components - Serial Prefix >=MY/SG/US6442

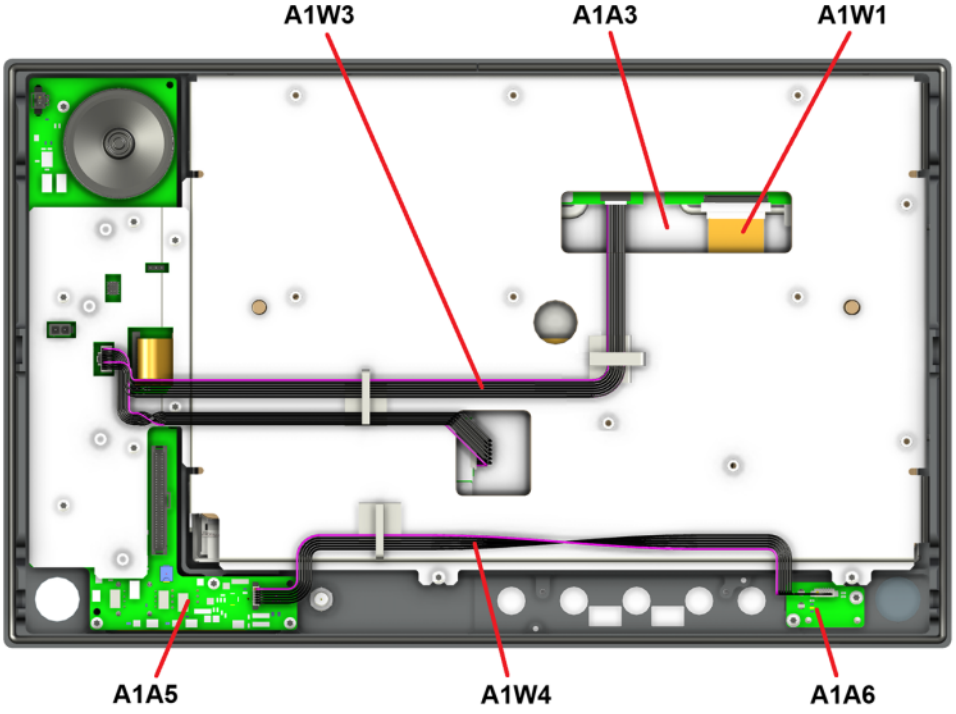
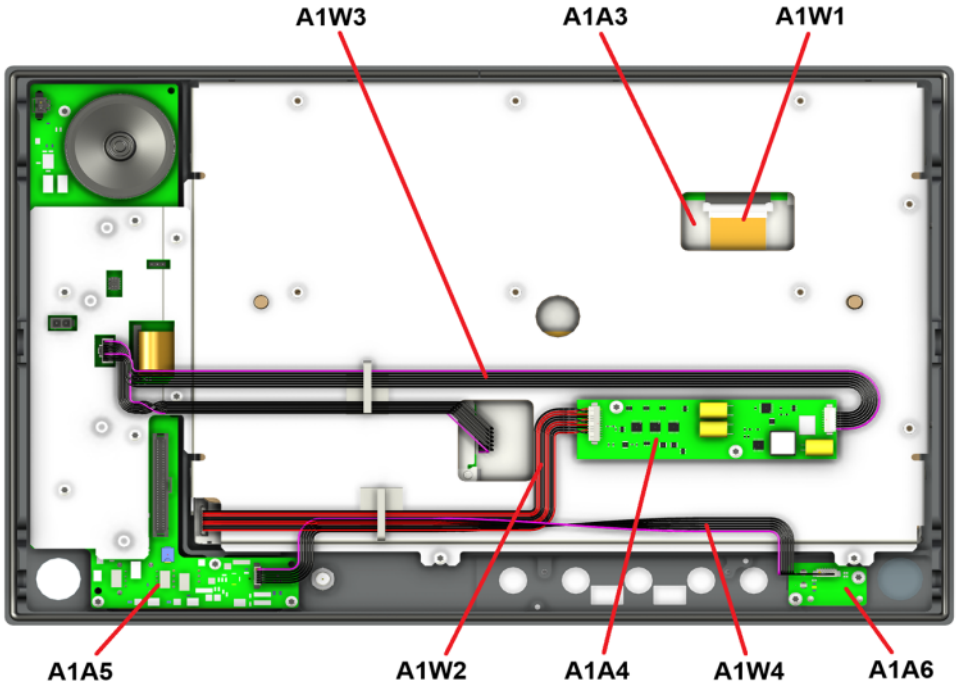


Figure 16-3 A1 Front Panel Components - Serial Prefix <MY/SG/US6442



NOTE

The removal of the instrument outer cover along with various inner sheet metal parts will be required to access the internal test ports and cables referenced in the functional verification procedures. If instructions are needed for any of this, see Chapter 20, “Assembly Replacement Procedures.”

A1A5 Front Panel Controller Board

The A1A5 Front Panel Controller board contains the following:

- LVDS buffers for LCD control
- Power supply regulators (+5 V, +3.3 V, and +2.5 V)
- USB 2 Hub
  - Front panel USB 2 ports
  - Keyboard controller
  - Touch screen interface
- Audio amplifier and speaker

The connections to and from the A1A5 Front Panel Controller are listed in Table 16-1, as seen in Figure 16-4 and Figure 16-5.

Table 16-1 A1A5 Front Panel Controller Connections

Port	Description	To/From	Cable
J2	Keyboard Interface	To A1A2 Main Keyboard J1	--
J4	Power Switch	To A1A6 Power Switch Keyboard J1	A1W4
J5	Audio Out	To Front Panel Headphone Jack	--
J7	USB 2	To Front Panel USB 2 Connector	--
J8	USB 2	To Front Panel USB 2 Connector	--
J11	Instrument Interface	From A7 Midplane J32	W1
J12	Probe Power	To Front Panel Probe Power	--
J13	Speaker	To Speaker	--
J15	LCD Control	To A1A3 Touch Screen Display	A1W1
J16	Backlight / Touch Control	To A1A3 Touch Screen Display	A1W3
MP6 J1	USB 2 High Power (1.5A)	To Front Panel USB 2 Connector	--

Figure 16-4 A1A2 Front Panel Controller Connections – Back Side

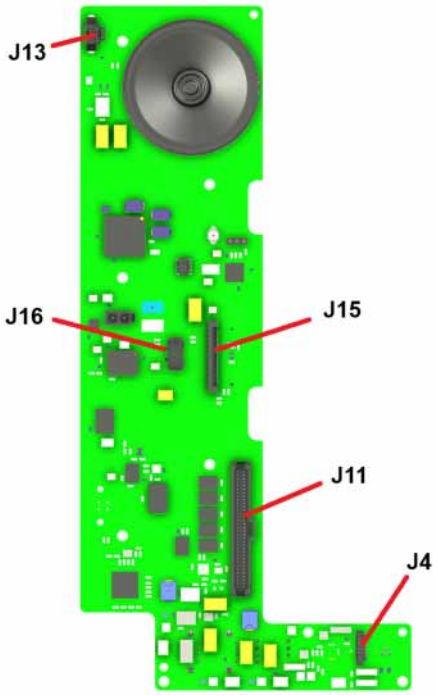
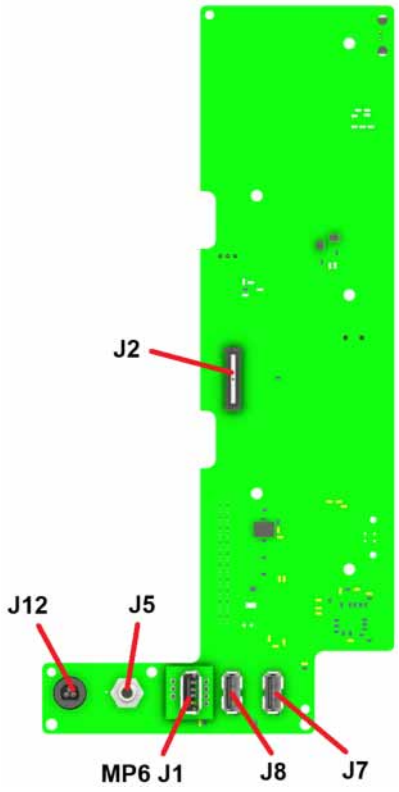


Figure 16-5 A1A2 Front Panel Controller Connections – Front Side



A1A3 Touch Screen Display

The A1A3 Touch Screen Display is a 14.1 inch WXGA TFT display, which has a resolution of 1280 x 800. It has three connections to the instrument, which are listed in Table 16-2 and seen in Figure 16-6 and Figure 16-7.

Table 16-2 A1A3 Touch Screen Display Connections

Description	To/From	Cable
Display Control	From A1A5 Front Panel Controller J15	A1W1
LED Backlight Control	From A1A5 Front Panel Controller J16[a]	A1W3[b]
USB Touch Control	From A1A5 Front Panel Controller J16	A1W3

a. From A1A4 DC to DC Converter J2 for serial prefix <MY/SG/US6442.
b. A1W2 for serial prefix <MY/SG/US6442.

Figure 16-6 A1A3 Touch Screen Display Connections - Serial Prefix >=MY/SG/US6442

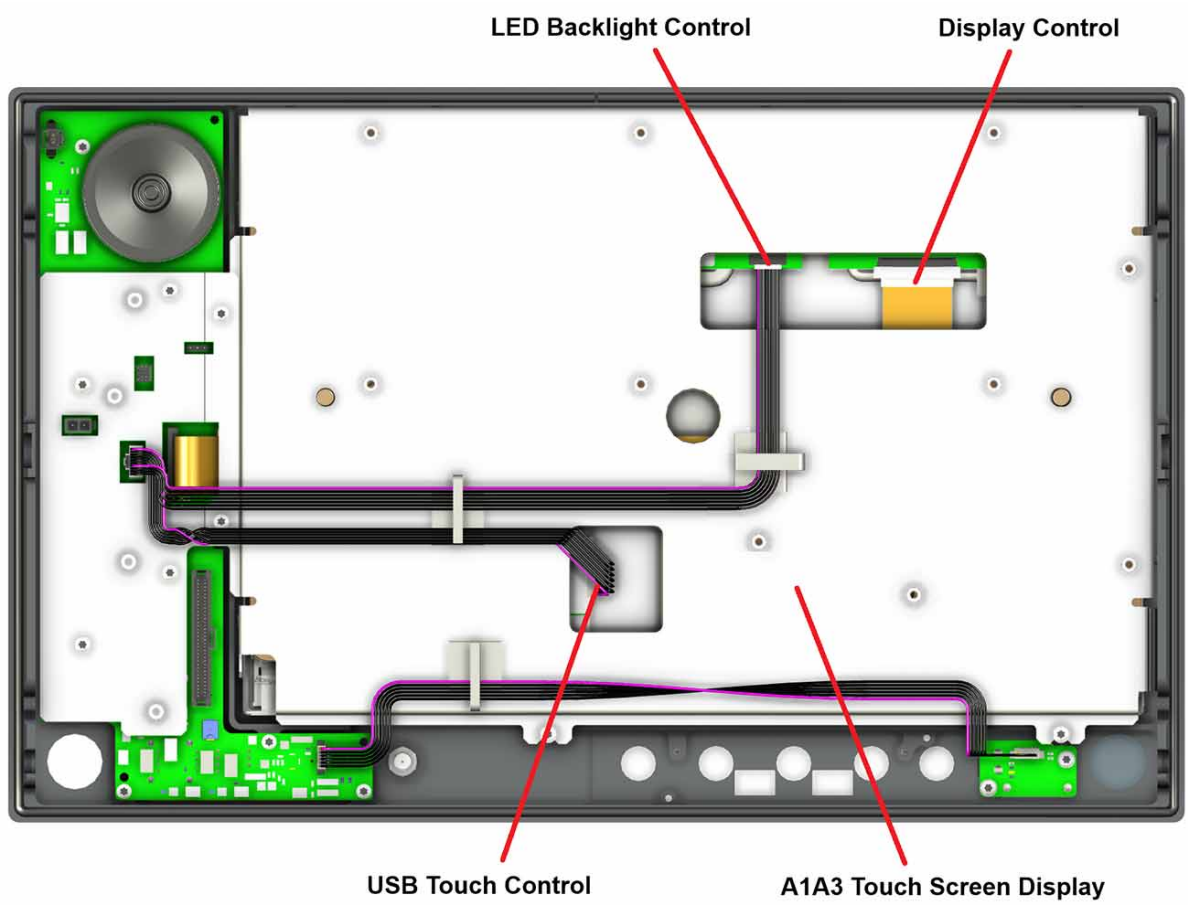
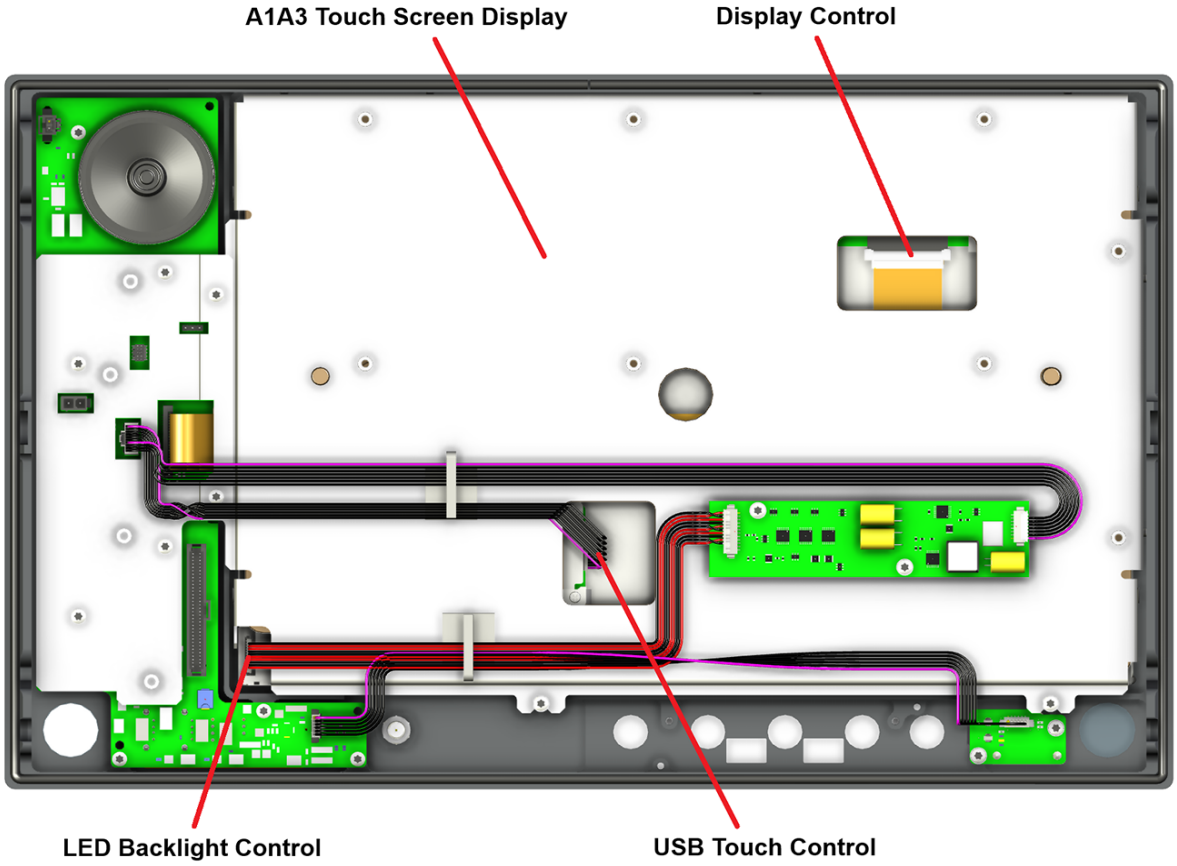


Figure 16-7 A1A3 Touch Screen Display Connections - Serial Prefix <MY/SG/US6442



If there is a question as to whether the display is working or not, see the "Troubleshooting a Blank Display" section in Chapter 2, "Boot Up and Initialization," to determine what the cause is.

A1A4 DC to DC Converter Board

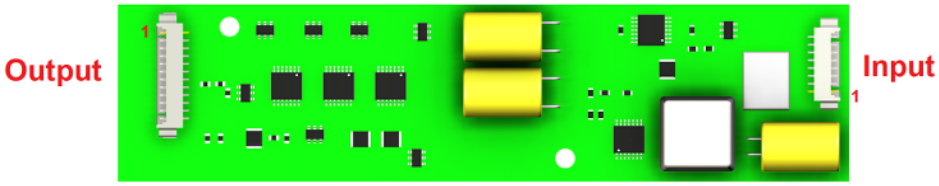
NOTE The A1A5 DC to DC Converter board is only used in instruments with a serial prefix <MY/SG/US6442. This functionality is built into the new A1A3 Touch Screen Displays.

The A1A4 DC to DC Converter board provides the power required by the LED backlights in the A1A3 Touch Screen Display. The connections to and from the A1A4 DC to DC Converter are listed in Table 16-3 and seen in Figure 16-8.

Table 16-3 A1A4 DC to DC Converter Connections

Description	To/From	Cable
Input	From A1A5 Front Panel Controller J16	A1W3
Output	To A1A3 Touch Screen Display	A1W2

Figure 16-8 A1A4 DC to DC Converter Board Connections



The input from the A1A5 Front Panel Controller should measure +12 volts DC on pins 1, 2, and 3. Pin 7 is an enable line which should always measure +3 volts DC. Pins 4, 5, and 6 are ground.

The output should measure +25 volts DC on pins 2, 4, 6, 8, and 10. The other pins are all ground.

If there is a question as to whether the display backlight is working or not, see the "Troubleshooting a Blank Display" section in Chapter 2, "Boot Up and Initialization," to determine what the cause is.

Miscellaneous

There are a few other miscellaneous parts on the A1 Front Panel assembly worth noting. They are:

- A1A2 Main Keyboard
- A1A6 Power Switch Board

A1A2 Main Keyboard

The A1A2 Main Keyboard plugs directly onto the A1A5 Front Panel Controller. It hosts the front panel rotary pulse generator (RPG) and has a series of contacts that the A1MP1 Main Keypad activates when a key is pressed. Other than an RPG failure, the A1A2 Main Keyboard should never need to be replaced.

A1A6 Power Switch Board

The A1A6 Power Switch Board hosts the front panel standby and power on LEDs along with the contacts for the momentary front panel power switch that the A1MP2 Power Switch Keypad activates when pressed. If there is a problem with the instrument turning on, see the “Instrument Does Not Turn On” section in Chapter 2, “Boot Up and Initialization,” to determine what the cause is. If either of the power status LEDs do not turn on, see the “Typical instrument boot-up process flow” section in Chapter 2, “Boot Up and Initialization,” to determine why.

17 Hardware Options

What You Will Find in This Chapter

The following information is found in this chapter.

A21 Wideband Analog IF Troubleshooting on page 347

A22 Wideband Digital IF Troubleshooting on page 353

Option RTS, Real-Time I/Q Data Streaming on page 354

Option H1G, 1 GHz Analysis Bandwidth Assembly on page 356

The UXA signal analyzer has a variety of hardware options that can be purchased and installed at the time of new instrument sale, or as a post-sale upgrade. Some of these hardware options require the installation of additional hardware, and others require licensing hardware already present in the standard instrument hardware configuration.

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

https://www.keysight.com/find/UXA_upgrades

A21 Wideband Analog IF Troubleshooting

A21 Wideband Analog IF Assembly Description

The analyzer's RF input signal is down converted to a 250 MHz, 750 MHz, or 877.148 MHz intermediate frequency by the A13 Front End assembly and routed through the A15 Front End controller to A15J901. Cable W41 connects to A21J17 Wideband Analog IF Input. The signal is filtered, attenuation and gain applied based upon the instrument settings. This signal is then sampled by the ADC and the resultant data is the sent to the A22 Wideband Digital IF (Option B2X) for processing via the flex circuit cable. If the instrument has Option B5X, 510 MHz Analysis BW, the resultant data is sent to the A22 and A23 Wideband Digital IF boards.The A22 and A23 Wideband Digital IF have no service accessible locations and should be troubleshot from the front panel controls.

The frequency of the IF input to the A21 Wideband Analog IF varies depending on the IF signal path being used. The ADC and DSP used also depends on the IF signal path. These dependencies can be seen in Table 17-1.

Table 17-1 IF Signal Path versus Frequency, ADC, and DSP

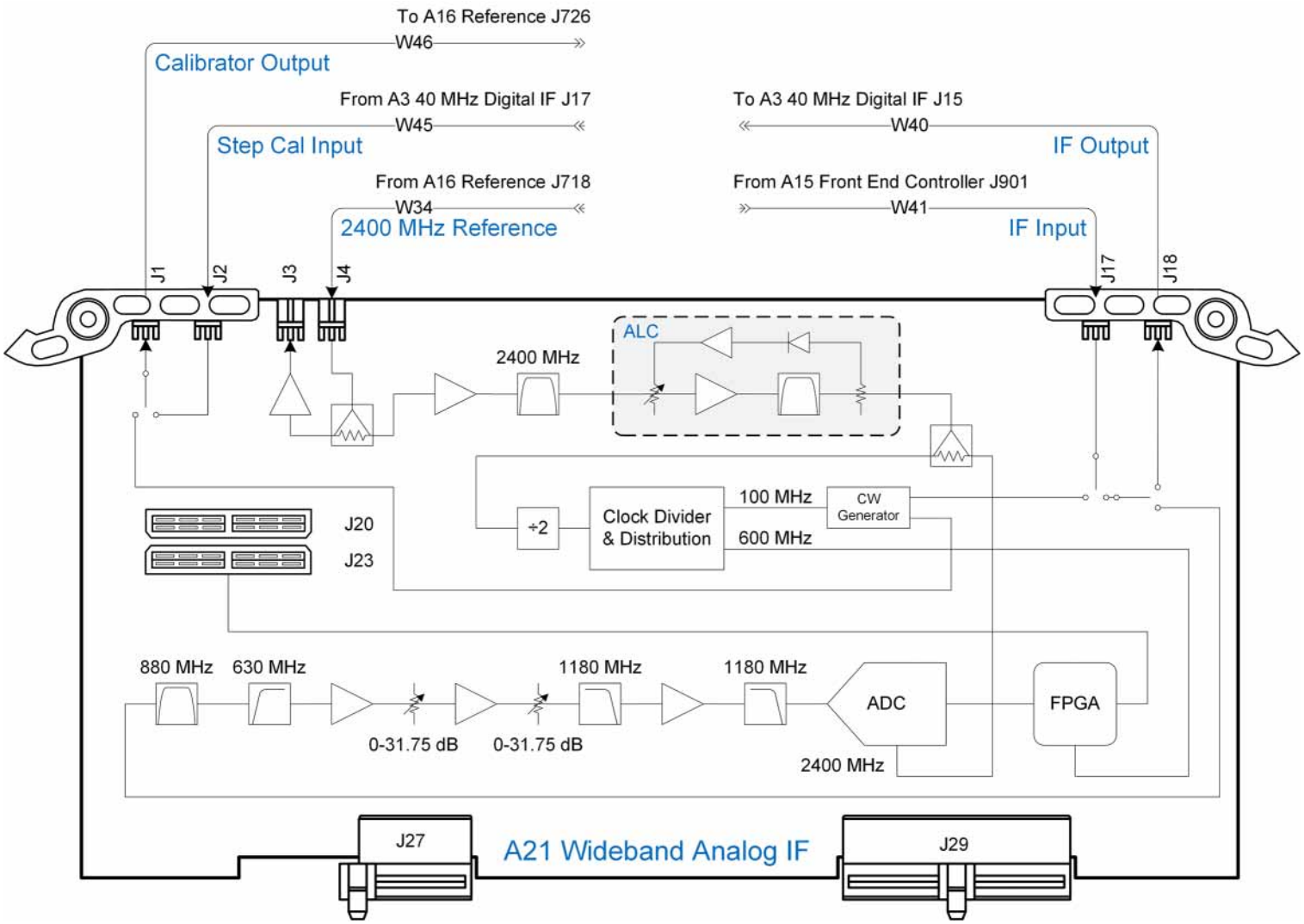
IF Path	Frequency	ADC	DSP
40 MHz	250 MHz	A3 40 MHz Digital IF	A3 40 MHz Digital IF
255 MHz	750 MHz	A21 Wideband Analog IF	A22 Wideband Digital IF
510 MHz	877.148 MHz	A21 Wideband Analog IF	A22 & A23 Wideband Digital IFs

The inputs and output to and from the A21 Wideband Analog IF can be seen in Table 17-2.

Table 17-2 A21 Wideband Analog IF Connections

Port	Description	To/From	Cable
J1	Calibrator Output	To A16 Reference J726	W46
J2	Step Cal Input	From A3 40 MHz Digital IF J17	W45
J3	2400 MHz Output	Not Used	--
J4	2400 MHz Reference input	From A16 Reference J718	W34
J17	IF Input	From A15 Front End Controller J901	W41
J18	IF Output	To A3 40 MHz Digital IF J15	W40
J23	ADC Data Output	To A22 Digital IF J778	W56 & W57
J27	Digital Card Cage	To/From A8 Motherboard J10	--
J29	Analog Card Cage	To/From A8 Motherboard J8	--

Figure 17-1 A21 Wideband Analog Block Diagram



A21 Wideband Analog IF Assembly Theory of Operation

The A21 Wideband Analog IF assembly primary role is to properly filter and apply attenuation or gain to optimize the level going to the ADC and provide sufficient pre-filtering to reject images that would otherwise interfere with the signal of interest. Precision alignments are used to calibrate the filters, attenuators and gain of this assembly. It is not uncommon that the reported failure will come from failures reported when an alignment fails for this assembly. The alignment history file is a good indicator of a failure for this assembly. This file is a text file that can be viewed using a text editor. The file is located in the following location:

E:\AlignDataStore\AlignmentHistory.txt

This file will list all alignments that have passed or failed. Alignments reporting a failure of the WBAIF assembly can in many cases be attributed to failure of this assembly. If however these errors follow errors in the RF section of the instrument, it is possible that additional WBAIF error will appear due to missing RF Calibration signals and not related to the A21 Wideband IF assembly.

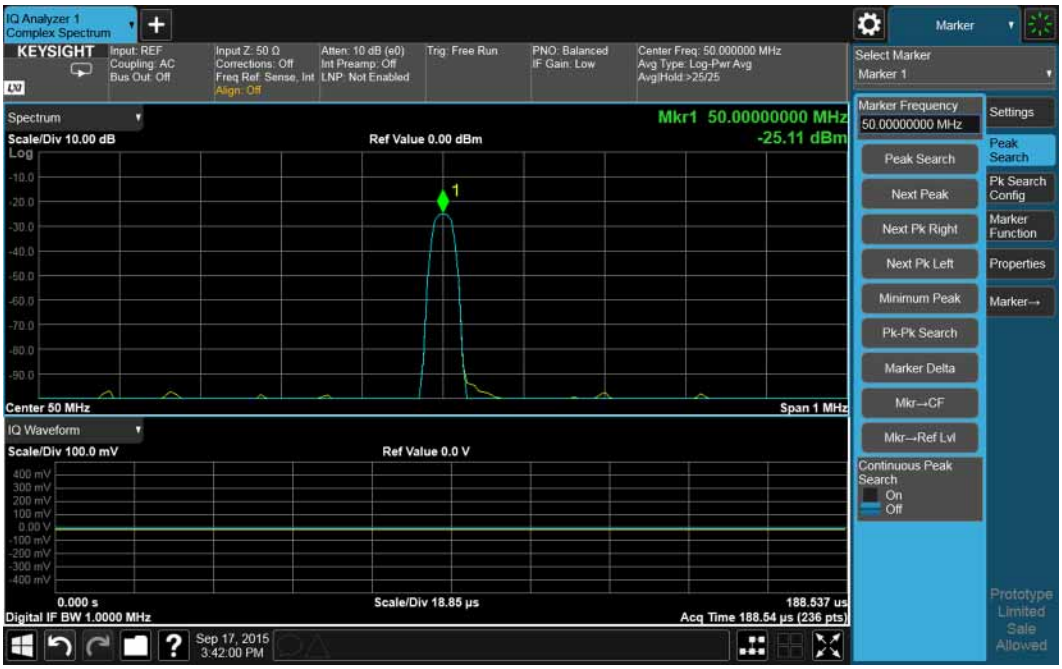
Manually troubleshoot the assembly is basically verifying the proper IF signal at J17 is present and at the proper level. In addition you will want to verify input and output levels of the various calibration and reference signals.

A21 Wideband Troubleshooting

Verify the J17 IF Input level

1. Turn the instrument off.
2. Remove the instrument enclosure and top brace covers. Refer to Chapter 20, “Assembly Replacement Procedures” in this service guide.
3. Turn on the signal analyzer and wait for the instrument to complete the boot up process.
4. Press **System**, **Alignments**, **Auto Align**, **Off**.
5. Press **Mode/Meas**, **IQ Analyzer (Basic)**, **Complex Spectrum**, **OK**
6. Press **Input/Output**, **RF Calibrator**, **50 MHz**
7. Press **Frequency** hard key and set the center frequency to 50 MHz.
8. Press **Meas Setup**, **IF Path**. Tap **IF Path** and choose **255 MHz** or **510 MHz** from the drop down menu. If Option B5X, 510 MHz, is installed, there is no 255 IF Path selection. Choose **510 MHz** in this case.
9. Verify the 50 MHz signal is at –25 dBm on the analyzer display by pressing **Peak Search** on the analyzer. The marker readout should be 50 MHz at –25 dBm ±3 dB. See Figure 17-2. If this reference signal is measuring incorrectly, see Chapter 7, “RF Section (RF/Microwave)” in this service guide.

Figure 17-2 50 MHz Signal



Verify the J18 Output

The J18 output is active only when the 40 MHz IF path is selected.

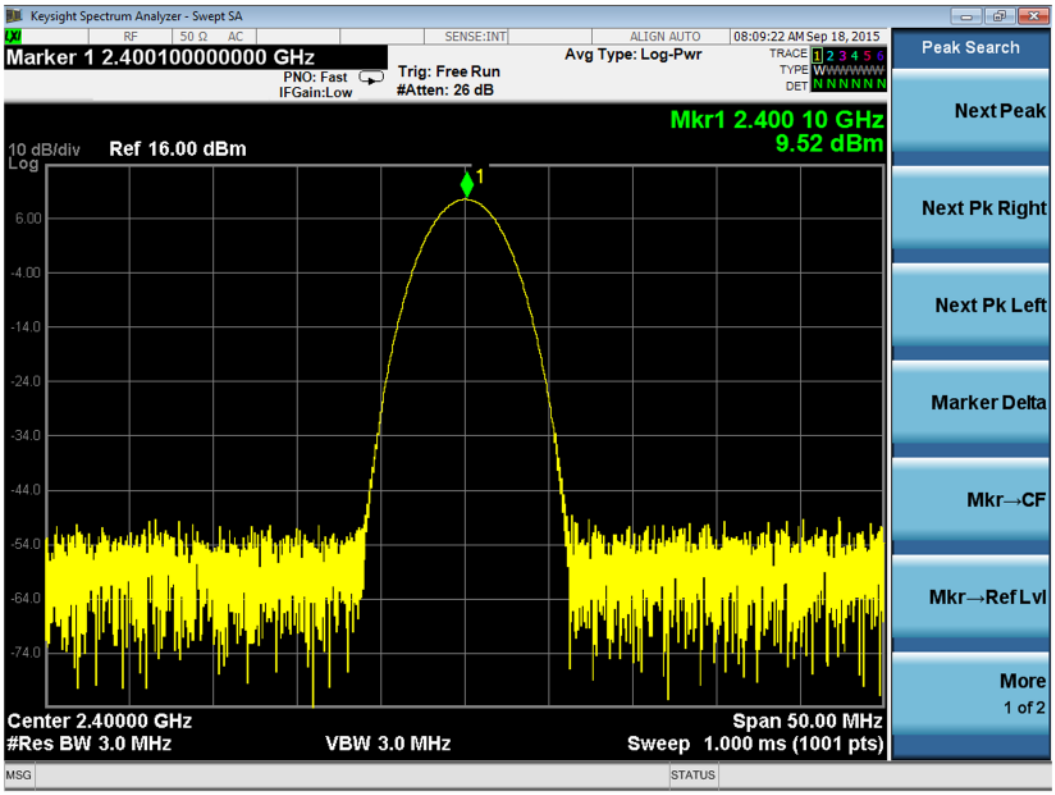
The following test can be used to assure the W41 cable and the switch on the A21 Wideband AIF are good.

1. To select the 40 MHz IF path, press **Meas Setup**, **IF Path**. Tap **IF Path** and choose **40 MHz** from the drop down menu.
2. Turn on the 50 MHz calibrator as explained in the last section. Set the center frequency to 50 MHz. Set the span to 0 Hz.
3. Connect A21J18 to a known good spectrum analyzer. Tune the spectrum analyzer to 250 MHz. This port switches the 250 MHz IF that is input to the A21 Wideband Analog IF to be routed to the A3J15 40 MHz Digital IF. If this –23 dBm ±3 dB signal is present, you have verified the 250 MHz IF from the A15J901 Front End Controller. If this signal is not present, verify the signal is present on A15J901 of the A15 Front End Controller.

Verify the 2400 MHz Frequency Reference

1. Turn the instrument off.
2. Remove the instrument cover. Refer to Chapter 20, “Assembly Replacement Procedures” in this service guide.
3. Turn on the signal analyzer and wait for the instrument to complete the boot up process.
4. Press **System**, **Alignments**, **Auto Align**, **Off**.
5. Press **Mode/Meas**, **IQ Analyzer**, **Complex Spectrum**, **OK**.
6. Press **Input/Output**, **RF Calibrator**, **50 MHz**
7. Press **Meas Setup**, **IF Path**. Tap **IF Path** and choose **255 MHz** or **510 MHz** from the drop down menu.
8. Verify the 50 MHz signal is at –25 dBm on the analyzer display by pressing **FREQ**, **50 MHz**, **SPAN**, **1 MHz**, **Peak Search** on the analyzer. The marker readout should be 50 MHz at –25 dBm ±3 dB. If this reference signal is measuring incorrectly, see Chapter 7, “RF Section (RF/Microwave)” in this service guide.
9. Connect a known good spectrum analyzer to A21J3. Verify reference signal at 2400 MHz at a level of + 9 dBm.

Figure 17-3 2400 MHz Signal



A22 Wideband Digital IF Troubleshooting

Normally failure of this assembly will occur during extensive alignments. Verify if there are alignment error related to the WBDIF located in the E:\AlignDataStore\AlignmentHistrory.txt files.

If errors are found related to WBDIF replace the A22 Wideband Digital IF assembly. To troubleshoot this module set the instrument up as below:

1. Turn on the analyzer and wait for the instrument to complete the boot up process.
2. Press **System**, **Alignments**, **Auto Align**, **Off**.
3. Press **Mode/Meas**, **IQ Analyzer (Basic)**, **Complex Spectrum OK**.
4. Press **Input/Output**, **RF Calibrator**, **50 MHz**
5. Press **Span**, **10 MHz**
6. Press **Meas Setup**, **IF Path**. Tap **IF Path** and choose **255 MHz** or **510 MHz** from the drop down menu.
7. Verify the 50 MHz signal is at –25 dBm on the analyzer display by pressing **Peak Search** on the analyzer. The marker readout should be 50 MHz at –25 dBm ±3 dB.
8. If this signal is not present, determine if the issue is only present with the Wideband 255 MHz or 510 MHz path. Press **Mode Setup**, **IF Path**, **40 MHz**. If the signal is now present, there is a likely failure of the A22 Wideband Digital IF or the A21 Wideband Analog IF

Option RTS, Real-Time I/Q Data Streaming

Description

Option RTS provides real time I and Q data to the instrument rear panel Wideband Digital Bus I and Q connectors.

External record and playback hardware is available from X-Com Systems to connect to the Option RTS rear panel ports.

Signal Analyzer Hardware Requirements

The signal analyzer must contain the Wideband Digital IF and Wideband Analog IF assemblies that are present when the analyzer has Option B2X or B5X.

To verify the option is licensed, and the Wideband Digital hardware is present, press **System**, **Show System** and verify the presence of one or more options listed above (when Option B5X is present, you will also see Option B2X).

Then press **System**, **Show Hardware** and confirm the instrument can identify the hardware. You will see both WB Analog IF and WB Digital IF listed. If Option B5X is installed, you will see two WB Digital IF assemblies listed.

The signal analyzer must contain the Wideband Digital IF Extension board. This board is also listed in the Show Hardware screen as WB DIF Extension.

The Wideband Digital IF Extension board is only present when Option RTS is installed in the instrument, and is located at the right rear of the instrument. The board has I and Q connectors that protrude out of slots in the rear panel, and are labeled Wideband Digital Bus.

The Wideband Digital IF Extension board provides buffering and level shifting to the I and Q signals that come from the Wideband Digital IF assembly via a flex circuit cable. If the instrument contains Option B5X (two Wideband Digital IF assemblies), there will be two flex cables.

Software Requirements

The instrument must have the following options installed:

– N9040B-RT1 or N9040B-RT2, Real Time Analysis

– N9040B-RTS Real Time Data Streaming

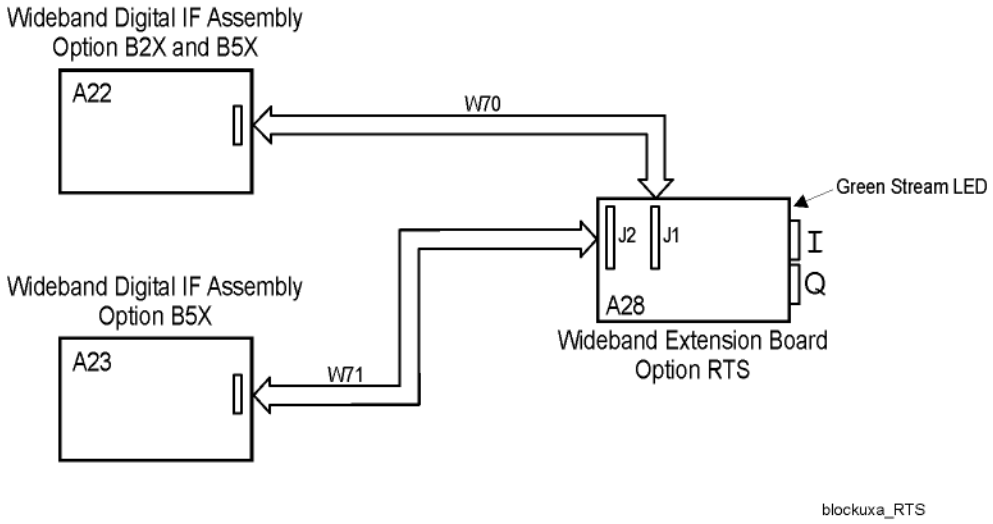
Press **System**, **Show System** and verify the options listed above are present.

Functionality Check

1. Enter Real Time Analysis mode by pressing **MODE/MEAS**. Select **Real-Time Spectrum Analyzer**, **OK**.
2. Press **Input/Output** and select **Output**.
3. Press **Wideband Digital Bus On** to activate the rear panel Wideband Digital Bus connectors, and then verify that the green Stream LED next to the I output connector on the rear panel is illuminated.

There is no easy way to determine if the I and Q data at the rear panel is correct. However if the instrument can complete the power on tests and alignments without an error, and you perform the functionality test above, Option RTS should be working correctly.

Figure 17-4 Option RTS



Option H1G, 1 GHz Analysis Bandwidth Assembly

Description

Option H1G provides 1 GHz Analysis Bandwidth in I Q Analyzer mode.

Signal Analyzer Hardware Requirements

- Analyzer frequency range 50 GHz or above
- Option H1G licensed
- H1G hardware Installed.

NOTE Option B2X, 255 MHz BW hardware is present on instruments that contain Option H1G. The "B2X" A21 Wideband Analog IF assembly provides signal routing.

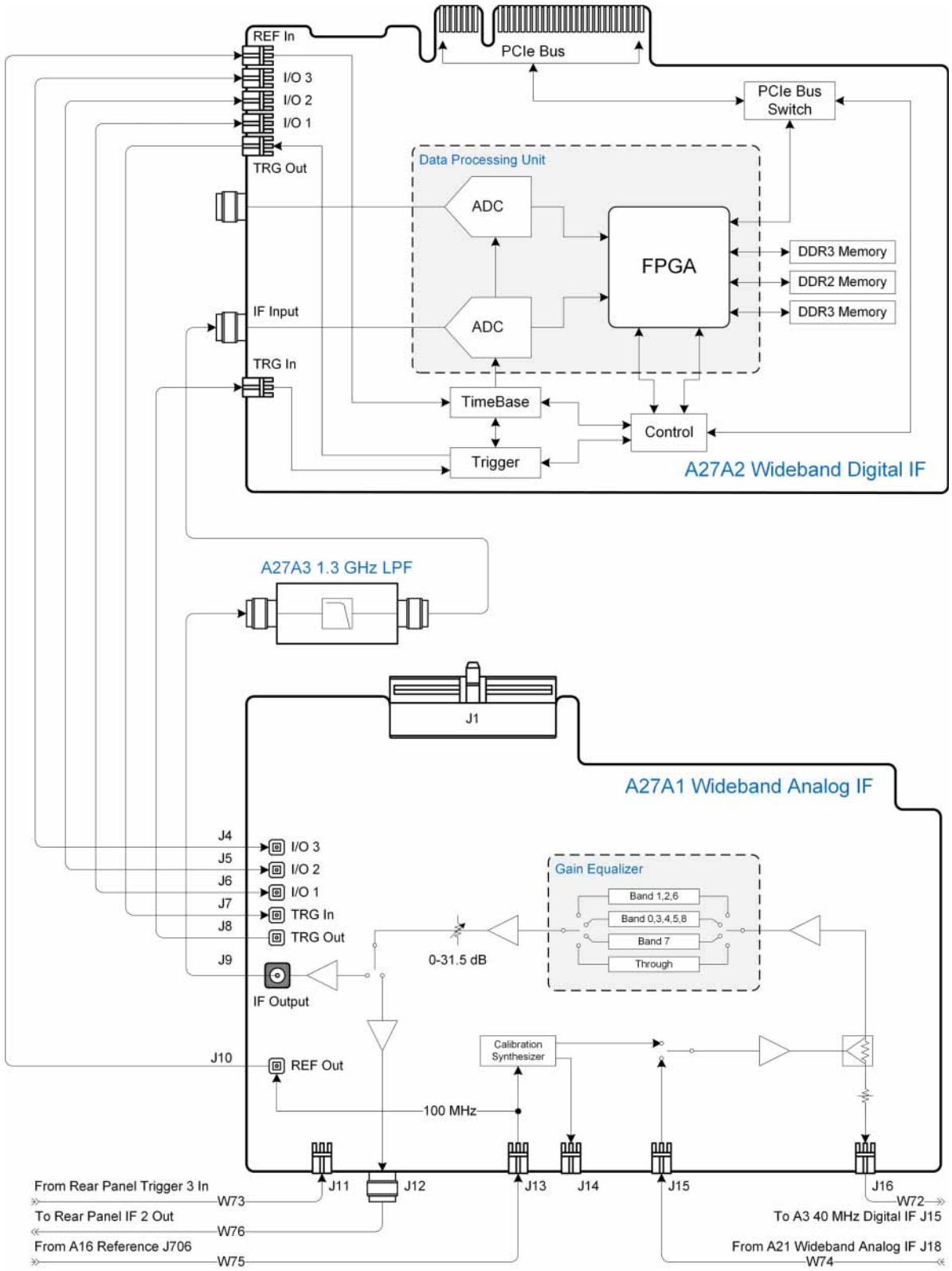
1 GHz Analysis Bandwidth Assembly Theory of Operation

The input signal is down converted to a 750 MHz IF in the A13 Front End assembly. The Front End assembly has a 1 GHz bandpass filter that is switched into the Lowband (<3.6 GHz input signal) signal path using coax switches mounted on the front end assembly. In the high band signal path, the preselector is bypassed to allow ample bandwidth.

Refer to Figure 17-5, “Option H1G Block Diagram.” The 750 MHz IF signal is routed from the A15 Front End Control assembly J901 to A21J17 on the A21 Wideband Analog IF assembly that is used in the 255 MHz IF Path. The 750 MHz IF signal leaves the A21 Wideband Analog IF through J18 and goes to the A27 1 GHz BW assembly.

The A27 1 GHz bandwidth assembly consists of a 1 GHz Analog IF and a Digital IF assembly and interface boards that allows insertion into the rear motherboard. The entire assembly must be replaced because the interconnections are difficult to remove/attach and troubleshooting the individual board assemblies is very difficult due to packaging constraints and lack of test points. Therefore the entire assembly must be replaced.

Figure 17-5 Option H1G Block Diagram



Operation and Verification

Enabling the 1 GHz IF path and verifying performance using the internal calibrator signal.

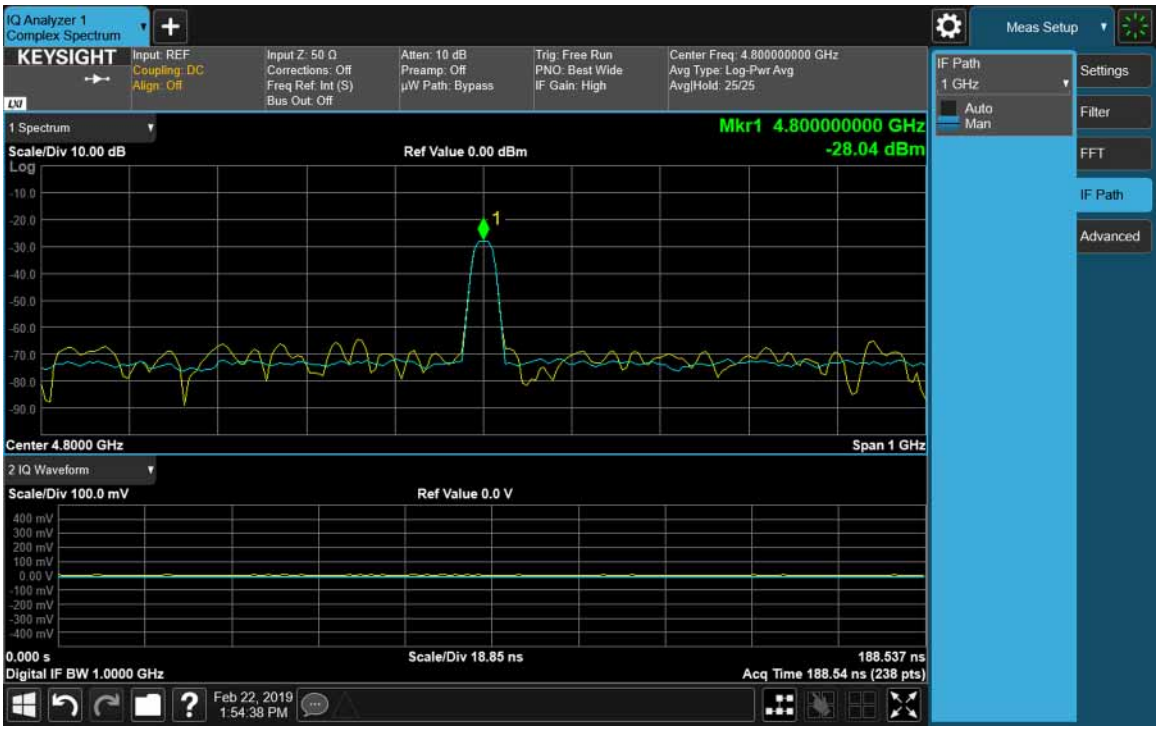
To enable the 1 GHz IF path, press the green **Mode Preset** key, then press **Mode/Meas** and select **IQ Analyzer (Basic)** mode. Assure **Complex Spectrum** is highlighted and tap **OK**.

Press the **Meas Setup** hardkey and tap **IF Path** then **IF Path** pull down and select **1 GHz**.

Turn on the 4.8 GHz calibrator signal by pressing **Input/Output**, **RF Calibrator** and select **4.8 GHz**. Press **FREQ**, and set **Span** to **1 GHz**.

Set the analyzer center frequency to 4.8 GHz and the calibrator signal should appear on screen at about -28 dBm if the 1 GHz path is working correctly. See Figure 17-6.

Figure 17-6 4.8 GHz Calibrator Signal



If the 4.8 GHz calibrator signal is not at the correct level in the 1 GHz IF path, check the calibrator signal level when using the 255 MHz IF path. Press **Meas Setup**, **IF Path** and chose **255 MHz** or **40 MHz**.

Verify the 4.8 GHz calibrator signal amplitude is about -28 dBm. If the signal level is now correct you have verified the problem is in the 1 GHz IF path.

If the signal level is not correct, the problem could be a faulty calibrator signal or some problem in the Front End or IF distribution chain. Go back to **Spectrum Analyzer** mode and troubleshoot using the 50 MHz and 4.8 GHz calibrator signals.

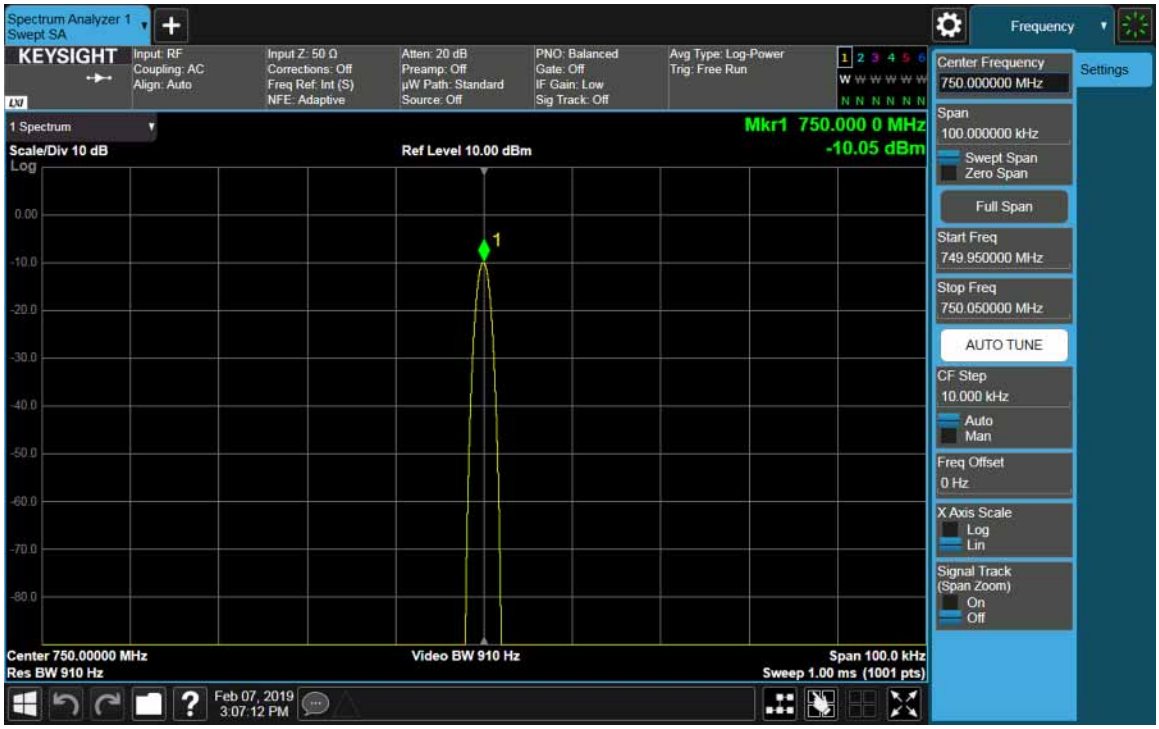
If the problem is only seen in the 1 GHz IF path, connect a spectrum analyzer to the sma rear panel IF 2 Out, that will allow you to measure the signal level out of the 1 GHz Analog IF assembly.

Assure the 1 GHz path is being used. Select **IQ Analyzer** mode. Press **Meas Setup**, **IF Path**, **1 GHz**. Assure the 4.8 GHz calibrator is on.

Enable the rear panel IF 2 Output by pressing **Input/Output**, **Output**, **IF 2 Out** and select **On**. You will see a message on the UXA screen that says 'No Result, measure invalid with IF 2 out set to on" This is because a switch on the 1 GHz IF assembly routed the 750 MHz IF signal to the rear panel and NOT through the rest of the internal signal path.

Set up the measuring spectrum analyzer as shown in Figure 17-7. Notice the 750 MHz signal measures -10 dBm.

Figure 17-7 Spectrum Analyzer Connected to Rear Panel IF 2 Out



Advanced Troubleshooting

This procedure will verify signal levels at the output of the A15 Front End Control assembly, the IF Output of the A21 Wideband Analog IF (B2X assy), the 100 MHz reference from the A16 Reference assembly, and the rear panel IF 2 output from the H1G Analog IF assembly. Refer to Figure 17-5, "Option H1G Block Diagram."

1. This procedure uses an external signal source connected to the analyzer's RF Input port.

   External source settings:

   Frequency: 1 GHz

   Amplitude: -20 dBm

   Connect the source 10 MHz Out to the signal analyzer Ext Ref, so both instruments share a single frequency reference.

2. UXA analyzer settings:

   Mode: IQ Analyzer, Complex Spectrum

   Meas Setup, IF Path, 1 GHz

   Center Frequency: 1 GHz

   Span: 1 GHz

   Atten: 10 dB

3. Locate the A15, Front End Control assembly in the instrument and remove the cable from A15J901 (IF Out). Connect a signal analyzer to this J901 MMCX female connector. One way to make this connection is to order a cable, 8121-2608 or 8121-2027 (this is the W16, SMA to MMCX cable used in the UXA).

   Set the measuring signal analyzer to the setting shown in Figure 17-7. The signal amplitude at 750 MHz should be about -40 dBm as shown in Figure 17-8.

Figure 17-8 IF Output of A15 Front End Controller at J901

4. Reconnect A15 J901 cable. Locate A21 Analog IF Assembly and disconnect cable from J718. Measure this 750 MHz signal level with the spectrum analyzer. The signal amplitude should be about 2 dB lower than the previous measurement since the signal is only going through some cabling and the switch on the A21 assembly.

   Reconnect the cable to A21J718.

5. Assure the 100 MHz reference signal at about 13 dBm is present at the A16 Reference Assembly J706.

6. Measure IF2 Out on rear panel. Press Input/Output, Output, IF 2 Out and select On.

   The 750 MHz signal level should be about -20 dBm.

7. If you do not change the -20 dBm amplitude of the signal source, but you change the frequency of the source, and the center frequency of the UXA; the rear panel IF 2 Out amplitude will change erratically due to the fact this is not a calibrated output.

   Here is the performance of one instrument:

Input Frequency	Rear Panel IF2 Output Amplitude	If you turn off IF2 Out, expect this signal level on the UXA screen:
1 GHz	–20.2 dBm	–20.5 dBm
5 GHz	–2.9 dBm	–20.9 dBm
10 GHz	–5.00 dBm	–21.3 dBm
20 GHz	–7.0 dBm	–22.0 dBm
30 GHz	–8.4 dBm	–22.6 dBm
40 GHz	–8.7 dBm	–23.0 dBm
50 GHz	–15.0 dBm	–24.0 dBm

NOTE

At stop frequencies less than 3.6 GHz, the analyzer is in Low Band path, and the there is a 1 GHz bandpass filter and switches connected to a metal plate on the Front End Assembly. See the block diagram for 50 GHz UXA with Option B5X, and notice SW4, the BPF, and SW5.

If the measurement at input frequency 1 GHz is incorrect, but the 5 GHz (or greater) input frequency measurement is correct, suspect a fault with the switches or band pass filter.

18 Service Menus

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 364

Service Menu Access on page 365

Service Menu on page 368

Service on page 368

Timebase DAC on page 373

Locator Tables on page 373

Meas Setup Menu on page 374

Service Diagnostics on page 374

Lock & LO on page 376

Overview

The service menus are intended for trained service technicians only, as there are settings in them that could alter the behavior of the instrument in a way that would cause the instrument to either not make measurements at all, or that would return inaccurate results. Because of this, a passcode is needed in order to enter the service menus. Once the passcode has been successfully entered and access has been granted, the service menus will remain accessible until the application is restarted.

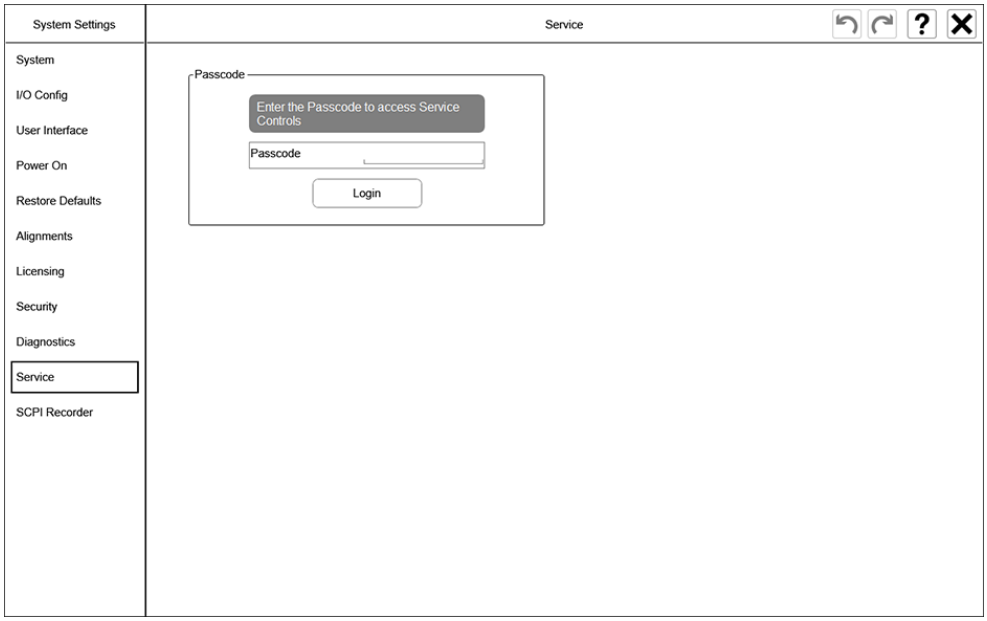
The service menus are intended to allow the service technician to see behind some of the instrument settings, turn some of the corrections off to see raw instrument hardware performance, isolate alignment issues, run front panel display and keyboard tests, and so forth.

Service Menu Access

Use the following procedure to access the service menu.

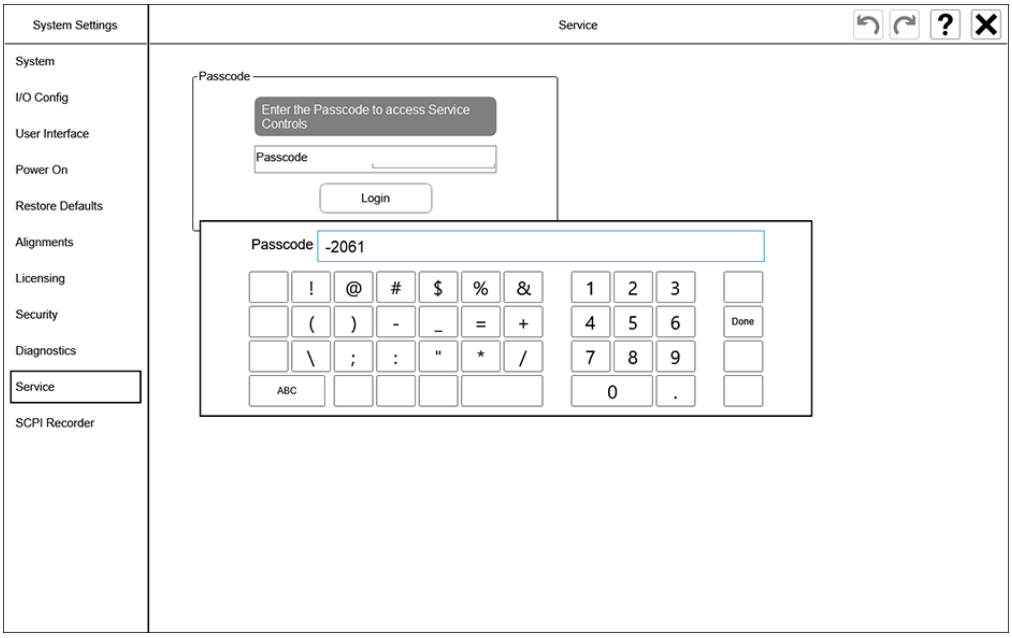
1. Press **System**, **Service** on the instrument. This will display the service menu without access yet granted, as seen in Figure 18-1.

Figure 18-1 Service Menu – Access Menu



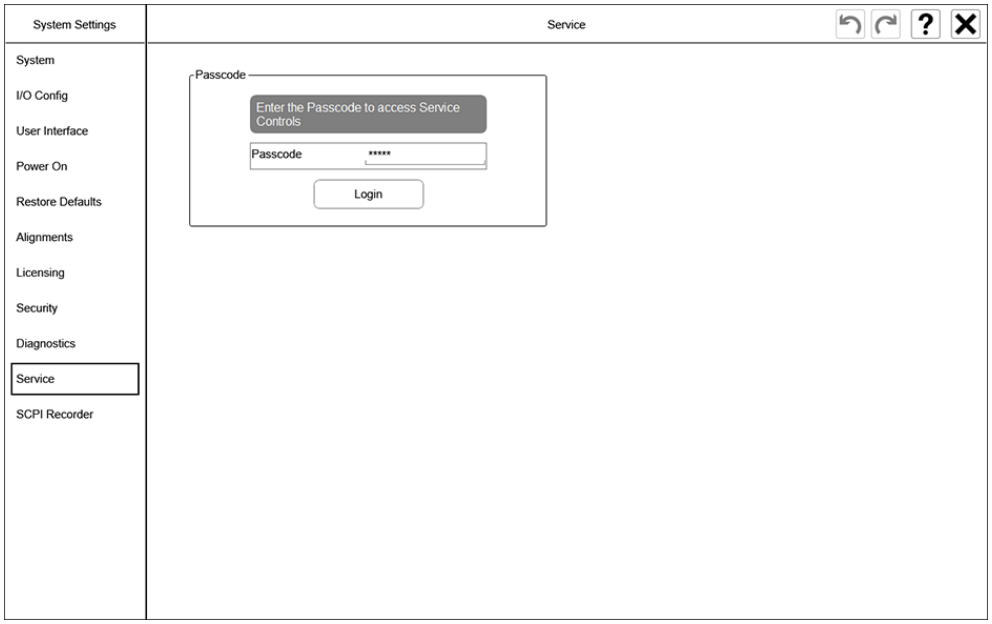
2. Select **Login** and a keyboard will appear, as seen in Figure 18-2.

Figure 18-2 Service Menu Keyboard Entry



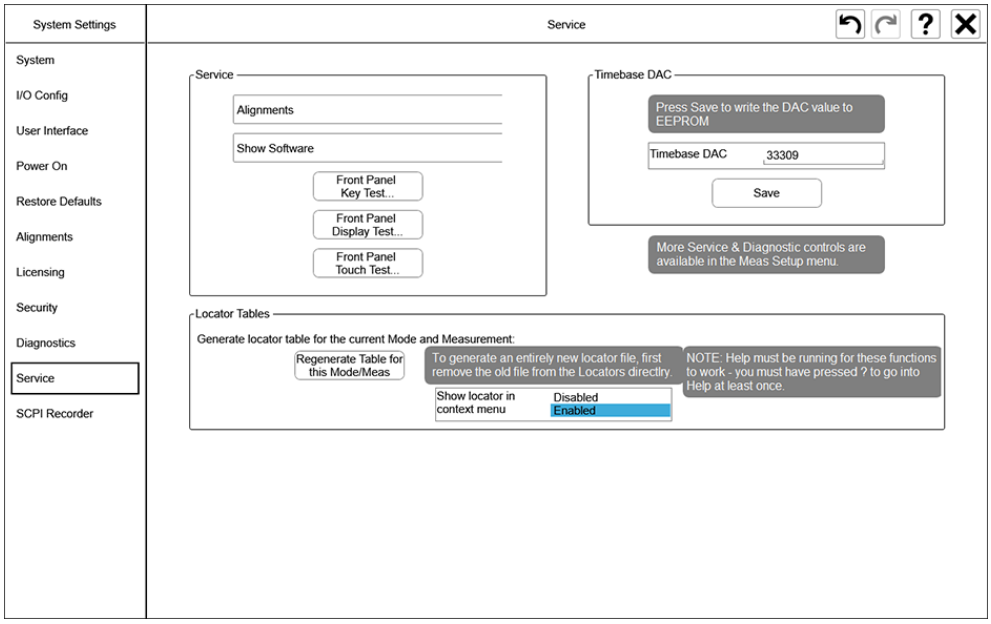
3. Enter the passcode **-2061** and press **Done**.
4. The Passcode will now be filled in, as seen in Figure 18-3.

Figure 18-3 Service Menu – Ready to Login



5. Press **Login** to access the service menu.
6. The service menu should now be accessible, as seen in Figure 18-4.

Figure 18-4 Service Menu



7. Note that in addition to what is seen on the service menu itself it says, **“More Service & Diagnostic controls are available in the Meas Setup menu.”**

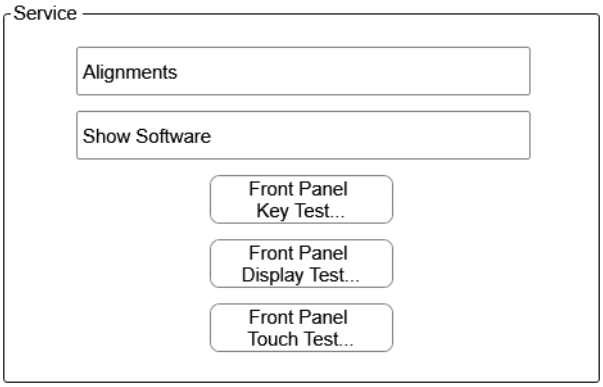
Service Menu

This section is for the service items found on the **System**, **Service** display.

Service

This section will cover the service items under the Service heading on the Service menu, as seen in Figure 18-5.

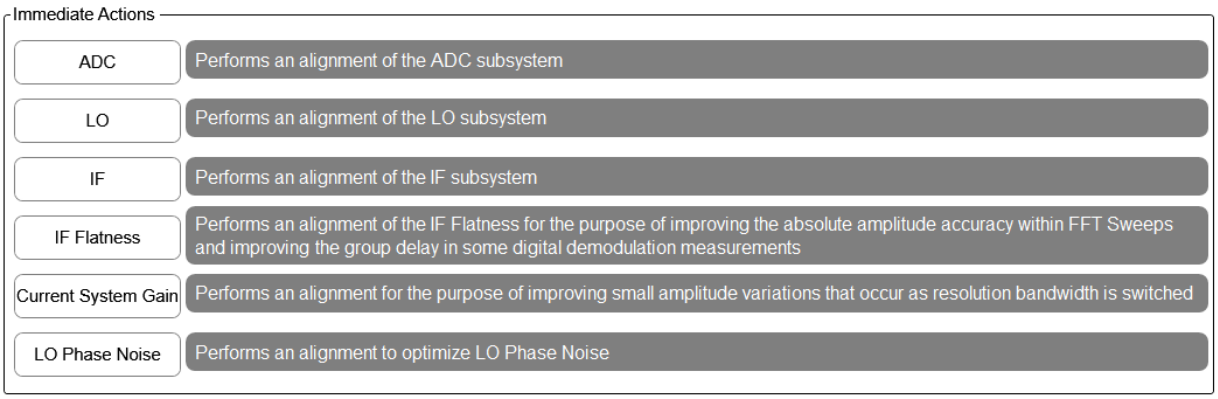
Figure 18-5 Service Menu - Service



Alignments

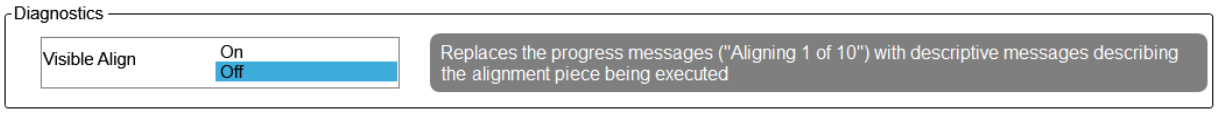
The Immediate Actions section will allow the running of pieces of the alignment system, as seen in Figure 18-6.

Figure 18-6 Service, Alignment, Immediate Actions



The Diagnostics section provides the ability to turn on Visible Align, as seen in Figure 18-7. When this is turned on the alignment status screen will display the name of the current alignment and the amount of time it has taken to run. This can be helpful to identify an alignment that might cause the process to hang up.

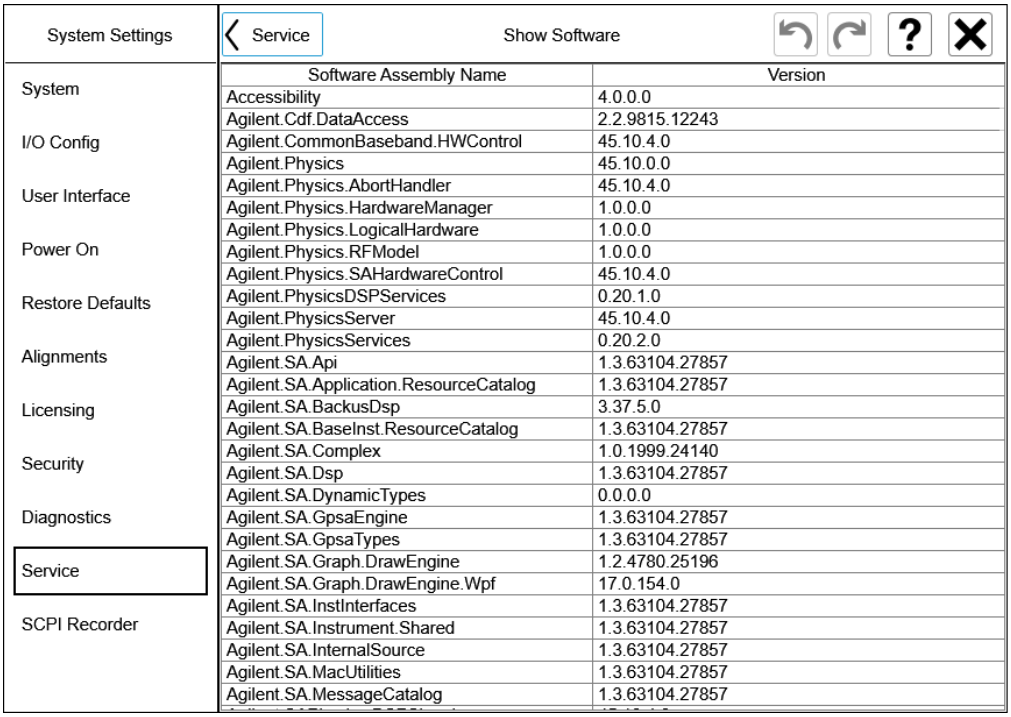
Figure 18-7 Service, Alignment, Diagnostics



Show Software

The Show Software screen displays a long list of the revision information for Keysight internal software that comprises the embedded application and programmable hardware devices (FPGAs and PLDs), as seen in Figure 18-8.

Figure 18-8 Show Software Information

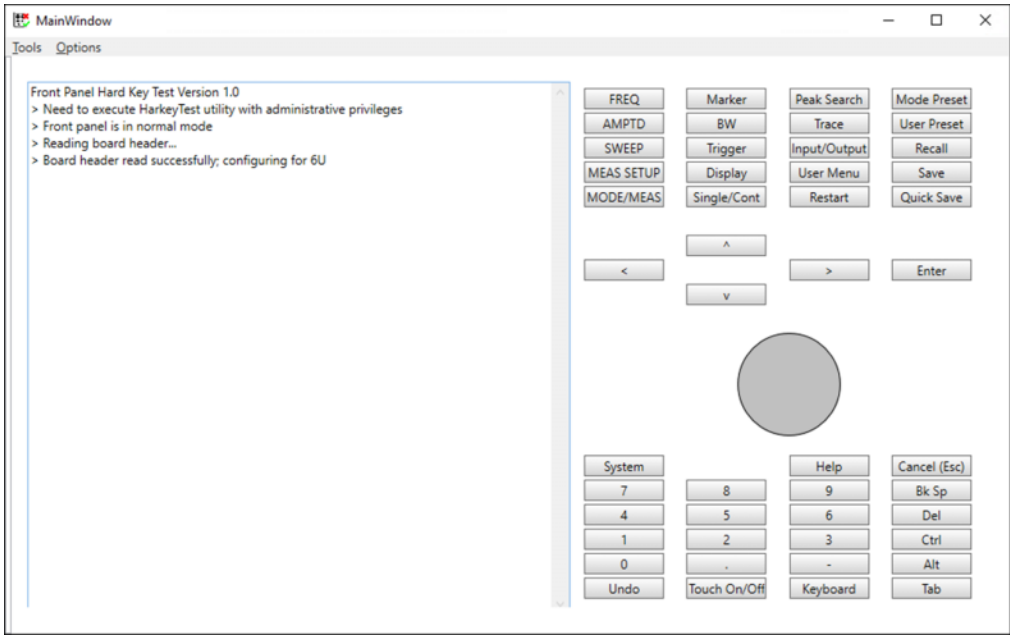


Software Assembly Name	Version
Accessibility	4.0.0.0
Agilent.Cdf.DataAccess	2.2.9815.12243
Agilent.CommonBaseband.HWControl	45.10.4.0
Agilent.Physics	45.10.0.0
Agilent.Physics.AbortHandler	45.10.4.0
Agilent.Physics.HardwareManager	1.0.0.0
Agilent.Physics.LogicalHardware	1.0.0.0
Agilent.Physics.RFModel	1.0.0.0
Agilent.Physics.SAHardwareControl	45.10.4.0
Agilent.PhysicsDSPServices	0.20.1.0
Agilent.PhysicsServer	45.10.4.0
Agilent.PhysicsServices	0.20.2.0
Agilent.SA.Api	1.3.63104.27857
Agilent.SA.Application.ResourceCatalog	1.3.63104.27857
Agilent.SA.BackusDsp	3.37.5.0
Agilent.SA.BaseInst.ResourceCatalog	1.3.63104.27857
Agilent.SA.Complex	1.0.1999.24140
Agilent.SA.Dsp	1.3.63104.27857
Agilent.SA.DynamicTypes	0.0.0.0
Agilent.SA.GpsaEngine	1.3.63104.27857
Agilent.SA.GpsaTypes	1.3.63104.27857
Agilent.SA.Graph.DrawEngine	1.2.4780.25196
Agilent.SA.Graph.DrawEngine.Wpf	17.0.154.0
Agilent.SA.InstInterfaces	1.3.63104.27857
Agilent.SA.Instrument.Shared	1.3.63104.27857
Agilent.SA.InternalSource	1.3.63104.27857
Agilent.SA.MacUtilities	1.3.63104.27857
Agilent.SA.MessageCatalog	1.3.63104.27857

Front Panel Key Test

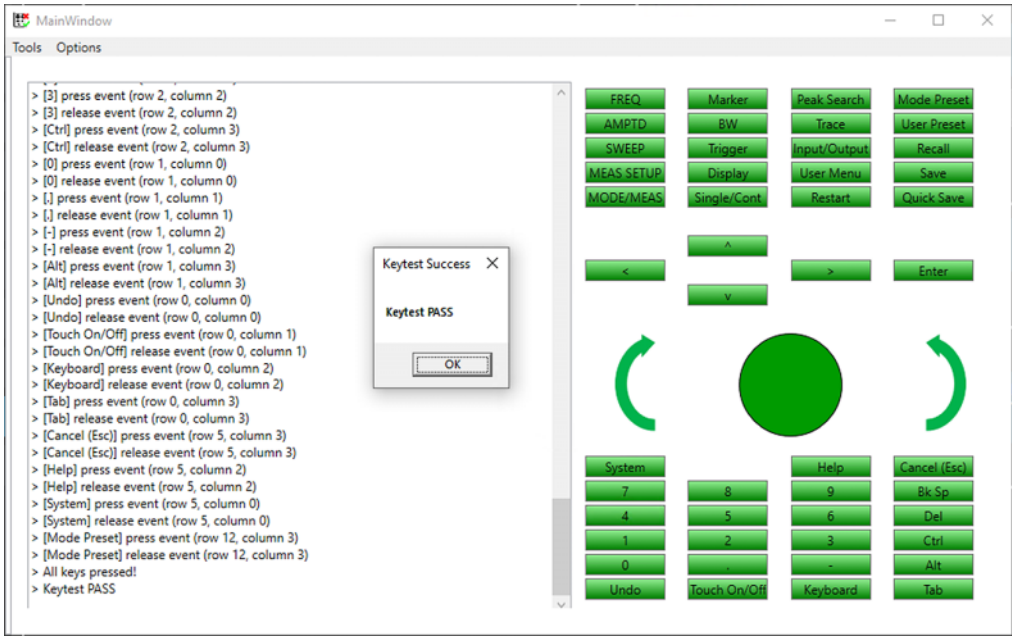
Selecting the front panel key test will first bring up a window as seen in Figure 18-9.

Figure 18-9 Front Panel Key Test



As each front panel hard key is pressed it will turn green in the test window, as will the knob as it is turned both clockwise and counterclockwise. Once all of the keys have been pressed and the knob has been turned in both directions a pass indicator will be displayed, as seen in Figure 18-10.

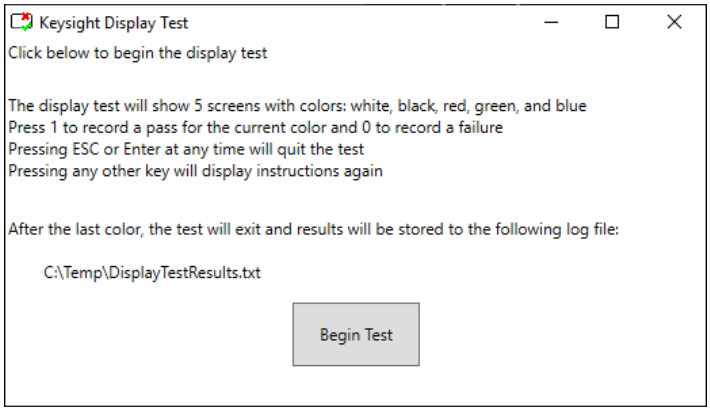
Figure 18-10 Front Panel Key Test Passed



Front Panel Display Test

Selecting the front panel display test will first bring up a window as seen in Figure 18-11.

Figure 18-11 Front Panel Display Test

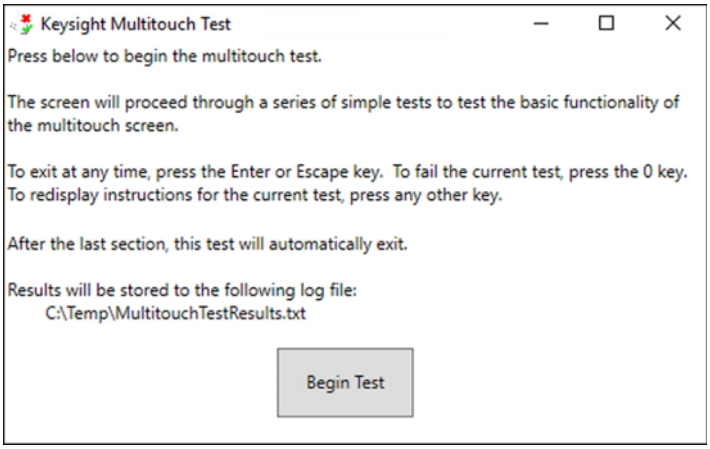


The display test will show five screens with colors: white, black, red, green, and blue, then two screens with gradient fill, and one screen with color bars. This can be used to identify defective pixels in the display or problems with the colors. The test results will be stored at C:\Temp\DisplayTestResults.txt.

Front Panel Touch Test

Selecting the front panel display test will first bring up a window as seen in Figure 18-12.

Figure 18-12 Front Panel Touch Test

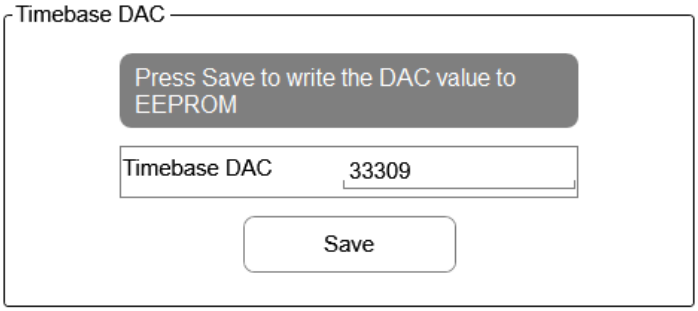


Follow the instructions given on the screen to complete the test. This will test the touch screen display functionality. The test results will be stored at C:\Temp\MultitouchTestResults.txt.

Timebase DAC

Allows adjustment of the instrument 10 MHz reference on the A16 Reference assembly. 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 **Save**, as seen in Figure 18-13.

Figure 18-13 Timebase DAC Adjustment



NOTE It is typically not advised to adjust the instrument timebase reference unless the instrument has been allowed to completely warm up. It should also be measured by using a precision device that has a very small measurement uncertainty. It is typically recommended that this be done using the automated adjustment provided with the performance verification and adjustment software for these instruments.

Locator Tables

This will generate a .csv file in the C:\Temp\AutogeneratedLocators folder of the instrument containing a complete list of all key presses available for the current mode and measurement. This was not put here as a tool needed to service the instrument.

Meas Setup Menu

Once the service passcode has been entered, two additional menus will be accessible from the instrument Meas Setup menu. These have been placed here so that they can be accessed while viewing the instrument measurement display and seeing the affect these setting have on the results.

Service Diagnostics

The selections on this service menu allow different instrument corrections to be turned off in order to see the raw instrument hardware performance, as seen in Figure 18-14.

Figure 18-14 Meas Setup, Service Diagnostics Menu

RF Flatness Video Shift

The RF Flatness Video Shift setting turns off the corrections for gain versus 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 frequency response of the instrument while maintaining the temperature corrections.

Temperature Gain & Tilt

This function controls both temperature adjustment mechanisms: overall gain vs. temperature, and the temperature-proportional tilt of the gain vs. frequency.

IF Flatness

The IF Flatness setting turns off the corrections for gain versus frequency across an IF passband. This can especially be helpful with the wideband IF paths that these instruments have.

Snapshot Alignments

During normal auto alignment operation, the firmware will perform a resolution bandwidth and IQ alignment when the resolution bandwidth state is changed, and on a timed basis thereafter. These alignments can hinder troubleshooting since they can change correction factors when the state is changed. Turning snapshot alignments off disables the resolution bandwidth portion of these alignments for more accurate troubleshooting.

LO Feedthrough Nulling

Control is available to set the state of LO Feedthrough nulling ON or OFF. In the ON state, the software will determine when it is appropriate to null the LO Feedthrough.

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.

ADC Direct

This setting allows for the ADC data to bypass all DSP processing. It is intended for use by the development team to evaluate ADC performance.

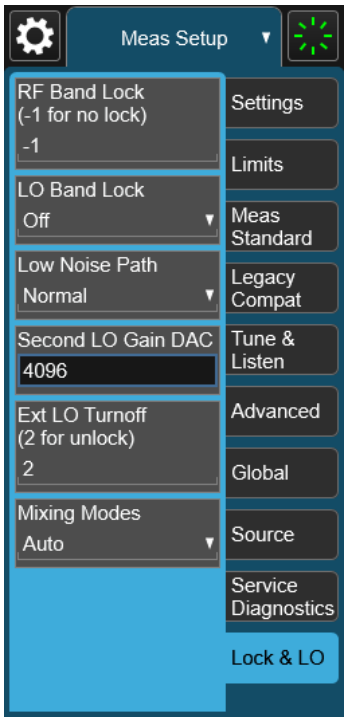
RF to IF Corrections

The RF to IF Corrections setting turns off a correction that is used for wideband signal paths that is in addition to the RF and IF flatness corrections. The amount of RF to IF Corrections is typically very small and can only be seen when using one of the wideband IF Paths. This setting is intended for use by the factory and development team. It has no real value for servicing the instrument in the field.

Lock & LO

The selections on this service menu allow miscellaneous LO controls along with locking the RF input band, as seen in Figure 18-15.

Figure 18-15 Meas Setup, Lock & LO Menu



RF Band Lock

Provides the ability to tune the instrument over as large a range as can be accommodated by the specified harmonic number and first LO frequency range. This feature can be used to check the performance in the frequency band overlap regions.

LO Band Lock

Provides the ability to tune the analyzer over as large a range as can be accommodated by the specified LO Band. This feature can be used to check performance in the LO band overlap regions.

Low Noise Path

Provides the ability to lock the Low Noise Path switch that is used in the µWave Path Control menu into the ON position, regardless of the state of the µWave Path Control menu or functions. The low noise path flatness corrections are applied.

Second LO Gain DAC

This provides the ability to adjust the output gain of the 2nd LO. 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. When using external mixing, this controls the level of the LO signal at the front panel Ext Mixer port.

EXT LO Turnoff

This can be used to disconnect the first LO path which will minimize the power level of the first LO signal at the front panel Ext Mixer port. A 1 will turn the LO signal off and a 2 will turn it back on. This can be used when testing the IF input of the Ext Mixer port.

Mixing Modes

Allows for the selection of the alternate mixing mode. Normal mixing mode is typically high side mixing and alternate mode is typically low side mixing.

19 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 19-1, “Major Assemblies,”	page 403
Figure 19-2, “External Hardware,”	page 405
Figure 19-3, “Top Brace and Card Cage Brace,”	page 407
Figure 19-4, “RF Area (Options 508, 513, 526),”	page 408
Figure 19-5, “RF Area Cables (Options 508, 513, 526),”	page 410
Figure 19-6, “Low Band Switch Cables (Options 508, 513, 526),”	page 410
Figure 19-7, “MPB/LNP Cables (Options 508, 513, 526),”	page 411
Figure 19-8, “RF Front End Cables (Options 508, 513, 526),”	page 411
Figure 19-9, “RF Front End Side Cables (Options 508, 513, 526),”	page 412
Figure 19-10, “RF Area (Options 544, 550),”	page 415
Figure 19-11, “RF Area Cables (Options 544, 550),”	page 417
Figure 19-12, “RF Front End Cables (Options 544, 550) (Option B5X shown),”	page 418
Figure 19-13, “RF Front End Side Cables (Options 544, 550),”	page 418
Figure 19-14, “Card Cage Boards,”	page 421
Figure 19-15, “Reference Assembly and Front End Controller Cables,”	page 422
Figure 19-16, “LO Synthesizer Cables,”	page 424
Figure 19-17, “AIF/DIF Assemblies,”	page 425
Figure 19-18, “AIF Cables,”	page 426

Figure 19-19, “DIF Cables,”	page 426
Figure 19-20, “CPU Assembly,”	page 428
Figure 19-21, “Disk Drive Tray Assembly - Option PC6, PC6S, PC8,”	page 429
Figure 19-22, “Rear Boards,”	page 430
Figure 19-23, “Wideband I.F. Ribbon Cables,”	page 431
Figure 19-24, “Wideband I.F. Cables,”	page 431
Figure 19-25, “Wideband Extension Board, Option RTS,”	page 433
Figure 19-26, “H1G Assembly,”	page 434
Figure 19-27, “Motherboards,”	page 435
Figure 19-28, “Chassis,”	page 436
Figure 19-29, “Fan Hardware,”	page 439
Figure 19-30, “Input Connector,”	page 440
Figure 19-31, “Front Frame Parts - Shield Removed,”	page 441
Figure 19-32, “Front Frame Exploded View,”	page 443

How to Order Parts

To order an assembly or mechanical part listed in this chapter, go to:

https://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 29.

Replaceable Parts

Some of the assemblies listed in the following table are related to options that are available with the UXA Signal Analyzer. These options are described below.

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1A1	Front Frame Assembly Replacement Kit[a] (Light Color) Includes:	n/a
	Front Frame	N9040-20021
	Cover Plate	N9040-00023
	Main Keyboard overlay	N9040-80001
	Braided gasket	8160-0660
	Display protection boot	N9040-40002
	USB EMI gasket	N9040-00020
	Front Frame Side Trim (2 included)	5041-9691
	Front Frame Top Trim (2 included)	5041-7901
	Connector Overlay	N9040-80002
	Front Frame Assembly Replacement Kit[a] (Dark Color) Includes:	N9040-60069
	Front Frame	n/a
	Cover Plate	N9040-00023
	Main Keyboard overlay	N9040-80018
	Braided gasket	8160-0660
	Display protection boot	N9040-40002
	USB EMI gasket	N9040-00020
	Front Frame Side Trim (2 included)	5041-7908
	Front Frame Top Trim (2 included)	5041-7907
	Connector Overlay	N9040-80019
A1A2	Main Keyboard	N9040-63006
A1A3	Touch Screen Display	
	Serial Prefix < MY/SG/US6442 (Upgrade Kit)	N9040-60130
	Serial Prefix ≥ MY/SG/US6442	2090-1166
A1A4	Backlight DC to DC Converter Board	0950-5670
A1A5	Front Panel Controller Board	N9040-63012
A1A6	Power Switch Keysboard	N9040-63016
A1MP1	Main Keypad	
	Light Color	N9040-40003
	Dark Color	N9040-40009

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1MP2	Power Switch Keypad	
	Light Color	N9040-40004
	Dark Color	N9040-40010
A1MP4	Frequency Label, 8.4 GHz	
	Light Color	N9040-80005
	Dark Color	N9040-80038
A1MP5	Frequency Label, 13.6 GHz	
	Light Color	N9040-80006
	Dark Color	N9040-80039
A1MP6	Frequency Label, 26.5 GHz	
	Light Color	N9040-80007
	Dark Color	N9040-80040
A1MP7	Label, Frequency, 44 GHz	N9040-80041
A1MP8	Label, Frequency, 50 GHz	N9040-80042
A1MP9	RPG Knob	
	Light Color	W1312-40017
	Dark Color	W1312-40179
A1MP10-15	Cable Clamps (miscellaneous front panel cables, to hold down DC-DC converter, display, and controller board cables)	1400-2225
A1MP14	Front Panel Controller Board Bracket	N9040-00052
A1MP21	Display Bracket	N9040-00018
A1MP22	Display Compression Pad	N9040-40001
A1MP23	Display Cable Hold Down (3M double-coated foam tape 4016)	source locally
A1MP24	Ext Mixer Front Panel Connector	1250-1666
A1MP25	Front Panel Interface Board Shield	N9040-00032
A1MP26 & MP27	Front Panel Interface Cable Loop Fasteners	0510-1303
A1W1	Cable Assembly, (Flex Circuit), Display to Front Panel Interface Board	N9040-60024
A1W2	Cable Assembly, DC-DC Converter to Display	N9040-60027

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1W3	Cable Assembly, A1A5 Controller Board J16 to Backlight DC to DC Converter Input	
	Serial Prefix < MY/SG/US6442	N9040-60029
	Cable Assembly, A1A5 Controller Board J16 to A1A3 Touch Screen Display	
	Serial Prefix ≥ MY/SG/US6442	N9040-60129
A1W4	Cable Assembly, Power Switch Keyboard to Front Panel Controller Board	N9040-60026
A2	25 MHz Analog IF Assembly	N9020-60290
	TAA Compliant	N9020-60290G
A3	40 MHz Digital IF Assembly	
	New	N9020-60016
	Exchange	N9020-69016
A3W1	Cable Assembly, Smart Noise Source (Wire Harness)	N9020-60090
A4	Processor Assembly (without A5 Disk Drive)	
	Options PC6, PC6S	W1312-60214
	Option PC8	W1312-60524
	Option PCA	W1312-60561
A4A1	Disk Drive Interconnect Board	
	Options PC6, PC6S	W1312-63377
	Option PC8	W1312-63377
	Option PCA	W1312-63571
A4A2	CPU SDHC Memory Card	
	Options PC6, PC6S, PC8	1819-1354
A4BT1	CPU Battery	1420-0356 (CR2032)
A5	Solid State Disk Drive	
	Options PC6, PC6S - Windows 7	N9020-60355
	Options PC6, PC6S - Windows 10	N9020-60381
	Option PC8 - Windows 10	N9032-60039
	Option PCA - Windows 10	N9032-60025
A5MP0	Disk Drive Tray Assembly	
	Options PC6, PC6S, PC8	E6607-61820
A5MP1	Disk Drive Tray	
	Options PC6, PC6S, PC8	W1312-40078

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
A5MP2	Disk Drive Rear Panel	
	Options PC6, PC6S, PC8	W1312-00103
A5MP3	Disk Drive Handle	
	Options PC6, PC6S, PC8	1440-0421
A6	Power Supply	0950-5748
A7	Midplane Board (Rear Motherboard) Assembly	N9040-63003
A8	Motherboard (Front/Horizontal mount)	N9040-63002
A9	RF Attenuator A (0-4 dB)	
	Options 508, 513, 526	33360-60011
	RF Attenuator A (0-10 dB)	
	Options 544, 550	33326-60013
A10	RF Attenuator B (0-66 dB)	
	Options 508, 513, 526	33321-60085
	RF Attenuator B (0-60 dB)	
	Options 544, 550	33325-60020
A11	Band Switch Assembly	
	Options 508, 513, 526	E4410-60121
	Options 544, 550	N9020-60368
A12	YTF Preselector	
	Options 508, 513, 526	5087-7382
	Options 544, 550	5087-7383
A12MP1	Gap Pad for A12 mounting	5022-7179
A13	Front End Assembly	
	Options 508, 513, 526	N9020-60129
	Options 508, 513, 526 with Option B5X	N9020-60208
	Options 544, 550	N9020-60210
	Options 544, 550 with Option B5X	N9020-60218
	Option 550 with Option H1G	N9020-60259
SW4	Switch, Coax, 510 MHz Bandpass Filter Bypass	
	Option B5X	N1810-60102
SW5	Switch, Coax, 510 MHz Bandpass Filter Bypass	
	Option B5X	N1810-60102

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
FL2	5.675 GHz Bandpass Filter	
	Option B5X	9135-6217
A14	DDS LO Synthesizer Assembly	N9020-60377
A15	Front End Controller	N9020-60295
A16	Reference Assembly	
	New	N9020-60387
	Exchange	N9020-69387
	TAA Compliant	N9020-60387G
A16A3	Reference OCXO	N9020-63194
A20	YTO Assembly	N9020-60009
A21	Wideband Analog I.F.	
	Option B2X & B5X	N9020-60043
A22	Wideband Digital I.F.	
	Option B5X - New	N9020-60311
	Optoin B5X - Exchange	N9020-69311
A23	Wideband Digital I.F.	
	Option B5X - New	N9020-60311
	Optoin B5X - Exchange	N9020-69311
A24	Interconnect Board	N9040-63004
A27	1 GHz Wideband IF Assembly	
	Option H1G - New	N9040-60102
	Option H1G - Exchange	N9040-69102
A28	Wideband Real-Time Streaming Board	
	Option RTS	N9020-60272
A28A1	EMI Gasket, Wideband Real-Time Streaming Board	
	Option RTS	N9020-20178
AT1	Attenuator, 6 dB Coax (connects to SW1 & W13)	
	Options 508, 513, 526	08493-60026
B1, B2	Fan	W1312-60063
FL1	7.2 GHz Bandpass Filter	9135-6218

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
FL2	5.675 GHz Bandpass Filter	
	Option B5X	9135-6217
J1	Type-N Input Connector Assembly	N9039-60030
	3.5 mm Input Connector Assembly (Option C35)	N9020-60196
	2.4 mm Input Connector Assembly	N9030-60011
	EMI O-Ring, Input Connector	8160-1637
J2	Ext Mixer Connector	1250-1666
	50 ohm Termination, SMA	1810-0118
SW1	Switch, Coax, Preselector Bypass, Lower	
	Options 508, 513, 526	N1810-60069
SW2	Switch, Coax, Preselector Bypass, Upper	
	Options 508, 513, 526	N1810-60069
SW3	Switch, Transfer, Low Noise Path	
	Options 508, 513, 526	87222-60026
	Options 544, 550	87222-60029
SW4	Switch, Coax, 510 MHz Bandpass Filter Bypass	
	Option B5X	N1810-60102
SW5	Switch, Coax, 510 MHz Bandpass Filter Bypass	
	Option B5X	N1810-60102
SW6	Switch, Transfer, Preselector Bypass	
	Options 544, 550	87222-60031
Chassis Parts		
	Chassis Base	N9040-00001
	Chassis Base Stiffener	N9040-00029
	Chassis Side, Left (inner)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00003
	s/n prefix ≥ 5605 and < 5616, Options 508, 513, 526 s/n prefix < 5616 Options 544 and 550	N9040-00037
	s/n prefix ≥ 5616 all frequency ranges	N9040-00059

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Chassis Side, Right (inner)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00004
	s/n prefix ≥ 5605 and < 5616, Options 508, 513, 526 s/n prefix < 5616 Options 544 and 550	N9040-00038
	s/n prefix ≥ 5616 all frequency ranges	N9040-00060
	Chassis Side, Right (outer)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00013
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00047
	Bracket, Fan (right side inner)	N9040-00007
	Bracket, Fan (Left side/outer)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00006
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00053
	Bracket, Chassis Front	N9040-00005
	Bracket, Chassis Front (inner/bottom)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00008
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00036
	Bracket, Midplane (Rear Motherboard)	
	s/n prefix < 5616	N9040-00002
	s/n prefix ≥ 5616	N9040-00058
	Bracket, Motherboard (Front/Horizontal)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00024
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00051
	Bracket, Power Supply	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00021
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00040
	Bracket, Right Side Support	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00012
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00041
	Bracket, Rear Brace	
	s/n prefix < 5616	N9040-00009
	s/n prefix ≥ 5616	N9040-00039
	s/n prefix ≥ 5616 Option H1G	N9040-00056

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Rear Panel	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00014
	s/n prefix ≥ 5605 and < 5616, Options 508, 5113, 526 s/n prefix < 5616 Options 544 and 550	N9040-00050
	s/n prefix ≥ 5616 all frequency ranges	N9040-00057
	Top Brace Front Card Cage	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00010
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00055
	Top Brace Front Card Cage Support	N9040-00034
	Top Brace Rear	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00011
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00049
	Bracket, Attenuator	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00016
	s/n prefix ≥ 5605 Options 508, 513, 526	N9040-00061
	Options 544, 550	N9040-00027
	Shield, Magnetic, Attenuator A	
	Options 544, 550	N9020-00043
	Shield, Magnetic, Attenuator B	
	Options 544, 550	N9020-00044
	Bracket, SW1	
	Options 508, 513, 526	E4410-00104
	Bracket, SW2	
	Options 508, 513, 526	N9040-00019
	Bracket, SW1 & SW2 Main	
	Options 508, 513, 526	N9040-00017
	Bracket, Transfer Switches	
	Option 544, 550	N9040-00028
	Shield, YTO, Top	N9020-00005
	Shield, YTO, Bottom	N9020-00006
	Bracket, Flex Circuit Support	
	Options B2X, B5X	N9040-00025

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Bracket, Wideband Extension Board	
	Option RTS	N9040-00033
Cables		
W1	Cable, Ribbon, A7 Midplane J32 to A1A2 Front Panel Interface J11	N9040-60030
W7	Cable, A15 Front End Controller J700 to A11 Band Switch J4	
	Options 508, 513, 526	N9040-60036
	Options 544, 550	N9040-60066
W5	Cable, Ribbon, A15 Front End Controller J800 to A9/A10 Attenuators	
	Options 508, 513, 526	N9040-60032
	Options 544, 550	N9040-60065
W22	Cable, Ribbon, A15 Front End Controller J102 to A13A1 Front End Assembly J12	N9040-60037
W23	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 YTO Control	N9040-60035
W28	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9040-60034
W43	Cable, Ribbon, A2 25 MHz Analog IF J820 to A3 40 MHz Digital IF J20	N9020-60046
W55	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch Control	N9040-60038
W56	Cable, Ribbon, Ribbon, A21 Wideband Analog IF J23 to Interconnect Bracket	
	Options B2X and B5X	N9040-60042
W57	Cable, Ribbon, Ribbon, Interconnect Bracket to A22 Wideband Digital IF J778	
	Option B2X	N9040-60045
	Cable, Ribbon, Interconnect Bracket to A22 Wideband Digital IF & A23 Wideband Digital IF J778	
	Option B5X	N9040-60041
W70	Cable, Flex Circuit, A22 Wideband DIF J9000 to A28 Wideband DIF Extension Board J1	
	Option RTS	N9040-60047
W71	Cable, Flex Circuit, A23 Wideband DIF J9000 to A28 Wideband DIF Extension Board J2	
	Option RTS with Option B5X	N9040-60048
W11	Cable, Wire harness, A15 Front End Controller J300 to A12 YTF J1	N9040-60033

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
W12	Wire Harness, A15 Front End Controller J801 to MPB Switch(s)	N9040-60039
	Wire Harness, A15 Front End Controller J801 to MPB Switch(s) & SW4/SW5 IF Filter Switches	
	Option B5X	N9040-60031
W16	Cable, Coax, A13A1 Front End Assembly J7 to A15 Front End Controller J902	
	Options 508, 513, 526	8121-2608
	Options 544, 550	8121-2027
W25	Cable, Coax, A15 Front End Controller J900 to A2 25 MHz Analog IF J100	8121-1865
W26	Cable, Coax, A15 Front End Controller J901 to A3 40 MHz Digital IF J15	
	Wthout Options B2X or B5X	8121-1919
W27	Cable, Coax, A15 Front End Controller J1100 to Rear Panel Aux IF Out	8121-1859
W30	Cable, Coax, A13A1 Front End Assembly J13 to A15 Front End Controller J903	
	Options 508, 513, 526	8121-1940
	Options 544, 550	8121-2608
W33	Cable, Coax, A16 Reference J705 to A13A1 Front End Assembly J6	8121-1940
W34	Cable, Coax, A16 Reference J718 to A21Wideband Analog IF J4	
	Option B2X and B5X	8121-0152
W36	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1919
W37	Cable, Coax, Rear Panel Ext Ref In to A16 Reference J704	8121-1863
W39	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1861
W40	Cable, Coax, A21 Wideband Analog IF J18 to A3 40 MHz Digital IF J15	
	Options B2X and B5X	8121-1401
W41	Cable, Coax, A15 Front End Controller J901 to A21 Wideband Analog IF J17	
	Options B2X and B5X	8121-1401
W42	Cable, Coax, A2 25 MHz Analog IF J601 to A3 40 MHz Digital IF J19	8121-2607
W45	Cable, Coax, A3 40 MHz Digital IF J17 to A21 Wideband Analog IF J2	
	Options B2X and B5X	8121-1919
W46	Cable, Coax, A16 Reference J726 to A21 Wideband Analog IF J1	
	Options B2X and B5X	8121-0152

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
W47	Cable, Coax, A3 40 MHz Digital IF J17 to A16 Reference J726	
	Without Options B2X or B5X	8121-1401
W72	Cable, Coax, A27 H1G Assembly J16 to A3 40 MHz Digital IF J15	
	Option H1G	8121-1401
W73	Cable, Coax, A27 H1G Assembly J11 to Rear Panel Ext Trig 3	
	Option H1G	8121-0958
W74	Cable, Coax, A21 Wideband Analog IF J18 to A27 H1G Assembly J15	
	Option H1G	8121-1401
W75	Cable, Coax, A16 Reference J706 to A27 H1G Assembly J13	
	Option H1G	8121-1861
W76	Cable, Coax, A27 H1G Assembly J12 to Rear Panel IF 2 Out	
	Option H1G	8121-2867
W2	Cable, Semi-rigid, RF Input Connector to A9 Attenuator A Input	
	Option CNF, Type-N Input	N9040-20025
	Option C35, 3.5 mm Input	N9040-20043
	Option 544, 550, 2.4 mm Input	N9040-20114
W3	Cable, Semi-rigid, A16 Reference J701 to A9 Attenuator Calibrator Input	
	Options 508, 513, 526	N9040-20027
	Options 544, 550	N9040-20103
W4	Cable, Semi-rigid, A9 Attenuator A Output to A10 Attenuator B Input	
	Options 508, 513, 526	N9040-20026
	Options 544, 550	N9040-20102
W8	Cable, Semi-rigid, A11 Band Switch J3 to A13 Front End Assembly J2	
	Options 508, 513, 526	N9040-20032
	Cable, Semi-rigid, A11 Band Switch J1 to A13 Front End Assembly J2	
	Options 544, 550	N9040-20108
W10	Cable, Semi-rigid, SW1 MPB Switch Port II to A12 YTF Input	
	Options 508, 513, 526	N9040-20033
W13	Cable, Semi-rigid, AT1 6 dB Attenuator to SW2 MPB Switch Port I	
	Options 508, 513, 526	N9040-20036

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
W14	Cable, Semi-rigid, A12 YTF Output to SW2 MPB Switch Port II	
	Options 508, 513, 526	N9040-20034
W15	Cable, Semi-rigid, SW2 Port C to A13A1 Front End Assembly J9	
	Options 508, 513, 526	N9040-20035
W17	Cable, Semi-rigid, A13A1 Front End Assembly J8 to Cable W29	N9040-60046
W18	Cable, Semi-rigid, A16 Reference J702 to A13A1 Front End Assembly J1	
	Options 508, 513, 526	N9040-20039
	Options 544, 550	N9040-20113
W20	Cable, Semi-rigid, A20 YTO Output to A14 DDS LO Synthesizer J2	N9040-20098
W21	Cable, Semi-rigid, A14 DDS LO Synthesizer J1 to A13A1 Front End Assembly J4	
	Options 508, 513, 526	N9040-20038
	Options 544, 550	N9040-20112
W29	Cable, Semi-rigid, Front Panel Ext Mixer Connector to Cable W17	N9040-20044
W31	Cable, Semi-rigid, A16 Reference J703 to FL1 7.2 GHz Bandpass Filter Input	N9040-20040
W32	Cable, Semi-rigid, FL1 7.2 GHz Bandpass Filter Output to A14 DDS LO Synthesizer J35002	N9020-20226
W48	Cable, Semi-rigid, A13A1 Front End Assembly J10 to A13A2 Switched IF Filter J2	
	Options 508, 513, 526 with Option B5X	N9020-20045
W49	Cable, Semi-rigid, A13A2 Switched IF Filter J5 to A13A1 RF Front End Assembly J11	
	Options 508, 513, 526 with Option B5X	N9020-20244
	Options 544, 550 with Option B5X	N9020-20110
W51	Cable, Semi-rigid, A10 Attenuator B Output to SW3 LNP Switch Port I	
	Options 508, 513, 526	N9040-20028
	Options 544, 550	N9040-20104
W52	Cable, Semi-rigid, SW3 LNP Switch Port 4 to A11 Band Switch J1	
	Options 508, 513, 526	N9040-20031
	Cable, Semi-rigid, SW3 LNP Switch Port 4 to A11 Band Switch J3	
	Options 544, 550	N9040-20106
W53	Cable, Semi-rigid, SW3 LNP Switch Port 2 to SW1 MPB Switch Port C	N9040-20029
	Options 508, 513, 526	

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
W54	Cable, Semi-rigid, Semi-Rigid, A11 Band Switch J2 to SW3 LNP Switch Port 3	
	Options 508, 513, 526	N9040-20030
	Options 544, 550	N9040-20107
W58	Cable, Semi-rigid, A13A2 Switched IF Filter J3 to A13A2 Switched IF Filter J4 (Delay Line)	N9020-20080
W59	Cable, Semi-rigid, SW4 Filter Switch Port II to A13A2 Switch IF Filter J2	
	Option B5X	N9020-20267
W60	Cable, Semi-rigid, SW4 Filter Switch Port I to FL2 Bandpass Filter Input	
	Option B5X	N9020-20268
W61	Cable, Semi-rigid, FL2 Bandpass Filter Output to SW5 Filter Switch Port I	
	Option B5X	N9020-20269
W62	Cable, Semi-rigid, A13A2 Switched IF Filter J5 to SW5 Filter Switch Port II	
	Option B5X	N9020-20264
W63	Cable, Semi-rigid, SW5 Filter Switch Port C to A13A1 Front End Assembly J11	
	Options 508, 513, 526 with Option B5X	N9020-20265
	Options 544, 550 with Option B5X	N9020-20276
W64	Cable, Semi-rigid, A13A1 Front End Assembly J10 to SW4 Filter Switch Port C	
	Option B5X	N9020-20266
W65	Cable, Semi-rigid, A13A1 Front End Assembly J3 to A13A2 Switched IF Filter J6	N9020-20245
W66	Cable, Semi-rigid, SW3 LNP Switch Port 2 to SW6 MPB Switch Port 1	
	Options 544, 550	N9040-20105
W67	Cable, Semi-rigid, SW6 MPB Switch Port 4 to A12 YTF Input	
	Options 544, 550	N9040-20109
W68	Cable, Semi-rigid, A12 YTF Output to SW6 MPB Switch Port 3	
	Options 544, 550	N9040-20110
W69	Cable, Semi-rigid, SW6 MPB Switch Port 2 to A13A1 Front End Assembly J9	
	Options 544, 550	N9040-20111
W77	Cable, Semi-rigid, Rear Panel IF 2 OUT to IF 2 IN Serial Number < US57212008	
	Option H1G	N9040-20065

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
Labels		
	Warning Label, External Mixing	N9030-80018
	Blank Label, Silver. Covers Rear Panel Wideband Digital Bus Connector Holes without Option RTS	N9040-80011
Miscellaneous		
	Card Guide (for chassis left and right)	W1312-40001
	Spiral Wrap; 0.250 IN OD; 0.160 IN ID; for Digital IF cables	0890-0025
	Spring Clip (Option B5X)	N9040-00035
	Nylon Cable Tie	1400-0507
	Clamp, Cable Hold Down (on Front Brace)	5023-2095
	Grommet, Fan Bracket	0400-0011
	Cable Clamp, Fan	1400-0053
	Fan Grill	3160-4253
Button Up		
	Dress Cover	
	Light Color	N9040-00015
	Dark Color	N9040-00046
	Rear Feet	
	Light Color	5041-9611
	Dark Color	5041-7903
	Bottom Feet	
	Light Color	5041-9167
	Dark Color	5041-7906
	Bottom Feet Key Locks	5021-2840
	Strap Handle	
	Light Color	E4400-60026
	Dark Color	N9040-60059
	Front Frame Handles	
	Light Color	5023-1399
	Dark Color	5023-3074
	Hole Plug, Nylon, for 0.5 D hole	6960-0149

Table 19-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Hole Plug, Nylon for 0.875 hole	6960-0177
	Hole Plug, Nylon for 0.312 hole	6960-0076
	Impact Cover, Front	
	Light Color	N5245-40001
	Dark Color	N9040-40007
	Impact Cover, Rear	
	Light Color	N5245-40002
	Dark Color	N9040-40008
	Touch-up Paint, Phantom-Gray, 1-Oz Bottle	6010-3330

a. Does not include nameplate, See A1MP3 through A1MP8.

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Analog IF	Digital IF	3	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Attenuators	Attenuator Bracket	2 per	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Attenuator Bracket	Chassis	2 per	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Chassis Base Stiffener (Covers A3, Digital I.F. Assembly)	Chassis Base	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
		2	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Chassis Bottom	Chassis Side Brackets (Left & Right)	13	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Chassis Front Brace	Chassis Side Brackets (Left & Right) & Chassis Bottom	9	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Chassis Front Bracket (Inner/Bottom)	Chassis Front Bracket	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Chassis Side (Right)	Chassis Side (Inside Right)	1	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Coax Switch	Coax Switch Bracket	2	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	6 inch-lbs
CPU Assembly	Chassis	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
DC-DC Converter	Display Bracket	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Digital I.F. Board Plate	Digital I.F. Board	8	2190-0068	Washers	n/a	n/a
		8	2950-0054	Nuts	5/8-inch socket	21 inch-lbs
Digital I.F. Board Plate	Digital I.F. Board Plate LVDS Connector	2	0515-1940	M3 X 0.45 (6 mm long)	Torx T-8	6 inch-lbs
Display	Display Bracket	4	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	6 inch-lbs
Display Bracket	Front Frame	6	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	6 inch-lbs
Disk Drive	Disk Drive Tray	4	0515-1035	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
"Ext Mixer" Connector	Front Frame	1	2950-0223	Hex Nut	n/a	21 inch-lbs
External Reference BNC	Rear Panel	1	2190-0102	Lock Washer	n/a	n/a
		1	0590-2332	Hex Nut	9/16” Nut Driver	21 inch-lbs
Fan Grill	Fan Bracket (Right)	3 per	0515-1038	M3 X 0.5 (35 mm long)	Torx T-10	9 inch-lbs
Fan/Bracket Assembly	Chassis (Left)	5	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Front Frame Assembly	Chassis	14	0515-2044	M4 X 0.7 (10 mm long)	Torx T-20	21 inch-lbs
		1	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Front Frame Cover Plate	Front Frame	2	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Front Frame Handles	Front Frame	8	0515-2044	M4 X 0.7 (10 mm long)	Torx T-20	21 inch-lbs
Front Panel Controller Board	Front Frame	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch lbs.
Front Panel Controller Board Bracket	Front Frame	4	0515-0664	M3 X 0.5 (12 mm long)	Torx T-10	9 inch lbs
		2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch lbs.
Front Panel Interface Board & Main Keypad	Front Frame	10	0515-0430	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Front Panel Interface Board Shield	Front Frame	41	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
L.O. Synthesizer Assembly Bracket	L.O. Synthesizer Assembly	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Low Band Switch	Chassis	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Low Band Switch (Option 544, 550)	Chassis	5	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Motherboard (Front)	Motherboard Bracket	9	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Motherboard Interconnect	Chassis Base	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Chassis Sides (Left & Right)	Rear Motherboard Bracket	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	New Chassis	8	0515-0433	M4 X 0.7 (8 mm long)	Torx T-20	21 inch-lbs

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Cable Clamp (Fan)	Fan Bracket	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Motherboard Bracket (Front)	Chassis	7	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Rear Motherboard	Rear Motherboard Bracket	3	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
On/Off Keyboard & Keypad	Front Frame	2	0515-0430	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Power Supply Bracket	Chassis	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	New Chassis	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	Power Supply	9	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Preselector Bypass Switch	Preselector Bypass Switch Bracket	2 per	0515-1992	M2.5 X 0.45 (20 mm long)	Torx T-8	6 inch-lbs
Rear Feet	Rear Panel	4	0515-1619	M4 X 0.7 (25 mm long)	Torx T-20	21 inch-lbs
		4	3050-0893	Flat Washer	n/a	n/a
Rear Brace	Chassis Side (Left & Right)	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	Wideband Digital I.F. Assembly	1	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
	H1G Assembly (Option H1G)	6	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Rear Frame	Chassis	21	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Rear Frame	Chassis Corners	4	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
RF Front End Assembly	Motherboard Bracket	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
RF Side Bracket (Right Side Outer)	Chassis Base & Bracket "S" Shape Chassis Side	7	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Small "T" Support Bracket	Top Brace (Front)	6	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Stiffener Brace	Chassis	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
		2	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
Top Brace (Front/Holes)	Chassis	6	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	Chassis & PCB Assemblies	9	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
	Chassis (Left & Right Sides)	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Top Brace (Rear/Solid)	Chassis Side	5	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
	Chassis Rear	1	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
	Chassis (Left & Right Sides)	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Strap Handles	Chassis Side	2 per	0515-0710	M4 X 0.8 (18 mm long)	Torx T-20	21 inch-lbs

Table 19-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Tool	Torque
Transfer Switch	Transfer Switch Bracket	4	0515-1934	M2.5 X 0.45 (6 mm long)	Torx T-8	6 inch-lbs
Transfer Switch Bracket	Chassis	3	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Wideband Analog I.F. Assembly Cable Bracket	Chassis Side	1	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
Wideband Analog I.F. Cable	Plastic Cable Guard	2	0515-1946	M3 X 0.5 (6 mm long)	Torx T-10	9 inch-lbs
YTF Preselector	Chassis	4	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
YTO Assembly	Chassis	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs
YTO Top Board	YTO Assembly	1	0515-0659	M2 X 0.4 (8 mm long)	Torx T-6	2 inch-lbs
YTO Top Shield	YTO Assembly	2	0515-0372	M3 X 0.5 (8 mm long)	Torx T-10	9 inch-lbs

Hardware

Figure 19-1 Major Assemblies

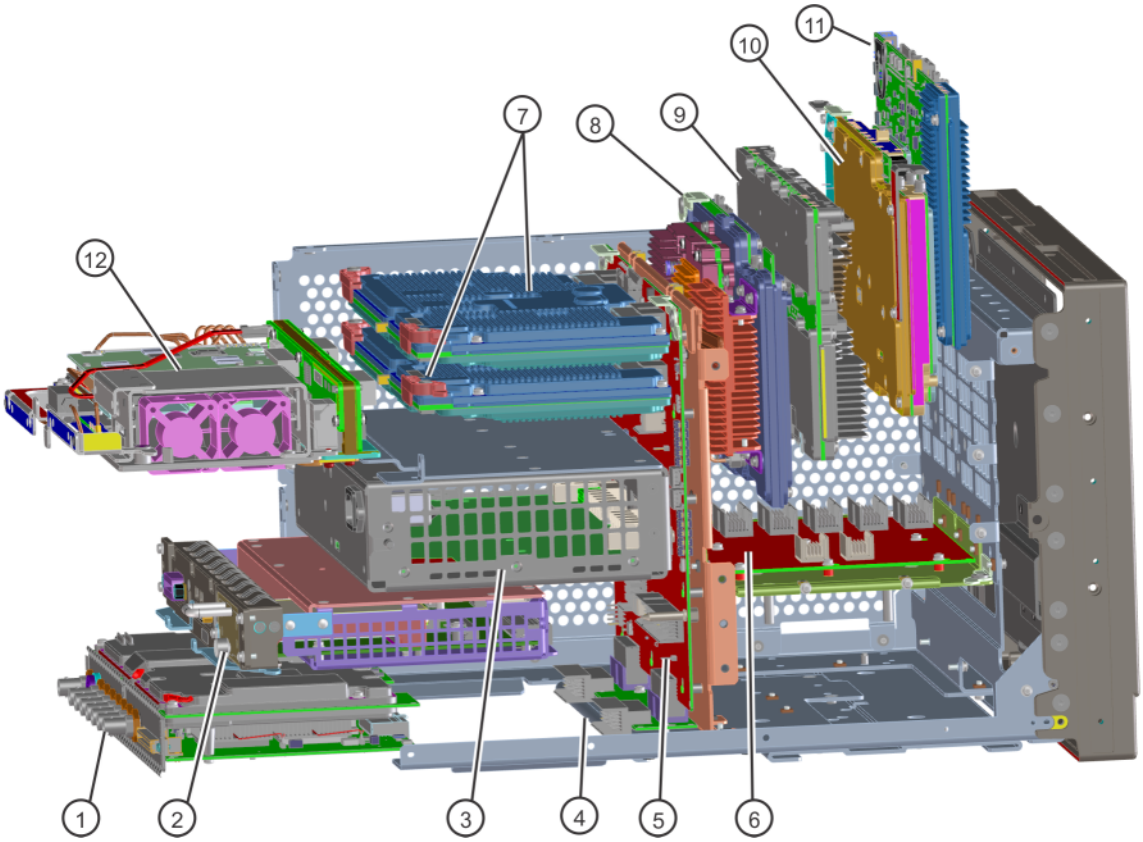


Table 19-3 Major Assemblies

Item	Description	Keysight Part Number
1	A2 Narrowband Analog I.F.	N9020-60290
	A3 Narrowband Digital I.F. Assembly	N9020-60016
2	A4 CPU Assembly	
	Options PC6, PC6S	W1312-60214
	Option PC8	W1312-60524
	Option PCA	W1312-60561
3	A6 Power Supply	0950-5748
4	A24 Motherboard Interconnect Board/ Bottom Motherboard	N9040-63004
5	A7 Rear Motherboard Assembly	N9040-63003
6	A8 Front Motherboard	N9040-63002
7	A22 & A23 Wideband Digital I.F. Assemblies (Options B2X and B5X)	See A22 and A23 in Table 19-1
8	A14 L.O. Synthesizer Assembly	N9020-60377
9	A21 Wideband Analog I.F. Assembly	N9020-60043
10	A16 Reference Assembly	N9020-60377
11	A15 Front End Controller	N9020-60295
12	A27 H1G Assembly (Option H1G) (not compatible with Option B5X)	N9040-60102

Figure 19-2 External Hardware

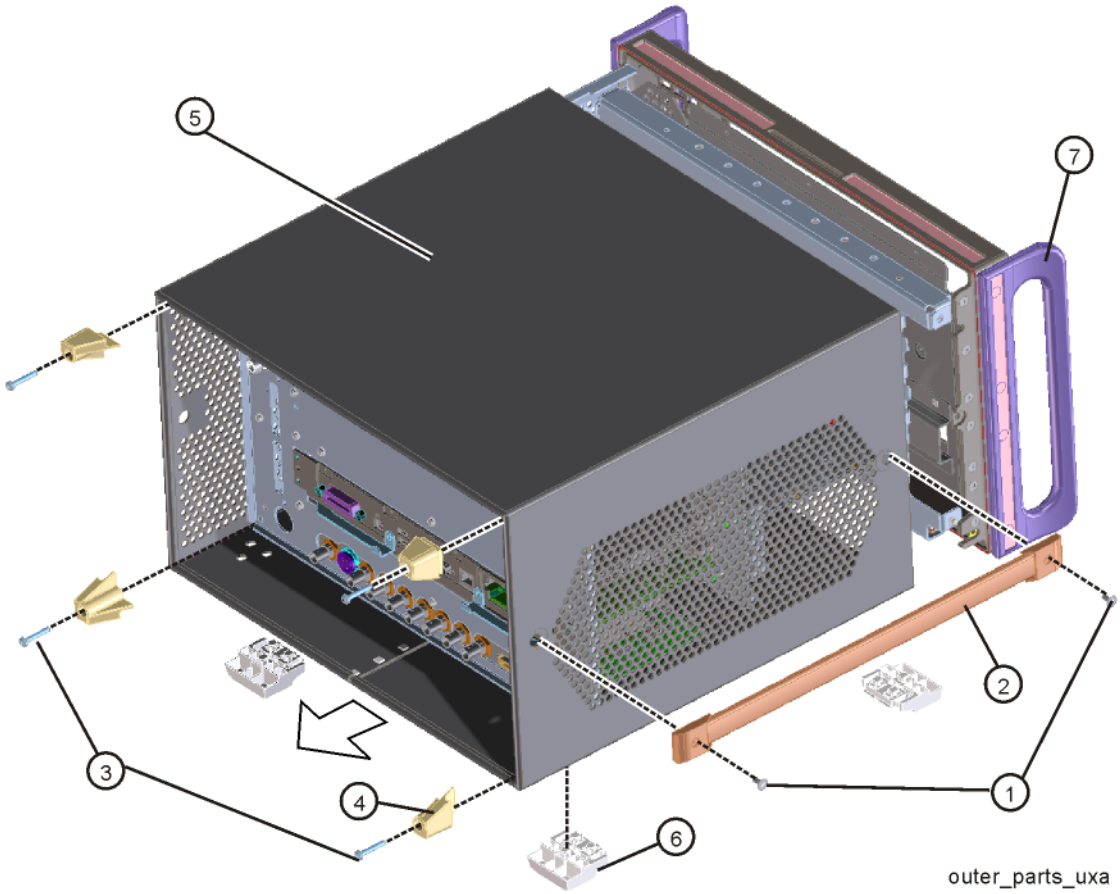


Table 19-4 External Hardware

Item	Description	Keysight Part Number
1, 2	Strap Handle (includes screws)	
	light color	E4400-60026
	dark color	N9040-60059N9040-60059
3	Screw	0515-1619
	Washer	3050-0893
4	Rear Feet	
	light color	5041-9611
	dark color	5041-7903
5	Dress Cover	
	light color	N9040-00015
	dark color	N9040-00046
6	Bottom feet	
	light color	5041-9167
	dark color	5041-7906
7	Front Frame Handles	
	light color	5023-1399
	dark color	5023-3074

Figure 19-3 Top Brace and Card Cage Brace

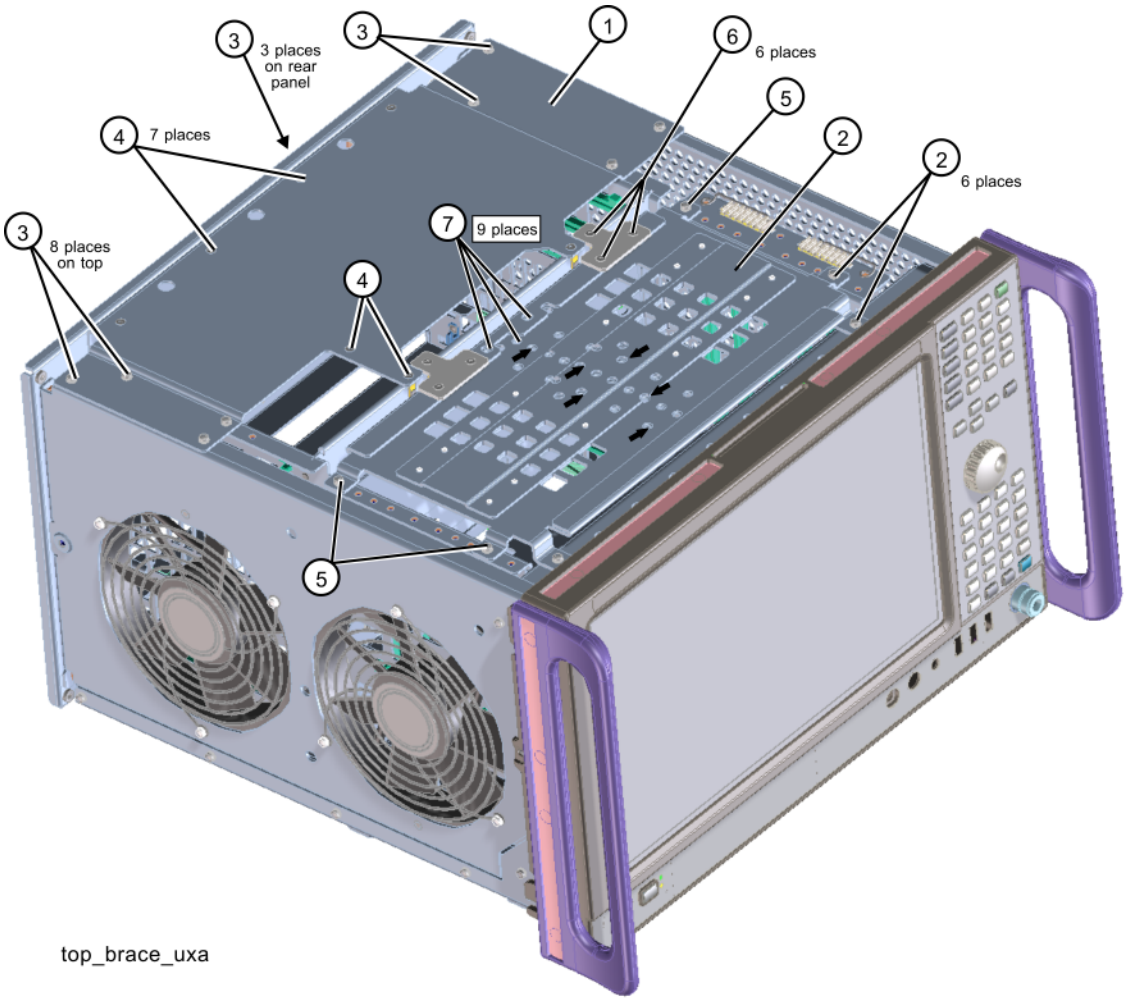


Table 19-5 Top Brace and Card Cage Brace

Item	Description	Keysight Part Number
1	Top Brace Rear	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00011
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00049
2	Top Brace Front Card Cage	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00010
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00055
5	Screw	0515-0372
3, 4, 6, 7	Screw	0515-1946

Figure 19-4 RF Area (Options 508, 513, 526)

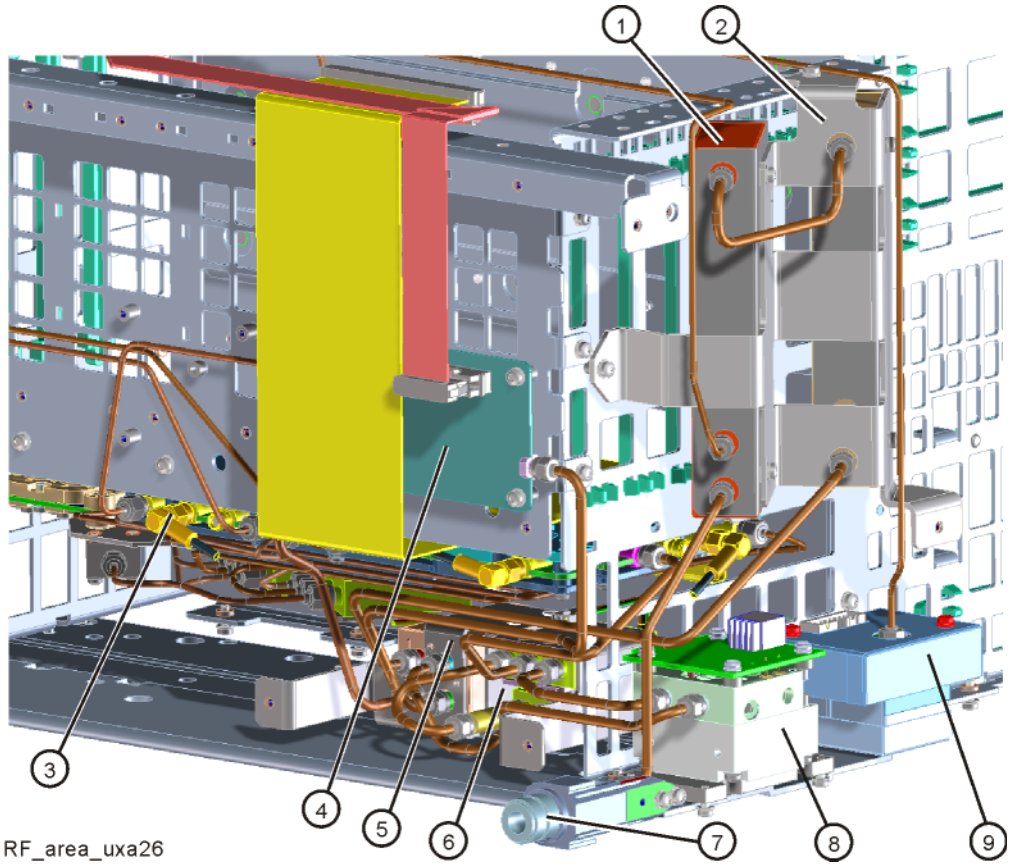


Table 19-6 RF Area (Options 508, 513, 526)

Item	Description	Keysight Part Number
1	A9 RF Attenuator A	33360-60011
2	A10 RF Attenuator B	33321-60085
3	A13 RF Front End Assembly	
	Std & Option B2X (Options 508, 513, 526)	N9020-60129
	Option B5X (Options 508, 513, 526)	N9020-60208
4	A11 Low Band Switch Assembly	E4410-60121
5	SW3 Transfer Switch Assembly	87222-60026
6	SW1 and SW2 Coax Switches	N1810-60069
7	J1 RF Input Connector	
	Type-N	N9039-60030
	3.5 mm (Option C35)	N9020-60196
8	A12 YTF Preselector	5087-7382
9	A20 YTO	N9020-60009

RF Area Cables (Options 508, 513, 526)

Refer to Figure 19-5 through Figure 19-9 for locations of RF area cables for Options 508, 513, and 526.

Figure 19-5 RF Area Cables (Options 508, 513, 526)

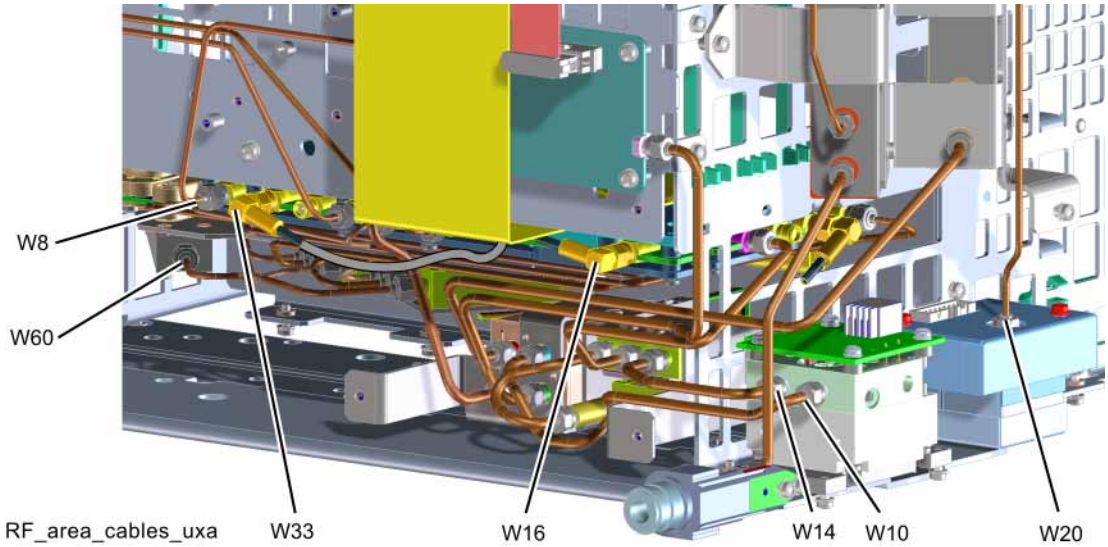
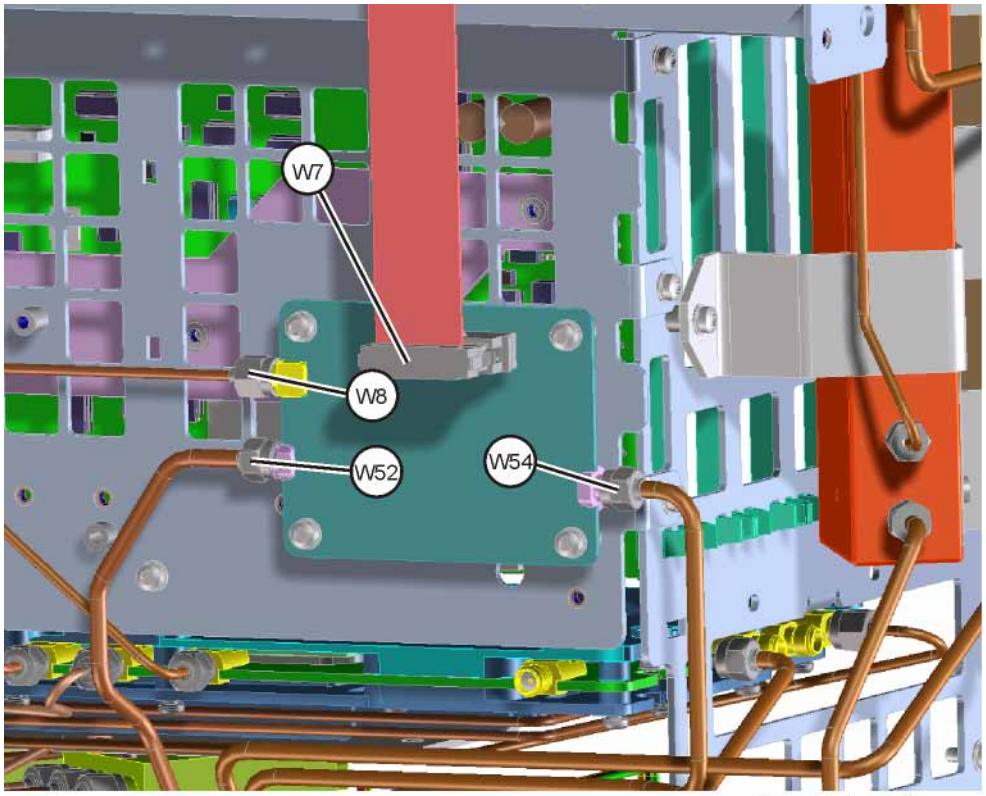


Figure 19-6 Low Band Switch Cables (Options 508, 513, 526)



LB_switch_cables_uxa

Figure 19-7 MPB/LNP Cables (Options 508, 513, 526)

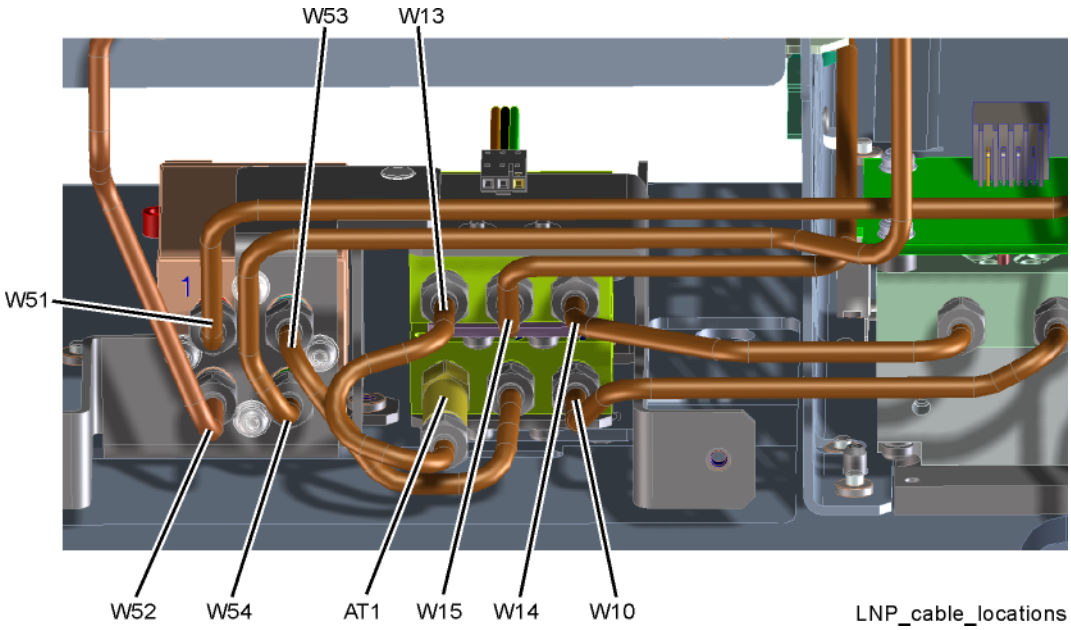


Figure 19-8 RF Front End Cables (Options 508, 513, 526)

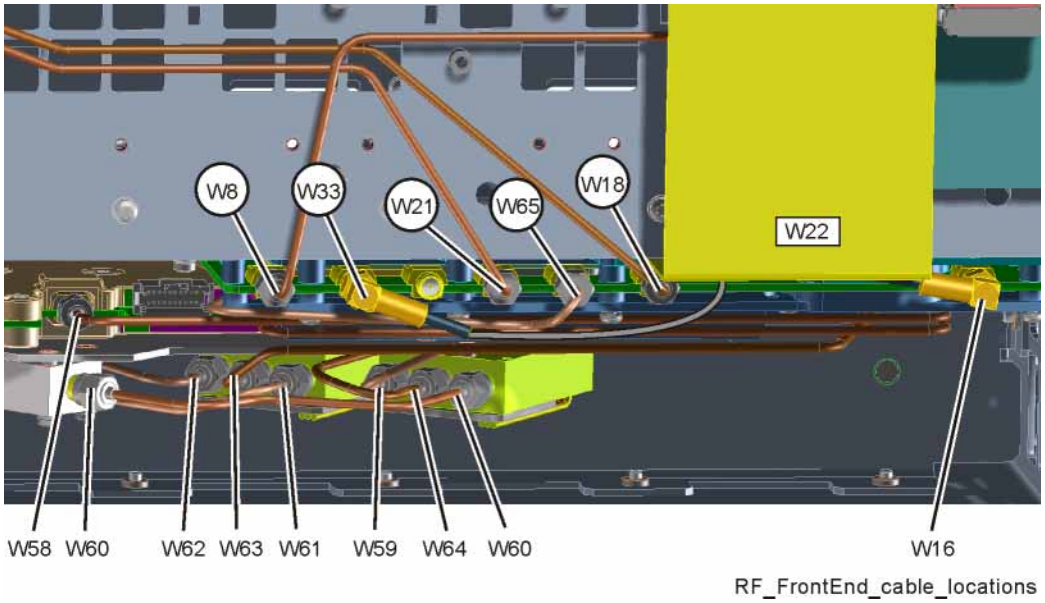


Figure 19-9 RF Front End Side Cables (Options 508, 513, 526)

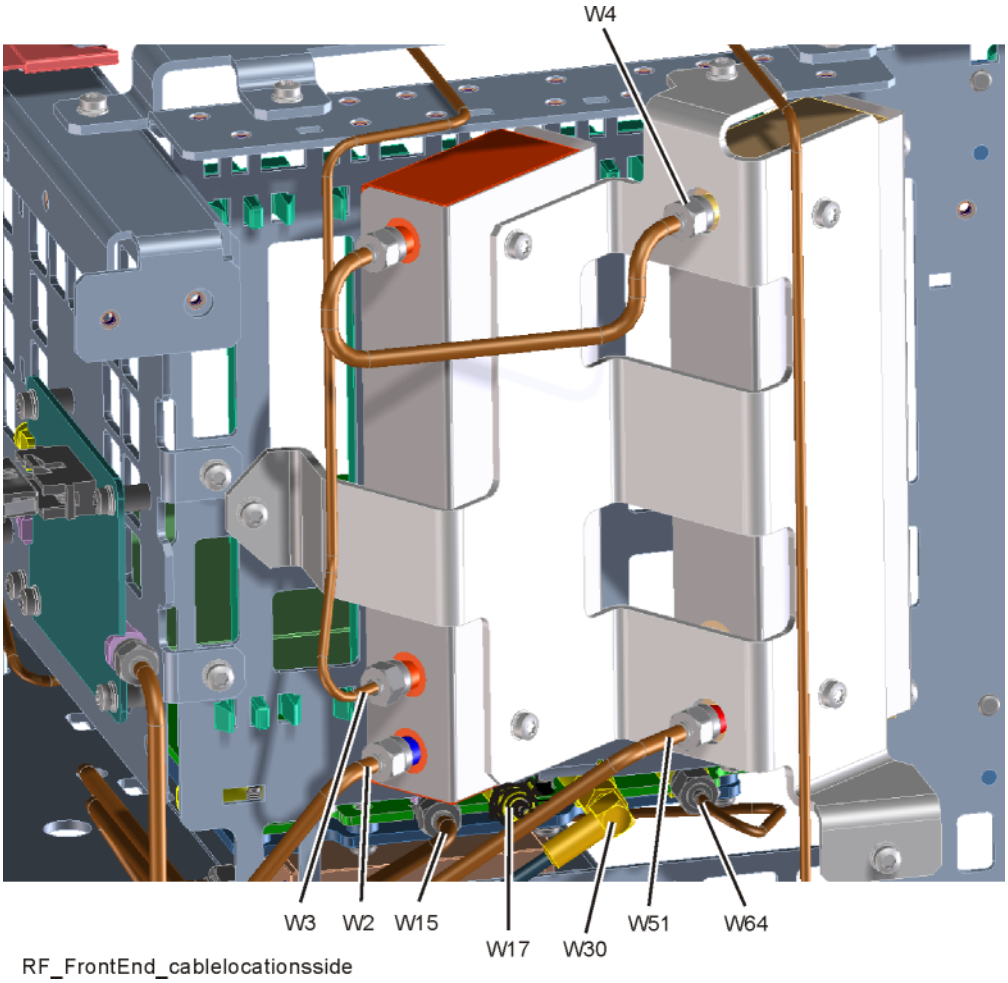


Table 19-7 RF Area Cables (Options 508, 513, 526)

Item	Description	Keysight Part Number
AT1	Attenuator, 6 dB Coax (connects to SW1 & W13)	08493-60026
W2	Cable, Semi-rigid, RF Input Connector to A9 Attenuator A Input	
	Option CNF, Type-N Input	N9040-20025
	Option C35, 3.5 mm Input	N9040-20043
W3	Cable, Semi-rigid, A16 Reference J701 to A9 Attenuator Calibrator Input	N9040-20027
W4	Cable, Semi-rigid, A9 Attenuator A Output to A10 Attenuator B Input	N9040-20026
W7	Cable, A15 Front End Controller J700 to A11 Band Switch J4	N9040-60036
W8	Cable, Semi-rigid, A11 Band Switch J3 to A13 Front End Assembly J2	N9040-20032
W10	Cable, Semi-rigid, SW1 MPB Switch Port II to A12 YTF Input	N9040-20033
W13	Cable, Semi-rigid, AT1 6 dB Attenuator to SW2 MPB Switch Port I	N9040-20036
W14	Cable, Semi-rigid, A12 YTF Output to SW2 MPB Switch Port II	N9040-20034
W15	Cable, Semi-rigid, SW2 Port C to A13A1 Front End Assembly J9	N9040-20035
W16	Cable, Coax, A13A1 Front End Assembly J7 to A15 Front End Controller J902	8121-2608
W17	Cable, Semi-rigid, A13A1 Front End Assembly J8 to Cable W29	N9040-60046
W18	Cable, Semi-rigid, A16 Reference J702 to A13A1 Front End Assembly J1	N9040-20039
W20	Cable, Semi-rigid, A20 YTO Output to A14 DDS LO Synthesizer J2	N9040-20098
W21	Cable, Semi-rigid, A14 DDS LO Synthesizer J1 to A13A1 Front End Assembly J4	N9040-20038
W22	Cable, Ribbon, A15 Front End Controller J102 to A13A1 Front End Assembly J12	N9040-60037
W30	Cable, Coax, A13A1 Front End Assembly J13 to A15 Front End Controller J903	8121-1940
W33	Cable, Coax, A16 Reference J705 to A13A1 Front End Assembly J6	8121-1940
W51	Cable, Semi-rigid, A10 Attenuator B Output to SW3 LNP Switch Port I	N9040-20028
W52	Cable, Semi-rigid, SW3 LNP Switch Port 4 to A11 Band Switch J1	N9040-20031
W53	Cable, Semi-rigid, SW3 LNP Switch Port 2 to SW1 MPB Switch Port C	N9040-20029
W54	Cable, Semi-rigid, Semi-Rigid, A11 Band Switch J2 to SW3 LNP Switch Port 3	N9040-20030
W58	Cable, Semi-rigid, A13A2 Switched IF Filter J3 to A13A2 Switched IF Filter J4 (Delay Line)	N9020-20080
W59	Cable, Semi-rigid, SW4 Filter Switch Port II to A13A2 Switch IF Filter J2	N9020-20267
W60	Cable, Semi-rigid, SW4 Filter Switch Port I to FL2 Bandpass Filter Input	N9020-20268
W61	Cable, Semi-rigid, FL2 Bandpass Filter Output to SW5 Filter Switch Port I	N9020-20269

Table 19-7 RF Area Cables (Options 508, 513, 526)

Item	Description	Keysight Part Number
W62	Cable, Semi-rigid, A13A2 Switched IF Filter J5 to SW5 Filter Switch Port II	N9020-20264
W63	Cable, Semi-rigid, SW5 Filter Switch Port C to A13A1 Front End Assembly J11	N9020-20265
W64	Cable, Semi-rigid, A13A1 Front End Assembly J10 to SW4 Filter Switch Port C	N9020-20266
W65	Cable, Semi-rigid, A13A1 Front End Assembly J3 to A13A2 Switched IF Filter J6	N9020-20245

Figure 19-10 RF Area (Options 544, 550)

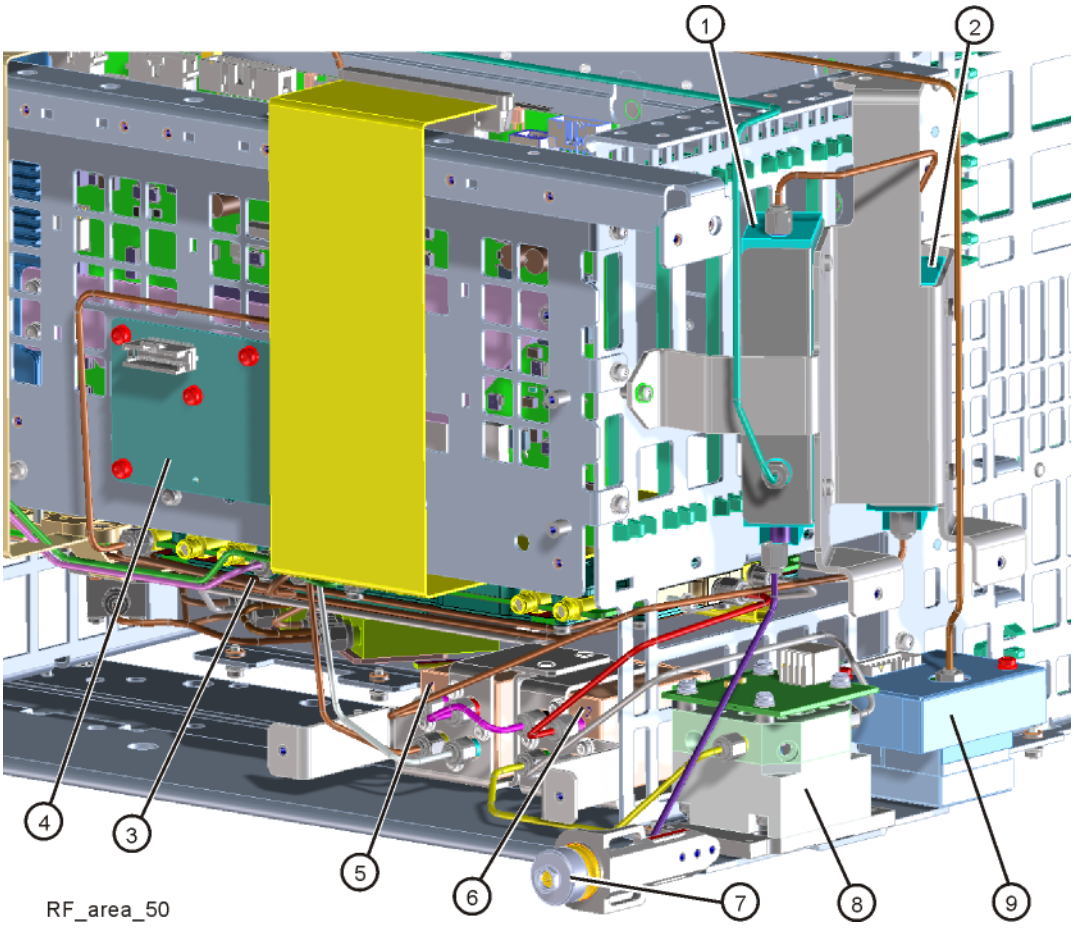


Table 19-8 RF Area (Options 544, 550)

Item	Description	Keysight Part Number
1	A9 RF Attenuator A	33326-60013
2	A10 RF Attenuator B	33325-60020
3	A13 RF Front End Assembly	
	Options 544, 550	N9020-60210
	Options 544, 550 with Option B5X	N9020-60218
	Option 550 with Option H1G	N9020-60259
4	A11 Low Band Switch Assembly	N9020-60368
5	SW3 Transfer Switch Assembly	87222-60029
6	SW6 Transfer Switch Assembly	87222-60031
7	J1 RF Input Connector	
	2.4 mm	N9030-60011
8	A12 YTF Preselector	5087-7383
9	A20 YTO	N9020-60009

RF Area Cables (Options 544, 550)

Refer to Figure 19-11 through Figure 19-13 for locations of RF area cables for Options 544 and 550.

Figure 19-11 RF Area Cables (Options 544, 550)

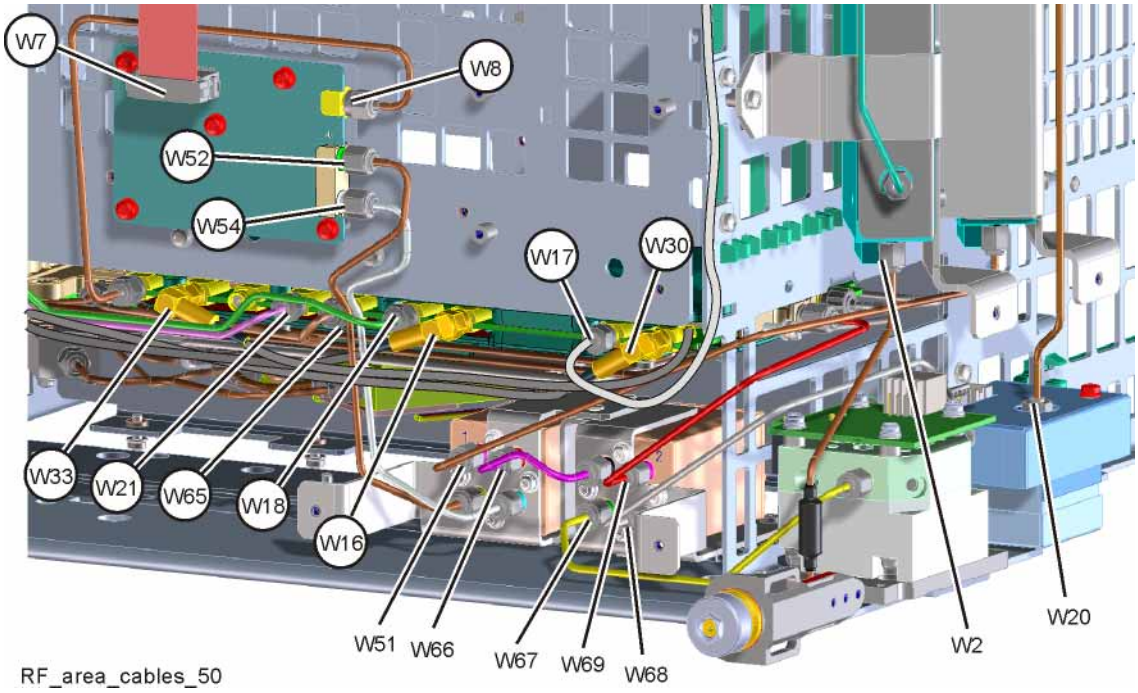


Figure 19-12 RF Front End Cables (Options 544, 550) (Option B5X shown)

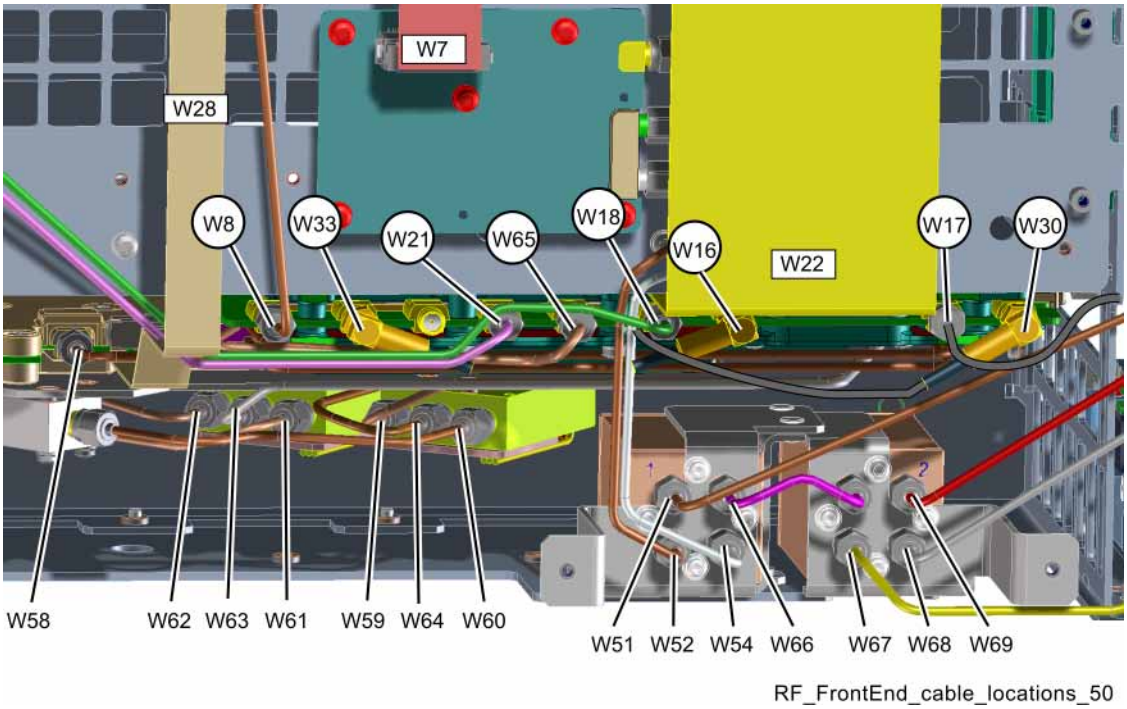


Figure 19-13 RF Front End Side Cables (Options 544, 550)

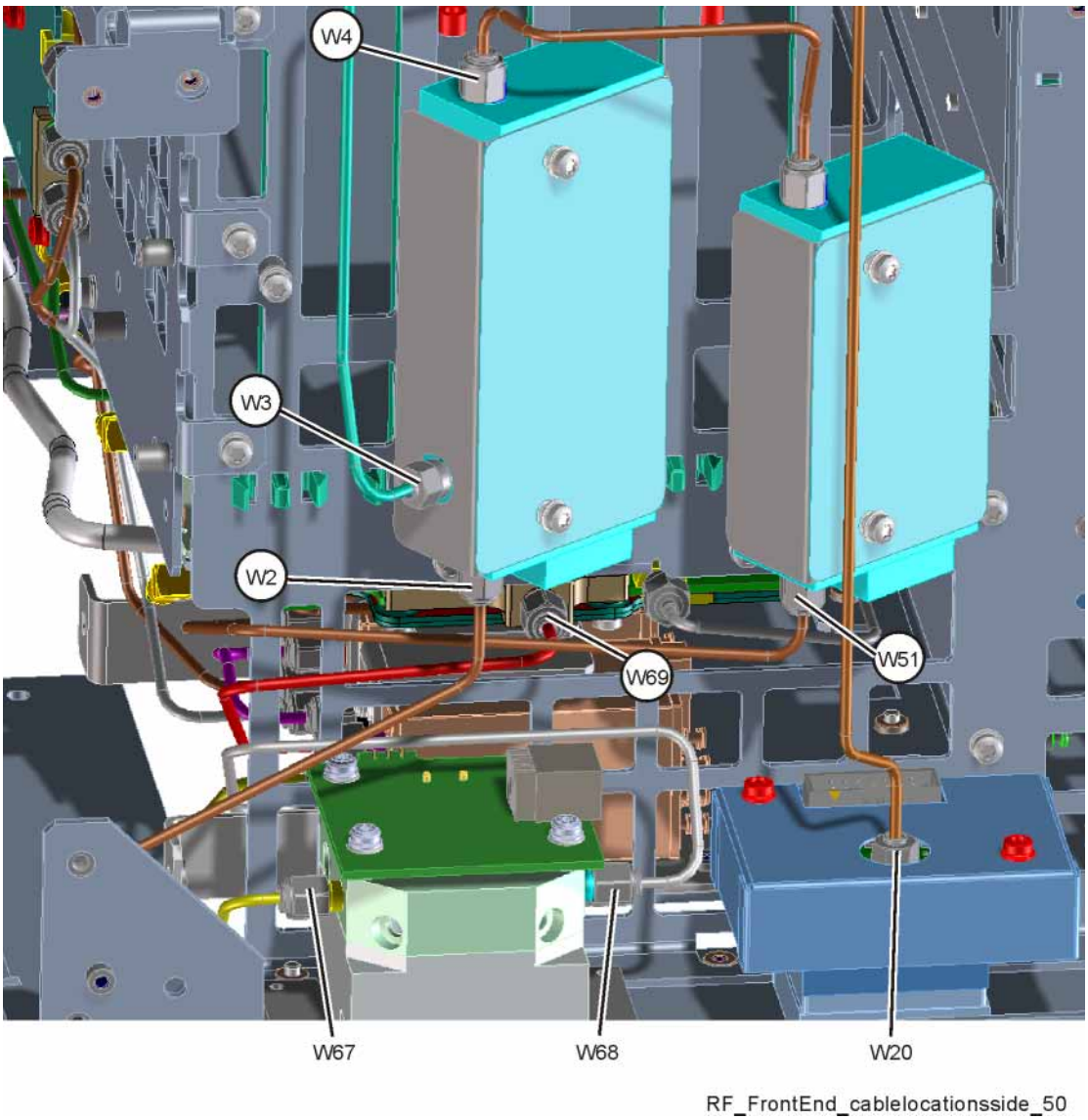


Table 19-9 RF Area Cables (Options 544, 550)

Item	Description	Keysight Part Number
W2	Cable, Semi-rigid, RF Input Connector to A9 Attenuator A Input	N9040-20114
W3	Cable, Semi-rigid, A16 Reference J701 to A9 Attenuator Calibrator Input	N9040-20103
W4	Cable, Semi-rigid, A9 Attenuator A Output to A10 Attenuator B Input	N9040-20102
W7	Cable, A15 Front End Controller J700 to A11 Band Switch J4	N9040-60066
W8	Cable, Semi-rigid, A11 Band Switch J3 to A13 Front End Assembly J2	N9040-20108
W16	Cable, Coax, A13A1 Front End Assembly J7 to A15 Front End Controller J902	8121-2027
W17	Cable, Semi-rigid, A13A1 Front End Assembly J8 to Cable W29	N9040-60046
W18	Cable, Semi-rigid, A16 Reference J702 to A13A1 Front End Assembly J1	N9040-20113
W20	Cable, Semi-rigid, A20 YTO Output to A14 DDS LO Synthesizer J2	N9040-20098
W21	Cable, Semi-rigid, A14 DDS LO Synthesizer J1 to A13A1 Front End Assembly J4	N9040-20112
W22	Cable, Ribbon, A15 Front End Controller J102 to A13A1 Front End Assembly J12	N9040-60037
W28	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9040-60034
W30	Cable, Coax, A13A1 Front End Assembly J13 to A15 Front End Controller J903	8121-2608
W33	Cable, Coax, A16 Reference J705 to A13A1 Front End Assembly J6	8121-1940
W51	Cable, Semi-rigid, A10 Attenuator B Output to SW3 LNP Switch Port I	N9040-20104
W52	Cable, Semi-rigid, SW3 LNP Switch Port 4 to A11 Band Switch J1	N9040-20106
W54	Cable, Semi-rigid, Semi-Rigid, A11 Band Switch J2 to SW3 LNP Switch Port 3	N9040-20107
W58	Cable, Semi-rigid, A13A2 Switched IF Filter J3 to A13A2 Switched IF Filter J4 (Delay Line)	N9020-20080
W59	Cable, Semi-rigid, SW4 Filter Switch Port II to A13A2 Switch IF Filter J2	N9020-20267
W60	Cable, Semi-rigid, SW4 Filter Switch Port I to FL2 Bandpass Filter Input	N9020-20268
W61	Cable, Semi-rigid, FL2 Bandpass Filter Output to SW5 Filter Switch Port I	N9020-20269
W62	Cable, Semi-rigid, A13A2 Switched IF Filter J5 to SW5 Filter Switch Port II	N9020-20264
W63	Cable, Semi-rigid, SW5 Filter Switch Port C to A13A1 Front End Assembly J11	N9020-20276
W64	Cable, Semi-rigid, A13A1 Front End Assembly J10 to SW4 Filter Switch Port C	N9020-20266
W65	Cable, Semi-rigid, A13A1 Front End Assembly J3 to A13A2 Switched IF Filter J6	N9020-20245

Table 19-9 RF Area Cables (Options 544, 550)

Item	Description	Keysight Part Number
W66	Cable, Semi-rigid, SW3 LNP Switch Port 2 to SW6 MPB Switch Port 1	N9040-20105
W67	Cable, Semi-rigid, SW6 MPB Switch Port 4 to A12 YTF Input	N9040-20109
W68	Cable, Semi-rigid, A12 YTF Output to SW6 MPB Switch Port 3	N9040-20110
W69	Cable, Semi-rigid, SW6 MPB Switch Port 2 to A13A1 Front End Assembly J9	N9040-20111

Figure 19-14 Card Cage Boards

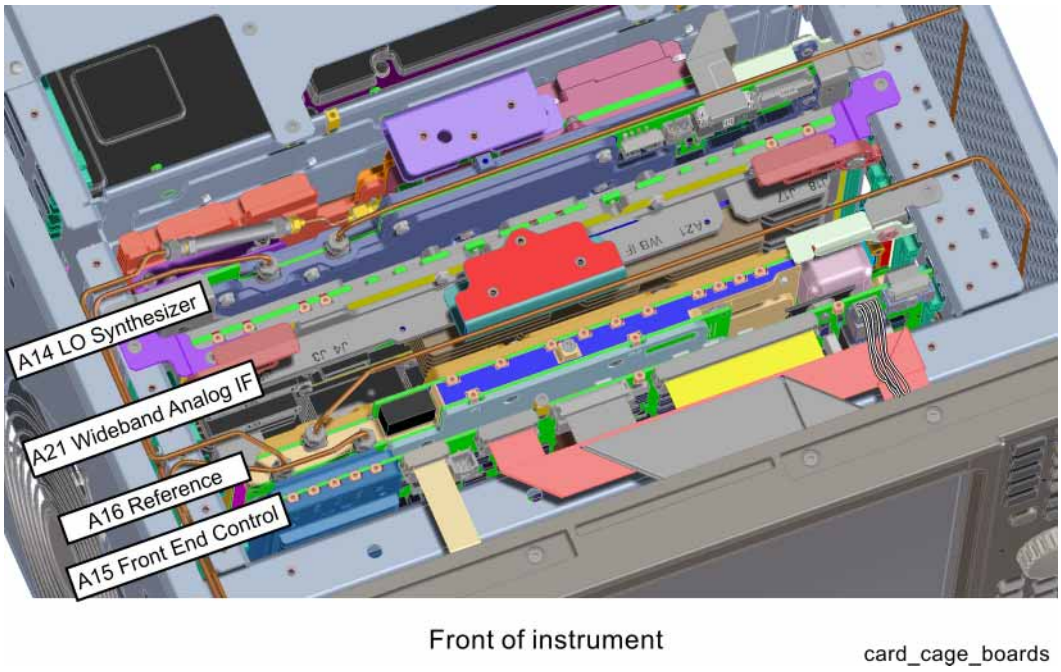


Table 19-10 Card Cage Boards

Item	Description	Keysight Part Number
1	A15 Front End Controller	N9020-60295
2	A16 Reference Assembly	N9020-60387
3	A21 Wideband Analog I.F. Assembly	N9020-60043
4	A14 L.O. Synthesizer Assembly	N9020-60377

Figure 19-15 Reference Assembly and Front End Controller Cables

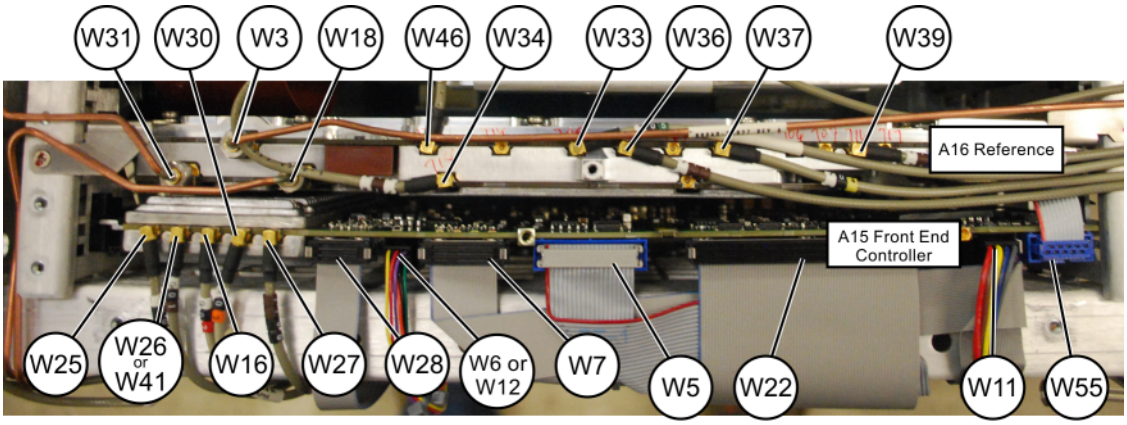


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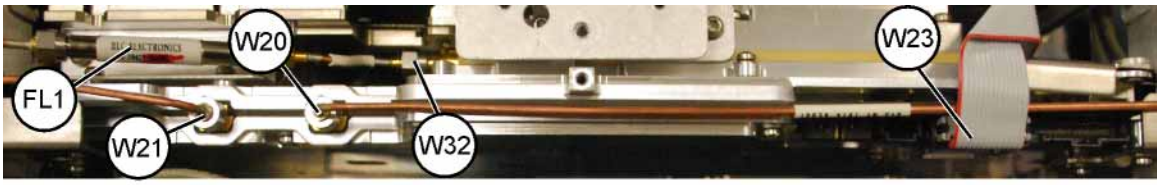
Table 19-11 Reference Assembly and Front End Controller Cables

Item	Description	Keysight Part Number
	A15 Front End Controller	N9020-60295
	A16 Reference	N9020-60387
W3	Cable, Semi-rigid, A16 Reference J701 to A9 Attenuator Calibrator Input	
	Options 508, 513, 526	N9040-20027
	Options 544, 550	N9040-20103
W5	Cable, Ribbon, A15 Front End Controller J800 to A9/A10 Attenuators	
	Options 508, 513, 526	N9040-60032
	Options 544, 550	N9040-60065
W7	Cable, A15 Front End Controller J700 to A11 Band Switch J4	
	Options 508, 513, 526	N9040-60036
	Options 544, 550	N9040-60066
W11	Cable, Wire harness, A15 Front End Controller J300 to A12 YTF J1	N9040-60033
W12	Wire Harness, A15 Front End Controller J801 to MPB Switch(s)	N9040-60039
W16	Cable, Coax, A13A1 Front End Assembly J7 to A15 Front End Controller J902	
	Options 508, 513, 526	8121-2608
	Options 544, 550	8121-2027

Table 19-11 Reference Assembly and Front End Controller Cables

Item	Description	Keysight Part Number
W18	Cable, Semi-rigid, A16 Reference J702 to A13A1 Front End Assembly J1	
	Options 508, 513, 526	N9040-20039
	Options 544, 550	N9040-20113
W22	Cable, Ribbon, A15 Front End Controller J102 to A13A1 Front End Assembly J12	N9040-60037
W25	Cable, Coax, A15 Front End Controller J900 to A2 25 MHz Analog IF J100	8121-1865
W26	Cable, Coax, A15 Front End Controller J901 to A3 40 MHz Digital IF J15	8121-1919
W27	Cable, Coax, A15 Front End Controller J1100 to Rear Panel Aux IF Out	8121-1859
W28	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9040-60034
W30	Cable, Coax, A13A1 Front End Assembly J13 to A15 Front End Controller J903	
	Options 508, 513, 526	8121-1940
	Options 544, 550	8121-2608
W31	Cable, Semi-rigid, A16 Reference J703 to FL1 7.2 GHz Bandpass Filter Input	N9040-20040
W33	Cable, Coax, A16 Reference J705 to A13A1 Front End Assembly J6	8121-1940
W34	Cable, Coax, A16 Reference J718 to A21Wideband Analog IF J4	8121-0152
W36	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1919
W37	Cable, Coax, Rear Panel Ext Ref In to A16 Reference J704	8121-1863
W39	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1861
W41	Cable, Coax, A15 Front End Controller J901 to A21 Wideband Analog IF J17	8121-1401
W46	Cable, Coax, A16 Reference J726 to A21 Wideband Analog IF J1	8121-0152
W55	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch Control	N9040-60038

Figure 19-16 LO Synthesizer Cables



LO_synth_cables_uxa

Table 19-12 LO Synthesizer Cables

Item	Description	Keysight Part Number
FL1	7.2 GHz Bandpass Filter	9135-6218
W20	Cable, Semi-rigid, A20 YTO Output to A14 DDS LO Synthesizer J2	N9040-20098
W21	Cable, Semi-rigid, A14 DDS LO Synthesizer J1 to A13A1 Front End Assembly J4	
	Options 508, 513, 526	N9040-20038
	Options 544, 550	N9040-20112
W23	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 YTO Control	N9040-60035
W32	Cable, Semi-rigid, FL1 7.2 GHz Bandpass Filter Output to A14 DDS LO Synthesizer J35002	N9020-20226

Figure 19-17 AIF/DIF Assemblies

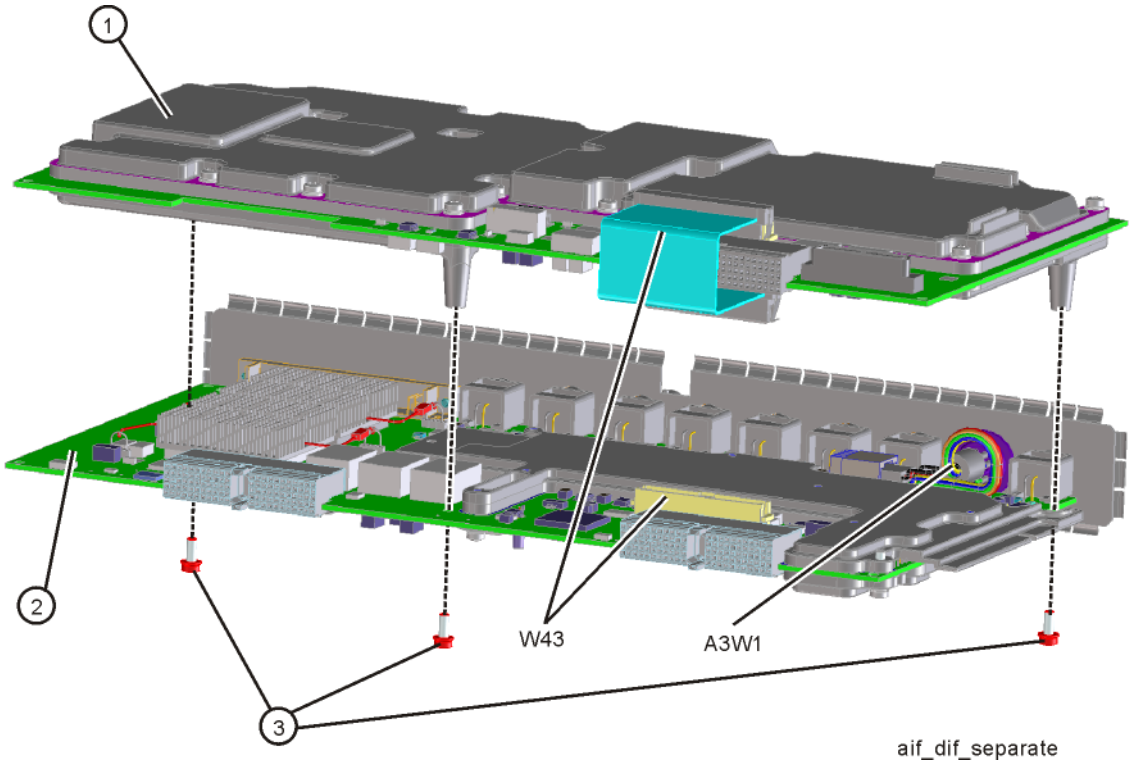


Table 19-13 AIF/DIF Assemblies

Item	Description	Keysight Part Number
1	A2 Analog I.F. Assembly	N9020-60290
2	A3 Digital I.F. Assembly	N9020-60016
3	Screw, M3 X 0.5 (8 mm long)	0515-0372
W43	Cable, Ribbon, A2 25 MHz Analog IF J820 to A3 40 MHz Digital IF J20	N9020-60046
A3W1	Cable Assembly, Smart Noise Source (Wire Harness)	N9020-60090

Figure 19-18 AIF Cables

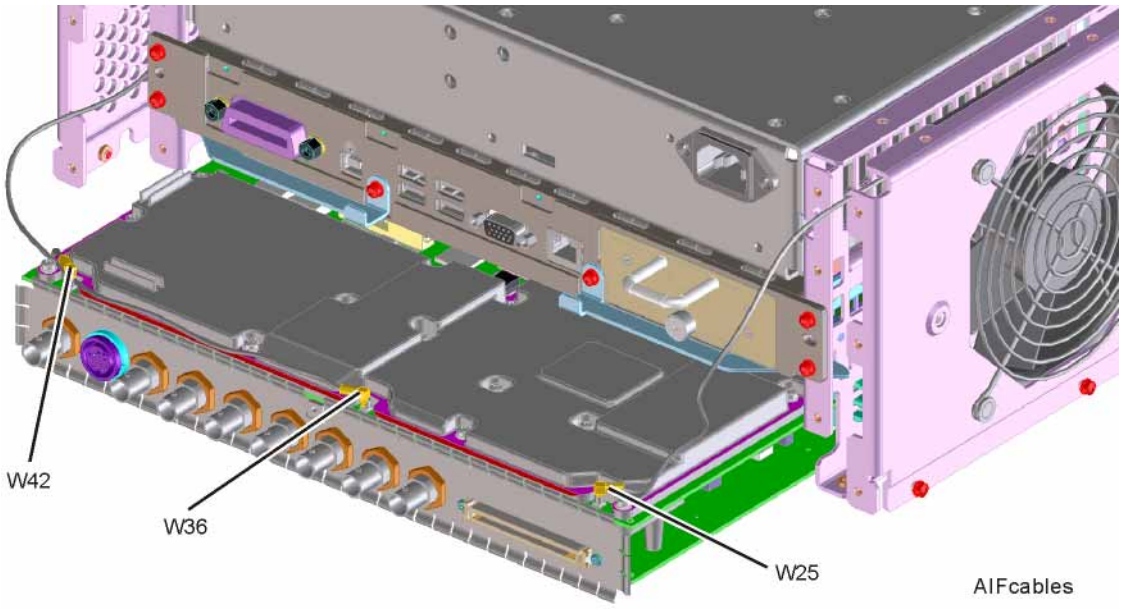


Figure 19-19 DIF Cables

Table 19-14 AIF and DIF Cables

Item	Description	Keysight Part Number
W25	Cable, Coax, A15 Front End Controller J900 to A2 25 MHz Analog IF J100	8121-1865
W26	Cable, Coax, A15 Front End Controller J901 to A3 40 MHz Digital IF J15	8121-1919
W36	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1919
W39	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1861
W40	Cable, Coax, A21 Wideband Analog IF J18 to A3 40 MHz Digital IF J15	8121-1401
W42	Cable, Coax, A2 25 MHz Analog IF J601 to A3 40 MHz Digital IF J19	8121-2607
W47	Cable, Coax, A3 40 MHz Digital IF J17 to A16 Reference J726	8121-1401

Figure 19-20 CPU Assembly

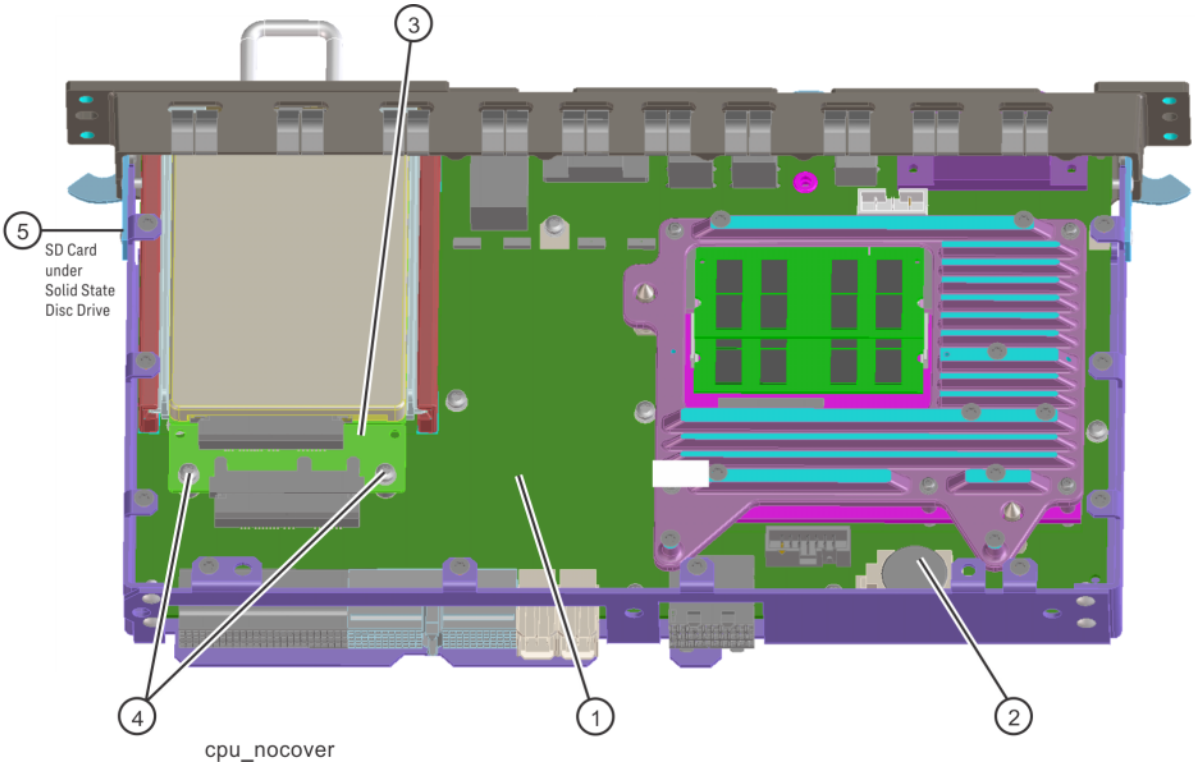


Table 19-15 CPU Assembly

Item	Description	Keysight Part Number
1	A4 CPU Assembly (Without A5 Disk Drive)	
	Option PC6, PC6S	W1312-60214
	Option PC8	W1312-60524
	Option PCA	W1312-60561
2	A4BT1 CPU Battery	1420-0356 (CR2032)
3	A4A1 Disk Drive Interconnect Board	
	Options PC6, PC6S	W1312-63377
	Option PC8	W1312-63377
	Option PCA	W1312-63571
4	Screw M3 x 0.5 (8 mm long)	0515-0372
5	A4A2 SD Memory Card	1819-1354

Figure 19-21 Disk Drive Tray Assembly - Option PC6, PC6S, PC8

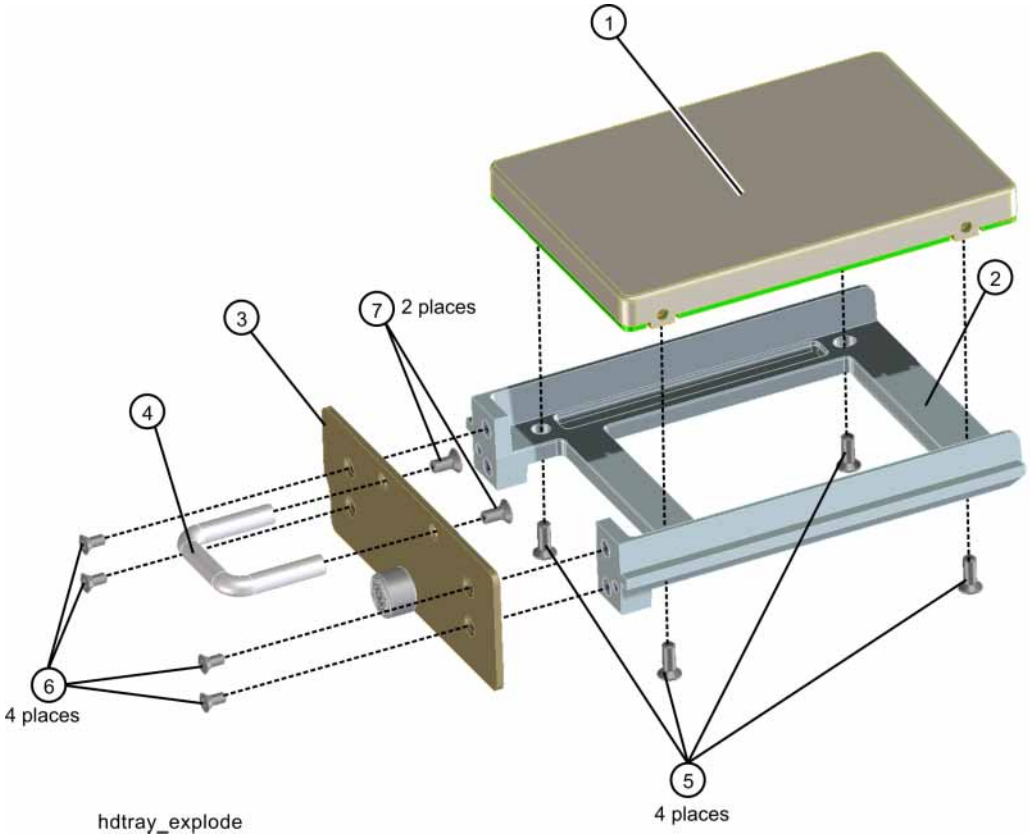


Table 19-16 Disk Drive Tray Assembly

Item	Description	Keysight Part Number
1	A5 Solid State Module	
	Options PC6, PC6S - Windows 7	N9020-60355
	Options PC6, PC6S - Windows 10	N9020-60381
	Option PC8 - Windows 10	N9032-60039
2	A5MP1 Disk Drive Tray	W1312-40078
3	A5MP2 Disk Drive Rear Panel	W1312-00103
4	A5MP3 Disk Drive Assembly Handle	1440-0421
5	Screw M3 x 0.5 (8 mm long)	0515-1035
6	Screw M2.5 x 0.45 (5 mm long)	0515-2219
7	Screw M3 x 0.5 (6 mm long)	0515-1227

Figure 19-22 Rear Boards

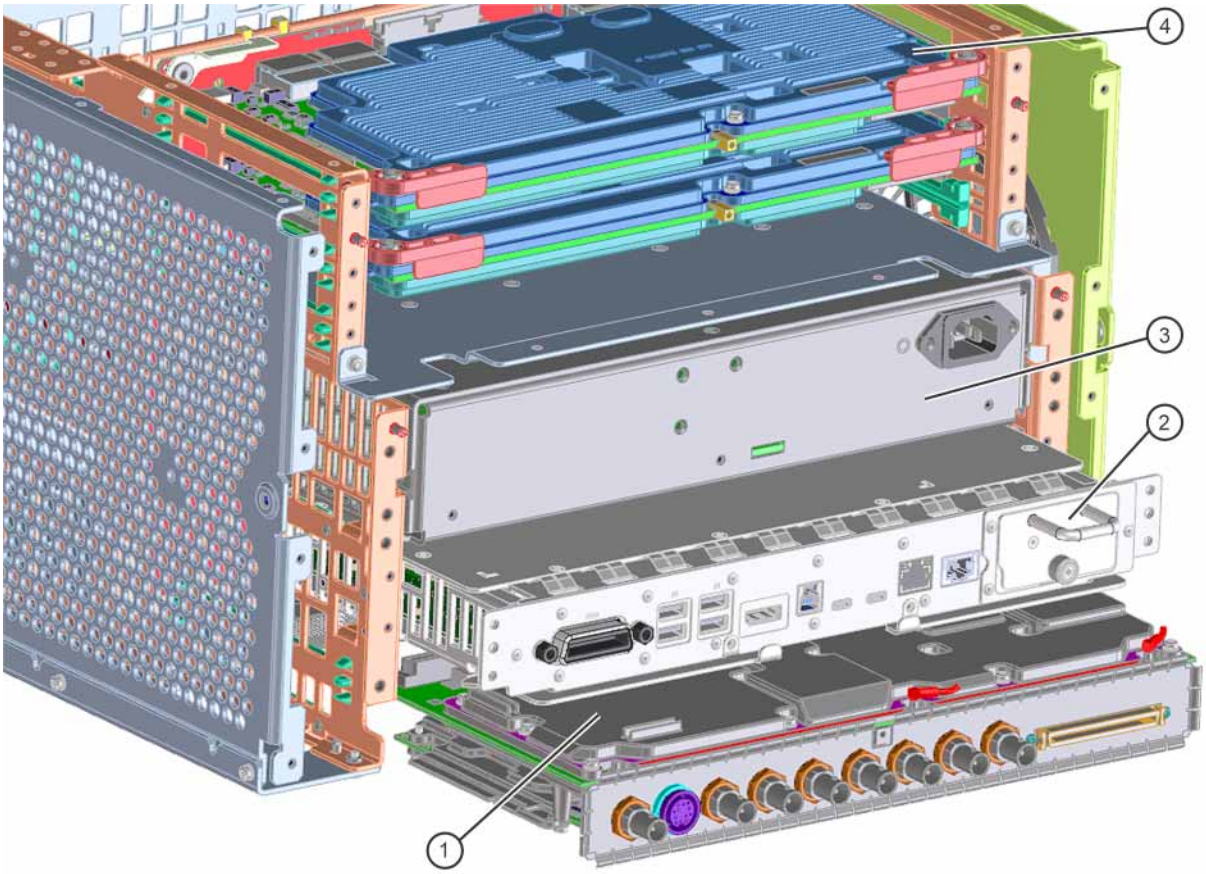


Table 19-17 Rear Boards

Item	Description	Keysight Part Number
1	A2 Narrowband Analog I.F. & A3 Narrowband Digital I.F. Assembly	N9020-60290 N9020-60016
2	A4 CPU Assembly	
	Options PC6, PC6S	W1312-60214
	Option PC8	W1312-60524
	Option PCA	W1312-60561
3	A6 Power Supply	0950-5748
4	A22 & A23 Wideband Digital I.F. Assemblies (Options B2X and B5X)	N9020-60311

Figure 19-23 Wideband I.F. Ribbon Cables

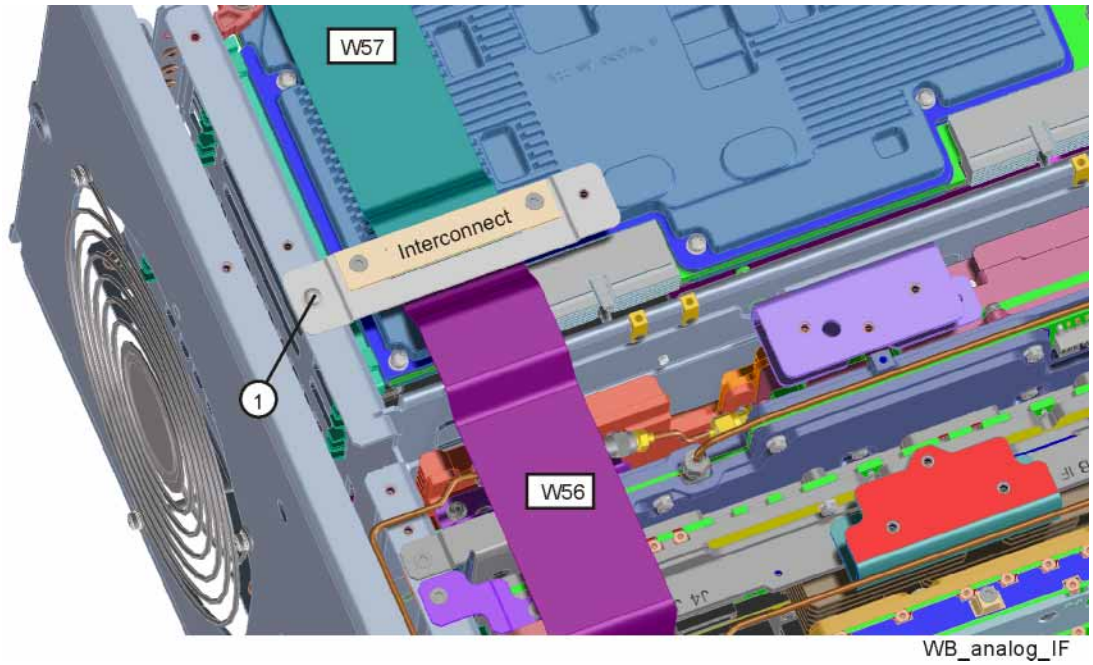


Figure 19-24 Wideband I.F. Cables

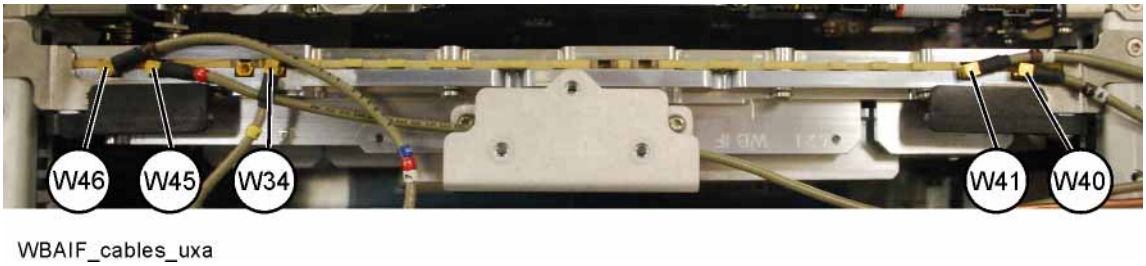


Table 19-18 Wideband I.F. Cables

Item	Description	Keysight Part Number
W34	Cable, Coax, A16 Reference J718 to A21Wideband Analog IF J4	8121-0152
W40	Cable, Coax, A21 Wideband Analog IF J18 to A3 40 MHz Digital IF J15	8121-1401
W41	Cable, Coax, A15 Front End Controller J901 to A21 Wideband Analog IF J17	8121-1401
W45	Cable, Coax, A3 40 MHz Digital IF J17 to A21 Wideband Analog IF J2	8121-1919
W46	Cable, Coax, A16 Reference J726 to A21 Wideband Analog IF J1	8121-0152
W56	Cable, Ribbon, Ribbon, A21 Wideband Analog IF J23 to Interconnect Bracket	N9040-60042
W57	Cable, Ribbon, Ribbon, Interconnect Bracket to A22 Wideband Digital IF J778	N9040-60045
	Cable, Ribbon, Interconnect Bracket to A22 Wideband Digital IF & A23 Wideband Digital IF J778	N9040-60041

Figure 19-25 Wideband Extension Board, Option RTS

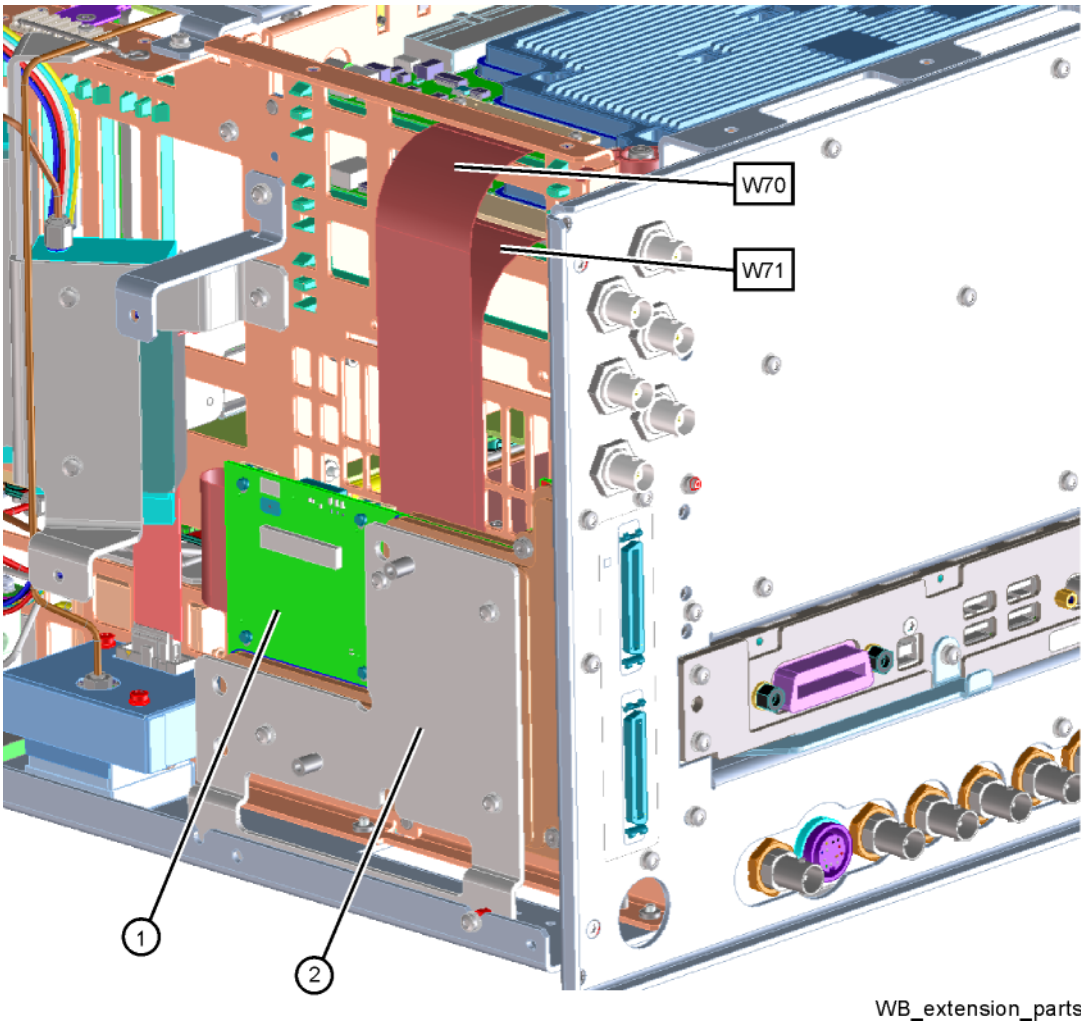


Table 19-19 Wideband Extension Board - Option RTS

Item	Description	Keysight Part Number
1	A28 Wideband Extension Board (Option RTS)	
2	Bracket, Wideband Extension Board (Option RTS)	
W70	Cable, Flex Circuit, A22 Wideband DIF J9000 to A28 Wideband DIF Extension Board J1	N9040-60047
W71	Cable, Flex Circuit, A23 Wideband DIF J9000 to A28 Wideband DIF Extension Board J2	N9040-60048

Figure 19-26 H1G Assembly

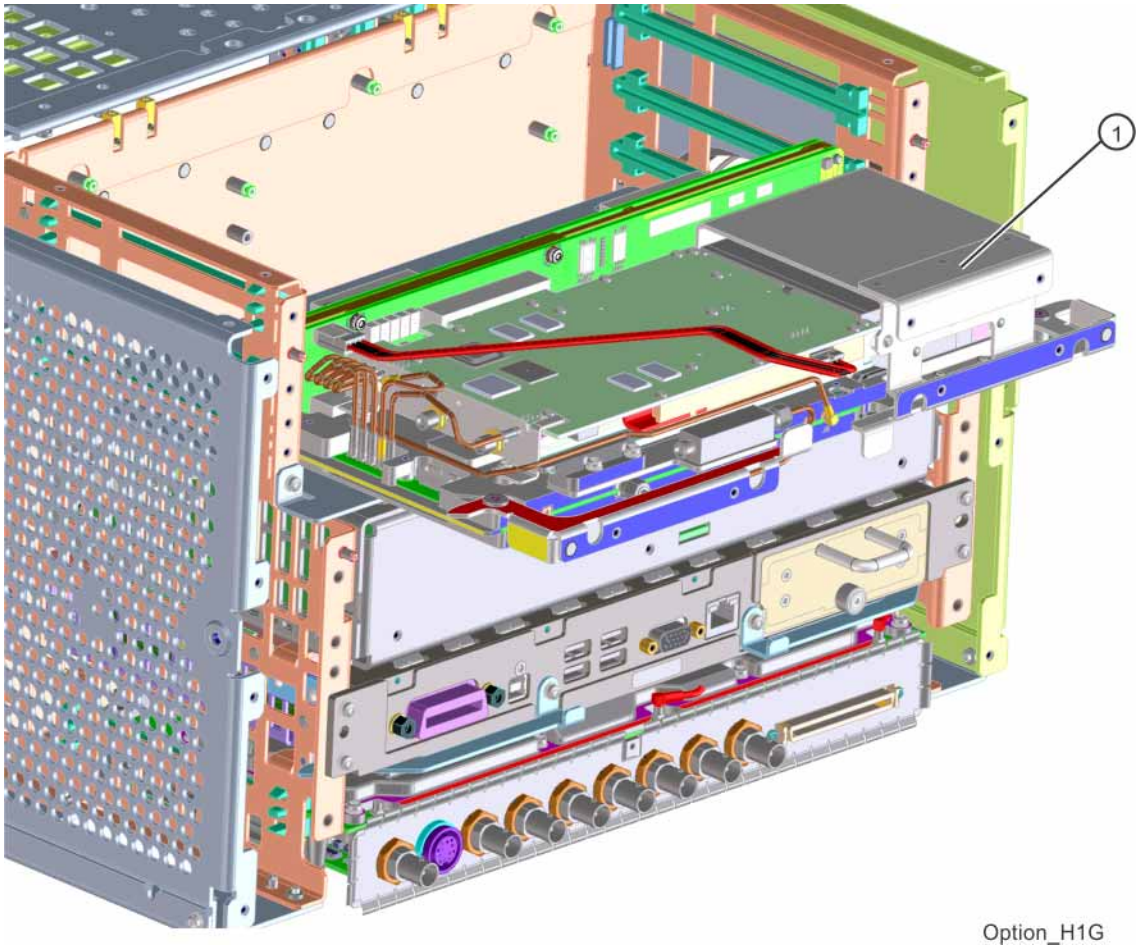


Table 19-20 H1G Assembly

Item	Description	Keysight Part Number
1	A27 H1G Assembly (Option H1G)	N9040-60102

Figure 19-27 Motherboards

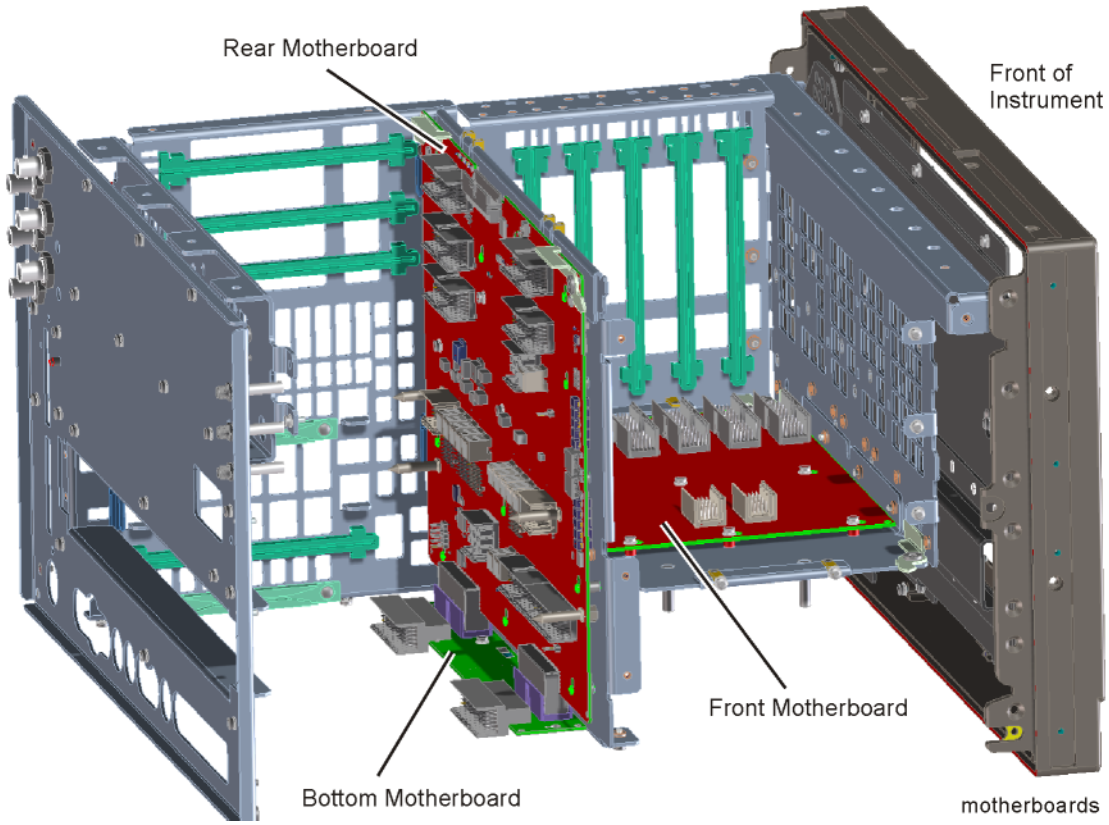


Table 19-21 Motherboards

Item	Description	Keysight Part Number
Rear Motherboard	A7 Midplane Board (Rear Motherboard) Assembly	N9040-63003
Front Motherboard	A8 Motherboard (Front/Horizontal mount)	N9040-63002
Bottom Motherboard	A24 Interconnect Board	N9040-63004

Figure 19-28 Chassis

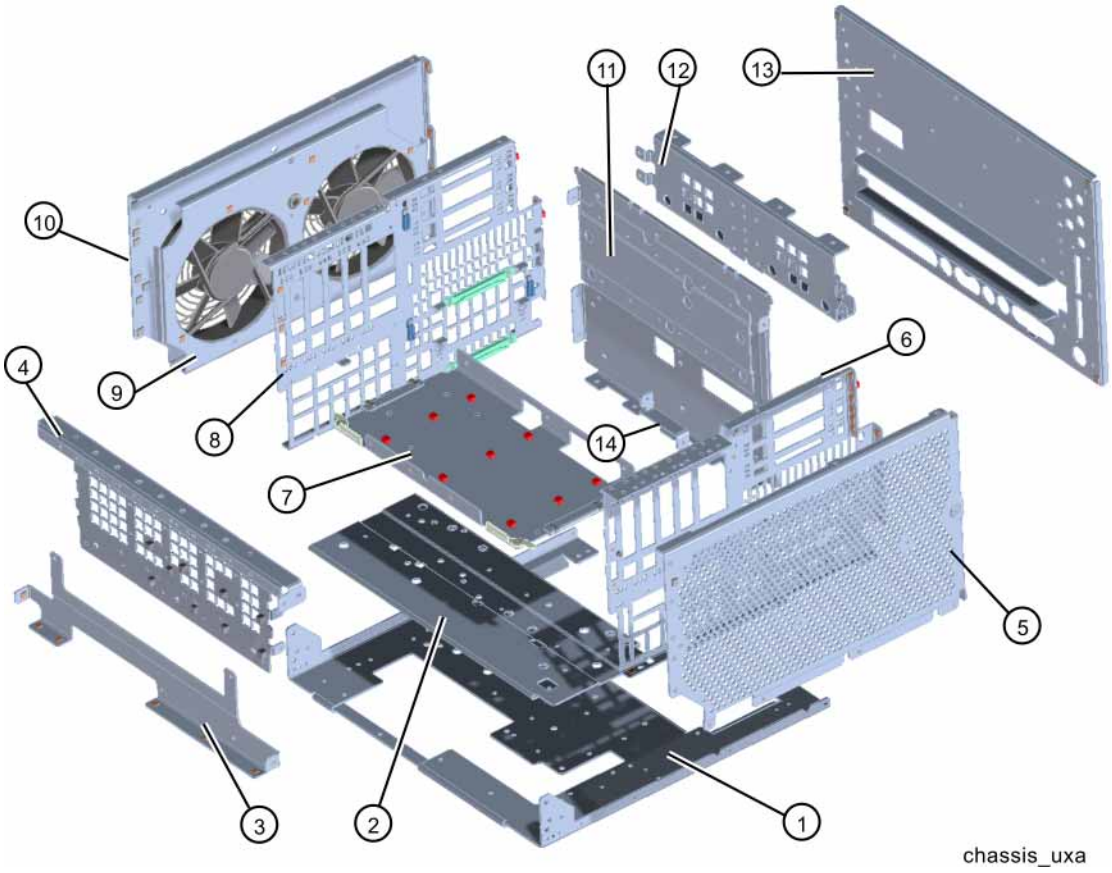


Table 19-22 Chassis

Item	Description	Keysight Part Number
1	Chassis Base	N9040-00001
2	Chassis Base Stiffener	N9040-00029
3	Bracket, Chassis Front (inner/bottom)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00008
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00036
4	Bracket, Chassis Front	N9040-00005
5	Chassis Side, Right (outer)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00013
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00047
6	Chassis Side, Right (inner)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00004
	s/n prefix ≥ 5605 and < 5616, Options 508, 513, 526 s/n prefix < 5616 Options 544 and 550	N9040-00038
	s/n prefix ≥ 5616 all frequency ranges	N9040-00060
7	Bracket, Midplane (Rear Motherboard)	
	s/n prefix < 5616	N9040-00002
	s/n prefix ≥ 5616	N9040-00058
8	Chassis Side, Left (inner)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00003
	s/n prefix ≥ 5605 and < 5616, Options 508, 513, 526 s/n prefix < 5616 Options 544 and 550	N9040-00037
	s/n prefix ≥ 5616 all frequency ranges	N9040-00059
9	Bracket, Fan (right side inner)	N9040-00007
10	Bracket, Fan (Left side/outer)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00006
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00053
11	Bracket, Motherboard (Front/Horizontal)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00024
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00051

Table 19-22 Chassis

Item	Description	Keysight Part Number
12	Bracket, Rear Brace	
	s/n prefix < 5616	N9040-00009
	s/n prefix ≥ 5616	N9040-00039
	s/n prefix ≥ 5616 Option H1G	N9040-00056
13	Rear Panel	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00014
	s/n prefix ≥ 5605 and < 5616, Options 508, 5113, 526 s/n prefix < 5616 Options 544 and 550	N9040-00050
	s/n prefix ≥ 5616 all frequency ranges	N9040-00057

Figure 19-29 Fan Hardware

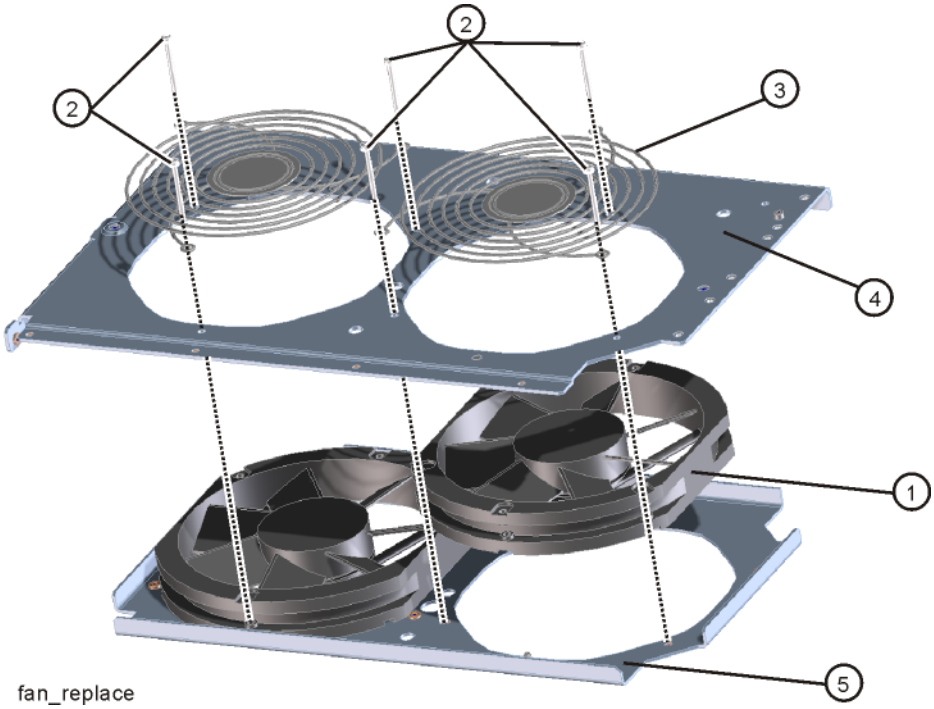


Table 19-23 Fan Hardware

Item	Description	Keysight Part Number
1	B1, B2 Fan	W1312-60063
2	Screw	0515-1038
3	Fan Grill (qty 2)	3160-4253
4	Bracket, Fan (Left side/outer)	
	s/n prefix < 5605 Options 508, 513, 526	N9040-00006
	s/n prefix ≥ 5605 and all Options 544 and 550	N9040-00053
5	Bracket, Fan (right side inner)	N9040-00007

Figure 19-30 Input Connector

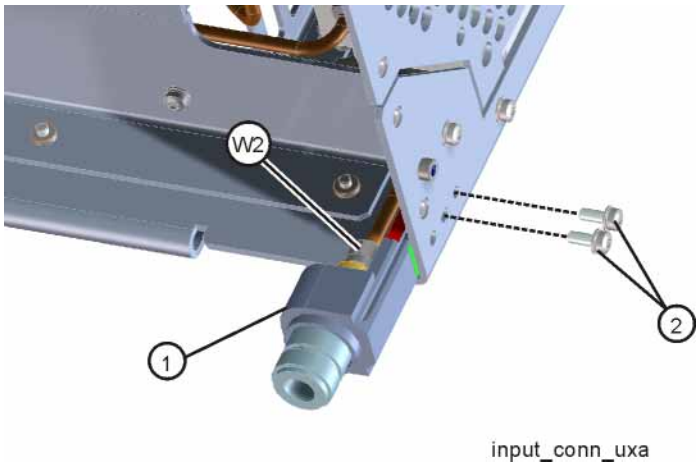


Table 19-24 Input Connector

Item	Description	Keysight Part Number
1	J1 Input Connector Assembly	
	Type-N	N9039-60030
	2.4 mm	N9030-60011
	3.5 mm (Option C35)	N9020-60196
2	Screw	0515-0372
W2	Cable, Semi-rigid, RF Input Connector to A9 Attenuator A Input	
	Option CNF, Type-N Input	N9040-20025
	Option 544, 550, 2.4 mm Input	N9040-20114
	Option C35, 3.5 mm Input	N9040-20043

Figure 19-31 Front Frame Parts - Shield Removed

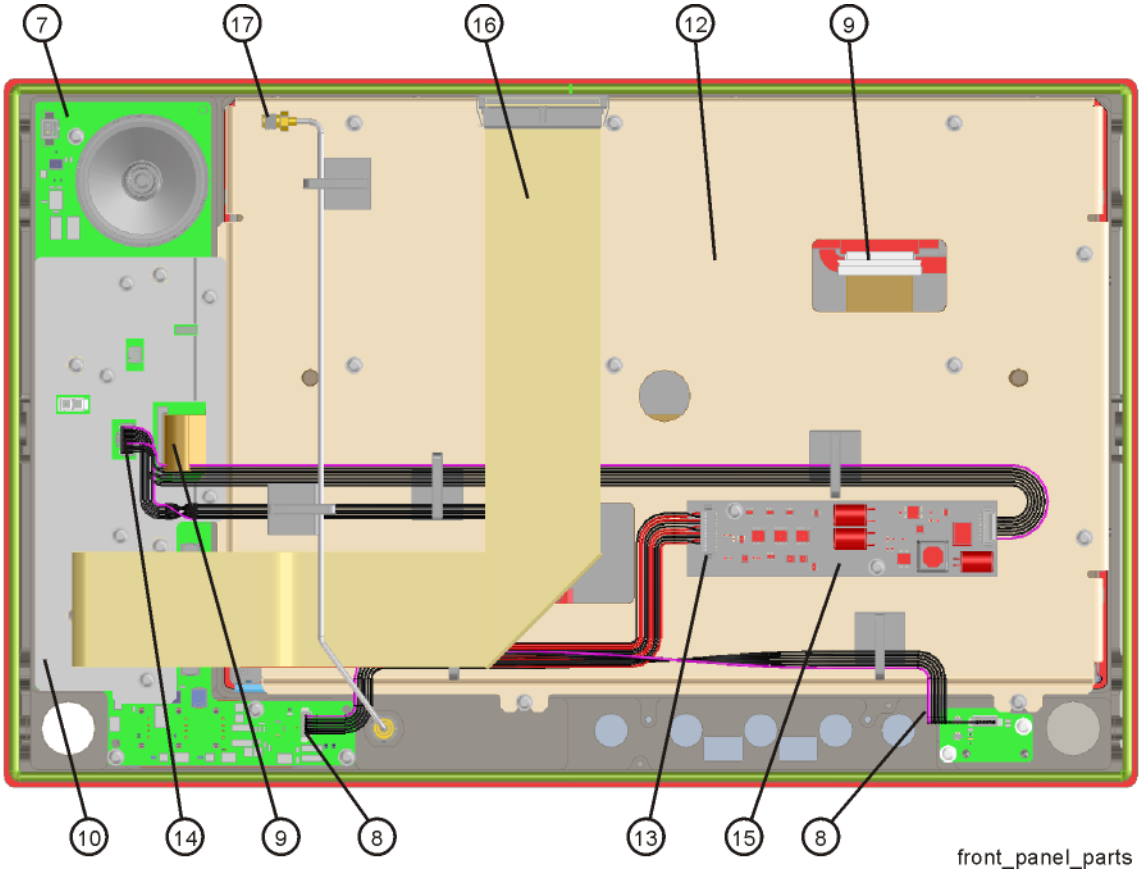


Table 19-25 Front Frame Parts

Item	Description	Part Number
7	A1A5 Controller Board	N9040-63012
8	A1W4 Cable	N9040-60026
9	A1W1 Cable	N9040-60024
10	A1MP14 Front Panel Interface Bracket	N9040-00052
12	A1MP21 Display Bracket	N9040-00018
13	A1W2 Cable	N9040-60027
14	A1W3 Cable	
	Cable Assembly, A1A5 Controller Board J16 to Backlight DC to DC Converter Input, Serial Prefix < MY/SG/US6442	N9040-60029
	Cable Assembly, A1A5 Controller Board J16 to A1A3 Touch Screen Display, Serial Prefix ≥ MY/SG/US6442	N9040-60029
15	A1A4 Converter DC-DC	0950-5670

Table 19-25 Front Frame Parts

Item	Description	Part Number
16	W1 Cable	N9040-60030
17	W29 Semi-Rigid Cable	N9040-20044

Figure 19-32 Front Frame Exploded View

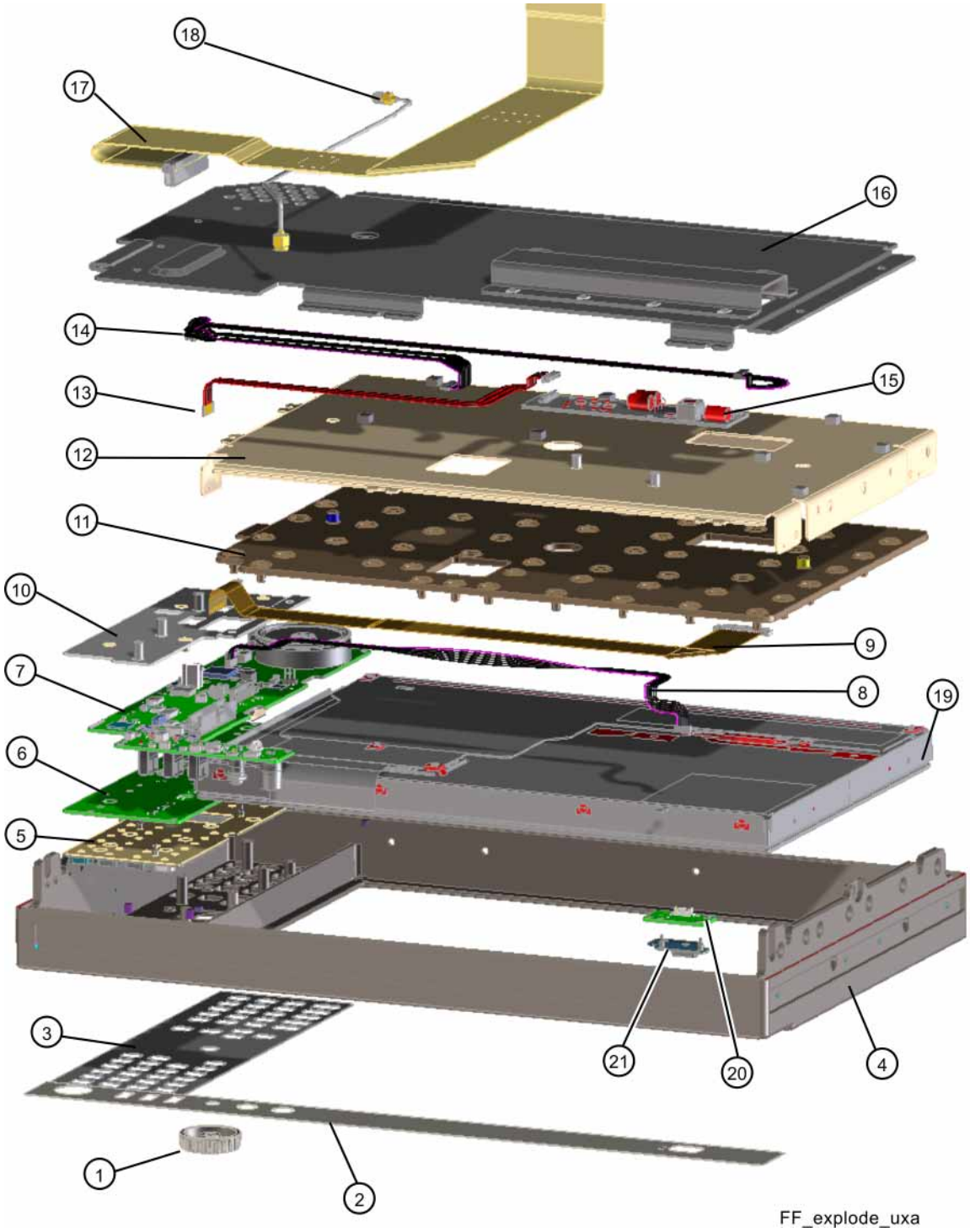


Table 19-26 Front Frame Parts

Item	Description	Keysight Part Number
1	A1MP9 RPG Knob	
	light color	W1312-40017
	dark color	W1312-40179
2	Connector Overlay (included in A1A1 Front Frame)	see Table 19-1
3	Main Keyboard Overlay (included in A1A1 Front Frame)	see Table 19-1
4	A1A1 Front Frame	see Table 19-1
5	A1MP1 Main Keypad	
	light color	N9040-40003
	dark color	N9040-40009
6	A1A2 Front Panel Keyboard	N9040-63006
7	A1A5 Front Panel Controller Board	N9040-63012
8	A1W4 Cable Assembly	N9040-60026
9	A1W1 Cable Assembly (Flex Circuit)	N9040-60024
10	A1MP14 Front Panel Controller Board Bracket	N9040-00052
11	A1MP22 Display Compression Pad	N9040-40001
12	A1MP21 Display Bracket	N9040-00018
13	A1W2 Cable Assembly	N9040-60027
14	A1W3 Cable	
	Cable Assembly, A1A5 Controller Board J16 to Backlight DC to DC Converter Input, Serial Prefix < MY/SG/US6442	N9040-60029
	Cable Assembly, A1A5 Controller Board J16 to A1A3 Touch Screen Display, Serial Prefix ≥ MY/SG/US6442	N9040-60029
15	A1A4 DC-DC Converter Board	0950-5670
16	A1MP25 Front Panel Interface Board Shield	N9040-00032
17	W1 Ribbon Cable	N9040-60030
18	W29 Semi-Rigid Cable	N9040-20044
19	A1A3 Touch Screen Display	
	Serial Prefix < MY/SG/US6442 (Upgrade Kit)	N9040-60130
	Serial Prefix ≥ MY/SG/US6442	2090-1166
20	A1A6 Front Panel On Button Keyboard	N9040-63016

Table 19-26 Front Frame Parts

Item	Description	Keysight Part Number
21	A1MP2 Front Panel On Button Keypad	
	light color	N9040-40004
	dark color	N9040-40010

Keysight Technologies
N9040B UXA Signal Analyzer

Service Guide

20 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 19, “Replaceable Parts.” for part numbers, assembly descriptions, and ordering information.

Instrument Outer Case on page 452

Top Brace and Card Cage Brace on page 454

RF Area - Options 508, 513, 526 on page 458

- A9 & A10 RF Attenuators on page 461
- A11 Low Band Switch on page 465
- A12 YTF Preselector on page 467
- A20 YTO on page 470
- Low Noise Path and Microwave Preselector Bypass Switches on page 471
- A13 RF Front End Assembly on page 481

RF Area - Options 544, 550 on page 488

- A9 & A10 RF Attenuators on page 490
- A11 Low Band Switch on page 493
- A12 YTF Preselector on page 495
- A20 YTO on page 498
- Transfer Switches on page 499
- A13 RF Front End Assembly on page 506

Card Cage Boards on page 513

- A15 Front End Control on page 514
- A16 Reference Assembly on page 515

A21 Wideband Analog I.F. Assembly (Option B2X and B5X only) on page 518

A14 L.O. Synthesizer on page 520

Rear Panel on page 521

A22 & A23 Wideband Digital I.F. Boards on page 524

A27 H1G Assembly (Option H1G) on page 528

A28 Wideband Extension Board (Option RTS) on page 534

A6 Power Supply on page 540

A4 CPU/A5 Solid State Drive on page 544

A2 AIF/A3 DIF on page 548

Fan Assembly on page 551

Motherboards on page 556

Input Connector on page 568

Front Frame Assembly on page 570

Front Panel Shield on page 577

Front Panel Cables on page 578

DC DC Converter Board on page 579

Controller Bracket and Controller Board on page 580

Display Assembly on page 582

Keyboard/Keypad on page 584

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 21.

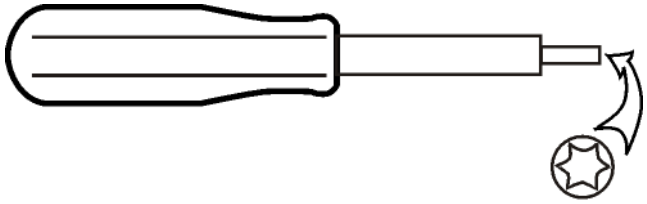
Safety

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 20-1 TORX Tool



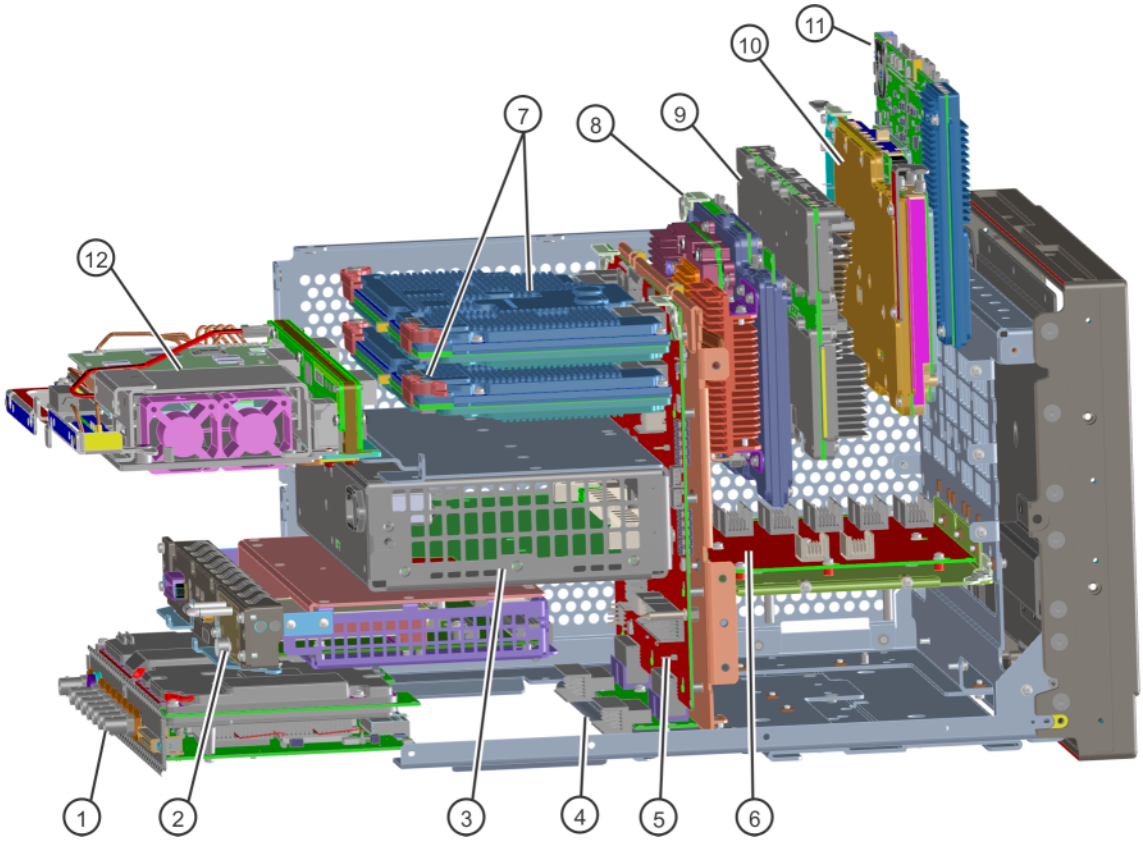
Description	Keysight Part Number
TORX Hand Driver - Size T-8	source locally
TORX Hand Driver - Size T-10	source locally
TORX Hand Driver - Size T-20	source locally
9/16 inch nut driver	source locally
1/4 inch nut driver	source locally
5/16 inch open-end wrench	source locally
1/4 inch open-end wrench	source locally
1/4 inch socket on 4 lb torque wrench	source locally
cable puller	5021-6773

Adjustments Tests after an instrument repair

Refer to Table 21-1 on page 589 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 20-2 Major Assemblies



Item	Description
1	A2 Narrowband Analog I.F. & A3 Narrowband Digital I.F. Assembly
2	A4 CPU Assembly
3	A6 Power Supply
4	A24 Motherboard Interconnect Board
5	A7 Rear Motherboard
6	A8 Front Motherboard
7	A22 Wideband Digital IF (Option B2X) & A23 Wideband Digital IF Assemblies (Option B5X)
8	A14 L.O. Synthesizer Assembly
9	A21 Wideband Analog I.F. Assembly (Options B2X and B5X)
10	A16 Reference Assembly
11	A15 Front End Controller
12	A27 H1G Assembly (Option H1G)

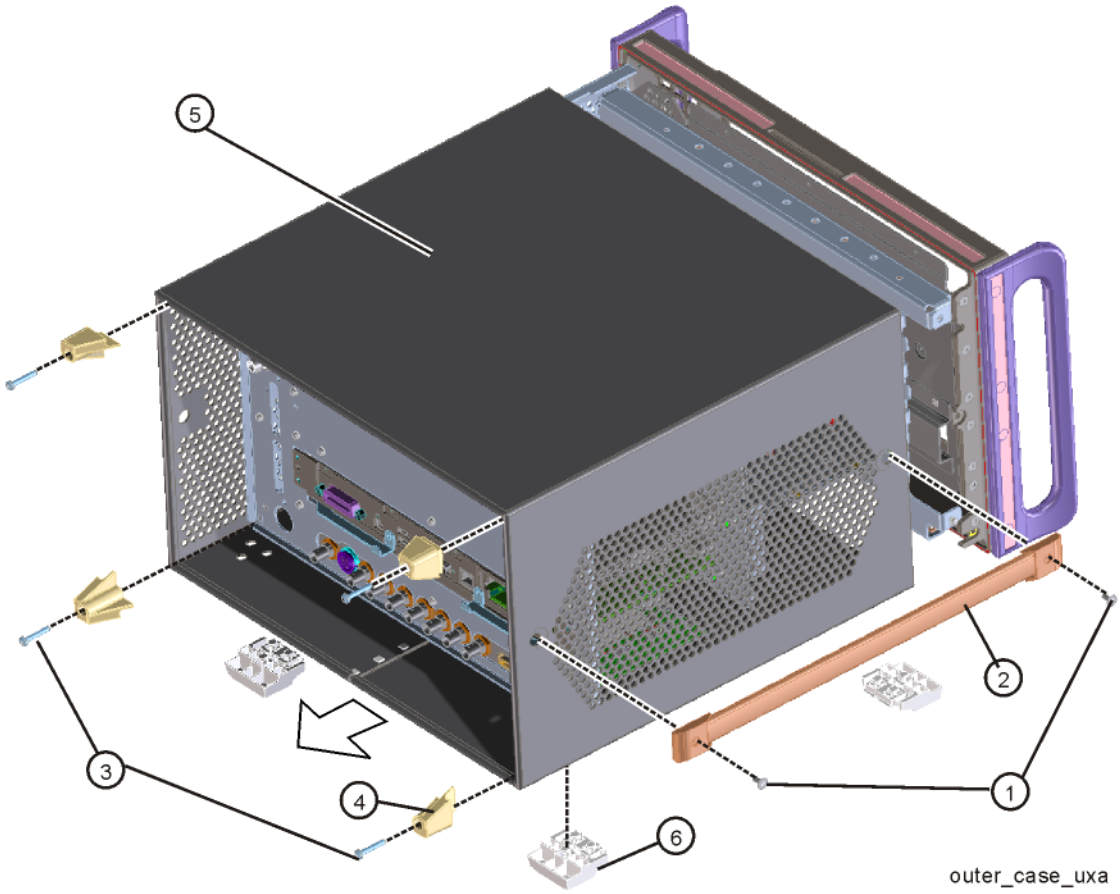
Instrument Outer Case

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 20-3. 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)**. Pull the locks out before 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 20-3 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.

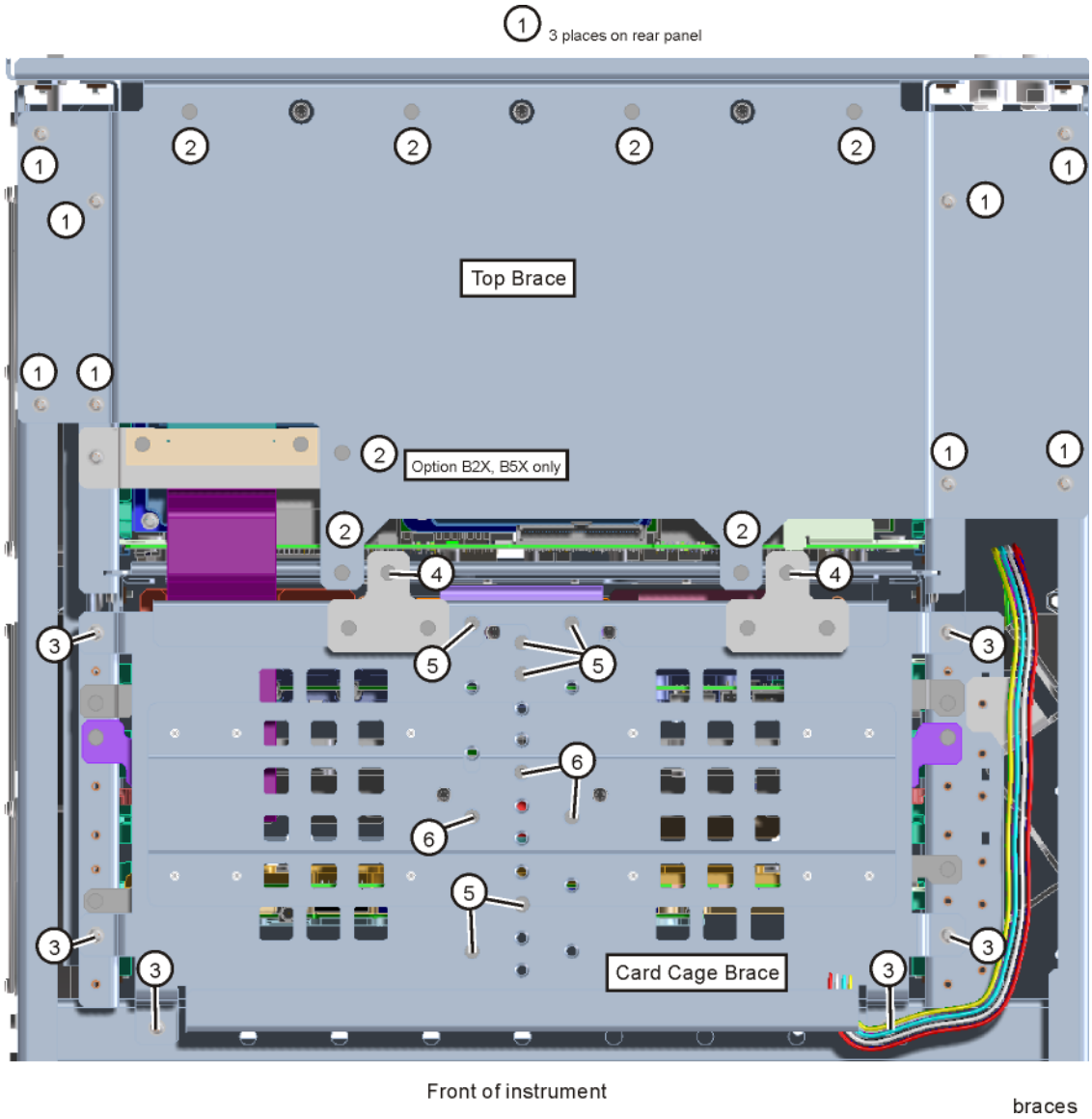
Top Brace and Card Cage Brace

Serial Number Prefix < 5605 Options 508, 513, 526

Removal

1. Disconnect the instrument from ac power.
2. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
3. Refer to Figure 20-4. To remove the Top Brace use the T-10 driver to remove the eleven screws **(1)** (0515-0372) and the seven screws **(2)** (0515-1946) attaching the top brace to the chassis.
4. To remove the Card Cage Brace use the T-10 driver to remove the six screws **(3)** (0515-0372), the two screws **(4)** (0515-1946), the six screws **(5)** (0515-1946), and the three screws **(6)** (0515-1946) (only on Option B2X and B5X) attaching the card cage brace to the chassis and the boards.

Figure 20-4 Top Brace and Card Cage Brace Removal - Serial Prefix < 5605 Options 508, 513, 526



Replacement

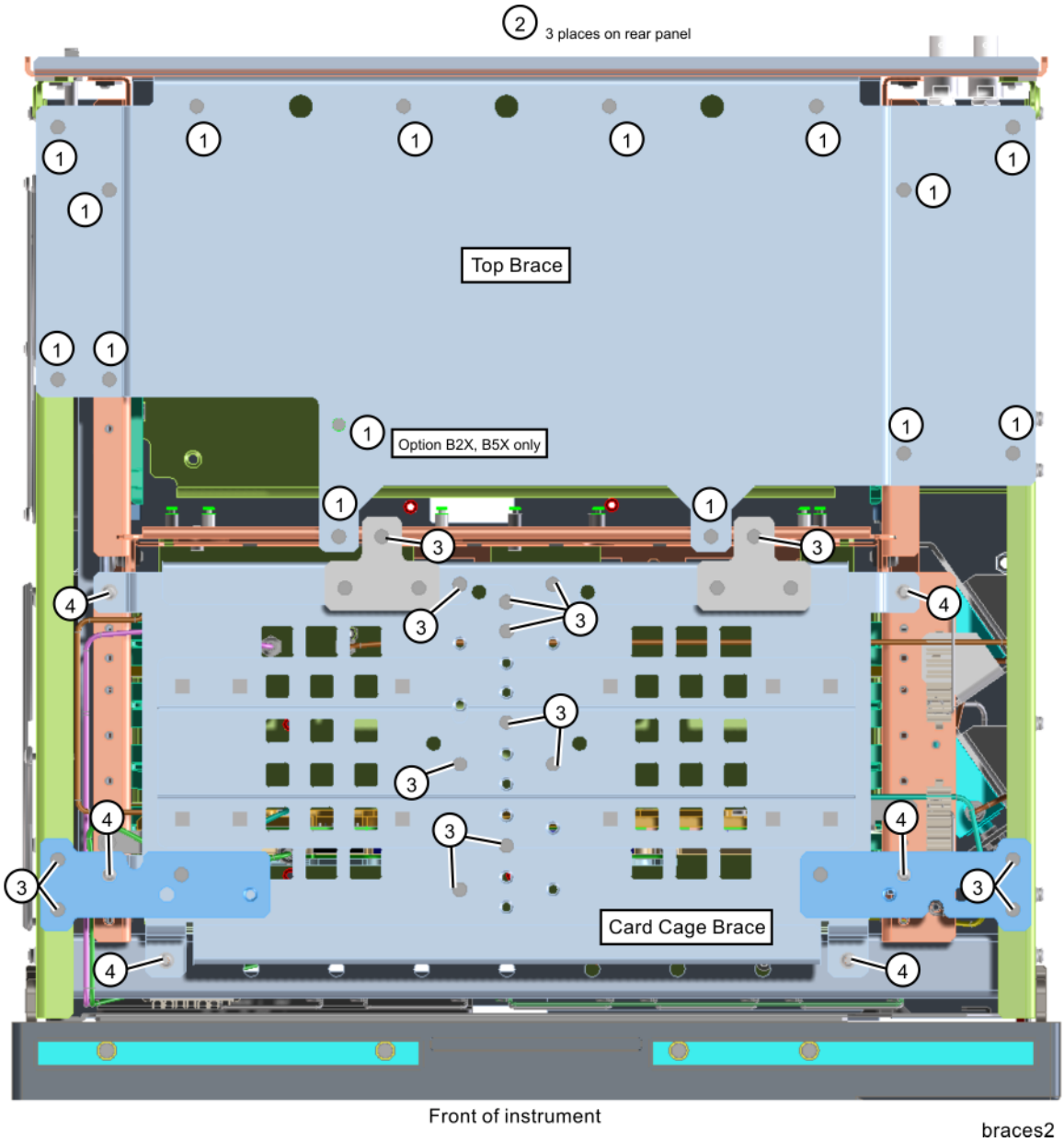
1. To replace the top brace or the card cage bracket, place them into the correct position and attach the screws referred to in the removal process. Torque to 9 inch-pounds.
2. Replace the instrument outer case. Refer to the “Instrument Outer Case” replacement procedure.

Serial Number Prefix ≥ 5605 and All Options 544 and 550

Removal

1. Disconnect the instrument from ac power.
2. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
3. Refer to Figure 20-5. To remove the Top Brace use the T-10 driver to remove the fifteen screws **(1)** (0515-1946) and the three screws on the rear panel **(2)** (0515-0372) attaching the top brace to the chassis.
4. To remove the Card Cage Brace use the T-10 driver to remove the screws **(3)** (0515-1946), and the six screws **(4)** (0515-0372) attaching the card cage brace to the chassis and the boards. The number of 0515-1946 screws will vary depending on the options installed (fifteen with Options B2X and B5X, twelve with Option B40 only).

Figure 20-5 Top Brace and Card Cage Brace Removal - Serial Prefix ≥ 5605 and All Options 544 and 550



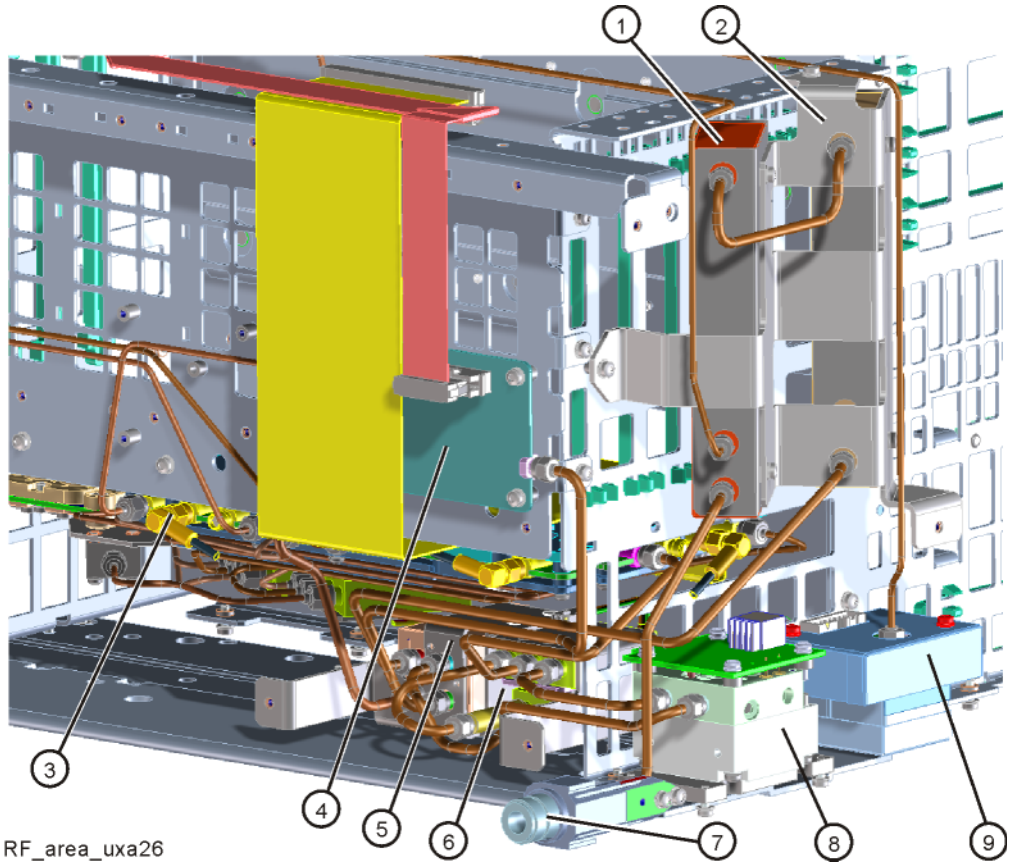
Replacement

1. To replace the top brace or the card cage bracket, place them into the correct position and attach the screws referred to in the removal process. Torque to 9 inch-pounds.
2. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

RF Area - Options 508, 513, 526

Refer to Figure 20-6. The RF area consists of A9 RF attenuator A **(1)**, A10 RF attenuator B **(2)**, A13 front end assembly **(3)**, A11 low band switch assembly **(4)**, transfer switch SW3 **(5)**, coax switches SW1 and SW2 **(6)**, RF input connector **(7)**, A12 YTF Preselector **(8)**, and A20 YTO **(9)**.

Figure 20-6 RF Area Components - Options 508, 513, 526



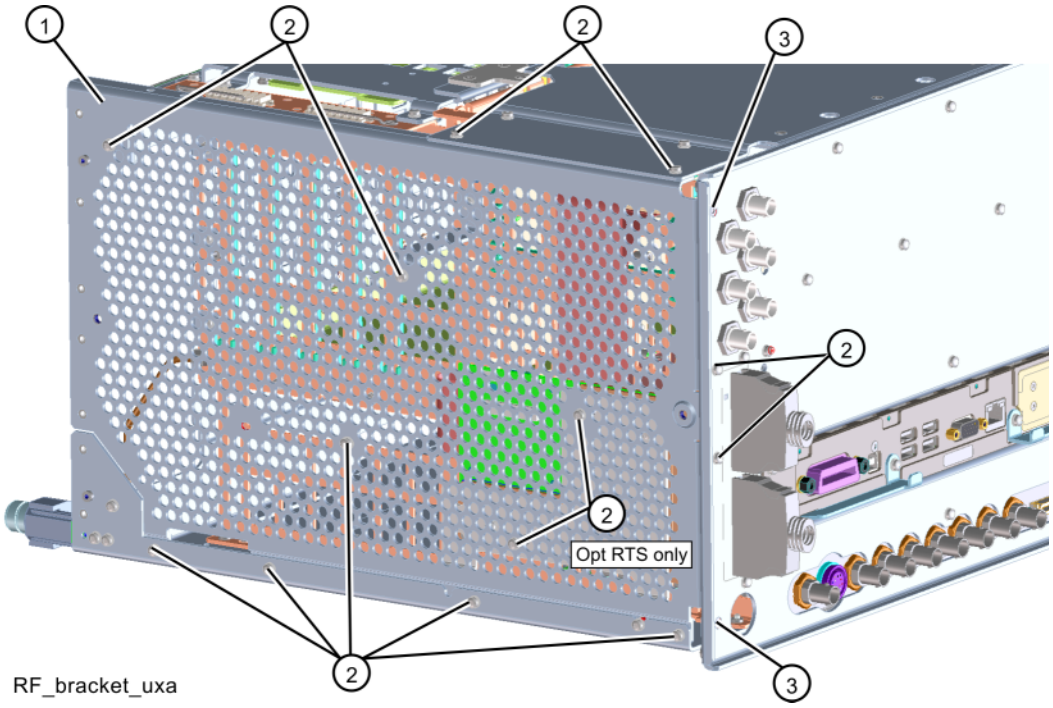
To gain access to any of the RF section parts for removal, follow these steps:

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. **For Serial Number Prefix < 5605:**

   – To access the attenuators, the YTF Preselector, or the YTO, it is necessary to also remove the RF bracket. Refer to Figure 20-7. Remove the RF bracket **(1)** by removing the eleven (or thirteen with Option RTS) screws **(2)** (0515-0372), and the two screws **(3)** (0515-1946), using the T-10 driver.

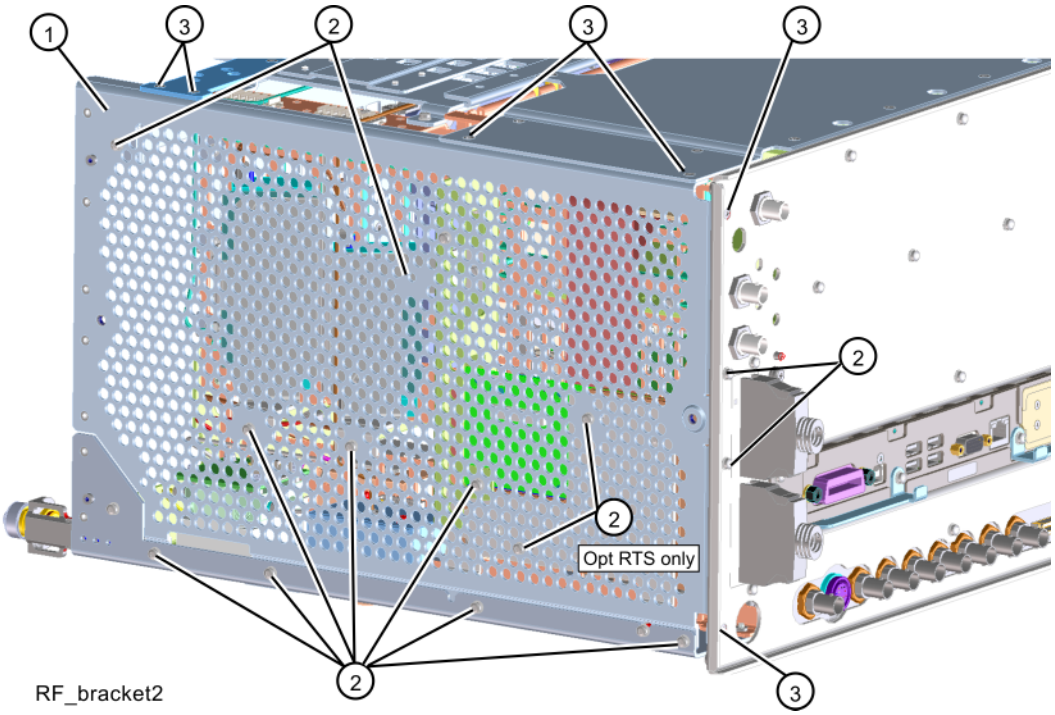
Figure 20-7 RF Bracket Removal,
Serial Number Prefix < 5605 Options 508, 513, 526



4. **Serial Number Prefix ≥ 5605:**

   – To access the attenuators, the YTF Preselector, or the YTO, it is necessary to also remove the RF bracket. Refer to Figure 20-8. Remove the RF bracket **(1)** by removing the eleven (or thirteen with Option RTS) screws **(2)** (0515-0372), and the six screws **(3)** (0515-1946), using the T-10 driver.

Figure 20-8 RF Bracket Removal,
Serial Number ≥ Prefix 5605 Options 508, 513, 526



After the part has been replaced, follow these steps:

1. Refer to Figure 20-7 or Figure 20-8. Position the RF bracket onto the chassis and replace the screws **(2)** (0515-0372), and the screws **(3)** (0515-1946), using the T-10 driver. Torque to 9 inch-pounds.
2. Replace the front panel. Refer to the "Front Frame Assembly" replacement procedure.
3. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

A9 & A10 RF Attenuators

Removal

1. Refer to Figure 20-9 or Figure 20-10, depending on the serial number prefix of your instrument. To remove A9 RF attenuator A **(1)** or A10 RF attenuator B **(2)**, remove the semi-rigid cables W2, W3, W4, and W51 using the 5/16 inch wrench.
2. Remove the ribbon cables attached to each attenuator.
3. Remove the two or three screws **(3)** (0515-0372), depending on the bracket in your instrument, that attach the attenuator bracket to the chassis using the T-10 driver.
4. Remove the attenuator from the bracket by removing the two screws **(4)** (0515-0372).

Figure 20-9 Attenuators Removal - Serial Number < 5605 Options 508, 513, 526

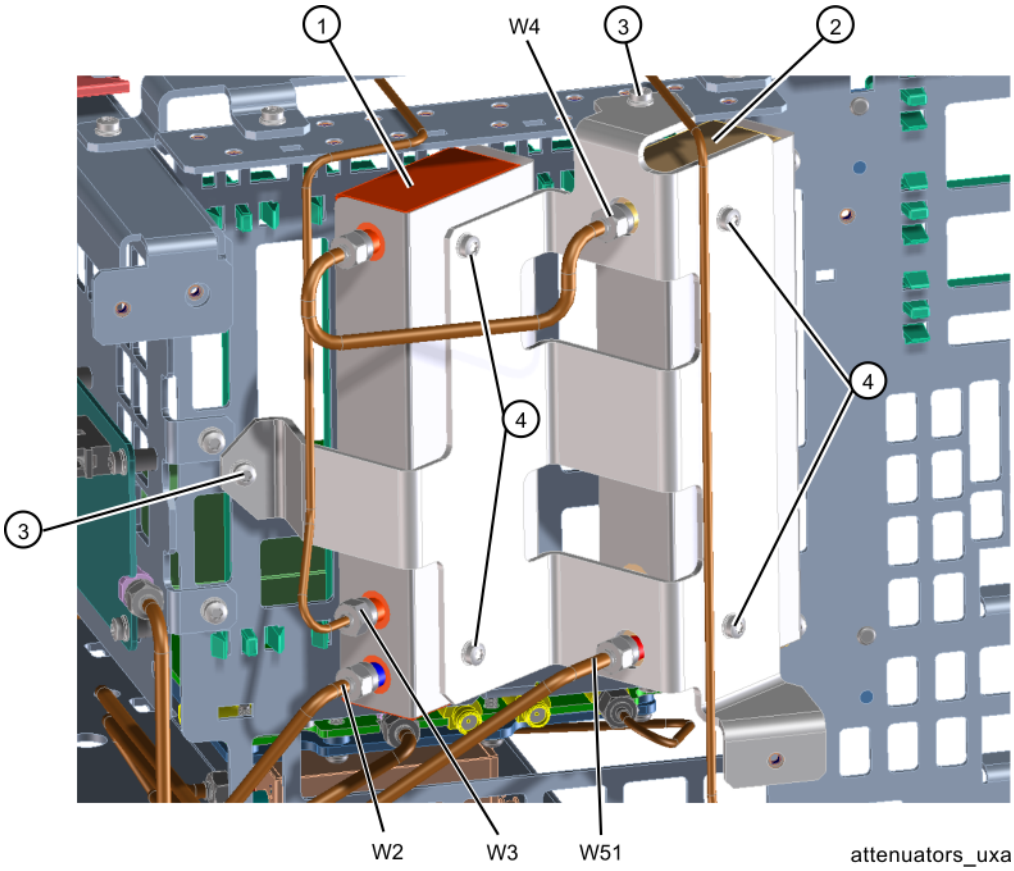
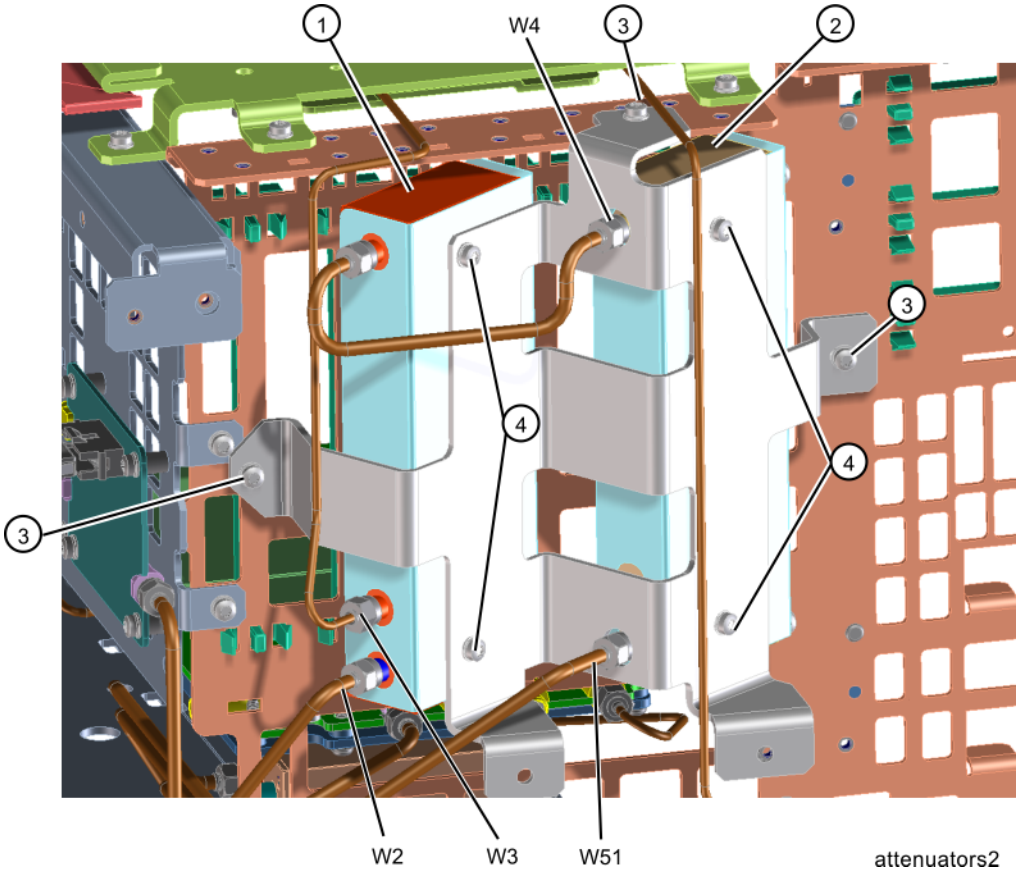


Figure 20-10 Attenuators Removal - Serial Number ≥ 5605 (Options 508, 513, 526)



Item	Keysight Part Number
W2	N9040-20025
W3	N9040-20027
W4	N9040-20026
W51	N9040-20028

Replacement

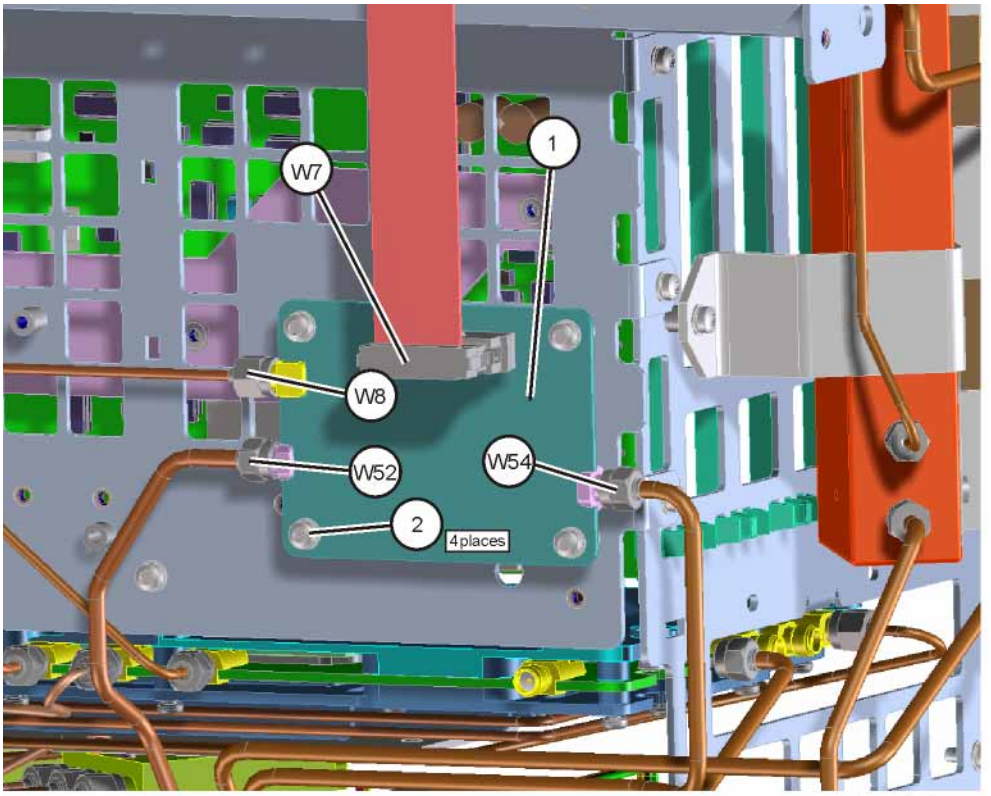
1. Refer to Figure 20-9 or Figure 20-10. Position the attenuator in the bracket so that the ribbon connector end is “down”.
2. Replace the two screws (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
3. Position the attenuators and bracket into the chassis and attach with the screws **(3)** (0515-0372). Torque to 9 inch-pounds.
4. Replace the ribbon cable and semi-rigid cables W2, W3, W4, and W51 to the attenuators. Torque the semi-rigid cables to 10 inch-pounds.
5. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A11 Low Band Switch

Removal

1. Refer to Figure 20-11. Remove the ribbon cable W7.
2. Remove the semi-rigid cables W8, W52, and W54 using the 5/16 inch wrench.
3. Remove the four screws **(2)** (0515-0372) using the T-10 driver. The A11 low band switch **(1)** can now be removed from the chassis.

Figure 20-11 Low Band Switch Cable Removal - Options 508, 513, 526



Item	Keysight Part Number
W8	N9040-20032
W52	N9040-20031
W54	N9040-20030

Replacement

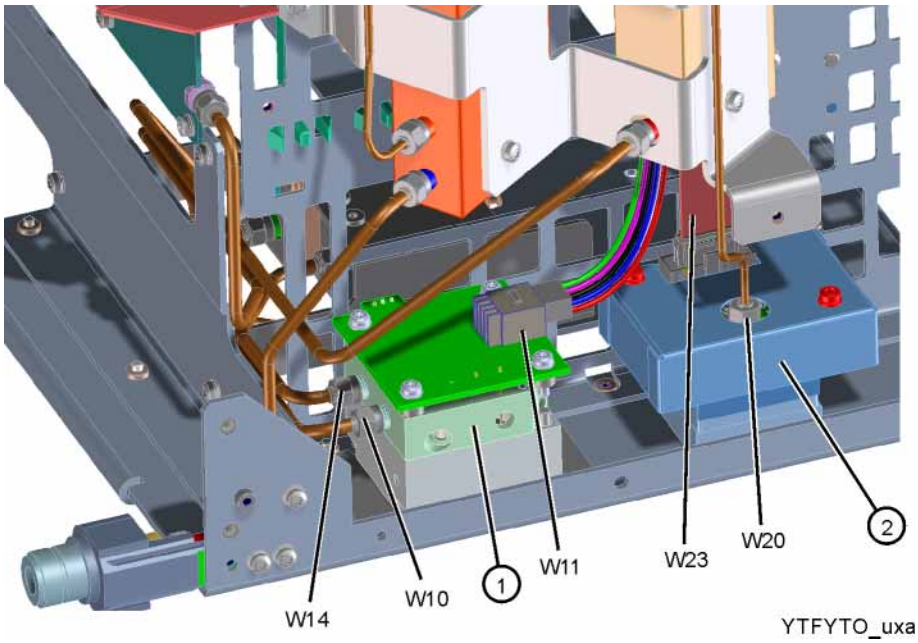
1. Refer to Figure 20-11. Place the switch into place into the chassis and replace the four screws (0515-0372). Torque to 9 inch-pounds.
2. Replace the semi-rigid cables W8, W52, and W54. Torque to 10 inch-pounds.
3. Replace the ribbon cable W7. Ensure locking tabs on the sides of the connector are engaged.
4. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A12 YTF Preselector

Removal

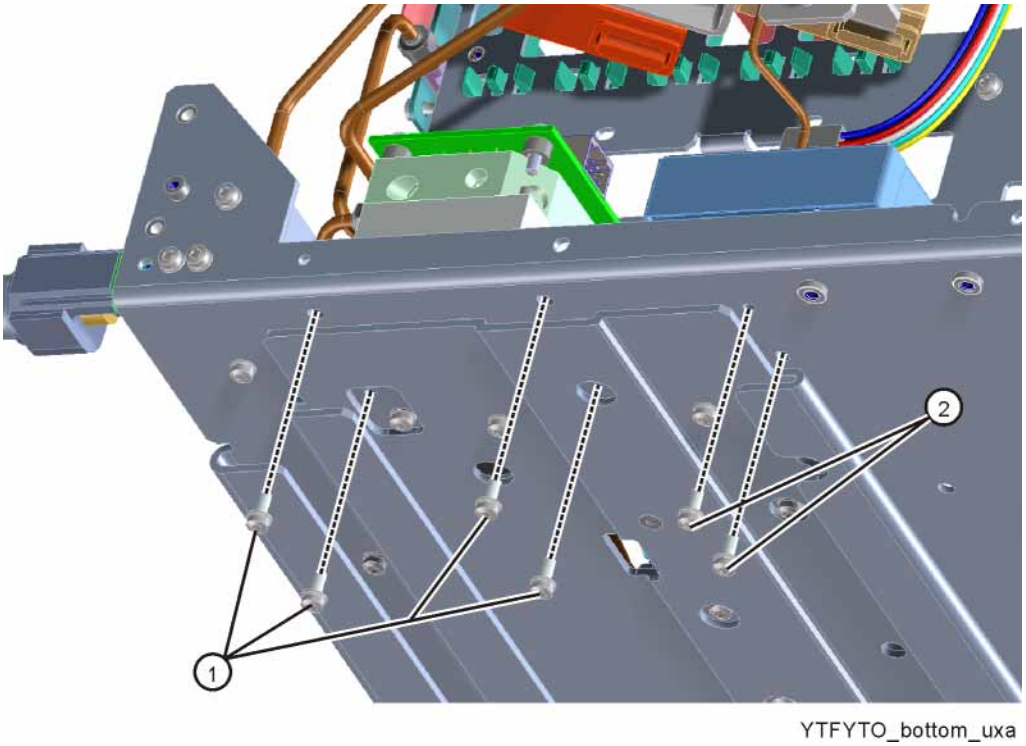
1. Refer to Figure 20-12. Remove cables W10 and W14 from the YTF Preselector **(1)**.
2. Remove the wire harness W11.
3. Refer to Figure 20-13. From the bottom of the instrument, remove the four screws **(1)** (0515-0372). The A12 YTF Preselector can now be removed from the chassis.

Figure 20-12 YTF Preselector Removal - Options 508, 513, 526



Item	Keysight Part Number
W10	N9040-20033
W14	N9040-20034

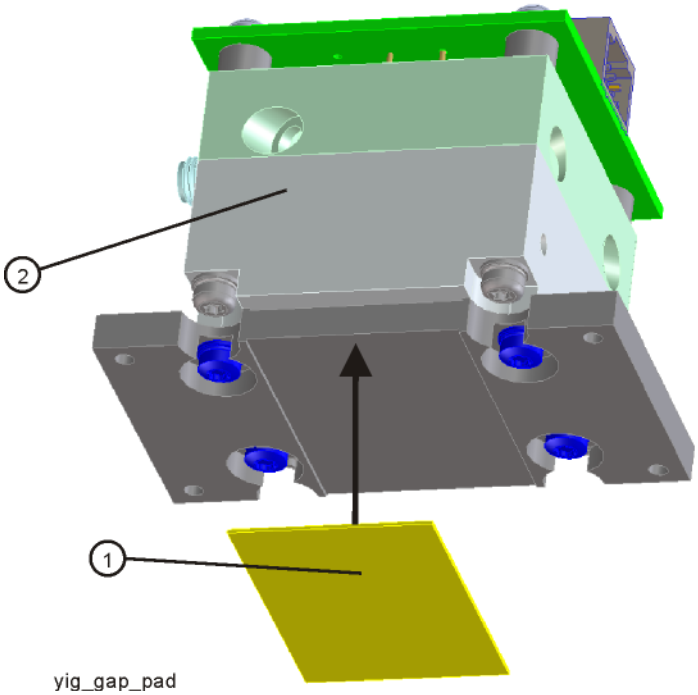
Figure 20-13 YTF Preselector and YTO Bottom Screws



Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see Figure 20-14, item **(1)**. The gap pad may remain attached to the faulty YTF Preselector.
2. Refer to Figure 20-14. Install the replacement gap pad **(1)** (5022-7179) into the recess in the base of the replacement YTF Preselector **(2)** 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 20-14 Gap Pad Installation



3. Refer to Figure 20-13. Place the YTF Preselector into the chassis with the ports toward the front of the instrument. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. Figure 20-12. Replace the cables W10 and W14. Torque to 10 inch-pounds.
5. Replace the wire harness W11.
6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A20 YTO

Removal

1. Refer to Figure 20-12. Remove cable W20 from the YTO **(2)**.
2. Remove the ribbon cable W23 by pulling forward on the locking latch.
3. Refer to Figure 20-13. From the bottom of the instrument, remove the two screws **(2)** (0515-0372). The A20 YTO can now be removed from the chassis.

Item	Keysight Part Number
W20	N9040-20098

Replacement

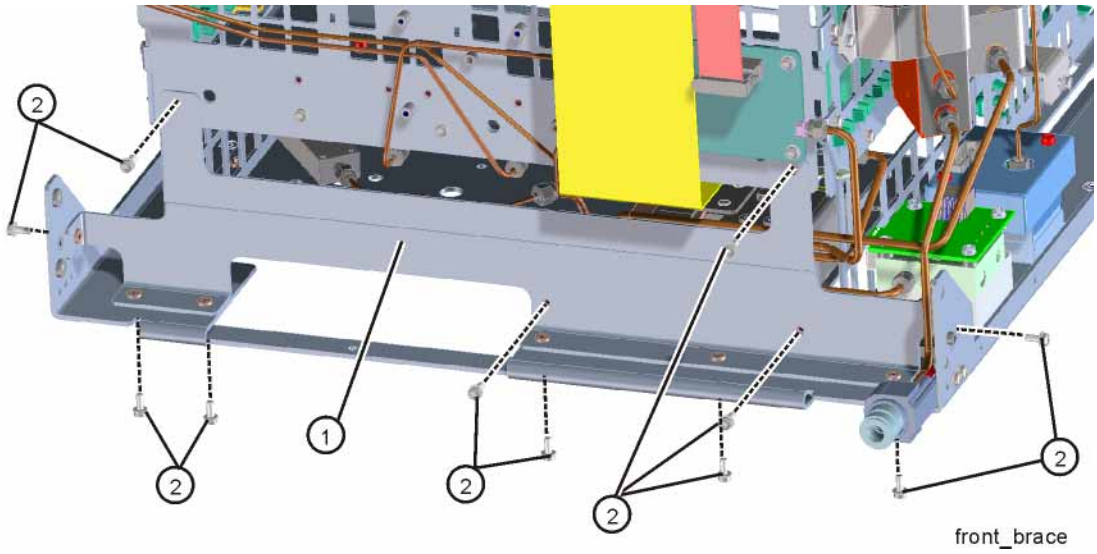
1. Refer to Figure 20-13. Place the YTO into the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
2. Figure 20-12. Replace the cable W20. Torque to 10 inch-pounds.
3. Replace the ribbon cable W23. Ensure the locking latch is engaged.
4. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

Low Noise Path and Microwave Preselector Bypass Switches

Removal

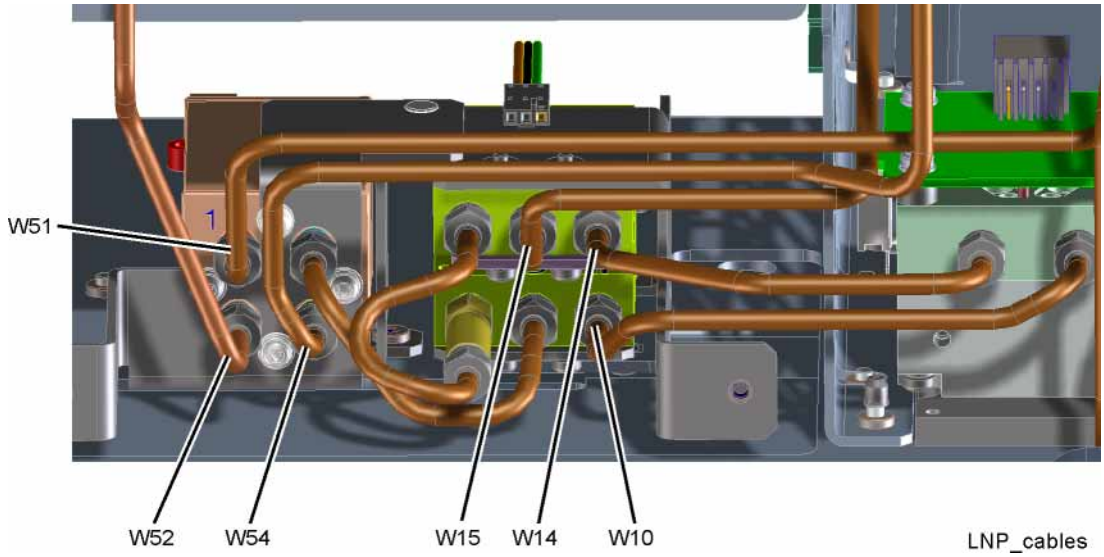
1. Refer to Figure 20-15. Remove the front brace **(1)** by removing the eleven screws **(2)** (0515-0372).

Figure 20-15 Front Brace Removal



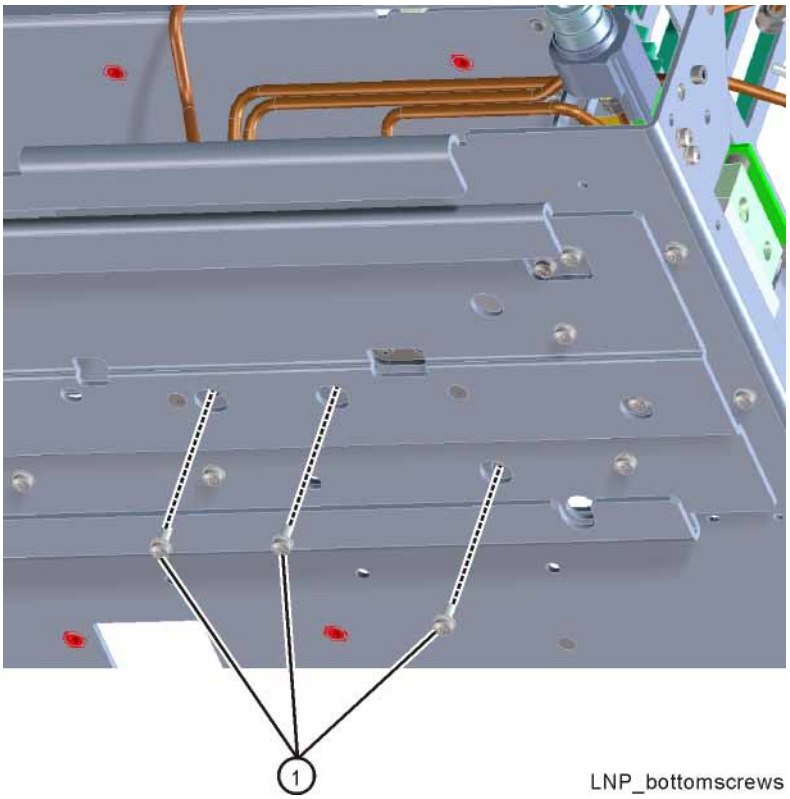
2. Refer to Figure 20-16. Remove cables W10, W14, W15, W51, W52, and W54.

Figure 20-16 W10, W14, W15, W51, W52, and W54 Cables Removal - Options 508, 513, 526



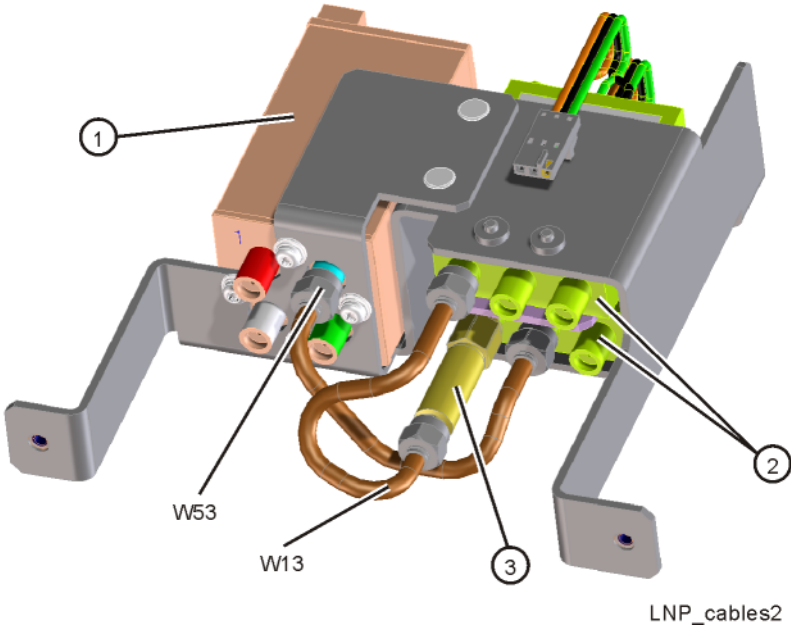
3. Refer to Figure 20-17. Remove the three screws **(1)** (0515-0372) that attach the switch bracket to the chassis. Unplug the ribbon cable and the wire harnesses from each switch. The switches and bracket can now be removed from the chassis.

Figure 20-17 Switch Bracket Bottom Screws



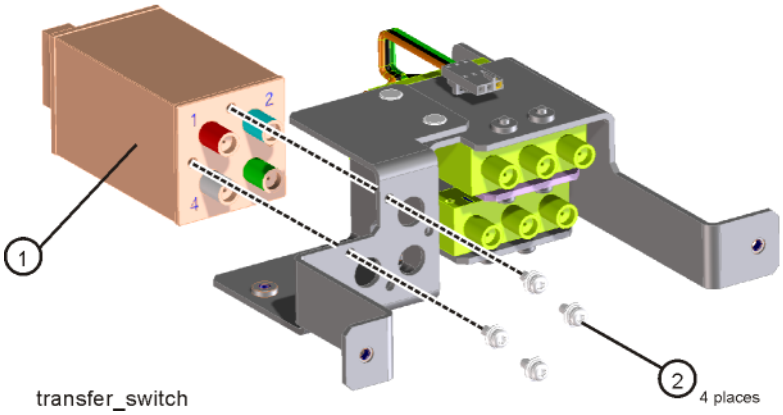
4. Refer to Figure 20-18. To remove the SW3 transfer switch **(1)** or the SW1 and SW2 coax switches **(2)** remove cables W13 and W53 as necessary to access the switch being removed. Remove AT1 attenuator **(3)** if necessary.

Figure 20-18 Transfer Switch, Coax Switches, and Cables - Options 508, 513, 526



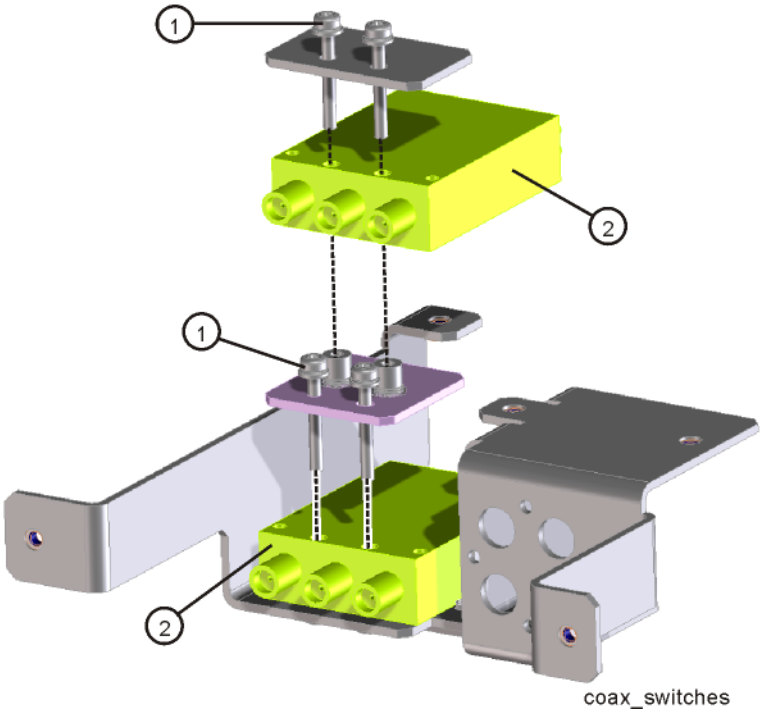
5. Refer to Figure 20-19. To remove the SW3 transfer switch **(1)** remove the four screws **(2)** (0515-1934) attaching the switch to the bracket.

Figure 20-19 Removing Transfer Switch from Bracket - Options 508, 513, 526



6. Refer to Figure 20-20. To remove the SW1 and SW2 coax switches **(2)** remove the two screws **(1)** (0515-1992) attaching each switch to the bracket.

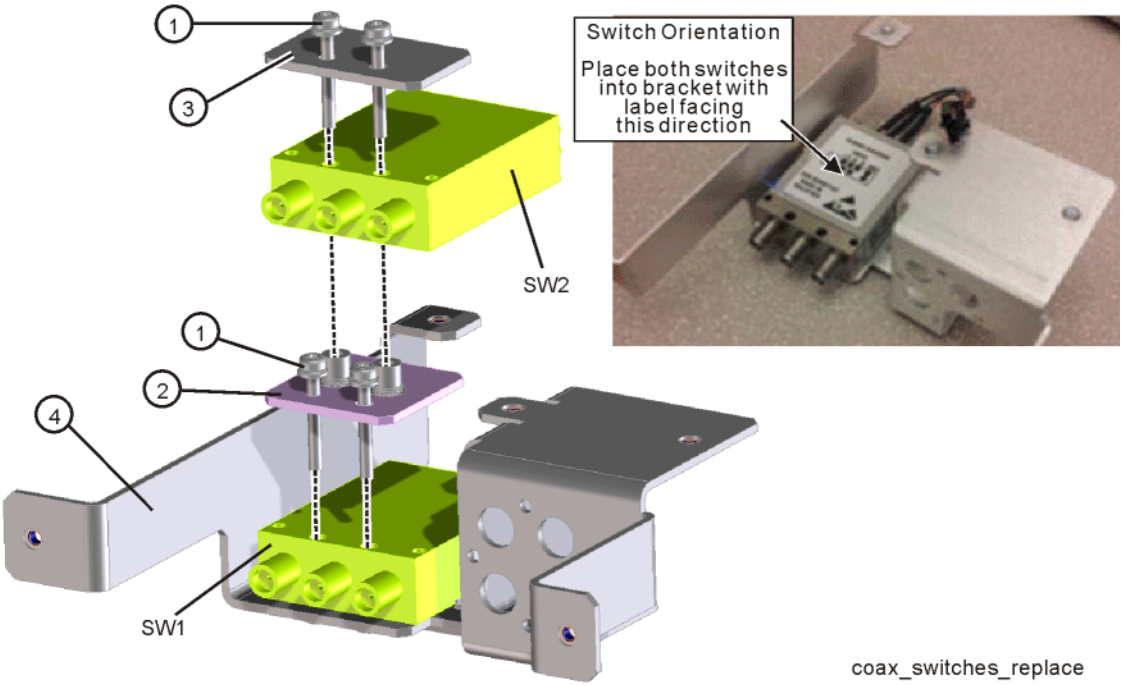
Figure 20-20 Removing Coax Switches from Bracket - Options 508, 513, 526



Replacement

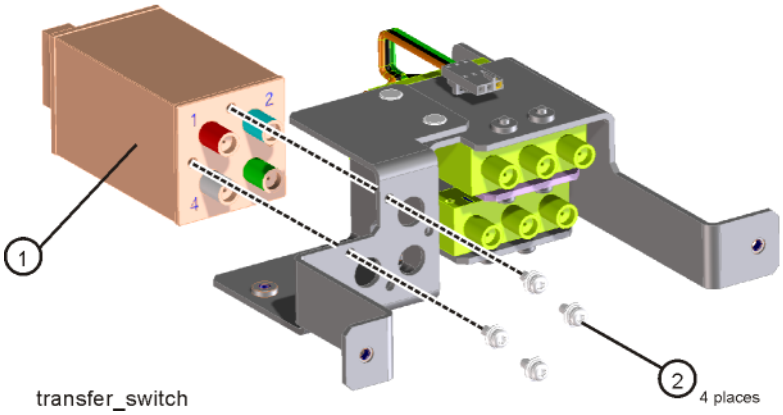
1. Refer to Figure 20-21. When replacing the coax switches, install them into the bracket with the label facing as shown. Install SW1 (bottom switch) and secure with the two screws **(1)** (0515-1992) and SW1 bracket **(2)** (E4410-00104) to the main switch bracket **(4)**. Torque to 6 inch-lbs. Install SW2 (top switch) with the two screws **(1)** (0515-1992) and SW2 bracket **(3)** (N9040-00019). Torque to 6 inch-lbs.

Figure 20-21 Coax Switches Replacement - Options 508, 513, 526



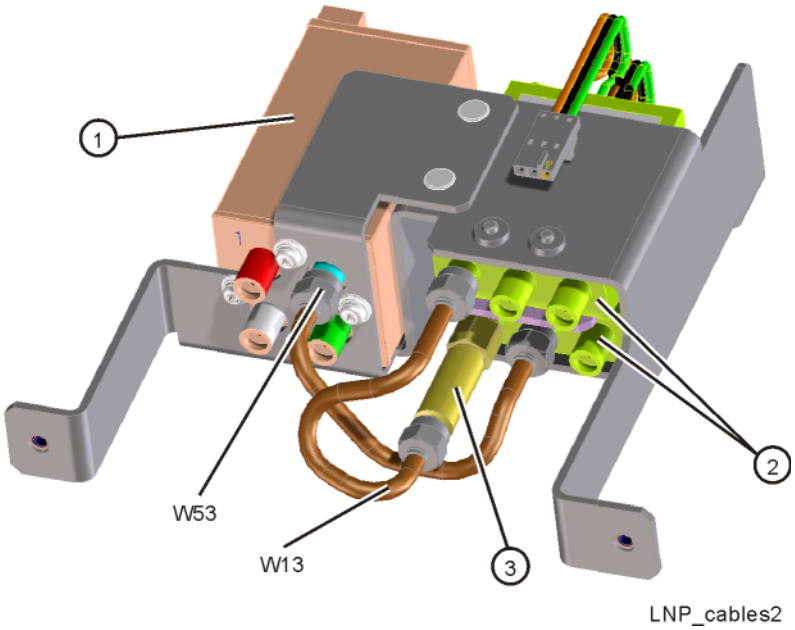
2. Refer to Figure 20-22. Place the SW3 transfer switch **(1)** into the bracket in the orientation shown, with port 1 in the upper left corner. Secure with the four screws **(2)** (0515-1934). Torque to 6 inch-lbs.

Figure 20-22 Replacing Transfer Switch - Options 508, 513, 526



3. Refer to Figure 20-23. Replace AT1 attenuator **(3)**. Torque to 10 inch-lbs. Replace cables W13 and W53. Torque to 10 inch-lbs.

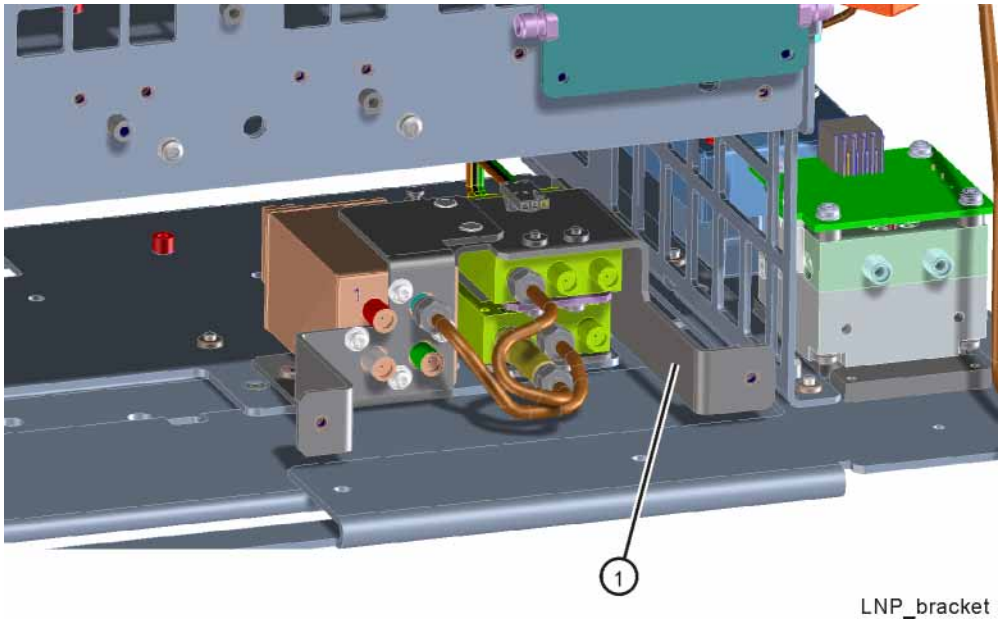
Figure 20-23 Replace Attenuator and Cables - Options 508, 513, 526



Item	Keysight Part Number
W13	N9040-20036
W53	N9040-20029

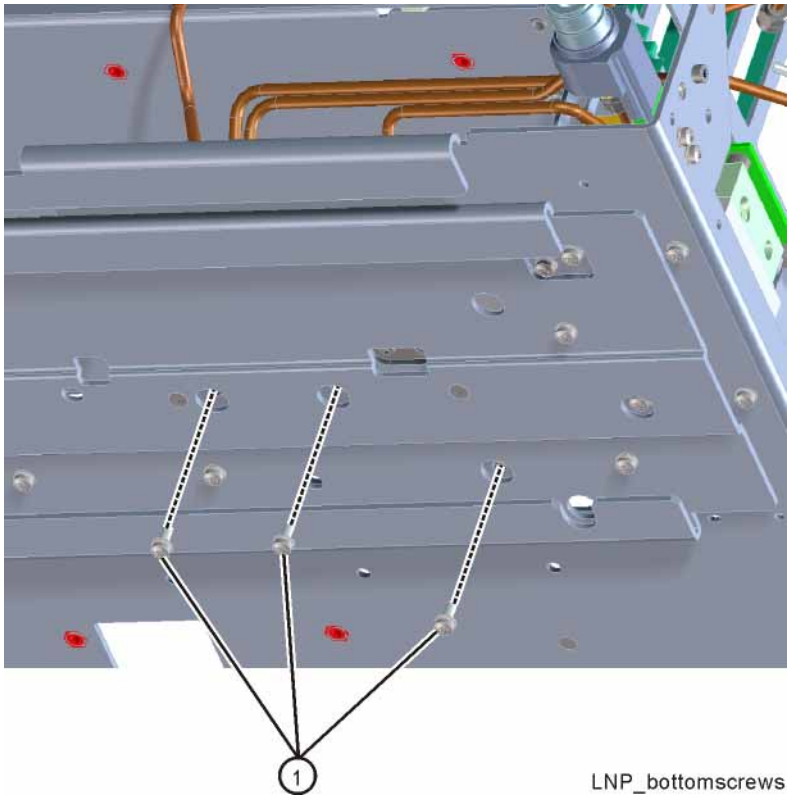
4. Place the switches and switch bracket **(1)** into the chassis as shown in Figure 20-24. Plug the ribbon cable and the wire harnesses into each switch.

Figure 20-24 Switch Bracket - Options 508, 513, 526



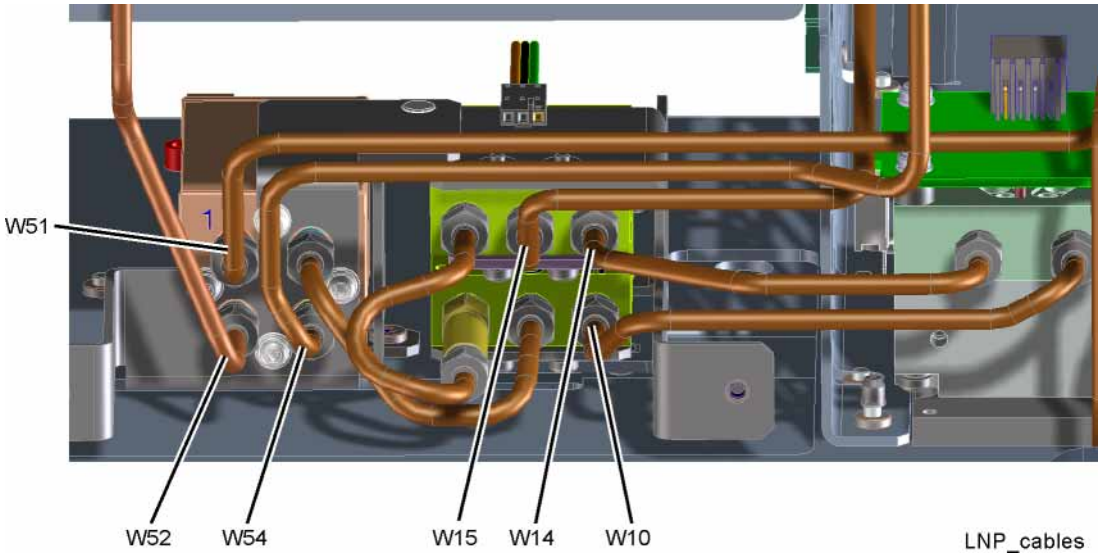
5. Replace the three screws **(1)** (0515-0372) that attach the switch bracket to the chassis as shown in Figure 20-25. Torque to 9 inch-lbs.

Figure 20-25 Switch Bracket Bottom Screws



6. Refer to Figure 20-26. Replace cables W10, W14, W15, W51, W52, and W54. Torque to 10 inch-lbs.

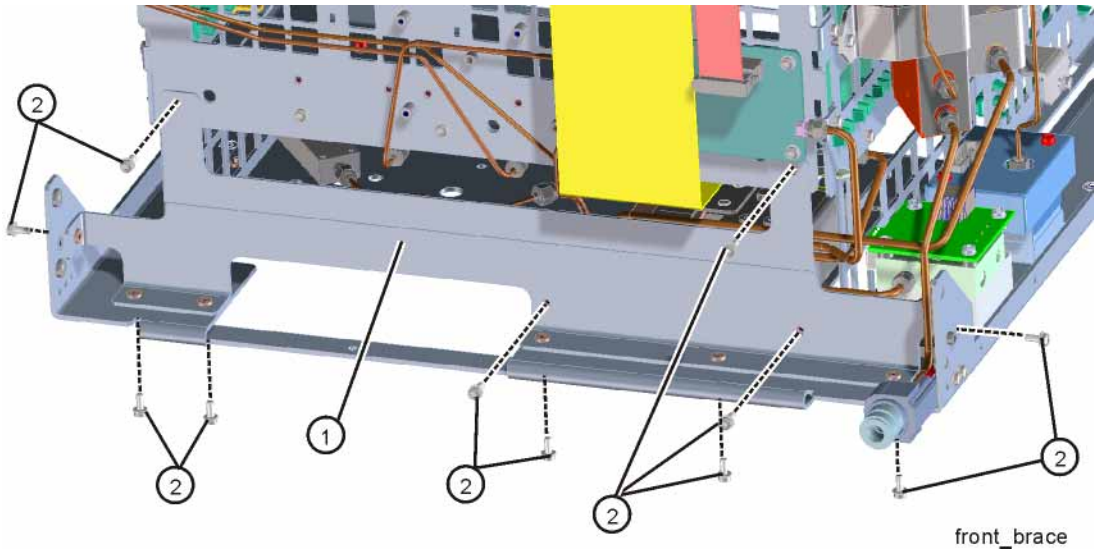
Figure 20-26 W10, W14, W15, W51, W52, and W54 Cables Replacement - Options 508, 513, 526



Item	Keysight Part Number
W10	N9040-20033
W14	N9040-20034
W15	N9040-20035
W51	N9040-20028
W52	N9040-20031
W54	N9040-20030

7. Refer to Figure 20-27. Place the front brace **(1)** into the chassis and secure with the eleven screws **(2)** (0515-0372). Torque to 9 inch-lbs.

Figure 20-27 Front Brace Replacement



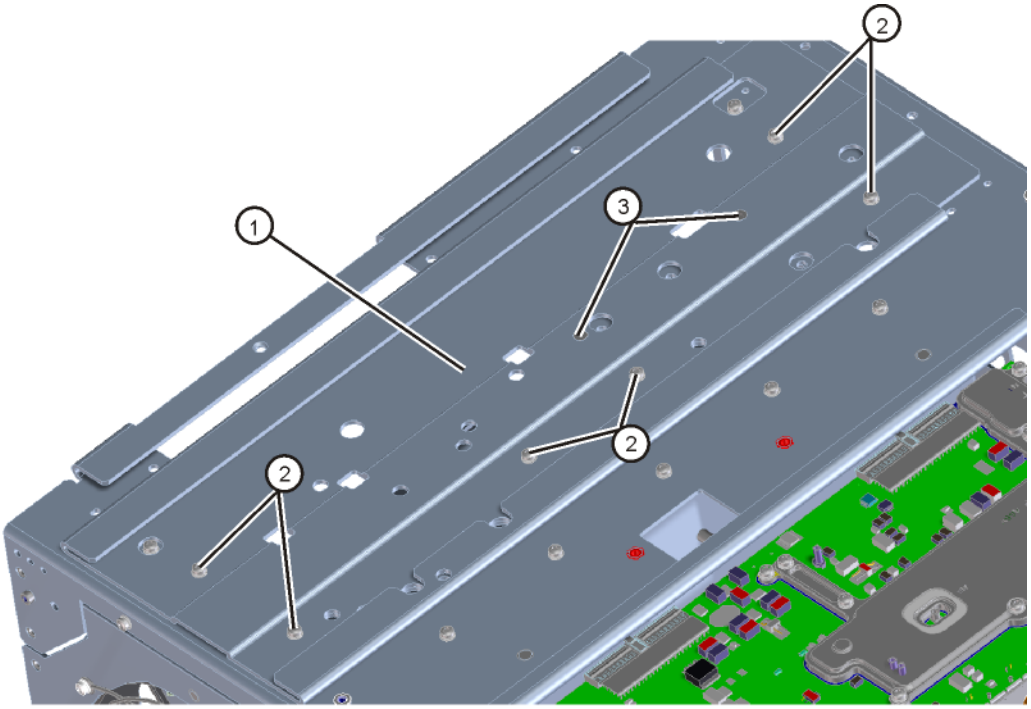
8. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A13 RF Front End Assembly

Removal

1. Perform step 1 through step 3 in the "Low Noise Path and Microwave Preselector Bypass Switches" removal procedure on page 471 to remove the bracket and switch assembly.
2. Refer to Figure 20-28. Remove the chassis base stiffener **(1)** by removing the six screws **(2)** (0515-0372) and the two screws **(3)** (0515-1946).

Figure 20-28 Chassis Base Stiffener Removal



base_stiffener

3. Refer to Figure 20-29 and Figure 20-30. Remove cables W8, W16, W17, W18, W21 W30, and W33 from the A13 Front End assembly.

Figure 20-29 Front End Assembly Cables Removal - Options 508, 513, 526

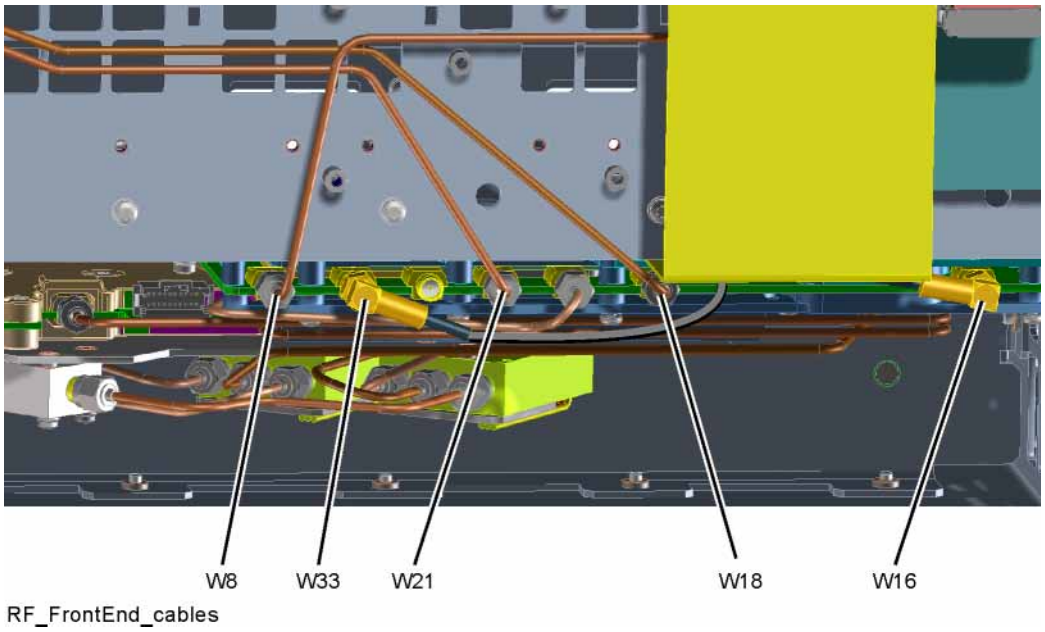
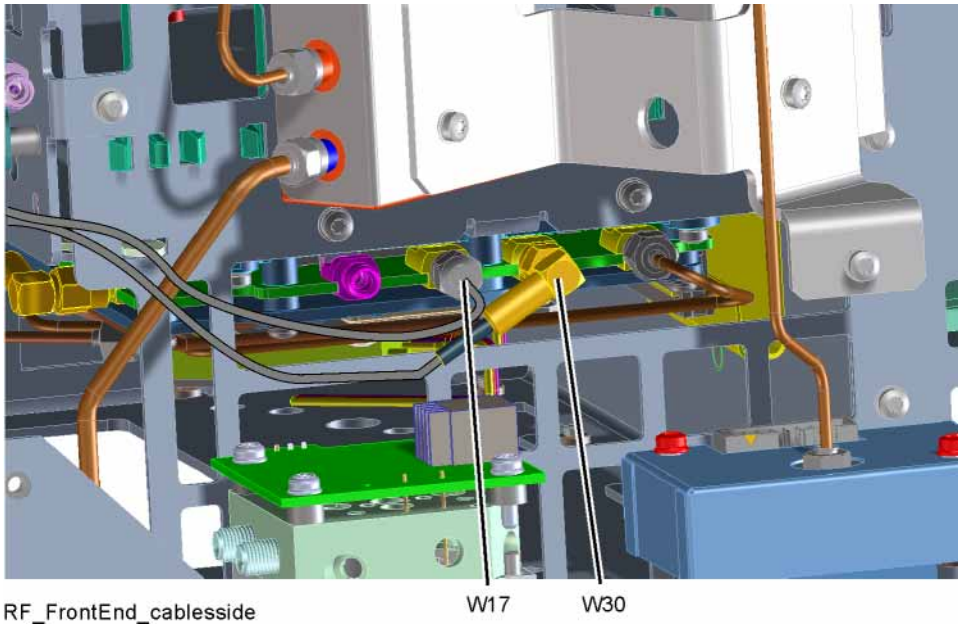
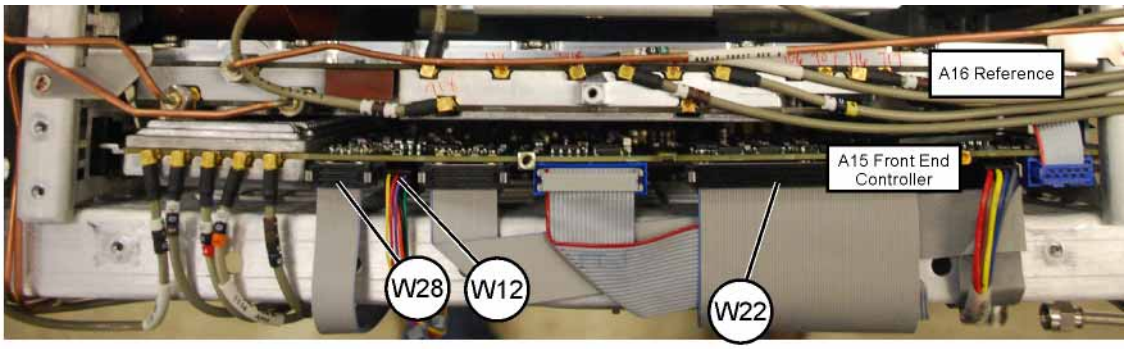


Figure 20-30 Front End Assembly Side Cables Removal - Options 508, 513, 526



4. Refer to Figure 20-31. Unplug ribbon cables W22 and W28, and wire harness W12 from the Front End Controller board.

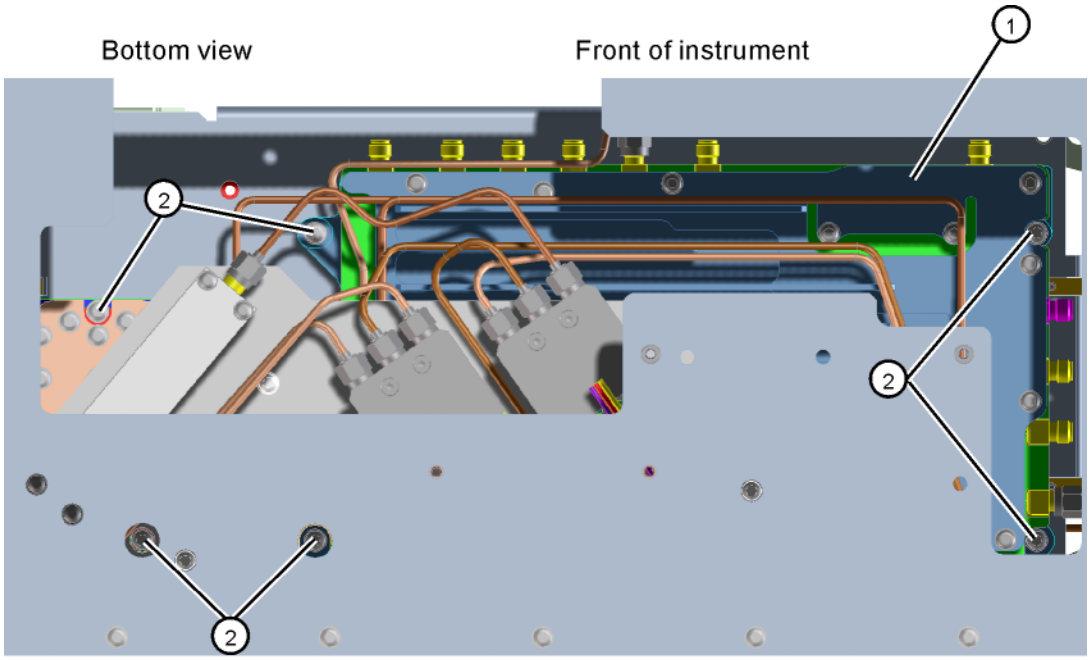
Figure 20-31 Front End Controller Board Cables



frontend_cables_uxa

5. Refer to Figure 20-32. From the bottom of the instrument, remove the six screws **(2)** (0515-0372) that attach the Front End assembly **(1)** to the chassis. The Front End assembly can now be removed.

Figure 20-32 Front End Assembly Bottom Screws - Removal



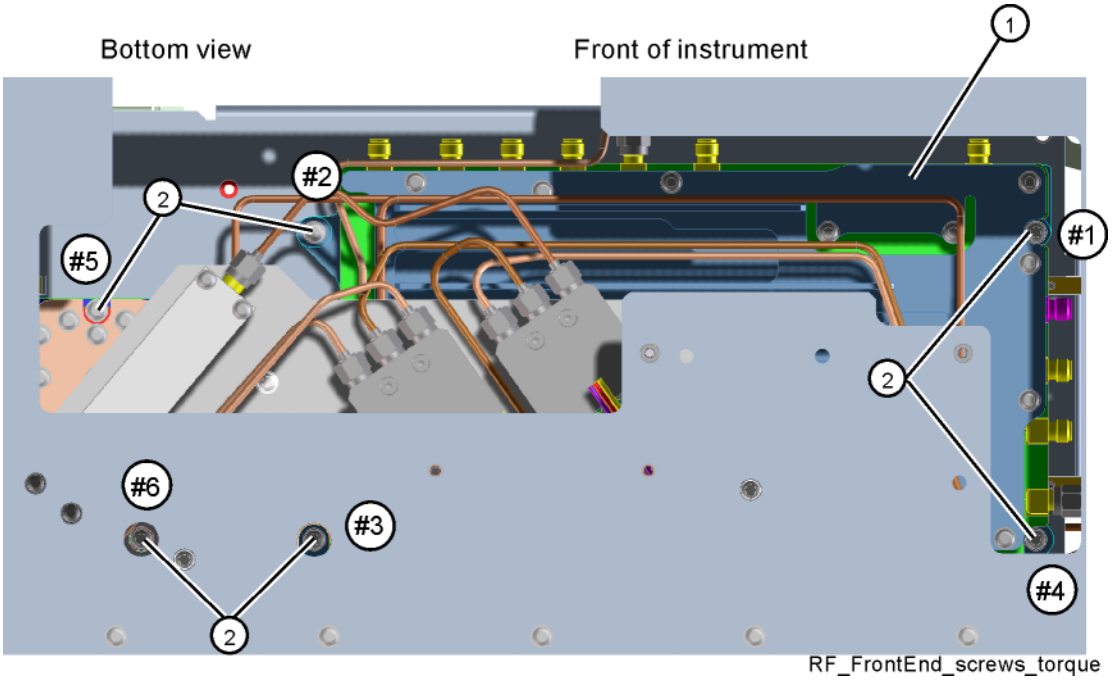
RF_FrontEnd_screws

Replacement

1. Refer to Figure 20-33. Place the Front End assembly into the chassis. From the bottom of the instrument, replace the six screws **(2)** (0515-0372) that attach the Front End assembly **(1)** to the chassis. Torque to 9 inch-pounds in the order shown (#1 to #6).

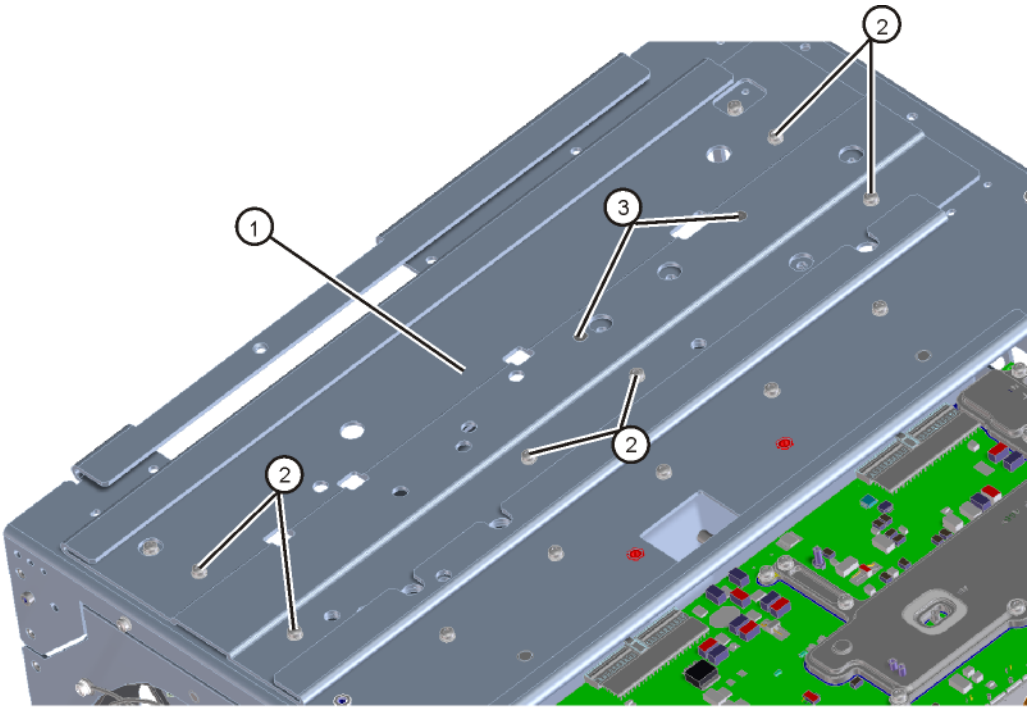
CAUTION Make sure ribbon cable W22 is under the 4 guide tabs on the back of the Front End assembly.

Figure 20-33 Front End Assembly Bottom Screws - Replacement



2. Refer to Figure 20-34. Place the chassis base stiffener **(1)** in position on the chassis base. Secure with the six screws **(2)** (0515-0372) and the two screws **(3)** (0515-1946). Torque all screws to 9 inch-pounds.

Figure 20-34 Chassis Base Stiffener Replacement



base_stiffener

3. Refer to Figure 20-35 and Figure 20-36. Replace cables W8, W16, W17, W18, W21 W30, and W33. Torque to 10 inch-pounds.

Figure 20-35 Front End Assembly Cables Replacement - Options 508, 513, 526

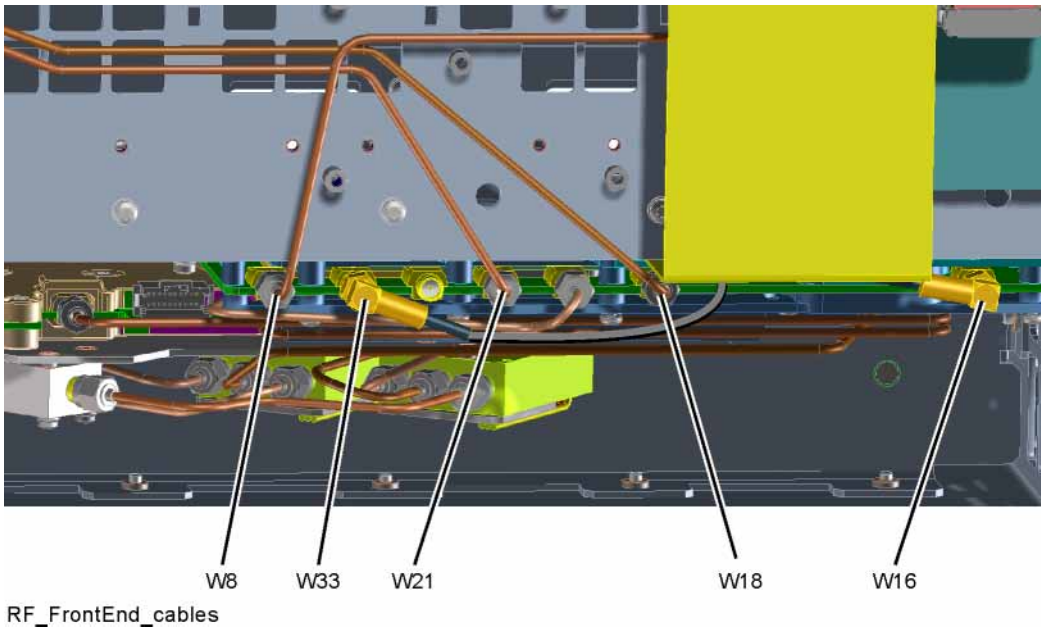
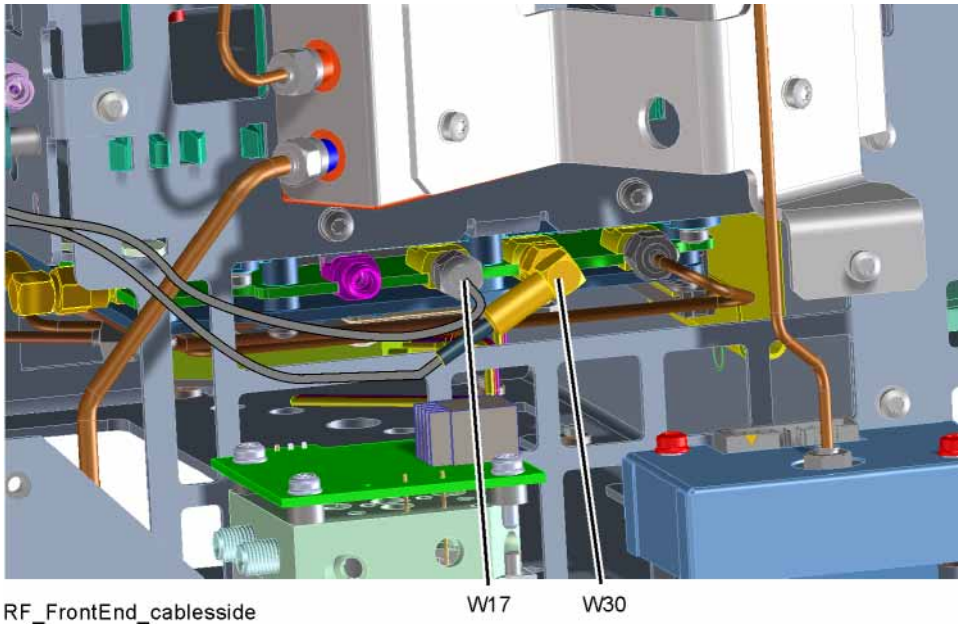


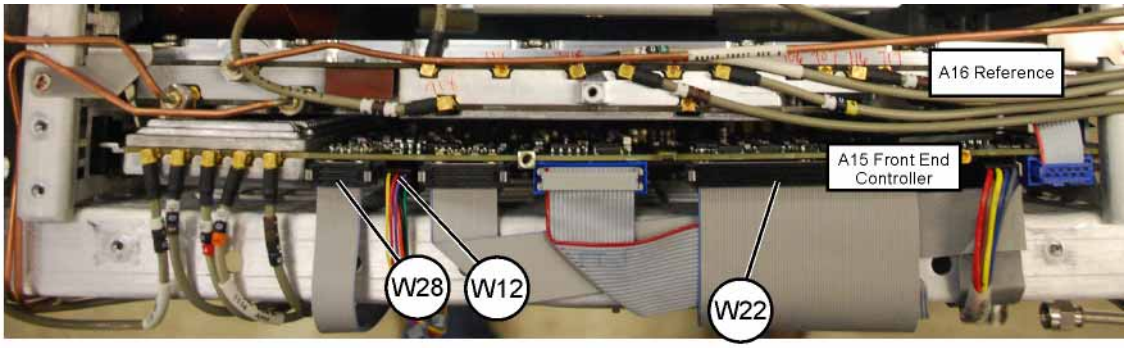
Figure 20-36 Front End Assembly Side Cables Replacement - Options 508, 513, 526



Item	Keysight Part Number
W8	N9040-20032
W16	8121-2608
W17	N9040-60046
W18	N9040-20039
W21	N9040-20038
W30	8121-1940
W33	8121-1940

4. Refer to Figure 20-37. Plug ribbon cables W22 and W28, and wire harness W12 back into the Front End Controller board.

Figure 20-37 Front End Controller Board Cables



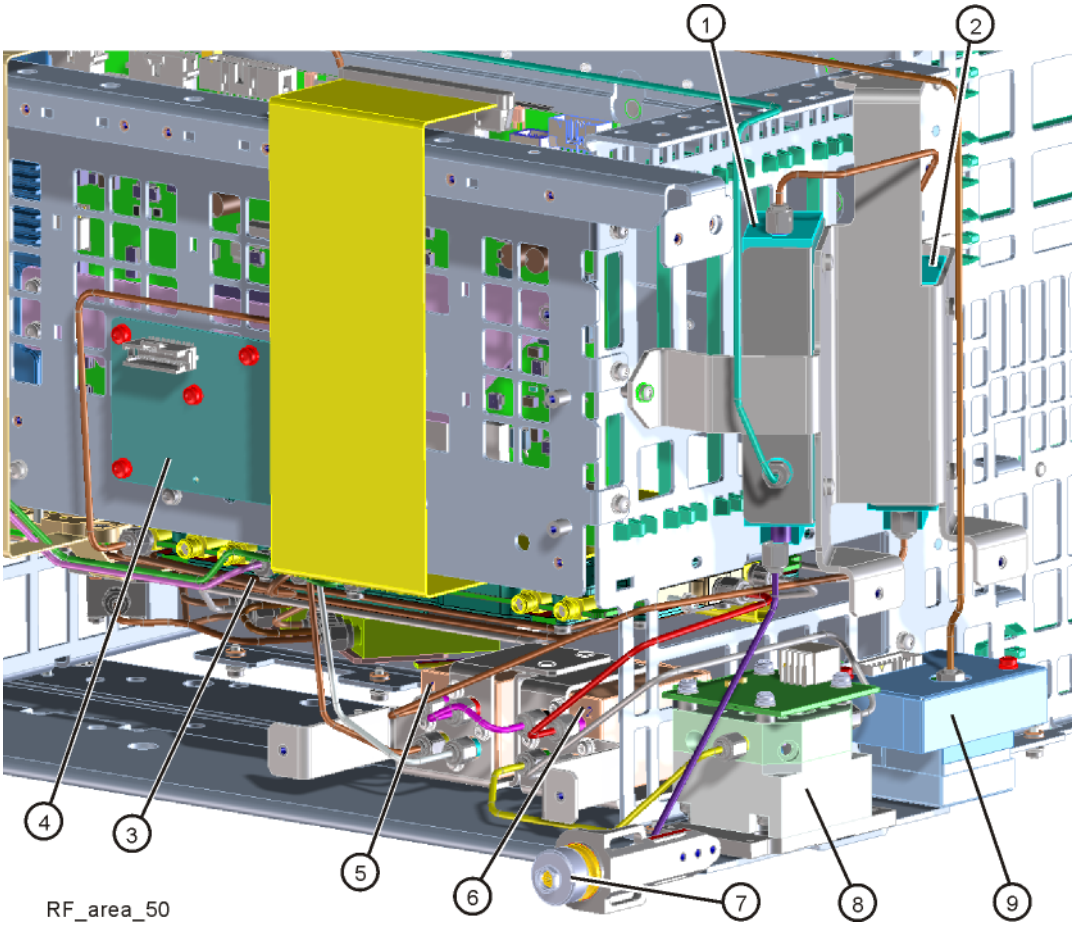
frontend_cables_uxa

5. Perform step 4 through step 7 in the "Low Noise Path and Microwave Preselector Bypass Switches" replacement procedure on page 477 to replace the bracket and switch assembly and front brace.
6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

RF Area - Options 544, 550

Refer to Figure 20-38. The RF area consists of A9 RF attenuator A **(1)**, A10 RF attenuator B **(2)**, A13 front end assembly **(3)**, A11 low band switch assembly **(4)**, transfer switch SW3 **(5)**, transfer switch SW6 **(6)**, RF input connector **(7)**, A12 YTF Preselector **(8)**, and A20 YTO **(9)**.

Figure 20-38 RF Area Components - Options 544, 550

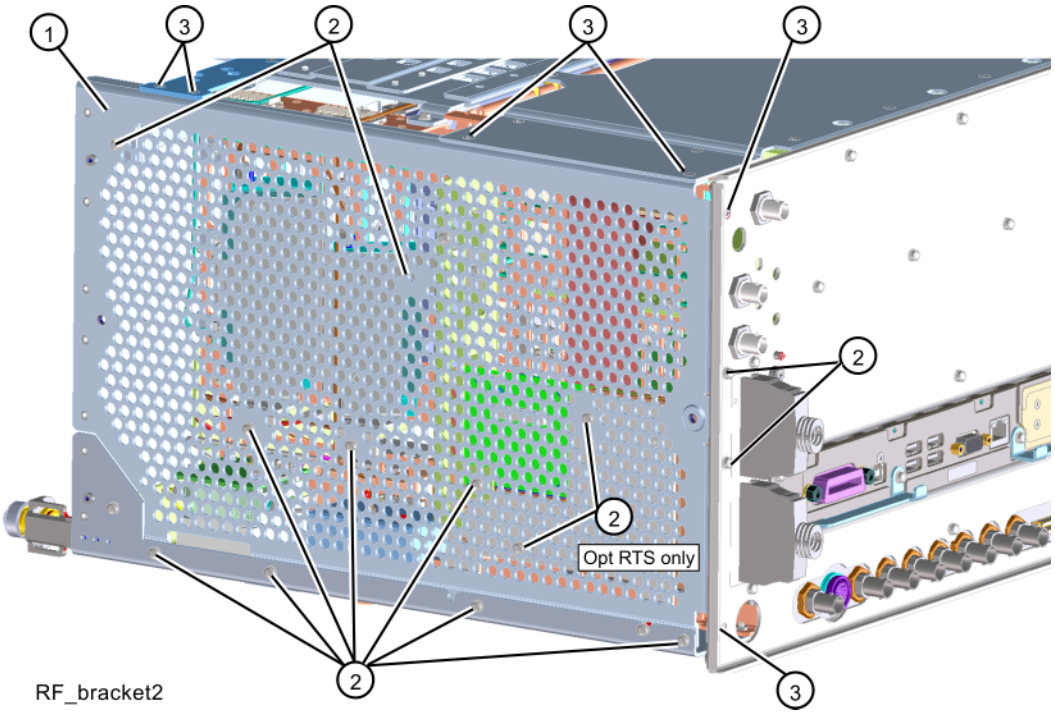


To gain access to any of the RF section parts for removal, follow these steps:

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. To access the attenuators, the YTF Preselector, or the YTO, it is necessary to also remove the RF bracket. Refer to Figure 20-39. Remove the RF bracket **(1)** by removing the eleven (or thirteen with Option RTS) screws **(2)** (0515-0372), and the six screws **(3)** (0515-1946), using the T-10 driver.

Figure 20-39 RF Bracket Removal - Options 544, 550



After the part has been replaced, follow these steps:

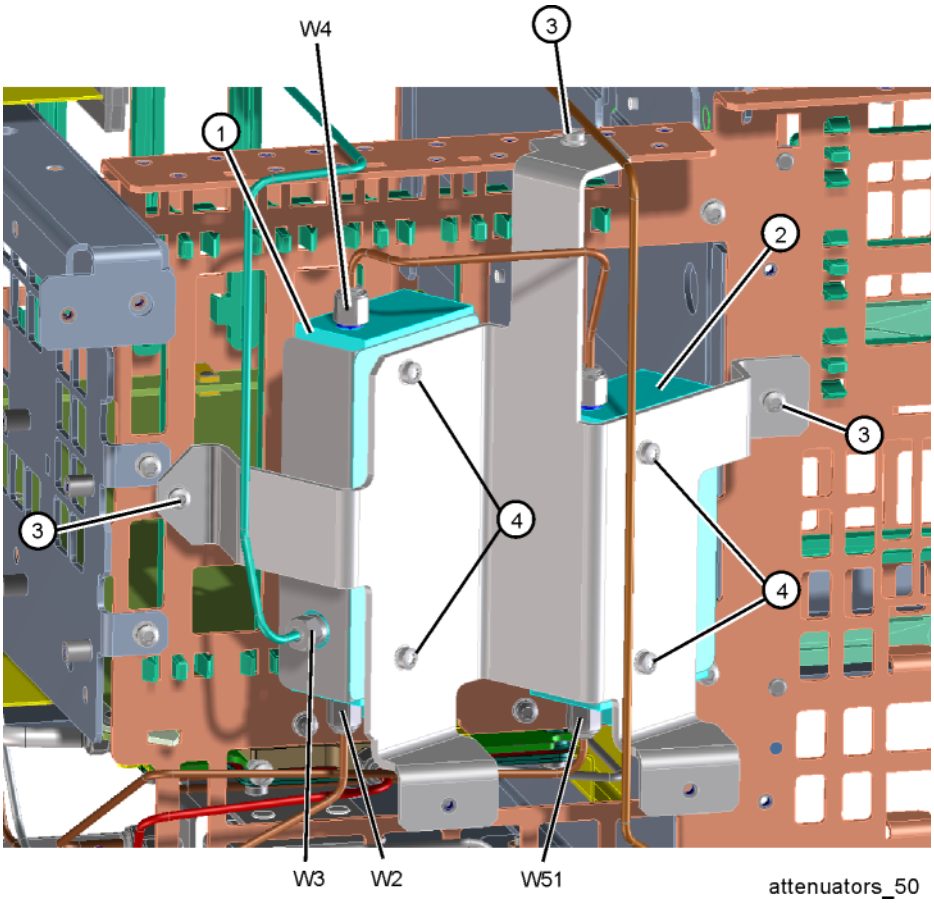
1. Refer to Figure 20-39. Position the RF bracket onto the chassis and replace the eleven screws **(2)** (0515-0372), and the six screws **(3)** (0515-1946), using the T-10 driver. Torque to 9 inch-pounds.
2. Replace the front panel. Refer to the "Front Frame Assembly" replacement procedure.
3. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

A9 & A10 RF Attenuators

Removal

1. Refer to Figure 20-40. To remove A9 RF attenuator A **(1)** or A10 RF attenuator B **(2)**, remove the semi-rigid cables W2, W3, W4, and W51 using the 5/16 inch wrench.
2. Remove the ribbon cables attached to each attenuator.
3. Remove the three screws **(3)** (0515-0372) that attach the attenuator bracket to the chassis using the T-10 driver.
4. Remove the attenuator from the bracket by removing the two screws **(4)** (0515-0372).

Figure 20-40 Attenuators Removal - Options 544, 550



Item	Keysight Part Number
W2	N9040-20114
W3	N9040-20103
W4	N9040-20102
W51	N9040-20104

Replacement

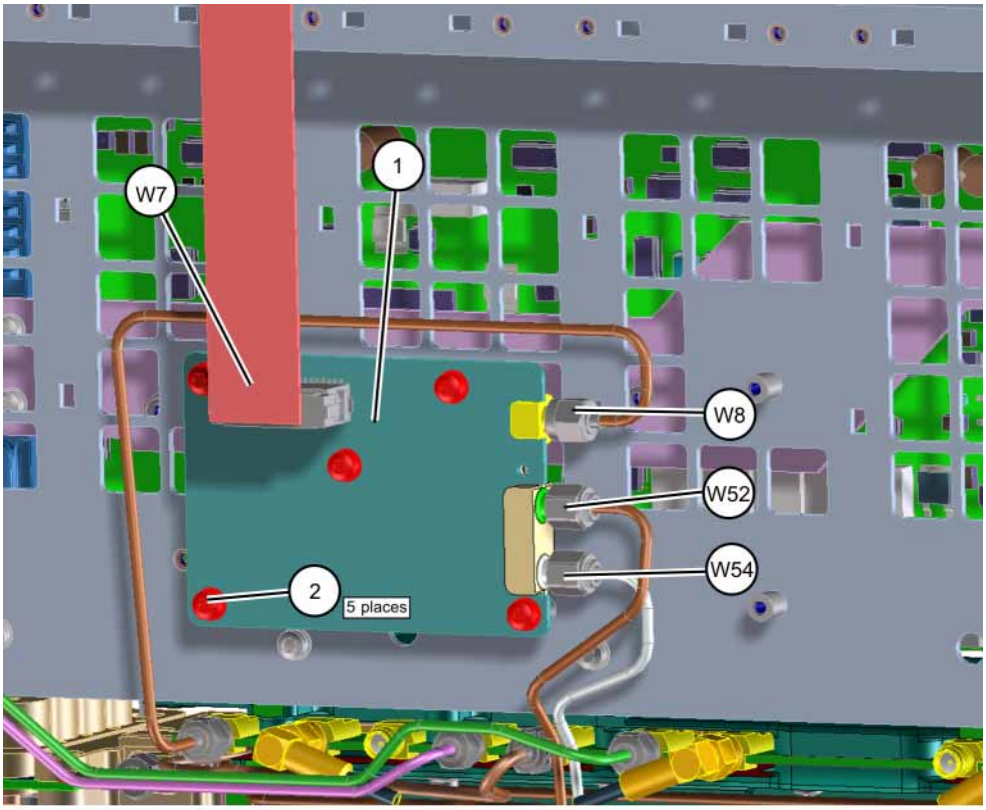
1. Assure the shield are installed on both attenuators.
2. Refer to Figure 20-40. Position the attenuator in the bracket so that the ribbon connector end is “down”.
3. Replace the two screws (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
4. Position the attenuators and bracket into the chassis and attach with the three screws **(3)** (0515-0372). Torque to 9 inch-pounds.
5. Replace the ribbon cable and semi-rigid cables W2, W3, W4, and W51 to the attenuators. Torque the semi-rigid cables to 10 inch-pounds.
6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A11 Low Band Switch

Removal

1. Refer to Figure 20-41. Remove the ribbon cable W7.
2. Remove the semi-rigid cables W8, W52, and W54 using the 5/16 inch wrench.
3. Remove the five screws **(2)** (0515-0372) using the T-10 driver. The A11 low band switch **(1)** can now be removed from the chassis.

Figure 20-41 Low Band Switch Cable Removal - Options 544, 550



LB_switch_50

Item	Keysight Part Number
W8	N9040-20108
W52	N9040-20106
W54	N9040-20107

Replacement

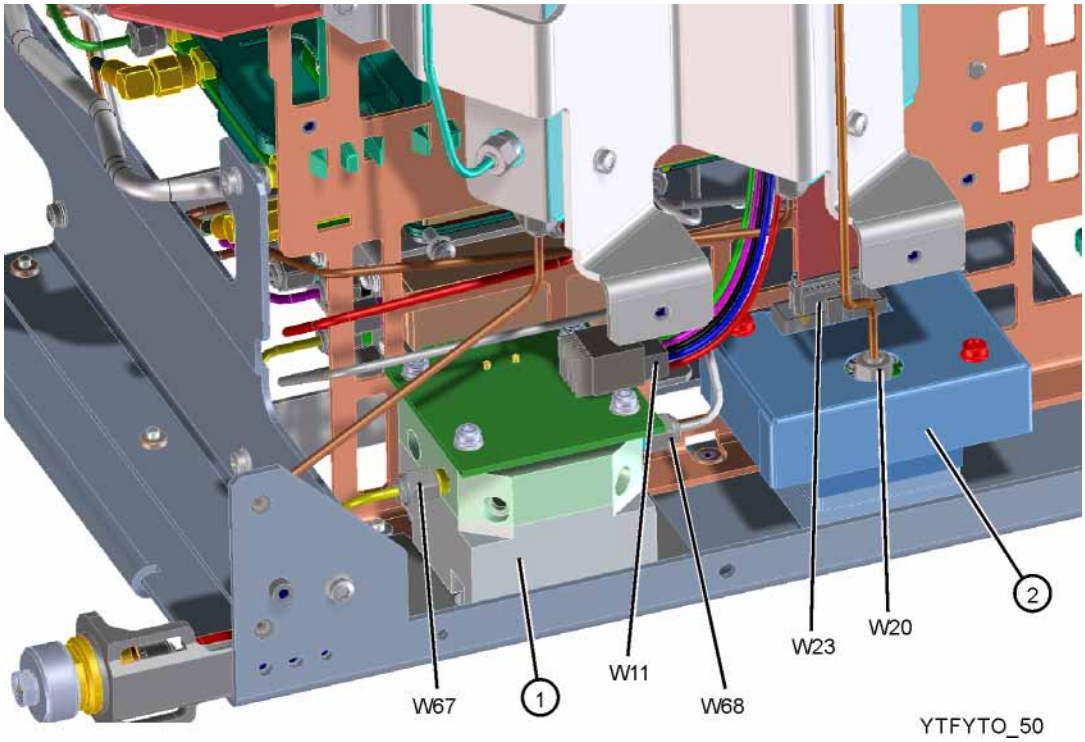
1. Refer to Figure 20-41. Place the switch into place into the chassis and replace the five screws (0515-0372). Torque to 9 inch-pounds.
2. Replace the semi-rigid cables W8, W52, and W54. Torque to 10 inch-pounds.
3. Replace the ribbon cable W7. Ensure locking tabs on the sides of the connector are engaged.
4. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A12 YTF Preselector

Removal

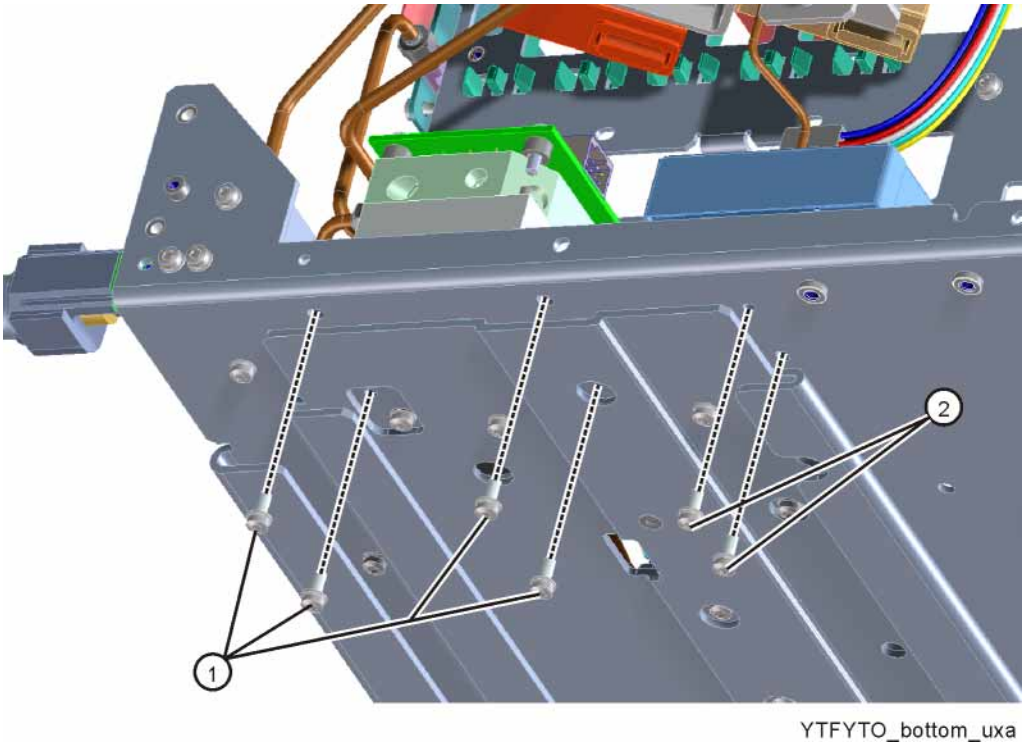
1. Refer to Figure 20-42. Remove cables W67 and W68 from the YTF Preselector **(1)**.
2. Remove the wire harness W11.
3. Refer to Figure 20-43. From the bottom of the instrument, remove the four screws **(1)** (0515-0372). The A12 YTF Preselector can now be removed from the chassis.

Figure 20-42 YTF Preselector Removal - Options 544, 550



Item	Keysight Part Number
W67	N9040-20109
W68	N9040-20110

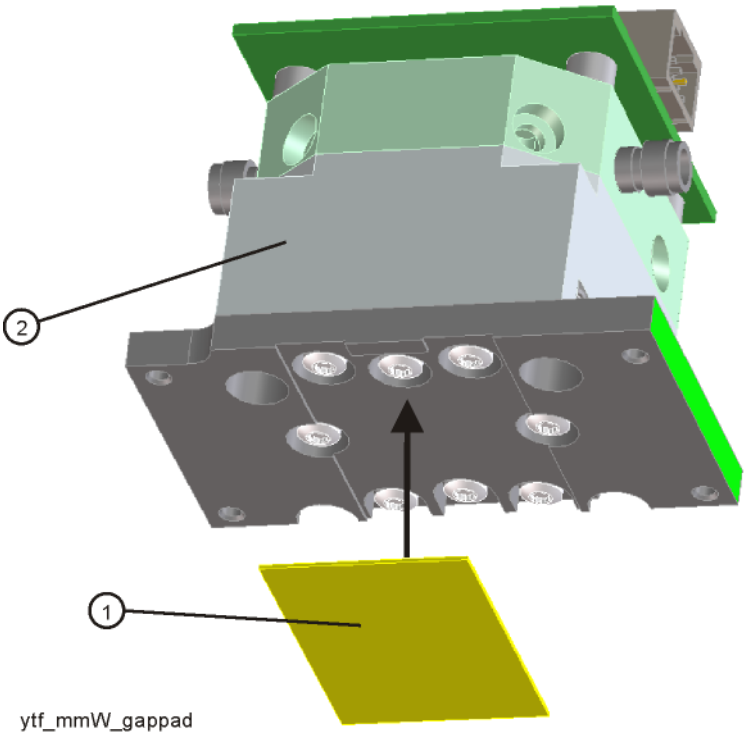
Figure 20-43 YTF Preselector and YTO Bottom Screws



Replacement

1. Inspect the chassis where the YTF Preselector mounts and remove the gap pad if present (see Figure 20-44, item **(1)**. The gap pad may remain attached to the faulty YTF Preselector.
2. Refer to Figure 20-44. Install the replacement gap pad **(1)** (5022-7179) into the recess in the base of the replacement YTF Preselector **(2)**. 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 20-44 Gap Pad Installation



3. Refer to Figure 20-43. Place the YTF Preselector into the chassis with the ribbon cable connector toward the rear of the instrument. Replace the four screws **(1)** (0515-0372). Torque to 9 inch-pounds.
4. Figure 20-42. Replace the cables W67 and W68. Torque to 10 inch-pounds.
5. Replace the wire harness W11.
6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A20 YTO

Removal

1. Refer to Figure 20-42. Remove cable W20 from the YTO **(2)**.
2. Remove the ribbon cable W23 by pulling forward on the locking latch.
3. Refer to Figure 20-43. From the bottom of the instrument, remove the two screws **(2)** (0515-0372). The A20 YTO can now be removed from the chassis.

Item	Keysight Part Number
W20	N9040-20098

Replacement

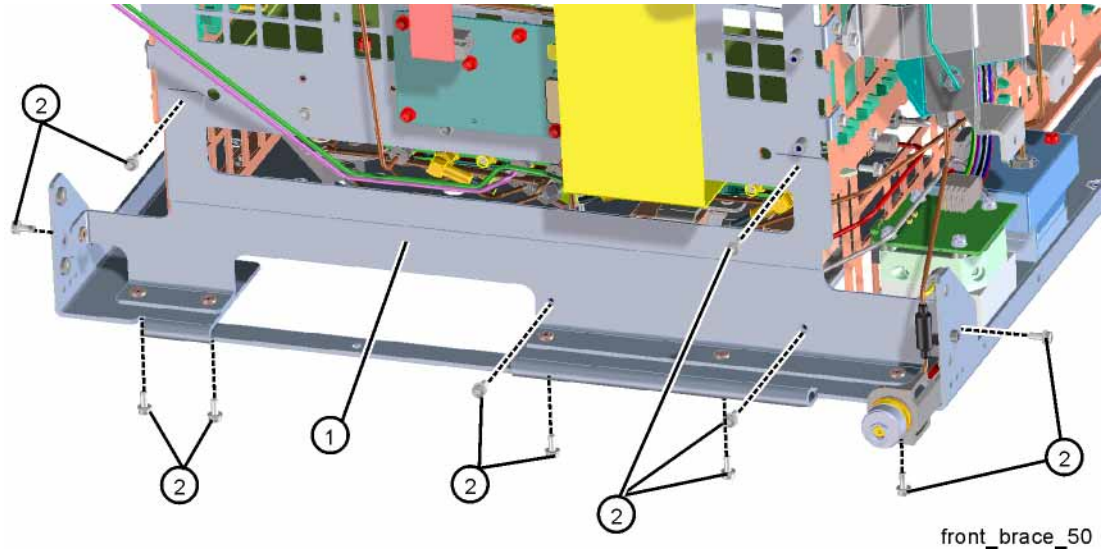
1. Refer to Figure 20-43. Place the YTO into the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
2. Figure 20-42. Replace the cable W20. Torque to 10 inch-pounds.
3. Replace the ribbon cable W23. Ensure the locking latch is engaged.
4. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

Transfer Switches

Removal

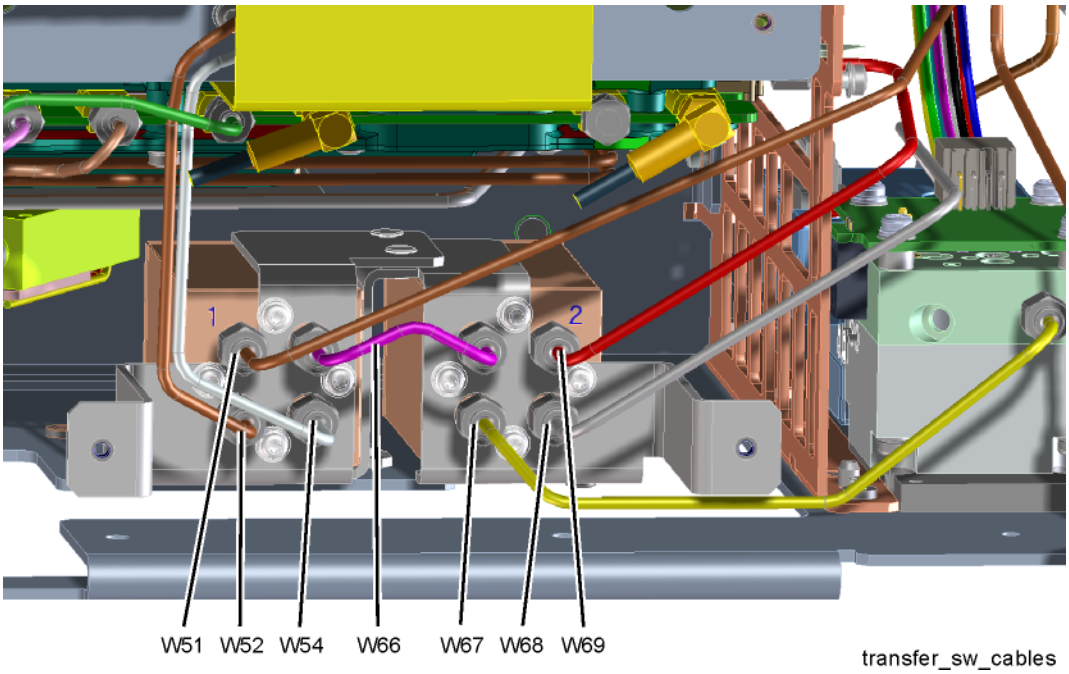
1. Refer to Figure 20-45. Remove the front brace **(1)** by removing the eleven screws **(2)** (0515-0372).

Figure 20-45 Front Brace Removal



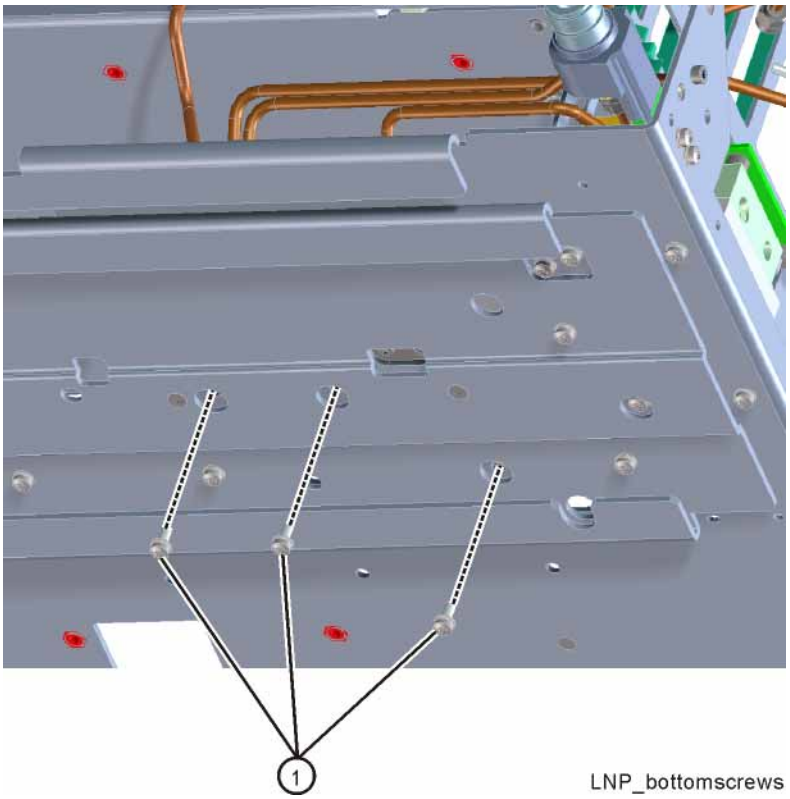
2. Refer to Figure 20-46. Remove cables W51, W52, W54, W66, W67, W68, and W69.

Figure 20-46 Transfer Switch Cables Removal - Options 544, 550



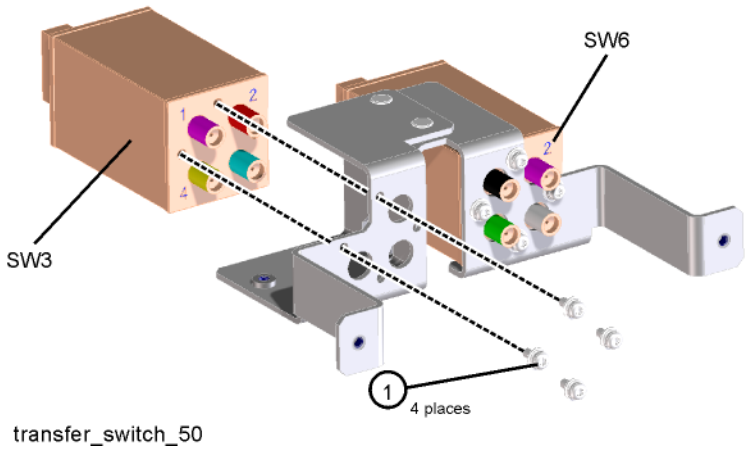
3. Refer to Figure 20-47. Remove the three screws **(1)** (0515-0372) that attach the switch bracket to the chassis. Unplug the ribbon cable and the wire harnesses from each switch. The switches and bracket can now be removed from the chassis.

Figure 20-47 Switch Bracket Bottom Screws



4. Refer to Figure 20-48. To remove either SW3 or SW6 transfer switch remove the four screws **(1)** (0515-1934) attaching the switch to the bracket.

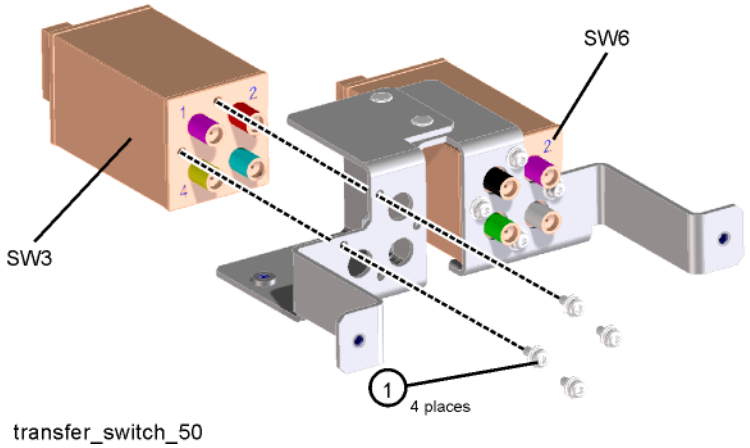
Figure 20-48 Removing Transfer Switch from Bracket - Options 544, 550



Replacement

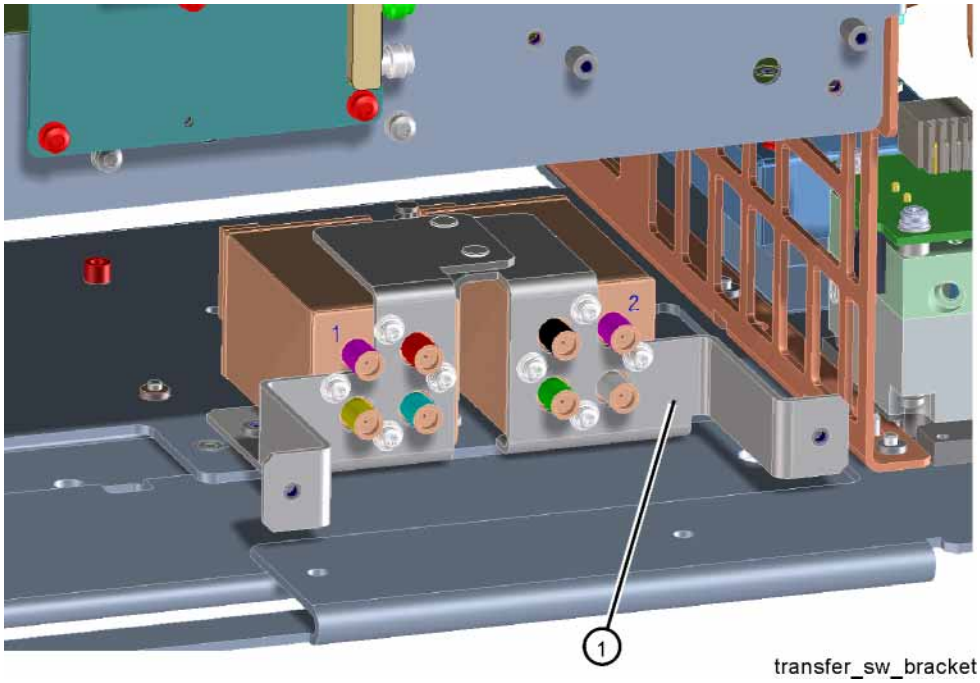
1. Refer to Figure 20-49. Place the SW3 or SW6 transfer switch into the bracket in the orientation shown, with port 1 in the upper left corner. Secure with the four screws **(1)** (0515-1934). Torque to 6 inch-lbs.

Figure 20-49 Replacing Transfer Switch - Options 544, 550



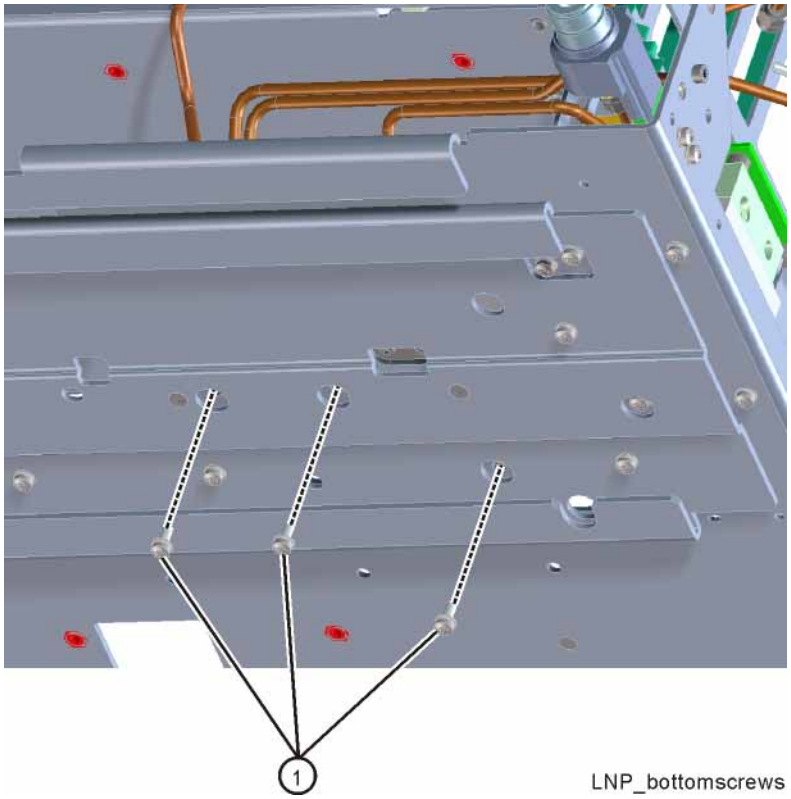
2. Place the switches and switch bracket **(1)** into the chassis as shown in Figure 20-50. Plug the ribbon cable and the wire harnesses into each switch.

Figure 20-50 Switch Bracket - Options 544, 550



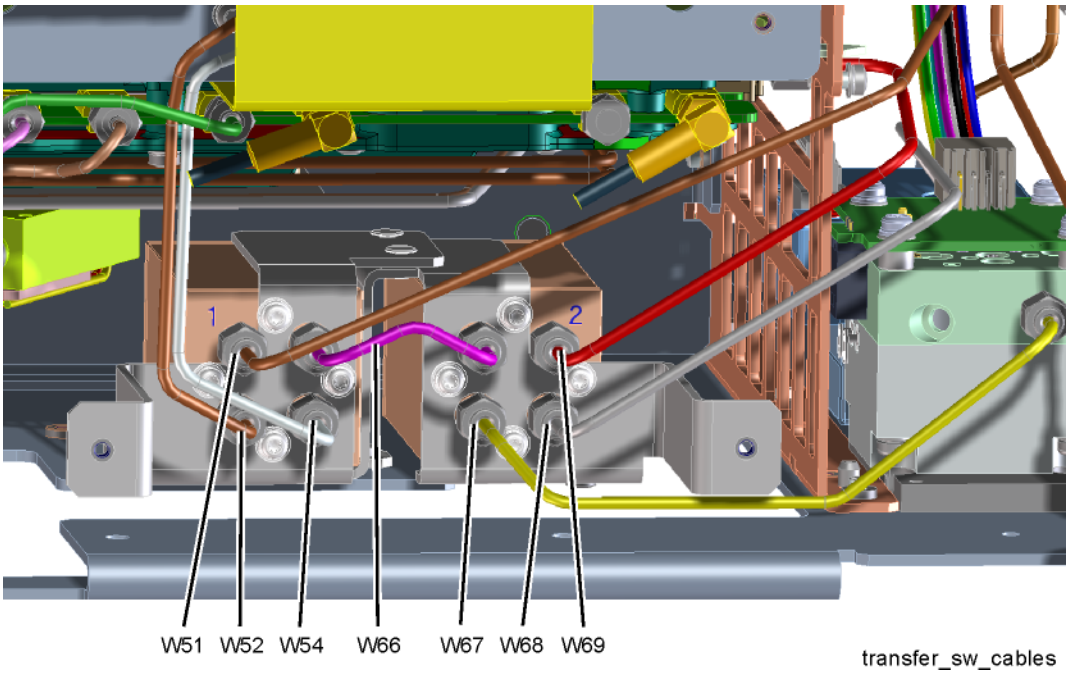
3. Replace the three screws **(1)** (0515-0372) that attach the switch bracket to the chassis as shown in Figure 20-51. Torque to 9 inch-lbs.

Figure 20-51 Switch Bracket Bottom Screws



4. Refer to Figure 20-52. Replace cables W51, W52, W54, W66, W67, W68, and W69. Torque to 10 inch-lbs.

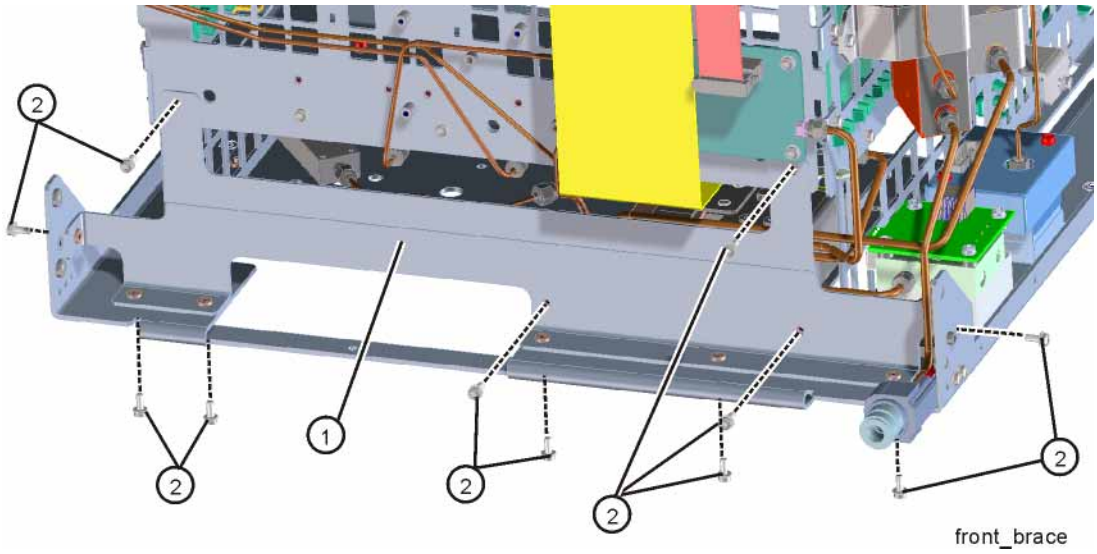
Figure 20-52 Transfer Switch Cables Replacement - Options 544, 550



Item	Keysight Part Number
W51	N9040-20104
W52	N9040-20106
W54	N9040-20107
W66	N9040-20105
W67	N9040-20109
W68	N9040-20110
W69	N9040-20111

5. Refer to Figure 20-53. Place the front brace **(1)** into the chassis and secure with the eleven screws **(2)** (0515-0372). Torque to 9 inch-lbs.

Figure 20-53 Front Brace Replacement



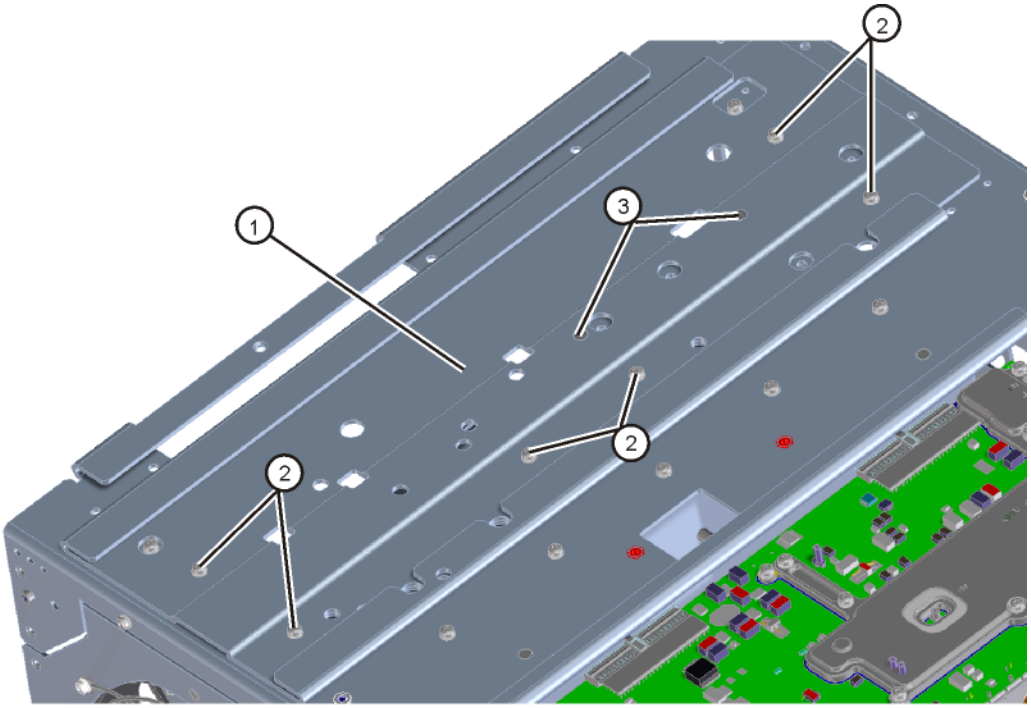
6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

A13 RF Front End Assembly

Removal

1. Perform step 1 through step 3 in the "Transfer Switches" removal procedure on page 499 to remove the bracket and switch assembly.
2. Refer to Figure 20-54. Remove the chassis base stiffener **(1)** by removing the six screws **(2)** (0515-0372) and the two screws **(3)** (0515-1946).

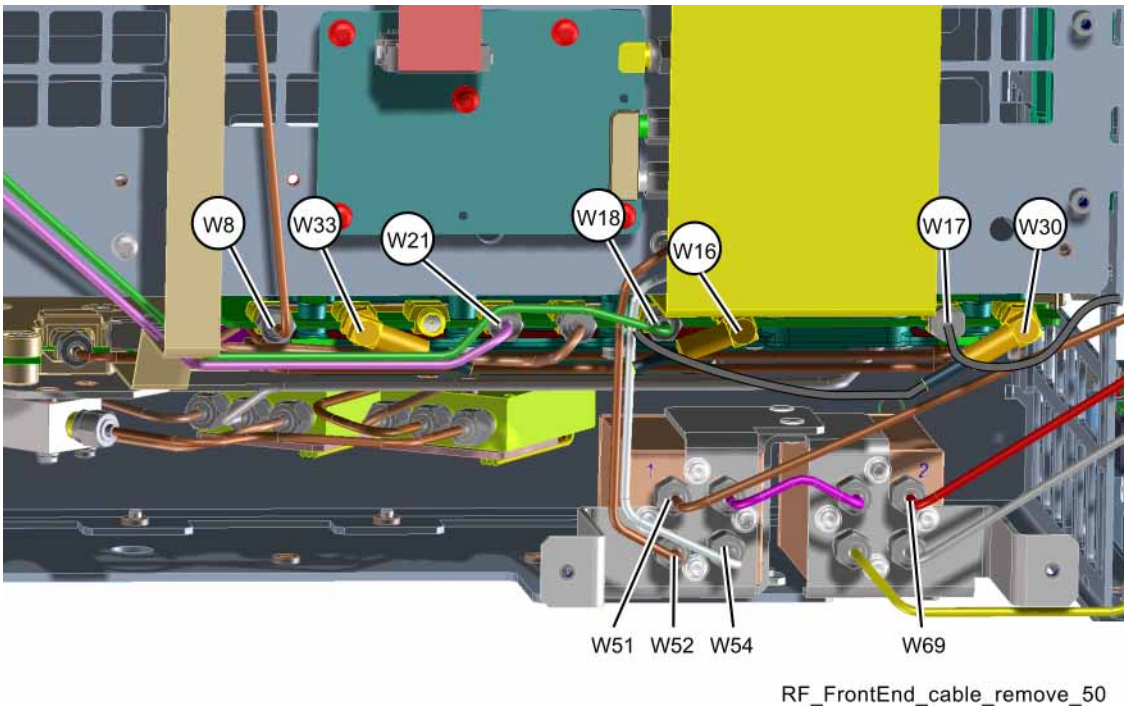
Figure 20-54 Chassis Base Stiffener Removal



base_stiffener

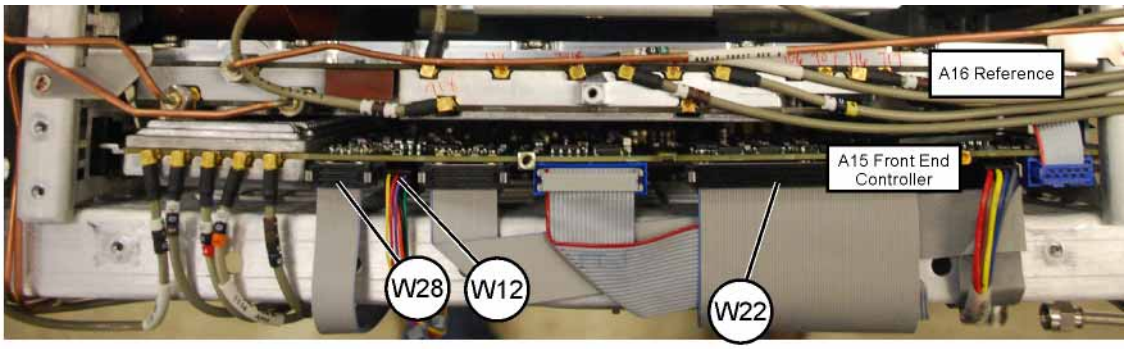
3. Refer to Figure 20-55. Remove the cables W8, W33, W21, W18, W16, W17, and W30 from the A13 Front End assembly. Some cables will not be present if the instrument is not Option B5X.

Figure 20-55 Front End Assembly Cables Removal - Options 544, 550 (Option B5X shown)



4. Refer to Figure 20-56. Unplug ribbon cables W22 and W28, and wire harness W12 from the Front End Controller board.

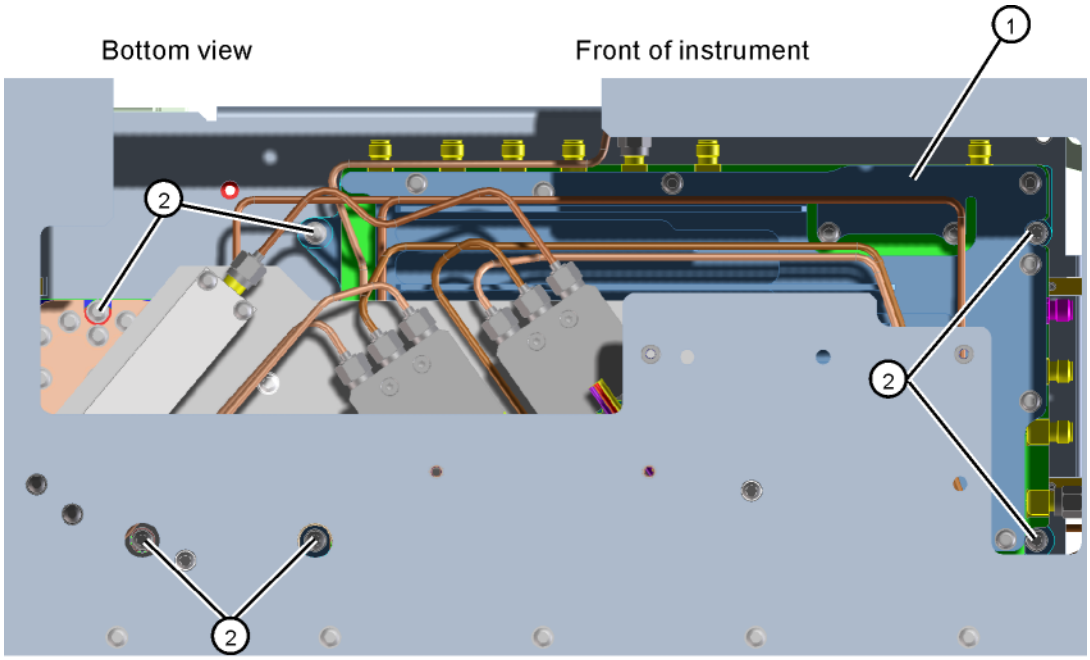
Figure 20-56 Front End Controller Board Cables



frontend_cables_uxa

5. Refer to Figure 20-57. From the bottom of the instrument, remove the six screws **(2)** (0515-0372) that attach the Front End assembly **(1)** to the chassis. The Front End assembly can now be removed.

Figure 20-57 Front End Assembly Bottom Screws - Removal



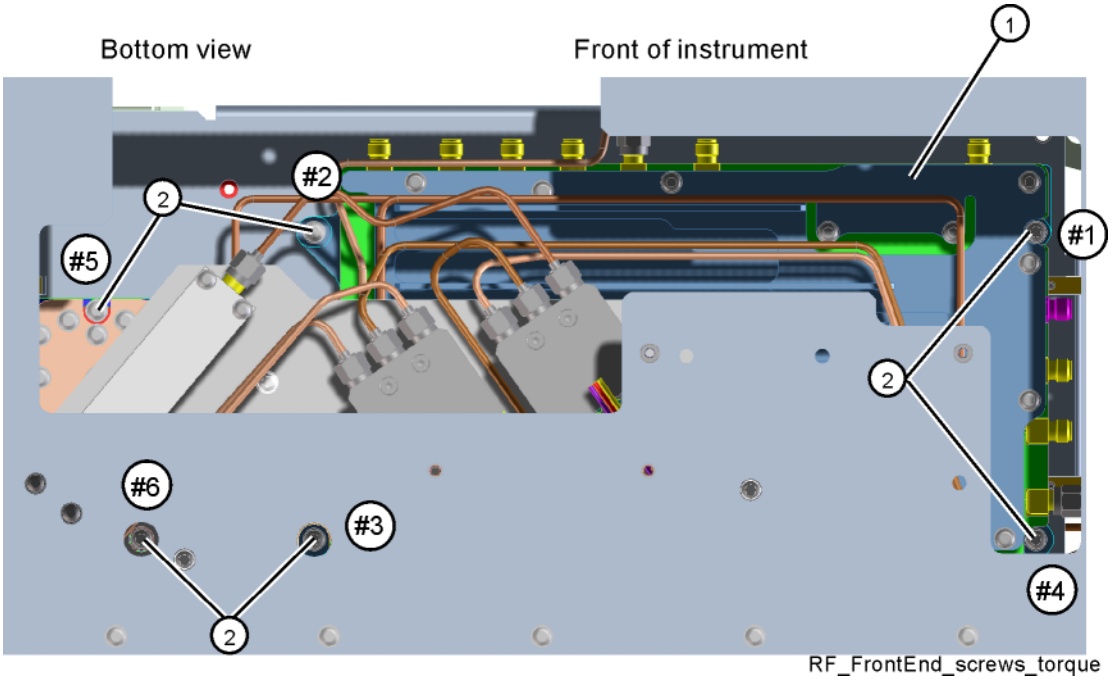
RF_FrontEnd_screws

Replacement

1. Refer to Figure 20-58. Place the Front End assembly into the chassis. From the bottom of the instrument, replace the six screws **(2)** (0515-0372) that attach the Front End assembly **(1)** to the chassis. Torque to 9 inch-pounds in the order shown (#1 to #6).

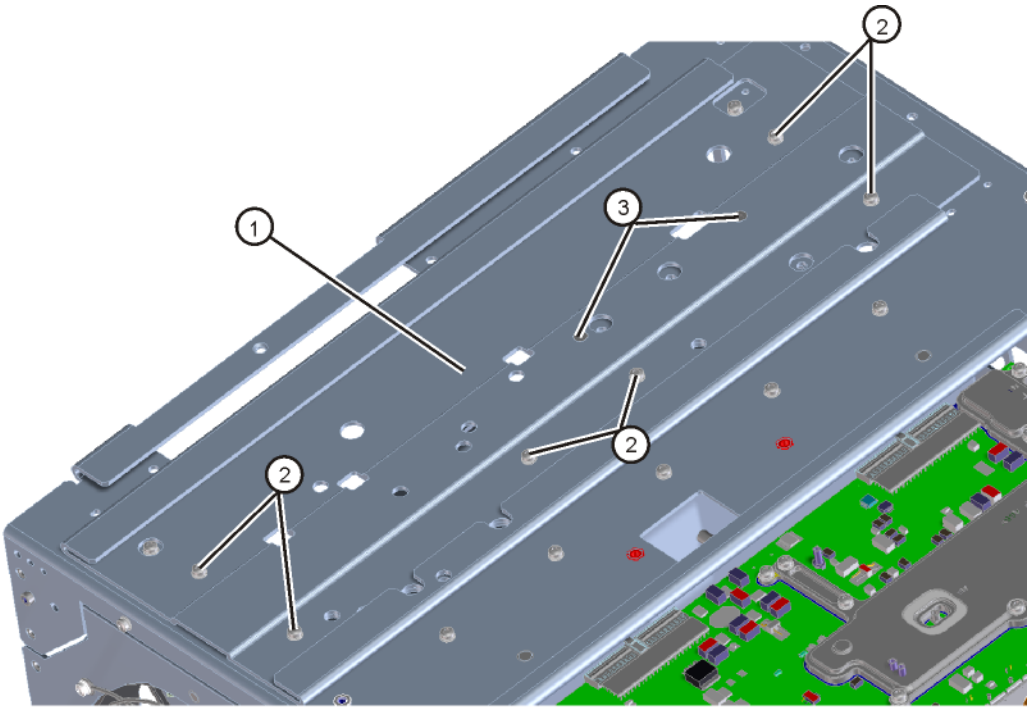
CAUTION Make sure ribbon cable W22 is under the 4 guide tabs on the back of the Front End assembly.

Figure 20-58 Front End Assembly Bottom Screws - Replacement



2. Refer to Figure 20-59. Place the chassis base stiffener **(1)** in position on the chassis base. Secure with the six screws **(2)** (0515-0372) and the two screws **(3)** (0515-1946). Torque all screws to 9 inch-pounds.

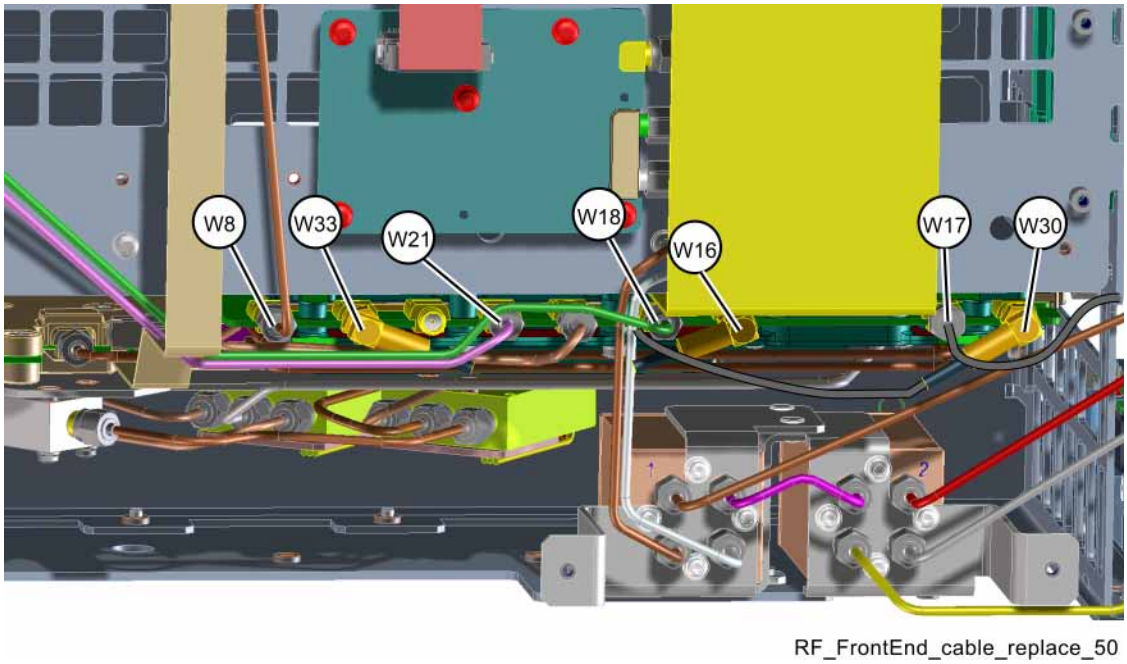
Figure 20-59 Chassis Base Stiffener Replacement



base_stiffener

3. Refer to Figure 20-60. Replace cables W8, W16, W17, W18, W21, W30, and W33. Torque to 10 inch-pounds.

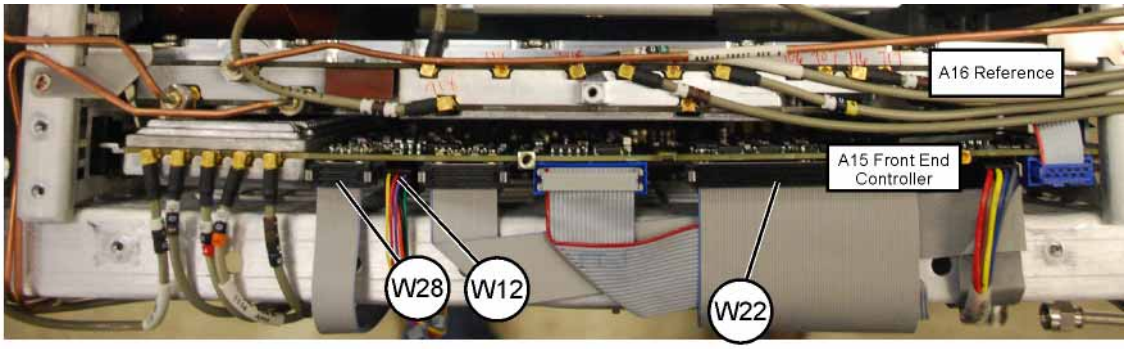
Figure 20-60 Front End Assembly Cables Replacement - Options 544, 550



Item	Keysight Part Number
W8	N9040-20032
W16	8121-2027
W17	N9040-60046
W18	N9040-20113
W21	N9040-20112
W30	8121-2608
W33	8121-1940
W51	N9040-20104
W52	N9040-20106
W54	N9040-20107
W69	N9040-20111

4. Refer to Figure 20-61. Plug ribbon cables W22 and W28, and wire harness W12 back into the Front End Controller board.

Figure 20-61 Front End Controller Board Cables



frontend_cables_uxa

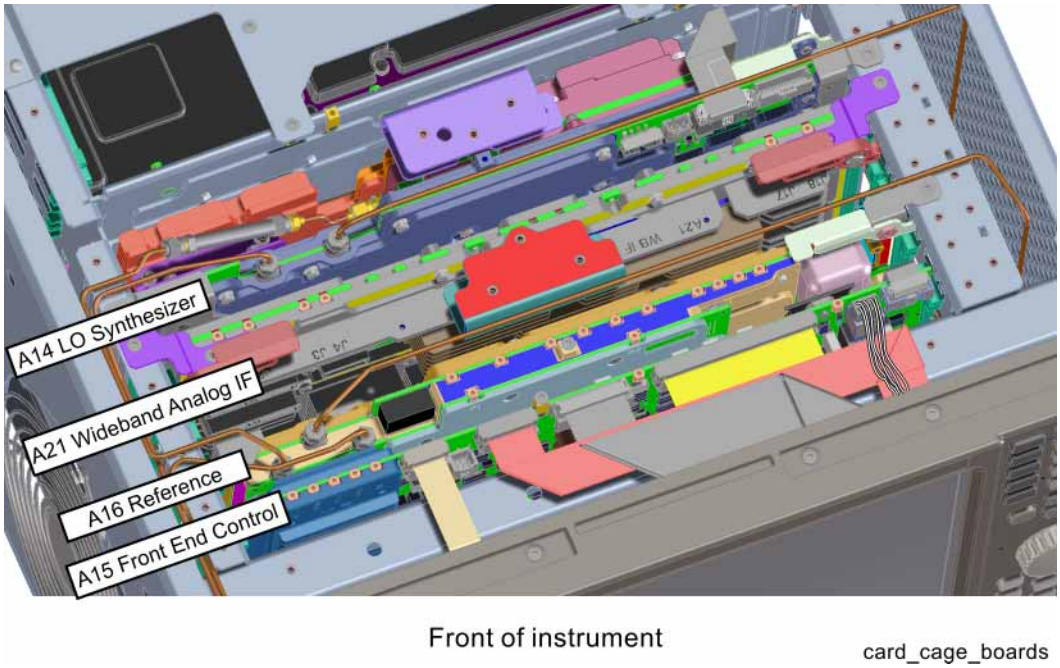
5. Perform step 4 through step 6 in the "Transfer Switches" replacement procedure on page 504 to replace the bracket and switch assembly and front brace.

6. Replace the RF bracket, front panel, and instrument outer case as described on page 460.

Card Cage Boards

The card cage boards are located in the front half of the chassis and consist of the A15 Front End Control, A16 Reference, A21 Wideband Analog I.F. (Option B2X and B5X only), and the A14 L.O. Synthesizer.

Figure 20-62 Card Cage Boards



To gain access to any of the card cage boards for removal, follow these steps:

1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the card cage brace. Perform step 4 in the "Top Brace and Card Cage Brace" removal procedure.

After the part has been replaced, follow these steps:

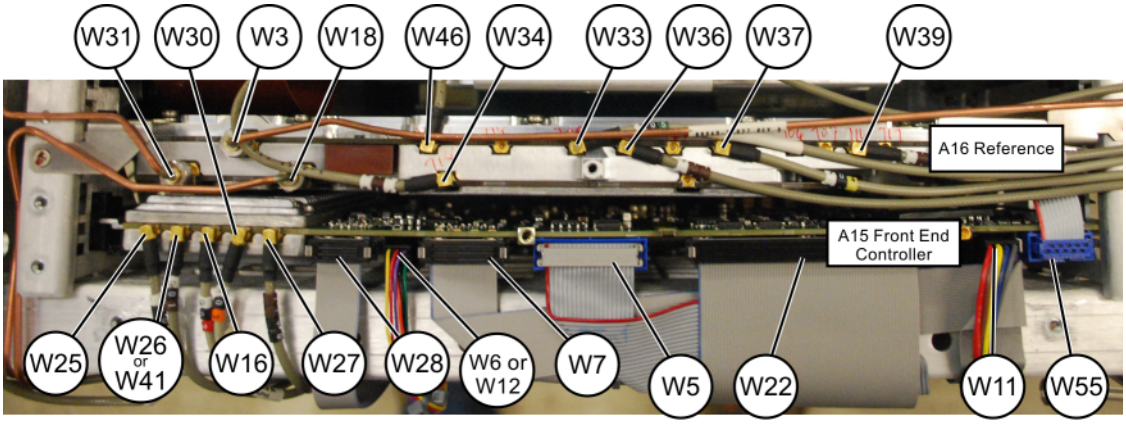
1. Replace the card cage brace as described in the "Top Brace and Card Cage Brace" replacement procedure.
2. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

A15 Front End Control

Removal

1. Refer to Figure 20-62. Locate the A15 Front End Control assembly.
2. Refer to Figure 20-63. Remove cables W5, W7, W11, W12, W16, W22, W25, W26, W27, W28, W30, and W55. The Front End Control assembly can now be removed from the chassis by pulling up to disengage from the front motherboard.

Figure 20-63 Front End Control Cables



front_cables_uxa

Replacement

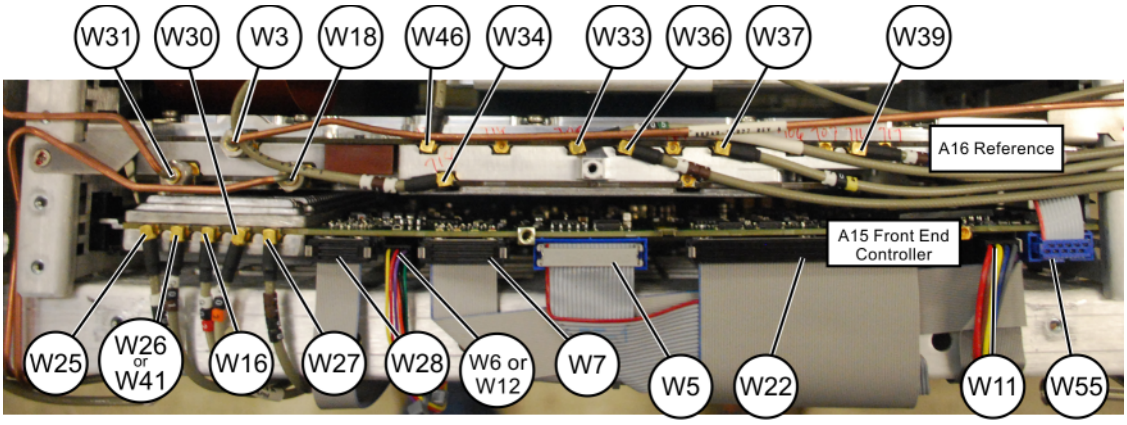
1. Reinstall the Front End Control assembly into the correct slot and push down to mate with the front motherboard.
2. Refer to Figure 20-63. Reinstall cables W5, W7, W11, W12, W16, W22, W25, W26, W27, W28, W30, and W55. You should hear a distinct "snap" when reinstalling the small mmcx cables.

A16 Reference Assembly

Removal

1. Refer to Figure 20-62. Locate the A16 Reference assembly.
2. Refer to Figure 20-64 or Figure 20-65. Remove cables W3, W18, W31, W33, W34 (if present), W36, W37, W39, and W46 or W47.

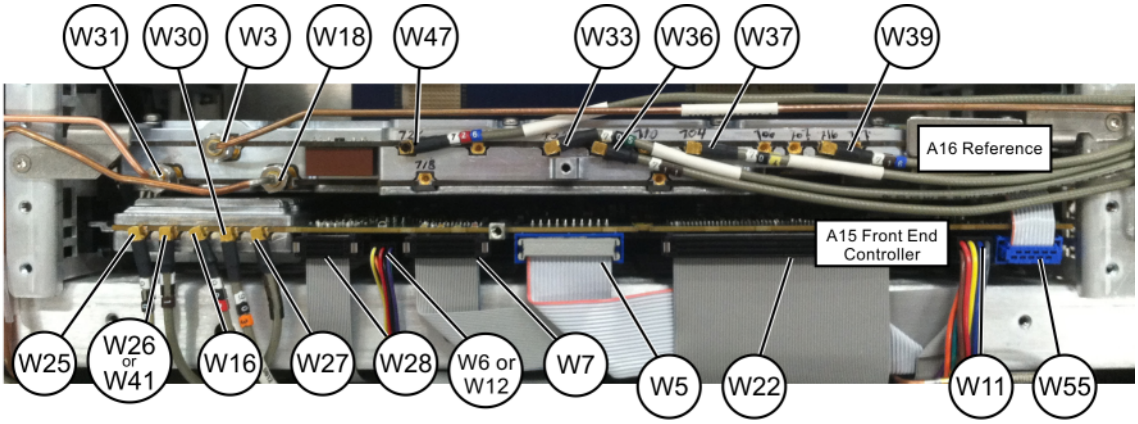
Figure 20-64 Reference Cables



front_cables_uxa

NOTE The cables will look different for an Option B40 instrument.

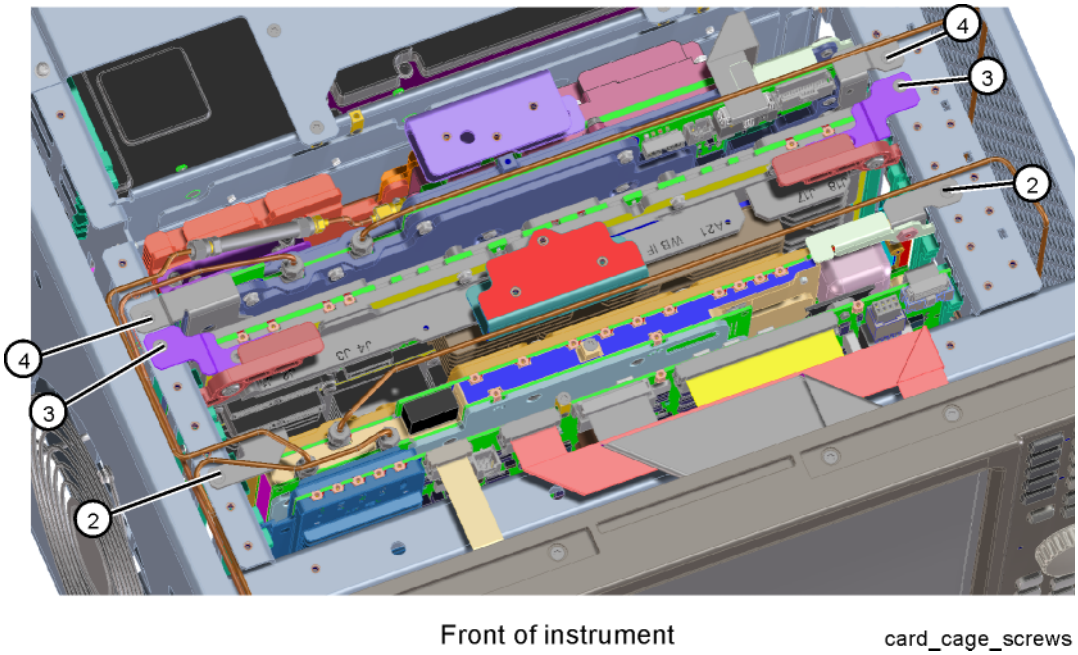
Figure 20-65 Reference Cables - Option B40



front_cables_B40_uxa

3. Refer to Figure 20-66. Remove the two screws **(2)** (0515-1946) that attach the Reference assembly to the chassis. Use the ejector on the Reference assembly to unplug from the motherboard and lift out of the chassis.

Figure 20-66 Card Cage Screws



Replacement

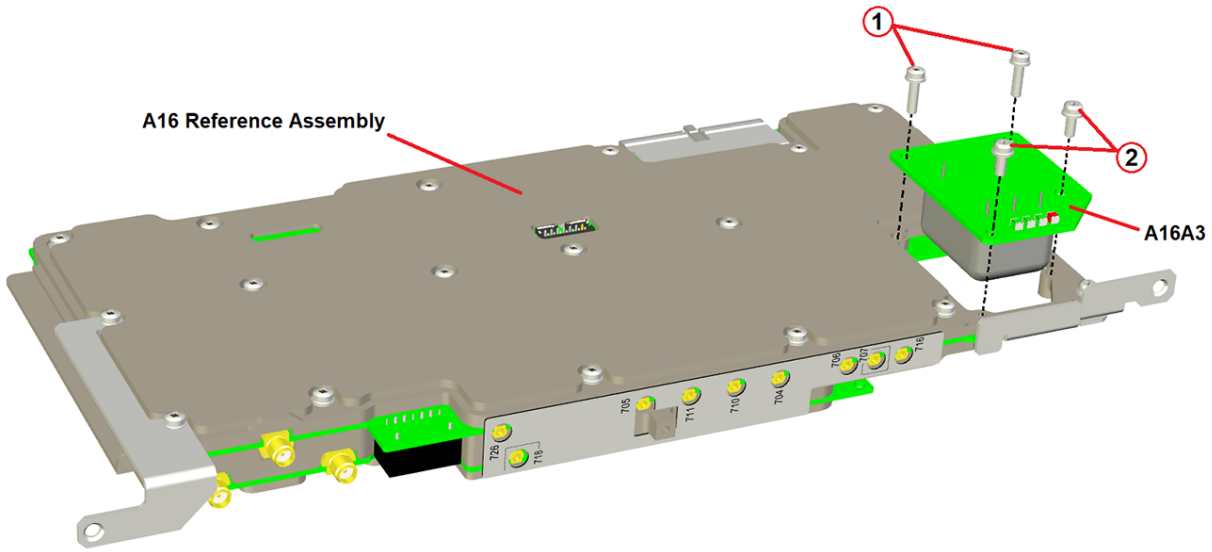
1. Reinstall the Reference assembly into the correct slot and use the ejector to secure and to mate with the motherboard.
2. Refer to Figure 20-66. Replace the two screws **(2)** (0515-1946). Torque to 9 inch-pounds.
3. Refer to Figure 20-64. Reinstall cables W3, W18, W31, W33, W34, W36, W37, W39, and W46. You should hear a distinct "snap" when reinstalling the small mmcx cables. Torque the semi-rigid cables to 10 inch-pounds.

A16A3 Reference OCXO

Removal

1. Remove the A16 Reference assembly from the instrument. Refer to the A16 Reference Assembly section in this chapter.
2. Referring to Figure 20-67, remove the four screws **(1)(2)** attaching the A16A3 Reference OCXO to the A16 Reference assembly.
3. Unplug the A16A3 Reference OCXO from the A16 Reference assembly.

Figure 20-67 A16A3 Reference OCXO



Replacement

4. Referring to Figure 20-67, carefully plug the A16A3 Reference OCXO into the A16 Reference assembly.
5. Secure the A16A3 Reference OCXO to the A16 Reference assembly using the two screws **(1)** (0515-0644) and the two screws **(2)** (0515-0372). Torque all four screws to 9 inch pounds.
6. Reinstall the A16 Reference assembly into the instrument. Refer to the A16 Reference Assembly section in this chapter.

Table 20-1 A16 Reference Assembly Related Parts

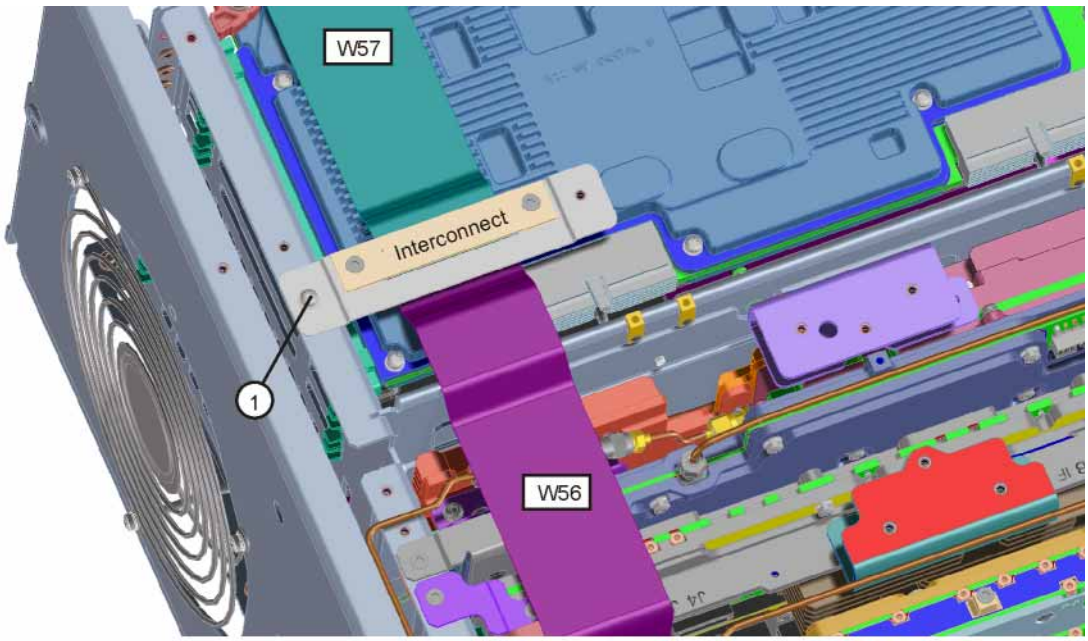
Item	Keysight Part Number
A16 Reference Assembly	N9020-60387
A16A3 Reference OCXO	N9020-63194

A21 Wideband Analog I.F. Assembly (Option B2X and B5X only)

Removal

1. To remove the A21 Wideband Analog I.F. assembly it is also necessary to remove the top brace. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure.
2. Refer to Figure 20-62. Locate the Wideband Analog I.F. assembly **(3)**.
3. Refer to Figure 20-68. Remove ribbon cable W56 by first removing the single screw **(1)** (0515-0372). Then unplug W56 from the interconnection with W57.

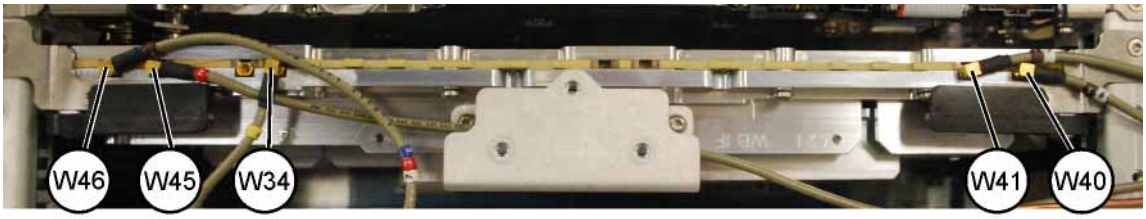
Figure 20-68 Wideband I.F. Ribbon Cable



WB_analog_IF

4. Refer to Figure 20-69. Remove cables W34, W40, W41, W45, and W46.

Figure 20-69 Wideband I.F. Cables



WBAIF_cables_uxa

5. Refer to Figure 20-66. Remove the two screws **(3)** (0515-1946) that attach the Wideband I.F. assembly to the chassis. Use the ejectors on the Wideband Analog I.F. assembly to unplug from the motherboard and lift out of the chassis.

Replacement

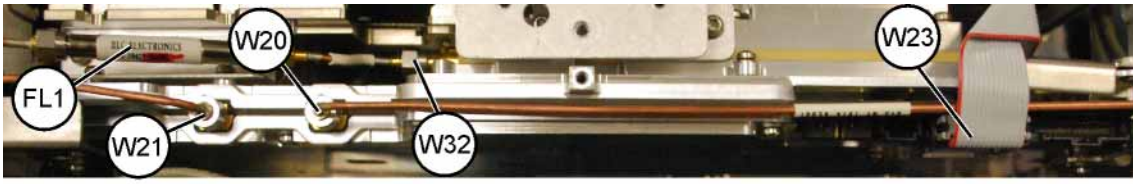
1. Reinstall the Wideband Analog I.F. assembly into the correct slot and use the ejectors to secure and to mate with the motherboard.
2. Refer to Figure 20-66. Replace the two screws **(3)** (0515-1946). Torque to 9 inch-pounds.
3. Refer to Figure 20-69. Reinstall cables W34, W40, W41, W45, and W46. You should hear a distinct "snap" when reinstalling the small mmcx cables.
4. Refer to Figure 20-68. Plug ribbon cable W56 into W57 at the interconnect. Replace the single screw **(1)** (0515-0372). Torque to 9 inch-pounds.
5. Replace the top brace as described in the “Top Brace and Card Cage Brace” replacement procedure.

A14 L.O. Synthesizer

Removal

1. Refer to Figure 20-62. Locate the A14 L.O. Synthesizer assembly **(4)**.
2. Refer to Figure 20-70. Remove cables W20, W21, W23, and W32.

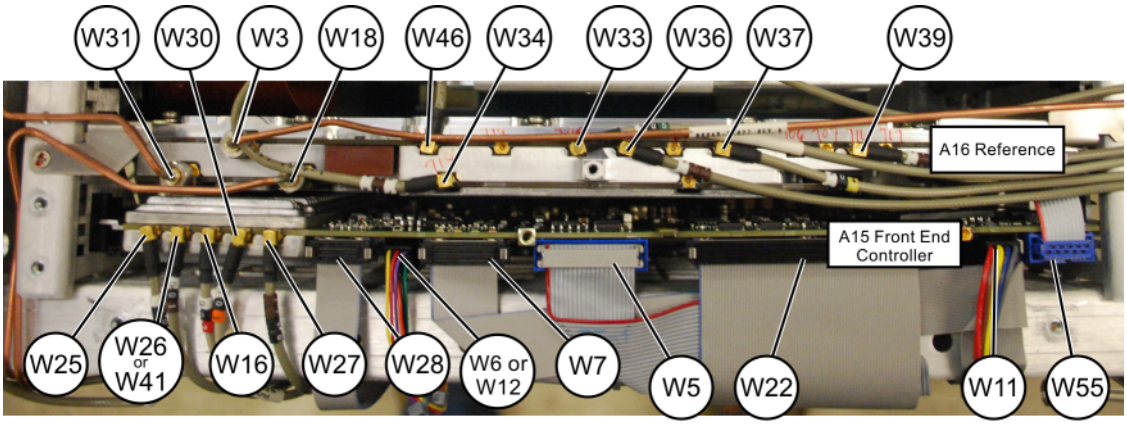
Figure 20-70 L.O. Synthesizer Cables



LO_synth_cables_uxa

3. Refer to Figure 20-71. Remove cable W31 from the Reference board.

Figure 20-71 Reference Board W31 Cable



front_cables_uxa

4. Refer to Figure 20-66. Remove the two screws **(4)** (0515-1946) that attach the L.O. Synthesizer assembly to the chassis. Use the ejector on the L.O. Synthesizer assembly to unplug from the motherboard and lift out of the chassis.

Replacement

1. Reinstall the L.O. Synthesizer assembly into the correct slot and use the ejector to secure and to mate with the motherboard.
2. Refer to Figure 20-66. Replace the two screws **(4)** (0515-1946). Torque to 9 inch-pounds.
3. Refer to Figure 20-70. Reinstall cables W20, W21, W23, and W32. Torque the semi-rigid cables to 10 inch-pounds.
4. Refer to Figure 20-71. Reinstall cable W31. Torque to 10 inch-pounds.

Rear Panel

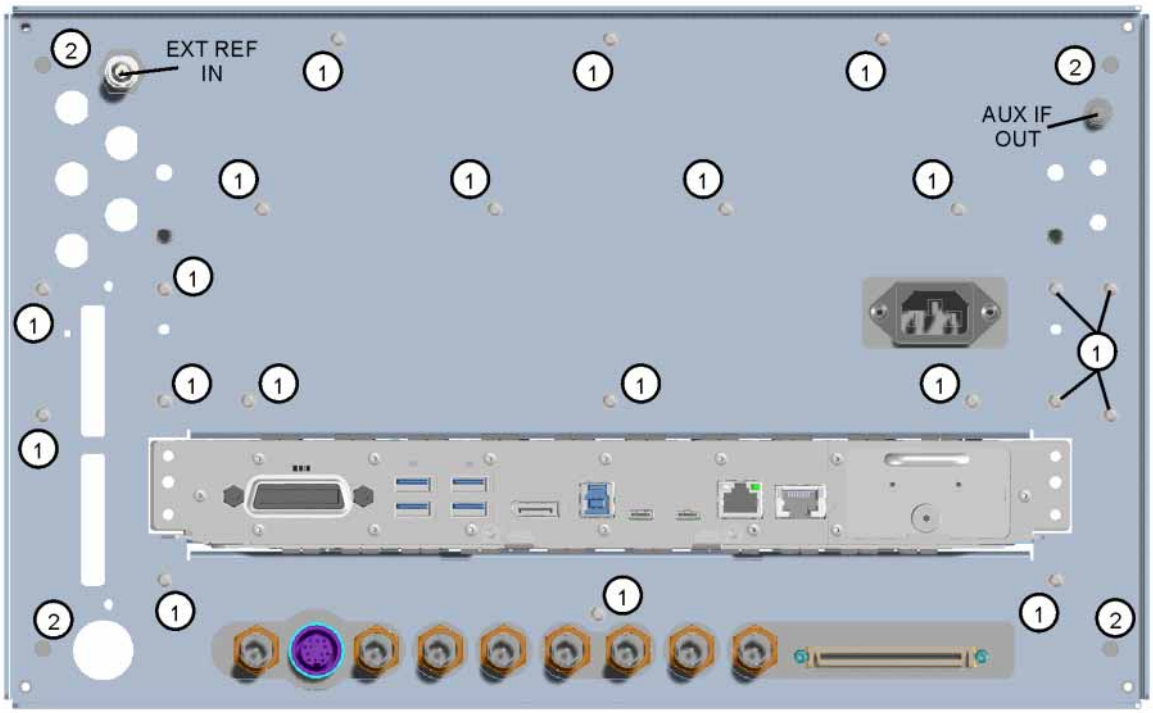
Removal

1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Refer to Figure 20-72. Use a 9/16 inch nut driver to remove the EXT REF IN connector from the rear panel. Use a 5/16 inch nut driver to remove the AUX IF OUT connector from the rear panel.

Serial Number Prefix < 5616

3. Refer to Figure 20-72. Remove the twenty-one screws **(1)** (0515-0372) and the four screws **(2)** (0515-1946). The rear panel can now be removed from the chassis.

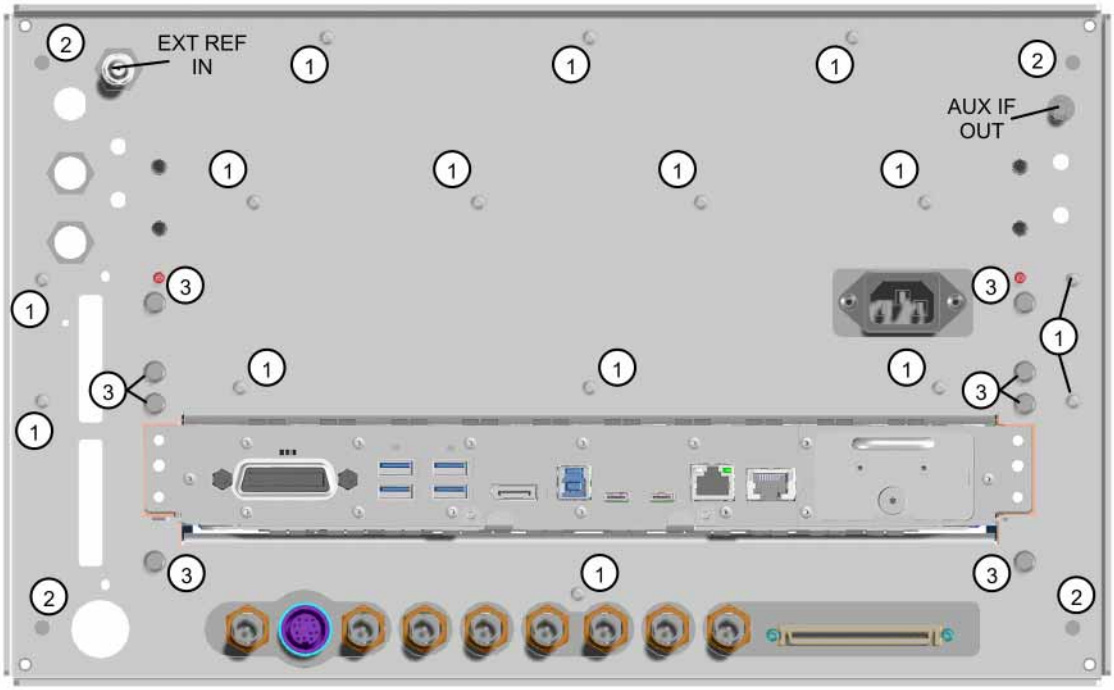
Figure 20-72 Rear Panel Screw Locations
Serial Number Prefix < 5616



Serial Number Prefix ≥ 5616

4. Refer to Figure 20-73. Remove the fifteen screws **(1)** (0515-0372), the four screws **(2)** (0515-1946), and the eight screws **(3)** (0515-0433). The rear panel can now be removed from the chassis.

Figure 20-73 Rear Panel Screw Locations
Serial Number Prefix ≥ 5616



Replacement

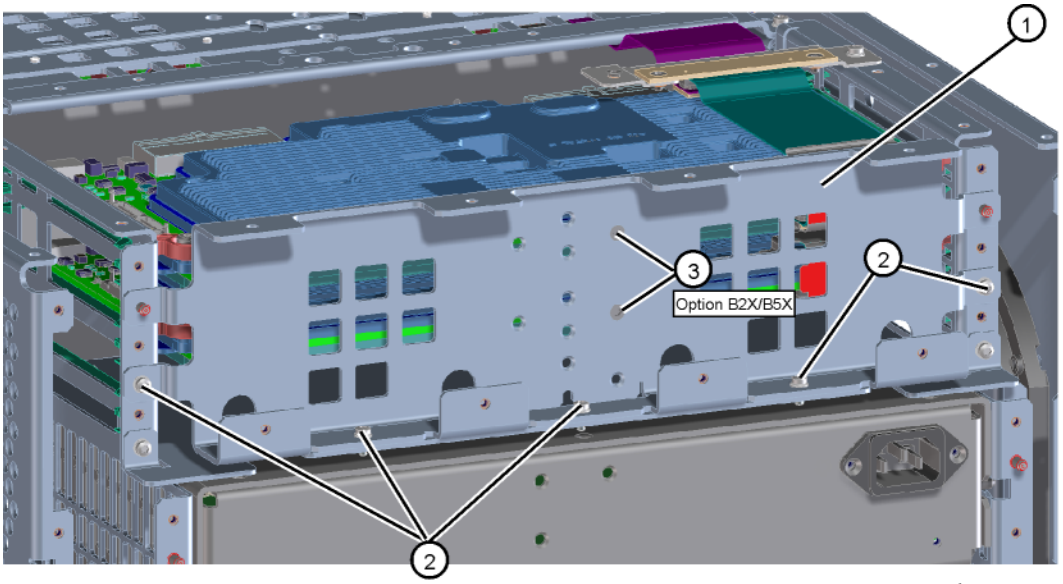
1. Refer to Figure 20-72. Install the EXT REF IN connector and the AUX IF OUT connector through the rear panel ports. Use the lock washers and nuts to secure. Use a 9/16 inch nut driver on the EXT REF IN connector and torque to 21 inch-pounds. Use a 5/16 inch nut driver on the AUX IF OUT connector and torque to 10 inch-pounds. Reinstall the rear panel into position in the chassis.
2. **For Serial Number Prefix < 5616**:
   - Refer to Figure 20-72. Replace the twenty-one screws **(1)** (0515-0372) and the four screws **(2)** (0515-1946). Torque all screws to 9 inch-pounds.
3. **For Serial Number Prefix ≥ 5616:**
   - Refer to Figure 20-73. Replace the fifteen screws **(1)** (0515-0372) and the four screws **(2)** (0515-1946). Torque to 9 inch-pounds.
   - Replace the eight screws **(3)** (0515-0433). Torque to 21 inch-pounds.
4. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

A22 & A23 Wideband Digital I.F. Boards

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. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure.
4. **For Serial Number Prefix < 5605 Options 508, 513, 526**:
   - Refer to Figure 20-74. Remove the rear brace **(1)** by removing the five screws **(2)** (0515-0372) and the one or two screws **(3)** (0515-1946). Option B2X instruments will only have the top screw, while Option B5X instruments will have both.

Figure 20-74 Rear Brace Removal
Serial Number Prefix < 5605 Options 508, 513, 526



rear_brace_uxa

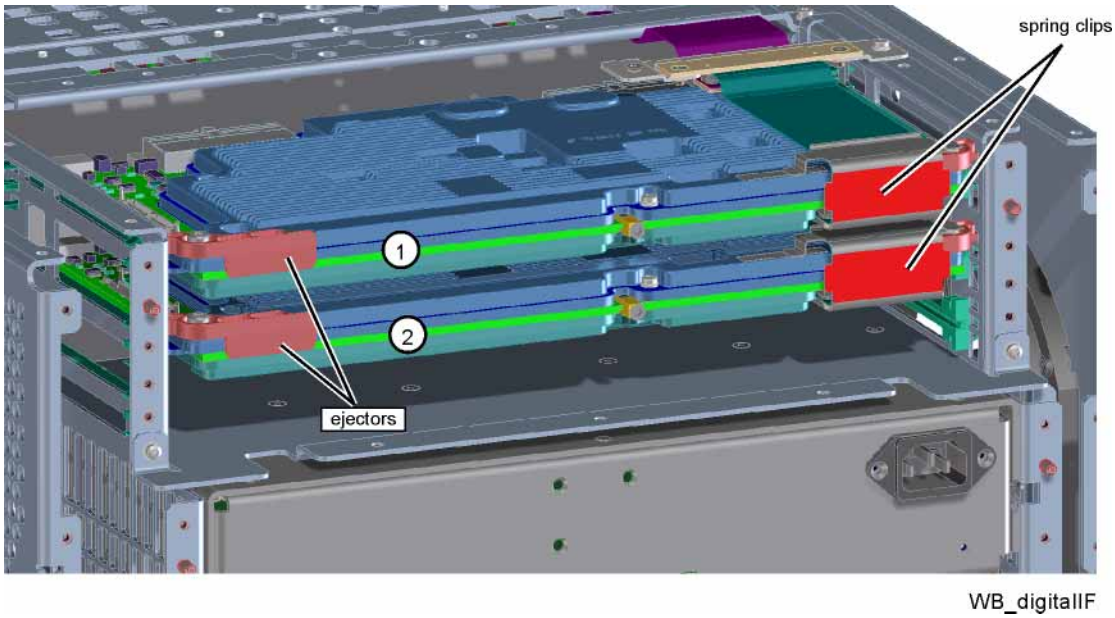
5. **For Serial Number Prefix ≥ 5605 and All Options 544 and 550**:

   – Refer to Figure 20-75. Remove the rear brace **(1)** by removing the four screws **(2)** (0515-0372) and the one or two screws **(3)** (0515-1946). Option B2X instruments will only have the top screw, while Option B5X instruments will have both.

Figure 20-75 Rear Brace Removal
Serial Number Prefix ≥ 5605 and All Options 544 and 550

6. Refer to Figure 20-76. Option B2X instruments will only have the top Wideband Digital I.F. board **(1)**. Option B5X instruments will have both boards **(1)** and **(2)**. Remove the spring clips securing the ribbon cables. Unplug the ribbon cables from each Wideband Digital I.F. board. Use the ejectors to remove the boards from the chassis by sliding them towards the rear of the instrument.

Figure 20-76 Wideband Digital I.F. Boards Removal



Replacement

1. Refer to Figure 20-76. Reinstall the Wideband I.F. boards into the slots as shown. Use the ejectors to mate the boards to the rear motherboard and lock into place.
2. Reconnect the ribbon cables to the boards. Place the spring clips into place to hold the ribbon cable.
3. **For Serial Number Prefix < 5605 Options 508, 513, 526**:
   - Refer to Figure 20-74. Reinstall the rear brace **(1)** into position. Secure with the five screws **(2)** (0515-0372) and the one or two screws **(3)** (0515-1946). Torque all screws to 9 inch-pounds.
4. **For Serial Number Prefix ≥ 5605 and All Options 544 and 550**:
   - Refer to Figure 20-75. Reinstall the rear brace **(1)** into position. Secure with the four screws **(2)** (0515-0372) and the one or two screws **(3)** (0515-1946). Torque all screws to 9 inch-pounds.
5. Replace the top brace as described in the "Top Brace and Card Cage Brace" replacement procedure.
6. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

A27 H1G Assembly (Option H1G)

There are two versions of Option H1G hardware that have been installed in the instrument. The early version is no longer available. Only the latest version is available for repair purposes.

The early version is identified by the presence of the rear panel connector IF 2 IN, and a semi-rigid jumper cable that connects IF 2 IN to IF 2 OUT.

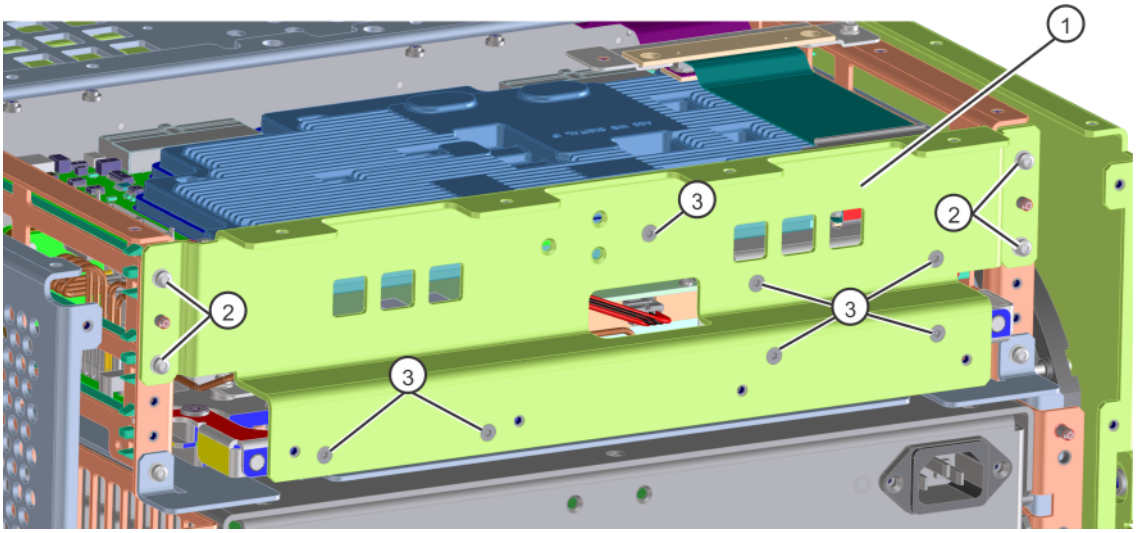
The latest version of Option H1G hardware only has the rear panel IF 2 OUT connector. The jumper cable is not present. Also the coaxial cable input /output connections on the H1G assembly have been re-color coded, which means you will need to remove and replace color bands on some flex coax cables when replacing the early H1G hardware with the latest version. The latest H1G assembly is provided as a replacement kit that includes a hole plug and the cable color bands. These color bands and hole plug are only required if you are replacing the early version H1G assembly.

Replacement process when the H1G assembly is the early version

Removal

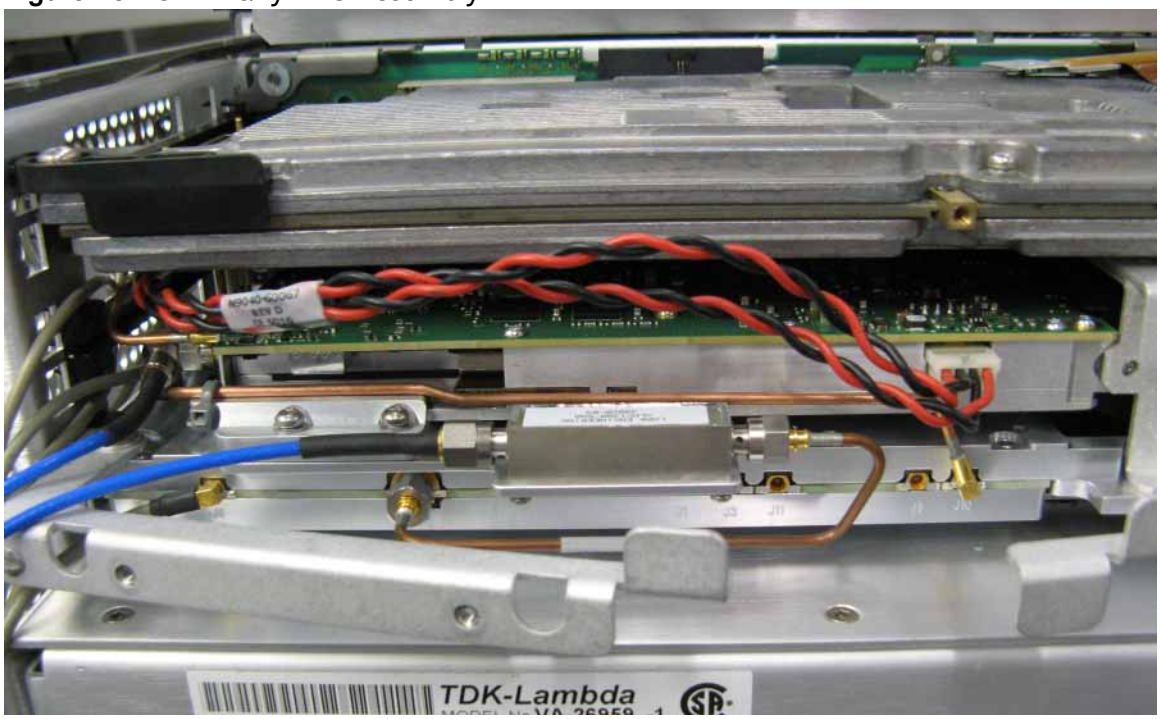
1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the top brace. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure. Save the screws for reuse.
3. On the rear panel remove the semi-rigid jumper cable between IF 2 IN and IF 2 OUT connectors. Discard this cable.
4. Remove the IF 2 IN and IF 2 OUT connector nuts and washers. Use a 5/16-inch wrench. One of these nuts and washers will be reused.
5. Remove the screws from the rear panel and carefully pull away from the instrument. Avoid damaging the cables still attached. Remove the IF 2 IN and IF 2 OUT cables from the rear panel.
6. Refer to Figure 20-77. Remove the rear brace **(1)** by removing the four screws **(2)** (0515-0372) and the seven screws **(3)** (0515-1946).

Figure 20-77 Rear Brace Removal



7. Locate the H1G assembly and use the board extractor handles to loosen the board slightly and allow access to the coax cables attached to the board.
8. Refer to Figure 20-78.Remove the snap-in cables from the board assembly. Leave the blue cables attached for removal later.

Figure 20-78 Early H1G Assembly



9. Remove the H1G assembly from the chassis, being careful to not pinch the gray coax cables on the left side of the instrument.
10. Remove the blue cable, 8121-2866, from the H1G assembly filter using a 5/16-inch wrench. Discard this cable
11. Remove the other blue cable, 8121-2867, from the H1G assembly. Save this cable for reuse.

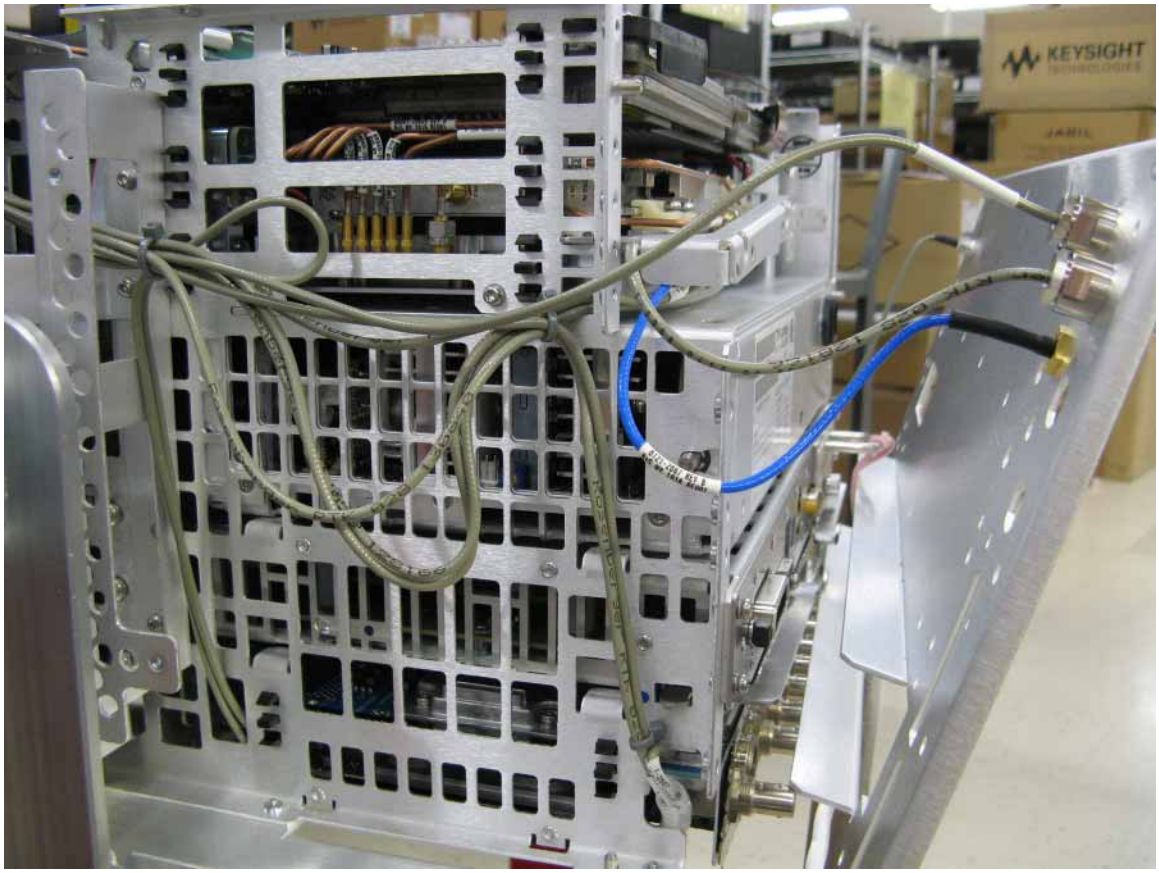
Replacement

1. Locate the cable marker color bands in the kit. Change the color code bands on the coax cables disconnected earlier.

   On the cable currently marked with the '9" color code band, remove the '9" band and install "1" and a "3" color bands to label this cable 13.

   When installing the color bands, first spread the color band to relax the plastic, then quickly push the color band onto the cable.
2. On the cable currently marked with the "3" color band, remove the "3' and install "1" and "5" color bands to label this cable 15.
3. On the cable currently marked with the "1" color band, install "6" color band to make this a "16" cable. There is an extra '1" color band in the kit if you need to replace the existing color band.
4. On the rear panel BNC cable Trigger 3 IN, attach two "1" color bands next to the mmcx connector to label this cable "11".
5. Locate the replacement H1G assembly in the kit, remove it from the shipping container and carefully insert it into the instrument. Leave the board extractor handles open which makes cable reattachment easier.
6. Locate the blue 8121-2867 cable removed earlier and attach the sma end to J12 of the H1G assembly. Use 5/16-inch wrench and torque to 10 inch-pounds. The cable will route under the left board extractor arm. The other end will be attached to the IF 2 OUT hole in the rear panel later.
7. Connect the "11" cable, from the rear panel to J11 on the H1G assembly. This cable routes over the left board extractor arm.
8. Refer to Figure 20-79. Connect the 13, 15 and 16 color cables to the H1G assembly J13, J15 and J16. Assure the cables snap in securely. You may need to remove the instrument right side RF cover and cut the cable ties if you need to adjust the cable length, so the cables connect easily and the cable are routed so any excess length is at the instrument side panel and not at the rear panel. Replace the cable ties after cable re-routing.

Figure 20-79 Cable Routing



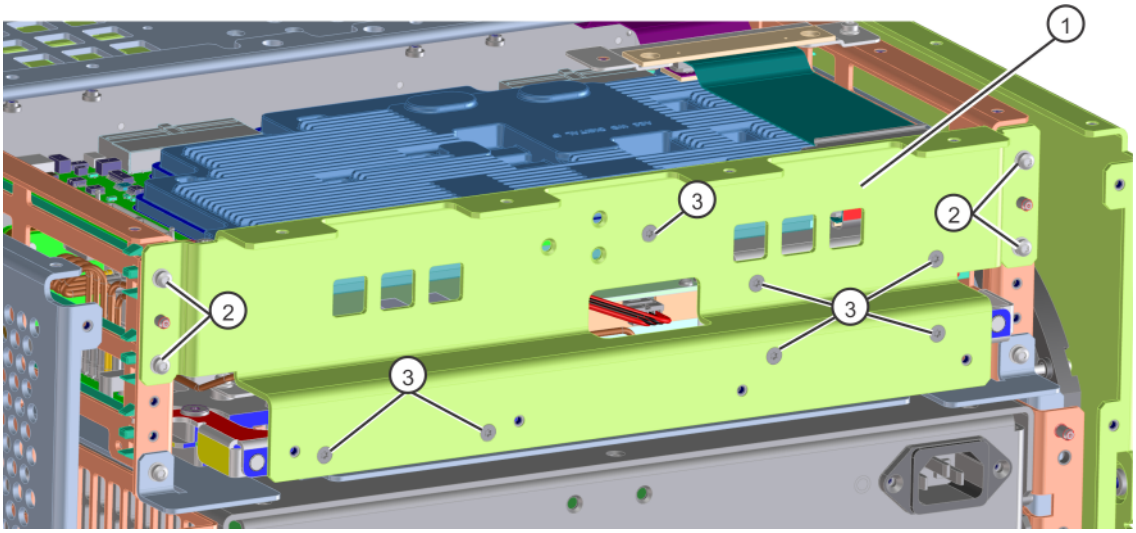
9. Locate the blue cable connected to J12 on the H1G assembly and install the sma end through the rear panel hole marked IF 2 OUT. Secure with the nut and washer removed earlier. Torque to 10 inch-pounds using a 5/16-inch wrench.
10. Re install the rear brace and rear panel using the screws removed earlier.
11. Locate the black plastic hole plug in the kit and install in the IF 2 IN hole on the rear panel.
12. Re install the top brace and instrument enclosure.

Replacement process when the H1G assembly is the later version

Removal

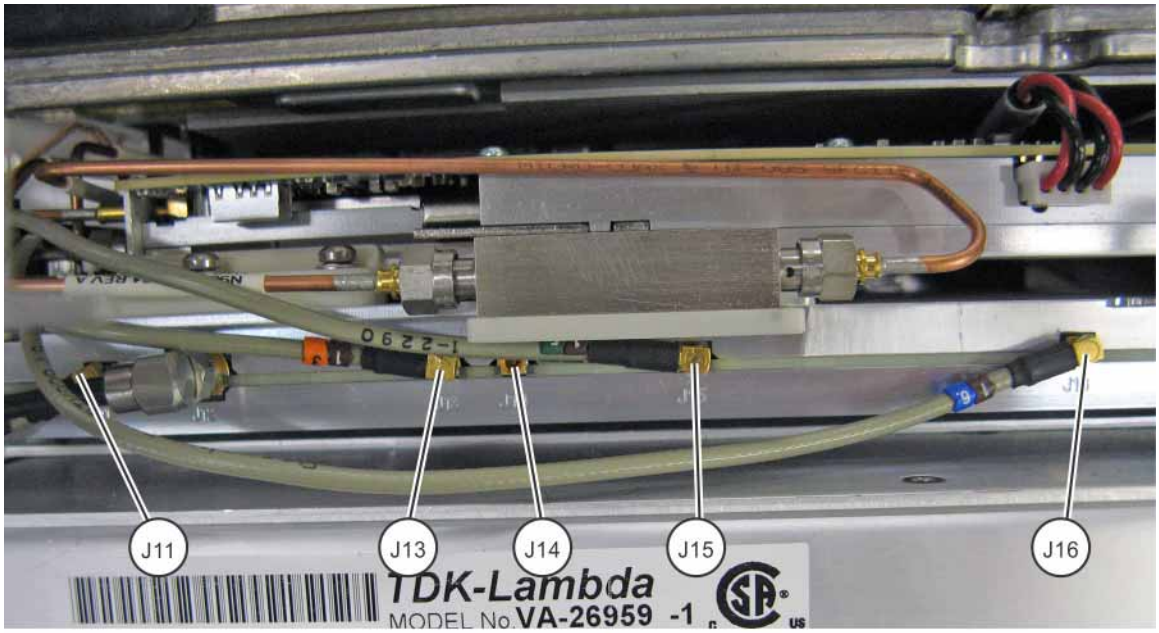
1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the top brace. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure. Save the screws for reuse.
3. Remove the screws from the rear panel and carefully pull away from the instrument. Avoid damaging the cables attached.
4. Refer to Figure 20-80. Remove the rear brace **(1)** by removing the four screws **(2)** (0515-0372) and the seven screws **(3)** (0515-1946). Save the screws for reuse.

Figure 20-80 Rear Brace Removal



5. Locate the H1G assembly and use the board extractor handles to loosen the board slightly and allow access to the coax cables attached to the board.
6. Remove the snap-in cables from the board assembly. Remove the blue cable from the H1G assembly J12 using a 5/16-inch wrench. See Figure 20-81.

Figure 20-81 H1G Cable Connections



H1G_cables

7. Remove the H1G assembly from the chassis, being careful to not pinch the gray coax cables on the left side of the instrument.

Replacement

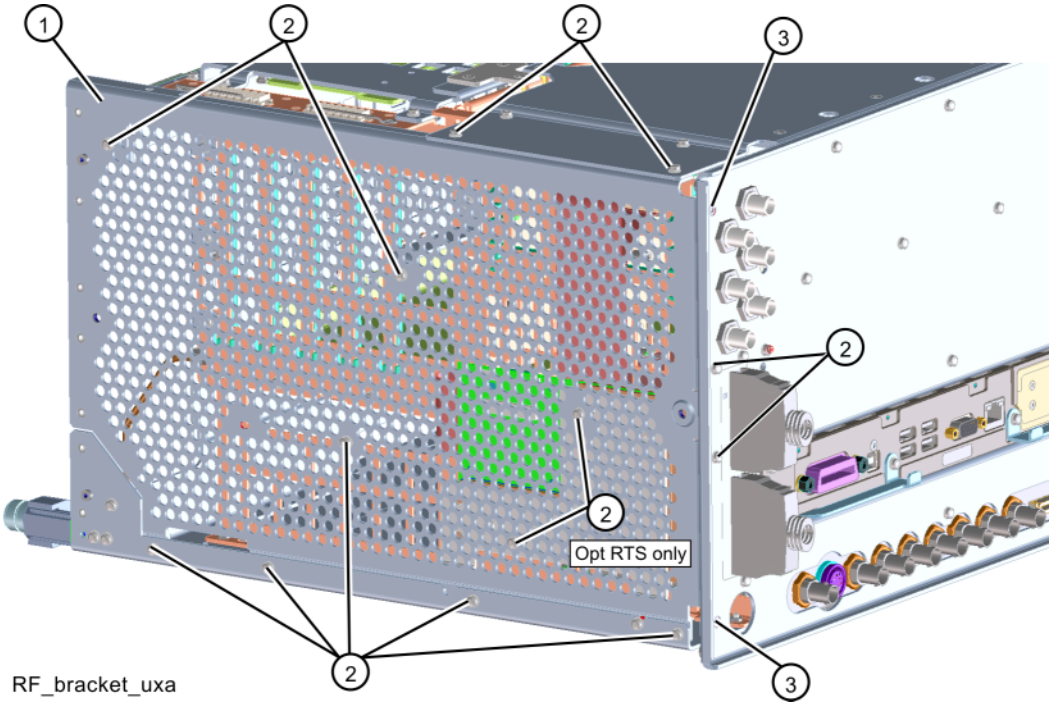
1. Locate the replacement H1G assembly in the kit, remove it from the shipping container and carefully insert it into the instrument. Leave the board extractor handles open which makes cable reattachment easier.
2. Locate the blue cable connected to the rear panel and route under the left board extractor arm. Use a 5/16-inch wrench and torque to 10 inch-pounds.
3. Connect the "11" cable, from the rear panel Trigger 3 IN to J11 on the H1G assembly. This cable routes over the left board extractor arm.
4. Connect the 13, 15 and 16 color cables to the H1G assembly J13, J15 and J16. Assure the cables snap in securely.
5. Re install the rear brace and rear panel using the screws removed earlier.
6. Re install the top brace and instrument enclosure.

A28 Wideband Extension Board (Option RTS)

Removal

1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the top brace. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure.
3. **For Serial Number Prefix < 5605:**
   - Refer to Figure 20-82. Remove the RF bracket **(1)** by removing the thirteen screws **(2)** (0515-0372), and the two screws **(3)** (0515-1946), using the T-10 driver.

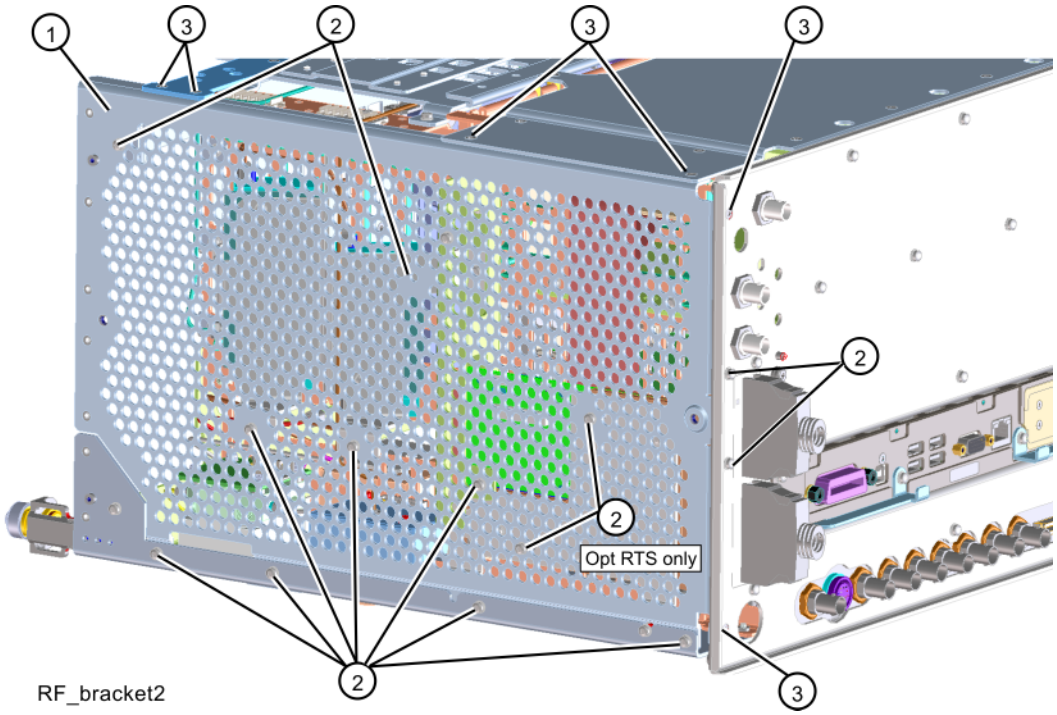
Figure 20-82 RF Bracket Removal, Serial Number Prefix < 5605



4. **Serial Number Prefix ≥ 5605:**

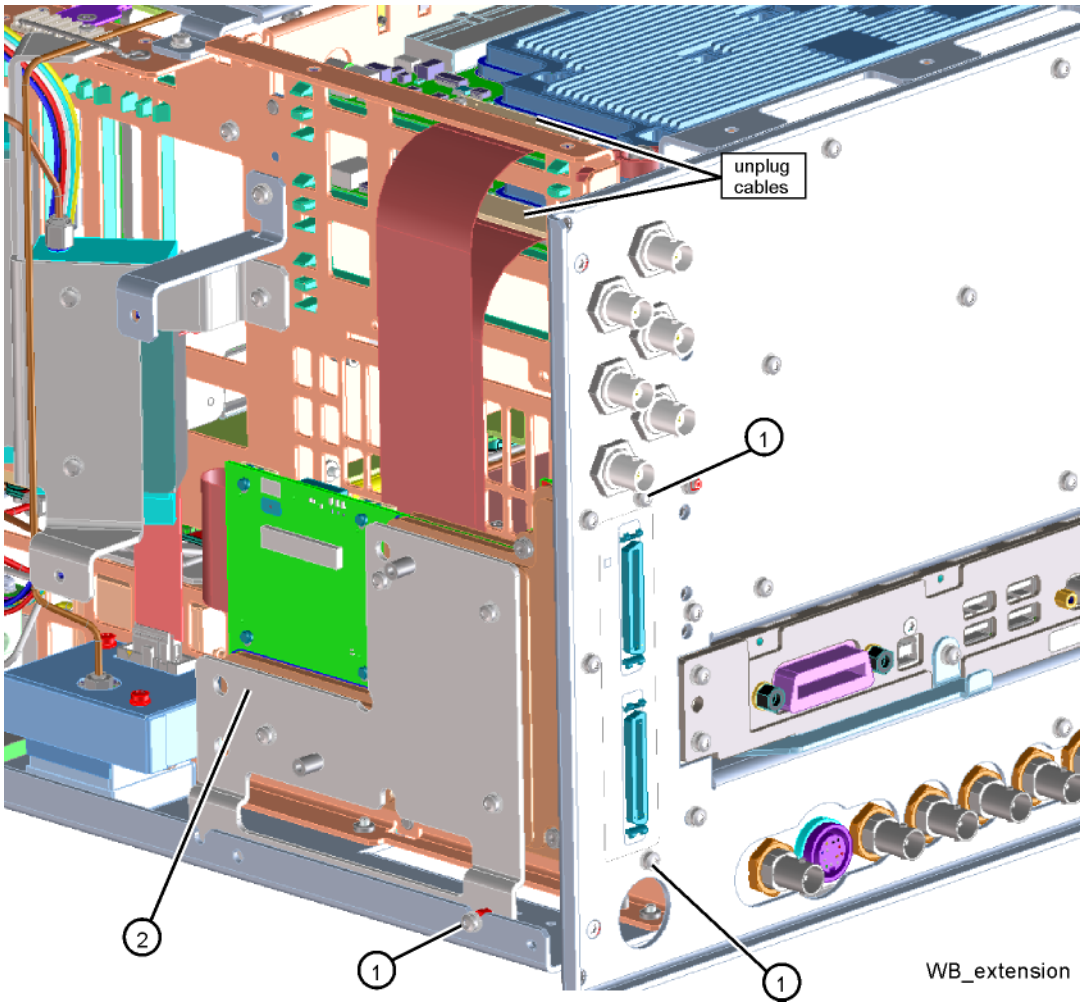
   – Refer to Figure 20-83. Remove the RF bracket **(1)** by removing the thirteen screws **(2)** (0515-0372), and the six screws **(3)** (0515-1946), using the T-10 driver.

Figure 20-83 RF Bracket Removal, Serial Number ≥ Prefix 5605



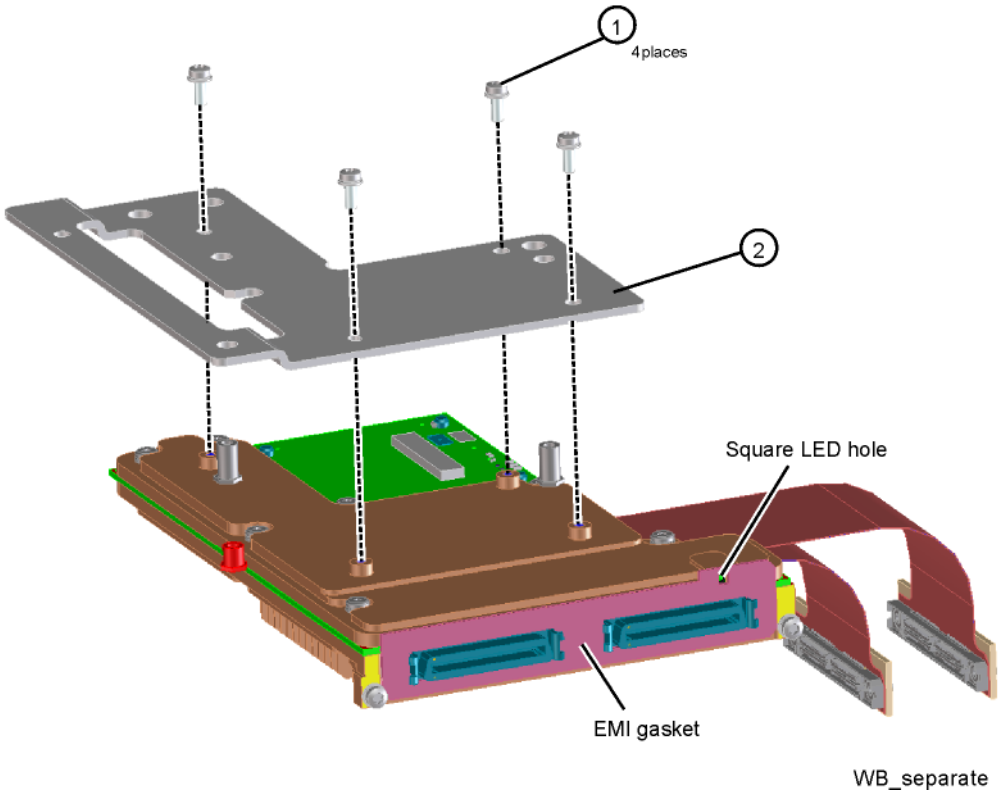
5. Refer to Figure 20-84. Option B2X instruments will only have the top Wideband Digital I.F. board. Option B5X instruments will have both boards. Unplug the flex circuit cables from each Wideband Digital I.F. board at the location shown. Remove the three screws **(1)** attaching the Wideband Extension board **(2)** to the chassis. The A28 Wideband Extension board can now be removed from the chassis.

Figure 20-84 Wideband Extension Board Removal



6. Refer to Figure 20-85. To separate the bracket **(2)** from the Wideband Extension board, remove the four screws **(1)** (0515-0372).

Figure 20-85 Wideband Extension Board and Bracket Separation



7. Attach the bracket to the new Wideband Extension board with the four screws. Torque to 9 inch-pounds.
8. Remove the flex circuit cable(s) from the old board and attach to the new Wideband Extension board, taking care to connect them to the same connectors as the old board. Refer to Figure 20-88. Option B2X instruments will have one flex cable. Option B5X instruments will have two flex cables.
9. When replacing the EMI gasket, notice the gasket has a small square hole and needs to be aligned with the square hole on the Wideband Extension Board casting. There is an LED in the casting, and the small square hole allows the LED to be visible from the rear panel.

   The gasket is fragile. Carefully peel off the backing from the gasket and apply the sticky side of the gasket over the two Wideband Extension board connectors.

Replacement

1. Refer to Figure 20-86 and Figure 20-87. The flex circuit cables will need to be routed as shown.

Figure 20-86 Flex Circuit Routing - 1

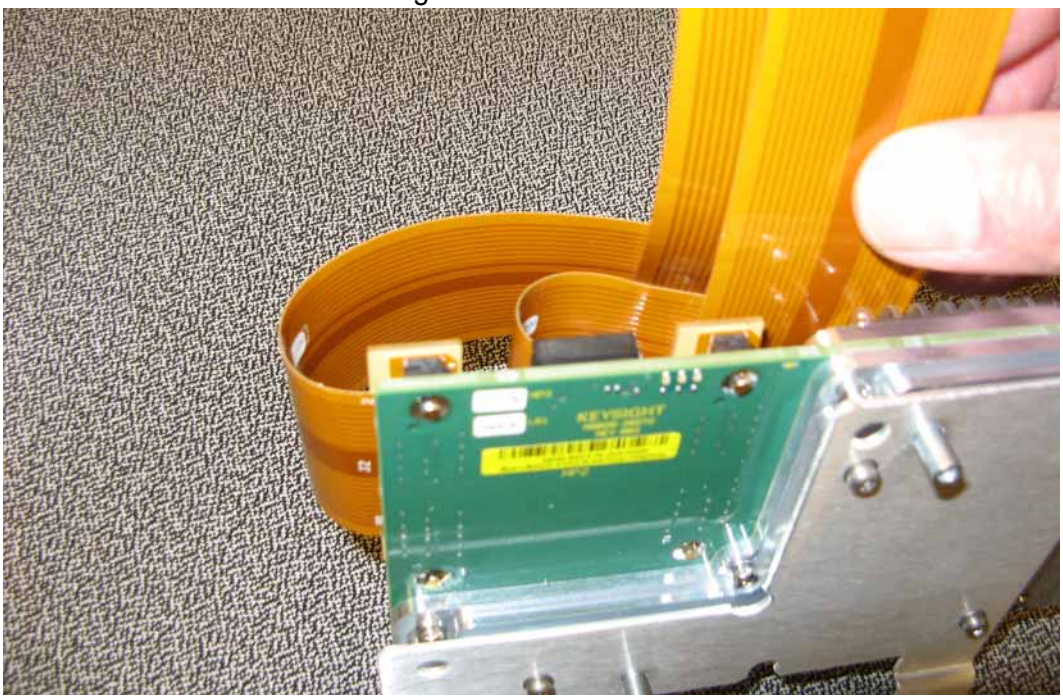
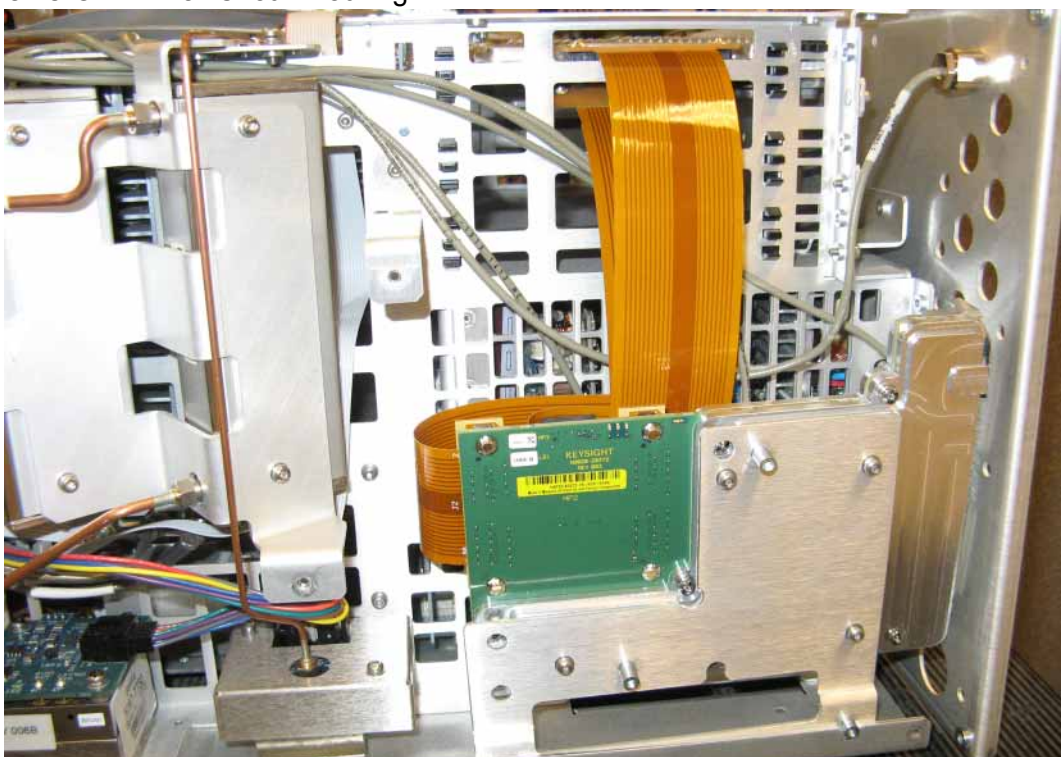


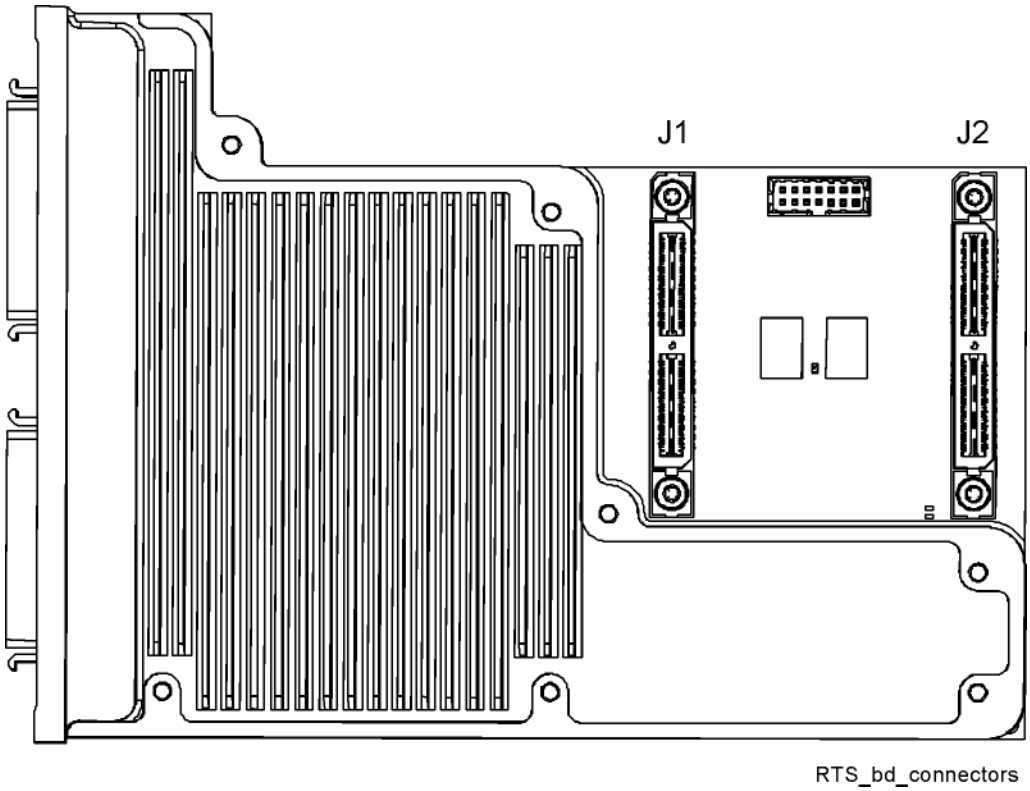
Figure 20-87 Flex Circuit Routing - 2



2. Refer to Figure 20-84. Place the W28 Wideband Extension board into the chassis in the position shown. Attach to the chassis with the three screws **(1)**. Torque to 9 inch-pounds.
3. Refer to Figure 20-88. Connect the flex circuit cables to the Wideband Digital boards in the card cage. If the UXA has only the top WB DIF board, connect the flex circuit cable from the Wideband Extension J1 to the connector on the WB Digital IF assembly.

   If the UXA has two WB Digital IF boards, connect the flex circuit attached to the Wideband Extension J2 (J2 is connector is on the edge of the Wideband Extension) to the bottom WB Digital IF board in the card cage. Connect the other flex circuit from the WB Digital IF Extension J1 to the top WB Digital IF board in the card cage.

Figure 20-88 Wideband Extension Board Connectors



4. Replace the RF panel as described on pages page 534 and page 535.
5. Replace the top brace. Refer to the "Top Brace and Card Cage Brace" replacement procedure.
6. Replace the instrument outer case. Refer to the "Instrument Outer Case" replace procedure.

A6 Power Supply

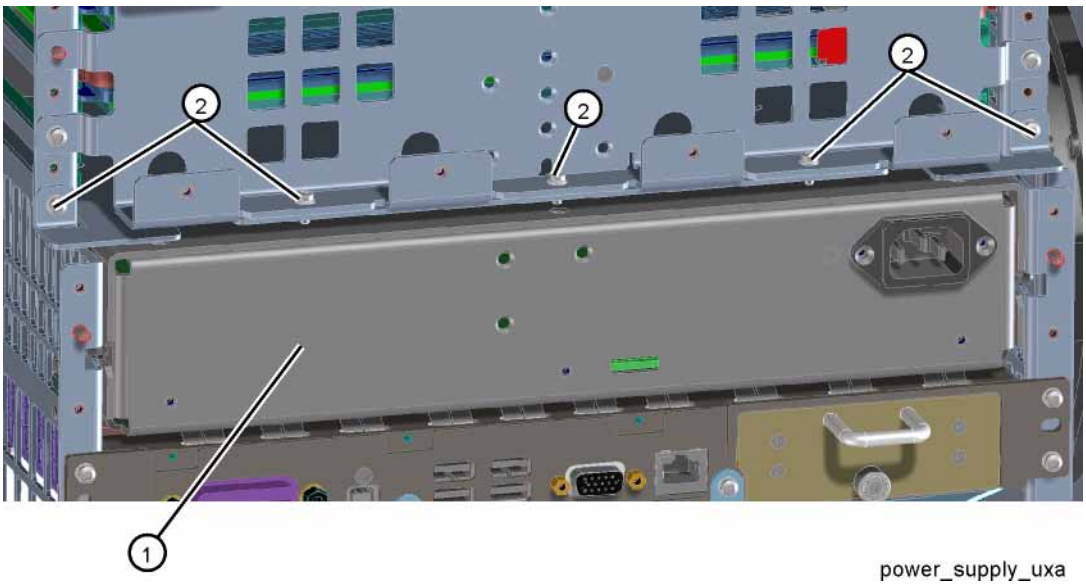
Removal

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. Perform step 3 in the "Top Brace and Card Cage Brace" removal procedure.

Serial Number Prefix < 5605 Options 508, 513, 526

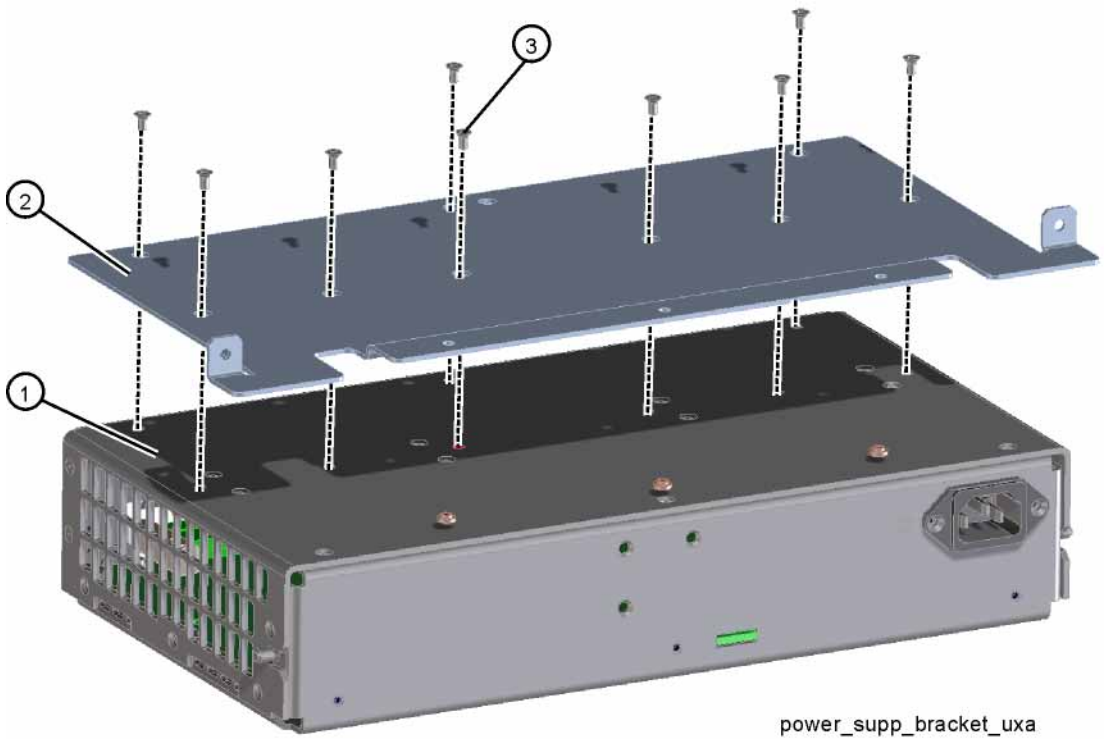
1. Refer to Figure 20-89. Remove the five screws **(2)** (0515-0372) that attach the A6 power supply **(1)** to the chassis. The power supply can now be removed by sliding it out of the rear of the chassis.

Figure 20-89 Power Supply Removal
Serial Number Prefix < 5605 Options 508, 513, 526



2. If replacing the power supply, the supply bracket will need to be removed from the old power supply and installed on the new one. Refer to Figure 20-90. Remove the nine screws **(3)** (0515-1946) that attach the power supply bracket **(2)** to the A6 power supply **(1)**. When reinstalling the bracket torque the screws to 9 inch-pounds.

Figure 20-90 Power Supply Bracket Separation
Serial Number Prefix < 5605 Options 508, 513, 526



Serial Number Prefix ≥ 5605 and All Options 544 and 550

1. If the instrument has Option B2X or B5X, the A22 and A23 Wideband Digital I.F. boards must be removed. Refer to the "A22 & A23 Wideband Digital I.F. Boards" removal procedure.
2. Refer to Figure 20-91. Remove the nine screws **(2)** (0515-1946) that attach the A6 power supply **(1)** to the bracket. The power supply can now be removed by sliding it out of the rear of the chassis.

Figure 20-91 Power Supply Removal
Serial Number Prefix ≥ 5605 and All Options 544 and 550

Replacement

Serial Number Prefix < 5605 Options 508, 513, 526

1. Reinstall the power supply into position in the chassis and slide forward to mate with the rear motherboard.
2. Refer to Figure 20-89. Replace the five screws **(2)** (0515-0372) that attach the power supply **(1)** to the chassis. Torque to 9 inch-pounds.
3. Replace the top brace as described in the "Top Brace and Card Cage Brace" replacement procedure.
4. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

Serial Number Prefix ≥ 5605 and All Options 544 and 550

1. Reinstall the power supply into position in the chassis and slide forward to mate with the rear motherboard.
2. Refer to Figure 20-91. Replace the nine screws **(2)** (0515-1946) that attach the A6 power supply **(1)** to the bracket. Torque to 9 inch-pounds.
3. If the instrument has Option B2X or B5X, the A22 and A23 Wideband Digital I.F. boards must be replaced. Refer to the "A22 & A23 Wideband Digital I.F. Boards" replacement procedure.
4. Replace the top brace as described in the "Top Brace and Card Cage Brace" replacement procedure.
5. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

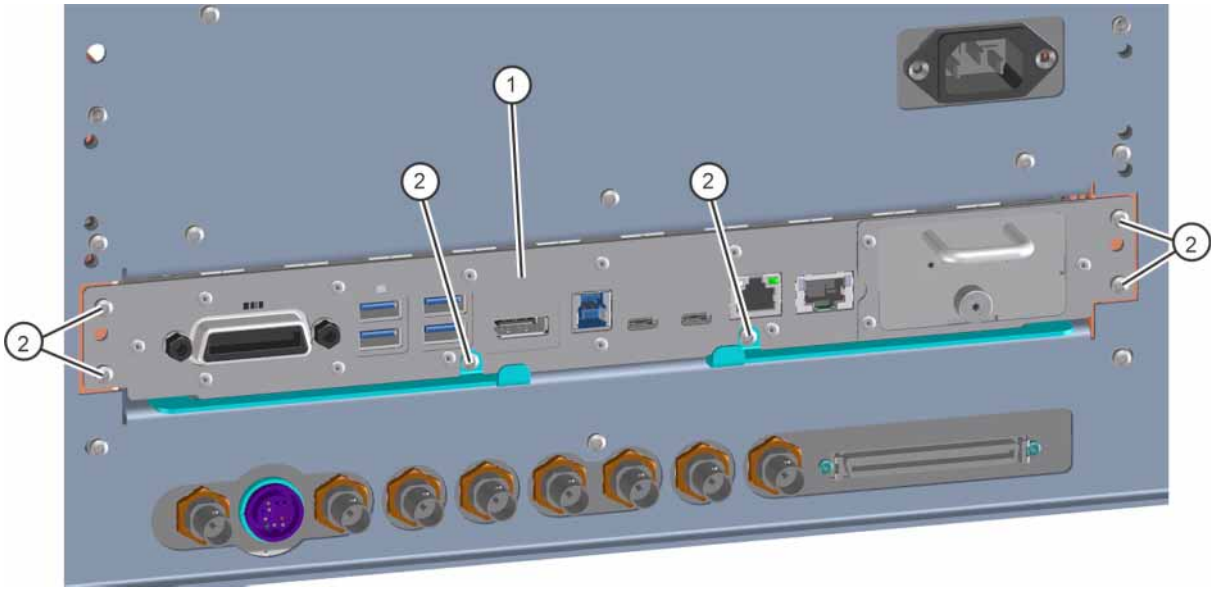
A4 CPU/A5 Solid State Drive

NOTE To remove the SSD or the memory card, it is not necessary to remove the CPU assembly from the chassis. See the "Replacement of A5 SSD or A4A1CPU Memory Card" procedure on page 545.

Removal

1. Refer to Figure 20-92. Remove the six screws **(2)** (0515-0372) that secure the A4 CPU assembly **(1)** to the chassis. Use the ejectors to disconnect the CPU from the rear motherboard and remove it from the chassis.

Figure 20-92 CPU Removal



Replacement

1. Refer to Figure 20-92. Slide the CPU assembly into the slot and use the ejectors to mate the CPU with the rear motherboard. Replace the six screws **(2)** (0515-0372). Torque to 9 inch-pounds.

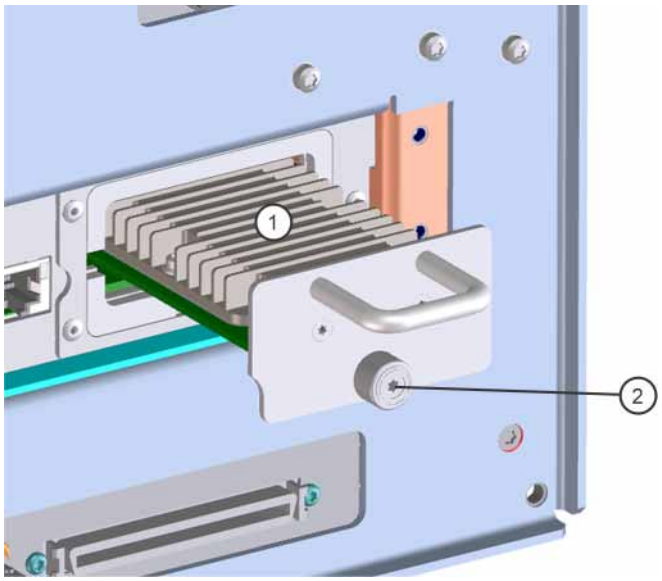
Replacement of A5 SSD or A4A1CPU Memory Card

Disk Drive

Removal

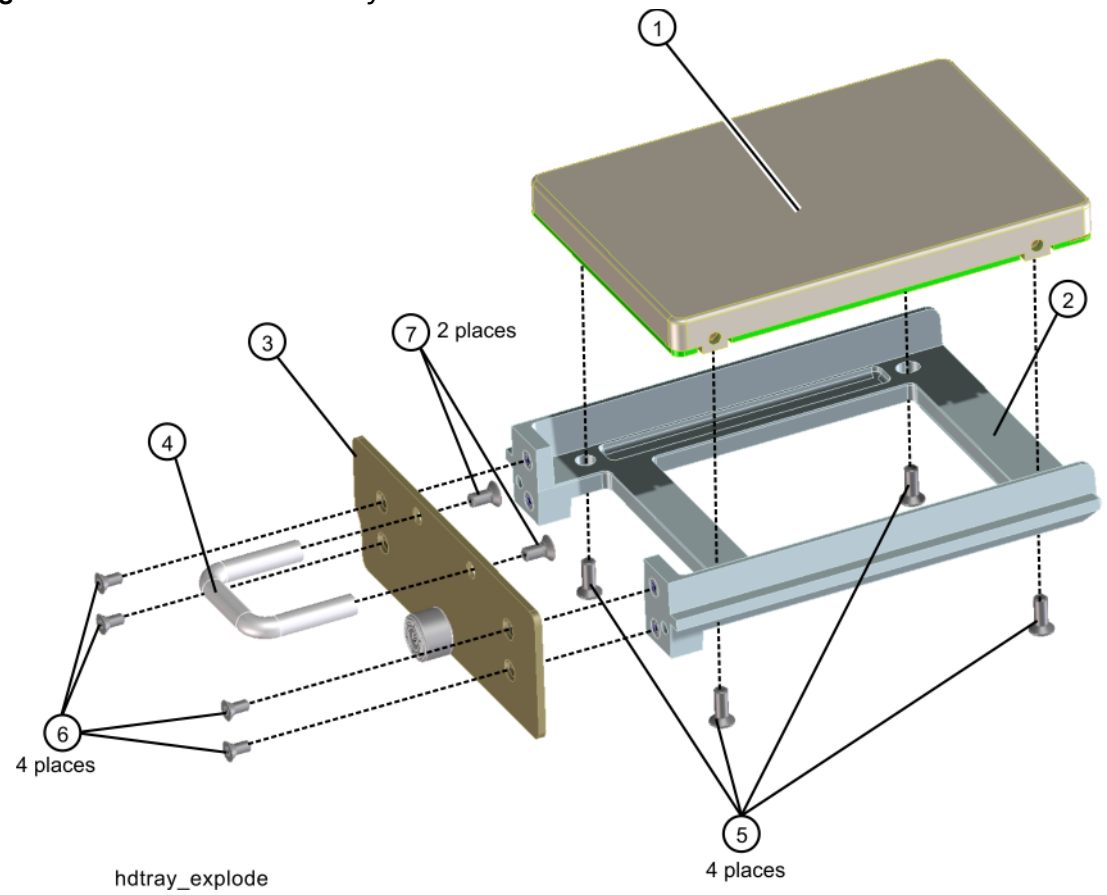
1. Refer to Figure 20-93. Loosen the thumb screw **(2)** and pull the SSD **(1)** out of the CPU assembly.

Figure 20-93 SSD Removal



2. Refer to Figure 20-94. Remove the four screws **(5)** (0515-1035) from the disk drive tray that secure the SSD **(1)**.

Figure 20-94 Disk Drive Tray Screws



Replacement

1. Refer to Figure 20-94. Place the new SSD into the tray assembly and attach with the four screws **(5)** (0515-1035). Torque to 9 inch-pounds.

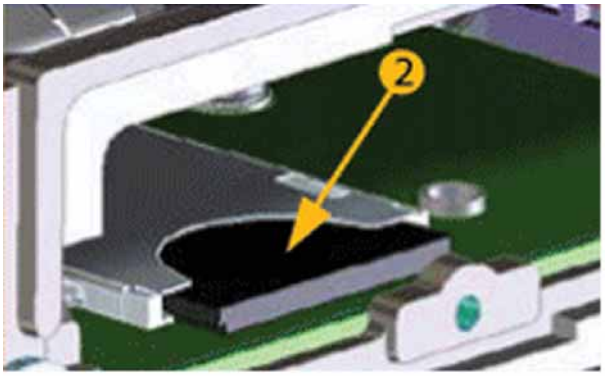
NOTE Make sure not to use the 0515-0372 screw because for the PC6 processor it will cause the SSD to interfere with the CPU memory card.

2. Refer to Figure 20-93. Slide the SSD into the CPU assembly and push to mate the connector. Secure the thumb screw to 9 inch-pounds.

A4A1 CPU Memory Card

1. Refer to Figure 20-95. Remove the SSD as described on page 545. The memory card **(2)** can be removed by pushing on the memory card and it will spring out. To install the memory card push it into the slot until you feel the spring catch. Then replace the SSD as described on page 546.

Figure 20-95 CPU Memory Card Removal



memorycard

A2 AIF/A3 DIF

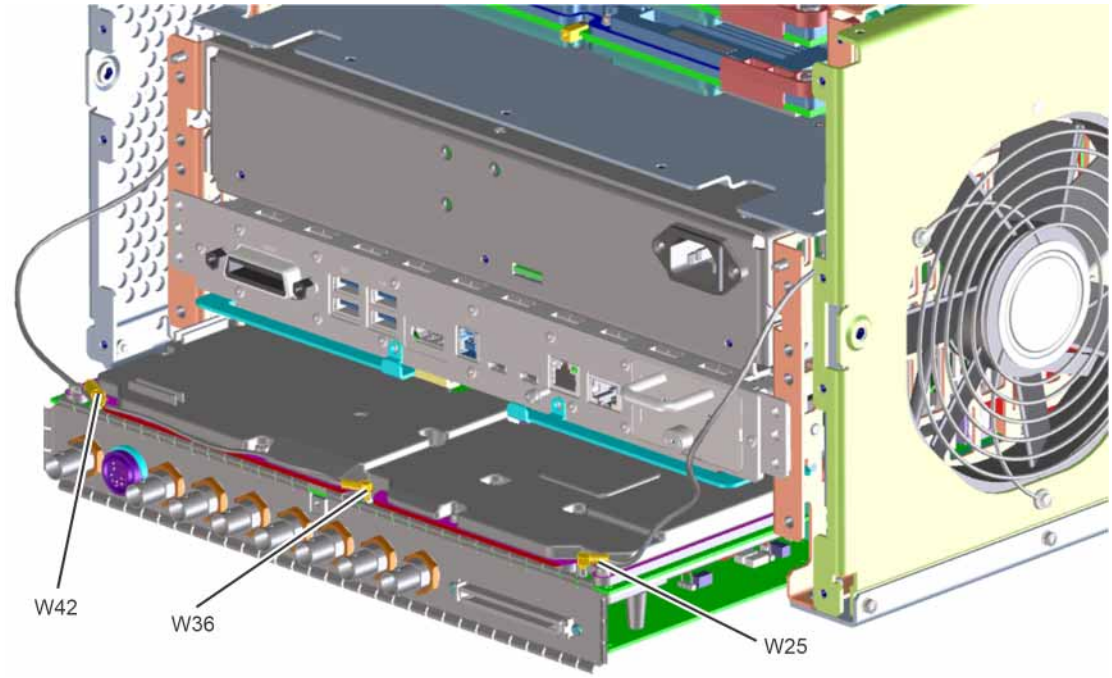
Removal

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 20-96. Remove cables W39, W40, W42, and W47 from the bottom of the DIF assembly.

Figure 20-96 DIF Cables

4. Refer to Figure 20-97. Pull the AIF/DIF assembly part way out of the chassis. Remove cables W25, W36, and W42 from the AIF assembly.

Figure 20-97 AIF Cables

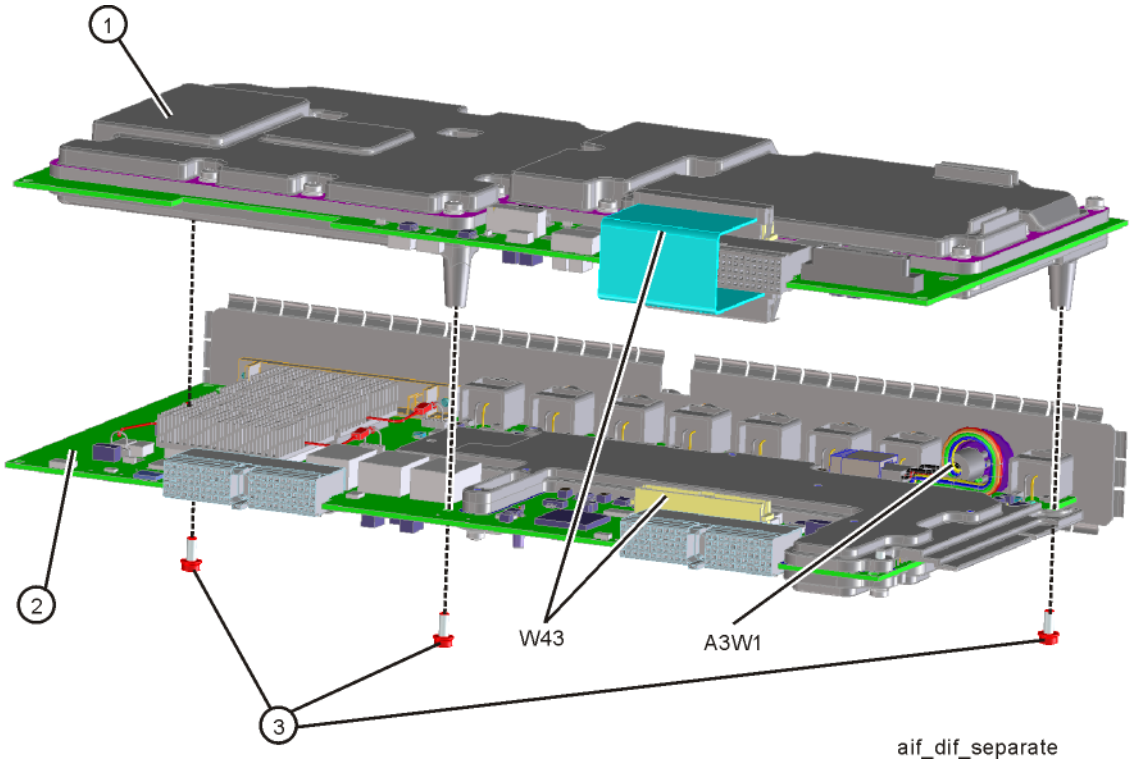


5. The AIF/DIF assembly can be removed from the chassis by pulling straight out the back.

Separate AIF/DIF Assembly

1. Refer to Figure 20-98. To separate the AIF **(1)** from the DIF **(2)**, unplug ribbon cable W43 from the AIF assembly.
2. From underneath the assembly, remove the three screws **(3)** (0515-0372).

Figure 20-98 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 W43.

Replacement

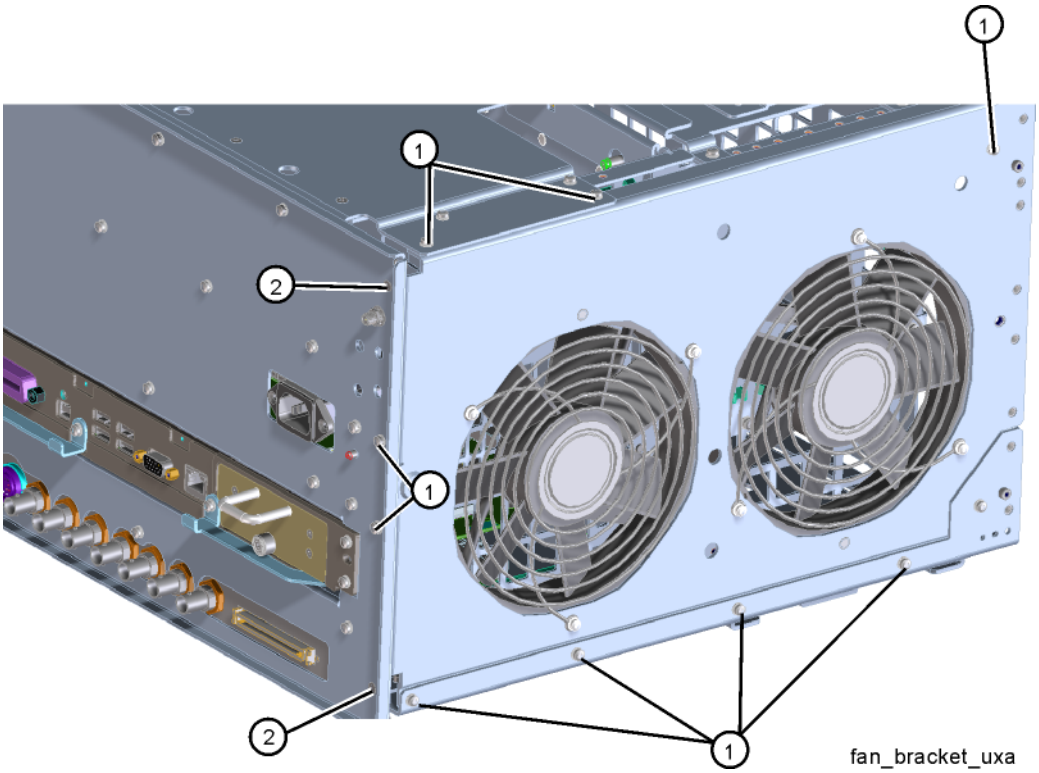
1. Slide the AIF/DIF assembly partially into the slot at the rear of the instrument.
2. Refer to Figure 20-97. Replace cables W25, W36, and W42 to the AIF assembly.
3. Push on the AIF/DIF assembly to mate the connectors to the motherboard assembly.
4. Refer to Figure 20-96. Replace cables W39, W40, W42, and W47 to the bottom of the DIF assembly.
5. Replace the rear panel. Refer to the “Rear Panel” replacement procedure.
6. Replace the instrument outer case. Refer to the “Instrument Outer Case” replace procedure.

Fan Assembly

Removal

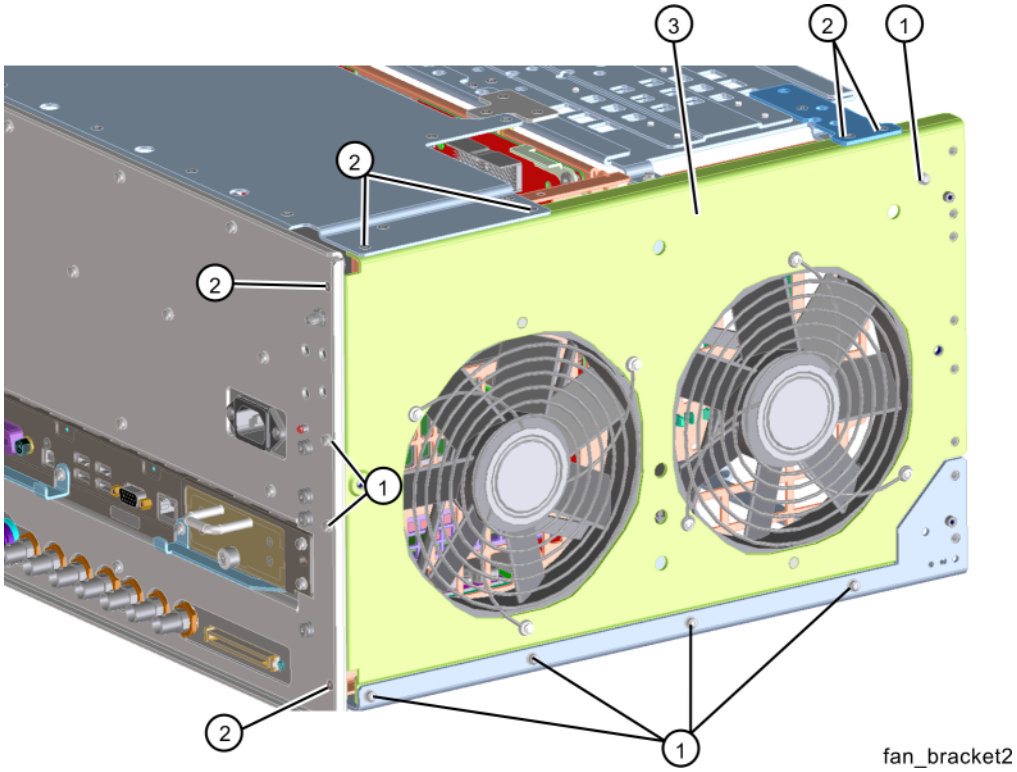
1. Remove the instrument outer case. Refer to the “Instrument Outer Case” removal procedure.
2. Remove the front frame. Refer to the “Front Frame Assembly” removal procedure.
3. **For Serial Number Prefix < 5605 Options 508, 513, 526**:
   - Refer to Figure 20-99. Remove the nine screws **(1)** (0515-0372) and the two screws **(2)** (0515-1946) that attach the fan bracket to the chassis.

Figure 20-99 Fan Bracket Removal
Serial Number Prefix < 5605 Options 508, 513, 526



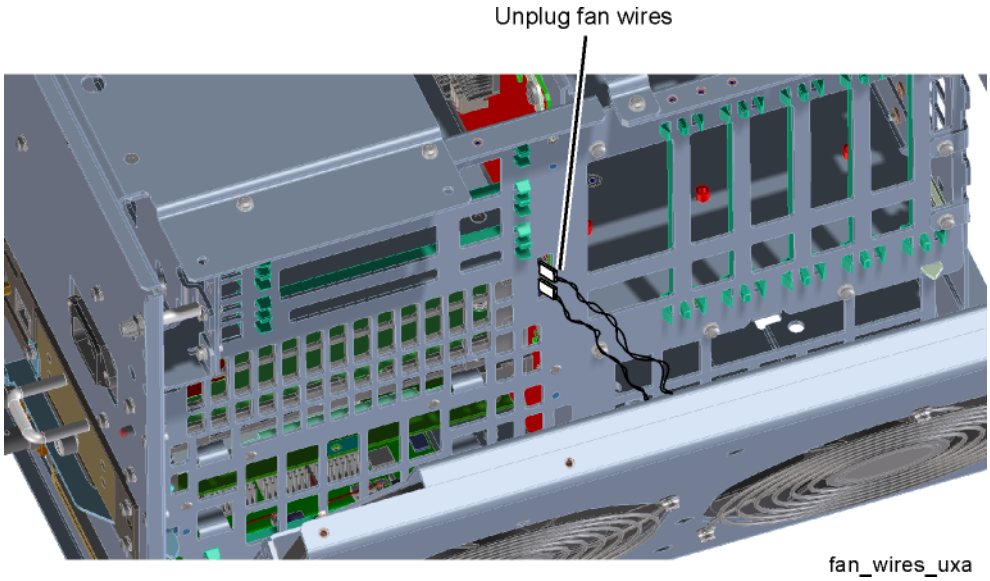
4. **For Serial Number Prefix ≥ 5605 and All Options 544 and 550**:
   - Refer to Figure 20-100. Remove the seven screws **(1)** (0515-0372) and the six screws **(2)** (0515-1946) that attach the fan bracket **(3)** to the chassis.

Figure 20-100 Fan Bracket Removal
Serial Number Prefix ≥ 5605 and All Options 544 and 550



5. Refer to Figure 20-101. Fold the fan bracket down and unplug both fan wires from the rear motherboard.

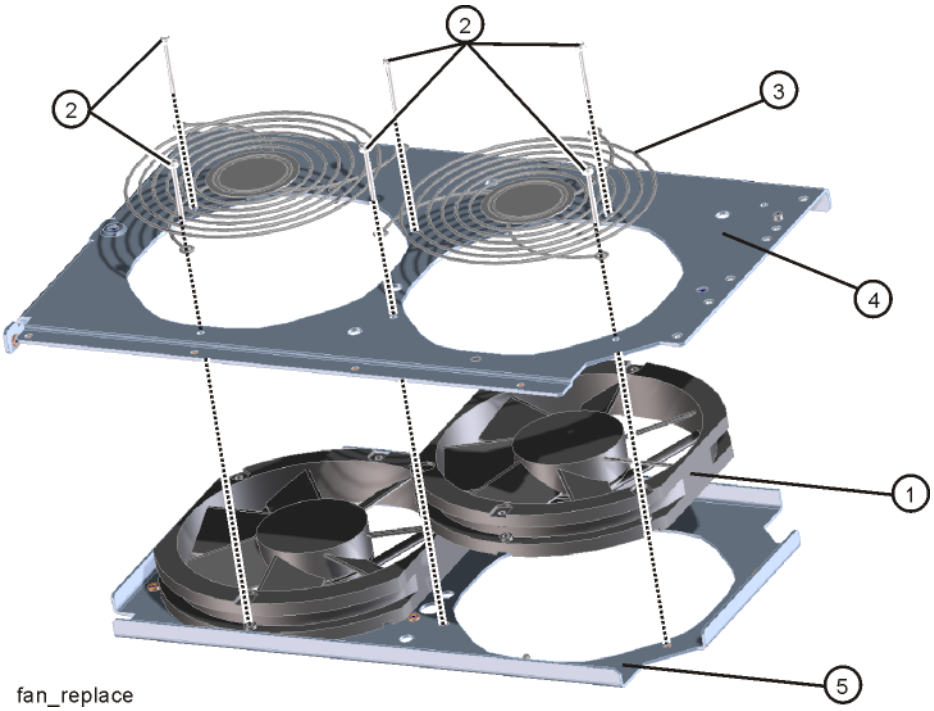
Figure 20-101 Unplug Fan Wires



Fan Replacement

1. Refer to Figure 20-102. To replace a fan **(1)**, remove the six screws **(2)** (0515-1038). Lift off the fan grills **(3)** and the side bracket **(4)**. Remove the screw (0515-0372) from the clip retaining the fan wires. The fan can now be lifted out and replaced.

Figure 20-102 Fan Replacement



2. When replacing a fan, place it on the inner side bracket **(5)** using the guide pins. Note the orientation of the fan air flow, the air flow marks on the fan point toward the bracket. Feed the fan wires through the grommet. Reattach the wire retaining clip with the screw (0515-0372).
3. Place the side bracket **(4)** into position and replace the six screws **(2)** (0515-1038). Torque to 9 inch-pounds.

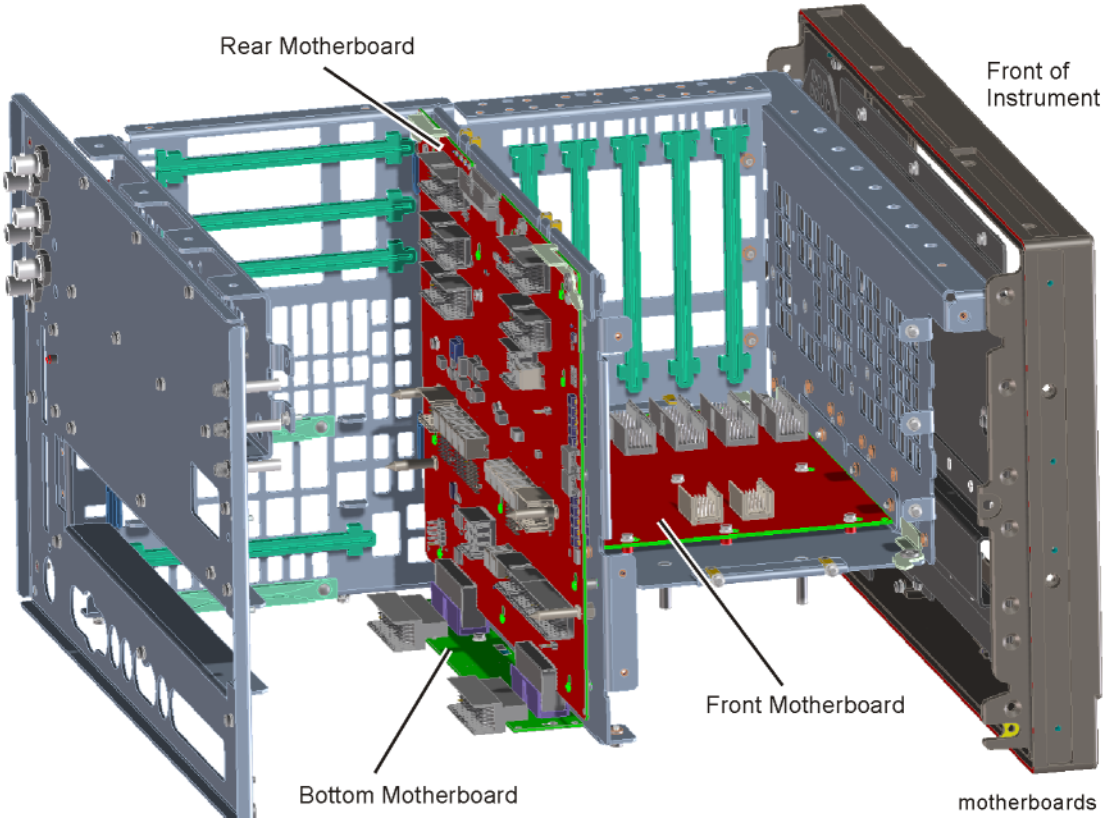
Replacement

1. Refer to Figure 20-101. Place the fan bracket next to the chassis and plug in the fan wires into the rear mother board.
2. **For Serial Number Prefix < 5605 Options 508, 513, 526**:
   - Refer to Figure 20-99. Place the fan bracket into position taking care to avoid pinching the fan wires between the fan bracket and the chassis. Replace the nine screws **(1)** (0515-0372) and the two screws **(2)** (0515-1946). Torque all screws to 9 inch-pounds.
3. **For Serial Number Prefix ≥ 5605 and All Options 544 and 550**:
   - Refer to Figure 20-100. Place the fan bracket into position taking care to avoid pinching the fan wires between the fan bracket and the chassis. Replace the seven screws **(1)** (0515-0372) and the six screws **(2)** (0515-1946) that attach the fan bracket **(3)** to the chassis. Torque all screws to 9 inch-pounds.
4. Replace the front frame. Refer to the "Front Frame Assembly" replacement procedure.
5. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

Motherboards

There are three motherboards in the UXA. The front motherboard (A8 Front Motherboard), rear motherboard (A7 Rear Motherboard), and bottom motherboard (A24 Motherboard Interconnect board). Figure 20-103 shows the locations of the motherboards with most of the other assemblies removed.

Figure 20-103 Motherboard Locations



Front Motherboard (A8 Front Motherboard)

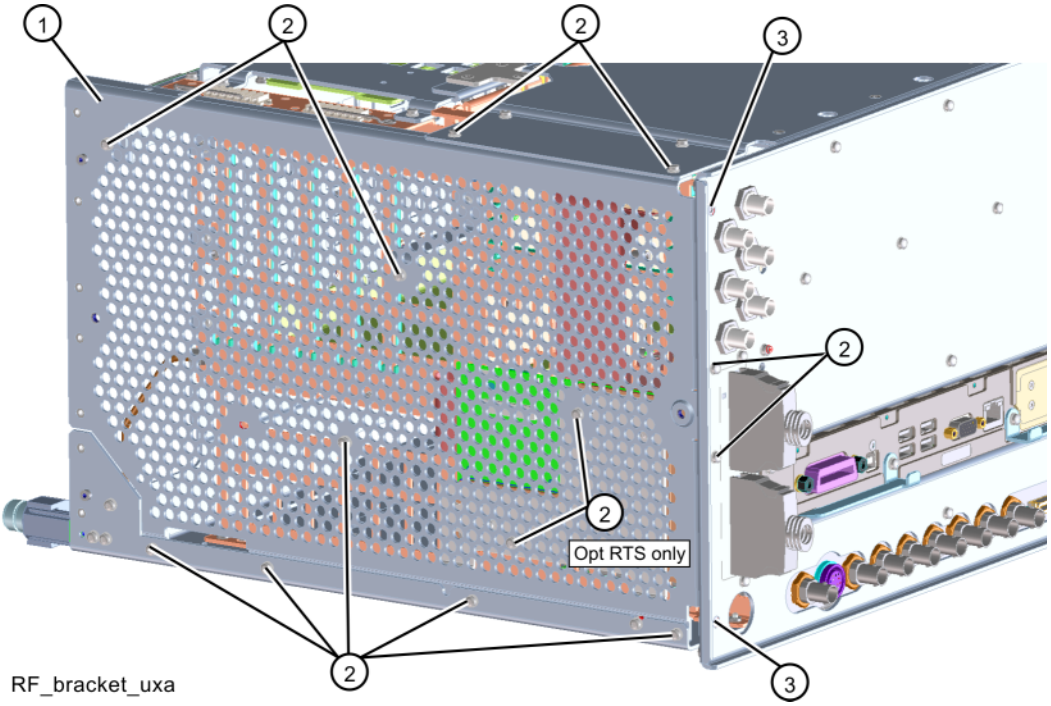
Removal

1. Remove the instrument outer case. Refer to the "Instrument Outer Case" removal procedure.
2. Remove the top brace and card cage brace. Refer to the "Top Brace and Card Cage Brace" removal procedure.
3. Remove the front frame. Refer to the "Front Frame Assembly" removal procedure.
4. Remove all of the card cage assemblies. Refer to the "Card Cage Boards" procedures.

5. **For Serial Number Prefix < 5605:**

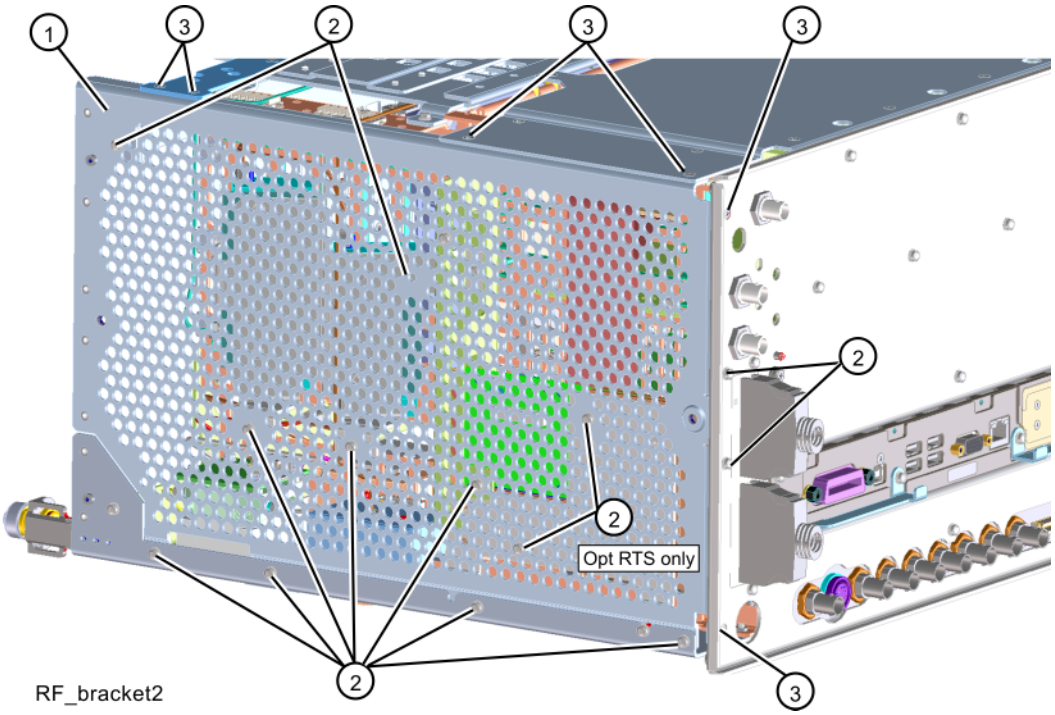
   – Refer to Figure 20-104. Remove the RF bracket **(1)** by removing the eleven (or thirteen with Option RTS) screws **(2)** (0515-0372), and the two screws **(3)** (0515-1946), using the T-10 driver.

Figure 20-104 RF Bracket Removal,
Serial Number Prefix < 5605



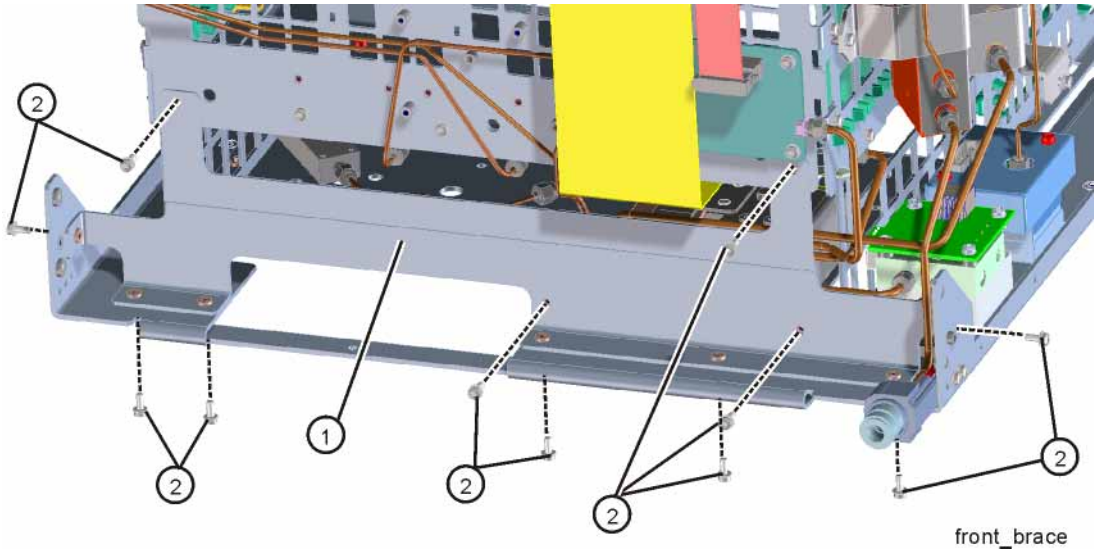
6. **Serial Number Prefix ≥ 5605:**
   - Refer to Figure 20-105. Remove the RF bracket **(1)** by removing the eleven (or thirteen with Option RTS) screws **(2)** (0515-0372), and the six screws **(3)** (0515-1946), using the T-10 driver.

Figure 20-105 RF Bracket Removal, Serial Number ≥ Prefix 5605



7. Remove the fan bracket. Refer to the "Fan Assembly" removal procedure.
8. Refer to Figure 20-106. Remove the front brace **(1)** by removing the eleven screws **(2)** (0515-0372).

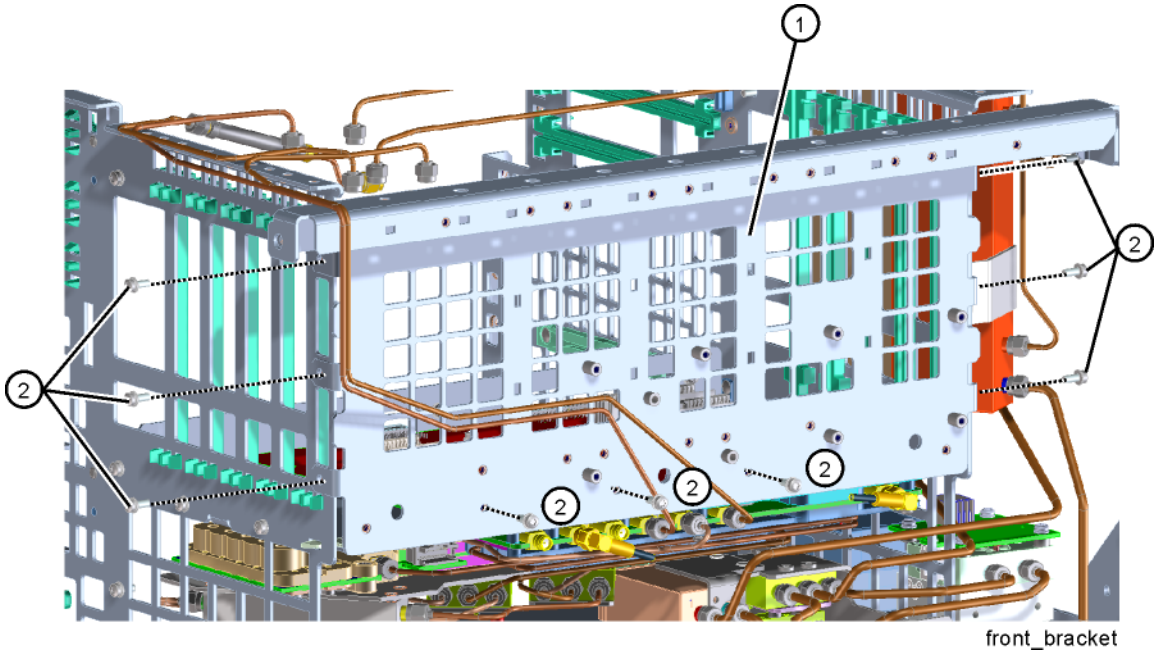
Figure 20-106 Front Brace Removal



9. Remove the Low Band switch assembly. Refer to the "A11 Low Band Switch" removal procedure.

10. Refer to Figure 20-107. Remove the front bracket **(1)** by removing the nine screws **(2)** (0515-0372).

Figure 20-107 Front Bracket Removal

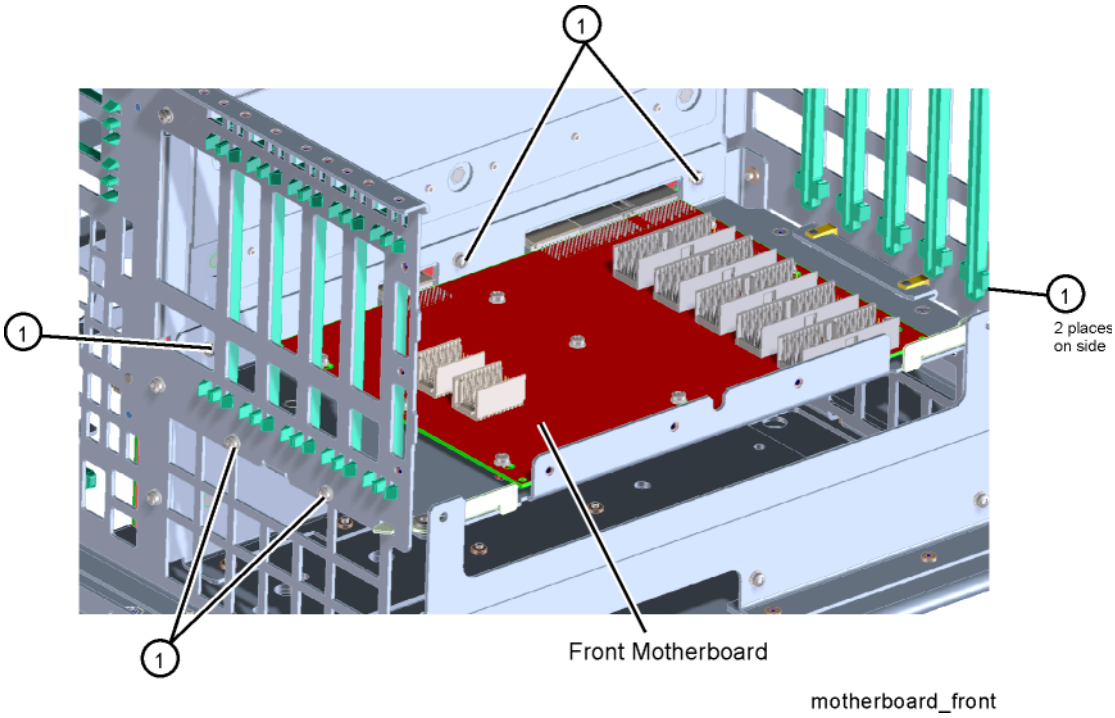


11. Remove the Low Noise Path and Microwave Preselector Bypass Switches. Refer to the "Low Noise Path and Microwave Preselector Bypass Switches" removal procedure.

12. Remove the Front End Assembly. Refer to the "A13 RF Front End Assembly" removal procedure.

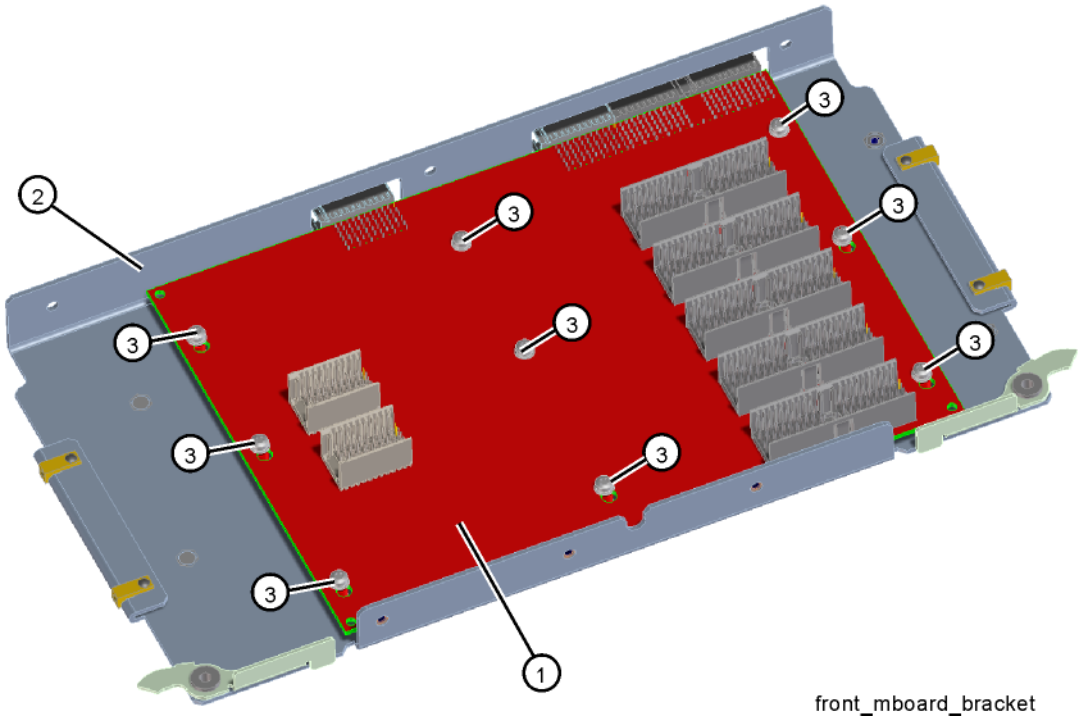
13. Refer to Figure 20-108. Remove the seven screws **(1)** (0515-0372) that attach the front motherboard bracket to the chassis. Use the ejectors to disconnect from the rear motherboard and pull out towards the front of the instrument to remove from the chassis.

Figure 20-108 Front Motherboard Removal



14. Refer to Figure 20-109. To separate the front motherboard **(1)** from the bracket **(2)**, remove the nine screws **(3)** (0515-0372). When replacing the screws, torque to 9 inch-pounds.

Figure 20-109 Front Motherboard and Bracket Separation



Replacement

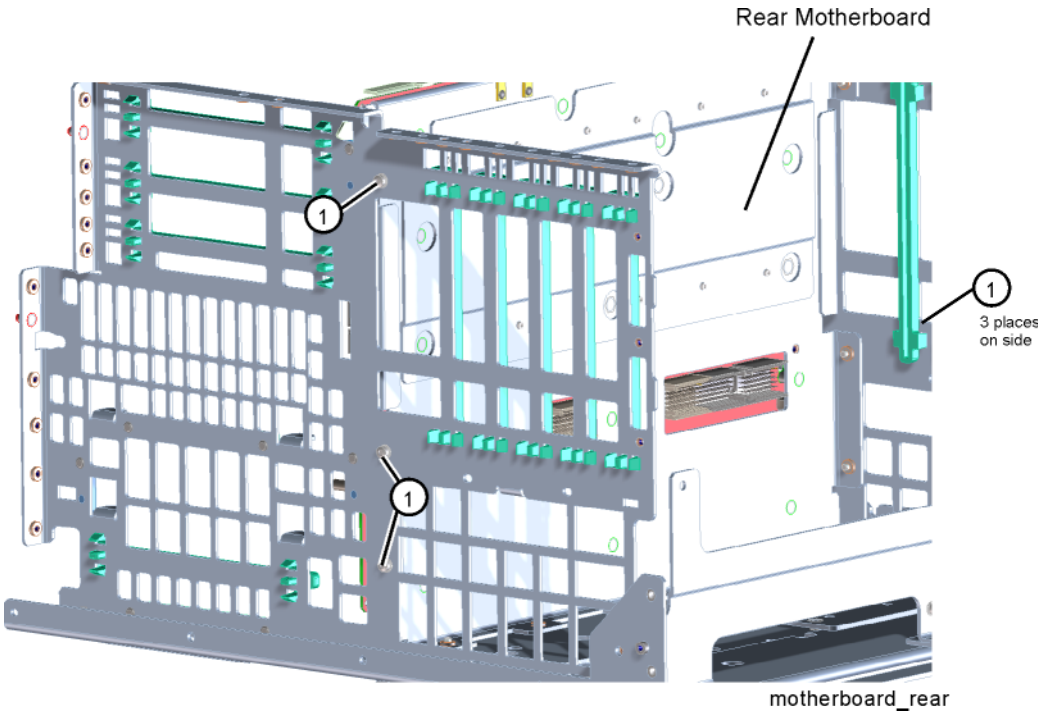
1. Refer to Figure 20-108. Slide the front motherboard into the slot and use the ejectors to mate with the rear motherboard connectors. Replace the seven screws **(1)** (0515-0372) that attach the front motherboard bracket to the chassis. Torque to 9 inch-pounds.
2. Refer to Figure 20-107. Place the front bracket **(1)** into position in the chassis and replace the nine screws **(2)** (0515-0372). Torque to 9 inch-pounds.
3. Replace the Low Band switch assembly. Refer to the "A11 Low Band Switch" replacement procedure.
4. Replace the Front End Assembly. Refer to the "A13 RF Front End Assembly" replacement procedure.
5. Replace the Low Noise Path and Microwave Preselector Bypass Switches. Refer to the "Low Noise Path and Microwave Preselector Bypass Switches" replacement procedure.
6. Refer to Figure 20-106. Place the front brace **(1)** into position in the chassis and replace the eleven screws **(2)** (0515-0372). Torque to 9 inch-pounds.
7. Replace the RF bracket. Refer to the RF Bracket removal steps on page 557 or page 558. Torque screws to 9 inch-pounds.
8. Replace the fan bracket. Refer to the "Fan Assembly" replacement procedure.
9. Replace all of the card cage assemblies. Refer to the "Card Cage Boards" procedures.
10. Replace the front frame. Refer to the "Front Frame Assembly" replacement procedure.
11. Replace the top brace and card cage brace. Refer to the "Top Brace and Card Cage Brace" replacement procedure.
12. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

Rear Motherboard (A7 Rear Motherboard)

Removal

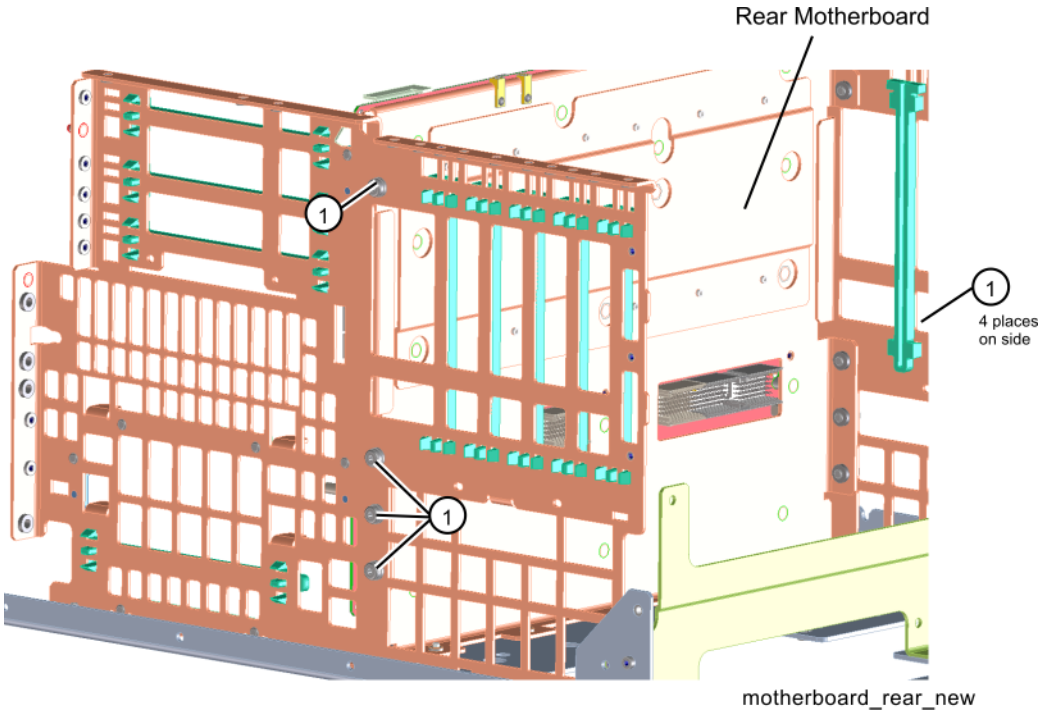
1. Remove the front motherboard. Refer to the "Front Motherboard (A8 Front Motherboard)" removal procedure.
2. Remove the wideband digital I.F. assemblies if present. Refer to the "A22 & A23 Wideband Digital I.F. Boards" removal procedure.
3. Remove the CPU assembly. Refer to the "A4 CPU/A5 Solid State Drive" removal procedure.
4. Remove the power supply. Refer to the "A6 Power Supply" removal procedure.
5. Remove AIF/DIF assembly. Refer to the "A2 AIF/A3 DIF" removal procedure.
6. **For Serial Number Prefix < 5616**:
   - Refer to Figure 20-110. Remove the six screws **(1)** (three on each side) (0515-0372) that attach the rear motherboard bracket to the chassis.

Figure 20-110 Rear Motherboard Removal
Serial Number Prefix < 5616



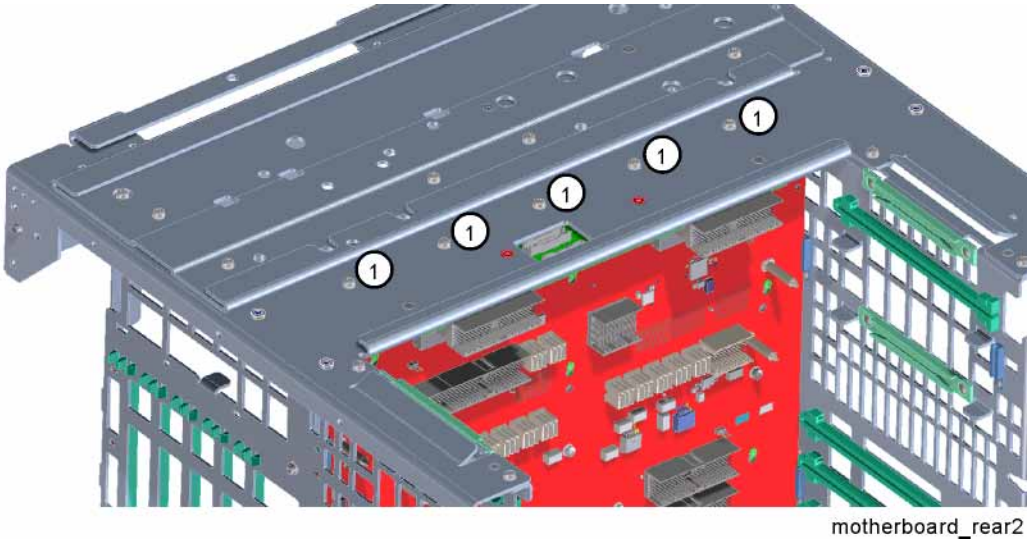
7. **For Serial Number Prefix ≥ 5616**:
   - Refer to Figure 20-111. Remove the eight screws **(1)** (four on each side) (0515-0433) that attach the rear motherboard bracket to the chassis.

Figure 20-111 Rear Motherboard Removal
Serial Number Prefix ≥ 5616



8. Refer to Figure 20-112. Remove the five screws **(1)** (0515-0372) that attach the rear motherboard bracket to the base of the chassis. Pull the rear motherboard up to disconnect from the bottom motherboard and pull out of the chassis.

Figure 20-112 Rear Motherboard Removal - Bottom Screws



Replacement

1. **For Serial Number Prefix < 5616**:
   - Refer to Figure 20-110. Place the rear motherboard and bracket into the chassis and push down to mate with the bottom motherboard. Replace the six screws **(1)** (three on each side) (0515-0372) to attach the rear motherboard bracket to the chassis. Torque to 9 inch-pounds.
2. **For Serial Number Prefix ≥ 5616**:
   - Refer to Figure 20-111. Place the rear motherboard and bracket into the chassis and push down to mate with the bottom motherboard. Replace the eight screws **(1)** (four on each side) (0515-0433) that attach the rear motherboard bracket to the chassis. Torque to 21 inch-pounds.
3. Refer to Figure 20-112. Replace the five screws **(1)** (0515-0372) to attach the rear motherboard bracket to the bottom of the chassis. Torque to 9 inch-pounds.

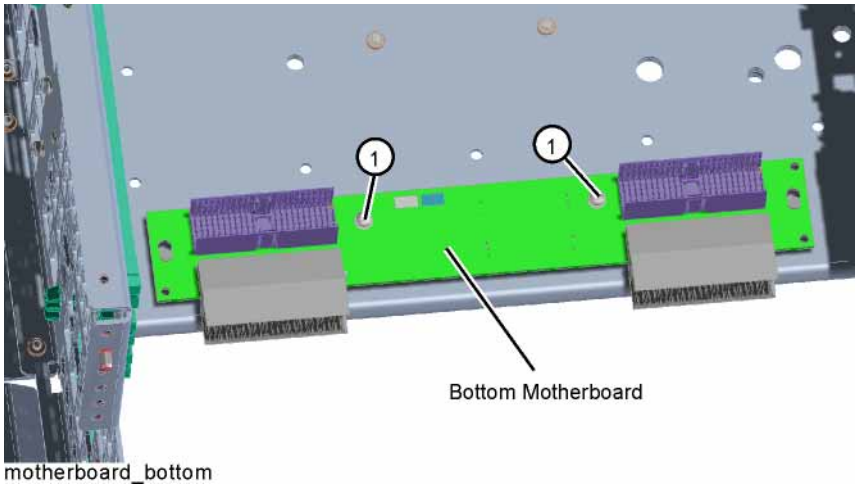
4. Replace AIF/DIF assembly. Refer to the "A2 AIF/A3 DIF" replacement procedure.
5. Replace the power supply. Refer to the "A6 Power Supply" replacement procedure.
6. Replace the CPU assembly. Refer to the "A4 CPU/A5 Solid State Drive" replacement procedure.
7. Replace the wideband digital I.F. assemblies if present. Refer to the "A22 & A23 Wideband Digital I.F. Boards" replacement procedure.
8. Replace the front motherboard. Refer to the "Front Motherboard (A8 Front Motherboard)" replacement procedure.

Bottom Motherboard (A24 Motherboard Interconnect)

Removal

1. Remove the front motherboard. Refer to the "Front Motherboard (A8 Front Motherboard)" removal procedure.
2. Remove the rear motherboard. Refer to the "Rear Motherboard (A7 Rear Motherboard)" removal procedure.
3. Refer to Figure 20-113. Remove the two screws **(1)** (0515-0372) that attach the bottom motherboard to the chassis. Push the bottom motherboard forward to disengage from the locking pins on the chassis.

Figure 20-113 Bottom Motherboard Removal



Replacement

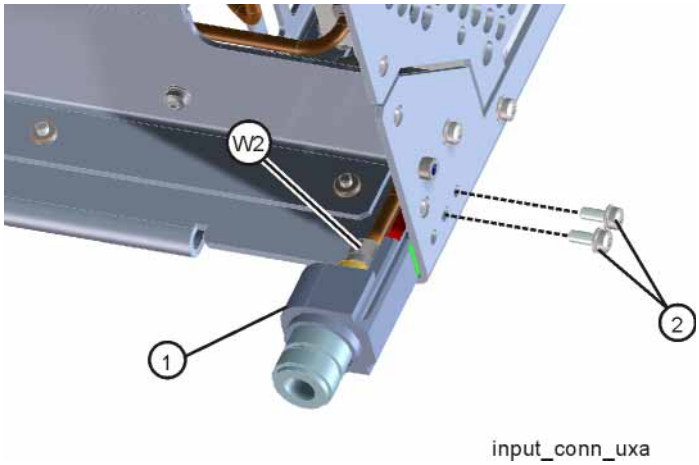
1. Refer to Figure 20-113. Place the bottom motherboard into position and line up the holes in the board to the pins on the chassis. Lower and push the board towards the rear of the chassis to lock into place. Replace the two screws **(1)** (0515-0372) to attach the bottom motherboard to the chassis. Torque to 9 inch-pounds.
2. Replace the rear motherboard. Refer to the "Rear Motherboard (A7 Rear Motherboard)" replacement procedure.
3. Replace the front motherboard. Refer to the "Front Motherboard (A8 Front Motherboard)" replacement procedure.

Input Connector

Removal

1. Remove the instrument outer case. Refer to the “Instrument Outer Case” removal procedure.
2. Remove the front frame. Refer to the “Front Frame Assembly” removal procedure.
3. Refer to Figure 20-114. Disconnect the W2 semi-rigid cable from the input connector **(1)**.

Figure 20-114 Input Connector Removal



4. Remove the two screws **(2)** (0515-0372) that attach the input connector to the chassis.

Replacement

1. Refer to Figure 20-114. Reinstall the input connector **(1)** into position in the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
2. Reconnect the semi-rigid cable W2 to the input connector. Torque to 10 inch-pounds.
3. Replace the front frame. Refer to the "Front Frame Assembly" replacement procedure.
4. Replace the instrument outer case. Refer to the "Instrument Outer Case" replacement procedure.

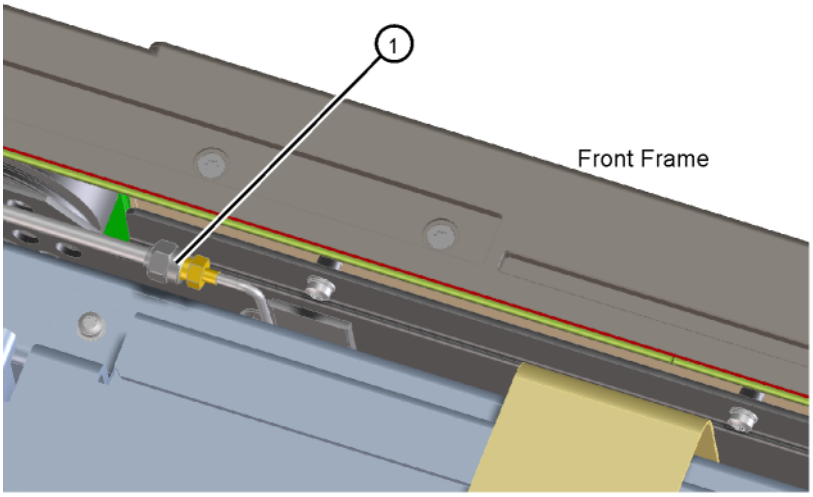
Front Frame Assembly

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. Refer to Figure 20-115. Disconnect the two cables **(1)** (just behind the front frame) with a 5/16-inch wrench and a 1/4-inch wrench.

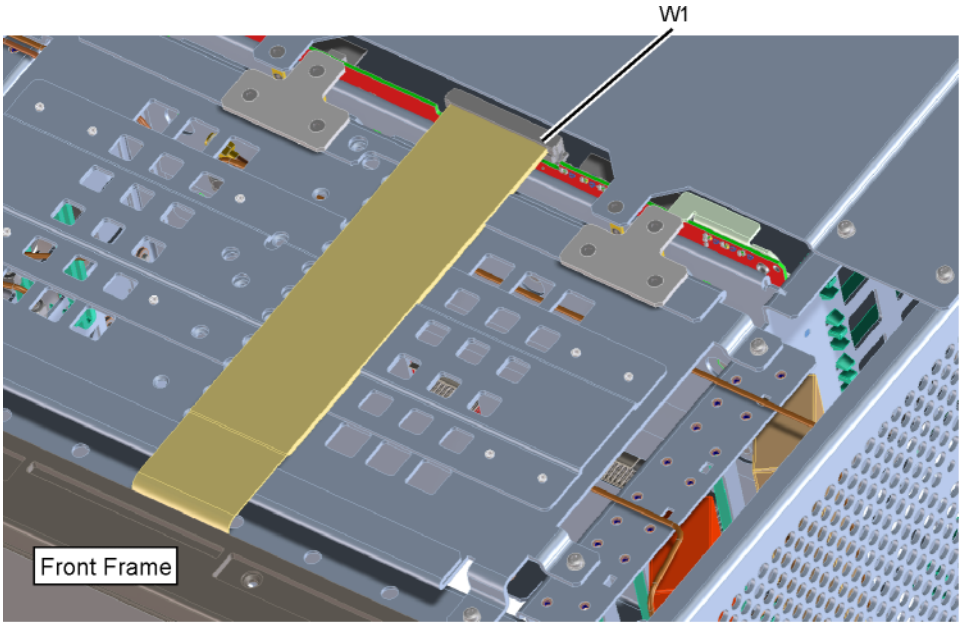
Figure 20-115 EXM Cable



EXM_cable

3. Refer to Figure 20-116. Disconnect W1 ribbon cable from the rear motherboard at the location indicated. The cable has locking tabs on each side, pinch and pull to release.

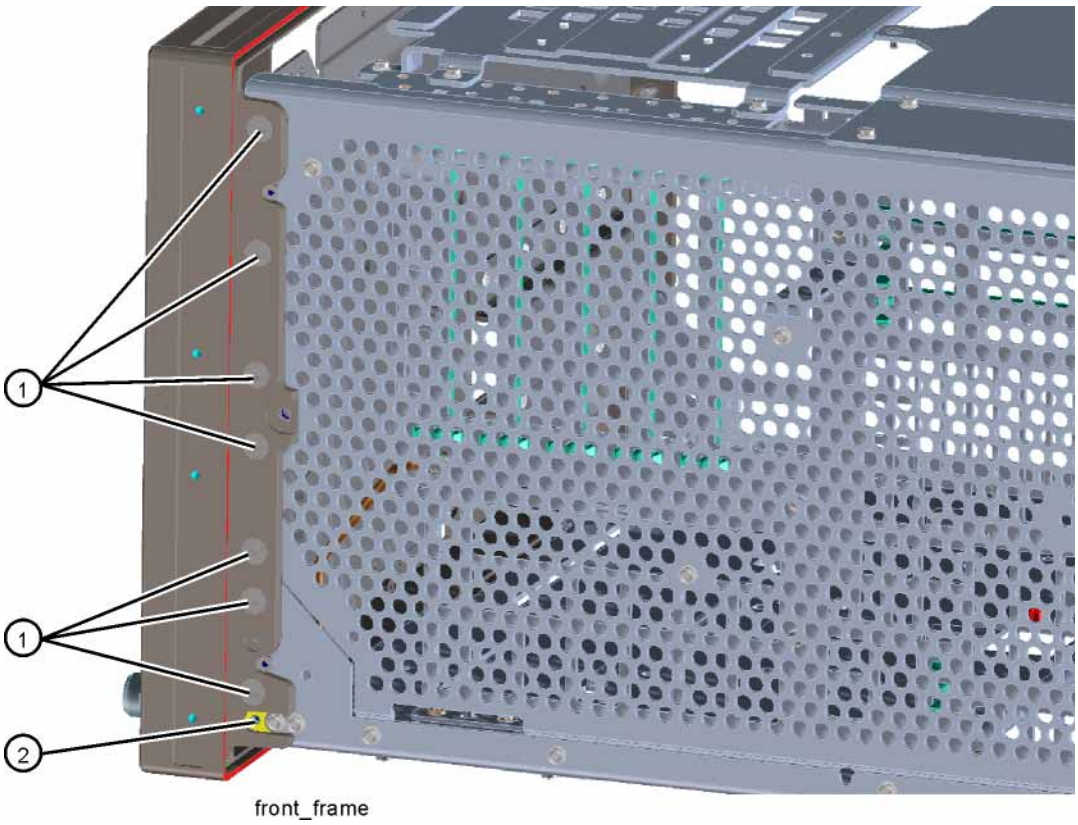
Figure 20-116 Front Panel Cable



cable_frontframe

4. Refer to Figure 20-117. Using the T-20 driver, remove the fourteen screws **(1)** (seven on each side) (0515-2044). Using the T-10 driver, remove the one screw **(2)** (0515-0372). The front frame can now be detached from the chassis.

Figure 20-117 Front Frame Assembly Removal



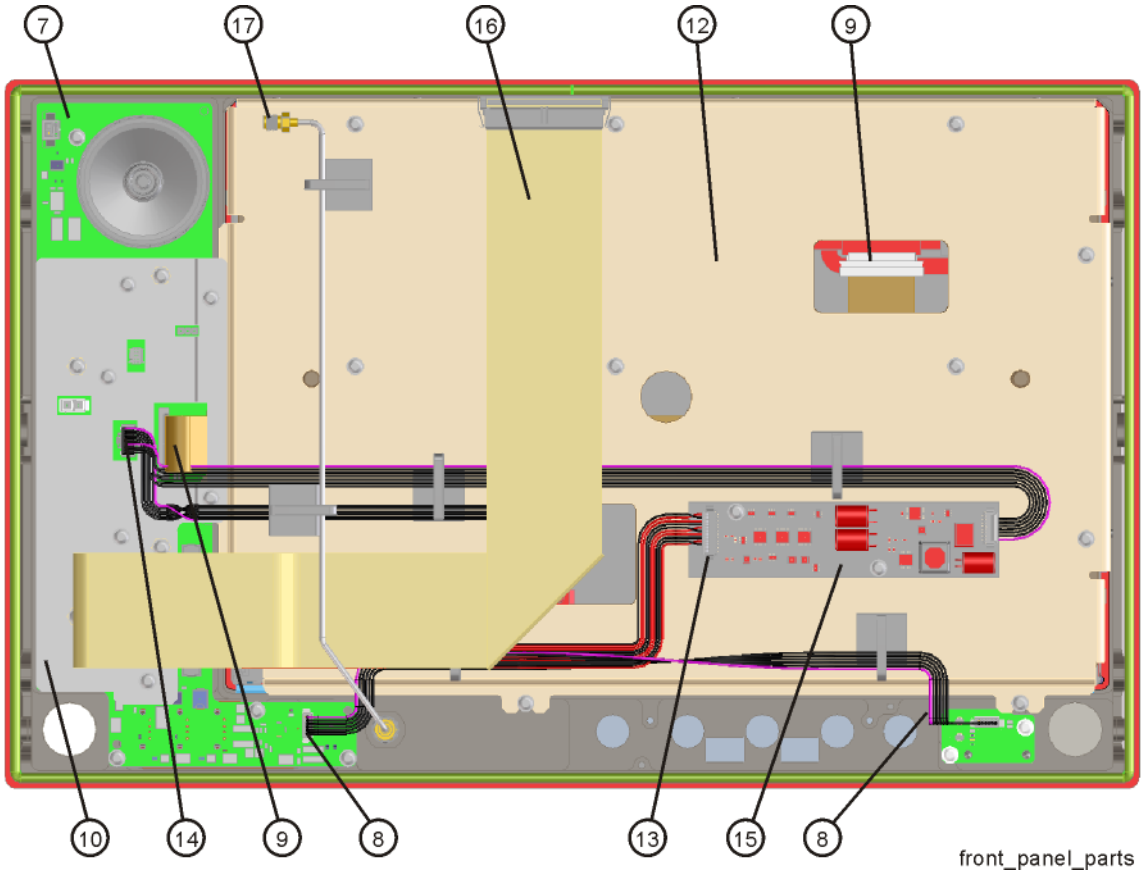
Replacement

1. Refer to Figure 20-117. Carefully position the front frame assembly onto the chassis. Ensure no cables are pinched. Ensure the O-ring is secured over the RF connector. Using the T-20 driver, replace the fourteen screws **(1)** (seven on each side) (0515-2044). Torque to 21 inch-pounds.
2. Using the T-10 driver, replace the one screw **(2)** (0515-0372). Torque to 9 inch-pounds.
3. Refer to Figure 20-116. Reattach the ribbon cable W1. Ensure the locking tabs are engaged.
4. Refer to Figure 20-115. Reconnect the two cables **(1)** just behind the front frame. Torque to 10 inch-pounds.
5. Replace the outer case. Refer to the "Instrument Outer Case" replacement procedure.

Front Frame Assembly Components

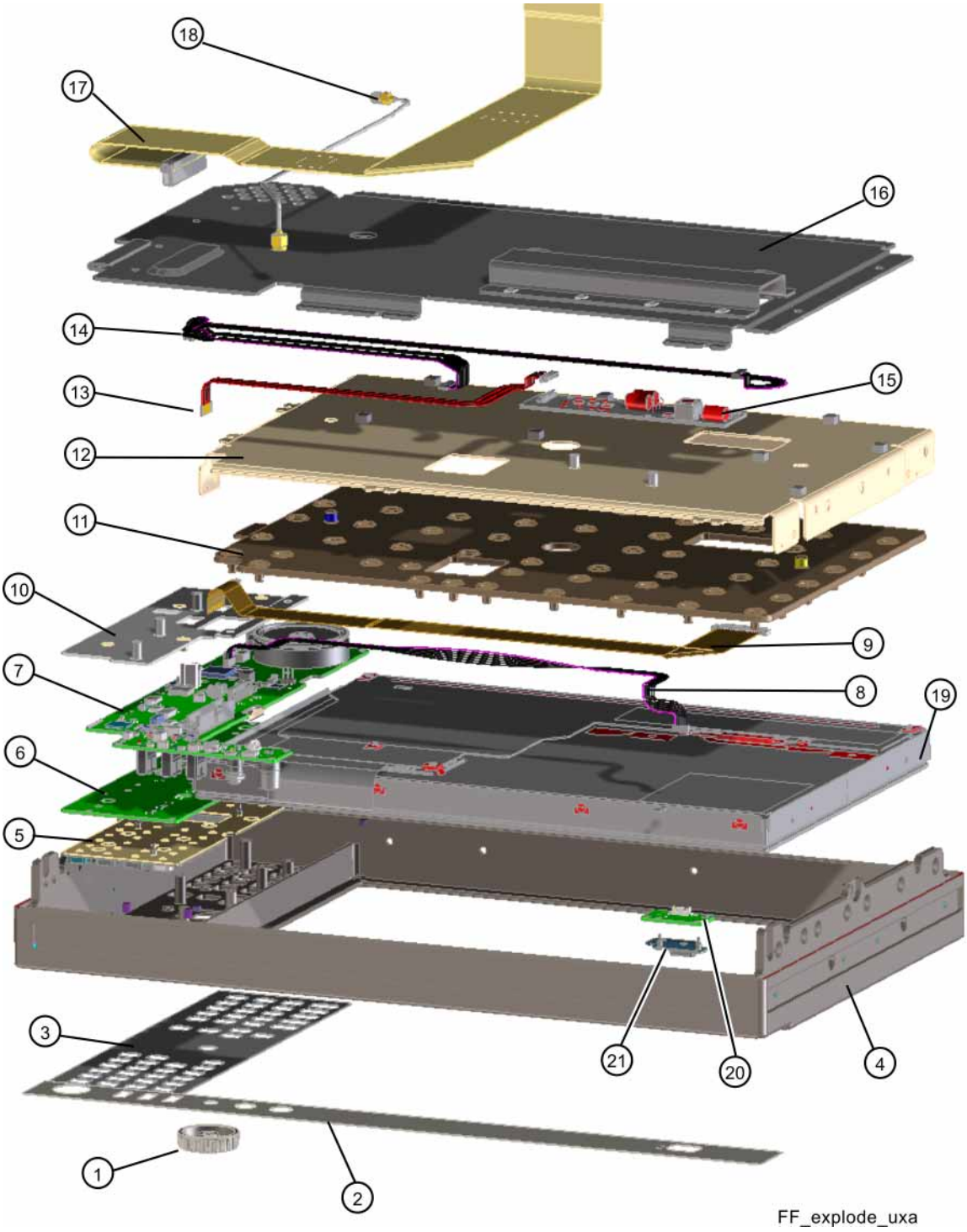
NOTE Access to any of the Front Frame assemblies requires removal of the Front Frame Assembly from the chassis.

Figure 20-118 Front Frame Parts



Item	Description	Item	Description
7	A1A5 Controller Board	13	A1W2 Cable
8	A1W4 Cable	14	A1W3 Cable
9	A1W1 Cable	15	A1A4 Converter DC-DC
10	A1MP14 Front Panel Interface Bracket	16	W1 Cable
12	A1MP21 Display Bracket	17	W29 Semi-rigid Cable

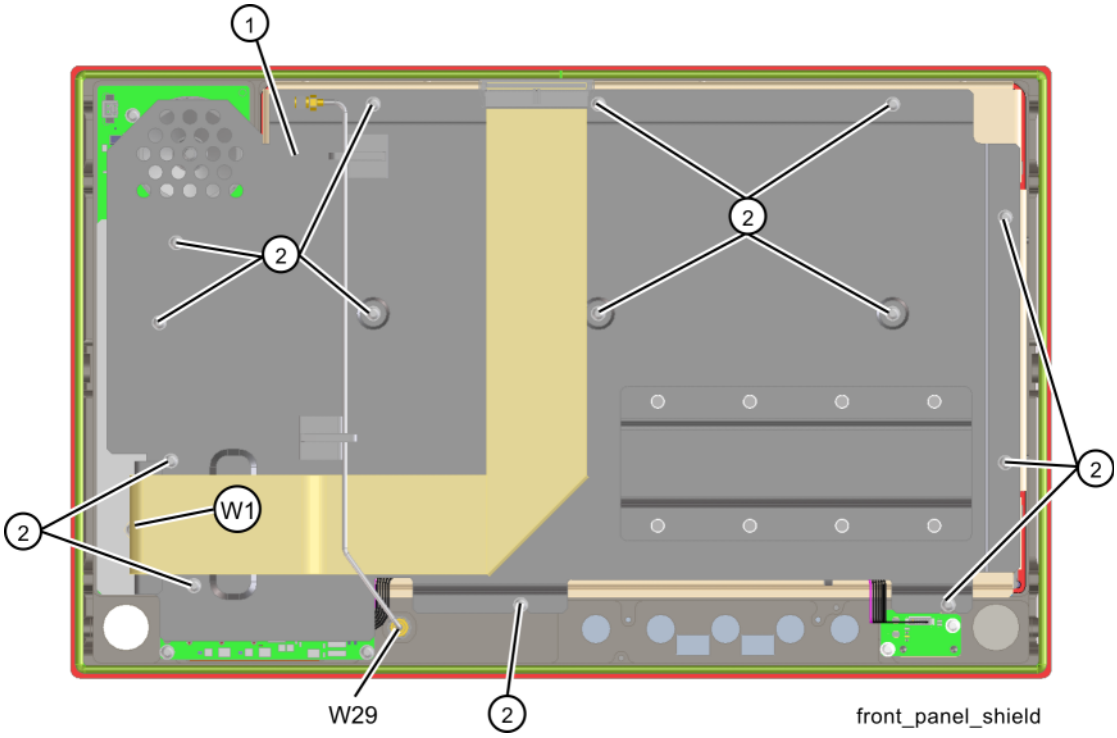
Figure 20-119 Front Frame Exploded View



Item	Description
1	A1MP9 RPG Knob
2	Connector Overlay
3	Main Keyboard Overlay
4	Front Frame
5	A1MP1 Main Keypad
6	Front Panel Interface Board
7	Front Panel Controller Board
8	A1W4 Cable Assembly
9	A1W1 Cable Assembly (Flex Circuit)
10	Front Panel Controller Board Bracket
11	Display Compression Pad
12	Display Bracket
13	A1W2 Cable Assembly
14	A1W3 Cable Assembly
15	DC-DC Converter Board
16	Front Panel Interface Board Shield
17	W1 Ribbon Cable
18	W29 Semi-Rigid Cable
19	A1A3 Touch Screen Display
20	A1A6 Front Panel On Button Keyboard
21	A1MP2 Front Panel On Button Keypad

Front Panel Shield

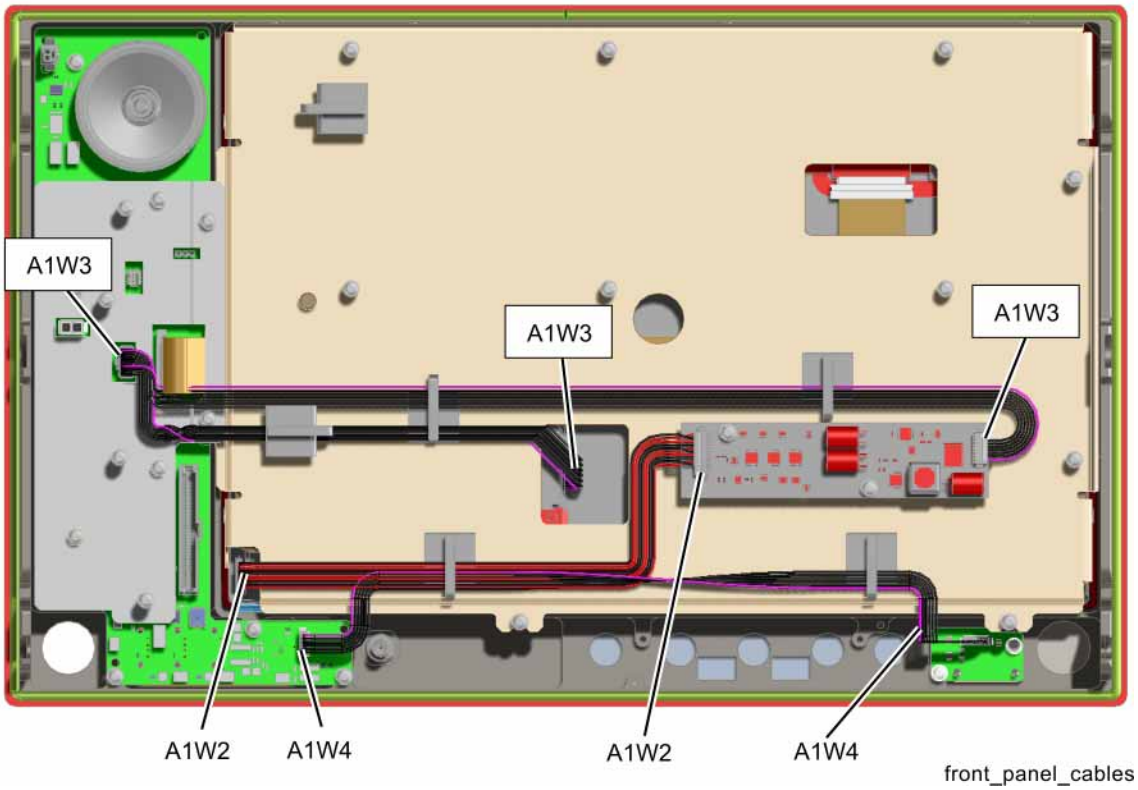
Figure 20-120 Front Panel Shield



1. Refer to Figure 20-120. Remove cable W29.
2. To remove the front panel shield **(1)**, remove the fourteen screws **(2)** (0515-0372).
3. When replacing the front panel shield, torque all screws to 9 inch-pounds, When replacing ribbon cable W1 press firmly on each side to ensure the hooks catch on the boards mating connector.
4. When replacing the cable W29 torque to 10 inch-pounds.

Front Panel Cables

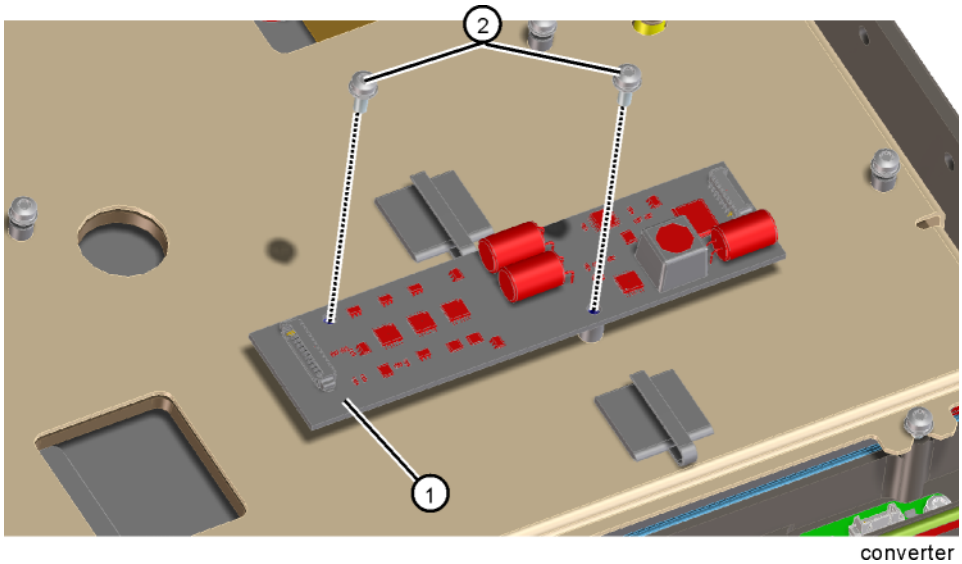
Figure 20-121 Front Panel Cables



1. Refer to Figure 20-121. Remove cables A1W2, A1W3, and A1W4.
2. When replacing the cables, dress in the appropriate cable clamps.

DC DC Converter Board

Figure 20-122 DC DC Converter Board

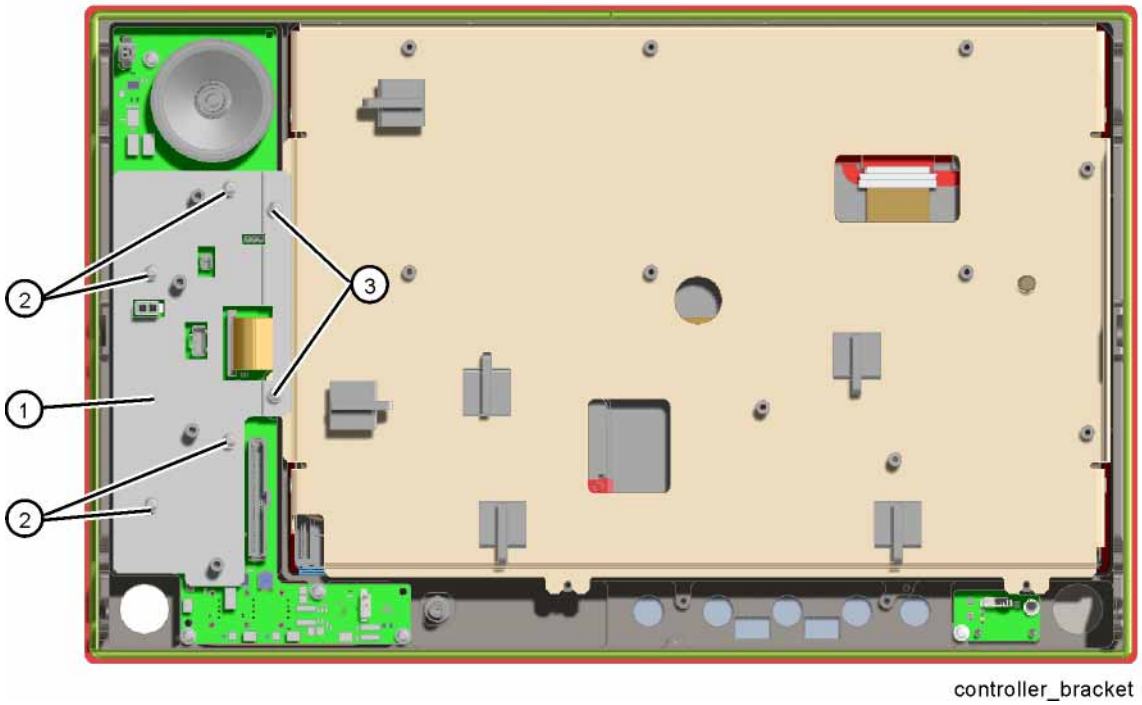


1. Refer to Figure 20-122. To remove the DC DC converter board **(1)**, remove the two screws **(2)** (0515-0372).
2. When replacing the board, torque the screws to 9 inch-pounds.

Controller Bracket and Controller Board

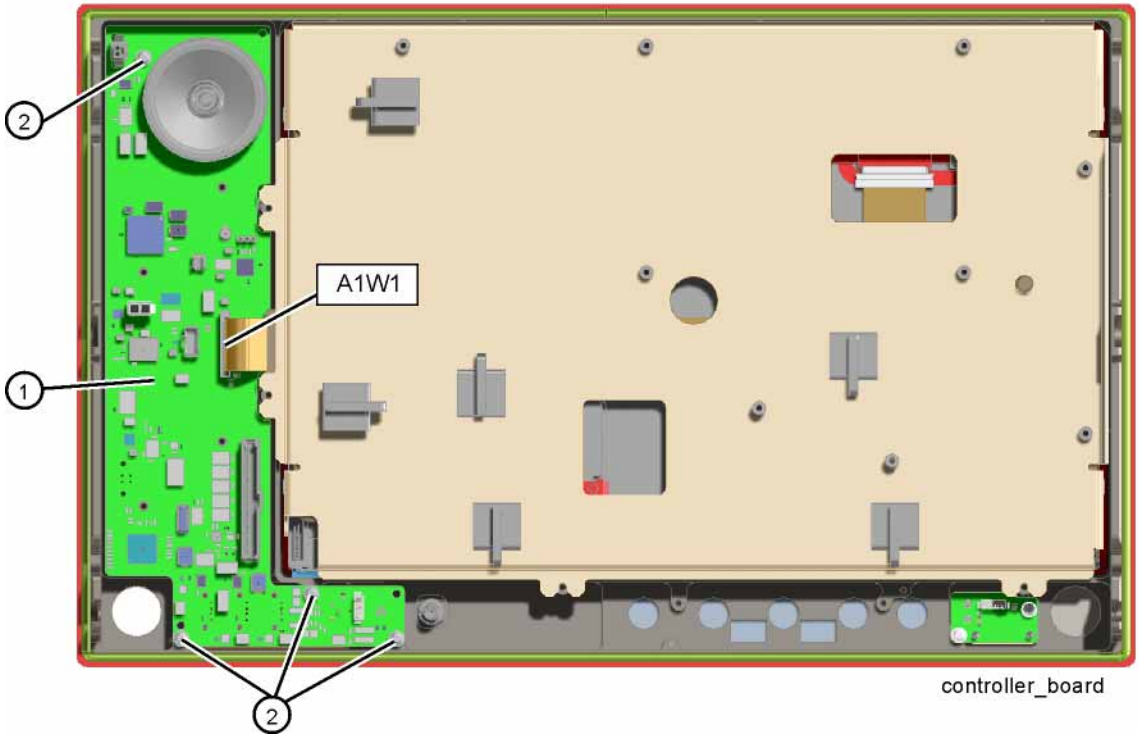
1. Refer to Figure 20-123. To remove the controller bracket **(1)**, remove the four screws **(2)** (0515-0664) and the two screws **(3)** (0515-0372).

Figure 20-123 Controller Bracket



2. Refer to Figure 20-124. Unplug cable A1W1 from the controller board at the location shown. Pull up on the locking tab to remove the cable. To remove the controller board **(1)**, remove the four screws **(2)** (0515-0372).

Figure 20-124 Controller Board



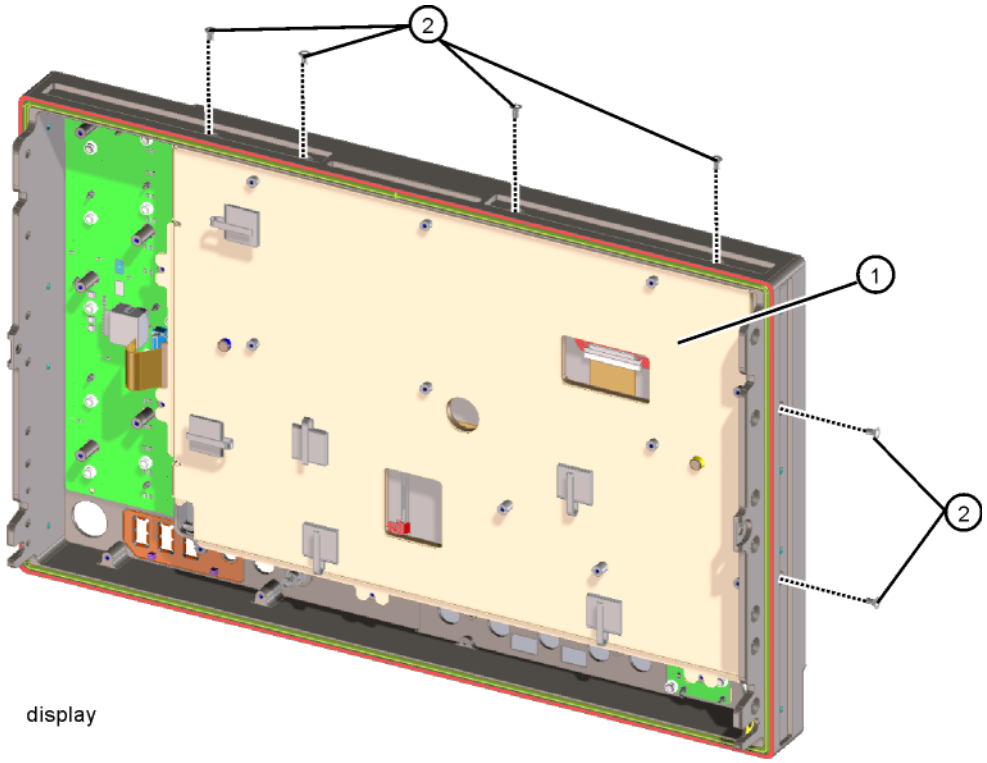
3. When replacing the board, position on top of the keyboard and press down to mate connectors. Torque the screws to 9 inch-pounds. When replacing the cable A1W1 press down on the locking tab with the cable fully seated to secure.

Display Assembly

Removal

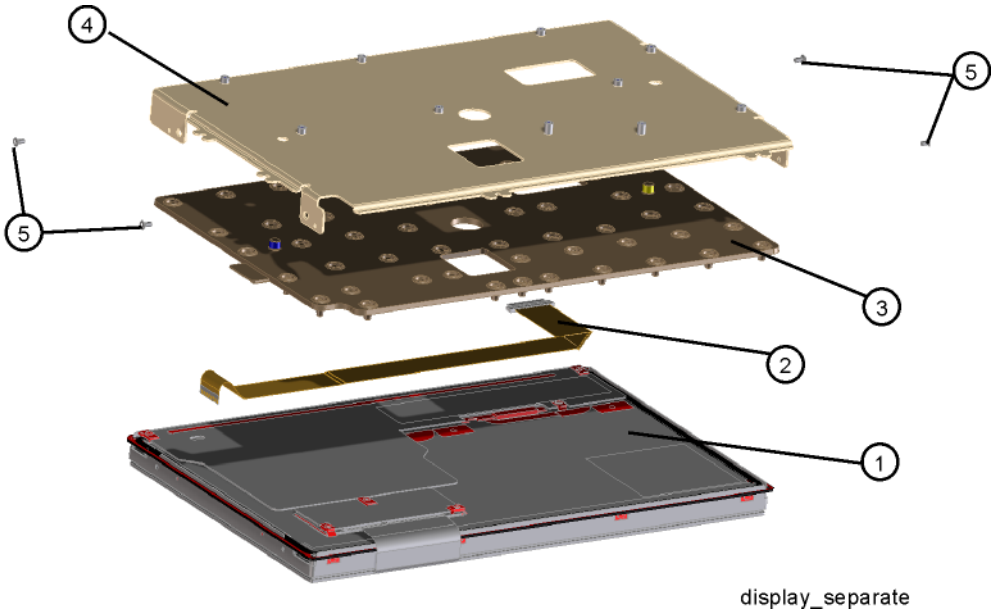
1. Refer to Figure 20-125. Remove the six screws **(2)** (0515-1946). The display assembly **(1)** can now be lifted out of the front frame.

Figure 20-125 Display Removal



2. Refer to Figure 20-126. To separate the display **(1)** from the display bracket **(4)**, remove the four screws **(5)** (0515-1946). The display bracket can now be separated from the display. Separate the display compression pad **(3)** and disconnect cable A1W1 **(2)**

Figure 20-126 Display and Bracket Separation

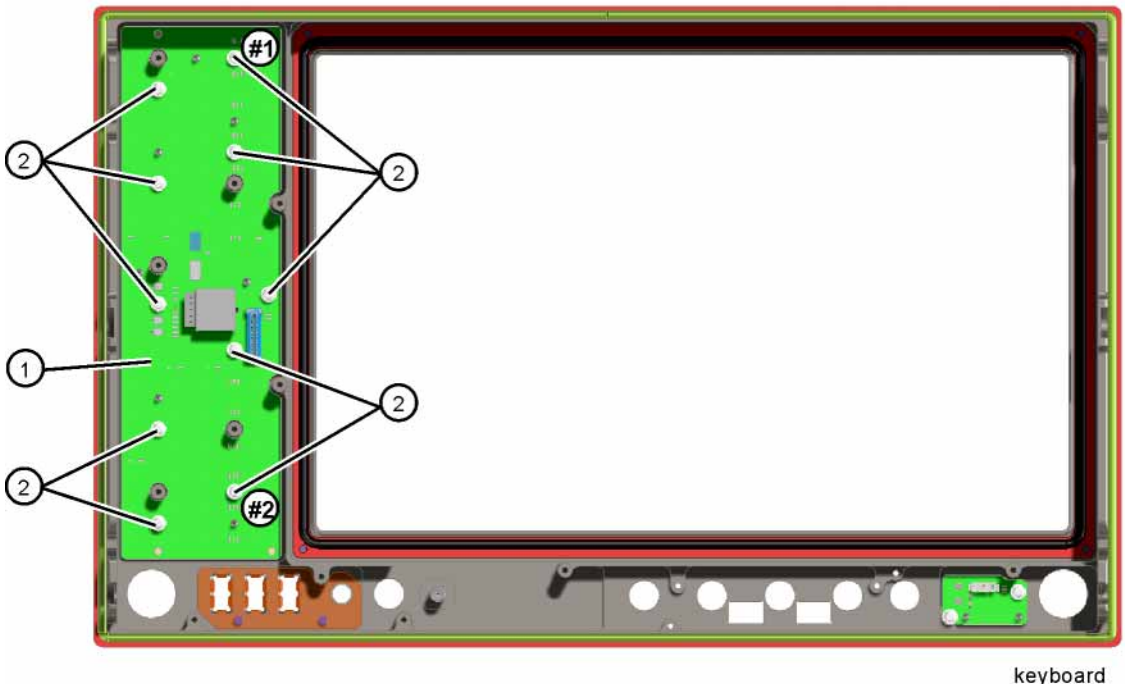


3. To reassemble the display assembly, first connect cable A1W1 **(2)** to the display **(1)**.
4. Place the display compression pad **(3)** on the display as shown in Figure 20-126. Make sure the pad is seated properly.
5. Place the display bracket **(4)** onto the display and replace the four screws **(5)** (0515-1946). Torque to 6 inch-pounds.

Keyboard/Keypad

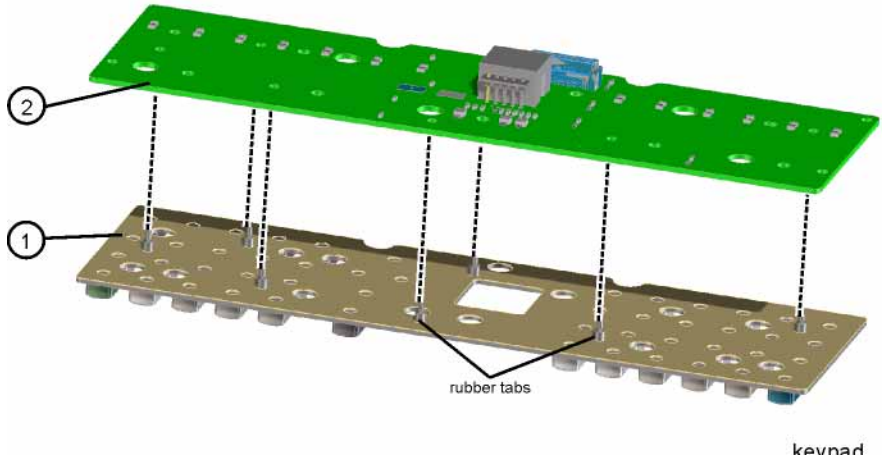
1. Refer to Figure 20-127. Remove the RPG knob by carefully pulling it off. To remove the keyboard **(1)**, remove the ten screws **(2)** (0515-0430).

Figure 20-127 Keyboard



2. Refer to Figure 20-128. To separate the keypad **(1)** from the keyboard **(2)**, pull the keypad away from the keyboard to release the multiple rubber tabs.

Figure 20-128 Keyboard Keypad Separation



3. Remove the protective film from the new keypad (if replacing). Lay the keypad on the keyboard and pull up on the tabs from the back of the board to seat them in place.
4. When replacing the board, position in the front frame and replace the ten screws. Torque the screws to 9 inch-pounds, starting with the screw #1 first and then #2 as shown in Figure 20-127. Replace the RPG knob by firmly pushing it onto the shaft.

21 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 analyzer has been turned on and allowed to warm up.
- Ensure that the analyzer is operating within a temperature range of 20 °C to 30 °C.

Post-Repair Procedures

Table 21-1 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 analyzer 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 "Additional Tasks" on page 593.

- "Calibration Data Backup and Restore"
- "BIOS Settings Verification"
- "FPGA Synchronization"
- "Programming Model and Serial Numbers"

Table 21-1 Post-Repair Testing Requirements

Assembly	Adjustments to Perform (in the order listed)[a]	Performance Verifications to Perform After Adjustments[a]
A1A2 Front Panel Interface	None	Residual Responses Displayed Average Noise Level
A1A3 Liquid Crystal Display	None	Residual Responses Displayed Average Noise Level
A2 Analog IF Assembly	IF Flatness Adjust (Option B25 or B40)	Power Bandwidth Accuracy Resolution Bandwidth Switching Uncertainty Residual Responses Displayed Average Noise Level IF Frequency Response (Option B25, B40) Absolute Amplitude Accuracy Display Scale Fidelity
A3 Digital IF Assembly	FPGA Synchronization[b]	Power Bandwidth Accuracy Resolution Bandwidth Switching Uncertainty Residual Responses Displayed Average Noise Level IF Frequency Response (Option B25, B40) Absolute Amplitude Accuracy Display Scale Fidelity
A4 CPU Assembly	BIOS Settings Verification[b] Set Instrument Time and Date[c]	Residual Responses Displayed Average Noise Level
A4BT1 Battery	BIOS Settings Verification[b] Set Instrument Time and Date[c]	Residual Responses Displayed Average Noise Level
A5 Disk Drive[d]	Accept End User License Agreement (EULA)[b] Instrument Software Update[e] All Adjustments[df]	Residual Responses Displayed Average Noise Level Frequency Response (All Tests)
A6 Power Supply	None	Residual Responses Displayed Average Noise Level Spurious Responses
A7 Midplane board	Program Instrument Model and Serial Number[b]	Residual Responses Displayed Average Noise Level
A8 Motherboard	None	Run all tests since instrument was disassembled.

Table 21-1 Post-Repair Testing Requirements (Continued)

Assembly	Adjustments to Perform (in the order listed)[a]	Performance Verifications to Perform After Adjustments[a]
A9 & A10 RF Attenuators	Hardware Statistical Reset Utility 50 MHz Calibrator Adjustment Frequency Response (All Adjustments) Attenuator Slope	Residual Responses Displayed Average Noise Level Spurious Responses Third Order Intermodulation Absolute Amplitude Accuracy Input Attenuation Switching Uncertainty Frequency Response (All Tests)
A11 Low Band Switch	Frequency Response (All Tests) Attenuator Slope	Residual Responses Displayed Average Noise Level Spurious Responses Third Order Intermodulation Second Harmonic Distortion Absolute Amplitude Accuracy Frequency Response (All Tests)
A12 YTF Preselector	YTF Alignment (Press **System**, **Alignments**, **Advanced**, **Characterize Preselector**) Frequency Response (All Adjustments) Attenuator Slope	Residual Responses Displayed Average Noise Level Spurious Responses Third Order Intermodulation Second Harmonic Distortion Absolute Amplitude Accuracy Frequency Response (All Tests)
A13 Front End Assembly	YTF Alignment (Press **System**, **Alignments**, **Advanced**, **Characterize Preselector**) RF Frequency Response (All Tests) IF Frequency Response UWBIF (Option B2X, or B5X, or H1G only) IF Frequency Response UWBIF Full Bypass Path (Option B2X, or B5X, or H1G, and FBP only) Attenuator Slope IF Phase Linearity (Option B2X, or B5X, or H1G only) TOI Adjustment Front End Controller Attenuator Adjustment Attenuator Slope Preamp On Characterize Noise Floor (Press **System**, **Alignments**, **Advanced**)	Residual Responses Displayed Average Noise Level Spurious Responses Third Order Intermodulation Second Harmonic Distortion Absolute Amplitude Accuracy RF Frequency Response (All Tests) IF Frequency Response UWBIF (Option B2X, or B5X, or H1G only) Effective DANL If the instrument has Option B2X, or B5X, or H1G, go to the Utilities menu and perform: IF Frequency Response UWBIF Check IF Phase Linearity Utility
A13 SW4/SW5 or FL2 (Option 510)	Characterize Noise Floor (Press **System**, **Alignments**, **Advanced**)	Residual Responses Displayed Average Noise Level Spurious Responses Third Order Intermodulation Second Harmonic Distortion Absolute Amplitude Accuracy Frequency Response (below 3.6 GHz) Effective DANL

Table 21-1 Post-Repair Testing Requirements (Continued)

Assembly	Adjustments to Perform (in the order listed)[a]	Performance Verifications to Perform After Adjustments[a]
A14 Synthesizer Assembly	FPGA Synchronization[b]	Residual Responses Displayed Average Noise Level Spurious Responses Phase Noise (All Tests) Frequency Response (All Tests)
A15 Front End Control Assembly	FPGA Synchronization[b] YTF Alignment (Press **System**, **Alignments**, **Advanced**, **Characterize Preselector**) Front End Controller Attenuator Adjustment Frequency Response (All Tests) Attenuator Slope TOI Adjustment Characterize Noise Floor (Press **System**, **Alignments**, **Advanced**)	Residual Responses Displayed Average Noise Level Absolute Amplitude Accuracy Frequency Response (All Tests) Effective DANL
A16 Reference Assembly	FPGA Synchronization[b] 10 MHz Frequency Reference Adjust 50 MHz Calibrator Amplitude Adjust 4800 MHz Calibrator Amplitude Adjust	Frequency Reference Accuracy Residual Responses Displayed Average Noise Level Frequency Readout Accuracy Count Accuracy Absolute Amplitude Accuracy Phase Noise (All Tests)
A20 YTO	Assure 1st LO unlocked or unleveled messages do not appear.	Residual Responses Phase Noise Frequency Response (all tests)
A21 Wideband Analog IF (Option B2X/B5X)	FPGA Synchronization[b] IF Frequency Response UWBIF IF Phase Linearity	Noise Density Spurious Responses IF Frequency Response UWBIF *Also, go to Utilities and perform:* IF Frequency Response UWBIF Check (utility) IF Phase Linearity Utility
A22 Wideband Digital IF (Option B2X/B5X)	FPGA Synchronization[b] IF Frequency Response UWBIF IF Phase Linearity	Noise Density Spurious Responses IF Frequency Response UWBIF *Also, go to Utilities and perform:* IF Frequency Response UWBIF Check (utility) IF Phase Linearity Utility
A27 H1G Assembly (Option H1G)	FPGA Synchronization[b] IF Frequency Response UWBIF IF Frequency Response UWBIF Full Bypass Path (if Option FBP is present) IF Phase Linearity	IF Frequency Response UWBIF *Also, go to Utilities and perform:* IF Frequency Response UWBIF Check (utility) IF Phase Linearity Utility

Table 21-1 Post-Repair Testing Requirements (Continued)

Assembly	Adjustments to Perform (in the order listed)[a]	Performance Verifications to Perform After Adjustments[a]
SW1 or SW2 Preselector bypass switch (Option MPB)	Frequency Response (all tests) Reset Preselector Bypass cycles using software utility Characterize Noise Floor (Press **System**, **Alignments**, **Advanced**)	Frequency Response (all tests) Effective DANL
SW3 Low Noise Path Switch (Option LNP)	Frequency Response (all tests) Reset Low Noise Path switch using software utility Characterize Noise Floor (Press **System**, **Alignments**, **Advanced**)	Frequency Response (all tests) Effective DANL

a. Calibration Application Software is required for all performance tests and most adjustments. For details go to http://www.keysight.com/find/calibrationsoftware
b. See the Additional Tasks section in this chapter for detailed instructions on this task.
c. To set the instrument time and date press **Start**, **Control Panel**, **Date Time Language and Regional Options**, **Date and Time**
d. Before replacing the A5 Disk Drive, see the “Calibration Data Backup and Restore” section in this chapter for details.
e. See Chapter 17, “Instrument Software” for instructions on updating the instrument software to the latest version.
f. The 50 MHz and 4800 MHz Calibrator Amplitude Adjustments must be done prior to Frequency Response Adjustments.

NOTE Some Adjustment tests may be found in the Utility portion of the Test Plan.

Additional Tasks

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.

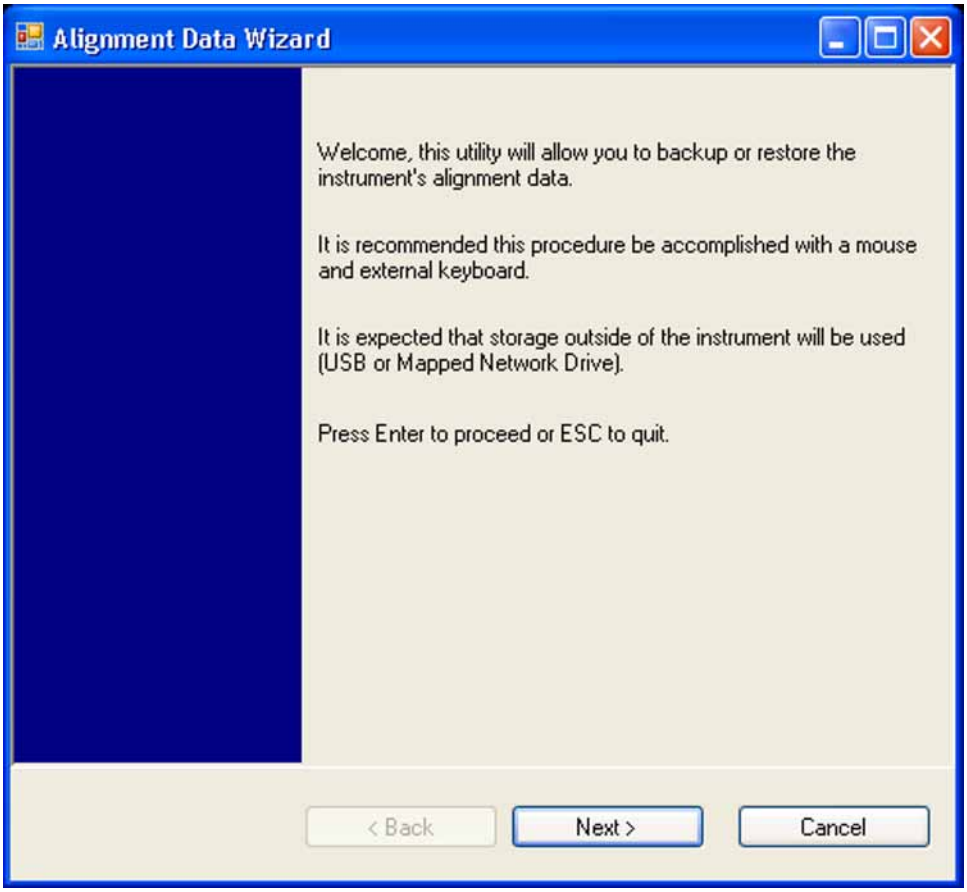
Data Backup

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 21-1 will appear.

Figure 21-1 Alignment Data Wizard



5. Follow the on-screen instruction to backup the calibration data to the USB FLASH drive.

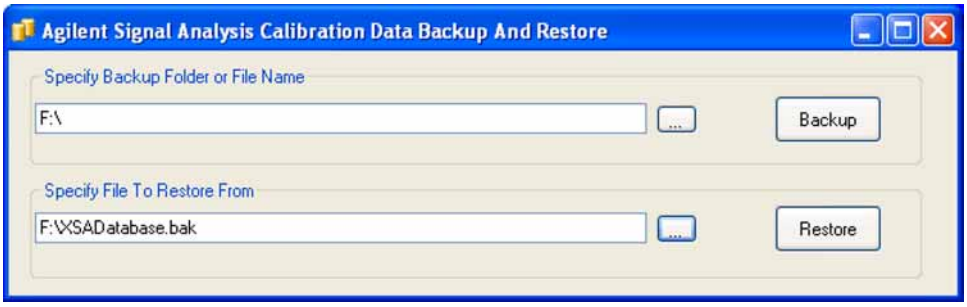
If the Instrument Software Application Will Not Run

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\Physics

4. Double-click on BackupAndRestore.exe and the window shown in Figure 21-2 will appear.

Figure 21-2 Calibration Data Backup



5. Under the “Specify Backup Folder or File Name” use the mouse to select the “...” button to open the “Browse For Folder” dialog box.
6. Select the USB FLASH drive and press **OK**.

NOTE

While you can use the “Make New Folder” button in the “Browse For Folder” dialog box to create a sub-folder on the USB FLASH drive, and you can specify a filename in the “Specify Backup Folder or File Name” window, you can also just use the root directory on the drive and let the instrument select a default filename for you.

7. Select “Backup” and wait for the calibration database to be backed up.
8. When the backup has completed close the Calibration Data Backup And Restore window.

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 21-1 will appear.
4. Follow the on-screen instruction to restore the previously saved calibration data from the USB FLASH drive.
5. Cycle instrument power.

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”.

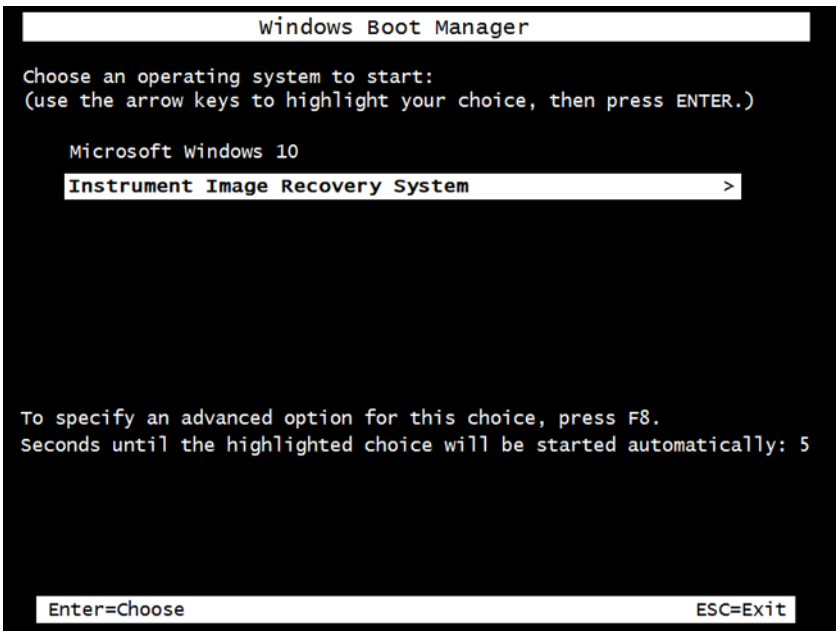
Operating System Initialization

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

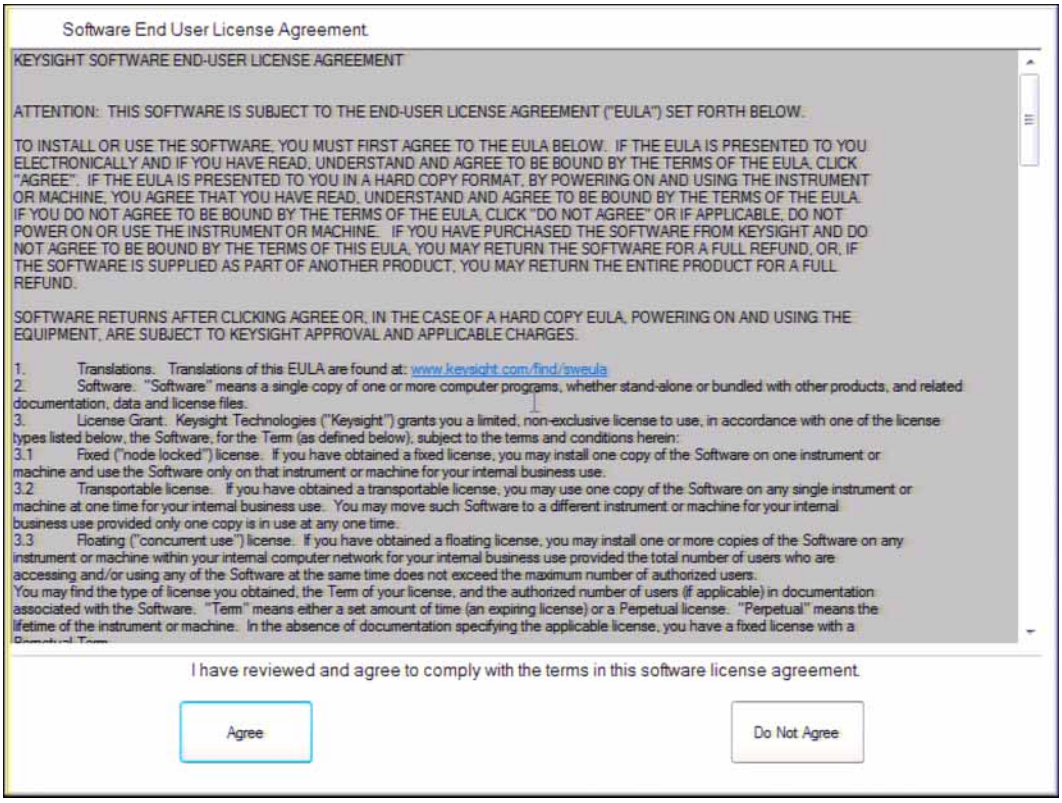
1. With the new disk drive installed power the instrument on.
2. Within a few seconds you will see the initial Keysight Technologies splash screen, and then the boot selection menu as seen in Figure 21-3.
3. Allow the instrument to boot the Windows operating system. (This will happen automatically after 5 seconds if the instrument is left alone).

Figure 21-3 Boot Selection Screen



4. After a few moments the License Agreement message window will appear, as shown in Figure 21-4.

Figure 21-4 License Agreement Window



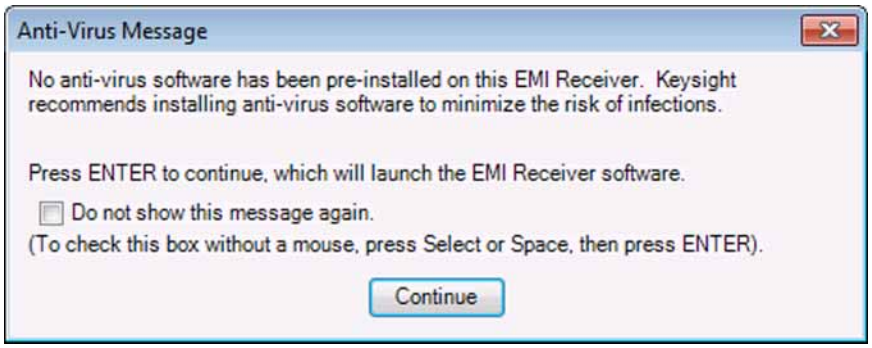
5. Select “Agree” to continue with the operating system initialization.

NOTE

If the initialization process would like to be postponed select “Do Not Agree” at this time to safely shut the instrument off. The next time this disk drive is powered on this process will be restarted.

6. The instrument will now reboot and complete the initialization process. Once this process has completed the Anti-Virus Message will appear, as shown in Figure 21-5. At this point the operating system initialization process will be completed and either selection can be made, or the instrument can be powered off.

Figure 21-5 Anti-Virus Message



7. The disk drive in use is now ready for further configuration.

FPGA Synchronization

There is FPGA (Field-Programmable Gate Array) program code on many different assemblies inside of the instrument, and all of these must be of a compatible version with the instrument software revision. In order to ensure that this requirement is met when either an assembly is replaced that contains FPGA code on it, or if the A5 Disk Drive is replaced with a drive that has a different version of software than the previous drive, you will need to take certain steps to ensure that the instrument operates properly.

NOTE

Even if an instrument appears to work properly when an assembly with FPGA code is replaced, that does not mean that the FPGA code is completely compatible with the software version installed in the instrument. There could be incompatibilities that will only be seen under certain measurement conditions.

Updating the Instrument FPGA Code

All instruments have a utility included in them that will update the FPGA code on all of the different assemblies in the instrument that have it. When this utility is run it will detect the assemblies that need to be updated and will update them to the correct revision.

NOTE

Once you start the FPGA programming process you MUST NOT interrupt the process for any reason. This would include turning the instrument off or unplugging the power cord to the instrument. Doing so will result in an inoperative instrument, requiring the affected assembly to be replaced.

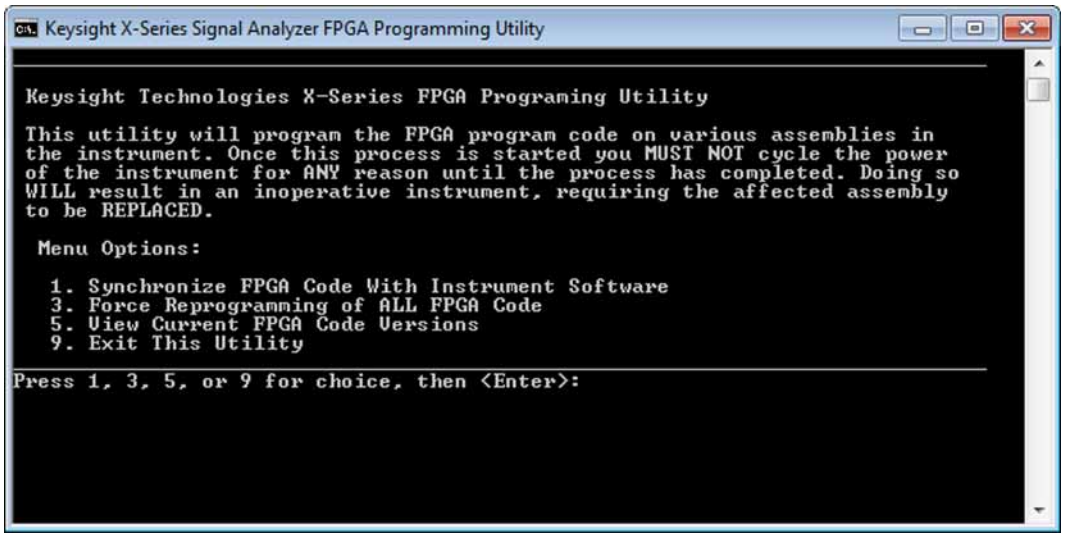
1. Close the instrument application software by pressing **File**, **Exit**, **Enter** using the front panel keys.
2. Connect a USB mouse to one of the instrument front panel USB ports.
3. Using the mouse double-click on the Windows Explorer link on the desktop and navigate to the following folder:

   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 21-6 will appear.

Figure 21-6 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 restore the license files will then be recognized and accepted, returning the instrument to the capability that was available prior to the A7 Midplane board assembly replacement.

To program the model and serial numbers into a replacement A7 Midplane board assembly the N7800A Keysight Calibration Application Software will be required.

Information regarding N7800A Keysight 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.

22 Functional Tests

Functional Test Versus Performance Verification

Functional tests are tests of various instrument parameters that give a high degree of confidence that the analyzer is operating correctly. They are recommended as a check of analyzer operation for incoming inspection or after a repair. Measurement uncertainty analysis is not available for functional tests, and the analyzer is checked against limits that are wider than the published specifications. The functional tests are designed to test an analyzer operating within the temperature range defined by the analyzer specifications using a minimum set of test equipment. If a test does not pass, performance verification tests must be run to determine whether a problem exists.

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**.
   b. If the **Freq Ref In** softkey does **not** show Internal, press the **Freq Ref Input** softkey and select Internal.
5. Following instrument warm-up, perform the auto align routine:

   Press **System**, **Alignments**, **Align Now, All**.

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

Analyzer Option	Item	Critical Specifications	Recommended Keysight Model	Alternate Keysight Model
	Adapters			
All	3.5 mm (f) to 3.5mm (f) (connector saver for source)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B	1250-1749
All	BNC (f) to SMA (m)	Frequency: 40 MHz	1250-1200	
All	Type N (f) to Type N (f)	Frequency: 10 MHz to 18 GHz VSWR: < 1.05:1	1250-1472	1250-0777
All	Type N (m) to 3.5 mm (m)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1743	
All	Type N (m) to 3.5 mm (f)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1744	
All	Type N (f) to 3.5 mm (f)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1745	
All	Type N (m) to BNC (f)	Frequency: 10 MHz to 1 GHz VSWR: < 1.05:1	1250-1476	
	Attenuators			
All	10 dB Step Attenuator	Frequency: 50 MHz Range: 0 to 70 dB	8495A	8496A
All	10 dB Fixed Attenuator (2 required)	Frequency: 50 MHz VSWR: < 1.2:1	8493C Option 010	8493A Option 010 or 8493B Option 010
Preamp Options (Pxx)	30 dB Fixed Attenuator	Accuracy: < 0.05 dB @ 50 MHz	11708A	

Table 22-1

Analyzer Option	Item	Critical Specifications	Recommended Keysight Model	Alternate Keysight Model
	Cables			
All	3.5 mm (1 meter)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1 Loss: < 2.0 dB	11500E	8120-4921
All	Cable, BNC (3 required)	120 cm (48 in.) BNC cable	10503A	
	Signal Source			
All	Synthesized Sweeper	Frequency: 10 MHz to 50 GHz[a] Harmonic level: < - 40 dBc Amplitude range: 10 to - 20 dBm Frequency Accuracy: 0.02%	PSG[b]	83630B, 83640B, 83650B
	Power Meter			
All	Power Meter	Power Reference Accuracy: ±1.2% Compatible with power sensor	E4418B	E4419B
All	Power Sensor	Frequency Range: 50 MHz to 3.66 GHz Amplitude Range: -70 to –20 dBm	8481D	8487D 8485D
508, 513	Power Sensor	Frequency Range: 50 MHz to 13.66 GHz Amplitude Range: -30 to +20 dBm	8481A	
526	Power Sensor	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: -30 to +20 dBm	8485A	
Preamp	Low Power Sensor	Frequency Range: 50 MHz to 50 GHz[c] Amplitude Range: –70 to –20 dBm	8487D	8485D[c]
	Miscellaneous Equipment			
All	Filter, 50 MHz Low Pass	Cutoff Frequency: 50 MHz Rejection at 65 MHz: > 40 dB Rejection at 75 MHz: > 60 dB Rejection at 80 MHz: > 60 dB Frequency: 10 MHz to 26.5 GHz	0955-0306	
526	Power Splitter, 3.5 mm	Nominal Insertion Loss: 6 dB Tracking Between Ports: < 0.25 dB	11667B	

Table 22-1

Analyzer Option	Item	Critical Specifications	Recommended Keysight Model	Alternate Keysight Model
508, 513	Power Splitter	Nominal Insertion Loss: 6 dB Tracking Between Ports: < 0.25 dB	11667A	11667B
All	Termination, 50 W	Type N (m) Connector Frequency: 30 Hz to 26.5 GHz	909A Option 012	

a. Maximum frequency equal to or greater than the maximum frequency of the UXA.
b. PSG model numbers: E8244A, E8254A, E8247C Option 520, E8247C Option H31 or 540, E8257D Option 520, E8257D Option 550, E8257D Option 567, E8267D Option 544.
c. Maximum frequency equal to or greater than the maximum frequency of the preamplifier option.

Displayed Average Noise Level (DANL)

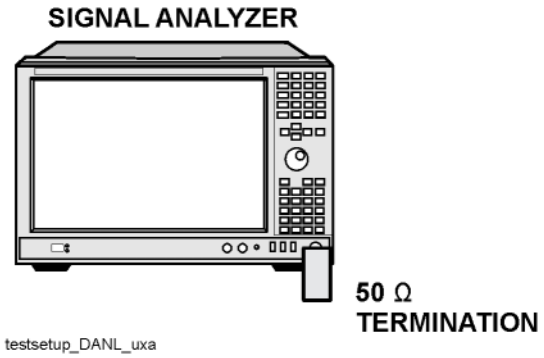
Test Limits (with 0 dB input attenuation)

See Table 22-2 on page 612 for values.

The Displayed Average Noise Level (DANL) of the signal analyzer is measured across a 10 kHz frequency span at several center frequencies. The analyzer input is terminated into a 50W 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.

Item	Critical Specifications (for this test)	Recommended Keysight Model
Termination, 50W Type-N(m)	Frequency: DC to 18 GHz	909A Option 012

Figure 22-1 DANL Test Setup



Procedure

1. Configure the equipment as shown in Figure 22-1.
2. Press **Mode/Meas**, **Spectrum Analyzer**, **OK**, **Mode Preset** on the analyzer.
3. Set up the signal analyzer by pressing:

   FREQ Channel, **Center Frequency**, 10, **MHz**
   Input/Output, select **INPUT FREQ (Channel)**, **RF**, **RF Coupling**, select **DC**
   Span, 10, **kHz**
   AMPTD Y Scale, –70, **dBm**
   AMPTD Y Scale, Attenuation, **MechAtten**, 0, **dB**
   BW, **Res BW**, 1, **kHz**
   BW, **Video BW**, 100, **Hz**
   Meas Setup, Average/Hold, Number, 20, **Enter**
   Trace, **Trace Average**
   Single

4. Press **Restart**, then wait for Average/Hold to display 20/20.
5. Press **Display**, then press **Display Line**, **On**.
6. Rotate the knob and set the display line at the average amplitude of the displayed noise floor by visual inspection.
7. 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.

---

8. Enter the value of the display line as the Measured Average Noise Level at 10 MHz column in Table 22-2.
9. 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.

---

10. Enter the normalized value of the displayed average noise level in. Table 22-2
11. The value of the normalized displayed average noise should be less than the specification value.
12. Change the analyzer center frequency to the next value listed in Table 22-2. Press: **FREQ Channel**, **Center Freq**, [Table 2-1 Value], **GHz**

13. Repeat step 4 through step 12 to fill in the remainder of Table 22-2 for your analyzer frequency range.

Table 22-2 Displayed Average Noise Level (DANL) Results

Center Frequency	Measured Average Noise Level (dBm)	Normalized Average Noise Level/(1 Hz BW) (dBm)	Test Limits (dBm)
10 MHz			–153
2 GHz			–152
6 GHz			–148
13 GHz			–147
20 GHz			–140
26.5 GHz			–133

Frequency Readout Accuracy

Test Limits

Frequency Readout Accuracy is equivalent to the following equation:

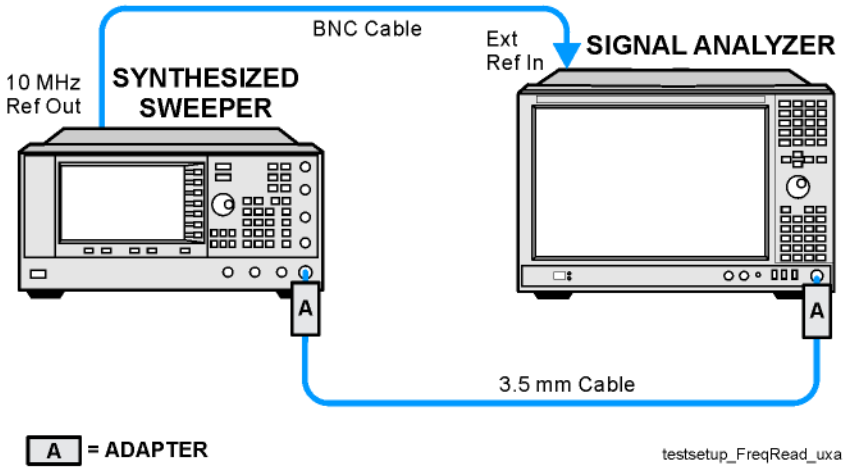
$$\pm(\mathbf{0.25}\% \times span + \mathbf{5}\% \times RBW + \mathbf{2}\ Hz + \mathbf{0.5} \times horizontal\ resolution)$$

See Table 22-3 on page 614 for actual values.

The frequency readout accuracy is measured in several spans and center frequencies that allow both internal analyzer synthesizer modes and prefilter bandwidths to be tested. Frequency reference error is eliminated by using the same frequency standard for the analyzer and signal source.

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 3.5 mm (f) to 3.5 mm(f)	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.1:1	83059B
Cable, 3.5 mm, 1 meter	Frequency: 10 MHz to 1.51 GHz VSWR: < 1.4:1	11500E
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Synthesized Sweeper	Frequency: 10 MHz to 1.51 GHz	PSG

Figure 22-2 Frequency Readout Accuracy Test Setup



Procedure

1. Configure the equipment as shown in Figure 22-2. Confirm the analyzer's built-in auto alignment has been performed within the past 24 hours.
2. On the synthesized sweeper, press **PRESET**, then set the controls as follows:

   FREQUENCY, 1505, **MHz**
   POWER LEVEL, –10, **dBm**
   RF, On

3. Set up the signal analyzer by pressing:

   Mode, **Spectrum Analyzer**
   Mode Preset
   Input/Output, More, **Freq Ref In**, **External**
   FREQ Channel, **Center Freq**, 1505, **MHz**
   SPAN X Scale, Span, 2990, MHz
   Trace/Detector, **More**, **Detector**, **Sample**
   Single

4. Press **Restart**.

   Press **Peak Search** on the analyzer. If the instrument is functioning correctly, the marker reading in the active function block will be between the values listed in Table 22-3. Record the marker value in the Marker Frequency Readout column in Table 22-3.

5. On the signal analyzer, change the span and center frequency as listed in Table 22-3.
6. Change the synthesized sweeper frequency to match the center frequency of the analyzer.
7. Repeat step 4 through step 6 until the Marker Frequency Readout column of Table 22-3 is complete.

Table 22-3 Frequency Readout Accuracy Results

Span (MHz)	Center Frequency (MHz)	Minimum	Marker Frequency Readout	Maximum
2990	1505	1495.9 MHz		1514.1 MHz
127.2	1505	1504.56 MHz		1505.44 MHz
54.1	1505	1504.8122 MHz		1505.1878 MHz
7.95	1505	1504.97240 MHz		1505.0276 MHz
0.106	1505	1504.999630 MHz		1505.000370 MHz
1.98	517.59	517.58316 MHz		517.59684 MHz
1.98	832.50	832.49316 MHz		832.50684 MHz

Second Harmonic Distortion (SHD)

Test Limits

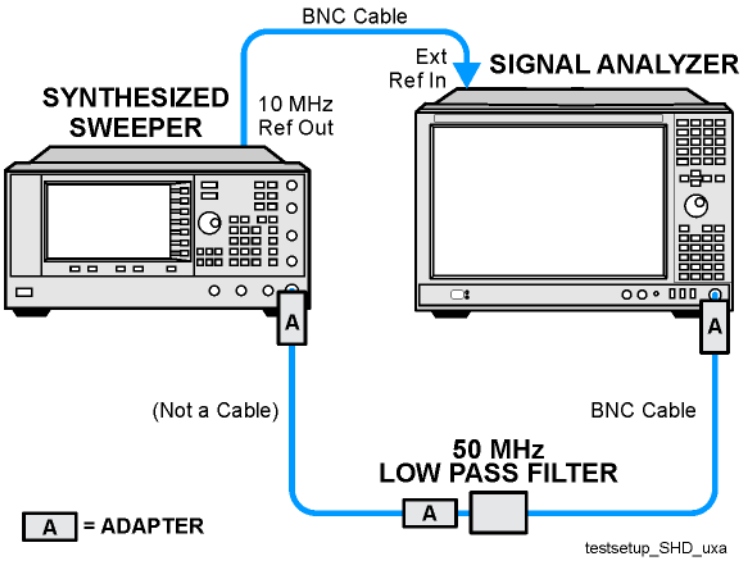
Applied Frequency	Mixer Level[a]	Distortion
40 MHz	–15 dBm	< –60 dBc

a. **Mixer Level = Input Level - RF Attenuation**

This test checks the second harmonic distortion of the signal analyzer 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 signal analyzer to prevent the source second harmonic from artificially raising the second harmonic product displayed on the analyzer.

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type-N (m) to BNC (f)	Frequency: 10 MHz to 80 MHz VSWR: < 1.05:1	1250-1476
Adapter BNC (f) to SMA (m)	Frequency: 40 to 80 MHz	1250-1200
Adapter 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 80 MHz VSWR: < 1.1:1	83059B
Cable, BNC 120 cm (2 required)	Frequency: 10 to 40 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
Synthesized Sweeper	Frequency: 50 MHz Spectral Purity: Better than –30 dBc	PSG

Figure 22-3 Second Harmonic Distortion Test Setup



Procedure

1. Configure the equipment as shown in Figure 22-3.
2. Press **Mode**, **Spectrum Analyzer**, **Mode Preset** on the signal analyzer and Preset the synthesized sweeper.
3. Set up the synthesized sweeper by pressing:

   Frequency, 40, **MHz**
   Amplitude, –5, **dBm**

4. Set up the signal analyzer by pressing:

   Input/Output, **More**, **Freq Ref In**, **External**
   FREQ Channel, **Center Freq**, 40, **MHz**
   SPAN X Scale, **Span**, 1, **MHz**
   AMPTD Y Scale, Attenuation, Mech Atten, 10, **dB**

5. On the analyzer, press **Peak Search**.
6. Adjust the synthesized sweeper amplitude for a signal analyzer display of –5 dBm ±0.1 dB.
7. On the signal analyzer, activate the marker delta function by pressing the **Marker** and **Delta** keys.
8. On the signal analyzer, press:

   FREQ Channel, **Center Freq**, 80, **MHz**
   Meas Setup, **Average/Hold Number**, 20, **Enter**
   Trace/Detector, Trace Average
   Single

9. Press **Peak Search**. Enter the displayed value under the Measured Second Harmonic Distortion (dBc) heading in Table 22-4.

Table 22-4 Second Harmonic Distortion Results

Applied Frequency (MHz)	Measured Second Harmonic Distortion (dBc)	Mixer Level (dBm)	Specification (dBc)
40		–15	–60

Amplitude Accuracy at 50 MHz

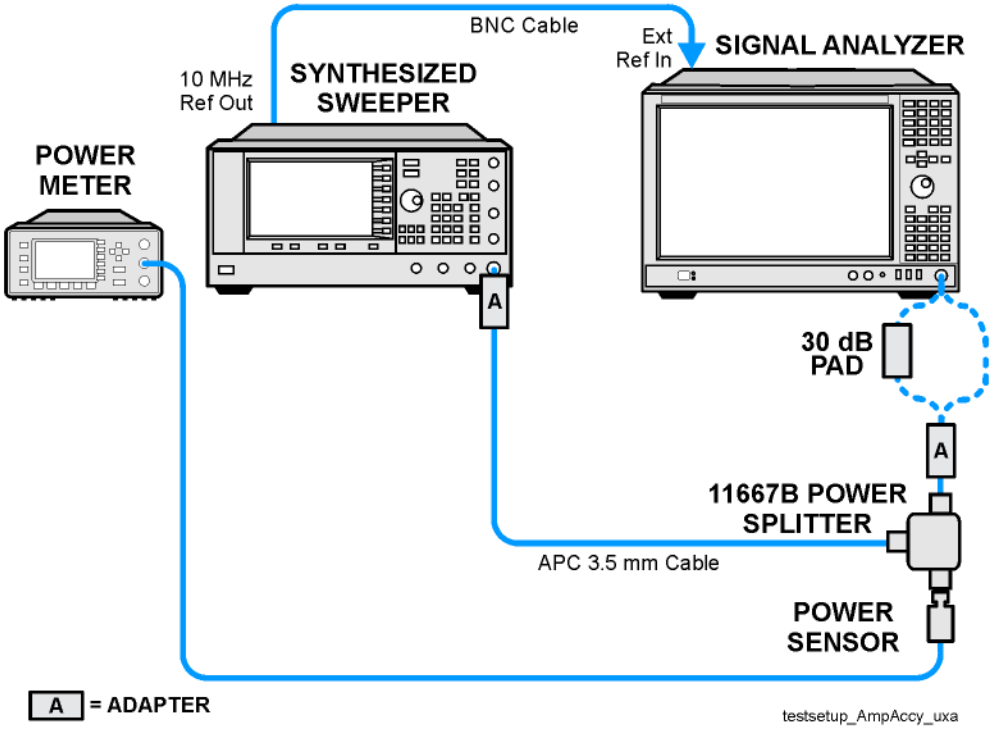
Test Limits

Amplitude Accuracy should remain within 1.13 dB of the measured source value across the range of source levels and changes in resolution bandwidth. The preamp (Option P08, P13, P26) should remain within ±1.3 dB of measured values.

A synthesized sweeper 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 signal analyzer. The source amplitude is measured by the power meter and signal analyzer at each setting, and the values compared. The difference between each pair of measurements indicates the amplitude accuracy.

Item	Critical Specifications	Recommended Keysight Model
Adapter	Type-N (m), to 3.5 mm (m)	1250-1743
Adapter	3.5 mm (f) to 3.5 mm (f)	83059B
Attenuator, 30 dB	Accuracy: < 0.5 dB at 50 MHz	11708A
Cable	3.5 mm, 1 meter	11500E
Cable	BNC, 120 cm	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Amplitude Range: -25 dBm to 10 dBm	8485A
Power Splitter	3.5 mm (f) connectors 6 dB loss	11667B
Synthesized Sweeper	Typical Temperature Stability: 0.01 dBc/°C	PSG

Figure 22-4 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 signal analyzer input through the adapter.

CAUTION To minimize stress on the test equipment connections, support the power sensor.

3. 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.
4. Press **Mode**, **Spectrum Analyzer**, **Mode Preset** on the analyzer.
5. Set up the synthesized sweeper by pressing:

   CW, 50, **MHz**
   Power Level, -4, **dBm**
   RF (On)

6. Set up the signal analyzer by pressing:

   Input/Output, More, Freq Ref In, External

FREQ Channel, Center Freq, 50, **MHz**
SPAN X Scale, 2, **MHz**
AMPTD Y Scale, **Attenuation, Mech Atten, 10, dB**
Input/Output, **RF Input**, **RF Coupling**, select **DC**
Sweep/Control, Sweep Setup, **Swp Time Rules**, **SA - Accuracy**
Meas Setup, **Average/Hold Number**, 20, **Enter**
Trace/Detector, **Trace Average**
Single

7. Perform the following steps for each row listed in Table 22-5:

   a. Set the synthesized sweeper amplitude to the value listed in the Nominal Source Amplitude column in Table 22-5.

   b. Set the Mech Atten as indicated in the Attenuation column in Table 22-5.

   c. Set the Span as listed in the Span column of Table 22-5.

   d. Record the synthesized sweeper amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-5.

   e. On the signal analyzer, press **Restart**.

   f. Wait for the signal analyzer to finish averaging.

   g. Press Peak Search.

   h. Record the signal amplitude, as measured by the analyzer in the Measured Amplitude column of Table 22-5.

   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 22-5 Amplitude Accuracy Results

Nominal Source Amplitude (dBm)	Attenuation (dB)	Span (MHz)	Measured Amplitude Meas_amp (dBm)	Power Meter Amplitude Power_meter (dBm)	Amplitude Accuracy Error (dB)	Test Limit (dB)
-4	10	2				±1.13 dB
-9	10	1				±1.13 dB
-14	10	0.5				±1.13 dB
-4	20	0.1				±1.13 dB
-14	20	0.1				±1.13 dB
-4	30	0.1				±1.13 dB
-14	30	0.1				±1.13 dB

Testing Preamp Option (P08, P13, P26)

Instruments containing Option P08, P13, P26 must have the preamp function turned on and tested.

Procedure

1. On the analyzer, press **AMPTD Y Scale**, **More**, **Internal Preamp**, **Low Band**.
2. Connect the equipment as shown in Figure 22-4 on page 619, using a 30 dB pad between the adaptor and the signal analyzer input.
3. Set the synthesized sweeper amplitude to the value listed in the Nominal Source Amplitude column in Table 22-6.
4. Set the signal analyzer input attenuation to 0 dB.
5. Set the Span as listed in Table 22-6.
6. Record the synthesized sweeper amplitude, as measured by the power meter, in the Power Meter Amplitude column of Table 22-6.
7. On the signal analyzer, press **Restart**.
8. Wait for the analyzer to finish averaging.
9. Press **Peak Search**.
10. Record the signal amplitude as measured by the analyzer in the measured amplitude column of Table 22-6.
11. Calculate the signal amplitude accuracy using the following equation:

    Amplitude Accuracy Error = Meas_amp + 30 dB - Power_meter

12. Record the results under the Amplitude Accuracy Error column of Table 22-6.

Table 22-6 Amplitude Accuracy Results (Option P08, P13, P26)

Nominal Source Amplitude (dBm)	Low-band Preamp	Res BW (kHz)	Span (kHz)	Measured Amplitude Meas_amp (dBm)	Power Meter Amplitude Power_meter (dBm)	Amplitude Accuracy Error (dB)	Test Limit (dB)
-13	ON	1	106				±1.30 dB

Frequency Response (Flatness)

Test Limits

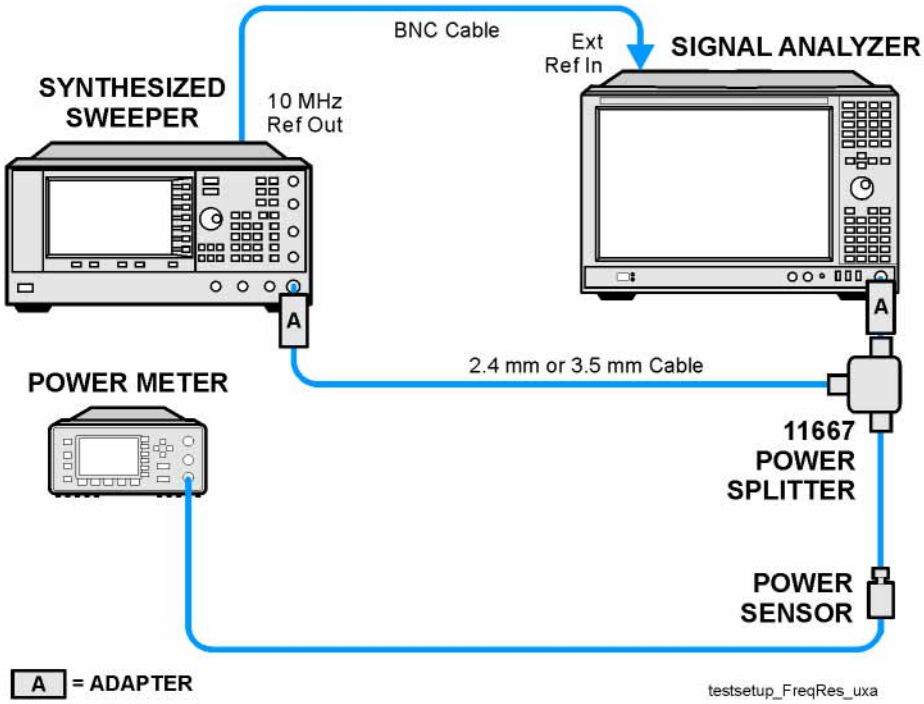
Frequency Range	Limit Relative to 50 MHz
20 Hz to 3.6 GHz	±1.5 dB
> 3.6 GHz to 8.4 GHz	±2.5 dB
> 8.4 GHz to 13.6 GHz	±3.0 dB
> 13.6 GHz to 26.5 GHz	±3.5 dB

The frequency response test measures the signal analyzer's amplitude error as a function of the tuned frequency. Measurements are made ranging from 50 MHz to the maximum frequency range of your analyzer. 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.

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, 3.5 mm, 1 meter (Opt 508, 513, 526)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1	11500E
Cables, BNC 120 cm	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Power Sensor (Opt 508, 513, 526)	Frequency Range: 50 MHz to 26.5 GHz	8485A
Power Splitter (Opt 508, 513, 526)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Synthesized Sweeper	Frequency Range: 50 MHz to 50 GHz[a]	PSG

a. Maximum frequency of the sweeper must be greater than or equal to maximum specified frequency of the UXA.

Figure 22-5 Frequency Response Test Setup



Procedure

1. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.
2. Configure the equipment as shown in Figure 22-5.

NOTE Connect the power splitter to the signal analyzer input using the appropriate adapter. Do not use a cable. An adapter will only be necessary if the UXA input connector is Type-N.

3. Assure the signal analyzer's built-in auto alignment has been performed within the last 24 hours.
4. Press **Mode**, **Spectrum Analyzer**, **Mode Preset** on the signal analyzer, and press **Preset** on the synthesized sweeper.
5. Set up the synthesized sweeper by pressing:

   CW, 50, **MHz**
   Power level, –4, **dBm**

6. Set up the signal analyzer by pressing:

   Input/Output, **More**, **Freq Ref In**, **External**
   FREQ Channel, Center Freq, 50, **MHz**
   SPAN X Scale, Span, 50, **kHz**
   AMPTD Y Scale, Ref Level, 0, **dBm**

7. Adjust the synthesized sweeper output power for a power meter reading of –10 dBm ±0.1 dB.
8. On the signal analyzer, press **Single**.
9. Press the **Peak Search** key on the signal analyzer to position the marker on the peak of the signal.
10. Refer to Table 22-7, "Frequency Response (Flatness) Results." Enter the amplitude of the signal displayed on the signal analyzer into the $Meas_{Amp}$ column of Table 22-7.
11. Enter the power meter reading into the $Power_{Meter}$ column of Table 22-7.
12. Tune the synthesized sweeper and signal analyzer to the next frequency listed in Table 22-7.
13. Enter the power sensor calibration factor into the power meter.
14. For frequencies 3.6 GHz and above, press **AMPTD Y Scale**, then **Presel Center** to center the preselector filter for an optimum amplitude measurement.
15. Repeat step 7 through step 14 and complete the remainder of Table 22-7 for the frequency range of your analyzer.
16. Compute the measurement error ($Meas_{Error} = Meas_{Amp} - Power_{Meter}$).
17. Compute the flatness error normalized to 50 MHz:
    ($Meas_{Error}$ - $Meas_{Error}$ @ 50 MHz)
18. Enter the computed flatness error value into the $Flat_{Norm}$ column of Table 22-7.
19. Compare the value of $Flat_{Norm}$ to the test limit.

Table 22-7 Frequency Response (Flatness) Results

Center Frequency	Analyzer Amplitude $Meas_{amp}$	Power Meter Measurement $Power_{meter}$	Meas Error $Meas_{error}$	Flatness Normalized to 50 MHz $Flat_{Norm}$	Flatness Error Test Limits (dB)
50 MHz				0	Ref
1 GHz					±1.5 dB
2 GHz					1.5 dB
3 GHz					±1.5 dB
3.5 GHz					±1.5 dB
4 GHz					±2.5 dB
6 GHz					±2.5 dB
8 GHz					±2.5 dB
9 GHz					±3.0 dB
11 GHz					±3.0 dB
13 GHz					±3.0 dB
14 GHz					±3.5 dB
17 GHz					±3.5 dB
20 GHz					±3.5 dB
23 GHz					±3.5 dB
26 GHz					±3.5 dB

Frequency Response (Flatness), Preamp On

Test Limits

Frequency Range	Limit Relative to 50 MHz
100 kHz to 3.6 GHz	±2.0 dB
> 3.6 GHz to 8.4 GHz	±3.0 dB
> 8.4 GHz to 13.6 GHz	±3.5 dB
> 13.6 GHz to 26.5 GHz	±4.0 dB

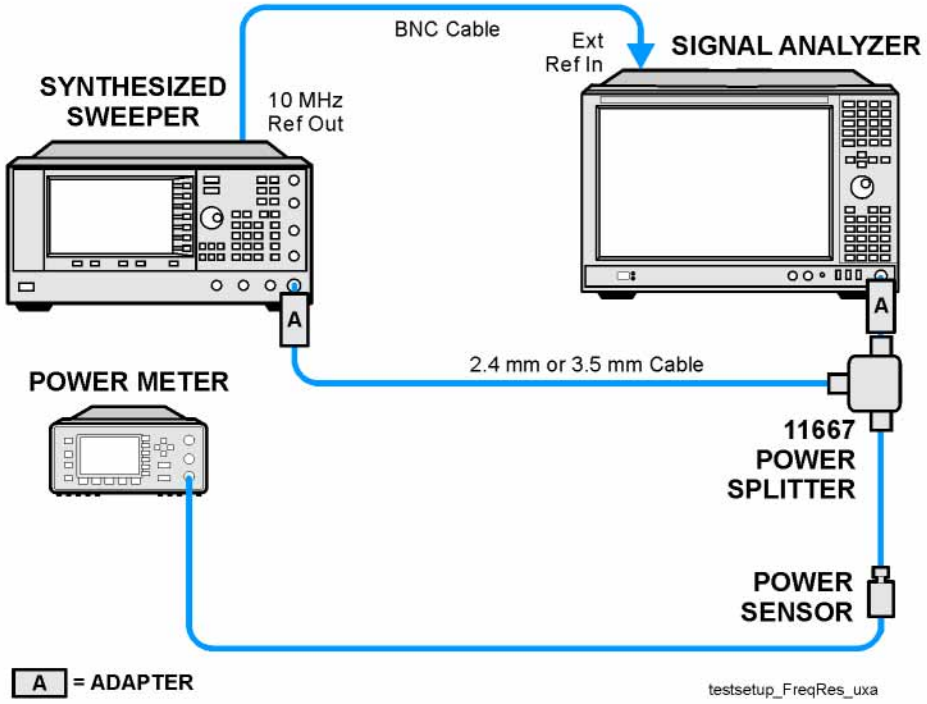
The frequency response test, with preamplifier on, measures the signal analyzer's amplitude error as a function of the tuned frequency. Measurements are made ranging from 50 MHz to the maximum frequency range of the preamp. The signal source amplitude is measured with a power meter to eliminate error due to source flatness. The measured value is normalized to 50 MHz.

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, 3.5 mm, 1 meter (Opt P08, P13, P26)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1	11500E
Cable, 2.4 mm, 1 meter (Opt P43, P44, P50)	Frequency: 10 MHz to 50 GHz VSWR: < 1.55:1	8120-6164
Cables, BNC 120 cm	Frequency: 10 MHz	10503A
Power Meter	Compatible with power sensor	E4418B
Attenuator, 30 dB Fixed	Frequency: 50 MHz Accuracy: ±0.05 dB	11708A
Power Sensor (Opt P08, P13, P13)	Frequency Range: 50 MHz to 26.5 GHz Amplitude Range: –65 dBm to –55 dBm	8485D

Item	Critical Specifications (for this test)	Recommended Keysight Model
Power Sensor (Opt P43, P44, P50)	Frequency Range: 50 MHz to 50 GHz Amplitude Range: –65 dBm to –55 dBm	8487D
Power Splitter (Opt P08, P13, P13)	Frequency Range: 50 MHz to 26.5 GHz Tracking between ports: < 0.25 dB	11667B
Power Splitter (Opt P43, P44, P50)	Frequency Range: 50 MHz to 50 GHz Tracking between ports: < 0.40 dB	11667C
Synthesized Sweeper	Frequency Range: 50 MHz to 50 GHz[a]	PSG

a. Maximum frequency of the sweeper must be equal to or greater than the maximum frequency of the preamplifier option.

Figure 22-6 Frequency Response Test Setup



Procedure

1. Zero and calibrate the power meter and power sensor as described in the power meter operation manual.
2. Configure the equipment as shown in Figure 22-5.

NOTE Connect the power splitter to the signal analyzer input using the appropriate adapter. Do not use a cable. An adapter will only be necessary if the UXA input connector is Type-N.

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3. Assure the signal analyzer's built-in auto alignment has been performed within the last 24 hours.
4. Press **Mode**, **Spectrum Analyzer**, **Mode Preset** on the signal analyzer, and press **Preset** on the synthesized sweeper.
5. Set up the synthesized sweeper by pressing:

   CW, 50, **MHz**
   Power level, –54, **dBm**

6. Set up the signal analyzer by pressing:

   Input/Output, **More**, **Freq Ref In**, **External**
   FREQ Channel, Center Freq, 50, **MHz**
   SPAN X Scale, Span, 50, **kHz**
   AMPTD Y Scale, **More**, **Internal Preamp Full Range**
   AMPTD Y Scale, **Attenuation**, **Mech Atten**, 0, **dB**
   AMPTD Y Scale, **Ref Level**, –55, **dBm**

7. Adjust the synthesized sweeper output power for a power meter reading of –60 dBm ±0.1 dB.
8. On the signal analyzer, press **Single**.
9. Press the **Peak Search** key on the signal analyzer to position the marker on the peak of the signal.
10. Refer to Table 22-7, "Frequency Response (Flatness) Results." Enter the amplitude of the signal displayed on the signal analyzer into the Meas_{Amp} column of Table 22-7.
11. Enter the power meter reading into the $\text{Power}_{\text{Meter}}$ column of Table 22-7.
12. Tune the synthesized sweeper and signal analyzer to the next frequency listed in Table 22-7.
13. Enter the power sensor calibration factor into the power meter.
14. For frequencies 3.6 GHz and above, press **AMPTD Y Scale**, then **Presel Center** to center the preselector filter for an optimum amplitude measurement.

15. Repeat step 7 through step 14 and complete the remainder of Table 22-7 for the frequency range of your preamp.
16. Compute the measurement error ($Meas_{Error}$ = $Meas_{Amp}$ - $Power_{Meter}$).
17. Compute the flatness error normalized to 50 MHz: ($Meas_{Error}$ - $Meas_{Error}$ @ 50 MHz)
18. Enter the computed flatness error value into the $Flat_{Norm}$ column of Table 22-7.
19. Compare the value of $Flat_{Norm}$ to the test limit.

Table 22-8 Frequency Response (Flatness) Results

Center Frequency	Analyzer Amplitude $Meas_{amp}$	Power Meter Measurement $Power_{meter}$	Meas Error $Meas_{error}$	Flatness Normalized to 50 MHz $Flat_{Norm}$	Flatness Error Test Limits (dB)
50 MHz				0	Ref
1 GHz					±2.0 dB
2 GHz					±2.0 dB
3 GHz					±2.0 dB
3.5 GHz					±2.0 dB
4 GHz					±3.0 dB
6 GHz					±3.0 dB
8 GHz					±3.0 dB
9 GHz					±3.5 dB
11 GHz					±3.5 dB
13 GHz					±3.5 dB
14 GHz					±4.0 dB
17 GHz					±4.0 dB
20 GHz					±4.0 dB
23 GHz					±4.0 dB
26 GHz					±4.0 dB

Scale Fidelity

Test Limits

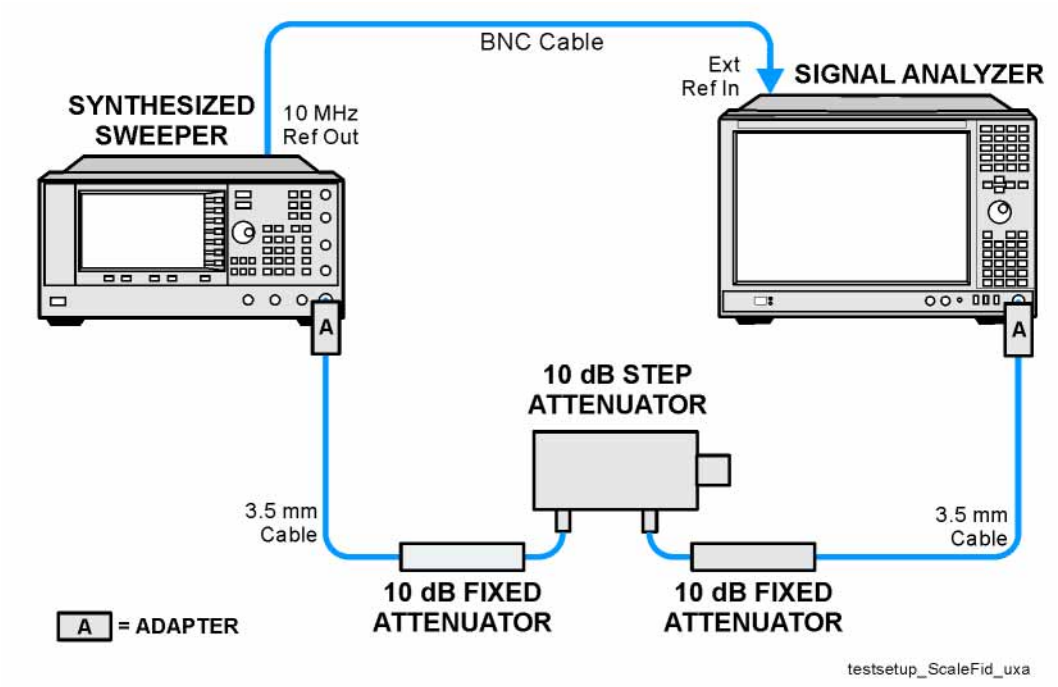
The scale fidelity error will be £ ±1.0 dB with £ -10 dBm at the mixer.

This test checks the scale fidelity of the instrument 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 instrument'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.

Item	Critical Specifications (for this test)	Recommended Keysight Model
Adapter Type-N (m) to 3.5 mm (f)	Frequency: 10 MHz to 18 GHz VSWR: < 1.1:1	1250-1745
Adapter 3.5 mm (f) to 3.5 mm (f)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.1:1	83059B
Attenuator, 10 dB Step	Range: 0-50 dB Frequency: 50 MHz Accuracy: ±0.25 dB	8495A
Attenuator, 10 dB fixed (2 required)	Frequency: 50 MHz VSWR: < 1.2:1	8493C, Option 010
Cable, 3.5 mm, 1 meter (2 required)	Frequency: 10 MHz to 26.5 GHz VSWR: < 1.4:1	11500E
Cable, BNC 120 cm	Frequency: 10 MHz	10503A
Synthesized Sweeper	Output Level Accuracy: 0 to –15 dBm: ±1.0 dB	PSG

Figure 22-7 Scale Fidelity Setup



NOTE Averaging is used for all measurements to improve repeatability and reduce measurement uncertainty.

Procedure

1. Configure the equipment as shown in Figure 22-7.
2. Preset the Source and press **Mode**, **Spectrum Analyzer**, **Mode Preset** on the analyzer.
3. Set up the synthesized sweeper by pressing:

   Frequency, 50, **MHz**
   Amplitude, +5, **dBm**
   RF On/Off, On

4. Set up the signal analyzer by pressing:

   Input/Output, **More**, **Freq Ref In**, **External**
   FREQ Channel, Center Freq, 50, **MHz**
   SPAN X Scale, Span, **1, MHz**
   AMPTD Y Scale, Ref Level, 0, **dBm**
   Meas Setup, Average/Hold Number, 10, **Enter**
   Trace/Detector, Trace Average
   Peak Search

5. Set the external 10 dB step attenuator to 0 dB.
6. Adjust the amplitude on the signal source until the marker amplitude on the analyzer reads –15 dBm ± 0.2 dB.
7. On the analyzer, press the **Single**, **Restart** to trigger a 10 sweep average.
8. On the analyzer, activate the Marker Delta function by pressing **Peak Search**, **Marker Delta**.
9. Perform the following steps for each attenuator setting listed in the table below:
    a. Select the next External attenuator setting.
    b. Press the **Restart** key to trigger a 10 sweep average.
    c. Enter the delta marker value into Table 22-9.
    d. Check delta marker reading against the test limits.

Table 22-9 Scale Fidelity Results

External Attenuator Setting	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

23 Instrument Software and FPGAs

What You Will Find in This Chapter

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- Software Licensing on page 638
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- Updating FPGA Code on page 640

Overview

There is a wide variety of software types and applications installed in one of these instruments as it leaves the factory. These include:

- Operating System
- Instrument Application Software
- Application Services
- License Manager Software
- Measurement Assembly FPGA Software

Keeping all of these in sync with each other is a large ongoing effort by the software development teams. In order to accomplish this, the instrument application software update package includes all of the applicable software updates needed by the instrument. However, when an instrument repair is performed there are actions that might need to be taken to make sure that all the software in the instrument remains in sync and compatible with the instrument hardware. The following two sections in this chapter will deal with any considerations that might come with an instrument repair.

NOTE

Whenever an instrument assembly is replaced, see Chapter 21 “Post-Repair Procedures” Perform all the tasks recommended for that assembly replacement.

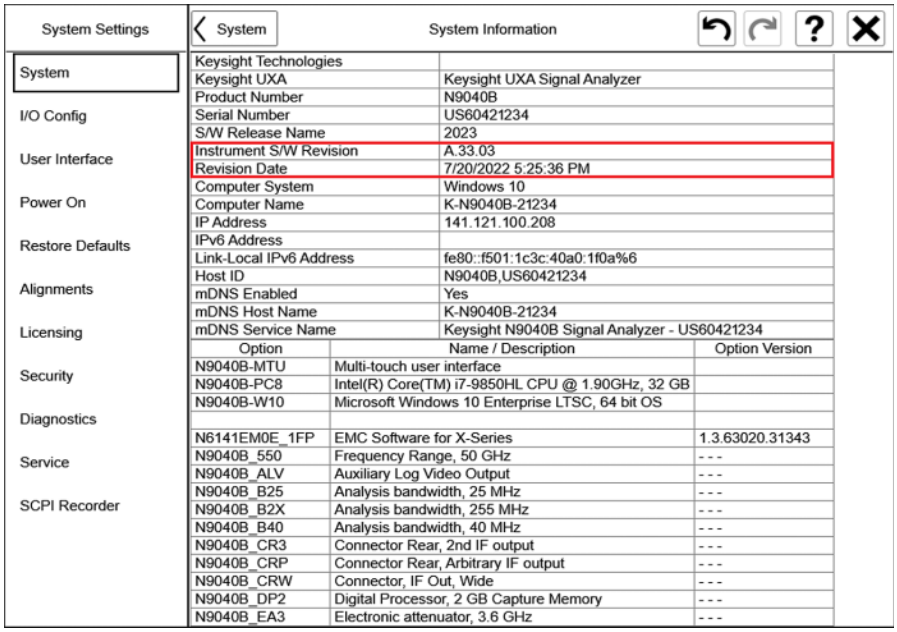
Instrument Software

Overview

The instrument software installed in every instrument contains not only the spectrum analyzer measurement application, but also all 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**, as seen in Figure 23-1.

Figure 23-1 System Information - Instrument S/W Revision



Keysight Technologies	
Keysight UXA	Keysight UXA Signal Analyzer
Product Number	N9040B
Serial Number	US60421234
S/W Release Name	2023
Instrument S/W Revision	A.33.03
Revision Date	7/20/2022 5:25:36 PM
Computer System	Windows 10
Computer Name	K-N9040B-21234
IP Address	141.121.100.208
IPv6 Address	
Link-Local IPv6 Address	fe80::f501:1c3c:40a0:1f0a%6
Host ID	N9040B,US60421234
mDNS Enabled	Yes
mDNS Host Name	K-N9040B-21234
mDNS Service Name	Keysight N9040B Signal Analyzer - US60421234

Option	Name / Description	Option Version
N9040B-MTU	Multi-touch user interface	
N9040B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB	
N9040B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS	
N6141EM0E_1FP	EMC Software for X-Series	1.3.63020.31343
N9040B_550	Frequency Range, 50 GHz	- - -
N9040B_ALV	Auxiliary Log Video Output	- - -
N9040B_B25	Analysis bandwidth, 25 MHz	- - -
N9040B_B2X	Analysis bandwidth, 255 MHz	- - -
N9040B_B40	Analysis bandwidth, 40 MHz	- - -
N9040B_CR3	Connector Rear, 2nd IF output	- - -
N9040B_CRP	Connector Rear, Arbitrary IF output	- - -
N9040B_CRW	Connector, IF Out, Wide	- - -
N9040B_DP2	Digital Processor, 2 GB Capture Memory	- - -
N9040B_EA3	Electronic attenuator, 3.6 GHz	- - -

Since the instrument application software is distributed in one complete package, when an update is installed, everything is 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. However, there are exceptions to this, one of them being the 89600 VSA software. While the latest revision of the 89600 VSA software is installed in each instrument as it left the factory, it must be updated, and kept in sync with the rest of the instrument application software independently.

Updating Instrument Application Software

When an instrument is repaired by replacing an assembly it is always advised that the instrument software be updated to the latest version available to be sure that everything is compatible and up to date. Even if an instrument already has the latest version of the software installed it is often beneficial to reinstall the same version to make sure that the replaced assembly has the correct FPGA code and/or driver.

To determine what the latest version of software for the instrument is, as well as to download the installer and installation instructions, go to the following web location:

https://www.keysight.com/find/uxa_software

Software Licensing

All application software needs to have a valid license in order to be available for use. This also includes the spectrum analyzer and IQ analyzer applications (N9060ES1E).

89600 VSA Software

Updates for the 89600 VSA software can be downloaded from:

https://www.keysight.com/find/vsa_software

The revision of the 89600 VSA software must be compatible with the revision of the instrument measurement application software package that is installed in the instrument. To determine what revisions are compatible, and if an update is required, see the software compatibility information on the instrument application software download web page listed above.

FPGAs

Overview

There is FPGA (Field-Programmable Gate Array) program code on many of the assemblies inside 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 whenever 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. This is normally achieved by installing the latest version of the instrument software, which will also update any FPGAs that need to be updated. The following is a list of all the instrument assemblies that have FPGA code that can be programmed when a software update is performed:

- A3 40 MHz Digital IF
- A14 DDS LO Synthesizer
- A14A1 DDS LO Reference
- A15 Front End Controller
- A16 Reference
- A16A1 Reference Daughter
- A21 Wideband Analog IF
- A22 Wideband Digital IF

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 FPGA Code

All instruments have a utility included in them that will update the FPGA code on all 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.

CAUTION

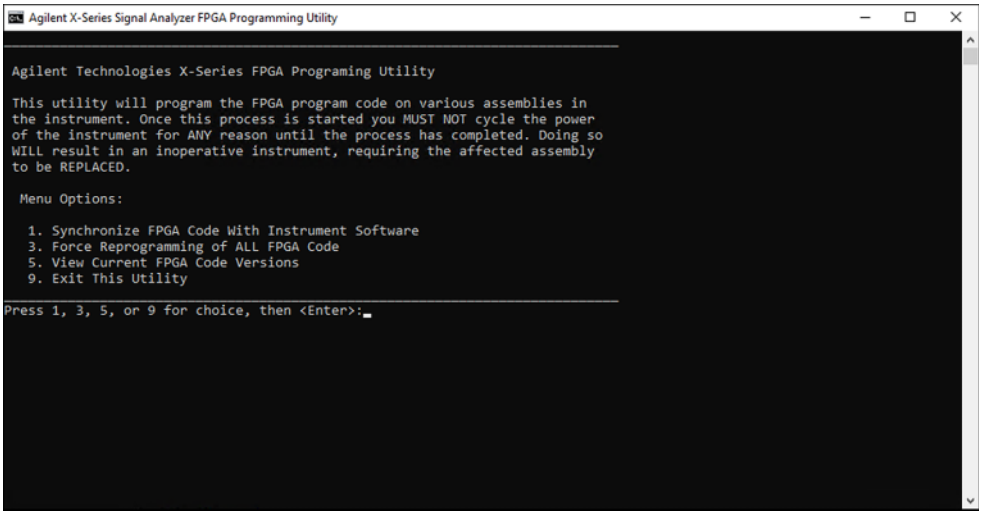
Once the FPGA programming process has started it MUST NOT be interrupted for any reason. This would include turning the instrument off or unplugging the power cord to the instrument. Doing so will result in an inoperative instrument, requiring the affected assembly to be replaced.

Use the following procedure to update the FPGA code in the instrument to match what is required by the currently installed software version.

1. Close the instrument application software by pressing System, Exit Program, OK.
2. Connect a USB mouse to one of the instrument front panel USB ports.
3. Use file explorer window to 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 23-2 will appear.

Figure 23-2 FPGA Programming Utility



6. To program the FPGAs, 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 FPGAs 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 be completed.

24 Performance Verification and Adjustment Software

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 644

Performance Verification Tests on page 644

Adjustments on page 644

Utilities on page 644

Required Test Equipment on page 644

Overview

This instrument can be fully tested and adjusted with the use of the N7814A X-Series Calibration Application software that's runs on the N7800B Enterprise Test Management System (ETMS).

N7814A Calibration Application Help for X-Series Signal Analyzers

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. Performance tests are designed to test an instrument operating within the operational temperature range defined by the instrument specifications.

Complete List of Performance Verification Tests

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.

Complete List of Instrument Adjustments

Utilities

Utilities are tasks that might need to be performed when certain assemblies are replaced.

Complete List of Instrument Utilities

Required Test Equipment

To perform all the instrument adjustments and performance verification testing a long list of required test equipment and accessories will be needed. A complete list of the equipment specified by the N7814A software can be found in the web help for the software.

Complete List of Required Test Equipment

This information is subject to change without notice.
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