
PXA Signal Analyzer

PXA Signal Analyzer N9032B

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

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

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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 PXA Signal Analyzer Overview on page 18

Instrument Option Descriptions on page 19

Before You Start Troubleshooting on page 21

ESD Information on page 22

Service Equipment You Will Need on page 26

Contacting Keysight Technologies on page 29

How to Return Your Instrument for Service on page 30

Keysight PXA Signal Analyzer Overview

The Keysight PXA 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 PXA 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 PXA 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 user 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 PXA 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 user's responsibility to install anti-virus software.

Instrument Option Descriptions

The PXA has a variety of hardware and measurement application options. Several of these options are “standard” so they are automatically installed on all PXA 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 PXA signal analyzer.

Table 1-1 Available Instrument Options

Option	Description	Notes
508	2 Hz to 8.4 GHz	
513	2 Hz to 13.6 GHz	
526	2 Hz to 26.5 GHz	
544	2 Hz to 44 GHz	
550	2 Hz to 50 GHz	
555	2 Hz to 55 GHz	
ALV	Auxiliary Log Video Output	
B25	Analysis Bandwidth, 25 MHz	Standard
B2X	Analysis Bandwidth, 225 MHz	Standard
B40	Analysis Bandwidth, 40 MHz	Standard
C35	3.5 mm Input Connector	Requires Option 526
CR3	Second IF Output	
CRP	Programmable IF Output	
CRW	Wideband IF Output	
DP2	Digital Processing 2 GB Capture Memory	Standard
EA3	Electronic Attenuator, 3.6 GHz	
EP0	Enhanced Performance DDS LO	Standard
ESC	External Source Control	
EXM	External Mixing	
FBP	Full Bypass Path	Requires Option LNP
FS1	Fast Sweep Capability	Standard

Table 1-1 Available Instrument Options

Option	Description	Notes
FS2	Enhanced Fast Sweep Speed	Standard
FSA	2 dB Step Attenuator	Standard
LFE	Low Frequency Enabled	Standard
LNA	Low Noise Preamplifier	Included with all Pxx Preamp Options
LNP	Low Noise Path	
MPB	Microwave Preselector Bypass	Standard
NF2	Noise Floor Extension	Standard
NUL	IM Nulling	Standard
P08	Preamp, 8.4 GHz	Requires Option 508
P13	Preamp, 13.6 GHz	Requires Option 513
P26	Preamp, 26.5 GHz	Requires Option 526
P44	Preamp, 44 GHz	Requires Option 544
P4L	Preamp, 44 GHz, Basic ^a	Requires Option 544
P50	Preamp, 50 GHz	Requires Option 550
P5L	Preamp, 50 GHz, Basic ^a	Requires Option 550
P55	Preamp, 55 GHz	Requires Option 555
P5N	Preamp, 55 GHz, Basic ^a	Requires Option 555
PFR	Precision Frequency Reference	Standard
R10	Analysis Bandwidth, 1 GHz	
R15	Analysis Bandwidth, 1.5 GHz	
R20	Analysis Bandwidth, 2 GHz	
RTL	Real Time Link	Standard
SF1	Security Features, Excluded Launching Programs	
SF2	Security Features, Prohibit Saving Results	
ST1	IQ Streaming, 1 GHz Bandwidth	
ST2	IQ Streaming, 2 GHz Bandwidth	Requires Option R20
WF1	Wideband Digital IF	Standard
YAV	Y-Axis Video Output	

a. Restricted export. LNA will not operate above 43.5 GHz when Full Range preamplifier is on.

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 auto-ranging 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.

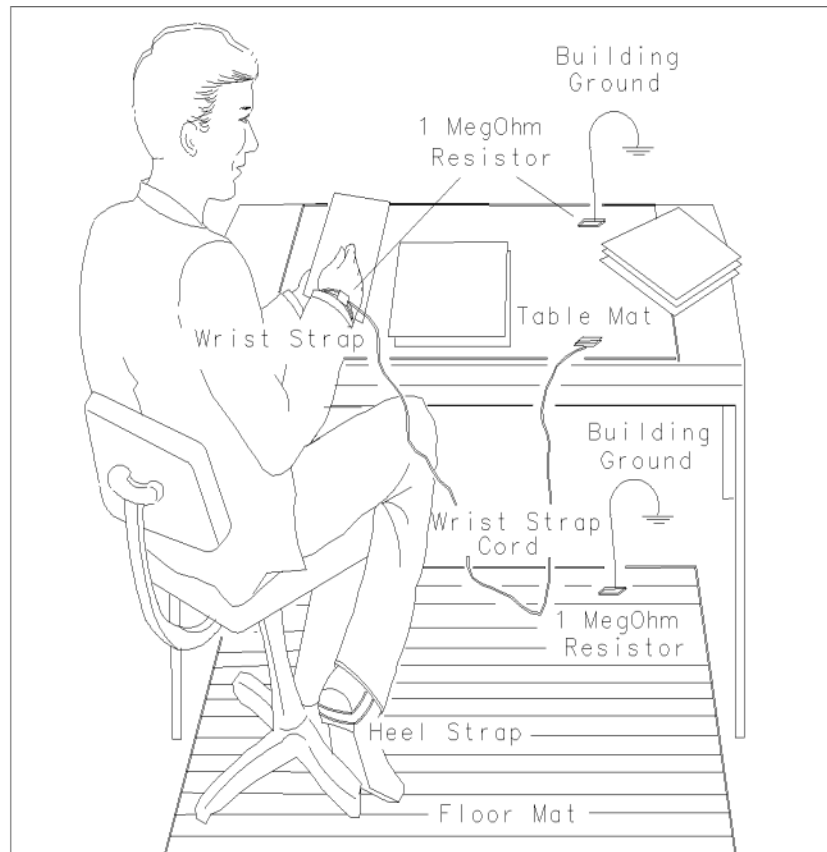
Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 megohm of isolation from ground.

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 30](#). 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 PXA Signal Analyzer. They include the following:

- Calibration Application Software
- USB Keyboard and Mouse
- USB Storage Device
- Test Equipment

Tools you will need

Figure 1-2 TORX Tool

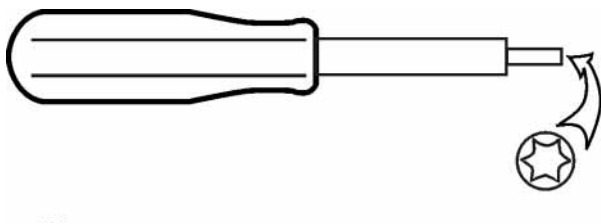


Table 1-2 Tools Required

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
Optical Cable Insertion Tool	N9041-20181
Socket, Claw Foot, 5/16 Inch, 1/4 Inch Square Drive	N5191-20299
Optical Data Interface Loop-Back	M8121-60004

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 MB.

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 N78111B Keysight Calibration Application Software. Refer to **Chapter 23, “Post-Repair Procedures,”** for a list of post-repair adjustments and performance tests based on which hardware has been changed.

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/n9032b_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. In any correspondence or telephone conversations, refer to the instrument by its model number (N9032B) and full serial number (ex. US60301234). 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>

How to Return Your Instrument for Service

Service Order Number

If an instrument is being returned to Keysight for servicing, refer to **“Contacting Keysight Technologies” on page 29** to find the nearest Keysight contact information. 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 31**.

Other Packaging

CAUTION

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

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

1. Protect the control panel with cardboard.
2. Wrap the instrument in antistatic plastic to reduce the possibility of damage caused by electrostatic discharge.
3. Use a strong shipping container. A double-walled, corrugated cardboard carton with 159 kg (350 lb) bursting strength is adequate. The carton must be both large enough and strong enough to accommodate the instrument. Allow at least 3 to 4 inches on all sides of the instrument for packing material.
4. Surround the equipment with three to four inches of packing material and prevent the equipment from moving in the carton. If packing foam is not available, the best alternative is S.D.-240 Air Cap™ from Sealed Air Corporation, Hayward, California, 94545.

Air Cap looks like a plastic sheet filled with 1-1/4 inch air bubbles. Use the pink-colored Air Cap to reduce static electricity. Wrapping the equipment several times in this material should both protect the equipment and prevent it from moving in the carton.
5. Seal the shipping container securely with strong nylon adhesive tape.
6. Mark the shipping container “FRAGILE, HANDLE WITH CARE” to assure careful handling.
7. Retain copies of all shipping papers.

Overview
How to Return Your Instrument for Service

2 Boot Up and Initialization

What You Will Find in This Chapter

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

The following sections are found in this chapter:

[Check the Basics on page 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](#)

[Instrument Does Not Turn On on page 39](#)

[Front Panel Power Switch Is Not Working on page 41](#)

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

[Green Power On LED Does Not Turn On on page 45](#)

[Fan\(s\) Are Not Operating on page 46](#)

[No Keysight Splash Screen Displayed on page 49](#)

[Instrument Hangs at the Keysight Splash Screen on page 51](#)

[Instrument Cannot Completely Load or Run the Operating System on page 52](#)

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

[Display Backlight Is Not Working on page 54](#)

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

[Signal Level Verification on page 59](#)

[Signal Level Problem with Input Frequencies < 3.6 GHz on page 59](#)

[Signal Level Problem with Input Frequencies > 3.6 GHz on page 60](#)

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 instrument **Datasheet** for specifications.
7. In order to meet specifications, the instrument must be aligned. Press **System, Alignments, Align Now, Align Now All**. The alignments should all pass. If the instrument displays a failure during these tests, refer to **“Fails an Internal Auto Alignment” on page 58**.
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 **Instrument S/W Revision**. For more information, refer to **Chapter 25, “Instrument Software and FPGAs.”**
9. Is the instrument displaying an error message? If so, refer to the **Instrument Messages** manual for more information.
10. If the necessary test equipment is available, perform the functional checks in **Chapter 24, “Functional Tests.”**

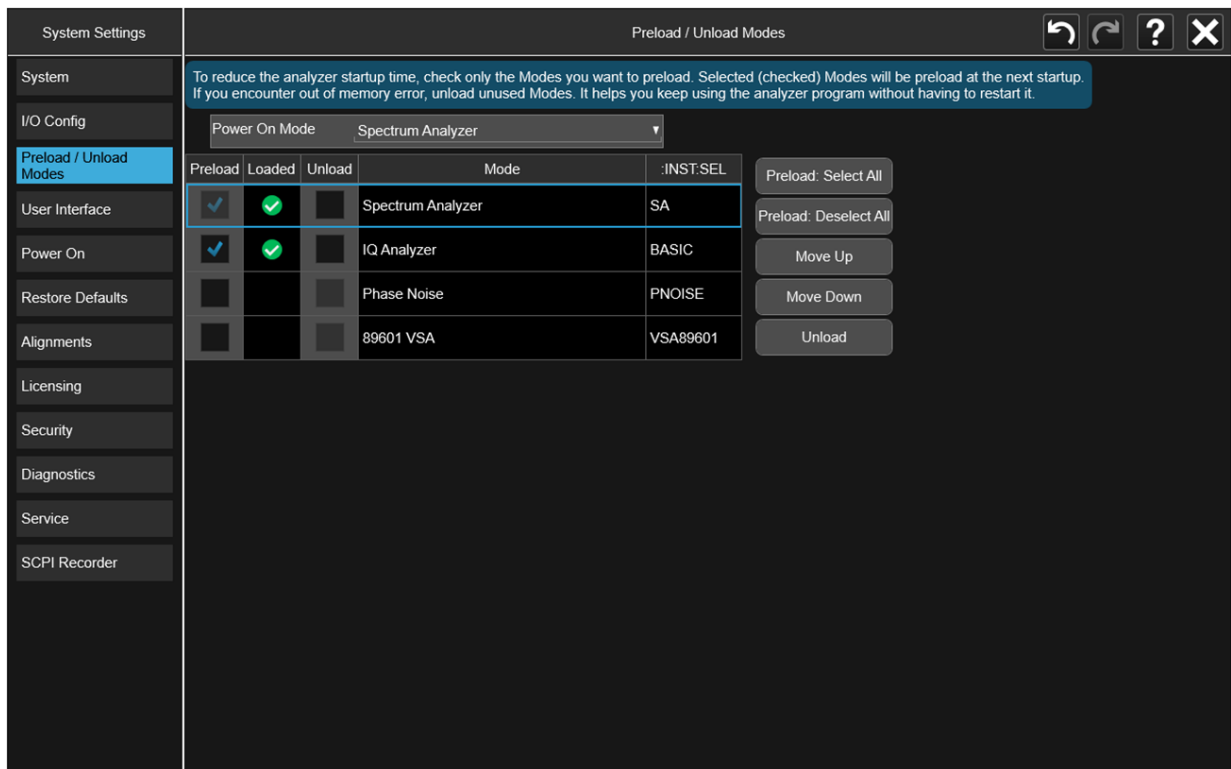
Instrument Boot Up Process

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 load 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 right-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 System Processor 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 16](#), “[System Processor and Disk Drive](#).” in this manual.

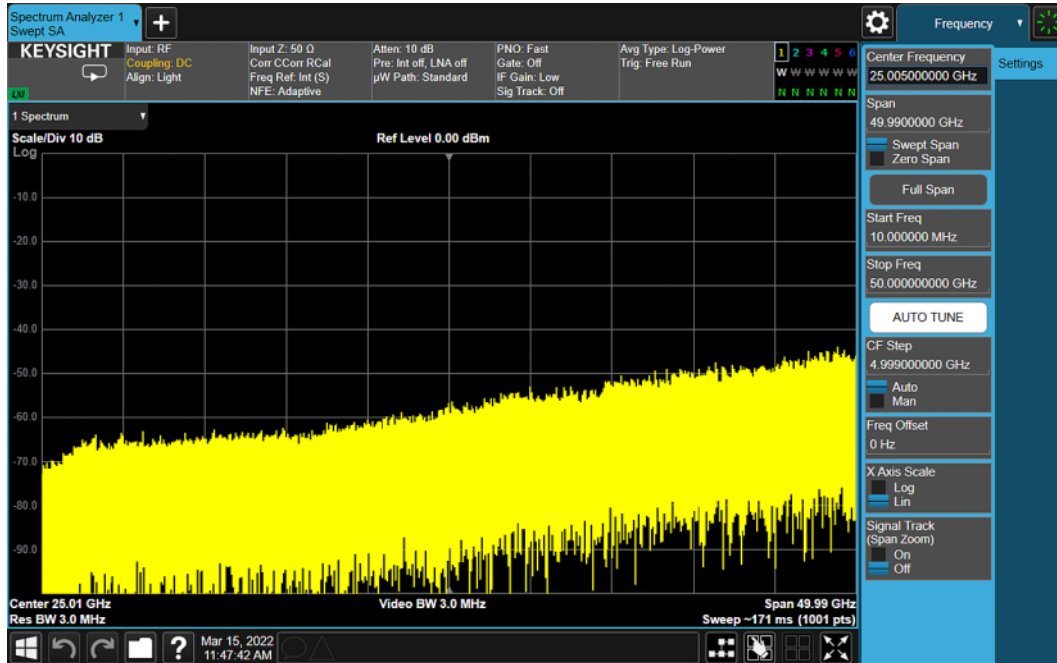
-
8. The operating system will then load and run. It will then proceed to display the desktop interface. This can take up to 4 minutes. If this does not occur refer to the “[Instrument Cannot Completely Load or Run the Operating System](#)” section in this chapter.
 9. By default, the initialization 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 Internal Auto Alignment](#)” section in this chapter.

11. Once the 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.

NOTE

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 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 the A8 Motherboard, then 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, top brace, and power supply bracket. Refer to **Chapter 22, "Assembly Replacement Procedures,"** in this manual.
3. Connect the AC power cord to the instrument, but do not try to turn it on, leave it in standby mode.
4. Momentarily short TP520 to ground 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.

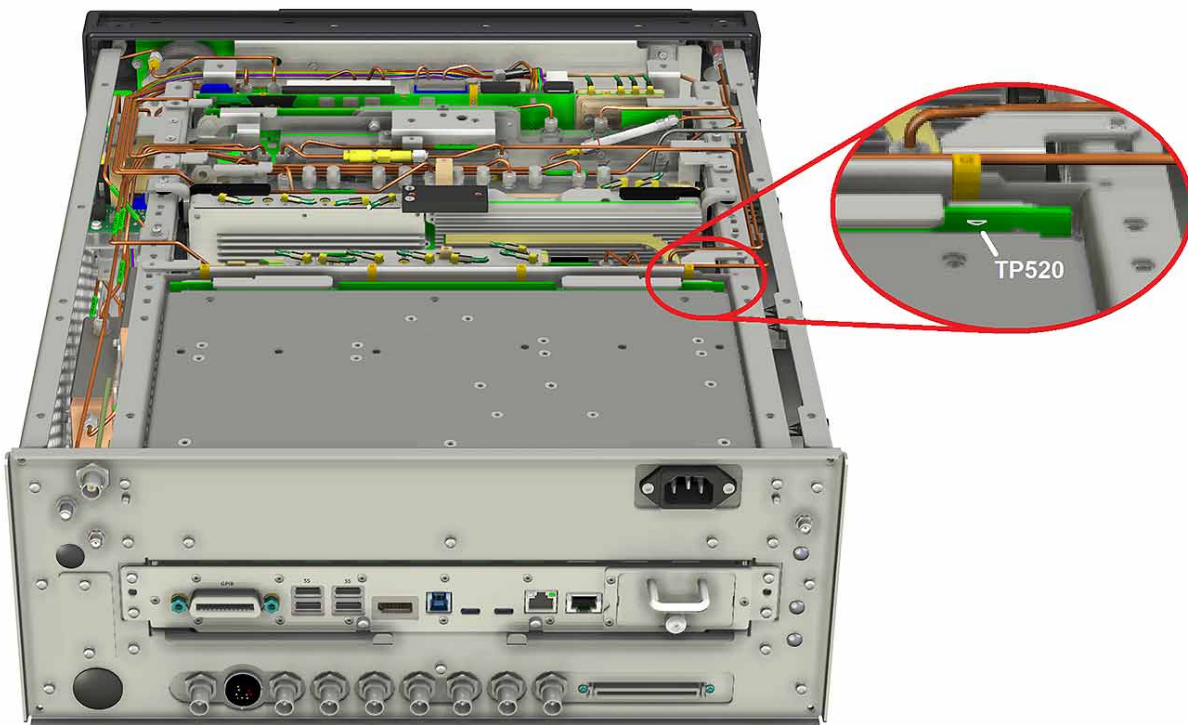
If no:

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 TP520 Location



5. Use a voltmeter to measure the DC voltage on TP520 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 TP520 on the A7 Midplane board is shorted to ground, and TP520 pulls down the same control line that the front panel power switch does, the problem must be in the connections between TP520 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 22, "Assembly Replacement Procedures,"](#) in this manual.
2. Referring to [Figure 2-4](#), remove W1 from J1 of the A1A2 Front Panel Controller board and measure the resistance from pin #68 of J1 to ground while holding down the front panel power switch.

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

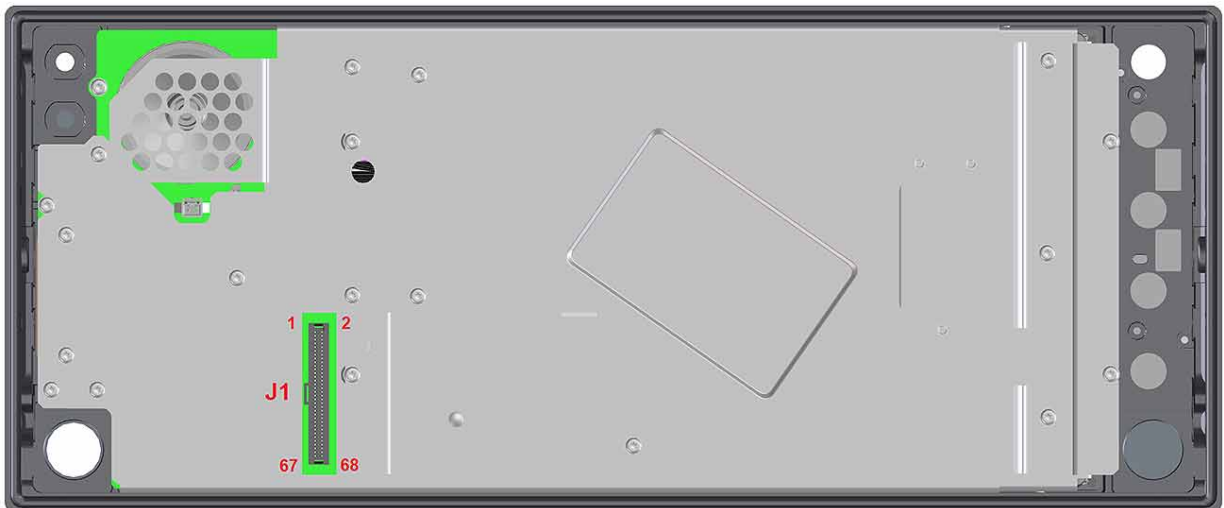
If yes:

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:

Replace the A1A2 Front Panel Controller.

Figure 2-4 A1 Front Panel Power Switch Troubleshooting



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, and the A8 Motherboard, 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 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 A1A2 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 22, "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?

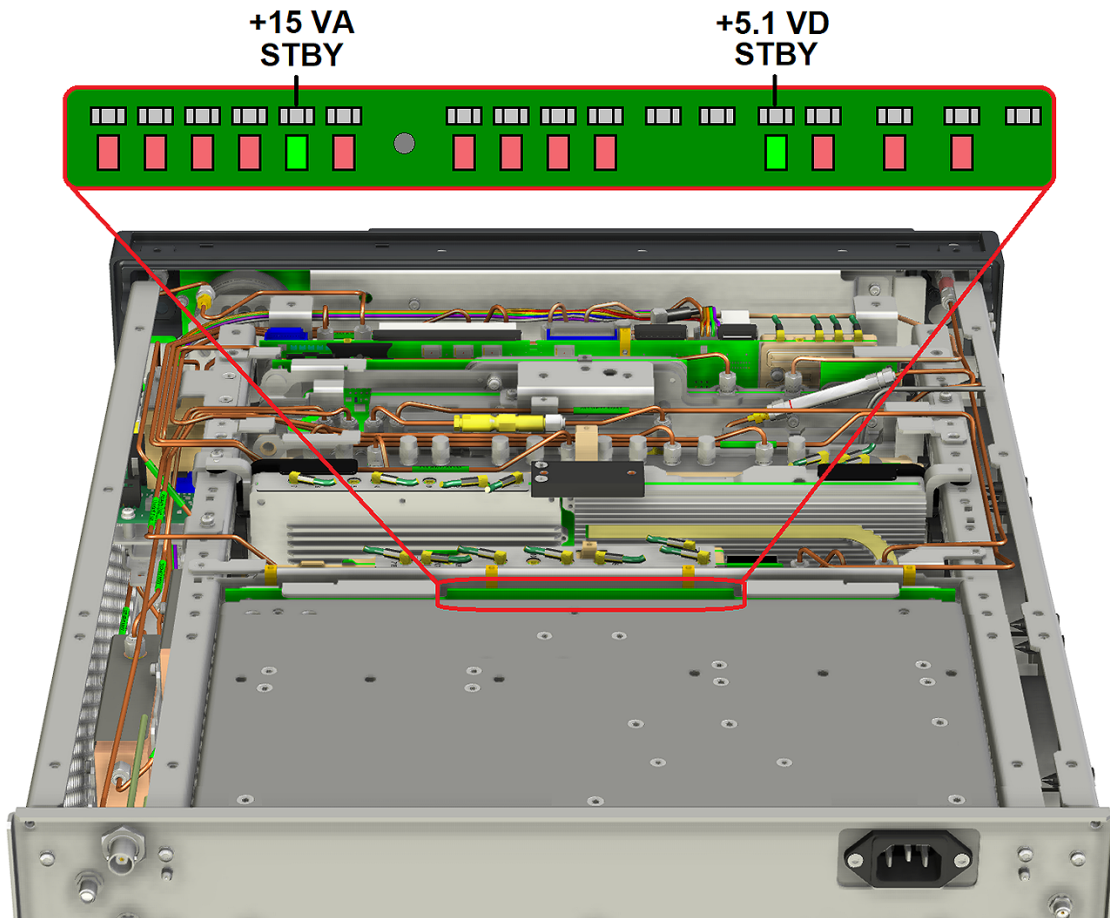
If yes:

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 the A1 Front Panel from the instrument along with W1 from J9 of the A8 Motherboard.
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 J9 of the A8 Motherboard to ground.

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

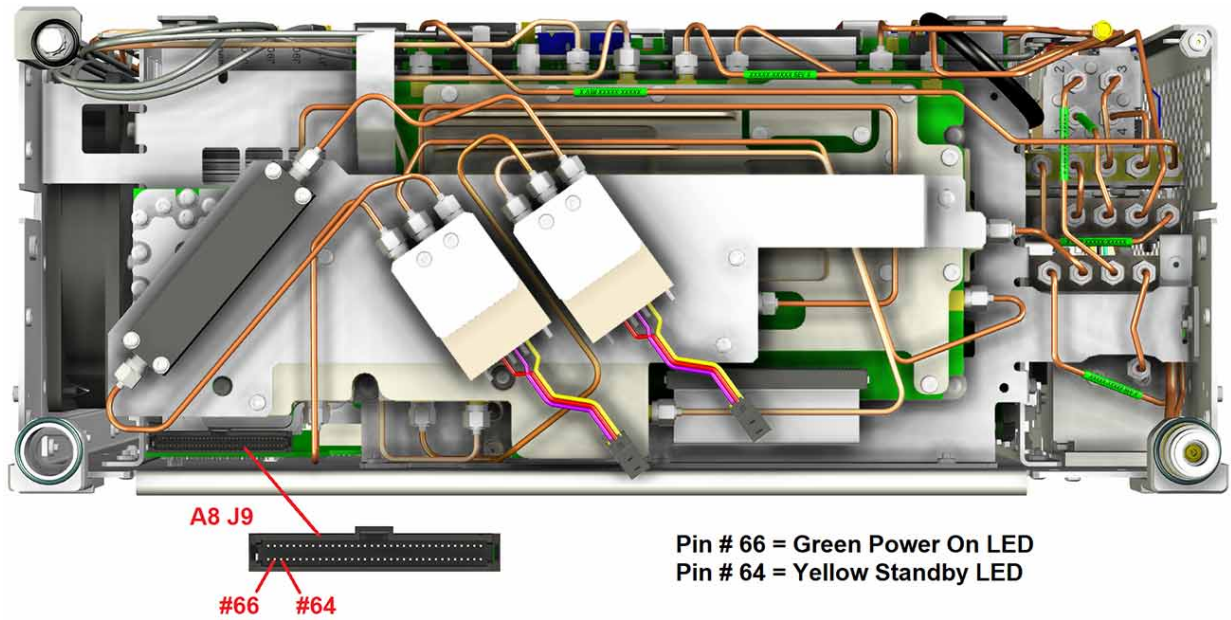
If yes:

Replace the A1A4 Keyboard.

If no:

Replace the A4 System Processor Assembly.

Figure 2-6 A8 Motherboard J9 Front Panel Power LED Control Lines



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, and the A8 Motherboard, 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 22, "Assembly Replacement Procedures,"** in this manual.
3. Referring to **Figure 2-6**, remove the A1 Front Panel from the instrument along with W1 from J9 of the A8 Motherboard.
4. Reconnect the AC power cord to the instrument and turn it back on by momentarily shorting TP520 on the A7 Midplane board to ground, as seen in **Figure 2-3**.
5. Referring to **Figure 2-6**, measure the DC voltage from pin #66 of J9 of the A8 Motherboard to ground.

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

If yes:

Replace the A1A4 Keyboard.

If no:

Replace the A4 System Processor Assembly.

Fan(s) Are Not Operating

All 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 procedures in this section assume 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.

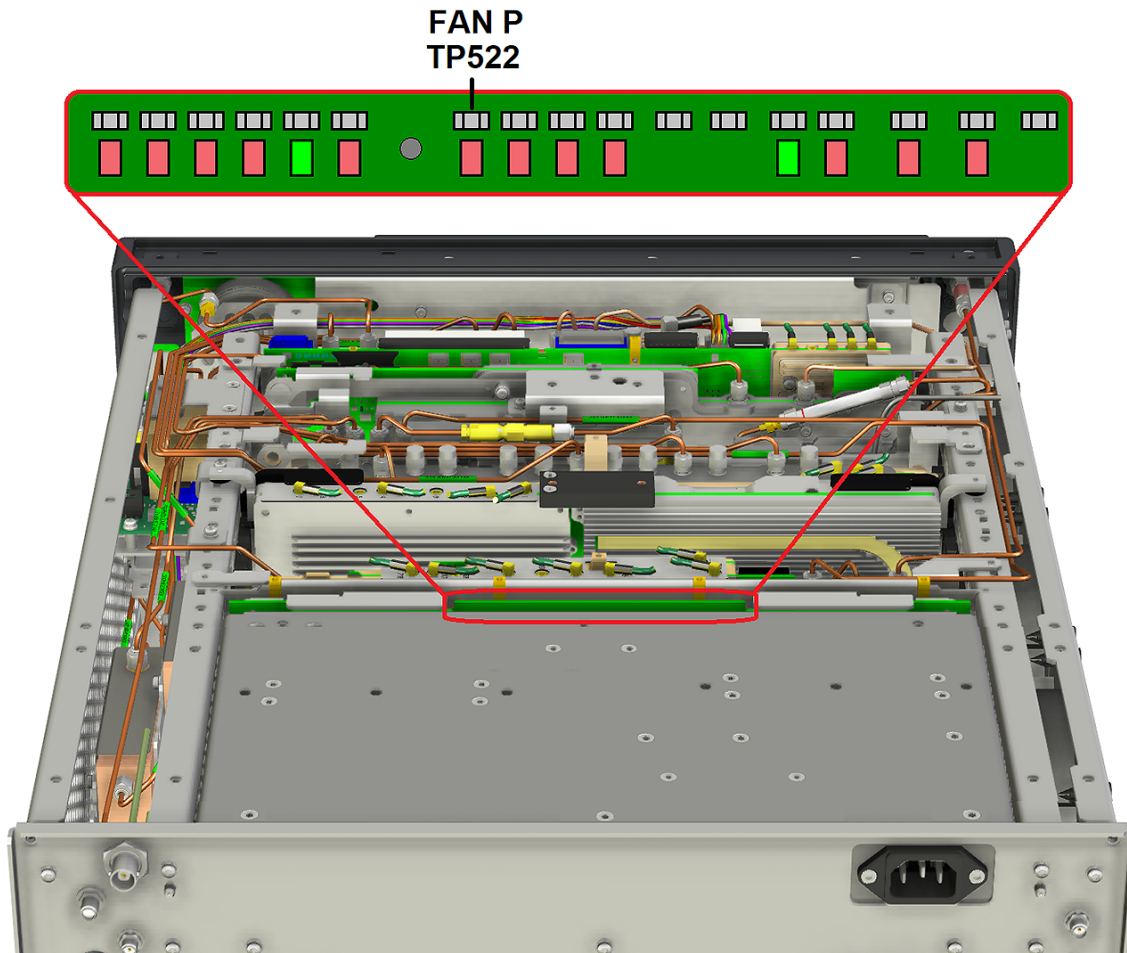
There is a temperature sensor on the A8 Motherboard that feeds information back to the A6 Power Supply, which regulates the speed of the cooling fans. When these fans do not come on it could be due to either one of these assemblies. This procedure will help to determine which one is the cause.

1. Remove the AC power cord and then remove the instrument cover. Refer to **Chapter 22, “Assembly Replacement Procedures,”** in this manual.
2. Plug the AC power cord back into the instrument and turn it on.
3. If any one of the fans is not spinning, verify that the FAN control voltage is correct by measuring the DC voltage at TP522 on the A7 Midplane board, as seen in **Figure 2-7**.

If the voltage at TP522 measures at least +7 VDC, proceed to next step.

If the voltage at TP522 does not measure at least +7 VDC, replace the A6 Power Supply assembly.

Figure 2-7 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 all of the fans are securely plugged into the A8 Motherboard 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 all of the fan wire harnesses from the A8 Motherboard.

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.

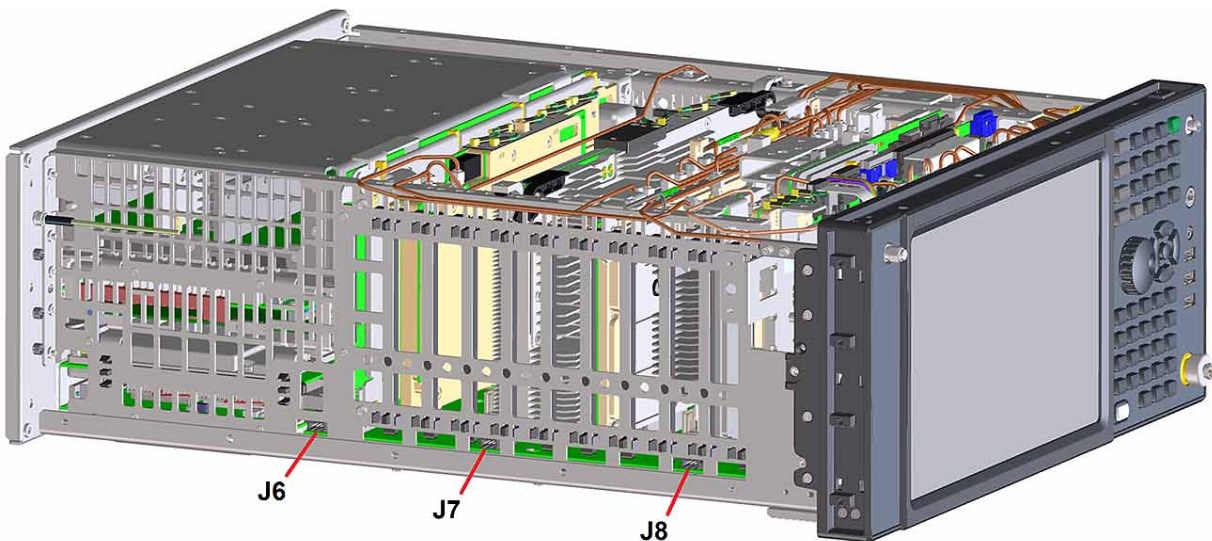
CAUTION

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 J6, J7, and J8 to chassis ground, as seen in [Figure 2-8](#). The DC voltage on pin #1 and pin #3 of all three connectors is expected to be approximately +8 VDC.

Figure 2-8 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.

If all the DC voltage measurements match the expected values, replace the fans that are not working.

If all the DC voltage measurements do not match the expected values, replace the A8 Motherboard.

No Keysight Splash Screen Displayed

(Black background with white “Keysight Technologies” text)

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

This procedure assumes that the 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 22, “Assembly Replacement Procedures,”** in this manual.
3. Reconnect the AC power cord and turn the instrument on.
4. Referring to **Figure 2-9** verify that all the red power supply fault LEDs along the top of the A7 Midplane board are off, and all the green power supply on LEDs 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 17** of this manual.

Are all the power supply LEDs in the correct state?

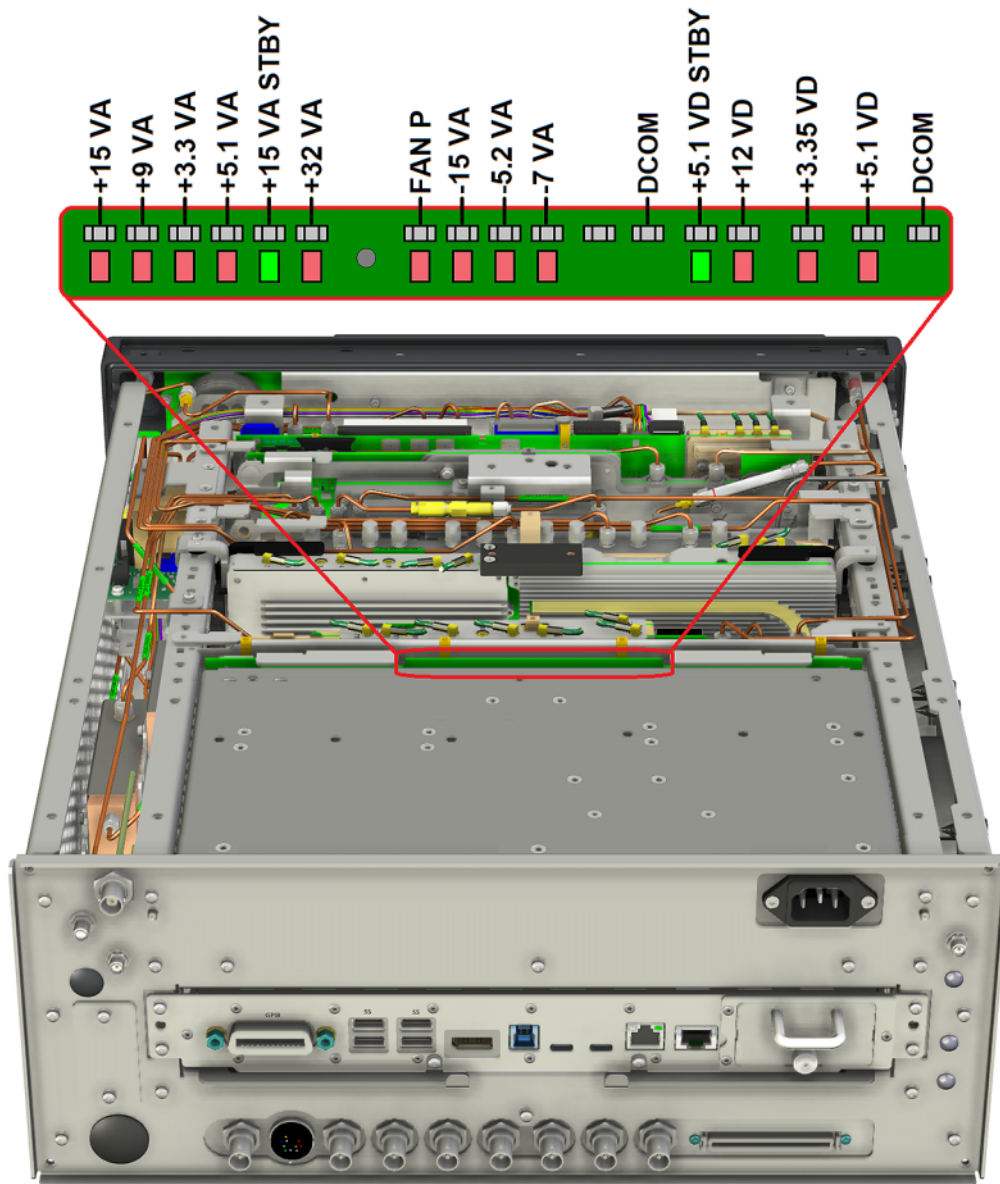
If yes:

Replace the A4 System Processor assembly.

If no:

Replace the A6 Power Supply assembly.

Figure 2-9 A7 Midplane Board Power Supply LEDs



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 the instrument cover. Refer to **Chapter 22, “Assembly Replacement Procedures”, on page 621** in this manual.
2. Reconnect the AC power cord and turn the instrument on.
3. Referring to **Figure 2-9** verify that all the red power supply fault LEDs along the top of the A7 Midplane board are off, and all the green power supply on LEDs 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 17** of this manual.

Are all the power supply LEDs in the correct state?

If yes:

Replace the A4 System Processor assembly.

If no:

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 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. Power on the instrument and attempt to run the “Instrument Image Recovery System”. See the **“Instrument Image Recovery System” on page 500**.

If the “Instrument Image Recovery System” does not correct the issue, 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 A8 Motherboard

A8 Motherboard to the A1A2 Front Panel Controller board via ribbon cable W1

A1A2 Front Panel Controller board to A1A4 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.

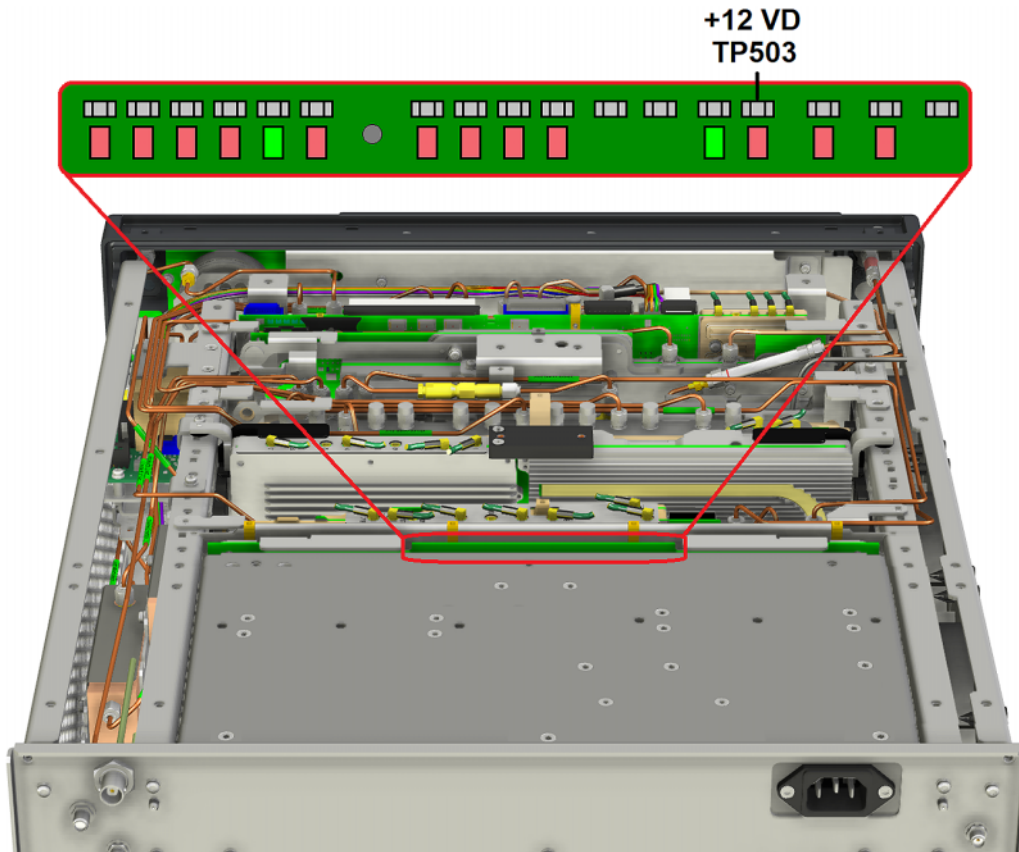
There are two user backlight controls on the **System, User Interface** menu. They are enable and intensity. If the user has set the enable to off or the intensity to such a low value that the display cannot be seen, when the instrument power is cycled the backlight will be automatically enabled and the intensity will return to a normal level. So if the backlight is not on, it should not be due to either of these settings once the instrument power has been cycled.

1. Remove the AC power cord, the instrument cover, the top brace, and the power supply bracket. Refer to **Chapter 22, "Assembly Replacement Procedures", on page 621** in this manual.
2. Reconnect the AC power cord and turn the instrument on.
3. Referring to **Figure 2-10**, use a DC voltmeter to measure the voltage at TP503 on the A7 Midplane board.

If the DC voltage measures at least +11 volts, proceed to the next step.

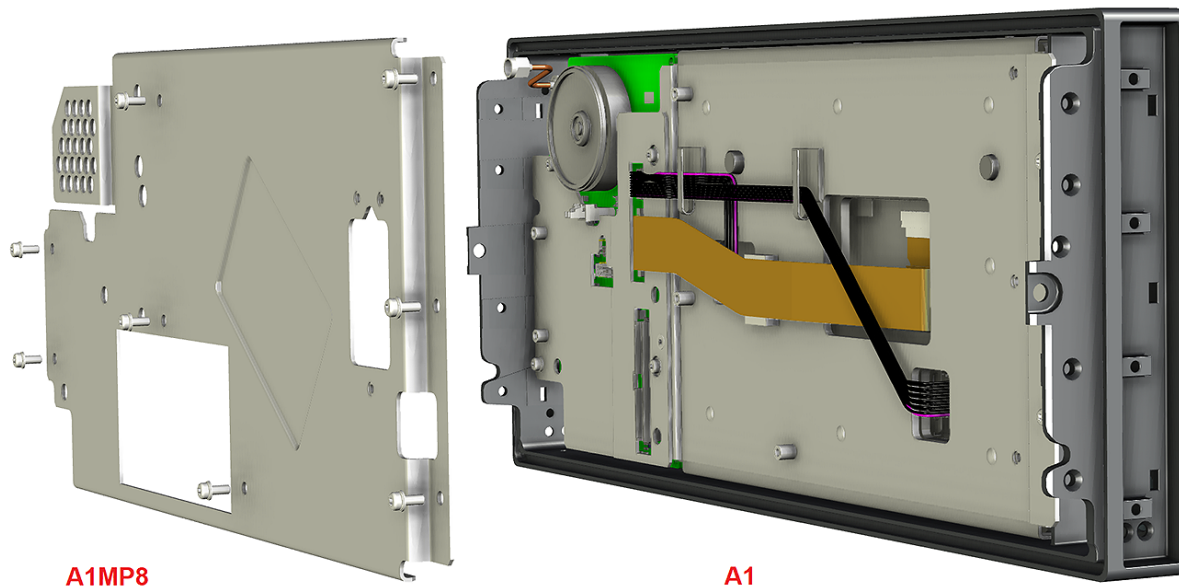
If the DC voltage does not measure at least +11 volts, replace the A6 Power Supply.

Figure 2-10 Backlight Power Supply



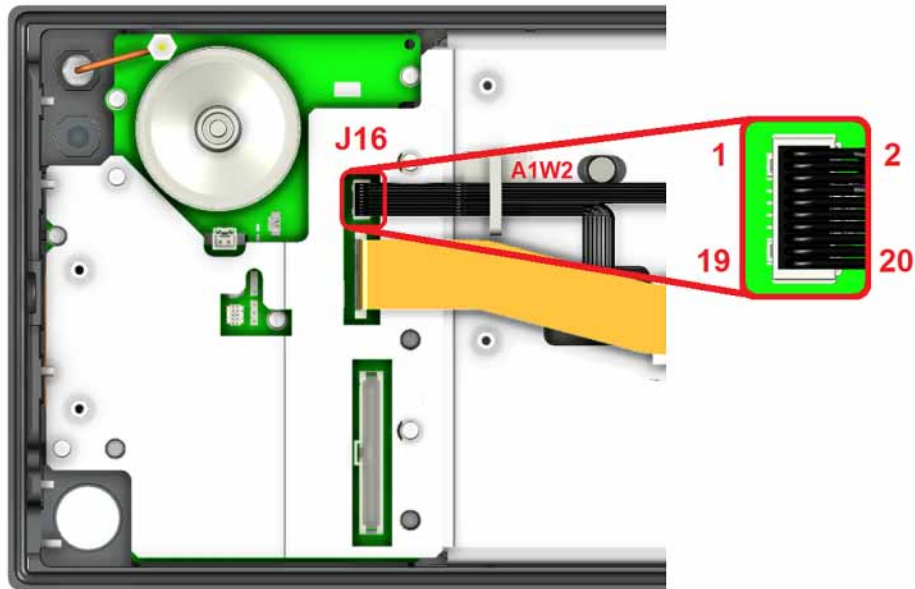
4. Remove the A1 Front Panel assembly along with the connecting ribbon cables. Refer to [Chapter 22, "Assembly Replacement Procedures"](#), on [page 621](#) in this manual.
5. Remove the A1MP8 Front Panel Shield from the A1 Front Panel assembly, as seen in [Figure 2-11](#).

Figure 2-11 Front Panel Shield Removal



6. Reconnect the W1 ribbon cable from the A8 Motherboard to the A1A2 Front Panel Controller board J1.
7. Reconnect the AC power cord and turn the instrument on.
8. Referring to **Figure 2-12**, 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 A1A2 Front Panel Controller board.

Figure 2-12 Backlight Control Voltage Verification



9. Referring to **Figure 2-12**, 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 A1A2 Front Panel Controller board.
10. Referring to **Figure 2-12**, 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 A1W2 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 A1A2 Front Panel Controller board.

Initializations Did Not Complete

During the initialization of the 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 a USB keyboard and mouse and selecting Start, type Run and press Enter. When the Run window comes up, type Eventvwr.exe and press Enter.

Once the Event Viewer comes up, look under Applications and Services Logs, SA for the latest error entries. Select any error events to view further details, which should give you some idea of what the problem is.

Fails an Internal Auto Alignment

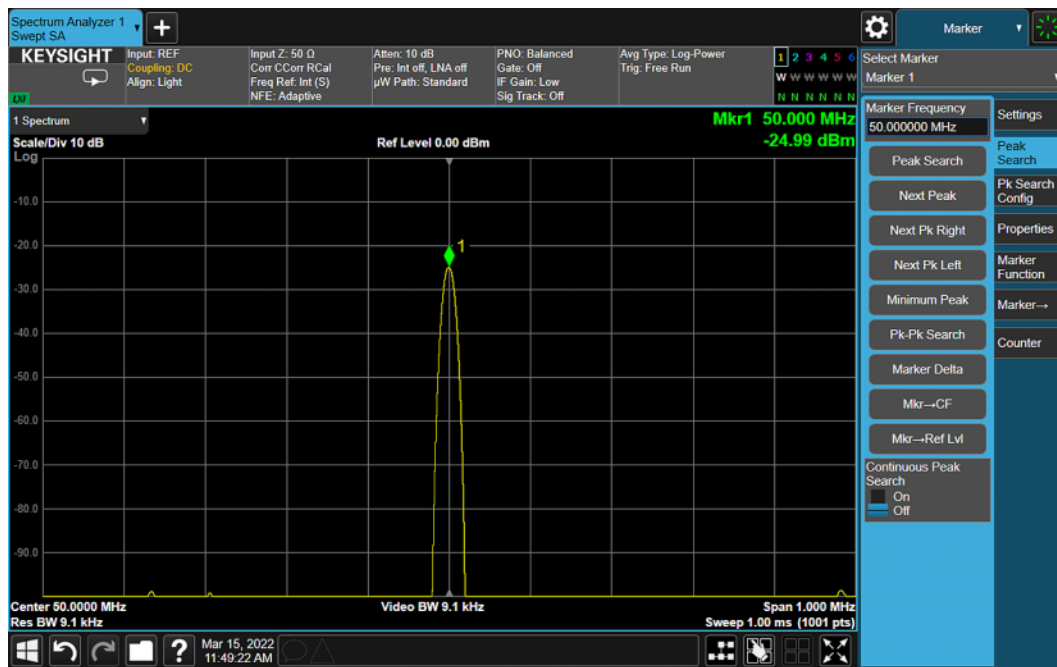
If the instrument fails an initial alignment at boot up, see the **“When an Alignment Fails”** section in **Chapter 4, “Internal Alignments”** for assistance in determining the cause.

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 $-25\text{ dBm} \pm 2\text{ dB}$. See the figure below.

Figure 2-13 50 MHz Calibrator Signal



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, “Signal Path Verification”** in this manual.

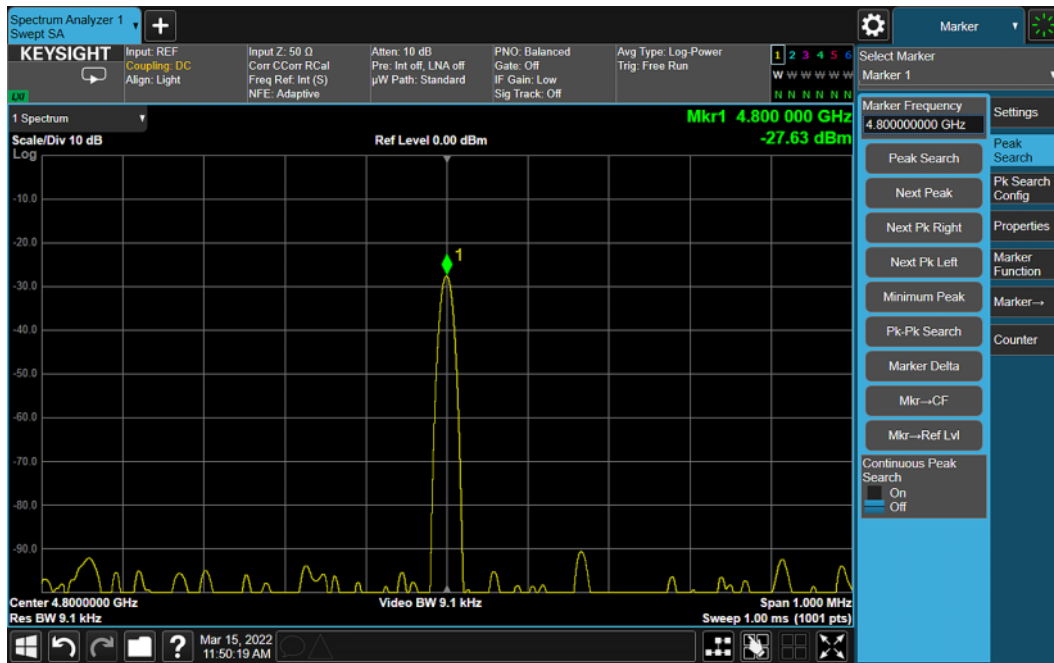
NOTE

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 $-28 \text{ dBm} \pm 2 \text{ dB}$. See the figure below.

Figure 2-14 4.8 GHz Calibrator Signal



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, Signal Path, Presel Center** to manually center the preselector. Refer to **Chapter 7, “Signal Path Verification”** 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 62

Instrument Serial Number on page 63

Instrument Licenses on page 64

License Installation on page 65

Instrument Calibration Database on page 66

Alignment Data Wizard on page 66

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.

NOTE

The instrument model number can only be programmed into replacement A7 Midplane boards by connecting them to the Keysight network and contacting the factory product support team for assistance.

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 PXA Signal Analyzer
Product Number	N9032B
Serial Number	US60420232
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-N9032B-20232
IP Address	
IPv6 Address	
Link-Local IPv6 Address	fe80::f581:1c3c:45a0:1f5a%6
Host ID	N9032B,US60420232
mDNS Enabled	Yes
mDNS Host Name	K-N9032B-20232
mDNS Service Name	Keysight N9032B Signal Analyzer - US60420232

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.

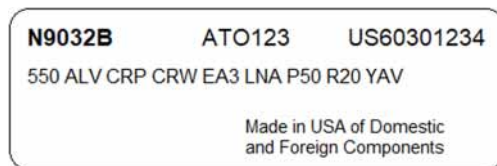
NOTE

The instrument serial number can only be programmed into replacement A7 Midplane boards by connecting them to the Keysight network and contacting the factory product support team for assistance.

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.

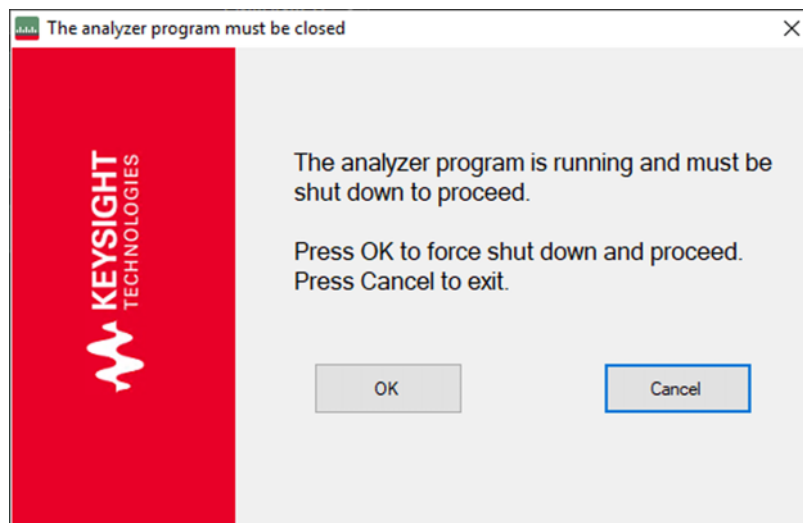
The instrument calibration data is saved in a MariaDB database on the A5 Solid State Drive in the AlignmentDataStorage folder on the E:\ partition. However, manually copying, moving, or backing up these files is not recommended or supported.

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

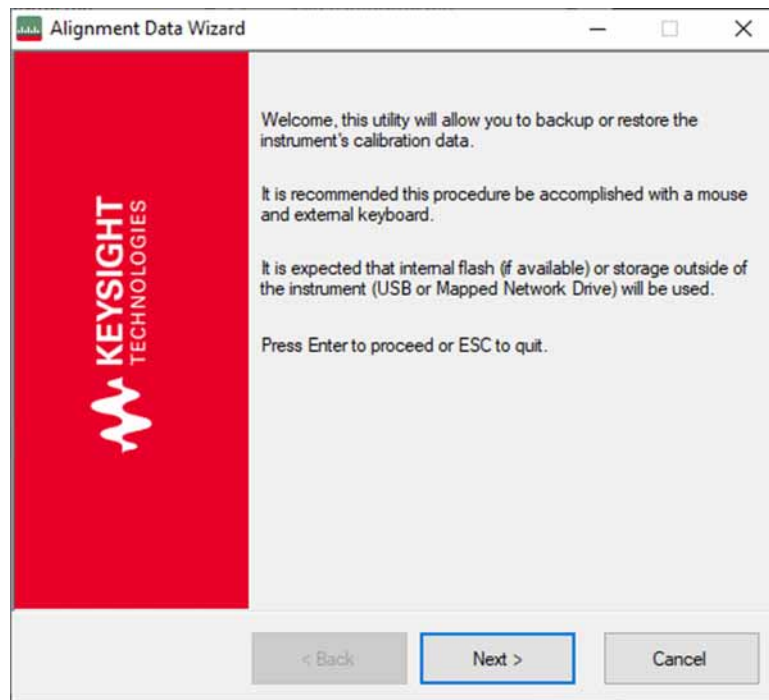
1. To run the Alignment Data Wizard, select **System, Alignments, Backup / Restore Align Data...**
2. When the Alignment Data Wizard starts, and the instrument application is running, you will see a prompt notifying you that it will first need to shut down the instrument application before it can run, 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



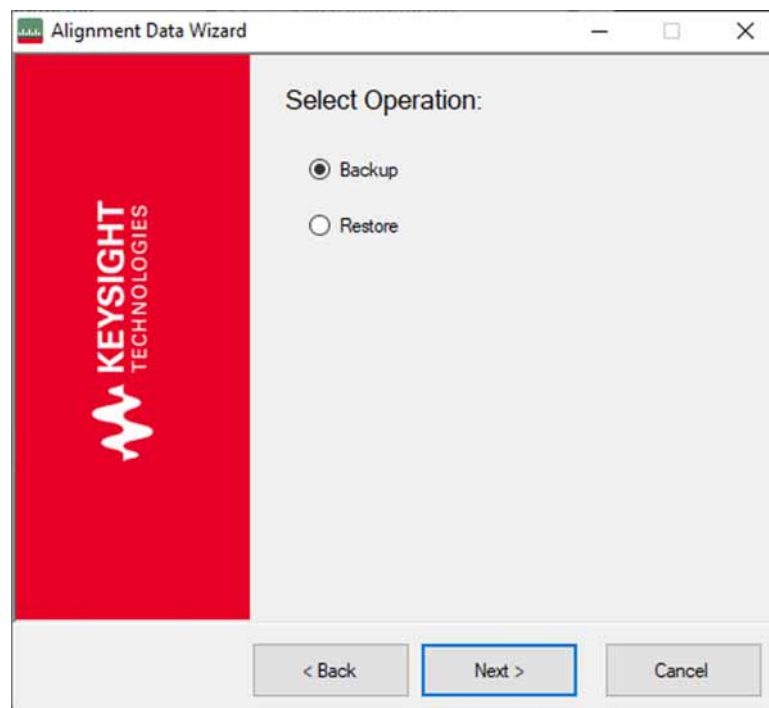
3. Once the instrument application shuts down, the wizard will continue with the prompt seen in **Figure 3-4**. Select **Next**.

Figure 3-4 Alignment Data Wizard - Welcome



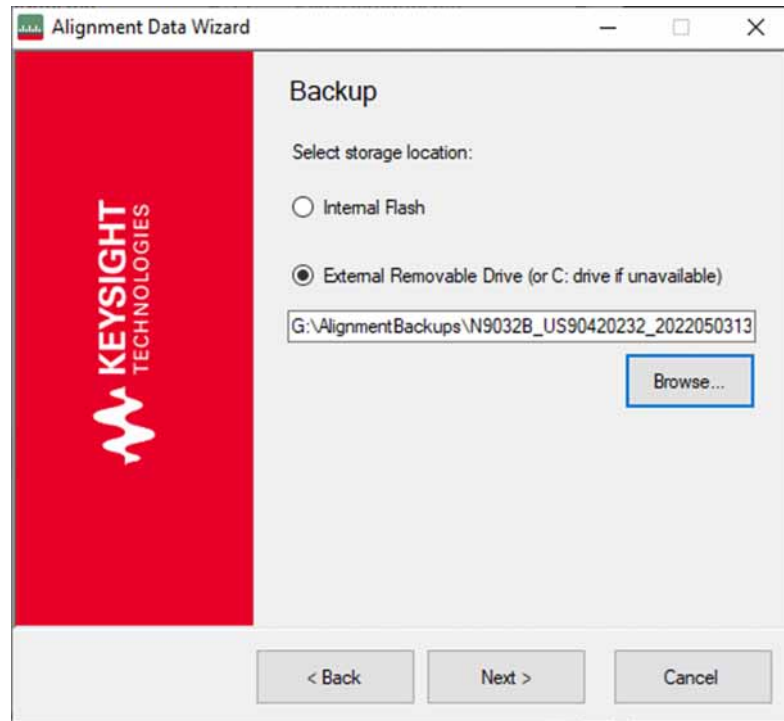
4. You will then be presented with a selection to either Backup or Restore the calibration data, as seen in [Figure 3-5](#). For this exercise select **Backup** and **Next**.

Figure 3-5 Alignment Data Wizard - Select Operation



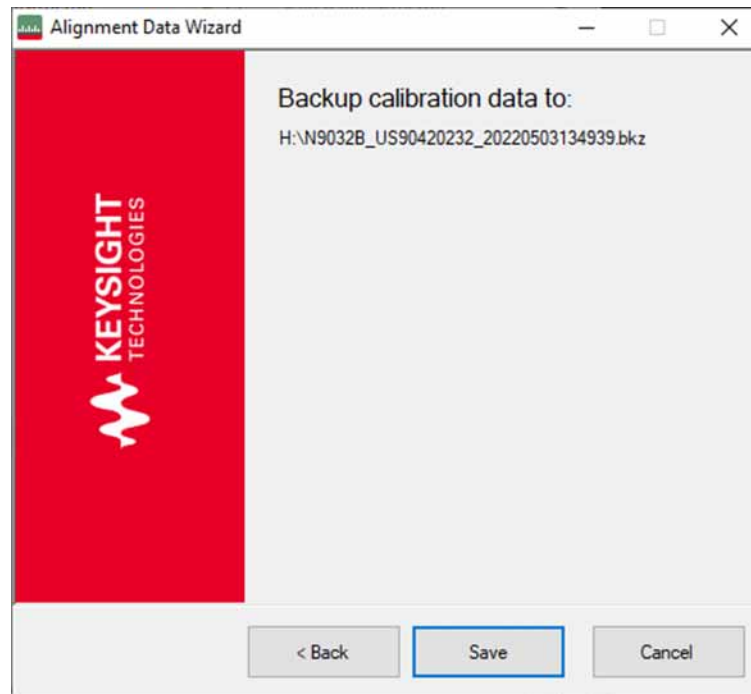
5. You will then need to select a location to backup the calibration database to, as seen in **Figure 3-6**. If you select Internal Flash, it will backup the database to the dedicated memory on the A4 Processor assembly. If you select External Removable Drive you can then select Browse to select any 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



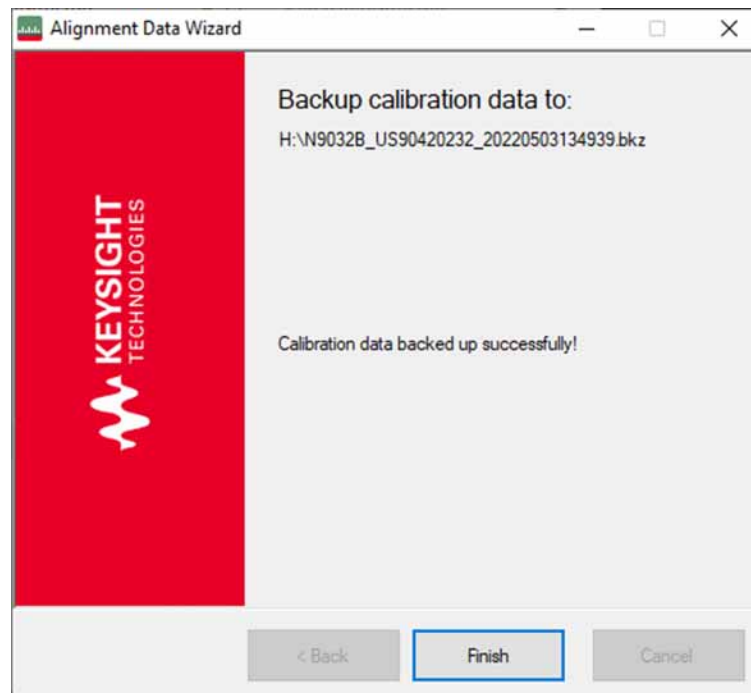
6. You will then need to confirm the Backup operation by selecting **Save**, as seen in **Figure 3-7**.

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

[Internal Alignments Overview on page 74](#)

[When an Alignment Fails on page 75](#)

[Multiple Alignment Failures on page 76](#)

[Auto Alignment Descriptions on page 77](#)

[AIF LC Narrow Prefilter Passband Fine Tuning Algorithm on page 77](#)

[AIF LC Narrow Prefilter Passband Tuning Algorithm on page 77](#)

[AIF LC Wide Prefilter Passband Fine Tuning Algorithm on page 78](#)

[AIF LC Wide Prefilter Passband Tuning Algorithm on page 78](#)

[AIF Scarlet WB Variable Attenuator Algorithm on page 79](#)

[AIF Step Gain Algorithm on page 79](#)

[AIF Variable Attenuator Algorithm on page 80](#)

[AIF Variable Gain Algorithm on page 80](#)

[AIF Xtal Narrow Prefilter Passband Tuning Algorithm on page 81](#)

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[Burst Carrier Trigger Curve Fit Alignment Algorithm on page 82](#)

[Chirp Rbw Alignment on page 83](#)

[Comb Cal Reference Alignment Algorithm on page 83](#)

[DDS Synth Fast Port Skew Training on page 84](#)

[DDS Synthesizer YTO Pretune DAC on page 84](#)

[DIF 25 Highband Phase Removal Algorithm on page 85](#)

[DIF 25 Pulse Stretcher Alignment Algorithm on page 85](#)

[DIF 40 Highband Phase Removal Algorithm on page 86](#)

[DIF 40 Pulse Stretcher Alignment Algorithm on page 86](#)

[DIF 40 Step Cal Adjustment Alignment Algorithm on page 87](#)

DIF 40 Step Cal Alignment Algorithm on page 87

DIF 40 Variable Attenuator Algorithm on page 88

Dither Level Algorithm on page 88

E Cal Path System Gain Algorithm on page 89

Electronic Attenuator Algorithm on page 89

EVM Optimization Setup Alignment Algorithm on page 90

Ext Mix LO Alignment Algorithm on page 90

High Band Low Noise Preamp Path System Gain Algorithm on page 91

High Band Nominal Path System Gain Algorithm on page 91

High Band Preamp Path System Gain Algorithm on page 92

High Band Preselector Bypass Low Noise Preamp Path System Gain Algorithm on page 92

High Band Preselector Bypass Path System Gain Algorithm on page 93

High Band Preselector Bypass Preamp Path System Gain Algorithm on page 94

LO Nulling Full Alignment Algorithm on page 94

LO Nulling Min Alignment Algorithm on page 95

LO Nulling Simplex MB Alignment Algorithm on page 95

LO Power Alignment Algorithm on page 96

Low Band Elec Atten Path System Gain Algorithm on page 96

Low Band Low Noise Preamp Path System Gain Algorithm on page 97

Low Band Nominal Path System Gain Algorithm on page 98

Low Band Preamp Path System Gain Algorithm on page 98

Low Noise Path System Gain Algorithm on page 99

Low Noise Path Low Noise Preamp Path System Gain Algorithm on page 100

Low Noise Preselector Bypass Path Low Noise Preamp Path System Gain Algorithm on page 100

Low Noise Preselector Bypass Path System Gain Algorithm on page 101

Mechanical Attenuator Algorithm on page 102

Narrow Band Step Cal Adjustment Alignment Algorithm on page 102

Narrow Band Step Cal Alignment Algorithm on page 103

Preselector Two Point Tuning Algorithm on page 103

Scarlet Feldspar Rx Data Alignment on page 104
Scarlet Wideband ADC Ping Pong Alignment on page 104
Scarlet Wideband Comb Alignment Algorithm on page 105
Second LO Loop Bandwidth on page 105
Second LO Saw Peak on page 106
Trac Trigger Wide Band IF Alignment Algorithm on page 106
VCXO Loop Bandwidth on page 106
WBIF MUX Variable Attenuator A Alignment Algorithm on page 107
WBIF MUX Variable Attenuator B Alignment Algorithm on page 107
WBIF MUX Variable Attenuator R15B0 Alignment Algorithm on page 108
WBIF MUX WB Variable Attenuator Alignment Algorithm on page 108
Glossary of Terms on page 109

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 60 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 off 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.

AIF LC Narrow Prefilter Passband Fine Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Narrow Comb from A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Fine tunes the 1 MHz LC prefilter on the A2 25 MHz Analog IF assembly and records the DAC value set.

The limits for this alignment are 0 to 255, so it should never fail unless the signal is missing.

AIF LC Narrow Prefilter Passband Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Narrow Comb from A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Course tunes the 1 MHz LC prefilter on the A2 25 MHz Analog IF assembly and records the DAC value set.

The limits for this alignment are 0 to 255, so it should never fail unless the signal is missing.

AIF LC Wide Prefilter Passband Fine Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Wide Comb from A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Fine tunes the 300 kHz LC prefilter on the A2 25 MHz Analog IF assembly and records the DAC value set.

The limits for this alignment are 0 to 255, so it should never fail unless the signal is missing.

AIF LC Wide Prefilter Passband Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Wide Comb from A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

Internal Alignments
Auto Alignment Descriptions

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Course tunes the 300 kHz LC prefilter on the A2 25 MHz Analog IF assembly and records the DAC value set.

The limits for this alignment are 0 to 255, so it should never fail unless the signal is missing.

AIF Scarlet WB Variable Attenuator Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to the SW1 Calibrator Switch P1 to the A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

1.0 GHz

Most Probable Cause of Failure:

A21 Wideband Digital IF

Description:

Measures the accuracy of the electronic step attenuators in the 255 MHz / 1.0 GHz signal path on the A21 Wideband Digital IF assembly. A range of 0 to 25 dB of attenuation is covered.

AIF Step Gain Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

22.5 MHz from the A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

Internal Alignments
Auto Alignment Descriptions

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Measures the gain of the output Step Gain amplifier on the A2 25 MHz Analog IF. This should nominally have 10 dB of gain.

AIF Variable Attenuator Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J705 to A13 Narrowband Downconverter J6

RF Signal Path:

Low Band – Partial

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Measures the accuracy of the 322.5 MHz variable attenuator on the A2 25 MHz Analog IF. A range of 0 to 19 dB of attenuation is covered.

AIF Variable Gain Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

22.5 MHz from the A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

Internal Alignments
Auto Alignment Descriptions

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Sets the gain of the 22.5 MHz variable gain amplifier on the A2 25 MHz Analog IF to three different values and records the DAC values set.

The limits for this alignment are 0 to 255, so it might never fail unless the signal is missing.

AIF Xtal Narrow Prefilter Passband Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Narrow Comb from the A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Tunes the 10 kHz crystal prefilter on the A2 25 MHz Analog IF assembly and records the DAC values set.

The limits for this alignment are 0 to 255, so it might never fail unless the signal is missing.

AIF Xtal Wide Prefilter Passband Tuning Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

Wide Comb from the A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Tunes the 75 kHz crystal prefilter on the A2 25 MHz Analog IF assembly and records the DAC values set.

The limits for this alignment are 0 to 255, so it might never fail unless the signal is missing.

Burst Carrier Trigger Curve Fit Alignment Algorithm

Alignment Group:

Trigger

Calibrator Signal(s) Used:

22.5 MHz from the A3 40 MHz Digital IF J20 to A2 25 MHz Analog IF J820

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

The Burst Carrier Trigger detects the level of the calibrator signal envelope before filtering the 22.5MHz IF and compares that detected level against the DC level of the trigger threshold.

Chirp Rbw Alignment

Alignment Group:

IF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J705 to A13 Downconverter J6

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Measures the deviation of the swept spectrum analyzer's resolution bandwidth from the ideal Gaussian shape and produces an equalizing filter for the 10 MHz resolution bandwidth.

Comb Cal Reference Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference

4.8 GHz from the A25 Wideband Calibrator

RF Signal Path:

High Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 Wideband Digital IF

Description:

Characterizes the difference between the 4.8 GHz calibrator signal and the A25 Wideband Calibrator when tuned to 4.8 GHz, for use when correcting the IF Flatness of the A21 Wideband Digital IF signal paths.

There are no limits for this alignment, so it may never fail unless the signal is missing.

DDS Synth Fast Port Skew Training

Alignment Group:

LO

Calibrator Signal(s) Used:

A14A1 DDS LO Reference output

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A14 DDS LO Synthesizer

Description:

Skew Training and bond training of the port between the A14 DDS LO Synthesizer main board and the A14A1 DDS LO Reference board.

DDS Synthesizer YTO Pretune DAC

Alignment Group:

LO

Calibrator Signal(s) Used:

A20 YTO output

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A14 DDS LO Synthesizer

A20 Yig Tuned Oscillator

Description:

Determines the pretune slope and offset for the A20 Yig Tuned Oscillator.

DIF 25 Highband Phase Removal Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9
Step Attenuator Calibrator input

RF Signal Path:

High Band – μ Wave Preselector Bypass

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Measures the phase error of the step cal signal injected into the high band path.

DIF 25 Pulse Stretcher Alignment Algorithm

Alignment Group:

Trigger

Calibrator Signal(s) Used:

Internal Sweep Trigger

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Aligns the pulse stretcher circuit to enable sub-sample correction (when a trigger arrives between 2 ADC samples).

DIF 40 Highband Phase Removal Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9
Step Attenuator Calibrator input

RF Signal Path:

High Band – μ Wave Preselector Bypass

IF Signal Path(s):

10/25 MHz

40 MHz

Most Probable Cause of Failure:

A2 25 MHz Analog IF

A3 40 MHz Digital IF

Description:

Measures the phase error of the step cal signal injected into the high band path.

DIF 40 Pulse Stretcher Alignment Algorithm

Alignment Group:

Trigger

Calibrator Signal(s) Used:

Internal Sweep Trigger

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A3 40 MHz Digital IF

Description:

Aligns the pulse stretcher circuit to enable sub-sample correction (when a trigger arrives between 2 ADC samples).

DIF 40 Step Cal Adjustment Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

48 kHz from A3 40 MHz Digital IF J17 to A16 Reference J726 to SW1
Calibrator Switch P1 to A9 Step Attenuator Calibrator input

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

40 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

A16 Reference

Description:

Characterizes the Step Cal source. This is to be run prior to running the DIF 40 Step Cal Alignment Algorithm.

DIF 40 Step Cal Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

48 kHz from A3 40 MHz Digital IF J17 to A16 Reference J726 to SW1
Calibrator Switch P1 to A9 Step Attenuator Calibrator input

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

40 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

A16 Reference

Description:

Characterizes the IF frequency response through the instrument for the 40 MHz IF path.

DIF 40 Variable Attenuator Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J705 to A13 Narrowband Downconverter J6

RF Signal Path:

Low Band – Partial

IF Signal Path(s):

40 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

A16 Reference

Description:

Measures the accuracy of the 250 MHz variable attenuator on the A3 40 MHz Digital. A range of 4 to 26 dB of attenuation is covered.

Dither Level Algorithm

Alignment Group:

IF

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

Description:

Correlates what level is produced for a given dither gain DAC setting, and then determines appropriate gain DAC values for a low and high level.

E Cal Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J705 to A13 Narrowband Downconverter J6

RF Signal Path:

Low Band – Partial

IF Signal Path(s):

10 MHz

Most Probable Cause of Failure:

A13 Narrowband Downconverter

Description:

Measures the 50 MHz calibrator signal level injected at A13 Narrowband Downconverter J6.

Electronic Attenuator Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to the SW1 Calibrator Switch P1 to the A9 Step Attenuator Calibrator input

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10 MHz

Most Probable Cause of Failure:

A13 Narrowband Downconverter

A15 Front End Controller

Description:

Measures the accuracy of the electronic step attenuator on the A13 Narrowband Downconverter. A range of 0 to 40 dB of attenuation is covered.

EVM Optimization Setup Alignment Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

All IF Signal Paths

Most Probable Cause of Failure:

See alignment history file for failure details.

Description:

Produces a lookup table to optimize for EVM across all signal path / IF combinations.

Ext Mix LO Alignment Algorithm

Alignment Group:

LO

Calibrator Signal(s) Used:

A14 DDS LO Synthesizer output

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A13 Narrowband Downconverter

Description:

When a USB mixer is connected the LO Out DAC is adjusted to achieve optimized LO Output signal level using the external mixers detector.

High Band Low Noise Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Standard – Low Noise Amplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

A11 Band Switch

SW2 Low Noise Amplifier Switch

A15 Front End Controller

Description:

Measures the loss or gain of the low noise amplifier signal path for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

High Band Nominal Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Standard

IF Signal Path(s):

All Available IF Paths except 10/25 MHz

Most Probable Cause of Failure:

Various Front End Assemblies
A15 Front End Controller

Description:

Measures the loss or gain of the standard signal path for the 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

High Band Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Standard – Full Range Preamplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

A11 Band Switch
A15 Front End Controller

Description:

Measures the gain of the high band preamplifier signal path for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

High Band Preselector Bypass Low Noise Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – μ Wave Preselector Bypass – Low Noise Amplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

A11 Band Switch

SW2 Low Noise Amplifier Switch

SW4 Microwave Preselector Bypass Switch

A15 Front End Controller

Description:

Measures the gain of the preselector bypass signal path with the low noise amplifier turned on for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

High Band Preselector Bypass Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – μ Wave Preselector Bypass

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW4 Microwave Preselector Bypass Switch

A15 Front End Controller

Description:

Measures the gain of the preselector bypass signal path for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

High Band Preselector Bypass Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – μ Wave Preselector Bypass – Full Range Preamplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW4 Microwave Preselector Bypass Switch

A11 Band Switch

A15 Front End Controller

Description:

Measures the gain of the preselector bypass signal path with the high band preamplifier turned on for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

LO Nulling Full Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

5.1225 GHz from A14 DDS LO Synthesizer J1

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A13 Narrowband Downconverter

Description:

Nulls the LO Feedthru using a full DAC search.

The limits for this alignment are very large, so it may never fail.

LO Nulling Min Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

5.1225 GHz from A14 DDS LO Synthesizer J1

RF Signal Path:

n/a

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A13 Narrowband Downconverter

A15 Front End Controller

Description:

Nulls the LO Feedthru by sweeping both the I and Q DACs on the A15 Front End Controller.

The limits for this alignment are very large, so it may never fail.

LO Nulling Simplex MB Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

5.05 and 5.065 GHz from A14 DDS LO Synthesizer J1

Internal Alignments
Auto Alignment Descriptions

RF Signal Path:

n/a

IF Signal Path(s):

40 MHz

Most Probable Cause of Failure:

A13 Narrowband Downconverter

Description:

Nulls the LO Feedthru at a range of low frequencies.

LO Power Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

Various frequencies from the A14 DDS LO Synthesizer J1

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A13 Narrowband Downconverter

A14 DDS LO Synthesizer

Description:

The power level of the first LO signal is adjusted on the A13 Narrowband Downconverter for each of the frequency bands and the DAC values are recorded.

The limits for this alignment are 0 and 4095, so it should never fail.

Low Band Elec Atten Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Internal Alignments
Auto Alignment Descriptions

2.0 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Electronic Attenuator

IF Signal Path(s):

10/25 MHz, 40 MHz, 1.0 GHz, 1.5 GHz (as available)

Most Probable Cause of Failure:

A13 Narrowband Downconverter

A15 Front End Controller

Description:

Measures the gain or loss of the low band electronic attenuator signal path for the 25 MHz, 40 MHz, 1 GHz, and 1.5 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

Low Band Low Noise Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

2.0 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Low Noise Amplifier

IF Signal Path(s):

10/25 MHz, 40 MHz, 1.0 GHz, 1.5 GHz (as available)

Most Probable Cause of Failure:

A11 Band Switch

SW2 Low Noise Amplifier Switch

A15 Front End Controller

Description:

Measures the gain of the low band signal path with the low noise amplifier turned on for the 25 MHz, 40 MHz, 1 GHz, and 1.5 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

Low Band Nominal Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

2.0 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz, 40 MHz, 1.0 GHz, 1.5 GHz (as available)

Most Probable Cause of Failure:

A11 Band Switch

A13 Front End Assembly

A15 Front End Controller

Description:

Measures the gain or loss of the low band standard signal path for the 25 MHz, 40 MHz, 1 GHz, and 1.5 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

Low Band Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Internal Alignments
Auto Alignment Descriptions

2.0 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Low Band Preamplifier

IF Signal Path(s):

10/25 MHz, 40 MHz, 1.0 GHz, 1.5 GHz (as available)

Most Probable Cause of Failure:

A13 Front End Assembly

A15 Front End Controller

Description:

Measures the gain or loss of the low band signal path with the preamplifier turned on for the 25 MHz, 40 MHz, 1 GHz, and 1.5 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

Low Noise Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

20 and 25 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Low Noise Path

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW3 Low Noise Path Switch

A13 Front End Assembly

A15 Front End Controller

Description:

Measures the gain or loss of the low noise signal path for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths except 25 and 40 MHz, so it should never fail for the others, unless the 4.8 GHz calibrator signal is not detected.

Low Noise Path Low Noise Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

20 and 25 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Low Noise Path – Low Noise Amplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW3 Low Noise Path Switch

A11 Band Switch

A15 Front End Controller

Description:

Measures the gain of the low noise signal path with the low noise amplifier turned on for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

Low Noise Preselector Bypass Path Low Noise Preamp Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

Internal Alignments
Auto Alignment Descriptions

20 and 25 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch
P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Full Bypass – Low Noise Amplifier

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW4 Microwave Preselector Bypass Switch

SW3 Low Noise Path Switch

A15 Front End Controller

Description:

Measures the gain of the full bypass signal path with the low noise amplifier turned on for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

Low Noise Preselector Bypass Path System Gain Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9
Step Attenuator Calibrator input.

20 and 25 GHz from the A25 Wideband Calibrator to SW1 Calibrator Switch
P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – Full Bypass

IF Signal Path(s):

All Available IF Paths

Most Probable Cause of Failure:

SW4 Microwave Preselector Bypass Switch

SW3 Low Noise Path Switch

A15 Front End Controller

Description:

Measures the gain of the full bypass signal path for the 25 MHz, 40 MHz, 1 GHz, 1.5 GHz, and 2 GHz IF signal paths, as available.

The limits for this alignment are ± 100 for all IF paths, so it should never fail, unless the 4.8 GHz calibrator signal is not detected.

Mechanical Attenuator Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A9 Step Attenuator

A10 Step Attenuator

A15 Front End Controller

Description:

Measures the accuracy of the two input step attenuators.

Narrow Band Step Cal Adjustment Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

24 kHz Step Cal signal from A3 40 MHz Digital IF J17 to A16 Reference J726 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

Internal Alignments
Auto Alignment Descriptions

A2 25 MHz Analog IF

A16 Reference

Description:

Characterizes the Step Cal source. This is to be run prior to running the Narrow Band Step Cal Alignment Algorithm.

Narrow Band Step Cal Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

24 kHz Step Cal signal from A3 40 MHz Digital IF J17 to A16 Reference J726 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A3 40 MHz Digital IF

A2 25 MHz Analog IF

A16 Reference

Description:

Characterizes the IF frequency response through the instrument for the 10 and 25 MHz IF paths.

Preselector Two Point Tuning Algorithm

Alignment Group:

System Gain

Calibrator Signal(s) Used:

Broadband noise from A11 Band Switch P3 to SW3 Low Noise Switch P3 to SW4 Preselector Bypass Switch P1 to A12 Yig Tuned Oscillator input.

RF Signal Path:

High Band – Standard

IF Signal Path(s):

10/25 MHz

Internal Alignments
Auto Alignment Descriptions

Most Probable Cause of Failure:

A12 Yig Tuned Filter
A11 Band Switch
A15 Front End Controller

Description:

Adjusts the high and low tuning end points for the A12 Yig Tuned Filter.

Scarlet Feldspar Rx Data Alignment

Alignment Group:

ADC

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A21 Wideband Digital IF

Description:

Aligns the LVDS Rx data from Feldspar into FPGA on the A21 Wideband Digital IF assembly.

Scarlet Wideband ADC Ping Pong Alignment

Alignment Group:

RF

Calibrator Signal(s) Used:

Various frequencies from the A25 Wideband Calibrator to SW1 Calibrator Switch P3 to A9 Step Attenuator Calibrator input.

RF Signal Path:

n/a

IF Signal Path(s):

255 MHz, 1.0 GHz, 1.5 GHz, 2.0 GHz (as available)

Most Probable Cause of Failure:

Internal Alignments
Auto Alignment Descriptions

A21 Wideband Digital IF

A25 Wideband Calibrator

Description:

Measures the interleave spur in the A21 Wideband Digital IF ADC and attempts to find a delay value to minimize the error.

Scarlet Wideband Comb Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

255 MHz, 1.0 GHz, 1.5 GHz, 2.0 GHz (as available)

Most Probable Cause of Failure:

A21 Wideband Digital IF

Description:

Characterizes the IF frequency response through the instrument for all IF paths wider than 40 MHz.

Second LO Loop Bandwidth

Alignment Group:

LO

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A16 Reference

Description:

Adjusts the loop bandwidth of the 2.4 GHz oscillator on the A16 Reference.

Second LO Saw Peak

Alignment Group:

LO

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A16 Reference

Description:

Adjusts the 2.4 GHz oscillator on the A16 Reference.

Trac Trigger Wide Band IF Alignment Algorithm

Alignment Group:

Trigger

Calibrator Signal(s) Used:

Internal Trigger

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A21 Wideband Digital IF

Description:

Adjusts the ADC offset and scale of the trac trigger of the A21 Wideband Digital IF.

VCXO Loop Bandwidth

Alignment Group:

Internal Alignments
Auto Alignment Descriptions

LO

Calibrator Signal(s) Used:

n/a

RF Signal Path:

n/a

IF Signal Path(s):

n/a

Most Probable Cause of Failure:

A16 Reference

Description:

Adjusts the loop bandwidth of the 100 MHz VCXO on the A16 Reference.

WBIF MUX Variable Attenuator A Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A23 IF Mux

Description:

Measures the accuracy of the electronic step attenuator at the input of the A23 IF Mux. A range of 0 to 14 dB of attenuation is covered.

WBIF MUX Variable Attenuator B Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

10/25 MHz

Most Probable Cause of Failure:

A23 IF Mux

Description:

Measures the accuracy of the electronic step attenuator at the 10/25/40 MHz IF path output of the A23 IF Mux. A range of 0 to 31 dB of attenuation is covered.

WBIF MUX Variable Attenuator R15B0 Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

50 MHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

Low Band – Standard

IF Signal Path(s):

1.5/2.0 GHz

Most Probable Cause of Failure:

A23 IF Mux

Description:

Measures the accuracy of the electronic step attenuator at the 1.5/2.0 GHz IF path output of the A23 IF Mux with a 950 MHz IF signal. A range of 0 to 31 dB of attenuation is covered.

WBIF MUX WB Variable Attenuator Alignment Algorithm

Alignment Group:

RF

Calibrator Signal(s) Used:

4.8 GHz from the A16 Reference J701 to SW1 Calibrator Switch P1 to A9 Step Attenuator Calibrator input.

RF Signal Path:

High Band – μ Wave Preselector Bypass

IF Signal Path(s):

1.5/2.0 GHz

Most Probable Cause of Failure:

A23 IF Mux

Description:

Measures the accuracy of the electronic step attenuator at the 1.5/2.0 GHz IF path output of the A23 IF Mux with a 1.2 GHz IF signal. A range of 0 to 31 dB of attenuation is covered.

Glossary of Terms

- Feldspar = Custom ASIC
- MediumBandIF = 40 MHz IF Path
- NarrowBandIF = 10/25 MHz IF Path
- Scarlet = A21 Wideband Digital IF
- WideBandIF1500MHz = 1.5 GHz IF Path
- WideBandIF2GHz = 2.0 GHz IF Path

Internal Alignments
Auto Alignment Descriptions

5 First-Look Troubleshooting

This chapter provides information on the following:

[Overview on page 112](#)

[Front Panel Troubleshooting on page 113](#)

[Overview on page 113](#)

[Initial Configuration Check on page 114](#)

[A25 Wideband Calibrator Usage on page 119](#)

[Mechanical Attenuator Evaluation on page 120](#)

[A12 Yig Tuned Filter Shape Verification on page 123](#)

[μWave Path Functionality on page 125](#)

[Preamplifier Functionality on page 128](#)

[IF Signal Path Isolation on page 132](#)

[IF Flatness Verification on page 134](#)

[Power Supply Verification on page 144](#)

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 and without the use of any 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 22, “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
- A25 Wideband Calibrator Usage
- Mechanical Attenuator Evaluation
- A12 Yig Tuned Filter Shape Verification
- μ Wave Signal Path Functionality
- Preamplifier Functionality
- IF Signal Path Isolation
- IF Flatness Verification

When there are multiple signal paths or alternate assemblies that can perform a similar task, such as IF signal paths, the following will show how to isolate one that might be having a problem.

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

System Settings	< System Hardware Information	
System	Keysight PXA	Keysight PXA Signal Analyzer
	Product Number	N9032B
	Serial Number	MY61010001
I/O Config	S/W Release Name	2023 Update 1.0
	Instrument S/W Revision	A.34.03
	Revision Date	11/17/2022 9:38:32 AM
Preload / Unload Modes	Assembly Name	Part #
	Analog IF	N902060290
	YIG Tuned Filter	50877382
User Interface	Digital IF	N902060016
	Front End Controller	N902060295
Power On	IF Mux-10GHz	N904160163
	Low Band Switch	N904060100
Restore Defaults	LO DDS Synthesizer	N902060175
	LO DDS Reference	M930560028
Alignments	Wideband Calibrator	N904060151
	Reference Plus Main	N902060185
	Reference Plus Daughter	N902060186
Licensing	Front End	N904160039
	Gen 4 DIF Controller	N904160048
Security	Switched IF Filter	N902060220
	YTO	N902060009
Diagnostics		
Service		
SCPI Recorder		

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	--
Digital IF	A3 40 MHz Digital IF	--
Front End Controller	A15 Front End Controller	--
IF Mux-10 GHz	A23 IF Mux	--
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
Wideband Calibrator	A25 Wideband Calibrator	A23 IF Mux
Reference Plus Main	A16 Reference	--
Reference Plus Daughter	A16A1 Reference Daughter	A16 Reference
FrontEnd	A13 Downconverter	A15 Front End Controller
Gen 4 DIF Controller	A21 Wideband DIF	--
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		System Information				
System	Keysight Technologies						
	Keysight PXA	Keysight PXA Signal Analyzer					
I/O Config	Product Number		N9032B				
	Serial Number		MY61010001				
	S/W Release Name		2023 Update 1.0				
Preload / Unload Modes	Instrument S/W Revision		A.34.03				
	Revision Date		11/17/2022 9:38:32 AM				
	Computer System		Windows 10				
User Interface	Computer Name		K-N9032B-10001				
	IP Address		141.121.151.154				
	IPv6 Address						
Power On	Link-Local IPv6 Address		fe80::1c1e:1a7b:d335:6641%14				
	Host ID		N9032B,MY61010001				
Restore Defaults	mDNS Enabled		Yes				
	mDNS Host Name		K-N9032B-10001				
	mDNS Service Name		Keysight N9032B Signal Analyzer - MY61010001				
Alignments	Option	Name / Description			Option Version		
	N9032B-MTU	Multi-touch user interface					
Licensing	N9032B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB					
	N9032B-SSD	MICRON_1300_MTFDDAK256TDL					
	N9032B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS					
Security							
	89601B_Agilent	VSA Temporary License - Agilent internal use/demo only			---		
Diagnostics	N6141EM0E_1FP	EMC Software for X-Series			1.3.63417.17325		
	N9032B_526	Frequency Range, 26.5 GHz			---		
Service	N9032B_ALV	Auxiliary Log Video Output			---		
	N9032B_B25	Analysis bandwidth, 25 MHz			---		
	N9032B_B2X	Analysis bandwidth, 255 MHz			---		
SCPI Recorder	N9032B_B40	Analysis bandwidth, 40 MHz			---		
	N9032B_CR3	Connector Rear, 2nd IF output			---		
	N9032B_CRP	Connector Rear, Arbitrary IF output			---		
	N9032B_CRW	Connector, IF Out, Wide			---		

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/n9032b_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 – R10, R15, or R20
- 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

System Settings	< Diagnostics Hardware Statistics    	
System	Keysight PXA	Keysight PXA Signal Analyzer
	Product Number	N9032B
I/O Config	Serial Number	MY61010001
	S/W Release Name	2023 Update 1.0
Preload / Unload Modes	Instrument S/W Revision	A.34.03
	Revision Date	11/17/2022 9:38:32 AM
User Interface	MechAtten #1 Count Total	1390982
	Calibrator Switch Cycles	694590
Power On	AC/DC Switch Cycles	240710
	2 dB #1 Mechanical Atten Cycles	192546
Restore Defaults	2 dB #2 Mechanical Atten Cycles	263136
	MechAtten #2 Count Total	1118065
Alignments	6 dB Mechanical Atten Cycles	278165
	10 dB Mechanical Atten Cycles	364971
Licensing	20 dB Mechanical Atten Cycles	227133
	30 dB Mechanical Atten Cycles	247796
Security	Low Noise Path Switch Cycles	73414
	Preselector Bypass Cycles	141562
Diagnostics	High temperature operating extreme	56.75
	Low temperature operating extreme	-275
Service	Elapsed Time (On-Time)(Hours)	9123
SCPI Recorder		

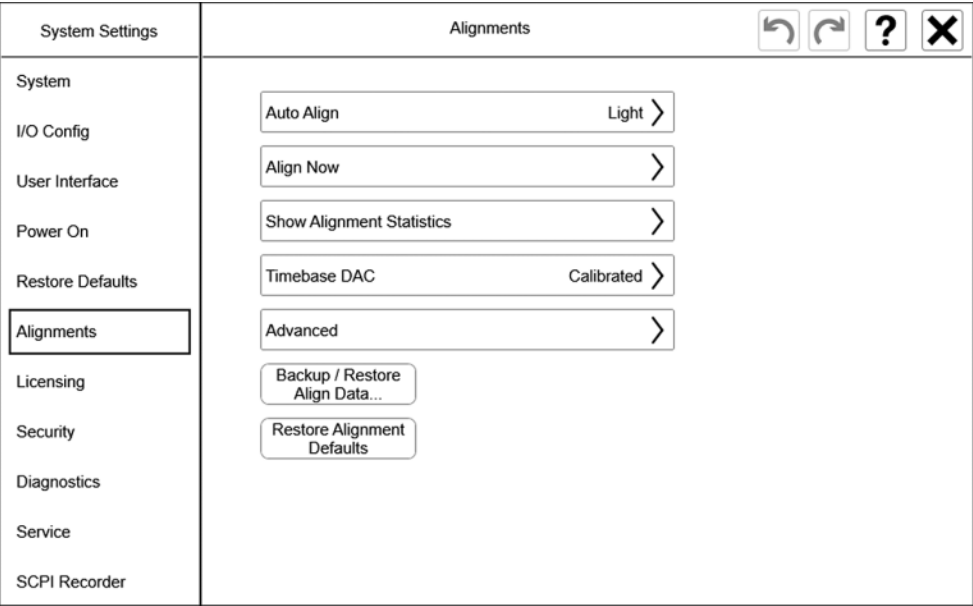
The things to look for on this screen would be the number of mechanical attenuator and switch cycles. Both have a typical life expectancy of 5 million cycles. This would normally take many years for them to reach this under normal use. But no matter if they are used at a normal rate or not, if they are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



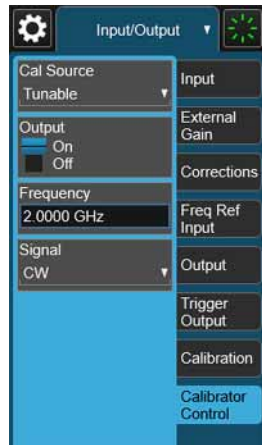
A25 Wideband Calibrator Usage

The internal wideband calibrator is used by the internal auto alignment routines to align different parts of the instrument. However, it can also be used to do manual system signal path and assembly verifications. While detailed information on what it is and how to verify that it is functioning properly can be found in the “**A25 Wideband Calibrator**” section of **Chapter 9, “RF Input Section,”** this section will use it to verify certain instrument functionalities.

Control for the A25 Wideband Calibrator can be found on the **Input/Output, Calibrator Control** menu, as seen in **Figure 5-5**.

Figure 5-5

A25 Calibrator Control



Once the **Cal Source** is set to **Tunable** and the **Output** is turned **On** the calibrator signal will be switched into the RF signal path by the SW1 Calibrator Switch and the A9 Step Attenuator input switch at whatever **Frequency** is set. The frequency can be set to any frequency that the instrument can tune to.

If when the A25 Wideband Calibrator is turned on no signal appears on the instrument display at the frequency it is tuned to, it could be that the calibrator is not working, the SW1 Calibrator Switch could not be switching it to the A9 Step Attenuator calibrator input port, the A9 Step Attenuator is not switching it into the RF signal path, or something else down the selected signal path is not working. If this is the case, many of the signal path verifications in this section can be used to help isolate the issue prior to removing any of the instrument covers, without the use of any other test equipment. If it is suspected that the A25 Wideband Calibrator is having a problem, select either the 50 MHz or 4.8 GHz calibrator sources instead to verify that nothing else in the signal path is causing the problem.

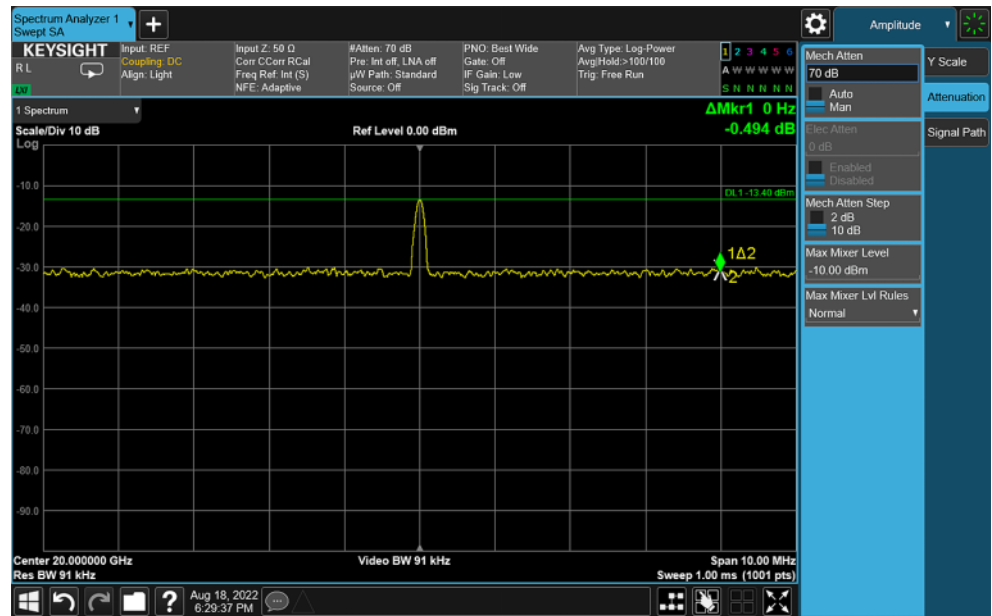
Mechanical Attenuator Evaluation

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 20 GHz, but any frequency of interest could be used.

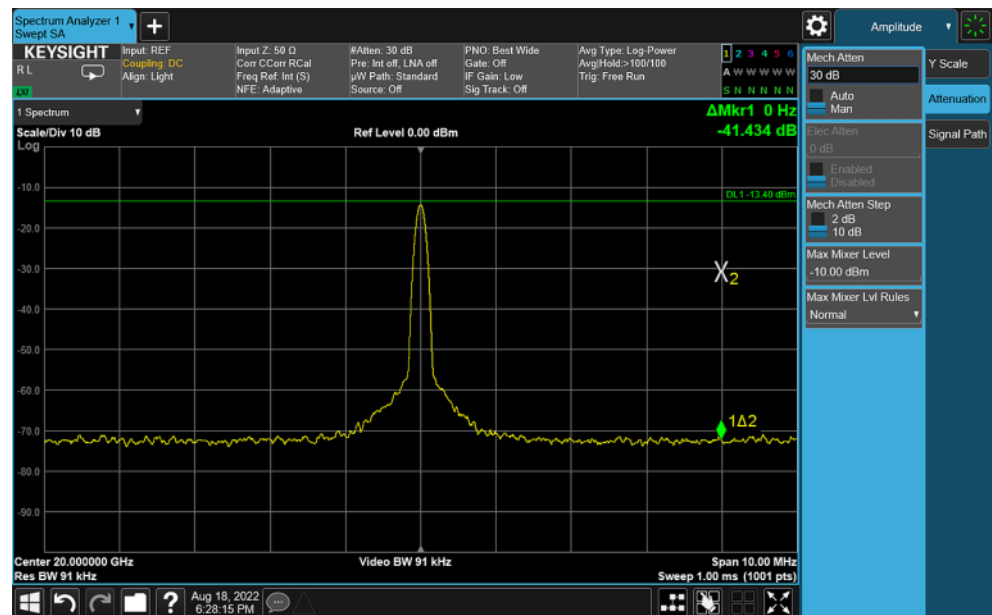
1. Return the instrument to a known state by pressing **Mode Preset**.
2. Turn the calibrator signal on and tune it to 20 GHz by pressing **Input/Output, Calibrator Control, Cal Source, Tunable, Output On, Frequency 20 GHz**.
3. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 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 -15 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 the display line on by pressing **Display, Display Line On**.
9. Adjust the **Display Line** level to put the line at the same level as the signal at the center of the screen.
10. Turn on trace averaging by pressing **Trace, Trace Type, Trace Averaging**.
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 5-6**.

Figure 5-6 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 5-7**.

Figure 5-7 Mechanical Attenuator – 40 dB Change



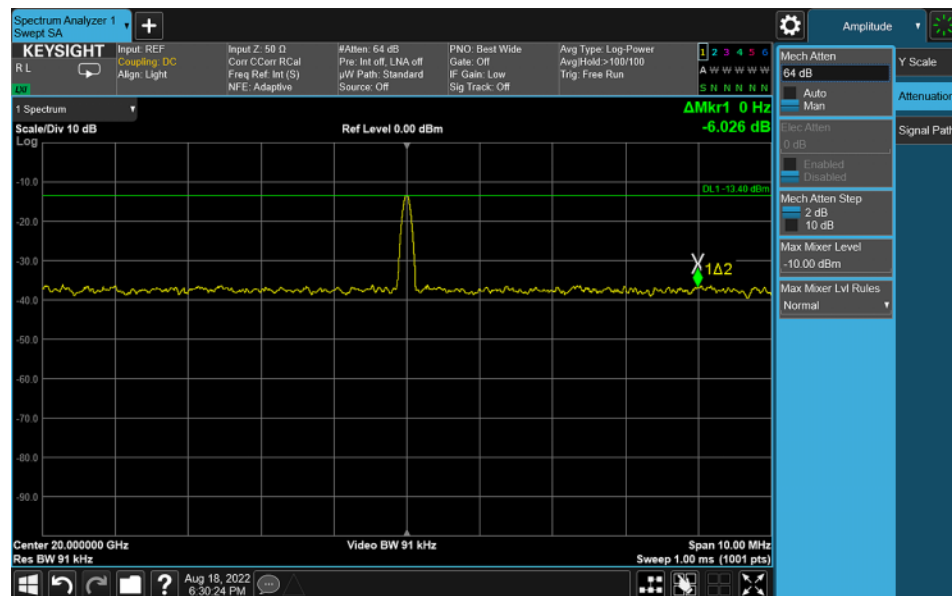
If the signal stays at the same level and the noise floor reduces at the same rate as the attenuation changes, it would indicate that the A10 Step Attenuator is stepping at the correct amount and the corrections are compensating for it accordingly.

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 5-8](#).

Figure 5-8 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 [“A9 / A10 Step Attenuators”](#) section in [Chapter 9, “RF Input Section,”](#) 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 20 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. Turn the calibrator signal on and tune it to 20 GHz by pressing **Input/Output, Calibrator Control, Cal Source Tunable, Output On, Frequency 20 GHz**.
4. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 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, μ W 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. See the "**Characterize Preselector**" section in **Chapter 23, "Post-Repair Procedures,"** for more information on this.

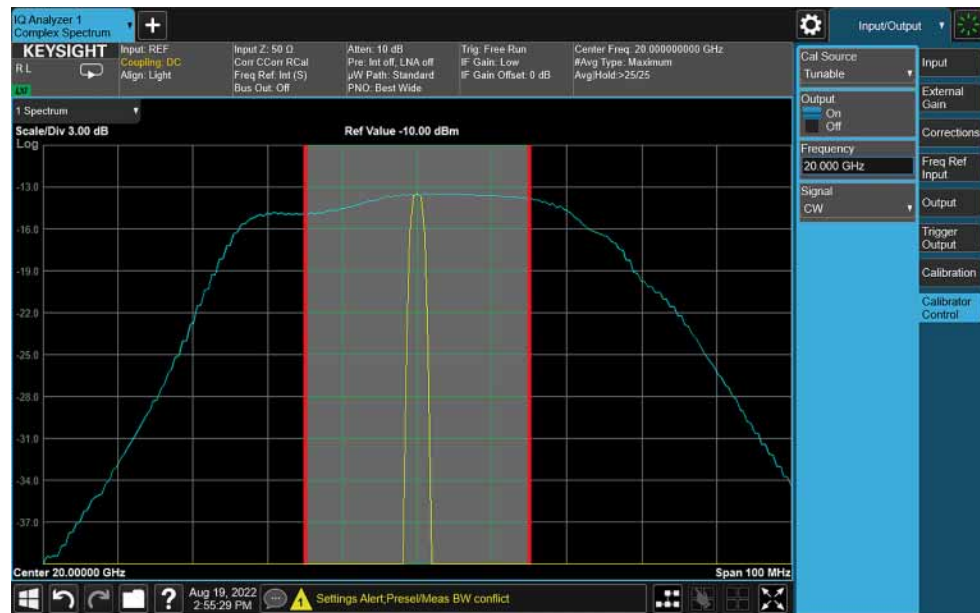
11. Change the average type to maximum by pressing **Meas Setup, Avg Type Maximum**.
12. Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.

13. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 50 MHz to draw the A12 YIG Tuned Filter shape on the display, as seen in [Figure 5-9](#).

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 5-9](#).

Figure 5-9 A12 YIG Tuned Filter Shape - 20 GHz



14. 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 5-9](#).

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 running the Characterize Preselector routine. See [Chapter 20, “Service Menus,”](#) for more information on this.

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 20 GHz, but any frequency higher than 3.6 GHz could be used.

NOTE

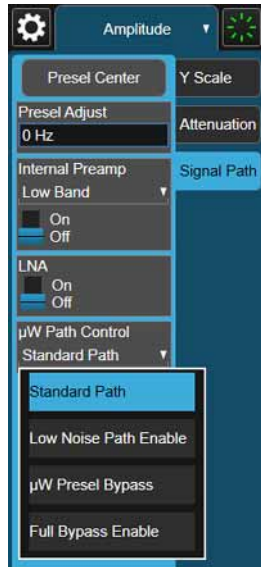
The options installed in the instrument will determine which μWave signal paths are available, as listed in [Table 5-2](#).

Table 5-2 Optional μWave Signal Paths

Option	μW Signal Path
Standard	Standard Path
LNP	Low Noise Path Enable
MPB	μW Presel Bypass
LNP & FBP	Full Bypass Enable

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. Turn the calibrator signal on and tune it to 20 GHz by pressing **Input/Output, Calibrator Control, Cal Source, Tunable, Output On, Frequency 20 GHz**.
4. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 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 5-10](#).

Figure 5-10 μ Wave Path Control - Standard Path

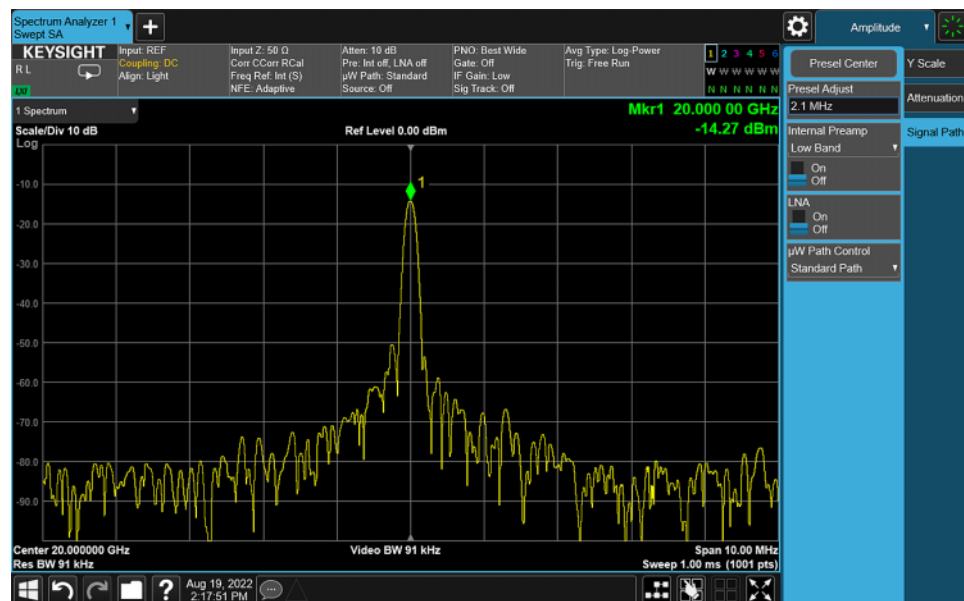


7. There should now be a signal at the center of the display at approximately -15 dBm, as seen in [Figure 5-11](#).

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. See [Chapter 20, "Service Menus,"](#) for more information on this.

Figure 5-11 μ Wave 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 A12 Yig Tuned Filter by pressing **Amplitude, Signal Path, μ Wave Path Control, μ Wave Presel Bypass**.

10. There should be a signal at the center of the display at approximately -15 dBm.

If there was previously no signal seen through the Standard path, but there is now through the μ W Presel Bypass path, there is most likely a problem with the A12 Yig Tuned Filter, or the control of it. See the “**A12 Yig Tuned Filter**” section in **Chapter 9, “RF Input Section,”** 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 μ W Presel Bypass path, there is most likely a problem with the SW4 MPB Switch, or the control of it. See the “**SW4 Microwave Preselector Bypass Switch**” section in **Chapter 9, “RF Input Section,”** to determine why there is a problem with the SW4 MPB Switch.

11. If the instrument has option LNP proceed to the next step. If not, go to **step 14**.

12. Bypass the A11 Band Switch by pressing **Amplitude, Signal Path, μ Wave Path Control, Low Noise Path Enable**.

13. There should be a signal at the center of the display at approximately -15 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 “**A11 Band Switch**” section in **Chapter 9, “RF Input Section,”** 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 “**SW3 Low Noise Path Switch**” section in **Chapter 9, “RF Input Section,”** to determine why there is a problem with the SW3 LNP Switch.

14. 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**” in this section for further fault isolation.

Preamplifier Functionality

There are three different preamplifiers in the instrument, all of which are available with any of the preamplifier options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N). They are the low band preamplifier on the A13 Downconverter, the high band preamplifier on the A11 Band Switch, and the low noise amplifier on the A11 Band Switch. All of these have a specified frequency range that they operate within, as seen in [Table 5-3](#).

Table 5-3 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
Low Noise	30 MHz	Instrument Max Frequency	18 dB

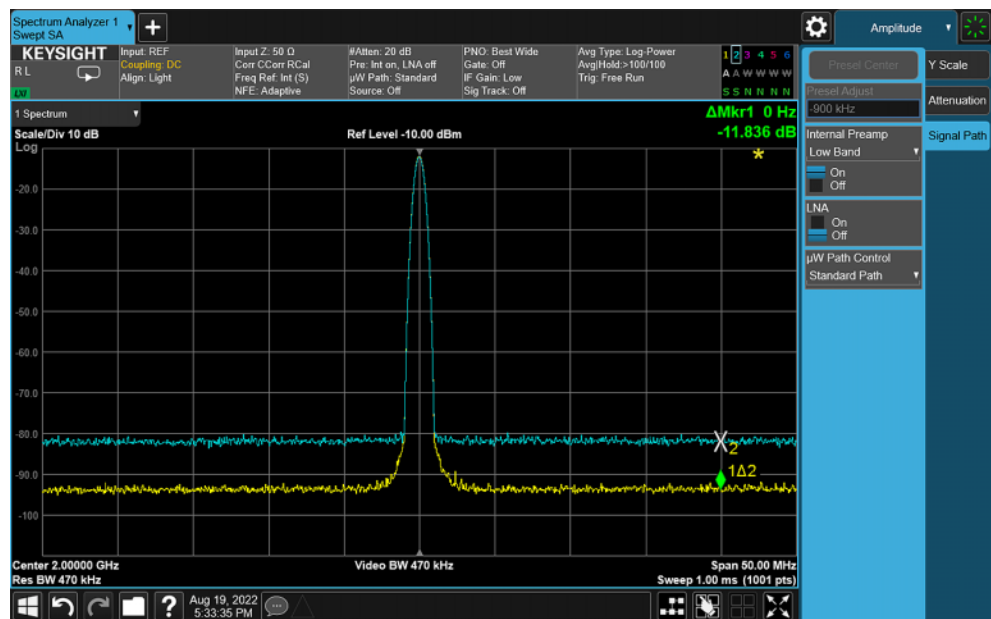
The P4L, P4L, P5L, and P5N options are for countries that have US export limitation. With one of these options the low noise amplifier is not allowed to operate above 43.5 GHz if the high band preamplifier is also turned on.

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 20 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. Turn the calibrator signal on and tune it to 2 GHz by pressing **Input/Output, Calibrator Control, Cal Source, Tunable, Output On, Frequency 2 GHz**.
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 -10 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 5-12](#).

Figure 5-12 Low Band Preamplifier On and Off



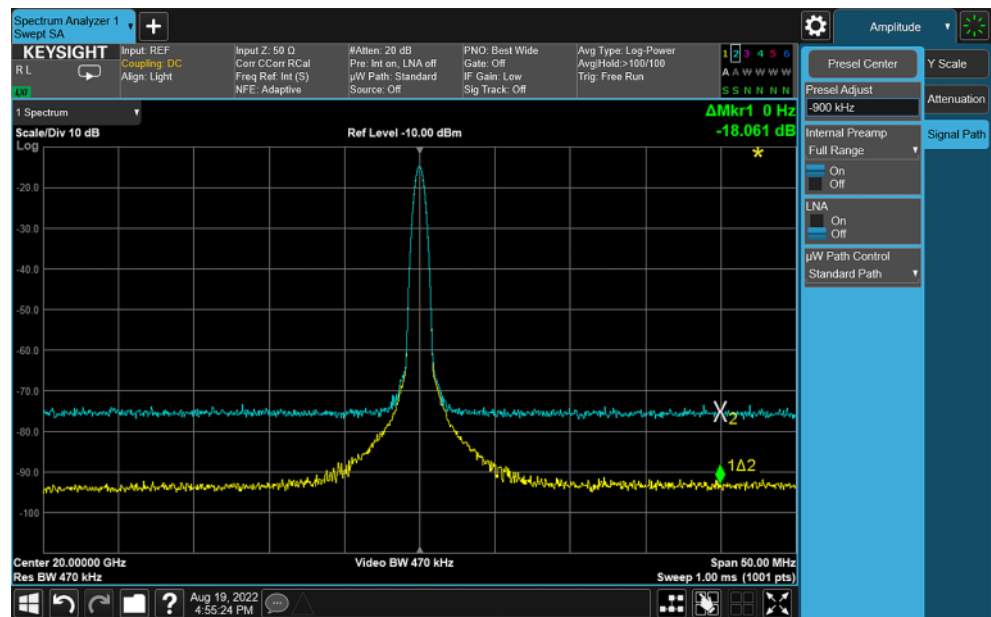
If either the signal level changes or the noise floor does not change as expected, see the [“A13 Downconverter”](#) section in [Chapter 10](#), [“Downconverter,”](#) to determine why the low band preamplifier is not working properly.

15. Turn the low band preamplifier off by pressing **Internal Preamp**, **Off**.
16. Turn the low noise amplifier on by pressing **LNA**, **On**.
17. The signal level should not change and the noise floor at the marker should also drop by approximately 10 dB, like that seen in [Figure 5-12](#).

If either the signal level changes or the noise floor does not change as expected, see the “**A11 Band Switch**” section in **Chapter 9, “RF Input Section,”** to determine why the low noise amplifier is not working properly.

18. Turn the low noise amplifier off by pressing **LNA, Off**.
19. Tune the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 GHz**.
20. Tune the calibrator to 20 GHz by pressing **Input/Output, Calibrator Control, Frequency 20 GHz**.
21. Center the A12 Yig Tuned Filter by pressing **Amplitude, Signal Path, Presel Center**.
22. 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**.
23. 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.
24. Activate the marker delta function by pressing **Marker Mode, Delta**.
25. Turn the high band preamplifier on by pressing **Amplitude, Signal Path, Internal Preamp, Full Range, On**.
26. Allow the **Avg/Hold** to reach 100.
27. The signal level should remain the same while the noise floor at the marker should drop by approximately 18 dB, as seen in **Figure 5-13**.

Figure 5-13 High Band Preamplifier On and Off



If either the signal level changes or the noise floor does not change as expected, see the “**A11 Band Switch**” section in **Chapter 9, “RF Input Section,”** to determine why the high band preamplifier is not working properly.

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

29. Turn the low noise amplifier on by pressing **LNA, On**.

30. The signal level should not change and the noise floor at the marker should drop by approximately 16 dB, like that seen in **Figure 5-13**.

If either the signal level changes or the noise floor does not change as expected, see the “**A11 Band Switch**” section in **Chapter 9, “RF Input Section,”** to determine why the low noise amplifier is not working properly.

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 20 GHz, but any frequency of interest could be used instead.

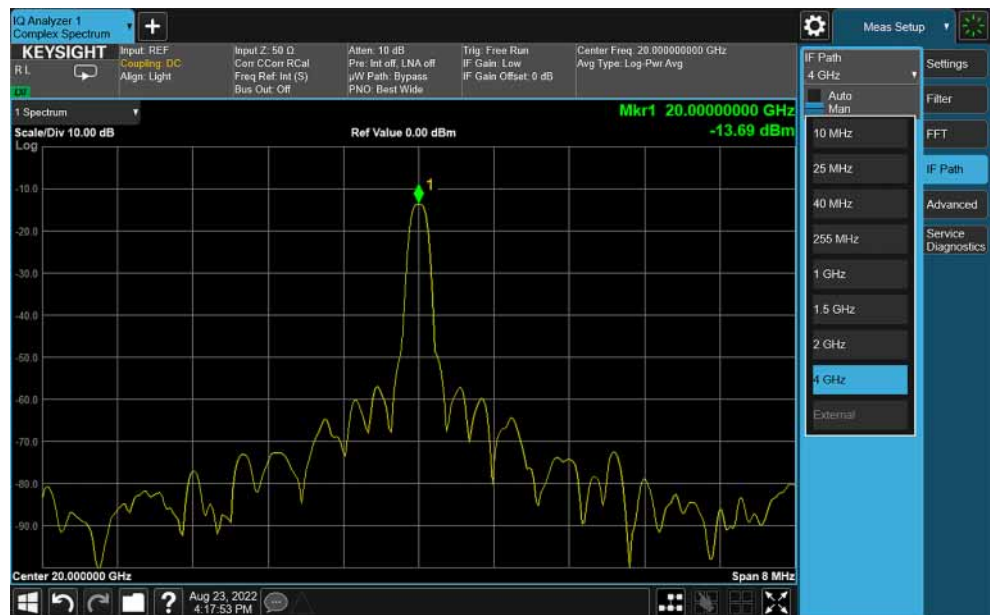
Once a fault has been narrowed down to certain frequencies and/or IF path(s), the information in **Table 5-4** can be used to find the assembly that might be at fault.

Table 5-4 IF Path versus IF Assembly

IF Path	IF Assembly
10/25 MHz	A2 & A3
40 MHz	A3 40 MHz DIF
255 MHz / 1 GHz	A21 Wideband DIF
1.5 GHz	A21 Wideband DIF

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. Turn the calibrator signal on and tune it to 20 GHz by pressing **Input/Output, Calibrator Control, Cal Source Tunable, Output On, Frequency 20 GHz**.
4. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 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 for the frequency used, as seen in **Figure 5-14**, and note any signal level drop-outs.

Figure 5-14 IF Signal Path Isolation - 20 GHz



9. If any problems are found after cycling through all the available IF Paths, refer to **Table 5-4** 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 a total of four different mixers in the A13 Downconverter, and all seven IF signal paths use multiple mixers. For example, the 1.0 GHz IF path uses 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 1.0 GHz IF signal path, as seen in [Table 5-5](#).

Table 5-5 IF Flatness Correction Variations

IF Path	Frequency Range	Mixer
10/25/40 MHz	10 MHz to 3.6 GHz	#1 & #2
	3.6 to 13.6 GHz	#2
	13.6 to 34.5 GHz	#3
	34.5 to 55 GHz	#4
255 MHz	400 MHz to 3.3 GHz	#1 & #2
	3.3 to 13.3 GHz	#2
	13.3 to 34.3 GHz	#3
	34.3 to 55 GHz	#4
1 GHz	700 MHz to 3.3 GHz	#1 & #2
	3.3 to 13.3 GHz	#2
	13.3 to 34.3 GHz	#3
	34.3 to 55 GHz	#4
1.5 GHz	950 MHz to 3.5 GHz	#1 & #2
	3.5 to 12.8 GHz	#2
	12.8 to 33.8 GHz	#3
	33.8 to 55 GHz	#4
2.0 GHz	3.5 to 12.8 GHz	#2
	12.8 to 33.8 GHz	#3
	33.8 to 55 GHz	#4

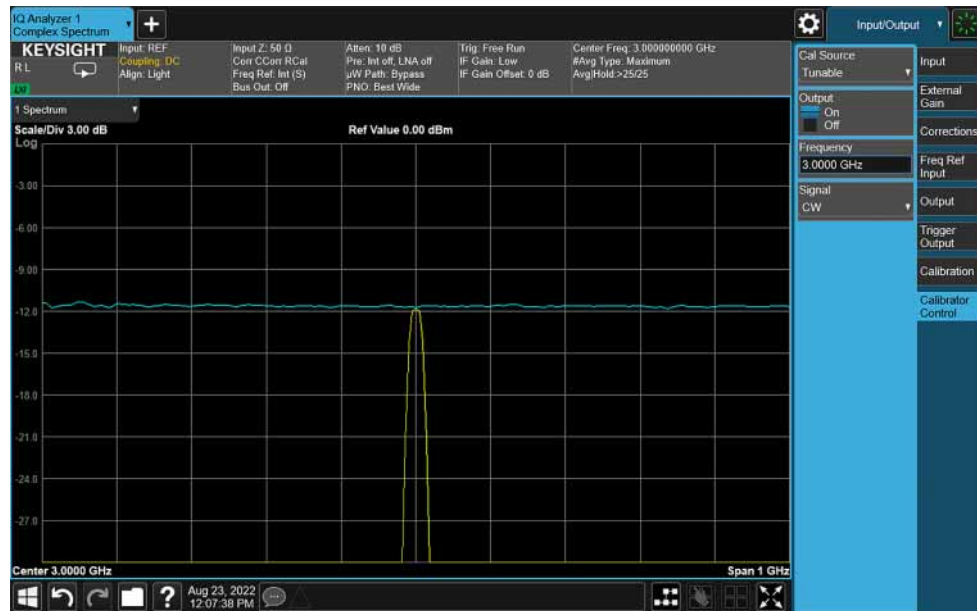
The following procedure can be used to view the IF response both with and without corrections applied for the 1.0 GHz IF Path for all four of the variations seen in [Table 5-5](#). If there is another bandwidth of interest that could be used instead.

NOTE

While this procedure operates as though the frequency response of the A25 Wideband Calibrator 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 calibrator 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 20, “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. Turn the calibrator signal on and tune it to 3 GHz by pressing **Input/Output, Calibrator Control, Cal Source Tunable, Output On, Frequency 3 GHz**.
5. Tune the center frequency of the instrument to 3 GHz by pressing **Frequency, Center Frequency 3 GHz**.
6. Set the span to 1 GHz by pressing **Span 1 GHz**.
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. Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.
10. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the corrected IF response using mixers #1 and #2 on the display, as seen in [Figure 5-15](#).

Figure 5-15 1.0 GHz IF Path Flatness - 3 GHz – IF Flatness On

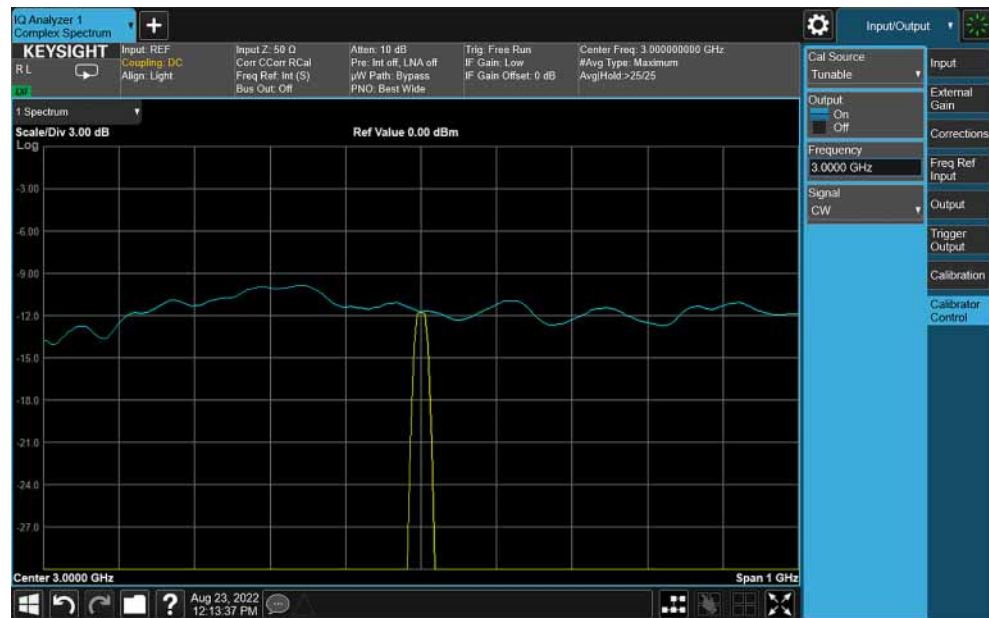


NOTE

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 5-15](#).

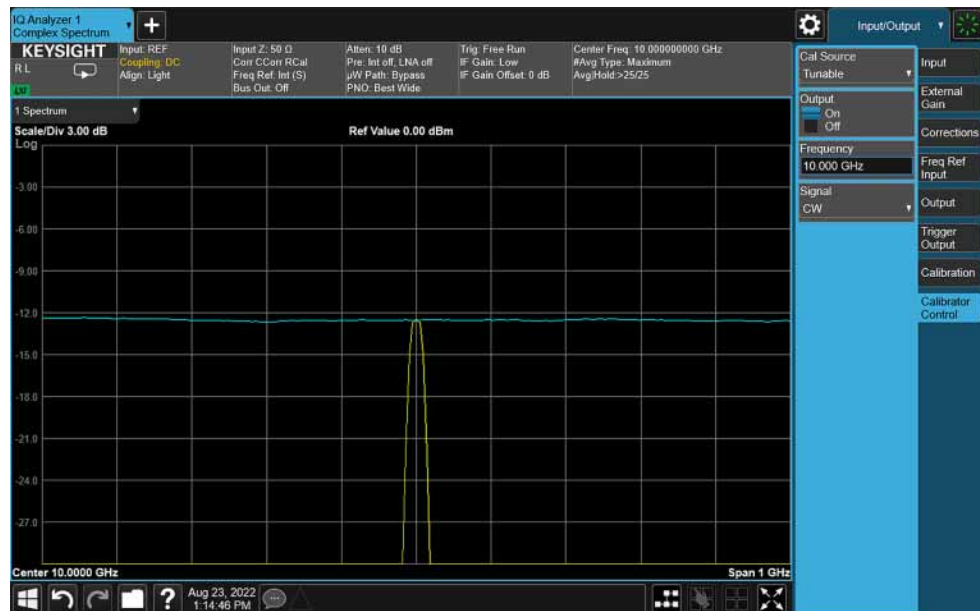
- 11.If the corrected frequency response error (blue trace) varies by more than ± 1 dB from the value at the center of the display, the IF flatness adjustment should probably be run. But before doing so, proceed to the next step and view the uncorrected frequency response to see if there is a larger problem that may need to be fixed before running the adjustment.
- 12.Turn the IF flatness off by pressing **Meas Setup, Service Diagnostics, IF Flatness Off**.
- 13.Restart the maximum trace by pressing **Sweep, Restart**.
- 14.Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.
- 15.Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the uncorrected IF response using mixers #1 and #2 on the display, as seen in [Figure 5-16](#).

Figure 5-16 1.0 GHz IF Path Flatness - 3 GHz – IF Flatness Off



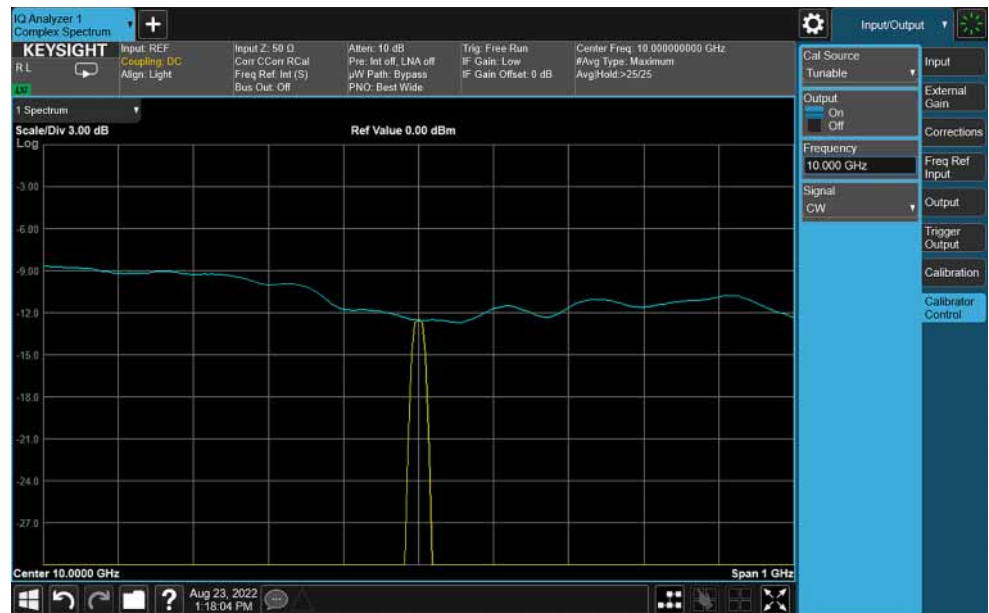
16. The uncorrected frequency response for the 1.0 GHz IF path at 3 GHz should look similar to that seen in [Figure 5-16](#). If it varies greatly from this, further troubleshooting will be needed to determine why.
17. Tune the center frequency of the instrument to 10 GHz by pressing **Frequency, Center Frequency 10 GHz**.
18. Turn the IF flatness on by pressing **Meas Setup, Service Diagnostics, IF Flatness On**.
19. Tune the calibrator signal to 10 GHz by pressing **Input/Output, Calibrator Control, Frequency 10 GHz**.
20. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the corrected IF response using mixer #2 on the display, as seen in [Figure 5-17](#).

Figure 5-17 1.0 GHz IF Path Flatness - 10 GHz - IF Flatness On



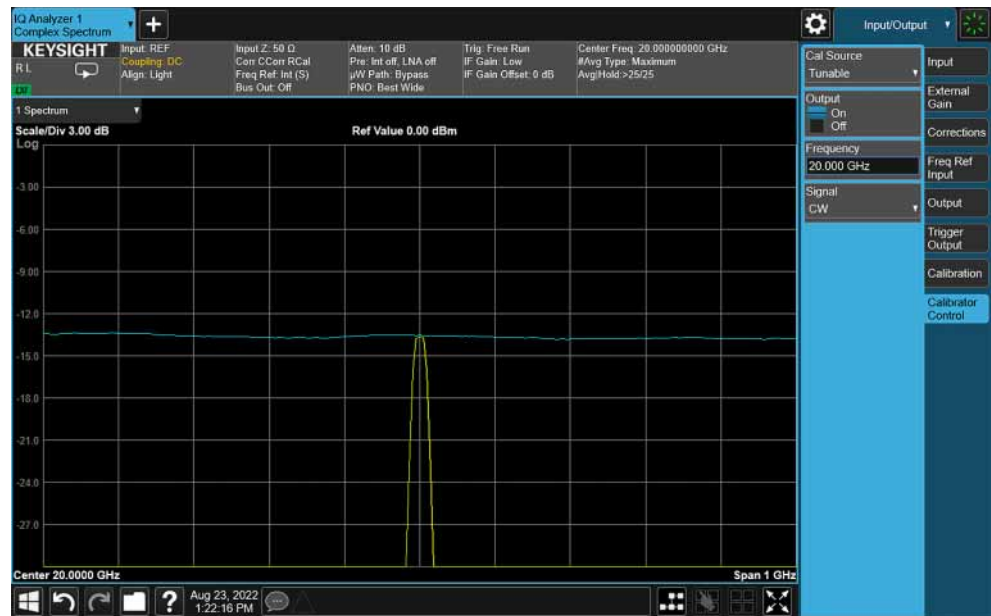
- 21.If the corrected frequency response error (blue trace) varies by more than ± 1 dB from the value at the center of the display, the IF flatness adjustment should probably be run. But before doing so, proceed to the next step and view the uncorrected frequency response to see if there is a larger problem that may need to be fixed before running the adjustment.
- 22.Turn the IF flatness off by pressing **Meas Setup, Service Diagnostics, IF Flatness Off**.
- 23.Restart the maximum trace by pressing **Sweep, Restart**.
- 24.Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.
- 25.Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the uncorrected IF response using mixer #2 on the display, as seen in [Figure 5-18](#).

Figure 5-18 1.0 GHz IF Path Flatness - 10 GHz - IF Flatness Off



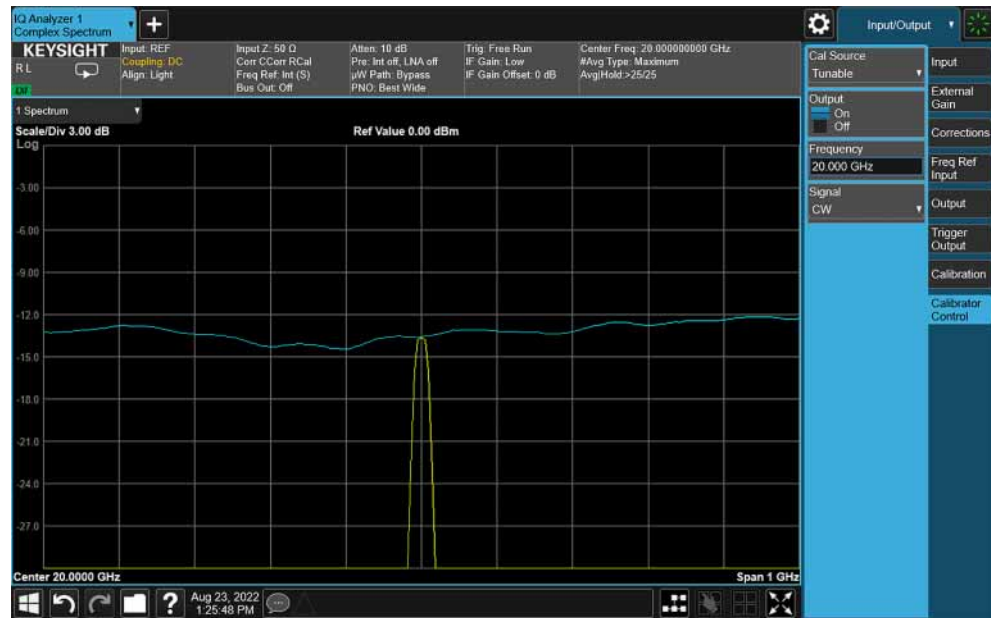
26. The uncorrected frequency response for the 1.0 GHz IF path at 10 GHz should look similar to that seen in [Figure 5-18](#). If it varies greatly from this, further troubleshooting will be needed to determine why.
27. Tune the center frequency of the instrument to 20 GHz by pressing **Frequency, Center Frequency 20 GHz**.
28. Turn the IF flatness on by pressing **Meas Setup, Service Diagnostics, IF Flatness On**.
29. Tune the calibrator signal to 20 GHz by pressing **Input/Output, Calibrator Control, Frequency 20 GHz**.
30. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the corrected IF response using mixer #5 on the display, as seen in [Figure 5-19](#).

Figure 5-19 1.0 GHz IF Path Flatness - 20 GHz - IF Flatness On



31. 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.
32. Turn the IF flatness off by pressing **Meas Setup, Service Diagnostics, IF Flatness Off**.
33. Restart the maximum trace by pressing **Sweep, Restart**.
34. Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.
35. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the uncorrected IF response using mixer #5 on the display, as seen in [Figure 5-20](#).

Figure 5-20 1.0 GHz IF Path Flatness - 20 GHz - IF Flatness Off



36. The uncorrected frequency response for the 1.0 GHz IF path at 20 GHz should look similar to that seen in [Figure 5-20](#). If it varies greatly from this, further troubleshooting will be needed to determine why.

37. Tune the center frequency of the instrument to 40 GHz by pressing **Frequency, Center Frequency 40 GHz**.

NOTE

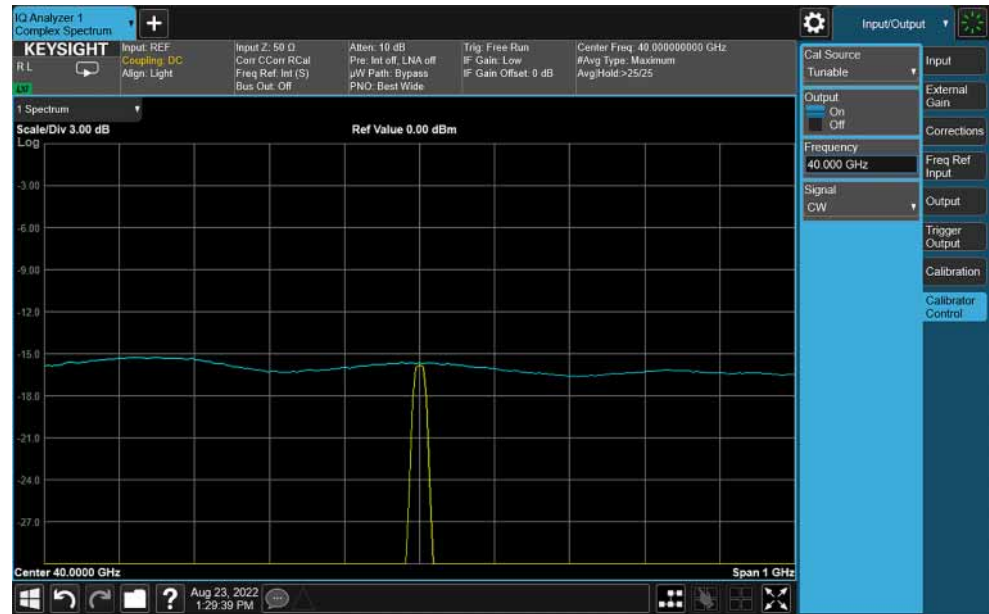
If the instrument being evaluated can only tune up to 26.5 GHz, use that frequency instead of 40 GHz to evaluate the IF flatness of the 1.0 GHz IF path through mixer #6.

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

39. Tune the calibrator signal to 40 GHz by pressing **Input/Output, Calibrator Control, Frequency 40 GHz**.

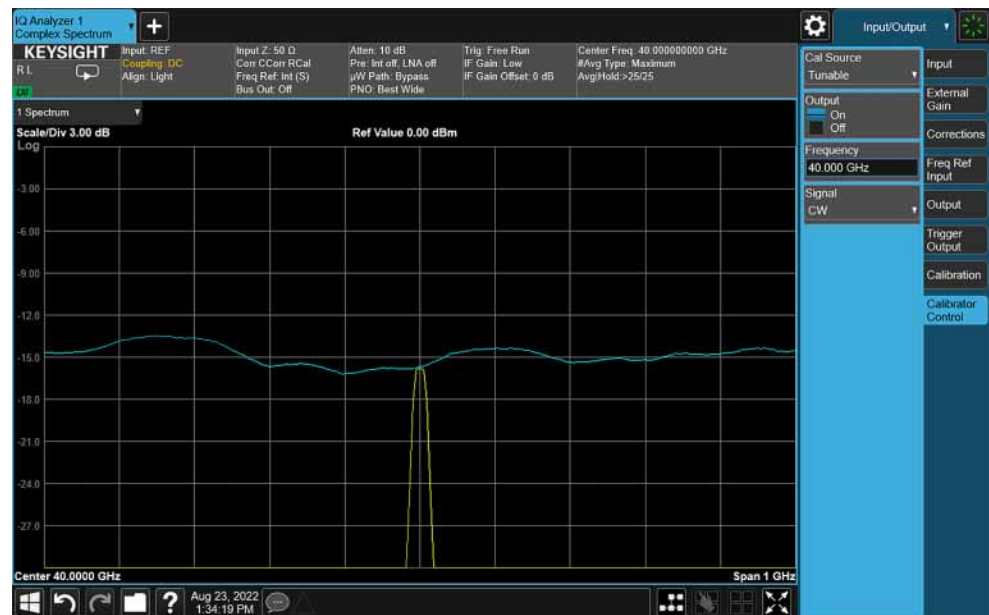
40. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the corrected IF response using mixer #6 on the display, as seen in [Figure 5-21](#).

Figure 5-21 1.0 GHz IF Path Flatness - 40 GHz - IF Flatness On



41. 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.
42. Turn the IF flatness off by pressing **Meas Setup, Service Diagnostics, IF Flatness Off**.
43. Restart the maximum trace by pressing **Sweep, Restart**.
44. Make the calibrator frequency the active function by pressing **Input/Output, Calibrator Control, Frequency**.
45. Use the front panel right and left arrow keys or RPG knob to step the frequency of the calibrator ± 500 MHz to draw the uncorrected IF response using mixer #6 on the display, as seen in [Figure 5-22](#).

Figure 5-22 1.0 GHz IF Path Flatness - 40 GHz - IF Flatness Off



46. The uncorrected frequency response for the 1.0 GHz IF path at 40 GHz should look similar to that seen in [Figure 5-22](#). 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 5-6](#), and the location of the LEDs for each can be seen in [Figure 5-23](#).

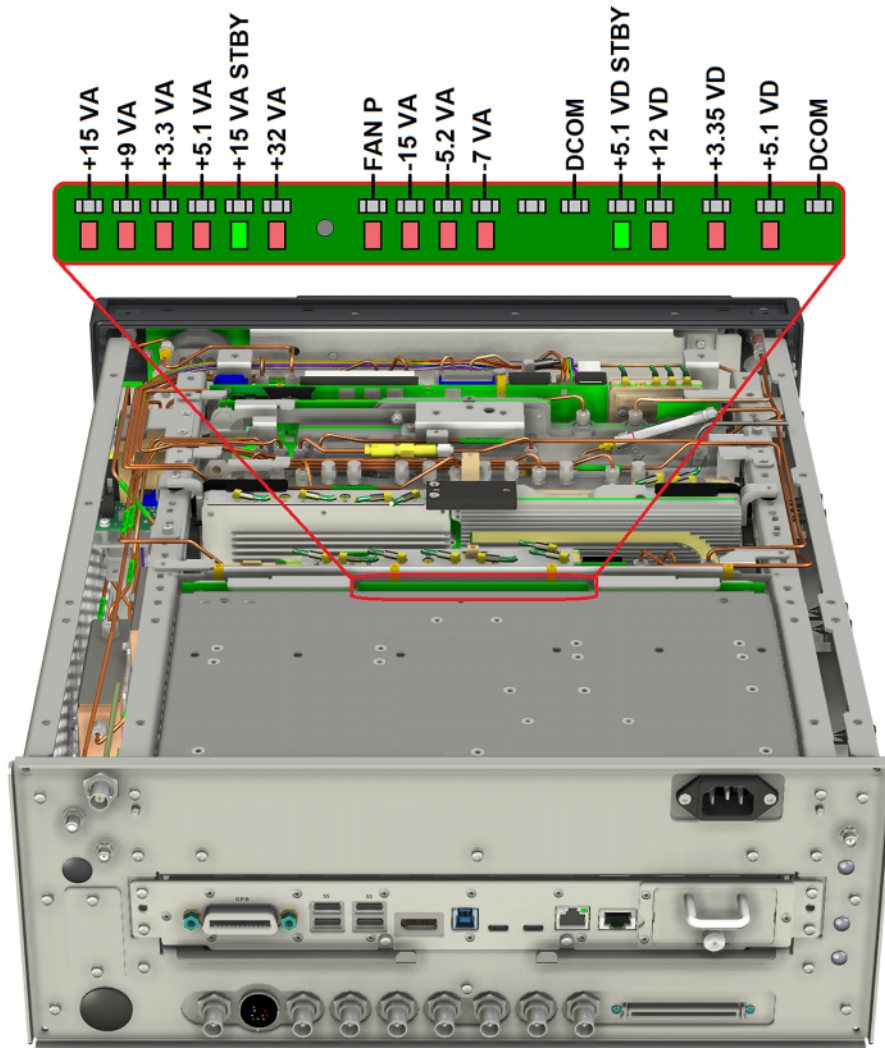
There are two different types of power supply LEDs to be monitored, both of which indicate the status of the supplies. The standby power supplies have green LEDs that should be on whenever the AC mains are connected to the instrument, whether it is turned on or not. The rest of the power supplies have red fault LEDs that will only be on when that power supply does not meet its required voltage level. This includes when the instrument is in standby mode.

Table 5-6 Power Supply Voltage

Supply Voltage	Regulated On	Test Point
+3.3 V Analog	A7 Midplane Board	TP515
+3.35 V Digital	A6 Power Supply	TP507
+5.1 V Standby	A6 Power Supply	TP502
+5.1 V Digital	A6 Power Supply	TP505
+5.2 V Analog	A6 Power Supply	TP513
+9 V Analog	A6 Power Supply	TP511
+12 V Digital	A6 Power Supply	TP503
+15 V Standby	A6 Power Supply	TP501
+15 V Analog	A6 Power Supply	TP509
+32 V Analog	A6 Power Supply	TP504
-5.2 V Analog	A7 Midplane Board	TP516
-7 V Analog	A6 Power Supply	TP514
-15 V Analog	A6 Power Supply	TP512
Fan	A6 Power Supply	TP522

Figure 5-23

Power Supply LED Locations – A7 Midplane Board



When the instrument is turned on the two green power supply LEDs should be on and the twelve red fault LEDs should all be off. 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 any of the voltages regulated on the A6 Power Supply are not at the correct level, see [Chapter 17, “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 18, “Motherboards,”](#) to determine why.

First-Look Troubleshooting
Power Supply Verification

6 Variable Gains

This chapter provides information on the following:

[Overview on page 148](#)

[A2 25 MHz Analog IF Variable Gains on page 150](#)

[Description on page 150](#)

[Associated Alignments on page 150](#)

[Manual Verification on page 151](#)

[A3 40 MHz Digital IF Variable Gains on page 154](#)

[Description on page 154](#)

[Associated Alignment on page 154](#)

[Manual Verification on page 155](#)

[A21 Wideband Digital IF Variable Gains on page 158](#)

[Description on page 158](#)

[Associated Alignment on page 158](#)

[Manual Verification on page 159](#)

[A23 IF Mux Variable Gains on page 162](#)

[Description on page 162](#)

[Associated Alignments on page 162](#)

[Manual Verification on page 163](#)

Overview

The instrument needs to be able to adjust the signal level through its different signal paths to maximize the signal to noise ratio and compensate for front end loss.

The instrument can make power level adjustments using variable gains on the following assemblies:

- A2 25 MHz Analog IF
- A3 40 MHz Digital IF
- A21 Wideband Digital IF
- A23 IF Mux

While these are called variable gains, the power level adjustments are made using electronic step attenuators, which are used in conjunction with amplifiers on these assemblies. Also, the electronic step attenuators used on these assemblies typically have a wider range than what the instrument uses, so not every step of their full range can be verified, only the ones that the instrument uses.

The **IF Gain Offset** setting under the **Meas Setup, Advanced** menu can be used to vary these IF gains.

The instrument's built-in auto alignment system is used to measure the accuracy of these electronic step attenuators to help keep the performance of the instrument within its published specifications. For more information on the individual internal alignments mentioned in this chapter, see [Chapter 4, "Internal Alignments."](#)

The following sections in this chapter will cover each of the assemblies listed above that contain variable gains. How to verify the performance of each of these will be outlined, along with information on what internal alignments are used to measure the performance of each of them.

If an instrument is having overall signal level issues, that should be resolved before proceeding with any of the step attenuator verifications. However, the verification procedures should be able to be run even if the absolute signal levels are not as described, if just a verification of the step attenuator functionality is desired.

The measurements made of the actual range of the electronic step attenuators outlined in this chapter may vary slightly from those listed, depending on the alignment of the instrument, especially if there is a signal level issue. The procedures in the chapter try to limit this variation by having the alignment data defaulted and the corrections that can be turned off, turned off before making any measurements.

NOTE

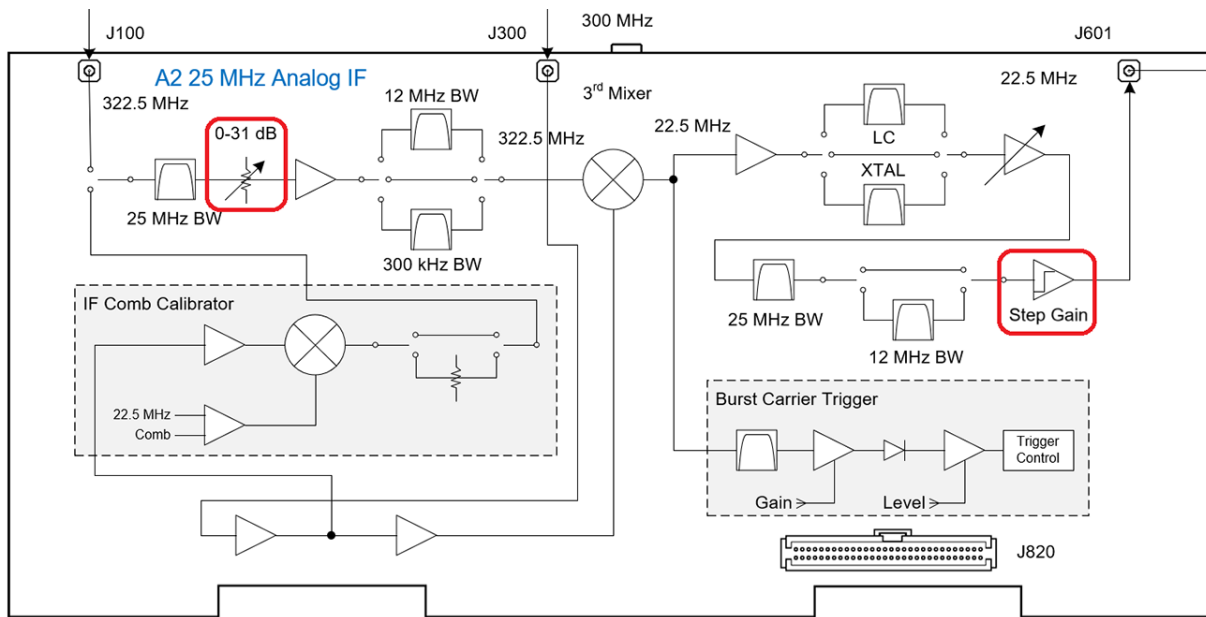
If while performing any of the manual verification procedures in this chapter the range of a step attenuator is not as wide as expected, be sure that the instrument has the latest version of software installed.

A2 25 MHz Analog IF Variable Gains

Description

There is an electronic step attenuator near the 322.5 MHz IF input of the A2 25 MHz Analog IF assembly, as seen in **Figure 6-1**. It has a range of 0 to 31 dB, in 1 dB steps. There is also a step gain amplifier at the 22.5 MHz output of the assembly that has a switchable 10 dB of amplification. These are both used in the 10 / 25 MHz IF signal path.

Figure 6-1 A2 25 MHz Analog IF Variable Attenuator



The easiest way to determine if these step attenuators are functioning properly is to run the internal alignments and then review the data output for the associated alignment listed below, which can be found in the instrument at:

E:\AlignDataStorage\AlignmentHistory.txt

If a manual verification of the functionality of the step attenuators is desired, see the manual verification procedure below.

Associated Alignments

AIF Variable Attenuator Algorithm

Measures the accuracy of the electronic step attenuators on the A2 25 MHz Analog IF assembly. While the step attenuator used has a range of 0 to 31 dB, this alignment only covers the range of 0 to 19 dB.

AIF Step Gain Algorithm

Measures the gain of the additional 10 dB of amplification of the step gain amplifier at the 22.5 MHz output.

Manual Verification

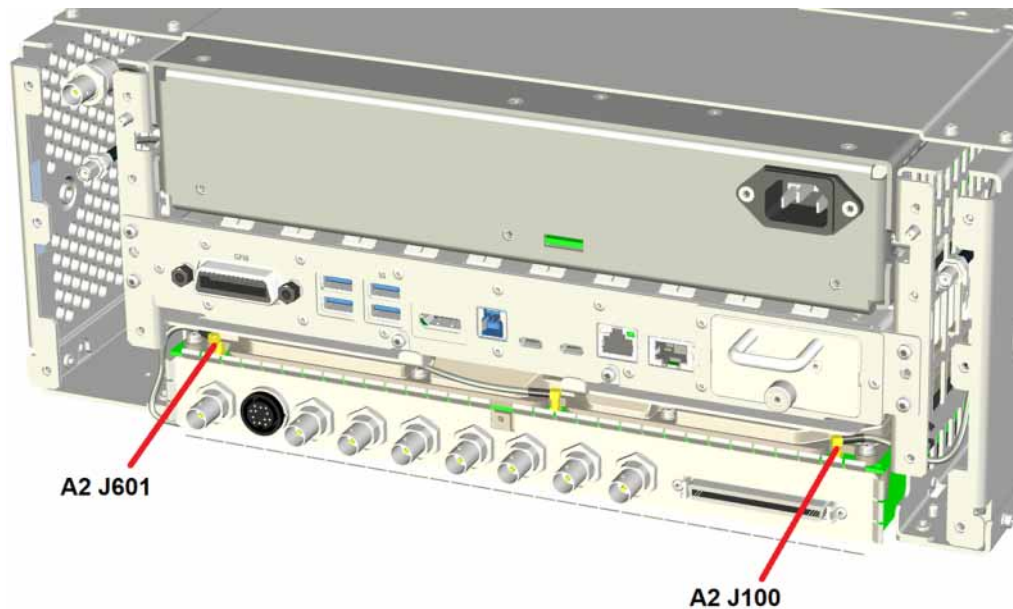
The following procedure will verify both the electronic step attenuator and the step gain amplifier on the A2 25 MHz Analog IF assembly.

1. Switch the instrument to IQ Analyzer mode by pressing **Mode/Meas, IQ Analyzer (Basic), OK**.
2. Place the instrument in a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Default the alignment data by pressing **System, Alignments, Restore Alignment Defaults**.
5. Set the span to 10 MHz by pressing **Frequency, Span 10 MHz**.
6. Set the IF gain to low by pressing **Meas Setup, Advanced, IF Gain Low Gain, Man**.
7. Enable the instrument Service Menus.

If information on enabling the Service Menus is needed, see the “**Service Menu Access**” section in **Chapter 20, “Service Menus.”**

8. Go to the **Meas Setup, Service Diagnostics** menu and turn off all the following:
 - RF Flatness Video Shift
 - Temperature Gain & Tilt
 - IF Flatness
 - RF to IF Corrections
9. Referring to **Figure 6-2**, remove W101 from the A2 25 MHz Analog IF J100.

Figure 6-2 A2 25 MHz Analog IF Connections



10. Connect a signal generator to J100.
11. Tune the signal generator to 322.5 MHz.
12. Set the power level of the signal generator to -20 dBm.
13. Verify that there is a signal at the center of the instrument display at appropriately -20 dBm.
If there is no signal on the display as expected, see the “A2 25 MHz Analog IF” section in [Chapter 13, “Analog and Digital IFs,”](#) to determine why before proceeding.
14. Referring to [Figure 6-2](#), remove W100 from the A2 25 MHz Analog IF J601.
15. Connect a spectrum analyzer to J601.
16. Tune the spectrum analyzer to 22.5 MHz with a span of 10 MHz.
17. Verify that there is a 22.5 MHz signal on the spectrum analyzer display at approximately -20 dBm.
If there is no signal as expected, see the “A2 25 MHz Analog IF” section in [Chapter 13, “Analog and Digital IFs,”](#) to determine why before proceeding.
18. Set the IF gain offset to maximum by pressing **Meas Setup, Advanced, IF Gain Offset, 12 dB**.
19. Place a marker on the 22.5 GHz signal on the spectrum analyzer display.
20. Enable to delta marker function on the spectrum analyzer.

21. Step the IF Gain Offset down to its minimum value 1 dB at a time using either the **Down Arrow** or the **Knob** on the front panel and observe the marker delta reading on the spectrum analyzer display.
22. Verify that the power level of the 22.5 MHz signal on the spectrum analyzer display steps down by approximately 1 dB at a time as the IF Gain Offset is decreased.

If the power level of the 22.5 MHz signal changes as expected, the step attenuator at the input of the A2 25 MHz Analog IF assembly is working as properly. Proceed to the next step.

If the power level of the 22.5 MHz signal does not change as expected, replace the A2 25 MHz Analog IF assembly.

NOTE

While the IF Gain Offset value will go from +12 to -12 dB, the power level of the 22.5 MHz signal is not expected to change a full 24 dB. It should change by 20 to 22 dB total.

-
23. Set the IF gain offset to the default value by pressing **IF Gain Offset 0 dB**.
 24. Zero the delta marker value on the spectrum analyzer.
 25. Set the IF gain to high by pressing **IF Gain High Gain**.
 26. Verify that the 22.5 MHz signal on the spectrum analyzer display increases by 10 dB, ± 1 dB.

If the power level of the 22.5 MHz signal changes as expected, the step gain amplifier at the output of the A2 25 MHz Analog IF assembly is working properly.

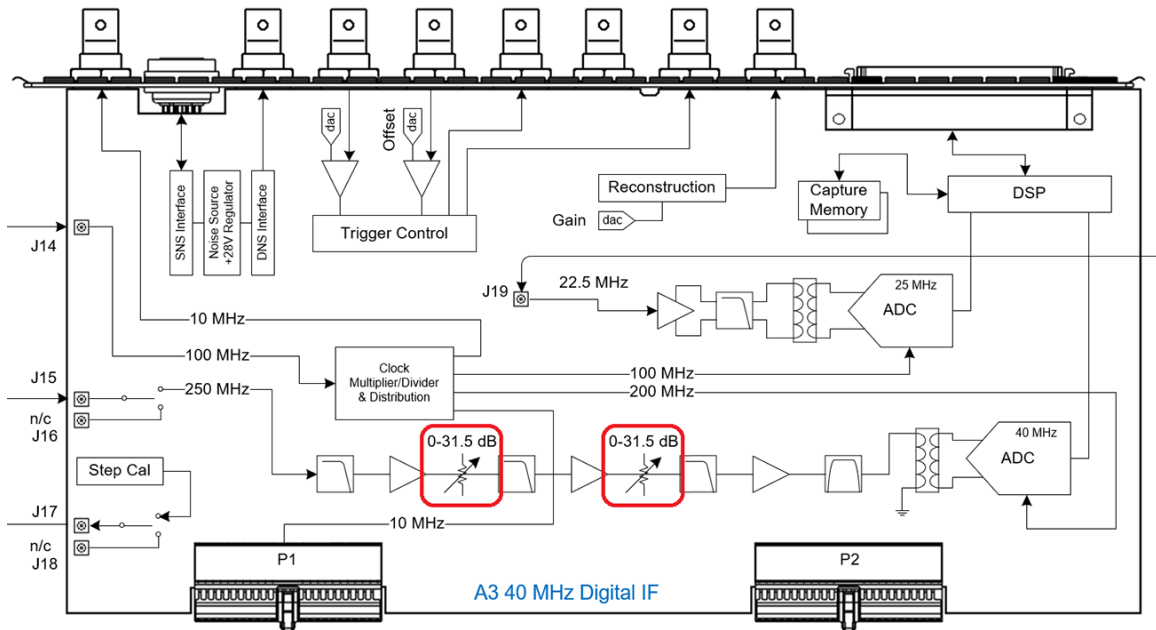
If the power level of the 22.5 MHz signal does not change as expected, replace the A2 25 MHz Analog IF assembly.

A3 40 MHz Digital IF Variable Gains

Description

There are two electronic step attenuators in the 250 MHz IF input of the A3 40 MHz Digital IF assembly, as seen in **Figure 6-3**. Each of these has a range of 0 to 31.5 dB, in 0.5 dB steps. These are both used for the 40 MHz IF signal path.

Figure 6-3 A3 40 MHz Digital IF Variable Attenuators



The easiest way to determine if these step attenuators are functioning properly is to run the internal alignments and then review the data output for the associated alignment listed below, which can be found in the instrument at:

E:\AlignDataStorage\AlignmentHistory.txt

If a manual verification of the functionality of the step attenuators is desired, see the manual verification procedure below.

Associated Alignment

DIF 40 Variable Attenuator Algorithm

Measures the accuracy of the electronic step attenuators on the A3 40 MHz Digital IF assembly. While the step attenuators used have a combined range of 0 to 63 dB, this alignment only covers the range of 4 to 26 dB.

Manual Verification

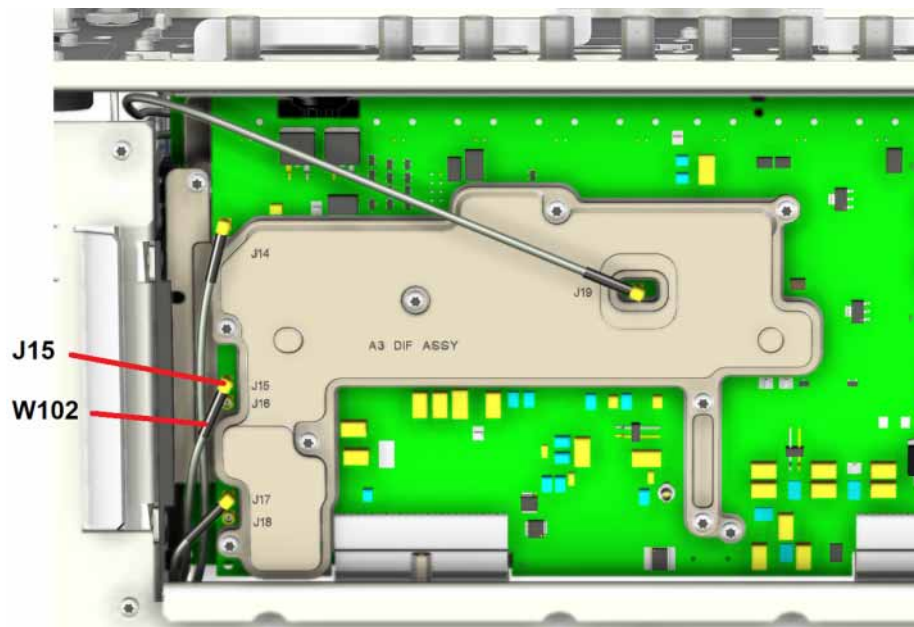
The following procedure will verify both electronic step attenuators on the A3 40 MHz Digital IF assembly. It will also verify what appears to be a step gain amplifier but is actually just another attenuator setting.

1. Switch the instrument to IQ Analyzer mode by pressing **Mode/Meas, IQ Analyzer (Basic), OK**.
2. Place the instrument in a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Default the alignment data by pressing **System, Alignments, Restore Alignment Defaults**.
5. Set the span to 40 MHz by pressing **Frequency, Span 40 MHz**.
6. Set the IF gain to low by pressing **Meas Setup, Advanced, IF Gain Low Gain, Man**.
7. Set the IF gain offset to maximum by pressing **Meas Setup, Advanced, IF Gain Offset, 12 dB**.
8. Enable the instrument Service Menus.

If information on enabling the Service Menus is needed, see the **“Service Menu Access”** section in **Chapter 20, “Service Menus.”**

9. Go to the **Meas Setup, Service Diagnostics** menu and turn off all the following:
 - RF Flatness Video Shift
 - Temperature Gain & Tilt
 - IF Flatness
 - RF to IF Corrections
10. Referring to **Figure 6-4**, remove W102 from the A3 40 MHz Digital IF J15.

Figure 6-4 A3 40 MHz Digital IF Connection



NOTE

An alternate method for performing this verification would be to remove W102 from the A15 Front End Controller J901 and connect the signal generator to the end of W102.

11. Connect a signal generator to J15.
12. Tune the signal generator to 250 MHz.
13. Set the power level of the signal generator to -20 dBm.
14. Verify that there is a signal at the center of the instrument display at appropriately -15 dBm.

If there is no signal on the display as expected, see the “A3 40 MHz Digital IF” section in [Chapter 13, “Analog and Digital IFs,”](#) to determine why before proceeding.
15. Put the instrument in ADC direct mode by pressing **Meas Setup, Service Diagnostics, ADC Direct On**.
16. Press **Peak Search** to place a marker on the signal displayed on the screen.
17. Adjust the power level of the signal generator for a marker reading of -10 dBm.
18. Make the IF Gain Offset adjustment the active function by pressing **Meas Setup, Advanced**.

19. Step the IF Gain Offset down to its minimum value 1 dB at a time using either the **Down Arrow** or the **Knob** on the front panel and observe the marker reading on the display.

20. Verify that the power level of the signal on the display steps down by approximately 1 dB at a time as the IF Gain Offset is decreased.

There will most likely not be any change to the displayed signal level until the IF Gain Offset value reaches somewhere around 8 dB.

If the power level of the signal changes as expected, proceed to the next step.

If the power level of the signal does not change as expected, replace the A3 40 MHz Digital IF assembly.

NOTE

While the IF Gain Offset value will go from +12 to -12 dB, the power level of the signal is not expected to change a full 24 dB. It will probably only change by 20 to 22 dB total.

21. Set the IF Gain Offset to 0 dB.

22. Note the power level of the signal on the screen.

23. Set the IF gain to high by pressing **IF Gain High Gain**.

24. Verify that the signal on the display increases by 10 dB, ± 1.5 dB.

If the power level of the signal changes as expected, the step attenuators on the A3 40 MHz Digital IF assembly are working properly.

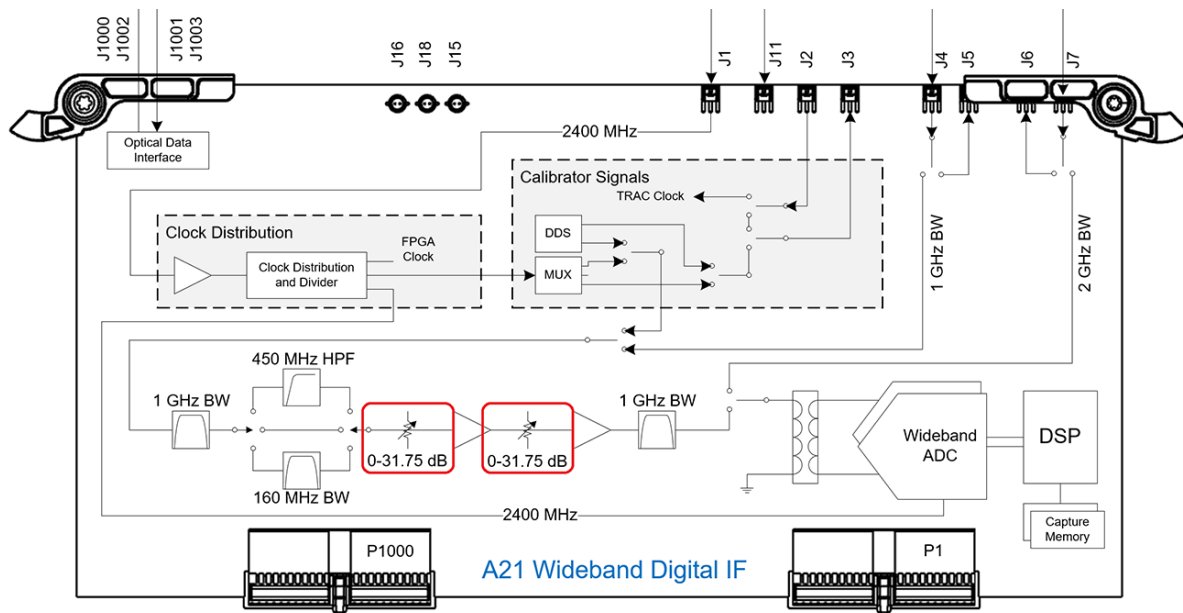
If the power level of the signal does not change as expected, replace the A3 40 MHz Digital IF assembly.

A21 Wideband Digital IF Variable Gains

Description

There are two electronic step attenuators in the 255 MHz / 1.0 GHz IF signal path of the A21 Wideband Digital IF assembly, as seen in **Figure 6-5**. Each of these has a range of 0 to 31.75 dB, in 0.25 dB steps. These are used for both the 255 MHz and 1.0 GHz IF signal paths.

Figure 6-5 A21 Wideband Digital IF Variable Attenuators



The easiest way to determine if these step attenuators are functioning properly is to run the internal alignments and then review the data output for the associated alignment listed below, which can be found in the instrument at:

E:\AlignDataStorage\AlignmentHistory.txt

If a manual verification of the functionality of the step attenuators is desired, see the manual verification procedure below.

Associated Alignment

AIF Scarlet WB Variable Attenuator Algorithm

Measures the accuracy of the electronic step attenuators in the 255 MHz / 1.0 GHz signal path on the A21 Wideband Digital IF assembly. A range of 0 to 25 dB of attenuation is covered.

Manual Verification

The following procedure will verify both electronic step attenuators on the A21 Wideband Digital IF assembly.

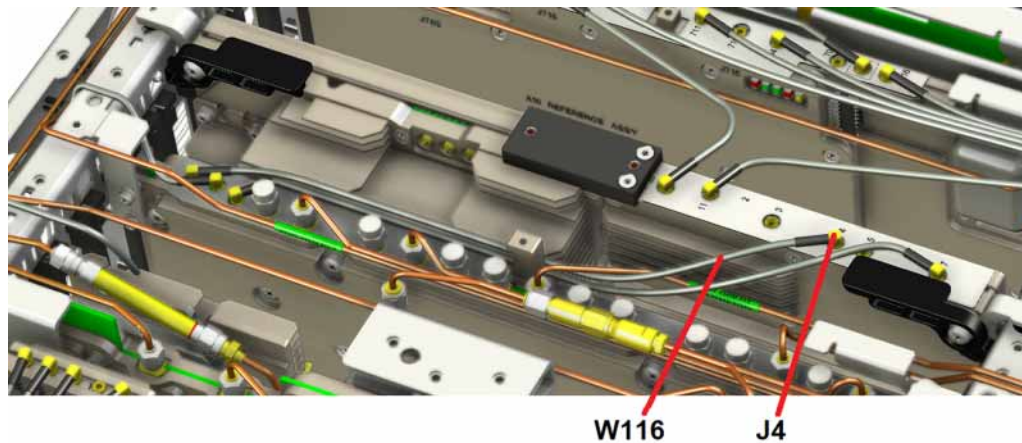
In addition to the electronic step attenuators on the A21 Wideband Digital IF assembly, the 255 MHz / 1.0 GHz IF signal path also uses an electronic step attenuator on the A23 IF Mux assembly. The effects of this will be seen in the following verification procedure. The step attenuator on the A23 IF Mux will change by 2 dB every five or six steps of the IF Gain Offset, which will cause the signal level on the display to increase by 2 dB to compensate for that change, which will make it appear that the stepping of the attenuators on the A21 Wideband Digital IF have a problem when they don't.

1. Switch the instrument to IQ Analyzer mode by pressing **Mode/Meas, IQ Analyzer (Basic), OK**.
2. Place the instrument in a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Default the alignment data by pressing **System, Alignments, Restore Alignment Defaults**.
5. Set the span to 1 GHz by pressing **Frequency, Span 1.0 GHz**.
6. Set the IF gain to low by pressing **Meas Setup, Advanced, IF Gain Low Gain, Man**.
7. Set the IF gain offset to 10 dB by pressing **Meas Setup, Advanced, IF Gain Offset, 10 dB**.
8. Enable the instrument Service Menus.

If information on enabling the Service Menus is needed, see the “**Service Menu Access**” section in **Chapter 20, “Service Menus.”**

9. Go to the **Meas Setup, Service Diagnostics** menu and turn off all the following:
 - RF Flatness Video Shift
 - Temperature Gain & Tilt
 - IF Flatness
 - RF to IF Corrections
10. Referring to **Figure 6-6**, remove W116 from the A21 Wideband Digital IF J4.

Figure 6-6 A21 Wideband Digital IF Connection



11. Connect a signal generator to J4.
12. Tune the signal generator to 690 MHz.
13. Set the power level of the signal generator to -20 dBm.
14. Verify that there is a signal at the center of the instrument display at appropriately -25 dBm.

If there is no signal on the display as expected, see the “A21 Wideband Digital IF” section in **Chapter 13, “Analog and Digital IFs,”** to determine why before proceeding.
15. Put the instrument in ADC direct mode by pressing **Meas Setup, Service Diagnostics, ADC Direct On**.

NOTE

When ADC Direct is turned on the signal will move away from the center of the display and the amplitude will increase, which is normal for this IF signal path.

16. Press **Peak Search** to place a marker on the signal displayed on the screen.
17. Adjust the power level of the signal generator for a marker reading of -10 dBm.
18. Make the IF Gain Offset adjustment the active function by pressing **Meas Setup, Advanced**.
19. Step the IF Gain Offset down to its minimum value 1 dB at a time using either the **Down Arrow** or the **Knob** on the front panel and observe the marker reading on the display.

There will most likely not be any change to the displayed signal level until the IF Gain Offset value reaches somewhere around 5 dB.

NOTE

As mentioned above, every five or six steps of the IF Gain Offset value will also cause the electronic step attenuator on the A23 IF Mux to increase, which in turn will cause the instrument to compensate for it, which will increase the signal level by 1 dB instead of decreasing it.

20. Verify that the power level of the signal on the display steps down by approximately 1 dB at a time as the IF Gain Offset is decreased.

NOTE

While the IF Gain Offset value will go from +32 to -32 dB, the power level of the signal is not expected to change by 64 dB. It will only change by approximately 24 dB. However, when the compensation for the step attenuator changes on the A23 IF Mux are taken into consideration, a visual change of 24 dB would equate to an actual step attenuator change of 36 dB.

If the power level of the signal changes as expected, proceed to the next step.

If the power level of the signal does not change as expected, replace the A21 Wideband Digital IF assembly.

21. Set the IF gain offset to minimum by pressing **IF Gain Offset -32 dB**.

22. Note the power level of the signal on the screen.

23. Set the IF gain to high by pressing **IF Gain High Gain**.

24. Verify that the signal on the display increases by at least 4 dB.

If the power level of the signal changes as expected, the step attenuators on the A21 Wideband Digital IF assembly are working properly.

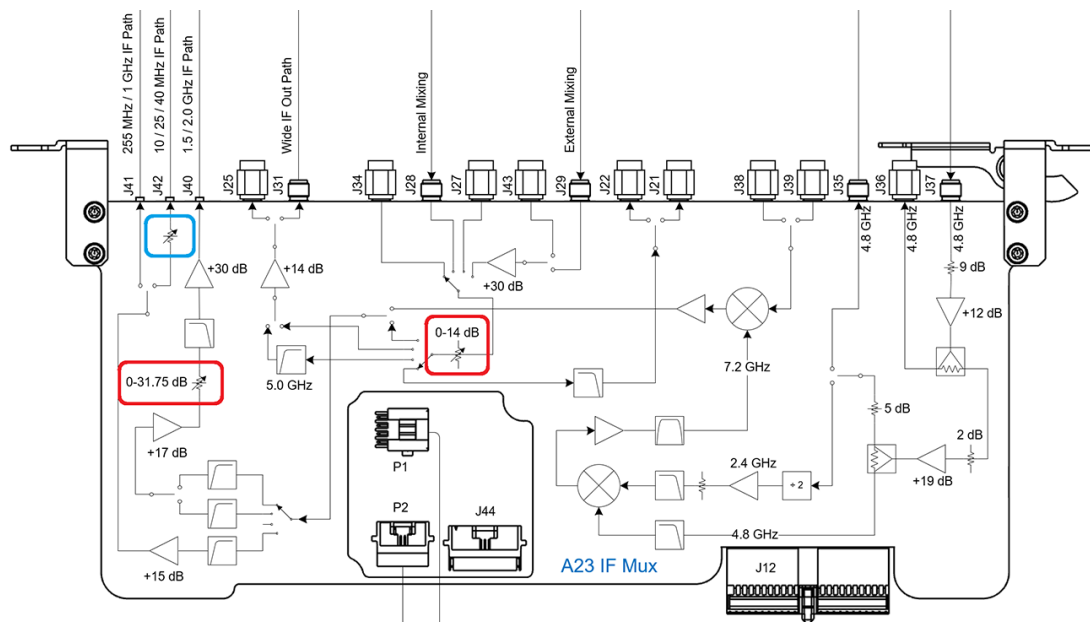
If the power level of the signal does not change as expected, replace the A21 Wideband Digital IF assembly.

A23 IF Mux Variable Gains

Description

There are three electronic step attenuators on the A23 IF Mux assembly, as seen in **Figure 6-7**. One of them have a range of 0 to 14 dB, in 2 dB steps, and two have a range of 0 to 31.75 dB, in 0.25 dB steps. These are in multiple IF signal paths.

Figure 6-7 A23 IF Mux Variable Attenuators



The easiest way to determine if these step attenuators are functioning properly is to run the internal alignments and then review the data output for the associated alignments listed, which can be found in the instrument at:

E:\AlignDataStorage\AlignmentHistory.txt

If a manual verification of the functionality of the step attenuators is desired, see the manual verification procedure below.

Associated Alignments

WBIF MUX Variable Attenuator A Alignment Algorithm

Measures the accuracy of the electronic step attenuator at the input of the A23 IF Mux. A range of 0 to 14 dB of attenuation is covered. The functionality of this step attenuator can be manually verified.

WBIF MUX Variable Attenuator B Alignment Algorithm

Measures the accuracy of the electronic step attenuator at the 10 / 25 / 40 MHz IF path output of the A23 IF Mux. A range of 0 to 31 dB of attenuation is covered. The functionality of this step attenuator cannot be manually verified.

WBIF MUX Variable Attenuator R15B0 Alignment Algorithm

Measures the accuracy of the electronic step attenuator at the 1.5 / 2.0 GHz IF path output of the A23 IF Mux with a 950 MHz IF signal, which is the intermediate frequency when using the 1.5 GHz IF path in low band. A range of 0 to 31 dB of attenuation is covered. The functionality of this step attenuator can be manually verified.

WBIF MUX WB Variable Attenuator Alignment Algorithm

Measures the accuracy of the electronic step attenuator at the 1.5 / 2.0 GHz IF path output of the A23 IF Mux with a 1.2 GHz IF signal, which is the intermediate frequency when using either of these IF paths in high band. A range of 0 to 31 dB of attenuation is covered. The functionality of this step attenuator can be manually verified.

Manual Verification

The functionality of the two electronic step attenuators shown in red in **Figure 6-7** can be manually verified using the following procedure. However, the functionality of the one in blue cannot be verified, as it is not currently being used by the instrument in normal operation.

1. Switch the instrument to IQ Analyzer mode by pressing **Mode/Meas, IQ Analyzer (Basic), OK**.
2. Place the instrument in a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Default the alignment data by pressing **System, Alignments, Restore Alignment Defaults**.
5. Set the span to 1 GHz by pressing **Frequency, Span 1.0 GHz**.
6. Enable the instrument Service Menus.

If information on enabling the Service Menus is needed, see the **“Service Menu Access”** section in **Chapter 20, “Service Menus.”**

7. Go to the **Meas Setup, Service Diagnostics** menu and turn off all the following:
 - RF Flatness Video Shift
 - Temperature Gain & Tilt
 - IF Flatness

– RF to IF Corrections

8. Set the IF gain to low by pressing **Meas Setup, Advanced, IF Gain Low Gain, Man.**

9. Set the IF gain offset to 5 dB by pressing **IF Gain Offset, 5 dB.**

10. Connect a signal generator to the instrument RF input connector.

11. Tune the signal generator to 1.0 GHz.

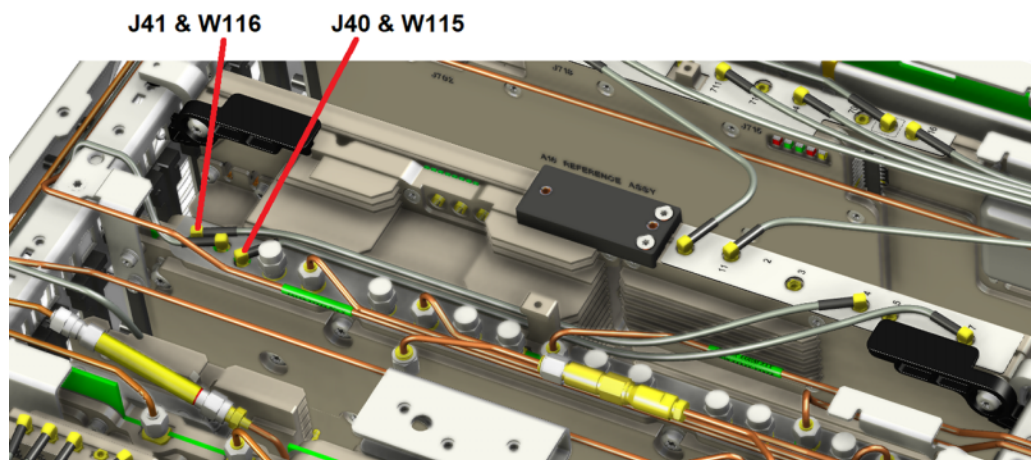
12. Set the power level of the signal generator to -10 dBm.

13. Verify that there is a signal at the center of the instrument display at appropriately -10 dBm.

If there is no signal on the display as expected, see [Chapter 5, “First-Look Troubleshooting,”](#) to determine why before proceeding.

14. Referring to [Figure 6-8](#), remove W116 from the A23 IF Mux J41.

Figure 6-8 A23 IF Mux Connections



15. Connect a spectrum analyzer to J41.

16. Tune the spectrum analyzer to 690 MHz with a span of 10 MHz.

17. Verify that there is a 690 MHz signal on the spectrum analyzer display at approximately -10 dBm.

18. Use the peak search function to place a marker on the signal displayed on the spectrum analyzer screen.

19. Adjust the power level of the signal generator for a marker reading of -10 dBm.

20. Activate the delta marker function on the spectrum analyzer.

21. With the IF Gain Offset as the active function, step it down to its minimum value 1 dB at a time using either the **Down Arrow** or the **Knob** on the front panel and observe the marker reading on the spectrum analyzer display.

There will most likely not be any change to the displayed signal level until the IF Gain Offset value reaches somewhere around 2 dB.

22. Verify that the power level of the signal on the spectrum analyzer display steps down by approximately 2 dB at a time as the IF Gain Offset is decreased, for a total decrease of approximately 12 dB.

NOTE

The signal level on the spectrum analyzer display should step down by 2 dB for every five or six steps of the IF Gain Offset value.

If the power level of the signal changes as expected, the 14 dB step attenuator at the input of the A23 IF Mux assembly is working properly. If the instrument has option R15, or R20, proceed to the next step. Otherwise, exit this procedure.

If the power level of the signal does not change as expected, replace the A23 IF Mux assembly.

23. Remove the spectrum analyzer from the A23 IF Mux J41.
24. Reconnect W116 to J41.
25. Set the IF gain to the default setting by pressing **IF Gain Offset 0 dB**.
26. Set the power level of the signal generator to -25 dBm.
27. Change the span to 1.5 GHz by pressing **Frequency, Span 1.5 GHz**.
28. Verify that there is a signal at the center of the instrument display at appropriately -25 dBm.

If there is no signal on the display as expected, see [Chapter 5, "First-Look Troubleshooting,"](#) to determine why before proceeding.
29. Set the IF gain offset to 10 dB by pressing **Meas Setup, Advanced, IF Gain Offset 10 dB**.
30. Referring to [Figure 6-8](#), remove W115 from the A23 IF Mux J40.
31. Connect a spectrum analyzer to J40.
32. Tune the spectrum analyzer to 950 MHz with a span of 10 MHz.
33. Verify that there is a 950 MHz signal on the spectrum analyzer display at approximately -10 dBm.
34. Use the peak search function to place a marker on the signal displayed on the spectrum analyzer screen.
35. Adjust the power level of the signal generator for a marker reading of -10 dBm.
36. Activate the delta marker function on the spectrum analyzer.

37.With the IF Gain Offset as the active function, step it down to its minimum value 1 dB at a time using either the **Down Arrow** or the **Knob** on the front panel and observe the marker reading on the spectrum analyzer display.

There will most likely not be any change to the displayed signal level until the IF Gain Offset value reaches somewhere around 4 dB.

38.Verify that the power level of the signal on the spectrum analyzer display steps down by approximately 1 dB at a time as the IF Gain Offset is decreased, for a total decrease of approximately 38 dB.

NOTE

This signal path uses part of two different electronic step attenuators on the A23 IF Mux assembly, the 14 dB step attenuator at the input and the 31.75 dB step attenuator near the 1.5 / 2.0 GHz IF signal path output, for the total of 35 to 38 dB.

If the power level of the signal changes as expected, the 31.75 dB step attenuator near the 1.5 / 2.0 GHz IF path output of the A23 IF Mux assembly is working properly.

If the power level of the signal does not change as expected, replace the A23 IF Mux assembly.

7 Signal Path Verification

What You Will Find in This Chapter

The following information is found in this chapter:

- Signal Paths Overview on page 168
- Troubleshooting Equipment Required on page 170
- μWave Signal Paths on page 171
 - Standard Path on page 172
 - Low Noise Signal Path on page 174
 - μWave Preselector Bypass Path on page 176
 - Full Bypass Path on page 178
- Preamplifier Signal Paths on page 180
 - Low Band Preamplifier on page 181
 - Full Range Preamplifier on page 183
 - Low Noise Amplifier on page 184
- IF Signal Paths on page 185
 - IF Signal Path Verification on page 186
 - Reference and LO Signal Verification on page 186
 - 10/25 MHz IF Signal Path on page 187
 - 40 MHz IF Signal Path on page 189
 - 255 MHz IF Signal Path on page 190
 - 1.0 GHz IF Signal Path on page 191
 - 1.5 GHz IF Signal Path on page 192
 - 2.0 GHz IF Signal Path on page 193
- Additional Signal Paths on page 194
 - Wide IF Out Signal Path on page 194
 - External Mixing Signal Path on page 195

Signal Paths Overview

There are multiple signal paths through the instrument, many of which are dependent on the options installed in the instrument. Others are limited by the frequency that the instrument is tuned to, or the bandwidth selected. There are also additional signal paths for using external devices for either extended frequency down conversion or external digitization. The signal paths available are:

μWave Signal Paths

- Standard Path
- Low Noise Path (Requires Option LNP)
- μWave Preselector Bypass
- Full Bypass (Requires Options LNP & FBP)

Preamp Signal Paths (Requires a Preamp Option)

- Low Band
- Full Range
- Low Noise Amp

IF Signal Paths

- 10/25 MHz Path
- 40 MHz Path
- 255 MHz Path
- 1.0 GHz Path (Requires Option R10, R15, or R20)
- 1.5 GHz Path (Requires Option R15, or R20)
- 2.0 GHz Path (Requires Option R20)

Additional Signal Paths

- Wide IF Out (Option CRW)
- External Mixing (Option EXM)

While only one IF Signal Path can be selected at a time, multiple other paths can be selected along with it. The instrument mode and measurement being used will often limit or specify the signal path options. So, when troubleshooting or verifying a signal path issue, you will need to first determine which signal path(s) is having a problem.

One other thing to keep in mind is that a given IF Signal Path may have alternate paths depending on the tuned frequency. Also, for frequencies in Band 0 the only μWave Signal Path that is used is the Standard Path, none of the other μWave Signal Paths have an effect in band 0.

Either failed performance test data or a reported complaint by the user of the instrument will often give a good indication of what signal path may be having a problem. For example, a performance test may only fail when one of the internal preamps is turned on, or when the instrument is using the low noise path. Or the user may complain of a signal level issue when using the 1.0 GHz IF Path. Once a starting point has been determined from this information, select the section in this chapter that best fits your initial evaluation.

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 22, "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 20 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 20 GHz¹

Power Meter

Minimum frequency range: 10 MHz to 20 GHz

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

Miscellaneous

Misc. cables and adapters

NOTE

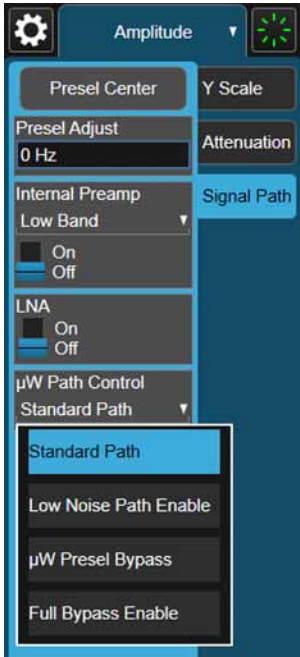
The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. 50 GHz if verifying option EXW High LO Out

μWave Signal Paths

There are four possible μWave signal paths available in these instruments, two of which require an optional license. The selection of these signal paths can be found under the **Amplitude**, **Signal Path**, **μW Path Control** menu, as seen in **Figure 7-1**.

Figure 7-1 μWave Signal Path Selection



The μWave signal path selection has no affect when the instrument is tuned to a frequency in Band 0. Tuned frequencies in Band 0 will always use the Standard Path.

The μWave signal path switching is controlled by the SW3 LNP Switch and the SW4 MPB Switch.

The following sections will describe the different μWave signal paths and provide typical signal path loss information for each path.

The settings for the measurements made in this section are as follows:

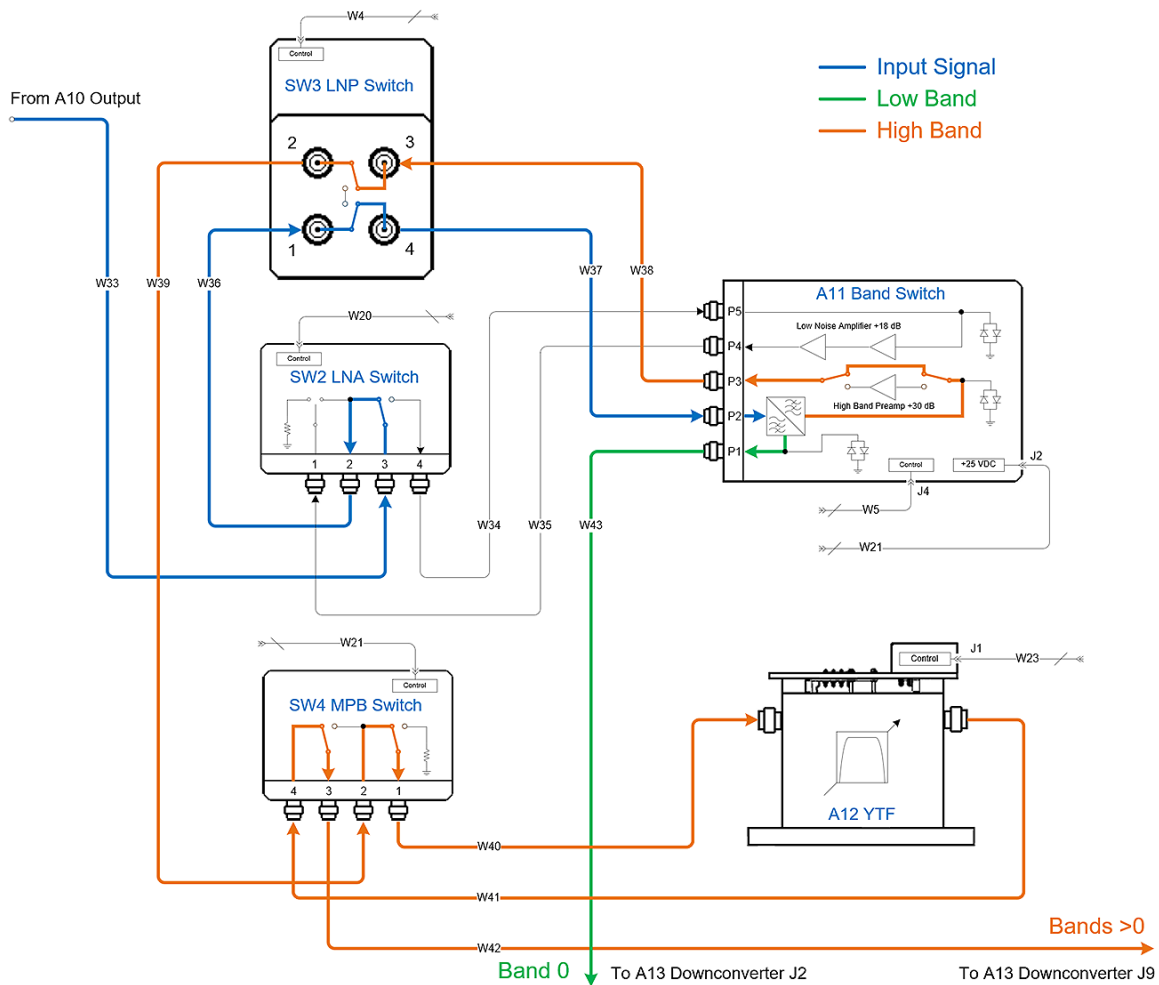
Mode:	Spectrum Analyzer
Measurement:	Swept SA
Span:	Zero Span
Input Attenuator:	0 dB
Auto Alignments:	Off
Input Power Level:	-20 dBm

Standard Path

While other μWave signal paths can be selected, the Standard signal path is the default (Mode Preset) μWave signal path for many instrument modes, including the Spectrum Analyzer mode.

The Standard signal path does not bypass any of the traditional signal analyzer hardware, as can be seen in the block diagram of **Figure 7-2**.

Figure 7-2 Standard μWave Signal Path



As can be seen in **Figure 7-2**, neither the SW3 LNP Switch or the SW4 MPB Switch are in the bypass position for the Standard signal path.

The typical signal loss through the Standard signal path as shown in [Figure 7-2](#) can be seen in [Table 7-1](#). The Signal Loss value listed in [Table 7-1](#) is the signal level difference from the -20 dBm input to that measured at the specified output port.

Table 7-1 **Typical Signal Loss - Standard Signal Path**

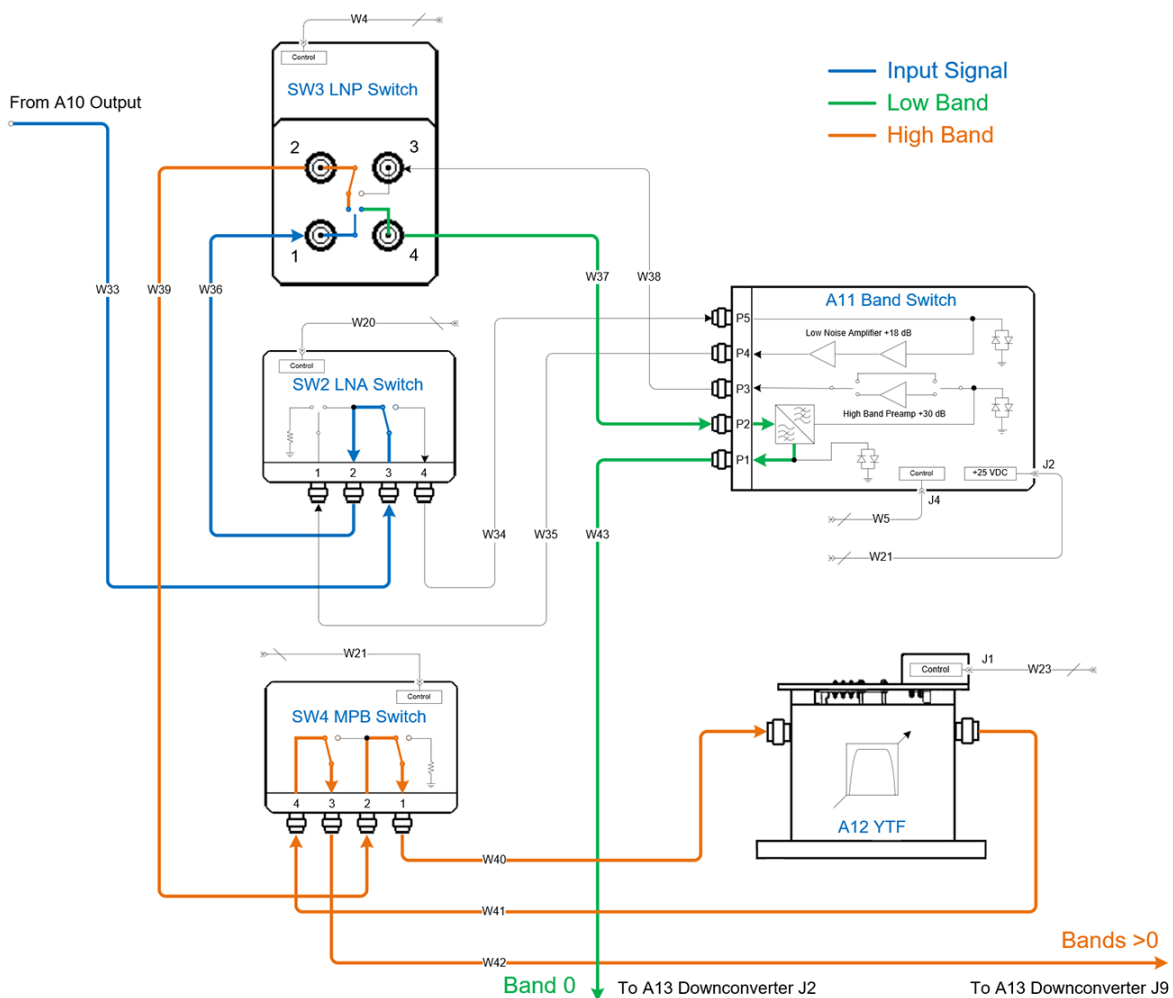
Band	Frequency	Measured At	Signal Loss
0	2 GHz	A11 P1	-3 dB
2	10 GHz	SW4 P4	-15 dB
4	20 GHz	SW4 P4	-18 dB

Low Noise Signal Path

Use of the Low Noise Signal Path requires that the instrument has option LNP installed.

The selection of the Low Noise signal path will not affect signals in band 0. The Low Noise signal path bypasses the portion of the A11 Band Switch assembly that is in the standard path for signals in Band 1 and higher, as seen in the block diagram of **Figure 7-3**. This is selected to reduce the amount of loss in this signal path, which can improve the overall signal-to-noise ratio.

Figure 7-3 Low Noise Signal Path



As can be seen in **Figure 7-3**, the SW3 LNP Switch is in the bypass position for tuned frequencies above Band 0, while the SW4 MPB Switch is not, for the Low Noise signal path.

The typical signal loss through the Low Noise signal path as shown in [Figure 7-3](#) can be seen in [Table 7-2](#). The Signal Loss value listed in [Table 7-2](#) is the signal level difference from the -20 dBm input to that measured at the specified output port.

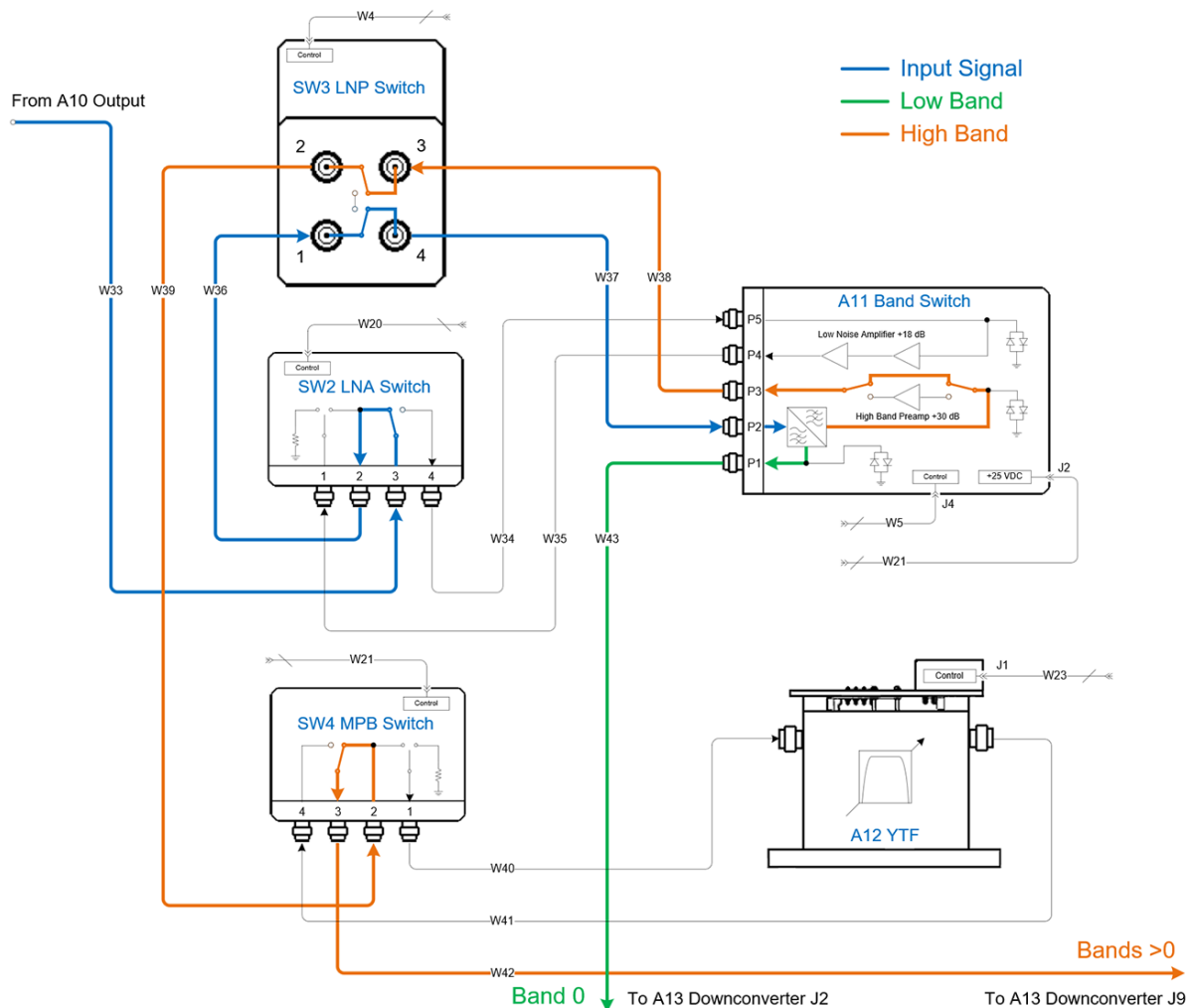
Table 7-2 **Typical Signal Loss - Low Noise Signal Path**

Band	Frequency	Measured At	Signal Loss
0	2 GHz	A11 P1	-3 dB
2	10 GHz	SW4 P4	-9 dB
4	20 GHz	SW4 P4	-12 dB

μWave Preselector Bypass Path

The selection of the μWave Preselector Bypass signal path will not affect signals in band 0. The μWave Preselector Bypass signal path bypasses the A12 Yig Tuned Filter, as seen in the block diagram of **Figure 7-4**. This is typically selected to increase the bandwidth for measurements that will use an IF Signal path greater than 25 MHz.

Figure 7-4 μWave Preselector Bypass Signal Path



As can be seen in **Figure 7-4**, the SW4 MPB Switch is in the bypass position for tuned frequencies above Band 0, while the SW3 LNP Switch is not, for the μWave Preselector Bypass signal path.

The μWave Preselector Bypass signal path is the default (Mode Preset) μWave signal path for the IQ Analyzer (Basic) mode.

The typical signal loss through the μWave Preselector Bypass signal path as shown in **Figure 7-4** can be seen in **Table 7-3**. The Signal Loss value listed in **Table 7-3** is the signal level difference from the -20 dBm input to that measured at the specified output port.

Table 7-3 Typical Signal Loss - μWave Preselector Bypass Signal Path

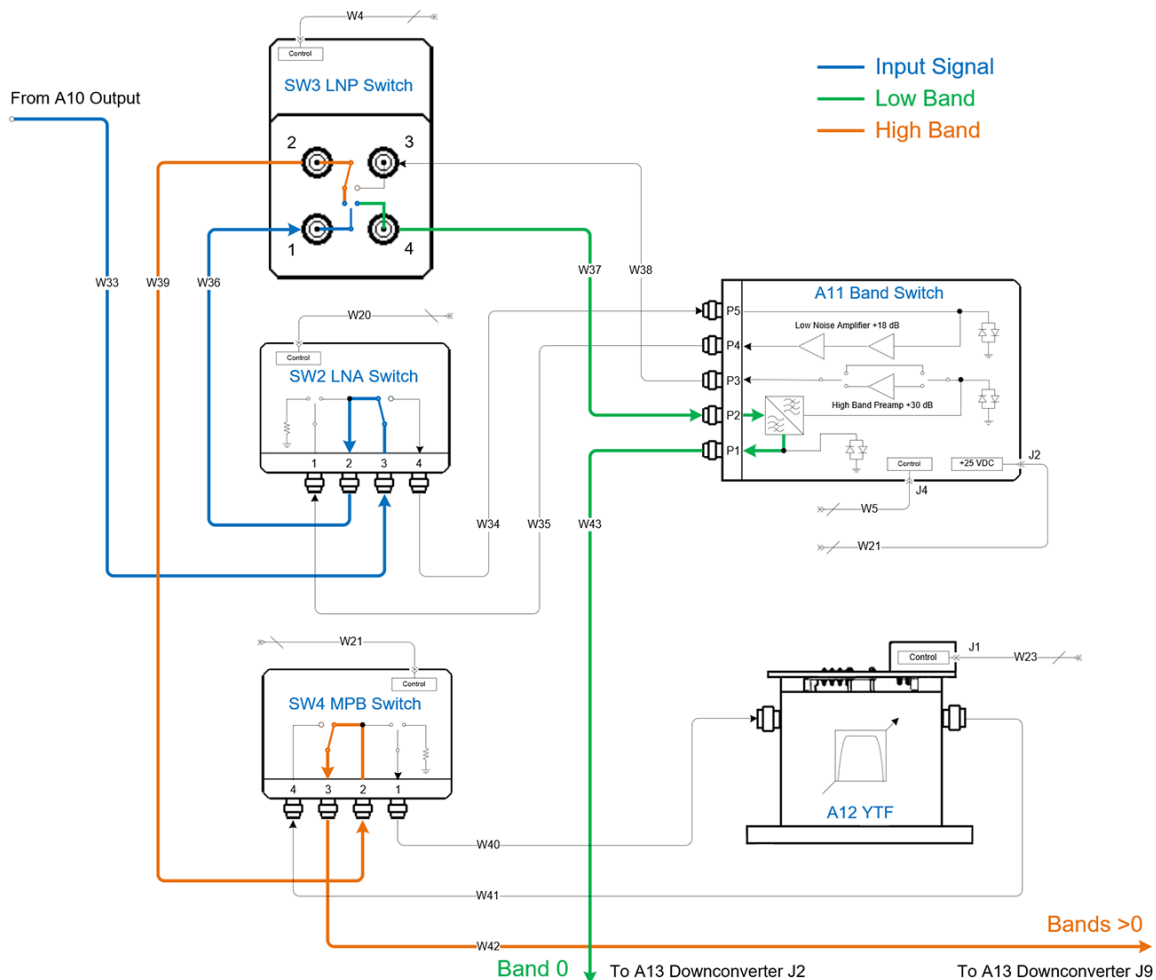
Band	Frequency	Measured At	Signal Loss
0	2 GHz	A11 P1	-3 dB
2	10 GHz	SW4 P4	-9 dB
4	20 GHz	SW4 P4	-12 dB

Full Bypass Path

Use of the Full Bypass Signal Path requires that the instrument has both option LNP and FBP installed.

The selection of the Full Bypass signal path will not affect signals in band 0. The Full Bypass signal path combines the Low Noise and the μWave Preselector Bypass signal paths to bypasses both the portion of the A11 Band Switch assembly and the A12 Yig Tuned Filter assembly that are used in the Standard signal path for signals in Band 1 or higher, as seen in the block diagram of **Figure 7-5**. This signal path is selected to increase both the signal-to-noise ratio and the measurement bandwidth.

Figure 7-5 Full Bypass Signal Path



As can be seen in **Figure 7-5**, both the SW3 LNP Switch and the SW4 MPB Switch are in the bypass position for tuned frequencies above Band 0, for the Full Bypass signal path.

The typical signal loss through the Full Bypass signal path as shown in [Figure 7-5](#) can be seen in [Table 7-4](#). The Signal Loss value listed in [Table 7-4](#) is the signal level difference from the -20 dBm input to that measured at the specified output port.

Table 7-4 **Typical Signal Loss - Full Bypass Signal Path**

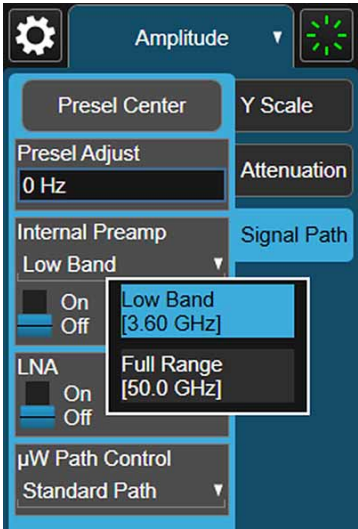
Band	Frequency	Measured At	Signal Loss
0	2 GHz	A11 P1	-3 dB
2	10 GHz	SW4 P4	-4 dB
4	20 GHz	SW4 P4	-6 dB

Preamp Signal Paths

Internal preamps are optional for all instruments. To have the internal preamp signal paths the instrument must have either option P08, P13, P26, P44, P4L, P55, P5L, P55, or P5N.

For all preamp options there are three different Preamp signal paths available. The selection of these signal paths can be found under the **Amplitude, Signal Path** menu, as seen in **Figure 7-6**.

Figure 7-6 Preamp Signal Path Selection



There are three different preamps in two different devices that make up the three different preamp signal paths. Two are in the A11 Band Switch and one is in the A13 Downconverter.

The following sections will describe the different Preamp signal paths and provide typical signal path gain information for each path.

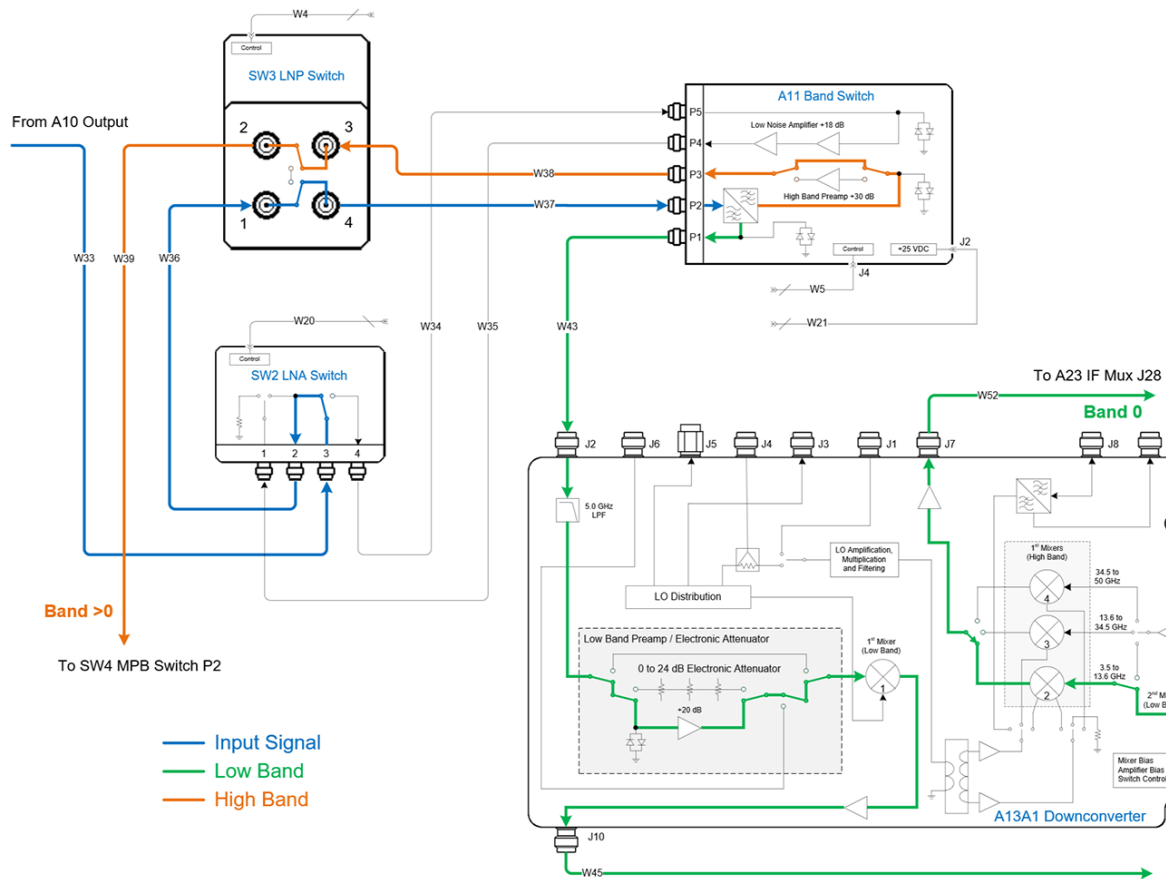
The settings for the measurements made in this section are as follows:

Mode:	Spectrum Analyzer
Measurement:	Swept SA
µWave Path Control:	Standard
Span:	Zero Span
Input Attenuator:	10 dB
Auto Alignments:	Off
Input Power Level:	-30 dBm

Low Band Preamp

The Low Band Preamp is for frequencies in Band 0 only. It is located in the A13 Downconverter assembly and has a gain of approximately 20 dB. While the gain of the preamp cannot be directly measured since it is placed just before the band 0 first mixer, the results can be measured at the 322.5 MHz second IF at the A13 Downconverter J7 output, as seen in [Figure 7-7](#).

Figure 7-7 Low Band Preamp Signal Path



The typical preamp gain through the Low Band Preamp signal path as shown in [Figure 7-7](#) can be seen in [Table 7-5](#). The Gain value listed in [Table 7-5](#) is the signal level difference measured with the Low Band Preamp turned On and Off.

Table 7-5 Typical Preamp Gain - Low Band Preamp Signal Path

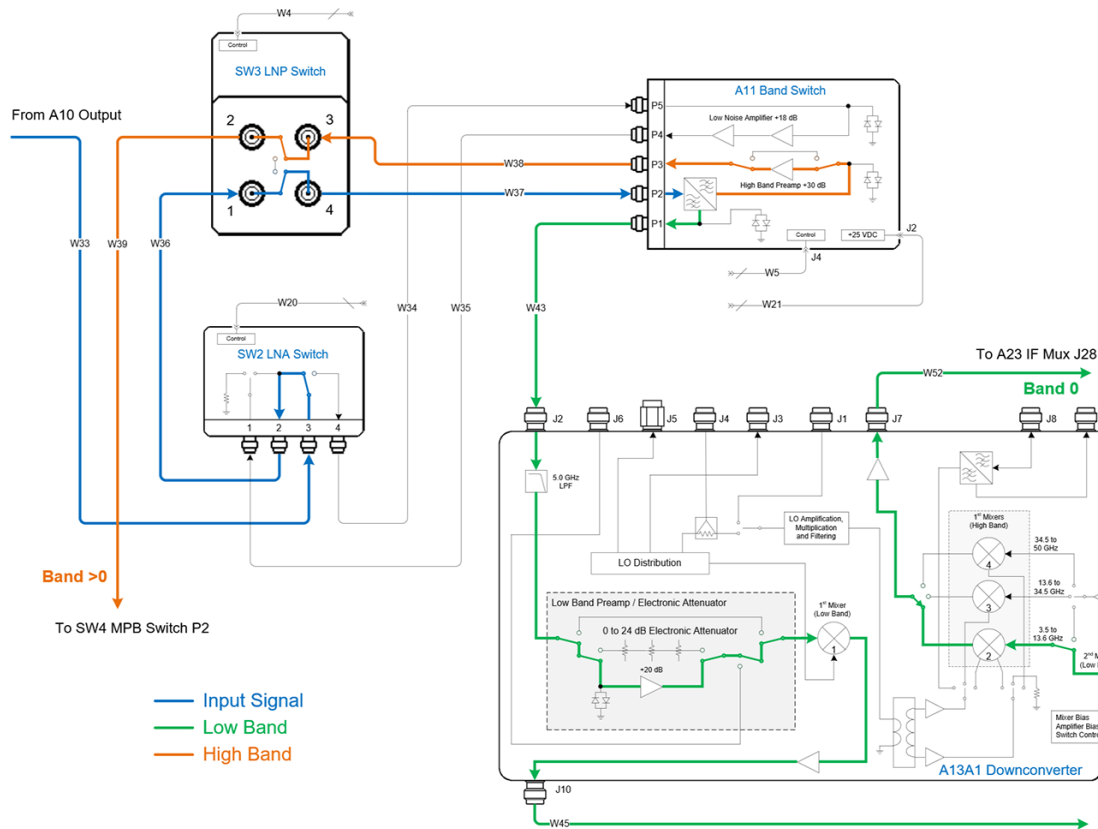
Band	Frequency	Measured At	Gain
0	1 GHz	A13 J7	16 dB
0	2 GHz	A13 J7	18 dB
0	3 GHz	A13 J7	16 dB

Full Range Preamp

The Full Range Preamp is a combination of two different preamps, the Low Band Preamp located in the A13 Downconverter assembly and the High Band preamp located in the A11 Band Switch, as seen in **Figure 7-8**.

The gain in Band 0 is approximately 20 dB, while the gain in bands greater than 0 is approximately 30 dB.

Figure 7-8 Full Range Preamp Signal Path



The typical preamp gain through the Full Range Preamp signal path as shown in **Figure 7-8** can be seen in **Table 7-6**. The Gain value listed in **Table 7-6** is the signal level difference measured with the Full Range Preamp turned On and Off.

Table 7-6 Typical Preamp Gain - Full Range Signal Path

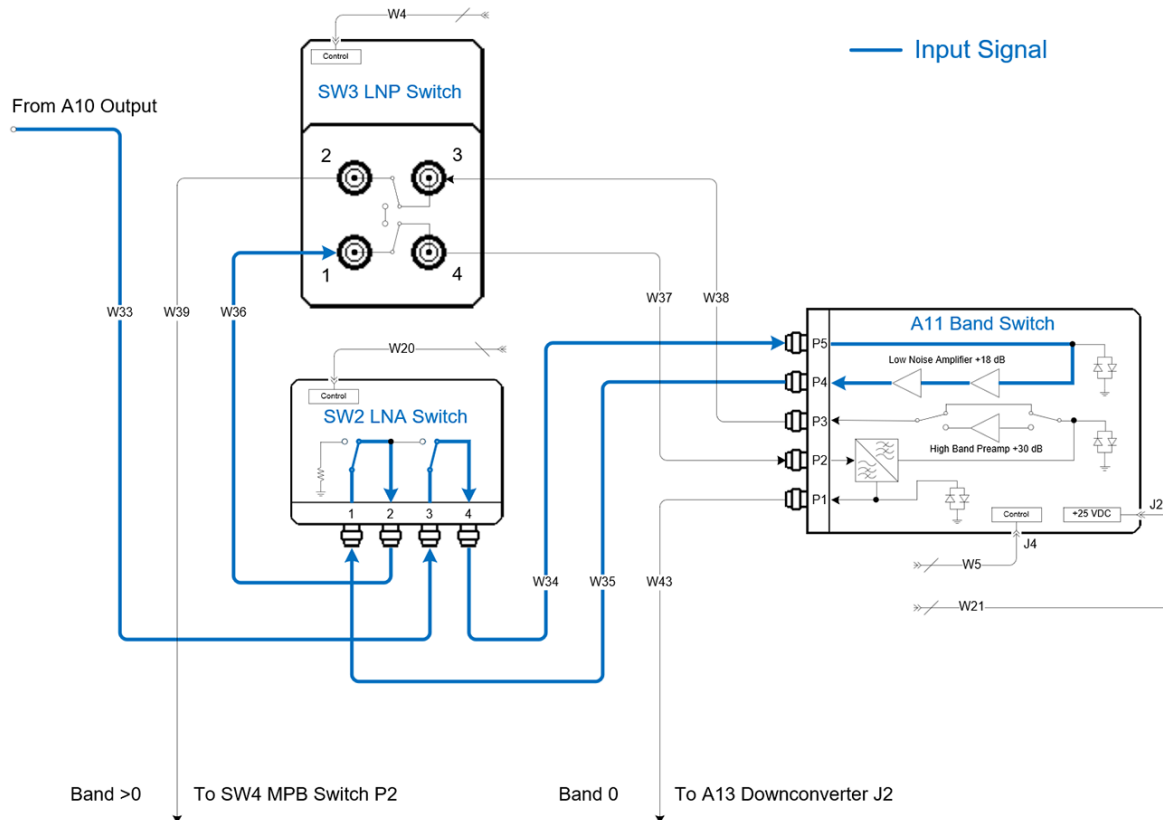
Band	Frequency	Measured At	Gain
0	2 GHz	A13 J7	18 dB
2	10 GHz	SW3 P2	30 dB
4	20 GHz	SW3 P2	30 dB

Low Noise Amplifier

The Low Noise Amplifier is located in the A11 Band Switch, as seen in **Figure 7-9**. The gain of this amplifier is approximately 18 dB.

Since either the Low Band Preamp or Full Range Preamp can also be turned on while the Low Noise Amplifier is on, this example measures the gain of the Low Noise Amplifier only, at the output of the SW2 LNA switch.

Figure 7-9 Low Noise Amplifier Signal Path



The typical amplifier gain through the Low Noise Amplifier signal path as shown in **Figure 7-9** can be seen in **Table 7-7**. The Gain value listed in **Table 7-7** is the signal level difference measured with the Low Noise Amplifier turned On and Off.

Table 7-7 Typical Amplifier Gain - Low Noise Amplifier Signal Path

Band	Frequency	Measured At	Gain
0	2 GHz	SW2 P2	21 dB
2	10 GHz	SW2 P2	18 dB
4	20 GHz	SW2 P2	18 dB

IF Signal Paths

There are up to seven different IF signal path selections possible for these instruments, two of which are optional. When configuring an instrument, an analysis bandwidth option must be selected, either 1 GHz, 1.5 GHz, or 2 GHz. All bandwidth options include all the narrower IF signal paths.

The IF signal paths can be selected from the **Meas Setup, IF Path** menu in the IQ Analyzer mode, as seen in **Figure 7-10**. The minimum tunable and specified frequencies for each IF signal path in the IQ Analyzer mode is shown in **Table 7-8**.

Figure 7-10 IF Signal Path Selection



Table 7-8 IF Signal Path Minimum Frequencies

IF Signal Path	Minimum Tunable Frequency	Minimum Specified Frequency
10 MHz	2 Hz	10 MHz
25 MHz	2 Hz	15 MHz
40 MHz	2 Hz	65 MHz
255 MHz	2 Hz	400 MHz
1.0 GHz	2 Hz	700 MHz
1.5 GHz	2 Hz	950 MHz
2.0 GHz	3.5 GHz	3.5 GHz

IF Signal Path Verification

Since the IQ Analyzer (Basic) mode is standard on all instruments, and it allows the selection of all available IF signal paths, the examples in this section will use this mode for all IF signal path verification. Also, in order to reduce the number of assemblies in the signal path and the overall loss the Full Bypass μ wave signal path will be used.

The following sections will describe each of the IF signal paths and provide any unique information about them. However, they will not provide a step-by-step procedure for verifying each IF signal path. Instead, the detailed block diagram for each signal path, that can be found in **Chapter 8, “Block Diagrams,”** are annotated with instrument settings, frequencies, and expected signal levels that can be used to trace and diagnose any signal path problem.

NOTE

The actual signal levels measured when tracing out an IF signal path may vary a few dB in either direction from the expected power levels given on the block diagrams. The main point when making these measurements is to verify that the gain or loss of any individual assembly is not out of line with that which is expected.

Reference and LO Signal Verification

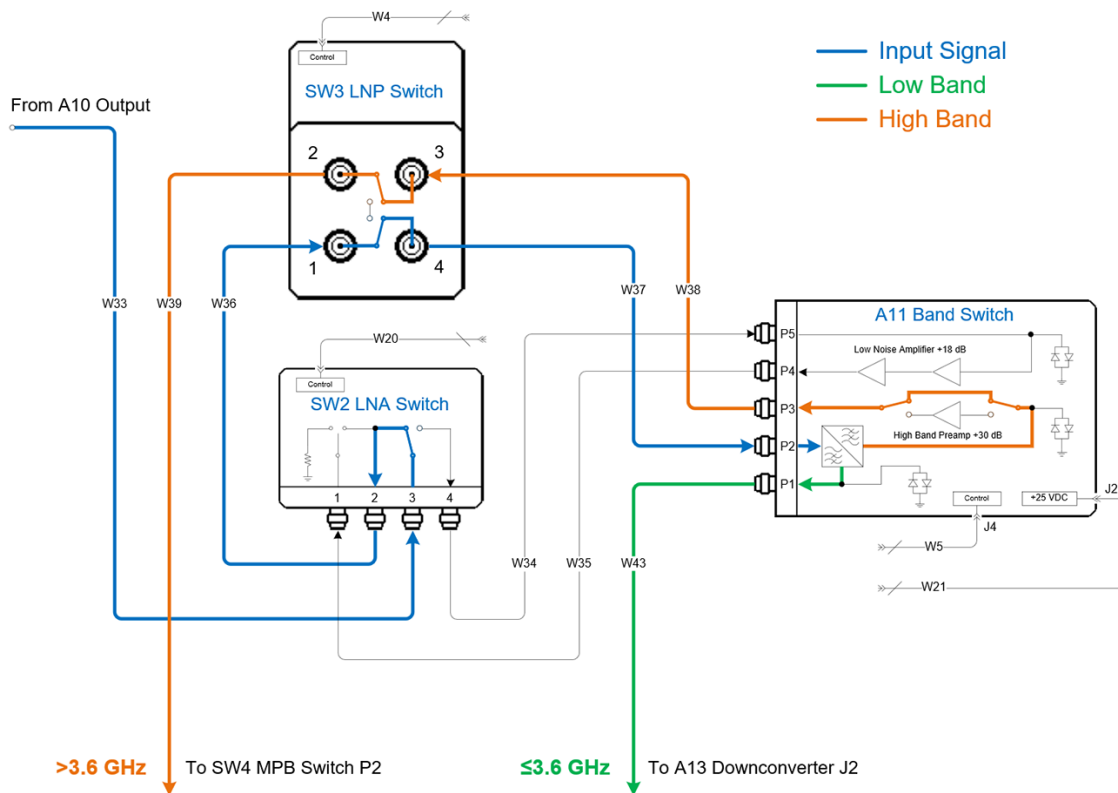
Each IF signal path has certain reference signals and LO requirements. The block diagram annotations for each IF signal path also includes the frequencies and power levels for these signals. A problem with any of these signals can also cause a problem with the overall signal path performance.

10/25 MHz IF Signal Path

The 10 MHz and 25 MHz IF signal paths are essentially the same signal paths, with the only differences being some of the bandpass filters used on the A2 25 MHz Analog IF assembly. When using the Swept SA measurement in the Spectrum Analyzer mode, the instrument will be using the 10 MHz IF signal path.

The 10/25 MHz IF Signal Path has two main frequency dependent variants. The frequency break point for these is at 3.6 GHz. Tuned frequencies of 3.6 GHz or lower exit the A11 Band Switch from P1 and follow the low band path, while tuned frequencies greater than 3.6 GHz follow the high band path, as seen in **Figure 7-11**.

Figure 7-11 10/25 MHz IF Signal Path Frequency Variations



NOTE

The example shown in **Figure 7-11** is without the Low Noise Path enabled. If Low Noise Path is enabled, when the instrument is tuned to frequencies above 3.6 GHz the SW3 LNP Switch will bypass the A11 Band Switch and go directly from P1 to P2. The Low Noise Path has no effect on tuned frequencies of 3.6 GHz or below.

To troubleshoot or verify the functionality of this signal path refer to the 10/25 MHz IF Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses an example input frequency for each of the two frequency dependent signal paths of 2 GHz, 8 GHz, and 20 GHz. The expected power levels can also be found in **Table 7-9**, along with values for 40 GHz if further verification is needed.

Table 7-9 10/25 MHz IF Signal Path Expected Power Levels

Test Port	Frequency			
	40 GHz	20 GHz	8 GHz	2 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm	-21 dBm
A11 P1	--	--	--	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm	--
Frequency Conversion	--	--	--	5.1225 GHz
A13SW2 Port C	--	--	--	-22 dBm
Frequency Conversion	322.5 MHz	322.5 MHz	322.5 MHz	322.5 MHz
A13 J7	-22 dBm	-18 dBm	-16 dBm	-18 dBm
A23 J42	-17 dBm	-12 dBm	-10 dBm	-14 dBm
A15 J900	-17 dBm	-12 dBm	-10 dBm	-14 dBm
Frequency Conversion	22.5 MHz	22.5 MHz	22.5 MHz	22.5 MHz
A2 J601	-10 dBm	-11 dBm	-11 dBm	-11 dBm

As can be seen in **Table 7-9**, the 10/25 MHz IF signal path has a final intermediate frequency of 22.5 MHz. The ADC for this signal path is the 25 MHz ADC on the A3 40 MHz Digital IF assembly.

40 MHz IF Signal Path

The 40 MHz IF Signal Path has two main frequency dependent variants. The frequency break point for these is at 3.6 GHz. Tuned frequencies of 3.6 GHz or lower exit the A11 Band Switch from P1 and follow the low band path, while tuned frequencies greater than 3.6 GHz follow the high band path, as seen in [Figure 7-11](#). However, all input signals end up at the 250 MHz input of the A3 40 MHz Digital IF assembly.

To troubleshoot or verify the functionality of this signal path refer to the 40 MHz IF Path block diagram that can be found in [Chapter 8, “Block Diagrams.”](#) It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses an example input frequency for each of the two frequency dependent signal paths of 2 GHz, 8 GHz, and 20 GHz. The expected power levels can also be found in [Table 7-10](#), along with values for 40 GHz if further verification is needed.

Table 7-10 40 MHz IF Signal Path Expected Power Levels

Test Port	Frequency			
	40 GHz	20 GHz	8 GHz	2 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm	-21 dBm
A11 P1	--	--	--	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm	--
Frequency Conversion	--	--	--	5.05 GHz
A13SW2 Port C	--	--	--	-22 dBm
Frequency Conversion	250 MHz	250 MHz	250 MHz	250 MHz
A13 J7	-22 dBm	-18 dBm	-16 dBm	-18 dBm
A23 J42	-18 dBm	-12 dBm	-10 dBm	-15 dBm
A15 J901	-25 dBm	-15 dBm	-14 dBm	-20 dBm

As can be seen in [Table 7-10](#), the 40 MHz IF signal path has a final intermediate frequency of 250 MHz. The ADC for this signal path is the 40 MHz ADC on the A3 40 MHz Digital IF assembly.

255 MHz IF Signal Path

The 255 MHz IF Signal Path has two main frequency dependent variants. The frequency break point for these is at 3.3 GHz. Tuned frequencies of 3.3 GHz or lower exit the A11 Band Switch from P1 and follow the low band signal path, while tuned frequencies greater than 3.3 GHz follow the high band signal path.

To troubleshoot or verify the functionality of this signal path refer to the 255 MHz IF Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses an example input frequency for each of the frequency dependent signal paths of 2 GHz, 8 GHz, and 20 GHz. The expected power levels can also be found in **Table 7-11**, along with values for 40 GHz if further verification is needed.

Table 7-11 255 MHz IF Signal Path Expected Power Levels

Test Port	Frequency			
	40 GHz	20 GHz	8 GHz	2 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm	-21 dBm
A11 P1	--	--	--	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm	--
Frequency Conversion	--	--	--	5.49 GHz
A13SW2 Port C	--	--	--	-23 dBm
Frequency Conversion	690 MHz	690 MHz	690 MHz	690 MHz
A13 J7	-22 dBm	-15 dBm	-15 dBm	-23 dBm
A23 J41	-13 dBm	-8 dBm	-9 dBm	-15 dBm

As can be seen in **Table 7-11**, the 255 MHz IF signal path has a final intermediate frequency of 690 MHz. The ADC for this signal path is the wideband ADC on the A21 Wideband DIF assembly.

1.0 GHz IF Signal Path

The 1.0 GHz IF Signal Path has two main frequency dependent variants. The frequency break point for these is at 3.3 GHz. Tuned frequencies of 3.3 GHz or lower exit the A11 Band Switch from P1 and follow the low band signal path, while tuned frequencies greater than 3.3 GHz follow the high band signal path.

To troubleshoot or verify the functionality of this signal path refer to the 1.0 GHz IF Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses an example input frequency for each of the frequency dependent signal paths of 2 GHz, 8 GHz, and 20 GHz. The expected power levels can also be found in **Table 7-12**, along with values for 40 GHz if further verification is needed.

Table 7-12 1.0 GHz IF Signal Path Expected Power Levels

Test Port	Frequency			
	40 GHz	20 GHz	8 GHz	2 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm	-21 dBm
A11 P1	--	--	--	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm	--
Frequency Conversion	--	--	--	5.49 GHz
A13SW2 Port C	--	--	--	-23 dBm
Frequency Conversion	690 MHz	690 MHz	690 MHz	690 MHz
A13 J7	-22 dBm	-15 dBm	-15 dBm	-23 dBm
A23 J41	-13 dBm	-8 dBm	-9 dBm	-15 dBm

As can be seen in **Table 7-12**, the 1.0 GHz IF signal path has a final intermediate frequency of 690 MHz. The ADC for this signal path is the wideband ADC on the A21 Wideband DIF assembly.

1.5 GHz IF Signal Path

The 1.5 GHz IF Signal Path has two main frequency dependent variants. The frequency break point for these is at 3.5 GHz. Tuned frequencies less than 3.5 GHz exit the A11 Band Switch from P1 and follow the low band signal path, while tuned frequencies of 3.5 GHz or higher follow the high band signal path.

To troubleshoot or verify the functionality of this signal path refer to the 1.5 GHz IF Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses an example input frequency for each of the frequency dependent signal paths of 2 GHz, 8 GHz, and 20 GHz. The expected power levels can also be found in **Table 7-13**, along with values for 40 GHz if further verification is needed.

Table 7-13 1.5 GHz IF Signal Path Expected Power Levels

Test Port	Frequency			
	40 GHz	20 GHz	8 GHz	2 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm	-21 dBm
A11 P1	--	--	--	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm	--
Frequency Conversion	--	--	--	5.75 GHz
A13SW2 Port C	--	--	--	-26 dBm
Frequency Conversion	1.2 GHz	1.2 GHz	1.2 GHz	950 MHz
A13 J7	-22 dBm	-15 dBm	-15 dBm	-25 dBm
A23 J40	+8 dBm	+5 dBm	+4 dBm	+2 dBm

As can be seen in **Table 7-13**, the 1.5 GHz IF signal path has a final intermediate frequency of either 950 MHz or 1.2 GHz. The ADC for this signal path is the wideband ADC on the A21 Wideband DIF assembly.

2.0 GHz IF Signal Path

Since the 2.0 GHz IF Signal Path is not used below 3.5 GHz, it only uses the high band signal path.

To troubleshoot or verify the functionality of this signal path refer to the 2.0 GHz IF Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. It uses example input frequencies of 8 GHz and 20 GHz. The expected power levels can also be found in **Table 7-14**, along with values for 40 GHz if further verification is needed.

Table 7-14 2.0 GHz IF Signal Path Expected Power Levels

Test Port	Frequency		
	40 GHz	20 GHz	8 GHz
RF Input	-10 dBm	-10 dBm	-10 dBm
A10 Output	-24 dBm	-23 dBm	-22 dBm
SW4 P3	-40 dBm	-31 dBm	-28 dBm
Frequency Conversion	1.2 GHz	1.2 GHz	1.2 GHz
A13 J7	-22 dBm	-15 dBm	-15 dBm
A23 J40	+8 dBm	+5 dBm	+4 dBm

As can be seen in **Table 7-14**, the 2.0 GHz IF signal path has a final intermediate frequency of 1.2 GHz. The ADC for this signal path is the wideband ADC on the A21 Wideband DIF assembly.

Additional Signal Paths

The additional signal paths are either optional and/or require external equipment. So, the replication of user configurations and verification of reported issues may be difficult to achieve. However, the following sections will describe each of these signal paths and how to best verify its functionality.

Wide IF Out Signal Path

Use of the rear panel Wide IF Out requires that the instrument has option CRW, as well as either option R15 or R20 installed. This will bypass the internal digitizers of the instrument and provide an IF output from the input signal with a maximum bandwidth of approximately 2 GHz.

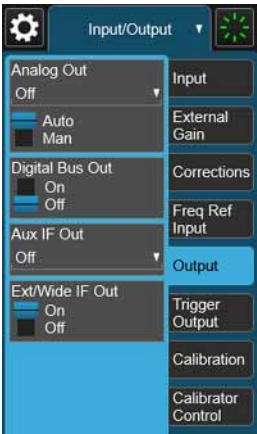
When the Wide IF Out is turned on the signal is routed out of the instrument so that the user can digitize their signals with an external device, no further internal analysis is performed. When this is selected, the instrument sweep will stop, and a message will appear on the display stating:

No Result; Meas invalid with Ext/Wide IF Out set to On

The selection to turn the Ext/Wide IF Out signal path on is found under the Input/Output, Output menu, as seen in **Figure 7-12**.

Figure 7-12

Ext/Wide IF Out Menu Selection



To troubleshoot or verify the functionality of this signal path refer to the Wide IF Out Signal Path block diagram that can be found in **Chapter 8, “Block Diagrams.”** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path.

External Mixing Signal Path

Use of the External Mixing Signal Path requires that the instrument has option EXM installed.

External Mixing is used to bypass the downconverter in the front end of the instrument and extend its frequency range. This can be done with the use of a wide variety of external mixers. Some of these mixers are USB devices that can communicate with the instrument and load their calibration data into it, while others are more basic and do not have a communication interface. With either type, the instrument needs to provide the external mixer with an LO signal which it will use to downconvert the high frequency signals to an intermediate frequency that it then provides to the instrument for further processing. These signals are both provided through the one Ext Mixer front panel connection of the instrument.

The best way to verify the functionality of this feature would be with an external mixer along with a very high frequency signal source. However, the signal path integrity can be verified without them.

To troubleshoot or verify the functionality of this signal path refer to the External Mixing Signal Path block diagram that can be found in **Chapter 8, "Block Diagrams."** It provides a table with the instrument settings used to replicate the annotated frequencies and expected power levels throughout the signal path. However, it is best to verify the LO signal from the instrument and the IF signal path separately, which the following procedure will outline.

The frequencies and power levels listed on the block diagram, as well as the following verification procedure is simulating the use of an M1970W USB Waveguide Harmonic Mixer. This should verify the overall functionality of the external mixing signal path for any model used.

This procedure will require a spectrum analyzer to measure the LO output, and a signal generator to simulate the IF input.

1. Set the instrument to **Spectrum Analyzer** mode, **Swept SA** measurement.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn off auto alignments by selecting **System, Alignments, Auto Align, Auto Align Off**.
4. Set the instrument input to external mixer by selecting **Input/Output, Select Input, External Mixer**.
5. Choose the external mixer setup equivalent to the M1970W by selecting **External Mixer Setup, Mixer Presets, W-Band** under the **Single Harmonic with Doubler** column, **Close**.
6. Select **Frequency** to verify that the instrument start frequency is now 75 GHz, and the stop frequency is 110 GHz.
7. Set the **Span** to **Zero Span**.
8. Tune the **Center Frequency** to **75 GHz**.

LO Signal Path Verification

9. Connect a spectrum analyzer to the front panel Ext Mixer port.
10. Set the spectrum analyzer reference level to +20 dBm.
11. Tune the spectrum analyzer to have a start frequency of 9 GHz and a stop frequency of 15 GHz.
12. Verify that the LO signal is at approximately 9.41 GHz with a power level of about +15 dBm.

NOTE

If at any point the frequency or power level measured do not match what is expected, refer to the External Mixing Signal Path block diagram that can be found in [Chapter 8, "Block Diagrams."](#) to trace the signal back to its source to determine the cause.

13. Tune the **Center Frequency to 110 GHz.**
14. Verify that the LO signal is now at approximately 13.79 GHz with a power level of about +16 dBm.

NOTE

Be sure to account for the cable loss when making power level measurements. If a power level still appears to be a little low, a power meter should be used to make a more accurate measurement.

IF Signal Path Verification

15. Enable the Service Menus.

NOTE

See [Chapter 20, "Service Menus,"](#) for instruction on how to enable the service menus.

16. Verify that the 13.79 GHz signal is still present on the spectrum analyzer display.
17. Disable the LO output from the Ext Mixer port by pressing **Meas Setup, Lock & LO, Ext LO Turnoff, 1 Enter.**
18. Verify that the 13.79 GHz signal is no longer on the spectrum analyzer display.

CAUTION

Since the Ext Mixer port is bi-directional, with a high power LO signal coming from the instrument and the IF signal from the external mixer, or in this case as signal generator, going into the instrument, caution needs to be taken to protect the signal generator being used to simulate the IF signal. To protect the signal generator, do not connect it to the Ext Mixer port until the LO signal has been turned off through the service menu.

19. Disconnect the spectrum analyzer from the Ext Mixer port.
20. Tune a signal generator to 322.5 MHz with a power level of -30 dBm.

21. Connect the signal generator to the Ext Mixer port.
22. Use the service menus to turn off the instrument flatness correction by pressing **Meas Setup, Service Diagnostics, RF Flatness Video Shift Off**.
23. Verify that there is now a flat trace across the instrument display at approximately -20 dBm.

If the signal on screen is not at or near -20 dBm, refer to the External Mixing Signal Path block diagram that can be found in **Chapter 8, "Block Diagrams,"** to trace the signal through the instrument to determine the source of the problem.
24. When done verifying the external mixing signal path set the input back to the RF input port by pressing **Input/Output, Select Input, RF**, then **Mode Preset** to revert the service menu selections made to their default settings for normal instrument operation.

8 Block Diagrams

What You Will Find in This Chapter

The following block diagrams are found in this chapter:

Full System Option 508, 513, 526

Full System Option 544, 550

Full System Option 555

Swept Spectrum Analyzer Option 508, 513, 526

Swept Spectrum Analyzer Option 544, 550

Swept Spectrum Analyzer Option 555

10/25 MHz IF Signal Path

40 MHz IF Signal Path

255 MHz IF Signal Path

1.0 GHz IF Signal Path

1.5 GHz IF Signal Path

2.0 GHz IF Signal Path

Wide IF Out Signal Path

External Mixing Signal Path

Overview

Multiple annotated block diagrams have been provided in this chapter that can be used to trace out signal level issues with the instrument. Since this instrument has multiple IF signal paths, a block diagram of the instrument has been provided for each of them.

At the top of each of the annotated signal path block diagrams is a table and legend that will outline the settings and signal path highlights to be able to replicate the settings required to duplicate the frequencies and power levels annotated on that block diagram. An example of one of these is seen in **Figure 8-1**, which is taken from the 1.0 GHz IF Path block diagram.

Figure 8-1 Block Diagram Settings Example - 1.0 GHz IF Path

Instrument Setup ¹			
Mode	IQ Analyzer		IQ Analyzer
Input Port	RF Input		RF Input
Center Frequency	20 GHz	8 GHz	2 GHz
Span	1.0 GHz	1.0 GHz	1.0 GHz
IF Path	1.0 GHz	1.0 GHz	1.0 GHz
Input Attenuator	10 dB	10 dB	10 dB
μWave Path Control	μW Presel Bypass	μW Presel Bypass	Standard
Auto Alignments	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

----- Input Signal Path (700 MHz – 3.3 GHz)
————— Input Signal Path (>3.3 – 50 GHz)
————— LO Signal Path
————— Reference Signal Path

¹Changes from Mode Preset

There are variations for most of the IF paths that are frequency dependent, so each block diagram has annotations and highlights for each of these. This can be seen in the example in **Figure 8-1** which has three frequency variations: 2 GHz, 8 GHz, and 20 GHz.

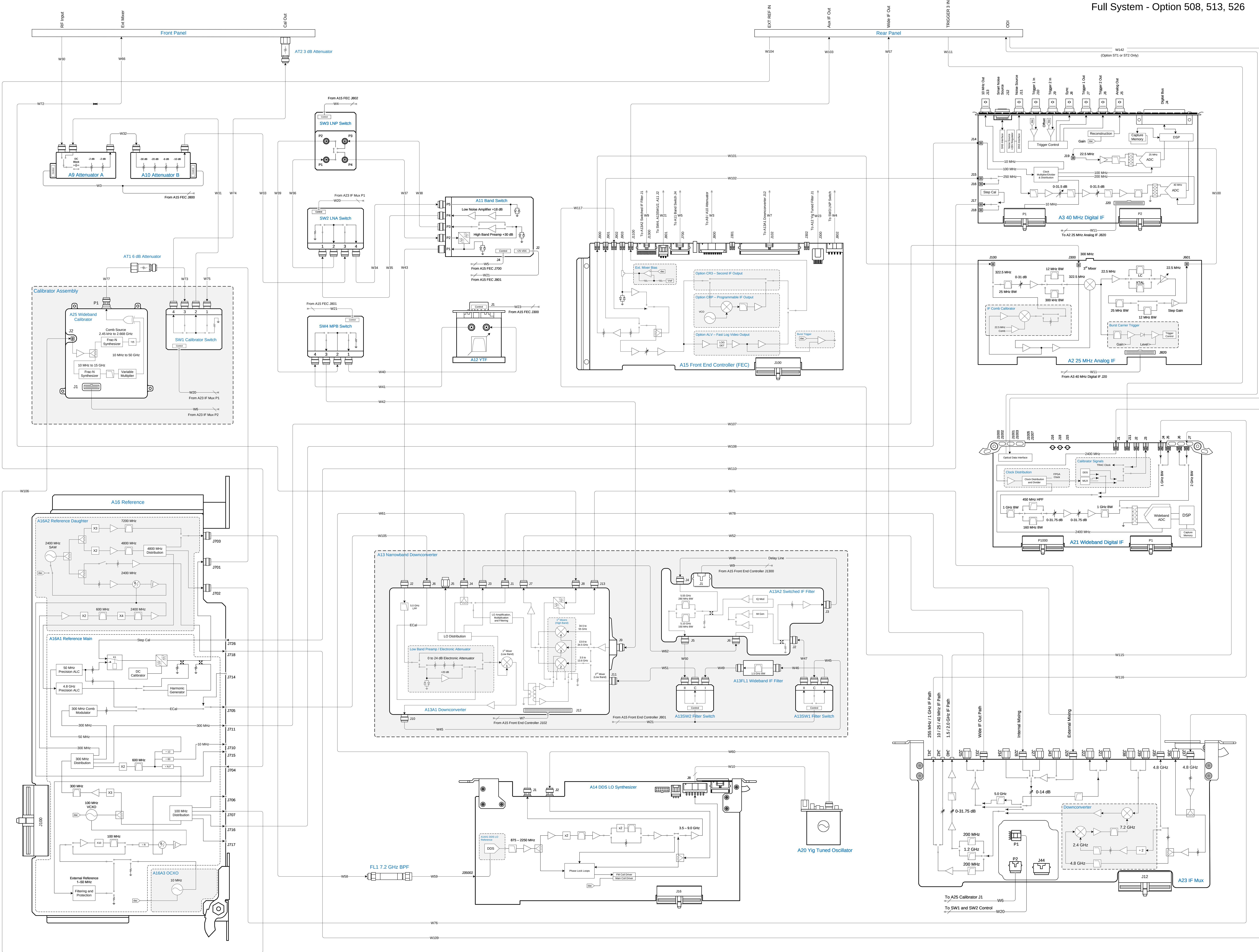
In addition to highlighting the input signal paths, the local oscillators and reference signal paths that are required are also highlighted for that signal path. So, in addition to the input signal, these signals will also need to be verified, as the instrument will not function properly without them.

While the description found in the different chapters of this guide for each of the assemblies in the instrument will assist with understanding what the function of each is and how it works, being familiar with the block diagrams and the different signal paths is essential for effectively troubleshooting these instruments.

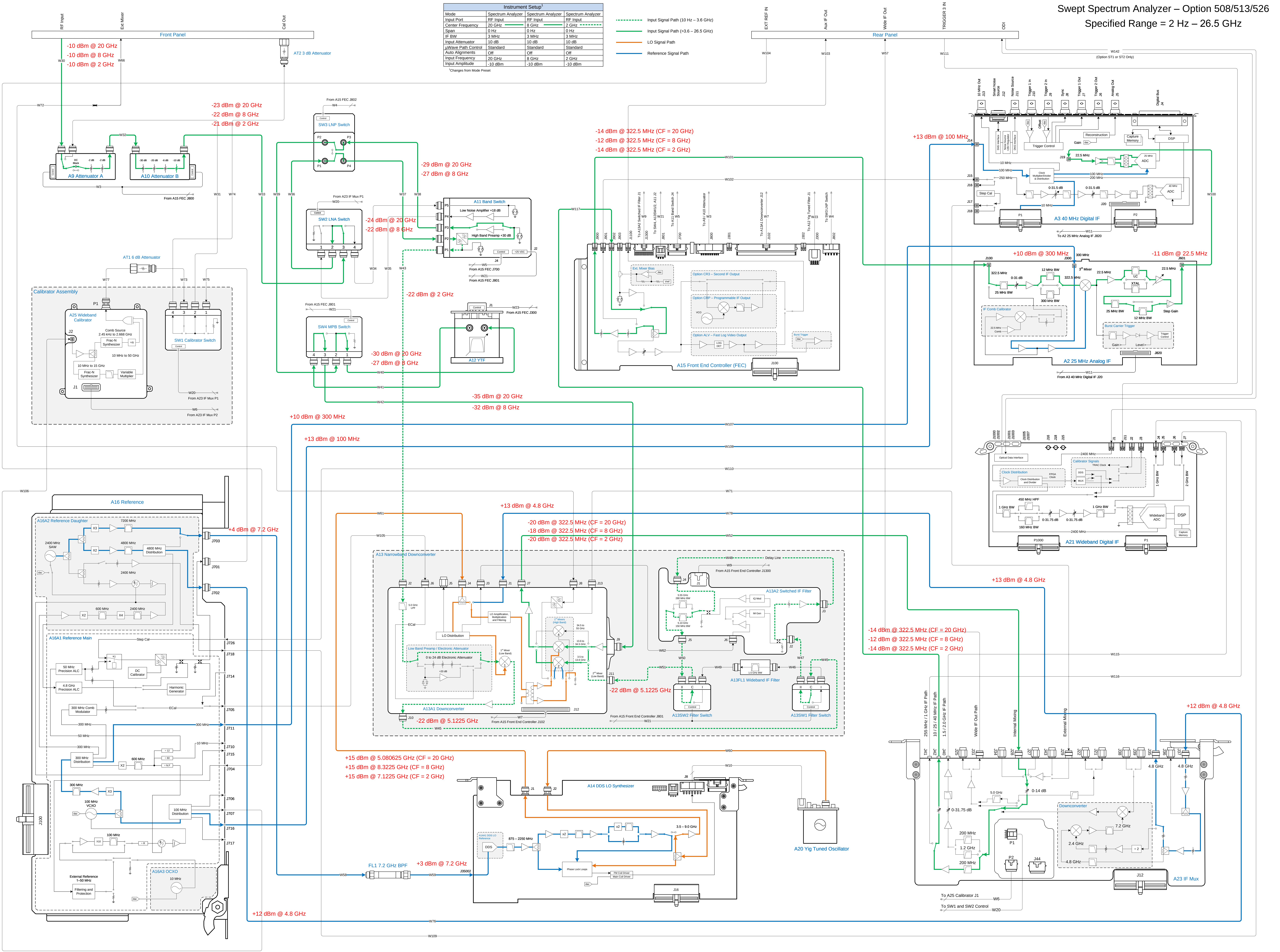
One other thing to keep in mind when it comes to the annotations on the block diagrams. Wherever there is an expected frequency and power level listed, if what is measured does not meet the expectation, a signal at that frequency and amplitude can always be injected with the use of a signal generator to substitute for the expected signal to verify the functionality of the rest of the signal path.

NOTE

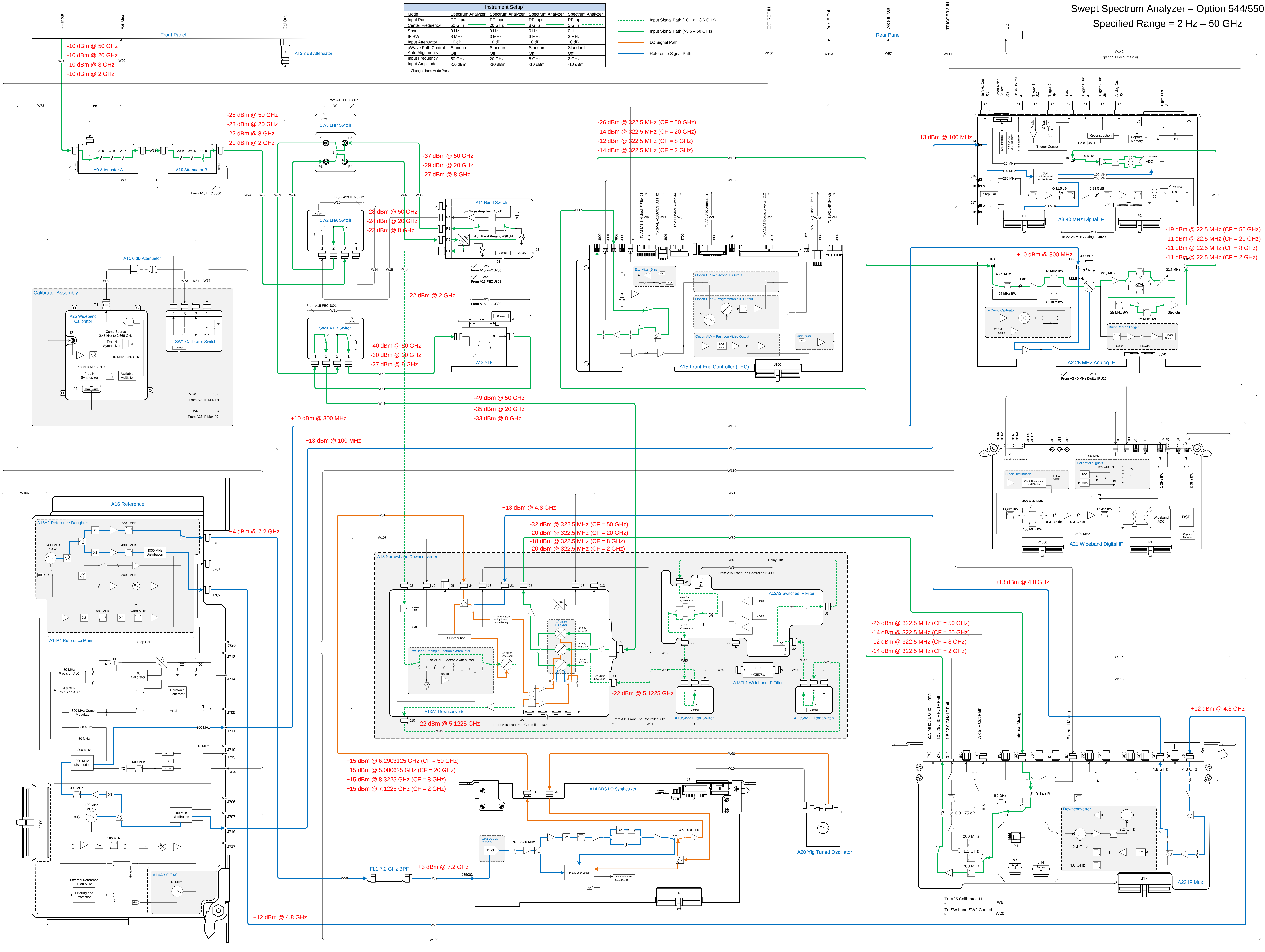
In order to display all the assemblies used in these instruments on one page, along with all the interconnects, the native size of the IF path block diagrams is 34" x 44" (E size). These are intended to either be printed on a large roll printer or viewed on a large computer screen.



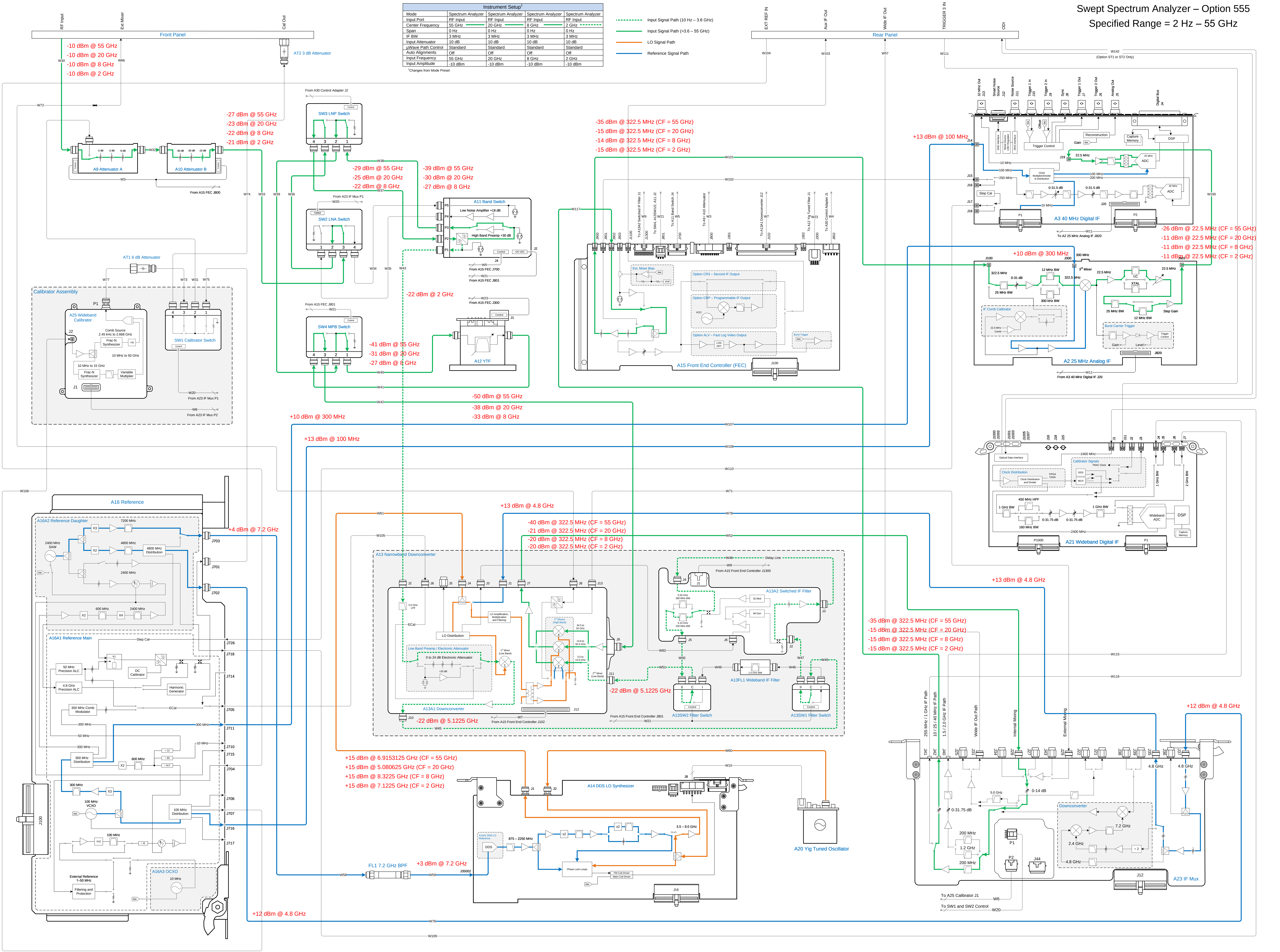
N9032B
Swept Spectrum Analyzer – Option 508/513/526
Specified Range = 2 Hz – 26.5 GHz



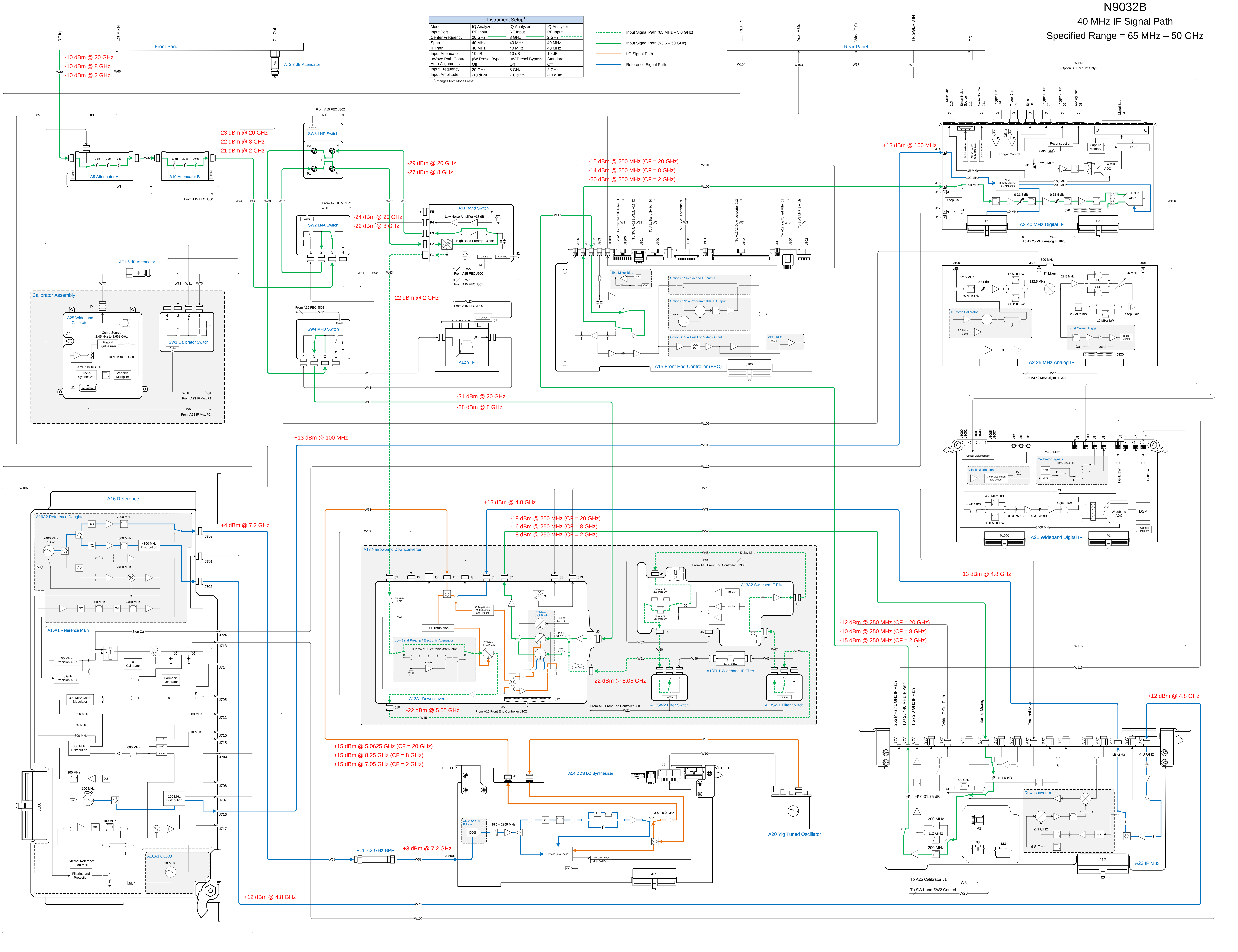
N9032B
Swept Spectrum Analyzer – Option 544/550
Specified Range = 2 Hz – 50 GHz



N9032B
Swept Spectrum Analyzer – Option 555
Specified Range = 2 Hz – 55 GHz



N9032B
40 MHz IF Signal Path
Specified Range = 65 MHz – 50 GHz



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	40 MHz	40 MHz	40 MHz
IF Path	40 MHz	40 MHz	40 MHz
Input Attenuator	10 dB	10 dB	10 dB
Wave Path Control	jW Presel Bypass	jW Presel Bypass	Standard
Auto Alignment	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

¹Changes from Mode Preset

- Input Signal Path (65 MHz – 3.6 GHz)
- Input Signal Path (>3.6 – 50 GHz)
- LO Signal Path
- Reference Signal Path

N9032B

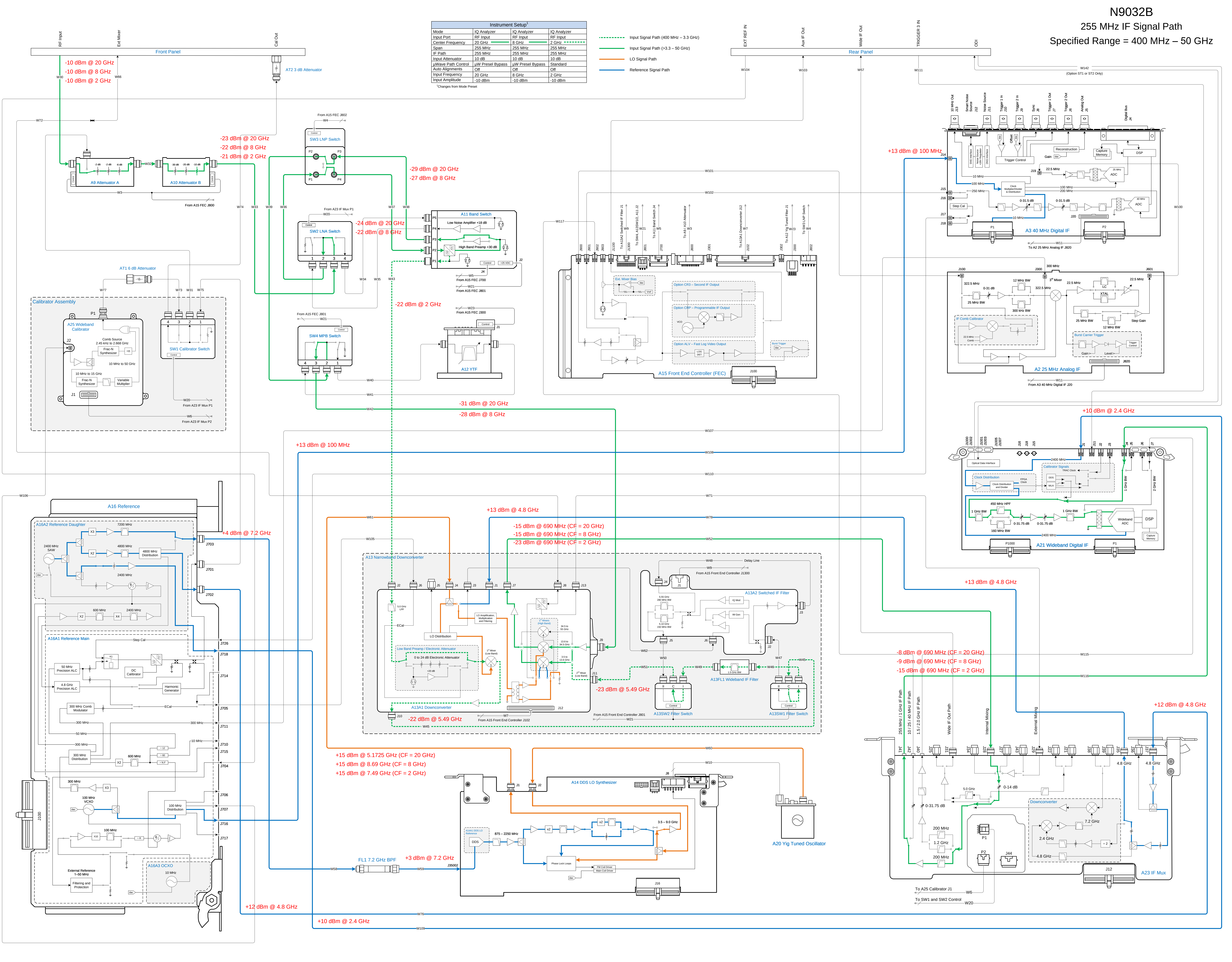
255 MHz IF Signal Path

Specified Range = 400 MHz – 50 GHz

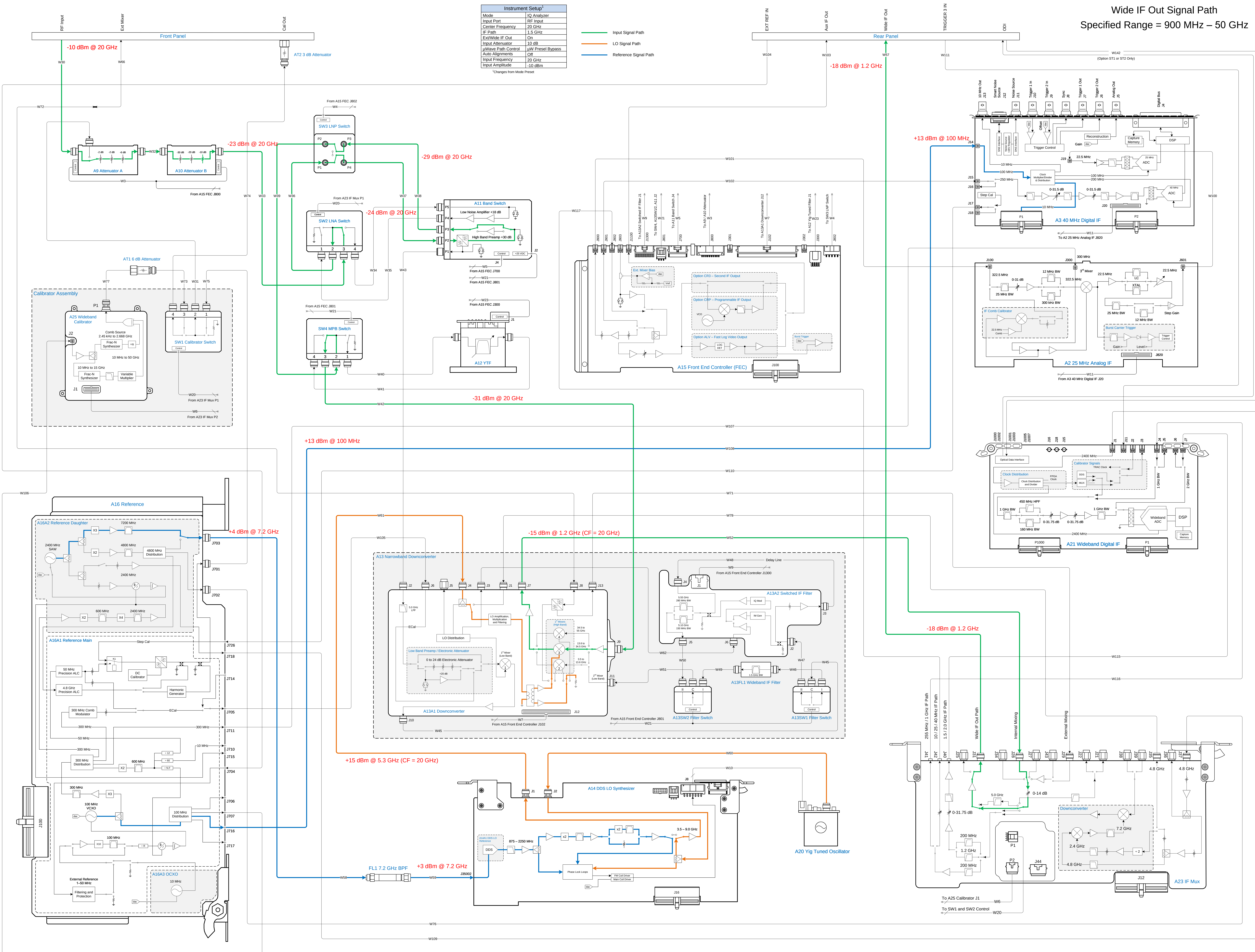
Mode	IQ Analyzer	IQ Analyzer	IQ Analyzer
Input Port	RF Input	RF Input	RF Input
Center Frequency	20 GHz	8 GHz	2 GHz
Span	255 MHz	255 MHz	255 MHz
IF Path	255 MHz	255 MHz	255 MHz
Input Attenuator	10 dB	10 dB	10 dB
Wave Path Control	Off	Off	Off
Auto Alignment	Off	Off	Off
Input Frequency	20 GHz	8 GHz	2 GHz
Input Amplitude	-10 dBm	-10 dBm	-10 dBm

¹Changes from Mode Preset

- Input Signal Path (400 MHz – 3.3 GHz)
- Input Signal Path (>3.3 – 50 GHz)
- LO Signal Path
- Reference Signal Path



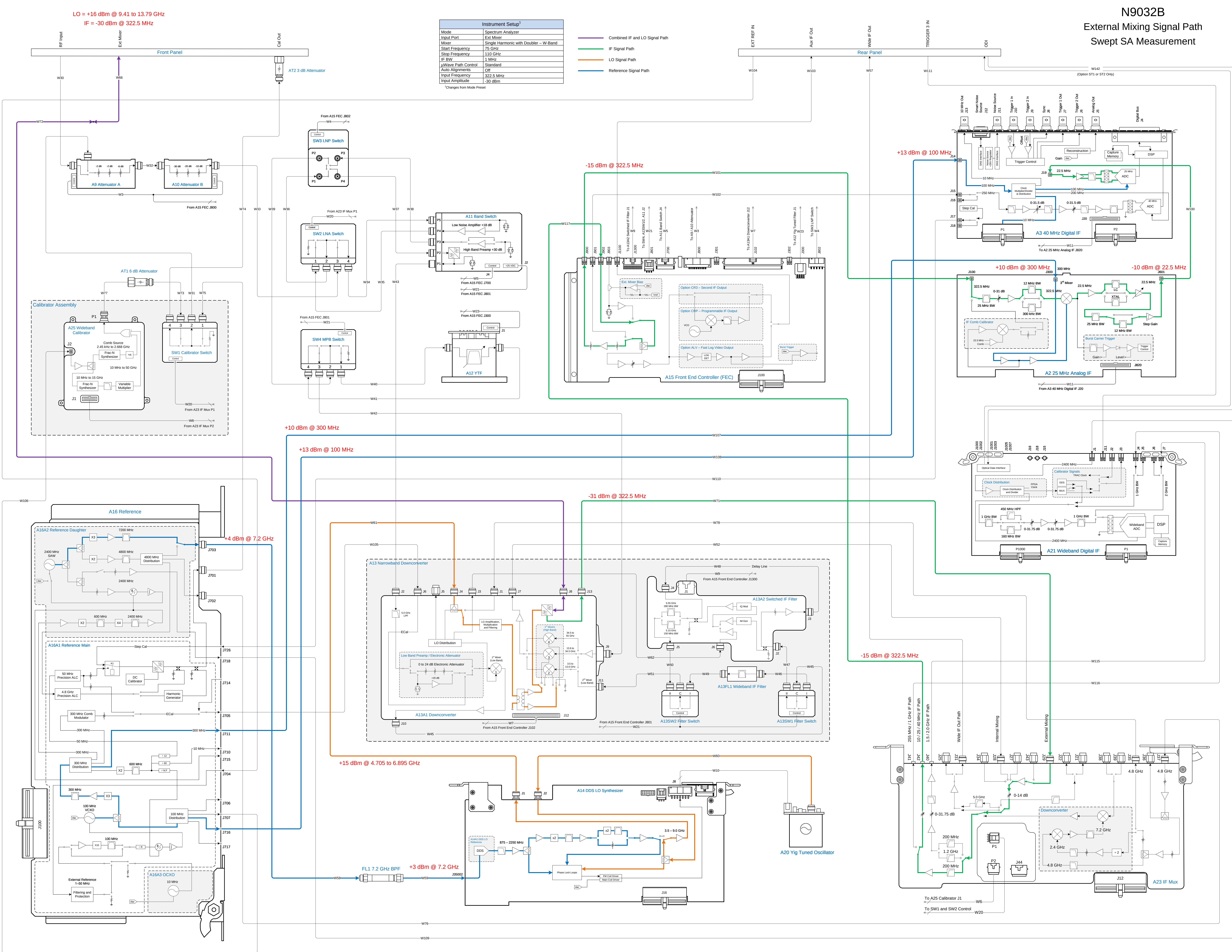
N9032B
Wide IF Out Signal Path
Specified Range = 900 MHz – 50 GHz



Instrument Setup ¹	
Mode	Spectrum Analyzer
Input Port	Ext Mixer
Mixer	Switching 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

¹Changes from Mode Preset

N9032B
External Mixing Signal Path
Swept SA Measurement



9 RF Input Section

What You Will Find in This Chapter

The following information is found in this chapter:

[Overview on page 218](#)

[Troubleshooting Equipment Required on page 221](#)

[A9 / A10 Step Attenuators on page 222](#)

[A11 Band Switch on page 247](#)

[A12 Yig Tuned Filter on page 256](#)

[A25 Wideband Calibrator on page 268](#)

[AT1 / AT2 Coaxial Fixed Attenuator on page 275](#)

[SW1 Calibrator Switch on page 277](#)

[SW2 Low Noise Amplifier Switch on page 283](#)

[SW3 Low Noise Path Switch on page 289](#)

[SW4 Microwave Preselector Bypass Switch on page 298](#)

Overview

The RF Input section of the instrument is made up of several components that can attenuate, amplify, filter, bypass, and direct the input signal to the appropriate downconverter input. This section consists of the following components:

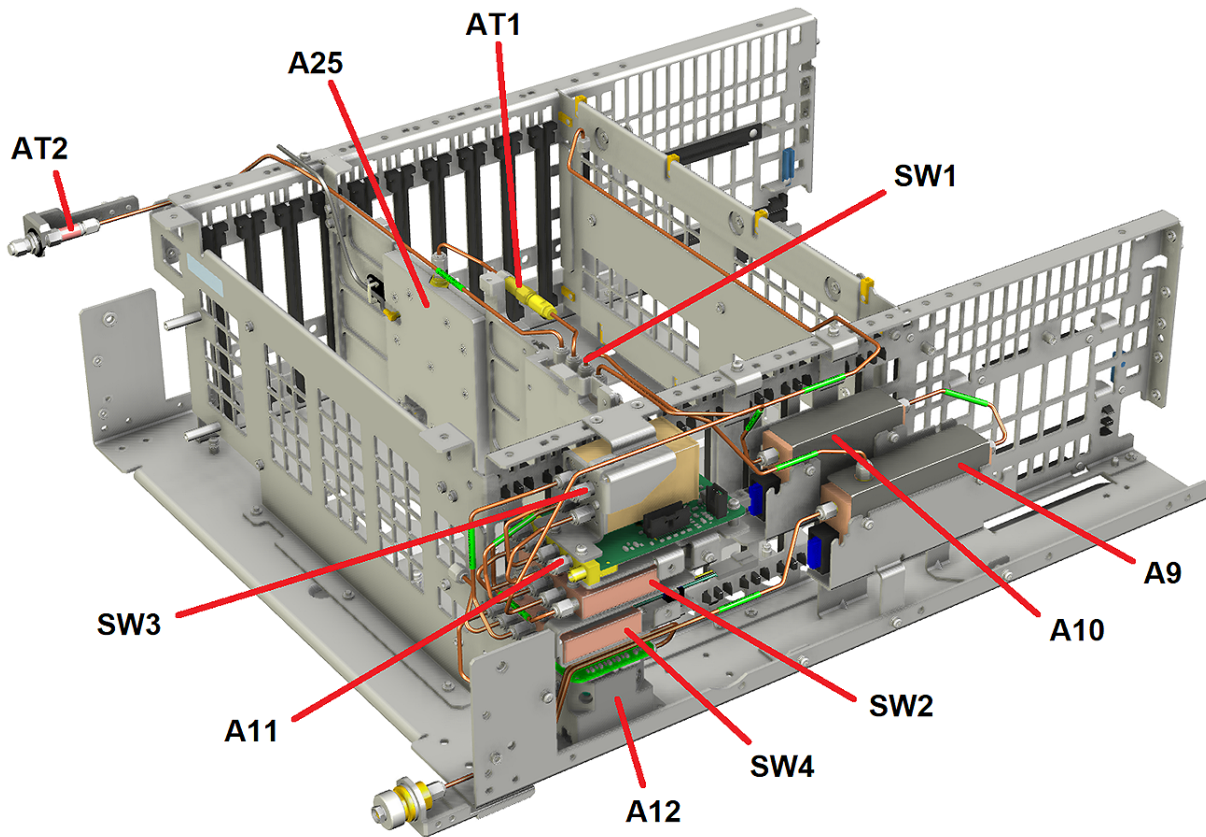
- A9 Step Attenuator A
- A10 Step Attenuator B
- A11 Band Switch
- A12 Yig Tuned Filter
- A25 Wideband Calibrator
- AT1 Coaxial Fixed Attenuator, 6 dB
- AT2 Coaxial Fixed Attenuator, 3 dB
- SW1 Calibrator Switch
- SW2 Low Noise Amplifier Switch
- SW3 Low Noise Path Switch
- SW4 Microwave Preselector Bypass Switch

The layout of these components can be seen in [Chapter 8, “Block Diagrams.”](#) The location of each of these components in the instrument can be seen in [Figure 9-1](#).

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.”](#)

Figure 9-1 Input Section Component Locations - Typical



Switch counts for many of the components in the input section can be found on the **System, Diagnostics, Hardware Statistics** screen in the instrument, as seen in [Figure 9-2](#).

Figure 9-2 Hardware Statistics Screen

System Settings	< Diagnostics Hardware Statistics    	
System	Keysight PXA	Keysight PXA Signal Analyzer
	Product Number	N9032B
	Serial Number	US60420232
I/O Config	S/W Release Name	2022 Update 2.1
	Instrument S/W Revision	A.32.12
User Interface	Revision Date	6/3/2022 1:26:12 PM
	MechAtten #1 Count Total	572409
Power On	Calibrator Switch Cycles	36738
	2 dB #1 Mechanical Atten Cycles	167840
	2 dB #2 Mechanical Atten Cycles	202724
Restore Defaults	6 dB Mechanical Atten Cycles	165107
Alignments	MechAtten #2 Count Total	434302
	10 dB Mechanical Atten Cycles	132731
	20 dB Mechanical Atten Cycles	147531
Licensing	30 dB Mechanical Atten Cycles	154040
Security		
	Low Noise Path Switch Cycles	182402
Diagnostics	Preselector Bypass Cycles	51763
	High temperature operating extreme	46.75
Service	Low temperature operating extreme	29
SCPI Recorder	Elapsed Time (On-Time)(Hours)	3063

The following sections for each of these components will describe them as well as outline how to verify that each one is functioning and being controlled properly.

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 22, "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 20 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 20 GHz

Power Meter

Minimum frequency range: 10 MHz to 20 GHz¹

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

Miscellaneous

Voltmeter

Misc. cables and adapters

NOTE

The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. Higher than 20 GHz will be needed if the instrument has option 544 or 550.

A9 / A10 Step Attenuators

Overview

There are two mechanical step attenuators in the instrument, A9 and A10. There are also two different sets of attenuators depending on the frequency range of the instrument. Instruments with a frequency range of 8.4, 13.6 or 26.5 GHz use one set of attenuators, which will be referred to as “ μ Wave Attenuators”, while instruments with a frequency range of 44, 50 or 55 GHz use another set, which will be referred to as “Millimeter Wave Attenuators”, as seen in [Figure 9-3](#) and [Figure 9-4](#).

Figure 9-3 Input Attenuator Connections - μ Wave Attenuators

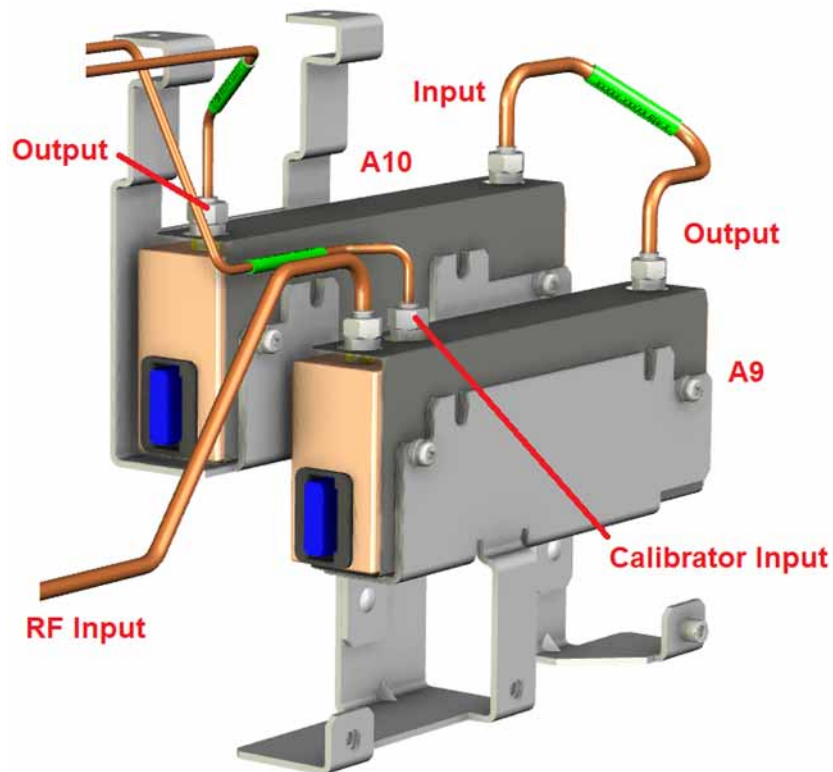
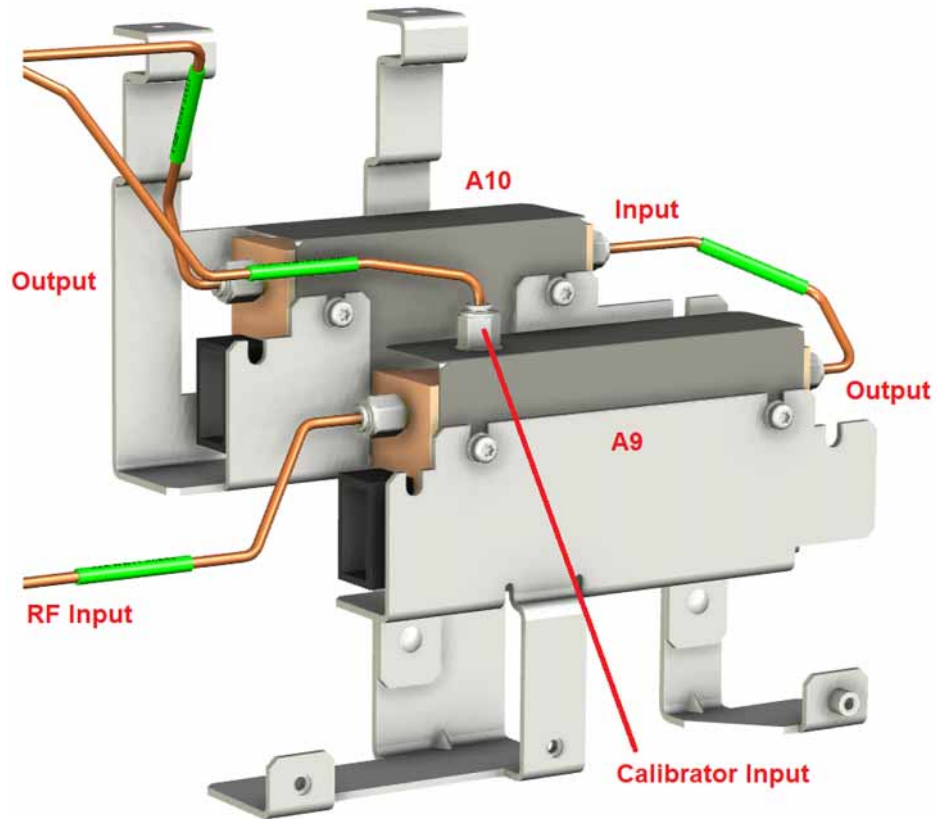


Figure 9-4 Input Attenuator Connections - Millimeter Wave Attenuators



Switch counts for the mechanical attenuators can be found on the **System, Diagnostics, Hardware Statistics** screen in the instrument, as seen in **Figure 9-5**. The average life expectancy for these attenuators is 5 million cycles.

Figure 9-5 Hardware Statistics Screen - A9 / A10 Attenuators - Typical

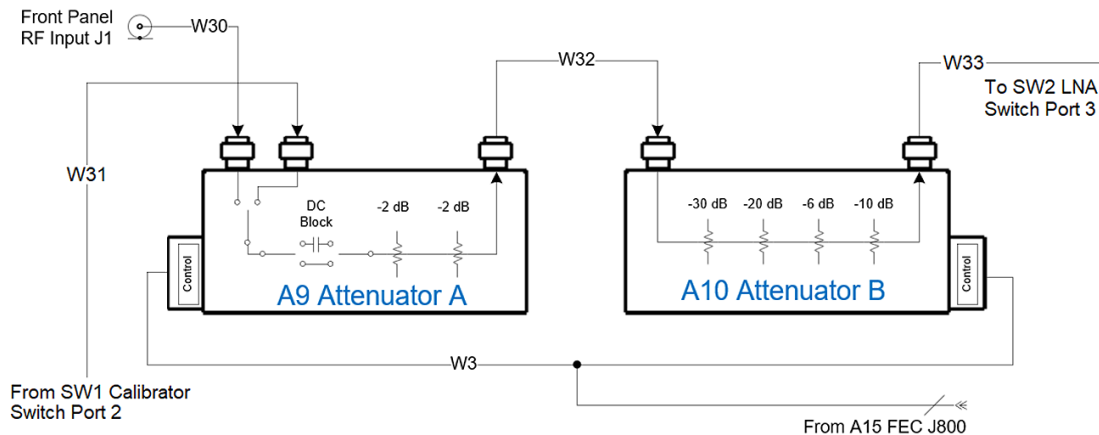
System Settings	< Diagnostics	Hardware Statistics				
System	Keysight PXA	Keysight PXA Signal Analyzer				
	Product Number	N9032B				
	Serial Number	US60420232				
I/O Config	S/W Release Name	2022 Update 2.1				
	Instrument S/W Revision	A.32.12				
	Revision Date	6/3/2022 1:26:12 PM				
User Interface	MechAtten #1 Count Total	572409				
	Calibrator Switch Cycles	36738				
Power On	2 dB #1 Mechanical Atten Cycles	167840				
	2 dB #2 Mechanical Atten Cycles	202724				
Restore Defaults	6 dB Mechanical Atten Cycles	165107				
	MechAtten #2 Count Total	434302				
Alignments	10 dB Mechanical Atten Cycles	132731				
	20 dB Mechanical Atten Cycles	147531				
Licensing	30 dB Mechanical Atten Cycles	154040				
Security	Low Noise Path Switch Cycles	182402				
	Preselector Bypass Cycles	51763				
Diagnostics						
	High temperature operating extreme	46.75				
Service	Low temperature operating extreme	29				
SCPI Recorder	Elapsed Time (On-Time)(Hours)	3063				

μWave Attenuators

The A9 step attenuator has three sections, two 2 dB sections for a total of 4 dB, as well as a switchable DC Block, as seen in **Figure 9-6**. This provides the 2 dB attenuator steps for greater granularity in the overall attenuator setting. It also has two input ports along with an input switch. This allows for the various internal calibrator signals from the SW1 Calibrator Switch to be routed into the input signal path.

The A10 step attenuator has four sections, a 6 dB section, a 10 dB section, a 20 dB section, and a 30 dB section for a total of 66 dB, as seen in **Figure 9-6**. This allows for the wide adjustment range of the overall input attenuation setting.

Figure 9-6 A9 / A10 Attenuators Block Diagram



Control

Control for both step attenuators comes from the A15 Front End Controller board through the W3 ribbon cable.

The attenuators can both be controlled from the **Amplitude, Attenuation** menu, as seen in **Figure 9-7**.

Figure 9-7 A9 and A10 Attenuator Control



Functional Verification

The functionality of the attenuator steps in both the A9 and A10 step attenuators can be manually verified with the use of the following procedure. This procedure will test the functionality of both attenuators as they are in the instrument. It will check the absolute loss through the two of them with 0 dB of attenuation, the different steps relative to the measured 0 dB setting loss, and the calibrator switch functionality.

This procedure will measure the signal path loss from the RF input connector to the output of the A10 attenuator. There are connectors and cables in the signal path in addition to the attenuators themselves. There is also the ribbon cable that connects the attenuators to the A15 Front End Controller. If the absolute 0 dB setting overall loss that is measured is more than what is expected, keep in mind that any of these other components could also be at fault.

NOTE

If the instrument is failing self alignments due to what appears to be a mechanical step attenuator problem, yet the instrument passes the following verifications, it is possible that the self alignment failure is due to the attenuator switching too slowly for the alignment process and needs to be replaced for that reason.

This procedure uses a frequency of 8 GHz to verify the functionality of the attenuators, but any frequency of interest could be verified. The expected 0 dB loss for different frequencies can be found in [Figure 9-8](#).

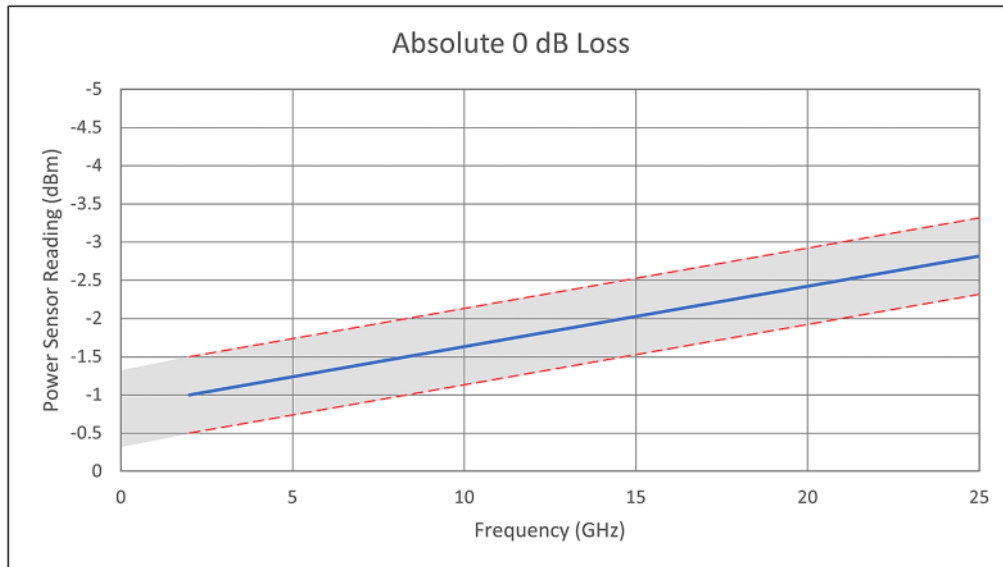
1. Remove the instrument outer cover and chassis right side cover to gain access to the step attenuator connections. Refer to [Chapter 22, "Assembly Replacement Procedures."](#) if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Referring to [Figure 9-3](#), remove the output cable from the A10 step attenuator.

Absolute 0 dB Setting Loss

5. Connect a cable that will connect to the instrument input to a signal generator RF output.
6. Tune the signal generator to 8 GHz.
7. Set the power level of the signal generator to 0 dBm.
8. Connect a power sensor to the other end of the cable connected to the signal generator.
9. Adjust the power level of the signal generator so that the power meter reads 0 dBm ± 0.1 dB.

10. Remove the power sensor from the cable and connect it to the output of the A10 attenuator.
11. Connect the cable from the signal generator to the instrument RF input.
12. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.
13. Verify that the power meter reading is within the range seen in [Figure 9-8](#) for the frequency being verified.

Figure 9-8 Expected Absolute 0 dB Setting Loss



14. If the loss is much greater than expected, inspect all the cables involved as well as the RF input connector. If all of these are fine, determine which of the two attenuators has the excessive 0 dB loss and replace it.
If the loss is as expected, proceed to the next step.

A9 Input Switch

15. With the power sensor still connected to the A10 attenuator output, turn on the instrument's 4.8 GHz calibrator signal by pressing **Input/Output, Calibrator Control, Cal Source 4.8 GHz**.
16. Verify that the power meter reading is $-29 \text{ dBm} \pm 1.5 \text{ dB}$.
If the power level of the 4.8 GHz calibrator is as expected, proceed to the ["A9 Attenuator Steps"](#) section below.
If the power level of the 4.8 GHz calibrator is not as expected, proceed to the next step.
17. Referring to [Figure 9-3](#), remove the cable from the calibrator port of the A9 Step Attenuator, which comes from the SW1 Calibrator Switch port 2.

18. Connect the power sensor to the end of the cable.

19. Verify that the power meter reading is $-28 \text{ dBm} \pm 1.5 \text{ dB}$.

If the power level of the 4.8 GHz calibrator is as expected, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the “**Control Verification**” section to verify that the attenuator is being controlled properly before replacing the A9 Attenuator.

If the power level of the 4.8 GHz calibrator level is still not as expected, see the “**SW1 Calibrator Switch**” section in this chapter to determine why the output from that switch is not correct.

20. Turn the 4.8 GHz calibrator signal off by pressing **Input/Output, Calibrator Control, Cal Source None**.

A9 Attenuator Steps

NOTE

If while verifying the functionality of either step attenuator it appears that the attenuator may not be switching at all, the problem could be in the control of the attenuator and not the attenuators themselves. For these cases, see the “**Control Verification**” section below to verify the control logic for the step attenuators.

21. Connect a spectrum analyzer to the output of the A10 attenuator.

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

23. Set the spectrum analyzer reference level to 0 dBm.

24. Put the marker of the spectrum analyzer on the peak of the signal and activate the marker delta function.

25. Make the step attenuator setting the active function on the instrument by pressing **Amplitude, Attenuation, Mech Atten**.

26. Use the up arrow to step the Mech Atten setting to 2 dB and 4 dB while monitoring the delta marker reading on the spectrum analyzer, verifying that it follows the Mech Atten setting.

27. Switch the RF Coupling to DC by pressing **Input/Output, RF Coupling DC**, and verify that the delta marker level does not change.

Table 9-1 A9 Attenuator Sections versus Mech Atten Setting

Mech Atten	Attenuator Section	
	2 dB #1	2 dB #2
0 dB	--	--
2 dB	--	X
4 dB	X	X

If all the attenuator steps are working properly, proceed to the next step.

If all the attenuator steps are not working properly, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the “Control Verification” section to verify that the attenuator is being controlled properly before replacing the A9 Attenuator.

28. Switch the **RF Coupling** back to **AC**.

A10 Attenuator Steps

29. Set the **Mech Atten** setting back to **0 dB**.

30. Set the **Mech Atten Step** to **10 dB**.

31. Verify that the spectrum analyzer marker delta reading is 0 dB, resetting it if necessary.

32. Make the step attenuator setting the active function on the instrument by pressing **Mech Atten**.

33. Use the up arrow to step the Mech Atten setting to 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, and 60 dB while monitoring the delta marker reading on the spectrum analyzer, verifying that it follows the Mech Atten setting.

34. Set the **Mech Atten** to **6 dB** and verify that the delta marker reading follows the attenuator setting.

Table 9-2 A10 Attenuator Sections versus Mech Atten Setting

Mech Atten	30 dB	20 dB	10 dB	6 dB
0 dB	--	--	--	--
6 dB	--	--	--	X
10 dB	--	--	X	--
20 dB	--	X	--	--
30 dB	X	--	--	--
40 dB	X	--	X	--

Table 9-2 A10 Attenuator Sections versus Mech Atten Setting

Mech Atten	30 dB	20 dB	10 dB	6 dB
50 dB	X	X	--	--
60 dB	X	X	X	--

If all the attenuator steps are working properly, proceed to the next step.

If all the attenuator steps are not working properly, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the “Control Verification” section to verify that the attenuator is being controlled properly before replacing the A10 Attenuator.

35. Both step attenuators appear to be functioning as expected. If the instrument is still failing a self alignment due to one of the step attenuators it is possible that they are just not switching fast enough.

Control Verification

The A9 and A10 Attenuators are both controlled through the same W3 ribbon cable connected to J800 on the A15 Front End Controller.

For each attenuator section there is both a “Select” and a “Bypass” control line. One of them should always be at 0 volts while the other is at 5 volts. They should never both be at the same level. The line that the controller pulls down to 0 volts DC is the activated line. For example: if the 2 dB Select line is 0 volts and its Bypass line is 5 volts, the 2 dB section is selected.

Since the A9 Attenuator also has a calibrator signal input port, it has a section to switch the internal calibrator signal in. When the Cal Source setting is set to None, the calibrator input is bypassed, so its “Bypass” line is 0 volts and its “Select” line is 5 volts. When the Cal Source is set to anything other than None its “Select” line is 0 volts, and its “Bypass” line is 5 volts.

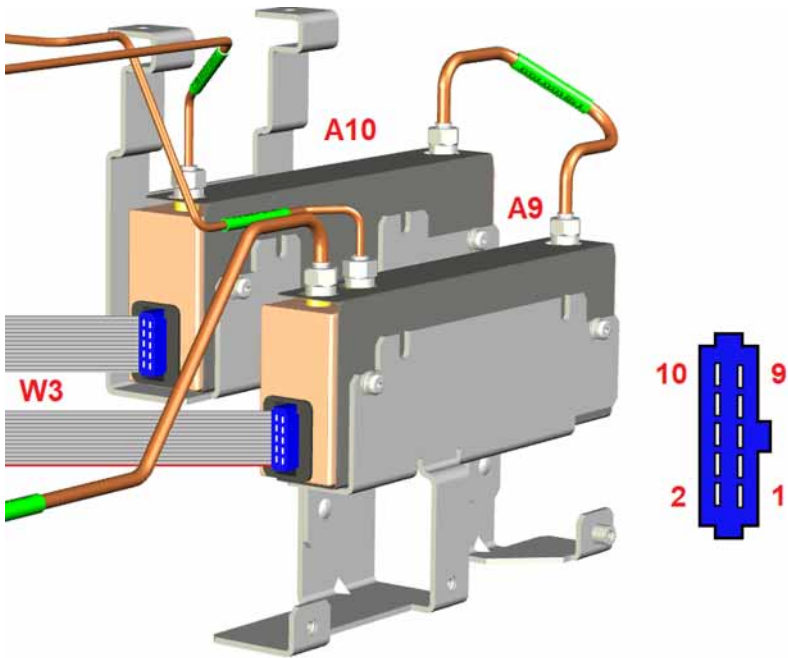
Use the following procedure to verify that the control voltages coming from the A15 Front End Controller are correct before replacing an attenuator for not switching properly.

1. Return the instrument to a known state by pressing **Mode Preset**.
2. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
3. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.

A9 Control Verification

4. Referring to **Figure 9-9**, use a DC voltmeter to measure the control lines at the W3 connector at the A9 Attenuator and verify the voltages match what is outlined in **Table 9-4** for the mechanical attenuation value selected.

Figure 9-9 A9 & A10 Control



If the control voltages are all correct, proceed to the next step.

If any of the voltages do not match what is outlined in [Table 9-4](#), inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.

Table 9-3 A9 Attenuator Pinout

Control Line	Pin #		Pin #	Control Line
Main Supply	10		9	AC/DC Select
2 dB #1 Select	8		7	2 dB #2 Bypass
2 dB #2 Select	6		5	2 dB #1 Bypass
AC/DC Bypass	4		3	Ground
Cal Switch Select	2		1	Cal Switch Bypass

Table 9-4 A9 Attenuator Control Logic (Cal Source = None)

Pin #	Mechanical Attenuator Setting			RF Coupling	
	0 dB	2 dB	4 dB	AC	DC
1	0 V	0 V	0 V	--	--
2	5 V	5 V	5 V	--	--
3	0 V	0 V	0 V	0 V	0 V
4	0 V	0 V	5 V	0 V	5 V
5	0 V	5 V	5 V	--	--
6	0 V	0 V	0 V	--	--
7	5 V	5 V	5 V	--	--
8	5 V	0 V	0 V	--	--
9	5 V	5 V	0 V	5 V	0 V
10	24 V	24 V	24 V	24 V	24 V

5. Increase the **Mech Atten** setting to the next value listed in Table 9-4 and repeat **step 4** until all mechanical attenuation values listed in Table 9-4 have been verified.
6. Switch the calibration input section to the Select position by pressing **Input/Output, Cal Source, 50 MHz**.
7. Verify that Pin #1 now measures 5 volts and Pin #2 measures 0 volts.
If the voltages on pins 1 and 2 are correct, the A9 attenuator control is working properly. Proceed to the next step to verify the control of the A10 attenuator.

If either of the voltages is not correct, inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.
8. Switch the calibration input section back to the Bypass position by pressing **Input/Output, Cal Source, None**.

A10 Control Verification

NOTE

The A10 Attenuator may need to be taken out of the instrument to gain access to the control connector so that the control voltage levels can be measured. The W3 ribbon cable should be long enough to allow this.

9. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.

10. Set the attenuator step to 10 dB by setting **Mech Atten Step** to 10 dB.

11. Referring to **Figure 9-9**, use a DC voltmeter to measure the control lines at the W3 connector at the A10 Attenuator and verify the voltages match what is outlined in **Table 9-6** for the mechanical attenuation value selected.

If the control voltages are all correct, proceed to the next step.

If any of the voltages do not match what is outlined in **Table 9-6**, inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.

Table 9-5 A10 Attenuator Pinout

Control Line	Pin #		Pin #	Control Line
Main Supply	10		9	6 dB Select
20 dB Select	8		7	30 dB Bypass
30 dB Bypass	6		5	20 dB Bypass
6 dB Bypass	4		3	Ground
10 dB Select	2		1	10 dB Bypass

Table 9-6 A10 Attenuator Control Logic

Pin #	Mechanical Attenuator Setting							
	0 dB	6 dB	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
1	0 V	0 V	5 V	0 V	0 V	5 V	0 V	5 V
2	5 V	5 V	0 V	5 V	5 V	0 V	5 V	0 V
3	0 V	0 V	0 V	0 V	0 V	0 V	0 V	0 V
4	0 V	5 V	0 V	0 V	0 V	0 V	0 V	0 V
5	0 V	0 V	0 V	5 V	0 V	0 V	5 V	5 V
6	0 V	0 V	0 V	0 V	5 V	5 V	5 V	5 V
7	5 V	5 V	5 V	5 V	0 V	0 V	0 V	0 V
8	5 V	5 V	5 V	0 V	5 V	5 V	0 V	0 V
9	5 V	0 V	5 V	5 V	5 V	5 V	5 V	5 V
10	24 V	24 V	24 V	24 V	24 V	24 V	24 V	24 V

12. Increase the **Mech Atten** setting to the next value listed in **Table 9-6** and repeat **step 11** until all mechanical attenuation values listed in **Table 9-6** have been verified.

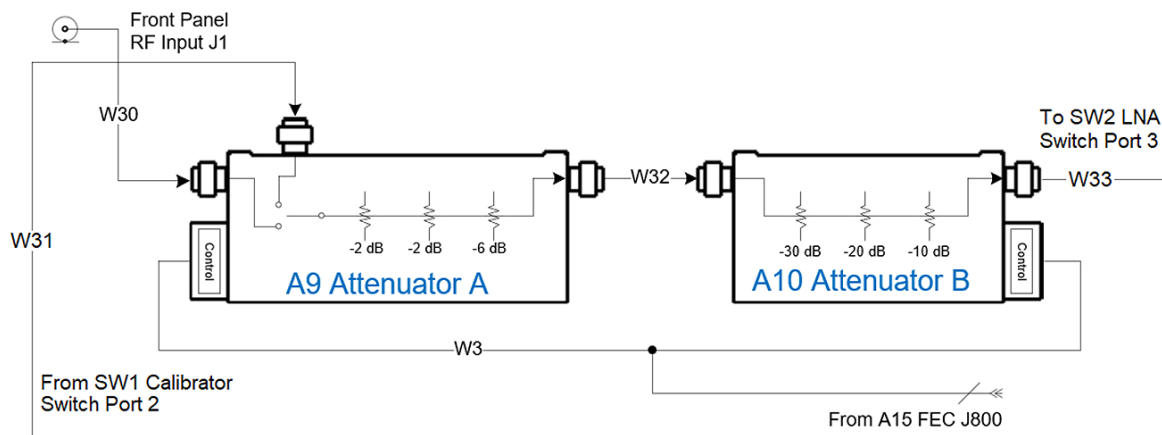
If all the voltages are correct, the A10 attenuator control is working properly.

Millimeter Wave Attenuators

The A9 step attenuator has three sections, two 2 dB sections and one 6 dB section for a total of 10 dB, as seen in **Figure 9-10**. This provides the 2 dB attenuator steps for greater granularity in the overall attenuator setting. It also has two input ports along with an input switch. This allows for the various internal calibrator signals from the SW1 Calibrator Switch to be routed into the input signal path.

The A10 step attenuator has three sections, a 10 dB section, a 20 dB section, and a 30 dB section for a total of 60 dB, as seen in **Figure 9-10**. This allows for the wide adjustment range of the overall input attenuation setting.

Figure 9-10 A9 / A10 Attenuators Block Diagram



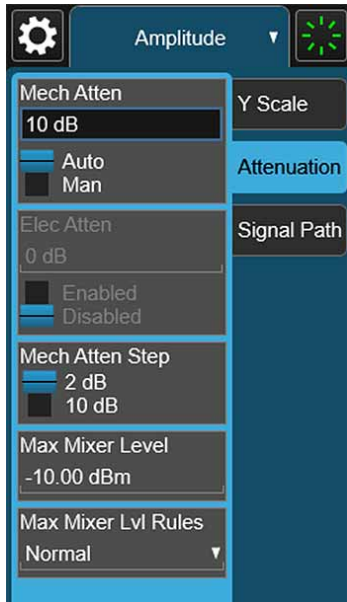
Control

Control for both step attenuators comes from the A15 Front End Controller board through the W3 ribbon cable.

The attenuators can both be controlled from the **Amplitude, Attenuation** menu, as seen in **Figure 9-11**.

Figure 9-11

A9 and A10 Attenuator Control



Functional Verification

The functionality of the attenuator steps in both the A9 and A10 step attenuators can be manually verified with the use of the following procedure. This procedure will test the functionality of both attenuators as they are in the instrument. It will check both the absolute loss through the two of them with 0 dB of attenuation, the different steps relative to the measured 0 dB setting loss, and the calibrator switch functionality.

This procedure will measure the signal path loss from the RF input connector to the output of the A10 attenuator. There are connectors and cables in the signal path in addition to the attenuators themselves. There is also the ribbon cable that connects the attenuators to the A15 Front End Controller. If the absolute 0 dB setting overall loss that is measured is more than what is expected, keep in mind that any of these other components could also be at fault.

NOTE

If the instrument is failing self alignments due to what appears to be a mechanical step attenuator problem, yet the instrument passes the following verifications, it is possible that the self alignment failure is due to the attenuator switching too slowly for the alignment process and needs to be replaced for that reason.

This procedure uses a frequency of 20 GHz to verify the functionality of the attenuators, but any frequency of interest could be verified. The expected 0 dB loss for different frequencies can be found in [Figure 9-12](#).

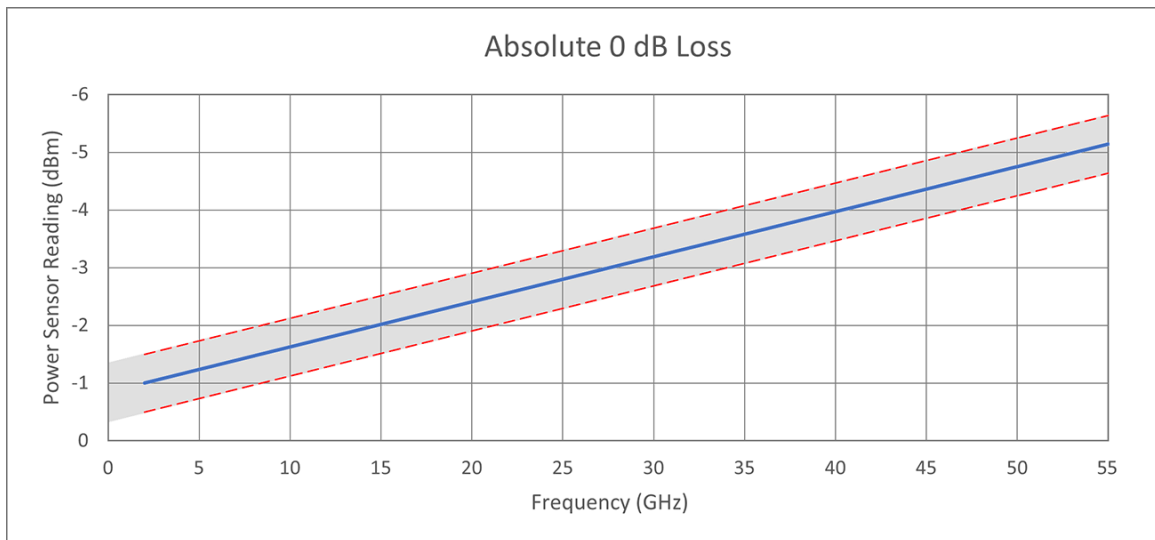
1. Remove the instrument outer cover and chassis right side cover to gain access to the step attenuator connections. Refer to [Chapter 22, "Assembly Replacement Procedures."](#) if information on how to remove these is needed.

2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Referring to [Figure 9-4](#), remove the output cable from the Output of the A10 step attenuator.

Absolute 0 dB Setting Loss

5. Connect a cable that will connect to the instrument input to a signal generator RF output.
6. Tune the signal generator to 20 GHz.
7. Set the power level of the signal generator to 0 dBm.
8. Connect a power sensor to the other end of the cable connected to the signal generator.
9. Adjust the power level of the signal generator so that the power meter reads 0 dBm ± 0.1 dB.
10. Remove the power sensor from the cable and connect it to the output of the A10 attenuator.
11. Connect the cable from the signal generator to the instrument RF input.
12. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.
13. Verify that the power meter reading is within the range seen in [Figure 9-12](#) for the frequency being verified.

Figure 9-12 Expected Absolute 0 dB Setting Loss



14. If the loss is much greater than expected, inspect all the cables involved as well as the RF input connector. If all of these are fine, determine which of the two attenuators has the excessive 0 dB loss and replace it.

If the loss is as expected, proceed to the next step.

A9 Input Switch

15. With the power sensor still connected to the A10 attenuator output, turn on the instrument's 4.8 GHz calibrator signal by pressing **Input/Output, Calibrator Control, Cal Source 4.8 GHz**.

16. Verify that the power meter reading is $-29 \text{ dBm} \pm 1.5 \text{ dB}$.

If the power level of the 4.8 GHz calibrator is as expected, proceed to the **A9 Attenuator Steps** section below.

If the power level of the 4.8 GHz calibrator is not as expected, proceed to the next step.

17. Referring to **Figure 9-4**, remove the cable calibrator input port of the A9 Step Attenuator, which comes from the SW1 Calibrator Switch port 2.

18. Connect the power sensor to the end of the cable.

19. Verify that the power meter reading is $-28 \text{ dBm} \pm 1.5 \text{ dB}$.

If the power level of the 4.8 GHz calibrator is as expected, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the **"Control Verification"** section to verify that the attenuator is being controlled properly before replacing the A9 Attenuator.

If the power level of the 4.8 GHz calibrator level is still not as expected, see the **"SW1 Calibrator Switch"** section in this chapter to determine why the output from that switch is not correct.

20. Turn the 4.8 GHz calibrator signal off by pressing **Input/Output, Calibrator Control, Cal Source None**.

A9 Attenuator Steps

NOTE

If while verifying the functionality of either step attenuator it appears that the attenuator may not be switching at all, the problem could be in the control of the attenuator and not the attenuators themselves. For these cases, see the **"Control Verification"** section below to verify the control logic for the step attenuators.

21. Connect a spectrum analyzer to the output of the A10 attenuator.
22. Tune the center frequency of the spectrum analyzer to 20 GHz with a span of 10 MHz.
23. Set the spectrum analyzer reference level to 0 dBm.
24. Put the marker of the spectrum analyzer on the peak of the signal and activate the marker delta function.

25. Make the step attenuator setting the active function on the instrument by pressing **Amplitude, Attenuation, Mech Atten**.

26. Use the up arrow to step the Mech Atten setting to 2 dB, 4 dB, 6 dB, and 8 dB while monitoring the delta marker reading on the spectrum analyzer, verifying that it follows the Mech Atten setting.

Table 9-7 A9 Attenuator Sections versus Mech Atten Setting

Mech Atten	Attenuator Section		
	2 dB #1	2 dB #2	6 dB
0 dB	--	--	--
2 dB	--	X	--
4 dB	X	X	--
6 dB	--	--	X
8 dB	X	--	X
10 dB	--	--	--

If all the attenuator steps are working properly, proceed to the next step.

If all the attenuator steps are not working properly, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the “**Control Verification**” section to verify that the attenuator is being controlled properly before replacing the A9 Attenuator.

A10 Attenuator Steps

27. Set the **Mech Atten** setting back to **0 dB**.

28. Set the **Mech Atten Step** to **10 dB**.

29. Verify that the spectrum analyzer marker delta reading is 0 dB, resetting it if necessary.

30. Make the step attenuator setting the active function on the instrument by pressing **Mech Atten**.

31. Use the up arrow to step the Mech Atten setting to 10 dB, 20 dB, 30 dB, 40 dB, 50 dB, and 60 dB while monitoring the delta marker reading on the spectrum analyzer, verifying that it follows the Mech Atten setting.

Table 9-8 A10 Attenuator Sections versus Mech Atten Setting

Mech Atten	30 dB	20 dB	10 dB
0 dB	--	--	--
10 dB	--	--	X
20 dB	--	X	--

Table 9-8 A10 Attenuator Sections versus Mech Atten Setting

Mech Atten	30 dB	20 dB	10 dB
30 dB	X	--	--
40 dB	X	--	X
50 dB	X	X	--
60 dB	X	X	X

If all the attenuator steps are working properly, proceed to the next step.

If all the attenuator steps are not working properly, inspect the W3 ribbon cable controlling the attenuators and replace it if damaged. If the cable is not damaged, proceed to the “Control Verification” section to verify that the attenuator is being controlled properly before replacing the A10 Attenuator.

- 32.**Both step attenuators appear to be functioning as expected. If the instrument is still failing a self alignment due to one of the step attenuators it is possible that they are just not switching fast enough.

Control Verification

The A9 and A10 Attenuators are both controlled through the same W3 ribbon cable connected to J800 on the A15 Front End Controller.

For each attenuator section there is both a “Select” and a “Bypass” control line. One of them should always be at 0 volts while the other is at 5 volts. They should never both be at the same level. The line that the controller pulls down to 0 volts DC is the activated line. For example: if the 6 dB Select line is 0 volts and its Bypass line is 5 volts, the 6 dB section is selected.

Since the A9 Attenuator also has a calibrator signal input port, it has a section to switch the internal calibrator signal in. When the Cal Source setting is set to None, the calibrator input is bypassed, so its “Bypass” line is 0 volts and its “Select” line is 5 volts. When the Cal Source is set to anything other than None its “Select” line is 0 volts, and its “Bypass” line is 5 volts.

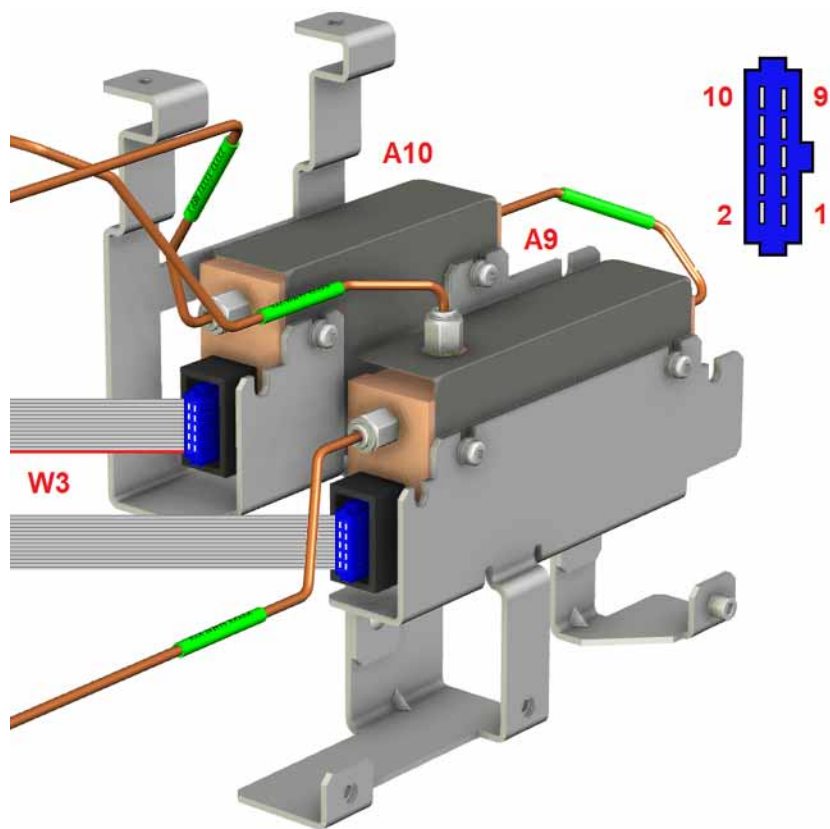
Use the following procedure to verify that the control voltages coming from the A15 Front End Controller are correct before replacing an attenuator for not switching properly.

1. Return the instrument to a known state by pressing **Mode Preset**.
2. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
3. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.

A9 Control Verification

4. Referring to **Figure 9-13**, use a DC voltmeter to measure the control lines at the W3 connector at the A9 Attenuator and verify the voltages match what is outlined in **Table 9-10** for the mechanical attenuation value selected.

Figure 9-13 A9 & A10 Control



If the control voltages are all correct, proceed to the next step.

If any of the voltages do not match what is outlined in [Table 9-4](#), inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.

Table 9-9 A9 Attenuator Pinout

Control Line	Pin #		Pin #	Control Line
Main Supply	10		9	2 dB #1 Select
2 dB #2 Select	8		7	6 dB Select
6 dB Bypass	6		5	2 dB #2 Bypass
2 dB #1 Bypass	4		3	Ground
Cal Switch Select	2		1	Cal Switch Bypass

Table 9-10 A9 Attenuator Control Logic (Cal Source = None)

Pin #	Mechanical Attenuator Setting				
	0 dB	2 dB	4 dB	6 dB	8 dB
1	0 V	0 V	0 V	0 V	0 V
2	5 V	5 V	5 V	5 V	5 V
3	0 V	0 V	0 V	0 V	0 V
4	0 V	0 V	5 V	0 V	5 V
5	0 V	5 V	5 V	0 V	0 V
6	0 V	0 V	0 V	5 V	5 V
7	5 V	5 V	5 V	0 V	0 V
8	5 V	0 V	0 V	5 V	5 V
9	5 V	5 V	0 V	5 V	0 V
10	24 V	24 V	24 V	24 V	24 V

5. Increase the Mech Atten setting to the next value listed in **Table 9-10** and repeat step 4 until all mechanical attenuation values listed in **Table 9-10** have been verified.
6. Switch the calibration input section to the Select position by pressing **Input/Output, Cal Source, 50 MHz**.
7. Verify that Pin #1 now measures 5 volts and Pin #2 measures 0 volts.
If the voltages on pins 1 and 2 are correct, the A9 attenuator control is working properly. Proceed to the next step to verify the control of the A10 attenuator.
If either of the voltages is not correct, inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.
8. Switch the calibration input section back to the Bypass position by pressing **Input/Output, Cal Source, None**.

A10 Control Verification

NOTE

The A10 Attenuator may need to be taken out of the instrument to gain access to the control connector so that the control voltage levels can be measured. The W3 ribbon cable should be long enough to allow this.

9. Set the attenuators to 0 dB by pressing **Amplitude, Attenuation, Mech Atten 0 dB**.
10. Set the attenuator step to 10 dB by setting **Mech Atten Step to 10 dB**.

11. Referring to **Figure 9-13**, use a DC voltmeter to measure the control lines at the W3 connector at the A10 Attenuator and verify the voltages match what is outlined in **Table 9-12** for the mechanical attenuation value selected.

If the control voltages are all correct, proceed to the next step.

If any of the voltages do not match what is outlined in **Table 9-12**, inspect W3 for any damage and replace it if needed. If W3 is not damaged and the control voltages are not correct, replace the A15 Front End Controller.

Table 9-11 A10 Attenuator Pinout

Control Line	Pin #		Pin #	Control Line
Main Supply	10		9	30 dB Select
20 dB Select	8		7	n/a
n/a	6		5	20 dB Bypass
30 dB Bypass	4		3	Ground
10 dB Select	2		1	10 dB Bypass

Table 9-12 A10 Attenuator Control Logic

Pin #	Mechanical Attenuator Setting						
	0 dB	10 dB	20 dB	30 dB	40 dB	50 dB	60 dB
1	0 V	5 V	0 V	0 V	5 V	0 V	5 V
2	5 V	0 V	5 V	5 V	0 V	5 V	0 V
3	0 V	0 V	0 V	0 V	0 V	0 V	0 V
4	0 V	0 V	0 V	5 V	5 V	5 V	5 V
5	0 V	0 V	5 V	0 V	0 V	5 V	5 V
6	--	--	--	--	--	--	--
7	--	--	--	--	--	--	--
8	5 V	5 V	0 V	5 V	5 V	0 V	0 V
9	5 V	5 V	5 V	0 V	0 V	0 V	0 V
10	24 V	24 V	24 V	24 V	24 V	24 V	24 V

12. Increase the **Mech Atten** setting to the next value listed in [Table 9-12](#) and repeat step 11 until all mechanical attenuation values listed in [Table 9-12](#) have been verified.

If all the voltages are correct, the A10 attenuator control is working properly.

A11 Band Switch

Overview

The A11 Band Switch provides multiple functions in the instrument, such as:

- Low Band / High Band Signal Routing
- Input Overload Protection
- High Band Preamplifier
- Low Noise Amplifier

Control of the A11 Band Switch comes from the A15 Front End Controller, via ribbon cable W5. There is also a +25 volt DC supply that also comes from the A15 Front End Controller via wire harness W21.

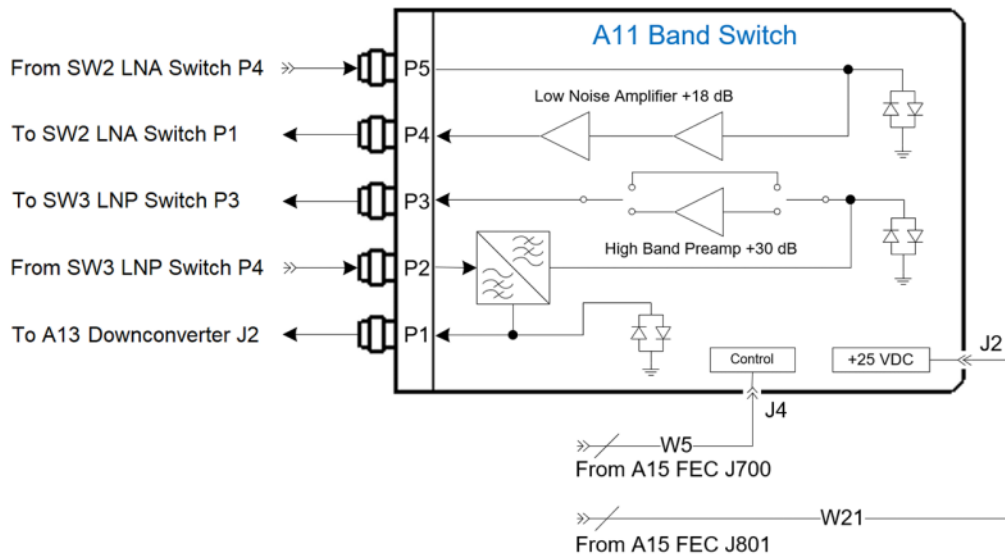
The connections to and from the A11 Band Switch are listed in **Table 9-13** and as illustrated in **Figure 9-14**.

Table 9-13 A11 Band Switch Connections

Port	Description	To/From	Cable
J2	+25 Volt DC Supply	From A15 FEC J801	W21
J4	Bias & Control	From A15 FEC J700	W5
P1	Low Band Output	To A13A1 Downconverter J2	W43
P2	RF Input	From SW3 LNP Switch P4	W37
P3	High Band Output	To SW3 LNP Switch P3	W38
P4	Low Noise Amplifier Output	To SW2 LNA Switch P1	W35
P5	Low Noise Amplifier Input	From SW2 LNA Switch P4	W34

RF Input Section
A11 Band Switch

Figure 9-14 A11 Band Switch Block Diagram



The A11 Band Switch will identify itself on the instrument Hardware Information screen as the **Low Band Switch**, as seen in Figure 9-15.

Figure 9-15 Hardware Information Screen – A11 Band Switch

System Settings

< System

Hardware Information

↶

↷

?

✖

System

Keysight PXA

Keysight PXA Signal Analyzer

I/O Config

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

Analog IF

N902060290

79204100103

011

1

A

57

Power On

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Restore Defaults

Digital IF

N902060016

79204100250

035

3

A

34

Alignments

Front End Controller

N902060295

79204100620

009

0

A

131

Licensing

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Security

Low Band Switch

N904060100

78200251477

000

2

B

135

Diagnostics

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

Service

LO DDS Reference

M930560028

79204100169

007

0

A

92

SCPI Recorder

Wideband Calibrator

N904060151

30202000005

004

2

A

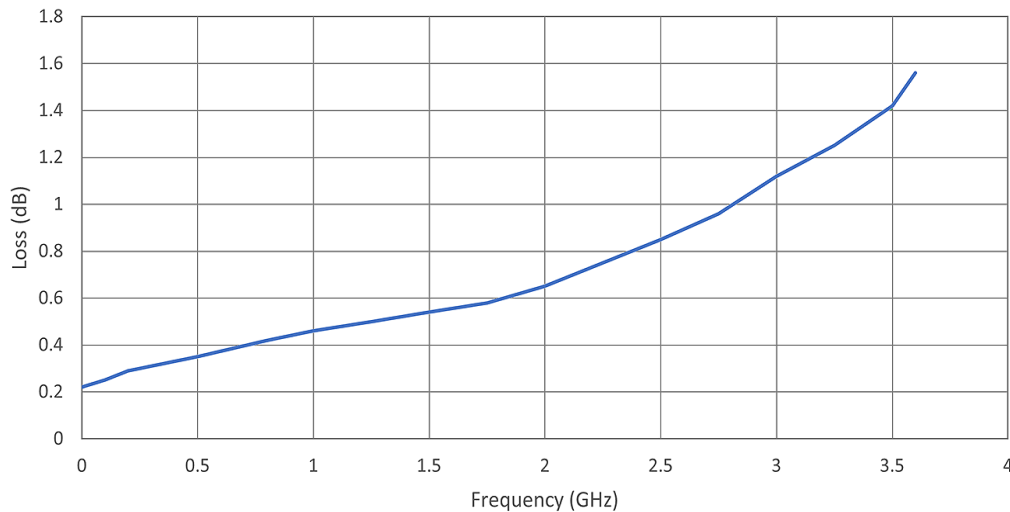
260

Low Band / High Band Signal Routing

Signals entering the P2 input port are directed to a PIN diode switch diplexer. When the instrument is tuned to 3.6 GHz or below, signals are routed back out the P1 low band output port. When the instrument is tuned higher than 3.6 GHz, signals are either routed directly back out the P3 high band output port or through the High Band Preamplifier then back out P3, if the Full Range preamplifier is turned on.

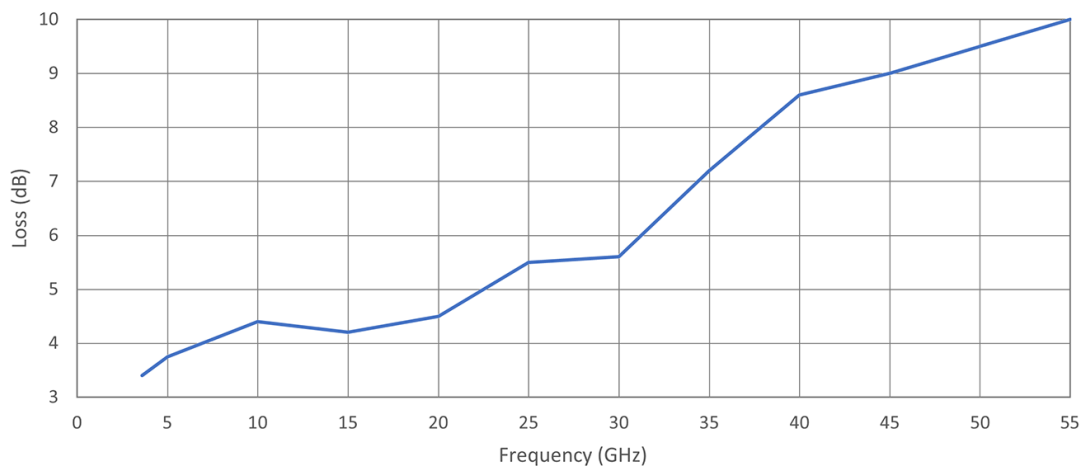
The typical loss of the Low Band signal path (P2 to P1) is shown in **Figure 9-16**.

Figure 9-16 Typical Low Band Signal Path Loss (P2 to P1)



The typical loss of the High Band signal path (P2 to P3), with the internal preamp turned off, is shown in **Figure 9-17**.

Figure 9-17 Typical High Band Signal Path Loss (P2 to P3)



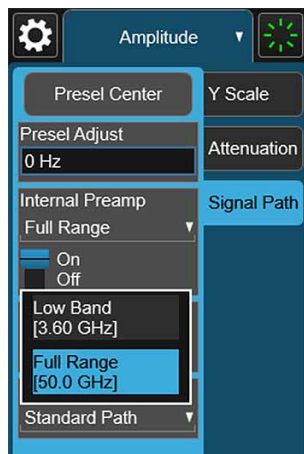
Input Overload Protection

Each of the three main signal paths through the A11 Band Switch (Low Band, High Band, Low Noise Amplifier) have diode limiters to protect the instrument from an input overload. If the instrument input is greatly overloaded these could be damaged and the assembly will need to be replaced.

High Band Preamplifier

The High Band Preamplifier is available for use with any of the instrument preamplifier options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N). It is turned on when the **Internal Preamp** is set to **Full Range** and then turned **On**, as seen in **Figure 9-18**. This preamplifier is in the high band signal path, so it only affects frequencies higher than 3.6 GHz. It has a nominal gain of 30 dB when the Low Noise Amplifier is turned off. When the Low Noise Amplifier is also turned on, it has a nominal gain of 20 dB.

Figure 9-18 High Band Preamplifier Control



Since the A11 Band Switch is bypassed when either the Low Noise or Full Bypass signal paths are enabled, it cannot be used when either of them is selected.

Low Noise Amplifier

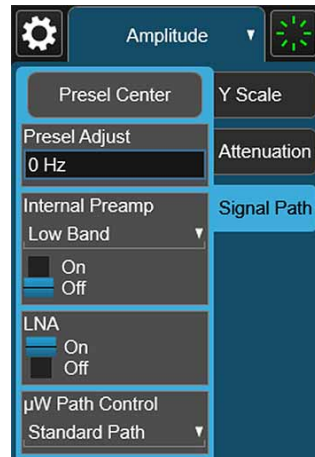
The Low Noise Amplifier is available for use with any of the instrument preamplifier options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N). It provides an additional amplifier at the front end of the instrument with a specified frequency range of 30 MHz to 50 GHz, and a nominal gain of 18 dB. However, if the instrument has either the P4L, P5L, or P5N preamplifier options, it cannot be used above 43.5 GHz when the Full Range preamplifier is turned on.

The low noise amplifier is always powered on for stability. When it is not switched into the instrument signal path by the SW2 LNA Switch its output is terminated within the switch itself.

RF Input Section
A11 Band Switch

Control of the Low Noise Amplifier (LNA) is found under the **Amplitude, Signal Path** menu, as seen in **Figure 9-19**.

Figure 9-19 Low Noise Amplifier Control



Functional Verification

Before proceeding to verify or troubleshoot the operation of the A11 Band Switch, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is a **Low Band Switch** in the list of hardware assemblies, as seen in **Figure 9-15**. If it is not listed, inspect the W5 ribbon cable and verify that it is properly connected between J4 of the assembly and J700 of the A15 Front End Controller board.

If the ribbon cable is not an issue, and the assembly is still not showing up in the Hardware Information screen, replace the A11 Band Switch.

If the assembly is showing up in the Hardware Information screen, use the following procedures to verify the proper operation of the assembly.

NOTE

Since the instrument communicates with the A11 Band Switch through the A15 Front End Controller, be sure that it is initializing properly and being recognized on the Hardware Information screen before replacing an A11 Band Switch for not initializing properly.

Low Band / High Band Signal Routing

This example uses certain frequencies for verifying the functionality of the two different signal paths. However, any frequency for the associated bands can be used and the results can be compared to the typical signal loss found in **Figure 9-16** for low band or **Figure 9-17** for high band.

1. Remove the instrument outer cover and chassis right side cover to gain access to the band switch connections. Refer to **Chapter 22, "Assembly Replacement Procedures."** if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the instrument center frequency to 2 GHz by pressing **Frequency, Center Frequency, 2 GHz**.
5. Set the span to 0 Hz by setting **Span to Zero Span**.
6. Connect a cable long enough to reach the A11 Band Switch RF ports to a signal generator.
7. Connect another cable long enough to reach the A11 Band Switch RF ports to a spectrum analyzer.
8. Connect the two loose cable ends together.
9. Tune the signal generator to 20 GHz with a power level of -10 dBm.
10. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.

11. Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
12. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
13. Note the signal generator power level setting at 20 GHz for future use.
14. Tune the signal generator to 2 GHz with a power level of -10 dBm.
15. Tune the spectrum analyzer to 2 GHz with a span of 10 MHz.
16. Use the marker peak search function of the spectrum analyzer to read the power level of the 2 GHz signal.
17. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
18. Note the signal generator power level setting at 2 GHz for future use.
19. Disconnect the two cables from each other.
20. Referring to **Figure 9-14**, remove the semi-rigid cables from the five RF ports of the A11 Band Switch.
21. Connect the cable coming from the signal generator output to P2 of the A11 Band Switch.

Low Band Signal Path

22. Connect the cable going to the spectrum analyzer input to P1 of the A11 Band Switch.
23. Use the marker peak search function of the spectrum analyzer to verify that the power level of the 2 GHz signal is approximately -10.6 dBm, ± 1 dB.

If the power level is correct, proceed to the next step.

If the power level is not correct, replace the A11 Band Switch.

Band Switch Isolation

24. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
25. Tune the instrument to high band by pressing **Frequency, Center Frequency, 20 GHz**.
26. Verify that the marker delta reading on the spectrum analyzer indicates that the 2 GHz signal has dropped by at least 20 dB.

If the signal level has dropped by at least 20 dB, proceed to the next step.

If the signal level has not dropped by at least 20 dB, replace the A11 Band Switch.
27. Turn off the marker delta function on the spectrum analyzer.

High Band Signal Path

28. Tune both the signal generator and the spectrum analyzer to 20 GHz.
29. Set the signal generator to the power level noted in [step 13](#).
30. Move the cable going to the spectrum analyzer to P3 of the A11 Band Switch.
31. Use the marker peak search function of the spectrum analyzer to verify the power level of the 20 GHz signal is approximately -14.5 dBm, ± 2 dB.

If the power level is correct, proceed to the next step.

If the power level is not correct, replace the A11 Band Switch.

NOTE

Extra care needs to be taken when making power level measurements in high band, as cable losses can add up quickly, and need to be accounted for before making a determination as to fault of an assembly. Also, when using a spectrum analyzer to make these measurements, be sure to use their preselector center or peak functions to maximize the measurement accuracy.

Band Switch Isolation

32. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
33. Tune the instrument to low band by pressing **Frequency, Center Frequency, 2 GHz**.
34. Verify that the marker delta reading on the spectrum analyzer indicates that the 20 GHz signal has dropped by at least 40 dB.

If the signal level has dropped by at least 40 dB, the A11 Band Switch has passed all the band switch verifications and appears to be working properly.

If the signal level has not dropped by at least 40 dB, replace the A11 Band Switch.
35. Turn off the marker delta function on the spectrum analyzer.

If the instrument has one of the preamplifier options continue to the next step. If it doesn't, this verification is complete.

High Band Preamplifier

36. Tune the instrument back to high band by pressing **Frequency, Center Frequency, 20 GHz**.
37. Reduce the signal generator power level to -30 dBm.
38. Use the peak search function of the spectrum analyzer to place a marker on the 20 GHz signal and activate the marker delta function.
39. Turn on the High Band Amplifier by pressing **Amplitude, Signal Path, Internal Preamp, Full Range, On**.

40. Verify that the marker delta reading on the spectrum analyzer is approximately +30 dB, ± 3 dB.

If the power level is correct, proceed to the next step.

If the power level is not correct, replace the A11 Band Switch.

41. Turn the low noise amplifier on by pressing **LNA On**.

42. Verify that the marker delta reading on the spectrum analyzer is approximately +20 dB, ± 3 dB.

If the power level is correct, proceed to the next step.

If the power level is not correct, replace the A11 Band Switch.

43. Turn off the marker delta function on the spectrum analyzer.

Low Noise Amplifier

44. Move the cable coming from the signal generator to P5 of the A11 Band Switch.

45. Move the cable going to the spectrum analyzer to P4 of the A11 Band Switch.

46. Set the signal generator power level to 20 dB lower than the level noted in **step 13**.

Example: If the power level noted in **step 13** is -4.5 dBm, set the power level to -24.5 dBm.

47. Use the marker peak search function of the spectrum analyzer to verify the power level of the 20 GHz signal is -14 dBm or higher. This would equate to a gain of at least 16 dB.

If the power level is correct, proceed to the next step.

If the power level is not correct, replace the A11 Band Switch.

48. Tune both the signal generator and the spectrum analyzer to 2 GHz.

49. Set the signal generator power level to 20 dB lower than the level noted in **step 18**.

50. Use the marker peak search function of the spectrum analyzer to verify the power level of the 2 GHz signal is -14 dBm or higher. This would equate to a gain of at least 16 dB.

If the power level is correct, the A11 Band Switch is functioning properly.

If the power level is not correct, replace the A11 Band Switch.

A12 Yig Tuned Filter

Overview

The A12 Yig Tuned Filter (YTF) is used for input frequencies higher than 3.6 GHz. This is a YIG tuned bandpass filter whose main purpose is to eliminate unwanted mixing products. When it is properly aligned, the tunable bandpass filter will track the instrument’s current input frequency. It has a 3 dB bandwidth greater than 40 MHz and an insertion loss of approximately 6.5 dB.

Control for this assembly comes from the A15 Front End Controller. The connections to and from this assembly are listed in [Table 9-14](#), as seen in [Figure 9-20](#) and [Figure 9-21](#).

There are two different A12 Yig Tuned Filters used, depending on the frequency range of the instrument. Instruments with a frequency range of 8.4, 13.6 or 26.5 GHz use one, which will be referred to as “μWave”, while instruments with a frequency range of 44, 50, or 55 GHz use another, which will be referred to as “Millimeter Wave”.

Table 9-14 A12 Yig Tuned Filter Connections

Port	Description	To/From	Cable
J1	Bias & Control	From A15 FEC J300	W23
Input	Input	From SW4 MPB Switch P4	W40
Output	Output	To SW4 MPB Switch P3	W41

Figure 9-20

A12 Yig Tuned Filter - μWave

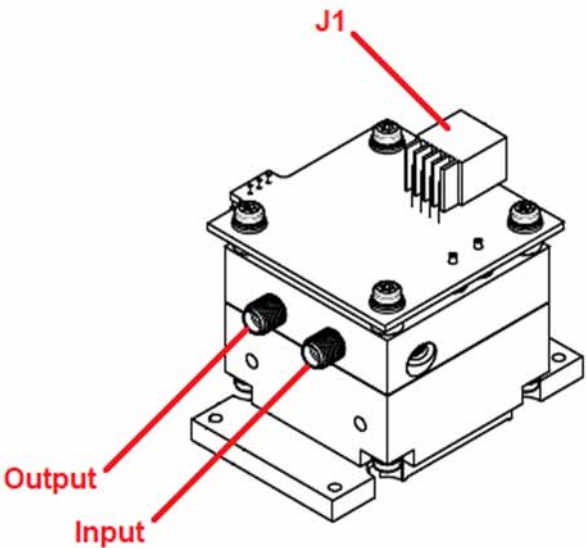
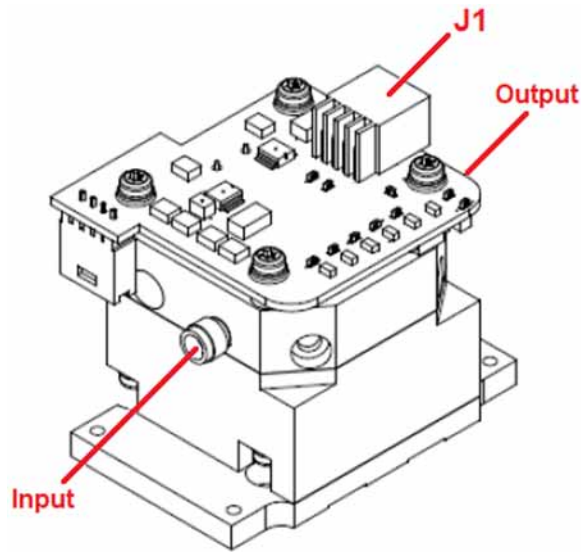


Figure 9-21 A12 Yig Tuned Filter - Millimeter Wave



The A12 Yig Tuned Filter will identify itself on the instrument Hardware Information screen as the **Yig Tuned Filter**, as seen in **Figure 9-22**.

Figure 9-22 Hardware Information Screen – A12 Yig Tuned Filter

System Settings

System

Hardware Information

↶

↷

?

✕

System

Keysight PXA

Product Number

Serial Number

S/W Release Name

Instrument S/W Revision

Revision Date

Keysight PXA Signal Analyzer

N9032B

MY61010001

2023 Update 1.0

A.34.03

11/17/2022 9:38:32 AM

I/O Config

Assembly Name

Analog IF

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

YIG Tuned Filter

Digital IF

50877382

13202309428

007

0

A

11

Preload / Unload Modes

Front End Controller

IF Mux-10GHz

Low Band Switch

N902060295

N904160163

N904060100

79204100620

30203900015

78200251477

009

004

000

0

1

2

A

A

B

131

264

135

Power On

LO DDS Synthesizer

LO DDS Reference

Wideband Calibrator

N902060175

M930560028

N904060151

79204000654

79204100169

30202000005

011

007

004

3

0

2

A

A

A

91

92

260

Restore Defaults

Reference Plus Main

Reference Plus Daughter

Front End

N902060185

N902060186

N904160039

79204701317

79204501221

78203535226

008

010

000

3

1

1

A

A

A

93

94

270

Licensing

Gen 4 DIF Controller

Switched IF Filter

N904160048

N902060220

30203600005

59200251433

003

005

3

0

A

B

208

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

Service

SCPI Recorder

Alignments

The A12 Yig Tuned Filter requires centering for maximum amplitude accuracy. There are three different levels of alignment that can be used to achieve this. They are:

1. A Preselector Two Point Tuning Algorithm routine that is performed in the instrument auto alignments that will help to keep it roughly centered across its frequency range. This can also be run manually by pressing **System, Alignments, Align Now, Align Now Preselector**.
2. A manually initiated routine that should be used to center the preselector for maximum amplitude accuracy at a given frequency. This is initiated by pressing **Amplitude, Signal Path, Presel Center**.
3. A full alignment across its frequency range can be run by pressing **System, Alignments, Advanced, Characterize Preselector**. This alignment will take approximately 10 minutes to run. See the **Characterize Preselector** section in **Chapter 23, "Post-Repair Procedures,"** for more information on this.

Functional Verification

There are a number of different aspects of the A12 Yig Tuned Filter functionality that can be verified with the procedures in this section. They are:

1. Assembly Initialization
2. Status LEDs
3. Supply Voltage
4. Signal Path Verification
 - a. Passband Insertion Loss
 - b. Passband Filter Shape
 - c. Passband Centering

For the following procedures, remove the instrument outer cover and chassis right side cover to gain access to the A12 Yig Tuned Filter. Refer to **Chapter 22, "Assembly Replacement Procedures."** if information on how to remove these is needed.

Assembly Initialization

Before the A12 Yig Tuned Filter will function properly it needs to initialize itself when the instrument is turned on and be recognized by the instrument software. To verify that this has happened look at the instrument Hardware Information screen. To view this information press **System, Show Hardware**. The A12 Yig Tuned Filter should identify itself on this list as **YIG Tuned Filter**, as seen in **Figure 9-22**. If this assembly does not identify itself the cause for this will need to be determined before any other troubleshooting is performed. The most probable causes for this type of a problem would be that the A12 Yig Tuned Filter itself is defective. However, be sure to verify the supply voltage to the assembly before replacing it.

NOTE

Since the instrument communicates with the A12 Yig Tuned Filter through the A15 Front End Controller, be sure that it is initializing properly and being recognized on the Hardware Information screen before replacing an A12 Yig Tuned Filter for not initializing properly.

Status LEDs (Millimeter Wave Only)

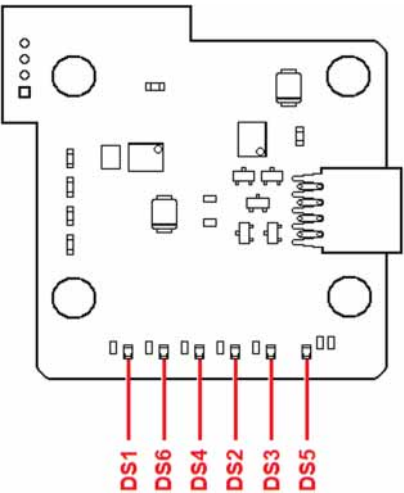
There is a series of status LEDs on the top of the A12 Yig Tuned Filter. These can be used to verify that the assembly has powered on correctly and what state it is in. Information on these status LEDs as well as what their state should be when an instrument is functioning properly is listed in [Table 9-15](#), and their location on the A12 Yig Tuned Filter is seen in [Figure 9-23](#).

Table 9-15 A12 Yig Tuned Filter Status LEDs

LED	Description	Normal Operation	During Boot Up
DS1	+3.3 V Regulated	On	On
DS2	EEROM Select	Off	On
DS3	Heater Control Select	On	Off
DS4	Temp Sensor Select	Off	Off
DS5	Heater On	Blinking	Off
DS6	Thermistor Select	Off	Off

Figure 9-23

A12 Yig Tuned Filter Status LED Locations



When the instrument is first turned on the only LEDs that should be on are DS1 and DS2. DS1 should be on whenever the instrument is turned on, as this indicates that the voltage regulator on the assembly is working. DS2 will remain on until the assembly has been initialized, which occurs during the time the instrument application initializes the hardware. After that, DS2 will turn off and DS3 will turn on. When DS3 turns on, DS5 will start to blink. It will blink whenever the heater is turned on, which will be more frequent for lower frequencies – when the current through the filter’s main coil is lower. It will continue blinking even when the instrument is tuned below 3.6 GHz, where the filter is not being used, so that it always remains warm.

Both DS4 and DS6 will turn on during the time that the instrument application initializes the hardware, but this will happen so fast that it may only be possible to see them change by measuring the voltage across them with an oscilloscope. They will also be turned on periodically as the instrument is running, but for only a very brief period – tens of milliseconds.

Supply Voltage Verification

The A12 Yig Tuned Filter can also have a problem initializing if the power supply voltage to it is not correct or if the voltage regulator on the assembly is faulty. To verify these voltages:

1. View the status of the LED DS1 on the A12 Yig Tuned Filter, as shown in [Figure 9-24](#) or [Figure 9-25](#).

If DS1 is not on, proceed to the next step.

If DS1 is on, the +30 volt DC supply to the assembly as well as the +3.3 volt regulator are both on.

Figure 9-24 A12 Yig Tuned Filter DS1 Location - μ Wave

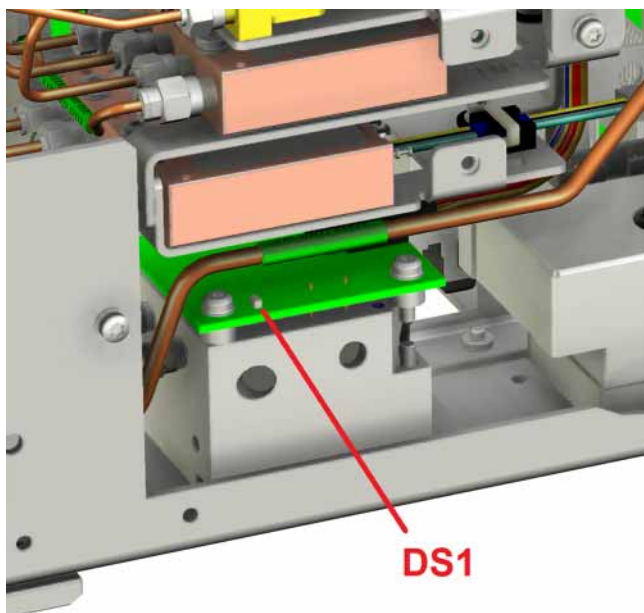
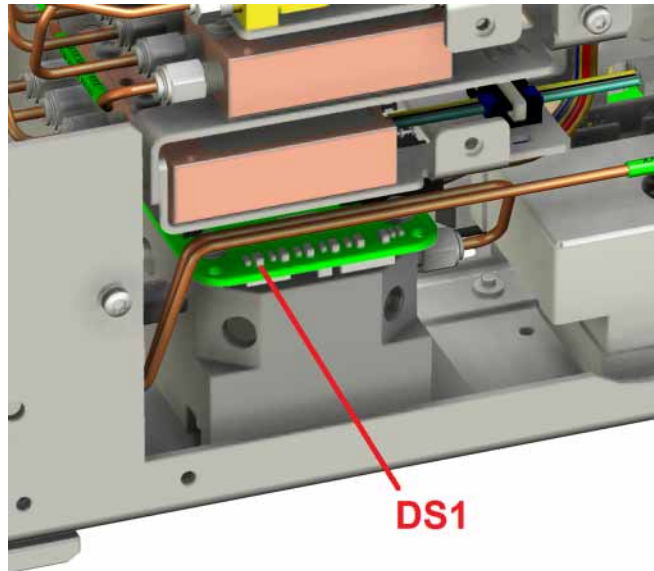


Figure 9-25 A12 Yig Tuned Filter DS1 Location - Millimeter Wave

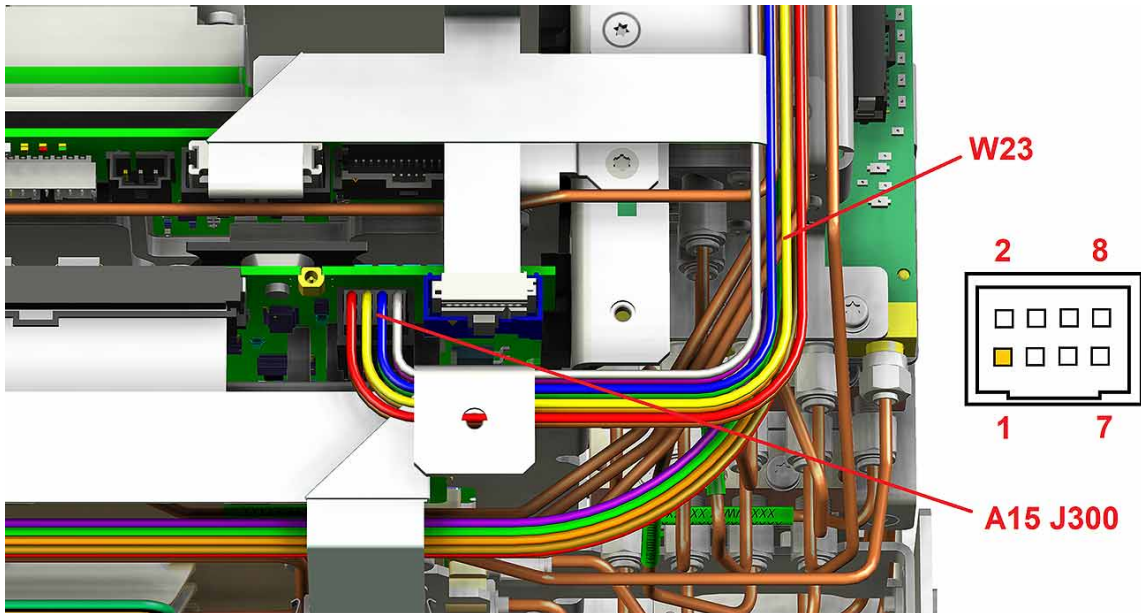


2. Using a voltmeter, measure the +30 volt DC supply to the A12 Yig Tuned Filter by measuring from Pin #1 on J300 of the A15 Front End Controller to chassis ground, as shown in [Figure 9-26](#).

If the voltage is between +28 and +32 volts yet DS1 is not on, replace the A12 Yig Tuned Filter.

If the voltage is less than +28 volts the A12 Yig Tuned Filter is most likely not the source of the failure, the cause for the low voltage level will need to be determined, which will most likely be caused by either the A6 Power Supply assembly or the A15 Front End Controller.

Figure 9-26 A12 Yig Tuned Filter +30 Volt Power Supply - A15 J300



Signal Path Verification

There are three different aspects of the A12 Yig Tuned Filter performance that need to be considered and verified. They are:

1. Passband Insertion Loss
2. Passband Filter Shape
3. Passband Centering

A failure of the A12 Yig Tuned Filter, causing excessive signal path loss, could be caused by any one of the three aspects mentioned. While a failure due to either excessive passband insertion loss or a distorted passband filter shape may require the replacement of the assembly, a problem with the passband centering will most often be solved by running the Characterize Preselector routine. See the “**Characterize Preselector**” section in **Chapter 23, “Post-Repair Procedures,”** for more information on this.

The following procedure will verify the three performance aspects listed above. It will do so using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Return the instrument to a known state by pressing **Mode Preset**.
2. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
3. Tune the instrument center frequency to 20 GHz by pressing **Frequency, Center Frequency, 20 GHz**.
4. Set the span to 0 Hz by setting **Span to Zero Span**.
5. Connect a signal generator to the instrument front panel RF Input.
6. Tune the signal generator to 20 GHz with a power level of -10 dBm.
7. Center the A12 Yig Tuned Filter by pressing **Amplitude, Signal Path, Presel Center**.

NOTE

After running the Presel Center routine, the amount of centering adjustment the instrument needed to make will be displayed as the **Presel Adjust** value. This will give a good indication of how accurate the filter characterization is.

-
8. Remove the cable from the signal generator from the front panel RF Input.
 9. Referring to **Figure 9-20** or **Figure 9-21**, remove W40 from the A12 Yig Tuned Filter input and W41 from the output.
 10. Connect a cable long enough to reach the A12 Yig Tuned Filter input to a signal generator.
 11. Connect another cable long enough to reach the A12 Yig Tuned Filter output to a spectrum analyzer.
 12. Connect the two loose cable ends together.

- 13.** Tune the signal generator to 20 GHz with a power level of -10 dBm.
- 14.** Tune the spectrum analyzer to 20 GHz with a span of 100 MHz.
- 15.** Set the reference level of the spectrum analyzer to -10 dBm.
- 16.** Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
- 17.** Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
- 18.** Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
- 19.** Disconnect the two cables from each other.
- 20.** Connect the cable coming from the signal generator to the A12 Yig Tuned Filter input.
- 21.** Connect the cable going to the spectrum analyzer to the A12 Yig Tuned Filter output.

Passband Insertion Loss

The insertion loss of the A12 Yig Tuned Filter at this frequency, with the current filter tuning, can now be read directly with the marker delta level displayed on the spectrum analyzer display.

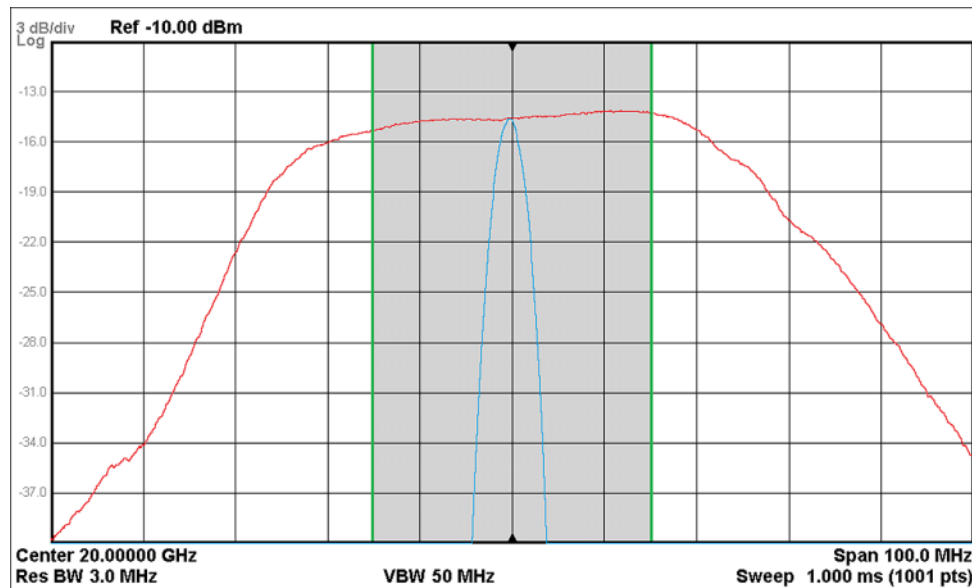
The passband insertion loss of the A12 Yig Tuned Filter itself should not be greater than 10 dB, when properly tuned.

If the passband insertion loss is greater than expected, the cause for this will need to be determined. It could be due to a greater loss than normal, distorted passband filter shape, or incorrect passband centering.

Passband Filter Shape

- 22.** Set the amplitude scale per division setting on the spectrum analyzer to 3 dB.
- 23.** Turn on trace 2 of the spectrum analyzer and set it to use the max hold function.
- 24.** Slowly vary the frequency of the signal generator between 19.95 GHz and 20.05 GHz (± 50 MHz) until the spectrum analyzer display looks like that of **Figure 9-27**.

Figure 9-27 A12 Yig Tuned Filter Passband Filter Shape



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 in [Figure 9-27](#).

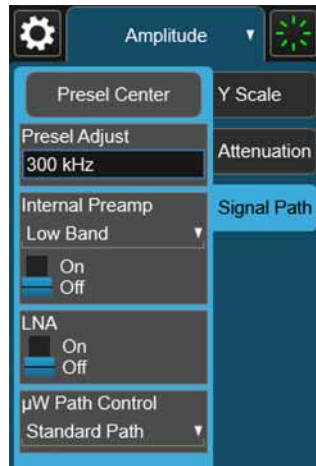
If the peak-to-peak variation within the ± 15 MHz area is greater than expected, but the filter passband is not centered in the display, causing the variation to be greater than expected, the passband centering will need to be adjusted by running the [Characterize Preselector](#) routine. See [Chapter 23, "Post-Repair Procedures."](#) for more information on this.

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.

Passband Centering

If the passband centering is not aligned properly, it can be manually tuned ± 500 MHz, which will help to verify that an adjustment of the filter centering will correct the alignment. This can be done by pressing **Amplitude, Signal Path, Presel Adjust** and entering either a positive or negative frequency to adjust the passband centering by, as seen in [Figure 9-28](#).

Figure 9-28 A12 Yig Tuned Filter Centering



Once an adjustment of this value is made **step 24** can be repeated to display the change in the passband centering. However, any changes made with this manual adjustment will not persist; it will go back to 0 Hz once the instrument is preset.

The passband centering can be adjusted by running the Characterize Preselector routine that is found on the **System, Alignments, Advanced** menu. This routine will take approximately 10 minutes to run. This routine needs to be run whenever the A12 Yig Tuned Filter or A15 Front End Controller is replaced. It should also be run if the alignment of the passband centering needs to be adjusted.

A25 Wideband Calibrator

Overview

The A25 Wideband Calibrator is used by the instrument when it runs many of its internal alignments. It has the ability to generate both continuous wave signals as well as comb signals. It can generate frequencies from 10 MHz up to the upper frequency limit of the instrument. The output power is a fixed level. For CW signals the power level across the band is approximately -6 dBm. However, there is a 6 dB attenuator (AT1) attached to its output that lowers it to approximately -12 dBm.

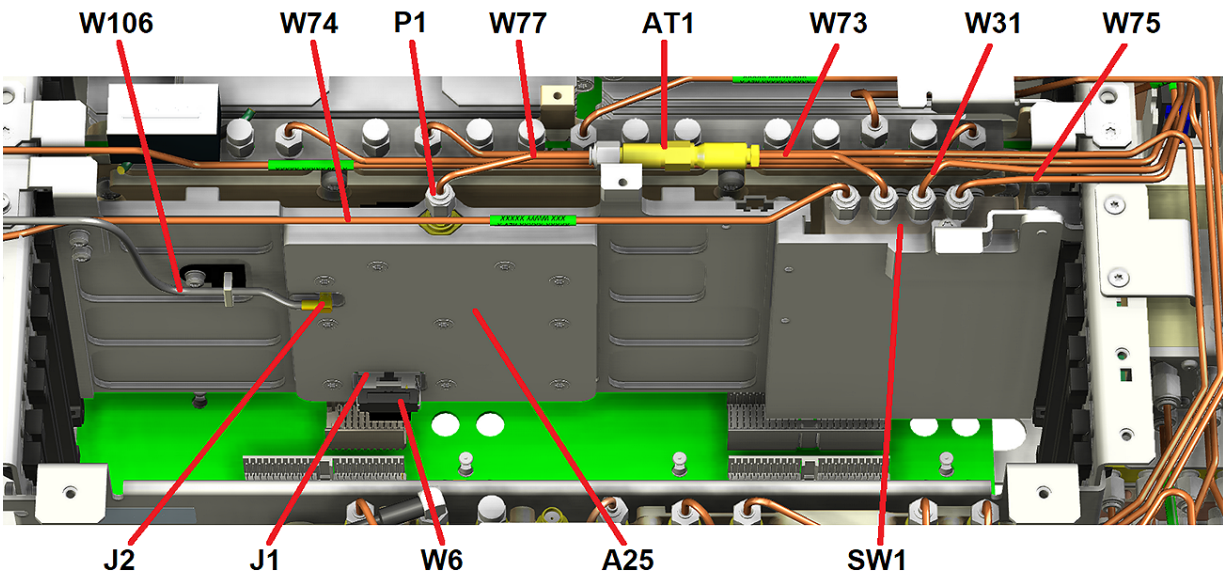
The output of the A25 Wideband Calibrator can also be routed to the front panel Cal Out port, which has an additional 3 dB attenuator (AT2) connected to it.

Control for the A25 Wideband Calibrator comes from the A23 IF Mux P2. It also requires a 100 MHz reference signal from the A16 Reference J707 at a power level of at least +10 dBm. The connections to and from this assembly are listed in [Table 9-16](#), as seen in [Figure 9-29](#).

Table 9-16 A25 Wideband Calibrator Connections

Port	Description	To/From	Cable
J1	Bias & Control	From A23 IF Mux P2	W6
J2	Reference Input	From A16 Reference J707	W106
P1	Output	To AT1 6 dB Attenuator Input	W77

Figure 9-29 A25 Wideband Calibrator Connections



The A25 Wideband Calibrator will identify itself on the instrument Hardware Information screen as the **Wideband Calibrator**, as seen in [Figure 9-30](#).

Figure 9-30 Hardware Information Screen - A25 Wideband Calibrator

System Settings

< System

Hardware Information

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

I/O Config

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Power On

Digital IF

N902060016

79204100250

035

3

A

34

Front End Controller

N902060295

79204100620

009

0

A

131

Restore Defaults

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Alignments

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Licensing

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Front End

N904160039

78203535226

000

1

A

270

Security

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

Service

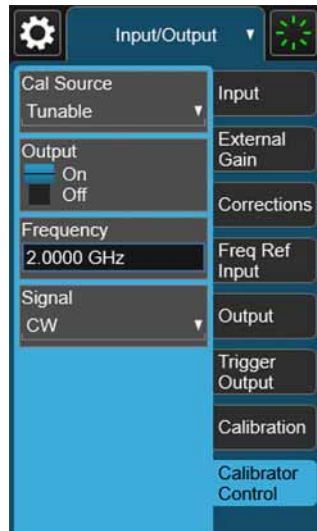
SCPI Recorder

The A25 Wideband Calibrator can be used to quickly input a signal of any frequency into the instrument to identify a signal path problem. Information on using this for troubleshooting can be found in [Chapter 5, “First-Look Troubleshooting.”](#) However, the procedures in this chapter and many others do not typically call for its use, as the power level is not adjustable and using an external signal generator further isolates any signal path issue from the instrument itself.

Control

Control of the A25 Wideband Calibrator comes from the A23 IF Mux P2. It can be manually controlled under the **Input/Output, Calibrator Control** menu, as seen in [Figure 9-31](#).

Figure 9-31 A25 Wideband Calibrator Control



The following is a description of what each of the menu selections will do to the state of the A25 Wideband Calibrator:

Cal Source

This will allow the selection of None, 50 MHz, 4.8 GHz, Tunable, or Calibration Out for the Cal Source.

The 50 MHz and 4.8 GHz selections will route those signals from the A16 Reference to the A9 Attenuator calibrator input, which will have no effect on the A25 Wideband Calibrator.

The Tunable selection will route the A25 Wideband Calibrator output to the A9 Attenuator calibrator input.

The Calibration Out selection will route the A25 Wideband Calibrator output to the front panel Cal Out port.

Output

This selection is only available when the Cal Source is set to either Tunable or Calibration Out, as it only affects the output state of the A25 Wideband Calibrator.

This selection will turn the A25 Wideband Calibrator output on or off.

Frequency

This selection is only available when the Cal Source is set to either Tunable or Calibration Out, as it only affects the output frequency of the A25 Wideband Calibrator.

This will allow the output frequency of the A25 Wideband Calibrator to be set to any frequency from 10 MHz to the upper frequency limit of the instrument.

Signal

This selection is only available when the Cal Source is set to either Tunable or Calibration Out, as it only affects the output of the A25 Wideband Calibrator.

This will allow the selection of either CW or Comb for the output signal type of the A25 Wideband Calibrator.

Comb Spacing

This selection is only available when the Signal type is set to Comb.

This will allow the comb spacing to be set to any frequency from 2.45 kHz to 2.66 GHz.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A25 Wideband Calibrator, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is a **Wideband Calibrator** in the list of hardware assemblies, as seen in [Figure 9-30](#). If it is not listed, inspect the W6 ribbon cable and verify that it is properly connected between J1 of the assembly and P2 of the A23 IF Mux board (See [Figure 9-32](#) for reference).

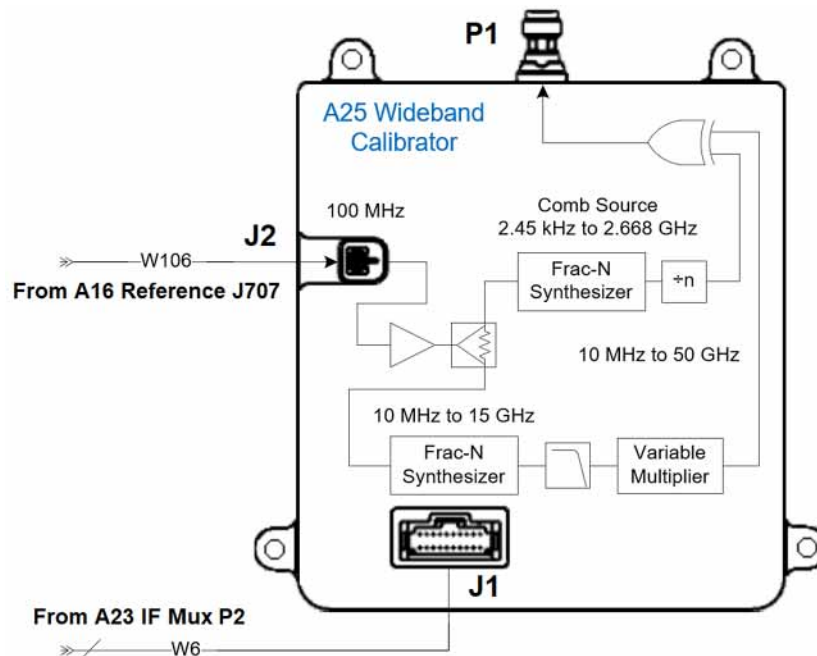
If the ribbon cable is not an issue, and the assembly is still not showing up in the Hardware Information screen, replace the A25 Wideband Calibrator.

NOTE

Since the instrument communicates with the A25 Wideband Calibrator through the A23 IF Mux, be sure that it is initializing properly and being recognized on the Hardware Information Screen before replacing an A25 Wideband Calibrator for not initializing properly.

Figure 9-32

A25 Wideband Calibrator Block Diagram



There are two parameters of the A25 Wideband Calibrator that will be verified in the following procedure:

- CW Power Level
- Comb Spacing

The following procedure will verify the functionality of the A25 Wideband Calibrator using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Remove the instrument outer cover, and top brace, to gain access to the wideband calibrator connections. Refer to [Chapter 22, “Assembly Replacement Procedures.”](#) if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Full Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Referring to [Figure 9-29](#), remove W77 from the A25 Wideband Calibrator output, P1.
5. Connect a spectrum analyzer to the P1 output of the A25 Wideband Calibrator.
6. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.
7. Select the A25 Wideband Calibrator by pressing **Input/Output, Calibrator Control, Cal Source, Tunable**.
8. Verify that the **Signal** selected is **CW**.
9. Tune the A25 Wideband Calibrator to 20 GHz by pressing **Frequency, 20 GHz**.
10. Turn the A25 Wideband Calibrator on by pressing **Output On**.

NOTE

If there is no output signal from the A25 Wideband Calibrator, or the signal is off frequency and/or unstable, verify that the power level of the 100 MHz reference signal at J2 from the A16 Reference J707 is at a power level of +10 dBm or higher.

-
11. Accounting for the loss of the cables used, verify that the power level of the 20 GHz signal on the spectrum analyzer display is -10 dBm or higher.

NOTE

Extra care needs to be taken when making power level measurements at higher frequencies, as cable losses can add up quickly, and need to be accounted for before making a determination as to fault of an assembly. Also, when using a spectrum analyzer to make these measurements, be sure to use their preselector center or peak functions to maximize the measurement accuracy. If the power still appears to be a little low a power meter could be used to get a more accurate measurement.

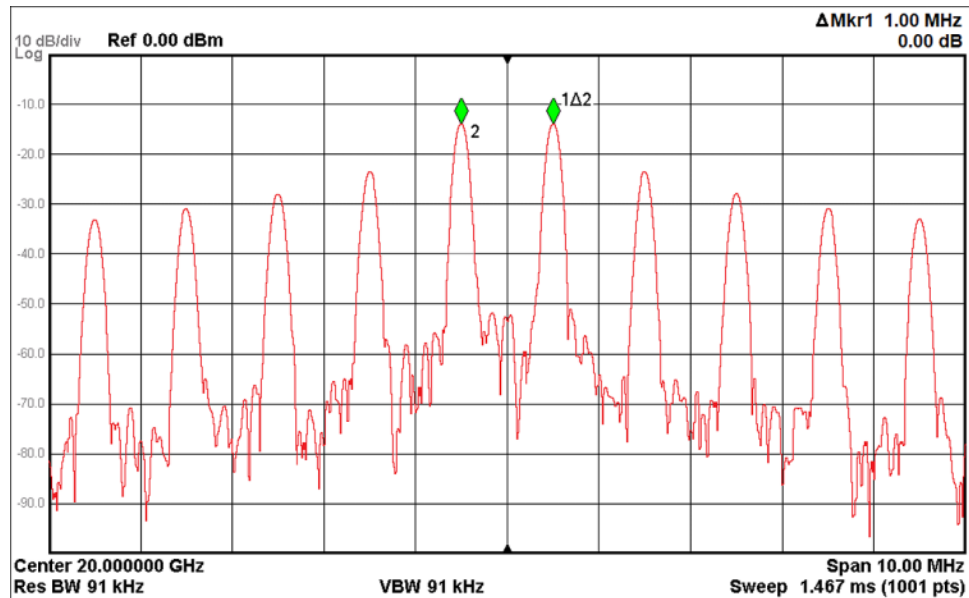
If the frequency and power level are as expected, proceed to the next step.

If the frequency or power level is not as expected, verify that the W6 control ribbon cable is not damaged and properly connected on both ends. If there is nothing wrong with W6, replace the A25 Wideband Calibrator.

12. Change the Signal type to comb by pressing **Signal, Comb**.
13. Set the comb spacing to 1 MHz by pressing **Comb Spacing, 1 MHz**.

14. Using the delta marker functionality on the spectrum analyzer, verify that the comb spacing of the output is 1 MHz, and resembles the signals seen in [Figure 9-33](#).

Figure 9-33 A25 Wideband Calibrator Comb Output



If the comb output is as expected, the A25 Wideband Calibrator is working properly.

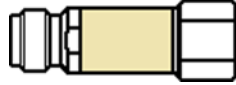
If the comb output is not as expected, verify that the W6 control ribbon cable is not damaged and properly connected on both ends. If there is nothing wrong with W6, replace the A25 Wideband Calibrator.

AT1 / AT2 Coaxial Fixed Attenuator

Overview

Both AT1 and AT2 are fixed coaxial attenuators, as seen in [Figure 9-34](#). AT1 is a 6 dB attenuator while AT2 is a 3 dB attenuator.

Figure 9-34 AT1/AT2 Fixed Coaxial Attenuators



AT1 is connected between the output of the A25 Wideband Calibrator and the input of the SW1 Calibrator Switch to adjust the output power level. AT2 is connected to the inside of the front panel Cal Out port to provide a level of protection to this output. These locations can be seen in [Figure 9-1](#).

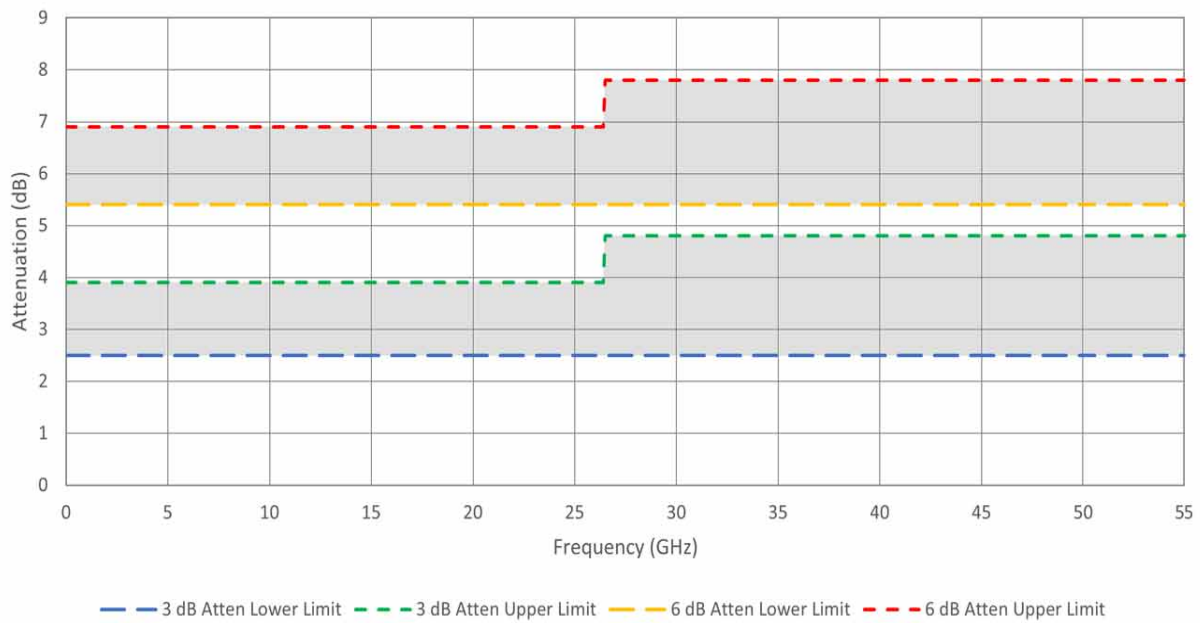
NOTE

Early instruments with a frequency range of 26.5 GHz and less did not have AT2 at all.

Functional Verification

If there is any question as to the performance of either AT1 or AT2 they can easily be removed from the instrument and tested independently. The performance limits for each are shown in **Figure 9-35**.

Figure 9-35 AT1 / AT2 Attenuation Limits



SW1 Calibrator Switch

Overview

The SW1 Calibrator Switch is made up of two single pole double throw ganged switches. It is used to switch one of the many internal calibrator signals to the A9 Attenuator calibrator input. It can also switch the A25 Wideband Calibrator output to the front panel Cal Out port.

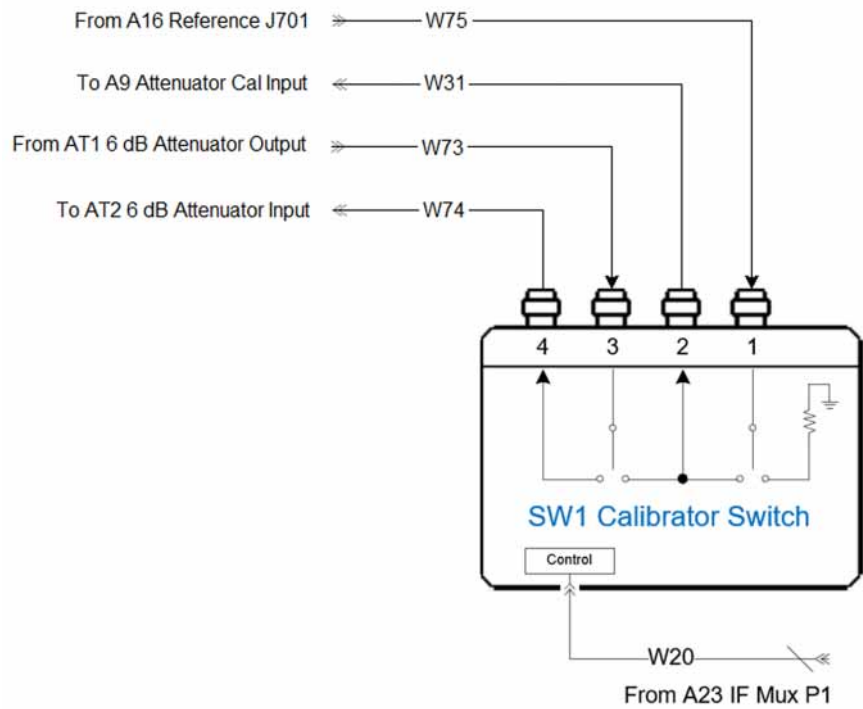
Control for the SW1 Calibrator Switch comes from the A23 IF Mux P1. The connections to and from this switch are listed in [Table 9-17](#), as seen in [Figure 9-36](#).

Table 9-17 SW1 Calibrator Switch Connections

Port	Description	To/From	Cable
Control	Bias & Control	From A23 IF Mux P1	W20
1	50 MHz, 4.8 GHz, Step Cal Input	From A16 Reference J701	W75
2	Switch Output	To A9 Attenuator Cal Input	W31
3	A25 Wideband Calibrator Input	From AT1 6 dB Atten Output	W73
4	Front Panel Cal Out	To AT2 6 dB Atten Input	W74

Figure 9-36

SW1 Calibrator Switch Block Diagram



Control

The SW1 Calibrator Switch cannot be directly controlled by itself but selecting one of the internal calibrator signals will cause the switch to change states accordingly. Control for this can be found under the **Input/Output, Calibrator Control** menu, as seen in [Figure 9-37](#).

Figure 9-37

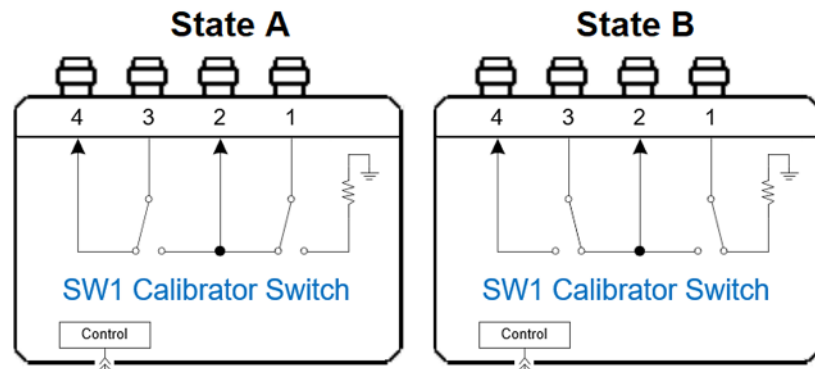
SW1 Calibrator Switch Control



Since the two switches are ganged, there are only two states for the switch to be in, as seen in [Figure 9-38](#).

Figure 9-38

SW1 Calibrator Switch States



The following is a description of what each of the menu selections will do to the state of the SW1 Calibrator Switch:

None

When None is selected the switch will be in **State A**, as seen in [Figure 9-38](#).

50 MHz or 4.8 GHz

This will switch either the 50 MHz or 4.8 GHz calibration signal coming from the A16 Reference at port 1 to the port 2 output, routing the signal to the A9 Attenuator calibrator input port. Selecting one of these calibrator signals will also enable that output from the A16 Reference. For this setting the internal switch configuration will be **State A**, as seen in [Figure 9-38](#).

Tunable

This will switch the A25 Wideband Calibrator input at port 3 to the port 2 output, routing the signal to the A9 Attenuator calibrator input port. For this setting the internal switch configuration will be **State B**, as seen in [Figure 9-38](#).

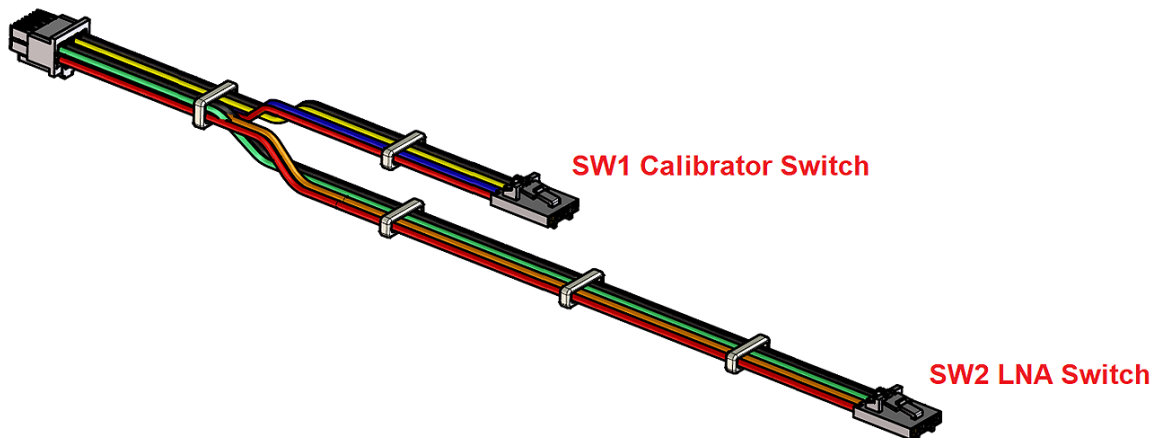
Calibration Out

This will switch the A25 Wideband Calibrator input at port 3 to the port 4 output, routing the signal to the front panel Cal Out port. For this setting the internal switch configuration will be **State A**, as seen in [Figure 9-38](#).

Of course, when the instrument runs its internal auto alignments it will change the positions of these switches as needed.

The control wire harness W20 that comes from the A23 IF Mux P1 is used to control both SW1 and SW2, as seen in [Figure 9-39](#). The four pin connector with the blue and yellow wires in the center goes to SW1 and the connector with the green and orange wires in the center goes to SW2. These should match up with the wire harnesses on the switches themselves.

Figure 9-39 W20 Wire Harness

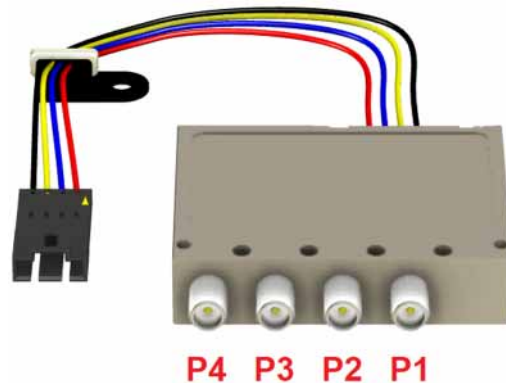


Functional Verification

The following procedure will verify the proper switching and insertion loss of the SW1 Calibrator Switch. It will do so using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Remove the instrument outer cover, and top brace, to gain access to the switch connections. Refer to **Chapter 22, "Assembly Replacement Procedures."** if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn 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. Remove the four semi-rigid cables from the four SW1 Calibrator Switch RF ports.
6. Connect a cable long enough to reach the RF ports of the SW1 Calibrator Switch to a signal generator.
7. Connect another cable long enough to reach the RF ports of the SW1 Calibrator Switch to a spectrum analyzer.
8. Connect the two loose cable ends together.
9. Tune the signal generator to 20 GHz with a power level of -10 dBm.
10. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.
11. Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
12. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
13. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
14. Disconnect the two cables from each other.
15. Connect the cable coming from the signal generator to the SW1 Calibrator Switch P3, as seen in **Figure 9-40**.

Figure 9-40 SW1 Calibrator Switch Port Locations



16. Connect the cable going to the spectrum analyzer to the SW1 Calibrator Switch P2.
17. Switch the state of the SW1 Calibrator switch by pressing **Input/Output, Calibrator Control, Cal Source, Tunable**.
18. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW1 Calibrator Switch.
19. Move the cable going to the spectrum analyzer from P2 to P4 of the SW1 Calibrator Switch.
20. Switch the state of the SW1 Calibrator switch by pressing **Cal Source, Calibration Out**.
21. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW1 Calibrator Switch.
22. Move the cable coming to the signal generator from P3 to P1 of the SW1 Calibrator Switch.
23. Move the cable going to the spectrum analyzer from P4 to P2 of the SW1 Calibrator Switch.
24. Switch the state of the SW1 Calibrator switch by pressing **Cal Source, 50 MHz**.
25. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, the SW1 Calibrator Switch is working as expected.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW1 Calibrator Switch.

SW2 Low Noise Amplifier Switch

Overview

The SW2 LNA Switch is made up of two single pole double throw ganged switches. It is used to switch the Low Noise Amplifier signal path in and out. Changing of the SW2 LNA Switch state does not turn the low noise amplifier on the A11 Band Switch on or off, it is always powered on for stability.

Even though one of the preamplifier options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N) is required for the Low Noise Amplifier to be enabled, the SW2 LNA Switch and the associated cabling for it exists in all instruments.

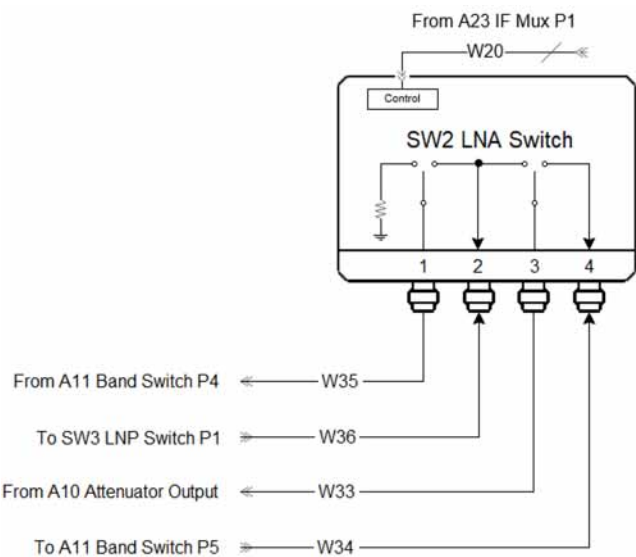
Control for the SW2 LNA Switch comes from the A23 IF Mux P1. The connections to and from this switch are listed in [Table 9-18](#), as seen in [Figure 9-41](#).

Table 9-18 SW2 LNA Switch Connections

Port	Description	To/From	Cable
Control	Bias & Control	From A23 IF Mux P1	W20
1	Low Noise Amplifier Output	From A11 Band Switch P4	W35
2	Switch Output	To SW3 LNP Switch P1	W36
3	Switch Input	From A10 Attenuator Output	W33
4	Low Noise Amplifier Input	To A11 Band Switch P5	W34

Figure 9-41

SW2 LNA Switch Block Diagram

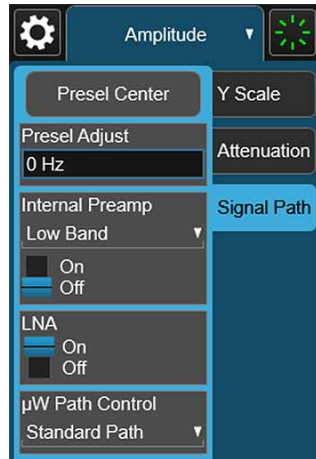


Control

Front Panel control for this switch is found on the **Amplitude, Signal Path** menu as **LNA On/Off**, as seen in [Figure 9-42](#). However, it is only available for instruments that have one of the preamplifier options installed. If either preamplifier option P4L, P5L, or P5N is installed, it cannot be selected above 43.5 GHz when the Full Range preamplifier is turned on.

Figure 9-42

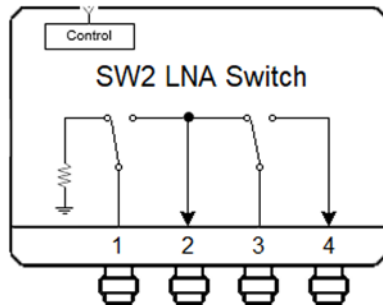
SW2 Low Noise Amplifier Control



When the LNA is turned off, the input signal from the A10 Attenuator output will bypass the low noise amplifier signal path and be routed directly to the SW3 Low Noise Path Switch P1 input. For this setting the internal switch configuration will be as seen in [Figure 9-43](#).

Figure 9-43

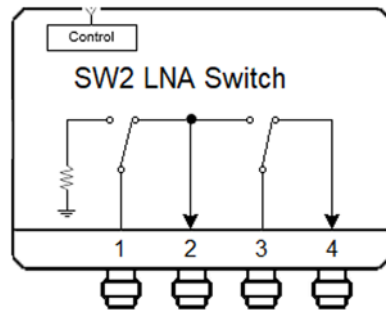
SW2 LNA Switch - LNA Off



When the LNA is turned on, the input signal from the A10 Attenuator output will be routed to low noise amplifier on the A11 Band Switch, then sent to the SW3 Low Noise Path Switch P1 input. For this setting the internal switch configuration will be as seen in [Figure 9-44](#).

Figure 9-44

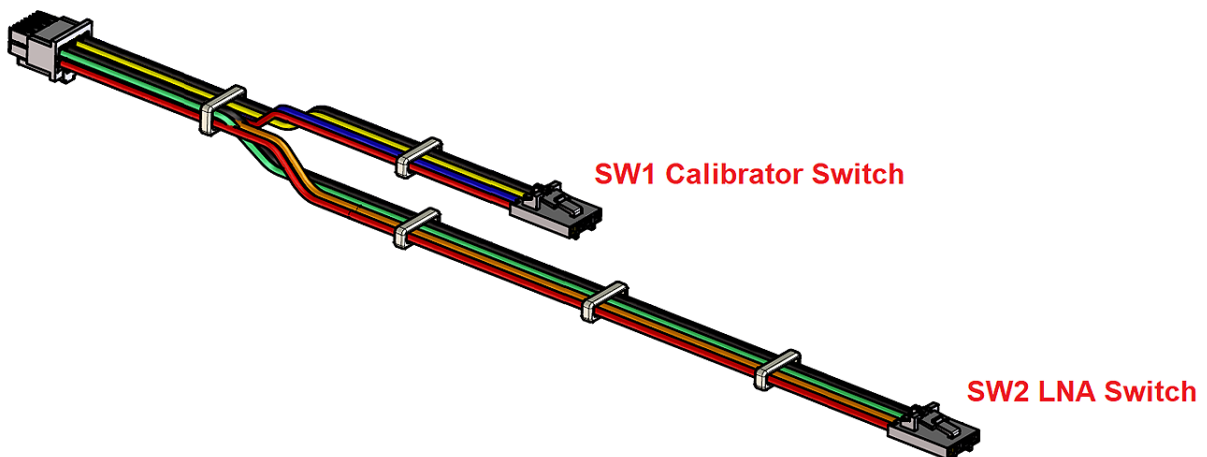
SW2 LNA Switch - LNA On



The control wire harness W20 that comes from the A23 IF Mux P1 is used to control both SW1 and SW2, as seen in [Figure 9-45](#). The four pin connector with the blue and yellow wires in the center goes to SW1 and the connector with the green and orange wires in the center goes to SW2. These should match up with the wire harnesses on the switches themselves.

Figure 9-45

W20 Wire Harness

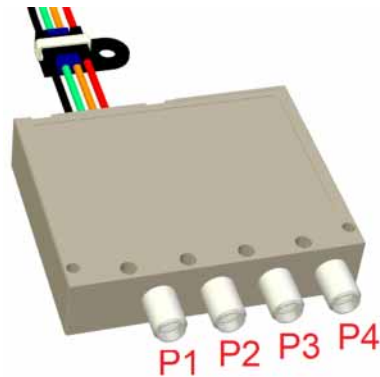


Functional Verification

The following procedure will verify the proper switching and insertion loss of the SW2 LNA Switch, whether a preamplifier option is installed or not. It will do so using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Remove the instrument outer cover, front panel, and chassis right side cover to gain access to the switch connections. Refer to [Chapter 22, "Assembly Replacement Procedures."](#) if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn 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. Remove the four semi-rigid cables from the four SW2 LNA Switch RF ports.
6. Connect a cable long enough to reach the RF ports of the SW2 LNA Switch to a signal generator.
7. Connect another cable long enough to reach the RF ports of the SW2 LNA Switch to a spectrum analyzer.
8. Connect the two loose cable ends together.
9. Tune the signal generator to 20 GHz with a power level of -10 dBm.
10. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.
11. Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
12. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
13. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
14. Disconnect the two cables from each other.
15. Connect the cable coming from the signal generator to the SW2 LNA Switch P3, as seen in [Figure 9-46](#).

Figure 9-46 SW2 LNA Switch Port Locations



16. Connect the cable going to the spectrum analyzer to the SW2 LNA Switch P2.
17. If the instrument has a preamplifier option installed press **Amplitude, Signal Path** and verify that the **LNA** is turned **Off**.
18. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW2 LNA Switch.
19. If the instrument has a preamplifier option installed proceed to the next step.

If the instrument does not have a preamplifier option installed the SW2 LNA Switch is working as expected. Exit this procedure.
20. Move the cable going to the spectrum analyzer from P2 to P4 of the SW2 LNA Switch.
21. Turn on the low noise amplifier by pressing **Amplitude, Signal Path, LNA On**.
22. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW2 LNA Switch.
23. Move the cable coming from the signal generator from P3 to P1 of the SW2 LNA Switch.
24. Move the cable going to the spectrum analyzer from P4 to P2 of the SW2 LNA Switch.

25. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, the SW2 LNA Switch is working as expected.

If the marker delta value is not as expected, verify that the W20 control cable is not damaged and properly connected on both ends. If there is nothing wrong with W20, replace the SW2 LNA Switch.

SW3 Low Noise Path Switch

Overview

The SW3 Low Noise Path Switch is made up of two single pole double throw ganged switches. It is used to bypass the A11 Band Switch for frequencies of 3.6 GHz and higher. Doing so reduces the signal path loss, thus reducing the noise floor of the instrument.

Control for the SW3 Low Noise Path Switch comes from the A15 Front End Controller J802. The connections to and from this switch are listed in [Table 9-19](#), as seen in [Figure 9-47](#) and [Figure 9-48](#).

Table 9-19 SW3 Low Noise Path Switch Connections

Port	Description	To/From	Cable
Control	Bias & Control	From A15 FEC J802	W4
1	Switch Input	From SW2 LNA Switch P2	W36
2	Switch Output	To SW4 MPB Switch P2	W39
3	A11 High Band Output	From A11 Band Switch High Band P3	W38
4	A11 Band Switch Input	To A11 Band Switch P2	W37

Figure 9-47 SW3 Low Noise Path Switch Block Diagram - Option 508, 513, 526, 544, 550

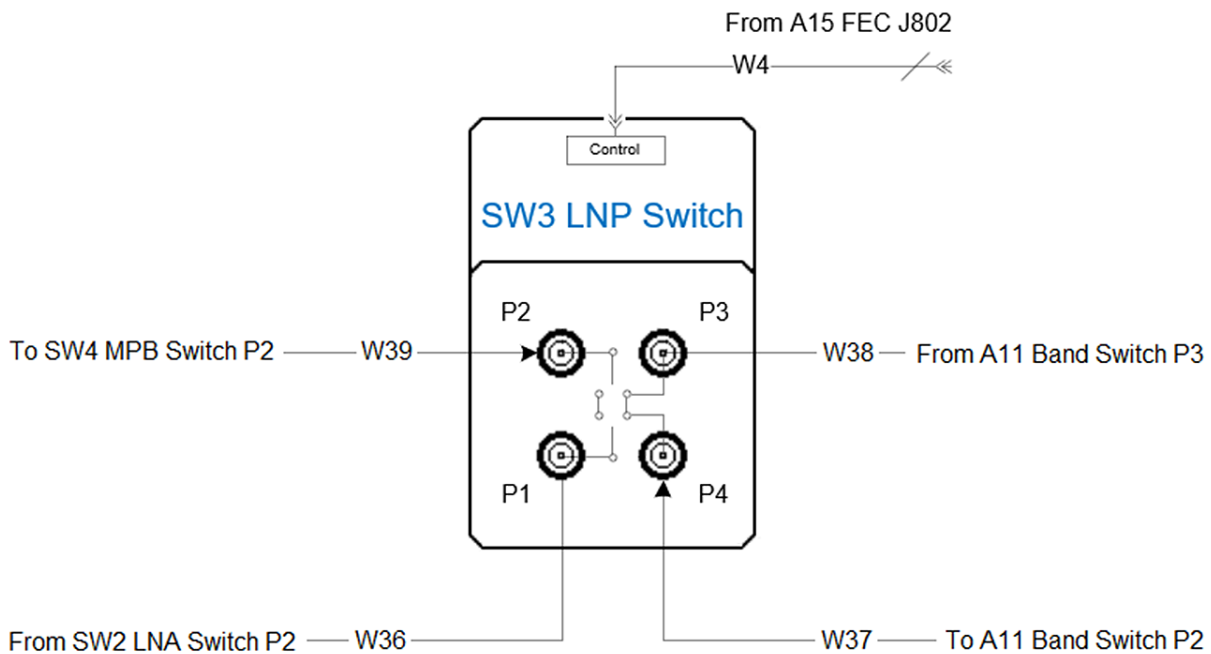
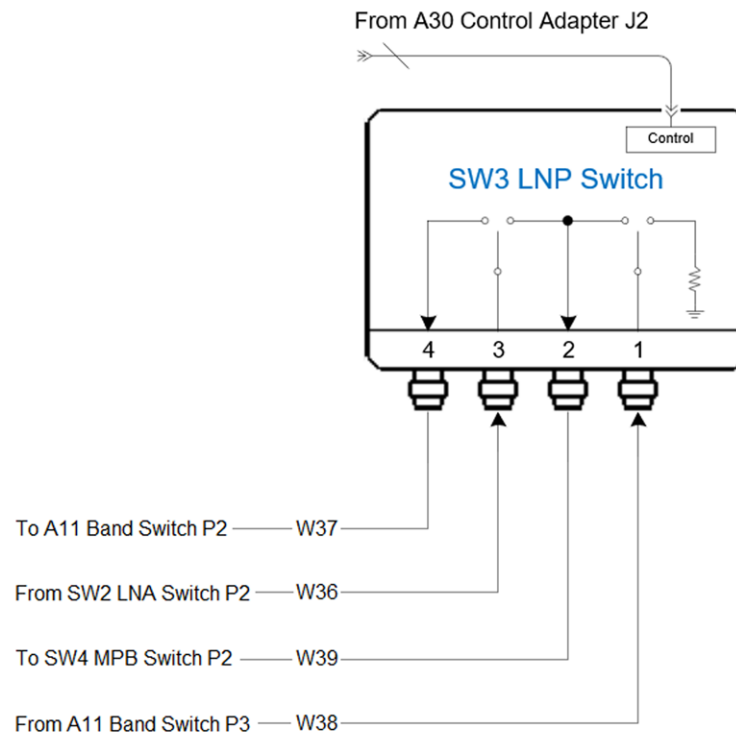


Figure 9-48

SW3 Low Noise Path Switch Block Diagram - Option 555



Switch counts for the SW3 LNP Switch can be found on the **System, Diagnostics, Hardware Statistics** screen in the instrument as **Low Noise Path Switch Cycles**, as seen in [Figure 9-49](#). The average life expectancy for the switches is 5 million cycles.

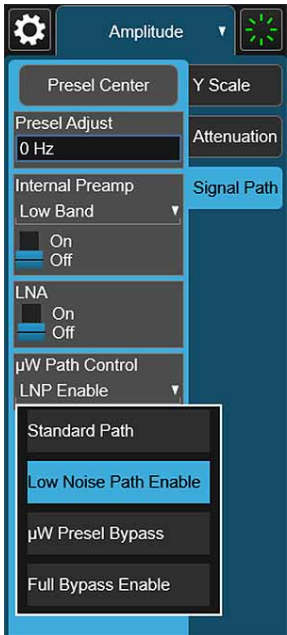
Figure 9-49 Hardware Statistics Screen - SW3 LNP Switch

System Settings	< Diagnostics Hardware Statistics    	
System	Keysight PXA	Keysight PXA Signal Analyzer
	Product Number	N9032B
I/O Config	Serial Number	US60420232
	S/W Release Name	2022 Update 2.1
User Interface	Instrument S/W Revision	A.32.12
	Revision Date	6/3/2022 1:26:12 PM
Power On	MechAtten #1 Count Total	572409
	Calibrator Switch Cycles	36738
Restore Defaults	2 dB #1 Mechanical Atten Cycles	167840
	2 dB #2 Mechanical Atten Cycles	202724
Alignments	6 dB Mechanical Atten Cycles	165107
	MechAtten #2 Count Total	434302
Licensing	10 dB Mechanical Atten Cycles	132731
	20 dB Mechanical Atten Cycles	147531
Security	30 dB Mechanical Atten Cycles	154040
Diagnostics	Low Noise Path Switch Cycles	182402
	Preselector Bypass Cycles	51763
Service		
	High temperature operating extreme	46.75
SCPI Recorder	Low temperature operating extreme	29
	Elapsed Time (On-Time)(Hours)	3063

Control

Control for the SW3 Low Noise Path Switch can be found under the **Amplitude, Signal Path, μ W Path Control** menu, as seen in [Figure 9-50](#).

Figure 9-50 SW3 Low Noise Path Switch Control



When **Standard Path** is selected, the input signal at P1 will be routed out P4 to the A11 Band Switch input. For frequencies higher than 3.6 GHz the A11 Band Switch high band output will then reenter the switch at P3 and will be routed out P2 to the SW4 MPB Switch P2 input. For this setting the internal switch configuration will be as seen in [Figure 9-51](#) and [Figure 9-52](#).

Figure 9-51 SW3 Low Noise Path Switch - Standard Path - Option 508, 513, 526, 544, 550

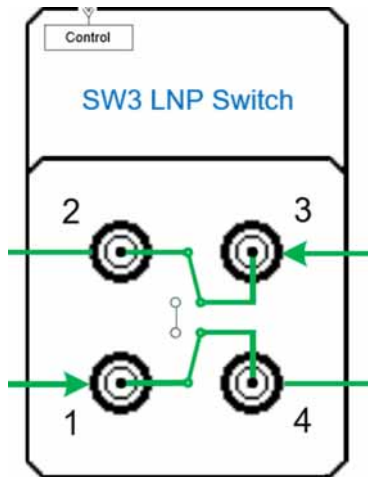
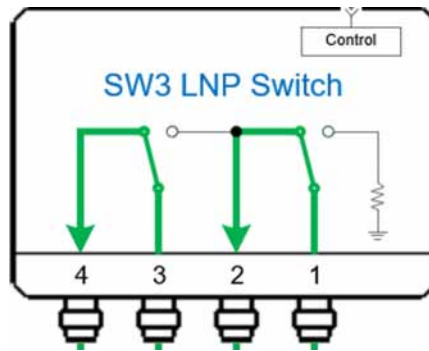


Figure 9-52

SW3 Low Noise Path Switch - Standard Path - Option 555



When **Low Noise Path Enable** is selected, the input signal at P1 will be routed directly out P2 to the SW4 MPB Switch P2 input. For frequencies 3.6 GHz or less the input signal at P1 will be routed out P4 to the A11 Band Switch input. For this setting the internal switch configuration will be as seen in **Figure 9-53** and **Figure 9-54**, where the dotted signal path is for frequencies 3.6 GHz or less only.

Figure 9-53

SW3 Low Noise Path Switch – Low Noise Path Enable - Option 508, 513, 526, 544, 550

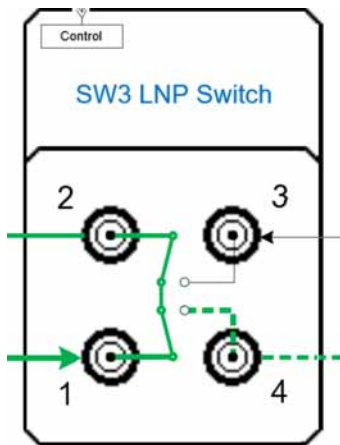
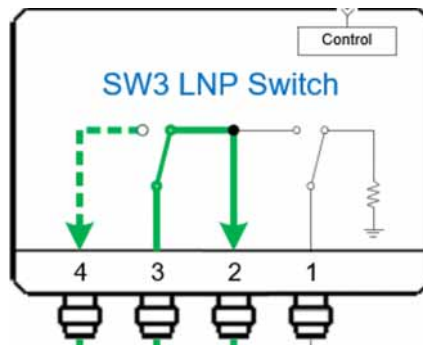


Figure 9-54

SW3 Low Noise Path Switch – Low Noise Path Enable - Option 555



When **Full Bypass Enable** is selected, the configuration of the SW3 LNP Switch will also be as seen in [Figure 9-53](#) or [Figure 9-54](#), as it enables both the Low Noise Path and the μ W Preselector Bypass path.

Functional Verification

The following procedure will verify the proper switching and insertion loss of the SW3 LNP Switch. It will do so using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Remove the instrument outer cover, front panel, and chassis right side cover to gain access to the switch connections. Refer to [Chapter 22, "Assembly Replacement Procedures."](#) if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the frequency to 20 GHz by pressing **Frequency, Center Frequency, 20 GHz**.
5. Set the span to 0 Hz by pressing **Frequency, Zero Span**.
6. Remove the four semi-rigid cables from the four SW3 LNP Switch RF ports.
7. Connect cable long enough to reach the RF ports of the SW3 LNP Switch to a signal generator.
8. Connect another cable long enough to reach the RF ports of the SW3 LNP Switch to a spectrum analyzer.
9. Connect the two loose cable ends together.
10. Tune the signal generator to 20 GHz with a power level of -10 dBm.
11. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.
12. Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
13. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
14. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
15. Disconnect the two cables from each other.
16. Connect the cable coming from the signal generator to the SW3 LNP Switch P1, as seen in [Figure 9-55](#) and [Figure 9-56](#).

Figure 9-55 SW3 LNP Switch Port Locations - Option 508, 513, 526, 544, 550

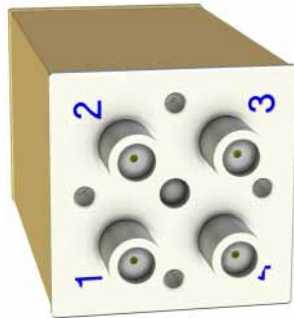
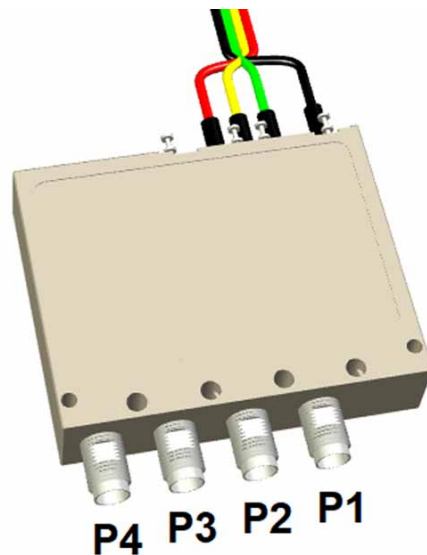


Figure 9-56 SW3 LNP Switch Port Locations - Option 555



17. Connect the cable going to the spectrum analyzer to the SW3 LNP Switch P4.
18. Verify that the low noise path is not selected by pressing **Amplitude, Signal Path, μ W Path Control, Standard Path**.
19. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W4 control ribbon cable is not damaged and properly connected on both ends. If there is nothing wrong with W4, replace the SW3 LNP Switch.
20. Move the cable going to the spectrum analyzer from P4 to P2 of the SW3 LNP Switch.
21. Switch the SW3 LNP Switch to the low noise path by pressing **μ W Path Control, Low Noise Path Enable**.

- 22.** Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W4 control ribbon cable is not damaged and properly connected on both ends. If there is nothing wrong with W4, replace the SW3 LNP Switch.

- 23.** Move the cable coming from the signal generator from P1 to P3 of the SW3 LNP Switch.

- 24.** Switch the SW3 LNP Switch back to the standard path by pressing **μ W Path Control, Standard Path.**

- 25.** Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, the SW3 LNP Switch is working as expected.

If the marker delta value is not as expected, verify that the W4 control ribbon cable is not damaged and properly connected on both ends. If there is nothing wrong with W4, replace the SW3 LNP Switch.

SW4 Microwave Preselector Bypass Switch

Overview

The SW4 Microwave Preselector Bypass Switch is made up of two single pole double throw ganged switches. It is used to bypass the A12 Yig Tuned Filter for frequencies higher than 3.6 GHz. Doing so allows for wideband analysis and reduces the signal path loss.

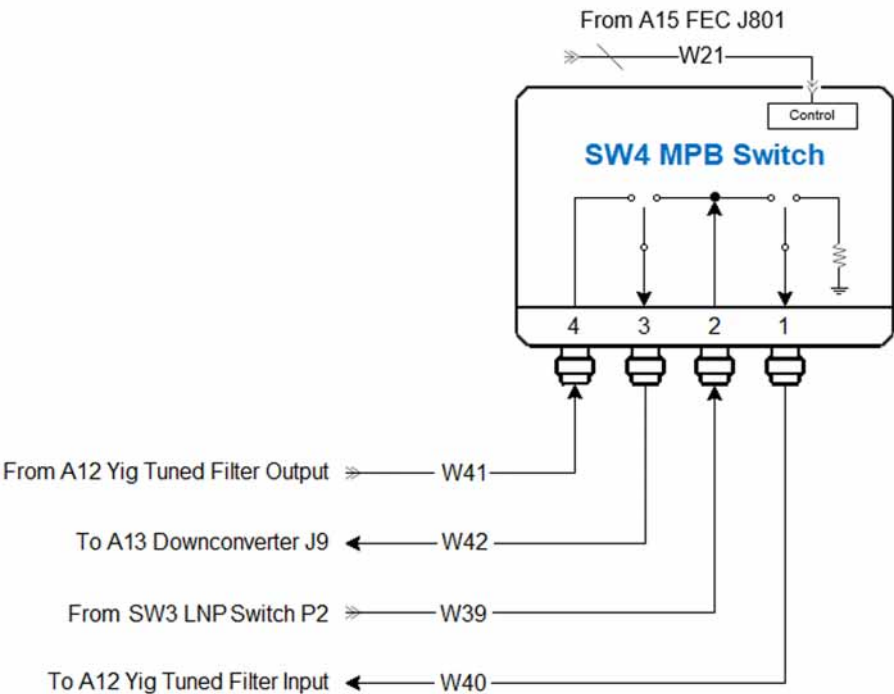
Control for the SW4 Microwave Preselector Bypass Switch comes from the A15 Front End Controller J801. The connections to and from this switch are listed in [Table 9-20](#), as seen in [Figure 9-57](#).

Table 9-20 SW4 Microwave Preselect Bypass Switch Connections

Port	Description	To/From	Cable
Control	Bias & Control	From A15 FEC J801	W21
1	A12 Yig Tuned Filter Input	To A12 Yig Tuned Filter Input	W40
2	Switch Input	From SW3 LNP Switch P2	W39
3	Switch Output	To A19 Wideband Downconverter P5	W42
4	A12 Yig Tuned Filter Output	From A12 Yig Tuned Filter Output	W41

Figure 9-57

SW4 Microwave Preselector Bypass Switch Block Diagram



Switch counts for the SW4 MPB Switch can be found on the **System, Diagnostics, Hardware Statistics** screen in the instrument as **Preselector Bypass Cycles**, as seen in **Figure 9-58**. The average life expectancy for the switches is 5 million cycles.

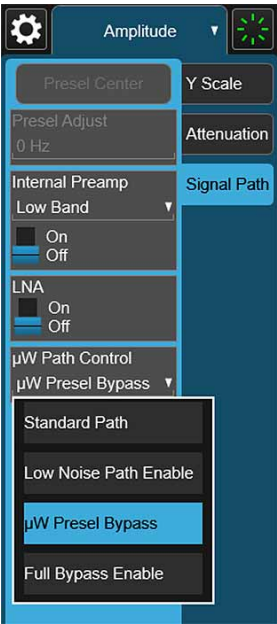
Figure 9-58 Hardware Statistics Screen - SW4 MPB Switch

System Settings	< Diagnostics Hardware Statistics    	
System	Keysight PXA	Keysight PXA Signal Analyzer
	Product Number	N9032B
	Serial Number	US60420232
I/O Config	S/W Release Name	2022 Update 2.1
	Instrument S/W Revision	A.32.12
	Revision Date	6/3/2022 1:26:12 PM
User Interface	MechAtten #1 Count Total	572409
	Calibrator Switch Cycles	36738
	2 dB #1 Mechanical Atten Cycles	167840
Power On	2 dB #2 Mechanical Atten Cycles	202724
	6 dB Mechanical Atten Cycles	165107
Restore Defaults	MechAtten #2 Count Total	434302
	10 dB Mechanical Atten Cycles	132731
	20 dB Mechanical Atten Cycles	147531
Alignments	30 dB Mechanical Atten Cycles	154040
Licensing		
Security	Low Noise Path Switch Cycles	182402
	Preselector Bypass Cycles	51763
Diagnostics	High temperature operating extreme	46.75
	Low temperature operating extreme	29
Service	Elapsed Time (On-Time)(Hours)	3063
SCPI Recorder		

Control

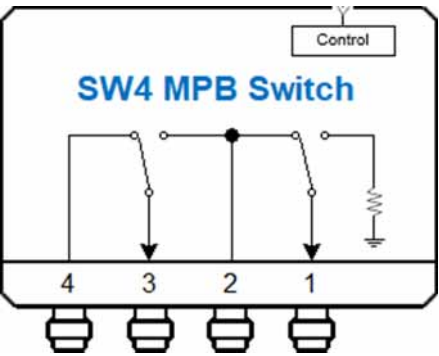
Control for the SW4 Microwave Preselector Bypass Switch can be found under the **Amplitude**, **Signal Path**, **μW Path Control** menu, as seen in **Figure 9-59**.

Figure 9-59 SW4 Microwave Preselector Bypass Switch Control



When **Standard Path** is selected, the input signal at P2 will be routed out P1 to the A12 Yig Tuned Filter input. The A12 Yig Tuned Filter output will then enter at P4 and will be routed out P3 to the A13 Downconverter J9 input. For this setting the internal switch configuration will be as seen in **Figure 9-60**.

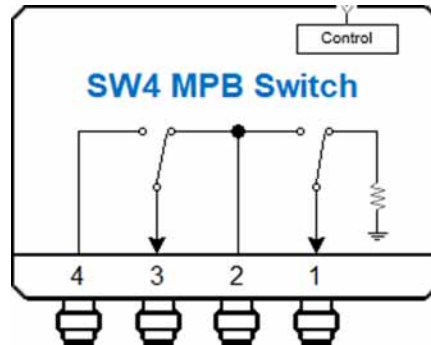
Figure 9-60 SW4 Microwave Preselector Bypass Switch – Standard Path



When **μW Presel Enable** is selected, the input signal at P2 will be routed directly out P3 to the Downconverter J9 input. For this setting the internal switch configuration will be as seen in **Figure 9-61**.

Figure 9-61

SW4 Microwave Preselector Bypass Switch - μ W Presel Bypass



When **Full Bypass Enable** is selected, the configuration of the SW4 MPB Switch will also be as seen in **Figure 9-61**, as it enables both the Low Noise Path and the μ W Preselector Bypass path.

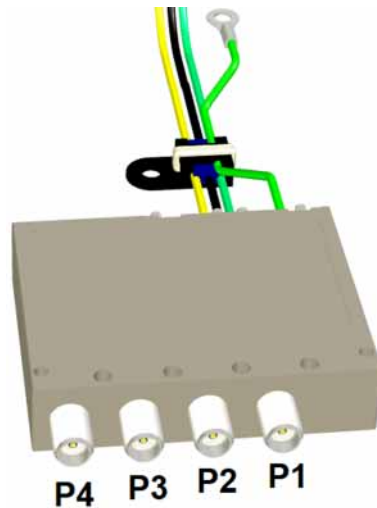
The control wire harness W21 that comes from the A15 Front End Controller J802 is used to control the SW4 MPB Switch, the A13SW1 Filter Switch, the A13SW2 Filter Switch, as well as to provide +25 volts to the A11 Band Switch.

Functional Verification

The following procedure will verify the proper switching and insertion loss of the SW4 MPB Switch. It will do so using a frequency of 20 GHz. If there is a particular frequency of interest use that instead.

1. Remove the instrument outer cover, front panel, and chassis right side cover to gain access to the switch connections. Refer to **Chapter 22, "Assembly Replacement Procedures."** if information on how to remove these is needed.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the frequency to 20 GHz by pressing **Frequency, Center Frequency, 20 GHz**.
5. Set the span to 0 Hz by pressing **Frequency, Zero Span**.
6. Remove the four semi-rigid cables from the four SW4 MPB Switch RF ports.
7. Connect a cable long enough to reach the RF ports of the SW4 MPB Switch to a signal generator.
8. Connect another cable long enough to reach the RF ports of the SW4 MPB Switch to a spectrum analyzer.
9. Connect the two loose cable ends together.
10. Tune the signal generator to 20 GHz with a power level of -10 dBm.
11. Tune the spectrum analyzer to 20 GHz with a span of 10 MHz.
12. Use the marker peak search function of the spectrum analyzer to read the power level of the 20 GHz signal.
13. Adjust the signal generator power level until the signal on the spectrum analyzer display measures -10 dBm.
14. Enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.
15. Disconnect the two cables from each other.
16. Connect the cable coming from the signal generator to the SW4 MPB Switch P2, as seen in **Figure 9-62**.

Figure 9-62 SW4 MPB Switch Port Locations



17. Connect the cable going to the spectrum analyzer to the SW4 MPB Switch P1.
18. Verify that the microwave preselector bypass path is not selected by pressing **Amplitude, Signal Path, μ W Path Control, Standard Path**.
19. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W21 control wire harness is not damaged and properly connected on both ends. If there is nothing wrong with W21, replace the SW4 MPB Switch.
20. Move the cable going to the spectrum analyzer from P1 to P3 of the SW4 MPB Switch.
21. Switch the SW4 MPB Switch to the bypass path by pressing **μ W Path Control, μ W Presel Bypass**.
22. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, proceed to the next step.

If the marker delta value is not as expected, verify that the W21 control wire harness is not damaged and properly connected on both ends. If there is nothing wrong with W21, replace the SW4 MPB Switch.
23. Move the cable coming from the signal generator from P2 to P4 of the SW4 MPB Switch.
24. Switch the SW4 MPB Switch back to the standard path by pressing **μ W Path Control, Standard Path**.

25. Verify that there is a 20 GHz signal on the spectrum analyzer display and that the marker delta value is ± 1 dB or less.

If the marker delta value is as expected, the SW4 MPB Switch is working as expected.

If the marker delta value is not as expected, verify that the W21 control wire harness is not damaged and properly connected on both ends. If there is nothing wrong with W21, replace the SW4 MPB Switch.

10 Downconverter

What You Will Find in This Chapter

The following sections are found in this chapter:

A13 Downconverter on page 306

Overview on page 306

Low Band on page 311

High Band on page 316

Miscellaneous on page 317

Control on page 320

Troubleshooting Equipment Required on page 321

Functional Verification on page 322

A13 Downconverter

Overview

The A13 Downconverter provides a variety of functions for the instrument, which include:

Low Band (2 Hz to 3.6 GHz)

- Input Low Pass Filter
- 24 dB Electronic Step Attenuator
- Low Band Preamplifier
- First and Second Mixer
- Selectable First IF Bandwidth Filtering
 - Maximum Bandwidth of 1.5 GHz
- LO and IM Nulling

High Band (3.6 GHz to 55 GHz)

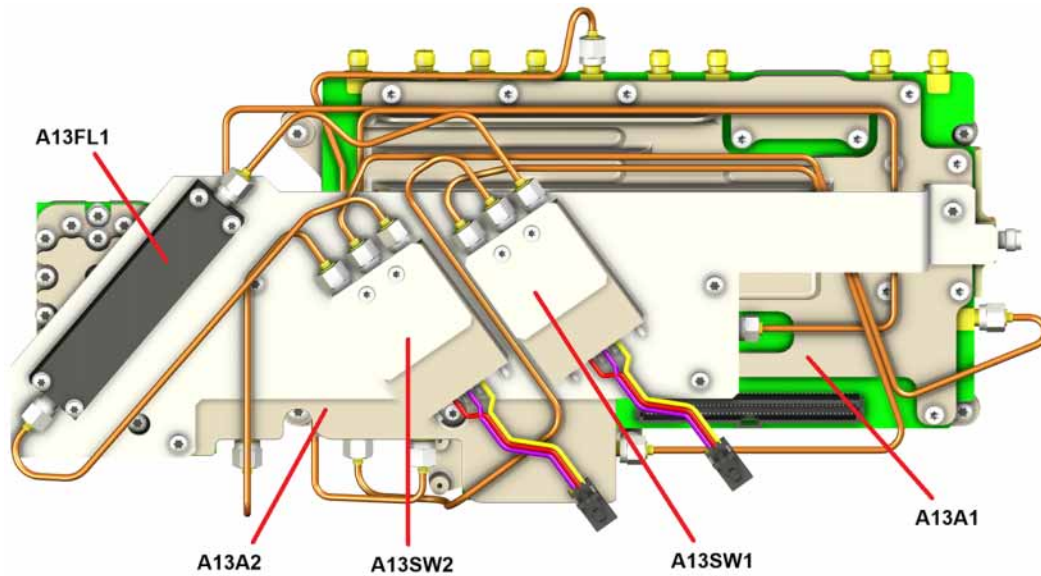
- Input Amplifier
- Selectable First Mixer
- Maximum Bandwidth of 2 GHz

Miscellaneous

- LO Distribution
- External Mixing Diplexer

The A13 Downconverter assembly is made up of a few different components, as seen in **Figure 10-1**. The A13A1 Downconverter and A13A2 Switched IF Filter are a matched set and cannot be replaced individually, they must be replaced along with the entire A13 assembly. However, the A13FL1 Wideband IF Filter as well as the A13SW1 and A13SW2 Filter Switches can be replaced individually.

Figure 10-1 A13 Downconverter Components



Control for the A13A1 Downconverter comes from the A15 Front End Controller J102. Control for the A13A2 Switched IF Filter comes from the A15 Front End Controller J1300. The connections to and from this assembly are listed in [Table 10-1](#), as seen in [Figure 10-2](#) and [Figure 10-3](#).

Table 10-1 A13 Downconverter Connections

Assembly	Port	Description	To/From	Cable
A13A1	J1	Low Band Second LO Input	From A23 IF Mux J35	W78
	J2	Low Band Input	From A11 Band Switch P1	W43
	J3	LO Nulling Output	To A13A2 IF Switched Filter J6	W62
	J4	First LO Input	From A14 DDS LO Synth J1	W61
	J5	First LO Output	Not used	--
	J6	Calibration Input	From A16 Reference J705	W105
	J7	IF Output	To A23 IF Mux J28	W52
	J8	External Mixing In/Out	To Front Panel Ext Mixer	W72
	J9	High Band Input	From SW4 MPB Switch P3	W42
	J10	Low Band First IF Output	To A13SW1 Filter Switch C	W45
	J11	Low Band First IF Input	From A13SW2 Filter Switch C	W51
	J12	Bias and Control	From A15 Front End Controller J102	W7
	J13	External Mixing IF Output	To A23 IF Mux J29	W71

Table 10-1 A13 Downconverter Connections

Assembly	Port	Description	To/From	Cable
A13A2	J1	Bias and Control	From A15 Front End Controller J1300	W9
	J2	Low Band First IF Input	From A13SW1 Filter Switch II	W47
	J3	Delay Line Output	To A13A2 IF Switched Filter J4	W48
	J4	Delay Line Input	From A13A2 IF Switched Filter J3	W48
	J5	Low Band First IF Output	To A13SW2 Filter Switch II	W50
	J6	LO Nulling Input	From A13A1 Downconverter J3	W62

Figure 10-2 A13 Downconverter Connections - Front

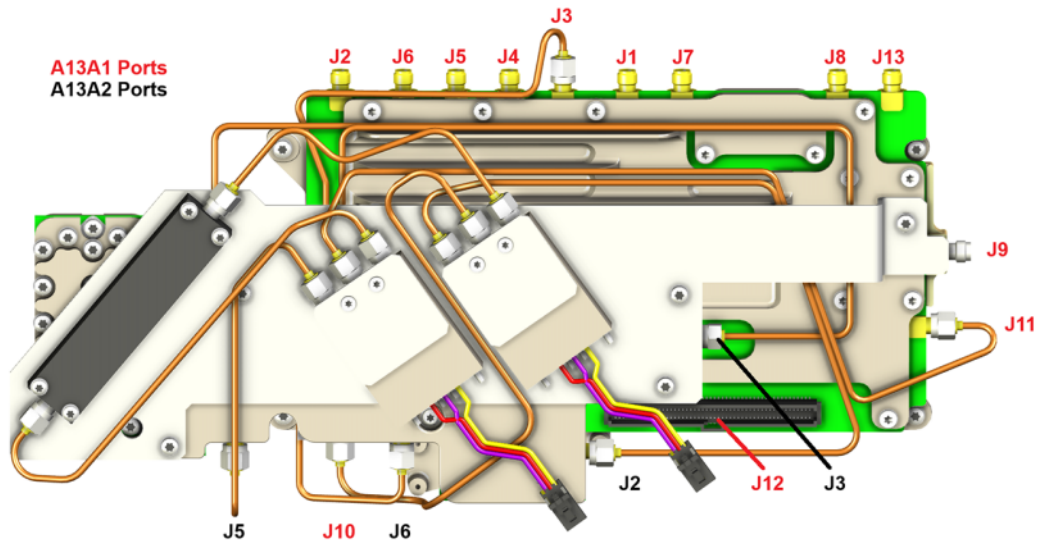
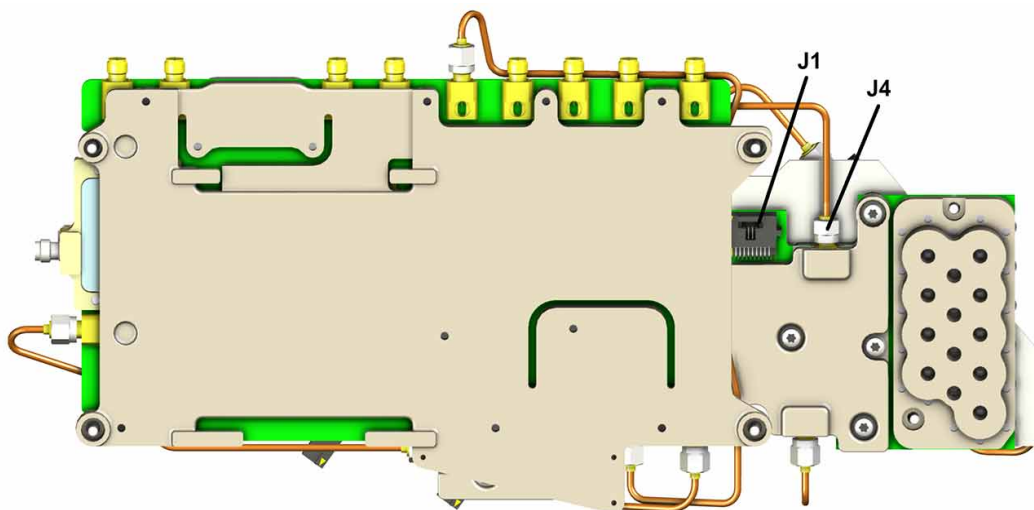


Figure 10-3 A13 Downconverter Connections - Rear



Downconverter
A13 Downconverter

Both the A13A1 Downconverter and the A13A2 Switch IF Filter will identify themselves on the instrument Hardware Information screen. The A13A1 Downconverter will identify as the **FrontEnd** and the A13A2 Switched IF Filter will identify as the **Switched IF Filter**, as seen in **Figure 10-4**.

Figure 10-4 Hardware Information Screen – A13 Downconverter

System Settings

< System

Hardware Information

?

X

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

I/O Config

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

Analog IF

N902060290

79204100103

011

1

A

57

Digital IF

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Front End Controller

N902060016

79204100250

035

3

A

34

Power On

N902060295

79204100620

009

0

A

131

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Restore Defaults

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Alignments

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Licensing

Front End

N904160039

78203535226

000

1

A

270

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

Service

SCPI Recorder

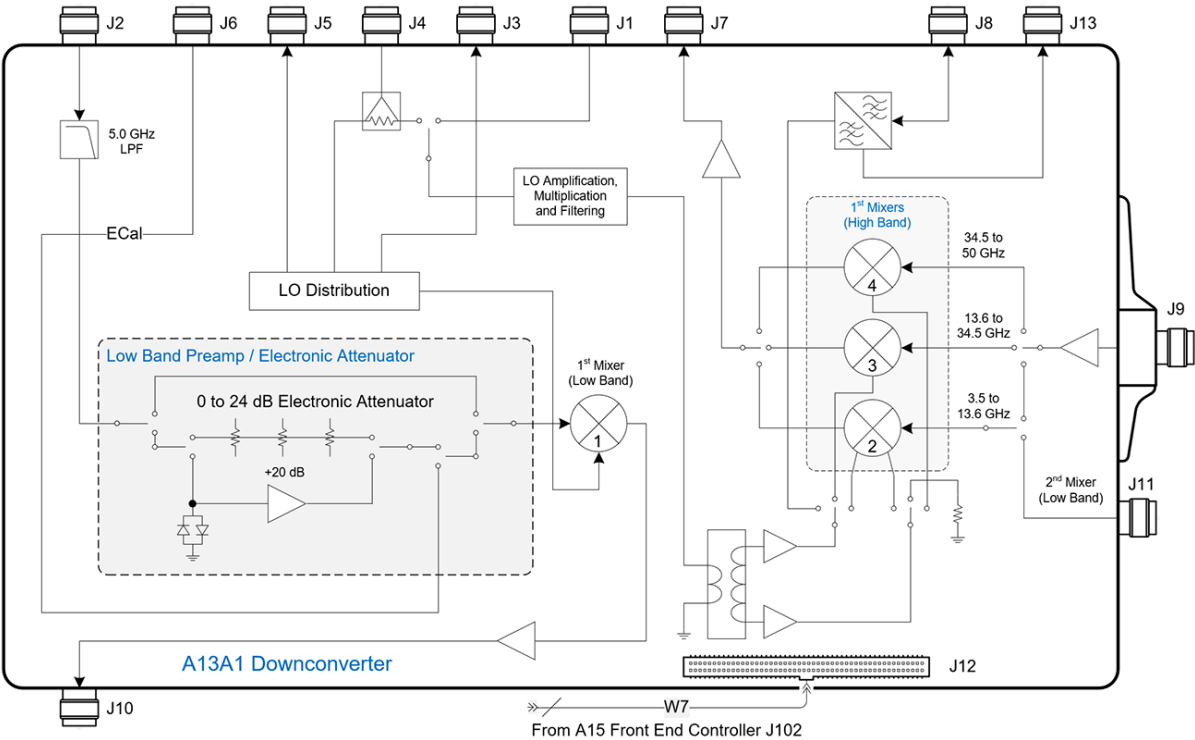
Downconverter
A13 Downconverter

There are seven frequency bands in the A13 Downconverter. The frequency breaks for each can be seen in **Table 10-2**. Knowing these frequency breaks can be useful when it comes to identifying the cause of a frequency related instrument failure.

Table 10-2 A13A1 Downconverter Frequency Bands - Swept SA

Band	Input Frequency
0	2 Hz to 3.6 GHz
1	>3.6 to 8.4 GHz
2	>8.4 to 13.6 GHz
3	>13.6 to 17.1 GHz
4	>17.1 to 26.5 GHz
5	>26.5 to 34.5 GHz
6	>34.5 to 55 GHz

Figure 10-5 A13A1 Downconverter Block Diagram



The intermediate output frequency from the A13A1 Downconverter depends on the IF signal path selected. For the Spectrum Analyzer mode Swept SA measurement the instrument uses the 10 MHz IF path. The intermediate frequency output from the A13A1 Downconverter for the different IF signal paths can be seen in [Table 10-3](#).

Table 10-3 A13A1 Downconverter IF Path versus IF Output

IF Path	Input Frequency		IF Output
	Lower	Upper	
10 MHz	10 MHz	55 GHz	322.5 MHz
25 MHz	15 MHz	55 GHz	322.5 MHz
40 MHz	65 MHz	55 GHz	250 MHz
255 MHz	400 MHz	55 GHz	690 MHz
1 GHz	700 MHz	55 GHz	690 MHz
1.5 GHz	950 MHz	3.5 GHz	950 MHz
	>3.5 GHz	55 GHz	1.2 GHz
2.0 GHz	3.5 GHz	55 GHz	1.2 GHz

Low Band

Low Band refers to band 0, which covers the frequency ranges seen in [Table 10-4](#) for the different IF signal paths.

Table 10-4 IF Signal Path versus Low Band Frequency Range

IF Signal Path	Lower Frequency	Upper Frequency
10 MHz	10 MHz	3.6 GHz
25 MHz	15 MHz	3.6 GHz
40 MHz	65 MHz	3.6 GHz
255 MHz	400 MHz	3.3 GHz
1.0 GHz	700 MHz	3.3 GHz
1.5 GHz	950 MHz	3.5 GHz
2.0 GHz	n/a	n/a

Low Pass Filter

There is a 5.0 GHz low pass filter at the low band input of the A13A1 Downconverter, as seen in the block diagram of the A13A1 Downconverter in [Figure 10-5](#). This is there to filter out high band signals from getting to the first mixer. It has a cutoff frequency of 5.0 GHz so that wideband signals up to 3.6 GHz would not be adversely affected.

24 dB Electronic Step Attenuator

The electronic attenuator is only available when option EA3 is installed. It can be used instead of the mechanical step attenuators, but it is not used by default, the user must select the use of it. It has a range of 24 dB with 1 dB increments. This is selected on the **Amplitude, Attenuation** menu, as seen in [Figure 10-6](#).

Figure 10-6 A13A1 Electronic Atten Control



Since the electronic step attenuator is only in the low band signal path, it can only be used up to 3.6 GHz. Also, as can be seen in the block diagram of the A13A1 Downconverter in [Figure 10-5](#), the electronic step attenuator and the low band preamplifier cannot both be selected at the same time.

Low Band Preamplifier

The low band preamplifier is only available for use with one of the preamplifier options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N). It has a gain of approximately 20 dB and is turned on whenever the Low Band or Full Range Internal Preamp is selected and turned on. This is selected on the **Amplitude, Signal Path** menu, as seen in [Figure 10-7](#).

Figure 10-7 A13A1 Low Band Preamp Control



Since the low band preamplifier is only in the low band signal path, it can only be used up to 3.6 GHz. Also, as can be seen in the block diagram of the A13A1 Downconverter in [Figure 10-5](#), the electronic step attenuator and the low band preamplifier cannot both be selected at the same time.

First and Second Mixer

Unlike high band, low band uses two mixers in the A13A1 Downconverter. The input signal is first upconverted by the first mixer, filtered, then downconverted by the second mixer to the final IF output shown in [Table 10-3](#) for the IF signal path being used.

While the first mixer uses the A14 DDS LO Synthesizer output as its LO, the second mixer uses the 4.8 GHz reference signal that originates on the A16 Reference assembly as its LO.

The IFs and LOs used in low band for the different IF signal paths are as seen in [Table 10-5](#).

Table 10-5 Low Band Intermediate and LO Frequencies

IF Path	First LO	First IF	Second LO	Second IF
10 MHz	5.1225 to 8.7225 GHz	5.1225 GHz	4.8 GHz	322.5 MHz
25 MHz	5.1225 to 8.7225 GHz	5.1225 GHz	4.8 GHz	322.5 MHz
40 MHz	5.05 to 8.65 GHz	5.05 GHz	4.8 GHz	250 MHz
255 MHz	5.49 to 9.09 GHz	5.49 GHz	4.8 GHz	690 MHz
1.0 GHz	5.49 to 9.09 GHz	5.49 GHz	4.8 GHz	690 MHz
1.5 GHz	5.75 to 9.35 GHz	5.75 GHz	4.8 GHz	950 MHz

The 2.0 GHz IF path is not available in low band.

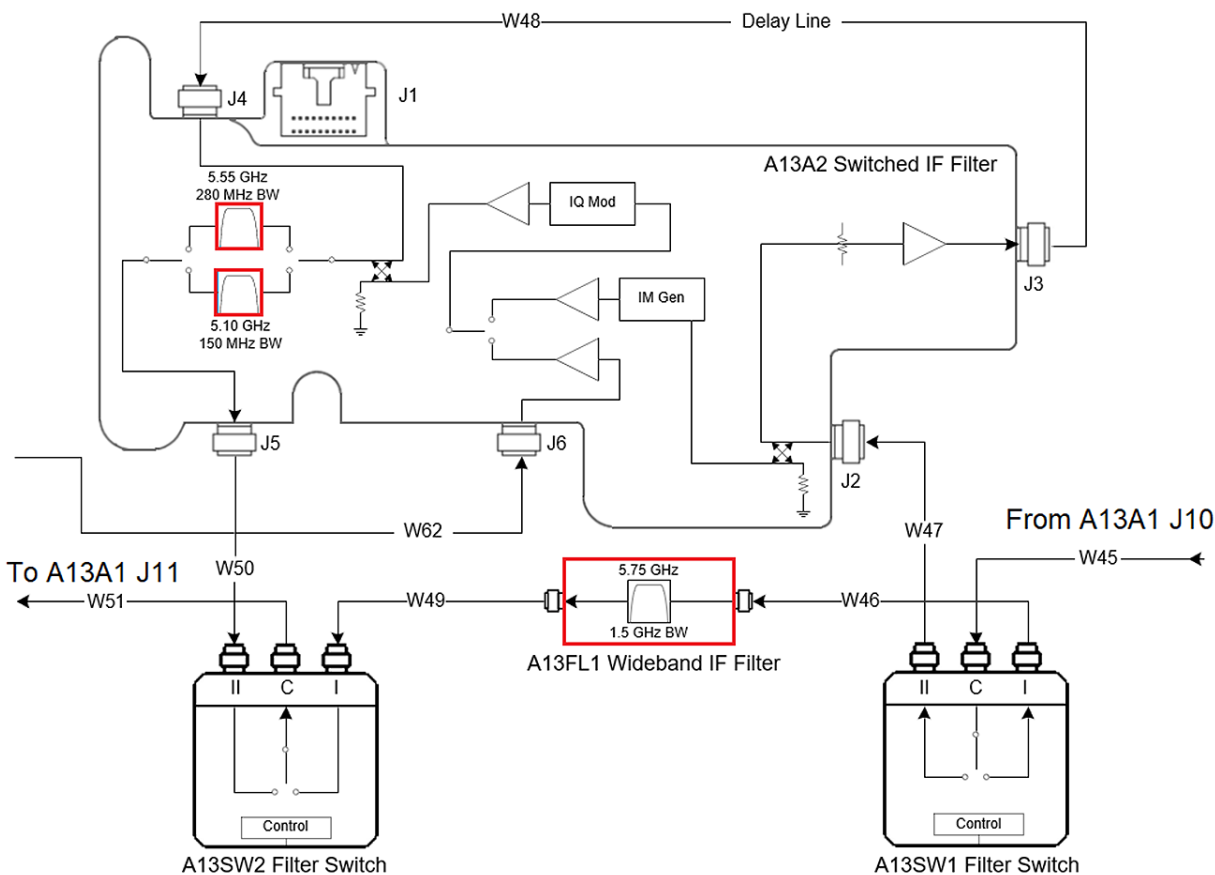
Selectable First IF Bandwidth Filtering

The A13A2 Switched IF Filter provides IF filtering of various widths to allow for wide analysis bandwidth measurements. The available paths and filters can be seen in [Table 10-6](#) and in the block diagram of the A13A2 Switched IF Filter in [Figure 10-8](#).

Table 10-6 A13A2 Switched IF Filter Paths

Filter Bandwidth	Center Frequency	IF Path Used In
150 MHz	5.10 GHz	10, MHz, 25 MHz, 40 MHz
280 MHz	5.55 GHz	255 MHz
1.5 GHz	5.75 GHz	1.0 GHz, 1.5 GHz

Figure 10-8 A13A2 Switch IF Filter Block Diagram



Since the maximum bandwidth of the A13A2 Switched IF Filter is 1.5 GHz, that is the widest IF path that can be used in low band.

LO and IM Nulling

The A13A2 Switched IF Filter has the ability to null the LO feedthrough, and IM nulling to improve TOI performance. The instrument auto alignments control these features.

Since the LO feedthrough only appears at 0 Hz when using low band, LO nulling has no affect anywhere else. The A13A2 Switched IF Filter assembly is only used in low band, so IM nulling only has an affect at 3.6 GHz and below.

Both the LO and IM nulling can be turned on and off from the instrument service menu. See **Chapter 20, “Service Menus.”** for more information on this.

High Band

High Band refers to Bands 1-6, which covers the frequency ranges seen in [Table 10-7](#) for the different IF signal paths.

Table 10-7 IF Signal Path versus High Band Frequency Range

IF Signal Path	Lower Frequency	Upper Frequency
10 MHz	>3.6 GHz	55 GHz
25 MHz	>3.6 GHz	55 GHz
40 MHz	>3.6 GHz	55 GHz
255 MHz	>3.3 GHz	55 GHz
1.0 GHz	>3.3 GHz	55 GHz
1.5 GHz	>3.5 GHz	55 GHz
2.0 GHz	3.5 GHz	55 GHz

Input Amplifier

The high band input amplifier has a gain of approximately 15 dB from the instrument RF input and the first mixers. This is to compensate for losses associated with the A9 and A10 Step Attenuators, the A11 Band Switch, the A12 Yig tuned Filter, as well as the switches and cables. This amplifier also provides isolation between the first mixers and the instrument input.

Selectable First Mixer

There are three first mixers in the A13A1 Downconverter for high band, each designed for a specific frequency range. The mixer used for each frequency band can be seen in [Table 10-8](#), along with the LO multiplier they internally use. The location of each of the mixers can be seen in the block diagram of the A13A1 Downconverter in [Figure 10-5](#).

Table 10-8 Frequency Bands versus First Mixer Used - Swept SA

Band	Input Frequency	First Mixer Used	Mixer LO Multiplier
1	3.6 to 8.4 GHz	#2	x1
2	8.4 to 13.6 GHz	#2	x1
3	13.6 to 17.1 GHz	#3	x2
4	17.1 to 26.5 GHz	#3	x2
5	26.5 to 34.5 GHz	#3	x2
6	34.5 to 55 GHz	#4	x4

Maximum Bandwidth

The high band section of the A13A1 Downconverter has a maximum bandwidth of 2 GHz.

Miscellaneous

LO Distribution

The first LO signal output from the A14 DDS LO Synthesizer assembly is routed to the A13A1 Downconverter LO input at J4. There it is split with one side being used to drive the three high band mixers on that assembly, and if needed, out J8 to the Ext Mixer port on the front panel for external mixing. The other side is split and distributed to the low band first mixer as well as to two LO output ports – J5, which is not used in this instrument, and J3 to the A13A2 Switched IF Filter for LO nulling. This can all be seen in the block diagram of the A13A1 Downconverter in [Figure 10-5](#).

When the IF signal path selection changes, the intermediate frequency will often change as well, which means that the LO frequency will also need to change for a given input frequency, as seen in [Table 10-3](#). The information in [Table 10-9](#) through [Table 10-12](#) outlines the LO frequencies used for each frequency band, and a table for each IF signal path. There is also a switchable LO doubler in the path to the three high band mixers. The total LO multiplier used for each frequency band can also be seen in these tables, which includes the mixer LO multiplier.

**Table 10-9 High Band Mixer Information - 10 and 25 MHz IF Path
– 322.5 MHz IF**

Band	Input Frequency	LO Frequency	Total LO Multiplier
1	3.6 to 8.4 GHz	3.9225 to 8.7225 GHz	x1
2	8.4 to 13.6 GHz	4.36125 to 6.96125 GHz	x2
3	13.6 to 17.1 GHz	6.96125 to 8.71125 GHz	x2
4	17.1 to 26.5 GHz	4.355625 to 6.705625 GHz	x4
5	26.5 to 34.5 GHz	6.705625 to 8.705625 GHz	x4
6	34.5 to 55 GHz	4.3528125 to 6.9153125 GHz	x8

Table 10-10 High Band Mixer Information - 40 MHz IF Path – 250 MHz IF

Band	Input Frequency	LO Frequency	Total LO Multiplier
1	3.6 to 8.4 GHz	3.85 to 8.65 GHz	x1
2	8.4 to 13.6 GHz	4.325 to 6.925 GHz	x2
3	13.6 to 17.1 GHz	6.925 to 8.675 GHz	x2
4	17.1 to 26.5 GHz	4.3375 to 6.6875 GHz	x4
5	26.5 to 34.5 GHz	6.6875 to 8.6875 GHz	x4
6	34.5 to 55 GHz	4.34375 to 6.90625 GHz	x8

Table 10-11 High Band Mixer Information - 255 MHz and 1.0 GHz
IF Path – 690 MHz IF

Band	Input Frequency	LO Frequency	Total LO Multiplier
1	3.3 to 8.4 GHz	3.99 to 9.09 GHz	x1
2	8.4 to 13.3 GHz	4.545 to 6.995 GHz	x2
3	13.3 to 17.1 GHz	6.995 to 8.895 GHz	x2
4	17.1 to 26.5 GHz	4.4475 to 6.7975 GHz	x4
5	26.5 to 34.3 GHz	6.7975 to 8.7475 GHz	x4
6	34.3 to 55 GHz	4.37375 to 6.96125	x8

Table 10-12 High Band Mixer Information - 1.5 and 2.0 GHz IF Path
– 1.2 GHz IF

Band	Input Frequency	LO Frequency	Total LO Multiplier
1	3.5 to 7.9 GHz	4.7 to 9.10 GHz	x1
2	7.9 to 13.3 GHz	4.55 to 7.25 GHz	x2
3	13.3 to 17.1 GHz	7.25 to 9.15 GHz	x2
4	17.1 to 26.5 GHz	4.575 to 6.925 GHz	x4
5	26.5 to 33.8 GHz	6.925 to 8.75 GHz	x4
6	33.8 to 55 GHz	4.375 to 7.025 GHz	x8

External Mixing Diplexer

There is a diplexer on the A13 Downconverter assembly to allow external mixing. The high pass filter portion allows the LO signal to be routed out J8 to the front panel Ext Mixer port. The low pass filter portion allows the IF signal from the external mixer that comes in through J8 to be routed out J13 to the A23 IF Mux J29.

Downconverter
A13 Downconverter

Control

Control for the A13A1 Downconverter comes through the W7 ribbon cable from the A15 Front End Controller.

Control for the A13A2 Switched IF Filter comes through the W9 ribbon cable from the A15 Front End Controller.

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 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 26.5 GHz

Power Meter

Minimum frequency range: 10 MHz to 26.5 GHz¹

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

Miscellaneous

Voltmeter

Misc. cables and adapters

NOTE

The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. Higher than 26.5 GHz will be needed if the instrument has option 544 or 550.

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A13 Downconverter, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is a **FrontEnd** and a **Switched IF Filter** in the list of hardware assemblies, as seen in [Figure 10-4](#).

If the **FrontEnd** is not listed, inspect the W7 ribbon cable and verify that it is properly connected between J12 of the assembly and J102 of the A15 Front End Controller board (See [Figure 10-2](#) for reference).

If the **Switched IF Filter** is not listed, inspect the W9 ribbon cable and verify that it is properly connected between J1 of the assembly and J1300 of the A15 Front End Controller board (See [Figure 10-3](#) for reference).

If neither of the ribbon cables is an issue, and either of the assemblies is still not showing up in the Hardware Information screen, replace the A13 Downconverter.

NOTE

Since the instrument communicates with the A13 Downconverter through the A15 Front End Controller, be sure that it is initializing properly and being recognized on the Hardware Information screen before replacing an A13 Downconverter for not initializing 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 22, "Assembly Replacement Procedures."](#)

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."](#)

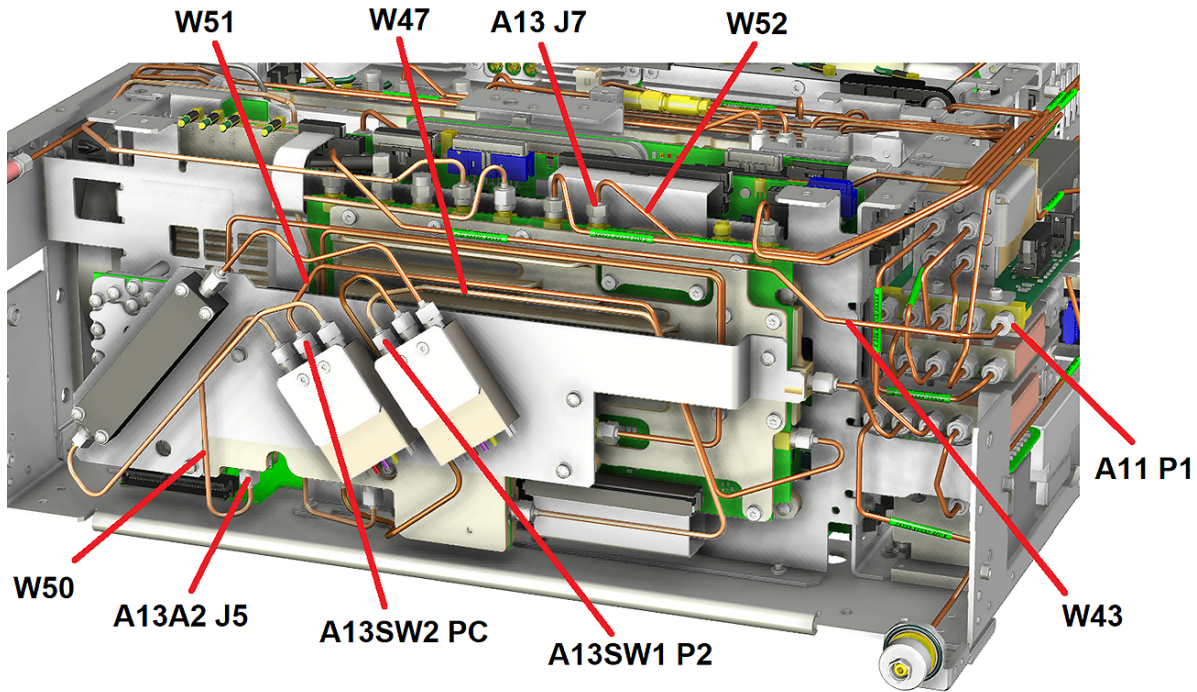
Low Band Signal Path

The following procedure will verify the functionality of the low band signal path through the A13 Downconverter. It will also verify the functionality of the 24 dB electronic attenuator. For a perceived problem with the low band preamplifier, see the ["Preamp Signal Paths"](#) section in [Chapter 7, "Signal Path Verification."](#) The following procedure uses a frequency of 2 GHz to verify functionality, but any frequency of 3.6 GHz or lower could be used.

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 internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the instrument to 2 GHz by pressing **Frequency, Center Frequency, 2 GHz**.

5. Set the instrument span to 0 Hz by pressing **Zero Span**.
6. Connect a signal generator to the instrument's front panel RF input.
7. Tune the signal generator to 2 GHz with a power level of -10 dBm.
8. Referring to **Figure 10-9**, remove W43 from the low band output of the A11 Band Switch P1.

Figure 10-9 A13 Downconverter Measurement Locations - Low Band



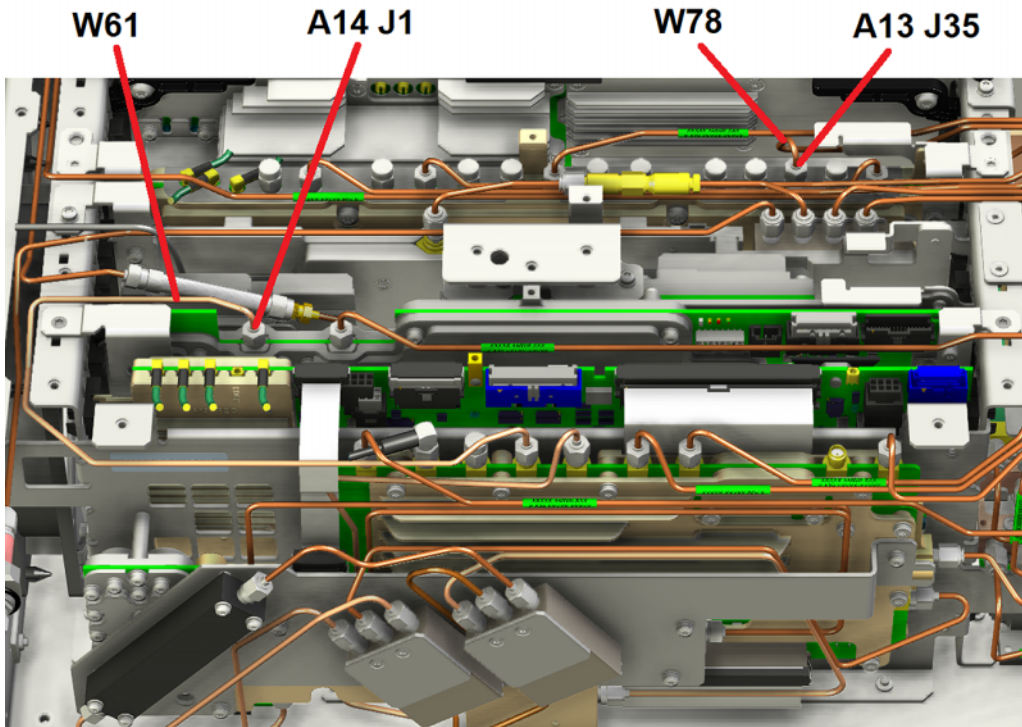
9. Connect a spectrum analyzer to the A11 Band Switch P1.
10. Tune the spectrum analyzer to 2 GHz with a span of 10 MHz.
11. Use the marker peak search function on the spectrum analyzer to verify that there is a 2 GHz signal at approximately -22 dBm.
If the signal is as expected, proceed to the next step.
If the signal is not as expected, see **Chapter 9, "RF Input Section,"** to determine why.
12. Adjust the power level of the signal generator until the level of the 2 GHz signal on the spectrum analyzer display is -22 dBm, ± 0.5 dB.
13. Remove the spectrum analyzer from A11 P1 and reconnect W43 to it.
14. Referring to **Figure 10-9**, remove W47 from A13SW1 P2.
15. Connect the spectrum analyzer to A13SW1 P2.
16. Tune the spectrum analyzer to 5.1225 GHz.

17. Use the marker peak search function on the spectrum analyzer to verify that there is a 5.1225 GHz signal at approximately -22 dBm.
If the signal is as expected, proceed to the next step.
If the signal is not as expected, proceed to step 32 to verify the first LO.
18. Remove the spectrum analyzer from A13SW1 P2 and reconnect W47 to it.
19. Referring to **Figure 10-9**, remove W51 from A13SW2 PC.
20. Connect the spectrum analyzer to A13SW2 PC.
21. Use the marker peak search function on the spectrum analyzer to verify that there is a 5.1225 GHz signal at approximately -22 dBm.
If the signal is as expected, proceed to step 26.
If the signal is not as expected, proceed to the next step.
22. Remove the spectrum analyzer from A13SW2 PC and reconnect W51 to it.
23. Referring to **Figure 10-9**, remove W50 from A13A2 J5.
24. Connect the spectrum analyzer to A13A2 J5.
25. Use the marker peak search function on the spectrum analyzer to verify that there is a 5.1225 GHz signal at approximately -22 dBm.
If the signal is as expected, see the “**A13SW1 / A13SW2**” section in **Chapter 11, “Front End Control,”** to verify that the switches are being controlled properly.
If the signal is not as expected, replace the A13 Downconverter.
26. Remove the spectrum analyzer from A13SW2 PC and reconnect W51 to it.
27. Referring to **Figure 10-9**, remove W52 from A13 J7.
28. Connect the spectrum analyzer to A13 J7.
29. Tune the spectrum analyzer to 322.5 MHz.
30. Use the marker peak search function on the spectrum analyzer to verify that there is a 322.5 MHz signal at approximately -21 dBm.
If the signal is as expected, the low band signal path is working properly. If the instrument has option EA3 Electronic Attenuator installed, proceed to step 42.
If the signal not as expected, proceed to the next step to verify that the correct first and second LO signals are present.
31. Remove the spectrum analyzer from A13 J7 and reconnect W52 to it.

First LO Verification

32. Referring to **Figure 10-10**, remove W61 from the A14 DDS LO Synthesizer J1.

Figure 10-10 A13 Downconverter First and Second LO Access



33. Set the spectrum analyzer reference level to +20 dBm.

34. Connect the spectrum analyzer to A14 J1.

35. Tune the spectrum analyzer to 7.1225 GHz.

$$1^{\text{st}} \text{ LO} = \text{RF} + 1^{\text{st}} \text{ IF} = 2 \text{ GHz} + 5.1225 \text{ GHz} = 7.1225 \text{ GHz}$$

36. Use the marker peak search function on the spectrum analyzer to verify that the first LO signal is at 7.1225 GHz at a power level of approximately +15 dBm.

If the frequency and power level are as expected, proceed to the next step.

If the frequency or power level are not as expected, see **Chapter 14, "LO Synthesizer,"** to determine why the A14 DDS LO Synthesizer J1 output is not correct.

Second LO Verification

37. Remove the spectrum analyzer from A14 J1 and reconnect W61 to it.
38. Referring to [Figure 10-10](#), remove W78 from the A23 IF Mux J35.
39. Connect the spectrum analyzer to A23 J35.
40. Tune the spectrum analyzer to 4.8 GHz.
41. Use the marker peak search function on the spectrum analyzer to verify that the second LO signal is at 4.8 GHz at a power level of approximately +13 dBm.

If the frequency and power level are as expected, repeat [step 28](#) through [step 30](#). If the 322.5 MHz signal measured in [step 30](#) is still not correct, inspect both ribbon cables W7 and W9 that power and control the A13 Downconverter to verify that they are not damaged and are connected properly on both ends. If there is nothing wrong with either ribbon cable, replace the A13 Downconverter.

If the frequency or power level are not as expected, see [Chapter 12, "IF Routing,"](#) to determine why the A23 IF Mux J35 output is not correct.

Electronic Attenuator Verification (Option EA3 Only)

42. Reconnect any cables that have been disconnected.
43. Activate the electronic attenuator on the instrument by pressing **Amplitude, Attenuation, Elec Atten Enabled**, as seen in [Figure 10-11](#).

Figure 10-11 Electronic Attenuator Control



44. With the spectrum analyzer still connected to the A13 J7 with the marker on the peak of the 322.5 MHz signal, enable the marker delta function on the spectrum analyzer and verify that it reads 0 dB.

45. While monitoring the marker delta reading on the spectrum analyzer display, step the **Elec Atten** value from 0 to 24 dB and verify that each step attenuates the signal accordingly.

If all the attenuator steps make a corresponding change to the marker delta reading, the electronic attenuator is working properly.

If all the attenuator steps do not make a corresponding change to the marker delta reading, inspect ribbon cable W7 for any damage and verify that it is connected properly on both ends. If there is nothing wrong with the W7 ribbon cable, replace the A13 Downconverter.

NOTE

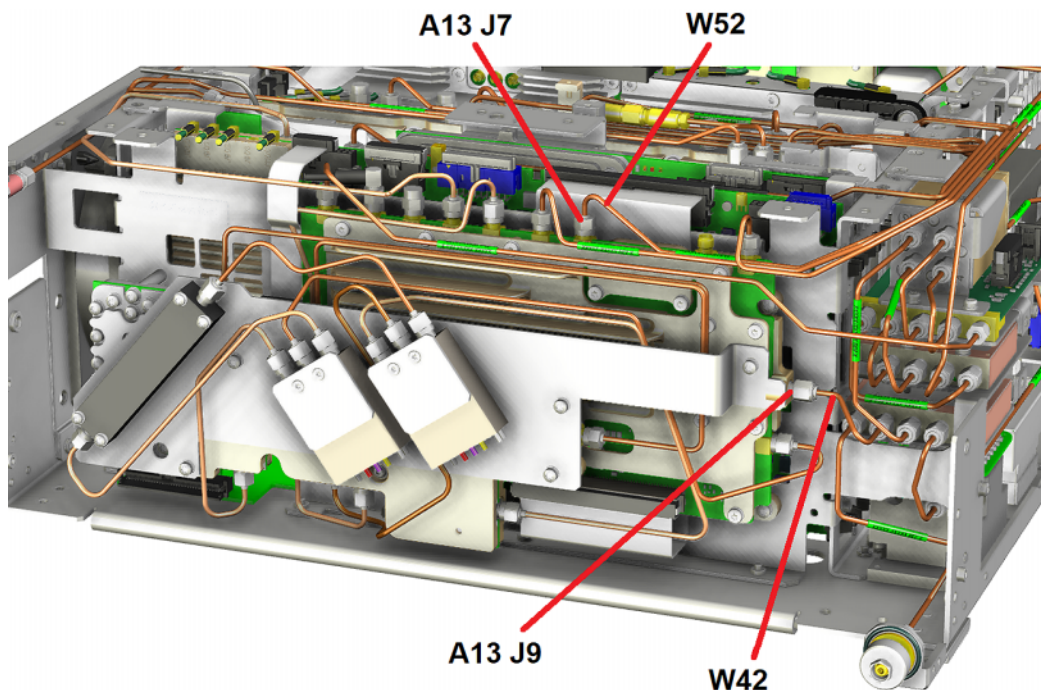
The overall attenuation value of the electronic attenuator may have an error of a little less than 1 dB by the time 24 dB is reached.

High Band Signal Path

The following procedure will verify the functionality of the high band signal path through the A13 Downconverter. This procedure uses a frequency of 20 GHz to verify functionality, but any frequency higher than 3.6 GHz could be used.

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 internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the instrument to 20 GHz by pressing **Frequency, Center Frequency, 20 GHz**.
5. Set the instrument span to 0 Hz by pressing **Zero Span**.
6. Connect a cable long enough to reach the A13A1 Downconverter high band input at J9, as seen in [Figure 10-12](#), to a signal generator output.

Figure 10-12 A13 Downconverter Measurement Locations - High Band



7. Connect a power meter to the loose end of the cable coming from the signal generator.
8. Tune the signal generator to 20 GHz with a power level of -28 dBm.
9. Adjust the signal generator power level until the level on the power meter reads -28 dBm, ± 0.25 dB.

10. Referring to **Figure 10-12**, remove W42 from the A13A1 Downconverter J9.
11. Remove the power meter from the cable connected to the signal generator and connect the cable to A13 Downconverter J9.
12. Referring to **Figure 10-12**, remove W52 from A13 J7.
13. Connect a spectrum analyzer to A13 J7.
14. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.
15. Use the marker peak search function on the spectrum analyzer to verify that there is a 322.5 MHz signal at approximately -12 dBm.

If there is a signal as expected, the high band signal path is working properly.

If there is not a signal as expected, proceed to the next step to verify that the correct LO signal is present.
16. Referring to **Figure 10-10**, remove W61 from the A14 DDS LO Synthesizer J1.
17. Set the spectrum analyzer reference level to +20 dBm.
18. Remove the spectrum analyzer from A13 J7 and connect it to A14 J1.
19. Tune the spectrum analyzer to 5.080625 GHz.

$$\begin{aligned} 1^{\text{st}} \text{ LO} &= (\text{RF} + 1^{\text{st}} \text{ IF}) / \text{LO Multiplier} = (20 \text{ GHz} + 322.5 \text{ MHz}) / 4 \\ &= 5.080625 \text{ GHz} \end{aligned}$$

NOTE

If an RF input frequency other than 20 GHz is used, the above calculation can be used to determine what frequency the LO output of the A14 DDS LO Synthesizer should be at. To find the correct LO multiplier for the RF input frequency used see **Table 10-9**.

-
20. Use the marker peak search function on the spectrum analyzer to verify that the first LO signal is at 5.080625 GHz at a power level of approximately +15 dBm.

If the frequency and power level are as expected, repeat steps 13 through 15. If the 322.5 MHz signal measured in step 15 is still not correct, inspect ribbon cable W7 that powers and controls the A13A1 Downconverter to verify that it is not damaged and are connected properly on both ends. If there is nothing wrong with the ribbon cable, replace the A13 Downconverter.

If the frequency or power level are not as expected, see [Chapter 14, “LO Synthesizer,”](#) to determine why the A14 DDS LO Synthesizer J1 output is not correct.

NOTE

Be sure to account for the cable loss when making power level measurements. If a power level still appears to be a low, a power meter should also be used to make a more accurate measurement.

External Mixing Diplexer

For a perceived problem with the external mixing LO output or IF input of the A13 Downconverter, see the [“External Mixing Signal Path”](#) section in [Chapter 7, “Signal Path Verification.”](#)

11 Front End Control

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 332](#)

[Troubleshooting Equipment Required on page 333](#)

[A15 Front End Controller on page 334](#)

[Overview on page 334](#)

[Functional Verification on page 337](#)

[Front End Component Control on page 338](#)

[A9 / A10 Step Attenuators Control on page 338](#)

[A11 Band Switch on page 338](#)

[A13 Downconverter on page 338](#)

[A12 Yig Tuned Filter on page 339](#)

[A13SW1 / A13SW2 on page 343](#)

[SW3 Low Noise Path Switch \(Option LNP Only\) on page 346](#)

[SW4 Microwave Preselector Bypass Switch on page 349](#)

[Narrowband IF Routing on page 352](#)

[Auxiliary IF Outputs on page 354](#)

[Second IF Output on page 355](#)

[Arbitrary IF Output on page 357](#)

[Fast Log Video on page 359](#)

Overview

There are two different assemblies that control the front end components in the instrument. The assembly used to control each of these can be seen in [Table 11-1](#).

Table 11-1 **Front End Component Controllers**

Front End Component	Controlled By
A9 / A10 Step Attenuators	A15 Front End Controller
A11 Band Switch	A15 Front End Controller
A12 Yig Tuned Filter	A15 Front End Controller
A13 Downconverter	A15 Front End Controller
A13SW1/2 Filter Switches	A15 Front End Controller
A25 Wideband Calibrator	A23 IF Mux
SW1 Calibrator Switch	A23 IF Mux
SW2 Low Noise Amplifier Switch	A23 IF Mux
SW3 Low Noise Path Switch	A15 Front End Controller
SW4 Microwave Preselector Bypass Switch	A15 Front End Controller

This chapter will only cover the A15 Front End Controller, as the main function of the other controlling assembly is not as a controller of the front end components.

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 22, "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 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 26.5 GHz

Power Meter

Minimum frequency range: 10 MHz to 26.5 GHz¹

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

Miscellaneous

Oscilloscope: 500 MHz, 1 M Ω input

Multimeter (Voltage and Resistance)

Fine Point Multimeter Test Leads – (Keysight Part Number 34138-37904)

Misc. cables and adapters

NOTE

The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. Higher than 26.5 GHz will be needed if the instrument has option 544 or 550.

A15 Front End Controller

Overview

The A15 Front End Controller provides a variety of functions in the instrument, which include:

Front End Component Control

- A9 / A10 Step Attenuators
- A11 Band Switch
- A12 Yig Tuned Filter
- A13 Downconverter
- A13SW1 / A13SW2 Filter Switches
- SW3 Low Noise Path Switch
- SW4 Microwave Preselector Bypass Switch

Narrowband IF Routing

- 10 / 25 MHz Bandwidth
- 40 MHz Bandwidth

Auxiliary IF Outputs

- Second IF Output – Option CR3
- Arbitrary IF Output – Option CRP
- Fast Log Video – Option ALV

The connections to and from the A15 Front End Controller are listed in **Table 11-2**, as seen in **Figure 11-1**.

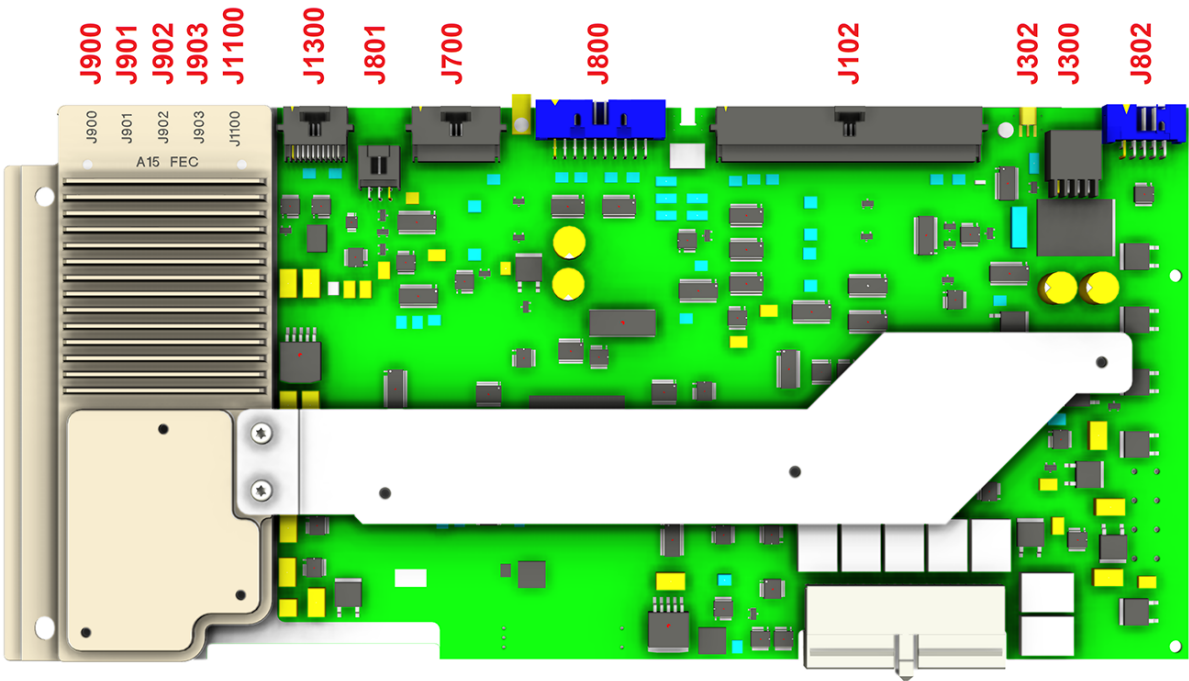
Table 11-2 **A15 Front End Controller Connections**

Port	Description	To / From	Cable
J102	A13A1 Downconverter Control	To A13A1 Downconverter J12	W7
J300	A12 Yig Tuned Filter Control	To A12 Yig Tuned Filter J1	W23
J302	Yig Tuned Filter Ramp	--	--
J700	A11 Band Switch Control	A11 Band Switch J4	W5
J800	A9/A10 Attenuator Control	To A9/A10 Attenuators	W3
J801	A13SW1/2 & SW4 Control	To SW4, A13SW1/222, & A11 J2	W21
J802	SW3 LNP Switch Control	To SW3 LNP Switch	W4
J900	10/25 MHz IF Output	To A2 25 MHz Analog IF J100	W101

Table 11-2 A15 Front End Controller Connections

Port	Description	To / From	Cable
J901	40 MHz IF Output	To A3 40 MHz Digital IF J15	W102
J902	Narrowband IF Input	From A23 IF Mux J42	W117
J903	Not used	--	--
J1100	Auxiliary IF Output	To Rear Panel Aux IF Out	W103
J1300	A13A2 Switched IF Filter Control	To A13A2 Switched IF Filter J1	W9

Figure 11-1 A15 Front End Controller Connections



Front End Control
A15 Front End Controller

The A15 Front End Controller will identify itself on the instrument Hardware Information screen as the **Front End Controller**, as seen in **Figure 11-2**.

Figure 11-2 Hardware Information Screen – A15 Front End Controller

System Settings

< System

Hardware Information

?

✖

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

Analog IF

N902060290

79204100103

011

1

A

57

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Digital IF

N902060016

79204100250

035

3

A

34

Front End Controller

N902060295

79204100620

009

0

A

131

Power On

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Restore Defaults

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Alignments

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Licensing

Front End

N904160039

78203535226

000

1

A

270

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

Service

SCPI Recorder

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A15 Front End Controller, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is a **Front End Controller** in the list of hardware assemblies, as seen in **Figure 11-2**. 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 25, “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.

- A15 Front End Controller assembly is defective

Solution: Replace the A15 Front End Controller 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.”**

Front End Component Control

The following sections will outline how the control of the different front end components can be verified. However, due to the design of the control board and the components that it controls, as well as the types of ribbon cables that are used, it can be difficult to make actual measurements of the control lines and voltages. For some of these, just being able to verify that the desired results are achieved is all that can be done.

A9 / A10 Step Attenuators Control

For information on verifying the control of the A9 and A10 Step Attenuators see the **“A9 / A10 Step Attenuators”** section in **Chapter 9, “RF Input Section.”**

A11 Band Switch

Unfortunately, there is no reasonable way to troubleshoot or verify the control of the A11 Band Switch, or the functionality on the A15 Front End Controller that relates to it. The only thing that can be done is to verify that the A11 Band Switch itself is working properly with the use of the **“A11 Band Switch”** section in **Chapter 9, “RF Input Section.”**

A13 Downconverter

Unfortunately, there is no reasonable way to troubleshoot or verify the control of the A13 Downconverter, or the functionality on the A15 Front End Controller that relates to it. The only thing that can be done is to verify that the A13 Downconverter itself is working properly with the use of the **“A13 Downconverter”** section in **Chapter 10, “Downconverter.”**

A12 Yig Tuned Filter

Control of the A12 YIG Tuned Filter comes from the A15 Front End Controller J300 through W23, as seen in **Figure 11-3**. The pinout of J300 can be seen in **Table 11-3**.

Figure 11-3 A15 Front End Controller J300 / W23 Location

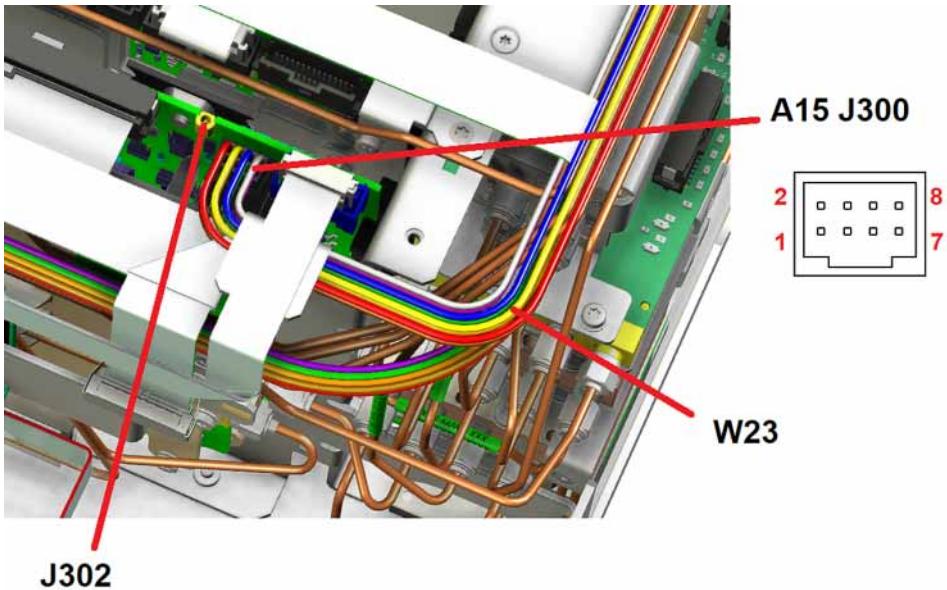


Table 11-3 A15 Front End Controller J300 Pinout

Pin #	Wire Color	Signal	Typical Voltage (DC)
1	Brown	Main Coil +	+32 Volts
2	Red	Main Coil -	+28 Volts (@ 10 GHz)
3	Orange	Power Supply	+30 Volts
4	Yellow	Ground	0 Volts
5	Green	Serial Clock	--
6	Blue	Serial In	--
7	Violet	Serial Out	--
8	Gray	Select	--

NOTE

For detailed information on the A12 Yig Tuned Filter see the “A12 Yig Tuned Filter” section in Chapter 9, “RF Input Section.”

There are three parts of the control for the A12 Yig Tuned Filter. They are:

1. **Power Supply**
2. **Serial Communication**
3. **Main Coil Drive**

As seen in **Table 11-3**, the power supply at pin #3 is a +30 volt supply. This is regulated from the +32 volt supply on the A15 Front End Controller. This provides power to the A12 Yig Tuned Filter for the heater chip and control, as well as to power the serial communication through a +3.3 volt regulator. If pin #3 is not at +30 volts, the instrument will not be able to communicate with the A12 Yig Tuned Filter.

The serial communication is required for the instrument to be able to identify the A12 Yig Tuned Filter. If the instrument cannot communicate with the filter, it will not control it. The serial communication on the A12 Yig Tuned Filter is powered by a +3.3 voltage regulator on it that is powered by the +30 volt supply.

The main coil drive provides the current required to tune the filter. The current creates a magnetic field inside the filter to tune the resonance of the YIG spheres. The higher the current, the stronger the magnetic field, the higher the tuned frequency. The sensitivity of the A12 Yig Tuned Filter is approximately 75 MHz / mA.

Pins #1 and #2 of J300 on the A15 Front End Controller provide the main coil drive. These lines go directly to both ends of the main coil in the A12 Yig Tuned Filter. The resistance of the main coil should be no more than 40 ohms. Pin #1 is a +32 volt supply from the A15 Front End Controller going to one end of the main coil and pin #2 is the voltage coming back from the other end of the main coil. If there is no voltage on pin #1, there is a problem with either the A15 Front End Controller or the A6 Power Supply. If there is +32 volts on pin #1 but nothing on pin #2, there is a problem with either W23 or the A12 Yig Tuned Filter.

There is a serial DAC on the A15 Front End Controller that provides the voltage required to control the main coil current driver. The output voltage level of this DAC can be measured at J302, as seen in **Figure 11-3**.

Use the following procedure to verify the control of the A12 Yig Tuned Filter.

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 frequency of the instrument to 10 GHz by pressing Frequency, Center Frequency 10 GHz.**
5. **Set the instrument span to 0 Hz by pressing Zero Span.**

6. Referring to **Figure 11-3**, use a DC voltmeter to measure the voltage on pin #3 of J300. It should measure between +27 and +31 volts.

If the voltage on pin #3 is as expected, proceed to **step 8**.

If the voltage on pin #3 is not as expected, proceed to the next step.
7. Measure the voltage on pin #1. It should measure between +30 and +33 volts.

If the voltage on pin #1 is as expected, and pin #3 is not, replace the A15 Front End Controller.

If the voltage on pin #1 is not as expected, see the **“Power Supply Verification”** section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A15 Front End Controller.
8. Measure the voltage on pin #2. It should measure between +24 and +30 volts at this frequency.

If the voltage on pin #2 is as expected, proceed to **step 10**.

If the voltage on pin #2 is not as expected, proceed to the next step.
9. Turn off the instrument and measure the resistance between pins #1 and #2. It should measure between 20 and 40 ohms.

If the resistance of the main coil is not as expected, inspect the W23 cable harness for any damage. If the cable is not damaged and is plugged in at both ends properly, replace the A12 Yig Tuned Filter.

If the resistance of the main coil is as expected, replace the A15 Front End Controller.
10. Referring to **Figure 11-3**, connect a voltmeter to J302 of the A15 Front End Controller.
11. Tune the instrument to 4 GHz by pressing **Frequency, Center Frequency 4 GHz**.
12. Set the span to 0 Hz by pressing **Span, Zero Span**.
13. Read the voltage on the meter and compare it to the expected value in **Table 11-4** for the frequency the instrument is set to for the the A12 Yig Tuned Filter used.

If the voltage level is as expected, proceed to the next step.

If the voltage level is not as expected, replace the A15 Front End Controller.
14. Repeat steps 11 through 13 for the rest of the frequencies in **Table 11-4** that the instrument can tune to.

NOTE

Instruments with option 508, 513 and 526 are considered μ Wave instruments. While instruments with option 544 or 550 are considered millimeter wave instruments.

Table 11-4 Typical J302 Voltage versus Frequency

Frequency	Voltage		
	μ Wave	Millimeter Wave	Option 555
4 GHz	1.2 volts	0.63 volts	0.59 volts
10 GHz	3.1 volts	1.75 volts	1.51 volts
20 GHz	6.2 volts	3.63 volts	3.04 volts
26.5 GHz	8.3 volts	4.83 volts	4.04 volts
30 GHz	--	5.48 volts	4.58 volts
40 GHz	--	7.36 volts	6.12 volts
44 GHz	--	8.10 volts	6.73 volts
50 GHz	--	9.25 volts	7.67 volts
55 GHz	--	--	8.45 volts

A13SW1 / A13SW2

Control of the A13SW1/2 Filter Switches comes from the A15 Front End Controller J801 through W21, as seen in **Figure 11-4**. The pinout of J801 can be seen in **Table 11-5**.

Figure 11-4 A15 Front End Controller J801 / W21 Location

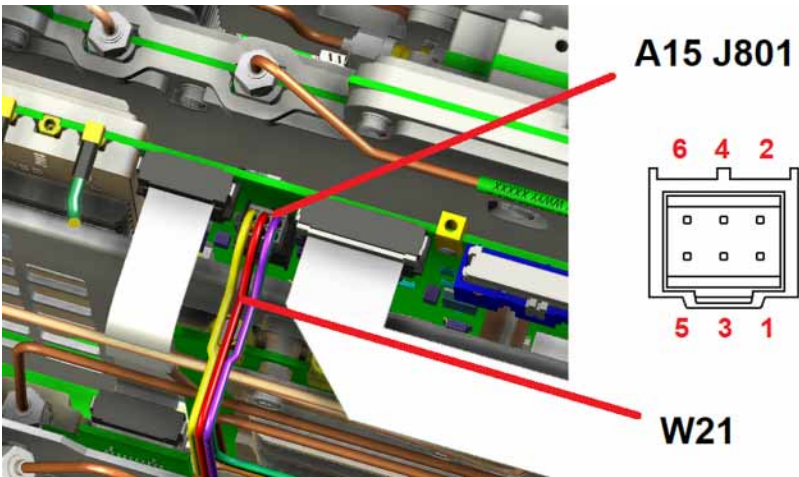


Table 11-5 A15 Front End Controller J801 Pinout

Pin #	Wire Color	Controls	Signal
1	Green	SW4 MPB Switch	Bypass Path
2	Violet	A13SW1/2	1.5 GHz Filter
3	Black	SW4 MPB Switch	+25 Volts
4	Red	A13SW1/2	+25 Volts
5	Orange	SW4 MPB Switch	Standard Path
6	Yellow	A13SW1/2	150/280 MHz Filter

NOTE

For detailed information on the A13SW1/2 Filter Switches see the “**Selectable First IF Bandwidth Filtering**” section in **Chapter 10, “Downconverter.”**

As can be seen in **Table 11-5**, J801 and W21 are used to control not only the A13SW1/2 Filter Switches, but also the SW4 MPB switch. This section is only going to focus on the A13SW1/2 Filter switches control.

While the two A13SW1/2 Filter switches are separate switches, they are controlled by the same control lines. They are powered by a +25 volt supply on pin #4 of J801. Pins #2 and #6 are used to control the switch state. Both are floating at approximately +24 volts when the switch is in a static state. The switch control on the A15 Front End Controller will pull the line it wants to enable down to 0 volts for about 20 ms to activate that state of the switch. If

pin #2 is pulled low it will bypass the A13A1 Switched IF Filter and use the A13FL1 Wideband IF Filter, and if pin #6 is pulled low it will use the A13A1 Switched IF Filter.

Use the following procedure to verify the control of the A13SW1/2 Filter Switches.

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. Tune the frequency of the instrument to 2 GHz by pressing **Frequency, Center Frequency 2 GHz**.
5. Verify that the instrument is using the 10 MHz IF path by pressing **Meas Setup, IF Path, IF Path, 10 MHz**.
6. Referring to **Figure 11-4**, use a DC voltmeter to measure the voltage on Pin #4 of J801. It should be between +23 and +26 volts.

If the voltage on pin #4 is as expected, proceed to the next step.

If the voltage on pin #4 is not as expected, see the **“Power Supply Verification”** section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A15 Front End Controller.

7. Setup an oscilloscope with the following settings:

Input Impedance = 1 M Ω

Y-Scale = 5 V / Division

X-Scale = 5 ms / Division

Trigger = Negative Edge

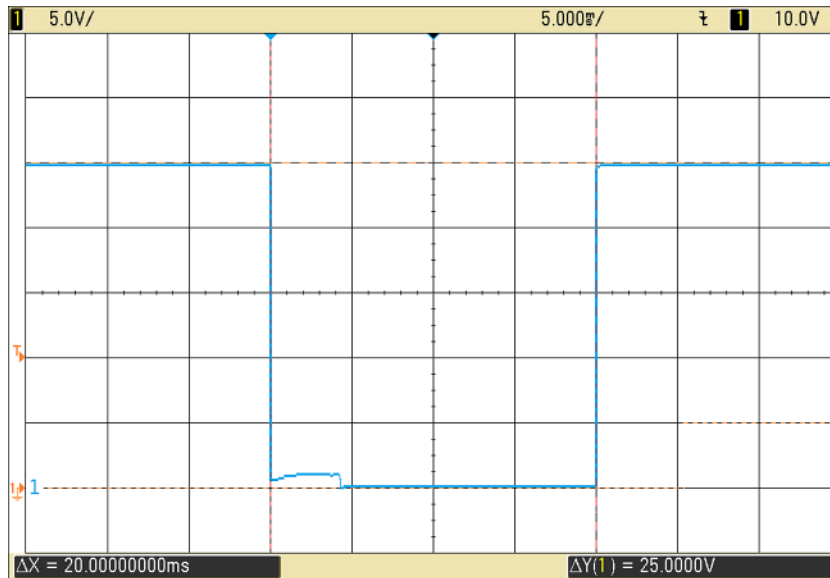
Trigger Level = 10 V

8. While probing pin #2 of J801 with the oscilloscope, switch the IF path to 1 GHz by pressing **IF Path, 1 GHz**.
9. Verify that there is a negative going pulse on the oscilloscope screen for approximately 20 ms, as seen in **Figure 11-5**.

If there is a negative going pulse on the oscilloscope display as expected, proceed to the next step.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A15 Front End Controller.

Figure 11-5 A13SW1/2 Filter Switch Control Signal



10.While probing pin #6 of J801 with the oscilloscope, switch the IF path to 10 MHz by pressing **IF Path, 10 MHz**.

11.Verify that there is a negative going pulse of the oscilloscope screen for approximately 20 ms, as seen in **Figure 11-5**.

If there is a negative going pulse on the oscilloscope display as expected, control of the A13SW1/2 Filter Switches appears to be working properly.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A15 Front End Controller.

SW3 Low Noise Path Switch (Option LNP Only)

Control of the SW3 Low Noise Path Switch comes from the A15 Front End Controller J802 through W4, as seen in **Figure 11-6**. The pinout of J802 can be seen in **Table 11-6**.

Figure 11-6 A15 Front End Controller J802 / W4 Location

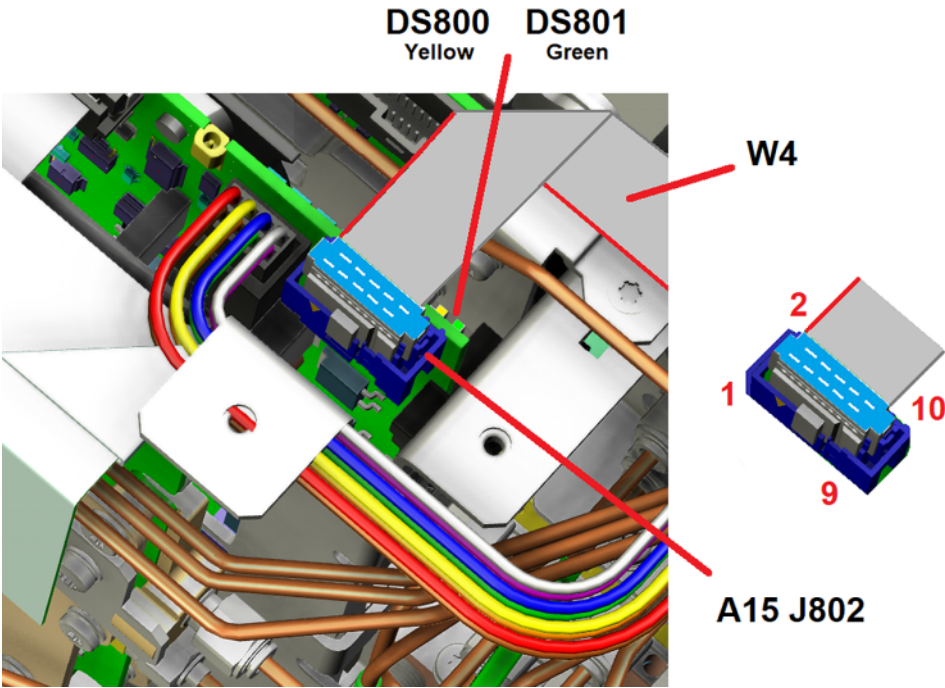


Table 11-6 A15 Front End Controller J802 Pinout

Pin #	Signal
1	+25 Volts
2	Ground
3	n/c
4	Bypass Status LED ^a
5	n/c
6	Standard Status LED ^a
7	Switch Control (TTL)
8	+5.2 Volts
9	Ground
10	n/c

a. Not active with option 555 instruments.

The SW3 Low Noise Path Switch is powered by a +25 volts supply on pin #1 of J802 and is controlled by a TTL level control signal on pin #7. It also has two status indicators built into the switch that indicate what state it is in. There are two LEDs (DS800 and DS801) on the A15 Front End Controller that display the status of the switch, as seen in [Figure 11-6](#).

NOTE

The SW3 Low Noise Path Switch status LEDs are not active in instruments with option 555, 55 GHz frequency range.

Table 11-7 SW3 Low Noise Path Switch LED Status versus μ W Path Control

μ W Path Control	Pin #7 (TTL)	DS801	DS800
Standard	Low	On	Off
Low Noise Path	High	Off	On
μ W Presel Bypass	Low	On	Off
Full Bypass	High	Off	On

While the voltage to drive the LEDs comes from the A15 Front End Controller, the SW3 Low Noise Path Switch controls which LED is turned on.

NOTE

For detailed information on the SW3 Low Noise Path Switch see the “[SW3 Low Noise Path Switch](#)” section in [Chapter 9, “RF Input Section.”](#)

When the instrument performs the hardware initialization when the instrument application starts, it attempts to switch the possible switch paths in the instrument and looks for certain indications that optional hardware that does not identify itself is installed. The SW3 Low Noise Path Switch is one of these that it looks for. If the instrument does not see any indication that the switch is there, the Low Noise Path selection under μ W Path Control will not be available, the two status indicator LEDs will not work, and the pin #7 voltage will always be 0 volts.

Use the following procedure to verify the control of the SW3 Low Noise Path Switch.

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 frequency of the instrument to 10 GHz by pressing **Frequency, Center Frequency 10 GHz**.
5. Set the instrument span to 0 Hz by pressing **Zero Span**.

6. Verify that the instrument recognizes the SW3 Low Noise Path Switch by pressing **Amplitude, Signal Path, μ W Path Control** and look for **Low Noise Path Enable**.

If **Low Noise Path Enable** is one of the selections available, proceed to **step 4**.

If **Low Noise Path Enable** is not one of the selections available, proceed to the next step.

7. Referring to **Figure 11-6**, use a DC voltmeter to measure the voltage on Pin #1 of J802. It should be between +23 and +26 volts.

If the voltage on pin #1 is as expected, replace the SW3 Low Noise Path Switch.

If the voltage on pin #1 is not as expected, see the **“Power Supply Verification”** section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A15 Front End Controller.

8. Verify that the instrument is in the Standard path by pressing **Amplitude, Signal Path, μ W Path Control, Standard Path**.

9. Measure the voltage on pin #7 of J802. It should measure ~0 volts.

If the voltage on pin #7 is as expected, proceed to the next step.

If the voltage on pin #7 is not as expected, replace the A15 Front End Controller.

10. Switch the instrument to the Low Noise Path by pressing **Amplitude, Signal Path, μ W Path Control, Low Noise Path Enable**.

NOTE

While the instrument will allow the uWave Path Control to be set to Low Noise Path Enable, it will not switch to the Low Noise Path if any part of the sweep is in Low Band (typically 3.6 GHz or less).

11. Measure the voltage on pin #7 of J802. It should measure between +4 and +5 volts.

If the voltage on pin #7 is as expected, control of the SW3 Low Noise Path Switch appears to be working properly.

If the voltage on pin #7 is not as expected, replace the A15 Front End Controller.

SW4 Microwave Preselector Bypass Switch

Control of the SW4 Microwave Preselector Bypass Switch comes from the A15 Front End Controller J801 through W21, as seen in **Figure 11-7**. The pinout of J801 can be seen in **Table 11-8**.

Figure 11-7 A15 Front End Controller J801 / W21 Location

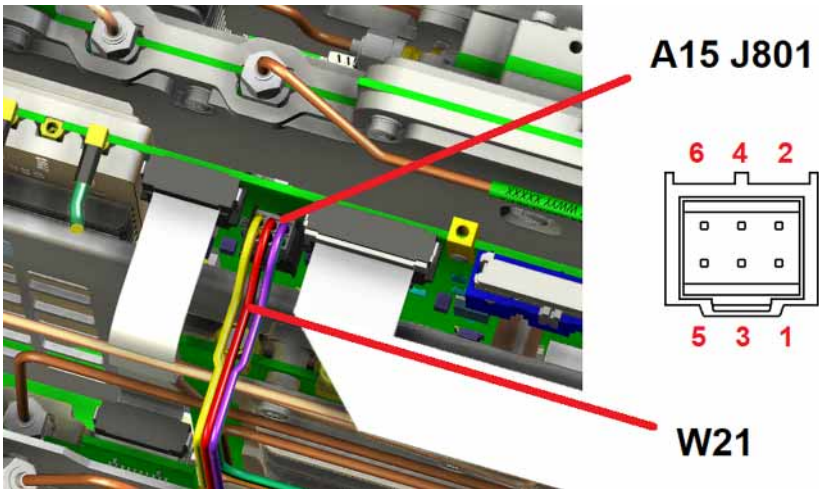


Table 11-8 A15 Front End Controller J801 Pinout

Pin #	Wire Color	Controls	Signal
1	Green	SW4 MPB Switch	Bypass Path
2	Violet	A13SW1/2	1.5 GHz Filter
3	Black	SW4 MPB Switch	+25 Volts
4	Red	A13SW1/2	+25 Volts
5	Orange	SW4 MPB Switch	Standard Path
6	Yellow	A13SW1/2	150/280 MHz Filter

NOTE

For detailed information on the SW4 Microwave Preselector Bypass Switch see the “**SW4 Microwave Preselector Bypass Switch**” section in **Chapter 9, “RF Input Section.”**

As can be seen in **Table 11-8**, J801 and W21 are used to control not only the SW4 MPB switch, but also the A13SW1/2 switches. This section is only going to focus on the SW4 MPB switch control.

The SW4 Microwave Preselector Bypass Switch is powered by a +25 volts supply on pin #3 of J801. Pins #1 and #5 are used to control the switch state. Both are floating at approximately +4 volts when the switch is in a static state. The switch control on the A15 Front End Controller will pull the line it wants to

enable down to 0 volts for about 20 ms to activate that state of the switch. If pin #1 is pulled low it will be in the standard path state, and if pin #5 is pulled low it will be in the bypass path state.

When the instrument performs the hardware initialization when the instrument application starts, it attempts to switch the possible switch paths in the instrument and looks for certain indications that optional hardware that does not identify itself is installed. The SW4 Microwave Preselector Bypass Switch is one of these that it looks for. If the instrument does not see any indication that the switch is there, the μ W Presel Bypass selection under μ W Path Control will not be available, and the instrument will not control it.

Use the following procedure to verify the control of the SW4 Microwave Preselector Bypass Switch.

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. Verify that the instrument recognizes the SW4 Microwave Preselector Bypass Switch by pressing **Amplitude, Signal Path, μ W Path Control** and look for **μ W Presel Bypass**.

If **μ W Presel Bypass** is one of the selections available, proceed to **step 6**.

If **μ W Presel Bypass** is not one of the selections available, proceed to the next step.

5. Referring to **Figure 11-7**, use a DC voltmeter to measure the voltage on Pin #3 of J801. It should be between +23 and +26 volts.

If the voltage on pin #3 is as expected, replace the SW4 Microwave Preselector Bypass Switch.

If the voltage on pin #3 is not as expected, see the **“Power Supply Verification”** section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A15 Front End Controller.

6. Setup an oscilloscope with the following settings:

Input Impedance = 1 M Ω

Y-Scale = 1 V / Division

X-Scale = 5 ms / Division

Trigger = Negative Edge

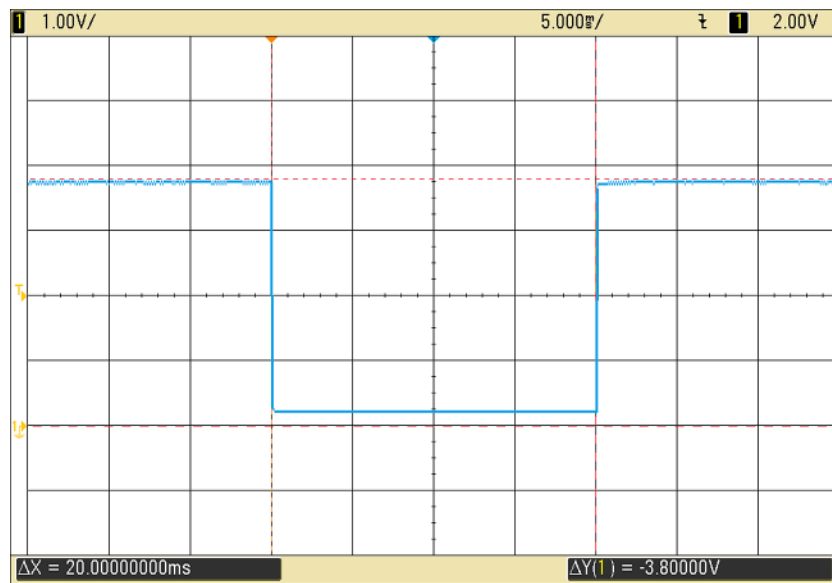
Trigger Level = 2 V

7. While probing pin #5 of J801 with the oscilloscope, switch the state of the SW4 Microwave Preselector Bypass Switch to the bypass path by selecting **μW Presel Bypass**.
8. Verify that there is a negative going pulse of the oscilloscope display for approximately 20 ms, as seen in **Figure 11-8**.

If there is a negative going pulse on the oscilloscope display as expected, proceed to the next step.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A15 Front End Controller.

Figure 11-8 SW4 Microwave Preselector Bypass Switch Control Signal



9. While probing pin #1 of J801 with the oscilloscope, switch the state of the SW4 Microwave Preselector Bypass Switch to the standard path by selecting **Standard Path**.
10. Verify that there is a negative going pulse of the oscilloscope display for approximately 20 ms, as seen in **Figure 11-8**.

If there is a negative going pulse on the oscilloscope display as expected, control of the SW4 Microwave Preselector Bypass Switch appears to be working properly.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A15 Front End Controller.

Narrowband IF Routing

When the IF path selection of the instrument is 40 MHz or less, the A15 Front End Controller is responsible for routing the IF to either the A2 25 MHz Analog IF or the A3 40 MHz Digital IF. When the IF path is 10 MHz or 25 MHz, or when the instrument is sweeping, the signal is routed to the A2 25 MHz IF, and when the IF path is 40 MHz it is routed to the A3 40 MHz Digital IF, as can be seen in [Figure 11-9](#) and [Figure 11-10](#).

Figure 11-9 Narrowband IF Routing - IF Path = 10/25 MHz

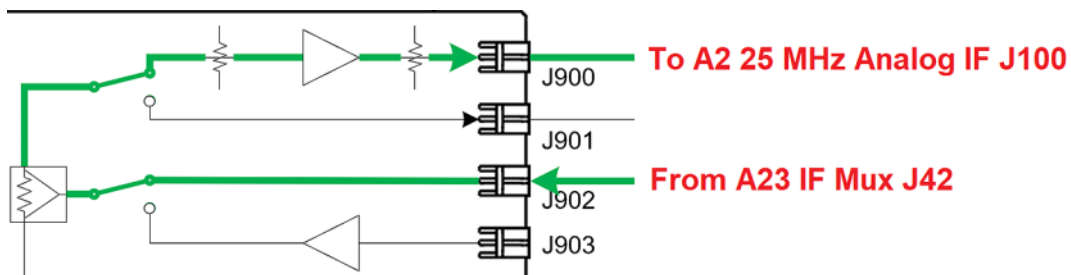
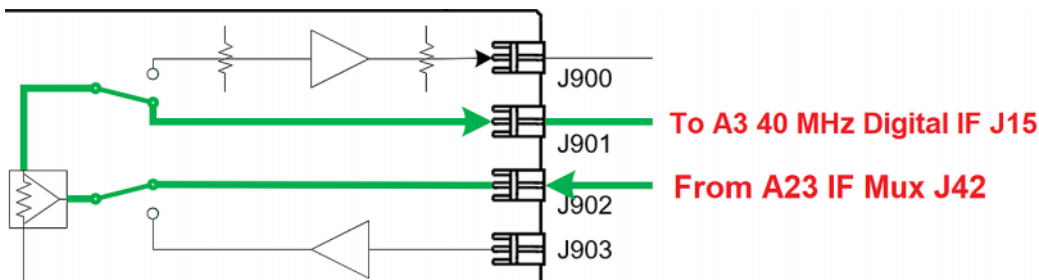


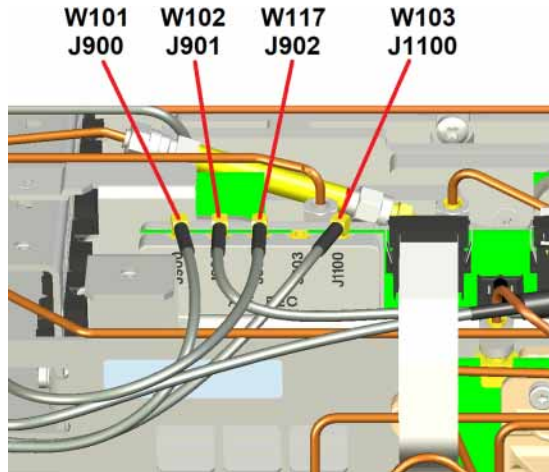
Figure 11-10 Narrowband IF Routing - IF Path = 40 MHz



The following procedure can be used to verify the functionality of the narrowband IF routing on the A15 Front End Controller.

1. Change the instrument mode to IQ Analyzer 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 IF path is set to 10 MHz by pressing **Meas Setup, IF Path, IF Path, 10 MHz**.
5. Referring to [Figure 11-11](#), remove W117 from J902 of the A15 Front End Controller.

Figure 11-11 A15 Front End Controller IF Connections



6. Connect a signal generator to J902.
7. Tune the signal generator to 322.5 MHz with a power level of -10 dBm.
8. Remove W101 from J900.
9. Connect a spectrum analyzer to J900.
10. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.
11. Verify that there is 322.5 MHz signal on the spectrum analyzer screen at approximately -10 dBm.
If the power level is as expected, proceed to the next step.
If the power level is not as expected replace the A15 Front End Controller.

NOTE

Be sure to account for the cable loss when making power level measurements. If a power level still appears to be a low, a power meter should also be used to make a more accurate measurement.

12. Change the IF path to 40 MHz by pressing **Meas Setup, IF Path, IF Path, 40 MHz**.
13. Tune both the signal generator and the spectrum analyzer to 250 MHz.
14. Remove W102 from J901 of the A15 Front End Controller.
15. Move the spectrum analyzer from J900 to J901.
16. Verify that there is 250 MHz signal on the spectrum analyzer screen at approximately -18 dBm.
If the power level is as expected, the narrowband IF routing on the A15 Front End Controller is working properly.
If the power level is not as expected replace the A15 Front End Controller.

Auxiliary IF Outputs

The A15 Front End Controller can route one of three different signals to the rear panel Aux IF Out port. They are:

- Second IF Output – Option CR3
- Arbitrary IF Output – Option CRP
- Fast Log Video – Option ALV

Control for this output is found on the **Input/Output**, **Output**, **Aux IF Out** menu, as seen in **Figure 11-12**.

Figure 11-12 Aux IF Out Menu



NOTE

If any of these options is not installed, it will not appear as a selection under the Aux IF Out drop-down menu.

The following sections will outline how to verify that each of the Aux IF Out selections are functioning properly.

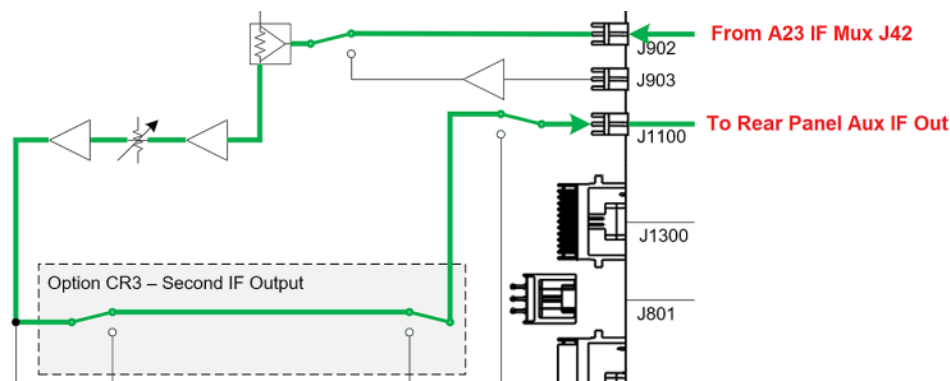
Second IF Output

The second IF output is only available when option CR3 is installed. This will route the second IF to the rear panel Aux IF Out connector. A list of the Aux IF Out frequencies versus IF path selected is seen in **Table 11-9**, and a block diagram of the circuit used for this is seen in **Figure 11-13**.

Table 11-9 Aux IF Out Frequency versus IF Path

IF Path	Aux IF Out Frequency
Swept SA	322.5 MHz
10/25 MHz	322.5 MHz
40 MHz	250 MHz

Figure 11-13 Second IF Output Block Diagram



NOTE

While this Aux IF Out selection is called “Second IF”, it is technically only the second IF for frequencies of 3.6 GHz and lower, as frequencies above 3.6 GHz are only downconverted once at this point.

When the IF Path is 40 MHz or narrower the instrument will continue to make measurements when the Second IF is selected. However, if a bandwidth wider than 40 MHz is selected the instrument will stop making live measurements and the following message will be displayed:

No Result; Meas invalid with this IF path and Aux IF Out setting

The following procedure can be used to verify the functionality of the second IF output. This procedure assumes that the instrument is able to properly display signals on screen for all the different IF paths. If there are any problems with the instrument displaying signals on screen, resolve those issues before proceeding with this verification of the second IF output.

Since this procedure will be verifying the functionality of an intermediate frequency, and it is assumed that the instrument is able to display signals on screen, this procedure will test one input frequency with one IF path. Any other input frequency or IF path of interest could also be used.

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 frequency of the instrument to 2 GHz by pressing **Frequency, Center Frequency 2 GHz**.
5. Set the instrument span to 0 Hz by pressing **Zero Span**.
6. Connect a signal generator to the instrument RF input.
7. Tune the signal generator to 2 GHz with a power level of -10 dBm.
8. Verify that there is a signal on screen with a power level of approximately -10 dBm.

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

If there is not a signal as expected, see the “**Front Panel Troubleshooting**” section in **Chapter 5, “First-Look Troubleshooting,”** to determine why there is no signal on screen for the 10 MHz IF Path and resolve the issue before proceeding with this procedure.

9. Place a marker on the peak of the 2 GHz signal by pressing **Marker**.
10. Adjust the signal generator power level until the 2 GHz signal on the screen of the instrument measures -10 dBm, ± 0.5 dB.
11. Connect a spectrum analyzer to the rear panel **Aux IF Out** connector.
12. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.
13. Turn on the Second IF output by pressing **Input/Output, Output, Aux IF Out, Second IF**.
14. Verify that there is a 322.5 MHz signal on the spectrum analyzer display at a power level of approximately -24 dBm or greater.

If there is a signal as expected, the Second IF output is working properly.

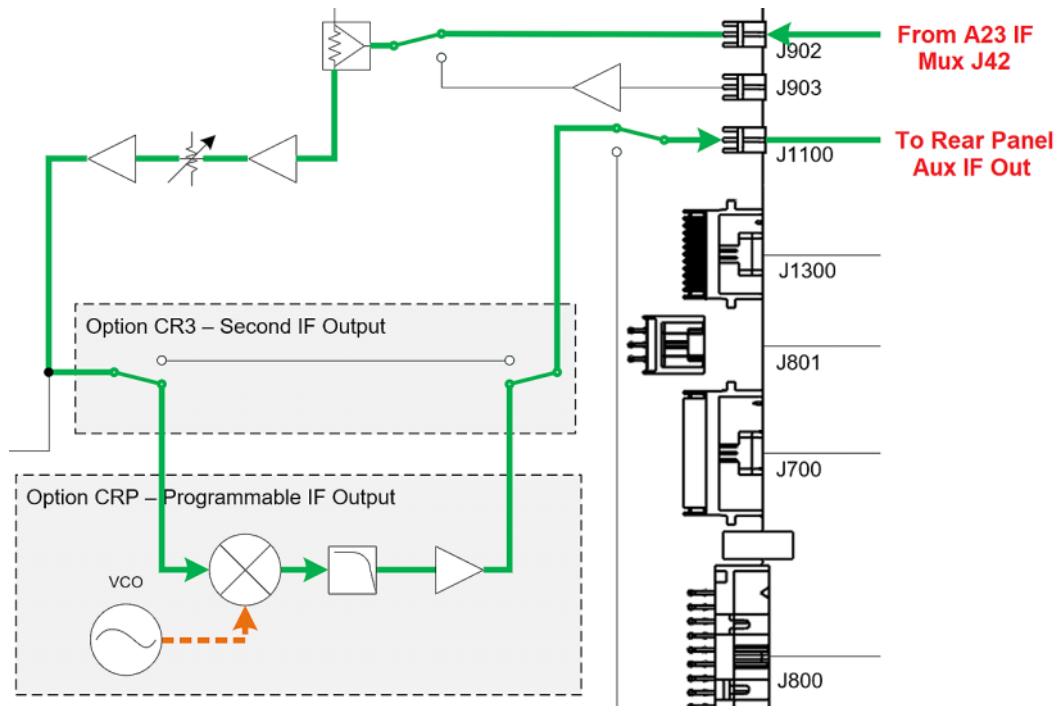
If there is a signal on screen, but the power level is lower than expected, run the Front End Controller Attenuator Adjustment. See **Chapter 26, “Performance Verification and Adjustment Software,”** for information on this.

If there is no signal at all replace the A15 Front End Controller.

Arbitrary IF Output

The arbitrary IF output is only available when option CRP is installed. This will output an IF with a selectable output frequency, from 10 MHz to 75 MHz. However, it only works when the IF path is 40 MHz or narrower. A block diagram of the circuit used for this is seen in **Figure 11-14**.

Figure 11-14 Arbitrary IF Output Block Diagram



The following procedure can be used to verify the functionality of the arbitrary IF output. This procedure assumes that the instrument is able to properly display signals on screen for all the different IF paths. If there are any problems with the instrument displaying signals on screen, resolve those issues before proceeding with this verification of the arbitrary IF output.

Since this procedure will be verifying the functionality of an intermediate frequency, and it is assumed that the instrument is able to display signals on screen, this procedure will test just one input frequency and two output frequencies. Any other input and/or output frequencies of interest could also be used.

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 frequency of the instrument to 2 GHz by pressing **Frequency, Center Frequency 2 GHz**.
5. Set the instrument span to 0 Hz by pressing **Zero Span**.
6. Connect a signal generator to the instrument RF input.
7. Tune the signal generator to 2 GHz with a power level of -10 dBm.
8. Verify that there is a signal on screen with a power level of approximately -10 dBm.

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

If there is not a signal as expected, see the “**Front Panel Troubleshooting**” section in **Chapter 5, “First-Look Troubleshooting,”** to determine why there is no signal on screen for the 10 MHz IF Path and resolve the issue before proceeding with this procedure.

9. Place a marker on the peak of the 2 GHz signal by pressing **Marker**.
10. Adjust the signal generator power level until the 2 GHz signal on the screen of the instrument measures -10 dBm, ± 0.5 dB.
11. Connect a spectrum analyzer to the rear panel **Aux IF Out** connector.
12. Tune the spectrum analyzer to 70 MHz with a span of 10 MHz.
13. Turn on the Second IF output by pressing **Input/Output, Output, Aux IF Out, Arbitrary IF**.
14. Verify that there is a 70 MHz signal on the spectrum analyzer display at a power level of approximately -24 dBm or greater.

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

If there is a signal on screen, but the power level is lower than expected, run the Front End Controller Attenuator Adjustment. See **Chapter 26, “Performance Verification and Adjustment Software,”** for information on this.

If there is no signal at all replace the A15 Front End Controller.

15. Tune the arbitrary IF output frequency to 10 MHz by pressing **Arbitrary IF Freq 10 MHz**.
16. Tune the spectrum analyzer to 10 MHz.
17. Verify that there is a 10 MHz signal on the spectrum analyzer display at a power level of approximately -24 dBm or greater.

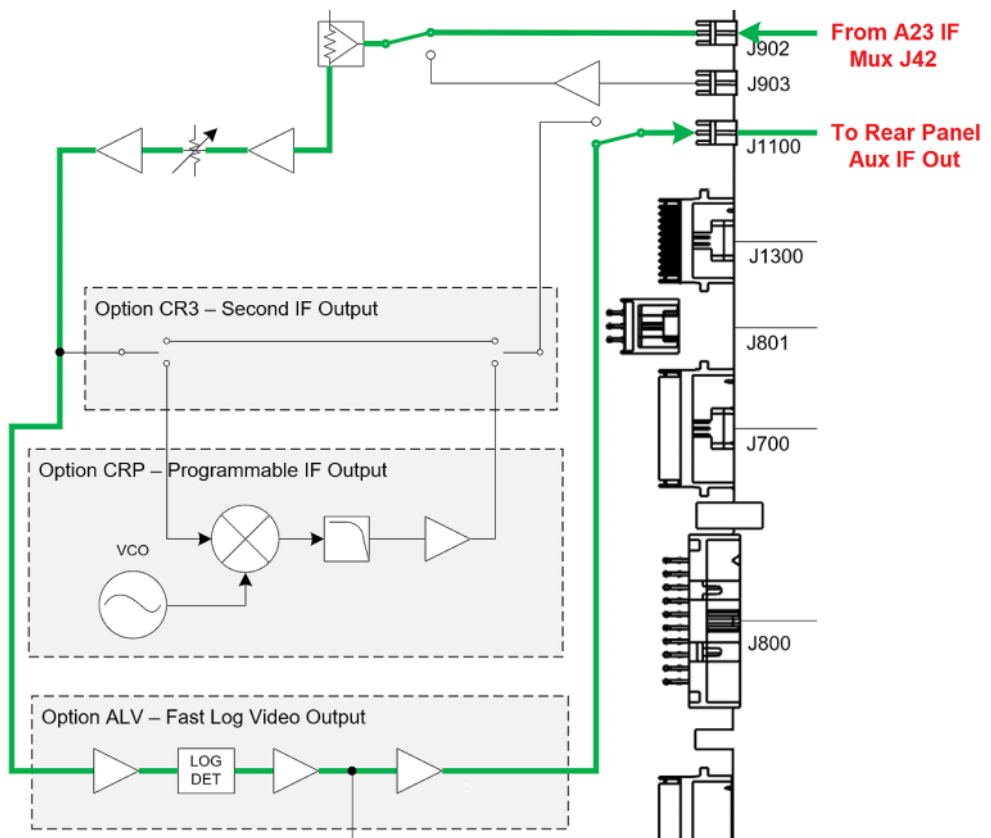
If there is a signal as expected, the Arbitrary IF output is working properly.

If there is not a signal as expected replace the A15 Front End Controller.

Fast Log Video

The fast log video output is only available when option ALV is installed. This will output a log envelope of the IF signal. The open circuit output level varies by about 25 mV per dB, with a top-of-screen signal producing about 1.6 Volts. A block diagram of the circuit used for this is seen in **Figure 11-15**.

Figure 11-15 Fast Log Video Block Diagram



The following procedure can be used to verify the functionality of the fast log video output. This procedure assumes that the instrument is able to properly display signals on screen for all the different IF paths. If there are any problems with the instrument displaying signals on screen, resolve those issues before proceeding with this verification of the arbitrary IF output.

Since this procedure will be verifying the functionality derived from an intermediate frequency, and it is assumed that the instrument is able to display signals on screen, this procedure will test just one input frequency. Any other input frequencies of interest could also be used.

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 frequency of the instrument to 2 GHz by pressing **Frequency, Center Frequency 2 GHz**.
5. Set the instrument span to 10 MHz by selecting **Span 10 MHz**.
6. Adjust the instrument reference level to -10 dBm by pressing **Amplitude, Ref Value -10 dBm**.
7. Connect a signal generator to the instrument RF input.
8. Tune the signal generator to 2 GHz with a power level of -10 dBm.
9. Verify that there is a signal on screen with a power level of approximately -10 dBm.

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

If there is not a signal as expected, see the “**Front Panel Troubleshooting**” section in **Chapter 5, “First-Look Troubleshooting,”** to determine why there is no signal on screen for the 10 MHz IF Path and resolve the issue before proceeding with this procedure.

10. Place a marker on the peak of the 2 GHz signal by pressing **Marker**.
11. Adjust the signal generator power level until the 2 GHz signal on the screen of the instrument measures -10 dBm, ± 0.25 dB.
12. Set the instrument span to 0 Hz by pressing **Frequency**, and selecting **Zero Span**.
13. Connect a DC voltmeter to the rear panel **Aux IF Out** connector.
14. Turn on the fast log video output by pressing **Input/Output, Output, Aux IF Out, Fast Log Video**.
15. Verify that the DC voltage level is approximately 1.6 volts.

If the DC output voltage is as expected, the Fast Log Video output is working properly.

If the DC output voltage is not as expected replace the A15 Front End Controller.

12 IF Routing

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 362](#)

[Troubleshooting Equipment Required on page 363](#)

[A23 IF Mux on page 364](#)

[Overview on page 364](#)

[IF Input Selection on page 367](#)

[IF Output Selection on page 368](#)

[4.8 GHz Reference Distribution on page 369](#)

[Front End Control on page 370](#)

[Functional Verification on page 371](#)

[IF Input Selection on page 372](#)

[IF Output Selection on page 374](#)

[4.8 GHz Reference Distribution on page 377](#)

[Front End Control on page 379](#)

[A25 Wideband Calibrator Control on page 379](#)

[SW1 Calibrator Switch and SW2 LNA Switch Control on page 379](#)

Overview

With the instrument having multiple ADCs, which are dependent on the IF signal path selected, there is a need for the IF signal to be routed to and from these assemblies. While the A15 Front End Controller does some of this for the narrowband IF paths, this is mainly handled by the A23 IF Mux assembly.

This chapter will only cover the A23 IF Mux assembly. For information on the narrowband IF routing that is handled by the A15 Front End Controller, see the **“Narrowband IF Routing”** section in **Chapter 11, “Front End Control.”**

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 22, “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 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 26.5 GHz

Power Meter

Minimum frequency range: 10 MHz to 26.5 GHz¹

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

Miscellaneous

Oscilloscope: 500 MHz, 1 M Ω input

Multimeter (Voltage and Resistance)

Fine Point Multimeter Test Leads – (Keysight Part Number 34138-37904)

Misc. cables and adapters

NOTE

The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. Higher than 26.5 GHz will be needed if the instrument has option 544 or 550.

A23 IF Mux

Overview

A23 IF Mux provides a variety of functions in the instrument, which include:

- IF Input Selection
- IF Output Selection
- 4.8 GHz Reference Distribution
- Front End Control
 - A25 Wideband Calibrator Control
 - SW1 Calibrator Switch and SW2 LNA Switch Control

The connections to and from the A23 IF Mux are listed in **Table 12-1**, as seen in **Figure 12-1**.

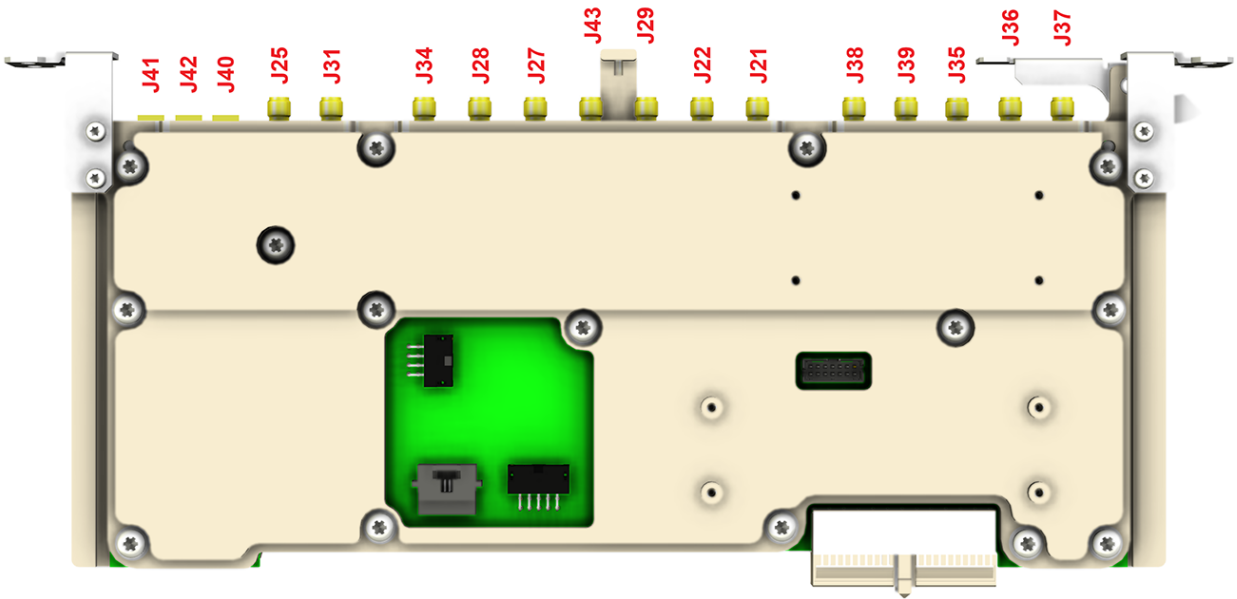
Table 12-1 **A23 IF Mux Connections**

Port	Description	To / From	Cable
J12	Bias & Control	From A8 Motherboard J8	--
J21	Not Used	50 ohm Termination	--
J22	Not Used	50 ohm Termination	--
J25	Not Used	50 ohm Termination	--
J27	Not Used	50 ohm Termination	--
J28	Downconverter Input	From A13 Downconverter J7	W52
J29	Not Used	50 ohm Termination	--
J31	Wide IF Output (CRW)	To Rear Panel Wide IF Out	W57
J34	Not Used	50 ohm Termination	--
J35	4.8 GHz Output	To A13 Downconverter J1	W78
J36	Not Used	50 ohm Termination	--
J37	4.8 GHz Input	From A16 Reference J702	W76
J38	Not Used	50 ohm Termination	--
J39	Not Used	50 ohm Termination	--
J40	1.5 / 2.0 GHz IF Path Output	To A21 Wideband DIF J7	W115
J41	255 MHz / 1.0 GHz IF Path Output	To A21 Wideband DIF J4	W116
J42	10 / 25 / 40 MHz IF Path Output	To A15 Front End Controller J902	W117

Table 12-1 A23 IF Mux Connections

Port	Description	To / From	Cable
J43	IF Input (EXM)	From A13 Downconverter J13	W71
J44	Not Used	--	--
P1	SW1 / SW2 Control	To SW1 and SW2	W20
P2	A25 Wideband Calibrator Control	To A25 Wideband Calibrator J1	W6

Figure 12-1 A23 IF Mux Connections



The A23 IF Mux will identify itself on the instrument Hardware Information screen as the **IF Mux-10GHz**, as seen in **Figure 12-2**.

Figure 12-2 Hardware Information Screen – A23 IF Mux

System Settings

< System

Hardware Information

↶

↷

?

✕

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

I/O Config

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

Preload / Unload Modes

Analog IF

N902060290

79204100103

011

1

A

57

User Interface

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Digital IF

N902060016

79204100250

035

3

A

34

Front End Controller

N902060295

79204100620

009

0

A

131

Power On

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Restore Defaults

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Alignments

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Licensing

Front End

N904160039

78203535226

000

1

A

270

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

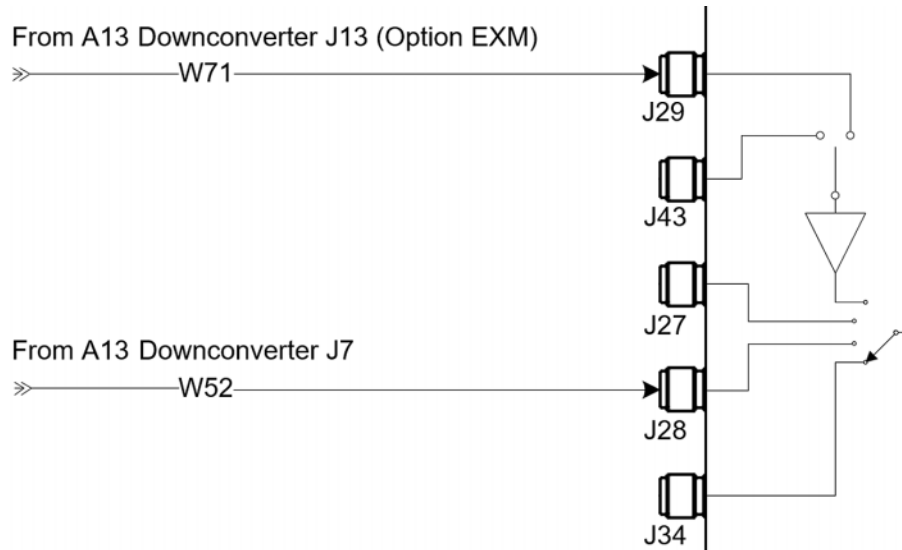
Service

SCPI Recorder

IF Input Selection

The input section of the A23 IF Mux has the ability to select one of five different IF inputs. However, in this application only two of them are used, as seen in the block diagram of **Figure 12-3**.

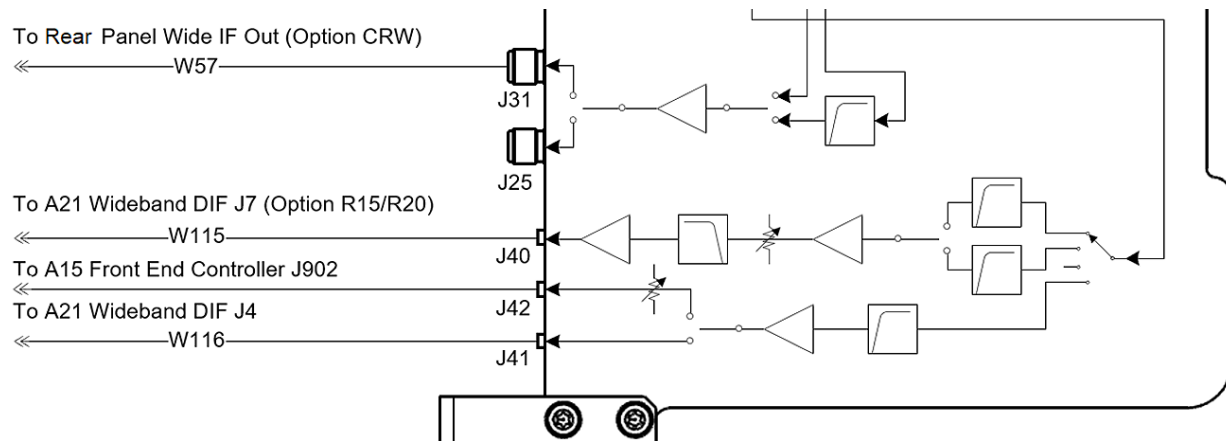
Figure 12-3 A23 IF Mux Input Selection Block Diagram



IF Output Selection

The output section of the A23 IF Mux is used to route the IF signal to one of the IF assemblies that the instrument can use, as seen in the block diagram of **Figure 12-4**. The instrument selects which output to use based on the IF Path selected.

Figure 12-4 A23 IF Mux Output Selection Block Diagram



The output at J31 requires option CRW to be used. It will route the IF signal directly to the rear panel Wide IF Out port for external digitization when the Ext/Wide IF Out is turned on.

The output at J40 requires option R15 or R20 to be used. It will route the IF signal to the A21 Wideband DIF J7 when either the 1.5 or 2.0 GHz IF Path is selected.

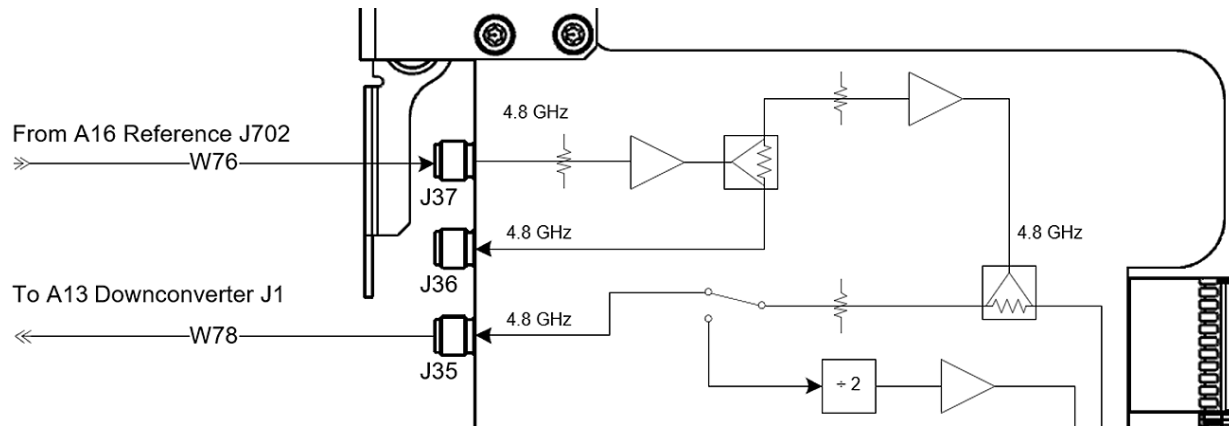
The output at J41 will route the IF signal to the A21 Wideband DIF J4 when the 255 MHz or 1.0 GHz IF Path is selected.

The output at J42 will route the IF signal to the A15 Front End Controller when the 10, 25, or 40 MHz IF Path is selected. The A15 Front End Controller will then route the signal to either the A2 25 MHz Analog IF or the A3 40 MHz Digital IF.

4.8 GHz Reference Distribution

The 4.8 GHz reference signal from the A16 Reference J702 is routed to the A23 IF Mux J37 where it is split and then routed to a few different places, as seen in **Figure 12-5**.

Figure 12-5 A23 IF Mux 4.8 GHz Reference Routing Block Diagram



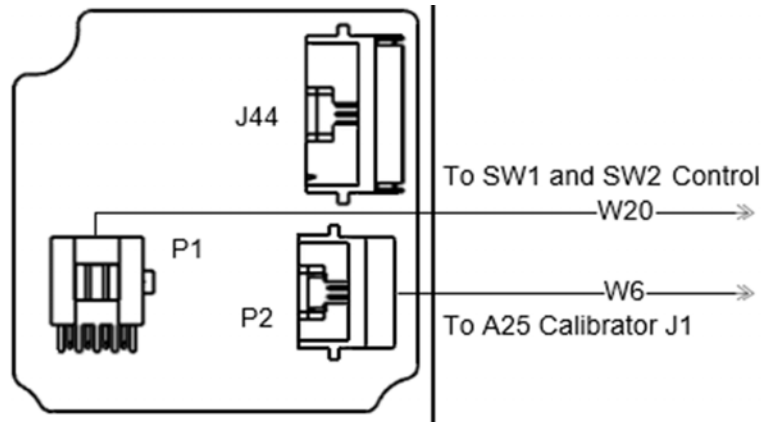
The 4.8 GHz output at J35 is routed to the A13 Downconverter J1 to provide the LO signal for the second mixer for Band 0 (≤ 3.6 GHz).

The input power level of the 4.8 GHz reference at J37 should be approximately +12 dBm, as will both output power levels.

Front End Control

The A23 IF Mux also controls the A25 Wideband Calibrator through ribbon cable W6 connected to P2, as well as the SW1 Calibrator Switch and the SW2 Low Noise Amplifier Switch through wire harness W20 connected to P1, as seen in **Figure 12-6**.

Figure 12-6 A23 IF Mux Front End Control



Functional Verification

Before proceeding to verify or troubleshoot the operation of the A23 IF Mux, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is an **IF Mux-10GHz** in the list of hardware assemblies, as seen in **Figure 12-2**. 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 25, “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
- A23 IF Mux assembly is defective
Solution: Replace the A23 IF Mux 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”**

The expected approximate signal levels in the following procedures are meant to be a rough estimate of what should be seen. Due to various gains in the system for the many different signal paths the values that are measured from instrument to instrument may vary by more than just a couple dB. These expected values are meant to be used, not as performance verification, but as a rough guide as to what should be expected. So do not be quick to replace an assembly just because the values measured are a little more than a few dB from what is expected.

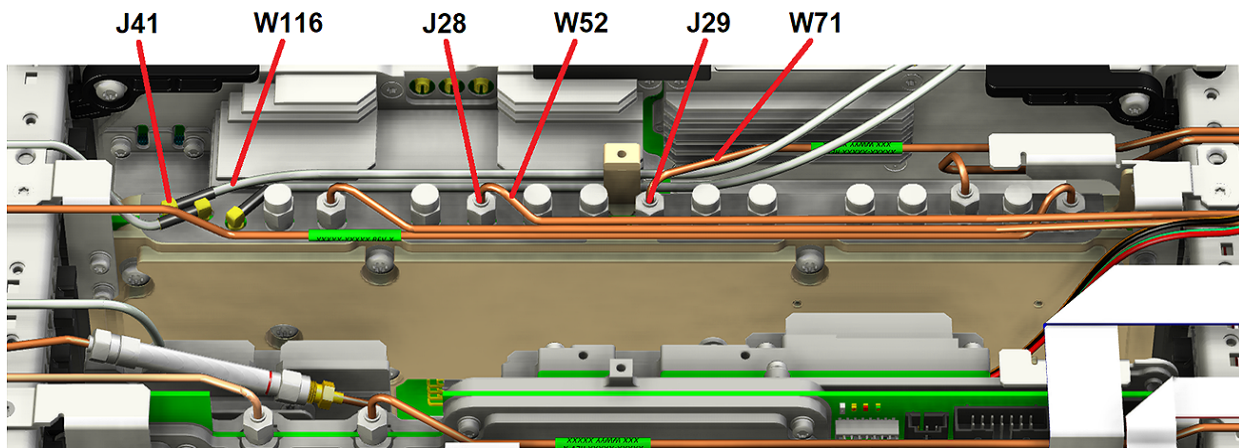
IF Input Selection

The procedure in this section can be used to verify that the A23 IF Mux IF input selection is working properly.

To verify the inputs to the A23 IF Mux it would be best to do so without changing the output used. The 255 MHz / 1.0 GHz IF path output at J41 is the output that the following verification procedure will use.

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 using the 1.0 GHz IF path by pressing **Meas Setup, IF Path, IF Path, 1.0 GHz**.
5. Referring to **Figure 12-7**, remove W52 from J28.

Figure 12-7 A23 IF Mux Input Connections



6. Tune a signal generator to 690 MHz at a power level of -20 dBm.
7. Connect the signal generator to the downconverter input at J28.
8. Remove W116 from J41.
9. Connect a spectrum analyzer to J41.
10. Tune the spectrum analyzer to 690 MHz with a span of 10 MHz.
11. Verify that there is a 690 MHz signal at approximately -12 dBm on the spectrum analyzer display.

If there is a signal as expected, the downconverter input is working properly, proceed to the next step.

If there is not a signal as expected, replace the A23 IF Mux.

12. Remove W71 from J29.
13. Move the signal generator from the downconverter input at J28 to the external mixing input at J29.
14. Enable the external mixing input by pressing **Input/Output**, **Select Input**, **External Mixer**.
15. Verify that there is a 690 MHz signal at approximately 0 dBm on the spectrum analyzer display.

If there is a signal as expected, the input selection section of the A23 IF Mux is working properly.

If there is not a signal as expected, replace the A23 IF Mux.

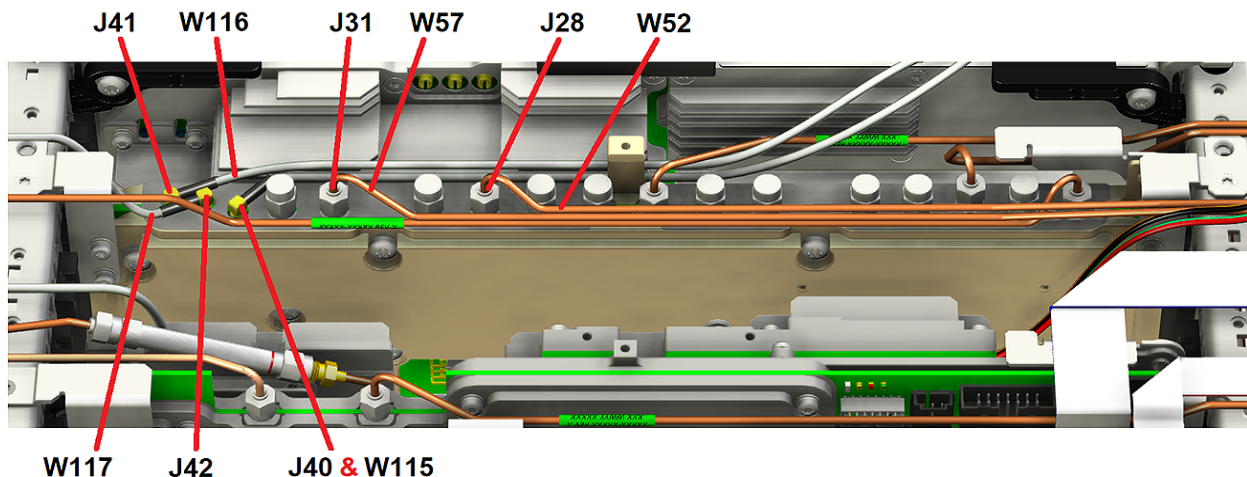
IF Output Selection

The procedure in this section can be used to verify that the A23 IF Mux IF output selection is working properly.

The following procedure will use the downconverter input at J28 to verify all the outputs of the A23 IF Mux.

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 using the 10 MHz IF path by pressing **Meas Setup, IF Path, IF Path, 10 MHz**.
5. Referring to **Figure 12-8**, remove W52 from J28.

Figure 12-8 A23 IF Mux Output Connections



6. Tune a signal generator to 322.5 MHz at a power level of -20 dBm.
7. Connect the signal generator to the downconverter input at J28.
8. Remove W117 from J42.
9. Connect a spectrum analyzer to J42.
10. Tune the spectrum analyzer to 322.5 MHz with a span of 10 MHz.
11. Verify that there is a 322.5 MHz signal at approximately -14 dBm on the spectrum analyzer display.

If there is a signal as expected, the narrowband IF output is working properly, proceed to the next step.

If there is not a signal as expected, replace the A23 IF Mux.

12. Remove W116 from J41.

13. Move the spectrum analyzer from the narrowband IF output at J42 to the 1.0 GHz wideband IF output at J41.

14. Change the frequency of both the signal generator and the spectrum analyzer to 690 MHz.

15. Change the IF path of the instrument to 1 GHz by pressing **IF Path, 1 GHz**.

16. Verify that there is a 690 MHz signal at approximately -12 dBm on the spectrum analyzer display.

If there is a signal as expected, the 1.0 GHz wideband IF output is working properly. If the instrument has option R15 or R20 proceed to the next step.

If there is not a signal as expected, replace the A23 IF Mux.

17. Remove W115 from J40.

18. Move the spectrum analyzer from the 1.0 GHz wideband IF output at J41 to the 1.5 / 2.0 GHz wideband IF output at J40.

19. Change the frequency of both the signal generator and the spectrum analyzer to 1.2 GHz.

20. Change the IF path of the instrument to 1.5 GHz by pressing **IF Path, 1.5 GHz**.

21. Verify that there is a 1.2 GHz signal at approximately 0 dBm on the spectrum analyzer display.

If there is a signal as expected, the 1.5 / 2.0 GHz wideband IF output is working properly. If the instrument has option CRW, proceed to the next step. If the instrument does not have option CRW, exit this procedure.

If there is not a signal as expected, replace the A23 IF Mux.

NOTE

Be sure to account for the cable loss when making power level measurements. If a power level still appears to be a little low, a power meter should be used to make a more accurate measurement.

Option CRW – Wide IF Out

22. Set the IF path to 1.5 GHz by pressing **Meas Setup, IF Path, IF Path, 1.5 GHz**.
23. Referring to **Figure 12-8**, Remove W57 from J31.
24. Tune the signal generator to 950 MHz with a power level of -20 dBm.
25. Tune the spectrum analyzer to 950 MHz with a span of 10 MHz.
26. Connect the spectrum analyzer to the Wide IF Out output at J31.
27. Enable the Wide IF Out by pressing **Input/Output, Output, Ext/Wide IF Out, On**.
28. Verify that there is a 950 MHz signal at approximately -25 dBm or greater on the spectrum analyzer display.

If there is a signal as expected, the option CRW wide IF output selection of the A23 IF Mux is working properly.

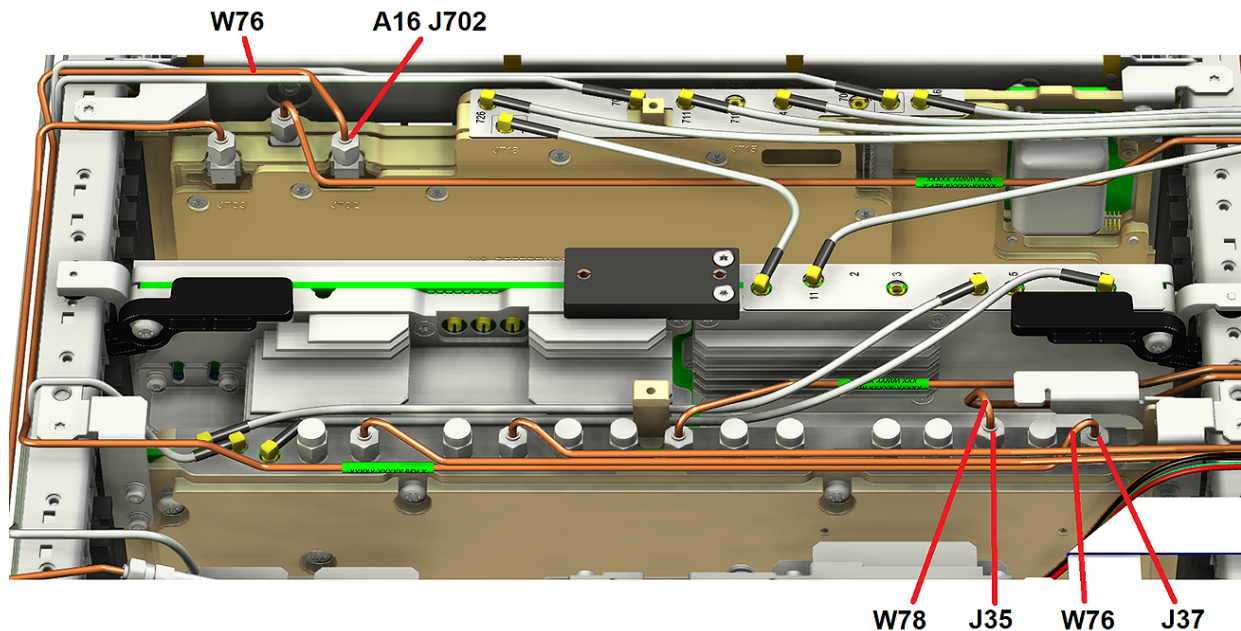
If there is not a signal as expected, replace the A23 IF Mux.

4.8 GHz Reference Distribution

The following procedure can be used to verify the 4.8 GHz distribution on the A23 IF Mux.

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. Since the J35 output is only active when the instrument is tuned to band 0, tune the instrument to 2 GHz by pressing **Frequency, Center Frequency 2 GHz**.
5. Stop the instrument from sweeping by pressing **Zero Span**.
6. Referring to [Figure 12-9](#), remove W76 from the A16 Reference J702.

Figure 12-9 A23 IF Mux 4.8 GHz Reference Connections



7. Connect a spectrum analyzer to A16 J702.
8. Tune the spectrum analyzer to 4.8 GHz with a span of 10 MHz.
9. Verify that there is a 4.8 GHz signal on the spectrum analyzer display at a power level of 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 15, "Reference,"](#) to determine why there is no 4.8 GHz signal coming from J702.

- 10.** Remove the spectrum analyzer from A16 J702 and reconnect W76 to it.
- 11.** Remove W78 from J35 and connect the spectrum analyzer to it.
- 12.** Verify that there is a 4.8 GHz signal on the spectrum analyzer display at a power level of approximately +12 dBm.

If there is a signal as expected, the A23 IF Mux 4.8 GHz distribution is working properly.

If there is not a signal as expected, replace the A23 IF Mux.

Front End Control

A25 Wideband Calibrator Control

Due to the location of the control connectors both on the A23 IF Mux (P2) and the A25 Wideband Calibrator (J1), as well as the design of the control ribbon cable (W6), it is not possible to verify the control lines of the A25 Wideband Calibrator. If the A25 Wideband Calibrator is not working properly the following procedure may help to identify the problem.

1. 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.”**
2. Verify that the A23 IF Mux is being recognized by the instrument by pressing **System, Show Hardware** and look for the **IF Mux-10GHz** on the Hardware Information screen, as seen in **Figure 12-2.**

If it is not there, replace the A23 IF Mux.

If it is there, proceed to the next step.

NOTE

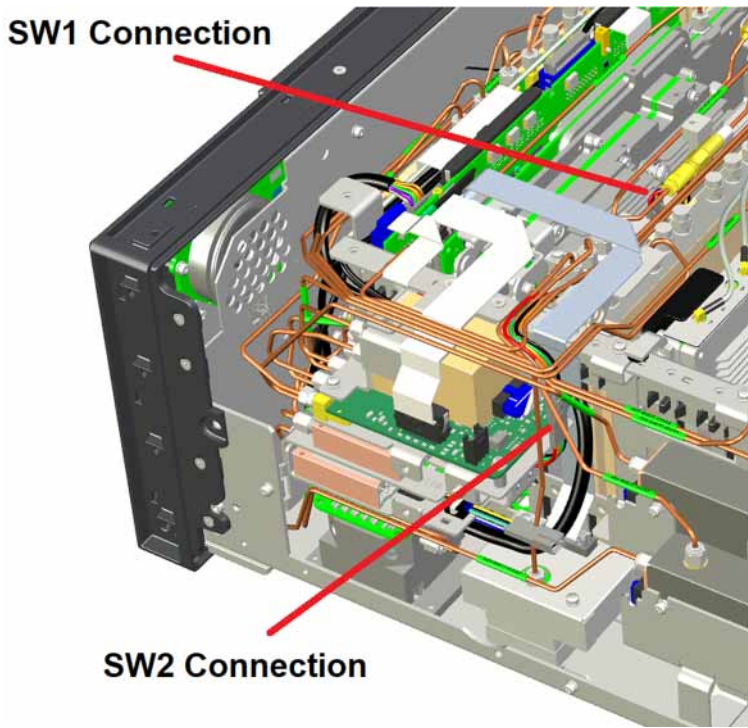
Since the instrument communicates with the A25 Wideband Calibrator through the A23 IF Mux, be sure that it is initializing properly and being recognized on the Hardware Information screen before replacing an A25 Wideband Calibrator for not initializing properly.

3. Verify that the W6 ribbon cable from the A23 IF Mux to the A25 Wideband Calibrator is not damaged and is properly connected on both ends. If there is nothing wrong with the cable or the connections, replace the A25 Wideband Calibrator.

SW1 Calibrator Switch and SW2 LNA Switch Control

Both the SW1 Calibrator switch and the SW2 LNA switch are controlled through the W20 wire harness. Due to the location of the control connector on the A23 IF Mux (P1) and the connections on the SW1 and SW2 switches, it is not possible to verify the control lines of the switches on either end. However, they can be probed at the connections between the W20 control wire harness and the switch wire harnesses, as seen in **Figure 12-10.**

Figure 12-10 W20 Control Cable Connection Location



SW1 and SW2 are each controlled by four lines, a +24 volt supply, ground, and two TTL control lines, as seen in [Table 12-2](#).

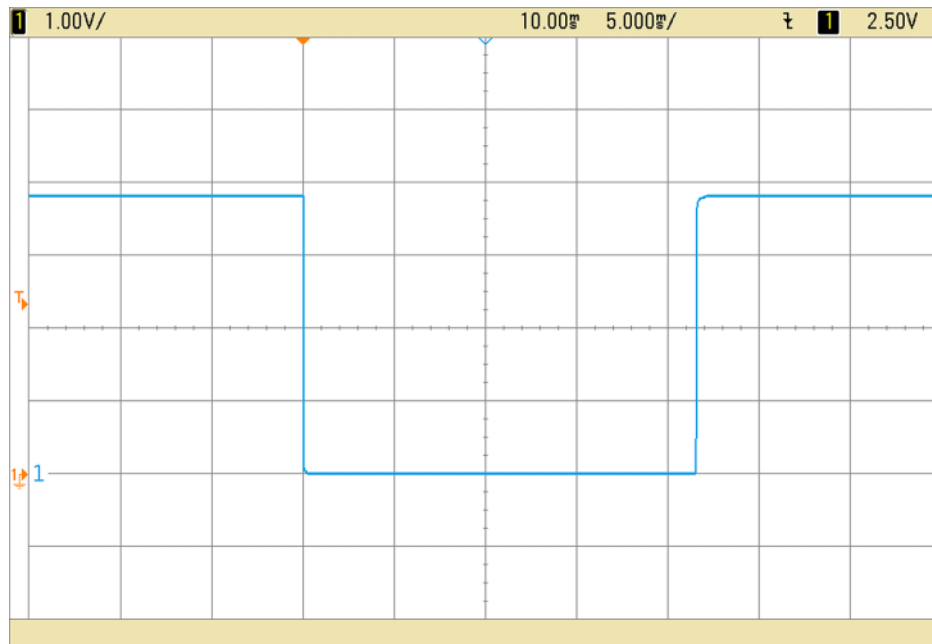
Table 12-2 W20 Pinout

A23 IF Mux P1	W20 Wire Color	SW1 Calibrator Switch	SW2 LNA Switch
1	Red	--	+24 Volts
2	Orange	--	LNA On
3	Red	+24 Volts	--
4	Blue	Calibration Out	--
5	Green	--	LNA Off
6	Black	--	Ground
7	Yellow	Tunable	--
8	Black	Ground	--

When the switches are in a static state the control lines will both measure at a TTL high level. When the instrument selects one of the switch positions, the associated control line will go to a TTL low level for approximately 20 ms, as seen in [Figure 12-11](#).

Figure 12-11

SW1 / SW2 Control Line Activation



The following procedure can be used to verify the control of the SW1 Calibrator Switch and the SW2 LNA Switch. Of course, control of the SW2 LNA Switch can only be verified if the instrument has one of the preamplifier options installed.

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. Put the instrument in 0 span to stop it from sweeping by pressing **Frequency, Zero Span**.
5. Setup an oscilloscope with the following settings:

Y-Scale = 1.0 V / Division

X-Scale = 5.0 ms / Division

Trigger = Negative Edge

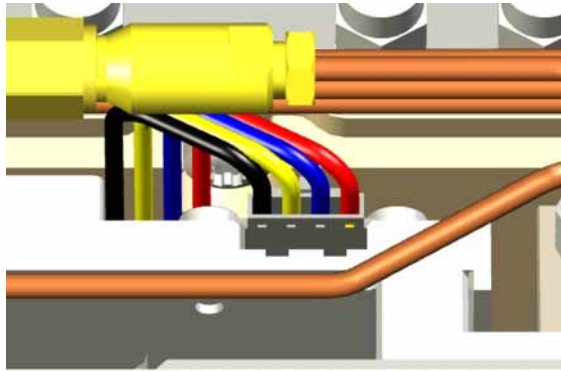
Trigger Level = 2.5 V

SW1 Control Verification

6. Referring to **Figure 12-12**, use a DC voltmeter to probe the RED wire of the SW1 Calibrator switch connection.

Figure 12-12

SW1 Calibrator Switch Probe Access Points



7. Verify that voltage measured on the RED wire is between +21 and +25 volts DC.
If the voltage is as expected, proceed to the next step.
If the voltage is not as expected, see the “**Power Supply Verification**” section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A23 IF Mux.
8. Using the oscilloscope, probe the YELLOW wire of the SW1 Calibrator switch connection.
9. Switch the SW1 Calibrator switch to the tunable position by pressing **Input/Output, Calibrator Control, Cal Source, Tunable**.
10. Verify that there is a negative going pulse on the oscilloscope screen for approximately 20 ms, as seen in **Figure 12-11**.
If there is a negative going pulse on the oscilloscope display as expected, proceed to the next step.
If there is not a negative going pulse on the oscilloscope display as expected, replace the A23 IF Mux.
11. Move the oscilloscope probe to the BLUE wire of the SW1 Calibrator switch connection.
12. Switch the SW1 Calibrator switch to the calibrator out position by pressing **Input/Output, Calibrator Control, Cal Source, Calibrator Out**.
13. Verify that there is a negative going pulse on the oscilloscope screen for approximately 20 ms, as seen in **Figure 12-11**.

If there is a negative going pulse on the oscilloscope display as expected, the SW1 Calibrator switch control is working properly. Proceed to the next step to verify the control of the SW2 LNA switch.

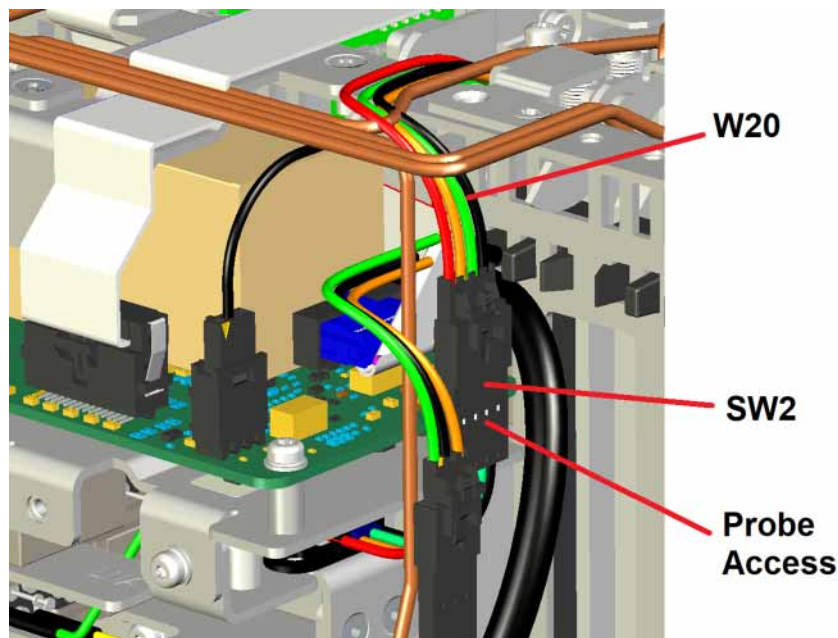
If there is not a negative going pulse on the oscilloscope display as expected, replace the A23 IF Mux.

SW2 Control Verification

14. Referring to **Figure 12-13**, use a DC voltmeter to probe the RED wire of the SW2 LNA switch connection.

Figure 12-13

SW2 LNA Switch Probe Access Points



15. Verify that voltage measured on the RED wire is between +21 and +25 volts DC.

If the voltage is as expected, proceed to the next step.

If the voltage is not as expected, see the “**Power Supply Verification**” section in **Chapter 5, “First-Look Troubleshooting,”** to see if there is an issue with the A6 Power Supply. If there is nothing wrong with the A6 Power Supply, replace the A23 IF Mux.

16. Using the oscilloscope, probe the ORANGE wire of the SW2 LNA switch connection.
17. Switch the SW2 LNA switch to the on position by pressing **Amplitude, Signal Path, LNA On**.
18. Verify that there is a negative going pulse on the oscilloscope screen for approximately 20 ms, as seen in **Figure 12-11**.

If there is a negative going pulse on the oscilloscope display as expected, proceed to the next step.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A23 IF Mux.

19. Move the oscilloscope probe to the GREEN wire of the SW2 LNA switch connection.

20. Switch the SW2 LNA switch to the off position by pressing **LNA Off**.

21. Verify that there is a negative going pulse on the oscilloscope screen for approximately 20 ms, as seen in **Figure 12-11**.

If there is a negative going pulse on the oscilloscope display as expected, the SW2 LNA switch control is working properly.

If there is not a negative going pulse on the oscilloscope display as expected, replace the A23 IF Mux.

13 Analog and Digital IFs

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 386](#)

[Troubleshooting Equipment Required on page 388](#)

[A2 25 MHz Analog IF on page 389](#)

[Overview on page 400](#)

[Functional Verification on page 404](#)

[A3 40 MHz Digital IF on page 400](#)

[Overview on page 400](#)

[Functional Verification on page 404](#)

[A21 Wideband Digital IF on page 424](#)

[Overview on page 424](#)

[Functional Verification on page 433](#)

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
- A21 Wideband Digital IF

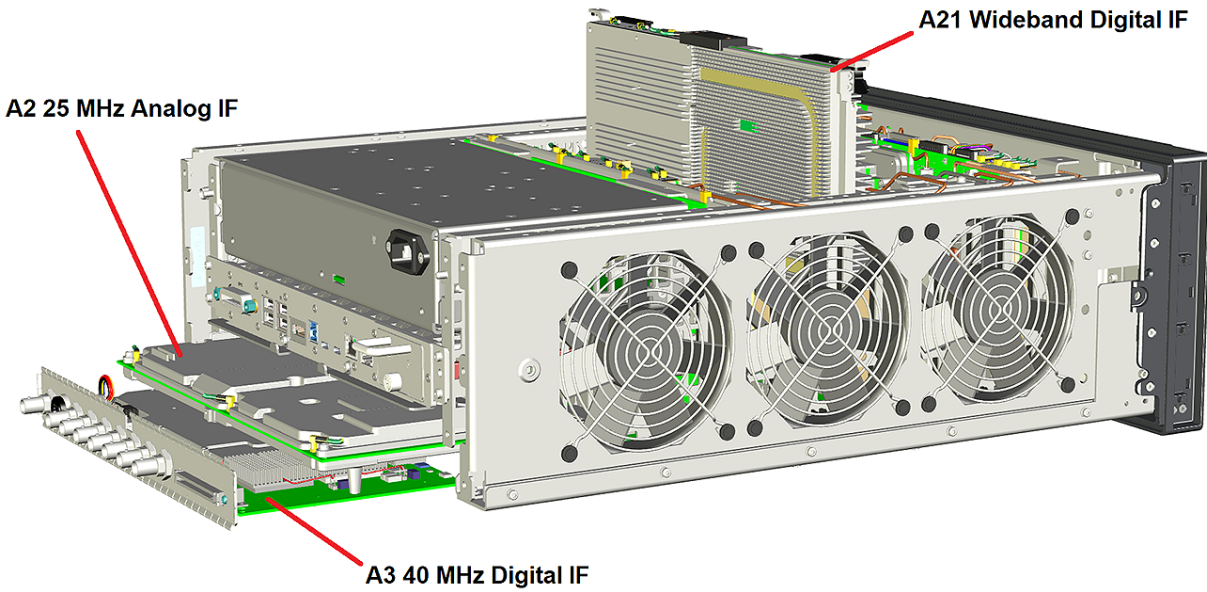
When the instrument uses each of these is outlined in **Table 13-1**, and the location of each can be seen in **Figure 13-1**.

Table 13-1 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
255 MHz	A21 Wideband Digital IF – 1.0 GHz BW Input	690 MHz
1.0 GHz	A21 Wideband Digital IF – 1.0 GHz BW Input	690 MHz
1.5 GHz	A21 Wideband Digital IF – Wideband Input	950 MHz or 1.2 GHz
2.0 GHz	A21 Wideband Digital IF – Wideband Input	1.2 GHz

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

Figure 13-1 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 22, "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 GHz¹

Signal Generator

Minimum frequency range: 10 MHz to 26.5 GHz

Power Meter

Minimum frequency range: 10 MHz to 26.5 GHz¹

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

Miscellaneous

Oscilloscope: 500 MHz, 1 M Ω input

Multimeter (Voltage and Resistance)

Misc. cables and adapters

NOTE

The instrument has a very flexible internal calibrator (A25 Wideband Calibrator) that could be used in many cases instead of the external signal generator, but the external signal generator is recommended to further isolate any issues encountered.

1. Higher than 26.5 GHz will be needed if the instrument has option 544 or 550.

A2 25 MHz Analog IF

Overview

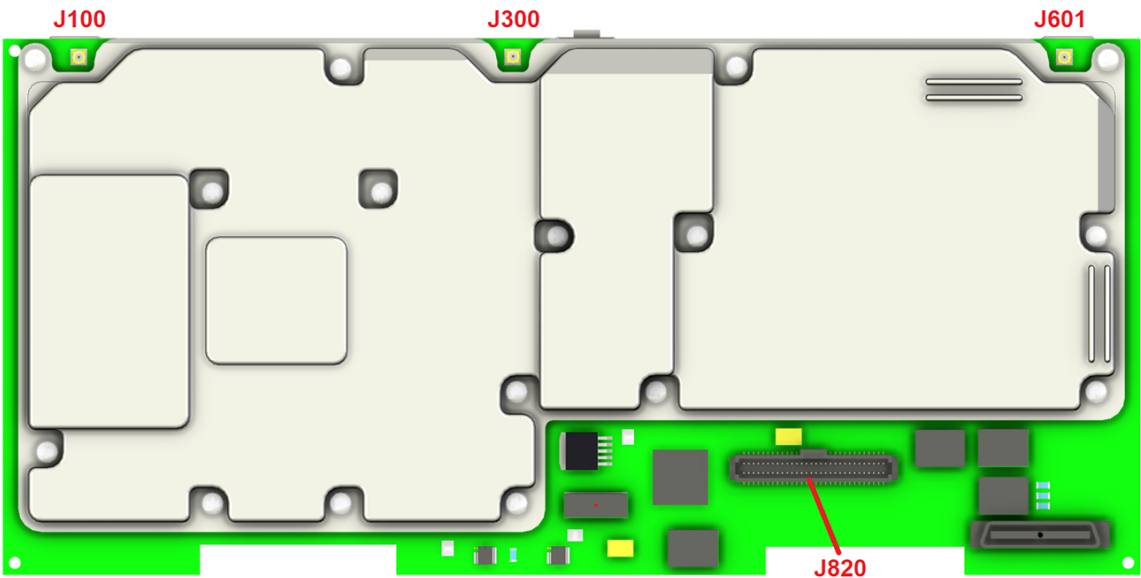
The A2 25 MHz Analog IF is used whenever the IF signal path is 10 MHz or 25 MHz and when any swept measurement is made. This assembly is basically a downconverter with multiple bandwidth filters. The output of this assembly is digitized and processed on the A3 40 MHz Digital IF assembly.

The connections to and from the A2 25 MHz Analog IF are listed in [Table 13-2](#), as seen in [Figure 13-2](#).

Table 13-2 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 13-2 A2 25 MHz Analog IF Connections



Analog and Digital IFs
A2 25 MHz Analog IF

The A2 25 MHz Analog IF will identify itself on the instrument Hardware Information screen as the **Analog IF**, as seen in **Figure 13-3**.

Figure 13-3 Hardware Information Screen – A2 25 MHz Analog IF

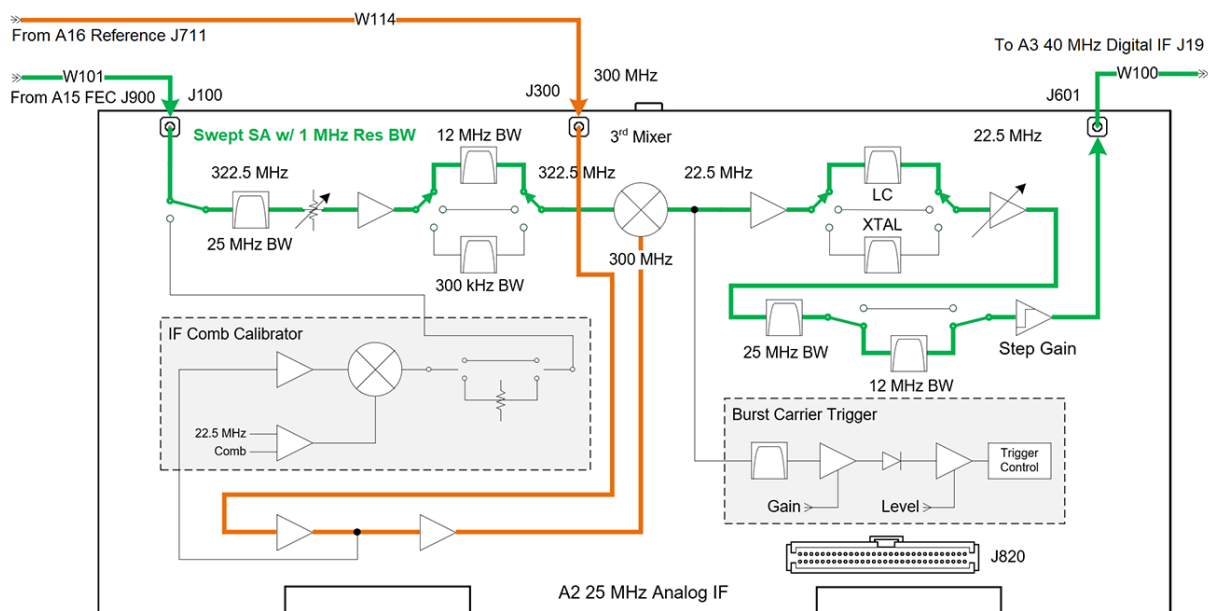
System Settings	< System Hardware Information    							
System	Keysight PXA Keysight PXA Signal Analyzer Product Number N9032B Serial Number MY61010001 S/W Release Name 2023 Update 1.0 Instrument S/W Revision A.34.03 Revision Date 11/17/2022 9:38:32 AM							
I/O Config	Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
Preload / Unload Modes	Analog IF	N902060290	79204100103	011	1	A	57	
User Interface	YIG Tuned Filter	50877382	13202309428	007	0	A	11	
Power On	Digital IF	N902060016	79204100250	035	3	A	34	
Restore Defaults	Front End Controller	N902060295	79204100620	009	0	A	131	
Alignments	IF Mux-10GHz	N904160163	30203900015	004	1	A	264	
Licensing	Low Band Switch	N904060100	78200251477	000	2	B	135	
Security	LO DDS Synthesizer	N902060175	79204000654	011	3	A	91	
Diagnostics	LO DDS Reference	M930560028	79204100169	007	0	A	92	
Service	Wideband Calibrator	N904060151	30202000005	004	2	A	260	
SCPI Recorder	Reference Plus Main	N902060185	79204701317	008	3	A	93	
	Reference Plus Daughter	N902060186	79204501221	010	1	A	94	
	Front End	N904160039	78203535226	000	1	A	270	
	Gen 4 DIF Controller	N904160048	30203600005	003	3	A	208	
	Switched IF Filter	N902060220	59200251433	005	0	B	132	
	YTO	N902060009	79204200133	006	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 Downconverter. This 322.5 MHz signal is then routed through the A23 IF MUX to 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 13-4](#).

Figure 13-4 A2 25 MHz Analog IF Signal Path



NOTE

Refer to the different signal path block diagrams in [Chapter 8, "Block Diagrams,"](#) for more details on how and when the A2 25 MHz Analog IF is used and what the expected power levels are.

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 13-4](#). 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 13-3**. 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

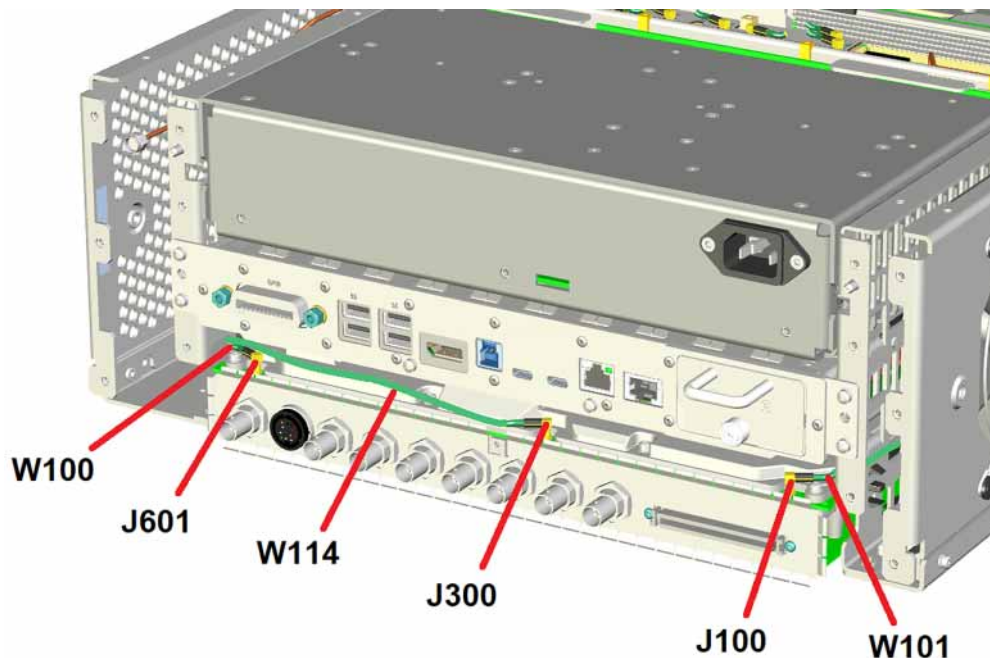
The following verification procedure for the A2 25 MHz Analog IF will verify the following:

- 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 13-5**, Remove W114 from J300 of the A2 25 MHz Analog IF.

Figure 13-5 A2 25 MHz Analog IF Connections



7. Connect a spectrum analyzer to the loose end of W114.
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 15, “Reference,”** to determine why there is not a 300 MHz reference signal at J711.

10. Reconnect W114 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 13-5**, remove W101 from J100 and W100 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 13-3**.

Table 13-3 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.

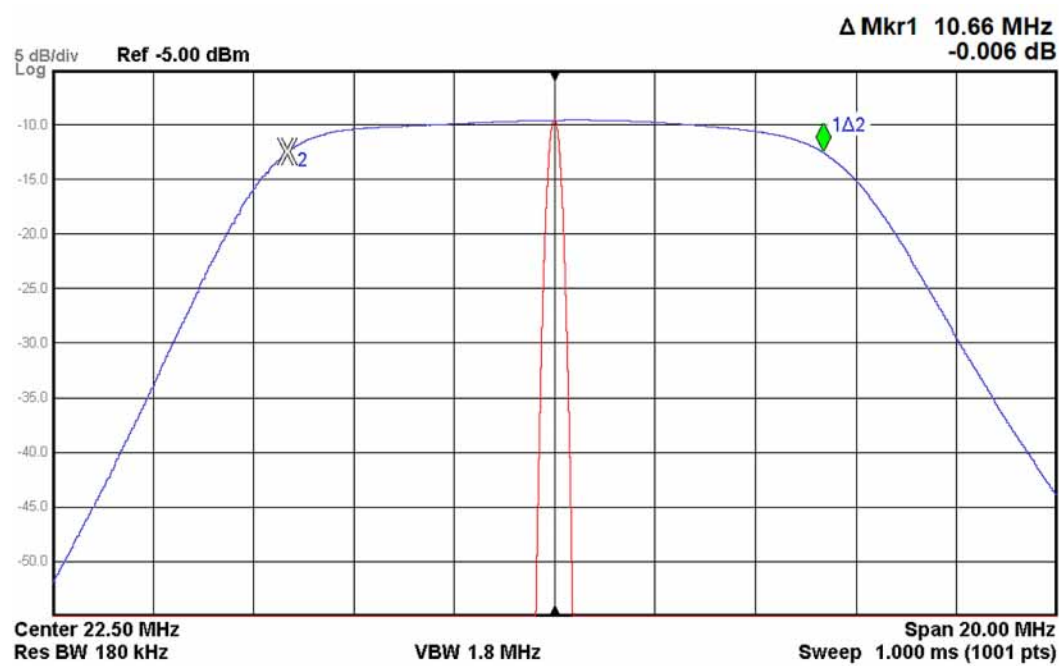
If the signal level increased as expected, the step gain amplifier is working properly. Proceed to the next step.

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 13-6**.

Figure 13-6 A2 25 MHz Analog IF Filter Shape - 12 MHz



31.Repeat steps 29 and 30 for the remaining filter paths in [Table 13-4](#).

Table 13-4 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 13-6
1 MHz	300 kHz	5 MHz	Figure 13-7
300 kHz	100 kHz	1 MHz	Figure 13-8
75 kHz	10 kHz	500 kHz	Figure 13-9
10 kHz	3 kHz	100 kHz	Figure 13-10

Figure 13-7 A2 25 MHz Analog IF Filter Shape - 1 MHz

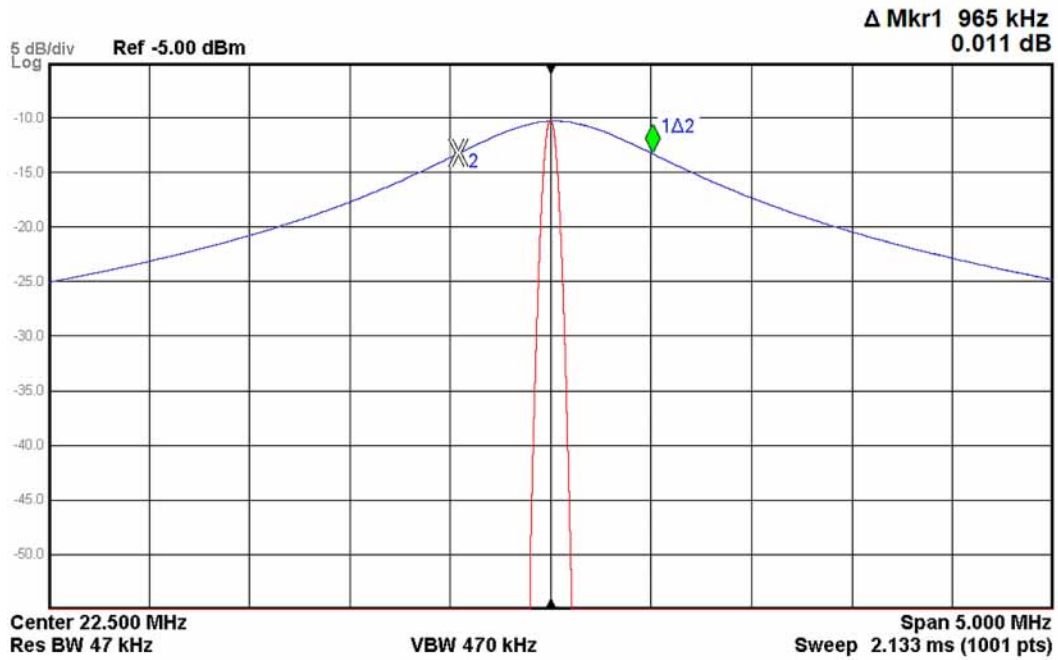


Figure 13-8 A2 25 MHz Analog IF Filter Shape - 300 MHz

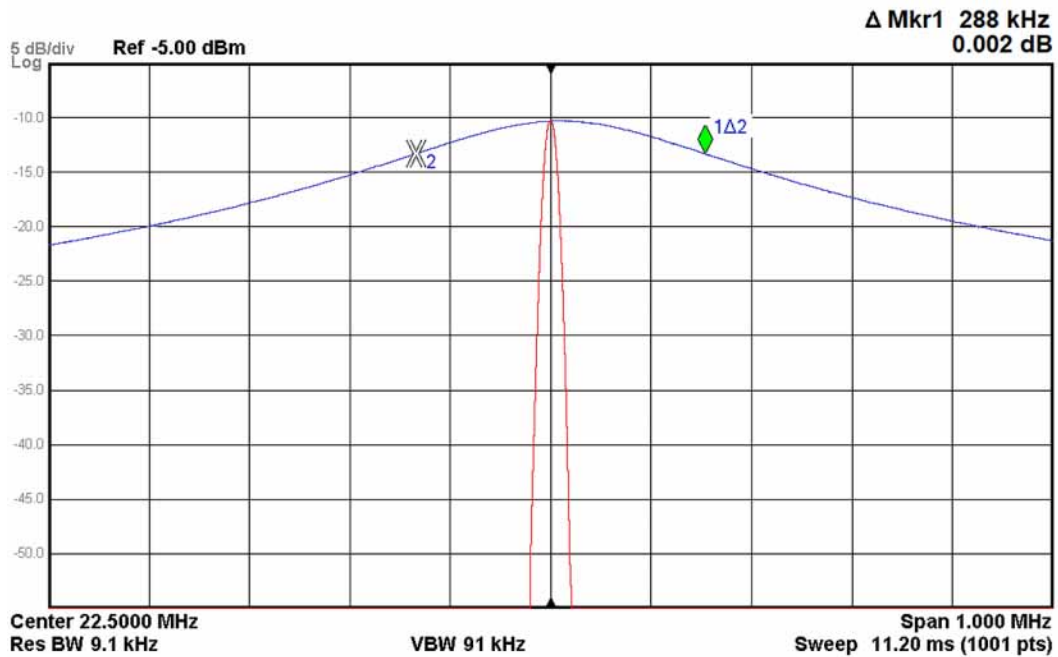


Figure 13-9 A2 25 MHz Analog IF Filter Shape - 75 kHz

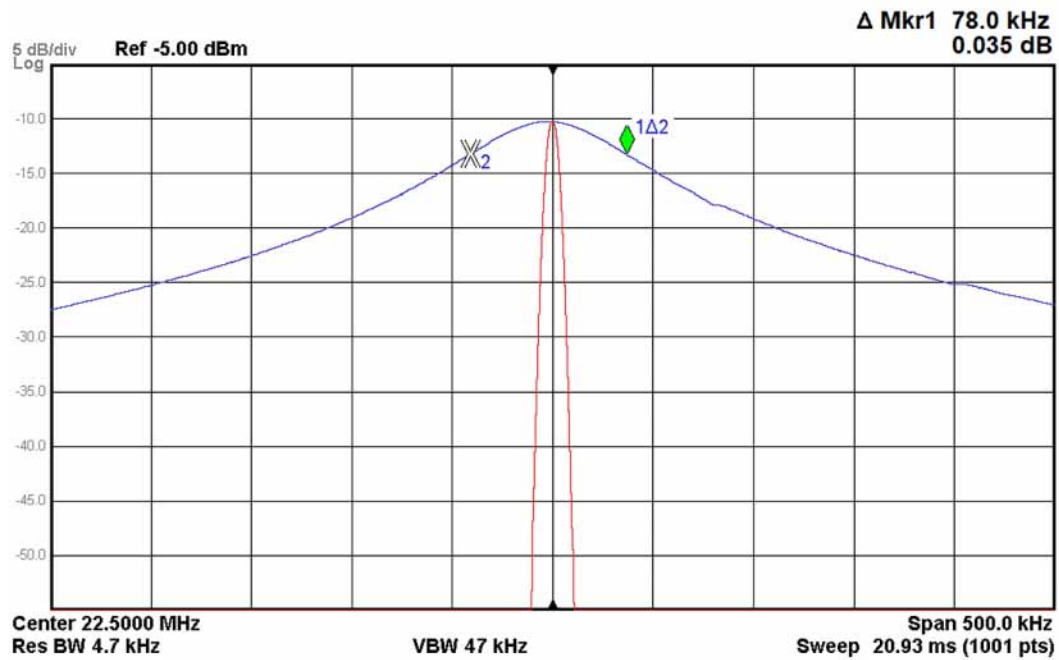
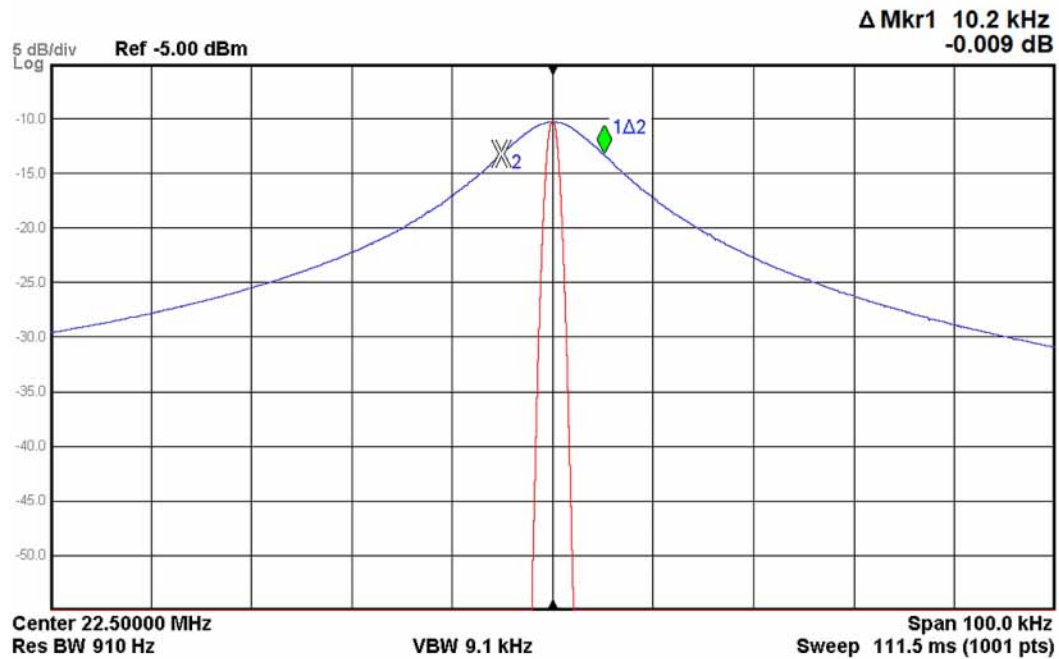


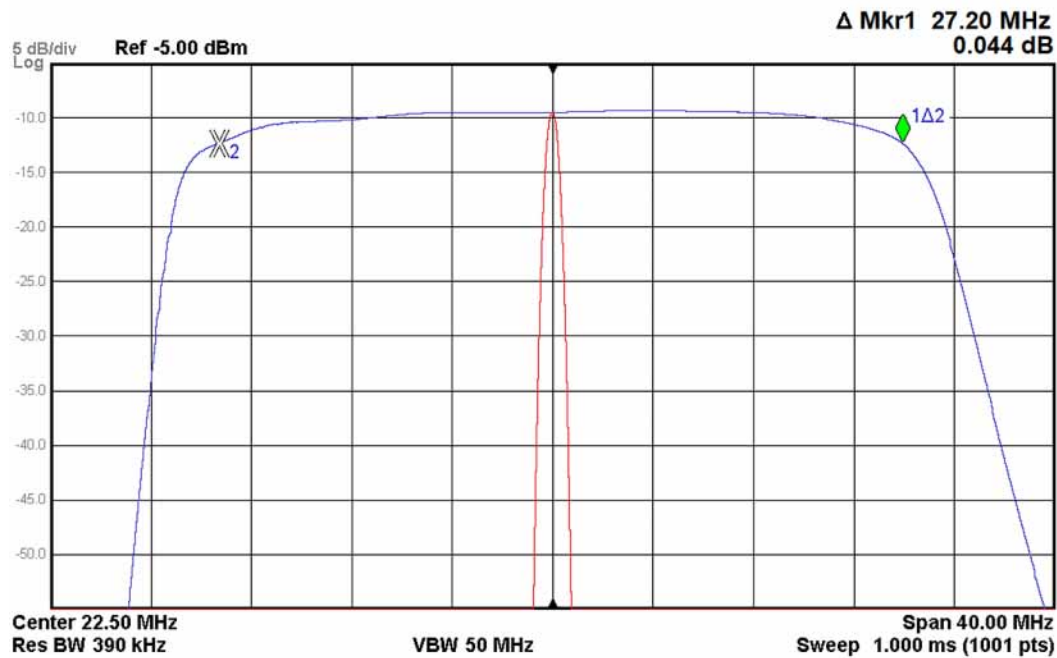
Figure 13-10 A2 25 MHz Analog IF Filter Shape - 10 kHz



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 13-11**.

Figure 13-11 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 13-5**, as seen in **Figure 13-12** and **Figure 13-13**.

Table 13-5 **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	A8 Motherboard J11	--
P2	PCI Card Cage Connector	A8 Motherboard J12	--

Figure 13-12 A3 40 MHz Digital IF Connections - Bottom

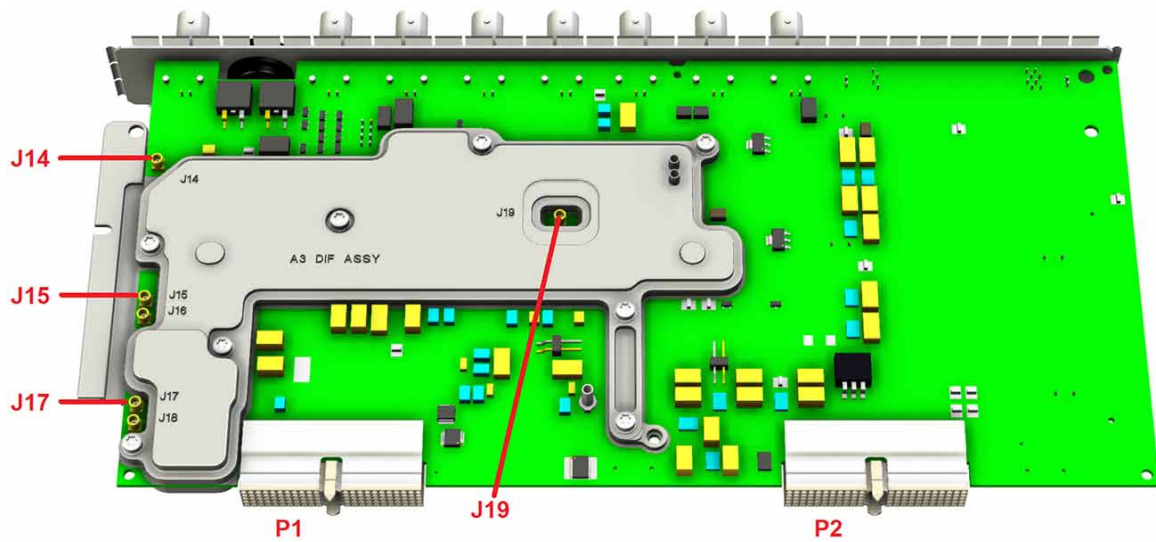
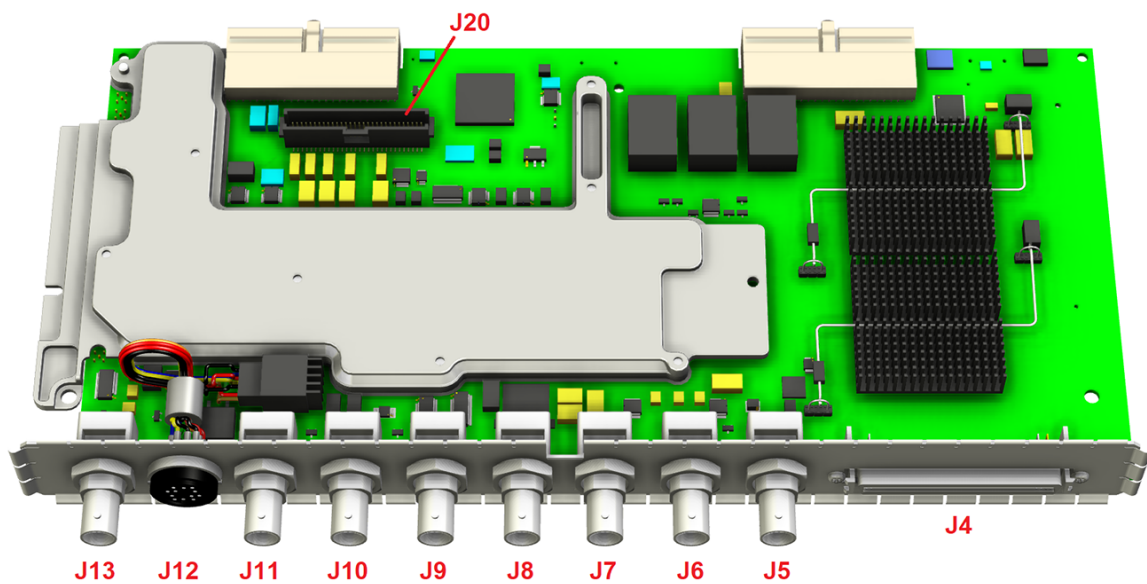


Figure 13-13 A3 40 MHz Digital IF Connections - Top



Analog and Digital IFs
A3 40 MHz Digital IF

The A3 40 MHz Digital IF will identify itself on the instrument Hardware Information screen as the **Digital IF**, as seen in **Figure 13-14**.

Figure 13-14 Hardware Information Screen – A3 40 MHz Digital IF

System Settings

< System

Hardware Information

?

X

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

Analog IF

N902060290

79204100103

011

1

A

57

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Digital IF

N902060016

79204100250

035

3

A

34

Front End Controller

N902060295

79204100620

009

0

A

131

Power On

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Restore Defaults

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Alignments

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Licensing

Front End

N904160039

78203535226

000

1

A

270

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

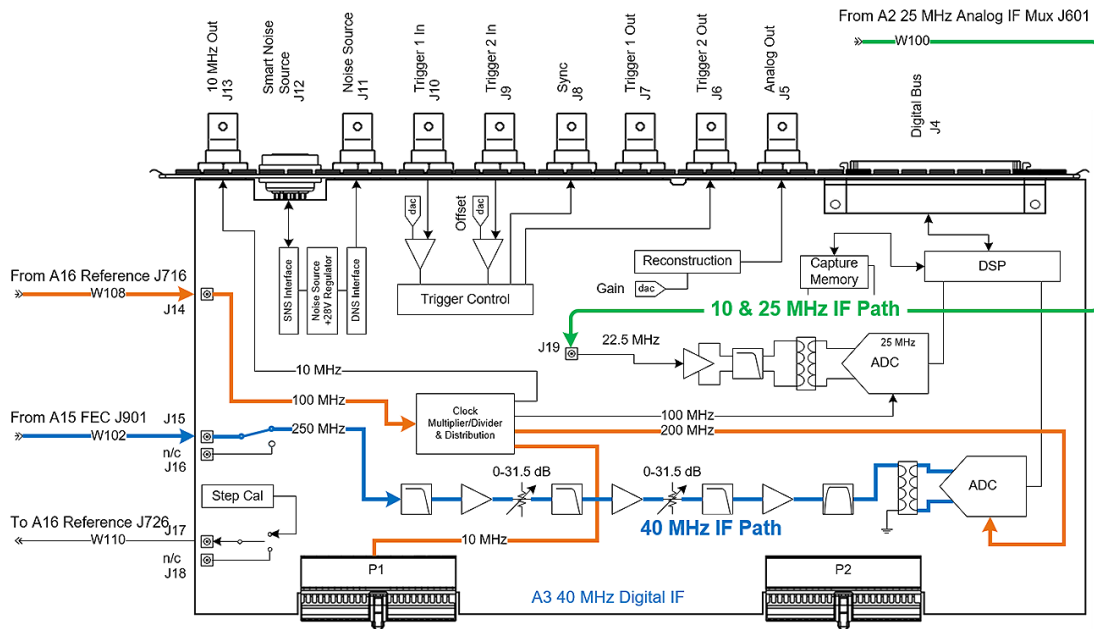
Service

SCPI Recorder

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 13-15**.

Figure 13-15 A3 40 MHz Digital IF Signal Paths



NOTE

Refer to the different signal path block diagrams in **Chapter 8, "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 13-15**.

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 13-14**. 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 25, “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.

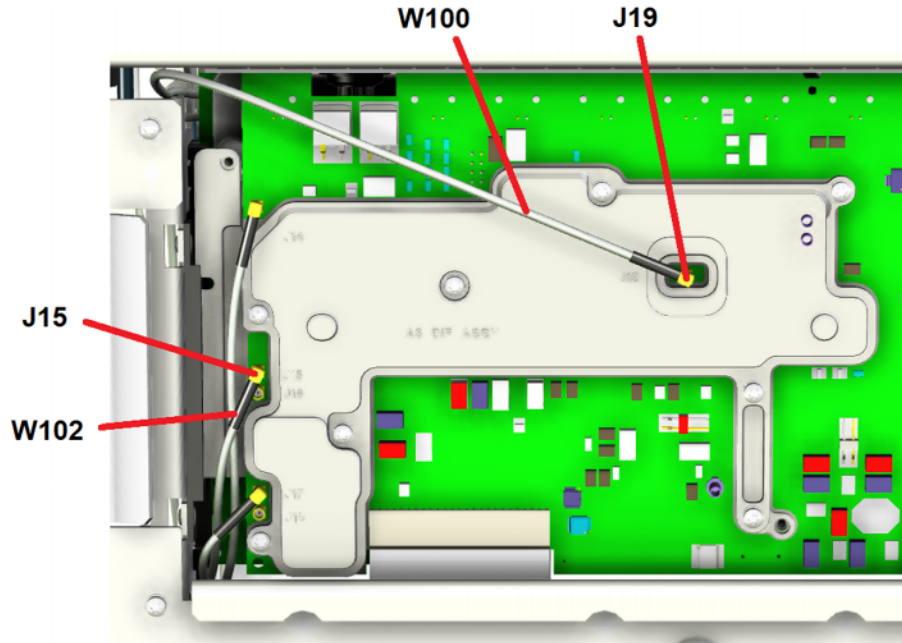
1. Switch the instrument to the IQ analyzer mode by pressing **Mode/Meas, IQ Analyzer, OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Verify that the instrument is tuned 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, 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 13-16**, remove W100 from the A3 40 MHz Digital IF 10/25 MHz input at J19.

Figure 13-16 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 W102 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. Connect the signal generator to the instrument RF input.

21. Tune the signal generator to 1 GHz with a power level of -10 dBm.

22. Change the IF path to 1 GHz by pressing **Meas Setup, IF Path, IF Path, 1 GHz**.

23. 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.

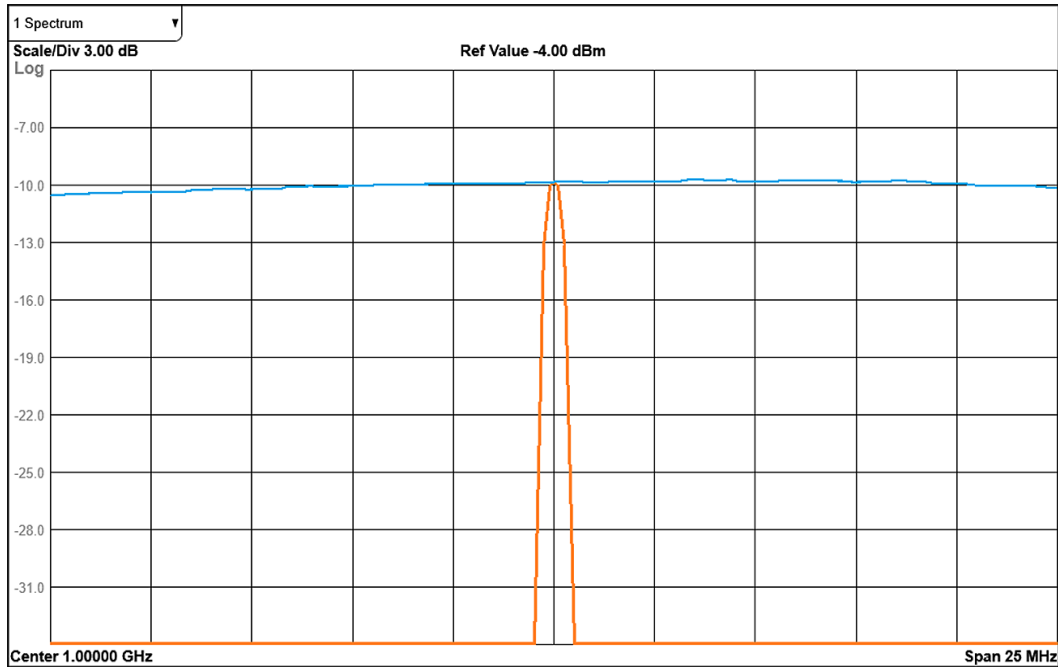
IF Frequency Response

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 20, "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 13-16](#), remove W100 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 13-17](#).

Figure 13-17 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 13-17](#).

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 13-16](#), remove W102 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**.

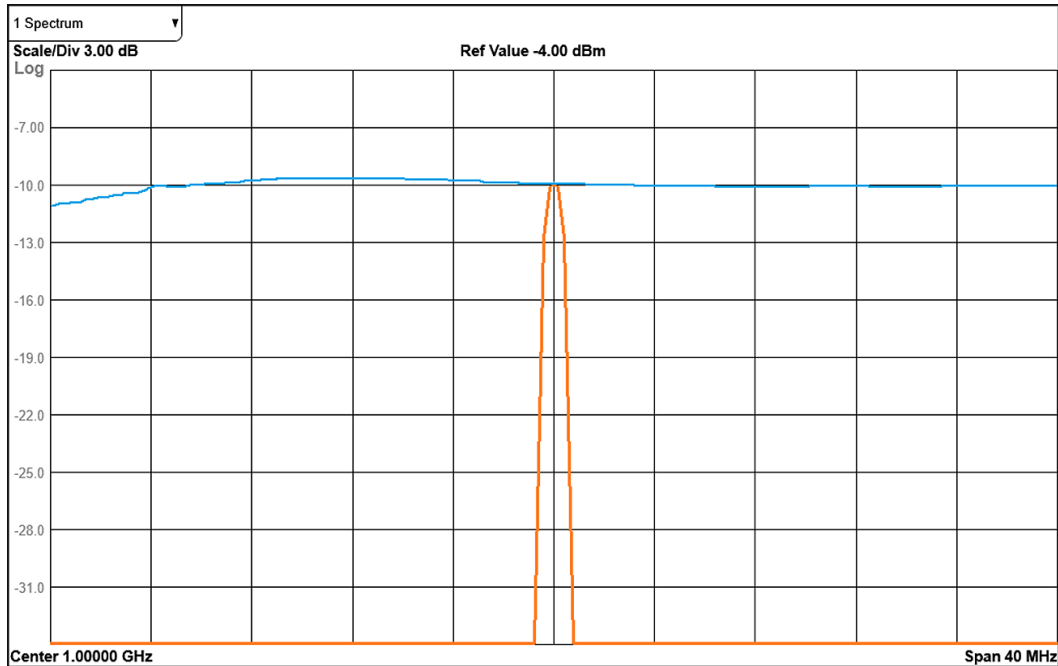
22. Change the span to 40 MHz by pressing **Frequency**, **Span 40 MHz**.

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 13-18**.

Figure 13-18 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.

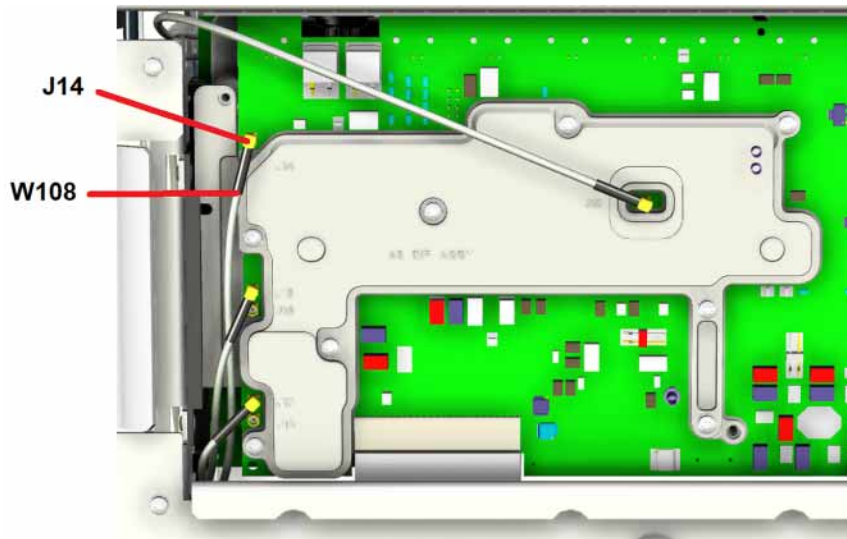
If the maximum trace is not as expected, replace the A3 40 MHz Digital IF.

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 13-19**, remove W108 from the A3 40 MHz Digital IF J14.

Figure 13-19 A3 40 MHz Digital IF 100 MHz Reference Input



3. Connect a spectrum analyzer to the loose end of W108.
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.

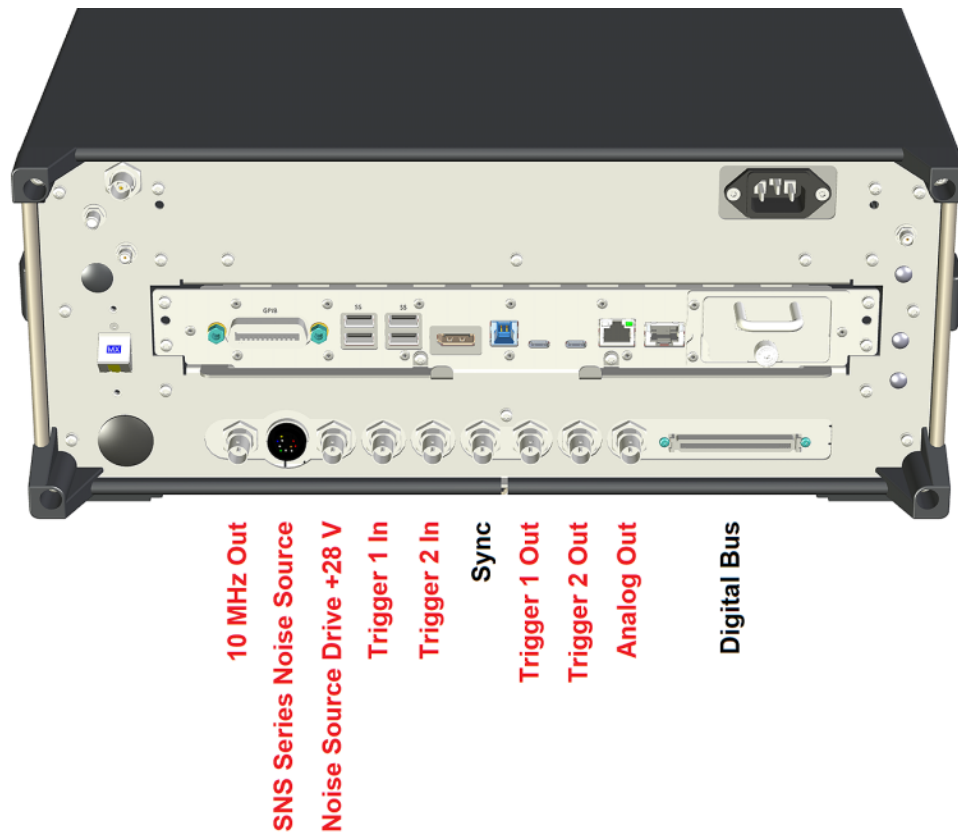
If there is not a signal as expected, see **Chapter 15, "Reference,"** to determine why there is a problem with the 100 MHz reference coming from J716 of the A16 Reference assembly.

6. Reconnect W108 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 13-20**.

Figure 13-20 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 13-20**.
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.

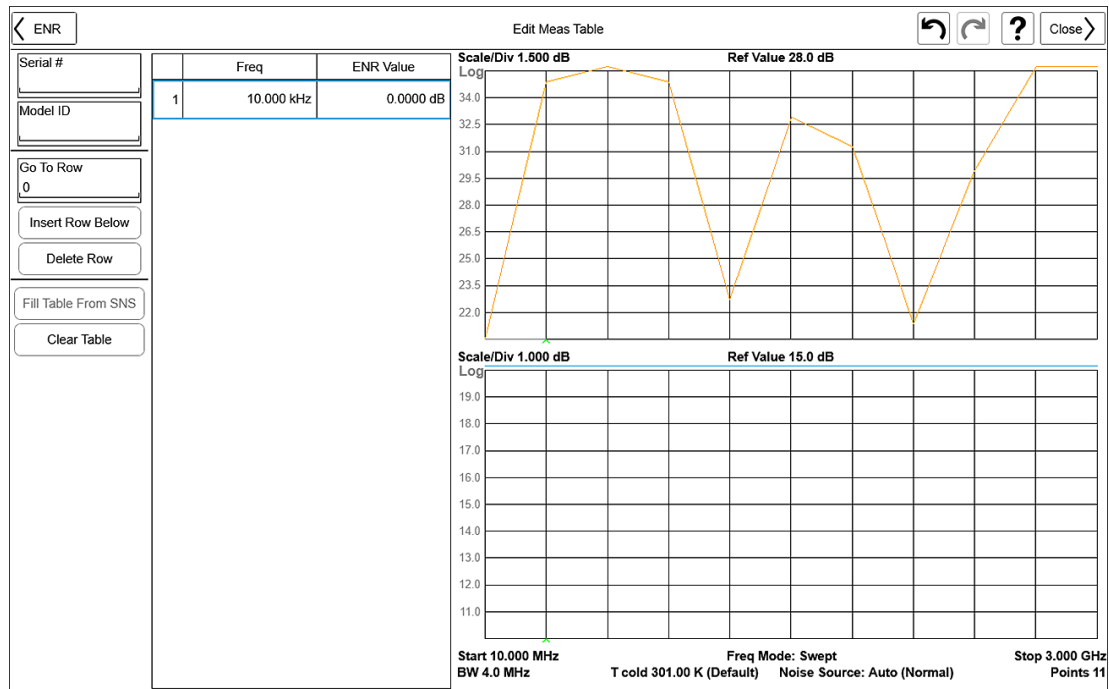
SNS Series Noise Source

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 13-20](#).
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 13-21](#).

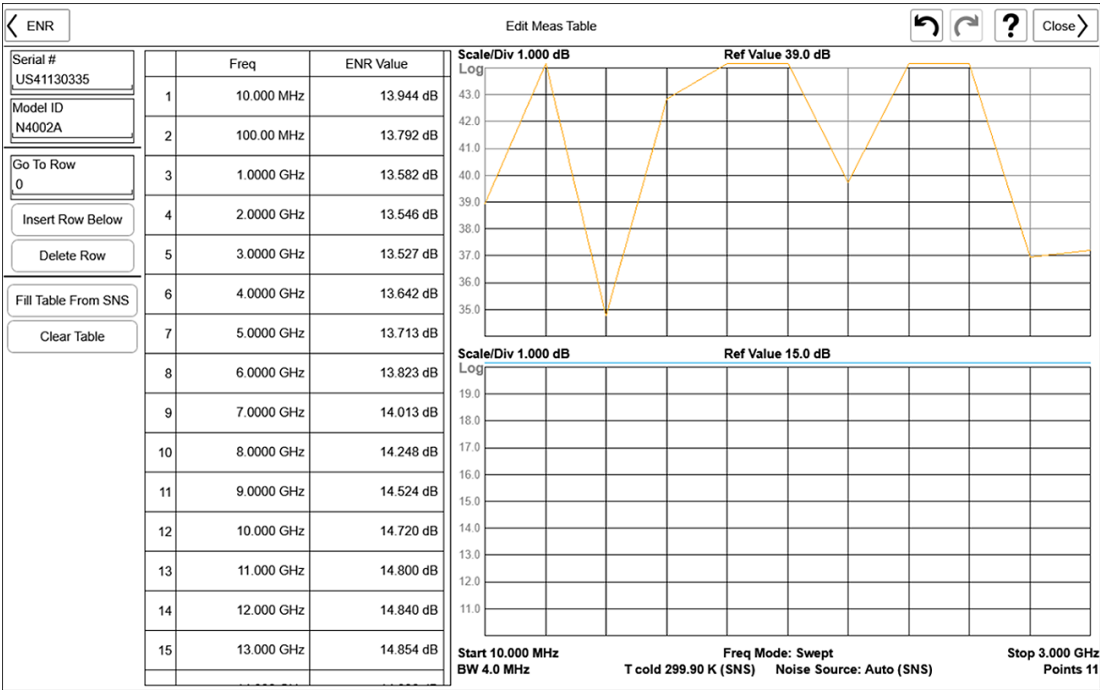
Figure 13-21 SNS Series Noise Source Communication - Not Connected



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 13-22**.

Figure 13-22 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.

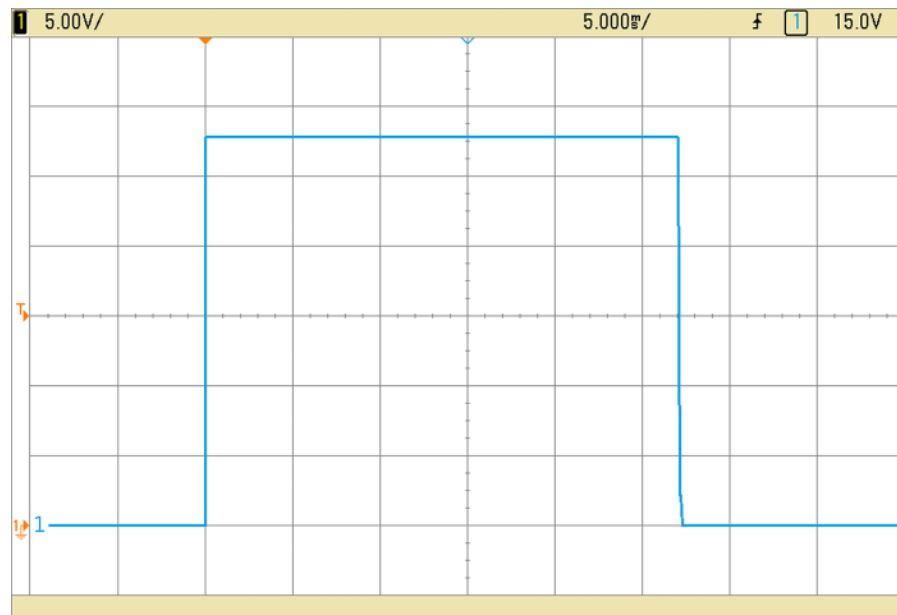
Noise Source Drive +28 Volts

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 M Ω
 - 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 13-20](#).
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 13-23](#). (It is normal for the pulse width to vary as the instrument sweeps).

Figure 13-23 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 13-20](#).
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 μ s.
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 sweep time 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 13-20](#).
6. Setup the oscilloscope with the following settings.

Input Impedance = 1 M Ω

Y-Scale = 1.0 V / Division

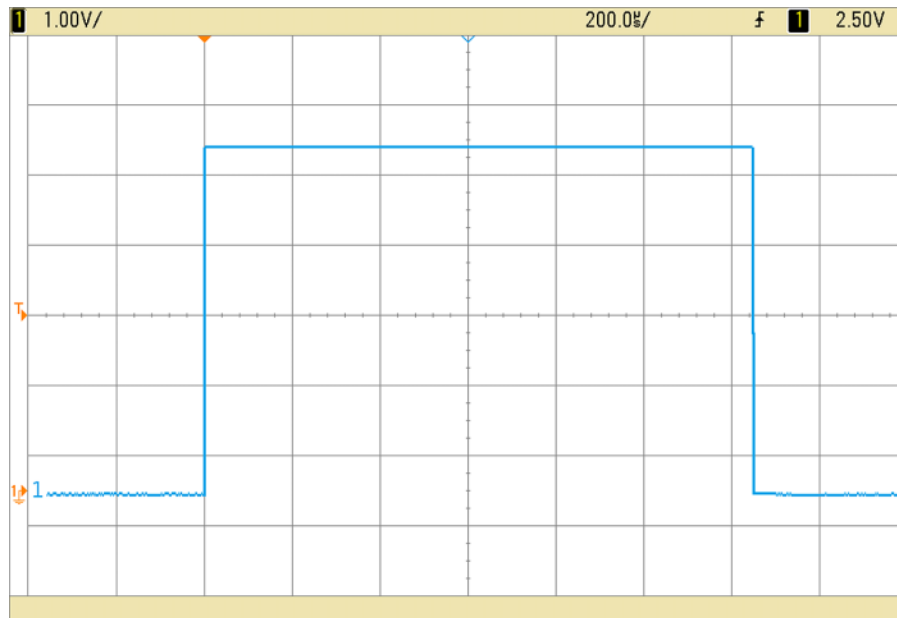
X-Scale = 200 μ s / Division

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 13-24](#).

Figure 13-24 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 (HWP)**.
11. Verify that there is a positive pulse on the oscilloscope screen as seen in **Figure 13-24**.

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.

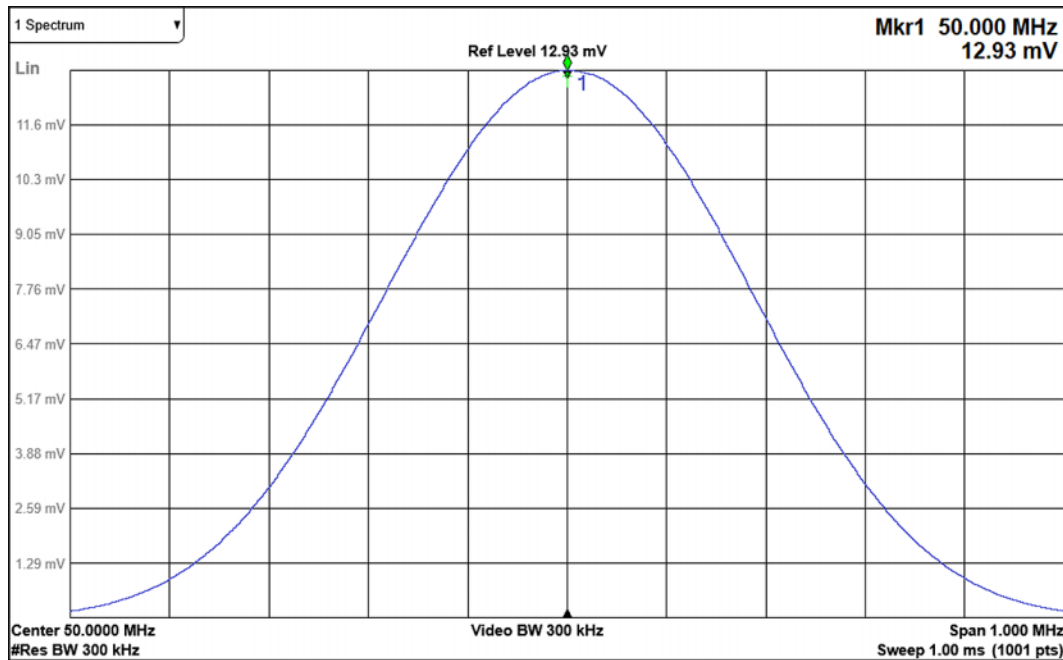
Analog Out

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 13-25**.

Figure 13-25 A3 40 MHz Digital IF - Analog Output Setup



12. Setup an oscilloscope with the following settings:

Input Impedance = 1 M Ω

Y-Scale = 200 mV / Division

X-Scale = 100 μ s / Division

Trigger = Positive Edge

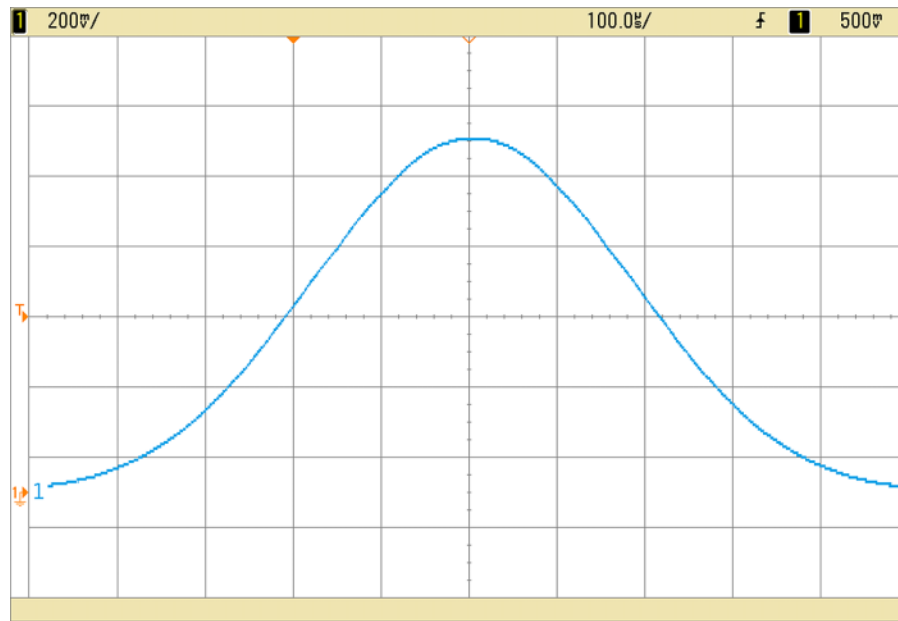
Trigger Level = +0.5 V

13. Connect the oscilloscope to the Analog Out port on the rear panel of the instrument, as seen in [Figure 13-20](#).

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 13-26](#).

Figure 13-26 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.

A21 Wideband Digital IF

Overview

A21 Wideband Digital IF provides a variety of functions in the instrument, which include:

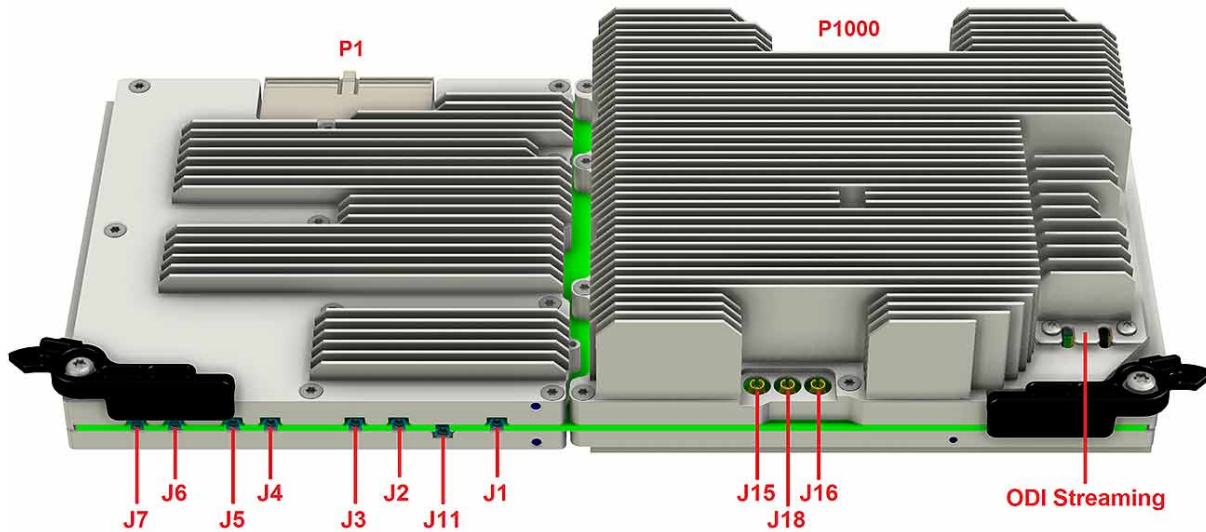
- Wideband ADC for IF paths of 255 MHz to 2.0 GHz
- Digital Signal Processing for IF paths of 255 MHz to 2.0 GHz
- Optical Data Interface (ODI)
 - Bidirectional IQ Data Streaming (Option ST1 and ST2)

The connections to and from the A21 Wideband Digital IF are listed in **Table 13-6**, as seen in **Figure 13-27**.

Table 13-6 **A21 Wideband Digital IF Connections**

Port	Description	To / From	Cable
J1	2400 MHz Reference	From A16 Reference J718	W109
J2	Not Used	--	--
J3	Not Used	--	--
J4	255 MHz / 1.0 GHz BW IF Input	From A23 IF Mux J41	W116
J5	Not Used	--	--
J6	Not Used	--	--
J7	1.5 / 2.0 GHz BW IF Input	From A23 IF Mux J40	W115
J11	Trigger Input	From Rear Panel Trigger 3 In	W111
J15	Not Used	--	--
J16	Not Used	--	--
J18	Not Used	--	--
P1	Power and Control	A8 Motherboard J71	--
P1000	Power and Control	A8 Motherboard J72	--

Figure 13-27 A21 Wideband Digital IF Connections



The A21 Wideband Digital IF will identify itself on the instrument Hardware Information screen as the **Gen 4 DIF Controller**, as seen in Figure 13-28.

Figure 13-28 Hardware Information Screen – A21 Wideband Digital IF

System Settings

System

Hardware Information

↶

↷

?

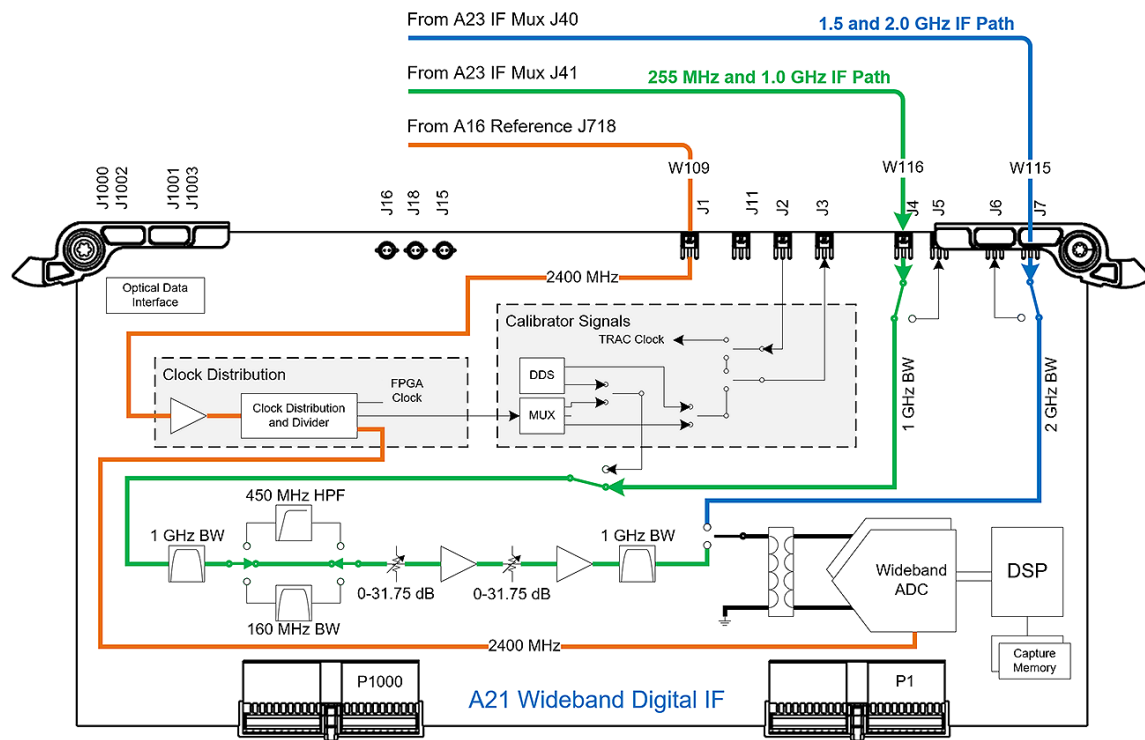
✕

System	Keysight PXA		Keysight PXA Signal Analyzer						
	Product Number		N9032B						
	Serial Number		MY61010001						
	S/W Release Name		2023 Update 1.0						
I/O Config	Instrument S/W Revision		A.34.03						
	Revision Date		11/17/2022 9:38:32 AM						
Preload / Unload Modes	Assembly Name		Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc
	Analog IF		N902060290	79204100103	011	1	A	57	
User Interface	YIG Tuned Filter		50877382	13202309428	007	0	A	11	
	Digital IF		N902060016	79204100250	035	3	A	34	
Power On	Front End Controller		N902060295	79204100620	009	0	A	131	
	IF Mux-10GHz		N904160163	30203900015	004	1	A	264	
Restore Defaults	Low Band Switch		N904060100	78200251477	000	2	B	135	
	LO DDS Synthesizer		N902060175	79204000654	011	3	A	91	
Alignments	LO DDS Reference		M930560028	79204100169	007	0	A	92	
	Wideband Calibrator		N904060151	30202000005	004	2	A	260	
Licensing	Reference Plus Main		N902060185	79204701317	008	3	A	93	
	Reference Plus Daughter		N902060186	79204501221	010	1	A	94	
Security	Front End		N904160039	78203535226	000	1	A	270	
	Gen 4 DIF Controller		N904160048	30203600005	003	3	A	208	
Diagnostics	Switched IF Filter		N902060220	59200251433	005	0	B	132	
	YTO		N902060009	79204200133	006	0	A	54	
Service									
SCPI Recorder									

IF Signal Path

The A21 Wideband Digital IF is used to digitize IF signal path bandwidths of 255 MHz to 2.0 GHz. It does this with the use of two different IF signal paths before the signal reaches the ADC, as seen in the block diagram of [Figure 13-29](#). Of course, instruments that only have option R10, 1.0 GHz analysis bandwidth option, will not use the 1.5 GHz to 2.0 GHz IF path through this assembly.

Figure 13-29 A21 Wideband Digital IF Signal Paths



NOTE

Refer to the different signal path block diagrams in [Chapter 8, “Block Diagrams,”](#) for more details on how and when the A21 Wideband Digital IF is used and what the expected power levels are.

While the 255 MHz / 1.0 GHz IF path through this assembly has bandpass filters to limit and filter the bandwidth of the input signal before it goes to the ADC, the 1.5 / 2.0 GHz IF path does not. The input signal for the wider path goes directly to the ADC.

The frequencies for the different IF paths at the inputs of the A21 Wideband Digital IF can be seen in [Table 13-7](#).

Table 13-7 **A21 Wideband Digital IF Input Frequency versus IF Path**

IF Path	A21 Input	RF Input Frequency	IF Input
255 MHz	J4	400 MHz to 55 GHz	690 MHz
1.0 GHz	J4	700 MHz to 55 GHz	690 MHz
1.5 GHz	J7	950 MHz to 3.5 GHz	950 MHz
	J7	>3.5 GHz to 55 GHz	1.2 GHz
2.0 GHz	J7	3.5 GHz to 55 GHz	1.2 GHz

The only other RF signal that the A21 Wideband Digital IF needs to function is a 2400 MHz reference signal at J1 that comes from the A16 Reference assembly. This reference signal is used to clock the wideband ADC and a calibrator signal, as seen in **Figure 13-29**.

Optical Data Interface

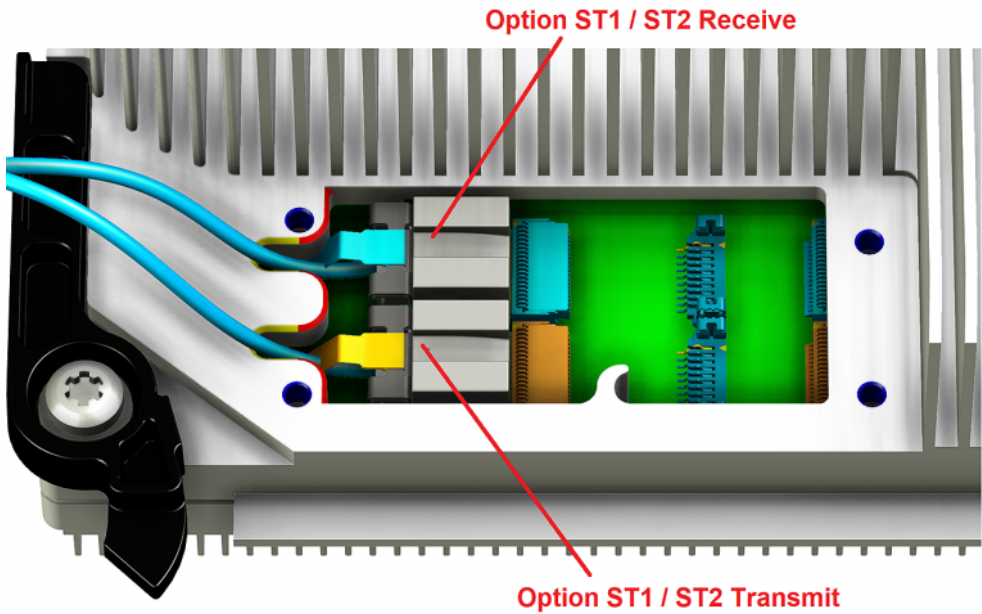
The A21 Wideband Digital IF also has an optical data interface. This is used for two available options, ST1 or ST2 IQ Streaming, out of the rear panel ODI port.

The connections to and from the A21 Wideband Digital IF that are related to ODI are listed in Table 13-8 and can be seen in Figure 13-30.

Table 13-8 A21 Wideband Digital IF ODI Connections

Port	Operation	To	Cable
J1000/J1002	Transmit	Rear Panel ODI	W57
J1001/J1003	Receive	Rear Panel ODI	W57

Figure 13-30 W21 Wideband Digital IF ODI Streaming Connections



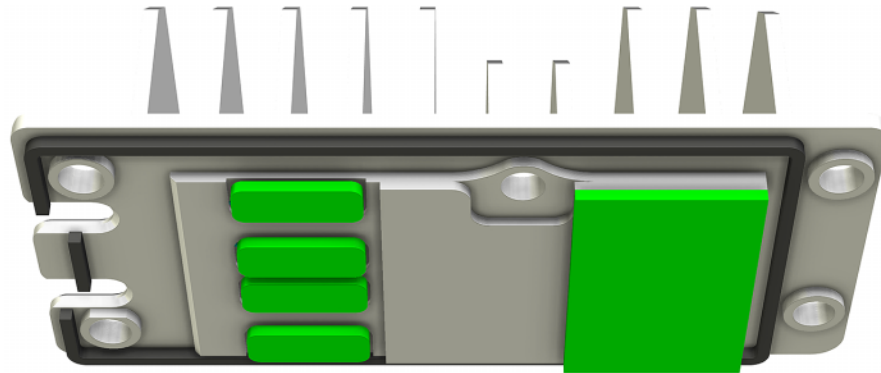
As can be seen, there are two cables going to the rear panel ODI port. This is because the rear panel ODI port both transmits and receives data.

The cables that are used to make connection to the A21 Wideband Digital IF are Samtec FireFly™ cables. The optical engines are built into the cable connectors, they are not on the board assemblies. Because of this, the cables are not bi-directional. The blue cable connectors are the receivers while the orange connectors are the transmitters. The colors written on the board assembly must match the cable connector colors.

The FireFly™ connectors do get hot. That is why there is a heatsink on top of these connectors on the A21 Wideband Digital IF assembly. There are also thermal pads that are attached to the underside of the heatsink that need to be in place, along with gasketing material, as seen in **Figure 13-31**. If the thermal pads or gasketing get damaged, replace the A21MP1 FireFly™ Heatsink.

Figure 13-31

A21 Wideband Digital IF FireFly™ Heatsink Thermal Pads



FireFly™ Connector Installation

The optical cable installation tool will be required to install the option ST1 / ST2 connectors on the A21 Wideband Digital IF, as seen in **Figure 13-32**. The back of these connectors is too close to the board heatsink to be able to push them into place without the tool.

Figure 13-32

ODI Connector Installation Tool



The tool will not be required to remove any of the FireFly™ connectors. Just pull up, then back, on the colored tab to unlock then disengage the connectors.

The following procedure for installing the FireFly™ connectors needs to be followed closely in order to not damage either the connector on the cable or the board assembly. These steps are illustrated in **Figure 13-33** through **Figure 13-36**.

1. Raise the locking clip into the unlocked position.
2. Insert the installation tool into the connector lock.
3. Lower the connector squarely over the mating connector on the board.
4. Use the installation tool to slide the connector forward to engage the forward connector.

5. Remove the installation tool from the connector lock.
6. Press the locking clip down into position.

NOTE

Do not slide the connector forward, as outlined in step 4, by pushing on the connector locking clip, as this could cause it to lock before it is properly in place. Slide the connector forward by pushing on the connector installation tool, as seen in [Figure 13-36](#).

Figure 13-33 ODI Connector Installation – Step 1

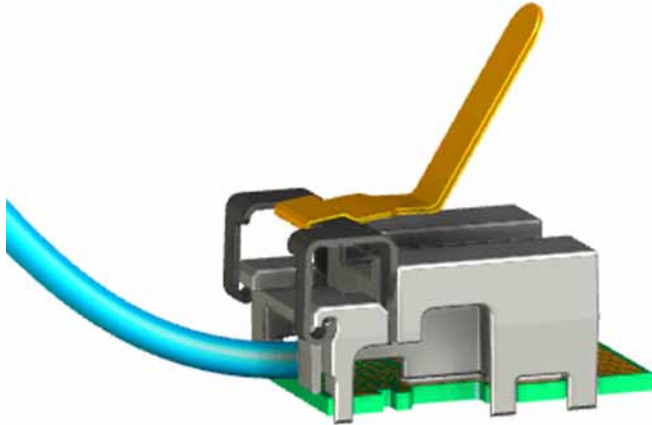


Figure 13-34 ODI Connector Installation – Step 2

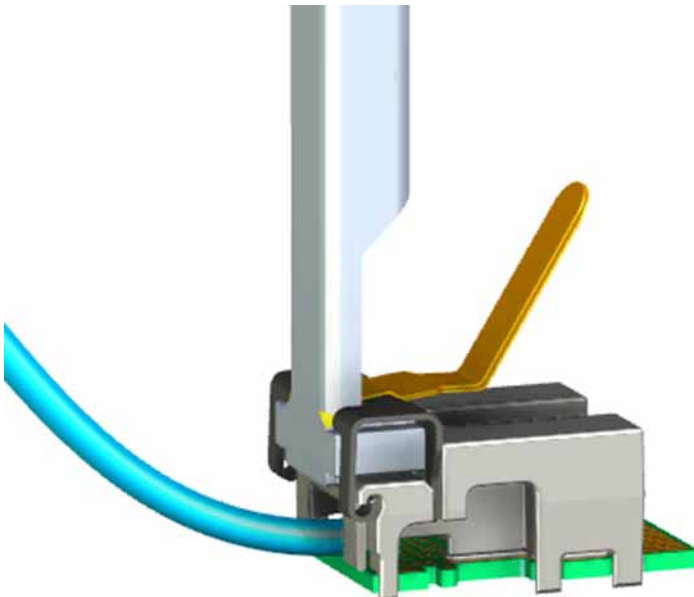


Figure 13-35 ODI Connector Installation – Step 3

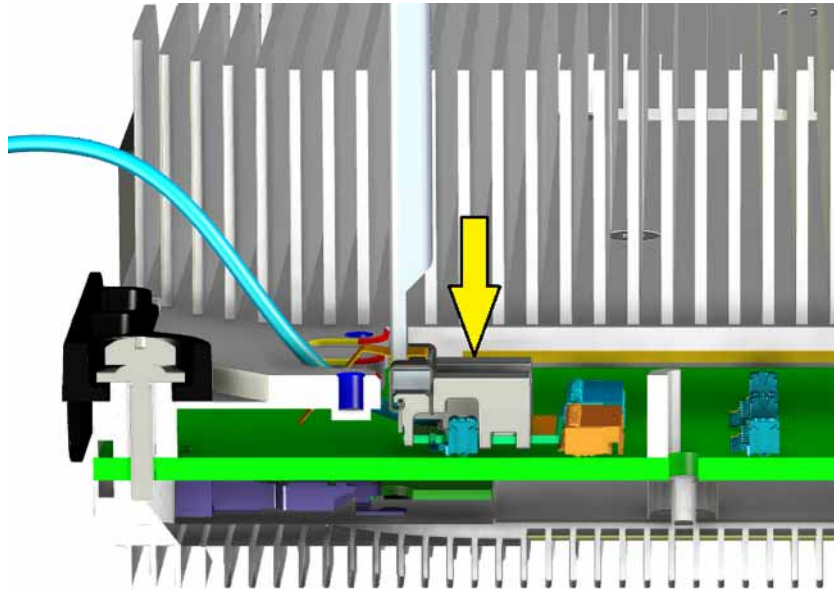


Figure 13-36 ODI Connector Installation – Step 4

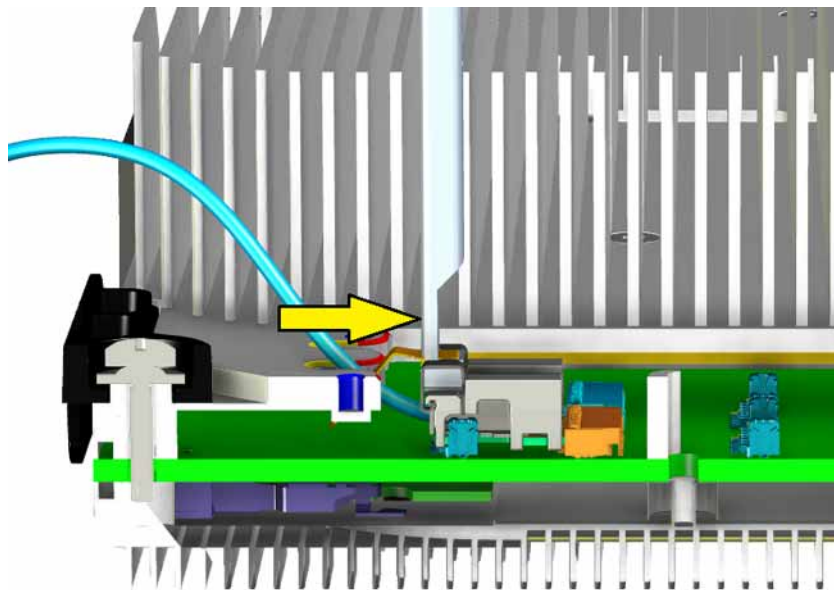


Figure 13-37 ODI Connector Installation – Step 5

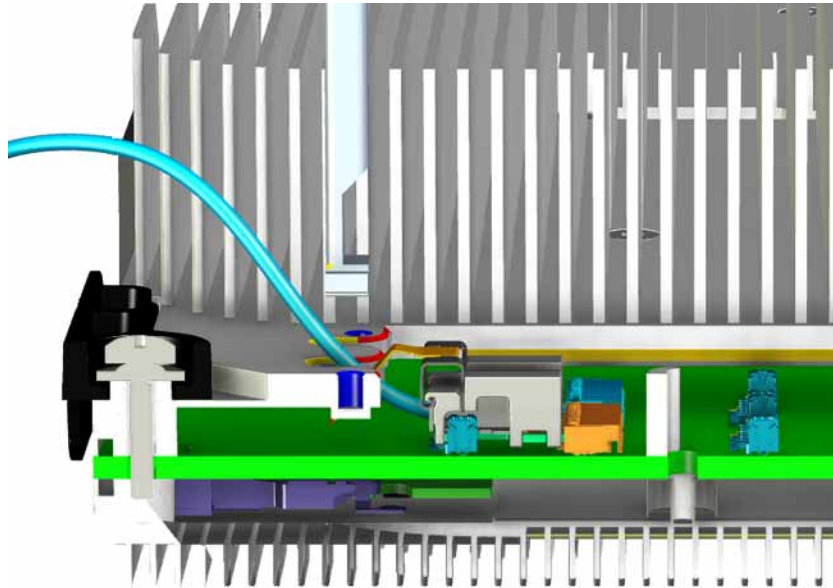
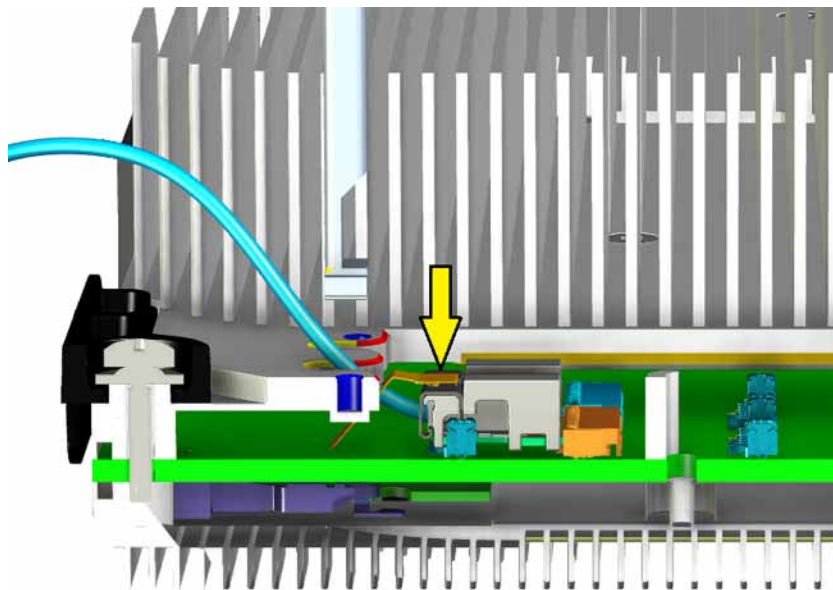


Figure 13-38 ODI Connector Installation – Step 6



CAUTION

Great care needs to be taken when installing or removing any of the FireFly™ connectors. Be sure to follow the steps outlined above for installing these connectors, and use the installation tool (N9041-20181).

Functional Verification

Before proceeding to verify or troubleshoot the operation of the A21 Wideband Digital IF, verify that it is being recognized by the instrument by pressing **System, Show Hardware** and verify that there is a **Gen 4 DIF Controller** in the list of hardware assemblies, as seen in [Figure 13-28](#). 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 FPGAs [“Overview”](#) section in [Chapter 25, “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.
- A21 Wideband Digital IF assembly is defective
Solution: Replace the A21 Wideband Digital IF assembly

NOTE

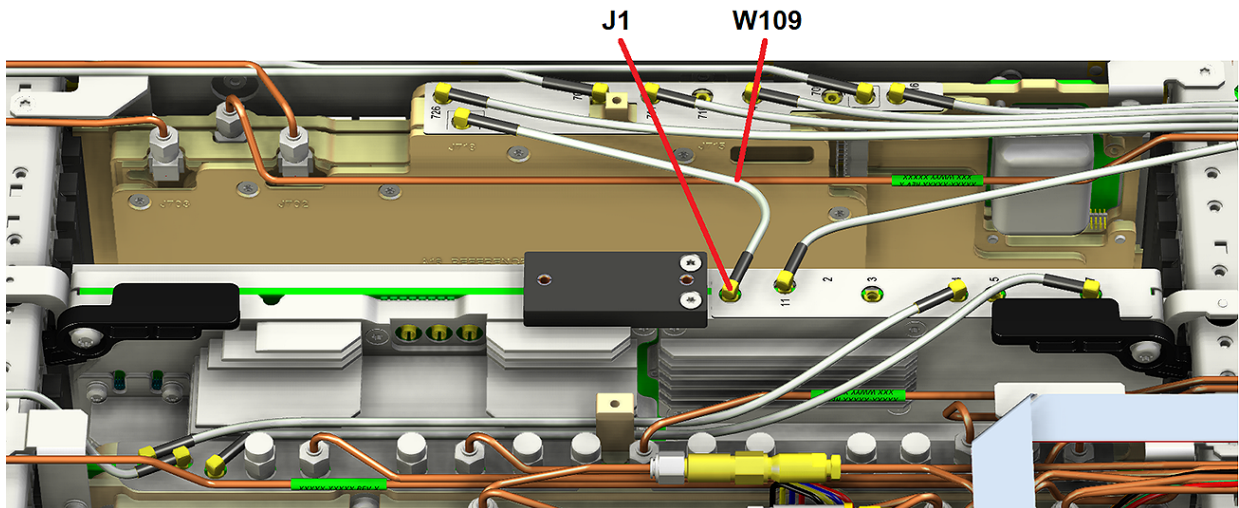
Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the [“Power Supply Verification”](#) section in [Chapter 5, “First-Look Troubleshooting.”](#)

2400 MHz Reference Verification

The 2400 MHz reference signal going to the A21 Wideband Digital IF is used to derive the clock signals for the ADCs, the FPGA clock, as well as calibrator signals used by the A21 Wideband Digital IF. If this signal to the A21 Wideband Digital IF is lost, all data acquisition in the instrument for the wide bandwidths will stop. So, when the following procedure is used to verify that there is a 2400 MHz reference signal going to the A21 Wideband Digital IF, the instrument application will need to be restarted to recover.

1. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
2. Referring to **Figure 13-39**, remove W109 from the A21 Wideband Digital IF J1.

Figure 13-39 A21 Wideband Digital IF 2400 MHz Reference Input



3. Connect a spectrum analyzer to the loose end of W109.
4. Tune the spectrum analyzer to 2.4 GHz with a span of 10 MHz.
5. 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, see **Chapter 15, "Reference,"** to determine why there is a problem with the 2400 MHz reference coming from J718 of the A16 Reference assembly.

6. Reconnect W109 to J1.
7. Restart the instrument application.

IF Signal Path Verification

The procedure in this section can be used to verify that the two A21 Wideband Digital IF inputs are working properly. Of course, instruments without an analysis bandwidth wider than 1.0 GHz will only use one of these inputs.

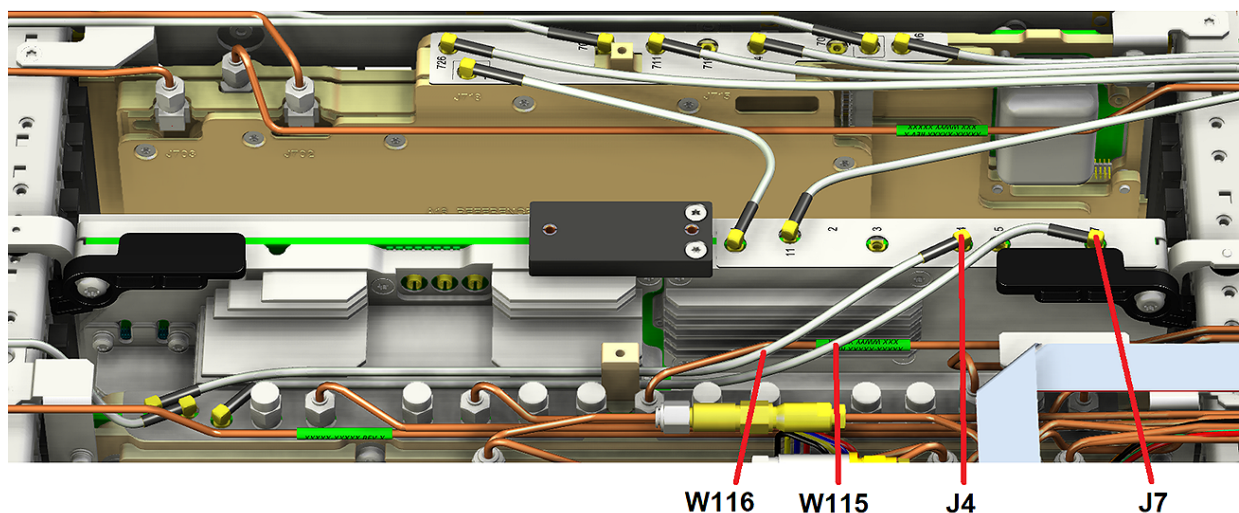
Since the only output of the A21 Wideband Digital IF is from its digital signal processor to the A4 System Processor, it is not possible to verify the actual output of the assembly. However, the following procedure will verify that the assembly receives known good signals and will then make the best assumptions possible as to the cause of a fault based on the instrument's ability to display the correct overall results.

NOTE

The following procedure assumes that the 2400 MHz Reference signal to the A21 Wideband Digital IF has been verified. If this has not been done, see the “[2400 MHz Reference Verification](#)” section in this chapter before proceeding.

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. Tune the instrument to 8 GHz by pressing **Frequency, Center Frequency 8 GHz**.
5. Change the IF path to 1 GHz by pressing **Meas Setup, IF Path, IF Path, 1 GHz**.
6. Referring to [Figure 13-40](#), remove W116 from the A21 Wideband Digital IF 255 MHz / 1.0 GHz input at J4.

Figure 13-40 A21 Wideband Digital IF Inputs



7. Connect a signal generator to J4.
8. Tune the signal generator to 690 MHz with a power level of -10 dBm.
9. 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 255 MHz / 1 GHz IF path through the A21 Wideband Digital IF is working as expected. If the instrument has option R15, or R20, proceed to the next step. If not, exit this procedure.

If there is not a signal as expected, make a note that the 255 MHz / 1 GHz IF path through the A21 Wideband Digital IF is not working as expected. If the instrument has option R15, or R20, proceed to the next step. If not, go to **step 15**.

10. Change the IF path to 2 GHz by pressing **Meas Setup, IF Path, IF Path, 2 GHz**.

NOTE

If the instrument does not have option R20, but does have option R15, change the IF Path to 1.5 GHz instead of 2 GHz in step 10.

11. Remove W115 from the A21 Wideband Digital IF 1.5 / 2.0 GHz input at J7.
12. Connect the signal generator to J7.
13. Tune the signal generator to 1.2 GHz with a power level of 0 dBm.

NOTE

Be sure to account for the cable loss when setting power levels.

14. Verify that there is a signal at the center of the instrument display with a power level of approximately -15 dBm.

If there is a signal as expected, the 1.5 / 2.0 GHz IF path through the A21 Wideband Digital IF is working as expected. Proceed to the next step.

If there is not a signal as expected, make a note that the 1.5 / 2 GHz IF path through the A21 Wideband Digital IF is not working as expected. Proceed to the next step.

Evaluate the Results

If both the 255 MHz / 1 GHz IF path and the 1.5 / 2 GHz IF path are working as expected, the A21 Wideband Digital IF is working as expected.

If one of the two IF paths is not working as expected, replace the A21 Wideband Digital IF.

If both the IF paths are not working, proceed to the next step.

15. Connect the signal generator to the instrument RF input.
16. Tune the signal generator to 8 GHz with a power level of -10 dBm.

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

18.Verify that there is a 8 GHz signal at the center of the instrument display at approximately -10 dBm.

If there is a signal on screen as expected, replace the A21 Wideband Digital IF.

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

IF Frequency Response Verification

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 A21 Wideband Digital IF, the following procedure can be used to evaluate its performance.

NOTE

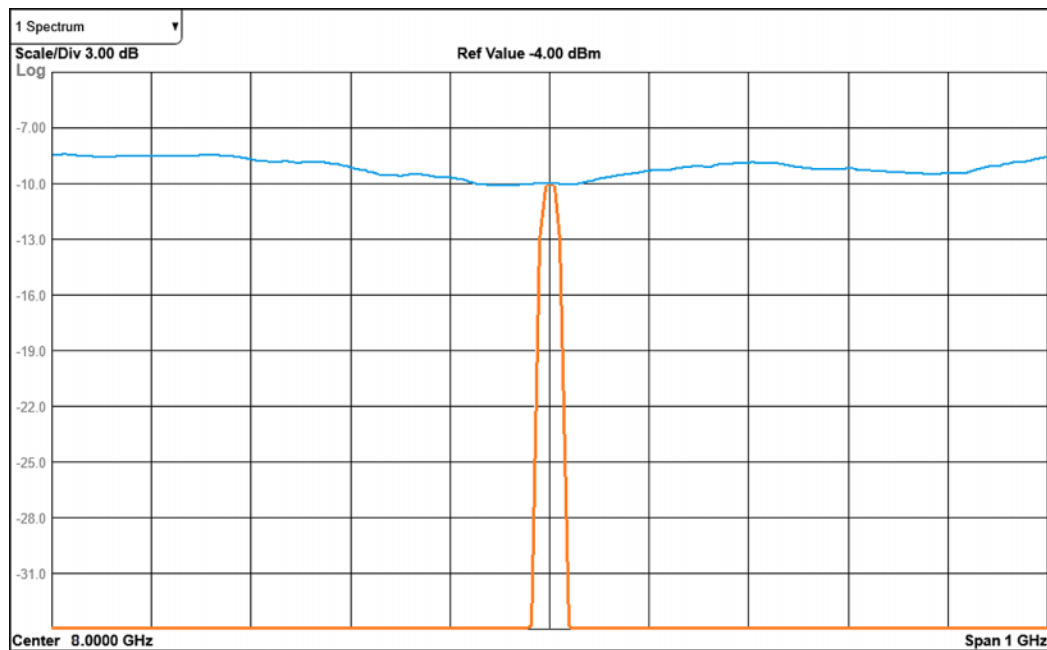
The following procedure assumes that it has already been verified that the instrument is able to digitize and display a signal of the correct level at the center of the 1.0 GHz IF path. If this is not the case, see the [“IF Signal Path Verification”](#) procedure in this section before proceeding.

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 1 GHz by pressing **Meas Setup, IF Path, IF Path, 1 GHz**.
5. Tune the frequency of the instrument to 8 GHz by pressing **Frequency, Center Frequency 8 GHz**.
6. Change the span to 1 GHz by pressing **Span 1 GHz**.
7. Set the instrument reference level to -4 dBm by pressing **Amplitude, Ref Value -4 dBm**.
8. Set the vertical scale per division to 3 dB by pressing **Scale/Div 3 dB**.
9. Activate the service menu. See [Chapter 20, “Service Menus,”](#) if instructions on how to do this are needed.
10. Turn the IF flatness corrections off by pressing **Meas Setup, Service Diagnostics, IF Flatness Off**.
11. Referring to [Figure 13-40](#), remove W116 from J4 of the A21 Wideband Digital IF.
12. Connect a signal generator to J4.
13. Tune the signal generator to 690 MHz with a power level of -10 dBm.
14. Adjust the power level of the signal generator until the level of the signal on the screen is -10 dBm, ± 0.25 dB.

15. Change the average type to maximum by pressing **Meas Setup, Avg Type, Maximum**.

16. Vary the frequency of the signal generator between 190 and 1190 MHz so that it draws out the IF frequency response of the 1 GHz IF path on the instrument screen, as seen in [Figure 13-41](#).

Figure 13-41 A21 Wideband Digital IF Typical IF Frequency Response – 1.0 GHz 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 13-41](#).

17. Verify that the maximum trace does not vary by more than 5 dB from the center trace point value.

If the maximum trace is as expected, the 1.0 GHz IF flatness is as expected. If the instrument has option R15, or R20, proceed to the next step. If not, exit this procedure.

If the maximum trace is not as expected, replace the A21 Wideband Digital IF.

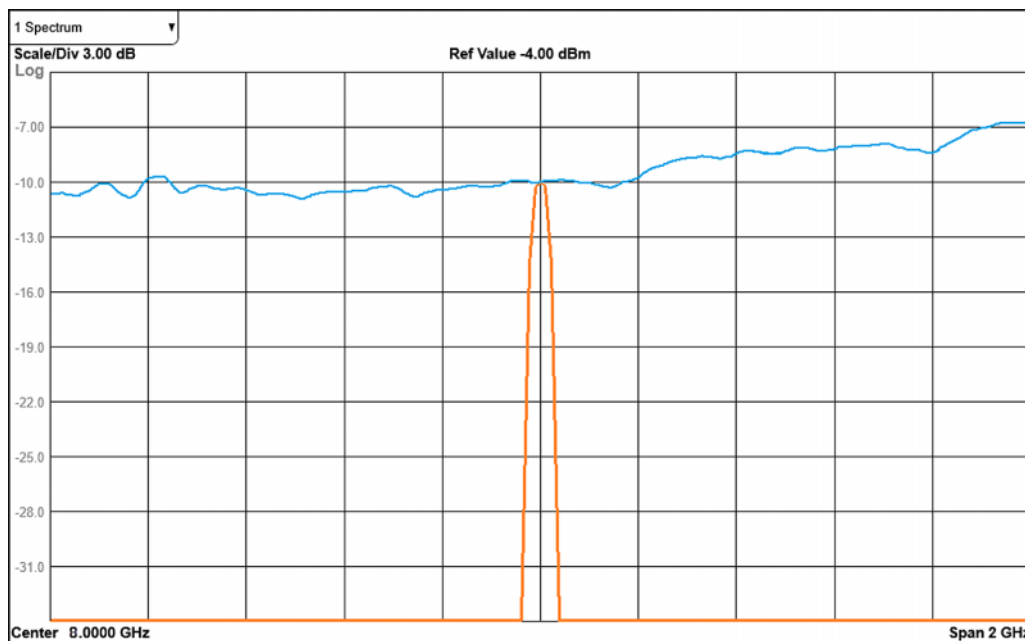
18. Referring to [Figure 13-40](#), remove W115 from J7 of the A21 Wideband Digital IF.

19. Move the signal generator to J7.

20. Tune the signal generator to 1.2 GHz.

21. Adjust the power level of the signal generator to +5 dBm.
22. Change the IF path to 2 GHz by pressing **Meas Setup**, **IF Path**, **IF Path**, **2 GHz**.
23. Change the span to 2 GHz by pressing **Frequency**, **Span 2 GHz**.
24. Adjust the power level of the signal generator until the level of the signal on the screen is -10 dBm, ± 0.25 dB.
25. Restart the maximum trace by pressing **Restart**.
26. Vary the frequency of the signal generator between 200 and 2200 MHz so that it draws out the IF frequency response of the 2 GHz IF path on the instrument screen, as seen in **Figure 13-42**.

Figure 13-42 A21 Wideband Digital IF Typical IF Frequency Response – 2.0 GHz IF Path



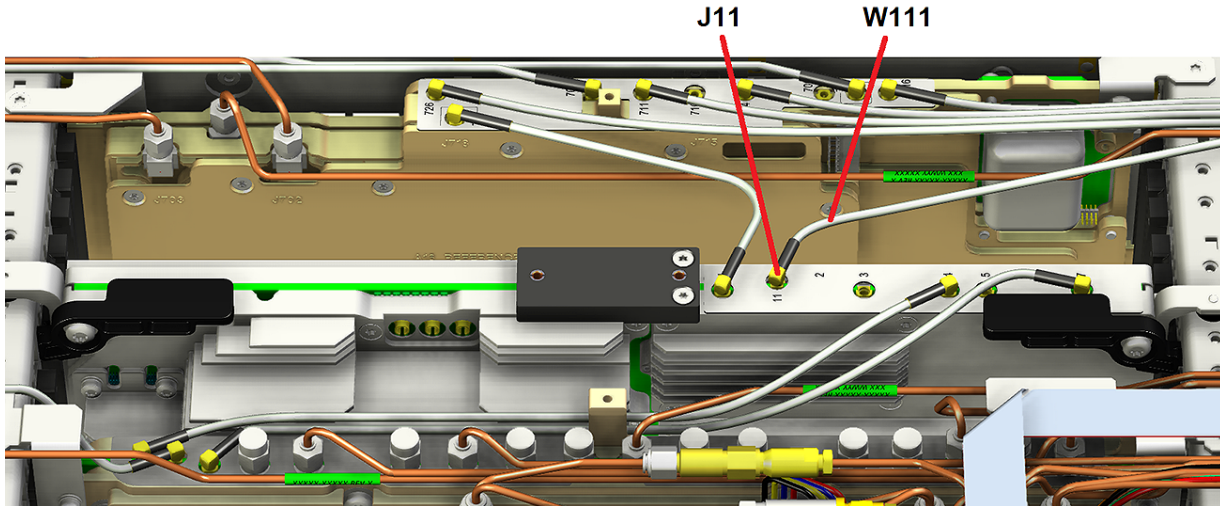
27. Verify that the maximum trace does not vary by more than 5 dB from the center trace point value.
If the maximum trace is as expected, the IF flatness of the A21 Wideband Digital IF is as expected.
If the maximum trace is not as expected, replace the A21 Wideband Digital IF.

Trigger 3 Input Verification

The following procedure can be used to verify the functionality of the Trigger 3 In rear panel port.

1. Verify that the instrument is in the IQ analyzer mode by pressing **Mode/Meas, IQ Analyzer, OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Note that the time in-between sweeps is very small.
4. Referring to **Figure 13-43**, remove W111 from J11 on the A21 Wideband Digital IF.
5. Connect a pulse generator to J11.

Figure 13-43 A21 Wideband Digital IF Trigger 3 Input



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 μ s.
7. Change the IF path to 1 GHz by pressing **Meas Setup, IF Path 1GHz**.
8. Change the instrument trigger to Trigger 3 In by pressing **Trigger, Select Trigger Source, External 3**.
9. Verify that the time in-between sweeps is now approximately one second.
If the instrument is sweeping as expected, the Trigger 3 In port is working as expected.
If the instrument is not sweeping as expected, replace the A21 Wideband Digital IF.

Analog and Digital IFs
A21 Wideband Digital IF

14 LO Synthesizer

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 444](#)

[Troubleshooting Equipment Required on page 445](#)

[A14 DDS LO Synthesizer on page 446](#)

[Overview on page 446](#)

[Functional Verification on page 452](#)

[A20 Yig Tuned Oscillator on page 461](#)

[Overview on page 461](#)

[Functional Verification on page 463](#)

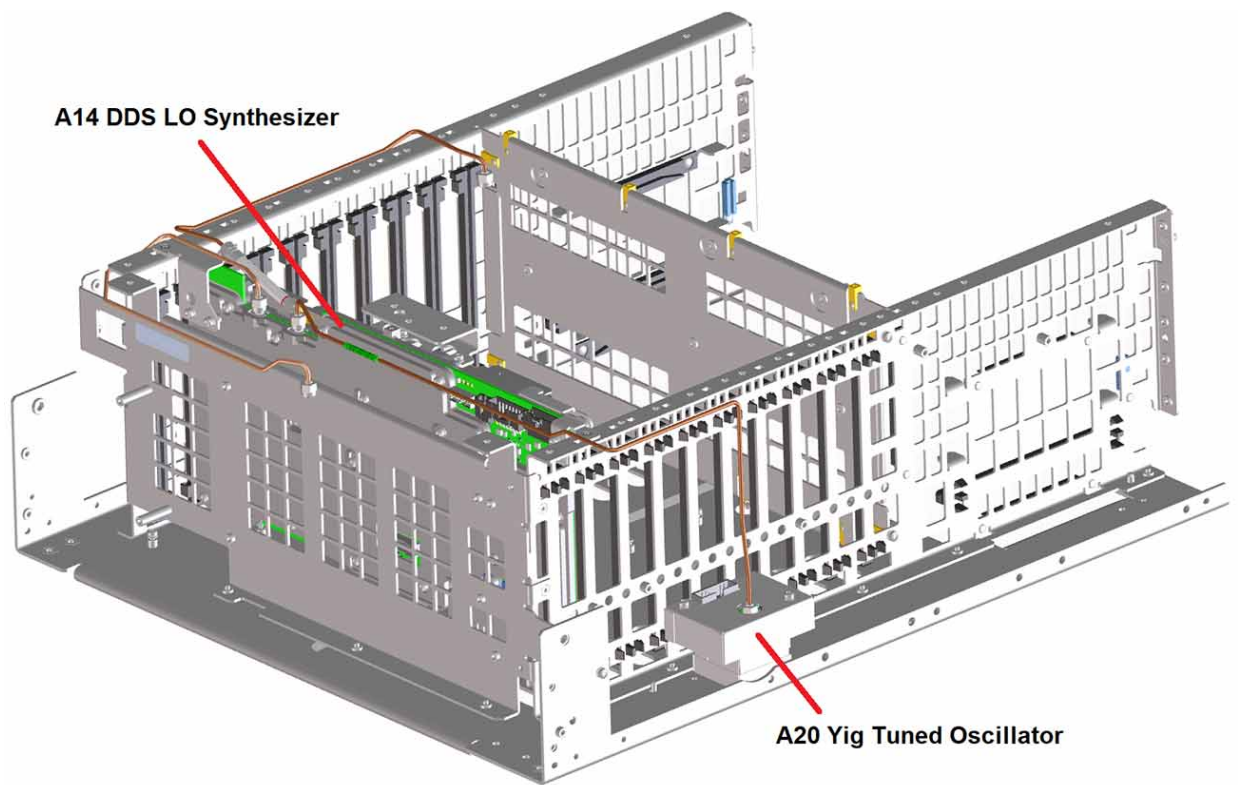
Overview

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 layout of these components can be seen in the DDS LO Synthesizer & Multiplier block diagram in [Chapter 8, “Block Diagrams.”](#) The location of each of these components in the instrument can be seen in [Figure 14-1.](#)

Figure 14-1 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 22, “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

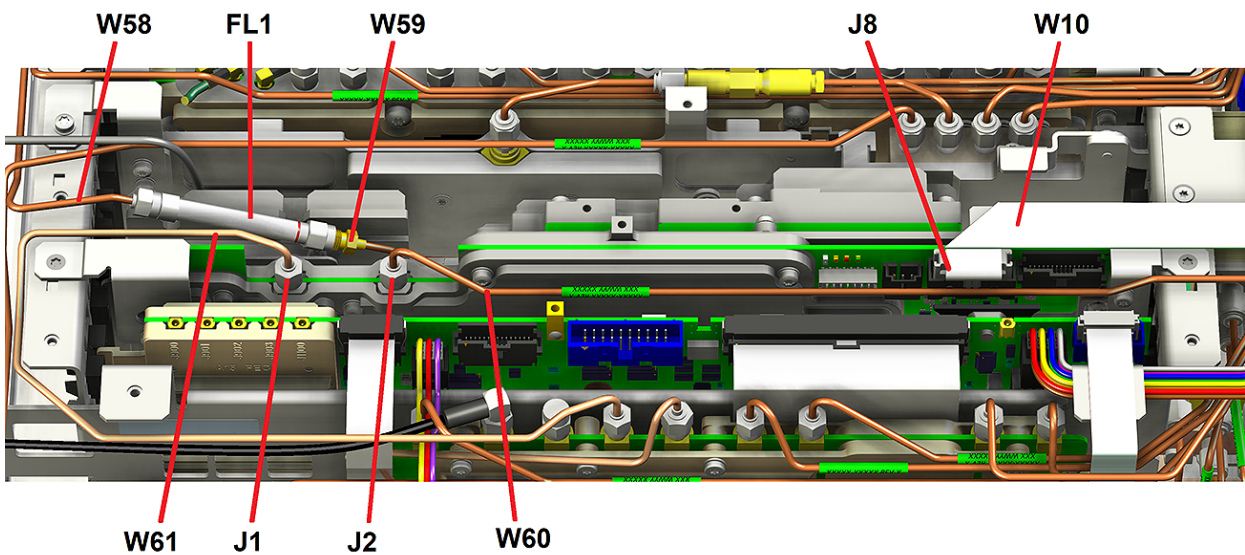
Overview

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 14-1](#), as seen in [Figure 14-2](#).

Table 14-1 A14 DDS LO Synthesizer Connections

Port	Description	To/From	Cable
J1	LO Output	To A13 Downconverter J4	W61
J2	Yig Tuned Oscillator Input	From A20 Yig Tuned Oscillator Output	W60
J8	Yig Tuned Oscillator Control	To A20 Yig Tuned Oscillator Control	W10
J16	Bias and Control	From A8 Motherboard J9	--
FL1 Input	7.2 GHz Reference Input	From A16 Reference J703	W58/W59

Figure 14-2 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 14-3](#).

Figure 14-3 Hardware Information Screen – A14 DDS LO Synthesizer

System Settings

System

Hardware Information

↶

↷

?

✕

System

Keysight PXA

Product Number

Serial Number

S/W Release Name

Instrument S/W Revision

Revision Date

Keysight PXA Signal Analyzer

N9032B

MY61010001

2023 Update 1.0

A.34.03

11/17/2022 9:38:32 AM

I/O Config

Preload / Unload Modes

Assembly Name

Analog IF

Part #

N902060290

79204100103

Serial #

13202309428

007

Matl Rev

Rev

OF Rev

Hw Id

Misc

1

A

57

User Interface

YIG Tuned Filter

Digital IF

50877382

N902060016

13202309428

79204100250

007

035

0

3

A

A

11

34

Power On

Front End Controller

IF Mux-10GHz

Low Band Switch

N902060295

N904160163

N904060100

79204100620

30203900015

78200251477

009

004

000

0

1

2

A

A

B

131

264

135

Restore Defaults

LO DDS Synthesizer

LO DDS Reference

N902060175

M930560028

79204000654

79204100169

011

007

3

0

A

A

91

92

Alignments

Wideband Calibrator

Reference Plus Main

Reference Plus Daughter

N904060151

N902060185

N902060186

30202000005

79204701317

79204501221

004

008

010

2

3

1

A

A

A

260

93

94

Licensing

Front End

Gen 4 DIF Controller

N904160039

N904160048

78203535226

30203600005

000

003

1

3

A

A

270

208

Security

Switched IF Filter

YTO

N902060220

N902060009

59200251433

79204200133

005

006

0

0

B

A

132

54

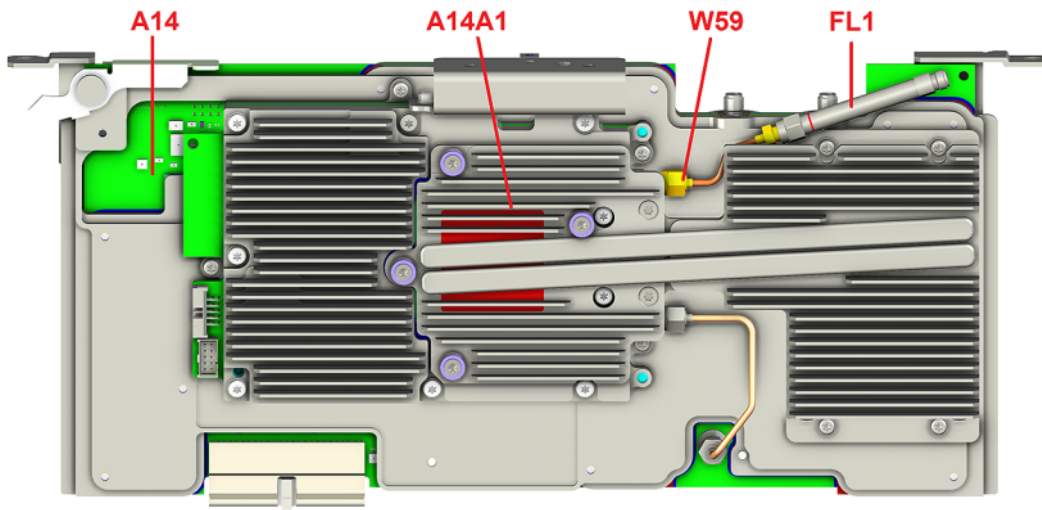
Diagnostics

Service

SCPI Recorder

The different components that make up the A14 DDS LO Synthesizer can be seen in **Figure 14-4**. A replacement A14 DDS LO Synthesizer includes both the A14 and A14A1, but not FL1 or W59.

Figure 14-4 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 14-5](#) and [Figure 14-6](#). The instrument settings determine which one to use.

Figure 14-5 A14 DDS LO Synthesizer Block Diagram – A20 Output

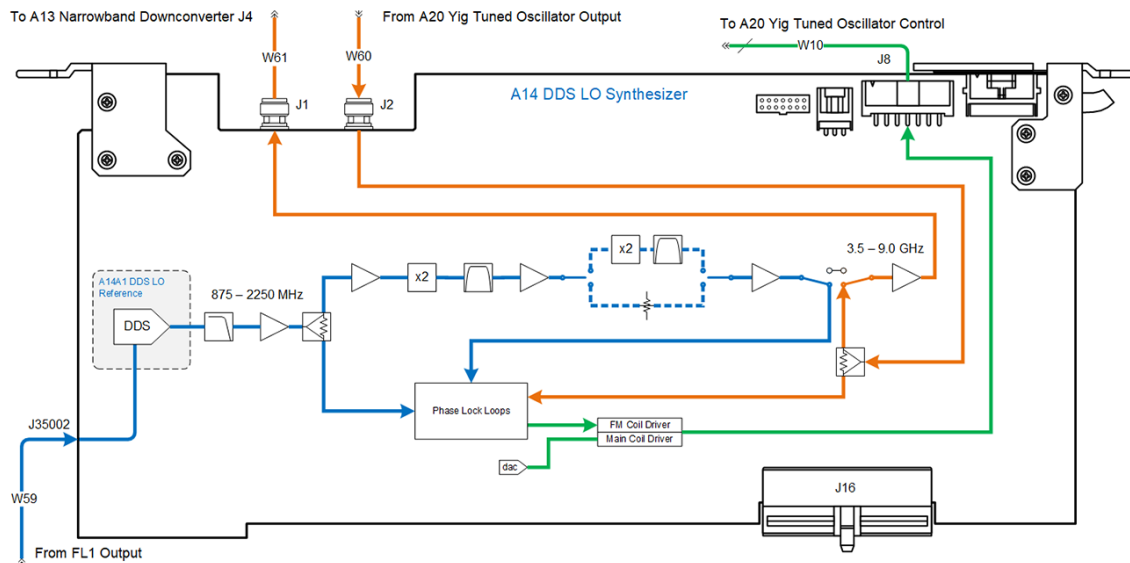
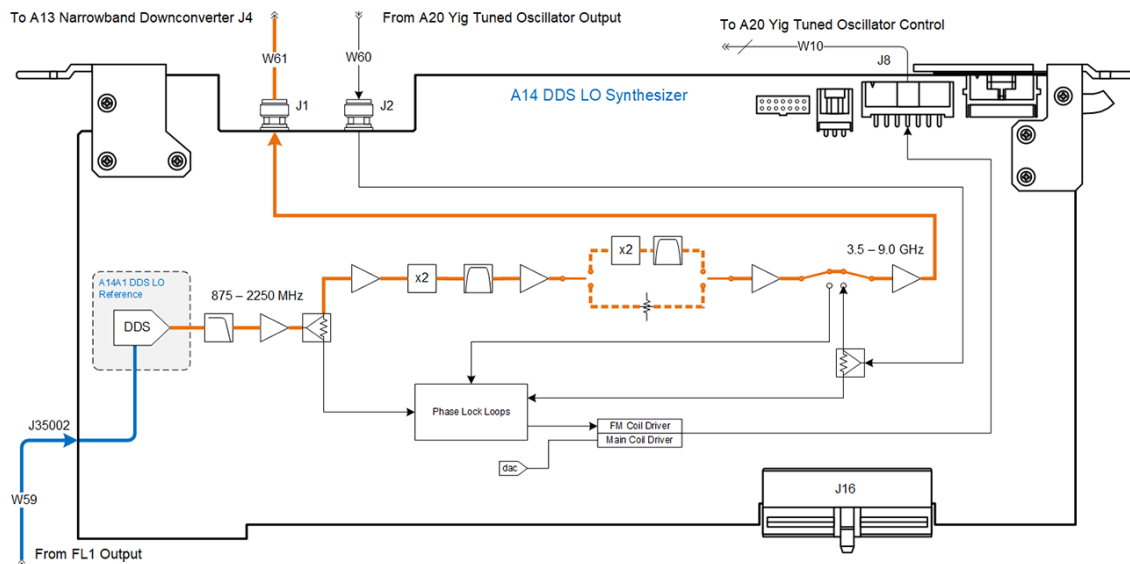


Figure 14-6 A14 DDS LO Synthesizer Block Diagram – A14A1 Output



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 Downconverter 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 14-2](#) through [Table 14-6](#) for the different IF signal paths.

Table 14-2 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 55 GHz	4.3528125 to 6.9153125 GHz	x8	322.5 MHz

Table 14-3 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 55 GHz	4.34375 to 6.90625 GHz	x8	250 MHz

Table 14-4 LO Frequency Range - 255 MHz and 1.0 GHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.3 GHz	5.49 to 8.79 GHz	x1	5.49 GHz
3.3 to 8.4 GHz	3.99 to 9.09 GHz	x1	690 MHz
8.4 to 17.1 GHz	4.545 to 8.895 GHz	x2	690 MHz
17.1 to 34.3 GHz	4.4475 to 8.7475 GHz	x4	690 MHz
34.3 to 55 GHz	4.37375 to 6.96125 GHz	x8	690 MHz

Table 14-5 LO Frequency Range - 1.5 GHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
0 to 3.5 GHz	5.75 to 9.25 GHz	x1	5.75 GHz
3.5 to 7.9 GHz	4.7 to 9.10 GHz	x1	1.2 GHz
7.9 to 17.1 GHz	4.55 to 9.15 GHz	x2	1.2 GHz
17.1 to 33.8 GHz	4.575 to 8.75 GHz	x4	1.2 GHz
33.8 to 55 GHz	4.375 to 7.025 GHz	x8	1.2 GHz

Table 14-6 LO Frequency Range - 2.0 GHz IF Path

Input Frequency	A14 Output Frequency	LO Multiplier	First IF
3.5 to 7.9 GHz	4.7 to 9.10 GHz	x1	1.2 GHz
7.9 to 17.1 GHz	4.55 to 9.15 GHz	x2	1.2 GHz
17.1 to 33.8 GHz	4.575 to 8.75 GHz	x4	1.2 GHz
33.8 to 55 GHz	4.375 to 7.025 GHz	x8	1.2 GHz

To determine what the A14 DDS LO Synthesizer output frequency should be for any input frequency, use the information in [Table 14-2](#) through [Table 14-6](#) 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 14-3](#). 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 25, “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

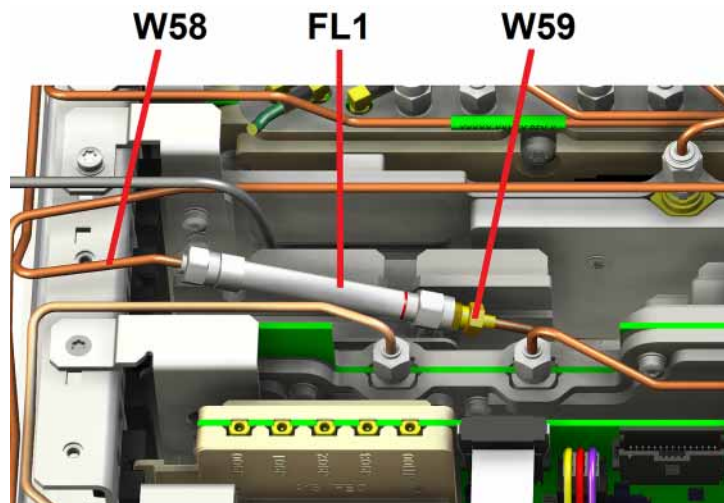
Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the [“Power Supply Verification”](#) section in [Chapter 5, “First-Look Troubleshooting.”](#)

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 14-7](#), remove W58 from the input of FL1.

Figure 14-7 A14 DDS LO Synthesizer 7.2 GHz Reference Connections



6. Connect a spectrum analyzer to the loose end of W58.
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 15, "Reference,"](#) to determine why there is a problem with the 7.2 GHz reference coming from J703 of the A16 Reference assembly.

9. Reconnect W58 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.

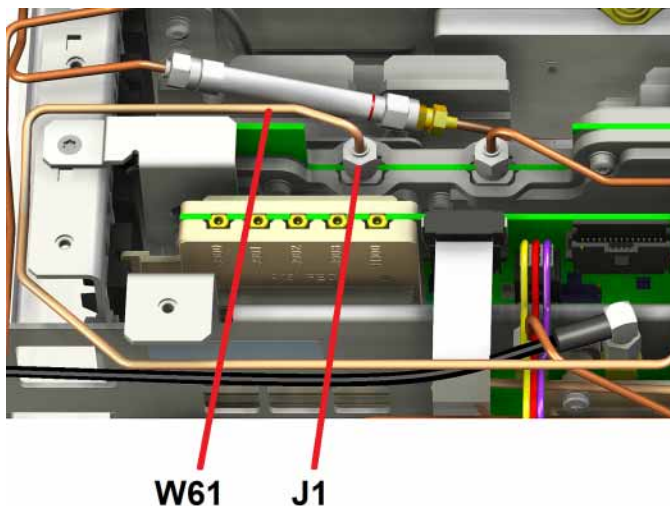
1. Verify that the instrument is in spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
2. Return the instrument to a known state by pressing **Mode Preset**.
3. Turn the internal alignments off by pressing **System, Alignments, Auto Align, Auto Align Off**.
4. Tune the instrument 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 14-3](#), 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 14-8](#), remove W61 from the A14 DDS LO Synthesizer J1.

Figure 14-8 A14 DDS LO Synthesizer Output Connection



8. Connect a spectrum analyzer to the A14 DDS LO Synthesizer output at J1.

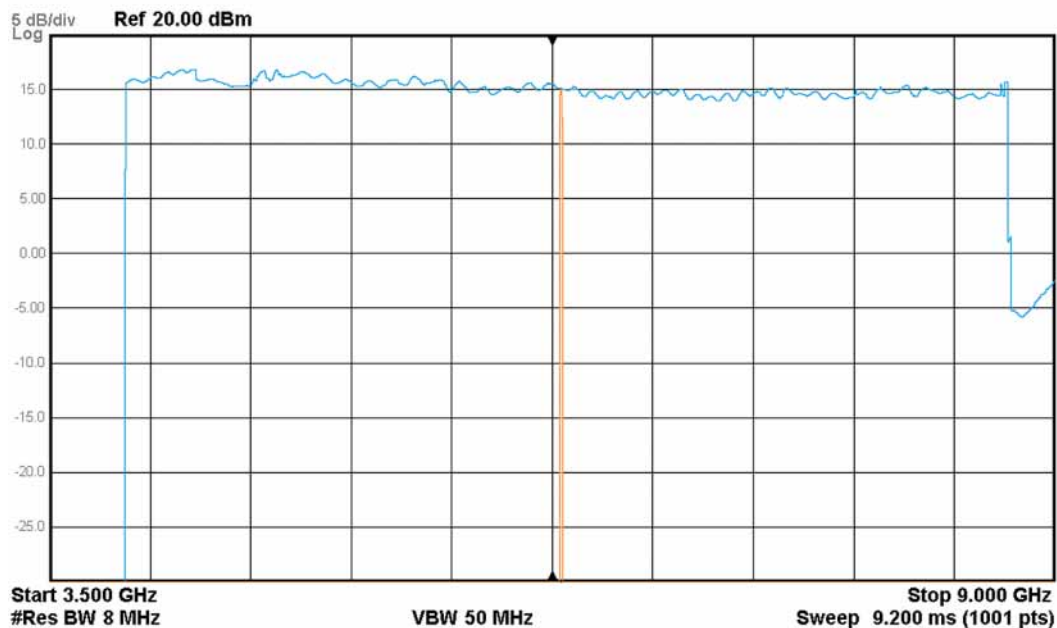
9. Tune the spectrum analyzer to a start frequency of 3.5 GHz and a stop frequency of 9 GHz
10. Set the spectrum analyzer reference level to +20 dBm with a vertical scale of 5 dB per division.
11. Set the spectrum analyzer resolution bandwidth as wide as it will go.
12. Turn the spectrum analyzer trace 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 14-9](#).

Figure 14-9 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.

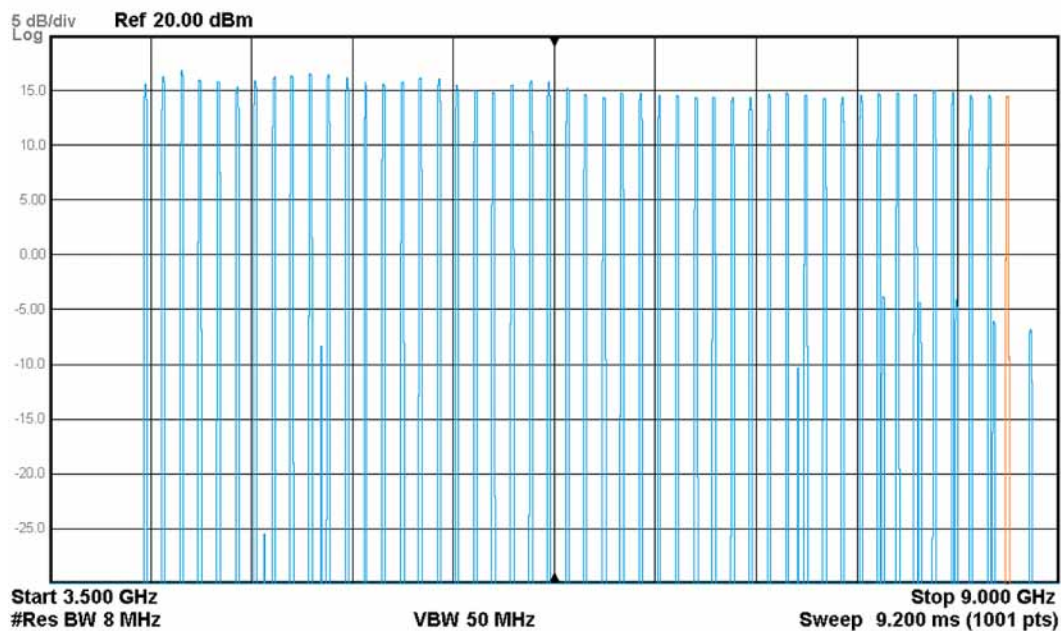
If the power level is not as expected, see the “**Output Power Level Verification**” section for the A20 Yig Tuned Oscillator later in this chapter to determine if its power level is correct. If it is determined that the power level of the A20 Yig Tuned Oscillator is correct, replace the A14 DDS LO Synthesizer.

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 14-10**.

Figure 14-10 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 13, “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.

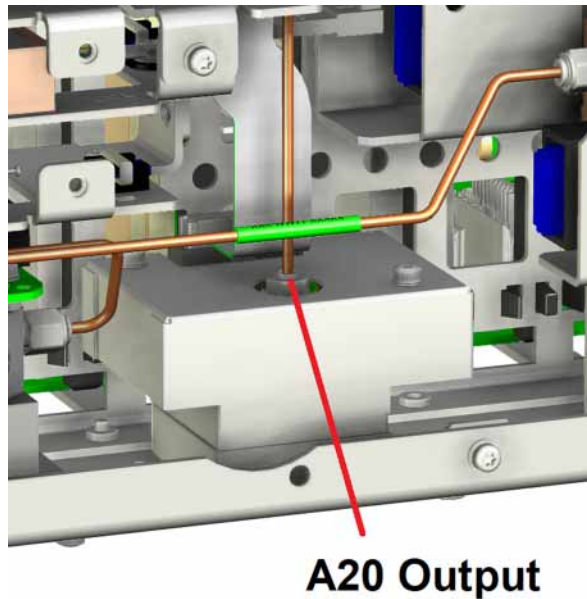
If the problem does not go away, replace the A14 DDS LO Synthesizer.

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 14-11**, remove W60 from the A20 Yig Tuned Oscillator output.

Figure 14-11 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 wandering 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.

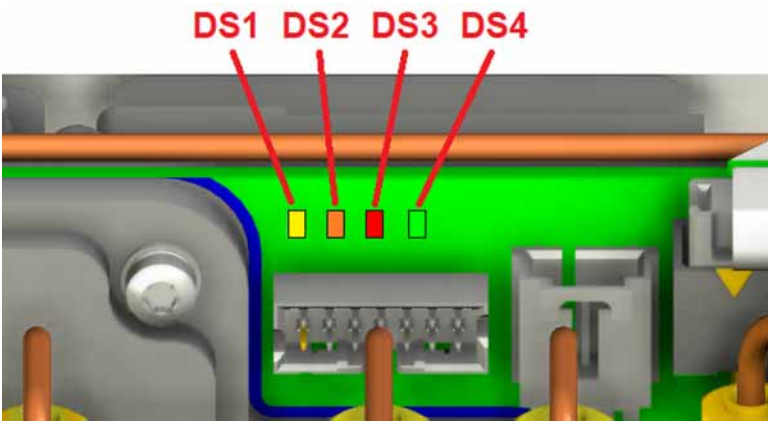
Synthesizer Status LEDs

There are four status LEDs on the A14 DDS LO Synthesizer assembly. A list of each LED can be seen in [Table 14-7](#), and the location of each can be seen in [Figure 14-12](#).

Table 14-7 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 14-12 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 sweep time 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 14-8**.

Table 14-8 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.

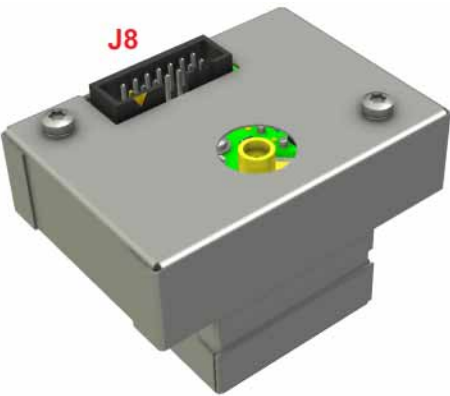
Control of the A20 Yig Tuned Oscillator comes from the A14 DDS LO Synthesizer assembly J8, via ribbon cable W10.

The connections to and from the A20 Yig Tuned Oscillator are listed in **Table 14-9** and as seen in **Figure 14-13**.

Table 14-9 **A20 Yig Tuned Oscillator Connections**

Port	Description	To/From	Cable
J8	Bias & Control	From A14 DDS LO Synthesizer J8	W10
Output	LO Output	To A14 DSS LO Synthesizer J2	W60

Figure 14-13 **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 14-14**.

Figure 14-14 Hardware Information Screen – A20 Yig Tuned Oscillator

System Settings	System		Hardware Information								   			
System	Keysight PXA		Keysight PXA Signal Analyzer											
	Product Number		N9032B											
	Serial Number		MY61010001											
I/O Config	S/W Release Name		2023 Update 1.0											
	Instrument S/W Revision		A.34.03											
	Revision Date		11/17/2022 9:38:32 AM											
Preload / Unload Modes	Assembly Name	Part #	Serial #	Matl Rev	Rev	OF Rev	Hw Id	Misc						
	Analog IF	N902060290	79204100103	011	1	A	57							
User Interface	YIG Tuned Filter	50877382	13202309428	007	0	A	11							
	Digital IF	N902060016	79204100250	035	3	A	34							
	Front End Controller	N902060295	79204100620	009	0	A	131							
Power On	IF Mux-10GHz	N904160163	30203900015	004	1	A	264							
	Low Band Switch	N904060100	78200251477	000	2	B	135							
Restore Defaults	LO DDS Synthesizer	N902060175	79204000654	011	3	A	91							
	LO DDS Reference	M930560028	79204100169	007	0	A	92							
	Wideband Calibrator	N904060151	30202000005	004	2	A	260							
Alignments	Reference Plus Main	N902060185	79204701317	008	3	A	93							
	Reference Plus Daughter	N902060186	79204501221	010	1	A	94							
Licensing	Front End	N904160039	78203535226	000	1	A	270							
	Gen 4 DIF Controller	N904160048	30203600005	003	3	A	208							
	Switched IF Filter	N902060220	59200251433	005	0	B	132							
Security	YTO	N902060009	79204200133	006	0	A	54							
Diagnostics														
Service														
SCPI Recorder														

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 14-14**. 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

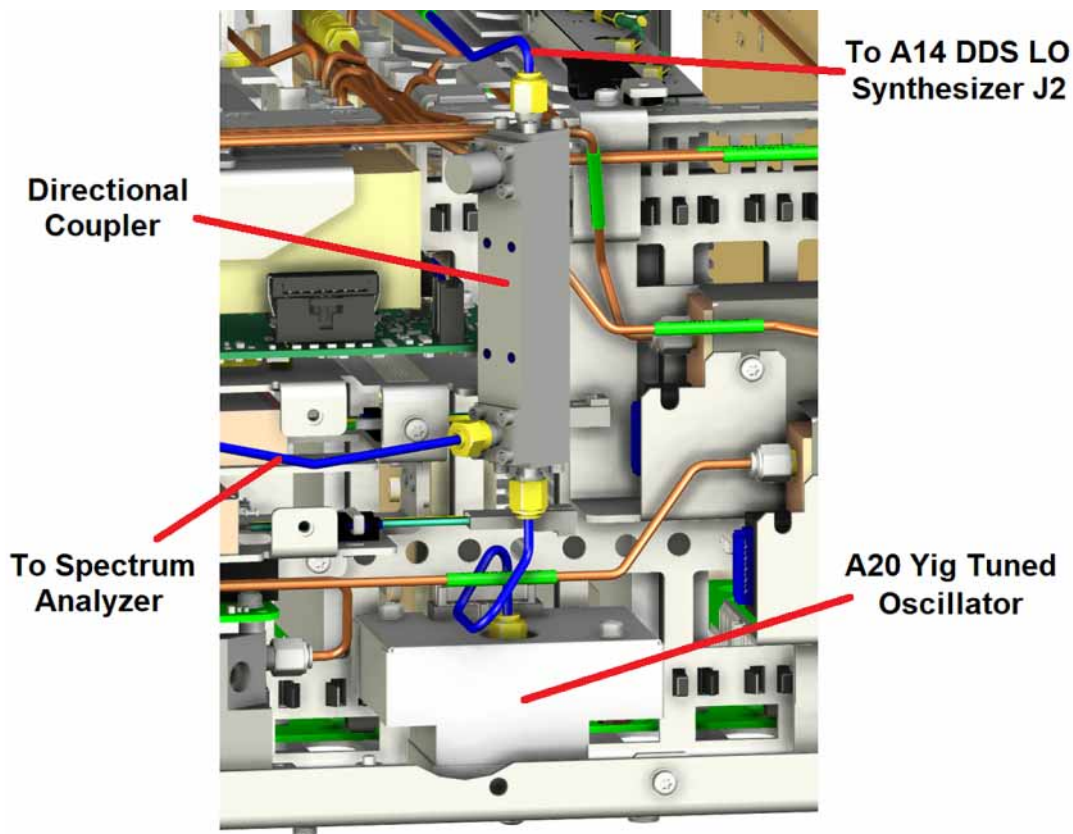
The following procedure will verify the output power level of the A20 Yig Tuned Oscillator.

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 14-15**, remove W60 from the A20 Yig Tuned Oscillator output and connect a directional coupler input to it. Then either reconnect W60 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 14-15 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 14-3](#), 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.

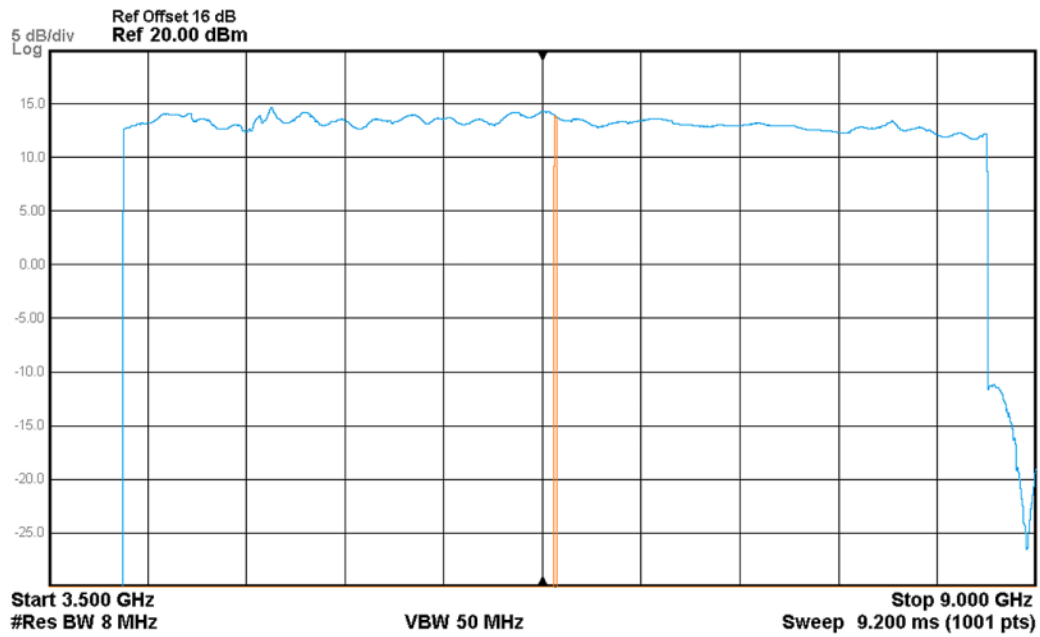
10. Set the sweep time to 30 seconds by pressing **Sweep, Sweep Time 30 sec**.
11. Tune the spectrum analyzer to a start frequency of 3.5 GHz and a stop frequency of 9 GHz
12. Set the spectrum analyzer reference level offset to the coupling factor of the directional coupler being used.
13. Set the spectrum 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 14-16](#), with the reference level offset set to equal the coupling factor of the directional coupler used.

Figure 14-16 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.

15 Reference

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 468](#)

[Troubleshooting Equipment Required on page 469](#)

[A16 Reference on page 470](#)

[Overview on page 470](#)

[Functional Verification on page 476](#)

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 22, "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:

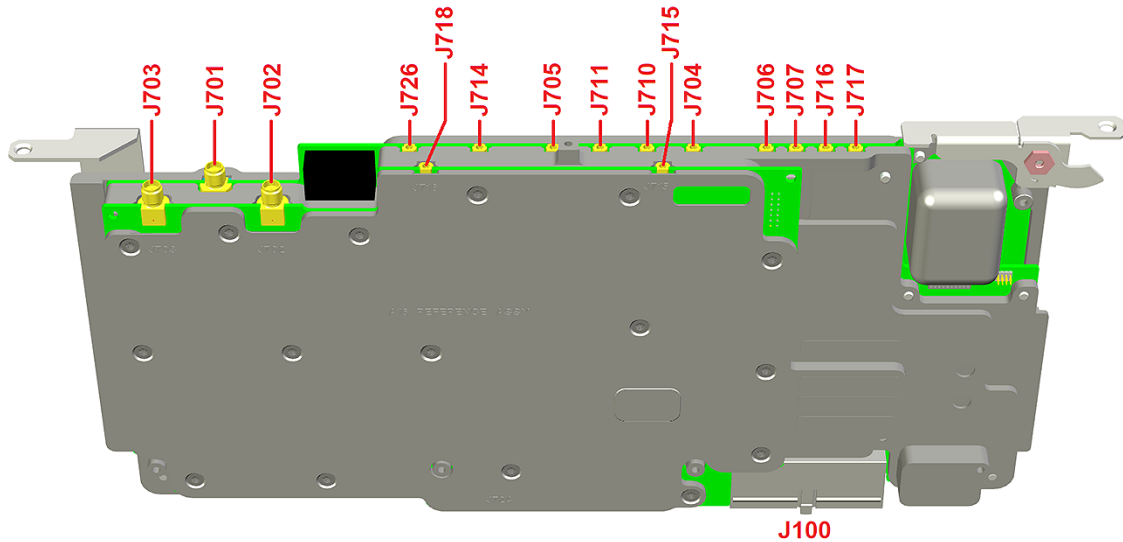
- Low Frequency Reference Signals
- High Frequency Reference Signals
- Calibrator Signals

The connections to and from the A16 Reference are listed in **Table 15-1**, as seen in **Figure 15-1**.

Table 15-1 A16 Reference Connections

Port	Description	To/From	Cable
J100	Control	From A8 Motherboard J6	--
J701	Calibrator Output	To SW1 Calibrator Switch P1	W75
J702	4.8 GHz Output	To A23 IF Mux J37	W76
J703	7.2 GHz Output	To FL1 7.2 GHz BPF Input	W58
J704	External Reference Input	From Rear Panel EXT REF IN	W104
J705	Ecal Output	To A13 Downconverter J6	W105
J706	Not Used	--	--
J707	100 MHz Output	To A25 Wideband Calibrator J2	W106
J710	Not Used	--	--
J711	300 MHz Output	To A2 25 MHz Analog IF J300	W107
J714	Not Used	--	--
J715	Not Used	--	--
J716	100 MHz Output	To A3 40 MHz Digital IF J14	W108
J717	Not Used	--	--
J718	2.4 GHz Output	To A21 Wideband Digital IF J1	W109
J726	Step Cal Input	From A3 40 MHz Digital IF J17	W110

Figure 15-1 A16 Reference Connections

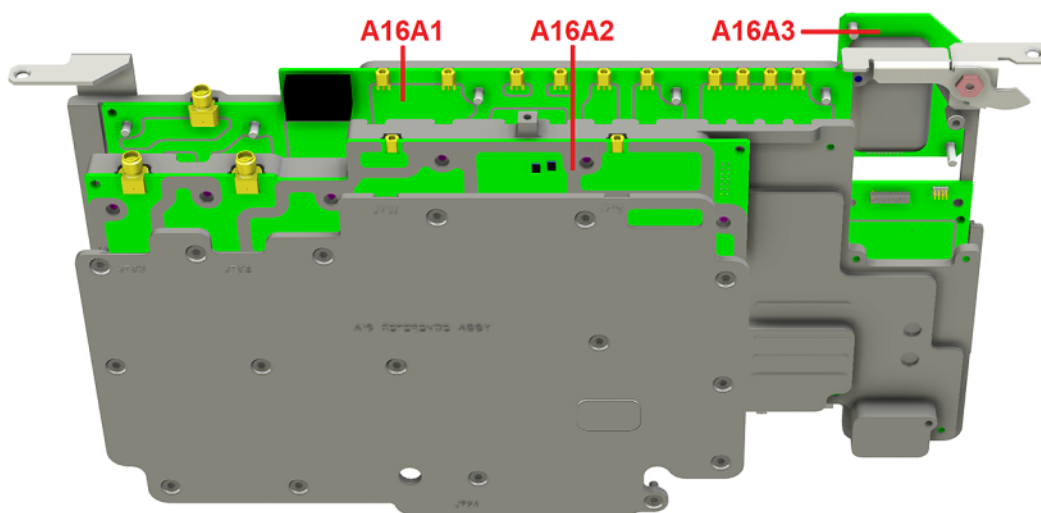


There are three hardware components that make up the A16 Reference assembly. They are:

- A16A1 Reference Main
- A16A2 Reference Daughter
- A16A3 Reference OCXO

The location of these three components can be seen in **Figure 15-2**. The A16A3 Reference OCXO is the only one of these assemblies that can be replaced individually.

Figure 15-2 A16 Reference Components



Reference
A16 Reference

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 15-3**. The A16A3 Reference OCXO will not identify on the Hardware Information screen.

Figure 15-3 Hardware Information Screen – A16 Reference

System Settings

< System

Hardware Information

?

✕

System

Keysight PXA

Keysight PXA Signal Analyzer

Product Number

N9032B

Serial Number

MY61010001

S/W Release Name

2023 Update 1.0

Instrument S/W Revision

A.34.03

Revision Date

11/17/2022 9:38:32 AM

Preload / Unload Modes

Assembly Name

Part #

Serial #

Matl Rev

Rev

OF Rev

Hw Id

Misc

User Interface

Analog IF

N902060290

79204100103

011

1

A

57

YIG Tuned Filter

50877382

13202309428

007

0

A

11

Digital IF

N902060016

79204100250

035

3

A

34

Front End Controller

N902060295

79204100620

009

0

A

131

Power On

IF Mux-10GHz

N904160163

30203900015

004

1

A

264

Low Band Switch

N904060100

78200251477

000

2

B

135

Restore Defaults

LO DDS Synthesizer

N902060175

79204000654

011

3

A

91

LO DDS Reference

M930560028

79204100169

007

0

A

92

Wideband Calibrator

N904060151

30202000005

004

2

A

260

Alignments

Reference Plus Main

N902060185

79204701317

008

3

A

93

Reference Plus Daughter

N902060186

79204501221

010

1

A

94

Licensing

Front End

N904160039

78203535226

000

1

A

270

Gen 4 DIF Controller

N904160048

30203600005

003

3

A

208

Switched IF Filter

N902060220

59200251433

005

0

B

132

Security

YTO

N902060009

79204200133

006

0

A

54

Diagnostics

Service

SCPI Recorder

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 15-4](#), and the destination of each low frequency reference signal is seen in [Table 15-2](#).

Figure 15-4 A16 Reference – Low Frequency References Block Diagram

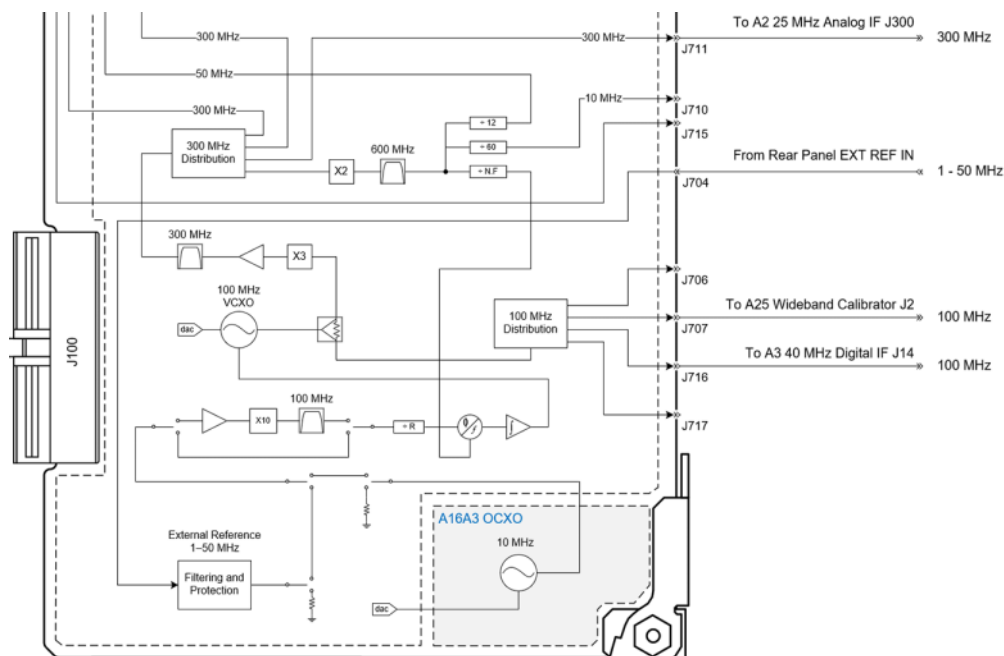


Table 15-2 A16 Low Frequency Reference Signals

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	A25 Calibrator Reference
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 15-5**, and the destination of each high frequency reference signal is seen in **Table 15-3**.

Figure 15-5 A16 Reference - High Frequency References Block Diagram

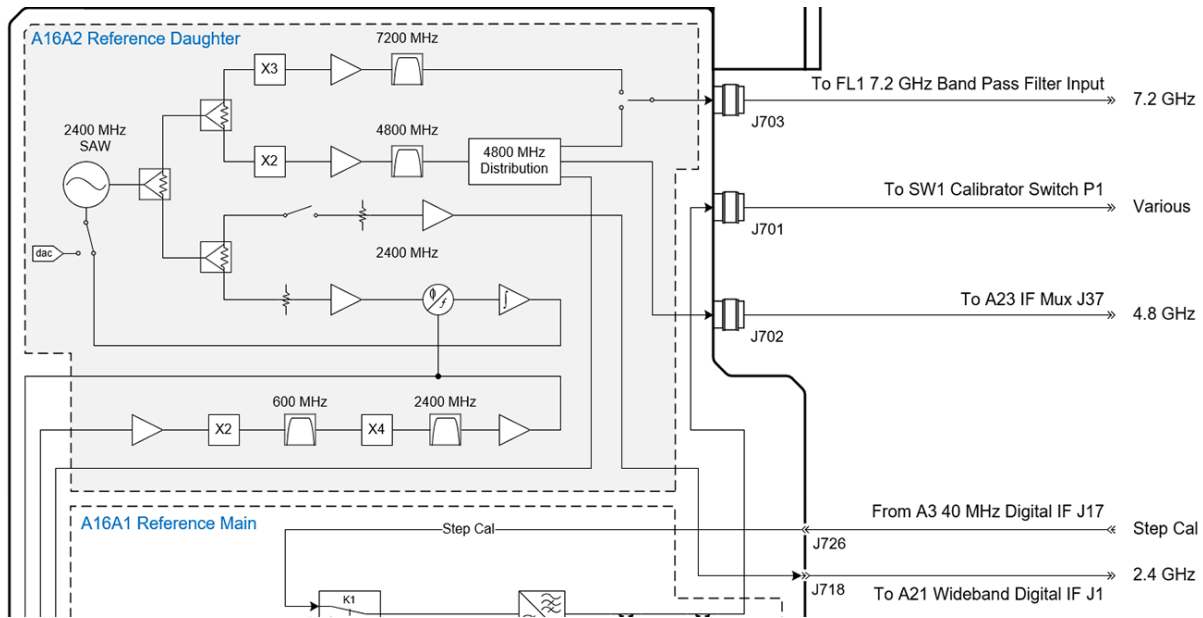


Table 15-3 A16 High Frequency Reference Signals

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 15-6**, and the signals that can be routed to each of the two calibrator outputs can be seen in **Table 15-4**.

Figure 15-6 A16 Calibrator Signals

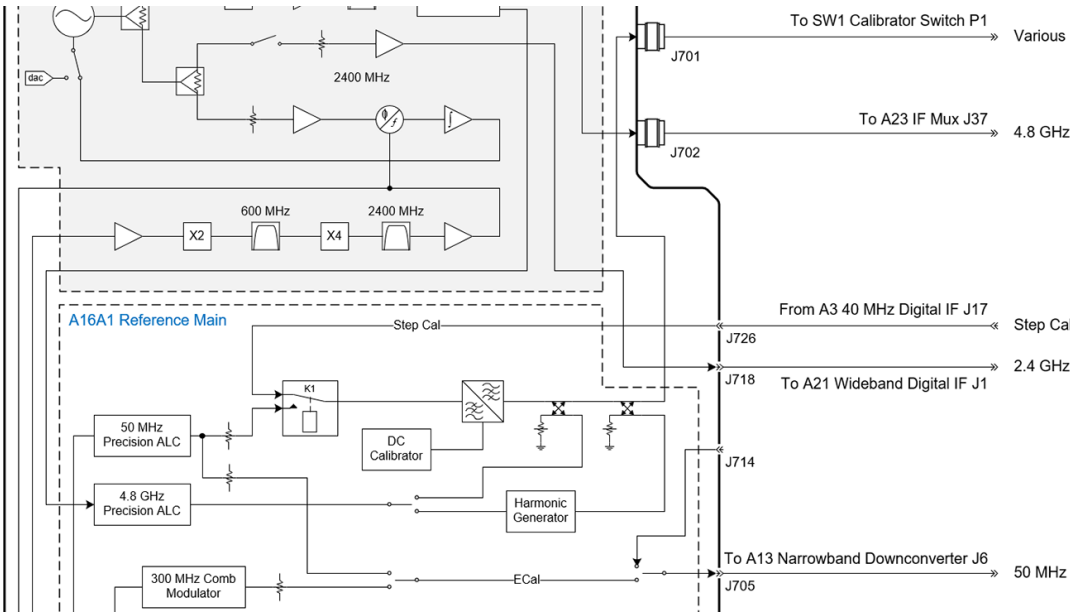


Table 15-4 A16 Calibrator Signal Potential Outputs

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 SW1 Calibrator Switch, that will route it to the calibrator input of the A9 Step Attenuator when needed.

The J705 calibrator output is routed to the A13 Downconverter 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 15-3](#). 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 25, “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

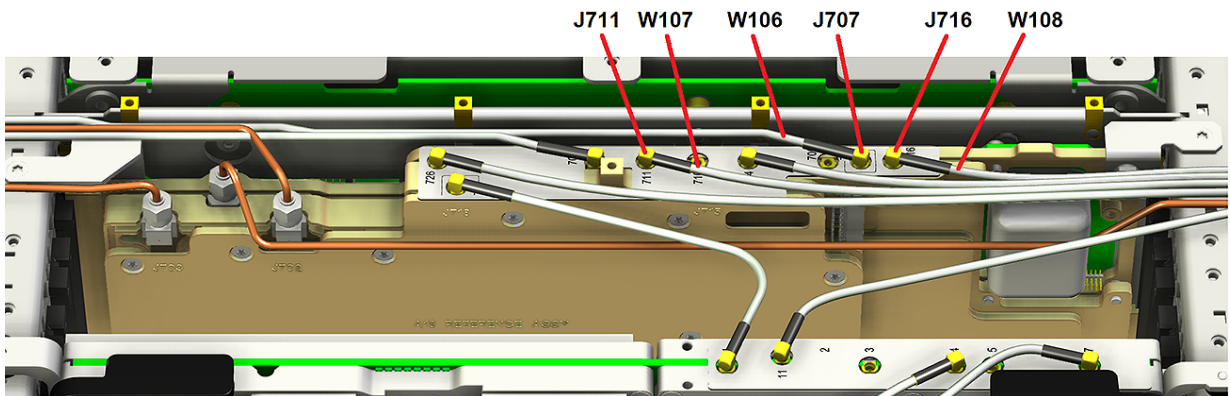
Before replacing any assembly due to a failure during the functional verification, be sure to verify that the instrument power supply is delivering all the required voltage levels. To do this, see the [“Power Supply Verification”](#) section in [Chapter 5, “First-Look Troubleshooting.”](#)

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 15-7**, remove W106 from J707 of the A16 reference.

Figure 15-7 A16 Reference Low Frequency Reference Signal Connections



7. Connect a spectrum analyzer to J707 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 J707 and reconnect W106 to it.
12. Remove W107 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 W107 to it.

17. Remove W108 from J716 of the A16 Reference.

18. Connect the spectrum analyzer to J716.

19. 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.

20. Remove the spectrum analyzer from J716 and reconnect W108 to it.

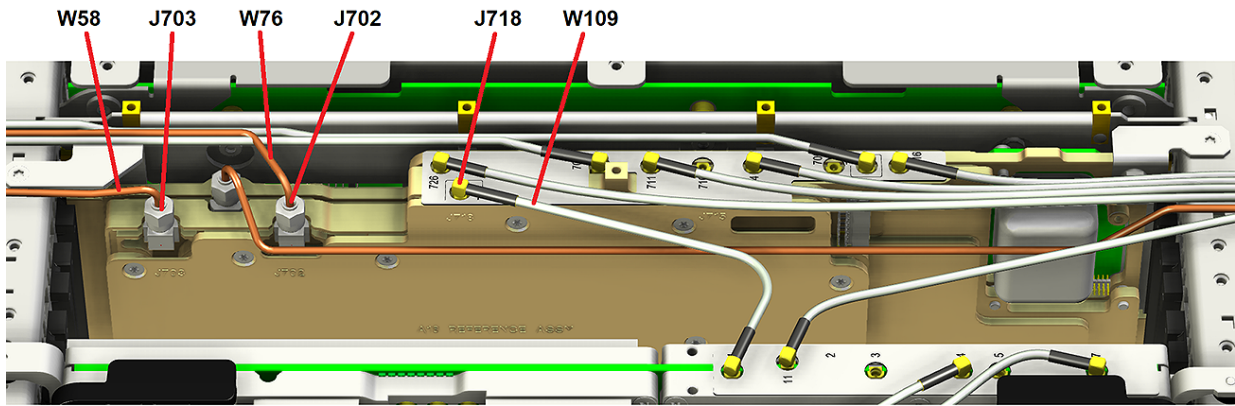
21. Restart the instrument application.

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 15-8**, remove W109 from J718 of the A16 reference.

Figure 15-8 A16 Reference High Frequency Reference Connections



7. Connect a spectrum analyzer to J718 on the A16 Reference.
8. Set the spectrum analyzer reference level to +20 dBm.
9. Tune the spectrum analyzer to 2.4 GHz with a span of 10 MHz.
10. 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.
11. Remove the spectrum analyzer from J718 and reconnect W109 to it.
12. Remove W76 from J702 of the A16 Reference.
13. Connect the spectrum analyzer to J702.
14. Tune the spectrum analyzer to 4.8 GHz with a span of 10 MHz.

15. 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.

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 J702 and reconnect W76 to it.

17. Remove W58 from J703 of the A16 Reference.

18. Connect the spectrum analyzer to J703.

19. Tune the spectrum analyzer to 7.2 GHz with a span of 10 MHz.

20. 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.

21. Remove the spectrum analyzer from J703 and reconnect W58 to it.

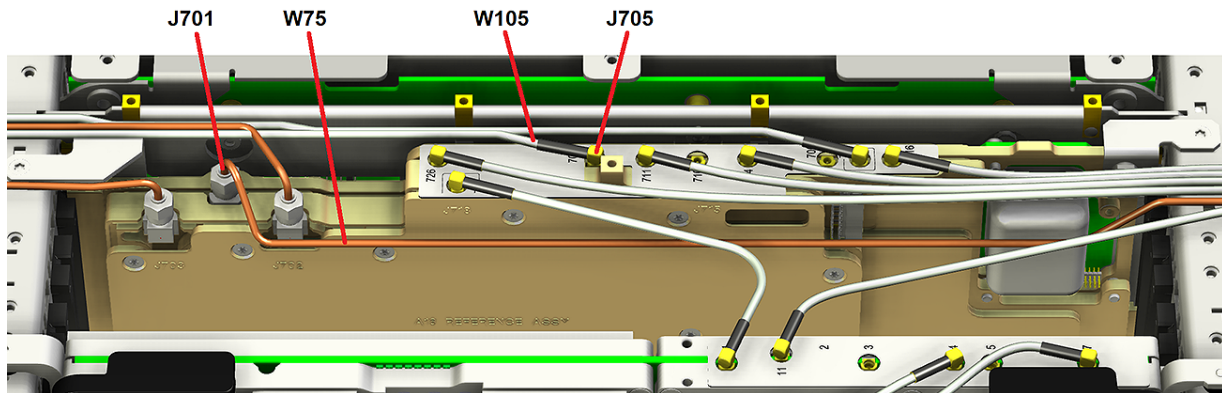
22. Restart the instrument application.

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 15-9](#), remove W105 from J705 of the A16 reference.

Figure 15-9 A16 Reference Calibrator Signal Connections



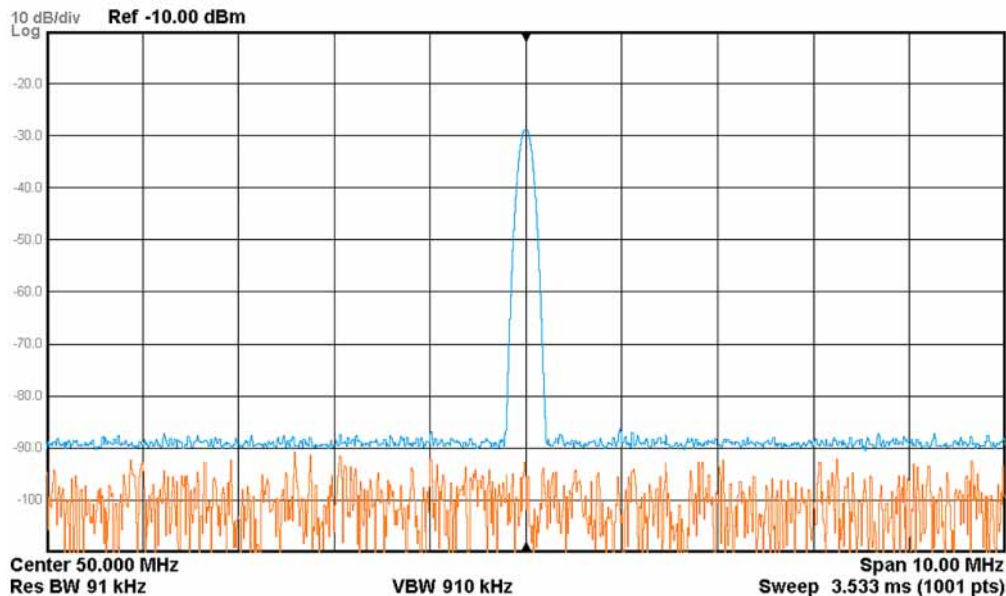
6. Connect a spectrum analyzer to J705 on the A16 Reference.
7. Tune the spectrum analyzer to 50 MHz with a span of 10 MHz.
8. Turn trace two of the spectrum analyzer on and turn the maximum hold function on.
9. Run the instrument RF alignments by pressing **System, Alignments, Align Now, Align Now RF**.

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 15-10](#).

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 15-10 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 W105 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 W75 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.

Reference
A16 Reference

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 W75 to it.

Status LEDs

There are status LEDs on all three of the A16 Reference assembly boards, some are visible while others are not.

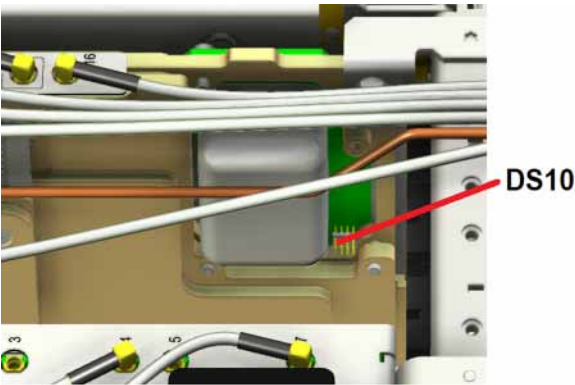
A16A1 Reference Main

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 15-11](#).

Figure 15-11

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 15-5](#), and the location of each can be seen in [Figure 15-12](#).

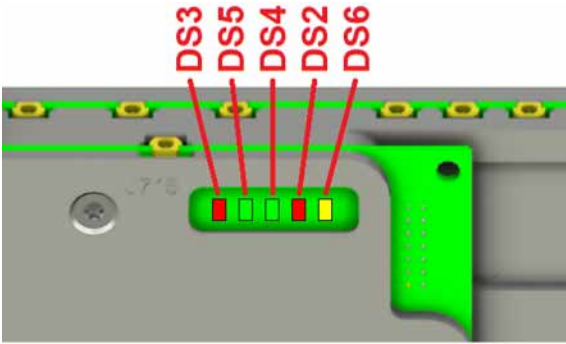
Table 15-5 A16A2 Reference Daughter Status LEDs

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 15-5 A16A2 Reference Daughter Status LEDs

LED	Description	Color	Normal State
DS6	FPGA Programming	Yellow	Off

Figure 15-12 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.

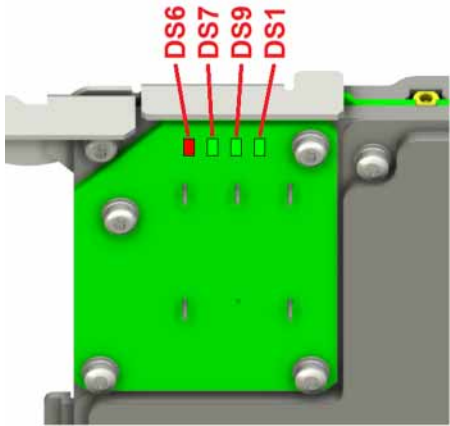
A16A3 Reference OCXO

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 15-6](#), and the location of each can be seen in [Figure 15-13](#).

Table 15-6 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 15-13 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.

16 System Processor and Disk Drive

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 488](#)

[A4 System Processor Assembly on page 489](#)

[Overview on page 489](#)

[Processor Battery on page 494](#)

[Boot-Up or Initialization Problems on page 494](#)

[BIOS Settings on page 494](#)

[A5 Disk Drive on page 496](#)

[Overview on page 496](#)

[Partitioning on page 498](#)

[Troubleshooting Software Related Issues on page 499](#)

[Instrument Image Recovery System on page 500](#)

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 16-1 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 22, "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 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 16-2**. An example of the rear panel of these A4 System Processor version can be seen in **Figure 16-3** and **Figure 16-4**.

Figure 16-2 A4 System Processor Identification – System Information

System Settings	System Information		
	System ↶ ↷ ? ✕		
System	Keysight Technologies	Keysight PXA Signal Analyzer	
	Keysight PXA	N9032B	
	Product Number	N9032B	
	Serial Number	MY61010001	
	S/W Release Name	2023 Update 1.0	
	Instrument S/W Revision	A.34.03	
	Revision Date	11/17/2022 9:38:32 AM	
	Computer System	Windows 10	
	Computer Name	K-N9032B-10001	
	IP Address	141.121.151.154	
	IPv6 Address		
	Link-Local IPv6 Address	fe80::1c1e:1a7b:d335:6641%14	
	Host ID	N9032B,MY61010001	
	mDNS Enabled	Yes	
	mDNS Host Name	K-N9032B-10001	
	mDNS Service Name	Keysight N9032B Signal Analyzer - MY61010001	
Alignments	Option	Name / Description	Option Version
	N9032B-MTU	Multi-touch user interface	
Licensing	N9032B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB	
	N9032B-SSD	MICRON_1300_MTFDDAK256TDL	
	N9032B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS	
Security			
	89601B_Agilent	VSA Temporary License - Agilent internal use/demo only	---
Diagnostics	N6141EM0E_1FP	EMC Software for X-Series	1.3.63417.17325
	N9032B_526	Frequency Range, 26.5 GHz	---
	N9032B_ALV	Auxiliary Log Video Output	---
Service	N9032B_B25	Analysis bandwidth, 25 MHz	---
	N9032B_B2X	Analysis bandwidth, 255 MHz	---
	N9032B_B40	Analysis bandwidth, 40 MHz	---
SCPI Recorder	N9032B_CR3	Connector Rear, 2nd IF output	---
	N9032B_CRP	Connector Rear, Arbitrary IF output	---
	N9032B_CRW	Connector, IF Out, Wide	---

Figure 16-3 A4 System Processor Rear Panel - PC8



Figure 16-4 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, as the drives for the PC8 and PCA versions of the A4 System Processor are completely different.

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.

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 PC8 version of the assembly, it is no longer being used on PCA and newer assemblies.

The SD memory card that was shipped with 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.

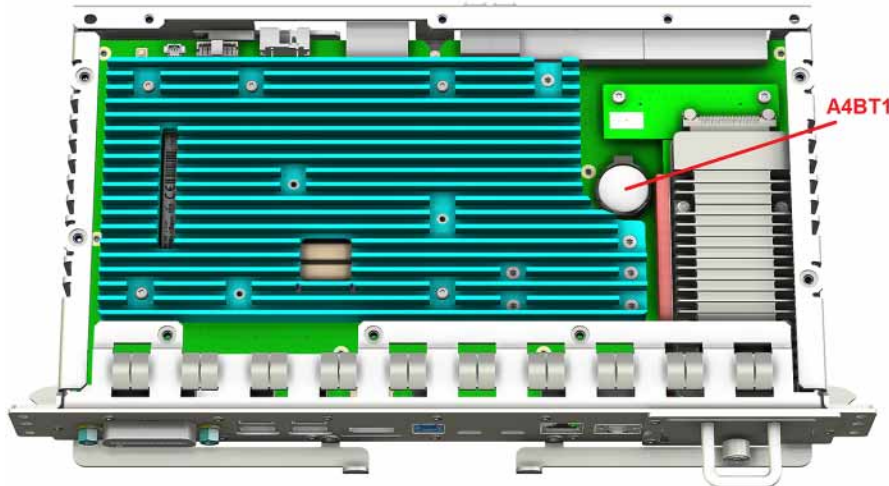
While the instrument working calibration database is contained on the E: drive, if when the instrument first boots up and finds a newer database on the SD memory card it will prompt the user to select which database to use. This is intended for use when the A5 disk drive assembly has been changed and 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 16-5**.

Figure 16-5 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 PC8 system processors have a 2.5 inch solid state disk drive, as seen in **Figure 16-6**, the PCA system processors have an M.2 solid state drive, as seen in **Figure 16-7**.

Figure 16-6 PC8 A4 Disk Drive – 2.5 Inch

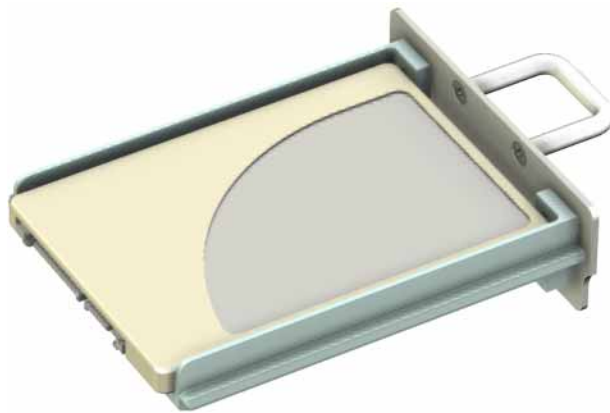
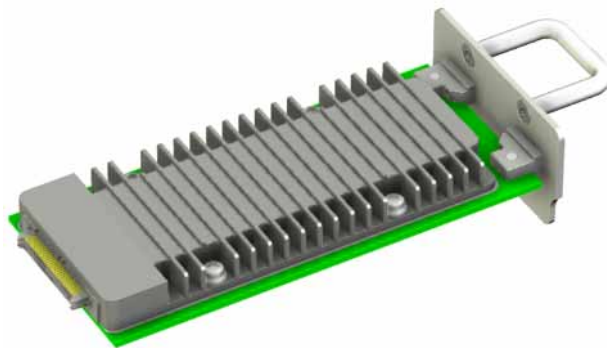


Figure 16-7 PCA A4 Disk Drive – M.2



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”](#) on page 66 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 25, “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:

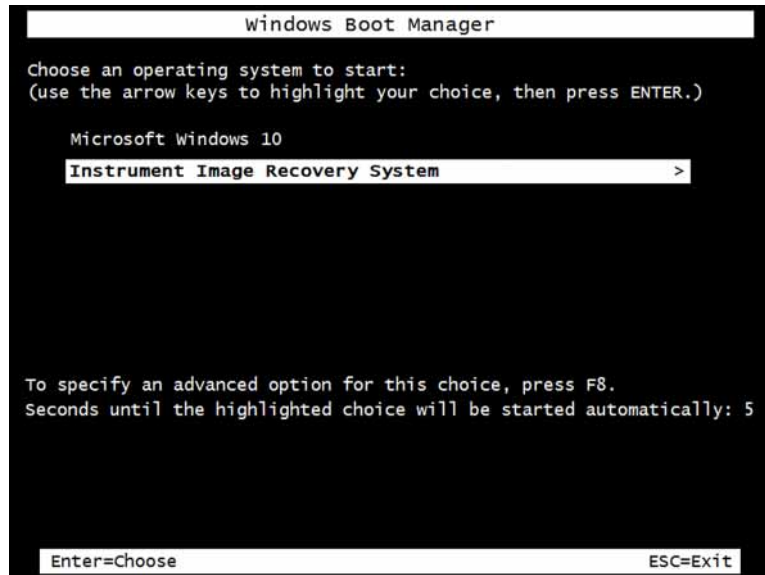
- Operating system configurations that were changed after the instrument was shipped from the factory. For example, service pack updates, user accounts, and windows configuration settings. After a recovery, these configurations will have to be redone by the end user.
- Additional software that was installed 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 16-8** will be displayed for 5 seconds.

Figure 16-8 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/n9032b_software

System Processor and Disk Drive
A5 Disk Drive

17 Power Supply and Cooling Fans

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 504](#)

[A6 Power Supply on page 505](#)

[Overview on page 505](#)

[Functional Verification on page 509](#)

[Instrument Cooling Fans on page 513](#)

[Overview on page 513](#)

[Troubleshooting on page 515](#)

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 22, “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 17-1 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 17-1](#), and seen in [Figure 17-2](#).

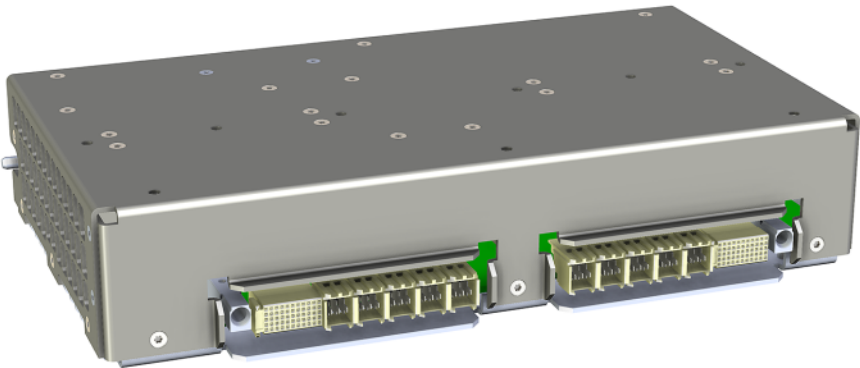
Table 17-1 A6 Power Supply Voltages

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 17-1 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 17-2 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

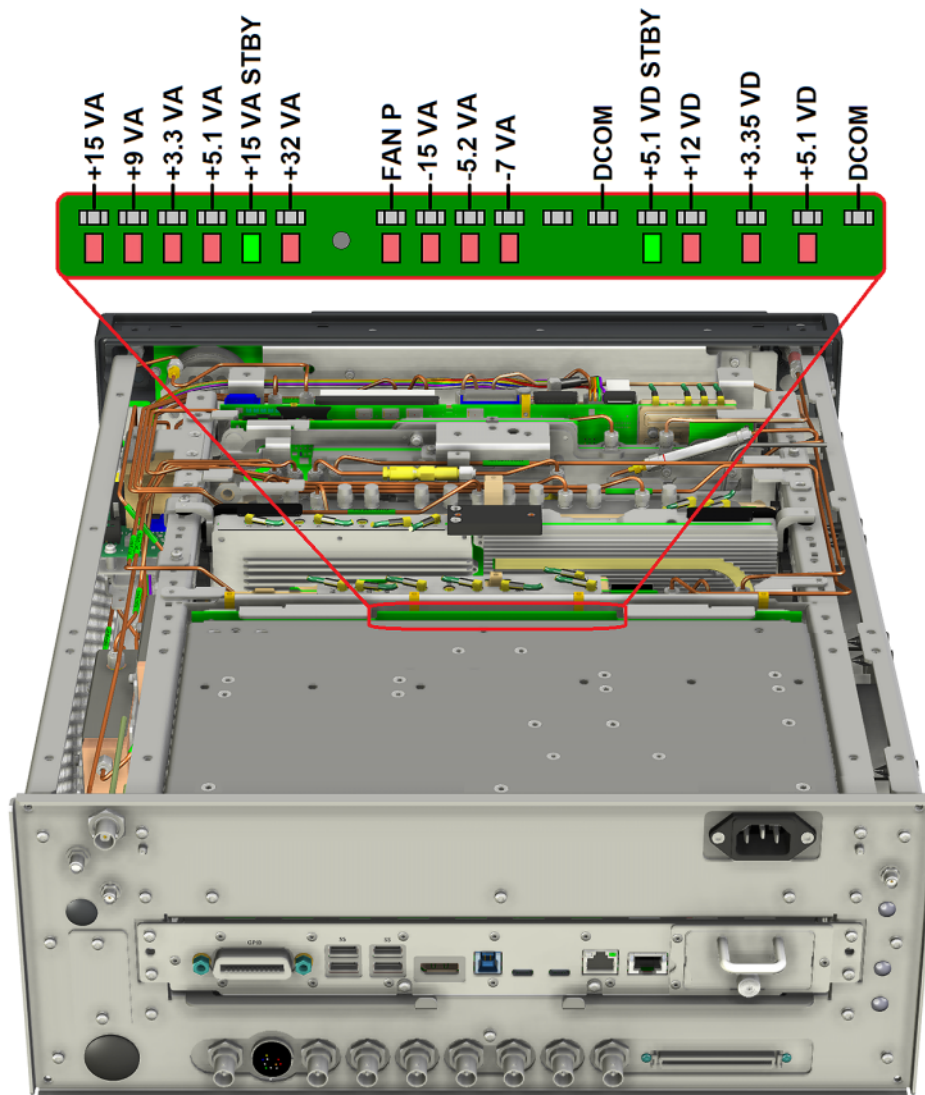
There are no status LEDs or test points on the A6 Power Supply itself. However, there is a status LED near the top of the A7 Midplane board for all twelve of the voltages that originate on the A6 Power Supply, along with two other voltages that are regulated on the A7 Midplane board. A list of the voltages can be seen in [Table 17-2](#), and the location of the LEDs for each can be seen in [Figure 17-3](#).

There are two different types of power supply LEDs to be monitored, both of which indicate the status of the supplies. The standby power supplies have green LEDs that should be on whenever the AC mains are connected to the instrument, whether it is turned on or not. The rest of the power supplies have red fault LEDs that will only be on when that power supply does not meet its required voltage level. This includes when the instrument is in standby mode.

Table 17-2 **A6 Power Supply Voltages**

Supply Voltage	Regulated On	LED	Test Point
+3.3 V Analog	A7 Midplane Board	DS514	TP515
+3.35 V Digital	A6 Power Supply	DS507	TP507
+5.1 V Standby	A6 Power Supply	DS500	TP502
+5.1 V Digital	A6 Power Supply	DS505	TP505
+5.2 V Analog	A6 Power Supply	DS512	TP513
+9 V Analog	A6 Power Supply	DS510	TP511
+12 V Digital	A6 Power Supply	DS502	TP503
+15 V Standby	A6 Power Supply	DS501	TP501
+15 V Analog	A6 Power Supply	DS508	TP509
+32 V Analog	A6 Power Supply	DS519	TP504
-5.2 V Analog	A7 Midplane Board	DS515	TP516
-7 V Analog	A6 Power Supply	DS513	TP514
-15 V Analog	A6 Power Supply	DS511	TP512
Fan	A6 Power Supply	DS503	TP522

Figure 17-3 A7 Midplane Power Supply Status LED and Test Point Location



When the instrument is plugged into the proper AC mains the two green standby LEDs, and the twelve red fault LEDs, should be on.

When the instrument is turned on the two green power supply LEDs should be on and the twelve red fault LEDs should all be off. 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.

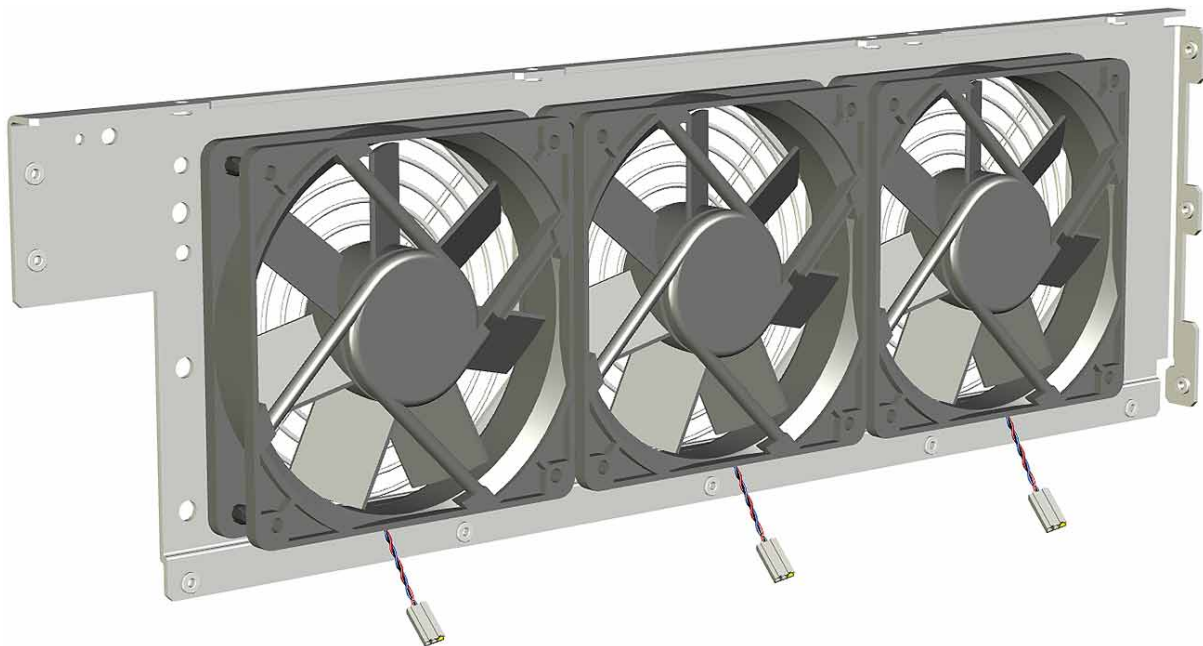
The -5.2 V analog power supply is regulated on the A7 Midplane board from the -7 V analog supply that comes from the A6 Power Supply. If the -5.2 V is not working, first verify that the -7 V is working before replacing the A7 Midplane board.

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 three large cooling fans in the instrument, as seen in **Figure 17-4**.

Figure 17-4 **Cooling Fans**

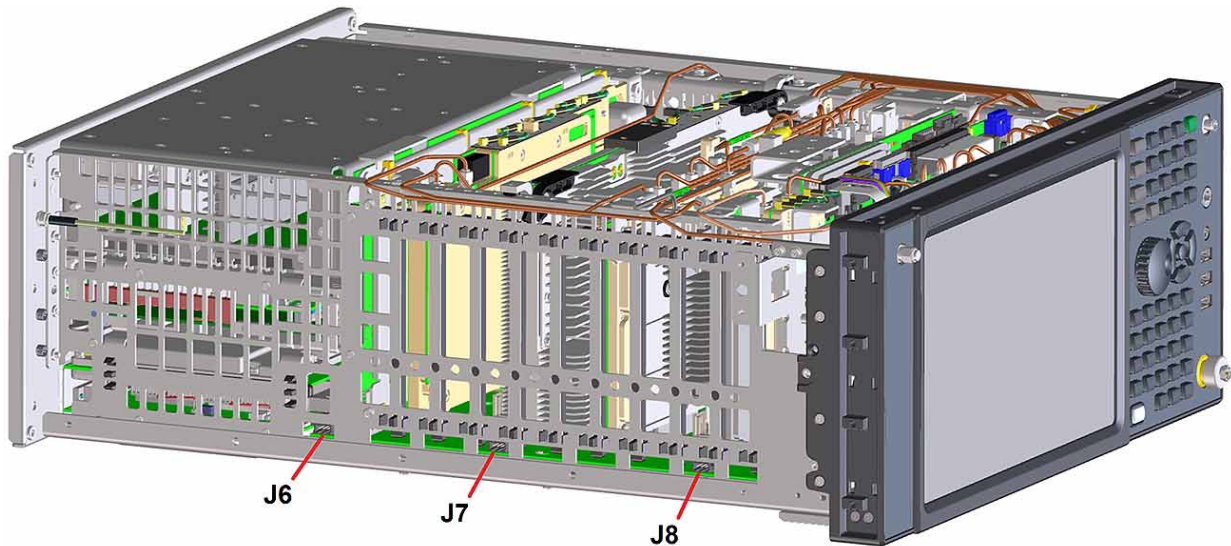


Fan Temperature Sensor and Control

There is a temperature sensor on the A8 Motherboard 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 A8 Motherboard can be seen on **Figure 17-5**.

Figure 17-5 A8 Motherboard 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.

Power Supply and Cooling Fans
Instrument Cooling Fans

18 Motherboards

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 518](#)

[A7 Midplane on page 519](#)

[Overview on page 519](#)

[Power Supply Voltages and Status LEDs on page 521](#)

[Additional Power Supply Regulation on page 523](#)

[Instrument Secure Storage on page 524](#)

[10 MHz Clock Distribution on page 524](#)

[Power Supply Dithering on page 524](#)

[A8 Motherboard on page 525](#)

[Fan Temperature Sensor and Control on page 527](#)

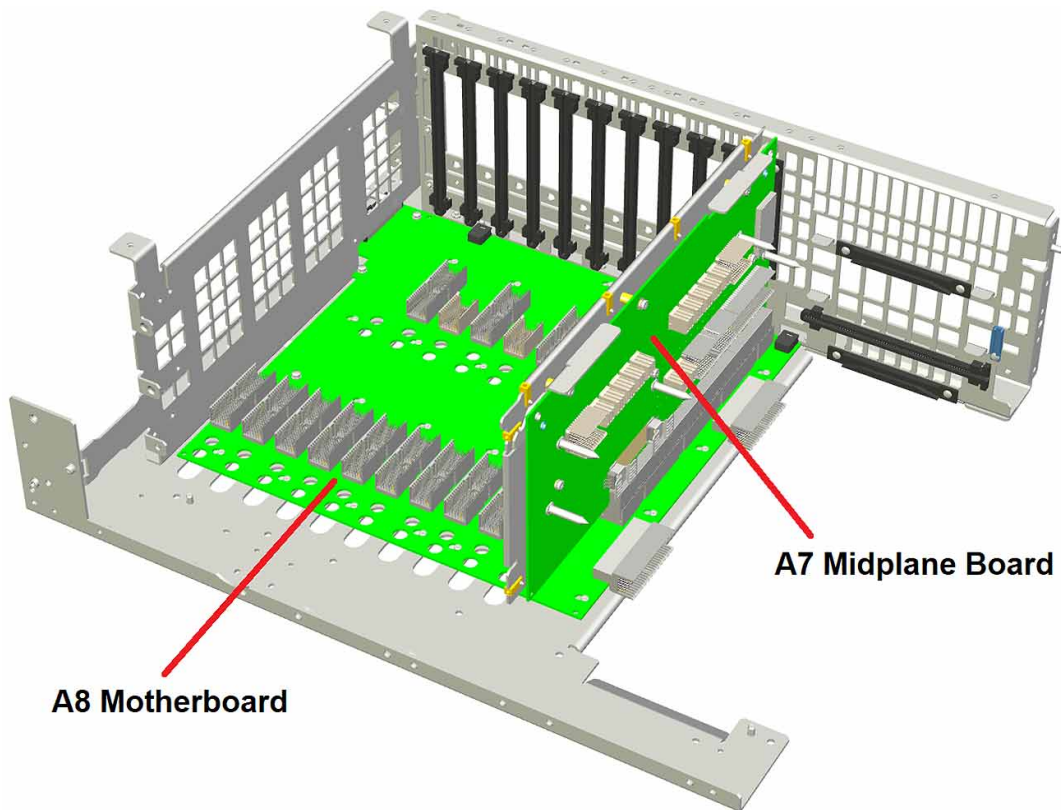
Overview

There are two 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

The location of each of these motherboards can be seen in [Figure 18-1](#).

Figure 18-1 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 22, "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:

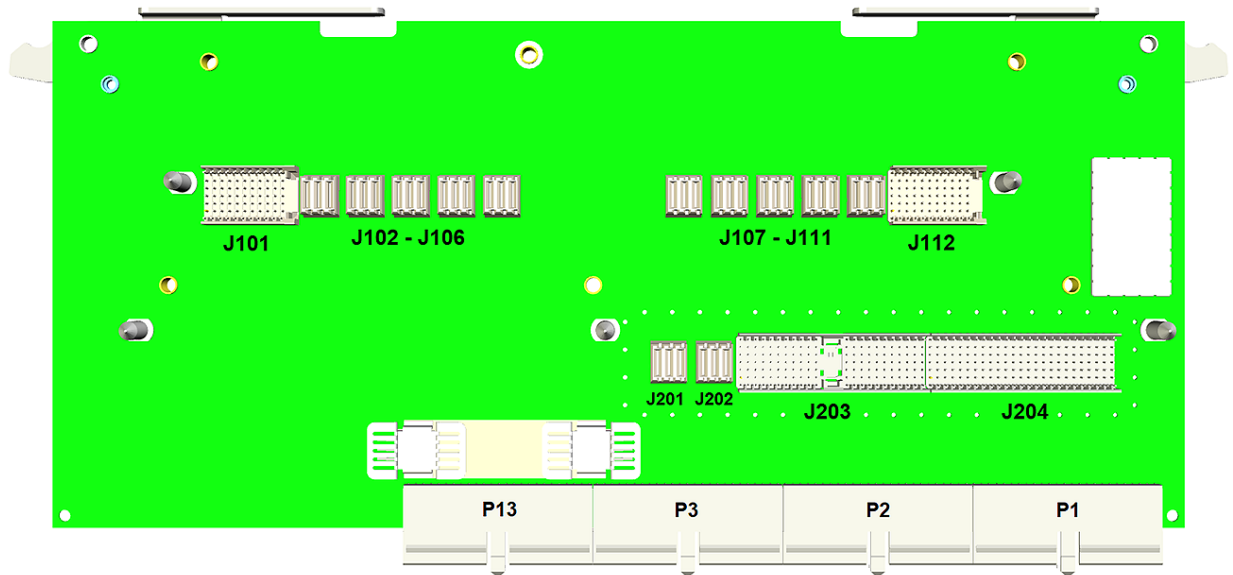
- Power supply voltage test points and status LEDs
- Additional power supply regulation
- Instrument secure storage
- 10 MHz clock distribution
- Power supply dither

The connections to and from the A7 Midplane board are listed in **Table 18-1**, as seen in **Figure 18-2**.

Table 18-1 A7 Midplane Connections

Connector	Connects To	Connector	Connects To
J1	A6 Power Supply	J11	A6 Power Supply
J2	A6 Power Supply	J12	A6 Power Supply
J3	A6 Power Supply	J201	A4 System Processor
J4	A6 Power Supply	J202	A4 System Processor
J5	A6 Power Supply	J203	A4 System Processor
J6	A6 Power Supply	J204	A4 System Processor
J7	A6 Power Supply	P1	A8 Motherboard
J8	A6 Power Supply	P2	A8 Motherboard
J9	A6 Power Supply	P3	A8 Motherboard
J10	A6 Power Supply	P13	A8 Motherboard

Figure 18-2 A7 Midplane Connector Locations



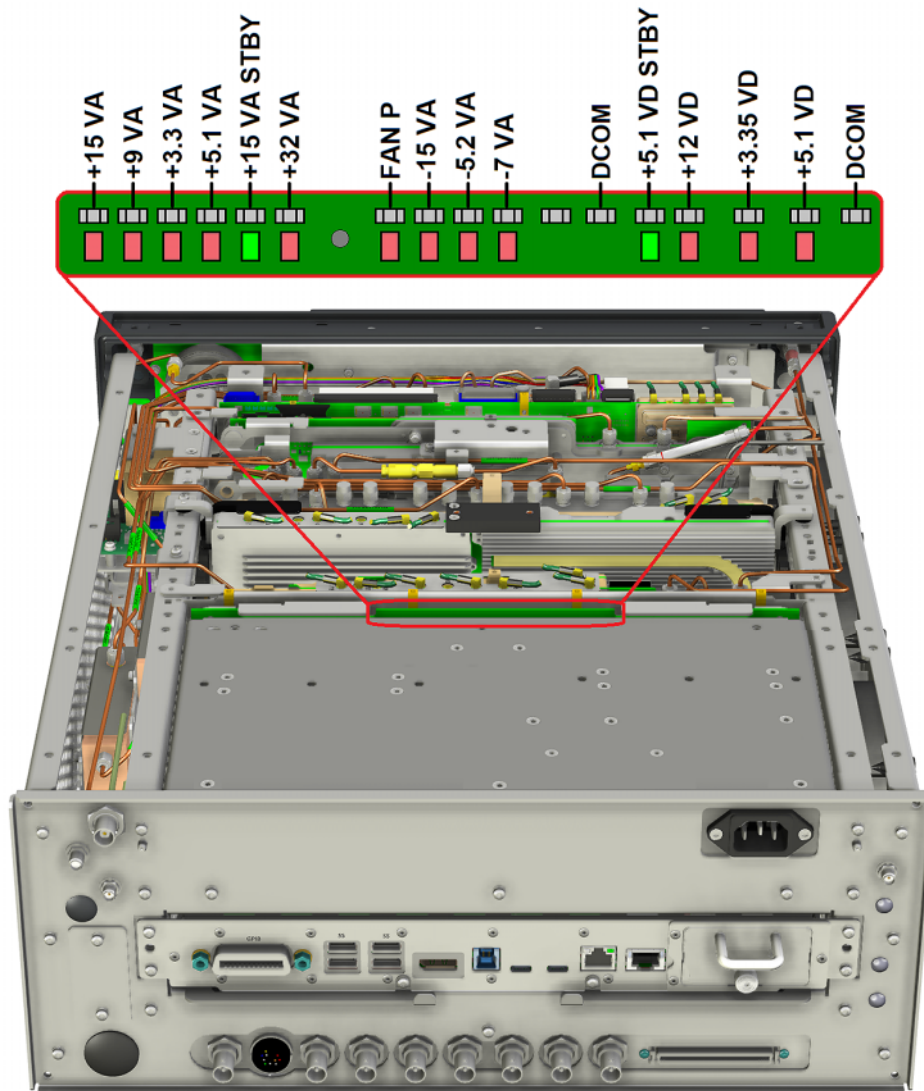
Power Supply Voltages and Status LEDs

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 18-2**, and their location can be seen in **Figure 18-3**.

Table 18-2 A6 Power Supply Voltages

Supply Voltage	Regulated On	LED	Test Point
+3.3 V Analog	A7 Midplane Board	DS514	TP515
+3.35 V Digital	A6 Power Supply	DS507	TP507
+5.1 V Standby	A6 Power Supply	DS500	TP502
+5.1 V Digital	A6 Power Supply	DS505	TP505
+5.2 V Analog	A6 Power Supply	DS512	TP513
+9 V Analog	A6 Power Supply	DS510	TP511
+12 V Digital	A6 Power Supply	DS502	TP503
+15 V Standby	A6 Power Supply	DS501	TP501
+15 V Analog	A6 Power Supply	DS508	TP509
+32 V Analog	A6 Power Supply	DS519	TP504
-5.2 V Analog	A7 Midplane Board	DS515	TP516
-7 V Analog	A6 Power Supply	DS513	TP514
-15 V Analog	A6 Power Supply	DS511	TP512
Fan	A6 Power Supply	DS503	TP522

Figure 18-3 A7 Midplane Power Supply Status LED and Test Point Location



When the instrument is plugged into the proper AC mains the two green standby LEDs and the twelve red fault LEDs should all be on.

When the instrument is turned on the two green power supply LEDs should be on and the twelve red fault LEDs should all be off. 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 Does Not Turn On”** section in **Chapter 2, “Boot Up and Initialization,”** to determine what the cause is.

Additional Power Supply Regulation

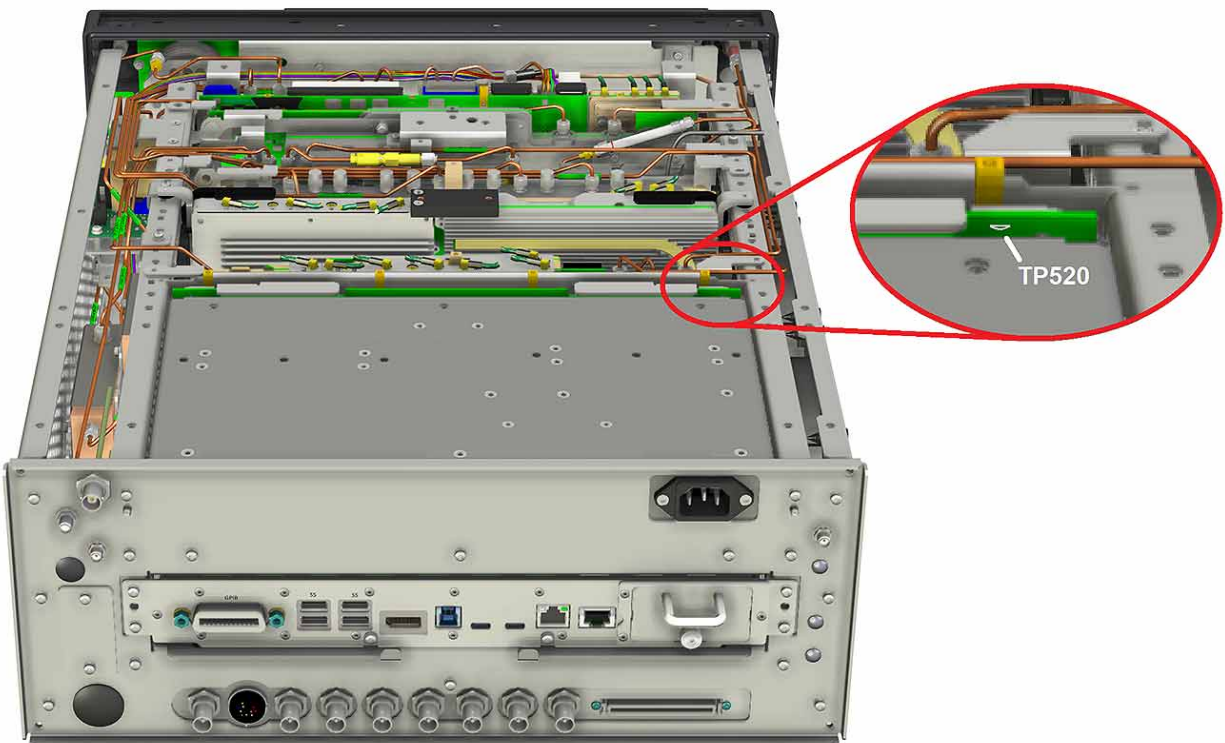
The +3.3 V analog power supply is regulated on the A7 Midplane board from the +5.2 V analog supply that comes from the A6 Power Supply. If the +3.3 V is not working, first verify that the +5.2 V is working before replacing the A7 Midplane board.

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.

Instrument Jump Start

There is a test point 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 18-4**. This can be used to troubleshoot a front panel power switch problem. Momentarily shorting this test point to ground will have the same effect as pushing the front panel power switch.

Figure 18-4 A7 Midplane Board Jump Start Test Point 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 interconnects for the measurement assemblies in the card cage of the instrument as well as temperature sensing for the speed control of the instrument cooling fans. The connections to and from the A8 Motherboard are listed in **Table 18-3**, as seen in **Figure 18-5**.

Table 18-3 A8 Motherboard Connections

Connector	Connects To	Connector	Connects To
J2	A7 Midplane Board	J42	Not Used
J3	A7 Midplane Board	J51	A21 Wideband Digital IF
J4	A7 Midplane Board	J52	A21 Wideband Digital IF
J5	A7 Midplane Board	J61	Not Used
J6	Fan B1	J62	Not Used
J7	Fan B2	J71	A23 IF MUX
J8	Fan B3	J72	Not Used
J9	W1 to A1 Front Panel	J81	Not Used
J11	A3 40 MHz Digital IF	J82	Not Used
J12	A3 40 MHz Digital IF	J91	Not Used
J21	A16 Reference	J92	Not Used
J31	Not Used	J101	A14 DDS LO Synthesizer
J32	Not Used	J111	A15 Front End Controller
J41	Not Used		

A8 Motherboard Connector Locations

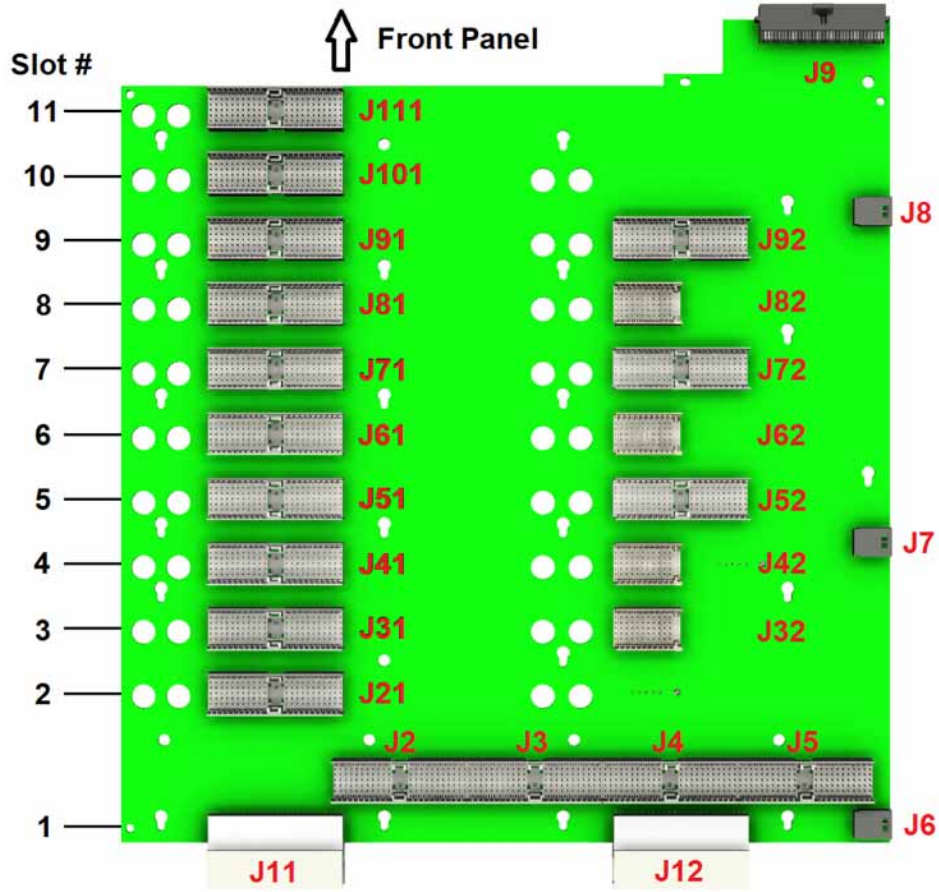


Table 18-4 A8 Motherboard Slot Allocation

Slot #	Board Assembly
11	A15 Front End Controller
10	A14 DDS LO Synthesizer
9	
8	A25 Wideband Calibrator
7	A23 IF Mux
6	A21 Wideband Digital IF
5	
4	--
3	--
2	A16 Reference
1	A3 40 MHz Digital IF

Fan Temperature Sensor and Control

There is a temperature sensor on the A8 Motherboard board that feeds information back to the power supply, which regulates the speed of the instrument fans.

Motherboards
A8 Motherboard

19 Front Panel

What You Will Find in This Chapter

The following information is presented in this chapter:

Overview on page 530

A1A2 Front Panel Controller Board on page 532

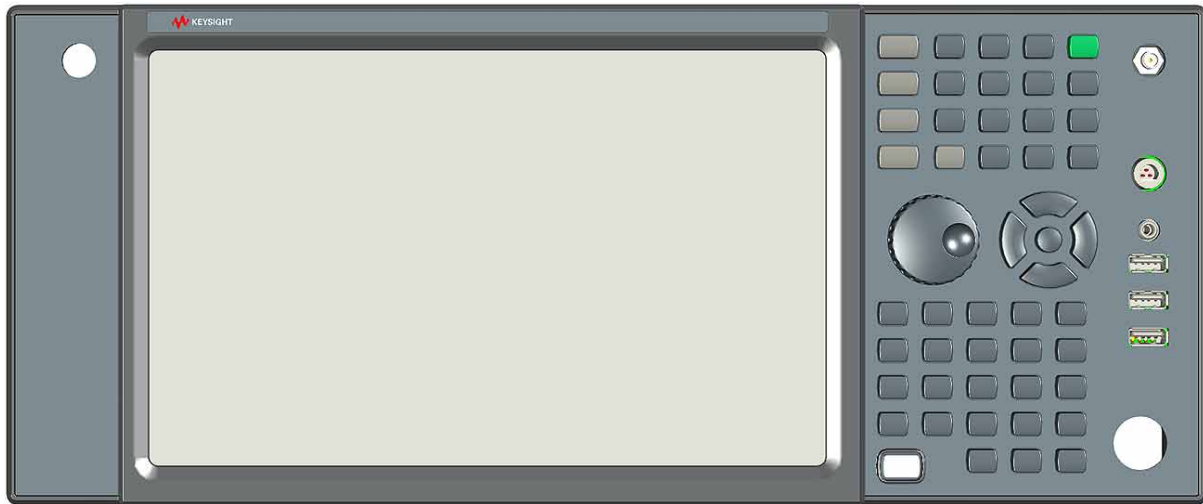
A1A3 Touch Screen Display on page 534

A1A4 Keyboard on page 535

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 19-1 A1 Front Panel Assembly

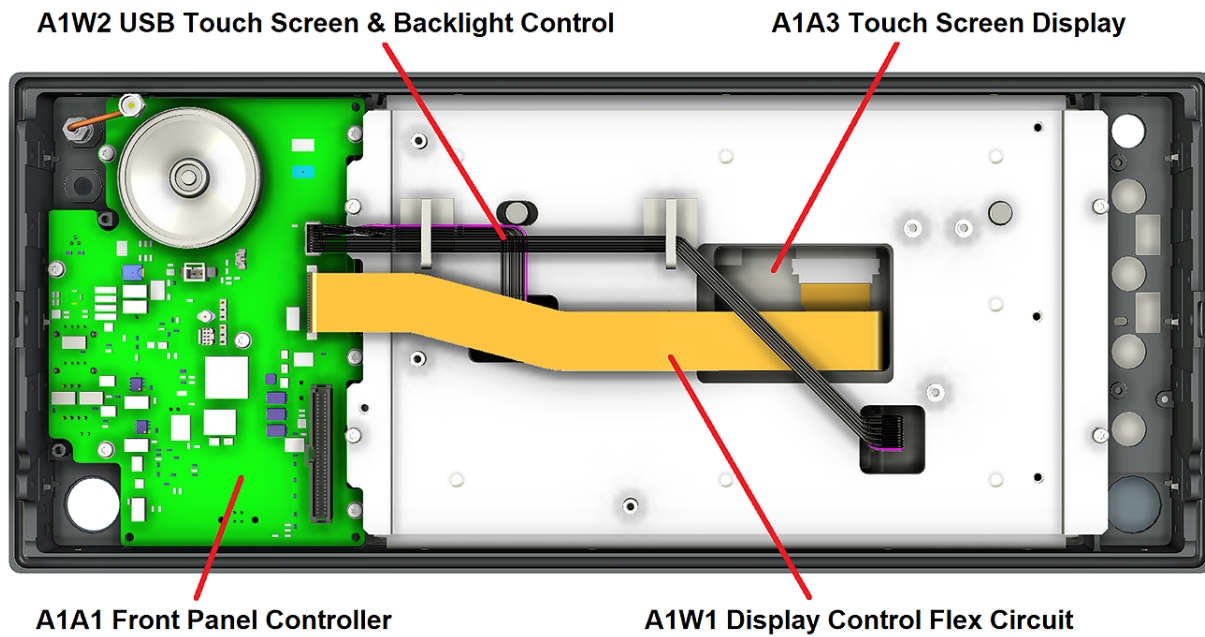


The major components of the A1 Front Panel Assembly are:

- A1A2 Front Panel Controller Board
- A1A3 Touch Screen Display
- A1A4 Keyboard

Each of these components can be replaced individually if needed. The location of each can be seen in **Figure 19-2**.

Figure 19-2 A1 Front Panel Components



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 22, "Assembly Replacement Procedures."](#)

A1A2 Front Panel Controller Board

The A1A2 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 A1A2 Front Panel Controller are listed in **Table 19-1**, as seen in **Figure 19-3** and **Figure 19-4**.

Table 19-1 **A1A2 Front Panel Controller Connections**

Port	Description	To/From	Cable
J1	Instrument Interface	To/From A8 Motherboard J9	W1
J2	Speaker Control	To Speaker	--
J3	Probe Power	To Front Panel Probe Power Connector	--
J4	USB 2 High Power	To Front Panel USB 2 High Power Connector	--
J5	USB 2	To Front Panel USB 2 Connector	--
J6	USB 2	To Front Panel USB 2 Connector	--
J7	Audio Out	To Front Panel Headphone Jack	--
J10	Display Control	To A1A3 Touch Screen Display	A1W1
J12	Not Used	--	--
J15	Keyboard Interface	To A1A4 Keyboard	--
J16	Touch Display/Backlight Control	To A1A3 Touch Screen Display	A1W2
J19	Not Used	--	--

Figure 19-3 A1A2 Front Panel Controller Connections – Back Side

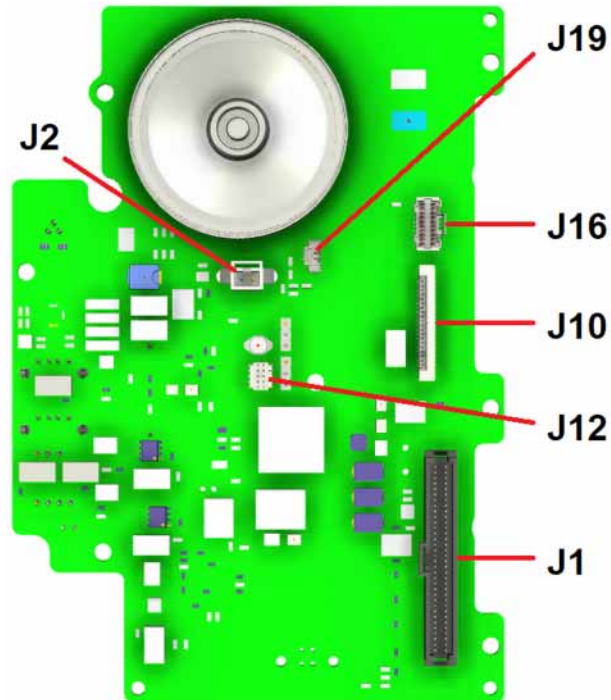
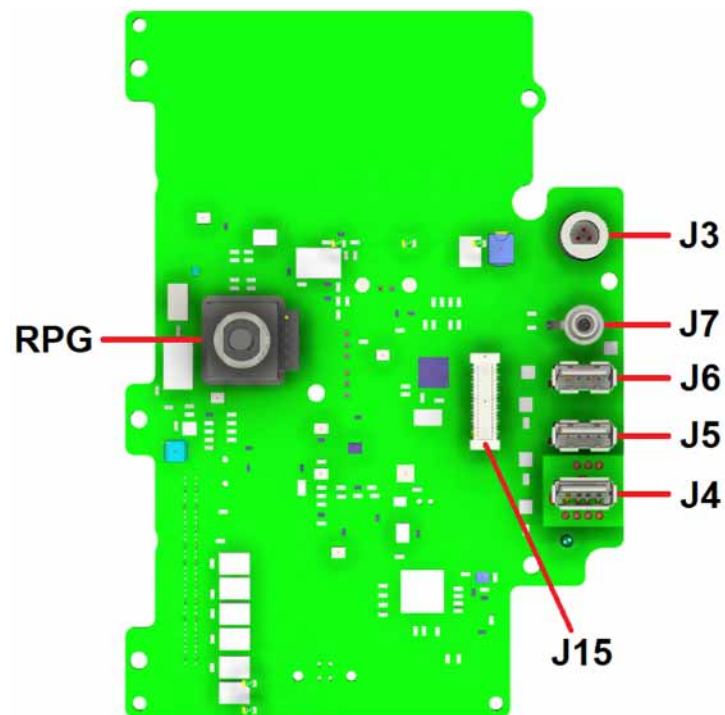


Figure 19-4 A1A2 Front Panel Controller Connections – Front Side



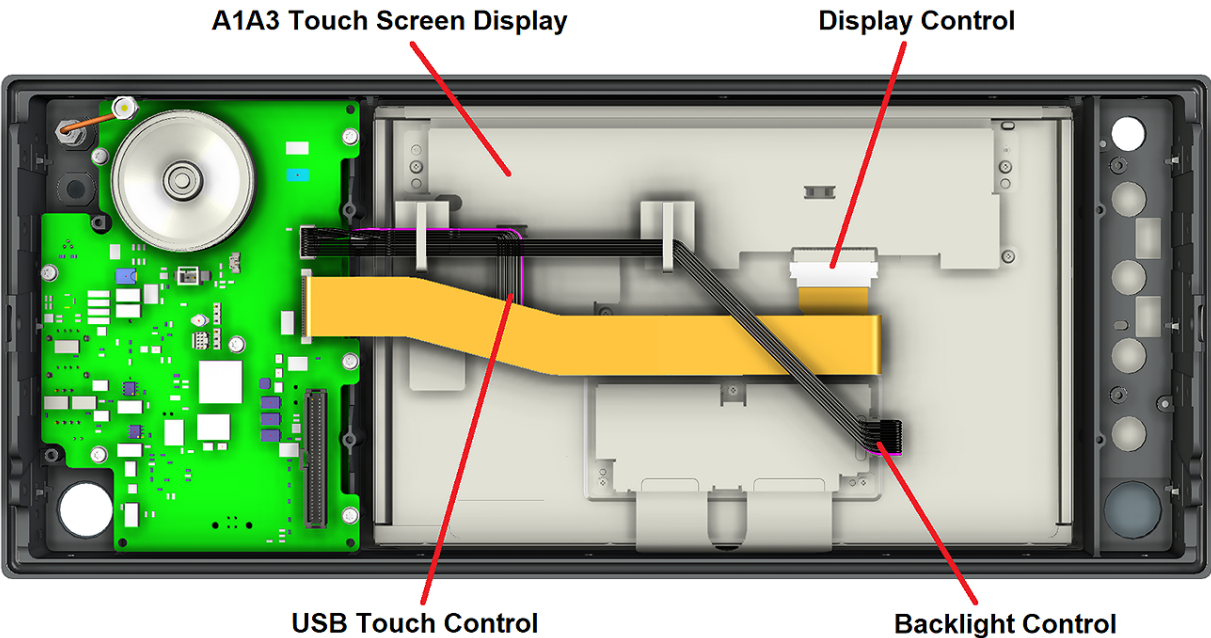
A1A3 Touch Screen Display

The A1A3 Touch Screen Display is a 10.6 inch WXGA TFT display, which has a resolution of 1280 x 768. It has three connections to the instrument, which are listed in [Table 19-2](#) and seen in [Figure 19-5](#).

Table 19-2 A1A3 Touch Screen Display Connections

Description	To/From	Cable
Display Control	From A1A2 Front Panel Controller J10	A1W1
LED Backlight Control	From A1A2 Front Panel Controller J16	A1W2
USB Touch Control	From A1A2 Front Panel Controller J16	A1W2

Figure 19-5 A1A3 Touch Screen Display Connections



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 Keyboard

The A1A4 Keyboard plugs directly onto the A1A2 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.

It also hosts the front panel standby and power on LEDs along with the contacts for the momentary front panel power switch. 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.

Front Panel Overview

20 Service Menus

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 538](#)

[Service Menu Access on page 539](#)

[Service Menu on page 541](#)

[Service on page 541](#)

[Timebase DAC on page 546](#)

[Locator Tables on page 546](#)

[Meas Setup Menu on page 547](#)

[Service Diagnostics on page 547](#)

[Lock & LO on page 549](#)

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.

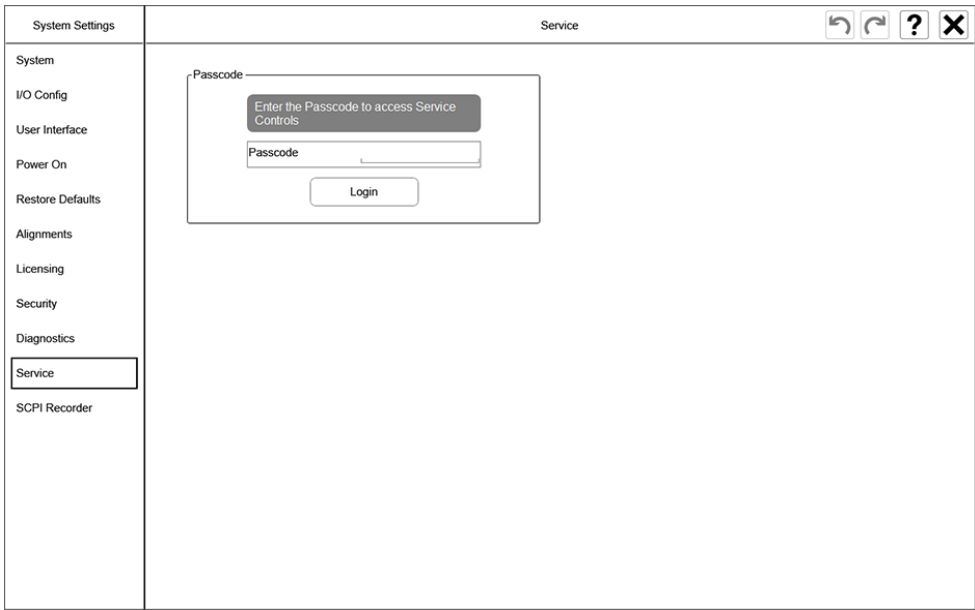
The service menus are intended to allow the service technician to see behind some of the instrument settings, turn some of the corrections off to see raw instrument hardware performance, isolate alignment issues, run front panel display and keyboard tests, and so forth.

Service Menu Access

Use the following procedure to access the service menu.

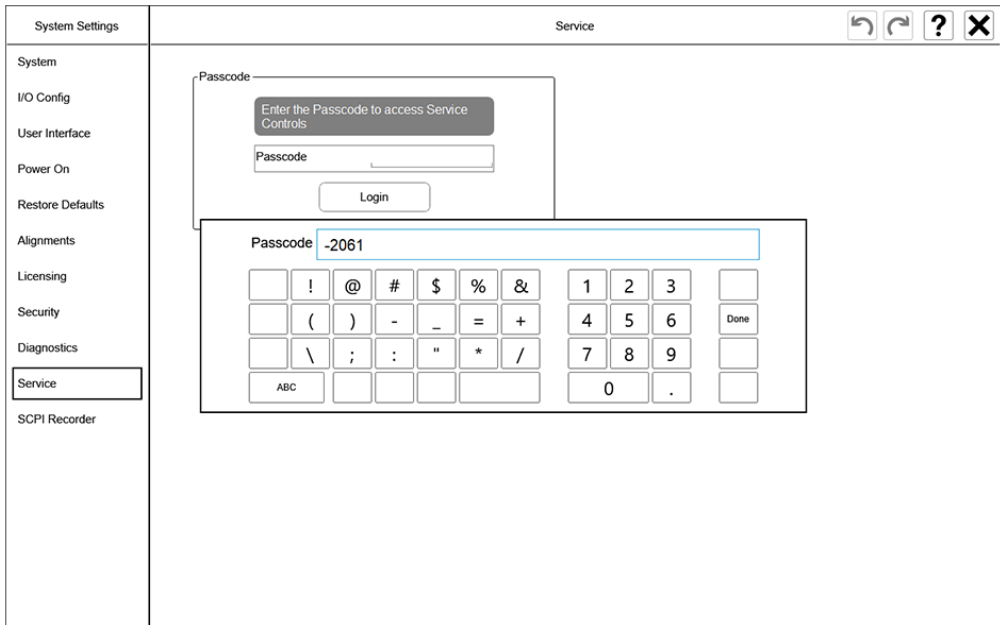
- 1. Press **System, Service** on the instrument. This will display the service menu without access yet granted, as seen in **Figure 20-1**.

Figure 20-1 Service Menu – Access Menu



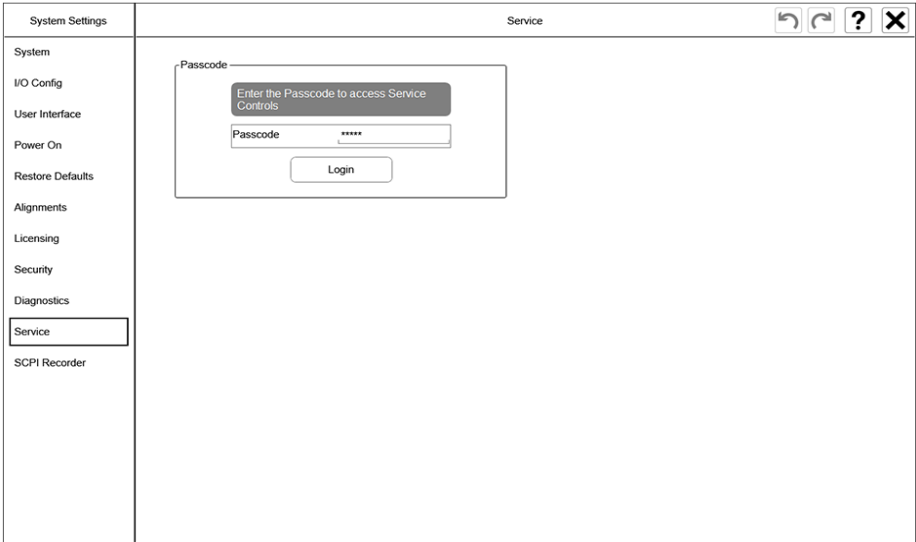
- 2. Select **Login** and a keyboard will appear, as seen in **Figure 20-2**.

Figure 20-2 Service Menu Keyboard Entry



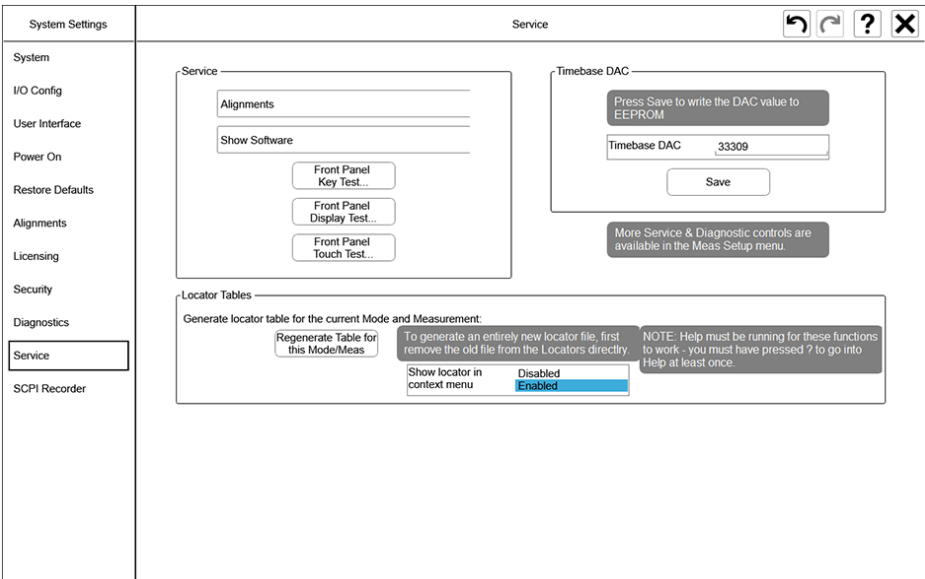
3. Enter the passcode **-2061** and press **Done**.
4. The passcode will now be filled in, as seen in **Figure 20-3**.

Figure 20-3 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 20-4**.

Figure 20-4 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."**

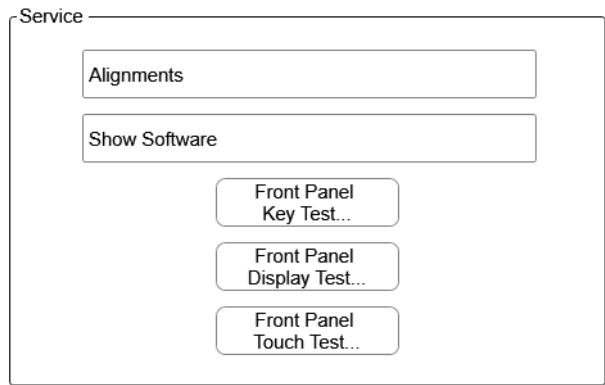
Service Menu

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 20-5**.

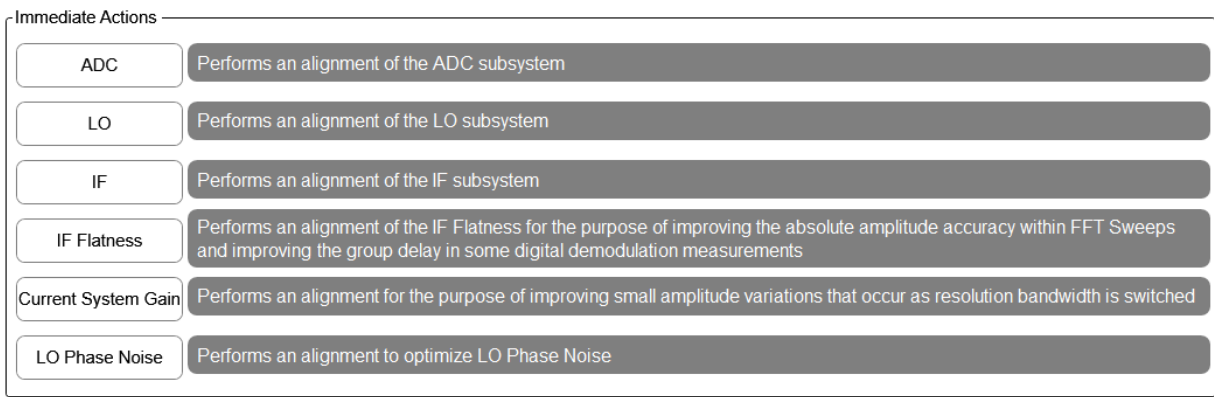
Figure 20-5 Service Menu - Service



Alignments

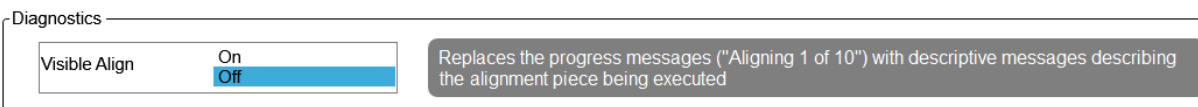
The Immediate Actions section will allow the running of pieces of the alignment system, as seen in **Figure 20-6**.

Figure 20-6 Service, Alignment, Immediate Actions



The Diagnostics section provides the ability to turn on Visible Align, as seen in **Figure 20-7**. 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 20-7 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 20-8**.

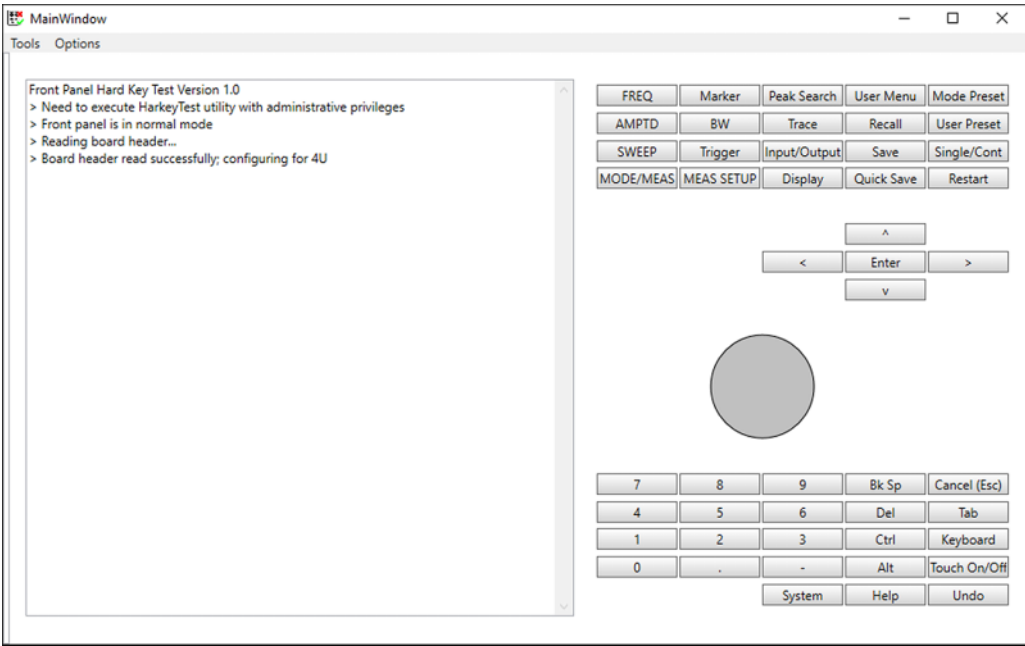
Figure 20-8 Show Software Information

System Settings	Service Show Software		⏮	⏭	?	✕
	Software Assembly Name	Version				
System	Accessibility	4.0.0.0				
	Agilent.Cdf.DataAccess	2.2.9815.12243				
I/O Config	Agilent.CommonBaseband.HWControl	45.10.4.0				
	Agilent.Physics	45.10.0.0				
User Interface	Agilent.Physics.AbortHandler	45.10.4.0				
	Agilent.Physics.HardwareManager	1.0.0.0				
Power On	Agilent.Physics.LogicalHardware	1.0.0.0				
	Agilent.Physics.RFModel	1.0.0.0				
Restore Defaults	Agilent.Physics.SAHardwareControl	45.10.4.0				
	Agilent.PhysicsDSPServices	0.20.1.0				
Alignments	Agilent.PhysicsServer	45.10.4.0				
	Agilent.PhysicsServices	0.20.2.0				
Licensing	Agilent.SA.Api	1.3.63104.27857				
	Agilent.SA.Application.ResourceCatalog	1.3.63104.27857				
Security	Agilent.SA.BackusDsp	3.37.5.0				
	Agilent.SA.BaseInst.ResourceCatalog	1.3.63104.27857				
Diagnostics	Agilent.SA.Complex	1.0.1999.24140				
	Agilent.SA.Dsp	1.3.63104.27857				
Service	Agilent.SA.DynamicTypes	0.0.0.0				
	Agilent.SA.GpsaEngine	1.3.63104.27857				
SCPI Recorder	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

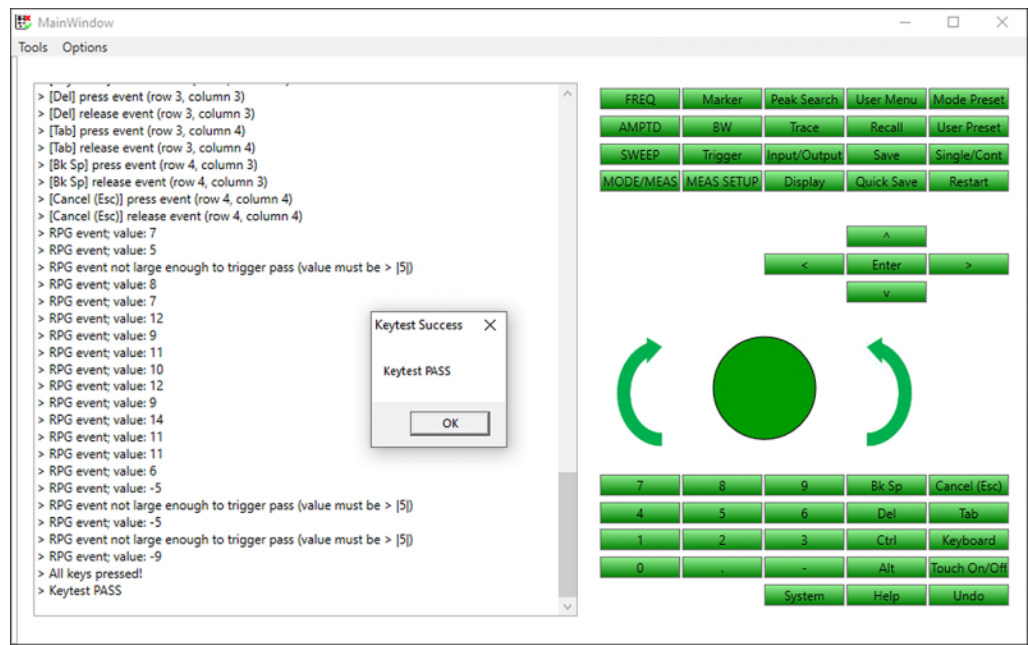
Selecting the front panel key test will first bring up a window as seen in **Figure 20-9**.

Figure 20-9 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 20-10**.

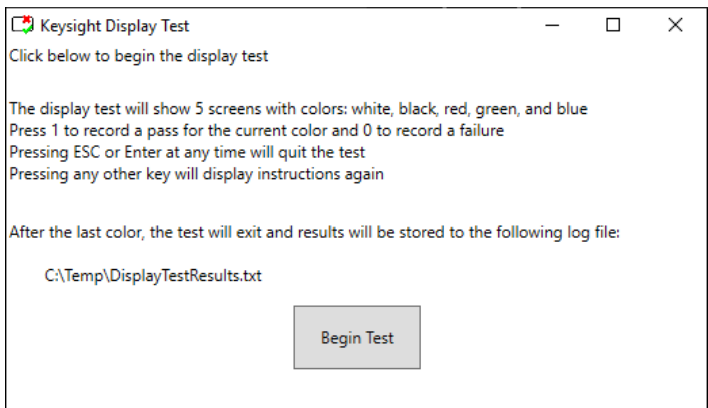
Figure 20-10 Front Panel Key Test Passed



Front Panel Display Test

Selecting the front panel display test will first bring up a window as seen in [Figure 20-11](#).

Figure 20-11 Front Panel Display Test



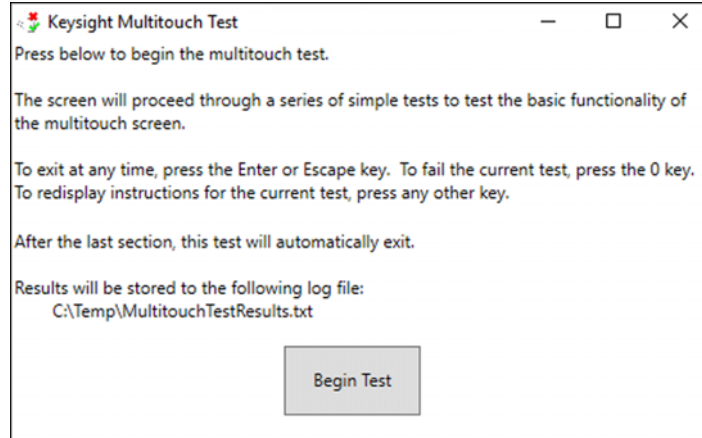
The display test will show five screens with colors: white, black, red, green, and blue, then two screens with gradient fill, and one screen with color bars. This can be used to identify defective pixels in the display or problems with the colors. The test results will be stored at C:\Temp\DisplayTestResults.txt.

Front Panel Touch Test

Selecting the front panel display test will first bring up a window as seen in [Figure 20-12](#).

Figure 20-12

Front Panel Touch Test

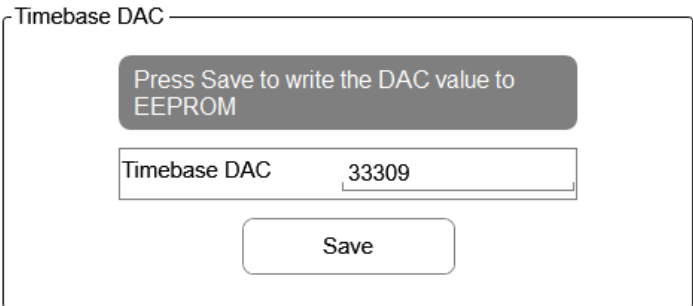


Follow the instructions given on the screen to complete the test. This will test the touch screen display functionality. The test results will be stored at C:\Temp\MultitouchTestResults.txt.

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 20-13**.

Figure 20-13 Timebase DAC Adjustment



Timebase DAC

Press Save to write the DAC value to EEPROM

Timebase DAC 33309

Save

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 20-14**.

Figure 20-14 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.

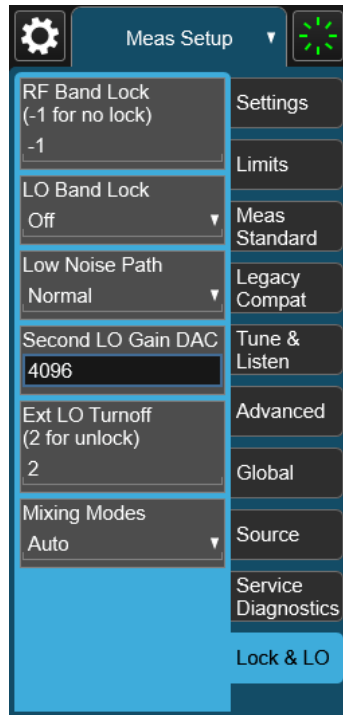
RF to IF Corrections

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 20-15](#).

Figure 20-15 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 μ Wave Path Control menu into the ON position, regardless of the state of the μ Wave 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.

21 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 21-1, “Major Assemblies”	page 576
Figure 21-2, “External Hardware”	page 578
Figure 21-3, “Power Supply Bracket and Top Brace”	page 579
Figure 21-4, “RF Area (with Options 508, 513, or 526)”	page 580
Figure 21-5, “RF Area (with Options 544 or 550)”	page 581
Figure 21-7, “A13 Downconverter (with Options 508, 513, 526)”	page 583
Figure 21-8, “A13 Downconverter (with Options 544, 550, 555)”	page 585
Figure 21-9, “RF Area Cables, Side View (with Options 508, 513, 526)”	page 587
Figure 21-10, “RF Area Cables, Side View (with Options 544, 550)”	page 588
Figure 21-12, “Front Card Cage Cables (with Options 508 513 526)”	page 590
Figure 21-13, “Front Card Cage Cables (with Options 544, 550)”	page 592
Figure 21-15, “Rear Card Cage Cables”	page 596
Figure 21-16, “Switch Area Cables (with Options 508, 513, 526)”	page 597
Figure 21-17, “Switch Area Cables (with Options 544, 550)”	page 599
Figure 21-19, “AIF/DIF Assemblies”	page 603
Figure 21-20, “AIF Cables”	page 604
Figure 21-21, “DIF Cables”	page 604
Figure 21-22, “Option EXM Cables”	page 606
Figure 21-23, “Option ODI Cables”	page 606

Replaceable Parts
What You Will Find in This Chapter

Figure 21-24, “CPU Assembly (Option PCA)”	page 608
Figure 21-25, “CPU Assembly (Option PC8)”	page 609
Figure 21-26, “Disk Drive Tray Assembly (Option PC8)”	page 610
Figure 21-27, “Chassis”	page 611
Figure 21-28, “Fan Hardware”	page 613
Figure 21-29, “Connectors (with Options 508, 513, 526)”	page 614
Figure 21-30, “Connectors (with Options 544, 550)”	page 615
Figure 21-31, “Front Frame Parts”	page 616
Figure 21-32, “Front Frame Exploded View”	page 618

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

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
Assemblies		
A1A1	Front Frame Assembly Replacement Kit	N9032-60035
	Includes:	
	Front Frame	
	Main Keyboard Overlay	N9020-80127
	Left Side Cover Plate	N9032-00008
	Left Side Overlay	N9032-80004
	Braided Gasket	8160-0660
	USB EMI gasket	N9020-20258
	Front Frame Side Trim (2 required)	N9020-40018
	Front Frame Adhesive Side Trim (2 required)	5041-7905
	Front Frame Top Trim	N9020-40005
	Hole Plug, No Option EXM	6960-0076
A1A2	Front Panel Controller Board	
	≥ MY/SG63080100	N9020-63296
	< MY/SG63080100	N9020-60268 ¹
A1A3	Touch Screen Display	
	≥ MY/SG63080100	2090-1158
	< MY/SG63080100	N9020-60268 ¹
A1A4	Keyboard	N9020-63275
A1MP1	Keypad	N9020-40001
A1MP2	RPG Knob	W1312-40179

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
A1MP3	Nameplate Label	
	Option 508	N9032-80001
	Option 513	N9032-80002
	Option 526	N9032-80003
	Option 544	N9032-80008
	Option 550	N9032-80009
	Option 555	N9032-80012
A1MP4	Front Panel Controller Board Shield	N9020-00064
A1MP5	Display Bracket	N9020-00078
A1MP6	Display Compression Pad	
	≥ MY/SG63080100	N9020-40026
	< MY/SG63080100	N9020-40003
A1MP7	Display Protective Boot	N9020-40002
A1MP8	Front Panel Shield	N9020-00066
A1MP9/10	Cable Clamps	1400-2219
A1MP11	Front Panel Control Cable Hook & Loop Fasteners	0510-1303
A1MP12/13	Display EMI Gasket (2 Required)	8160-1997
A1W1	Cable, Flex Circuit, A1A2 Front Panel Controller Board J10 to A1A3 Touch Display	N9020-60273
A1W2	Cable, Wire Harness, A1A2 Controller Board J16 to A1A3 Touch Display	N9020-60217
A2	25 MHz Analog IF	N9020-60290
	TAA Compliant	N9020-60290G
A3	40 MHz Digital IF	N9020-60016
A3W1	Cable, Wire Harness, Smart Noise Source	N9020-60090
A4	System Processor	
	Option PC8	W1312-60524
	Option PCA	W1312-60561
A4BT1	Processor Battery (CR2032)	1420-0356
A4A1	SDHC Memory Card (16 GB), Option PC8	1819-1354

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
A5	Solid State Drive, Programmed	
	Option PC8	N9032-60016
	Option PCA	N9032-60025
A5MP1	Disk Drive Tray, Option PC8	W1312-40078
A5MP2	Disk Drive Rear Panel, Option PC8	W1312-00103
A5MP3	Disk Drive Handle, Option PC8	1440-0421
A6	Power Supply	0950-5748
A7	Midplane Board	W1312-63310
A8	Motherboard	N9032-63002
A9	Attenuator A	
	Option 508, 513, 526	33360-60011
	Option 544, 550, 555	33326-60020
A10	Attenuator B	
	Option 508, 513, 526	33321-60085
	Option 544, 550, 555	33325-60027
A11	Band Switch	N9040-60100
A12	Yig Tuned Filter	
	Option 508, 513, 526	5087-7382
	Option 544, 550	5087-7383
	Option 555	5087-7433
A12MP1	Gap Pad for A12 Mounting	5022-7179
A13	Downconverter	N9041-60039
A13FL1	Filter, Bandpass, 5.675 GHz, 1.5 GHz BW	9135-6659
A13SW1	Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
A13SW2	Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
A14	DDS LO Synthesizer Assembly	N9020-60377
A15	Front End Controller	
	Option 508, 513, 526, 544, 550	N9020-60295
	Option 555	N9032-60295

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
A16	Reference Assembly	N9020-60387
	TAA Compliant	N9020-60387G
A16A3	Reference OCXO	N9020-63194
A20	Yig Tuned Oscillator	N9020-60009
A21	Wideband Digital IF	N9032-60058
A21MP1	FireFly™ Heatsink	N9041-20154
A23	IF Mux	N9032-60193 ²
A25	Wideband Calibrator	
	Option 508, 513, 526, 544, 550	N9032-60171
	Option 555	N9032-60271
A30	Switch Control Adapter, Option 555	N9032-63298
AT1	Attenuator, Coaxial Fixed, 6 dB	
	Option 508, 513, 526	08493-60026
	Option 544, 550	08490-60040
	Option 555	08490-60038
AT2	Attenuator, Coaxial Fixed, 3 dB	
	Option 544, 550	08490-60039
	Option 555	08490-60037
B1, B2, B3	Cooling Fan (3 Required)	3160-4199
	Fan Grill (3 Required)	3160-0281
FL1	Filter, Bandpass, 7.2 GHz (DDS Clock)	9135-6218
J1	RF Input Connector Assembly	
	1.85 mm	N9032-60038
	2.4 mm	N9048-60111
	3.5 mm (Option C35 only)	N9048-60119
	Type-N	N9048-60121

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
J2	Cal Out Connector	
	Option 508, 513, 526	1250-1666
	Option 544, 550	1250-3667
	Option 555	E7790-60022
	Cal Out Connector Bracket	
	Option 508, 513, 526	N9032-00007
	Option 544, 550, 555	N9032-00017
J3	Ext Mixer Connector - SMA	1250-1666
J4	Wide IF Out Connector - SMA	1250-1251
SW1	Switch, 4-Port Transfer, Calibrator	
	Option 508, 513, 526	N9032-60003
	Option 544, 550	N9032-60019
	Option 555	N9032-60031
SW2	Switch, 4-Port Transfer, Low Noise Amplifier	
	Option 508, 513, 526	N9032-60001
	Option 544, 550	N9032-60017
	Option 555	N9032-60029
SW3	Switch, 4-Port Transfer, Low Noise Path	
	Option 508, 513, 526	87222-60026
	Option 544, 550	87222-60029
	Option 555	N9032-60032
SW4	Switch, 4-Port Transfer, Microwave Preselector Bypass	
	Option 508, 513, 526	N9048-60004
	Option 544, 550	N9048-60005
	Option 555	N9032-60030
	Optical Adapter, Female-Female, Rear Panel Mount	1005-1388
	50 Ohm Termination - 1.85 mm	1250-4527
	50 Ohm Termination - 2.4 mm	0955-2394
	50 Ohm Termination - SMA	1810-0118

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Female-Female Adapter - 1.85 mm	85058-60114
Cables		
W1	Cable, Ribbon, A8 Motherboard J9 to A1A2 Front Panel Controller J1	N9020-60216
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators	
	Option 508, 513, 526	E4410-60157
	Option 544, 550	N9048-60023
	Option 555	N9032-60998
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W6	Cable, Ribbon, A23 IF Mux P2 to A25 Wideband Calibrator J1	N9032-60006
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downconverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W11	Cable, Ribbon, A2 25 MHz Analog IF J820 to A3 40 MHz Digital IF J20	N9020-60046
W20	Cable, Wire Harness, A23 IF Mux P1 to SW1 Calibrator Switch and SW2 LNA Switch	
	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020
W21	Cable, Wire Harness, A15 Front End Controller J801 to A13SW1, A13SW2, SW4 MPB Switch, A11J2	N9048-60027
W23	Cable, Wire Harness, A15 Front End Controller J300 to A12 Yig Tuned Filter J1	N9032-60009
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input	
	1.85 mm Input	N9032-20115
	2.4 mm Input	N9032-20049
	3.5 mm Input	N9032-20029
	Type-N Input	N9032-20001
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	
	Option 508, 513, 526	N9032-20002
	Option 544, 550	N9032-20034
	Option 555	N9032-20101

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input	
	Option 508, 513, 526	N9032-20021
	Option 544, 550	N9032-20047
	Option 555	N9032-20113
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	
	Option 508, 513, 526	N9032-20000
	Option 544, 550	N9032-20033
	Option 555	N9032-20100
W34	Cable, Semi-Rigid, SW2 LNA Switch P4 to A11 Band Switch P5	
	Option 508, 513, 526	N9032-20015
	Option 544, 550	N9032-20046
	Option 555	N9032-20112
W35	Cable, Semi-Rigid, SW2 LNA Switch P1 to A11 Band Switch P4	
	Option 508, 513, 526	N9032-20014
	Option 544, 550	N9032-20045
	Option 555	N9032-20111
W36	Cable, Semi-Rigid, SW2 LNA Switch P2 to SW3 LNP Switch P1	
	Option 508, 513, 526	N9032-20007
	Option 544, 550	N9032-20038
	Option 555	N9032-20106
W37	Cable, Semi-Rigid, SW3 LNP Switch P4 to A11 Band Switch P2	
	Option 508, 513, 526	N9032-20010
	Option 544, 550	N9032-20041
	Option 555	N9032-20107
W38	Cable, Semi-Rigid, SW3 LNP Switch P3 to A11 Band Switch P3	
	Option 508, 513, 526	N9032-20009
	Option 544, 550	N9032-20040
	Option 555	N9032-20104

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
W39	Cable, Semi-Rigid, SW3 LNP Switch P2 to SW4 MPB Switch P2	
	Option 508, 513, 526	N9032-20008
	Option 544, 550	N9032-20039
	Option 555	N9032-20105
W40	Cable, Semi-Rigid, SW4 MPB Switch P1 to A12 Yig Tuned Filter Input	
	Option 508, 513, 526	N9032-20012
	Option 544, 550	N9032-20043
	Option 555	N9032-20109
W41	Cable, Semi-Rigid, SW4 MPB Switch P4 to A12 Yig Tuned Filter Output	
	Option 508, 513, 526	N9032-20013
	Option 544, 550	N9032-20044
	Option 555	N9032-20110
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	
	Option 508, 513, 526	N9032-20011
	Option 544, 550	N9032-20042
	Option 555	N9032-20108
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016
W45	Cable, Semi-Rigid, A13 Downconverter J10 to A13SW1 Filter Switch Port C	N9020-20266
W46	Cable, Semi-Rigid, A13SW1 Filter Switch Port I to A13FL1 Bandpass Filter Input	N9020-20268
W47	Cable, Semi-Rigid, A13SW1 Filter Switch Port II to A13A2 Switched IF Filter J2	N9020-20267
W48	Cable, Semi-Rigid, A13A2 Switched IF Filter J3 to J4 - Delay Line	N9020-20080
W49	Cable, Semi-Rigid, A13FL1 Bandpass Filter Output to A13SW2 Filter Switch Port I	N9020-20293
W50	Cable, Semi-Rigid, A13A2 Switched IF Filter J5 to A13SW2 Filter Switch Port II	N9020-20292
W51	Cable, Semi-Rigid, A13SW2 Filter Switch Port C to A13 Downconverter J11	N9020-20276
W52	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	
	Option 508, 513, 526, 544, 550	N9032-20051
	Option 555	N9032-20117
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W58	Cable, Semi-Rigid, A16 Reference J703 to FL1 7.2 GHz BPF Input	N9020-20303

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
W59	Cable, Semi-Rigid, FL1 7.2 GHz BPF Output to A14 DDS LO Synthesizer J35002	N9020-20226
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W62	Cable, Semi-Rigid, A13A1 Downconverter J3 to A13A2 Switched IF Filter J6	N9020-20245
W66	Cable, Semi-Rigid, W72 to Front Panel Ext Mixer, Option EXM	N9020-20166
W71	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	
	Option 508, 513, 526, 544, 550	N9032-20053
	Option 555	N9032-20119
W72	Cable, Semi-Rigid, A13A1 Downconverter J8 to W66, Option EXM	N9020-20167
W73	Cable, Semi-Rigid, AT1 Output to SW1 Calibrator Switch P3	
	Option 508, 513, 526	N9032-20028
	Option 544, 550	N9032-20048
	Option 555	N9032-20114
W74	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to Front Panel Cal Out	N9032-20006
	Option 508, 513, 526	
	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to AT2 at Front Panel Cal Out	
	Option 544, 550	N9032-20037
	Option 555	N9032-20103
W75	Cable, Semi-Rigid, A16 Reference J701 to SW1 Calibrator Switch P1	
	Option 508, 513, 526	N9032-20004
	Option 544, 550, 555	N9032-20035
W76	Cable, Semi-Rigid, A16 Reference J702 to A23 IF Mux J37	N9032-20019
W77	Cable, Semi-Rigid, A25 Wideband Calibrator P1 to AT1	
	Option 508, 513, 526	N9032-20005
	Option 544, 550	N9032-20036
	Option 555	N9032-20102
W78	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	
	Option 508, 513, 526, 544, 550	N9032-20052
	Option 555	N9032-20118

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
W100	Cable, Coax, A2 25 MHz Analog IF J601 to A3 40 MHz Digital IF J19	8121-2607
W101	Cable, Coax, A15 Front End ControllerJ900 to A2 25 MHz Analog IF J100	8121-1865
W102	Cable, Coax, A15 Front End ControllerJ901 to A3 40 MHz Digital IF J15	8121-1919
W103	Cable, Coax, A15 Front End ControllerJ1100 to Rear Panel Aux IF Out	8121-1859
W104	Cable, Coax, A16 Reference J704 to Rear Panel EXT REF IN	8121-1860
W105	Cable, Coax, A16 Reference J705 to A13A1 Downconverter J6	8121-1940
W106	Cable, Coax, A16 Reference J707 to A25 Wideband Calibrator J2	8121-2292
W107	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1861
W108	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1401
W109	Cable, Coax, A16 Reference J718 to A21 Wideband DIF J1	8120-0152
W110	Cable, Coax, A16 Reference J726 to A3 40 MHz Digital IF J17	8121-1401
W111	Cable, Coax, A21 Wideband DIF J11 to Rear Panel TRIGGER 3 In	8121-1859
W115	Cable, Coax, A23 IF Mux J40 to A21 Wideband DIF J7	8121-8868
W116	Cable, Coax, A23 IF Mux J41 to A21 Wideband DIF J4	8121-8868
W117	Cable, Coax, A23 IF Mux J42 to A15 Front End ControllerJ902	8121-8868
W142	Cable, Optical TX/RX, A21 Wideband DIF J1000/1002 and J1001/1003 to Rear Panel Streaming (Option ST1 or ST2 Only)	N9032-61000
Chassis		
	Chassis Base	N9048-00020
	Chassis Side, Right - Outer	
	Option 508, 513, 526, 544, 550	N9032-00000
	Option 555	N9032-00101
	Chassis Side, Left - Outer	N9032-00010
	Chassis Side, Right - Inner	N9032-00016
	Chassis Side, Left - Inner	W1312-00117
	Card Guides (22 Required)	W1312-40001
	Midplane Board Bracket	W1312-00048
	Power Supply Bracket	W1312-00131
	Chassis Front Bracket	N9032-00006

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Rear Panel	N9032-00015
	Non-Streaming Blank Plate	N9041-00050
	Top Brace	N9048-00014
	DDS LO Synthesizer Support Bracket	N9020-00058
	LNP Switch Mounting Bracket	
	Option 508, 513, 526, 544, 550	N9032-00014
	Option 555	N9032-00100
	LNA-MPB Switch Mounting Bracket	N9032-00002
	Band Switch Mounting Bracket	N9032-00003
	Attenuator Bracket	N9038-01202
	Magnetic Shield - A9 Attenuator A	
	Option 508, 513, 526	N9032-00012
	Option 544, 550, 555	N9020-00043
	Magnetic Shield - A10 Attenuator B	
	Option 508, 513, 526	N9032-00013
	Option 544, 550, 555	N9020-00044
	YTO Top Shield	N9020-00005
	YTO Bottom Shield	N9020-00006
	Left Side Connector Bracket	N9048-20618
Labels		
	Reference Board Connector Label	5190-6301
	IF Mux Connector Label	N9032-80006
	Wide IF Out Rear Panel Warning Label	N9032-80005
	External Mixing Front Panel Warning Label	N9030-80018
Miscellaneous		
	Cable Hold Down - 50 mm	5023-1379
	Cable Hold Down - 160 mm	5023-1397
	Nylon Tie Wraps	1400-0249
	Optical Cable Clip, Screw Mount, Option ST1, ST2	1400-0082

Table 21-1 All Replaceable Parts

Reference Designator	Description	Part Number
	Cable Clip, Adhesive, Option ST1, ST2	1400-1254
	Wire Saddle, Screw Mount	1400-3690
	Red Rubber Vibration Mount, Adhesive	0460-2725
Button Up		
	Dress Cover	N9020-00069
	Strap Handle (2 required)	N9020-60253
	Bottom Feet (4 required)	5041-7906
	Lock (4 required)	5021-2840
	Rear Feet (4 required)	5041-7903
	Hole Plug, 0.312 in	6960-0076
	Hole Plug, 0.5 in	6960-0149
	Hole Plug, 0.875 in	6960-0177

1. Original part discontinued. N9020-60268 is the Front Panel Interface and Display Replacement Kit to replace both A1A2 Front Panel Controller and A1A3 Touch Screen Display assemblies to ensure compatibility. Verify the instrument has not already had the kit installed; the previous part numbers for these assemblies are N9020-63294 and 2090-1103, respectively.
2. If replacing an N9041-63163 A23 with the N9032-60193 you will also need to order a new N9032-60020 W20.

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
A1 Front Frame Assy	Chassis Base	4	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Outer	2	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Outer	2	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Connector Bracket, Right	2	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Connector Bracket, Left	2	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Connector Bracket, Cal Out	1	0515-2032	Flat Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A1A2 Front Panel Controller Bd	A1 Front Panel Assy	7	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A1A3 Touch Screen Display	A1MP5 Display Bracket	4	0515-0365	Pan Head	M2 X 0.4 (4 mm)	Torx T-6	2 inch-lbs
A1A4 Keyboard	A1 Front Panel Assy	8	0515-0430	Pan Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
A1MP4 Front Panel Controller Board Shield	A1 Front Panel Assy	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch lbs
		2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A1MP5 Display Bracket	A1 Front Panel Assy	7	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch lbs
		4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
A1MP8 Front Panel Shield	A1 Front Panel Assy	8	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Left Side Cover Plate	A1 Front Panel Assy	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
J4 Ext Mixer Connector	A1 Front Panel Assy	1	2190-0067	Lock Washer	n/a	n/a	n/a
		1	2950-0223	Hex Nut	n/a	3/8"	21 inch-lbs
A3 40 MHz Digital IF	A2 25 MHz Analog IF	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A4 System Processor	Chassis Side, Right - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A4 System Processor Extractors	A4 System Processor	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A5 Solid State Drive, Programmed (PC8)	A5MP1 Disk Drive Tray	4	0515-1035	Flat Head	M3 x 0.5 (8 mm)	Torx T-10	9 inch-lbs
A5MP2 Disk Drive Rear Panel (PC8)	A5MP1 Disk Drive Tray	4	0515-2219	Flat Head	M2.5 x 0.45 (5 mm)	Torx T-8	6 inch-lbs
A5MP3 Disk Drive Handle (PC8)	A5MP2 Disk Drive Rear Panel	2	0515-1227	Flat Head	M3 x 0.5 (6 mm)	Torx T-10	9 inch-lbs
A6 Power Supply	Power Supply Bracket	3	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
Power Supply Bracket	Chassis Side, Right - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Outer	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Outer	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A7 Midplane Board	Midplane Bracket	6	0515-0375	Pan Head	M3 X 0.5 (16 mm)	Torx T-10	9 inch-lbs
A8 Motherboard	Chassis Base	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Midplane Bracket	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A9 Attenuator A	Attenuator Bracket	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A10 Attenuator B	Attenuator Bracket	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Attenuator Bracket	Chassis Base	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A11 Band Switch	Band Switch Mounting Bracket	5	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A12 Yig Tuned Filter	Chassis Base	4	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
A13 Downconverter	Chassis Front Bracket	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A13FL1 Bandpass Filter	A13 Downconverter	4	0515-2007	Pan Head	M2.5 X 0.45 (16 mm)	Torx T-8	6 inch-lbs
A13SW1 Filter Switch	A13 Downconverter	2	0515-2218	Flat Head	M2.5 X 0.45 (16 mm)	Torx T-8	6 inch-lbs
A13SW2 Filter Switch	A13 Downconverter	2	0515-2218	Flat Head	M2.5 X 0.45 (16 mm)	Torx T-8	6 inch-lbs
Chassis Front Bracket	Chassis Base	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Inner	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Inner	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A14 DDS LO Synthesizer	Chassis Side, Right - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
DDS LO Synthesizer Support Bracket	A14 DDS LO Synthesizer	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A16 Reference Assembly	Chassis Side, Right - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
A16A3 Reference OCXO	A16 Reference Assembly	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
		2	0515-0664	Pan Head	M3 X 0.5 (12 mm)	Torx T-10	9 inch-lbs
A20 Yig Tuned Oscillator	Chassis Base	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
YTO Top Shield	A20 Yig Tuned Oscillator	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A21 Wideband DIF ODI Heatsink	A21 Wideband Digital IF	4	0515-2332	Pan Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
		1	0515-0666	Pan Head	M3 X 0.5 (18 mm)	Torx T-10	9 inch-lbs
A23 IF Mux Assembly	Chassis Side, Right - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
A25 Wideband Calibrator	Right Extractor	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
A30 Switch Control Adapter	LNP Switch Bracket	2	0515-0430	Pan Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
J1 RF Input Connector Assembly	Chassis Base	2	0515-6548	Flat Head	M4 X 0.7 (6 mm)	Torx T-10	12 inch-lbs
Left Blank Connector Bracket	Chassis Base	2	0515-6548	Flat Head	M4 X 0.7 (6 mm)	Torx T-10	12 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
J2 Cal Out Connector	Cal Out Connector Bracket	1	2190-0067	Lock Washer	n/a	n/a	n/a
		1	2950-0223	Hex Nut	n/a	3/8"	21 inch-lbs
Cal Out Connector Bracket	Chassis Side, Left - Outer	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
J4 Wide IF Out Connector	Rear Panel	1	Supplied Hardware	n/a	n/a	n/a	10 inch-lbs
		1	3050-0629	Washer	n/a	n/a	n/a
SW1 Calibrator Switch	A25 Wideband Calibrator	3	0515-1410	Pan Head	M3 X 0.5 (20 mm)	Torx T-10	9 inch-lbs
SW1 Calibrator Switch Wire Harness	A25 Wideband Calibrator	2	0515-0663	Pan Head	M3 X 0.5 (4 mm)	Torx T-10	9 inch-lbs
	A25 Wideband Calibrator	1	0515-0430	Pan Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
SW2 LNA Switch	LNA-MPB Switch Mounting Bracket	2	0515-1410	Pan Head	M3 X 0.5 (20 mm)	Torx T-10	9 inch-lbs
SW2 LNA Switch Wire Harness	LNA-MPB Switch Mounting Bracket	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
LNA-MPB Switch Mounting Bracket	Band Switch Mounting Bracket	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
SW3 LNP Switch			0515-1940	Pan Head	M2.5 X 0.45 (6 mm)	Torx T-8	6 inch-lbs
All Except Option 555	LNP Switch Mounting Bracket	4	0515-1940	Pan Head	M2.5 X 0.45 (6 mm)	Torx T-8	6 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
Option 555	LNP Switch Mounting Bracket	2	0515-1410	Pan Head	M3 X 0.5 (20 mm)	Torx T-10	9 inch-lbs
LNP Switch Mounting Bracket	A11 Band Switch	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Inner	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
SW4 MPB Switch	LNA-MPB Switch Mounting Bracket	2	0515-1410	Pan Head	M3 X 0.5 (20mm)	Torx T-10	9 inch-lbs
SW4 MPB Switch Wire Harness	LNA-MPB Switch Mounting Bracket	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
W104 EXT REF IN Cable	Rear Panel	1	2190-0102	Lock Washer	n/a	n/a	n/a
		1	0590-2332	Hex Nut	n/a	9/16"	21 inch-lbs
W103 AUX IF OUT Cable	Rear Panel	1	Supplied Hardware	n/a	n/a	5/16"	10 inch-lbs
W111 TRIGGER 3 IN Cable	Rear Panel	1	Supplied Hardware	n/a	n/a	5/16"	10 inch-lbs
Chassis Base	Chassis Side, Right - Inner	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	6	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Front Bracket	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Side, Right - Inner	Midplane Board Bracket	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
Chassis Side, Right - Outer	Chassis Base	5	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Band Switch Mounting Bracket	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	LNA-MPB Mounting Bracket	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	LNP Bracket - Option 555	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Side, Left - Inner	Midplane Board Bracket	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Chassis Side, Left - Outer	Chassis Base	5	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Front Brace	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Cooling Fans	Chassis Side, Left - Outer	12	0361-1272	Nylon Rivet	n/a	n/a	n/a

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
Top Brace	Chassis Side, Right - Inner	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Outer	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Outer	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Front Bracket	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Power Supply Bracket	3	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	Midplane Bracket	4	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A16 Reference Assembly	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A21 Wideband Digital IF	2	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A23 IF Mux Assembly	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A25 Wideband Calibrator	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A14 DDS LO Synthesizer	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs
	A15 Front End Controller	1	0515-1946	Flat Head	M3 X 0.5 (6 mm)	Torx T-10	9 inch-lbs

Table 21-2 Attaching Hardware

Attach	To	Qty	Part Number	Type	Size	Tool	Torque
ODI Cable Hold Down	Chassis Side, Right - Inner	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Rear Panel	Chassis Side, Right - Inner	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Right - Outer	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Inner	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	Chassis Side, Left - Outer	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	A6 Power Supply	3	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
	A2 25 MHz Analog IF	1	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
ODI Connector	Rear Panel	1	0515-2151	Flat Head	M2 X 0.4 (4 mm)	Torx T-6	2 inch-lbs
Non-Streaming Blank Plate	Rear Panel	2	0515-0372	Pan Head	M3 X 0.5 (8 mm)	Torx T-10	9 inch-lbs
Rear Feet	Rear Panel	4	3050-0893	Flat Washer	n/a	n/a	n/a
		4	0515-1619	Pan Head	M4 X 0.7 (25 mm)	Torx T-20	21 inch-lbs
Strap Handle	Chassis Side, Right - Outer	n/a	n/a	n/a	n/a	Torx T-20	21 inch-lbs
	Chassis Side, Left - Outer	n/a	n/a	n/a	n/a	Torx T-20	21 inch-lbs

Hardware

Figure 21-1 Major Assemblies

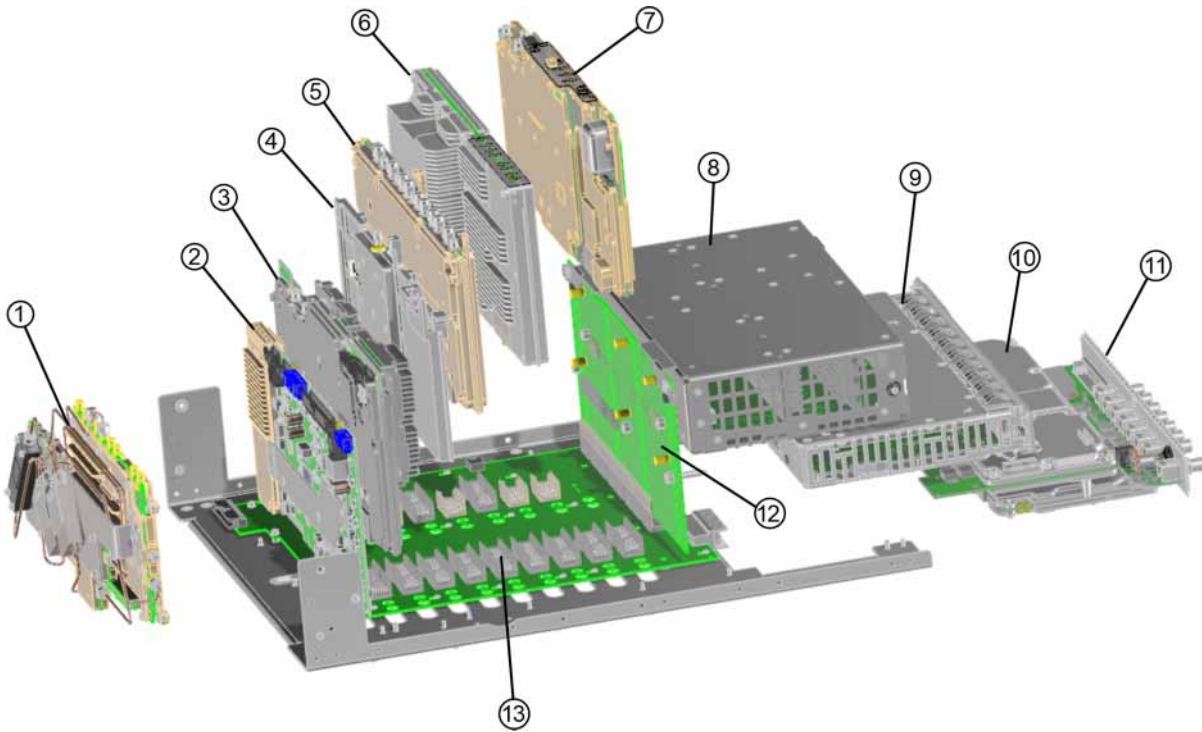


Table 21-3 Major Assemblies

Item	Description	Keysight Part Number
1	A13 Downconverter	N9041-60039
2	A15 Front End Controller	
3	A14 DDS LO Synthesizer Assembly	N9020-60377
4	A25 Wideband Calibrator	
5	A23 IF Mux	N9032-60193
6	A21 Wideband Digital IF	N9032-60058
7	A16 Reference Assembly	N9020-60387
	TAA Compliant	N9020-60387G
8	A6 Power Supply	0950-5748
9	A4 System Processor	
	Option PC8	W1312-60524
	Option PCA	W1312-60561
10	A2 25 MHz Analog IF	N9020-60290
11	A3 40 MHz Digital IF	N9020-60016
12	A7 Midplane Board	W1312-63310
13	A8 Motherboard	N9032-63002

Figure 21-2 External Hardware

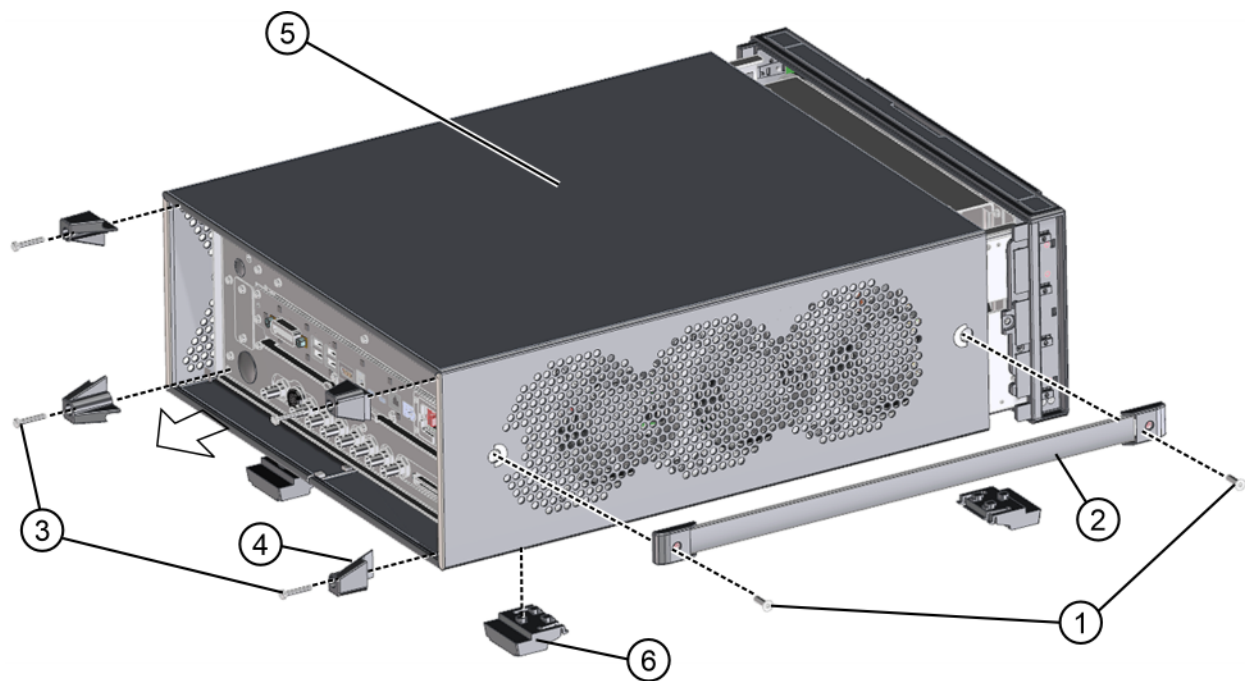


Table 21-4 External Hardware

Item	Description	Keysight Part Number
1, 2	Strap Handle (includes screws)	N9020-60253
3	Screw	0515-1619
	Washer	3050-0893
4	Rear Feet	5041-7903
5	Dress Cover	N9020-00069
6	Bottom feet	5041-7906

Figure 21-3 Power Supply Bracket and Top Brace

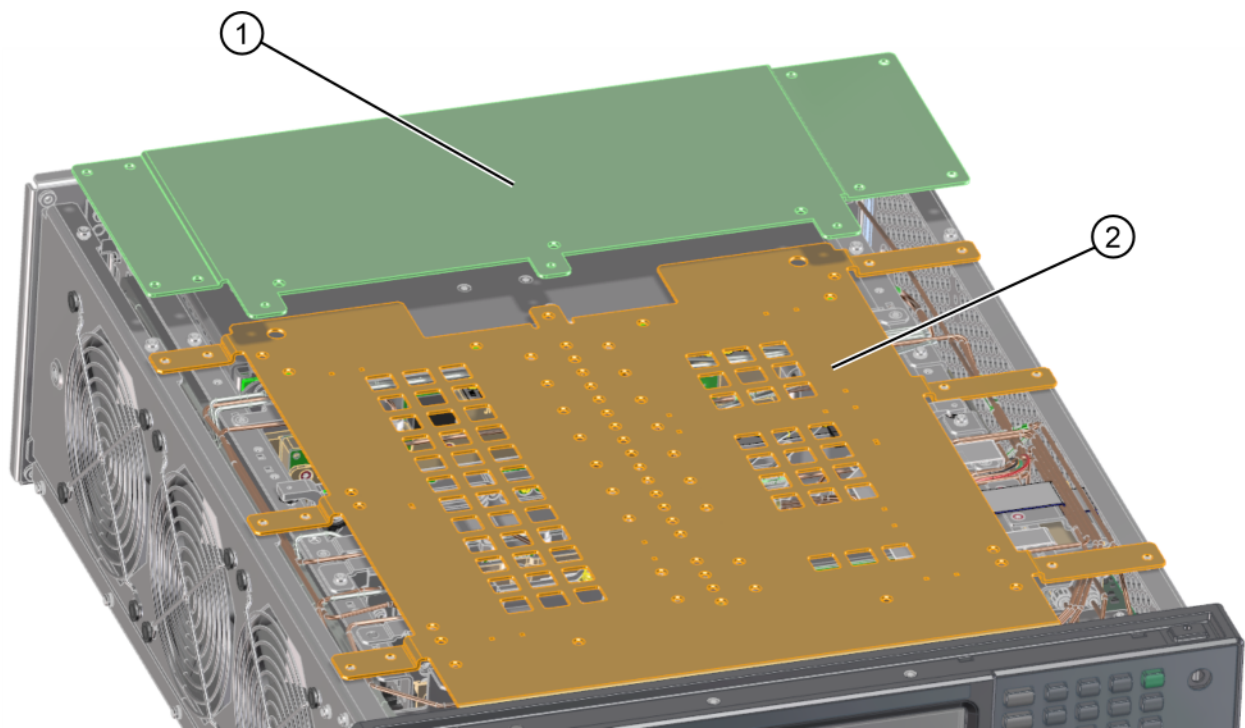


Table 21-5

Item	Description	Keysight Part Number
1	Power Supply Bracket	W1312-00131
2	Top Brace	

Figure 21-4 RF Area (with Options 508, 513, or 526)

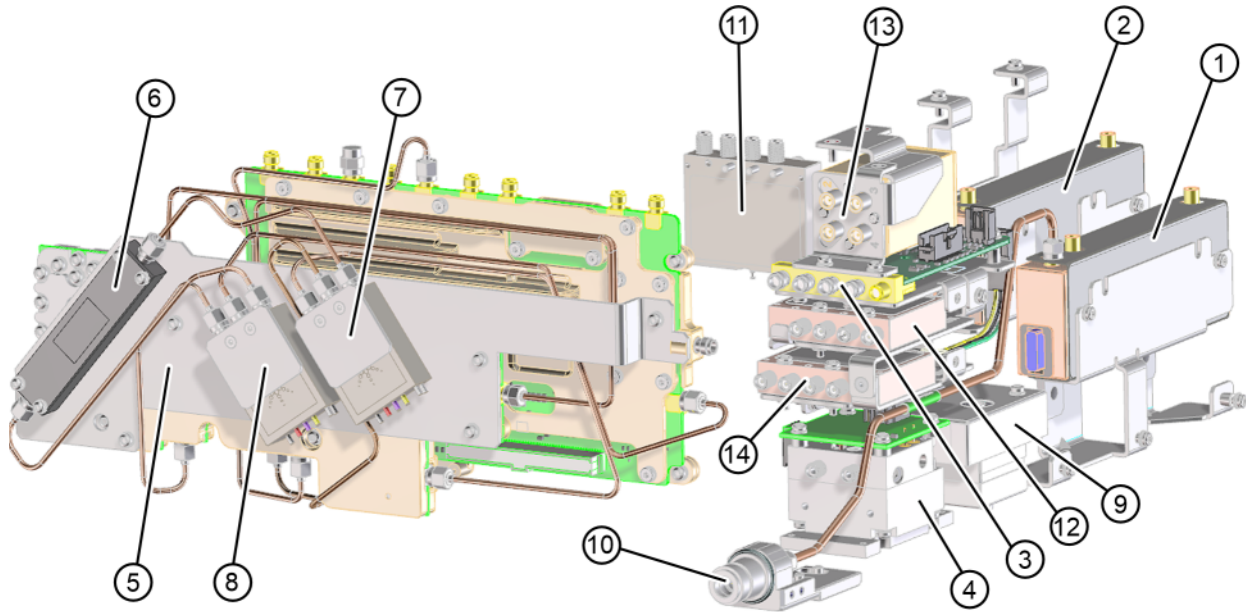


Table 21-6 RF Area (with Options 508, 513, or 526)

Item	Description	Keysight Part Number
1	A9 Attenuator A	33360-60011
2	A10 Attenuator B	33321-60085
3	A11 Band Switch	N9040-60100
4	A12 Yig Tuned Filter	5087-7382
5	A13 Downconverter	N9041-60039
6	A13FL1 Filter, Bandpass, 5.675 GHz, 1.5 GHz BW	9135-6659
7	A13SW1 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
8	A13SW2 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
9	A20 Yig Tuned Oscillator	N9020-60009
10	J1 RF Input Connector Assembly	
	3.5 mm (Option C35 only)	N9048-60119
	Type-N	N9048-60121
11	SW1 Switch, 4-Port Transfer, Calibrator	N9032-60003
12	SW2 Switch, 4-Port Transfer, Low Noise Amplifier	N9032-60001
13	SW3 Switch, 4-Port Transfer, Low Noise Path	87222-60026
14	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass	N9048-60004

Figure 21-5 RF Area (with Options 544 or 550)

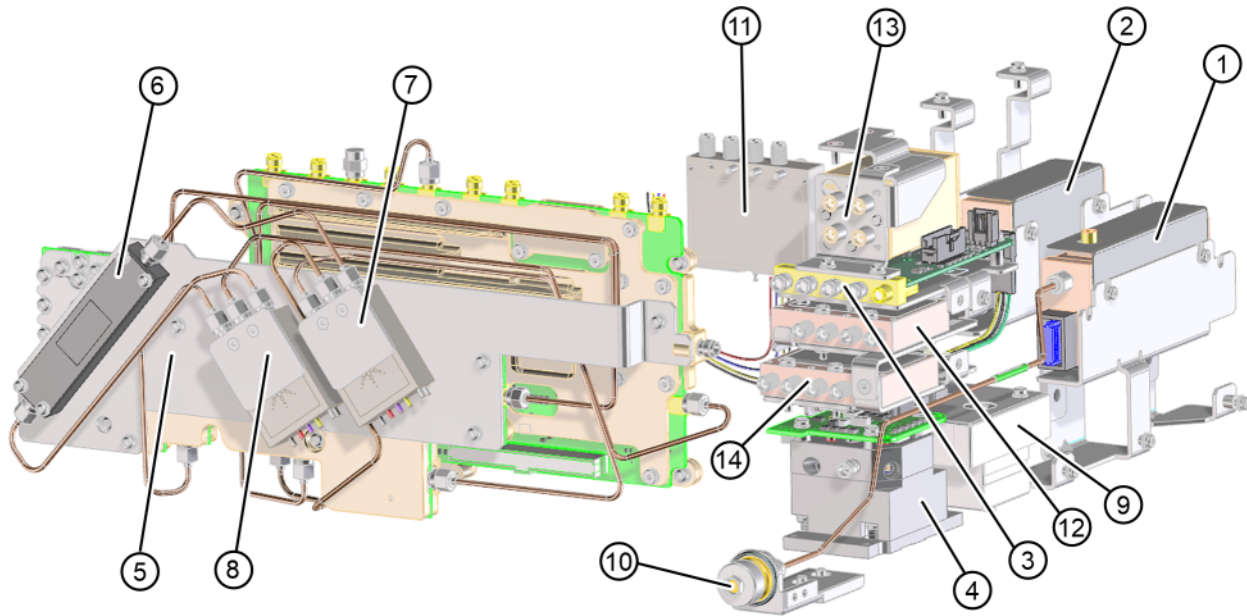


Table 21-7 RF Area (with Options 544 or 550)

Item	Description	Keysight Part Number
1	A9 Attenuator A	33326-60020
2	A10 Attenuator B	33325-60027
3	A11 Band Switch	N9040-60100
4	A12 Yig Tuned Filter	5087-7383
5	A13 Downconverter	N9041-60039
6	A13FL1 Filter, Bandpass, 5.675 GHz, 1.5 GHz BW	9135-6659
7	A13SW1 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
8	A13SW2 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
9	A20 Yig Tuned Oscillator	N9020-60009
10	J1 RF Input Connector Assembly 2.4 mm	N9048-60111
11	SW1 Switch, 4-Port Transfer, Calibrator	N9032-60019
12	SW2 Switch, 4-Port Transfer, Low Noise Amplifier	N9032-60017
13	SW3 Switch, 4-Port Transfer, Low Noise Path	87222-60029
14	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass	N9048-60005

Figure 21-6 RF Area (with Options 555)

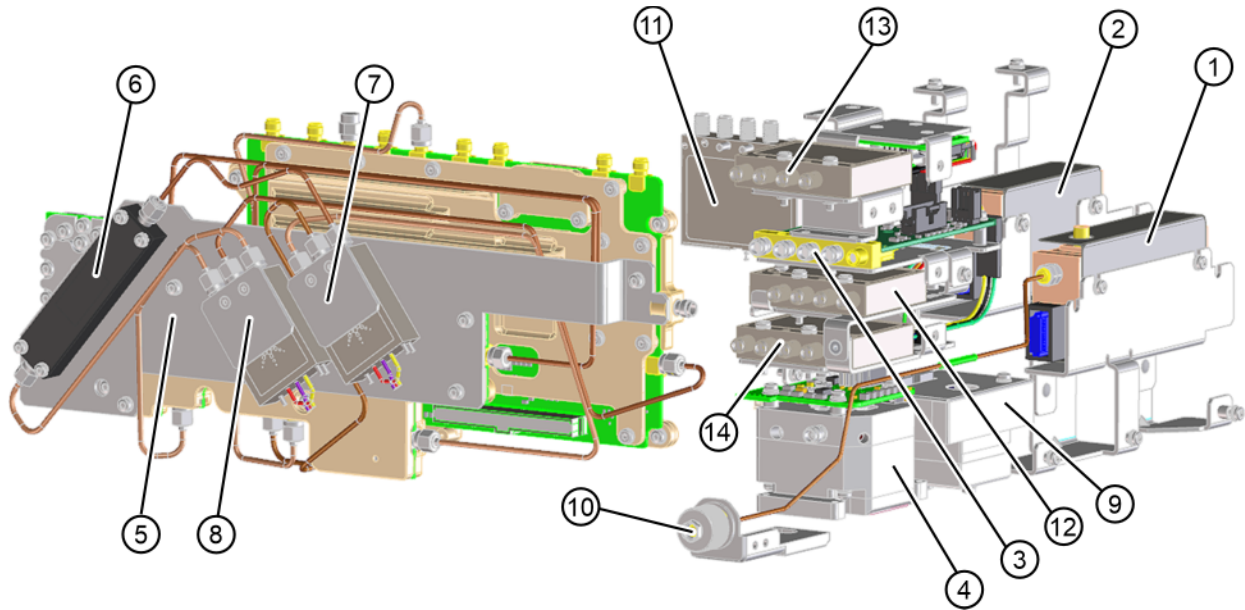


Table 21-8 RF Area (with Options 555)

Item	Description	Keysight Part Number
1	A9 Attenuator A	33326-60020
2	A10 Attenuator B	33325-60027
3	A11 Band Switch	N9040-60100
4	A12 Yig Tuned Filter	5087-7433
5	A13 Downconverter	N9041-60039
6	A13FL1 Filter, Bandpass, 5.675 GHz, 1.5 GHz BW	9135-6659
7	A13SW1 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
8	A13SW2 Switch, 3-Port SPDT, 1.5 GHz Bandpass Filter Bypass	N1810-60102
9	A20 Yig Tuned Oscillator	N9020-60009
10	J1 RF Input Connector Assembly 1.85 mm	N9032-60038
11	SW1 Switch, 4-Port Transfer, Calibrator	N9032-60031
12	SW2 Switch, 4-Port Transfer, Low Noise Amplifier	N9032-60029
13	SW3 Switch, 4-Port Transfer, Low Noise Path	N9032-60032
14	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass	N9032-60030

RF Area Cables

Refer to **Figure 21-7** through **Figure 21-19** for locations of RF area cables.

Figure 21-7 A13 Downconverter (with Options 508, 513, 526)

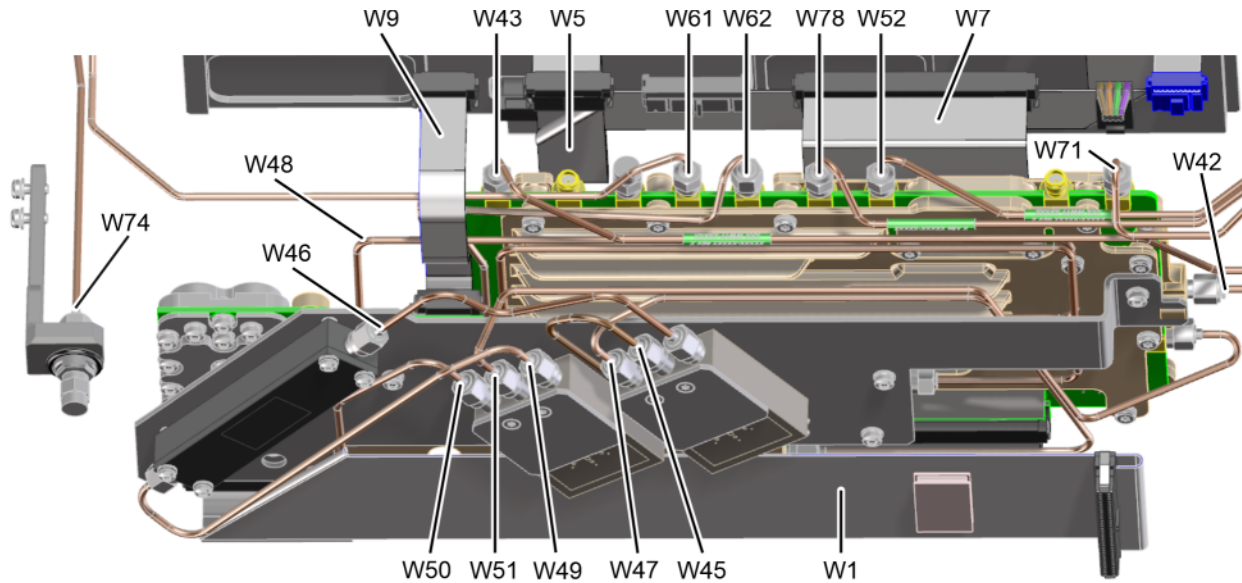


Table 21-9 RF Area Cables, A13 Downconverter (with Options 508, 513, 526)

Item	Description	Part Number
W1	Cable, Ribbon, A8 Motherboard J9 to A1A2 Front Panel Controller J1	N9020-60216
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downconverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20011
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016
W45	Cable, Semi-Rigid, A13 Downconverter J10 to A13SW1 Filter Switch Port C	N9020-20266
W46	Cable, Semi-Rigid, A13SW1 Filter Switch Port I to A13FL1 Bandpass Filter Input	N9020-20268
W47	Cable, Semi-Rigid, A13SW1 Filter Switch Port II A13A2 Switched IF Filter J2	N9020-20267
W48	Cable, Semi-Rigid, A13A2 Switched IF Filter J3 to J4 - Delay Line	N9020-20080
W49	Cable, Semi-Rigid, A13FL1 Bandpass Filter Output to A13SW2 Filter Switch Port I	N9020-20293
W50	Cable, Semi-Rigid, A13A2 Switched IF Filter J5 to A13SW2 Filter Switch Port II	N9020-20292
W51	Cable, Semi-Rigid, A13SW2 Filter Switch Port C to A13 Downconverter J11	N9020-20276
W52	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W62	Cable, Semi-Rigid, A13A1 Downconverter J3 to A13A2 Switched IF Filter J6	N9020-20245
W71	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	
W74	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to Front Panel Cal Out Option 508, 513, 526	N9032-20006
W78	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	

Figure 21-8 A13 Downconverter (with Options 544, 550, 555)

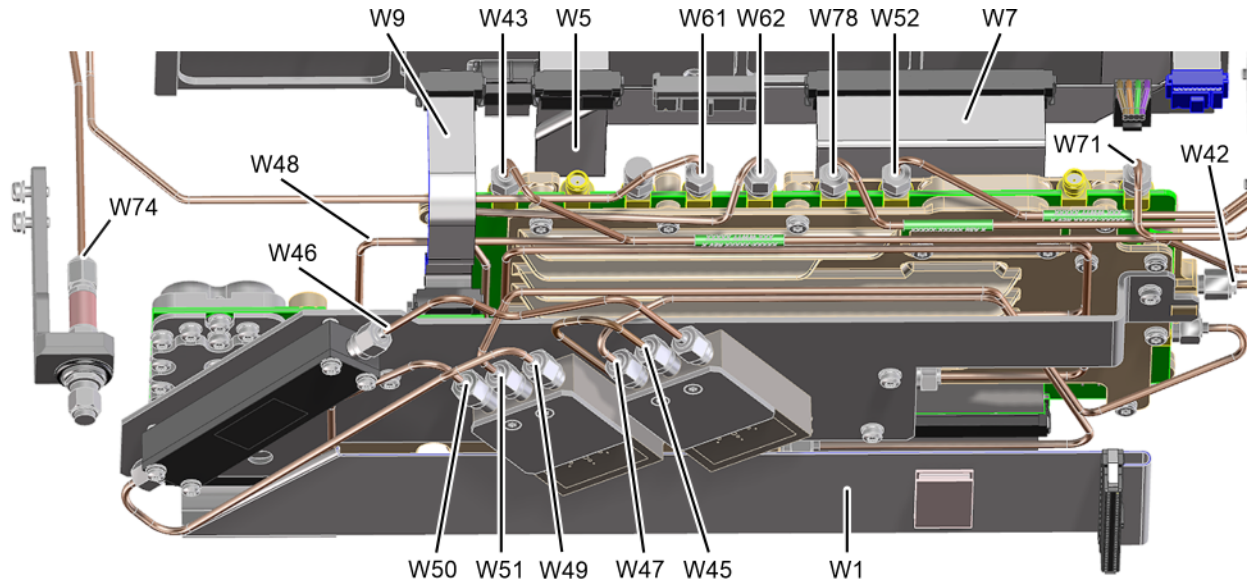


Table 21-10 RF Area Cables, A13 Downconverter (with Options 544, 550, 555)

Item	Description	Part Number
W1	Cable, Ribbon, A8 Motherboard J9 to A1A2 Front Panel Controller J1	N9020-60216
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downcomverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	
W42	Option 544, 550	N9032-20042
	Option 555	N9032-20108
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016
W45	Cable, Semi-Rigid, A13 Downconverter J10 to A13SW1 Filter Switch Port C	N9020-20266
W46	Cable, Semi-Rigid, A13SW1 Filter Switch Port I to A13FL1 Bandpass Filter Input	N9020-20268
W47	Cable, Semi-Rigid, A13SW1 Filter Switch Port II A13A2 Switched IF Filter J2	N9020-20267
W48	Cable, Semi-Rigid, A13A2 Switched IF Filter J3 to J4 - Delay Line	N9020-20080
W49	Cable, Semi-Rigid, A13FL1 Bandpass Filter Output to A13SW2 Filter Switch Port I	N9020-20293
W50	Cable, Semi-Rigid, A13A2 Switched IF Filter J5 to A13SW2 Filter Switch Port II	N9020-20292
W51	Cable, Semi-Rigid, A13SW2 Filter Switch Port C to A13 Downconverter J11	N9020-20276
	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	
W52	Option 508, 513, 526, 544, 550	N9032-20051
	Option 555	N9032-20117
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W62	Cable, Semi-Rigid, A13A1 Downconverter J3 to A13A2 Switched IF Filter J6	N9020-20245
	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	
W71	Option 508, 513, 526, 544, 550	N9032-20053
	Option 555	N9032-20119
	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to AT2 at Front Panel Cal Out	
W74	Option 544, 550	N9032-20037
	Option 555	N9032-20103
	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	
W78	Option 508, 513, 526, 544, 550	N9032-20052
	Option 555	N9032-20118

Figure 21-9 RF Area Cables, Side View (with Options 508, 513, 526)

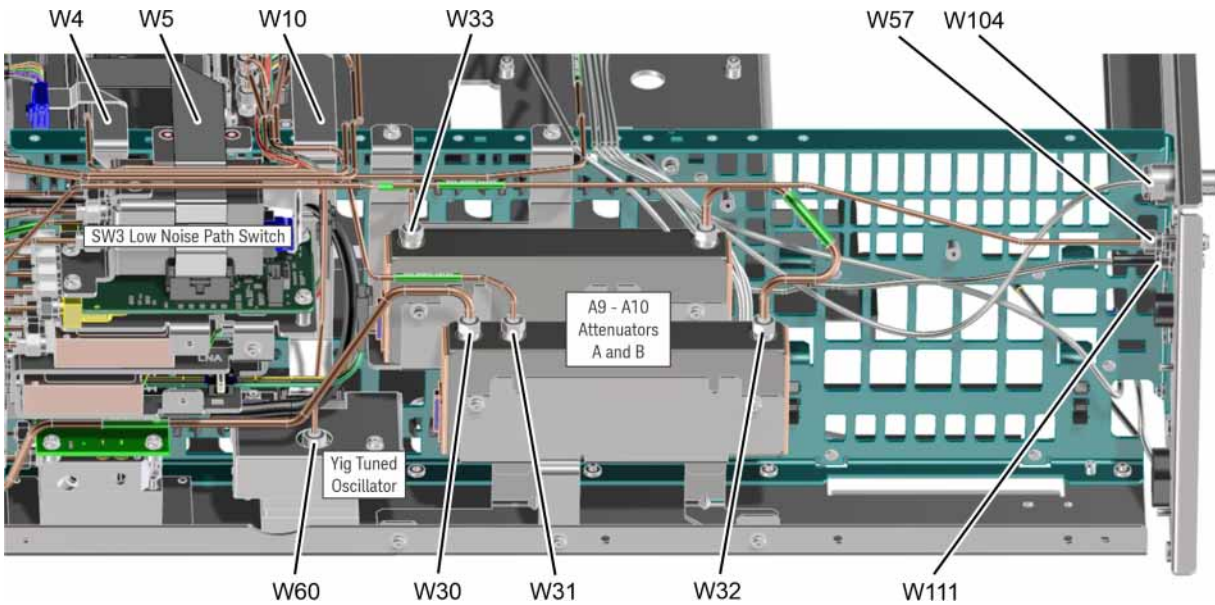


Table 21-11 RF Area Cables, Side View (with Options 508, 513, 526)

Item	Description	Part Number
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input	
	3.5 mm Input	N9032-20029
	Type-N Input	N9032-20001
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20002
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input	N9032-20021
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20000
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W104	Cable, Coax, A16 Reference J704 to Rear Panel EXT REF IN	8121-1860
W111	Cable, Coax, A21 Wideband DIF J11 to Rear Panel TRIGGER 3 In	8121-1859

Figure 21-10 RF Area Cables, Side View (with Options 544, 550)

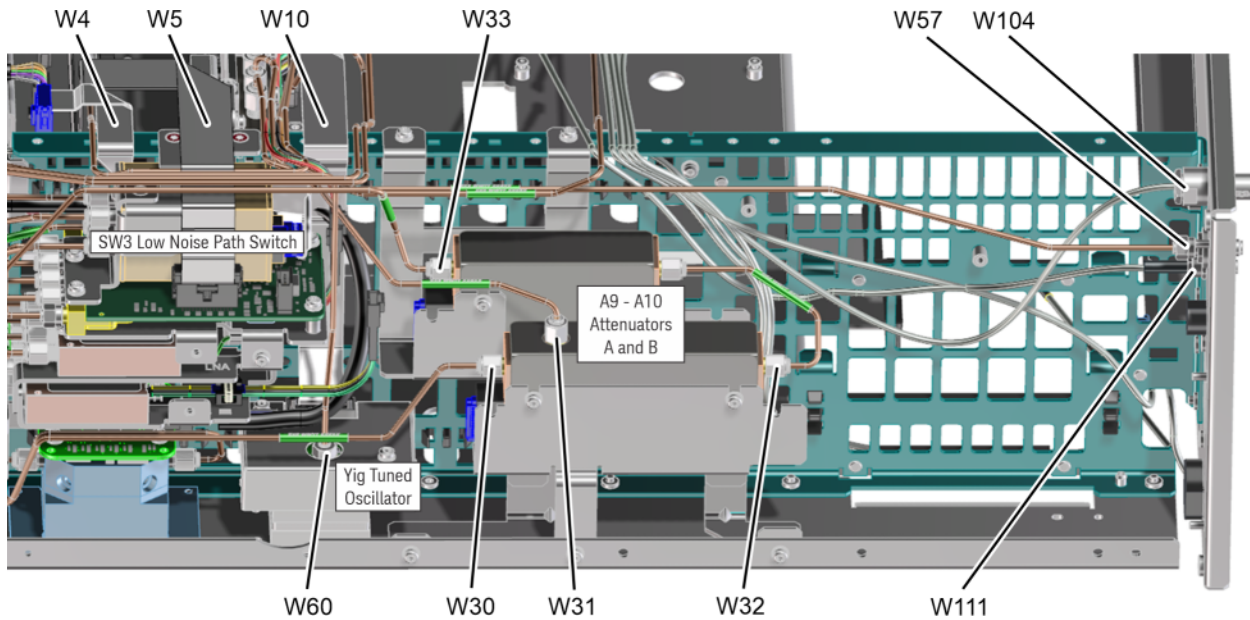


Table 21-12 RF Area Cables, Side View (with Options 544, 550)

Item	Description	Part Number
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input 2.4 mm Input	N9032-20049
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20034
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input	N9032-20047
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20033
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20042
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W104	Cable, Coax, A16 Reference J704 to Rear Panel EXT REF IN	8121-1860
W111	Cable, Coax, A21 Wideband DIF J11 to Rear Panel TRIGGER 3 In	8121-1859

Figure 21-11 RF Area Cables, Side View (with Options 555)

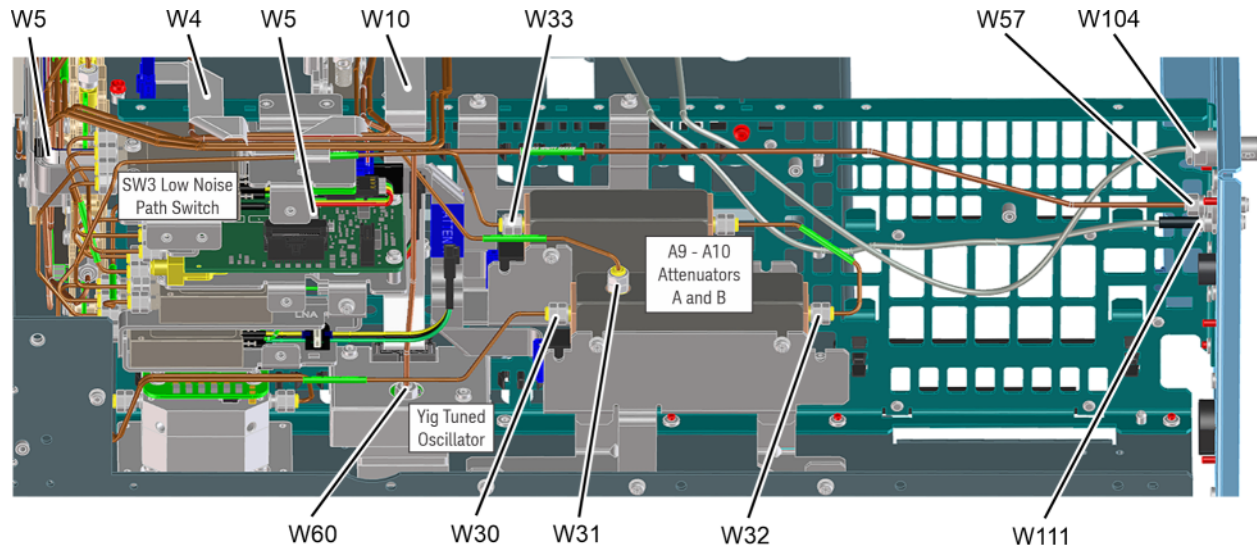


Table 21-13 RF Area Cables, Side View (with Options 555)

Item	Description	Part Number
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input 1.85 mm Input	N9032-20115
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20101
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input	N9032-20113
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20100
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20108
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W104	Cable, Coax, A16 Reference J704 to Rear Panel EXT REF IN	8121-1860
W111	Cable, Coax, A21 Wideband DIF J11 to Rear Panel TRIGGER 3 In	8121-1859

Figure 21-12 Front Card Cage Cables (with Options 508 513 526)

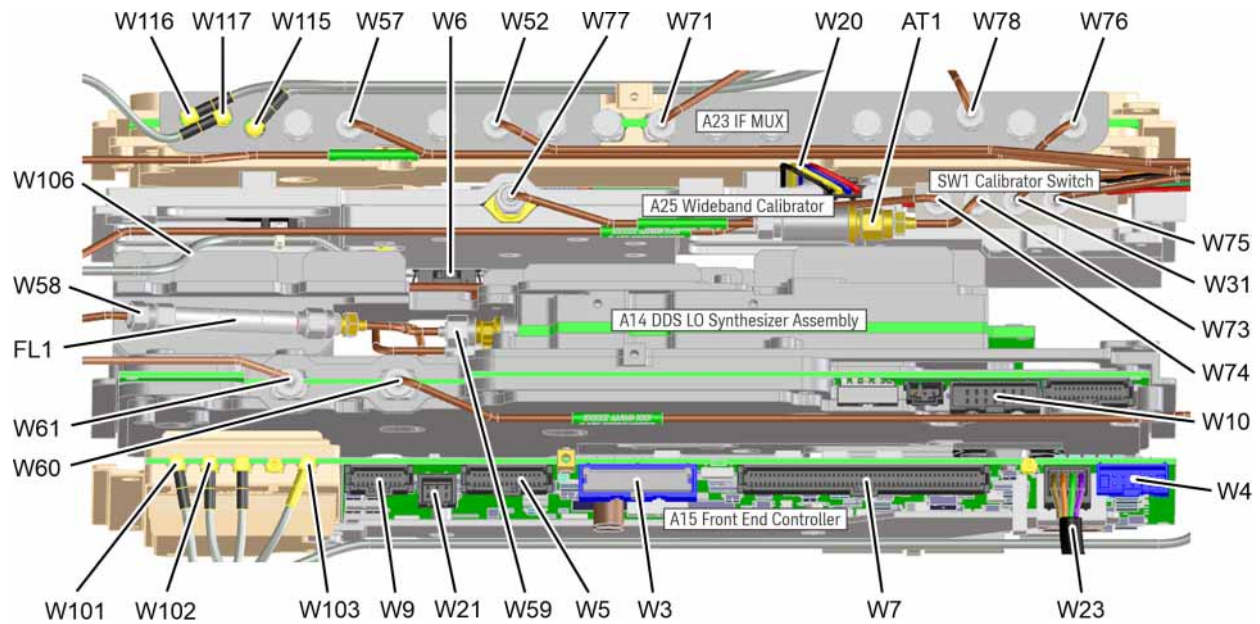


Table 21-14 Front Card Cage Cables (with Options 508, 513, 526)

Item	Description	Part Number
AT1	Attenuator, Coaxial Fixed, 6 dB	08493-60026
FL1	Filter, Bandpass, 7.2 GHz (DDS Clock)	9135-6218
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators	E4410-60157
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W6	Cable, Ribbon, A23 IF Mux P2 to A25 Wideband Calibrator J1	N9032-60006
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downconverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W20	Cable, Wire Harness, A23 IF Mux P1 to SW1 Calibrator Switch and SW2 LNA Switch	
	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020
W21	Cable, Wire Harness, A15 Front End Controller J801 to A13SW1, A13SW2, SW4 MPB Switch, A11J2	N9032-60009
W23	Cable, Wire Harness, A15 Front End Controller J300 to A12 Yig Tuned Filter J1	N9032-60009

Table 21-14 Front Card Cage Cables (with Options 508, 513, 526)

Item	Description	Part Number
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20002
W52	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W58	Cable, Semi-Rigid, A16 Reference J703 to FL1 7.2 GHz BPF Input	N9020-20303
W59	Cable, Semi-Rigid, FL1 7.2 GHz BPF Output to A14 DDS LO Synthesizer J35002	N9020-20226
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W71	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	
W73	Cable, Semi-Rigid, AT1 Output to SW1 Calibrator Switch P3	N9032-20028
W74	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to Front Panel Cal Out Option 508, 513, 526	N9032-20006
W75	Cable, Semi-Rigid, A16 Reference J701 to SW1 Calibrator Switch P1	N9032-20004
W76	Cable, Semi-Rigid, A16 Reference J702 to A23 IF Mux J37	N9032-20019
W77	Cable, Semi-Rigid, A25 Wideband Calibrator P1 to AT1	N9032-20005
W78	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	
W101	Cable, Coax, A15 Front End ControllerJ900 to A2 25 MHz Analog IF J100	8121-1865
W102	Cable, Coax, A15 Front End ControllerJ901 to A3 40 MHz Digital IF J15	8121-1919
W103	Cable, Coax, A15 Front End ControllerJ1100 to Rear Panel Aux IF Out	8121-1859
W106	Cable, Coax, A16 Reference J707 to A25 Wideband Calibrator J2	8121-2292
W115	Cable, Coax, A23 IF Mux J40 to A21 Wideband DIF J7	8121-8868
W116	Cable, Coax, A23 IF Mux J41 to A21 Wideband DIF J4	8121-8868
W117	Cable, Coax, A23 IF Mux J42 to A15 Front End ControllerJ902	8121-8868

Figure 21-13 Front Card Cage Cables (with Options 544, 550)

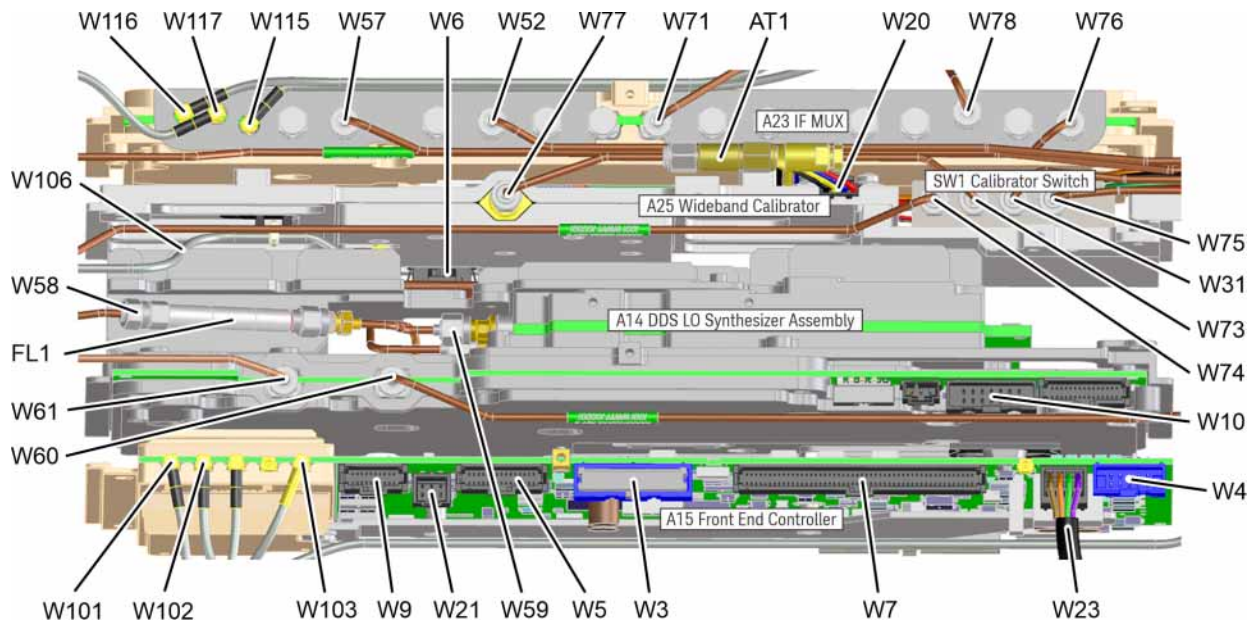


Table 21-15 Front Card Cage Cables (with Options 544, 550)

Item	Description	Part Number
AT1	Attenuator, Coaxial Fixed, 6 dB	08490-60040
FL1	Filter, Bandpass, 7.2 GHz (DDS Clock)	9135-6218
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators	N9048-60023
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W6	Cable, Ribbon, A23 IF Mux P2 to A25 Wideband Calibrator J1	N9032-60006
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downconverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W20	Cable, Wire Harness, A23 IF Mux P1 to SW1 Calibrator Switch and SW2 LNA Switch	
	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020
W21	Cable, Wire Harness, A15 Front End Controller J801 to A13SW1, A13SW2, SW4 MPB Switch, A11J2	N9032-60009
W23	Cable, Wire Harness, A15 Front End Controller J300 to A12 Yig Tuned Filter J1	N9032-60009

Table 21-15 Front Card Cage Cables (with Options 544, 550)

Item	Description	Part Number
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20034
W52	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W58	Cable, Semi-Rigid, A16 Reference J703 to FL1 7.2 GHz BPF Input	N9020-20303
W59	Cable, Semi-Rigid, FL1 7.2 GHz BPF Output to A14 DDS LO Synthesizer J35002	N9020-20226
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W71	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	
W73	Cable, Semi-Rigid, AT1 Output to SW1 Calibrator Switch P3	N9032-20048
W74	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to AT2 at Front Panel Cal Out	
W75	Cable, Semi-Rigid, A16 Reference J701 to SW1 Calibrator Switch P1	N9032-20035
W76	Cable, Semi-Rigid, A16 Reference J702 to A23 IF Mux J37	N9032-20019
W77	Cable, Semi-Rigid, A25 Wideband Calibrator P1 to AT1	N9032-20036
W78	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	
W101	Cable, Coax, A15 Front End ControllerJ900 to A2 25 MHz Analog IF J100	8121-1865
W102	Cable, Coax, A15 Front End ControllerJ901 to A3 40 MHz Digital IF J15	8121-1919
W103	Cable, Coax, A15 Front End ControllerJ1100 to Rear Panel Aux IF Out	8121-1859
W106	Cable, Coax, A16 Reference J707 to A25 Wideband Calibrator J2	8121-2292
W115	Cable, Coax, A23 IF Mux J40 to A21 Wideband DIF J7	8121-8868
W116	Cable, Coax, A23 IF Mux J41 to A21 Wideband DIF J4	8121-8868
W117	Cable, Coax, A23 IF Mux J42 to A15 Front End ControllerJ902	8121-8868

Figure 21-14 Front Card Cage Cables (with Options 555)

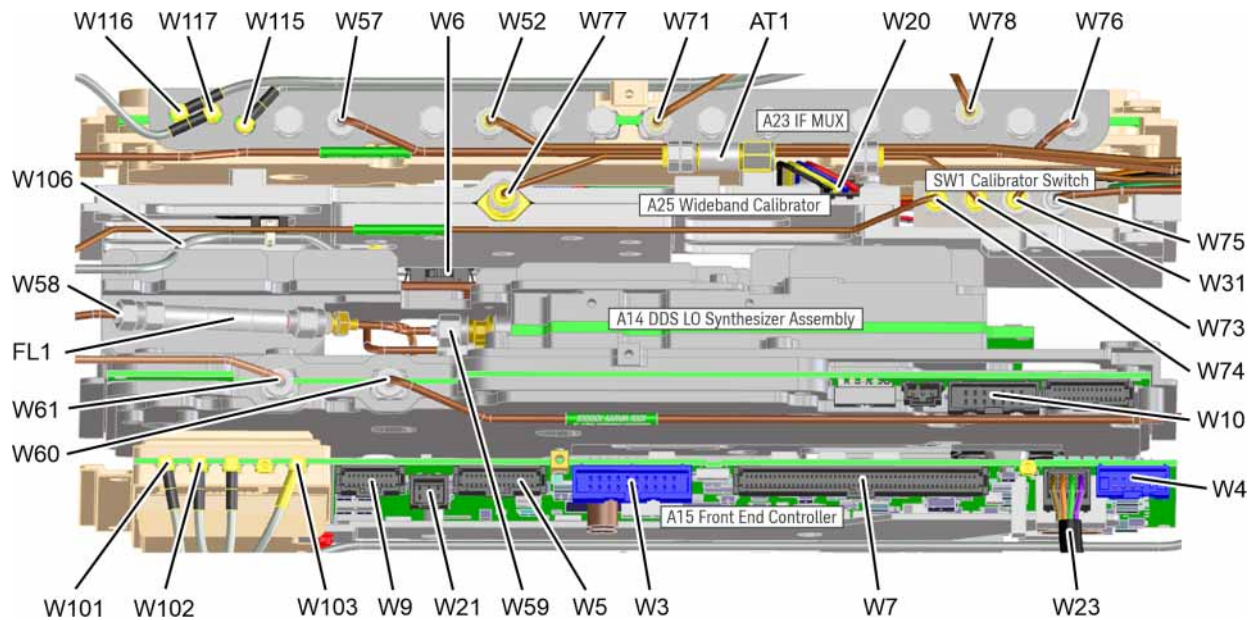


Table 21-16 Front Card Cage Cables (with Options 555)

Item	Description	Part Number
AT1	Attenuator, Coaxial Fixed, 6 dB	08490-60038
FL1	Filter, Bandpass, 7.2 GHz (DDS Clock)	9135-6218
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators	N9032-60998
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch	N9020-60087
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4	N9020-60092
W6	Cable, Ribbon, A23 IF Mux P2 to A25 Wideband Calibrator J1	N9032-60006
W7	Cable, Ribbon, A15 Front End Controller J102 to A13 Downconverter J12	E4410-60156
W9	Cable, Ribbon, A15 Front End Controller J1300 to A13A2 Switched IF Filter J1	N9020-60064
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator	N9020-60024
W20	Cable, Wire Harness, A23 IF Mux P1 to SW1 Calibrator Switch and SW2 LNA Switch	
	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020
W21	Cable, Wire Harness, A15 Front End Controller J801 to A13SW1, A13SW2, SW4 MPB Switch, A11J2	N9032-60009
W23	Cable, Wire Harness, A15 Front End Controller J300 to A12 Yig Tuned Filter J1	N9032-60009

Table 21-16 Front Card Cage Cables (with Options 555)

Item	Description	Part Number
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port	N9032-20101
W52	Cable, Semi-Rigid, A13 Downconverter J7 to A23 IF Mux J28	N9032-20117
W57	Cable, Semi-Rigid, A23 IF Mux J31 to Rear Panel Wide IF Out	N9032-20054
W58	Cable, Semi-Rigid, A16 Reference J703 to FL1 7.2 GHz BPF Input	N9020-20303
W59	Cable, Semi-Rigid, FL1 7.2 GHz BPF Output to A14 DDS LO Synthesizer J35002	N9020-20226
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2	N9032-20026
W61	Cable, Semi-Rigid, A14 DDS LO Synthesizer J1 to A13 Downconverter J4	N9020-20301
W71	Cable, Semi-Rigid, A13A1 Downconverter J13 to A23 IF Mux J29	N9032-20119
W73	Cable, Semi-Rigid, AT1 Output to SW1 Calibrator Switch P3	N9032-20114
W74	Cable, Semi-Rigid, SW1 Calibrator Switch P4 to AT2 at Front Panel Cal Out	N9032-20103
W75	Cable, Semi-Rigid, A16 Reference J701 to SW1 Calibrator Switch P1	N9032-20035
W76	Cable, Semi-Rigid, A16 Reference J702 to A23 IF Mux J37	N9032-20019
W77	Cable, Semi-Rigid, A25 Wideband Calibrator P1 to AT1	N9032-20102
W78	Cable, Semi-Rigid, A13A1 Downconverter J1 to A23 IF Mux J35	N9032-20118
W101	Cable, Coax, A15 Front End ControllerJ900 to A2 25 MHz Analog IF J100	8121-1865
W102	Cable, Coax, A15 Front End ControllerJ901 to A3 40 MHz Digital IF J15	8121-1919
W103	Cable, Coax, A15 Front End ControllerJ1100 to Rear Panel Aux IF Out	8121-1859
W106	Cable, Coax, A16 Reference J707 to A25 Wideband Calibrator J2	8121-2292
W115	Cable, Coax, A23 IF Mux J40 to A21 Wideband DIF J7	8121-8868
W116	Cable, Coax, A23 IF Mux J41 to A21 Wideband DIF J4	8121-8868
W117	Cable, Coax, A23 IF Mux J42 to A15 Front End ControllerJ902	8121-8868

Figure 21-15 Rear Card Cage Cables

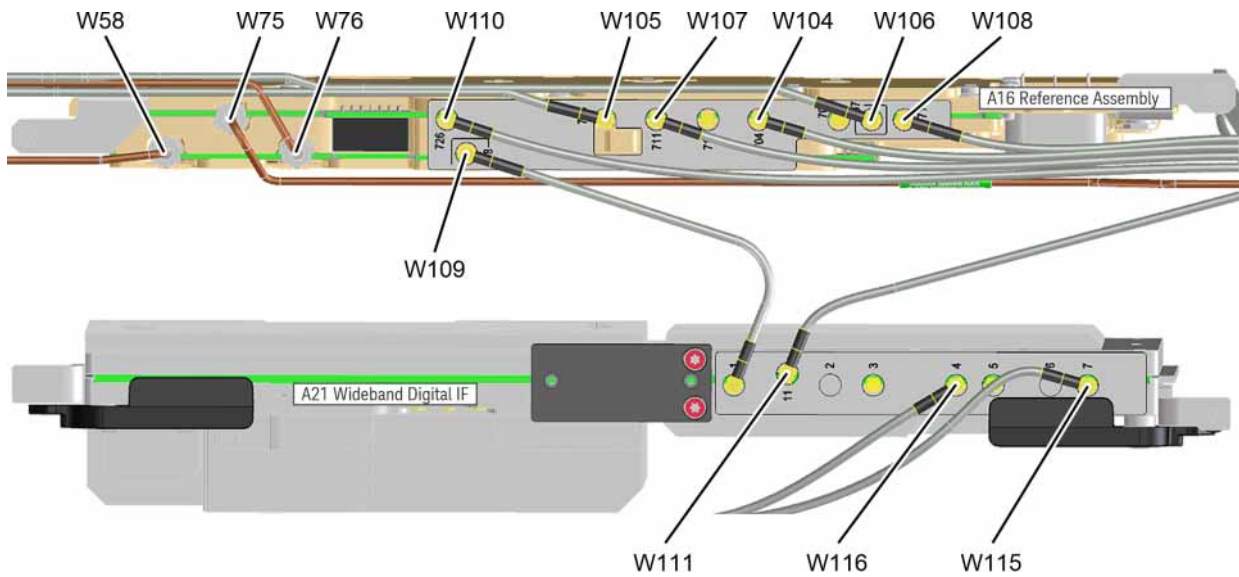


Table 21-17 Rear Card Cage Cables

Item	Description	Part Number
W58	Cable, Semi-Rigid, A16 Reference J703 to FL1 7.2 GHz BPF Input	N9020-20303
W75	Cable, Semi-Rigid, A16 Reference J701 to SW1 Calibrator Switch P1	
	Option 508, 513, 526	N9032-20004
	Option 544, 550, 555	N9032-20035
W76	Cable, Semi-Rigid, A16 Reference J702 to A23 IF Mux J37	N9032-20019
W104	Cable, Coax, A16 Reference J704 to Rear Panel EXT REF IN	8121-1860
W105	Cable, Coax, A16 Reference J705 to A13A1 Downconverter J6	8121-1940
W106	Cable, Coax, A16 Reference J707 to A25 Wideband Calibrator J2	8121-2292
W107	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1861
W108	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1401
W109	Cable, Coax, A16 Reference J718 to A21 Wideband DIF J1	8120-0152
W110	Cable, Coax, A16 Reference J726 to A3 40 MHz Digital IF J17	8121-1401
W111	Cable, Coax, A21 Wideband DIF J11 to Rear Panel TRIGGER 3 In	8121-1859
W115	Cable, Coax, A23 IF Mux J40 to A21 Wideband DIF J7	8121-8868
W116	Cable, Coax, A23 IF Mux J41 to A21 Wideband DIF J4	8121-8868

Figure 21-16 Switch Area Cables (with Options 508, 513, 526)

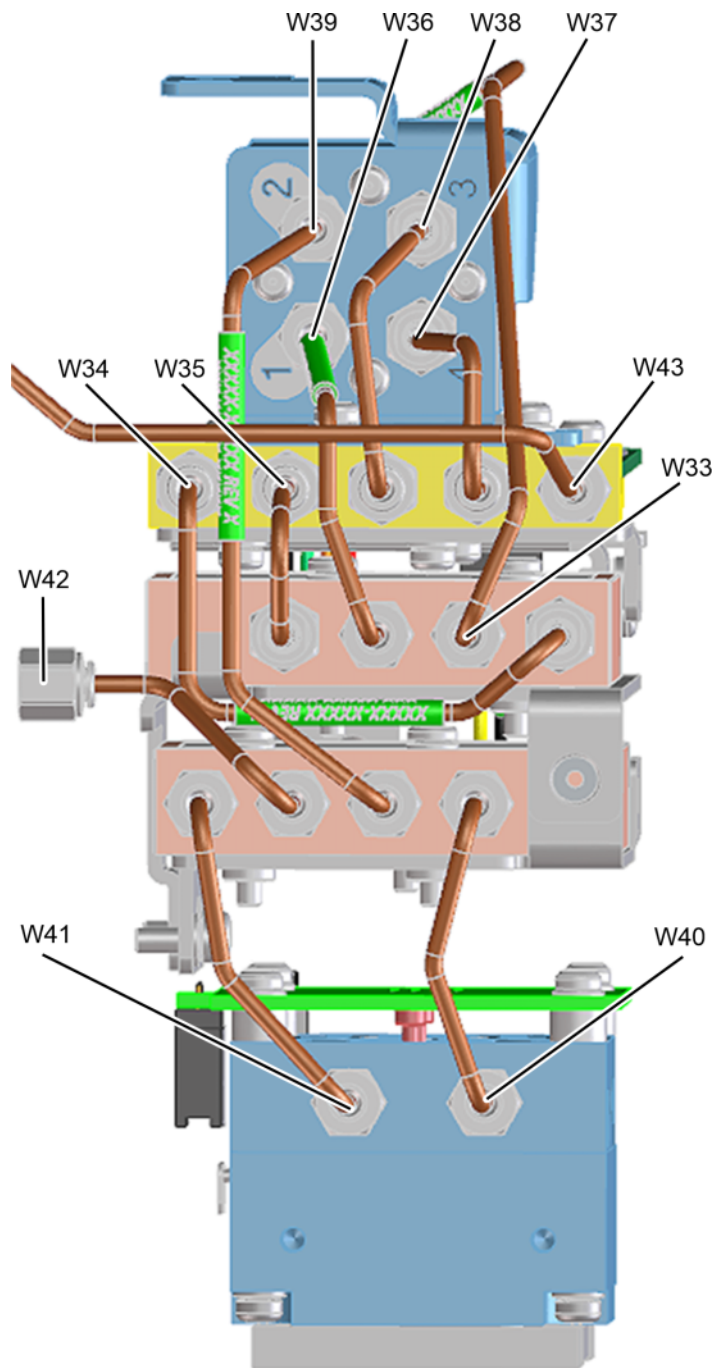


Table 21-18 Switch Area Cables (with Options 508, 513, 526)

Item	Description	Part Number
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20000
W34	Cable, Semi-Rigid, SW2 LNA Switch P4 to A11 Band Switch P5	N9032-20015
W35	Cable, Semi-Rigid, SW2 LNA Switch P1 to A11 Band Switch P4	N9032-20014
W36	Cable, Semi-Rigid, SW2 LNA Switch P2 to SW3 LNP Switch P1	N9032-20007
W37	Cable, Semi-Rigid, SW3 LNP Switch P4 to A11 Band Switch P2	N9032-20010
W38	Cable, Semi-Rigid, SW3 LNP Switch P3 to A11 Band Switch P3	N9032-20009
W39	Cable, Semi-Rigid, SW3 LNP Switch P2 to SW4 MPB Switch P2	N9032-20008
W40	Cable, Semi-Rigid, SW4 MPB Switch P1 to A12 Yig Tuned Filter Input	N9032-20012
W41	Cable, Semi-Rigid, SW4 MPB Switch P4 to A12 Yig Tuned Filter Output	N9032-20013
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20011
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016

Figure 21-17 Switch Area Cables (with Options 544, 550)

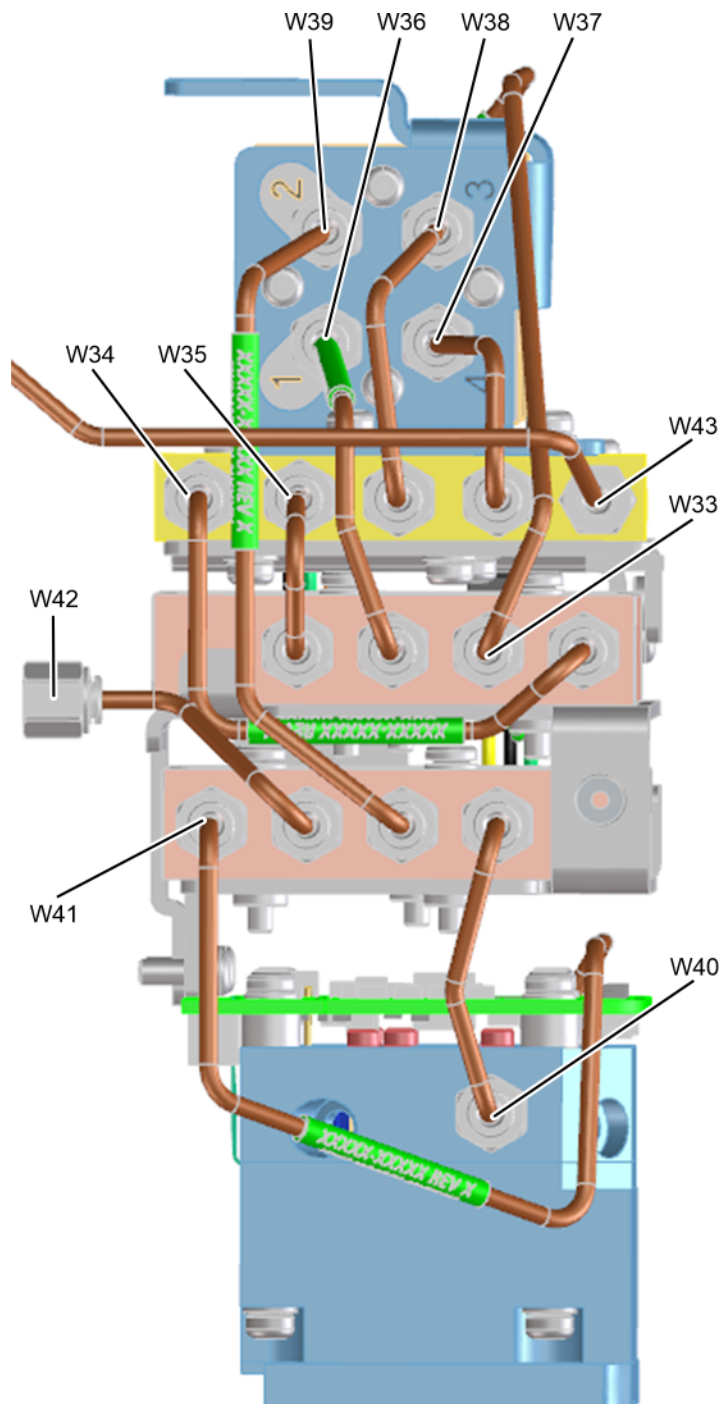


Table 21-19 Switch Area Cables (with Options 544, 550)

Item	Description	Part Number
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20033
W34	Cable, Semi-Rigid, SW2 LNA Switch P4 to A11 Band Switch P5	N9032-20046
W35	Cable, Semi-Rigid, SW2 LNA Switch P1 to A11 Band Switch P4	N9032-20045
W36	Cable, Semi-Rigid, SW2 LNA Switch P2 to SW3 LNP Switch P1	N9032-20038
W37	Cable, Semi-Rigid, SW3 LNP Switch P4 to A11 Band Switch P2	N9032-20041
W38	Cable, Semi-Rigid, SW3 LNP Switch P3 to A11 Band Switch P3	N9032-20040
W39	Cable, Semi-Rigid, SW3 LNP Switch P2 to SW4 MPB Switch P2	N9032-20039
W40	Cable, Semi-Rigid, SW4 MPB Switch P1 to A12 Yig Tuned Filter Input	N9032-20043
W41	Cable, Semi-Rigid, SW4 MPB Switch P4 to A12 Yig Tuned Filter Output	N9032-20044
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20042
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016

Figure 21-18 Switch Area Cables (with Option 555)

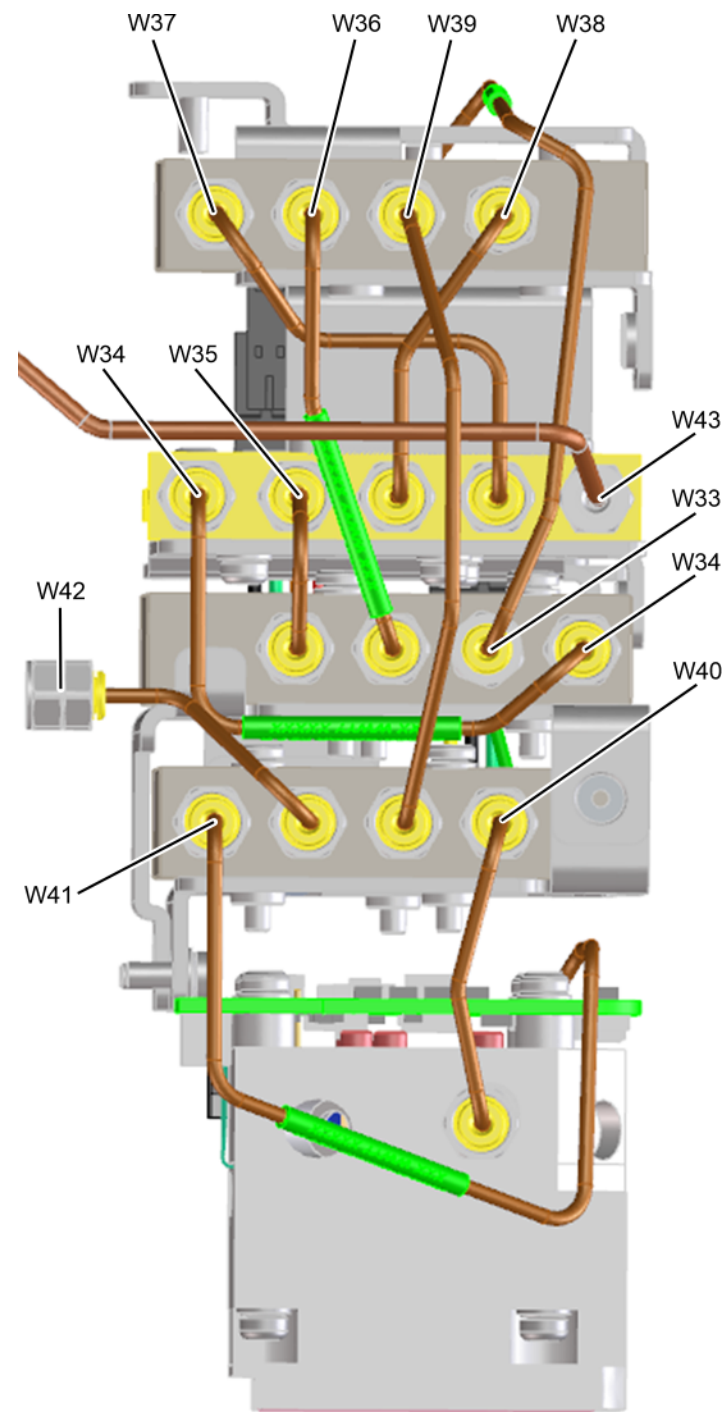


Table 21-20 Switch Area Cables (with Option 555)

Item	Description	Part Number
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3	N9032-20100
W34	Cable, Semi-Rigid, SW2 LNA Switch P4 to A11 Band Switch P5	N9032-20112
W35	Cable, Semi-Rigid, SW2 LNA Switch P1 to A11 Band Switch P4	N9032-20111
W36	Cable, Semi-Rigid, SW2 LNA Switch P2 to SW3 LNP Switch P1	N9032-20106
W37	Cable, Semi-Rigid, SW3 LNP Switch P4 to A11 Band Switch P2	N9032-20107
W38	Cable, Semi-Rigid, SW3 LNP Switch P3 to A11 Band Switch P3	N9032-20104
W39	Cable, Semi-Rigid, SW3 LNP Switch P2 to SW4 MPB Switch P2	N9032-20105
W40	Cable, Semi-Rigid, SW4 MPB Switch P1 to A12 Yig Tuned Filter Input	N9032-20109
W41	Cable, Semi-Rigid, SW4 MPB Switch P4 to A12 Yig Tuned Filter Output	N9032-20110
W42	Cable, Semi-Rigid, SW4 MPB Switch P3 to A13 Downconverter J9	N9032-20108
W43	Cable, Semi-Rigid, A11 Band Switch P1 to A13 Downconverter J2	N9032-20016

Figure 21-19 AIF/DIF Assemblies

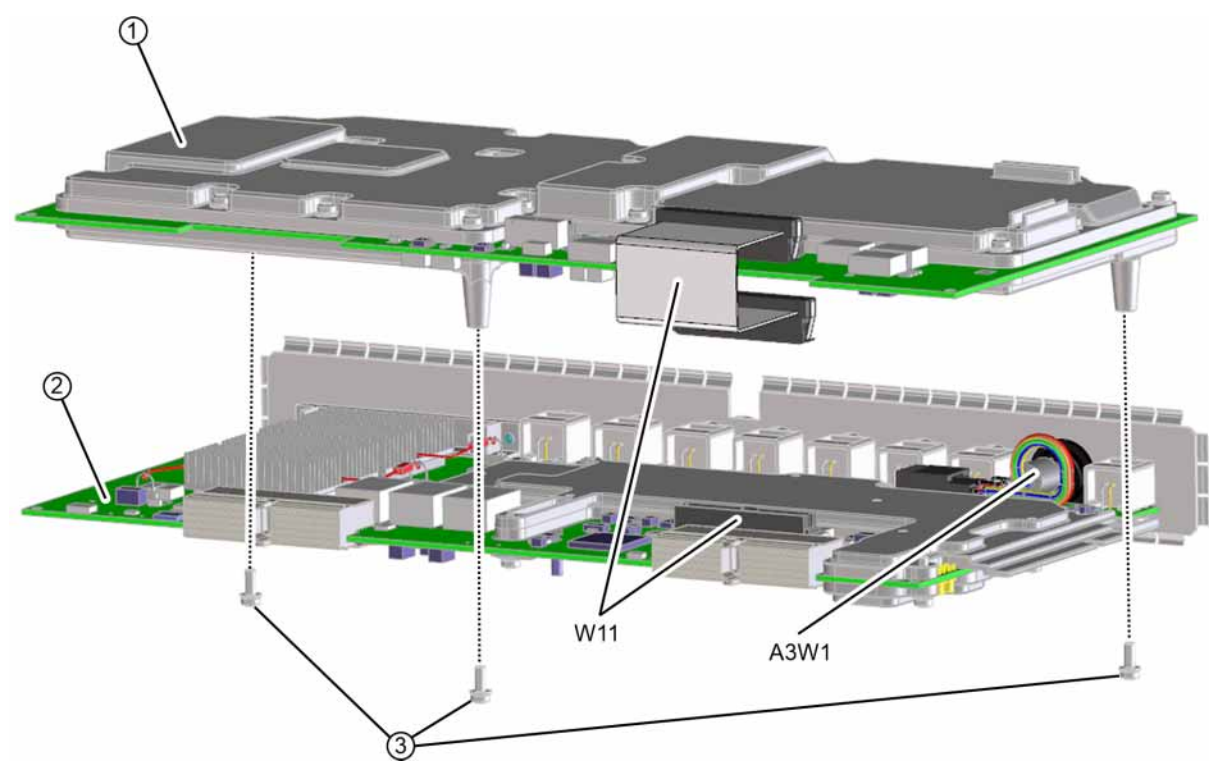


Table 21-21 AIF/DIF Assemblies

Item	Description	Keysight Part Number
1	A2 25 MHz Analog IF TAA Compliant	N9020-60290 N9020-60290G
2	A3 40 MHz Digital IF	N9020-60016
3	Screw, M3 X 0.5 (8 mm long)	0515-0372
A3W1	Cable, Wire Harness, Smart Noise Source	N9020-60090
W11	Cable, Ribbon, A2 25 MHz Analog IF J820 to A3 40 MHz Digital IF J20	N9020-60046

Figure 21-20 AIF Cables

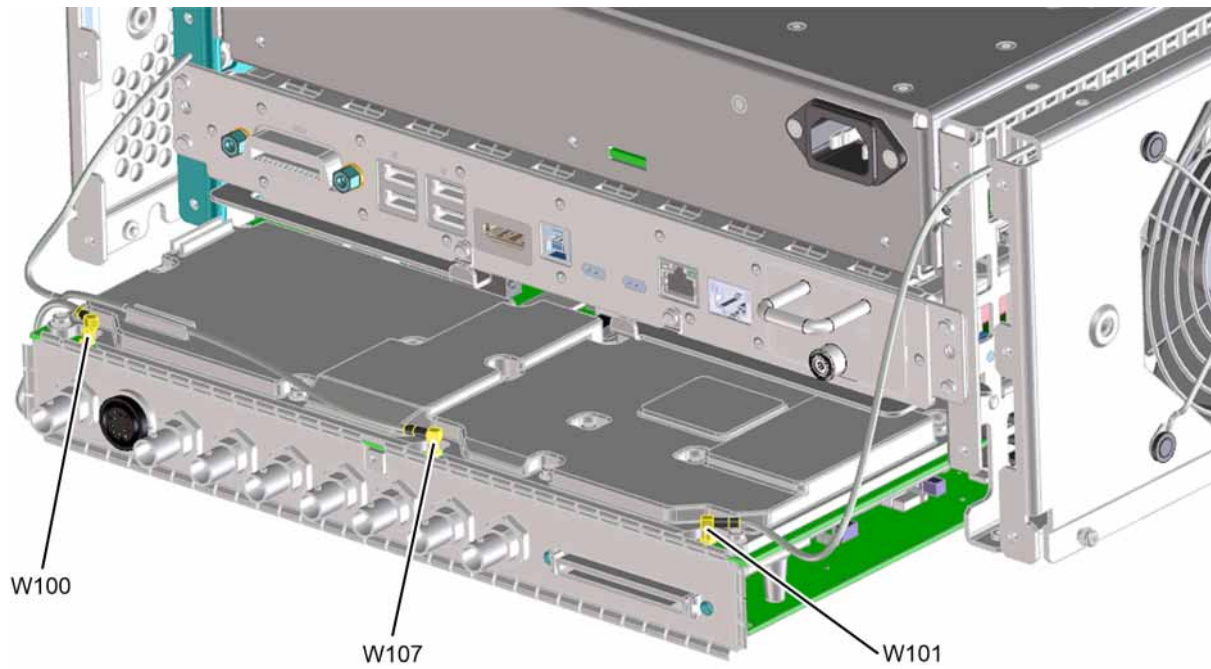


Figure 21-21 DIF Cables

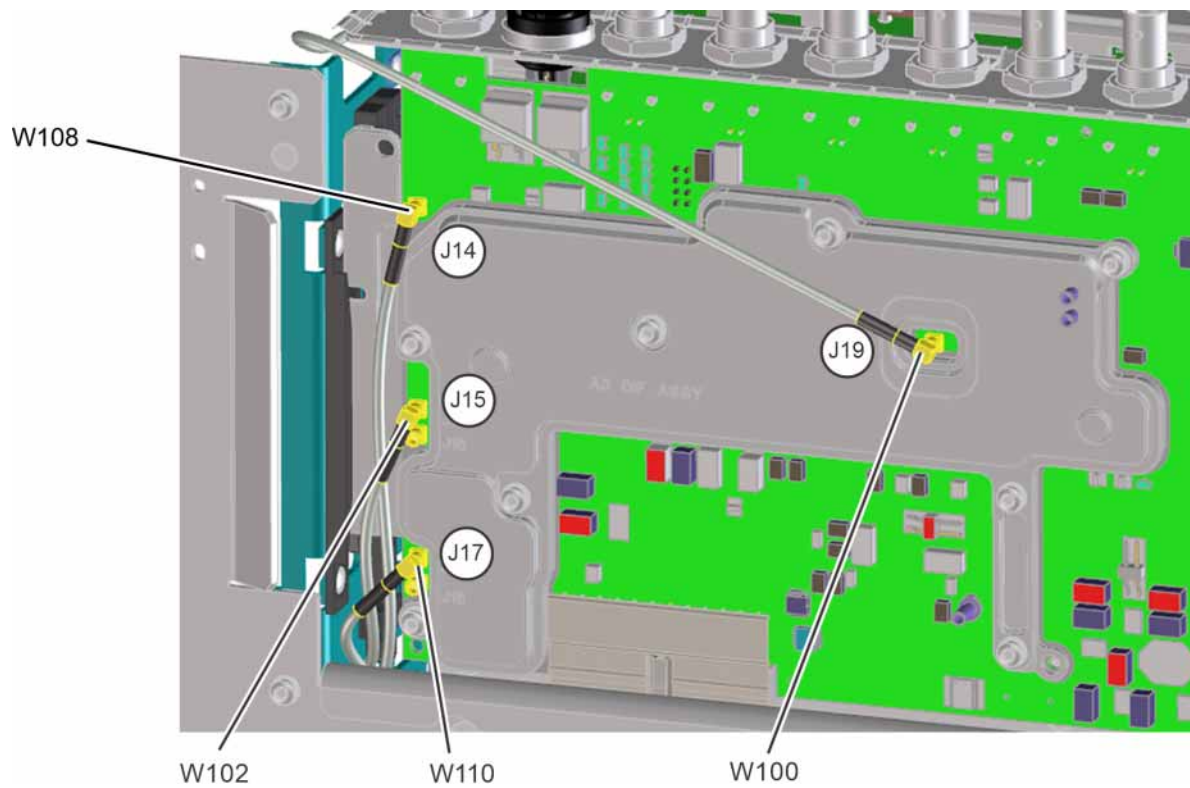


Table 21-22 AIF and DIF Cables

Item	Description	Keysight Part Number
W100	Cable, Coax, A2 25 MHz Analog IF J601 to A3 40 MHz Digital IF J19	8121-2607
W101	Cable, Coax, A15 Front End ControllerJ900 to A2 25 MHz Analog IF J100	8121-1865
W102	Cable, Coax, A15 Front End ControllerJ901 to A3 40 MHz Digital IF J15	8121-1919
W107	Cable, Coax, A16 Reference J711 to A2 25 MHz Analog IF J300	8121-1861
W108	Cable, Coax, A16 Reference J716 to A3 40 MHz Digital IF J14	8121-1401
W110	Cable, Coax, A16 Reference J726 to A3 40 MHz Digital IF J17	8121-1401

Replaceable Parts
Hardware

Option Cables

Figure 21-22

Option EXM Cables

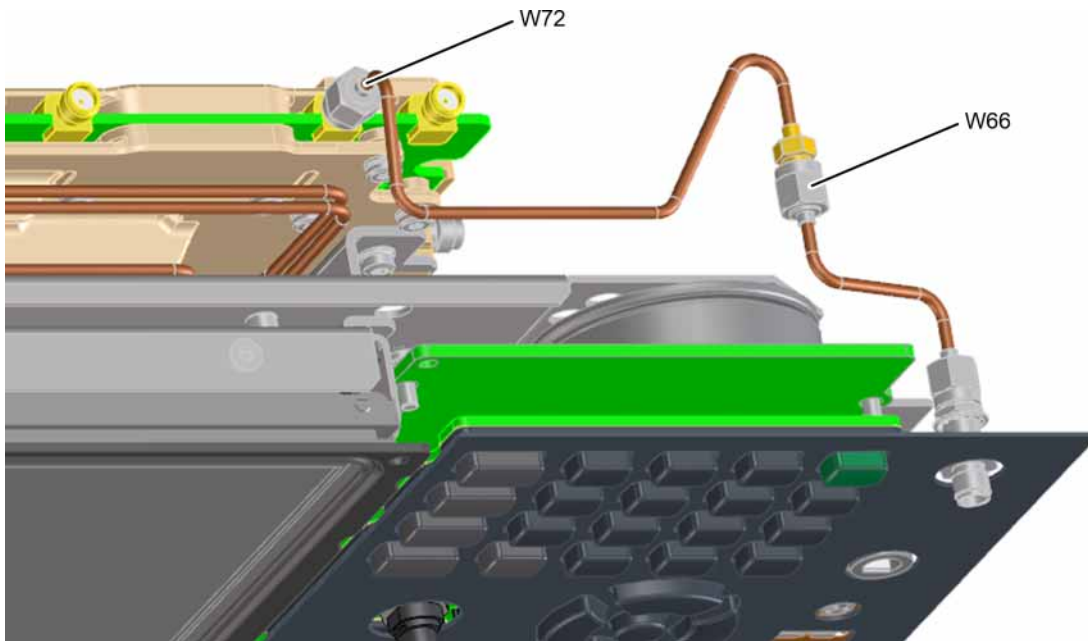


Figure 21-23

Option ODI Cables

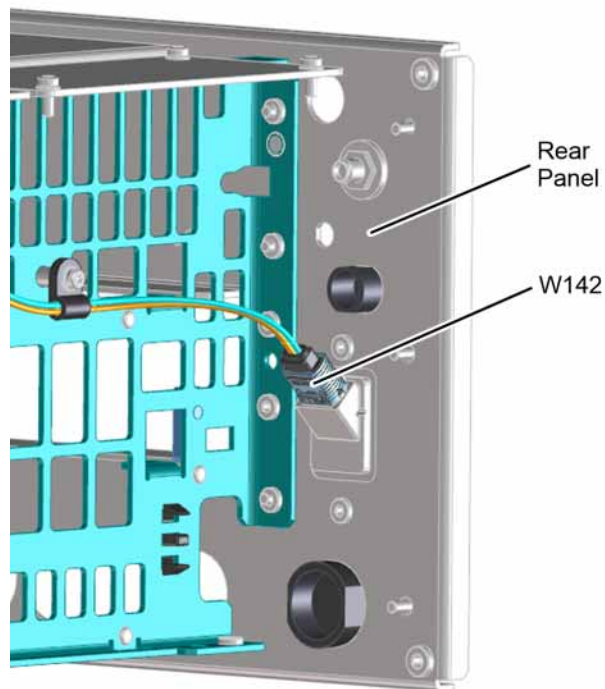


Table 21-23 Option Cables

Item	Description	Keysight Part Number
W66	Cable, Semi-Rigid, W72 to Front Panel Ext Mixer, Option EXM	N9020-20166
W72	Cable, Semi-Rigid, A13A1 Downconverter J8 to W66, Option EXM	N9020-20167
W142	Cable, Optical TX/RX, A21 Wideband DIF J1000/1002 and J1001/1003 to Rear Panel Streaming (Option ST1 or ST2 Only)	N9032-61000

Figure 21-24 CPU Assembly (Option PCA)

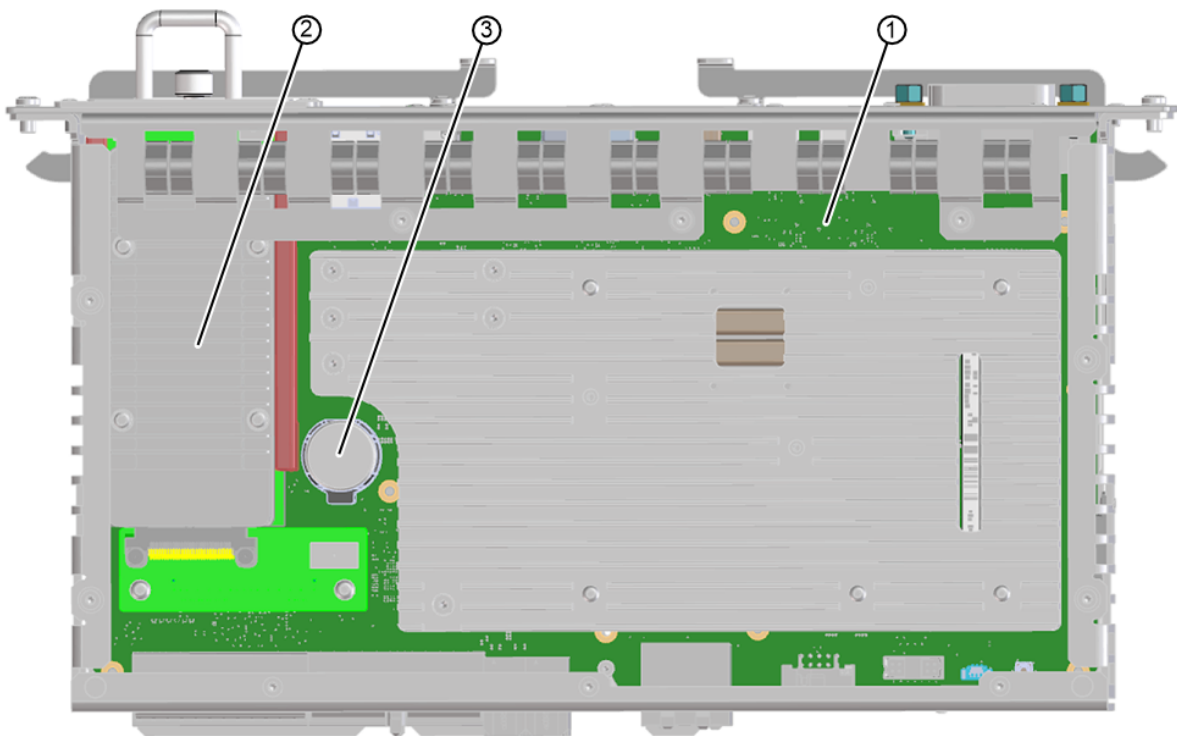


Table 21-24 CPU Assembly (Option PCA)

Item	Description	Keysight Part Number
1	A4 System Processor	W1312-60561
2	A4BT1 Processor Battery (CR2032)	1420-0356
3	A5 Solid State Drive, Programmed	N9032-60025

Figure 21-25 CPU Assembly (Option PC8)

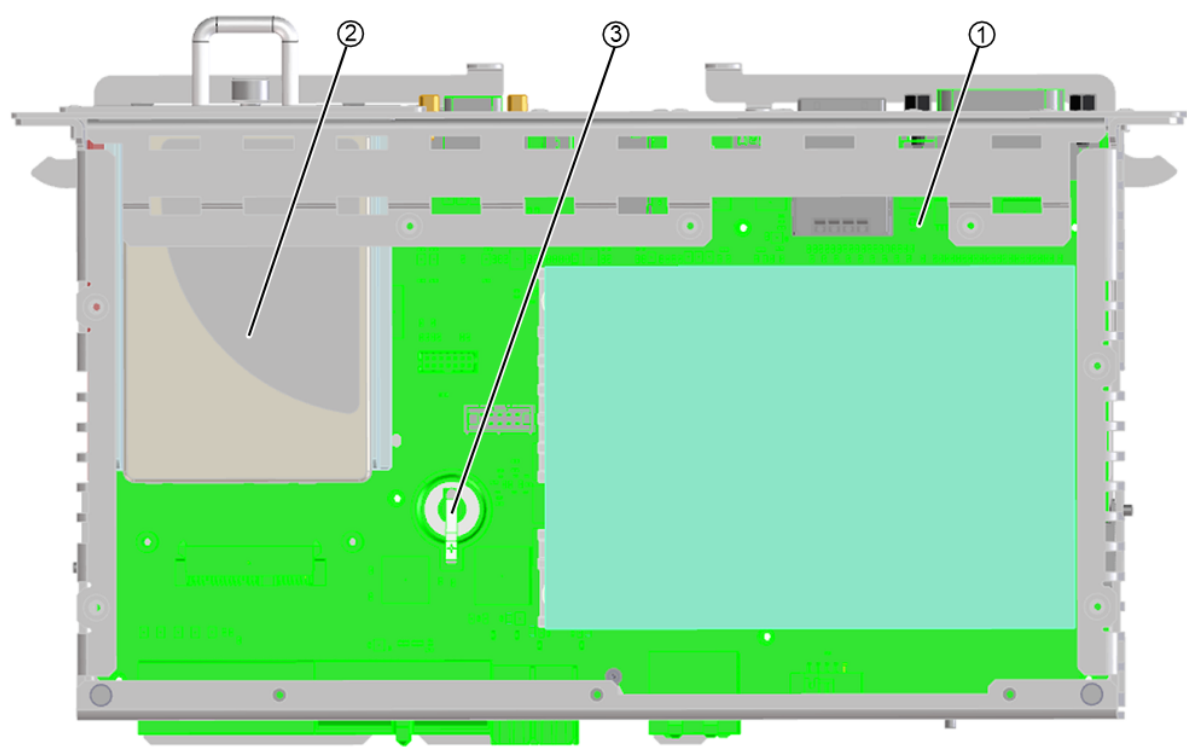


Table 21-25 CPU Assembly (Option PC8)

Item	Description	Keysight Part Number
1	A4 System Processor	W1312-60524
2	A4BT1 Processor Battery (CR2032)	1420-0356
3	A5 Solid State Drive, Programmed	N9032-60016

Figure 21-26 Disk Drive Tray Assembly (Option PC8)

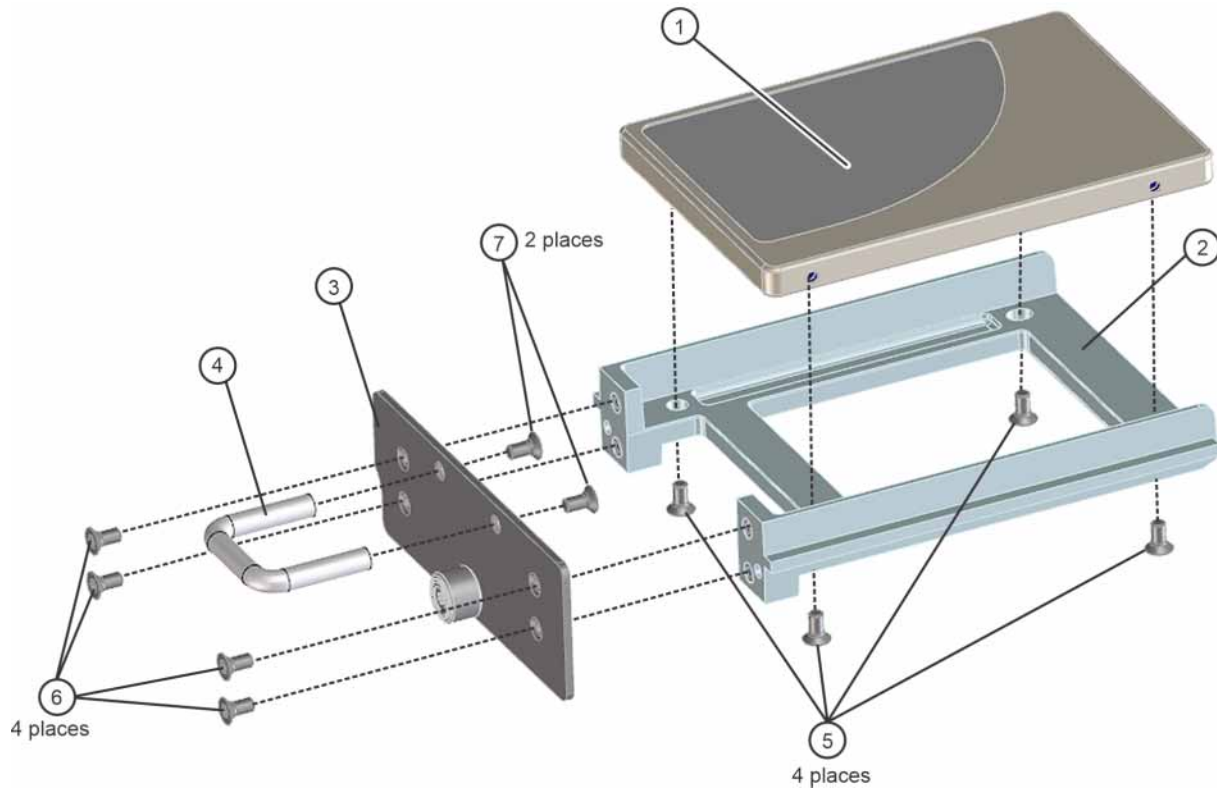


Table 21-26 Disk Drive Tray Assembly

Item	Description	Keysight Part Number
1	A5 Solid State Drive, Programmed	N9032-60016
2	A5MP1 Disk Drive Tray, Option PC8	W1312-40078
3	A5MP2 Disk Drive Rear Panel, Option PC8	W1312-00103
4	A5MP3 Disk Drive Handle, Option PC8	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 21-27 Chassis

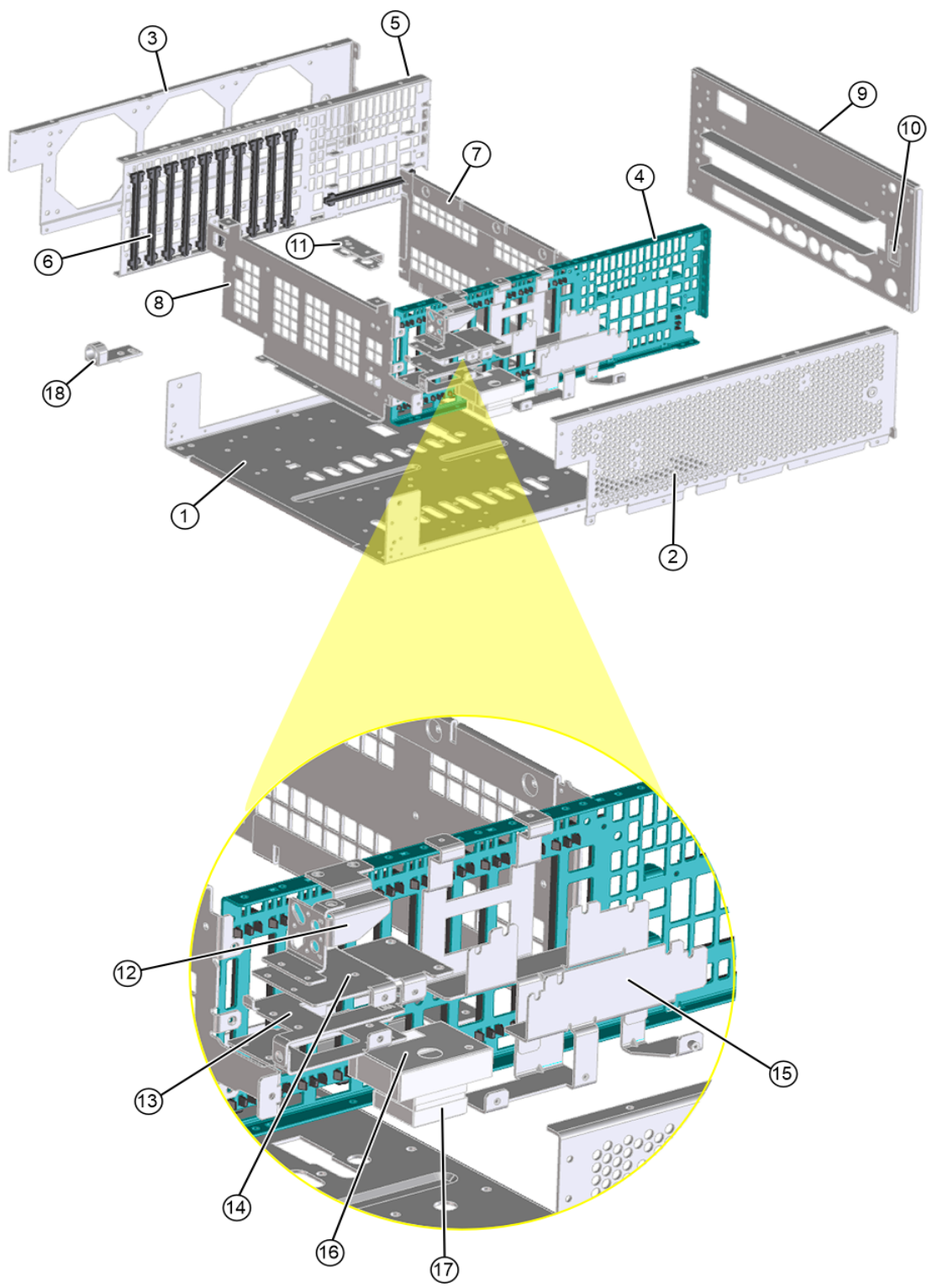


Table 21-27 Chassis

Item	Description	Keysight Part Number
1	Chassis Base	N9048-00020
2	Chassis Side, Right - Outer	
3	Chassis Side, Left - Outer	N9032-00010
4	Chassis Side, Right - Inner	N9032-00016
5	Chassis Side, Left - Inner	W1312-00117
6	Card Guides (22 Required)	W1312-40001
7	Midplane Board Bracket	W1312-00048
8	Chassis Front Bracket	N9032-00006
9	Rear Panel	N9032-00015
10	Non-Streaming Blank Plate	N9041-00050
11	DDS LO Synthesizer Support Bracket	N9020-00058
12	LNP Switch Mounting Bracket	
13	LNA-MPB Switch Mounting Bracket	N9032-00002
14	Band Switch Mounting Bracket	N9032-00003
15	Attenuator Bracket	N9038-01202
16	YTO Top Shield	N9020-00005
17	YTO Bottom Shield	N9020-00006
18	Left Side Connector Bracket	N9048-20618

Figure 21-28 Fan Hardware

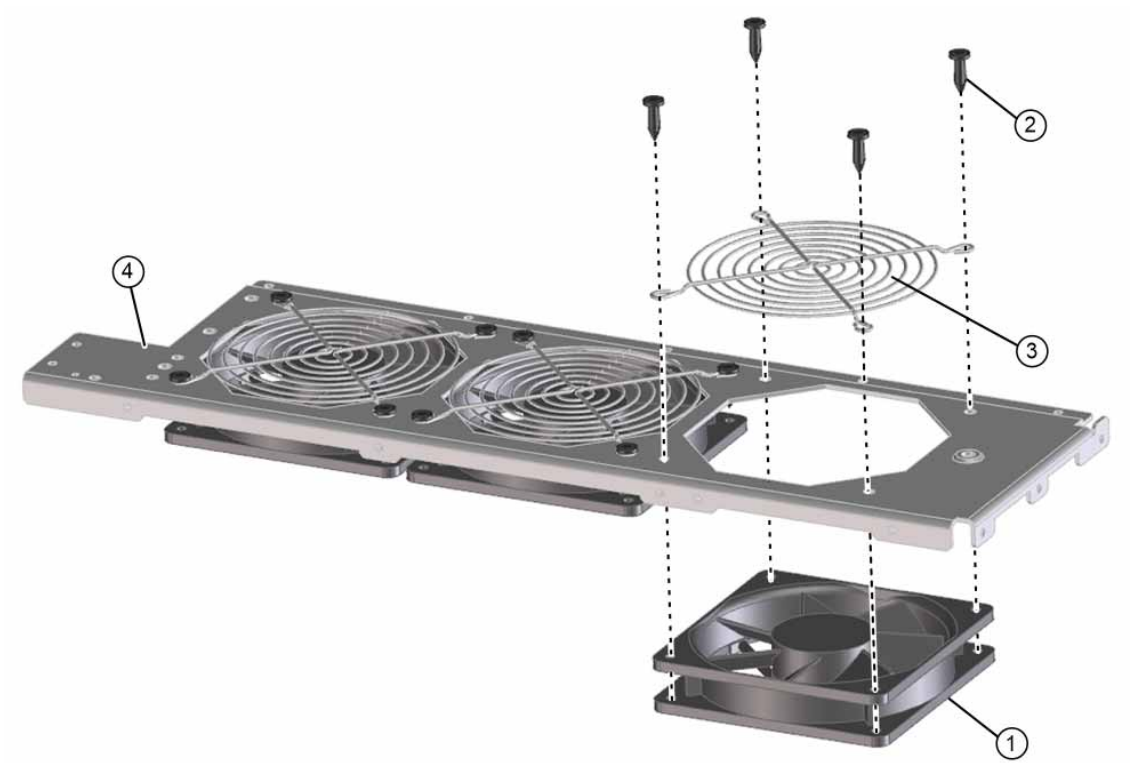


Table 21-28 Fan Hardware

Item	Description	Keysight Part Number
1	B1, B2, B3 Cooling Fan (3 Required)	3160-4199
2	Rivet-Plastic Flat-HD 0.17-in-DIA 0.33-0.39-in-Grip-Range Nylon Black-finish	0361-1272
3	Fan Grill (3 Required)	3160-0281
4	Chassis Side, Left - Outer	N9032-00010

Figure 21-29 Connectors (with Options 508, 513, 526)

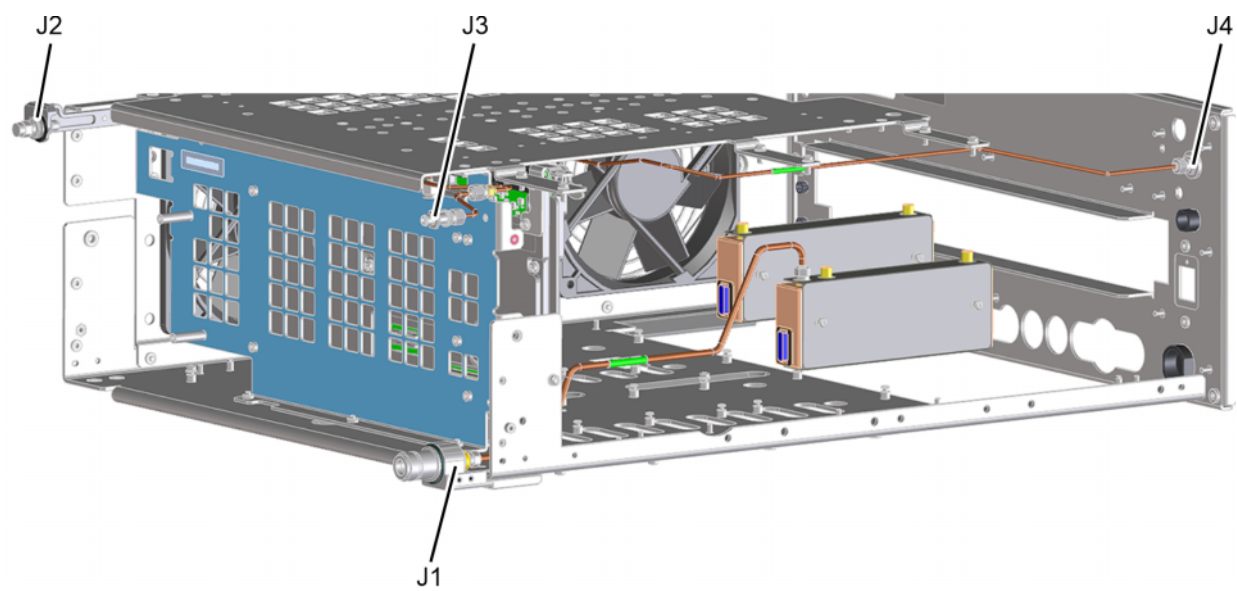


Table 21-29 Connectors (with Options 508, 513, 526)

Item	Description	Keysight Part Number
J1	RF Input Connector Assembly	
	3.5 mm (Option C35 only)	N9048-60119
	Type-N	N9048-60121
J2	Cal Out Connector	1250-1666
	Cal Out Connector Bracket	N9032-00007
J3	Ext Mixer Connector - SMA	1250-1666
J4	Wide IF Out Connector - SMA	1250-1251

Figure 21-30 Connectors (with Options 544, 550)

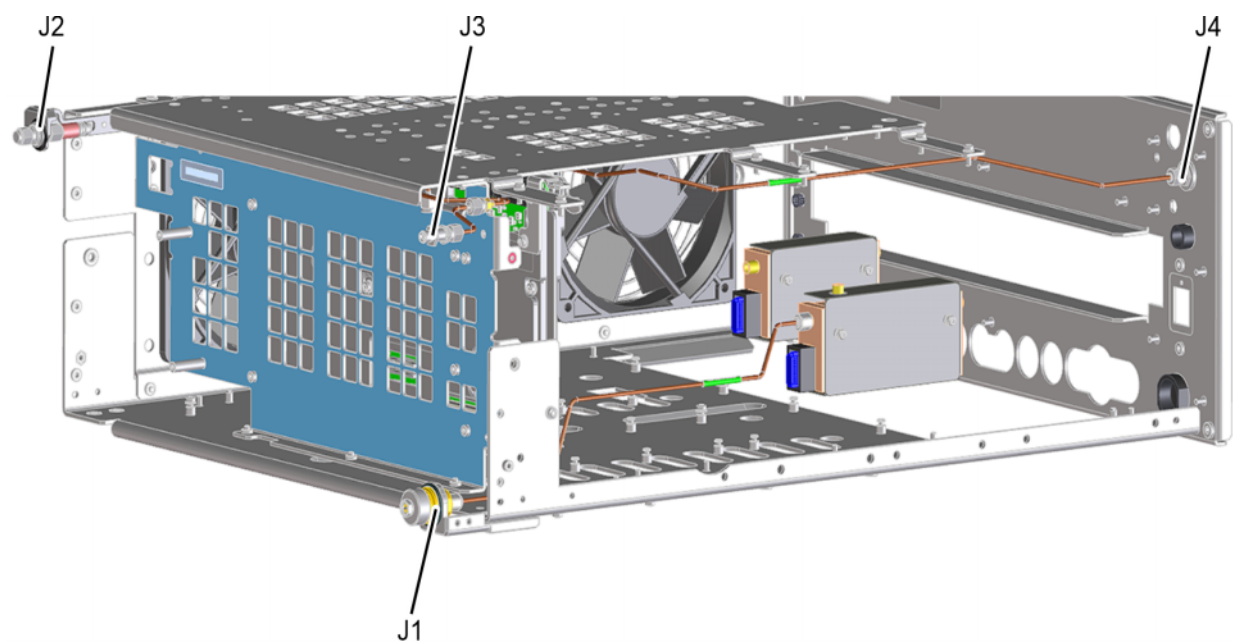


Table 21-30 Connectors (with Options 544, 550)

Item	Description	Keysight Part Number
J1	RF Input Connector Assembly, 1.85 mm	N9032-60038
J2	Cal Out Connector	1250-3667
	Cal Out Connector Bracket	N9032-00017
J3	Ext Mixer Connector - SMA	1250-1666
J4	Wide IF Out Connector - SMA	1250-1251

Figure 21-31 Front Frame Parts

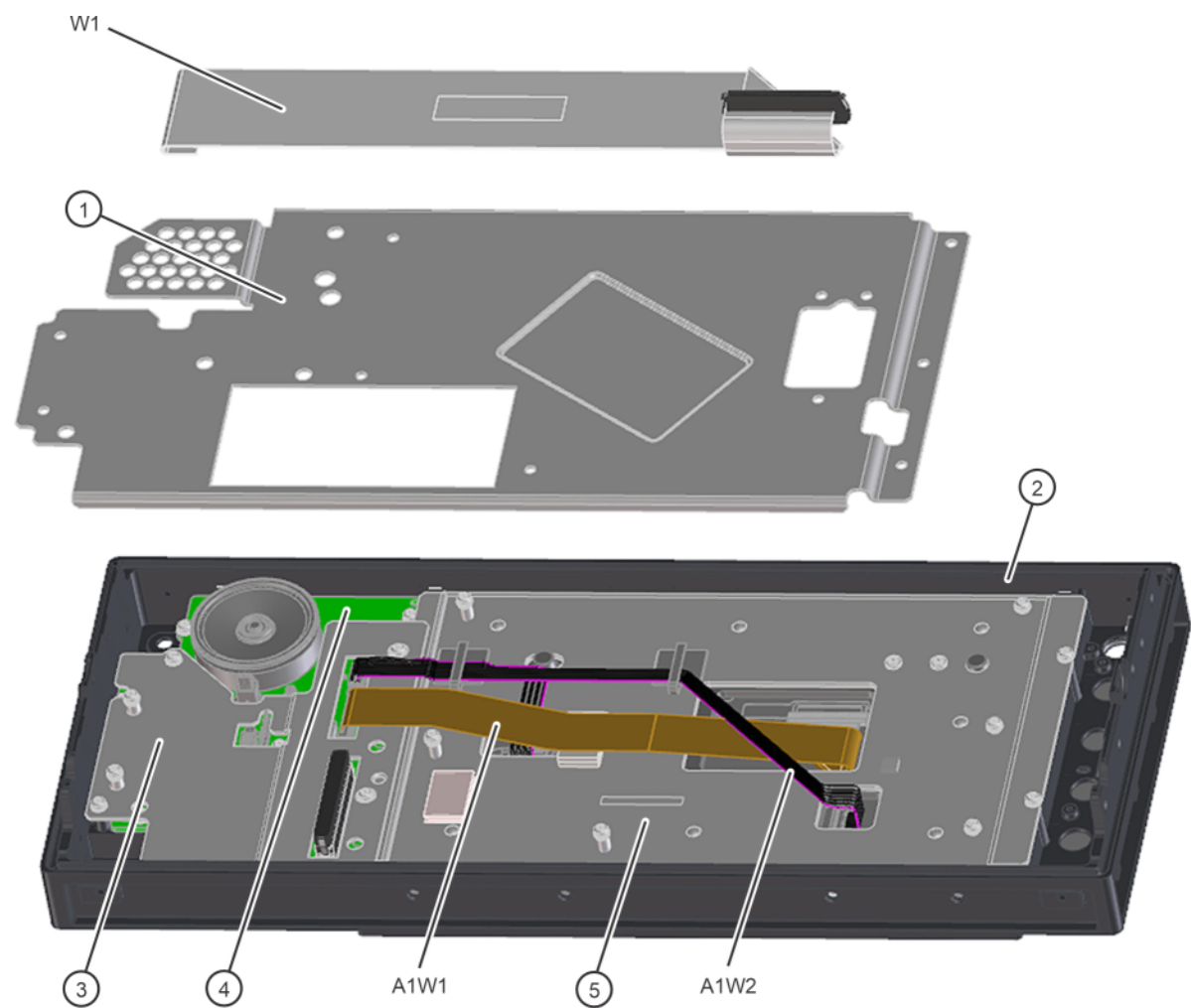


Table 21-31 Front Frame Parts

Item	Description	Keysight Part Number
1	A1MP8, Front Panel Shield	N9020-00066
2	A1A1, Front Frame Assembly Replacement Kit	N9032-60035
3	A1MP4, Front Panel Controller Board Shield	N9020-00064
4	A1A2, Front Panel Controller Board	
	≥ MY/SG63080100	N9020-63296
	< MY/SG63080100	--- ¹
5	A1MP5, Display Bracket	N9020-00078
A1W1	Cable, Flex Circuit, A1A2 Front Panel Controller Board J10 to A1A3 Touch Display	N9020-60273
A1W2	Cable, Wire Harness, A1A2 Controller Board J16 to A1A3 Touch Display	N9020-60217
W1	Cable, Ribbon, A8 Motherboard J9 to A1A2 Front Panel Controller J1	N9020-60216

1. Original part number not orderable, see **N9020-60268** kit. Note that the original part may have already been replaced with the newer part, in which case, see part number for serial number ≥MY/SG63080100.

Figure 21-32 Front Frame Exploded View

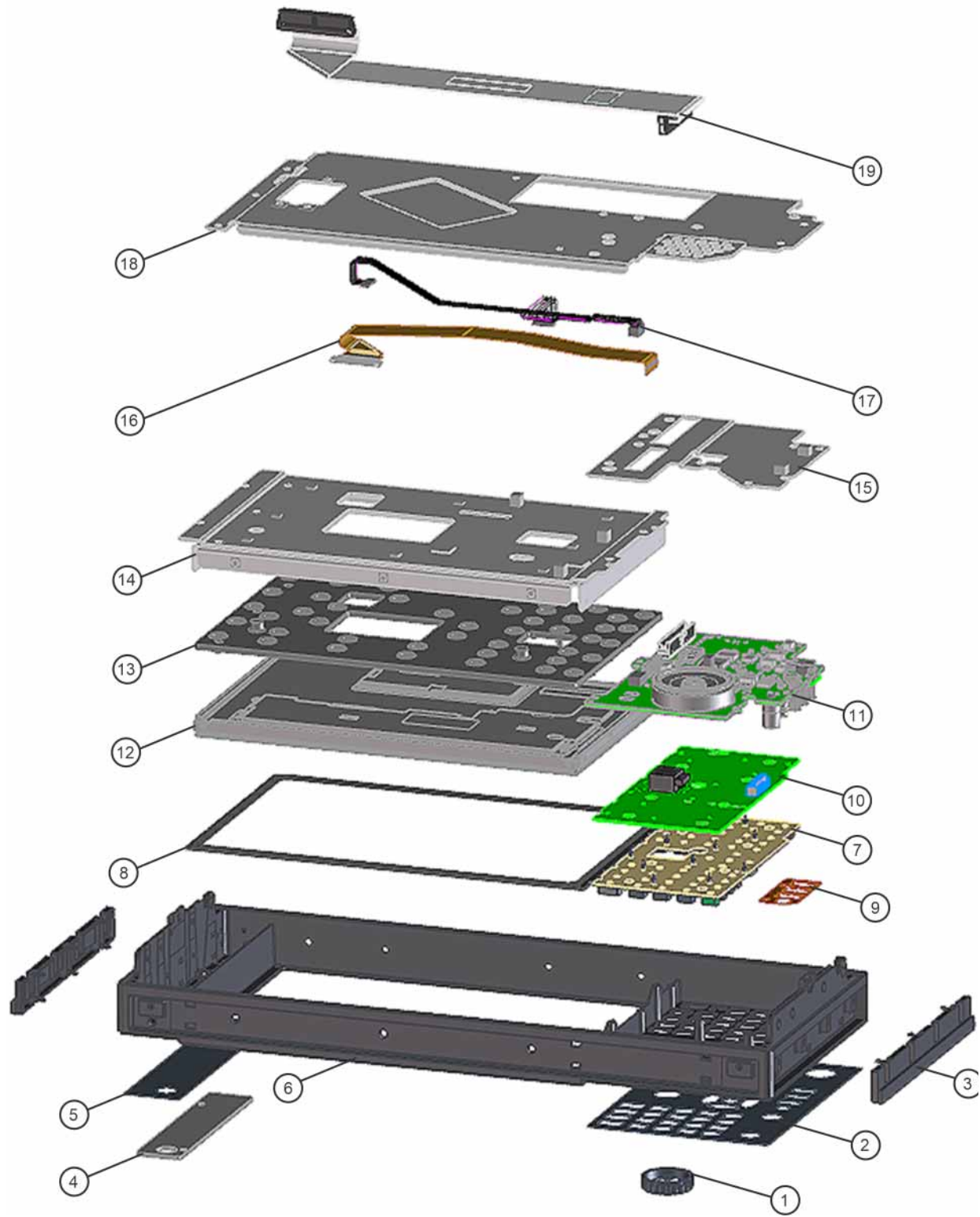


Table 21-32 Front Frame Parts - Exploded

Item	Description	Keysight Part Number
1	A1MP2 RPG Knob	W1312-40179
2	Main Keyboard Overlay	N9020-80127
3	Front Frame Side Trim (2 required)	N9020-40018
4	Left Side Overlay	N9032-80004
5	Left Side Cover Plate	N9032-00008
6	Front Frame	Non-orderable part. See A1A1 .
7	A1MP1 Keypad	N9020-40001
8	A1MP7 Display Protective Boot	N9020-40002
9	USB EMI gasket	N9020-20258
10	A1A4 Keyboard	N9020-63275
11	A1A2 Front Panel Controller Board	
	≥ MY/SG63080100	N9020-63296
	< MY/SG63080100	--- ¹
12	A1A3 Touch Screen Display	
	≥ MY/SG63080100	2090-1158
	< MY/SG63080100	--- ¹
13	A1MP6 Display Compression Pad	
	≥ MY/SG63080100	N9020-40026
	< MY/SG63080100	N9020-40003
14	A1MP5 Display Bracket	N9020-00078
15	A1MP4 Front Panel Controller Board Shield	N9020-00064
16	A1W1 Cable, Flex Circuit, A1A2 Front Panel Controller Board J10 to A1A3 Touch Display	N9020-60273
17	A1W2 Cable, Wire Harness, A1A2 Controller Board J16 to A1A3 Touch Display	N9020-60217
18	A1MP8 Front Panel Shield	N9020-00066
19	W1 Cable, Ribbon, A8 Motherboard J9 to A1A2 Front Panel Controller J1	N9020-60216

1. Original part number not orderable, see [N9020-60268](#) kit. Note that the original part may have already been replaced with the newer part, in which case, see part number for serial number ≥MY/SG63080100.

22 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 21, “Replaceable Parts.”** for part numbers, assembly descriptions, and ordering information.

Major Assembly Locations on page 626

Instrument Outer Case on page 627

Top Brace and Power Supply Bracket on page 629

Front Frame Assembly on page 631

RF Area (Options 508, 513, 526) on page 634

Access to the RF Area Parts on page 636

A9 & A10 RF Attenuators on page 637

SW3 Low Noise Path Switch and A11 Band Switch on page 639

Remove SW2 Low Noise Amplifier Switch on page 645

Remove SW4 Microwave Preselector Bypass Switch on page 646

Remove A12 Yig Tuned Filter on page 648

Remove A20 Yig Tuned Oscillator on page 649

Replace A20 Yig Tuned Oscillator on page 650

Replace A12 Yig Tuned Filter on page 651

Replace SW4 Microwave Preselector Bypass Switch on page 652

Replace SW2 Low Noise Amplifier Switch on page 654

Replace SW3 Low Noise Path Switch and A11 Band Switch on page 655

RF Area (Options 544, 550) on page 658

Access to the RF Area Parts on page 660

A9 & A10 RF Attenuators on page 661

SW3 Low Noise Path Switch and A11 Band Switch on page 663

Remove SW2 Low Noise Amplifier Switch on page 669

Remove SW4 Microwave Preselector Bypass Switch on page 670

Remove A12 Yig Tuned Filter on page 672

Remove A20 Yig Tuned Oscillator on page 673

Replace A20 Yig Tuned Oscillator on page 674

Replace A12 Yig Tuned Filter on page 651

Replace SW4 Microwave Preselector Bypass Switch on page 652

Replace SW2 Low Noise Amplifier Switch on page 654

Replace SW3 Low Noise Path Switch and A11 Band Switch on page 655

RF Area (Options 555) on page 682

Access to the RF Area Parts on page 684

A9 & A10 RF Attenuators on page 685

SW3 Low Noise Path Switch, A11 Band Switch, and A30 Switch Control Adapter on page 687

Remove SW2 Low Noise Amplifier Switch on page 693

Remove SW4 Microwave Preselector Bypass Switch on page 694

Remove A12 Yig Tuned Filter on page 696

Remove A20 Yig Tuned Oscillator on page 697

Replace A20 Yig Tuned Oscillator on page 698

Replace A12 Yig Tuned Filter on page 699

Replace SW4 Microwave Preselector Bypass Switch on page 700

Replace SW2 Low Noise Amplifier Switch on page 702

Replace SW3 Low Noise Path Switch and A11 Band Switch on page 703

A13 Downconverter on page 706

A13SW1 and A13SW2 Bandpass Filters on page 710

A13FL1 Bypass Filter on page 712

Card Cage Boards on page 713

A15 Front End Controller on page 714

A14 DDS LO Synthesizer on page 716

A25 Wideband Calibrator on page 718

A23 IF Mux on page 723

A21 Wideband Digital IF Assembly on page 725

A16 Reference Assembly on page 728

Rear Panel on page 731

A6 Power Supply Assembly on page 733

A4 System Processor on page 735

A5 Solid State Drive on page 737

A2 Analog IF/A3 Digital IF on page 741

A7 Midplane Board Assembly on page 745

A8 Motherboard Assembly on page 747

Fan Assembly on page 752

Input Connector Assembly on page 756

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 22**.

Initial Disassembly

In order to access the microcircuit or board assemblies, it will be necessary to remove the Outer Case and often the Top Brace and Power Supply Bracket. Refer to **“Instrument Outer Case”** and **“Top Brace and Power Supply Bracket”** removal procedures.

Adjustments Tests after an instrument repair

Refer to **“Post-Repair Procedures” on page 761** 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.

Safety

WARNING

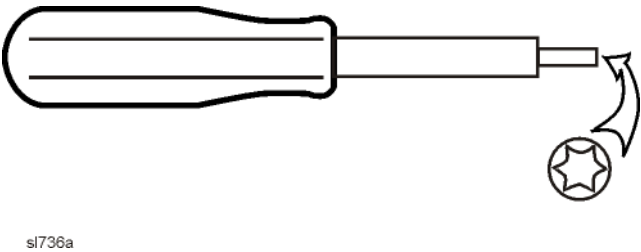
The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

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 22-1 TORX Tool

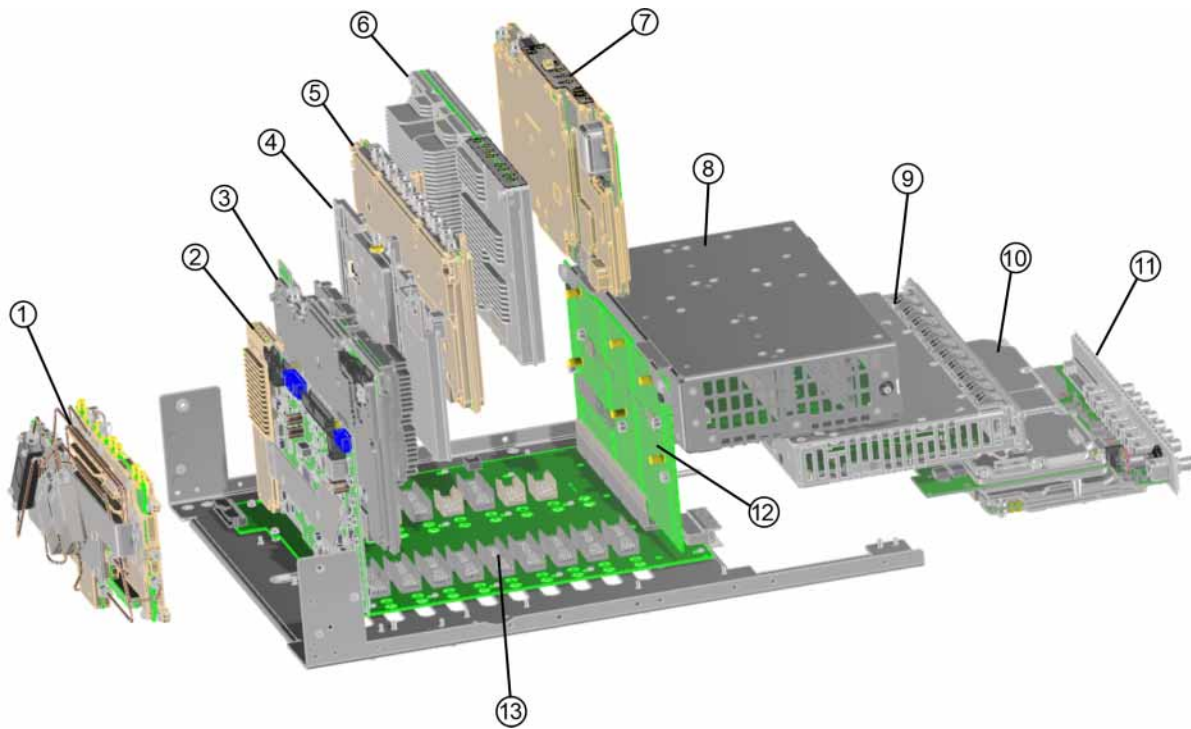


sl736a

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
Socket, Claw Foot, 5/16 Inch, 1/4 Inch Square Drive	N5191-20299
cable puller	5021-6773

Major Assembly Locations

Figure 22-2 Major Assemblies



Item	Description
1	A13 Downconverter
2	A15 Front End Controller
3	A14 DDS LO Synthesizer Assembly
4	A25 Wideband Calibrator
5	A23 IF Mux
6	A21 Wideband Digital IF
7	A16 Reference Assembly
8	A6 Power Supply
9	A4 System Processor
10	A2 25 MHz Analog IF
11	A3 40 MHz Digital IF
12	A7 Midplane Board
13	A8 Motherboard

Instrument Outer Case

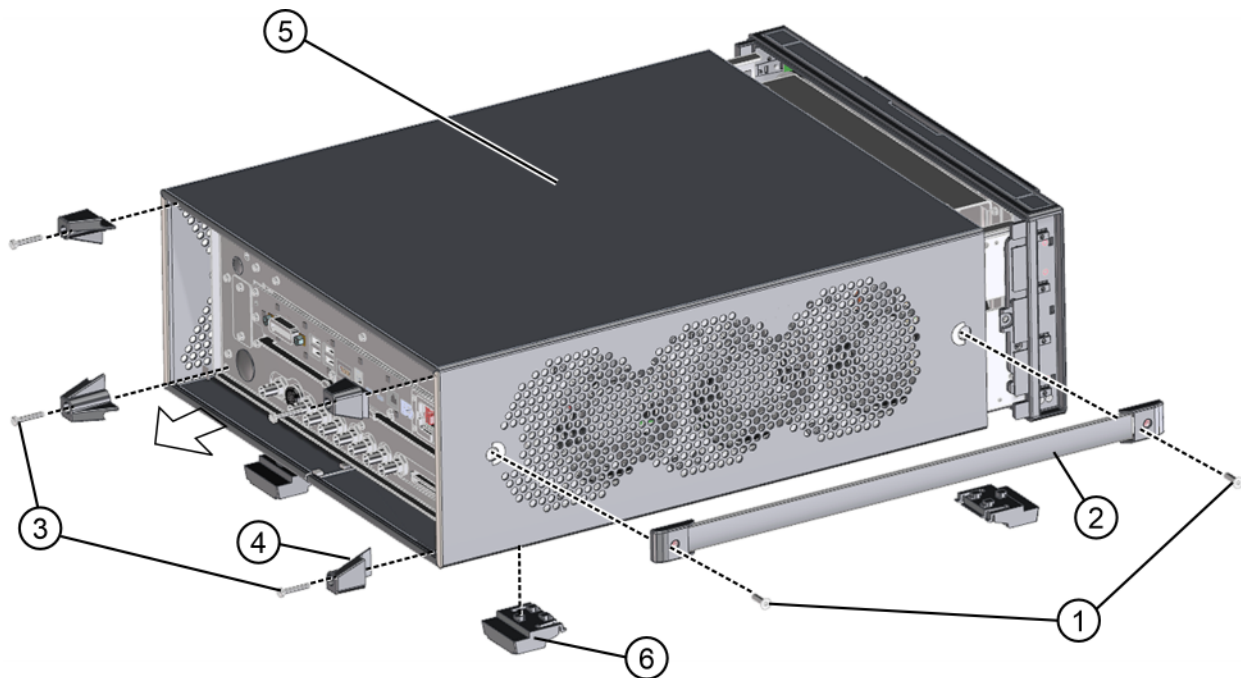
CAUTION

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 22-3**. Using the T-20 driver, remove the four screws (two on each side) (1) that attach the strap handles (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 22-3 Instrument Outer Case Removal



Replacement

1. Disconnect the instrument from ac power.
2. Slide the instrument cover back onto the instrument 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 strap handles on both sides of the instrument. Torque the handle strap screws to 21 inch-pounds.

Top Brace and Power Supply Bracket

Removal

1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Refer to **Figure 22-4**. To remove the top brace (1), use the T-10 driver to remove the twelve screws (3) (0515-0372) attaching the top brace to the chassis. Remove the wire hold down 1 (as shown in **Figure 22-5**). Remove the sixteen screws (4) (0515-1946) attaching the top brace to the boards.
3. To remove the power supply bracket (2), use the T-10 driver to remove the eight screws (5) (0515-0372) attaching the power supply bracket to the instrument and the three screws (6) (0515-1946) attaching the power supply bracket to the power supply.

Figure 22-4 Top Brace and Power Supply Bracket Removal

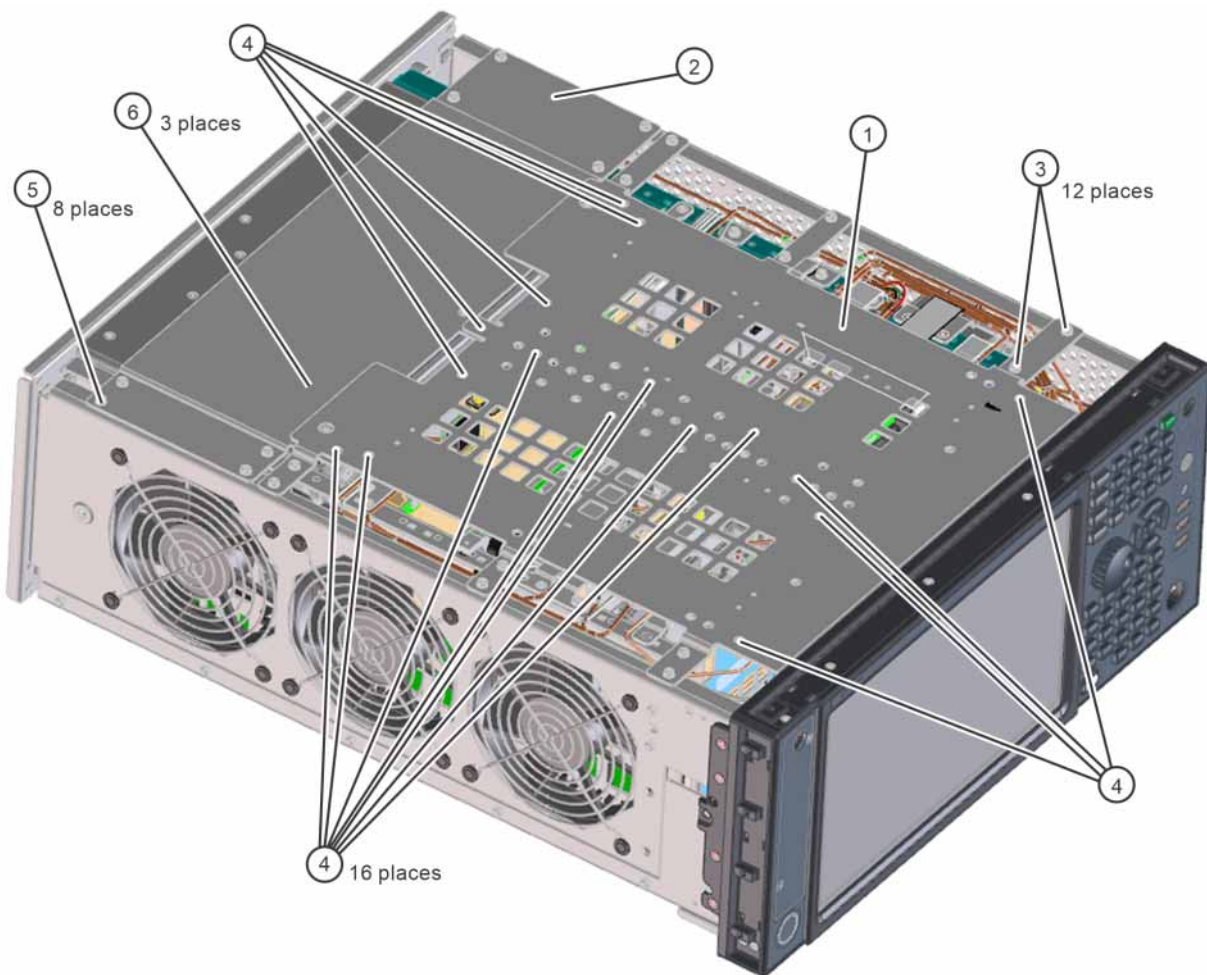
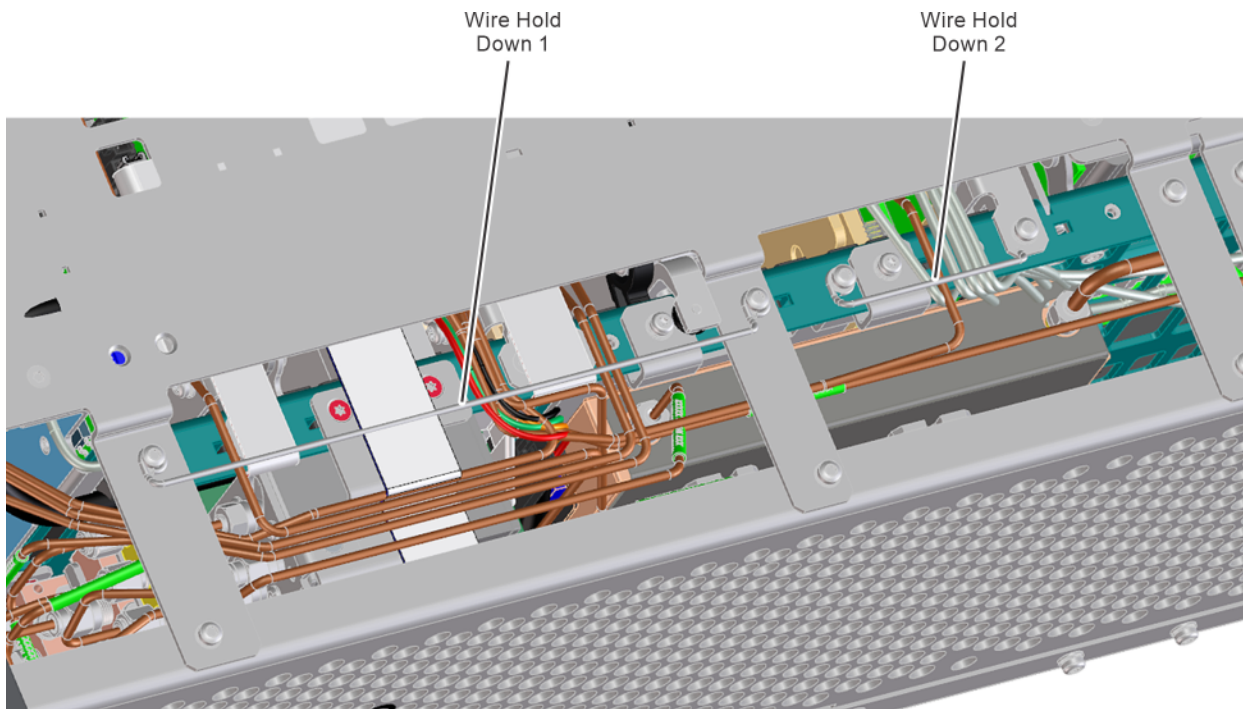


Figure 22-5 Wire Hold Downs



Replacement

1. Refer to [Figure 22-4](#). To replace the top brace or the power supply bracket, place them into the correct position and attach the screws referred to in the removal process. Reinstall wire hold down 1. Torque all screws to 9 inch-pounds.

Front Frame Assembly

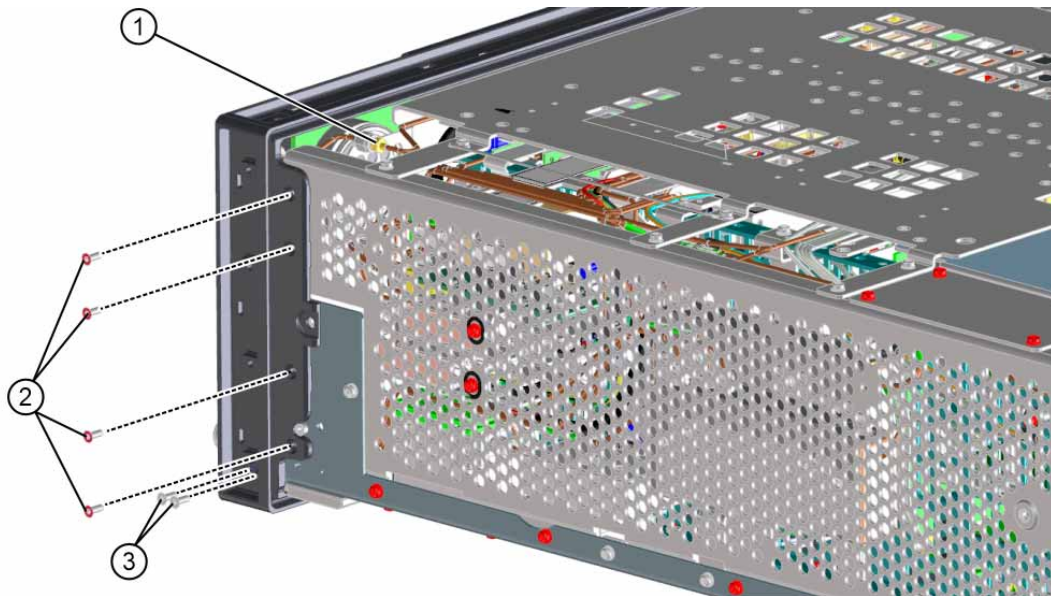
Removal

NOTE

Make sure any connectors on the front panel are removed.

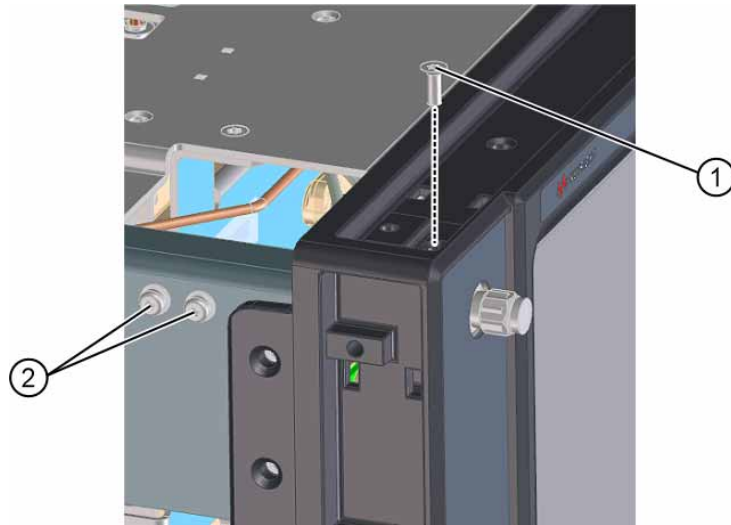
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. If Option EXM, External Mixing, is installed disconnect semi-rigid cable connection **(1)** on LO/IF cable.
3. Refer to **Figure 22-6**. Using the T-10 driver, remove the eight screws **(2)** (0515-2032), four on each side.
4. Using the T-10 driver, remove the four screws **(3)** (0515-2032), two on each side.

Figure 22-6 Front Frame Assembly Removal



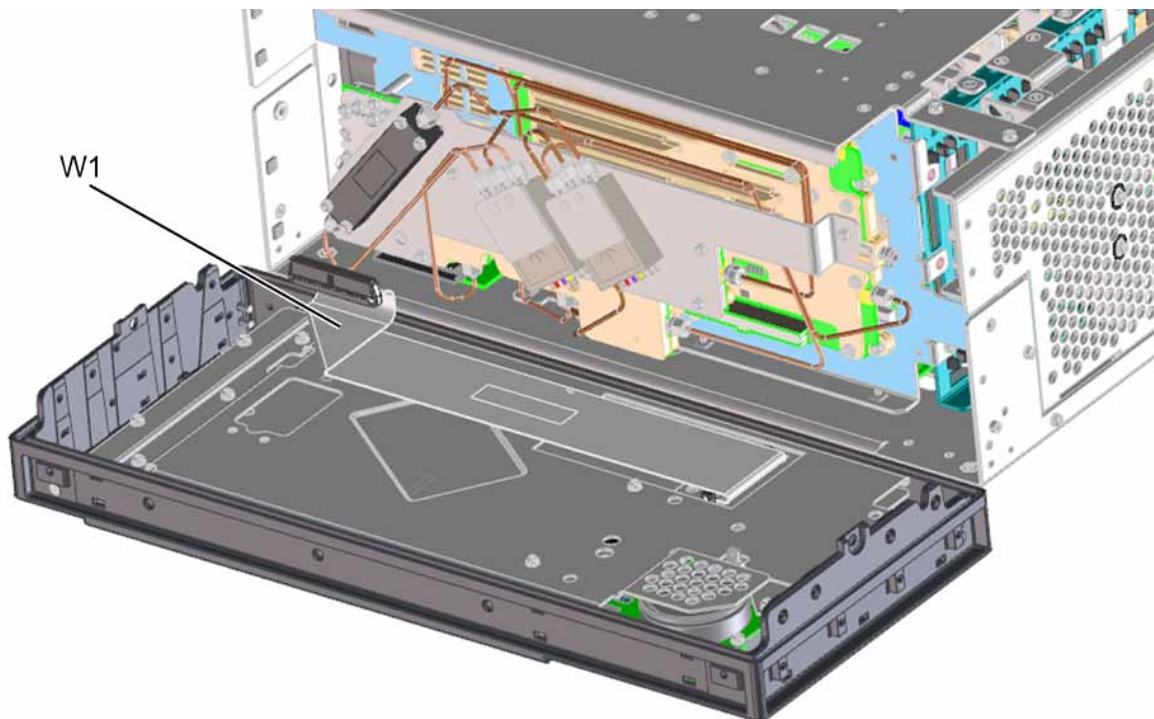
5. Refer to **Figure 22-8**. Remove the one screw (1) (0515-2032) holding the Cal Out Connector to the Front Frame Assembly.

Figure 22-7 Front Panel Left Side



6. Refer to **Figure 22-8**. Pull the Front Frame Assembly carefully away from the chassis. Remove the ribbon cable W1 from the motherboard. The cable has locking tabs on each side, pinch and pull to release.

Figure 22-8 Front Panel Cable



Replacement

1. Reattach the ribbon cable W1. Ensure the locking tabs are engaged.
2. Refer to **Figure 22-6**. Carefully position the Front Frame assembly onto the chassis. Ensure no cables are crushed. Replace the eight screws **(2)** (0515-2032), four on each side of the chassis. Do not tighten the screws at this point.
3. If Option EXM, External Mixing, is installed attach semi-rigid LO/IF cable. Torque to 10 inch-pounds.
4. Replace the four screws **(3)** (0515-2032), two on each side. Do not tighten the screws at this point.
5. Refer to **Figure 22-7**. Install the one flathead screw **(1)** (0515-2032) on the top of the instrument. If there is a problem with lining this screw hole up, temporarily loosen the two panhead screws **(2)**.
6. Torque all the screws securing the Front Panel assembly to the instrument to 9 in-lbs.
7. Replace the outer case. Refer to the **Instrument Outer Case** replacement procedure.

Table 22-1 Front Panel Related Parts

Item	Keysight Part Number
A1A1	N9032-60035
W1	N9020-60216

RF Area (Options 508, 513, 526)

Refer to **Figure 22-9** for the location of the RF area components. Refer to **Table 22-2** for a list of components included in the RF area.

Figure 22-9 RF Area Components and Cables (Options 508, 513, 526)

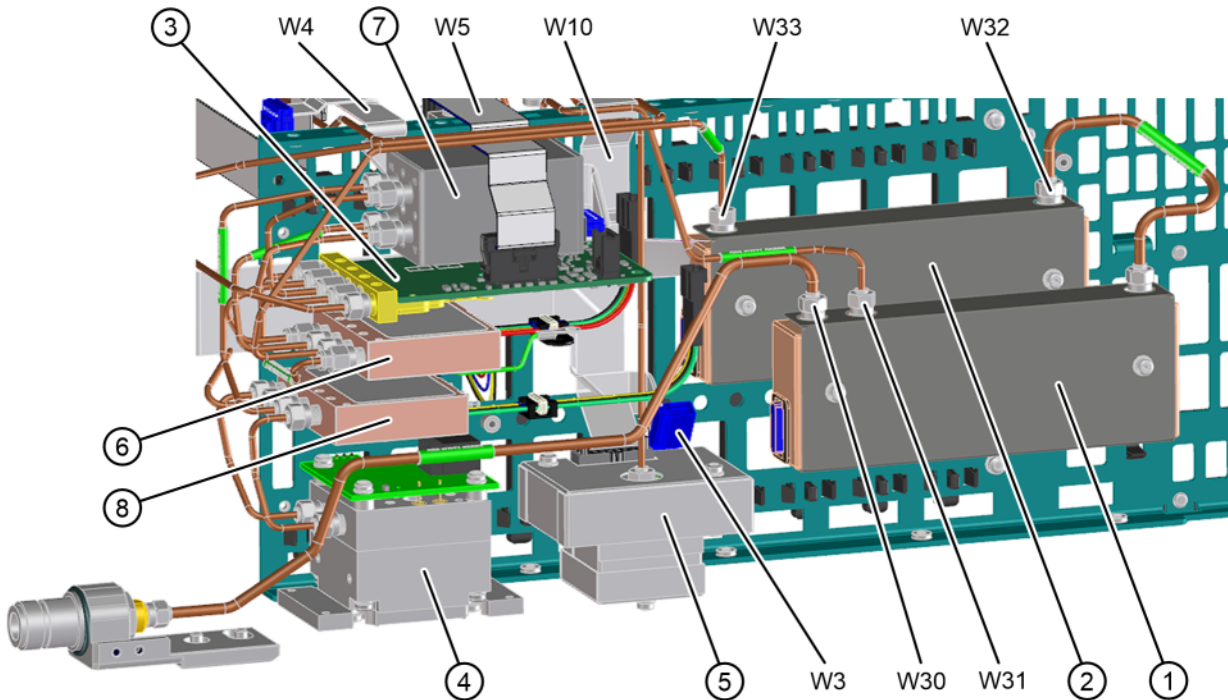


Table 22-2 RF Area

Item	Description
1	A9 Attenuator A
2	A10 Attenuator B
3	A11 Band Switch
4	A12 Yig Tuned Filter
5	A20 Yig Tuned Oscillator
6	SW2 Switch, 4-Port Transfer, Low Noise Amplifier
7	SW3 Switch, 4-Port Transfer, Low Noise Path
8	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch

Table 22-2 **RF Area**

Item	Description
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3

Access to the RF Area Parts

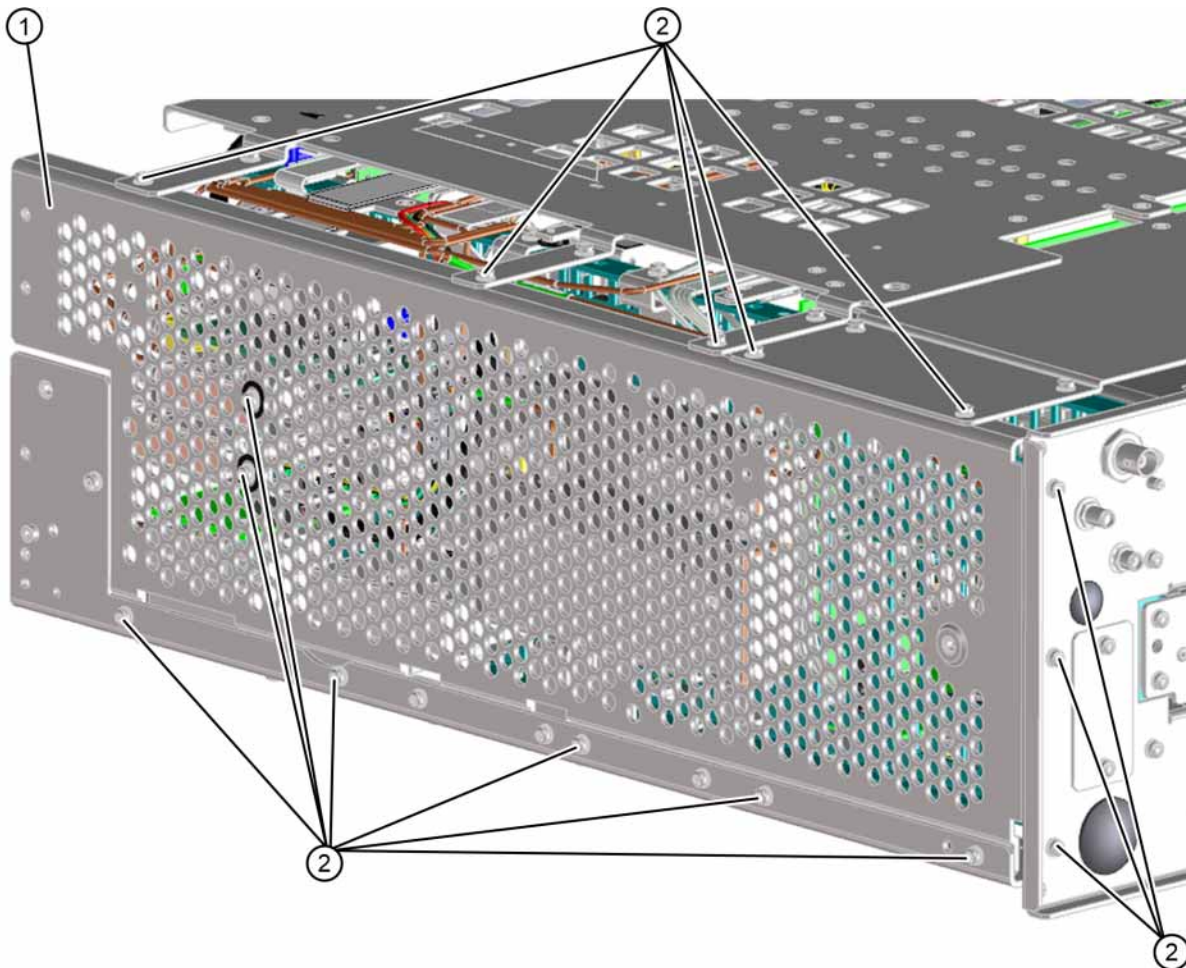
To access the RF area parts for removal follow these steps:

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. Refer to **Figure 22-10**. Using the T-10 driver, remove the RF bracket (1) by removing the fifteen screws (2) (0515-0372).

NOTE

Before re-securing the RF bracket, ensure that all RF area cables and wire harnesses are securely fastened in place.

Figure 22-10 RF Side Bracket Removal

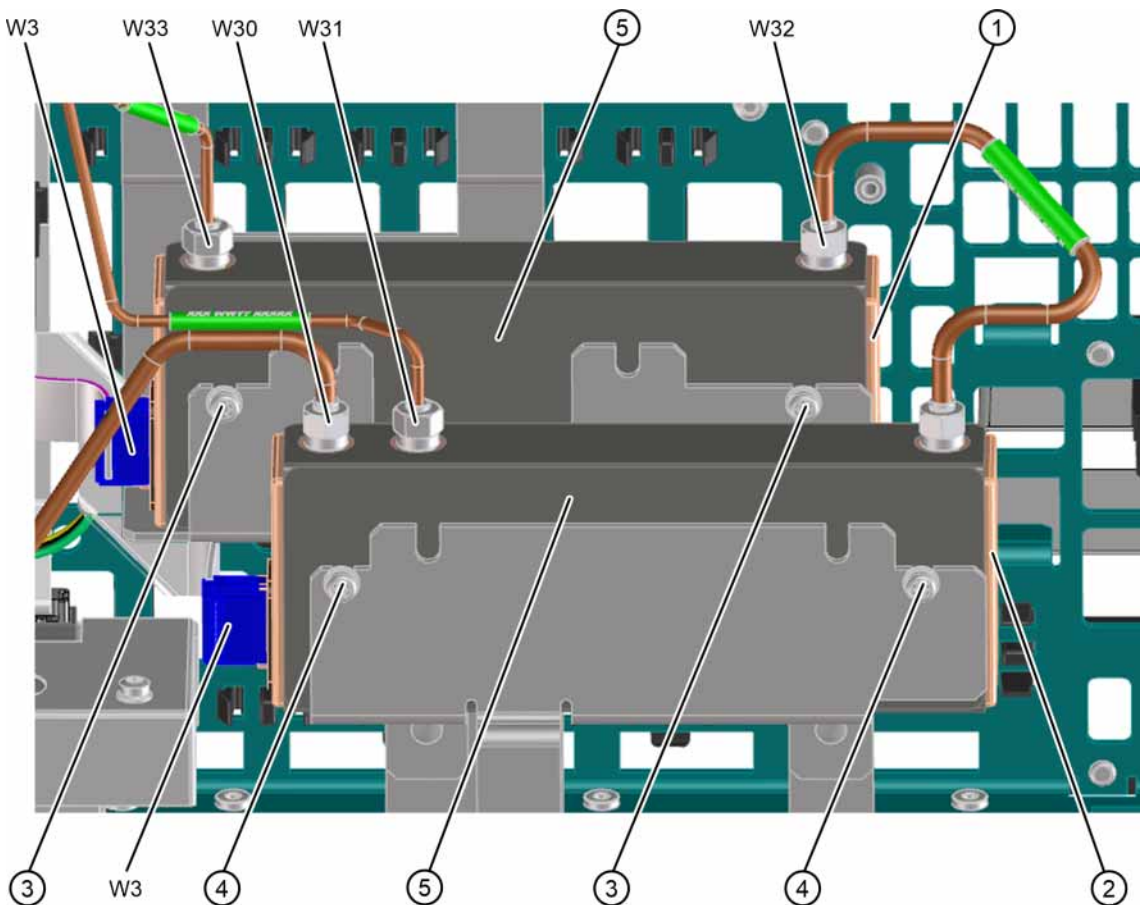


A9 & A10 RF Attenuators

Removal

1. Refer to **Figure 22-11**. Using the 5/16 inch wrench, remove the semi-rigid cables W30, W31, W32, and W33.
2. Remove, or loosen, the two screws **(3)** (0515-0372) from the A10 Attenuator B bracket.
3. Lift up A10 Attenuator B **(1)** and remove the ribbon cable W3. Remove the attenuator.
4. Remove, or loosen, the two screws **(4)** (0515-0372) from the A9 Attenuator A bracket.
5. Lift up A9 Attenuator A **(2)** and remove the ribbon cable W3. Remove the attenuator.
6. Each attenuator has a magnetic shield **(5)** that can be removed after the preceding steps are complete.

Figure 22-11 Attenuators Removal



Replacement

1. Slip the magnetic shield (5) on to each attenuator.
2. Refer to **Figure 22-11**. Reconnect the ribbon cable W3 to A9 Attenuator A (2).
3. Reposition the A9 Attenuator A in the lower attenuator bracket.
4. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
5. Reconnect the ribbon cable W3 to A10 Attenuator B (1).
6. Reposition the A10 Attenuator B in the upper attenuator bracket.
7. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
8. Replace the semi-rigid cables W30, W31, W32, and W33 using the 5/16 inch wrench. Torque to 10 inch-pounds.

Table 22-3 A9 & A10 RF Attenuator Related Parts

Item	Keysight Part Number
A9	33360-60011
A9 Magnetic Shield	N9032-00012
A10	33321-60085
A10 Magnetic Shield	N9032-00013
W3	E4410-60157
W30	N9032-20001
	N9032-20029 (Option C35)
W31	N9032-20002
W32	N9032-20021
W33	N9032-20000

SW3 Low Noise Path Switch and A11 Band Switch

Removal

1. Refer to **Figure 22-12**. Using the 5/16 inch wrench, remove the semi-rigid cables W36, W37, W38, and W39 from the SW3 Low Noise Path Switch **(1)**.
2. Using the 5/16 inch wrench, remove the semi-rigid cables W34, W35, and W43 from the A11 Band Switch **(4)**.
3. Disconnect the ribbon cables W5 and W21 from the A11 Band Switch.
4. Remove the two screws **(2)** **(0515-1940)** from the LNP bracket using the T-10 driver.
5. Remove the screw **(3)** **(0515-0372)** from the band switch bracket using the T-10 driver.
6. Disconnect the ribbon cable W4 from the SW3 Low Noise Path Switch.
7. The LNP switch, and band switch, can now be removed together.

Figure 22-12 Low Noise Path Switch and Band Switch Removal

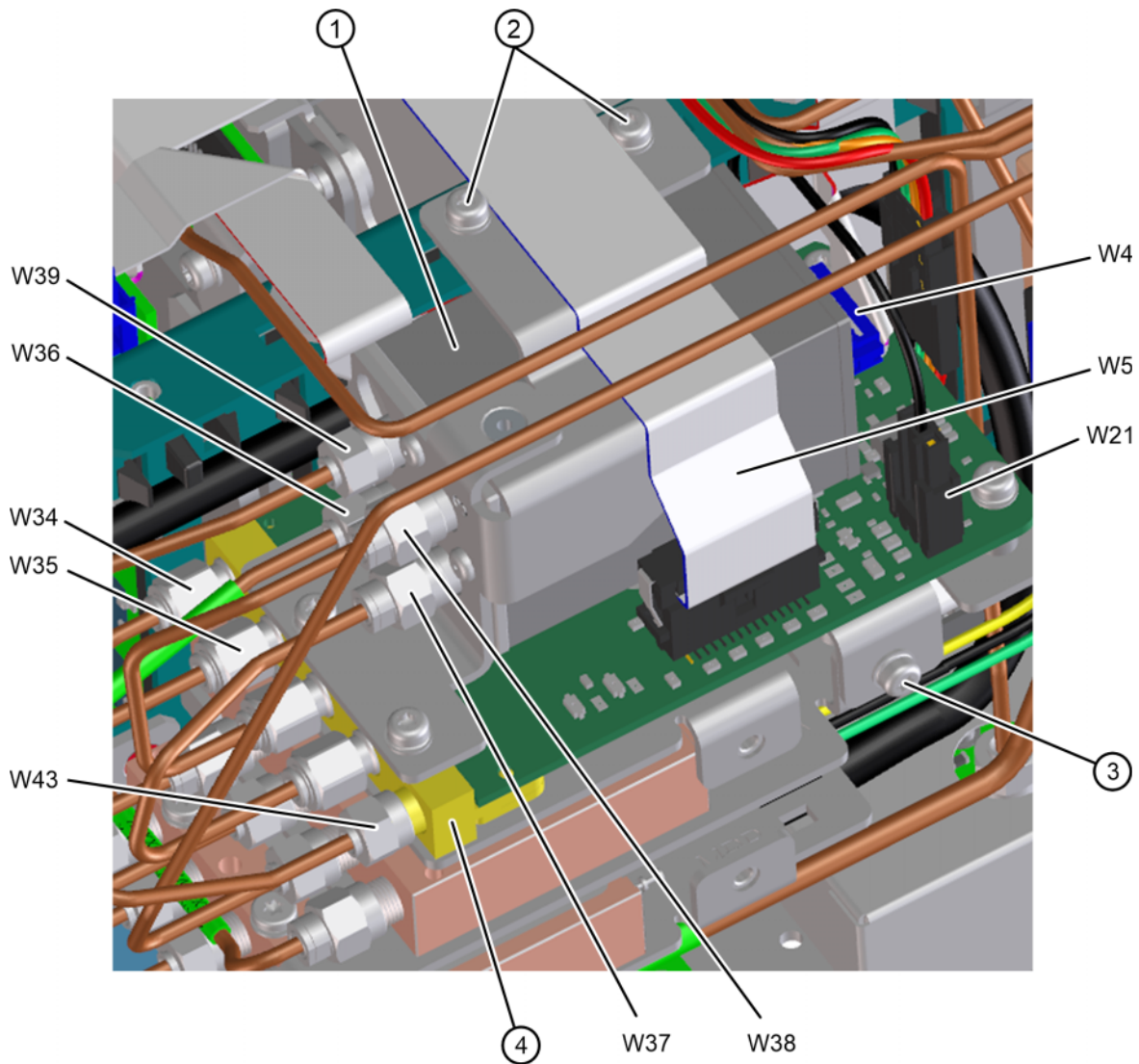
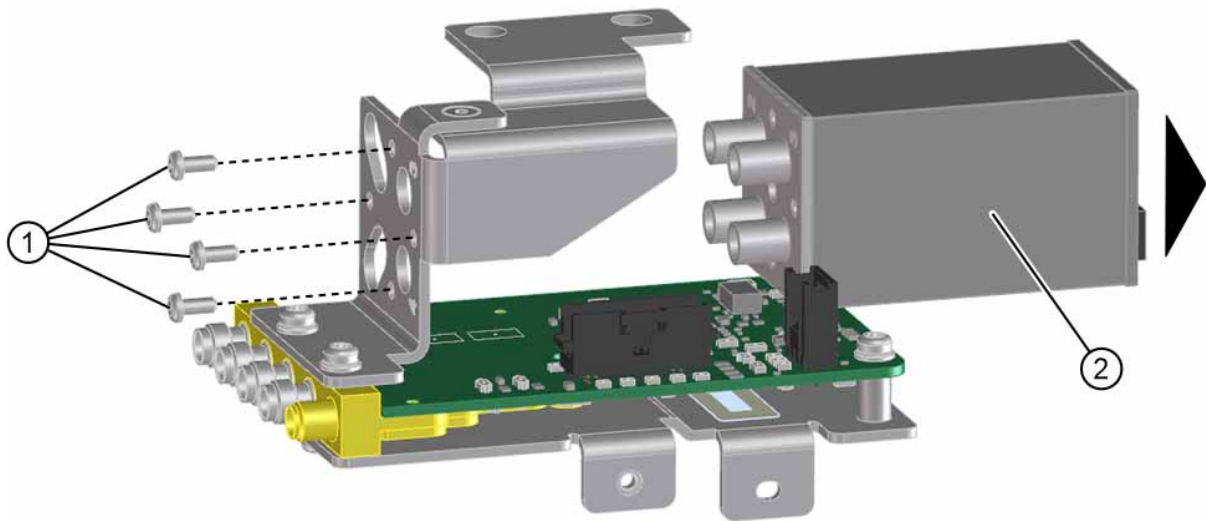


Figure 22-13 Detach LNP Switch from bracket

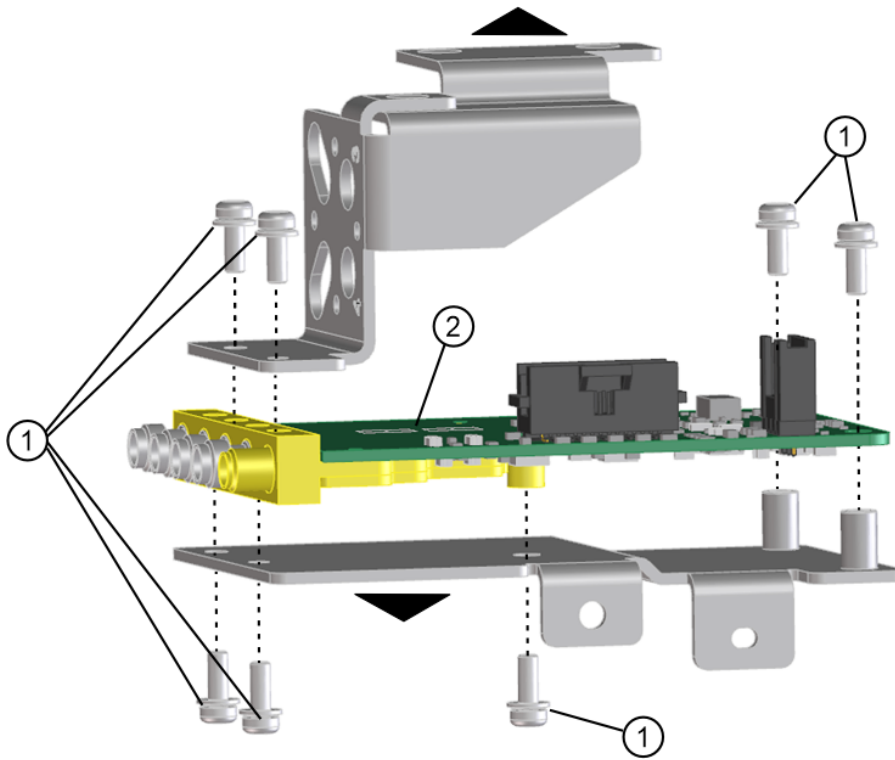


8. Refer to **Figure 22-13**. Using the T-8 driver, remove the four screws **(1)** (**0515-1940**).
9. The SW3 Low Noise Path Switch **(2)** can now be detached from the bracket.

10. Refer to **Figure 22-14**. Using the T-10 driver, remove the seven screws **(1)** (0515-0372).

11. The A11 Band Switch **(2)** can now be detached from the upper and lower brackets.

Figure 22-14 Detach Band Switch from brackets



Replacement

Replace A11 Band Switch

- 1. Refer to **Figure 22-15**. To replace the switch, place the A11 switch **(1)** in position on top of the band switch bracket **(3)**. Secure with five screws **(2)** (**0515-0372**). Torque to 9 inch-pounds.

Figure 22-15

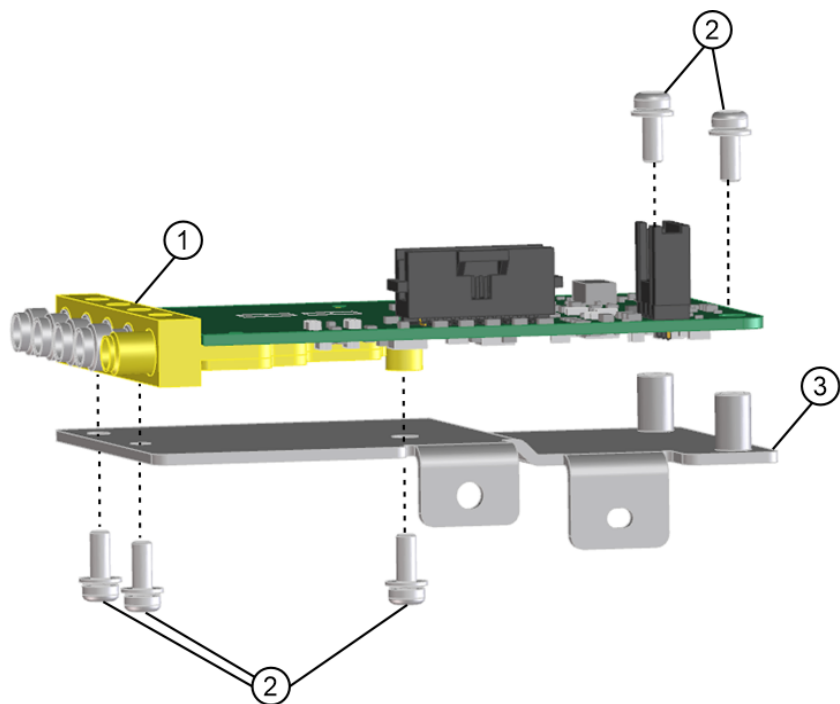


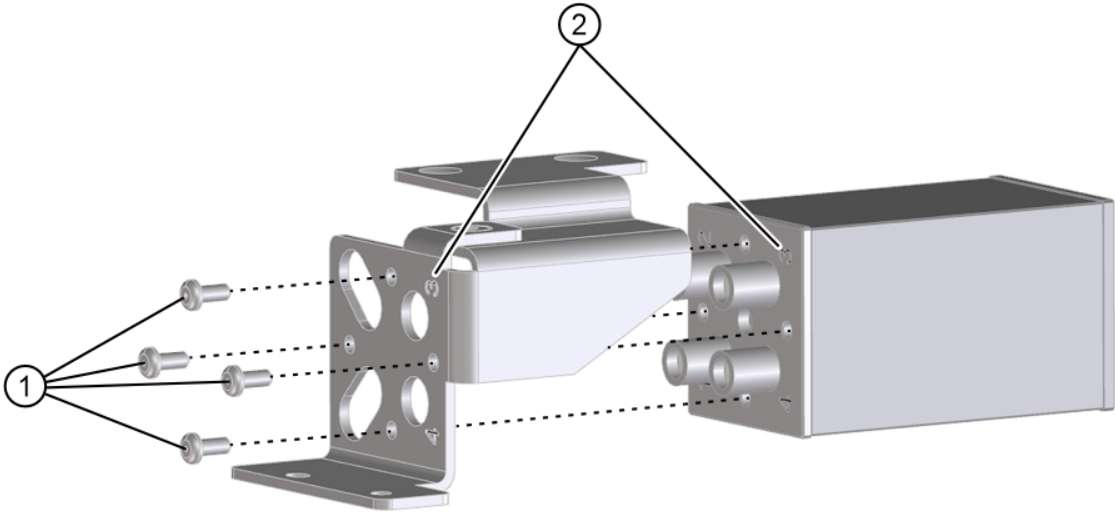
Table 22-4 A11 Band Switch Related Parts

Item	Keysight Part Number
A11	N9040-60100

Replace SW3 LNP Switch

1. Refer to **Figure 22-16**. Before attaching the LNP Switch to the bracket ensure that the numbers displayed on each are aligned with each other.

Figure 22-16



2. Using the T-8 driver, secure the bracket to the LNP switch using the four screws (1) (0515-1940). Torque to 6 inch-pounds.

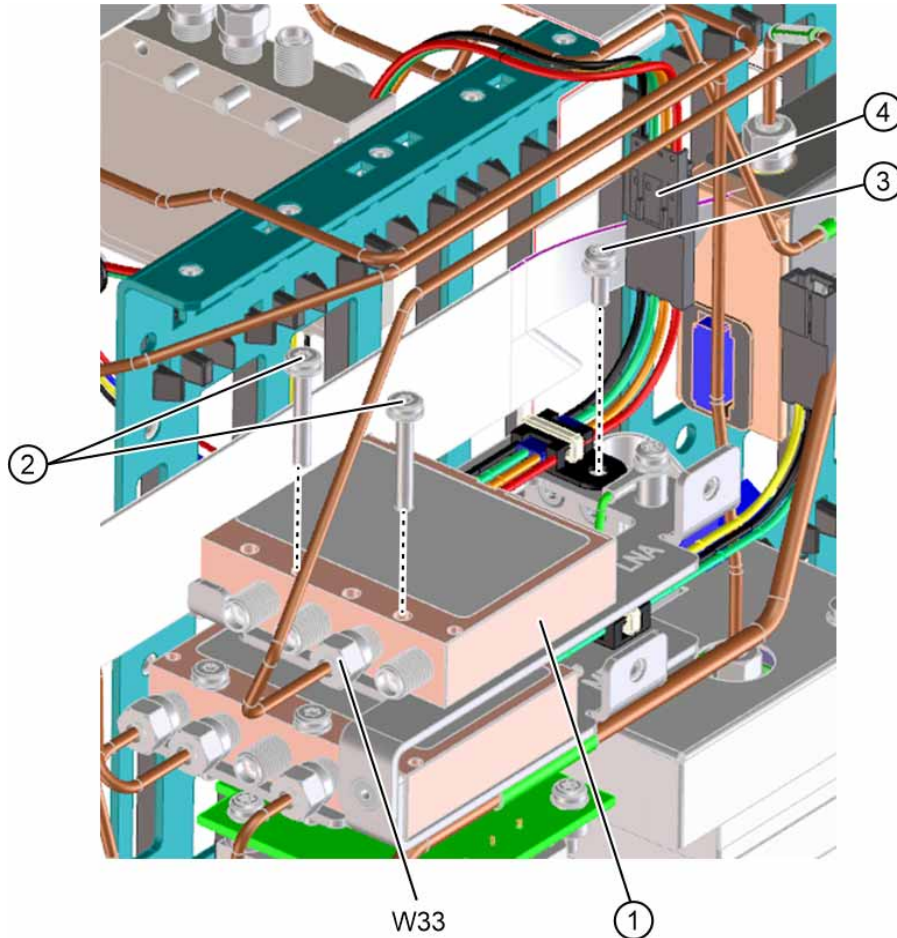
Table 22-5 SW3 LNP Switch Related Parts

Item	Keysight Part Number
SW3	87222-60026

Remove SW2 Low Noise Amplifier Switch

1. With the SW3 Low Noise Path and A11 Band switches removed, refer to **Figure 22-17**. Remove the semi-rigid cable W33 from the SW2 Low Noise Amplifier Switch (1) using the 5/16 inch wrench.

Figure 22-17

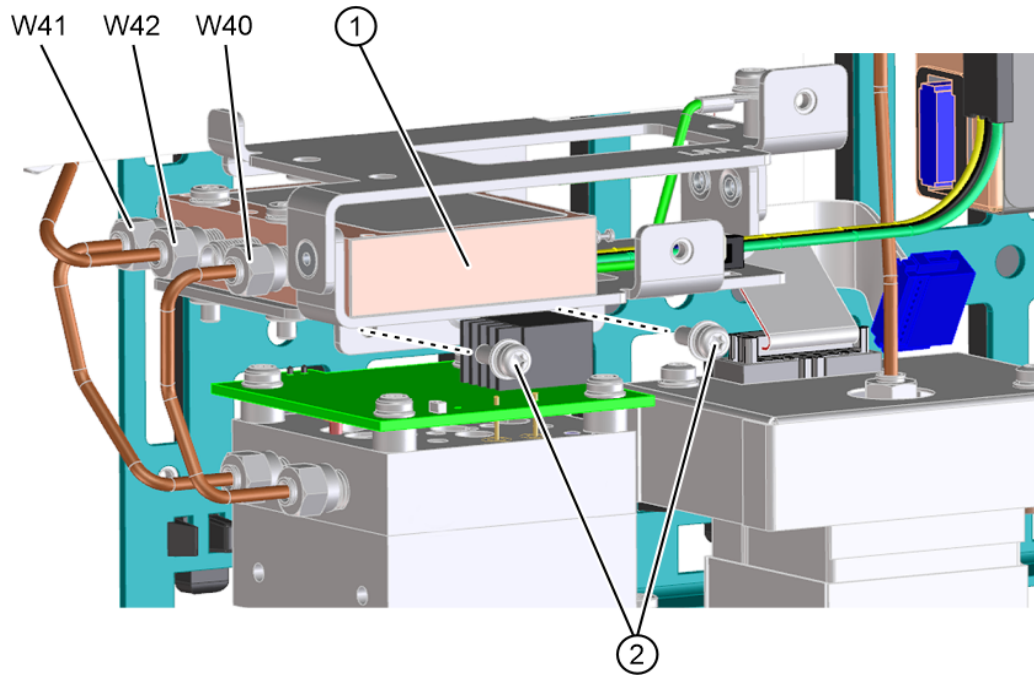


2. Remove the two screws (2) (0515-1410) using a T-10 driver.
3. Using a T-10 driver, remove the SW2 LNA switch wire harness screw (3).
4. Lift the SW2 LNA switch away from the assembly. Disconnect the SW2 LNA Switch wire harness from the W20 cable (4). The SW2 Low Noise Amplifier Switch can now be removed.

Remove SW4 Microwave Preselector Bypass Switch

1. With the SW2 Low Noise Amplifier Switch removed, refer to **Figure 22-18**. Remove the semi-rigid cables W41, W42, and W40 from the SW4 MPB Switch (1) using the 5/16 inch wrench.

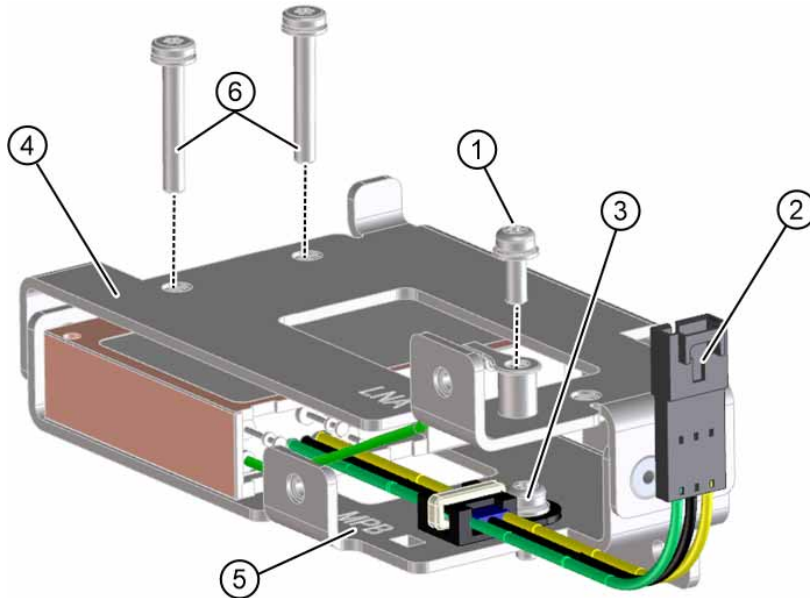
Figure 22-18



2. Remove the two screws (2) (0515-0372) securing the bracket to the chassis using a T-10 driver.

3. Refer to **Figure 22-19**. Disconnect the SW4 MPB switch wire harness (2).
4. Remove the screw (1) (0515-0372) securing the single green MPB switch ground wire to the LNA switch bracket (4).

Figure 22-19

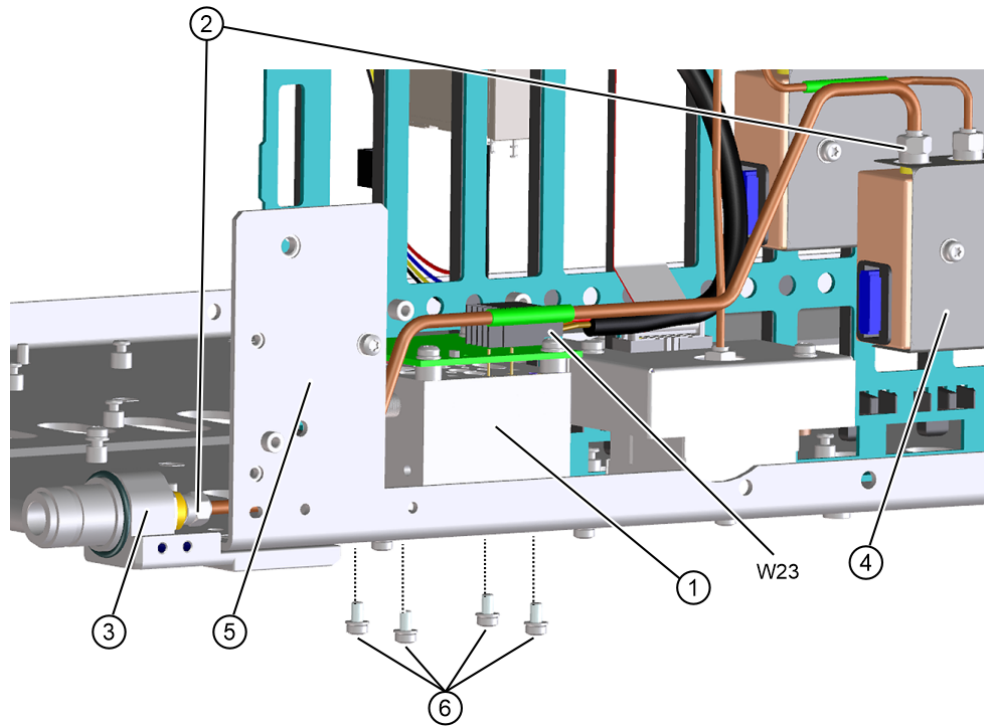


5. Remove the screw (3) (0515-0372) securing the MPB switch wire harness (2) to the MPB-LNA switch bracket (5).
6. Remove the two screws (6) (0515-1410) securing the SW4 MPB switch to the LNA-MPB switch mounting bracket.

Remove A12 Yig Tuned Filter

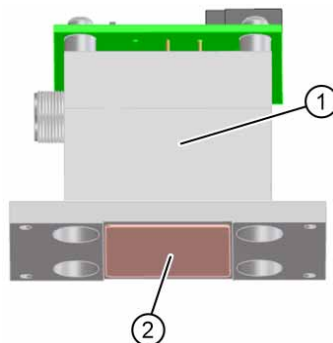
1. Refer to **Figure 22-20**. Using a 5/16 inch open-end wrench, remove the semi-rigid cable (2) from the RF Input Connector (3) and A9 Attenuator A (4).

Figure 22-20



2. Disconnect the wire harness W23.
3. Remove the 4 screws (6) (0515-0372) from the chassis base (5) using a T-10 driver.
4. Refer to **Figure 22-21**. Detach the Yig Tuned Filter (1) from the chassis base. Removal may require slight effort due to residual adhesive on the YTF Gap Pad (2).

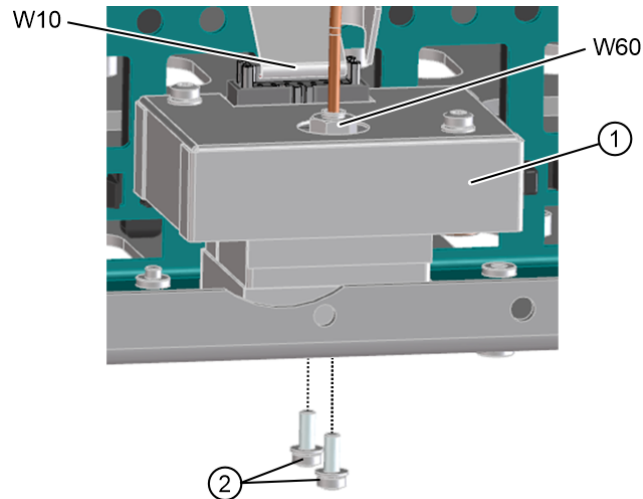
Figure 22-21



Remove A20 Yig Tuned Oscillator

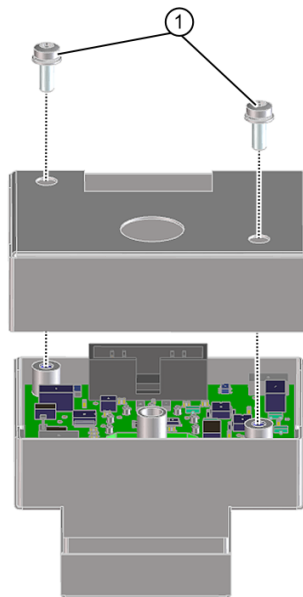
1. Refer to **Figure 22-22**. Using the 5/16 inch wrench, remove the semi-rigid cable W60 from the A20 Yig Tuned Oscillator **(1)**.

Figure 22-22



2. Disconnect the W10 ribbon cable from the A20 Yig Tuned Oscillator **(1)**.
3. Remove the 2 screws **(2)** (**0515-0372**) from the chassis base **(5)** using a T-10 driver.
4. Refer to **Figure 22-23**. Separate the A20 Yig Tuned Oscillator from the YTO top and bottom shields by removing the two screws **(1)** (**0515-0372**).

Figure 22-23



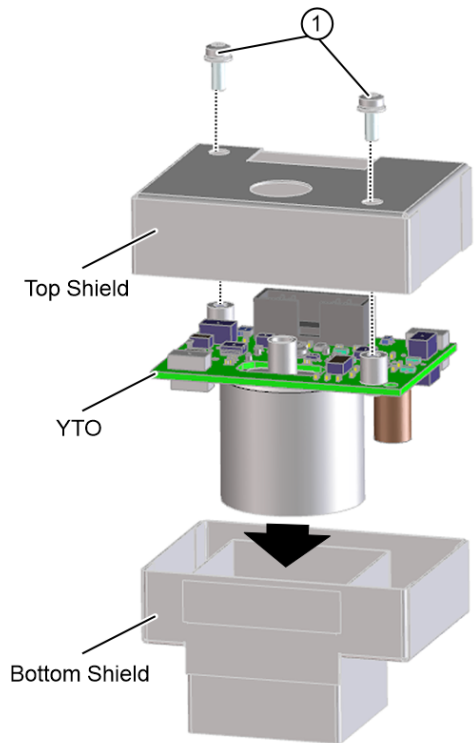
Replace A20 Yig Tuned Oscillator

1. Refer to **Figure 22-24**. Place the new YTO into the shields and secure with the two screws **(1)** (0515-0372). Torque to 9 inch-pounds.

NOTE

Before securing the top shield to the YTO ensure that the locking tabs on the YTO's W10 ribbon cable receiver are in the up position.

Figure 22-24



2. Refer to **Figure 22-22**. Place the YTO into the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
3. Referring to **Figure 22-22** connect the semi-rigid cable W60 using a 5/16 inch open-end wrench. Torque to 10 inch-pounds.
4. Replace the ribbon cable W10. Ensure the locking tabs are engaged.

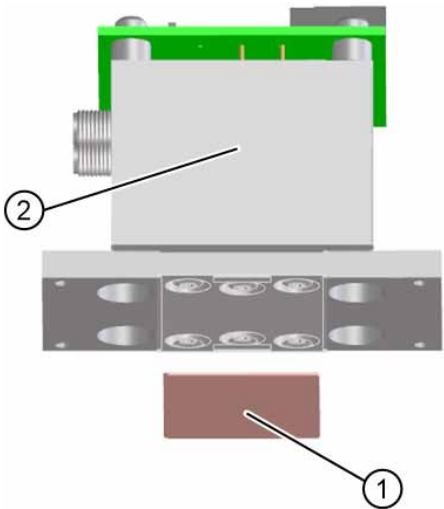
Table 22-6 A20 Yig Tuned Oscillator Related Parts

Item	Keysight Part Number
A20	N9020-60009
W10	N9020-60024
W60	N9032-20026

Replace A12 Yig Tuned Filter

1. Inspect the chassis where the YTF mounts and remove the gap pad if present (see [Figure 22-25](#), item (1)). The gap pad may remain attached to the faulty YTF.
2. Refer to [Figure 22-25](#). Install the replacement gap pad (1) into the recess in the base of the replacement YTF (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 22-25 Gap Pad Installation



3. Refer to [Figure 22-20](#). Place the YTF into the chassis with the connector for the control wire harness toward the rear of the instrument. Replace the four screws (6) (0515-0372). Torque to 9 inch-pounds.
4. Referring to [Figure 22-20](#), connect the wire harness W23 to the A12 YTF.
5. Refer to [Figure 22-20](#). Using a 5/16 inch open-end wrench, re-install the semi-rigid cable (2) from the RF Input Connector (3) to the A9 Attenuator. Torque to 10 inch-pounds.

Table 22-7 A12 Yig Tuned Filter Related Parts

Item	Keysight Part Number
A12	5087-7382
A12MP1	5022-7179
W23	N9032-60009

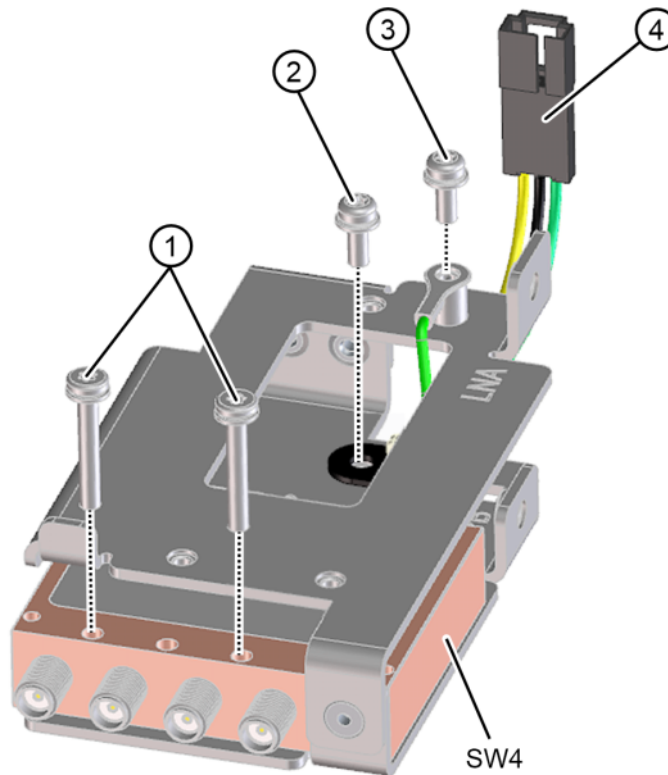
Replace SW4 Microwave Preselector Bypass Switch

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

1. Referring to **Figure 22-26**, install the SW4 MPB switch into the lower switch bracket and attach it with the two panhead screws (1) (0515-1410). Torque the screws to 9 in-lbs.
2. Attach the SW4 MPB switch wire harness to the lower switch bracket with the panhead screw (2) (0515-0372) and its ground wire with the panhead screw (3) (0515-0372). Torque the screws to 9 in-lbs.

Figure 22-26 SW4 MPB Switch Installation



3. Referring to **Figure 22-18**, attach the SW4 bracket to the instrument chassis using the two panhead screws (1) (0515-0372). Torque the screws to 9 in-lbs.
4. Referring to **Figure 22-18**, re-attach the semi-rigid cables W40, W41 and W42 to the SW4 MPB switch (1) using the 5/16 inch wrench. Torque each to 10 inch-pounds.

5. Referring to **Figure 22-26**, connect the SW4 MPBS wire harness **(4)** to W21 wire harness.

Table 22-8 SW4 Microwave Preselector Bypass Switch Related Parts

Item	Keysight Part Number
SW4	N9048-60004
W21	N9048-60027
W40	N9032-20012
W41	N9032-20013
W42	N9032-20011

Replace SW2 Low Noise Amplifier Switch

- 1. Refer to **Figure 22-27**. To replace the switch, place the SW2 switch in position on top of the LNA switch bracket. Secure with two pan-head screws **(2)** (**0515-1410**) using a T-10 driver. Torque to 9 inch-pounds.
- 2. Secure the SW2 LNA switch wire harness screw **(3)** (**0515-0372**) using a T-10 driver. Torque to 9 inch-pounds.
- 3. Connect the SW2 LNA switch wire harness to the W20 Wire Harness **(4)**.
- 4. Using the 5/16 inch wrench, connect the W33 semi-rigid cable from the SW2 LNA switch to the A10 Attenuator B **(5)**. Torque to 10 inch-pounds.

Figure 22-27

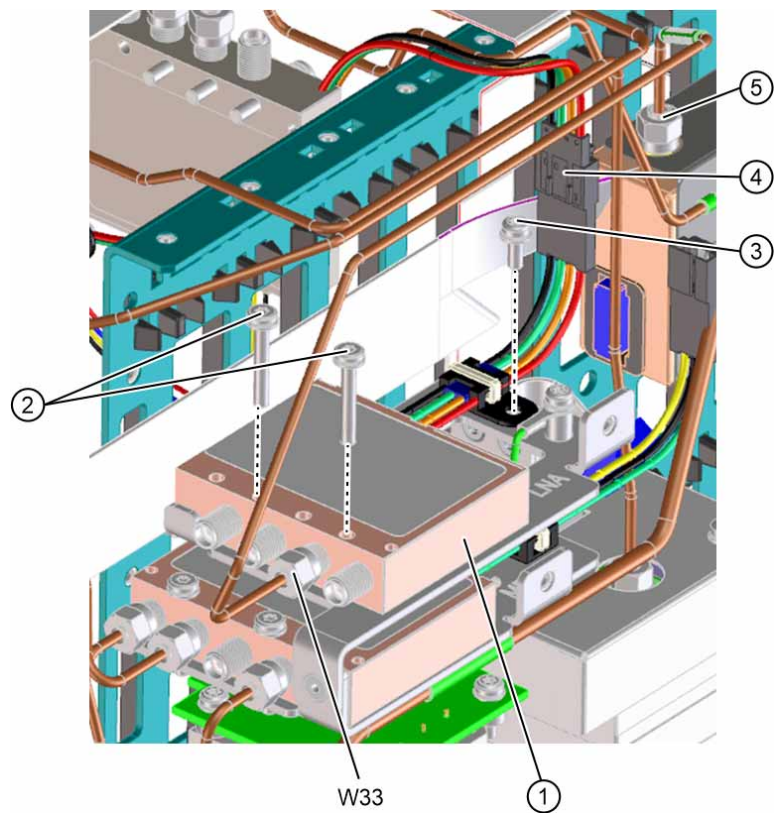


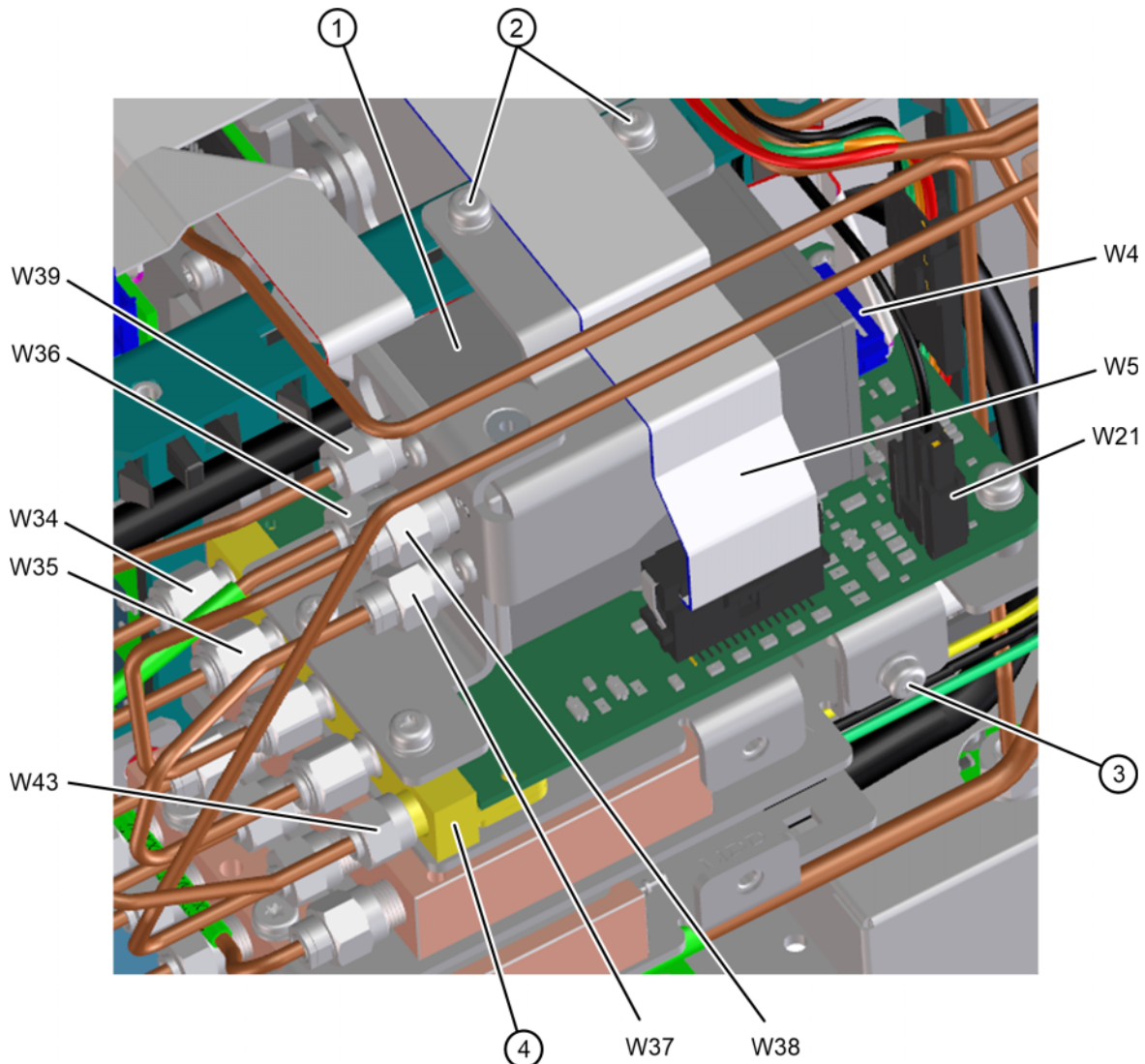
Table 22-9 SW2 Low Noise Amplifier Switch Related Parts

Item	Keysight Part Number
SW2	N9032-60001
W20	N9032-60007 (A23 IF Mux N9041-60163)
	N9032-60020 (All Others)
W33	N9032-20000

Replace SW3 Low Noise Path Switch and A11 Band Switch

1. For instructions on replacing the SW3 Low Noise Path Switch or the A11 Band Switch individually, refer to **“SW3 Low Noise Path Switch and A11 Band Switch”** on page 639.
2. To install the combined SW3 LNP switch and A11 Band switch back into the RF area refer to **Figure 22-28**. Connect the W4 ribbon cable to the SW3 LNP switch.

Figure 22-28 Low Noise Path Switch and Band Switch Replacement



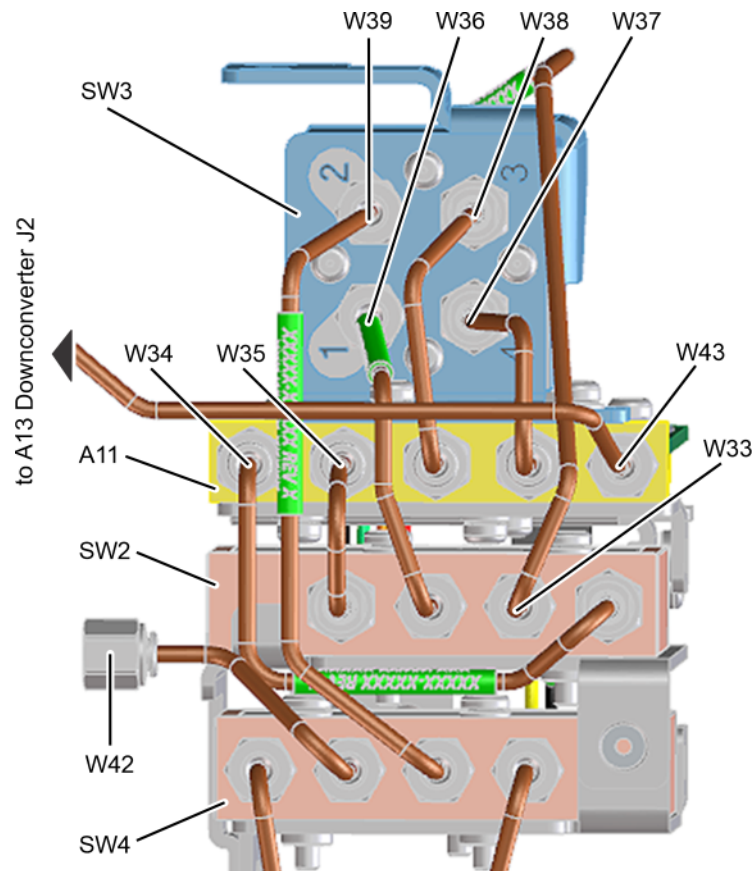
3. Place the combined SW3/A11 switch bracket onto the LNA bracket and secure with one screw (3) (0515-0372) using a T-10 driver. Torque to 9 inch-pounds.

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

4. Secure the top of the LNP bracket to the chassis with two screws (2) (0515-1940) using a T-10 driver. Torque to 9 inch-pounds.
5. Connect the W5 and W21 ribbon cables to the A11 Band switch.
6. Refer to Figure 22-29. Using the 5/16 inch wrench, connect the semi-rigid cables W34, W35, and W43 to the A11 Band switch. Torque to 10 inch-pounds.

Figure 22-29 Switch Area Cables (with Options 508, 513, 526)



7. Using the 5/16 inch wrench, connect the semi-rigid cables W36, W37, W38, and W39 to the SW3 LNP switch. Torque to 10 inch-pounds.

Table 22-10 SW3 LNP Switch and A11 Band Switch Related Parts

Item	Keysight Part Number
A11	N9040-60100
SW3	87222-60026
W4	N9020-60087
W5	N9020-60092
W21	N9048-60027
W34	N9032-20015
W35	N9032-20014
W36	N9032-20007
W37	N9032-20010
W38	N9032-20009
W39	N9032-20008
W43	N9032-20016

RF Area (Options 544, 550)

Refer to **Figure 22-30** for the location of the RF area components. Refer to **Table 22-30** for a list of components included in the RF area.

Figure 22-30 RF Area Components and Cables (Options 544, 550)

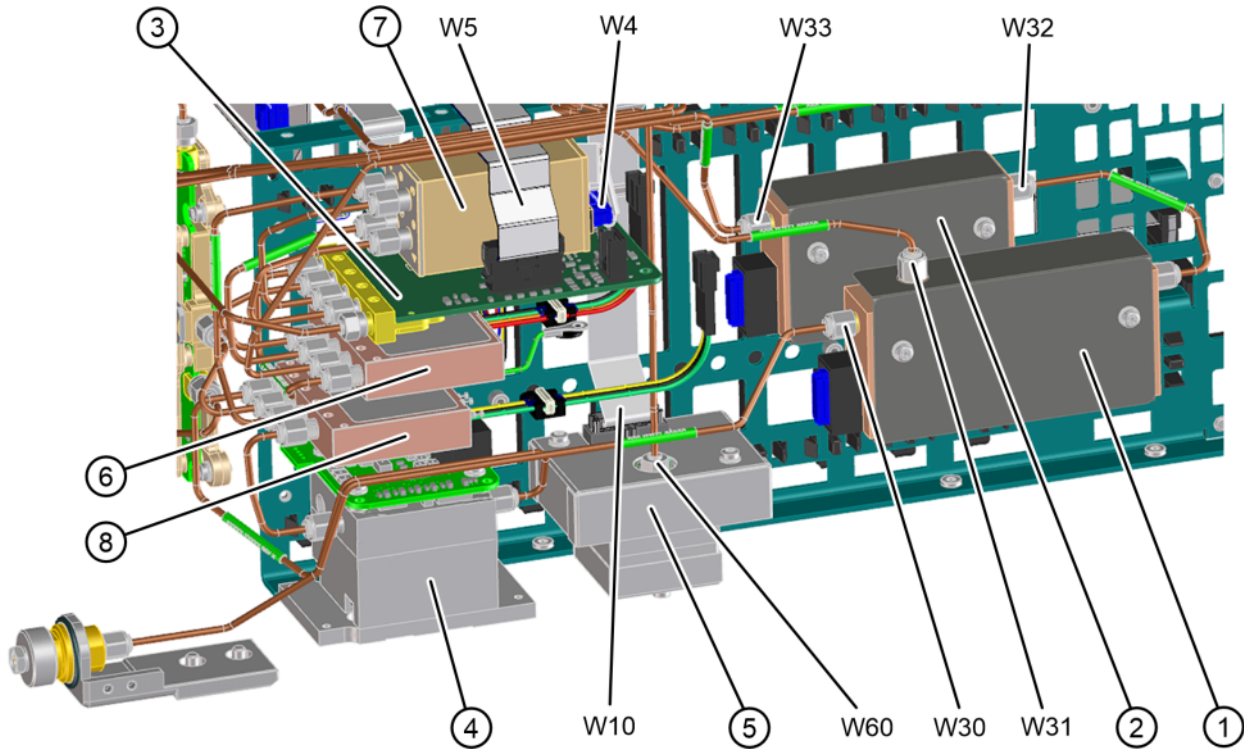


Table 22-11 RF Area

Item	Description
1	A9 Attenuator A
2	A10 Attenuator B
3	A11 Band Switch
4	A12 Yig Tuned Filter
5	A20 Yig Tuned Oscillator
6	SW2 Switch, 4-Port Transfer, Low Noise Amplifier
7	SW3 Switch, 4-Port Transfer, Low Noise Path
8	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch

Table 22-11 **RF Area**

Item	Description
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3

Access to the RF Area Parts

To access RF area parts for removal follow these steps:

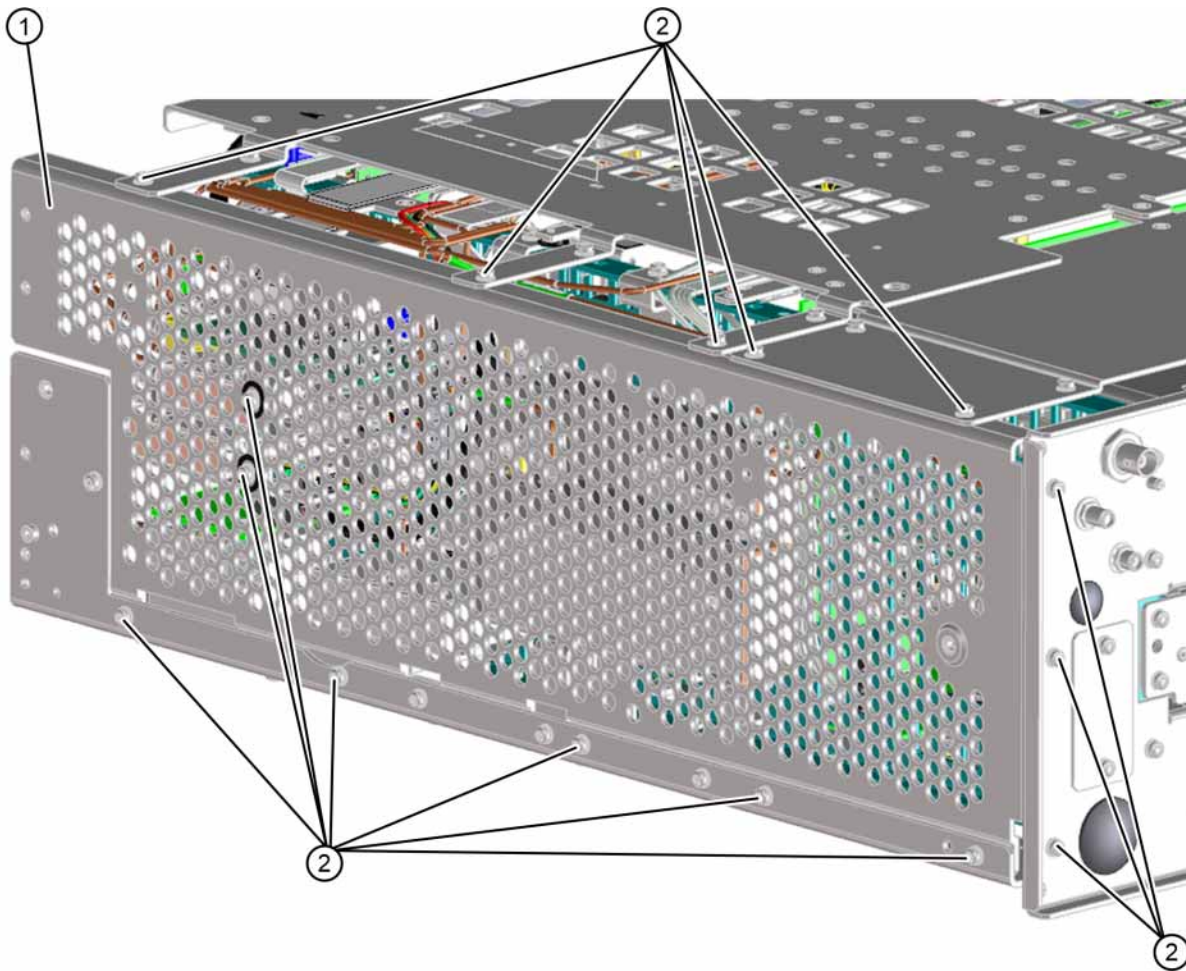
1. Refer to the **Instrument Outer Case** removal procedure and remove the outer case.
2. Refer to the **Front Frame Assembly** removal procedure and remove the front panel.
3. Refer to **Figure 22-31**. Using the T-10 driver, remove the RF bracket (1) by removing the fifteen screws (2) (0515-0372).

NOTE

Before re-securing the RF bracket, ensure that all RF area cables and wire harnesses are securely fastened in place.

Figure 22-31

RF Side Bracket Removal

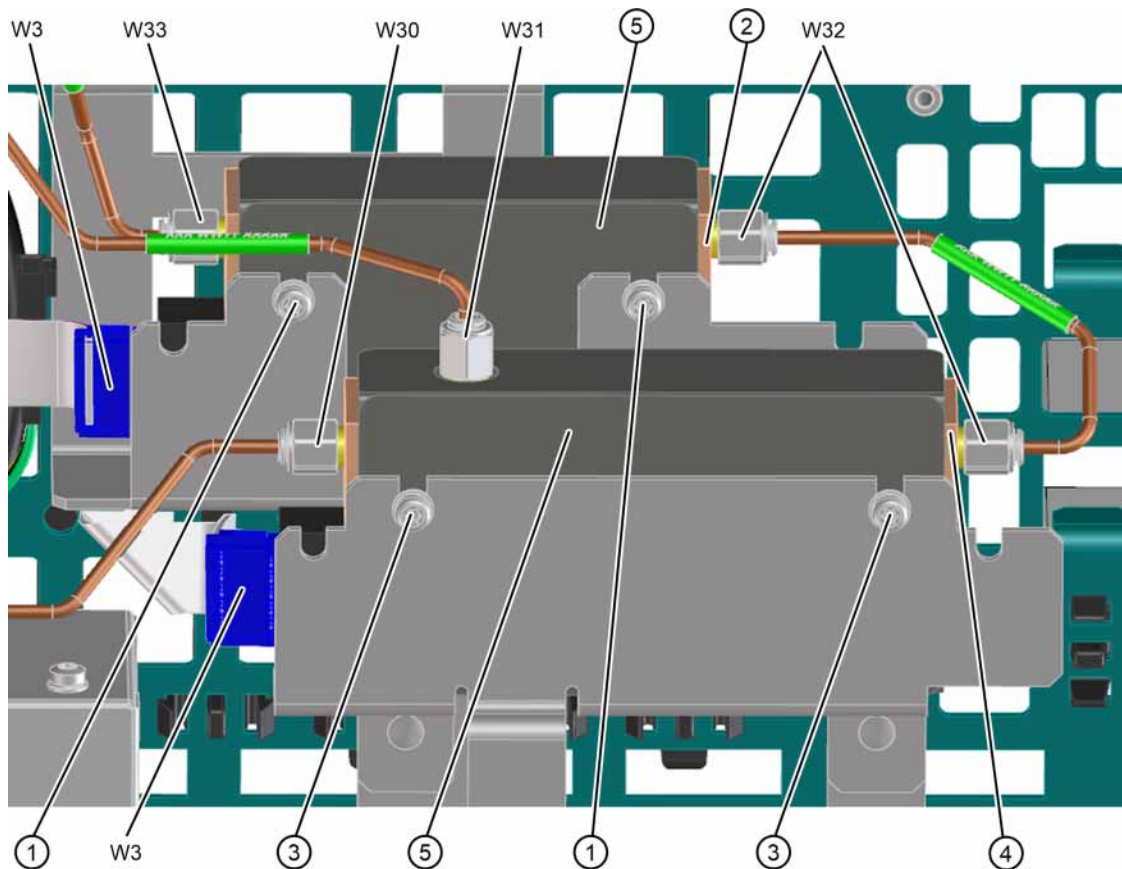


A9 & A10 RF Attenuators

Removal

1. Refer to **Figure 22-32**. Using the 5/16 inch wrench, remove the semi-rigid cables W30, W31, W32, and W33.
2. Remove, or loosen, the two screws **(1)** (0515-0372) from the A10 Attenuator B bracket.
3. Lift up the A10 Attenuator B **(2)** and disconnect the ribbon cable W3. Remove the attenuator.
4. Remove, or loosen, the two screws **(3)** (0515-0372) from the A9 Attenuator A bracket.
5. Lift up A9 Attenuator A **(4)** and disconnect the ribbon cable W3. Remove the attenuator.
6. Each attenuator has a magnetic shield **(5)** that can be removed after the preceding steps are complete.

Figure 22-32 Attenuators Removal



Replacement

1. Slip the magnetic shield (5) on to each attenuator.
2. Refer to **Figure 22-32**. Reconnect the ribbon cable W3 to A9 Attenuator A (5).
3. Reposition the A9 Attenuator A in the lower attenuator bracket.
4. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
5. Reconnect the ribbon cable W3 to A10 Attenuator B (3).
6. Reposition the A10 Attenuator B in the upper attenuator bracket.
7. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
8. Reconnect the semi-rigid cables W30, W31, W32, and W33 using the 5/16 inch wrench. Torque to 10 inch-pounds.

Table 22-12 A9 & A10 RF Attenuator Related Parts

Item	Keysight Part Number
A9	33326-60020
A10	33325-60027
W3	E4410-60157
W30	N9032-20049
W31	N9032-20034
W32	N9032-20047
W33	N9032-20033

SW3 Low Noise Path Switch and A11 Band Switch

Removal

1. Refer to **Figure 22-33**. Using the 5/16 inch wrench, remove the semi-rigid cables W36, W37, W38, and W39 from the SW3 Low Noise Path Switch **(1)**.
2. Remove the semi-rigid cables W34, W35, and W43 from the A11 Band Switch **(4)** using the 5/16 inch wrench.
3. Disconnect the ribbon cables W5 and W21 from the A11 Band Switch.
4. Remove the two screws **(2)** **(0515-1940)** from the LNP bracket using the T-10 driver.
5. Remove the screw **(3)** **(0515-0372)** from the band switch bracket using the T-10 driver.
6. Disconnect the ribbon cable W4 from the SW3 Low Noise Path Switch.
7. The LNP switch, and band switch, can now be removed together.

Figure 22-33 Low Noise Path Switch and Band Switch Removal

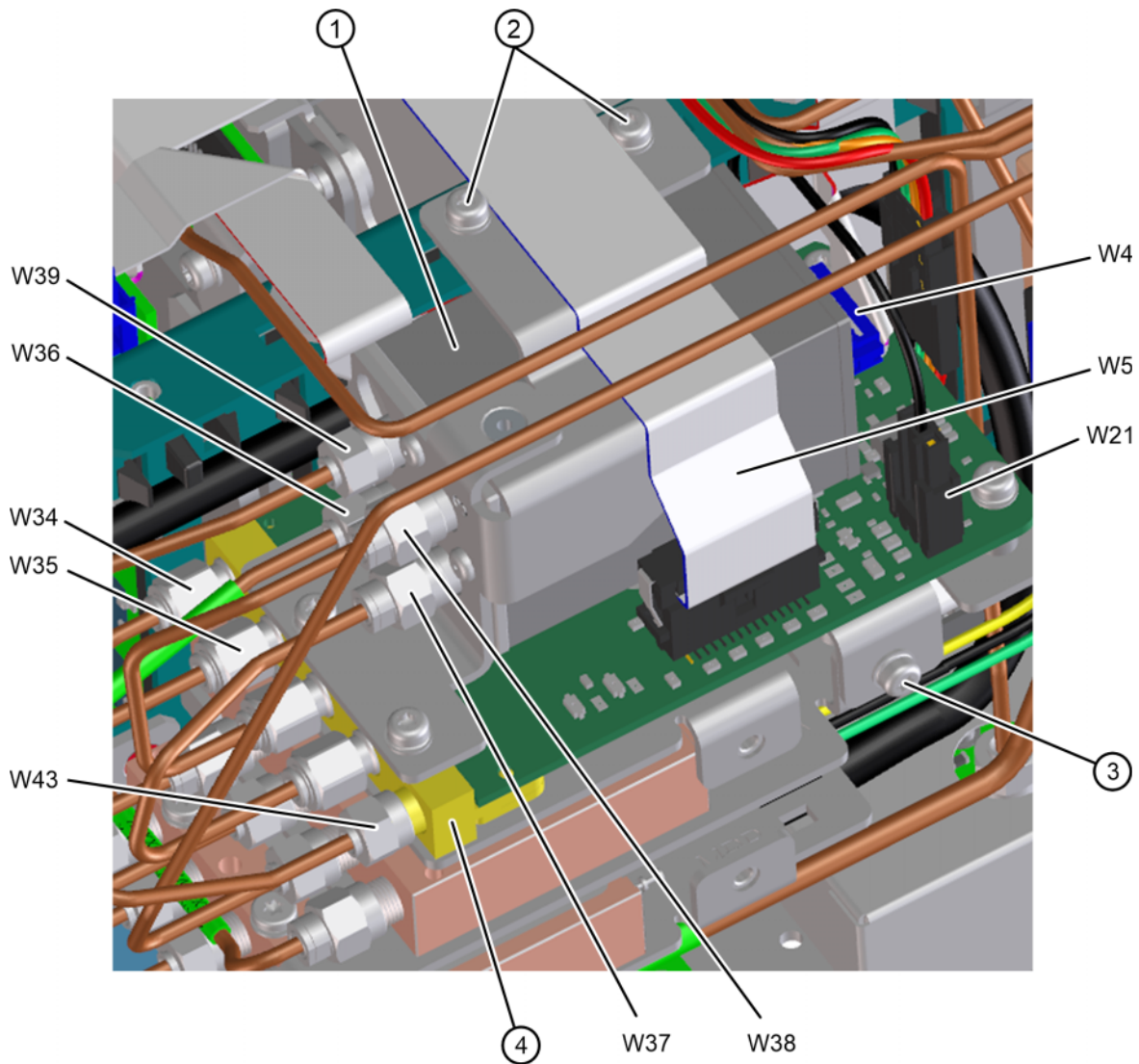
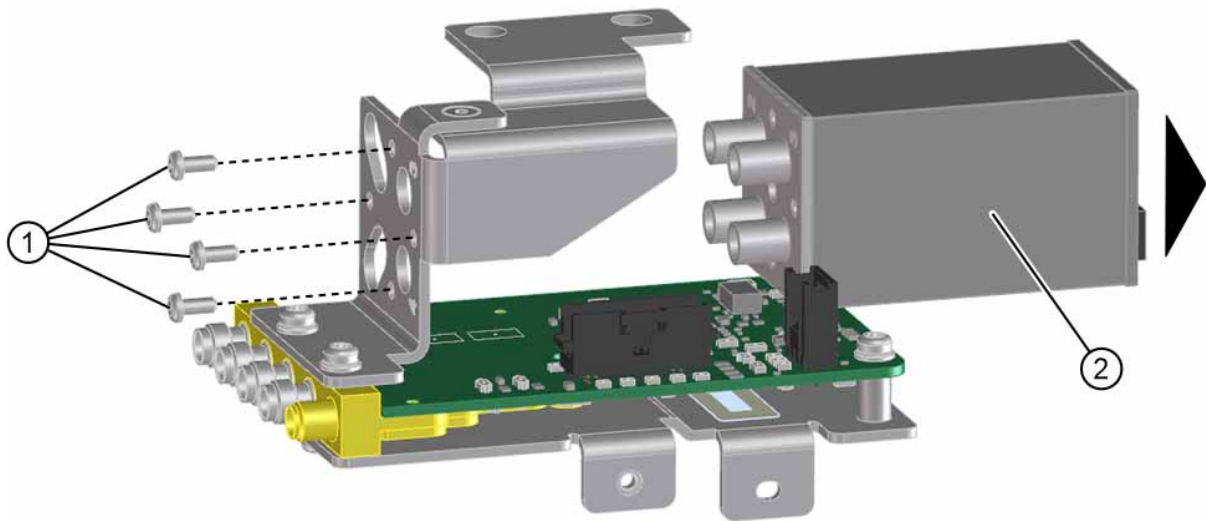


Figure 22-34 Detach LNP Switch from bracket

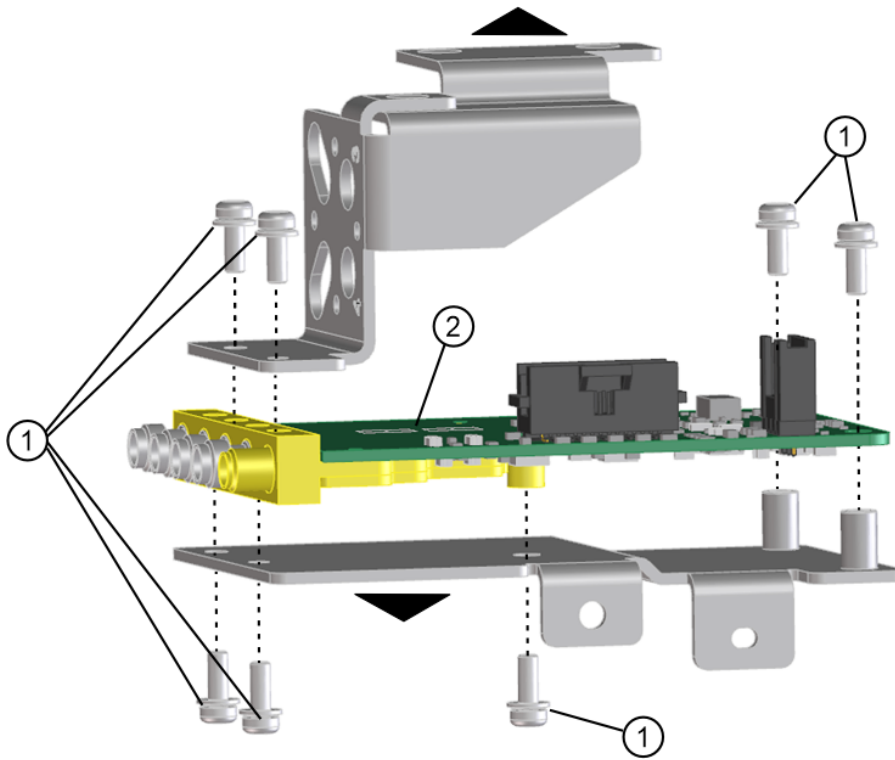


8. Refer to **Figure 22-34**. Using the T-8 driver, remove the four screws (1) (0515-1940).
9. The SW3 Low Noise Path Switch (2) can now be detached from the bracket.

10. Refer to **Figure 22-35**. Remove the seven screws (1) (0515-0372) using the T-10 driver.

11. The A11 Band Switch (2) can now be detached from the upper and lower brackets.

Figure 22-35 Detach Band Switch from brackets



Replacement

Replace A11 Band Switch

1. Refer to **Figure 22-25**. To replace the switch, place the A11 switch **(1)** in position on top of the band switch bracket **(3)**. Secure with the five screws **(2)** (**0515-0372**). Torque to 9 inch-pounds.

Figure 22-36

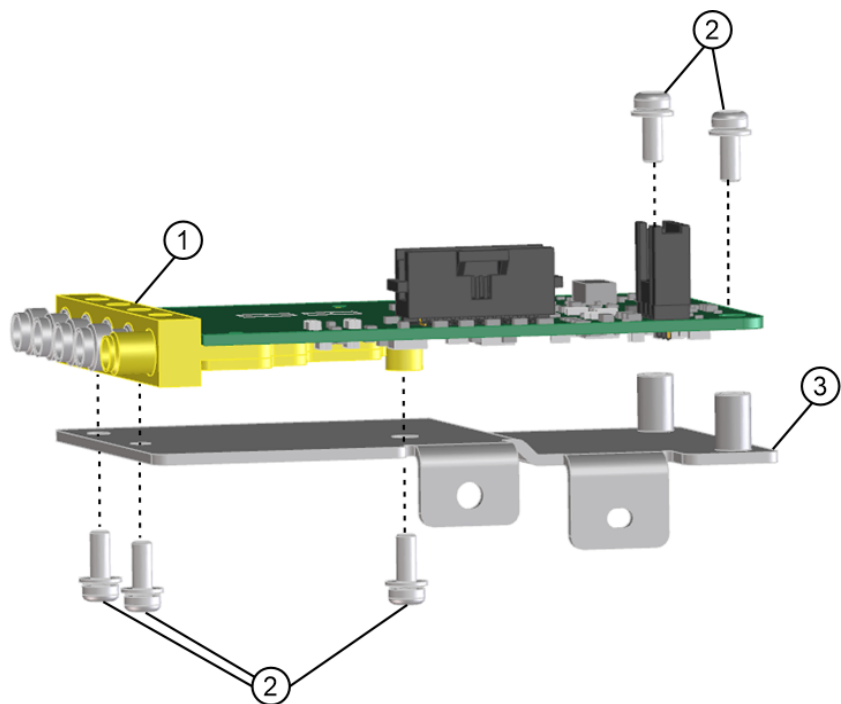


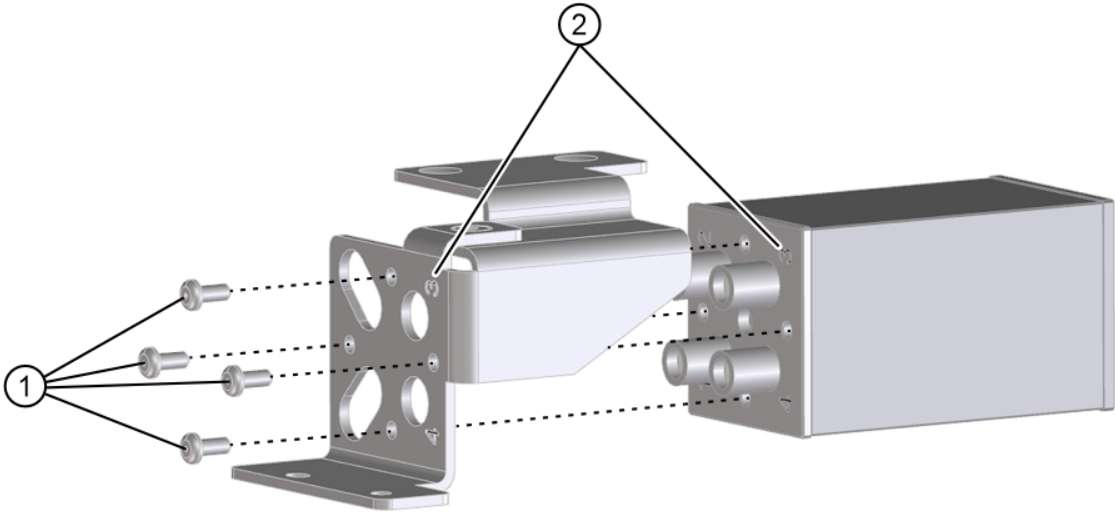
Table 22-13 A11 Band Switch Related Parts

Item	Keysight Part Number
A11	N9040-60100

Replace SW3 LNP Switch

1. Refer to **Figure 22-37**. Before attaching the LNP Switch to the bracket ensure that the numbers displayed on each are aligned with each other.

Figure 22-37



2. Using the T-8 driver, secure the bracket to the LNP switch using the four screws (1) (0515-1940). Torque to 6 inch-pounds.

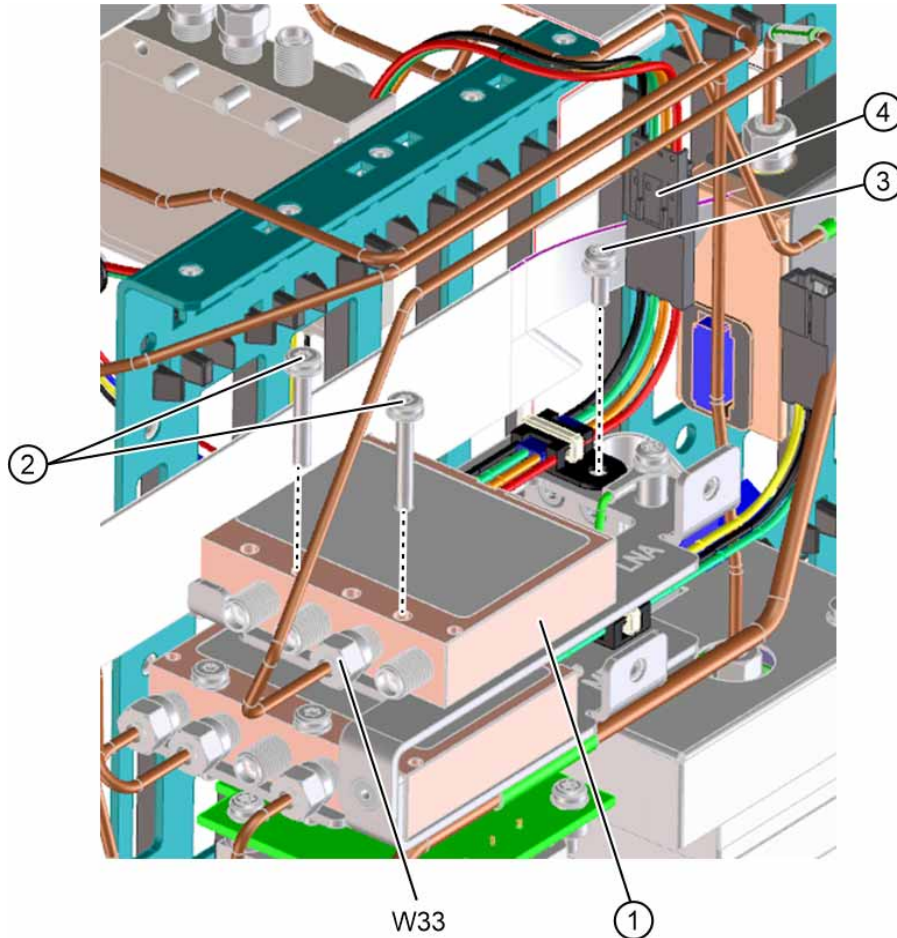
Table 22-14 SW3 LNP Switch Related Parts

Item	Keysight Part Number
SW3	87222-60029

Remove SW2 Low Noise Amplifier Switch

1. With the SW3 Low Noise Path and A11 Band switches removed, refer to **Figure 22-38**. Using the 5/16 inch wrench, remove the semi-rigid cable W33 from the SW2 Low Noise Amplifier Switch **(1)**.

Figure 22-38

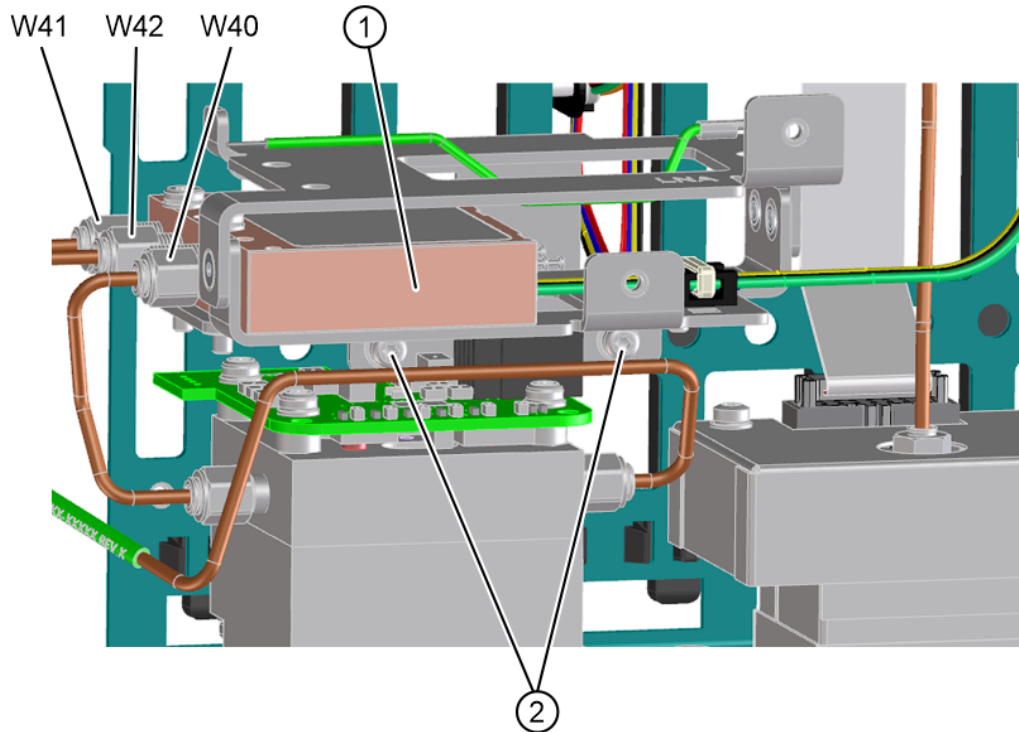


2. Using a T-10 driver, remove the two screws **(2)** (0515-0372).
3. Using a T-10 driver, remove the SW2 LNA switch wire harness screw **(3)**.
4. Lift the SW2 LNA switch away from the assembly. Disconnect the SW2 LNA switch wire harness from the W20 cable **(4)**. The SW2 Low Noise Amplifier Switch can now be removed.

Remove SW4 Microwave Preselector Bypass Switch

1. With the SW2 Low Noise Amplifier Switch removed, refer to **Figure 22-39**. Using the 5/16 inch wrench, remove the semi-rigid cables W41, W42, and W40 from the SW4 MPB switch (1).

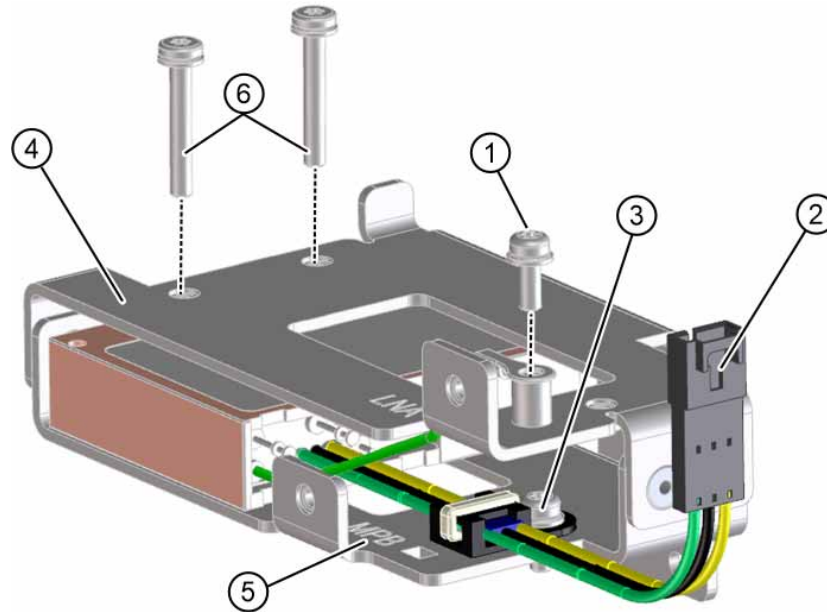
Figure 22-39



2. Using a T-10 driver, remove the two screws (2) (0515-0372) securing the bracket to the chassis.

3. Disconnect the SW4 MPBS wire harness (2).
4. Refer to **Figure 22-40**. Remove the screw (1) (0515-0372) securing the single green MPB switch ground wire (1) to the LNA switch bracket (4).

Figure 22-40

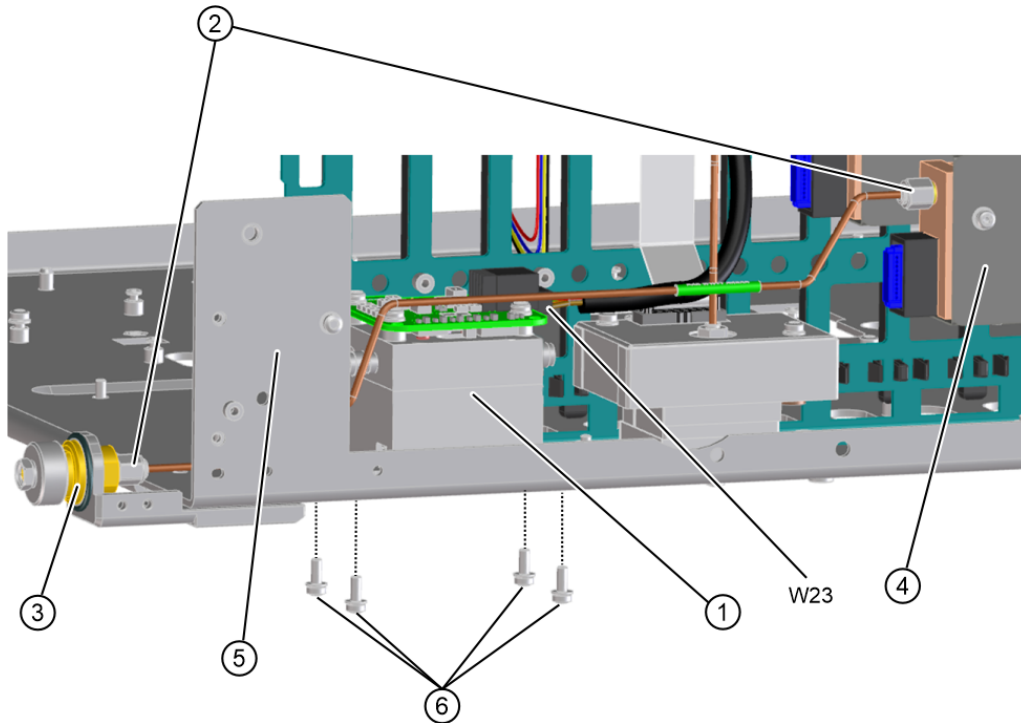


5. Remove the screw (3) (0515-0372) securing the MPB switch wire harness (2) to the MPB-LNA switch bracket (5).
6. Remove the two screws (6) (0515-1410) securing the SW4 MPB switch to the LNA-MPB switch mounting bracket.

Remove A12 Yig Tuned Filter

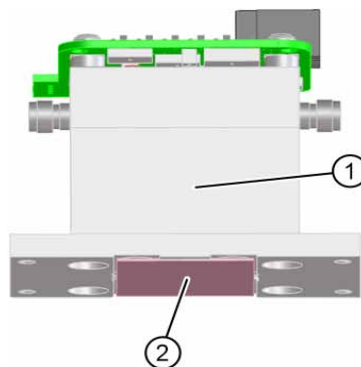
1. Refer to **Figure 22-41**. Using a 5/16 inch open-end wrench, remove the semi-rigid cable (2) from the RF Input Connector (3) and A9 Attenuator A (4).

Figure 22-41



2. Disconnect the wire harness W23.
3. Using a T-10 driver, remove the 4 screws (6) (0515-0372) from the chassis base (5).
4. Refer to **Figure 22-42**. Detach the Yig Tuned Filter (1) from the chassis base. Removal may require slight effort due to residual adhesive on the YTF Gap Pad (2).

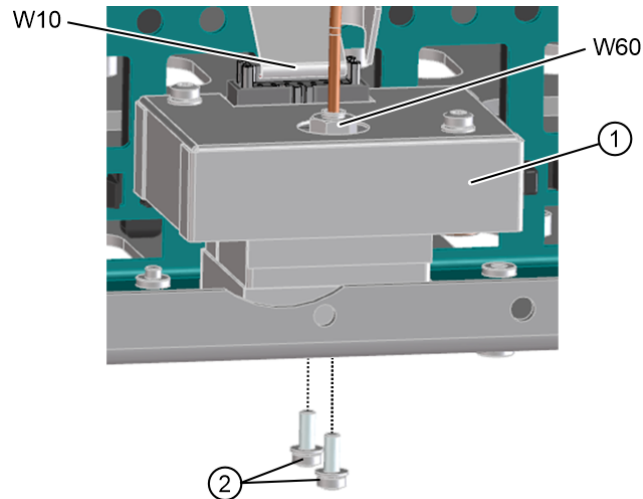
Figure 22-42



Remove A20 Yig Tuned Oscillator

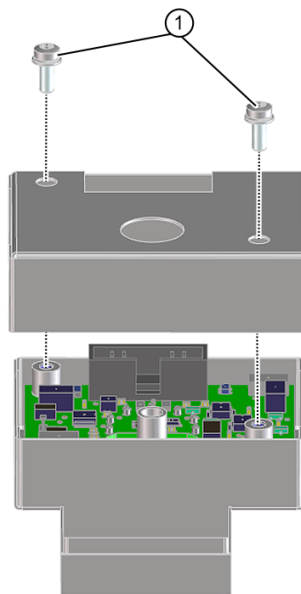
1. Refer to **Figure 22-43**. Using the 5/16 inch wrench, remove the semi-rigid cable W60 from the A20 Yig Tuned Oscillator **(1)**.

Figure 22-43



2. Disconnect the ribbon cable W10 from the A20 Yig Tuned Oscillator **(1)**.
3. Using a T-10 driver remove the 2 screws **(2)** (0515-0372) from the chassis base **(5)**.
4. Refer to **Figure 22-44**. To remove the A20 Yig Tuned Oscillator from the YTO top and bottom shields remove the two screws **(1)** (0515-0372) using a T-10 driver.

Figure 22-44



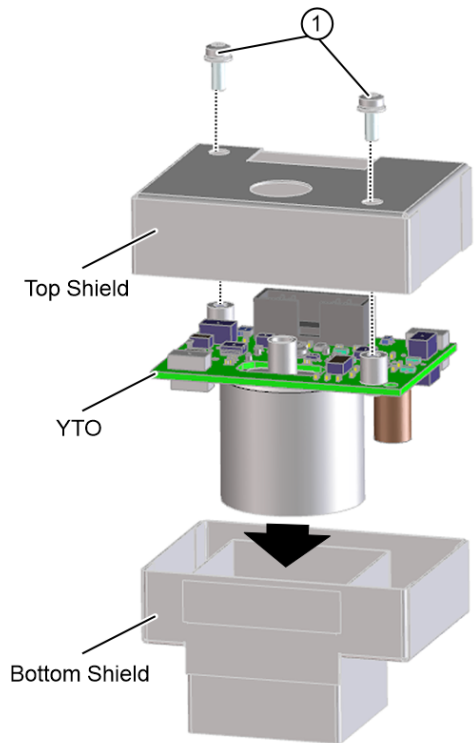
Replace A20 Yig Tuned Oscillator

1. Refer to **Figure 22-45**. Place the new YTO into the shields and secure with the two screws **(1)** (0515-0372). Torque to 9 inch-pounds.

NOTE

Before securing the top shield to the YTO ensure that the locking tabs on the YTO's W10 ribbon cable receiver are in the up position.

Figure 22-45



2. Refer to **Figure 22-43**. Place the YTO into the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
3. Referring to **Figure 22-43**, connect the semi-rigid cable W60 using a 5/16 inch open-end wrench. Torque to 10 inch-pounds.
4. Replace the ribbon cable W10. Ensure the locking tabs are engaged.

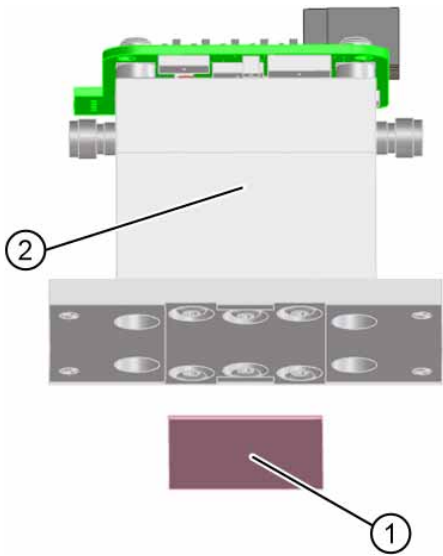
Table 22-15 A20 Yig Tuned Oscillator Related Parts

Item	Keysight Part Number
A20	N9020-60009
A12MP1	5022-7179
W10	N9020-60024
W60	N9032-20026

Replace A12 Yig Tuned Filter

1. Inspect the chassis where the YTF mounts and remove the gap pad if present (see [Figure 22-46](#), item (1)). The gap pad may remain attached to the faulty YTF.
2. Refer to [Figure 22-46](#). Install the replacement gap pad (1) into the recess in the base of the replacement YTF (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 22-46 Gap Pad Installation



3. Refer to [Figure 22-41](#). Place the YTF into the chassis with the connector for the control wire harness toward the rear of the instrument. Replace the four screws (6) (0515-0372). Torque to 9 inch-pounds.
4. Referring to [Figure 22-41](#) connect the wire harness W23 to the A12 YTF.
5. Refer to [Figure 22-41](#). Using a 5/16 inch open-end wrench, re-install the semi-rigid cable (2) from the RF Input Connector (3) to the A9 Attenuator. Torque to 10 inch-pounds.

Table 22-16 A12 Yig Tuned Filter Related Parts

Item	Keysight Part Number
A12	5087-7383
A12MP1	5022-7179
W23	N9032-60009

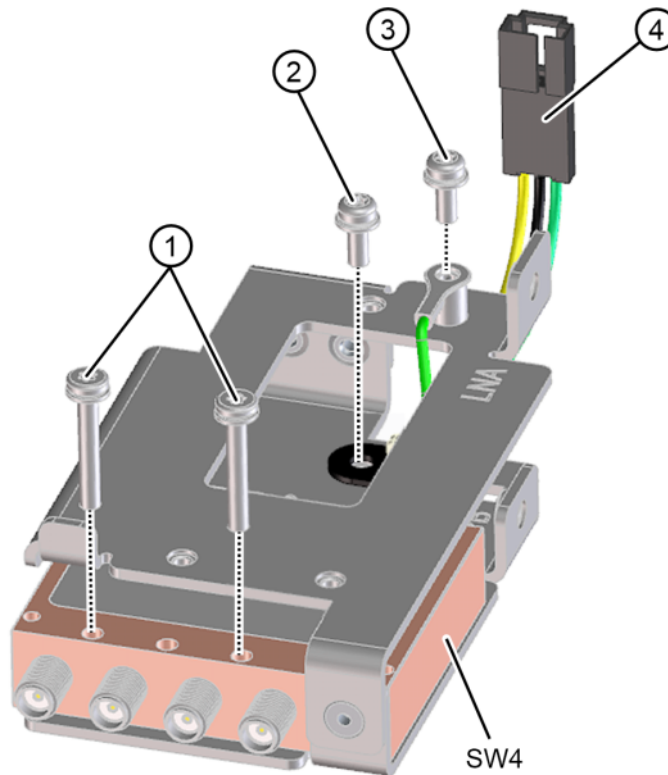
Replace SW4 Microwave Preselector Bypass Switch

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

1. Referring to **Figure 22-47**, install the SW4 MPB switch into the lower switch bracket and attach it with the two panhead screws (1) (0515-1410). Torque the screws to 9 in-lbs.
2. Attach the SW4 MPB switch wire harness to the lower switch bracket with the panhead screw (2) (0515-0372) and its ground wire with the panhead screw (3) (0515-0372). Torque the screws to 9 in-lbs.

Figure 22-47 SW4 MPB Switch Installation



3. Referring to **Figure 22-39**, attach the SW4 bracket to the instrument chassis using the two panhead screws (2) (0515-0372). Torque the screws to 9 in-lbs.
4. Referring to **Figure 22-39**, re-attach the semi-rigid cables W40, W41, and W42 from the SW4 MPB switch (1) using the modified 5/16 inch wrench. Torque each to 10 inch-pounds.

5. Referring to **Figure 22-47**, connect the SW4 MPBS wire harness **(4)** to W21 wire harness.

Table 22-17 SW4 Microwave Preselector Bypass Switch Related Parts

Item	Keysight Part Number
SW4	N9048-60005
W21	N9048-60027
W40	N9032-20043
W41	N9032-20044
W42	N9032-20042

Replace SW2 Low Noise Amplifier Switch

- 1. Refer to **Figure 22-48**. To replace the switch, place the SW2 switch in position on top of the LNA switch bracket. Secure with two pan-head screws **(1)** (**0515-1410**) using a T-10 driver. Torque to 9 inch-pounds.
- 2. Secure the SW2 LNA switch wire harness screw **(3)** (**0515-0372**) using a T-10 driver. Torque to 9 inch-pounds.
- 3. Connect the SW2 LNA switch wire harness to the W20 Wire Harness **(4)**.
- 4. Connect the W33 semi-rigid cable from the SW2 LNA switch to the A10 Attenuator B **(5)** using the 5/16 inch wrench. Torque to 10 inch-pounds.

Figure 22-48

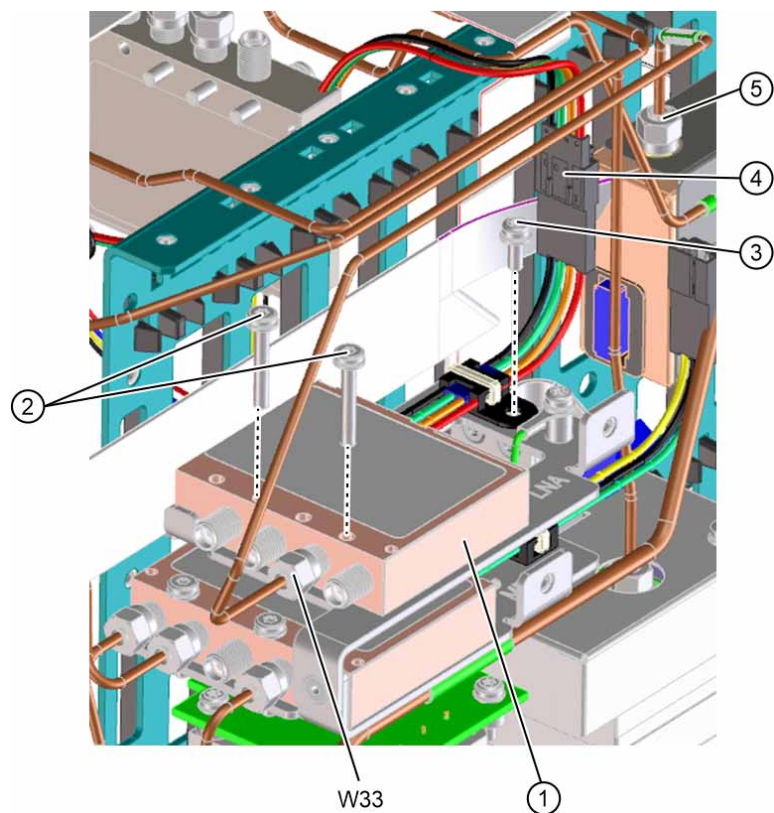


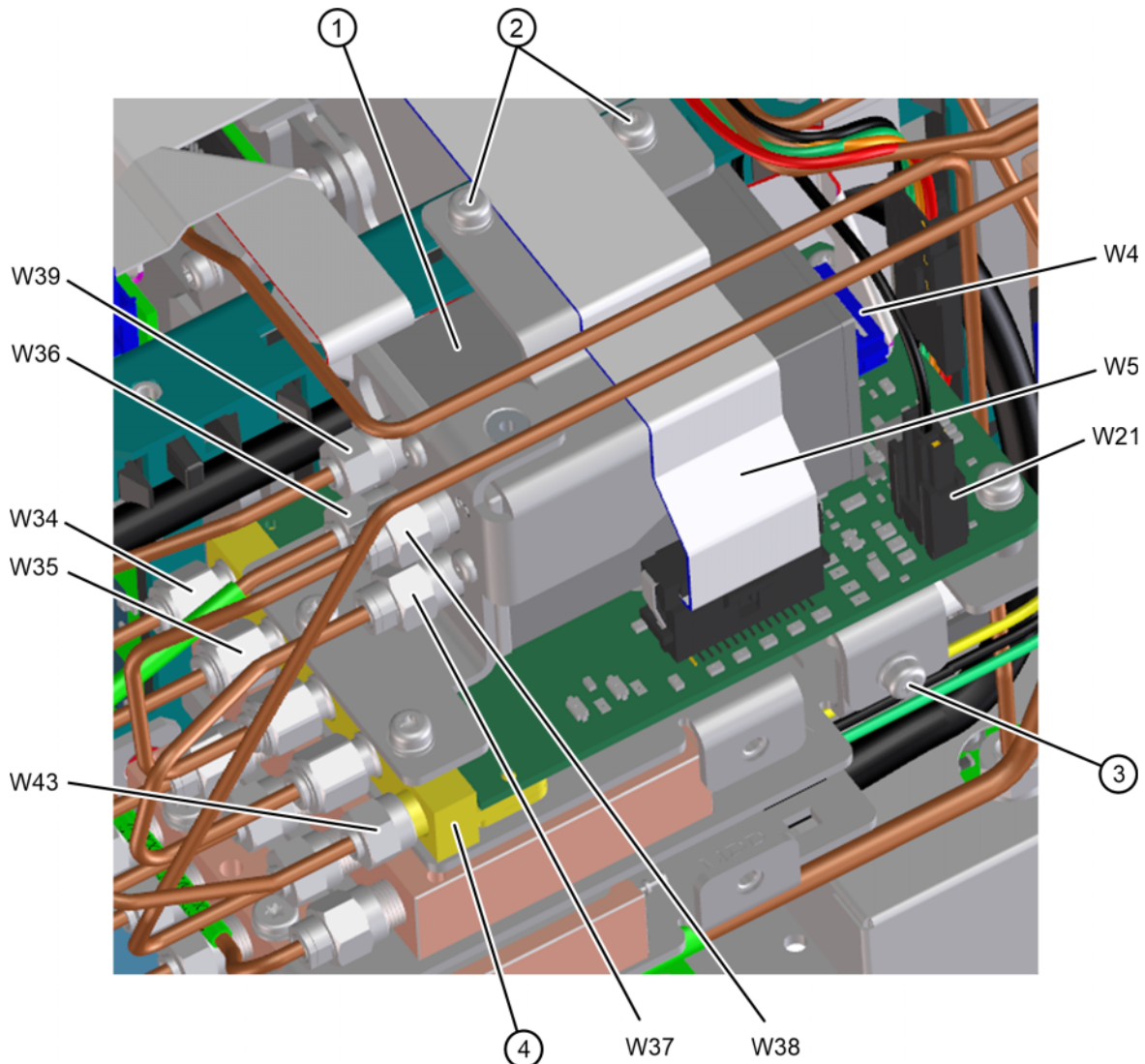
Table 22-18 SW2 Low Noise Amplifier Switch Related Parts

Item	Keysight Part Number
SW2	N9032-60017
W20	N9032-60007 (A23 IF Mux N9041-60163)
	N9032-60020 (All Others)
W33	N9032-20033

Replace SW3 Low Noise Path Switch and A11 Band Switch

1. For instructions on replacing either the SW3 Low Noise Path Switch or A11 Band Switch individually, refer to “**SW3 Low Noise Path Switch and A11 Band Switch**” on page 663.
2. To install the combined SW3 LNP switch and A11 Band switch back into the RF area refer to **Figure 22-49**. Connect the W4 ribbon cable to the SW3 LNP switch.

Figure 22-49 Low Noise Path Switch and Band Switch Replacement



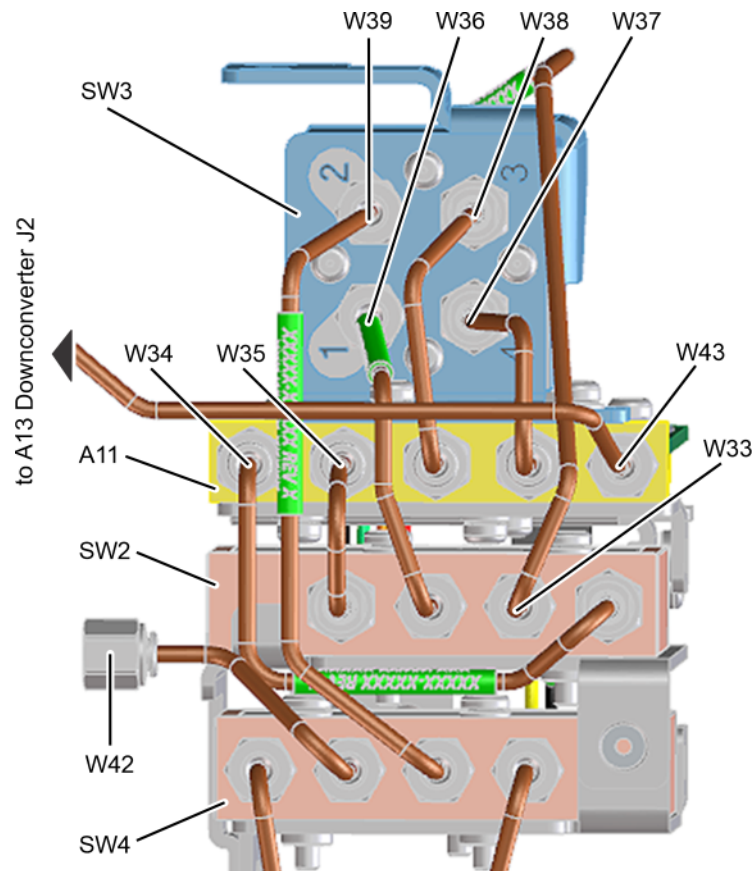
3. Place the combined SW3/A11 switch bracket onto the LNA bracket and secure with one screw (3) (0515-0372) using a T-10 driver. Torque to 9 inch-pounds.

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

4. Using a T-10 driver, secure the top of the LNP bracket to the chassis with two screws (2) (0515-1940). Torque to 9 inch-pounds.
5. Connect the W5 and W21 ribbon cables to the A11 Band switch.
6. Refer to Figure 22-50. Using the 5/16 inch wrench, connect the semi-rigid cables W34, W35, and W43 to the A11 Band switch. Torque to 10 inch-pounds.

Figure 22-50 Switch Area Cables (with Options 544, 550)



7. Using the 5/16 inch wrench, connect the semi-rigid cables W36, W37, W38, and W39 to the SW3 LNP switch. Torque to 10 inch-pounds.

Table 22-19 SW3 LNP Switch and A11 Band Switch Related Parts

Item	Keysight Part Number
A11	N9040-60100
SW3	87222-60029
W4	N9020-60087
W5	N9020-60092
W21	N9048-60027
W34	N9032-20046
W35	N9032-20045
W36	N9032-20038
W37	N9032-20041
W38	N9032-20040
W39	N9032-20039
W43	N9032-20016

RF Area (Options 555)

Refer to **Figure 22-51** for the location of the RF area components. Refer to **Table 22-20** for a list of components included in the RF area.

Figure 22-51 RF Area Components and Cables (Options 555)

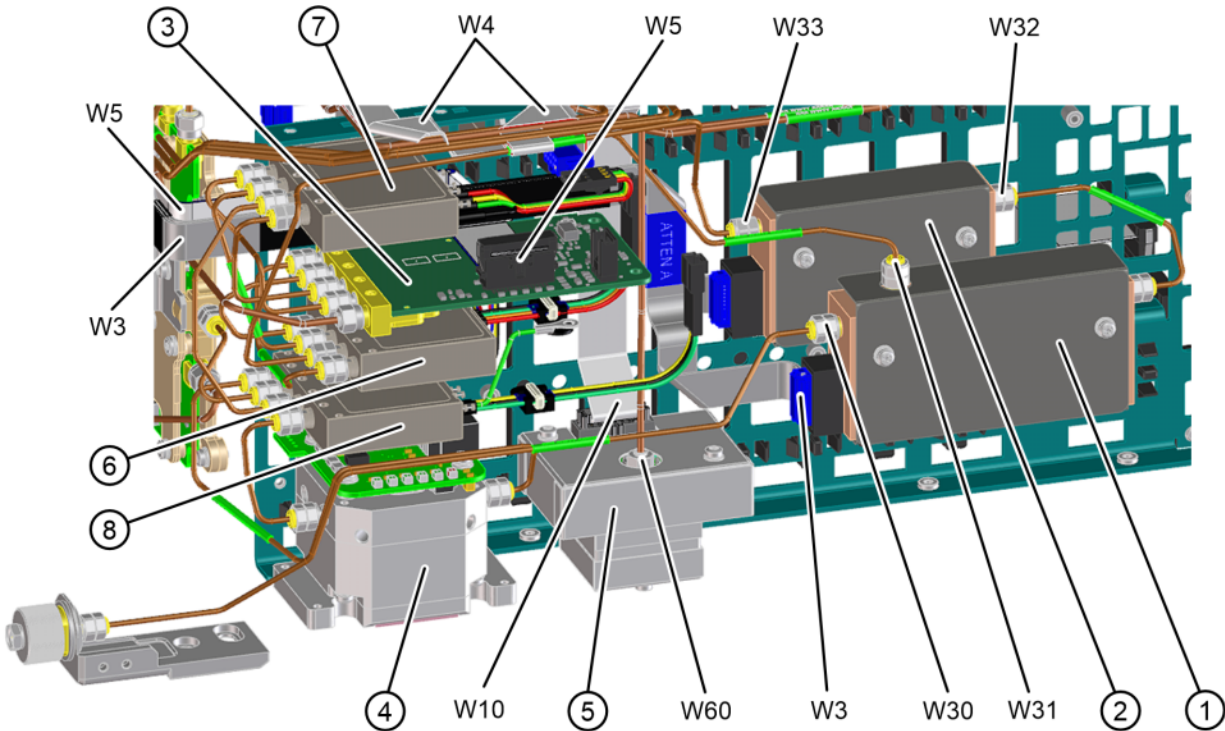


Table 22-20 RF Area

Item	Description
1	A9 Attenuator A
2	A10 Attenuator B
3	A11 Band Switch
4	A12 Yig Tuned Filter
5	A20 Yig Tuned Oscillator
6	SW2 Switch, 4-Port Transfer, Low Noise Amplifier
7	SW3 Switch, 4-Port Transfer, Low Noise Path
8	SW4 Switch, 4-Port Transfer, Microwave Preselector Bypass
W3	Cable, Ribbon, A15 Front End Controller J800 to A9 / A10 Attenuators
W4	Cable, Ribbon, A15 Front End Controller J802 to SW3 LNP Switch

Table 22-20 **RF Area**

Item	Description
W5	Cable, Ribbon, A15 Front End Controller J700 to A11 Band Switch J4
W10	Cable, Ribbon, A14 DDS LO Synthesizer J8 to A20 Yig Tuned Oscillator
W30	Cable, Semi-Rigid, RF Input Connector to A9 Attenuator A Input
W31	Cable, Semi-Rigid, SW1 Calibrator Switch P2 to A9 Attenuator A Calibrator Port
W32	Cable, Semi-Rigid, A9 Attenuator A Output to A10 Attenuator B Input
W33	Cable, Semi-Rigid, A10 Attenuator B Output to SW2 LNA Switch P3
W60	Cable, Semi-Rigid, A20 Yig Tuned Oscillator Output to A14 DDS LO Synthesizer J2

Access to the RF Area Parts

To access RF area parts for removal follow these steps:

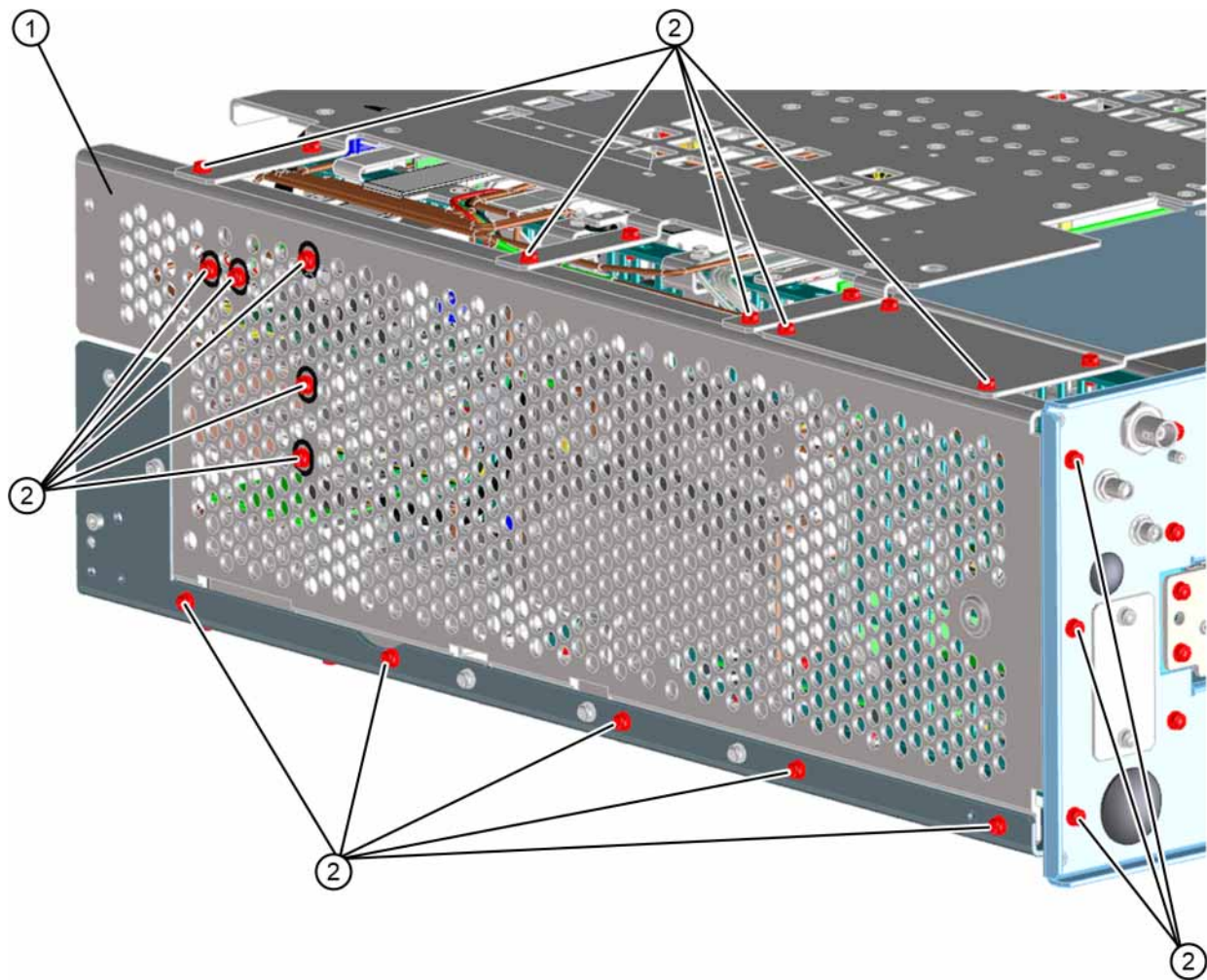
1. Refer to the **Instrument Outer Case** removal procedure and remove the outer case.
2. Refer to the **Front Frame Assembly** removal procedure and remove the front panel.
3. Refer to **Figure 22-52**. Using the T-10 driver, remove the RF bracket (1) by removing the eighteen screws (2) (0515-0372).

NOTE

Before re-securing the RF bracket, ensure that all RF area cables and wire harnesses are securely fastened in place.

Figure 22-52

RF Side Bracket Removal

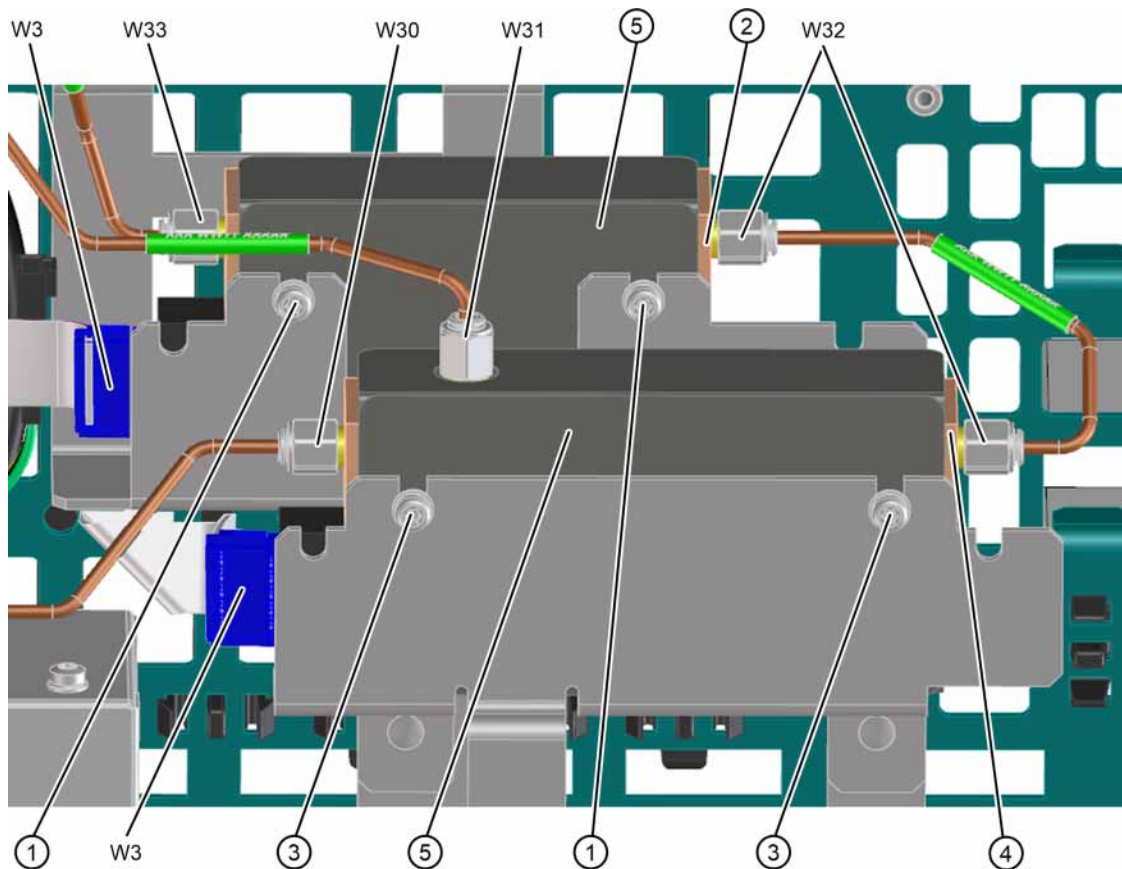


A9 & A10 RF Attenuators

Removal

1. Refer to **Figure 22-53**. Using the 5/16 inch wrench, remove the semi-rigid cables W30, W31, W32, and W33.
2. Remove, or loosen, the two screws **(1)** (0515-0372) from the A10 Attenuator B bracket.
3. Lift up the A10 Attenuator B **(2)** and disconnect the ribbon cable W3. Remove the attenuator.
4. Remove, or loosen, the two screws **(3)** (0515-0372) from the A9 Attenuator A bracket.
5. Lift up A9 Attenuator A **(4)** and disconnect the ribbon cable W3. Remove the attenuator.
6. Each attenuator has a magnetic shield **(5)** that can be removed after the preceding steps are complete.

Figure 22-53 Attenuators Removal



Replacement

1. Slip the magnetic shield (5) on to each attenuator.
2. Refer to **Figure 22-53**. Reconnect the ribbon cable W3 to A9 Attenuator A (5).
3. Reposition the A9 Attenuator A in the lower attenuator bracket.
4. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
5. Reconnect the ribbon cable W3 to A10 Attenuator B (3).
6. Reposition the A10 Attenuator B in the upper attenuator bracket.
7. Replace the two screws (2) (0515-0372) that attach the attenuator to the bracket. Torque to 9 inch-pounds.
8. Reconnect the semi-rigid cables W30, W31, W32, and W33 using the 5/16 inch wrench. Torque to 10 inch-pounds.

Table 22-21 A9 & A10 RF Attenuator Related Parts

Item	Keysight Part Number
A9	33326-60020
A10	33325-60027
W3	N9032-60998
W30	N9032-20115
W31	N9032-20101
W32	N9032-20113
W33	N9032-20100

SW3 Low Noise Path Switch, A11 Band Switch, and A30 Switch Control Adapter

Removal

1. Refer to **Figure 22-54**. Using the 5/16 inch wrench, remove the semi-rigid cables W36, W37, W38, and W39 from the SW3 Low Noise Path Switch **(1)**.
2. Remove the semi-rigid cables W34, W35, and W43 from the A11 Band Switch **(4)** using the 5/16 inch wrench.
3. Disconnect the ribbon cables W5 and W21 from the A11 Band Switch.
4. Remove the two screws **(2)** **(0515-1940)** from the LNP bracket using the T-10 driver.
5. Remove the screw **(3)** **(0515-0372)** from the band switch bracket using the T-10 driver.
6. Disconnect the ribbon cable W4 from the SW3 Low Noise Path Switch.
7. The LNP switch, and band switch, can now be removed together.

Figure 22-54 Low Noise Path Switch and Band Switch Removal

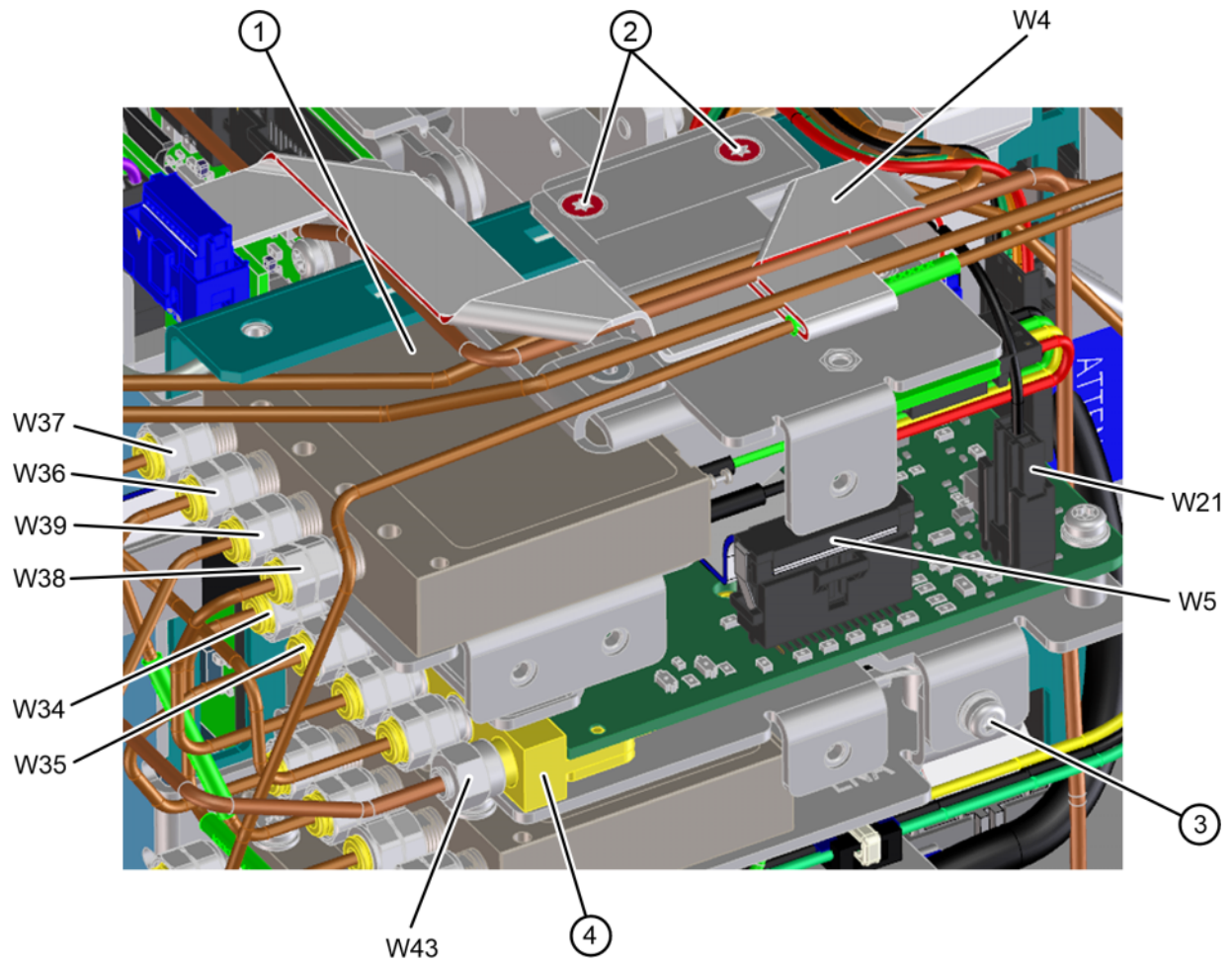
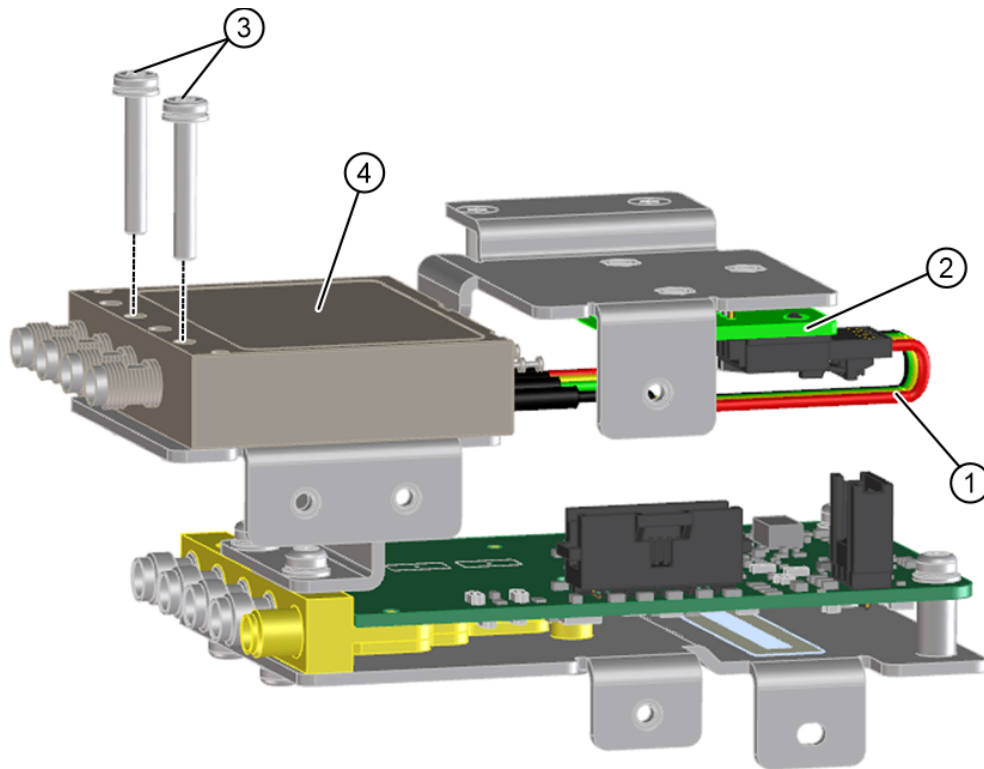


Figure 22-55 Detach LNP Switch from bracket

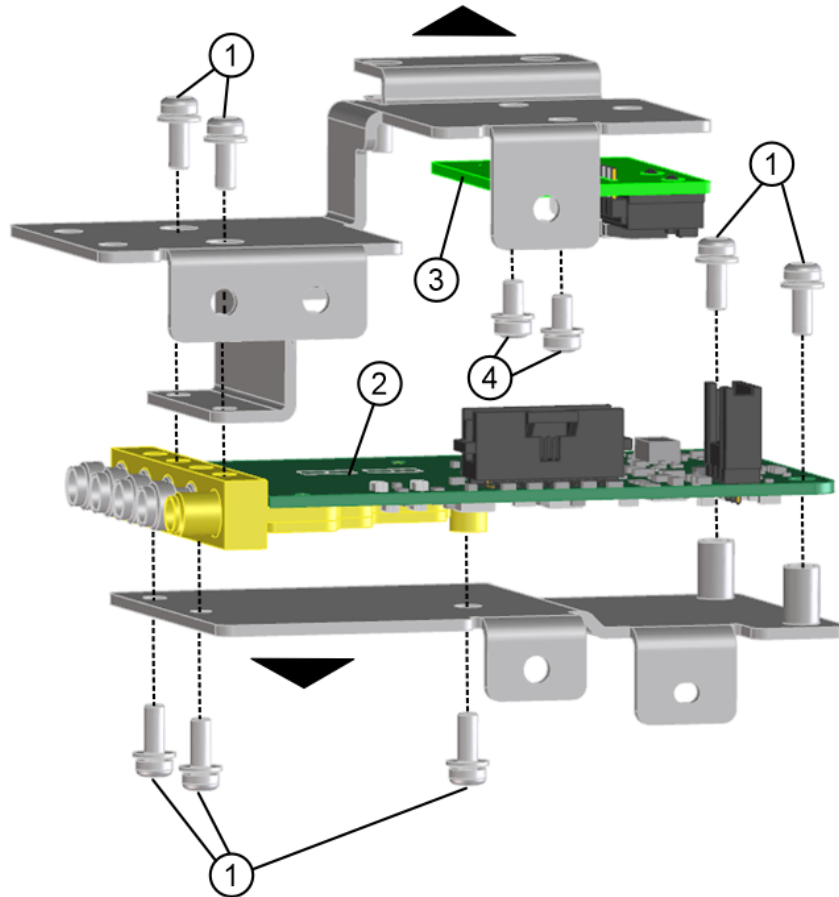


8. Refer to **Figure 22-55**. Disconnect the SW3 wire harness (1) from the A30 Switch Control Adapter board assembly (2).
9. Using the T-10 driver, remove the two screws (3) (0515-1410).
10. The SW3 Low Noise Path Switch (4) can now be detached from the bracket.

11. Refer to **Figure 22-56**. Remove the seven screws (1) (0515-0372) using the T-10 driver.

12. The A11 Band Switch (2) can now be detached from the upper and lower brackets.

Figure 22-56 Detach Band Switch and A30 Switch from brackets



13. The A30 Switch Control Adapter can also be removed at this time. Refer to **Figure 22-56**. Remove the two screws (4) (0515-0430) using the T-10 driver.

Replacement

Replace A11 Band Switch

1. Refer to **Figure 22-57**. To replace the switch, place the A11 switch **(1)** in position on top of the band switch bracket **(3)**. Secure with the five screws **(2)** (**0515-0372**). Torque to 9 inch-pounds.

Figure 22-57

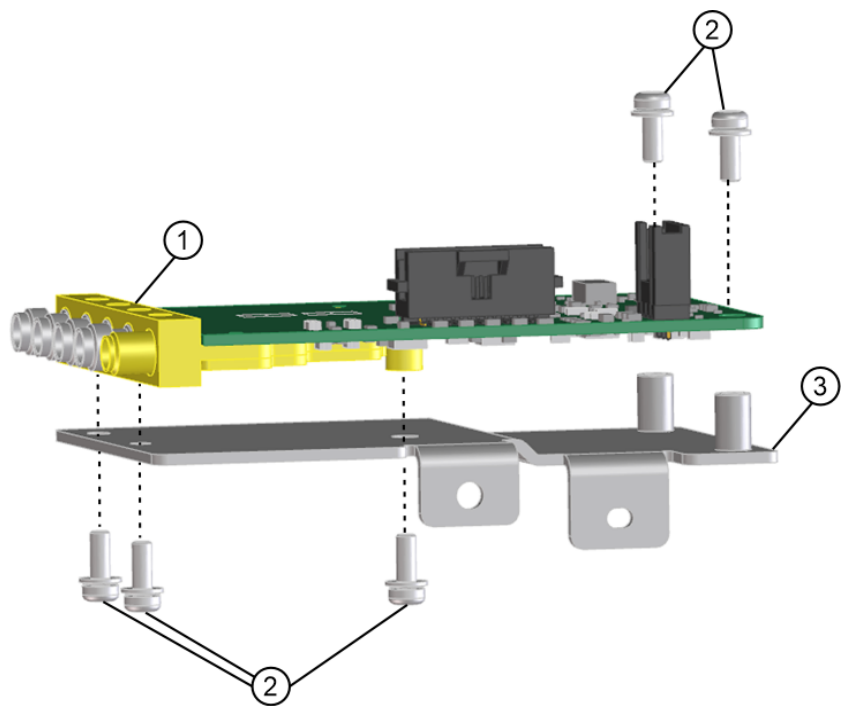


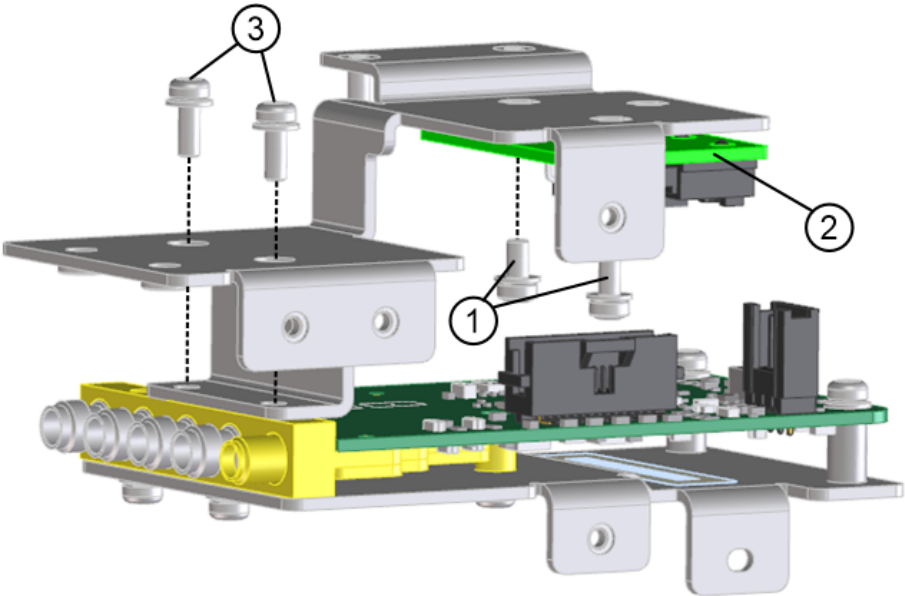
Table 22-22 A11 Band Switch Related Parts

Item	Keysight Part Number
A11	N9040-60100

Replace SW3 LNP Switch and A30 Switch Control Adapter

1. Refer to **Figure 22-58**. Using the T-10 driver, secure the A30 (2) switch to the LNP bracket using the two screws (1) (0515-0430). Torque to 9 inch-pounds.
2. Using the T-10 driver, secure the bracket to the LNP switch using the two screws (3) (0515-0372). Torque to 9 inch-pounds.

Figure 22-58



3. Refer to **Figure 22-55**. Using the T-10 driver, secure the two screws (1) (0515-1410). Torque to 9 inch-pounds.

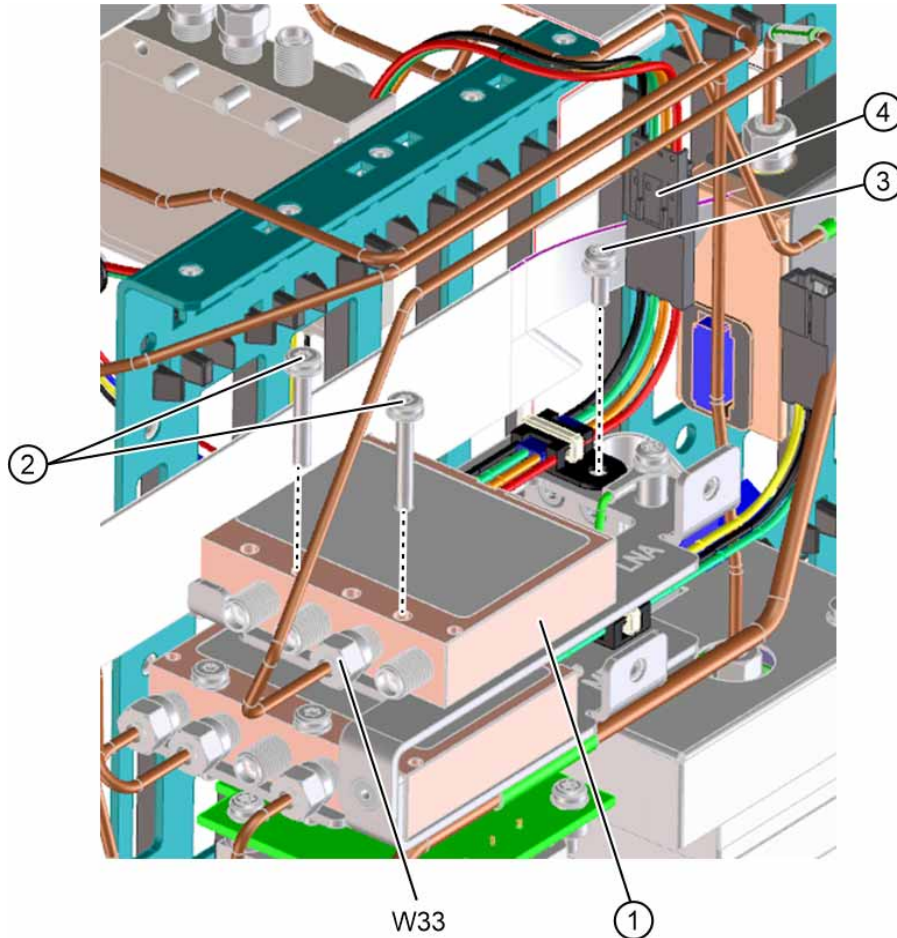
Table 22-23 SW3 LNP Switch Related Parts

Item	Keysight Part Number
A30	N9032-63298
SW3	N9032-60032

Remove SW2 Low Noise Amplifier Switch

1. With the SW3 Low Noise Path and A11 Band switches removed, refer to **Figure 22-59**. Using the 5/16 inch wrench, remove the semi-rigid cable W33 from the SW2 Low Noise Amplifier Switch **(1)**.

Figure 22-59

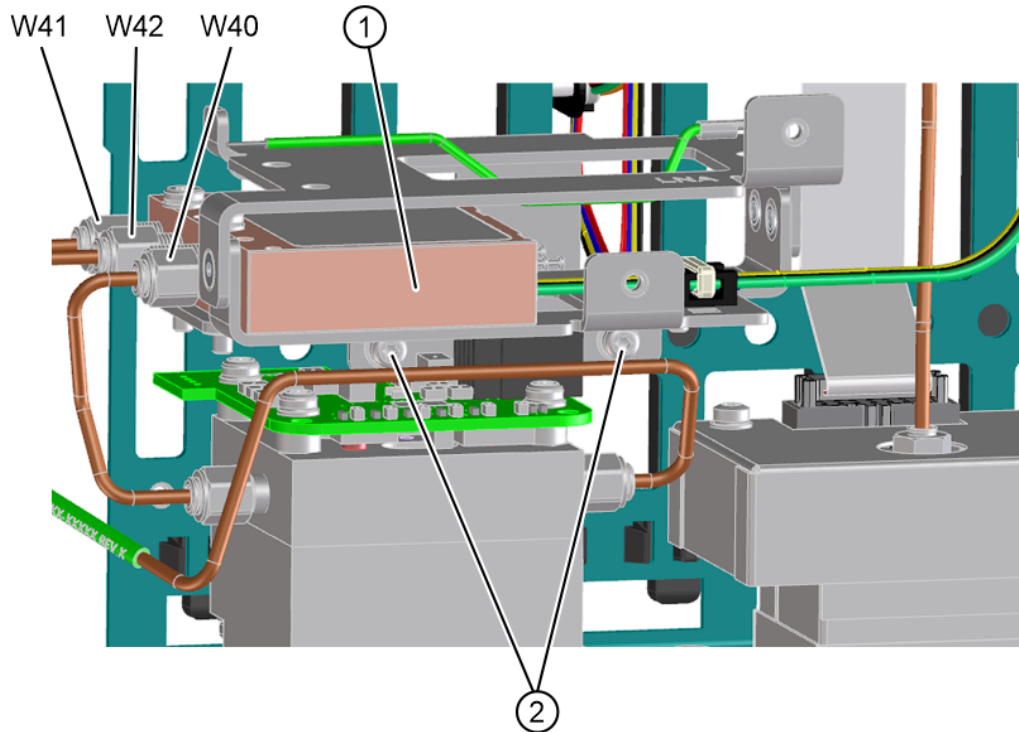


2. Using a T-10 driver, remove the two screws **(2)** (0515-0372).
3. Using a T-10 driver, remove the SW2 LNA switch wire harness screw **(3)**.
4. Lift the SW2 LNA switch away from the assembly. Disconnect the SW2 LNA switch wire harness from the W20 cable **(4)**. The SW2 Low Noise Amplifier Switch can now be removed.

Remove SW4 Microwave Preselector Bypass Switch

1. With the SW2 Low Noise Amplifier Switch removed, refer to **Figure 22-60**. Using the 5/16 inch wrench, remove the semi-rigid cables W41, W42, and W40 from the SW4 MPB switch (1).

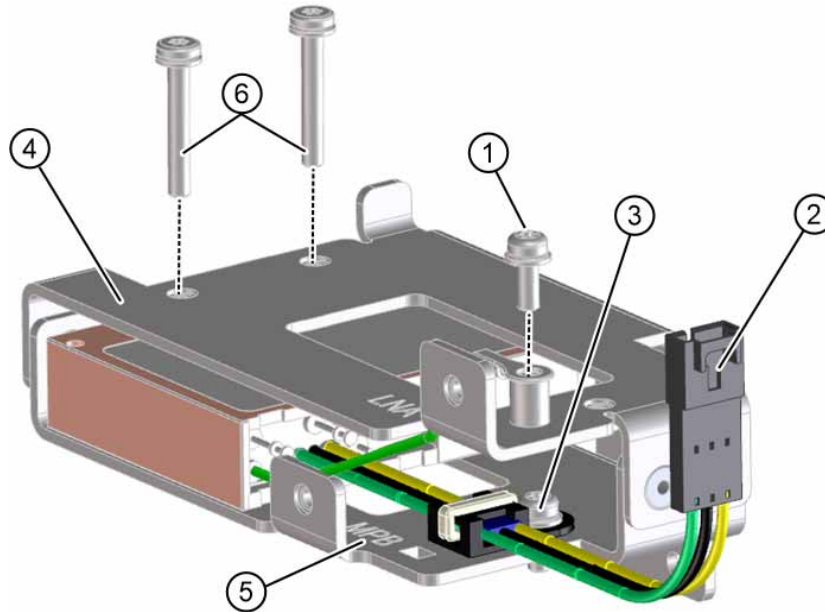
Figure 22-60



2. Using a T-10 driver, remove the two screws (2) (0515-0372) securing the bracket to the chassis.

3. Disconnect the SW4 MPBS wire harness (2).
4. Refer to **Figure 22-61**. Remove the screw (1) (0515-0372) securing the single green MPB switch ground wire (1) to the LNA switch bracket (4).

Figure 22-61

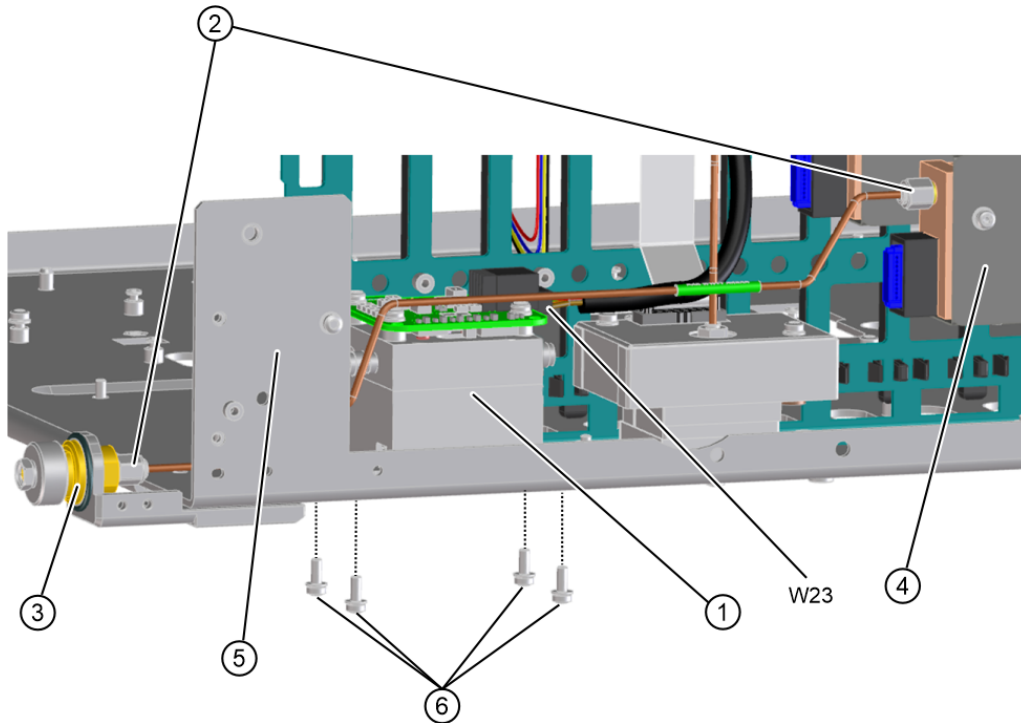


5. Remove the screw (3) (0515-0372) securing the MPB switch wire harness (2) to the MPB-LNA switch bracket (5).
6. Remove the two screws (6) (0515-1410) securing the SW4 MPB switch to the LNA-MPB switch mounting bracket.

Remove A12 Yig Tuned Filter

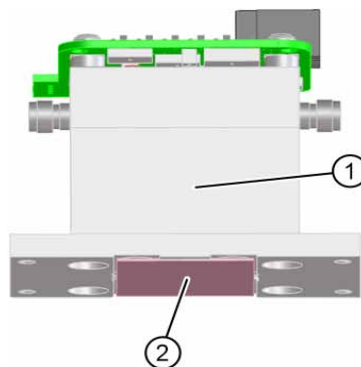
1. Refer to **Figure 22-62**. Using a 5/16 inch open-end wrench, remove the semi-rigid cable (2) from the RF Input Connector (3) and A9 Attenuator A (4).

Figure 22-62



2. Disconnect the wire harness W23.
3. Using a T-10 driver, remove the 4 screws (6) (0515-0372) from the chassis base (5).
4. Refer to **Figure 22-63**. Detach the Yig Tuned Filter (1) from the chassis base. Removal may require slight effort due to residual adhesive on the YTF Gap Pad (2).

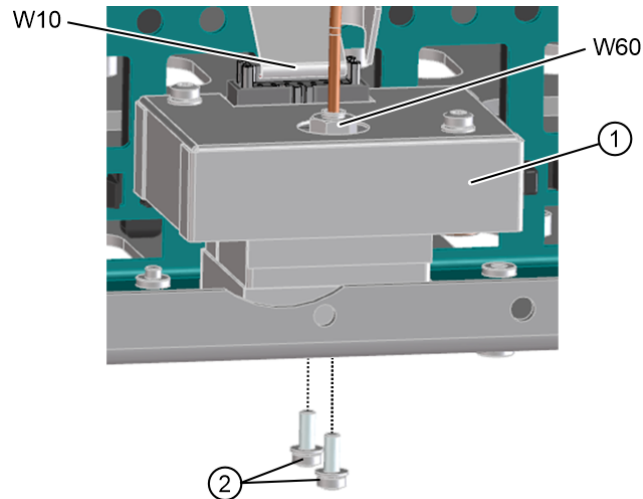
Figure 22-63



Remove A20 Yig Tuned Oscillator

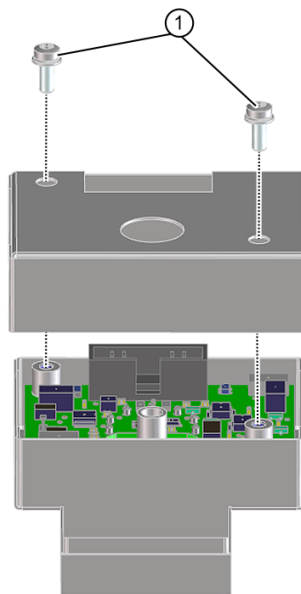
1. Refer to **Figure 22-64**. Using the 5/16 inch wrench, remove the semi-rigid cable W60 from the A20 Yig Tuned Oscillator **(1)**.

Figure 22-64



2. Disconnect the ribbon cable W10 from the A20 Yig Tuned Oscillator **(1)**.
3. Using a T-10 driver remove the 2 screws **(2)** (0515-0372) from the chassis base **(5)**.
4. Refer to **Figure 22-65**. To remove the A20 Yig Tuned Oscillator from the YTO top and bottom shields remove the two screws **(1)** (0515-0372) using a T-10 driver.

Figure 22-65



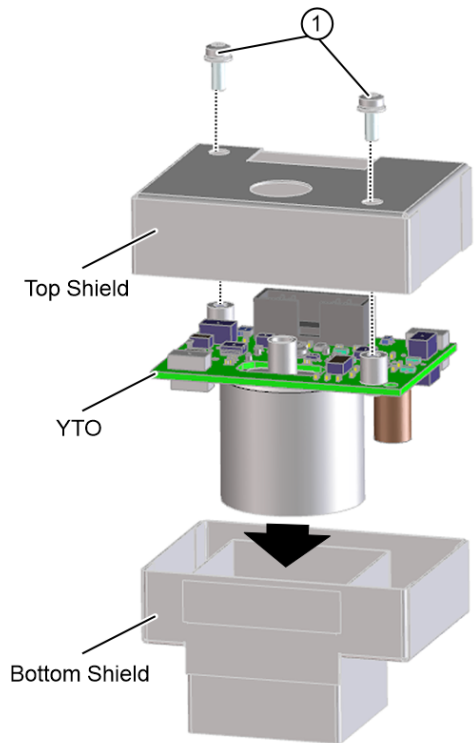
Replace A20 Yig Tuned Oscillator

1. Refer to **Figure 22-66**. Place the new YTO into the shields and secure with the two screws **(1)** (0515-0372). Torque to 9 inch-pounds.

NOTE

Before securing the top shield to the YTO ensure that the locking tabs on the YTO's W10 ribbon cable receiver are in the up position.

Figure 22-66



2. Refer to **Figure 22-64**. Place the YTO into the chassis. Replace the two screws **(2)** (0515-0372). Torque to 9 inch-pounds.
3. Referring to **Figure 22-64**, connect the semi-rigid cable W60 using a 5/16 inch open-end wrench. Torque to 10 inch-pounds.
4. Replace the ribbon cable W10. Ensure the locking tabs are engaged.

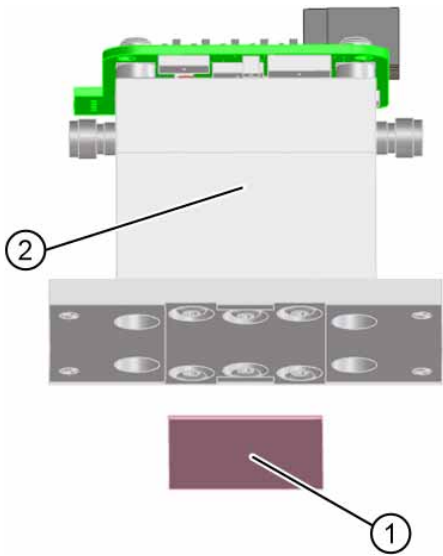
Table 22-24 A20 Yig Tuned Oscillator Related Parts

Item	Keysight Part Number
A20	N9020-60009
A12MP1	5022-7179
W10	N9020-60024
W60	N9032-20026

Replace A12 Yig Tuned Filter

1. Inspect the chassis where the YTF mounts and remove the gap pad if present (see [Figure 22-67](#), item **(1)**). The gap pad may remain attached to the faulty YTF.
2. Refer to [Figure 22-67](#). Install the replacement gap pad **(1)** into the recess in the base of the replacement YTF **(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 22-67 Gap Pad Installation



3. Refer to [Figure 22-62](#). Place the YTF into the chassis with the connector for the control wire harness toward the rear of the instrument. Replace the four screws **(6)** ([0515-0372](#)). Torque to 9 inch-pounds.
4. Referring to [Figure 22-62](#) connect the wire harness W23 to the A12 YTF.
5. Refer to [Figure 22-62](#). Using a 5/16 inch open-end wrench, re-install the semi-rigid cable **(2)** from the RF Input Connector **(3)** to the A9 Attenuator. Torque to 10 inch-pounds.

Table 22-25 A12 Yig Tuned Filter Related Parts

Item	Keysight Part Number
A12	5087-7383
A12MP1	5022-7179
W23	N9032-60009

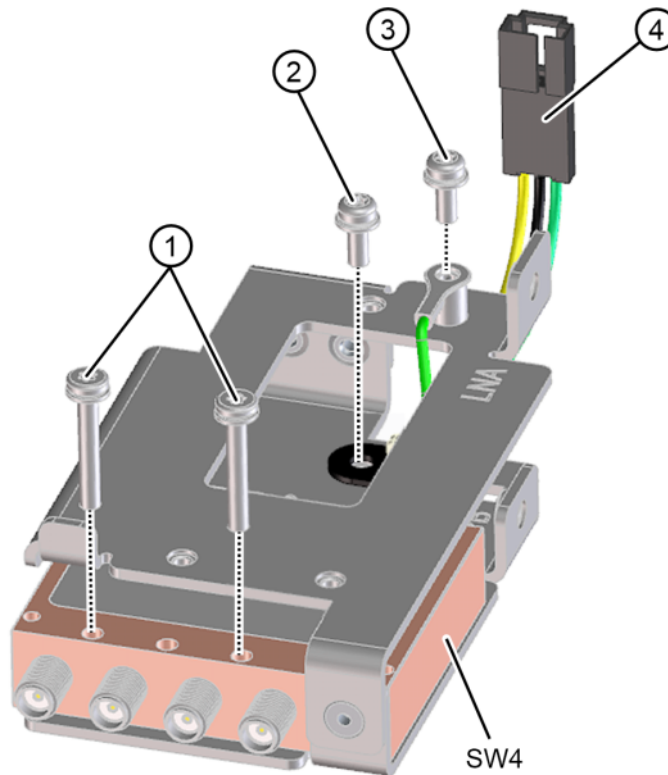
Replace SW4 Microwave Preselector Bypass Switch

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

1. Referring to **Figure 22-68**, install the SW4 MPB switch into the lower switch bracket and attach it with the two panhead screws (1) (0515-1410). Torque the screws to 9 in-lbs.
2. Attach the SW4 MPB switch wire harness to the lower switch bracket with the panhead screw (2) (0515-0372) and its ground wire with the panhead screw (3) (0515-0372). Torque the screws to 9 in-lbs.

Figure 22-68 SW4 MPB Switch Installation



3. Referring to **Figure 22-60**, attach the SW4 bracket to the instrument chassis using the two panhead screws (2) (0515-0372). Torque the screws to 9 in-lbs.
4. Referring to **Figure 22-60**, re-attach the semi-rigid cables W40, W41, and W42 from the SW4 MPB switch (1) using the modified 5/16 inch wrench. Torque each to 10 inch-pounds.

5. Referring to **Figure 22-68**, connect the SW4 MPBS wire harness **(4)** to W21 wire harness.

Table 22-26 SW4 Microwave Preselector Bypass Switch Related Parts

Item	Keysight Part Number
SW4	N9032-60030
W21	N9048-60027
W40	N9032-20109
W41	N9032-20110
W42	N9032-20108

Replace SW2 Low Noise Amplifier Switch

1. Refer to **Figure 22-69**. To replace the switch, place the SW2 switch in position on top of the LNA switch bracket. Secure with two pan-head screws **(1)** (**0515-1410**) using a T-10 driver. Torque to 9 inch-pounds.
2. Secure the SW2 LNA switch wire harness screw **(3)** (**0515-0372**) using a T-10 driver. Torque to 9 inch-pounds.
3. Connect the SW2 LNA switch wire harness to the W20 Wire Harness **(4)**.
4. Connect the W33 semi-rigid cable from the SW2 LNA switch to the A10 Attenuator B **(5)** using the 5/16 inch wrench. Torque to 10 inch-pounds.

Figure 22-69

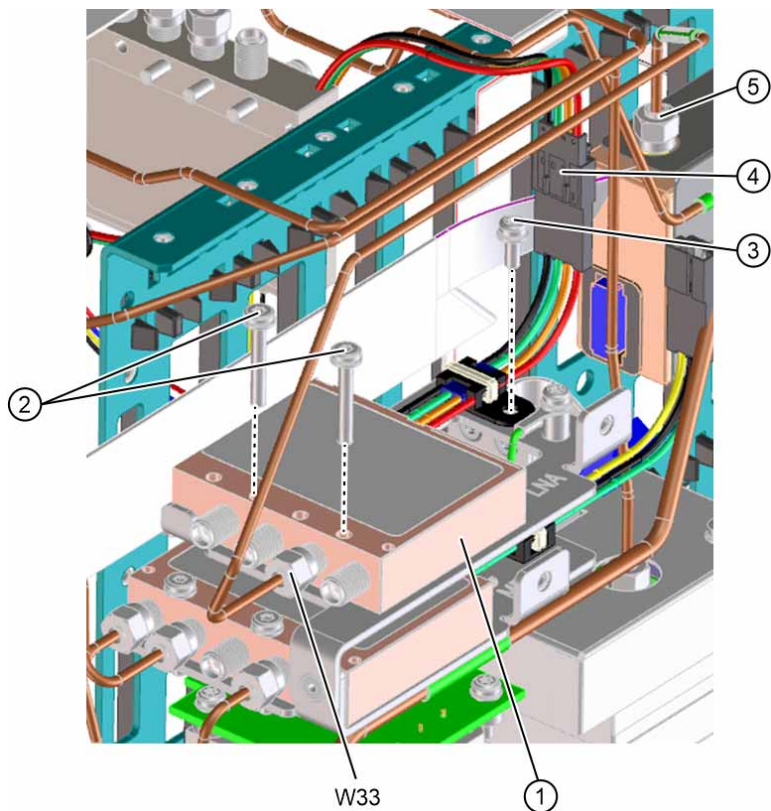


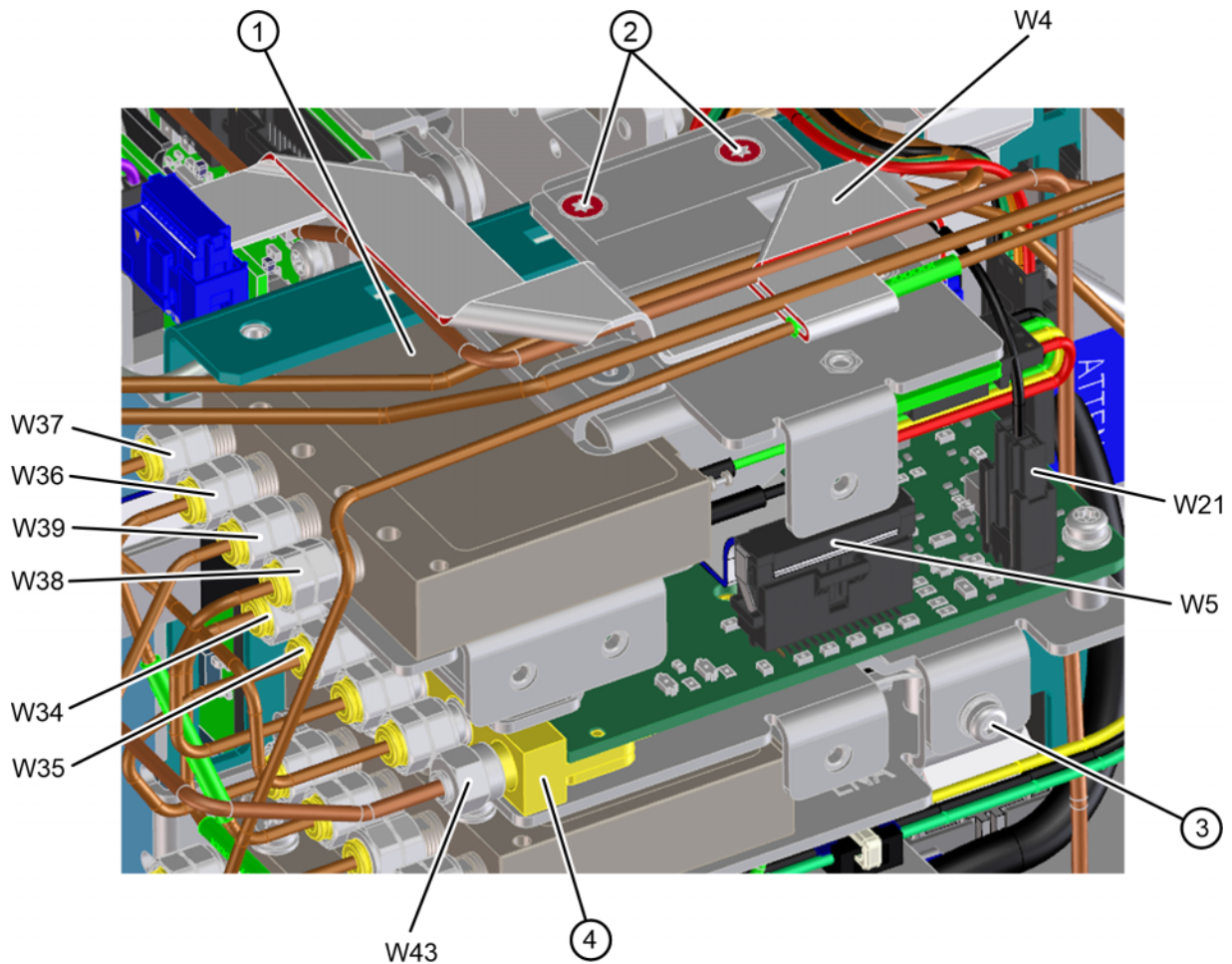
Table 22-27 SW2 Low Noise Amplifier Switch Related Parts

Item	Keysight Part Number
SW2	N9032-60029
W20	N9032-60007 (A23 IF Mux N9041-60163)
	N9032-60020 (All Others)
W33	N9032-20100

Replace SW3 Low Noise Path Switch and A11 Band Switch

1. For instructions on replacing either the SW3 Low Noise Path Switch or A11 Band Switch individually, refer to “**SW3 Low Noise Path Switch and A11 Band Switch**” on page 663.
2. To install the combined SW3 LNP switch and A11 Band switch back into the RF area refer to **Figure 22-70**. Connect the W4 ribbon cable to the SW3 LNP switch.

Figure 22-70 Low Noise Path Switch and Band Switch Replacement



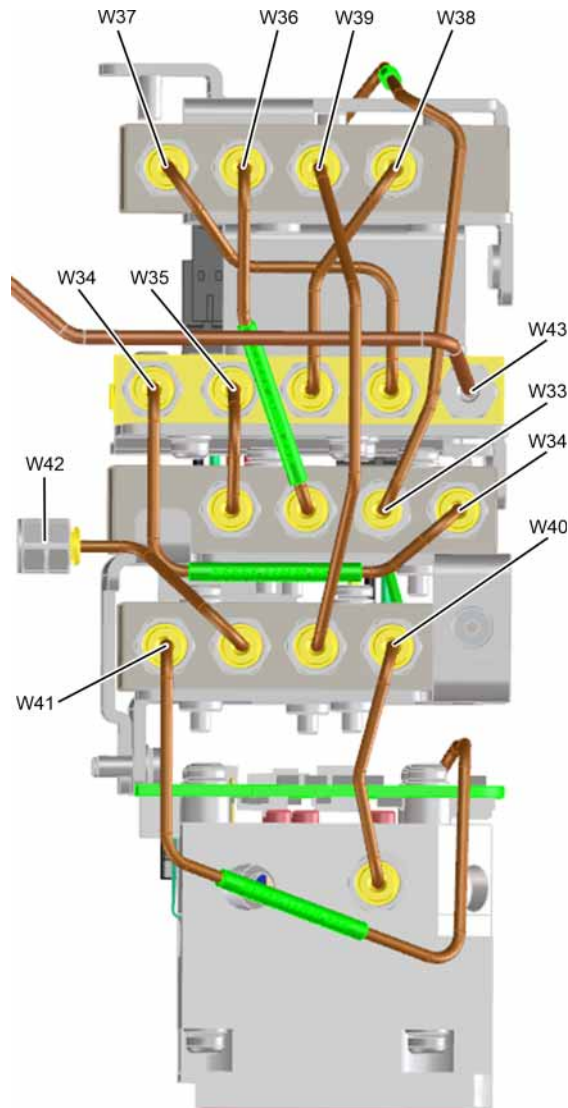
3. Place the combined SW3/A11 switch bracket onto the LNA bracket and secure with one screw (3) (0515-1410) using a T-10 driver. Torque to 9 inch-pounds.

CAUTION

When replacing RF switches be careful not to pinch any ribbon cables, wire harnesses or coax cables between the switch assembly and the chassis side panel.

4. Using a T-10 driver, secure the top of the LNP bracket to the chassis with two screws (2) (0515-1940). Torque to 9 inch-pounds.
5. Connect the W5 and W21 ribbon cables to the A11 Band switch.
6. Refer to **Figure 22-71**. Using the 5/16 inch wrench, connect the semi-rigid cables W34, W35, and W43 to the A11 Band switch. Torque to 10 inch-pounds.

Figure 22-71 Switch Area Cables (with Options 555)



7. Using the 5/16 inch wrench, connect the semi-rigid cables W36, W37, W38, and W39 to the SW3 LNP switch. Torque to 10 inch-pounds.

Table 22-28 SW3 LNP Switch and A11 Band Switch Related Parts

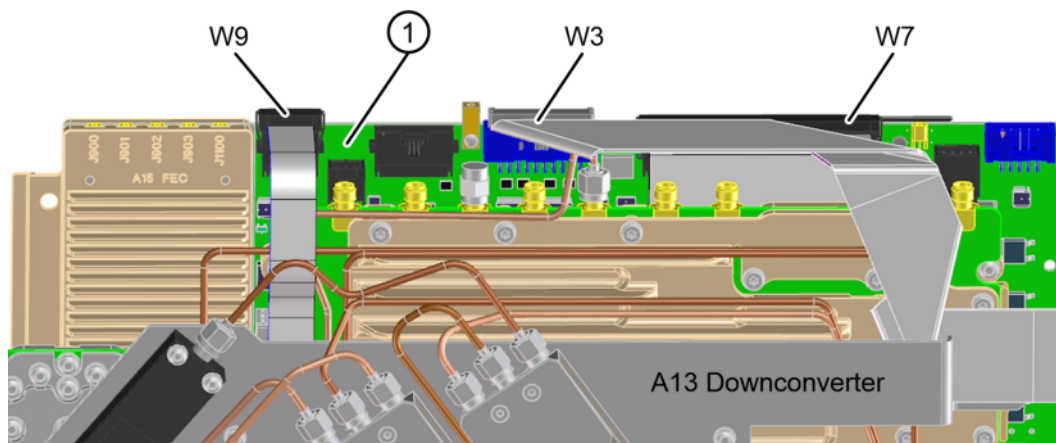
Item	Keysight Part Number
A11	N9040-60100
SW3	87222-60029
W4	N9020-60087
W5	N9020-60092
W21	N9048-60027
W33	N9032-20100
W34	N9032-20046
W35	N9032-20045
W36	N9032-20038
W37	N9032-20041
W38	N9032-20040
W39	N9032-20039
W42	N9032-20108
W43	N9032-20016

A13 Downconverter

Removal

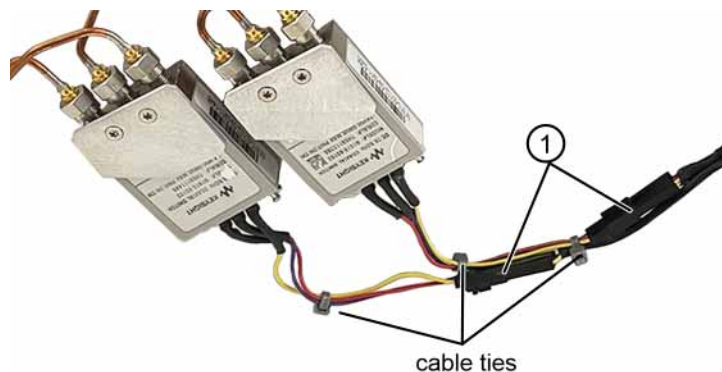
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the instrument top brace. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
3. Remove the front panel. Refer to the **Front Frame Assembly** removal procedure.
4. Refer to **Figure 22-72**. Disconnect the soft ribbon cables W9 and W7 from the A15 Front End Controller (1). Disconnect ribbon cable W3 from the A15 Front End Controller to allow access to the semi-rigid cables on the A13 Downconverter.

Figure 22-72



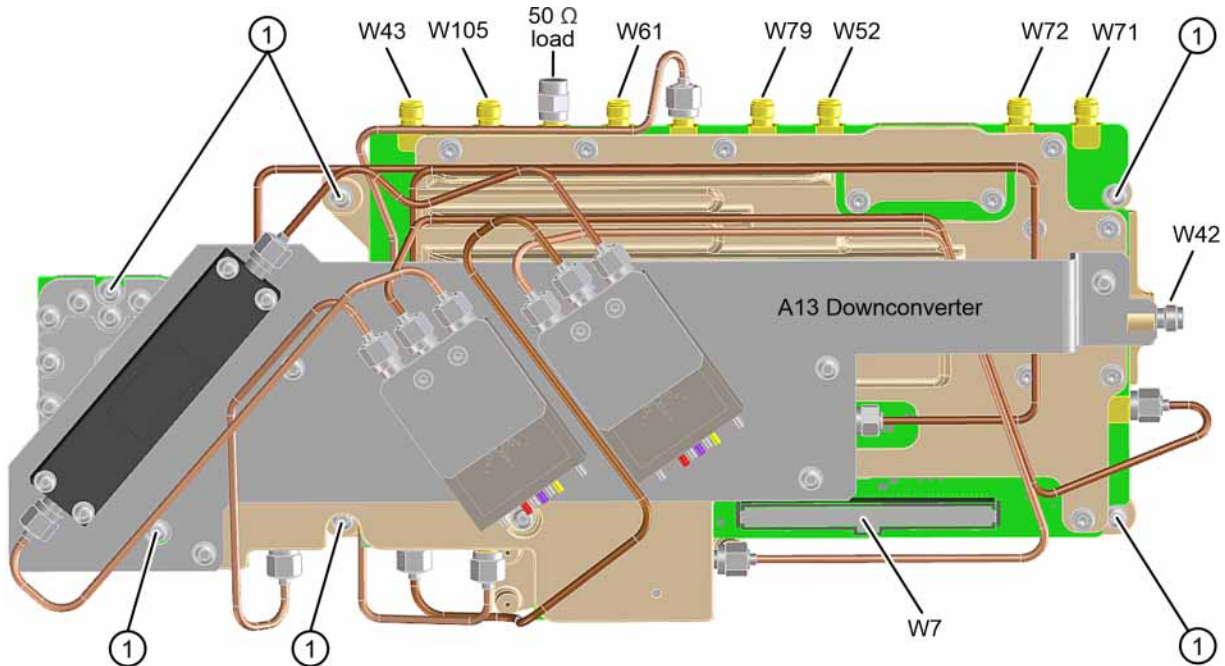
5. Refer to **Figure 22-73**. Disconnect the SW1 and SW2 wire harnesses (1) and remove any cable ties holding them together.

Figure 22-73



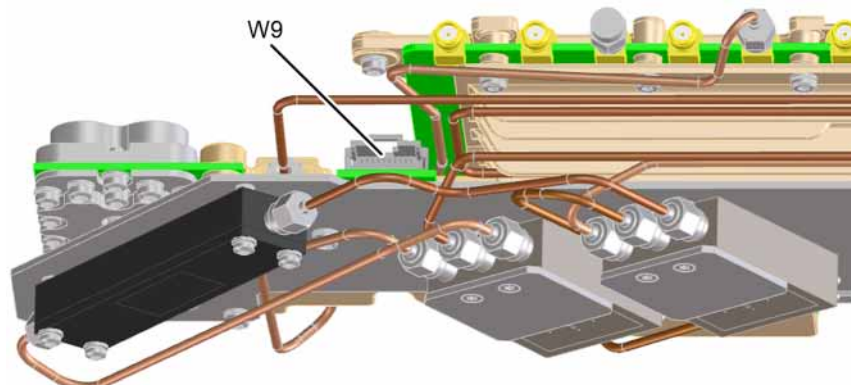
6. Refer to [Figure 22-74](#). Using the 5/16 inch wrench, disconnect the semi-rigid cables W43, W105, W61, W79, W52, W71, and W42. If the analyzer has Option EXM, remove the semi-rigid cable W72 also.

Figure 22-74



7. Remove the 50 ohm load. Set aside to install on the new A13 Downconverter.
8. Using the T-10 driver, remove the six screws (1) (0515-0372). The A13 Downconverter can now be removed from the chassis.
9. Refer to [Figure 22-74](#) and [Figure 22-75](#). Disconnect ribbon cables W7 and W9 from the A13 Downconverter. Detach the piece of Velcro adhering ribbon cable W7 to ribbon cable W3. Release W7 from the tabs holding it to the back of the A13 Downconverter.

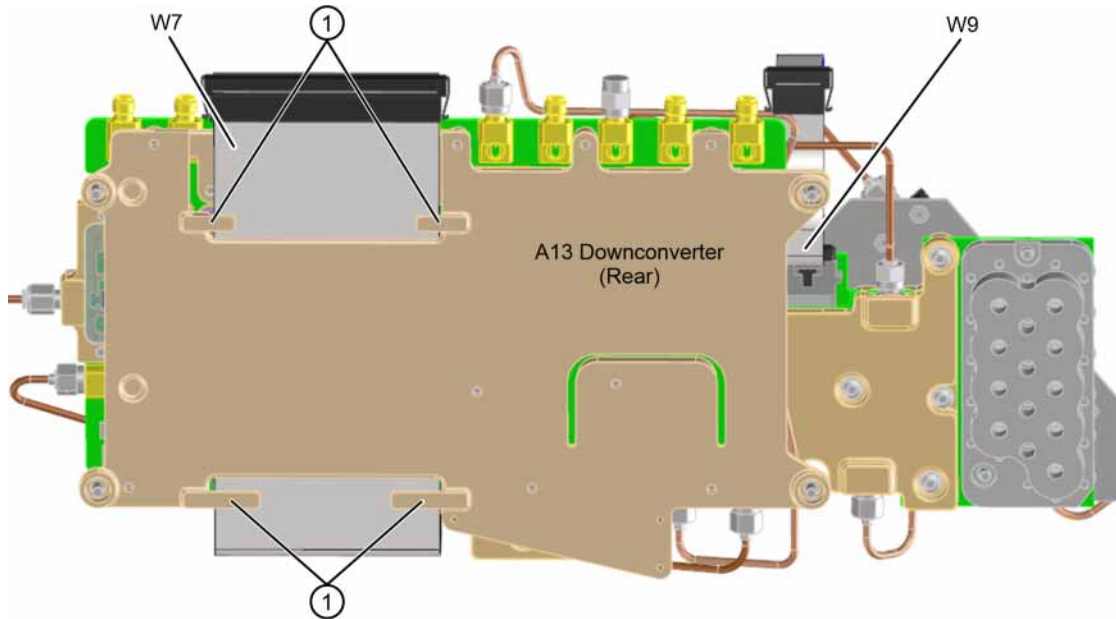
Figure 22-75



Replacement

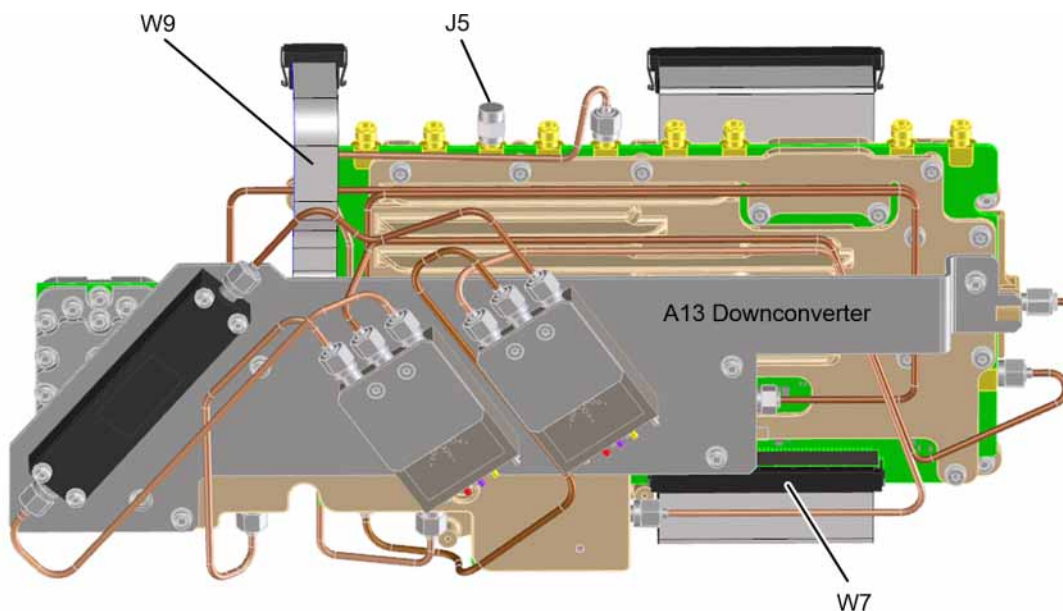
1. Refer to [Figure 22-76](#) and [Figure 22-77](#). Connect ribbon cables W9 and W7 to the A13 Downconverter. Route ribbon cable W7 behind the A13 Downconverter and ensure the cable is engaged under the tabs, then place the A13 Downconverter into the chassis. Re-attach the piece of Velcro adhering ribbon cable W7 to ribbon cable W3.

Figure 22-76



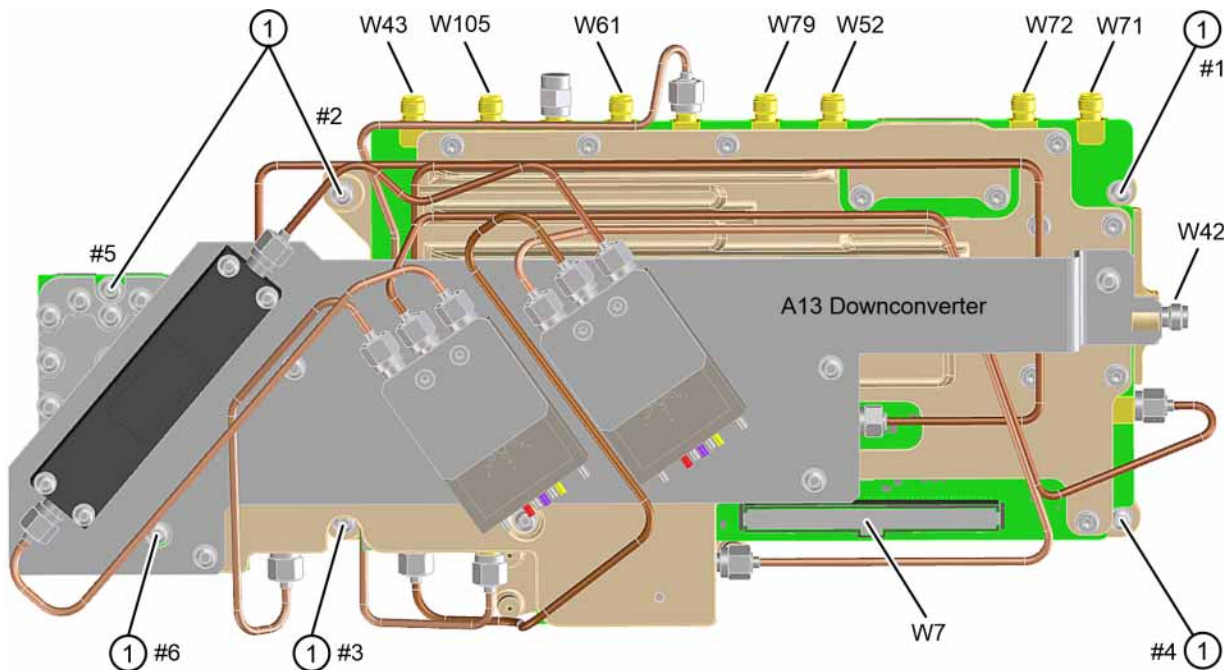
2. Refer to [Figure 22-77](#). If you are replacing the A13 Downconverter make sure to reinstall the 50 ohm load onto J5. Torque to 10 inch-pounds.

Figure 22-77



3. Refer to **Figure 22-78**. Replace the six screws **(1)** (0515-0372). Torque to 9 inch-pounds in the sequence shown, starting with #1.

Figure 22-78



4. Refer to **Figure 22-72**. Attach ribbon cable W9, W7, and W3 to the A15 Front End Controller.
5. Refer to **Figure 22-73**. Connect the SW1 and SW2 wire harnesses **(1)** and replace cable ties holding them together.
6. Refer to **Figure 22-78**. Using the 5/16 inch wrench, connect the semi-rigid cables W43, W105, W61, W79, W52, W71, and W42. If the analyzer has Option EXM, connect the semi-rigid cable W72 also. Torque the semi-rigid cables to 10 inch-pounds.
7. Replace the front panel. Refer to the **Front Frame Assembly** replacement procedure.
8. Replace the instrument top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
9. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Table 22-29 A13 Downconverter Related Parts

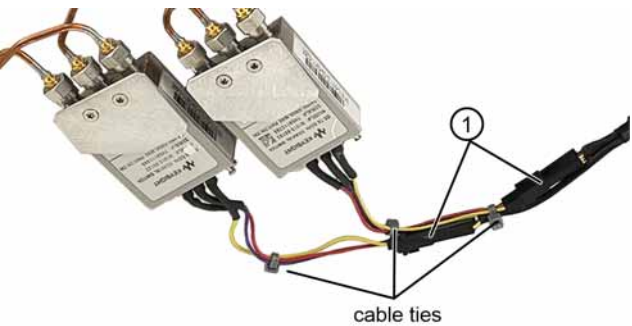
Item	Keysight Part Number
A13	N9041-60039

A13SW1 and A13SW2 Bandpass Filters

Removal

- 1. Refer to **Figure 22-79**. Disconnect the SW1 and SW2 wire harnesses (1) and remove any cable ties holding them together.

Figure 22-79

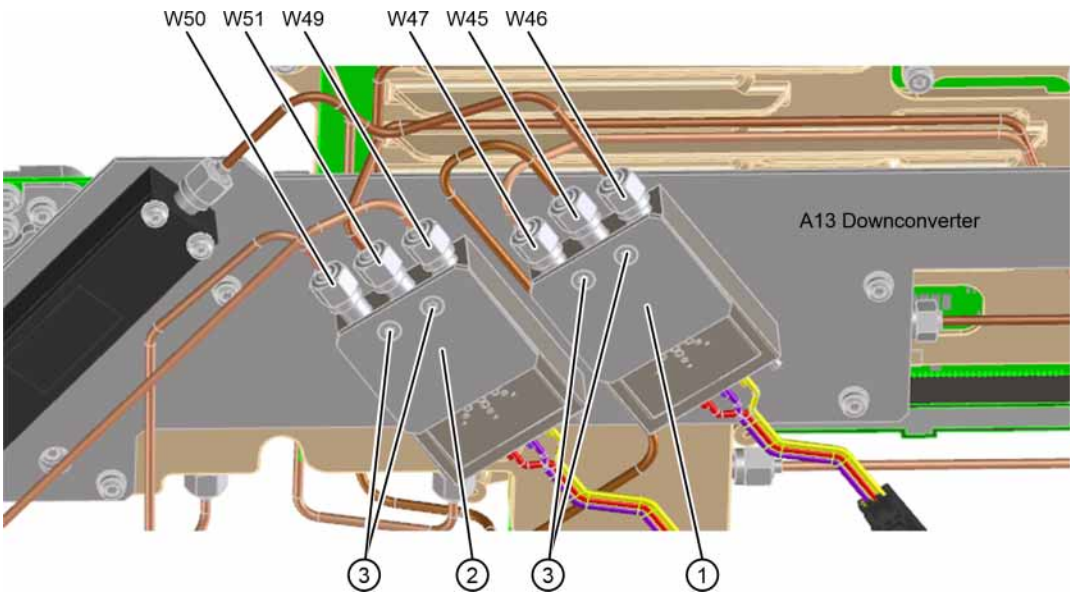


- 2. To remove either the SW1 or SW2 filter switch, refer to **Figure 22-80**. Using the 5/16 inch wrench, disconnect the following semi-rigid cables from A13SW1 (1) or A13SW2 (2):

Table 22-30 A13SW1 and A13SW2 Related Semi-rigid Cables

Switch	Cable Number
A13SW1	W47, W45, W46
A13SW2	W50, W51, W49

Figure 22-80



3. Refer to **Figure 22-80**. Using the T-8 driver, remove the four screws **(3)**, 2 in each filter (0515-2218), from the switch brackets. The A13SW1 and A13SW2 filter switches can now be removed from the A13 Downconverter.

Replacement

1. Refer to **Figure 22-80**. Using the T-8 driver, replace the four screws **(3)**, 2 in each filter (0515-2218), to the switch brackets.
2. To replace either the A13SW1 or A13SW2 filter switch refer to **Figure 22-80**. Using the 5/16 inch wrench, connect the semi-rigid cables to the A13SW1 **(1)** or A13SW2 **(2)** switches indicated in **Table 22-30**.
3. Refer to **Figure 22-79**. Connect the A13SW1 and A13SW2 wire harnesses **(1)** and replace any cable ties holding them together.

Table 22-31 A13SW1 and A13SW2 Bandpass Filters Related Parts

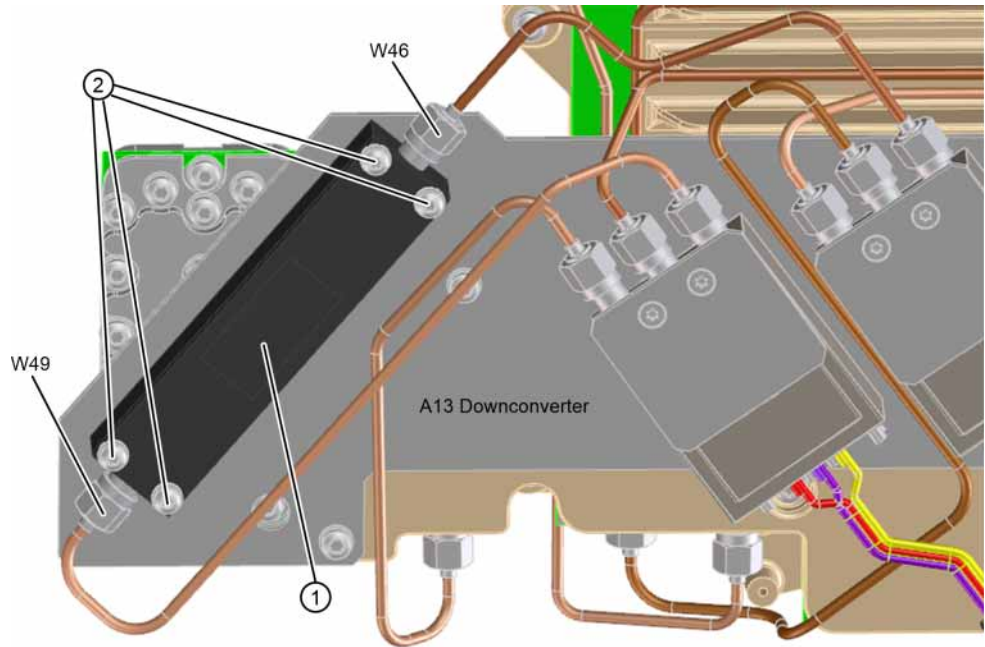
Item	Keysight Part Number
A13SW1 or A13SW2	N1810-60102
W45	N9020-20266
W46	N9020-20268
W47	N9020-20267
W49	N9020-20293
W50	N9020-20292
W51	N9020-20276

A13FL1 Bypass Filter

Remove

1. To remove the A13 Bypass Filter (1) refer to **Figure 22-81**. Using the 5/16 inch wrench, disconnect semi-rigid cables W46 and W49 from the bypass filter.

Figure 22-81



2. Using the T-8 driver, remove the four screws (2) (0515-2007), from the bypass filter. The bypass filter can now be removed from the A13 Downconverter.

Replacement

1. Refer to **Figure 22-81**. Using the T-8 driver, replace the four screws (2) (0515-2007), from the bypass filter.
2. Using the 5/16 inch wrench, Connect semi-rigid cables W46 and W49 to the bypass filter.

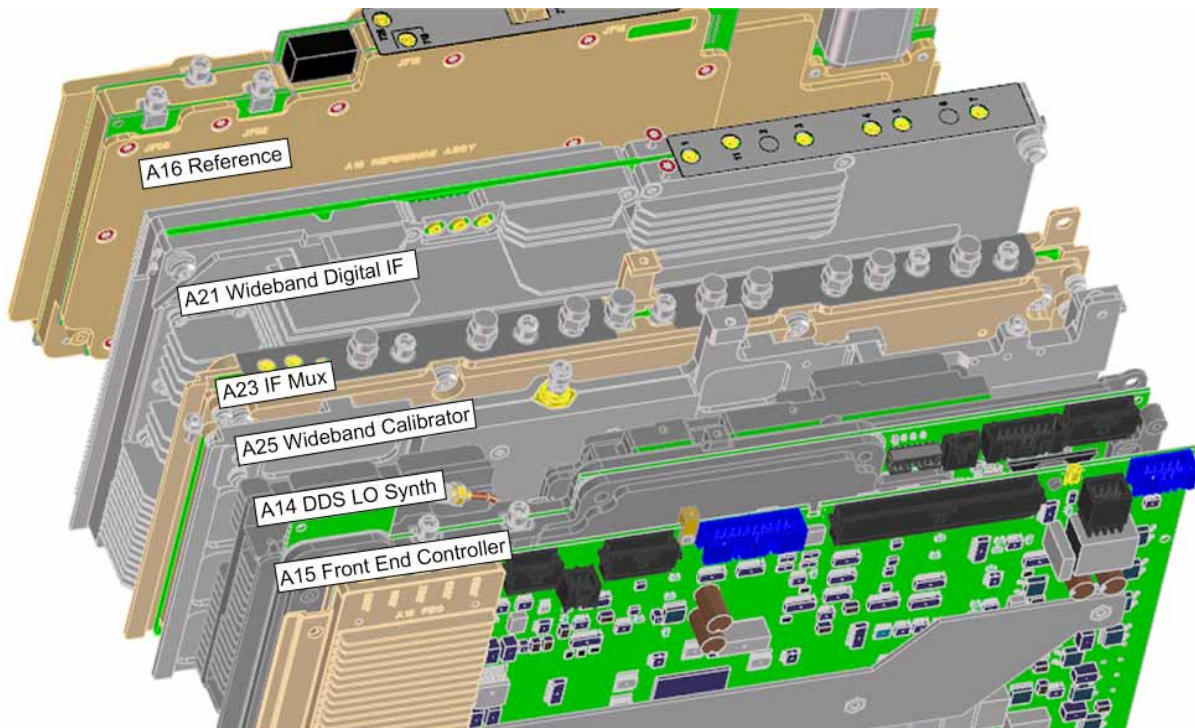
Table 22-32 SW1 and SW2 Bandpass Filters Related Parts

Item	Keysight Part Number
A13 Bypass Filter	N1810-60102
W46	N9020-20268
W49	N9020-20293

Card Cage Boards

The card cage boards are located in the front half of the chassis and consist of the (from front to back) A15 Front End Controller, A14 DDS LO Synthesizer, A25 Wideband Calibrator, A23 IF Mux, A21 Wideband Digital IF, and A16 Reference.

Figure 22-82 Card Cage Boards

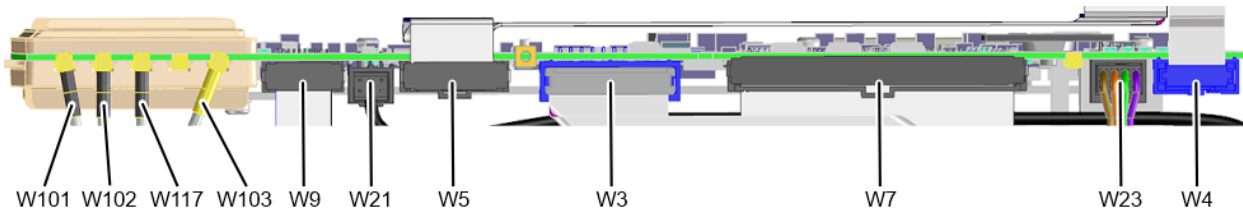


A15 Front End Controller

Removal

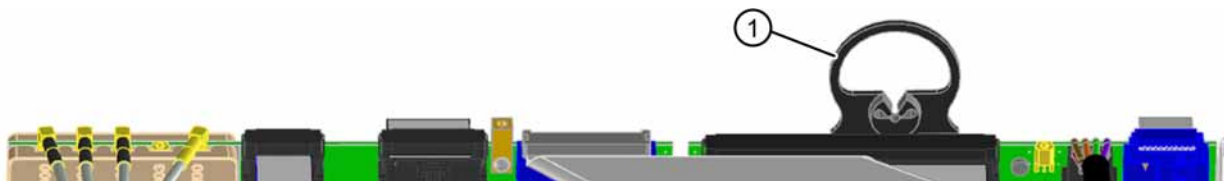
1. Refer to [Figure 22-82](#). Locate the A15 Front End Controller assembly.
2. Refer to [Figure 22-83](#). Using a cable puller, remove cables W101, W102, W117, and W103. Disconnect soft cables W9, W21, W5, W3, W7, W23, and W4.

Figure 22-83



3. Refer to [Figure 22-84](#). The Front End Controller assembly can now be removed from the chassis by pulling up on the ring-tab (1) provided on the back of the Front End Controller to disengage from the front motherboard.

Figure 22-84



Replacement

1. Reinstall the Front End Controller assembly into the correct slot and push down to mate with the front motherboard.
2. Refer to **Figure 22-83**. Reinstall cables W101, W102, W117, and W103. The numbers on the cables should correspond to the casted numbers on the Front End Controller. You should hear a distinct "snap" when reinstalling the small mmcx cables.
3. Reconnect soft cables W9, W21, W5, W3, W7, W23, and W4.

Table 22-33 A15 Front End Controller Related Parts

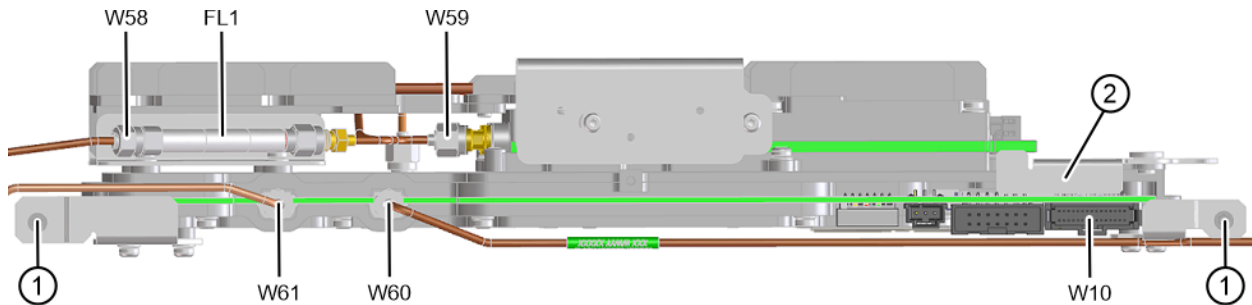
Item	Keysight Part Number
A15 Front End Controller	
W3	Options 508, 513, 526 Options 544, 550
W4	
W5	
W7	
W9	
W21	
W23	
W101	
W102	
W103	
W117	

A14 DDS LO Synthesizer

Removal

1. Refer to **Figure 22-82**. Locate the A14 DDS LO Synthesizer assembly.
2. Refer to **Figure 22-85**. Using a 5/16 inch wrench, remove cables W60 and W61. Remove cable W58 from FL1 and leave FL1 and W59 connected to the DDS LO Synthesizer. Remove ribbon cable W10.

Figure 22-85



3. Remove the two screws **(1)** (0515-1946) that attach the DDS LO Synthesizer assembly to the chassis. Use the ejector **(2)** on the DDS LO Synthesizer assembly to unplug from the motherboard and lift out of the chassis.
4. After the assembly is removed from the chassis, remove FL1/W59 from the connector and install onto the replacement DDS LO assembly.

Replacement

1. Reinstall the DDS LO Synthesizer assembly into the correct slot and use the ejector to secure and mate with the motherboard.
2. Replace the two screws **(1)** (0515-1946). Torque to 9 inch-pounds.
3. Reinstall cables W58, W60, and W61. Replace ribbon cable W10. Torque the semi-rigid cables to 10 inch-pounds.

Table 22-34 A14 DDS LO Synthesizer Related Parts

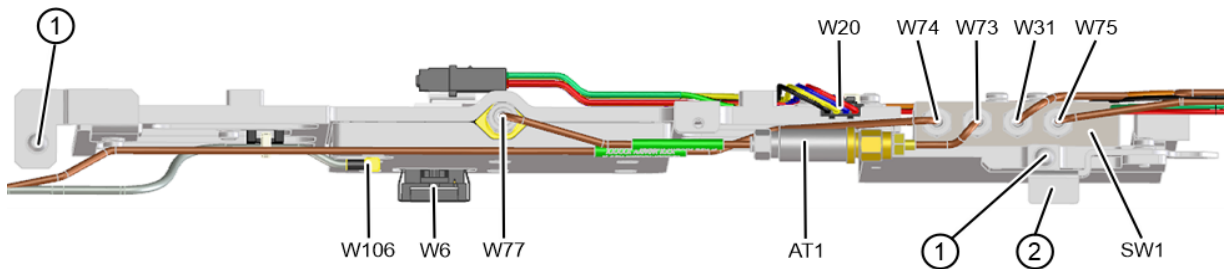
Item	Keysight Part Number
A14 DDS LO Synthesizer	N9020-60377
FL1	9135-6218
W10	N9020-60024
W58	N9020-20303
W59	N9020-20226
W60	N9032-20026
W61	N9020-20301

A25 Wideband Calibrator

Removal

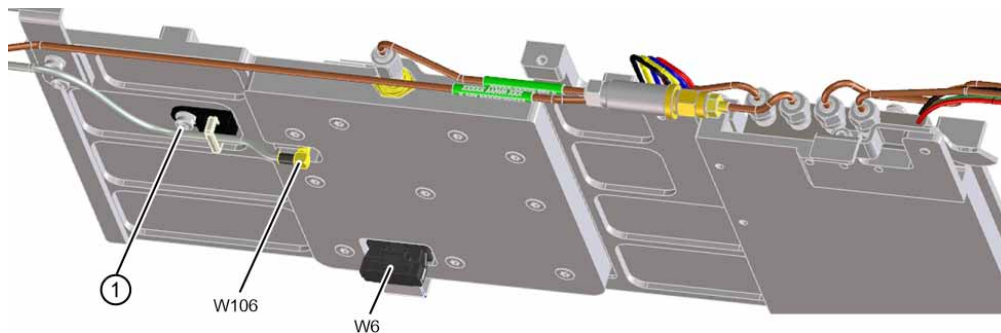
1. Refer to **Figure 22-82**. Locate the A25 Wideband Calibrator assembly.
2. Refer to **Figure 22-86**. Using a 5/16 inch wrench, remove semi-rigid cables W77 from the Wideband Calibrator, and W73 from the SW1 Calibrator Switch. Set aside with the AT1 Attenuator with cables attached for replacement later in the procedure.

Figure 22-86



3. Using a 5/16 inch wrench, disconnect semi-rigid cables W74, W31, and W75 from the SW1 Calibrator Switch.
4. Disconnect wire harness W20 from the Wideband Calibrator.
5. Using a T-10 driver, remove the two screws **(1)** (0515-0372) from the Wideband Calibrator.
6. Use the ejector on the Wideband Calibrator **(2)** to lift out the assembly from the chassis.
7. Refer to **Figure 22-87**. Once the Wideband Calibrator is lifted from the chassis, use a cable puller to disconnect coax cable W106.

Figure 22-87

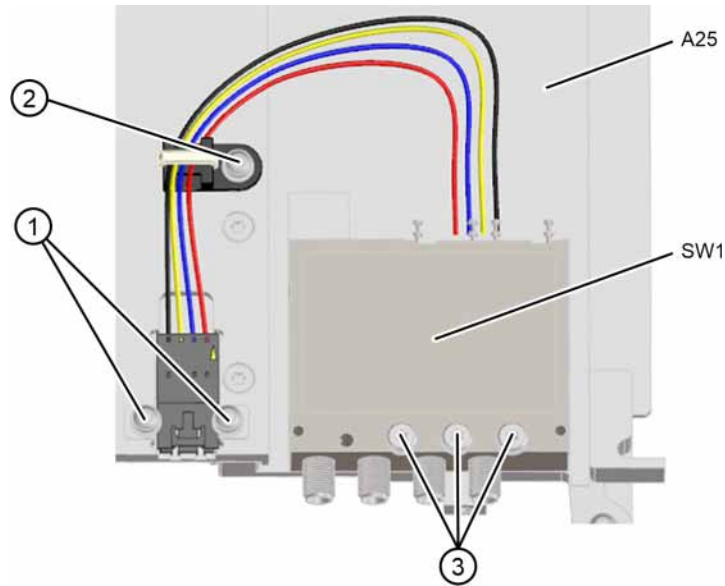


8. Using a T-10 driver, remove the screw **(1)** (0515-0430) securing the W106 cable clip.
9. Disconnect wire harness W6 from the front of the Wideband Calibrator.

SW1 Calibrator Switch Removal

1. Refer to **Figure 22-85**. Using a T-10 driver, remove the two screws **(1)** (0515-0663) holding the SW1 Calibrator Switch Wire Harness in place, and the one screw **(2)** (0515-0430) securing the wire harness cables.

Figure 22-88



2. Using a T-10 driver, remove the three screws **(3)** (0515-1410) to release the SW1 Calibrator Switch from the A25 Wideband Calibrator.

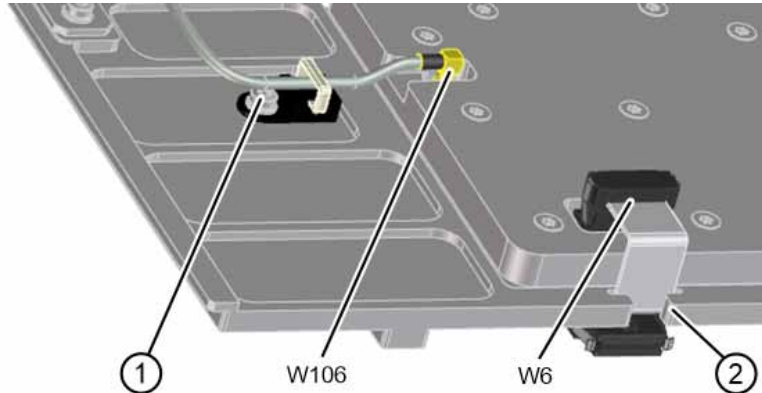
SW1 Calibrator Switch Replacement

1. Refer to **Figure 22-85**. Using a T-10 driver, replace the three screws **(3)** (0515-1410) to secure the SW1 Calibrator Switch to the A25 Wideband Calibrator. Torque to 9 inch-lbs.
2. Using a T-10 driver, replace the two screws **(1)** (0515-0663) holding the SW1 Calibrator Switch Wire Harness in place, and the one screw **(2)** (0515-0430) securing the wire harness cables. Torque all to 9 inch-lbs.

A25 Wideband Calibrator Replacement

1. Refer to **Figure 22-89**. Connect wire harness W6 to the front of the Wideband Calibrator. Make sure to secure the wire harness through the tabs provided on the bottom of the Wideband Calibrator **(2)**.

Figure 22-89



2. Using a T-10 driver, replace the screw **(1)** (0515-0430) securing the W106 cable clip. Torque to 9 inch-pounds.
3. Attach coax cable W106 to the Wideband Calibrator ensuring that you hear it "snap" into place.
4. Refer to **Figure 22-86**. Carefully fit the Wideband Calibrator assembly into the chassis taking care not to pinch cables and wire harnesses during the placement. Use the ejector **(2)** to secure the Wideband Calibrator in place.
5. Using a T-10 driver, replace the two screws **(1)** (0515-0372) into the Wideband Calibrator bracket. Torque to 9 inch-pounds.
6. Connect wire harness W20 to the Wideband Calibrator.
7. Using a 5/16 inch wrench, connect semi-rigid cables W75, W31, and W74 to the SW1 Attenuator. Torque to 10 inch-pounds.
8. Refer to **Figure 22-90**. If the AT1 Attenuator requires replacement, detach semi-rigid cables W77 and W73 from the attenuator using a 5/16 inch wrench. Reattach the two cables to the replacement attenuator and torque both to 10 inch-pounds.

AT1

Figure 22-90 AT1 Attenuator (Options 508, 513, 526, 544, and 550)

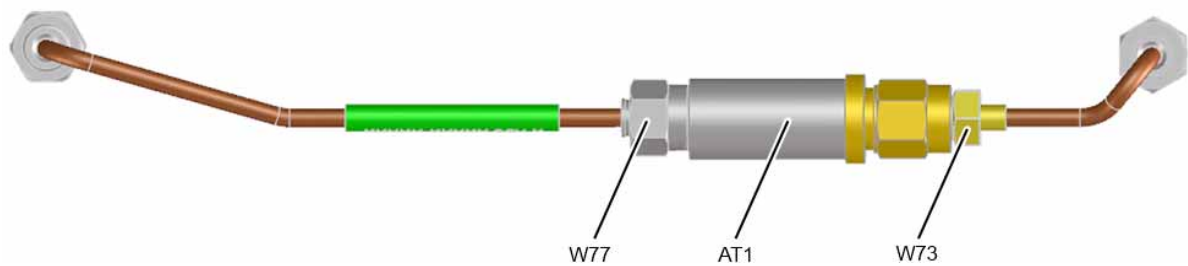
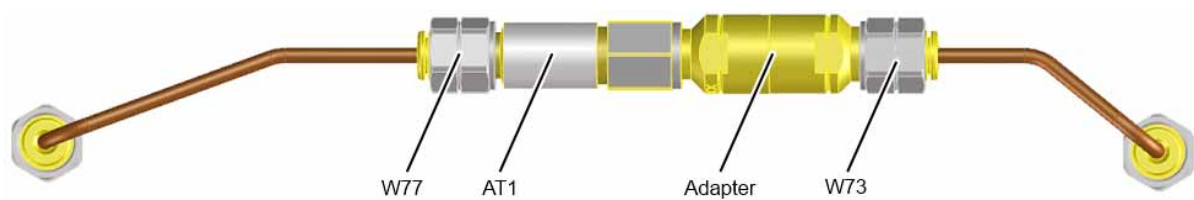


Figure 22-91 AT1 Attenuator (Options 555)



9. Refer to **Figure 22-86**. Using a 5/16 inch wrench, attach semi-rigid cables W77 to the Wideband Calibrator, and W73 to the SW1 Calibrator Switch. Torque both to 10 inch-pounds.

Table 22-35 A25 Wideband Calibrator Related Parts

Item		Keysight Part Number
A25 Wideband Calibrator		
AT1 Attenuator	Options 508, 513, 526	08493-60026
	Options 544, 550	08490-60040
	Options 555	08490-60038
	Options 555 Adapter	85058-60114
SW1 Calibrator Switch	Options 508, 513, 526	N9032-60003
	Options 544, 550	N9032-60019
	Options 555	N9032-60031
W6		N9032-60006
W20	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020

Table 22-35 A25 Wideband Calibrator Related Parts

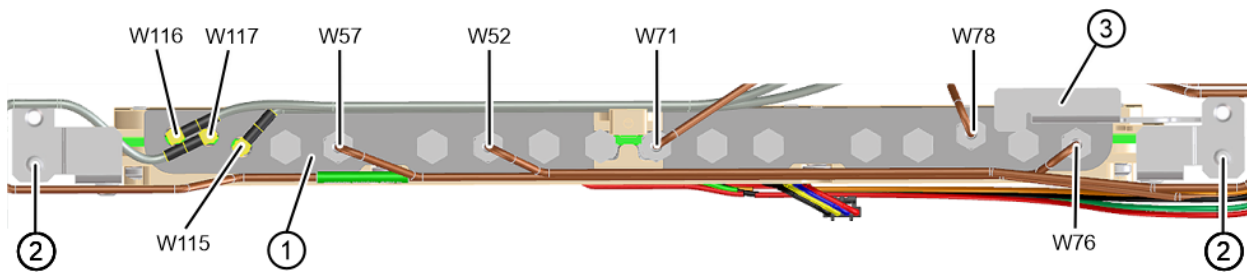
Item	Keysight Part Number
W31	Options 508, 513, 526 N9032-20002
	Options 544, 550 N9032-20034
	Option 555 N9032-20101
W73	Options 508, 513, 526 N9032-20028
	Options 544, 550 N9032-20048
	Option 555 N9032-20114
W74	Options 508, 513, 526 N9032-20006
	Options 544, 550 N9032-20037
	Option 555 N9032-20103
W75	Options 508, 513, 526 N9032-20004
	Options 544, 550, 555 N9032-20035
W77	Options 508, 513, 526 N9032-20005
	Options 544, 550 N9032-20036
	Option 555 N9032-20102
W106	8121-2292

A23 IF Mux

Removal

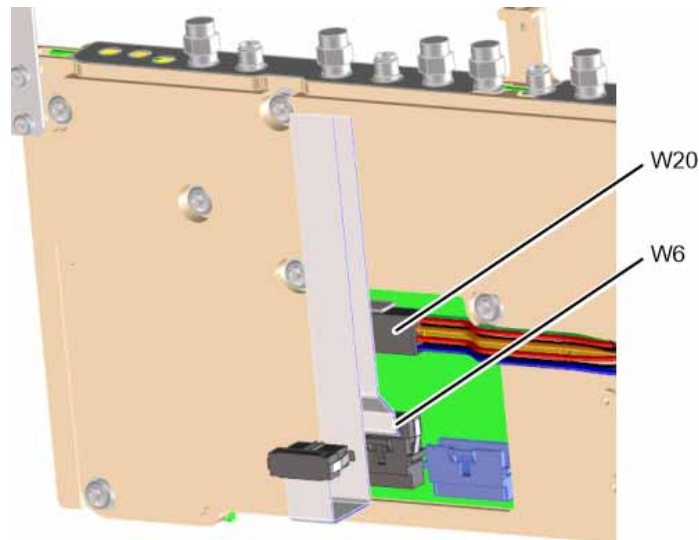
1. Refer to [Figure 22-82](#). Locate the A23 IF Mux.
2. Refer to [Figure 22-92](#). Using a cable puller remove cables W116, W117, and W115 from the A23 IF Mux assembly (1).
3. Using a 5/16 inch wrench, remove cables W57, W52, W71, W78, and W76.

Figure 22-92



4. Using a T-10 driver, remove the two screws (2) (0515-1946) that attach the IF Mux assembly to the chassis. Use the ejector (3) on the IF Mux assembly to unplug from the motherboard and lift partially up but not out of the chassis.
5. Refer to [Figure 22-93](#). Remove ribbon cable W6 and wire harness W20.

Figure 22-93



Replacement

1. Refer to **Figure 22-93**. Reinstall the IF Mux assembly into the correct slot. Before the assembly is completely inserted into the chassis, reconnect ribbon cable W6 and wire harness W20.
2. Refer to **Figure 22-92**. Use the ejector to secure and to mate with the motherboard.
3. Replace the two screws **(4)** (0515-1946). Torque to 9 inch-pounds.
4. Reconnect the semi-rigid cables W57, W52, W71, W78, and W76. Torque to 10 inch-pounds.
5. Refer to **Figure 22-92**. Reinstall cables W116, W117, and W115 from the A23 IF Mux assembly **(1)** ensuring that you hear them "snap" into place.

Table 22-36 A23 IF Mux Related Parts

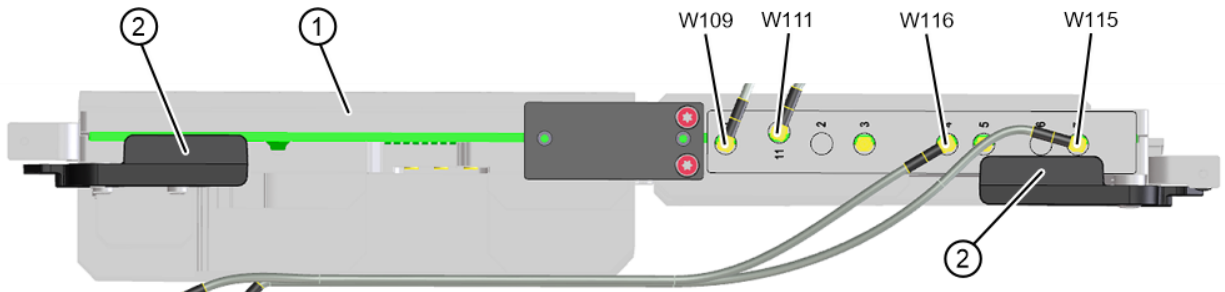
Item		Keysight Part Number
A23 IF Mux		N9032-60193
W6		N9032-60006
W20	A23 IF Mux N9041-60163	N9032-60007
	All Others	N9032-60020
W52	Options 508, 513, 526, 544, 550	N9032-20051
	Option 555	N9032-20117
W57		N9032-20054
W71	Options 508, 513, 526, 544, 550	N9032-20053
	Option 555	N9032-20119
W76		N9032-20019
W78	Options 508, 513, 526, 544, 550	N9032-20052
	Option 555	N9032-20118
W115		8121-8868
W116		8121-8868
W117		8121-8868

A21 Wideband Digital IF Assembly

Removal

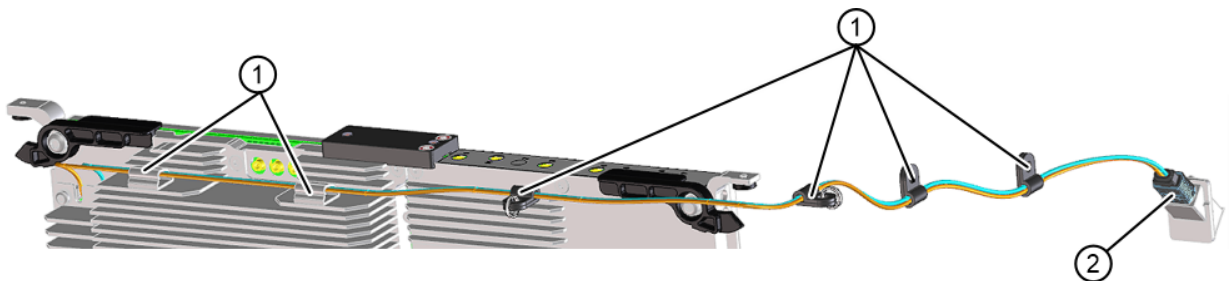
1. Refer to [Figure 22-82](#). Locate the A21 Wideband Digital IF assembly.
2. Refer to [Figure 22-94](#). Using a cable puller, remove cables W109, W111, W116, and W115 from the A21 Wideband Digital IF assembly (**1**).

Figure 22-94



3. Refer to [Figure 22-95](#). The A21 Wideband Digital IF also has an optical data interface (ODI). If the instrument is equipped with either Option ST1 or ST2 IQ Streaming, the clips and cables ties securing the wires in place will need to be released, or removed (**1**), before the Wideband Digital IF can be lifted away from the chassis.

Figure 22-95



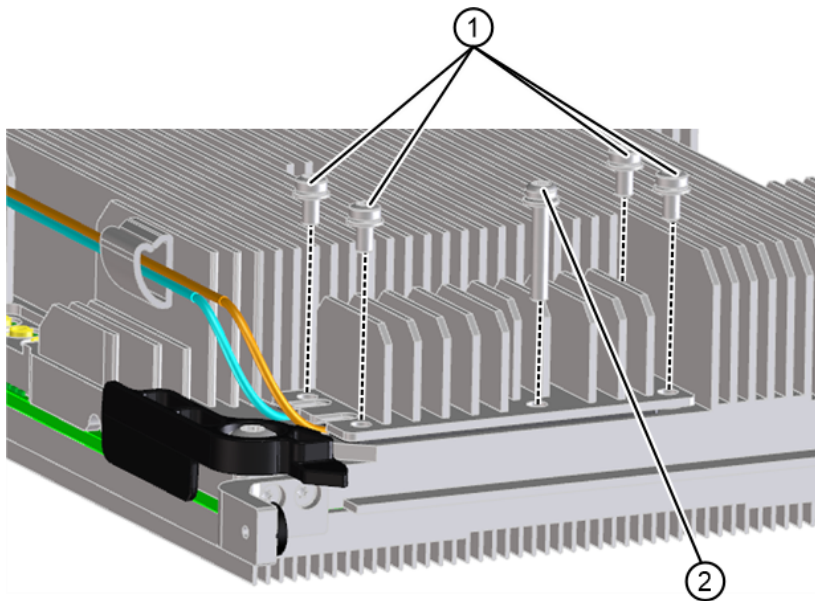
4. Disconnect the blue ODI cable connector (**2**) from the ODI streaming adapter.
5. Refer to [Figure 22-94](#). Use the ejectors (**2**) to remove the board from the chassis.
6. Once the A21 assembly is removed, the ODI wires can be disconnected.

- a. Refer to **Figure 22-96**. Remove the four screws **(1)** (0515-2332), and the one screw **(2)** (0515-0666) from the FireFly™ heatsink. Remove the heatsink cover.

CAUTION

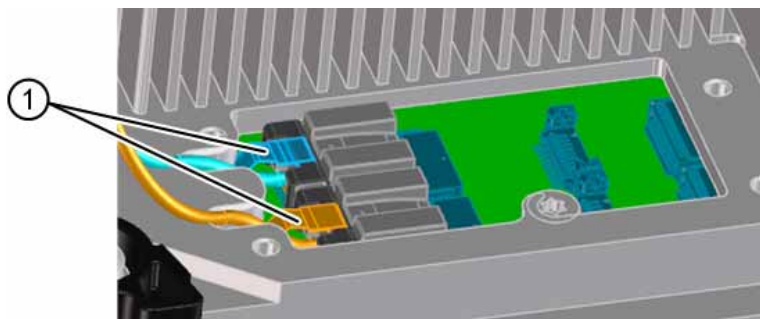
Great care needs to be taken when removing any of the FireFly™ connectors.

Figure 22-96



- b. Refer to **Figure 22-97**. To remove the FireFly™ Connectors, lift up on the tabs **(1)** to release the connectors, then pull backwards to disengage and remove them.

Figure 22-97



Replacement

1. To reinstall the optional FireFly™ Connectors refer to the **FireFly™ Connector Installation** section in **Chapter 13, “Analog and Digital IFs.”**

CAUTION

Great care needs to be taken when installing or removing any of the FireFly™ connectors. Be sure to follow the steps outlined above for installing these connectors, and use the installation tool (N9041-20181).

2. Reinstall the Wideband Digital IF assembly into the slot as shown. Use the ejectors to mate the board to the chassis.
3. Refer to **Figure 22-94**. If the instrument is equipped with either Option ST1 or ST2 IQ Streaming, the clips and cables ties securing the wires in place will need to be resecured **(1)**.
4. Refer to **Figure 22-94**. Reconnect the coax cables W109, W111, W116, and W115 ensuring that you hear them "snap" into place.

Table 22-37 A21 Wideband Digital IF Assembly Related Parts

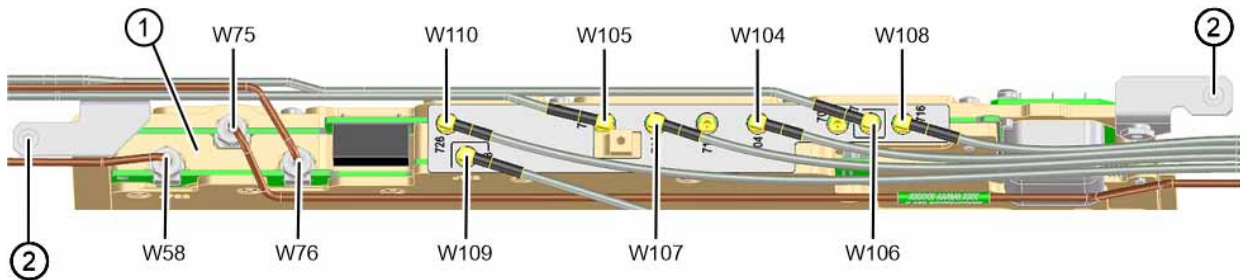
Item	Keysight Part Number
A21 Wideband Digital IF	N9032-60058
A21MP1 FireFly™ Heatsink	N9041-20154
W109	8120-0152
W111	8121-1859
W115	8121-8868
W116	8121-8868

A16 Reference Assembly

Removal

1. Refer to **Figure 22-82**. Locate the A16 Reference assembly.
2. Refer to **Figure 22-98**. Using a 5/16 inch wrench, remove cables W58, W75, and W76 from the A16 Reference assembly **(1)**.

Figure 22-98



3. Using a cable puller, remove cables W109, W110, W105, W107, W104, W106, and W108.
4. 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.

Replacement

1. Refer to **Figure 22-98**. Reinstall the Reference assembly into the correct slot and use the ejector to secure and to mate with the motherboard.
2. Replace the two screws **(2)** (0515-1946). Torque to 9 inch-pounds.
3. Refer to **Figure 22-98**. Reinstall cables W58, W75, W76, W109, W110, W105, W107, W104, W106, and W108. You should hear a distinct "snap" when reinstalling the small mmc cables. Torque the semi-rigid cables to 10 inch-pounds.

Table 22-38 A16 Reference Assembly Related Parts

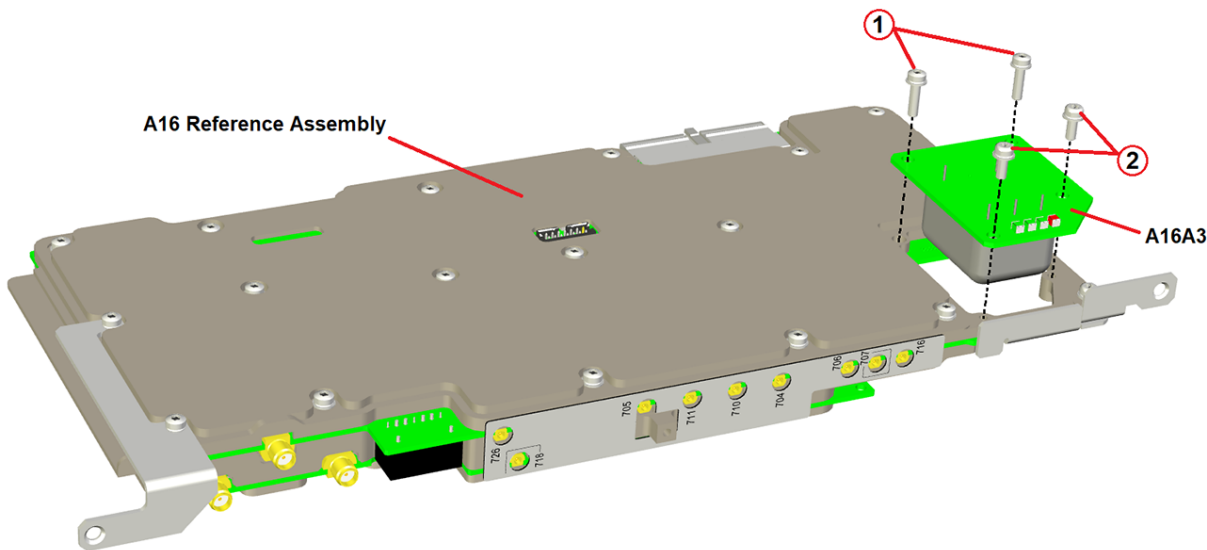
Item		Keysight Part Number
A16 Reference Assembly		N9020-60387
TAA Compliant		N9020-60387G
W58		N9020-20303
W75	Option 508, 513, 526	N9032-20004
	Option 544, 550, 555	N9032-20035
W76		N9032-20019
W104		8121-1860
W105		8121-1940
W106		8121-2292
W107		8121-1861
W108		8121-1401
W109		8120-0152
W110		8121-1401

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 22-99**, 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 22-99 A16A3 Reference OCXO



Replacement

4. Referring to **Figure 22-99**, 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 22-39 A16 Reference Assembly Related Parts

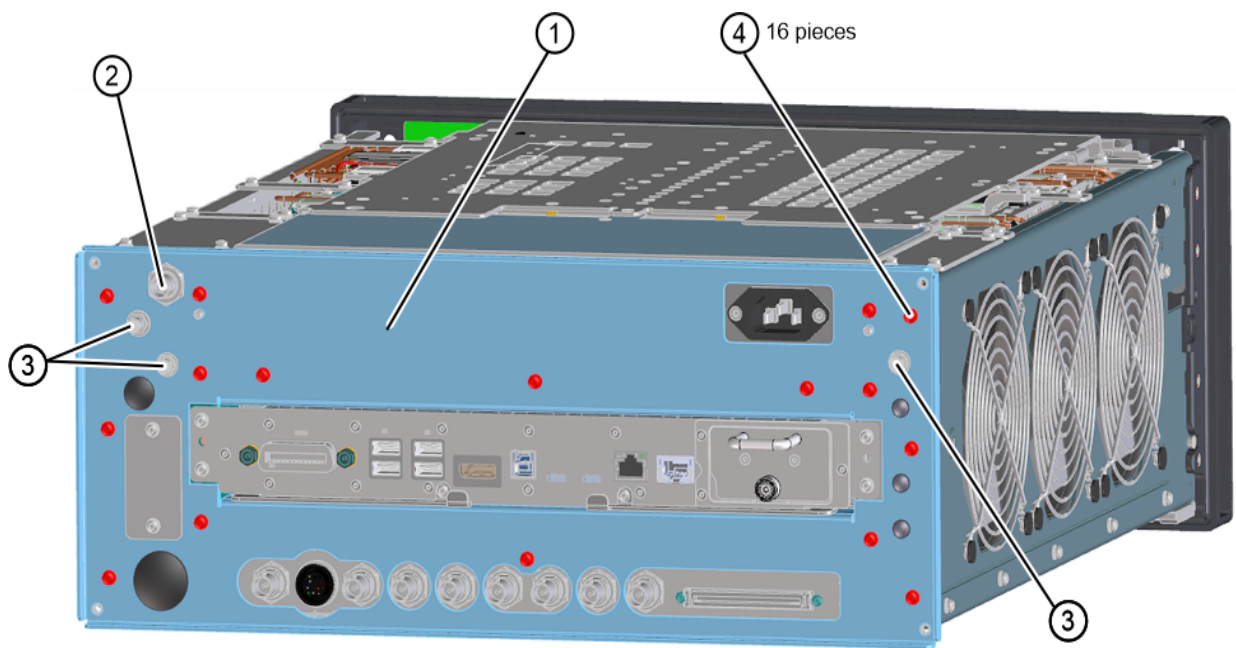
Item	Keysight Part Number
A16 Reference Assembly	N9020-60387
A16A3 Reference OCXO	N9020-63194

Rear Panel

Removal

1. Remove the instrument outer case. Refer to the **“Instrument Outer Case”** removal procedure.
2. Refer to **Figure 22-100**. Remove W104 (2) cable from the rear panel using the 9/16- inch nut driver. Using the 1/4 inch open-end wrench, remove the nuts and lock washers from the Wide IF Out, Port 3, and Aux IF Out ports (3).

Figure 22-100 Rear Panel Removal



3. Using the T-10 driver, remove the sixteen screws (4) (0515-0372) attaching the rear panel (1) to the chassis. The rear panel can now be removed.

Replacement

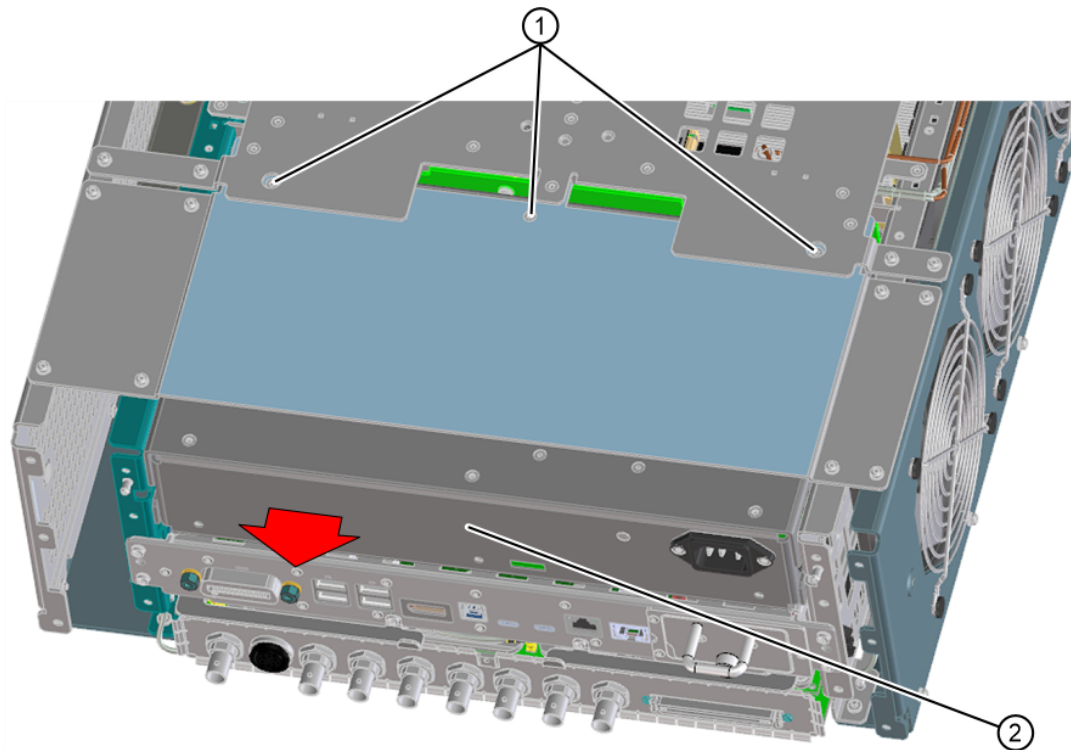
1. Refer to **Figure 22-100**. Place the rear panel into position in the chassis.
2. Reattach the W104 **(2)** cable to the rear panel. Torque to 21 inch-pounds using the 9/16-inch nut driver.
3. Using the 1/4 inch open-end wrench, replace the nuts and lock washers from the Wide IF Out, Port 3, and Aux IF Out ports **(3)**. Torque to 10 in-lbs.
4. Replace the sixteen screws (**0515-0372**) to attach the rear panel to the chassis. Torque to 9 inch-pounds.
5. Replace the instrument outer case. Refer to the **“Instrument Outer Case”** replacement procedure.

A6 Power Supply Assembly

Removal

1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
3. Refer to **Figure 22-101**. Using the T-10 driver, remove the three screws (1) (0515-1946) attaching the power supply to the chassis.
4. The power supply assembly can be removed from the chassis by pulling straight out the back.

Figure 22-101



Replacement

1. Slide the power supply assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the midplane assembly.
2. Refer to **Figure 22-101**. Replace the three screws **(1)** **(0515-19460515-1946)** through the power supply bracket and into the power supply. Torque to 9 inch-pounds.
3. Replace the rear panel. Refer to the **Rear Panel** replacement procedure.
4. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

A4 System Processor

Removal

1. Refer to **Figure 22-102**. Using the T-10 driver, remove the six screws (1) (0515-0372) attaching the system processor assembly to the chassis.
2. The system processor assembly can be removed from the chassis by pulling straight out the back. Use the two ejectors to pull the system processor assembly out from the chassis.

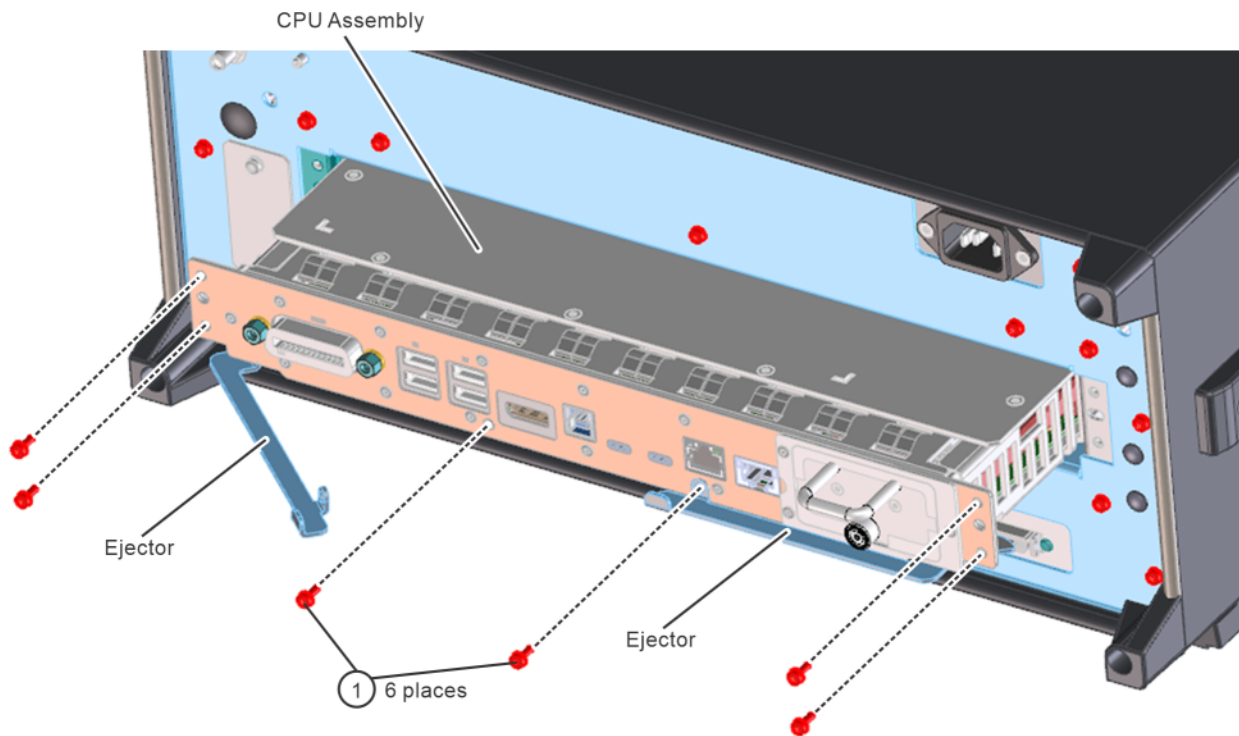
NOTE

If the A4BT1 CPU board battery is being changed, refer to **Chapter 23, "Post-Repair Procedures,"** for setup instructions.

WARNING

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

Figure 22-102



Replacement

1. Slide the system processor assembly into the slot at the rear of the instrument and push on the assembly to mate the connectors to the midplane assembly. Secure the board with the ejectors.
2. Refer to **Figure 22-102**. Replace the six screws **(1) (0515-0372)** that attach the system processor assembly to the chassis. Torque to 9 inch-pounds.

A5 Solid State Drive

CAUTION

Electrostatic discharge (ESD) can damage or destroy electronic components. All work on electronic assemblies should be performed at a static-safe workstation. Refer to the documentation that pertains to your instrument for information about static-safe workstations and ordering static-safe accessories.

Drive Removal and Replacement

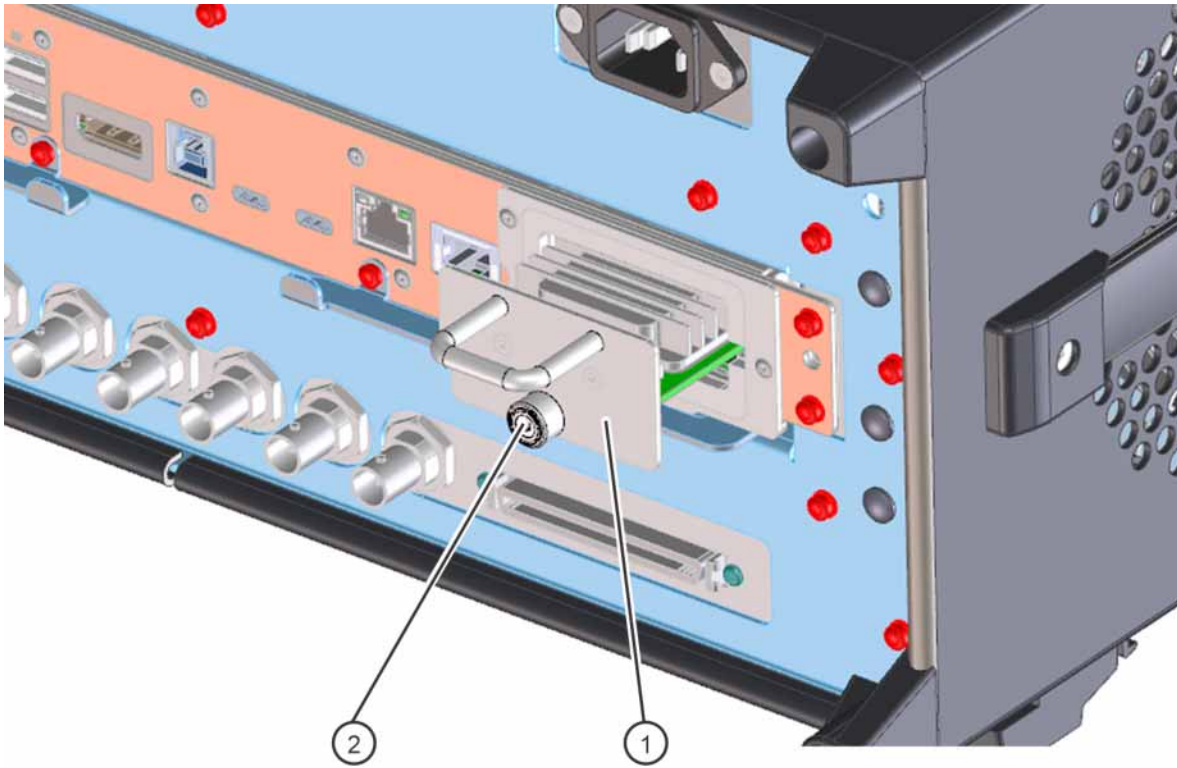
1. Turn the instrument off and remove the AC power cord.
2. Before replacing the A5 SSD it is highly recommended that the factory calibration data be backed up to an external drive if at all possible. If this data is not backed up prior to replacing the SSD all instrument adjustments and performance verification tests will need to be run after the drive is replaced.

For information on how to backup this data see the “[Calibration Data Backup](#)” section in [Chapter 23, “Post-Repair Procedures,”](#) of this manual.

If this data cannot be backed up because the instrument will not fully boot, go ahead and change the A5 SSD and perform all adjustments listed in [Chapter 23, “Post-Repair Procedures,”](#) for the A5 assembly.

3. Refer to **Figure 22-103**. Locate and remove the existing SSD carrier assembly (1) from the instrument by loosening the rear panel screw (2).

Figure 22-103

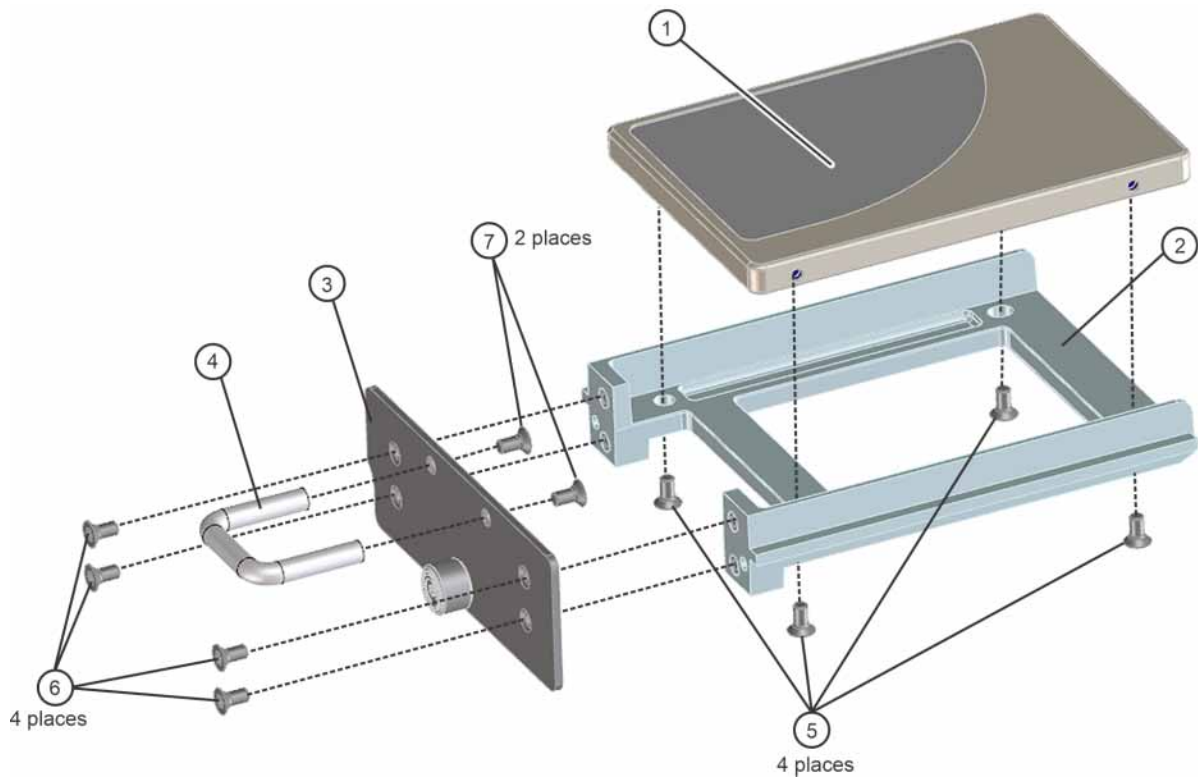


NOTE

Instruments with A4 System Processor assembly PCA installed, proceed to **step 9**. If the instrument has assembly PCA PC8 installed, proceed to the **step 4**.

4. Refer to **Figure 22-104**. To remove the SSD (1), remove the 4 machine screws (5) (0515-1035) from the SSD tray (2) that secure the drive.

Figure 22-104 SSD Tray Screws (PC8 System Processors Only)



5. To remove the handle, first remove the 4 screws (6) (0515-2219) holding the SSD rear panel to the SSD tray (2). Then, remove the 2 screws (7) (0515-1227) to remove the handle.
6. To replace the handle, attach the 2 screws (7) (0515-1227) through the SSD rear panel. Torque to 9 inch-pounds.
7. Reattach the SSD rear panel (3) to the SSD tray (2) using the 4 screws (0515-2219). Torque to 6 inch-pounds.
8. Place the new SSD onto the SSD tray and attach with the 4 machine screws (5) (0515-1035). Torque to 9 in-pounds.
9. Refer to Figure 22-103. Replace the SSD carrier assembly (1) into the instrument and tighten the screw (2) to 9 in-pounds.
10. Refer to Chapter 23, “Post-Repair Procedures.” and perform all of the specified tasks for replacing the A5 Solid State Drive assembly.

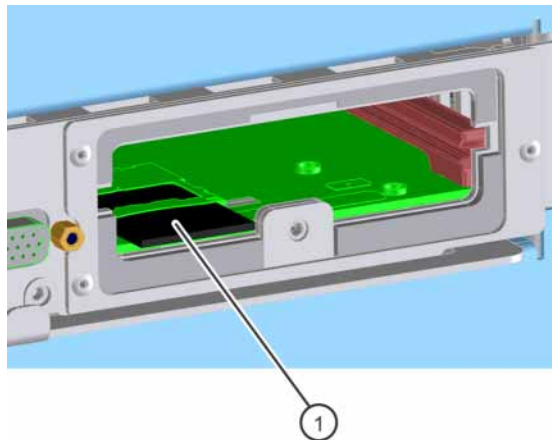
A4A1 CPU Memory Card (PC8 System Processors Only)

NOTE

Instruments with A4 System Processor assembly PC8 have the SD memory card while ones with PCA do not.

1. Refer to Figure 22-105. Remove the SSD as described on page 738. The memory card (1) 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 above in step 9.

Figure 22-105 CPU Memory Card Removal

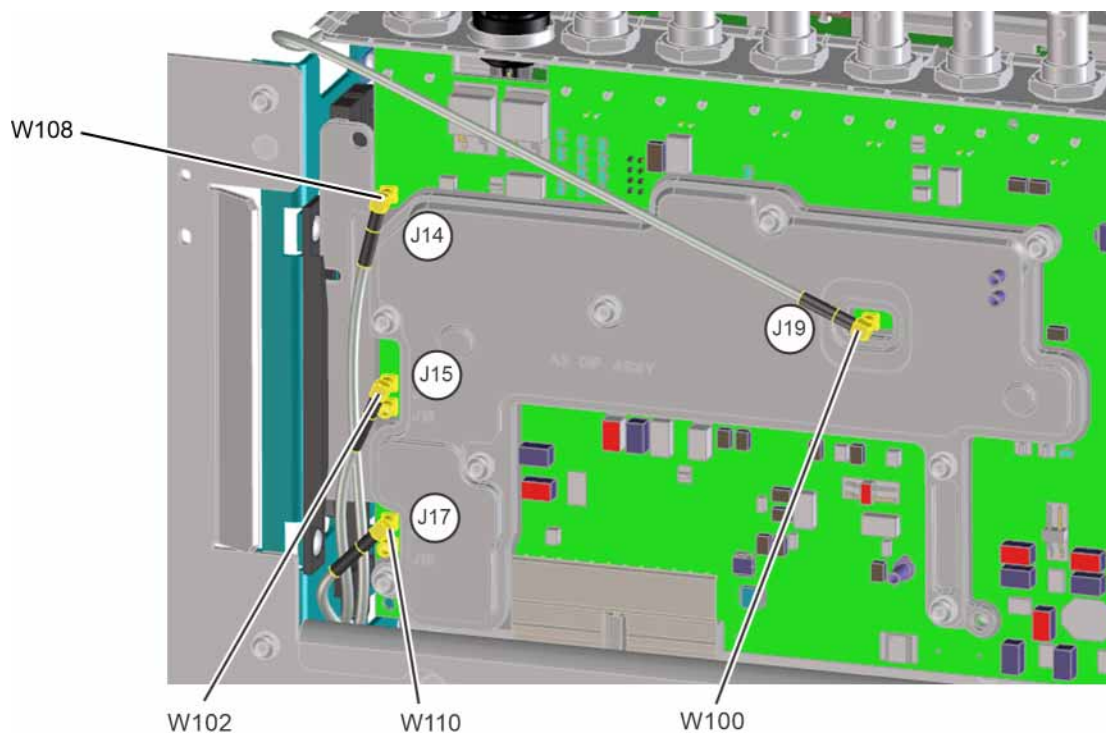


A2 Analog IF/A3 Digital IF

Removal

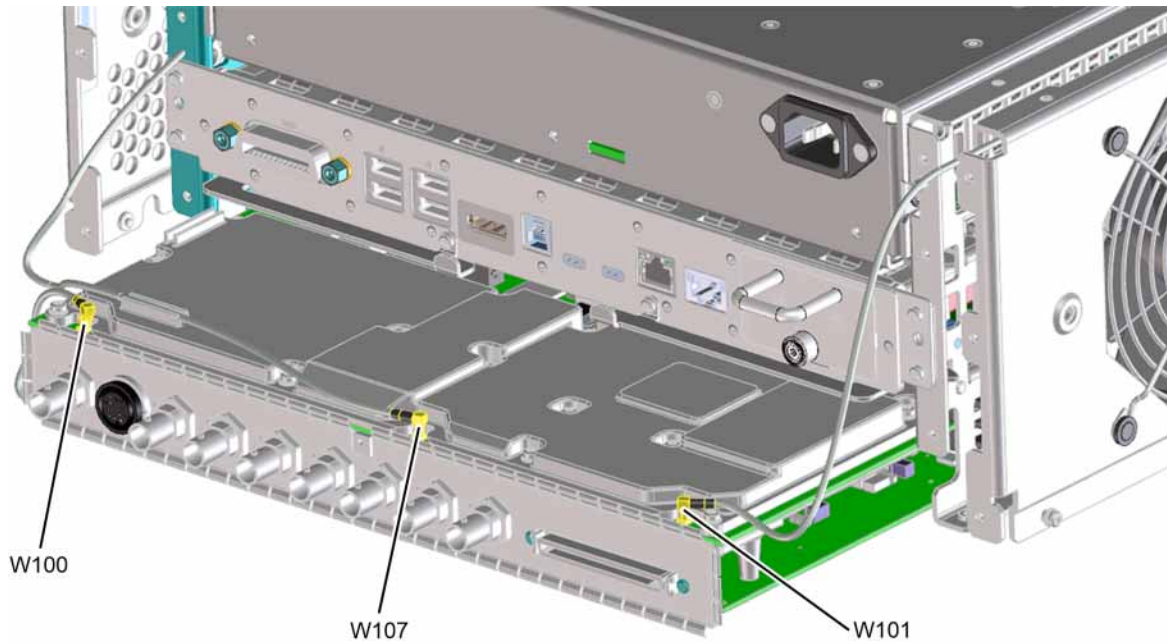
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
3. Refer to **Figure 22-106**. Remove cables W100, W102, W108, and W110 from the bottom of the A3 40 MHz Digital IF assembly.

Figure 22-106 A3 40 MHz Digital IF Cables



4. Refer to **Figure 22-107**. Pull the AIF/DIF assembly part way out of the chassis. Remove cables W100, W101, and W107 from the A2 25 MHz Analog IF assembly.
5. The AIF/DIF assembly can be removed from the chassis by pulling straight out the back.

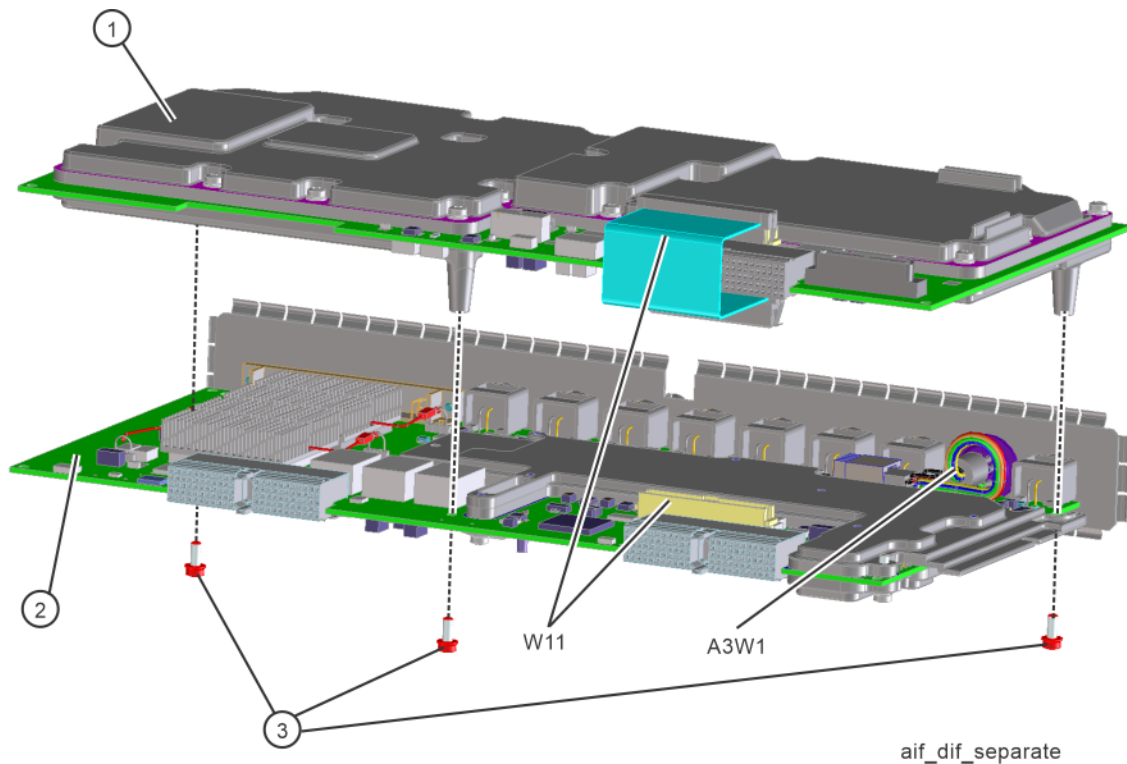
Figure 22-107 AIF Cables



Separate AIF/DIF Assembly

1. Refer to **Figure 22-108**. To separate the A2 25 MHz Analog IF (**1**) from the A3 40 MHz Digital IF (**2**), unplug ribbon cable W11 from the AIF assembly.
2. From underneath the assembly, remove the three screws (**3**) (**0515-0372**).

Figure 22-108 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 W11.

Replacement

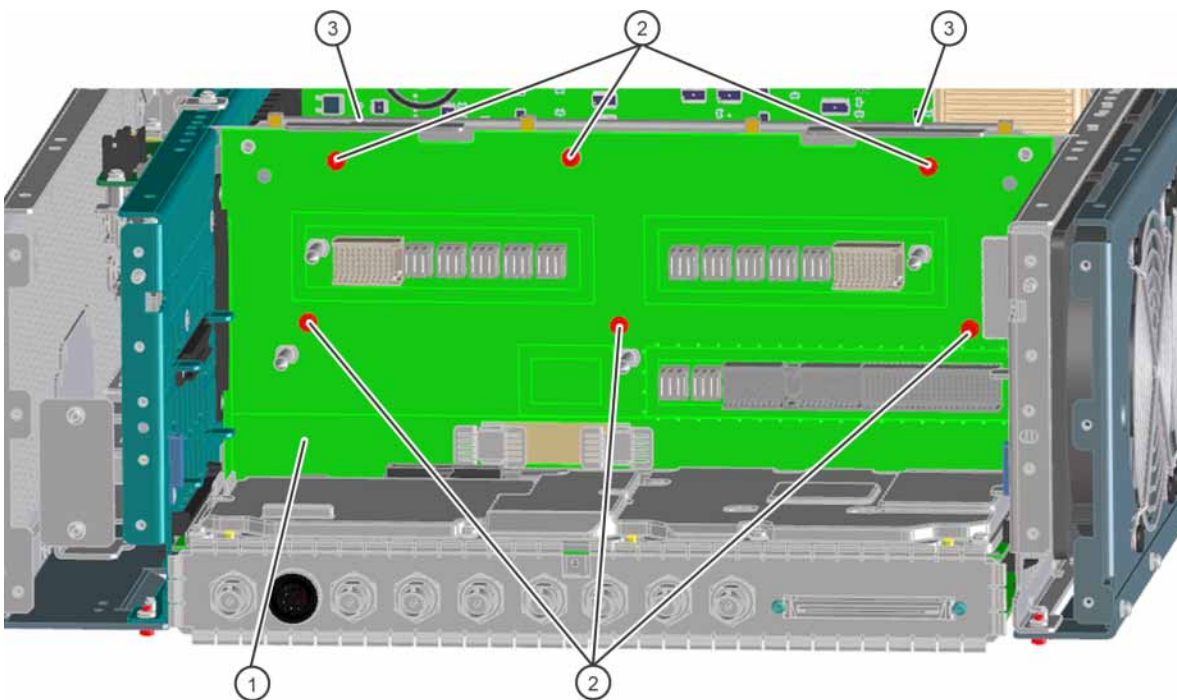
1. Slide the AIF/DIF assembly partially into the slot at the rear of the instrument.
2. Refer to **Figure 22-107**. Replace cables W100, W101, and W107 to the AIF assembly.
3. Push on the AIF/DIF assembly to mate the connectors to the motherboard assembly.
4. Refer to **Figure 22-106**. Replace cables W100, W102, W108, and W110 from 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** replacement procedure.

A7 Midplane Board Assembly

Removal

1. Remove the instrument outer case. Refer to the [Instrument Outer Case](#) removal procedure.
2. Remove the top brace and power supply bracket. Refer to the [Top Brace and Power Supply Bracket](#) removal procedure.
3. Refer to [Figure 22-109](#). Locate the Midplane Board assembly (1).

Figure 22-109 Midplane Board Assembly Removal



4. Remove the system processor assembly. Refer to the [A4 System Processor](#) removal procedure.
5. Remove the rear panel. Refer to the [Rear Panel](#) removal procedure.
6. Remove the power supply assembly. Refer to the [A6 Power Supply Assembly](#) removal procedure.

7. Remove the six screws **(2)** **(0515-0375)** attaching the midplane board assembly **(1)** to the midplane bracket. The midplane board assembly can now be pulled up from the chassis by use of the ejectors **(3)**.

Replacement

1. Refer to **Figure 22-109**. Install the midplane assembly into the chassis using the ejectors and attach to the midplane bracket using the six screws **(0515-0375)** removed earlier. Torque to 9 inch-pounds.
2. Replace the power supply assembly. Refer to the **A6 Power Supply Assembly** replacement procedure.
3. Replace the rear panel. Refer to the **Rear Panel** replacement procedure.
4. Replace the processor assembly. Refer to the **A4 System Processor** assembly replacement procedure.
5. Replace the top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
6. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

A8 Motherboard Assembly

Removal

1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the rear panel. Refer to the **Rear Panel** removal procedure.
3. Remove the top brace and power supply bracket. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
4. Remove the Front Frame Assembly. Refer to the **Front Frame Assembly** removal procedure.
5. Remove the reference assembly. Refer to the **A16 Reference Assembly** removal procedure.
6. Remove the CPU assembly. Refer to the **A4 System Processor** removal procedure.
7. Remove the power supply assembly. Refer to the **A6 Power Supply Assembly** removal procedure.
8. Remove the AIF/DIF assembly. Refer to the **A2 Analog IF/A3 Digital IF** removal procedure.
9. Remove the Front End Control assembly. Refer to the **A15 Front End Controller** removal procedure.
10. Remove the LO Synthesizer assembly. Refer to the **A14 DDS LO Synthesizer** removal procedure.
11. Remove the Midplane assembly. Refer to the **A7 Midplane Board Assembly** removal procedure.
12. Remove the RF bracket. Refer to **Access to the RF Area Parts**.
13. Remove the fan assembly. Refer to the **Fan Assembly** removal procedure.
14. Refer to **Figure 22-110** and **Figure 22-111**. Remove the midplane bracket (1) by removing the eight screws (2) (0515-0372) (two on each side and four on the bottom).

Figure 22-110 Midplane Bracket Removal

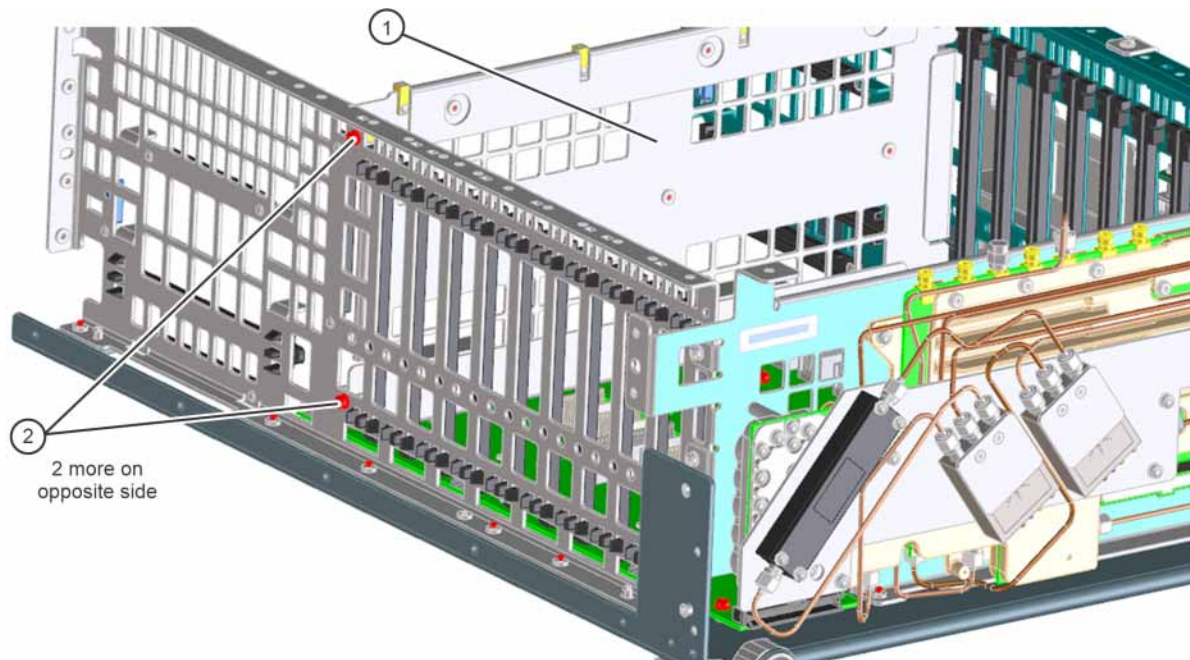
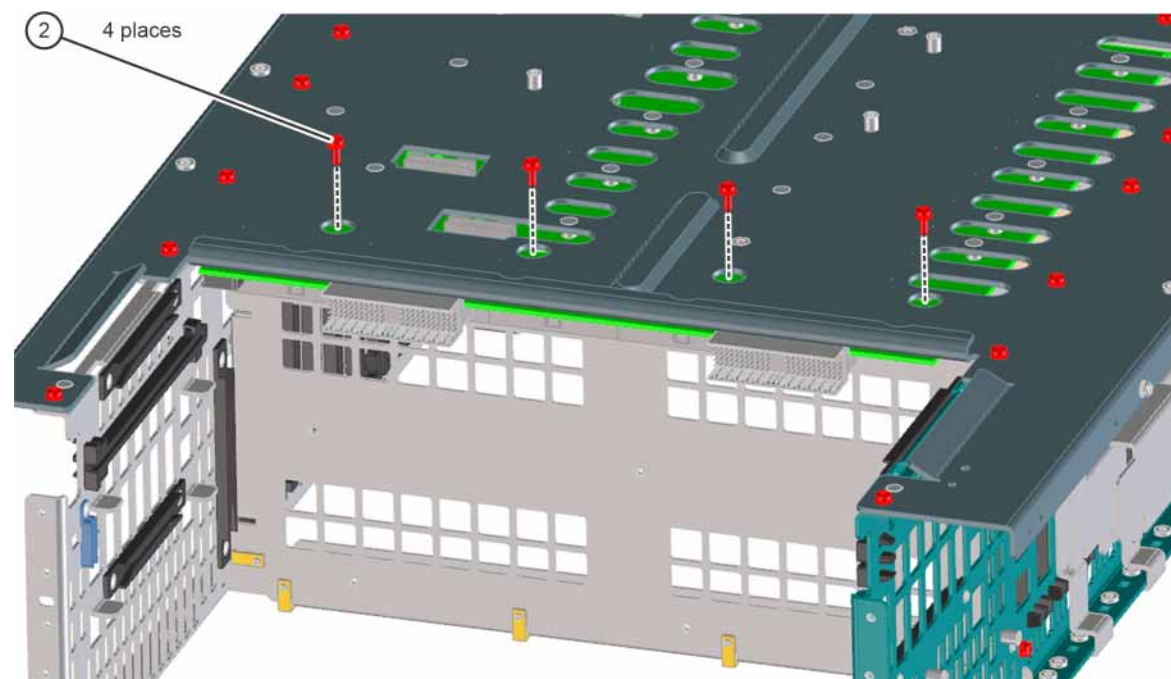
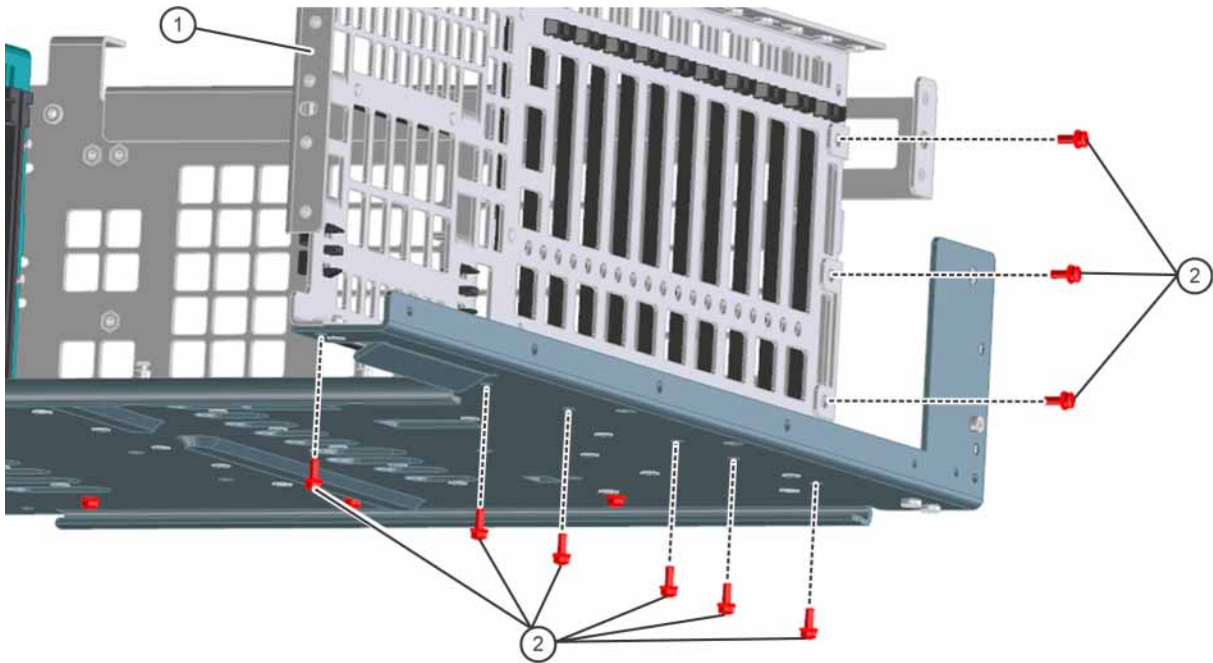


Figure 22-111 Bottom Screws



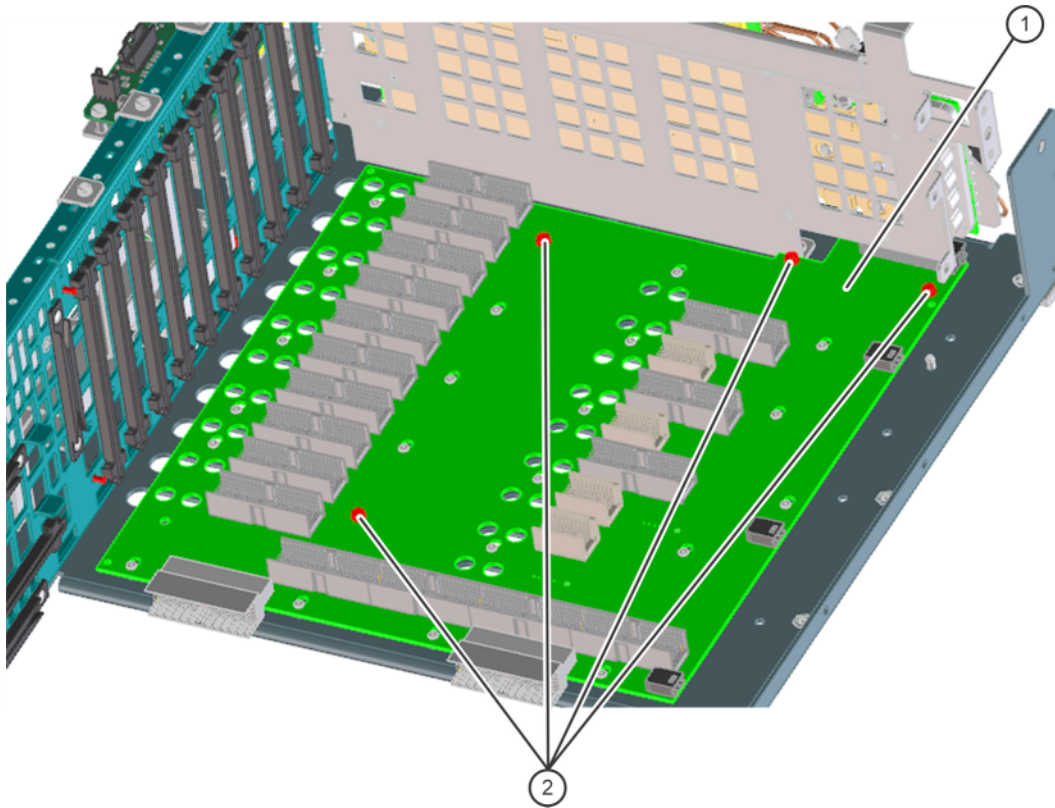
15. Refer to **Figure 22-112**. Remove the left side chassis (**1**) (same side as the fan) by removing the nine screws (**2**) (**0515-0372**) (six on the bottom).

Figure 22-112 Chassis Side Removal



16. Refer to **Figure 22-113**. Remove the motherboard (1) by removing the four screws (2) (0515-0372). Slide the motherboard back off the standoffs and lift it up and out.

Figure 22-113 Motherboard Assembly Removal



Replacement

1. Refer to **Figure 22-113**. Place the motherboard (1) on standoffs and slide into position in the chassis and replace the four screws (2) (0515-0372). Torque to 9 inch-pounds.
2. Refer to **Figure 22-112**. Replace the left side chassis by replacing the nine screws (0515-0372). Torque to 9 inch-pounds.
3. Refer to **Figure 22-110**. Replace the midplane bracket (1) by replacing the eight screws (2) (0515-0372). Torque to 9 inch-pounds.
4. Replace the fan assembly. Refer to the **Fan Assembly** replacement procedure.
5. Replace the RF bracket. Refer to **Access to the RF Area Parts**.
6. Replace the Midplane assembly. Refer to the **A7 Midplane Board Assembly** replacement procedure.

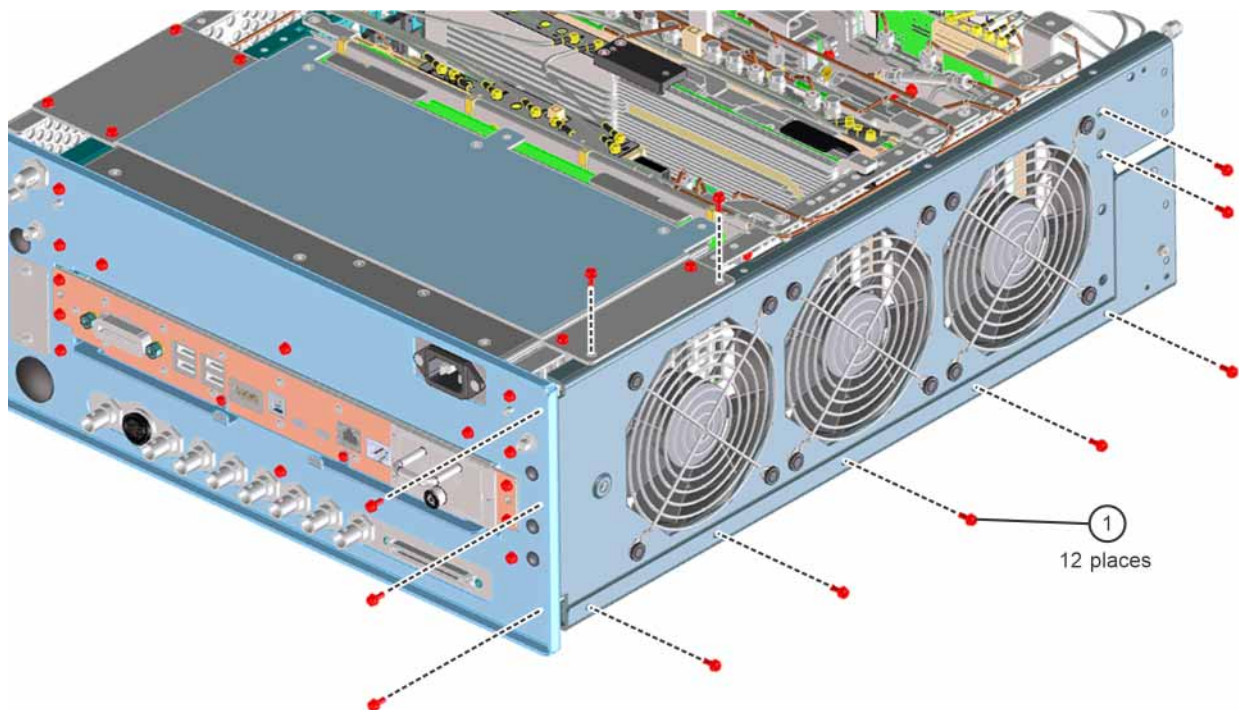
7. Replace the LO Synthesizer assembly. Refer to the **A14 DDS LO Synthesizer** removal procedure.
8. Replace the Front End Control assembly. Refer to the **A15 Front End Controller** replacement procedure.
9. Replace the AIF/DIF assembly. Refer to the **A2 Analog IF/A3 Digital IF** replacement procedure.
10. Replace the power supply assembly. Refer to the **A6 Power Supply Assembly** replacement procedure.
11. Replace the CPU assembly. Refer to the **A4 System Processor** replacement procedure.
12. Replace the reference assembly. Refer to the **A16 Reference Assembly** replacement procedure.
13. Replace the Front Frame Assembly. Refer to the **Front Frame Assembly** replacement procedure.
14. Replace the top brace and reference bracket. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
15. Replace the rear panel. Refer to the **Rear Panel** replacement procedure.
16. Ensure all cables are plugged in or connected and torqued.
17. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Fan Assembly

Removal

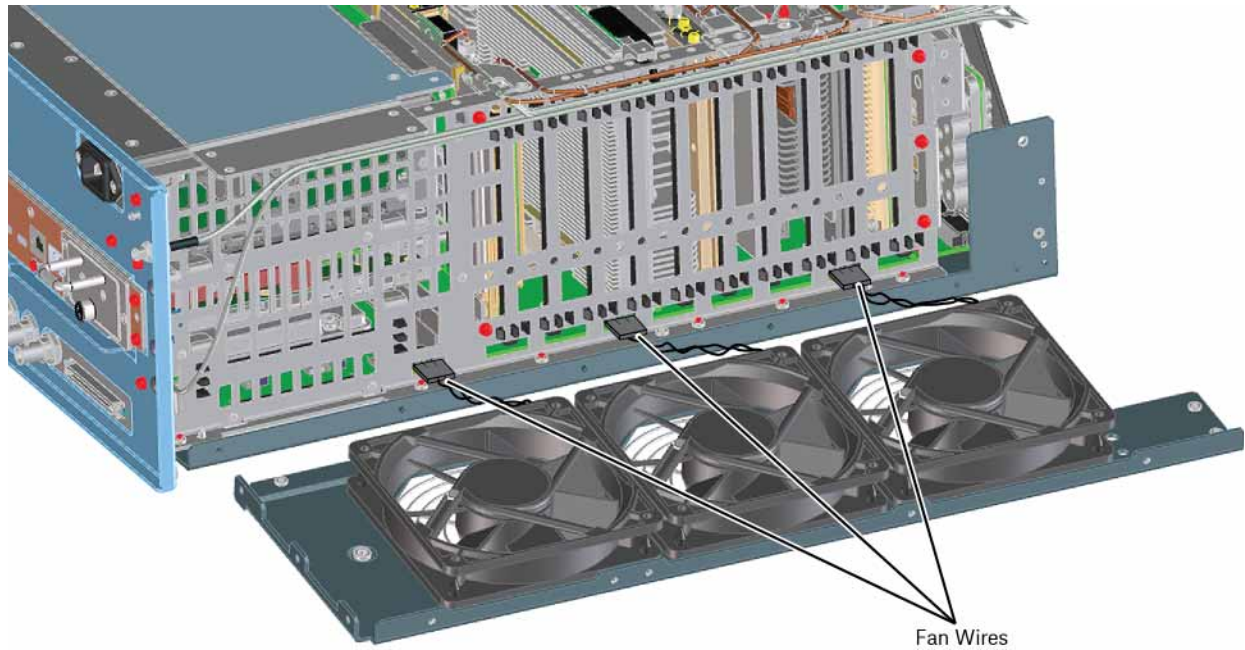
1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the top brace. Refer to the **Top Brace and Power Supply Bracket** removal procedure.
3. Remove the Front Frame Assembly. Refer to the **Front Frame Assembly** removal procedure.
4. Refer to **Figure 22-114**. Remove the twelve remaining screws (1) (0515-0372) that attach the fan assembly to the chassis.

Figure 22-114



5. Refer to **Figure 22-115**. Unplug the fan wires from the motherboard. The fan assembly can now be lifted from the chassis.

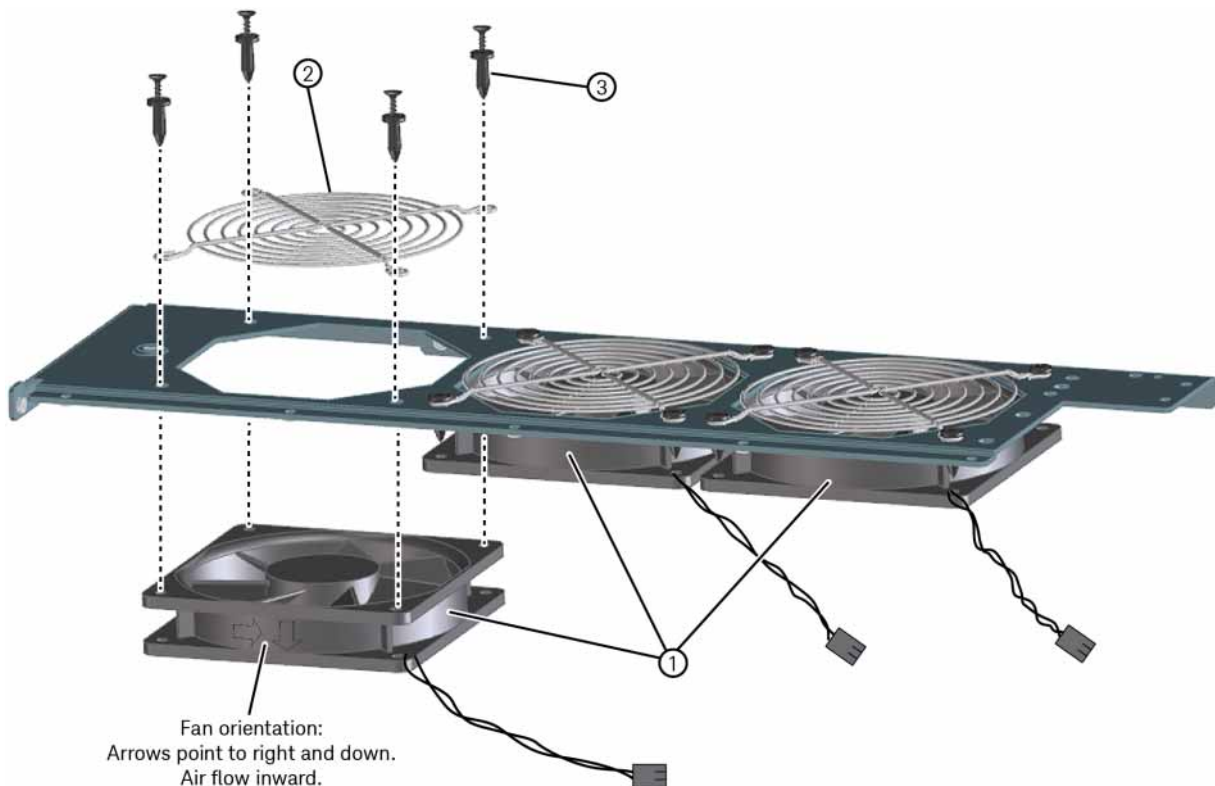
Figure 22-115 Fan Wires



Replacing a Fan

1. Refer to **Figure 22-116**. To replace a fan, it is necessary to remove the 4 plastic rivets (3) (0361-1272) that attach the fan (1) and guard (2) to the fan bracket. To do this use a small screwdriver to unscrew the rivet and remove it from the bracket. The rivets may need to be cut or pushed out from behind. They are not reusable.

Figure 22-116



2. Position the new fan on the work surface with the arrows pointing to the right and down.
3. Orient the fan guard so that the rings are on the outside, and that the “V” of the support legs are pointing to the neighboring fan.
4. With the rivets center posts raised, snap the rivets into place through the fan grill and fan bracket and into the fan. Screw the center posts into place. This may require a small hammer or push tool to push the rivets in.

Replacement

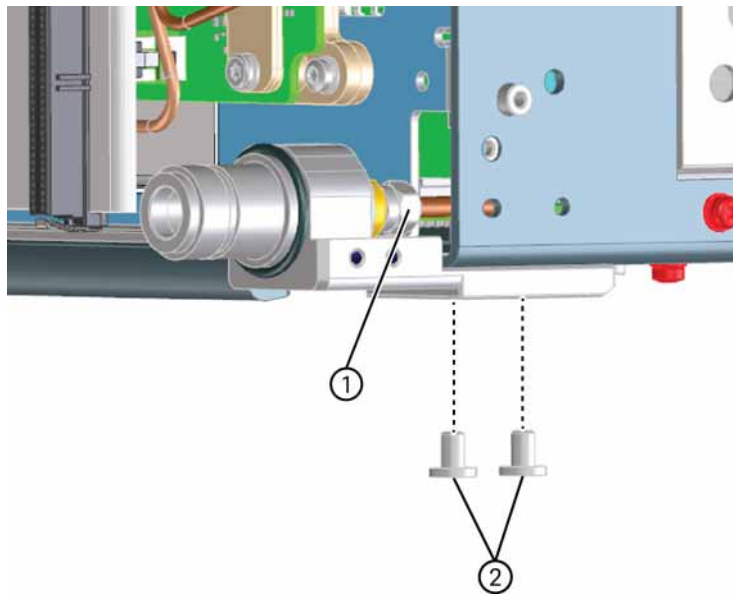
1. Refer to **Figure 22-115**. Plug the fan wires into the motherboard.
2. Refer to **Figure 22-114**. Place the fan assembly into position in the chassis. Replace the twelve screws **(1) (0515-0372)** to attach the fan assembly to the chassis. Ensure the fan wires are not pinched. Torque to 9 inch-pounds.
3. Replace the Front Frame Assembly. Refer to the **Front Frame Assembly** replacement procedure.
4. Replace the top brace. Refer to the **Top Brace and Power Supply Bracket** replacement procedure.
5. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Input Connector Assembly

Removal

1. Remove the instrument outer case. Refer to the **Instrument Outer Case** removal procedure.
2. Remove the Front Frame Assembly. Refer to the **Front Frame Assembly** removal procedure.
3. Refer to **Figure 22-117**. Disconnect the semi-rigid cable **(1)** from the Input Connector Assembly.

Figure 22-117



4. Remove the two screws **(2)** (**0515-6548**) that attach the Input Connector Assembly to the chassis. The connector assembly can now be lifted from the chassis.

Replacement

1. Refer to **Figure 22-117**. Place the Input Connector Assembly into position in the chassis. Replace the two screws **(2)** (**0515-6548**) to attach the Input Connector Assembly to the chassis. Torque to 12 inch-pounds.
2. Reconnect the semi-rigid cable **(1)** to the Input Connector Assembly. Torque to 10 inch-pounds.
3. Replace the Front Frame Assembly. Refer to the **Front Frame Assembly** replacement procedure.
4. Replace the instrument outer case. Refer to the **Instrument Outer Case** replacement procedure.

Table 22-40 J1 RF Input Connector Assembly Related Parts

Item		Keysight Part Number
J1 F Input Connector Assembly	1.85 mm	N9032-60038
	2.4 mm	N9048-60111
	3.5 mm (Option C35 only)	N9048-60119
	Type-N	N9048-60121

23 Post-Repair Procedures

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 760](#)

[Before Starting on page 760](#)

[Post-Repair Procedures on page 761](#)

[Additional Tasks on page 763](#)

[Default BIOS Settings on page 763](#)

[Operating System Initialization on page 764](#)

[Program Model and Serial Number on page 766](#)

[FPGA Synchronization on page 767](#)

[Update Instrument Software on page 769](#)

[Calibration Data Backup on page 770](#)

[Calibration Data Restore on page 774](#)

[Characterize Preselector on page 778](#)

[Front Panel Tests on page 782](#)

[ODI Loopback Test on page 785](#)

Overview

This chapter provides information that will enable you to return an instrument to full operation following the replacement of any assembly. This information includes a table that shows which additional tasks, utilities, adjustments, and 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

The following table lists the additional tasks, utilities, adjustments, and performance verification tests needed after an assembly replacement.

After an assembly is replaced, find the assembly that has been replaced across the top of the table, and then perform the recommended tasks in the order in which they are listed. Completing these tasks in themselves doesn't guarantee all published specifications are being met. Only a full instrument calibration will do that.

Post Repair Procedures	A1A2 Front Panel Controller	A1A3 Touch Screen Display	A2 25 MHz Analog IF	A3 40 MHz Digital IF	A4 System Processor	A4BT1 Battery	A5 Disk Drive ^c	A6 Power Supply	A7 Midplane	A8 Motherboard	A9 Step Attenuator A	A10 Step Attenuator B	A11 Band Switch	A12 Yig Tuned Filter	A13 Downconverter	A14 DDS LO Synthesizer	A15 Front End Controller	A16 Reference	A16A3 Reference OCXO	A20 Yig Tuned Oscillator	A21 Wideband Digital IF	A23 IF Mux	A25 Wideband Calibrator	SW1 Calibrator Switch	SW2 LNA Switch	SW3 LNP Switch	SW4 MPB Switch
Additional Tasks^b																											
Default BIOS Settings					X	X																					
Operating System Initialization							X																				
Program Model and Serial Numbers									X																		
FPGA Synchronization				X												X	X	X			X	X					
Update Instrument Software							X										X										
Calibration Data Restore							X																				
Characterize Preselector														X			X										
Wideband Comb Alignment															X						X	X					
Front Panel Touch Test	X	X																									
Front Panel Display Test	X	X																									
Front Panel Key Test	X																										
ODI Loopback Test (Option ST1 or ST2)																					X						
Utilities^a																											
Statistics Reset											X	X														X	X
Adjustments^a																											
10 MHz Internal Frequency Reference							*											X	X								
50 MHz Calibrator Amplitude							*				X	X	X		X			X			X	X		X	X	X	
4800 MHz Calibrator Amplitude							*				X	X	X	X	X			X			X	X		X	X	X	X
Attenuator Slope							*				X	X	X		X										X	X	
Freq Resp Below 3.6 GHz Preamp Off							*				X	X	X		X										X	X	
Freq Resp Below 3.6 GHz Preamp On							*				X	X	X		X										X	X	
Freq Resp Above 3.6 GHz Preamp Off							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz MPB Preamp Off							*				X	X	X		X							X			X	X	X
Freq Resp Above 3.6 GHz Preamp On							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz MPB Preamp On							*				X	X	X		X							X			X	X	X
Freq Resp Above 3.6 GHz LNP							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz FBP							*				X	X	X		X							X			X	X	X
Freq Resp Below 3.6 GHz EA3							*				X	X	X		X										X	X	
Freq Resp Below 3.6 GHz LNA							*				X	X	X		X										X	X	
Freq Resp Above 3.6 GHz LNA							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz LNA Preamp On							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz LNA MPB							*				X	X	X		X							X			X	X	X
Freq Resp Above 3.6 GHz LNA LNP							*				X	X	X	X	X							X			X	X	X
Freq Resp Above 3.6 GHz LNA FBP							*				X	X	X		X							X			X	X	X
Freq Resp Above 3.6 GHz LNA MPB Preamp On							*				X	X	X		X							X			X	X	X
Wideband Calibrator Adjustment							*																X	X			
Freq Resp Wideband FBP							*				X	X	X		X							X	X	X	X	X	X
Freq Resp Wideband MPB							*				X	X	X		X							X	X	X	X	X	X
Freq Resp Wideband MPB Preamp On							*				X	X	X		X							X	X	X	X	X	X
Freq Resp Wideband LNA FBP							*				X	X	X		X							X	X	X	X	X	X
Freq Resp Wideband LNA MPB							*				X	X	X		X							X	X	X	X	X	X
Freq Resp Wideband LNA MPB Preamp On							*				X	X	X		X							X	X	X	X	X	X
IF Frequency Response			X	X			*				X	X	X	X	X							X			X	X	X
RF to IF Adjustment							*				X	X	X								X	X	X	X	X	X	X
IF Input Gain EXM Adjustment							*								X							X					
LO Output Power EXM Adjustment							*								X												
Front End Controller Attenuator							*										X										
Backup Cal Data			X	X			X				X	X	X	X	X		X	X	X		X	X	X	X	X	X	X
Performance Verification^a																											
Frequency Reference Accuracy							*		X	X								X	X								
RBW Switching Uncertainty			X	X			*		X	X																	
Power Bandwidth Accuracy			X	X			*		X	X																	
Noise Density							*		X	X												X					
Residual Response	X	X	X	X	X	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Displayed Average Noise Level	X	X	X	X	X	X	*	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Phase Noise							*		X	X					X			X	X	X							
IF Frequency Response			X	X			*		X	X			X		X						X	X		X	X	X	X
IF Amplitude Accuracy			X	X			*		X	X			X		X						X	X		X	X	X	X
Frequency Response Above 50 MHz							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response Above 3.6 GHz MPB On							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response Above 50 MHz Preamp On LNA Off							*		X	X	X	X	X	X	X	X	X			X		X		X	X	X	X
Frequency Response Above 50 MHz Preamp Off LNA On							*		X	X	X	X	X	X	X	X	X			X		X		X	X	X	X
Frequency Response Above 3.6 GHz Preamp On LNA On							*		X	X	X	X	X	X	X	X	X			X		X		X	X	X	X
Frequency Response Above 3.6 GHz Low Noise Path On							*		X	X	X	X	X	X	X	X	X			X		X		X	X	X	X
Frequency Response Below 50 MHz Preamp On LNA Off							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response Below 50 MHz Preamp Off LNA On							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response 100 kHz to 3.6 GHz EA3							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response 100 kHz to 50 MHz							*		X	X	X	X	X		X	X	X			X		X		X	X	X	X
Frequency Response Below 100 kHz							*		X	X																	
Frequency Response Below 100 kHz EA3							*		X	X																	
Frequency Counter Accuracy							*		X	X									X	X							
Frequency Readout Accuracy							*		X	X									X	X							
Frequency Span Accuracy							*		X	X						X			X	X							
Spurious Responses							*	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X
Absolute Amplitude Accuracy			X	X			*		X	X	X	X	X	X	X		X	X	X	X		X		X	X	X	X
Absolute Amplitude Accuracy EA3			X	X			*		X	X	X	X	X		X		X	X	X	X		X		X	X	X	X
Display Scale Fidelity			X	X			*		X	X																	
Input Attenuation Switching Uncertainty							*		X	X	X	X															
IF Input Gain Accuracy EXM							*		X	X					X							X					
LO Output Power Accuracy EXM							*		X	X					X	X				X							
Third Order Intercept							*		X	X	X	X	X	X	X												
Second Harmonic Distortion							*		X	X	X	X	X	X	X												

^a Performance Verification and Adjustment Software required for all performance tests, adjustments and utilities.

^b See the Additional Tasks section in this chapter for detailed instructions on these tasks

^c Before replacing the A5 Disk Drive, see the Calibration Data Backup section in this chapter for details

X = Must Perform in the order listed

* = Must Perform if calibration file cannot be transferred to new disk drive

Additional Tasks

The following are additional manual tasks that will need to be done when specified in Table 23-1 to return the instrument to full operation after a repair has been performed.

Default BIOS Settings

Whenever either the A4 System Processor assembly or the A4BT1 Processor Battery is changed the processor BIOS settings need to be verified. If these are not set correctly the instrument may not boot up or operate properly. Use the following procedure to default the BIOS settings.

1. Connect an external USB keyboard to one of the front panel USB ports.
2. Turn the instrument power on.
3. Confirm that the 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 Changes** and **Exit**.

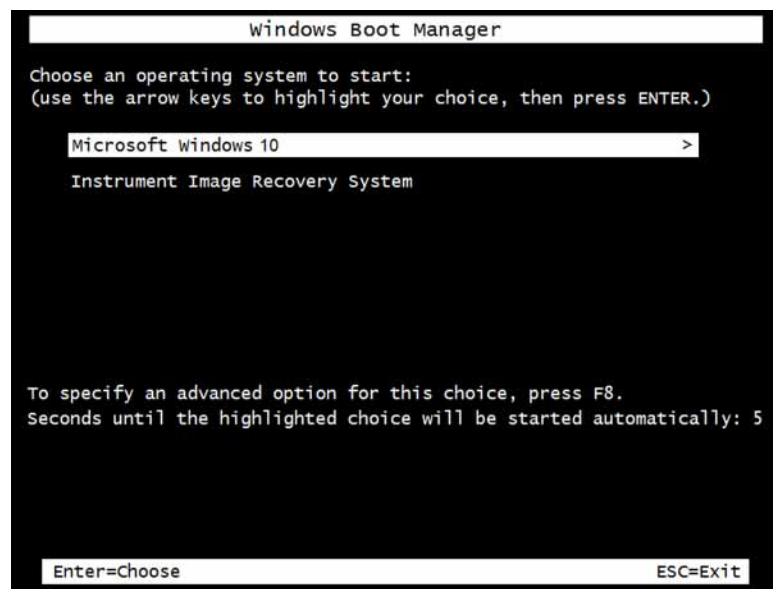
Operating System Initialization

When a new A5 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

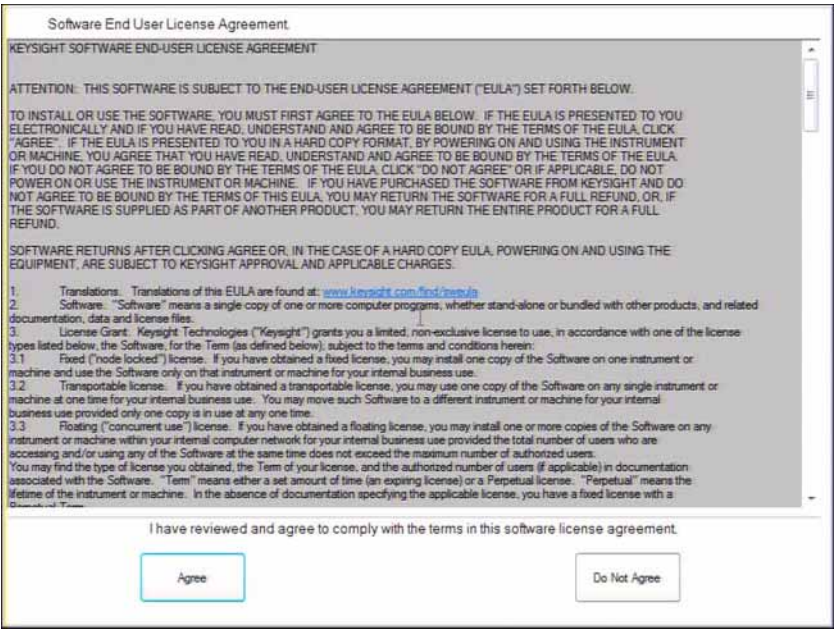
1. With the new A5 Disk Drive installed power the instrument on.
2. Within a few seconds you will see the initial Keysight Technologies splash screen, and then the boot selection menu as seen in [Figure 23-1](#).

Figure 23-1 Boot Selection Menu



3. Allow the instrument to boot the windows operating system. (This will happen automatically after 5 seconds if the instrument is left alone).
4. After a few moments the End User License Agreement window will appear, as shown in [Figure 23-2](#).

Figure 23-2 End User License Agreement



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 may reboot a time or two in order to complete the initialization process.

Program Model and Serial Number

Since the instrument model and serial numbers are stored only on the A7 Midplane board, this information will be lost when this board is replaced. Until the instrument model and serial numbers are restored the instrument application software will not allow any user measurements to be made, since all previously installed licenses will not be accepted. However, the license files will not be automatically deleted. Once the model and serial numbers are restored the licenses will then be recognized and accepted, returning the instrument to the capability that was available prior to the A7 Midplane board replacement.

NOTE

The instrument model and serial number can only be programmed into replacement A7 Midplane boards by connecting them to the Keysight network and contacting the factory product support team for assistance.

Since the instrument model and serial numbers are stored on the A7 Midplane board, this should only be required when this board has been replaced with a new one.

FPGA Synchronization

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 for the instrument application software version that is installed.

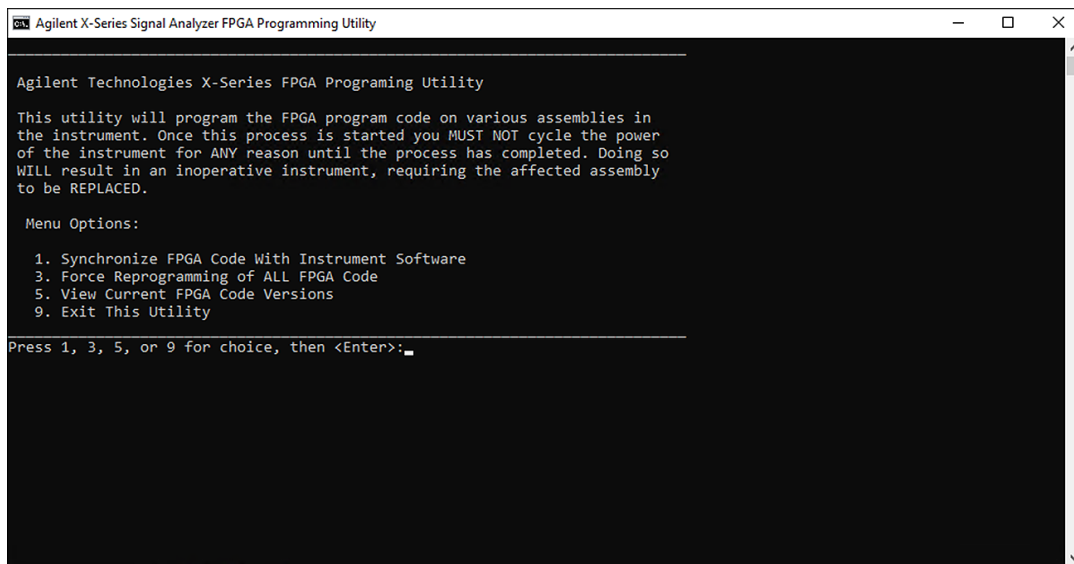
NOTE

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 a file explorer window to navigate to the following folder:
C:\Program Files\Agilent\SignalAnalysis\Physics
4. In this folder find and run the file named: **FPGA_Prog.bat**
5. The FPGA Programming Utility will start, and a window as shown in **Figure 23-3** will appear.

Figure 23-3 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** again.

- 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.

Update Instrument 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 download the latest version of software for the instrument, as well as the installation instructions, go to the following web location:

https://www.keysight.com/find/n9032b_software

Calibration Data Backup

There is an Alignment Data Wizard in the instrument that is designed to handle the backing up and restoring of the instrument's calibration database. There is also dedicated memory in the A4 System Processor assembly for calibration database backups. Use the following procedure to backup the instrument calibration data to this location **before** an A5 Disk Drive has been replaced.

1. To run the Alignment Data Wizard, select **System, Alignments, Backup / Restore Align Data...**

NOTE

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

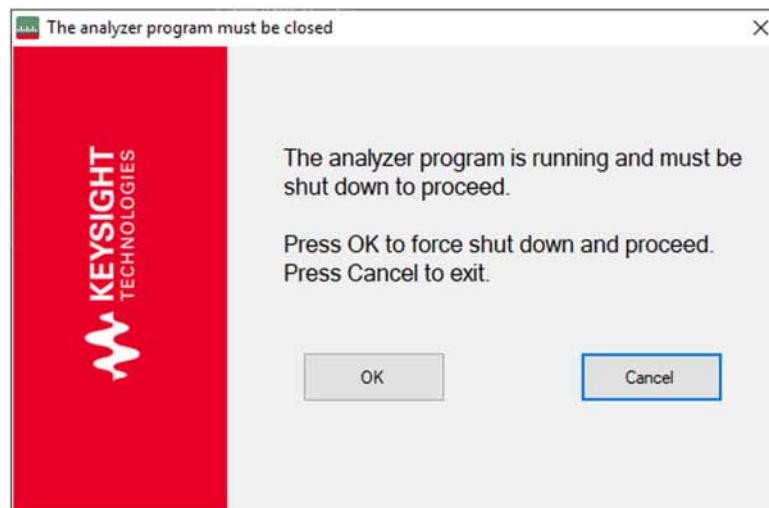
C:\Program Files\Agilent\SignalAnalysis\Infrastructure

and run the following program:

BackupRestoreAlignDataWizard.exe

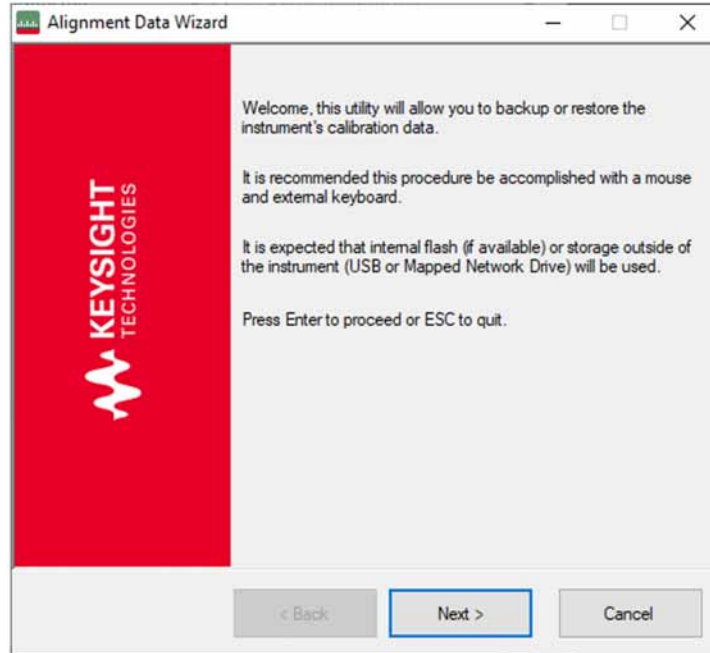
2. When the Alignment Data Wizard starts, and the instrument application is running, you will see a prompt notifying you that it will first need to shut down the instrument application before it can run, as seen in **Figure 23-4**. This is so that the instrument application does not try to access the calibration database while it is being backed up or restored. Select OK to continue.

Figure 23-4 Application Shutdown Confirmation



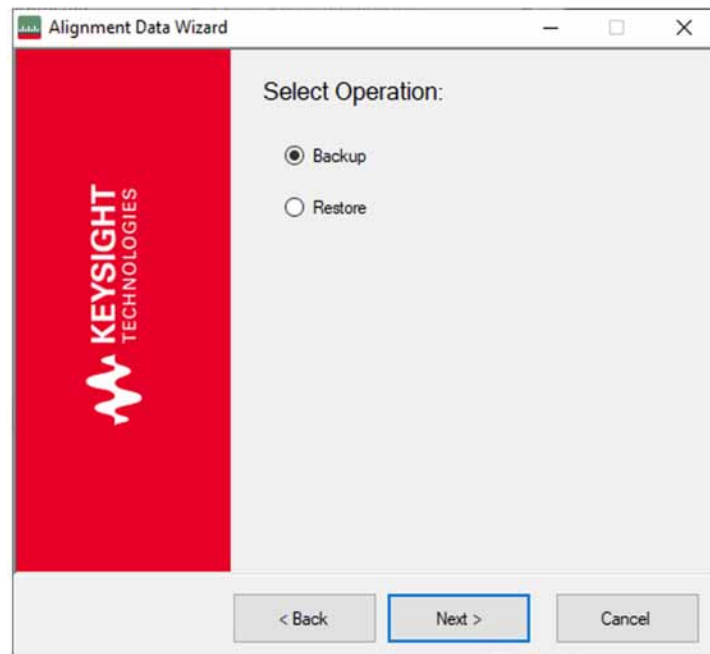
3. Once the instrument application shuts down, the wizard will continue with the prompt seen in [Figure 23-5](#). Select **Next**.

Figure 23-5 Alignment Data Wizard Welcome



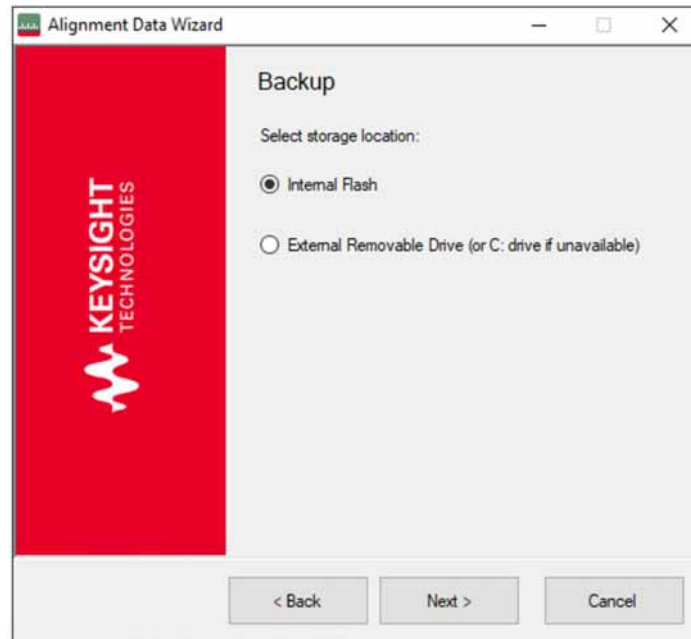
4. You will then be presented with a selection to either Backup or Restore the calibration data, as seen in [Figure 23-6](#). Select **Backup** and **Next**.

Figure 23-6 Select Backup Operation



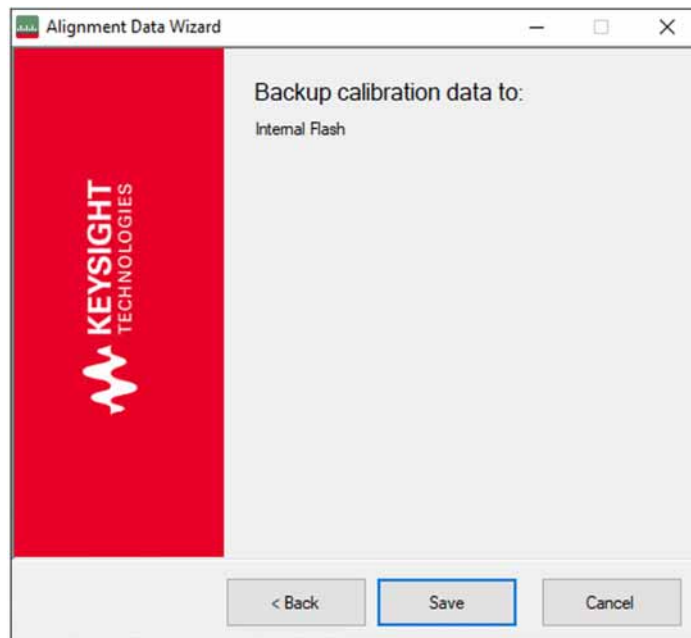
5. The default location to backup the calibration data to will be the dedicated internal memory on the A4 System Processor, as seen in [Figure 23-7](#). Select **Next**.

Figure 23-7 Backup to Internal Flash



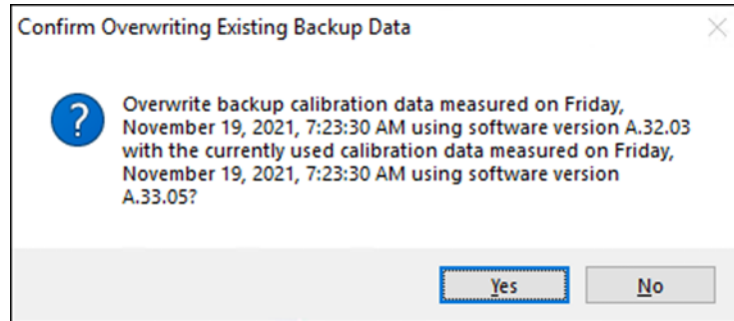
6. The confirmation window seen in [Figure 23-8](#) will then be seen. Select **Restore**.

Figure 23-8 Confirm Backup to Internal Flash



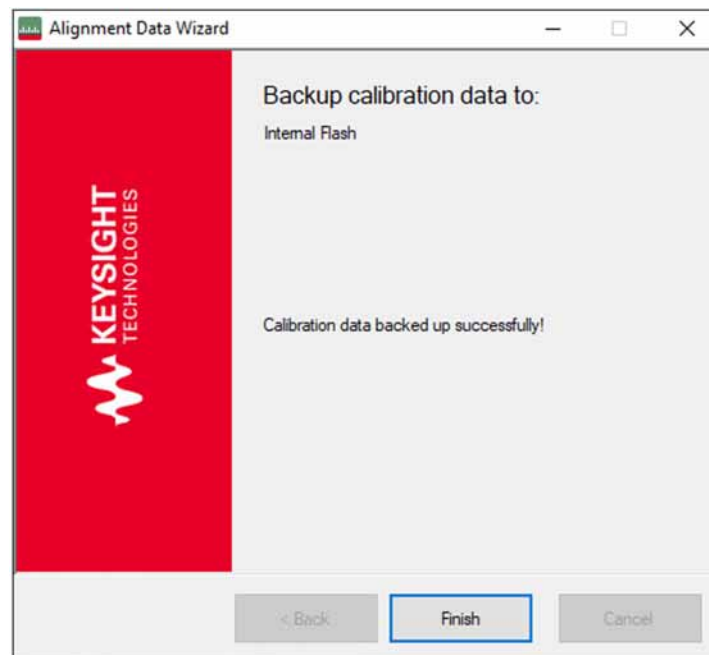
7. You will then be asked to confirm the backup operation along with the dates of the data to backup, as seen in [Figure 23-9](#). Select **Yes**.

Figure 23-9 Final Confirmation



8. Once the calibration data is backed up the window seen in [Figure 23-10](#) will appear. Select **Finish** to complete the backup process.

Figure 23-10 Backup Completed



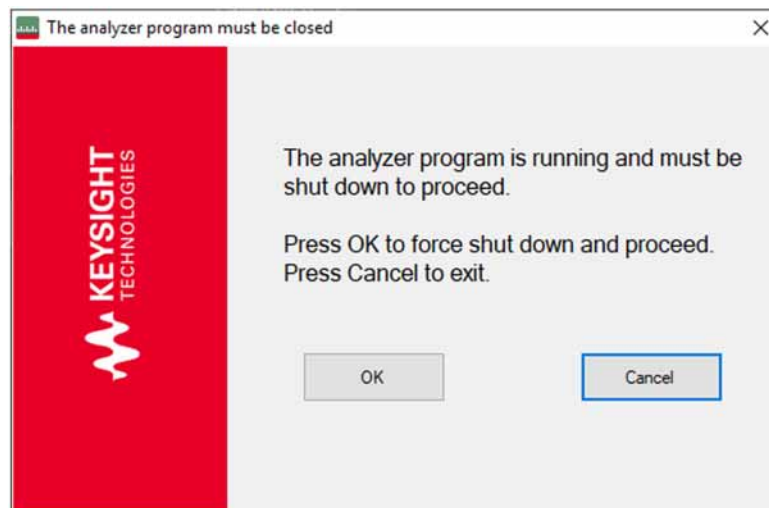
9. The instrument application will now load and run.

Calibration Data Restore

There is an Alignment Data Wizard in the instrument that is designed to handle the backing up and restoring of the instrument's calibration database. There is also dedicated memory in the A4 System Processor assembly for calibration database backups. Use the following procedure to restore the instrument calibration data from this location **after** an A5 Disk Drive has been replaced.

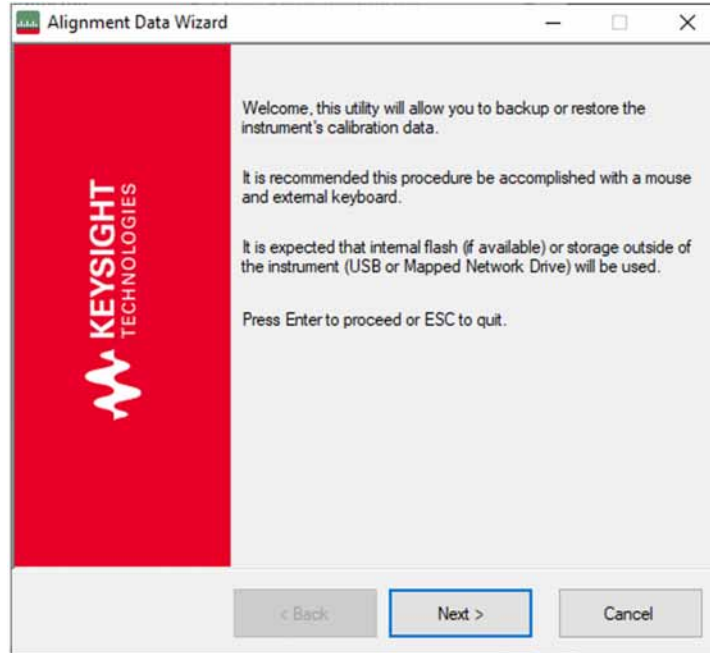
1. To run the Alignment Data Wizard, select **System, Alignments, Backup / Restore Align Data...**
2. When the Alignment Data Wizard starts, and the instrument application is running, you will see a prompt notifying you that it will first need to shut down the instrument application before it can run, as seen in **Figure 23-11**. 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 23-11 Application Shutdown Confirmation



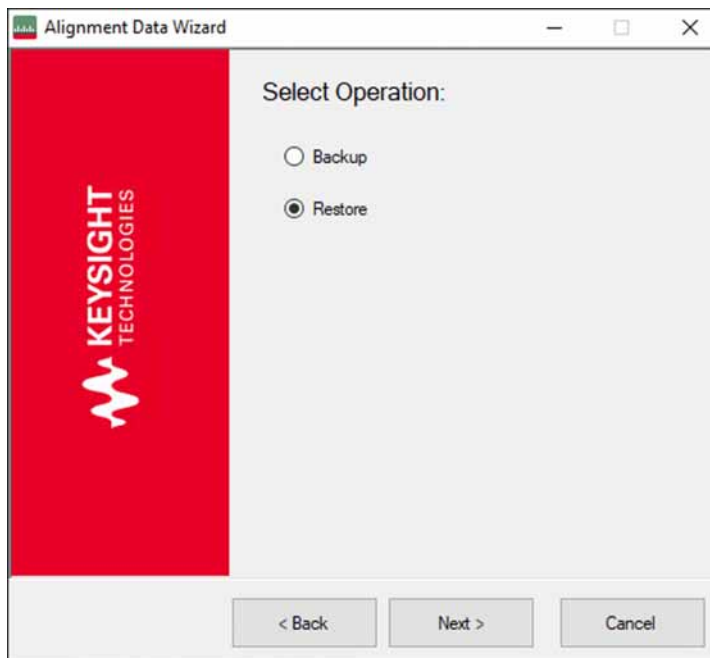
3. Once the instrument application shuts down, the wizard will continue with the prompt seen in [Figure 23-12](#). Select **Next**.

Figure 23-12 Alignment Data Wizard Welcome



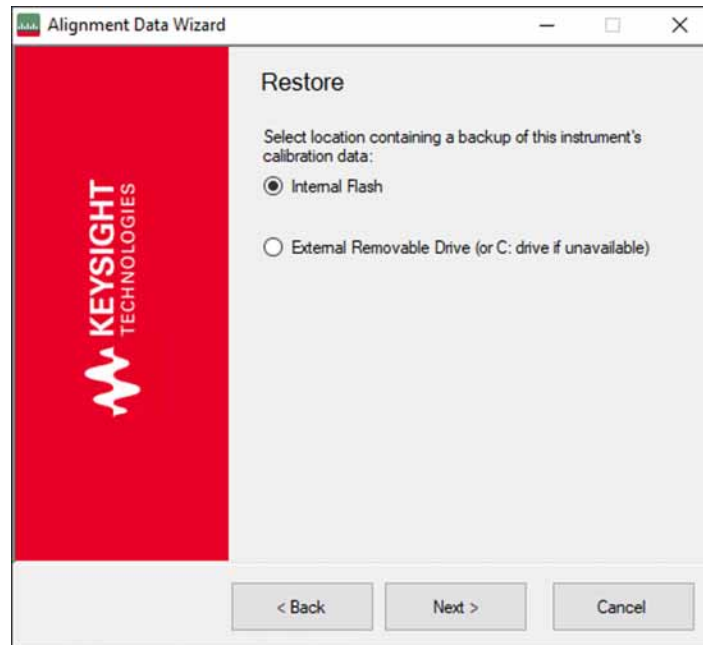
4. You will then be presented with a selection to either Backup or Restore the calibration data, as seen in [Figure 23-13](#). Select **Restore** and **Next**.

Figure 23-13 Select Restore Operation



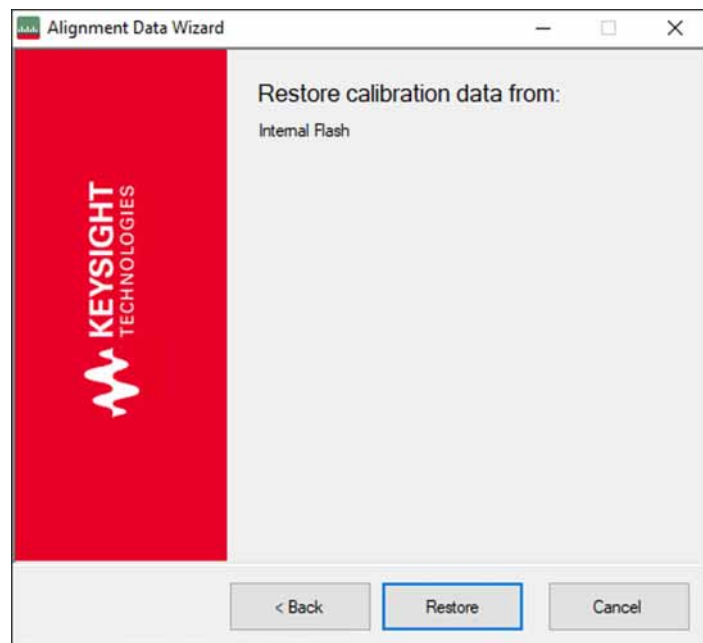
5. The default location to restore the calibration data from will be the dedicated internal memory on the A4 System Processor, as seen in [Figure 23-14](#). Select **Next**.

Figure 23-14 Restore from Internal Flash



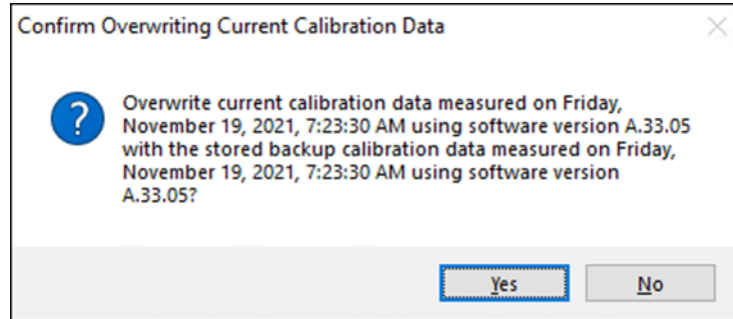
6. The confirmation window seen in [Figure 23-15](#) will then be seen. Select **Restore**.

Figure 23-15 Confirm Restore from Internal Flash



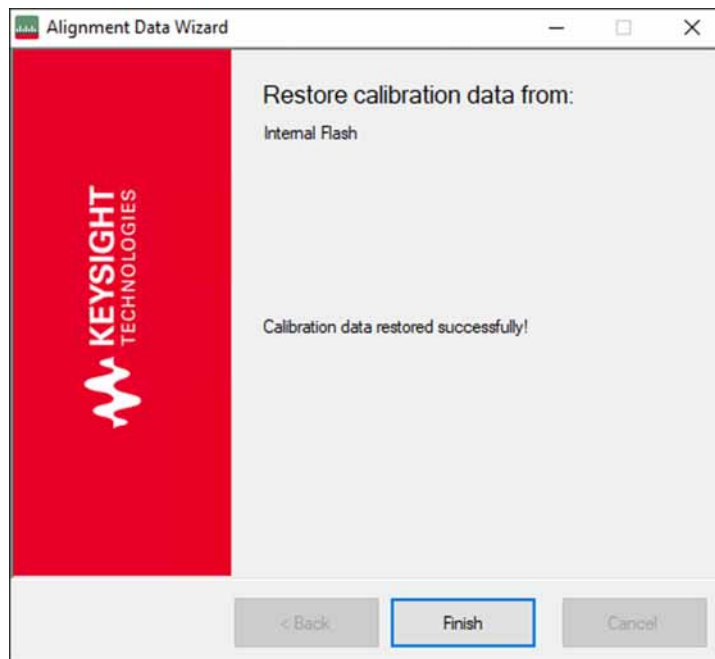
7. You will then be asked to confirm the restore operation along with the dates of the data to restore, as seen in **Figure 23-16**. Select **Yes**.

Figure 23-16 Final Confirmation



8. Once the calibration data is restored the window seen in **Figure 23-17** will appear. Select **Finish** to complete the restore process.

Figure 23-17 Restore Completed



9. The instrument application will now load and run with the restored data.

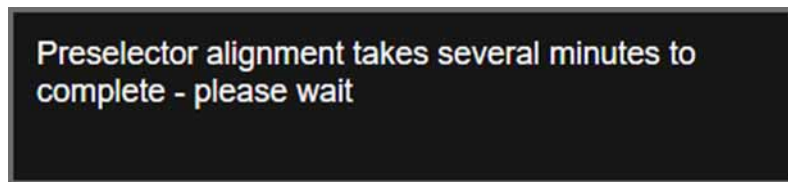
Characterize Preselector

After the A12 Yig Tuned Filter or the A15 Front End Controller is replaced the filter characterization needs to be run to update the instrument calibration data for the new assembly. This function is built into the instrument advanced alignments and can be run with the following procedure.

1. Return the instrument to a known state by pressing **Mode Preset**.
2. Access the advanced alignments menu by pressing **System, Alignments, Advanced**.
3. From the advanced menu, select **Characterize Preselector**.

This alignment will take 10 to 15 minutes to complete. While it is running there will be a message on the instrument display as seen in **Figure 23-18**.

Figure 23-18 Characterize Preselector in Progress



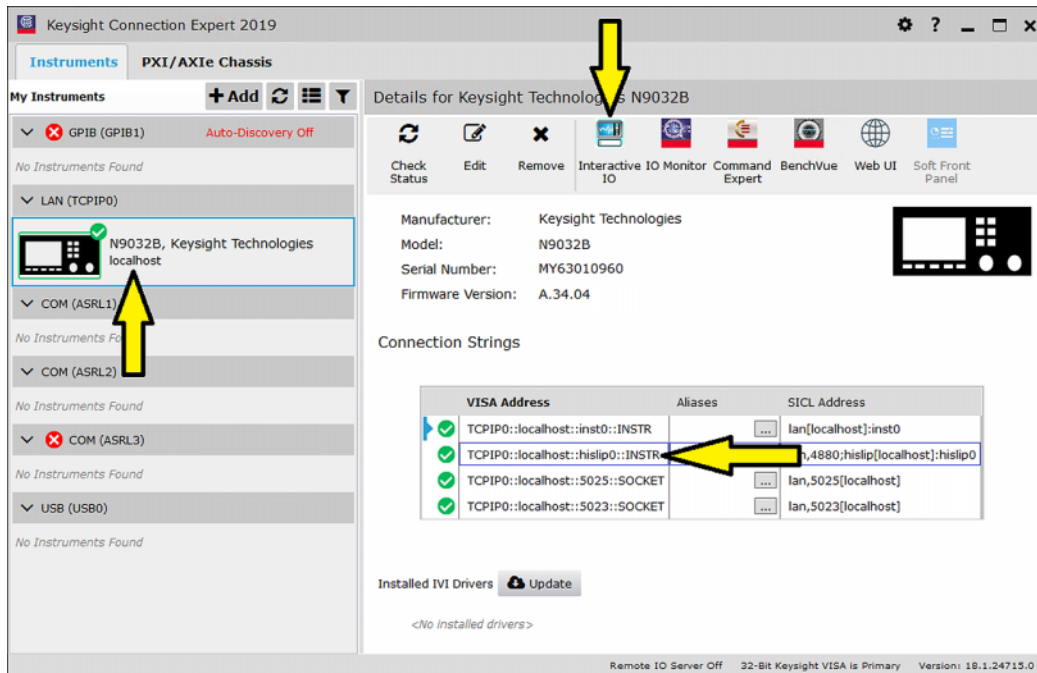
4. There will be no confirmation when the alignment completes successfully. The instrument will return to the preset state it was in before running the alignment.

Wideband Comb Alignment

Use the following procedure to force the running of the wideband comb alignments when an assembly is replaced.

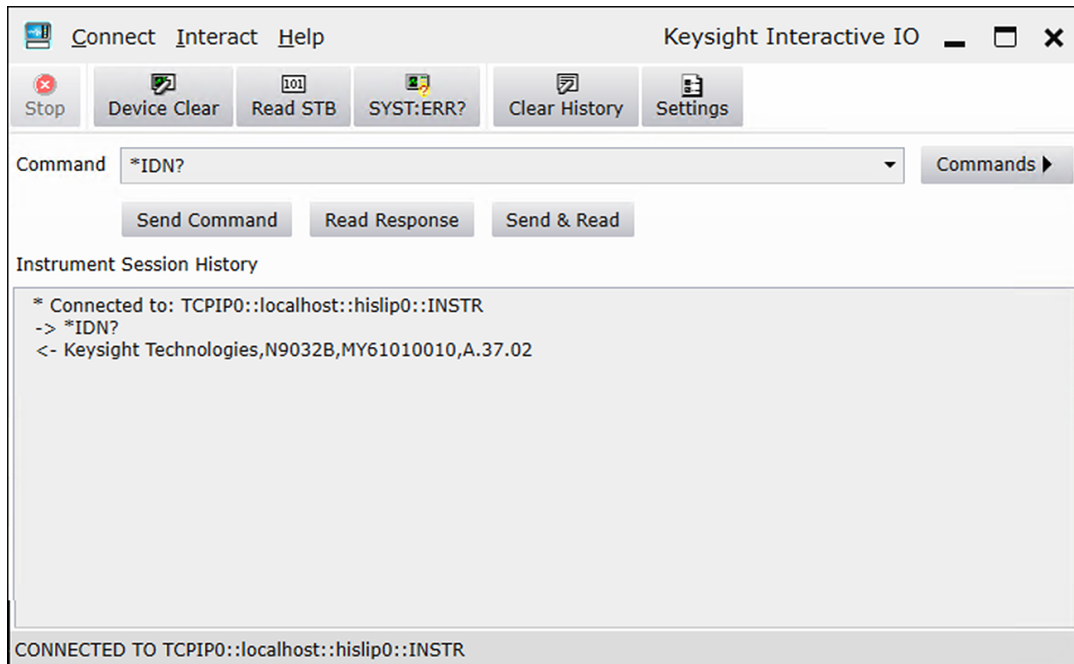
1. Verify that the instrument application is running.
2. Connect a USB keyboard and mouse to the instrument.
3. Using the USB mouse, select **Start, Keysight Connection Expert**. You should then see the connection expert, as seen in [Figure 23-20](#).

Figure 23-19 Keysight Connection Expert



4. Select the instrument listed as **localhost**, select the **hislip0** VISA Address, then select **Interactive IO** for it. You will then see the Interactive IO window for the instrument, as seen in [Figure 23-20](#).
5. Press **Send & Read** and verify that the instrument returns its model and serial number, as seen in [Figure 23-20](#).

Figure 23-20 Interactive IO



6. To run the alignment, type the following command into the **Command** field:

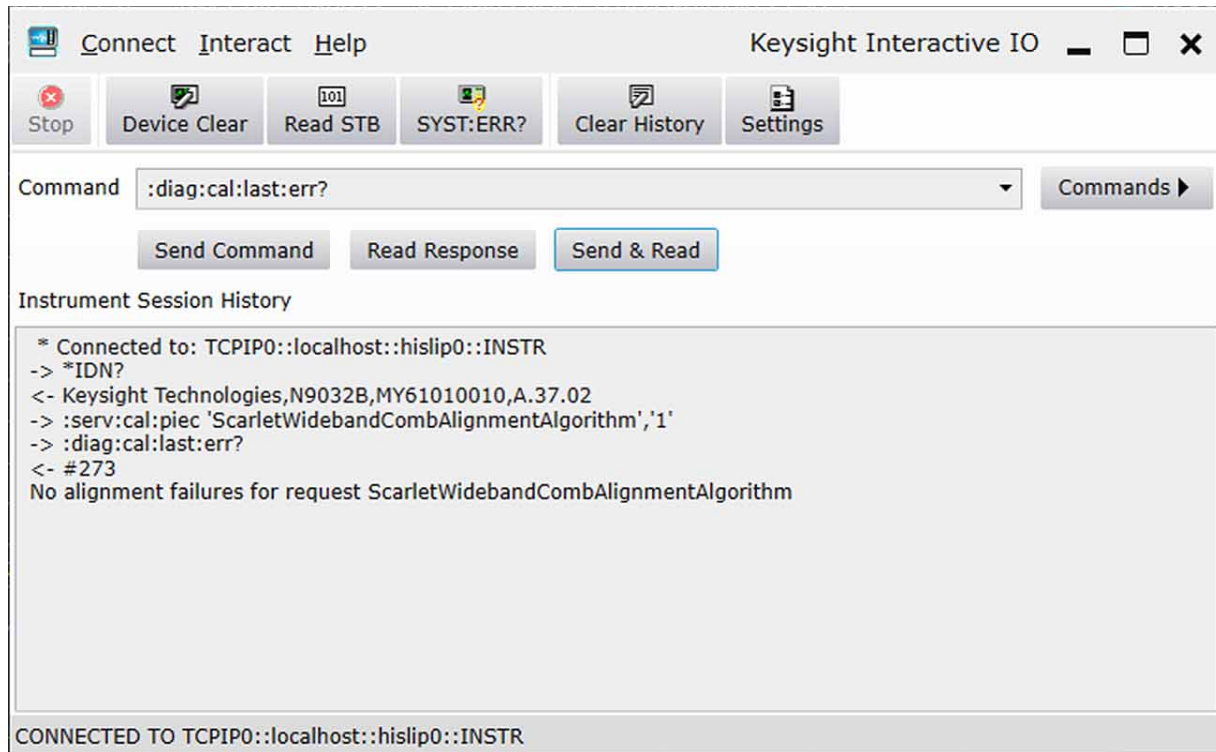
`:serv:cal:piec 'ScarletWidebandCombAlignmentAlgorithm';1'`

NOTE

It is very important that the **'1'** be added to the end of this command, as this will force the running of this alignment. The instrument will not run it otherwise, unless it thinks it needs to.

7. Press **Send Command**.
8. Wait for the alignment to complete. This will take a couple of minutes.
9. To verify that the alignment passed, type the following into the Command field:
`:diag:cal:last:err?`
10. Press **Send & Read**.
11. As seen in [Figure 23-21](#), the response from the instrument should include:
No alignment failures for request
ScarletWidebandCombAlignmentAlgorithm

Figure 23-21 Wideband Comb Alignment Results



Front Panel Tests

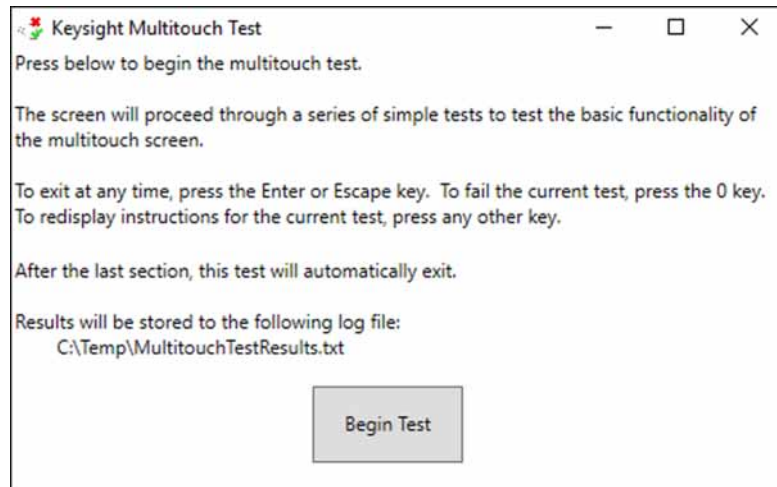
The front panel tests covered in this section will require access to the instrument service menu. If instructions on how to gain access to the service menu are needed, see the “**Service Menu Access**” section in **Chapter 20**, “**Service Menus.**”

Front Panel Touch Test

Use the following procedure to run the Front Panel Touch Test.

1. Activate the service menus.
2. Start the touch test by pressing **System, Service, Front Panel Touch Test**.
3. Follow the instructions given on the instrument display, starting with those seen in **Figure 23-22**.

Figure 23-22 Touch Test Instructions



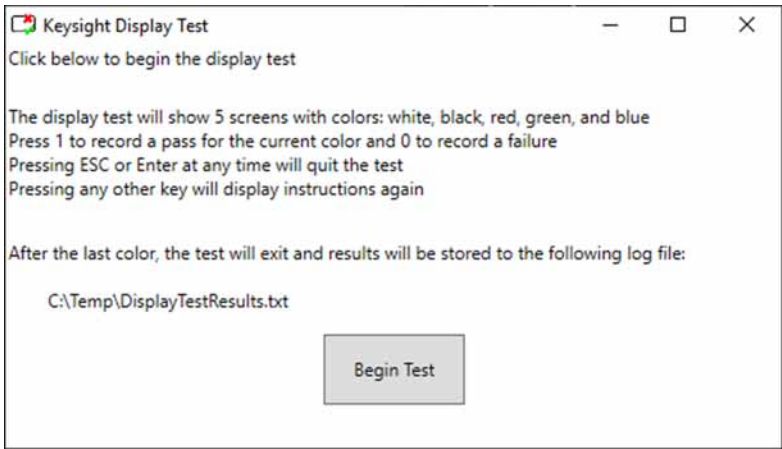
4. Verify that all parts of the test pass.

Front Panel Display Test

Use the following procedure to run the Front Panel Display Test.

1. Activate the service menus.
2. Start the touch test by pressing **System, Service, Front Panel Display Test**.
3. Follow the instruction given on the instrument display, starting with those seen in **Figure 23-23**.

Figure 23-23 Display Test Instructions



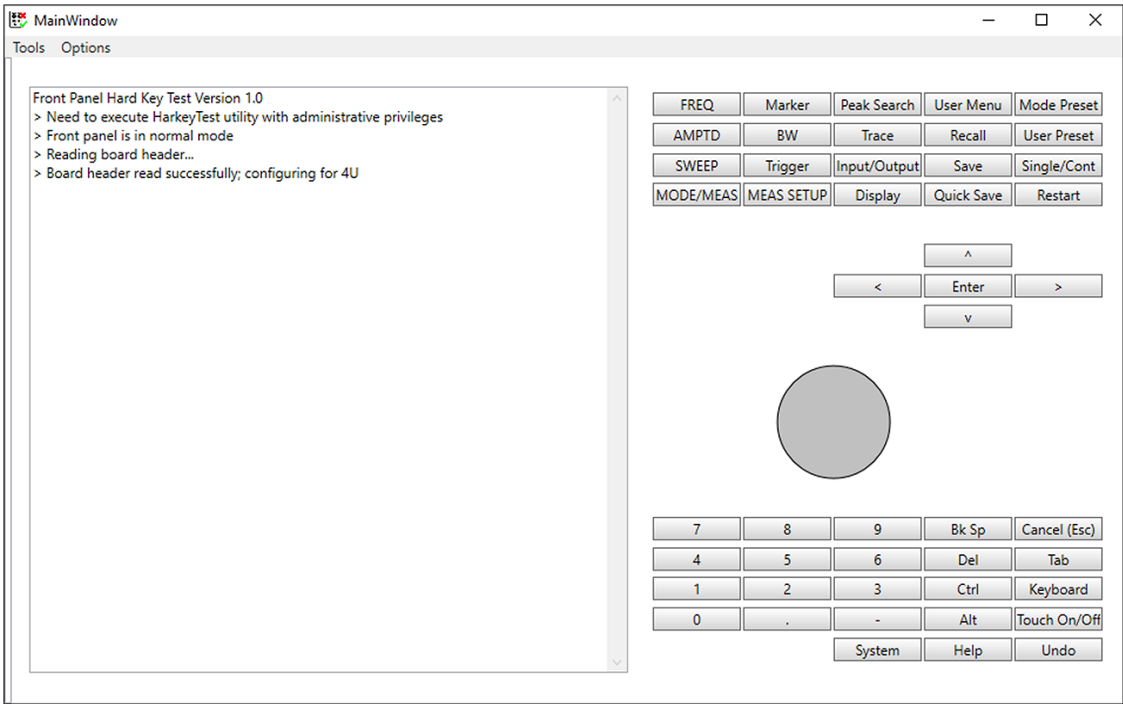
4. Verify that all parts of the test pass.

Front Panel Key Test

Use the following procedure to run the Front Panel Key Test.

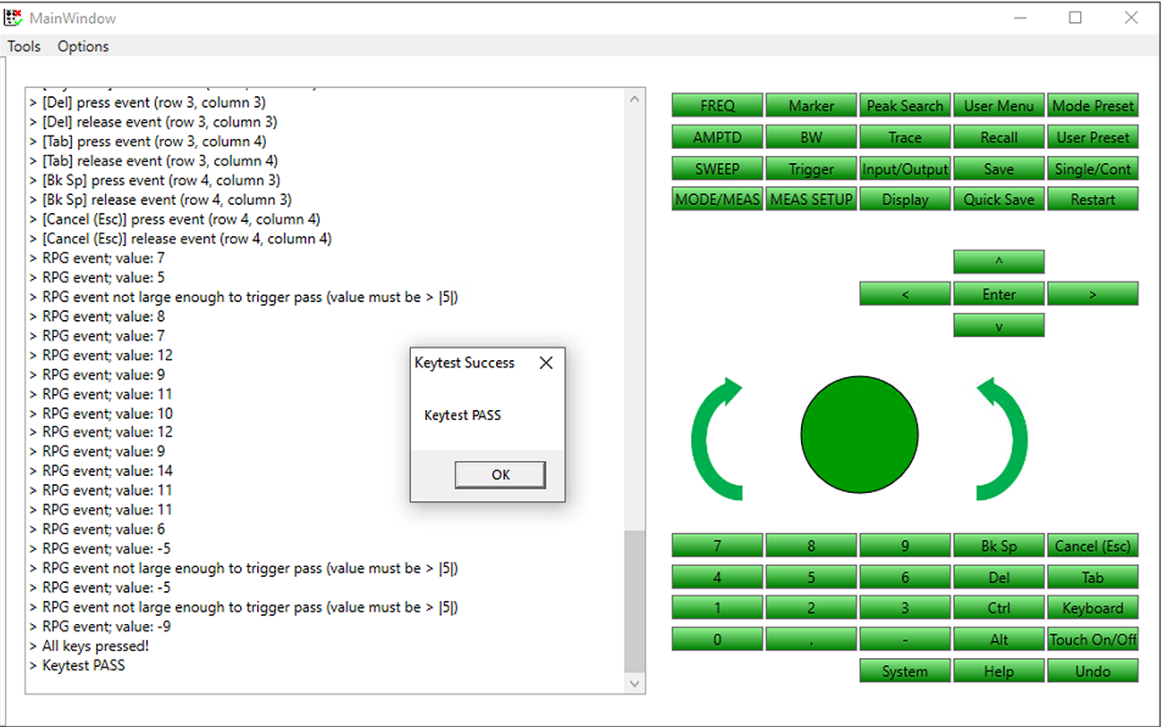
- 1. Activate the service menus.
- 2. Start the touch test by pressing **System, Service, Front Panel Key Test**.
- 3. The key test window seen in **Figure 23-24** will be displayed.

Figure 23-24 Key Test Start



4. Press each of the front panel hard keys and rotate the knob both clockwise and counterclockwise. As each key is pressed it should turn green in the test window, as seen in **Figure 23-25**.

Figure 23-25 Key Test Completed



5. Once all keys have been verified the test will show a pass, as seen in **Figure 23-25**.
6. Press **OK** and the test will end.

ODI Loopback Test

Whenever the A21 Wideband Digital IF assembly is replaced in an instrument with either option ST1 or ST2 the functionality of the ODI output needs to be verified. The following procedure outlines how to run the loopback test to verify that the hardware is working properly.

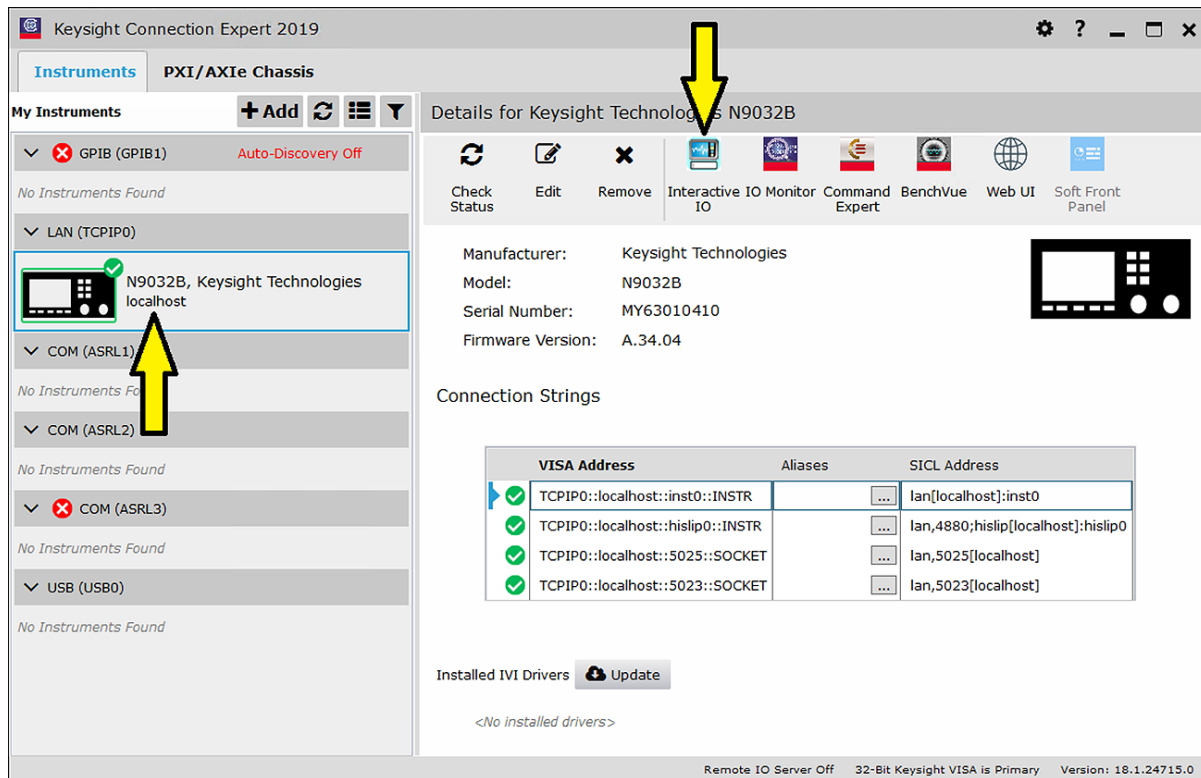
1. Connect a USB keyboard and mouse to the instrument.
2. Change the instrument mode and measurement to the IQ Analyzer mode and the Streaming measurement by pressing **Mode/Meas, IQ Analyzer, Streaming, OK**.
3. Insert the optical data interface loopback dongle (M8121-60004) into the rear panel ODI port with the alignment tab pointing up, making sure that it positively snaps into place.

NOTE

It is very important that the dongle is correctly inserted all the way into the rear panel ODI port. It must click into place such that it cannot be removed without sliding the spring loaded latch to release it.

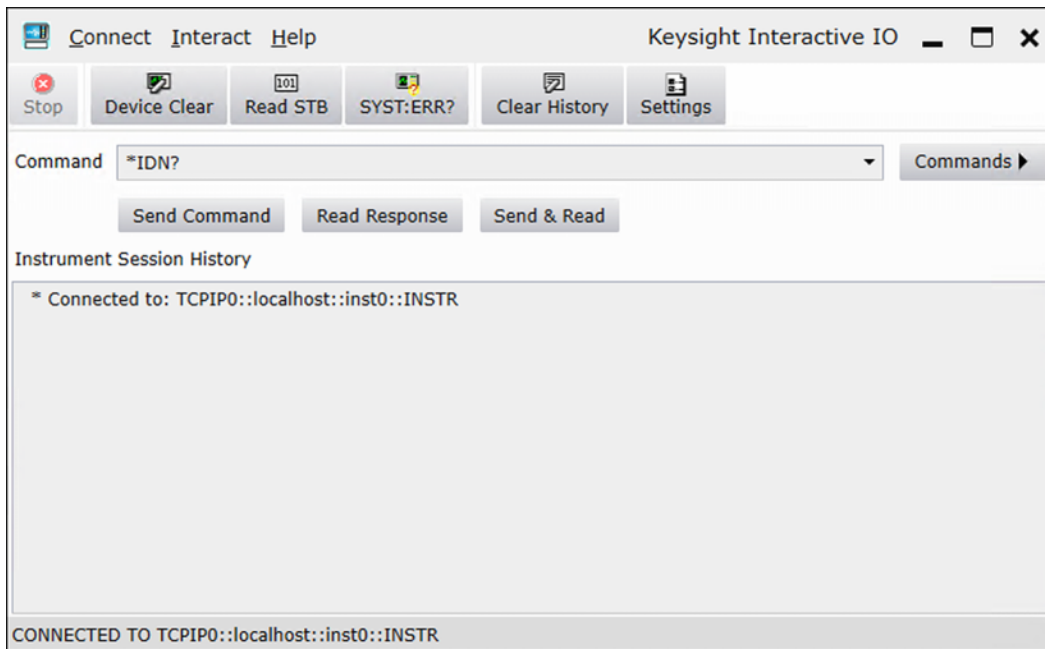
4. Using the USB mouse, select **Start, Keysight Connection Expert**. You should then see the connection expert, as seen in [Figure 23-26](#).

Figure 23-26 Keysight Connection Expert



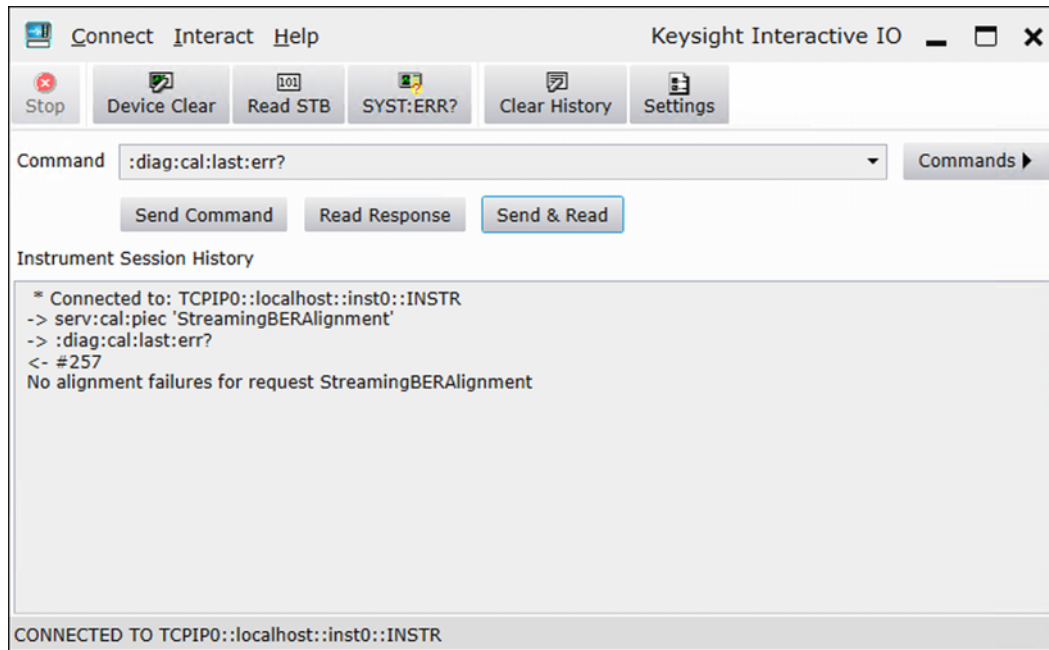
5. Select the instrument listed as **localhost**, then select **Interactive IO** for it. You will then see the Interactive IO window for the instrument, as seen in **Figure 23-27**.

Figure 23-27 Interactive IO



6. To run the test, type the following command into the **Command** field:
:serv:cal:piec 'StreamingBERAlignment'
7. Press **Send Command**.
8. To verify that the test passed, type the following into the **Command** field:
:diag:cal:last:err?
9. Press **Send & Read**.
10. As seen in **Figure 23-28**, the response from the instrument should include:
No alignment failures for request StreamingBERAlignment

Figure 23-28 Loopback Test Results



If the test shows a failure, make sure that the loopback dongle is properly inserted into the rear panel ODI port.

Post-Repair Procedures
Additional Tasks

24 Functional Tests

What You Will Find in This Chapter

The following information is presented in this chapter:

Functional Test Versus Performance Verification on page 790

Before Performing a Functional Test on page 791

Displayed Average Noise Level on page 792

Procedure on page 792

Test Results on page 793

Frequency Readout Accuracy on page 794

Procedure on page 794

Test Results on page 795

Second Harmonic Distortion on page 796

Procedure on page 796

Test Results on page 797

Amplitude Accuracy at 50 MHz on page 798

Procedure on page 798

Test Results on page 800

Preamp Option on page 801

Test Results on page 801

Frequency Response on page 802

Procedure on page 802

Test Results on page 805

Frequency Response, Preamp On on page 806

Procedure on page 806

Test Results on page 805

IF Frequency Response on page 810

Procedure on page 810

Test Results on page 813

Functional Test Versus Performance Verification

Functional tests are tests of various instrument parameters that give a high degree of confidence that the instrument is operating correctly. They are recommended as a check of instrument 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 instrument operating within the temperature range defined by the specifications using a minimum set of test equipment.

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.

NOTE

The functional tests outlined in this chapter are only to be run once the instrument has completed its specified warm up period and is in a stable environment with a ambient temperature of 20 to 30°C. If either of these requirements are not satisfied, the test limits listed will not apply.

Before Performing a Functional Test

1. Ensure that you have the proper test equipment.
2. Switch the device under test on and let it warm up in accordance with warm-up requirements in the instrument specifications.
3. Ensure that the device under test's frequency reference is set to Internal:
 - a. Press the **Input/Output, Freq Ref Input**.
 - b. If the Freq Ref Input softkey does not show Internal, press **Freq Ref Input**, and select **Internal**.
4. Following instrument warm-up, perform the auto align routine:
 - a. Press **System, Alignments, Align Now, 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.

Displayed Average Noise Level

The displayed average noise level (DANL) of the instrument is measured across a 10 kHz span at several frequencies. The instrument input is terminated into a 50Ω 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. The equipment required to perform this test is listed in [Table 24-1](#).

Table 24-1 Required Equipment

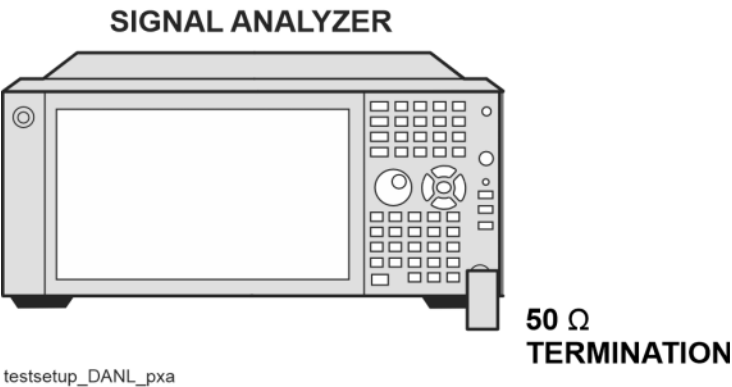
Item	Critical Specifications	Recommended Keysight Model
50Ω Termination	Frequency: DC to 50 GHz ^a	85138B, 2.4 mm (f) 909D, 3.5 mm (f) 909A, Type-M (m)

a. Maximum frequency must be equal to or greater than the maximum frequency of the device under test.

Procedure

1. Configure the equipment as shown in [Figure 24-1](#).

Figure 24-1 Displayed Average Noise Level Test Setup



2. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
3. Return the signal analyzer to a known state by pressing **Mode Preset**.
4. Set up the signal analyzer by pressing:
 - Frequency, Center Frequency 10 MHz**
 - Span 10 kHz**
 - Amplitude, Ref Level -70 dBm**
 - Attenuation, Mech Atten 0 dB**
 - BW, Res BW 1 kHz**
 - Video BW 100 Hz**
 - Meas Setup, Advanced, Noise Floor Extension, Off**

**Meas Setup, Avg|Hold Number 20, Enter
Trace, Trace Type, Trace Average
Display, Display Line On
Single**

5. Restart the measurement by pressing **Restart**.
6. Adjust the display line so that it is visually placed at the average level of the displayed noise floor.

NOTE

Ignore any residual responses that might be within the measurement span when adjusting the display line to the average level.

7. Enter the level of the display line as the **Measured Average Noise Level** column for 10 MHz center frequency in [Table 24-2](#).
8. Normalize the measured value to a 1 Hz resolution bandwidth by subtracting 30 dB from the measured value and enter the result in the **Normalized Average Noise Level** column of [Table 24-2](#) for 10 MHz.
9. Change the center frequency to the next value in [Table 24-2](#) and repeat steps 5 through 8 until all frequencies that can be measured with the device under test have been completed.
10. Verify that all the **Normalized Average Noise Level** values are within the **Test Limit** specified.

Test Results

Table 24-2 Displayed Average Noise Level Results

Center Frequency	Measured Average Noise Level (dBm)	Normalized Average Noise Level (dBm/Hz)	Test Limits (dBm)
10 MHz			-150
2 GHz			-147
6 GHz			-143
13 GHz			-143
20 GHz			-138
25 GHz			-135
32 GHz			-131
42 GHz			-124
50 GHz			-119

Frequency Readout Accuracy

The frequency readout accuracy is measured in several spans and center frequencies that allow both internal instrument synthesizer modes and prefilter bandwidths to be tested. Frequency reference error is eliminated by using the same frequency standard for the instrument and signal generator. The equipment required to perform this test is listed in [Table 24-3](#).

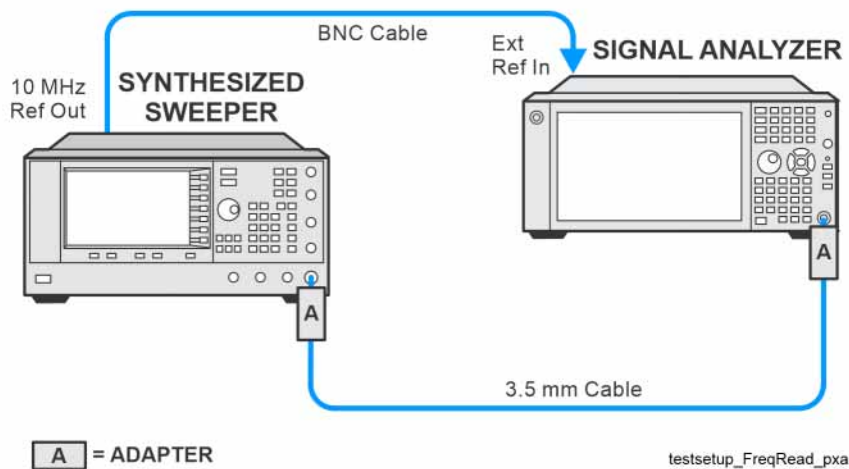
Table 24-3 Required Equipment

Item	Critical Specification	Recommended Keysight Model
Synthesized Sweeper	Frequency: 10 MHz to 1.51 GHz	N5181B, E8257D
Cable, 3.5 mm, 1 m	Frequency: 10 MHz to 1.51 GHz VSWR: <1.4:1	11500E
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Adapters as needed	Frequency: 10 MHz to 1.51 GHz VSWR: <1.1:1	

Procedure

1. Configure the equipment as shown in [Figure 24-2](#).

Figure 24-2 Frequency Readout Accuracy Test Setup



2. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
3. Return the signal analyzer to a known state by pressing **Mode Preset**.
4. Preset the synthesized sweeper.

5. Setup the synthesized sweeper as follows:

Frequency 1505 MHz
Power Level -10 dBm
RF Output On

6. Setup the signal analyzer by pressing:

**Input/Output, Freq Ref Input, Freq Ref Input, External
Frequency, Center Frequency 1505 MHz
Span 2990 MHz
Trace, Detector, Detector Sample
Single**

7. Restart the measurement by pressing **Restart**.

8. Set the marker on the signal peak by pressing **Peak Search**.

9. Enter the marker frequency value in the **Marker Frequency Readout** column of **Table 24-4** for the Span and Center Frequency of the signal analyzer.

10. Change the span and center frequency of the signal analyzer to the values in the next row of **Table 24-4**.

11. Change the frequency of the synthesized sweeper to match the center frequency of the signal analyzer.

12. Repeat steps 7 through 11 until the **Marker Frequency Readout** column of **Table 24-4** is complete.

13. Verify that all the **Marker Frequency Readout** values recorded in **Table 24-4** are within the Minimum and Maximum values specified.

Test Results

Table 24-4 Frequency Readout Accuracy Results

Span (MHz)	Center Frequency (MHz)	Minimum (MHz)	Marker Frequency Readout	Maximum (MHz)
2990	1505	1495.9		1514.1
127.2	1505	1504.56		1505.44
54.1	1505	1504.8122		1505.1878
7.95	1505	1504.97240		1505.0276
0.106	1505	1504.999630		1505.000370
1.98	517.59	517.58316		517.59684
1.98	832.50	832.49316		832.50684

Second Harmonic Distortion

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 signal analyzer. The equipment required to perform this test is listed in [Table 24-5](#).

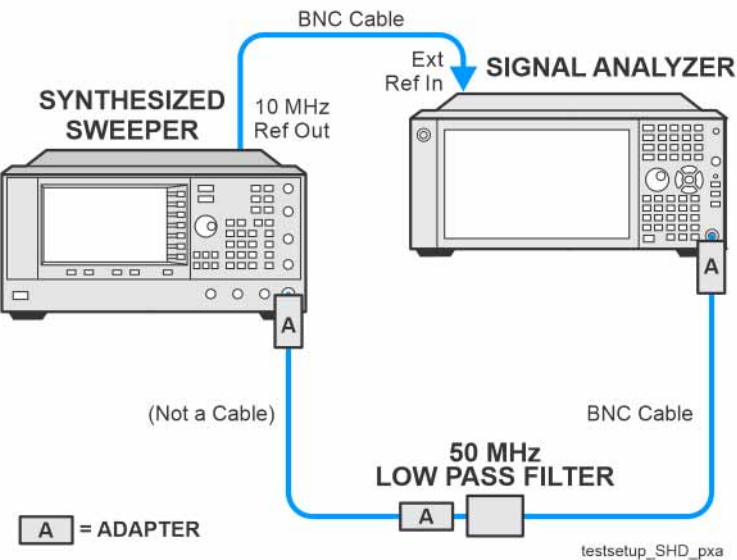
Table 24-5 Required Equipment

Item	Critical Specifications	Recommended Keysight Model
Synthesized Sweeper	Frequency: 50 MHz Spectral Purity: Better than -30 dBc	N5181B, E8257D
Filter, 50 MHz Low Pass	Cutoff Frequency: 50 MHz Rejection at 65 MHz: >40 dB Rejection at 75 MHz: >60 dB	0955-0306
Cable, BNC, 120 cm (2 required)	Frequency: 10 to 40 MHz	10503A
Adapters as needed	Frequency: 10 to 80 MHz VSWR: <1.1:1	

Procedure

1. Configure the equipment as shown in [Figure 24-3](#).

Figure 24-3 Second Harmonic Distortion Test Setup



2. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
3. Return the signal analyzer to a known state by pressing **Mode Preset**.

4. Preset the synthesized sweeper.
5. Setup the synthesized sweeper as follows:
Frequency 40 MHz
Power Level -5 dBm
RF Output On
6. Setup the signal analyzer by pressing:
**Input/Output, Freq Ref Input, Freq Ref Input, External
Frequency, Center Frequency 40 MHz
Span 1 MHz
Amplitude, Attenuation, Mech Atten 10 dB**
7. On the signal analyzer, press **Peak Search**.
8. Adjust the power level of the synthesized sweeper until the marker level on the signal analyzer is -5 dBm, ± 0.1 dB.
9. Activate the marker delta function on the signal analyzer by pressing **Marker, Marker Mode, Delta**.
10. Setup the signal analyzer by pressing:
**Frequency, Center Frequency 80 MHz
Meas Setup, Avg|Hold Number, 20, Enter
Trace, Trace Type, Trace Average
Single**
11. Set the marker on the signal peak by pressing **Peak Search**.
12. Enter the marker delta reading in **Table 24-6** as the **Measured Second Harmonic Distortion** value.
13. Verify that the **Measured Second Harmonic Distortion** value entered in **Table 24-6** is lower than the **Test Limit** specified.

Test Results

Table 24-6 Second Harmonic Distortion Test Results

Center Frequency	Measured Second Harmonic Distortion (dBc)	Mixer Level	Test Limit (dBc)
40 MHz		-15 dBm	-58

Amplitude Accuracy at 50 MHz

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 (Optional) 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. The equipment required to perform this test is listed in **Table 24-7**.

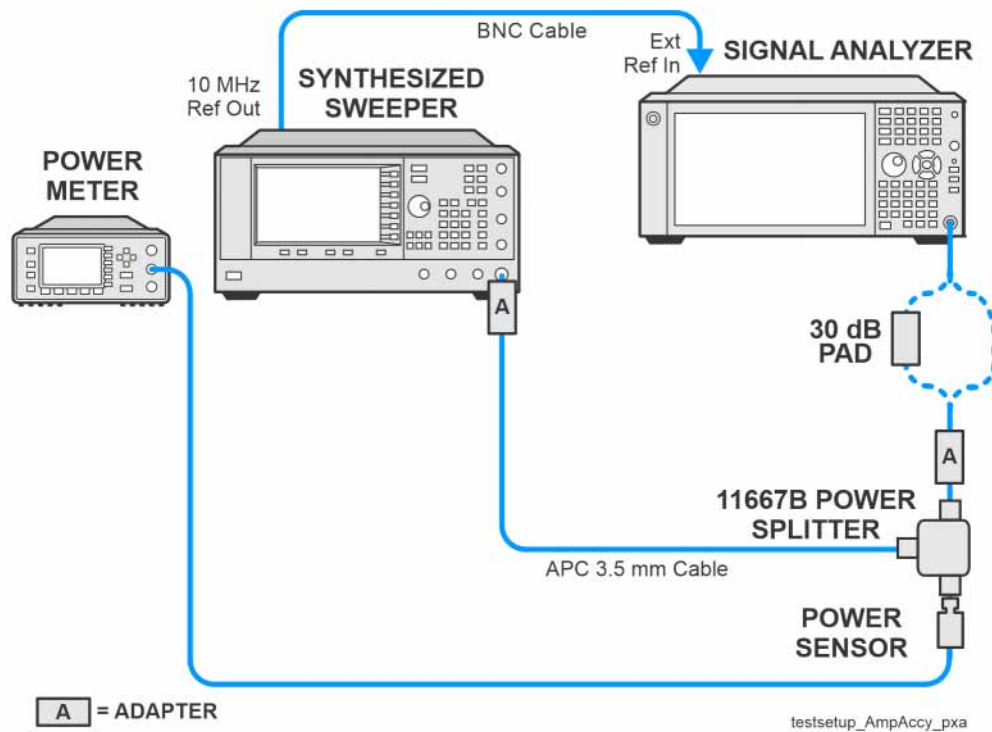
Table 24-7 Required Equipment

Item	Critical Specification	Recommended Keysight Model
Synthesized Sweeper	Frequency: 50 MHz	N5181B, E8257D
Power Splitter, 3.5 mm	Insertion Loss: 6 dB	11667B
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency: 50 MHz Amplitude: -25 to +10 dBm	8485A
Attenuator, 30 dB	Accuracy: <0.5 dB at 50 MHz	8493C-030
Cable, 3.5 mm, 1 m	Frequency: 50 MHz VSWR: <1.4:1	11500E
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Adapters as needed	Frequency: 50 MHz VSWR: <1.1:1	

Procedure

1. Zero and calibrate the power meter / sensor.
2. Perform the signal analyzer internal alignment by pressing **System, Alignments, Align Now, Align Now All**.
3. Configure the equipment as seen in **Figure 24-4** with the power splitter connected directly to the signal analyzer through the adapter and the power sensor connected directly to the power splitter.

Figure 24-4 Amplitude Accuracy at 50 MHz Test Setup



4. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
5. Return the signal analyzer to a known state by pressing **Mode Preset**.
6. Preset the synthesized sweeper.
7. Setup the synthesized sweeper as follows:
 - Frequency 50 MHz
 - Power Level -4 dBm
 - RF Output On
8. Setup the signal analyzer by pressing:
 - Input/Output, Freq Ref Input, Freq Ref Input, External Frequency, Center Frequency 50 MHz**
 - Span 2 MHz**
 - Amplitude, Attenuation, Mech Atten 10 dB**
 - Sweep, Sweep Config, Sweep Time Rules, SA-Accuracy**
 - Meas Setup, Avg|Hold Number, 20, Enter**
 - Trace, Trace Type, Trace Average**
 - Single**
9. Perform the following steps for each row listed in **Table 24-8**:
 - a. Set the synthesized sweeper power level to the value listed in the **Source Amplitude** column.

- b. Set the Mech Atten of the signal analyzer to the value listed in the **Attenuation** column.
- c. Set the Span of the signal analyzer to the value listed in the **Span** column.
- d. Read and record the power meter level as the value in the **Power Meter Amplitude** column.
- e. Restart the signal analyzer measurement by pressing **Restart**.
- f. Once the averaging finishes press **Peak Search**.
- g. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column.
- h. Calculate the signal analyzer amplitude accuracy error using the following equation and record the results as the value in the **Amplitude Accuracy Error** column.

$$\text{Amplitude Accuracy Error} = \text{Measured Amplitude} - \text{Power Meter Amplitude}$$

10. Verify that all the **Amplitude Accuracy Error** values entered in **Table 24-8** are within the **Test Limit** specified.

Test Results

Table 24-8 Amplitude Accuracy Results at 50 MHz Results

Source Amplitude (dBm)	Attenuation (dB)	Span (MHz)	Measured Amplitude (dBm)	Power Meter Amplitude (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

Preamp Option

If the instrument has one of the internal preamp options (P08, P13, P26, P44, P4L, P50, P5L, P55, P5N) continue with the following procedure to verify its functionality.

11. Reconfigure the equipment as seen in [Figure 24-3](#), with the 30 dB attenuator now between the power splitter and the signal analyzer.
12. Turn the low band preamplifier on by pressing **Amplitude, Signal Path, Internal Preamp Low Band, On**.
13. Set the power level of the synthesized sweeper to -13 dBm.
14. Set the signal analyzer input attenuator to 0 dB by pressing **Amplitude, Attenuation, Mech Atten, 0 dB**.
15. Set the signal analyzer span to 100 kHz by pressing **Frequency, Span 100 kHz**.
16. Set the signal analyzer resolution bandwidth to 1 kHz by pressing **BW, Res BW 1 kHz**.
17. Read and record the power meter level as the value in the **Power Meter Amplitude** column of [Table 24-9](#).
18. Restart the signal analyzer measurement by pressing **Restart**.
19. Once the averaging finishes press **Peak Search**.
20. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column in [Table 24-9](#).
21. Calculate the signal analyzer amplitude accuracy error using the following equation and record the results as the value in the **Amplitude Accuracy Error** column in [Table 24-9](#).
$$\text{Amplitude Accuracy Error} = \text{Measured Amplitude} + 30 \text{ dB} - \text{Power Meter Amplitude}$$
22. Verify that the **Amplitude Accuracy Error** value entered in [Table 24-9](#) is within the **Test Limit** specified.

Test Results

Table 24-9 Amplitude Accuracy at 50 MHz Results – Preamplifier On

Source Amplitude (dBm)	Attenuation (dB)	Span (kHz)	Measured Amplitude (dBm)	Power Meter Amplitude (dBm)	Amplitude Accuracy Error (dB)	Test Limit (dB)
-13	0	100				±1.3

Frequency Response

This test can only be performed if the device under test has one of the preamplifier options installed (P08, P13, P26, P44, P4L, P50, P55, P5L, or P5N).

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 the signal analyzer. The synthesized sweeper amplitude is measured with a power meter to eliminate error due to source flatness. The measured value is normalized to 50 MHz. The equipment required to perform this test is listed in [Table 24-10](#).

Table 24-10 Required Equipment

Item	Critical Specifications	Recommended Keysight Model
Synthesized Sweeper	Frequency: 50 MHz to 50 GHz ^a	E8257D
Power Splitter	Frequency: 50 MHz to 50 GHz ^a Tracking between ports: <0.25 dB	11667C, 2.4 mm 11667B, 3.5mm 11667A, Type-N
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency: 50 MHz to 50 GHz ^a Amplitude: -25 to +20 dBm	8487A
Cable, 1 m	Frequency: 50 MHz to 50 GHz ^a VSWR: <1.4:1	2.4 mm 11500E, 3.5mm 11500D, Type-N
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Adapters as needed	Frequency: 50 MHz to 50 GHz ^a VSWR: <1.1:1	

a. Maximum frequency must be equal to or greater than the maximum frequency of the device under test.

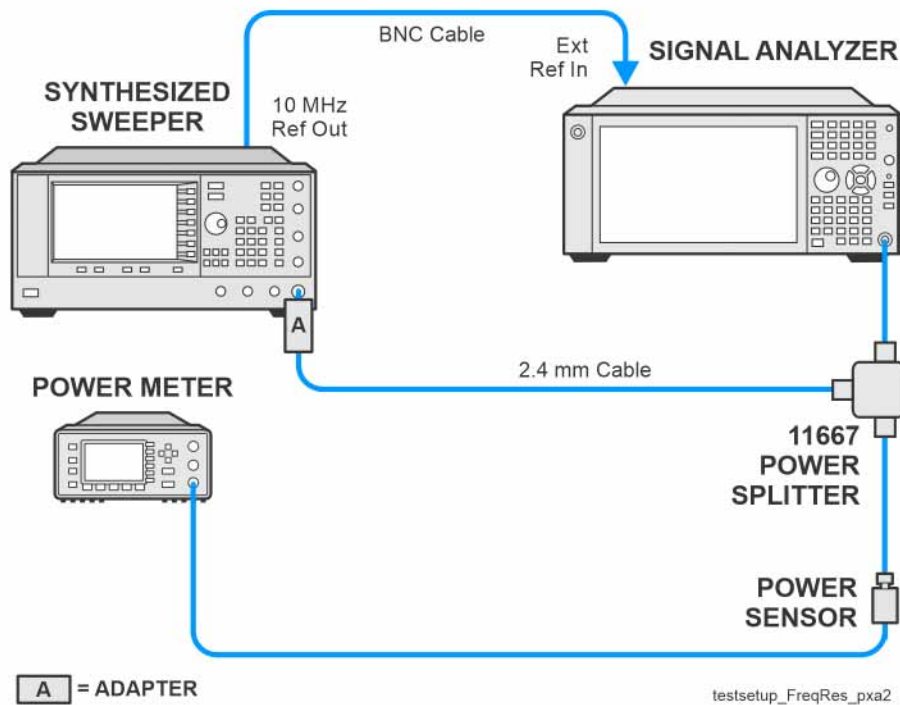
Procedure

1. Zero and calibrate the power meter / sensor.
2. Perform the signal analyzer internal alignment by pressing **System, Alignments, Align Now, Align Now All**.
3. Configure the equipment as seen in [Figure 24-5](#) with the power splitter connected directly to the signal analyzer and the power sensor connected directly to the power splitter.

NOTE

Connect one end of the power splitter output directly to the signal analyzer input and the power sensor directly to the other power splitter output. No adapter will be necessary for either of these connections if the prescribed equipment is used.

Figure 24-5 Frequency Response Test Setup



4. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
5. Return the signal analyzer to a known state by pressing **Mode Preset**.
6. Preset the synthesized sweeper.
7. Setup the synthesized sweeper as follows:
 - Frequency 50 MHz
 - Power Level -4 dBm
 - RF Output On
8. Setup the signal analyzer by pressing:
 - Input/Output, Freq Ref Input, Freq Ref Input, External**
 - Frequency, Center Frequency 50 MHz**
 - Span 50 kHz**
 - BW, Res BW 1 kHz**
 - Amplitude, Ref Level 0 dBm**
 - Attenuation, Mech Atten, 10 dB, Man**
 - Sweep, Sweep Config, Sweep Time Rules, SA-Accuracy**
9. Adjust the power level of the synthesized sweeper until the power meter reading is -10 dBm, ± 0.1 dB.
10. Read and record the power meter level as the value in the **Power Meter Amplitude** column for the 50 MHz center frequency in [Table 24-11](#).

11. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
12. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column for the 50 MHz center frequency in **Table 24-11**.
13. Calculate the measurement error at 50 MHz with the following formula:
$$\text{Amplitude Error} = \text{Analyzer Amplitude} - \text{Power Meter Amplitude}$$
14. Enter the calculated amplitude error as the value in the **Amplitude Error** column for the 50 MHz center frequency in **Table 24-11**.
15. Perform the following steps for each row listed in **Table 24-11** that the signal analyzer is able to tune to.
 - a. Tune the signal analyzer to the next center frequency.
 - b. Tune the synthesized sweeper to the same center frequency as the signal analyzer.
 - c. Enter the power sensor calibration factor into the power meter for the new center frequency.
 - d. Read and record the power meter level as the value in the **Power Meter Amplitude** column.
 - e. If the test frequency is greater than 3.6 GHz, center the signal analyzer preselector by pressing **Amplitude, Signal Path, Presel Center**.
 - f. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
 - g. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column.
 - h. Calculate the measurement error with the following formula:
$$\text{Amplitude Error} = \text{Analyzer Amplitude} - \text{Power Meter Amplitude}$$
 - i. Enter the calculated amplitude error as the value in the **Amplitude Error** column.
 - j. Calculate the error normalized to 50 MHz with the following formula and record the results as the value in the Error Normalized to 50 MHz column in **Table 24-11**.
$$\text{Error Normalized to 50 MHz} = \text{Amplitude Error} - \text{Amplitude Error @ 50 MHz}$$
16. Verify that all the **Error Normalized to 50 MHz** values entered in **Table 24-11** are within the **Test Limit** specified.

Test Results

Table 24-11 Frequency Response Results

Center Frequency	Analyzer Amplitude	Power Meter Amplitude	Amplitude Error	Error Normalized to 50 MHz	Test Limits
50 MHz				0	Reference
1 GHz					±1.35 dB
2 GHz					±1.35 dB
3 GHz					±1.35 dB
4 GHz					±2.7 dB
7 GHz					±2.5 dB
10 GHz					±2.5 dB
15 GHz					±2.5 dB
20 GHz					±2.5 dB
25 GHz					±3.0 dB
30 GHz					±3.3 dB
35 GHz					±3.5 dB
40 GHz					±4.1 dB
45 GHz					±4.1 dB
50 GHz					±4.1 dB

Frequency Response, Preamp On

This test can only be performed if the device under test has one of the preamplifier options installed (P08, P13, P26, P44, P4L, P55, P5L, or P5N).

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 the signal analyzer. The synthesized sweeper amplitude is measured with a power meter to eliminate error due to source flatness. The measured value is normalized to 50 MHz. The equipment required to perform this test is listed in [Table 24-12](#).

Table 24-12 **Required Equipment**

Item	Critical Specifications	Recommended Keysight Model
Synthesized Sweeper	Frequency: 50 MHz to 50 GHz ^a	E8257D
Power Splitter	Frequency: 50 MHz to 50 GHz ^a Tracking between ports: <0.25 dB	11667C, 2.4 mm 11667B, 3.5mm 11667A, Type-N
Power Meter	Compatible with power sensor	E4418B
Power Sensor	Frequency: 50 MHz to 50 GHz ^a Amplitude: -65 to +55 dBm	8487A
Cable, 1 m	Frequency: 50 MHz to 50 GHz ^a VSWR: <1.4:1	2.4 mm 11500E, 3.5mm 11500D, Type-N
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Adapters as needed	Frequency: 50 MHz to 50 GHz ^a VSWR: <1.1:1	

a. Maximum frequency must be equal to or greater than the maximum frequency of the device under test.

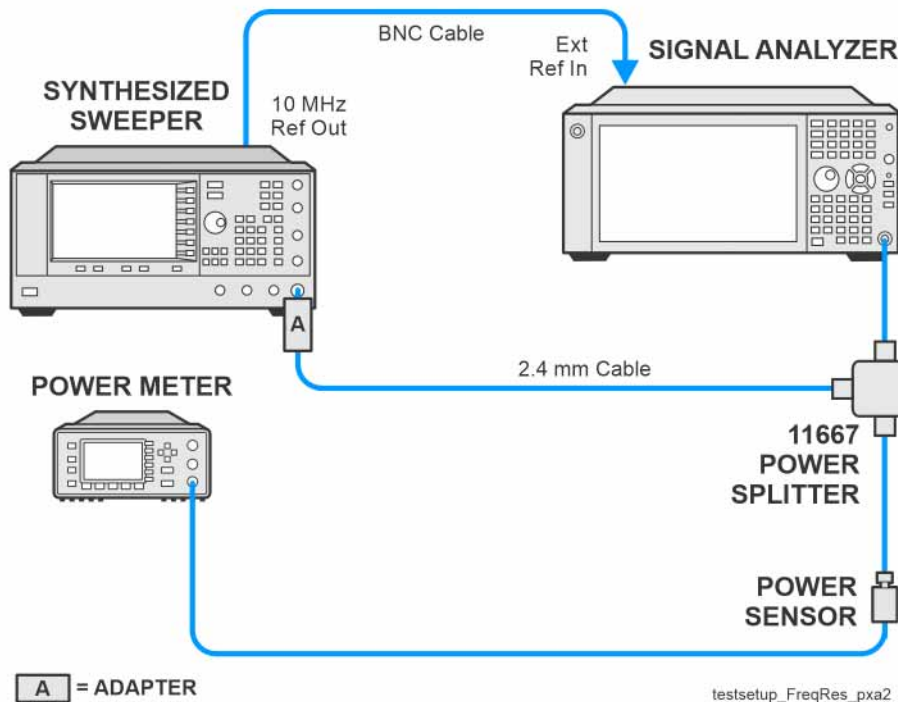
Procedure

1. Zero and calibrate the power meter / sensor.
2. Perform the signal analyzer internal alignment by pressing **System, Alignments, Align Now, Align Now All**.
3. Configure the equipment as seen in [Figure 24-6](#) with the power splitter connected directly to the signal analyzer and the power sensor connected directly to the power splitter.

NOTE

Connect one end of the power splitter output directly to the signal analyzer input and the power sensor directly to the other power splitter output, no adapter will be necessary for either of these connections if the prescribed equipment is used.

Figure 24-6 Frequency Response, Preamp On Test Setup



4. Verify that the signal analyzer is in the spectrum analyzer mode by pressing **Mode/Meas, Spectrum Analyzer, OK**.
5. Return the signal analyzer to a known state by pressing **Mode Preset**.
6. Preset the synthesized sweeper.
7. Setup the synthesized sweeper as follows:
 - Frequency 50 MHz
 - Power Level -54 dBm
 - RF Output On
8. Setup the signal analyzer by pressing:
 - Input/Output, Freq Ref Input, Freq Ref Input, External**
 - Frequency, Center Frequency 50 MHz**
 - Span 50 kHz**
 - BW, Res BW 1 kHz**
 - Amplitude, Signal Path, Internal Preamp, Full Range, On**
 - Amplitude, Ref Level -55 dBm**
 - Attenuation, Mech Atten, 0 dB**
 - Sweep, Sweep Config, Sweep Time Rules, SA-Accuracy**
9. Adjust the power level of the synthesized sweeper until the power meter reading is -60 dBm, ± 0.1 dB.
10. Read and record the power meter level as the value in the **Power Meter Amplitude** column for the 50 MHz center frequency in [Table 24-13](#).

11. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
12. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column for the 50 MHz center frequency in **Table 24-13**.
13. Calculate the measurement error at 50 MHz with the following formula:
$$\text{Amplitude Error} = \text{Analyzer Amplitude} - \text{Power Meter Amplitude}$$
14. Enter the calculated amplitude error as the value in the **Amplitude Error** column for the 50 MHz center frequency in **Table 24-13**.
15. Perform the following steps for each row listed in **Table 24-13** that the signal analyzer is able to tune to.
 - a. Tune the signal analyzer to the next center frequency.
 - b. Tune the synthesized sweeper to the same center frequency as the signal analyzer.
 - c. Enter the power sensor calibration factor into the power meter for the new center frequency.
 - d. Read and record the power meter level as the value in the **Power Meter Amplitude** column.
 - e. If the test frequency is greater than 3.6 GHz, center the signal analyzer preselector by pressing **Amplitude, Signal Path, Presel Center**.
 - f. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
 - g. Read and record the signal analyzer marker amplitude level as the value in the **Measured Amplitude** column.
 - h. Calculate the measurement error with the following formula:
$$\text{Amplitude Error} = \text{Analyzer Amplitude} - \text{Power Meter Amplitude}$$
 - i. Enter the calculated amplitude error as the value in the **Amplitude Error** column.
 - j. Calculate the error normalized to 50 MHz with the following formula and record the results as the value in the Error Normalized to 50 MHz column in **Table 24-13**.
$$\text{Error Normalized to 50 MHz} = \text{Amplitude Error} - \text{Amplitude Error @ 50 MHz}$$
16. Verify that all the **Error Normalized to 50 MHz** values entered in **Table 24-13** are within the **Test Limit** specified.

Test Results

Table 24-13 Frequency Response Preamp On Results

Center Frequency	Analyzer Amplitude	Power Meter Amplitude	Amplitude Error	Error Normalized to 50 MHz	Test Limits
50 MHz				0	Reference
1 GHz					±1.6 dB
2 GHz					±1.6 dB
3 GHz					±1.6 dB
4 GHz					±3.3 dB
7 GHz					±3.0 dB
10 GHz					±3.0 dB
15 GHz					±3.0 dB
20 GHz					±3.2 dB
25 GHz					±3.7 dB
30 GHz					±3.9 dB
35 GHz					±4.4 dB
40 GHz					±4.4 dB
45 GHz					±4.4 dB
50 GHz					±4.4 dB

IF Frequency Response

The IF frequency response test measures the signal analyzer’s amplitude error across the measurement bandwidth. The following procedure will use three different center frequencies that will test the 1 GHz IF Path. The equipment required to perform this test is listed in **Table 24-14**.

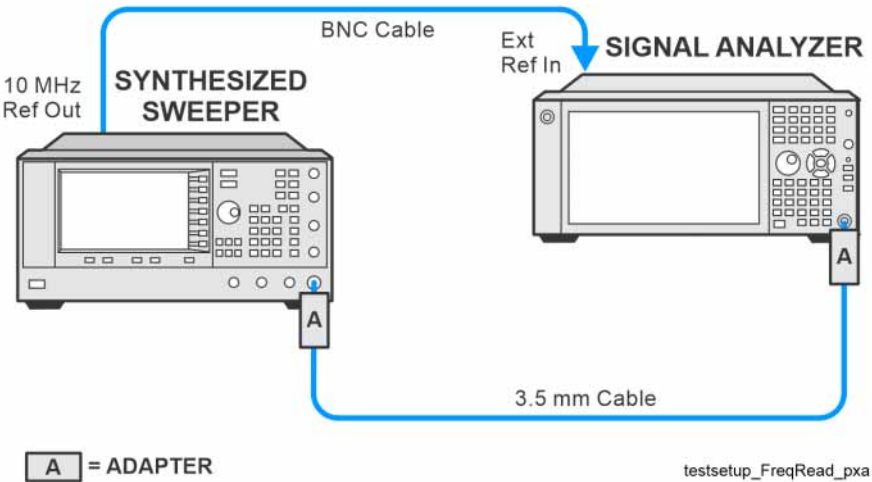
Table 24-14 Required Equipment

Item	Critical Specifications	Recommended Keysight Model
Synthesized Sweeper	Frequency: 1.5 to 25.5 GHz	N5183B, E8257D
Cable, 3.5 mm, 1 m	Frequency: 1.5 to 25.5 GHz VSWR: <1.4:1	11500E
Cable, BNC, 120 cm	Frequency: 10 MHz	10503A
Adapters as needed	Frequency: 1.5 to 25.5 GHz VSWR: <1.1:1	

Procedure

1. Configure the equipment as seen in **Figure 24-7**.

Figure 24-7 IF Frequency Response Test Setup



2. Verify that the signal analyzer is in the IQ analyzer mode by pressing **Mode/Meas, IQ Analyzer, OK**.
3. Return the signal analyzer to a known state by pressing **Mode Preset**.
4. Preset the synthesized sweeper.

5. Setup the synthesized sweeper as follows:

Frequency 2 GHz
Power Level -10 dBm
RF Output On

6. Setup the signal analyzer by pressing:

**Input/Output, Freq Ref Input, Freq Ref Input, External
Meas Setup, IF Path, 1 GHz
Frequency, Center Frequency 2 GHz
Span 1 GHz
Attenuation, Mech Atten, 10 dB**

7. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.

8. Adjust the power level of the synthesized sweeper until the marker reading is -10 dBm, ± 0.1 dB.

9. Record the marker power level as the **Center Amplitude** value for 2 GHz in [Table 24-15](#).

10. Set the signal analyzer reference level to -4 dBm by pressing **Amplitude, Ref Level -4 dBm**.

11. Set the signal analyzer vertical scale to 3 dB per division by pressing **Scale/Div 3 dB**.

12. Set trace two of the signal analyzer to maximum hold by pressing **Meas Setup, Avg Type, Maximum**.

13. Setup the synthesized sweeper as follows:

Start Frequency 1.5 GHz
Stop Frequency 2.5 GHz
Number of Points 1001
Step Dwell 10 msec
Sweep

14. Allow the synthesized sweeper two sweep a few times then stop the sweep.

15. Place the marker on the maximum hold trace by pressing **Marker, Properties, Marker Trace, Spectrum Avg**.

16. Find the maximum positive deviation of the IF frequency response by pressing **Peak Search**.

17. Enter the marker amplitude value as the **Maximum Positive** value for 2 GHz in [Table 24-15](#).

18. Find the maximum negative deviation of the IF frequency response by pressing **Minimum Peak**.

19. Enter the marker amplitude value as the **Maximum Negative** value for 2 GHz in **Table 24-15**.
20. Change the synthesized sweeper frequency to 4 GHz.
21. Change the signal analyzer center frequency to 4 GHz by pressing **Frequency, Center Frequency 4 GHz**.
22. Place the marker on the active trace by pressing **Marker, Properties, Marker Trace, Spectrum**.
23. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
24. Adjust the power level of the synthesized sweeper until the marker reading is -10 dBm, ± 0.1 dB.
25. Record the marker power level as the **Center Amplitude** value for 4 GHz in **Table 24-15**.
26. Setup the synthesized sweeper as follows:
 - Start Frequency 3.5 GHz
 - Stop Frequency 4.5 GHz
 - Number of Points 1001
 - Step Dwell 10 msec
 - Sweep
27. Allow the synthesized sweeper to sweep a few times then stop the sweep.
28. Place the marker on the maximum hold trace by pressing **Marker, Properties, Marker Trace, Spectrum Avg**.
29. Find the maximum positive deviation of the IF frequency response by pressing **Peak Search**.
30. Enter the marker amplitude value as the **Maximum Positive** value for 4 GHz in **Table 24-15**.
31. Find the maximum negative deviation of the IF frequency response by pressing **Minimum Peak**.
32. Enter the marker amplitude value as the **Maximum Negative** value for 4 GHz in **Table 24-15**.
33. Change the synthesized sweeper frequency to 25 GHz.
34. Change the signal analyzer center frequency to 25 GHz by pressing **Frequency, Center Frequency 25 GHz**.
35. Place the marker on the active trace by pressing **Marker, Properties, Marker Trace, Spectrum**.
36. Put the signal analyzer marker on the signal peak by pressing **Peak Search**.
37. Adjust the power level of the synthesized sweeper until the marker reading is -10 dBm, ± 0.1 dB.

38.Record the marker power level as the **Center Amplitude** value for 25 GHz in **Table 24-15**.

39.Setup the synthesized sweeper as follows:

Start Frequency 24.5 GHz
Stop Frequency 25.5 GHz
Number of Points 1001
Step Dwell 10 msec
Sweep

40.Allow the synthesized sweeper two sweep a few times then stop the sweep.

41.Place the marker on the maximum hold trace by pressing **Marker, Properties, Marker Trace, Spectrum Avg**.

42.Find the maximum positive deviation of the IF frequency response by pressing **Peak Search**.

43.Enter the marker amplitude value as the **Maximum Positive** value for 25 GHz in **Table 24-15**.

44.Find the maximum negative deviation of the IF frequency response by pressing **Minimum Peak**.

45.Enter the marker amplitude value as the **Maximum Negative** value for 25 GHz in **Table 24-15**.

46.Calculate the **Positive Deviation** for each center frequency using the following formula and enter the results in **Table 24-15**:

Positive Deviation = Maximum Positive - Center Amplitude

47.Calculate the **Negative Deviation** for each center frequency using the following formula and enter the results in **Table 24-15**:

Negative Deviation = Maximum Negative - Center Amplitude

48.Verify that all the calculated **Positive Deviation** and **Negative Deviation** values are within the **Test Limit** specified.

Test Results

Table 24-15 IF Frequency Response Results

Center Frequency (GHz)	Center Amplitude (dBm)	Maximum Positive (dBm)	Maximum Negative (dBm)	Positive Deviation (dB)	Negative Deviation (dB)	Test Limit (dB)
2 GHz						±2.6
4 GHz						±2.35
25 GHz						±2.4

Functional Tests
IF Frequency Response

25 Instrument Software and FPGAs

What You Will Find in This Chapter

[Overview on page 816](#)

[Instrument Software on page 817](#)

[Overview on page 817](#)

[Updating Instrument Application Software on page 818](#)

[Software Licensing on page 818](#)

[89600 VSA Software on page 818](#)

[FPGAs on page 819](#)

[Overview on page 819](#)

[Updating FPGA Code on page 820](#)

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 23 “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 25-1**.

Figure 25-1 System Information - Instrument S/W Revision

System Settings	System Information	
System	Keysight Technologies	Keysight PXA Signal Analyzer
I/O Config	Product Number	N9032B
Preload / Unload Modes	Serial Number	MY61010001
User Interface	S/W Release Name	2023 Update 1.0
Power On	Instrument S/W Revision	A.34.03
Restore Defaults	Revision Date	11/17/2022 9:38:32 AM
Alignments	Computer System	Windows 10
Licensing	Computer Name	K-N9032B-10001
Security	IP Address	141.121.151.154
Diagnostics	IPv6 Address	
Service	Link-Local IPv6 Address	fe80::1c1e:1a7b:d335:6641%14
SCPI Recorder	Host ID	N9032B,MY61010001
	mDNS Enabled	Yes
	mDNS Host Name	K-N9032B-10001
	mDNS Service Name	Keysight N9032B Signal Analyzer - MY61010001
	Option	Name / Description
	N9032B-MTU	Multi-touch user interface
	N9032B-PC8	Intel(R) Core(TM) i7-9850HL CPU @ 1.90GHz, 32 GB
	N9032B-SSD	MICRON_1300_MTFDDAK256TDL
	N9032B-W10	Microsoft Windows 10 Enterprise LTSC, 64 bit OS
	89601B_Agilent	VSA Temporary License - Agilent internal use/demo only
	N6141EM0E_1FP	EMC Software for X-Series
	N9032B_526	Frequency Range, 26.5 GHz
	N9032B_ALV	Auxiliary Log Video Output
	N9032B_B25	Analysis bandwidth, 25 MHz
	N9032B_B2X	Analysis bandwidth, 255 MHz
	N9032B_B40	Analysis bandwidth, 40 MHz
	N9032B_CR3	Connector Rear, 2nd IF output
	N9032B_CRP	Connector Rear, Arbitrary IF output
	N9032B_CRW	Connector, IF Out, Wide

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/n9032b_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 Digital IF
- A23 IF Mux

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.

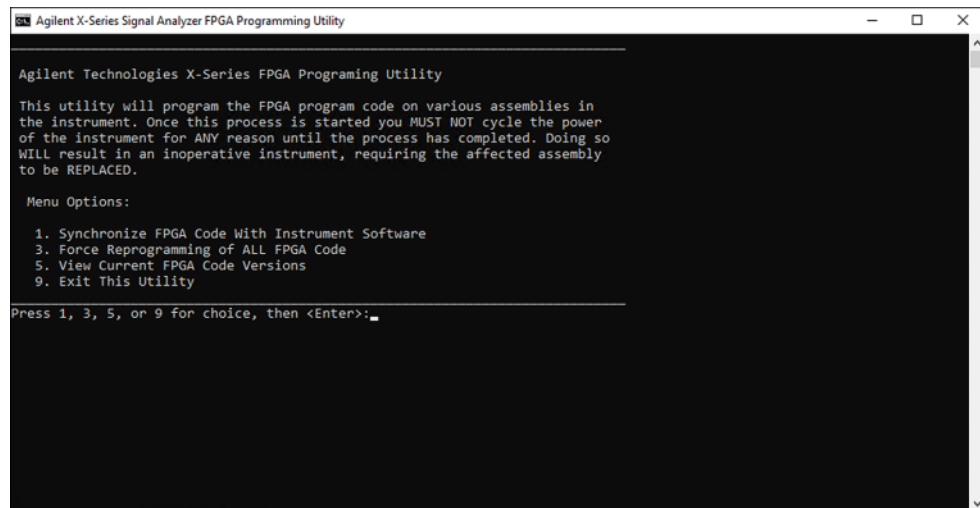
CAUTION

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 25-2** will appear.

Figure 25-2 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.

26 Performance Verification and Adjustment Software

What You Will Find in This Chapter

The following information is presented in this chapter:

[Overview on page 824](#)

[Performance Verification Tests on page 824](#)

[Adjustments on page 824](#)

[Utilities on page 824](#)

Overview

This instrument can be fully tested and adjusted with the use of the N78111B PXA Calibration Application software that's runs on the N78000B Enterprise Test Management System (ETMS).

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.

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.

Utilities

Utilities are tasks that might need to be performed when certain assemblies are replaced.

