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PXIe-5820

GETTING STARTED GUIDE

PXIe-5831

Up to 44 GHz, 1 GHz Bandwidth, Vector Signal Transceiver



Note Before you begin, install and configure your chassis and controller.

This document explains how to install, configure, and test the PXIe-5831. The PXIe-5831 is a half-duplex RF communications instrument with up to 1 GHz of instantaneous bandwidth, designed for testing 5G mmWave components. You can program the PXIe-5831 instrument using RFmx or NI-RFSA and NI-RFSG driver software.

The PXIe-5831 IF only instrument configuration comprises the following modules:

- PXIe-5820 Vector Signal Transceiver
- PXIe-3622 Vector Signal Up/Down Converter

The PXIe-5831 IF and mmWave instrument configuration comprises the following modules:

- PXIe-5820 Vector Signal Transceiver
- PXIe-3622 Vector Signal Up/Down Converter
- PXIe-5653 RF Analog Signal Generator (LO source)
- One or two mmRH-5582 mmWave Radio Heads

There is no single instrument labeled "PXIe-5831."

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Verifying the System Requirements

To use the PXIe-5831, your system must meet certain requirements. For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the readme, which is installed or available at ni.com/manuals.

Unpacking the Kit

 **Notice** To prevent electrostatic discharge (ESD) from damaging the device, ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.

1. Touch the antistatic package to a metal part of the computer chassis.
2. Remove the device from the package and inspect the device for loose components or any other sign of damage.



Notice Never touch the exposed pins of connectors.



Note Do not install a device if it appears damaged in any way.

3. Unpack any other items and documentation from the kit.

Store the device in the antistatic package when the device is not in use.

Verifying the Kit Contents

The kit contents for the PXIe-5831 varies by your instrument configuration.

Table 1. Kit Contents by Configuration

Configuration	Included Items
Intermediate frequency (IF) only instrument	<ul style="list-style-type: none">• Modules:<ul style="list-style-type: none">– PXIe-5820– PXIe-3622• Cables:<ul style="list-style-type: none">– SMA (m)-to-SMA (m) cable, 304.8 mm– MMPX (m)-to-MMPX (m) cable, 200 mm– MMPX (m)-to-MMPX (m) cable, 152 mm (x8)– MMPX (m)-to-SMA (m) cable, 152 mm (x2)
IF and mmWave instrument, which includes one mmWave radio head with one of the following port configurations: <ul style="list-style-type: none">• Direct TRX Ports (0-1)• Switched TRX Ports (0-7), Direct TRX Port (8)• Switched TRX Ports (0-15)	<ul style="list-style-type: none">• Modules:<ul style="list-style-type: none">– PXIe-5820– PXIe-3622– PXIe-5653– mmRH-5582• Cables:<ul style="list-style-type: none">– SMA (m)-to-SMA (m) cable, 304.8 mm– SMA (m)-to-SMA (m) cable, 1 m (x3)– MMPX (m)-to-MMPX (m) cable, 200 mm– MMPX (m)-to-MMPX (m) cable, 152 mm (x8)– MMPX (m)-to-SMA (m) cable, 152 mm (x2)– Mini HDMI-to-Mini HDMI cable• AC power supply adapter for mmRH-5582

Table 1. Kit Contents by Configuration (Continued)

Configuration	Included Items
<p>IF and mmWave instrument, which includes two mmWave radio heads, each with one of the following port configurations:</p> <ul style="list-style-type: none"> • Direct TRX Ports (0-1) • Switched TRX Ports (0-7), Direct TRX Port (8) • Switched TRX Ports (0-15) 	<ul style="list-style-type: none"> • Modules: <ul style="list-style-type: none"> – PXIe-5820 – PXIe-3622 – PXIe-5653 – mmRH-5582 (x2) • Cables: <ul style="list-style-type: none"> – SMA (m)-to-SMA (m) cable, 304.8 mm – SMA (m)-to-SMA (m) cable, 1 m (x6) – MMPX (m)-to-MMPX (m) cable, 200 mm – MMPX (m)-to-MMPX (m) cable, 152 mm (x8) – MMPX (m)-to-SMA (m) cable, 152 mm (x2) – 1.85 mm (m)-to-1.85 mm (m) cable, 200 mm – Mini HDMI-to-Mini HDMI cable (x2) • AC power supply adapter for mmRH-5582 (x2)

Other Equipment

There are required items not included in your kit that you need to install or operate the PXIe-5831. Your application may require additional items not included in your kit to install or operate your hardware.

Required Items

- A PXI Express chassis and chassis documentation. To ensure specifications are valid, NI recommends using the PXIe-1095 Chassis or PXIe-1092 Chassis for your hardware. For more information about compatible chassis options, refer to [ni.com](https://www.ni.com).
- A PXI Express embedded controller or MXI controller system that meets the system requirements specified in this guide and chassis documentation.

Optional Items

- A 0.9 N · m (8 lb · in.) calibrated torque wrench, 5/16 in. (NI part number 751120-01).

Preparing the Environment

Ensure that the environment you are using the PXIe-5831 in meets the following specifications.

Operating ambient temperature	0 °C to 45 °C
Operating relative humidity	10% to 90%, noncondensing (IEC 60068-2-56)

Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Pollution Degree	2

Indoor use only.



Notice Clean the hardware with a soft, nonmetallic brush or lint free cloth. Make sure that the hardware is completely dry and free from contaminants before returning it to service.



Note Refer to the *PXIe-5831 Specifications* at ni.com/manuals for complete specifications.

Choosing and Installing the Software

Software Options

NI provides three software options for programming the PXIe-5831—RFmx, NI-RFSA and NI-RFSG instrument driver software.

Table 2. PXIe-5831 Software Options

Software Option	Description	Use Case
RFmx	<p>Provides a single-handle instrument driver with built-in measurements.</p> <p>You can use instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.</p>	<p>Use RFmx SpecAn to perform spectral measurements.</p> <p>Use RFmx Demod to perform modulation quality measurements, such as EVM.</p> <p>Use RFmx personalities to perform physical layer analysis on supported communications and connectivity signals.</p>
NI-RFSA and NI-RFSG instrument driver	<p>The NI-RFSA and NI-RFSG APIs each provide a fixed API for interacting with your hardware.</p> <p>NI-RFSA and NI-RFSG provide standard IVI-based functionality needed for most vector signal analyzer and vector signal generator applications.</p> <p>You can use NI-RFSA and NI-RFSG instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.</p>	<p>Use NI-RFSA to create custom measurements or applications that require I/Q data.</p> <p>Use NI-RFSG to generate CW or modulated waveforms.</p> <p>Use NI-RFSA and NI-RFSG with the NI Modulation Toolkit to develop software-defined radio transmitters and receivers.</p> <p>Use NI-RFSG with the NI Modulation Toolkit to create and generate modulated signals to test receivers.</p>

Related Information

Refer to the [RFmx SpecAn Help](#), the [RFmx Demod Help](#), the [NI RF Vector Signal Analyzers Help](#), or the [NI RF Signal Generators Help](#) for more information about using the RFmx, NI-RFSA, and NI-RFSG instrument driver FPGA extensions.

Installing the Software

You must be an Administrator to install NI software on your computer.

1. Install an ADE, such as LabVIEW or LabWindows™/CVI™.

2. Install the driver software using NI Package Manager or by inserting your driver software media into your computer.

If you do not already have NI Package Manager installed, visit ni.com/r/NIPMDownload to download NI Package Manager. Refer to the *NI Package Manager Manual* for more information about installing, removing, and upgrading NI software using NI Package Manager.

3. Follow the instructions in the installation prompts.



Note Windows users may see access and security messages during installation. Accept the prompts to complete the installation.

4. When the installer completes, select **Restart** in the dialog box that prompts you to restart, shut down, or restart later.

Installing the PXIe-5831



Notice To prevent damage to the PXIe-5831 caused by ESD or contamination, handle the module using the edges or the metal bracket.

You must install the software before installing the hardware.

Before you install the hardware, refer to the guidelines in the *Maintain Forced-Air Cooling Note to Users* included with the module to ensure that the device can cool itself effectively.

To use the included cables, you must install the PXIe-5820 immediately to the left of the PXIe-3622. If your kit included the PXIe-5653 to use as an LO source, you must install the PXIe-5653 immediately to the right of the PXIe-3622.

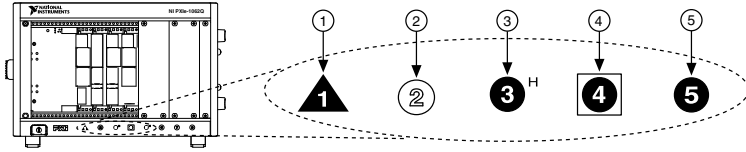
Complete the following steps for each module in your instrument configuration.

1. Ensure the AC power source is connected to the chassis before installing the module.

The AC power cord grounds the chassis and protects it from electrical damage while you install the module.

2. Power off the chassis.
3. Inspect the slot pins on the chassis backplane for any bends or damage prior to installation. Do not install a module if the backplane is damaged.
4. Remove the black plastic covers from all the captive screws on the module front panel.
5. Identify a supported slot in the chassis. The following figure shows the symbols that indicate the slot types.

Figure 1. Chassis Compatibility Symbols

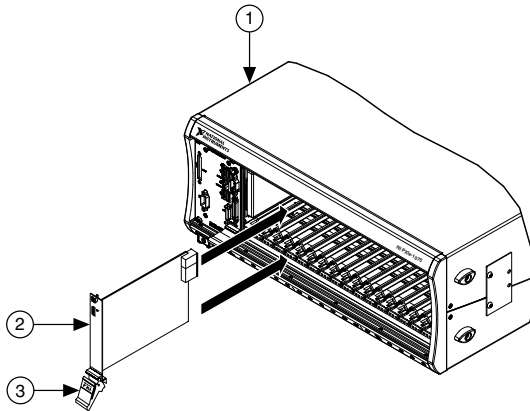


- | | |
|---------------------------------------|-----------------------------------|
| 1. PXI Express System Controller Slot | 4. PXI Express System Timing Slot |
| 2. PXI Peripheral Slot | 5. PXI Express Peripheral Slot |
| 3. PXI Express Hybrid Peripheral Slot | |

The modules that comprise the PXIe-5831 can be placed in PXI Express peripheral slots, PXI Express hybrid peripheral slots, or PXI Express system timing slots.

6. Touch any metal part of the chassis to discharge static electricity.
7. Ensure that the ejector handle is in the downward (unlatched) position.
8. Place the module edges into the module guides at the top and bottom of the chassis. Slide the module into the slot until it is fully inserted.

Figure 2. Module Installation



1. Chassis
2. Hardware Module
3. Ejector Handle in Downward (Unlatched) Position

9. Latch the module in place by pulling up on the ejector handle.
10. Secure the module front panel to the chassis using the front-panel mounting screws.



Note Tightening the top and bottom mounting screws increases mechanical stability and also electrically connects the front panel to the chassis, which can improve the signal quality and electromagnetic performance.

11. Cover all empty slots using EMC filler panels or fill using slot blockers to maximize cooling air flow, depending on your application.

12. Power on the chassis.

Related Information

[Installing the Software](#) on page 6

Interconnecting the PXIe-5831 Modules

Take the following considerations into account when interconnecting the PXI Express modules that comprise the PXIe-5831.

- Inspect all RF connectors before attaching mating cables. Clean with dry compressed air, if necessary, to remove any contaminants that may be present.
- Position RF cables with instrument connectors to ensure center pins are straight and aligned before mating.
- Press MMPX connectors until they noticeably snap into place.
- For all threaded RF connectors (SMA, SMA 27 GHz, and 2.4 mm), engage and finger-tighten the connector nuts. The connector nuts should thread easily without binding, but if not, ensure the connector is straight and that center pins have not been damaged.
- Carefully complete tightening all threaded RF connectors to $0.9 \text{ N} \cdot \text{m}$ ($8 \text{ lb} \cdot \text{in}$) using an appropriate torque wrench (not included) or torque screwdriver and driver bit. Tighten only until the wrench clicks.

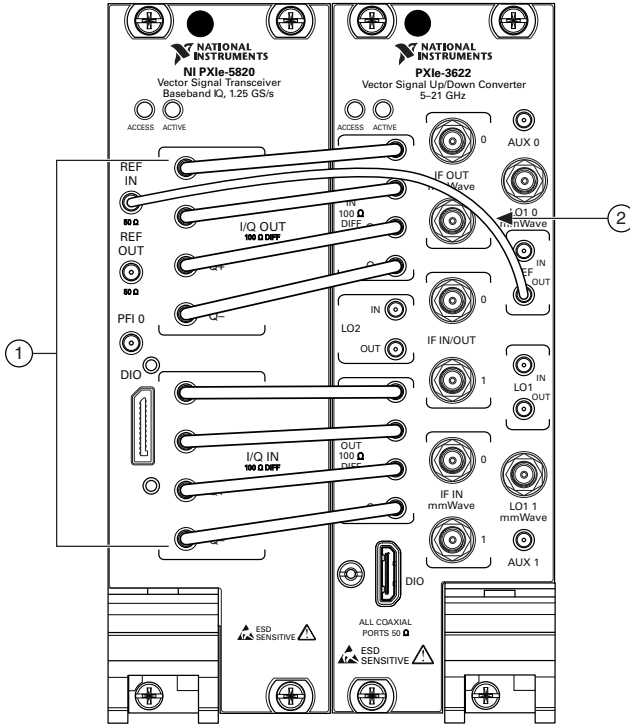


Notice Incorrect torque at SMA connections can damage device connectors and degrade signal fidelity.

Connecting the PXIe-5820 and PXIe-3622

Complete the following steps for the baseband signal connections and Reference Clock connection, as shown in the following figure.

Figure 3. PXIe-5831 Equipment Setup (IF Only)



1. MMPX (m)-to-MMPX (m) Cable, 152 mm
2. MMPX (m)-to-MMPX (m) Cable, 200 mm

1. Complete the following baseband signal cable connections between the PXIe-5820 and PXIe-3622 front panels using the included eight 152 mm MMPX (m)-to-MMPX (m) cables for transmit and receive I/Q signals.

Table 3. Baseband Signal Cable Connections

PXIe-5820 Connector	PXIe-3622 Connector
I/Q OUT I+	I/Q IN I+
I/Q OUT I-	I/Q IN I-
I/Q OUT Q+	I/Q IN Q+
I/Q OUT Q-	I/Q IN Q-
I/Q IN I+	I/Q OUT I+
I/Q IN I-	I/Q OUT I-

Table 3. Baseband Signal Cable Connections (Continued)

PXIe-5820 Connector	PXIe-3622 Connector
I/Q IN Q+	I/Q OUT Q+
I/Q IN Q-	I/Q OUT Q-

- Use the 200 mm MMPX (m)-to-MMPX (m) cable to connect the PXIe-5820 REF IN front panel connector to the PXIe-3622 REF OUT front panel connector.

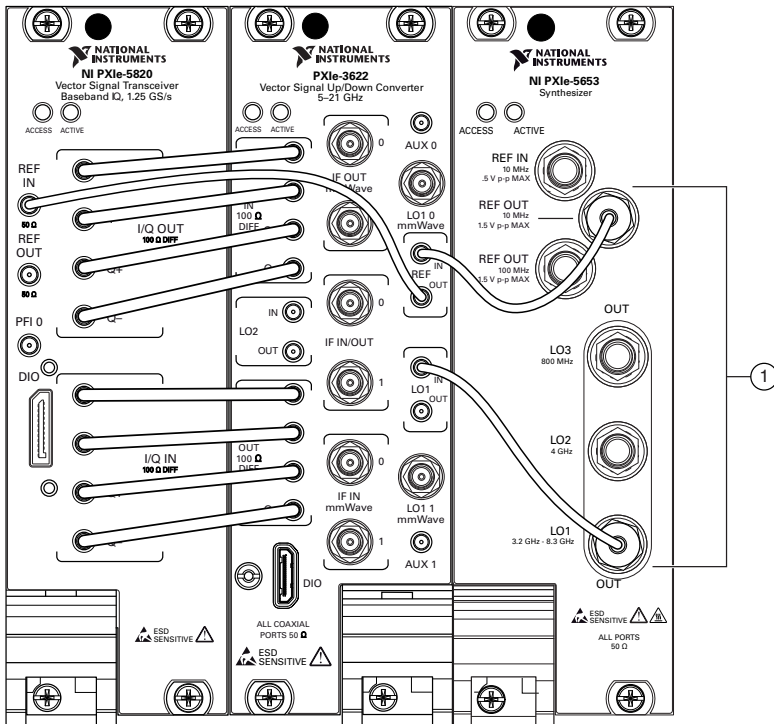
This completes the Reference Clock connection.

Connecting the PXIe-5653 LO Source

If you purchased the IF and mmWave instrument configuration, complete the following steps to connect the PXIe-5653 as an LO source, as shown in the following figure.

Skip this section if your configuration does not include the PXIe-5653.

Figure 4. PXIe-5831 with PXIe-5653 Equipment Setup



- MMPX (m)-to-SMA (m) Cable, 152 mm

- Use one of the 152 mm MMPX (m)-to-SMA (m) cables to connect the PXIe-3622 REF IN front panel connector to the PXIe-5653 REF OUT (10 MHz) front panel connector.

- Use the other 152 mm MMPX (m)-to-SMA (m) cable to connect the PXIe-3622 LO1 IN front panel connector to the PXIe-5653 LO1 OUT front panel connector.

Related Information

Refer to the PXIe-5831 section of the NI RF Vector Signal Transceivers Help for more information about how to make connections using an external clock.

Connecting mmWave Radio Heads

Depending on the hardware configuration you purchased, complete this section to connect either one or two mmRH-5582 mmWave Radio Heads to the PXIe-5831.

Skip this section if your configuration does not include a mmWave radio head.

Recommended Torque

Ensure that connectors are torqued to the appropriate level when connecting mmWave radio heads to the system.

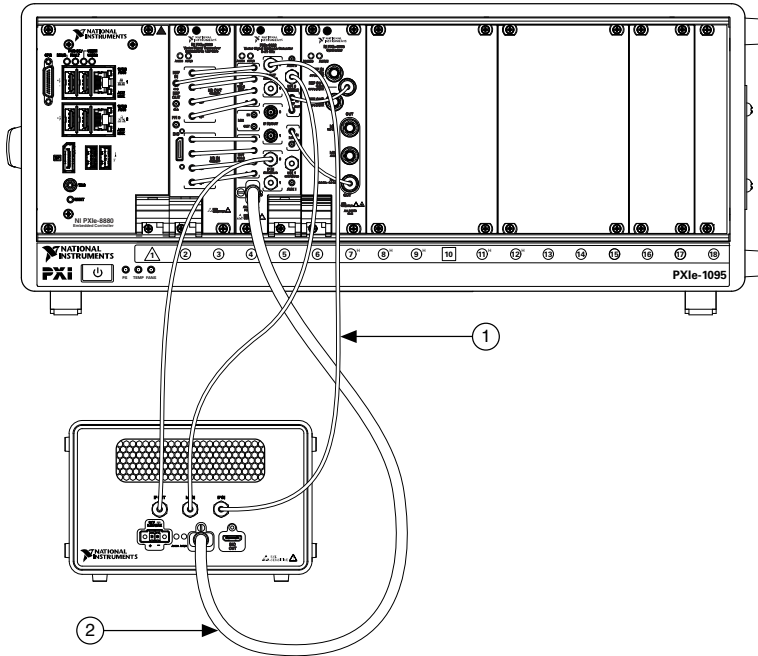
Table 4. Recommended Connector Torque

Connector Type	Torque
2.4 mm	0.9 N · m (8 lb · in)
SMA 27 GHz	0.9 N · m (8 lb · in)
Mini HDMI	0.34 N · m (3 lb · in), maximum
Power connector jack	0.34 N · m (3 lb · in), maximum

Connecting One mmWave Radio Head to the PXIe-5831

Complete the following steps to connect one mmRH-5582 mmWave Radio Head to the PXIe-5831, as shown in the following figure.

Figure 5. Equipment Setup with One mmWave Radio Head (Power Adapter and Cables Not Shown)



1. SMA (m)-to-SMA (m) Cable, 1 m
2. Mini-HDMI-to-Mini-HDMI Cable

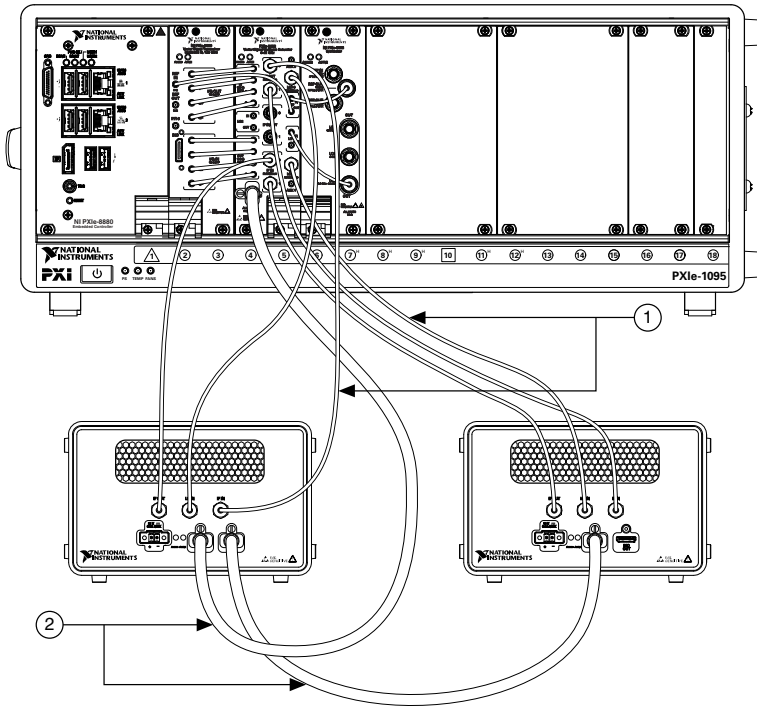
1. Use one of the included 1 m SMA (m)-to-SMA (m) cables to connect the mmRH-5582 IF OUT connector to the PXIe-3622 IF IN mmWave 0 front panel connector.
2. Use another 1 m SMA (m)-to-SMA (m) cable to connect the mmRH-5582 LO IN connector to the PXIe-3622 LO1 0 mmWave front panel connector.
3. Use another 1 m SMA (m)-to-SMA (m) cable to connect the mmRH-5582 IF IN connector to the PXIe-3622 IF OUT mmWave 0 front panel connector.
4. Use the Mini-HDMI-to-Mini-HDMI cable to connect the mmRH-5582 DIO IN connector to the PXIe-3622 DIO front panel connector. Insert the jackscrew and finger-tighten the jackscrew to the PXIe-3622 front panel.
5. Connect the AC power supply adapter to the mmRH-5582 power input. Finger-tighten the locking screws on the power supply connector to the mmRH-5582 using a small flat blade screwdriver.
6. Connect the mmWave radio head to power by connecting the AC power cable to the power input on the adapter and connecting the other end to a wall socket.

Connecting Two mmWave Radio Heads to the PXIe-5831

Prior to starting this procedure, connect the first mmWave radio head to your PXIe-5831 as directed in the [Connecting One mmWave Radio Head to the PXIe-5831](#) section.

Complete the following steps to connect a second mmRH-5582, as shown in the following figure.

Figure 6. Equipment Setup with Two mmWave Radio Heads (Power Adapter and Cables Not Shown)



1. SMA (m)-to-SMA (m) Cable, 1 m
2. Mini-HDMI-to-Mini-HDMI Cable

1. Use one of the included 1 m SMA (m)-to-SMA (m) cables to connect the mmRH-5582 IF OUT connector to the PXIe-3622 IF IN mmWave 1 front panel connector.
2. Use another 1 m SMA (m)-to-SMA (m) cable to connect the mmRH-5582 LO IN connector to the PXIe-3622 LO1 1 mmWave front panel connector.
3. Use another 1 m SMA (m)-to-SMA (m) cable to connect the mmRH-5582 IF IN connector to the PXIe-3622 IF OUT mmWave 1 front panel connector.
4. Use the Mini-HDMI-to-Mini-HDMI cable to connect the first mmRH-5582 DIO OUT back panel connector to the second mmRH-5582 DIO IN back panel connector. Fingertighten the jackscrews to secure the Mini-HDMI-to-Mini-HDMI cable.

The connection is daisy chained on the back panel of the mmRH-5582.

5. Connect the AC power supply adapter to the mmRH-5582 power input. Fingertighten the locking screws on the power supply connector to the mmRH-5582 using a small flat blade screwdriver.

Direct Connections to the PXIe-5831

The PXIe-5831 is a precision RF instrument that is sensitive to ESD and transients. Ensure you are making proper direct connections to the PXIe-5831 to avoid damaging the hardware.



Notice Apply external signals only while the hardware is powered on. Applying external signals while the hardware is powered off may cause damage.

- Ensure you are properly grounded when manipulating cables or antennas connected to the instrument.
- If you are using noninsulated devices, such as an RF antenna, ensure the devices are maintained in a static-free environment.
- If you are using an active device, such as a preamplifier or switch routed to the PXIe-5831, ensure that the device cannot generate signal transients greater than the RF and DC specifications of the PXIe-5831.

Configuring the PXIe-5831 in MAX

Use Measurement & Automation Explorer (MAX) to configure your NI hardware. MAX informs other programs about which NI hardware products are in the system and how they are configured. MAX is automatically installed with NI-RFSA, NI-RFSG, and RFmx.

1. Launch MAX.
2. In the configuration tree, expand **Devices and Interfaces** to see the list of installed NI hardware.

Installed modules appear under the name of their associated chassis.

3. Expand your **Chassis** tree item.

MAX lists all modules installed in the chassis. Your default names may vary.



Note If you do not see your module listed, press <F5> to refresh the list of installed modules. If the module is still not listed, power off the system, ensure the module is correctly installed, and restart.

4. Record the identifier MAX assigns to the PXIe-3622. Use this identifier when programming the PXIe-5831.
5. Associate the hardware modules that comprise your instrument.
 - a) Select the PXIe-3622 that is identified as not configured in the configuration tree.
 - b) In the Associated Devices section, select the appropriate module from each system component drop-down listbox.

Select the PXIe-5820 from the **Baseband** list. If you are using the PXIe-5653 as an LO source, select the PXIe-5653 from the **LO1 (mmWave LO)** list.



Note If you connected a mmRH-5582 mmWave Radio Head to the system, the mmRH-5582 automatically appears as connected in MAX when you expand the PXIe-3622 configuration tree item.

- c) Click **Save** in the MAX toolbar.



Note Module associations may be lost when you move the modules to different chassis slots.

6. Self-test the hardware by selecting the item in the configuration tree and clicking **Self-Test** in the MAX toolbar. Repeat this step for all modules in your PXIe-5831 system.

The MAX self-test performs a basic verification of hardware resources.

Related Information

[Interconnecting the PXIe-5831 Modules](#) on page 9

[Troubleshooting](#) on page 22

If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit ni.com/support.

Self-Calibration

Self-calibration adjusts the PXIe-5831 for variations in the module environment using onboard power detectors.

The PXIe-5831 modules are externally calibrated at the factory; however, you should perform a self-calibration in any of the following situations:

- After first installing and interconnecting your PXIe-5831 instrument
- After any module in the chassis is installed, uninstalled, or moved
- After inter-module cabling has been changed, reconnected, or repositioned
- After changing controllers, computers, or reinstalling the driver software
- When the system is in an environment where the ambient temperature varies or the module temperature has drifted more than ± 5 °C from the temperature at the last self-calibration
- To periodically adjust for small performance drifts that occur with product aging



Note To ensure specifications before you use the instrument or perform self-calibration, power on the PXI Express chassis and mmWave radio heads, if applicable; set the chassis fan speeds to AUTO or HIGH, depending on the chassis; wait for the operating system to completely load; and then allow the instrument to warm up for 30 minutes.



Note Ensure that any connected external hardware is in an idle state and not transmitting during self-calibration. It is not recommended to perform self-calibration while connected in direct loopback configurations.

Performing a Self-Calibration Using NI-RFSA

NI recommends you perform the self-calibration using the NI-RFSA example when you self-calibrate the module.

1. Select **Start»All Programs»National Instruments»LabVIEW** to launch LabVIEW.

2. Launch the Example Finder and navigate to the example.
 - a) Select **Hardware Input and Output»Modular Instruments»NI-RFSA»Utilities»RFSA Self Calibration**.
 - b) Open the example.
3. Complete the following steps to configure the example:
 - a) Select the device identifier assigned to the PXIe-3622 in MAX in the **[Resource Name]** drop-down menu.
 - b) Set Clock Source to **OnboardClock**.
 - c) Set Self Calibration Step Operations to **Perform All Self Calibration Steps**.
4. Run the VI.

Locating the Software and Examples

Software Locations

Table 5. Location of PXIe-5831 Software Options

Software Option	ADE	Location
RFmx	LabVIEW	Available on the LabVIEW Functions palette at Measurement I/O»NI-RFmx .
	LabWindows/CVI	RFmx functions are available from the LabWindows/CVI Library menu at Library»RFmx SpecAn Library and Library»RFmx Demod Library .
	Microsoft Visual C/C++	<p>Use the header files located in the <code><NIDir>\Shared\ExternalCompilerSupport\C\include</code> directory and import library files located in one of the following directories:</p> <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- <code><NIDir>\Shared\ExternalCompilerSupport\C\include</code> • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit) : <ul style="list-style-type: none"> – 32-bit installation-<code><NIDir>\Shared\ExternalCompilerSupport\C\lib32\msvc</code> – 64-bit installation-<code><NIDir>\Shared\ExternalCompilerSupport\C\lib64\msvc</code> <p>where <code><NIDir></code> is one of the following locations:</p> <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)- Program Files\National Instruments • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)- Program Files (x86)\National Instruments
	Microsoft .NET	For the location of .NET class libraries, refer to the installed RFmx readme.

Table 5. Location of PXIe-5831 Software Options (Continued)

Software Option	ADE	Location
NI-RFSA	LabVIEW	Available on the LabVIEW Functions palette at Measurement I/O»NI-RFSA .
	LabWindows/CVI	Available in the <code><IVIROOTDIR32>\Drivers\niRFSA</code> directory, where <code><IVIROOTDIR32></code> is one of the following locations: <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)-Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)-Program Files (x86)\IVI Foundation\IVI
	Microsoft Visual C/C++	Use the header files located in the <code><IVIROOTDIR32>\Include</code> directory and import library files located in the <code><IVIROOTDIR32>\Lib</code> directory, where <code><IVIROOTDIR32></code> is one of the following directories: <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)-Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)-Program Files (x86)\IVI Foundation\IVI
	Microsoft .NET	Use the NI-RFSA .NET class library by adding a reference to <code>NationalInstruments.ModularInstruments.NIRfsa.Fx40</code> or <code>NationalInstruments.ModularInstruments.NIRfsa.Fx45</code> and any dependent class libraries from within the Solution Explorer in Visual Studio.

Table 5. Location of PXIe-5831 Software Options (Continued)

Software Option	ADE	Location
NI-RFSG	LabVIEW	Available on the LabVIEW Functions palette at Measurement I/O»NI-RFSG .
	LabWindows/CVI	Available in the <IVIROOTDIR32>\Drivers\niRFSG directory, where <IVIROOTDIR32> is one of the following locations: <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)-Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)-Program Files (x86)\IVI Foundation\IVI
	Microsoft Visual C/C++	Use the header files located in the <IVIROOTDIR32>\Include directory and import library files located in the <IVIROOTDIR32>\Lib directory, where <IVIROOTDIR32> is one of the following directories: <ul style="list-style-type: none"> • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)-Program Files\IVI Foundation\IVI • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)-Program Files (x86)\IVI Foundation\IVI
	Microsoft .NET	Use the NI-RFSG .NET class library by adding a reference to NationalInstruments.ModularInstruments.NIRfsg.Fx40 or NationalInstruments.ModularInstruments.NIRfsg.Fx45 and any dependent class libraries from within the Solution Explorer in Visual Studio.

Programming Examples Locations

Using the NI Example Finder

If you are using RFmx, NI-RFSA, or NI-RFSG with LabVIEW or LabWindows/CVI, use the NI Example Finder to locate programming examples.

1. Launch LabVIEW or LabWindows/CVI.
2. Select **Help»Find Examples** to open the NI Example Finder.

3. Navigate to **Hardware Input and Output»Modular Instruments**.
4. Open the example that best matches your application requirements.

Using Microsoft Visual C/C++

If you are using RFmx or NI-RFSA with Microsoft Visual C/C++, locate examples in the following directories.

Table 6. Location of Microsoft Visual C/C++ Programming Examples

Software Option	Examples Location
RFmx	<p><NIDocDir>\RFmx\Demod\Examples</p> <p><NIDocDir>\RFmx\SpecAn\Examples</p> <p>where <NIDocDir> is the Users\Public\Public Documents \National Instruments directory.</p>
NI-RFSA	<p><NIDocDir>\NI-RFSA\examples</p> <p>where <NIDocDir> is the Users\Public\Public Documents \National Instruments directory.</p>

Making a First Measurement

You can verify proper installation and configuration of your instrument by making a measurement using the NI-RFSG and NI-RFSA Examples in LabVIEW.

1. Connect the PXIe-5831 as appropriate for your application.
2. Launch LabVIEW.
3. Complete the following steps to open the Getting Started Examples:
 - a) Select **LabVIEW»Help»Find Examples**.
 - b) Select **Hardware Input and Output» Modular Instruments»NI-RFSA»Getting Started»RFSA Getting Started Spectrum (5830 and 5831).vi**.
 - c) Select **Hardware Input and Output»Modular Instruments»NI-RFSG»Getting Started»RFSG Getting Started Single Tone Generation (5830 and 5831).vi**.
4. Select the device identifier assigned to the PXIe-5831 in MAX in the **Resource Name** control within each example.
5. Select the ports you want to generate and acquire a CW tone using the **Selected Ports** control within each example.
6. Start the NI-RFSG example to generate the CW tone at the port you specified.
7. Start the NI-RFSA example to acquire the CW tone at the port you specified.

Related Information

[Interconnecting the PXIe-5831 Modules](#) on page 9

Troubleshooting

If an issue persists after you complete a troubleshooting procedure, contact NI technical support or visit ni.com/support.

What Should I Do if the PXIe-3622 Does Not Appear in MAX?

1. In the MAX configuration tree, expand **Devices and Interfaces**.
2. Expand the **Chassis** tree to see the list of installed hardware, and press <F5> to refresh the list.
3. If the module is still not listed, power off the system, ensure that all hardware is correctly installed, and restart the system.
4. Navigate to the Device Manager.

Operating System	Description
------------------	-------------

Windows 10/8.1	Right-click the Start button, and select Device Manager .
----------------	--

Windows 7	Select Start » Control Panel » Device Manager .
-----------	--

5. Verify the PXIe-3622 appears in the Device Manager.
 - a) Under **NI Modular Instruments**, confirm that a PXIe-3622 entry appears.



Note If you are using a PC with a device for PXI remote control system, under **System Devices**, also confirm that no error conditions appear for the **PCI-to-PCI Bridge**.

- b) If error conditions appear, reinstall the driver software and the PXIe-3622.

Why Is the ACCESS LED Off When the Chassis Is On?

The LEDs may not light until the device has been configured in MAX. Before proceeding, verify that the PXIe-5831 appears in MAX.

If the module appears in MAX but the ACCESS LED fails to light after you power on the chassis, a problem may exist with the chassis power rails, the hardware module, or the LED.



Notice Apply external signals only while the hardware is powered on. Applying external signals while the hardware is powered off may cause damage.

1. Disconnect any signals from the PXI Express module front panel.
2. Power off the PXI Express chassis.
3. Remove the module from the PXI Express chassis and inspect it for damage. Do not reinstall a damaged device.
4. Install the module in a different PXI Express chassis slot from which you removed it.
5. Power on the PXI Express chassis.

6. Restart your computer.
7. Verify that the device appears in MAX.

What Should I Do if the Module Fails the Self-Test?

1. Restart the system.
2. Launch MAX, and perform the self-test again.
3. Power off the chassis.
4. Reinstall the failed module in a different slot.
5. Power on the chassis.
6. Perform the self-test again.

What Should I Do if the Instrument Does Not Initialize?

Failure to initialize may indicate a problem with module interconnections or with MAX. If the niRFSA Initialize VI or niRFSG Initialize VI returns an error and the PXIe-5831 fails to initialize, complete the following steps:

1. Reconnect the PXIe-5831 front panel cables securely.
2. Power on your system and run the MAX configuration and self-test procedures.

Hardware Connectors and Indicators

PXIe-5820 Front Panel and LEDs

Front Panel and LEDs

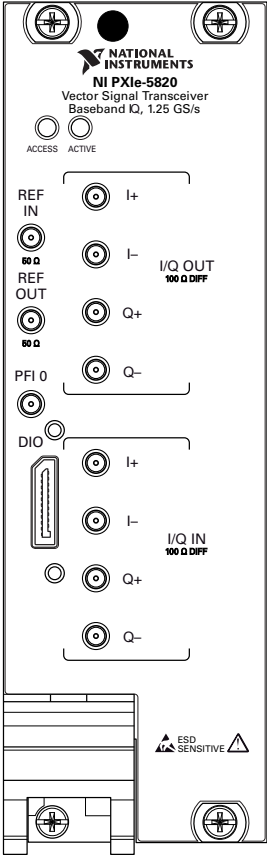


Table 7. General Connector Descriptions

Connector	Description	Connector Type
REF IN	Input connector that allows for the use of an external 10 MHz Reference Clock.	MMPX (f)
REF OUT	Output connector that can export a 10 MHz Reference Clock.	MMPX (f)


Table 7. General Connector Descriptions (Continued)

Connector	Description	Connector Type
PFI 0	Programmable-function digital I/O (DIO) connector for use with triggers or events.	MMPX (f)
DIO	Multi-signal DIO connector that provides access to FPGA multi-gigabit transceivers (MGTS) and general purpose LVCMOS signals.	Nano-Pitch I/O

Table 8. I/Q Connector Descriptions

Connector		Description	Connector Type
I/Q OUT	I+	Output connector for I+ signals.	MMPX (f)
	I-	Output connector for I- signals.	MMPX (f)
	Q+	Output connector for Q+ signals.	MMPX (f)
	Q-	Output connector for Q- signals.	MMPX (f)
I/Q IN	I+	Input connector for I+ signals.	MMPX (f)
	I-	Input connector for I- signals.	MMPX (f)
	Q+	Input connector for Q+ signals.	MMPX (f)
	Q-	Input connector for Q- signals.	MMPX (f)

Table 9. LED Indicators

LED	Indications
ACCESS	<p>Indicates the basic hardware status of the device.</p> <p>Off—The device is not yet functional or has detected a problem with a PXI Express power rail.</p> <p>Amber—The device is being accessed. <i>Accessed</i> means that you are writing to the device setup registers to control the device, reading from the device to monitor the device status, or transferring data to/from the device.</p> <p>Green—The device is controllable through the software.</p>
ACTIVE	<p>Off—The device is idle.</p> <p>Solid green—The device is generating a waveform.</p> <p>Dim amber—The device is waiting for an acquisition Reference Trigger.</p> <p>Solid amber—The device is acquiring a waveform.</p> <p>Solid red—The device has detected an error. The LED remains red until the error condition is removed.</p> <p> Note The indicators are listed in increasing order of priority. For example, if you are generating a waveform using NI-RFSG and waiting on an acquisition Reference Trigger in NI-RFSA, the LED is dim amber.</p>

DIO Connector Pinout

Reserved	A1	B1	5.0 V
GND	A2	B2	GND
MGT Rx+ 0	A3	B3	MGT Tx+ 0
MGT Rx- 0	A4	B4	MGT Tx- 0
GND	A5	B5	GND
MGT Rx+ 1	A6	B6	MGT Tx+ 1
MGT Rx- 1	A7	B7	MGT Tx- 1
GND	A8	B8	GND
DIO 4	A9	B9	DIO 6
DIO 5	A10	B10	DIO 7
GND	A11	B11	GND
MGT REF+ / DIO 0	A12	B12	DIO 2
MGT REF- / DIO 1	A13	B13	DIO 3
GND	A14	B14	GND
MGT Rx+ 2	A15	B15	MGT Tx+ 2
MGT Rx- 2	A16	B16	MGT Tx- 2
GND	A17	B17	GND
MGT Rx+ 3	A18	B18	MGT Tx+ 3
MGT Rx- 3	A19	B19	MGT Tx- 3
GND	A20	B20	GND
5.0 V	A21	B21	Reserved

PXIe-3622 Front Panel and LEDs

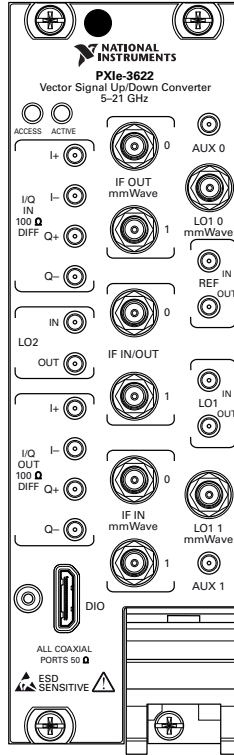


Table 10. I/Q Connector Descriptions

Connector		Description	Connector Type
I/Q IN	I+	Input connector for I+ signals.	MMPX (f)
	I-	Input connector for I- signals.	MMPX (f)
	Q+	Input connector for Q+ signals.	MMPX (f)
	Q-	Input connector for Q- signals.	MMPX (f)

Table 10. I/Q Connector Descriptions (Continued)

Connector		Description	Connector Type
I/Q OUT	I+	Output connector for I+ signals.	MMPX (f)
	I-	Output connector for I- signals.	MMPX (f)
	Q+	Output connector for Q+ signals.	MMPX (f)
	Q-	Output connector for Q- signals.	MMPX (f)

Table 11. General Connector Descriptions

Connector		Description	Connector Type
LO2	IN	Input connector for the external local oscillator signal used for the up and down conversion between baseband and IF.	MMPX (f)
	OUT	Output connector for the local oscillator signal used for the up and down conversion between baseband and IF.	MMPX (f)
DIO		Digital input/output connector for connecting mmWave radio heads.	Mini HDMI
IF OUT mmWave	0	Output connector that routes IF transmit signals to a mmWave radio head.	SMA 27 GHz (f)
	1	Output connector that routes IF transmit signals to a secondary mmWave radio head.	SMA 27 GHz (f)
IF IN/OUT	0	IF0 bi-directional connector for both input and output.	SMA 27 GHz (f)
	1	IF1 bi-directional connector for both input and output.	SMA 27 GHz (f)
IF IN mmWave	0	Input connector that receives IF signals from a mmWave radio head.	SMA 27 GHz (f)
	1	Input connector that receives IF signals from a secondary mmWave radio head.	SMA 27 GHz (f)
AUX 0		Reserved for internal use.	MMPX (f)
LO1 0 mmWave		Output connector that routes a local oscillator signal to a mmWave radio head.	SMA 27 GHz (f)

Table 11. General Connector Descriptions (Continued)

Connector		Description	Connector Type
REF	IN	Input connector for the Reference Clock.	MMPX (f)
	OUT	Output connector for the Reference Clock.	MMPX (f)
LO1	IN	Input connector for the external local oscillator signal from the mmWave radio head, used for the up and down conversion between IF and mmWave.	MMPX (f)
	OUT	Output connector for the local oscillator signal to the mmWave radio head, used for the up and down conversion between IF and mmWave.	MMPX (f)
LO1 1 mmWave		Output connector that routes a local oscillator signal to a secondary mmWave radio head.	SMA 27 GHz (f)
AUX 1		Reserved for internal use.	MMPX (f)

Table 12. LED Indicators

LED	Indications
ACCESS	<p>Indicates the basic hardware status of the module.</p> <ul style="list-style-type: none"> • OFF—The driver software has not yet loaded, or the module exceeded approved operating temperature and thermal shutdown occurred or has detected a problem with a power rail. • AMBER—The module is being accessed. <i>Accessed</i> means that the device setup registers are being written to in order to control the device. • GREEN—The module is ready to be programmed by software.
ACTIVE	<ul style="list-style-type: none"> • OFF—The module is idle. • RED—The module detected an error state.

PXIe-5653 Front Panel and LEDs

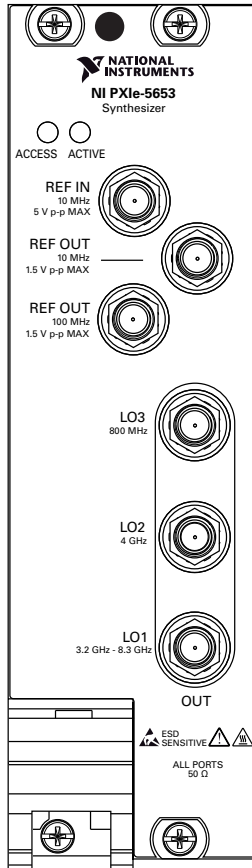


Table 13. Connector Descriptions

Connector	Description
REF IN	Accepts a 10 MHz frequency signal with a maximum voltage of $2 V_{pk-pk}$.
REF OUT (10 MHz)	Routes a frequency reference signal from the synthesizer/LO module onboard 10 MHz oven-controlled crystal oscillator (OCXO).
REF OUT (100 MHz)	Routes a frequency reference signal from the synthesizer/LO module onboard 100 MHz OCXO.

Table 13. Connector Descriptions (Continued)

Connector	Description
LO1 OUT	Output terminal for the LO1 (3.2 GHz to 8.3 GHz) source. LO1 OUT is an SMA connector with an impedance of 50 Ω (nominal).
LO2 OUT	Output terminal for the LO2 (4 GHz) source. LO2 OUT is an SMA connector with an impedance of 50 Ω (nominal).
LO3 OUT	Output terminal for the LO3 (800 MHz) source. LO3 OUT is an SMA connector with an impedance of 50 Ω (nominal).



Note The PXIe-5653 LO2 OUT and LO3 OUT connectors are not used in any PXIe-5831 instrument configuration.

Table 14. LED Indicators

LED	Indication
ACCESS	<p>Indicates the basic hardware status of the module.</p> <ul style="list-style-type: none"> • OFF—The module is not yet functional, or the module detected a problem with a power rail. • AMBER—The module is being accessed. <i>Accessed</i> means that the device setup registers are being written to in order to control the device. • GREEN—The module is ready to be programmed.
ACTIVE	<p>Indicates the module state.</p> <ul style="list-style-type: none"> • OFF—The module is not generating a signal. • AMBER—The module phased-locked loops (PLLs) are attempting to lock. • GREEN—The module is generating a signal; applicable PLLs are locked. • RED—The module detected an error state. An error state may indicate the module exceeded approved operating temperature and thermal shutdown occurred or that the module detected a power supply failure. If the power supply fails, contact NI technical support.

mmRH-5582 Front Panel, Back Panel, and LEDs

Front Panel

Figure 7. mmRH-5582 with Direct TRX Ports Only

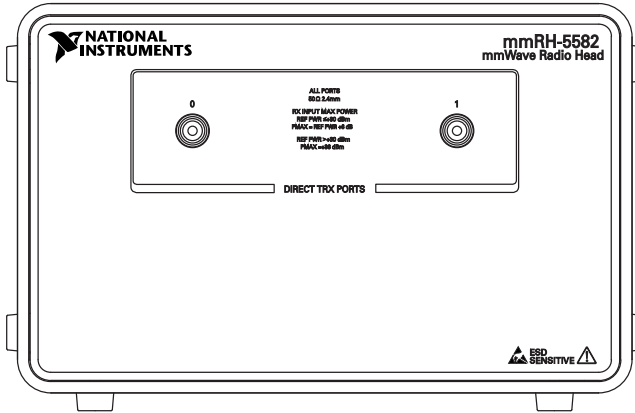


Figure 8. mmRH-5582 with Switched and Direct TRX Ports

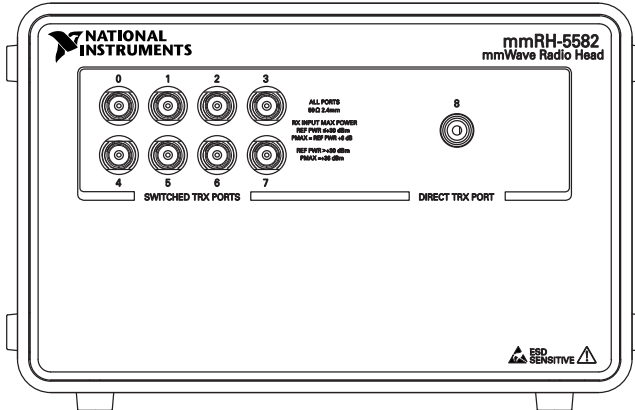


Figure 9. mmRH-5582 with Switched TRX Ports Only

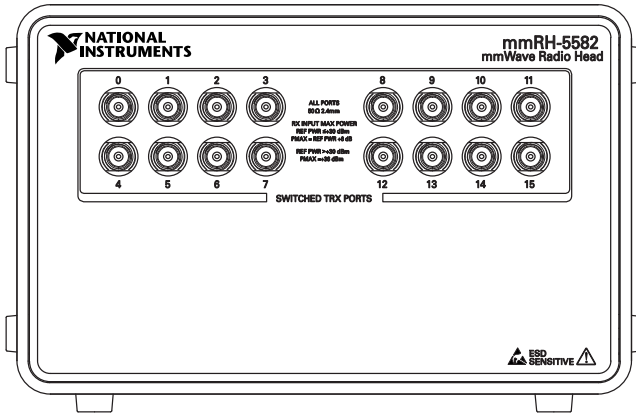


Table 15. Connector Descriptions

Connector	Description	Connector Type
DIRECT TRX PORTS (0,1, or 8 on modules labeled with DIRECT TRX PORTS only)	Bi-directional connector for both input and output of RF signals.	2.4 mm (f), 50 Ω
SWITCHED TRX PORTS (0 through 7 or 0 through 15 on modules labeled with SWITCHED TRX PORTS only)	Bi-directional connector for both input and output of RF signals.	2.4 mm (f), 50 Ω

Back Panel

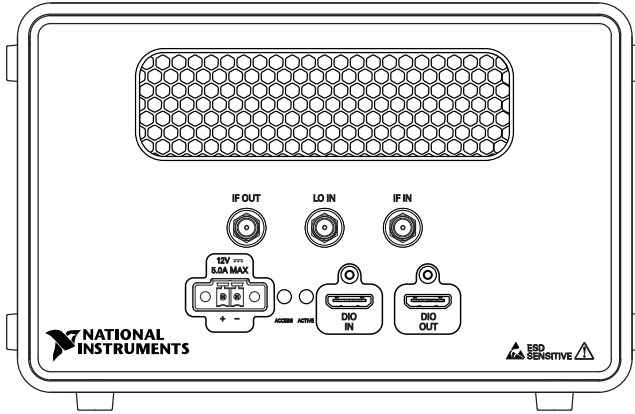


Table 16. Connector Descriptions

Connector	Description	Connector Type
IF OUT	IF output connector that routes receive signals to IF IN mmWave 0 or 1 connector on the PXIe-3622.	SMA 27 GHz (f)
LO IN	Local oscillator input connector.	SMA 27 GHz (f)
IF IN	IF input connector that receives signals from the IF OUT mmWave 0 or 1 connector on the PXIe-3622.	SMA 27 GHz (f)
Power	Power supply input.	MINI-COMBICON
DIO IN	Digital input/output control.	Mini HDMI
DIO OUT	Digital input/output control for daisy chaining to adjacent mmWave radio heads.	Mini HDMI

Table 17. LED Indicators

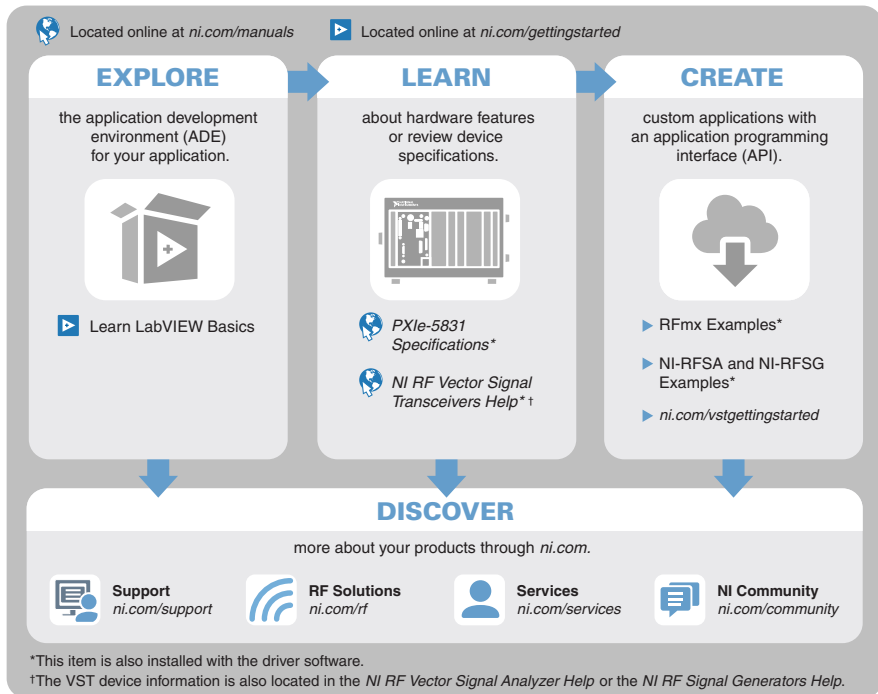
LED	Indications
ACCESS	Indicates the basic hardware status of the module. <ul style="list-style-type: none">• OFF—The module is not yet functional, or the module has detected a problem with a power rail.• AMBER—The module is being accessed. <i>Accessed</i> means that the device setup registers are being read from or written to in order to control the device.• GREEN—The module is ready to be programmed by software.
ACTIVE	Indicates the state of the module. <ul style="list-style-type: none">• OFF—The module is not powered.• AMBER—The module is being configured.• GREEN—The module is ready for configuration.• RED—The module has encountered a hardware setup error or the module is exceeding approved operating temperature and is in a state of thermal shutdown.

Related Information

Refer to the [PXIe-5831 Specifications](#) for more information about front panel connectors and LEDs.

Where to Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.



Tip The *NI RF Vector Signal Transceivers Help*, available at ni.com/manuals, is an HTML version of a traditional user manual that includes detailed information about RF fundamentals, device features, and programming for vector signal transceivers.

Worldwide Support and Services

The NI website is your complete resource for technical support. At ni.com/support, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit ni.com/services for information about the services NI offers.

Visit ni.com/register to register your NI product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

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