NI PXIe-5646R Getting Started Guide

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Contents

PXIe-5646 Getting Started Guide

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

This document explains how to install, configure, and test the PXIe-5646. The PXIe-5646 is an RF vector signal transceiver (VST), and ships with the following software options, which you use to program the device.

- NI-RFmx driver software
- NI-RFSA and NI-RFSG driver software
- NI LabVIEW Instrument Design Libraries for Vector Signal Transceivers (instrument design libraries)

Notice The protection provided by this equipment may be impaired if it is used in a manner not described in the documentation.

Electromagnetic Compatibility Guidelines

This product was tested and complies with the regulatory requirements and limits for electromagnetic compatibility (EMC) stated in the product specifications. These requirements and limits provide reasonable protection against harmful interference when the product is operated in the intended operational electromagnetic environment.

This product is intended for use in industrial locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with radio and television reception and prevent unacceptable performance degradation, install and use this product in strict accordance with the instructions in the product documentation.

Furthermore, any changes or modifications to the product not expressly approved by

NI could void your authority to operate it under your local regulatory rules.

Caution To ensure the specified EMC performance, operate this product only with shielded cables and accessories.

Caution To ensure the specified EMC performance, operate this product only with cables less than 3 meters in length.

Verifying the System Requirements

To use the PXIe-5646, 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.

   Caution Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted.

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.

Preparing the Environment

Ensure that the environment you are using the PXIe-5646 in meets the following specifications.

Operating ambient temperature (IEC 60068-2-1, IEC 60068-2-2)	0 °C to 55 °C
Operating relative humidity (IEC 60068-2-56)	10% to 90%, noncondensing
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-5646 Specifications*** at ni.com/manuals for complete specifications.

Verifying the Kit Contents

Other Equipment

There are several required items not included in your device kit that you need to operate the PXIe-5646. Your application may require additional items not included in your kit to install or operate your PXIe-5646.

Required Items

- A PXI Express chassis and chassis documentation
- A PXI Express embedded controller or PC with MXI controller system that meets the system requirements specified in this guide and chassis documentation

Optional Items

- PXI Slot Blocker kit (NI part number 199198-01)
- SMA (m)-to-SMA (m) coaxial cables, RG-402, 50 Ω, 1 M (NI part number 781845-01)

Visit ni.com for more information about these additional items.

Software Options

NI provides three software options for programming the PXIe-5646—NI-RFmx, NI-RFSA and NI-RFSG instrument driver software, and the instrument design libraries.

Table 1. PXIe-5646 Software Options

Software Option	Description	Use Case
NI-RFmx	Provides a single-handle instrument driver with built-in measurements. You can use instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.	Use NI-RFmx SpecAn to perform spectral measurements. Use NI-RFmx Demod to perform modulation quality measurements, such as EVM.

Software Option	Description	Use Case
		Use NI-RFmx cellular personalities to perform physical layer measurement analysis on supported cellular signals.
NI-RFSA and NI-RFSG instrument driver	The NI-RFSA and NI-RFSG APIs each provide a fixed API for interacting with your PXIe-5646 device. NI-RFSA and NI-RFSG provide standard IVI-based functionality needed for most vector signal analyzer and vector signal generator applications. You can use NI-RFSA and NI-RFSG instrument driver FPGA extensions to customize the device FPGA using precompiled bitfiles.	Use NI-RFSA to create custom measurements or applications that require I/Q data. Use NI-RFSG to generate continuous or modulated waveforms. Use NI-RFSA and NI-RFSG with the NI Modulation Toolkit to develop software-defined radio transmitters and receivers. Use NI-RFSG with the NI Modulation Toolkit to create and generate modulated signals to test receivers.
Instrument design libraries	The instrument design libraries allow you to customize your PXIe-5646 device to suit the needs of your application. Sample projects, which allow you to take common measurements with your device, are included with the installation.	Use the instrument design libraries with the LabVIEW FPGA Module to customize the behavior of the device FPGA to create application-specific instrument designs.

Note You can use either NI-RFmx or NI-RFSA and NI-RFSG instrument driver software in combination with the instrument design libraries in a single application; however, only one software option can access the device at a time.

Related information:

- Refer to the NI RF Vector Signal Analyzers Help or the NI RF Signal Generators Help for more information about using the NI-RFSA and NI-RFSG instrument driver FPGA extensions.

Comparison of Software Features

NI-RFmx, NI-RFSA and NI-RFSG instrument driver software, and the instrument design libraries vary in the features they support.

Table 2. Comparison of Software Features

Feature	NI-RFmx	NI-RFSA and NI-RFSG	Instrument Design Libraries
Customization of onboard FPGA	Supported using the instrument driver FPGA extensions	Supported using the instrument driver FPGA extensions	Supported using the LabVIEW FPGA Module
Source availability	Closed source	Closed source	Open source
LabVIEW support	Yes	Yes	Yes
Microsoft .NET support	Yes	Yes	No
RF Standards Toolkits support	No	Yes	Additional programming required for integration.
NI-RFSA and NI-RFSG Soft Front Panels support	Yes	Yes	Yes
LabVIEW examples or sample projects	Includes LabVIEW examples	Includes LabVIEW examples	Includes LabVIEW sample projects, with additional examples available at ni.com/vstgettingstarted.

Installing the Software

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

1. Install NI LabVIEW.
2. (Recommended) Install NI LabVIEW FPGA Module.

> **Note** Installation of the LabVIEW FPGA Module is required to customize the behavior of the device FPGA if you are using the instrument design libraries.

3. (Optional) Install NI LabVIEW Real-Time Module.
4. (Recommended) Install the latest service pack for LabVIEW and any LabVIEW modules you are using.
5. Download the driver software installer from ni.com/downloads.
   NI Package Manager downloads with the driver software to handle the installation. Refer to the NI Package Manager Manual for more information about installing, removing, and upgrading NI software using NI Package Manager.
6. 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.

> **Note** The default installation installs
> NI LabVIEW Instrument Design Libraries for Vector Signal Transceivers, NI-RFmx, NI-RFSA, and NI-RFSG.

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

Installing the PXIe-5646

> **Notice** To prevent damage to the PXIe-5646 caused by ESD or contamination, handle the module using the edges or the metal bracket.

Note

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. This document is also available at ni.com/manuals.

The PXIe-5646 is a three-slot module with two backplane connectors. The module must be installed into three adjacent chassis slots, and the left two slots must be PXI Express compatible.

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. If the chassis has multiple fan speed settings, ensure the fans are set to the highest setting.

   Note Inadequate air circulation could cause the temperature inside the chassis to rise above the optimal operating temperature for the device, potentially causing thermal shutdown, shorter lifespans, or improper performance.

5. Position the chassis so that inlet and outlet vents are not obstructed.

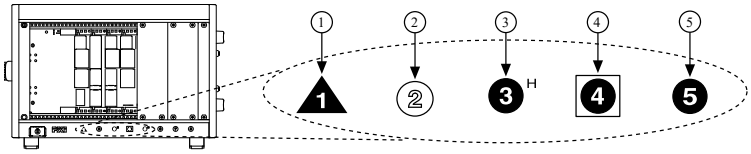
   Caution Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted.

6. Remove the black plastic covers from all the captive screws on the module front

panel.

7. Identify a supported slot in the chassis. The following figure shows the symbols that indicate the slot types.

Figure 1. Chassis Compatibility Symbols

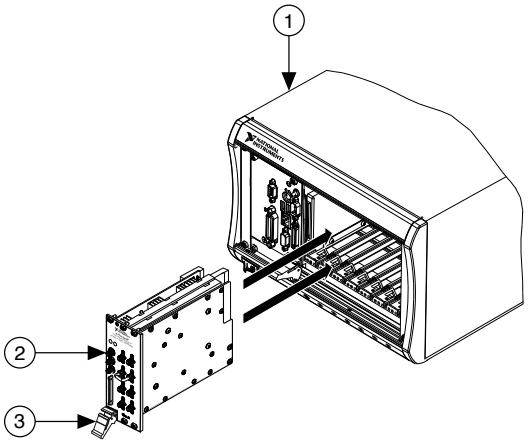


1. PXI Express System Controller Slot
2. PXI Peripheral Slot
3. PXI Express Hybrid Peripheral Slot
4. PXI Express System Timing Slot
5. PXI Express Peripheral Slot

The PXIe-5646 can be placed in PXI Express peripheral slots, PXI Express Hybrid peripheral slots, or PXI Express system timing slots.

8. Touch any metal part of the chassis to discharge static electricity.
9. Ensure that the ejector handle is in the unlatched (downward) position.
10. Hold the module by the edges and slide it into the empty compatible slots. Ensure the base engages with the guides in the chassis.

Figure 1. PXIe-5646 Module Installation



1. PXI Express Chassis
2. PXIe-5646 Module
3. Ejector Handle in Down Position

11. Latch the module in place by pulling up on the ejector handle.
12. 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.

13. Cover all empty slots using either filler panels (standard or EMC) or slot blockers with filler panels, depending on your application.

Note For more information about installing slot blockers and filler panels, go to ni.com/r/pxiblocker.

14. Power on the chassis.

Direct Connections to the PXIe-5646

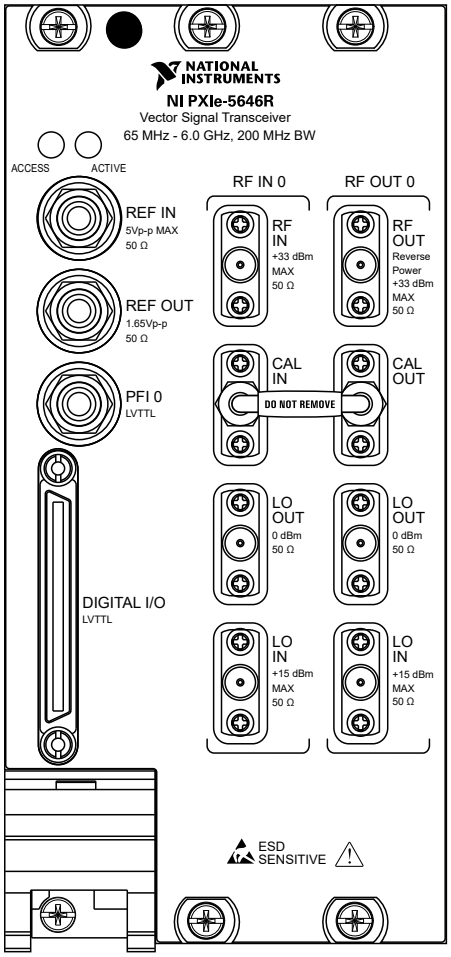
The PXIe-5646 is a precision RF instrument that is sensitive to ESD and transients. Ensure you take the following precautions when making direct connections to the PXIe-5646 to avoid damaging the device.

Notice Apply external signals only while the PXIe-5646 is powered on. Applying external signals while the device is powered off may cause damage.

- Ensure you are properly grounded when manipulating cables or antennas connected to the PXIe-5646RF IN connector.
- If you are using nonisolated devices, such as a nonisolated 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-5646RF IN connector, ensure that the device cannot generate signal transients greater than the RF and DC specifications of the PXIe-5646RF IN connector.

Hardware Front Panel Connectors and Indicators

Figure 1. PXIe-5646 Front Panel



Notice Apply external signals only while the PXIe-5646 is powered on. Applying external signals while the device is powered off may cause damage.

Table 3. Device Front Panel Icon Definitions

⚠	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.
	The signal pins of this product's input/output ports can be damaged if subjected to ESD. To prevent damage, turn off power to the product before connecting cables and employ industry-standard ESD prevention measures during installation, maintenance, and operation.

Table 4. General Connector Descriptions

Connector	Use
REF IN	Input terminal that allows for the use of an external 10 MHz Reference Clock.
REF OUT	Output terminal that can export a 10 MHz Reference Clock or the 250 MHz Sample Clock.
PFI 0	Programmable-function digital I/O (DIO) connector for use with triggers or events.
DIGITAL I/O	DIO terminal that contains general-purpose 3.3 V LVTTL DIO signals. DIO lines are direction-configurable as input or output.

Table 5. RF Connector Descriptions

Connector		Use
RF IN 0	RF IN	Input terminal for RF signals.
	CAL IN	**Notice** Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted. Terminal that is used when running self-calibration on the device.
	LO OUT	Output terminal for exporting the RF IN 0 LO source.
	LO IN	Input terminal that allows the use of an external LO for RF IN 0.

Connector		Use
RF OUT 0	RF OUT	Output terminal for RF signals.
	CAL OUT	**Notice** Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted. Connector that is used when running self-calibration on the device.
	LO OUT	Output terminal for exporting the RF OUT 0 LO source.
	LO IN	Input terminal that allows for the use of an external LO for RF OUT 0.

Table 6. LED Indicators

LED	Indications
ACCESS	Indicates the basic hardware status of the device. Off—The device is not yet functional or has detected a problem with a PXI Express power rail. Amber—The device is being accessed. ***Accessed*** 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. Green—The device is controllable through the software.
ACTIVE	The device behavior is programmable using the instrument design libraries and the LabVIEW FPGA Module. If no behavior is defined, the LED

LED	Indications
	will be OFF. When using NI-RFSA and NI-RFSG, the ACTIVE LED indicates the state of the device. Off—The device is idle. Solid green—The device is generating a waveform. Dim amber—The device is waiting for an acquisition Reference Trigger. Solid amber—The device is acquiring a waveform. Solid red—The device has detected an error. The LED remains red until the error condition is removed. **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.

Related concepts:

- Refer to your device specifications document for more information about front panel connectors and LEDs.

Configuring the Hardware in MAX

Use Measurement & Automation Explorer (MAX) to configure your NI hardware. MAX informs other programs about which devices reside in the system and how they are configured. MAX is automatically installed with the instrument design libraries and NI-

RFSA and NI-RFSG.

1. Launch MAX.
2. In the Configuration pane, expand **Devices and Interfaces** to see the list of installed devices. Installed devices appear under the name of their associated chassis.
3. Expand your **Chassis** tree item.
   MAX lists all devices installed in the chassis. PXIe-5646 devices appear as NI-RIO devices in the list. Your default device names may vary.

   Note If you do not see your hardware listed, refer to the ***Troubleshooting*** section of this document.

4. Record the device identifier MAX assigns to the hardware. Use this identifier when programming the PXIe-5646.

   Note When you install, uninstall, or move an NI-RIO device in your system, resource identification of your NI-RIO devices may change. Whenever any of these changes occur, verify resource identification of all your NI-RIO devices in MAX, and, if necessary, make changes to your software and documentation.

Self-Calibration

Self-calibration adjusts the PXIe-5646 for variations in the module environment using an onboard high-precision calibration tone. Perform a complete self-calibration after first installing your module and letting it warm up for 30 minutes.

Note Warm up begins when the PXI Express chassis has been powered on and the operating system has completely loaded.

The PXIe-5646 modules are externally calibrated at the factory; however, you should perform a self-calibration in any of the following situations:

- After first installing the PXIe-5646 into your chassis
- After any module in the chassis is installed, uninstalled, or moved

- 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

NI recommends you perform the self-calibration from the installed self-calibration executable located at **Start » All Programs » National Instruments » Vector Signal Transceivers » VST Self Calibrate**. When using LabVIEW, you can also use the niVST Self-Calibrate function, located on the **Functions » Instrument I/O » Instrument Drivers » NI VST Calibration** palette.

Related concepts:

- Refer to the NI RF Vector Signal Transceivers Help for more information about self-calibration and self-calibrating in text-based languages.

Software Locations

Table 7. Location of PXIe-5646 Software Options

Software Option	ADE	Location
NI-RFmx	LabVIEW	Available on the LabVIEW Functions palette at **Measurement I/O » NI-RFmx**.
	LabWindows/CVI	NI-RFmx functions are available from the LabWindows/CVI**Library** menu at **Library » RFmx SpecAn Library** and **Library » RFmx Demod Library**.
	Microsoft Visual C/C++	Use the header files located in the `<NIDir>\Shared\ExternalCompilerSupport\C\include` directory and import library files located in one of the following directories: • Windows 10 (32-bit)/8.1 (32-bit)/7

Software Option	ADE	Location
		(32-bit)—<NIDir>\Shared\ExternalCompilerSupport\C\include • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit): ◦ 32-bit installation—<NIDir>\Shared\ExternalCompilerSupport\C\lib32\msvc ◦ 64-bit installation—<NIDir>\Shared\ExternalCompilerSupport\C\lib64\msvc where <NIDir> is one of the following locations: • 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 NI-RFmx readme.
NI-RFSA	LabVIEW	Available on the LabVIEW Functions palette at **Measurement I/O » NI-RFSA**.
	LabWindows/CVI	Available in the <IVIROOTDIR32>\Drivers\niRFSA directory, where <IVIROOTDIR32> is one of the following locations: • Windows 10 (32-bit)/8.1 (32-bit)/7

Software Option	ADE	Location
		(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: • 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	To use the .NET API, you must install the .NET class libraries. For download and installed file locations, visit ni.com/info and enter Info Code `NETAPIdriversupport`.
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:

Software Option	ADE	Location
		• 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: • 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	To use the .NET API, you must install the .NET class libraries. For download and installed file locations, visit ni.com/info and enter Info Code `NETAPIdriversupport`.
Instrument design libraries	LabVIEW	Available in one of the following directories: • Windows 10 (32-bit)/8.1 (32-bit)/7 (32-bit)—`Program Files\National Instruments\LabVIEW 2014\instr.lib\RF-RIO` • Windows 10 (64-bit)/8.1 (64-bit)/7 (64-bit)—`Program Files(x86\`

Software Option	ADE	Location
		National Instruments\ LabVIEW 2014\instr.lib\RF-RIO

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 LabVIEW Sample Projects

If you're using the instrument design libraries, use the included LabVIEW sample projects to begin programming the PXIe-5646.

1. Launch LabVIEW.
2. In the **New Project** dialog box, select **Sample Projects** in the left pane.
3. Navigate to and open the project 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 8. Location of Microsoft Visual C/C++ Programming Examples

Software Option	Examples Location
RFmx	<NIDocDir>\RFmx\Demod\Examples

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

PXIe-5646 First Measurement Options

You can verify proper installation and configuration of your device using the NI-RFSG Soft Front Panel and NI-RFSA Soft Front Panel. Additionally, if you installed the instrument design libraries, you can make a measurement using a LabVIEW sample project.

Making a Measurement with Soft Front Panels

Use the NI-RFSG Soft Front Panel and NI-RFSA Soft Front Panel to verify proper installation and configuration of the PXIe-5646 hardware.

1. Connect the RF IN port to the RF OUT port using an SMA (m)-to-SMA (m) cable.

   > **Caution** Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted.

2. Select **Start » All Programs » National Instruments » NI-RFSG » NI-RFSG Soft Front Panel** to launch the NI-RFSG Soft Front Panel.
3. Select the device identifier assigned to the PXIe-5646 in MAX in the **Device** drop-

down menu.
4. Click the **RF On/Off** button to generate a 1 GHz continuous wave (CW) tone RF signal at the RF output terminal of your device.
5. Select **Start » All Programs » National Instruments » NI-RFSA » NI-RFSA Soft Front Panel** to launch the NI-RFSA Soft Front Panel.
6. Select the device identifier assigned to the PXIe-5646 in MAX in the **Device** drop-down menu.
7. Verify that the NI-RFSA Soft Front Panel is receiving the CW tone.
8. Close the NI-RFSA Soft Front Panel and NI-RFSG Soft Front Panel.

Related concepts:

- Refer to the NI-RFSG Soft Front Panel Help for more information about using the NI-RFSG Soft Front Panel.
- Refer to the NI-RFSA Soft Front Panel Help for more information about using the NI-RFSA Soft Front Panel.

Making a Measurement with a Sample Project

This measurement requires installation of the instrument design libraries.

1. Launch LabVIEW.
2. Select **File » Create Project**.
3. On the left side of the Create Project window, select **Vector Signal Transceiver (VST)**.
4. On the right side of the Create Project window, select the **Simple VSA and VSG** sample project for your device and click **Next**.
5. Specify a name and location for the project in the Create Project window and click **OK**.
   LabVIEW creates, configures, and opens a new Simple VSA and VSG project.
6. In the project tree, navigate to **My Computer » Project Documentation**, open `Simple VSA and VSG.html`, and navigate to the ***Running this Sample Project*** section of the documentation.
7. Follow the instructions in the project documentation for making the measurement.

Troubleshooting

If an issue persists after you complete a troubleshooting procedure, search our KnowledgeBase for additional information our technical support engineers create as they answer common user questions and resolve unexpected issues.

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-5646 appears in MAX.

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

> **Notice** Apply external signals only while the PXIe-5646 is powered on. Applying external signals while the device is powered off may cause damage.

1. Disconnect any signals from the PXI Express module front panels.

   > **Caution** Do not disconnect the cable that connects CAL IN to CAL OUT. Removing the cable from or tampering with the CAL IN or CAL OUT front panel connectors voids the product calibration and specifications are no longer warranted.

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 PXIe-5646 Doesn't 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	Select **Start** » **Control Panel** » **Device Manager**.
Windows 8.1	Right-click the Start button, and select **Device Manager**.
Windows 7	Select **Start** » **Control Panel** » **Device Manager**.

5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. If error conditions appear in the list, right-click the **PXIe-5646** and **NI-RIO FPGA Device** nodes and select **Update Driver**. If you are using an MXI controller, right-click **PCI-to-PCI Bridge**, and select **Properties** from the shortcut menu to verify that the bridge is enabled.
6. Restart your computer.