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Find the *National Instruments PXI-5671* at our website: *Click HERE*

GETTING STARTED GUIDE

NI PXI-5671

2.7 GHz RF Vector Signal Generator

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

This document explains how to install, configure, and test the NI PXI-5671 (NI 5671). The NI 5671 is a 2.7 GHz RF vector signal generator (VSG) with digital upconversion. The NI 5671 ships with the NI-RFSG instrument driver, which you use to program the device.

The NI 5671 comprises the following devices:

- NI PXI-5610 (NI 5610) RF upconverter module
- NI PXI-5441 (NI 5441) arbitrary waveform generator (AWG) module

To access NI 5671 documentation, navigate to **Start»All Programs»National Instruments»NI-RFSG»Documentation**.

The specifications document for your device is installed with the driver software. Refer to *ni.com/manuals* for the most recent specifications for your device.

Caution The protection provided by this product may be impaired if it is used in a manner not described in this document.

Hot Surface If the NI 5671 has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 5671 to cool before removing it from the chassis.

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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 are designed to 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 modifications to the product not expressly approved by National Instruments 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, the length of all I/O cables must be no longer than 3 m (10 ft).

Verifying the System Requirements

To use the NI-RFSG instrument driver, your system must meet certain requirements.

For more information about minimum system requirements, recommended system, and supported application development environments (ADEs), refer to the product readme, which is available on the driver software media or online at *ni.com/updates*.

Unpacking the Kit

Caution 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.

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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.

   Caution Never touch the exposed pins of connectors.

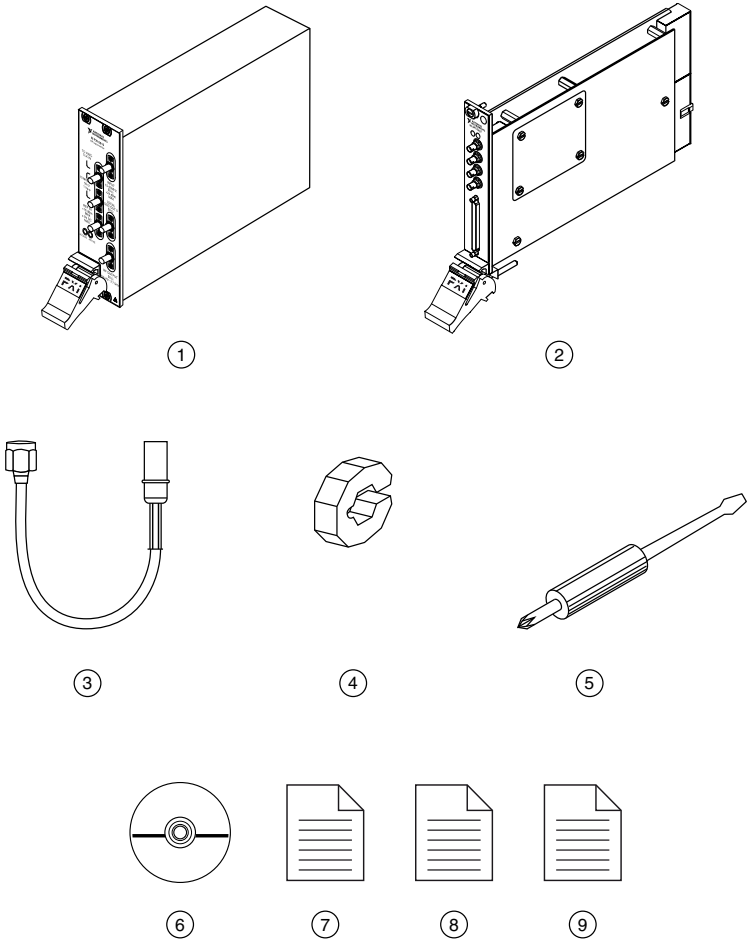
   Notify NI if the device appears damaged in any way. Do not install a damaged device.
3. Unpack any other items and documentation from the kit.

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

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Verifying the Kit Contents

Figure 1. NI 5671 Kit Contents



1. NI PXI-5610 RF Upconverter Module
2. NI PXI-5441 AWG Module
3. Two Semi-Flexible SMA (m)-to-SMB Cables, Part Number 190846B-01
4. Two Cable Wrenches, Part Number 746016-01
5. Screwdriver, Part Number 772006-01
6. Driver Software DVD
7. NI PXI-5671 Getting Started Guide (this document)
8. Read Me First: Safety and Electromagnetic Compatibility
9. Maintain Forced-Air Cooling Note to Users

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Other Equipment

There are several required items not included in your device kit that you need to install or operate the NI 5671.

Required Items

- A PXI chassis and chassis documentation. The NI PXIe-1085 chassis is one available option for your device. For more information about compatible chassis options, refer to *ni.com*.
- A PXI embedded controller or MXI controller system that meets the system requirements specified in this guide and chassis documentation.

Optional Items

- A 1 N · m standard SMA torque wrench (NI part number 780487-01).

Preparing the Environment

Ensure that the environment you are using the NI 5671 in meets the following specifications.

Operating ambient temperature

NI PXI-5610 upconverter.....0 °C to 55 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL PRF-28800F Class 3 low temperature limit and MIL PRF-28800F Class 2 high temperature limit.)

NI PXI-5441 AWG.....0° to 45° (When installed in an NI PXI-101X or NI PXI-1000B chassis.)

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.

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

Note Refer to the *NI PXI-5670/5671 Specifications* at *ni.com/manuals* for complete specifications.

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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. Insert the driver software DVD into your computer. The installer should open automatically.

   If the installation window does not appear, navigate to the drive, double-click it, and double-click `autorun.exe`.
3. Follow the instructions in the installation prompts to install the NI-RFSG driver software.

   Note Windows users may see access and security messages during installation. Accept the prompts to complete the installation.
4. When the installer completes, restart your system.

Installing the NI 5671

Caution To prevent damage to the device caused by ESD or contamination, handle the device using the edges or the metal bracket.

You must install NI-RFSG 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 chassis can cool the device effectively.

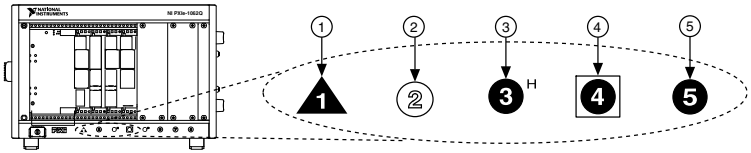
To use the included cables, you must install the NI 5441 AWG module in the slot immediately to the right of the NI 5610 RF upconverter module.

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

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

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Figure 2. Chassis Compatibility Symbols

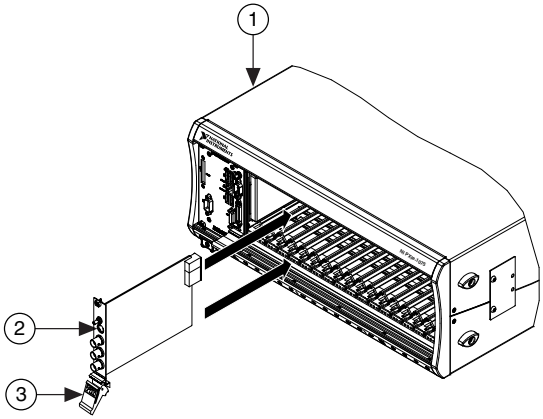


1. PXI Express System Controller Slot
2. PXI Peripheral Slot
3. PXI Express Hybrid Peripheral Slot
4. PXI Express System Timing Slot
5. PXI Express Peripheral Slot

NI 5671 modules can be placed in PXI peripheral slots or PXI Express Hybrid peripheral slots.

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

Figure 3. Module Installation



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

9. Latch the module in place by pulling up on the ejector handle.
10. Secure the device 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 filler panels or slot blockers to maximize cooling air flow.

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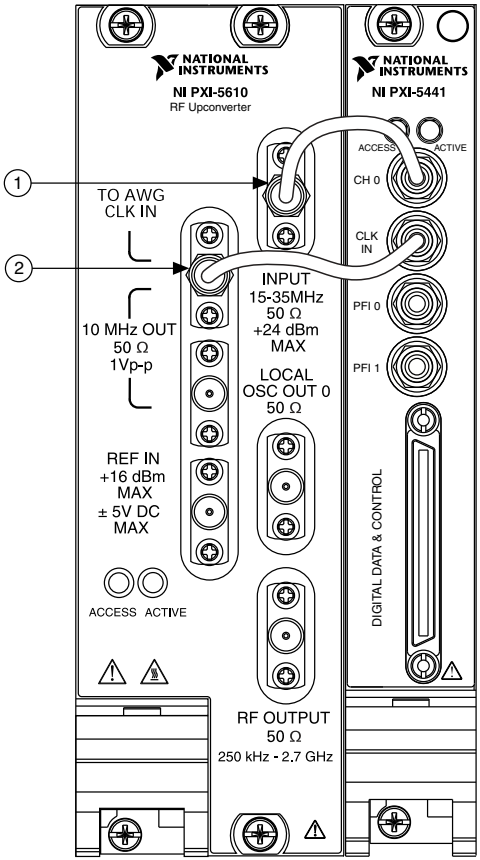
12. Power on the chassis.

Related Information

Installing the Software on page 6

Interconnecting the NI 5671 Modules

Figure 4. NI 5671 Front Panel Interconnection



1. Flexible SMA-to-SMB Cable
2. Flexible SMA-to-SMB Cable

1. Using a flexible SMA-to-SMB cable, connect the INPUT connector on the NI 5610 front panel to the CH 0 connector on the NI 5441 front panel.

Note Ensure that the SMA cable center pins properly align with the SMA connectors to avoid bending the cable pins or damaging the front panel connectors on the device.

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2. Using a flexible SMA-to-SMB cable, connect the TO AWG CLK IN connector on the NI 5610 front panel to the CLK IN connector on the NI 5441 front panel.
3. Hand-tighten all SMA cable ends on the SMA connectors. The cable connectors should tighten without much torque or effort.
4. Carefully complete tightening all SMA connectors to 1 N · m using an appropriate torque wrench or torque screwdriver and SMA driver bit (not included). Tighten only until the wrench clicks.

   Caution Incorrect torque at SMA connections can degrade signal fidelity and phase-locked loop (PLL) performance and may cause insertion loss. Use an appropriate torque wrench or torque screwdriver and SMA driver bit to ensure all SMA connections are properly torqued. SMA connectors for connections to external equipment may require torque different from 1 N · m, depending on the connector type, material, and manufacturer.
5. Power on your PXI chassis and controller system.
6. Verify that the ACCESS LED is illuminated on all modules. If an LED is not illuminated, refer to the *Troubleshooting* section of this document.

Related Information

Configuring the NI 5671 in MAX on page 15

Direct Connections to the NI 5671

The NI 5671 is a precision RF instrument that is sensitive to ESD and transients. Ensure you take the following precautions when making direct connections to the NI 5671 to avoid damaging the device.

Note Do not apply external signals to the NI 5671. Applying external signals may cause damage.

- Ensure you are properly grounded when manipulating cables or antennas connected to the NI 5671.
- If you are using noninsulated devices, such as a noninsulated 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 NI 5671, ensure no signal transients are sourced to the NI 5671.

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NI 5610 RF Upconverter Module

The NI 5610 RF upconverter module contains six connectors and two multicolor LEDs.

Figure 5. NI 5610 RF Upconverter Module Front Panel

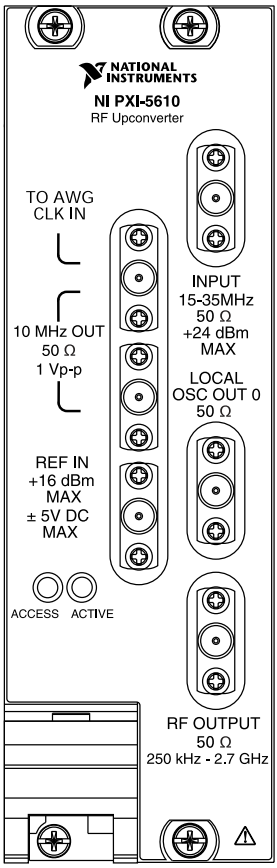


Table 1. Device Front Panel Icon Definition

⚠	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.

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Table 2. NI 5610 RF Upconverter Module Front Panel Connectors

Connector	Use
TO AWG CLK IN	Connects to the CLK IN connector on the NI 5441 AWG module front panel. Both connectors are output terminals for replications of the upconverter 10 MHz frequency reference signal, which is useful for driving other devices. Each replication is 180° out of phase with the other. The output signal at these connectors is always on and cannot be disabled.
10 MHz OUT	
REF IN	Routes an external frequency reference signal that can be propagated to the PXI backplane. The NI 5610 can lock to this signal.
INPUT	Connects to the CH 0 output on the NI 5441 AWG module front panel. Routes the IF signal from the NI 5441 AWG module for frequency translation.
LOCAL OSC OUT 0	Routes the auxiliary local oscillator signal.
RF OUTPUT	Routes the upconverted signal at the requested RF frequency.

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Table 3. NI 5610 RF Upconverter Module Front Panel LEDs

LED	Indications
ACCESS	Indicates the basic hardware status of the module. OFF—The module is not yet functional, or the module has detected a problem with a PXI power rail. AMBER—The module is being accessed. *Accessed* 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 NI-RFSG.
ACTIVE	Indicates the status of the module PLLs. OFF—The module is in an uninitialized state; there is no error. AMBER—The module PLLs are attempting to lock. GREEN—The module is in a ready state; applicable PLLs are locked and the reverse power protection circuit is closed. RED—The module has detected an error state; this state may indicate an overload (reverse power protection circuit is open), a PLL lock failure, or a thermal shutdown condition.

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NI 5441 AWG Module

The NI 5441 AWG module front panel contains five connectors and two multicolor LEDs.

Figure 6. NI 5441 AWG Module Front Panel

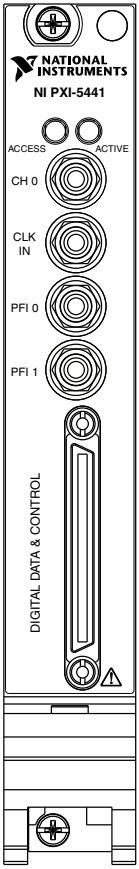


Table 4. Device Front Panel Icon Definition

⚠	Refer to the user documentation for required maintenance measures to ensure user safety and/or preserve the specified EMC performance.

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Table 5. NI 5441 AWG Module Front Panel Connectors

Connector	Use
CH 0	Connects to the IF INPUT connector on the NI 5610 front panel. This connector is the output terminal for an IF waveform for upconversion to the desired RF frequency.
CLK IN	Connects to the REF OUT connector on the NI 5610 front panel. This connector is the input terminal for the NI 5441 Reference Clock signal.
PFI 0	Both connectors accept a trigger from an external source to start or step through signal generation. Both terminals are bidirectional SMB connectors.
PFI 1	
DIGITAL DATA & CONTROL	Routes the 16-bit digital pattern outputs, digital pattern clock output, trigger outputs, trigger inputs, and a clock input.

Table 6. NI 5441 AWG Module Front Panel LEDs

LED	Indications
ACCESS	Indicates the basic hardware status of the module. OFF—The module is not yet functional or has detected a problem with a power rail. AMBER—The module is being accessed. *Accessed* means that the device setup registers are being written to in order to control the device or load waveforms. GREEN—The module is ready to be programmed by NI-RFSG.
ACTIVE	Indicates the state of the module. OFF—The module is not armed or triggered. AMBER—The module is armed and waiting for a Start Trigger. GREEN—The module has received a Start Trigger and is generating a waveform. RED—The module has detected an error state; this state may indicate a PLL lock failure or a thermal shutdown condition.

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Configuring the NI 5671 in MAX

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

1. Launch MAX.
2. In the configuration tree, double-click **Devices and Interfaces** to see the list of installed devices.

   Note If you are using the NI 5671 with the LabVIEW Real-Time Module, expand **Remote Systems**. Find your target IP address or name, expand it, and then expand **Devices and Interfaces**.

   Installed devices appear under the name of their associated chassis.
3. Expand your **Chassis** tree item.

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

   Note If you do not see your device listed, press <F5> to refresh the list of installed devices. If the device is still not listed, power off the system, ensure the device is correctly installed, and restart.
4. Record the device identifier MAX assigns to the hardware. Use this identifier when programming the NI 5671.
5. Associate the hardware modules that comprise your device.
   a) Select the NI 5610 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.

      For the NI 5671, you must associate the NI 5610 RF upconverter module with the NI 5441 AWG module.
   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 device modules by selecting the modules in the configuration tree, and clicking **Self-Test** in the MAX toolbar. Repeat this step for all modules in your NI 5671 system.

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

Related Information

Interconnecting the NI 5671 Modules on page 8

Refer to the NI RF Signal Generators Help for information about renaming devices.

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Programming the NI 5671

You can generate signals interactively using the NI-RFSG Soft Front Panel (SFP) or you can use the NI-RFSG instrument driver to program your device in the supported ADE of your choice.

Table 7. NI 5671 Programming Options

Application Programming Interface (API)	Location	Description
NI-RFSG SFP	Available from the Start menu at **Start»All Programs»National Instruments»NI-RFSG» NI-RFSG Soft Front Panel**.	NI-RFSG SFP controls, generates, and presents data similar to stand-alone RF vector signal generators. NI-RFSG SFP operates on the PC, so it provides additional processing, storage, and display capabilities.
NI-RFSG Instrument Driver	LabVIEW—Available on the LabVIEW Functions palette at **Measurement I/O»NI-RFSG**.	NI-RFSG configures and operates the device hardware, performs waveform programming and generation, and performs basic modulation tasks using LabVIEW VIs or LabWindows/CVI functions. After you associate the modules of the NI 5671 in MAX, NI-RFSG operates the modules as a single instrument.
	LabWindows/CVI—Available at **Program Files»IVI Foundation» IVI»Drivers»niRFSG**.	
	Microsoft Visual C/C++	Add all required include and library files to your project to create an NI-RFSG application in Microsoft Visual C/C++.

Related Information

Refer to the Getting Started section of the NI RF Signal Generators Help for detailed instructions about how to generate signals in a specific ADE.

Refer to the Creating an Application with Microsoft Visual C and C++ topic of the NI RF Signal Generators Help to manually add all required include and library files to your project.

NI-RFSG Examples

Examples demonstrate the functionality of the device and serve as programming models and building blocks for your own applications. The NI Example Finder is a utility available for some ADEs that organizes examples into categories and allows you to easily browse and search installed examples. You can see descriptions and compatible hardware models for each example or see all the examples compatible with one particular hardware model.

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You can locate LabVIEW or LabWindows/CVI examples with the NI Example Finder. Within LabVIEW or LabWindows/CVI, select **Help»Find Examples** and navigate to **Hardware Input and Output»Modular Instruments**.

Generating a Signal Using the NI-RFSG Soft Front Panel

To verify your device configuration, use the NI-RFSG Soft Front Panel (SFP) in MAX to generate a simple signal.

1. Within MAX, select the NI 5610 module in the configuration tree.
2. Select **Soft Front Panel** from the MAX toolbar.

   The NI-RFSG SFP launches.
3. Within the NI-RFSG SFP, specify a frequency and a power level for signal generation.

   Caution Clicking **RF On/Off** generates a signal from the RF OUTPUT connector of the NI 5610 front panel. Disconnect any equipment that can be damaged by the test signal prior to clicking the **RF On/Off** button on the NI-RFSG SFP.
4. Click **RF On/Off** to begin signal generation.

   Note Refer to the *Troubleshooting* section of this document if an ACTIVE LED does not turn on or if the NI-RFSG SFP generates an error.

   During signal generation, the ACTIVE LED on each of the NI 5671 hardware modules illuminates.
5. Click **RF On/Off** to stop signal generation.

Building a Basic NI-RFSG Application

You can build a basic NI-RFSG application in LabVIEW for generating continuous sine wave signals.

Adding the Core NI-RFSG VIs to a Blank VI

Create a new application that includes the core NI-RFSG VIs.

1. Launch LabVIEW.
2. To create a blank VI, select **File»New VI**.
3. Display the block diagram by selecting **Window»Show Block Diagram**.

   Tip Activate the LabVIEW context help by selecting **Help»Show Context Help**.
4. Right-click the VI block diagram to launch the Functions palette.
5. Navigate to the NI-RFSG VIs on the **NI-RFSG** palette.

   Tip You can use the **Search** button on the **Functions** palette to find the **NI-RFSG** palette.
6. Add the core NI-RFSG VIs from the NI-RFSG palette to the block diagram, and wire the VIs together as shown in the following figure.

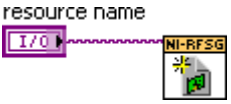
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Figure 7. Basic NI-RFSG Block Diagram



7. Right-click the resource name input on the niRFSG Initialize VI, and select **Create**» **Control** to create a front panel control where you specify the NI RF vector signal generator device name.

Figure 8. Resource Name Input on the niRFSG Initialize VI



8. Right-click the frequency (Hz) input on the niRFSG Configure RF VI, and select **Create**» **Control**.
9. Right-click the power level (dBm) input on the niRFSG Configure RF VI, and select **Create**»**Control**.
10. Display the VI front panel by clicking it or by selecting **Window**»**Show Front Panel**.
11. In the VI front panel **power level (dBm)** control, enter `0`. In the **frequency (Hz)** control, enter `100M` (100 MHz).
12. In the VI front panel **resource name** control, enter the NI 5610 upconverter device name that you specified in MAX.

Adding a While Loop

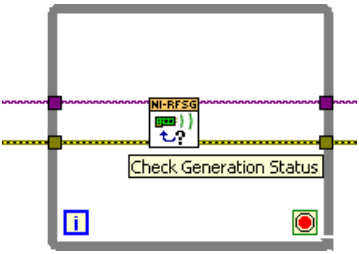
Add a While Loop to continuously generate the signal and check the generation status until you click the **Stop** button.

1. Display the VI block diagram, and select the While Loop on the Structures palette.

Tip You can use the **Search** button on the Functions palette to find the Structures palette.

2. Enclose the niRFSG Check Generation Status VI in the While Loop, as shown in the following figure.

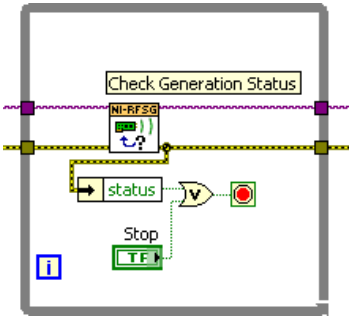
Figure 9. The niRFSG Check Generation Status VI Enclosed in the While Loop



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3. Right-click the While Loop tunnels, and select **Replace with Shift Register**.
4. Select the Or function on the Boolean palette. Place the function inside the While Loop.
5. Wire the output of the Or function to the conditional terminal of the While Loop.
6. Select the Unbundle by Name function on the Cluster, Class, & Variant palette. Place the function inside the While Loop.
7. Wire the error out output of the niRFSG Check Generation Status VI to the Unbundle by Name function.
8. Wire the output of the status element to an input of the Or function.
9. Right-click the unused input of the Or function, and select **Create»Control** to create a **Boolean** control.
10. In the VI front panel, right-click the Boolean control created in step 9, and select **Replace»Modern»Boolean»Stop Button** to create a **Stop** button.

Figure 10. While Loop with Stop Button



Adding an Error Indicator

Add an error indicator to the VI front panel.

1. Create an error indicator by right-clicking the error out output of the niRFSG Close VI and selecting **Create»Indicator**.
2. Verify that the VI block diagram and VI front panel now look similar to the following figures.

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Figure 11. Basic Sine Wave Generation VI Block Diagram

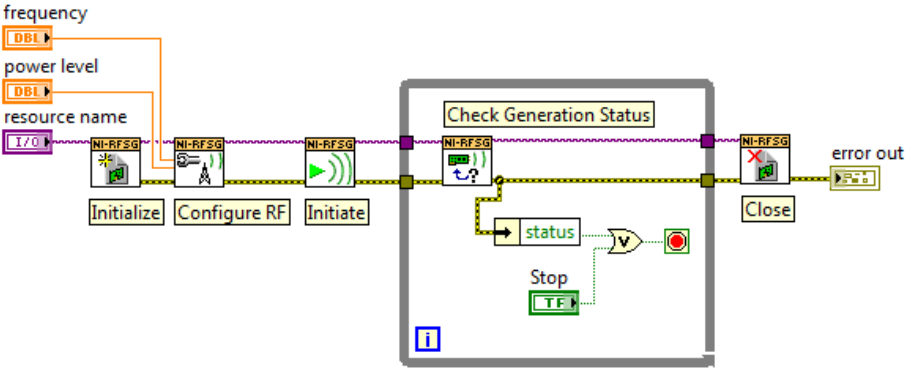
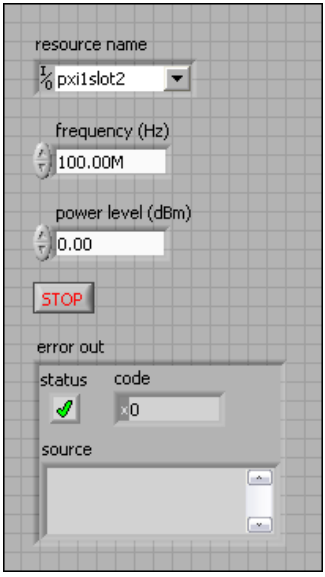


Figure 12. Basic Sine Wave Generation VI Front Panel



3. Open the VI front panel, and select the NI 5610 upconverter module name specified in MAX in the **resource name** control.
4. Click the **Run** button on the toolbar to initiate sine wave generation.
5. Click the VI front panel **STOP** button to stop sine wave generation.

You have successfully generated a continuous sine wave signal using the NI-RFSG instrument driver and the NI 5671.

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Troubleshooting

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

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

The LEDs may not illuminate until the device has been configured in MAX. Before proceeding, verify that the NI 5671 appears in MAX.

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

Caution Apply external signals only while the NI 5671 is powered on. Applying external signals while the device is powered off may cause damage.

1. Disconnect any signals from the module front panels.
2. Power off the chassis.
3. Remove the module from the chassis and inspect it for damage. Do not reinstall a damaged device.
4. Reinstall the module in a different chassis slot.
5. Power on the chassis.
6. Verify that the device appears in MAX.
7. Reset the device in MAX and perform a self-test.

What Should I Do if the NI 5671 Doesn't Appear in MAX?

1. In the MAX configuration tree, click **Devices and Interfaces**.
2. Expand the **Chassis** tree to see the list of installed devices, 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 8	Right-click the Start screen, and select **All apps»Control Panel» Hardware and Sound»Device Manager**.
Windows 7	Select **Start»Control Panel»Device Manager**.
Windows Vista	Select **Start»Control Panel»System and Maintenance»Device Manager**.
Windows XP	Select **Start»Control Panel»System»Hardware»Device Manager**.

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5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. Reinstall NI-RFSG and the device if error conditions appear in the list. 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.

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 Thermal Shutdown Error Appears?

The thermal shutdown error appears when device temperatures exceed safe limits. The NI 5671 shuts down until temperatures fall to acceptable levels and you reset the device in MAX.

1. Power off the chassis that contains the device.
2. Review the *Maintain Forced-Air Cooling Note to Users* included in the NI 5671 kit and make any necessary adjustments to ensure that the device is effectively cooled.
3. Reset the device in MAX.

   The thermal shutdown error continues to be reported until you successfully reset the device.

What Should I Do if I Experience Performance Issues Using an MXI Connection?

When you use an MXI-3 connection to control the PXI chassis, you must run the MXI Optimization Application prior to using the NI 5671. By default, this application runs automatically when Windows starts. Using an MXI connection without running this application may result in a **`time exceeded`** message, an **`internal software error`** message, an initialization timeout, or a performance issue when using the NI 5671.

1. Ensure the MXI software is installed. If the MXI software is not installed, refer to the setup instructions included with the MXI kit.

   After installation, you may be required to restart your computer before using the MXI application.
2. For MXI-3 optimization, select **Start»All Programs»National Instruments MXI-3»MXI-3 Optimization**.

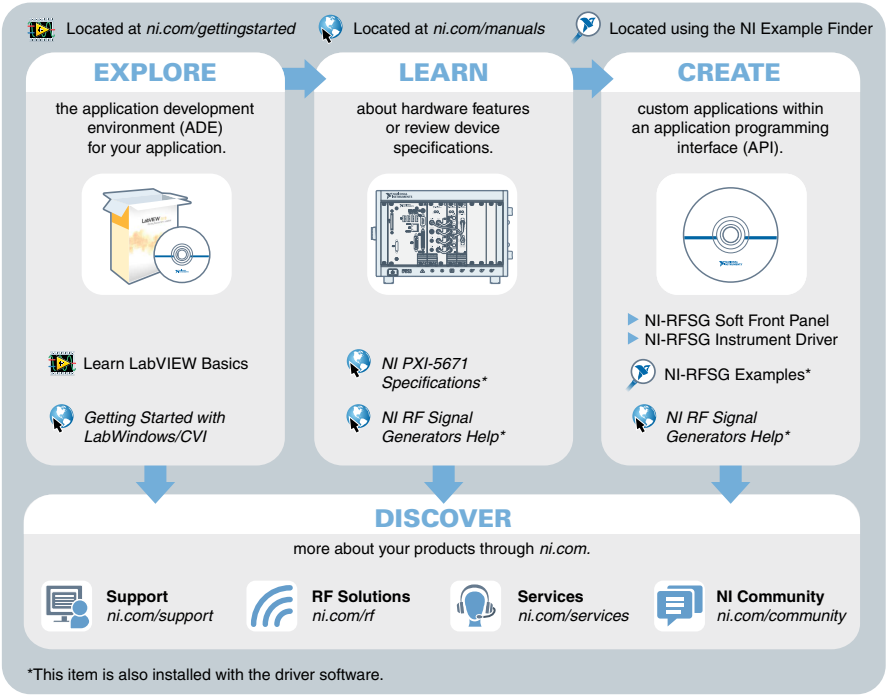
   MXI-4 optimization is performed automatically by the MXI-4 hardware.

If you continue to have initialization or performance issues, refer to the MXI documentation included in your MXI kit, contact NI technical support, or visit *ni.com/support*.

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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 Signal Generators Help* is an HTML version of a traditional user manual that includes detailed information about RF fundamentals, device features, and programming with NI-RFSG.

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