APEX WAVES

COMPREHENSIVE SERVICES

We offer competitive repair and calibration services, as well as easily accessible documentation and free downloadable resources.

SELL YOUR SURPLUS

We buy new, used, decommissioned, and surplus parts from every NI series. We work out the best solution to suit your individual needs.

〜〜 Sell For Cash   〜〜 Get Credit   〜〜 Receive a Trade-In Deal

OBSOLETE NI HARDWARE IN STOCK & READY TO SHIP

We stock **New, New Surplus, Refurbished,** and **Reconditioned** NI Hardware.

Bridging the gap between the manufacturer and your legacy test system.

📞 **1-800-915-6216**

🌐 **www.apexwaves.com**

✉️ **sales@apexwaves.com**

Request a Quote   ✉ **CLICK HERE**   **PXIe-1075**

GETTING STARTED GUIDE

NI PXIe-5667 (3.6 GHz)

Spectrum Monitoring Receiver

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

This document explains how to install, configure, and test the NI PXIe-5667 (3.6 GHz) (NI 5667). The NI 5667 is a modular spectrum monitoring receiver. The NI 5667 ships with the NI-RFSA instrument driver, which you use to program the device.

The NI 5667 comprises the following devices:

- NI PXIe-5603 (NI 5603) RF downconverter module
- NI PXIe-5622 (NI 5622) IF digitizer module
- NI PXIe-5653 (NI 5653) LO source module
- NI PXIe-5693 (NI 5693) RF preselector module
- NI PXIe-5694 (NI 5694) IF conditioning module

⚠ **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 5667 has been in use, it may exceed safe handling temperatures and cause burns. Allow the NI 5667 to cool before removing it from the chassis.

Contents

NATIONAL INSTRUMENTS

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-RFSA 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.

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.
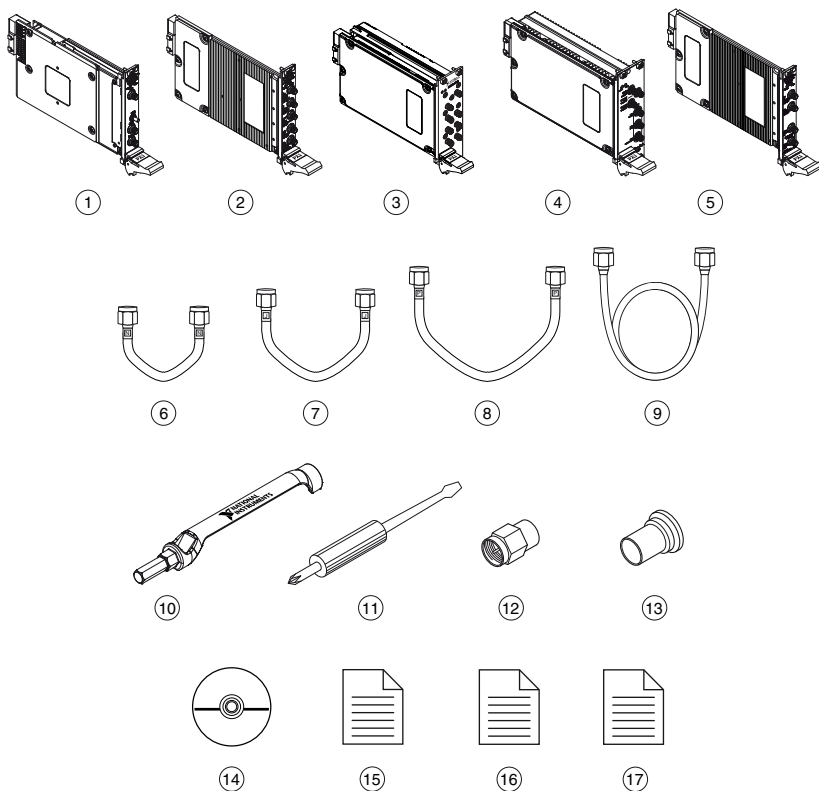
⚠️ **Caution** Never touch the exposed pins of connectors.

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.

Verifying the Kit Contents

1. NI PXIe-5622 IF Digitizer Module
2. NI PXIe-5694 IF Conditioning Module
3. NI PXIe-5603 RF Downconverter Module
4. NI PXIe-5653 Synthesizer/LO Source Module
5. NI PXIe-5693 RF Preselector Module
6. Short, Semi-Rigid SMA-to-SMA Cable (x2), Labeled N, Part Number 154048A-01
7. Medium, Semi-Rigid SMA-to-SMA Cable (x3), Labeled J, Part Number 151611A-01
8. Long, Semi-Rigid SMA-to-SMA Cable, Labeled P, Part Number 154049A-01
9. Flexible, 7-Inch, RF SMA-to-SMA Cable (x2), Part Number 763282-07

10. SMA Driver Bit, Part Number 190487A-01
11. Screwdriver, Part Number 772006-01
12. 50 Ω Termination Load (x5), Part Number 778353-01
13. Plastic Cap (x21), Part Number 775067-01
14. Driver Software DVD
15. Read Me First: Safety and Electromagnetic Compatibility
16. Maintain Forced-Air Cooling Note to Users
17. NI 5667 3.6 GHz Spectrum Monitoring Receiver Getting Started Guide (This Document)

Other Equipment

There are several required items not included in your device kit that you need to install or operate the NI 5667.

Required Items

- A PXI Express chassis and chassis documentation. The NI PXIe-1075 chassis is one available option for your device. For more information about compatible chassis options, refer to *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 1 N · m standard SMA torque wrench (NI part number 780487-01).

Preparing the Environment

Ensure that the environment you are using the NI 5667 in meets the following specifications.

Operating ambient temperature..........................0 °C to 55 °C
(IEC-60068-2-1, IEC-60068-2-2)

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 PXIe-5667 (3.6 GHz) Specifications* at *ni.com/manuals* for complete specifications.

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 media 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.

   📝 **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 NI 5667

⚠ **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-RFSA 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 NI 5694 IF conditioning module immediately to the left of the NI 5603 RF downconverter module, the NI 5622 IF digitizer module immediately to the left of the NI 5694 module, the NI 5653 LO source module immediately to the right of the NI 5603 RF downconverter module, and the NI 5693 RF preselector module immediately to the right of the NI 5653 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.

Figure 1. Chassis Compatibility Symbols
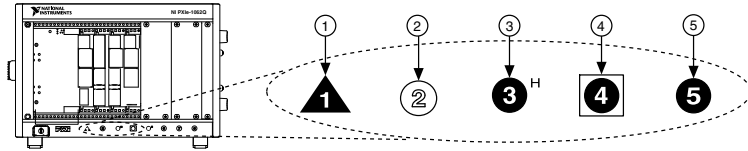
1. PXI Express System Controller Slot
2. PXI Peripheral Slot
3. PXI Express Hybrid Peripheral Slot
4. PXI Express System Timing Slot
5. PXI Express Peripheral Slot

NI 5667 modules can be placed in PXI Express 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 2. Module Installation
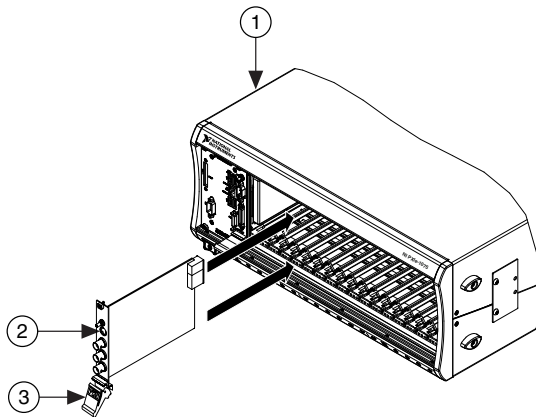
1. Chassis
2. Hardware Module
3. Ejector Handle in Down (Unlatched) Position

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.
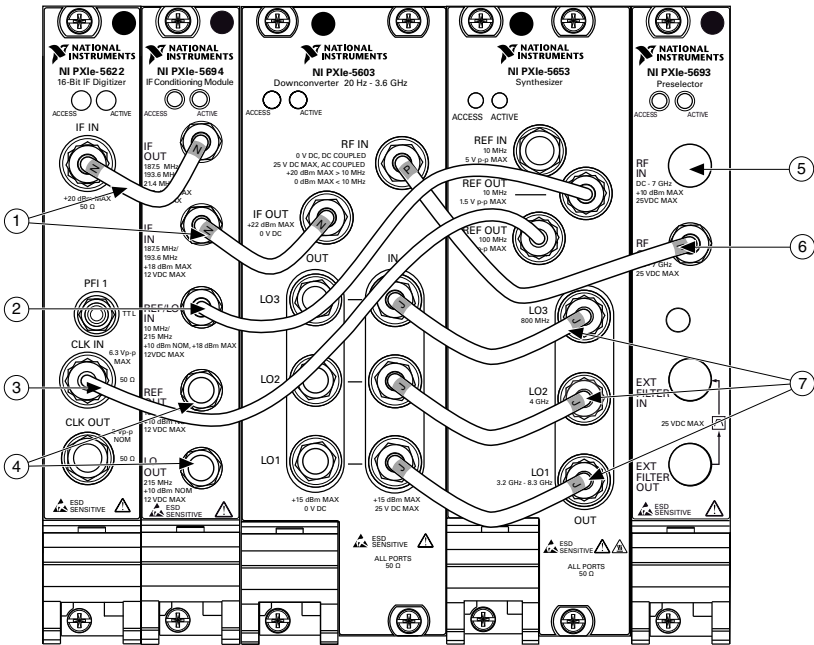
12. Power on the chassis.

Interconnecting the NI 5667 Modules

⚠️ **Caution** The signal pins of this product's input/output ports can be damaged if subjected to ESD. To prevent damage, remove power from the product before connecting cables and employ industry-standard ESD prevention measures during installation, maintenance, and operation.

Figure 3. Installation of Included NI 5667 Cables and Termination Loads

1. Short, Semi-Rigid SMA-to-SMA Cable, Labeled N
2. Flexible RF SMA-to-SMA Cable
3. Flexible RF SMA-to-SMA Cable
4. 50 Ω Termination Load
5. Plastic Cap
6. Long, Semi-Rigid SMA-to-SMA Cable, Labeled P
7. Medium, Semi-Rigid SMA-to-SMA Cable, Labeled J

1. Using the short semi-rigid SMA-to-SMA coaxial cable (labeled N), connect the IF IN connector on the NI 5622 front panel to the IF OUT connector on the NI 5694 front panel.

2. Using the short semi-rigid SMA-to-SMA coaxial cable (labeled N), connect the IF IN connector on the NI 5694 front panel to the IF OUT connector on the NI 5603 front panel.

3. Using the long semi-rigid SMA-to-SMA coaxial cable (labeled P), connect the RF IN connector on the NI 5603 front panel to the RF OUT connector on the NI 5693 front panel.

4. Using the flexible RF SMA-to-SMA coaxial cable, connect the CLK IN connector on the NI 5622 front panel to the REF OUT 100 MHz connector on the NI 5653 front panel.

5. Using the flexible RF SMA-to-SMA coaxial cable, connect the REF/LO IN connector on the NI 5694 front panel to the REF OUT 10 MHz connector on the NI 5653 front panel.

6. Using the three medium semi-rigid SMA-to-SMA coaxial cables (labeled J), connect the LO1, LO2, and LO3 connectors on the NI 5653 front panel to the associated LO1 IN, LO2 IN, and LO3 IN connectors on the NI 5603 front panel.

7. Hand-tighten all SMA cable ends on the SMA connectors after the cable center pins are correctly aligned and connected. The cable connectors should tighten without much torque or effort. If a cable bends due to incorrect alignment, remove the cable from the front panel connector and reconnect the cable center pin on the SMA cable to the SMA connector.

8. Carefully complete tightening all SMA connectors to 1 N · m using an appropriate torque wrench (not included) or torque screwdriver and SMA driver bit. 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.

9. Power on the PXI Express chassis and controller system.

10. Verify that the ACCESS LED is on for all modules.

Related Information

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

Refer to the NI RF Vector Signal Analyzers Help for information about how to connect the NI 5667 using an external clock or how to connect multiple NI 5667 modules.

Direct Connections to the NI 5603

The NI 5603 is a precision RF instrument that is sensitive to ESD and transients. Ensure you are making proper direct connections to the NI 5603 to avoid damaging the device.

<table>
<tr><td>⚠</td><td>Caution Apply external signals only while the NI 5603 is powered on. Applying external signals while the device is powered off may cause damage.</td></tr>
</table>

- Ensure you are properly grounded when manipulating cables or antennas connected to the NI 5603 RF IN connector.
- 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 5603 RF IN connector, ensure that there are no signal transients greater than the RF and DC specifications for the device that are being generated and sourced to the NI 5603 RF IN connector.

NI 5603 RF Downconverter Module Front Panel

The NI 5603 RF downconverter module front panel contains eight connectors and two LEDs.

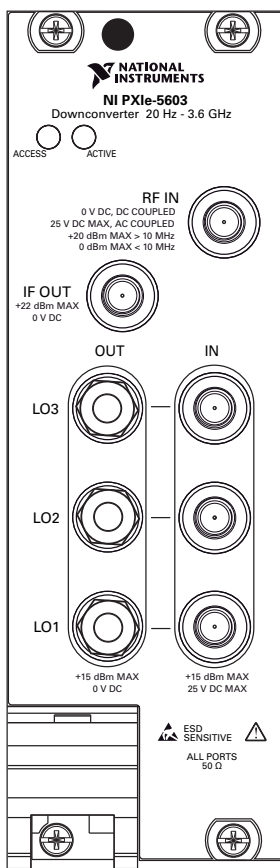**Figure 4.** NI 5603 RF Downconverter Module Front Panel

Table 1. 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.
⚠ESD	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 2. NI 5603 RF Downconverter Front Panel Connectors

Connector	Use
RF IN	Connects to the RF OUT connector on the NI 5693 front panel. The RF IN connector is rated at 0 VDC when DC coupled and 25 VDC when AC coupled. NI recommends setting the **Channel Coupling** property to AC Coupled or setting the NIRFSA_ATTR_CHANNEL_COUPLING attribute to NIRFSA_VAL_AC_COUPLED when the input signal is ≥10 MHz. RF IN is rated at +20 dBm maximum at >10 MHz and at 0 dBm maximum at <10 MHz. To properly configure the input attenuators, set the reference level at or above the input signal level with the **Reference Level** property or the NIRFSA_ATTR_REFERENCE_LEVEL attribute. ⚠ **Caution** To reinstall the DC block on the NI 5603 RF IN connector, use a torque wrench set to a maximum torque of 0.79 N · m to 1.02 N · m (7 lb · in. to 9 lb · in.). Using more than the recommended amount of torque may damage the RF IN connector.
IF OUT	Connects to the IF IN connector on the NI 5694 module front panel. This connector is the output terminal for the frequency-translated IF signal. The IF OUT connector is rated at +22 dBm maximum, 0 VDC. The maximum safe voltage is 24 VDC.
LO1 IN	Connects to the LO1 OUT connector on the NI 5653 module front panel. This connector is the input terminal for the LO1 (3.2 GHz to 8.3 GHz) source. LO1 IN is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.

Table 2. NI 5603 RF Downconverter Front Panel Connectors (Continued)

Connector	Use
LO2 IN	Connects to the LO2 OUT connector on the NI 5653 module front panel.
	This connector is the input terminal for the LO2 (4 GHz) source. LO2 IN is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.
LO3 IN	Connects to the LO3 OUT connector on the NI 5653 module front panel.
	This connector is the input terminal for the LO3 (800 MHz) source. LO3 IN is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.
LO1 OUT	Output terminal for the LO1 (3.2 GHz to 8.3 GHz) source.
	In multichannel systems, LO1 OUT exports the signal received at LO1 IN to other NI 5603 modules. LO1 OUT is disabled by default. LO1 OUT is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.
LO2 OUT	Output terminal for the LO2 (4 GHz) source.
	In multichannel systems, LO2 OUT exports the signal received at LO2 IN to other NI 5603 modules. LO2 OUT is disabled by default. LO2 OUT is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.
LO3 OUT	Output terminal for the LO3 (800 MHz) source.
	In multichannel systems, LO3 OUT exports the signal received at LO3 IN to other NI 5603 modules. LO3 OUT is disabled by default. LO3 OUT is an SMA connector with an impedance of 50 Ω (nominal) and a maximum safe power level of +15 dBm. The maximum safe voltage is 25 VDC.

Note LO1 OUT, LO2 OUT, and LO3 OUT enable phase-coherent operation of multiple devices by allowing you to use common LO signals when daisy-chaining the signals to other RF downconverter modules. When you are not using the LO OUT connectors, connect a 50 Ω termination load to each of these connectors.

Table 3. NI 5603 RF Downconverter Front Panel LEDs

LED	Indication
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 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-RFSA.
ACTIVE	Indicates the module state. OFF—The module is in a quiescent state. AMBER—The module is waiting for the Advance Trigger from the configuration list. GREEN—The module is triggered and is running a step from the configuration list. RED—The module has detected an error state. An error state may indicate the module has exceeded approved operating temperature and thermal shutdown has occurred or that the module has detected a power supply failure. If the power supply fails, contact NI technical support.

NI 5622 IF Digitizer Module

The NI 5622 IF digitizer module front panel contains four connectors and two LEDs

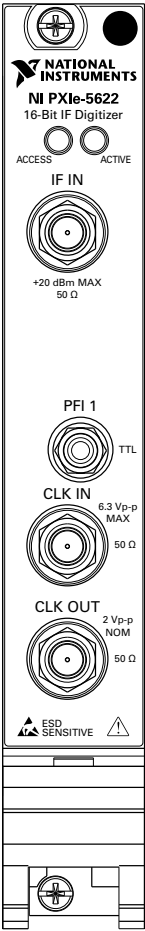**Figure 5.** NI 5622 IF Digitizer Module Front Panel

Table 4. 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 5. NI 5622 IF Digitizer Front Panel Connectors

Connector	Use
IF IN	Connects to the IF OUT connector on the NI 5694 front panel. This connector is the input terminal for a frequency-translated IF waveform from the RF downconverter, filtered by the NI 5694, for digitization and measurement. IF IN is an SMA connector with an input impedance of 50 Ω (nominal). When used in a NI 5667 the IF IN connector has a +4 dBm full-scale input level and a -6 dBm input level (nominal). The maximum input level is +20 dBm or damage can occur.
CLK IN	Connects to the 100 MHz REF OUT connector on the NI 5653 LO source module. The CLK IN connector is the input terminal for the Reference Clock or Sample Clock. CLK IN is an SMA connector with an input impedance of 50 Ω (nominal). The sine wave peak-to-peak input amplitude range is 0.63 V to 2.8 V (0 dBm to +13 dBm). The square wave peak-to-peak input amplitude range is 0.25 V to 2.8 V. The maximum peak-to-peak reference signal level is 6.3 V (+20 dBm) or damage can occur.
CLK OUT	The CLK OUT connector is the output terminal for the NI 5622 Reference Clock or Sample Clock. CLK OUT is an SMA connector with an output impedance of 50 Ω (nominal). The output power delivered to a 50 Ω load is >10 dBm.
PFI 1	Receives a digital trigger from an external source. PFI 1 is an SMB connector and has an absolute voltage rating of -3.3 V to +8 V.

Table 6. NI 5622 IF Digitizer Front Panel LEDs

LED	Indication
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 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-RFSA.
	RED—The module has exceeded approved operating temperature and thermal shutdown has occurred.
ACTIVE	Indicates the module state.
	OFF—The module is not armed, triggered, or acquiring a waveform.
	AMBER—The module is armed and waiting for a trigger.
	GREEN—The module has received a Reference Trigger. A green LED also indicates that the module is acquiring a waveform.
	RED—The module has detected an error. NI-RFSA must access the module to determine the cause of the error. The LED remains red until the error condition is removed.

NI 5653 LO Source Module

The NI 5653 synthesizer/LO source module front panel contains six connectors and two LEDs.

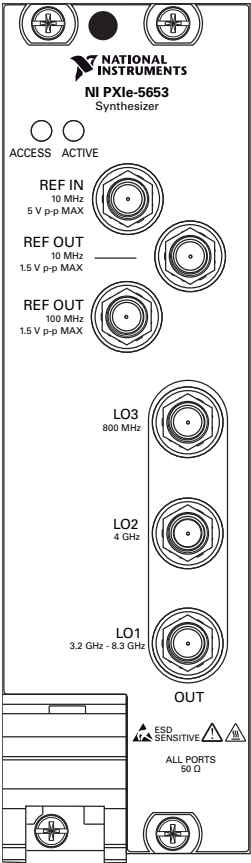**Figure 6.** NI 5653 Synthesizer/LO Source Module Front Panel

Table 7. 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.
♨	If this device has been in use, it may exceed safe handling temperatures and cause burns. Allow the device to cool before removing it from the chassis.

Table 8. NI 5653 Synthesizer/LO Source Front Panel Connectors

Connector	Use
REF IN	Routes a frequency reference signal to the RF synthesizer/LO source. This connector accepts a 10 MHz frequency signal with a maximum voltage of 2 $V_{pk\text{-}pk}$.
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)	Connects to the CLK IN connector on the NI 5622 front panel. This connector routes a frequency reference signal from the synthesizer onboard 100 MHz OCXO.
LO1	Connects to the LO1 IN connector on the NI 5603 module front panel. This connector is the 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	Connects to the LO2 IN connector on the NI 5603 module front panel. This connector is the output terminal for the LO2 (4 GHz) source. LO2 OUT is an SMA connector with an impedance of 50 Ω (nominal).
LO3	Connects to the LO3 IN connector on the NI 5603 module front panel. This connector is the output terminal for the LO3 (800 MHz) source. LO3 OUT is an SMA connector with an impedance of 50 Ω (nominal).

Table 9. NI 5653 Synthesizer/LO Source 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 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-RFSA.
ACTIVE	Indicates the state of the module. 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 has detected an error state. An error state may indicate the module detects a PLL lock failure, is exceeding approved operating temperature and is in a state of thermal shutdown, or the module detects a power supply failure. If the power supply fails, contact NI technical support.

Note The NI 5653 LO source has 10 MHz and 100 MHz reference outputs. For best performance, connect the 100 MHz REF OUT connector to the NI 5622 CLK IN connector.

NI 5693 RF Preselector Module

The NI 5693 RF preselector module front panel contains four connectors and two LEDs.

Figure 7. NI 5693 RF Preselector Module Front Panel

Table 10. 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 11. NI 5693 RF Preselector Module Front Panel Connectors

Connector	Use
RF IN	Connects to the analog RF input signal to be measured by the NI 5667.
RF OUT	Routes the preselector processed RF signal to the RF IN connector on the NI 5603 module front panel.
EXT FILTER IN	Connects to the custom external filter output connector. Receives an external preselector filter signal in the 20 MHz to 3 GHz frequency range.
EXT FILTER OUT	Connects to the custom external filter input connector. This connector is the output terminal for an external preselector filter in the 20 MHz to 3 GHz frequency range.

Table 12. NI 5693 RF Preselector 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 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-RFSA.
ACTIVE	Indicates the module state. OFF—The module is in a quiescent state. AMBER—The module is waiting for the Advance Trigger from the configuration list. GREEN—The module is triggered and is running a step from the configuration list. RED—The module has detected an error state. An error state may indicate the module has exceeded approved operating temperature and thermal shutdown has occurred or that the module has detected a power supply failure. If the power supply fails, contact NI technical support.

NI 5694 IF Conditioning Module

The NI 5694 IF conditioning module front panel contains five connectors and two LEDs.

Figure 8. NI 5694 IF Conditioning Module Front Panel

Table 13. 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 14. NI 5694 IF Conditioning Module Front Panel Connectors

Connector	Use
IF OUT	Routes the processed intermediate frequency signal to the IF IN connector on the NI 5622 front panel. This connector is the output terminal for the frequency-translated IF signal for digitization.
IF IN	Connects to the IF OUT connector on the NI 5603 front panel.
REF/LO IN	Connects to the REF OUT 10 MHz connector on the NI 5653 front panel when used as a reference signal to the internal 215 MHz PLL in downconversion mode. Connect the REF/LO IN connector to a 215 MHz LO signal for use while in downconversion mode for phase-coherent systems.
REF OUT	Output terminal for a 10 MHz signal received at the REF/LO IN connector.
LO OUT	Output terminal for either a 215 MHz LO signal received at the REF/LO IN connector or an internally generated 215 MHz LO signal.

Table 15. NI 5694 IF Conditioning 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 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-RFSA.
ACTIVE	Indicates the module state.
	OFF—The module is in a quiescent state.
	AMBER—The module is waiting for the Advance Trigger from the configuration list.
	GREEN—The module is triggered and is running a step from the configuration list.
	RED—The module has detected an error state. An error state may indicate the module has exceeded approved operating temperature and thermal shutdown has occurred or that the module has detected a power supply failure. If the power supply fails, contact NI technical support.

Configuring the NI 5667 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-RFSA.

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 5667 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 5667.

5. Associate the hardware modules that comprise your device.

   a) Select the NI 5603 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 5667, you must associate the NI 5622 IF digitizer module, the NI 5653 LO source module, the NI 5693 RF preselector module, and the NI 5694 IF conditioning 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 5667 system.

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

Related Information

Troubleshooting on page 28

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

Interconnecting the NI 5667 Modules on page 7

Refer to the NI RF Vector Signal Analyzers Help for more information about renaming devices.

Self-Calibration

It is important to perform a self-calibration after first connecting your system because of cabling and mismatch effects and some degree of residual error, which result from module interconnections. You can determine and reduce these undesired effects through self-calibration, which adjusts the NI 5667 with respect to an onboard high-precision calibration tone. Additionally, you should periodically run a self-calibration to adjust for performance drifts that occur with product aging.

The NI 5667 modules are independently calibrated at the factory; however, you should perform a self-calibration in any of the following situations:
- After first installing and interconnecting your NI 5667 system
- When there is a physical change to any of the system components, such as replacement of modules

- When there is a change to the system cabling
- When the system is in an environment where external variables, such as temperature, can affect measurements

You should also perform a self-calibration if your device has exceeded any of the following temperature or time limits since the last device self-calibration:

- IF flatness: ±5 °C and/or 7 days
- Gain reference: ±5 °C and/or 7 days
- LO self-calibration: ±10 °C and/or 30 days
- Digitizer self-calibration: ±5 °C and/or 90 days

Performing a Device Self-Calibration Using the NI-RFSA SFP

NI recommends you run the self-calibration from the NI-RFSA Soft Front Panel (SFP). You can also run a self-calibration programmatically using the NI-RFSA API.

1. Launch the NI-RFSA SFP by navigating to **Start**»**All Programs**»**National Instruments**»**NI-RFSA**»**NI-RFSA Soft Front Panel**.
2. Click **Device/System**»**Calibration**»**Self Calibration**.
3. Select the self-calibration steps you want to perform from the **Self-Calibration** dialog box.
4. Click **Next** to run the self-calibration.

Programming the NI 5667

You can acquire data interactively using the NI-RFSA Soft Front Panel (SFP) or use NI-RFSA to program your device in the ADE of your choice.

Table 16. NI 5667 Programming Options

Application Programming Interface (API)	Location	Description
NI-RFSA SFP	Available from the Start menu at **Start»All Programs»National Instruments»NI-RFSA»NI-RFSA Soft Front Panel**.	NI-RFSA SFP controls, analyzes, and presents data similar to stand-alone RF vector signal analyzers. The NI-RFSA SFP operates on the PC, so it provides processing, storage, and display capabilities.
NI-RFSA Instrument Driver	LabVIEW—Available on the LabVIEW Functions palette at **Measurement I/O»NI-RFSA**. C or LabWindows/CVI—Available at **Program Files»IVI Foundation»IVI»Drivers»niRFSA**.	NI-RFSA configures and operates the device hardware and acquires and analyzes data using LabVIEW VIs or LabWindows/CVI functions. After you associate the modules of the NI 5667 in MAX, NI-RFSA operates the modules as a single instrument.
	Microsoft Visual C/C++—Use examples located in the `<NIDocDir>\NI-RFSA\examples` directory, where `<NIDocDir>` is one of the following directories: • Windows 8/7/Vista—`Users\Public\Public Documents\National Instruments` • Windows XP—`Documents and Settings\All Users\Documents\National Instruments`	You can modify an NI-RFSA example to create an application with Microsoft Visual C/C++, and all required include and library files are automatically added to the project.

Related Information

Refer to the Getting Started with NI-RFSA section of the NI RF Vector Signal Analyzers Help for detailed instructions about how to acquire data in a specific ADE.

Refer to the Creating an Application with Microsoft Visual C and C++ topic of the NI RF Vector Signal Analyzers Help if you prefer to manually add all required include and library files to the project.

NI-RFSA 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.

Table 17. Locating NI-RFSA Examples

ADE	How to Locate Examples
LabVIEW or LabWindows/CVI	Locate examples with the NI Example Finder. Within LabVIEW or LabWindows/CVI, select **Help»Find Examples** and navigate to **Hardware Input and Output»Modular Instruments**.
ANSI C or Visual Basic	Locate examples in the `<NIDocDir>`\NI-RFSA\examples directory, where `<NIDocDir>` is one of the following directories: • Windows 8/7/Vista—`Users\Public\Public Documents\National Instruments` • Windows XP—`Documents and Settings\All Users \Documents\National Instruments`

Note LabVIEW examples that demonstrate integration of the NI 5667 with NI RF vector signal generators and NI toolkit software, including the Modulation Toolkit, are also available online at *ni.com/examples*.

Troubleshooting

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

Installation

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 NI 5667 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.

Caution Apply external signals only while the NI 5667 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 5667 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**.

5. If you are using a PXI controller, verify that a **National Instruments** entry appears in the system device list. Reinstall NI-RFSA 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.

Configuration

What Should I Do if the Device Does Not Initialize?

Failure to initialize may indicate a problem with module interconnections or with MAX. If the niRFSA Initialize VI or the `niRFSA_init` function returns an error and the NI 5667 fails to initialize, complete the following steps:

1. Reconnect the NI 5667 hardware module front panel cables securely.

2. Power on your system and run the MAX configuration and self-test procedures.

What Should I Do if the NI 5622 IF Digitizer Module Does Not Phase-Lock to the NI 5653 LO Source Module?

If the NI 5622 IF digitizer module fails to phase-lock to the NI 5653 LO source module internal reference through the front panel, complete the following steps:

1. Verify that the cable is not faulty and that all cables are connected to the correct terminals.

2. Verify that there is a reference signal generated from the NI 5653 REF OUT 100 MHz front panel connector.

   If there is a 100 MHz signal coming from the NI 5653 REF OUT 100 MHz front panel connector, the NI 5622 phase-lock circuitry may be at fault.

If failures continue and there is no signal at these output terminals, there may be a problem with the NI 5653 hardware. Contact NI technical support or visit *ni.com/support*.

What Should I Do if the NI-RFSA Soft Front Panel Does Not Launch?

1. Verify the front panel interconnections for your RF spectrum monitoring receiver.

2. Verify the MAX device association for your NI 5667.

3. If you have verified the interconnections and associations of your device and you are still unable to launch the NI-RFSA SFP, try uninstalling and then reinstalling NI-RFSA.

Measurements

What Should I Do if the Device Amplitude Reading Does Not Match the Source?

1. Verify that the discrepancy between the NI 5667 and the source is within the error limits of the devices.

   a) Verify the absolute amplitude accuracy of the NI 5667 using the appropriate value.

   b) Verify the level accuracy of the input signal into the receiver.

2. Check for cable loss, which can be substantial. For example, an RG58 coaxial cable loses about 2.1 dB of signal amplitude per foot at 2 GHz. Unless you are using high-quality cables, expect losses when working with high-frequency signals.

3. Perform a self-calibration for the NI 5667.

If errors continue, contact NI technical support or visit *ni.com/support*.

Where to Go Next

Refer to the following figure for information about other product tasks and associated resources for those tasks.
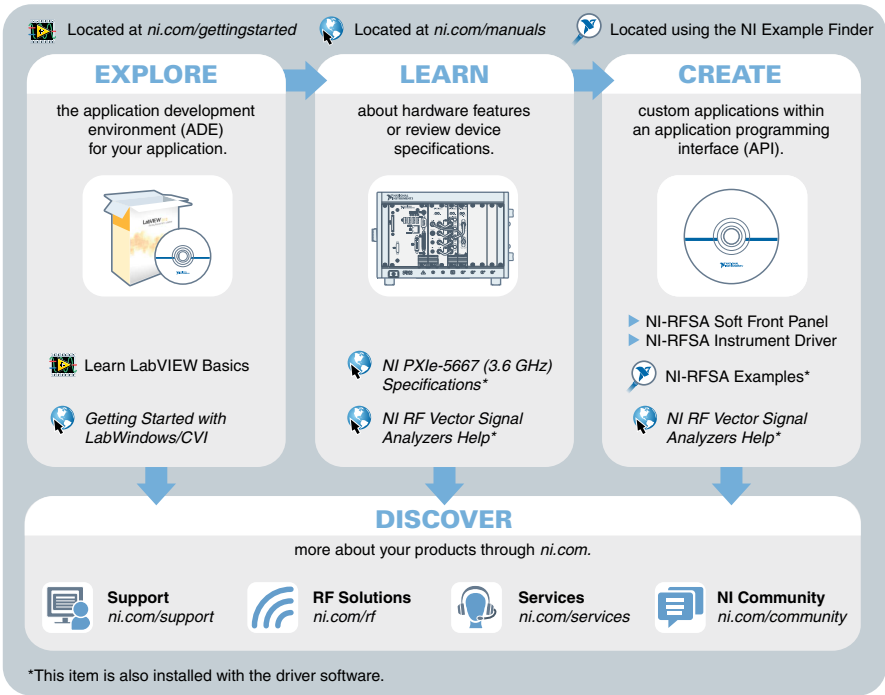
💡 **Tip** The *NI RF Vector Signal Analyzers Help* is an HTML version of a traditional user manual that includes detailed information about RF fundamentals, device features, and programming with NI-RFSA.

Worldwide Support and Services

The National Instruments 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 NI Factory Installation Services, repairs, extended warranty, and other services.

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

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting *ni.com/certification*. If your product supports calibration, you can obtain the calibration certificate for your product at *ni.com/calibration*.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.