VRTS with 4 GHz Bandwidth Getting Started

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Contents

VRTS Getting Started Guide

This document explains how to install, configure, and test the Vehicle Radar Test System with 4 GHz Bandwidth.

The VRTS and NI-VRTS instrument driver can be used to test automotive radars at frequencies of 75 GHz to 82 GHz.

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Unpacking the Kit

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

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

   > (!) **Notice** Never touch the exposed pins of connectors.

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

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

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

Required Equipment

VRTS configurations require a combination of the following hardware:

- PXIe-5551 Variable Delay Generator
- mmRH-5591 mmWave Radio Head and power supply

- PXIe-5841 Vector Signal Transceiver (optional)
- PXI Express Chassis
- PXI Express Controller
- Cables included in your product bundle(s)

    - 0.15 m SMA-SMA cable(s), part number 763187-06
    - 0.46 m SMA-SMA cable(s), part number 763187-18
    - 1 m Mini HDMI-Mini HDMI cable(s), part number 143045A-01
    - 0.12 m MMPX-MMPX cable(s), part number 763376-01 (optional)

The term **system** describes the modules and radio head assembled as described in this document. There is no single system component labeled "VRTS."

Verifying the System Requirements

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

Refer to the product readme, which is available online on the driver software download page or at ni.com/manuals, for more information about minimum system requirements, recommended system, and supported application development environments (ADEs).

Installing the Software

You must be an Administrator to install NI software on your computer.
Ensure that you have installed the latest version of NI Package Manager. To access the download page for NI Package Manager, visit ni.com/r/nipmdownload.

1. Install LabVIEW.
2. Install the latest NI-VRTS instrument driver.
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. If you are using a PXIe-5841, install the software described in the **PXIe-5841 Getting Started Guide**.

Installing the Hardware

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The Vehicle Radar Test System with 4 GHz Bandwidth is a modular system with a variety of configuration options. This guide uses two example configurations to illustrate the hardware installation process. Module placement and cabling varies depending on the modules that comprise your system.

Installing the VRTS Modules

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

1. Ensure the AC power source is connected to the chassis before installing 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. Identify supported slots in the chassis.

   - Place the controller in the first slot.
   - Place the PXIe-5551 module(s) in the slots to the right of the controller.
   - If you are using a PXIe-5841, place it in the slots to the right of the PXIe-5551 module(s).

   > **✎** **Note** PXIe-5551 and PXIe-5841 modules can be placed in PXI Express peripheral slots, PXI Express hybrid peripheral slots, or PXI Express system timing slots.

5. Touch any metal part of the chassis to discharge static electricity.
6. Ensure that the ejector handle is in the downward (unlatched) position.
7. Place the module edges into the module guides at the top and bottom of the chassis. Slide the module into the slot until it is fully inserted.
8. Latch the module in place by pulling up on the ejector handle.
9. Tighten the screws on the front panel of the module.
10. Repeat steps 5 through 9 for all PXIe modules in your system.

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

Figure 1. VRTS with One PXIe-5551, Installed Modules
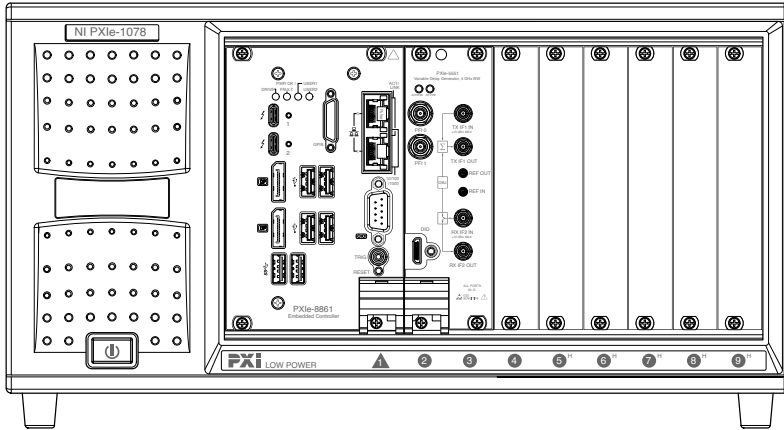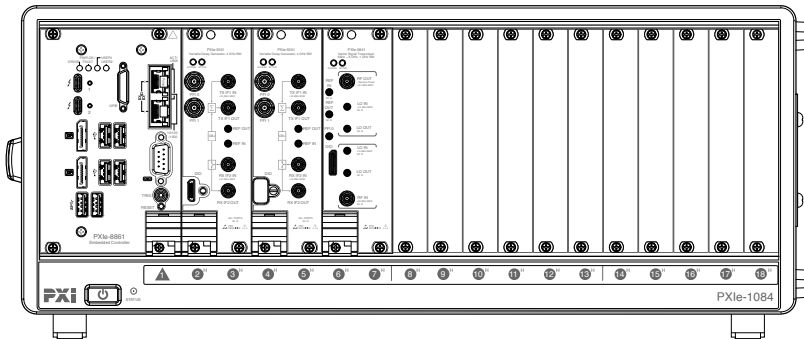

Figure 2. VRTS with Two PXIe-5551 Modules and One PXIe-5841 Module, Installed Modules

Installing Antennas onto the mmRH-5591

Install antennas onto the mmRH-5591 prior to operation.

1. Locate the clips on the right and left sides of the plastic covering with integrated microwave absorber on the front of the radio head and pry them outward.

2. Pull off the plastic covering with integrated microwave absorber.

3. Place the antenna over one of the two waveguides on the radio head.

4. Insert the four waveguide screws. Evenly tighten the screws.

5. Repeat steps 3 and 4 to attach the second antenna to the radio head.

6. Replace the plastic covering with integrated microwave absorber on the front of the radio head.

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Setting up the mmRH-5591

1. Connect the radio head to the power source included in its kit.

2. Situate the radio head so that it is level and directly across from the radar under test.
    Ensure that the distance between the radio head and radar under test is within the setup distance range described in the **VRTS with 4 GHz Bandwidth Specifications**.

Cabling the VRTS

1. Collect the cables that shipped with your VRTS modules and separate them by cable type.

2. Connect your modules and radio head as shown in the following figures. Adhere to the following guidelines when cabling your system:

    -   Do not remove terminations from unused ports. If a cable connector is capped with a termination, remove it to connect cables.

    -   Screws on all Mini HDMI connections must be tightened after they are connected.

    -   Tighten all SMA connections to 8 in-lb. to 9 in-lb.

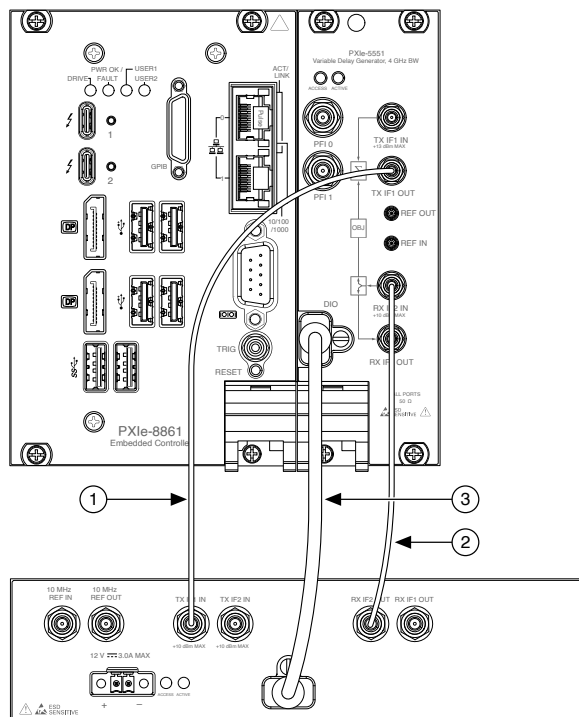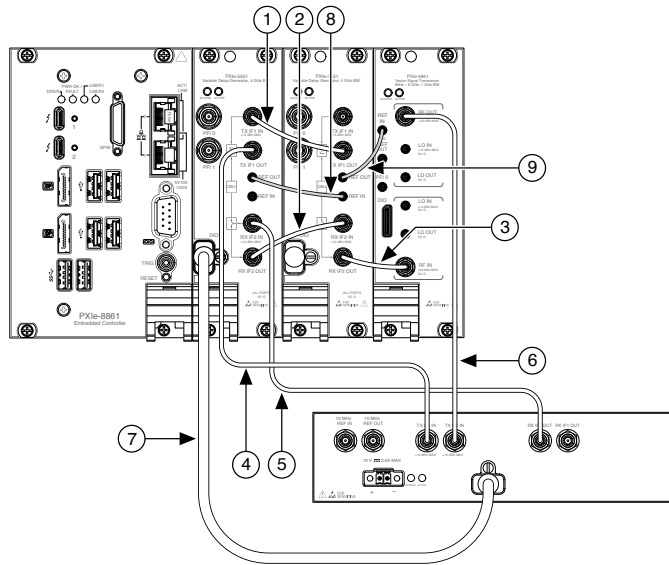**Figure 3.** Connections for the VRTS with One PXIe-5551

Table 1. Connections for the VRTS with One PXIe-5551

Cable Type	Connection 1	Connection 2	Label in Figure
0.46 m SMA-SMA	PXIe-5551, slots 2 and 3, TX IF1 OUT	mmRH-5591, TX IF1 IN	1
	PXIe-5551, slots 2 and 3, RX IF2 IN	mmRH-5591, RX IF2 OUT	2
1 m Mini HDMI-Mini HDMI	PXIe-5551, slots 2 and 3, DIO	mmRH-5591, DIO	3

Figure 4. Connections for the VRTS with Two PXIe-5551 Modules and One PXIe-5841

Table 2. Connections for the VRTS with Two PXIe-5551 Modules and One PXIe-5841

Cable Type	Connection 1	Connection 2	Label in Figure
0.15 m SMA-SMA	PXIe-5551, slots 2 and 3, TX IF1 IN	PXIe-5551, slots 4 and 5, TX IF1 OUT	1
	PXIe-5551, slots 2 and 3, RX IF2 OUT	PXIe-5551, slots 4 and 5, RX IF2 IN	2
	PXIe-5551, slots 4 and 5, RX IF2 OUT	PXIe-5841, slots 6 and 7, RF IN	3
0.46 m SMA-SMA	PXIe-5551, slots 2 and 3, TX IF1 OUT	mmRH-5591, TX IF1 IN	4
	PXIe-5551, slots 2 and 3, RX IF2 IN	mmRH-5591, RX IF2 OUT	5
	PXIe-5841, slots 6 and 7, RF OUT	mmRH-5591, TX IF2 IN	6
1 m Mini HDMI-Mini HDMI	PXIe-5551, slots 2 and 3, DIO	mmRH-5591, DIO	7
0.12 m MMPX-MMPX	PXIe-5551, slots 2 and 3, REF OUT	PXIe-5551, slots 4 and 5, REF IN	8
	PXIe-5551, slots 4 and 5, REF OUT	PXIe-5841, slots 6 and 7, REF IN	9

3. (Optional) Connect the controller to a monitor, as described in its Getting Started Guide.
4. Power on the chassis and controller.

Configuring the VRTS in MAX

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

1. Launch MAX.

2. In the configuration tree, expand **Devices and Interfaces** to see the list of installed NI hardware.
   Installed modules appear under the name of their associated chassis.

3. Expand your **Chassis** tree item.
   MAX lists all modules installed in the chassis. Your default names may vary.

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

4. Record the identifier MAX assigns to the hardware. Use this identifier when programming the VRTS.

5. Self-test the hardware by selecting the item in the configuration tree and clicking **Self-Test** in the MAX toolbar.
   The MAX self-test performs a basic verification of hardware resources.

NI-VRTS Instrument Driver

The NI-VRTS instrument driver features a set of VIs and examples that exercise the capabilities of the VRTS, including object simulation, object simulation with measurement, object simulation with interference, and other system-specific functions.

NI-VRTS VIs

NI-VRTS includes a variety of examples and VIs for use with the VRTS.

Locate NI-VRTS VIs at **Functions** » **Instrument I/O** » **Instrument Drivers** » **NI-VRTS**.

Using the NI Example Finder

Use the NI Example Finder in LabVIEW to locate programming examples.

1. Launch LabVIEW.

2. Select **Help** » **Find Examples** to open the NI Example Finder.

3. In the NI Example Finder window, select the **Browse** tab.

4. Select the **Directory Structure** option button.

5. Navigate to **instr** » **niVRTS**.

6. Open the example that best matches your application requirements. NI-VRTS includes the following examples:

   - VRTS Basic Single Object Simulation.vi demonstrates how to simulate an object.

   - VRTS Basic Multiple Object Simulation.vi demonstrates how to simulate multiple objects.

   - VRTS Object Simulation and CHP Measurement.vi demonstrates how to simultaneously simulate an object and perform a measurement.

   - VRTS Object Simulation and Interference.vi demonstrates how to use NI-VRTS with NI-RFSG to simulate an object while injecting a single-tone continuous wave signal as interference.

Beginning Object Simulation

Complete the following steps to simulate objects at frequencies within either Band 1, 76 GHz to 80 GHz, or Band 2, 77 GHz to 81 GHz.

1. Use the NI Example Finder to locate NI-VRTS examples.

2. Select **VRTS Basic Single Object Simulation** or **VRTS Basic Multiple Object Simulation**. Click **Open**.

> **Note** Only systems containing more than one PXIe-5551 module support multiple object simulation.

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3. Follow the instructions on the VI front panel.

4. Run the VI.

5. Click **STOP** to conclude the simulation.

Taking a Measurement with the PXIe-5841

Complete the following steps to take measurements at frequencies within any of the supported frequency bands.

Only systems containing a PXIe-5841 support measurement capabilities.

1. Use the NI Example Finder to locate NI-VRTS examples.

2. Select **VRTS Object Simulation and CHP Measurement**. Click **Open**.

3. Follow the instructions on the VI front panel.

4. Run the VI.

5. Click **STOP** to conclude the measurement.

Injecting Interference with the PXIe-5841

Complete the following steps to inject a single-tone continuous wave signal as interference.

Only systems containing a PXIe-5841 support interference injection capabilities.

1. Use the NI Example Finder to locate NI-VRTS examples.

2. Select **VRTS Object Simulation and Interference**. Click **Open**.

3. Follow the instructions on the VI front panel.

4. Run the VI.

5. Click **STOP** to conclude the session.

Removing the VRTS Modules

To remove the VRTS modules from a PXI Express chassis, complete the following steps.

1. Power off the chassis.

2. Remove any cables that may be attached to the module front panels.

3. Unscrew the four bracket-retaining screws in the front panel.

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4. Press the ejector handle down.

5. Slide the unit out of the chassis.

Module Front and Back Panels

Figure 5. mmRH-5591 Front Panel

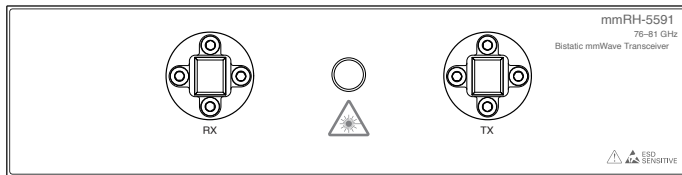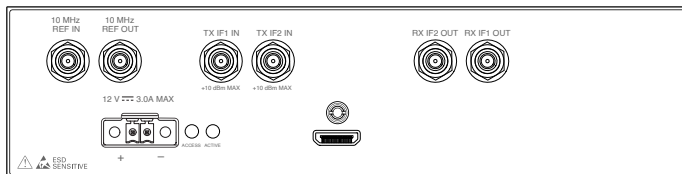**Figure 6.** mmRH-5591 Back Panel

Figure 7. PXIe-5551 Front Panel

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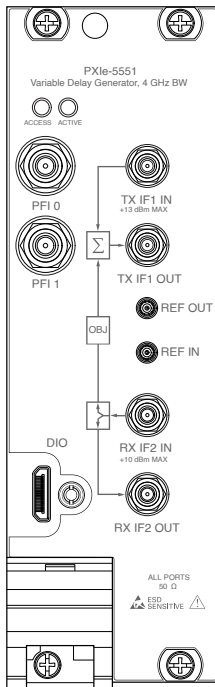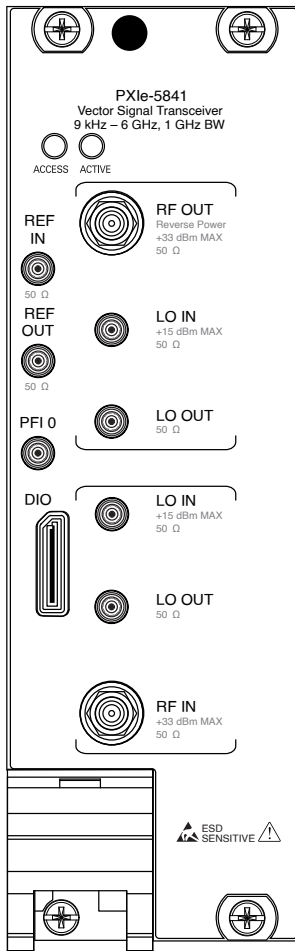Site Web : www.es-france.com

Figure 8. PXIe-5841 Front Panel

Where To Go Next

Refer to the following resources for more information about programming and using your VRTS.

1. Explore the application development environment (ADE) for your application. Search ni.com/manuals for **Getting Started with LabVIEW**.

2. Learn about the capabilities of your hardware with device specifications. Search ni.com/manuals for **VRTS Specifications**.

3. Create custom applications within an application programming interface (API).
   Search ni.com/drivers for:

   - NI-VRTS instrument driver

- NI-RFSG instrument driver

Use the following resources to help with development:

- Examples in the NI Example Finder
- **NI-VRTS Help** and **NI-RF Signal Generators Help**, installed with the instrument driver or at ni.com/manuals

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