Agilent Virtual Rack Mount Kits Based on IVI
Application Note

Agilent Technologies

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Introduction

The goal of this application note is to familiarize the reader with the Virtual Rack Mount Kits (VRMKs) that are used to connect IVI Instrument Classes to the Virtual Rack Framework. First, VRMKs in general are discussed. Then the specific VRMK for this application note is covered in detail.

Virtual Rack mount kits

Virtual Rack Mount Kits (VRMKs) are used to connect existing hardware and/or software components to the Virtual Rack framework. The VRMK converts the foreign protocol or programming language of the external component to the internal VR behavioral model. This allows the component to show up in the Virtual Rack system where it can be seen in the VR Explorer, mounted, operated, recorded, and have any other VR Services applied.

VRMK scope

VRMKs can cover anywhere from a single component to a whole family of components. To the maximum extent possible, a single VRMK will cover a broad range of components by leveraging an existing intermediate interface that is shared by multiple components. For example, the LabVIEW VRMK allows countless numbers of components written in LabVIEW to be mounted to the Virtual Rack. However, many times a component has an entirely unique interface, typically provided as a unique DLL, and consequently must have a dedicated VRMK.

VRMKS for IVI-Based Components

The IVI VRMKs are mount kits that support interfaces shared by families of IVI instruments. These instrument families are defined by the IVI Foundation and are called Instrument Classes. Additional information about the IVI Foundation can be found at:
www.ivifoundation.org

IVI-C and IVI-COM

At the time of this writing, there are two IVI implementations available. IVI-C and IVI-COM. Virtual Rack has VRMKs that use IVI-C and VRMKs that use IVI-COM. To a large degree, the implementation in use is transparent to the user.

IVI instrument classes

IVI uses a pre-defined interface based approach to instruments. These interfaces are defined for each class of instrument. Not all classes of instruments are supported. Currently, the following IVI Instrument Classes have interfaces defined:

- DC power supply
- Digital multimeter (DMM)
- Function generator and arb
- Oscilloscope
- Power meter
- RF signal generator
- Spectrum analyzer
- Switch

Each of these IVI Instrument Classes has specific interfaces that the vendor must implement and provide. The vendor may provide an IVI-C implementation, an IVI-COM implementation, or both.

IVI VRMKs

There are two IVI VRMKs for each of the Instrument Classes, one for IVI-C and one for IVI-COM. The appropriate VRMK will already be associated with the component in the VR Storeroom.

Adding IVI equipment to the VR storeroom

As new IVI instruments are released by equipment manufacturers, they can be added to the VR Storeroom without modifying the existing IVI VRMKs. This is due to the IVI class interfaces which do not change.

If any new IVI Instrument classes become defined, then additional IVI VRMKs for the new classes will need to be generated that can then be associated with the equipment in the VR Storeroom entries.

IVI Software Dependencies

IVI instruments have software dependencies, primarily the IVI Compliance Package. IVI does not need to be installed to run the VRMK in simulate mode and can be deferred until it is time to actually connect to the hardware.

National Instruments IVI, MAX, and VISA

IVI is dependent on the IVI Store provided by National Instruments. This requires 3 of the National Instrument software packages to be installed. These are:

- NI Measurement and Automation Explorer (NI-MAX)
- NI IVI Compliance Package
- NI-VISA

All 3 of these software packages can be installed at one time using NI's Device Drivers installation process. The NI IVI Compliance Package can be obtained from the following link: During installation of the NI software, the user will be prompted to select the components to install. IVI will require the "IVI Compliance Package", "NI Measurement and Automation Explorer", and "NI-VISA" to be selected as shown in the dialog below.

Agilent VISA

Some IVI instruments require Agilent VISA (part of Agilent IO Libraries) to be installed as well. Agilent VISA must be installed as a secondary VISA, so it must be installed or re-installed after any installation or re-installation of NI-VISA.

Agilent IO Libraries Product Download:

http://adn.tm.agilent.com/index. cgi?CONTENT_ID=745
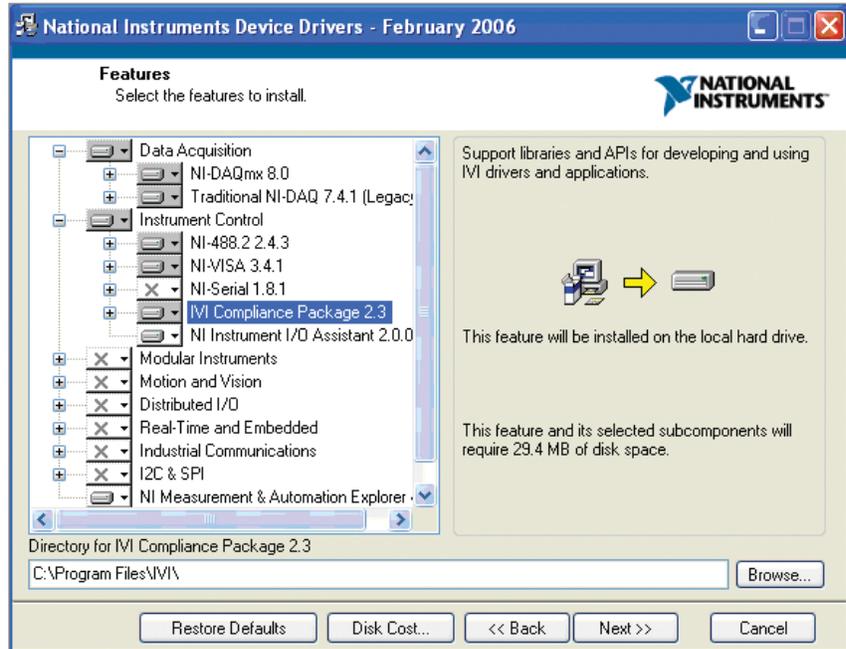

Figure 1. NI device driver component selection

Hardware Interface Installation

Physical hardware interfaces (such as GPIB) should be installed into the computer after installing the NI-MAX software. This way Windows can detect and automatically install the correct drivers for them. NI-MAX should be launched at least once afterwards to verify that the interfaces appear under the "Devices and Interfaces" folder.

Uninstalling a hardware interface

If you installed the hardware interface before installing NI-MAX, then the hardware will need to be uninstalled first. The following sub-sections walk through an example of uninstalling a hardware interface. The process will vary depending on the interface type and the vendor. Please refer to the vendor's uninstall instructions.

For this example, we will uninstall a USB-GPIB device:

Right-mouse-click on "My Computer" and select the "Properties" menu item

Figure 2. Properties of my computer

This will display the System Properties Dialog shown in Figure 3.

Figure 3. System properties dialog

Select the Hardware tab of the System Properties Dialog, and then click on the "Device Manager" button highlighted below.

Figure 4. Device manager button on hardware tab

This will display the Device Manager dialog which shows the devices in your computer in a hierarchical tree form.
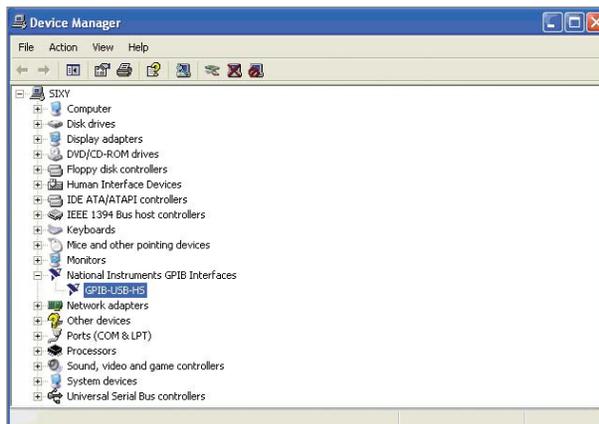

Figure 5. Device manager tree view

Expand the tree to the device you want to uninstall. Right-mouse-click on the device, and select the "Uninstall" menu item.

Restart the computer to finalize the uninstall.

Reinstalling the hardware interface

Now the next time you boot the computer, Windows will see the hardware interface device as if it was installed for the first time. With NI-MAX installed, the correct drivers will now be used for the device.

Connecting Equipment

Physically connecting the equipment

Equipment should be connected to the hardware interface following the manufacturer's instructions. Some hardware interfaces such as PXI requires the computer and chassis to be turned off first. Other hardware interfaces such as serial or GPIB can be connected while the computer is running.

NI-MAX devices

After connecting equipment to the hardware interfaces, they will appear in NI-MAX under the respective hardware interface under the "Devices and Interfaces" MAX tree node. Some hardware interfaces such as PXI automatically scan for instruments during bootup. Other hardware interfaces such as GPIB require the user to initiate the scan for instruments.

Scan for GPIB instruments

NI-MAX does not automatically scan for GPIB instruments. After connecting the external equipment to a GPIB hardware interface, the user will need to go to each individual GPIB interface and scan for instruments.
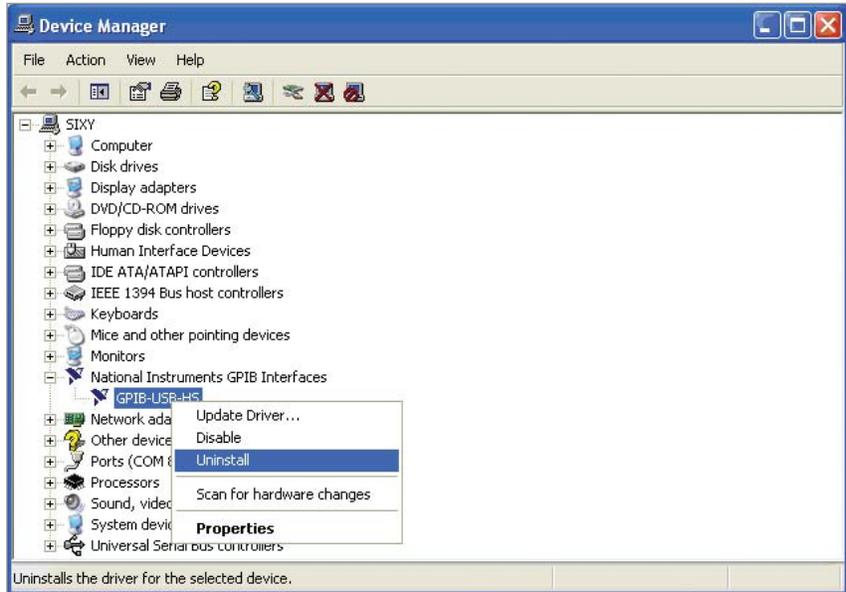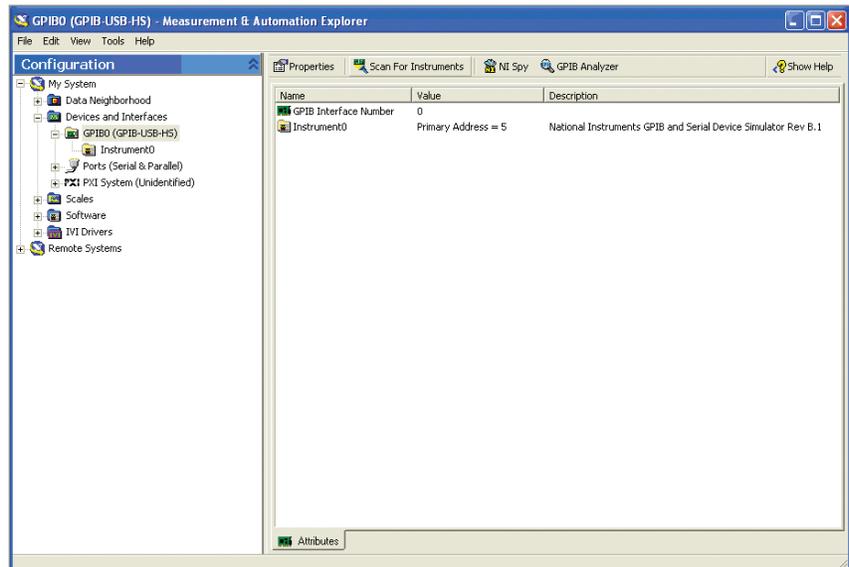

Figure 6. Uninstall menu item

Figure 7. Scanning for GPIB instruments

Configuring IVI Instruments in NIMAX

NI-MAX is used to configure IVI instruments for access by the IVI VRMK. IVI configuration is done in multiple layers. It is best to configure the layers from the bottom up in the following order:

1) IVI instrument driver
2) IVI hardware Asset (NI-MAX version 4.0 and earlier)
3) IVI driver session
4) IVI logical name

Each of these steps are covered in the next few sections.

Figure 8. Example .MSI installation file

IVI Instrument Driver

Before an IVI instrument can be used, the instrument driver (sometimes called device driver) should be installed.

This section will use an Agilent E4419B Power Meter as an example on how to install and configure an instrument in NI-MAX to be used with an IVI-based VRMK.

IVI instrument driver installation

Instrument driver installation programs will vary between products. Typically the drivers are distributed in a MSI package. You can double-click the .msi file to run the installer for that device.

IVI entry under instrument driver software modules

After the instrument driver is successfully installed, a new entry for that driver class will appear in the "My System\IVI Drivers\Advanced\Instrument Driver Software Modules" folder in NI-MAX.
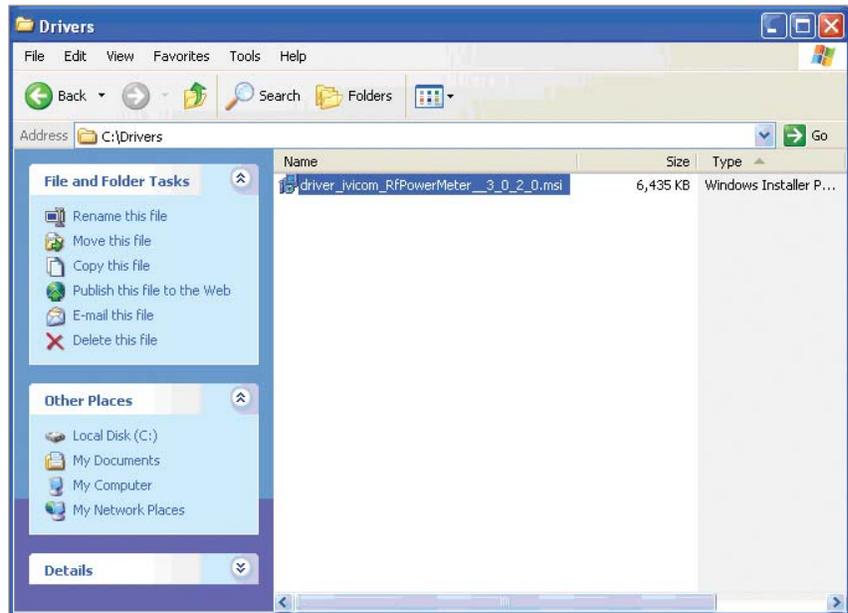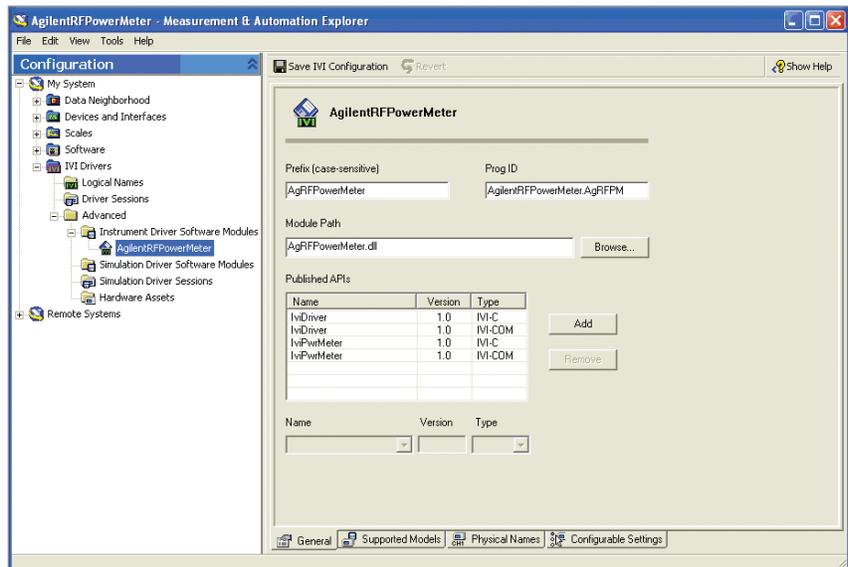

Figure 9. IVI instrument driver software modules

IVI Hardware Assets

IVI Hardware assets are created by the user to inform the IVI system that a particular piece of equipment connected to the computer will be used as an IVI component.

IVI Hardware Assets cannot be created until after the IVI Instrument Driver has been installed (prior section).

Creating the IVI hardware asset

An IVI hardware asset needs to be created for each instrument. To create a new asset, right-click on the "Hardware Assets" folder and select the "Create New (case-sensitive)..." menu item.

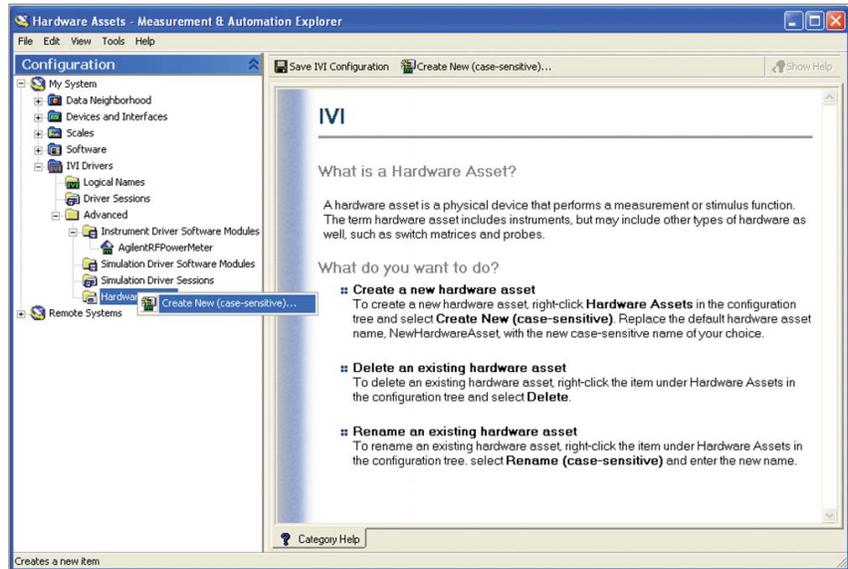This will create a new entry under the Hardware Assets folder of NI-MAX.

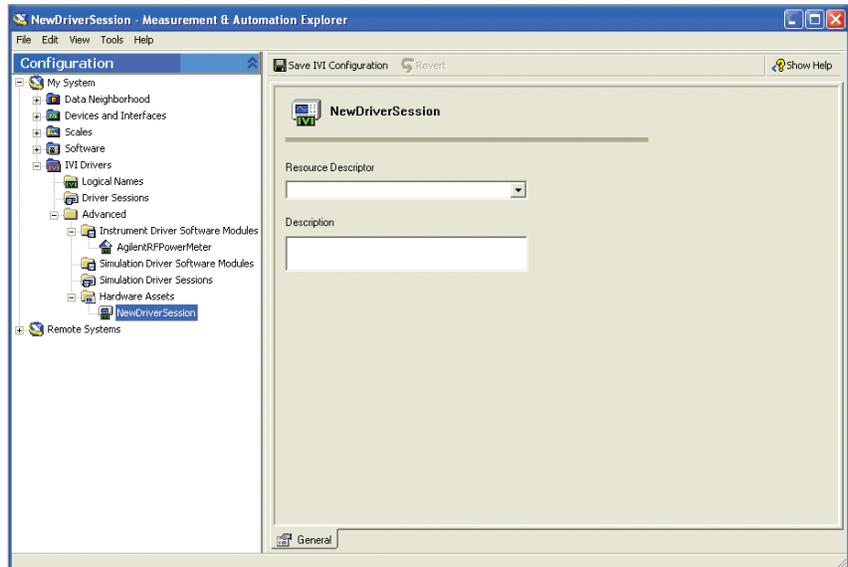Figure 10. Create new hardware asset menu item

Figure 11. New hardware asset entry

Renaming the IVI hardware asset

After the asset is created, it can be renamed to something more appropriate. The screenshot below shows the hardware asset after it has been renamed to "Power Meter Asset". It is a good idea to keep the suffix "Asset" in the name to distinguish it from the other layers of IVI.

Configuring the IVI hardware asset

Configuring the IVI Hardware Asset is done by selecting it in the NI-MAX tree under the "My System\IVI Drivers\Advanced\Hardware Assets\" node. The configuration is then done in the tabs on the right side of the window.

In the "General" tab of the "Power Meter Asset", the "Resource Descriptor" combo box should be set to the VISA resource identifier of the instrument established in the prior section. The "Description" text box can be filled in with something meaningful.
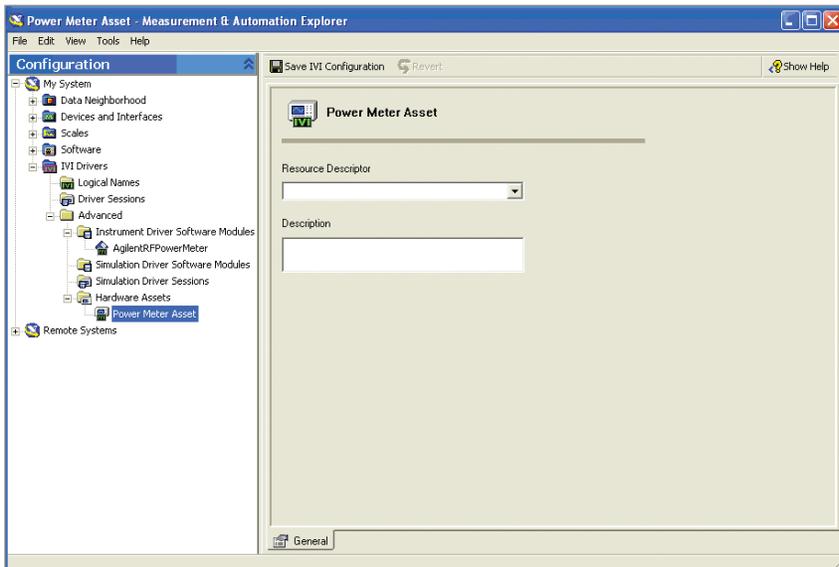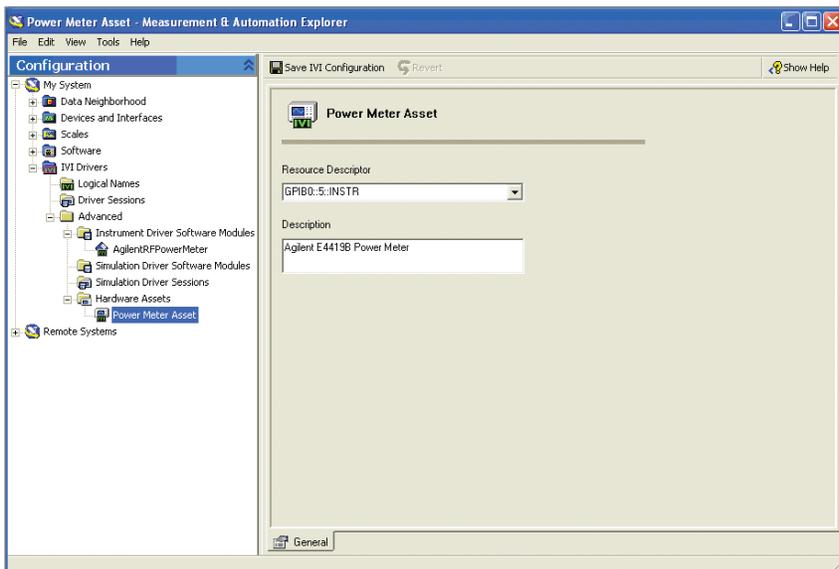

Figure 12. Renamed IVI hardware asset

Figure 13. IVI hardware asset configuration

IVI Driver Sessions

IVI Driver Sessions are an additional layer required by IVI to indirectly associate an IVI Class with a specific IVI Hardware Asset and Software Module combination. The IVI Driver Sessions will reference the IVI Hardware Asset(s) as well as the device driver Software Modules created in the previous sections.

Creating an IVI driver session

An IVI driver session needs to be created for each instrument. To create a new session, right-click on the "Driver Sessions" folder and select the "Create New (case-sensitive)..." menu item.

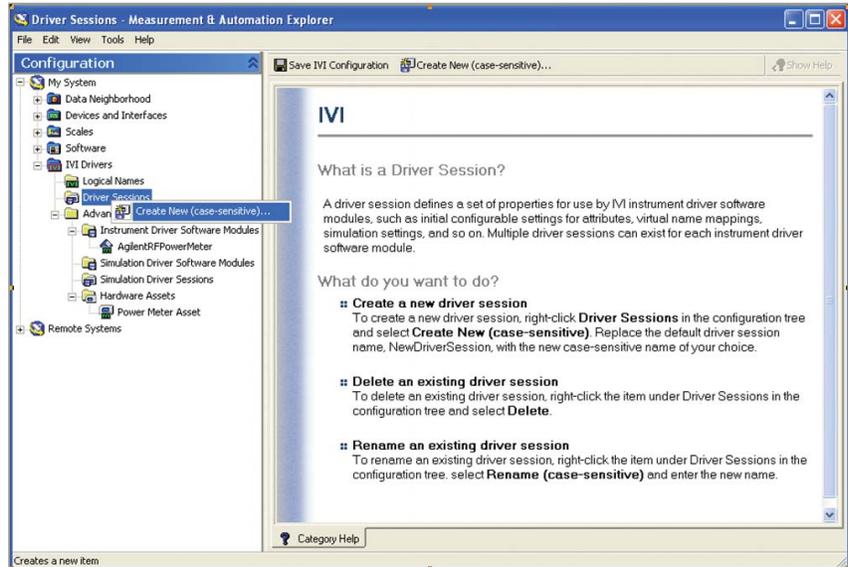This will create a new entry under the "Driver Sessions" folder of NI-MAX.
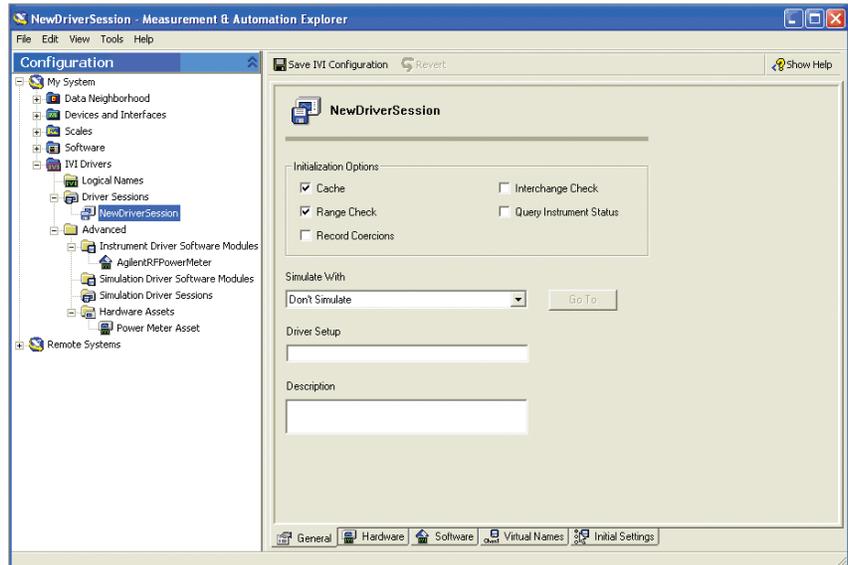

Figure 14. Create new driver session menu item

Figure 15. New driver session entry

Renaming the IVI driver session

After the session is created, it can be renamed to something more appropriate. It is a good idea to use "Session" as the suffix for the name so that it can be distinguished from other IVI layers. The figure below shows the result of creating a new IVI Driver Session and renaming it to "Power Meter Session".

Configuring the IVI driver session

Configuring the IVI Driver Session is done by selecting it in the NI-MAX tree, and editing the tabs on the right side of the window. There are 5 tabs for configuring the IVI driver session. The default configuration values in the "General", "Virtual Names", and "Initial Settings" tabs do not need to be changed, but they can be modified as the user desires.

Assigning the hardware asset to the driver session

The procedure for configuring the driver session hardware is different depending on the version of NI-MAX you have installed.

NI-MAX Version 4.0 and earlier

In the "Hardware" tab, the "Hardware Asset" combo box should be changed to the IVI hardware asset you want to assign to this session. When it is selected, the "Resource Descriptor" and "Description" text boxes will automatically change to correspond to the asset.
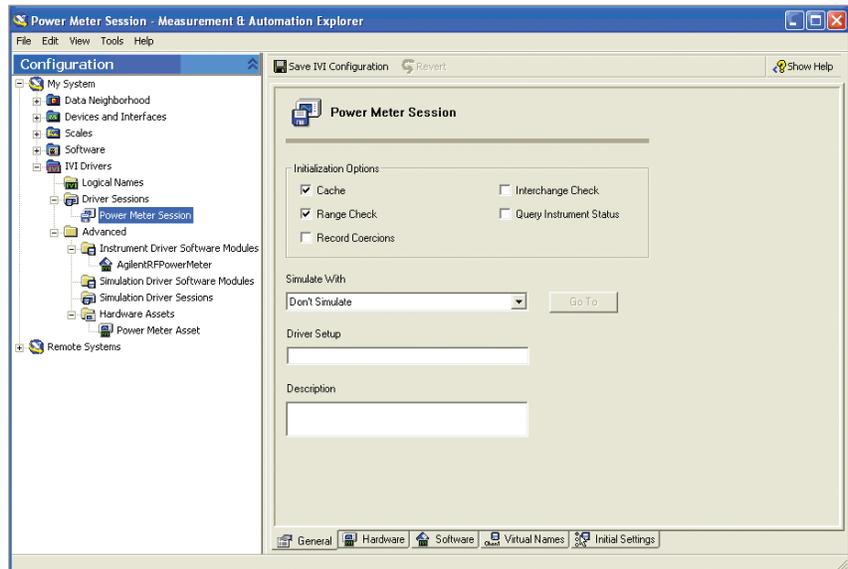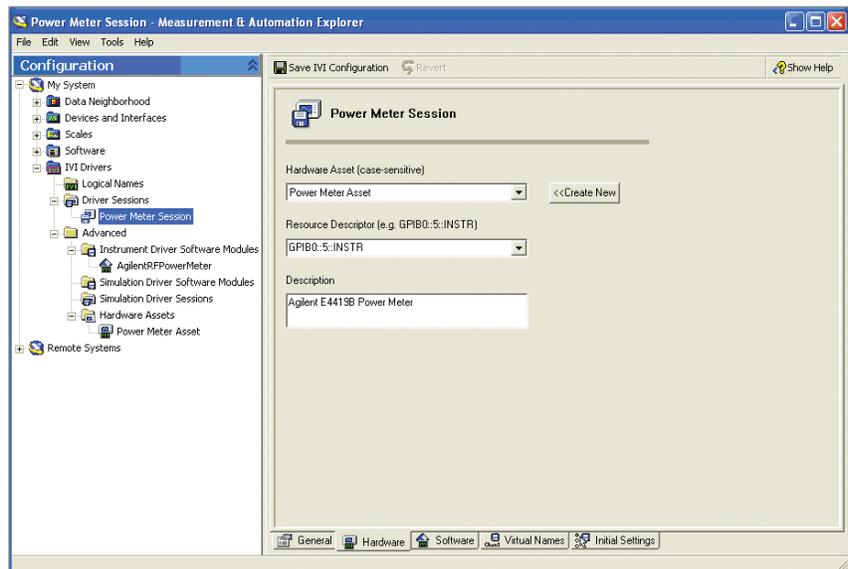

Figure 16. Renamed IVI driver session

Figure 17. IVI driver session hardware configuration tab, early NI-MAX

NI-MAX Version 4.1 and later

Versions of NI-MAX after 4.0 do not require configuration of a hardware asset, and allow the user to define the hardware information in the driver session hardware tab.

Begin by clicking the "Add" button and typing in "Power Meter Asset" as the hardware asset name.

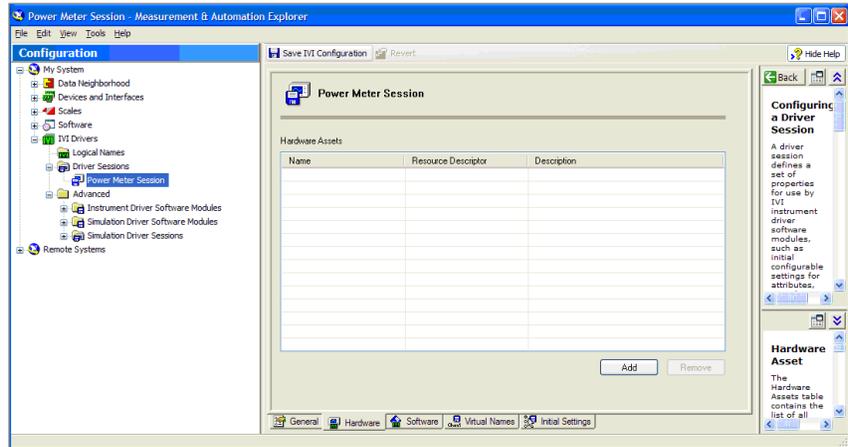Now select the hardware descriptor from the drop down list.

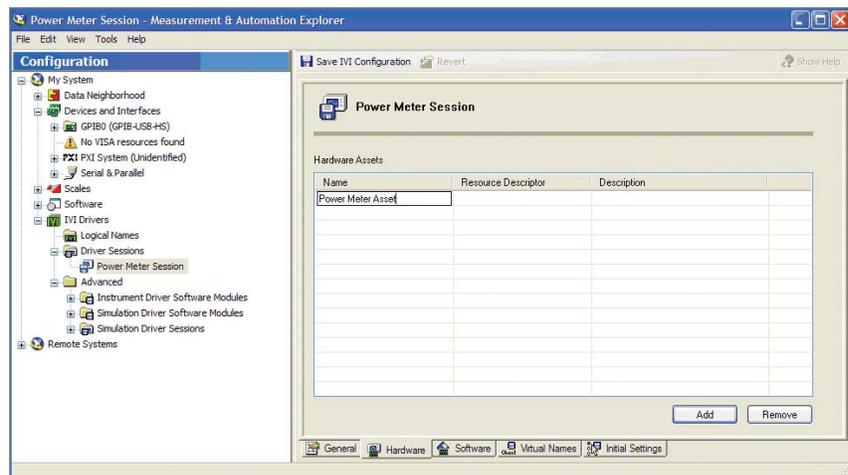**Figure 18. IVI driver session hardware configuration tab, new NI-MAX**

Figure 19. IVI driver session hardware configuration asset naming, new NI-MAX
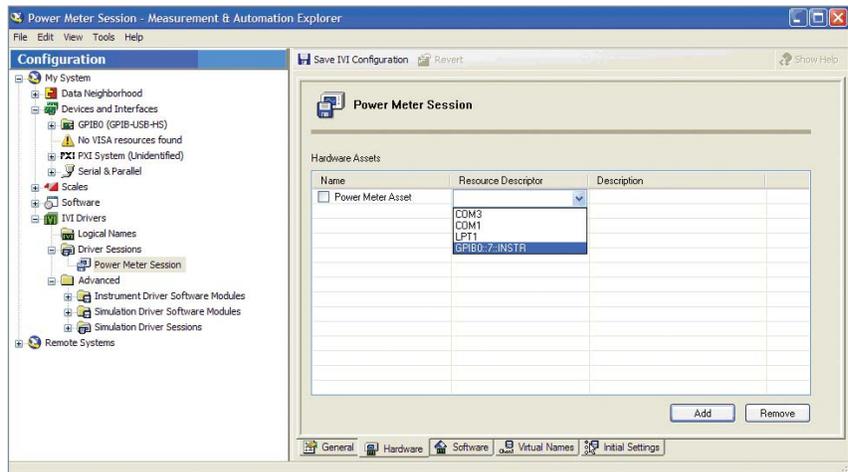

Figure 20. IVI driver session hardware configuration resource selection, new NI-MAX

Finally enable the hardware asset by clicking the check box on the left.

Remember to click the 'Save IVI Con-figuraiton' button before leaving this screen.

Assigning the software module to the driver session

In the "Software" tab, the "Soft-ware Module" combo box should be changed to the IVI driver Software Module corresponding to the instru-ment. When it is selected, the text boxes will automatically change to correspond to the module.
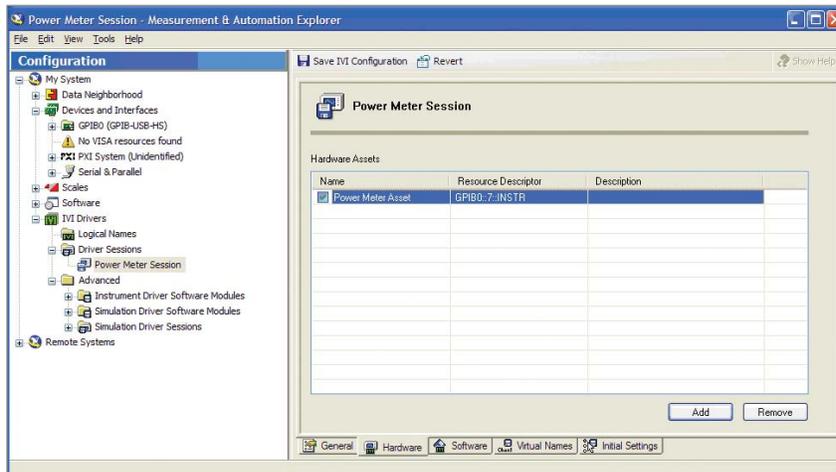
Figure 21. IVI driver session hardware configuration complete, new NI-MAX
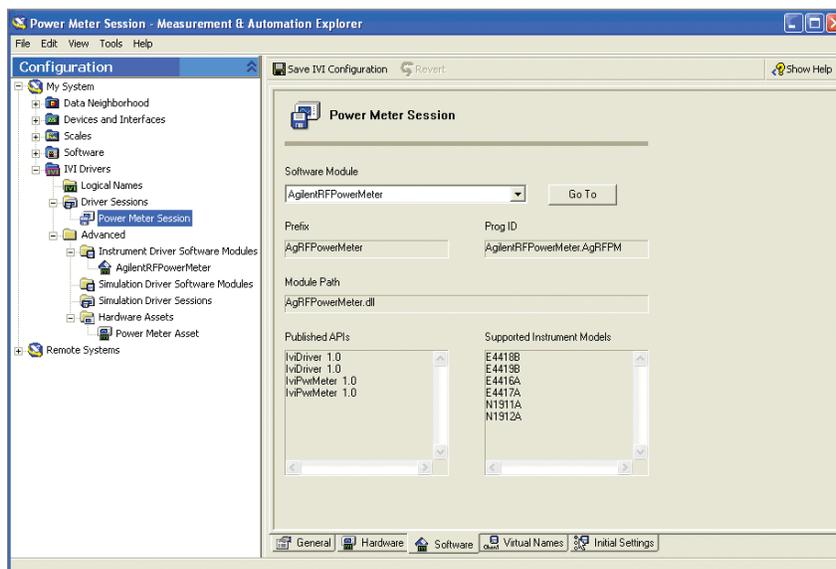
Figure 22. IVI driver session software configuration tab

IVI Logical Names

IVI Logical Names are the final IVI layer to be configured. This is the name that will be sued by the IVI-based VRMK to access the underlying IVI instrument.

Creating the IVI logical name

To create a new IVI logical name, right-click on the "Logical Names" folder and select the "Create New (case-sensitive)..." item.

This will create a new entry under the Hardware Assets folder of NI-MAX.

Renaming the IVI logical name

After the logical name is created, it can be renamed to something more appropriate. The figure below shows a new logical name entry which has been renamed to "Power Meter".
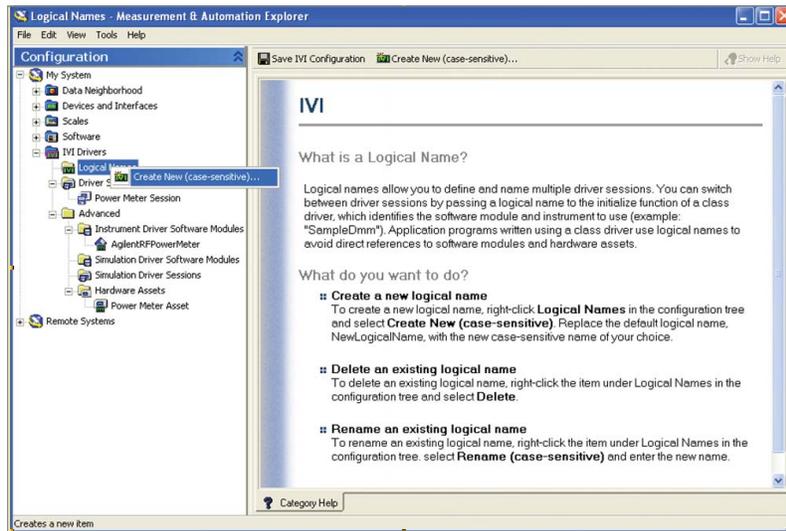

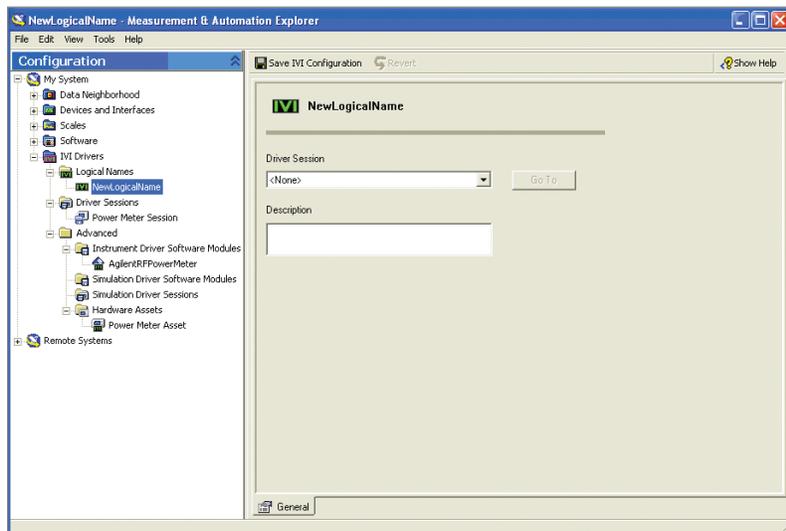**Figure 23. Create new logical name menu item**

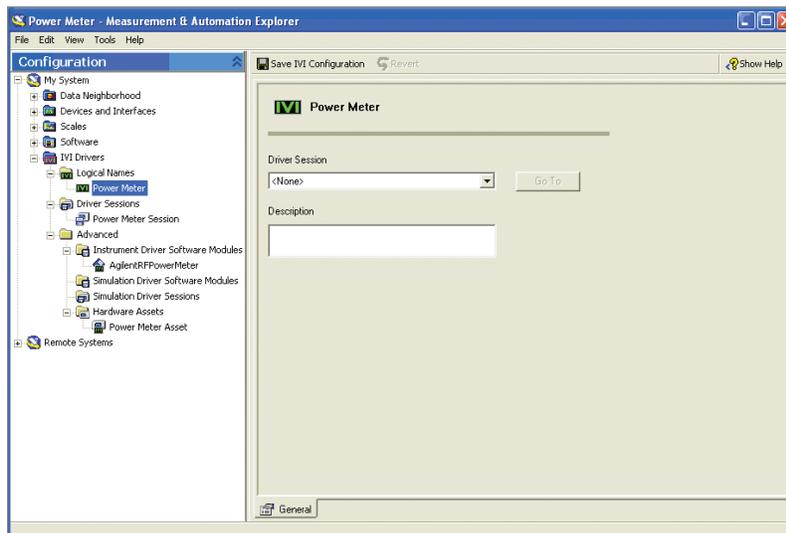**Figure 24. New logical name entry**

Figure 25. Renamed IVI logical name

Assigning the IVI logical name to a driver session

In the "General" configuration tab of the "Power Meter" logical name, the "Driver Session" combo box should be set to the driver session of the instrument. When it is selected, the "Description" text box will automatically change to correspond to the session.

Boot Parameter Setup in the Virtual Rack®

This section will describe how to set the bootup parameters when mounting the IVI VRMK in the Virtual Rack®. Refer to the Virtual Rack® Quick Start Guide or the Virtual Rack® Explorer Manual for standard mounting instructions.

Parameter setup for IVI-based VRMK's

Following the example with the Agilent E4419B Power Meter, the following Boot Parameters dialog will appear after clicking "Mount" on the VR Storeroom entry for the E4419B power meter:

Simulate boot parameter
The Simulate boot parameter determines whether the VRMK connects to the device or runs in software simulation mode without trying to connect to the device. If Simulate is set to TRUE, then none of the other boot parameters need to be filled in.
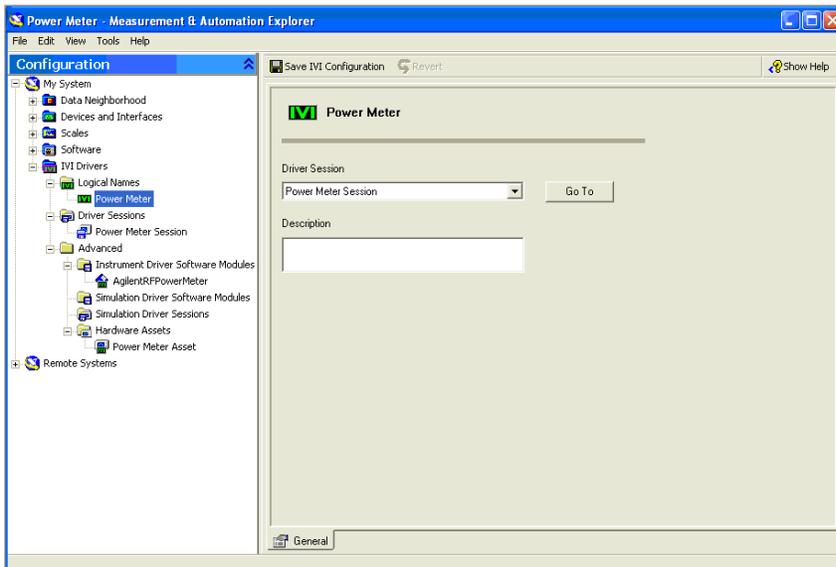

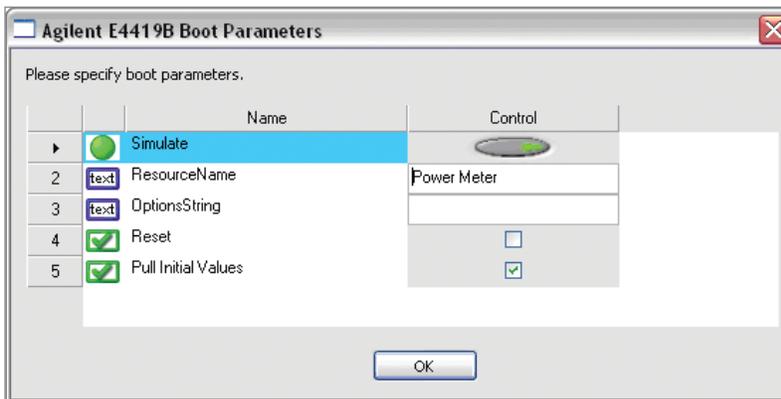**Figure 26. IVI logical name general configuration tab**

Figure 27. IVI based VRMK boot parameters

ResourceName boot parameter
The ResourceName boot parameter is where you enter the IVI Logical Name for this piece of equipment. The IVI Logical Name was configured in IVI in one of the previous sections of this application note.

OptionsString boot parameter
 The OptionsString boot parameter should be set to any additional options that may be needed by the instrument driver in order to connect to the device. The current example with the Agilent E4419B power meter does not require additional options. However, some switches may require them in order to determine switch topologies.

Reset boot parameter
The Reset boot parameter determines whether the VRMK should reset the device once it connects to it.

Pull Initial Values Boot Parameter
The Pull Initial Values boot parameter determines whether the VRMK should pull initial values of all of a device's properties. Various devices may not always support the entire set of IVI-defined properties which would result in error messages in the Virtual Rack Tricorder when initial values are pulled. Various devices may have so many properties that pulling initial values will require a significant amount of time.

Additional Resources

Below are references to additional resources you can use for additional information about the Virtual Rack. They can be downloaded from the Virtual Rack website.

Manuals

1) Installation Manual
2) Quick Start Guide
3) Virtual Rack Explorer Manual
4) Virtual Rack Service Manuals
a. VR Bounds Service
b. VR History Service
c. VR State Service
d. VR TestStand Service
e. VR Tricorder Service
f. VR Subscription Service
g. VR Mnemonic Service
h. VR Telemetry Service

Web site

The Virtual Rack website is located at http://www.agilent.com/find/virtualrack. The website contains tutorials, demos, white papers and other information to assist you.

Contact

Technical support
Virtual Rack Technical Support can be reached via any of the following:

Phone: United States hours: 9:00 a.m. to 5:00 p.m. MST, Monday through Friday
(970) 679-3889 phone

Email: support_virtualrack@agilent.com

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LXI

www.lxistandard.org
LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

Lightwave component analyzer online information:
www.agilent.com/find/lca

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Finland	358 (0) 10 855 2100
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	**0.14€/minute
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