



Agilent M9360A PXI Attenuator/Preselector 100 kHz to 26.5 GHz



Service Guide

Version 1.0.0



Agilent Technologies

Notices

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Sales and Technical Support

To contact Agilent for sales and technical support, refer to the “support” links on the following Agilent web resources:

- www.agilent.com/find/M9360A (product-specific information and support, software and documentation updates)
- www.agilent.com/find/M9392A (product-specific information and support, software and documentation updates)
- www.agilent.com/find/assist (worldwide contact information for repair and service)

Information on preventing damage to your Agilent equipment can be found at www.agilent.com/find/tips.

Regulatory Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. To review the Declaration of Conformity, go to <http://regulations.corporate.agilent.com/DoC/search.htm>.

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Safety Notices

The following safety precautions should be observed before using this product and any associated instrumentation.

This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product.

WARNING

If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.

The types of product users are:

- **Responsible body** is the individual or group responsible for the use and maintenance of equipment, for ensuring that the equipment is operated within its specifications and operating limits, and for ensuring operators are adequately trained.
- **Operators** use the product for its intended function. They must be trained in electrical safety procedures and proper use of the instrument. They must be protected from electric shock and contact with hazardous live circuits.
- **Maintenance personnel** perform routine procedures on the product to keep it operating properly (for example, setting the line voltage or replacing consumable materials). Maintenance procedures are described in the user documentation. The procedures explicitly state if the operator may perform them. Otherwise, they should be performed only by service personnel.
- **Service personnel** are trained to work on live circuits, perform safe installations, and repair products. Only properly trained service personnel may perform installation and service procedures.

Agilent products are designed for use with electrical signals that are rated Measurement Category I and Measurement Category II, as described in the International Electrotechnical Commission (IEC) Standard IEC 60664. Most measurement, control, and data I/O signals are Measurement Category I and must not be directly connected to mains voltage or to voltage sources with high transient over-voltages. Measurement Category II connections require protection for high transient over-voltages often associated with local AC mains connections. Assume all measurement, control, and data I/O connections are for connection to Category I sources unless otherwise marked or described in the user documentation.

Exercise extreme caution when a shock hazard is present. Lethal voltage may be present on cable connector jacks or test fixtures. The American National Standards Institute (ANSI) states that a shock hazard exists when voltage levels greater than 30V RMS, 42.4V peak, or 60VDC are present. A good safety practice is to expect that hazardous voltage is present in any unknown circuit before measuring.

Operators of this product must be protected from electric shock at all times. The responsible body must ensure that operators are prevented access and/or insulated from every connection point. In some cases, connections must be exposed to potential human contact. Product operators in these circumstances must be trained to protect themselves from the risk of electric shock. If the circuit is capable of operating at or above 1000V, no conductive part of the circuit may be exposed.

Do not connect switching cards directly to unlimited power circuits. They are intended to be used with impedance-limited sources. NEVER connect switching cards directly to AC mains. When connecting sources to switching cards, install protective devices to limit fault current and voltage to the card.

Before operating an instrument, ensure that the line cord is connected to a properly-grounded power receptacle. Inspect the connecting cables, test leads, and jumpers for

possible wear, cracks, or breaks before each use.

When installing equipment where access to the main power cord is restricted, such as rack mounting, a separate main input power disconnect device must be provided in close proximity to the equipment and within easy reach of the operator.

For maximum safety, do not touch the product, test cables, or any other instruments while power is applied to the circuit under test. ALWAYS remove power from the entire test system and discharge any capacitors before: connecting or disconnecting cables or jumpers, installing or removing switching cards, or making internal changes, such as installing or removing jumpers.

Do not touch any object that could provide a current path to the common side of the circuit under test or power line (earth) ground. Always make measurements with dry hands while standing on a dry, insulated surface capable of withstanding the voltage being measured.

The instrument and accessories must be used in accordance with its specifications and operating instructions, or the safety of the equipment may be impaired.

Do not exceed the maximum signal levels of the instruments and accessories, as defined in the specifications and operating information, and as shown on the instrument or test fixture panels, or switching card.

When fuses are used in a product, replace with the same type and rating for continued protection against fire hazard.

Chassis connections must only be used as shield connections for measuring circuits, NOT as safety earth ground connections.

If you are using a test fixture, keep the lid closed while power is applied to the device under test. Safe operation requires the use of a lid interlock.

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A **WARNING** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a **WARNING** notice until the indicated conditions are fully understood and met.

Instrumentation and accessories shall not be connected to humans.

Before performing any maintenance, disconnect the line cord and all test cables.

To maintain protection from electric shock and fire, replacement components in mains circuits – including the power transformer, test leads, and input jacks – must be purchased from Agilent. Standard fuses with applicable national safety approvals may be used if the rating and type are the same. Other components that are not safety-related may be purchased from other suppliers as long as they are equivalent to the original component (note that selected parts should be purchased only through Agilent to maintain accuracy and functionality of the product). If you are unsure about the applicability of a replacement component, call an Agilent office for information.

WARNING

No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers. For continued protection against fire hazard, replace fuse with same type and rating.

PRODUCT MARKINGS:



The CE mark is a registered trademark of the European Community.



The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.



This symbol indicates product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001). It also identifies the product is an Industrial Scientific and Medical Group 1 Class A product (CISPR 11, Clause 4).



This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).



This symbol on an instrument means caution, risk of danger. You should refer to the operating instructions located in the user documentation in all cases where the symbol is marked on the instrument.



This symbol indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.



This symbol indicates the instrument is sensitive to electrostatic discharge (ESD). ESD can damage the highly sensitive components in your instrument. ESD damage is most likely to occur as the module is being installed or when cables are connected or disconnected. Protect the circuits from ESD damage by wearing a grounding strap that provides a high resistance path to ground. Alternatively, ground yourself to discharge any built-up static charge by touching the outer shell of any grounded instrument chassis before touching the port connectors.

CLEANING PRECAUTIONS:

WARNING

To prevent electrical shock, disconnect the Agilent Technologies instrument from mains before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally. To clean the connectors, use alcohol in a well-ventilated area. Allow all residual alcohol moisture to evaporate, and the fumes to dissipate prior to energizing the instrument.

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Service Guide Introduction

This document is intended for use by Agilent Service Centers and by self-maintaining customers.

Structure of This Document

- [Getting Started](#) (page 9): Use this section to make sure you have the module installed (software and hardware) as a prerequisite for conducting diagnostic tests.
- [High-Level Diagnostic Tools, Processes and References](#) (page 15): This section provides high-level tools, processes, and references to help you diagnose problems with your module). The procedures and tools noted in this section do not validate performance to published, factory-set specifications; to verify performance to these specifications, see the Performance Verification Tests section.
- [Performance Verification Tests](#) (page 22): These tests are designed to provide the highest level of confidence that the module being tested conforms to published, factory-set [specifications](#). If the module is unable to pass any of the performance tests, you may need to exchange the defective module (see [Module Core Replacement](#) (page 36).
- [Service](#) (page 35): This section provides reference information and procedures to help you service your Agilent M9360A, including the replaceable parts list, module core replacement instructions, and a [Test Record Card](#) (page 40) you can use to record your performance test findings.

Related Documentation

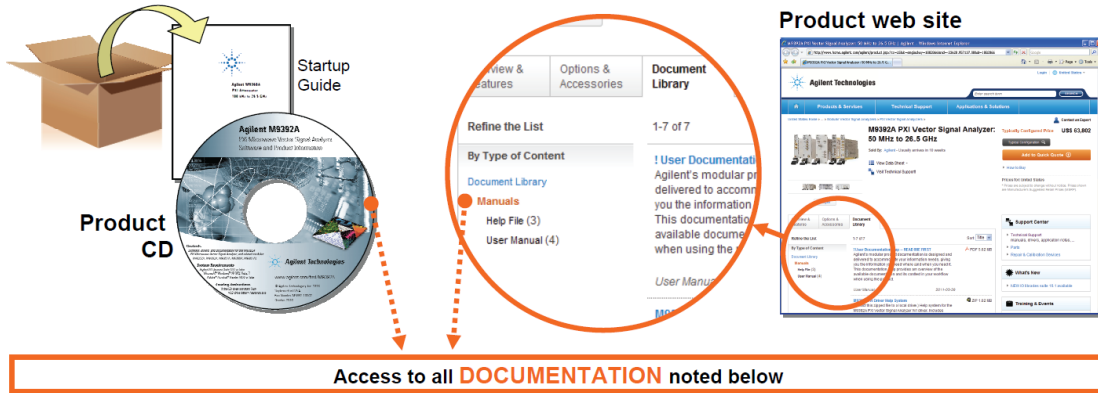
In addition to this Service Guide, the related documentation for the M9360A module includes:

- **Startup Guide:** Provides instructions to unpack, inspect, install (software and hardware), perform instrument connections, verify operability, and troubleshoot problems. The key elements from the Startup Guide are duplicated in this Service Guide's [Getting Started](#) material (see page 9) for your convenience.
- **Data Sheet:** In addition to a detailed product introduction, the data sheet supplies full product specifications.
- **Soft Front Panel (SFP) help system:** Provides product introduction, tour of the SFP user interface, how-to procedures (for example, configuration, self test, operational check), and troubleshooting.
- **IVI Driver reference (help system):** Provides detailed documentation of the IVI-COM and IVI-C driver API functions, as well as information to help you get started with using the IVI drivers in your application development environment.
- **LabVIEW Driver reference (help system):** Provides detailed documentation of the LabVIEW G driver API functions.

If you ran the product software installer on your PC, you can access the related documentation (startup guide, data sheet, SFP help, and LabVIEW help) from **Start > Programs > Agilent > M9392**. The IVI driver help is accessed from **Start > Programs > Agilent IVI Drivers > AgM9360**.

All of the product's documentation noted above is provided on the product CD. To find the very latest versions of the user documentation, go to the product web site (www.agilent.com/find/M9360A) and download the files from the Manuals list (go to **Document Library > Manuals**).

Documentation Map



Startup Guide



- Unpack product
- Verify shipment
- Install software
- Install & connect hardware
- Verify operation
- Troubleshooting

Data Sheet



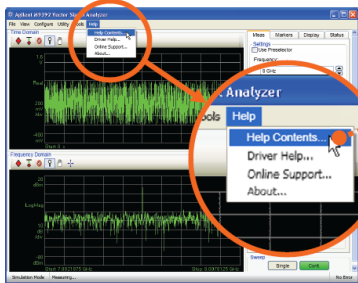
- Product description
- Technical specifications

Service Guide

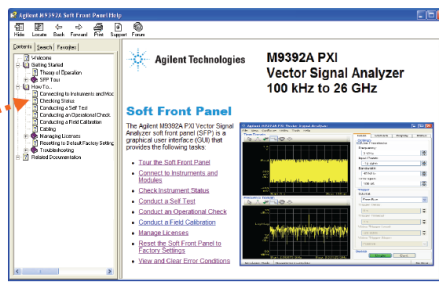


- Diagnostic tools, troubleshooting
- Replaceable parts
- Assembly/disassembly
- Performance verification tests
- Test results form

Soft Front Panel (SFP) user interface

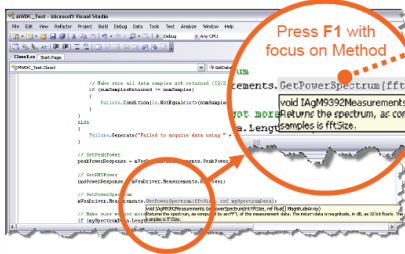


SFP help system

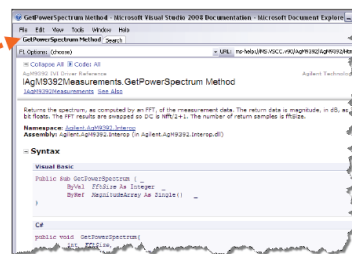


- Theory of operation
- Block diagram
- Configuration
- Self test
- Operational check
- Field calibration
- Troubleshooting

Visual Studio

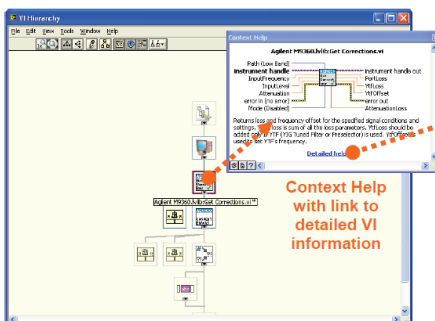


IVI Driver help system

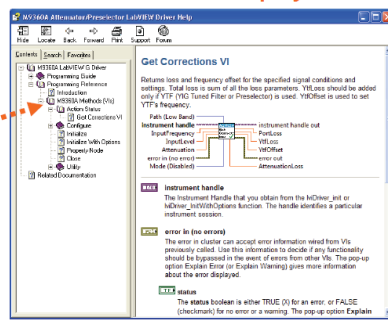


- IVI-COM and IVI-C driver programmer's reference
- Sample programs

LabVIEW



LabVIEW Driver help system



- LabVIEW driver programmer's reference
- Sample programs

Getting Started

NOTE

Much of this material, although found in the Startup Guide, is available for your convenience to make sure the module and software are properly installed as a prerequisite for conducting diagnostic procedures – see [High-Level Diagnostic Tools, Processes and References](#) (page 15) and [Performance Verification Tests](#) (page 22).

In this section:

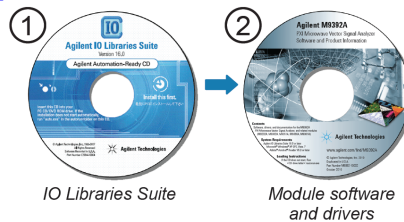
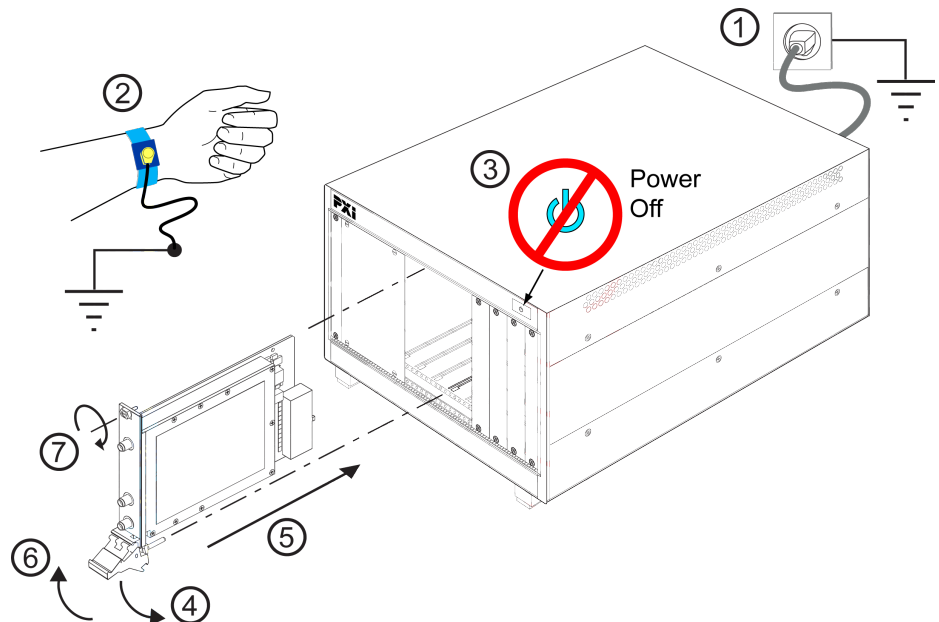
- [Follow the Startup Sequence](#) (page 9)
- [Step 1: Unpack and Inspect the Module](#) (page 10)
- [Step 2: Install the Software](#) (page 10)
- [Step 3: Install the Module](#) (page 12)

Follow the Startup Sequence

WARNING

Closely follow the startup process flow in this document. Deviating from the sequence can cause unpredictable system behavior, damage your system, and may cause personal injury.

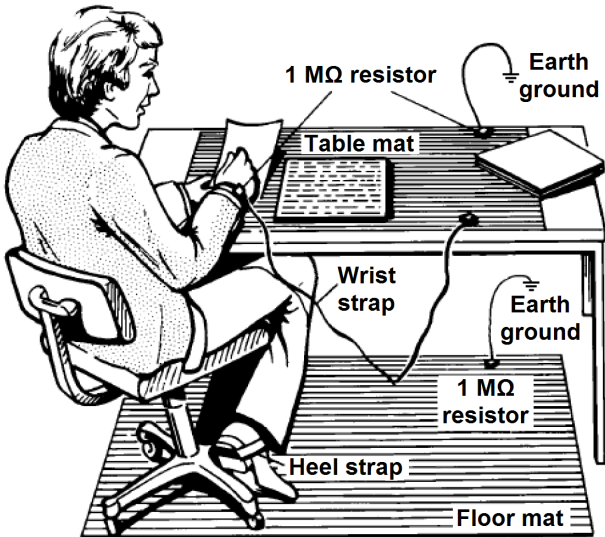
Step 1: Unpack and Inspect

Step 2: Install Drivers and Software

Step 3: Install Module


Step 1: Unpack and Inspect the Module

CAUTION The module is shipped in materials which prevent damage from static. The module should only be removed from the packaging in an anti-static area ensuring that correct anti-static precautions are taken. Store all modules in anti-static envelopes when not in use.

ESD



Electrostatic discharge (ESD) can damage or destroy electronic components. Use a static-safe work station to perform all work on electronic assemblies. The figure (left) shows a static-safe work station using two types of ESD protection: conductive table-mat and wrist-strap combination, and conductive floor-mat and heel-strap combination. Both types, when used together, provide a significant level of ESD protection. Of the two, only the table-mat and wrist-strap combination provides adequate ESD protection when used alone. To ensure user safety, the static-safe accessories must provide at least 1 MΩ of isolation from ground.

WARNING DO NOT use these techniques for a static-safe work station when working on circuitry with a voltage potential greater than 500 volts.

Step 2: Install the Software

System Requirements

Topic	Requirements	
Operating system	Window XP, Service Pack 3	Windows Vista®, SP1 and SP2 (32-bit and 64-bit), Windows 7 (32 bit and 64 bit)
Processor speed	600 MHz or higher required 800 MHz recommended	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64
Available memory	256 MB minimum (1 GB or greater recommended)	1 GB minimum
Available disk space ¹	1.5 GB available hard disk space, includes: <ul style="list-style-type: none"> • 1 GB available for Microsoft .NET Framework 3.5 SP1 ² • 100 MB for Agilent IO Libraries Suite 	
Video	Super VGA (800x600) 256 colors or more	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)
Browser	Microsoft Internet Explorer 6.0 or greater	Microsoft Internet Explorer 7.0 or greater

¹ This is the required disk space for installation. Typically, less disk space is required for operation than is required for installation.

² .NET Framework Runtime Components are installed by default with Windows Vista. Therefore, you may not need this amount of disk space.

Hardware Requirements

Topic	Requirements
Chassis	cPCI(J1), PXI-1, or PXIe hybrid chassis slot.
PXIe system/ host controller	A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis via a PCI-to-PXI interface) is required.
Embedded controller	Agilent M9036A or an embedded controller that meets the following requirements: <ul style="list-style-type: none"> PXIe system controller (PXI-1 embedded controllers are not compatible) Utilize a 2x8, 4x4, or 1x4 PXIe system slot link configuration. Run one of the operating systems listed in System Requirements (above).
Remote controller	(for Agilent M9018A chassis use only) Agilent M9021 Cable Interface x8 with one of the following PC interface options: <ul style="list-style-type: none"> Agilent M9045 PCIe ExpressCard Adaptor x1, with cable (for a laptop PC) Agilent M9047 PCIe Desktop Adaptor x8, with cable (for desktop PCs) Or an equivalent remote controller using a PC running one of the operating systems listed in System Requirements (above).

Power up the Controller

CAUTION

If you are using a remote controller and you have installed the interface cable, you must power up the chassis **BEFORE** you power up the PC. When you power down your chassis, Shut Down the PC **BEFORE** you power down the chassis.

- If you are using an embedded controller, complete the following steps:
- Install the embedded controller module into the compatible chassis. The Agilent M9036A PXIe Embedded Controller and Agilent M9018A PXIe Chassis are recommended. Please refer to the embedded controller and chassis documentation for further details.
- Connect peripherals (mouse, keyboard, monitor).
- Power up the chassis.

Install the Software

This installation includes the following:

- Agilent IO Libraries Suite (IOLS), which includes the Agilent Connections Expert. This software is included with your shipment (CD part number E2904-60003), and is also available at www.agilent.com/find/iosuite. This software must be installed first.

NOTE

Version 16.0 (or newer) of the Agilent IO Libraries Suite is required.

- Instrument software, which includes the SFP, device drivers (IVI-C, IVI-COM, and LabVIEW G) and documentation for all modules and for the M9392A Vector Signal Analyzer. This software is included with your shipment (CD part number M9392-10002), and is also available at www.agilent.com/find/M9392A.

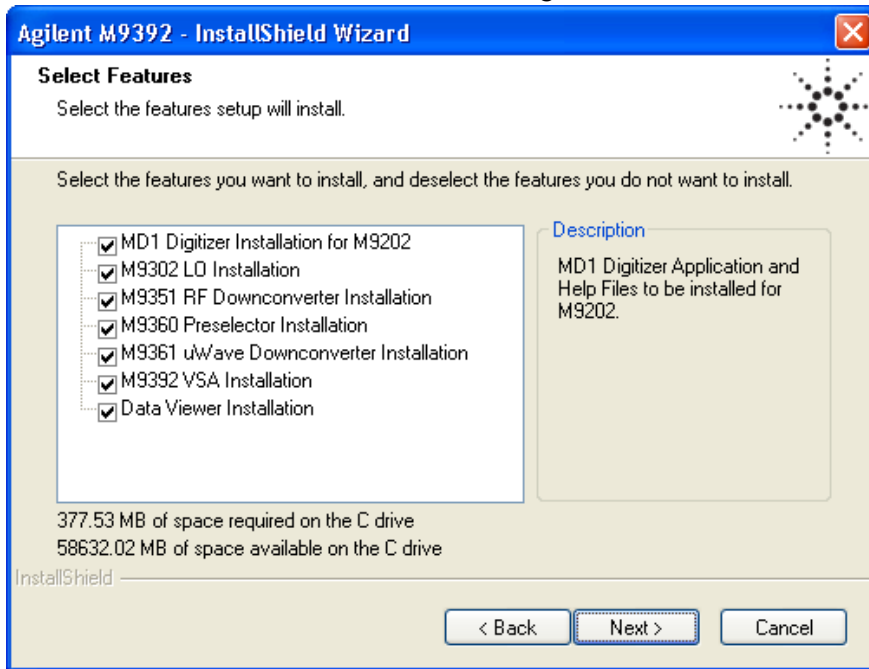
NOTE

Each module has unique device drivers, soft front panel software and documentation. Performing the software installation offers the opportunity to install software components for one or more of the available modules: Agilent M9202A, M9302A, M9351A, M9360A and M9361A. Notice in the figure following Step 4, the software components for the Agilent M9202A PXIe IF Digitizer are called "MD1 Digitizer Installation for M9202".

Step 3: Install the Module

Software Installation Procedure

1. From the Agilent IOLS CD (E2904-60003) browser launch the installer.
2. Follow the installer prompts to install the IO libraries.
3. From the M9392A PXI Vector Signal Analyzer Software and Product Information CD. (M9392-10002) launch the installer.
4. Follow the installer prompts. Choose a "Complete" installation to install all software and documentation, or a "Custom" installation to select from a listing of modules and other features.



5. After installation is complete, power down the host PC, and then the chassis if using a remote controller.

CAUTION

If you are using a remote controller, Shut Down the PC **BEFORE** you power down the chassis. When you restore power, power up the chassis **BEFORE** you power up the PC.

Step 3: Install the Module

CAUTION

PXI hardware does not support "hot-swap" capabilities (changing modules while power is applied to the chassis). Before installing or removing a module to/from the chassis, power off the chassis to prevent damage to the module.

NOTE

This module can be used in a chassis with cPCI(J1), PXI-1, or PXIe hybrid slots.

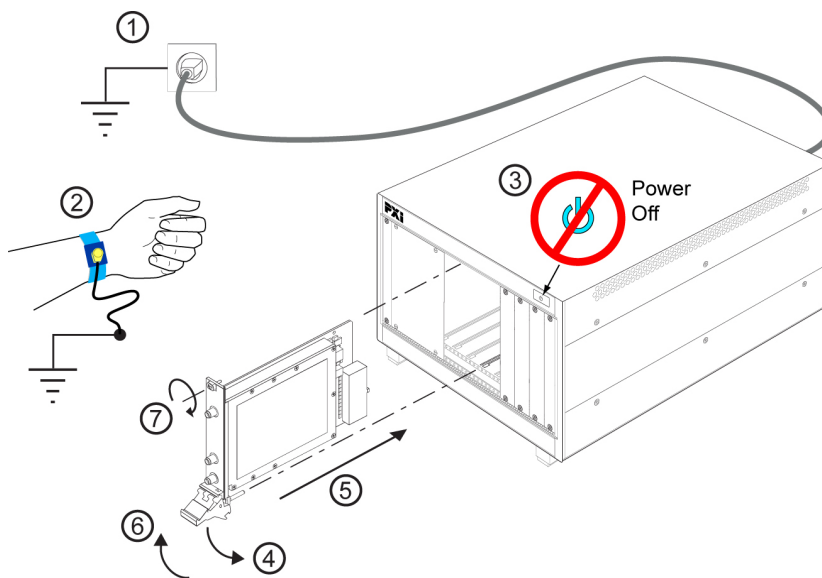
3

The module can be installed in any standard PXI slot marked with a peripheral slot compatibility image (a circle containing the slot number).

7^H

The module can also be installed in any hybrid PXI slot marked with a peripheral slot compatibility image (the letter "H" and a solid circle containing the slot number).

1. Make sure that the line cord is plugged in to establish earth ground and that the chassis power switch is in the Off (Standby) position.
2. If the chassis has multiple fan speed settings, ensure that the fans are set to automatic.
3. Position the chassis so that there is ample space between the chassis fan intake and exhaust vents. Blockage by walls or obstructions affects the air flow needed for cooling. (Refer to the chassis documentation for more information about cooling).
4. Before installing a module, be sure to remove the plastic thread protectors from the mounting screws. Before inserting the module into the chassis, back the mounting screws out to ensure that there is no interference between the screws and the mounting rails.
5. Holding the module by the injector/ejector handle, slide it into an available PXI (or hybrid) slot, as shown in the figure below.
 - a. Install the module into the PXI slot of the chassis by placing the module card edges into the front module guides (top and bottom).
 - b. Slide the module to the rear of the chassis and ensure that the injector/ejector handle is pushed down in the unlatched (downward) position.
 - c. Slide the module completely into the chassis. When you begin to feel resistance, pull up on the injector/ejector handle to fully inject the module into the chassis.



6. Secure the front panel to the chassis using the two module front-panel mounting screws. Performance may suffer if the screws are not tightened properly.
7. Verify that the PXI chassis fans are operable and free of dust and other contaminants that may restrict airflow.
8. Install all filler panels after installing the module. Missing filler panels may disrupt necessary air circulation in the chassis.
9. If you are using a PCIe Cable Interface, such as the Agilent M9021, connect the Cable Interface in the chassis to the PC host per the instructions that came with the Cable Interface.
10. Power up the PXI chassis.
11. Reboot the PC host.
12. Run the module soft front panel (SFP) software, this initializes the module.
13. Check the status LEDs on the module front panel.

Agilent M9360A PXI Attenuator/Preselector Front Panel Features

CAUTION

The maximum input to the RF input connector (RF IN) must not exceed +30 dBm.



Front Panel Connectors

Connector	Description
RF IN	This APC 3.5 mm female connector inputs a signal (100 kHz to 26.5 GHz) that can be attenuated and be directed to either the RF 1 OUT connector or the RF 2 OUT connector.
RF 1 OUT	This SMA female connector supplies an output signal (100 kHz to 2.9 GHz) to the RF IN connector of the Agilent M9351A PXI Downconverter.
RF 2 OUT	This SMA female connector supplies an output signal (2.75GHz to 26.5 GHz) to the RF IN connector of the Agilent M9361A PXI Downconverter.
LO IN	This SMA female connector receives the LO signal from the Agilent M9302A Local Oscillator. This LO signal is then internally switched to the LO 1 OUT or LO 2 OUT connector.
LO 1 OUT	This SMA female connector provides the LO signal to the Agilent M9351A PXI Downconverter.
LO 2 OUT	This SMA female connector provides the LO signal to the Agilent M9361A PXI Downconverter.

Front Panel LEDs

NOTE

The front panel LED behavior is valid only when the soft front panel (SFP) is running.

LED	Description
STATUS	<p>This LED indicates the overall health of the M9360A and is a summary of the following LEDs, covering the power supplies and other hardware operations. The M9360A has extensive built-in-test (BIT) and specific issues can be identified by observing the status indicator on the front panel. This LED has four possible states:</p> <ul style="list-style-type: none"> • Green = Power supplies are operational and in specification. It also indicates that all module hardware is operational. • Amber = Power supplies are operational and in specification, but there is a hardware failure. • Red = Power supply failure and a hardware failure. • Off = Power supply failure, but the other module hardware appears to be functional. Since a power supply failure can mask other hardware problems, this is not an indication that only a power supply could be at fault.
ACCESS	Each time the module is written to, or read from, this amber LED blinks.

High-Level Diagnostic Tools, Processes and References

This section provides high-level tools, processes, and references to help you diagnose problems with your module).

NOTE

The procedures and tools noted in this section do not validate performance to published, factory-set specifications ("hard specs"). To verify performance to hard specs, see "[Performance Verification Tests](#)" on page [22](#).

NOTE

Before attempting to diagnose the Agilent M9360A, make sure you have followed the necessary startup instructions (see "[Getting Started](#)" on page [1](#)).

In this section:

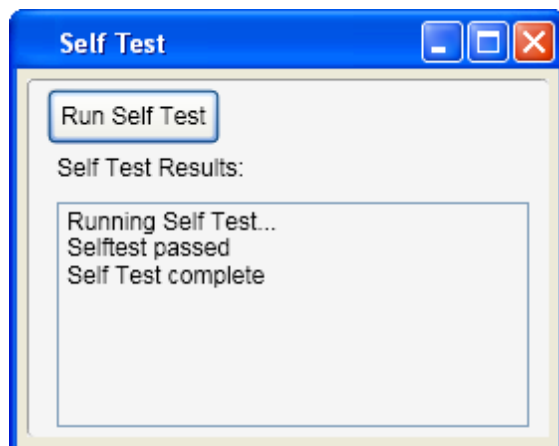
- [Specifications](#) (page [15](#))
- [Self Test](#) (page [15](#))
- [Hardware Status Display](#) (page [16](#)) – Soft Front Panel feature
- [Front Panel LEDs](#) (page [17](#))
- [Block Diagram](#) (page [17](#))
- [Operational Check](#) (page [18](#))

Specifications

The Data Sheet for the is included on the Agilent M9392A VSA Software and Product Information CD that came with your module. This document contains specification information. To find the latest update, go to <http://cp.literature.agilent.com/litweb/pdf/5990-6057EN.pdf>.

Self Test

The Soft Front Panel (SFP) provides a self test utility to verify power and perform an internal check of module sub-components. To access the SFP, go to **Start > All Programs > Agilent > M9392 > M9360 SFP**. To conduct the self test from the SFP, go to **Utility > Self Test...**, and then click the Run Self Test button.



Hardware Status Display

The Soft Front Panel (SFP) displays the module's hardware status. To access the SFP, go to **Start > All Programs > Agilent > M9392 > M9360 SFP**. The status is automatically updated once every five seconds. The status can also be manually updated by a refresh (**View > Refresh**).

- **Temperature** – the temperature value that is displayed indicates the internal real-time ambient temperature of the module in degrees Celsius.
- **Voltage** – the +12 V, +5 V, +3.3 V, and -12 V power supplies display as green when they are functioning and within tolerance.
- **Self Test** – the word "Pass" along with a green background color indicates that the module's self test passed. If the self test fails, the word "Fail" is displayed and the background color turns red.

Hardware Status	
Step Attenuator:	40 dB
Preselector	Temperature: 37.8
Enabled:	YES
Frequency:	8 GHz
RF Path:	2 (High-band)
Estimated Loss	Voltage: +12 +5 +3.3 -12
Port Loss:	0.30 dB
Preselector Loss:	1.20 dB
Attenuator Loss:	42.10 dB
Total Loss:	43.60 dB
	Self Test: Pass
	Serial #: 12345678

- **Serial #** – the module's serial number is displayed.
- **Estimated Loss**
 - **Port Loss** – displays the estimated amount of loss that occurs through the RF IN port connector.
 - **Preselector Loss** – displays the estimated loss that occurs through the YTF preselector filter path.
 - **Attenuator Loss** – displays the estimated loss that occurs through the step attenuator path.
 - **Total Loss** – displays the sum of the estimated Port Loss, Preselector Loss, and Attenuator Loss.
- The values for **Step Attenuator**, Preselector (**Enabled** and **Frequency**), and **RF Path** reflect the settings you've made in the SFP interface. For reference, refer also to the [Block Diagram](#) (page 17).

Front Panel LEDs

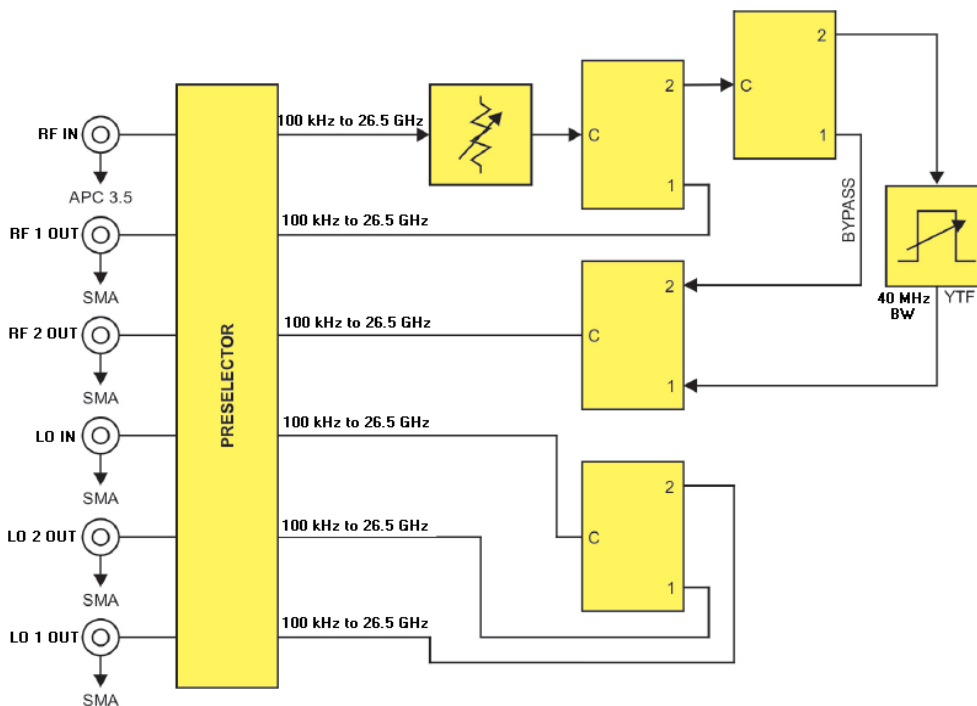
NOTE

The front panel LED behavior is valid only when the soft front panel (SFP) is running.



LED	Description
STATUS	<p>This LED indicates the overall health of the M9360A and is a summary of the following LEDs, covering the power supplies and other hardware operations. The M9360A has extensive built-in-test (BIT) and specific issues can be identified by observing the status indicator on the front panel.</p> <p>This LED has four possible states:</p> <ul style="list-style-type: none"> • Green = Power supplies are operational and in specification. It also indicates that all module hardware is operational. • Amber = Power supplies are operational and in specification, but there is a hardware failure. • Red = Power supply failure and a hardware failure. • Off = Power supply failure, but the other module hardware appears to be functional. Since a power supply failure can mask other hardware problems, this is not an indication that only a power supply could be at fault.
ACCESS	<p>Each time the module is written to, or read from, this amber LED blinks.</p>

Block Diagram



Operational Check

NOTE

This operational check procedure is used for high-level troubleshooting – a rough diagnostic to ascertain if the module is functioning properly. You do not have to conduct the operational check if you conduct the [Performance Verification Tests](#) (see page [22](#)).

Requirements for Operational Check

The Agilent M9360A PXI Attenuator/Preselector operational check measures the signal paths from the RF IN connector to the RF 1 OUT and RF 2 OUT connectors. The following process demonstrates that all associated switches, connectors, cables and circuitry are operational. The signal paths from the LO IN connector to the LO 1 OUT and LO 2 OUT connectors are also measured.

Required Hardware

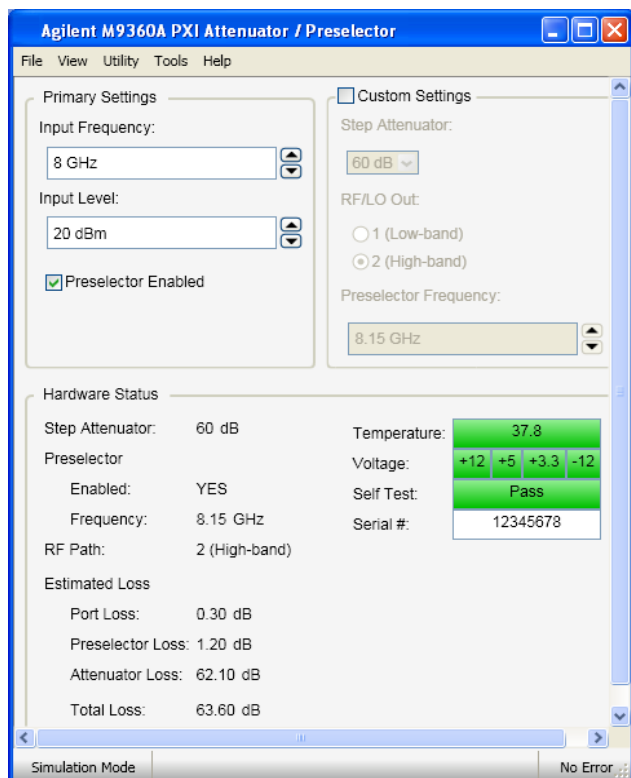
To demonstrate that the module works properly requires external equipment. This includes a precision microwave source and a power meter. You will not be using the module interconnect cables, so some high-quality flexible 3.5 mm cables will be required, plus adaptors to connect the PSG (precision signal generator) and power sensors to 3.5 mm connectors. Please refer to the following table for recommended hardware.

Hardware	Description
Agilent E8257D-532 or E8267D-532	Precision Signal Generator 31.8 GHz
Agilent N1913A or N1914A	Single / Dual Channel Power Meter
Agilent N8485A, Option 100	10 MHz to 26.5 GHz Power Sensor
Agilent 11730A	Power Sensor Cable
Agilent 11667B	Power Splitter
Agilent N9020A-526	Signal Analyzer (optional)

M9360A Operational Check Procedure

NOTE

To use a single power meter in place of two power meters and sensors, characterize the PSG output power at the different frequencies and then connect the PSG output directly to the M9360A RF IN. Connect the power sensor to the outputs listed in the procedure below.

**CAUTION**

Do not exceed the maximum power level to the RF IN connector (+30 dBm).

1. Run the M9360A soft front panel (SFP).
2. Conduct a Self Test (**Utility > Self Test... > Run Self Test**).
 - a. If self test passes, go to next step.
 - b. If self test fails, the module needs repair.
3. Disconnect cables from RF IN, RF 1 OUT, RF 2 OUT, LO IN, LO 1 OUT, and LO 2 OUT
4. Under Primary Settings:
 - a. Deselect Preselector Enabled to remove the YTF and place the M9360A in “bypass” mode (click inside the small square to remove the check mark).
 - b. Set the Input Level to 0 dBm.
5. Select Custom Settings (click inside the small square and a check mark appears).
 - a. Set the step attenuator to 0 dB.
 - b. Verify that RF/LO Out 2 (high band) is selected.
6. Set the PSG output to:
 - a. 0 dBm
 - b. 3 GHz
 - c. RF ON
 - d. Modulation OFF

Operational Check

7. Connect the PSG RF OUTPUT to
 - a. The power splitter input.
 - b. Connect a power sensor to one power splitter output.
 - c. Connect the other power splitter output to the M9360A RF IN.
 - d. Connect the second power sensor to RF 2 OUT.
8. Step the PSG frequency from 3 GHz to 26.5 GHz in 500 - MHz steps
9. The delta between the power meter readings should be ≤ 7 dB maximum loss between RF IN and RF 2 OUT at each frequency.
10. Using the M9360A SFP, under Custom Settings:
 - a. Increase the attenuation to 10 dB.
 - b. The power meter reading on the RF 2 OUT connector should drop approximately 10 dBm.
 - c. Continue increasing attenuation in 10 dB steps to 20 dB, and 30 dB. Verify that the RF 2 OUT power decreased approximately 10 dB with each step.
11. Deselect Custom Settings (click inside the small square and the check mark disappears).
12. Under Primary Settings:
 - a. Set the Input Frequency to 3 GHz.
 - b. Select Preselector Enabled (click inside the small square and a check mark appears).
 - c. Set the Input Level to -40 dBm (this sets the Preselector internal attenuator to 0 dB).
13. Step the PSG frequency from 3 GHz, to 26.5 GHz in 500 - MHz steps and set the Input Frequency to the same frequency as the PSG. If the frequency is in italics, press the keyboard return key.
 - a. The delta between the power meter readings should be ≤ 12 dB maximum loss between RF In and RF 2 OUT at each frequency.
 - b. Deactivate Preselector Enabled (click inside the small square and the check mark disappears).
14. Under Primary Settings:
 - a. Set the Input Frequency to 2 GHz.
 - b. Move the power sensor from RF 2 OUT to RF 1 OUT.
 - c. Set the PSG to 0 dBm, 100 MHz, RF ON, Modulation OFF.
 - d. Step the frequency from 100 MHz to 3 GHz in 500 - MHz steps.
 - e. The delta between the power meter readings should be ≤ 2 dB maximum loss between the RF IN and RF 1 OUT.
15. Under Primary Settings; set the Input Frequency to 5 GHz
16. On the PSG:
 - a. Set the power to 0 dBm, frequency to 3 GHz, RF- ON, Modulation - Off.
 - b. Move the cable from the RF IN to LO IN.
 - c. Move the power sensor from RF 1 OUT to LO 2 OUT.
 - d. Step the PSG frequency from 3 GHz to 10 GHz in 500 - MHz steps.
 - e. The delta in power between LO IN and LO 2 OUT should be ≤ 1 dB.

17. Under Primary Settings:
 - a. Set the Input Frequency to 2 GHz.
 - b. Move the power sensor from LO 2 OUT to LO 1 OUT.
 - c. Step the PSG frequency from 3 GHz to 10 GHz in 500 - MHz steps.
 - d. The delta in power between LO IN and LO 1 OUT should be ≤ 1 dB.
18. If all measurements are correct the module is working properly, if not the module requires servicing.

If a Problem is Found

If a problem is found, do the following checks:

1. Verify that all relevant hardware is turned on.
2. Verify that the signal generator is set to the proper power/frequency and that all cables are properly connected. All SMA connector are torqued to 8 Lb-In (0.904 Nm).
3. Check that the Status LED is green.
4. Verify that the ACCESS LED flashes each time that the module is written to.
5. See [Performance Verification Tests](#) (page 22) to verify the module is performing according to published, factory-set specifications.

If you need to swap a defective module with a core replacement module from Agilent, see [Module Core Replacement](#) (page 36).

Performance Verification Tests

The performance verification tests are designed to provide the highest level of confidence that the module being tested conforms to published, factory-set [specifications](#). The tests are designed to test a module operating within the temperature range defined by the module specifications. If the module is unable to pass any of the performance tests, you may need to exchange the defective module for a new one – see [Module Core Replacement](#) (page 36). Use the provided [Test Record Card](#) (page 40) to record your findings.

NOTE

Before attempting to conduct performance tests with the Agilent M9360A, make sure you have followed the necessary startup instructions (see "[Getting Started](#)" on page 9).

Performance verification tests:

- [Insertion Loss above 10 MHz](#) (page 22)
- [Insertion Loss below 10 MHz](#) (page 28)
- [YTF 3 dB Bandwidth Test](#) (page 31)

Insertion Loss above 10 MHz

Test Method

This test measures the insertion loss (above 10 MHz) from the M9360A RF IN port to the RF 1 OUT port. This test also measures the insertion loss (above 10 MHz) from the RF IN port to the RF 2 OUT port through the preselector bypass path as well as the YTF path (for reference on paths, see "[Block Diagram](#)" on page 17). This test also measures the insertion loss (above 10 MHz) from the LO IN port to the LO 1 OUT and LO 2 OUT ports.

Limitations and Considerations

Limitations

This measurement cannot be easily made with a signal generator and power meters/sensors due to the proximity of connectors on the M9360A. The use of right-angle SMA adaptors are necessary for feasible connections and may degrade the signal enough to make it immeasurable at higher frequencies. Test times will become very large if sensor/adaptor characterizations are needed; therefore, it is clear that a network analyzer best fits the needs of this measurement.

Methodology

This measurement is made using a vector network analyzer (VNA). The methodology was selected when considering the test time as well as the connections necessary. It is assumed that this measurement is performed manually. The use of a VNA allows for swept measurements as well as direct measurement on the input and output ports without the need for adaptors. The VNA cannot measure the full frequency range of the M9360A module; therefore, frequencies below 10 MHz are made using an RF signal source and power meter in a procedure that is documented separately (see "[Insertion Loss below 10 MHz](#)" on page 28).

Specification

Table 1

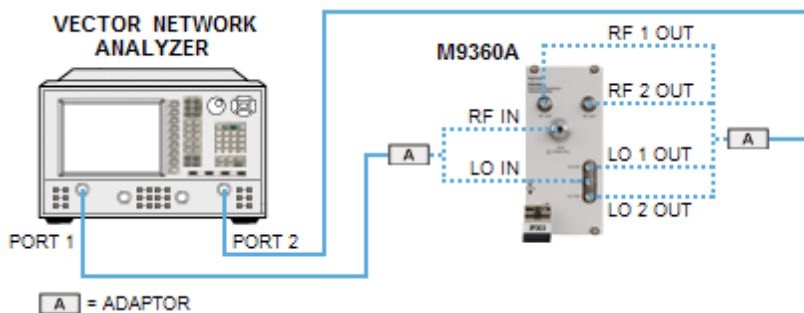
Insertion Loss	Conditions	Source
≤ 2 dB	RF IN to RF 1 OUT, 100 kHz to 2.9 GHz, minimum attenuation	M9360A Data Sheet
≤ 6 dB	RF IN to RF 1 OUT, 2.9 GHz to 26.5 GHz, minimum attenuation	
≤ 7 dB	RF IN to RF 2 OUT (Bypass), minimum attenuation	
≤ 1 dB	LO IN to LO 1 OUT, ≤ 10 GHz	
≤ 1.5 dB	LO IN to LO 1 OUT, ≤ 26.5 GHz	
≤ 1 dB	LO IN to LO 2 OUT, ≤ 10 GHz	
≤ 1.5 dB	LO IN to LO 2 OUT, ≤ 26.5 GHz	

Equipment

Table 2

Equipment	Supported Models	Notes
Vector Network Analyzer (VNA)	Agilent N5245A	Other models include N5244A; N5230C Opt 525; N5230C Opt 520; N5230C Opt 425; N5230C Opt 420; E8361C; E8362C; E8363C; E8364C. If you use one of these models, download the uncertainty calculator to calculate (worse-case) the uncertainty values for the measurements: www.agilent.com/find/na_calculator .
Calibration Kit	Agilent N4691B ECal Opt OOF; 85052B	
Cables	85133D cable kit	The supported models listed here assume N5245A. The VNAs specified are configured with 2.4 mm and 1.85 mm. Appropriate cables and adaptors are needed to connect to the M9360A 3.5 mm female connectors.
Cable	8121-1221	Coaxial cable, 3.5 mm (m) connectors, 1220 mm length
Adaptor	83059A	Coaxial adaptor, 3.5 mm (m) to 3.5 mm (m)
Adaptor	11901C	Adaptor, 2.4 mm (m) to 3.5 mm (f)
Adaptor	11901D	Adaptor, 2.4 mm (f) to 3.5 mm(m)

Test Configuration



Test Procedure

Test Setup

1. Turn on the VNA and allow it to warm up for 90 minutes.
2. Install the M9360A into the PXI chassis.
3. Turn on the PXI chassis and allow it to warm up for 15 minutes.
4. Connect the cables and adaptors to the VNA so that the ends of both cables have 3.5 mm male connectors.
5. Preset the VNA.
6. Configure the VNA as shown in **Table 3**.

Table 3

Parameter	Value	Notes
Start Frequency	10 MHz	
Stop Frequency	26.5 GHz	
RF Output Power	-15 dBm	Use preset value
IF Bandwidth	1 kHz	
Number of Trace Points	601	

Calibrate the Vector Network Analyzer

There are two options for calibrating the VNA: use Option A or Option B as noted below.

Option A. Using an Agilent N4691B ECal module:

1. Connect the ECal module to the VNA. ECal port A connects to VNA PORT 1, and ECal port B connects to VNA PORT 2. Connect the USB cable between the ECal module and the VNA.
2. Allow the ECal to warm up and indicate a READY status.
3. Perform a full two-port calibration on the VNA.
4. Press the **Cal** key on the VNA.
5. From the softkey menu, press **Start Cal**, and then **Cal Wizard**.
6. In the **Calibration Wizard Begin** dialog box, select **Use Electronic Cal (ECal)** and then click the **Next** button.
7. Follow the ECal wizard instructions for a full two-port calibration, relying on the calibration data stored in the ECal module.

Option B. Using an Agilent 85052B Calibration Kit:

1. In the **Calibration Wizard Begin** dialog box, click **SmartCal (GUIDED Calibration)**, use **Mechanical Standards**, and then click the **Next** button.
2. Follow the wizard instructions for a full two-port calibration.
3. When prompted for the type of thru calibration, select **Unknown Thru Cal**.
4. Set the VNA set **Single Trigger** mode.
5. Set the VNA Meas to S21 (measurement mode).
6. Set the VNA Format to **Log Mag**.

Setup for LO Paths Measurements

1. Connect the equipment as shown in the Test Configuration diagram above (see page [23](#)):
 - a. Connect VNA PORT 1 to LO IN on the M9360A.
 - b. Connect VNA PORT 2 to LO 1 OUT on the M9360A.
2. Open the M9360A Soft Front Panel and configure the M9360A as shown in **Table 4**.

Table 4

Parameter	Value	Notes
Input Frequency	n/a	This setting is not important to the measurement.
Input Level	n/a	This setting is not important to the measurement.
Preselector Enabled	Unchecked	
Custom Settings	Checked	
Step Attenuator	0 dB	
RF/LO OUT	1 (Low-band)	This setting applies to the LO 1 OUT path.

Measurement - LO 1 OUT Insertion Loss

1. Take a sweep on the VNA.
2. Select **Scale** > **AutoScale** on the VNA.
3. Select **Search** > **Min** (perform min marker search).
4. Record the marker value as the Measured Insertion Loss of the LO 1 OUT path (use the Test Report Card – page [40](#)).

Measure LO 2 OUT Insertion Loss

1. Disconnect the cable from LO 1 OUT on the M9360A, and connect it to LO 2 OUT on the M9360A. For reference, see the Test Configuration diagram above (see page [40](#)).
2. Configure the M9360A Soft Front Panel as shown in **Table 5**.

Table 5

Parameter	Value	Notes
RF/LO OUT	2 (High-band)	This setting applies to the LO 2 OUT path.

3. Take a sweep on the VNA.
4. Select **Scale** > **AutoScale** on the VNA.
5. Select **Search** > **Min** (perform min marker search).
6. Record the marker value as the Measured Insertion Loss of the LO 2 OUT path (use the Test Report Card – page [40](#)).

Setup for RF Paths Measurements

1. Connect the equipment as shown in the Test Configuration diagram above (see page [23](#)):
 - a. Disconnect the cable from LO IN on the M9360A, and connect it to RF IN on the M9360A.
 - b. Disconnect the cable from LO 2 OUT on the M9360A, and connect it to RF 1 OUT on the M9360A.
2. Configure the M9360A Soft Front Panel as shown in **Table 6**.

Table 6

Parameter	Value	Notes
RF/LO OUT	1 (Low-band)	This setting applies to the RF 1 OUT path.

3. Configure the VNA as shown in **Table 7**.

Table 7

Parameter	Value	Notes
Stop Frequency	2.9 GHz	According to the specification of RF 1 OUT.

Measure RF 1 OUT Insertion Loss ≤ 2.9 GHz

1. Take a sweep on the VNA.
2. Select **Scale > AutoScale** on the VNA.
3. Select **Marker Search >Min** (perform min marker search).
4. Record the marker value as the Measured Insertion Loss (≤ 2.9 GHz) of the RF 1 OUT path (use the Test Report Card – page [40](#)).

Measure RF 1 OUT Insertion Loss 2.9 GHz to 26.5 GHz

1. Configure the VNA as shown in **Table 8**.

Table 8

Parameter	Value	Notes
Start Frequency	2.9 GHz	According to the specification of RF 1 OUT.
Stop Frequency	26.5 GHz	According to the specification of RF 1 OUT.

2. Take a sweep on the VNA.
3. Select **Scale > AutoScale** on the VNA.
4. Select **Marker Search >Min** (perform min marker search).
5. Record marker value as the Measured Insertion Loss (> 2.9 GHz) of the RF 1 OUT path (use the Test Report Card – page [40](#)).

Measure RF 2 OUT (bypass) Insertion Loss

1. Disconnect the cable from RF 1 OUT on the M9360A, and connect it to RF 2 OUT on the M9360A.
2. Configure the M9360A Soft Front Panel as shown in **Table 9**.

Table 9

Parameter	Value	Notes
RF/LO OUT	2 (High-band)	This setting applies to the RF 2 OUT path.

3. Configure the VNA as shown in **Table 10**.

Table 10

Parameter	Value	Notes
Start Frequency	10 MHz	According to the specification of RF 2 OUT(bypass).
Stop Frequency	26.5 GHz	According to the specification of RF 2 OUT(bypass).

4. Take a sweep on the VNA.
5. Select **Scale > AutoScale** on the VNA.

6. Select **Marker Search >Min** (perform min marker search).
7. Record the marker value as the Measured Insertion Loss of the RF 2 OUT (bypass) path (use the Test Report Card – page [40](#)).

Measure RF 2 OUT (YTF) Insertion Loss

1. Configure the M9360A Soft Front Panel as shown in **Table 11**.

Table 11

Parameter	Value	Notes
Preselector Enable	Checked	Only needs to be done in unchecked, You should hear a "click" indicating a path has been selected..
Custom Settings	Unchecked	
Input Frequency	First/next frequency	See Table 12 - Test Points .
Input Levels	-15 dBm (same as VNA power)	This setting is not important to the measurement, it will affect the attenuator which is manually set anyway.
Custom Settings	Checked	
Step Attenuator	0 dB	
RF/LO OUT	2 (High-band)	This setting applies to the LO 2 OUT path.

NOTE: For each measurement iteration (frequency) in **Table 12**, be sure to apply the **Table 11** settings in the specific order (top to bottom in the table).

Table 12 - Test Points

Parameter	Value
RF Center Frequency for YTF path	2.8 GHz
	3.1 GHz
	10.0 GHz
	20.0 GHz
	26.45 GHz

2. Configure the VNA as shown in **Table 13**.

Table 13

Parameter	Value	Notes
Center Frequency	Same as M9360A	Should match Input Frequency of M9360A.
Span	100 MHz	Get full YTF shape on screen.

3. Take a sweep on the VNA.
4. Select **Scale > AutoScale** on the VNA.
5. Set Marker at VNA center frequency.
6. Record the marker value as the Measured Insertion Loss of the RF 2 OUT (bypass) path (use the Test Report Card – page [40](#)).
7. Repeat steps 1-6 above for each frequency in **Table 12 - Test Points**.

Measurement Uncertainty

The insertion loss measurement is measured directly by the Agilent N5245A VNA. The VNA’s accuracy, when measuring insertion loss, is specified to be ± 0.2 dB. For the purposes of this test, this is the expanded measurement uncertainty.

If you use a VNA other than the Agilent N5245A (such as the other potential VNAs listed in the equipment list), you will need to download the uncertainty calculator to calculate (worse-case) the uncertainty values for the measurements you record in the [test record card](#) (see page 40): www.agilent.com/find/na_calculator.

Insertion Loss below 10 MHz

Test Method

This test measures the insertion loss (below 10 MHz) of the M9360A, from the RF IN port to the RF 1 OUT port and the RF 2 OUT port when in the preselector bypass setting. This test also measures the insertion loss (below 10 MHz) from the LO IN port to the LO 1 OUT and LO 2 OUT ports.

Limitations and Considerations

Methodology

This measurement is made using a signal source, two-resistor splitter and power meters/power sensors.

Specification

Table 1

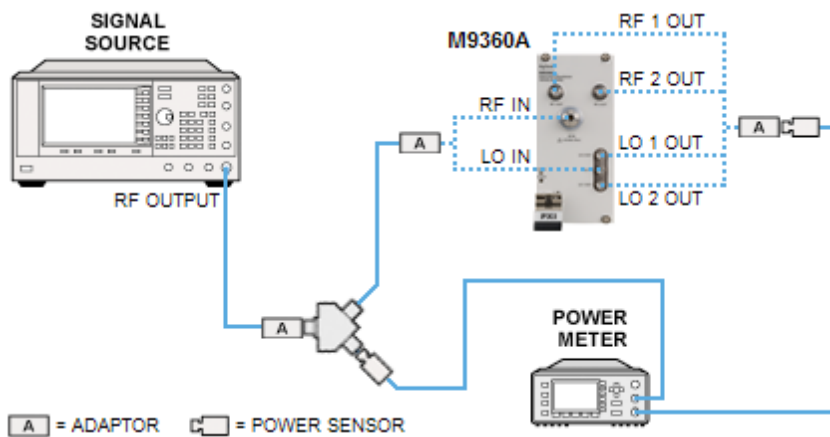
Insertion Loss	Conditions	Source
≤ 2 dB	RF IN to RF 1 OUT, 100 kHz to 2.9 GHz, Minimum Attenuation	M9360A Data Sheet
≤ 7 dB	RF IN to RF 2 OUT (Bypass), Minimum Attenuation	
≤ 1 dB	LO IN to LO 1 OUT, ≤ 10 GHz	
≤ 1 dB	LO IN to LO 2 OUT, ≤ 10 GHz	

Equipment

Table 2

Equipment	Supported Models	Notes
Signal Source	Agilent E8267D; E8257D,	
Power Meter	Agilent N1914A; N1912A; E4419B	
Two-resistor splitter	Agilent 11667A (Opt 001/002)	
Power Sensor (2 each)	Agilent N8482A; E9304A; 8482A	
Adaptor: 3.5 mm (m) to Type-N (m)	1250-1743	Splitter to 1250-1748
Adaptor: 3.5 mm (m) to Type-N (f)	1250-1750	Sensor to M9360A
Adaptor, right angle SMA	1250-1397	Sensor to M9360A
Adaptor, 3.5 mm (m) to 3.5 mm (m) (2 each)	1250-1748; 83059A; 1250-1159	1. Sensor to M9360A 2. 1250-1743 to M9360A

Test Configuration



Test Procedure

Test Setup

1. Turn on the power meter (with power sensors connected) and the signal source. Allow 90-minute warm-up.
2. Install the M9360A into the PXI chassis.
3. Turn on the PXI chassis and allow it to warm up for 15 minutes.
4. Perform a power meter zero and calibration on both power sensors.
5. Preset the signal source and the power meter.
6. Configure the signal source as shown in **Table 3**.

Table 3

Parameter	Value
Frequency	250 kHz
RF Output Level	-10 dBm
RF Power	Off

Insertion Loss below 10 MHz

7. Open the M9360A Soft Front Panel and configure as follows:

Table 4

Parameter	Value
Input Frequency	250 kHz
Input Level	-10 dBm

RF IN to RF 1 OUT measurement

1. Connect the RF output of the signal generator to the input of the two-resistor splitter using an RF cable and appropriate adaptors.
2. Connect the channel A power sensor to an output port of the two-resistor splitter.
3. Connect the other output port of the two-resistor splitter to the RF IN port of the M9360A module, using an appropriate adaptor.
4. Connect the channel B power sensor to the RF 1 OUT port of the M9360A, using the right angle SMA and 3.5 mm (m) to 3.5 mm (m) adaptors.
5. Set the RF power of the signal source to ON.
6. Configure the M9360A as shown in **Table 5**.

Table 5

Parameter	Value
Preselector Enabled	No
RF/LO Out	1 (Low band)
Step Attenuator	0 dB

7. For each frequency listed in **Table 6- Test Points**:

Table 6 - Test Points

Frequency
250 kHz
1 MHz
2 MHz
5 MHz
9.9 MHz

- a. Set the power meter frequency. From the N1914A front panel, press the Channel button, highlight the Frequency field, and enter the frequency for both channels.
- b. Note the displayed power for both channels.
- c. Calculate the insertion loss as: Channel A power – Channel B power.
- d. Record the insertion loss value for RF 1 OUT in the Test Record Card (see page [40](#)).

RF IN to RF 2 OUT measurement

1. Move the Channel B power sensor to the M9360A RF 2 OUT port, using the right angle SMA and 3.5 mm (m) to 3.5mm (m) adaptors.
2. Using the M9360A Soft Front Panel, enable **Custom Settings** and set the M9360A **RF/LO Out** to 2 (High band).

- Repeat steps 7.a. to 7.c. from **RF IN to RF 1 OUT measurement** in the above procedure.
- Record the insertion loss value for RF 2 OUT in the Test Record Card (see page [40](#)).

LO IN to LO 1 OUT measurement

- Move the Channel A power sensor to the LO IN port on the M9360A.
- Move the Channel B power sensor to the LO 1 OUT port on the M9360A, using the right angle SMA and 3.5 mm (m) to 3.5mm (m) adaptors.
- Using the M9360A Soft Front Panel, set the M9360A **RF/LO OUT** to 1 (Low band).
- Repeat steps 7.a. to 7.c. from **RF IN to RF 1 OUT measurement** in the above procedure.
- Record the insertion loss value for LO 1 OUT in the Test Record Card (see page [40](#)).

LO IN to LO 2 OUT measurement

- Move the Channel B power sensor to the LO 2 OUT port on the M9360A, using the right angle SMA and 3.5 mm (m) to 3.5mm (m) adaptors.
- Using the M9360A Soft Front Panel, set the M9360A **RF/LO OUT** to 2 (High band).
- Repeat steps 7.a. to 7.c. from **RF IN to RF 1 OUT measurement** in the above procedure.
- Record the insertion loss value for LO 2 OUT in the Test Record Card (see page [40](#)).

Measurement Uncertainty

The expanded uncertainty of measurement for this test (noted as the “Uncertainty” value provided in the [Test Record Card](#) -- see page [40](#)) represents the standard uncertainty of measurement multiplied by the coverage factor $k=2$. For normal distribution, this corresponds to a coverage probability of approximately 95%.

YTF 3 dB Bandwidth Test

Test Method

This test uses a spectrum analyzer to measure relative power to determine the 3 dB bandwidth of the M9360A preselector. For this test, 3 dB YTF Bandwidth is defined as the bandwidth between the upper and lower frequencies where the gain of the YTF is 3 dB lower than the gain at the center frequency.

Limitations and Considerations

This test searches for the 3 dB points on either side of the center frequency. The number of trace points chosen provides enough resolution to acquire repeatable, reliable results with a reasonable amount of margin.

Specification

Table 1

Frequency	Bandwidth	Conditions	Source
< 3 GHz	35 MHz (min), 120 MHz (max)	3 dB Bandwidth	M9360A Data Sheet
≥ 3 GHz	40 MHz (min), 120 MHz (max)		

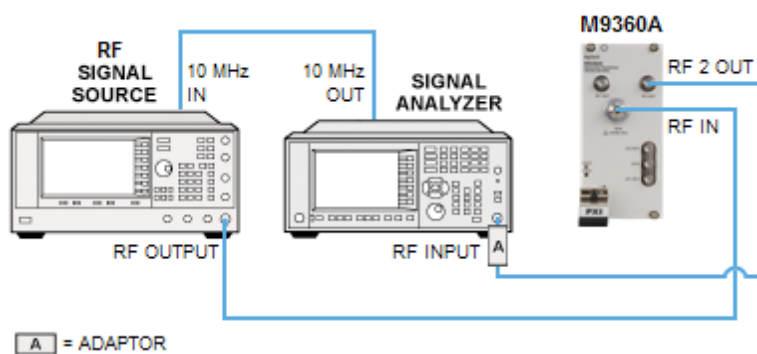
Equipment

Table 2

Equipment	Supported Models	Notes
Signal Analyzer	Agilent E4440A; N9030A	
Signal Source	Agilent E8257D; E8267D	
Adaptor: 3.5 mm (f) to Type-N(m)	Agilent 1250-1744	UUT to Analyzer
Adaptor, SMB (m) to SMA (f)	Agilent 1250-0674	if necessary
Adaptor, 3.5 mm (f) to Type-N(f)	Agilent 1250-1745	if necessary
Adaptor, 3.5 mm (f) to 3.5 mm (f)	Agilent 1250-1749	if necessary
Cable (2 each)	Agilent 11500E/F; semi-rigid cables are also acceptable	LO Source to UUT RF Source to UUT

Test Configuration

Figure 1



Test Procedure

Test Setup

1. Turn on the signal source and allow for a warm up of 15 minutes.
2. Install the M9360A into the PXI chassis.
3. Turn on the PXI chassis and allow it to warm up for 15 minutes.
4. Preset all equipment.
5. Connect the equipment as seen in **Figure 1**.
 - a. Connect the signal analyzer 10 MHz OUT port to the signal source 10 MHz IN port.
 - b. Connect the RF OUT of the signal source to the RF IN port of the M9360A preselector.
 - c. Connect the spectrum analyzer to the RF 2 OUT port of the M9360A preselector.
6. Open the M9360A Soft Front Panel and configure as shown in **Table 3**.

Table 3

Parameter	Value
Center (Input) Frequency	See Table 6 - Test Points
Input Level	-40 dBm
Custom Settings	Unchecked
Preselector Enabled	Checked

7. Configure the signal source as shown in **Table 4**.

Table 4

Parameter	Value
Start Frequency	M9360A Center Frequency - 0.1 GHz
Stop Frequency	M9360A Center Frequency + 0.1 GHz
Dwell Time	10 ms
Points	1000

8. Configure the signal analyzer as shown in **Table 5**.

Table 5

Parameter	Value
Continuous Sweep	Yes
Center Frequency	M9360A Center Frequency
Input Attenuation	10 dB (preset value)
Span	130 MHz
Sweep Time	10 ms
Sweep Points	1001
Reference Level	-40 dBm
Scale	3 dB/div
Trace	Max Hold

9. Turn on the RF OUTPUT of the signal source.

Table 6 - Test Points

Parameter	Value
RF Center Frequency	2.8 GHz
	3.1 GHz
	10 GHz
	20 GHz
	26.45 GHz

Lower 3 dB Point Measurement

1. Wait until at least one source sweep has finished and the filter shape is present on the screen of the signal analyzer.
2. Turn on Marker 1 and set it to the Center Frequency of the signal analyzer.

YTF 3 dB Bandwidth Test

3. Set the **Marker Type** as **Delta**.
4. Move the marker to the left until the marker delta observed is just less than 3 dB.
 - a. Record the marker amplitude as y_1 .
 - b. Record the marker frequency as x_1 .

NOTE: The marker must be one marker step away from the above 3 dB point and the marker delta should be less than 3 dB.

5. Move the marker to the left one step.
 - a. Record the marker amplitude as y_2 .
 - b. Record the marker frequency as x_2 .
6. Calculate the lower 3 dB point frequency, x (assuming amplitude of $y = -3$ dB).

$$\frac{y-y_1}{x-x_1} = \frac{y_2-y_1}{x_2-x_1}$$

Solving for x yields: (in dB)

$$x = \frac{(y-y_1)}{\left(\frac{y_2-y_1}{x_2-x_1}\right)} + x_1$$

Upper 3 dB Point Measurement

1. Move the marker to the right until the marker delta observed is just less than 3 dB.
 - a. Record the marker amplitude as y_1 .
 - b. Record the marker frequency as x_1 .

NOTE: The marker must be one marker step away from the above 3 dB point and the marker delta should be less than 3 dB.

2. Move the marker to the right one step.
 - a. Record the marker amplitude as y_2 .
 - b. Record the marker frequency as x_2 .
3. Calculate the lower 3 dB point frequency, x (assuming amplitude of $y = -3$ dB).

$$x = x_{offset} + x_1$$

3 dB Bandwidth Measurement

1. Calculate the 3 dB bandwidth:

$$B = [x]_{upper} - [x]_{lower}$$

2. Record the 3 dB measurement bandwidth value for RF 2 OUT in the Test Record Card (see page [40](#)).

Loop Through Test Point Table

1. Repeat steps **Test Setup** (Step 7) through **3 dB Bandwidth Calculation** (Step 1) for each frequency in **Table 6 - Test Points**.

Measurement Uncertainty

The expanded uncertainty of measurement for this test (noted as the “Uncertainty” value provided in the [Test Record Card](#) -- see page [40](#)) represents the standard uncertainty of measurement multiplied by the coverage factor $k=2$. For normal distribution, this corresponds to a coverage probability of approximately 95%.

Service

This section provides reference information and procedures to help you service your Agilent M9360A.

In this section:

- [Replaceable Parts](#) (page 35)
- [Module Core Replacement](#) (page 36)
- [Test Record Card](#) (page 40)

Replaceable Parts

Where Used	Cable Reference Designator	Agilent Part Number	Description
Accessory Hardware	n/a	5023-1450	Wrench, socket, 5/16 inch
Accessory Hardware	n/a	5002-3361	SMB/MMCX Removal Tool
All PXI Modules	n/a	1440-0655	Injector/Ejector assembly
M9361A IF OUT to M9202A INPUT 1	C3	8120-5531	Cable, SMB - SMA coaxial (190 mm)
M9302A REF 2 OUT to M9202A REF IN	C4	8121-2042	Cable, A06/A32 80G (SMB – MMCX)
M9351A REF IN to M9302A REF 2 OUT	B1	8120-5016	Cable, coaxial. SMB-SMB (160 mm)
M9351A IF OUT to M9361A AUX IN	B2	8121-2072	Cable, coaxial, SMB-SMB (75 mm)
M9302A LO OUT to M9360A LO IN	A1	M9360-20001	Cable, semi-rigid, Master LO
M9360A RF 1 OUT to M9351A RF IN	A2	M9351-20001	Cable, semi-rigid, SMA-SMA
M9360A RF 2 OUT to M9361A RF IN	A3	M9361-20001	Cable, semi-rigid SMA-SMA
M9360A LO 2 OUT to M9361A LO IN	A4	M9361-20002	Cable, semi-rigid SMA-SMA
M9360A LO 1 OUT to M9351A LO IN	A5	M9351-20002	Cable, semi-rigid SMA-SMA
M9360A PXI Attenuator/Preselector 100 kHz to 26.5 GHz	n/a	M9360-60003	PXI Attenuator/Preselector 100 kHz to 26.5 GHz replacement core assembly
M9360A PXI Attenuator/Preselector 100 kHz to 26.5 GHz	n/a	M9360-69003	PXI Attenuator/Preselector 100 kHz to 26.5 GHz replacement core assembly EXCHANGE

Module Core Replacement

Ordering a core replacement module

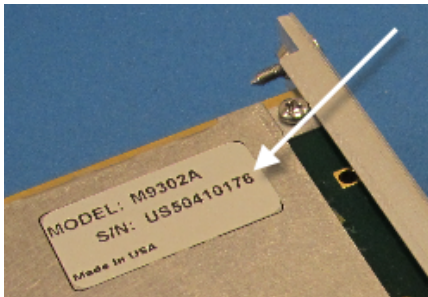
1. Contact Agilent (see www.agilent.com/find/assist).
2. Order a core replacement for your module (par number M9360-60003).
3. When the core replacement arrives, the package includes:
 - Entitlement Certificate
 - Replacement module
 - Calibration certificate for the replacement module
 - RMA number
 - Return instructions

Replacing the defective module

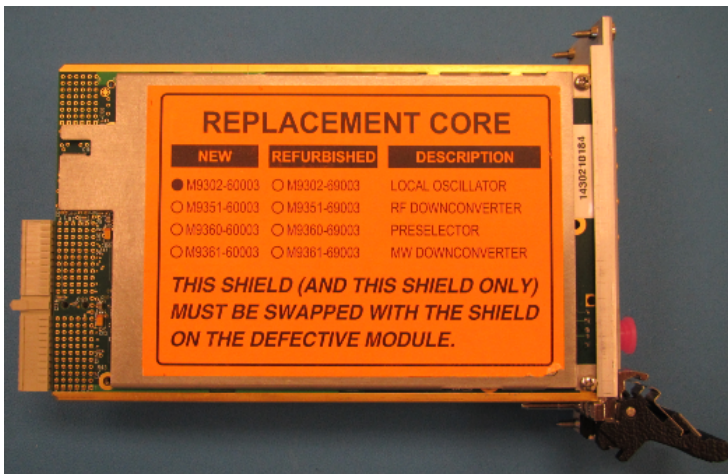
CAUTION

Before opening a packaged module for troubleshooting, ensure that all ESD (electrostatic discharge) precautions are observed. Refer to [ESD](#) (page 10) for details.

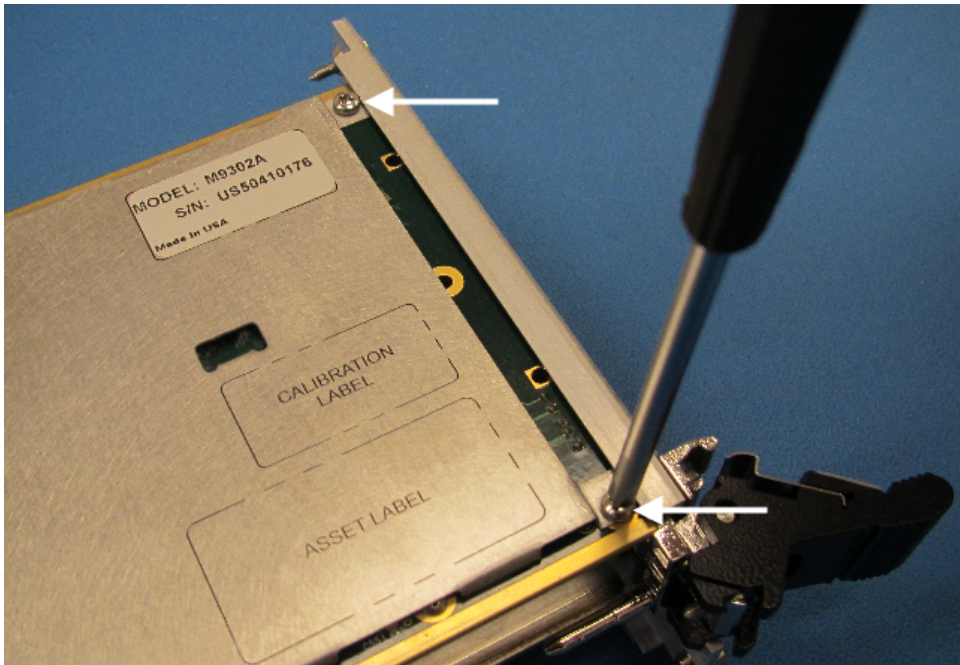
1. Power down the chassis.
2. Remove the defective module from the chassis.
3. Write down the serial number shown on the side shield of the defective module. You will assign this serial number to the replacement module using the Agilent M9392A Serial Number Update Utility.



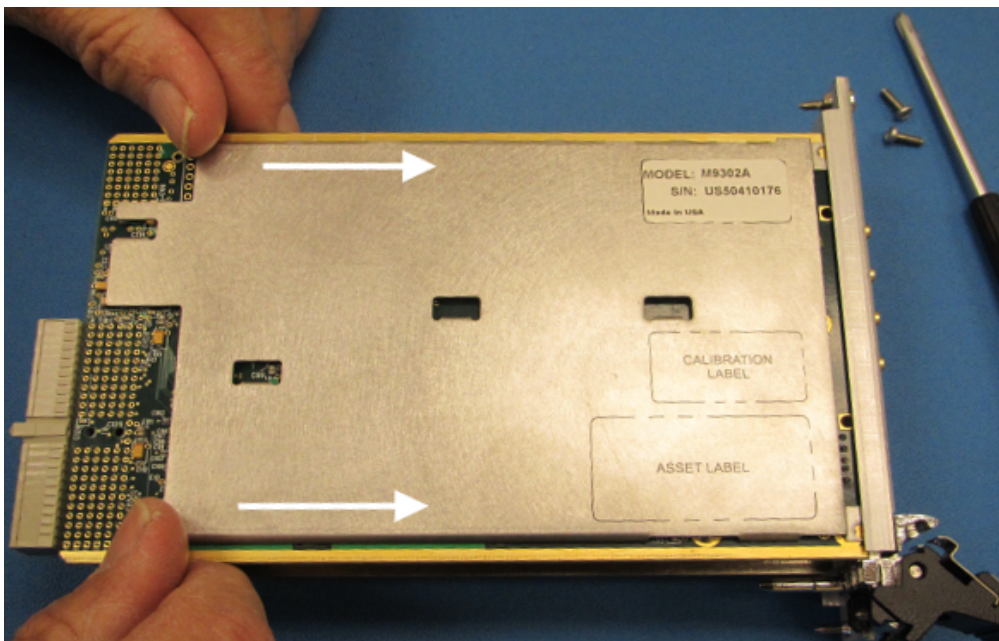
4. Remove the replacement module from the box and shipping material.



5. Remove the side shield from the defective module.
 - a. Using a Philips #1 (PH1) screwdriver, remove the two screws that secure the side shield to the module. **NOTE: Keep the screws;** extra screws are not included with the replacement module.

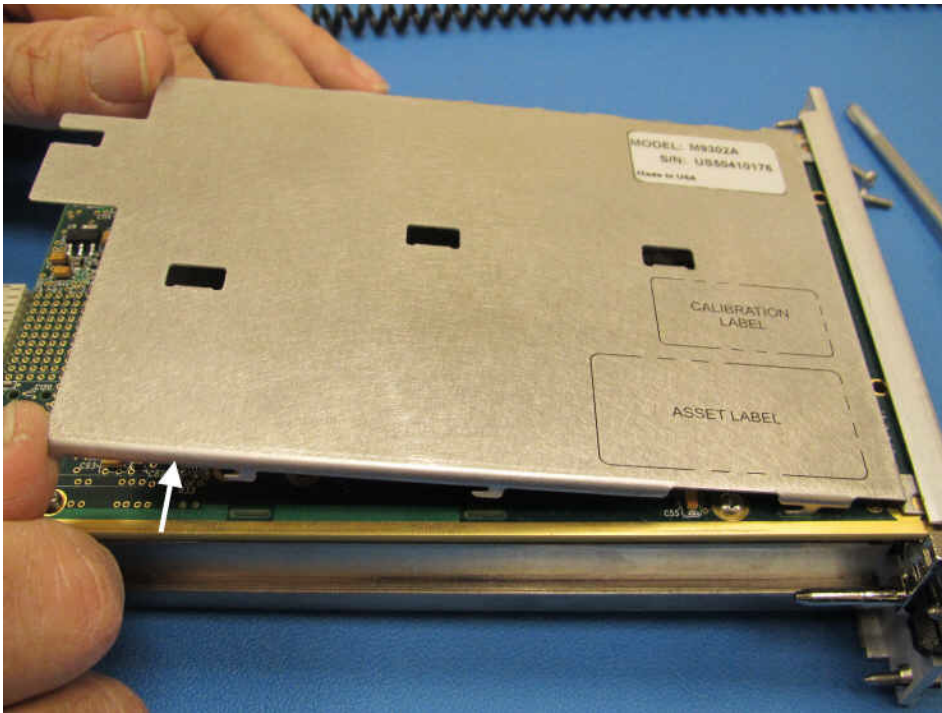


- b. Slide the shield toward the module's front panel. This aligns the engagement tabs so you can remove the shield.

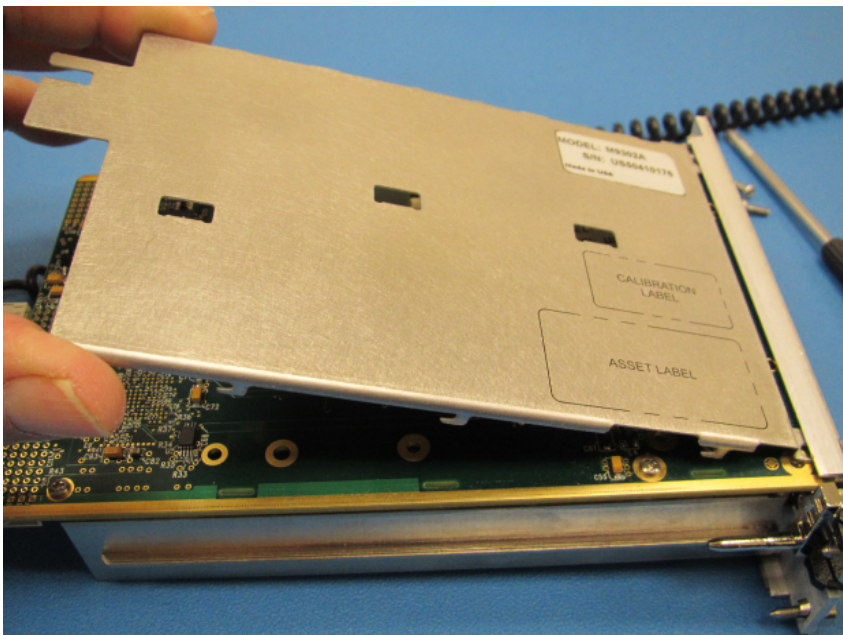


Module Core Replacement

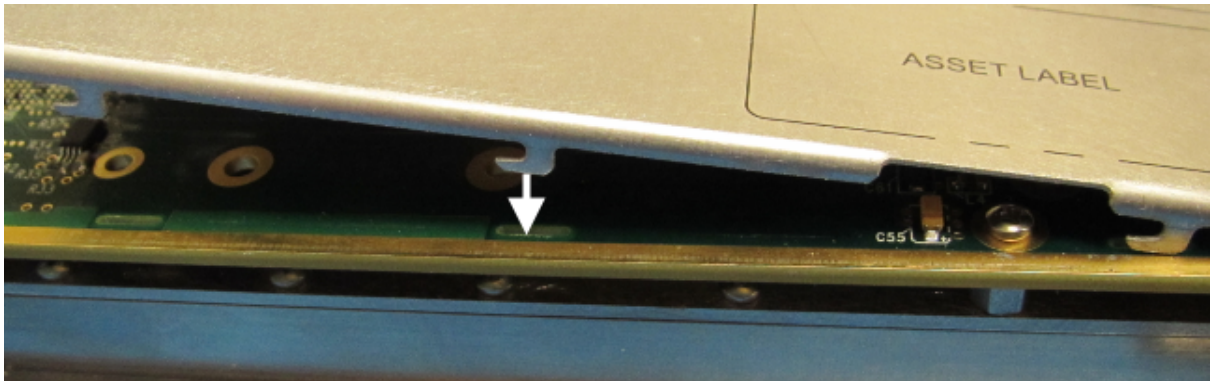
- c. Raise the side shield and lift it away from the module.



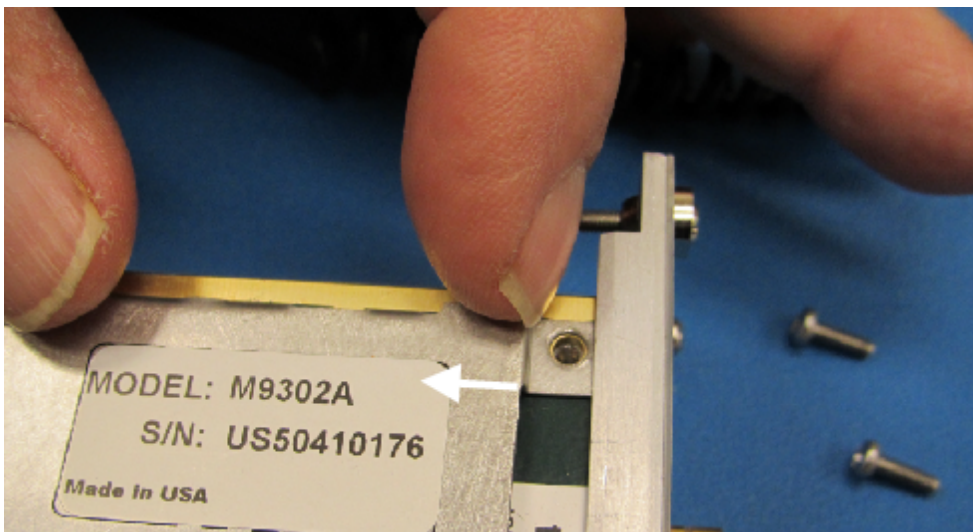
6. Remove the side shield from the defective module, using the same process as in Step 5 above.
7. Attach the original side shield from the defective module to the replacement module.
 - a. Position the side shield so that the screw tabs align with the screw holes on the module, and then slide the side shield against the front panel.



- b. Lower the side shield so the engagement tabs drop into the slots on the module's printed circuit board.



- c. Back the side shield away from the front panel to align the screw holes.



- d. Install the two screws to secure the side shield to the module.
8. Install the replacement module into the chassis.
 9. Power up the chassis.
 - a. If you are using a remote controller, power up the computer. (If you are using an embedded controller, skip to Step 10.)
 10. Program the replacement module with the serial number from the defective module.
 - a. If you don't already have the Agilent M9392A Serial Number Update Utility, download it from www.agilent.com/find/M9392A (from this site, select **Support Center > Drivers, Updates & Examples**), and install it on your computer or embedded controller.
 - b. Launch the Agilent M9392A Serial Update Utility (launch from the **Start menu** program group "**Agilent Utilities**") and follow the embedded instructions for programming the serial number.

Test Record Card

11. Attach the side shield from the replacement module to the defective module, and return it to Agilent according to the following procedure:
 - a. Review the warranty information shipped with your product.
 - b. Write the following information on a tag and attach it to the malfunctioning equipment:
 - Name and address of owner. A P.O. box is not acceptable as a return address.
 - Product model number (for example, M9360A).
 - Product serial number. The serial number label is located on the side panel of the module. The serial number can also be read from the Soft Front Panel interface, but only after the hardware is installed.
 - Description of failure or service required.
 - Return Material Authorization (RMA) number.
 - c. Pack the module in its original ESD bag and packing carton. If the original carton is not available, use bubble wrap or packing peanuts and place the instrument in a sealed container and mark the container "FRAGILE".
 - d. On the shipping label, write ATTENTION REPAIR DEPARTMENT and the RMA number.

NOTE

If any correspondence is required, refer to the product by serial number and model number.

Test Record Card

Agilent has provided a Test Record Card you can use to record your findings as you conduct performance verification tests. Click the link below to open the Test Record Card (a PDF form). Save the file to your hard drive and fill in as needed to record your test results.

[Open Test Record Card](#)



TIP: Use Ctrl/click to open the Test Record Card as a separate document.



The Modular Tangram

The four-sided geometric symbol that appears in Agilent modular product literature is called a tangram. The goal of this seven-piece puzzle is to create shapes—from simple to complex. As with a tangram, the possibilities may seem infinite as you begin to create a new test system. With a set of clearly defined elements—hardware, software—Agilent can help you create the system you need, from simple to complex.



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PXI www.pxisa.org

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www.agilent.com/find/modular

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