



Agilent M9302A PXI Local Oscillator 3 GHz to 10 GHz



Service Guide

Version 1.1.0



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/M9302A (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.

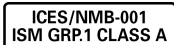
PRODUCT MARKINGS:



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 16): This section provides high-level tools, processes, and references to help you diagnose problems with your module.
- [Performance Verification Tests](#) (page 21): 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 one of the performance tests, you may need to exchange the defective module (see [Module Core Replacement](#) on page 32).
- [Service](#) (page 31): This section provides reference information and procedures to help you service your Agilent M9302A, including the replaceable parts list, module core replacement instructions, and a [Test Record Card](#) (page 36) you can use to record your performance test findings.

Related Documentation

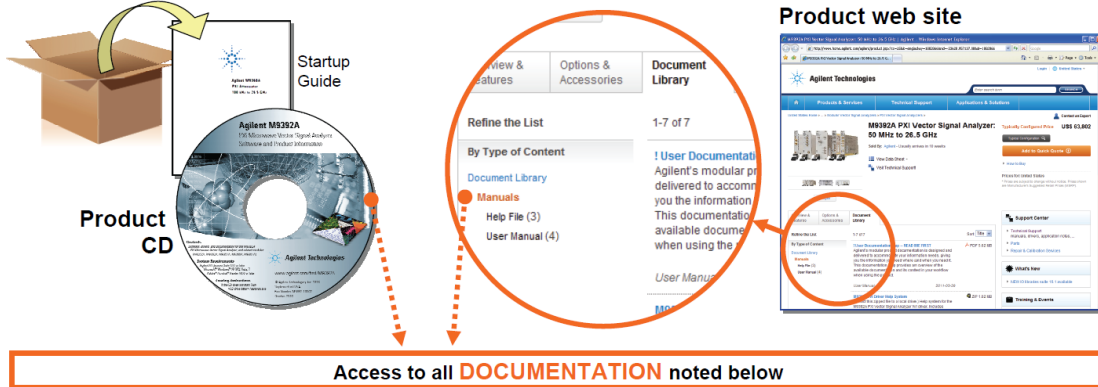
In addition to this Service Guide, the related documentation for the M9302A module includes:

- **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:** Provides a detailed product introduction and 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 documentation of the IVI-COM and IVI-C driver API functions, and information to help you start using the drivers in your application development environment.
- **LabVIEW Driver reference (help system):** Provides documentation of the LabVIEW G driver API.

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 > M9302**. For IVI driver help, see **Start > Programs > Agilent IVI Drivers > AgM9302**.

All the product documentation noted above is provided on the product CD. To find the latest versions of the documentation, go to the product web site (www.agilent.com/find/M9302A) 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



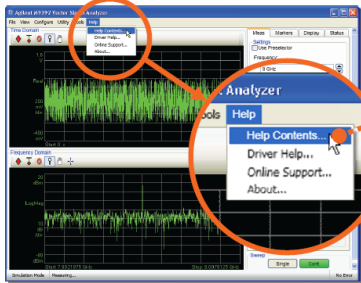
- Product description
- Technical specifications

Service Guide

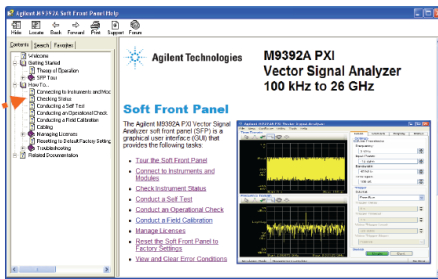


- Diagnostic tools, troubleshooting
- Replaceable parts
- Assembly/disassembly
- Performance verification tests
- Test results form

Soft Front Panel (SFP) user interface

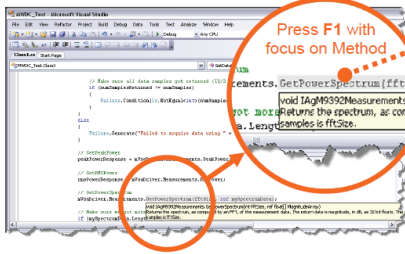


SFP help system



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

Visual Studio

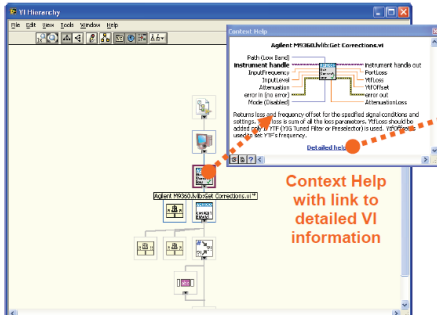


IVI Driver help system

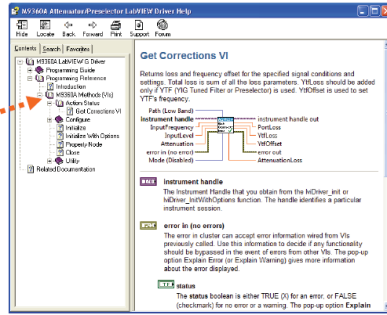


- IVI-COM and IVI-C driver programmer's reference
- Sample programs

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. If you are familiar with this material, proceed to [High-Level Diagnostic Tools, Processes and References](#) (page 16).

In this section:

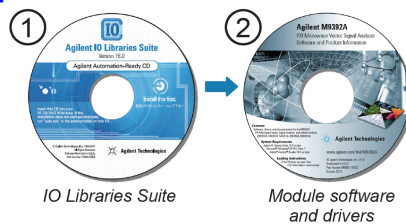
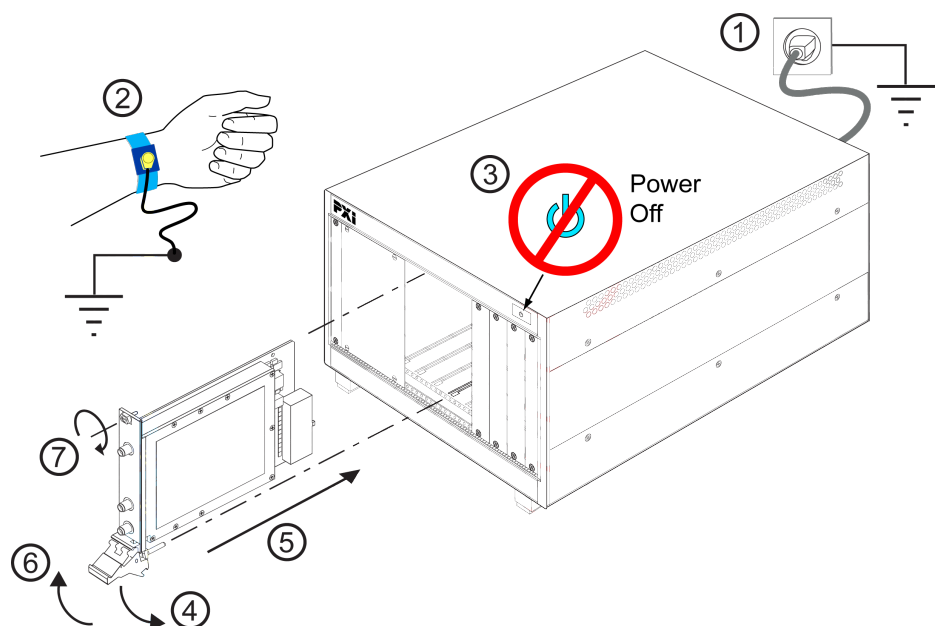
- [Follow the Startup Sequence](#) (page 9)
- [Step 1: Unpack and Inspect the Module](#) (page 10)
- [Step 2: Install the Software](#) (page 10)
- [Step 3: Install the Module](#) (page 13)

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.

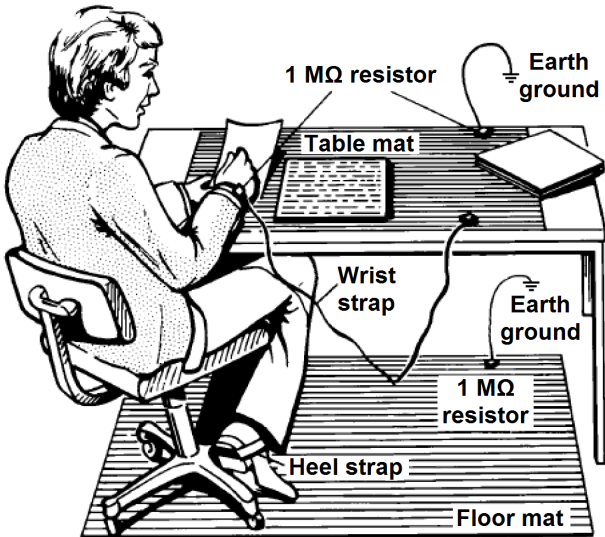
Step 1: Unpack and Inspect

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	Windows® 7 and Vista Requirements	Windows® XP Requirements
Operating system	Windows 7 (32 bit and 64 bit); Windows® Vista, SP1 and SP2 (32-bit and 64-bit)	Window® XP, Service Pack 3
Processor speed	1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64	600 MHz or higher required 800 MHz recommended
Available memory	1 GB minimum	256 MB minimum (1 GB or greater recommended)
Available disk space	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	Support for DirectX 9 graphics with 128 MB graphics memory recommended (Super VGA graphics is supported)	Super VGA (800x600) 256 colors or more
Browser	Microsoft® Internet Explorer 7.0 or greater	Microsoft® Internet Explorer 6.0 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 7 and 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
Host controller	A PXI or PXI Express embedded controller or remote controller (external PC connected to the chassis by 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 M9045B PCIe ExpressCard Adaptor x1, with cable (for a laptop PC) • Agilent M9048A 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:

1. 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.
2. Connect peripherals (mouse, keyboard, monitor).
3. Power up the chassis.

Software Installation Overview

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 E2094-60003), and is also available at www.agilent.com/find/iosuite. This software must be installed first.

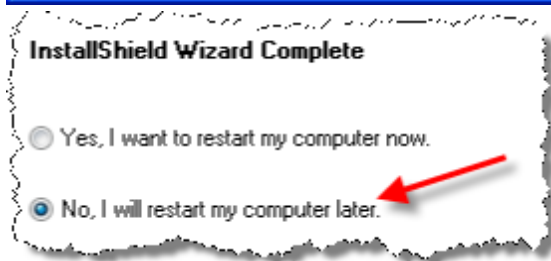
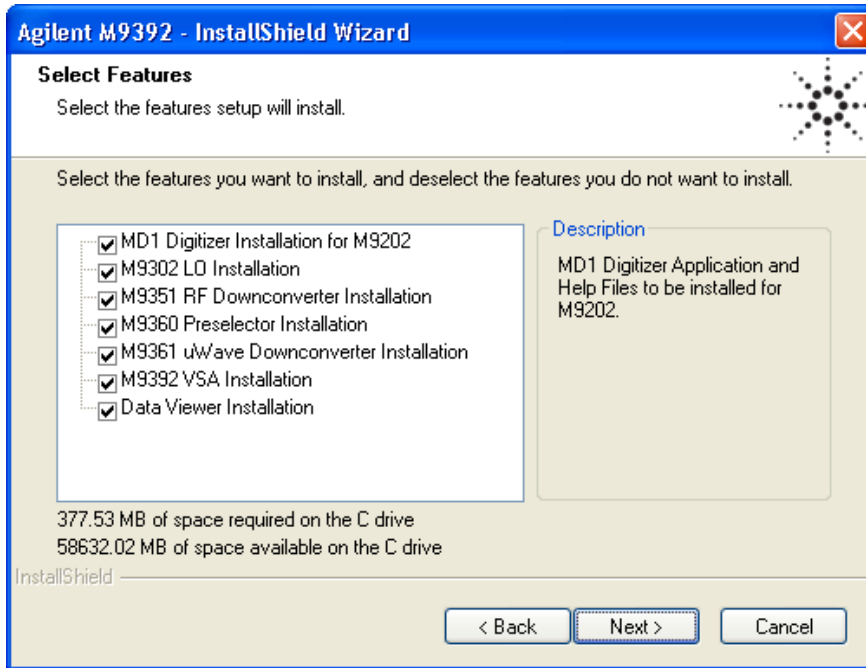
NOTE

Version 16.3.16603.3 (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 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.

Software Installation Procedure

1. Install the Agilent IO Libraries Suite from the Agilent IO Libraries Suite CD (E2094-60003) provided in your ship kit. Follow the installer prompts to install the IO libraries.
2. Install the M9302A product software:
 - a. Using the Agilent M9392A PXI Vector Signal Analyzer Software and Product Information CD (M9392-10002), launch the installer.
 - b. 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.



3. Power down the host PC.

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" (changing modules while power is applied to the chassis) capabilities. 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.

Recommended Practices for Temperature Control

- Use slot blockers and EMC filler panels in empty module slots to assure proper operating temperatures.
- At ambient temperatures above 45° C (113° F) set the chassis fan to High.
- The use of an Agilent M9018A Chassis and slot blockers optimizes module temperature performance.

Module Installation Procedure

3

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

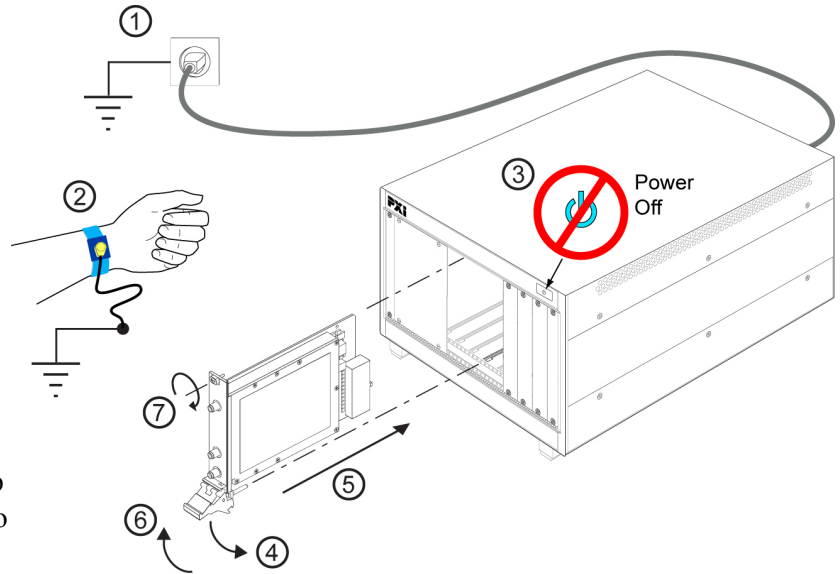
7^H

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 Off.
2. If the chassis has multiple fan speed settings, ensure that the fan switch is set to **AUTO**.
3. Position the chassis to provide 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 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.

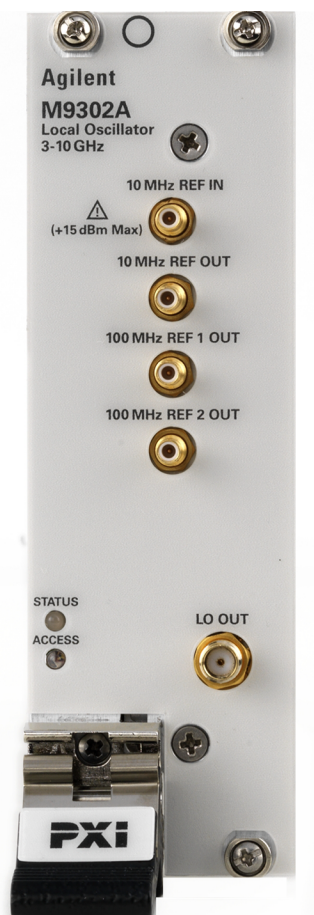
Getting Started

- a. Install the module into the 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.



7. 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.
8. Verify that the PXI chassis fans are operable and free of dust and other contaminants that may restrict airflow.
9. Install filler panels and slot blockers after installing the module. Missing filler panels or slot blockers may disrupt air circulation in the chassis.
10. Use the Cabling Diagram plus the Cable and Module Table on the next page to attach the cables to the instrument. The torque specification for SMA connectors is 8 Lb-In (0.904 Nm).
11. 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.
12. Power up the PXI chassis.
13. Reboot the PC host.

Agilent M9302A PXI Local Oscillator Front Panel Features



NOTE The front panel LED behavior is valid only when the soft front panel (SFP) is running or when the `Initialize` function/method has been called, using the application programming interface (API).

Front Panel Connectors

Connector	Description
10 MHz REF IN	This SMB male connector is used to supply a 10 MHz reference input to the front panel at 0 ± 4 dBm. NOTE: For best measurement performance, connect a high-quality 10 MHz reference to the M9302A REF IN input. If no other reference is available, connect the 10 MHz reference supplied on the back of the PXI chassis.
10 MHz REF OUT	This SMB male connector is used to supply a 10 MHz reference signal out from the front panel.
100 MHz REF 1/2 OUT	These SMB male connectors supply a 100 MHz reference signal out from the front panel. These 100 MHz reference signals are phase-coherent with the 10 MHz reference being used.
LO OUT	This SMA female connector is used to deliver the local oscillator signal (3 GHz to 10 GHz) out of the front panel.

Front Panel LEDs

LED	Description
STATUS	This LED indicates the overall health of the M9302A and is a summary of the following LEDs, covering the power supplies and other hardware operations. The M9302A has extensive built-in-tests (BIT) and specific issues can be identified by observing the status indicator on the front panel. This LED has four possible states: <ul style="list-style-type: none"> • Green = Power supplies are operational and in specification. It also indicates that all module hardware is operational and a 10 MHz REF IN is connected. • Amber = Power supplies are operational and in specification, but there may be a hardware failure. • Red = Power supply failure and a hardware failure or the 10 MHz REF in is absent. • 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

Before attempting to diagnose the Agilent M9302A, make sure you have followed the necessary startup instructions (see "[Getting Started](#)" on page 1).

In this section:

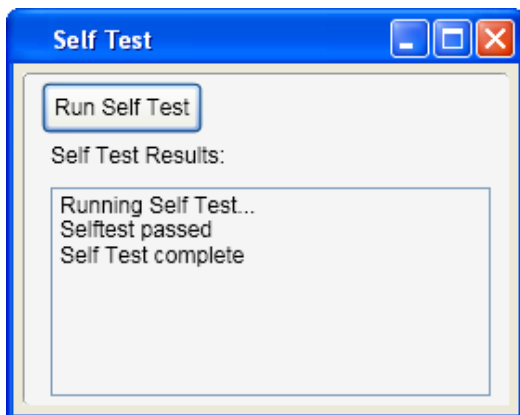
- [Specifications](#) (page 16)
- [Self Test](#) (page 16)
- [Front Panel LEDs](#) (page 17)
- [Block Diagram](#) (page 18)
- [Operational Check](#) (page 18)

Specifications

The Data Sheet for the M9302A 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/5990-6053EN.pdf>.

Self Test

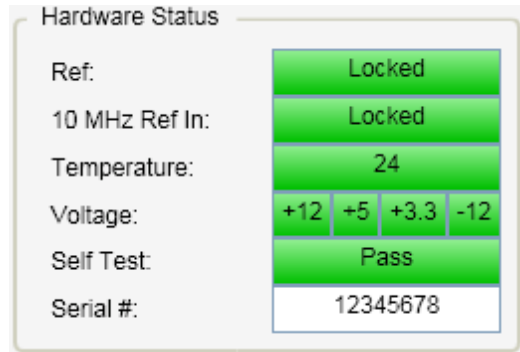
The Soft Front Panel (SFP) provides a self test utility to verify power and perform an internal check of module sub-components. To access the SFP, go to **Start > All Programs > Agilent > M9392 > M9302 SFP**. To conduct the self test from the SFP, go to **Utility > Self Test...**, and then click the 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 > M9302 SFP**. The status is automatically updated once every five seconds. The status can also be manually updated by a refresh (**View > Refresh**).

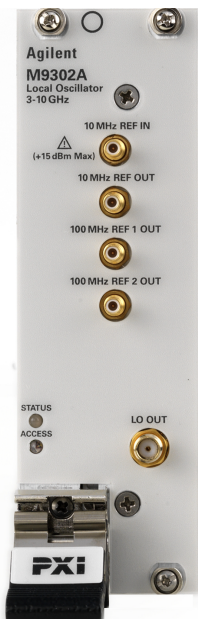
- **Ref** – the word "Locked" along with a green background color indicates that the module's internal reference is locked to the LO signal and that it has settled. If the internal reference is unlocked, the word "Unlocked" is displayed and the background color turns red.
- **10 MHz Ref In** – the word "Locked" along with a green background color indicates that the module's internal reference is locked to the external reference signal applied at REF IN. If the internal reference is unlocked, the word "Unlocked" is displayed and the background color turns red.
- **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.
- **Serial #** – the module's serial number is displayed.



Front Panel LEDs

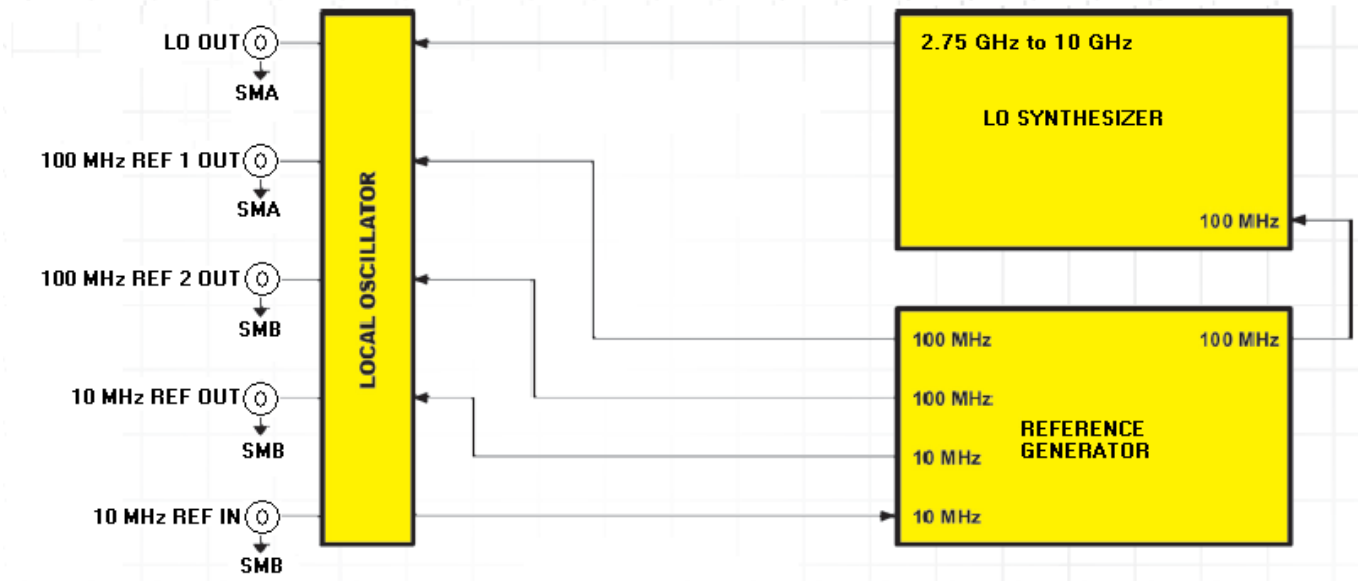
NOTE

The front panel LED behavior is valid only when the soft front panel (SFP) is running or when the Initialize function/method has been called, using the application programming interface (API).



LED	Description
STATUS	<p>This LED indicates the overall health of the M9302A and is a summary of the following LEDs, covering the power supplies and other hardware operations. The M9302A has extensive built-in-tests (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 and a 10 MHz REF IN is connected. • Amber = Power supplies are operational and in specification, but there may be a hardware failure. • Red = Power supply failure and a hardware failure or the 10 MHz REF in is absent. • 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.

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 21).

Requirements for Operational Check

The Agilent M9302A PXI Local Oscillator operational check measures the LO OUT signal and uses that as a reference to compare the signal paths to the 10 MHz REF OUT and the two 100 MHz REF OUT connectors. The following process demonstrates that all associated connectors, cables and circuitry are operational.

Required Hardware

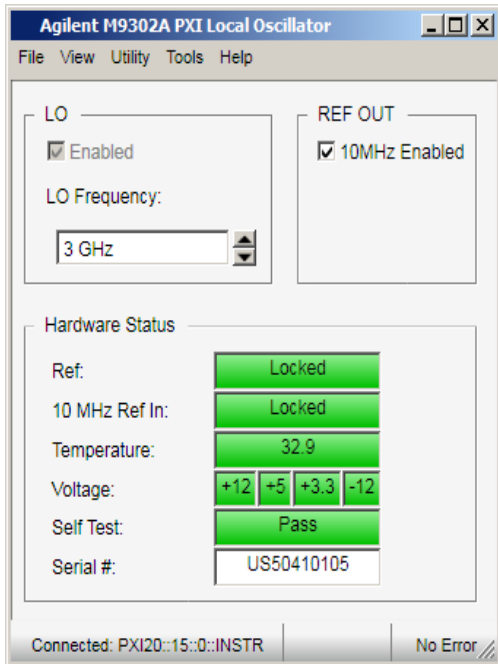
To demonstrate that the module works properly requires external equipment. You will not be using the module interconnect cables, so some high-quality flexible 3.5 mm cables will be required, plus adaptors to connect the PSG (precision signal generator) and power sensors to 3.5 mm connectors. Please refer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

Hardware	Description
Agilent N1913A	Single 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)

M9302A Operational Check Procedure

NOTE

Run this operational check prior to the Agilent M9351A PXI Downconverter module or the Agilent M9361A PXI Downconverter module. The M9302A is used in performing the operational check of these downconverters.



1. Run the M9302A 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. Check the voltage and PLL indicators. They are GREEN if the power supplies are good and the M9302A LO and Reference loops are locked.
4. Set the LO Frequency to 3 GHz. The LO is always enabled.
5. Using the power meter:
 - a. Connect the power sensor to LO OUT.
 - b. Verify the power is +16 dBm (± 2 dB).
6. Change the LO Frequency from 2.75 GHz to 10 GHz in 500-MHz steps, validating that the power is still +16 dBm (± 2 dB).
7. Enable 10 MHz REF OUT.
8. Using the power meter:
 - a. Connect the power meter to the 10 MHz REF OUT, 100 MHz REF 1 OUT, and 100 MHz REF 2 OUT.
 - b. Verify the output levels are 0 dBm (± 3 dB).
9. 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 M9302A paths are correctly set from the SFP and that the signal generator is set to the proper power/frequency and that all cables are properly connected. All SMA connectors 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 the module is written to.
5. See [Performance Verification Tests](#) (page 21) 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 32).

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 [32](#)). Use the provided [Test Record Card](#) (page [36](#)) to record your findings.

NOTE

Before attempting to conduct performance tests with the Agilent M9302A, make sure you have followed the necessary startup instructions (see "[Getting Started](#)" on page [9](#)).

Performance verification tests:

- [10 MHz Lock Range Test](#) (page [21](#))
- [Output Power Test](#) (page [22](#))
- [Phase Noise Test](#) (page [25](#))
- [Harmonic Distortion Test](#) (page [27](#))

10 MHz Lock Range Test

Test Method

This test checks the ability of the M9302A to lock on to an external 10 MHz reference signal when the reference signal frequency is slightly off from 10 MHz. This test is a functional test. A signal at a frequency just beyond the M9302A lock range is applied and the 10 MHz lock status is checked.

Limitations and Considerations

Measurement Frequencies

The signal frequency at which the 10 MHz lock status is checked is equal to the lock range of the M9302A plus an addition offset based on the frequency accuracy of the signal source internal frequency reference. It is assumed that an E8257D is the signal source and that the calibration interval is 3 years. The E8257D frequency accuracy is no worse than 0.1 ppm. The lock range specification is 3 ppm. Therefore, the frequencies applied when checking the M9302A lock range are 3.1 ppm or 10 MHz \pm 31 Hz.

Specification

Table 1

Frequency Lock Range	Conditions	Source
10- MHz \pm 3 ppm	n/a	M9302A Data Sheet

Equipment

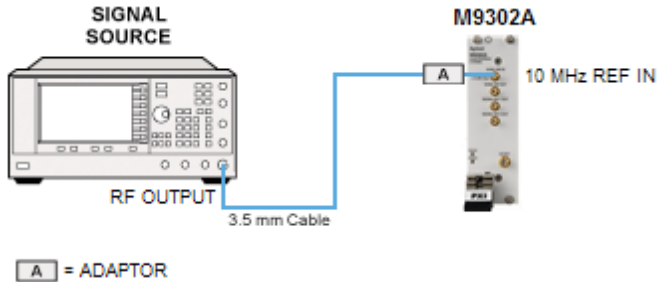
Table 2

Equipment	Supported Models
Signal Source	Agilent E8257D

Performance Verification Tests

Equipment	Supported Models
Adaptor, 3.5 mm (f) to SMB (f)	1250-1743
Cable, APC 3.5	8120-4921

Test Configuration



Test Procedure

Test Setup

1. Turn on the signal source and allow for a warm up of 30 minutes.
2. Install the M9302A into the PXI chassis.
3. Turn on the PXI chassis and allow it to warm up for 15 minutes.
4. Connect the signal source RF OUT to the 10 MHz REF IN port.
5. Set the signal source to 10 MHz.
6. Set the signal source RF power level to +2 dBm.
7. Turn on the signal source RF power.

Measurement (record your findings on the Test Record Card – see page [36](#))

1. Open the M9302A soft front panel (SFP) and check that the 10 MHz lock indicator shows that the M9302A is locked.
2. Set the signal source frequency to 9,999,969 Hz.
3. In the M9302A SFP, check that the 10 MHz lock indicator shows that the M9302A is locked.
4. Set the signal source frequency to 10,000,031 Hz.
5. In the M9302A SFP, check that the 10 MHz lock indicator shows that the M9302A is locked.
6. If the M9302A 10 MHz reference remains locked in both cases, the test passes.

Measurement Uncertainty

This test is a functional test and does not report a measured value or an uncertainty. The uncertainty of the signal source frequency is accounted for in the measurement frequencies.

Output Power Test

Test Method

This test measures the output power of at the LO OUT port and the three reference output ports of the M9302A LO module by direct measurement using a power meter and power sensor.

Specification

Table 1

Power	Conditions	Source
+16 dBm \pm 2 dBm	LO Port, 3 to 10 GHz	M9302A Data Sheet
0 dBm \pm 3 dBm	REF OUT Port (10 MHz)	
0 dBm \pm 3 dBm	REF1 OUT Port (100 MHz)	
0 dBm \pm 3 dBm	REF2 OUT Port (100 MHz)	

Equipment

Table 2

Equipment	Supported Models
Power Meter	Agilent N1914A; N1912A; E4419B
Power Sensor	Agilent N8485A
Adaptor, 3.5 mm (m) to 3.5 mm (f) (for LO OUT port)	83059C
Adaptor, SMA (f) to SMB (m) (for REF 1 OUT and REF 2 OUT ports)	1250-0674
Adaptor, SMB (f) to SMB (f) (for REF 1 OUT and REF 2 OUT ports)	1250-0672

Test Configuration

Figure 1

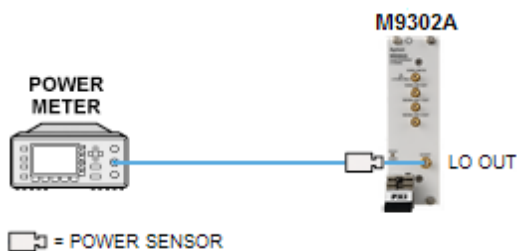
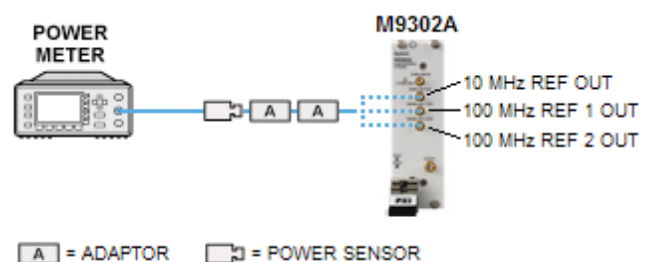


Figure 2



Test Procedure

Test Setup

1. Turn on the power meter (with power sensor connected) and allow for warm up of 90 minutes.
2. Install the M9302A 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 the power sensor.
5. Open the M9302A soft front panel (SFP) and set the LO Frequency to 3.0 GHz (default value).
6. Connect the power sensor to the LO OUT connector on the M9302A (see **Figure 1**).
7. Configure the reference power meter as shown in **Table 3**.

Table 3

Parameter	Value
Filter/Averaging	On
Filter Mode/Meas Avg	Auto
Display Resolution	4

Measurement (record your findings on the Test Record Card – see page 36)

1. Measure the LO OUT port. For each LO Frequency in Table 4:

Table 4 – Test Points

LO Frequency
3.0 GHz
3.5 GHz
4.0 GHz
4.5 GHz
5.0 GHz
5.5 GHz
6.0 GHz
6.5 GHz
7.0 GHz
7.5 GHz
8.0 GHz
8.5 GHz
9.0 GHz
9.5 GHz
10.0 GHz

- a. Set the M9302A frequency.
 - b. Set the power meter measurement frequency.
 - c. Record the power reading from the power meter.
2. Disconnect the power sensor from the LO OUT port.
 3. Connect the SMA to SMB adaptor to the power sensor and connect the power sensor to the 10 MHz REF OUT port using the SMB (m) to SMB (m) adaptor. (see **Figure 2**)
 4. Set the power meter measurement frequency to 10 MHz.
 5. Record the power reading from the power meter for the 10 MHz REF OUT port.
 6. Disconnect the power sensor from the 10 MHz REF OUT port and connect it to the 100 MHz REF 1 OUT port. (see Figure 2)
 7. Set the power meter measurement frequency to 100 MHz.
 8. Record the power reading from the power meter for the 100 MHz REF 1 OUT port.

9. Disconnect the power sensor from the 100 MHz REF 1 OUT port, and connect it to the 100 MHz REF 2 OUT port.
10. Record the power reading from the power meter for the 100 MHz REF 2 OUT port.

Measurement Uncertainty

The expanded uncertainty of measurement for this test (noted as the “Uncertainty” value provided in the [Test Record Card](#) -- see page 36) 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%.

Phase Noise Test

Test Method

Phase Noise is measured using the phase noise measurement capability of either a PXA or PSA signal analyzer.

Limitations and Considerations

Phase Noise

The limiting factor in this measurement is the base phase noise of the signal analyzer. Ideally, the phase noise of the signal analyzer is much lower than the measured phase noise of the device under test. The PXA series of signal analyzers have low phase noise and are ideal for this measurement. The PSA series of signal analyzers phase noise is about the same as the device under test. The PSA is only suitable if it is first calibrated with a low noise signal source and the noise cancellation feature is employed, which was not considered for this test.

Specification

Table 1

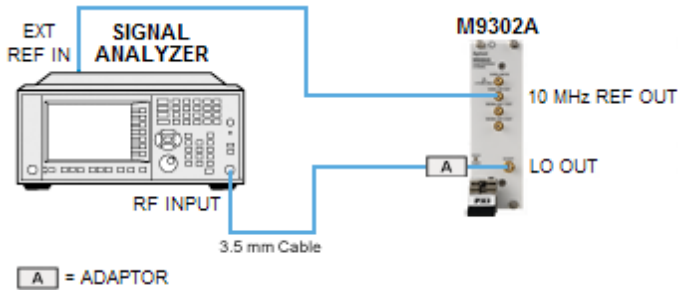
Phase Noise	Conditions	Source
≤ -115 dBc/Hz	@10 GHz, 10 kHz Offset	M9302A Data Sheet

Equipment

Table 2

Equipment	Supported Models
Signal Analyzer	Agilent N9030A, Opt 513 + N9068A Phase Noise Measurement
Cable: APC 3.5	8120-4921

Test Configuration



Test Procedure

Test Setup

1. Turn on the signal analyzer and allow it to warm up for 15 minutes.
2. Install the M9302A into the PXI chassis.
3. Turn on the PXI chassis and allow it to warm up for 15 minutes.
4. Preset all equipment.
5. On the signal analyzer, perform an **Auto Align** now.
6. Connect the M9302A 10 MHz REF OUT port to the 10 MHz REF IN port of the signal analyzer.
7. Connect the M9302A LO OUT port to the RF IN port of the signal analyzer.
8. Use the M9302A soft front panel to set the M9302A frequency to 10 GHz.
9. Configure the signal analyzer for measuring phase noise.
 - a. From the front panel, select **Mode** and then select **Phase Noise** from the soft keys.
 - b. Set the signal analyzer **Center Frequency** to 10 GHz.
 - c. Set the signal analyzer **Amplitude Reference** to 20 dBm.
 - d. View the signal at spectrum domain, using **Monitor Spectrum**. **Note:** it is always a good idea to use the monitor spectrum measurement to ensure that your analyzer is set to the correct frequency.
10. View the log plot.
 - a. Set the signal analyzer carrier frequency to 10 GHz
 - b. Set the signal analyzer **Amplitude Reference** to 20 dBm.
 - c. Set the **Start Offset** to 100 Hz and **Stop Offset** to 1 MHz and then **Restart**.
 - d. Turn the Decade Table on , so that you can have both graphic and tabular presentations.

Measurement (record your findings on the Test Record Card – see page [36](#))

1. Press the **Carrier Search** soft key and wait until the phase noise display has updated.
2. Note the marker value at the 10 kHz offset frequency.

Measurement Uncertainty

The phase noise measurement is measured directly by the signal analyzer. The signal analyzer's accuracy, when measuring phase noise, is specified to be ± 0.2 dB. For the purposes of this test, this is the expanded measurement uncertainty.

Harmonic Distortion Test

Test Method

This test measure the second harmonic distortion of the LO Output of the M9302A LO module.

Limitations and Considerations

Methodology

This measurement is made using a signal analyzer. However, the signal analyzer frequency response is calibrated using a two-resistor splitter and a power sensor prior to measuring harmonic distortion. To provide more isolation at the signal analyzer, a 10 dB pad is used.

Higher Order Harmonics

This test assumes that the second harmonic distortion is worst case. That is, the higher order harmonics are of lower amplitude than higher order harmonics and are not measured

Specification

Table 1

Harmonic Distortion	Conditions	Source
≤ -20 dBc	3 to 6 GHz	M9302A Data Sheet
≤ -12 dBc	>6 GHz	

Equipment

Table 2

Equipment	Supported Models
Signal Source	Agilent E8267D; E8257D
Signal Analyzer	Agilent E4440A; N9030A Opt 526
Power Meter	Agilent N1914A; N1912A; E4419B
Two-resistor Splitter	Agilent 11667B
Power Sensor	Agilent N8485A
Fixed Attenuator	Agilent 8493C Opt 020
Adaptor, 3.5 mm (m) to Type-N (m)	1250-1743
Cable, 3.5 mm (m) to 3.5 mm (m)	11500E/F; 8120-4921

Test Configuration

Figure 1

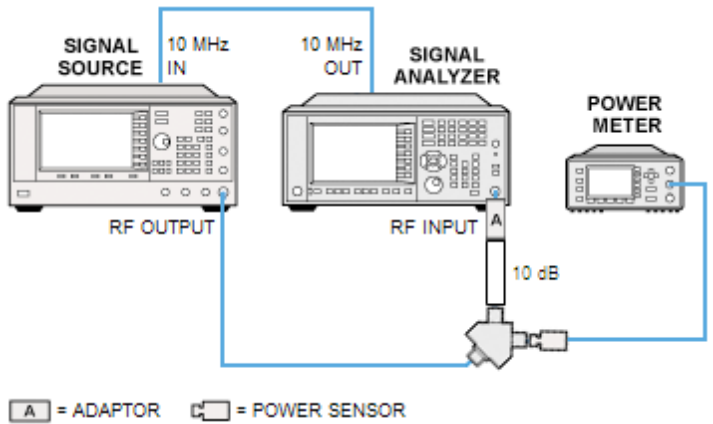
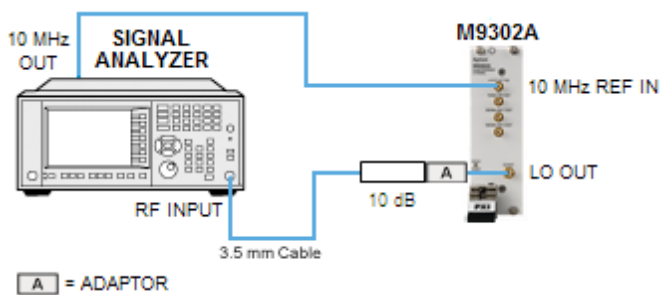


Figure 2



Test Procedure

Test Setup

1. Turn on the power meter (with power sensor connected) and the signal source and allow for warm up of 90 minutes.
2. Install the M9302A 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 the power sensor.
5. Open the M9302A soft front panel and set the LO Frequency to 3 GHz (default value).
6. Connect the equipment as shown in **Figure 1**.
 - a. Connect the RF OUT of the signal source to the input of the two-resistor splitter using a 3.5 mm (m) to 3.5 mm (m) RF cable.
 - b. Connect the power sensor to one of the output arms of the two-resistor splitter.
 - c. Connect the other output arm of the two-resistor splitter to the RF IN of the signal analyzer, using a 10 dB fixed attenuator and a 3.5 (m) to Type-N (m) adaptor. The connection is to be made without cables.
 - d. Connect the 10 MHz OUT of the signal analyzer to the 10 MHz IN port of the signal source.

7. Configure the signal analyzer as shown in **Table 3**.

Table 3

Parameter	Value
Center Frequency	3.0 GHz
Span	1 kHz
RBW	100 kHz
Averages	5
Reference Level	20 dBm

8. Configure the reference power meter as shown in **Table 4**.

Table 4

Parameter	Value
Filter/Averaging	On
Filter Mode/Meas Avg	Auto
Resolution (display resolution)	4
Relative (power measurement)	Checked

Measurement (record your findings on the Test Record Card – see page [36](#))

1. Determine the signal analyzer flatness correction. For each LO Frequency in **Table 5**:

Table 5 – Test Points

LO Frequency
3.0 GHz
3.5 GHz
4.0 GHz
4.5 GHz
5.0 GHz
5.5 GHz
6.0 GHz
6.5 GHz
7.0 GHz
7.5 GHz
8.0 GHz
8.5 GHz
9.0 GHz
9.5 GHz
10.0 GHz

- a. Set the signal source frequency.
- b. Set the signal source power to 0 dBm.

Performance Verification Tests

- c. To achieve -16 dBm at the signal analyzer and -6 dBm at the power sensor:
 - i. Keep power at the signal analyzer above -20 dBm.
 - ii. Keep power at the power sensor below -1 dBm.
 - d. Set the signal analyzer center frequency.
 - e. Set the power meter measurement frequency.
 - f. On the signal analyzer, perform a peak search, and select **Marker Delta**.
 - g. On the power meter, set the relative power reading (the power meter should now display 0 dB).
 - h. Set the signal source frequency to twice the LO Frequency.
 - i. Set the signal analyzer center frequency to twice the LO Frequency.
 - j. Set the power meter measurement frequency to twice the LO Frequency.
 - k. On the signal analyzer, perform a peak search.
 - l. Note the marker delta value as well as the relative power reading on the power meter in the Test Record Card (see **Marker Delta 1** column).
 - m. Record the flatness correction value in the Test Record Card for each LO frequency as the difference between the marker delta (**Marker Delta 1**) reading on the signal analyzer and the relative power reading on the power meter. The Test Record Card PDF calculates the flatness correction value for you.
2. Connect the equipment as shown in **Figure 2**.
 - a. Disconnect the 10 dB fixed attenuator from the two-resistor splitter.
 - b. Using an RF cable, connect the 10 dB fixed attenuator to the M9302A LO OUT port,.
 3. Measure the second harmonic distortion. For each LO frequency in **Table 5**:
 - a. Set the M9302A frequency. (Use the M9302A soft front panel software to do this.)
 - b. Set the signal analyzer center frequency.
 - c. On the signal analyzer, perform a peak search, and select **Marker Delta**.
 - d. Set the signal analyzer center frequency to twice the LO frequency.
 - e. On the signal analyzer, perform a peak search.
 - f. Note the marker delta value in the Test Record Card (see **Marker Delta 2** column). Second harmonic distortion is defined as the marker delta value from the signal analyzer minus the flatness correction. The Test Record Card PDF calculates the second harmonic distortion value for you.

Measurement Uncertainty

The expanded uncertainty of measurement for this test (noted as the “Uncertainty” value provided in the [Test Record Card](#) -- see page 36) 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 M9302A .

In this section:

- [Replaceable Parts](#) (page 31)
- [Module Core Replacement](#) (page 32)
- [Test Record Card](#) (page 36)

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
M9302A PXI Local Oscillator	n/a	M9302-60003	PXI Local Oscillator: 3 GHz TO 10 GHz replacement core assembly
M9302A PXI Local Oscillator	n/a	M9302-69003	PXI Local Oscillator: 3 GHz TO 10 GHz replacement core assembly EXCHANGE

Module Core Replacement

Ordering a core replacement module

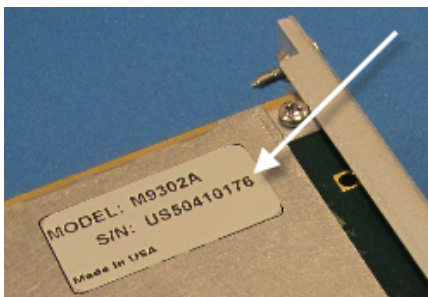
1. Contact Agilent (see www.agilent.com/find/assist).
2. Order a core replacement for your module (part number M9302-60003).
3. When the core replacement arrives, the package includes:
 - Entitlement Certificate
 - Replacement module
 - Calibration certificate for the replacement module
 - RMA number
 - Return instructions

Replacing the defective module

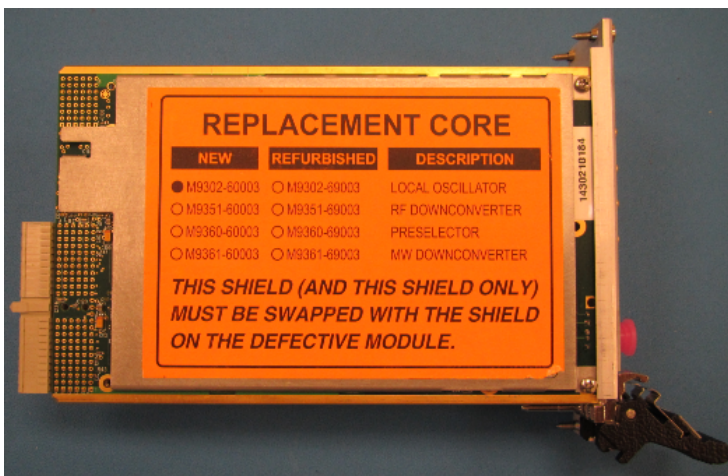
CAUTION

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

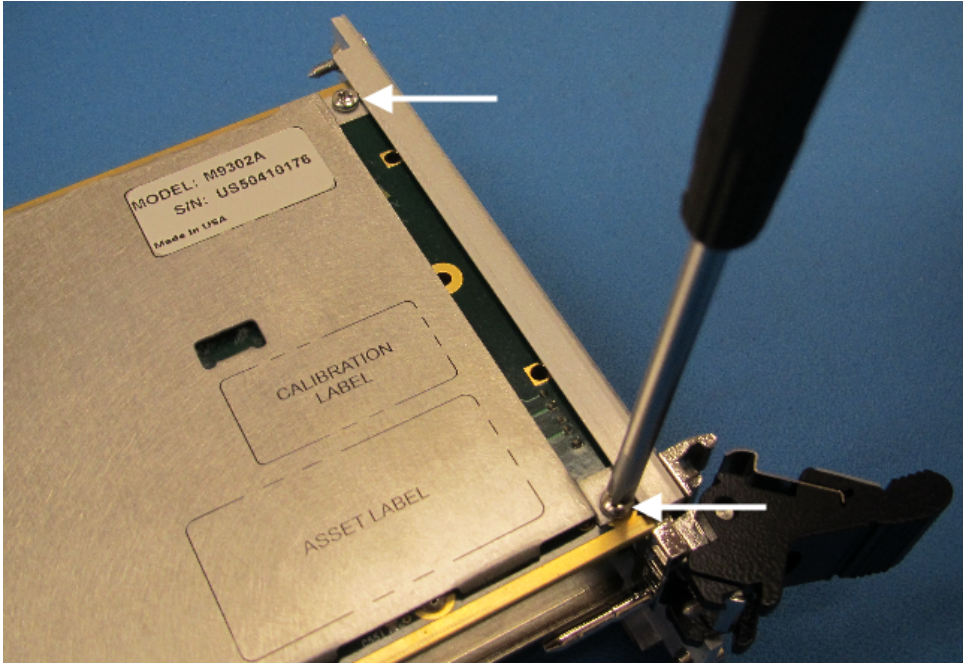
1. Power down the chassis.
2. Remove the defective module from the chassis.
3. Write down the serial number shown on the side shield of the defective module. You will assign this serial number to the replacement module using the Agilent M9392A Serial Number Update Utility.



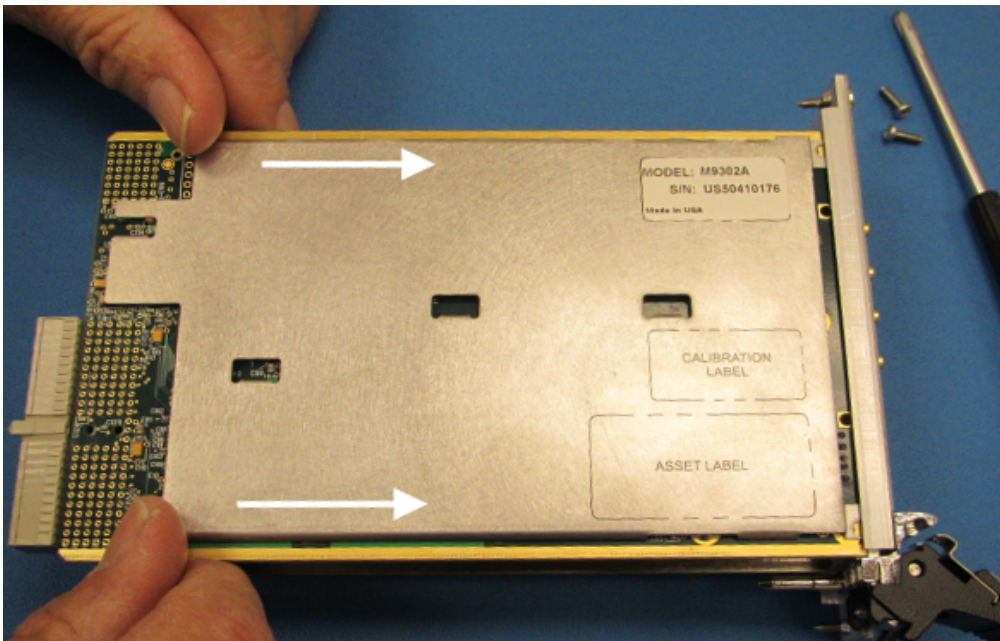
4. Remove the replacement module from the box and shipping material.



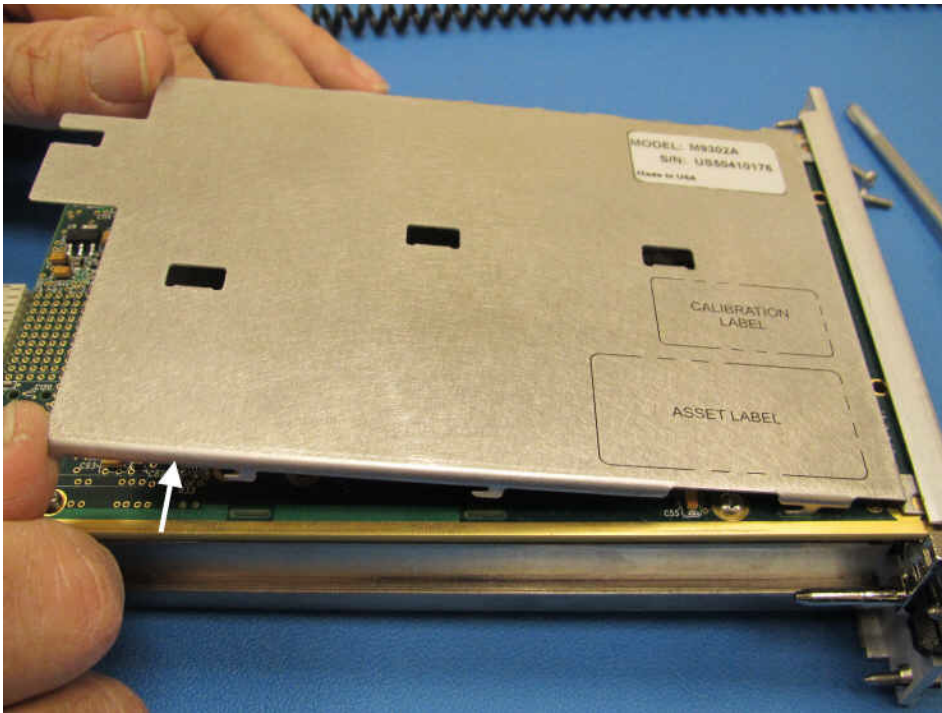
5. Remove the side shield from the defective module.
 - a. Using a Philips #1 (PH1) screwdriver, remove the two screws that secure the side shield to the module. **NOTE: Keep the screws**; extra screws are not included with the replacement module.



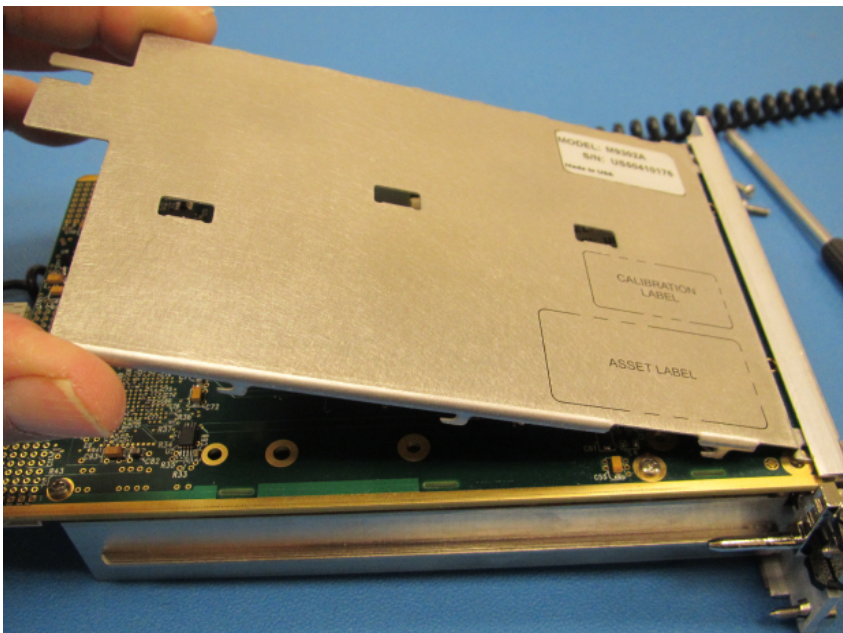
- b. Slide the shield toward the module's front panel. This aligns the engagement tabs so you can remove the shield.



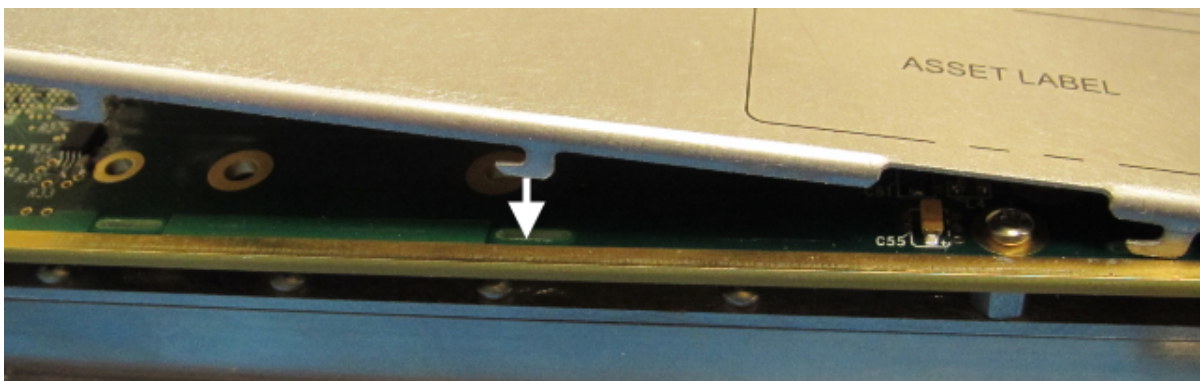
- c. Raise the side shield and lift it away from the module.



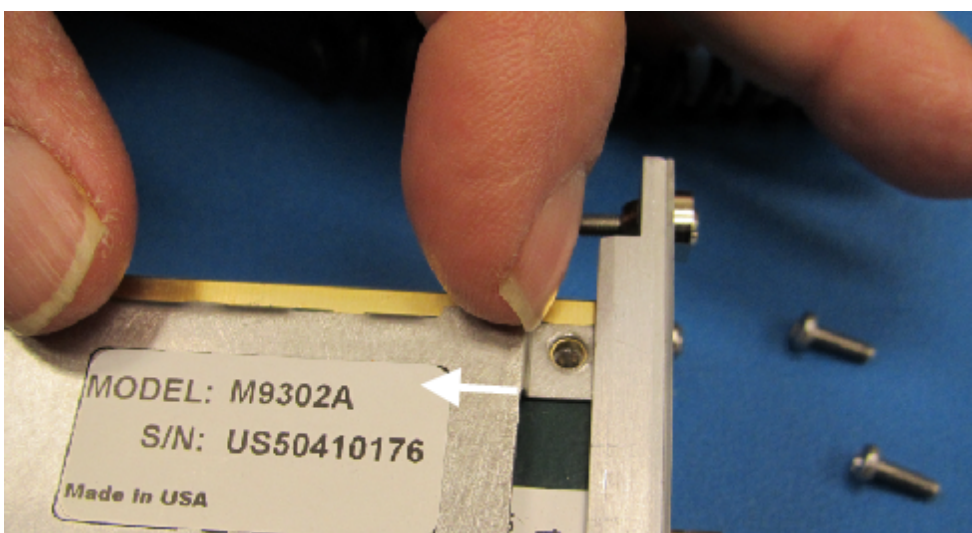
- 6. Remove the side shield from the replacement module, using the same process as in Step 5 above.
- 7. Attach the original side shield from the defective module to the replacement module.
 - a. Position the side shield so that the screw tabs align with the screw holes on the module, and then slide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

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, M9302A).
 - 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](#)

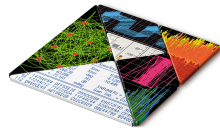


TIP: Use Ctrl/click to open the Test Record Card as a separate document.



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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www.agilent.com/find/modular

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