

# **Agilent Technologies**

## **M9405A**

User's and Service Guide



# **Agilent Technologies M9405A**

## **User's and Service Guide**



**Agilent Technologies**

**Manufacturing Part Number: M9499-90004**

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## Statement of Compliance

This instrument has been designed and tested in accordance with CAN/CSA 22.2 No. 61010-1-04, UL Std No. 61010-1 (2nd Edition).

## Declaration of Conformity

A copy of the declaration of conformity is available upon request, or a copy is available on the Agilent Technologies web site at <http://regulations.corporate.agilent.com/DoC/search.htm>

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## Safety Notices

The following safety notes are used throughout this document. Familiarize yourself with each of these notes and its meaning before performing any of the procedures in this document.

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**WARNING**      **Warning denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury or loss of life. Do not proceed beyond a warning note until the indicated conditions are fully understood and met.**

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**CAUTION**      Caution denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the product. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

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## General Safety Information

### Introduction

This product is intended for use by qualified personnel that are familiar with the safety precautions required to avoid any possible injury. Read and follow all installation, operation, and maintenance information carefully before using this product. Refer to the user documentation for complete product specifications

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

### Cleaning Precautions

To clean the connectors use alcohol in a well ventilated area. Allow all residual alcohol moisture to evaporate, and fumes to dissipate prior to energizing the instrument.

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**WARNING**      **To prevent electrical shock, remove the Agilent Technologies M9405A from the chassis 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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## Instrument Markings



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).



The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)



This is a required mark signifying compliance with an EMC requirement. The C-Tick mark is a registered trademark of the Australian Spectrum Management Agency.



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 that PXI is a U.S. registered trademark of the PXI System Alliance.



Maximum RF Input power.

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## Contents



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# **M9405A**

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## Introduction

The scope of this User's and Service Guide is to detail the processes of receiving and installing the M9405A module, installing the required software, and verifying basic module operations. If you have any inquiries after reviewing this information, contact your local Agilent Technologies Inc. representative or refer to ["Contacting Agilent" on page 17](#).

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## Description

Congratulations on your purchase from Agilent Technologies, Inc.

The M9405A is a 1-slot, 1U PXIe Amplifier. The M9405A operates over a frequency range of 300 kHz to 26.5 or 50 GHz.

To get the most out of your purchase, it is recommended that this User's and Service Guide be read carefully and completely.

**Table 1**      **Model and Options**

| Module | Option | Description                   |
|--------|--------|-------------------------------|
| M9405A | H01    | Standard PXIe Amplifier       |
|        | F26    | Frequency 300 kHz to 26.5 GHz |
|        | F50    | Frequency 300 kHz to 50 GHz   |

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## Technical Specification and Characteristics

### Definitions

**Specifications** describe the warranted performance of calibrated instruments. Data represented in this document are specifications unless otherwise noted under the following conditions.

- Full temperature range = Individual module temperature of  $\leq 75$  °C as reported by the module, and environment temperature of 0 to 55 °C.
- Controlled temperature range = Individual module temperature of  $\leq 55$  °C as reported by the module, and environment temperature of 20 to 30 °C.

**Temperatures referred to in this document are defined as follows:**

- Calibrated instruments have been stored for a minimum of 2 hours within the full temperature range
- 45 minute warm-up time
- Calibration cycle maintained
- When used with Agilent M9300A frequency reference and Agilent interconnect cables

**Characteristics** describe product performance that is useful in the application of the product, but that is not covered by the product warranty. Characteristics are often referred to as *Typical* or *Nominal* values and are italicized.

- **Typical** describes characteristic performance, which 80% of instruments will meet when operated within the controlled temperature range.
- **Nominal** describes representative performance that is useful in the application of the product when operated within the controlled temperature range.

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## Verifying the Shipment

To verify the content shipped with your module, refer to the “Box Content List” included with the shipment.

Inspect the shipping container for damage. Report any damage to the shipping agent immediately, such damage is not covered by the warranty (warranty information can be found at the beginning of this manual). Keep the damaged shipping materials (if any) for inspection by the carrier and an Agilent Technologies representative. Refer to [“Contacting Agilent” on page 17](#).

Carefully remove the contents from the shipping container and verify that your order is complete. Confirm that the options you ordered are included with the shipment. Refer to the serial number label on the side panel and the packing literature included with the shipment.

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## Electrostatic Discharge Protection

Electrostatic discharge (ESD) can damage or destroy electronic components. The module is shipped in materials which prevent damage from static, and should only be removed from the packaging in an anti-static area ensuring that the correct anti-static precautions are taken.

Two types of ESD protection are listed below. Purchase acceptable ESD accessories from your local supplier.

- Conductive table-mat and wrist-strap combination
- Conductive floor-mat and heel-strap combination

Both types, when used together, provide a significant level of ESD protection. To ensure user safety, static-safe accessories must provide at least 1 M $\Omega$  of isolation from ground.

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**WARNING**     **These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.**

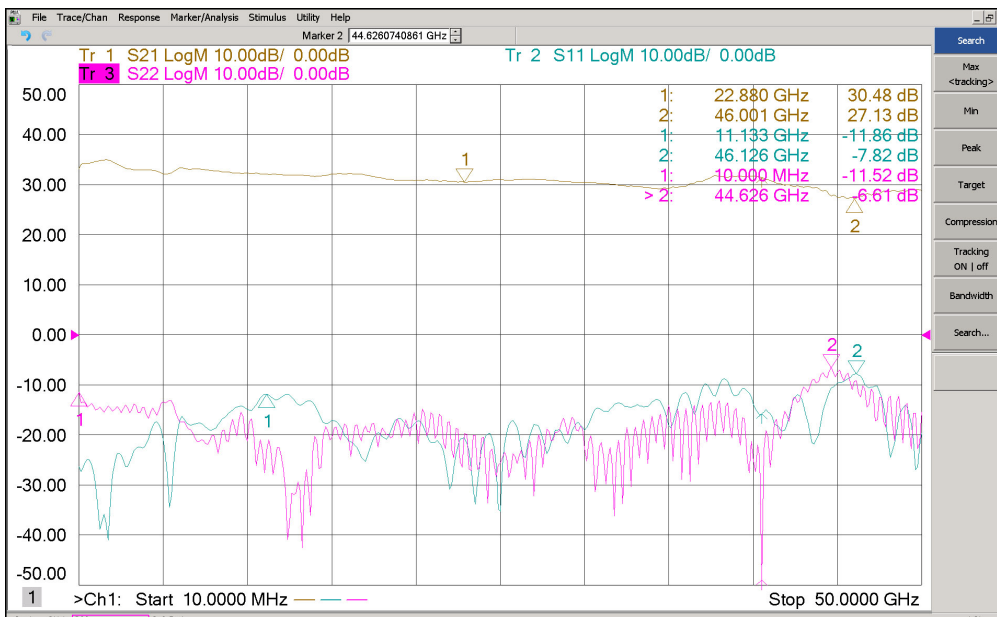
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# General Characteristics

**Table 2** Nominal Performance

| Frequency Range   | 300 kHz to 50 GHz |            |      |
|---|-------------------|------------|------|
| Input Power at Compression (dBm)<br>(0.1 dB and 1 dB compression)   |                   | 0.1 dB     | 1 dB |
|   | 1 GHz             | -22        | -18  |
|   | 10 GHz            | -22        | -13  |
|   | 26.5 GHz          | -22        | -14  |
|   | 50 GHz            | -20        | -13  |
| Maximum Input Power M9405A  | -10 dBm           |            |      |
| Impedance   | 50 Ohms           |            |      |
|   | Option F26        | Option F50 |      |
| Return Loss (dB)<br>RF Input (S11)<br>RF Output (S22)   | ≤ -10             | ≤ -5       |      |
| Gain (dB) (S21)   | ≥ 27              | ≥ 24       |      |
| NF (dB)<br>(The conversion loss of the link is the primary contributor to the NF results. Amplification is recommended to reduce NF). | 7                 | 9          |      |
| RF Connectors   | 3.5 mm            | 2.4 mm     |      |

**Figure 1** Nominal Performance



## Front Panel Features

Figure 2 M9405A Front Panel



### Status LED

- Green, the status LED indicates the chassis is powered on and communicating with the module when the soft front panel is opened (SFP).

### Access Ports 3.5 or 2.4 mm (female)

- RF Input/Output 300 kHz to 26.5 or 50 GHz.

### PXI Latch

- Secures the modules to the mainframe.

## Install the Software

**Table 3 System and Hardware Requirements**

| Topic                             | Requirements  |  |
|-----------------------------------|---|--|
| <b>System Requirements</b>        |   |  |
| 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<br>800 MHz recommended   | 1 GHz 32-bit (x86), 1 GHz 64-bit (x64), no support for Itanium64   |
| Available memory                  | 256 MB minimum<br>(1 GB or greater recommended)   | 1 GB minimum   |
| Available disk space <sup>1</sup> | 1.5 GB available hard disk space, includes:<br>  1 GB available for Microsoft.NET Framework 3.5 SP1 <sup>2</sup><br>  100 MB for Agilent IO Libraries Suite   |  |
| Video                             | Super VGA (800x600)<br>25 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   |
| <b>Hardware Requirements</b>      |   |  |
| Chassis                           | 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.   |  |
| 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:<br>- PXIe system controller (PXI-1 embedded controllers are not compatible)<br>- 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 M9021A Cable Interface x8 with one of the following PC interface options:<br>- Agilent M9045B PCIe ExpressCard Adaptor x1, with cable (for a laptop PC)<br>- 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). |  |

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.

## 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. As well, you must power 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 and monitor).
3. Turn On the chassis.

## Install the Software

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**NOTE** Administrator privileges will be needed for software and hardware installation. This includes first-time installation of a module in a different chassis slot.

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The software installation includes the following:

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**NOTE** Version 16.2 (or newer) of the Agilent IO Libraries Suite is required.

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- The Agilent IO Libraries Suite CD (E2094-60003), includes the Agilent Connection Expert. It is also available on the internet at: <http://www.agilent.com/find/iosuite>
- Instrument software, which includes the soft front panel (SFP), device driver (IVI-COM) and documentation for the M9405A. This software CD is included with your shipment (M9499-10002).

Use the following procedure to install the software:

1. From the Agilent IO Libraries Suite CD (E2094-60003) browser, launch the installer.
2. Follow the installer prompts to install the IO Libraries Suite.
3. From the Product Software and Information CD (M9499-10002) browser, launch the installer.
4. Follow the installer prompts to install all software and documentation for the module.
5. After installation has completed, power down the host PC.



## Install the M9405A

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**NOTE** The M9405A can be used in a chassis with a PXIe or PXI-H chassis peripheral slot.

---

**7**<sup>H</sup>

The M9405A 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).

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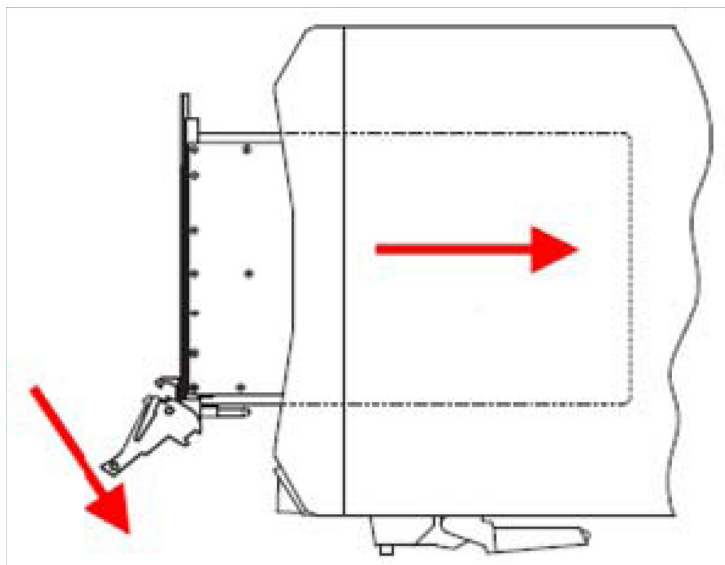
**CAUTION** PXI hardware does not support "hot-swap" capabilities (changing modules while power is applied to the chassis).

Before installing a module into the chassis, the chassis must be powered off to prevent damage to the module.

---

1. Ensure that the PXI 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. Do not set the fan speed to low or turn it off.
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. Holding the module by the injector/ejector handle, slide it into the card edges on the guide slot (top and bottom) as shown in [Figure 3](#).
  - a. Slide the module to the rear of the chassis and ensure that the injector/ejector handle is pushed down in the unlatched (downward) position.
  - b. Slide the module completely into the chassis. When you begin to feel resistance, push up on the injector/ejector handle to fully insert the module into the chassis.

**Figure 3** Installing the Module



5. Secure the front panel to the chassis using the front panel mounting screws. Performance may suffer if the screws are not tightened properly.
6. Verify that the PXI chassis fans are operable and free of dust and other contaminants that may restrict air flow.
7. Install all chassis covers and filler panels. Missing filler panels may disrupt necessary air circulation in the chassis.
8. Power up the PXI chassis.

---

## M9405A Operational Check Procedure

The operational check measures the signal paths from the RF Input of the M9405A module. The following procedure verifies that the connectors and circuitry are operating correctly.

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**CAUTION** Do not exceed the maximum input power level of +20 dBm.

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### Equipment Required

To demonstrate that the module works properly requires external equipment with operating frequency range of 10 MHz to 26.5 or 50 GHz. This includes a network analyzer, or optionally, a signal source and power meter or spectrum analyzer.

**Table 4 Hardware Test Configuration**

| Hardware   | Description                         |
|------------|-------------------------------------|
| Option I   | Network Analyzer                    |
| Option II  | Signal Source and Power Meter       |
| Option III | Signal Source and Spectrum Analyzer |

### Equipment Test Configuration Option I (Network Analyzer)

1. Adjust the Network Analyzer Stimulus Power for the M9405A to –30 dBm.
2. Set the Frequency Sweep from 10 MHz to 26.5 or 50 GHz depending on Options F26 or F50.
3. Perform a 2-Port Network Analyzer calibration (normalization response is adequate).
4. Connect the Stimulus Source (Network Analyzer Port 1) to the M9405A RF Input Port.
5. Connect Port 2 of the Network Analyzer to the M9405A RF Output Port.

---

**NOTE** Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

---

6. Measure the Return Loss (S11 & S22) and Gain (S21). Compare it to the typical performance in [Table 2 on page 5](#).

## Equipment Test Configuration Option II (Signal Source & Power Meter)

1. Adjust the Signal Source Stimulus Power for the M9405A to  $-30$  dBm.
2. Set the Signal Source to a CW Frequency of 50 MHz.
3. Perform a Power Meter calibration.
4. Connect the Stimulus Source to M9405A RF Input Port.
5. Connect the Power Meter Sensor to M9405A RF Output Port.

---

**NOTE** Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

---

6. Measure the Power and compare the Gain ( $P_{\text{measured}} - P_{\text{stimulus}}$ ).
7. Set the Signal Source to a CW Frequency of 10 GHz.
8. Repeat [step 5](#) thru [step 6](#).
9. Set the Signal Source to a CW Frequency of 26.5 GHz.
10. Repeat [step 5](#) thru [step 6](#).
11. Set the Signal Source to a CW Frequency of 50 GHz.
12. Compare the Gain to [Table 1 on page 2](#).

**Equipment Test Configuration Option III (Signal Source & Spectrum Analyzer)**

1. Adjust the Signal Source Stimulus Power for the M9405A to  $-30$  dBm.
2. Set the CW Frequency Sweep to 50 MHz.
3. Set the Center Frequency to 50 MHz on the Spectrum Analyzer respectively.
4. Connect the Stimulus Source to M9405A RF Input Port.
5. Connect the Spectrum Analyzer to M9405A RF Output Port.

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**NOTE** Depending on your instrument's power handling capability it may be necessary to use a 20 dB attenuator to protect the instrument.

---

6. Measure the Power and compare the Gain ( $P_{\text{measured}} - P_{\text{stimulus}}$ ).
7. Set the Signal Source to a CW Frequency of 10 GHz.
8. Repeat [step 5](#) thru [step 6](#).
9. Set the Signal Source to a CW Frequency of 26.5 MHz.
10. Repeat [step 5](#) thru [step 6](#).
11. Set the Signal Source to a CW Frequency of 50 GHz.
12. Compare the Gain to [Table 1 on page 2](#).

---

## Service

### If a Problem is Found

If a problem is found, complete the following procedures:

1. Verify that the relevant hardware is turned on.
2. Verify that the stimulus signal is set to the proper power/frequency and that all cables are properly connected.

### Module Core Replacement

#### Replaceable Parts

| Description               | Agilent Part Numbers | Part Number Description   |
|---------------------------|----------------------|---------------------------|
| PXle Amplifier Option F26 | M9405-60001          | Replacement core assembly |
| PXle Amplifier Option F26 | M9405-69001          | Exchange core assembly    |
| PXle Amplifier Option F50 | M9405-60002          | Replacement core assembly |
| PXle Amplifier Option F50 | M9405-69002          | Exchange core assembly    |

#### Ordering a Core Replacement Module

1. Contact Agilent on the internet at: <http://www.agilent.com/find/assist>
2. Order a core replacement for your module.
3. When the core replacement arrives, the package includes:
  - Entitlement Certificate
  - Replacement module
  - Functional Certificate for the replacement module
  - RMA number
  - Return instructions

## Replacing the Defective Module

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**CAUTION** Before opening a packaged module for troubleshooting, ensure that all electrostatic discharge (ESD) precautions are observed. Refer to “[Electrostatic Discharge Protection](#)” on [page 4](#) for details.

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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 M9405A Simple Module (SFP).
4. Remove the replacement module from the box and shipping material.
5. Remove the side shield from the defective module using a Torx #8 driver.
  - a. There are five screws to secure the side shield to the module.  
Important: Keep the screws, new ones are not included with the replacement module.
6. Remove the side shield from the replacement module using this same process.
7. Attach the original side shield from the defective module to the replacement module.
8. Install the replacement module into the chassis.
9. Power up the chassis.
10. If you are using a remote controller, power up the computer. (If you are using an embedded controller, continue to the [step 11](#).)
11. Program the replacement module with the serial number from the defective module.
  - a. If you don't already have the Agilent M9405A Simple Module SFP, download it from <http://www.agilent.com/find/M9405A> (from this site, select Technical Support > Drivers, Firmware & Software), and install it on your computer or embedded controller.
  - b. Launch the Agilent M9405A Simple Module SFP (launch from the Start menu program group “Agilent/SimpleModuleSFP”) and follow the embedded instructions for programming the serial number.

12. 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, M9405A).
    - 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.

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**NOTE** If any correspondence is required, refer to the product by serial number and model number or refer to ["Agilent Support, Services, and Assistance" on page 17](#).

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## Agilent Support, Services, and Assistance

### Service and Support Options

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**NOTE** There are many other repair and calibration options available from the Agilent Technologies support organization. These options cover a range of service agreements with varying response times. Contact Agilent for additional information on available service agreements for this product.

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### Contacting Agilent

Assistance and information or finding a local Agilent office are available on the internet at:  
<http://www.agilent.com/find/assist>

If you do not have access to the Internet, contact your field engineer.

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**NOTE** In any correspondence or telephone conversation, refer to the Agilent product by its model number and full serial number. With this information, the Agilent representative can determine the warranty status of your unit.

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### Return for Service or Repair

Should it be necessary to return the product for repair or service, please include the following information:

- Contact Agilent for instructions on where to ship your analyzer.
- Your company's name and address.
- A technical contact person within your company and the person's complete telephone number, including county code and area code.
- A detailed description of the problem and how the device was begin used when the problem occurred (such as calibration, measurement, failed test or error message).

