Agilent E4418/19A Power Meter Hardware Upgrade Kit

(E9300 Compatible)

Installation Guide

Agilent Technologies

Notices

Manual Part Number

E4418-90082

Edition

First Edition, February 23, 2009

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Santa Clara, CA 95052 USA

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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.

Equipment Operation

Warnings and Cautions

This guide uses warnings and cautions to denote hazards.

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 loss of life. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.**

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.

Personal Safety Considerations

This is a Safety Class I product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor, inside or outside the instrument, is likely to make the instrument dangerous. Intentional interruption is prohibited. If this instrument is not used as specified, the protection provided by the equipment could be impaired. This instrument must be used in a normal condition (in which all means of protection are intact) only.

No operator serviceable parts inside. Refer servicing to a qualified personnel. To prevent electrical shock, do not remove covers. For continued protection against fire hazard, replace the line fuse(s) only with fuse(s) of the same type and rating (for example, normal blow, time delay, etc.). The use of other fuses or material is prohibited.

General Safety Considerations

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies, Inc. assumes no liability for the customer's failure to comply with these requirements.

WARNING

- **Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the AC power cable to a socket outlet provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.**

CAUTION

- Any adjustments or service procedures that require operation of the instrument with protective covers removed should be performed only by trained service personnel.

Safety Symbols

The following symbol on the instrument and in the documentation indicates precautions that must be taken to maintain safe operation of the instrument.

	Direct current (DC)		Off (supply)
	Alternating current (AC)		On (supply)
	Both direct and alternating current		Caution, risk of eletric shock
	Three-phase alternating current		Caution, risk of danger (refer to this manual for specific Warning or Caution information)
	Earth (ground) terminal		Caution, hot surface
	Protective conductor terminal		Out position of a bi-stable push control
	Frame or chassis terminal		In position of a bi-stable push control
	Equipotentiality		This symbol indicates that a device, or part of a device, may be susceptible to electrostatic discharges (ESD) which can result in damage to the product. Observe ESD precautions given on the product, or its user documentation, when handling equipment bearing this mark.
	Equipment protected throughout by double insulation or reinforced insulation		

Regulatory Markings

CE	The CE mark shows that the product complies with all the relevant European legal Directives (if accompanied by a year, it signifies when the design was proven).		The CSA mark is a registered trademark of the Canadian Standards Association.
ISM Group 1 Class A	This is the symbol of an Industrial Scientific and Medical Group 1 Class A product.		External Protective Earth Terminal. While this is a Class I product, provided with a protective earthing conductor in a power cord, an external protective earthing terminal has also been provided. This terminal is for use where the earthing cannot be assured. At least an 18AWG earthing conductor should be used in such an instance, to ground the instrument to an assured earth

IEC 1010-1 Compliance

This instrument has been designed and tested in accordance with IEC Publication 1010-1 +A1:1992 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use and has been supplied in a safe condition. The instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the instrument in a safe condition.

Statement of Compliance

This product has been designed and tested for compliance with IEC 60529 (1989) Degrees of Protection Provided by Enclosures (IP Code). Level IPx4 is attained if, and only if, the carry case (Agilent part number 34141A) is fitted.

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1 Installation

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This chapter contains information of Agilent E4418A and E4419A EPM Series Power Meter Hardware upgrade kit (E9300 compatible) installation procedures.

Introduction

Programmed part, RAM (E4418- 80023) is no longer orderable. Therefore, average assembly (E4418- 60003) and firmware version (A1.04.00 or above) are required to make E4418 power meter compatible with E9300 Series power sensors. These changes are required to allow the E9300 Series power sensors to operate with the E4418A and E4419A power meters.

The average assembly (E4418- 60003) allow the users to utilize the new E9300 Series power sensors with EPM power meter. These sensors are capable of performing the following:

- Wide dynamic range measurement of all modulated signals.
- Accurate measurement of signals with high peak to average ratios.
- Flat calibration factors give accurate measurement of multi- tone signals.

Replaceable Parts

The following tables list the material parts used to install the E4418A and E4419A hardware upgrade kit accordingly.

Table 1-1 E4418A Hardware Upgrade Information

Item	Part Number	Quantity	Description
1	E4418-60021	1	EPM HW upgrade kit E9300 compatibility • Installation Guide • Measurement Board E4418-60003
2	11683A	1	Range calibrator
3	11730A	1	Power sensor cable

Table 1-2 E4419A Hardware Upgrade Information

Item	Part Number	Quantity	Description
1	E4419-60021	1	EPM HW upgrade kit E9300 compatibility • Installation Guide • Measurement Board E4418-60003
2	11683A	1	Range calibrator
3	11730A	1	Power sensor cable

Installation Procedures

The following describes the installation of the E4418A and E4419A EPM Series Power Meter.

E4418A Power Meter

WARNING The power meter contains potentially hazardous voltages.

1. Ensure all power and sensor cables are disconnected from the power.
2. Remove the carrying handle. To remove the handle, rotate it to the vertical position and pull both handle outwards.
3. Remove the front/rear bumpers. To remove the bumper, pull one side of the bumper outwards to disengage it and pull it away from the power meter.
4. Remove the two screws attaching to the rear panel by using a 9 lb/in T15 screwdriver. See Figure 1- 1.

Figure 1-1 Remove the attached screws

5. Remove the cover by sliding it towards the rear of the power meter.
6. Remove the sensor flex- cable from the measurement board by pushing the connector tab forward and lift it up.

7 Remove the current measurement board by pulling the extractor tab outward. See Figure 1-2.

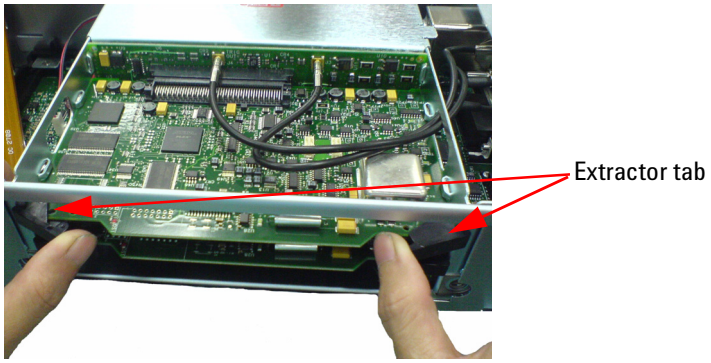

Figure 1-2 Pull the extractor tab outward

8 Slide the measurement board out from the side of the power meter. See Figure 1-3.

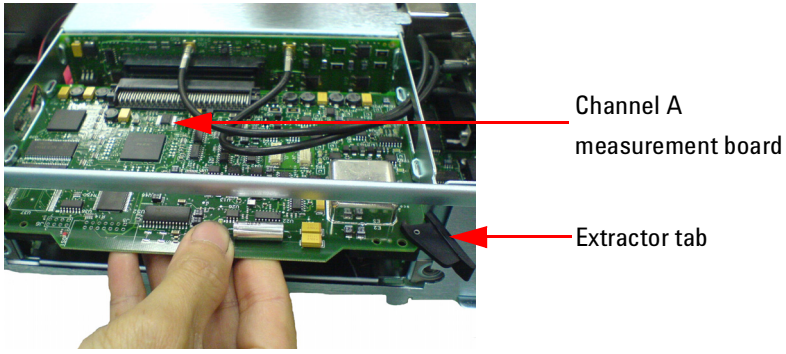

Figure 1-3 Removing Channel A measurement board

9 Replace new measurement board (E4418-60003) by sliding it in from the side of the power meter.

10 Push the extractor tab back to its place.

11 Connect the sensor flex-cable (gold pad facing down) to the flex circuit connector on the Channel A measurement board (E4418-60003). See Figure 1-4, Figure 1-5, and Figure 1-6 on page 5 and page 6.

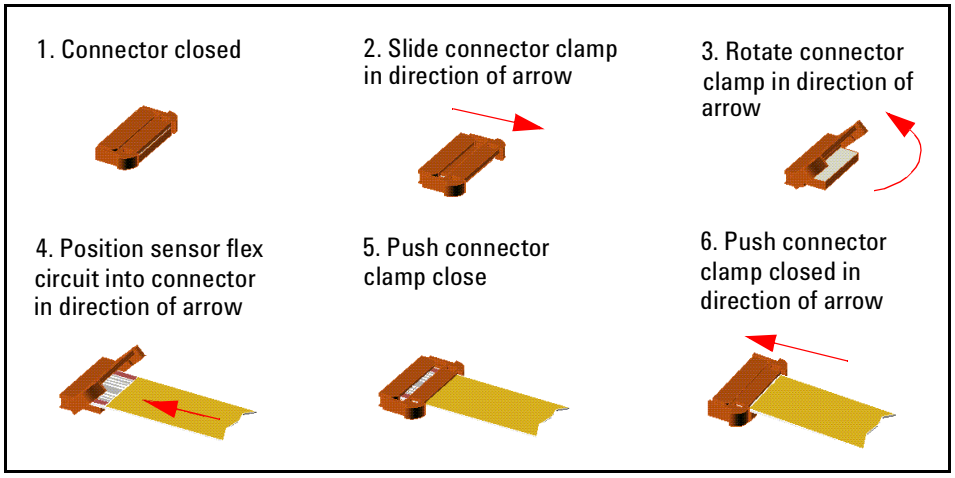

Figure 1-4 Connecting sensor flex cable

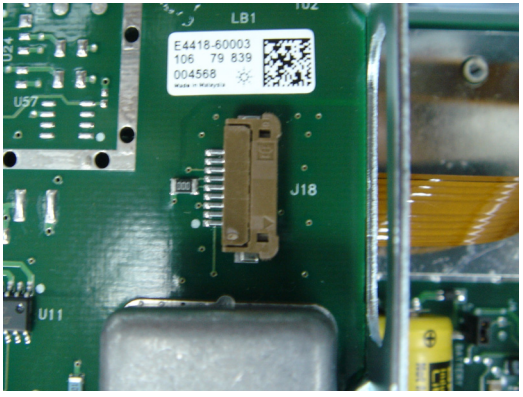

Figure 1-5 Flex circuit connector

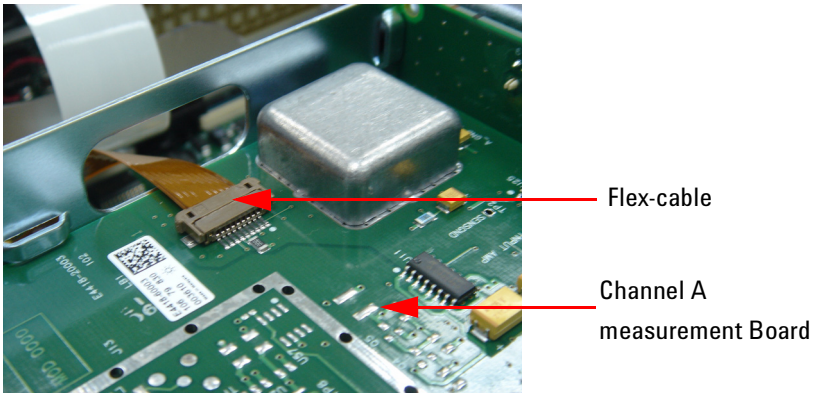

Figure 1-6 Connected Flex-Cable to Channel A measurement Board

12 Reassemble the power meter. Reassembling procedure is the reverse of step 2 to step 5.

E4419A Power Meter

1. Ensure all power and sensor cables are disconnected from the power.
2. Remove the carrying handle. To remove the handle, rotate it to the vertical position and pull both handle outwards.
3. Remove the front/rear bumpers. To remove the bumper, pull one side of the bumper outwards to disengage it and pull it away from the power meter.
4. Remove the two screws attaching to the rear panel by using a 9 lb/in T15 screwdriver.
5. Remove the cover by sliding it towards the rear of the power meter.
6. Remove the front panel Channel A flex- cable from the measurement board by pushing the connector tab forward and lift it up.
7. Remove the current measurement board by pulling the extractor tab outward. See Figure 1-2.
8. Slide the measurement board out from the side of the power meter.

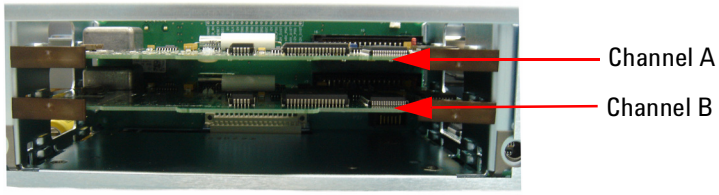

Figure 1-7 Channel A and Channel B Measurement Boards

9. Remove and replace the current Channel A and Channel B measurement board by sliding it out from the side of the power meter.
10. Push the extractor tab back to its place.

11 Connect the sensor flex- cable to the connector on Channel A measurement board (E4418- 60003) followed by Channel B measurement board (E4418- 60003).

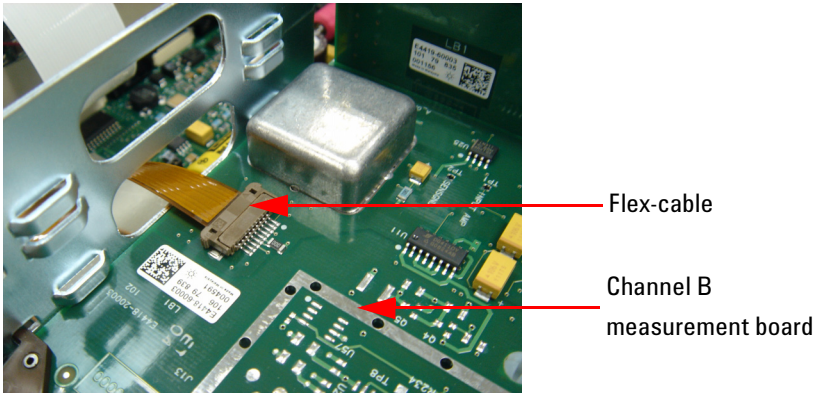

Figure 1-8 Connected Flex-cable to Channel B Measurement Board

12 Reassemble the power meter. Reassembling procedure is the reverse of step 2 to step 5.

Power Meter Verification

Ensure that the power meter go through and passes the Power On Self Test and Instrument Self Test after the measurement board (E4418- 60003) is replaced.

Procedures:

1 Reconnect the power cord and switch the power meter on.

2 On the power meter, press System Inputs > More > `Service` > `Self Test` > `Instrument Self Test`.

3 Verify all tests pass.

4 If any Measurement Assy tests fail, switch off the power meter and proceed as follow:

   a Remove the power cord and remove the cover as described in "step 2 to step 5" on page 3.

   b Ensure the EEPROM, flex circuit, and measurement assemblies are correctly located.

   c Refit the cover and retest the power meter.

5 Press `Done` to exit the Instrument Self Test menu.

6 Verify that the DSP Revision after the Instrument Self Test has passed.

   Press System Inputs > More > `Service` > `Version` to check the DSP Revision of A.01.11 as shown on Figure 1- 9:

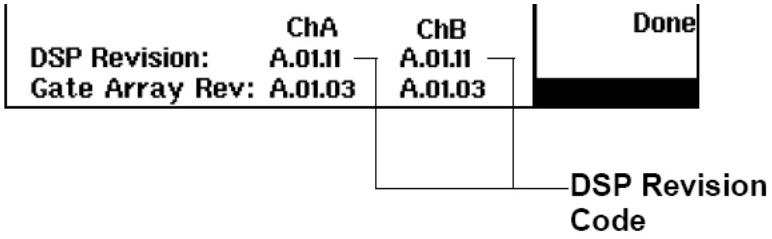

Figure 1-9 DSP Revision Check

7 Press `Done` to exit.

Measurement Path Verification

Self Test

1. Reconnect the power cord and press to power up the power meter.
2. Ensure that the power meter passes all the power- up self tests before proceeding to perform the Zero Test and Instrument Accuracy Tests. The retrofit and verification are now complete.
3. Install the latest power meter firmware by accessing the following URL:

http://www.home.agilent.com/agilent

4. Go to **Technical Support** menu. See Figure 1- 10.

Figure 1-10 Technical support menu

5. Click on **Downloads, Firmware & Drivers**. See Figure 1- 10.

6 Enter the product model number and click **Find**. See Figure 1- 11.

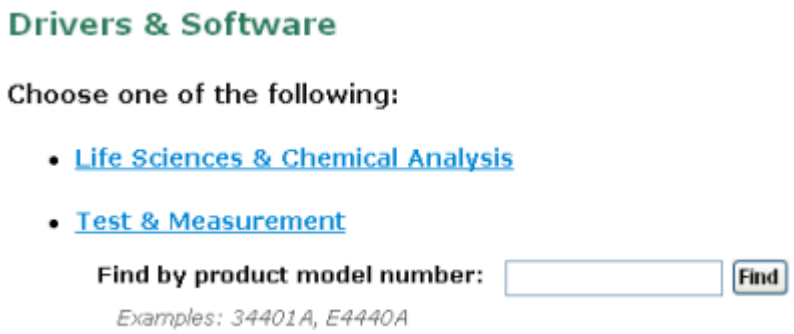

Figure 1-11 Search for product model

7 Select the latest firmware and follow the on- screen instructions to perform the firmware upgrade.

Zero Test

Description

After the power meter is initially calibrated and zeroed, the change in the digital readout is monitored. This test also takes drift and noise into account, since drift, noise, and zero readings cannot be differentiated.

Specification

Table 1-3 Zero test performance limits

Electrical characteristics	Performance limits
Accuracy: Zero set (Digital settability of zero)	±0.0764 µW[1]

[1] This performance limit is determined by the zero set specification of the power sensor used in the measurement plus the measurement noise. The range calibrator has a zero set specification of ±0.05 µW. The calibrator measurement noise specification is 110 nW at 16 averages. At 512 averages a noise multiplier of 0.24 is required, giving a measurement noise specification of 0.0264 µW (0.24x512).

Equipment

Range Calibrator ..... Agilent 11683A
Power Sensor Cable ..... Agilent 11730A

Procedure

The following procedure should be performed for the Zero Test.

NOTE The procedure below details the key presses required on the E4418A power meter. For E4419A power meter the equivalent key presses should be performed on both channels.

1 Connect the equipment as shown in Figure 1- 12.

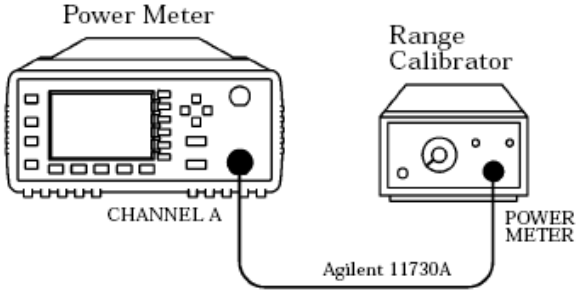

Figure 1-12 Zero test setup

2 Switch the power meter on.

3 Press Preset Local then `confirm`.

4 Press dBm/W, `W` for a reading in watts.

5 Set the range calibrator as follows:

RANGE..... 3 µW

POLARITY..... NORMAL

FUNCTION..... STANDBY

LINE..... ON

NOTE When switching the range calibrator to STANDBY, allow enough time for the range calibrator to settle to its zero value before attempting to zero the power meter. This setting would appear on the power meter display as downward drift. When the drift has reached minimum, (typically less than 60 seconds), the range calibrator is settled.

6 On the power meter press System Inputs, `Input settings`, More, `Filter`, `Filter On`, `Mode Man`, `Length`, and set the filter length to 512 in the pop-up window then press `Enter`.

7 On the power meter press Zero Cal, `Zero`. Wait approximately 10 seconds for the wait symbol to disappear.

8 Verify that the power meter's reading is within ±0.05 µW after 30 seconds wait. Record the reading.

Table 1-4 Zero Test Results

Min	Channel A actual results	Channel B actual results (Agilent E4419A only)	Max
-76.40 nW	_____	_____	+76.40 nW

Instrument Accuracy Test

Description

The power meter accuracy is verified for various power inputs. There are two different methods described here that can be used to perform this test, although one of these methods has a relatively high measurement uncertainty values associated with it.

Specification

Table 1-5 Instrument accuracy test performance limits

Electrical characteristics	Performance limits
Accuracy	±0.5% or ±0.02 dB[1]

[1] This performance limit does not include the corresponding sensor power linearity specification.

Test Procedure

NOTE The measurement uncertainty of this test procedure is relatively high at power levels of 30 uW and below, as it uses a standard 11683A Range Calibrator. As such, this test procedure should be used for reference only.

Equipment

Range Calibrator ..... Agilent 11683A
Power Sensor Cable ..... Agilent 11730A

Procedure

The following procedure should be performed for the Instrument Accuracy Test.

NOTE This procedure details the key presses required on the E4418A power meter. For E4419A power meter, the equivalent key presses should be performed on both channels.

1 Connect the equipment as shown in Figure 1- 13.

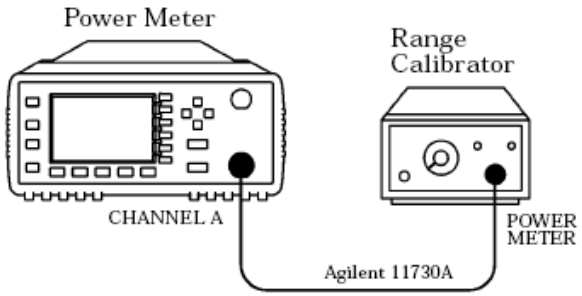

Figure 1-13 Instrument Accuracy Test Setup

2 Switch the power meter on.

3 Press Preset Local then `Confirm.`

4 Press dBm/W, `W` for a reading in watts.

5 Set the range calibrator as follows:

RANGE..... 3 µW

POLARITY..... NORMAL

FUNCTION..... STANDBY

LINE ..... ON

NOTE When switching the range calibrator to STANDBY, allow enough time for the range calibrator to settle to its zero value before attempting to zero the power meter. This setting would appear on the power meter display as downward drift. When the drift has reached minimum, (typically less than 60 seconds), the range calibrator is settled.

6 On the power meter press System Inputs, `Input settings`, More, `Filter`, `Filter On`, `Mode Man`, `Length`, and set the filter length to 512 in the pop-up window then press `Enter`.

7 On the power meter press Zero Cal, `Zero`. Wait approximately 10 seconds for the wait symbol to disappear. Verify that the display reads 0 ±0.05 µW.

8 Set the range calibrator's FUNCTION switch to CALIBRATE.

9 Set the range calibrator's RANGE switch to 1 mW.

10 Press `Cal` to calibrate the power meter.

11 Set the range calibrator's RANGE switch to the positions shown in Table 1- 6 on page 18. For each setting, verify that the power meter's reading is within the limits shown.

Table 1-6 Instrument accuracy results (for reference only)

Range calibrator setting	Min[1]	Channel A actual results	Channel B actual results (Agilent E4419B only)	Max[1]
3 µW	3.100 µW	_____	_____	3.230 µW
10 µW	9.900 µW	_____	_____	10.10 µW
30 µW	31.40 µW	_____	_____	31.80 µW
100 µW	99.50 µW	_____	_____	100.50 µW
300 µW	314.00 µW	_____	_____	318.00 µW
1 mW	0.995 mW	_____	_____	1.005 mW
3 mW	3.141 mW	_____	_____	3.171 mW
10 mW	9.984 mW	_____	_____	10.08 mW
30 mW	31.63 mW	_____	_____	31.94 mW
100 mW	100.9 mW	_____	_____	101.8 mW

[1] These performance limits are determined by the zero set specification of the power sensor used in the measurement plus the measurement noise.

NOTE

- The nominal outputs for the 3 µW, 30 µW, 300 µW, 3 mW, 10 mW, 30 mW and, 100 mW settings are 3.16 µW, 31.6 µW, 316 µW, 3.156 mW, 10.03 mW, 31.78 mW, and 101.3 mW respectively.
- It is not necessary to check instrument accuracy in dBm. The power meter uses the same internal circuitry to measure power and mathematically converts Watts to dBm.

Communicating and Reprogram the instrument ID information

NOTE The IO Libraries Suite 14.2 and above should be installed before making any communication with any instruments.

1 Go to **Start** > **All Programs** > **Agilent IO Libraries Suite** > **Agilent Connection Expert** to launch the Connection Expert.

2 The detected E4418A (or E4419A) Series Power Meter will be visible on the **Instrument I/O on this PC** explorer pane. Right- click on the E4418A (or E4419A) instrument on the explorer pane.

3 A context menu will appear and select **Send Commands To This Instrument**.

4 The **Agilent Interactive IO** dialog box as shown on Figure 1- 14 will appear. Example click **Send & Read** to send the *IDN? default command. The instrument's response should appear in the **Instrument Session History** panel as shown below.

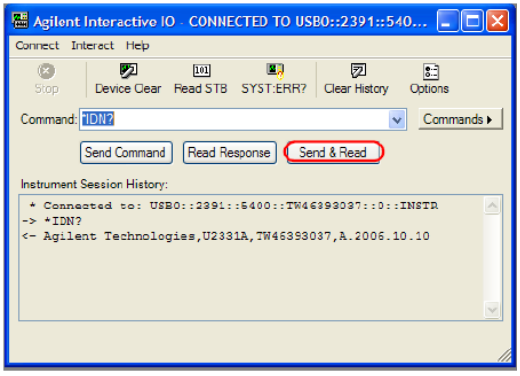

Figure 1-14 Agilent Interactive IO

5 If the Connection Expert can successfully communicate with the E4418 instrument, this indicates that the instrument is installed correctly.

6 Send the following SCPI commands to the **Commands** menu (one by one).

Serial Number – `SERV:SNUM xxxxxxxx`

Proc. Bd. Version – `SERV:VERS:PROC "C"`

System Version – `SERV:VERS:SYST "2"`

Installed Option – `SERV:OPT "xxx"`

NOTE Ensure the `x` is replaced with the correct value. Please refer to the power meter's rear panel label for the correct serial number and installed option.

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Contact us

To obtain service, warranty or technical support assistance, contact us at the following phone numbers:

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China:
(tel) 800 810 0189 (fax) 800 820 2816
Europe:
(tel) 31 20 547 2111
Japan:
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(tel) (305) 269 7500
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Product specifications and descriptions in this document are subject to change without notice.

Printed in Malaysia
First Edition, February 23, 2009

E4418-90082

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