

**OM2210**  
**Coherent Receiver Calibration Source**  
**User Guide**



071-3050-01

**Tektronix**



**OM2210**  
**Coherent Receiver Calibration Source**  
**User Guide**

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- In North America, call 1-800-833-9200.
- Worldwide, visit [www.tektronix.com](http://www.tektronix.com) to find contacts in your area.

## Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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# 1 Safety Information

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## 1.1 Safety Notices

### CAUTION

Indicates a potentially hazardous condition or procedure that could result in damage to the instrument.



### CAUTION

Indicates a potentially hazardous condition or procedure that could result in minor or moderate bodily injury.



### WARNING

Indicates a potentially hazardous condition or procedure that could result in serious injury or death.



This symbol on the unit indicates that the user should consult this document for further information regarding the nature of the potential hazard and actions that should be taken to avoid or mitigate the hazard.

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## 1.2 Laser Safety

The laser sources included in this product are classified according to IEC/EN 60825-1: 1994+A1:2001+A2:2001 and IEC/EN 60825-2:2004

This laser product complies with 21CFR1040.10 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



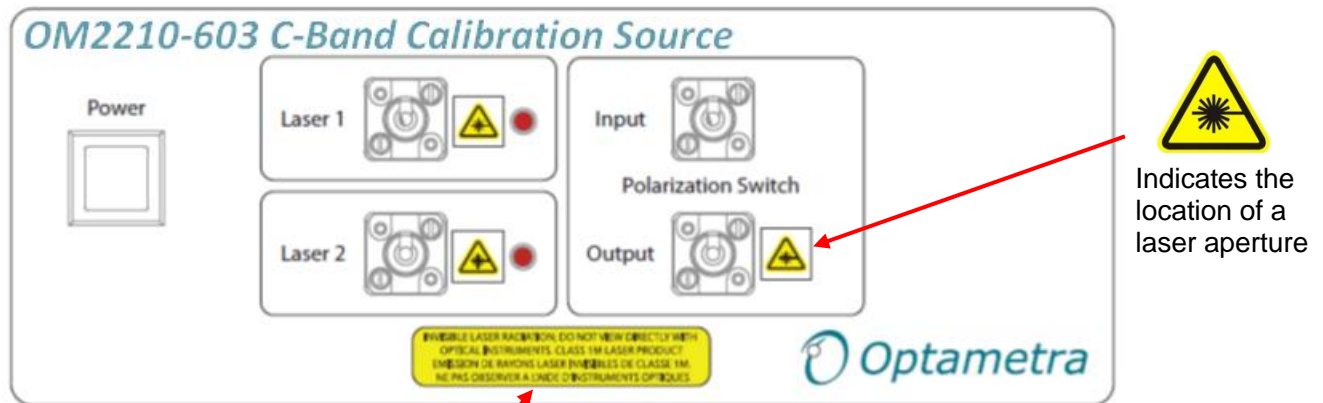
### CAUTION

***Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.***

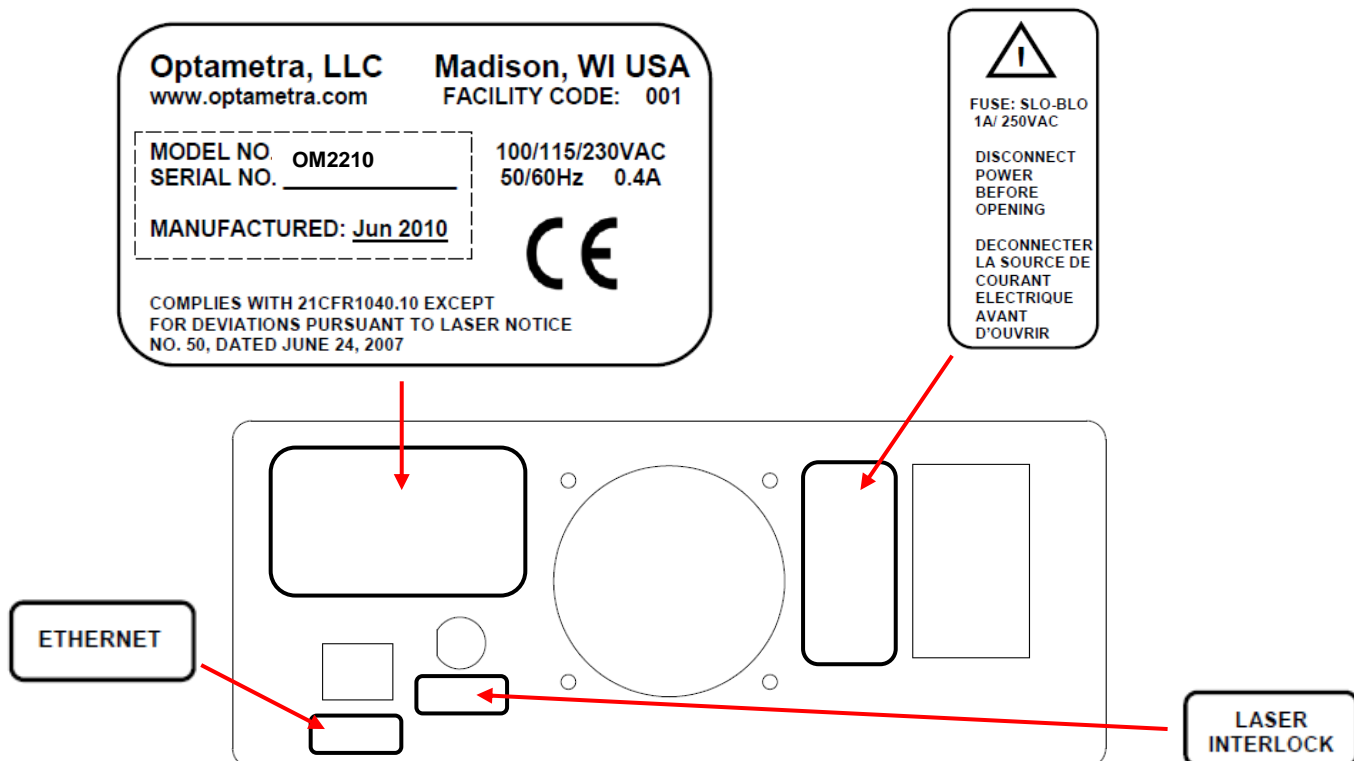
***Under no circumstances should you use any optical instruments to view the laser output directly.***



## 1.3 OM2210 Laser Labels and Locations



**INVISIBLE LASER RADIATION; DO NOT VIEW DIRECTLY WITH  
OPTICAL INSTRUMENTS. CLASS 1M LASER PRODUCT  
EMISSION DE RAYONS LASER INVISIBLES DE CLASSE 1M.**



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## 2 Introduction

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### 2.1 Purpose

The Optametra calibration products, featuring the OM2210 Calibration Source and Optametra's proprietary software, are used in laboratory or industrial facilities to calibrate coherent fiber optic receivers. These products are primarily targeted for calibrating polarization-diverse, phase-diverse receivers that are linear or can be set in a linear mode. The end result is a transfer matrix, measured at a particular heterodyne frequency over a specified wavelength range, which describes the optical-to-electrical transfer function of the analog portion of the receiver. The transfer matrix is then used to compute critical receiver specifications such as quadrature phase angle, polarization cross-talk, and path gains. This information can be used for quantitative evaluation of the receiver, or to provide calibrated optical field measurements when used with the Optametra signal analysis software.

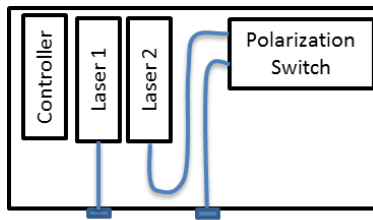
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### 2.2 The Optametra Calibration Approach

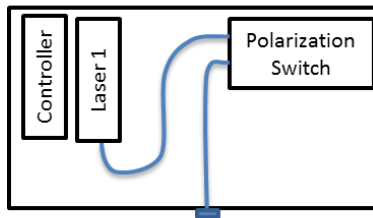
Optical communications signals can be described as the combination of a continuous (cw) laser field and a modulation field which carries the data. In the case of polarization multiplexed signals, there can be as many as two independent lasers and modulators that are polarization multiplexed together. Optametra signal processing software is designed to extract the cw and modulation for each polarization from which data and signal quality metrics may be extracted. Since the software extracts fields, not just data, it is necessary to have independent measurements of the receiver properties so that the effect of the receiver may be removed. This process consists of a low-frequency measurement of the linear OE transfer matrix relating the input field vector,  $\mathbf{E}$ , to the output voltages,  $\mathbf{V}$ , and a separate frequency response measurement. The Optametra calibration kit is provided to measure the linear OE transfer matrix,  $H$ , at frequencies well within the oscilloscope bandwidth.  $\mathbf{V} = [\mathbf{H}]\mathbf{E}$

This process can be applied both to linear receivers like the Optametra OM3105 as well as receivers with automatic gain control (AGC) such as commercial coherent receivers. The AGC must be turned off during the calibration so that the software can measure the linear portion of the transfer function. The matrix can then be normalized to simulate the AGC operation.

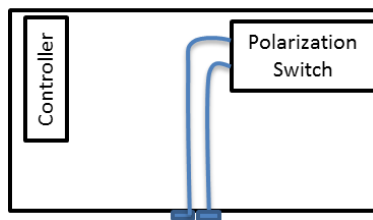
The Optametra calibration kit contains the OM2210 Calibration Source that is available in the various configurations shown below.



**-603** C-band Calibration Source and Software. Includes 2 lasers. Use this option when C-band receiver has no Optametra sources. (L-band version is -604)



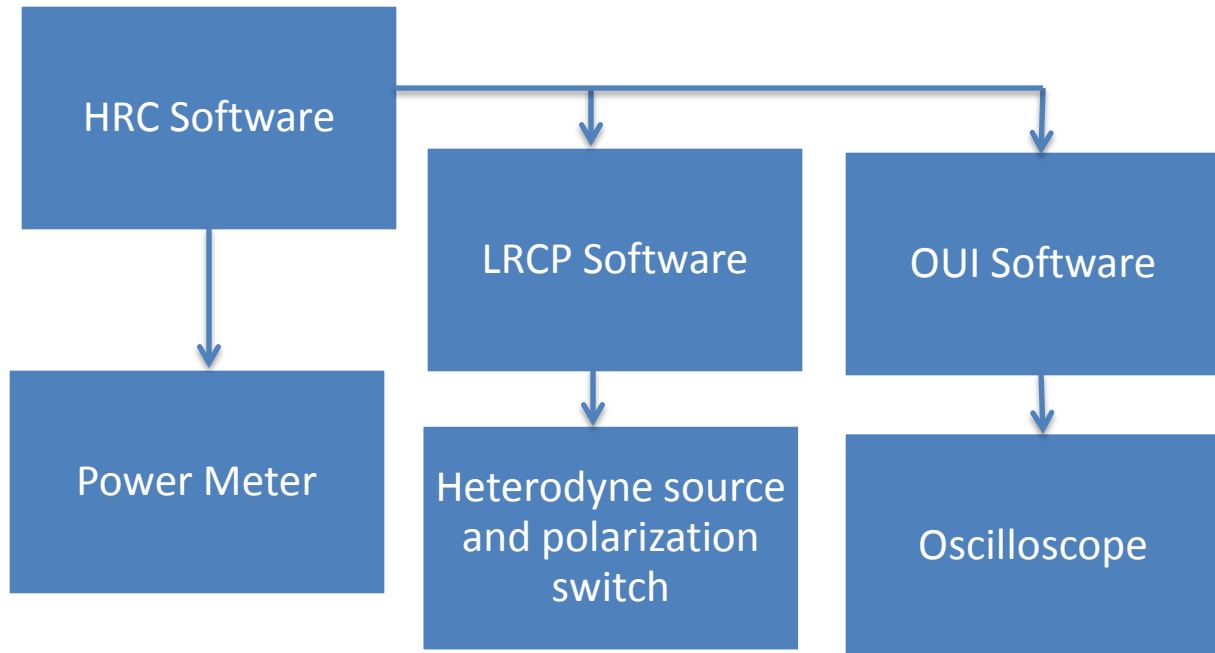
**-601** C-band Calibration Source and Software. Includes 1 laser. Use this option when C-band receiver has an Optametra Reference Laser. (L-band version is -602)  
A C+L version is also available (-605)



**-600** Calibration Source and Software. Includes no lasers. Use this option when receiver has 2 Optametra sources for Reference and Signal.

**Figure 1: C or L-band Calibration Source options**

The calibration kit extracts the hybrid matrix,  $H$ , by applying a heterodyne signal with different polarizations and then measuring the resulting sine wave outputs on the oscilloscope and separately monitoring the power. Proprietary calculations are performed to extract the hybrid matrix in the presence of receiver impairments, heterodyne phase fluctuations, and channel skews. This process is directed by the Optametra Hybrid Receiver Calibration (HRC) Software. The HRC software controls the heterodyne source via the Optametra Laser Receiver Control Panel (LRCP) and collects data from the oscilloscope via the Optametra User Interface (OUI).



***Figure 2: Hierarchy of the software and hardware used to perform the calibration***

The final results are provided in .mat, .csv, and .xls formats. The .mat format is used by the Optametra OUI software hybrid calibration function. The other formats are provided for viewing the results. The results and configurations are also stored in an SQL database.

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## 3 Getting Started

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### 3.1 Configuring the Hardware

#### 3.1.1 OM2210 Calibration Source

Ensure that the required power sources for the OM2210 (100, 115 or 230 VAC, 50–60 Hz, 0.4A), the equipment to be calibrated, associated oscilloscope, and the external computer (if used) are available. Use the IEC power cord provided to connect to a rack or wall outlet.

Associated cabling includes the IEC power cord, an Ethernet cable, and fiber optic cables to connect the OM2210 and the Device Under Test (DUT).

Several options for use of the OM2210 are available. For use with the Optametra OM3105 Coherent Modulation Receiver, a polarization-maintaining (PM) fiber optic patchcord is used to connect the OM3105's Laser 1 to the OM2210's Polarization Switcher Input, and the Polarization Switcher Output is connected via single-mode (SM) fiber optic patchcord to an optical splitter. From the splitter, 90% of the optical power is directed to the OM3105 Signal Input, and 10% is routed to an optical power meter connected to the computer being used to run the calibration. Four coaxial cables connect the receiver to a high-speed sampling oscilloscope. Ethernet cables connect the OM2210, via a router, to a computer, receiver and oscilloscope. The Optametra User Interface running on the computer controls the oscilloscope, while the Laser-Receiver Control Panel (LRCP) controls the OM3005/3105 and the OM2210.

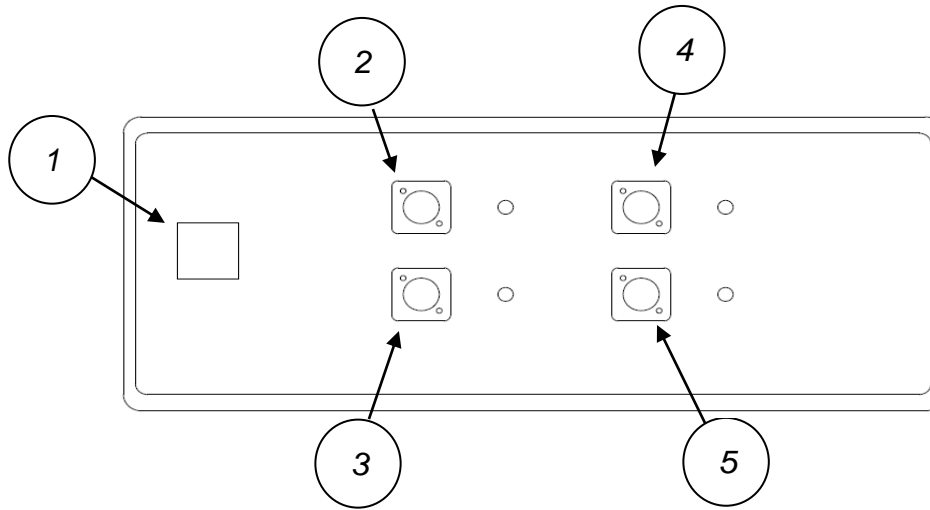
The OM2210 can also be purchased with internal lasers for use in calibrating receivers that do not already contain two Optametra tunable lasers that can reach the same wavelength.

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**Note:** A password is required to turn on the lasers through the Laser / Receiver Control Panel. The default is '1234'

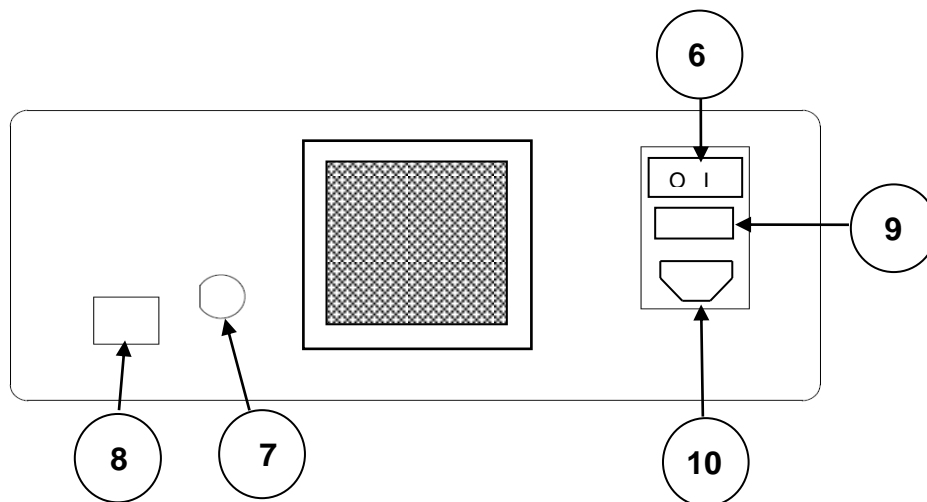
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### 3.1.2 OM2210 Controls and I/O Connections



**Front Panel Controls and I/O Connectors**

1. On/Off switch
2. Laser 1 Output (with LED indicator)
3. Laser 2 Output (with LED indicator)
4. Input
5. Output



**Rear Panel Controls and I/O Connectors**

6. Power switch
7. BNC connector for optional laser remote interlock
8. Ethernet port
9. Fuse drawer
10. Input power receptacle

### 3.1.3 List of Components

#### OM2210 Calibration Source

- IEC power cable
- Ethernet cable
- BNC shorting cap for interlock
- Dust covers for optical inputs not in use (2 or 4)

Additional items supplied by Optametra or another source:

- Digitizer or real time oscilloscope with at least 20 GS/s sampling rate on four channels. Agilent, Tektronix, and LeCroy real time oscilloscopes with at least 10GHz bandwidth are supported. The Tektronix 8GHz oscilloscope is also supported.
- Power cable
- Ethernet cable
- Mouse and keyboard (unless touch-screen controlled)
- System controller PC running Windows XP, Matlab (if using the OM4x06) and the Optametra User Interface (OUI) software
  - Monitor plus cable
  - Mouse and keyboard
  - Power cables
  - Ethernet cable
- An Ethernet switch or hub plus a router running DHCP, and associated cabling (not shown)
- SM patch cable ( 1 or 2, depending on the application) to connect the Polarization Switcher Output to the DUT
- PM patch cable to connect the DUT to the Polarization Switcher Input
- Optical power meter
- Optical amplifier
- Optical splitter



#### WARNING

***To avoid the possibility of electrical shock, do not connect your OM2210 to a power source if there are any signs of damage to the instrument enclosure.***

### 3.1.4 Electrical Power Requirements

The OM2210 can operate from any AC power source that provides 100, 115, or 230 VAC, at a frequency of 50 Hz or 60 Hz. The OM2210 must be connected directly to a grounded power outlet only.



## WARNING

*The OM2210 must be connected to a 100, 115, or 230VAC/50 or 60Hz grounded outlet only. Operating the OM2210 without connection to a grounded power source could result in serious electrical shock. Always connect the unit directly to a grounded power outlet.*



## CAUTION

*Protective features of the OM2210 may be impaired if the unit is used in a manner not specified by Optametra.*

### 3.1.5 Location and Positioning

Be sure to position the OM2210 so that the power switch at the rear of the unit can be easily accessed.

## CAUTION

*Be sure not to obstruct the fan so that there is an adequate flow of cooling air to the electronics compartment whenever the unit is operating.*

### 3.1.6 Operating Environment

The OM2210 may be operated within the following conditions:

Temperature	10°C to +35°C (50°F to +95°F)
Humidity	<85%R.H. non-condensing from 10°C to +35°C (50°F to +95°F)
Altitude	< 2,000m (6560ft)



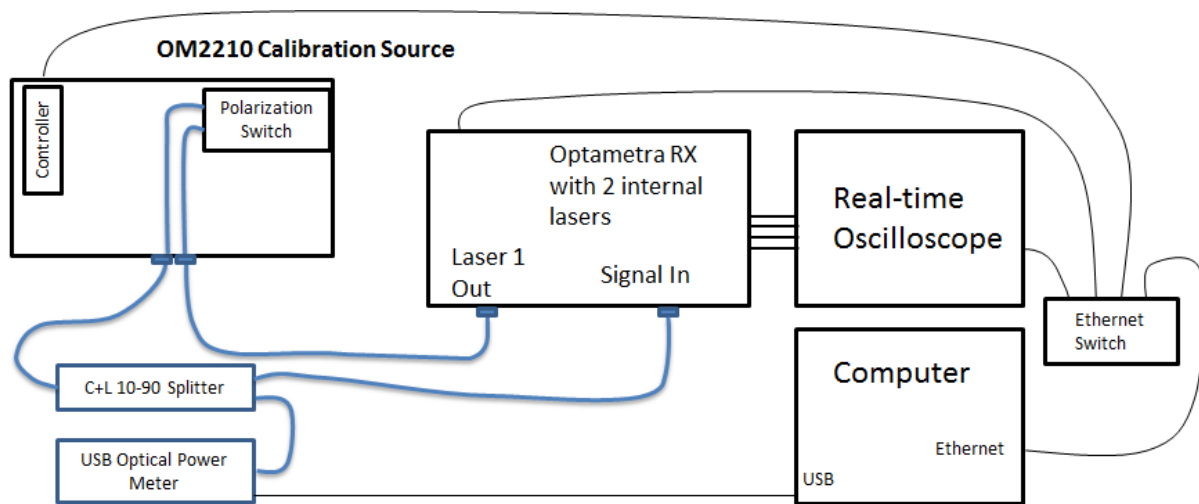
### 3.1.7 Computer

Operating System:	XP Service Pack 3 (.NET 4.0 required), or Windows-7
Processor:	min: Intel Pentium 4 or equivalent, recommended: Intel Core2Duo, Core2Quad, I7, or equivalent; min clock speed 2GHz.
RAM:	3 GB. Future 64-bit releases will benefit from as much memory as is available.
Hard Drive Space:	min 20 GB, 300GB recommended for large data sets
Video Card:	NVIDIA dedicated graphics board w/ 512+ MB min. graphics memory; Consult factory for compatibility if using a different card.
Networking:	Gigabit Ethernet (1Gb/s)
Display:	Large flat screen recommended for displaying multiple graph types eg. 20" min
Other Requirements:	DVD Optical drive, 2 USB 2.0 ports

### 3.1.8 First Setup

Once everything is securely placed, make electrical connections in the following order:

1. Ethernet connections and other computer connections. See 3.1.2
2. Power connections for the OM2210 and other equipment.
3. RF connections from the DUT to oscilloscope
4. Fiber optic patch cable connections from the OM2210 to the DUT.
5. Store all dust covers and coaxial connector caps for future use.



**Figure 3: Typical system configuration for calibration of Optametra Receiver. For 3<sup>rd</sup> party receiver calibration, use an OM2210 with internal sources to provide the Laser 1 and LO laser functions.**

Once the equipment is positioned and connected, turn on the computer, the oscilloscope, the DUT, and the main power switch on the back of the OM2210. The OM2210 front-panel power button will light briefly after main power is applied indicating it is searching for a DHCP server. When an IP address has been assigned or when the search fails in the case of an isolated network, the power light will go off. Press the power button one time to enable the unit. The steady power button light indicates the OM2210 is ready for use and that lasers may be activated at any time if a user connects via the Ethernet connection. The light will go out and the unit will be disabled any time main power is removed or the IP address is changed. Press the power button to re-enable. This feature prevents a remote user from activating the lasers when the local user may not be ready.

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**Note:** Ethernet only allows devices on the same subnet to communicate.

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You should now have four devices on an Ethernet network: computer, oscilloscope, DUT, and OM2210. This little network may be connected to your corporate network or router or you may choose to leave it isolated. IP setup is normally done by Optametra personnel at the time of installation. You should only need the following instructions if you are reconfiguring your network.

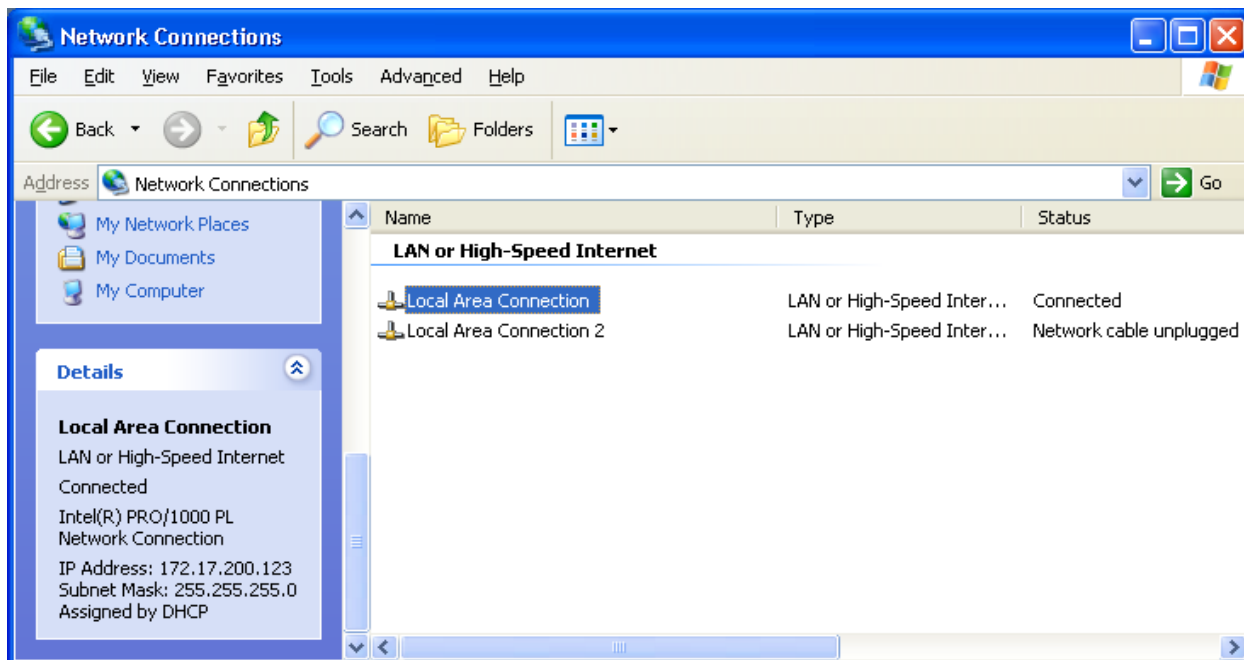
### 3.1.8.1 IP setup on a network with DHCP (dynamic IP assignment)

DHCP allows “automatic” assignment of the IP address the connected devices need to communicate with each other. However, automatic IP assignment must be selected on each device before this will be allowed. The OM2210 is shipped with automatic IP assignment enabled. Your computer and oscilloscope may need this turned on.

Once automatic IP assignment is selected, you may still need the cooperation of your corporate IT department to get IP addresses assigned. If you are using a centralized server, ask your network administrator to make an IP reservation for you so that you get the same number each time the device is powered on. Once these are set up for the oscilloscope and the OM2210 you will have no trouble finding them in the future.

Once your equipment gets an IP address from DHCP you can find that address using the operating system of the oscilloscope or computer. For example, in the XP operating system there is a window that looks like the one below. Notice that when you select the active Ethernet connection the IP address shows up in the Details box in the lower-left corner of the window.

To configure the IP connection of the OM2210, please see the OM4006/OM4106 User Guide Chapter on using the Laser Receiver Control Panel (LRCP).



### 3.1.8.2 IP setup on an isolated network or one not running a DHCP server

When there is no DHCP server, the Ethernet connected devices don't know what address to assign to themselves. In this case you must manually set the IP address. On a corporate network this means getting the IP addresses from your network administrator first and then setting each device.

Your network administrator may need the MAC addresses of the computer, oscilloscope, and OM2210. Contact Optametra if you need the MAC address for your OM2210. On newer models the MAC address is printed on the real-panel label. Please see the OM4006/OM4106 User Guide Chapter on using the Laser Receiver Control Panel (LRCP) to set the IP address. If you have a network isolated from your corporate network you are free to use any IP numbering scheme. Optametra recommends 172.17.200.XXX where XXX is any unique number between 0 and 255 (each device needs a unique number). There is nothing special about this scheme other than that it is the default for new OM2210 units. Use the operating systems of the oscilloscope and computer to set their IP addresses. The first three sets of numbers in the IP address need to be the same on the computer and the connected devices for them to communicate in most cases.

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## 4 Optametra Calibration Software

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### 4.1 Installation

The Optametra software is primarily distributed through the website <http://portal.optametra.com> . Call Optametra if you need login credentials. Each customer location has a web page where the customer can download the latest release as well as installation instructions and User's Guides. Follow the installation instructions provided with the release you are installing. In general, Optametra software consists of two portions: the Optametra software and the drivers needed for the software to work with hardware components.

An important part of the Optametra software is the copy protection provided by the USB HASP key. The HASP key is used in two ways: 1) It prevents the software from being run in more places than there are HASP keys, and 2) it enables or disables features such as QAM and hybrid calibration. To see which features are available on your key, you can direct a web browser to <http://localhost:1947> and click on HASP Keys and Features. The following features are presently available:

Feature Number	Description
3	Optametra User Interface (OUI)
4	Optametra Signal Analysis Software
14	QAM and advanced formats
15	Hybrid Calibration

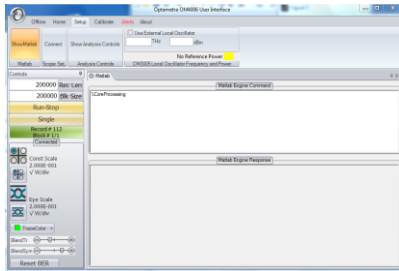
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### 4.2 Operation

As shown in Figure 2, the Optametra Hybrid Receiver Calibration (HRC) program controls the Optametra User Interface (OUI) and the Laser Receiver Control Panel (LRCP). The OUI in turn controls the oscilloscope, while the LRCP controls the Optametra hardware. To launch the complete application, use the following procedure.

- 1) First follow the instructions in the Measurement Setup section to get the hardware configured properly and powered up.
- 2) Launch the OUI. Click the "Show Matlab" button on the Setup tab. Delete the contents of the Matlab Engine Window or place a % before each line since it will not be used for computations.
  - a. Click on Connect and use the dialog box to select four channels.
  - b. Be sure to enable four channels

### c. Disconnect



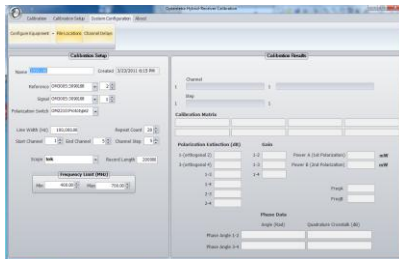
For further information on the OUI, see the OM4006/OM4106 Users Guide.

- 3) Launch the LRCF. Connect to the Optametra hardware that will be used for the calibration. Turn on the lasers that will be used for the calibration and tune them to the same wavelength.

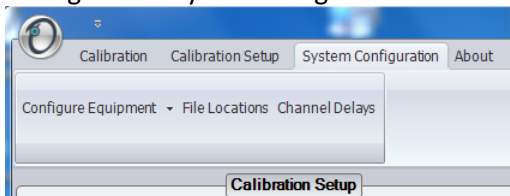


For further information on the LRCF, see the OM4006/OM4106 Users Guide.

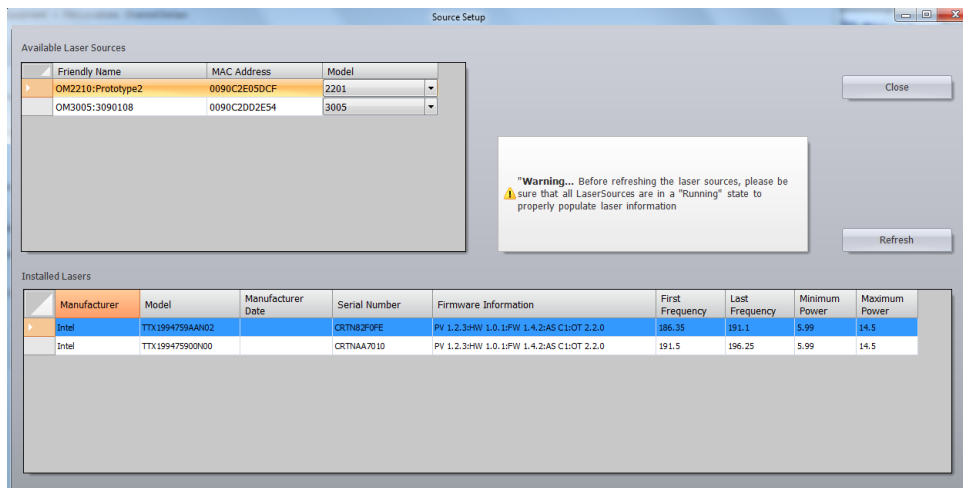
- 4) Launch the HRC



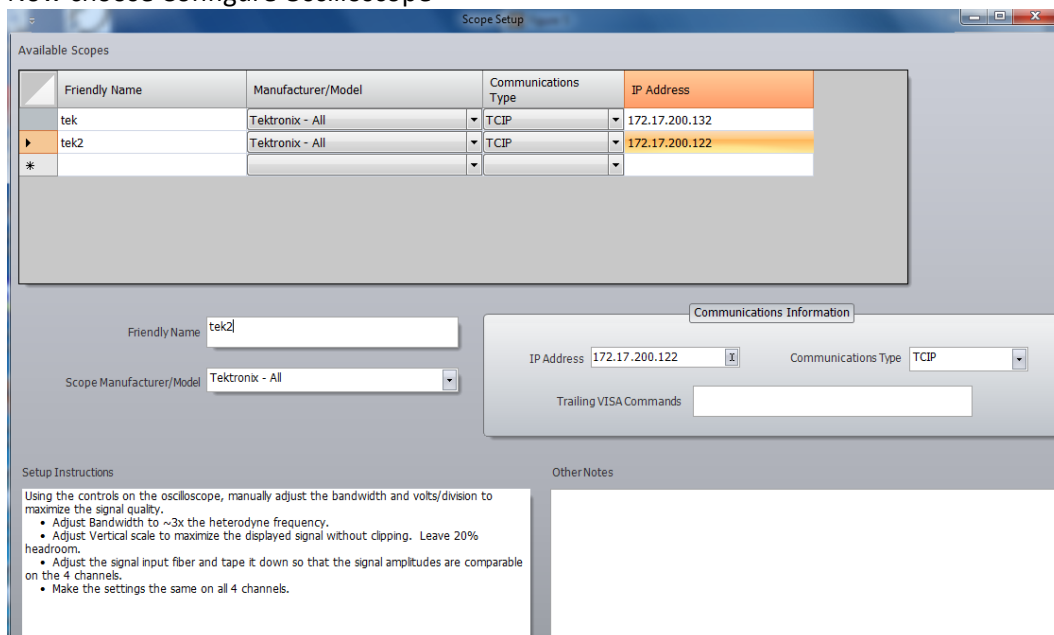
- 5) Connect the USB Power Meter to the computer that is running the HRC. Be sure both lights on the Power Meter are on.
- 6) Configure the system using the HRC. Click on System Configuration



- 7) Click on the Configure Equipment button and choose Configure Laser Source

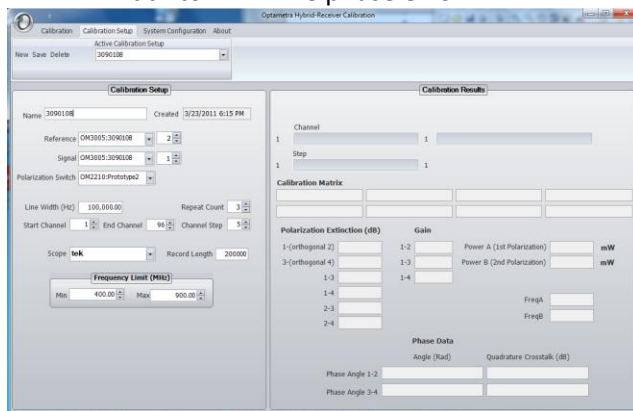


- a. Be sure the that LRCP window shows a connection to the Calibration Source and all of the laser sources to be used in the calibration
  - b. Click on Refresh to pull the information from the LRCP into the HRC, then click Close
- 8) Now choose Configure Oscilloscope



- 9) The Configure Oscilloscope screen helps you define the oscilloscope connection. Typical values are shown above. The trailing command, ::INSTR is required for most instruments. Each oscilloscope setup has a Friendly Name that can be used for recalling the settings.
- 10) Follow the setup instructions shown to get a good heterodyne signal on the oscilloscope.
- 11) After making adjustments on the oscilloscope front panel, always press the "Single" button on the oscilloscope front panel to get it ready for external control
- 12) Close the window when complete. Now choose File Locations.
  - a. The default location for the CoreProcessing Directory is C:\Program Files (x86)\Optametra\OUI4006\. Don't change this unless the OUI installed to a different directory. For example, on 32 bit machines the directory is C:\Program Files\Optametra\OUI4006\.

- b. Browse to where you would like to save the results files by clicking on the Folder Icon on the Results Folder row. It is best to choose ... My Documents\Optametra\Hybrid-Receiver Calibration\ to easily find the files again.
- 13) Next choose Configure Power Meter. Enter the correct serial number to replace the default value. The connect string, USB0::0x1313::0x8072::P2000608::INSTR has the serial number as the last digits. The Power Meter serial number is printed on the body of the Power Meter. Choose a Power Multiplier of 10 if the 10% coupler is being used to monitor the power.
- 14) Now it is time to setup the calibration. Click on the Calibration Setup tab and set the following in the main body of the HRC on the left side:
  - a. Click **New** in the upper left of the Calibration Setup tab to create a new setup unless you want to modify an existing setup.
  - b. Name: this is the base name that will be used with the time and date to form the file-name for the results. It will also be used to recall this setup in the future. Use the serial number of the device under test for easiest recall of data.
  - c. Choose the Reference Laser (LO), Signal Laser (the one connected through the polarization switch), and Polarization Switch using the drop-down menus.
  - d. Laser Line Width in Hz. This sets the time constant for the phase recovery algorithm. Only an estimate is required. 100,000 is the best choice for Optametra ECDLs.
  - e. Start Channel, End Channel, Channel Step define the wavelength channels over which the calibration will be performed. The channel definition is set by the LRCP. The calibration will be taken a number of times set by the Repeat Count and then averaged for each wavelength.
  - f. The Record Length should be set so that the time window width on the oscilloscope is at least  $0.2 / (\text{Line Width})$  or more. For a 100,000 Hz Line Width, a good choice is a 4us window which is 200,000 samples at 20ps/sample.
  - g. Choose the oscilloscope configuration from the drop-down menu
  - h. Set the frequency limit for the heterodyne frequency during the calibration. Typical values of 400 to 900 MHz work well with ~40-50Gs/s oscilloscopes. The frequency can be lower for lower sampling rates. The upper frequency should be  $<1/3$  the system bandwidth to minimize phase error.

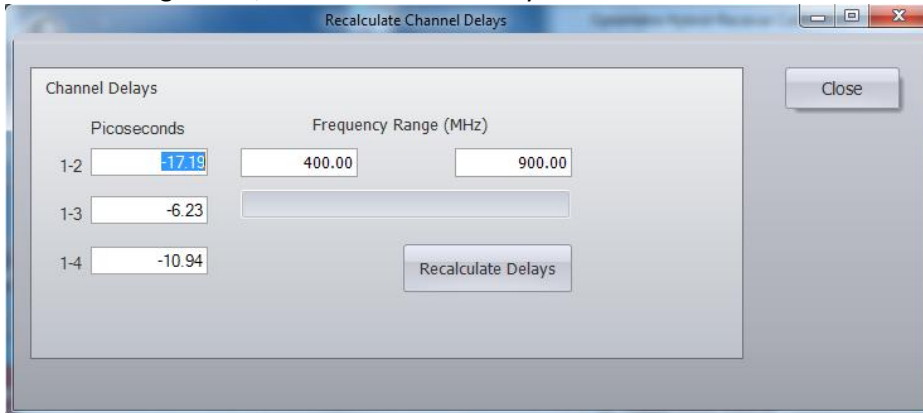


Click Save to store your settings for future use.

- 15) Click on Channel Delays. Enter the relative skew between channels 1 to 2, 1 to 3, and 1 to 4 in the boxes provided if known. To determine the relative channel delays, this utility can measure phase vs. frequency over a given range and find the average slope. Enter the min and max frequencies for the utility to use. These should auto-populate to equal to the range shown on the

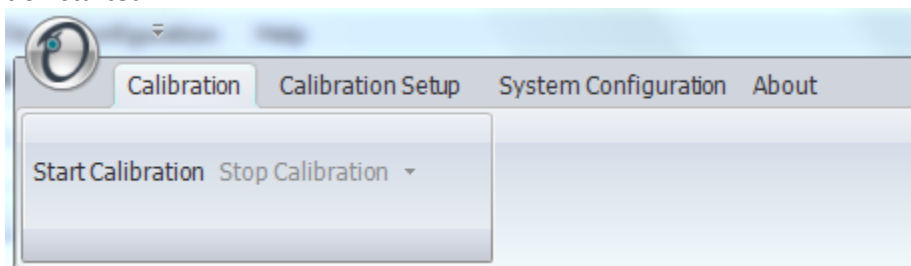


Calibration Setup window, but you can measure delays over any frequency range less than 10GHz. The range chosen should also be less than  $\sim 1/3$  the oscilloscope bandwidth setting. Once the range is set, click Recalculate Delays.



Once the utility completes a sweep over the desired range at a wavelength in the center of the band to be tested, it will fill in the Channel Delays. Inspect the Matlab plot to verify that the data was taken over the desired range and is well behaved. You may also type *Status* in the separate Matlab program window to see the rms and peak phase error in the measurement. Close the Recalculate Channel Delays utility to use these values.

- 16) (for advanced users) As mentioned above, entering a Frequency Range and Clicking on Recalculate Delays will sweep the heterodyne frequency while measuring the resulting channel to channel phase relationship. The slope of the phase vs. frequency gives the average channel delays. Alternatively, the FindChannelDelays function can be run from the OUI Matlab Engine Window. Running the function manually in this way gives you more control over which frequencies are used for the delay calculation. When complete, you can type Status in the Matlab Command Window to see the results and error magnitude.
- 17) Now that the system is configured, click on Calibration, then Start Calibration to get the calibration started.



- 18) The following screen gives you an opportunity to review the calibration setup before getting the measurements underway. Once the measurement is started, it may take approximately 1 hour to finish depending on the number of repeats and wavelengths chosen.

**Verify Calibration Settings**

You are about to calibrate with the following settings do you wish to continue?

Repeat Count	3	Line Width	100000	<input type="button" value="Yes"/>
Scope Connection String	TCPIP0::172.17.200.132::INSTR			<input type="button" value="No"/>
Core Processing Folder	C:\Program Files (x86)\Optametra\OUI4006			
Reference Laser	OM3005:3090108(172.17.200.113)		2	
Signal Laser	OM3005:3090108(172.17.200.113)		1	
Polarization Switch	OM2210:Prototype2(172.17.200.123)			
Results Folder	C:\			
Base File Name	3090108 3-29-2011 17.51.35			
Channel Range	1	To	5	Step 5
Channel Delays (1-2)	-17.19	1-3	-6.2304	1-4 -10.937 ps
Power Multiplier	10			
Record Length	200000			
Frequency Limits	400	To	900	MHz
Power Meter	USB0::0x1313::0x8072::P2000608::INSTR			
Channel 1 Frequency	191.5	THz	Grid Spacing	0.05 THz

As the HRC executes, it shows the results of each step on a dashboard called “Calibration Results” on the right side of the window. The area shows the channel and step status as well as the following:

*Calibration Matrix:* The actual values being output to the calibration data file

*Polarization Extinction:* A list of calculated crosstalk levels based on the measured calibration matrix.

*Gain:* the Relative gain between channels

*Power A, B:* Power measured for each polarization setting

*Freq A, B:* Measured heterodyne frequency at each polarization setting

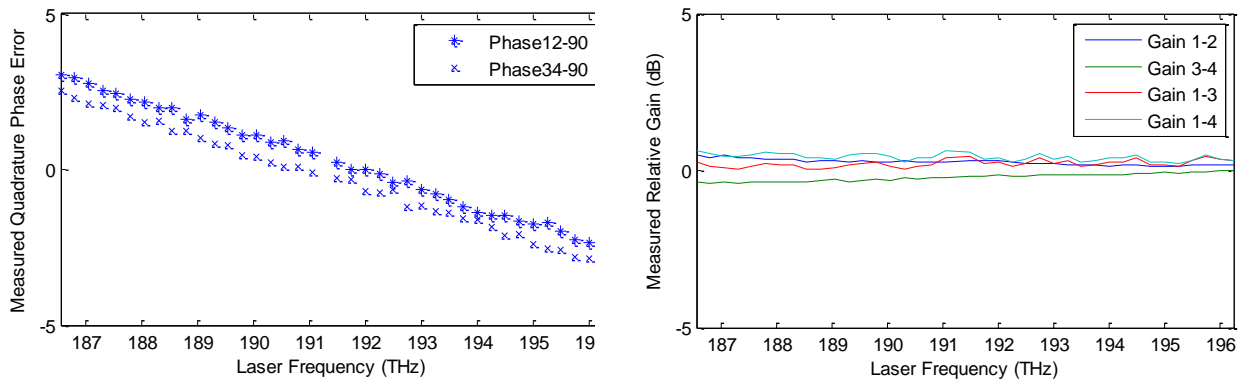
*Phase Data:* Quadrature phase angles and calculated I-Q crosstalk

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## 4.3 Results

The output of the calibration is both a hybrid-matrix data set and a set of calculated performance metrics. These plots are updated at each wavelength step. Channels 1,2,3,4 are X-I, X-Q, Y-I, Y-Q respectively. Example data is shown below:



These plots are calculated from the pHybTable variable which is the primary output of the program. The pHybTable has one row for each laser channel tested: a column for each of the 8 entries in the complex pHyb matrix and a first column for the laser channel frequency. This information is stored in the following ways:

- 1) The pHybCalib.mat file. This file is designed for use with the OUI4006. To do so, move the file from the place designated in the File Locations path to Program Files (x86)\Optametra\ExecFiles. Rename the old version in case you need to go back. If the file name is changed in any way, the OUI will not use the file. When using the OUI, you may type *load pHybCalib* in the separate Matlab program window and then type *SerialInformation* to see which file is in use.
- 2) The data is also stored in .mat, .csv, and .xls files in the directory indicated in the File Locations box.
- 3) The configuration information is stored in an SQL database called OPTAMETRA in the OPTAMETRACONFIG SQL server. SQL Server Management Studio Express (SSMSE) from Microsoft is a free program that can be used to examine the database.

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## 5 Maintenance and Cleaning

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### 5.1 Maintenance

There are no user-serviceable components or subsystems within the OM2210. Attempting any internal repairs will void your warranty. Never remove the external lid on the unit.



#### CAUTION

***Removing the dust covers from the laser output connectors while the lasers are operating may result in exposure to invisible laser radiation. Never view directly with optical instruments.***

If it becomes necessary to replace the fuse in the power input module in the rear of the unit, use a 5X20mm “slo-blo” fuse rated at 1A, 250VAC. Use a small screwdriver to gently pry open the fuse drawer.



#### WARNING

***Disconnect the unit from the power source when changing the fuse to ensure that line voltage is not present during the replacement.***

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### 5.2 Cleaning

To clean the outside of the OM2210 enclosure, use a dry, soft cotton cloth. Do not use any liquid cleaning agents or chemicals that could possibly infiltrate the enclosure, or that could damage markings or labels.

If the dust filter on the underside of the unit becomes clogged, use a small vacuum or brush to clean the filter.

From time to time it will be necessary to clean the optical input and output connectors on the front of the unit. Use square-ended swabs made for this purpose to clean each connector.

Do not attempt to clean the inside of the instrument; cleaning of internal parts is not necessary.

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## 6 Appendix A – Reference Documents

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### 6.1 Software license agreement

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This Software License Agreement ("AGREEMENT") is entered into between OPTAMETRA, LLC ("OPTAMETRA") and the licensee purchasing Core Processing software ("LICENSEE"). In consideration of the mutual obligations described in this AGREEMENT and other good and valuable consideration, the sufficiency and receipt of which are hereby severally acknowledged, the parties agree as follows:

**1. Term.** This AGREEMENT shall become effective upon acceptance by OPTAMETRA and shall continue in effect until terminated in accord with Section 10.

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**B. Enhancements.** "ENHANCEMENTS" shall mean that OPTAMETRA shall inform LICENSEE when each new release of SOFTWARE containing system enhancements is made commercially available, and upon written request from LICENSEE shall provide to LICENSEE one (1) copy of each such release of SOFTWARE and corresponding technical documentation.

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**B. Assignment.** Any assignment of this AGREEMENT by either party (except to an entity controlling, controlled by or under common control with said party) without the written consent of the other shall be void.

**C. Severability.** Any provision of this AGREEMENT that is held to be invalid by a court of competent jurisdiction shall be severed from this AGREEMENT, and the remaining provisions shall remain in full force and effect.

**D. Waiver.** Failure or delay by either party to enforce compliance with any term or condition of this AGREEMENT shall not constitute a waiver of such term or condition.

**E. Entire Agreement.** This AGREEMENT constitutes the entire agreement between the parties with regard to the subject matter of this AGREEMENT and supersedes all previous communications, whether oral or written, between the Parties with respect to such subject matter.

**F. Foreign Trade Restrictions.** LICENSEE shall not either directly or indirectly export or re-export SOFTWARE in violation of the Export Administration Regulations promulgated by the U.S. Department of Commerce.

**10. Termination.** LICENSEE may terminate this AGREEMENT at any time prior to the shipment of SOFTWARE from OPTAMETRA. OPTAMETRA may terminate this AGREEMENT upon thirty (30) days' prior written notice if LICENSEE fails to comply with any of the terms and conditions of this AGREEMENT or the terms and conditions of the Purchase Order, and such noncompliance is not cured during said thirty (30) day period. Promptly upon termination of this Agreement, LICENSEE must immediately return to OPTAMETRA all SOFTWARE and CONFIDENTIAL INFORMATION delivered by OPTAMETRA to LICENSEE including all copies, if any. LICENSEE's insolvency, receivership, bankruptcy, or assignment for the benefit of creditors (or the institution of proceedings therefor) shall immediately terminate this AGREEMENT without notice. Rights and obligations accruing prior to termination of AGREEMENT shall survive termination of AGREEMENT.