QUANTIFI PHOTONICS™

OSA

1000 Series

Optical Spectrum Analyzer

PXIE USER MANUAL

quantifiphotonics.com

Trademarks

Units of Measurement

Units of measurement in this publication conform to SI standards and practices.

CE mark related enquiries

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2 Conventions

Please make yourself familiar with these conventions; we use them throughout this user manual:

> ⚠ **WARNING**
>
> Indicates a potentially hazardous situation which, if not avoided, could result in **death or serious injury**.
>
> Do not proceed unless the required conditions are met and understood.

> ⚠ **CAUTION**
>
> Indicates a potentially hazardous situation which, if not avoided, may result in **minor or moderate injury** or **component damage**.
>
> Do not proceed unless the required conditions are met and understood.

> **NOTE**
>
> Indicates relevant information that requires your attention.

3 Safety information

Carefully read all safety information before using your Quantifi Photonics product.

3.1 Optical laser radiation precautions

WARNING

To protect yourself from harm caused by optical radiation:

- Do not install or terminate fibers while the light source is active.
- Turn the Quantifi Photonics product OFF before inspecting the end face(s) of the product, or any optical patch cords connected to it.
- Never look directly into a live fiber; ensure that your eyes are protected at all times.

CAUTION

The use of controls, adjustments, and procedures other than those specified in this document may result in exposure to hazardous situations involving optical radiation.

3.2 Electromagnetic compatibility

CAUTION

For electromagnetic compatibility, this product is a Class A product. It is intended for use in an industrial environment. There may be potential difficulties in ensuring electromagnetic compatibility in other environments, due to conducted as well as radiated disturbances.

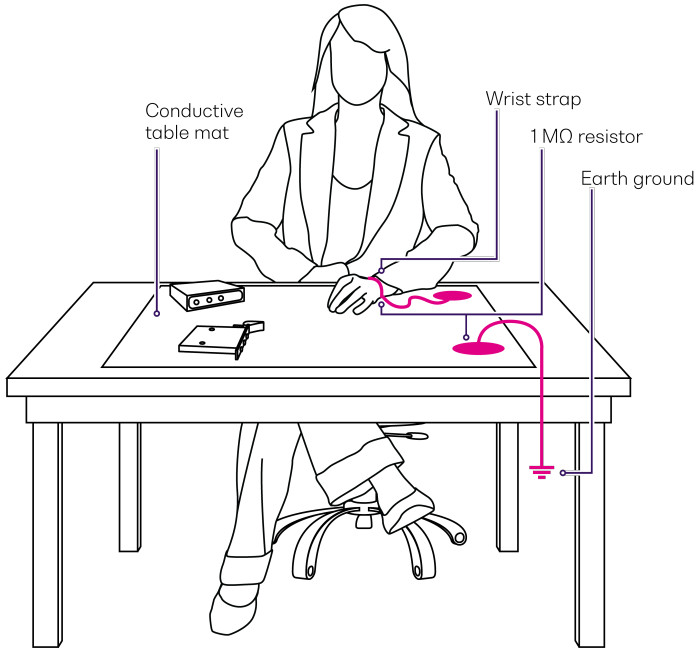
This symbol on the unit refers to documentation provided with the product for related safety information. Ensure that the required conditions are met and understood before using the product.

3.3 Electrostatic discharge precautions

CAUTION

The product is sensitive to electrostatic discharge (ESD). To ensure that you do not cause ESD damage to the product:

- Always follow proper grounding and ESD management practices.
- Store the unused product in the original protective electrostatic packaging that it was shipped in.
- Use a wrist strap and grounding table mat when unpacking or handling the product.



4 Introducing the OSA 1000 Series

The OSA 1000 Series enables cost-effective spectral test and measurement in a compact form factor. The OSA is grating-based and is designed for efficient, space saving performance where space and time are critical. It is an excellent fit for fully automated production testing of optical sources, amplifiers, transceivers, and passive optical components.

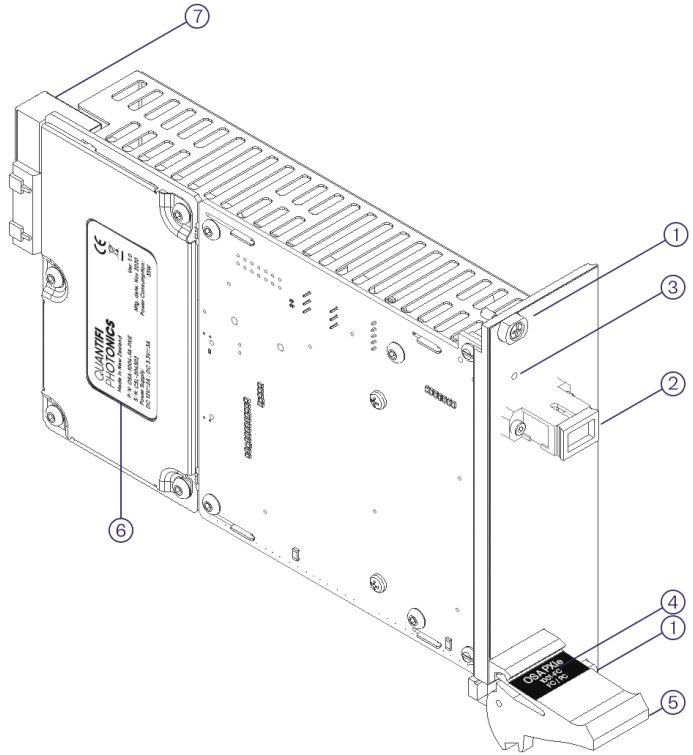
Programming interfaces

Through its programming interfaces you can take advantage of the SCPI-compliant command language and choose from programming tools such as LabView, C++, Python, or any of the other popular programming languages used to control automatic test equipment (ATE).

CohesionUI™

Quantifi Photonics' web-based graphical user interface CohesionUI is hosted on Microsoft Windows® and enables you to control your device from any supported web browser.

4.1 Hardware description



1	Fastening screws	5	Fastening clip
2	Optical input	6	OSA PXIe module information
3	Status LEDs	7	PXIe headers
4	Optical connector information		

4.2 Status LEDs

The LED shows the status of the channel:

LED	Meaning
OFF	Product is powered OFF
solid GREEN	Product is powered ON

5 Setting up hardware

Quantifi Photonicsmodules are designed for easy installation in a PXIe-compatible chassis.

Make sure to follow these instructions when installing or removing a Quantifi Photonics module from a PXIe chassis.

Ensure that the chassis being used supports PXIe (or contains PXI-hybrid compatible slots). If you are unsure if your chassis is compatible with your Quantifi Photonics product, please contact Quantifi Photonics Customer Support.

⚠ CAUTION

The product is sensitive to electrostatic discharge (ESD). To prevent damage from ESD:

> Do not remove the product from the antistatic packaging until required to do so.
> Wear a grounded wrist strap at all times when handling the product.

⚠ CAUTION

Skin contact may leave corrosive residue and damage a connector:

> Always clean optical end faces before mating.

NOTE

- Please check for the fiber end-face type of the optical ports, such as PC or APC, and only use the same type optical connector to avoid damaging the end-face.

For advice on connector and fiber care, please refer to Working with optical fibers.

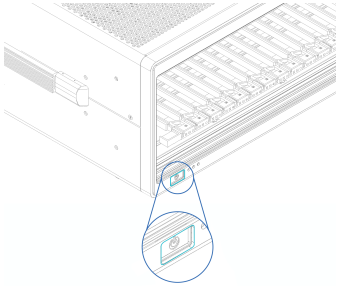
5.1 Install the module in a PXIe chassis

WARNING

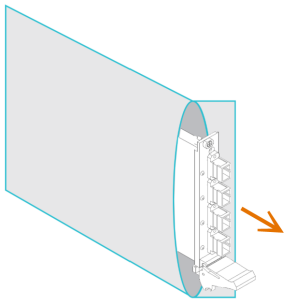
When attempting to install or remove a module or any component of the PXIe chassis:

- Power the chassis OFF.
- Follow these installation instructions.
- After powering the PXIe chassis ON, please wait at least 2 minutes before attempting to communicate with the module. This gives the chassis time to boot and initialize the communication server.

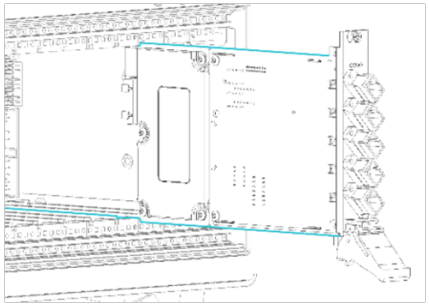
1 Power the chassis OFF.



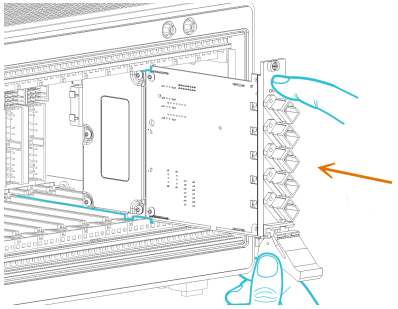
2 Remove the module from the anti-static bag. Retain the bag.



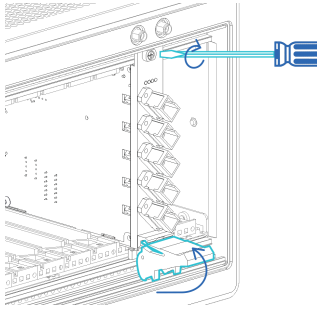
3 Align the module with the slot guide rails.



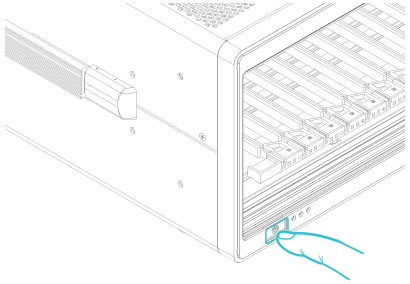
4 Push module into slot until you feel resistance from the backplane connection.



5 Engage the fastening clip. Secure all fastening screws.



6 Power the chassis ON.



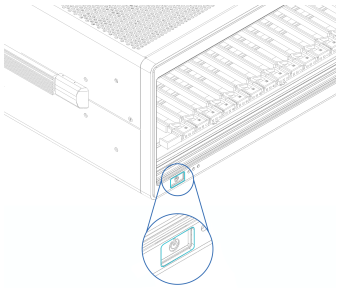
5.2 Uninstall the module from a PXIe chassis

WARNING

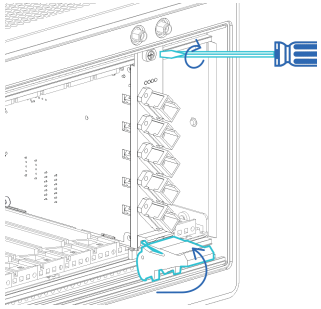
When attempting to install or remove a module or any component of the PXIe chassis:

> Power the chassis OFF.
> Follow these installation instructions.

1 Power the chassis OFF.

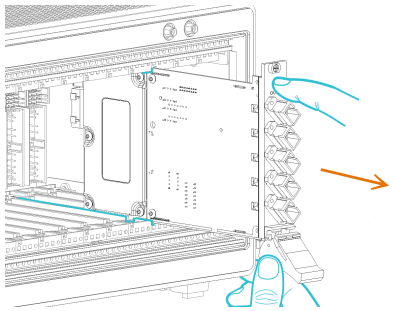


2 Unsecure the fastening screws and fastening clip.

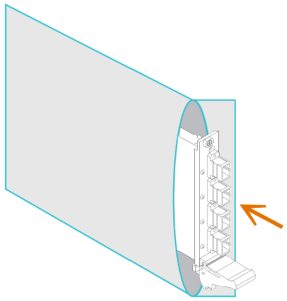


3 Pull out the module.

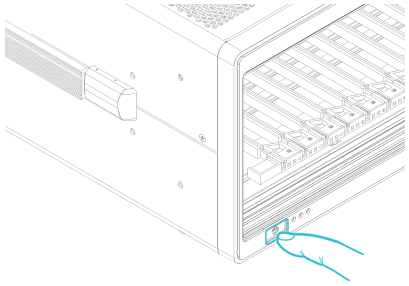
Use the fastening clip to pull. Do NOT pull on the connectors.



4 Store the module in its antistatic bag.



5 Power ON the chassis.



6 Installing software

The Cohesion Installer software package enables communication between the PXIe controller and Quantifi Photonics modules installed in a chassis.

The Cohesion Installer contains all required drivers and software:

CohesionDriver	Driver Service for Quantifi Photonics PXIe modules
CohesionSCPI	VXI11 compliant server for remote SCPI communication
CohesionUI	Web-based Graphical User Interface
Cohesion Manager	Single-window utility application that shows the status of all Cohesion Software Services running on the system.
Cohesion Firmware Updater	Single-window utility application that shows the current firmware status of all Quantifi Photonics PXIe modules installed in the chassis.

6.1 Install the Cohesion Installer software package

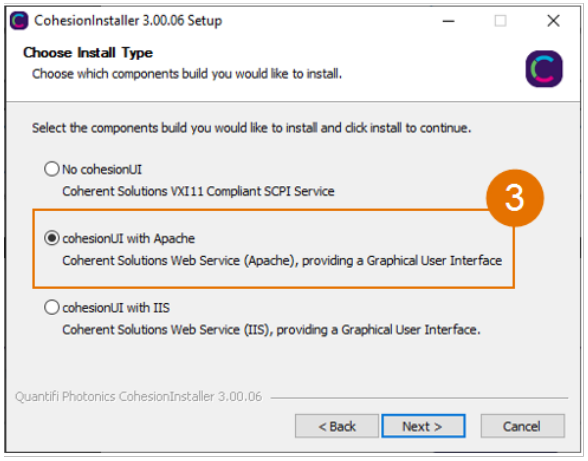
Install Cohesion Installer on:

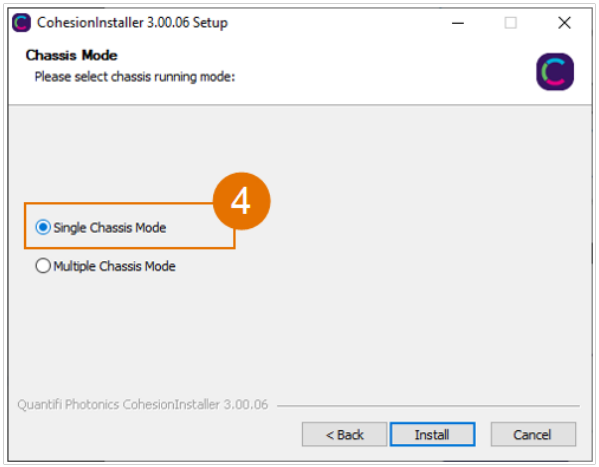
- the PXIe controller of the PXIe Chassis in which the Quantifi Photonics module(s) will be installed, or
- the controller PC (multi-chassis MXI setup)

▶ To install Cohesion Installer:

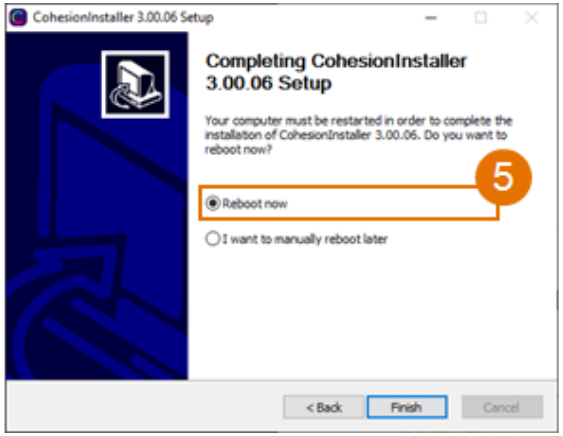
1. We recommended that you save your work and close open programs before installing Cohesion Installer.
2. Locate and run **CohesionInstaller-<version_number>.exe** from the provided USB media device (or download it from the Quantifi Photonics website) and follow the on-screen installation prompts.
3. Select the Installation Type: **CohesionUI with Apache** (this is the default setting)
4. Select the Chassis Mode: **Single Chassis Mode** (this is the default setting). If unsure, select this default setting.

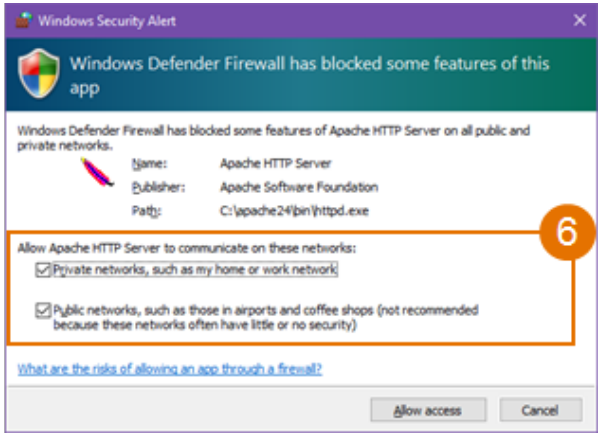
   To operate in Multiple Chassis Mode, additional hardware modules are required. As you can change the Chassis Mode later, we recommend to select **Single Mode** unless all other configuration requirements have been met.





5. At the end of the installation, we recommend you select the **Reboot now** option, and click **Finish** to complete the installation process.
6. A Windows Security Alert may prompt the user for network access. We recommend that **both options are ticked**, to allow any network configuration.





7. On startup after rebooting the system a User Account Control prompt might be displayed.
   Click **Yes** to allow running of the **Cohesion Firmware Updater Utility** and proceed with the application.

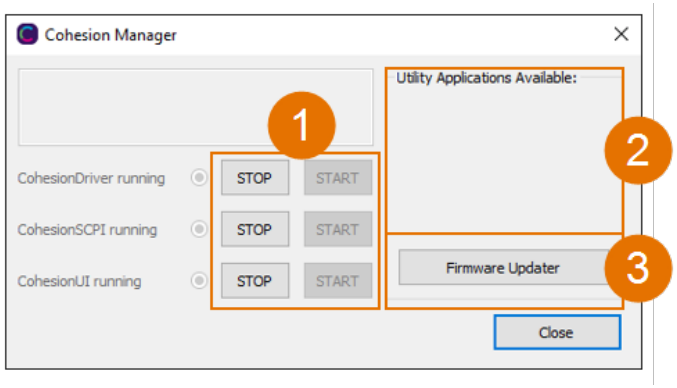
6.2 Cohesion Manager

Cohesion Manager is a single-window utitlity application that shows the status of all Cohesion Software Services running on the system.

By default, these Cohesion Software Services will start automatically on startup of Windows and need to be running to facilitate proper communication with the Quantifi Photonics PXIe modules.

CohesionDriver	required	manages installed Quantifi Photonics modules
CohesionSCPI	required	VXI11 compliant SCPI interface for TCP communication with the installed Quantifi Photonics modules
CohesionUI	optional	web service providing a graphical interface for simplified operation of installed Quantifi Photonics modules

- To open Cohesion Manager:
  - > Search for Cohesion Manager in the Windows Start Menu.
- From Cohesion Manager you can:
  1. Start or stop the CohesionDriver service, CohesionSCPI service, or CohesionUI service independently.
  2. View all installed Quantifi Photonics system utilities.
  3. In this example you can open the Cohesion Firmware Updater application.



- If you can't detect or communicate with modules:
  - > Open Cohesion Manager.
  - > Check the status of software services, and start a service if required.

6.3 Cohesion Firmware Updater

Cohesion Firmware Updater launches automatically when you install a new version of Cohesion Installer on the system and reboot. Or, you can open it via the Cohesion Manager application.

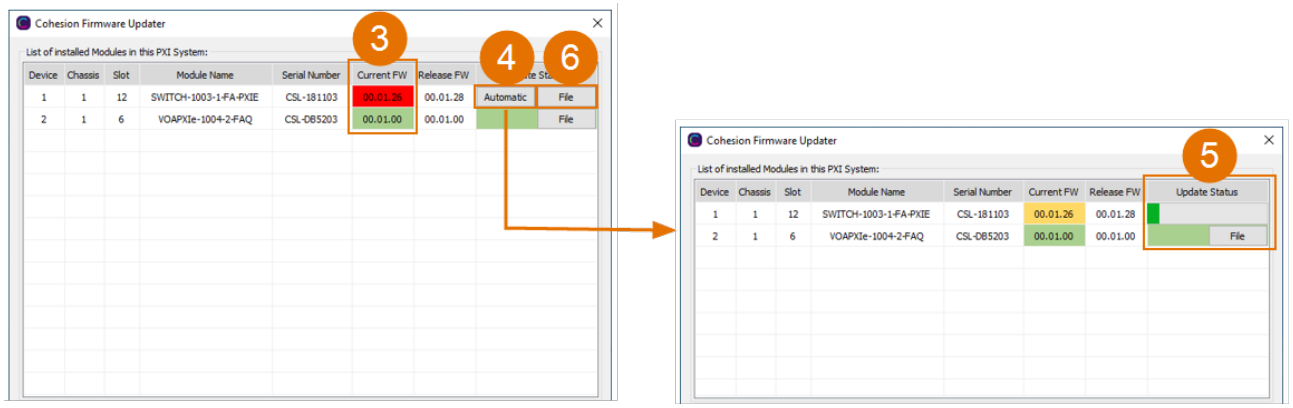
It is a single-window summary application that enables you to:

- view the current firmware status of all Quantifi Photonics PXIe modules installed in the chassis.
- update firmware to a new version if available.

> We recommended that you update firmware if a new version is available.

▶ To upgrade firmware:

1. Open **Cohesion Manager**, for example by searching for it in the Windows Start Menu.
2. In **Cohesion Manager**, click **Firmware Updater**.
3. Modules with out-of-date firmware are highlighted red.
4. Click **Automatic** to update automatically.
5. Progress will be displayed in **Update Status**.
6. Click **File** to update to a specific firmware package.

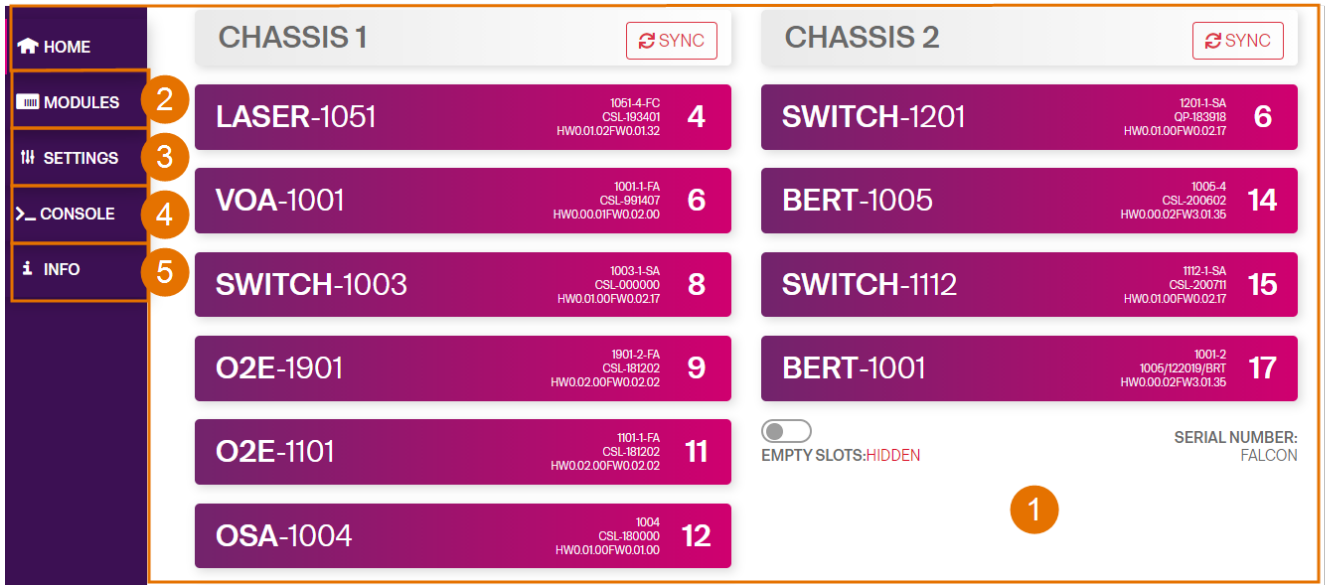


7 CohesionUI - Overview

CohesionUI is a web-based graphical interface that you can use to work with your Quantifi Photonics products.

> CohesionUI is part of the Cohesion Installer software package.

1. **HOME**: View all modules in the chassis
2. **MODULES**: Access a module
3. **SETTINGS**: Change CohesionUI settings
4. **CONSOLE**: Communicate with modules using SCPI commands
5. **INFO**: Display chassis information



7.1 Access a module with CohesionUI

You can access Quantifi Photonics modules via CohesionUI from the chassis controller, or from a controller PC.

To connect with a module, you need the IP address of the chassis the module is installed in.

▶ To obtain the IP address of the chassis:

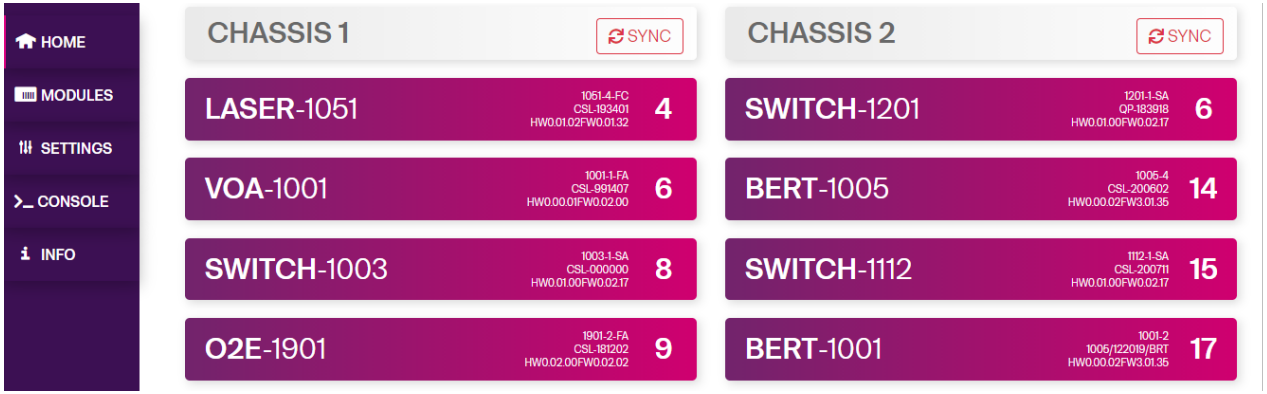
1. Open the **Command Prompt** window on the chassis controller.
2. Run the `ipconfig` command.
3. Note down the IPv4 address that is displayed.

▶ To connect with modules via CohesionUI:

1. On the controller or controller PC, open CohesionUI, for example by double-clicking the desktop icon, or open a supported browser.
2. Enter the IP address of the chassis as the URL.

   On the controller you can use `127.0.0.1` as the URL instead.

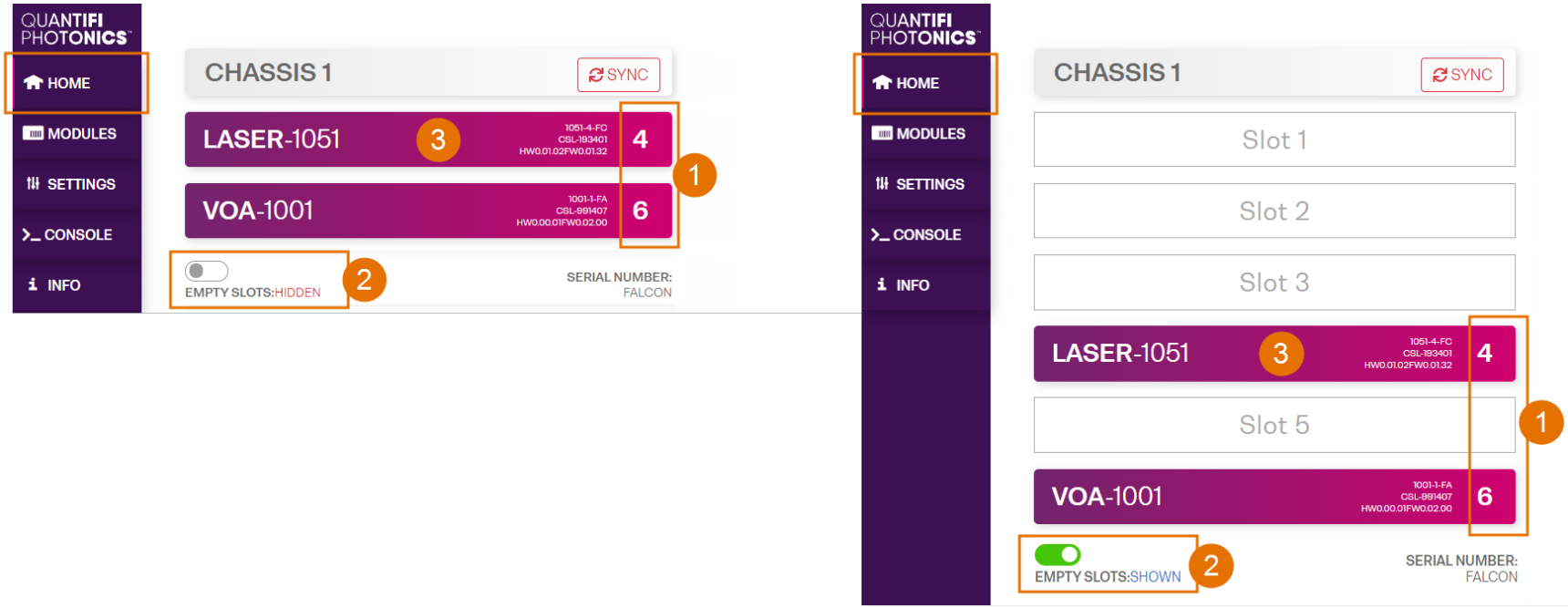
3. CohesionUI will launch in the browser, listing all available Quantifi Photonics modules installed in the chassis.



7.2 Display modules in a chassis

The **HOME** page is the main landing page in CohesionUI; it displays all available Quantifi Photonics modules in the PXIe chassis.

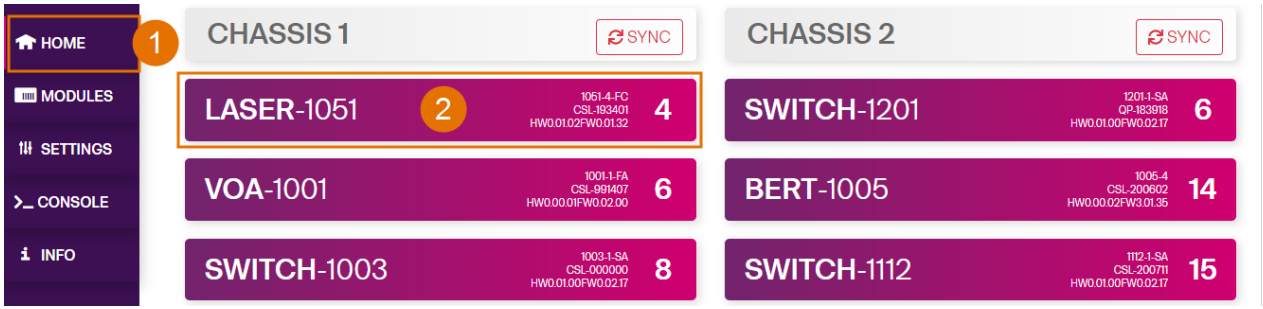
1. Numbers indicate the slots the modules are installed in.
2. You can hide (default setting) or show empty slots in the PXIe chassis by toggling the **EMPTY SLOTS** button.
3. You can select a module to work with by clicking it.



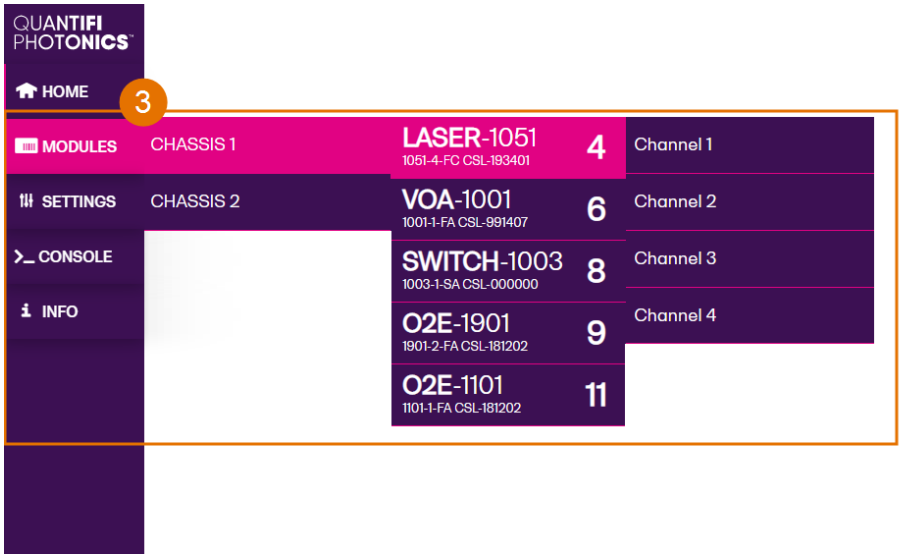
7.3 Select a module to work with

To select a module:

1. Go to the **HOME** page.
2. Click the on the module.



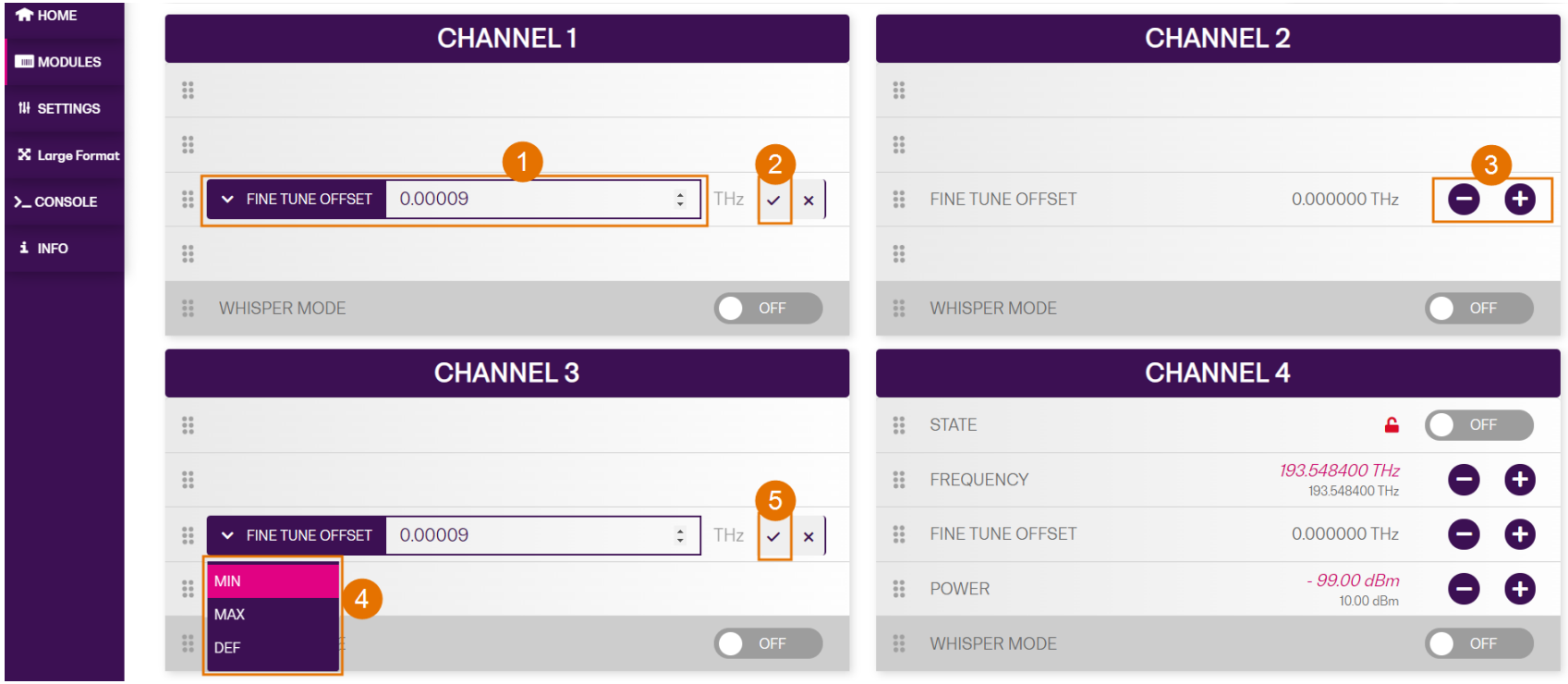
3. Or, hover over the **MODULES** menu and select a module or channel from the list.



7.4 Set values

In CohesionUI you can set values for parameters where applicable.

- To set a value:
  1. Click on a parameter and enter a value.
  2. Confirm the value.
  3. Alternatively, you can use + and - to increase or decrease the value. You can edit the step size in the **SETTINGS** menu.
- To set a pre-defined value, for example **MIN**, **MAX** or **DEF**:
  4. Click on a parameter and select a value from the dropdown menu.
  5. Confirm the value.

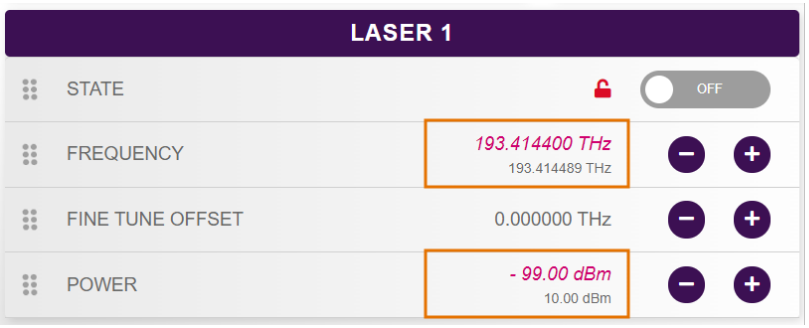


For details on how to change the step size, refer to Manage CohesionUI settings.

7.5 SET values and ACTUAL values

In some cases you can manually set a value that will be displayed alongside the actual value as follows:

- ***ACTUAL***: The actual value of the parameter as queried by the product.
- SET: The intended value of a given parameter as set by the user.



7.6 Manage CohesionUI settings

On the **SETTINGS** page you can configure CohesionUI settings and unit preferences.

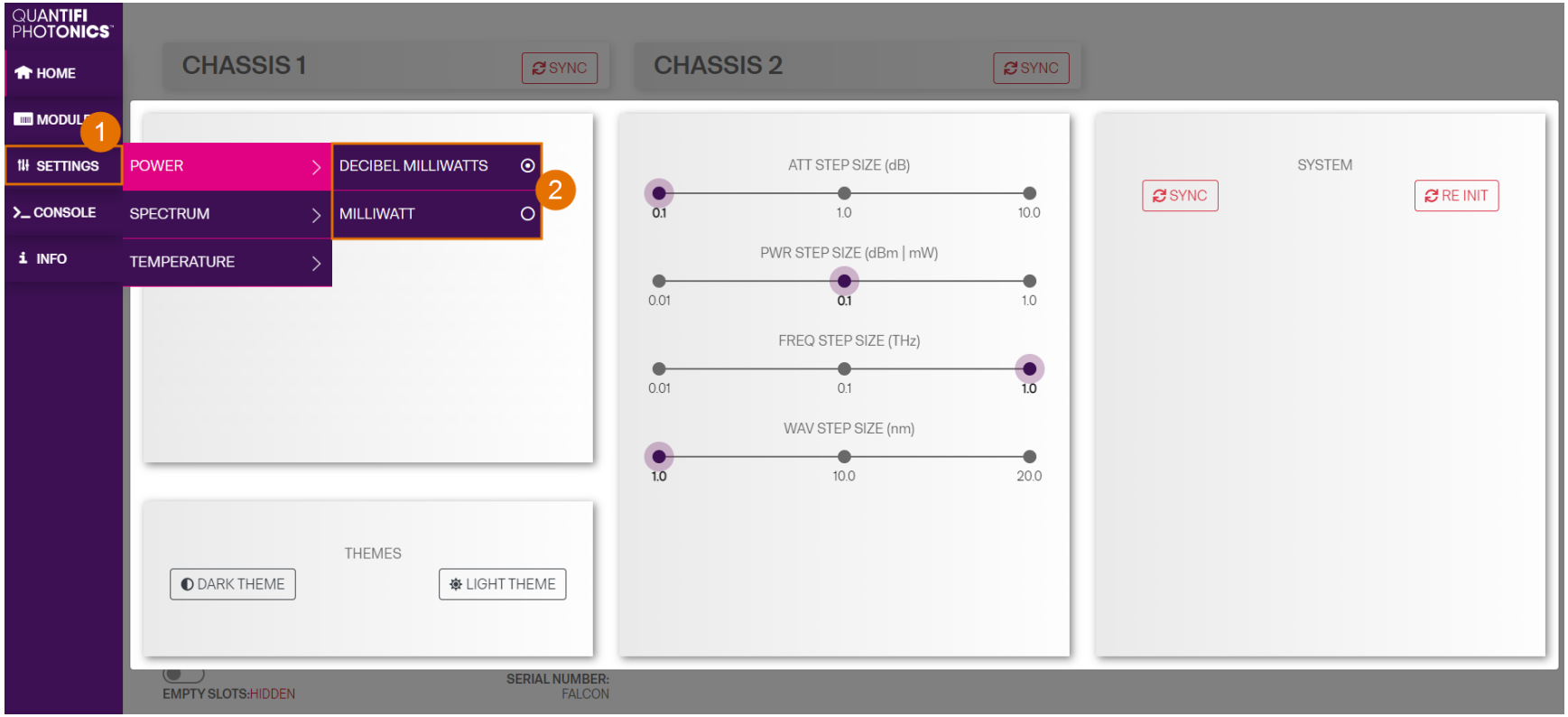
> **NOTE**
>
> CohesionUI reverts to default settings when power-cycling the chassis.

▶ To view all settings and unit preferences and adjust as required:

1. Click **SETTINGS**.
2. Change settings or unit preferences as required, for example temperature units.
   Please note that the units displayed on this page are not always relevant for each product.
3. **Step size** refers to the amount by which a value is increased or decreased when clicking the **+** or **-** button.

To adjust unit preferences one at a time:

1. Hover over **SETTINGS**.
2. Select a unit from the dropdown, for example the power unit.



7.7 Synchronize and reinitialize CohesionUI

You can update CohesionUI with the latest information from your Quantifi Photonics modules by synchronizing or reinitializing.

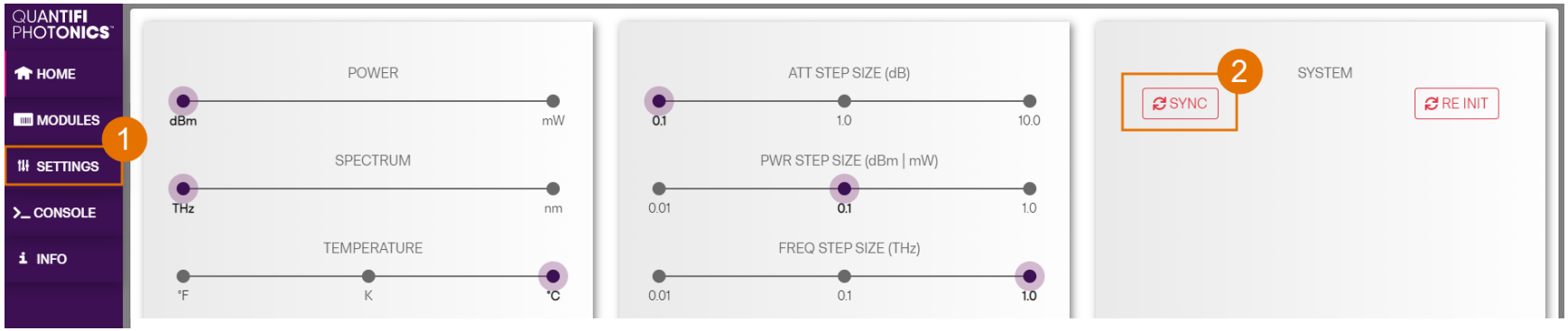
Synchronizing	Updates **CohesionUI** with the latest information from the **CohesionSCPI service**
Reinitializing	Updates **CohesionUI and the CohesionSCPI service** with the latest information from the **CohesionDriver service**

This can be particularly useful when operating a multi-chassis MXI setup and enables you to:

- Re-discover modules that CohesionUI does not display as expected.
- Discover modules that have been installed after the initial startup.

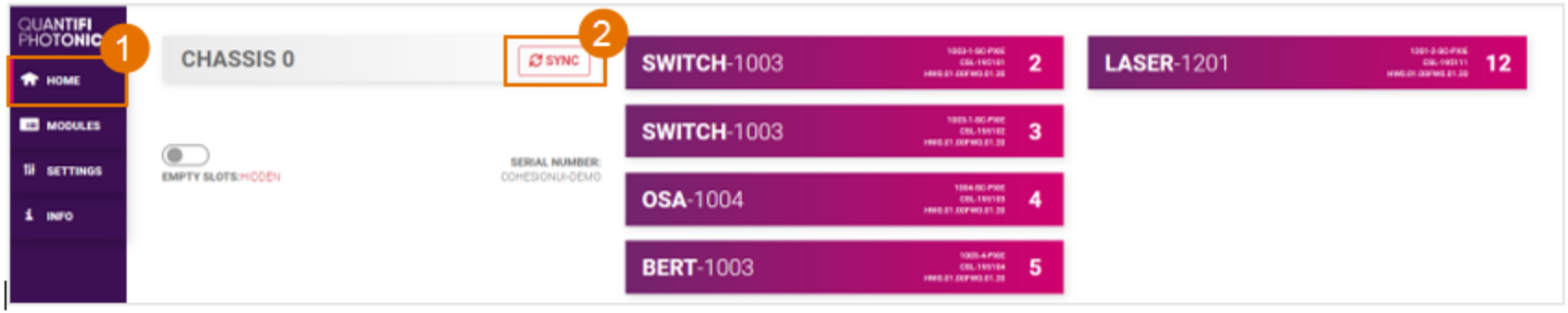
▶ To **synchronize** CohesionUI across **all modules in all chassis**:

1. Click **SETTINGS**.
2. Click **SYNC**.
3. The page will be disabled while synchronizing.



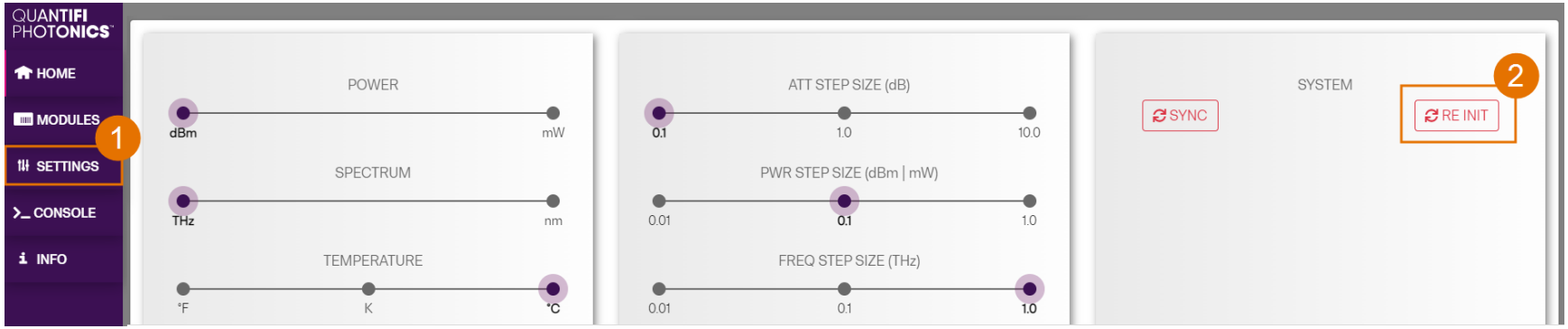
- To **synchronize** CohesionUI across **all modules in a selected chassis** only:

  1. Click **HOME**.
  2. Click **SYNC** for a selected chassis.
  3. The page will be disabled while synchronizing.



- To **reinitialize** CohesionUI across **all modules in all chassis**:

  1. Click **SETTINGS**.
  2. Click **RE-INIT**.
  3. All modules will be disabled and temporarily disconnected while reinitializing.



7.8 SCPI CohesionUI Command Console

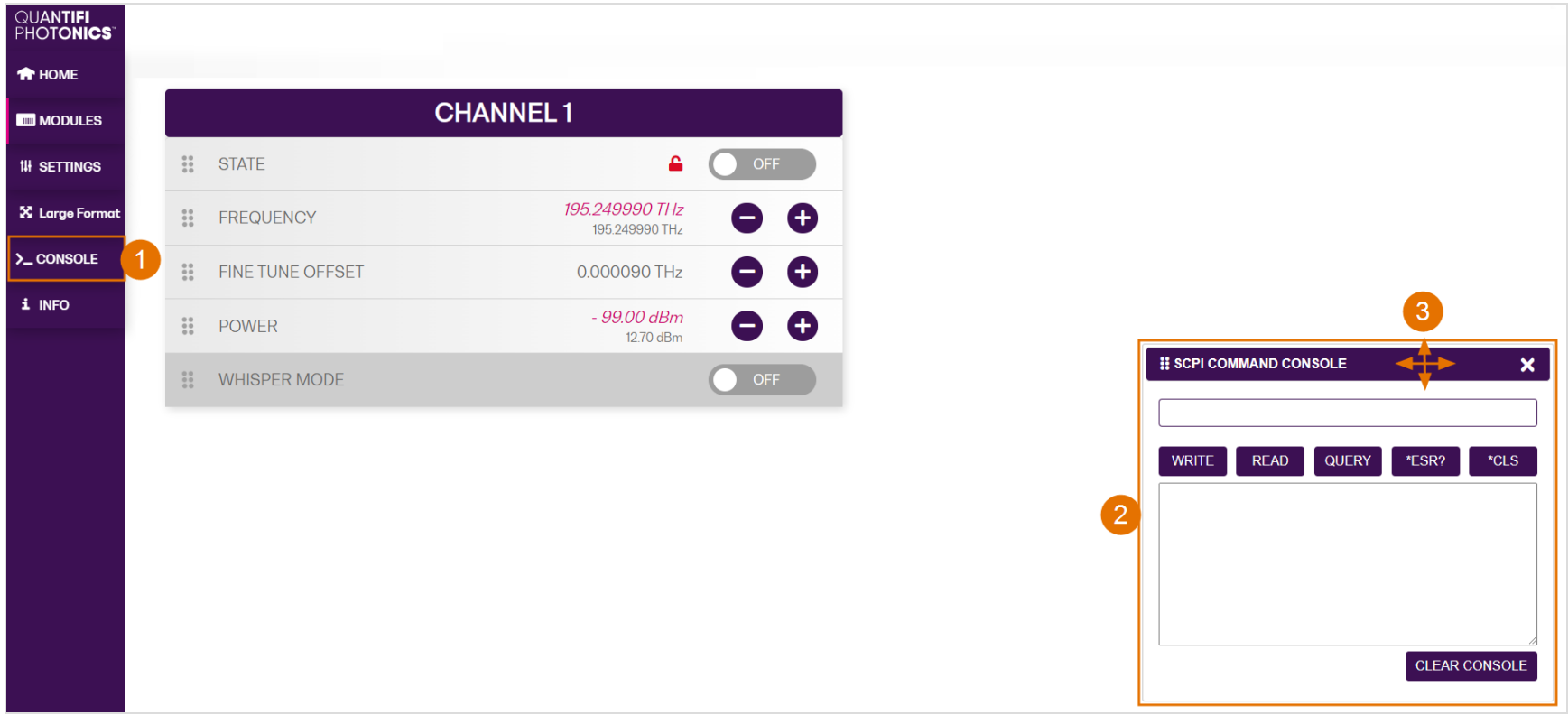
The CohesionUI SCPI Command Console enables you to communicate with Quantifi Photonics PXIE modules via SCPI commands. It enables you to test commands and verify their syntax.

For details on available SCPI commands, refer to the SCPI command section.

▶ To open the SCPI Command Console:

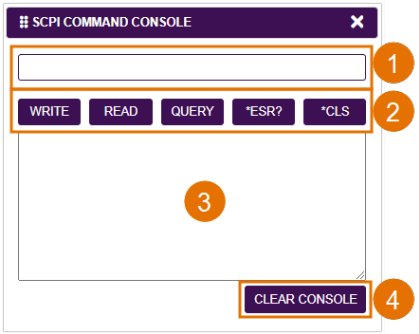
1. On the CohesionUI menu, click **CONSOLE**.
2. The console will appear in the bottom right corner of the screen.
3. You can move the console by clicking on the title bar and dragging it to any position on the screen. On closing and re-opening, the console will re-appear at its last position.

The console remains open when navigating between different modules. It floats on top of the UI so that you can observe the effect of SCPI commands on a module in real-time.



▶ To communicate with a module via the SCPI Command Console:

1. Enter a command.
2. Select action(s).
3. Review the action response in the output area.
4. (optional) Clear the output area.



You can choose from these SCPI command actions:

Action	Meaning	FAILED response
WRITE	Send the command to the instrument	The command is invalid. Please check the command and syntax.
READ	(after WRITE) Request the response from the instrument	Response buffer is empty.
QUERY	WRITE and READ	
*ESR?	Query the status event status register (ESR) – this will give you more details and specific information about command failures. For details on error codes, please refer to the programming guide in this manual.	
*CLS	Clear the response buffer and start fresh – useful when getting out of sync with WRITE and READ actions	

Example 1: Send instrument identification query `*idn?`

1. Enter the command: `*idn?`
2. Click **QUERY**.
3. The module returns the requested information.

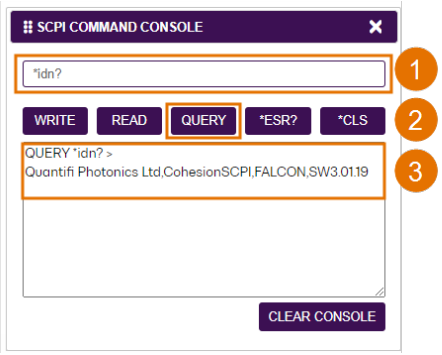
Example 2: What happens when I send an incorrect command?

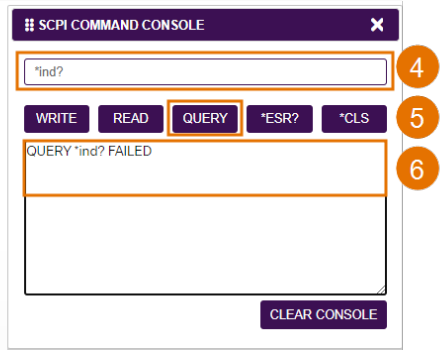
4. Enter an incorrect command, for example: ***ind?**
5. Click **QUERY**.
6. The module returns **FAILED**.

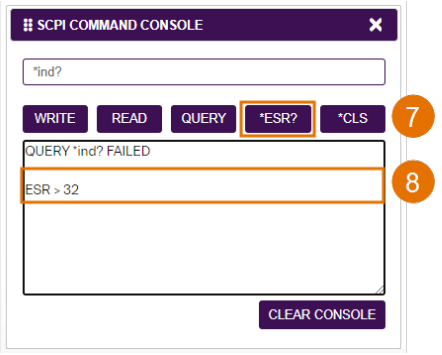
Example 3: Investigate a command failure:

7. Click `*ESR?` to query the event status register and request information about the command failure.
8. The instrument returns the error code, for example 32.

   For details on error codes, please refer to the *ESR? command in the programming guide.





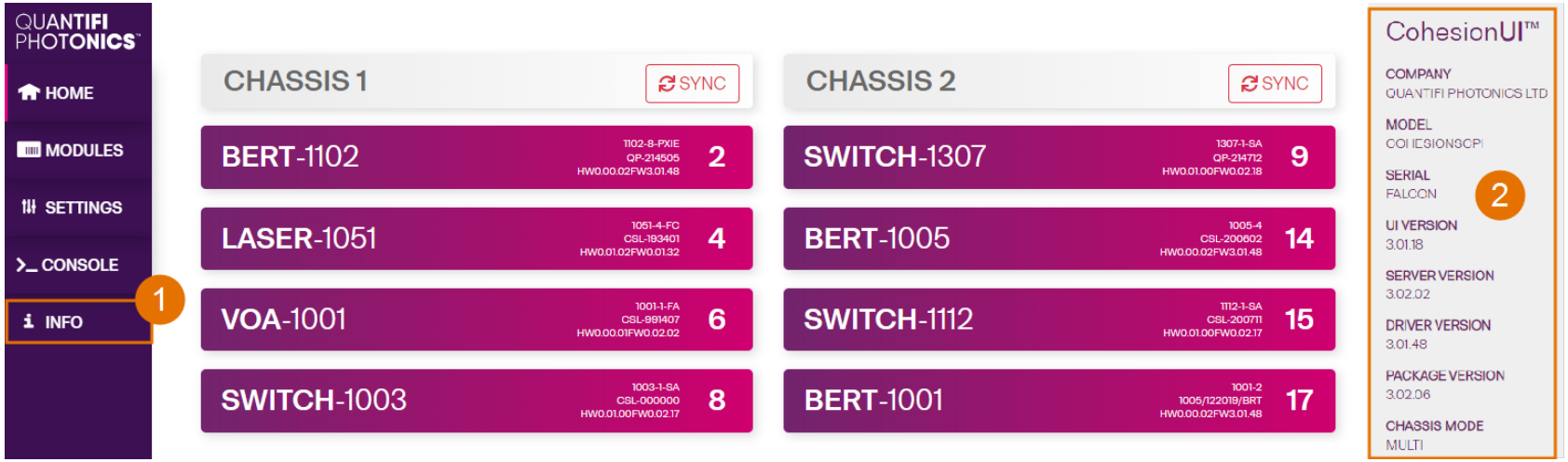


7.9 View system information

7.9.1 PXIe Chassis

- To display chassis information:

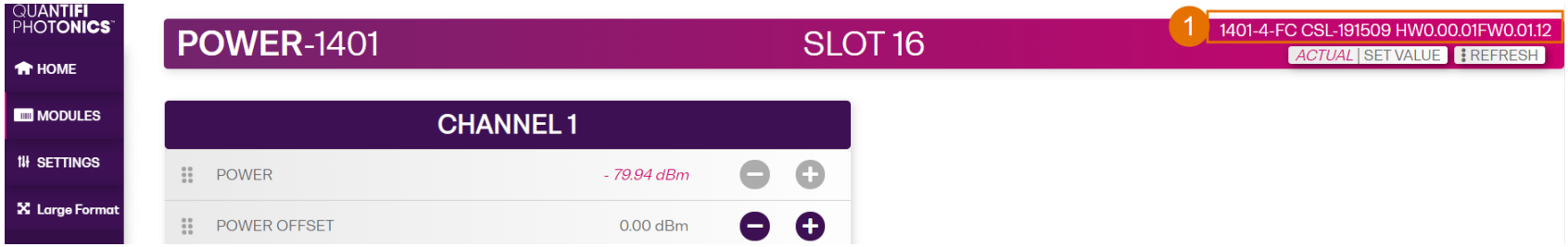
1. Click **INFO**.
2. The information panel will display operation mode, manufacturer, model, and serial number of the chassis, and the version of CohesionUI and CohesionSCPI service running on the chassis.



7.9.2 Module

- To view module information when working with a module in CohesionUI:

1. Model number, serial number and firmware versions are displayed in the top right corner.

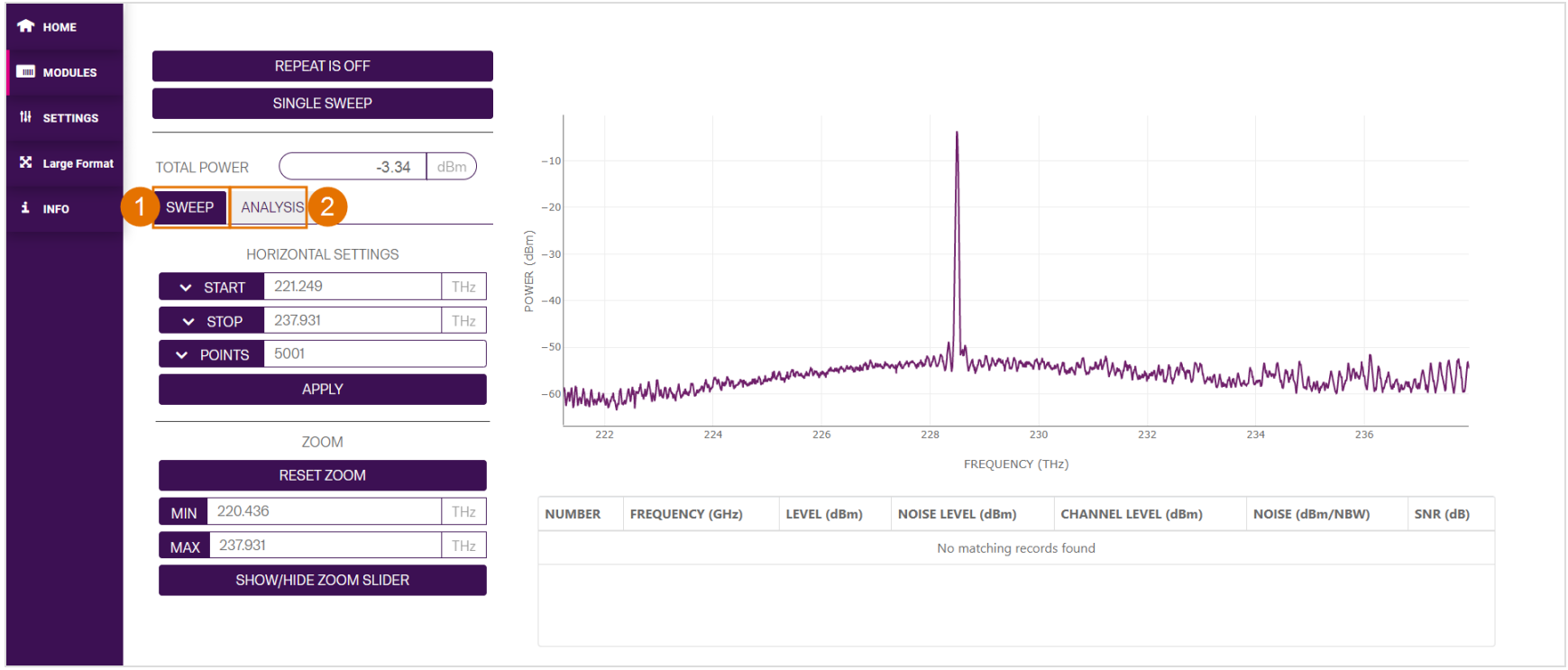


8 Controlling your OSA with CohesionUI

You can use Quantifi Photonics' graphical user interface CohesionUI to work with your OSA module. For details on how to get started with CohesionUI, refer to CohesionUI - Overview.

In CohesionUI you can control:

1. OSA sweep settings
2. OSA analysis settings



8.1 OSA sweep settings

Parameters and settings in the **SWEEP** tab control the start and stop values, between which the spectrum of the optical input will be recorded. The spectrum can also be zoomed to show a specific section of the recorded spectrum, by clicking and dragging the desired area with the cursor.

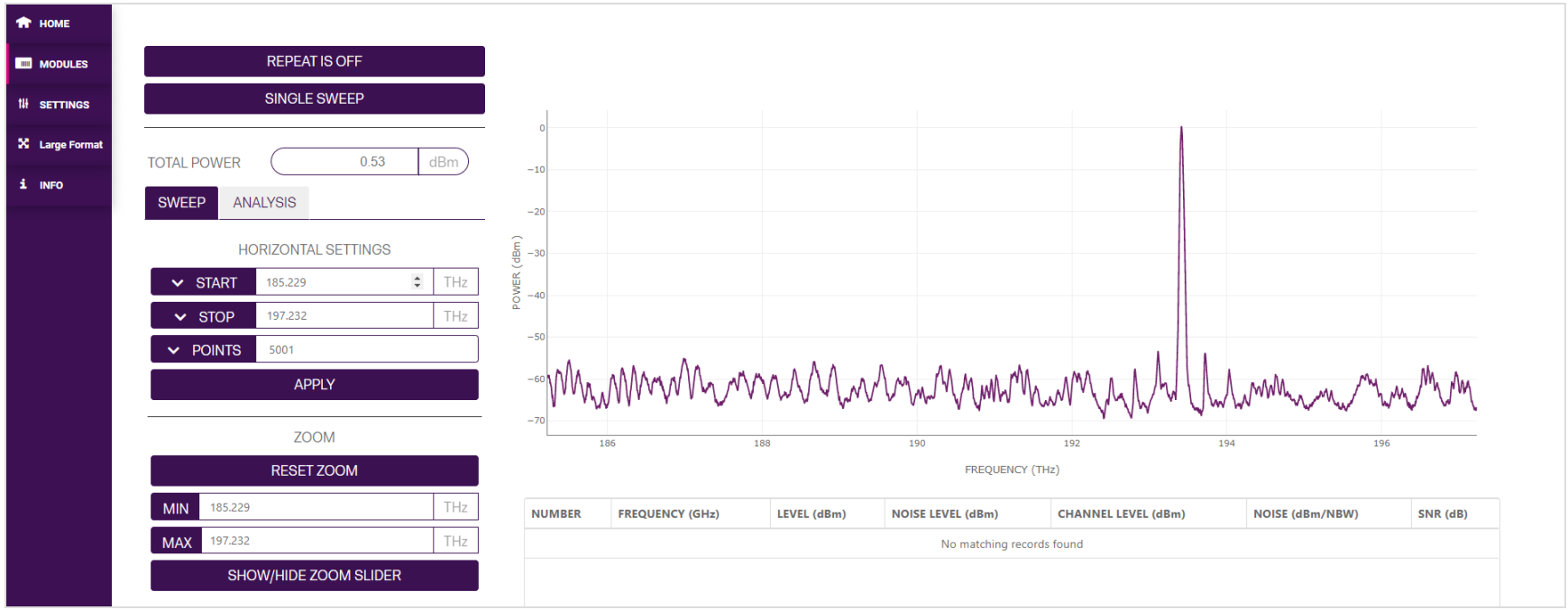
The sweep settings for an OSA can be entered manually into any parameter field, or by clicking the up and down arrow buttons in the value field, to increment or decrement the value by a set amount. This step size is set in the **SETTINGS** menu. Alternatively, the parameter can also be set to the **MIN**, **MAX** or **DEFAULT** values by clicking the dropdown menu in the name of the parameter.

This applies to the following parameters:

- **START**: The frequency (wavelength) value that the OSA should begin scanning from.
- **STOP**: The frequency (wavelength) value that the OSA should stop scanning at.
- **POINTS**: The number of data points that the OSA will gather between the **START** and **STOP** frequencies (wavelengths).

The integrated power across the START / STOP bandwidth is displayed as the **TOTAL POWER**.

After setting the **START** and **STOP** frequency / wavelength values and the number of sweep **POINTS**, clicking **APPLY** will save the parameter values into memory and update the sweep settings of the OSA.



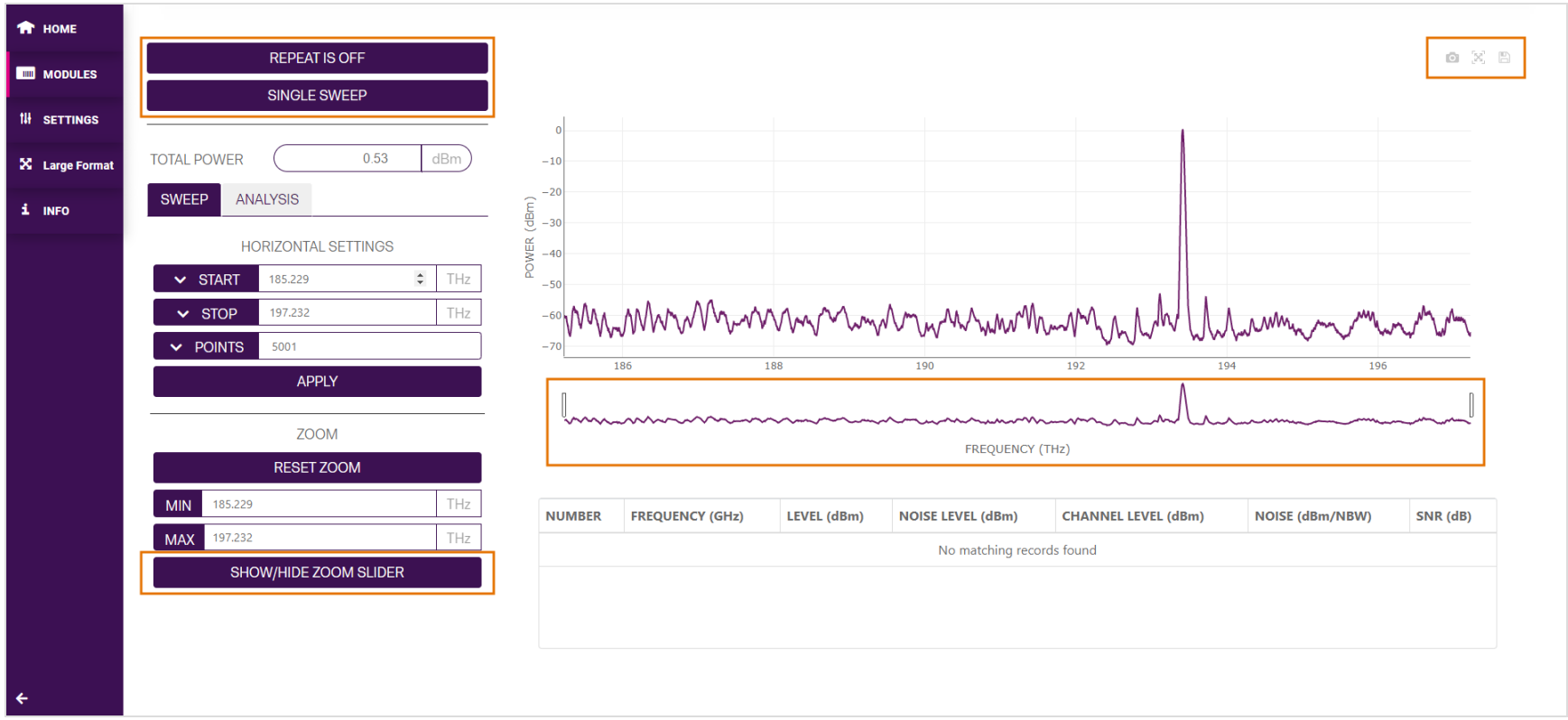
Clicking the **SINGLE SWEEP** button will conduct a single scan over the set frequency / wavelength span.

If a continuously repeating scan is desired, then clicking the **REPEAT IS OFF** toggle button will conduct repeated sweeps of the frequency / wavelength range, and the button will display **REPEAT IS ON** text.

By clicking **SHOW / HIDE ZOOM SLIDER** an interactive OSA trace is displayed below the main trace.

This second panel has two draggable bars at either end of the frequency / wavelength span, which can be moved to zoom the main trace view to a specific range.

Zooming does not change the actual START and STOP frequency / wavelength sweep values; it only changes the displayed trace.



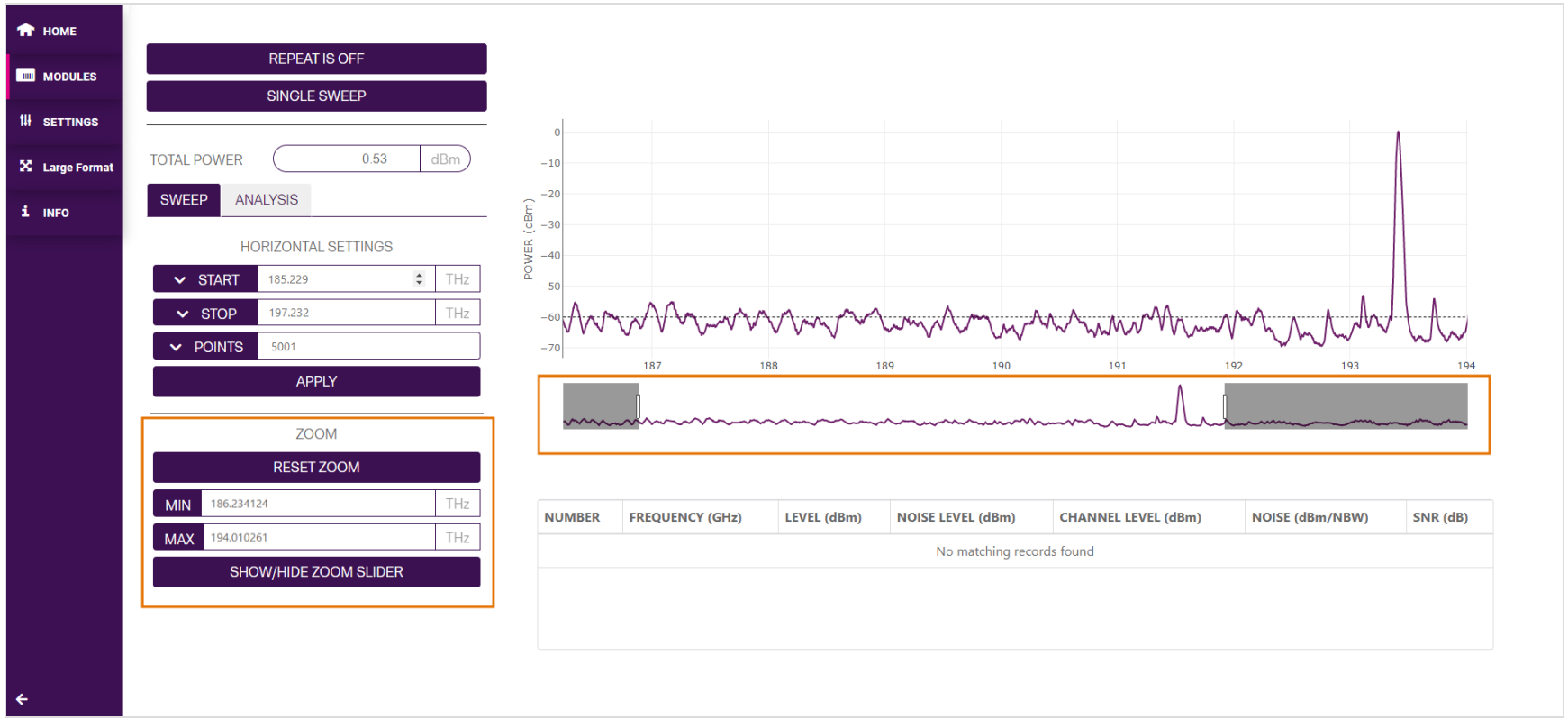
You can download the trace as a .png file, export a .csv file that lists Power (dBm), Wavelength (nm) and Frequency (THz) values of the trace, or autoscale the trace by using one of the options in the top right corner (available from Cohesion version 4.00.06).

The zoomed trace will show the zoom window by rendering a mask over the second OSA trace to illustrate the position of the zoom window.

When the interactive zoom bars are dragged around, their corresponding values are automatically populated into the **MIN** and **MAX** fields. These values denote the minimum and maximum frequency / wavelength values that form the zoom window. The values can be set to their minimum or maximum by clicking the parameter name. This will automatically change the display window to reflect the **MIN** / **MAX** values.

Clicking **RESET ZOOM** will revert the zoom window to the full frequency / wavelength span as defined in the SWEEP settings. Alternatively, clicking and dragging over the main trace window will also zoom the trace. Double clicking anywhere in the trace window will reset the zoom to the default view.

> The **MIN** and **MAX** values are limited by the **START** and **STOP** values that were set in the **SWEEP** settings. The OSA cannot zoom the display to a value outside the **START / STOP** range.



8.2 OSA analysis settings

Parameters and controls in the **ANALYSIS** tab allow the user to perform some processing on the OSA traces. These functions provide the user with analysis ability for the most common actions that are performed on OSA traces. Clicking the dropdown menu will display the following options:

- **OSNR** – Optical Signal to Noise Ratio
- **SMSR** – Side Mode Suppression Ratio
- **SPECTRAL WIDTH**
- **FIND PEAKS**

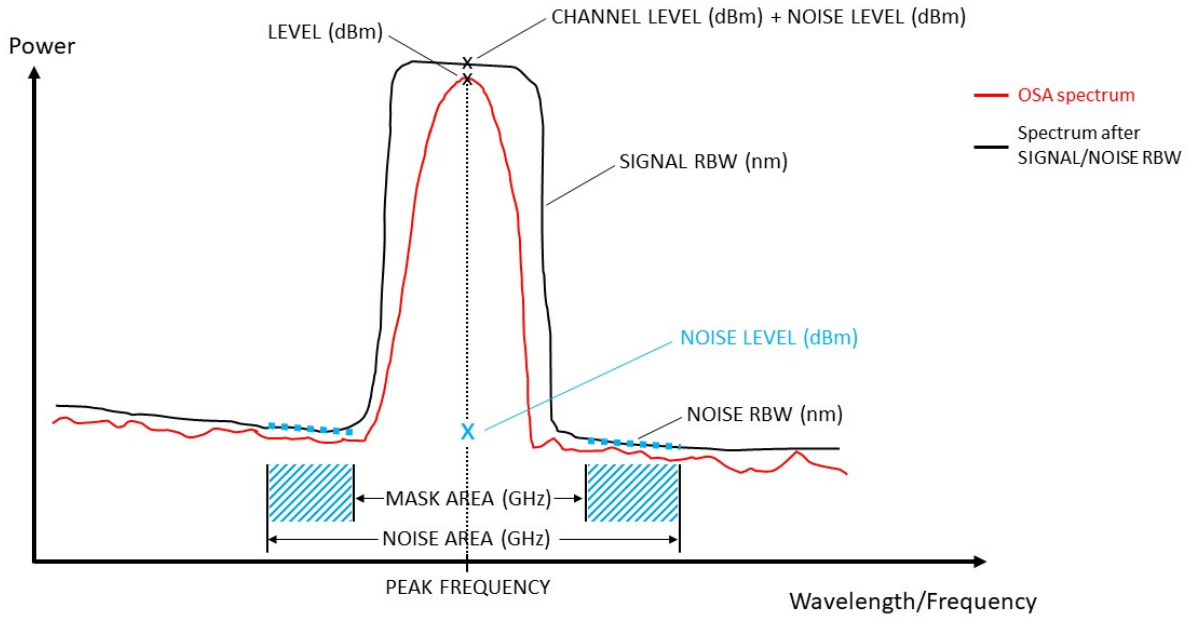
8.2.1 OSNR

The OSNR (Optical Signal to Noise Ratio) can be computed between all detected peaks and the average noise level of the OSA trace.

Parameters:

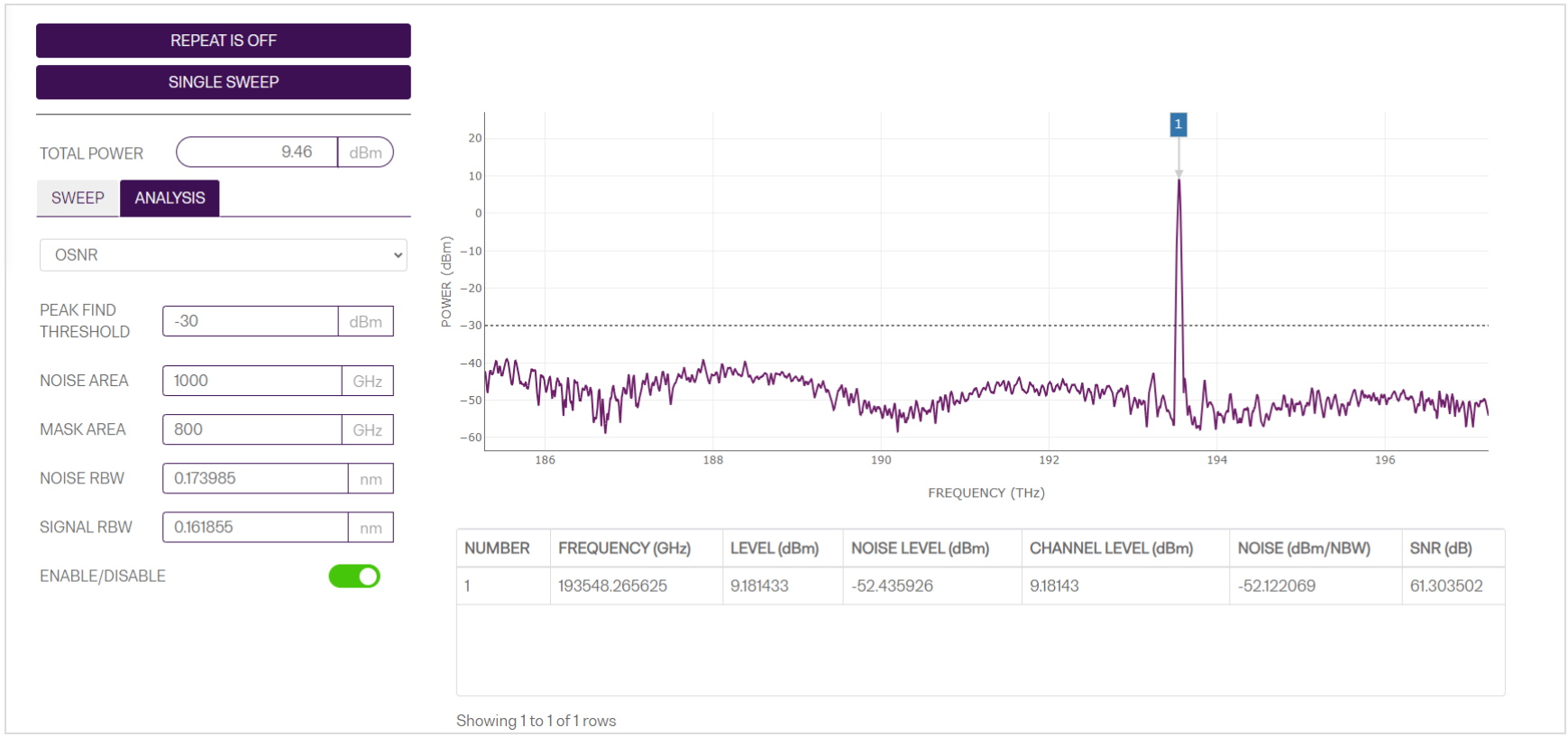
PEAK FIND THRESHOLD (dBm)	Power level above which the OSA will detect peaks. NOTE: If set close to the noise floor of the OSA, more peaks will be detected. If the threshold value is lower than the noise floor (so that the ratio of peak power to noise power is negative), an error will be returned, and no peaks will be detected at all. In this instance it is advisable to increase the threshold value.
NOISE AREA (GHz)	The **NOISE AREA (GHz)** is centered at the peak. By default, or if you enter a zero value, this value represents the full channel bandwidth (if only one peak is found), or the distance between adjacent peaks (if there are multiple peaks). The OSA rejects any side peaks in the **NOISE AREA (GHz)**. **NOISE AREA (GHz) excluding MASK AREA (GHz)** defines the part of the OSA trace that is used for calculating noise values.
MASK AREA (GHz)	The **MASK AREA (GHz)** is centered at the peak and defines the part of the OSA trace that is excluded from the **NOISE AREA (GHz)** for noise calcualations. By default, or if you enter a zero value, this value represents half of the noise area. If **MASK AREA (GHz) = NOISE AREA (GHz)**, the OSA will use the entire **NOISE AREA (GHz)** for noise calculations. If set **MASK AREA (GHz) > NOISE AREA (GHz)**, the OSA will decrease the **MASK AREA (GHz)** to equal the **NOISE AREA (GHz)**.

SIGNAL RBW (nm)	Signal resolution bandwidth. The bandwidth of the signal as measured 3dB below the peak value of the OSA filter response.
NOISE RBW (nm)	Noise resolution bandwidth. Determined by the width of the rectangle that represents the same area as the spectrum area of the OSA filter response at the **SIGNAL RBW (nm)**.
NUMBER	Refers to a detected peak
FREQUENCY (GHz)	Peak frequency
LEVEL (dBm)	Peak signal power, adjusted by set **SIGNAL RBW (nm)** for an integrated power value.
NOISE LEVEL (dBm)	Average noise power, calculated based on the noise power values within the set **NOISE AREA (GHz)** of the peak (excluding **MASK AREA (GHz)**).
NOISE (dBm/NBW)	Normalized noise power, adjusted for **NOISE RBW (nm) ≠ SIGNAL RBW (nm)**: $$\mathbf{NOISE}\ (dBm/NBW) = \mathbf{NOISE\ LEVEL}\ (\mathbf{dBm}) + 10 \times \log_{10}\left(\frac{\mathbf{NOISE\ RBW}\ (\mathbf{nm})}{\mathbf{SIGNAL\ RBW}\ (\mathbf{nm})}\right)$$
CHANNEL LEVEL (dBm)	Channel power at **SIGNAL RBW (nm)**. **CHANNEL LEVEL (dBm) = LEVEL (dBm) – NOISE (dBm/NBW)**
SNR (dB)	Optical signal to noise ratio **SNR=CHANNEL LEVEL (dBm)-NOISE (dBm/NBW)**


Power
LEVEL (dBm)
CHANNEL LEVEL (dBm) + NOISE LEVEL (dBm)
OSA spectrum
Spectrum after SIGNAL/NOISE RBW
SIGNAL RBW (nm)
NOISE LEVEL (dBm)
NOISE RBW (nm)
MASK AREA (GHz)
NOISE AREA (GHz)
PEAK FREQUENCY
Wavelength/Frequency

To analyze a scan:

- Set parameters: **PEAK FIND THRESHOLD**, **NOISE AREA** and **MASK AREA**.
- Apply the parameters by toggling the **ENABLE/DISABLE** button to **ENABLE**.
- Detected peaks will be highlighted in the trace, measurements will be displayed in the table below the trace.



NUMBER	FREQUENCY (GHz)	LEVEL (dBm)	NOISE LEVEL (dBm)	CHANNEL LEVEL (dBm)	NOISE (dBm/NBW)	SNR (dB)
1	193548.265625	9.181433	-52.435926	9.18143	-52.122069	61.303502

8.2.2 SMSR

The SMSR (Side Mode Suppression Ratio) can be computed between the primary peak and adjacent peaks of lower optical power in the OSA trace.

The following adjacent peak detection methods are available for calculating SMSR:

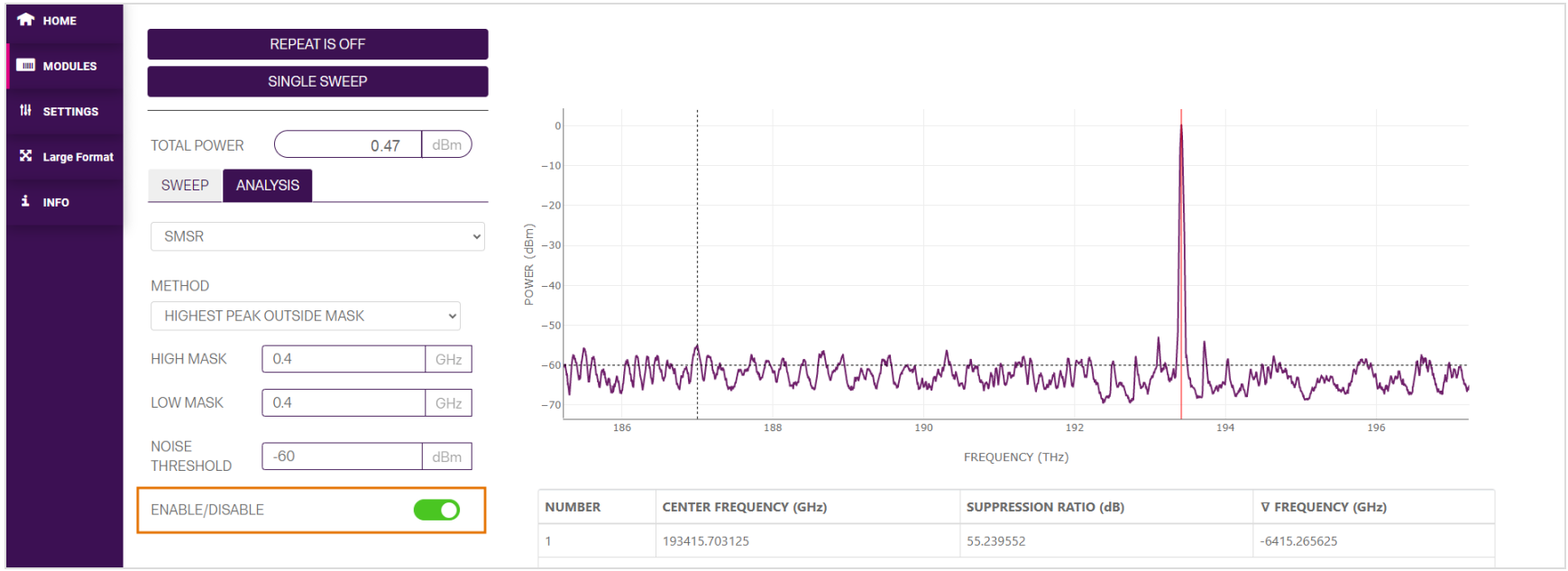
- Highest peak outside mask
- Highest adjacent peak
- Highest peaks on either side of mask
- Highest adjacent peaks on either side

For all the SMSR functions, there are options to set a **LOW MASK**, **HIGH MASK** or **NOISE THRESHOLD**. Each of these parameters can either be set by manually entering a valid number or by using the arrows to increment or decrement to the desired value.

> It is important to note that the **LOW MASK** and **HIGH MASK** values must be **positive**.

The different SMSR calculation methods are included to allow control over the peak detection constraints. Instances when these methods are beneficial are illustrated in the **HIGHEST ADJACENT PEAK** and **HIGHEST PEAKS ON EITHER SIDE OF MASK** methods.

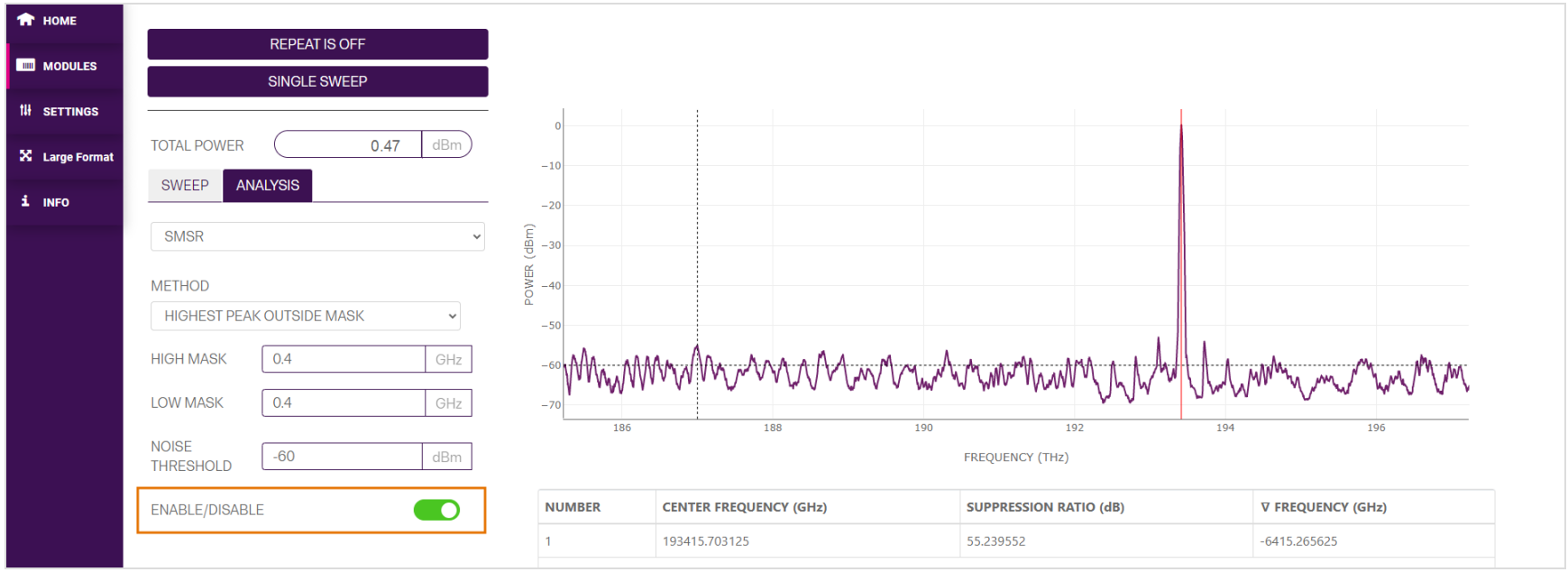
After all parameters have been set, toggle the **ENABLE / DISABLE** button to apply the changes.



8.2.2.1 Highest peak outside mask

This detection mode for SMSR calculation will find the primary peak of highest power. It will then apply a mask either side of this peak, and only detect the highest peak that is outside this mask and above the set **NOISE THRESHOLD**.

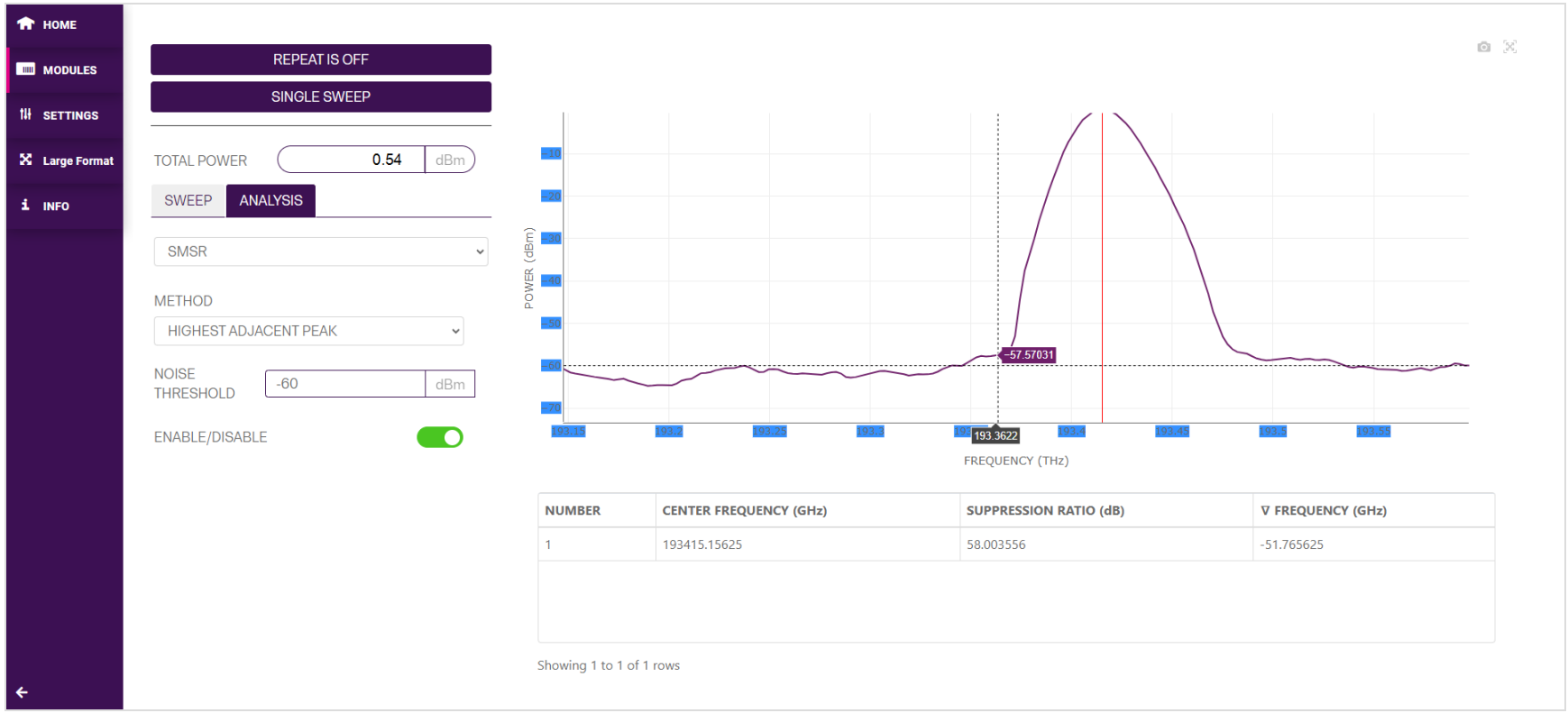
In the example below, the mask has been set to be 400 GHz either side of the primary peak at approximately 193.415 THz (as shown in the **CENTER FREQUENCY**). The **NOISE THRESHOLD** has also been moved down to -60 dBm, to facilitate valid peak detection.



8.2.2.2 Highest adjacent peak

This detection mode for SMSR calculation will find the primary peak of highest power. It will then scan and find the closest peak of highest power that is above the set **NOISE THRESHOLD**.

In the example below, the laser has a secondary peak within the primary mode, at approximately 193.362 THz. This could be a valid side mode that exists very close to the primary mode but could have been missed with a masking method.

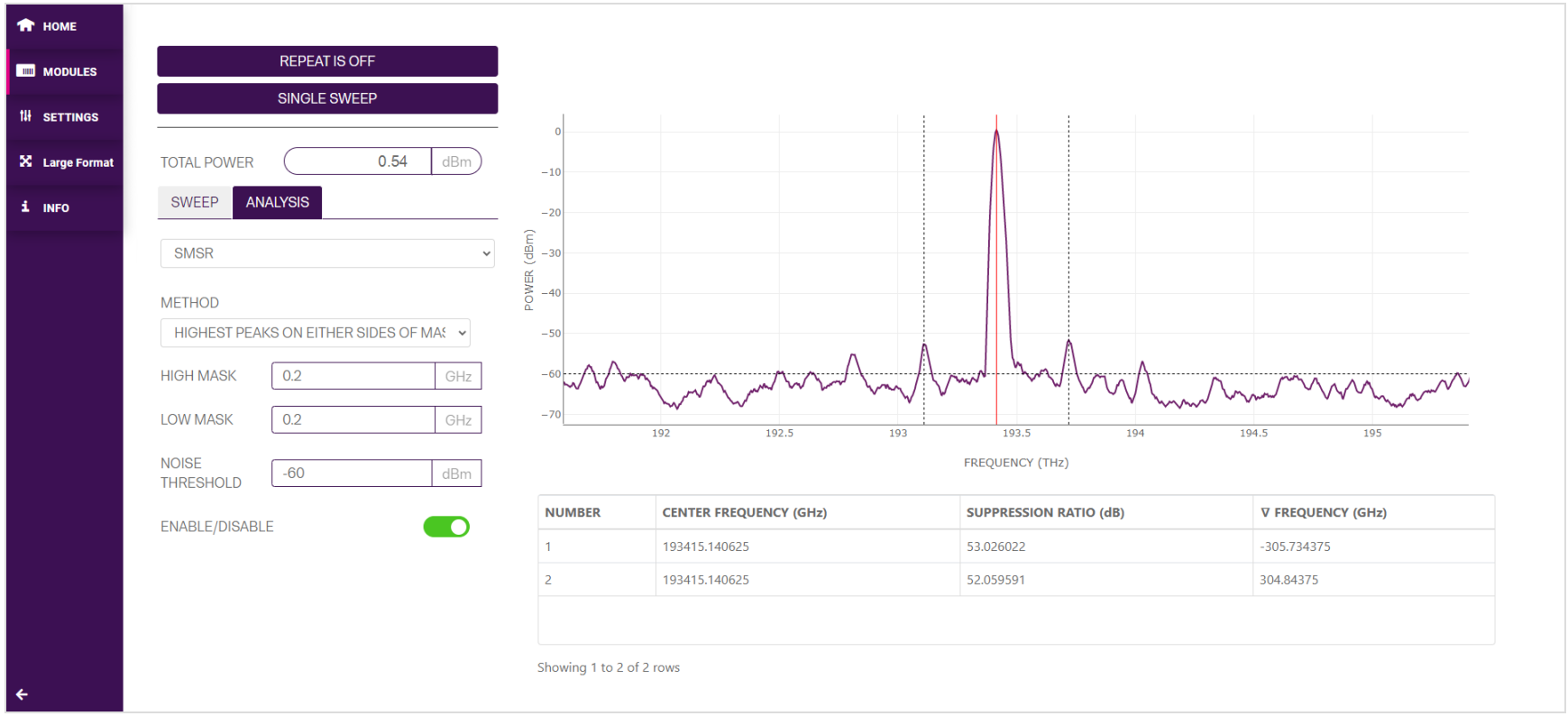


8.2.2.3 Highest peaks on either side of mask

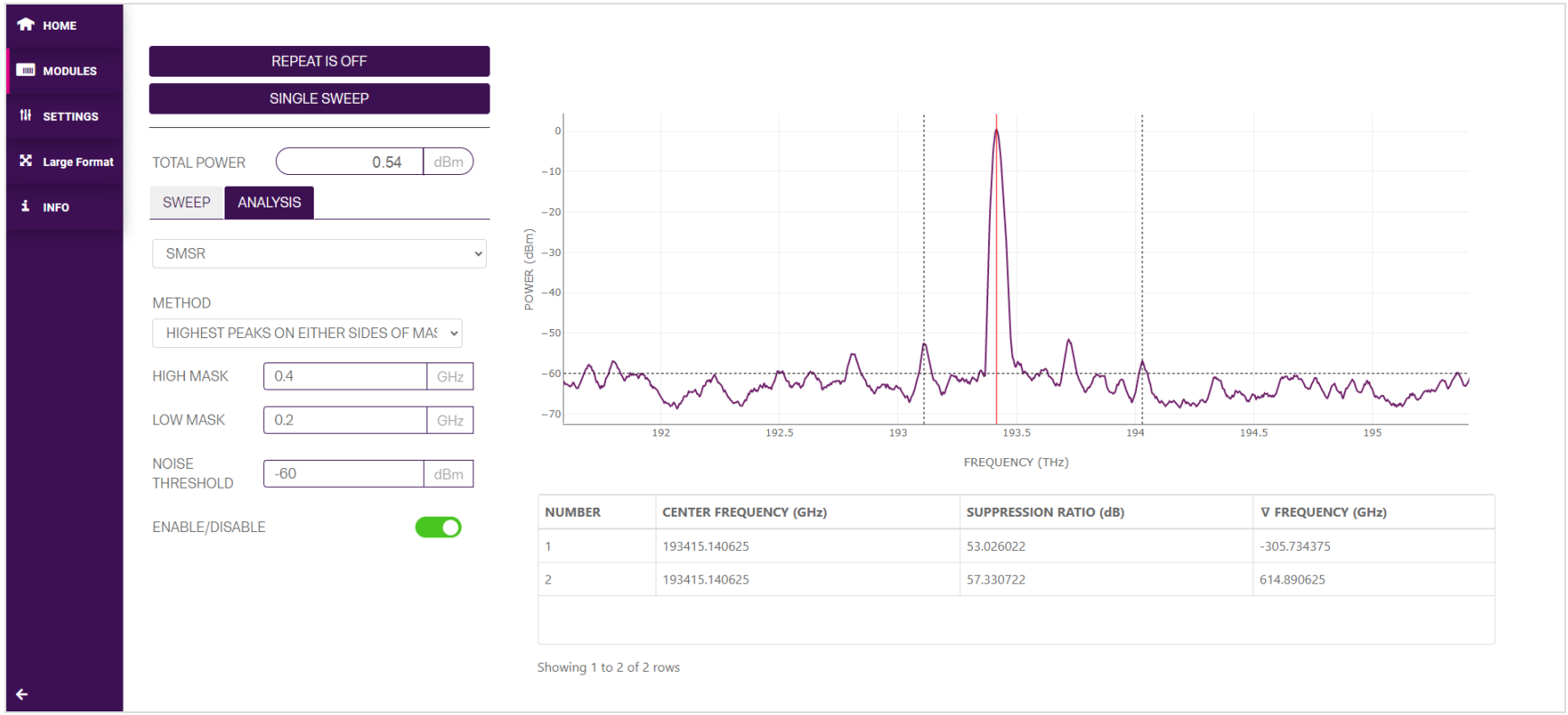
This detection mode for SMSR calculation will find the primary peak of highest power. It will then apply a mask either side of the primary peak and detect the highest peaks on either side of this mask that are also above the set **NOISE THRESHOLD**.

The benefit of this detection method is the ability to mask out the secondary peak that exists in the primary mode.

In the example below, it detects and calculates the SMSR between the primary peak and the two detected peaks at approximately 193.109 THz and 193.719 THz.

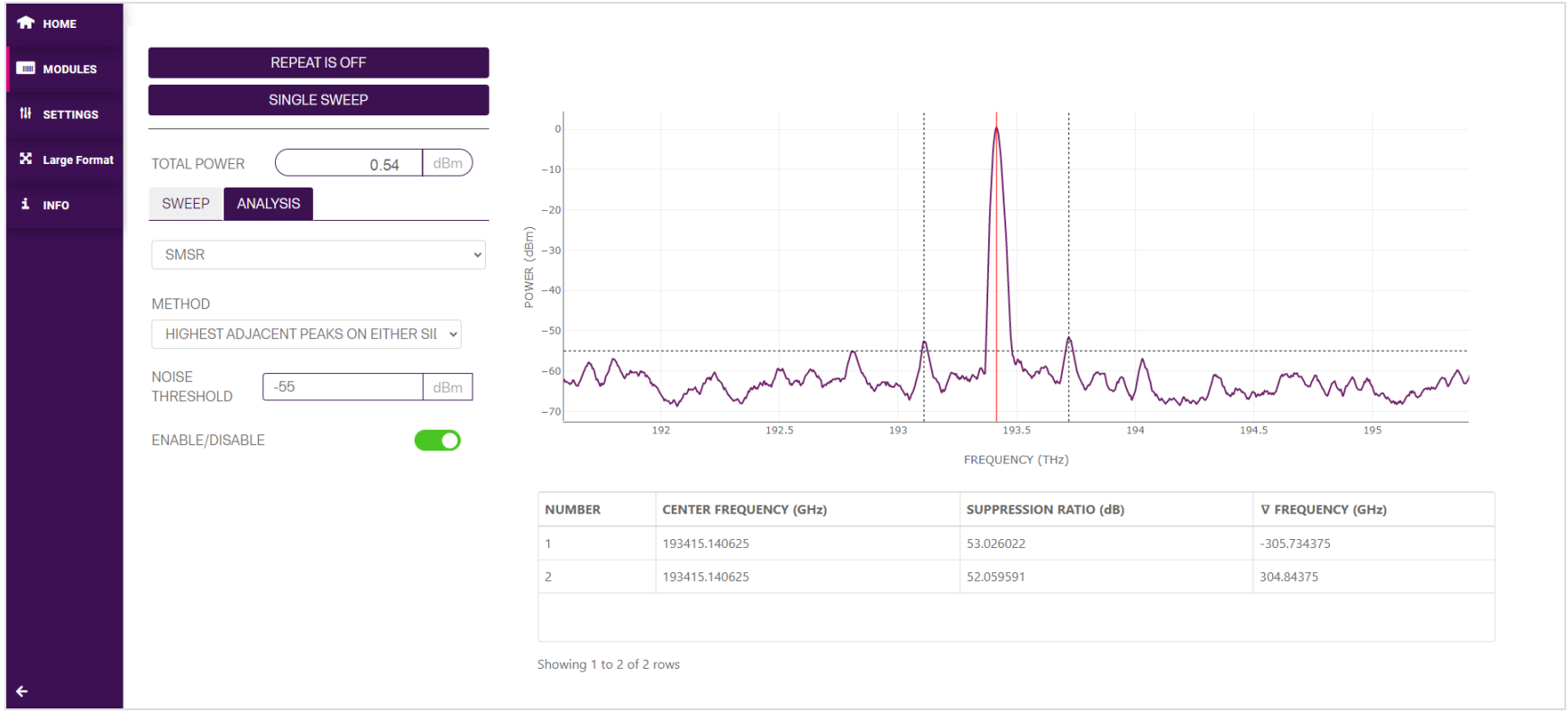


A non-symmetric mask can also be applied with this SMSR method, to facilitate SMSR calculation between other side modes. In the example below, the SMSR is calculated between the peaks at approximately 193.109 THz and 194.030 THz.



8.2.2.4 Highest adjacent peaks on either side

This detection mode for SMSR calculation will find the primary peak of highest power. It will then detect the highest peaks on either side of this primary peak that are also above the set **NOISE THRESHOLD**.



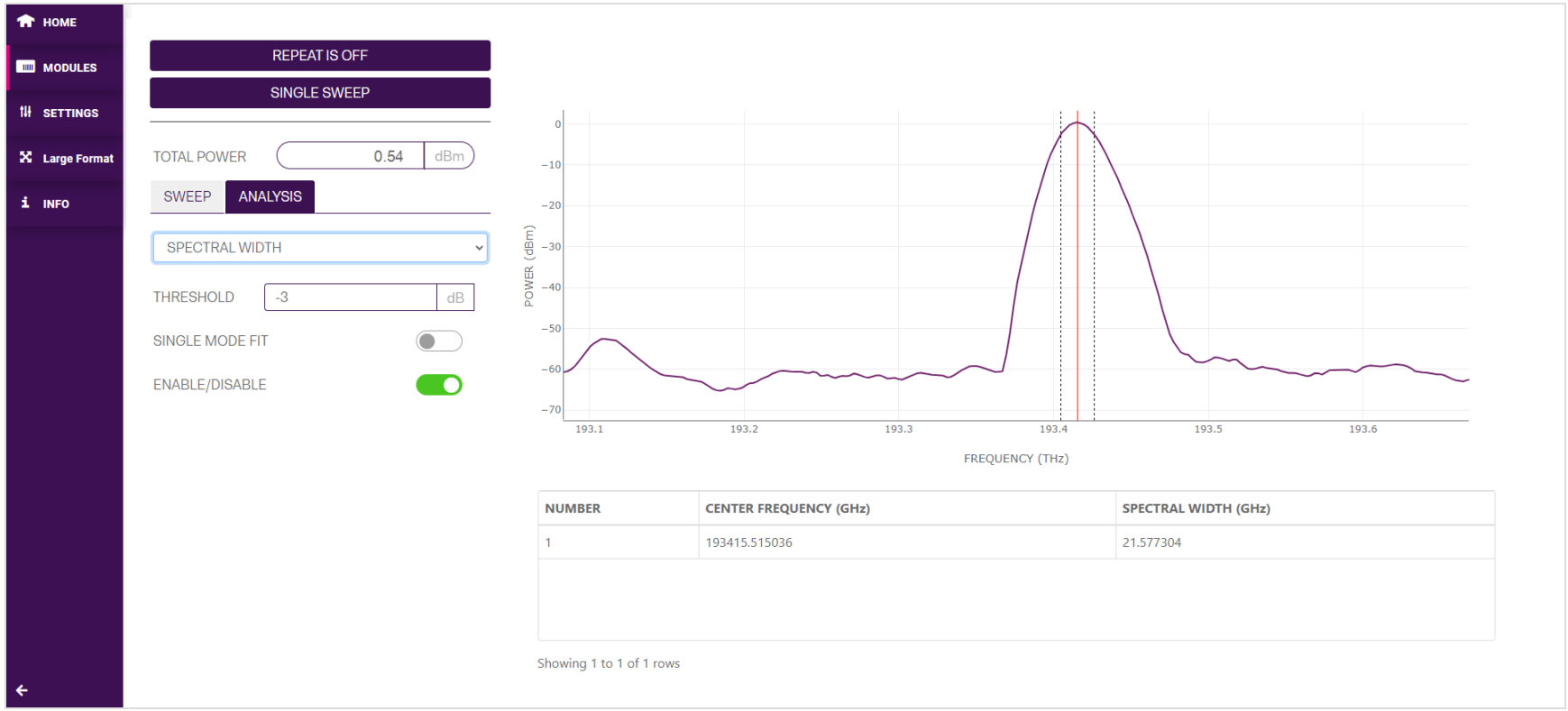
8.2.3 Spectral width

The **SPECTRAL WIDTH** function allows the user to calculate the width of a given peak in the OSA trace.

The **THRESHOLD** value sets how far below the peak power to calculate the spectral width between. This parameter can be entered manually or by using the arrows to increment or decrement the value. **This value must be a negative number.**

In the example below, the **THRESHOLD** has been set to 30 dB below the peak power value. The spectral width is then calculated as the frequency difference between the two points that are closest to the threshold on either side of the peak power value.

To calculate the **SPECTRAL WIDTH**, toggle the **ENABLE / DISABLE** button.



8.2.4 Find peaks

The **FIND PEAKS** function will detect all valid peaks above a given **THRESHOLD** level in an OSA trace.

The **THRESHOLD** value is the power level above which all valid peaks will be detected and displayed. This parameter can be entered manually or by using the arrows to increment or decrement the value.

If the THRESHOLD is set close to the noise floor of the OSA, more peaks will be detected and displayed.

To calculate and display the peaks, toggle the **ENABLE / DISABLE** button.

9 Controlling your OSA with SCPI commands

Remote communication with the CohesionSCPI service is achieved through the Standard Commands for Programmable Instruments (SCPI).

Support for VISA I/O API over TCP/IP is provided by the VXI-11 compliant CohesionSCPI service. With VISA communication drivers installed on the client, the implementation of VISA programming within environments such as MATLAB becomes available.

This section details the programming and measurement conventions to follow while executing the commands for the CohesionSCPI service.

> **NOTE**
> In NI-MAX a RIO interface will show up, however there are no communication methods available or implemented on this interface. Quantifi Photonics products are **ONLY** accessible through the **VISA TCPIP INSTR** interface provided by the CohesionSCPI service installed on the system.

9.1 Overview

You can operate your OSA product using SCPI commands.

For details on available SCPI commands, refer to:

- Command summary
- Command descriptions

9.2 Programming conventions

This section details the programming and measurement conventions to follow while executing the commands for the CohesionSCPI service.

Parameter	Default Unit	Alternative Units
Power	DBM	DBM
Frequency	HZ	THZ, GHZ, MHZ, KHZ
Frequency Fine	HZ	THZ, GHZ, MHZ, KHZ
Wavelength	M	NM, PM

Argument	Data Format
`<wsp>`	Specifies whitespace character (01_{16} – 09_{16}, $0B_{16}$ – 20_{16})
`<value>`	Is numerical data, an integer, a decimal, exponential (10e-9 or 5.8e6) or string
`[VALUE1 | VALUE2]`	A parameter choice. The '|' separates the unique parameters available, only one of the choices can be used. In the example, either the input parameter `[VALUE1]` or `[VALUE2]` can be used, but not both. Some commands may have more than two choices available. This parameter can be omitted where the command has a default defined in the command description.

9.2.1 Index addressing of modules (slot, source) and units (channel)

When executing commands, it is almost always necessary to provide the index of a specific module or an index of a specific installed unit.

For the commands that require index values:

Index	Description	Value
<c>	the chassis index in which the specific blade module is installed	integer, inclusive of 0
<n>	the slot (or source) index of the specific blade module	integer 1 to 18
<m>	the channel index of a specific unit in the module	integer <1 to 4>

Message queues

Information is exchanged in the form of messages. These messages are held in input and output queues.

The output queue stores responses to query commands. The CohesionSCPI service transmits any data in the output queue when a read request is received. Unless specified, all output response data is transmitted in ASCII format.

9.3 Status and event registers

9.3.1 Standard Event Status Register

The Standard Event Status Register (SESR) is modified by the Quantifi Photonics product with the results of the command operations.

Bit	Description
7 (MSB), 6	Not used
5	Is set when a Command Error event has been detected
4	Is set when a command Execution Error has been detected
3	Is set when a Device Dependent Error event has been detected
2	Is set when there a Query Error event has been detected
1	Not used
0 (LSB)	Is set when an Operation Complete event has been generated

9.3.2 Standard Event Status Enable Register (Mask)

The Standard Event Status Enable Register (SESR Mask) is used to build the Event Status Bit (ESB) within the Status Byte Register (STB). To ignore any of the events detected and set in the SESR, set the corresponding bit within the SESR Mask to 0. The STB can then be queried and the value of the ESB can be used to determine service request requirements based on the SESR Mask applied.

NOTE

The 0 (LSB) value within the SESR Mask is 0.

9.3.3 Status Byte Register

The Status Byte Register (STB) is built from all other status registers and masks. This register can be used in queries to determine if an event has been detected and where that event has been detected.

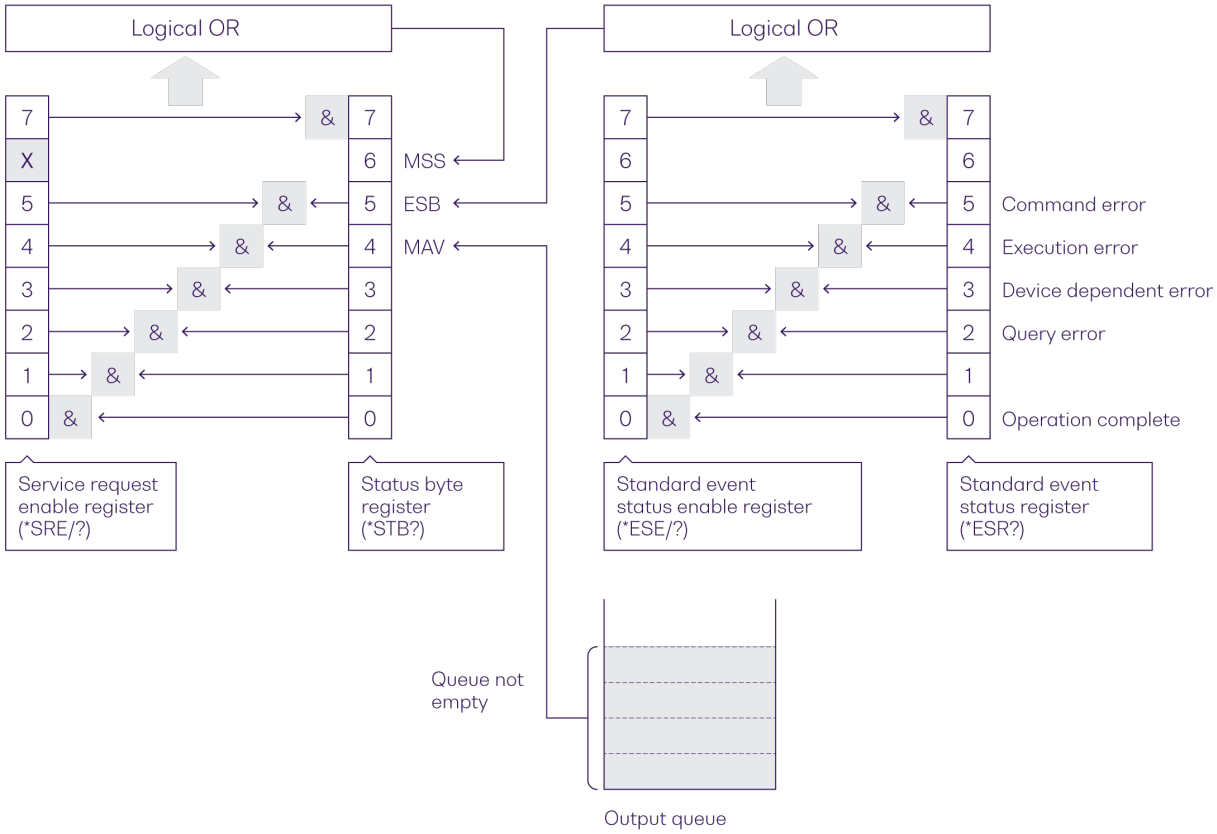
Bit	Description
7 (MSB)	Not used
6	The Master Summary Status (MSS) bit is set from the STB and SRE Mask
5	The Event Status Bit (ESB) is set from the SESR and the SESR Mask
4	Message Available (MAV) is set when there is data in the output queue
3, 2, 1, 0 (LSB)	Not used

9.3.4 Service Request Enable Register (Mask)

The Standard Request Enable Register (SRE Mask) is used to build the Master Summary Status Bit (MSS) within the Status Byte Register (STB). To ignore any of the events detected and set in the STB register itself, set the corresponding bit within the SRE Mask to 0. The STB can then be queried and the value of the MSS can be used to determine the type of service request required based on the SRE Mask applied.

Bit	Description
7 (MSB)	Not used
6	The Master Summary Status (MSS) bit is set from the STB and SRE Mask
5	The Event Status Bit (ESB) is set from the SESR and the SESR Mask
4	Message Available (MAV) is set when there is data in the output queue
3, 2, 1, 0 (LSB)	Not used

9.3.5 Status and event registers diagram



9.4 PXIe Multi Chassis mode operation

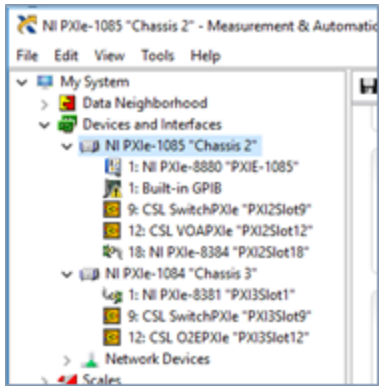
Multiple chassis can be connected to operate in **Multi Chassis Mode**.

To operate in Multi Chassis Mode, **CohesionSCPI service must be version 1.02.06 or later**.

9.4.1 NI-MAX application Multi Chassis mode

> **NOTE**
>
> The CohesionSCPI service does not manage the chassis numbers. These are controlled by the NI Platform Services (and through NI-MAX).
>
> Even if the CohesionSCPI service is in Multi Chassis mode, if a chassis is connected but has no installed modules, it will not show up when `*OPT?` is run.

In the example shown below, there are two chassis connected via the PXIe-8384 to PXIe-8381 connection. Chassis #2 has the controller running CohesionSCPI service, and Chassis #3 is the 'extended' chassis.



9.4.2 SCPI Multi Chassis commands

NOTE

Changing the CohesionSCPI service Chassis Mode will rediscover all Chassis and installed modules.

Command	`:SYSTEM:CHASSIS?`
Syntax	`:SYSTEM:CHASSIS?<wsp>[LIST|MODE]`
Description	Query the Chassis Mode configuration
Parameters	No parameters
Response	**`List`**: Returns a comma separated list of valid chassis index numbers discovered by the CohesionSCPI service. These are chassis that have modules installed.
	`MODE`: Returns the current Chassis Mode the CohesionSCPI service is operating in (SINGLE or MULTI).
	`None`: Returns the number of chassis managed by the CohesionSCPI service. If operating in SINGLE mode, this will always return 1.

Example	In Single chassis mode:
	`:SYSTEM:CHASSIS? -> 1`
	`:SYSTEM:CHASSIS? LIST -> 0`
	`:SYSTEM:CHASSIS? MODE -> SINGLE`
	
	In Multi chassis mode:
	`:SYSTEM:CHASSIS? -> 2`
	`:SYSTEM:CHASSIS? LIST -> 2,3`
	`:SYSTEM:CHASSIS? MODE -> MULTI`

Command	`:SYSTEM:CHASSIS`
Syntax	`:SYSTEM:CHASSIS<wsp>[SINGLE|MULTI]`
Description	Set the Chassis Mode configuration
Parameters	**`SINGLE`**: Set CohesionSCPI service to operate in SINGLE Chassis Mode
	`MULTI`: Set CohesionSCPI service to operate in MULTI Chassis Mode
Response	No response
Example	`:SYSTEM:CHASSIS SINGLE`

In Multi chassis mode, all commands listed in the command summary section will still work, but they must be prefixed with `:CHASSIS<c>`.

Common command example:

Single Chassis Mode	`:SLOT2:IDN?`
Multi Chassis Mode	`:CHASSIS1:SLOT2:IDN?`

Specific command example:

Single Chassis Mode	`:SOUR2:CHAN2:POW? MAX`
Multi Chassis Mode	`:CHASSIS1:SOUR2:CHAN2:POW? MAX`

9.5 Command summary

9.5.1 Common commands

Command	Description
`*IDN?`	Query the CohesionSCPI service identification >>
`*CLS`	Clear session message queues >>
`*OPT?`	Query the modules managed by the CohesionSCPI service >>
`*OPC?`	Query the Operation Complete Status >>
`*ESR?`	Query the Standard Event Status Register >>

9.5.2 Slot commands

Slot commands	Description
`:SLOT<n>`	
`:OPC?`	Query the Operation Complete Status of the module >>
`:TeST?`	Query the module self-test status >>
`:ReSeT`	Reset the module to default power-on settings >>
`:OPTions?`	Query the modules managed by the CohesionSCPI service >>
`:IDN?`	Query the slot identification >>
`:CHANnel<m>`	
`:TEMPerature?`	Query the module temperature >>

9.5.3 Configuration commands

Configuration commands	Description
:INITiate<n>	
:CHANnel<m>	
:SWEep	Initiate the Sweep to populate the data buffer >>
:SMODe?	Query the sweep mode >>
:SMODe	Set the sweep mode >>
:SENSe<n>	
:CHANnel<m>	
:WAVelength	
:STARt?	Query the start wavelength for the wavelength sweep >>
:STARt	Set the start wavelength for the wavelength sweep >>
:STOP?	Query the stop wavelength for the wavelength sweep >>
:STOP	Set the stop wavelength for the wavelength sweep >>
:FREQuency	
:STARt?	Query the start frequency for the frequency sweep >>
:STARt	Set the start frequency for the frequency sweep >>
:STOP?	Query the stop frequency for the frequency sweep >>
:STOP	Set the stop frequency for the frequency sweep >>
:SWEep	
:WAVelength?	Query the wavelength sweep (Y data) >>
:FREQuency?	Query the frequency sweep (Y data) >>
:POINts?	Query the number of sweep points >>
:POINts	Set the number of sweep points >>
:CALCulate<n>	
:CATegory<m>	
:OSNR?	Query the OSNR measurement of a sweep >>
:POWer?	Query the Total Power of a sweep >>
:SMSR?	Query the SMSR measurement of a sweep >>
:SWTHresh?	Query the Spectral Width of a peak in a sweep >>
:MARKer<m>	
:MSEarch?	Query the peak locations of a sweep >>

9.6 Command descriptions

9.6.1 Common commands

Command	**`*IDN?`**	Summary >>
Syntax	`*IDN?`	
Description	Query the CohesionSCPI service identification	
Parameters	N/A	
Response	Comma separated string with the <manufacturer>,<server name>,<chassis controller name>,<server version>	
Example	`*IDN? -> Quantifi Photonics, CohesionSCPI service,PXIE-8133,FW2.0.15`	

Command	**`*CLS`**	Summary >>
Syntax	`*CLS`	
Description	Clear session message queues	
Parameters	N/A	
Response	N/A	
Example	`*CLS`	

Command	**`*OPT?`**	Summary >>
Syntax	`*OPT?`	
Description	Query the modules managed by the CohesionSCPI service	
Parameters	N/A	
Response	Comma separated string of the installed modules in the chassis	
Example	`*OPT? -> ,LaserPXIe-1002-2-FA,SwitchPXIe-1003-1-FC,,VOAPXIe-1001-2-FA,,,,O2EPXIe-1001-1-FC,,,,,,,,`	

Command	**`*OPC?`**	Summary >>
Syntax	`*OPC?`	
Description	Query the Operation Complete Status	
Parameters		
Response	**`1`**: all modules installed in the chassis are ready to execute commands	
	`0`: modules installed in the chassis still have commands to execute in the input queue	
	NOTE: Any commands sent to the module when `*OPC?` is NOT equal `1`, may not execute or return an error.	
Example	`*OPC? -> 1`	

Command	***ESR?**		Summary >>
Syntax	`*ESR?`		
Description	Query the Standard Event Status Register		
Parameters	N/A		
Response	Unsigned integer 8 bit value for the register <0 to 255>, as a string.		
	Bit	Description	Decimal Value
	7 (MSB)	Not used	0
	6	Not used	0
	5	Command error	32
	4	Command Execution Error	16
	3	Device Dependent Error	8
	2	Not used	0
	1	Not used	0
	0 (LSB)	Operation Complete	1
Example	`*ESR? -> 8` `*ESR? -> 32`		

NOTE

It is recommended to use the `*ESR?` command query after every command that is sent to the device. The `*ESR?` query will be able to catch:

- **Device dependent Error** – the device is reporting an error in operation.
- **Execution Error** – SCPI was unable to execute the given command.
- **Command Error** – SCPI was unable to parse the given command, likely due to an incorrect command.

9.6.2 Slot commands

Command	**:SLOT<n>:OPC?**	Summary >>
Syntax	`:SLOT<n>:OPC?`	
Description	Query the Operation Complete Status of the module	
Parameters	N/A	
Response	**1**: the module is ready to accept a new command	
	0: the module is busy performing a previous operation	
	NOTE: Any commands sent to the module when `:SLOT<n>:OPC?` is NOT `1`, may not execute or return an error.	
Description	`:SLOT2:OPC? -> 1`	

Command	**:SLOT<n>:TeST?**	Summary >>
Syntax	`:SLOT<n>:TeST?`	
Description	Query the module self-test status	
Parameters	N/A	
Response	Functional readiness status of the module. A non-zero response reports an error.	
Example	`:SLOT1:TST? -> 0`	

Command	**:SLOT<n>:ReSeT**	Summary >>
Syntax	`:SLOT<n>:ReSeT`	
Description	Reset the module to default power-on settings	
Parameters	N/A	
Response	N/A	
Example	`:SLOT1:RST`	

Command	**:SLOT<n>:OPTions?**	Summary >>
Syntax	`:SLOT<n>:OPTions?`	
Description	Query the modules managed by the CohesionSCPI service	
Parameters	N/A	
Response	A comma separated array, or a single integer value based on the arguments given	
Example	`:SLOT2:OPT? -> 1,1,,`	

Command	**:SLOT<n>:IDN?**	Summary >>
Syntax	:SLOT<n>:IDN?	
Description	Query the slot identification	
Parameters	N/A	
Response	A comma-separated string containing "<manufacturer>,<model name>,<serial number>,<hardware version><firmware version>". Note that the hardware and firmware versions are not comma separated.	
Example	:SLOT2:IDN? -> Quantifi Photonics,LaserPXIe-1002-2-FA,QuantifiPhotonics-192001,HW1.0FW1.021,QP-000000,HW0.00.01FW0.00.01	

Command	**:SLOT<n>:CHANnel<m>:TEMPerature?**	Summary >>
Syntax	:SLOT<n>:CHANnel<m>:TEMPerature?<wsp>[MIN|MAX|ACT|ALL>]	
Description	Query the module temperature	
Parameters	**MIN**: Returns the minimum temperature	
	MAX: Returns the maximum temperature	
	ACT: Returns the actual measured temperature	
	ALL: Returns all the above values in a comma separated string	
Response	A single value, or a comma-separated array of values	
Example	:SLOT1:CHAN1:TEMP? ALL -> 5.0,60.0,17.1	

9.6.3 Configuration Commands

Command	**:INITiate<n>:CHANnel<m>:SWEep**	Summary >>
Syntax	:INITiate<n>:CHANnel<m>:SWEep	
Description	Initiate the Sweep to populate the data buffer	
Parameters	N/A	
Response	N/A	
Example	:INIT1:CHAN1:SWE	

Command	**:INITiate<n>:CHANnel<m>:SMODe?**	Summary >>
Syntax	:INITiate<n>:CHANnel<m>:SMODe?<wsp>[DEF|LIST|SET|ALL]	
Description	Query the sweep mode	
Parameters	**DEF**: Returns the default sweep mode	
	LIST: Returns a comma separated list of the supported sweep modes	
	SET: Returns the set sweep mode	
	ALL: Returns all the above values in a comma separated list	
Response	A single value, or a comma-separated array of values	
Example	:INIT1:CHAN1:SMOD? -> REP	

Command	**:INITiate<n>:CHANnel<m>:SMODe**	Summary >>
Syntax	:INITiate<n>:CHANnel<m>:SMODe<wsp>[DEF|REPeat|SINGLe]	
Description	Set the sweep mode	
Parameters	**DEF**: Sets the sweep mode to the default (SINGLE)	
	REPeat: Sets the sweep mode to a REPEAT sweep	
	SINGLe: Sets the sweep mode to a SINGLE sweep	
Response	N/A	
Example	:INIT1:CHAN1:SMOD REP	

Command	**:SENSe<n>:CHANnel<m>:WAVelength:STARt?**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:WAVelength:STARt?<wsp>[MIN|MAX|DEF|SET]	
Description	Query the start wavelength for the wavelength sweep	
Parameters	**MIN**: Returns the minimum start wavelength value	
	MAX: Returns the maximum start wavelength value	
	DEF: Returns the default start wavelength value	
	SET: Returns the set start wavelength value (default units of nm)	
Response	A single value, or a comma-separated array of values	
Example	:SENS1:CHANnel1:WAV:STAR? SET -> 1520.006784	

Command	**:SENSe<n>:CHANnel<m>:WAVelength:STARt**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:WAVelength:STARt<wsp>[<value>|MIN|MAX|DEF]	
Description	Set the start wavelength for the wavelength sweep	
Parameters	**<value>**: Sets the start wavelength to the user defined value (default units of nm)	
	MIN: Sets the start wavelength to the minimum wavelength value	
	MAX: Sets the start wavelength to the maximum wavelength value	
	DEF: Sets the start wavelength to the default wavelength value	
Response	N/A	
Example	:SENS1:CHAN1:WAV:STAR 1520	

Command	**:SENSe<n>:CHANnel<m>:WAVelength:STOP?**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:WAVelength:STOP?<wsp>[MIN|MAX|DEF|SET]	
Description	Query the stop wavelength for the wavelength sweep	
Parameters	**MIN**: Returns the minimum stop wavelength value	
	MAX: Returns the maximum stop wavelength value	
	DEF: Returns the default stop wavelength value	
	SET: Returns the set stop wavelength value (default units of nm)	
Response	A single value, or a comma-separated array of values	
Example	:SENS1:CHANnel1:WAV:STOP? SET -> 1600.002444	

Command	**:SENSe<n>:CHANnel<m>:WAVelength:STOP**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:WAVelength:STOP<wsp>[<value>|MIN|MAX|DEF]	
Description	Set the stop wavelength for the wavelength sweep	
Parameters	**<value>**: Sets the stop wavelength to the user defined value (default units of nm)	
	MIN: Sets the stop wavelength to the minimum wavelength value	
	MAX: Sets the stop wavelength to the maximum wavelength value	
	DEF: Sets the stop wavelength to the default wavelength value	
Response	N/A	
Example	:SENS1:CHAN1:WAV:STOP 1600	

Command	**:SENSe<n>:CHANnel<m>:FREQuency:STARt?**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:FREQuency:STARt?<wsp>[MIN|MAX|DEF|SET]	
Description	Query the start frequency for the frequency sweep	
Parameters	**MIN**: Returns the minimum start frequency value	
	MAX: Returns the maximum start frequency value	
	DEF: Returns the default start frequency value	
	SET: Returns the set start frequency value (default units of GHz)	
Response	A single value, or a comma-separated array of values	
Example	:SENS1:CHANnel1:FREQ:STAR? SET -> 186000	

Command	**:SENSe<n>:CHANnel<m>:FREQuncy:STARt**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:FREQuncy:STARt<wsp>[<value>|MIN|MAX|DEF]	
Description	Set the start frequency for the frequency sweep	
Parameters	**<value>**: Sets the start frequency to the user defined value (default units of GHz)	
	MIN: Sets the start frequency to the minimum frequency value	
	MAX: Sets the start frequency to the maximum frequency value	
	DEF: Sets the start frequency to the default frequency value	
Response	N/A	
Example	:SENS1:CHAN1:FREQ:STAR 186000	

Command	**:SENSe<n>:CHANnel<m>:FREQuency:STOP?**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:FREQuency:STOP?<wsp>[MIN|MAX|DEF|SET]	
Description	Query the stop frequency for the frequency sweep	
Parameters	**MIN**: Returns the minimum stop frequency value	
	MAX: Returns the maximum stop frequency value	
	DEF: Returns the default stop frequency value	
	SET: Returns the set stop frequency value (default units of GHz)	
Response	A single value, or a comma-separated array of values	
Example	:SENS1:CHANnel1:FREQ:STOP? SET -> 191000	

Command	**:SENSe<n>:CHANnel<m>:FREQuency:STOP**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:FREQuency:STOP<wsp>[<value>|MIN|MAX|DEF]	
Description	Set the stop frequency for the frequency sweep	
Parameters	**<value>**: Sets the stop frequency to the user defined value (default units of GHz)	
	MIN: Sets the stop frequency to the minimum frequency value	
	MAX: Sets the stop frequency to the maximum frequency value	
	DEF: Sets the stop frequency to the default frequency value	
Response	N/A	
Example	:SENS1:CHAN1:FREQ:STOP 191000	

Command	**:SENSe<n>:CHANnel<m>:SWEep:WAVelength?** Summary >>
Syntax	:SENSe<n>:CHANnel<m>:SWEep:WAVelength?[<wsp><X|Y|FULL>]
Description	Query the wavelength sweep (Y data)
Parameters	**X**: Returns the array of wavelength data
	Y: Returns the array of power
	FULL: Returns both arrays of wavelength data and power
Response	A comma separated string with the <wavelength data>, <power>, <number of points>, <sweep data>.
Example	:SENS1:CHAN1:SWE:WAV? -> 1520.006784, 1600.002444, 10, -67.304688,-67.007813,-67.910156,-68.132813,-67.324219, -66.691406,-67.230469, -67.277344,-67.230469,-67.265625 :SENSE12:CHAN2:SWEEP:WAV? X ->> 10,1522.051816,1530.335876,1538.710604,1547.177498,1555.738087,1564.393935,1573.146642, 1581.997841,1590.949205,1600.002444'In :SENSE12:CHAN2:SWEEP:WAV? Y ->> 10,-62.019531,-52.089844,-50.312500,-55.757813,-51.796875,-47.878906,-48.628906, -55.117188,-45.941406,-44.242188 :SENSE12:CHAN2:SWEEP:WAV? FULL ->> 10,X,1522.051816,1530.335876,1538.710604,1547.177498,1555.738087, 1564.393935,1573.146642,1581.997841,1590.949205,1600.002444,Y,-62.019531,-52.089844, -50.312500,-55.757813,-51.796875,-47.878906,-48.628906,-55.117188,-45.941406,-44.242188'

Command	**:SENSe<n>:CHANnel<m>:SWEep:FREQuency?** Summary >>
Syntax	:SENSe<n>:CHANnel<m>:SWEep:FREQuency?[<wsp><X|Y|FULL>]
Description	Query the frequency sweep (Y data)
Parameters	**X**: Returns the array of frequency data
	Y: Returns the array of power
	FULL: Returns both arrays of frequency data and power
Response	A comma separated string with the <frequency data>, <power>, <number of points>, <sweep data>.
Example	:SENS1:CHAN1:SWE:FREQ? -> 186000, 191000, 10, -76.867188,-76.878906,-76.300781,-75.781250,-75.949219, -75.800781,-75.914063,-75.953125,-75.617188,-75.007813,-74.457031 :SENS1:CHAN1:SWEEP:FREQ? X ->\ 10,187370.000000,188436.222222,189502.444444,190568.666667,191634.888889,192701.111111, 193767.333333,194833.555556,195899.777778,196966.000000 :SENS1:CHAN1:SWEEP:FREQ? Y ->\ 10,-44.242188,-45.941406,-55.117188,-48.628906,-47.878906,-51.796875,-55.757813, -50.312500,-52.089844,-62.019531 :SENS1:CHAN1:SWEEP:FREQ? FULL ->\ 10,X,187370.000000,188436.222222,189502.444444,190568.666667,191634.888889,192701.111111, 193767.333333,194833.555556,195899.777778,196966.000000,Y,-44.242188,-45.941406,-55.117188, -48.628906,-47.878906,-51.796875,-55.757813,-50.312500,-52.089844,-62.019531'

Command	**:SENSe<n>:CHANnel<m>:SWEep:POINts?** Summary >>
Syntax	:SENSe<n>:CHANnel<m>:SWEep:POINts?<wsp>[MIN|MAX|DEF|SET]
Description	Query the number of sweep points
Parameters	**MIN**: Returns the minimum number of sweep points
	MAX: Returns the maximum number of sweep points
	DEF: Returns the default number of sweep points
	SET: Returns the number of sweep points to the user defined value
Response	A single value, or a comma-separated array of values
Example	:SENS1:CHAN1:SWE:POIN? -> 1000

Command	**:SENSe<n>:CHANnel<m>:SWEep:POINts**	Summary >>
Syntax	:SENSe<n>:CHANnel<m>:SWEep:POINts<wsp>[MIN|MAX|DEF|<value>]	
Description	Set the number of sweep points	
Parameters	**<value>**: Sets the number of sweep points to the user defined value	
	MIN: Sets the minimum number of sweep points	
	MAX: Sets the maximum number of sweep points	
	DEF: Sets the default number of sweep points	
Response	N/A	
Example	:SENS1:CHAN1:SWE:POIN 1000	

Command	**:CALCulate<n>:CATegory<m>:OSNR?**	Summary >>
Syntax	:CALCulate<n>:CATegory<m>:OSNR?<wsp><PTH>,<IBW>,<NOISE>,<MASK>,<NBW>,<SBW>	
Description	Query the OSNR measurement of a sweep	
Parameters	**PTH**: The power threshold above which peaks should be detected (units of dBm)	
	IBW: The integration bandwidth for power calculation of each detected peak (units of GHz)	
	NOISE: The noise area, centered at the peak. The OSA rejects any side peaks in this area. (units of GHz)	
	MASK: The mask area, centered at the peak. The OSA will exclude this area from OSNR callculations (units of GHz)	
	NBW: Noise resolution bandwidth (units of nm)	
	SBW: Signal resolution bandwidth (units of nm)	
Response	A comma separated string containing <peak number>,<peak frequency>,<peak power>,<noise power>,<channel power>,<noise power per NBW>,<SNR>. <peak frequency> in units of GHz <peak power> in units of dBm <noise power> in units of dBm <channel power> in units of dBm <noise power per NBW> in units of dBm/NBW <SNR> in units of dB	
Example	:CALC2:CAT1:OSNR? -30,0.5,0,0,0,0 -> 1,193542.578125,-12.710617,-66.198472,-12.710636,-66.198472,53.487855	

Command	**:CALCulate<n>:CATegory<m>:POWer?**	Summary >>
Syntax	:CALCulate<n>:CATegory<m>:POWer?	
Description	Query the Total Power of a sweep	
Parameters	N/A	
Response	A string of the value representing total calculated optical power in units of dBm.	
Example	:CALC2:CAT1:POW? -> -5.3265	

Command	**:CALCulate<n>:CATegory<m>:SMSR?**	Summary >>
Syntax	:CALCulate<n>:CATegory<m>:SMSR?<wsp><MTH>,<MSH>,<MSL>,<PTH> :CALCulate<n>:CATegory<m>:SMSR?<wsp><MTH>,<PTH>	
Description	Query the SMSR measurement of a sweep	
Parameters	**MTH**: The SMSR method to base the calculation on. Valid options are: 1. Highest peak outside mask 2. Highest adjacent peak 3. Highest peaks on either sides of mask 4. Highest adjacent peaks on either sides of mask	
	MSH: The maximum frequency location of the mask in THz	
	MSL:The minimum frequency location of the mask in THz	
	PTH: The power threshold above which peaks should be detected (units of dBm)	
Response	A comma separated string containing the <peaks>,<center freq GHz>,<suppression ratio dB>,<delta freq GHz>	
Example	:CALC1:CAT1:SMSR? 1,0,0,-50 ->\n1,193409.171875,50.379475,-304.25 :CALC1:CAT1:SMSR? 2,-50 ->\n1,193409.171875,50.379475,-304.25 :CALC1:CAT1:SMSR? 3,0,0,-50 ->\n1,193409.171875,50.379475,-304.25\n2,193409.171875,52.401028,303.875 :CALC1:CAT1:SMSR? 4,-50 ->\n1,193409.171875,50.379475,-304.25\n2,193409.171875,52.401028,303.875	

Command	**:CALCulate<n>:CATegory<m>:SWTHresh?** Summary >>
Syntax	:CALCulate<n>:CATegory<m>:SWTHresh?<wsp><FIT>,<PTH>[DBM]
Description	Query the Spectral Width of a peak in a sweep
Parameters	**FIT**: Enable (1) or disable (0) single mode fit.
	PTH: The power threshold below the peak power at which the spectral width should be calculated (units of dB).
Response	A comma separated string containing the <peak frequency>,<spectral width>. <peak frequency> in units of GHz <spectral width> in units of GHz
Example	:CALC1:CAT1:SWTH? 0,-3 -> 193542.664143,20.940859

Command	**:CALCulate<n>:MARKer<m>:MSEarch?** Summary >>
Syntax	:CALCulate<n>:MARKer<m>:MSEarch? <PTH>
Description	Query the peak locations of a sweep
Parameters	**PTH**: The power threshold above which to register a peak (units of dBm)
Response	A comma separated string containing the <number of peaks>,<peak frequency locations>,<peak powers>. <peak frequency locations> a comma separated string of all peaks above the specified power threshold in ascending value order. <peak powers> a comma separated string of each recorded peak's corresponding optical power in units of dBm.
Example	:CALC2:MARK1:MSE? -58 -> 3,185641.921875,185648.765625,193542.796875,-57.020798,-56.928300,-11.050784

9.7 Programming examples

The following is a simple example of how to control the OSA 1000 Series using SCPI commands. See the previous section for specific details and extra parameters that the listed commands accept.

We recommend that you use the `*ESR?` query after every command that is sent to the device. This enables you to debug unreceived or incorrect commands sent to the product.

```
#Identifying the OSA product
:*IDN?                                  #Query to confirm the correct PXIe chassis is setup
:*OPT?                                  #Query the available module configuration
:SLOT1:IDN?                             #Query the identification information for a specific slot module

#Configurig the OSA product
:SOURce1:CHANnel1:POWer 10 DBM          #Set the laser output power to 10 dBm
:SENSe1:CHANnel1:FREQuency:STARt MIN    #Set the start frequency sweep value to MINIMUM
:SENSe1:CHANnel1:FREQuency:STOP 195THZ  #Set the stop frequency sweep value 195.0 THz
:SENSe1:CHANnel1:SWEep:POINts 4000      #Set the number of sweep points
:INITiate1:CHANnel1:SMODe SINGLe        #Set the sweep mode to single, so that a single spectrum is captured once SWEep
is executed

#Querying the OSA product configuration values
:SENSe1:CHANnel1:FREQuency:STARt?       #Query the set start frequency sweep value
:SENSe1:CHANnel1:FREQuency:STOP?        #Query the set stop frequency sweep value
:SENSe1:CHANnel1:SWEep:POINts?          #Query the set number of sweep points
:INITiate1:CHANnel1:SMODe?              #Query the set sweep mode

#Initiating an OSA sweep and querying the sweep data
:INITiate1:CHAN1:SWEep                  #Initiate the sweep to populate the data buffer
:SENSe1:CHAN1:SWEep:FREQuency?          #Query the sweep data, with the x values as frequencies

#Using the analysis functions on an OSA trace
:CALCulate1:CATegory1:POWer?            #Query the total optical power in the OSA trace
:CALCulate1:MARKer1:MSEarch? -35DBM     #Find all peaks in the OSA trace above -35 dBm in power
```

10 Programming examples and applications

Remote communication with the CohesionSCPI service is achieved through the Standard Commands for Programmable Instruments (SCPI).

Support for VISA I/O API over TCP/IP is provided by the VXI-11 compliant CohesionSCPI service. With VISA communication drivers installed on the client, the implementation of VISA programming within environments such as MATLAB becomes available.

This section details the programming and measurement conventions to follow while executing the commands for the CohesionSCPI service.

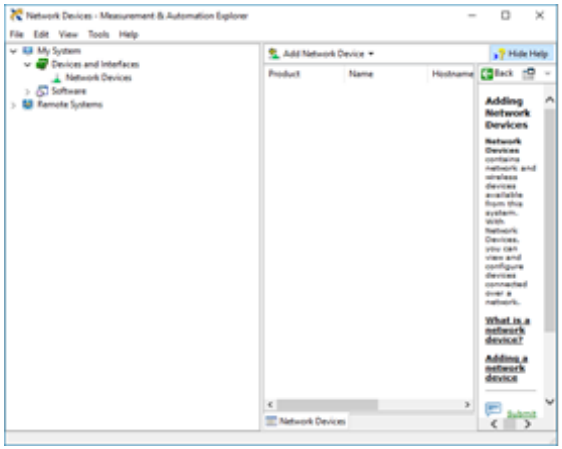
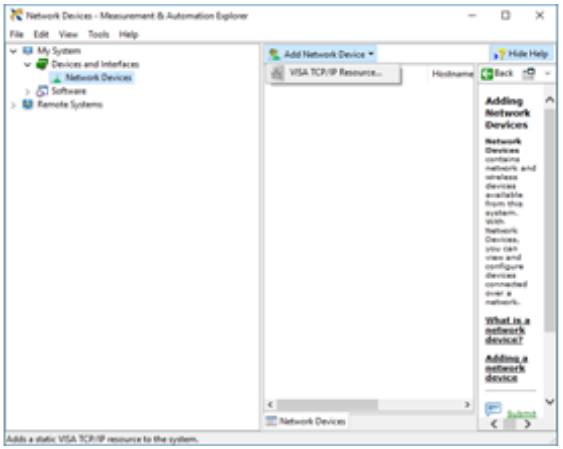
NOTE

In NI-MAX a RIO interface will show up, however there are no communication methods available or implemented on this interface. Quantifi Photonics products are **ONLY** accessible through the **VISA TCPIP INSTR** interface provided by the CohesionSCPI service installed on the system.

10.1 Setting up NI-MAX application

To communicate with any Quantifi Photonics product, the chassis / benchtop product must first be setup as a TCP/IP instrument.

1. After installing NI-MAX, launch the application. In the left side panel of the window, click the **Devices and Interfaces** option. A drop down of available instruments detected will show up.
2. Click on **Network Devices**, then click **Add Network Devices** and select **VISA TCP/IP Resource**.

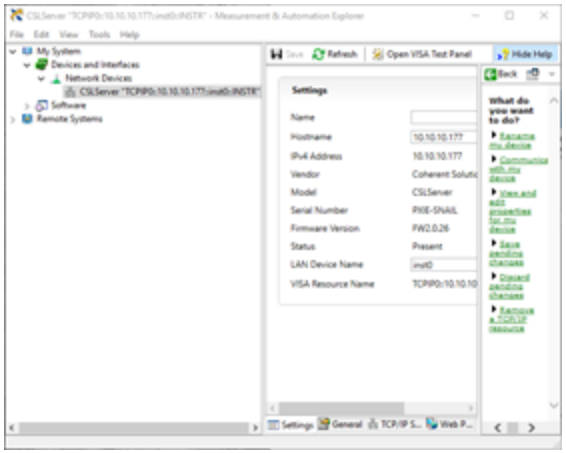



3. Select **Manual Entry of LAN Instrument**. Enter in the Hostname or IP Address.
   Note when operating locally, enter in the localhost IP address of **127.0.0.1**. Click **Finish** to end the setup process.

10.2 Setting up NI-VISA application

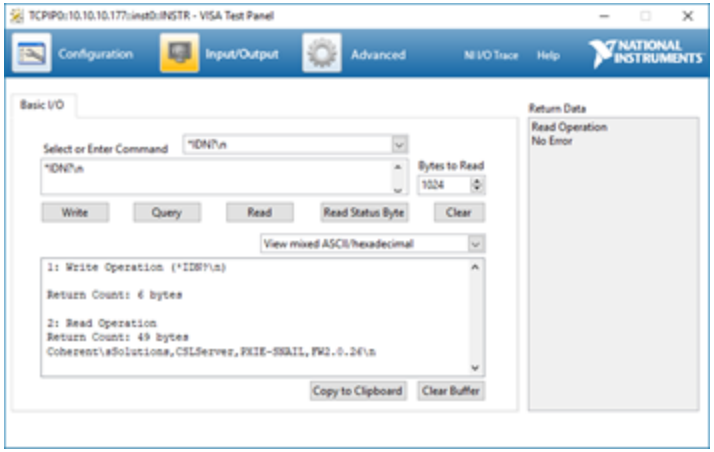
NI-VISA is used to communicate with the PXIe chassis or installed modules / instruments. The above steps must be completed before attempting to communicate using NI-VISA.

1. Launch NI-MAX. In the left-hand side menu, select an instrument from the **Network Devices** list.



2. On the right-hand side panel, select **Open VISA Test Panel**. A new window will popup. Click the **Input / Output** button from the window menu.

   Valid chassis and module commands can be entered in, and their returns queried



10.3 Python® 2.7 code example

The following example shows how to communicate with the Quantifi Photonics product using Python code.

```
# You can get VXI11 from pip:
# pip install python-vxi11==0.9
import vxi11
from vxi11.vxi11 import Vxi11Exception
# replace this with the IP of your device
ip = "127.0.0.1"
try:
    print("connecting to " + ip + " ... ")
    instrument = vxi11.Instrument(ip)
    print("connected")
    print("checking IDN...")
    command = "*IDN?"
    data = instrument.ask(command)
    print("IDN: " + data)
    print("checking OPT...")
    command = "*OPT?"
    data = instrument.ask(command)
    print("OPT: " + data)
# replace this with a valid command for your device (read # the programming guide section for examples)
    command = ""
    print("writing a specific command")
    instrument.write(command)
print("checking ESR")
command = "*ESR?"
    data = instrument.ask(command)
    print("*ESR?: " + data)
except Vxi11Exception as e:
    # pass
    print("ERROR" + str(e) + ", command: " + str(command))
```

10.4 MATLAB® code example

To communicate with the Quantifi Photonics product in MATLAB® the installation of a VISA IO driver is required. These drivers enable the creation of the Interface Object for instrument communication.

If developing locally on the PXIE Platform, then these will already be installed. However, if development is on a remotely connected system the VISA Libraries, e.g. National Instruments NI-VISA will have to be installed.

NOTE

MATLAB 2010x or later with the Instrument Control Toolbox is required to execute the code detailed in this section.

The following example shows how to communicate with a Quantifi Photonics product using MATLAB code.

```
% Find a VISA-TCPIP object. This is if the VISA object has already been
% created with tmtool or has been removed from the workspace without
% first being closed (cleanly disconnected).
PXIE_Chassis = instrfind('Type', 'visa-tcpip', ...
'RsrcName', 'TCPIP0::10.10.10.89::inst0::INSTR', 'Tag', '');
% Create the ‘agilent’ VISA-TCPIP object if it does not exist
% otherwise use the object that was found.
if isempty(PXIE_Chassis)
    PXIE_Chassis = visa('agilent', 'TCPIP0::10.10.10.89::inst0::INSTR');
else
    fclose(PXIE_Chassis);
    PXIE_Chassis = PXIE_Chassis (1);
end
% Open the connection to the VISA object.
fopen(PXIE_Chassis);
% Query the PXIE_Chassis.
response = query(PXIE_Chassis, '*IDN?');
disp('The *IDN query response:');
disp(response);
response = query(PXIE_Chassis, '*OPT?');
disp('The *OPT query response:');
disp(response);
% Replace this with a valid command for your device (read the programming
% guide section for examples)
command = ''
% Close the connection to the object.
```

11 Working with optical fibers

Quantifi Photonics products are equipped with high quality optical connectors in compliance with EIA-455-21A standards.

⚠ CAUTION

Keep connectors clean and in good condition to ensure maximum power and to avoid erroneous readings:

> Always inspect fiber end faces for cleanliness using a fiber inspection probe before inserting them into a port..
> If required, clean fibers and faces as detailed below.

Quantifi Photonics is not responsible for damage or errors caused by bad fiber cleaning or handling.

NOTE

To avoid damaging ferrules or fiber faces due to mismatched connectors, always check ports and connector type information before inserting a connector. All Quantifi Photonics units are labeled with connector type information.

▶ When connecting a fiber-optic cable to a port:

1. Visually inspect the fiber end face using a fiber inspection microscope.
2. If a **connector end face** is dirty:
   > Wipe the connector end face using a reel-type cleaner and inspect again.
   > For stubborn hard to clean connectors:
   - Use lint-free fiber-cleaning wipes soaked in a fiber optic cleaning solution.
   - Wipe the connector on the soaked part.
   - Dry the connector by wiping on the dry part of the wipe, or by using a reel-type cleaner.

   > Repeat the process until connector inspection shows a clean fiber face.
3. If a **bulkhead inner connector face** is dirty:
   > Use a pen-type dry cleaner, align the cleaning tip with the port and push the cleaner until you hear the characteristic click. Inspect again.
   > For stubborn hard to clean bulkhead connectors:
   - Use a stick-type cleaner dipped in a fiber optic cleaning solution.
   - Carefully align and insert the stick into the connector and gently rotate the stick for several seconds applying light pressure.
   - Use a pen-type cleaner to dry the connector.

   > Repeat the process until connector inspection shows a clean fiber face.
4. If the fiber end face is clean:
   > Carefully align the connector and port to prevent the fiber end from touching the outside of the port or other surfaces.
   If the connector features a key, mate it correctly into the corresponding notch of the port bulkhead.

> Push the connector in so that the fiber-optic cable is firmly in place with adequate contact.
If your connector features a screw sleeve, tighten the connector to firmly maintain the fiber in place. Do not over-tighten, as this will damage the fiber and the port bulkhead.

NOTE

Failing to align and/or connect fiber-optic cables properly will result in significant signal loss and reflection.

12 System requirements

Quantifi Photonics PXIe modules

Supported browsers for working with CohesionUI	Google Chrome™ Microsoft Edge®
Chassis	PXIe-compatible chassis that • supports PXIe, or • contains PXI hybrid compatible slots
Recommended PXIe controller operating system	Microsoft Windows® 10 (64-bit)

Quantifi Photonics MATRIQ / EPIQ instruments

Supported browsers for working with CohesionUI	Google Chrome™ Microsoft Edge®
Recommended client computer operating system	Microsoft Windows® 10 (64-bit)

13 Maintenance

To help ensure long, trouble-free operation:

- Always inspect fiber-optic connectors before using them and clean them if necessary.
- Keep the unit free of dust.
- Store the unit at room temperature in a clean and dry area. Keep the unit out of direct sunlight.
- Avoid high humidity or significant temperature fluctuations.
- Avoid unnecessary shocks and vibrations.
- If any liquids are spilled on or into the unit, power off the chassis immediately. Remove the unit and allow to dry completely.

> **WARNING**
>
> The use of controls, adjustments, and procedures other than those specified herein may result in exposure to hazardous situations or impair the protection provided by this unit.

13.1 Annual calibration schedule

To ensure that the unit is performing within specification, we recommend it is re-calibrated every 12 months.

All Quantifi Photonics products are calibrated during manufacture, and each product is shipped to the customer with a Calibration Certificate. On this certificate, the calibration date, as well as the next calibration due date are mentioned.

We recommend your product is returned for re-calibration before the listed due date, to ensure continued performance of the product. For re-calibration service information, or to send in a product for re-calibration service, email support@quantifiphotonics.com.

If the Calibration Certificate has been misplaced, or the calibration due date is not known, email support@quantifiphotonics.com.

14 Technical Support

14.1 Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact Quantifi Photonics:

support@quantifiphotonics.com

To accelerate the process, please provide information such as the name and the serial number (see the product identification label), as well as a description of your problem.

14.2 Transportation

Maintain a temperature range within specifications when transporting the unit.

Transportation damage can occur from improper handling.

The following steps are recommended to minimize the possibility of damage:

- Pack the product in its original packing material when shipping. If the original packaging is unavailable, use appropriate foam packaging to provide shock absorption and avoid displacement of the product inside the shipping box. Please avoid any shipping material making contact with the sensitive connectors of the product.
- Avoid high humidity or large temperature fluctuations.
- Keep the product out of direct sunlight.
- Avoid unnecessary shocks and vibrations.

15 Warranty Information

15.1 General information

Quantifi Photonics Ltd (Quantifi Photonics) warrants from the date of the original shipment (the Warranty Period) that this product will conform to specifications and will be free from defects in material and workmanship for the applicable Warranty Period. Quantifi Photonics also warrants that the equipment will meet applicable specifications under normal use.

NOTE

The warranty can become null and void if:

- The unit has been tampered with, repaired, or worked upon by unauthorized individuals or non-Quantifi Photonics personnel.
- The warranty sticker has been removed.
- The unit has been opened, other than as explained in this guide.
- The unit serial number has been altered, erased, or removed.
- The unit has been misused, neglected, or damaged by accident.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL QUANTIFI PHOTONICS BE LIABLE FOR SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

For full warranty terms and conditions, please visit quantifiphotonics.com.

15.2 Liability

Quantifi Photonics shall not be liable for damages resulting from the use of the product, nor shall be responsible for any failure in the performance of other items to which theproduct is connected or the operation of any system of which the product may be a part.

Quantifi Photonics shall not be liable for damages resulting from improper usage, transportation or unauthorized modification of the product, its accompanying accessories and software.

The external power supply that has been supplied by Quantifi Photonics with the unit can only be used with that unit, do not use it with any other product.

15.3 Exclusions

Quantifi Photonics reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, batteries and universal interfaces (EUI)

used with Quantifi Photonics products are not covered by this warranty.

This warranty excludes failure resulting from: Improper use or installation, normal wear and tear, accident, abuse, neglect, fire, water, lightning or other acts of nature, causes external to the product or other factors beyond the control of Quantifi Photonics.

15.4 Certification

Quantifi Photonics certifies that this equipment met its published specifications at the time of shipment from the factory.

15.5 Service and repairs

To send any equipment for service, repair or calibration please contact the Technical Support Group: support@quantifiphotonics.com.

QUANTIFI PHOTONICS™

Test. Measure. Solve.

Quantifi Photonics is transforming the world of photonics test and measurement. Our portfolio of optical and electrical test instruments is rapidly expanding to meet the needs of engineers and scientists around the globe. From enabling ground-breaking experiments to driving highly efficient production testing, you'll find us working with customers to solve complex problems with optimal solutions.

To find out more, get in touch with us today.

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