MATERIALS THAT MATTER

II-VI

WaveAnalyzer™

Family of Optical Spectrum Analyzers

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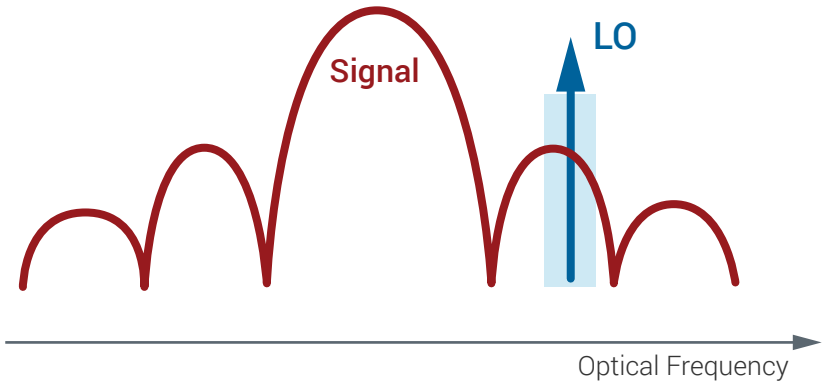
The WaveAnalyzer family of Optical Spectrum Analyzers is designed for researchers and engineers working in research labs on advanced concepts of optical transmission systems as well as for technicians on the manufacturing floor aiming for high throughput of their devices under test.

The WaveAnalyzer family uses a heterodyne measurement principle in which a fast sweeping laser, serving as local oscillator (LO), is scanning across the wavelength range of interest. The beat signal, generated by mixing the local oscillator signal with the signal under test, is detected by a Polarization Multiplex Receiver. The fast sweeping Modulated Grating Y-branch laser is electronically tuned so the instrument does not contain any moving parts (except the fan on the WaveAnalyzer 1500S).



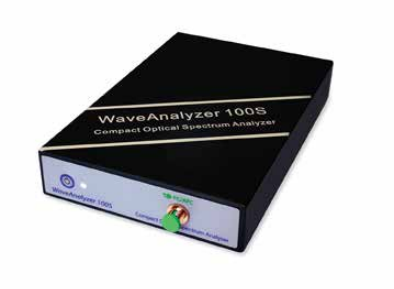
This measurement principle provides a unique combination of measurement performance and speed. All members of the WaveAnalyzer family can provide highest spectral resolution and maximum measurement (sweep) speed at the same time. For example, the WaveAnalyzer (WA) 1500S provides a resolution bandwidth of 180 MHz (about 1.4 pm) while taking measurements with update rates of up to 10 sweeps per second.

Software package

- Graphical User Interface (GUI) included, which controls the WA 100S and the WA 1500S
- GUI serves as a viewer for measurement traces taken with the WA 200A
- WaveAnalyzer Analysis Server included, which provides comprehensive analysis capabilities on measurement data taken with the WA 100S and the WA 1500S
- Server can be accessed via a RESTful http based Application Programming Interface (API)
- Runs on Windows 10
- Available for download at www.ii-vi.com/instruments

WaveAnalyzer 100S

Compact Optical Spectrum Analyzer



The WaveAnalyzer 100S is a Compact Optical Spectrum Analyzer covering the C-band of optical communications. It has been designed in particular to measure key parameters of DWDM systems like channel power, channel center frequency and optical signal to noise ratio (OSNR). The instrument is designed for use in optical labs, on manufacturing floors and during installation and maintenance of optical networks.

The instrument is controlled via II-VI's WaveAnalyzer GUI software package which is available for Windows based PCs.

The WA 100S is based on a coherent measurement principle which allows operation without any moving part inside the instrument.

Key Features

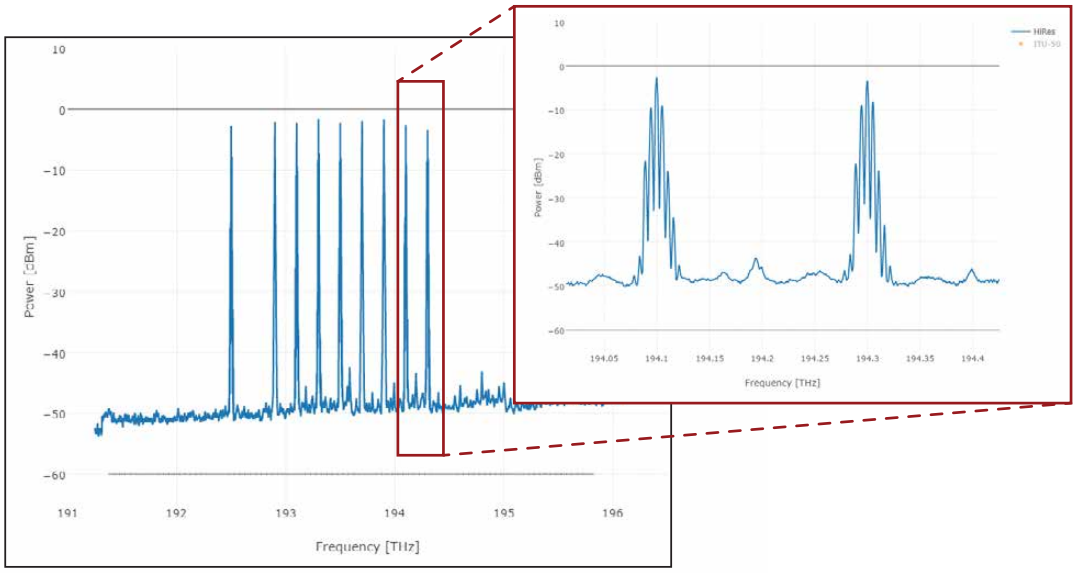
- Full C-band coverage
- Resolution bandwidth: 1.75 GHz
- Fast: 2 updates / second
- Very small, lightweight
- USB interface
- No moving parts

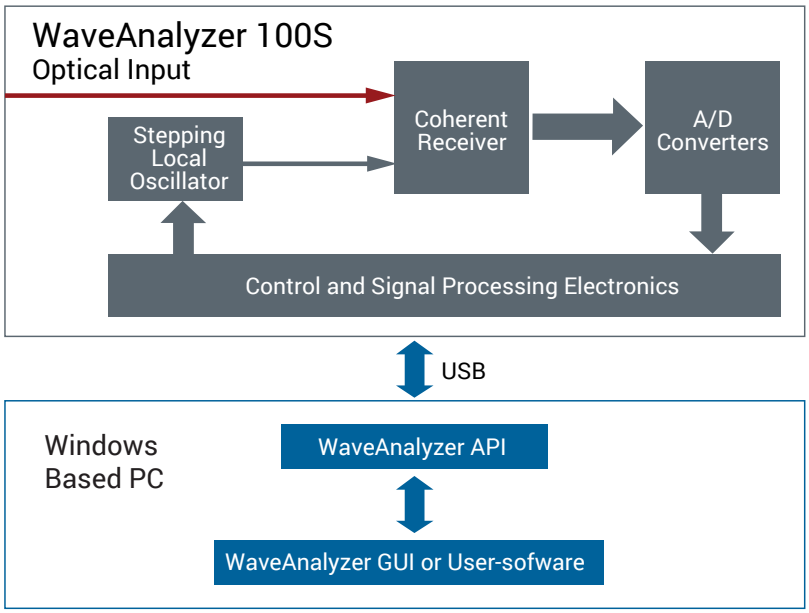
Applications

- Optical system test
- DWDM testing
- Channel power and OSNR testing
- Channel equalizing
- Network test

Measurement

The graph below shows a typical measurement across the C-band, with a comb of signals modulated at 10 Gb/s. Zooming into the scan reveals great spectral detail of the signals, enabled by the 1.75 GHz resolution bandwidth of the instrument.





WaveAnalyzer 100S Specifications

Spectral	Frequency Range	191.1 to 196.2 THz (1527.8 to 1568.8 nm)
	Spectral Sampling Resolution	312.5 MHz
	Resolution Bandwidth (FWHM)	1.75 GHz (15 pm)
	Absolute Frequency Accuracy (1)	+/- 1 GHz
	Frequency Repeatability (sweep to sweep)	200 MHz
	Measurement Update Rate Full C-band scan	2 updates / s
Power	Max Total Power	10 dBm
	Max Power Density	-5.5 dBm / 1.75 GHz
	Noise floor	-58.5 dBm / 1.75 GHz
	Relative Power Accuracy	+/-0.5 dB (2)
Mechanical, Electrical and Environmental	Operating Temperature	15°C to 35°C
	Operating Humidity	10% to 85%
	Communications Interface	USB 2.0
	Power Consumption	100 V - 240 V; < 8 W
	Connector Type	FC/APC
	Size	164 mm x 108 mm x 28 mm
	Weight	< 1 kg

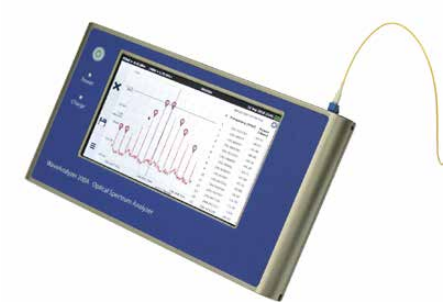
Notes: (1) Valid within recommended recalibration period (2) Valid for power values larger than -40 dBm; measured using a 12.5 GHz wide ASE signal

Part Number	Description
WA-AA-0100S-ZZ-H	WaveAnalyzer 100S Compact Optical Spectrum Analyzer, C-band, FC/APC

WaveAnalyzer 200A

Portable Optical Spectrum Analyzer

The WaveAnalyzer 200A is a lightweight portable Optical Spectrum Analyzer covering the C-band of optical communications. It has been designed for flexible use in the laboratory and also during installation, turn up and trouble shooting of optical networks in telecom and datacenter applications. Automatic ranging allows signals from +20 dBm to -50 dBm to be characterized without adjusting settings or adding attenuators. The instrument is controlled via touch-screen using II-VI's WaveAnalyzer GUI. A protective rubber bumper comes along with the instrument allowing operation of the unit in rugged environments.



The WA 200A is based on a coherent measurement priciple which allows operation without any moving part inside the instrument.

Key Features

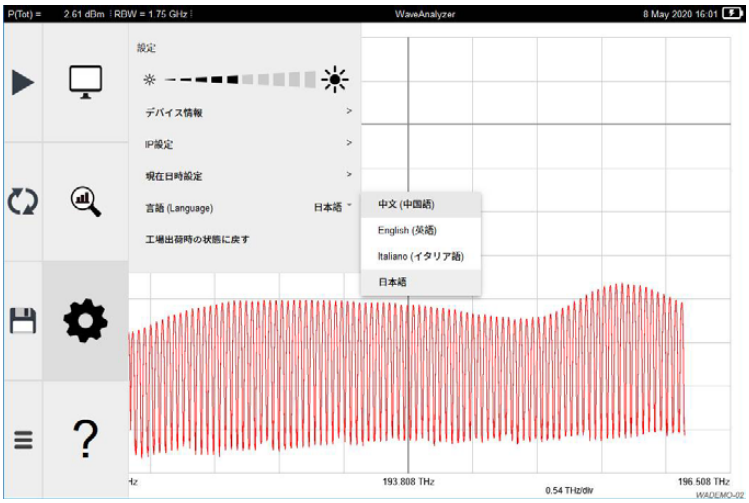
- Full C-band coverage
- Resolution bandwidth: 1.75 GHz
- Fast: 2 updates / second
- Battery operated
- Remote Control via Ethernet
- Language support (incl. Japanese and Chinese)
- No moving parts

Applications

- System turn up and trouble shooting
- DWDM testing
- Channel power and OSNR testing
- Channel equalizing
- Lab, network and data center

Language Support

The WA 200A includes localized GUI with language support for English, Japanese, Chinese and Italian.



Ruggedness

A special protective bumper ensures the integrity of the instrument even in rugged environments or when dropped on the floor. The instrument comes in a hard-shell case proving protection during transportation and shipment.

Control

The WA 200A can be connected through an Ethernet port to Local Area Networks and allows signal monitoring and data gathering or simply remotely controlling either via the internal webserver which can be accessed by any browser or through the integrated RESTful API. The WA 200A supports both acquiring the IP address through DHCP and setting a fixed address. The USB port allows time-stamped data to be saved for later analysis when no network is available.

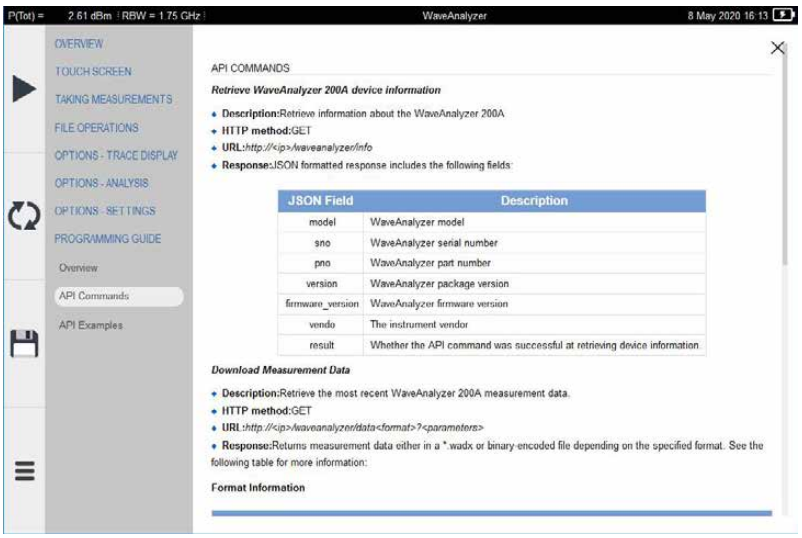
The WA 200A integrates with II-VI's well-known WaveAnalyzer PC software. The WaveAnalyzer GUI serves as PC based viewer for measurement traces collected on the WA 200A.

In-built Signal Analysis

The WA 200A provides full channel analysis of 50 and 100 GHz channels, as well as supporting proposed non-standard channel spacings such as 37.5 GHz for future high-capacity 400 Gb/s interconnects. Reporting includes channel power, center frequency and OSNR measurements.

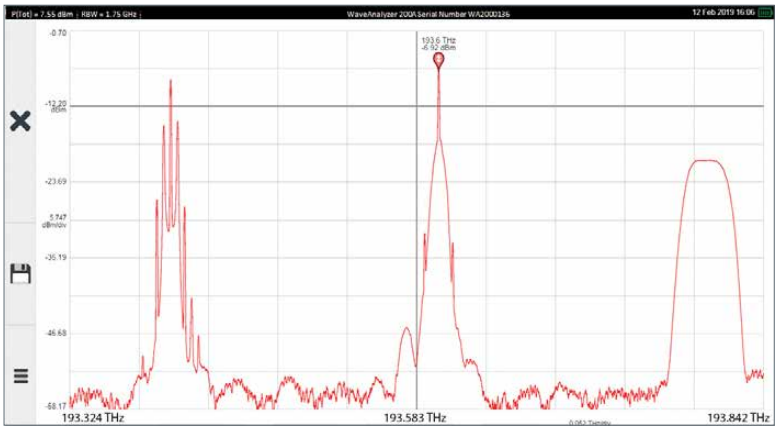
Onscreen Help

The WA 200A includes a detailed Onscreen Help function, which supports the user in all important measurement tasks.

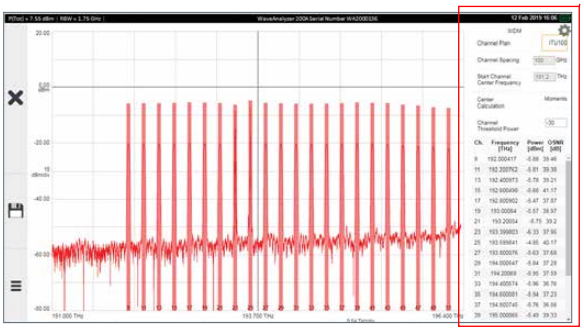


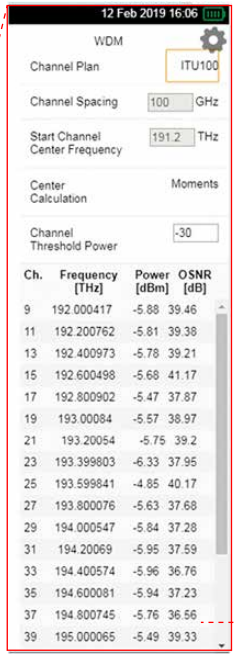
Measurement

The screenshots below show measurements taken with the WA 200A on DWDM channels across the C-band.



Modulation sidebands on signals modulated with 10 Gb/s can be identified on the channel in the center and on the left; the channel on the right has been shaped out of an ASE signal





The DWDM Analysis provides precise information on the ITU channel number, the center frequency, power level and the OSNR

WaveAnalyzer 200A Specifications

Spectral	Frequency Range	191.1 to 196.2 THz (1527.8 to 1568.8 nm)
	Spectral Sampling Resolution	312.5 MHz
	Resolution Bandwidth (FWHM)	1.75 GHz (15 pm)
	Absolute Frequency Accuracy (1)	+/- 1 GHz
	Frequency Repeatability (sweep to sweep)	200 MHz
	Measurement Update Rate Full C-band scan	2 updates / s
	Max Total Power	27 dBm
Power	Max Power Density	+11.5 dBm / 1.75 GHz
	Noise floor	-58.5 dBm / 1.75 GHz
	Relative Power Accuracy	+/-0.5 dB (2)
	Operating Temperature	5°C to 35°C
Mechanical, Electrical and Environmental	Operating Humidity	10% to 85%
	Communications Interface	Ethernet, USB 2.0 (master)
	Power Consumption (3)	100 V - 240 V; 40 VA
	Connector Type	FC/APC, LC/PC
	Size — Instrument only	255 mm x 140 mm x 30 mm
	Size — instrument including protective bumper	273 mm x 168 mm x 50 mm
	Weight — Instrument only	1.25 kg
	Weight — instrument including protective bumper	1.5 kg

Notes: (1) Valid within recommended recalibration period
(2) Guaranteed when using an ASE source
(3) Condition: Battery is charging and instrument is operated

Part Number	Description
WA-00200A-C-P-1-AA-00	WaveAnalyzer 200A Portable Optical Spectrum Analyzer, C-Band, FC-APC Connector
WA-00200A-C-P-4-AA-00	WaveAnalyzer 200A Portable Optical Spectrum Analyzer, C-Band, LC-PC Connector

WaveAnalyzer 1500S

High Resolution Optical Spectrum Analyzer

The WaveAnalyzer 1500S Optical Spectrum Analyzer is a real-time, very-high-resolution optical spectrum analyzer for R&D and production test applications. Based on II-VI's fast-stepping solid-state laser, the WA 1500S uses coherent detection techniques to achieve an outstanding combination of resolution, dynamic range and measurement speed. Instrument versions are available for C- and L-bands.

This next-generation Optical Spectrum Analyzer provides spectral measurements with sub-pm resolution at an update rate of 4 measurements per second across the entire C- or L-band. Scanning across smaller spectral regions is even faster, with update rates of over 10 measurements per second across any 200 GHz window, enabling interactive adjustment of optical components and systems.

The WaveAnalyzer's coherent receiver provides polarization resolved data of the signal while its two input ports, for different power levels, ensures coverage of a large range of optical input signals. Low power single channel signals can be analyzed as accurately as high power WDM signals.

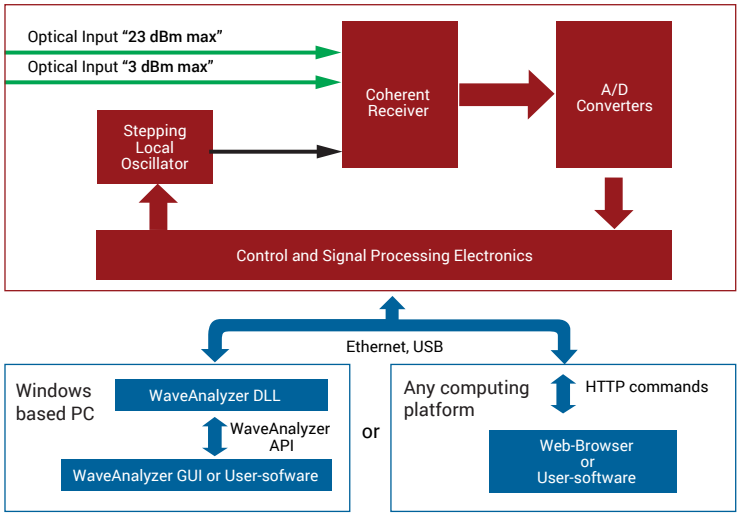
The WA 1500S is very compact and rugged, as it contains no moving parts. It is controlled using a USB or Ethernet connection to a Windows-based computer which runs II-VI's WaveAnalyzer software package.

Key Features

- High spectral resolution
- Real time measurement
- Instrument versions for C-band and for L-band available
- Update rate:
  - 4 Hz for full C- or L-band scan
  - 10 Hz for scan across any 200 GHz window
- Spurious-free dynamic range > 50 dB
- External trigger
- Internal web server

Applications

- High-resolution spectral analysis on optical components
- OSNR measurements
- Modulation analysis on optical signals
- Modulator test
- Modulator bias and polarization adjustments
- Transceiver test
- Side-mode Suppression Ratio (SMSR) measurements
- Network monitoring
- General purpose spectral analysis in optical labs

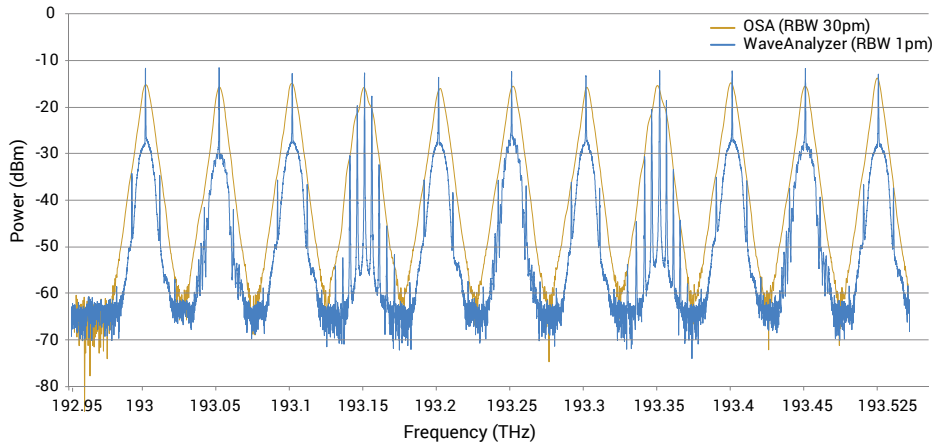


Block diagram of WaveAnalyzer system

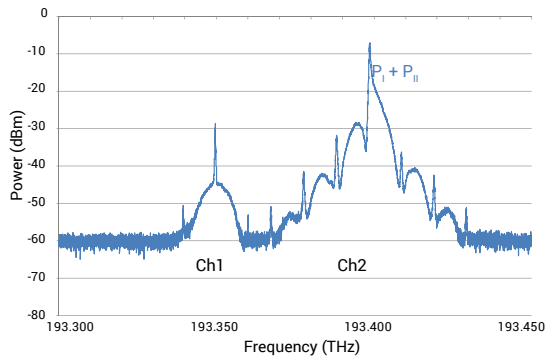
Measurement

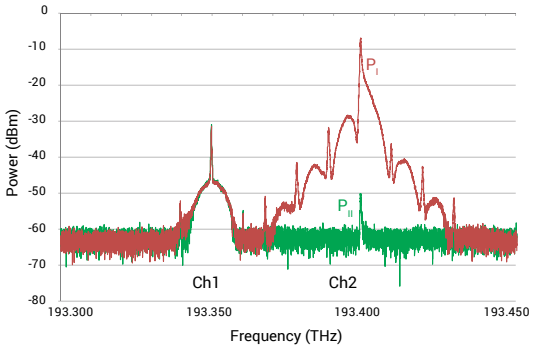
The WA 1500S supports spectral measurement applications in various domains, including communications and pulsed lasers, as shown in the examples below.

10G channels, 50GHz spaced, with various modulation formats



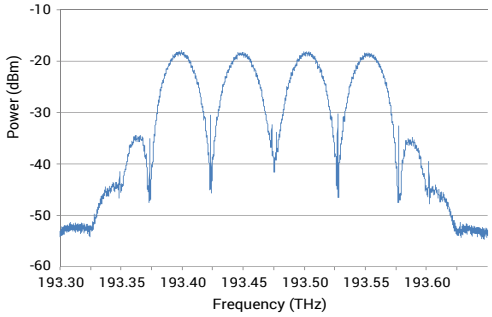
10 Gb/s NRZ





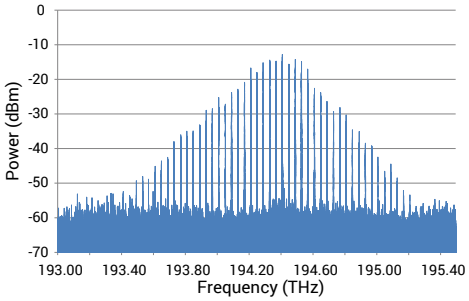
Two 10 Gb/s channels separated by 50 GHz; Channel 1 being attenuated by 20 dB. The graph top shows the sum of the two polarization components, whereas the graph right displays the polarization components P_I and P_{II} separately.

4 channel 100G DQPSK



Measurement taken on 4 channels of a dual polarization DQPSK signal , spaced by 50 GHz

40 GHz mode-locked laser



Spectral details of the mode-structure of a 40 GHz mode-locked laser. The real-time update rate supports precise adjustment of the laser cavity.

Measurement Analysis Functions

The PC based GUI package offers various analysis functions:

The 3-point-measurement allows very simple and quick OSNR measurements using the traditional approach in which a 0.1nm resolution bandwidth measurement scan is taken from which the noise and the signal powers are estimated.

The advanced 6-point-measurement allows OSNR measurements even between densely spaced channels, see figure on the right. The measurement bands can be precisely adjusted to capture the noise floor and the signal accurately.

The polarization extinction ratio method allows in-band OSNR measurements, provided the optical signal is single polarization only (which can be verified with the WaveAnalyzer instrument).

The Multi Channel Analysis function provides measurements of the OSNR, channel power and channel center frequency of all channels simultaneously with an update rate of up to 10 Hz, depending on scan range. For documentation or further analysis, the results can be exported in a table.

The Wavelength Meter function provides fast measurements of the power and the wavelength of multiple narrow band signals. It can measure several hundred lines simultaneously and provides a wavelength accuracy which is similar to dedicated wavelength meters.

Markers

The user interface contains a powerful marker scheme which supports further analysis capabilities, like peak detection, display of difference frequencies and integrated power in user definable frequency ranges.

Interfacing

The user can connect to the WaveAnalyzer in point-to-point mode from a computer using an Ethernet or USB connection, or Remote Network Device mode over an IP network.

To ensure fastest measurement rates, it is preferred to connect the WaveAnalyzer directly to the user's computer via a Gigabit Ethernet connection using the point-to-point mode.

Trigger scheme

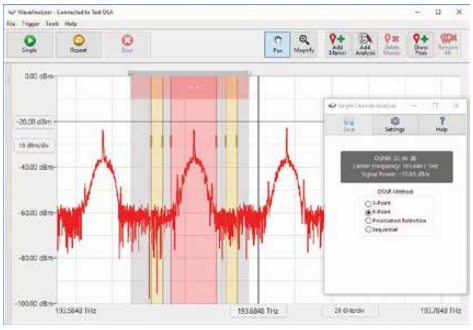
The WaveAnalyzer 1500S includes a trigger scheme which allows taking measurement samples in precisely defined time windows. This enables, for example, taking spectral measurements of signals traveling in recirculating loops.

HTTP based programming interface

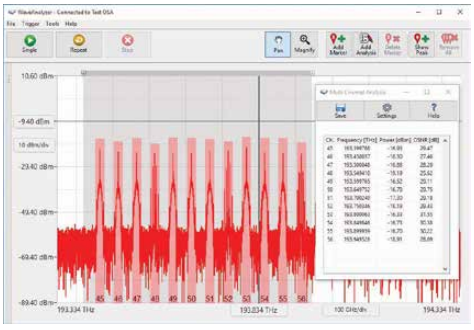
The WaveAnalyzer 1500S offers an HTTP based programming interface. This greatly simplifies remotely controlling the instrument, as it is independent of the programming platform.

Web server

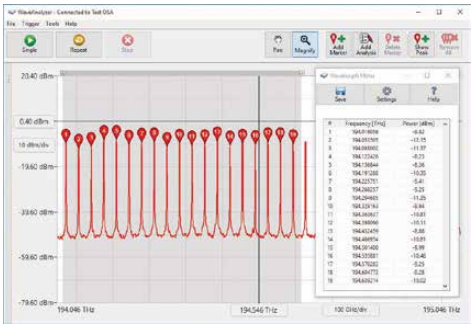
The WaveAnalyzer instrument includes a simple web server which allows controlling the instrument and taking measurements with a web browser.



6-point OSNR measurement



Multi Channel Analysis



Wavelength Meter

WaveAnalyzer 1500S Specifications

Specifications are guaranteed except where stated as typical (typ).

Model		WA 1500S / C-Band	WA 1500S / L-Band
Spectral	Frequency Range	191.05 to 196.35 THz (1526.8 to 1569.1 nm)	186.0 to 191.05 THz (1569.1 to 1611.7 nm)
	Spectral Sampling Resolution	20 MHz	
	Resolution Bandwidth (FWHM)	180 MHz (typ.)	
	Absolute Frequency Accuracy (1)	+/- 500 MHz	
	Frequency Repeatability (sweep to sweep)	50 MHz	
	Measurement Update Rate (2):		
	Full C- or L-band scan	4 updates / s	
	Scan across any 200 GHz window	10 updates / s	
Power	Max Total Power	23 dBm (3 dBm for "3 dBm max" optical input)	
	Max Power Density	0 dBm / 20 MHz	
	Relative Power Accuracy	+/-0.2 dB (4)	
	Spurious Free Dynamic Range (1)	> 50 dB	
	Close-In Dynamic Range (5)	> 38 dB @ +/- 2 GHz	
Mechanical, Electrical and Environmental	Operating Temperature	15°C to 35°C	
	Operating Humidity	10% to 85%	
	Communications Interface	USB 2.0, Ethernet	
	Trigger Input	TTL (SMA)	
	Trigger Output	TTL (SMA)	
	Power Consumption	100 V - 240 V; 20 VA	
	Connector Type	FC/APC	
	Size	241 mm x 88 mm x 316 mm	
	Weight	< 4 kg	

Notes: (1) Valid within recommended recalibration period
(2) Requires a PC with at least an i7 processor or equivalent and a Gigabit Ethernet connection
(3) Specifications valid on the "23 dBm max" optical port, except where stated differently
(4) Guaranteed when using an ASE source
(5) When measuring on one optical channel

Part Number	Description
WA-AA-1500S-ZZ-H	WaveAnalyzer 1500S, bench-top, C-band
WA-AA-1500S-RM-H	WaveAnalyzer 1500S, rack-mount, C-band
WA-AA-1500S-L-H	WaveAnalyzer 1500S, bench-top, L-band

II-VI Knowledgebase

Obtain further application and technical information about the Optical Instrumentation Portfolio including the WaveAnalyzer Family by clicking here: http://www.finisarknowledgebase.com

WaveAnalyzer Demonstration on YouTube

Watch product demo at: https://www.youtube.com/user/finisarcorp

About II-VI

II-VI Incorporated, a global leader in engineered materials and optoelectronic components, is a vertically integrated manufacturing company that develops innovative products for diversified applications in communications, materials processing, aerospace & defense, semiconductor capital equipment, life sciences, consumer electronics, and automotive markets. Headquartered in Saxonburg, Pennsylvania, the Company has research and development, manufacturing, sales, service, and distribution facilities worldwide. The Company produces a wide variety of application-specific photonic and electronic materials and components, and deploys them in various forms, including integrated with advanced software to support our customers. For more information, please visit us at www.ii-vi.com.