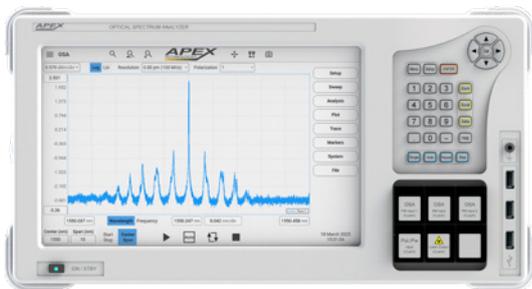


## Optical Spectrum Analyzer

### OSA-APx Series



#### High Resolution OSA

500x better resolution than a grating-based OSA  
Accurately measure the smallest spectral features

Combines:

- Optical Spectrum Analyzer
- Wavemeter
- Polarimeter
- Component Analyzer

## Optical Complex Spectrum Analyzer

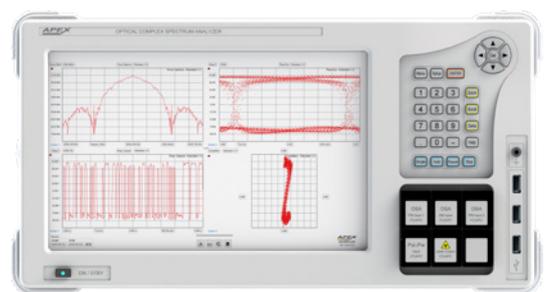
### OCSA-APx Series

#### High Resolution OSA + High Bandwidth Optical Modulation Analyzer

All the benefits of the OSA-APx Series plus accurate phase measurements with no symbol rate limitation.

Combines:

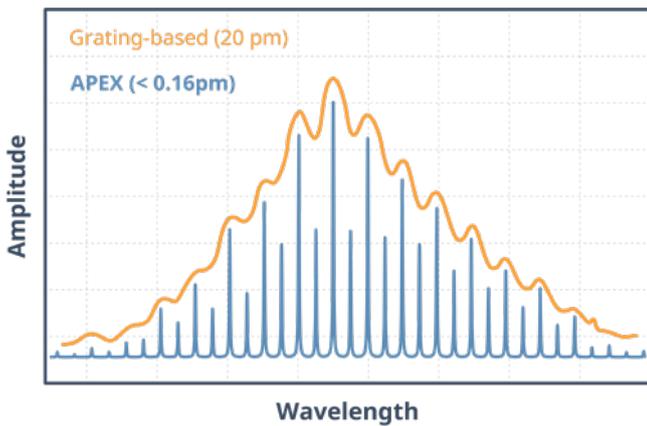
- Optical Complex Spectrum Analyzer
- Modulation Analyzer
- Wavemeter
- Polarimeter
- Component Analyzer



## OSA/OCSA Advantages

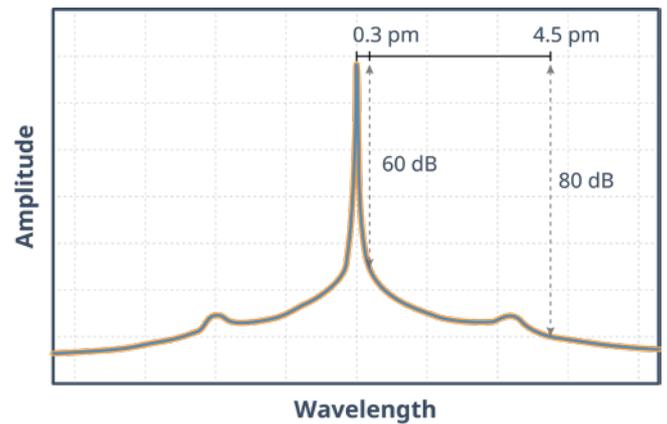
Advantages	Benefits	Features
High Resolution	Most precise analysis of optical signals	> 380x more resolution than <u>best</u> grating-based OSA
High Dynamic Range	Detect and distinguish close-in optical signals	Quasi-rectangular resolution filters 800x better close-in dynamic range than <u>best</u> grating-based OSA
High Wavelength Accuracy	Reliable measurements	Three (3) internal references
Ease of Use	Time-saving	User-friendly interface & Remote control capabilities
Versatility	Cost-effective multi-analysis tool	High-resolution Spectrum Analyzer + Up to 4 tunable laser sources + Polarization & Component Analysis + Phase Analysis (OCSA)

### Ultra-high Optical Bandwidth Resolution



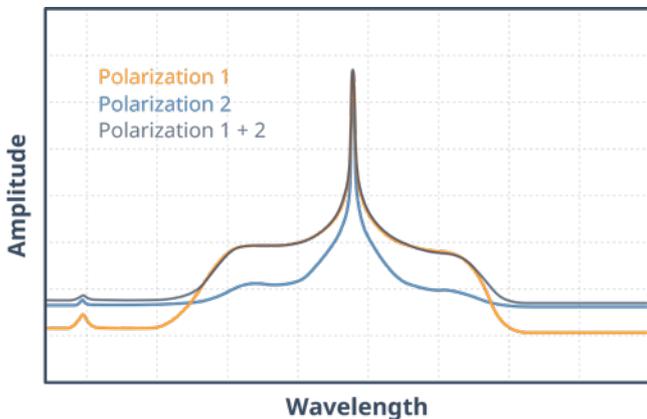
Hundreds of times better resolution than grating-based/monochromator OSA allows to accurately measure the smallest features.

### High Close-in Dynamic Range



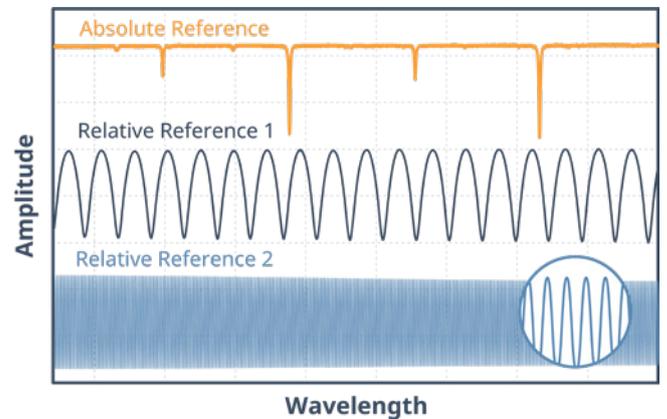
A 83 dB dynamic range to retrieve the weakest optical signals among strong spectral features.

### Two Orthogonal Polarization Channels



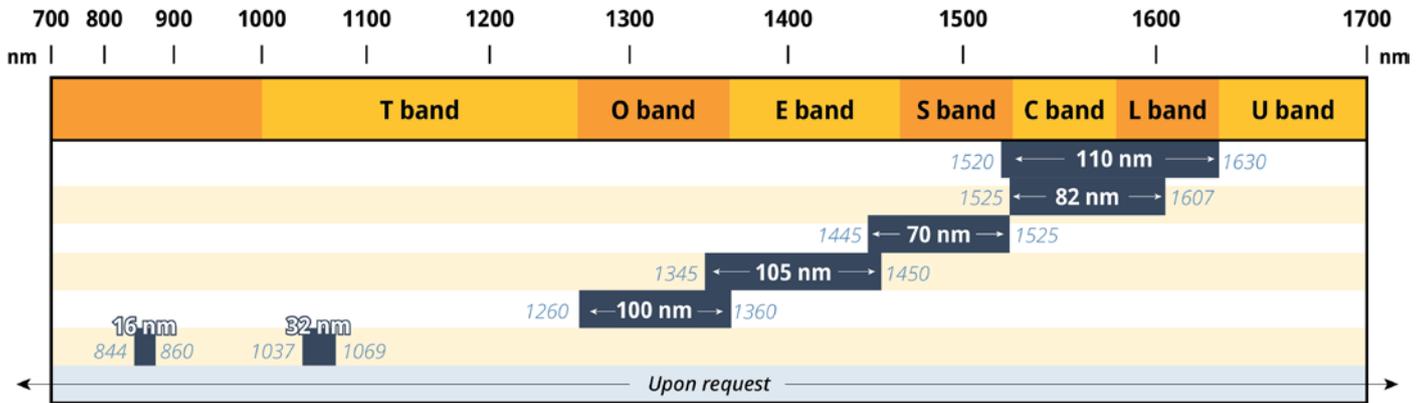
Two polarization channels displayed separately and simultaneously, or combined for polarization independent measurements.

### High Wavelength Accuracy

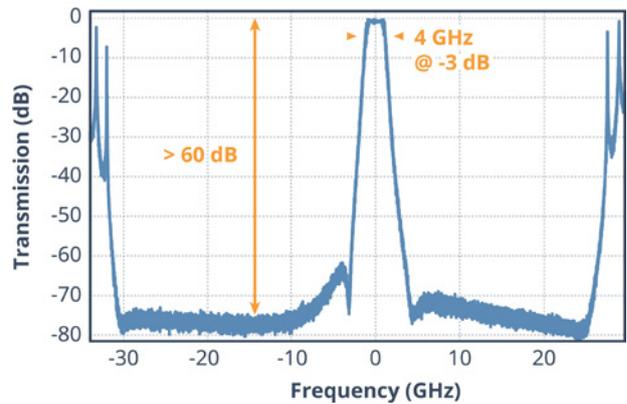
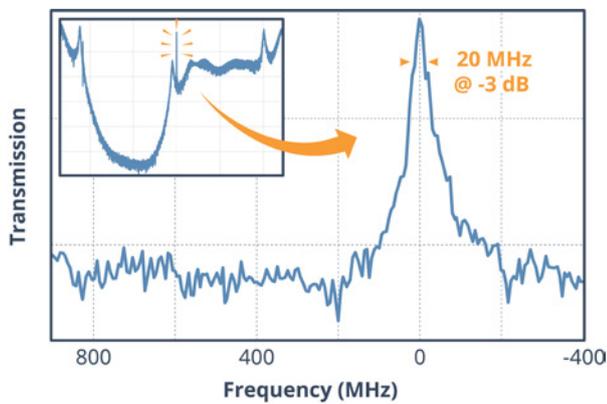


Absolute accuracy of the tunable laser source, maintained using three (3) distinct wavelength references, also allowing the analyzer to be used as a wavelength meter.

## Tunable Laser Sources Wavelength Ranges

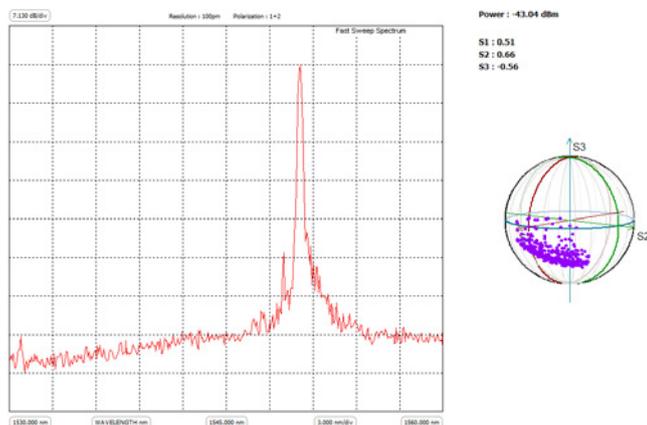


## Tunable Laser Source(s) & Tracking Generator

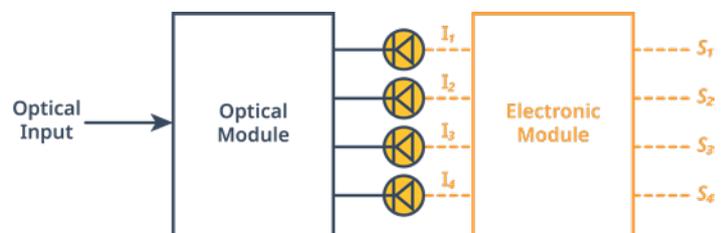


Built-in or external tunable laser with narrow linewidth wide mode-hop-free tuning range lasers, along with the tracking generator option, enable both reflection and transmission analysis of components, with up to 1 MHz resolution and more than 60 dB of dynamic range.

## Polarization Analysis

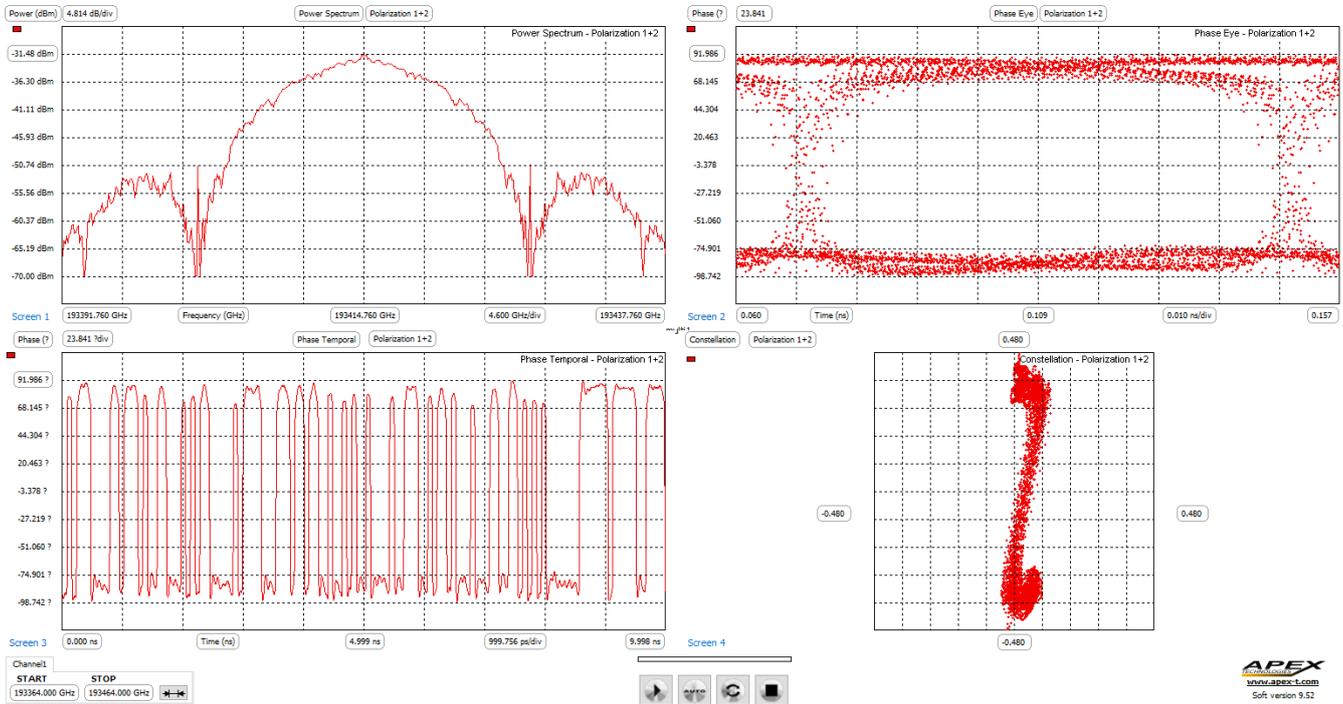


## Polarimeter Module Diagram



SOP, DOP, and PER measured with high accuracy and allowing fast sampling rates, over a wide range of input optical power. Information displayed as Jones vectors, Poincare sphere, and Stokes parameters.

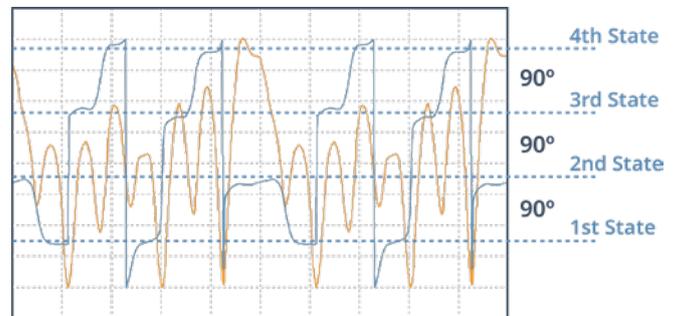
# Complex Phase Analysis from Time Domain Measurements



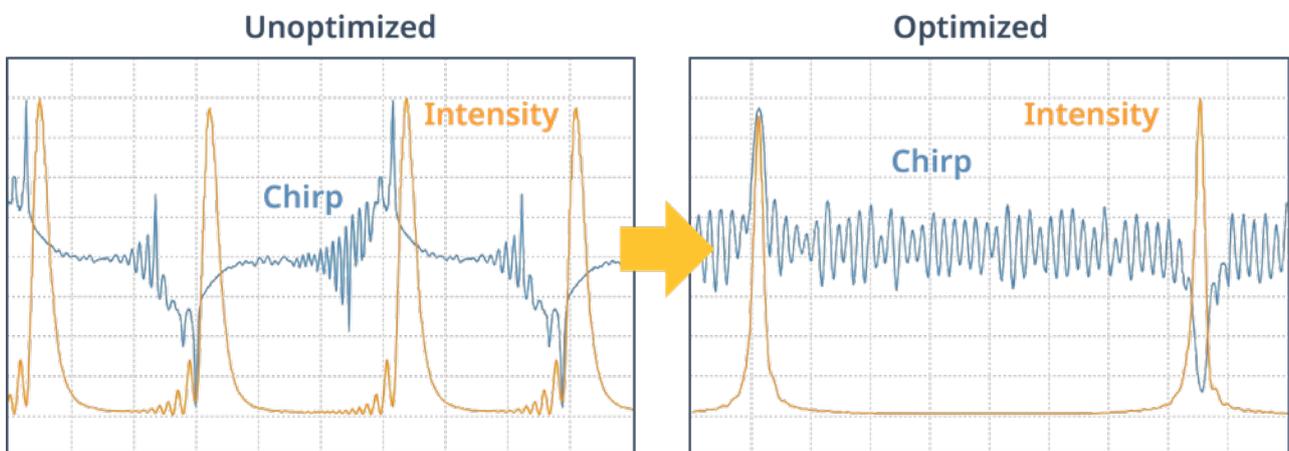
## Available phase-related analysis:

- Intensity and Phase vs Frequency
- Intensity, Phase, Alpha Parameter, and Chirp vs Time
- Eye Diagram, Constellation
- Group Delay and Chromatic Dispersion
- Complex transfer function of components

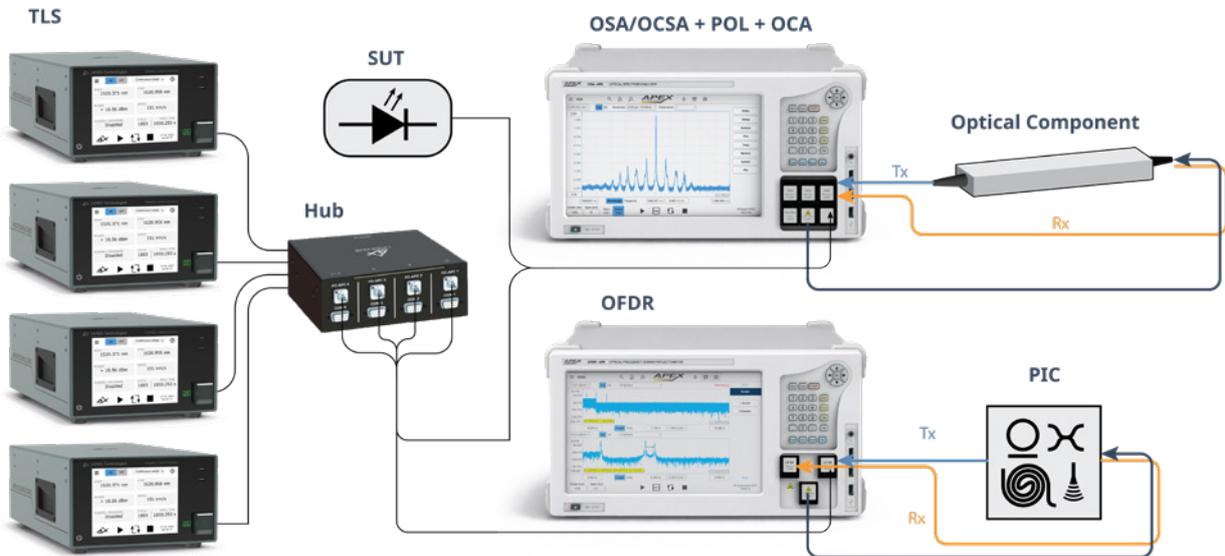
## Phase Measurement Example



## Chirp Optimization Example

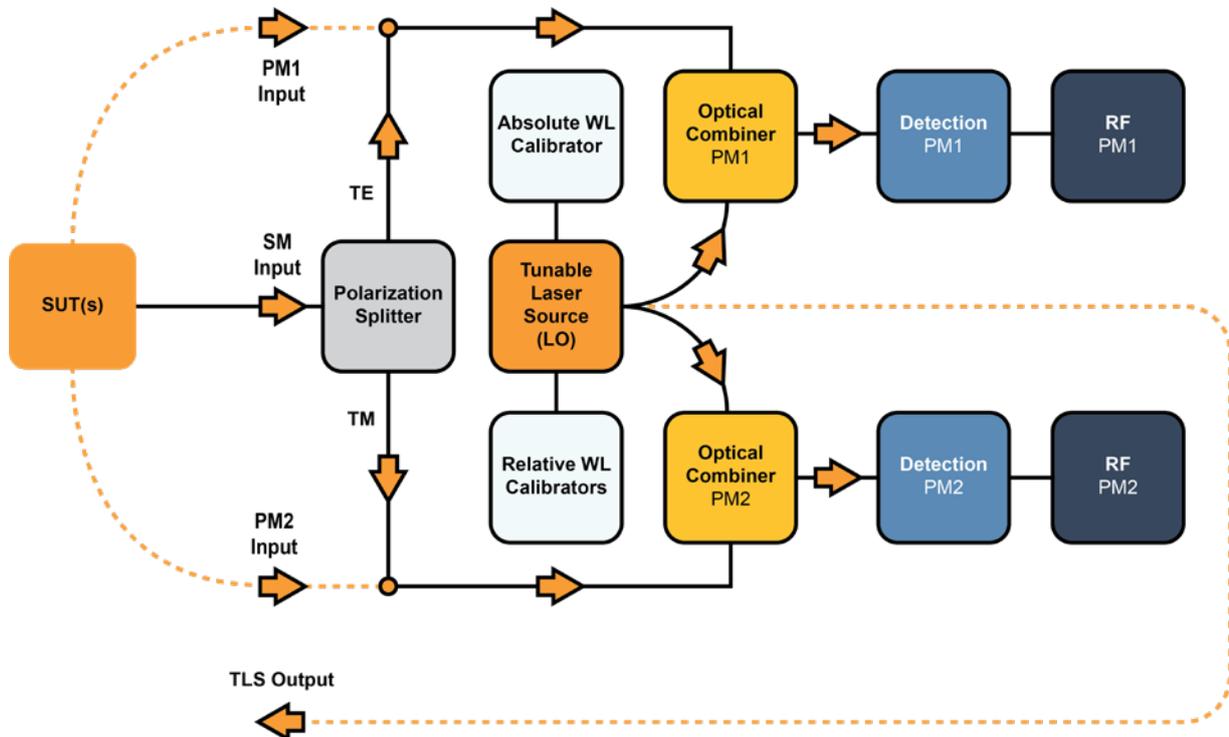


## The ultimate optical test and measurement laboratory setup



The external tunable laser source option allows for a versatile test setup where the same laser(s) can be used on different APEX Technologies analyzers while remaining available for other experiments in the facility.

## Two independent measurement paths



With the three (3) optical inputs option, 2 additional input ports (PM) can be used to ensure polarization of the signal is maintained, or to simultaneously connect two independent active or passive devices, reducing repeated fiber connect/disconnect during testing, for example.

## OSA/OCSA Common Specifications

	OSA-AP4	OSA-AP5	OSA-AP6
<b>Laser Sources</b> <i>Bands</i>	TLS ±852 nm	TLS ±1064 nm	TLS O   E   S   C+L   C+L Ext.
<b>Wavelength Resolution</b> <i>@ 3 dB</i>	5 MHz    0.01 pm 20 MHz    0.05 pm 100 MHz   0.24 pm 140 MHz   0.34 pm	5 MHz    0.02 pm 20 MHz    0.08 pm 100 MHz   0.38 pm 140 MHz   0.53 pm	5 MHz    0.04 pm 20 MHz    0.16 pm 100 MHz   0.80 pm 140 MHz   1.12 pm
<b>Absolute Wavelength Accuracy</b>	± 2 pm Typical (± 3 pm Max)		
<b>Wavelength Repeatability</b>	< 0.5 pm <sup>1</sup>		
<b>Dynamic Range</b>	70 dB	89 dB	87 dB <sup>2</sup>
<b>Close-in Dynamic Range</b>	> 40 dB @ ± 0.1 pm > 50 dB @ ± 0.4 pm > 70 dB @ ± 6 pm	> 40 dB @ ± 0.1 pm > 60 dB @ ± 0.4 pm > 80 dB @ ± 6 pm	
<b>Spurious-free Dynamic Range</b>	55 dB Typical (50 dB min)		
<b>Power Level Range</b>	-55 dBm to +15 dBm	-79 dBm to +10 dBm	-77 dBm to +10 dBm
<b>Absolute Power Level Accuracy<sup>3</sup></b>	± 0.3 dB		
<b>Power Level Repeatability<sup>4</sup></b>	< 1 dB	< ± 0.1 dB	
<b>Sweep Rate</b>	Up to 20 nm/s <sup>5</sup>		
<b>Optical Input Connectors</b>	FC/PC for SM fiber ( <i>other connectors under request</i> )		
<b>Dimensions (W x H x D)</b>	450 x 250 x 485 mm 17.7 x 9.9 x 19.1 in		
<b>Weight</b>	18 – 23 kg (40 – 51 lbs) ( <i>depending on options</i> )		
<b>I/O Connectors</b>	Ethernet, GPIB, Electrical trigger input, USB x5, VGA		
<b>Power</b>	115-230 VAC, 50/60 Hz   350 W		
<b>Environmental Conditions</b>	Operating Temp.: +5 to +35°C   Storage Temp.: -10 to +50°C Humidity: 20 – 80% RH (non-condensing)		

(1) Standard deviation over 20 measurements.

(2) 4 dB less for 2-laser configurations; 8 dB less for 3 & 4-laser configurations.

(3) Typical value @1310 or 1550 nm, with 0 dBm. Monochromatic input signal and resolutions above 5 MHz.

(4) Monochromatic input signal ; standard deviation over 20 measurements. Resolutions above 5 MHz.

(5) Filter resolution 100 MHz.

## OCSA Specifications

	OCSA-AP5/AP6
<b>Optical Bandwidth</b>	3 THz
<b>Clock Power</b>	> -17 dBm
<b>Repetition Rate</b>	From 70 MHz to 900 MHz <i>No upper limitation if modulation applied<sup>1</sup></i>
<b>Maximum Temporal Resolution</b>	325 fs
<b>Measurement Rate</b>	6 nm/s (750 GHz/s)

(1) For faster repetition rates, add external modulation between 70-900 MHz or PPG/AWG with patterns with sufficient length to reduce rate within range (example for 100 GBaud: any pattern between 100 and 1428 bits, including PRBS7/8/9/10.)

## OSA/OCSA Options

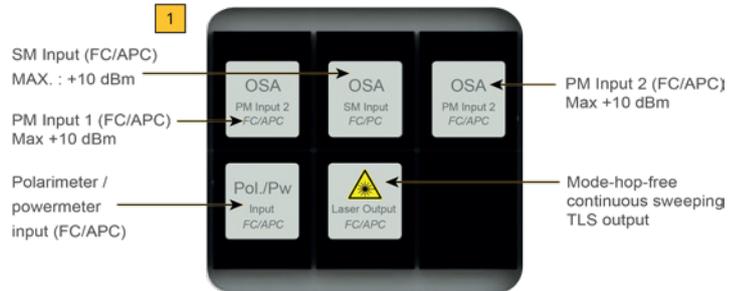
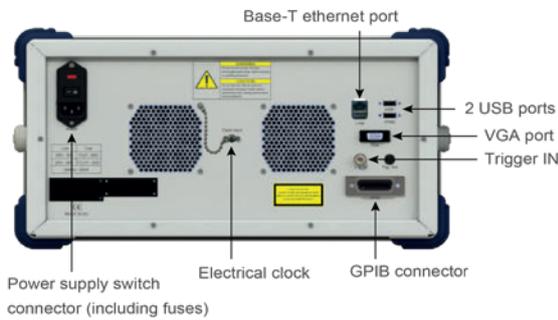
Options	Parameters	OSA-AP4	OSA-AP5/AP6
<b>Continuous &amp; Step-by-step Optical Tunable Laser Source Output</b> <i>(OSA-APX-1 / OCSA-APX-1)</i>	Output Power	-8 dBm	-4 dBm (1 laser) -7 dBm (2/3 lasers) -11 dBm (4 lasers)
	Spectrum Linewidth	< 133 kHz (Gaussian) < 10 kHz (Lorentzian)	
	Side-mode Suppression Ratio (SMSR)	> 55 dB / 0.8 pm	
	Relative Intensity Noise (RIN)	-158 dB/Hz	
	Wavelength Stability	±1 pm @ 1 hour	
	Power Stability	0.07 dB @ 15 min. 0.09 dB @ 1 hour	
	Fiber + Connector Type	PM + FC/APC	
	Sweep speed	Adjustable from 5 to 200 nm/s	
<b>Optical Tracking Generator Output for Transmission Measurements</b> <i>(SM: OSA-APX-2-1 / PM OCSA-APX-2-2)</i>	Dynamic Range	50 dB	60 dB
	Resolution	1 MHz	
	Output Type	Choose either SM or PM outputs	
<b>Three (3) Optical Inputs</b> <i>(OSA-APX-3 / OCSA-APX-3)</i>	Input Connectors	FC/PC ( <i>default</i> ) <sup>1</sup> for SM fiber input x1 FC/APC for PM fiber inputs x2	
<b>Integrated Polarimeter</b> <i>(OSA-APX-4 / OCSA-APX-4)</i>	Wavelength Range	—	1260 to 1610 nm
	Input Power Range	—	-60 to +10 dBm
	Max Sampling Rate	—	4 KS/s
	SOP Accuracy	—	± 0.25° (-30 to +2 dBm) < 2° (-60 to +10 dBm)
	Display modes	—	Full Poincaré sphere, Jones graph, Stokes Oscilloscope
	Azimuth Accuracy	—	± 0.25° (-30 to +2 dBm)
	Ellipticity Accuracy	—	± 0.25° (-30 to +2 dBm)
	DOP Accuracy	—	± 1% (-35 to +5 dBm)
	Relative Power Accuracy	—	± 0.2% (-35 to +5 dBm)
	Absolute Power Accuracy	—	± 0.1% (-35 to +5 dBm)
<b>Remote Control by GPIB</b> <i>(OSA-APX-5 / OCSA-APX-5)</i>	Ports	+ GPIB <i>(Ethernet always included)</i>	
<b>TLS C+L Extended Upgrade</b> <i>(OSA-APX-6 / OCSA-APX-6)</i>	Wavelength Range	—	1520 to 1630 nm
<b>External Benchtop TLS LO<sup>2</sup></b> <i>(OSA-APX-7 / OCSA-APX-7)</i>	Peak Output Power	7	10 – 13 dBm
	Max Power Full Span	6	7 – 9 dBm
<b>Group Delay &amp; Chromatic Dispersion Analysis</b> <i>(OCSA-APX-8)</i>	Enable measurement of phase, group delay and chromatic dispersion of a component, using an external reference signal		

(1) FC/APC and other connectors available upon request.

(2) Refer to TLS datasheet for details

# See the invisible ► Create the impossible

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