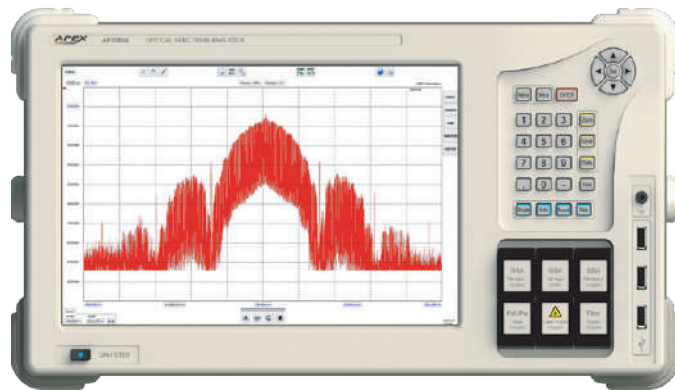


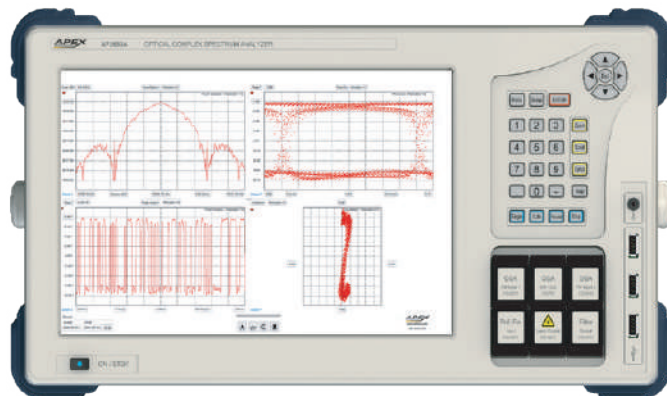
# Optical Spectrum Analyzer

OSA-APX series



# Optical Complex Spectrum Analyzer

OCSA-APX series





# THE WORLD HIGHEST RESOLUTION OPTICAL SPECTRUM ANALYZER

Based on an interferometric principle, our ultra high resolution optical spectrum analyzer can achieve a 500 times better resolution than monochromator OSA

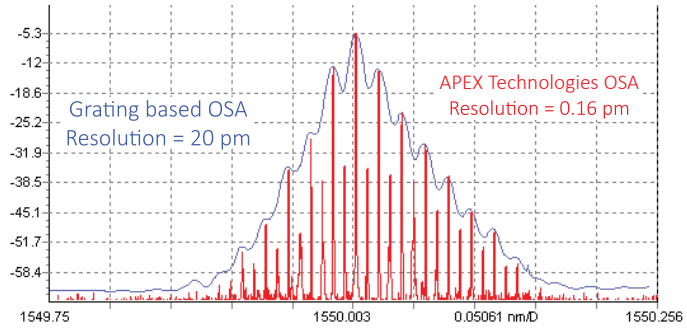
## OSA-APX Series

### Features

- From 5 MHz to 250 GHz resolution
- Now available at any wavelengths between 1030 nm to 1630 nm
- +/- 2 pm wavelength accuracy
- High dynamic range
- Rectangular-shape resolution filters
- High close-in dynamic range
- Built-in tunable laser source

### Applications

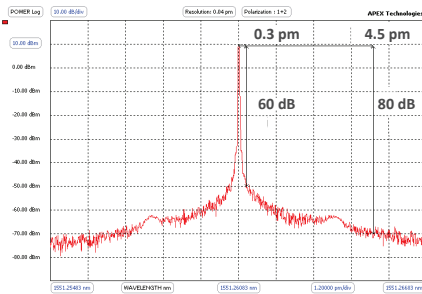
- Advanced modulation formats analysis
- Comb generator measurement
- Laser characterization
- OSNR measurement
- Optical component characterization



Direct comparison between the two different Optical Spectrum Analyzer types measuring a 1.25 GHz modulated signal

Now available at any wavelengths between 1030 nm to 1630 nm

1000	1260	1360	1460	1530	1565	1625	1655
T band		O band	E band	S band	C band	L band	U band
				1520 nm	110 nm		1630 nm
			1420 nm	100 nm	1520 nm		
		1335 nm	100 nm	1435 nm			
		1260 nm	100 nm	1360 nm			
		1150 nm	100 nm	1250 nm			
1030 nm	40 nm	1070 nm					
Other wavelength ranges between 700 to 1900 nm can be customized under request							



### High close-in dynamic range

The resolution of APEX Technologies OSA are not related to optical filters but electrical ones. These electrical filters are close to rectangular shape.

Thanks to these special electrical filter forms, the close-in dynamic range is very high :

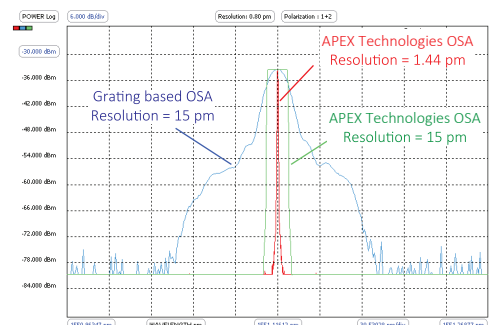
- @ +/- 0.1 pm from the peak, dynamic > 40 dB
- @ +/- 0.4 pm from the peak, dynamic > 60 dB
- @ +/- 6 pm from the peak, dynamic > 80 dB

The high close-in dynamic range helps to well separate optical peaks which are extra-close to each other.

### Rectangular shape filters

APEX Technologies OSA rectangular shape filters allow a nearly perfect integration of the signal over the selected resolution, while a grating based OSA filter integrates inside a wide base triangular shape.

This sharp integration allows our OSA to perform a much more realistic level measurement.



APEX Technologies and grating based OSA wavelength resolution filters shapes comparison

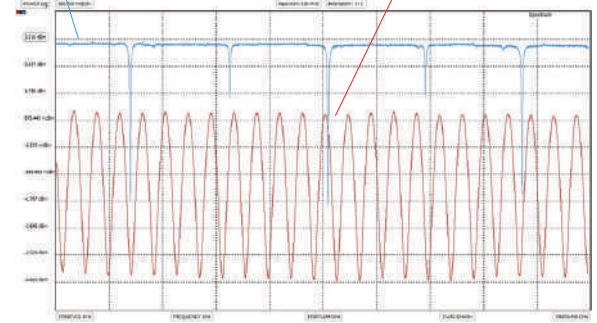
## High wavelength accuracy

The two different internal wavelength calibrators (absolute and relative) furnish to the equipment an accurate wavelength value of the TLS position. This technique provides a very high wavelength accuracy specification of +/- 2 pm.

The absolute wavelength calibrator is a gas cell and the relative one is a Fabry-Perot with a fixed Free Spectral Range

Absolute calibrator

Relative calibrator



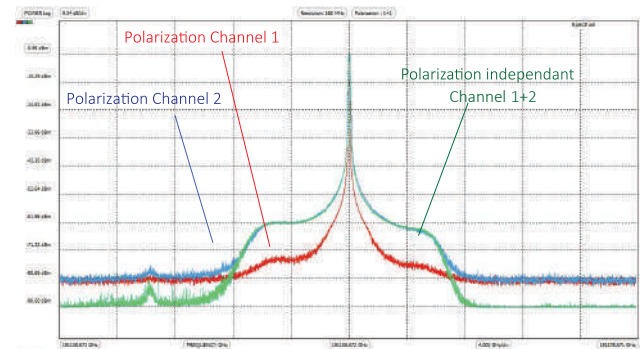
## Two internal channels (one OSA per polarization axis)

### SM input independent of polarization:

The input signal is split into two orthogonal polarization axis and analyzed simultaneously by two internal independent channels. By using this method, APEX OSA can display the two polarization channels separately or recombine them and display a polarization independent measurement.

### Additional two PM inputs:

Optionally, two different additional PM inputs are available. The two signals can be analysed simultaneously by two internal independent channels. By using this method, APEX OSA can display the two signals separately.

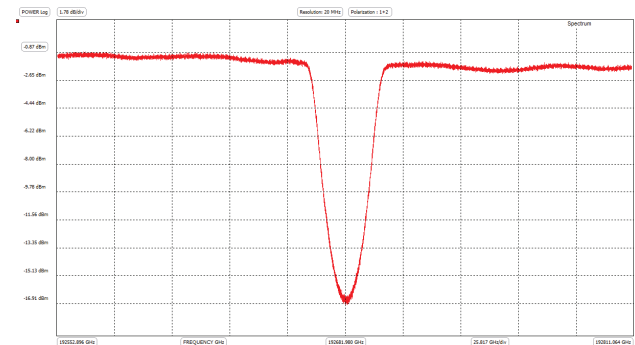


## Tunable Laser Source & Tracking generator

- The built-in Tunable Laser Source local oscillator can also be used as an independent TLS. In option, a TLS output and a control software can be integrated into the equipment.

- The tracking generator option allows the user to synchronise the wavelength TLS output with the OSA measurement. With this combination, active and passive components transmission measurements (insertion loss/gain) are possible with a dynamic range of 63 dB and a resolution of 1 MHz.

Bragg grating profile measurement using the tracking generator



## Polarization analysis

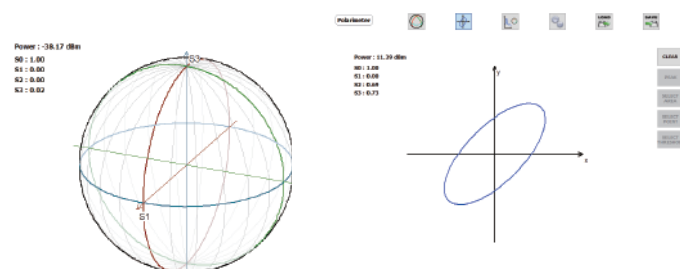
Optionally, the equipment can be used as a polarimeter (SOP and DOP measurement). Three different displaying modes exist: Jones graph, Poincaré sphere and Stokes parameter oscilloscope.

The SOP can be measured with an accuracy of +/- 0.25°.

Polarization extinction ratio (PER) can be measured too

Jones Vector

Poincaré sphere



# OPTICAL COMPLEX SPECTRUM ANALYZER FOR ADVANCED MODULATION ANALYSIS

## OCSA-APX

### Features

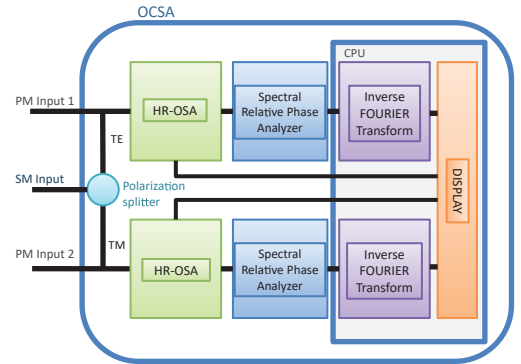
- From 5 MHz to 250 GHz resolution
- Now available at any wavelengths between 1030 nm to 1630 nm
- +/- 2 pm wavelength accuracy
- High dynamic range
- Rectangular-shape resolution filters
- High close-in dynamic range
- Built-in tunable laser source
- No Baud rate limitation
- No modulation format limitation (BPSK, DPSK, 16QAM, 64QAM...)
- Phase, chirp, intensity vs time - Constellation - Eye diagram

### Applications

- Advanced modulation formats analysis
- Modulator characterization
- Comb generator temporal and spectral measurement
- Chromatic dispersion analysis
- Complex transfer function of components

Use it as an high performances OSA and Optical Modulation Analyzer !

This equipment is based on interferometric method and is able to measure spectrums with the same specifications as the OCSA-APX instruments. It also has the added benefit of measuring phase as a function of frequency. The phase and intensity informations can then be used to calculate chirp, phase, alpha parameter or pulse shape as a function of time. Furthermore it can display constellation, phase and intensity eye diagrams.

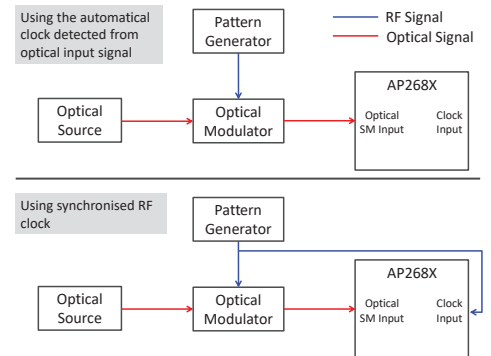


### OCSA time-domain measurement advantages

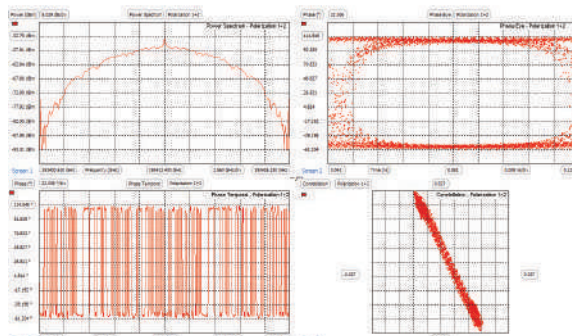
Contrary to standard optical modulation analyzers and thanks to the fact that the measurement is made in the spectral domain, APEX Technologies OCSA have no real rate-limitation. It means that you can see it as an utopist 3 THz bandwidth optical modulation analyzer without electronic limitation able to measure any modulated signal rates (from 70 Mbaud to ~ 1,5 Tbaud). Furthermore, it does not need any special software adapted to each modulation format and can measure any of them even the very rare and the new ones.

### Complex measurement setup

As mentioned, a complex measurement needs not only the intensity but also the phase as a function of frequency. To measure the phase, the signal under test must be a repetitive signal with a pattern frequency between 70 MHz to 900 MHz. Commercially available PPG and AWG are able to generate the right pattern length to match this pattern frequency range for any signal-rate. A reference RF pattern clock repetition signal is also required. Manually, the user can plug an external clock to the equipment. To simplify the setup, a new optical clock recovery function is available, it allows to do complex measurement without reference clock signal.



Measurement configuration with OCSA-APx



Optical complex analysis of a PRBS signal with the pattern length of  $2^7-1$

### User-friendly and powerful user interface

With only a few clicks, via the touch screen or USB mouse, you could have all types of results of your measurement displayed :

- High resolution spectrum
- Intensity, phase vs. frequency
- Intensity, phase, Alpha parameter, chirp vs. time
- Eye diagram, constellation
- Group delay, chromatic dispersion
- Complex transfer function of components

## How to choose your OSA/OCSA:

### STEP 1

Choose The OSA corresponding to your need:

- OSA-AP1: The best performance price ratio OSA C+L bands maximal wavelength range

- OSA-AP5: Top of the line (around 1064 nm)

- OSA-AP6: Top of Line Telecommunication range from 1260 to 1630 nm

### STEP 2

Choose the built-in Tunable Laser(s)

- OSA-AP1 (You can integrate up to 2 Tunable Lasers):  
 - C band laser (OSA-AP1-C)  
 - L band laser (OSA-AP1-L)  
 - C+L band laser (OSA-AP1-CL)

- OSA-AP5: 1 Laser from 1030 to 1070 nm only

- OSA-AP6 (You can integrate up to 4 Tunable Lasers):  
 - OSA-AP6-CL: From 1525 to 1607 nm  
 - OSA-AP6-O: From 1260 to 1360 nm  
 - OSA-AP6-E: From 1335 to 1435 nm  
 - OSA-AP6-S: From 1435 to 1520 nm  
 - OSA-AP6-CLO: C + L & O bands  
 - OSA-AP6-CLE: C + L & E bands  
 - OSA-AP6-CLS: C + L & S bands  
 - OSA-AP6-OS: S & O bands  
 - OSA-AP6-OE: O & E bands  
 - OSA-AP6-ES: E & S bands  
 - OSA-AP6-CLOE: C + L & O & E bands  
 - OSA-AP6-CLOS: C + L & O & S bands  
 - OSA-AP6-CLES: C + L & E & S bands  
 - OSA-AP6-OSE: O & S & E bands  
 - OSA-AP6-CLOSE: C + L & O & S & E bands

### STEP 3

Choose additional common option(s):

- OSA-APX-1: Tunable Laser output and software

- OSA-APX-2-1: Component analysis with SM fiber output

- OSA-APX-2-2: Component analysis with PM fiber output

- OSA-APX-3: Three inputs (1 SM + 2 PM inputs)

- OSA-APX-4: Polarimeter from 1260 to 1630 nm

- OSA-APX-5: GPIB remote control

- OSA-APX-6: Upgrade the C+L band to extended C+L band

- OSA-APX-7: Tunable Laser Source in external benchtop

- OSA-AP1-X: Additional 5 MHz and 100 MHz optical bandwidth filter resolution

		OSA-AP1	OSA-AP5 & OCSA-AP5	OSA-AP6 & OCSA-AP6
<b>Wavelength ranges (depending on built-in Tunable Laser(s) possibility(es))</b>				
Around 1064 nm			✓	
O band				✓
E band				✓
S band				✓
C band		✓		
L band		✓		
C+L bands				✓
Extended C+L bands				✓
<b>Resolution Bandwidth</b>				
Optical filter bandwidth resolutions	5 MHz	Optional	✓	✓
	20 MHz	✓	✓	✓
	100 MHz	Optional	✓	✓
	140 MHz	✓	✓	✓
Virtual bandwidth resolutions		✓	✓	✓
<b>Built-in Tunable Laser source type</b>				
DFB Lasers array		✓		
External cavity laser (Littman -Metcalf principle)			✓	✓
<b>Sweep Speed (Max.)</b>				
1.2 nm/s		✓		
35 nm/s			✓	✓
<b>Possibility to integrate several Tunable Lasers</b>				
Built-in Tunable Laser(s) room		2 Lasers room	1 Laser room	4 Lasers room
<b>Complex measurement</b>				
Complex analysis (intensity, phase, chirp vs. time); constellation, eye diagram			✓OCSA-AP5 X OSA-AP5	✓OCSA-AP6 X OSA-AP6
<b>Possibility to upgrade an OSA-APX into an OCSA-APX</b>				
Upgradable equipment			✓	✓
<b>Possibility to upgrade with additional built-in Tunable Laser(s)</b>				
Upgradable equipment		✓		✓

OSA specifications

	OSA-AP1			OSA-AP5	OSA-AP6				
<b>Wavelength measurement range<sup>a</sup></b>	OSA-AP1-C: From 1526 to 1567 nm	OSA-AP1-L: From 1567 to 1608 nm	OSA-AP1-CL: From 1526 to 1608 nm	T band TLS from 1030 to 1070 nm	O band TLS from 1265 to 1345 nm	E band TLS from 1335 to 1435 nm	S band TLS from 1435 to 1520 nm	C+L band TLS from 1525 to 1607 nm	Extended C+L band TLS from 1520 to 1630 nm
<b>Wavelength span range</b>	8 pm to 41 pm	8 pm to 41 pm	8 pm to 82 pm	8 pm to 40 pm	8 pm to 80 pm	8 pm to 110 pm	8 pm to 85 pm	8pm to 82pm	8 pm to 110 pm
<b>Wavelength resolution<sup>a</sup> (@3dB)</b>	20 MHz / 0.16 pm and 140 MHz / 1.12 pm			5 MHz / 0.04 pm ; 20 MHz / 0.16 pm ; 100 MHz/ and 140 MHz / 1.12 pm					
<b>Absolute wavelength accuracy<sup>b</sup></b>	+/- 2 pm Typical (+/- 3 pm Max)								
<b>Wavelength repeatability</b>	< 0.5 pm (standard deviation over 20 measures)								
<b>Dynamic range<sup>d</sup></b>	86 dB <sup>c</sup>			89 dB*				87 dB*	
<b>Close-in Dynamic range</b>	> 40 dB @ +/- 1.3 pm > 60 dB @ +/- 8 pm > 80 dB @ +/- 30 pm			> 40 dB @ +/- 0.1 pm > 60 dB @ +/- 0.4 pm > 80 dB @ +/- 6 pm					
<b>Spurious free dynamic</b>	55 dB Typical (50 dB min)								
<b>Measurement level range<sup>d</sup></b>	-76 dBm to +10 dBm			-79 dBm to +10 dBm				-77 dBm to +10 dBm	
<b>Absolute level accuracy<sup>a e f</sup></b>	+/- 0.3 dB (monochromatic input signal)								
<b>Level repeatability<sup>f</sup></b>	< +/- 0.1 dB (monochromatic input signal ; standard deviation over 20 measures)								
<b>Sweep time</b>	1.2 nm/s			MAX. 35 nm/s (filter resolution 100 MHz)					
<b>Optical input</b>	FC/APC for SM fiber (other connectors under request)								
<b>Dimensions</b>	OSA-AP1: WxHxD: 488x242x380.1 mm / 15.27x9.57x14.96 inch			OSA-AP5, OSA-AP6: WxHxD: 450x250x500 mm / 17.72x9.84x19.69 inch					
<b>Weight</b>	OSA-AP1: Around 18 kg / 39.68 lbs (depending on options)			OSA-AP5, OSA-AP6: Around 13 kg / 28.66 lbs (depending on options)					

- a) Typical
- b) After wavelength calibration
- c) Resolution 20 MHz
- d) 4 db dynamic loss in case of polarimeter
- e) At 1550 or 1310 nm and 0 dBm
- f) All resolution except 5 MHz
- g) Resolution 5 MHz

\* -4 dB if 2 lasers are included  
-8 dB if 3 or 4 lasers are included

Optical complex spectrum analyser

	OCSA-APx
All specifications except modulation analysis related	Identical as OSA-APx
Spectrum domain measurement	Intensity, Phase
Time domain measurement	Intensity, Phase, Chirp, Constellation, Intensity or phase eye diagrams
Clock input frequency	Clock frequency = repetition rate
Optical bandwidth	3THz
Polarization	2 Modulation Analyzer, 1 for each polarization channel
Clock power	> -17dBm at repetition rate
Repetition rate (direct measurement)	From 70 MHz to 900MHz
Repetition rate after modulation <sup>1</sup> (= Initial repetition rate / pattern length)	From 70MHz to NO UPPER LIMITATION Including 10, 40, 100, 400GHz, 1THz etc. For example At 100 Gbaud : use any pattern length between 100 and 1428 (PRBS 2 <sup>n</sup> -1, 2 <sup>n</sup> -1, 2 <sup>n</sup> -1, 2 <sup>n</sup> -1 included)
Measured modulation format	ALL
Optical spectral components measurement sensibility	-70dBm
Maximum temporal resolution	325fs
Measurement time	6nm/s (750GHz/s)

General specifications

X scale display	Wavelength in nm or frequency in GHz
Y scale display	Optical power in mW or dBm
Connectics	GPIO, Ethernet, Electrical trigger input port, USB, VGA
Power requirements	100 to 240 V AC, 50/60 Hz, approx. 350 VA
Environmental conditions	Operating temperature: +5 to +35°C Storage temperature: -10 to +50°C Humidity: 20 to 80% RH (no condensation)

## OSA and OCSA options

Option	Specifications	OSA-AP1	OSA-AP5 / OCSA-AP5 OSA-AP6 / OCSA-AP6
<b>Option OSA-APX-1 / OCSA-APX-1:</b> Continuous and step by step optical tunable laser source output	<b>Wavelength range</b>	Identical as the WL measurement range of the chosen model	
	<b>Spectrum Line width (@3 dB)</b>	1 MHz Typical	< 300 kHz
	<b>Output power</b>	C band: -3 dBm L band: -4 dBm C+L band: -6 dBm @ C band, -7 dBm @ L band	-4 dBm**
	<b>SMSR</b>	> 50 dBc	> 45 dBc
	<b>RIN</b>	-158 dB/Hz	
	<b>Wavelength stability</b>	1 pm @ 15 minutes, 2 pm @ 1 hour	+/- 1 pm @ 1 hour
	<b>Power stability</b>	0.07 dB @ 15 minutes, 0.09 dB 1 hour	
	<b>Fiber / connector type</b>	PM fiber FC/APC connector	
<b>Option OSA-APX-2 /OCSA-APX-2:</b> Optical tracking generator output for transmission measurement (SM or PM fiber output)	<b>Dynamic</b>	55 dB	60 dB
	<b>Resolution</b>	1 MHz	
<b>Option OSA-APX-3 /OCSA-APX-3:</b> 3 inputs	<b>Input connectors</b>	FC/APC for SM fiber input x1 FC/APC for PM fiber inputs x2	
<b>Option OSA-APX-4 / OCSA-APX-4:</b> Polarimeter	<b>Wavelength range</b>	1520 to 1610 nm	
	<b>Input power range</b>	-60 to +10 dBm	
	<b>Maximum sampling rate</b>	1 KS/s	
	<b>SOP accuracy</b>	+/- 0.25° (-30 to +2 dBm) ; < 2° (-35 to +5 dBm)	
	<b>Displaying modes</b>	Full Poincaré sphere, Jones graph, Stokes Oscilloscope	
	<b>Azimuth accuracy</b>	+/- 0.25° (-30 to +2 dBm)	
	<b>Ellipticity accuracy</b>	+/- 0.25° (-30 to +2 dBm)	
	<b>DOP accuracy</b>	+/- 0.5% (-35 to +5 dBm)	
	<b>Relative Power accuracy</b>	+/- 0.2% (-35 to +5 dBm)	
<b>Absolute Power accuracy</b>	+/- 0.1% (-35 to +5 dBm)		
<b>Option OSA-APX-5 / OCSA-APX-5:</b> Remote control by GPIB	<b>Ports</b>	Ethernet (standard) + GPIB (Optional)	
<b>Option OCSA-APX-6:</b> Group Delay and chromatic dispersion analysis	Possibility to measure the phase, the group delay and the chromatic dispersion of a component with an external reference signal (optical modulated signal or comb laser)		
<b>Option OSA-AP1-X</b>	additional 5 MHz (40 fm) and 100 MHz (800 fm) optical bandwidth filter resolution		

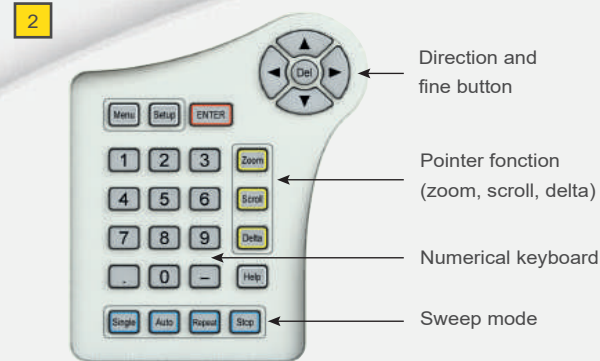
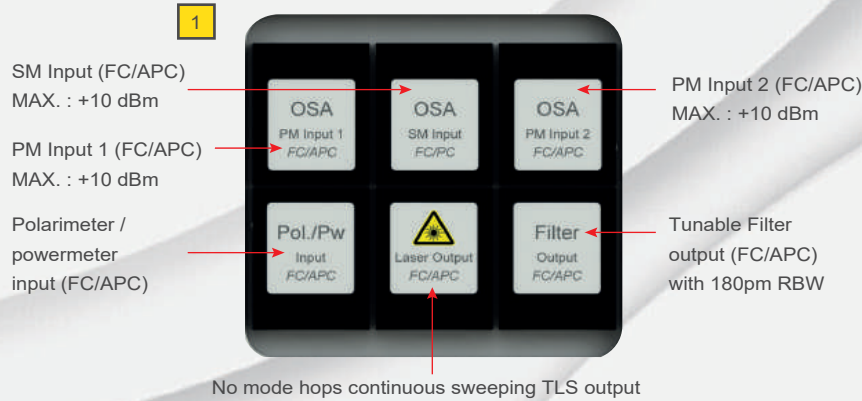
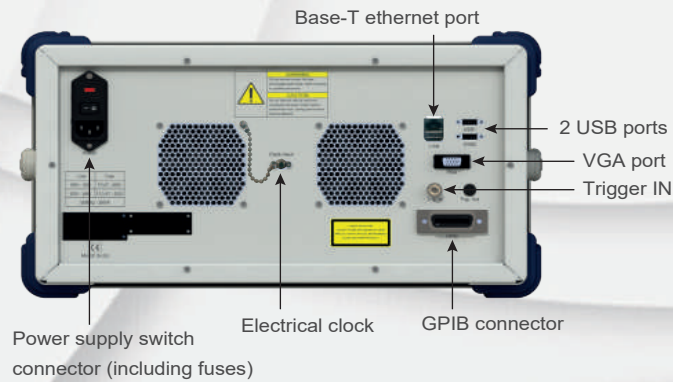
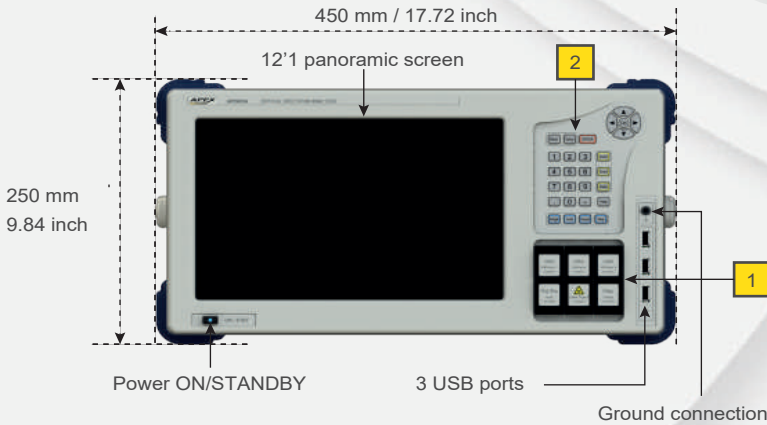
\*\* -7 dBm if 2 lasers are included  
-11 dBm if 3 or 4 lasers are included

# Stand-alone OSA/OCSEA Source Benchtop

APEX Technologies now proposes compact stand-alone benchtop with many possibilities of remote control technologies and a user-friendly interface.

## FULL OPTIONS OSA-APX OCSEA-APX

500 mm  
19.69 inch



# APEX TECHNOLOGIES

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