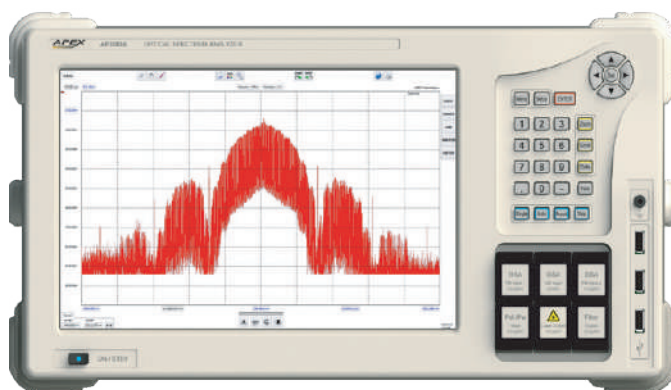


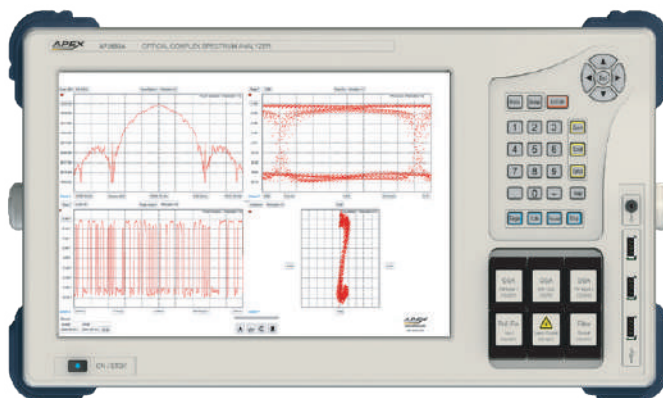
Optical Spectrum Analyzer

OSA-APX series



Optical Complex Spectrum Analyzer

OCSA-APX series



APEX Technologies

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

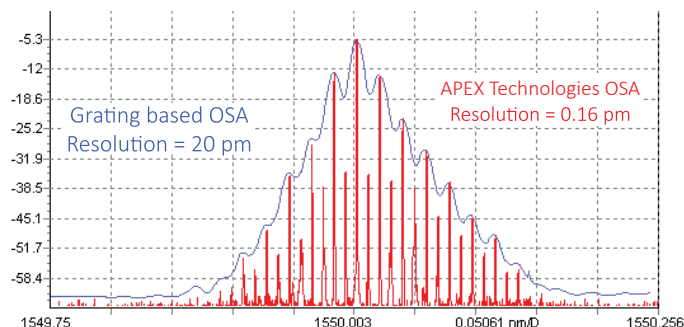
OSA-APX Series

Features

- From 5 MHz to 250 GHz resolution
- Now available at any wavelengths between 725 nm to 1650 nm
- +/- 2 pm wavelength accuracy
- High dynamic range
- Rectangular-shape resolution filters
- High close-in dynamic range
- Built-in tunable laser source

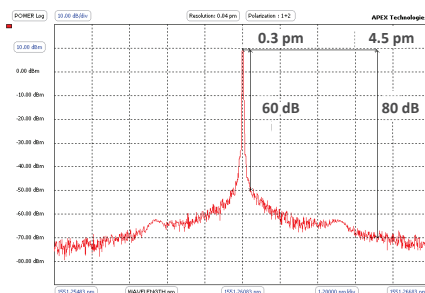
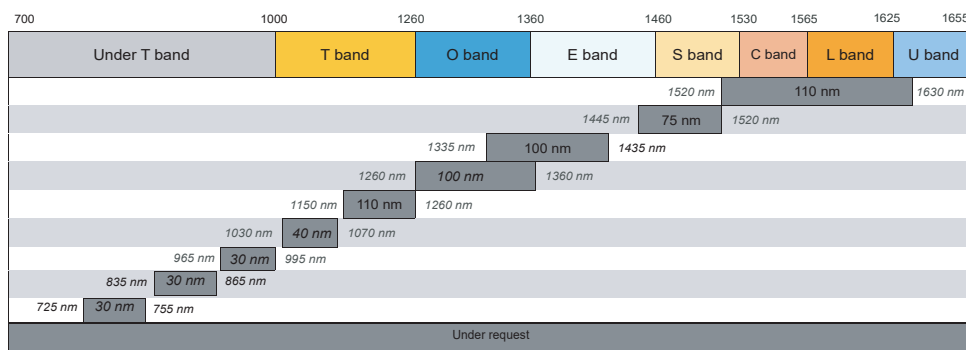
Applications

- 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 725 nm to 1650 nm



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.

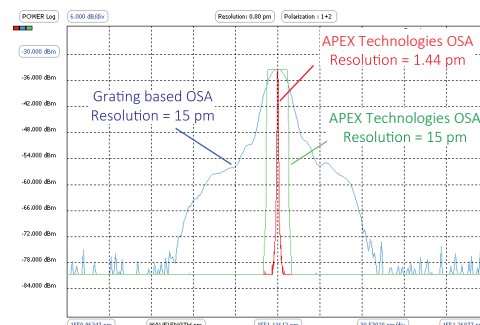
Thanks to these special electrical filter forms, the close-in dynamic range is very high :

- @ +/- 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

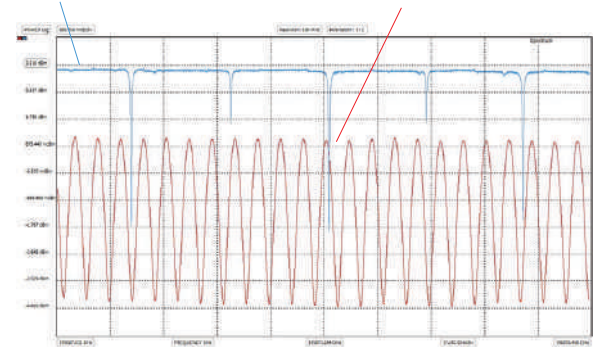
High wavelength accuracy

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



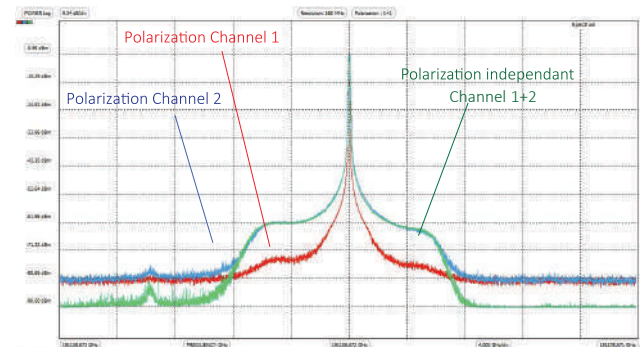
Two internal channels (one OSA per polarization axis)

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.

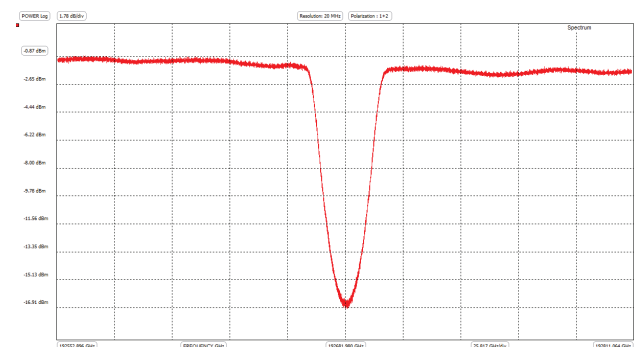


Tunable Laser Source & Tracking generator

- 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

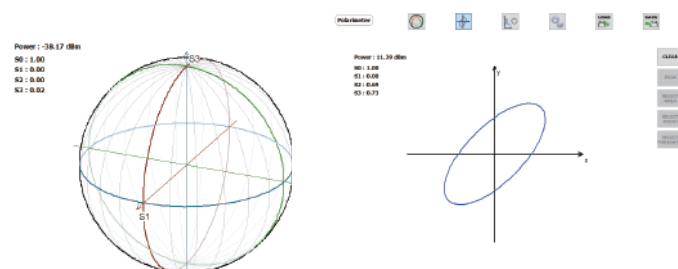
Optionally, the equipment can be used as a polarimeter (SOP and DOP measurement). Three different displaying modes exist: Jones graph, Poincaré sphere and Stokes parameter oscilloscope.

The SOP can be measured with an accuracy of $\pm 0.25^\circ$.

Polarization extinction ratio (PER) can be measured too

Jones Vector

Poincaré sphere



OPTICAL COMPLEX SPECTRUM ANALYZER FOR ADVANCED MODULATION ANALYSIS

OCSA-APX

Features

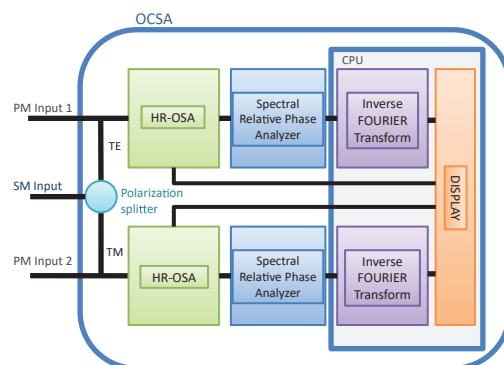
- From 5 MHz to 250 GHz resolution
- Now available at any wavelengths between 725 nm to 1650 nm
- +/- 2 pm wavelength accuracy
- High dynamic range
- Rectangular-shape resolution filters
- High close-in dynamic range
- Built-in tunable laser source
- No Baud rate limitation
- No modulation format limitation (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.

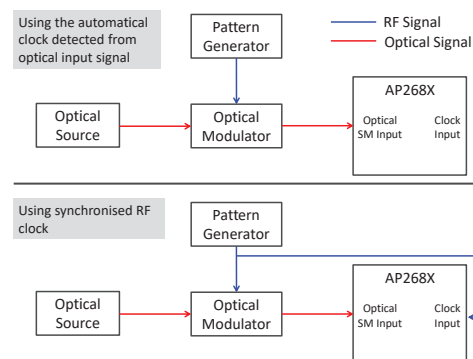
It means that you can see it as an utopist 3 THz bandwidth optical modulation analyzer without electronic limitation able to measure any modulated signal rates (from 70 Mbaud to ~ 1,5 Tbaud).

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.

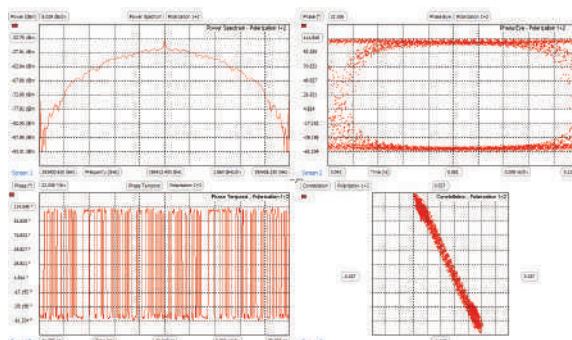
Complex measurement setup

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^{21}

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-AP2: Top of Line (around 740 nm)
- OSA-AP3: Top of Line (around 850 nm)
- OSA-AP4: Top of Line (around 980 nm)
- OSA-AP5: Top of Line (around 1064 nm)
- OSA-AP6: Top of Line Telecommunication range from 1150 to 1650 nm

STEP 2

Choose the built-in Tunable Laser(s) you want to integrate inside the equipment:

- OSA-AP1 (You can integrate up to 2 Tunable Lasers):
 - C band Laser (option OSA-AP1-1)
 - L band Laser (option OSA-AP1-2)
- OSA-AP2: Laser from 725 to 755 nm (option OSA-AP2-1)
- OSA-AP3: Laser from 840 to 870 nm (option OSA-AP3-1)
- OSA-AP4: Laser from 960 to 990 nm (option OSA-AP4-1)
- OSA-AP5: Laser from 1040 to 1070 nm (option OSA-AP5-1)
- OSA-AP6 (You can integrate up to 4 Tunable Lasers):
 - Laser from 1150 to 1250 nm (option OSA-AP6-1)
 - O band (option OSA-AP6-2)
 - E band (option OSA-AP6-3)
 - S band (option OSA-AP6-4)
 - C+L band (option OSA-AP6-5)
 - Extended C+L band (option OSA-AP6-6)

The built-in Tunable Laser(s) sweeping range(s) define(s) the OSA/OCSA measurement range(s)

STEP 3

Choose additional common option(s):

- OSA-APX-1: Tunable Laser output and software
- OSA-APX-2: Tracking Generator for component analysis
- OSA-APX-3: Three inputs (1 SM+ 2 PM inputs)
- OSA-APX-4: Polarimeter
- OSA-APX-5: GPIB remote control

Comparison of OSA series:

		OSA-AP1	OSA-AP2	OSA-AP3 &	OSA-AP4	OSA-AP5	OSA-AP6
Wavelength ranges (depending on built-in Tunable Laser(s) possibility(es))							
Around 740 nm			✓				
Around 850 nm				✓			
Around 980 nm					✓		
Around 1064 nm						✓	
Around 1200 nm							✓
O band							✓
E band							✓
S band							✓
C band		✓					
L band		✓					
C+L bands							✓
Extended C+L bands							✓
Resolution Bandwidth							
Optical filter bandwidth resolutions	5 MHz	Optional	✓	✓	✓	✓	✓
	20 MHz	✓	✓	✓	✓	✓	✓
	100 MHz	Optional	✓	✓	✓	✓	✓
	140 MHz	✓	✓	✓	✓	✓	✓
Virtual bandwidth resolutions		✓	✓	✓	✓	✓	✓
Built-in Tunable Laser source type							
DFB Lasers array		✓					
External cavity laser (Littman -Metcalf principle)			✓	✓	✓	✓	✓
Sweep Speed (Max.)							
1.2 nm/s		✓					
35 nm/s			✓	✓	✓	✓	✓
Possibility to integrate several Tunable Lasers							
Built-in Tunable Laser(s) room		2 Lasers room	1 Laser room	1 Laser room	1 Laser room	1 Laser room	4 Lasers room
Complex measurement							
Complex analysis (intensity, phase, chirp vs. time); constellation, eye diagram			✓ OCSA-AP2 ✗ OSA-AP2	✓ OCSA-AP3 ✗ OSA-AP3	✓ OCSA-AP4 ✗ OSA-AP4	✓ OCSA-AP5 ✗ OSA-AP5	✓ OCSA-AP6 ✗ OSA-AP6
Possibility to upgrade an OSA-APX into an OCSA-APX							

	OSA-AP1		OSA-AP2	OSA-AP3	OSA-AP4	OSA-AP5	OSA-AP6					
Wavelength measurement range ^a	Option	Option	Option	Option	Option	Option	Option	Option	Option	Option	Option	Option
	OSA-AP1-1: From 1526 to 1567 nm	OSA-AP1-2: From 1567 to 1608 nm	OSA-AP2-1 : Center wavelength 740 nm	OSA-AP3-1 : Center wavelength 850 nm	OSA-AP4-1: Center wavelength 980 nm	OSA-AP5-1: 1040 nm to 1070 nm	OSA-AP6-1: 1150 nm to 1260 nm	OSA-AP6-2 : 1260 nm to 1360 nm	OSA-AP6-3 : 1335 nm to 1435 nm	OSA-AP6-4 : 1445 nm to 1520 nm	OSA-AP6-5 : 1525nm to 1607 nm	OSA-AP6-6 : 1520nm to 1630 nm
Wavelength span range ^a	8pm to 41nm	8pm to 41 nm	8pm to 30 nm	8pm to 30nm	8pm to 30nm	8pm to 30nm	8pm to 100nm	8pm to 100nm	8pm to 100nm	8pm to 75nm	8pm to 82nm	8pm to 110nm
Wavelength resolution (@3dB) ^a	5MHz/0.04pm and 100MHz/0.8pm (standard resolution included with OSA-AP2, OSA-AP3, OSA-AP4, OSA-AP5, OSA-AP6 ; Optional for OSA-AP1 with option OSA-AP1-3) 20MHz/0.16pm 140MHz/1.12pm Optical virtual bandwidth resolutions											
Absolute wavelength accuracy ^b	+/- 2pm Typ. (+/- 3pm Max.)											
Wavelength repeatability	< 0.5pm (standard deviation over 20 measures)											
Dynamic range ^d	C band ^c : 86 dB L band /C+L band ^c : 83 dB		79dB ^h								87dB ^h	
Close-in dynamic range	>40dB ^c @ +/- 1.3pm >60dB ^c @ +/- 8pm; >80dB ^c @ +/- 30pm		>40dB ^h @ +/- 0.1pm; >60dB ^h @ +/- 0.4pm; >80dB ^h @ +/- 6pm									
Spurious free dynamic	55dB Typical(50dB min) ⁽¹⁾ c		55dB Typical(50dB min) ⁽¹⁾ h									
Measurement level range ^d	C band ^c : -76 dBm to +10 dBm L band/C+L band ^c : -76dBm to +10 dBm		-73 to +10dBm ^h					-69dBm to +10dBm ^h	-73 to +10dBm ^h			
Absolute level accuracy ^{a e f}	+/- 0.3dB ⁽²⁾ (monochromatic input signal)											
Level repeatability ^f	< +/- 0.1dB (monochromatic input signal ; standard deviation over 20 measures)											
Sweep time	Max. 35nm/s (filter resolution 100MHz)											
Optical input	FC/PC for SM fiber (other connectors under request)											
Dimensions	OSA-AP1 : W x H x D : 488 x 242 x 380.1 mm / 15.27 x 9.57 x 14.96 inch ; OSA-AP2, OSA-AP3, OSA-AP4, OSA-AP5, OSA-AP6 : W x H x D : 450 x 250 x 500 mm / 17.72 x 9.84 x 19.69 inch											
Weight	OSA-AP1 : Around 18 kg / 39.68 lbs (depending on options) OSA-AP2, OSA-AP3, OSA-AP4, OSA-AP5, OSA-AP6 : Around 13 kg / 28.66 lbs (depending on options)											

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 ¹ (= 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 ⁿ -1, 2 ⁿ -1, 2 ⁿ -1, 2 ⁿ -1 indet)
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

	OSA-AP1/OCSA-AP1	OSA-AP2/OCSA-AP2, OSA-AP3/OCSA-AP3, OSA-AP4/OCSA-AP4, OSA-AP5/OCSA-AP5, OSA-AP6/OCSA-AP6
Tunable Laser Source Specifications (Option OSA-APX-1/OCSA-APX-1)		
Wavelength range	Identical as the WL measurement range of the chosen model	
Spectrum line width (@3dB)	3MHz Typical	
Output power ^a	- C-Band : -3dBm - L-Band : -4 dBm Typical - C+L Band : -6dBm @ C-Band, -7 dBm @ L-band	>-10 dBm
SMSR	> 50dBc	> 45dBc
ASE	< 50dBc over 0.1nm	
RIN	-135dB/Hz	
Wavelength stability	1pm @ 15 minutes, 2pm @ 1 hour	+/- 1pm @ 1 hour
Power stability	0.07dB @ 15 minutes, 0.09dB @ 1 hour	
Fiber/connector type	PM fiber FC/APC connector	
Optical tracking generator specifications (Option OSA-APX-2/OCSA-APX-2)		
Dynamic ^g	55dB	60dB
Resolution	1MHz	
3 inputs (Option OSA-APX-3/OCSA-APX-3)		
Input connectors	FC/PC for SM fiber input x1 FC/APC for PM fiber inputs x2	
Polarimeter (Option OSA-APX-4/OCSA-APX-4)		
Wavelength range	1520 to 1610 nm	
Input power range	-60 to +10 dBm	
Maximum sampling rate	1KS/s	
SOP accuracy	+/-0.25° (-30 to +2 dBm) ; < 2° (-35 to+5 dBm)	
Displaying modes	Full Poincaré sphere, Jones graph, Oscilloscope	
Azimuth accuracy	+/-0.25° (-30 to +2 dBm)	
Ellipticity accuracy	+/-0.25° (-30 to +2 dBm)	
DOP accuracy	+/-0.5% (-35 to +5 dBm)	
Relative Power accuracy	+/-0.2% (-35 to +5 dBm)	
Absolute Power accuracy	+/-1% (-35 to +5 dBm)	
Remote control by GPIB (Option OSA-APX-5/OCSA-APX-5)		
Ethernet (standard) + GPIB (Optional) ports for remote control		
Group delay and chromatic dispersion analysis (Option OCSA-APX-6)		
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)		

- a) Typical
b) After wavelength calibration
c) Resolution 20MHz
d) 4 dB dynamic loss in case of polarimeter
e) At 1550 or 1310 nm and 0dBm
f) All resolutions except 5MHz
g) Resolution 140MHz
h) Resolution 5MHz
i) If modulation frequency = initial repetition rate

- 1) Inside spurious free dynamic
2) Relative to total signal power
Otherwise: possible power offset
 $< 10^{-6} \times \text{Total signal power (mW)}$

Stand-alone OSA/OCSA Source Benchtop

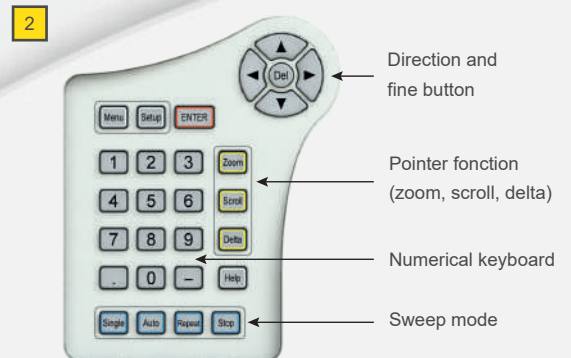
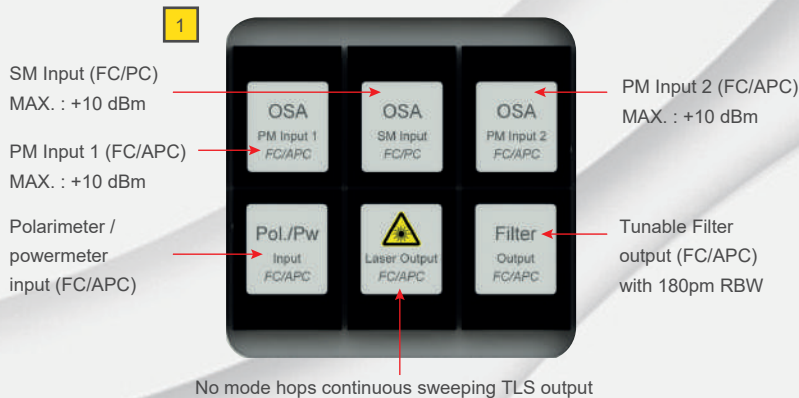
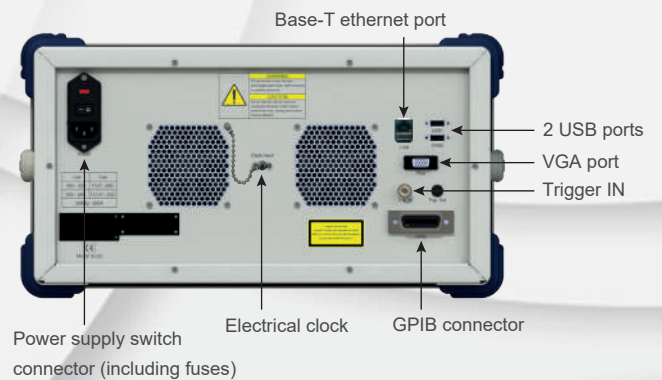
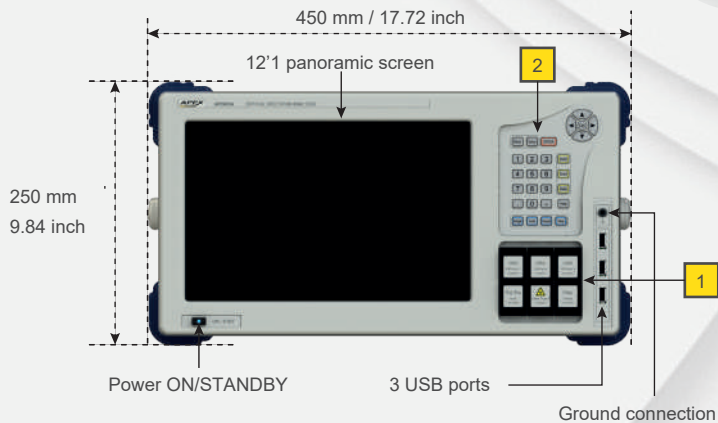
APEX Technologies now proposes compact stand-alone benchtop with many possibilities of remote control technologies and a user-friendly interface.

FULL OPTIONS OSA-APX OCSA-APX

500 mm
19.69 inch

Interlocking feet

Handles



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