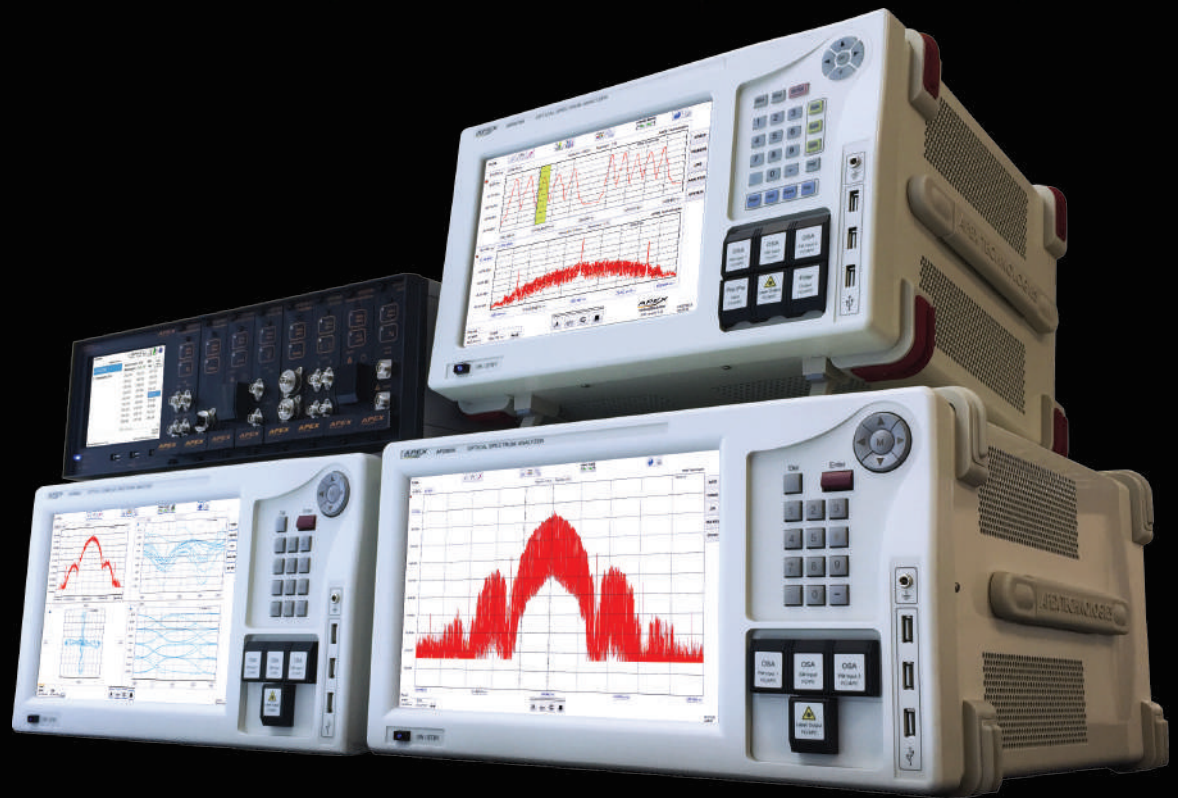


APEX Technologies

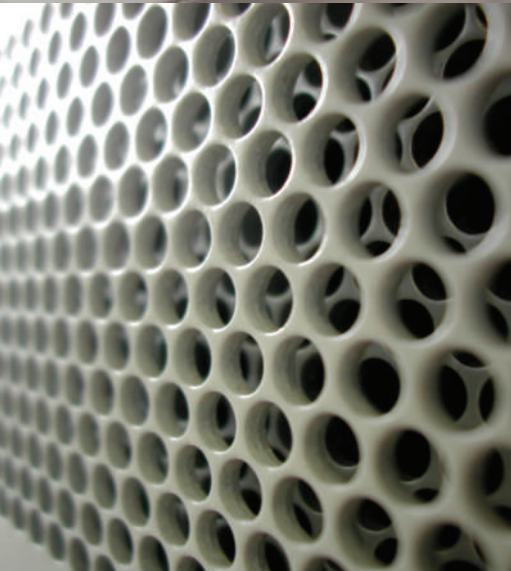
OPTICAL TEST & MEASUREMENT

Catalog



APEX
TECHNOLOGIES

Experts in next generation test equipment



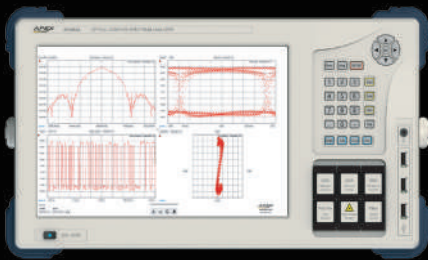
Experts in next generation test equipment

Founded in 1998, APEX Technologies is located in the south of Paris in France. For over 23 years, we have focused on developing and manufacturing innovative ultra high performance test equipment intended for fiber optic telecommunications research. Since introducing the world's first commercially available ultra high resolution optical spectrum analyser, APEX Technologies has also been dedicated to the continued development of the optical measurement area. Our experience means we know that innovations never cease and we are driven by the "knowledge is power" policy in order to stay at the top of the advanced technology.

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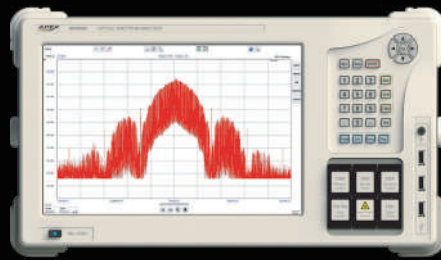
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OPTICAL SPECTRUM ANALYZERS



Complex OSA

Combination of High Resolution OSA and Optical Modulation Analyzer



Top of the line OSA

The best specifications
Ultra High Resolution OSA



Cost effective OSA

The best performance-price ratio
High Resolution OSA

STAND-ALONE BENCHTOP INSTRUMENTS



Tunable Laser Source

Various broadband wavelength range TLS



ASE source

Various broadband ASE sources



Polarimeter

Versatile polarimeter

MULTI-TESTS PLATFORMS



Plug-in Modules

Tunable Laser Source, DFB Laser Source, Optical Amplifier (EDFA), Power Meter, Variable Optical Attenuator, Polarimeter, Optical Tunable Filter, Optical Switch



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

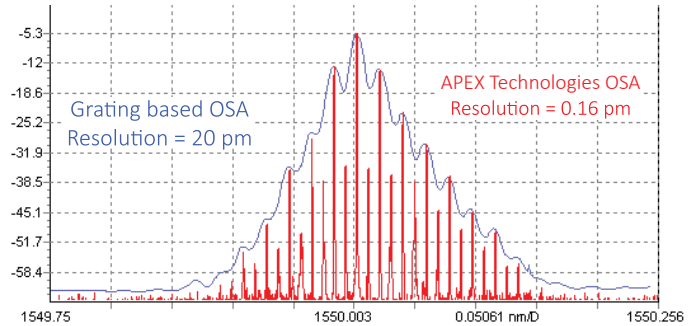
OSA-APx Series

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

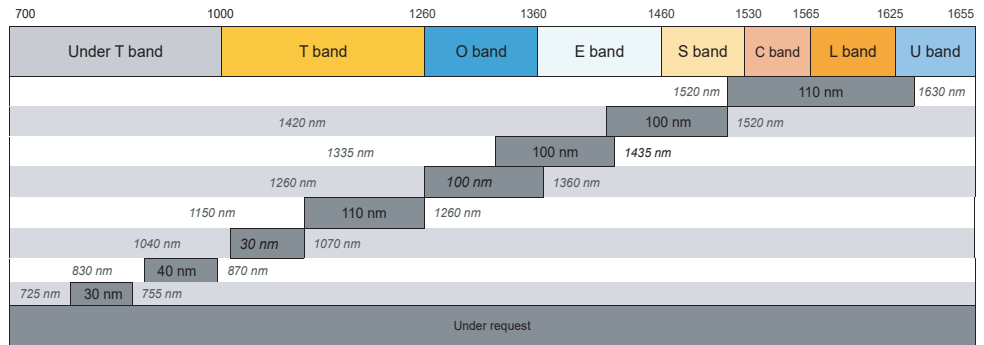
Applications

- 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

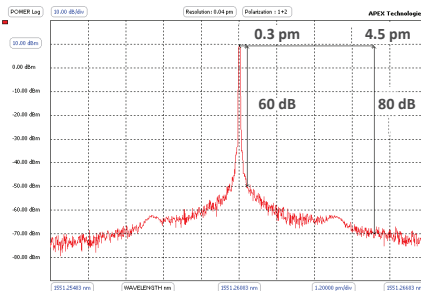


High close-in dynamic range

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 :

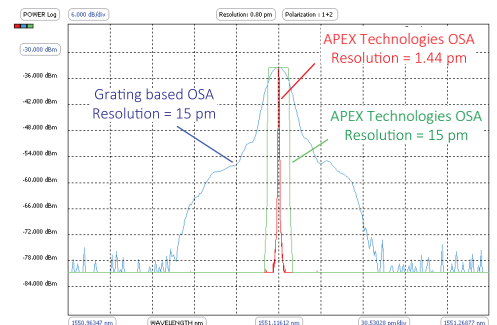
- @ +/- 0.1 pm from the peak, dynamic > 40 dB
 - @ +/- 0.4 pm from the peak, dynamic > 60 dB
 - @ +/- 6 pm from the peak, dynamic > 80 dB
- The high close-in dynamic range helps to well separate optical peaks which are extra-close to each other.



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.

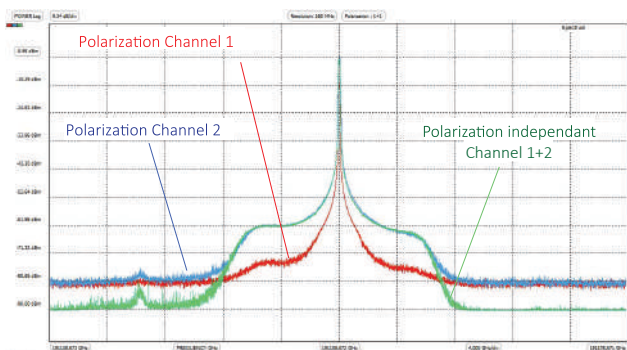
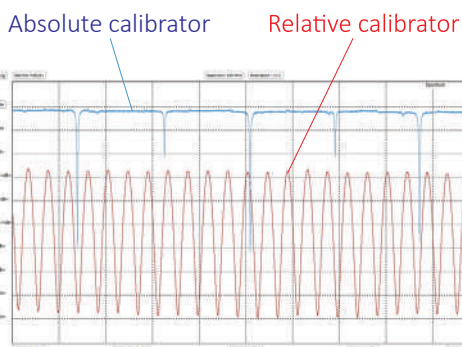


APEX Technologies and grating based OSA wavelength resolution filters shapes comparison

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.



Two internal channels (one OSA per polarization axis)

SM input independent of polarization:

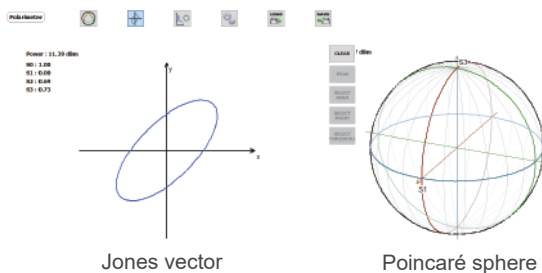
The input signal is split into two orthogonal polarization axis and analysed simultaneously by two internal independent channels. By using this method, APEX OSA can display the two polarization channels separately or recombine them and display a polarization independent measurement.

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.

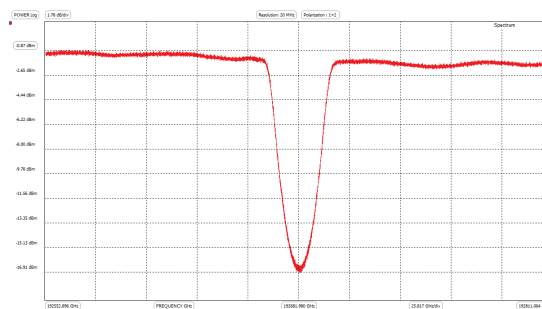
Polarization analysis

Optionally, the equipment can be used as a polarimeter (SOP and DOP measurement). Three different displaying modes exist: Jones graph, Poincaré sphere and Stokes parameters oscilloscope. The SOP can be measured with an accuracy of +/- 0.25°. Polarization extinction ratio (PER) can be measured too.



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 optical 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

OPTICAL COMPLEX SPECTRUM ANALYZER FOR ADVANCED MODULATION ANALYSIS

OCSA-APX

Features

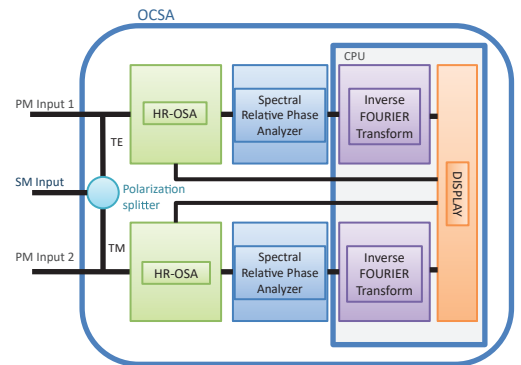
- From 5 MHz to 250 GHz resolution
- Now available at any wavelengths between 725 nm to 1650 nm
- +/- 2 pm wavelength accuracy
- High dynamic range
- Rectangular-shape resolution filters
- High close-in dynamic range
- Built-in tunable laser source
- No Baud rate limitation
- No modulation format limitation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

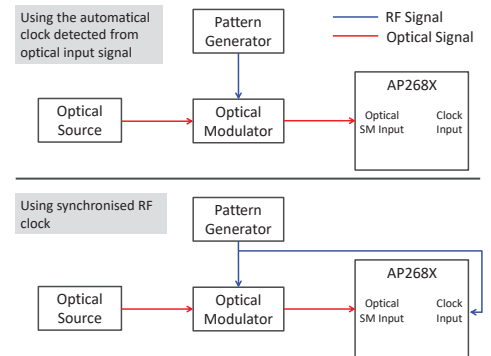


OCSA time-domain measurement advantages

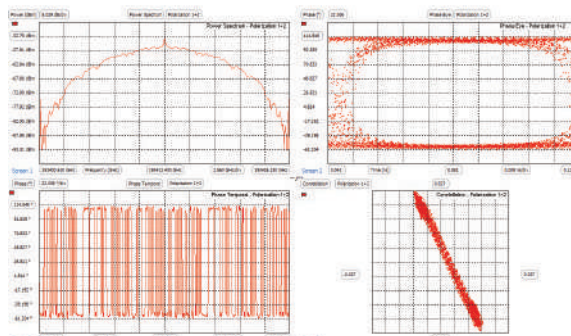
Contrary to standard optical modulation analyzers and thanks to the fact that the measurement is made in the spectral domain, APEX Technologies OCSA have no real rate-limitation. It means that you can see it as an utopist 3 THz bandwidth optical modulation analyzer without electronic limitation able 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 2^7-1

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-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)

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

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

Comparison of OSA Series:

		OSA-AP1	OSA-AP2 & OCSA-AP2	OSA-AP3 & OCSA-AP3	OSA-AP4 & OCSA-AP4	OSA-AP5 & OCSA-AP5	OSA-AP6 & OCSA-AP6
Wavelength ranges (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 X OSA-AP2	√OCSA-AP3 X OSA-AP3	√OCSA-AP4 X OSA-AP4	√OCSA-AP5 X OSA-AP5	√OCSA-AP6 X OSA-AP6
Possibility to upgrade an OSA-APX into an OCSA-APX							
Upgradable equipment			√	√	√	√	√
Possibility to upgrade with additional built-in Tunable Laser(s)							
Upgradable equipment		√					√

	OSA-AP1		OSA-AP2	OSA-AP3	OSA-AP4	OSA-AP5	OSA-AP6					
Wavelength measurement range ^a	Option OSA-AP1-1: From 1526 to 1567 nm	Option OSA-AP1-2: From 1567 to 1608 nm	Option OSA-AP2-1 : Center wavelength 740 nm	Option OSA-AP3-1 : Center wavelength 850 nm	Option OSA-AP4-1: Center wavelength 980 nm	Option OSA-AP5-1: 1040 nm to 1070 nm	Option OSA-AP6-1: 1150 nm to 1260 nm	Option OSA-AP6-2 : 1260 nm to 1360 nm	Option OSA-AP6-3 : 1335 nm to 1435 nm	Option OSA-AP6-4 : 1445 nm to 1520 nm	Option OSA-AP6-5 : 1525nm to 1607 nm	Option OSA-AP6-6 : 1520nm to 1630 nm
Wavelength span range ^a	1nm to 41nm	1nm to 41 nm	1nm to 30 nm	1nm to 30nm	1nm to 30nm	1nm to 30nm	1nm to 100nm	1nm to 100nm	1nm to 100nm	1nm to 75nm	1nm to 82nm	1nm 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 ⁱ (= 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 ¹ -1, 2 ² -1, 2 ³ -1, 2 ³¹ -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	GPIB, 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 ⁹	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 x Total signal power (mW)

OPTICAL FREQUENCY DOMAIN REFLECTOMETER (OFDR)

New

OFDR-APX

Features

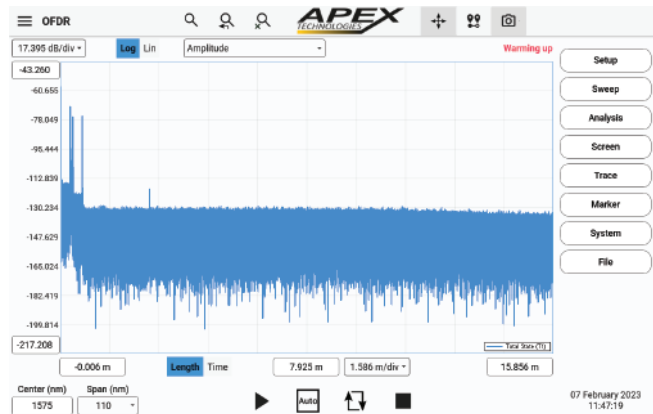
- Ranges from 1520 nm to 1630 nm
- Resolution < 8 μ m
- Measurement range up to 350 m
- High dynamic range of 110 dB

Applications

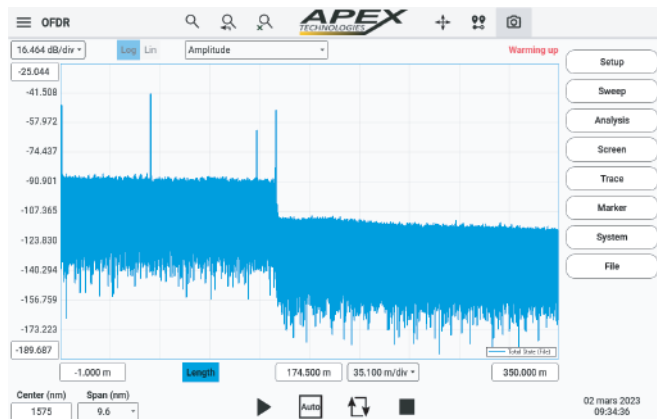
- Photonic Integrated Circuit (PIC)
- Optical communications
- Passive optical components (Switches, waveguides, filters...)
- Verify the quality of fiber connector and slices
- Optical cable maintenance and construction

APEX Technologies OFDR-APX series is an Optical Frequency Domain Reflectometer with high resolution < 8 μ m, a dynamic range of 110 dB and a measurement range up to 350 m. Our system is able to analyze the back reflection and transmission characteristics of fiber optic devices/components in the spatial domain. This allows the measurement of reflection, transmission, return loss and polarization effects of fiber components and within photonic integrated circuits. The system produces a trace like an OTDR (Optical Time Domain Reflectometer), but with much higher resolution and precision

Full span high resolution short length mode



OFDR measurement with 350 m measurement range

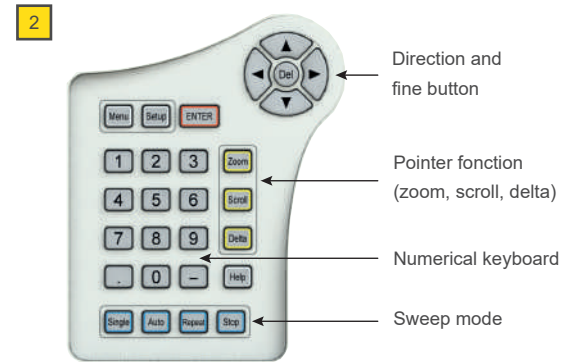
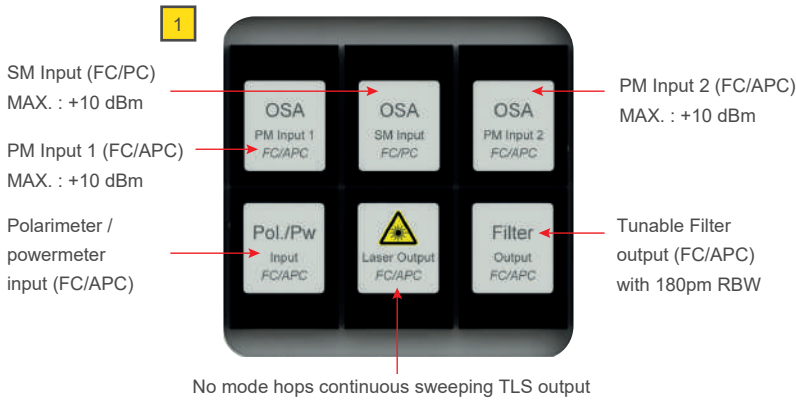
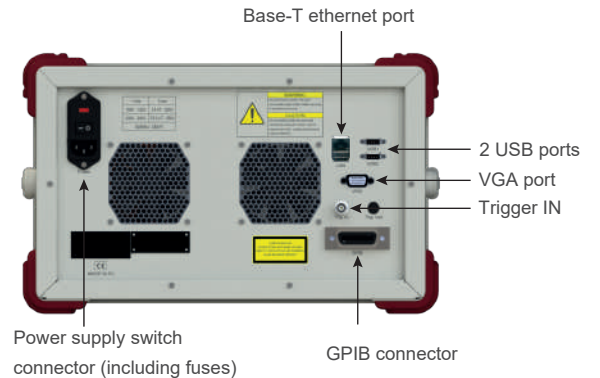
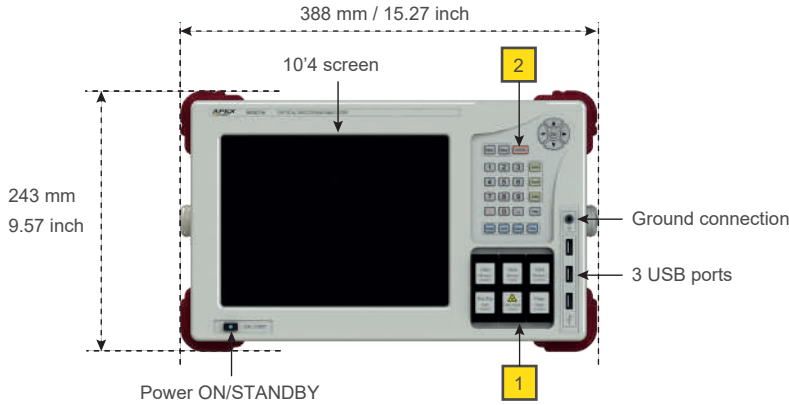


Specifications:

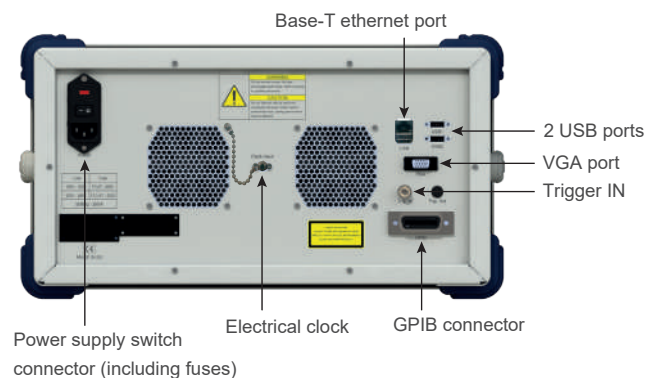
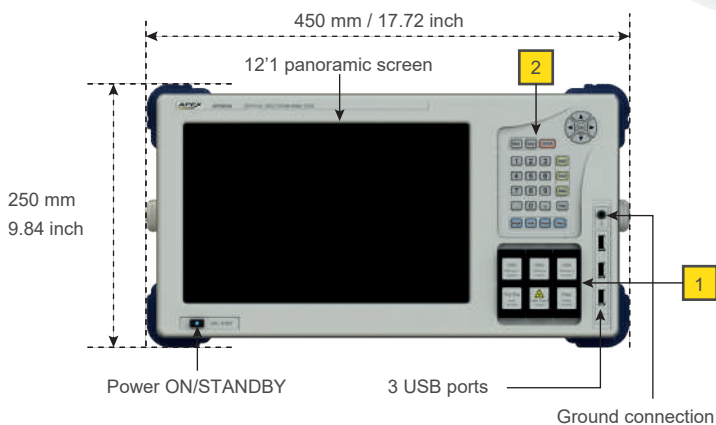
Parameter	Specification
Wavelength range*	1520 – 1630 nm
Measurement range*	16, 60, 350 m
Spatial resolution	7.74, 15.36, 92.03 μ m
Return loss dynamic range	110 dB
Insertion loss dynamic range	18 dB
Sensitivity	-125 dB
Insertion loss and return loss resolution	\pm 0.05 dB

* Can be customized under request

FULL OPTIONS OCSA-APX



FULL OPTIONS OCSA-APX OSA-APX OFDR-APX



STAND-ALONE BENCHTOP OPTICAL INSTRUMENTS

New

**TLS-APX
PAL-APX
ASE-APX**

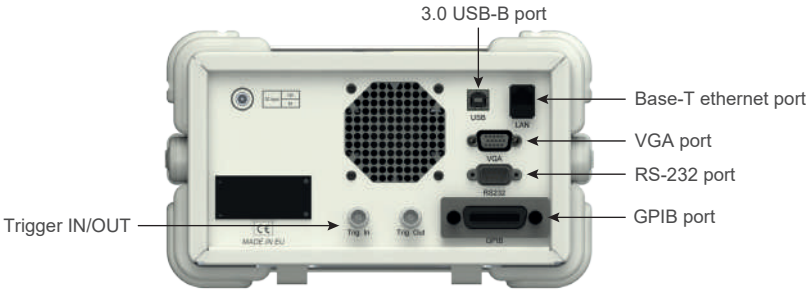
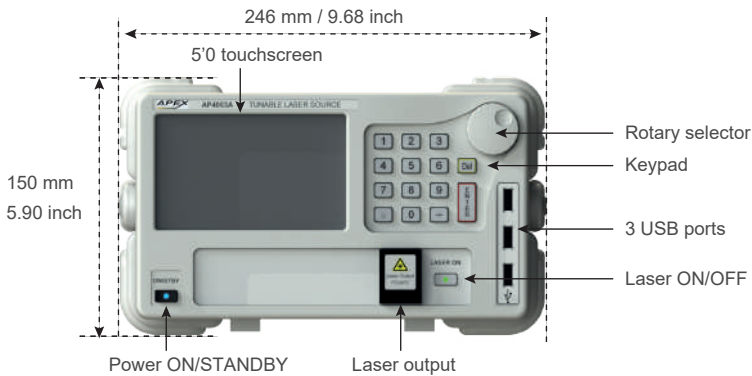
Features

- A variety of compact optical instruments
- GPIB, Ethernet, RS-232 or USB remote control
- Trigger in and out
- Internal memory
- Keypad, rotary selector and three USB connectors
- 5.0 inch touchscreen and VGA output

Instruments

- Wide wavelength range Tunable Laser Source
- Broadband Amplified spontaneous emission source
- Polarimeter

Apex Technologies now proposes compact stand-alone benchtop optical instruments, including several Tunable Laser Sources with wide and various wavelength ranges, broadband Amplified Spontaneous Emission sources with a choice of wavelength ranges and a polarimeter. They come with many possibilities of remote control technologies and a user-friendly interface

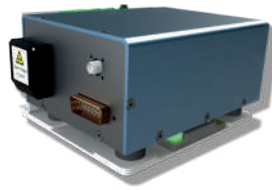


Specifications:

	Stand-alone benchtop optical instruments
Connector type	FC/APC (other connectors on demand)
USB-A connectors	3 USB-A 2.0 ports (enables keyboard, mouse and USB stick)
USB remote control	Yes, Via USB-B 3.0 port
Ethernet	Yes
GPIB	Yes
RS-232	Yes
Internal memory	64 Gbit
File format	txt, bmp and setup file formats
Display	5.0" touchscreen pad and VGA port
Dimensions	W x H x D: 246 x 150 x 341 mm / 9.68 x 5.90 x 13.42 inch
Weight	Average: 4.5 kg / 9.92 lb
Environmental conditions	Operating temperature: +5 to +35°C Storage temperature: -10 to +50°C Humidity: 20 to 80% RH (no condensation)
Power requirement	Furnished AC Adaptor with 12V/5A DC output, power 60W

Wide wavelength range Tunable Laser Source

The TLS-APBX/TLS-APX is a high performance external cavity Littman/Metcalf tunable laser source combining wide tuning range, high output power and high signal-to-noise ratio

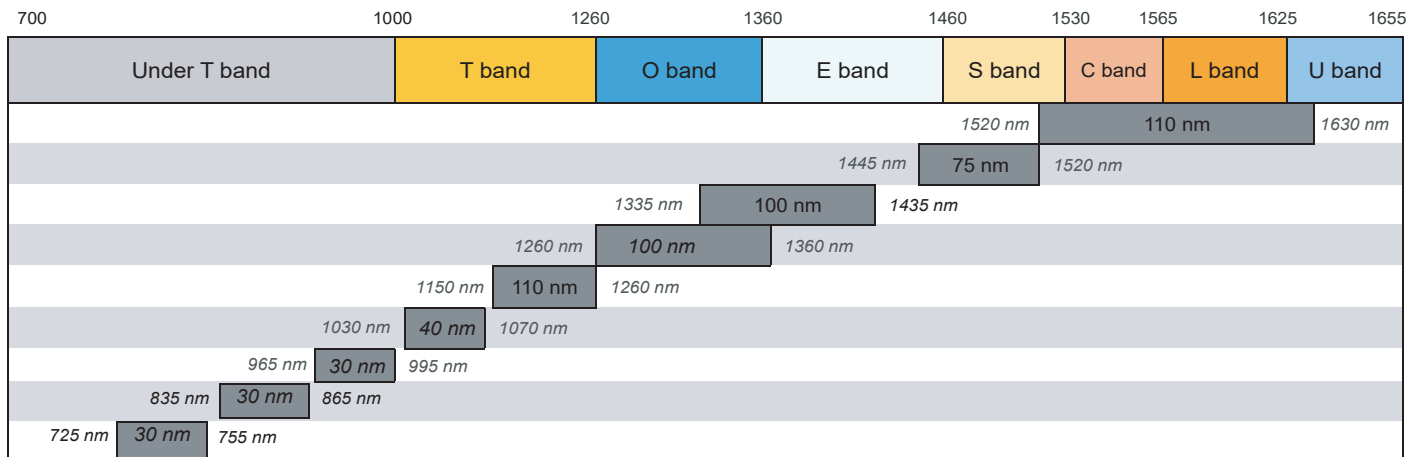


Features:

- Mode-hop-free continuous sweeping
- High output power: up to +13 dBm
- Narrow Linewidth: < 500 kHz
- High SMSR: > 45 dB
- Wavelength accuracy: +/- 5 pm
- GPIB, Ethernet, RS-232 and USB-B control
- Fine tuning piezo control
- Wavelength etalon option

TLS-APBX (Benchtop version)

TLS-APX (OEM version)



TLS-APBX/TLS-APX model	Wavelength range (nm)	Peak Output Power* (dBm)	Full span output power (dBm)
TLS-APB-1/TLS-AP-1	725-755	10	6
TLS-APB-2/TLS-AP-2	835-855	10	6
TLS-APB-3/TLS-AP-3	965-995	10	6
TLS-APB-4/TLS-AP-4	1030-1070	13	9
TLS-APB-5/TLS-AP-5	1150-1250	10	6
TLS-APB-6/TLS-AP-6	1260-1360	13	9
TLS-APB-7/TLS-AP-7	1335-1435	13	9
TLS-APB-8/TLS-AP-8	1445-1520	10	6
TLS-APB-9/TLS-AP-9	1525-1607	10	6
TLS-APB-10/TLS-AP-10	1520-1630	10	6

Common specifications	
Wavelength setting resolution	1 pm
Wavelength stability	± 1 pm
Absolute Wavelength accuracy @ 25°C (+/- 1) *	+/- 1 pm (typical)
Wavelength repeatability*	+/- 1 pm (typical)
Power flatness (Step mode)	0.05 dB
Power flatness (Sweep mode)	0.3 dB
Sweep speed	Adjustable from 5 to 100 nm/s
Fine tuning scan range (input piezo control)	≥ 3 GHz
Power stability @ 24h	+/- 0.2 dB
Power repeatability (Step mode)	+/- 0.05 dB
Dynamic power repeatability (Sweep mode @ 10 nm/s)	+/- 0.01 dBm
Dynamic power repeatability (Sweep mode @ 100 nm/s)	+/- 0.06 dBm
RIN	-135 dB/Hz
Lorentzian linewidth (Fundamental)	60 kHz
Linewidth (Integration over 50 ms)	500 kHz
SMSR	≥ 45 dB/0.1 nm
Signal to total source spontaneous emission ratio	≥ 50 dB (typical)

* Maximum absolute wavelength accuracy +/- 4 pm

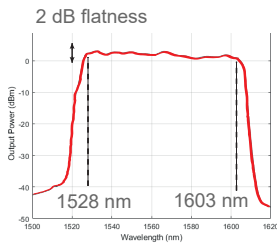
Broadband Amplified Spontaneous Emission source



Features:

- Large band: T, C, L or C+L band
- High output power: up to +23 dBm
- High output power stability
- Spectrum flatness: ~2 dB
- Isolated output
- GPIB and Ethernet control

Spectrum of ASE-AP1



obtained with OSA-AP4 with 0.1nm resolution

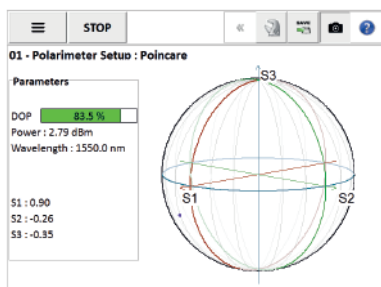
ASE-APX	Specifications
ASE-AP1	From 1529 to 1570 nm (C band)
Option ASE-AP1-1	Output power: +20 dBm
Option ASE-AP1-2	Output power: +21 dBm
Option ASE-AP1-3	Output power: +23 dBm
ASE-AP2	From 1568 to 1603 nm (L band)
Option ASE-AP2-1	Output power: +20 dBm
Option ASE-AP2-2	Output power: +21 dBm
Option ASE-AP2-3	Output power: +23 dBm
ASE-AP3	From 1529 to 1603 nm (C+L band)
Option ASE-AP3-1	Output power: +20 dBm
Option ASE-AP3-2	Output power: +21 dBm
Option ASE-AP3-3	Output power: +23 dBm
ASE-AP4	From 1035 to 1083 nm (T band)
Option ASE-AP4-1	Output power: +20 dBm
Output isolation (common)	30 dB
Output power stability (common)	0.02 dB
Spectrum flatness	2 dB for the ASE-AP1, ASE-AP2 & ASE-AP3 8 dB for the ASE-AP4

Polarimeter

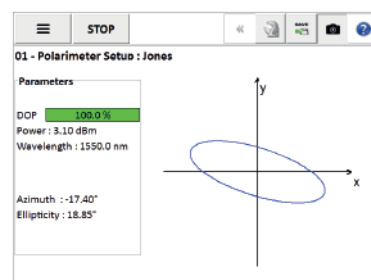


Features:

- Four Stockes parameters measurement
- Instantaneous state of polarization (SOP)
- Degree of polarization of input light (DOP)
- Three different displaying modes: Jones graph, Poincaré sphere and Stockes parameters oscilloscope
- Extinction ratio measurements of polarizers or alignment of PM fiber
- PER measurement **New**

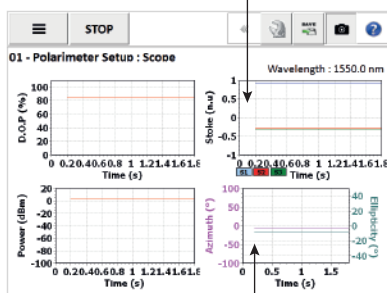


Poincaré sphere



Jones graph

Stockes parameters S1, S2, S3 vs. Time



Azimuth / Ellipticity vs. Time

Stockes parameters oscilloscope

	Pol-AP1
Wavelength range	1520nm to 1610nm
Input power range	-60dBm to +10dBm
Maximum sampling rate	333 S/s
SOP accuracy	+/- 0.25° (-30 to +2 dBm) < 2° (-35 to +5 dBm)
Measurable SOP states	Full Poincaré sphere
Azimuth accuracy	+/- 0.25° (-30 to +2 dBm)
Ellipticity accuracy	+/- 0.25° (-30 to +2 dBm)
DOP accuracy	+/- 0.5% (-35 to +5 dBm)
Rel. power meas. accu	+/- 0.2% (-35 to +5 dBm)
Abs. power meas. accu	+/- 1% (-35 to +5 dBm)

HIGH PERFORMANCE & COST EFFECTIVE OPTICAL MULTITEST PLATFORM

BUILD YOUR OWN FLEXIBLE MULTI-TEST SYSTEM

AP1000-2
AP1000-5
AP1000-8
AP1000-12

Features

- A variety of measurement modules
- Three USB connectors on the front panel
- Internal memory
- GPIB and Ethernet remote control
- .txt file format
- 5.7 inch touchscreen

Modules

- Tunable Laser Source
- DFB Laser
- Optical Power Meter
- Optical Amplifier (EDFA)
- Optical Variable Attenuator
- Optical Tunable Filter
- Optical Switch
- Polarimeter



AP1000-2 mainframe controller:
- Accepts up to two modules



AP1000-5 mainframe controller:
- Accepts up to five modules



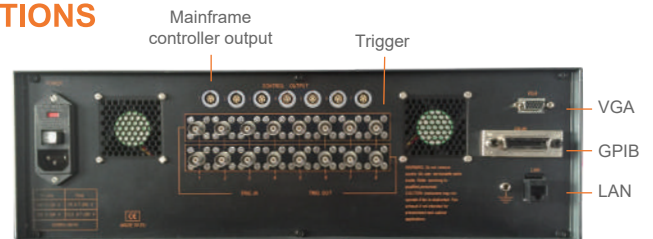
AP1000-8 mainframe controller:
- Accepts up to eight modules
- Can control up to seven AP1000-12 (92 modules in total)



AP1000-12 mainframe controller extension:
- Accepts up to twelve modules
- Can be controlled by an AP1000-8 or work independently by remote control
- Allows the system to integrate up to 92 test modules using a single AP1000-8

MULTIPLE CONNECTIONS

- VGA connector
- USB connectors
- GPIB control
- LAN connector
- Optional mainframe controller output
- Optional trigger function



AP1000-8 back

SPECIFICATIONS

	AP1000-2	AP1000-5	AP1000-8	AP1000-12
Module slot	2	5	8	12
Internal memory	64 Gbit			
File format	txt, bmp and setup file formats			
GPIB connector	Yes			
Ethernet connector	Yes			
USB connectors	3	3	3	0
Mainframe controller outputs	No	No	7	No
Screen	Yes	Yes	Yes	No
Dimensions (mm)	236x135x477	340x135x477	460x135x477	460x135x477
Mainframe weight (kg)	4.2	4.8	5.7	5.7
Modules weight (kg)	Average: 0.65			
Environmental conditions	Operating temperature: +5 to +35°C Storage temperature: -10 to +50°C Humidity: 20 to 80% RH (no condensation)			
Power requirement	AC 100-200V or 200-250V, 50/60Hz			

EQUIPMENT CONTROL

- Touchscreen
- Mouse and keyboard (three USB ports)

REMOTE CONTROL

- Control and perform data transfer with a computer through GPIB or ethernet
- Remote control of the equipment through Internet

Tunable Laser Source modules

VERY GOOD PERFORMANCE TO PRICE RATIO SOLUTIONS



Features:

- Continuous sweeping
- ITU channels selection
- Narrow linewidth: ~ 300 kHz
- High output Power: maximum +13 dBm
- Ultra high wavelength accuracy: +/- 6 pm
- High SMSR: > 47 dB
- Narrow wavelength setting resolution: < 1pm

Software features:

- Output modes
 - Static
 - Continuous sweep
 - Step by step sweep
 - Grid
- Scale modes
 - Wavelength or frequency
 - mW or dBm
- Calibration offset access
- Other modules measurement display

Specifications:

	AP3350A	AP3352A
Wavelength range	1526nm to 1567nm	1567nm to 1608nm
Wavelength setting resolution	1pm	
Spectrum line width @ 3dB	300kHz typical	500kHz typical
Wavelength accuracy	+/- 6pm	
Output power	10dBm typical	
Output power adjustment	> 20dB	
SMSR	47dB (within a 0.1nm resolution)	
Signal to source spontaneous-emission ratio	67dB (within a 140MHz resolution filter at +/- 0.2nm from the signal)	
Optical isolation	25dB	
RIN	-135dB/Hz	
Wavelength stability @ +9dBm	1pm @ 15 minutes, 2pm @ 1 hour	
Power stability @ +9dBm	0.03dB @ 15 minutes, 0.05dB @ 1 hour	
Static Wavelength tuning speed	Max. 3s between any two static wavelength positions	
Continuous Sweeping Speed	Adjustable from 0.11 to 1.5nm/s	
Fiber/connector type	Polarization maintaining fiber FC/APC connector	
Operating temperature	From +5°C to +35°C	
Option TLS01	Typ. +13dBm maximum output power (up to +15dBm under request)	
Option TLS02	External sine modulation (from 10kHz to 20MHz)	
Option TLS03	Low SSE > 85dB	

Optical Variable Attenuator modules

ATTENUATION RANGE OF 30 dB, ATTENUATION STEP OF 0.1 dB



Features:

- Simple or Double module
- Attenuation range: 30dB
- Minimum insertion loss: < 1dB
- Attenuation step: 0.1 dB

Software features

- Two channels immediate display
- Attenuation controlled by powermeter
- Other modules measurement display

Specifications:

	AP3364A (single VOA)	AP3364B-2		
	AP3364A-2 (double VOA)	Dual VOA mode	Single VOA mode	Switch mode
Wavelength range	1310nm to 1550nm			
Attenuation range	30dB		60dB	
Attenuation step size	0.1dB			
Insertion loss	< 1dB	< 2dB	< 2.5dB	
Temperature dependent loss	< 0.2dB		< 0.25dB	
Wavelength dependent loss	< 0.3dB			
Polarization dependent loss	< 0.2dB			
Polarization mode dispersion	< 0.1ps			
Return loss	> 45dB			
Response speed	< 100ms/3dB			
Attenuation setting repeatability	< +/- 0.05dB			
Attenuation setting backlash	< 0.2dB			
Maximum optical power	300mW			
Operating temperature	+5°C to +35°C			

DFB Laser modules

ITU GRID COVERING C-BAND, L-BAND AND O-BAND



Features:

- Selected wavelength according to ITU-T Grid, C-band, L-band and O-band available
- High optical output power up to 20 mW for C-band & L-band, up to 16 mW for O-band
- High side mode suppression ratio (SMSR)
- 50 GHz spacing available
- Narrow linewidth (down to 1 MHz) available

Specifications:

	AP3390A	AP3392A	AP3395A
Peak emission wavelength	ITU-Grid for C band	ITU-Grid for L band	1310nm
Spectrum linewidth @ 3dB	1MHz		5MHz
Output power	20mW Typ.		16mW Typ.
Wavelength accuracy	+/- 6pm		
Wavelength tunability	3nm (without mode hopping)		
Side Mode Suppression Ratio	45dB Typ.		
Min. optical isolation	30dB		
RIN	-138dB/Hz		-155dB/Hz
Polarization Extinction Ratio	20dB		
Fiber/connector type	Polarization maintaining fiber Standard FC/PC connector (FC/APC under request)		Corning SMF-28 FC/PC connector
Operating temperature	From +5°C to +35°C		

Polarimeter module

POLARIZATION ANALYSIS COVERING C+L BAND

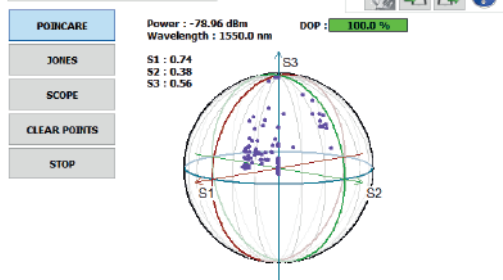
New



Features:

- Four Stockes parameters measurement
- Instantaneous state of polarization (SOP)
- Degree of polarization of input light (DOP)
- Three different displaying modes: Jones graph, Poincaré sphere and Stockes parameters oscilloscope
- Extinction ratio measurements of polarizers or alignment of PM fiber
- PER measurement

01 - Polarimeter Setup Menu



	AP3321A
Optical connector	Standard FC/APC connector
Wavelength range	1520nm to 1610nm
Input power range	-60dBm to +10dBm
Maximum sampling rate	333 S/s
SOP accuracy	+/- 0.25° (-30 to +2 dBm) < 2° (-35 to +5 dBm)
Measurable SOP states	Full Poincaré sphere
Azimuth accuracy	+/-0.25° (-30 to +2 dBm)
Ellipticity accuracy	+/-0.25° (-30 to +2 dBm)
DOP accuracy	+/-0.5% (-35 to +5 dBm)
Rel. power meas. accu	+/-0.2% (-35 to +5 dBm)
Abs. power meas. accu	+/-1% (-35 to +5 dBm)
Environmental conditions	Operating temperature: +5 to +35°C Storage temperature: -10 to +50°C Humidity: 20 to 80% RH (no condensation)

Optical Power Meter modules

DISPLAY RANGE FROM -70 dBm TO + 10 dBm



Features:

- 1 or 2 inputs
- Wavelength range: 800 to 1700 nm
- Display range: -70 to +10 dBm
- Different style of interchangeable connectors
- InGaAs Photodiode

Software features:

- 2 inputs immediate display
- Scale modes : mW or dBm
- Min/Max percentage function
- Other modules measurement display
- Active Power Control function : Maintains a constant optical output (Available with EDFA module and/or Variable Optical Attenuator module)

Specifications:

	AP3314A-1 (one input +10 dBm max) AP3314A-11 (Two inputs +10 dBm max)
Wavelength range	800 to 1700nm
Calibrated wavelengths	980,1310, 1480,1550,1610nm
Photodiode	InGaAs
Fiber type	9/125 to 50/125µm
Display range	-68 to 10dBm
Max permitted level	10 dBm
Intrinsic uncertainty	± 0.2dB (down to -66dBm)
Overall measurement uncertainty	980nm ±0.5dB ±0.2nW 1310~1610nm ±0.2dB ±0.1nW
Optional optical connectors	FC (female): Different styles of optical connector interchangeable adapter (ST/SC/...) and bare optical fiber adapter can be defined by customer
Fiber type	Single-mode or Multimode 9/125µm or 50/125µm
Operating temperature	+5°C to +35°C

Optical Switch modules

1x2, 2x2, 1x4, 1x8 SWITCHES



Features:

- Wide Operating wavelength range
- Low Insertion loss
- Low Polarization dependence loss
- Fast Switch speed

Software features:

- Easy control
- Other modules measurement display

Specifications:

	OS-APM1 Switches			
	1x2	2x2	1x4	1x8
Wavelength	1290~1330nm and 1525~1610nm			
Insertion loss (max)	0.8dB	0.9dB	1.0dB	1.5dB
Return loss (min)	45dB			
Polarization Dependent loss (max)	0.07dB		0.1dB	
Crosstalk (min)	60dB			
Repeatability (max)	+/- 0.02dB		+/- 0.05dB	
WDL (max)	0.2 dB			
Switch time (max)	4ms		10ms	
Durability (min)	10 ⁷ times			
Operating temperature	+5°C to +35°C			

EDFA modules

C OR L BAND, HI-GAIN, LOW NOISE FIGURE, SATURATED OUTPUT POWER ACHIEVES UP TO +22 dBm



Features:

- Wavelength range: 1528 to 1563 nm or 1568 to 1612 nm **New**
- Three series of EDFA modules: Booster / Line / Pre-amplifier
- Gain flattened version available
- Input power down to -40 dBm
- Saturated output power up to 22 dBm
- Large input power range
- Low noise figure

Software features:

- Manual or Automatic control
- Output and Gain control
- Scale modes: mW or dBm
- Easy parameter access
- Other modules measurement display

Specifications:

	AP3370A	AP3372A	AP3370B	AP3372B	AP3370C	AP3372C
	Booster Amplifier		Line Amplifier		Pre-Amplifier	
Operating wavelength range	1528-1563nm	1568-1612nm	1528-1563nm	1568-1612nm	1528-1563nm	1568-1612nm
Input power range	-10 to +4dBm	-10 to +6dBm	-20 to 0dBm	-25 to -10dBm	-38 to -6dBm	-35 to -16dBm
Output Power	From +13 to +22dBm ^a				From -10 to +10dBm ^a	
Noise figure	Typ: 4.5dB / Max: 5dB		Typ: 5dB / Max: 6dB		Typ: 5dB / Max: 5.5dB	
Polarization dependent loss	≤ 0.3dB					
Polarization dependent gain	≤ 0.3dB		≤ 0.5dB			
Polarization mode dispersion	≤ 0.3ps		≤ 0.5ps			
Pump power leakage	-30dB Max.					
Output & input isolation	≥ 30dB					
Return loss	≥ 40dB					
Fiber type	SMF-28, 900µm loose tube, FC/APC (FC/PC on demand)					
Operating temperature	+5°C to +35°C					
Control	Manual Automatic fixed Output control		Manual Automatic fixed Output control Automatic fixed gain control		Manual	
Gain Flattened option: Flatness<1.5 dB	Full range	1570-1609nm	Full range	1570-1609nm	Full range	1570-1609nm

a) According to the model

Optical Tunable Filter modules

C-BAND, L-BAND AND C+L-BAND TUNABILITY AND ATTRACTIVE FEATURES



Features:

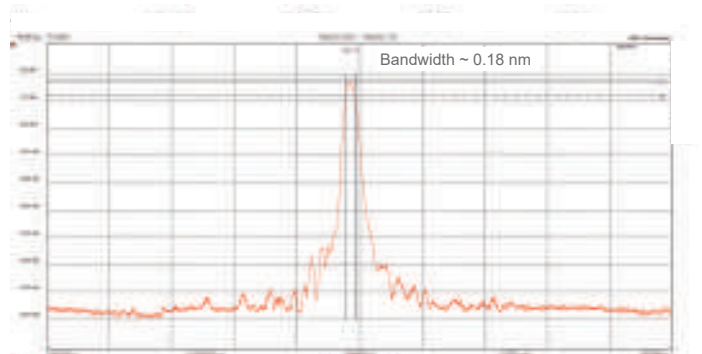
- Excellent MEMS durability, thermal stability and repeatability
- Superior optical performance
- Gaussian-shaped pass band
- Pass band optimized for 50 GHz and 100 GHz channel spacing
- C+L band tunable filter **New**

Specifications:

	AP3380A	AP3381A	AP3382A
Tuning range (nm)	1529-1564	1526-1610	1575-1610
Min IL @ peak ^a	< 4.0dB	< 4.5dB	< 4.0dB
Bandwidth @ 3dB	> 0.15nm	< 0.32nm	> 0.15nm
Bandwidth @ 20dB	< 0.68nm	~1nm	< 0.68nm
PDL	< 0.3dB	< 0.4dB	< 0.3dB
Back reflection	> 40dB		
Setting error	< +/- 50pm		
Tuning resolution	10pm		
Tuning speed	< 30ms		
Optical power	< 500mW		
Durability	> 1 billion cycles		
Operating temperature	+5°C to +35°C		
Fiber type	9/125µm SM, FC/APC (FC/PC on demand)		

a) IL measured at 25°C. IL < 5.0 dB over entire operating temperature range

Optical Transmission Spectrum*:



Optical transmission spectrum of AP3380A C-band Tunable filter

* The spectrum is obtained with an AP208x series OSA in tracking mode (1 MHz resolution)

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