APEX TECHNOLOGIES

*Experts in next generation test equipment*

Catalog edition 2014

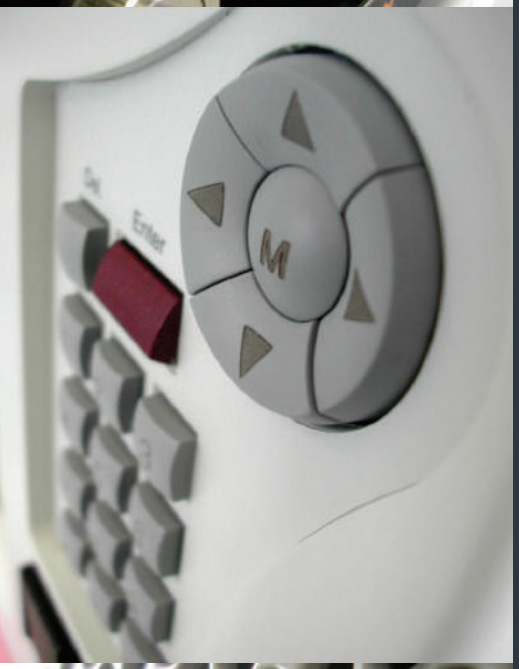
# OPTICAL TEST & MEASUREMENT

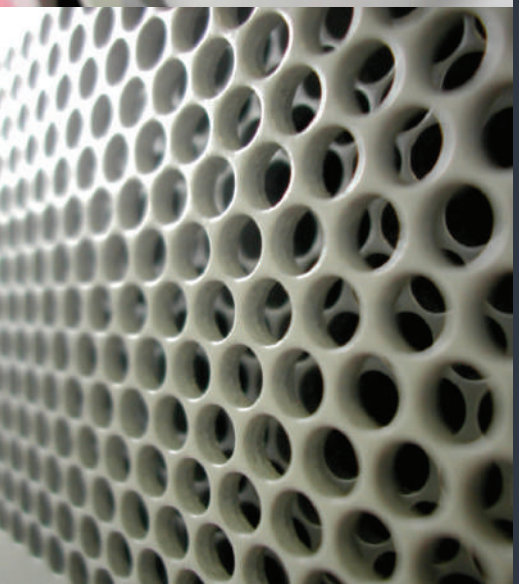
Optical Spectrum Analyzer

Optical Complex Spectrum Analyzer

Optical MultiTest Platform & Modules





# Experts in next generation test equipment

Created on 1998, APEX Technologies is located in the south of Paris in France. For over 15 years, APEX Technologies has 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 analyzer, 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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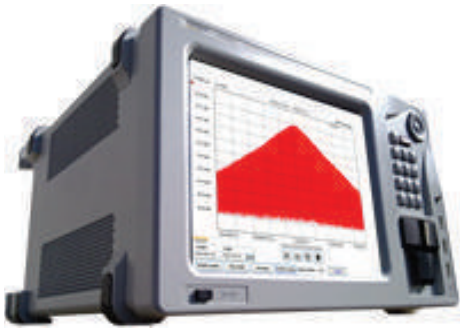


# HIGH RESOLUTION
## OPTICAL SPECTRUM ANALYZER
### HIGHEST RESOLUTION IN THE WORLD

RESOLUTION UP TO 5 MHz / 0.04 pm
WAVELENGTH ACCURANCY +/- 3 pm
DISPLAY BOTH POLARIZATION STATES
TUNABLE LASER SOURCE OUTPUT OPTION
1 MHz RESOLUTION OPTICAL COMPONENT ANALYSIS

# OPTICAL COMPLEX
## SPECTRUM ANALYZER
### OPTICAL MODULATION & SPECTRUM ANALYSIS
### FREQUENCY & TIME DOMAIN MEASUREMENT

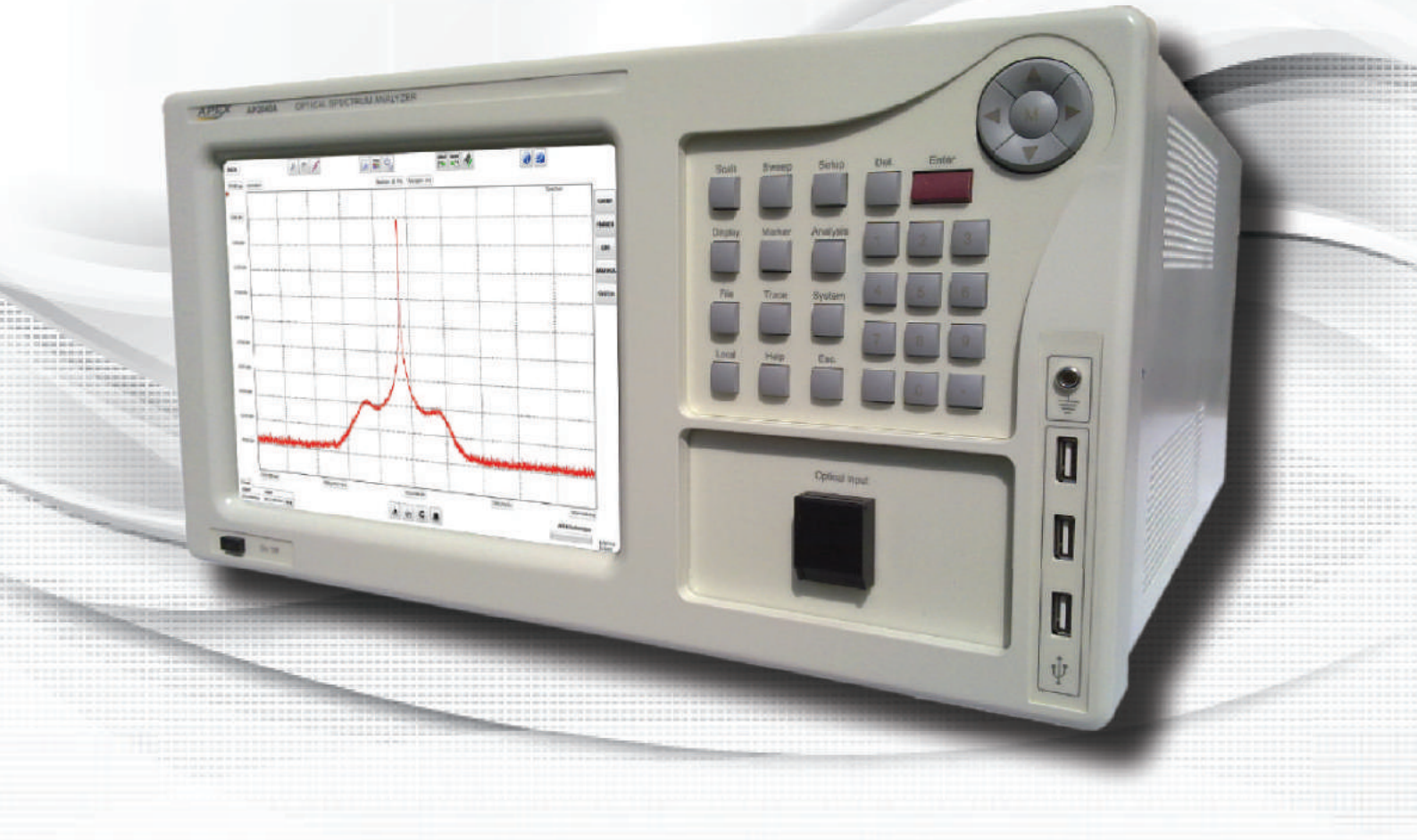
OPTICAL BANDWIDTH UP TO 13 THz
NO MODULATION FORMAT LIMITATION
PRBS PATTERNS ANALYSIS

# OPTICAL MULTITEST
## PLATFORM & MODULES
### HIGH PERFORMANCE AND COST EFFECTIVES

TUNABLE LASER SOURCE, POWER METER,
EDFA, VARIABLE ATTENUATOR, SWITCH

# HIGHEST RESOLUTION OPTICAL SPECTRUM ANALYZERS IN THE WORLD

RESOLUTION OF 5 MHz (0.04 pm)
500 TIMES BETTER THAN MONOCHROMATOR OPTICAL SPECTRUM ANALYZER



## AP2040 series - Optical Spectrum Analyzers

### Features:

- From 250 GHz to 5 MHz resolution
- C&L Band
- +/-3 pm wavelength accuracy
- Close-in dynamic range > 60dB @ +/- 0.4 pm
- Rectangular shape resolution filters
- 2 channels, one per polarization axis
- Built in tunable laser source
- Component transmission analysis

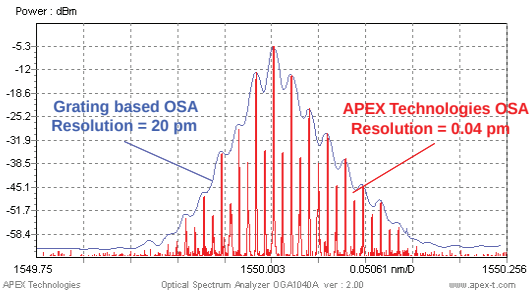
### Applications:

- Transmission network characterization
- Comb generator measurement
- Laser characterization
- OSNR measurement
- OFDM
- Optical sensor characterization

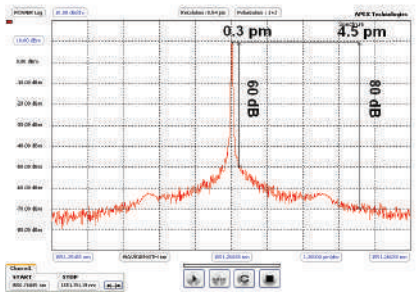
## Technical specifications:

| | AP2041B | AP2043B |
|---|---|---|
| Wavelength measurement range | 1525 nm to 1607 nm | 1520 nm to 1630 nm |
| Wavelength span range [e] | 80 pm to 82 nm | 80 pm to 110 nm |
| Wavelength resolution (@ 3 dB) [d] | 5MHz/0.04pm 10GHz/80pm 140MHz/1.12pm 20GHz/160pm 2GHz/16pm 50GHz/0.4nm | 100GHz/0.8nm 200GHz/1.6nm 400GHz/3.2nm Manual setting: From 500MHz to 250 GHz |
| Dynamic range [a f] | 83 dB | |
| Close-in dynamic range [a f] | >40 dB @ +/- 0.1 pm >60 dB @ +/- 0.4 pm >80 dB @ +/- 6 pm | |
| Spurious free dynamic [d] | 55 dB Typical (50 dB min) | |
| Sweep time [d f] | 1s for 8 nm | |
| Wavelength absolute accuracy [a c] | +/- 3 pm | |
| Measurement level range [a f] | -73 dBm (monochromatic) to +10dBm | |
| Absolute level accuracy [a b e] | +/- 0.3 dB (monochromatic) | |
| Level repeatability [a b d e] | +/- 0.2 dB | |
| Optical input | FC/PC for SM fiber | |
| Internal absolute WL calibrator | Yes | |
| Display capabilities | | |
| X scale | Wavelength in nm or frequency in GHz | |
| Y scale | Optical power in mW or dBm | |
| **Option OSA01** | | |
| Optical tunable laser source specifications | | |
| Wavelength range | 1525 nm to 1607 nm | 1520 nm to 1630 nm |
| Spectrum line width (@ 3 dB) | 500 kHz typical | |
| Output power | -8 dBm typical | |
| SMSR | >45 dBc | |
| ASE | < -40 dBc over 0.1 nm | |
| RIN | < -135 dB/Hz | |
| Wavelength stability | +/- 10 pm over 1 hour | |
| Power stability | +/- 0.09 dB over 1 hour | |
| Fiber/connector type | Polarization maintaining fiber FC/APC connector | |
| **option OSA02** | | |
| Optical tracking generator specifications | | |
| Dynamic [e] | 63 dB | |
| Resolution [e] | 1 MHz | |
| **Option OSA08** | | |
| Optical inputs | 1 FC/PC for SM fiber input 2 FC/PC for PM fiber inputs | |

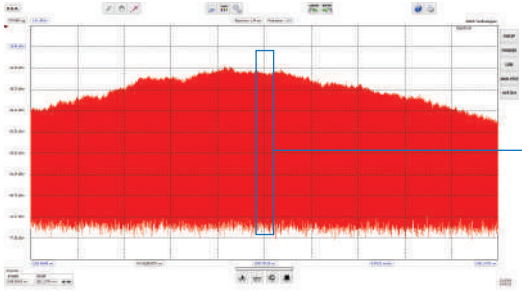
a) At 1550 nm
b) At 0 dBm
c) After Wavelength calibration
d) Typical
e) Resolution 140 MHz
f) Resolution 5 MHz




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

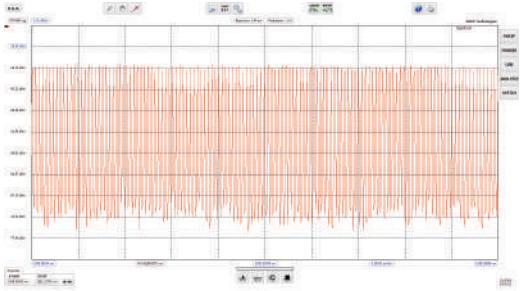



High close-in dynamic range: >40dB @+/- 0.1 pm, >80dB @+/- 6 pm.



Comb measurement.

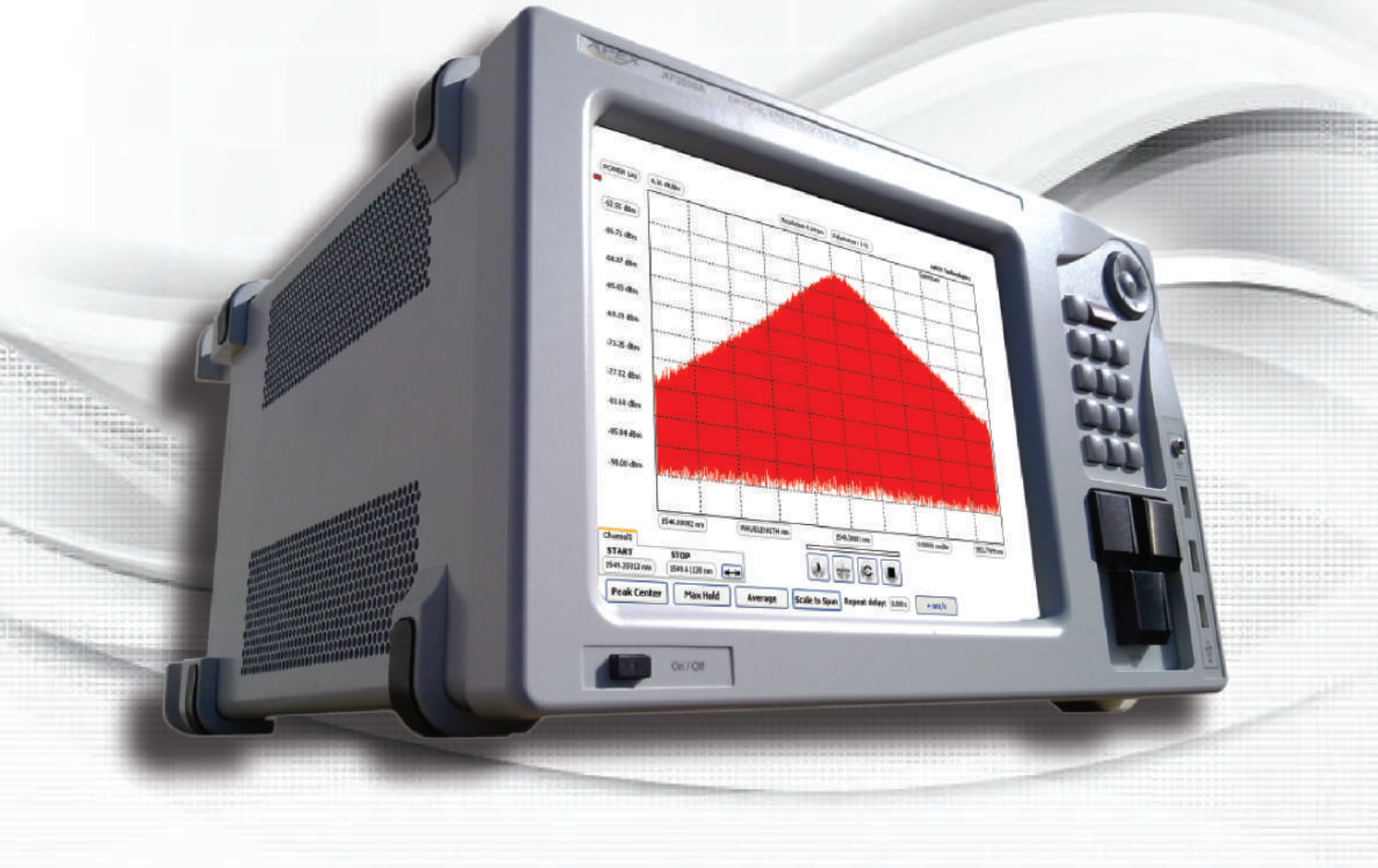
ZOOM



Comb measurement (Zoom).

# HIGH RESOLUTION OPTICAL SPECTRUM ANALYZERS

RESOLUTION OF 20 MHz (0.16 pm).
HIGH PERFORMANCE AND COST EFFECTIVE SOLUTIONS




## AP2050 series - Optical Spectrum Analyzers

### Features:

- From 250 GHz to 20 MHz resolution
- 3 models: C-band / L-band / C&L Band
- +/-3 pm wavelength accuracy
- Close-in dynamic range > 60dB @ +/- 8 pm
- Rectangular shape resolution filters
- 2 channels, one per polarization axis
- Built in tunable laser source
- Component transmission analysis

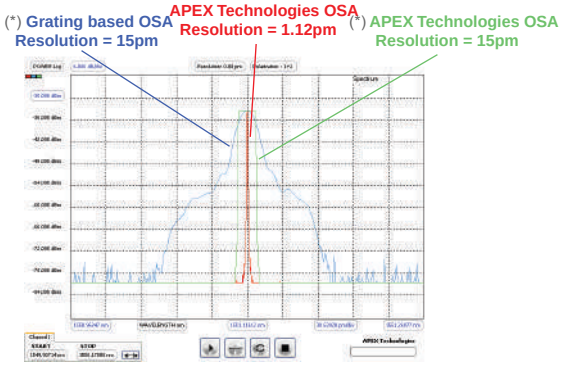
### Applications:

- Transmission network characterization
- Comb generator measurement
- Laser characterization
- OSNR measurement
- OFDM
- Optical sensor characterization

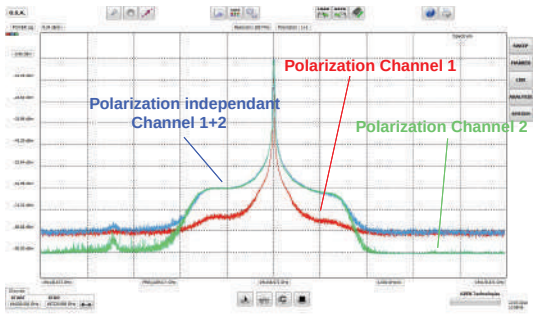
## Technical specifications:

| | AP2050A | AP2052A | AP2051A |
|---|---|---|---|
| Wavelength measurement range | 1526 nm to 1567 nm | 1567 nm to 1607 nm | 1526 nm to 1607 nm |
| Wavelength span range | 170 pm to 41 nm | 170 pm to 40 nm | 170 pm to 81 nm |
| Wavelength resolution (@ 3 dB) [d] | 20MHz/0.16pm, 140MHz/1.12pm, 2GHz/16pm, 10GHz/80pm, 20GHz/160pm, 50GHz/0.4nm, 100GHz/0.8nm, 200GHz/1.6nm, 400GHz/3.2nm, Manual setting: From 500MHz to 250 GHz | | |
| Dynamic range [a g] | 83 dB | | |
| Close-in dynamic range [a g] | >40 dB @ +/- 1.3 pm | >60 dB @ +/- 8 pm | >70 dB @ +/- 30 pm |
| Spurious free dynamic [d g] | 50 dB (1) | | |
| Sweep time [d] | Between 0.4 nm/s (min) & 1.2 nm/s (max) | | |
| Wavelength absolute accuracy [a c] | +/- 3 pm | | |
| Measurement level range [a g] | -73 dBm (monochromatic) to +10 dBm | | |
| Absolute level accuracy [a e] | +/- 0.3dB (2) | | |
| Level repeatability [a b d e] | +/- 0.2dB | | |
| Optical input | FC/PC for SM fiber | | |
| Internal absolute WL calibrator | Yes | | |
| Display capabilities | | | |
| X scale | Wavelength in nm or frequency in GHz | | |
| Y scale | Optical power in mW or dBm | | |
| **Option OSA07** | | | |
| Optical tunable laser source specifications | | | |
| Wavelength range | 1526 nm to 1567 nm | 1567 nm to 1607 nm | 1526 nm to 1607 |
| Spectrum line width (@ 3 dB) | 3 MHz Typical | | |
| Output power | -8 dBm typical | | |
| SMSR | > 50 dBc | | |
| ASE | < - 50 dBc over 0.1 nm | | |
| RIN | -135 dB/Hz | | |
| Wavelength stability | 1 pm @ 15 min, 2 pm @ 1 h | | |
| Power stability | 0.07 dB @ 15 min, 0.09 dB @ 1 h | | |
| Fiber/connector type | Polarization maintaining fiber FC/APC connector | | |
| Optical tracking generator specifications | | | |
| Dynamic [e] | 60 dB | | |
| Resolution [e] | 10 MHz | | |
| **Option OSA08** | | | |
| 3 inputs specifications | | | |
| Optical inputs | 1 FC/PC for SM fiber input | 2 FC/PC for PM fiber inputs | |

a) At 1550 nm
b) At 0 dBm
c) After Wavelength calibration
d) Typical
e) Resolution 140 MHz
f) Resolution 5 MHz
g) Reolution 20 MHz
1) Relative to total signal power
2) Inside spurious free dynamic
Otherwise: possible power offset (mW) < $10^{-6}$ x total signal power (mW)



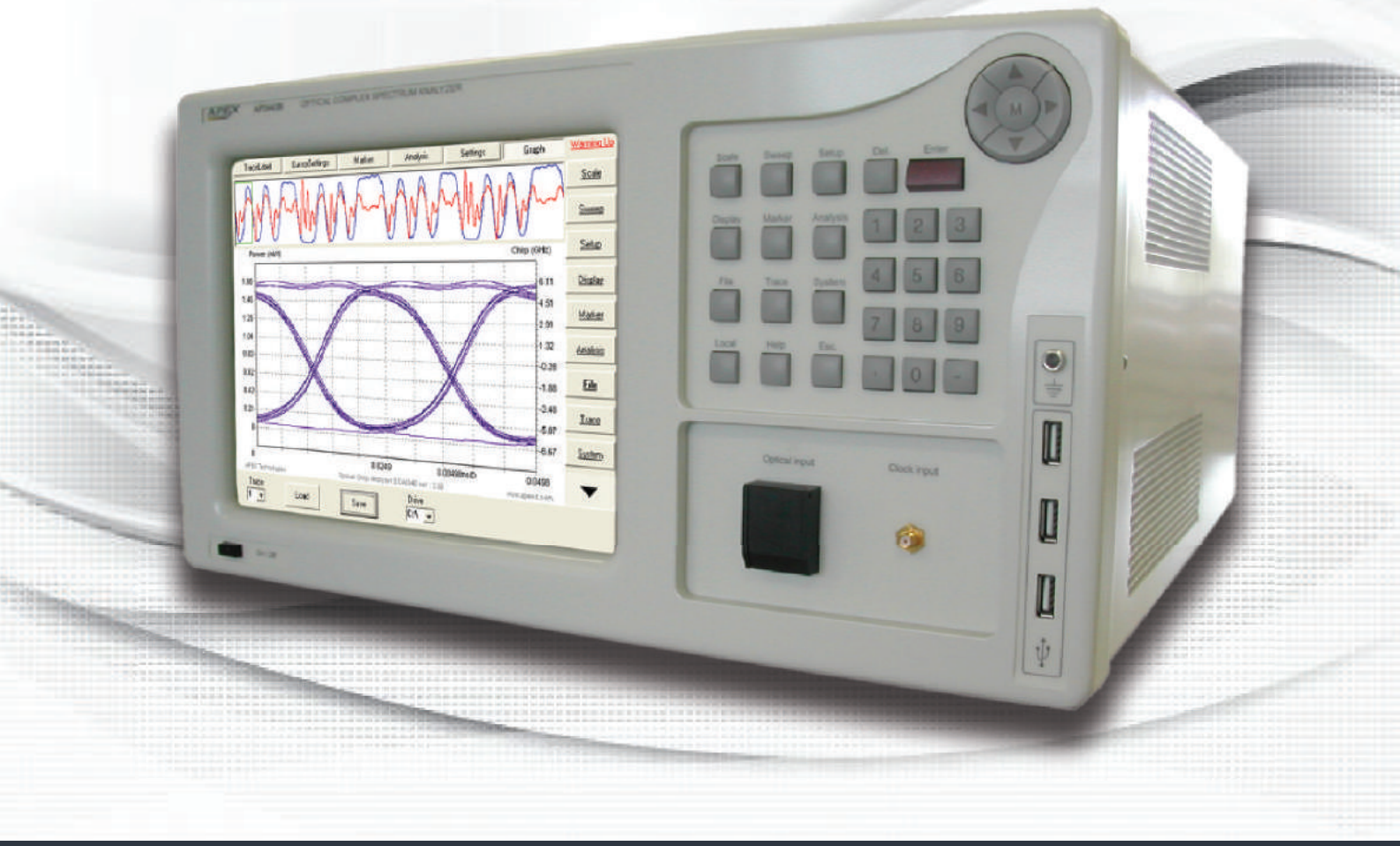

(*) APEX Technologies and grating based OSA wavelength resolution filters shapes comparison.




Display simultaneously 2 orthogonal polarization channels and the polarization independent mesurement.

# HIGH ACCURACY OPTICAL COMPLEX SPECTRUM ANALYZERS

## OPTICAL MODULATION ANALYZER AND HIGH RESOLUTION OPTICAL SPECTRUM ANALYZER IN ONE EQUIPMENT



## AP2440 series - Optical Complex Spectrum Analyzers

### Optical Spectrum Analyzer Features:

- From 250 GHz to 5 MHz spectral resolution
- C&L Band
- +/-3 pm wavelength accuracy
- Close-in dynamic range > 60dB @ +/- 0.4pm
- Rectangular shape resolution filters
- 2 channels, one per polarization axis
- Built in tunable laser source
- Component transmission analysis

### Optical Modulation Analyzer Features:

- No Baud rate limitation (13 THz Optical Bandwidth)
- No modulation format limitation (BPSK, DPSK, QPSK, DP-QPSK, 16 QAM, 64 QAM...)
- Polarization diversity
- High temporal accuracy
- Phase, chirp, intensity vs time - Constellation - Eye diagram - EVM

### Applications:

- Advanced modulation formats analysis
- Modulator characterization
- Comb generator temporal and spectral measurement
- Mode locked laser temporal and spectral characterization

## Technical specifications:

| | AP2441B | AP2443B |
|---|---|---|
| **Optical spectrum analyzer specifications** | | |
| Wavelength measurement range | 1525 nm to 1607 nm | 1520 nm to 1630 nm |
| Wavelength span range [e] | 80 pm to 82 nm | 80 pm to 110 nm |
| Wavelength resolution (@ 3 dB) [d] | 5 MHz/0.04 pm, 100 MHz/0.8 pm | |
| Dynamic range [a f] | 83 dB | |
| Close-in dynamic range [a f] | >40 dB @ +/- 0.1 pm >60 dB @ +/- 0.4 pm >80 dB @ +/- 6 pm | |
| Spurious free dynamic [d] | 55 dB Typical (50 dB min) | |
| Sweep time [d f] | 1s for 8 nm | |
| Wavelength absolute accuracy [a c] | +/- 3 pm | |
| Measurement level range [a f] | -73 dBm (monochromatic) to +10dBm | |
| Absolute level accuracy [a b e] | +/- 0.3 dB (monochromatic) | |
| Level repeatability [a b d e] | +/- 0.2 dB | |
| Optical input | FC/PC for SM fiber | |
| Internal absolute WL calibrator | Yes | |
| **Optical Complex spectrum analyzer specifications** | | |
| Wavelength measurement range | 1525nm to 1607nm | 1520nm to 1630nm |
| Clock frequency | Fclk1 = 9.92GHz to 12.5GHz or Fclk2 = 2.47 to 3.13GHz | |
| Clock frequency (option OCSA03) | Fclk1 = 6GHz to 12.5GHz or Fclk2 = 1.5GHz to 3.13GHz | |
| Clock power | 0 to +10dBm | |
| Pattern frequency | Fr1 = 2.48GHz to 3.12GHz and Fr2 = 620MHz to 781MHz (see pattern table below) | |
| Pattern frequency (option OCSA03) | Fr1 = 1.5GHz to 3.12GHz and Fr2 = 375MHz to 781MHz (see pattern table below) | |
| Measurement level range [i] | -55dBm to + 10dBm | |
| Maximum temporal resolution [g] | 95fs | 75fs |
| Chirp accuracy [h] | +/- 60MHz | |
| Measurement time [h] | 5s | 7s |
| **Display capabilities** | | |
| X scale | Time in ps or Wavelength in nm or Frequency in GHz | |
| Y scale | Intensity in mW or dBm, chirp in GHz, phase in degree, alfa parameter | |
| **Options** | | |
| OSA01 | Continuous and step by step Optical Tunable laser source | |
| OSA02 | Optical tracking generator for transmission measurements | |
| OCSA03 | No bit rate limitation option (see pattern table below) | |
| OCSA04 | Group delay and chromatic dispersion analysis | |

**Optical complex spectrum analyzer pattern length**

The bit rate of the signal under test divided by the pattern length must be included in the pattern frequency range [j]

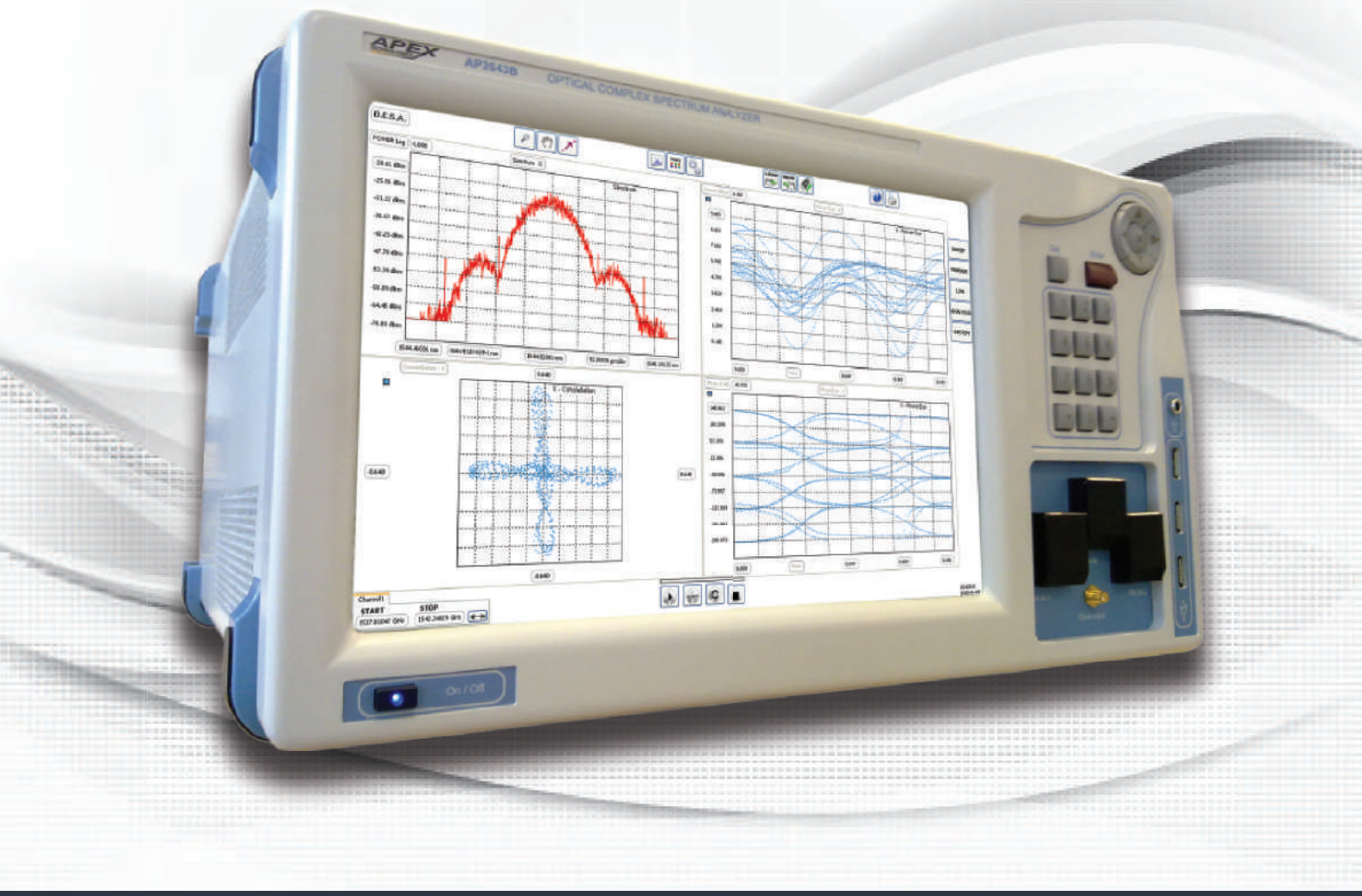
| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bit rate | 2.48Gb/s to 3.12Gb/s | 4.96Gb/s to 6.24Gb/s | 9.92Gb/s to 12.5Gb/s | 19.84Gb/s to 25Gb/s | 39.68Gb/s to 50Gb/s | 79.36Gb/s to 100Gb/s | 158.72Gb/s to 200Gb/s | 317,44Gb/s to 400Gb/s | 634,88Gb/s to 800Gb/s |
| Bit rate (OCSA03) | 1.5Gb/s to 3.12Gb/s | 3Gb/s to 6.24Gb/s | 6Gb/s to 12.5Gb/s | 12Gb/s to 25Gb/s | 24Gb/s to 50Gb/s | 48Gb/s to 100Gb/s | 96Gb/s to 200Gb/s | 192Gb/s to 400Gb/s | 384Gb/s to 800Gb/s |
| Pattern length for Fr1 | 1bit | 2 bits | 4 bits | 8 bits | 16 bits | 32 bits | 64 bits | 128 bits | 256 bits |
| Pattern length for Fr2 | 4 bits | 8 bits | 16 bits | 32 bits | 64 bits | 128 bits | 256 bits | 512 bits | 1024 bits |

a) At 1550 nm
b) At 0 dBm
c) After Wavelength calibration
d) Typical
e) Resolution 140 MHz
f) Resolution 5 MHz
g) If modulated signal covers the complete wavelength range
h) Maximum chirp deviation measured on a 2.5 GHz sinusoidal signal with 30% modulation ratio
i) Power range of complex spectrum components for an accurate analysis
j) The pattern repetition frequency must be included in the pattern frequency range, the clock and the pattern must be synchronised

New

# OPTICAL COMPLEX SPECTRUM ANALYZERS

PRBS & LONG PATTERN ANALYSIS




## AP2640 series - Optical Complex Spectrum Analyzers

### Optical Spectrum Analyzer Features:

- From 250 GHz to 20 MHz spectral resolution
- C&L Band
- +/-3 pm wavelength accuracy
- Close-in dynamic range > 60dB @ +/- 3pm
- Rectangular shape resolution filters
- 2 channels, one per polarization axis
- Built in tunable laser source
- Component transmission analysis

### Optical Modulation Analyzer Features:

- No Baud rate limitation (13 THz Optical Bandwidth)
- No modulation format limitation (BPSK, DPSK, QPSK, DP-QPSK, 16 QAM, 64 QAM...)
- PRBS Patterns analysis
- Polarization diversity
- Fast measurement
- Phase, chirp, intensity vs time - Constellation - Eye diagram - EVM - BER

### Applications:

- Advanced modulation formats analysis
- Modulator characterization
- Comb generator temporal and spectral measurement
- Mode locked laser temporal and spectral characterization

## Optical spectrum analyzer specifications:

| | AP2641B | AP2643B |
|---|---|---|
| Wavelength measurement range | 1525 nm to 1607 nm | 1520 nm to 1630 nm |
| Wavelength span range | 80 pm to 82 nm | 80 pm to 110 nm |
| Polarization | 2 OSA, 1 for each polarization channel | |
| Wavelength resolution (@3dB)[d] | 20 MHz (0.16 pm) , 180 MHz (1.44 pm), Manual setting from 200MHz to 250GHz | |
| Dynamic range[a e] | 80 dB | |
| Close-in dynamic range[a e] | >40 dB @ +/- 1 pm >60 dB @ +/- 3 pm | |
| Spurious free dynamic[d] | 55 dB Typical (50 dB min) | |
| Sweep time[d e] | 1s for 11 nm | |
| Wavelength absolute accuracy[a c] | +/- 3 pm | |
| Measurement level range[a e] | -70dBm (monochromatic) to +10dBm | |
| Absolute level accuracy[a b e] | +/- 0.3dB (monochromatic) | |
| Level repeatability[a b d e] | +/- 0.2dB | |
| Optical input | FC/PC for SM fiber | |
| Internal absolute WL calibrator | Yes | |
| Display capabilities | | |
| X scale | Wavelength in nm or frequency in GHz | |
| Y scale | Optical power in mW or dBm | |
| Analysis functions | OSNR, linewidth, SMSR, Trace A – B, Peak search | |
| **Option OSA01** | | |
| Optical tunable laser source specifications | | |
| Wavelength range | 1525 nm to 1607 nm | 1520 nm to 1630 nm |
| Spectrum line width (@ 3 dB) | 500 kHz typical | |
| Output power | -7 dBm typical | |
| SMSR | >45 dBc | |
| ASE | < -40 dBc over 0.1 nm | |
| RIN | < -135 dB/Hz | |
| Wavelength stability | +/- 10 pm over 1 hour | |
| Power stability | +/- 0.02 dB over 1 hour | |
| Fiber/connector type | Polarization maintaining fiber FC/APC connector | |
| **Option OSA02** | | |
| Optical tracking generator specifications | | |
| Dynamic[a d] | 63 dB | |
| **Option OSA08** | | |
| 3 inputs specifications | | |
| Optical inputs | 1 FC/PC for SM fiber input 2 FC/PC for PM fiber inputs | |

## Optical modulation analyzer specifications:

| | AP2641B | AP2643B |
|---|---|---|
| Clock input frequency | Clock frequency = pattern frequency[f] | |
| Optical Bandwidth | 10 THz | 13 THz |
| Polarization | 2 Modulation Analyzers, 1 for each polarization channel | |
| Clock power | > -17 dBm at pattern frequency[f] | |
| Pattern frequency | From 50 MHz to 1 GHz | |
| Measurement level range | Optical Spectral components must be between -60 dBm to 0 dBm | |
| Maximum temporal resolution | 95 fs | 75 fs |
| Measurement time | 6 nm (750 GHz) /s | |

**The baud rate of the signal under test divided by the pattern length must be included in the pattern frequency range**

For example at 10 GBaud : you can use any pattern length between 10 and 200 (PRBS 2^7-1 included)
For example at 28 GBaud : you can use any pattern length between 28 and 560 (PRBS 2^7-1, 2^8-1, 2^9-1 included)
For example at 40 GBaud : you can use any pattern length between 40 and 800 (PRBS 2^7-1, 2^8-1, 2^9-1 included)
For example at 100 GBaud : you can use any pattern length between 100 and 2000 (PRBS 2^7-1, 2^8-1, 2^9-1, 2^10-1 included)
For example at 400 GBaud : you can use any pattern length between 400 and 8000 (PRBS 2^9-1, 2^10-1, 2^11-1, 2^12-1 included)
For example at 1000 GBaud : you can use any pattern length between 1000 and 20000 (PRBS 2^10-1, 2^11-1, 2^12-1, 2^13-1, 2^14-1 included)

**The equipment has no Baud rate upper limitation and it can measure any modulation format**

a) At 1550 nm
b) At 0 dBm
c) After Wavelength calibration
d) Typical
e) Resolution 180 MHz
f) Pattern frequency = Baud Rate / Pattern Length

# HIGH PERFORMANCE & COST EFFECTIVES OPTICAL MULTITEST PLATFORM

AVAILABLE MODULES: TUNABLE LASER SOURCES, DFB LASERS, POWER METERS, OPTICAL AMPLIFIERS, VARIABLE ATTENUATORS, TUNABLE FILTERS, SWITCHES

## AP1000 series - Plug-in Modules Mainframe

### 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 Sources
- DFB Lasers
- Optical Power Meters
- Optical Amplifers (EDFA)
- Optical Variable Attenuators
- Optical Tunable Filters
- Optical Switches

## 4 PLUG-IN MAINFRAME MODELS

AP1000-2

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

AP1000-5

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

AP1000-8

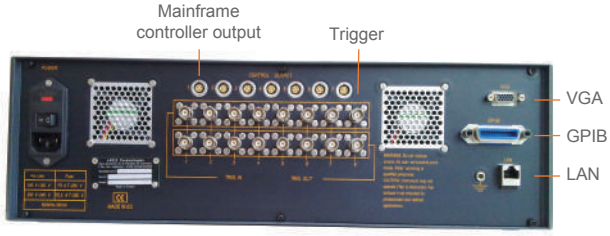
AP1000-8 mainframe controller:
- Accepts up to 8 modules
- Can control up to 7 AP1000-12
(92 modules in total)

AP1000-12

AP1000-12 mainframe expansion:
- Accepts up to 12 modules
- Must be connected to an AP1000-8
- Allows the system to integrate up to
92 test modules using a single AP1000-8

## MULTIPLE CONNECTIONS

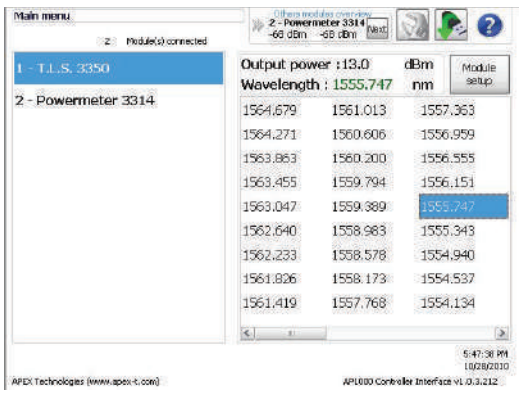
- Mainframe controller output (to control AP1000-12)
- Trigger function
- VGA connector
- USB connectors
- GPIB control
- LAN connector




AP1000-8 back

## SOFTWARE

APEX Technologies Plug-in modules mainframe is appreciated by novice as well as expert users. It combines a full panel of functions with an impressive list of features:




## SPECIFICATIONS

| | AP1000-2 | AP1000-5 | AP1000-8 | AP1000-12 |
|---|---|---|---|---|
| Plug-in slots | 2 | 5 | 8 | 12 |
| USB connectors | 3 | 3 | 3 | No |
| Internal memory | Yes | Yes | Yes | No |
| File format | .txt format | | | |
| GPIB connector | Yes | Yes | Yes | No |
| Ethernet connector | Yes | Yes | Yes | No |
| Mainframe controller outputs | No | No | 7 | No |
| Mouse and keyboard | Yes | Yes | Yes | No |
| Screen | Yes | Yes | Yes | No |
| Operating temperatue | 15°C to 35°C | | | |
| Power requirement | AC 100 to 120 V/200 to 250 V, 50/60 Hz | | | |

### STORAGE

- 32 Gb hard drive
- 3 USB ports.
- bmp, txt and setup file formats

### EQUIPMENT CONTROL

-The touch screen
- A mouse and keyboard

### REMOTE CONTROL

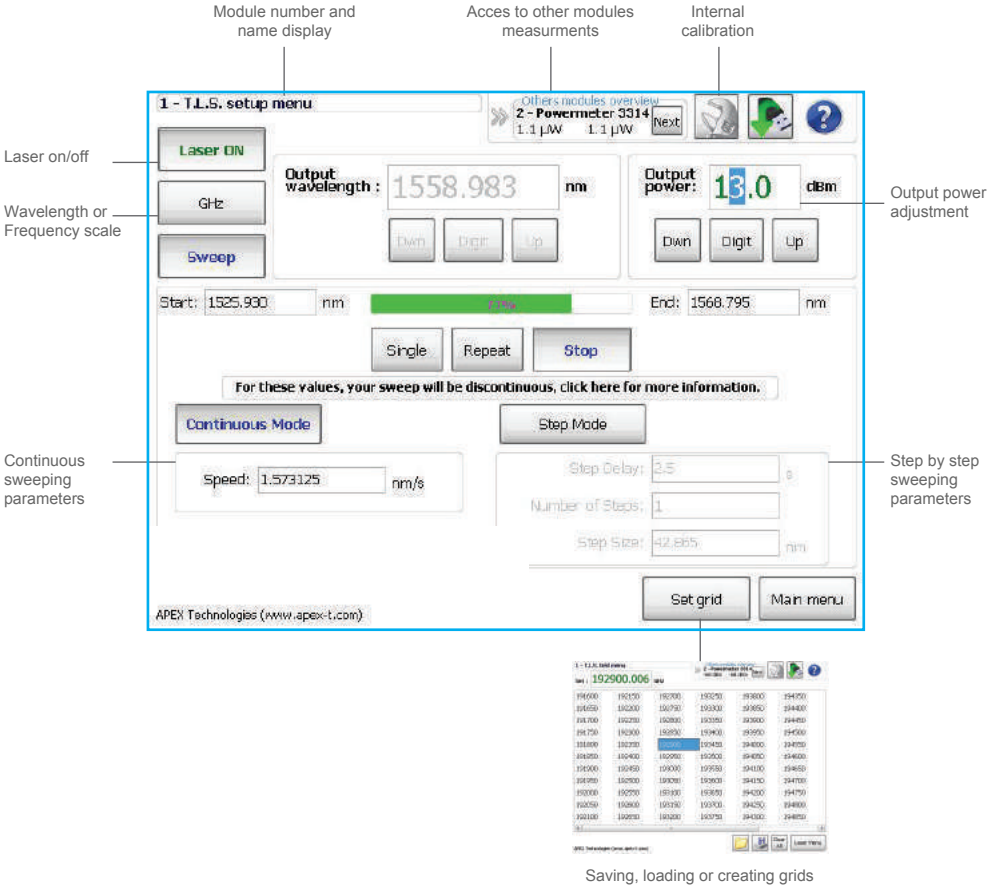
- Control and perform data transfer with a computer through GPIB or ethernet.
- Remote control of the equipment through Internet

# AP3350 - 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
- Narow wavelength setting resolution: < 1 pm






Saving, loading or creating grids

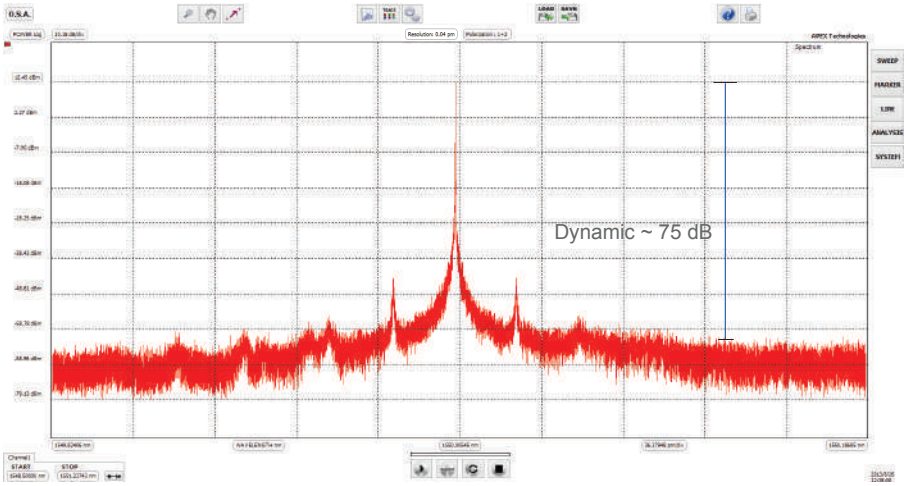
## Software features:

- 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

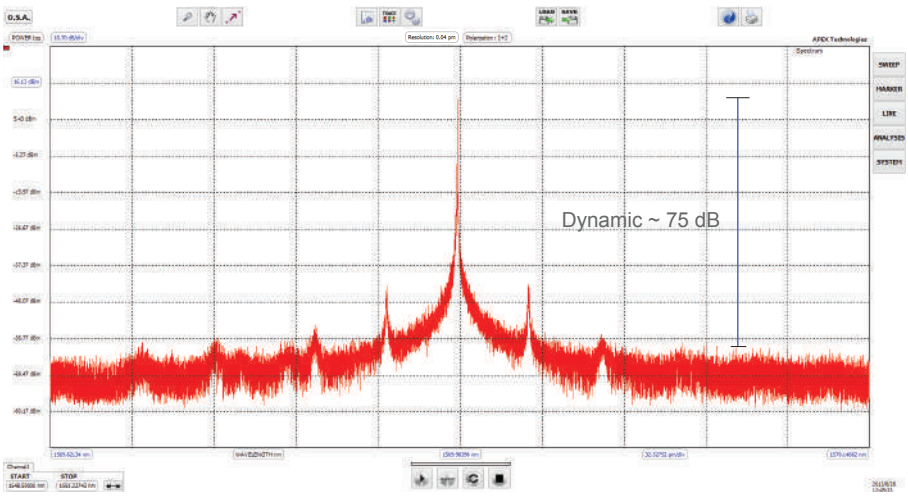
## Specifications:

| | AP3350A | AP3352A |
|---|---|---|
| Wavelength range | 1526 nm to 1567 nm | 1567 nm to 1608 nm |
| Wavelength setting resolution | 1 pm | |
| Spectrum line width @ 3 dB | 300 kHz typical | |
| Wavelength accuracy | +/- 6 pm | |
| Output power | 10 dBm typical | |
| Output power adjustment | > 30 dB | |
| SMSR | 47 dB (within a 0.1 nm resolution) | |
| Signal to source spontaneous-emission ratio | 67 dB (within a 140 MHz resolution filter at +/- 0.2 nm from the signal) | |
| Optical isolation | 25 dB | |
| RIN | -135 dB/Hz | |
| Wavelength stability @ +9 dBm | 1 pm @ 15 min, 2 pm @1 h | |
| Power stability @ +9 dBm | 0.03 dB @ 15min,0.05 dB @ 1h | |
| Static Wavelength tuning speed | Max. 3 s between any two static wavelength positions | |
| Continuous Sweeping Speed | Adjustable from 0.11 to 1.5 nm/s | |
| Fiber/connector type | Polarization maintaining fiber FC/APC connector | |
| Operating temperature | From 15°C to 35°C | |
| Weight | 530g | |
| Dimensions (WxHxD) | 35 x 130 x 175 mm | |
| Option TLS01 | +13 dBm maximum output power | +11.7 dBm maximum output power |
| Option TLS02 | External sine modulation (from 10 kHz to 20 MHz) | |

## Optical Spectrums*:




**Optical spectrum of AP3350A C-band Tunable laser source @1550 nm**




**Optical spectrum of AP3352A L-band Tunable laser source @1570 nm**

*** The spectrums are obtained by the AP2040 series Optical Spectrum Analyzer with 5 MHz resolution**

# AP3390 - 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)**
- **50GHz spacing available**
- **Narrow linewidth (down to 1 MHz) available**


## Specifications:

| | AP3390A | AP3392A | AP3395A |
|---|---|---|---|
| Wavelength range | 1530 nm to 1565 nm | 1565 nm to 1610 nm | 1290 nm to 1330 nm |
| Spectrum line width @ 3 dB | < 5 MHz | | |
| Output power | 20 mW Typ. | | 16 mW Typ. |
| Wavelength accuracy | +/- 6 pm | | |
| Wavelength tunability | 3 nm (without mode hopping) | | |
| Side Mode Suppression Ratio | 45 dB Typ. | | |
| Min. optical isolation | 30 dB | | |
| RIN | -138 dB/Hz | | -155 dB/Hz |
| Polarization Extinction Ratio | 20 dB | | |
| Fiber/connector type | Polarization maintaining fiber FC/APC connector | | Corning SMF-28 FC/PC connector |
| Operating temperature | From 20°C to 35°C | | |

## ITU Frequency table:

### AP3390A (C-band):

| Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) |
|---|---|---|---|---|---|---|---|
| 1529.55 | 196.00 | 1538.98 | 194.80 | 1548.51 | 193.60 | 1558.17 | 192.40 |
| 1530.33 | 195.90 | 1539.77 | 194.70 | 1549.32 | 193.50 | 1558.98 | 192.30 |
| 1531.12 | 195.80 | 1540.56 | 194.60 | 1550.12 | 193.40 | 1559.79 | 192.20 |
| 1531.90 | 195.70 | 1541.35 | 194.50 | 1550.92 | 193.30 | 1560.61 | 192.10 |
| 1532.68 | 195.60 | 1542.14 | 194.40 | 1551.72 | 193.20 | 1561.42 | 192.00 |
| 1533.47 | 195.50 | 1542.94 | 194.30 | 1552.52 | 193.10 | 1562.23 | 191.90 |
| 1534.25 | 195.40 | 1543.73 | 194.20 | 1553.33 | 193.00 | 1563.05 | 191.80 |
| 1535.04 | 195.30 | 1544.53 | 194.10 | 1554.13 | 192.90 | 1563.86 | 191.70 |
| 1535.82 | 195.20 | 1545.32 | 194.00 | 1554.94 | 192.80 | 1564.68 | 191.60 |
| 1536.61 | 195.10 | 1546.12 | 193.90 | 1555.75 | 192.70 | | |
| 1537.40 | 195.00 | 1546.92 | 193.80 | 1556.55 | 192.60 | | |
| 1538.19 | 194.90 | 1547.72 | 193.70 | 1557.36 | 192.50 | | |

### AP3392A (L-band):

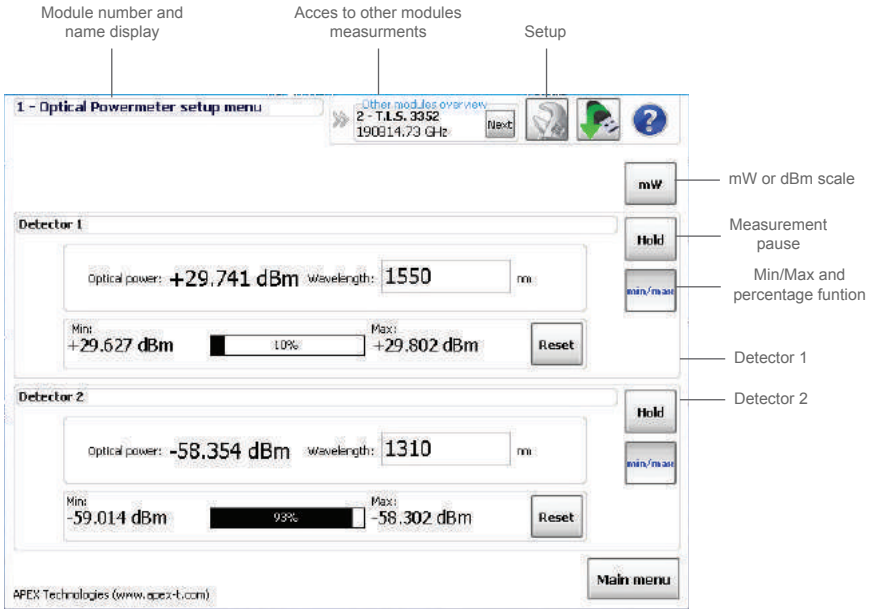
| Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) | Wavelength (nm) | ITU Freq. (THz) |
|---|---|---|---|---|---|---|---|
| 1565.50 | 191.50 | 1577.03 | 190.10 | 1588.73 | 188.70 | 1600.60 | 187.30 |
| 1566.31 | 191.40 | 1577.86 | 190.00 | 1589.57 | 188.60 | 1601.46 | 187.20 |
| 1567.13 | 191.30 | 1578.69 | 189.90 | 1590.41 | 188.50 | 1602.31 | 187.10 |
| 1567.95 | 191.20 | 1579.52 | 189.80 | 1591.26 | 188.40 | 1603.17 | 187.00 |
| 1568.77 | 191.10 | 1580.35 | 189.70 | 1592.10 | 188.30 | 1604.03 | 186.90 |
| 1569.59 | 191.00 | 1581.18 | 189.60 | 1592.95 | 188.20 | 1604.88 | 186.80 |
| 1570.42 | 190.90 | 1582.02 | 189.50 | 1593.79 | 188.10 | 1605.74 | 186.70 |
| 1571.24 | 190.80 | 1582.85 | 189.40 | 1594.64 | 188.00 | 1606.60 | 186.60 |
| 1572.06 | 190.70 | 1583.69 | 189.30 | 1595.49 | 187.90 | 1607.47 | 186.50 |
| 1572.89 | 190.60 | 1584.53 | 189.20 | 1596.34 | 187.80 | 1608.33 | 186.40 |
| 1573.71 | 190.50 | 1585.36 | 189.10 | 1597.19 | 187.70 | 1609.19 | 186.30 |
| 1574.54 | 190.40 | 1586.20 | 189.00 | 1598.04 | 187.60 | 1610.06 | 186.20 |
| 1575.37 | 190.30 | 1587.04 | 188.90 | 1598.89 | 187.50 | 1610.92 | 186.10 |
| 1576.20 | 190.20 | 1587.88 | 188.80 | 1599.75 | 187.40 | 1611.79 | 186.00 |

# AP3314 - Optical Power Meter modules

STANDARD DISPLAY RANGE FROM -80 dBm TO + 10 dBm
HIGH POWER DISPLAY RANGE FROM -60 dBm TO + 33 dBm

## Features:

- 1 or 2 inputs
- Wavelength range : 800 to 1 700 nm
- Display range : -80 to +10 dBm & -60 to +30dBm
- Different style of interchangeable connectors
- InGaAs Photo diode




## Software features:

- 2 inputs immediate display
- Scale modes: mW or dBm
- Min/Max percentage function
- Other modules measurement display

## Specifications:

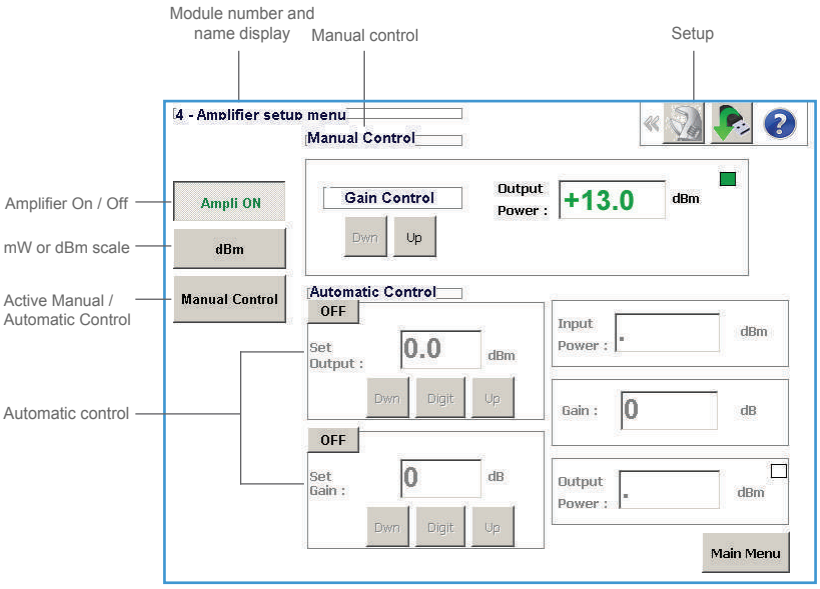
| | AP3314A-1 (one input +10dBm max)<br>AP3314A-11 (Two inputs +10dBm max) | AP3314A-3 (one input +33dBm max)<br>AP3314A-33 (Two inputs +33dBm max) |
|---|---|---|
| | AP3314A-13 (Two inputs; one +10dBm max plus one +33dBm) | |
| Wavelength range | 800 to 1700 nm | |
| Calibrated wavelengths | 980,1310, 1480,1550,1610 nm | |
| Photo diode | InGaAs | |
| Fiber type | 9/125 to 50/125 µm | |
| Display range(*2) | -70 to +10dBm | -50 to +30dBm |
| Display range after zeroing(*2) | -80 to +10dBm | -60 to +30dBm |
| Max. permitted level | +10dBm | +30dBm (+33dBm few min) |
| Intrinsic uncertainty(*1) | ± 0.21 dB (±5%) | |
| Overall measurement uncertainty | -80 to +10dBm<br>980nm ±0.5dB ±0.2nW<br>1310~1610nm ±0.2dB ±0.1nW | -60 to +30dBm (+33dBm few mn)<br>980nm ±0.5dB ±20nW<br>1310~1610nm ±0.2dB ±10nW |
| 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 9/125 or 50/125 µm | |
| Ambient temperature | Nominal range of use −10°C to +40°C ; Storage and transport −40°C to +70°C | |

# AP3370 - EDFA modules

HIGH GAIN, LOW NOISE FIGURE, SATURATED OUTPUT POWER ACHIEVES UP TO +22 dBm.


## Features:

- 3 series of EDFA module in standard version
  - Booster / Line / Pre-amplifier
- Gain flattened version available
- Input power down to -30 dBm
- Saturated output power up to 22 dBm
- Wavelength range 1528 to 1563 nm
- Large input power range
- Low noise figure
- Easy control




## Software features:

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

## Specifications:

| | AP3370A Booster Amplifier | | | AP3370B Line Amplifier | | | AP3370C Pre-Amplifier | | |
|---|---|---|---|---|---|---|---|---|---|
| | Min. | Typical | Max. | Min. | Typical | Max. | Min. | Typical | Max. |
| Output Power (dBm) | From +13 dBm to +22 dBm according to the model [a] | | | | | | From -10 dBm to +10 dBm according to the model [d] | | |
| Input Power Range[b] (dBm) | -10 | 0 | +4 | -20 | -10 | 0 | | -30 | |
| Operating Wavelength range (nm) | 1528 to 1563 nm | | | | | | | | |
| Noise Figure[c] (dB) | | 4.5 | 5.0 | | 5.0 | 6.0 | | 5.0 | 5.5 |
| Polarization Dependent Loss (dB) | ≤ 0.3 | | | | | | | | |
| Polarization Dependent gain (dB) | ≤ 0.3 | | | ≤ 0.5 | | | | | |
| Polarization Mode Dispersion (ps) | ≤ 0.3 | | | ≤ 0.5 | | | | | |
| Pump Power leakage (dB) | -30 Max. | | | | | | | | |
| Output & input isolation | ≥ 30 | | | | | | | | |
| Return loss (dB) | ≥ 40 | | | | | | | | |
| Fiber type | SMF-28, 900 µm loose tube | | | | | | | | |
| Operating temperature (°C) | 0 to 65 °C | | | | | | | | |

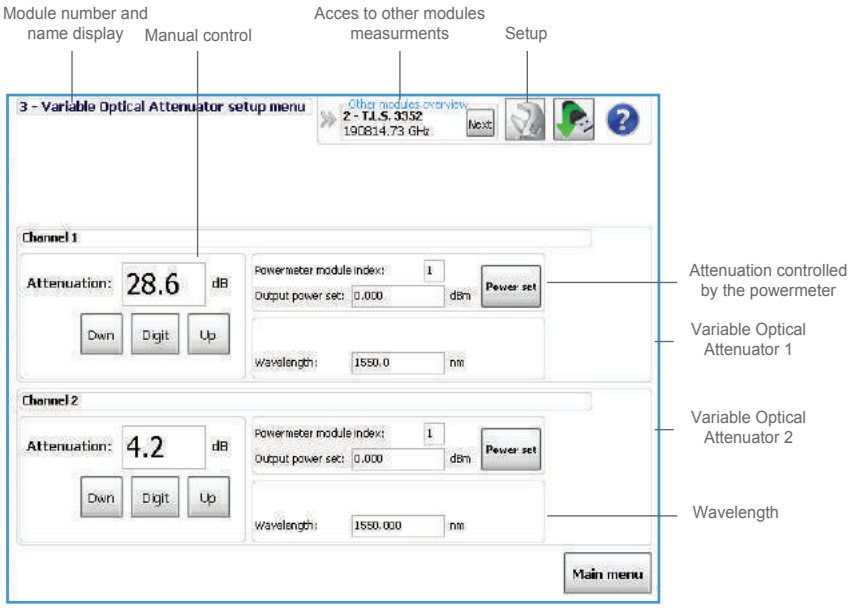
a) Pin = 0 dBm
b) The range of optical input power can be specified.
c) Pin = -6 dBm
d) Pin = -30 dBm

# AP3364 series - 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:

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

## Specifications:

| | AP3364A (simple variable optical attenuator) & AP3364A-2 (double variable optical attenuator) |
|---|---|
| Wavelength | 1550 nm |
| Attenuation range | 30 dB |
| Attenuation step size | 0.1 dB |
| Minimum insertion loss | < 1 dB |
| Temperature dependence loss | < 0.2 dB |
| Wavelength dependence loss | < 0.3 dB |
| Polarization dependence loss | < 0.2 dB |
| Polarization mode dispersion | < 0.1 ps |
| Return loss | >45 dB |
| Response speed | < 100 ms / 3 dB |
| Attenuation setting repeatability | < 0.1 dB |
| Attenuation setting backlash | < 0.2 dB |
| Maximum optical power | 300 mW |
| Operating temperature | -15°C to 35°C |

# AP3380 - Optical Tunable Filter modules

C-BAND AND L-BAND TUNABILITY AND ATTRACTIVE FEATURES


## Features:

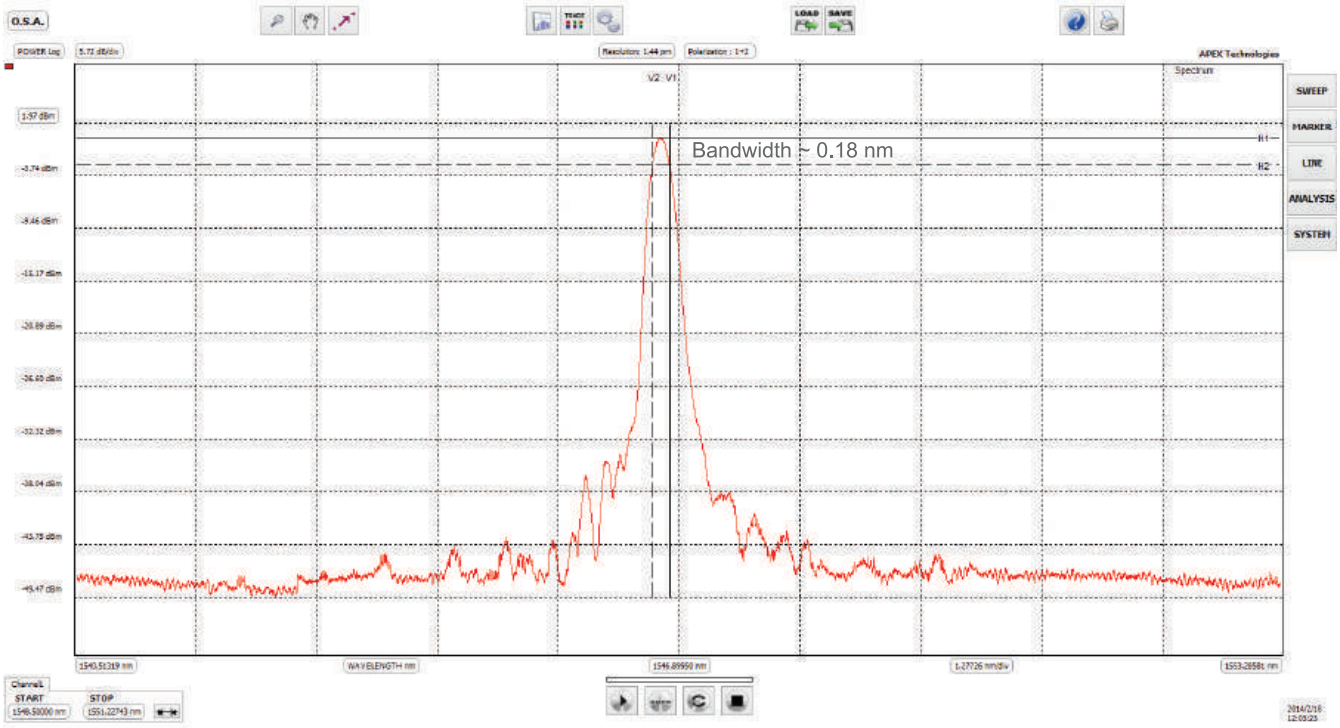
- **Excellent MEMS durability, thermal stability, and repeatability**
- **Superior optical performance**
- **Gaussian-shaped pass band**
- **Pass band optimized for 50 GHz channel spacing**
- **Customized pass bands and tuning ranges available**

## Specifications:

| | AP3380A | AP3382A |
|---|---|---|
| Tuning Range | 1529 to 1564 nm | 1575 to 1610 nm |
| Min IL @ Peak[1] | < 4.0 dB | |
| Bandwidth @ 3 dB | > 0.15 nm | |
| Bandwidth @ 20 dB | < 0.68 nm | |
| Back Reflection | > 40 dB | |
| PDL | < 0.3 dB | |
| Setting Error | < +/- 50 pm | |
| Tuning Resolution | 10 pm | |
| Tuning Speed | < 30 ms | |
| Optical Power | < 500 mW | |
| Durability | > 1 billion cycles | |
| Operating Temp | -5 to 70 °C | |
| Storage Temp | -40 to 85 °C | |
| Fiber Type | 9/125 µm single mode | |

**1. IL measured at 25 °C. IL < 5.0dB over entire operating temperature range.**

## Optical Transmission Spectrum*:




**Optical transmission spectrum of AP3380A C-band Tunable filter**

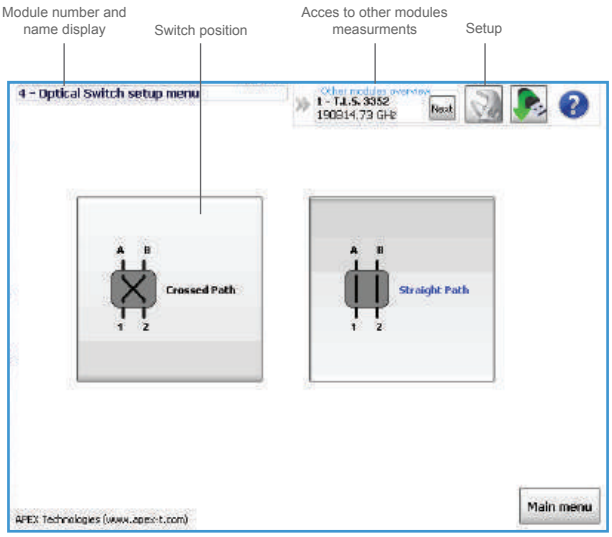
*** The spectrum is obtained by the AP2040 series Optical Spectrum Analyzer using the tracking generator feature with 1 MHz resolution.**

# AP3344 - 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:

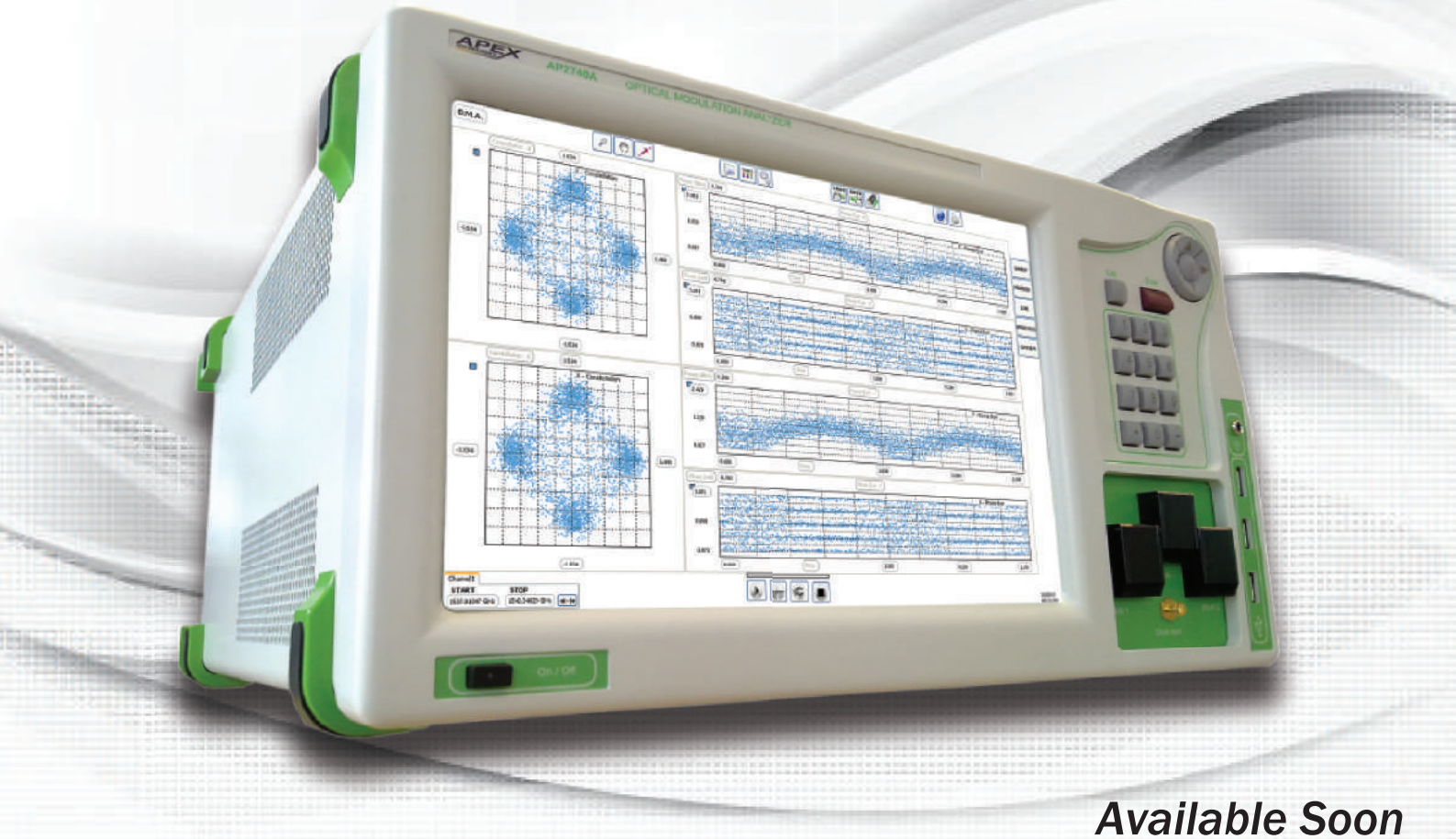
- Easy control
- Other modules measurement display

## Specifications:

| | AP3344A Switches | | | |
|---|---|---|---|---|
| | 1x2 | 2x2 | 1x4 | 1x8 |
| Wavelength | 1290~1330 nm and 1525~1610 nm | | | |
| Insertion loss (max) | 0.8 dB | 0.9 dB | 1.0 dB | 1.5 dB |
| Return loss (min) | 45 dB | | | |
| Polarization Dependent loss (max) | 0.07 dB | | 0.1 dB | |
| Crosstalk (min) | 60 dB | | | |
| Repeatability (max) | +/- 0.02 dB | | +/- 0.05 dB | |
| WDL (max) | 0.2 dB | | | |
| Switch time (max) | 4 ms | | 10 ms | |
| Durability (min) | 10^7 times | | | |
| Operating temperature | -10 to +40°C | | | |

# OPTICAL MODULATION ANALYZERS

OPTICAL LINEAR SAMPLING OSCILLOSCOPE
ULTRA HIGH LINEAR SAMPLING RATE (> 112 Gbaud)
INTENSITY AND PHASE MEASUREMENTS FOR ADVANCED MODULATION FORMATS




***Available Soon***

## AP2740 series - Optical Modulation Analyzer

### Features:

- Transmission range up to 112 GBaud
- Advanced modulation formats analysis: BPSK, DPSK, QPSK, DP-QPSK, 16 QAM, 64 QAM...
- Polarization diversity
- Real time measurement (5 Hz)
- Intensity - Phase - Constellation - Eye diagram - EVM - BER

### Applications:

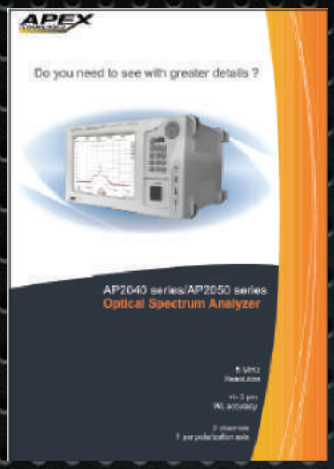
- Advanced modulation formats analysis
- Modulator characterization

## Preliminary specifications:

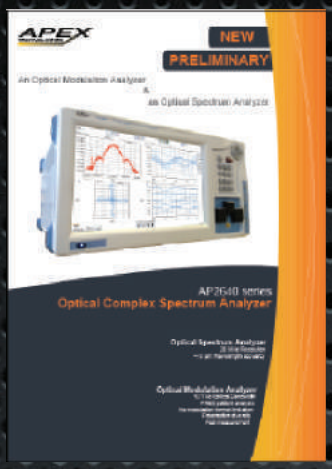
| | |
|---|---|
| Screen | 12.1 inch, color TFT |
| Front keyboard | Yes |
| USB connector | Yes |
| Internal memory | More than 1 000 traces |
| File format | Trace file (.dat, .txt), setup file, screen copy (.bmp), marker table |
| Mouse and keyboard | Yes (USB type in front panel) |
| GPIB | Yes |
| Ethernet | Yes (10/100 base T) |
| Operating temperature | +10°C to + 35°C |
| Power requirement | AC 100 to 120V / 200 to 250V, 50/60Hz |
| Optical input | FC/PC SMF28 |

| | **AP2740A** |
|---|---|
| Transmission rates | Up to 112 GBaud |
| Wavelength range | C band |
| Polarization | 2 Modulation Analyzers, 1 for each polarization channe l |
| Measurement frequency | 5 Hz |
| Detection Threshold | -15 dBm |
| Maximum measurable EVM | 40% |
| Amplitude (EVM) error | ~3% |
| Maximum input power | +10 dBm |
| Clock | Clock recovery (automatically) |
| Modulation format | BPSK, DPSK, QPSK, DP-QPSK, 16QAM, 64 QAM… |
| Pattern Analysis | Including PRBS patterns |
| **Intensity, Phase, Constellation, Eye diagram, EVM, BER…** | |

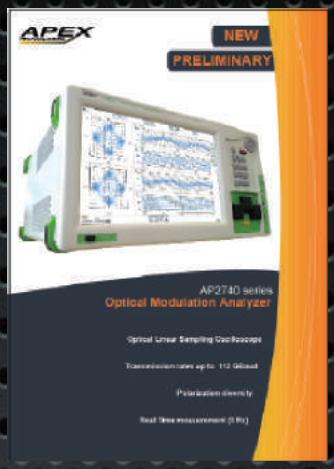
## Please find the other datasheets:




Optical Spectrum Analyzer




Optical Complex Spectrum Analyzer




Optical Modulation Analyzer


MultiTest Platform/ Modules


## Please visit our website: www.apex-t.com

# International distributors

## EUROPE

### Germany

*Polytec GmbH*
*Polytec-Platz 1-7*
*76337 Waldbronn*
*Germany*

*E-mail : d.samiec@polytec.de*
*Phone : 07243 604 4440*
*www.polytec.de*

### France

*ABSYS s.a*
*19 rue Levacher Cintrat*
*91460 MARCOUSSIS*
*FRANCE*

*E-mail : sales@absysfrance.fr*
*Phone : 01 69 63 26 30*
*www.absysfrance.com*

### UK

*Lambda Photometrics Ltd*
*Lambda House, Batford Mill, Harpenden*
*Hertfordshire, AL5 5BZ, UK*

*E-mail : contact@lambdaphoto.co.uk*
*Phone: +44(0)1582 764334*
*www.lambdaphoto.co.uk*

### Israel

*FAST Laser GROUP Ltd.*
*11 HaYesira st*
*Raanana*
*Israel 43663*

*E-mail : nachum@fastlaser.co.il*
*Phone: 972-(0)9-7444-112*
*www.fastlaser.co.il*

## ASIA

### China

*LUSTER LightTech Co., Ltd.*
*Yiyuan Cultural Industry Park*
*Building No. 2, Zone C*
*XingShiKou Road*
*Beijing 100195 China*

*Tel: +86-10-52348689*
*E-mail: baili@lusterinc.com*
*www.lusterinc.com*

### Japan

*HIKARI, INC*
*Yushima Fuji bldg. 301,*
*3-11-8 Yushima Bunkyo-ku*
*Tokyo 113-0034*
*JAPAN*

*Phone : (03) 3832 3117*
*E-mail : contact@hikari-trading.com*
*www.hikari-trading.com*

### Korea

*Panoptics Corp.*
*B-834 Sigma 2 Bldg., Gumi-dong*
*Bundang, Seongnam, 463-741*
*Gyeonggi*
*Rep. Korea*

*Phone : 0502-702-9999*
*E-Mail: panoptics@panoptics.net*
*www.panoptics.net*

## AMERICA

### US East Coast

*New England, Upstate New York, Metro NY/NJ,*
*Eastern PA, Delaware, Southern NJ, Mid Atlantic.*
*Advanced Technical Marketing (ATM)*
*1719 Route 10, Suite 113*
*Parsippany, NJ 07054*

*E-mail : sales@atm1.com*
*Phone : 973-683-1411*
*www.atm1.com*

### USA West Coast, Middle & South East Coast

*APEX Technologies USA (AMASCO)*
*3830 Valley Centre Drive, #705-481*
*San Diego, CA 92130*

*E-mail : jim@amasco.com*
*Phone : 858-509-1820*
*www.amasco.com*

APEX TECHNOLOGIES

www.apex-t.com

Your local contact


**Headquarters**

APEX Technologies
9bis, rue ANGIBOUST
91460 MARCOUSSIS
FRANCE
Tel: +33 (0)169632630
Fax: +33 (0)169632637
e-mail: sales@apex-t.com