CMA 5000

Optical Spectrum Analysis Application

Ideal Solution For Any Test Scenario

As a part of the CMA 5000 platform, the OSA applications are just one other way to accelerate the deployment of services while reducing the cost of measurement. With test and measurement options ranging from OTDR, connector inspection and dispersion to optical spectral analysis, bit error rate, SONET/SDH analysis and Gigabit Ethernet, the CMA 5000 is the ideal single solution for all your testing needs.

Today's competitive environment demands that networks offer exceptional performance and reliability with minimal down time. When characterizing and documenting such stringent performance levels, the CMA 5000 Optical Spectrum Analysis (OSA) applications are the ideal single solution for facilitating accurate and efficient channel management, power balancing and tuning throughout the network. The OSA applications lower CWDM and DWDM installation and maintenance costs by providing industry leading spectral analysis of system critical parameters.

Operating from 1250 to 1650 nm, these OSA modules for the CMA5000 are the perfect tools for testing large wavelength range CWDM system.

Two different modules are available to meet all test requirements: the OSA 425 and the OSA 400.

OSA 425: the optimized cost OSA.
This OSA is ready for field operation and harsh environment. Its internal calibration valid over all temperature range gives you accurate power and wavelength measurement in all conditions without any user calibration.

OSA 400: the highest performances for your WDM system. The OSA 400 extends the performances of the OSA 425 and provides lab specifications in a rugged field module. With best in class ORR, this OSA can compute OSNR measurements with very high accuracy. The unique flat top filter can drop signal up to 40Gb/s to do transport analysis.

Added value through performance:
- **Wide spectral range for characterization of the full telecom spectral range with a single unit**
- **High wavelength and power accuracy in all conditions**
- **Exclusive Channel Select option allows user to drop a wavelength for additional analysis for any modulation rate up to 40Gb/s (OSA 400)**
- **High ORR: up to 65 dBc at 50 GHz from peak (OSA 400)**

Reduced cost of measurement:
- **Easy-to-use one button complete spectral characterization**
- **User-defined configurations for custom CWDM and DWDM testing**
- **Reduced test time through targeted applications**

Key Features

Best in Class Optical Rejection for Accurate OSNR Measurements

Optical REJECTION Ratio (ORR) is a very important parameter for an Optical Spectrum Analyzer. This parameter gives the noise floor at a specified distance away from the center wavelength of the channel under test (see fig.1). ORR values are generally specified either at 50 GHz, 25GHz or 12.5 GHz away from the center of the channel. High ORR values guarantee high OSNR measurement accuracy. With its high Optical Rejection Ratio, more than 65dBc at 50 GHz from peak, the OSA400 is the perfect tool for measuring accurate OSNR on DWDM channels.

- ORR (OSA 400) :

  – 65 dBc at ± 50 Ghz
  – 55 dBC at ± 25 Ghz
  – 35 dBc at ± 12.5 Ghz

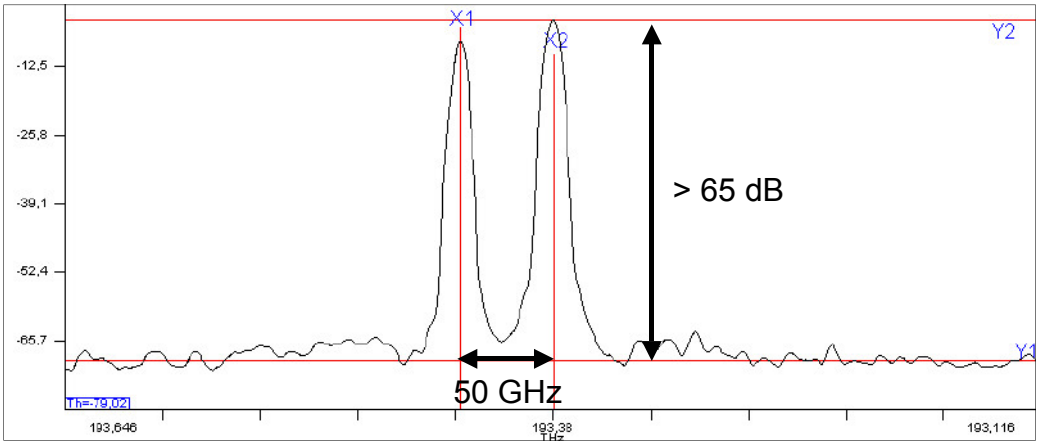


Fig.1: Two peaks at 50Ghz spacing with OSA400. OSNR measurements are no longer limited by the OSA optical response.

Excellent Polarization Dependant Loss (PDL)

The polarization sensitivity of an optical spectrum analyzer is a measurement of the power response fluctuation due to the input signal state of polarization. PDL is the ratio between the transmittances in the best and worst polarization states. The results is expressed in dB. This parameter can strongly impact the accuracy of the power measurement: for a same level of input power, an OSA displays different results depending on the state of polarization of the incoming light. For field OSA, PDL is as important as power accuracy. Change of temperature, vibration over fiber, or fiber bend will modify the polarization of light. In such a situation - frequent in the field - the power accuracy can only be guaranteed with a minimum PDL. Here are some examples that illustrate how important the PDL value is on the power measurement accuracy (see fig.2):

- Polarization Dependent Loss:
  ± 0.1 dB (Typ)

- PDL + Repeatability:
  ± 0.15 dB

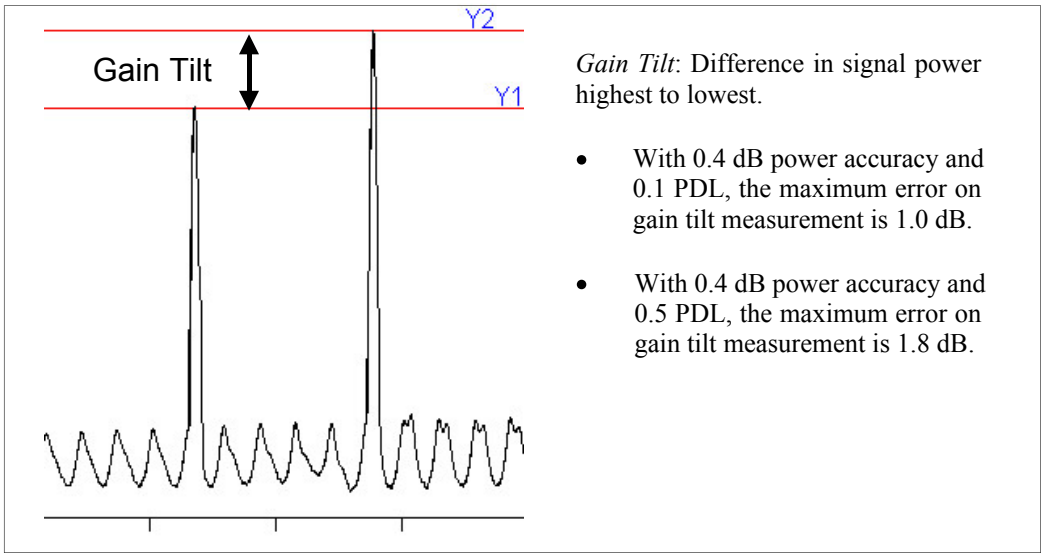


Fig.2: Influence of PDL on power accuracy measurement . With +/-0.1 dB of PDL, the CMA 5000 OSA modules guarantee high power accuracy measurements in any conditions.

Automatic EDFA tests

Erbium-Doped Fiber Amplifiers (EDFAs) are commonly used in today's WDM networks. Optical amplification is the main function of an EDFA and consequently, the gain is one of the most important parameter to measure. Nevertheless, the gain is depending on many other parameters: wavelengths, polarization, power… In theory, the EDFA gain is supposed to be flat in its operating window, but in practical it can vary from one wavelength to another. The noise figure of an EDFA must also be checked as this value will determine how many amplifiers can be cascaded on a link. That's why it is important to be able to measure the dependence of the EDFA gain to these parameters with an OSA. The CMA5000 OSA's provide automatic test for fast and easy EDFA characterization:

Benefits and Features

- Automatic computation of EDFA parameters:
  - Input power for each channel
  - Output power for each channel
  - EDFA gain in dB for each channel
  - EDFA noise values
- User-programmable thresholds for minimum and maximun power values
- Visual indication when thresholds are triggered.

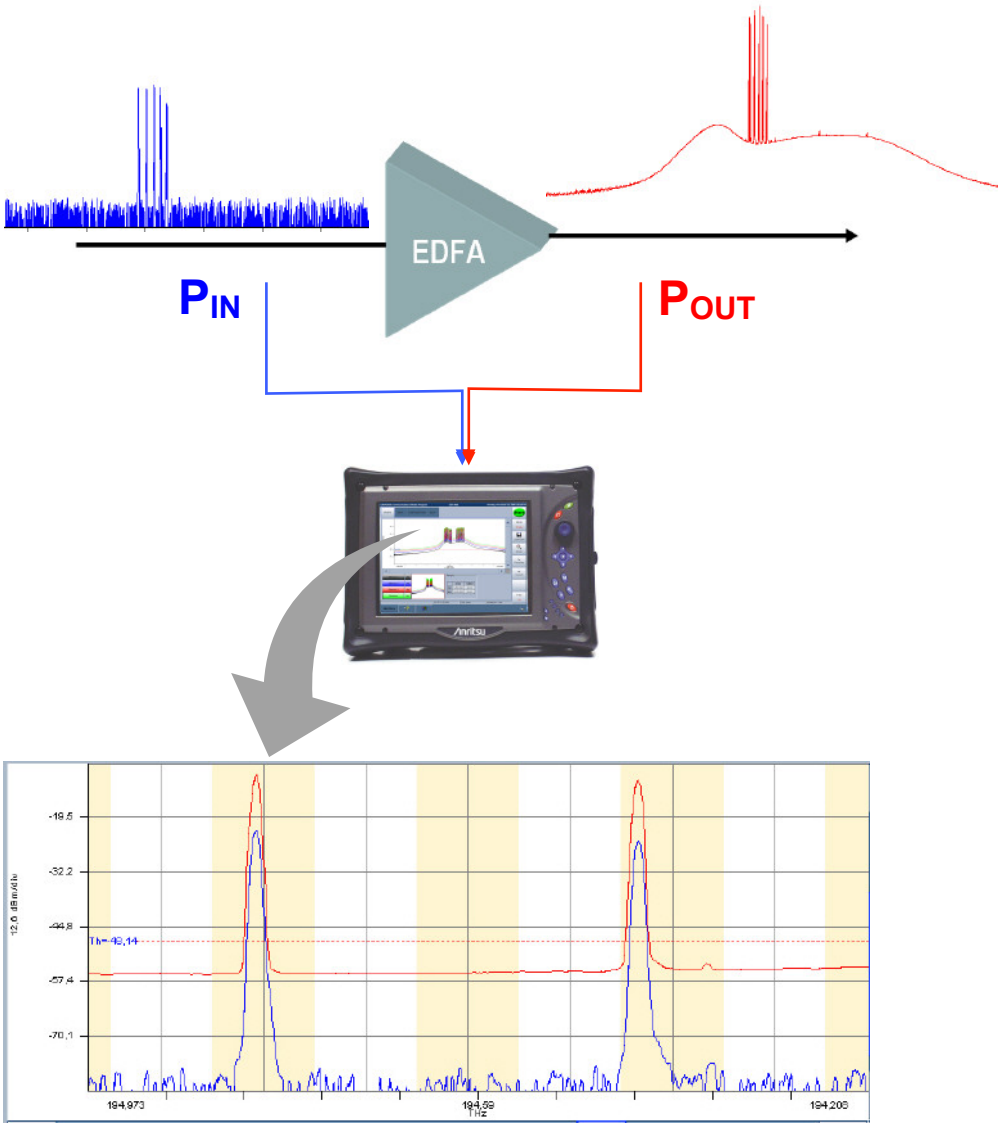


Fig.3: Input and Output EDFA curves display on the same graph for immediate analysis.

Channel	λ (nm)	P in (dBm)	P out (dBm)	Gain (dB)	Noise figure (dB)
1	1,359.982	-31.27	-14.07	37.20	-15.69
2	1,361.422	-18.69	-11.63	7.06	-3.22
3	1,591.980	-39.84	-10.22	29.62	-13.15
4	1,592.855	-20.26	-10.09	10.16	0.91
5	1,639.755	-33.50	-9.97	23.53	-7.25
6	1,640.447	-15.88	-1.43	14.46	1.05

Fig.4: The OSA application automatically computes the EDFA parameters from the curves and displays the results in a table with coloured threshold indication.

Key Features

- Unique Tunable flat top sharp-edge filter for channel drop
- Ability to drop a signal up to 40 Gbps for transport analysis
- User-programmable filter width

Unique Channel Drop Filter (OSA 400 only)

The deployment of DWDM systems presents system engineers and maintenance personnel with the added challenge of how to selectively choose one channel among many and analyze its performance. For example, WDM networks are commonly used to transport SDH/SONET signal. Each data channel is carried on its own unique wavelength. Several channels are transmitted on the fiber at the same time. To analyze the SDH/SONET signal, it is necessary to select and drop the corresponding wavelength. The main challenge is to ensure that the bandwidth of the filter does not degrade the integrity of the channel under test. In the case of a 10 Gb/sec modulated signal, depending on the modulation technique, the bandwidth of the filter within the spectrum analyzer may need to be in excess of 20 GHz. For practical use, it is desirable that the bandwidth of the filter be large enough to accommodate center wavelength drift of both the channel under test and the measuring device, as well as the sidebands of the modulated signal. For a 40 Gb/sec system the bandwidth of the device may need to exceed 80 GHz. The OSA 400 has unique embedded channel drop filter. Any wavelength can be selected via the tunable flat top sharp-edge filter. The bandwidth of the filter is also adjustable depending on the modulation rate of the signal. The OSA 400 filter can support modulation rate up to 40 Gbps. The combination of the OSA module and the SONET/SDH module (XTA or UTA module) in the same CMA 5000 platform is particularly useful to completely test WDM links carrying SONET/SDH signals as shown below:

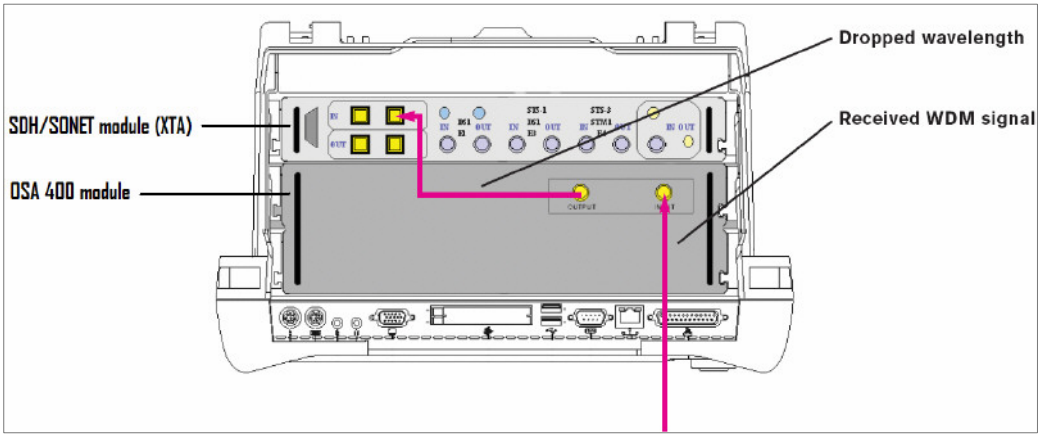
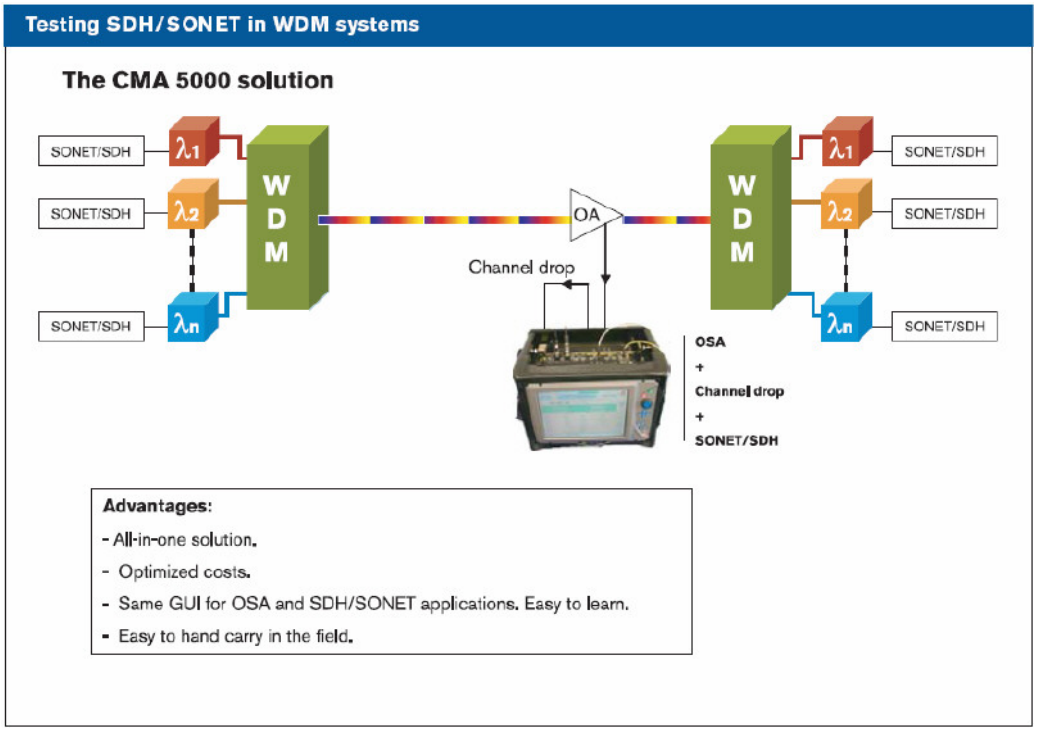


Fig.5: The CMA 5000 offers a "all-in-one" solution for extracting SDH/SONET signal from WDM networks



OSA Specifications	OSA 400	OSA 425
Spectral Range	1250-1650 nm	
Wavelength Accuracy [1,2]	±40 pm ±15 pm [3]	
Wavelength Repeatability [4]	±5 pm	
Wavelength Stability [5]	±10 pm	
Wavelength Linearity [2]	±15 pm	
Maximum Total Safe Power	+25 dBm	
Power Range per Channel [2,6]	+20 to -70 dBm	
Noise Floor [6,7]	-75 dBm	
Power Accuracy [8]	±0.4 dB	
Power Repeatability [4]	±0.04 dB	
Power Linearity [1]	±0.1 dB	
Power Flatness [2]	±0.3 dB	
Power Stability [5]	±0.1 dB	
Polarization Dependent Loss [9,10]	±0.1 dB	
PDL + Repeatability [9]	±0.15 dB	
Optical Resolution Bandwidth (FWHM) [2]	60 pm; 100 pm; 200 pm & 500 pm [12]	<70 pm
Settings Resolution Bandwidth	Full, 0.1 nm, 0.2 nm, 0.5 nm, 1 nm	Full, 0.1 nm, 0.2 nm, 0.5 nm, 1 nm
Optical Rejection Ratio [2,11]	65 dBc at ±50 Ghz from peak 55 dBc at ±25 GHz from peak 35 dBc at ±12.5 Ghz from peak	40 dBc at ±50 Ghz from peak 35 dBc at ±25 GHz from peak 25 dBc at ±12.5 Ghz from peak
Optical Return Loss	>45 dB	>40 dB
Maximum Measurement Time	8s (for 400 nm and 80,000 sampling points)	
Scanning Time [13]	< 2s	
Channel Number	1024	
Wavelength Readout Resolution	1 pm	
Power Readout Resolution	0,01 dB	
Internal Temperature Sensor	Yes	
Internal Wavelength Calibration	Yes (Automatic)	

Notes

[1] Signal from +5 to -30 dBm from 15°C to 30°C

[2] in C&L band (1530-1610 nm)

[3] User offset with external calibration

[4] in 5 consecutive scans

[5] in 1 hour

[6] with averaging

[7] In C Band (1530-1570 nm)

[8] at -15 dBm in C band (1530-1570 nm)

[9] at 1550 nm; at 23°C ±2°C

[10] Typical

[11] with the finest resolution

[12] ±10%

[13] 45 nm scan

[14] For FWHM > 150 pm

Notes

[2] in C&L band (1530-1610 nm)

[9] at 1550 nm; at 23°C ±2°C

[10] Typical

[14] For FWHM > 150 pm

Channel Drop Features	OSA 400	OSA 425
Spectral Range	1250-1650 nm	NA
Modulation Rate	Up to 40 Gbps	NA
Filter Bandwidth [9]	User selectable from 60 to 800 pm	NA
Insertion Loss [9]	<10 dB	NA
Autopositioning Accuracy [10]	±40 pm	NA
Wavelength Resolution	5 pm	NA
Polarization Dependent Loss [9,10]	±0.1 dB	NA
Optical Bandwidth Resolution	20 pm	NA
Flatness [14]	Width at -0.2 dB> FWHM / 2	NA
Crosstalk [2]	Up to 65 dB	NA

General Specifications	
Operating Temperature	0°C to +40°C
Storage Temperature	-20°C to +70°C
Humidity	95% RH non-condensing
Battery Operation	Yes
Calibration Cycle	1 year recommended
Warranty	1 year standard
CMA 5000 platform features are detailed in the CMA 5000 platform specifications sheet	

Ordering Guide

References	Description
5510-100-OSA-XXX	OSA 400 with filter: High resolution Optical Spectrum Analyzer covering 1250-1650 nm with channel selector for signals up to 40 Gbps
5525-000-OSA-XXX	OSA 425: Optical Spectrum Analyzer covering 1250-1650nm
XXX= connector option	UFC = FC/UPC USC= SC/UPC AFC= FC/APC ASC= SC/APC

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