RXT-4500 OSA Module
CWDM and DWDM Testing

RXT-1200
Modular Test Platform

Optical Spectrum/Channel Analyzer for CWDM and DWDM Networks
Using superior micro-optic design and MEMS tuning technology, the RXT-4500 OSA module measures key optical parameters such as wavelength, channel power, and OSNR.

Platform Highlights

- Precise measurement of WDM wavelengths
- Wide wavelength range
- High wavelength accuracy and resolution
- Built-in wavelength reference
- High power sensitivity
- Excellent power accuracy
- Rugged, reliable design - No moving parts
- Superior shock resistance
- Periodic calibration not required
- Ultra-low power consumption
- Low temperature sensitivity
- Intuitive operation with dedicated test functions
- Touch screen for simple zooming and navigation
- Battery operating time > 8 hours

Key Features

- Wavelength range from 1260 to 1650 nm
- In-band OSNR measurement
- Resolution 0.1 nm C-band; 0.32 nm C+L band
- Fast continuous scanning at ≤ 5 sec
- Simultaeous measurements of up to 200 channels
- DWDM channel spacing down to 37.5 GHz
- Channel power measurement
- Channel threshold detection
- Span power measurement
- Continuous sweep with min/max hold
- Channel frequency and wavelength delta vs. ITU grid
- High wavelength accuracy: ± 50 pm
- High dynamic range: ≥ 65 dB
- OSNR measurement: up to 35 dB
- Low Polarization Dependent Loss (PDL): < 0.3 dB
- Universal optical interface with industry standard adaptors
- Supports 10/40/100 Gbps transmission modulation types
- DFB laser qualification
- DWDM channel monitoring per ITU G.694.1 grid
- CWDM channel monitoring per ITU G.694.2 grid
- OSNR measurement compliant with IEC 61280-2-9

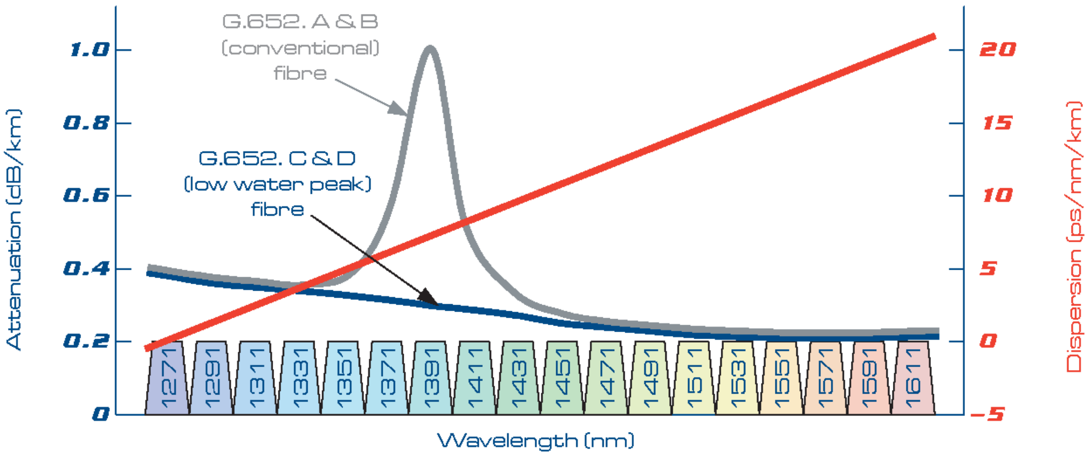
Applications

The OSA module is a perfect compromise between a full blown OSA and an optical channel analyzer. The unit features the most important spectrum analysis capabilities required to install, commission and troubleshoot DWDM and CWDM networks. High reliability is achieved through a rugged mechanical design which features no moving parts and does not require periodic calibration. The hardware and user interface are optimized for simplicity - measurements settings are also kept to a minimum, making it easy to use for any skill level. Despite its simple operation, the unit still features the most critical OSA measurement capabilities such as precise power and wavelength characterization.

CWDM Technology

Coarse Wavelength Multiplexing (CWDM) technology is used frequently in enterprise or metro networks to increase bandwidth capacity economically. CWDM transmission systems can transport up to 16 channels (wavelengths) in the 1270 nm to 1610 nm spectrum with a 20 nm channel interval. The width of each channel is 13 nm while the remaining 7 nm is designed to be the guard band to the next channel. Due to the 20 nm channel spacing, cost-effective un-cooled lasers can be used.

CWDM technology is often used to transport different types of services, e.g. Ethernet, SDH/SONET, and Fibre Channel (FC) but it has limitations in the distance over which the traffic is transported and also in the total channel count.



ITU-T G.694.2 - CWDM Wavelength Grid

Testing CWDM Networks

Test parameters in a CWDM network are normally less stringent compared to DWDM systems – due in part to more lenient laser wavelength tolerances and wide pass-band filters being used. Since there are no active components like Erbium Doped Fibre Amplifiers (EDFA) to create noise in a CWDM network, using a complex and expensive OSA would be an overkill and inappropriate for field testing.

The RXT-4500 full band OSA option quickly determines the presence/absence of each of the 16 wavelengths and checks their power levels accurately. Thanks to excellent sensitivity and a large power input range of 65 dB dynamic range, the OSA can be connected to a 20 dB monitoring tap on the OADM, making it ideal for non-intrusive channel analysis.

Sophisticated MEMS tuning technology that has no moving parts, allows the unit to make faster measurements than most complex OSAs, enabling quick troubleshooting of a CWDM network.

Applications *cont'd*

DWDM Technology

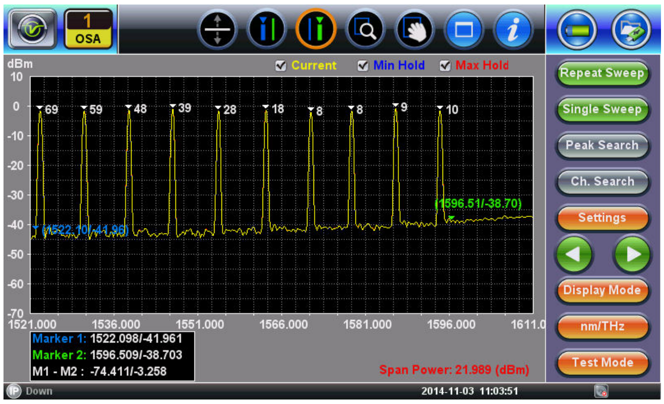
DWDM technology is particularly suitable for long-haul transmission systems because its supports Erbium Doped Fiber Amplification (EDFA). The ITU-T G.694.1 recommendation defines the wavelengths found in the C-band (1527-1567 nm) and L-band (1565-1620 nm) with channel spacing at 50 GHz (0.4 nm), 100 GHz (0.8 nm) or 200 GHz (1.6 nm). Densely packed channels aren't without their limitations especially as precision lasers must keep channels exactly on target.

Testing DWDM Networks

Boasting impressive specifications, the OSA is suitable for lab operation or harsh field environments. An Athermal design assures calibration is valid over all temperature ranges resulting in accurate power and wavelength measurement in adverse or controlled conditions. The OSA supports C-band or C+L-band measurements with superior wavelength and channel resolution. The unit is an indispensable tool for checking critical parameters responsible for transmission faults.

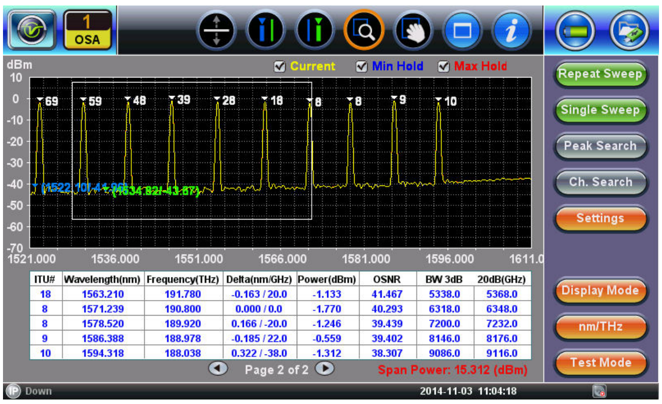
Critical DWDM Parameters

- Channel wavelength or frequency stability
- In-band OSNR
- Channel wavelength and frequency delta vs. ITU grid
- Levels below threshold or fluctuating over time
- Optical Signal-to-Noise Ratio (OSNR) below limits
- Excessive noise level per channel bandwidth
- Noisy amplifiers (EDFA)
- Channel Crosstalk (channels too close together)
- Power Tilt for channel equalization
- EDFA gain flatness and balancing



Viewing Modes

Measurements can be viewed in graphical and tabular formats and the display can be optimized "on the fly" during or after the test depending on what information needs to be presented. A level threshold can be set to display channels above a defined limit or it can also be used to reduce the number of overall channels viewed.



Zooming - Specific channel/s can be analyzed in detail by defining a zoomed area on screen using a stylus or finger.

Channel Search - Quickly identifies valid DWDM channels. Markers are placed automatically on the channel along with wavelength and level information.

Peak Search/Hold – Simplifies channel measurement and enables long-term stability testing of wavelength or level with drift function. Peak hold is also very useful to verify power levels before and after signal amplification (EDFA).

EDFA Testing

Erbium-Doped Fiber Amplifiers (EDFAs) are commonly used in DWDM networks. Ideally, amplifier gain is supposed to be flat, but several factors including wavelength, polarization, and input power influence the gain performance and thus the tilt of channels. The DWDM OSA models offers very good polarization sensitivity to ensure level measurements are not overly impacted by wavelengths having different states of polarization. With ± 0.5 dB power accuracy and < 0.3 dB Polarization Dependent Loss (PDL), the OSA is able to perform EDFA gain tilt measurements with an uncertainty of < 1 dB.

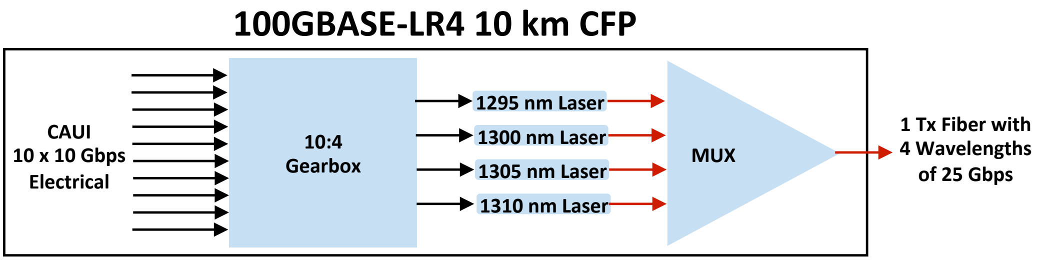
Applications *cont'd*

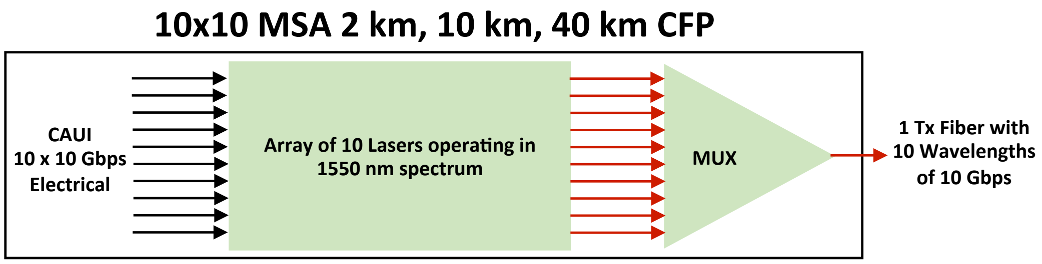
100G Transmission Systems

100G systems are being deployed rapidly, resulting in a transition to multi-wavelength CFPs (C form-factor pluggable) transceivers (client-side). CFPs are key to reliable system deployment, so operators need to make sure these optical modules work error-free and can interoperate with other standards-compliant modules. CFPs presents a new set of challenges, and testing power and wavelength performance of each optical lane has become increasingly important.

10X10 Multi Source Agreement (MSA)

The key impediment to faster 100GE adoption has been the high-cost and high-power footprint of the IEEE standardized client side CFP modules using four wavelengths. The 10X10 MSA defines a CFP module that maps 10 electrical lanes at 10 Gbps directly onto 10 lasers over single-mode fiber up to 40 km. Designed primarily for 100 Gigabit Ethernet (100 GE) systems using 10 lanes of 10.3125 Gbps (total 103.125 Gbps), the specification also supports 10 lanes of 11.18 Gbps for Optical Transport Unit 4 (OTU4) applications at 111.81 Gbps.





100G Service Testing

Since 4X25 and 10X10 CFPs use WDM technology, simple aggregate power measurement of the wavelengths will not prove the system is operating correctly. Depending on the CFP range, wavelength levels can differ significantly due to channel insertion loss, Transmission and Dispersion Penalties (TDP). It is imperative to check that the receive power level of each optical lane falls within the CFP's sensitivity limits and not to rely on the internal diagnostics of the CFP itself.

Reliable 100G Measurement

The RXT-4500 OSA is ideal for testing CFP based WDM optical networks. Different models cover the required wavelength spectrum ranging from 1260 – 1650 nm. Center wavelengths are measured precisely in GHz and dBm, and are presented in both graphic and tabular formats for simplified viewing and diagnostics.

Applications *cont'd*

DFB Laser Characteristic Measurement

Laser performance parameters including peak wavelength, peak amplitude, SMSR (Side-Mode Suppression Ratio), and more can be evaluated.

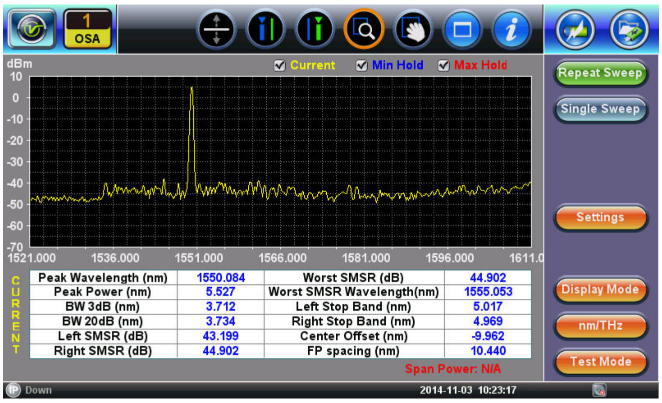
Side mode suppression ratio (SMSR) - amplitude difference between the main and largest side mode

Stop band - wavelength spacing between the lower (left) and upper (right) side modes adjacent to the main mode

Mode Offset - wavelength separation between the main and largest side mode

Center offset - indicates how well the main mode is centered in the stop band

Bandwidth - main spectral component of the DFB laser

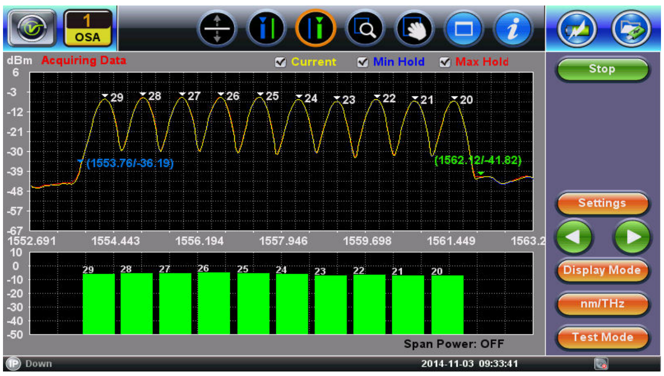


Optical Channel Monitoring

DWDM and CWDM channels are scanned and detected automatically according to pre-defined ITU spectrum grids. For DWDM, this includes 50, 100 and 200 GHz channel spacings in the C and C+L bands as defined by ITU-T G.694.1 recommendations, including Flex Grid applications down to 37.5 GHz. For CWDM, this covers channel spacing defined in G.694.2 recommendation.

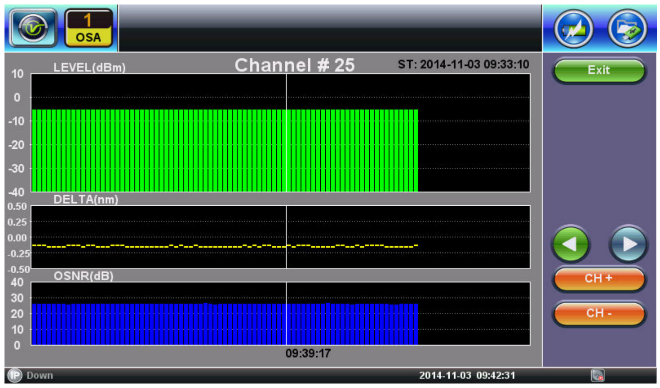
Split screen

Results can be displayed in spectrum or bar chart mode or together in an intuitive split screen mode. This convenient "channel checker" not only verifies the ITU channel #, but also the performance of each channel simplifying the installation, maintenance and upgrades of xWDM systems.



Histogram function

Intuitive histograms allow the user to monitor signal dynamics and identify performance change over time.



Threshold Settings

Being able to set alarm thresholds to visualize the current or historical status of channels is a powerful tool to optimize operational performance.

Event Table

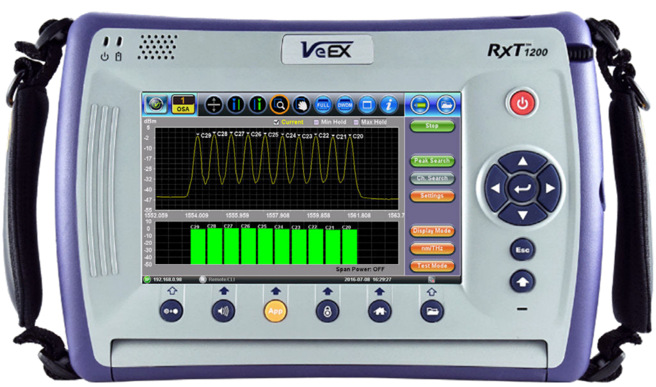
Frequency drifts, power level deviations and OSNR fluctuations are listed with time stamps in a comprehensive event table which stores up to 1,000 events along with the alarm type and value detected.

Specifications[1]

Parameter	Unit	Full Band + C Band	Full Band	C+L Band	C Band
Wavelength Range[2]	nm	1260 - 1650	1260 - 1650	1521 - 1611	1527 - 1567
Number of Channels	#	Up to 96 Channels @ 50 GHz C-band / 200 @ 50 GHz C+L band			
Channel Spacing	GHz	50, 100, 200 GHz, Flex Grid down to 37.5 GHz, or User Defined			
Maximum Input Power	dBm	30			
Input Power Range	dBm	+15 to -50			
Channel Peak Power Accuracy[3,4]	dB	± 0.5[5]	± 1.0	± 0.5	± 0.5
Integrated Channel Power Accuracy[3,4]	dB	± 1.0			
Power Measurement Repeatability[4]	dB	± 0.1			
Polarization Dependent Loss (PDL)	dB	< 0.3[6]	< 0.5	< 0.3	< 0.3
Absolute Wavelength Accuracy	pm	± 50[1]	± 500	± 50	± 50
Wavelength Repeatability	pm	± 10[1]	± 100	± 10	± 10
Wavelength Resolution (FWHM)	nm	3.5 Full/0.15[1] C-band	3.5 typical	0.35 typical	0.16 typical
Wavelength Readout	pm	10/1	10	1	1
Optical Rejection Ratio (ORR)[7]	dB	> 40			
Noise Floor[8]	dBm	≥ -55 dBm C-band			
Sweep Time	s	5			
Optical Interface		Universal base with interchangeable FC, SC, LC, E2000 adaptors			

Notes:

1. Unless othewise stated, all specifications valid at 23°C ± 2°C (73°F ± 3.6°F) using FC/UPC connector
2. Fullband mode 1250-1650 nm; C-band mode 1527-1567 nm; C+L band 1521-1611 nm
3. Specifications guaranteed for input power range from -10 to -40 dBm
4. Does not include PDL
5. Accuracy ± 0.5 for C-band; ± 1.0 for Fullband
6. PDL < 0.3 or C-band; < 0.5 for Fullband
7. ORR @ 200 G
8. Noise Floor ≥ -65 dBm Fullband; ≥ -55 dBm or C-band and C+L band



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