Lightvision

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Finally, we have it....

Affordable, No Moving Parts

μs SPEED Tunable Filter

The Lightwaves2020's Electro-Optic Fabry-Perot Tunable Filter is a specialized filter based on the Electro-Optic crystal Fabry-Perot Etalon technology. The wavelength tuning is achieved by an applied electrical field, which modulates the refractive index of crystal. There are no moving parts in the filter. The integrated high-speed tunable filter does not need alignment in application. Therefore, the product is shock resistant and has small footprint. Its maximum scanning frequency to 100kHz can be used in the fast transient phenomenon test.

The high-speed tunable filter is essentially none-sensitive to input polarization of the optical signal. The polarization independent feature makes it very stable and repeatable without a polarization controller.

The bandwidth of the tunable filter can be designed from 0.2nm to 0.001nm by choosing the finesse of the Etalon. The temperature-controlled design has as high as 10 - 6nm wavelength stability.

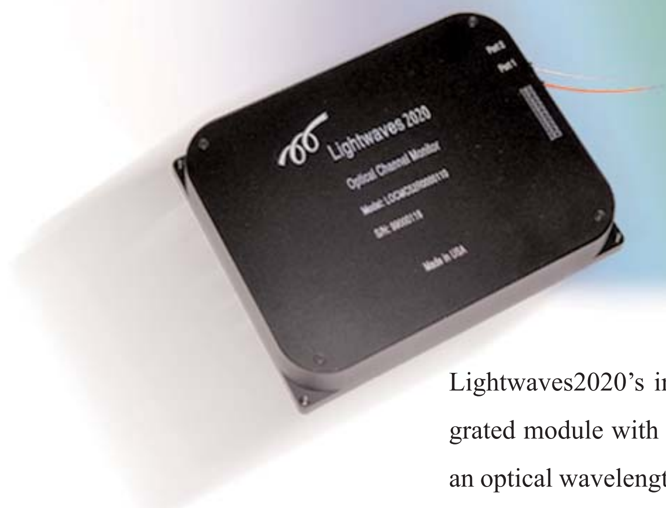
A 0 - 5V of scanning voltage enables the tunable filter to scan whole C-band, L-band, and even C+L-band wavelength range. The scanning voltage can be programmed to select any expected wavelength transmitted. These features make the high-speed tunable filter a unique candidate in many high-speed network applications, such as WDM, OPM, OCM, RODAM, WSS et al system design.

Main Applications:

The main applications of the high-speed tunable filter are: ultra-high resolution Optical Spectrum Analysis (OSA), Optical Performance Monitoring (OPM) and Optical Channel Monitoring (OCM), tunable channel drop for WDM, tunable optical noise filtering and channel locking, optical IR spectroscopy, and sensing applications.

Compact, Affordable ....

Optical Channel Monitor



Lightwaves2020's innovative Optical Channel Monitor (OCM) is a compact integrated module with multiple functions. It can serve as an optical channel monitor, an optical wavelength meter, and a DWDM spectrum analyzer at the same time. The OCM, combining Lightwaves2020's proprietary micro optics and optical thin film technology with high-speed electronics and advanced algorithm in signal processing, sequentially scans the wavelength range of the whole C-band and provides accurate real-time and non-intrusive measurements of the optical channel power and wavelength with large dynamic range at ITU grids of 100GHz or 50GHz.

The OCM has been a very useful tool in channel power/wavelength measuring, wavelength routing and path provisioning, multi-channel EDFA gain balancing, fiber optic sensing, etc.

Lightwaves2020's OCM, which has passed related Telcardia tests, is highly reliable. Compared with products of other suppliers, Lightwaves2020's OCM comes in compact size and with low costs. In addition, it is capable of measuring / monitoring multiple lines simultaneously. Undoubtedly, Lightwaves2020's high performance OCM renders the best solution in DWDM network monitoring, ROADM, WSS and other applications.

Main Features:

- 50GHz or 100GHz ITU grids, C-band, L-band or C+L bands
- Excellent temperature stability
- Single port or multiple (2 to 4) port monitoring
- High accuracy in power and wavelength measurements
- In-line OSNR

Cost effective OSNR monitor using LC phase shifter

1. Introduction

We report an improved cost effective OSNR monitoring technique using Liquid-Crystal (LC) phase shifter [3]. The operation principle is assumed that the incident signal is polarized and the Amplified Spontaneous Emission (ASE) noise is random [4]. Then, the signal and noise can be separated and the OSNR is calculated.
When an incident light polarization was controlled to be parallel to p direction of the polarization beam splitter (PBS), theoretically we received the maximum optical power, which is the sum of signal and half of the ASE noise:

$$I_1 = S + \frac{1}{2} ASE \qquad (1)$$

Where in the s direction, we received the minimum optical power, which is half of ASE noise:

$$I_2 = \frac{1}{2} ASE \qquad (2)$$

So the OSNR can be simply calculated as:

$$OSNR = \frac{I_1 - I_2}{2 I_2} \qquad (3)$$

2. Experimental Setup

The experimental setup is shown in *Fig.1*. A novel fiber-optic Variable Polarization Beam Splitter (VPBS), developed in house, is employed electrically controlled LC cells as phase shifter to control incoming light polarization. The fiber-optic VPBS consists of liquid-crystal (LC) cells and polarization beam splitter (PBS). Compared to other technologies, the LC phase-shifters provide many attractive features, including low residual loss, high polarization extinction ratio, high damage threshold, low polarization-dependent loss (PDL), and excellent tenability and controllability. [3].

Usually one or two LC cells are used in this configuration. In order to improve searching convenience, two cells are preferred, one is aligned at 45° with respect to the horizontal, and the other one is parallel to vertical or horizontal orientation. The control voltage applied on the LC cells driver to change the phase retardation between two polarization components of incoming signal. Thus, for an arbitrarily polarized incident light, no matter what its polarization is, linear, circular or elliptical, the LC phase shifter can change it to be a linear polarized state.

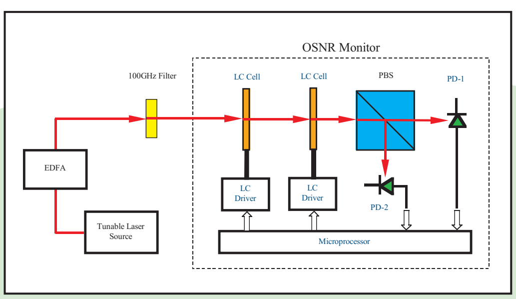


Fig.1 Experimental setup-1 with PBS cube as polarization splitter

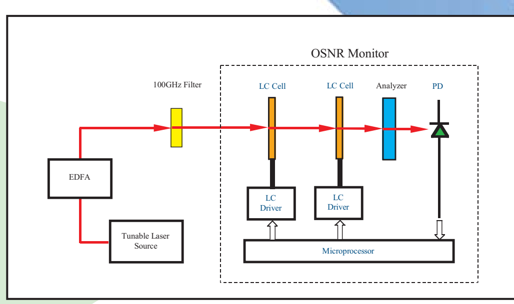


Fig.2 Alternative experimental setup-2 with analyzer

In the experiment, the PBS cube has maximum polarization extinction ratio of ~ 35dB. To achieve higher OSNR measurement, PBS with higher extinction ratio is required. A special analyzer with extinction ratio of ~ 60dB is used to replace PBS cube. The alternative experimental setup using analyzer is showed in *Fig.2*. With changes in the applied voltage to the LC cells driver, the polarization of the incident light can be tuned to be parallel and perpendicular to the optical axis of analyzer respectively. Only one photodiode needed to receive the transmitted maximum and minimum light power. The maximum corresponds S+ ½ ASE and the minimum corresponds ½ ASE. Accordingly, with the using of analyzer, more compact and reliable fiber-optic VPBS system can be constructed

3. Results

The test results for the above two setup were summarized in *Fig.3* (A) and (B). The vertical Cartesian coordinate shows the optical power detected by photodiode. The horizontal shows the voltage on the LC cell-2 driver with range from 0 to 5VDC, while the LC cell-1 voltage was shown as a parameter. *Fig.3* (A) showed the optical power of PD-1 and PD-2 for the first setup. The maximum optical power difference 33.5dB from PD-1 and PD-2 were obtained at V1 = 0.61V and V2 = 4.9V. The OSNR was calculated to be 32.8dB.

Fig.3 (A) *Fig.3 (B)*

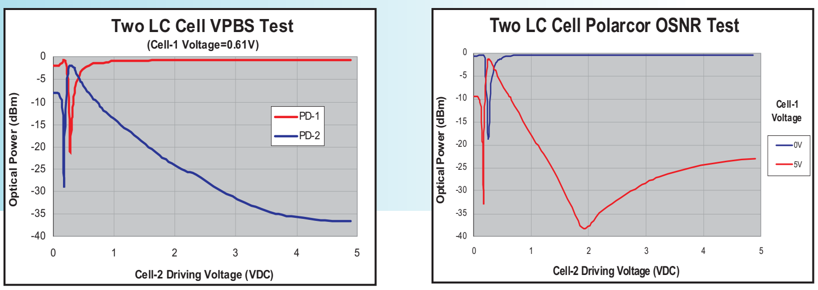


Fig.3.Optical power detected by photodiode vs. voltage on LC cell-2

Fig.3 (B) showed the PD reading in the second setup. The maximum optical power – 0.34dBm at V1= 0V,V2= 0.93V, while a minimum optical power – 38.28dBm at V1= 5V, V2= 1.94V were obtained. The calculated OSNR was 34.9dB.

The test condition and calculated OSNR were listed in Table-1.

Table-1 OSNR

		Cell-1 Voltage (VDC)	Cell-2 Voltage (VDC)	Optical Power (dBm)	OSNR (dB)
VPBS	Max.	4.9	0.44	-0.76	32.82
	Min.			-34.28	
Polarcor	Max.	0	0.93	-0.34	34.93
	Min.	5	1.94	-38.28	

4. Conclusions

We have demonstrated a novel, cost effective and practical OSNR monitoring technique using a LC phase shifter and a fiber-optic VPBS. Experimental results showed that this novel OSNR technique with properly calibrated could be used in optical channel / performance monitoring in DWDM networks.

Lightwaves2020, a consistent exhibitor at BiOS and Photonic West, has achieved extraordinary success by actively participating in these two trade shows. The advanced coating technology developed by Lightwaves2020 has caught huge attention at BiOs and Photonic West this year.

Lightwaves2020 launched the optical channel monitor (OCM) and high-speed products at the OFC / NFOEC 2008, which has become a tremendous hit. With the aid of eye-catching background posters, Lightwaves2020's booth was constantly busy and crowded.

Lightwaves2020 starts to advertise its innovative OCM and high-speed products with impressive slogans in February. These phenomenal advertisements can be found in the February, March, and May issues of Laser Focus World and Lightwave Magazine.

The brief introduction of Lightwaves2020's high-speed polarization controller was released in the new/innovative products section of the March issue of Laser Focus World (p. 101) and Photonics Spectra (p. 146).

Lightwaves2020 delightfully welcome Bill Chen to join the company.

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Lightvision is a publication of Lightwaves2020 as a service to customers and sales associates.

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