

WHITE PAPER

Low Phase Noise Laser Improves Coherent Communication R&D

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Introduction

This paper aims to describe TeraXion's Tunable Narrow-Linewidth Laser, the PureSpectrum™-TNL, a laser module developed for coherent communication R&D.



PureSpectrum™ PS-TNL - Tunable Narrow-Linewidth Laser

The PS-TNL features a 1 kHz narrow-linewidth calculated from a white frequency noise value at >500 MHz. The white noise filtering system is based on true optical filtering using an ultra-narrowband multi-wavelength fiber Bragg grating (FBG), as illustrated in Figure 1. This full C-band tunable gridless operation ITLA laser module is well suited for coherent communication labs using advanced modulation formats at 100 and 400 Gbps and soon 1 Tbps.

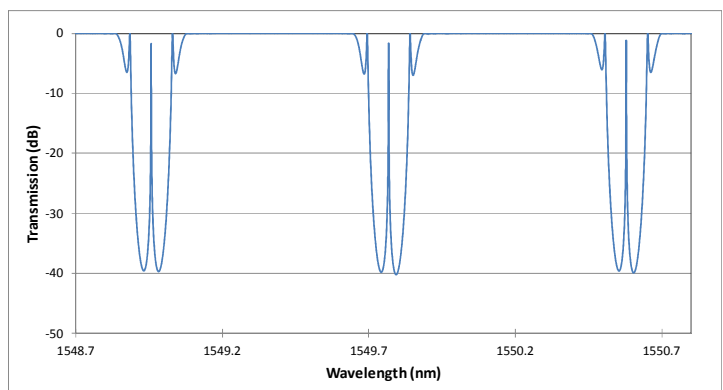
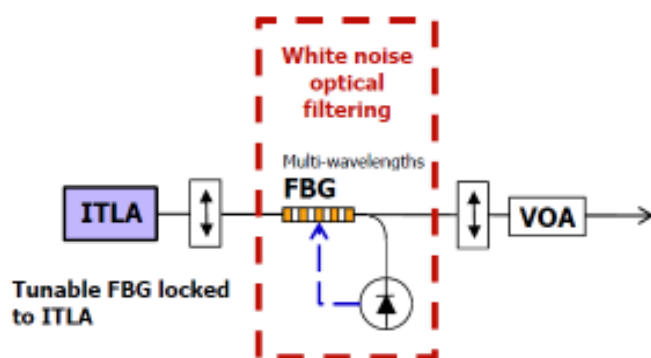


Figure 1: Narrow-linewidth laser equipped with white frequency noise optical filtering system based on multi-channel FBG.

The white noise optical filtering system developed by TeraXion shows its benefits above 100 MHz, as shown in Figure 2. The white-noise plateau of the free-running ITLA (black) is considerably reduced in the frequency range >100 MHz (by up to 20 dB), when the ultra-narrowband multi-wavelength FBG-based optical filtering system is locked on the ITLA laser. The white frequency noise optical filtering system developed by TeraXion is effective between 100 MHz and 10 GHz. After 10 GHz the white noise of a typical semi-conductor laser is by design significantly reduced; white frequency noise optical filtering is therefore not required. TeraXion believes the next-generation ITLA lasers may benefit to use the principle of FBG-based white noise optical filtering to achieve better phase noise performances.

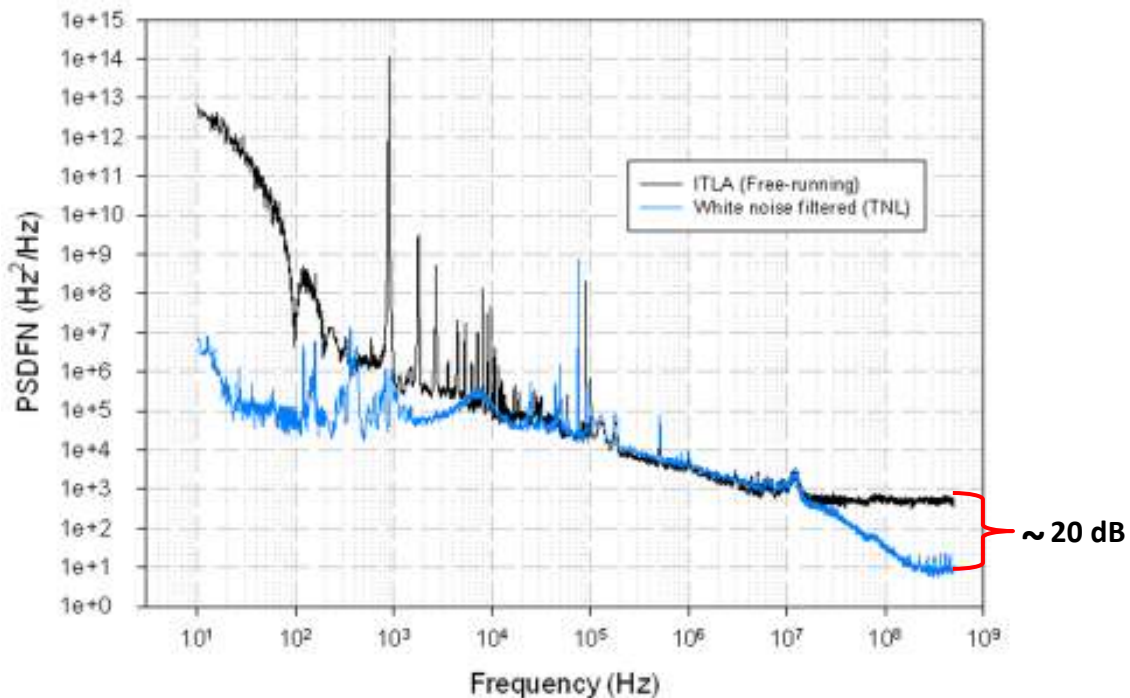


Figure 2: Power spectral density of frequency noise of an ITLA free running and a white noise filtered ITLA laser

Summary

The reduction of white frequency noise brought by TeraXion's FBG-based optical filtering system improves the Q-factor of coherent communication experiments limited by phase noise. The PureSpectrum™-TNL is an essential lab building block for anyone testing different advanced modulation formats for rates of 100 and 400 Gbps, with an eye on 1 Tbps.

Parameters	PS-TNL—Tunable Narrow-Linewidth Laser
Laser type	ITLA semiconductor laser diode C-band tunable
Filtering type	White noise suppression by optical filtering with multi-channel FBG
Filtering efficiency range	~20 dB white noise suppression between 100 MHz to 10 GHz
Output power	10 dBm
Linewidth*	1 kHz
Wavelength stability <i>Long term, under stable case temperature (A)</i> <i>Wavelength drift versus case temperature (B)</i>	0.6 pm (in 15 hours) (A) 0.2 pm / °C (B)
Dimensions (HxWxD)	44 x 219 x 301 mm
Temperature of operation	10 to 35 °C
Applications targeted	Coherent Communications Research

*Lorentzian contribution to linewidth calculated from white frequency noise value at >500 MHz: $\Delta\nu = \pi S_0$

Figure 3: TeraXion’s PS-TNL typical specifications

Please visit TeraXion’s web site at www.teraxion.com for more information, or contact Carl Paquet at cpaquet@teraxion.com

About TeraXion

TeraXion is a leading-edge photonic solutions provider for high-end applications of the optical communications, industrial lasers and optical sensing markets. Its line of OEM chromatic dispersion management solutions includes Telcordia-qualified low-loss static and tunable dispersion compensators for terrestrial and submarine networks. TeraXion offers customized filtering solutions based on advanced FBG technology and narrow linewidth semiconductor laser sources for coherent detection systems.

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