The Pilot Photonics Optical Wavelength Comb Source and its Expansion

Optical frequency comb sources have recently stirred a lot of interest due to wide ranging applications such as optical arbitrary waveform generation, photonic microwave signal generation, optical signal processing and multi-carrier spectrally efficient transmission techniques with the sub-channel spacing equal to the symbol rate of each sub-channel. Optical frequency comb sources with good spectral flatness, stability, low linewidth and wavelength flexibility are highly desirable for such applications. One of the conventional approaches used in realizing a comb source is based on mode-locked semiconductor lasers (MLL) . Although this technique can generate multi-carrier signals spanning over a wide bandwidth, it inherently suffers from cavity complexity and does not offer free spectral range (FSR) tunability since the comb line spacing is fixed by the cavity length of the laser. Moreover, the optical linewidth of the individual comb lines can be relatively large (several MHz) preventing higher order (or low baud rate) advanced modulation formats to be imposed. Another established technique involves the use of single or cascaded Mach Zehnder modulators (MZM) to generate the phase correlated optical comb. Although this technique provides a relatively flat optical comb, the large insertion loss of the modulator coupled with the modulation efficiency can prove prohibitive. The extra optical component also adds to the cost and complexity of the transmitter, rendering this technique unsuitable for short reach applications.

Pilot Photonics' Optical Wavelength Comb Source (OWCS) is an attractive and cost efficient alternative which provides a highly coherent and stable output with tunable FSR.. Based on a direct modulation technique it allows for generation of an optical comb with a separation frequency limited by its modulation bandwidth. This allows for the tunability of the FSR within such a bandwidth. An example of an optical spectrum recorded with high resolution optical spectrum analyzer is presented in Fig.1a. It consists of 8 tones within 3 dB of spectral bandwidth, with an FSR at 10.7 GHz, and extinction ratio of at least 45 dB.

Also available are customized versions of the Optical Wavelength Comb Source offering more comb lines achieved by employing spectral expansion techniques. One such technique involves the use of a phase modulator which doubles the number of frequency tones, while maintaining the flatness of the spectral envelope and the extinction ratio. The optical spectrum resulting from such an expanded Pilot Photonics Optical Wavelength Comb Source applied can be seen in Fig1b. version second technique relies on the use of dispersion compensating fibre and highly nonlinear fibre. The spectral output of this product is as presented in Fig.1c. The resulting optical spectrum features good flatness with approximately 50 tones within a 3 dB window.

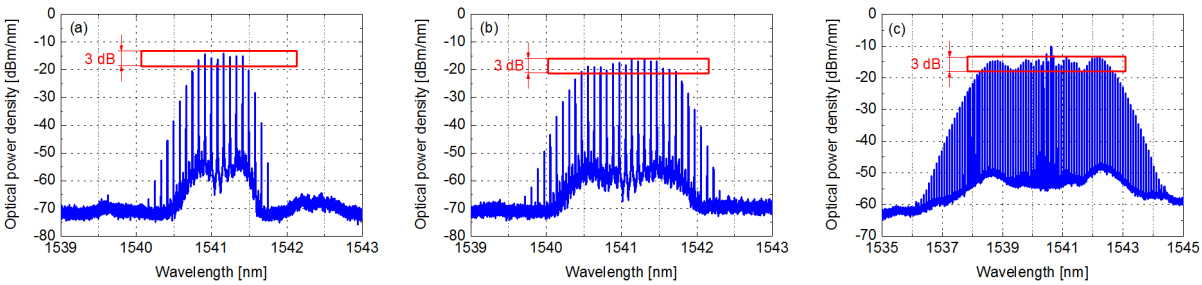

Fig. 1 Optical comb produced by gain switched DM-LD.(a), and its further expansion with use of phase modulator (b) and nonlinearities of optical fiber (c). The optical spectra recorded with a high resolution optical spectrum analyzer.

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