A STUDY OF HIGH BIT RATE SPECTRUM-SLICED DWDM PON SYSTEM

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Spectrum sliced dense wavelength division multiplexed passive optical network (SS-DWDM PON) are an attractive and cost effective solution to satisfy the growing worldwide demand for transmission capacity in the next generation fiber optical access networks. The strength of SS-WDM PON technology is use of one common broadband seed light source and its ability to place electronics and optical elements in one central office in that way simplifying the architecture of fiber optical network. Such optical systems benefit from the same advantages as WDM, while employing low cost incoherent light sources like amplified spontaneous emission (ASE) source. This spectral slicing method is a promising cost-efficient solution for a transmitter in an optical network terminal of WDM-PON architecture. The optical bandwidth per channel of spectrum sliced DWDM PON system is large compared to the bit rate. Therefore, dispersion considerably degrades the performance of this system more than it is observed in conventional laser-based systems. The influence of chromatic dispersion (CD) needs to be studied in order to understand the characteristic of a SS-WDM PON system employing a standard single mode optical fiber.

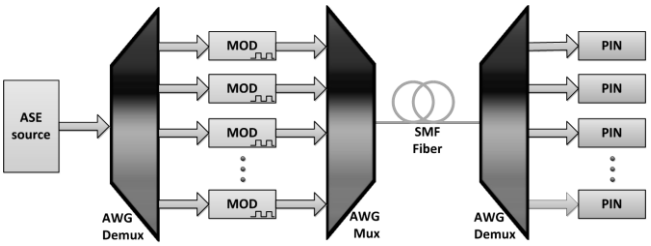

Figure 1. Operating principle of spectrum-sliced WDM PON system with ASE broadband light source

This paper contains the investigation of reach improvement of DWDM-PON system using spectrum-sliced amplified spontaneous emission (ASE) source as a seed light. It is shown that flat-top AWG unit provides excellent channel separation and filtering at the same time passing sufficient high optical power. The maximum reach of SS-DWDM PON system with data transmission speed 2.5 Gbit/s can be fairly limited by CD. This paper contains the investigation of improved high speed 8-channel SS-DWDM PON system with efficient CD compensation methods like dispersion compensating fiber (DCF) and fiber Bragg grating (FBG) implemented in dispersion compensation module (DCM). In this research it is shown that CD compensation has an important role for guaranteed downstream optical link performance and maximum link length of high speed SS-DWDM PON system.

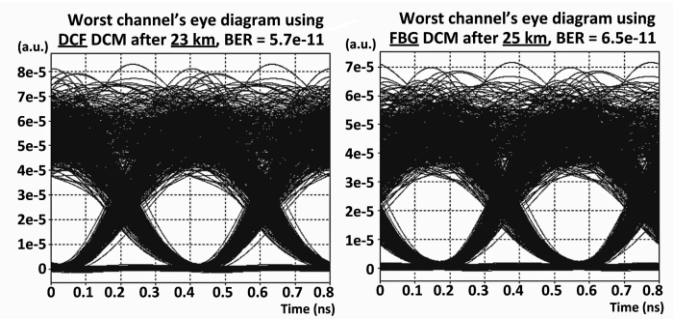

Figure 2. SS-DWDM PON system's eye diagrams and BER values of the received signal from worst channels where different CD compensation methods are realized

The results show that FBG used for CD compensation in high speed spectrum-sliced dense WDM PON systems provides better accumulated CD compensation and increase link length up to 150% (from 10 km up to 25 km) while DCF fiber provides up to 130% reach improvement (from 10 km up to 23 km). Basis on the obtained results we recommend to use FBG in DCM unit for full compensation of accumulated CD in flat-top type AWG Spectrum Sliced DWDM PON systems with data rate 2.5 Gbit/s per channel.