EVALUATION OF COMBINED CHROMATIC DISPERSION COMPENSATION METHODS IN FIBER OPTICAL TRANSMISSION SYSTEMS

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Chromatic dispersion (CD) compensation is very important premise to significantly improve performance of fiber optical transmission systems (FOTS) and increase maximum data rate and transmission distance. Chromatic dispersion causes optical signal pulses to broaden, lose their shape and interfere with adjacent pulses as they travel along the optical fiber [1, 2].

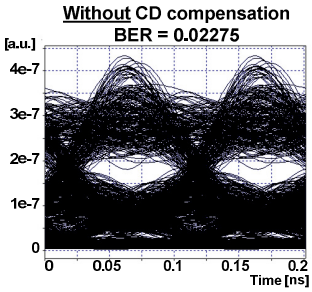

Fig.1 Output eye diagram of 10 Gbit/s 4 channel WDM system's second channel without CD compensation

In the work, using OptSim 5.0 simulation software, we have realized an experimental 10 Gbit/s high-speed 4 channel NRZ coded WDM FOTS model, with link length of 160 km and channel spacing of 100 GHz, where dispersion compensation methods like dispersion compensating fiber (DCF), fiber Bragg grating (FBG) and optical phase conjugator (OPC) were used together. To realize a CD compensation DCF fiber has a large negative dispersion (D = -80 ps/nm/km) that is achieved by developing a complex refractive index profile, but FBG has a grating with linearly increasing grating period, that changes propagation delay for different signal wavelength. In contrast of DCF and FBG, OPC is a nonlinear optical CD compensation method which realizes inversion of optical signal phase, and there signal distortions occurred before OPC are canceled by distortions occurred after OPC [1, 2].

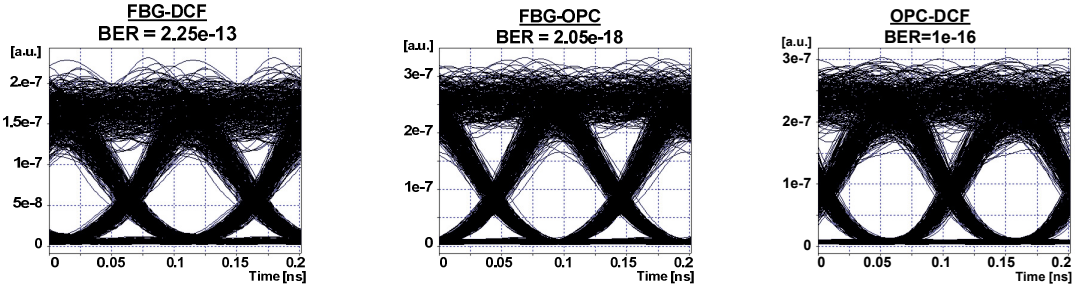

Fig.2 Output eye diagrams of 10 Gbit/s 4 channel WDM system's second channel where different combined CD compensation methods are realized

As one can see, the performance of realized FOTS without CD compensation was very poor (Fig. 1), but, it has been shown that using combined compensation methods (FBG-DCF, FBG-OPC, and OPC-DCF) system performance can be improved greatly (Fig. 2).

The best results were obtained by using combined FBG-OPC dispersion compensation method which showed the lowest BER value.

References

1. Agrawal G. Fiber – Optic Communication Systems. – USA: John Wiley and Sons, 2002. – 561 p.
2. S.Spolitis, V. Bobrovs, G.Ivanovs. *Realization of Combined Chromatic Dispersion Compensation Methods in High Speed WDM Optical Transmission Systems*. Lithuanian Journal of Electronics and Electrical Engineering. 2011, No.5(111)