Investigation of External Electromagnetic Disturbance in HDWDM System

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Fiber optics telecommunication systems (FOTS) are developing at a very high rate. The reasons for this steady growth include the availability of optical fibers with small attenuation and dispersion characteristics, invention of powerful and narrow band lasers, development of high-speed optical modulators and use of very sensitive optical receivers. Due to rapidly growing capacity requirements for FOTS high-speed high-density wavelength division multiplexing (HDWDM) systems are advancing into high data transmission rate and narrow channel spacing is used to utilize the available bandwidth more effectively [1]. In HDWDM communication systems optical wave's polarization becomes the main effect. In principle, external electric, magnetic and electromagnetic (EM) fields can affect light transmission in optical fibers through Kerr effect, Faraday effect and Pockels effect. As it is well known, Kerr effect is based on the material refractive index changes depending on the electromagnetic field strength. According to [2], external electric field can effectively rotate the polarization plane of light in the fiber due to the Kerr effect by the angle φ. In our experiments, influence of external electromagnetic disturbance in HDWDM communication system (see fig.1.) with the minimum allowed channel spacing in wavelength nm range 1546 nm - 1554 was studied. Our polarization rotation studies show BER changes from 10^{-12} to 10^{-9} which is close to critical value by ITU-T recommendations.

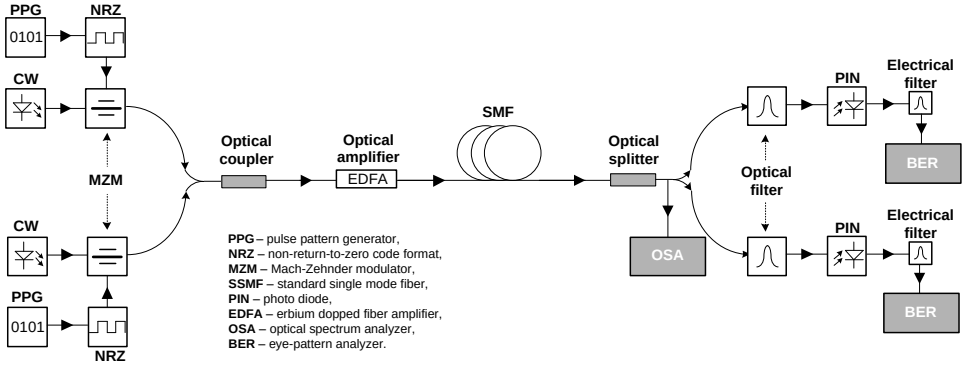

Figure 1. The setup used for investigation of HDWDM transmission.

The results indicate that for 10 Gbit/s HDWDM transmission with suitable channel interval 37.5 GHz between adjacent channels BER changes from 10^{-12} to 10^{-6} due to the change plane of polarization which is critical for system performance. In the case when the polarization is rotated by 45^0 when using HDWDM with 37,5 GHz spacing between the channels it is necessary to increase the spacing up to around 50 GHz.

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2. Sokolov, S.A., "Features of polarization mode dispersion in optical cable with a wave seal from lightning" // *The first Russian conference on lightning protection. Book of abstracts* (in Russian), 111.-114, 2007.