

EVALUATION OF THE MAXIMUM PERMISSIBLE TRANSMISSION DISTANCE FOR MIXED HDWDM SYSTEMS

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The authors have investigated the maximum permissible transmission distance for the high density wavelength division multiplexed (WDM) fiber-optic transmission systems (FOTSs) that complies with the following criteria: 1) optical signals are transmitted with two different per channel bitrates – 10 and 40 Gbit/s; 2) not only in FOTS traditionally used modulation formats, such as no-return to zero encoded on-off keying (NRZ-OOK) or NRZ encoded differential phase shift keying (NRZ-DPSK) but also the advanced modulation formats (e.g., 2-POLSK – orthogonal polarization shift keying) are used in system’s channels; 3) the minimum equal and unequal “non ITU-T” Recommendation G.694.2 defined channel spacing values are used for the obtaining of the maximum system’s spectral efficiency [1, 2].

In equaled spaced channels central wavelengths values are obtained using 75 GHz frequency intervals, while for unequally spaced they are as it is shown in the following scheme obtained in [2]: {[1st ($f_c=193.0250$ THz), 4th ($f_c=192.8250$ THz) and 7th ($f_c=193.2375$ THz) channels: NRZ-OOK, R=10 Gbit/s] – [2nd ($f_c=193.100$ THz), 5th ($f_c=192.8875$ THz) and 8th ($f_c=193.3000$ THz) channels: 2-POLSK, R=40 Gbit/s] – [3rd ($f_c=193.1750$ THz), 6th ($f_c=192.9625$ THz) and 9th ($f_c=193.3750$ THz) channels: NRZ – DPSK, R=40 Gbit/s]}. Note that the both systems configurations are identical and differ only with channels’ central wavelengths. Such distance was detected using the number of iteration loops consisted of chromatic dispersion compensation module (DCM) based on the use of dispersion compensating fiber (DCF), inline optical erbium doped fiber amplifier (EDFA) and 50 km of standard single mode fiber (SSMF, ITU-T Rec. G.652).

It is revealed that for the systems with equally spaced (using 75 GHz spacing) channel as well as unequally spaced (using purposed frequency grid) channels optical signals can be transmitted and then successfully detected with appropriate error probability over only one loop (see Fig. 1). The maximum transmission distance can be increased by the reduction of systems’ spectral efficiency.

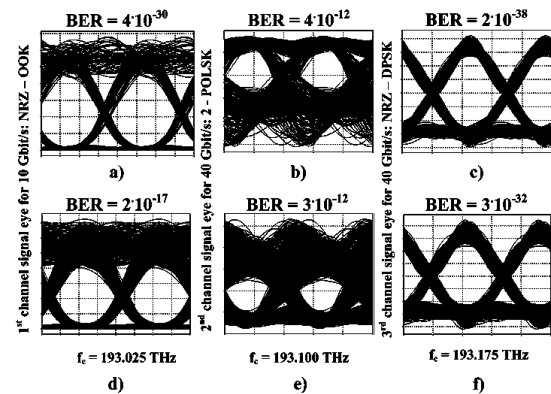


Fig. 1 Eye diagrams and BER values for the signals detected in equally spaced (a – c) and unequally spaced (d – f) channels of investigated mixed WDM system with the maximum permissible system’s spectral efficiency after the transmission over two iteration loops.

References

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