Investigation of Spectrally Efficient Transmission in Mixed WDM Systems

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Abstract— The authors have investigated the minimal allowed channel spacing for developed mixed wavelength division multiplexing (WDM) systems in order to obtain maximal spectral efficiency for system's channels. These fiber optic transmission systems can be considered under the concept of next generation optical networks and is offered as a model for the future design of backbone optical networks. In a case of different telecom operators' optical networks convergence a necessity to transmit differently modulated optical signals over a single optical fiber even with different per channel bitrates may occur in the soon future. Authors have revealed the optimal parameter configuration for developed mixed transmission systems and obtained in system's channels detected signals bit-error-rate (BER) correlation diagrams. They represent BER as a function from different system's parameters such us channel output power level, optical amplifier fixed output power level and system's channels allotment in C-band of ITU-T recommended spectral grid. As a model of developed combined WDM systems that is offered for the future design of backbone optical networks, is considered WDM system with the following configuration: [1st channel: NRZ-OOK (10 or 40 Gbit/s)] — [2nd channel: 2-POLSK (10 or 40 Gbit/s)] — [3rd channel: NRZ-DPSK (10 or 40 Gbit/s)]. It is also found out that minimal channel spacing for differently modulated optical signals in investigated mixed data rates WDM system is equal to 75 GHz if optical signals are transmitted with 10 Gbit/s and 40 Gbit/s per channel bitrates. As well as, system's average spectral efficiency depends not only from the minimal allowable channel spacing but also from mixed system's configuration if equal frequency intervals are used for channels separation.