Performances of 1 Gbps optical Direct Sequence CDMA system based on Sampled Fiber Bragg Gratings.

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Abstract

Optical Direct Sequence Code Division Multiple Access systems providing simultaneous and asynchronous multi-user access, is an attractive solution in the all-optical communication field.

Prime Sequences (PS) are shown as optimized codes in direct detection CDMA system [1-3]. Two PS codewords have been implemented using Sampled Fiber Bragg gratings (S-FBG) [4]. The incident pulses reflected with some time delays by the different fiber Bragg gratings (FBG) of a S-FBG represent the codewords. Each FBG of one S-FBG is designed with a different reflection rate, to compensate the incident wave attenuation through the S-FBG. The codeword pulses are reflected with a same high level to improve the system link budget. The 1.6 nm S-FBG bandwidth allows optical channel noise rejection without additional external individual filter.

A 50 ps optical pulse train is RZ modulated by an electro-optic modulator at 1 Gbps data rate per user. A pseudorandom signal is applied to another electro-optic modulator in order to generate a pseudorandom user data stream. The signal is encoded separately by S-FBG₁ and S-FBG₂ devices. The encoded signals are superposed by a 3dB coupler and transmitted to the matched S-FBG₁ decoder.

BER measurements show error free operation when the interferer is delayed from the desired signal (asynchronous case), however a higher bit error rate owing to multiple access interference (MAI) between two signals is achieved in the synchronous case.

S-FBG technological limitations and optical interferences due to the source coherence time have been observed and will be discussed.

Keywords: Fiber Bragg Grating, optical DS-CDMA, BER measurement, optical interferences, coherent source

References: