ORTHOGONAL MULTIPLE ACCESS OVER RADIO OVER FIBER

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ABSTRACT

This work analyzes the performance of Orthogonal Frequency Division Multiplexing (OFDM) and Asymmetrically Clipped Optical OFDM (ACO-OFDM) in an RoF system. OFDM suffers from fiber non-linearities in an optical network. ACO-OFDM is used to mitigate the impact of non-linearities for optimal system performance. In ACO-OFDM, only one set of subcarriers (even/odd) carry the data. ACO-OFDM makes use of Hermitian symmetry and clipping after IFFT so that the bipolar signal is converted to a unipolar signal so as to enable optical transmission. The transmitter generates the 1 Gbps data rate ACO-OFDM modulated signal which is converted to an optical frequency of 193.1 THz by the MZM external modulator. The signal is transmitted through the optical fiber of 100-km. The receiver converts the received optical signal to an electrical signal with the help of the PIN photodiode. The performance metrics such as BER and RF power at the photodetector are measured by varying the length and transmit power of the optical fiber. The Radio over Fiber transmission proposed method performance is analyzed using the Optisystem tool and MATLAB software. The experimental results are compared with the simulated results and the BER is analyzed.

Keywords: *Orthogonal Frequency Division Multiplexing (OFDM), Asymmetrically Clipped Optical OFDM (ACO-OFDM), Radio Over Fiber (RoF), Inverse Fast Fourier Transform (IFFT)*

1. INTRODUCTION

Orthogonal Frequency Division Multiplexing (OFDM) is a multicarrier modulation technique in which the high data rate stream is splitted into lower rate streams. By the use of guard interval in the transmitted signals, the signal quality is high with less inter-symbol interference (ISI) [1]. The second major advantage of OFDM is that no cost of digital parts of receiver is required if there is no phase variation with frequency is required [2]. With these two major advantages, OFDM is used in optical wireless communication, single mode fiber and multimode fiber [4,5]. When OFDM used in wireless communication system, the OFDM signal is used to modulate the amplitude and phase of the RF carrier. But when OFDM is used in optical wireless and multimode fiber, intensity modulation and direct detection (IM/DD) is used where the desired signal is modulated along the intensity of the optical wave [6].The output of OFDM modulator is complex and bipolar. In IM optical systems quadrature modulation is not possible as the output is complex and bipolar [7]. The optical signal must be real and positive. So the bipolar signal should be converted into the unipolar signal so that the OFDM is commonly used in RF communications. By taking hermitian symmetry on the odd subcarriers, the time domain of the OFDM signal is real valued with some negative values. To eliminate these negative samples and to convert bipolar to unipolar signal two OWC techniques are reported namely, ACO-OFDM and DCO-OFDM [8-9]. In ACO-OFDM, after applying hermitian symmetry to the odd subcarriers, the time domain of the OFDM signal is real valued with some negative values. The negative values are clipped off and hence converted to a unipolar signal without adding a dc bias value. The mean optical power is reduced by clipping the negative signals to zero. In [11-12], the ACO-OFDM is performed experimentally and parameters like BER and PAPR are analyzed. In [13], a novel diversity technique is combined with conventional ACO-OFDM and the BER performance is improved. This technique finds its application in wireless communication. In [14], the OFDM is implemented practically for optical wireless communication systems using non-coherent light. In this paper, the experimental results are compared with the simulation results and the BER performance is almost the same.