Abstract

Many indoor applications operate at narrowband (3 kHz - 148.5 kHz) speed and for such applications, power line communication (PLC) and visible light communication (VLC) networks can be naturally connected and adapted to complement each other in order to gain more overall system performance in terms of bit error rate (BER) and computational complexity. In this research, the joint decoding of parallel PLC and VLC systems is proposed and its BER performance is compared to that of the PLC and the VLC systems. The joint decoding is applied either at the inner (Viterbi) or at the outer (Reed-Solomon) decoder. The proposed system is adopted according to the PLC G3 physical layer specification but direct current optical orthogonal frequency division multiplexing OFDM (DCO-OFDM) is used in the VLC system to ensure that only positive (unipolar) signals are transmitted. A realistic VLC channel model is adopted in this research by considering the VLC channel as an additive white Gaussian noise (AWGN) channel affected by attenuation in terms of angle of orientation between the source and the receiver and effective surface area of the receiver. Furthermore, the PLC channel is modeled as an AWGN channel with background and impulsive noise generated using Middleton Class-A noise distribution model. It is shown through simulation results and analysis that the proposed joint decoded system outperforms the PLC and the VLC systems in terms of BER performance depending on the distance of separation between the source and the receiver.

Key words: Power line communication (PLC), Visible light communication (VLC), Bit error rate (BER), Joint decoding, Orthogonal frequency division multiplexing (OFDM), DC optical OFDM (DCO-OFDM), Additive white Gaussian noise (AWGN).