ABSTRACT

Generalized Frequency Division Multiplexing (GFDM) is a multicarrier modulation technique developed as an alternative to OFDM to improve spectral efficiency and system flexibility in communications. One of the developments in GFDM is the use of Offset Quadrature Amplitude Modulation (OQAM) to reduce Inter-Carrier Interference (ICI) and Inter-Symbol Interference (ISI). However, due to the nature of digital communication systems which are vulnerable to noise disturbances, channel coding techniques such as convolutional codes are needed to enhance transmission conditions. This study aims to analyze the performance of the GFDM-OQAM system with and without channel coding using convolutional codes. The evaluation is based on Bit Error Rate (BER) and channel capacity parameters over varying Signal to Noise Ratio (SNR) through MATLAB-based simulations. The coded system uses a convolutional encoder with a code rate of ½ and decoding employs the Viterbi algorithm based on hard decision. Simulation results show that the system without channel coding maintains a high BER performance and fails to achieve the BER standard of $< 10^{-3}$ across the entire SNR range. The use of convolutional codes does not consistently improve BER performance; in some cases, it even performs worse than the uncoded system. However, from the channel capacity perspective, the coded system demonstrates a significant increase in capacity compared to the uncoded system, especially at high SNR. This indicates that channel coding plays a role in improving transmission efficiency, even though it does not directly enhance BER performance consistently. Thus, the GFDM-OQAM system with convolutional coding has the potential to improve communication system efficiency, particularly in terms of channel capacity, but further development is needed to optimize BER performance.

Keywords: AWGN, Bit Error Rate, GFDM, channel capacity, convolutional code, OQAM, Viterbi