ABSTRACT

The future communication system requires a technology that supports high-speed communication, low latency, and high reliability. One of the methods is the implementation of Generalized Frequency Division Multiplexing (GFDM) technology in 5G cellular communication. The GFDM system involves modulation techniques, and in this research, 16-QAM modulation is used with the utilization of Offset-QAM (OQAM) technique. OQAM has been proven to achieve better spectral efficiency and reduce occurrences of Inter Carrier Interference (ICI) and Inter Symbol Interference (ISI). This study explores two equalization techniques, Zero Forcing (ZF), and Minimum Mean Square Error (MMSE), for signal detection. The research considers three variations of the roll-off factor (α) 0,3; 0,5; and 1. Audio data is employed as input with an AWGN channel, and a Root Raised Cosine filter is used for pulse shaping. The final outcomes of the study demonstrate that the use of GFDM-OQAM MMSE outperforms GFDM-OQAM ZF. In terms of Bit Error Rate (BER) and Symbol Error Rate (SER) performance, MMSE equalization yields values of 0,00034444 and 0,000645833 at a Signal to Noise Ratio (SNR) of 20 dB. Furthermore, concerning the roll-off factor variations, the best results for both ZF and MMSE are achieved when α = 0,3. This is evident from the BER and SER values at an SNR of 20 dB using ZF for α = 0,3; which are 0,000369444 and 0,00069270; respectively. For MMSE, the corresponding BER and SER values are 0,000391667 and 0,000734375. The employment of equalization techniques and the choice of α significantly influence the decrease in BER and SER values as SNR increases, indicating an improved system performance.

Keywords: *GFDM, MMSE, OQAM, Roll-Off Factor, Zero Forcing*