

## **ABSTRACT**

*The 5th generation (5G) network is developed to support enhanced Mobile Broadband (eMBB) services, designed to meet the high data rate demands of modern applications such as 4K streaming and Virtual Reality. Consequently, the selection of an optimal waveform is critical. This study presents a comparative performance analysis of F-OFDM, FBMC, UFMC, and GFDM based on an evaluation of key metrics: Bit Error Rate (BER), Spectral Efficiency (SE), Peak-to-Average Power Ratio (PAPR), and Power Spectral Density (PSD). The analysis indicates a significant performance trade-off. In terms of data rate and reliability, F-OFDM achieves the highest SE value of **6.00 bit/s/Hz** and the lowest BER of **0.0003**. However, the evaluation of other metrics reveals its drawbacks: FBMC exhibits the best spectral containment, while GFDM offers the highest power efficiency with the lowest PAPR. Conversely, F-OFDM records the highest PAPR value. Despite its shortcomings in the PAPR aspect, F-OFDM remains the most suitable choice for the eMBB scenario. Its better performance in SE and BER directly meets the fundamental requirements of the service—high data rates and reliable connectivity—to support an optimal user experience.*

**Keywords:** *Waveform, F-OFDM, FBMC, UFMC, GFDM.*