

## **ABSTRACT**

*Based on research conducted by Huawei and Ericsson, it was mentioned that in 2021 there would be an increase in users as much as 13 times compared to the previous year. An increase in users naturally results in increased data speed requirements. Users not only need voice services, but also demand data communication services with high data rates. One technique that supports high data access speeds is the Orthogonal Frequency Division Multiple Access (OFDMA) technique. In addition, the transmission media is also an important factor in realizing data rates with high data rates in accordance with increased user requirements.*

*Based on the problem above, this study simulates a Radio over Fiber (RoF) network system by applying OFDMA-QAM to meet user needs for high data speeds. In addition, the RoF system is implemented to support data access speeds with high data rates and are more resistant to electromagnetic wave interference. In the RoF technology, radio signals are superimposed on optical fibers. The bit rate used in this study was 1 Gbps, then the bits of PRBS were modulated using 16-QAM, then the signal was carried by a radio frequency of 3.5 GHz and the radio signal was modulated using the Mach-Zehnder Modulator to be transmitted through the optical signal. This design includes three main parts, namely the transmitter, optical link and receiver which are simulated using Optisystem Simulator with several distance variations: 8 Km, 20 Km, 35 Km and 50 Km. This final project simulated two scenarios, namely the external modulation and direct modulation.*

*In this study, it was found that RoF performance with an external modulation scheme is better than the direct modulation. In external modulation, the designed system met a distance up to 35 km with the best BER value at a distance of 8 km with a BER value of  $6.14109 \times 10^{-12}$ . Meanwhile, in the direct modulation model, the system met a distance up to 20 km with the highest BER value at a distance of 8 km with a BER value of  $7.19313 \times 10^{-12}$ .*

**Keywords:** *QAM, RoF, External Modulation, Direct Modulation*