

# **Performance Analysis of 16-Fsk Modulator and Demodulator Over AWGN Channel Parameters**

**Md Hasibul Hasan**

Department of Electrical and Electronics  
World University of Bangladesh  
0920754666@student.wub.edu.bd

**Md. Quamruzzaman and Md. Sharif Uddin Shajib**

Department of Electrical and Electronics  
World University of Bangladesh  
Dhaka, Bangladesh  
md.quamruzzaman@eee.wub.edu.bd, Sharif.uddin@eee.wub.edu.bd

## **Abstract**

Wireless communications are the fastest-growing segment of the communication industry. The most widely used wireless communication is mobile communication. However, many technical challenges must overcome. A signal transmitted on a wireless channel is subject to Fading, Shadowing, Interference, Propagation path loss. There is always a higher demand for capacity with high-quality service. In this situation, orthogonal frequency division multiplexing (OFDM) is a well-defined technique, which is a suitable option for high bandwidth data transmission by converting the wideband signal into narrowband signals for transmission. The transmission of these individual narrowband signals has executed with the orthogonal carrier. This paper presents the theoretical background of digital modulation. It evaluates the performance of 32FSK, modulation techniques concerning Bit Error Rate in the presence of Gaussian, Rayleigh, and Rician noise. The primary objective of any communication system is to receive the data with minimum errors as the errors degrade the system performance. Bit Error Rate (BER) is an essential factor that decides the performance of different modulation techniques. This paper focusses on the effect of different types of noise for the modulation mentioned above schemes under AWGN channel. The complete system has implemented in MATLAB Simulink environment.

## **Keywords**

FSK, 16FSK, Digital Modulation, AWGN, Rayleigh, Rician, BER

## **Biographies**

**Md Hasibul Hasan** is an undergraduate student in the Department of Electrical and Electronic Engineering (EEE) at the World University of Bangladesh (WUB), Dhaka, Bangladesh. His primary academic focus is on digital communication systems, signal processing, and performance analysis of modulation techniques over various channel models. He is passionate about applying theoretical communication principles to optimize real-world wireless links. This final year project on 16-FSK performance analysis reflects his core interest in modeling and validating high-throughput communication systems.

**Prof. Dr. Md. Quamruzzaman** is the Head of the Department of Electrical and Electronic Engineering (EEE) at the World University of Bangladesh (WUB). He holds extensive experience and doctoral expertise in the field of Telecommunications Engineering. His guidance was instrumental in shaping the theoretical and methodological framework of this research project, ensuring the academic and technical rigor of the performance analysis.

**Md. Sharif Uddin Shajib** is a faculty member in the Department of Electrical and Electronic Engineering (EEE) at the World University of Bangladesh (WUB). His expertise in Digital Systems and Communication Networks provided essential technical support and critical insights throughout the project's development, aiding the students in the practical execution of the simulation model.