

MIMO-OFDM Techniques for Wireless Communication System: Performance Evaluation Review

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ABSTRACT

The use of multiple antennas in wireless communication systems has resulted in multiple channels that facilitate the speed of data transfer and improved channel capacity. This technique that basically involves multiple input and multiple output (MIMO) antennas helps to improve system performance by reducing bit error rate (BER) while increasing signal to noise ratio (SNR). Also, the use of orthogonal frequency division multiplexing (OFDM) has helped in mitigating inter-symbol interference (ISI). A combination of MIMO and OFDM produces the MIMO-OFDM scheme. This paper reviewed the performance of BER in MIMO-OFDM system considering various digital modulation techniques. An empirical review of previous studies on MIMO-OFDM system regarding BER performance evaluation was carried out. The study demonstrated the performance of digital modulation schemes in OFDM system with respect to the Quadrature Amplitude Modulation (QAM). The results of the simulation based on MATLAB code revealed that lower order modulation yielded better BER performance than higher order. Furthermore, MIMO-OFDM system was modeled in MATLAB/Simulink and simulated to show that the use of multiple antennas at the transmitter and receiver helps in improving the performance of wireless communication system by reducing BER while increasing SNR considering two multipath channels – Rayleigh and Rician.

Keywords -Bit error rate, MIMO, MIMO-OFDM, OFDM, Signal to noise ratio

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1. INTRODUCTION

Communicating effectively over a large distance has been a challenge in wireless communication and the transition of modulation systems from analog to digital has further complicated the situations. Digital modulation schemes offer more information carrying capacity, better quality communication, data security and RF spectrum sharing to accommodate more services. Nevertheless, the implementation of digital modulation techniques like the Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK) and Phase Shift Keying (PSK) comes with the different compromise. There is a tradeoff needed to be made between the available bandwidth and the number of bits/symbol that can be transmitted over the line, which in turn limits the maximum data rate on the link. Thus the selection of digital modulation techniques is absolutely critical, especially in an environment like the satellite uplink-downlink where resources are very limited and time slots are assigned at very high cost. The primary standards to determine modulation scheme depends on Bit Error Rate (BER), Signal to Noise Ratio (SNR), Available Bandwidth, Power efficiency, better Quality of

Service (QoS), cost effectiveness. Hence, it is necessary to ascertain which modulation technique that is capable of transmitting more bits per symbol and is more immune to error caused by noise and interference induced in the channel.

The digital modulation technique is an indispensable module for transmitting and receiving information instead of analog modulation. Compared to analog modulation, the digital modulation has improved noise immunity and robustness to channel impairment. However, the transmission of audio or video signal requires more cost of bandwidth and need to have no loss of information at receiving end. Hence, it is very important and useful to analyze the performance of digital modulation schemes in wireless communication system.

One of the key determinant performance factors of wireless communication system is the Bit Error Rate (BER). Thus selecting the best modulation scheme that can transmit more data and offer low error rate will be economically worthwhile.

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Table of Contents Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan

1. Understanding the eBook Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - The Rise of Digital Reading Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Advantages of eBooks Over Traditional Books
2. Identifying Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - User-Friendly Interface
4. Exploring eBook Recommendations from Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Personalized Recommendations
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan User Reviews and Ratings
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan and Bestseller Lists
5. Accessing Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan Free and Paid eBooks
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan Public Domain eBooks
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan eBook Subscription Services
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan Budget-Friendly Options

6. Navigating Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan eBook Formats
 - ePub, PDF, MOBI, and More
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan Compatibility with Devices
 - Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Highlighting and Note-Taking Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Interactive Elements Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
8. Staying Engaged with Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
9. Balancing eBooks and Physical Books Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Setting Reading Goals Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Fact-Checking eBook Content of Advanced Techniques To Improve The Performance Of Ofdm Wireless Lan
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements

- Interactive and Gamified eBooks

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