

ABSTRAK

ANALISIS PERFORMA SISTEM TRANSMISI GAMBAR PADA SISTEM KOMUNIKASI *ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING* MELALUI KANAL *ADDITIVE WHITE GAUSSIAN NOISE*

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Penelitian ini bertujuan untuk mengevaluasi kinerja sistem komunikasi digital berbasis *Orthogonal Frequency Division Multiplexing* (OFDM) yang diimplementasikan secara *stand-alone* dalam proses transmisi citra digital melalui kanal *Additive White Gaussian Noise* (AWGN). Sistem ini dilengkapi dengan mekanisme pengkodean kanal *Hamming* (7,4) yang berfungsi untuk mendeteksi serta mengoreksi kesalahan bit yang terjadi akibat gangguan *noise*. Dalam pengujian, digunakan dua skema modulasi yang berbeda, yaitu *Binary Phase Shift Keying* (BPSK) dan *Quadrature Phase Shift Keying* (QPSK), guna membandingkan performa terhadap variasi kualitas kanal. Simulasi dilakukan menggunakan perangkat lunak MATLAB, dengan input berupa citra berukuran antara 1 MB hingga 10 MB. Nilai *Signal-to-Noise Ratio* (SNR) divariasikan dari 0 dB hingga 30 dB untuk mengamati perubahan kinerja sistem. Hasil simulasi menunjukkan bahwa BPSK mampu menjaga *Bit Error Rate* (BER) tetap rendah pada kondisi SNR serendah 0 dB, dengan nilai sekitar 0,077, sementara QPSK baru menunjukkan kinerja optimal pada SNR minimal 15 dB dengan BER mendekati nol. Ukuran citra tidak memberikan pengaruh signifikan terhadap hasil transmisi. Kualitas sistem dipengaruhi oleh sejumlah faktor teknis, seperti jenis modulasi, efektivitas pengkodean kanal, rasio sinyal terhadap derau (SNR), panjang *cyclic prefix*, dan jumlah *subcarrier* yang digunakan. Penggunaan *Hamming code* terbukti meningkatkan reliabilitas sistem secara signifikan. Seluruh hasil simulasi menunjukkan konsistensi dan kesesuaian dengan analisis teoretis, sehingga memperkuat validitas pendekatan sistem yang digunakan.

Kata Kunci: OFDM, Kanal AWGN, Transmisi Gambar Digital, Perbandingan Skema Modulasi, Rasio Noise Sinyal

ABSTRACT

PERFORMANCE ANALYSIS OF IMAGE TRANSMISSION SYSTEM IN ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING COMMUNICATION SYSTEM THROUGH ADDITIVE WHITE GAUSSIAN NOISE CHANNEL

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This study aims to evaluate the performance of a digital communication system based on Orthogonal Frequency Division Multiplexing (OFDM) implemented as a stand-alone system in the process of transmitting digital images through an Additive White Gaussian Noise (AWGN) channel. This system is equipped with a Hamming (7,4) channel coding mechanism that functions to detect and correct bit errors that occur due to noise interference. In the test, two different modulation schemes were used, namely Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK), to compare performance against variations in channel quality. Simulations were carried out using MATLAB software, with input in the form of images ranging in size from 1 MB to 10 MB. The Signal-to-Noise Ratio (SNR) value was varied from 0 dB to 30 dB to observe changes in system performance. The simulation results show that BPSK can maintain a low Bit Error Rate (BER) at SNR conditions as low as 0 dB, with a value of around 0.077, while QPSK only shows optimal performance at an SNR of at least 15 dB with a BER close to zero. Image size does not significantly affect transmission results. System quality is influenced by several technical factors, such as modulation type, channel coding effectiveness, signal-to-noise ratio (SNR), cyclic prefix length, and the number of subcarriers used. The use of Hamming code has been shown to significantly improve system reliability. All simulation results demonstrate consistency and agreement with the theoretical analysis, thus strengthening the validity of the system approach used.

Keywords: *OFDM, AWGN channel, digital image transmission, Modulation Scheme Comparison, Signal Noise Ratio*