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Evaluation of BER for AWGN, Rayleigh Fading Channels under M-QAM Modulation Scheme

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***ABSTRACT*-The concert of wireless communication systems depends on wireless channel environment. By properly analyzing the wireless channels, we can develop an efficient wireless communication system. M-QAM modulation schemes are preferred because in this scheme more than one bit can be grouped and transmit at a time, which is very effective for band limited channels. M-QAM (M-Quadrature Amplitude Modulation) is the most effective digital modulation technique as it is more power efficient for larger values of M. In this paper, we analyze OFDM system inimitability in AWGN (additive White Gaussian Noise) and Rayleigh fading channel using M-QAM modulation schemes. Rayleigh fading channel is describe by Clarke and Gans model. The performance measured in terms of bit error rate (BER) is evaluated for M = 4, 8 and 16 modulation schemes of M-QAM numerically and verified our analytical results by computer simulation. It has been demonstrated that the BER increases as the modulation order increases.**

Key Terms: OFDM, M-QAM, AWGN, Rayleigh fading channel, BER, SNR.

I. INTRODUCTION

In wireless and mobile communication system, Orthogonal Frequency Division Multiplexing (OFDM) plays vital role, because it can tolerate the severe effects of different fading channel environment. OFDM has a number of applications together with Digital Video Broadcasting [1]. OFDM can be seen as either a modulation technique or a multiplexing technique allows high speeds at wireless communications; its hierarchy corresponds to the physical and medium access layer. Designing high performance wireless communication system basically depends on the effect of channel environment. Channel estimation is a method of characterizing the effect of the physical medium on the input data stream. For wireless communication, OFDM is excellent multi-carrier scheme due to its essence of strong resistance to interference and more spectral efficiency, high data rate transmission. Channel estimation technologies are implemented in order to estimate the effect of propagation delay and channel synchronization [2].

Estimation of Channel can be classified into two categories: blind channel estimation and pilot-aided channel estimation. The channel estimation advances are described with all pilot-aided, for pilot-aided channel estimation are more applicable in fast-fading frequency selective radio transmission channel [3], [4]. The spectra of subcarriers coincide each other but each subcarrier can be extracted by baseband processing. This overlapping property makes OFDM more spectral efficient than the conventional multicarrier communication design.

The Rayleigh fading is caused by multipath reception. Rayleigh fading is a statistical model for the effect of a propagation atmosphere on a radio signal. It is a practical model for troposphere and ionospheres signal propagation as well as the effect of urban environments on radio signals. Rayleigh fading is most applicable when there is no line of sight (LOS) between the transmitter and receiver.

A. *Multipath Propagation*

In wireless telecommunications, multipath is the transmission phenomenon that results in radio signals reaching the receiving antenna by two or more paths. Reasons for multipath incorporate environmental ducting, ionosphere reflection and refraction, and reflection from water bodies and physical protests i.e., mountains and structures. The impacts of multipath include constructive and destructive interference and phase shifting of the signal. In digital radio communications, multipath propagation can affect the quality of communications. By including the impact of development of either transmitter or receiver or the Surrounding disorder.

The major paths result in the arrival of delayed variations of the signal at the receiver. In addition, the radio signal undergoes scattering on a local scale for every major path. Such local scattering is typically characterized by a large amount of reflections by objects near the mobile. These irresolvable elements combine at the receiver and give rise to the phenomenon recognized as multipath fading. Due to this phenomenon, each major path behaves as a discrete fading path. Typically, the fading method is characterized by a Rayleigh

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