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[Sahu * *et al.*, 7(6): June, 2018]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

A REVIEW ON PERFORMANCE OF OPTICAL COMMUNICATION NETWORKS USING DIFFERENT MODULATION TECHNIQUE

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DOI: 10.5281/zenodo.1299118

ABSTRACT

The demand for high-speed mobile wireless communications is growing at a very fast rate. OFDM technology is a key technique for achieving the high data rate and spectral efficiency requirements for wireless communication systems. Orthogonal Frequency Division Multiplexing (OFDM) [3–6] has emerged as a successful air-interface technique. The Orthogonal frequency division Multiplexing was originally developed from the multi-carrier modulation techniques used in high Frequency military radios. This paper presents, using Additive White Gaussian Noise channel (AWGN) and racian channel to studyand compair the performance analysis of Bit Error rate (BER) Vs Signal to Noise ratio (SNR).

The model of OFDM with Rician fading channel using simulink in MATLAB is discussed. This model is used for performance enhancement of the OFDM with QPSK and QAM modulation schemes and channel condition. The throughput and packet error rate are used to evaluate the performance of communication with the change in physical layer parameter. The performance analysis of different technique used in the QAM OFDM is compared by visualizing the BER vs SNR curve.

Keywords: OFDM, QAM, AWGN, QPSK, BER, SNR, etc.

I. INTRODUCTION

1.1 OFDM

Increase in telecommunications services that demand large amounts of bandwidth. Services such as interactive multimedia, video conferencing and streaming audio have made the capacity of the existing optical fiber systems insufficient. To increase this capacity, time division multiplexing (TDM) has been used traditionally. However, TDM has a few drawbacks. The important is that the existing electronic technology allows multiplexing only up to about 10 Gb/s. Thus; an alternative optical multiplexing technique that avoids the 10Gb/s electronic.

In OFDM, the optical transmission spectrum is divided into a number of no overlapping Frequency bands, with each Frequency supporting a single communication channel operating at peak electronic speed. Thus, by allowing multiple OFDM channels to coexist on bottleneck is very attractive. OFDM is one such promising technique that can be used to exploit the huge available bandwidth of the optical fiber a single fiber, the huge bandwidth can be tapped into. OFDM is a technique for simultaneous transmission of two or more optical signals on the same fiber. The signals from different sources are combined by a multiplexer and fed into an optical fiber which is the transmission medium. At the receiving end, different signals are separated by a demultiplexer and detected by photo detectors. The OFDM scheme increases the transmission capacity of optical communication systems considerably. The two configurations of OFDM systems that are possible are the one-way and the two-way transmission systems, while the one-way system requires only one receiver or one transmitter per channel at each end, the two-way (bidirectional optical fiber) system requires both receiver and transmitter at each end of every channel. Optical multiplexers and demultiplexers may be classified into Frequency selective and Frequency nonselective devices .The Frequency selective devices are either active or passive. The active devices are implemented using multi-Frequencylight Sources or multiFrequency photodiodes [5].

ISSN: 2277-9655
Impact Factor: 5.164
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1.2 Digital modulation technique

The basic concept behind digital modulation is to identify efficient schemes taking M different symbols in a given digital alphabet and transforming them into waveforms that can successfully transmit the data over the transmission channel. There are three basic types of modulation schemes which are follows as

1. Amplitude shift keying (ASK)
2. Frequency shift keying (FSK)
3. Phase-shift keying (PSK)

This will be described in this paper one by one.

1.2.1Amplitude shift keying (ASK)

Amplitude-shift keying (ASK) is a form of modulation that represents digital data as variations in the amplitude of a carrier wave. The level of amplitude can be used to represent binary logic 0s and 1s.

1.2.2 Frequency shift keying (FSK)

In binary Frequency shift keying (BFSK), the Frequency of a constant amplitude carrier signal is switched between two values according to the two possible message states, corresponding to a binary 1 or 0.

1.2.3Phase-shift keying (PSK)

In Phase-shift keying (PSK) the phase of carrier is variation according to binary data.
Binary data is represent in NRZ signaling is multiplied with carrier to generate the PSK signal.

1.2.3.1 Binary Phase Shift Keying (BPSK)

Binary Phase Shift Keying (BPSK) modulation is a special case of the general *M*aryphase shift keying with $M = 2$. In particular, the binary data selects one of the twoopposite phases of the carrier

1.2.3.2 QPSK (Quadrature Phase Shift Keying): QPSK is type of phase shift keying. Unlike BPSK which is a DSBCS modulation scheme with digital information for the message, QPSK is also a DSBCS modulation scheme but it sends two bits of digital information a time (without the use of another carrier frequency).The amount of radio frequency spectrum required to transmit QPSK reliably is half that required for BPSK signals, which in turn makes room for more users on the channel. Quadrature phase shift keying (QPSK) is another modulation technique, and it's a particularly interesting one because it actually transmits two bits per symbol. In other words, a QPSK symbol doesn't represent 0 or 1—it represents 00, 01, 10, or 11.This two-bits-per-symbol performance is possible because the carrier variations are not limited to two states. In ASK, for example, the carrier amplitude is either amplitude option A (representing a 1) or amplitude option B (representing a 0). In QPSK, the carrier varies in terms of phase, not frequency, and there are *four* possible phase shifts.

II. LITERATURE SURVEY

ANGEL DAVID TORRES PALENCIA: "Linear Effects present in a system of radio over optical fiber using Frequency division multiplexing"Because of the large bandwidth that the opticalfiber offers as transmission medium of information and the flexibility of communication of the wireless systems, a new mixed infrastructure called radio over fiber system (Radio over Fiber,RoF) have been developed, these have been characterized for implementing division multiplexing Frequency (OFDM) and these work with radio carrier signals in the band of extremely high frequencies (extremely high frequency, EHF.) 978-1-4577-0856-5/11/ ©2011 IEEE

T.P. SUREKHA, T. ANANTHAPADMANABHA, C. PUTTAMADAPPA: Members, IEEE, Modeling and Simulation can play an important role during all phases of the design and engineering of communication systems. Orthogonal Frequency Division Multiplexing (OFDM) was originally developed from the multi-carrier modulation techniques used in high Frequency Military radios. BER curve with Model simulation in is compared with BER Tool curve. BER Tool is a Graphical User Interface (GUI) for analyzing bit error - rate statistics of a communication model. BER Tool helps us to generate and analyze the BER data for a given system with theoretical plot (1)". /10.1109/PACCS.2011.5990181 IEEE 18 August 2011

SAI KRISHNA BORRA; SUMAN KRISHNA CHAPARALA: A Frequency division Multiplexing (OFDM) scheme offers high spectral efficiency and better resistance to fading environments. In OFDM the data is modulated using multiple numbers of sub-carriers that are orthogonal to each other because of which the problems associated with other modulation schemes such as Inter Symbol Interference (ISI) and Inter Carrier

Interference (ICI) are reduced. This paper deals with the analysis of OFDM System utilizing different modulation techniques (QAM and BPSK) over Rayleigh, Rician and Additive White Gaussian Noise (AWGN) fading environments with the use of pilot aided arrangement and finally the results are conveyed." Volume 3, Issue 3, March 2013IEEE.

ASHUTOSH KUMAR MISHRA, RASHMI PANDEY: This review work based on the Performance analysis of OAM-OFDM system in AWGN Channel. In Digital communication system with multi carrier modulation technique can play very important role in all phase of designing and engineering. In this work we discuss about the performance analysis of 16QAM-OFDM system. We compare the performance analysis of different technique used in the 16 QAM OFDM and discuss the BER vs SNR Ratio. [3], Volume 4, Issue 3, Maech 2014.

K.SHAMGANTH AND M.P.REENA: Increasing demand for high-performance 4G broadband wireless is enabled by the use of multiple antennas at both transmitter and receiver ends. Multipleantenna technologies enable high capacities suited for Internet and multimedia services, and also dramatically increase range and reliability. The combination of multiple-input multiple-output (MIMO) signal processing with Frequency division multiplexing (OFDM) is regarded as a promising solution for enhancing the data rates of next-generation wireless communication systems operating in Frequency selective fading environments. In this paper, we focus mainly on Internet users in hotspots like Airport etc. requiring high data rate services. A high data rate WLAN system design is proposed using MIMO-OFDM. In the proposed WLAN system, IEEE 802.11a standard design is adopted but the results prove a data rate enhancement from the conventional IEEE 802.11a.

MEHDI AHMADI, EHSAN ROHANI, POOYA MONSHIZADEH NAEENI AND SIED MEHDI FAKHRAIE: IEEE 802.22, also called Wireless Regional Area Network (WRAN), is the newest wireless standard being developed for remote and rural areas. In this paper an overview of the standard and more specifically its PHY layer is introduced. In order to evaluate the performance of the system, we modethe PHY layer in MATLAB/SIMULINK and extract the Bit Error Rate (BER) of the system for different code rates and modulation schemes with noisy channel". 2nd International Conference on Future Computer and Communication (ICFCC)-2010, Wuhan, ISBN: 978-1-4244-5821-9, 21-24 May 2010, Vol 3 V3-62 - V3-66, INSPEC Accession Number : 11538274

Ali Kareem Nahar1, 2 and Kamarul H. Bin Gazali1 : Channel estimation is an exact significant technique to work around the influence of channel fading's which jamming pilot symbols and produced Bit Error Rate (BER) degradation. That the market for wireless communications infrastructure matures equipment vendors are under increasing pressure to provide low cost solutions toreduce and operators wireless technology complexity. The system suggested that was based on a combination of classic particle swarm optimization and genetic local search algorithms.

In the previous work discuss in literature review shows that there is need has improvement in system in terms of Noise level. BER should be decrease so that in higher level QAM will be implemented at higher noise level such as 32 QAM, 64 QAM as so on. The recent advancement have improve the bit error rate upto some extent but the system that analyzed for more no of carriers decreases the ISI and ISF using deferent technique All wireless communication systems use modulation schemes to map the information signal to a form that can be effectively transmitted over the communication channel. We presented a performance study of M-ary modulation schemes viz. PSK, OQPSK, QAM and DPSK for FFT-OFDM technique using the system parameters for WLAN standard (IEEE 802.11a).The performance analysis of the WLAN system is based on BER versus SNR for above mentioned modulation formats in Additive white guassian noise channel and the Rayleigh fading channel which is one of the channel scenarios as found in most of the wireless applications. The SNR for each modulation takes into account the number of bits per symbol, and so the signal power corresponds to the energy per bit times the number of bits per symbol. The higher E_b/N_0 required for transferring data means that more energy is required for each bit transfer. From the performed simulations, it was found that in AWGN channel, Coherent QAM performsbest in that it shows the least bit error rate requiring the least SNR for M=16 while differential PSK is the worst for the same value of M. Whereas for M = 4, OQPSK performs the best as it requires least SNR and DPSK performs the worst in AWGN channel. Similarly, for Rayleigh channel, OQPSK modulation done on the transmitted bits performs the best of all the other modulation techniques i.e. PSK and

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

DPSK for the various values of M. The low efficiency of PSK in AWGN channel is a result of underutilization of the IQ vector space. As it is a known fact that PSK only uses the phase angle to convey information, with amplitude being ignored, QAM uses both amplitude and phase for information transfer and so is more efficient than PSK in AWGN channel for an OFDM system.

III. RESULTS ANALYSIS

Result analysis has been done using previous paper where BER using different modulation schem such as BPSK, QPSK, 8-PSK, DPSK, 8-QAM, OQPSK. In different channel fading (AWGN, Rayleigh, and rician channel)

Table 1 BER Comparision in different channel.

Modulation Technique	**BER (Rayleigh Fading)**	**BER (AWGN Channel)**	**BER (Raician Channel)**
BPSK	**0.031**	**0.0786**	**0.1464**
QPSK	**0.01**	**0.0786**	**0.1464**
8-PSK	**0.0012**	**0.1226**	**0.1818**
8-QAM	**0.0012**	**0.1326**	**0.1888**
DPSK	***0.0001***	***0.1966***	***0.25***
OQPSK	**0.1**	**0.0786**	**0.1464**

IV. CONCLUSION

In this paper we can evidently conclude that the QPSK gives better performance under AWGN, and Rician Channel compared to other modulation scheme's and channels. Performance of the system is analyzed under different K factors with different FEC techniques, which show satisfactory results in terms of better BER values. The throughput and packet error are used to evaluate the performance of the model with different k factor parameter. here we give a comparision analysis of QAM, QPSK, PSK, and FSK technique. Futher using different optimization technique we will try to improve SNR over different modulation technique.

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ISSN: 2277-9655
Impact Factor: 5.164
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CITE AN ARTICLE

Sahu, J. K., & Sahayam, N. (2018). A REVIEW ON PERFORMANCE OF OPTICAL COMMUNICATION NETWORKS USING DIFFERENT MODULATION TECHNIQUE. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY, 7*(6), 559-563.