A Review on Modelling and Performance of QAM-OFDM System with AWGN Channel

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Abstract - This review work based on the Performance analysis of QAM-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.

Keywords—QAM-OFDM, DAB, VHDSL, FFT,

I. INTRODUCTION

Orthogonal Frequency Division Multiplexing is based on the principal of transmitting data by dividing the stream into several parallel bit streams of multi-carrier transmission. In an OFDM technique, a large number of orthogonal, overlapping, narrow band sub-channels or subcarriers, transmitted in parallel, divide the available transmission bandwidth. This avoids the need to have non-overlapping subcarrier channels to eliminate inter-carrier interference. OFDM is being used in a number of wired and wireless voice and data application due to its flexible system architecture. Some examples of OFDM applications are Digital Audio broadcasting (DAB), and High Rate Digital Subscribers Line (HDSL), and very high rate digital subscriber line (VHDSL) systems, which operate over twisted pair channels.

The basic idea behind multi-tone modulation is to replace one wideband signal with several simultaneously transmitted narrowband signals with the same overall bandwidth as the original signal. In principle, the two techniques are equivalent in an AWGN channel. To implement OFDM transmitters and receivers in discrete time, Inverse fast Fourier transform (IFFT) and Fast Fourier transform (FFT) are used respectively. OFDM transmits symbols that have long time duration, which is less or equal to the maximum delay spread. To eliminate ISI, guard intervals are used between OFDM symbols.

II. METHODOLOGY

OFDM is of great interest by investigation and investigators laboratories all over the world. it is expected to be used for wireless broadband multimedia communications. OFDM can be seen as either a modulation technique or a multiplexing technique. One of the main reasons to use OFDM is to increase the robustness against frequency selective fading or narrowband interference. In a single carrier system, a single fade or interferer can cause the entire link to fail, but in a multicarrier system, only a small percentage of the subcarriers will be affected. Error correction coding can then be used to correct for the few erroneous subcarriers. The concept of using parallel data transmission and frequency division multiplexing was published in the mid-1960s. Some early progress is traced back to the 1950s. A U.S. patent was filed and issued in January 1970.

In a classical parallel data system, the total signal frequency band is divided into N no overlapping frequency sub channels. Each sub channel is modulated with each symbol and then the N sub channels are frequency-multiplexed. It looks good to avoid spectral overlap of channels to eliminate interchannel interference. Though, this leads to in proficient use of the accessible spectrum.
To manage with the inefficiency, the ideas projected from the mid-1960s were to use parallel data and FDM with overlapping subchannels, in which, each handling a signaling rate b is spaced b apart in frequency to avoid the use of high-speed equalization and to combat impulsive noise and distortion in multipath, as well as to fully use the available bandwidth.

To realize the overlapping multicarrier technique, though we need to decrease crosstalk between subcarriers, this means that we want orthogonality between the different modulated carriers. The word orthogonal indicates that there is an accurate mathematical relationship between the frequencies of the carriers in the system. In a usual frequency-division multiplex system, several carriers are spaced apart in such a way that the signals can be received using conventional filters and demodulators. In these type receivers, guard bands are introduced between the different carriers and in the frequency domain, which results in a decreasing of spectrum efficiency. It is possible, though, to arrange the carriers in an OFDM signal so that the sidebands of the individual carriers overlap and the signals are still received without adjacent carrier interference. To do this, the carriers must be scientifically orthogonal. The receiver acts as a bank of demodulators, translating each carrier down to DC, with the resulting signal incorporated over a symbol period to recover the unrefined data. If the other carriers all strike down the frequencies that, in the time domain, have a entire number of cycles in the symbol period T, then the incorporation process results in zero involvement from all these other carriers. Thus, the carriers are linearly independent (i.e., orthogonal) if the carrier spacing is a multiple of 1/T.

Much of the investigation focuses on the high proficient multicarrier transmission technique based on orthogonal frequency carriers. Weinstein and Ebert in 1971 applied the discrete Fourier transform (DFT) to parallel data transmission systems as part of the modulation and demodulation process. Therefore, if we use DFT at the receiver and calculate correlation values with the center of frequency of each subcarrier, we improve the transmitted data with no crosstalk. Additionally, using the DFT-based multicarrier system, frequency-division multiplex is achieved not by band pass filtering but by baseband processing. Besides, to eliminate the banks of subcarrier oscillators and coherent demodulators required by frequency-division multiplex, digital implementations could be building around special-purpose hardware performing the fast Fourier transform (FFT), which is an proficient of the DFT.

Recent advances in very large scale integration (VLSI) technology make high speed, large size FFT chips commercially reasonable. With this method, both transmitter and receiver are implemented using proficient FFT techniques that decrease the number of operations from N2 in DFT down to NlogN. In the 1980, OFDM was studied for high speed modems, digital mobile communications and high-concentration recording. One of the systems realized the OFDM techniques for multiplexed QAM using DFT and by using pilot tone, stabilizing carrier and clock frequency arrange and implement trellis coding are also implemented. Besides, various speed modems were developed for telephone networks. In the 1990s, OFDM was broken for wideband data communications over mobile radio FM channels, high-bit-rate digital subscriber lines (HDSL; 1.6 Mbps), asymmetric digital subscriber lines (e.g. ADSL; up to 6 Mbps), very-high-speed digital subscriber lines (VDSL; 100 Mbps), digital audio broadcasting (DAB), and high-definition television (HDTV) terrestrial broadcasting.

The OFDM transmission technique has the following key advantages:

- Makes proficient use of the spectrum by allowing overlap
- By dividing the communication channel into narrowband flat fading sub channels, OFDM is more Resistant to frequency selective fading than single carrier systems are.
- Eliminates ISI and IFI through use of a cyclic prefix.
- Using sufficient channel coding and interleaving one can recover symbols lost due to the frequency selectivity of the channel.
- Channel equalization becomes easier than by using adaptive equalization technique with single carrier systems.
- It is probable to use ML decoding with logical complexity, as discussed in OFDM is computationally proficient by using FFT techniques to implement the modulation and demodulation functions.
- In combination with differential modulation, there is no need to implement a channel estimator.
- Is less responsive to sample timing offsets than single carrier systems are.
- Provides good defense against co-channel interference and impulsive parasitic noise.
III. PREVIOUS WORK

In 2012 Bozovic, R.R., [1] worked on Analyse of BER performances of OFDM systems in terms of modulation schemes, length and kind of guard intervals for various propagation conditions. OFDM transport technique because of spectral efficiency has found wide application in communication systems of fourth generation. Within the initial a part of this work, BER performances of OFDM communication systems were analyzed in terms of QAM modulation form of subcarriers and for different form of transmission channels. Within the second a part of this work, it absolutely was done BER analyze of 256 QAM OFDM systems in terms of kind and length of guard intervals and for multipath propagation channels. Simulations of OFDM systems were implemented on MATLAB.

In 2012 Riche, Larry, Sujaee, K., George, Roy, [2] investigated on "The performance of high order modulation QAM-OFDM within the presence multipath weakening channels". The restricted quantity frequency spectrum on the market to wireless communication systems makes it tough to satisfy the speedily growing demand for wireless service. Spectral efficiency may be multiplied by exploiting higher order modulation techniques, but this come at the price of enhanced likelihood of error. In this work we tend to investigate through MATLAB simulation, the execution of orders of construction modulation (QAM) a lot of usually utilized in wired networks. The BER performance of 256, 512, 1024, 2048, and 4096 QAM-Orthogonal Frequency Division Multiplexing (OFDM) signals within the presence of third Baron Rayleigh and Rician multipath channels with additive white mathematician noise area unit simulated.

In 2011 Surekha, T. P., Ananthapadmanabha, T., Puttamadappa, C., projected [3] "Modeling and Performance Analysis of QAM-OFDM System with AWGN Channel". Modeling and Simulation will play a very important role during all phases of the look and engineering of communication systems. Orthogonal Frequency Division Multiplexing (OFDM) was originally developed from the multi-carrier modulation techniques employed in high frequency military radios. During this work, a simulink primarily based simulation system is enforced using Additive White Gaussian Noise channel (AWGN) to review the performance analysis of Bit Error rate (BER) vs Signal to Noise quantitative relation (SNR). The impact of noise over AWGN channel is determined by using Constellation diagrams and results area unit ended by examination the simulated information with BER Tool.

In 2011 Mendes, L.L., Filho, R.B., [4] worked on "Clipping Distortion Performance of Nonsquare M-QAM OFDM Systems on nonlinear Time-Variant Channels". Orthogonal frequency-division multiplexing (OFDM) systems typically build use of a collection of square M Quadrature Amplitude Modulation (M-QAM) constellations to get a decent exchange between output and symbol-error strength. Though, the switch to succeeding constellation will increase the quantity of bits per modulation image by 2. The introduction of non-square M - QAM constellations in such systems brings additional benefits like smoother transition among bit rates and a discount of the peak-to-average ratio of the OFDM signal. Therefore, this work unfolds analytical expressions to judge the symbol-error performance of non-square M-QAM OFDM on nonlinear time-variant additive white Gaussian noise channels, considering clipping distortion. Cross and overlaid M-QAM square measure thought of. Analytical performances were evaluated and compared with process simulations that show smart agreement.

In 2009 Yen, R.Y., Hong-Yu Liu, Wu, C. M., investigated on Correlation between ICI and therefore the carrier signal in OFDM underneath Christian Johann Doppler unfold influence during this work, we tend to derive a particular expression for the facility correlation between the inter-carrier interference (ICI) and therefore the carrier signal and show that the correlation is non-negligible for traditional Christian Johann Doppler unfold values. However, the correlation tends to fade as Christian Johann Doppler unfold approaches eternity. Then, the image error rates (SERs) for M-QAM OFDM systems over frequency-selective Ricean weakening channels supported each the correlate and therefore the unrelated ICI models area unit given for comparison.
IV. CONCLUSION AND FUTURE SCOPE

In the previous work which was discuss in literature review shows that there is need to improvement in system in terms of Noise level. If Noise level will the BER should be decreased 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 some extant but the system that analysed for more no of carriers that decreased the ISI and ISF using deferent technique.

REFERENCES