International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 11 | Nov -2016 www.irjet.net p-ISSN: 2395-0072

Simulation Based Analysis of M-array QAM with Phase Noise for OFDM

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Abstract *In the rapid development in wireless communication technology is becoming essential for high speed network due to which data signals can be communicated faster. In the complex signal architecture has requirement of multiple data to be transmitted under the modern technique like OFDM. Service providers always face to the problem of accommodating more users within limited bandwidth of the network. So that OFDM technique under M-array QAM is helpful to meet for a data signal sub-carrier with controlled phase noise. Different modulation data bits like 64QAM, 128QAM, 256QAM, 512QAM modulation as well as demodulation under this paper are simulated in MATLAB Simulink Model. In this paper, we propose the model for better performance for transmitter and receiver end under the variation of bit error rate based on OFDM technique*.

Key Words: **M-array QAM, AWGN, phase noise, OFDM**

1.INTRODUCTION

In modern day technology of communication, due to the rapid and innovative development in wireless communication network will improve the level of communication with people[1]. Due to evolution in mobile phone technology, which has a major impact for multiple data communicated with each other under WLAN (wireless local area networks) anywhere on the planet. Transmitting and receiving part of these technologies have made great development in signal design, modulation, demodulation and bit error rate. In a wireless communications system main requirement is the allocation of bandwidth, band for multiple signal to be transmitted. So that wireless multi-carrier modulation is proceeding under the OFDM technique. At this transmitting of streams of data by dividing into the serial to parallel and parallel to serial under modulation and demodulation technique[2].

1.1 WIRELESS COMMUNICATION

Today wireless communication like 3G,4G in which multiple signals are transmitted and received under the one of the most popular technique is OFDM (Orthogonal Frequency Division Multiplexing).By this technique, different carriers are signed by orthogonal to each other to become its independent each other. It is the technique to solve the problem of multipath reception under the wideband modulation [3].So that signal carrier is divided into sub-carrier under wideband frequency selective fading channel for transmitting on the signal path.due to each sub-channel flat the number of data is transmitted by overlapping digital signals in parallel under one wideband[4].Due to the parallel channels for transmission is increased, the symbol periods lengthen must become first requirement. So that symbol time is merged under the reflected wave delay time in transmission part of OFDM[5].

1.2 OFDM TECHNIQUE

The evolution of OFDM technique can be further divided into three parts: Frequency Division Multiplexing, Multicarrier Communication and Orthogonal Frequency Divison Multiplexing[6].Frequency Division multiplexing are basically linked with the form of a signal having non overlapping frequency ranges or channel for different signals merging to be transmitted. One term has also involved that is guard band between each of these channels[7]. It means one channel does not overlap with the signal from consecutive one. In the Multicarrier communication is the study of signal of one channel split into number of signals over the frequency range of one channel signal[8].At the starting end, signals are transmitted under multiplexer for parallel communication at the receiver end signals are de-multiplexer for serial communication[9].

2 THEORY OF OPERATION

The operation of M-array QAM (Quadrature Amplitude Modulation) is technically explained on the different bit

ranges of the data stream to be transmitted under the OFDM technique. M-array is the part of the modulation (M= 8, 16, 32, 64, 128, 256, 512), which is linked to transmission under channel of signal divided into sub-channel under multiple bits of data orthogonally. The block diagram of basic network of transmitter and receiver based on OFDM technique with implementation of QAM modulation.

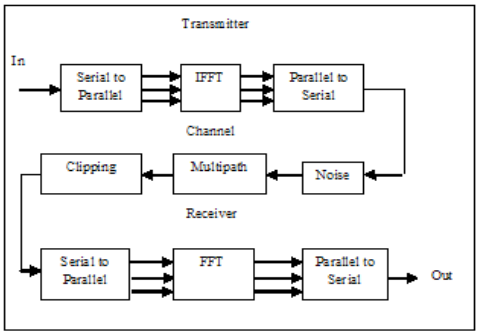

Fig-1: block diagram of OFDM with 512QAM technique.

M-array QAM (Quadrature Amplitude Modulation) is the part of digital modulation technique which is performed in the Matlab Simulink model under the AWGN, phase noise variation output wave formation. 512QAM modulation is done at the transmitter side which will contain a mathematic function of IFFT . It is explained mathematically here,

$$X_i = \frac{1}{N}\sum_{n=0}^{N-1} Fn \; e^{\frac{2\pi j}{N} ni} \qquad (1)$$

In the calculation of inverse fast Fourier transforms for the input signal according explain above equation no.1 take place at the transmitter side under 512QAM modulation technique. After that AWGN channel is used, which is basically Additive White Gaussian Noise for the impairment in communication in linear addition of wideband and also with constant spectral density is happening under white noise.A further part of Simulink model is explained for the phase noise channel is used for the variation of the M-array data bit rate process under the orthogonal multiplexing, the combination of AWGN and phase noise channel is analysis under 512QAM modulation technique for OOFDM. Here the output of demodulation of 512QAM is recorded for the calculation of bit error rate under the error calculation channel for transmission and receiving. At error calculation, there are three different parts values like symbol period, SER, no. of bits are calculated under bit data variation of the M-array QAM technique. The proposed work in Matlab under the Simulink model is explained as,

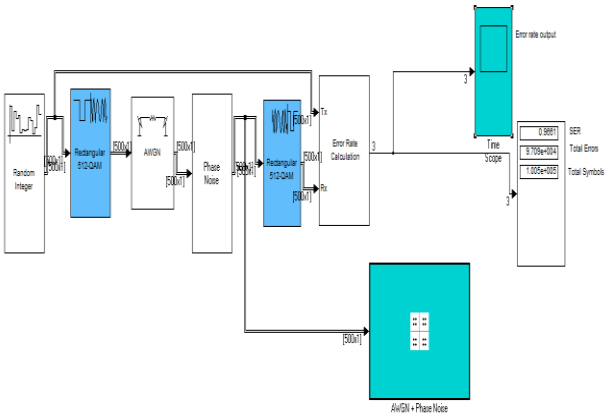

Fig-2: Simulink model of 512QAM modulation technique with phase noise for OFDM.

3 SIMULATION RESULTS IN MATLAB

In Matlab, Simulink model different channels will allow examination of the effects of AWGN, phase noise, multipath etc. By using random data is as input to the transmitted signal, then simple noise can be simulated under M-array QAM modulation technique for OFDM. This gives the information regarding practical implementation problem in OFDM where the peak to average power ratio is high. At the receiver the inverse of the transmitter is done under FFT. M-array QAM (M= 128,256,512) having different cases are explained in Matlab simulation.

Case:1 M = 512, AWGN + phase noise, error rate calculation

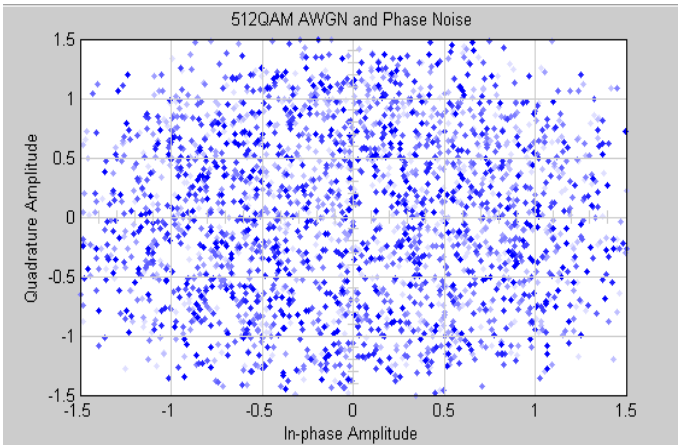

Fig-3: Output result of 512QAM AWGN +phase noise for OFDM.

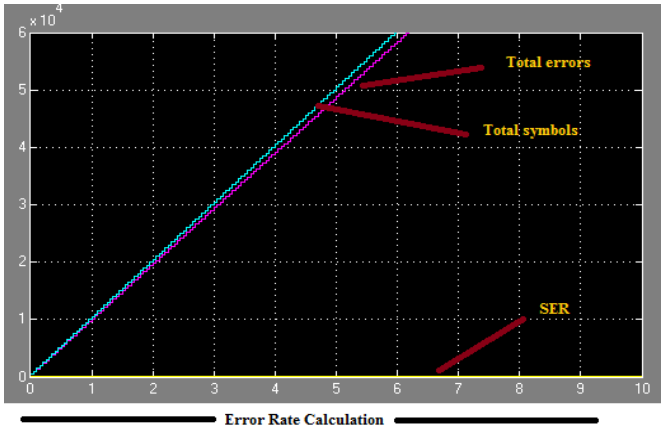

Fig-4: Output results for the error rate calculation for 512QAM technique.

Case 2: M=256, AWGN + phase noise, error rate calculation

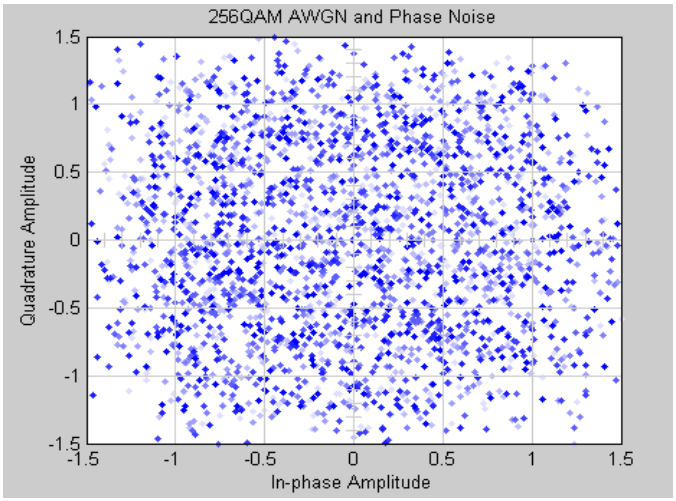

Fig-5: Output result of 256QAM AWGN +phase noise for OFDM.

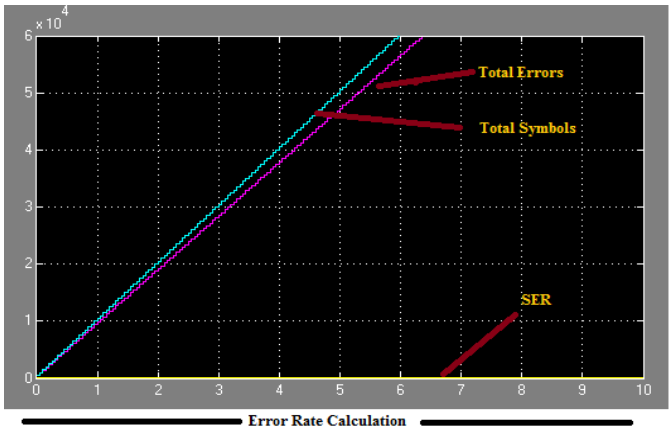

Fig-6: Output results for the error rate calculation for 256QAM technique.

Case 3: M=128, AWGN + phase noise, error rate calculation

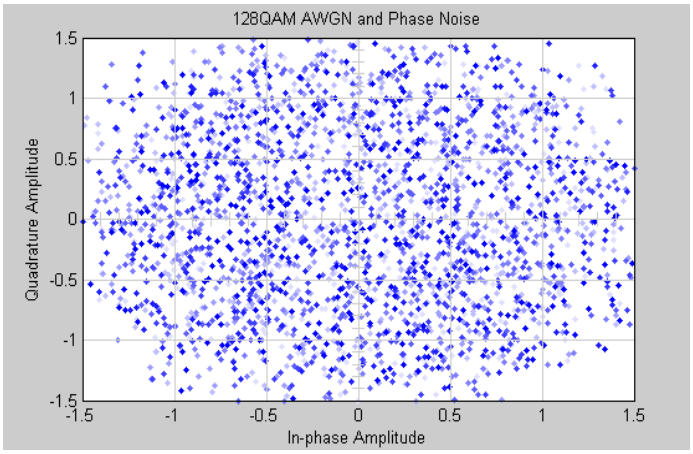

Fig-7: Output result of 128QAM AWGN +phase noise for OFDM.

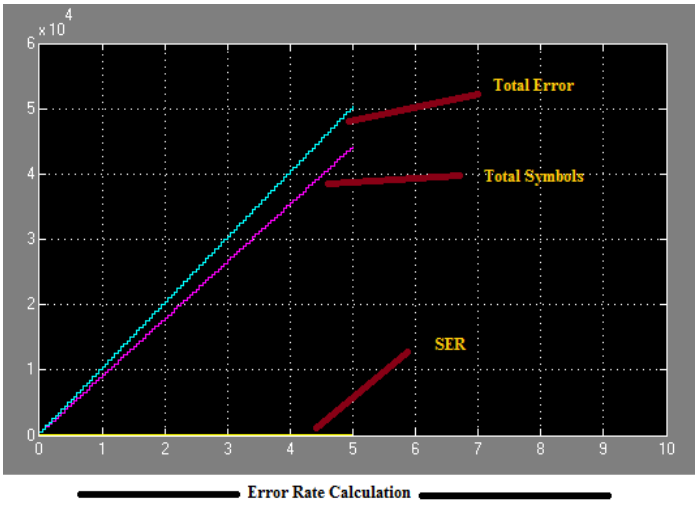

Fig-8: Output results for the error rate calculation for 128QAM technique.

Table -1: Analysis of different parts of M-array QAM

Sr. No.	M-array QAM	Total Error	Total Symbols	SER
1.	64	7.866e+004	1.005e+005	0.7826
2.	128	8.828e+004	1.005e+005	0.8784
3.	256	9.419e+004	1.005e+005	0.9372
4.	512	9.709e+004	1.005e+005	0.9661

3. CONCLUSION

The main aim of this paper is to implement the M-array QAM with the analysis of phase noise for OFDM. It is simulated using Matlab, Simulink model for testing of data pattern of different array like (M = 64,128,256,512). In these design suites, the analysis of the error rate calculation is also done under waveforms. This is a very basic implementation of M-array QAM with phase noise detection with less time of processing and complexity. By increasing the number of sub-carriers, the spectral frequency can be enhanced. This is basically oriented to the work of phase noise and AWGN for 512QAM modulation as well demodulation technique for calculating the changes in error arises.

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