Modelling and Analysis of 8PSK Modulation Scheme Using AWGN Channel for WCDMA System

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Abstract—This paper is concerned with the study of the 8PSK (Phase shift keying) modulation technique using AWGN (Additive white gaussian noise). In 8PSK scheme we can transmit one of the 8 possible signals during each interval of signalling. WCDMA systems are based on higher modulation to provide transmission at higher data rates. In this we studied the bit error rate, scatter plot, eye diagram, signal trajectory of the 8PSK system using simulink tool of Matlab 7.10. To view the systems performance it is very essential to analyze to the system in terms of probability of errors. A different modulation technique has different performance characteristics when they deal with various signals which are affected by noise and interference.

Index Terms—8PSK, Wideband CDMA, modulation technique, AWGN, M-ary, scatter plot, eye diagram

I. INTRODUCTION

Wideband Code Division Multiple access technique is a third generation cellular communication system which provides higher bandwidth that enables a range of new applications such as video streaming, TV broadcast, video calls, enhanced gaming for users and high speed networking, video conferencing, real time financial information for business. [1]

II. SYSTEM MODEL

In a communication system the most important parameters which lead to successful communication are transmitter, receiver and channel to perform any operation. In WCDMA, [2] the transmitter section consists of source, spreader and a basic modulator. The transmitter section then passes the signal from source to receiver through channel. The receiver section consists of de-spreader and the demodulator circuit. [3]

A. Random Integer Generator

The block is used a source to produce a sequence of integers. It provides output of n random integers in the range of a to b. In this user can specify to remove or to allow the duplicate integers and the decision of sorting or random order of the output.

B. Integer to Bit Converter

This block converts each integer into the corresponding binary sequence or representation.

C. 8-PSK Modulator

The function of 8-PSK modulator is to modulate the input signal by using phase shift keying technique. It is an angle modulation scheme with constant amplitude and frequency.

D. AWGN Channel

The function of this block is to add White gaussian noise to the modulated data. [4] Noise is an unwanted signal which is always present in the transmitted signal. It cannot be removed but by using various techniques it can be minimized. Additive in AWGN means that the noise is superimposed onto the signal which will mask the signal and it limits the ability of the receiver to make its decision. [5]

E. 8-PSK Demodulator

The function of Demodulator is to demodulate the received signal or to extract the original signal. [6] The extraction of the original signal without any loss determines the ability of
the receiver to receive correct data. [7]

III. PERFORMANCE CHARACTERISTICS

A. Eye Diagram
The eye diagram is obtained from the discrete-time eye diagram scope that displays the multiple traces of a modulated signal that are used to analyze the modulation characteristics. [8] These are pulse shaping or the characteristics as channel distortion of the various signals. [9] An Eye Diagram which is also known as eye pattern is observed by taking the signal in time-domain and overlapping their traces for a certain number of symbols. [10] The overlapped signals provide the complete communication system-level perspective. This is popularly known as eye pattern as for several types of coding this pattern resembles to a series of eyes between a pair of rails.

![Eye Diagram](image)

![Eye Diagram](image)

B. Scatter Plot
Discrete time scatter plot block is used to obtain scatter plot for different digital modulation techniques. The scatter plots are to visualize signal constellation and to reveal the modulation characteristics associated with digital modulation. It displays the signal constellation of a signal being modulated in its signal space by plotting the graph between its in-phase component and quadrature component as shown in fig 3. It is for comparing the system performance with some standards like 3GPP. [11]

![Scatter Plot](image)

C. Signal Trajectory
The discrete-time signal trajectory plots the graph of modulated signal between its in-phase component and quadrature component and displays the trajectory of the signal in its signal space.

![Signal Trajectory](image)

D. Theoretical Plot
In theoretical plot of 8-PSK modulation, the plot is between bit error rate and $E_b/N_0$ as shown below.

![Theoretical Plot](image)

E. Semi-Analytic Plot
By using bertool in matlab we can evaluate the semi-analytic plot and we get a plot between bit error rate and $E_b/N_0$ as shown below.

![Semi-analytic Plot](image)
F. Monte Carlo Plot

The Monte Carlo plot shows the relation between the simulated path after simulation of bit error rate and $E_b/N_0$. As shown below it is the plot with the theoretical and semi-analytical plot.

Fig 7: Monte Carlo Plot

IV. CONCLUSION

In this we have analyzed the performance of 8-PSK WCDMA system under AWGN channel. The 8-PSK digital modulation technique is used to conserve the bandwidth but as we analyzed the transmitted power and error probability increases using M-ary signalling schemes such as 8 PSK techniques. Thus the paper is focussed on the study of an example of M-ary digital modulation technique and analyzing the results through scatter plot, signal trajectory and eye diagram.

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REFERENCES


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