International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue 3, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

Analysis on QPSK Modulation Technique for Wideband Code Division Multiple Access

Harshpreet Kaur, Dr. Vishal Gupta, Prof. S.C. Gupta

Abstract **- This paper is the study of the QPSK (Quadrature Phase shift keying) modulation technique using AWGN (Additive white Gaussian noise) and Multipath Rayleigh fading channel. In QPSK scheme we can transmit one of the 4 possible signals during each interval of signalling. WCDMA systems are based on higher modulations which provide transmission at higher data rates. In this we studied the scatter plot, eye diagram and signal trajectory of QPSK system over different communication channels. All modulation techniques have different performance characteristics over various signals which are affected by noise and interference.**

Keywords **- QPSK, WCDMA, AWGN, Rayleigh Fading, Scatter Plot, Signal Trajectory, Eye Diagram.**

I. INTRODUCTION

In WCDMA system, high data rate signal transmission is used which enable multimedia rich applications such as video streams and high resolution pictures to the users. Therefore in WCDMA suitable modulation technique and error correction mechanism are required. [1] In 2G system, GSM (Global system for mobile) communication uses GMSK technique. Using this modulation we can transmit data rate of one bit per symbol. Therefore this modulation scheme is not used for next generation communication systems. So there is requirement of new modulation schemes which provide high data rate transmission. In WCDMA cellular communication, for the implementation of high data rate modulation techniques that have efficient bandwidth requires efficient modulators, demodulators, filter and transmission path. Immunity to errors is more in those modulation schemes which can efficiently transmit more bits per symbol as they are less affected by noise and interference in the channel. As the numbers of users are increased the errors can be easily introduced and the mobile terminal is subjected to mobility. Thus the requirement of high modulation schemes is increased. [2]-[5] the transition of EDGE to 3G uses a new TDMA based radio access technique which uses current frequency band. Introduction of EDGE enables high data rates and increase the spectral efficiency to thrice by employing PSK modulation.

II. SYSTEM MODEL

In cellular communication system, different channel qualities are used by different users in terms of SNR due to the difference in distance between various base station, fading, and interference. To obtain optimal bit rate for all the channel quantities link quality control is used as it adapts the data protection according to the channel quality. [6]-[10] To suit the link quality, the system adopts AMC. WCDMA system users higher modulation techniques to increase the transmission data rate.

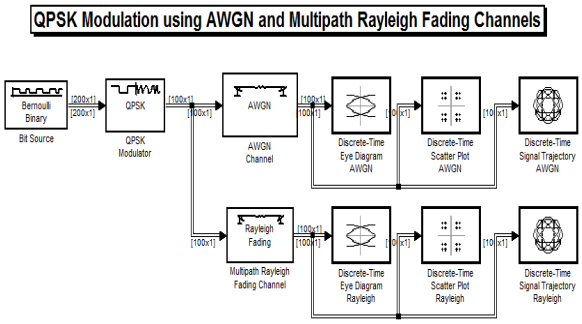

Fig.1. QPSK model

A. Digital Modulation Technique

QPSK is one example of the higher modulation technique used for Wideband code division multiple access systems. This is a M-ary PSK modulation technique where M = 4 and it transmit two bits per symbol.

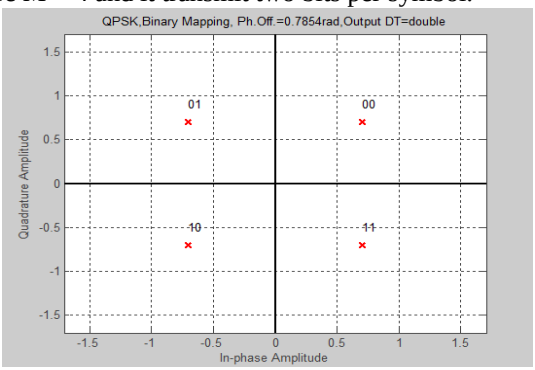

Fig.2. Constellation Diagram

B. AWGN Channel

In this channel model the only impairment to communication is linear addition of white noise having a constant spectral density with a Gaussian distribution of amplitude. In AWGN the noise is additive and is commonly used to transmit signals.[7]

C. Rayleigh Fading Channel

It is a model for the effect of a propagation environment on a radio signal i.e used by wireless device. These models assume that magnitude of that is travelled through this medium will vary randomly or fade according to a Rayleigh distribution of the radial component of the sum of two uncorrelated Gaussian random variables.

III. PERFORMANCE CHARACTERISTICS

A) Eye Diagram

It is obtained from the discrete-time eye diagram scope that displays the multiple traces of a modulated signal that

International Journal of Electronics Communication and Computer Engineering
Volume 4, Issue 3, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209

we use to analyze the modulation characteristics. [8] These are pulse shaping or the characteristics as channel distortion of the various signals. [9]

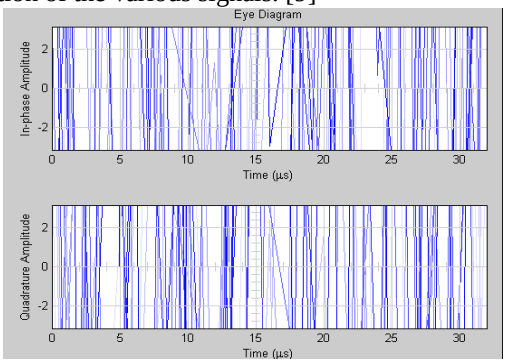

Fig.2. Eye Pattern for AWGN Channel

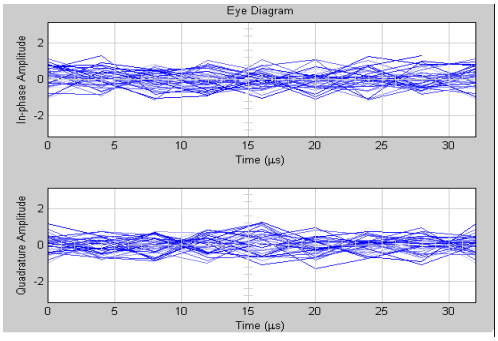

Fig.3. Eye Pattern for Rayleigh Fading Channel

B) Signal Trajectory

It is obtained from the discrete-time signal trajectory that 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.

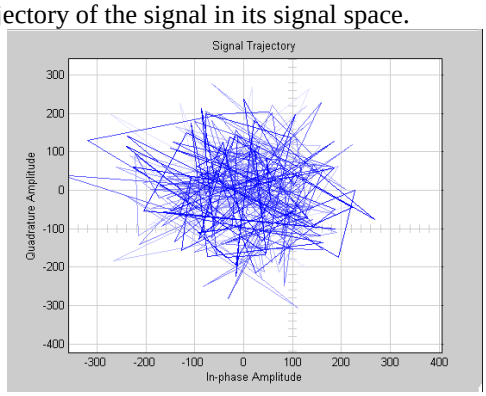

Fig.4. Signal Trajectory for AWGN Channel

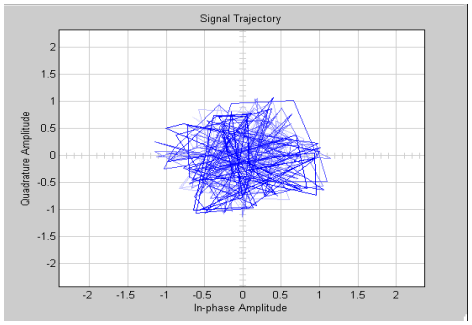

Fig.5.Signal Trajectory for Rayleigh Fading Channel

C) *Scatter Plot*

It obtained from the discrete time scatter plot block that is used to obtain scatter plot for different digital modulation techniques. The scatter plots are used to visualize signal constellation and to reveal the modulation characteristics associated with digital modulation [11]

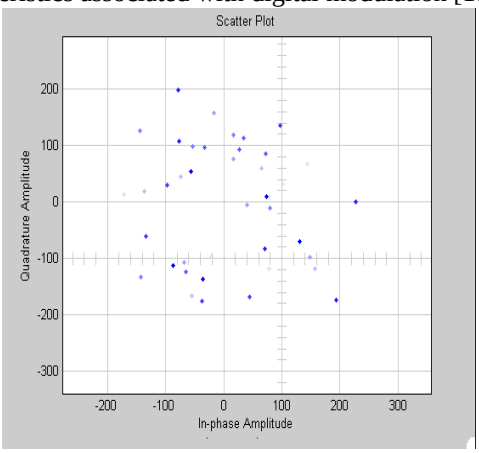

Fig.6. Scatter Plot for AWGN Channel

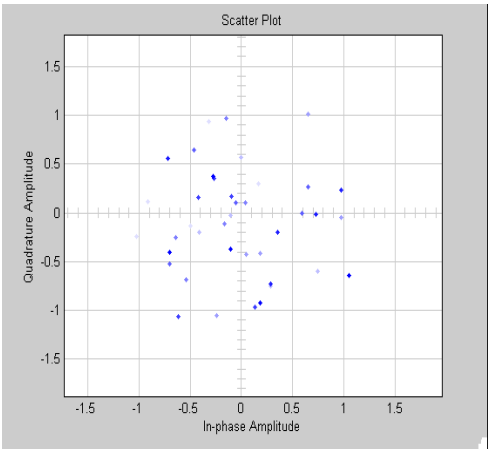

Fig.7. Scatter Plot for Rayleigh Fading Channel

IV. RESULTS

The results are discussed below:

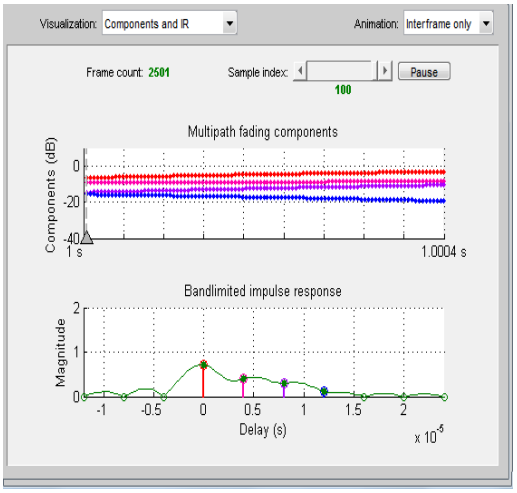

Fig.8. Components and IR Plot

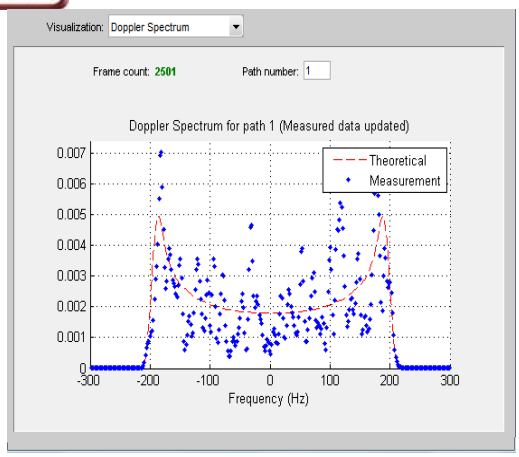

Fig.9. Doppler Spectrum

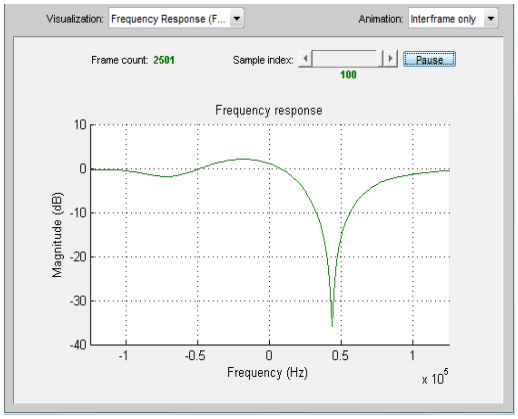

Fig.10. Frequency Response

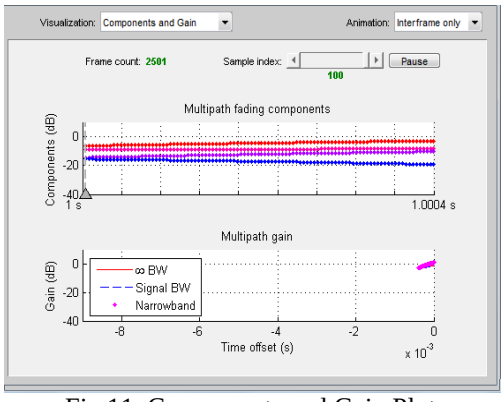

Fig.11. Components and Gain Plot

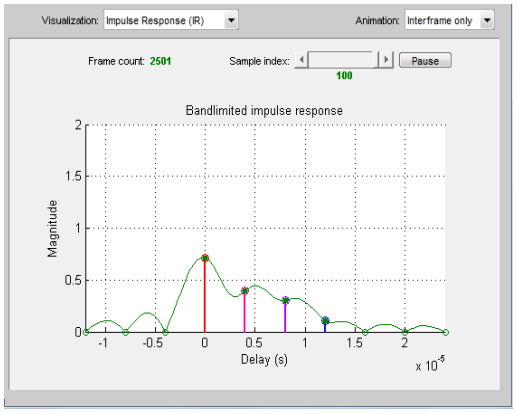

Fig.12. Impulse Response Spectrum

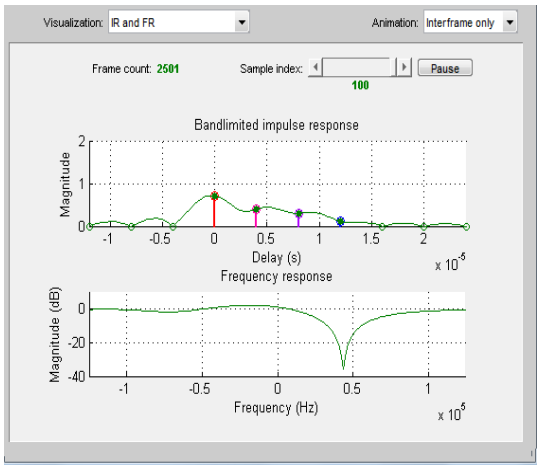

Fig.13. IR and FR Spectrum

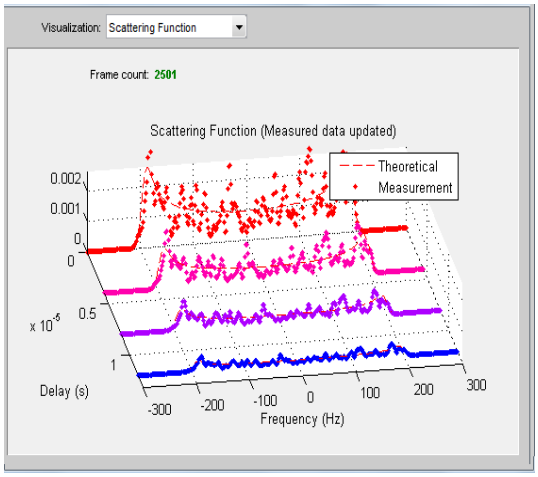

Fig.14. Scattering Plot

V. Conclusion

This research has been focussed on the analysis and performance evaluation of QPSK modulation scheme for WCDMA system under AWGN and Multipath Rayleigh fading channel. The QPSK digital modulation technique is used to conserve the bandwidth but as we analyzed the transmitted power. Thus the paper is focussed on the study of Phase Shift keying technique and analyzing the results through scatter plot, eye diagram and different component parameters considered in Rayleigh fading channel

Acknowledgment

The authors are grateful to their colleagues for their valuable comments.

References

[1] G. Harri Holma, Toskala Both of Nokia, Finland, “WCDMA for UMTS radio Access for the UMTS radio access for the third generation mobile communications”, JOHN WILEY & SONS, LTD, 2000.

[2] Theodore S. Rappaport, "Wireless Communication: Principle and Practice", Pearson Educational International, 2nd edition. 2002

[3] John G. Proakis, “Digital Communications”, McGraw-Hill, 3rd Edition, 1995.
[4] John A. C. Bingham, “Multicarrier Modulation for Data Transmission: An Idea Whose Time Has come”, IEEE Communications Magazine, Vol. 28, Issue 5, pp. 5-14, 1990.
[5] Performance study on high data rates modulation techniques of “W-CDMA in MULTIPATH FADING CHANNEL”, Muhammad Najib Bin Ismail.
[6] S. Haykin, “Communication systems”, John Wiley& Sons.
[7] AWGN Channel Capacity for Multi-Cell Interference Model in WCDMA-FDD Systems Ehab H. Abdelhayt and Fayz W. Zaki.
[8] Bernard Sklar, "Rayleigh Fading Channel in Mobile Digital Communication System Part 1: Characterization", IEEE Communication Magazine
[9] Laurence B. Milstein, “Wideband Code Division Multiple Access”, IEEE Journal On Selected Areas In Communications, Vol. 18, No. 8, 2000.
[10] Taub & Schilling “Principles of Communication” 2005.
[11] Dixon, R.C., “Spread spectrum systems”, 2nd edition, john wiley and sons, new York.

AUTHOR’S PROFILE

Harshpreet Kaur
received the Bachelor’s degree in E.C.E from Lovely Institute of Technology, Phagwara, Punjab in 2011. She is currently pursuing Master’s degree in Wireless and Mobile Communication from GRD Institute of Mangement and Technology, Dehradun. Her research area is Digital Communication.

Dr. Vishal Gupta
received the Doctorate degree from IIT, Roorkee. He is presently working as Director in GRD Institute of Mangement and Technology, Dehradun. His research area is Wireless Communication.

Prof. S.C. Gupta
is a member of Advisory Board in GRD Institute of Mangement and Technology, Dehradun. His research area is Digital Communication and Wireless Communication.