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An Effective Examination on OFDM Performance Characteristics for Wireless Broadband Applications

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Abstract

This paper mainly deals with the communication. With the rapid growth of digital wireless communication in recent years, the need for high speed mobile data transmission has increased. New modulation techniques are being implemented to keep up with the desired more communication capacity. Processing power has increased to a point where Orthogonal Frequency Division Multiplexing (OFDM) has become feasible and economical. OFDM become very popular, allowing high speed wireless communications. A basic OFDM system consists of QPSK modulator, a serial to parallel data, and an IFFT and FFT module, Guard interval inserter, in phase and quadrature phase signal generator, and parallel to serial data. In this paper,we have implemented the OFDM modulator and demodulator by using different types of digital modulation techniques such as BPSK, QPSK, 8-QAM, 16-QAM, and 64-QAM. BER for OFDM by using 8-QAM,16-QAM,64-QAM. MATLAB environment was used for simulation of proposed work.

Keywords: OFDM, QPSK, BPSK, QAM, BER.

1. INTRODUCTION:

The evolution of OFDM can be divided into three parts. These are 1) Frequency Division Multiplexing (FDM), 2) Multicarrier Communication (MC) 3) Orthogonal Frequency Division Multiplexing (OFDM).

1.1 Frequency Division Multiplexing (FDM): Frequency Division Multiplexing (FDM) has been used for a long time to carry more than one signal over a telephone line. FDM is the concept of using different frequency channels to carry the information of different users. Each channel is identified by the center frequency of transmission. To ensure that the signal of one channel did not overlap with the signal from an adjacent one, some gap or guard band was left between different channels. Obviously, this guard band will lead to inefficiencies which were exaggerated in the early days since the lack of digital filtering is made it difficult to filter closely packed adjacent channels.

1.2 Multicarrier Communication (MC): The concept of multicarrier (MC)communications uses a form of FDM technologies but only between a single data source and a single data receiver. As multicarrier communications was introduced, it enabled an increase in the overall capacity of communications, thereby increasing the overall throughput. Referring to MC as FDM, however, is somewhat misleading since the concept of multiplexing refers to the ability to add signals together. MC is actually the concept of splitting a signal into a number of signals, modulating each of these new signals over its own frequency channel, multiplexing these different frequency channels together in an FDM manner; feeding the received signal via a receiving antenna into a demultiplexer that feeds the different frequency channels to different receivers and combining the data output of the receivers to form the received signal.

1.3 Orthogonal Frequency Division Multiplexing (OFDM): Orthogonal Frequency Division Multiplexing (OFDM) is simply defined as a form of multi-carrier modulation where the carrier spacing is carefully selected so that each sub-carrier is orthogonal to the other sub-carriers. Orthogonality can be achieved by carefully selecting the sub-carrier frequencies. One of the ways is to select sub-carrier frequencies such that they are harmonics to each other. Orthogonal Frequency Division Multiplexing (OFDM) [4] has grown to be the most popular communications systems in high speed communications. OFDM technology is the future of wireless communications

1.4 Characteristics and Principles of Operation;In OFDM, the sub-carrier frequencies are chosen so that the sub-carriers are orthogonal to each other, meaning that cross-talk between the sub-channels is eliminated and inter-carrier guard bands are not required. This greatly simplifies the design of both the transmitter and the receiver; unlike conve ntional FDM, a separate filter for each sub-channel is not required.

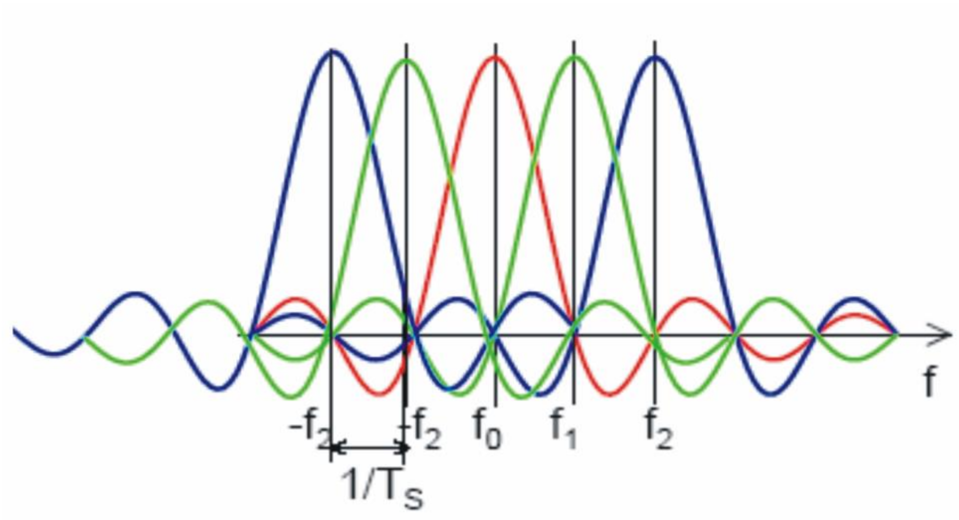

Figure 1: OFDM spectrum

2. PROPOSED WORK

2. OFDM System Implementation: The principle of OFDM was already around in the 50's and 60's as an efficient MCM technique. But, the system implementation was delayed due to technological difficulties like digital implementation of FT/IFFT, which were not possible to solve on that time. In 1965, Cooley and Turkey presented the algorithm for FFT calculation and later its efficient implementation on chip makes the OFDM into application. The digital implementation of OFDM system is achieved through the mathematical operations called Discrete Fourier Transform (DFT) and its counterpart Inverse Discrete Fourier Transform (IDFT). These two operations are extensively used for transforming data between the timedomainand frequency domains. In case of OFDM, these transforms can be seen as mapping data onto orthogonal subcarriers.In order to perform frequencydomaindata into time domain data, and IDFT correlates the frequency domain input data with its orthogonal basis functions, which are sinusoids at certain frequencies. In other ways, this correlation is equivalent to mapping the input data onto the sinusoidal basis functions. In practice, OFDM systems employ combination of fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT) blocks which are mathematical equivalent version of the DFT and IDFT.At the transmitter side, an OFDM system treats the source symbols as though they are in the frequency domain.These symbols are feed to an IFFT block which brings the signal into the time domain. If the N numbers of subcarriers are chosen for the system, the basic functions for the IFFT are N orthogonal sinusoids of distinct frequency and IFFT receive symbols at a time. Each of N complex valued input symbols determines both the amplitude and phase of the sinusoid for that sub carrier. The output of the IFFT is the summation of all N sinusoids and makes up a single OFDM symbol. The length of the OFDM symbol is NT where T is the IFFT input symbol period. In this way, IFFT block provides a simple way to modulate data onto N orthogonal sub carriers.At the receiver side, The FFT blocks perform the reverse process on the received signal and bring it back to frequencydomain.The block diagram in Figure 3.3 depicts the switch between frequency domain and time domain in an OFDM system.

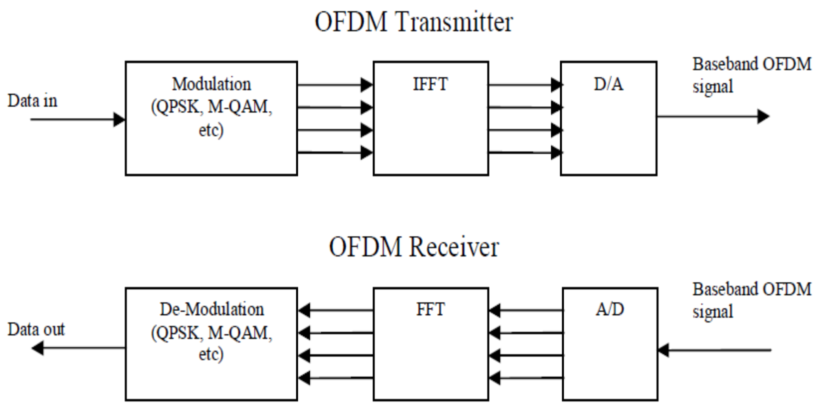

Figure 2: Basic OFDM Transmitter and Receiver

2.2 OFDM System Design Considerations:OFDM system design issues aim to decrease the data rate at the subcarriers, hence, the symbol duration increases and as a result, the multipath effects are reduced effectively. The insertion of higher valued CP will bring good results against combating multipatheffects but at the same time it will increase loss of energy. Thus, a tradeoff between these two parameters must be done to obtain a reasonable system design.

2.3 System Design Requirements:

OFDM system depends on the following four requirements:

Available bandwidth: The bandwidth limit will play a significant role in the selection of number of subcarriers.Large amount of bandwidth will allow obtaining a large number of subcarriers with reasonable CP length b) required bit rate: The system should be able to provide the data rate required forth specific purpose. c) Tolerable delay spread: A user environment specific maximum tolerable delay spread should be known beforehand in determining the CP length.d) Doppler values: The effect of Doppler shift due to user movement should be taken into account.

a) Required bit rate: The system should be able to provide the data rate required forth specific purpose.

b) Tolerable delay spread: A user environment specific maximum tolerable delay spread should be known beforehand in determining the CP length.

2.4 Adaptive Transmission

a) The resilience to severe channel conditions can be further enhanced if information about the channel is sent over a return-channel. Based on this feedback information, adaptive modulation, channel coding and power allocation may be applied across all sub-carriers

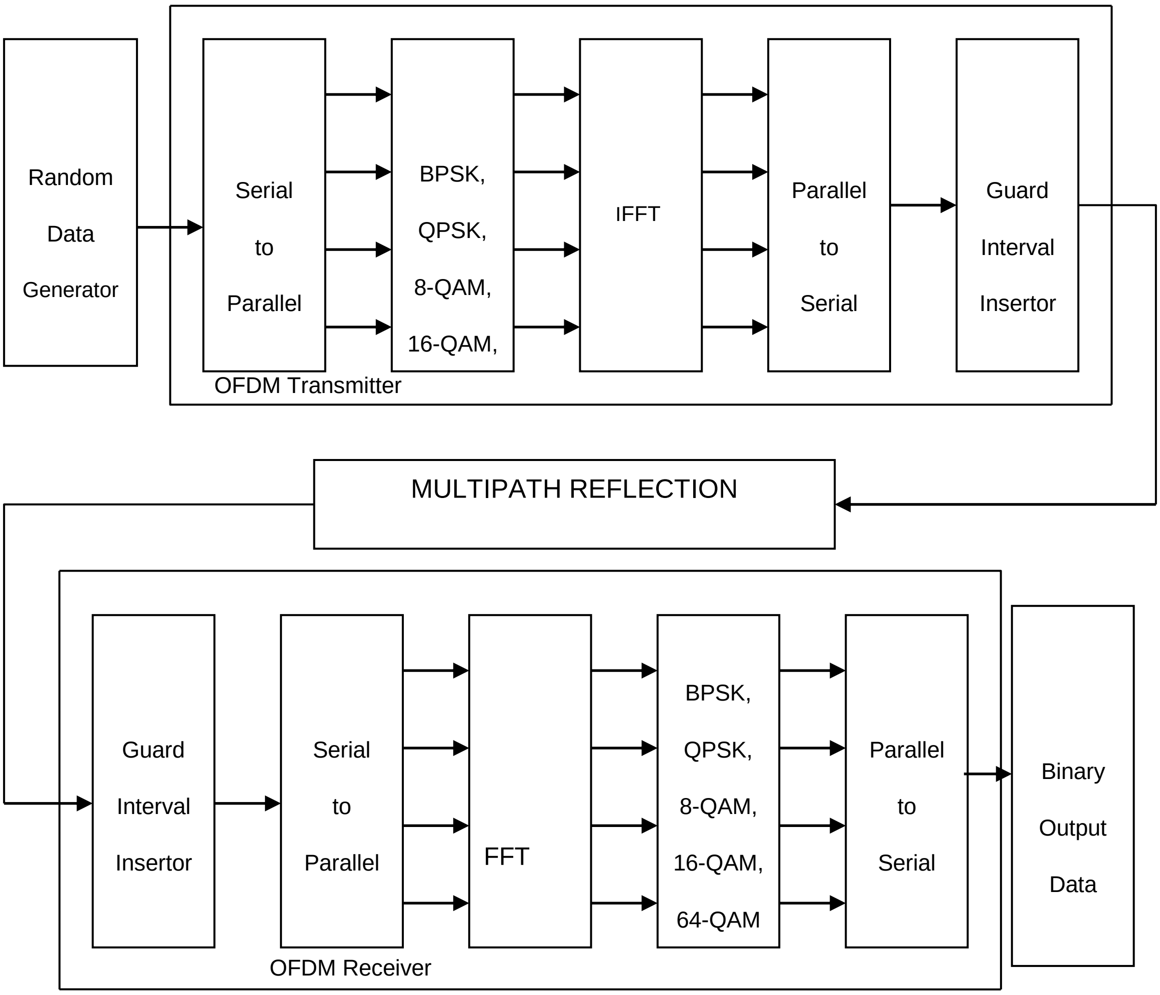

Figure 2.4: OFDM system model used for simulation

3. WORK INITIATION

3.1 Flowchart for OFDM Trans receiver: There were three program functions that used to model the OFDM System, those were transmit function, genrand function and receive function. The transmit function, the genrand function and the receive function were used as a Model OFDM transmitter, a data generator and an OFDM receiver, respectively. The other parts of OFDM system such as channels, AWGN, impulse noise, etc were written directly inside the main program. The Flowchart of various functions and main program that used to simulate various Configuration of OFDM systemsis shown in Figure 3.1.

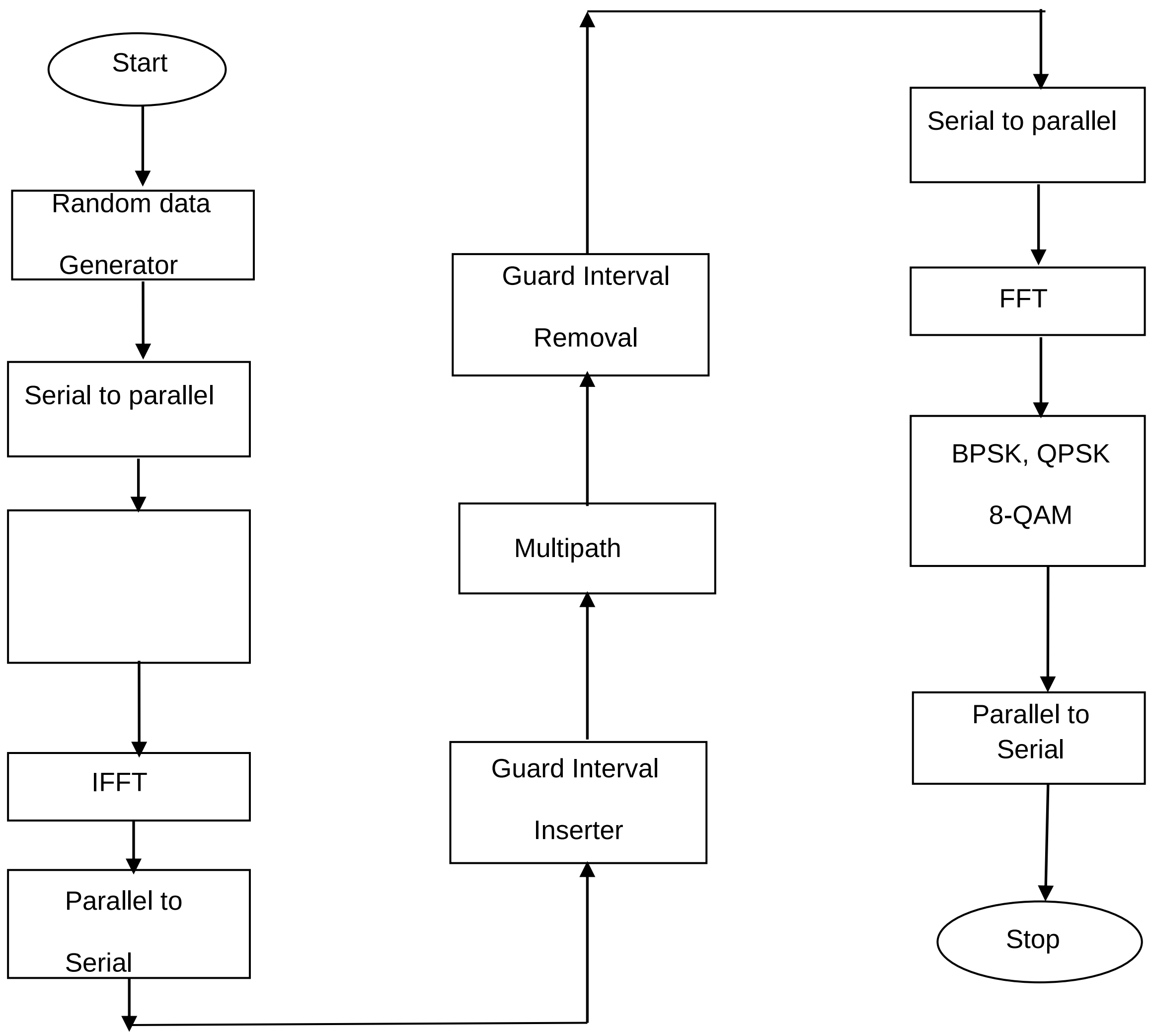

Figure 3.1: Flow chart for main program

4. SIMULATION RESULTS

4.1 QPSK Modulation:

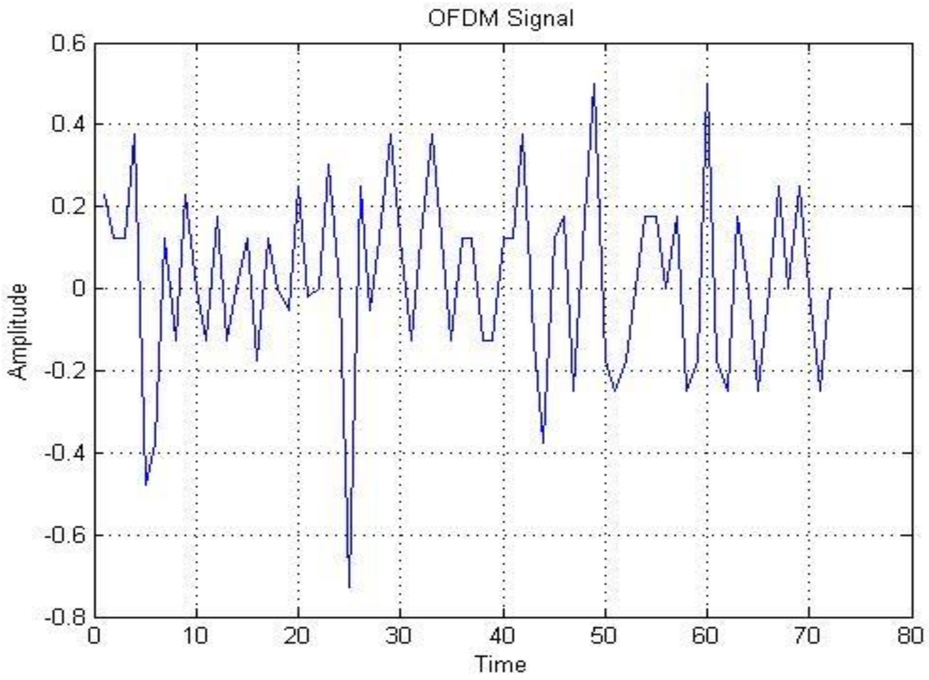

Figure 4.1: OFDM signal

4.2 BPSK Modulation:

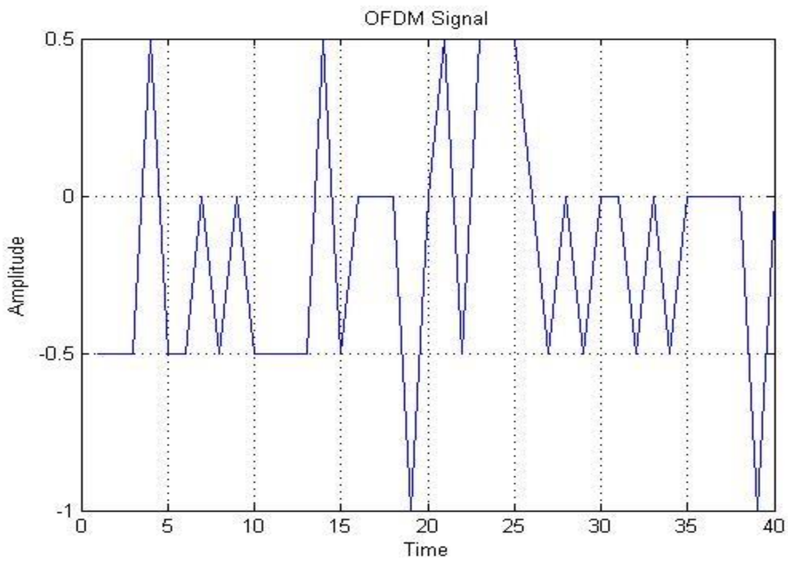

Figure 4..2: OFDM signal

4.3 8-QAM Modulation:

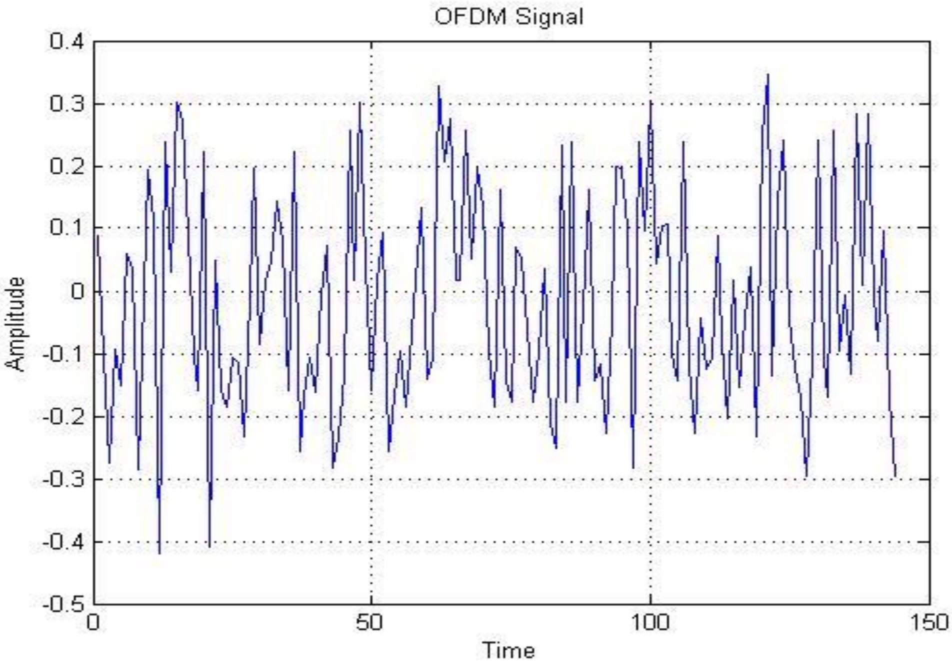

Figure 4.3: OFDM signal

5. CONCLUSION AND FUTURE SCOPE

This thesis has concentrated on OFDM;Using MATLAB simulation of OFDM was done with different modulation techniques. The digital modulation schemes such as BPSK, QPSK, 8-QAM, 16-QAM, and 64-QAMwere selected to generate the OFDM signal and also can be used to improve the efficiency further. In this paper, I proposed the algorithms for OFDM transmitter and receiver for by using different types of digital modulation techniquesand also drawn the flow chart for OFDM transmitter and receiver. Earlier OFDM system was developed by using DFT at receiver side and IDFT at transmitter side. In this project in order to improving the system performance, bandwidth efficacy, easy computations by using FFT used at receiver side and IFFT used at transmitter side. OFDM overcomes even severe inter-symbol interference through the use of the IFFT and a Cyclic Prefix.Wimax is a fourth generation technology. It is supporting OFDM technology to transmit information between base station and subscriber station.OFDM which can also supports MIMO-systems, OFDMA (orthogonal frequency division multiple access).More work could be done on investigating suitable techniques for doing this OFDM promises to be a suitable modulation technique for high capacity wireless communications and will become increasing important in the future as wireless networks become more relied on.

6.REFERENCES

[1] T. Rappaport, “Wireless Communications, Principle & Practice”, IEEE Press, Prentice Hall, pp. 3, 1996.

[2] Wayne tomasi,”advanced electronic communications systems”, 5thEdition.

[3] Chang, R.w and Gibbey, R.A (1968). A theoretical study of performance of an orthogonal multiplexing data transmission scheme, IEEE transactions on communications technology 16(4), 529-540.

[4] A.Bahai and B.K saltzberg multicarrier digital communication: theory and applications of OFDM, Springer 2004.

[5] Downlink BER Simulation for IEEE 802.16e OFDM-PHY by Pangan Tint, Yung-Yet Juan, Chia-Tsung Lin, Yu-Tao Hsieh, Chi-Fang Li, Tsar-Huang Chen, ShuennGi Wei Chao-Kai J-HLee, Ping Change, Wen, Racy Cheng IEEE 2005

[6] “Air interface for fixed broadband wireless access systems”, IEEE802.16-2004

[7] P. Banelli and S. Cacopardi.Theoretical analysis and performance of OFDM signals in nonlinear AWGN channels.IEEE Trans. on Communications Mar. 2000.

[8] “Air interface for fixed and mobile broadband wireless access systems”, IEEE802.16e/d, 2005.

[9] Simon Haykin, Digital Communications, Wiley Publications Ltd, Singapore, 1988.

[10] S. Swales, M. Beach, “Third Generation Wireless Networks”, University of Bristol, Future Communication Systems course, April 1994.