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JUDUL: W-CDMA SIMULATION FOR RECEIVER PART AND BER PERFORMANCE IN AWGN, RAYLEIGH CHANNEL AND RICIAN

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W-CDMA SIMULATION FOR RECEIVER PART AND BER PERFORMANCE IN AWGN, RAYLEIGH CHANNEL AND RICIAN

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This report is submitted in partial fulfillment of the requirement for a degree of Bachelor of Electronic Engineering (Telecommunication Electronics)

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I declare that this report entitled *"W-CDMA Simulation for Receiver Part and BER Performance in AWGN, Rayleigh Channel and Rician"* is the result of my own research except as cited the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Dedicated

To my beloved parents,

Mama and Papa,

My sisters and brother,

And to all my friends,

Fifi, Ayu, Jihad, Bit, Didy &Tiara

With thanks for all the cares, love and supports.....

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ABSTRACT

The global wireless mobile telecommunications encounter dramatic changes from the first generation analog system with frequency division multiple access (FDMA) technology to the second generation digital system with time division multiple access (TDMA) and finally now into the third generation system with code division multiple access (CDMA) technology. The reason for wideband code division multiple access (WCDMA) is to cope with growing mobile voice and data volumes that is more efficient than 2G and 2.5G. WCDMA is fulfilling its potential as the key foundation for third generation public mobile services. The initial WCDMA cellular systems are envisioned to spread over 5MHz. This thesis is studied the performance of WCDMA using Matlab version 7. This research is divided into two parts. First part is the development of CDMA system and WCDMA system. Chip rate for CDMA system is 1.2288 Mchip per second while for WCDMA system is 3.84 Mchip per second. Second part is running the simulation models to study the system behaviour. The input data is transmitted through AWGN channel, Rayleigh fading channel and Rician fading channel.

ABSTRAK

Sistem telekomunikasi tanpa wayar bergerak sejagat menghadapi perubahan yang mendadak dari sistem analog generasi pertama dengan teknologi pembahagian frekuensi berbilang capaian (FDMA) ke sistem digital generasi kedua dengan teknologi pembahagian masa berbilang capaian (TDMA) dan akhirnya, kini ke sistem digital generasi ketiga dengan teknologi pembahagian kod berbilang capaian (CDMA). Tujuan perubahan kepada WCDMA ialah untuk memenuhi perkembangan telekomunikasi suara, penghantaran data suara dimana ia lebih efisyen dari 2 G dan 2.5 G. Pembahagian kod jalur lebar berbilang capaian (WCDMA) memenuhi potensinya sebagai asas kepada sistem mudah alih 3 G. Sistem mudah alih WCDMA mampu untuk melebarkan lebar jalur sehingga 5 MHz. Kajian ini adalah mengenai simulasi untuk mengkaji pencapaian WCDMA dengan menggunakan Matlab versi 7. Kajian ini dibahagikan kepada dua bahagian, di mana bahagian pertama adalah membangunkan sistem CDMA dan WCDMA. Bagi menjalankan sistem CDMA, kadar cip 1.28 Mcip per saat telah dipilih manakala bagi menjalankan sistem WCDMA, kadar cip yang dipilih ialah 3.84 Mcip per saat.. Manakala bahagian kedua ialah menjalankan simulasi ke atas sistem CDMA dan WCDMA.

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LIST OF ABBREVIATIONS

AWGN	Additive White Gaussian Noise
BER	Bit Error Rate
BPSK	Binary Phase Shift Keying
CDMA	Code Division Multiple Access
DS -CDMA	Direct Sequence - Code Division Multiple Access
FDD	Frequency Division Duplex
FDMA	Frequency Division Multiple Access
FH -CDMA	Frequency Hopping - Code Division Multiple Access
GSM	Global System for Mobile
IMT-2000	International Mobile Telecommunications-2000
ITU	International Telecommunications Union
LOS	Line of Sight
PN	Pseudonoise
QPSK	Quadrature Phase Shift Keying
SNR	Signal to Noise Ratio
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
WCDMA	Wideband Code Division Multiple Access

CHAPTER I

PROJECT OVERVIEW

1.1 Introduction

The goal for the next generation of mobile communications system is to seamlessly provide a wide variety of communication services to anybody, anywhere, anytime. The intended service for next generation mobile phone users includes services like transmitting high speed data, video and multimedia traffic as well as voice signals. The technology needed to tackle the challenges to make these services available is popularly known as the Third Generation (3G) Cellular Systems. The first generation systems are represented by the analog mobile systems designed to carry the voice application traffic. Their subsequent digital counterparts are known as second generation cellular systems. Third generation systems mark a significant leap, both in applications and capacity, from the current second generation standards. Whereas the current digital mobile phone systems are optimized for voice communications, 3G communicators are oriented towards multimedia message capability.

1.2 Problem Statement

The differences in the air interface reflect the new requirements of the third generation systems. For example, a larger bandwidth of 5 MHz is needed to support higher bit rates. Transmit diversity is included in WCDMA to improve the downlink and uplink. Transmit diversity is not supported by the second generation standards. The mixture of the different bit rates, services and quality requirements in third generation systems required advanced radio resource management algorithms to guarantee quality of services and to maximize system throughput. Most importantly, WCDMA system increased multipath diversity improves the coverage.

1.3 Objective

The objectives of this project are to develop CDMA system and WCDMA system at receiver part and to evaluate the performance of WCMA system in term of bit error rate performance. Additive White Gaussian Noise (AWGN), Rayleigh fading channel and Rician fading channel are used to study the performance in different types of propagating medium. The simulation models are simulated to study the system behaviour. The results are compared with the theoretical result for AWGN channel and Rayleigh channel.

1.4 Scope of Project

This project is divided into three parts. First part is to study the literature review on 2G systems for CDMA system and 3G systems for WCDMA system including the Despreader, QPSK Demodulator, SNR and BER for AWGN channel, BER for Rayleigh channel and BER Rician channel. Second, the model of conventional CDMA and WCDMA is developed using Matlab version 7. This project is only focused at receiver part and is done followed by the simulation of the developed system through Additive White Gaussian Noise (AWGN), Rayleigh fading channel and Rician fading channel. In this part the results obtained from the simulation are presented. Finally, all the simulation results are analyzed to interpret the BER performance of WCDMA system and compared with the conventional CDMA system.

1.5 Thesis Organization

This thesis comprises of five chapters. Chapter I give a brief overview on mobile evolution, problem statement, objective, scope of works and thesis organization.

Chapter II describes the multiple access techniques; time division multiple access (TDMA), frequency division multiple access (FDMA) and code division multiple access (CDMA). This chapter discusses WCDMA system, which is the main part of this project.

Chapter III explains the methodology to implement WCDMA system and conventional CDMA system using Matlab simulation. It involves parameter setting for input generator, Walsh code, QPSK demodulator, AWGN channel, Rayleigh fading channel and Rician fading channel.

Chapter IV presents the results obtained from the simulation block. This chapter consists of analysis of performance of BER for different types of channel. This simulation is plotted using BER versus Eb/No graph.

Last but not least, Chapter V summarizes the whole project. Conclusion and recommendation for future work are also presented.

CHAPTER II

LITERATURE REVIEW

2.1 Multiple Access Techniques

Multiple access schemes are used to allow many mobile users to share simultaneously a finite amount of radio spectrum. The sharing of spectrum is required to achieve high capacity by simultaneously allocating the available bandwidth to multiple users. An idealized multiple access mobile radio system consists of base stations, coverage areas, and mobile stations. Mobile means any subscriber station, moving or still. Traditionally mobile communications have separate users by frequency channels, time slots or both.

2.1.1 Frequency Division Multiple Access (FDMA)

Frequency division multiple access (FDMA) assigns individual channels to individuals users. In FDMA, users are assigned different frequencies within a given band, where no other users can access this channel until the subscriber's call is ended, or when the original call is handed off to a different channel by the system [1].

FDMA using large cells with high transmission power, base station equipment bulky and one transceiver is required per channel; this persuaded to the use of TDMA for second generation mobile communications. Figure 2.1 shows time versus frequency for FDMA system.

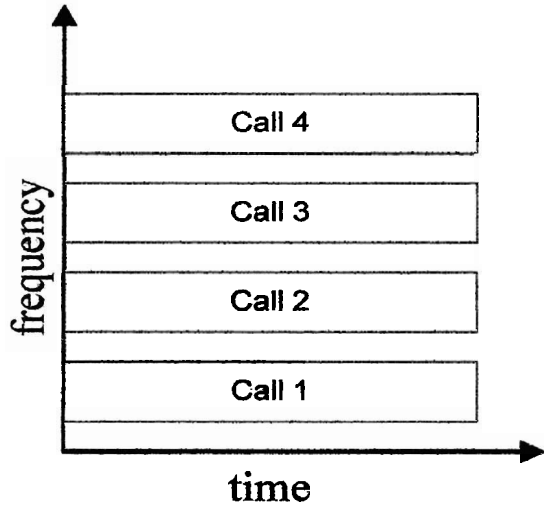

Figure 2.1: Frequency Division Multiple Access (FDMA)

2.1.2 Time Division Multiple Access (TDMA)

Time Division Multiple Access (TDMA) systems divide the radio spectrum into time slots, and in each slot only one user is allowed to either transmit or receive. In TDMA, the system starts with the slice of spectrum as carrier. The carrier will be subdivided into timeslots. One subscriber is assigned to each slot, or channel. No other users can access this channel until the subscriber's call ended, or when the original call is handed off to a different channel by the system. Figure 2.2 is shows time versus frequency for TDMA system [1].

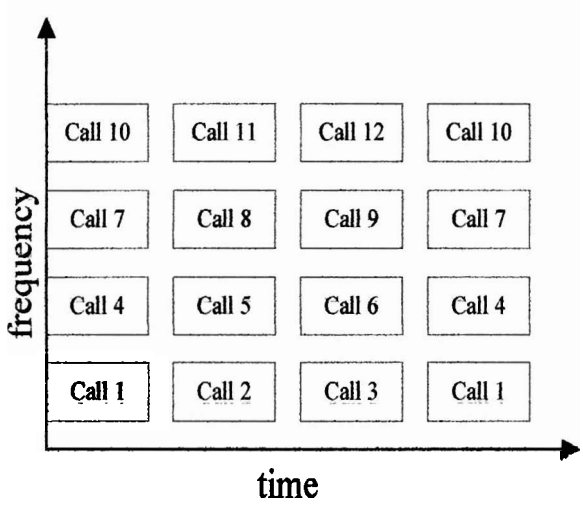

Figure 2.2: Time Division Multiple Access (TDMA)

2.1.3 Code Division Multiple Access (CDMA)

Code division multiple access (CDMA) is uniquely digital codes. Users are channelized with different code in a given frequency bands. The codes are shared by both base station and mobile station. All users share the same carrier frequency and may transmit simultaneously. Others assign a unique PN codes, which is orthogonal to PN codes used each channel [1].