

WIRELESS DATA COMMUNICATIONS: A STUDY OF BIT
ERROR RATE, MODULATION TYPE AND SIGNAL SPEED



BUREAU OF RESEARCH AND CONSULTANCY
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM
MALAYSIA

BY:
ASSOCIATE PROFESSOR DR. DEEPAK K. GHODGAONKAR
HADZLIHAJI HASHIM
NORASIMAH KHADRI

AUGUST 2000

ACKNOWLEDGEMENT

We would like to acknowledge the help and support given by following persons for successful completion of this research project.

Zuhana Binti Mohd. Said
Mohd. Shukri Haji Ahmad
Awang Mokhtar Mohamad
Olivia Rajatin Gilbert

(B. Eng. (Hons) Electrical Project Students, 1996-1999)

TABLE OF CONTENTS

CHAPTER	PAGE
Letter of Appointment	i
Research Members	ii
Acknowledgement	iii
List of Tables	v
List of Figures	vi
Abstract	1
1.0 INTRODUCTION	2
2.0 BACKGROUND	3
3.0 WIRELESS DATA COMMUNICATION SYSTEM (WDC)	9
4.0 WIRELESS DATA COMMUNICATION SYSTEM OPERATION	18
5.0 EXPERIMENTAL RESULTS	25
6.0 CONCLUSIONS AND RECOMMENDATIONS	56
REFERENCES	58
APPENDIX A	
A conference paper presented at the <i>National Conference on Telecommunications Technology</i> , December 1-2,1998, UPM, Serdang, Malaysia.	59

ABSTRACT

Wireless data communications (WDC) services such as wireless local area networks (WLANs), wireless access to internet, remote weather stations, wireless telemetry systems, provides flexibility and freedom for communication of information between people, personal computers (PCs) and machines. Due to WDC systems, it is possible to move around notebook computers and portable data terminals as long as they are within the coverage area of the wireless hub/server.

For this study, we have developed a WDC system using portable two-way radios (walkie-talkie), voice-band modems and PCs. It is a low-cost and low-speed (less than few kilobits per second) WDC system with a range of 2-4 kilometers. In this report, we are reporting measured end-to-end bit error rate (BER), block error rate (BLER) and error free second (EFS (%)) for the WDC system at different distances (0-300 meters) and at various relative noise levels (0 to ,10).

1.0 Introduction

Wireless data communications (WDC) services such as wireless local area networks, wireless access to internet, remote weather stations, wireless telemetry systems, provide flexibility and freedom for communication of information between people, personal computers (PC) and machines. Flexibility and mobility make wireless systems effective extensions and attractive alternatives to wired systems. But, the initial investment required for wireless hardware can be expensive as compared with the wired hardware. For wireless systems, overall installation expenses and life cycle costs can be significantly lower. Also, long term cost benefits of wireless systems are greatest in dynamic environments requiring frequent moves and changes. In this project, the point-to-point wireless data communication (WDC) system consists of two portable data terminals separated by a distance. The portable data terminal is constructed by connecting a voice-band modem to a personal computer or notebook computer via RS-232 interface. Then, the analog input/output of the modem is connected to the portable two-way radio (walkie-talkie). This WDC system is a low-cost and low-speed (less than few kilobits per second) communication system with a range of 2-4 kilometers [1]. As compared to other WDC systems such as pager and cellular phone, it has the advantage of not requiring any line charge and monthly rental. In applications such as wireless telemetry systems and remote weather stations, this WDC system employing two-way radios can be used.

Portable two-way radios are the Motorola Radius (GP 300) walkie-talkies. They operate in the frequency band of 460-495 MHz with an output power of 4 watts. Voice-band modems are phone modems VM12/EV from ElettronicaVeneta, Traviso, Italy. A data tester (Data Tool 5500) is used for making end-to-end bit error rate (BER) measurements. The modem VM 12 has three signal speeds of 300, 600 and 1200 bits/s. It can operate in half-duplex or full-duplex mode and uses frequency shift keying (FSK) modulations at all speeds. Portable two-way radios operates in half-duplex mode with frequency modulation. The interface used between modem and portable radio is an external headset accessory. It is attached to GP 300 so that VOX (Voice Activated Transmission) operation can be activated.

In this research, we have measured end-to-end bit error rate (BER), block error rate (BLER) and error free second (EFS (%)) for the WDC system at different distances (0-300 meters) and at various relative noise levels (0 to 10).