

**PROPAGATION PREDICTION AND MEASUREMENT ON OUTDOOR
WIRELESS LAN 2.4 GHz APPLICATIONS AT UNIVERSITI TEKNOLOGI
MALAYSIA**

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ABSTRACT

Propagation prediction and measurement has become the most important step in designing and implementing an outdoor Wireless Local Area Network (WLAN). It leads to the necessity of a sound and precise radio network planning tools. The objectives of this project are to give practical study on the losses of the signal strength which is affecting the coverage and to compare between the measurement and the prediction of the received signal strength. In this project, three-dimensional (3-D) software known as the Advanced Topographic Development and Image (ATDI) has been used to predict the signal strength in outdoor environment then the measurement of the signal strength was conducted by using the AirMagnet software. The area of the measurement and the prediction was chosen at Universiti Teknologi Malaysia (UTM) campus which is Kolej Tun Hussien Onn (KTHO). After that, it was divided into three scenarios. The carrier frequency which is being used is the unlicensed band 2.4 GHz (IEEE 802.11g) and at the transmitter end omni directional antenna has been used. The results of the comparison show a great amount of agreement between the measurement and prediction. It also gives a clear explanation about the effect of the building and trees on the design performance.

ABSTRAK

Ramalan perambatan dan pengukuran merupakan langkah yang penting dalam rekabentuk dan pelaksanaan *Wireless Local Area Network* (WLAN) luaran. Ia akan membawa kepada perlunya alatan perancangan jaringan radio yang tepat. Objektif projek ini adalah memperoleh kajian praktikal dari segi kehilangan kuasa isyarat yang mengganggu liputan dan juga membandingkan Antara pengukuran dan ramalan kuasa isyarat yang diterima. Dalam projek ini, satu perisian tiga dimensi yang dikenali sebagai Advanced Topographic Development and Image (ATDI) digunakan dalam meramalkan kuasa isyarat di persekitaran luaran manakala pengukuran dilaksanakan dengan menggunakan perisian AirMagnet. Kawasan pengukuran dan peramalan yang dipilih ialah Universiti Teknologi Malaysia (UTM) kampus iaitu Kolej Tun Hussien Onn (KTHO). Selepas itu, ia akan dibahagikan kepada dua kategori, Pembawa Frekuensi yang digunakan ialah jalur tanpa lesen 2.4GHz (IEEE 802.11g) manakala antenna omnidirectional digunakan pada pemancar. Hasil perbandingan menunjukkan bahawa pengukuran dan ramalan adalah hampir sama. Ia juga memberi penjelasan yang terang tentang kesan bangunan dan pokok terhadap persensuhan rekabentuk.

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CHAPTER 1

INTRODUCTION

1.1 Overview

In wireless networks the most important component is the access point (AP), which is important for providing and extending the physical range of wireless services to the users. The other device is the mobile clients (MC), can be laptop or PDA provided by WLAN network interface card (NIC). The wireless networks still need to be connected to wired networks in some points. The access points are normally distributed in different locations in order to create the network infrastructure; they can be indoor as well as outdoor.

Wireless LANs are growing rapidly due to their efficiency and flexibility but they face some restricting factors such as interference and multipath fading. As with sound waves, electromagnetic waves can be reflected, diffracted and attenuated depending on the medium between the transmitter and the receiver and the size of the obstacles that the wave faces. The reflection occurs when the wave hits a surface of an object whose dimension is much larger than its wavelength. The diffraction happens when a wave hits the edge of an object or an object whose dimension is smaller than its wavelength. The scattering waves will be generated or resulted from the diffraction [1].

Further the signal can be attenuated due to the absorption of the medium .As a result from these factors the signal will arrive from different paths which means different phases and different levels of power .The signal will be summation of the received signals which mean constructive or destructive .This is known as multi-path fading. In this project the measurement and the investigation of these waves were done in outdoor environment as well as the prediction .The wireless LAN 802.11 b/g has been used for this project.

The project has given a real comparison between the measurement and the prediction in terms of signal strength. That will cover indeed the effects and the causes of the differences between the two results, such as buildings and trees .The field measurement were done by AirMagnet and the prediction has done by ATDI. The project will show important points and criteria about these softwares from telecommunication perspective.

1.2 Problem Statement

Planning and implementing wireless networks is a time consuming and can be a tedious work but this is not the only problems. The wireless performance could be hampered due to the change in environment and the number of increased users. These disadvantages can be overcome by using a good prediction tools. Showing agreement between the prediction and the measurement is the only way to achieve the task.

1.3 Objective

The objectives of this research are to compare the differences between the prediction and the measurement in terms of signal strength and to investigate the outdoor propagation coverage for WLAN 802.11b/g which will be affected by the outdoor environment at Universiti Teknologi Malaysia (UTM).

1.4 Project Scope

1- A review of the existence softwares will be carried out to simplify the general concept of these tools.

2- The AirMagnet surveyor which is installed in the laptop will do the Wireless LAN field measurement.

3- The software which will be used in simulation of the wireless deployment to predict our signal is a network planning tool called Advanced Topographic Development and Image (ATDI) ICS Telecom Engine.

4- Compare and analyze the signal strength and the interference of the two different methods, prediction and field measurement.

5- Observe the effect of buildings and the terrain to the signal strength as well as the maximum coverage that can be obtained.

1.5 Layout of Thesis

This section outlines the structure of the thesis. The thesis is divided into six chapters.

Chapter one briefly introduces this project by elaborating on the project overview, objectives, and scope of project.

In Chapter two, the background of the wireless communication technology has been discussed with more concentrate on wireless LAN. The chapter is grasped form the previous literature.

Chapter three explains the basics of the radio wave propagation and existing outdoor techniques is provided in this chapter clear explanation will be given about the models and the important parameters used in measurement and prediction.

Chapter four discusses the project methodology. The steps of the project will be mentioned and the method of achieving the objects will be illustrated.

Chapter five shows results of the measurement and the predication then the analysis of the results.

Chapter six is the conclusion of the project, the project findings and the suggestions about the improvement in the future.

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