

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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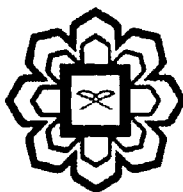
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Chapter 25

Rain Attenuation Measurements in Malaysia

Jalel Chebil¹ and Tharek Abd. Rahman²

25.1 Introduction

Rainfall can cause severe degradation for the radiowave propagation at frequencies above 10 GHz. The affect of rain is even more serious in tropical regions such as Malaysia which is characterized by high intensity rainfall. In such cases, The knowledge of the rain attenuation at the frequency of operation is extremely required for the design of any reliable line-of-sight or satellite communication systems. The ITU-R model for predicting rain attenuation is well known and produces good results in temperate regions [1,2]. When the ITU-R model is applied to tropical regions for the design of microwave links for cellular mobile system, the performance of these links is much below the expectation and it affects significantly the overall system performance. Similar problems are faced with satellite communications systems. Some studies in tropical regions showed that the ITU-R model underestimates significantly the rain attenuation and this is due mainly to the lack of data in this region [3-5]. The Universiti Teknologi Malaysia in collaboration with CELCOM Sdn. Bhd. has collected rainfall and rain attenuation data in Malaysia. The ITU-R model for the rain attenuation A is given by

$$A = a \cdot R^b \cdot r \cdot L \quad (25.1)$$

where the parameters a and b depend on frequency, drop size distribution (DSD), temperature and the polarization of the radio wave. R is the rainfall rate statistics, L is the path length and r is the reduction factor which depends on the assumption about the structure of the rain cell distribution [1]. The product of the first two terms in Equation 25.1 is called specific attenuation or attenuation per unit length and it is usually denoted by γ

$$\gamma = a \cdot R^b \quad (25.2)$$

25.2 System Setup

A microwave link at 18.585 GHz, horizontally polarized, was set up between two points inside the Universiti Teknologi Malaysia-Skudai campus (UTM-Skudai) at a separation of 300m. The data collection system is controlled by a computer which operates 24 hours

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