

ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

MD. RAFIQUUL ISLAM B.Sc., M.Sc., Ph.D., MIEEE
International Islamic University Malaysia

JALEL CHEBIL B.Sc., M.Sc., Ph.D., MIEEE
International Islamic University Malaysia



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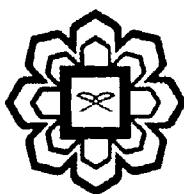
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Chapter 32

Path Length Reduction Factor For Rain Attenuation Prediction In Malaysia

Md Rafiqul Islam¹, Jalel Chebil¹ and Tharek Abd. Rahman²

32.1 Introduction

Attenuation due to rainfall can severely degrade the radiowave propagation at centimeter or millimeter wavelengths. It restricts the path length of radio communication systems and limits the use of higher frequencies for line-of-sight microwave links and satellite communications.

In order to predict the attenuation due to rain accurately, the consideration of macrophysical structure of rain such as cell size distribution and the distribution of rain inside the rain cell plays an important role. These phenomena reduce the effective length of raining along the propagation path. The simplest model for the calculation of rain attenuation A which is adopted by the ITU-R is given by [1]

$$A = a R^b L_{\text{eff}} \quad (32.1)$$

where the parameters a and b depend on frequency, drop size distribution, temperature and the polarization of the radio wave. R is the rainfall rate statistics and L_{eff} is the effective path length of microwave link over which the rain is considered as uniform. Effective path length depends on the actual path length L and a reduction factor r and is expressed as

$$L_{\text{eff}} = L \times r \quad (32.2)$$

r depends on the spatial distribution of rain rate and accounts horizontal variations of rain along a propagation path.

This paper investigates five reduction factor models based on one-year measured rain attenuation data at 15 GHz frequency over five different locations of Peninsular Malaysia. The five models are explained in the next section.

¹ *Department of Electrical and Computer Engineering, Kulliyah of Engineering International Islamic University Malaysia (IIUM)*

² *Wireless Communication Centre, Faculty of Electrical Engineering, University of Technology Malaysia, Locked bag 791, 80990 Johor Bahru, Malaysia*