ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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IIUM PRESS

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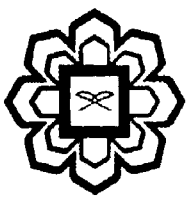

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011
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Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Md. Rafiqul Islam & Jalel chebil: Antennas and Propogation: Modeling, Simulation & Measurements
Bibliography p.
Includes Index
ISBN

ISBN: 978-967-418-138-3

Member of Majlis Penerbitan Ilmiah Malaysia – MAPIM
(Malaysian Scholarly Publishing Council)

Printed By:
IIUM PRINTING SDN.BHD.
NO. 1, JALAN INDUSTRI BATU CAVES 1/3
TAMAN PERINDUSTRIAN BATU CAVES
BATU CAVES CENTRE POINT
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Chapter 32

Path Length Reduction Factor For Rain Attenuation Prediction In Malaysia

Md Rafiqul Islam[1], Jalel Chebil[1] and Tharek Abd. Rahman[2]

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]

$$A = a R^b L_{eff} \tag{32.1}$$

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

$$L_{eff} = L \times r \tag{32.2}$$

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.

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