ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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IIUM PRESS

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

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
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Chapter 38

Rain fade Slope Prediction Model Based on Satellite Data Measured in Malaysia

Md. Rafiqul Islam[1], Khalid Al-Khateeb[1], Sheroz Khan[1] and Hassan Dao[1]

38.1 Introduction

In satellite communication on frequencies above 10 GHz, rain attenuation is great propagation phenomenon that influence large variations in received signal levels. Rain attenuaton is inordinately degraded received signal. That is why many mitigating approachs have been developed to reduce fading outage of communication links.

Rain attenuation behaviours are extensively studied and measured but dynamic aspect of rain attenuation still has sparse study. Knowledge on rain fade dynamics is noticeable important in the design of new satellite communication systems. Adaptive power control (APC) and Uplink power control (ULPC) are ones of rain countermeasure techniques relies on rain fade dynamics parameters by increasing transmitted power to compensate rain fading on propagation path. fade slope is one behaviour of fade dynamics characteristics that assesses tracking speed contributing factor to fade mitigation techniques (FMT) [1, 2]

Various researchers have studied and proposed parameters and prediction models for rain fade slope. Most studies have based on temperate region measurements [1, 3, 4, 5, 6, and 7]. ITU-R P.1623 [8] has recommended a prediction model for fade slope based on Van De Kamp model [3, 4] measured at Netherlands receiving signal from Olympus satellite ($\varepsilon = 26.78^{\circ}$) on 12.5 - 30 GHz. The model was examined using data from other sites in the UK, France, Belgium, Italy, and the US [1]. However, some measurements [9] in tropical zones have indicated the model is required to improve in order to correspond to different climate zones.

This chapter analyses rain fade slopes characteristic on different sampling times and comparing between available model and measurement in Kuala Lumpur, Malaysia. Derivative of fade slope crucial parameters has also been focused and proposed on high elevation angle as a function of sampling time intervals. This chapter has elaborated the paper published by the authors [16].

38.2 Experimental Setup

Experimental system has been monitored signal from MEASAT 3 (geostationary at 91.5° E) at 10.982 GHz frequency (Ku-Band), vertical polarization with QPSK modulation provided 15 channels for Malaysian direct broadcast satellite (DBS) pay television service (Astro). The received signal level has been collected for 12 months period since 1st July

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