ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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IIUM PRESS

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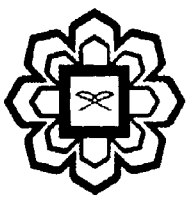

IIUM Press

Published by:
IIUM Press
International Islamic University Malaysia

First Edition, 2011

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
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Chapter 39

Effects of Rain on Free Space Optical Propagation

Suriza A.Z.[1]Md. Rafiqul ,Islam [1], Wajdi Al-Khateeb[1]and A.W.Naji[1]

39.1 Introduction

In telecommunication infrastructure, backbone network and last mile access is required to have efficient telecom and internet connectivity. With the existing connectivity gap, Free Space Optics (FSO) provides an excellent alternative. FSO technology promise point-to-point, high speed communications links. It is a technology which offers the speed of fiber with the flexibility of wireless. Available communication system like fiber optic is one of the backbones in most cities. It is the most reliable solution for optical communications. However, the cost to digging and laying down the fiber cable are huge. Furthermore, the time of deployments is also economically too expensive. It is also quiet difficult to relocate fiber cable once it is already been deployed [1,2].

Another matured technology that offers longer distance is Radio Frequency (RF) technology. However, RF is a spectrum license network (require some time to get it), not immune to interferences, costly and limited in capacity. Copper infrastructure is an old technology and available almost everywhere. Even though, the percentage of building connected using copper wire is higher than fiber but it is not a practical alternative for last mile connectivity bottleneck [3]. Other disadvantage of copper system is bandwidth limitation and unable to provide true broadband services. With all of the above justifications, FSO is a feasible option for high speed and larger bandwidth. Technologically, FSO communication system is similar to fiber optics communication system. Both share the same advantages such as higher speed, unlimited bandwidth and protocol independent. In term of cost and time of deployment, FSO system is cheaper and sorter to deploy since no laying down cable need to complete.

However, local weather condition is the foremost limitation of FSO link availability. The attenuation in atmosphere is unpredictable and can cause the attenuation from a few dBs to hundred of dBs per kilometer distance. In temperate region, the availability of FSO link is limited by fog and heavy snow [4]. In tropical region like Malaysia, rainy events can be experienced throughout the year. Therefore, rain is an important factor of attenuation and distortion signals in receiver systems [5]. Heavy rain is expected to be the limiting factor for FSO link availability. Recently, few prediction models have been proposed by ITU-R based on France and Japan's measurement. The rain attenuation on FSO links and corresponding rainfall intensity has been measured at IIUM for a period of one year. This chapter has compared attenuation predicted by models and those measured over Free Space Optical links in Malaysia. This chapter has elaborated the paper published in IIUM Engineering Journal by the authors [24].

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