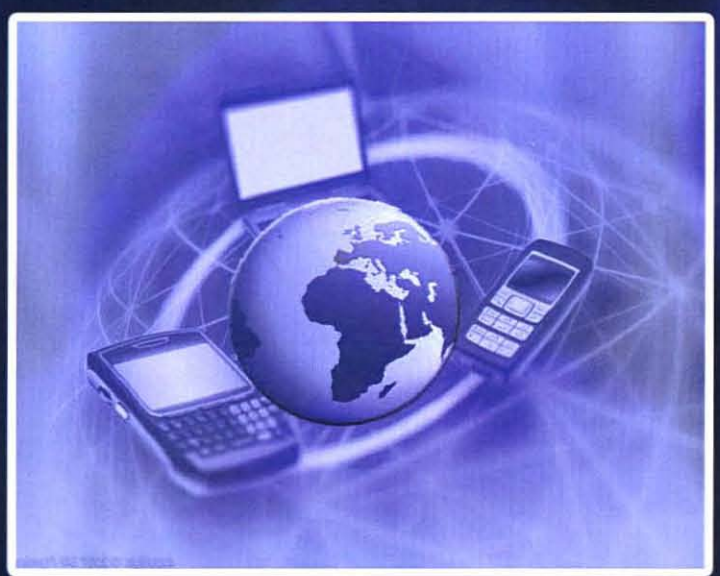
Research Issues in Wireless

Communications and Networking

Farhat Anwar
Wajdi Al-Khateeb



IIUM Press
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

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Published by:
IIUM Press
International Islamic University Malaysia

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

Farhat Anwar & Wajdi Al-Khateeb: Research Issues in Wireless Communications Networking

ISBN: 978-967-418-149-9

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
68100 Batu Caves
Selangor Darul Ehsan
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CHAPTER 23

Free Space Optic Communications – A Review of Quality Parameters

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23.1 INTRODUCTION

The optical telecommunications have paved the way for a massive expansion in global telecommunications networks over the past few decades. There has been a tremendous explosion in bandwidth demand and requirements. For the end user to access and utilize the broad array of services made available through these developments, network designers must provide a flexible and cost-effective solution for the "last mile" between the LANs, MANs, or WANs.

High bandwidth, rapid installation, higher security, and non-binding accessibility are some of the features that describe Free Space Optical (FSO) Technology. As such, FSO would be able and solve many problems faced by today's traditional wireless communications, from security, bandwidth limitations to last mile problem. Considering that FSO Technology uses optical signals, the performance of FSO links happen to be highly dependent on weather conditions more than microwave radio links.

Link quality expressed in terms of link margin, bit error rate, attenuation and availability is dependant on several parameters. These parameters can be divided into two different categories: internal and external parameters [1]. Internal parameters are related to the design of a FSO system and include transmitted optical power, wavelength, transmission bandwidth, receiver aperture area, receiver sensitivity, divergence angle and optical losses. External parameters are equipment independent and are related to the environment where the link is situated, and includes link distance, atmospheric attenuation, scintillation, link position (rural vs. urban area), etc. Therefore, in order asses the quality of a link, one must consider mentioned parameters, and see their effect on the transmitted signal.

23.2 INTERNAL FSO PARAMETERS

FSO System comprises of FSO Transmitter, FSO Receiver and channel between the two. The performance of FSO System is determined by the following parameters: the transmit power, wavelength, transmit and receive aperture area, receiver sensitivity and divergence angle. Each of these parameters has a direct impact on the performance of the FSO System.

23.2.1 Transmit Power

The increased transmit power, the signal can afford more loss through the atmosphere and can penetrate further and achieve longer ranges. However each transmitter is being designed to comply with the maximum transmit power regulations. These regulations put restrictions on power released in order to ensure that transmission is not harmful to living creatures. Even if these restrictions are ignored, increasing power without boundaries does not always help the signal strength. Addition of power beyond the saturation level makes no impact on the signal strength, and therefore, when designing the transmitter, saturation level must be determined and taken into consideration. Another issue with transmit power limitation is the cost, the more power means more cost, and in communication cost effective equipment are crucial. Following table, that was constructed based on the data sheets from various vendors, shows power consumption and power output of some of the models of FSO transmitters. As