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Evaluation of FSO System Availability in Haze Condition

A. A. Anis[1], **C. B. M. Rashidi**[1*], **S. A. Aljunid**[1] **and A. K. Rahman**[2]
[1] Advance Communication Engineering, Centre of Excellence School of Computer & Communication Eng. Universiti Malaysia Perlis, (UniMAP) Kangar, 01000, Kangar Perlis
[2] Departments of Electrical and Electronic Eng. Universiti Malaysia Sarawak, (UNIMAS), Sarawak

E-mail: rashidibeson@unimap.edu.my

Abstract. In this paper, we proposed the evaluation of FSO system availability in haze condition. The atmospheric attenuation by weather conditions in the atmosphere as the most challenging problem of FSO system as the system performance is severely degraded and causing the signal optic to be transmitted poorly. The effects of haze condition on the performance of FSO system is stressed out and focused in this paper. From the evaluation of the analysis, designs of FSO system are proposed to obtain a system with improved link performance in haze conditions. The scattering coefficient and the atmospheric attenuation are determined using Beer's Lambert equation. From the research, the link performance of the system is greatly improved using Design 2 with minimum BER of 10^{-127} and maximum Q Factor of 23.98. The FSO system using Design 2 has better performance compared to Design 1 in haze condition as the optical signals could penetrate the dense haze better without losing much optical power during the transmission to the scattering.

1. Introduction

Free space optic (FSO) communication is the transmission of modulated near-infrared (NIR) beams. They are transmitted via the atmosphere to obtain optical communication [1]. There are several important features of FSO system such as that it is unaffected by electromagnetic interference and radio frequency interference, high bandwidth and requires no licensing. Due to these interesting advantages, FSO system has been use in many applications. They are metro network extension, fiber backup, backhaul, enterprise connectivity, and military applications [2].

Despite its multiples advantages, FSO systems have its weaknesses. One of the primary drawbacks which could effectively degrade the Free Space Optics (FSO) link performance is none other than the weather condition. Several parameters such as the link range, the bit error rate (BER), quality factor, and optical power will experience extreme attenuation in the weather environment. Atmospheric attenuation due to this problem happens to prevent the link transmission in the weather conditions effectively thus achieving a high performance FSO system is impossible [3]. It can affect the system by means of absorption and scattering of laser beam by aerosols and particles in mid-air [4].

One of the local weather conditions which severely affect the optical transmission of FSO system is haze. The signal transmission during hazy days is really bad especially in low visibility haze condition. A laser beam experiences power loss when it travels through the air. The selection of distance between transmitter and receiver, bit rate, attenuation, and diameter aperture can be adjusted to greatly reduce