

Impact of rain weather over free space optic communication transmission

A.K Rahman¹, N Julai², C.B.M.Rashidi³, Nurdiani Zamhari⁴, S.K Sahari⁵, N.A.A Mohtadzar⁶,
M.R.M Sharip⁷

^{1,2,4,5,6,7}Faculty of Engineering, Department of Electrical Electronic, University Malaysia Sarawak, Malaysia

³Advance Communication Engineering, Centre of Excellence, SCCE, University Malaysia Perlis, Malaysia

Article Info

Article history:

Received Sep 27, 2018

Revised Nov 26, 2018

Accepted Nov 5, 2018

Keywords:

Attenuation

Free space optic

Rain

Scattering effect

ABSTRACT

This paper focuses the rain effect over FSO link medium in Malaysia environment. In this work, a rain data samples that collected from Malaysian Meteorological Department (MMD) to determine the scattering coefficient, atmospheric attenuation and total attenuation. From the analysis, the precipitation rate give different impact over FSO link which can cause the attenuation and bit error rate increase. The results also show the comparison parameter for optimal geometrical loss such as beam divergence, aperture size and receiver sensitivity.

Copyright © 2019 Institute of Advanced Engineering and Science.
All rights reserved.

Corresponding Author:

Abdul Rahman Bin Kram,

Department of Electrical and Electronic Engineering,

University Malaysia Sarawak,

Fakulti Kejuruteraan, Jalan Dato Mohd. Musa, 94300 Kota Samarahan, Sarawak, Malaysia.

Email: karahman@unimas.my

1. INTRODUCTION

In telecommunications, Free Space Optics (FSO) which utilizes light propagation in free space to transmit data between two points has become an attractive alternative to optical fiber communication or radio frequency system [1]. Various applications can be applied in FSO systems, such as the last mile high bandwidth internet connectivity, the temporary high bandwidth data links, the mobile telephony backhaul (3G), satellite links as well as the various applications where the optical fibers cannot be used. However FSO communication is vulnerable to atmospheric weather.

There are several factors which contribute to the degradation of FSO performance, which includes scintillation, absorption and scattering [2], [3]. In propagation of optical signals, the performance changes even more easily, especially in varying weather effects. Fog, rain, dust, snow, smoke, and other aerosol particulate matter primarily attenuate the signal-carrying laser beam [4].

This work focuses on attenuation due to rainfall, which in turn generates the scattering effect. Scattering is caused by particles such as fog, haze and rain. The type of scattering is determined by the size of the source particles. Scattering caused by particles which are equal or larger compared to the transmitted light wavelength is referred to as Mie scattering. To analyze the scattering rate in these cases, it is more appropriate to use geometric optics. In scattering, energy is taken from the beam when the beam encounters particles or molecules of different sizes and shapes. Thus, the main atmospheric attenuation component was assumed to be only of scattering losses. Other factors such as dust or liquid particles in air could also produce scattering, given that there are irregularities on the signal-entry surface.