AN EXPERIMENTAL STUDY OF SAND STORM EFFECTS ON AN FSO COMMUNICATION LINK

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ABSTRACT: In this paper we have focused on the analysis of Free Space Optical (FSO) link communication performance, under sand storm condition. Over the last two decades FSO communication has become more and more interesting topic of research, as an alternative to radio frequency communication.

FSO offers a wider modulation bandwidth, consumes low power and provides much improved security against electromagnetic interference. Most of the studies of FSO had been performed in the continents of Europe, East Asia, North America, where the main atmospheric effects are fog, rain, snow, smoke and turbulence. In the preceding studies, the effects of sand and dust have been ignored, mainly because they do not exist in those environments. In this paper we have investigated the effects of sand storms and dust storms, on an FSO communication link.

At the onset, we designed an indoor chamber, to simulate the condition of sand storm and dust storm, where wind speed, sand blowing and turbulence was generated, controlled and maintained over a longer period of time. In such a set up, we observed the effects of sand wind, both as horizontal and perpendicular to optical length. The arrangement was made to get the different angles of sand wind direction, to get the effect of entire range of directions projected to the optical length.

Based on visibility range, according to the World Meteorological Organization, we categorized the types of sand, like dust haze, blowing dust, dust storm and severe dust storm. We observed the signal scattering, absorption and fluctuation in each step. We got the parameters, like atmospheric transmittance and attenuation coefficient. We also calculated the Q-factor and Bit Error Rate (BER).

The signal from the source was sent to optical modulation through the chamber, and was given to optical detector. At receiver, transimpedance amplifier was there to convert the current to voltage and do filtering. Later, data acquisition was done to display the detector response.

KEYWORDS: free-space optical communication, atmospheric propagation, sand storms, visibility range, attenuation model, artificial indoor chamber.