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***Original Research Article***

# REGENERATED SPATIAL DIVERSITY PERFORMANCE OF WIRELESS OPTICAL COMMUNICATION OVER STRONG TURBULENT ATMOSPHERIC CHANNEL

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## Abstracts

Innovative technologies are required to satisfy the ever increasing bandwidth demand associated with new communication services. Optical free space communication, with its ability to transmit information via a collimated laser beam at high data rates using compact, low-mass terminals, while avoiding interference problems and without exhausting the radio frequency bandwidths, is a promising candidate in the field. While optical inter-satellite links are state-of-the-art technology, laser communications from ground suffers from cloud coverage, harsh weather conditions, and atmospheric turbulence. Additionally, scattering and absorption mechanisms in a communication channel cause a progressive attenuation of light signals as they travel along that channel. At some point the signals need to be amplified so that the receiver can interpret them properly. Spatial diversity, on the other hand, is an attractive technique to mitigate fades in the received signal. In contrast to spatial diversity for wireless systems, spatial diversity for atmospheric optical systems can be readily implemented since the coherence length is of the order of centimeters, i.e., the multiple transmitters or receivers only need to be placed centimeters apart to see approximately independent channel fades. The object of this paper is to design an amplified MIMO-FSO system with different types of EDFA link and analyze its performance in difficult background conditions. The achievable performance improvement including received power levels, bit error rate (BER) and Q-factor are discussed taking into account the effect of atmospheric attenuation. It was found that, the received power is increased by approximately 12 dB, when the operating environment is of light fog and the MIMO system has 4 units in each side of the transmission channel. In addition, higher values of Q-factor (64.7) and lower levels of BER are achieved, given that the operating environment is ideal, through the use of MIMO technology.

**Keywords :**

Free space optical communications (FSOC's); MIMO mechanism; non-return to zero (NRZ); Avalanche photodiode (APD); bit error rate (BER); Q-factor.

 