



# On the Performance of a CSI Assisted Dual-Hop Asymmetric FSO/RF Communication System over Gamma-Gamma atmospheric turbulence considering the effect of pointing error

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## Abstract

This paper investigates performance of an asymmetric dual-hop hybrid Free Space Optical / Radio Frequency (FSO/RF) communication system over wide range of atmospheric turbulences, from moderate to strong. Also the effects of transreceiver misalignment are taken into consideration, in order to be closer to the actual results. The proposed asymmetric structure is particularly suitable for links where direct RF connection between mobile users and base station is not possible due to atmospheric conditions. In the proposed structure, mobile users are connected to the base station with the help of an amplify and forward relay, which is aware about the channel state information (CSI). First and second hops are respectively consisted of RF and FSO links. It is the first time that effect of number of users on the performance of such a multi-user structure is investigated. Considering FSO link at Gamma-Gamma atmospheric turbulence with the effect of pointing error and RF link at Rayleigh fading, for the first time, closed-form expressions are derived for Bit Error Rate (BER) and outage probability ( $P_{out}$ ) of the proposed structure. MATLAB simulations verified accuracy of the derived expressions. It is shown that the proposed system is less sensitive to the number of users within the cell. As a result, the proposed structure does not need to adaptive processing to get adapted at different atmospheric conditions, and this reduces its power consumption, cost and complexity.

**Key words:** Free Space Optical / Radio Frequency, Gamma-Gamma atmospheric turbulence, pointing error, asymmetric link, multiuser communication;

## 1. Introduction

Various modulation schemes are used in FSO systems, among them On – Off keying (OOK) is widely used. In OOK, detection is according to a threshold based on CSI, thus it requires