Dual Amplitude-Width PPM for Free Space Optical Systems

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Abstract—**The PPM (Pulse Position Modulation) is commonly used in Free Space Optic (FSO) systems owing to its power efficiency, but it shows a rapid decline in spectral efficiency with increase in the power efficiency and moderate data rate. In order to improve these two parameters, we present a modified modulation scheme of the existing PPM, on the basis of PPM, PAM (Pulse Amplitude Modulation) and PWM (Pulse Width Modulation). This modified version called DAWPPM (Dual Amplitude-Width PPM).**
The average power requirements, bandwidth efficiency and normalized data rate are studied after introducing symbol structure. The proposed scheme shows an improvement in terms of data rate and bandwidth efficiency, and when in come to power efficiency it shows lower efficiency compared to PPM. We present theoretical expressions of data rate, spectral efficiency, and normalized power requirements, and we present comparison results to PPM modulation scheme.

Index Terms—**PPM, PAM, PWM, DAWPPM, data rate, power requirements and bandwidth efficiency.**

1. Introduction

Free Space Optic (FSO), also called Wireless

coherent modulation techniques like phase and frequency modulation [2], a great number of applications use Intensity Modulation/Direct Detection (IM/DD) as the transmission-reception technique due to its simplicity of implementation [3]. Intensity modulation is easily obtained through variations on the bias current of the transmitter device, which modulates the signal onto the instantaneous power of the transmitted beam.
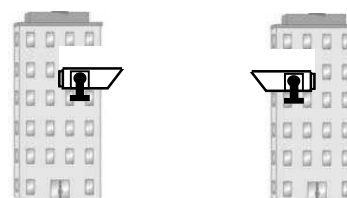

Fig 1: FSO transmitter and receiver mounted on top of two buildings in point to point connection

Various modulation techniques compatible with IM/DD have been proposed and studied for the successful operation of the Free Space Optical