

## **BER improvement for multi-gigabits-per-second free space optical communications by stabilizing the decision threshold level**

### **ABSTRACT**

A new transmission and detection technique namely Double Carrier Modulation/Differential Detection (DCM/Diff.D) for free space optical (FSO) is proposed. The technique employs two beams, one modulated with the data, the other with the inverted version of the same data. A differential detection technique is used at the receiver whereby the inverted data are used as the reference to perform the decision making, as opposed to the fixed threshold used in conventional technique. The probability of error under threshold instability in DCM/Diff.D technique and Intensity Modulation/Direct Detection (IM/DD) technique, is compared. A simulation under heavy rainfall condition of  $8.33 \times 10^{-4}$  cm/sec at bit rate of 2.5 Gbps with 0 dBm of optical transmitter power shows that this technique achieves an improvement of more than twice of distance of the conventional IM/DD.

**Keyword:** Differential detection; Intensity modulation direct detection; Free space optical; Non-selective scattering; Probability of error