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# Improvement of the bit error rate of a non-coherent OCDMA system for FTTH network applications

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**Abstract** In this paper, an optical code division multiple access (OCDMA) system was analysed to improve the bit error rate (BER) performance at 10 Gbps. The improvements to this system were based on a modified double weight code and a NAND subtraction technique and aimed to support the large number of active users in the fibre-to-the-home network. The system performance was investigated through extensive theoretical and numerical simulation analyses. The theoretical and simulation results revealed that the new detection technique exhibits improved BER performance compared to conventional techniques, such as complimentary subtraction techniques. The system performance was characterised by the signal-to-noise ratio, the bit error rate (BER), and various transmit powers ($P_{sr}$ − 10 dBm). The results show that the proposed system, which is based on a new detection technique, can achieve the optimal BER with a high number of users and maintains the error floor transmission rate ($\leq 10^{-9}$).

**Keywords** Modified double weight code (MDW) · NAND subtraction technique · Complimentary subtraction technique · Fiber–Bragg–Grating (FBG) · OCDMA

## 1 Introduction

For over a decade, the use of an optical code division multiple access (OCDMA) system has been a promising candidate for broadband access networks (Menendez et al. 2005). Thus, there is renewed interest in the OCDMA system. One of the main advantages of an OCDMA system is that it allows multiple users to transmit information over the same channel. However, the main disadvantage of this system is the performance degradation. In an OCDMA system, multiple access interference (MAI) is a dominant source that degrades the system performance (Smith et al. 1998). The presence of multiple users accessing the

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