

IMPROVE THE SIGNAL TO NOISE RATIO USING AND SUBTRACTION TECHNIQUE IN OPTICAL CDMA

M. Othman^[1], N.A. Cholan^[1], R. Talib^[1], E. Baharudin^[1], M.F.M. Rejab^[1], S.A. Aljunid^[2] and M.K. Abdullah^[3]

¹ Department of Communication Engineering, Faculty of Electrical and Electronic Engineering, Universiti Tun Hussein Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia.

² Photonics Laboratory, Department of Computer and Communication System, Faculty of Engineering, Universiti Putra Malaysia, 43400 Serdang, Selangor, Malaysia.

³ School of Computer & Communication Engineering, Universiti Malaysia Perlis, No 12 & 14, Jalan Satu, Taman Seberang Jaya Fasa 3, 02000 Kuala Perlis, Perlis, Malaysia.

maisara@uthm.edu.my, syedalwee@unimap.edu.my, khazani@eng.upm.edu.my

ABSTRACT

AND subtraction technique is proposed and presented in this paper. The theory is being elaborated and the simulation results have been done by comparing AND subtraction technique against Complementary subtraction technique by using DW code. The result shows that the OSNR for AND subtraction technique give 39.5 dB at 10 km, while Complementary technique is only 24.5 dB. In this paper we have proved that AND subtraction technique gives better optical signal to noise ratio (OSNR) performance due to reduce the multiple access interference (MAI) compared to the Complementary subtraction technique.

KEY WORDS

Optical CDMA, and multiple access interference (MAI).

1. Introduction

Future telecommunication systems and networks are expected to provide a variety of integrated broadband services to the customers. There has been a tremendous interest in applying Code Division Multiple Access (CDMA) techniques to fiber optic communication systems. This technique is one of the multiplexing schemes that is becoming popular because of the flexibility in the allocation of channels, ability to operate asynchronously, enhanced privacy and increased capacity in bursty networks [1-2].

The primary goal of the design of Optical Code Division Multiple Access (OCDMA) systems is the data extraction by a user in the presence of other users or in other words, the presence of multiple access interference (MAI). MAI is the dominant source of deterioration in an OCDMA system; therefore, good design of the code sequences and detection scheme is important to reduce the affect of MAI.

In OCDMA systems, the presence of multiple users accessing the same medium using the same time and frequencies for transmitting concurrent data streams will produce MAI. In order to reduce the effects of this

interference, the codes should meet specific conditions of cross correlations. However, MAI can also be reduced by using subtraction techniques, at the detection system [3-4]. The most common subtraction technique is the complementary subtraction technique, which is also known as balanced detection technique [5-6].

In most researches [6-9], complementary method has been used at the receiver side to recover the original signal. In this paper, AND subtraction technique [10-12] which already recovered that given an improvement to reduce the receiver complexity and at the same time to improve the system performance. In order to compare the performance of the subtraction techniques, Double Weight (DW) Code [13] is applied because of the possess ideal cross correlation properties, which are important characteristics in OCDMA systems since these can eliminate MAI and reduce noise.

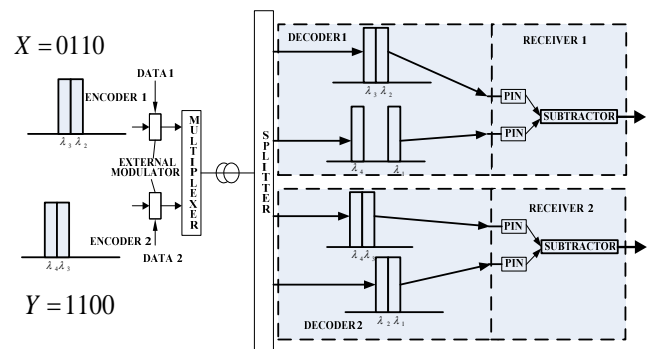


Figure 1. Implementation of the Complementary Subtraction Technique.

2. Theory

2.1 Complementary Subtraction Technique

In the receiver, the received signal is divided into two complementary branches of spectral chips as shown in Figure 1. These two branches of spectral signals are sent