TO INVESTIGATE THE OPTICAL COMMUNICATION SYSTEM (OCS) USING MODULATION TECHNIQUES AND VARIOUS MODERN TECHNIQUES OF COMPENSATION AT DIFFERENT BIT RATES FOR C-BAND AND L-BAND

Kulwant Singh
Assistant Professor, ECE Department, YCOE Campus, Punjabi University, Punjab.

Abstract
An optical communication system uses a transmitter, which encodes a message into an optical signal, a channel, which carries the signal to its destination, and a receiver, which reproduces the message from the received optical signal. The various modulation techniques and compensation techniques using wavelength division multiplexing (WDM) technology that can transmit multiple information streams simultaneously over the single fiber. In this paper we are analyzing different wavelength channels on wavelength division multiplexing (WDM) system using modulation formats and compensation scheme at bit rates (20Gbps) with standard and dispersion compensated fiber on the basis of their Quality factor (Q-F) and bit error rate (BER) using EDFA.

I. INTRODUCTION

In this paper we are doing comparative analysis of channels wavelength division multiplexing (WDM) system using different modulation formats (NRZ, RZ) and compensation schemes at bit rate 20 Gbps with standard and dispersion compensated fiber on the basis of Q-factor, eye-diagram and bit error rate for fixed gain EDFA and length both type of fiber.

II. MODULATION FORMATS

A. NRZ Format

Fig.1 (a) shows the schematic of NRZ transmitter. It is a type of amplitude –shift-keying. Traditionally, NRZ modulation format has been widely used format.

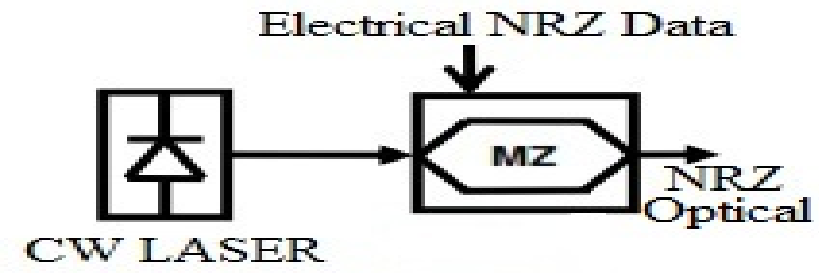


Fig 1(a) NRZ Transmitter

B. RZ (return-to-zero)Format

Fig.1 (b) shows the schematic of RZ transmitter. It has narrow optical spectrum then the conventional RZ format and high tolerance to group velocity dispersion (GVP) and mixed effect of self phase modulation (SPM).

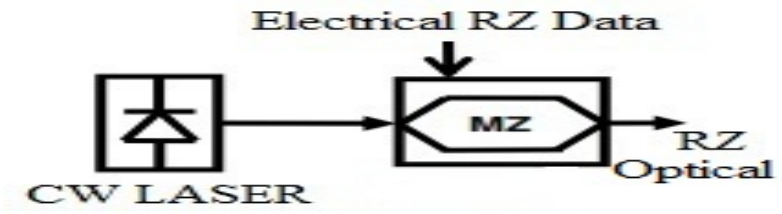


Fig 1(b) RZ Transmitter

III. METHODOLOGY

We are using Optisystem software for simulation and designing. It is an innovative, powerful and rapidly evolving software design tool. It enables users to test, plan and simulate almost all type of optical link. In Fig.2 shows the schematic of simulation setups of channels WDM system which is consist of transmitter, fiber and receiver. Transmitter has CW laser array with various ports which has equally spaced emission frequency range from 1530-1565 nm, data modulator and the optical multiplexer. Data modulators are connected to each output port of CW laser array then signals from data modulator is fed to 16 input ports optical multiplexer having bandwidth 30GHz. EDFA (Erbium doped fiber amplifier) is placed after every fiber to compensate the losses of the fiber with constant noise figure. DWDM system is analyzed for Post compensation. In post compensation scheme DCF fiber is placed after SMF to compensate the dispersion and nonlinearities and two inline EDFA are used. The Signals are demultiplexed by the optical demultiplexer has 16 output ports and detected by the PIN detector.

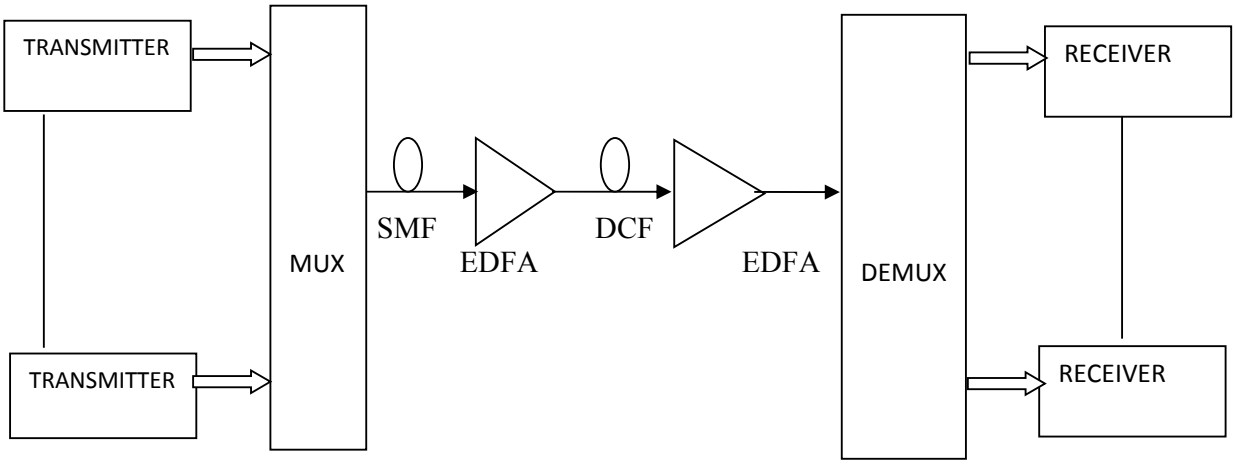
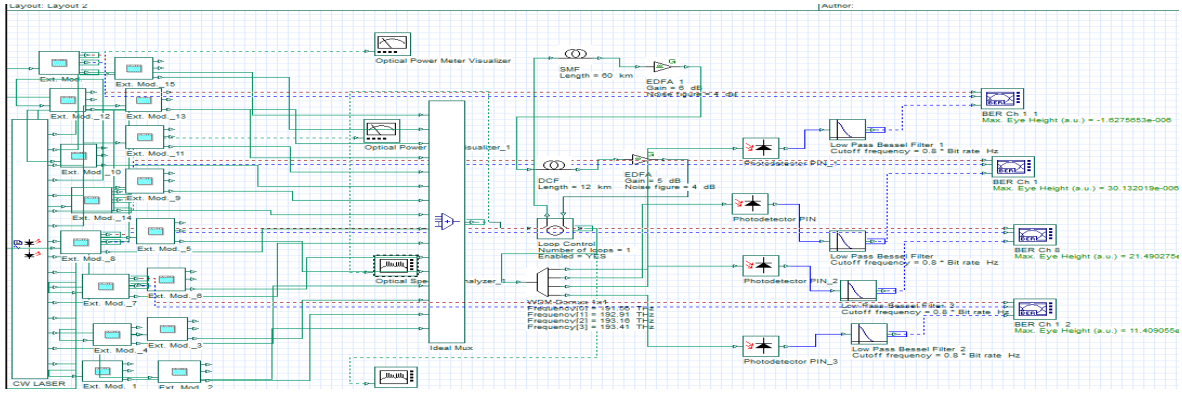


Fig 2- Post compensation scheme

CIRCUIT SCHEME



Simulation parameters

- Table 1 shows the simulation parameters
- Table 2 shows the fiber parameters used in the WDM system.

Table1 - Simulation Parameter

S.No	Parameter	Value taken
2	Frequency	1530 nm to 1564.99 nm. <C-BAND> and 1565 to 1625 nm <L-BAND>
3	Line width	10
4	Tx aperture diameter	5 cm
5	Power	1 to 10 mW
6	Rx aperture diameter	7.5 cm
7	Beam divergence	0.25 cm
8	Transmitted loss	1 dB
9	Additional loss	1 dB
10	Responsivity	1 A/W
11	Dark current	10 nA

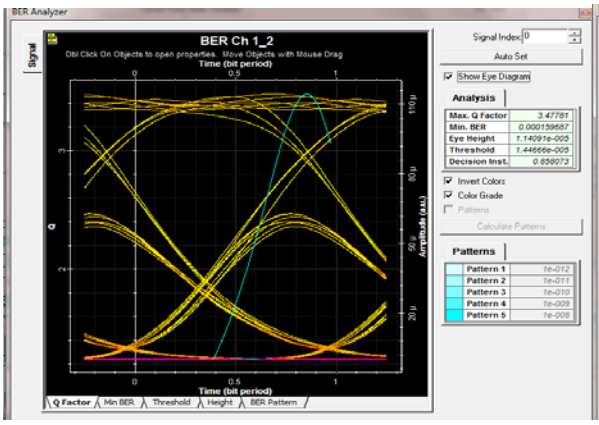
Table2 - Fiber Parameter

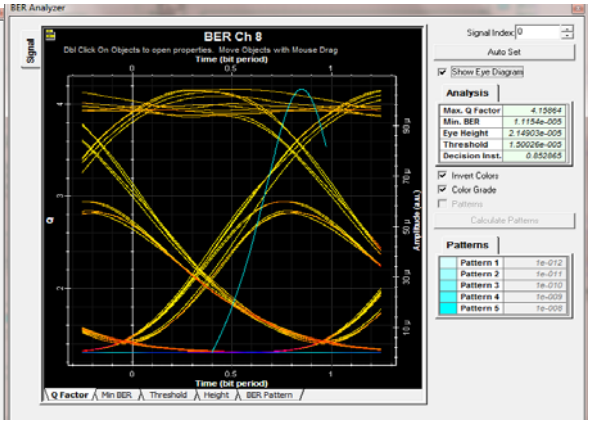
	SMF	**DCF**
Attenuation(dB/Km)	**0.2**	**0.5**
Length(km/span)	**100**	**20**
Dispersion(ps/Km-nm)	**17**	**-85**
Differential group delay(ps/km)	**0.2**	**0.2**
Effective Area μm^2	**80**	**22**

IV. RESULTS AND DISCUSSION

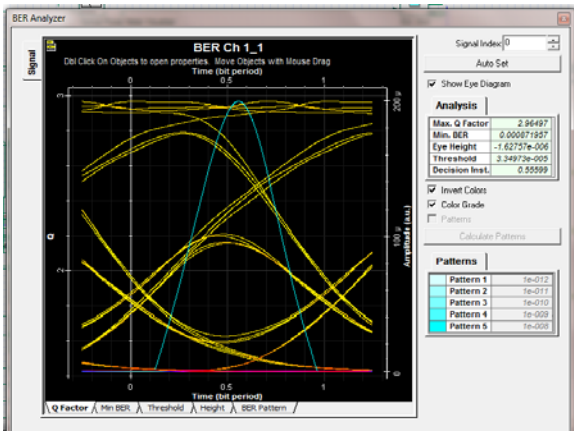
Below figures shows the simulated results of various channels of WDM optical communication system. This system is analysed for post compensation at different bit rates.In this paper we are doing comparative analysis channels wavelength division multiplexing (WDM) system using different modulation formats (NRZ,RZ) and Post compensation at different bit rates and with standard and dispersion compensated fiber on the basis of Q-factor, eye-diagram and bit error rate for fixed gain EDFA and length both type of fiber. On the basis of simulate result we can say advanced modulation formats plays very important role. As we increases bit rate, quality factor start to decreases and bit error rate increases. At high speed advanced modulation formats and dispersion compensation scheme gives better results.

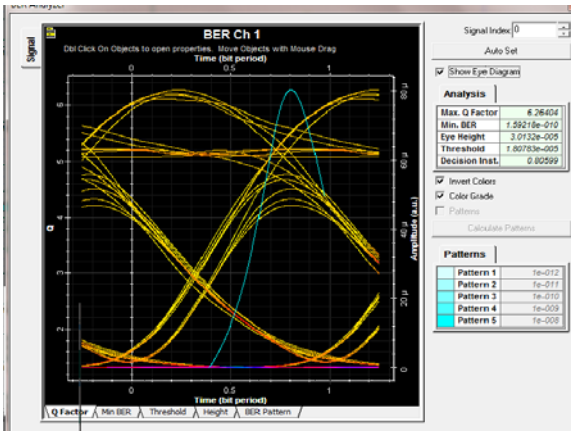
RESULTS USING NRZ FORMAT AT 20GBPS





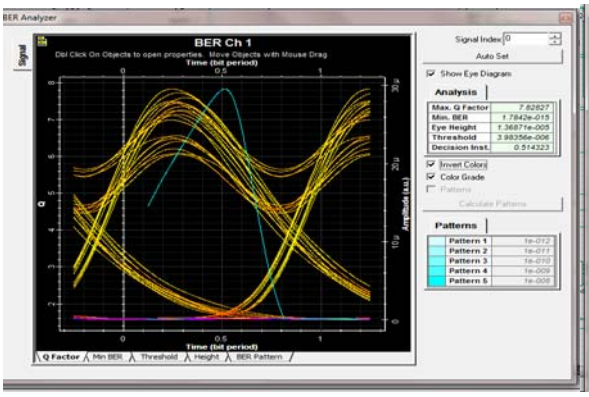
Q-FACTOR- 3.477 at 1548.999999999618 nm Q-FACTOR- 4.15 at 1549.99999999 nm

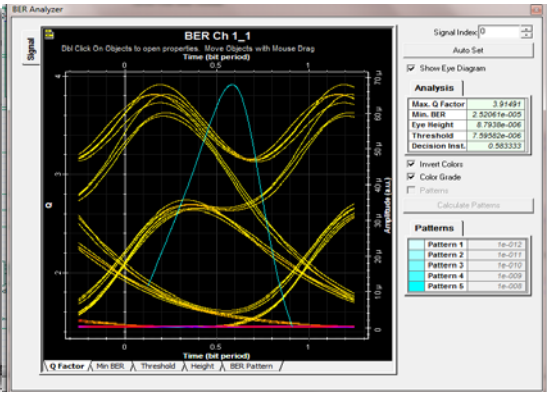




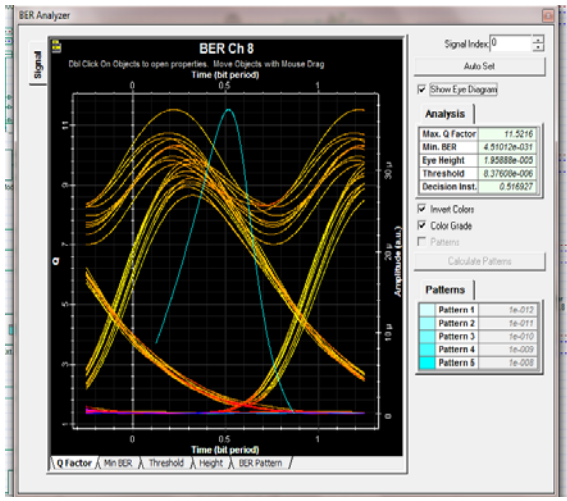
Q-FACTOR- 2.96 at 1565.0000000 nm Q-FACTOR- 6.26 at 1549.9999999999 nm

RESULTS USING RZ FORMAT AT 20GBPS

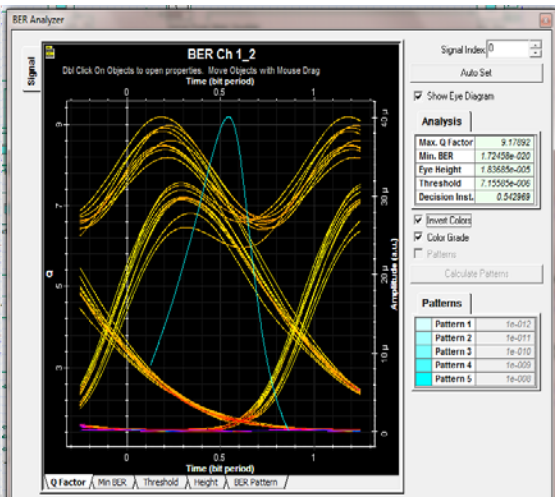




Q-FACTOR 7.82 AT 1549.9999999999 nm Q-FACTOR 3.91 AT 1565.0000000 nm



Q-FACTOR 11.52 AT 1549.9999999999 nm



Q-FACTOR 9.17 AT 1548.999999999618 nm

V. CONCLUSION

In this paper we have analysed the various channels WDM optical communication system for post dispersion compensation scheme using DCF using different modulation system NRZ, RZ at different bit rates and at different wavelengths. We observed that at high bit rate RZ format gives better performance on the basis of Q factor, bit error rate (BER) and eye opening. In the we can say that RZ modulation format is faithful for long distance communication. Similarly on using L-band of optical communication the results will be far better for RZ format.

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