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Complete Performance Analysis of L- band Optical Communication System for NRZ and RZ Format.

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***Abstract*-The performance of optical communication system is mainly determined by the various modulation formats in L band at different bit rates. For analyzing these conditions Optisys software is used for simulation of optical communication using WDM (Mux.) and WDM (Demux.) by comparing with Return-to-zero(RZ), Non-Return-to-zero(NRZ) modulation formats. It has been investigated that in L band the distance covered with more data rates in RZ formats gives better results as compare with NRZ. The high quality factor is obtained in case of RZ format. The study of optical communication systems is multidisciplinary involving a wide range of area including: optical communication design, channel modelling, communications and information theory. The value of wavelength with RZ at 35 Gbps is 1625 nm gives a bit error rate of 5.187e-010.**

***Index Terms* component; EDFA, WDM, fiber length, pump power, gain, noise figure.**

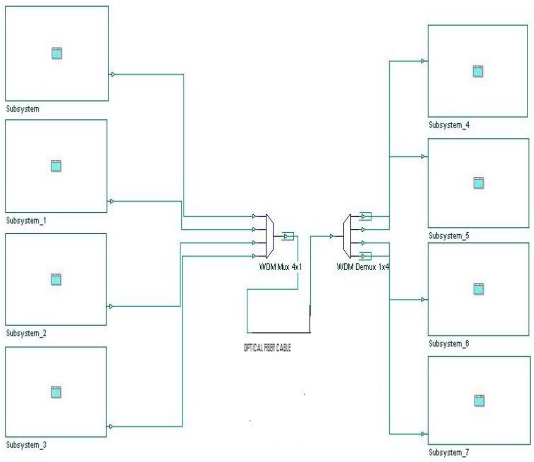
I- INTRODUCTION

The word telecommunication has its roots in two words: *Tele* in Greek meaning distant and *communicatio* in Latin meaning connection. Telecommunication is the distant transfer of meaningful information from one location (the sender, transmitter, or source) to second location[3].

The term telecommunication is used in a very broad sense to imply transfer of information over cable (copper or fiber) and includes all of the hardware and software necessary for its transmission and reception. A first important step in the route toward a modern information society and the information superhighway was the ability to represent information in digital form as binary digits or bits. These bits are then stored electronically, and transmitted either as electrical or light pulses over a physical network or by broadcast signals between sites[4]. An important advantage of digital communication lies in its versatility. Almost any form of information—audio, video, or data—can be encoded into bits, transmitted, and then decoded back into the desired final form at the receiver. As a result, it is almost always possible to establish a communications system that will transfer the exact types of information needed[1]. The term telephony is limited to the transmission of sound over wire or wireless. It connects voice or spoken and heard information and it usually assumes a temporarily dedicated point-to-point connection rather than broadcast connection. Not long ago, telecommunication implied communication by wire, but with the use of radio waves to transmit information, the distinction between telephony and telecommunication has become difficult to make. With the arrival of computers and the transmittal of digital information over telephone systems, voice messages can be sent as connectionless packet[5]

. II- DESIGN DETAILS

The Optical Communication system with WDM is a technology that puts the data from different optical sources on to a optical communication system link with each channel carried its own separate light wavelength[1]. In this set up for different modulation formats four channels of different wavelengths 1605 nm, 1608 nm, 1610 nm, 1613 nm at bit rate 40Gbps are combined to make a WDM system. The simulation parameters are same for all conditions.

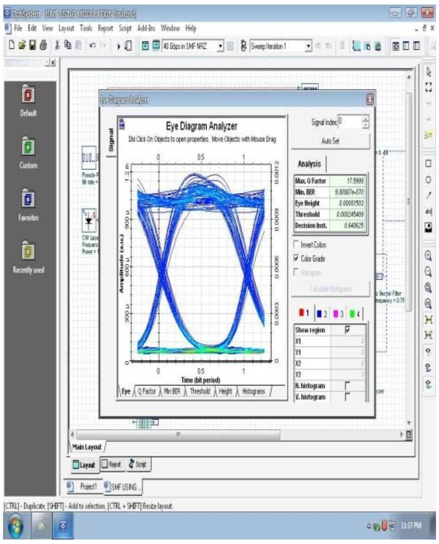


block diagram of wdm system

The internal parts (transmitter and receiver) of the subsystems are shown below. The transmitter consists of PBRS generator, RZ pulse generator, optical source and Mach-Zehnder modulator. At the receiver, subsystem consists of optical receiver (PIN- photo detector) with BER analyzer.

III - RESULTS OF DESIGN

The results of simulation of WIRED OPTICAL system optical communication WIRED OPTICAL system with different data rates, wavelengths and various modulation formats are shown below. The results include the tables for different wavelengths result, eye diagrams and graphs for each format. The best results are obtained in wavelength 1610 nm.



Eye diagram with NRZ at λ-1610 nm & Q-factor=17.59

NRZ

A logic "one" is defined as the high voltage state, while a logic "zero" is defined as the low voltage state. Often times, there is also a logic clock signal associated with a logic circuit. If at each "tick" of the clock, the logic signal switches to the opposite state, then a pulse transition edge occurs. If, however, there is no logic state change, then no pulse transition edge occurs, i.e., there is a "non-return-to-zero". If a string of "ones" is transmitted, there are no transitions. Likewise, if a string of "zeros" is transmitted, there are no transitions. In these situations with no transitions, an NRZ signal appears to have a "DC" nature.

RZ

In RZ signals, the lower trace is the associated logic clock signal. The definition of RZ logic is if the logic state is a "one", then a pulse of 1/2 the clock period occurs. If the logic state is a "zero", then no pulse occurs, and the signal remains at the baseline. Obviously, due to its basic pulse nature, an RZ signal has many more transitions compared to NRZ, and less "DC" contents.

IV- CONCLUSION

The major conclusion for comparing RZ vs. NRZ is that an RZ data signal requires twice the bandwidth of an NRZ data signal operating at the same bit rate. The bandwidth of an NRZ channel can be lowered down to as low as 0.75 * Bit Rate before any degradation of the eye height or eye width occurs. Any further bandwidth filtering starts to rapidly degrade the eye. The bandwidth of an RZ channel can be lowered only down to as low as RZ data. Filtered RZ data, BW = 1.5 * Bit Rate 1.5 * Bit Rate before eye diagram degradation occurs. For RZ bandwidths less than 1.5 * Bit Rate, the eye amplitude, Vpk, rapidly drops, and the valley point, Vv, and cross point, Vx, rapidly grow. The valley points are due to incomplete extinction of pulses for a continuous sequence of "one" pulses. The cross points are due to alternating sequences of "ones" and "zeros

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