Analysis of Optical Link Using 4x1 WDM

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Abstract: The future in the field of communication the change will be faster. The wide range of variety technique implementing in WDM (wavelength Division Multiplexing) has taken. The reason behind to taken the optical fiber the attenuation, dispersion and total internal reflection. In the paper, we focused mainly on the intensity and its attenuations are calculated and accordingly the signal power and noise power link performance Q factor power and BER are calculated. Hence parameters will be calculated with BER Analyzer and the modulator is used. This examination is done in a simulation tool named OptiSystem and was improved by Optiwave.

Keywords: Quality Factor, Signal Power, Noise power, Link performance

I. INTRODUCTION

Wave Length Division Multiplexing (WDM) is a multiplexing technique which multiplexes multiple optical carrier signals on single optical fiber by using different wavelength (colors) of light to carry different signals.

WDM puts together multiple signals and sends them at the same time along fiber; with transmission taking place at different wavelength this turns a single fiber in to virtual equivalent handful of fiber [1]. The most modern of these systems allows for much more than handful of fiber.

Wave-division multiplexing is a multiplexing a number of optical carrier signal combine on to a single optical fiber by using different wavelength of laser light. This technique enables bidirectional communication over a fiber the bandwidth of a channel id divided into multiple channels and each channel occupies a part of the large frequencies spectrum. Now day's existence there are two types of WDM CWDM (Coarse Wavelength Division Multiplexing) the spacing between wavelengths in CWDM is about 10to20mm

WDM (Dense Wavelength division Multiplexing) supports eight or more wavelengths. The spacing wavelength about 1 to 2mm.DWDM is designed for long-haul transmission [2].

WDM system consists off

1) Optical fiber link.
2) Optical amplifier
3) Multiplexing and DE multiplexing

Optical fiber

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Optical fiber acts like as transmission medium from source to destination. When higher levels of performance are required.it is necessary that the fiber optical link can operate over greater distances and with higher dates rates, then laser are use. The light output is directional and this enables a much higher level of efficiency in the transfer of the light in to fiber optic cable. Lasers have a very narrow spectral bandwidth as result of the fact that they produce coherent light. This narrow spectral width enables the laser to transmit data at much higher rates. Laser diodes are often directly modulated. This provides a very simple and effective method of transferring the data on to the optical signal. Laser output power is proportional to current above the threshold the current and operating 5to40ma. In laser coupled power very high. The speed laser is very high when compared to LED'S the output pattern is lower operating and bandwidth of laser very high and wavelength 0.78 to 1.65 micrometer. Laser can operate the single mode fiber and multimode mode fiber the life time of optical fiber is very long. Cost is very high. The installation process and use is very harder [7].

Optical amplifier

Optical amplifier is used to amplify the optical signals directly without conversion into electrical signal

Multiplexing: -

Multiplexing is the process of combining multiple signal on to a single transmission link (one path has many channels)

Multiplexing can be achieved whenever the transmission capacity of a medium linking two devices is greater than the transmission needs of the devices [2].

Multiplexing is very useful where it saves time and money, instead of having a link for every channel we can have one link for multiple channels and transmit and receive the information without any problems [3].

De multiplexing

Demultiplexing is a process combination signal gets spited back into various individual signal information.

1.1LASER:

LASER stands for light amplification by simulated emission of light. Laser is a device that emits light through a process of optical amplification based on the simulated emission of electromagnetic radiation. It emits light coherently; spatial coherence allows the laser to be focused to a light spot.

Laser is a coherent and focused beam of photons. Laser is created when the electrons in atoms in special glasses, crystal, or gasses absorb energy from an electrical current or another laser and become excited. The excited electrons move from lower energy orbit to a higher-energy orbit around the atom nucleus. When they return to the electron emit photons. Its light contain only one wavelength and laser light is direction

1.2 NRZ SIGNAL:

NRZ signal stands for NONRETURN TO ZERO. The signal has varying the both time varying axis x-axis and y-axis.in NRZ signal has varying the voltage either positive and negative. It has two different schemes

1.2.1 NRZ-L: It seems to be signal positive voltage per one symbol per positive signal and one symbol per negative for other.

1.2.2 NRZ-I: It is some quite opposite the negative per symbol and positive signal another signal then it starts the negative direction. It has no error correction detection and no synchronization in this model. It has two level voltages.

1.3 RZ signal:

In the transmission signal in the middle either the signal has high to low or low to high. It can transmit two symbol per second .it requires the more bandwidth require. No DC components are involving. It has no synchronization model and no error correction and detection techniques and mean while implementation more complex. I have three level voltages.

1.4 Mach-zehnder modulator:

Mach-zehnder modulator is used to control the amplitude of an optical wave. The input wave is split up in two waveguide interferometer arms. If a voltage is applied across of the arms, a phase shift for the wave passing through that arm .when arms are recombined, the phase difference the two waves is converted the arm

The combination of one message signal and carrier signal is called modulation [4]

1.5 Low pass filter:

The desired signal can be achieved the processing remove unwanted components and noise in the signal use the filter can be achieved. By the low pass filter which allows the low range cut-off frequency and unwanted signal or high range cut-off frequency does not allow the signal. In the low pass filter L and C components plays the vital role in the filter. Cut-off frequency

Frequency that limit of the filter range of low pass filter. Inductive –increases the frequency and impedance and tends to block high frequency getting loaded. Capacitive –decreases with corresponding to the load remove the shot-out frequency signal dropping voltage the low pass filter has cut-off frequency the signal output 70% of the input signal.

1.6 PHOTODETECTOR:

The main working principle of photo detector converting the optical signal in to electrical signal. Photo detector are made semiconductor elements absorbs the incident photons and produce the electrical signal. It has two categories

(i) Photo conductive detector

(ii)Junction photo detector

Pseudo random bit sequence it is knows as deterministic random generator sequence random sequence generator the sequence of generating a number sequence properties random numbers not truly random completely relative set to initial value to reproduce sequence of random sequence status from a seed state.

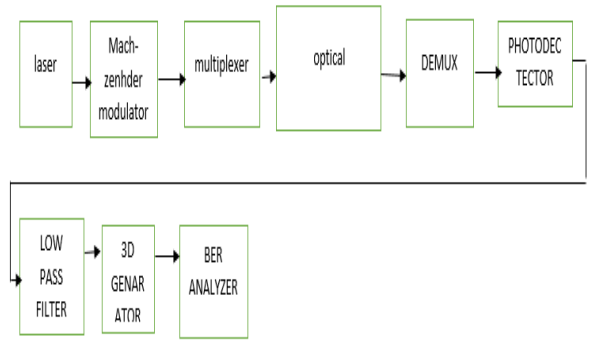

Fig: 1.1 WDM BLOCK DIAGRAM

Efficient: produces much number in short period of time and efficiency results produce.

Deterministic: number can be reproducing later

Periodic: sequence automatically repeat itself describe the characteristics [6]

2. System Model:

This system consists of a WDM NRZ and RZ models.

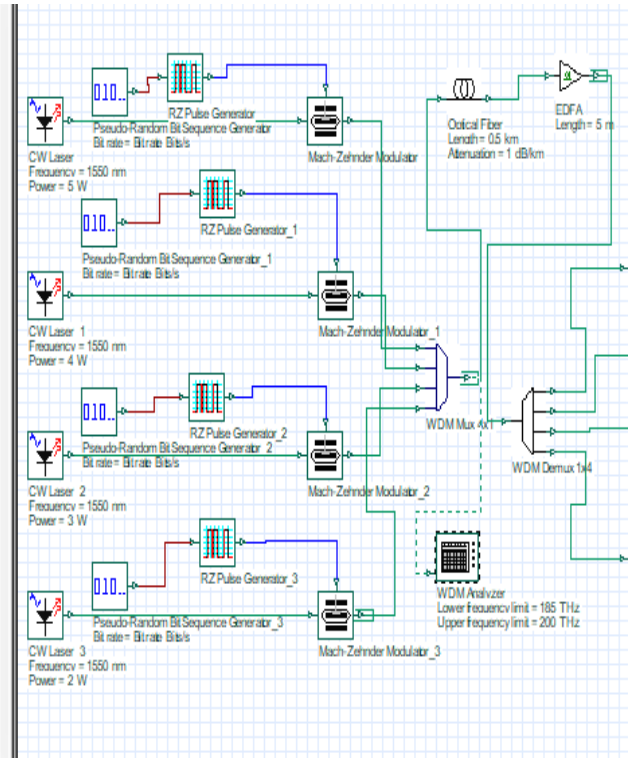

Fig: 2.1 WDM RZ simulation setup

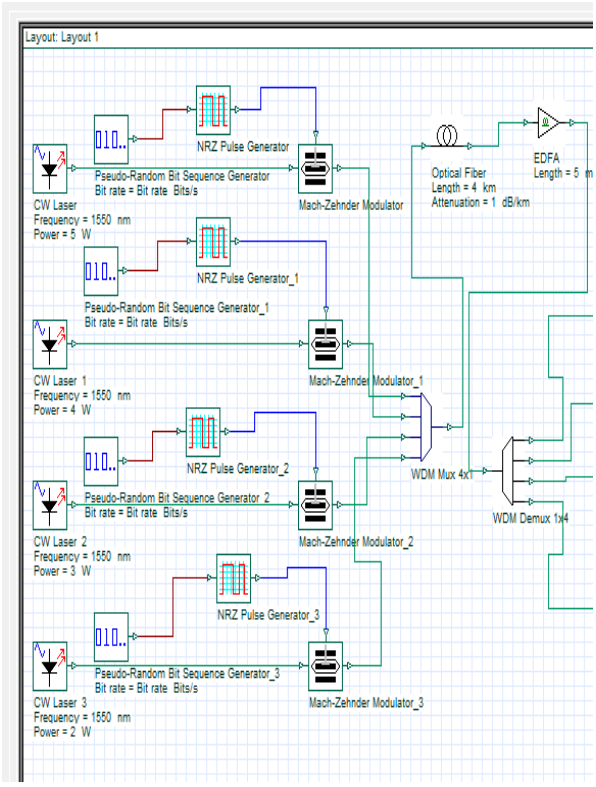

Fig: 2.2 WDM NRZ Simulation setup

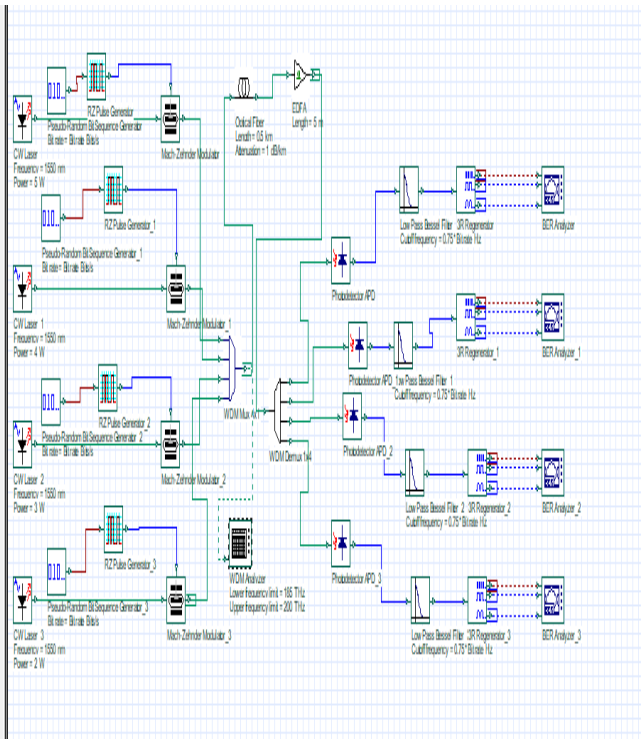

Fig: 2.3 WDM complete layout

II. RESULTS AND DISCUSSIONS

In this paper we are calculating the both NRZ and RZ signal calculating the Signal and Noise Power

Frequency (TZD) (NRZ&RZ)	SIGANL POWER(dBm)	NOISE POWER(dBM)
1933.41449	15.279022	-37.689321
193.414449	10.616219	-37.689321

Table.3.1 NRZ AND RZ

In the above table.3.1 result the signal power in the NRZ signal has signal power has more power when compared to RZ signal and noise power are equal.

Distance	QUALITY FACTOR	QUALITY FACTOR	QUALITY FACTOR	QUALITY FACTOR
4	3.70025	2.16097	2.67372	3.81392
3	3.53E+00	2.20746	2.69E+00	3.75822
2	4.19602	0	2.73446	3.67213
1	3.45272	0	2.73446	9.54933
0.5	4.282	0	3.11791	9.79785

Table.3.2 NRZ SIGNAL

The above the table 3.2 for varying the length of optical fiber from higher distance to lower distance comparing one length to another length decreasing the length of the optical fiber less distance gives more quality factor.

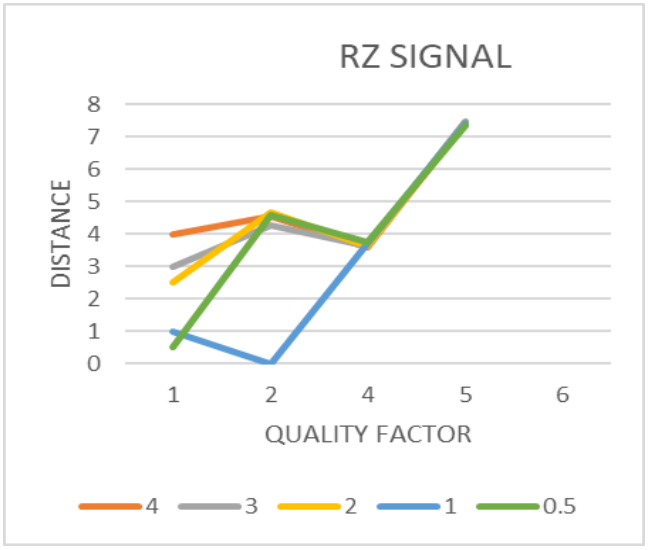

Fig: 3.1 Variation of Distance respective quality factor

The above Fig: 3.1 show that for a range up to 4 km is better than RZ signal the each color indicates the different distance and showing the quality factor.

Distance	QUALITY FACTOR	QUALITY FACTOR	QUALITY FACTOR	QUALITY FACTOR
4	4.5569	2.16097	3.58882	7.45235
3	4.26936	289919	3.62934	7.45044
2.5	4.66932	2.81868	3.63241	7.44511
1.5	0	3.02305	3.69222	7.41237
0.5	4.59799	2.90115	3.73394	7.34958

Table.3.3 NRZ varying the distance range up to 4 km

The above the table 3 for varying the length of optical fiber from higher distance to lower distance comparing one length to another length decreasing the length of the optical fiber less distance gives more quality factor

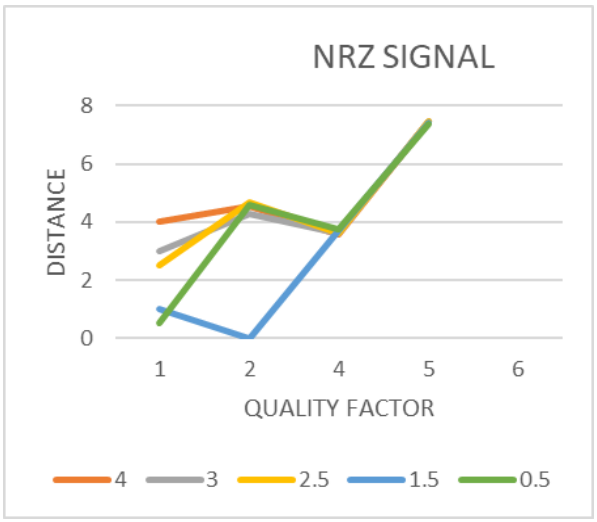

Fig: 3.2 Variation of Distance respective quality factor

The above Fig.3.2 shows that for a range up to 4 km is better than RZ signal the each color indicates the different distance and showing the quality factor.

The WDM system length decreases the gives better quality factor and the bit error rate is quite inversely proportional to the quality factor. In this paper calculated the link performance of optical fiber 0.5 to 4 km. The calculated the signal power and noise power of RZ and NRZ. When the tool has run the quality factor is achieved at the BER Analyzer. And from the Fig a and Fig b we can see there are optical power meters and electrical power visualizes these help in examining of the average amount of power used and the consumed electrical energy by the electrical devices used in the design. The graphs representing below helps in identifying the variation of quality factor for various models and also helps in identifying the best model even when using NRZ and RZ.

III. CONCLUSION

The results compared from the graphs decreases the optical fiber length gives the better quality factor and signal power and noise power for RZ and NRZ. The link range of an optical fiber is 0.5 to 4 Km. We can clearly say the RZ gives better performance than NRZ

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