

COMPARISON ANALYSIS OF 80 GBPS CELLULAR NETWORK USING DISPERSION COMPENSATOR

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Abstract:-

The long distance communication system in a cellular network for higher bit rate can be designed using the various dispersion compensator like DCF , FBG and ECF as well as hybrid techniques. We have compared different Q-factors for the SMF of 50 km and 100 km with or without using fiber bragg grating as dispersion comparator . In this paper the system performance is analyzed on the basis of Q-factor , Eye diagram at different length with and without compensator . Data transmission for high speed data transmission requires more bandwidth requirement , which is an important factor for the communication system . In DWDM system , each laser must emit light at a different wavelength , with all the lasers light multiplexed together onto a single optical fiber. After being transmitted through a high-bandwidth optical fiber , the combined optical signals must be de-multiplexed at the receiving end by distributing the total optical power to each output port and then requiring that each receiver selectively recover only one wavelength by using a tunable optical filter . In this paper , by using FBG the four wave mixing effect is reduced at different value of Q-factor .

Keywords :- Dense Wavelength Division Multiplexing , Fiber Bragg Grating , Bit Error Rate(BER) , Q-Factor .

I.INTRODUCTION

Fiber-optic communication is a method of transmitting information from one place to another by sending pulses of light through an optical fiber. The light forms an electromagnetic carrier wave that is modulated to carry information .The process of communicating using fiber-optics involves the following basic steps : Creating the optical signal involving the use of a transmitter, relaying the signal along the fiber, ensuring that the signal does not become too distorted or weak, receiving the optical signal, and converting it into an electrical signal[1]. Due to much lower attenuation and interference optical fiber has large advantages over existing copper wire in long-distance and high-demand applications.

Optical fiber carries much more information than conventional copper wire with high security of information. Optical fiber is compact, low-loss, immune to electromagnetic interference, secure, non-corrosive, and has almost unlimited bandwidth. Optical fiber has been proven to have the widest bandwidth compared to any other media known, including wireless, copper wire, sonar, and even free-space-optics. Tera Hertz (10 to the 12th power) bit rate has been demonstrated in the lab by using the standard single mode telecom fiber[2].

Four Wave Mixing

Four-wave mixing (FWM) is an intermodulation phenomenon in non-linear optics, whereby interactions between two or three wavelengths produce two or one new wavelengths. It is similar to the third-order intercept point in electrical systems. Four-wave mixing can be compared to the intermodulation distortion in standard electrical systems[3].

II. RELATED WORK

A 32 channel DWDM system is designed with a channel spacing of 100 GHz , at the data rate 80Gbps , with the optimal parameters in RZ modulation format to achieve the maximum transmission distance . Fiber Bragg Grating and Erbium Doped Fiber Amplifier are the key components for the implementation of high data rate long haul optical communication system . The maximum transmission distance that could be achieved is 100 km with RZ modulation format . Fibers are standard single mode fibers SMF with high group velocity dispersion enable larger repeater spacing and larger sign on the transmitted signals . Increasing the capacity of optical systems may require either an increase in the bit rate , usage of WDM or ultimately both [4] . At high bit rates , the modulation format , type of dispersion compensation scheme , and channel power become important issues for optimum system design.

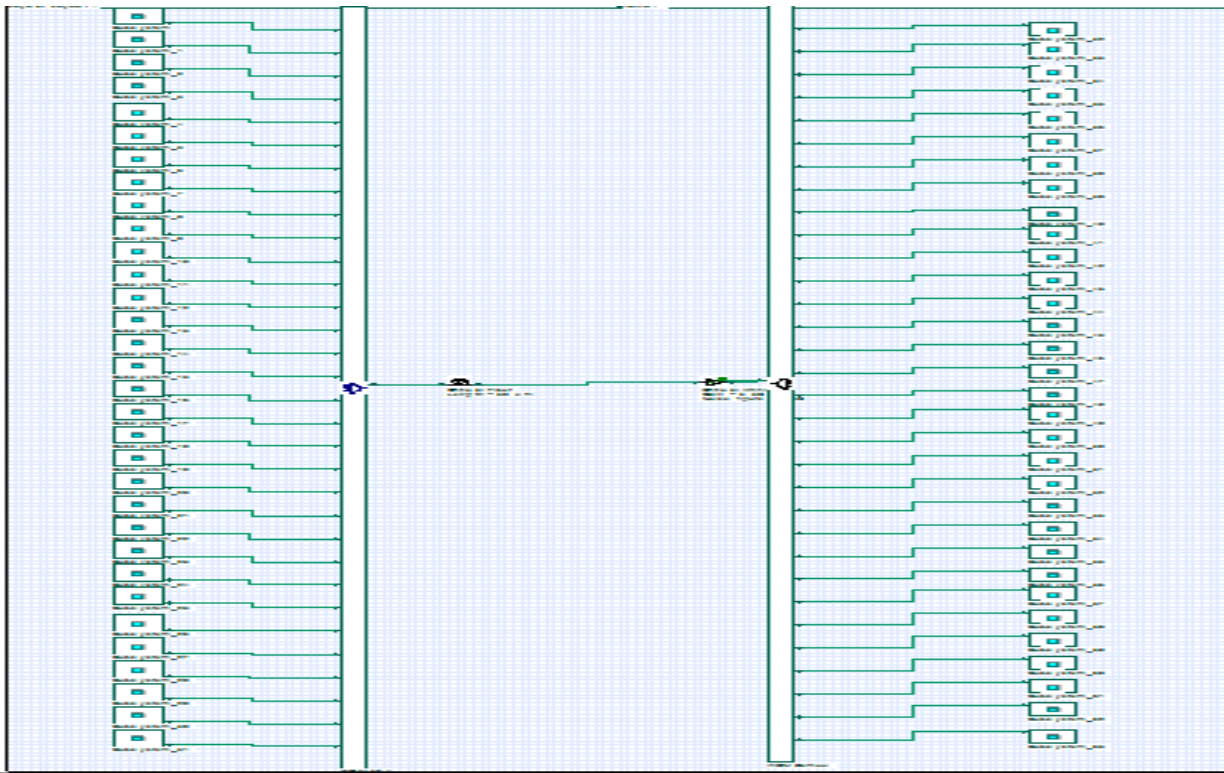


Fig.1:- Simulation Model of 32 channel DWDM at 50km

In the transmitter side , a Pseudo-Random Bit Sequence Generator is used to generate a binary sequence that generates with a deterministic algorithm which is difficult to predict and is similar to truly random sequence . Then the sequence generated is digital in nature which is given as input to RZ Pulse Generator which creates a sequence of return to zero pulses by the process of encoding . A Continuous Wave Laser is a laser that emits a continuous laser beam with heat output . Both the outputs of RZ Pulse Generator and Cw Laser is given as input to Mach-Zehnder Modulator [5]. A Mach-Zehnder modulator is used for controlling the amplitude of an optical wave. The input waveguide is split up into two waveguide interferometer arms . If a voltage is applied across one of the arms , a phase shift is induced for the wave passing through that arm . When the two arms are recombined , the phase difference between the two waves is converted to an amplitude modulation.

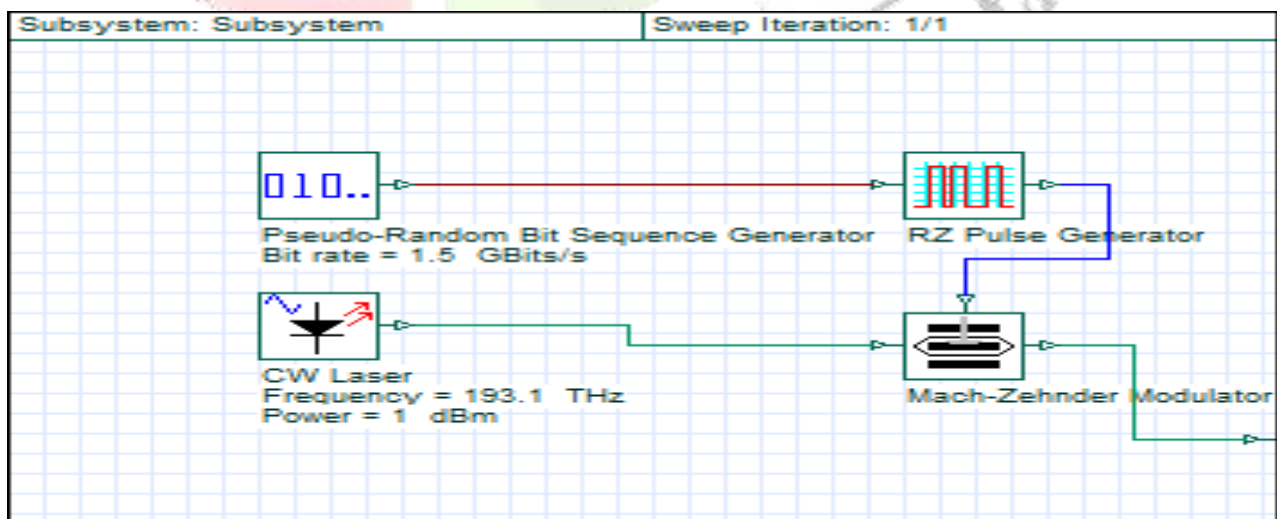


Fig. 2:- Transmitter Section

In the receiver side, An avalanche photodiode (APD) is a highly sensitive semiconductor electronic device that exploits the photoelectric effect to convert light to electricity. APDs can be thought of as photo-detectors that provide a built-in first stage of gain through avalanche multiplication[6] . Then the signal is passed through Band-Pass Gaussian Filter which helps in obstructing the unwanted signals . Then the signal is passed through 3R Generator thus to increase the bit error rate. Than the BER analyzer is

used which is used in digital transmission, the number of bit errors is the number of received bits of a data stream over a communication channel that have been altered due to noise, interference, distortion or bit synchronization errors. The bit error rate is the number of bit errors per unit time.

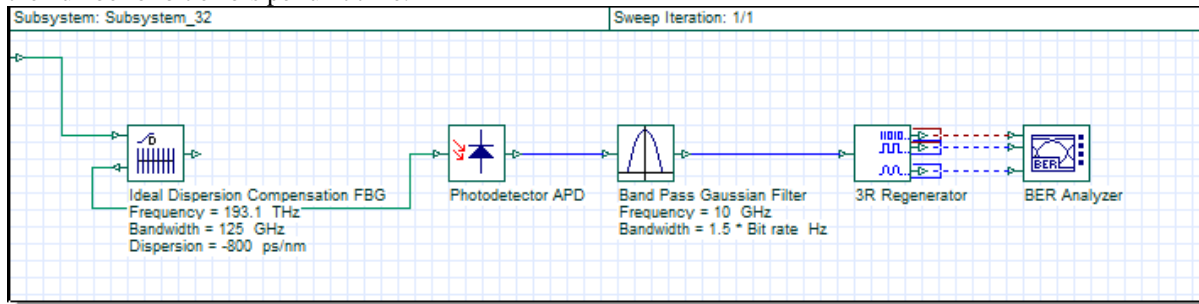


Fig.3:- Receiver Section

III. SIMULATION RESULTS & ITS ANALYSIS :-

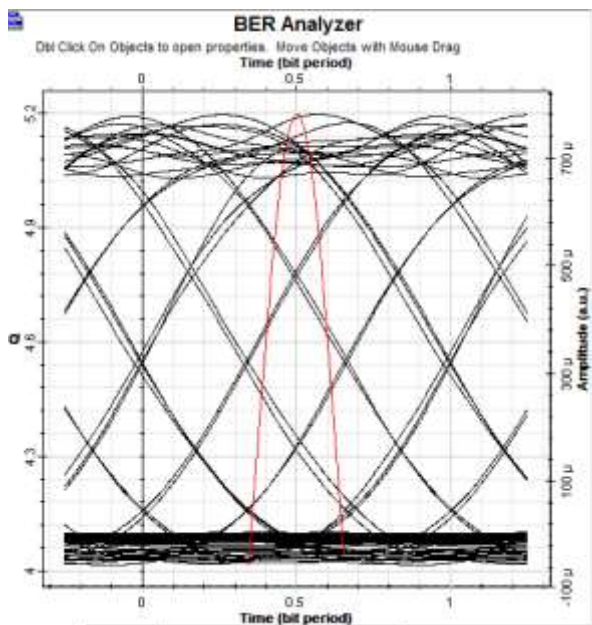


Fig.4.1:- Eye diagram at 50 km without

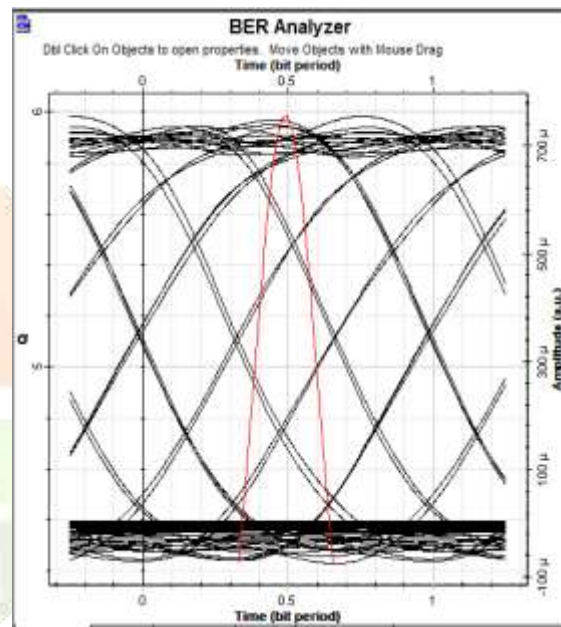


Fig.4.2:-Eye diagram at 50 km by using using FBG at channel=0

So, after doing simulation we have analyzed the eye-diagram at length=50 km and channel=0 with and without using compensator. We found out that the Q-factor is better when we are using fiber bragg grating. The values of Q-factor with and without using FBG is 5.19 and 5.98 respectively.

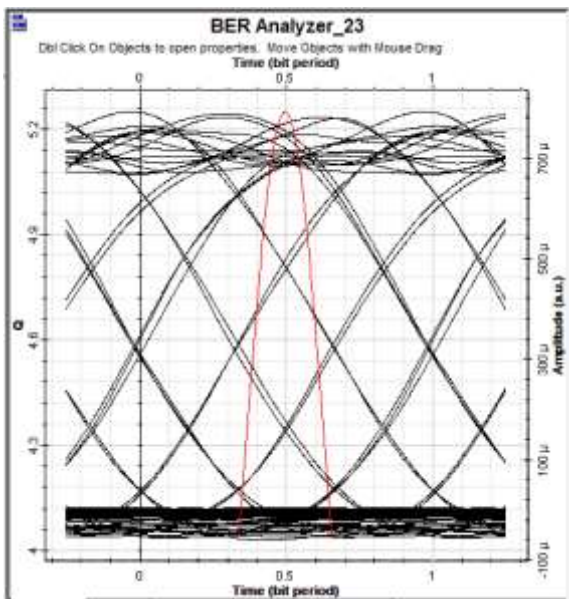


Fig.5.1:-Eye diagram at 50 km without using FBG at channel=23

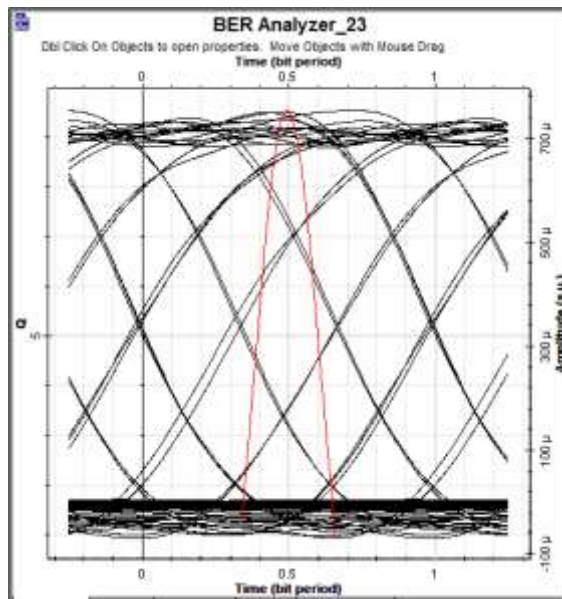


Fig.5.2:-Eye diagram at 50 km by using FBG at channel=23

Again we have analyzed the eye diagram at length=50 km and at channel=23 and we have a got a better Q-factor by using FBG as compared to without using FBG . The values of Q-factor with and without using FBG is 5.25 and 5.90 respectively.

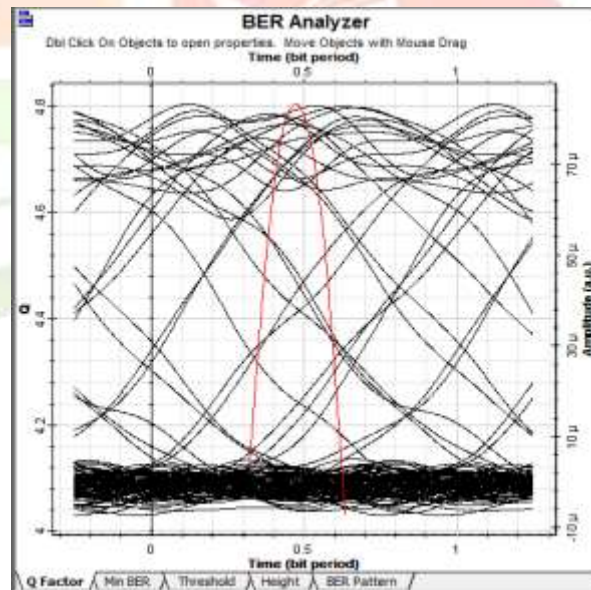
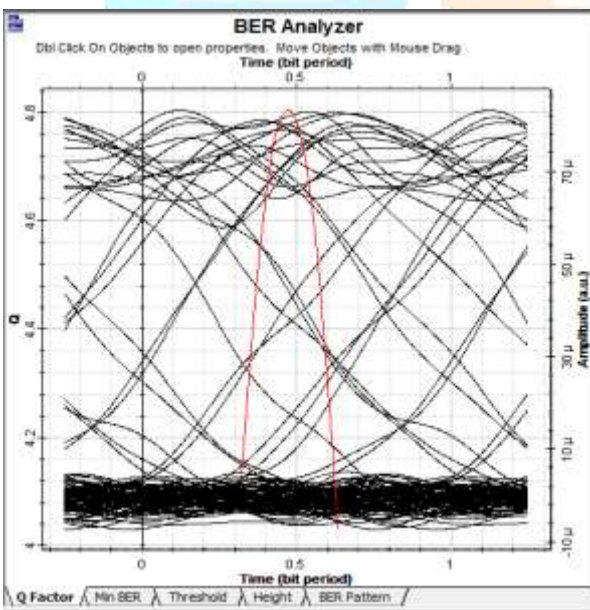


Fig.6.1 :-Eye diagram at 100 km without using FBG & by using FBG at channel=0

Again we have analyzed the eye-diagram at length=100 km and channel=0 with and without using compensator . We found out that the Q-factor is better when we are using fiber bragg grating . The values of Q-factor with and without using FBG is 4.80 and 4.80 respectively .

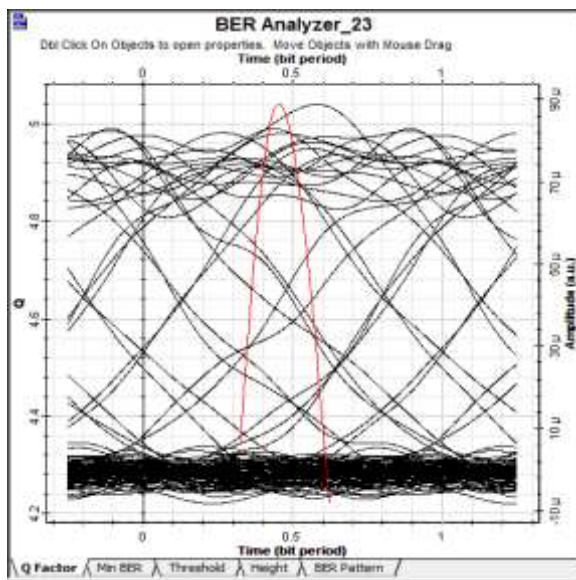


Fig.7.1:-Eye diagram at 100 km without FBG

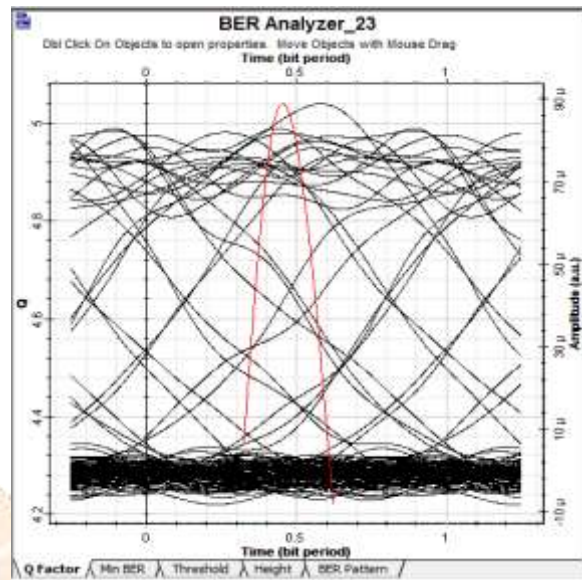


Fig.7.2:-Eye diagram at 100 km by using channel=23

Again we have analyzed the eye diagram at length=100 km and at channel=23 and we have a got a better Q-factor by using FBG as compared to without using FBG . The values of Q-factor with and without using FBG is 5.04 and 5.20 respectively .

We have analyzed by comparing the eye diagram and Q-factor with and without using fiber bragg grating as dispersion compensator at different length and channel . So , it's analyzed that when we are using fiber bragg grating as dispersion compensator we are getting a better Q-factor which helps in long distance fiber optics communication.

IV. COMPARISON TABLE OF Q-FACTOR :-

Table 1:- Comparison table of Q-factor

Sl.No.	Channel No.	Length	Q-factor without using FBG	Q-factor using FBG
1.	0	50 km	5.19	5.98
	8		5.47	5.98
	16		5.17	5.83
	23		5.25	5.90
	31		5.47	6.02
2.	0	100 km	4.80	4.80
	8		4.63	3.62
	16		3.63	5.00
	23		5.04	5.20
	31		5.10	4.78

V. CONCLUSION :-

The objective of the thesis is to analyze the comparison of 80 Gbps cellular network using dispersion compensator and with dispersion managed RZ pulse . The RZ pulse is efficient for long-distance, high bit-rate , dense wavelength in division multiplexed (DWDM) transmission dispersion-managed systems[7] . The effect of varying the dispersion parameter of single mode fiber on optical communication system has been noted . It is observed that with increase in the value of dispersion parameter, there is an increase in the average eye opening and Q-factor value . Also a good desirable bit error rate value has been achieved and reported . The effect of varying duty cycle of the

has been noted . It is observed that with increase in the value of dispersion parameter, there is an increase in the average eye opening and Q-factor value . Also a good desirable bit error rate value has been achieved and reported . The effect of varying duty cycle of the

RZ pulse for a fixed value of dispersion parameter has been performed . It has been shown that by reducing the duty cycle , the performance of the system is improved . It is concluded that RZ pulse system enhance the performance of optical communication networks at high bit rate.

VI. REFERENCES :-

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