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Performance Analysis of Fiber Optical Communication using Fiber Bragg Grating as Dispersion Compensator

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ABSTRACT: With the increasing growth and demand for capacity in national, regional, and even metropolitan optical networks, high bit rate fiber transmission has recently become an essential part of communications. The high bit rate transmission improves spectral utilization which results in increased overall system capacity and reduces overall cost. The optical communication systems are used as high speed long–haul communication systems. Although optical fiber communication has a lot of advantages, dispersion is the main performance limiting factor. There are various types of optical fiber compensators, but Fiber Bragg Grating (FBG) is commonly chosen as important components to compensate the dispersion in optical communication system. FBG is very simple, has low cost filter for wavelength selection and low insertion loss, it has also customized reflection spectrum and wide bandwidth. We have analyzed the dispersion compensation using Fiber Bragg Grating at different fiber lengths and at different value of input power and fbg length. The simulated transmission system have been analyzed on the basic of different parameters which include input power (dBm), fiber cable length (km), FBG Length (mm) by using OptiSystem 7 **.**

KEYWORDS:fiber Optical Transmission System, Fiber Bragg Grating (FBG), dispersion compensation, EYE DIAGRAM, Q-factor, Optisystem7

I.INTRODUCTION

In fiber optic communication is transmitted pulses of light through an optical fiber, where the light forms an electromagnetic carrier wave that is modulated to transport information. This way the fiber optic is the medium, and the light pulses the message. Fiber optics is a medium for carrying information from one point to another in the form of light. Unlike, the copper form of transmission, fiber optics is not electrical in nature. A basic fiber optic system consists of a transmitting device that converts an electrical signal into a light signal, an optical fiber cable that carries the light, and a receiver that accepts the light signal and converts it back into an electrical signal .Fiber Bragg gratings (FBGs) have been widely applied in optical Sensors and optical communications due to the promising Performances with electro-magnetic immunity, compactness, Remote sensing, ease of fabrication and wavelength selectivity[1].

Optisystem is an innovative optical communication system simulation package that designs tests and optimizes virtually any type of optical link in the physical layer of a broad spectrum of optical networks, from analog video broadcasting systems to intercontinental backbones. It is a system level simulator based on the realistic modelling of fiber-optic communication systems.

In this study, the simulation of the optical system in optical fiber has been discussed by analyzing the effect of the components by using different parameters setting. The value of parameters has been investigated such as Signal power (dBm), output power (dbm),Q-Factor

II.SYSTEM MODEL

In transmitter side, each single channel consists of Psuedo Random Bit Sequence (PRBS) generator followed by NRZ pulse generator. Initially CW laser having power 0dBm is used. The laser at each channel having different frequencies ranging from 193.1 to 193.8 THz followed by Mach Zehnder modulator.[4].Mach Zehnder Modulator to modulate the information pulse with the CW laser source output. Then they transmit over the fiber, the optical fiber we have taken is

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single mode (SMF) because it has less distortion occur. The simulation is taken by putting the FBG in the path of optical fiber .FBG is so chosen which has step size of 5 mm. the following parameters are so select for simulation.

TABLE 1: SIMULATION PARAMETERS

C/W LASER POWER	15 dBm
C/W LASER FREQ	193.1THz
REFERENCE WAVELENGTH	1550nm
FIBER LENGTH	15km
ATTENUATION	0.2db/km
EDFA LENGTH	5km
FBG Length	5mm

2.1Simulation model of a transmission system

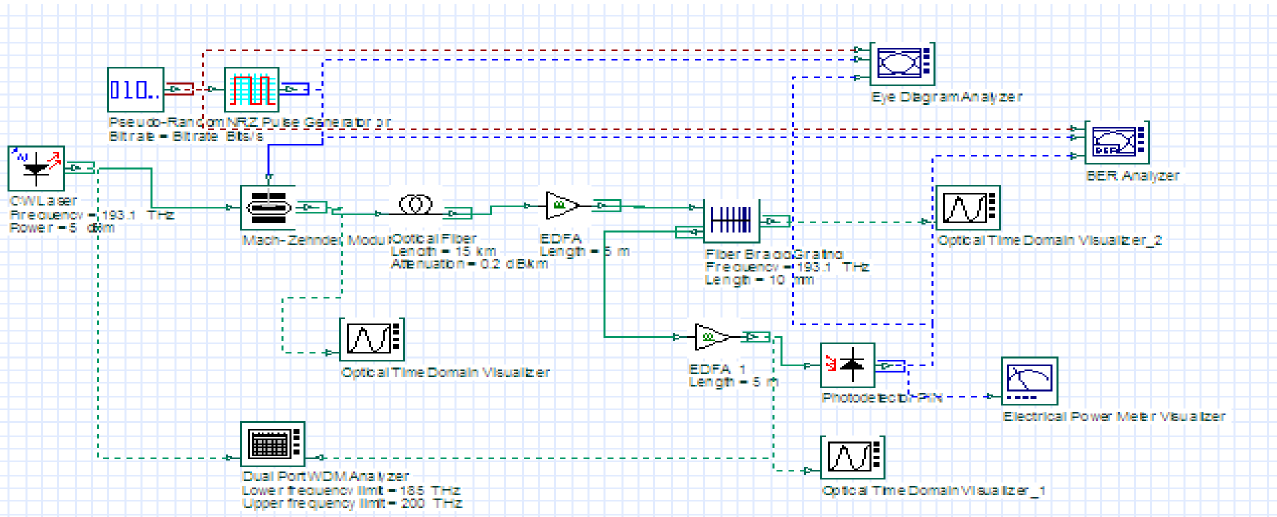

Fig 1: Designed simulation model using Optisystem7

III.RESULTS AND ANALYSIS

The simulation and optimization of the design is done by Optisystem 7.0 simulation software. The eye diagrams and results of output power (dBm) at receiver are tabulated by using different values of input power (dBm) and variable length of FBG (mm) &fiber length (in KM). The Simulation design of optical system is shown in Figure 4 where the parameter taken are input power 5db , Reference wavelength 1550nm fiber length 15km, Attenuation coefficient at cable 0.2dbm &fbg is 5mm as also indicate in Table1 .

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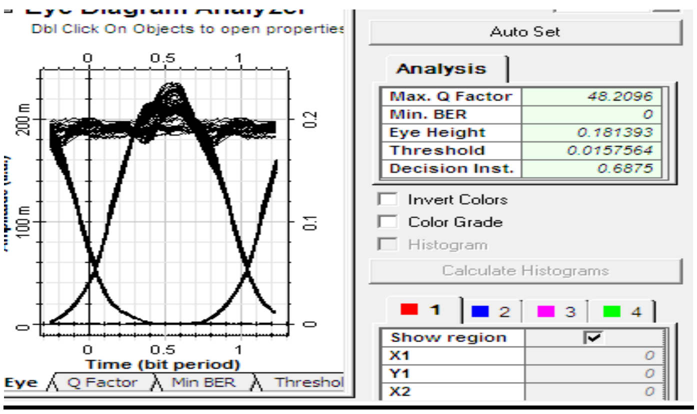
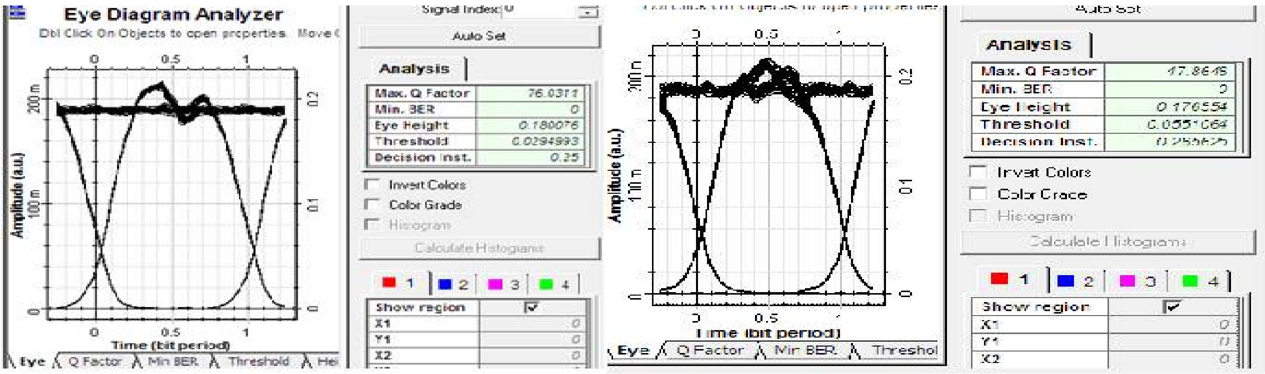
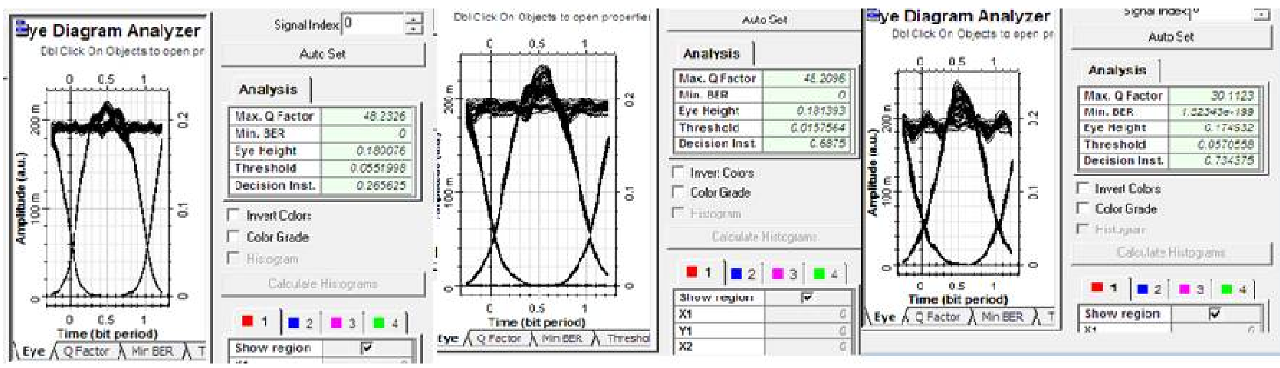


Fig 2. Eye diagrams Simulation of a transmission system of analyzed



5km **10km**

Fig 3 .Eye diagrams are analyzed using different values of OFC length at input power 0dBm



10km **15km** **20km**

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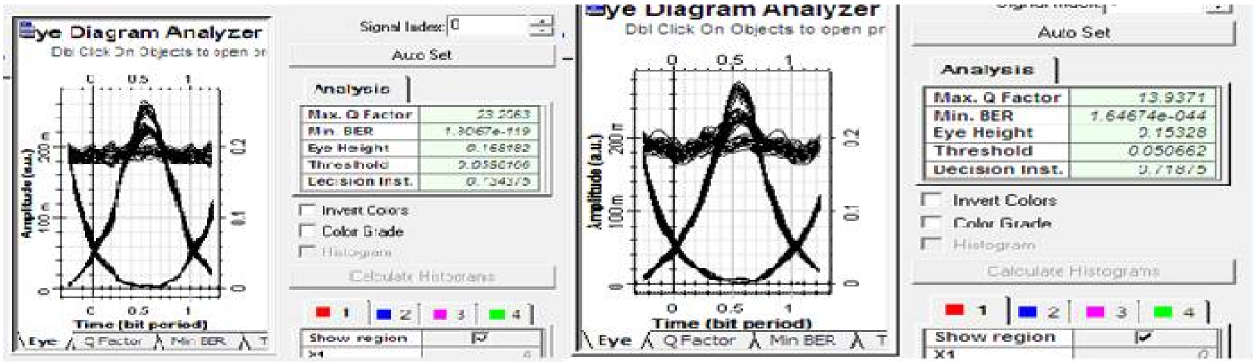
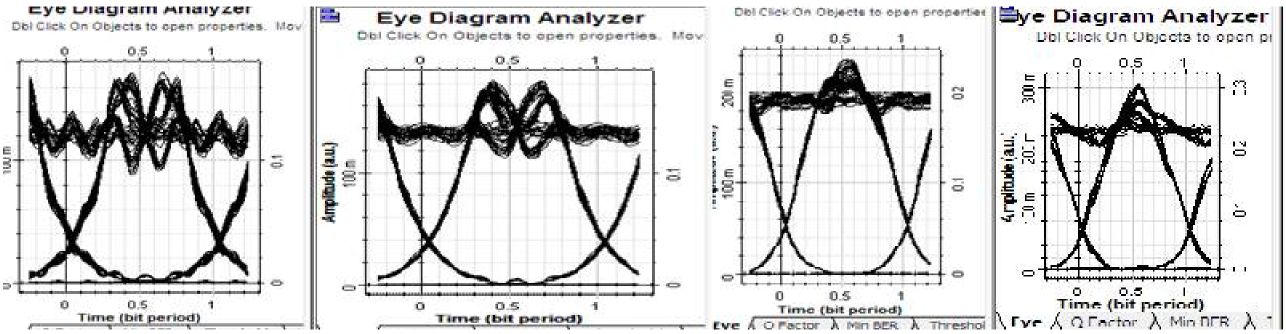


25km **30km**

Fig 4 .Eye diagrams are analyzed using different values of fiber length at input power 5dBm



1mm **2mm** **5mm** **10mm**

Fig 5. Eye diagrams are analyzedat different values of fiberbragg grating

Table 2: output readings are tabulated by varying the OFC Length (km)

OFC LENGTH(KM)	OUTPUT POWER(dBm)	Q-FACTOR (dB)
10	12.134	48.2326
15	12.094	48.2096
20	12.061	30.1123
25	12.035	23.2063
30	12.009	13.9371

Table 3: output readings are tabulated at different input power

Input power (dBm)	Output power (dBm)	Q-factor (dB)
0	11.911	48.2268
1	11.955	48.3883
5	12.094	48.2096
10	12.009	44.8206

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Table 4 : output readings are tabulated at different value of fiber Bragg gratings

FBG (mm)	Output power (dBm)	Q-factor (dB)
1	8.402	16.884
2	9.371	17.49
5	12.094	48.2096
10	13.759	49.4881

IV.CONCLUSION

We have analyzed the dispersion compensation using Fiber Bragg Grating at different fiber lengths and at different fbg. The simulated transmission system has been analyzed on the basic of different parameters. The optical transmission system has been modelled by using Optisystem7.0 simulator as shown in Figure 5 in order to investigate different parameters of the system. From the simulation result, it can conclude that the fiber Bragg grating length and the input power are directly proportional to the signal power. . When input power (dBm) is increased then its output power (dbm), is increased but Q-Factor (db) is decreased . FBG Length (db) is increased then output power (dbm) and Q-Factor(db) are increased.

REFERENCES

[1] B.Prasad1 B.Mallick2 A.K.Parida3**“Fiber Bragg Grating as a Dispersion Compensator in an Optical Transmission System Using Optisystem Software” in ,** International Research Journal of Engineering and Technology (IRJET) , Volume: 02 Issue: 06 | Sep -2015

[2] S. O. Mohammadi,SaeedMozzaffari and M. Mahdi Shahidi, (2011). **“Simulation of a transmission system to compensate dispersion in an optical fiber by chirp gratings**.” International Journal of the Physical Sciences, Vol. 6(32), pp. 7354 - 7360, 2 December.

[3] Anandita joy agarwal1 ,Mukeshkumar 2 , A.K Jaiswal 3 , RohiniSaxena**“Analysis to Compensate Dispersion in Optical Communication Link Using Chirp Grating”**International Journal of Electronics and Computer Science Engineering(IJECSE),Volume2, Number 3,pg 980-986.

[4] Gopika P1 , Sunu Ann Thomas **“Performance Analysis of Dispersion Compensation using FBG and DCF in WDM Systems”** International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 10, October 2015.

[5] Nidhiya Shan, Asha A S, **”Simulation and Analysis of Optical WDM System Using FBG as Dispersion Compensator,** ”International Journal of Engineering Research and General Science, Volume 3,Issue 2,March-April 2015.

[6] Navneet Singh Aulakh**, " Investigations on fiber bragg gratings for fiber optic communication systems”** department of electronics &communication engineering thapar university 2010.

[7] **Impact of Fiber Bragg Grating As Dispersion Compensator on the Receiver Characteristics** ByOjuswiniArora, Dr.Amit Kumar GargM.M.University, Mullana, Ambala. Global Journal ofResearches in Engineering Volume XI Issue VII VersioK. R. Chowdhury, M. Di Felice, “Search: a routing protocol for mobile cognitive radio ad hoc networks,” Computer Communication Journal, vol. 32, no. 18, pp. 1983-1997, Dec.2011