As per UGC guidelines an electronic bar code is provided to seure your paper

International Journal for Modern Trends in Science and Technology, 7(02): 174-177, 2021

ISSN: 2455-3778 online
DOI: https://doi.org/10.46501/IJMTST0702029
Available online at: http://www.ijmtst.com/vol7issue02.html

Performance Analysis of Optical Wireless Communication using Optical wireless channel and Fiber Bragg Grating asDispersion Compensator

Dr.ManpreetSingh | Dr. Sushil Kakkar | Prince Jindal

EE Department, BGIET Sangrur, Punjab
manpreet4panesar@gmail.com, Sushil.kakkar@bgiet.ac.in, prince.jindal@bgiet.ac.in

To Cite this Article
Dr.ManpreetSingh, Dr. Sushil Kakkar and Prince Jindal, "Performance Analysis of Optical Wireless Communication using Optical wireless channel and Fiber Bragg Grating asDispersion Compensator", *International Journal for Modern Trends in Science and Technology*, Vol. 07, Issue 02, February 2021, pp: 174-177.

Article Info
Received on 20-January-2021, Revised on 19-February-2021, Accepted on 21-February-2021, Published on 27-February-2021.

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 wireless communication systems are used as high speed long–haul communication systems. Although optical wirelesscommunication has a lot of advantages, dispersion is the main performance limiting factor. There are various types ofoptical fiber compensators, but Fiber Bragg Grating (FBG) is commonly chosen as important components tocompensate the dispersion in optical communication system. FBG is very simple, has low cost filter for wavelengthselection and low insertion loss, it has also customized reflection spectrum and wide bandwidth. We have analyzed thedispersion compensation using Fiber Bragg Grating at different range of optical wireless channel and at different value of input power .The simulated transmission system have been analyzed on the basic of different parameters which includeinput power (dBm), range of wireless channel (km), FBG Length (mm) by using Optisim 7[6][7] .A circuit is designed for the distance of optical wireless channel from 5km to 25 km where the length of EDFA amplifier is 5m and the frequencies of the channel are 193.1THz. The simulation of system will be designed & analyzed based on different parameters by using Opt system simulator. This paper is represents the analysis of Quality-factor, Bit Error Rate, Power of an Optical signal in Optical wireless communication by using Erbium Doped Fiber Amplifier, Vertical Cavity Surface Emitting Laser optical and Optical wireless channel.

KEYWORDS:*Optical Transmission System, Fiber Bragg Grating (FBG), dispersion compensation, Optical wireless channel.*

INTRODUCTION

Optical wireless communication (OWC) is a communication technology that uses line of sight (LOS) path propagating in free space for transmission of signal/data/information between two desired points for telecommunications or computer networking[1].The OWC is based on the optical communication with only**.** The OWC is based on the optical communication with only difference that this system does not use solids as a transmission medium such as optical fiber cable or optical transmission line. Optical fiber is one of the

most important communications media in communication system. Due to its versatile advantages and negligible transmission loss it is used in high speed data transmission. Although optical fiber communication has a lot of advantages, dispersion is the main performance limiting factor. 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, anoptical 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. Fiber Bragg Gratings (FBG) is added for the design of OpticalTransmission System.

EXPERIMENTAL SETUP

In this transmission link design, optical wireless channel is used. The length of OWC channel is 20 km and frequency is 1550 nm is used in this design. Fiber Bragg Grating (FBG) is used to compensate the dispersion effect and EDFA is used as amplifier to compensate the fiber linear loss (attenuation).In receiver section, PIN photo-detector is connected at the output to detect the optical signal and convert it to electrical signal and send it to low pass Bessel filter which pass the low frequency signal and discard high frequency carrier signal. Then BER Analyzer is used to calculate the bit error rate and quality factor of the designed system

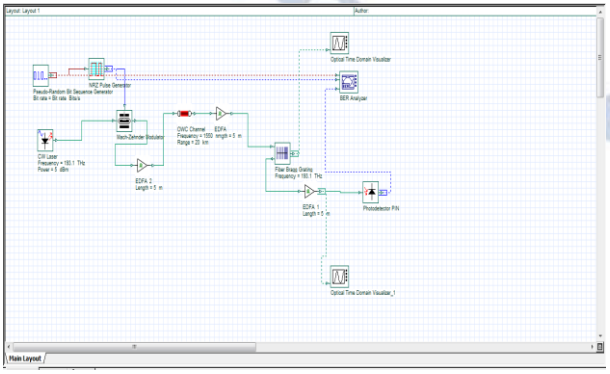


Figure 1:Designed simulation model

RESULTS

New parameters, including Q factor, received power, BER and eye height, will be used for the evaluation of performance. One of the main parameters describing the quality of the data link is a bit error rate BER (Bit Error Rate). With BER is possible to compare the quality of different systems for data transmission. Bit error rate is defined by the following equation,

BER $=nc/NB$

Where nc is the number of bits received in error and NB is the total number of bits received in the defined time interval. Maximum BER is calculated for performance analysis from the maximum Q factor.

$$\text{BER} \approx \frac{1}{\sqrt{2\pi Q}} \exp\left(\frac{-Q^2}{2}\right)$$

BER is inversely proportional to Q Factor. In other words, higher values of Q Factor ensure lower BER or higher signal to noise ratio (SNR).

Table 1: Standard Parameter Taken For Simulation:

Parameter	Value
CW Laser Frequencies	193.1 THz
CW Laser Power	15 dBm
Length of EDFA amplifier	5 km
Extinction ratio	6 dB
Frequencies of OWC channel	1550 nm
Modulation Type	NRZ

The proposed circuit of figure starts to operate at 5km distance of OWC channel. At 5km the Q-factor is 441, BER is 0 and power is 12.82dBm, which is very high.The eye diagram of 20 GHz which is given below

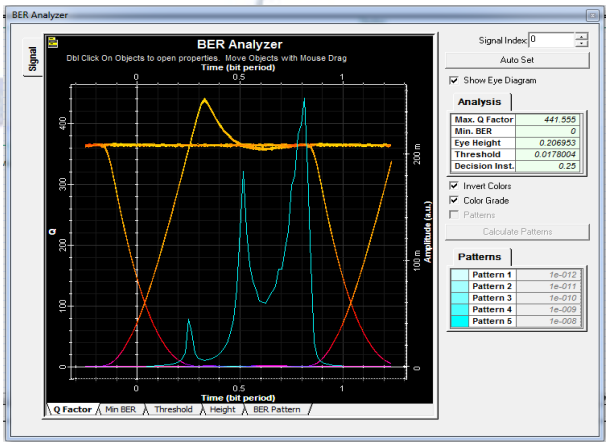


Figure 2: Eye diagram at 5km

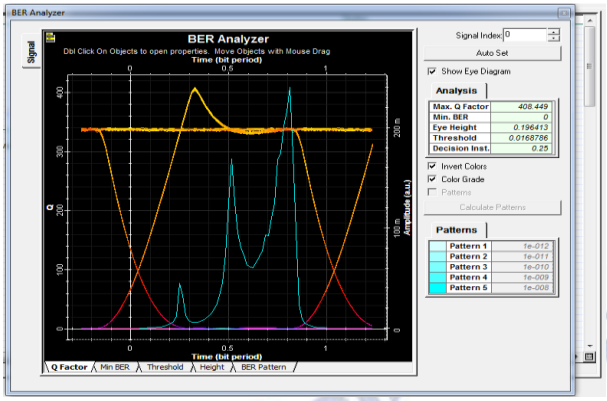


Figure 3: Eye diagram at 10km

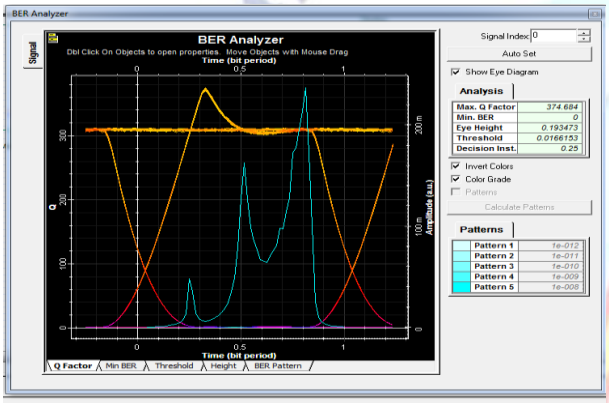


Figure 4: Eye diagram at15km

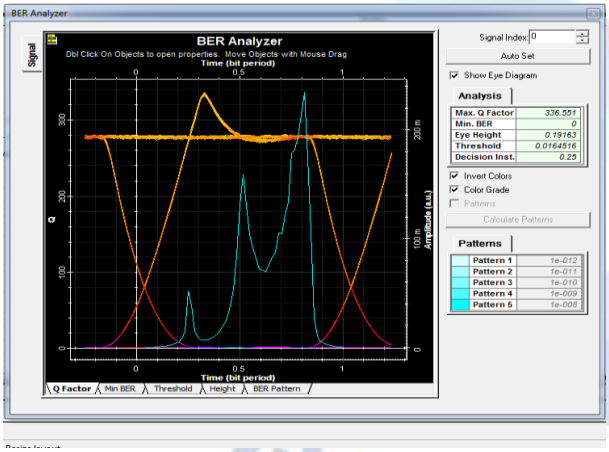


Figure 5: Eye diagram at 20km

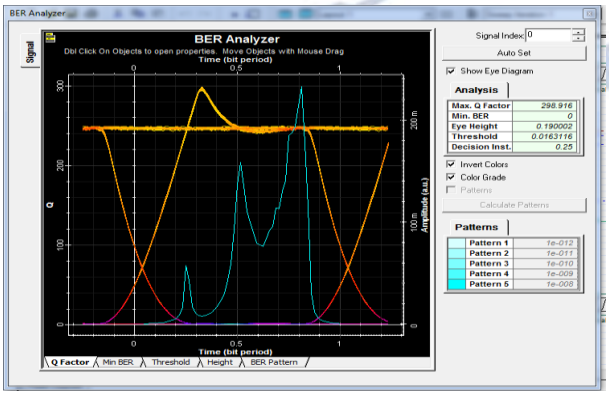


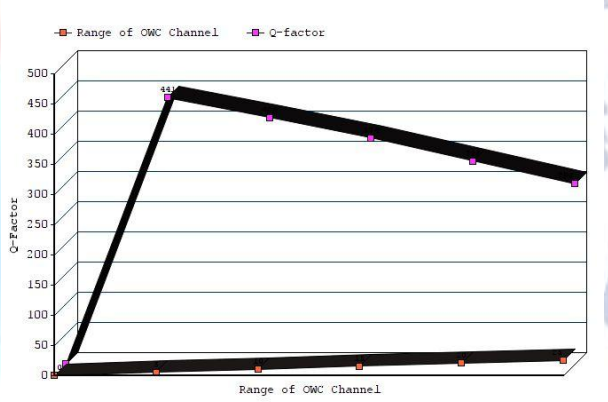
Figure 6: Eye diagram at 25km

If we increase the distance of the OWC channel from 5km to 25km the Q-factor decrease and BER decreases.

Table 1: Q-Factor, BER and Power of output signal by varying the distance of OWC channel

Range of OWC channel in km	Q- factor	BER	Power in dBm
5	441	0	12.82
10	408	0	12.37
15	374	0	12.24
20	336	0	12.17
25	298	0	12.10

Range of OWC channel vs Q-factor



CONCLUSION

During the previous few years, a lot of research work has been done on OWC channel. We have focused in this paper OWC channel involving semiconductor laser, amplifier. In this work we are using EDFA amplifier, optical CW laser We have analyzed the dispersion compensation using Fiber Bragg Grating at different range of optical wireless channel.The simulated transmission system has been analyzed on the basic of different parameters. The optical transmissionsystem has been modelled by using Optisystem7.0 simulator as shown in Figure in order to investigate differentparameters of the system. From the simulation result, it can conclude that the fiber Bragg grating length and the inputpower are directly proportional to the signal power. As comparison to the optical wired system Q-factor is increasein wireless channel.

When we increase the range of optical wireless channel from 5km to 25 km, the Q-factor decrease and BER is 0 and the power is also decrease.

REFERENCES:

[1] Heena Goyal, "Performance Analysis of Optical Communication System using Different Channels,"International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 9, September 2015.

[2] Roshni Joy, Ami Lavingia, KrutiLavingia, "performance evaluation of transmission distance and bit rates in inter-satellite optical wireless communication system," in 2016.

[3] Ahmed NabihZaki Rashed1, Abd El–Naser A. Mohamed2,Hamdy A. Sharshar3, and EhabSalah El-dien4, "Optical Wireless Transmitting Communications Based Satellite Orbit to Orbit Communication Systems Enhancement with EDFA Amplifiers,"International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE) Volume 5, Issue 8, August 2016.

[4] Bibhu Prasad , K. C. Patra, N.K Barpanda Research Scholar, SUIIT Sambalpur , odisha, India "Performance Analysis of Fiber Optical Communication using Fiber Bragg Grating as Dispersion Compensator" (April 2016).

[5] Jangal, E. M., &Wadhwa, E. D. S. Polarization Mode Dispersion System LMS Algorithm Based on Feed-Forward Compensation System Balance. International Journal of Engineering Research & Technology (IJERT), (4).

[6] Paliwal, Pratibha, and Manpreet Singh. "Design Implementation of Digital Down Converter for WiMAX System." International Journal of Advanced Research in Computer and Communication Engineering 2.9: 3336-3338.

[7] Singh, Manpreet, and Amandeep Singh Sappal." Indoor Optical Wireless Communication Channel Models" Journal of Xidian University Science Press (2020) Volume 14, ISSUE 5, pp- 3031-3038.