International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 6, pp 107-110, June-2021

https://doi.org/10.47001/IRJIET/2021.506021

Optimization of Dense Wavelength Division Multiplexing for Optical Fiber System

Abdelhamid Mohammedahmed Abdelbagi

Omdurman Islamic university, Faculty of Engineering Sciences, Department of Electrical and Electronic Engineering, Sudan

E-mail: abdelhamidmdih@gmail.com

***Abstract* - This paper presents the design and the main performance results of dense wave length division multiplexing (DWDM) before optimization and after optimization with eye equalizer and BER (bit error rate) equalizer. The aim of this paper is to comparison between DWDM before optimization (using fewer channels (four channel)) and after optimization (using more channels (11channels).This optimization of DWDM will be achieved with optisym 7.0 program. There are four 10GBPS channels were combined and transmitted over the 72.8km long optical fiber. The paper was based on simulation the given solution and optimized it.**

Keywords: Optimization, DWDM, optical fiber, Eye diagram, bit error rate,optisym7.0, optical signal to noise ratio, EDFA= Eridium Doped Fiber Amplifier.

I. INTRODUCTION

There is an increasing demand for dense wavelength division multiplexing system (DWDM) to support asset of network requirements (span length, total distance capacity, etc). Use DWDM systems as a backbone nowadays. Due to the constant growth of information exchange worldwide, DWDM system built are in need of frequent cost-effective optimization. There are a lot of ways how to evaluate and optimize areal working DWDM system. One of the most efficient ways to perform these tasks is to use simulation software.

Simulation software takes all kinds of parameters into account for DWDM system, through which the measurement results of various instruments can be get, and it can simplify design process and save a lot of time and funding for theoretical research. In order to do so a thorough inspection of hardware documentation is needed as well as various measurements of the components of transmission system must be taken. Improving the simulation and giving proposals for further optimization of the transmission system and I aims in this study is to comparison between DWDM before optimization (using fewer channels) and after optimization (using more channels).This optimization of DWDM will be achieved with optisym 7.0 program.

II. LITERATURE REVIEW

Wire and analog transmission systems for communication suffer of low capacity and high losses and transmission to long distance and high cost for maintenance compared to the modern system like optical fiber (dense wavelength division multiplexing) by using more channel for improvement of transmission of communication signals. Comparison between DWDM before optimization (using fewer channels) and after optimization of DWDM Will achieved with optisym 7.0 program and Eye diagram to reduce bit error rate (BER).

There is published study said that ((all machine learning models are able to correctly predict the quality of transmission (QoT) of more than 90% of the light paths to channel to signals also it being able to correctly predict the QoT of almost 99.9% of the light paths but it said that Artificial neural network (ANN) is able to estimate the residual margin of a light path with an average error of only 0.4 dB, by Rui Manuel Morais and João Pedro (2018))). In this paper I reduced the error to lower for transmission of signal.

Also there is another published study that it proposed ((a four-channel optical demultiplexer based on photonic crystal resonant cavities. For performing wavelength selection task, we used four resonant cavities with different lengths in order to choose four channels with different wavelengths, by Mahdi Zavvari (2017))). But in my paper I used more channel before optimization and fewer channel after optimization and made comparison between them.

Also a published study said that ((The simulated demonstration targets the transmission of two downstream channels of each 2 Gbps with channel spacing of 0.1 nm to realize the proposed system and achieves a fiber link of 30 Km with split ratio of 16,by Vishal Sharma, Shivani Sharma (2014))) but here paper There are four 10GBPS channels were combined and transmitted over the 72.8km long optical fiber.

Another study published said that ((Reconfigurable optical add-drop multiplexers (ROADMs) allow for transparent networking at 50 GHz channel spacing, published by Sethumadhavan Chandrasekhar, Xiang Liu (2010))). But here

© 2021-2017 IRJIET All Rights Reserved

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 6, pp 107-110, June-2021

https://doi.org/10.47001/IRJIET/2021.506021

in this paper I used four 10GBPS channels were combined and transmitted over the 72.8km long optical fiber

Transmitter (Tx) I used 4 channels:

λ1 =1530.334nm
λ2=1531.116nm
λ3=1533.465nm
λ4=1534.250nm

And spacing 100 GHZ. In Receiver (Rx) I used 11 channels and reduce spacing to 50 GHz. The study was based on simulation the given solution and optimized it.

Moreover the DWDM can identify faults ((Fault detect ability in DWDM includes detailed descriptions of the properties of light and optical communications, optical components, interaction of wavelengths and faults affecting the quality of the optical signal and the system, correlation of faults, aspects of fault management, published by Stamatios V Kartalopoulos(march 2001))). I used in this paper a technique of detect the error in the Receiver (Rx) the as Eye diagram to detect the Noise and measuring BER to the Signal in Receiver after optimization and before optimization.

Finally DWDM network is very important and can be integrated with Asynchronous transfer mode (ATM) it has high transmission speed technique it has speed reaches 100MBPS.

((History shows that transmission networks have been reconstructed on a regular basis, and the reconstruction, based on fiber, SONET, and DWDM (dense wave division multiplexing)), allows TDM transmission capabilities to be integrated with ATM switches, resulting in increased transmission efficiencies, effective bandwidth management, and greatly reduced capital, operational, and maintenance costs, by A.G. Malis (1999))).

III. METHODOLOGY

Experimental part is based on a standard real working Bidirectional DWDM solution (transmission of 4 channels 10Gbps over the optical fiber) and 11channels after optimization.

Figure (1) shows the block scheme of standard DWDM system with a link length of 72.8km(standard link length for 10Gbps) with dispersion compensation module(DCM).Two groups of channel are being transmitted into the line each consists of two channel with spacing 100GHZ .the center wave length are:

λ1=1530.334nm
λ2=1531.116nm
λ3=1533.465nm
λ4=1534.250nm

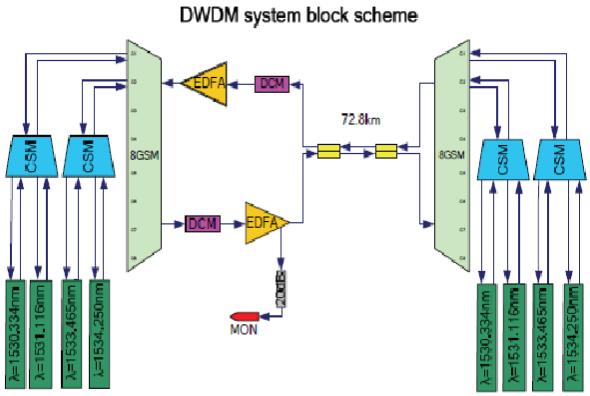


Figure 1: Block scheme of standard DWDM system

The specific TCP for further research and simulation. Technical parameters of chosen transmission system like center frequency for each channel. Input attenuation of fiber, dispersion compensation, amplifier gain .length and optical fiber were measured with reflect meter beforehand.

Simulation first part:

Is based on building identical DWDM transmission system in all optical network simulator optsim 7.0 .evaluation of simulation based on analyzing such system parameters as BER (bite error rate).

And optical SNR (OSNR) .BUT in present work we show Spectrum and EYE diagram for various simulation setups.

EYE diagram must be opened wide enough and spectrum diagrams should be regulars without negative multipack structure for good system performance.

EYE diagram shows the patterns of electrical signal after detection.

Height of EYE diagram shows amount of noise that can be tolerated by the signal.

Width of EYE diagram shows the time over which the wave form can be successfully sampled.

Simulation second part:

Is based on improved previously simulated DWDM Transmission system .there are a lot ways to perform this task. Most classic are increasing the length of optical fiber, decreasing the spacing between channels. Increasing the number of channels and the increasing transmission speed of channels.

© 2021-2017 IRJIET All Rights Reserved

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 5, Issue 6, pp 107-110, June-2021

https://doi.org/10.47001/IRJIET/2021.506021

IV. RESULTS

I have investigated the performance of a standard bidirectional DWDM solution with dispersion compensation and EDFA amplification where four 10GBPS channel were combined and transmitted over the 72.8km long optical fiber. The research was based on simulation the given solution and optimized it.

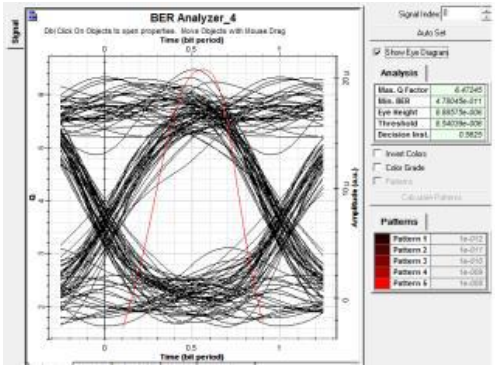
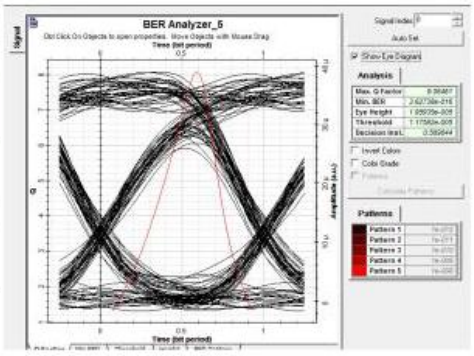


Figure 2(a): BER 4.78e-11



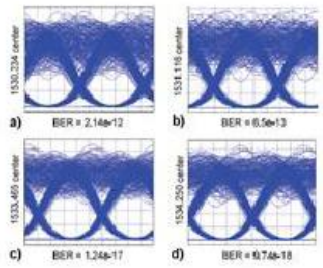


Figure 2(b): BER 3.63e-16 measured eye diagram

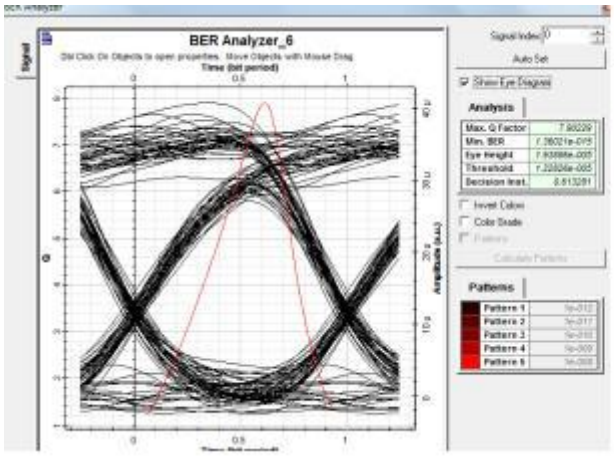


Figure 2(c): BER 1.36e-15

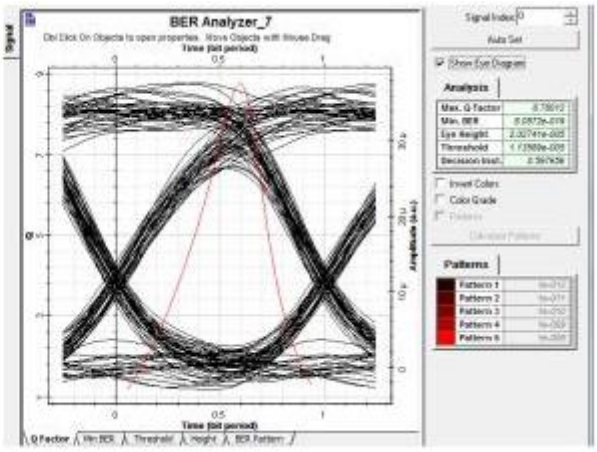


Figure 2(d): BER 8.06e-19

Fig (2) shows the Eye diagrams of each channel's output electrical signal.

a- λ1 = 1530.334 nm; b - λ2 = 1531.116 nm; c - λ3 = 1533.465 nm; d – λ4 = 1534.250 nm

The paper was based on simulation the given solution and optimized it.

109.CONCLUSIONS

In this study a comparison was made by successfully between DWDM before optimization (using fewer channels) and after optimization (using more channels). Also the optimization of DWDM will be achieved with optisym 7.0 program.

ACKNOWLEDGEMENT

I thank all of our parents, all my family members, who have been credited with encouraging and following me constantly, and for all those who given me a good word or idea, guidance, observation and advice.

REFERENCES

[1] Jean –Pierre laude, DWDM Fundamentals: Components and Applications, Artech house roston London, 2002.

[2] JAMES Downing, Fiber –optic communication, Thomas Delmar learning, 2005.

[3] Nick Massa, Fiber optic telecommunication, spring field technical community: college spring field massa chusetts.

[4] Introduction to DWDM technology, Cisco systems, INC USA, 2000.

© 2021-2017 IRJIET All Rights Reserved

ISSN (online): 2581-3048
Volume 5, Issue 6, pp 107-110, June-2021
https://doi.org/10.47001/IRJIET/2021.506021

[5] Introduction to DWDM technology, IEEE PRESS, Wiley intercedence john wiley and sons. INC Publication NewYork, 2000.

[6] Introduction to DWDM technology, Cisco systems, NC USA, 2000.

[7] International Telecommunication Union: Recommendations G.694.1(06\2004), G.697(06\2004), G.694.1(02\2012), G.656(07\2010), G.698.3(02\2012), G.973.1(11\2009).

[8] Rui Manuel Morais and João Pedro, Machine learning Models for Estimating Quality of Transmission in DWDM Networks, Journal of Optical Communications and Networking Vol. 10, Issue 10, pp. D84-D99 (2018) - https://doi.org/10.1364/JOCN.10.000D84

[9] Mahdi Zavvari, Design of Photonic Crystal-Based Demultiplexer with High-Quality Factor for DWDM Applications, Journal of Optical Communications, Volume 40, Issue 2, Pages 135–138, eISSN 2191-6322, ISSN 0173-4911, DOI: https://doi.org/10.1515/joc-2017-0058, 22-06- 2017.

[10] Vishal Sharma, Shivani Sharma, High speed ,long-reach bidirectional OFDM-DWDM-EPON Access system, ACCT '14: Proceedings of the 2014 Fourth International Conference on Advanced Computing & Communication Technologies, February 2014 Pages 150–152.

[11] Sethumadhavan Chandrasekhar, Xiang Liu, 40 Gbps DBPSK and DQPSK formats for transparent 50 GHz DWDM transmission, Bell Labs Technical Journal - February 2010- Bell Labs Technical Journal, Volume 14, Issue 4, February 2010, pp 11–25.

[12] Stamatios V Kartalopoulos, Fault Detectability in DWDM: Toward Higher Signal Quality and System Reliability, Wiley-IEEE Press-ISBN: 978-0-7803-6044-0, Pages156, March2001.

[13] A.G. Malis-Ascend Communications Inc, IEEE Communications Magazine (Volume: 37, Issue: 6, June 1999)-Page(s):140 – 145.

AUTHOR'S BIOGRAPHY

Abdelhamid Mohammedahmed Abdelbagi, I was born in Shandi town in Sudan, I graduated from Omdurman Islamic university, faculty of engineering sciences in department of electrical and electronic engineering (B.Sc with honors in 2008), Sudan and MSc in Electronics from Sudan Academy of sciences (2015)-Sudan.

Citation of this Article:

Abdelhamid Mohammedahmed Abdelbagi, "Optimization of Dense Wavelength Division Multiplexing for Optical Fiber System" Published in *International Research Journal of Innovations in Engineering and Technology - IRJIET*, Volume 5, Issue 6, pp 107-110, June 2021. Article DOI https://doi.org/10.47001/IRJIET/2021.506021

****

© 2021-2017 IRJIET All Rights Reserved