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A Performance Evaluation of WDM System Using 32 Channels Optical Amplifiers

Dawinder Singh*, Jagneet Kour*, Inderpreet Kaur* and Kamal Kant Sharma*

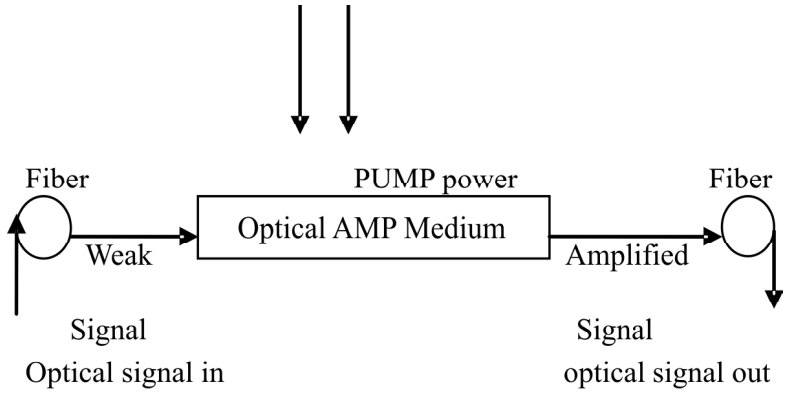
ABSTRACT

In this paper, 32 -channel WDM system transmitted is presented gets amplification EDFA and SOA amplifiers considering pre, post and in-line amplification configuration spread over 70 km distance. The WDM network is designed for amplifying 32 channels WDM system EDFA-SOA amplifier configuration ranging from 1471nm to 1671nm; considering improvement in power at input side for receiving side. Performance of Erbium Doped Fiber Amplifier (EDFA) and solid state optical amplifiers has been analyzed for different parameters; Q- Factor, BER rate, height and threshold frequency. Results indicate that pre amplifier configuration give favorable results than post amplifiers and in-line amplifier configurations after analyzing performance of a system.

Keywords: EDFA; SOA; WDM;BER.

I. INTRODUCTION

A device which is used to amplify the discrete signal; used in optical communication is termed as optical amplifier [1]. A communication empowers amplifiers used to increase the power of receiver within a range so that performance of transmitted signal improves. [2]. Figure shows the general form of an optical amplifier [2]



WDM empowers wavelength multiplexed which is used for optical network; in other words, superimposing of optical networks. This type of communications spreads for multiple dependent or individual channels [3].WDM system pertains to well established methodology of using amplifiers for utilization of fiber bandwidth available that is through several combinations of various amplifiers in separate wavelength ranges [4]. Somehow, channels are so closely spaced leads to dense multiplexing. [5]. Various channels are series packed to some extent , spaced small less than 3 nm ; where as some are spaced less than 2 nm [5]. Division Multiplexing at wavelength end is an emerging field that joins several independent information carrying wavelengths and for the single fiber [5]. In WDM, every optical channel has a wavelength range

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with its own wavelength. The spacing of typical optical channel may be 1nm wide or less. Optical amplifier is the key component of WDM system. While considering various channels in similar range of frequency range, very much spaced, dense exists in WDM system [6]. The position of amplifier placed in a system effect performance with distinct characteristics and to meet different goals [7]. Amplifiers in optical communication operate in in-line and pre- amplification strategies as boosters [8].There are different types of EDFAs amplifier configurations: Booster; this kind of amplifier is used to increase the power of transmission and preferably placed after a transmitter. With this booster, transmission distances can be advanced till 100 km; used with high input power [8]. The main hindrance lies in selecting power of the selected amplifier at output end. For example if we want to amplify a mixed WDM network of 10 channels from -5 dBm by 8 dB the total output power of the amplifier will be 10 channels at 3dBm (that is, 2 mW). Total amplifier power needed in this case is 20 mW[8]. In optical communication, sometimes, strength of signal is low, and we need to amplify and compensate with losses and reduce the overlap between repeaters; therefore distance must be increased. In order to remove overlapping and improve amplification for low level signal; In-Line optical configuration can be used. While applying the configuration; the main hindrance is external low frequency level in terms of noise, value of gain and power at output end [8].For pre amplification, high sensitivity with high gain and low value of noise is required. [8]. An optical amplifier is used for all three configuration and possess better performance such as high frequency range and gain as compared with solid state devices like avalanche photodiodes or optical heterodyne detectors [9].The different amplifier configurations in WDM system as shown in Fig.1,fig.2,fig.3 transmits thirty two channels wavelengths ranging from 1471 nm to 1611 nm. The transmitter subsystem comprises of input signals and a multiplexer. Then, in the optical transmission link, several fiber spools are placed before the receiver subsystem which consists of a carrier for demultiplexing.

1. When EDFA-SOA is connected Using Pre- amplifier configuration-

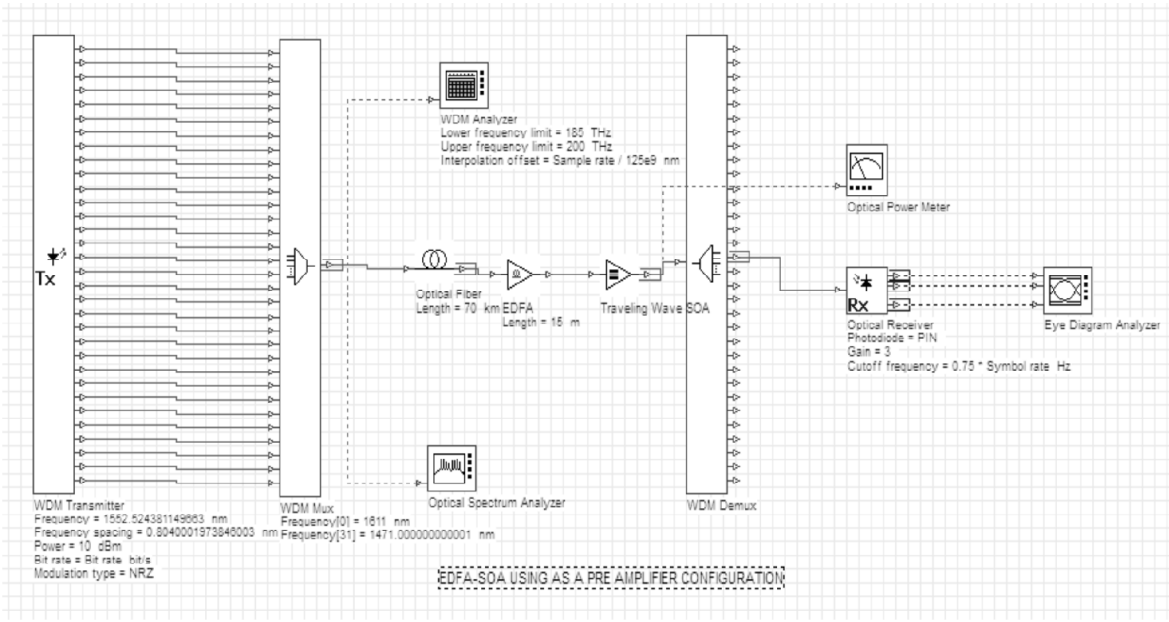


Figure 1. shows - EDFA-SOA is connected Using Pre- amplifier configuration

2. When EDFA-SOA is connected Using Post-amplifier configuration

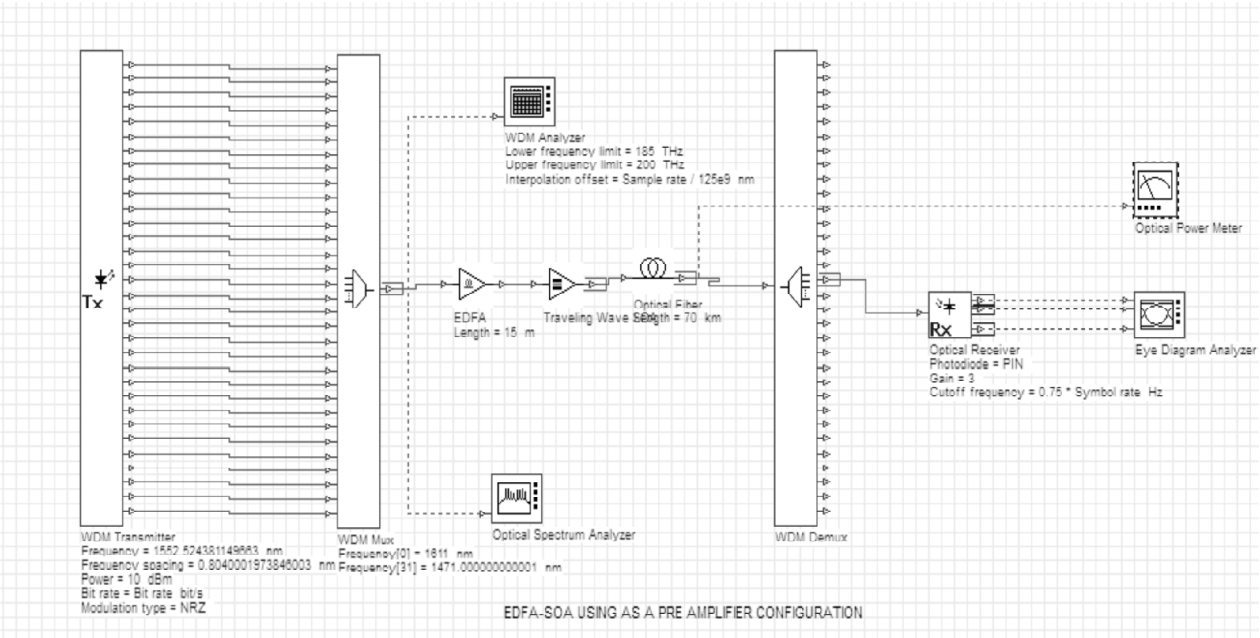


Figure 2. shows - EDFA-SOA is connected Using Pre- amplifier configuration

3. When EDFA-SOA is connected Using inline-amplifier configuration-

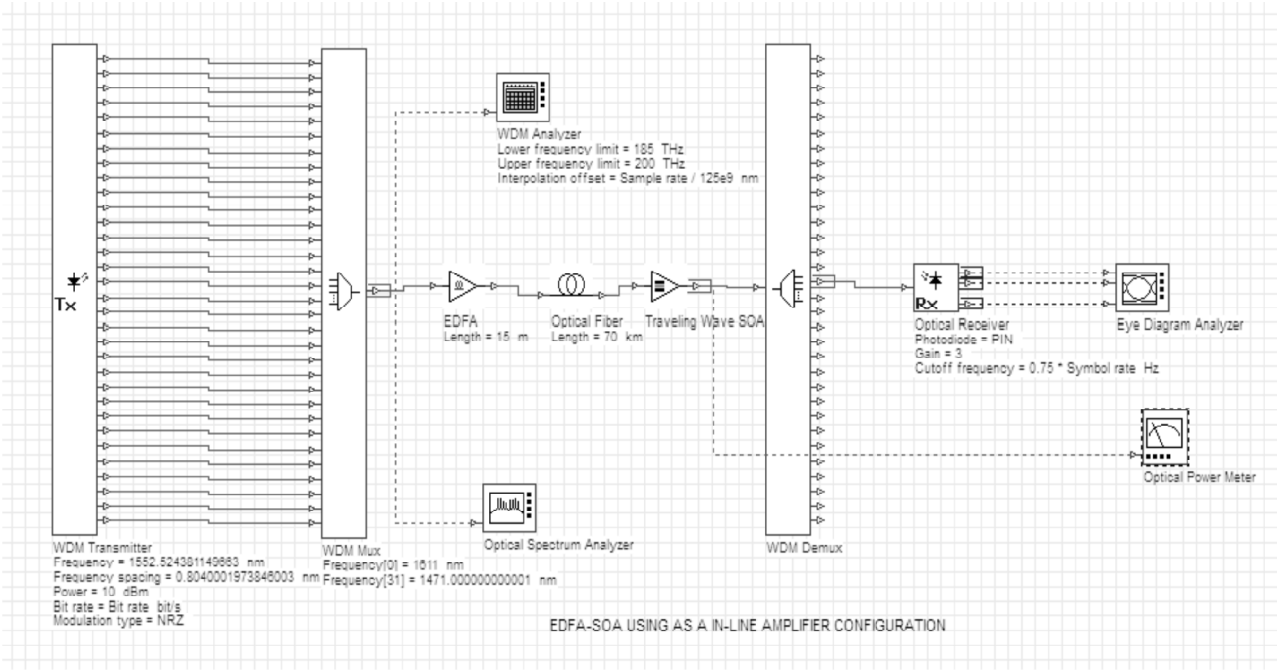


Figure 3. shows - EDFA-SOA is connected Using In-line - amplifier configuration

II. PERFORMANCE ANALYSIS OF EDFA-SOA IS CONNECTED USING PRE-AMPLIFIER CONFIGURATION AT EDFA LENGTH 15M

Figure 1. (a) Eye Diagram

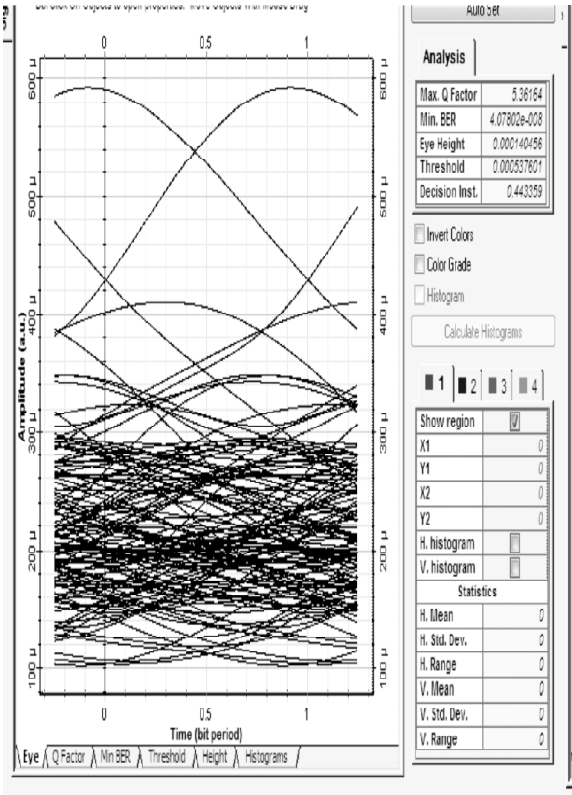


Figure 1.(b) Q-Factor

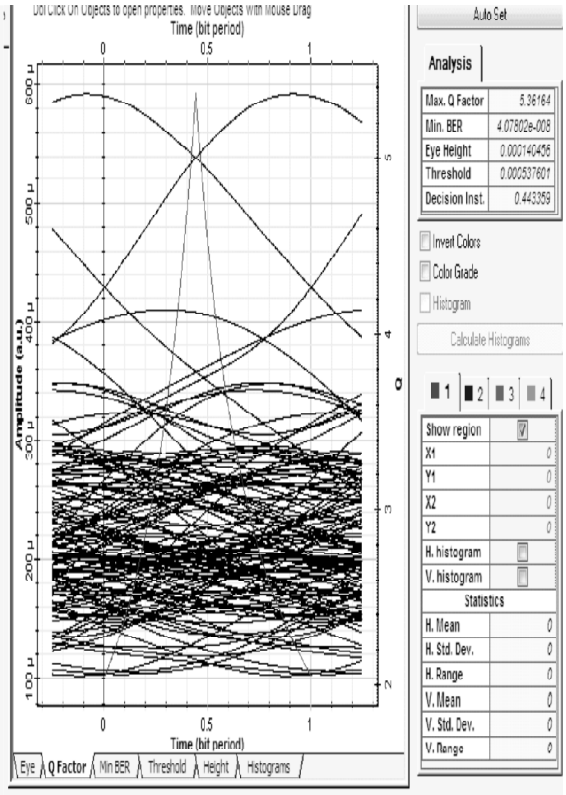


Figure 1. (c) Eye Diagram

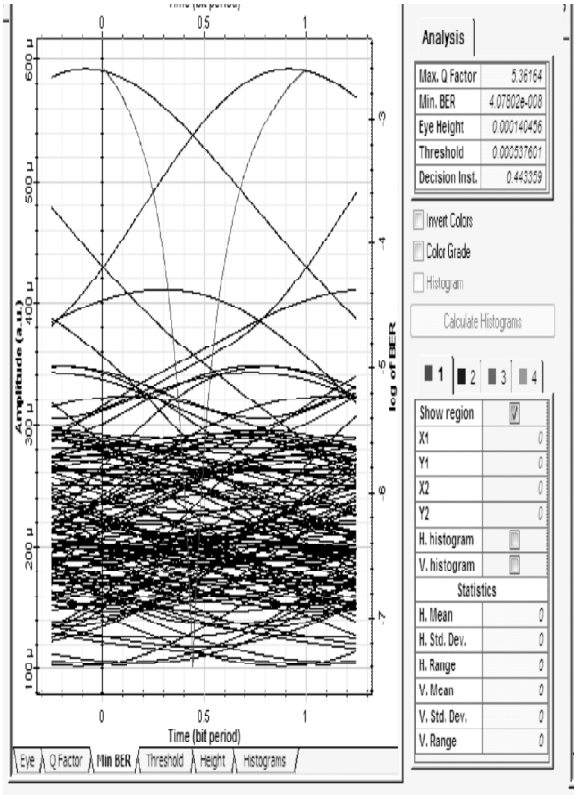


Figure 1.(d) Q-Factor

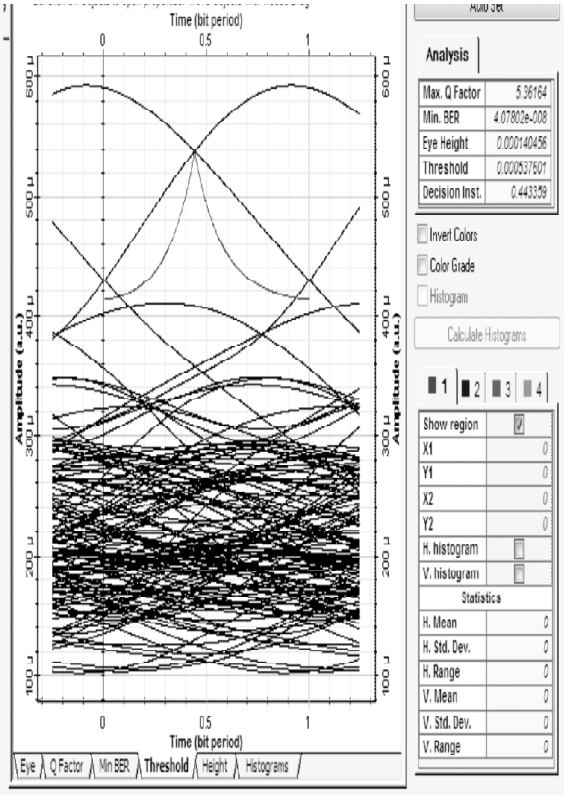
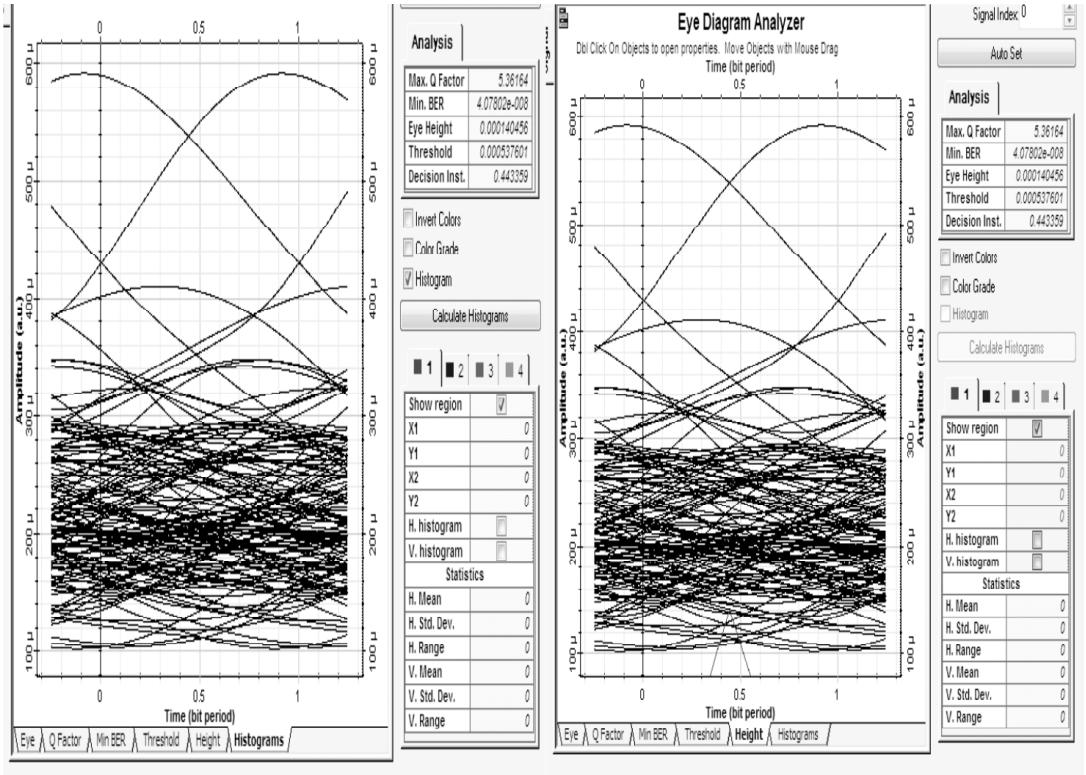


Figure 1. (e) Eye Diagram

Figure 1.(f) Q-Factor



III. PERFORMANCE ANALYSIS OF EDFA-SOA IS CONNECTED USING POST-AMPLIFIER CONFIGURATION AT EDFA LENGTH 15M-

Effect has been shown in figures on the eye diagram, Q-factor, Min. (BER), threshold, height and histogram using EDFA at length 15m.

Figure 2. (a) Eye Diagram

Figure 2. (b) Q-Factor

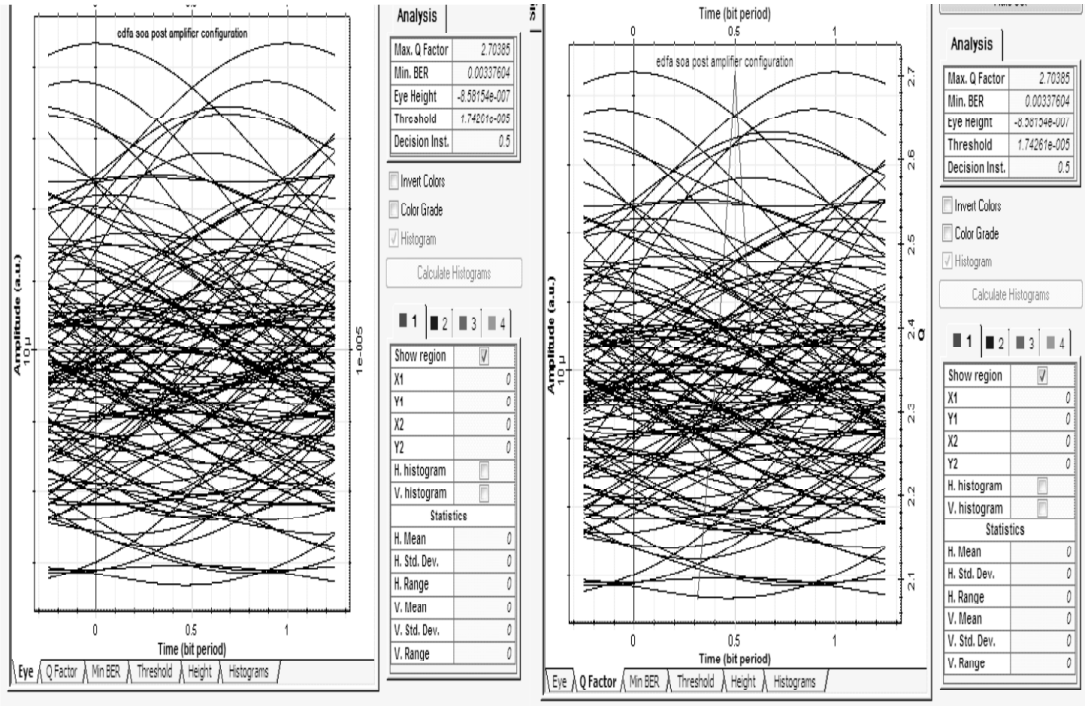


Figure 2.(c) Min BER

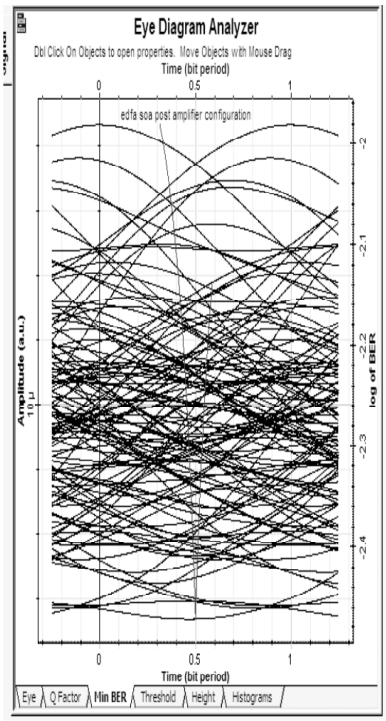


Figure 2.(d)Threshold

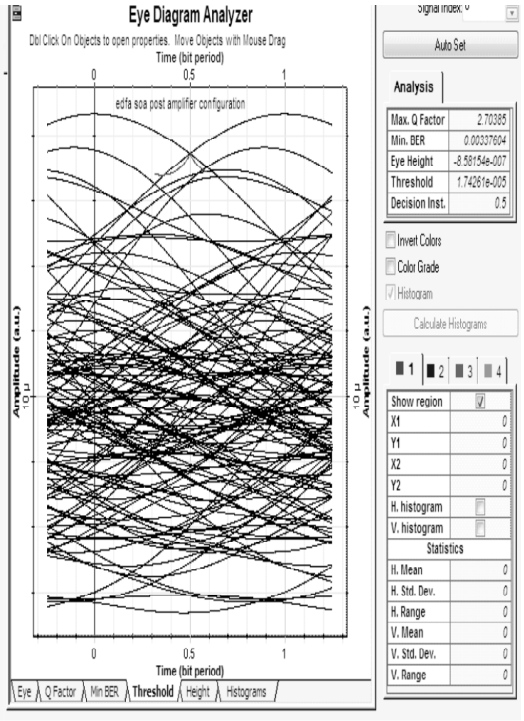


Figure 2. (e) Height

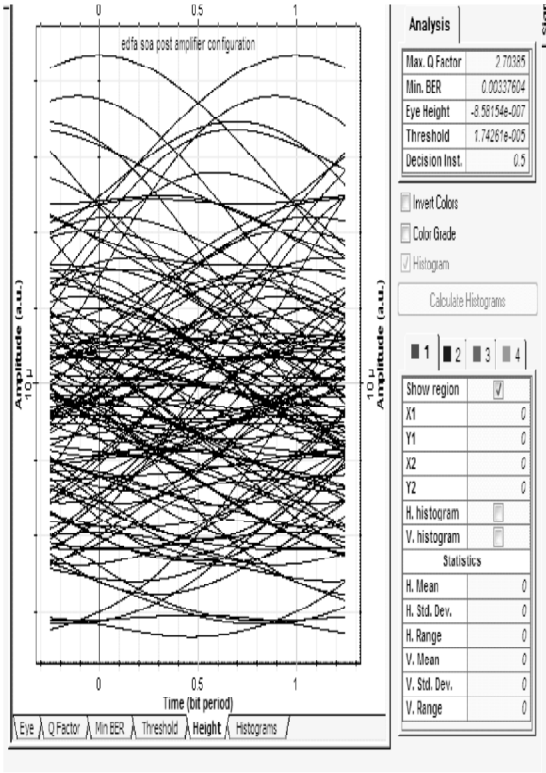
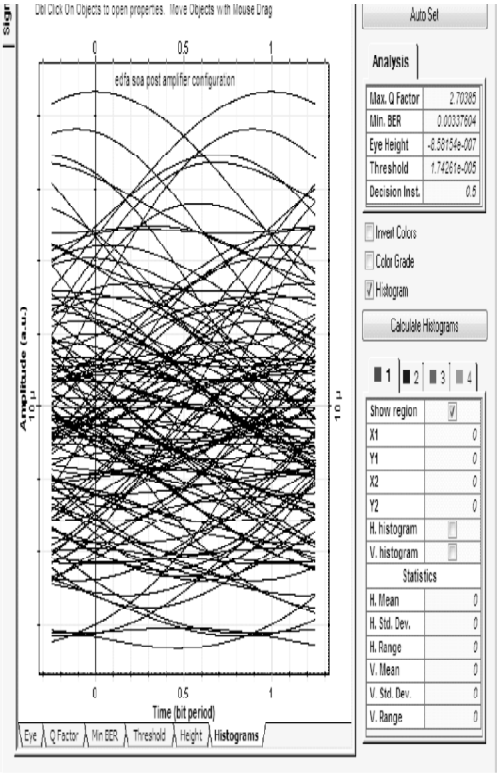


Figure 2. (f) Histogram



IV. PERFORMANCE ANALYSIS OF EDFA-SOA IS CONNECTED USING INLINE-AMPLIFIER CONFIGURATION AT EDFA LENGTH 15M-

Effect has been shown in figures on the eye diagram, Q-factor, Min. (BER), threshold, height and histogram using EDFA at length 15m

Figure 3 (a) Eye Diagram

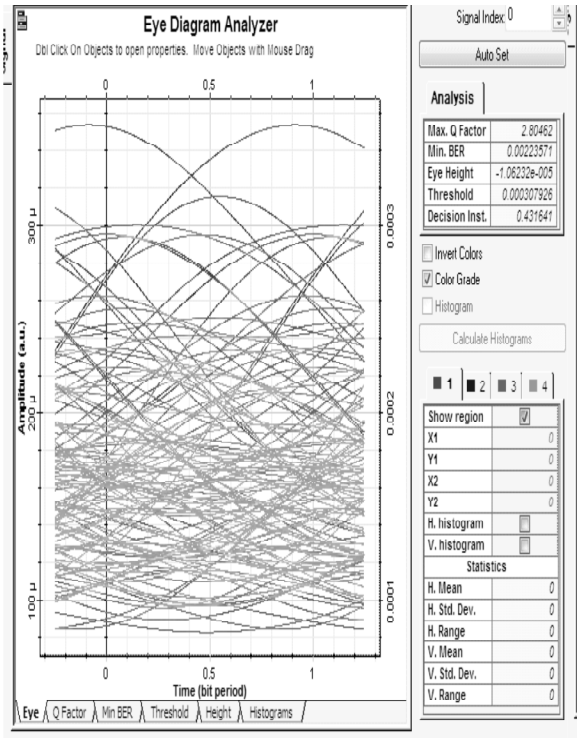


Figure 3 (b) Q-Factor

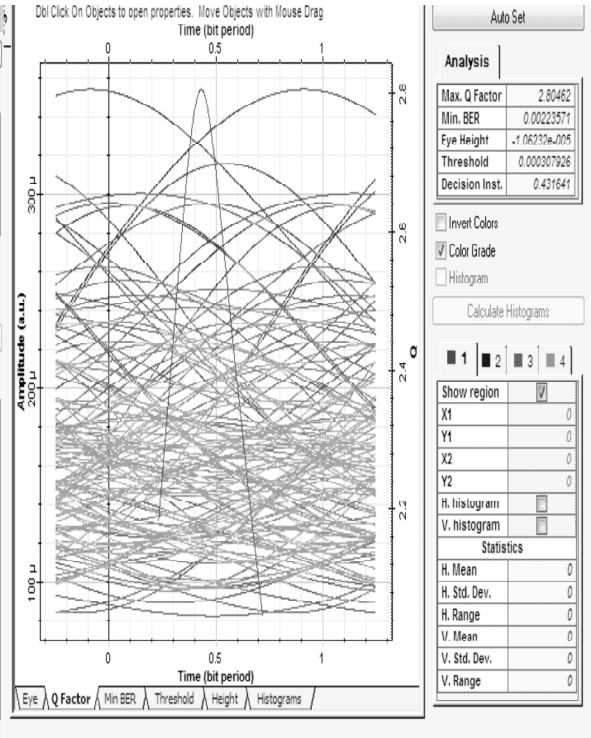


Figure 3 (c) Min BER

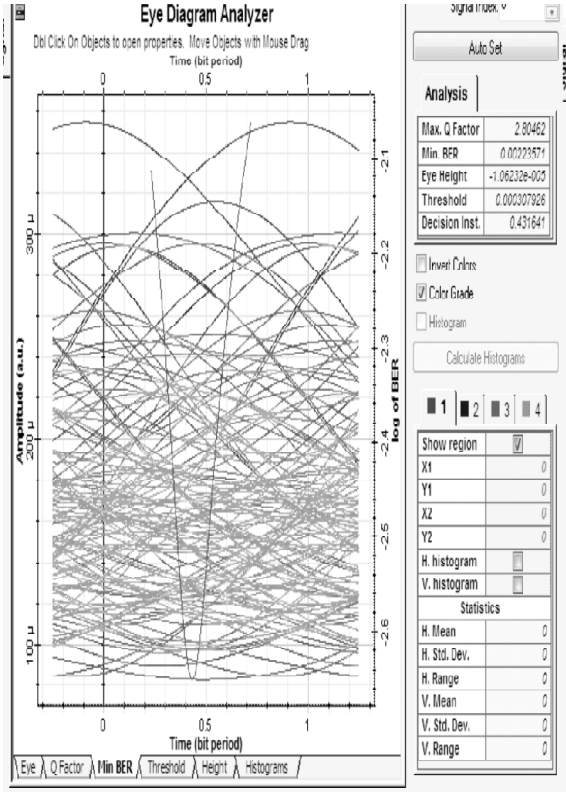


Figure 3 (d) Threshold

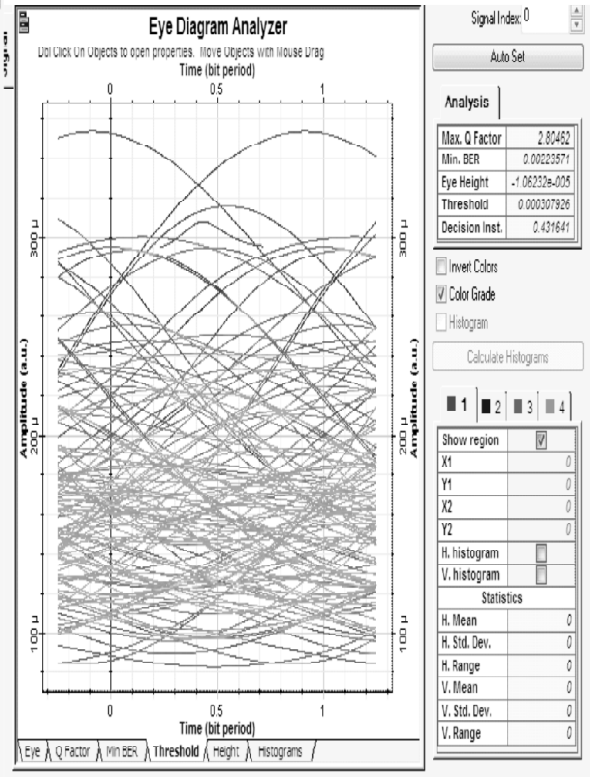
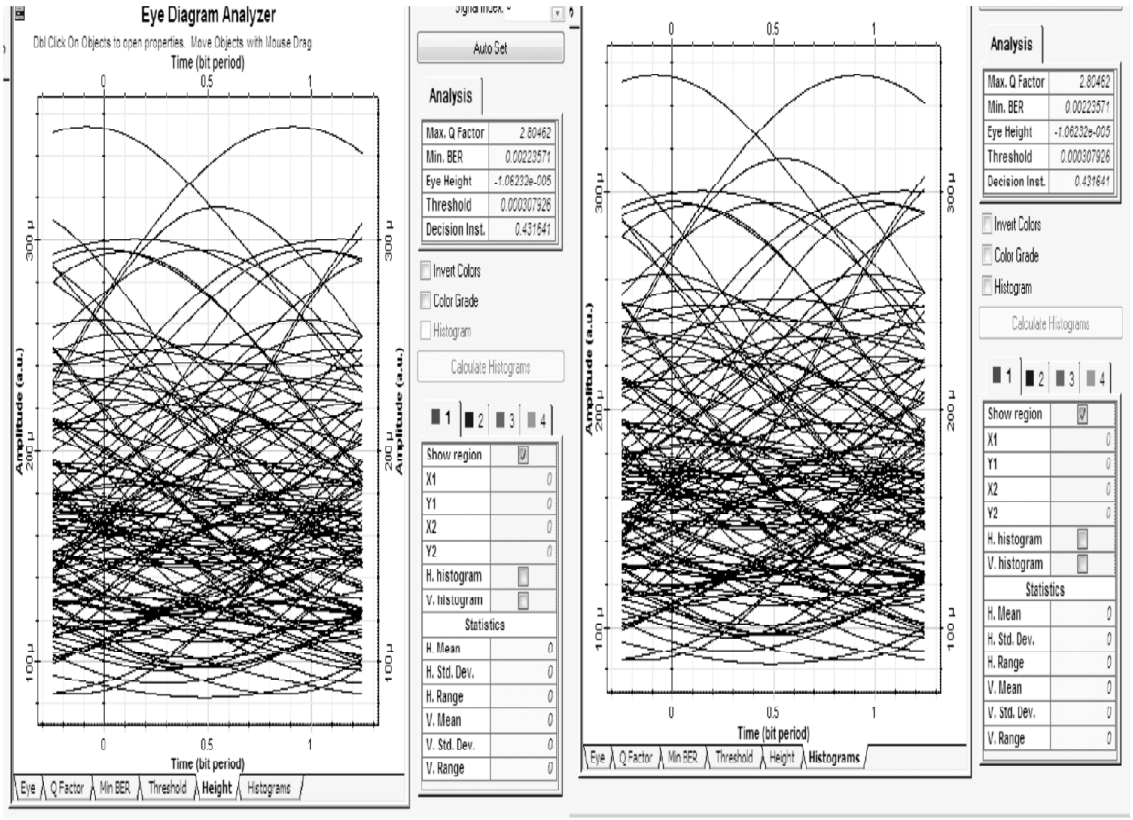


Figure 3 (e) Height

Figure 3 (f) Histogram



V. PERFORMANCE ANALYSIS FOR OPTICAL POWER METER

(1) THE POWER FOR POWER (BOOST) AMPIFIER CONFIGURATION IS-

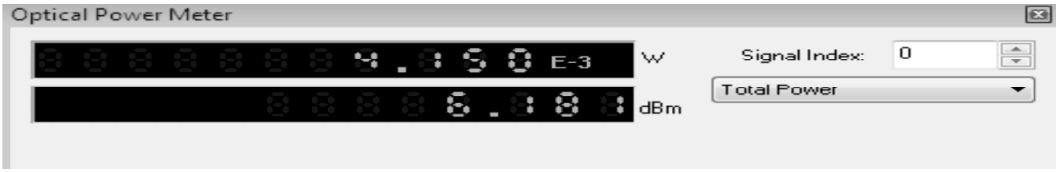


Figure 4 (a) shows power for power amplifier configuration.

(2) THE POWER FOR PREAMPLIFIER CONFIGURATION IS-

Figure 4 (a) shows that power for preamplifier amplifier configuration.

(3) THE POWER FOR IN-LINE AMPLIFIER CONFIGURATION IS-

Figure 4 (a) shows that power for In-line amplifier amplifier configuration

RESULT AND ANALYSIS

Parameters	*EDFA-SOA (Length of EDFA is 15m) Using pre amplifier configuration*	*EDFA-SOA (Length of EDFA is 15m) Using post amplifier configuration*	*SOA-EDFA(Length of EDFA is 15m) Using line amplifier configuration*
Q-Factor	5.36164	2.70385	2.80462
MIN BER	4.07802e-008	0.00337604	0.00223571
EYE HEIGHT	0.000140456	-8.58154e-007	-1.06232e-005
THRESHOLD	0.000537601	1.74261e-005	0.000307926
DECISION INSTANTANEOUS VALUE	0.443359	0.5	0.431641
Power(dbm)	20.182	6.181	19.362

CONCLUSION

In this work,we have investigated that by using the 32-channel WDM system transmitted over 70 km distance is amplified with EDFA-SOA pre-amplifier, power(or boost) amplifier and inline amplifier configuration at EDFA length is 15 m. The proposed EDFA-SOA preamplifier and inline amplifier configurations improve the input power to the receiver subsystem. We have analyzed the performance of EDFA –SOA is connected using pre-amplifier configuration gives better results than post and inline amplifier configurations.The Q-factor and min BER rate is maximum for EDFA-SOA is connected using preamplifier configuration (q=5.36164and BER rate =4.07802e-008).

REFERENCES

[1] D.A. Chapman, "Erbium doped fiber amplifiers: the latest revolution in optical communications", electronics and communication journal, April 1994.

[2] A P. Urquhart, O.G. Lopez, "Optical Amplifiers for telecommunications", DEPARMENT OF IEEE, 2007.

[3] Mr. S.chaugule,"WDM and Optical amplifier", ICMEE, 2010.

[4] I., Kaur, N., Gupta, "Enhancing the Performance of WDM Systems by Using TFF in Hybrid Amplifiers", 2010 IEEE 2nd International Advance Computing Conference, Patiala, India, pp 106-109, Feb 2010.

[5] I., Kaur, N., Gupta, "Optimization of Fiber Length for EDFA to Enhance the Channel Capacity of DWDM System" 2012 International Symposium on Instrumentation & Measurement, Sensor Network and Automation (IMSNA), Volume 1, pp 7 – 10, August 25-28, 2012 Sanya, Hainan.

[6] Arun Kumar, Aprajita Sharma, V. K. Sharma, "Optical Amplifier: A Key element of high speed optical network" IEEE, 2014.

[7] K. Ismail, P. Susthitha Menon, S. Shaariand A.A. Ehsan," Measurement of a Post-amplified CWDM System Performance with EDFA-SOA Amplifiers", IEEE, 2015.

[8] I., Kaur,J., Kaur, "Performance Analysis of Different Hybrid Amplifiers Configurations For Variable Channels WDM System",International Journal of Advanced Electrical and Electronics Engineering(IJAEEE),Vol-5 Issue-2,May 2016.

[9] I., Kaur, N., Gupta, "Hybrid Fiber Amplifiers" 1st Edition, InTech Publishers, 2012, Chapter 4, ISBN: 97-87953-51-0170-3.

[10] I., Kaur,J., Kaur, "Performance Analysis of Different Hybrid Amplifiers Configurations For Variable Channels WDM System",International Journal of Advanced Electrical and Electronics Engineering(IJAEEE),Vol-5 Issue-2,May 2016.

[11] Kaur, Inderpreet, Gupta, Neena, "Increasing the Amplification Bandwidth of Erbium Doped Fiber Amplifiers by Using a Cascaded Raman-EDFA Configuration", Photonics 2008, P.284, Dec. 2008 at IIT, Delhi.

[12] Kamal Kant Sharma, Inderpreet Kaur "Implementation of Genetic Algorithm for Optimization of Network Rout" Proceedings of 2nd Springer AISC International Conference on Computer and Communication Technologies (IC3T 2015) Indexed, pp. 234-237, July 2015.

[13] Jagneet Kour, Inderpreet Kaur, Kamal Kant Sharma "Comparison of Various optical Amplifiers on the performance of 16-64 channels WDM Systems" International Journal of Recent and Innovation Trends in Computing and Communication vol. 4, issue 5, pp. 183-187, 2016.