

Comparative Investigation Of inter-Satellite Optical Wireless Communication By Using Different Modulation Formats

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ABSTRACT

The optical wireless communication systems have got greater popularity in the previous couple of years because of its benefit over conventional radio frequency conversation structures. This paper reviews the effect of the usage of NRZ, RZ and Gaussian pulse generator modulation codecs on the performance of the optical wireless communication (OWC) channel in terms of Quality factor aspect and Minimum BER at bit rate of 10 Gbps. It has been watched that NRZ function generator gives better execution for optical wireless association conversely with RZ and Gaussian association for different values of aperture diameters and range.

Keywords: Non-Return to zero (NRZ), Inter-satellite optical wireless communication (IsOWC), Q Factor, BER.

Date of Submission: 17 May 2016



Date of Accepted: 12 November 2016

I. INTRODUCTION

Over the long decades, attention continued to OWC restraint, mainly to be used covertly marine applications, [1]. In addition to space programs such as inter-satellite TV for PC and profound-space hyperlinks. [2]. OWC's It has been spreading rapidly mass market so far restrained except for IrDA which became a surprisingly a success wireless brief-range transmission solution.[3]. Improvement of modern and effective wireless technologies for a number of transmission links is essential for constructing destiny heterogeneous conversation networks to aid a huge range of service sorts with various patterns and to meet the ever-increasing demands for higher information fees. Variations of OWC ability be potentially utilized in anumerous variety of verbal exchange packages ranging from optical interconnects inside integrated circuits thru outside inter-constructing hyperlinks to satellite communications.

The optical wireless communication (OWC) is a verbal exchange era that makes use of line of sight (LOS) direction propagating in free area for transmission of sign/information/information between two favored focuses for media communications or computer networking organizing[4]. The OWC is based on the optical communication with best A distinction that this device does now not use solids as a transmission medium together with optical fiber cable or optical transmission line. OWC is basically followed when The bodily connection isn't always almost viable due to excessive fee or other consideration [5]. Hence, this technology utilized air as the environment of a transmission, the sensitivity towards atmospheric phenomena is inevitable. Those disturbances will appreciably have an effect on the OWC transmission performances. The climatic turbulences will purpose the fast fluctuation of receiving electricity and subsequently will lessen the device excels. Moreover, the interruption of the laser beam consisting of cook flap can even disturb the verbal exchange channel energy which may be stepped forward by way of the use of amplifier [6]. OWC hyperlink is still taken into consideration, particularly as a new technology, although fiber optic verbal exchange has been widely used in global extensive Telecommunications industry. This work makes a specialty of distinct modulation codec's and their effect on the rate of transmission for LEO ISLs. This paper pursuits to find the most suitable modulation layout for helping excessive speed ISLs. The performance of numerous modulation sorts was investigating the use of the Q-factor and BER..

II. SYSTEM DESCRIPTION

To investigate the performance of the optical wireless communication (OWC) device for NRZ, RZ and Gaussian codecs we first setup device as shown in fig1 until fig3. And same setup is repeated for one of a kind bit rate one of a kind range of the wireless channel. This optical communication system contains three predominant components, optical Transmitter, optical wireless channel and optical receiver. At transmitter a PRBS generator is used to generate records at high speed of 10 Gbps and this feed to enter of NRZ/RZ/ Gaussian pulse generator to Generate modulating formats this electric signal in addition feed into electric enter of MZM optical modulator to with CW laser to modulated sign and transmitted the use of wireless verbal

exchange channel and detected at receiver aspect the use of photo detector this signal feed into low bypass filter to eliminate excessive frequency sign which is in particular noise after this Q factor and min BER analyzed the usage of BER Analyzer[7].When I planned the models of IsOWC, which is operating at wavelength 1550 nm by way of the use of extraordinary modulation codec's i.e of NRZ ,RZ and Gaussian pulse generator. The most modern optical wireless communication system in which the transmitter is inside the primary satellite and the receiver is within the other satellite. The unfastened area among the satellites is the propagation medium is the OWC channel this used to transmit the mild sign. Optical wireless communications use mild at close to-infrared frequency to speak. The IsOWC machine isn't an awful lot unique of unfastened area optics and fiber communication in which the distinction is based on the propagation channel[8].

A. IsOWC model utilizing NRZ modulation at 1550 nm

In this model design by using optsystem v9 software utilized the NRZ at 1550 nm wavelength. The power of transmitted is 10 dBm will be utilized as shown in figure 1.

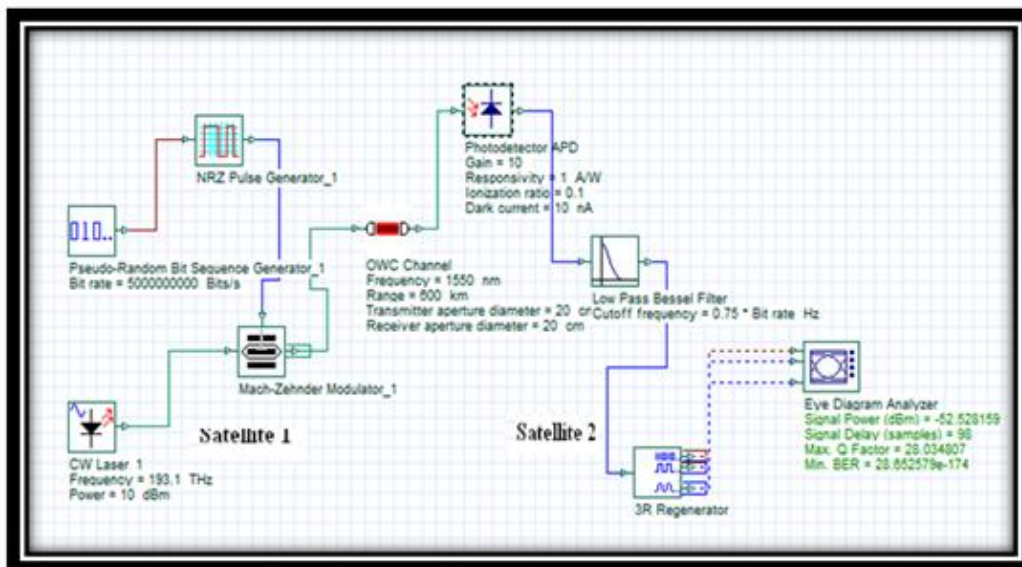


Fig.1 . IsOWC joins utilizing NRZ at wavelength 1550 nm.

B. IsOWC model utilizing RZ format at 1550 nm

In this model we utilized the modulation RZ at 1550nm wavelength. The value of transmitting power is 10 dBm will be utilized as shown in figure 2.

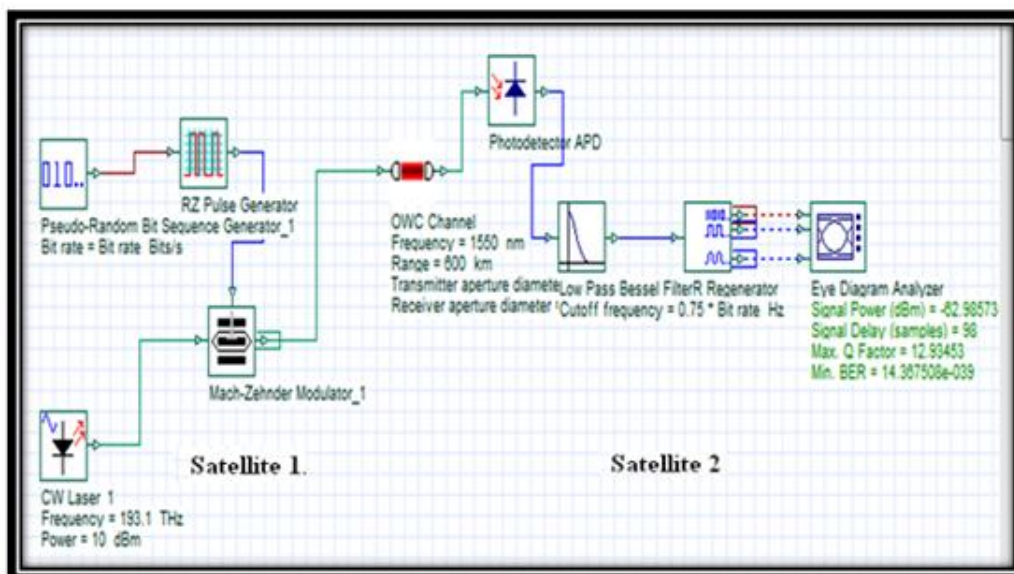


Fig.2 . IsOWC joins utilizing RZ at wavelength 1550 nm..

C. IsOWC model utilizing Gaussian pulse generator format operating at 1550 nm

In this model we utilized the modulation Gaussian pulse generator at 1550nm wavelength. The value of transmitting power is 10 dBm will be utilized as shown in

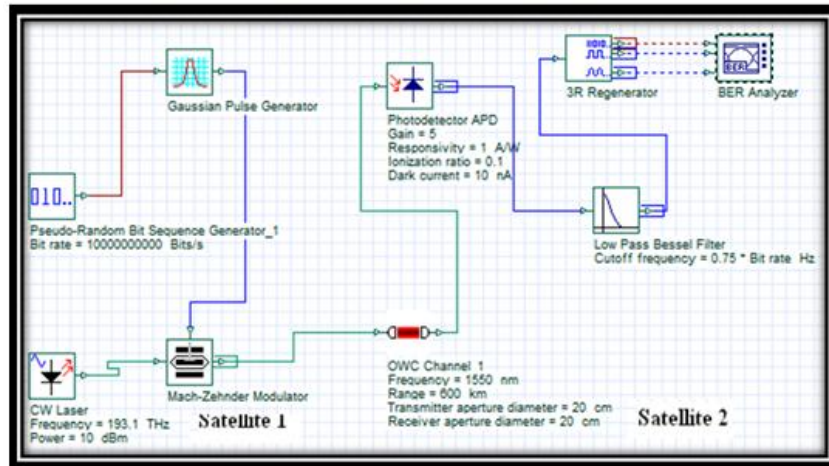


Fig.3 . IsOWC joins utilizing Gaussian at wavelength 1550 nm..

To accomplish the IsOWC join with the maximum of selected distance 600 km at data bit rate 10 Gbps and using wavelength at 1550 nm by using NRZ,RZ and Gaussian modulation formats.The type of laser used is CW laser.It can be described as the information used in shows the simulation parameter table.

Table. Simulation parameters for link at 1550nm by using NRZ ,RZ and Gaussian.

Values	Parameters
Laser	CW LASER
Transmitting power	10dBm
Transmission Bit Rate	10 Gbps
Link distance	600km
Modulation type	NRZ,RZ,Gaussian
Photo detector Type	APD (Avalanche Photodiode)
Additional losses	0.2dB
Aperture diameter of Transmitter and receiver	20cm
Responsivity	1 A/W
Dark current	10 nA

III. RESULTS AND DISCUSSION

In this the system distinct modulation formats have been evaluated on a single channel IsOWC link. A comparative take a look at of superior modulation schemes NRZ, RZ and Gaussian modulation formats have been developed.An the IsOWC is designed with the assist of an optisystem v9.Simulator along with two satellites with a different range of (200-400-600) km replacing outside modulated optical data rate of 10 Gbps via the unfastened-area medium at the operating wavelength of 1550 nm by way of the usage of three modulation codecs i.e. NRZ , RZ and Gaussian. Above Table indicates the performance evaluation of hyperlink by means of the use of modulation codecs between two satellites . From Fig 4. Into the Fig.6.Explain measurement of the eye diagram, Q. Factor and BER by using the BER analyzer device of link in which the range is 600 km at the data rate is 10 Gbps with the wavelength is 1550 nm by the usage of the three different modulation with transmitting and receiving diameter is20cm.

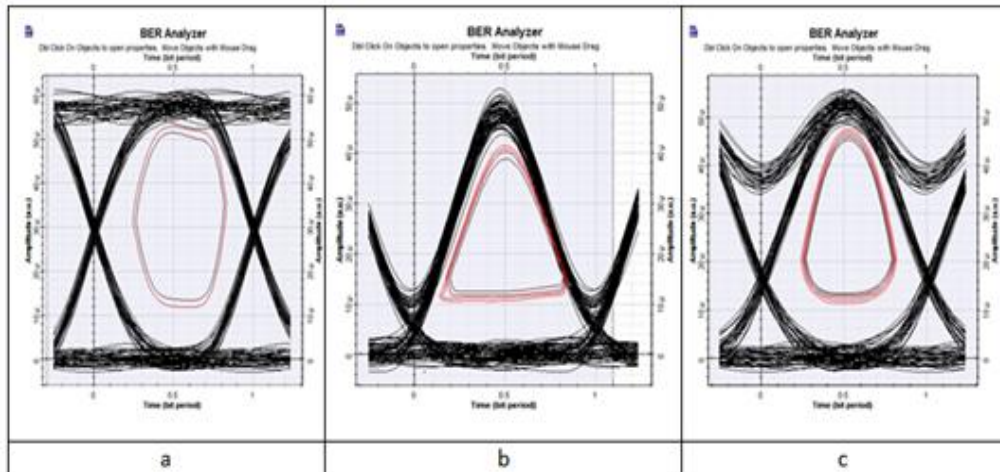


Fig. 4 :Eye diagram of IsOWC system at range 600km, (a) NRZ Pulse Generator (b) RZ Pulse Generator .(c) Gaussian pulse generator.

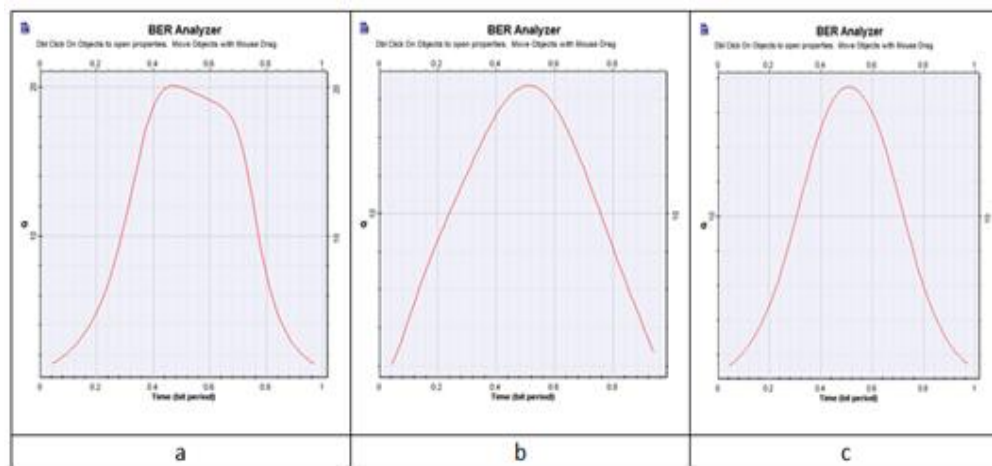


Fig.5:Maximum Q. Factor of IsOWC system at range 600km, (a),NRZ Pulse Generator (b) RZ Pulse Generator. (c). Gaussian pulse generator.

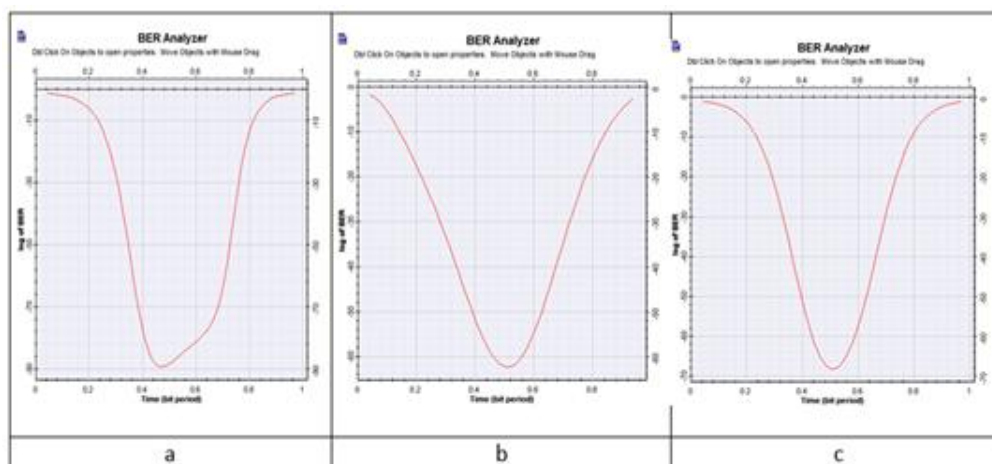


Fig.6 :Minimums BER of IsOWC system at range 600km, (a),NRZ Pulse Generator (b) RZ Pulse Generator .(c) Gaussian pulse generator.

The relation between most extreme Q-Factor with the range, which show ended in Fig.7.This relationship, which depends on the different distance from 200km in to 600 km. The power transmitted is believed for a set value of 10dB. The aperture diameter is setting on 20cm for three modulations of format.

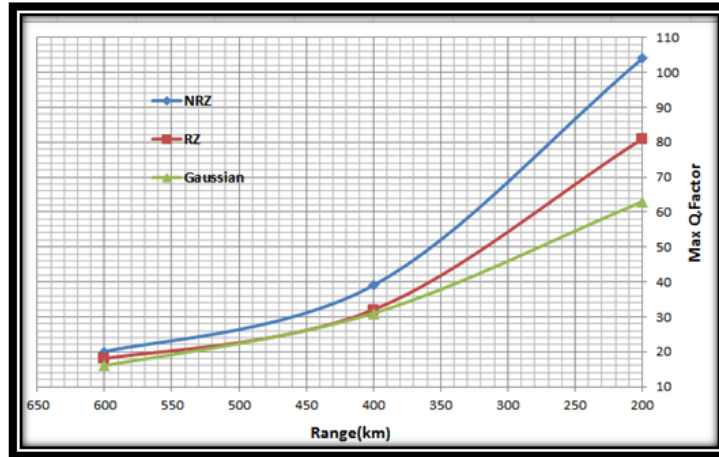


Fig.7. Q-Factor vs Range for three different formats.

Fig.8 demonstrates the diagram amongst Max. Q.Factor and receiver aperture diameter, which variable from 10cm into 20cm at an information rate of 10Gbps. It has been demonstrated that there is an increase in Q.Factor when increasing receiver aperture depending on the type of modulation will be used.

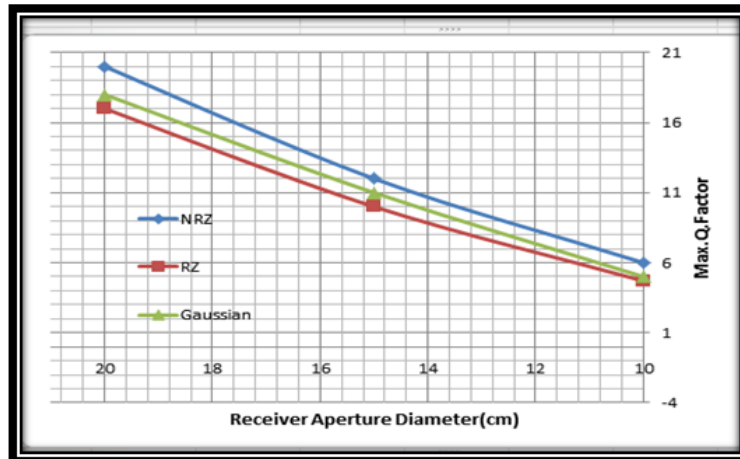


Fig.8 Q-Factor vs Receiver Aperture Diameter for three different formats.

The graphs 9 show the relationship between Min. BER and the range for different distances between two satellites at three types of modulation format.

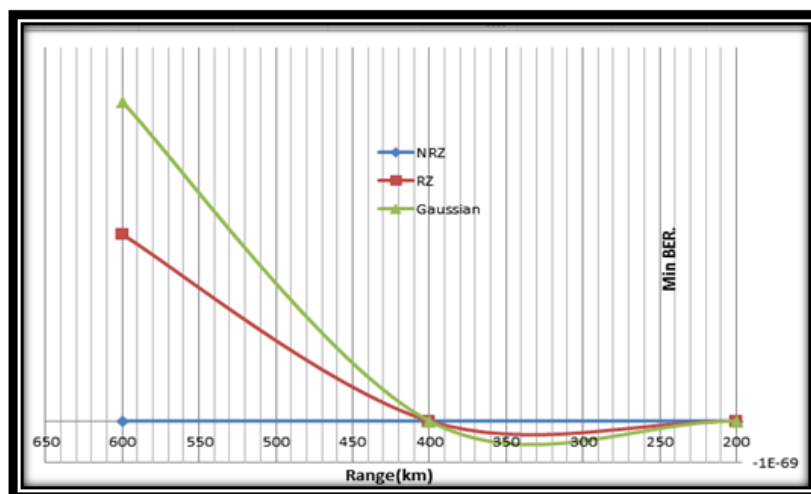


Fig.9 Min. BER vs Range for three different formats

In this paper, have a look at the overall performance of the inter satellite optical wireless conversation can be predestined in a lot ways, together with the aid of studying the Q-Factor and Min. BER. The BER we can say to be the proportion of the variance of bit mistakes disclose in the receiver and the quantity of bits transmitted, a Q-Factor is one of the vital signs of the degree the optical overall performance through which the BER is characterized. Fig. 4 into Fig 6 explain the eye diagram of link in which the range is 600 km and the data rate is 10 Gbps, which operation on wavelength is 1550 nm with the aid of using modulation NRZ, RZ and Gaussian with transmitting energy 10 dB., the Q factor is 20, 18 and 17 and Min BER. Are 4.6×10^{-90} , 4.5×10^{-69} and 7.7×10^{-69} respectively. Fig. 7 Show the relation between maximum Q-factor with a variation of the range when compression results at 400km for three format NRZ, RZ and Gaussian 39.3, 32 and 31 respectively. Through these results it appeared that NRZ gives the best results. Fig. 8 explain the relationship of Max. Q-Factor and receiver aperture diameter, for NRZ, RZ and Gaussian format is 20, 18 and 17 respectively at receiver aperture 20cm.

IV. CONCLUSION

In this work, the different modulation schemes of NRZ, RZ and Gaussian are compared with varying transmission distances and the receiver aperture diameter at 10Gbps system. The proposed gadget gave exact effects as proved from analyzing the signature course become numerous parameters of the system treats are varied. Consequently, the impact diameters of aperture and range on system conduct is investigated. IsOWC system execution is examined in phrases of Max. Q-Factor, and Min BER. The estimation diameters of aperture across differing from 10 cm to 20 cm. It's far watched that as whilst increasing the values of aperture diameters, the Q-element increases, however the bit error rate is decreasing, because inversely proportional between the Q-Factor and the Min. BER. But the range increased from 200km into 600km with a constant value of receiver aperture diameters, the value Q-factor diminished then the bit error rate is additionally expanded. Through the results we have obtained, conclude that NRZ is better than RZ and Gaussian modulation. Because there is higher Q-Factor and minimum BER in NRZ rather than RZ and Gaussian modulation

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