



## Impact of various multiplexing, modulation and coding techniques on ISOWC System: A Review

<sup>1</sup>Shubham Sharma, <sup>2</sup>Gurjot Kaur Walia, <sup>3</sup>Harminder Kaur

<sup>1</sup>M. Tech Student, ECE <sup>2,3</sup>Assistant Professor, ECE

Guru Nanak Dev Engineering College, Ludhiana, India

<sup>1</sup>sharmashubu33@gmail.com, <sup>2</sup>gurjotwalia@yahoo.com, <sup>3</sup>aulakh.harminder@gmail.com

### ABSTRACT

Nowadays, Inter satellite Optical Wireless Communication is considered as a cutting edge technology to establish communication in space. It is among the most imperative applications of FSO and provides excellent framework to achieve power efficient and high bandwidth allocation for an optical system. The purpose of this paper is to review speed and to improve the data transmission capacity with minimum BER. The comparative analysis is done on the basis of literature to investigate the optimum technique which will work excellent for an ISOWC system. Besides, pointing errors are also outlined for ISOWC systems. This summarized paper will help to create a new idea to design a base framework for ISOWC systems in near future based on the conclusions drawn in the past.

**Key words:** Inter satellite Optical Wireless Communication, Bit Error Rate, Modulation, Multiplexing, Free Space Optics.

### INTRODUCTION

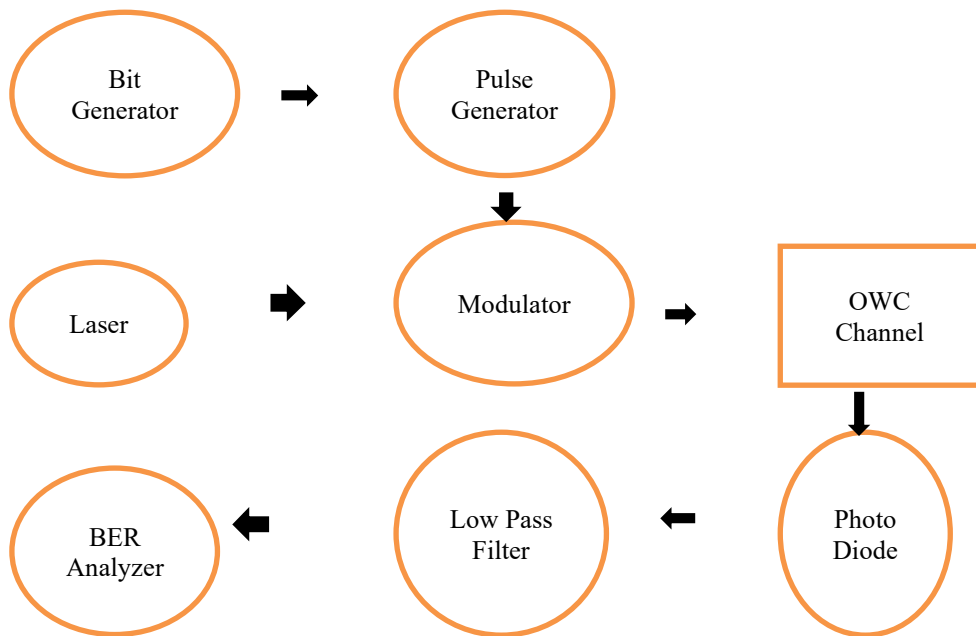
In the recent years a massive growth is witnessed in the field of communication. This gives birth to a new technology which is OWC. It has many advantages over RF (Radio Frequency Signal) technology and due to these advantages OWC is used in various applications. When Laser due to its coherent properties intensively used to communicate in space then it becomes ISOWC. It has various properties like high speed and high data carrying capacity. Now with the time new improvements are done in this like many different types of modulation and various kind of multiplexing techniques are used in it to make the system more advance and more effective. Some modulation techniques are as: -

- ASK (Amplitude Shift Keying): - Frequency and phase of carrier signal remains constant in this modulation technique while its amplitude varies. The carrier is transmitted only when value of signal is 1 otherwise transmission not happens.
- PSK (Phase Shift Keying): - The amplitude and frequency of carrier signal remains constant in this and phase is varied in terms of sine and cosine.
- FSK (Frequency Shift Keying): - The frequency of carrier signal is varied in this modulation technique. It is used for caller ID etc.
- DPSK (Differential Phase Shift Keying): - There is no reference signal present in DPSK. The comparison of next input signal after shifting its phase is done with previous signal.

- QPSK (Quadrature Phase Shift Keying): - Two successive bits are grouped together in this type of modulation and they are modulated together.
- QAM (Quadrature Amplitude Modulation): - It is used for both analog and digital signals. The amplitude of two transmitted carrier waves are varied with time using ASK. It has phase difference of 90 degrees but has same frequency. Hence, they are known as Quadrature Carriers.

**IS-OWC SYSTEM**

The block diagram of Is-OWC System is as under.



**Fig. 1** Block diagram of Is-OWC System

A bit sequence generator here is used to generate bits then these bits inserted to pulse generator. Trains of pulses are generated by pulse generator. Then its output is fed to modulator. There is a laser present there which is used to produce high beam of light. The laser beam light and data of pulse generator are modulated. The signal after modulation transmit to optical channel and receiving end contains photo diode and low pass filter which is used to covert signal into original form and do necessary filtration in the signal. At the end BER is used to provide required Q factor.

**RELATED WORK**

Reference No	Year	Methodology	Outcomes
[1]	2021	Mode division multiplexing technique and Non Return to zero coding technique	Data is successfully transmitted of inter satellite link over 1600 kms
[2]	2019	Mode Division multiplexing, Manchester Coding technique and DPSK, DQPSK as modulation techniques	Best performance is shown by DQPSK as compared to DPSK and Manchester which is at 2500 kms.
[3]	2019	Mode division multiplexing and modulation techniques like CSRZ-DQPSK, MDRZ-DQPSK and DRZ-DQPSK.	Best Q- factor with minimum BER is shown by MDRZ-DQPSK among all three.
[4]	2020	WDM and PDM as multiplexing technique	The information is successfully transmitted with acceptable Q-factor over 58000 kms
[5]	2020	PDM as multiplexing and QPSK as modulation technique.	Data is successfully transmitted over 40000 kms with acceptable BER.
[6]	2021	DWDM as multiplexing technique	160 Gbps data transmitted over 7000 kms with

			optical amplifier with minimum power
[7]	2019	DP-QPSK as modulation and OFDM as multiplexing technique.	Data is successfully transmitted to 15600 kms with laser power of 30 db and BER value of - 2.42.
[8]	2020	Hybrid Multiplexing Technique WDM-TDM is used	WDM is recommended due to better performance.
[9]	2019	WDM as multiplexing and various modulation techniques used.	RZ technique shows performance as compared to other techniques having minimum BER and good Q-factor.
[10]	2016	PSK, DPSK and OQPSK as modulation techniques	OQPSK shows better results and transmits data over 90 kms with Minimum BER and good Q-factor
[11]	2016	RZ and NRZ as coding Technique	NRZ shows better results with Q Factor of 6.45 and minimum BER.
[12]	2019	Hybrid WDM-TDM as multiplexing and AMI, DPSK and chirped as modulation techniques	WDM-TDM- DPSK technique shows best results
[13]	2020	MDM as modulation technique	The data is transmitted up to 6000 kms with acceptable Q factor > 6db
[14]	2020	Various modulation techniques	NRZ is better among various modulation techniques.
[15]	2015	NRZ and RZ as modulation techniques	NRZ performs better than RZ due to high Q factor and low BER.
[16]	2016	WDM as multiplexing and NRZ as coding technique.	Data is transmitted over 1000 kms with 120 Gbps speed.
[17]	2016	Modulation Techniques like CO QPSK, CO QAM CO-16 PSK etc.	Best results are shown by CO QPSK and CO QAM .
[18]	2019	DPSK Modulation with and without Manchester Coding	DPSK with Manchester Coding shows better results
[19]	2016	RZ, NRZ and DPSK Modulation techniques	RZ with DPSK shows better performance.
[20]	2017	4 Quadrature Shift Modulation and 4 Phase shift modulation techniques	4 Quadrature Shift Modulation technique is better
[21]	2019	PDM as multiplexing technique and 4QAM encoding technique	Data is transmitted up to 60000 kms with acceptable SNR

### CONCLUSION

The conclusion is that by using different modulation techniques Is-OWC system shows better results than without using any technique. By using different modulation techniques system shows different performance. But NRZ coding technique shows better results of all and hybrid of MDM-WDM Multiplexing technique shows better results.

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