PERFORMANCE COMPARISION OF 5G – 28GHZ SIGNAL TRANSMISSION OVER FSO LINK IN DUSTY WEATHER CONDITIONS USING BPSK, FSK, OOK MODULATION

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Abstract--- Dynamic 5G remote systems guarantee to give enormous data transfer capacity to different sorts of associations. In such systems, the backhaul/fronthaul areas ought to be anything but difficult to convey and bolster the necessary high data transmission. To improve the free space optic (FSO) connect transmission capacity with the goal that it can supplant fiber links and bolster 5G systems, all-optical FSO frameworks were proposed which adventure propelled tweak designs in the transmitter side and sound location in the collector side. Be that as it may, such connections will endure a lot under cruel outside condition, particularly under mist and residue conditions than conventional FSO joins that have constrained transfer speed. Impact of haze on such connections has been examined in the writing. Be that as it may, the residue impact isn't secured. Right now, first tentatively examined the impacts of residue storms on the presentation of an all-optical FSO interface conveying a Binary shift keying, Frequency shift keying, On OFF keying5G signal. The outcomes exhibit that the all-optical FSO interface is fundamentally influenced by low perceivability go, with serious piece mistake rate (BER), and blunder vector extent (EVM) limits showing up at a 50-m perceivability extend for a 2.7-m channel length. For a perceivability run more prominent than 200-m, the BER and EVM were improved to 10□9 and 5.5% of the root mean square, separately. Moreover, the investigation demonstrated that the residue storm condition presents _at blurring over the recurrence extend under examination, i.e., 21_29 GHz. Second, an examination among FSO and radio recurrence (RF) channels under the equivalent dusty conditions were performed. The outcomes demonstrated that the impacts of the residue storm are immaterial for the RF connect which makes it appropriate as a reinforcement for FSO interface under serious residue conditions. At last, a crossover fell FSO/RF connect was introduced and investigated as far as perceivability range, BER, and EVM the outcomes determined are BER, Eye diagram.

Keywords—Free Space Optical Communication, EDFA, RAMAN, SOA, Hybrid Optical Ampifier, Attenuation.

1. INTRODUCTION

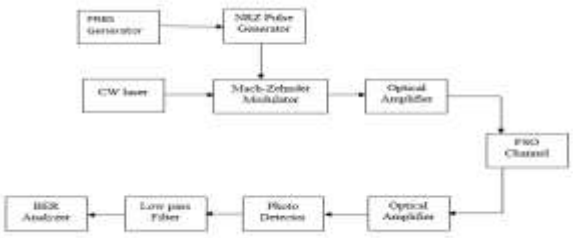
FSO could be a communication system wherever free house acts as medium between transceivers and that they ought to be in LOS for no-hit transmission of optical signal. Medium may be air, location, or vacuum. This techniques may be used for communication purpose in hours and in lesser economy. FSO is Associate in nursing optical communication technology during which knowledge is transmitted by propagation of sunshine in free house permitting optical property. There is no requirement of the optical fiber cable. The working of FSO is similar to OFC(Optical Fiber Cable)network but the only difference is that the optical beam are send through free air instead of OFC cores that is glass fiber. Mobile wireless networks are evolving rapidly to cope with massive capacity demands that are dominated by video consumption and social network applications. Currently, 4G wireless networks are able to connect individuals with a download speed of up to 100 Mbps. However, this connection speed must be improved to match the increased bandwidth consumption. In addition to connectivity for individuals, 5G is designed to provide interconnection for devices and machines through the internet of things, as well as in smart city networks with the capability to control such devices, thereby facilitating new services and industries. Therefore, future 5G networks are expected to provide broadband high-speed connections of up to 20Gbps. Providing higher capacity in addition to enhanced broadband services requires the connectivity of machines and sensors to be managed on multiple radio bands. Instead of using traditional IM/DD FSO systems that are limited in bandwidth, future demonstrations will use all- optical coherent FSO system and exploit advanced modulation formats to improve the bandwidth efficiency and hence support high bandwidth links, needed by 5G networks.

However, the channel in such systems is more challenging and can highly limit their applications. Therefore, in this

study, we experimentally investigate and the performance of all-optical coherent FSO links that can support 5G networks under harsh dusty conditions. The analysis will consider first the performance of an FSO link carrying a Binary phase shift keying, Frequency shift keying, On OFF keying modulations 5G signal. Then, we investigate and compare the effects of dust on parallel hybrid FSO/RF links, both carrying the same signal. After that, we analyze the performance of a cascaded hybrid FSO/RF link carrying a 5G signal in terms of received power, bit-error-rate (BER), and Eye diagram. To the best of our knowledge, this study is the first to consider all-optical coherent FSO transmission of 5G signals over dusty weather conditions. Binary Phase Shift Keying (BPSK) is a two phase modulation scheme, where the 0's and 1's in a binary number. FSK is the digital modulation technique in which the frequency of the carrier signal varies according to the digital signal changes. FSK is a scheme of frequency modulation. On Off Keying denotes the simplest form of amplitude-shift keying (ASK) modulation that represents digital data as the presence or absence of a carrier wave.

2. FSO COMMUNICATION SYSTEMS

The block diagram of the FSO communication system is shown in Figure 1.



The block diagram of the FSO Communicat system is shown in Figure 1.

In free space optics (FSO) system the laser beam is Exploited to send very high bandwidth data from the source

Point to the destination point through the free space atmospheric channel. This can also be attained by applying a modulated narrow laser beam by transmitted through the transmitting antenna and later on received at the receiver antenna in the atmosphere.

FSO is an optical communication method where light is exploited to transfer information through the air as the medium. There is no need of fibre optical cable. The function of FSO is similar to that of fibre optical cable, except the fact that here optical beams are spread through the air instead of fibre. It also provides full duplex communication as it comprises of optical transceivers at both ends. Each block of the FSO system is explained below. FSO system can be described as:

A. FSO Transmitter

Figure 1 shows the block diagram of the FSO communication system. Free space optical communication system comprises of three main functional blocks they are, transmitter, atmospheric channel, and receiver. At the modulator using intensity modulation and the electrical signal is converted into an optical signal using optical sources like LED or LASER. Light sources are exploited for the transmission of data via light. It also propagates via free space from transmitter to receiver and then transmits data at higher data rate. The light sources like LED or LASER has been exploited to transmit the data.

B. FSO Channel

Free space or air or vacuum can be act as the communication medium in FSO system. Data can be transmitted through any one of these mediums from transmitter to receiver. Fog, rain, dust, smokes these are the some atmospheric aspects which affects the communication.

C. FSO Receiver

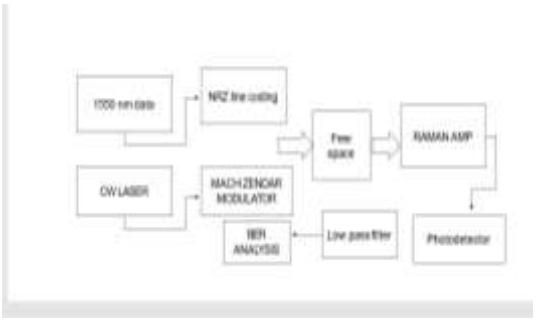
The optical detector in the receiver is utilized to find the received data. The optical detectors can be either PIN photo detector or APD photo detector. The photo detector is basically a square law optoelectronics transducer which is mainly used to generate an electrical signal. The photo detector at the receiver has to face some of these tight performance requirements such as a low noise level, an adequate bandwidth and high performance. As because this optical signal is usually weak, also it has to travel via communication channel the telescope at the receiver exploited to receive the transmitted signal and send it to the optical fibre. The optical fibres are designed in such a way to pass only the wavelength of the signal and blocks all other radiation from the atmosphere. The optical signals are then changed to the electrical signal by the detector and sends it to the amplifier. As shown in figure 1, the transmitter blocks consist of, NRZ pulse generator, Mach Zehnder Modulator, a laser source and PRBS (Pseudo Random Bit Sequence) generator.

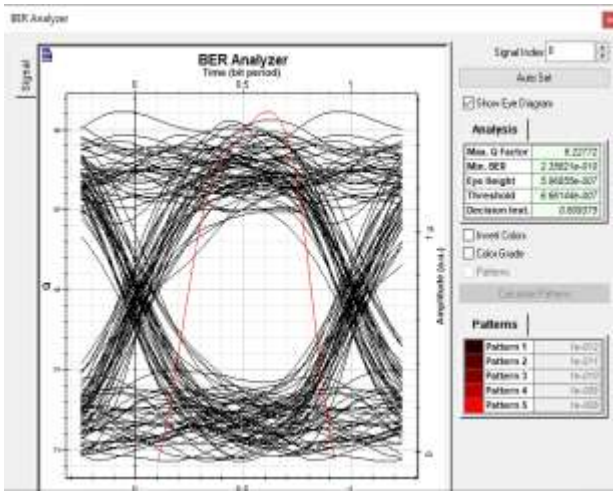
The Mach Zehnder Modulator at first encodes the data which have been yielded by the pseudo random bit sequence generator and then modulates the data into light. The CW laser used here is acting as the origin of carrier. Optical amplifiers are then used to amplify the light modulated signal and transmitted to the receiver through any of the free space optical or medium. These signals are then received by the photo detector by APD and low pass Bessel filter is exploited to filter the quality signal from noise.

3. PERFORMANCE ANALYSIS OF BPSK

Binary section shifting keying may be a 2 PM theme, wherever the zero's and one's during a binary message square measures pictured by 2 totally different section states within the carrier signal: zero degree for binary 1 and one hundred eighty degree for binary 0.In digital techniques, a collection of basis function square measures chosen for a selected modulation theme. Basis function will be derived victimization Gram Helmut Schmidt Orthogonalization procedure. In BPSK, just one sinusoid is taken because the basis operate.

Block diagram of BPSK





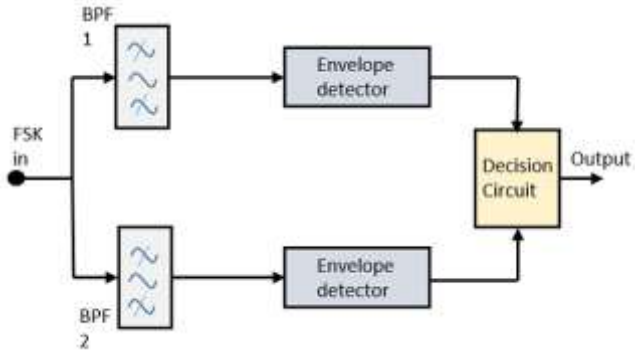
The above figure shows the eye diagram of BPSK.

4. PERFORMANCE ANALYSIS OF FSK

FSK is the advanced balance method where the recurrence of the transporter signal shifts as indicated by the computerized signal changes. FSK is a plan of recurrence regulation.

The yield of a FSK adjusted wave is high in recurrence for a parallel high info and is low in recurrence for a twofold low information. The parallel 1s and 0s are called imprint and space frequencies. The FSK modulator square chart involves two oscillators with a clock and the info parallel grouping. The two oscillators, creating a higher and a lower recurrence signals, are associated with a switch alongside an interior clock. To evade the sudden stage discontinuities of the yield waveform during the transmission of the message, a clock is applied to both the oscillators, inside. The paired 1s and 0s are called imprint and space frequencies. The FSK modulator square chart includes two oscillators with a clock and the info parallel arrangement the two oscillators delivering a higher and a lower recurrence signals are associated with a switch alongside an inner clock. To evade the unexpected stage discontinuities of the yield waveform during the transmission of the message a clock is applied to both the oscillators , inside. The paired info succession is applied to the transmitter in order to pick the frequencies as indicated by the twofold information. The are various strategies for demodulating a FSK wave. The fundamental techniques for FSK recognition are offbeat finder and synchronous detector. The synchronous identifier is a rational one, while no concurrent locator is a non-reasonable one. The square graph of Nonconcurrent FSK indicator comprises of two band pass channels, two envelope finders, and a choice circuit.

BLOCK DIAGRAM FOR FSK



BER

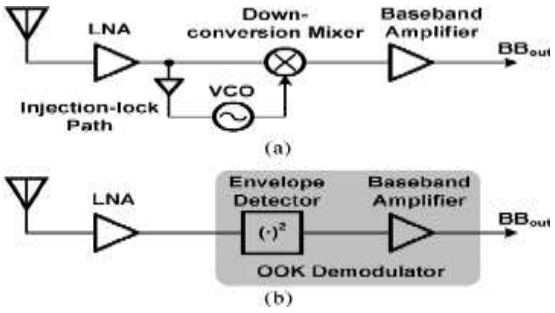
Bitrate=150e+009
Order = 16.

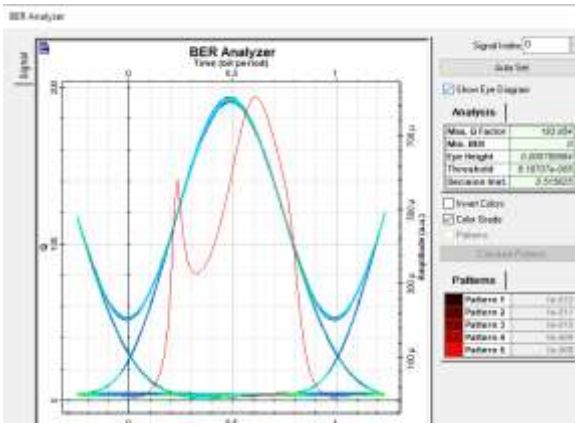
The above figure shows the FSK simulation.

5. PERFORMANCE ANALYSIS OF OOK

On-off scratching (OOK) indicates the easiest type of abundancy move scratching (ASK) adjustment that speaks to computerized information as the nearness or nonappearance of a bearer wave. In its least complex structure, the nearness of a bearer for a particular term speaks to a paired one, while its nonappearance for a similar span speaks to a twofold zero. Some increasingly complex plans fluctuate these terms to pass on extra data. It is undifferentiated from unipolar encoding line code. On-off keying is most usually used to transmit Morse code over radio frequencies alluded to as CW (ceaseless wave) activity, despite the fact that on a basic level any advanced encoding plan might be utilized. OOK has been utilized in the ISM groups to move information between PCs, for example. OOK is more frightfully productive than recurrence move keying, yet progressively touchy to commotion when utilizing a regenerative recipient or an inadequately executed excessively heterodyne beneficiary. For a given information rate, the transmission capacity of a BPSK (Twofold Stage Move keying) signal and the data transfer capacity of OOK signal are equivalent. Notwithstanding RF bearer waves, OOK is likewise utilized in optical correspondence frameworks (for example IrDA).In flight, some perhaps unmanned air terminals have gear that let pilots key their VHF radio various occasions so as to demand a Programmed Terminal Data Administration communicate, or turn on runway lights

BLOCK DIAGRAM OF OOK





OUTPUT SIMULATION FOR OOK

Max. Q Factor	193.954
Min. BER	0
Eye Height	0.000780984
Threshold	8.18707e-005
Decision Inst.	0.515625

The above figure shows the BIT ERROR RATE for OOK.

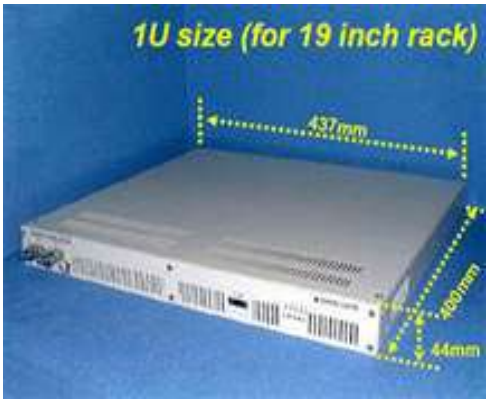
This Table shows the performance of BPSK, FSK, OOK.

Modulations	BPSK	FSK	OOK
Amplifier	RAMAN	RAMAN	RAMAN
BER	2.35821e-010	16	0
Eye height	5.96855e-007	-	8.187e-005

6. SYSTEM MODEL

RAMAN AMPLIFIER: A Raman amplifier is an optical amplifier based on raman gain, which results from the effect of stimulated raman scattering. The Raman active medium is often an optical fiber, although it can also be a bulk crystal, a waveguide in a photonic integrated circuited, a cell with a gas or liquid medium. An input signal can be amplified while counter propagating with a pump beam, the wavelength of which is typically a few tens of nanometers shoter. For application in telecom system, fiber Raman amplifiers compete with EDFA. Compared with those, their typical features are: Raman amplifiers can be operated in very difficult wavelength regions, provided that a suitable pump source is available. A Raman amplifier requires high pump power and high pump brightness, but it can also generate high output powers. A greater length of fiber is required. However, the transmission fiber in a telecom system may be used, so that no additional fiber is required. They also have a fast reaction to changes of the pump power, particularly for co-propagating pump, and very different saturation characteristics. Raman amplifier based upon the gain which results from the effect of stimulated Raman scattering. Raman amplifier is little high power pump laser when compared to other amplifiers and wavelength division multiplexing WDM. Here the amplification occur itself in the fiber and it is distributed in the path it has a wide bandwidth of 10nm. It can amplify up to 10db in optical fiber. Raman amplifier is combined with EDFA to expand gain attend bandwidth. If we insert an optical beam in the optical fiber then the Raman scattering occur in an silica glass then the signal passes through the fiber and the frequency around it through pump. Raman amplifier based on two cases Raman amplifier

distributed and discrete. Here the amplification occurs according to the fiber between two stations and it is near the transmitter then it is forwarded pump or if it is near to the receiver it is reverse pump.



The above diagram shows the block diagram of RAMAN AMPLIFIER

7. CONCLUSION

In this paper, we experimentally analysis the performance of 5G-28GHZ signal transmission over FSO link using BPSK modulation in 5G network. The obtained results shows considerable signal transmission over FSO the results are BER, SNR, EYE DIAGRAM. The FSO link was unaffected because of its large wavelength compared to the dust particle size. Therefore, a hybrid FSO link is an excellent choice to overcome dusty channel effects because

The FSO link with low bandwidth works under severe dust storm conditions and the FSO operates when weather conditions improve above a certain threshold. Thus we increase the distance of visibility range above 100m though in existing method it is about 50m.

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