DEMOTING TECHNIQUE FOR RADIO OVER FIBER APPLICATIONS

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ABSTRACT

In the modern days of communication, the total number of users is increasing. There is a need to meet the data rate, resulting in the increase of spectral efficiency. Radio-over- Fiber (R o F) helps to achieve the spectral efficiency with a marginal reduction in the bit error rate. The proposed work focuses on the Bit Error Rate (BER) analysis in a Radio over Fiber system application. Light signal from the source is modulated by Amplitude Shift Keying (ASK) modulation. This optically promoted signal of 5Gbps/15GHz is transmitted through a Single Mode Fiber (SMF) of about 40 km length, then converted into 5Gbps/30GHz and 5Gbps/5GHz with the help of Fiber Bragg Grating (FBG). The bit error rate is tested for these different signals. The BER analysis in the reception of different signals by transmitting through the fiber result in the marginal reduction of BER to achieve the required spectral efficiency.

Keywords: Radio-over-fiber, Bit error rate, Amplitude shift keying, single mode fiber, fiber Bragg Grating, SNR, Optisystem software.

I. INTRODUCTION

In the modern days of communication, the number of users is increasing in a enormous manner. There is a need to meet the data rate, resulting in the increase of spectral efficiency. Radio-over- Fiber (R o F) helps to achieve the spectral efficiency with a marginal reduction in the bit error rate. The proposed work focuses on the Bit Error Rate (BER) analysis in a Radio over Fiber system application. Light signal from the source is modulated by Amplitude Shift Keying (ASK) modulation. This optically promoted signal of 5Gbps/15GHz is transmitted through a Single Mode Fiber (SMF) of about 40 km length, then converted into 5Gbps/30GHz and 5Gbps/5GHz with the help of Fiber Bragg Grating (FBG). The bit error rate is tested for these different

II. FIBER OPTIC COMMUNICATION

An optical fiber is a flexible, transparent fiber made of extruded glass (silica) or plastic slightly thicker than a human air. It can function as a waveguide, or “light pipe”, to transmit light between the two ends of the fiber. The field of applied science and

engineering concerned with the design and application of optical fibers is known as fiber optics. Optical fibers are widely used in fiber-optic communications, where they permit transmission over longer distances and at higher bandwidths (data rates) than wire cables. Fibers are used instead of metal wires because signals travel along them with less loss and are also immune to electromagnetic interference. Fibers are also used for illumination, and are wrapped in bundles. So that they may be used to carry images, thus allows viewing in confined spaces. Specially designed fibers are used for a variety of other applications, including sensors and fiber lasers. Joining lengths of optical fiber is more complex than joining electrical wire or cable. The ends of the fibers must be carefully cleaved, and then carefully spliced together with the cores perfectly aligned. A mechanical splice holds the ends of the fibers together mechanically, while fusion splicing uses heat to fuse the ends of the fibers together. Special optical fiber connectors for temporary or semi-permanent connections are also available.

III. RADIO OVER FIBER TECHNOLOGY

Radio over Fiber (RoF) technology entails the use of optical fiber links to distribute RF signals from a central location (head end) to Remote Antenna Units (RAUs). In narrow band communications systems and WLANs, Radio Frequency (RF) signal processing functions such as frequency up-conversion, carrier modulation , and multiplexing, are performed at the Base station (BS) or the Remote Access Point (RAP), and immediately fed into the antenna. ROF makes it possible to Centralize the RF signal processing functions in one shared location (head end), and then to use optical fiber, which offers low signal loss(0.3 db/km for 1550 nm, and 0.5 db/km for 1310nm wavelengths) to distribute the RF signals to the Remote Antenna Unit (RA us). By so doing, Remote Antenna Units are simplified significantly, as they only need to perform optoelectronic conversion and amplification functions.

Multi-operated and multi-service operation

Radio over fiber (ROF) offers system operational flexibility. Depending on the microwave generation technique, the ROF distribution system can be made signal-format transparent. For instance the Intensity Modulation and Direct Detection (IM-DD) technique can be made to operate as a linear system and therefore as a transparent system. This can be achieved by using low dispersion fiber (SMF) in combination with pre-modulated RF subcarriers (SCM). In that case, the same ROF network can be used to distribute multi-operator and multi-service traffic resulting in huge economic savings. The principles of Optical Frequency Multiplication (OFM), which is the focus of this is can also be used to achieve multi-service operation in combination with either WDM or SCM, because it is tolerant to chromatic dispersion.

IV. LITERATURE SURVEY

Several researches have come up with the idea of Radio over Fiber wave system by using different technologies [1].This paper mainly proposed the transmission distance of a 100GHz DD-OFDM-ROF system through the reduction of chromatic dispersion-induced phase noise. The implementation of a pilot-aided phase noise suppression scheme enabled the transmission of distance-insensitive 16.97-Gbps QPSK OFDM over 0~150-km fiber and 2-m air transmission via a DFB laser with line width of 1~10-MHz and applied bit loading algorithm. Disadvantage –the use of an optical local oscillator in the CO scheme requires an additional laser and an optical hybrid coupler at remote nodes, with increases complexity and costs.

Cheng-ling ying, et al [2] proposed a hybrid WDM light wave transport system based on fiber – wireless and fiber-VLLC convergences. It describes for microwave or baseband signals that are transmission based on fiber-wireless and fiber-visible laser light communication convergences is proposed and demonstrated. A broadband light source with an optical signal- to-noise enhancement scheme in this is employed. Light is optically promoted from a 5Gbps/15GHz RF data signal to 5Gbps/60GHz MMW and 5Gbps/30GHz MW data signal the fiber wireless convergences. Disadvantage – Adding noise and fiber dispersion degrades the transmission performance because of the nature characteristics of the two optical sidebands.

Masha Najafi et al [3] proposed a Synchronization of a MIMO-OFDM based radio-over-fiber communication system in the presence of phase noise. It describes the impact of ROF optical subsystem on the sensitivity to the phase noise of OFDM in a MIMO system is evolved and a method for reducing effect of these phase noise is presented using computer simulation. Disadvantage- the effective approaches to compensate the nonlinear effects of the optical subsystem for AWGN channel in MIMO-OFDM-ROF system. The system performance degrades by decreasing the OBO or equivalently, increasing the nonlinearity of optical system.

A. Mohamed et al [4] proposed a Transmission characteristics of radio over fiber (ROF) millimeter wave system in local area optical communication networks. It presented and modulated with parametrical investigation the transmission performance characteristics of the ROF system that is modulated with multiple bits rates using different transmission techniques such as soliton, and maximum division multiplexing techniques. These are employed through two ultra multiplexing techniques, 4 links SDM , DWDM over optical window of special interest. Disadvantage Unwanted crosstalk is referred to as in homodyne or heterodyne or inter channel crosstalk, or simply as out of band crosstalk this does not severely impair network performance as it is at a different wavelength as the desired signal and is simply added to the signal in the electrical Beena R.ballal, Dr.shika nema proposed a digital radio over fiber links to overcome impairments in fiber wireless networks. It describes a digitized RF-over-fiber transmission scheme based on band pass sampling theory is being introduced. Various impairments of analog ROF link such as nonlinearity, inter modulation distortion, chromatic dispersion can be mitigated by use of digital radio over fiber link.BER and SNR for various input schemes such as BPSK, QPSK and 16 QAM are analyzed for analog and digital link and comparison is presented. Impairments of fiber wireless network such as nonlinearity are being over combed by using digital radio over fiber link. Disadvantage – it inherently suffer from intermodulation distortions arising from the nonlinearity of both microwave and optical components that make up the optical link.

V. EXISTING SYSTEM

The existing system is that it requires the input signal to be at baseband or low frequency in the case of a data-modulated sub-carrier signal. In the section, they investigate the impact of channel response flatness on the performance of the two RoF system architecture. They compare the performance of the two IMDD RoF system architecture when delivering 60GHz wireless signals, which are ASK-modulated with data-rates up to 4Gbps and transported over 500m of standard single mode fiber. We study in detail the performance improvement due to feed forward equalization (FFE) on each system. This system support multi standard wireless communication at data speeds exceeding only 14Gbps. In the past voice and low bit-rate data services were the focus of wireless communication .these services have been adequately provided by the existing wireless system having data speed of up to few tens of Mbps

VI. METHODOLOGY IN PROPOSED SYSTEM

ASK MODULATION

The transmission of digital signals is increasing at a rapid rate. Low frequency analogue signals are often converted to digital format (PAM) before transmission. The source signals are generally referred to as baseband signals. An antenna of this size is not practical for efficient transmission. The low-frequency signal is often frequency translated to a higher frequency range for efficient transmission. The use of a higher frequency range reduced antenna size. Amplitude shift keying (ASK) modulation is the form of amplitude modulation. It represents the digital data as variation in the amplitude of a carrier wave. In ASK modulation, if signal value 1, then carrier signal will be transmitted. Otherwise a signal value of 0 will be transmitted. It is also called as ON-OFF KEYING. Fig 3.2 shows the ASK waveform. An amplitude-shift keying (ASK) signal can be defined by

$S(t) = A\, m(t) \cos 2\pi f c t,\ 0<t<T$

Where A is a constant,

M (t) =1 or 0,

F c is the carrier frequency, and

T is the bit duration. It has a power $P=A^2/2$,

So that $A=\sqrt{2P}$. Thus S (t) can be written as

$$S(t) = \sqrt{\frac{2}{T}} COS 2\Pi f_c t$$

SIGNAL TO NOISE RATIO

It is defined as the ratio of the signal power to the noise power, often expressed in decibels. A ratio higher than 1:1 (greater than 0 db) indicates more signal than noise. While SNR commonly quoted electrical signal, it can be applied to any form of signal. The signal to noise ratio, bandwidth and the channel capacity of the communication channel are connected by the Shannon-Hartley theorem. Signal to noise ratio is sometimes used informally to refer to the ratio useful information false or irrelevant data in a conversation or exchange.

SNR for various modulation systems

Amplitude modulation

Channel signal-to-noise ratio is given by

$$(SNR)_{C,\,AM} = \frac{A_C^2\,(1+K_a^2 P)}{2WN_0}$$

Where W is the bandwidth and k_a is modulation index.

IMPROVING SNR in practice

The real measurements are distributed by noise. This includes electronic noise, but can also include external events that affect the measured phenomenon-wind, vibration, gravitational attraction of the moon , variations of temperature, variation of humidity, etc., depending on what is measured and of the sensitivity of the device. It is often possible to reduce the noise by controlling the environment. Otherwise, when the characteristics of the noise are known and are different from the signals, it is possible to filter it or to process the signal.

VII. BLOCK DIAGRAM

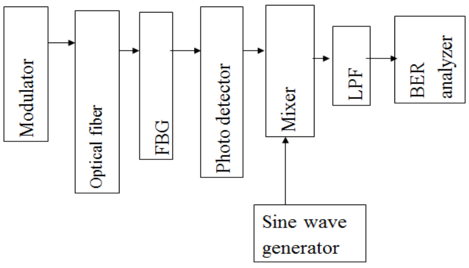

Fig 1 Block diagram

The BLS modulated at 5Gbps data stream mixed with 15GHz RF carrier to generate the 5Gbps/15GHz amplitude shift keying (ASK) data signal. The output of the modulator is passed through the optical fiber. And the data signal is given to the fiber Bragg Grating. Here the signal is separated with respect to odd and even channel. The outputs with even sidebands are fed into a photo detector. Then the signal is mixed with sin wave signal which is generated by sine wave generator. The data signal is filtered by using low pass filter then the corresponding bit error rate is analzised with the help of BER analyzer.

VIII. Layout diagram

The layout diagram of the proposed system in optiwave system software is shown in fig 2

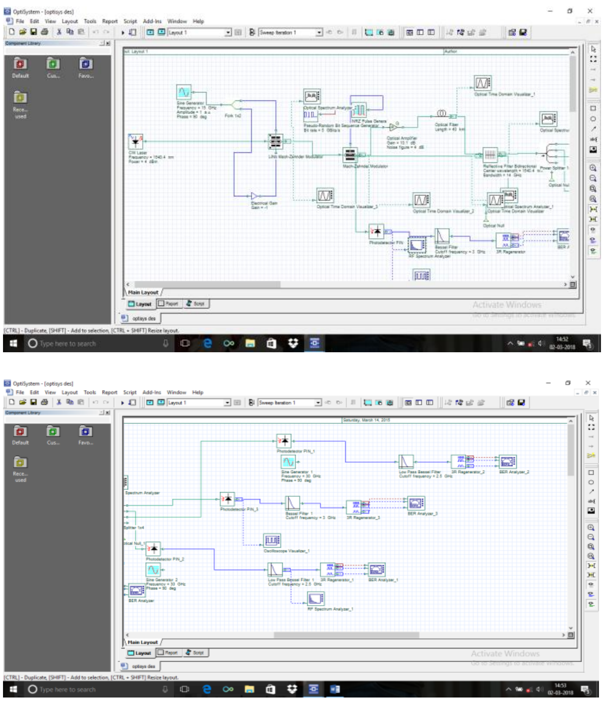

Fig 2. Optisystem layout diagram of proposed system

IX. RESULT AND DESCRIPTION

RESULT OF 5Gbps/5GHz SIGNAL

The result of the 5GHz signal is shown in Fig 3.

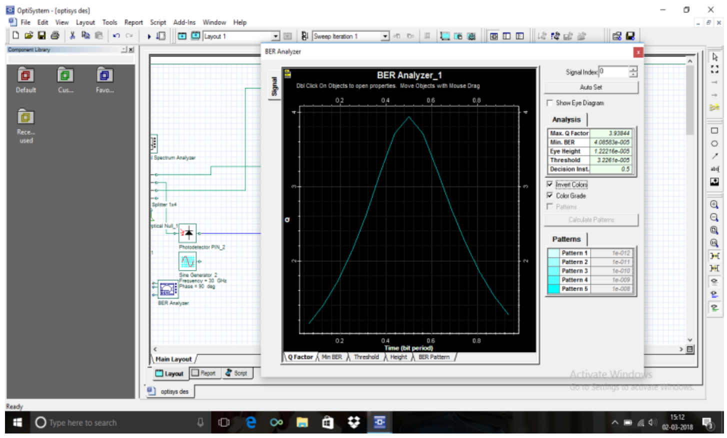

Fig 3. 5GHz signal pulse

The duration of the 5GHz signal pulse is 0.85s. it start from 0.1s and ends at 0.95s. And the amplitude of the pulse is 140 micro volts.

Eye diagram

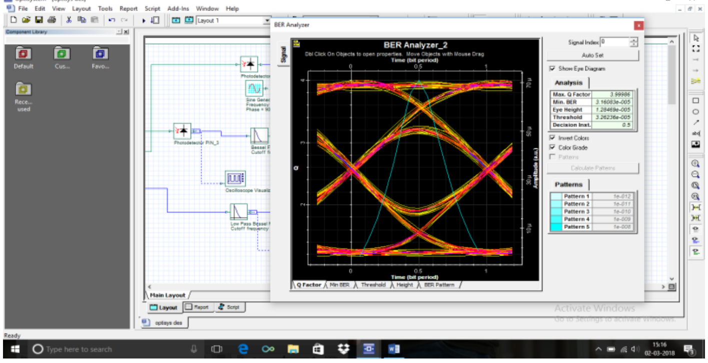

Fig 4 Eye diagram of 5GHz signal

The eye pattern of the 5Gbps/5GHz signals is shown in Fig. this pattern is obtained after the transmission of the signal through filter. Here the signal power is 100 μ V and the noise power is 6 μ V. The signal to noise ratio of the 5Gbps/5GHz signal is 12.6dB and the jitter value is 0.08s. this bit rate (BER) of 2.7×10^{-6} is obtained.

Result of 5Gbps/30GHz signal

The result of the 5Gbps/30GHz signal is shown in Fig 4.

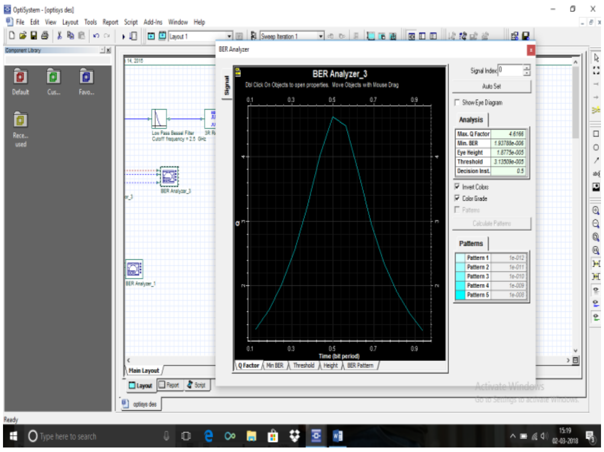

Fig 5. 5Gbps/30GHz signal

The duration of the 5Gbps/30GHz signal pulse is 0.85s. It starts from 0.1s and end at 0.95s. And the amplitude of the pulse signal is 300 micro volts (μ V).

Eye diagram

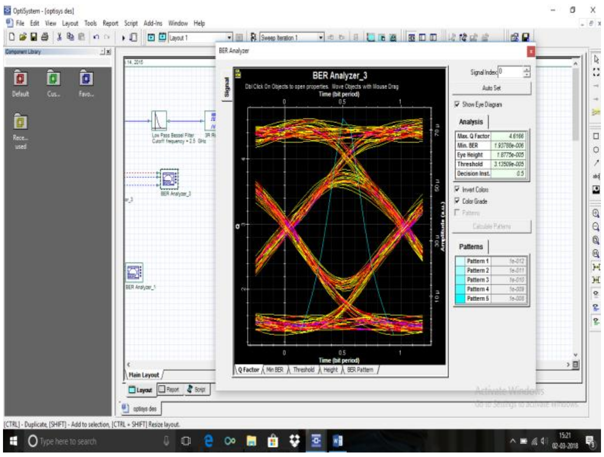

Fig 6. Eye diagram of 30GHz signal

The eye pattern of the 5Gbps/30GHz signal is shown in Fig.6. This pattern is obtained after the transmission of the signal through filter. Here the signal power is 120 μ V and the noise power is 6 μ V. The signal to noise ratio of the 5Gbps/5GHz signal is 13dB and the jitter value is 0.98s. this bit rate (BER) of 2.73×10^{-6} is obtained.

X. CONCLUSION

The base band signal is modulated by the amplitude shift keying (ASK) modulation and the it is transmitted via single mode fiber (SMF). At the end of fiber it is promoted to 5Gbps/30GHz microwave signal by the means of fiber Bragg Grating (FBG). Then the bit error rates 5Gbps/5GHz baseband signal and 5Gbps/30GHz microwave signal are analyzed by the use of bit error rate tester (BERT).

An average bit error rate around 10^{-6} is obtained for both the base band and microwave signals with the consequent increase in the spectral efficiency. Thus the transmission of different signals in Radio over Fiber (ROF) system application ns helps to achieve the spectral efficiency.

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