Effect of Noise on the Performance of SCM Radio Over Fiber System

Rabia Kousar[1*], Rakesh Goyal[2], Amit Gupta[3], Monika Rani[4]
[1]*M. Tech Student I.K.G. Punjab Technical University Kapurthala*
[2,3]*Assistant Professor, I.K.G. Punjab Technical University Kapurthala*
[4]*Assistant Professor, Kanya Maha Vidyalaya, Jalandhar*
Email: [1]areebachoudhary86@gmail.com, [2]drrakeshgoyal15@gmail.com
[3]amitguptacgc@gmail.com, [4]gargnitk24@gmail.com

***Abstract*— Now days the growing petition for bandwidth in optical communication persuades the expansion of high data speed and low-cost optical broadcast. Radio-over-Fiberknowledge is measured as an effective and applied solution for providing (broadband wireless admittance). In this paper, Radio-over-Fiber (ROF) system using Subcarrier Multiplexing/Amplitude Shift Keying techniques to transmit signal. The wavelength is common for both up-link and down-link channel and 1Gbps data rate is distribute over the distance 21 km bidirectional optical fiber. Reflective Filter remains used to remodulation of signal from down-link to up-link at different parameter of noise add or remove. Now the average result obtained from our experience are with noise and without noise as shown Max Q-factor =9.022 for downlink Min BER= 1.105*10^-19 and Q-factor = 6.125 for uplink, Min BER=2.008*10^-10 and eye diagram using Opti-System software-17.1.**

Keywords: ROF, SCM, ASK, BER.

I. Introduction

Opticalfibercommunication is a communication modernization that operates light pluses on the way to transfer data starting from one point to the another through an optical fiber. Now a day a wide demand of bandwidth in wireless and wired communication has been observed [1]. In ROF, radio frequency (RF) signal is transmitted later they are modulated to from an Analog optical connection. RF signal are transmitted from downlink and uplink, to and from Central Stations (CS) to Base Stations (BS). Through RAU, direct detection improves the communicated RF signal in the PIN photodetector [2].

For supportive high capacity transmission at low cost and aiding fiber based wireless, admittance SCM utilized. An effort has been minimize the electronic components number for the detection of baseband signals. Without-any electrical demodulation module baseband signals are directly detected after optical signals. This technique overcomes electronic components limitations and reduces system cost simultaneously[3].

The chromatic dispersion (D) is one of the important factors that used for designing optical fiber communication system results from the limited spectral linewidth of the optical source moreover effect on the system performance [4-5]. The Optical subcarrier multiplexing (SCM) is system which have multiple different signals are multiplexed with the radio frequency signal and carried by a single wavelength. This system has the simple operation, low cost, better spectral efficiency and offers not as much of delicate to chromatic fiber dispersion as compared to conventional time-division multiplexing technique with narrow spacing channel [6 ,7]. Among several optical amplifiers offered,aexcessive preference standsfor EDFA due to its high gain and low noise features.

EDFA remainsintended for long distance broadcast through multi-wavelength causes since their wide bandwidth and optimum Bit Error Rate (BER). EDFAs come across the effects of attenuation, distortion also Rayleigh scattering [8].At the present time, due to changed requirements of operators of the system, the data volume of wireless communication has been totallyextended from modest sound and messages to multimedia through evolutional future facilities. Today knowledge we have two transmitter channel.

Commonly transmitter consume the same components, as shown in figure 1. one transmitter component sinvolve from many components, the pseudo-random bit sequence generator (PRBSG) handed-down for producing the random seeds of the bit[9-21].

II. Opti-system Simulation Setup

The opti-system setup of Radio over Fiber technology used for distribution wavelength for mutually down-link and up-link is design with Opti-System Software version 16.1 as exposed in figure 1. At the transmitter side, pseudorandom bit sequence generator generates the inflection data indication at bit rate 1 Gbps.

Carrier frequency used for amplitude modulation is 1.7 GHz. The RF signal is unitedthrough subcarrier multiplexing component that comprised carrier generator set at 80 channels of 6 MHz arrangement with frequency

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takes 50 MHz in addition sine wave signal generator which consumes 10GHz frequency. The system setup which operated at frequency 193.1THz. The communicated signal is amplified by ideal EDFA at 15 dBm power amplifier also 5 dB noise figure. To evade optical interference among the down-link and up-link signals the circulator is used. The conveyed signals are broadcasted through 21km bidirectional optical fiber.

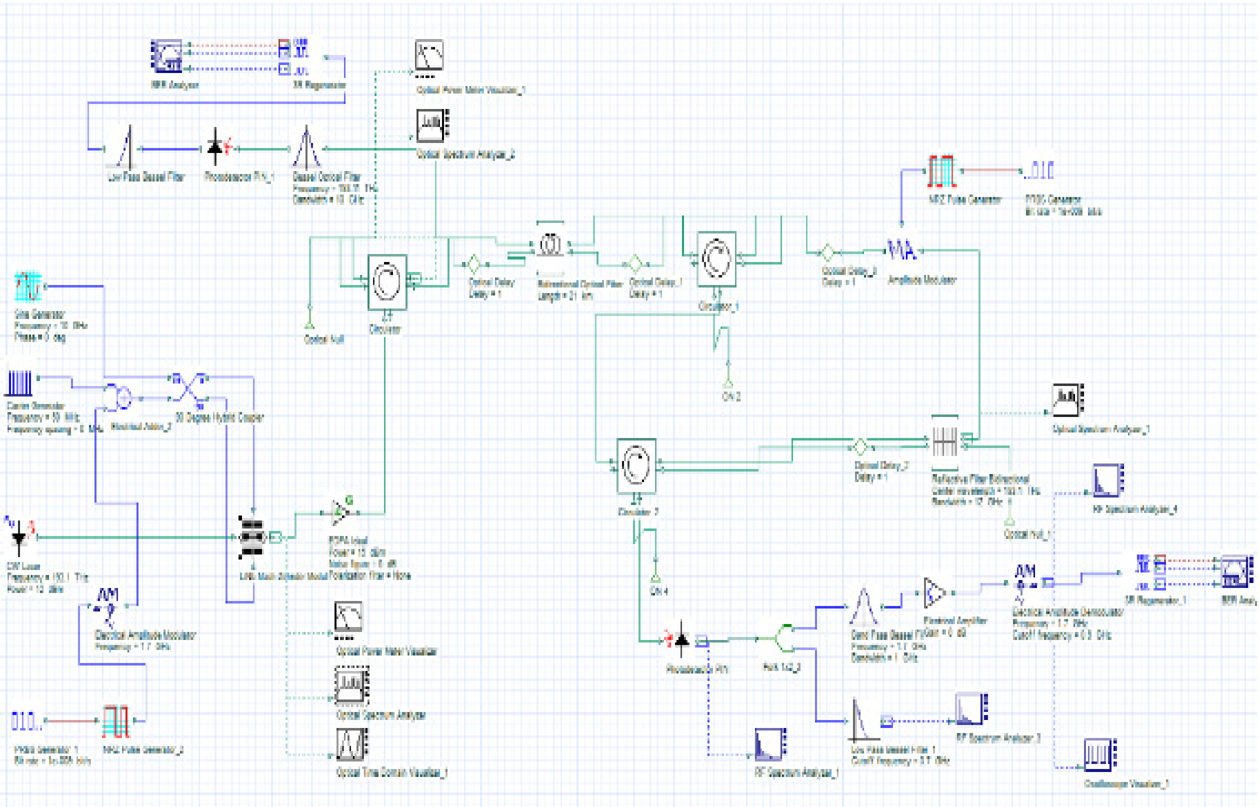

Fig.1: Simulation Setup of SCM/ASK

III. Results and Discussion

The performance and analysis of bidirectional ROF system is evaluated in BER and Q-Factor with noise effect and without noise effect by Opti-system software version 16.1. In figure.2 showed the downlink optical band for 1Gbps bit rate on frequency 193.1 THz. Subsequently optical LiNb Mach-Zehnder Modulator as shown in figure.3 describes the downlink signal through 21 km bidirectional optical fiber. Now Figure .4 represents the band which inwards at receiver later broadcasted signal up-link optical range after bidirectional reflected filter that remodulation by AM modulator.

The analysis for both uplink and downlink system with Noise and without Noise with Q-Factor and BER value to show the improved performance. The result of simulation setup with better Noise performance as compare without Noise.as shown in Figure.5With noise Max Q-factor =9.022 for downlink Min BER= 1.105*10^-19. Figure.6 shows the up-link signal with noise Q-factor = 6.125 for uplink, Min BER=2.008*10^-10.

Table 1: Fiber Parameter

Parameters	Bidirectional ROF
Length	21
Wavelength	1550
Attenuation	0.22
Frequency	193.1
Data rate	1000 Mbit/s
EDFA power	15dB
Dispersion	16.75ps/nm/km
Bandwidth	12GHz
Sample rate	500GHz

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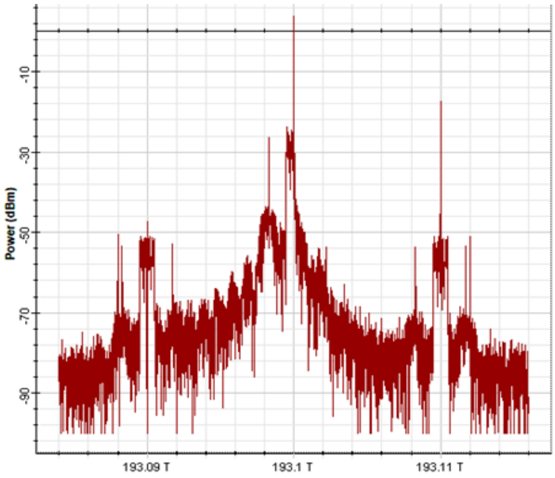
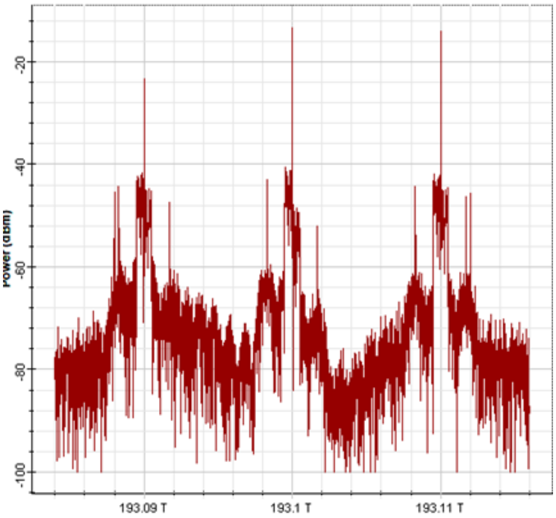
TABLE 2: SIMULATION RESULTS

Channels	Downlink		Uplink	
	Q-factor	**BER**	**Q-factor**	**BER**
Without Noise	9.133	3.32*10^-20	6.551	2.37*10^-11
With Noise	8.737	1.105*10^-19	6.125	2.0*10^-10
Add signal-ASE Noise	8.610	3.39*10^-18	5.791	3.02*10^-9
Add Thermal Noise	8.169	1.51*10^-16	6.206	2.39*10^-10
Add Shot Noise	8.883	3.24*10^-19	5.805	2.72*10^-9



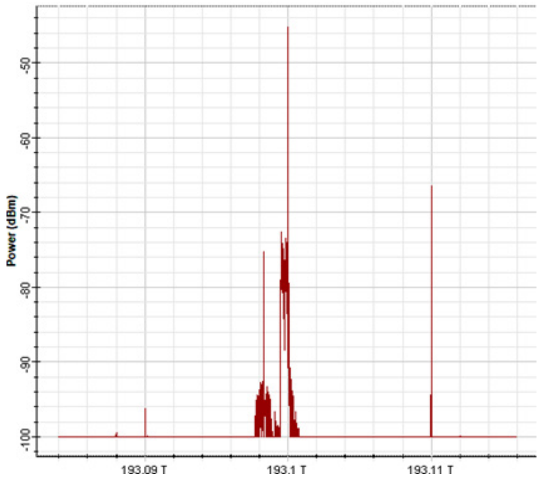
Frequency (THz)

Fig. 2: Optical Spectrum Analyzer at 193.1 THz Before Bidirectional



Frequency (THz)

Fig. 3: Optical Spectrum Analyzer-1 at 193.1 THz After Bidirectional



Frequency (THz)

Fig. 4: Optical Spectrum Analyzer-2 at 193.1 THz After Bidirectional

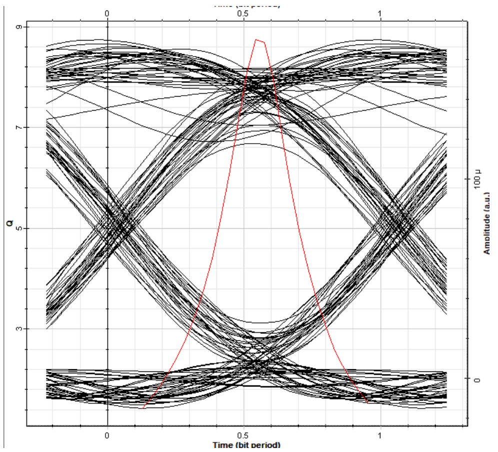


Fig. 5: Eye Diagram for Downstream Signal with Noise Q-factor is 8.737, BER is 1.105*10^-19

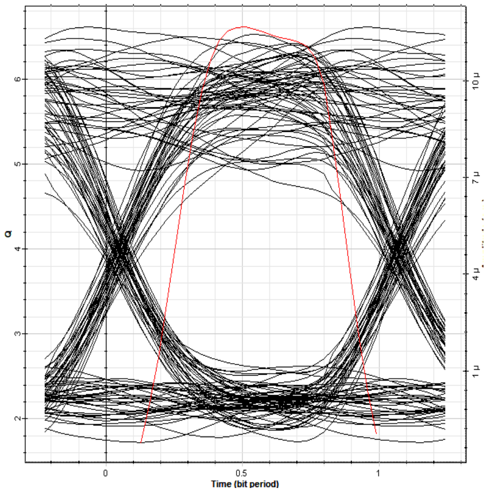


Fig. 6: Eye Diagram for Upstream Signal with Noise Q-factor is 6.125,BER 2.0*10^-10.

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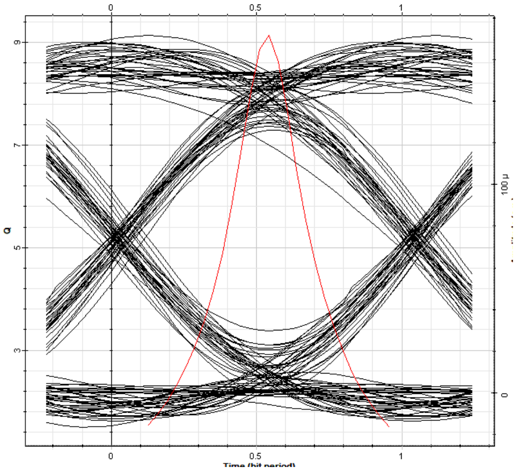

Fig.7: Eye Diagram for Downstream Signal Without Noise Q-factor is 9.133,BER 3.32*10^-20.

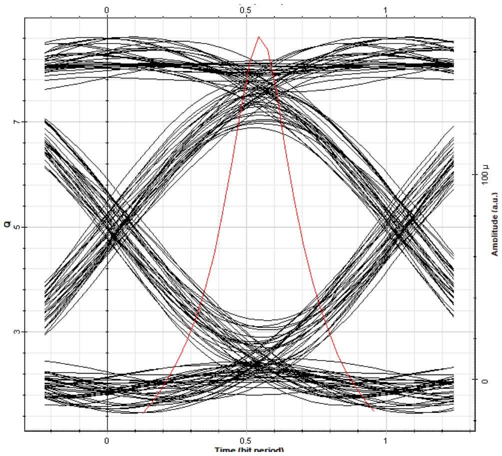

Fig.10: Eye Diagram for Upstream Signal With ASE noise Q-factor is 5.791,BER 3.02*10^-9.

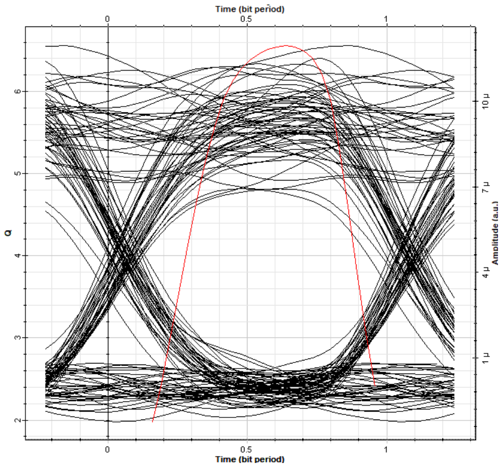

Fig. 8: Eye Diagram For Upstream Signal Without Noise Q-factor is 6.551,BER 2.37*10^-11.

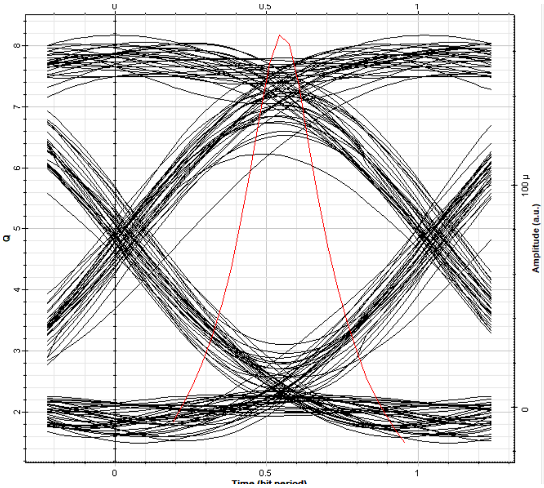

Fig.11: Eye Diagram For Downstream Signal With Thermal Noise Q-factor 8.16, BER 1.51*10^-16.

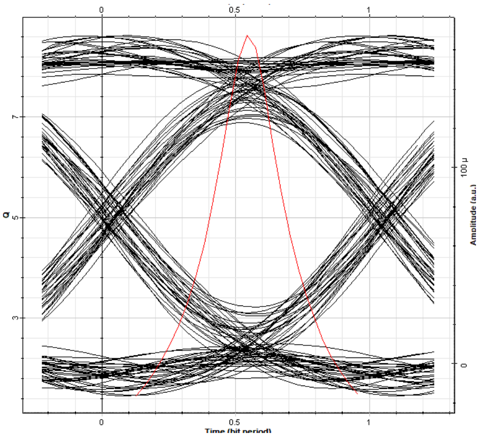

Fig. 9: Eye Diagram For Downstream Signal With ASE noise Q-factor 8.61, BER 3.39*10^-18.

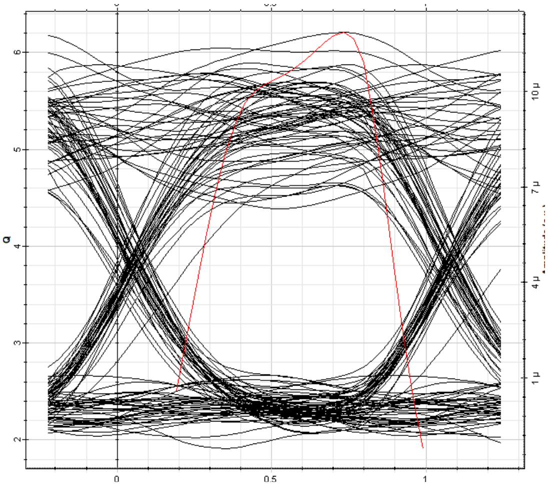

Fig.12: Eye Diagram for Upstream Signal with Thermal Noise Q-factor 5.805,BER 2.72*10^-9.

IV. Conclusion

The optisystem setup overcomes the losses and attenuation and we proposed the comparison effect of noise and without noise during data transmission. After 21 km optical fiber length for downlink and uplink. Through a bidirectional reflected filter ROF using SCM/ASK method, replicated filter used to remodulation signal.

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