Volume 5, Issue 5, May 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Design and Performance Analysis of ROF System Incorporating Dispersion Compensation Fiber

[1]Nisha Sharma*, [2]Anamika Basnotra, [3]Sahil Makhnotra
[1, 2] M.Tech(Computer science) Punjab Technical University, Punjab, India
[3] B.Tech (ECE) BGSBU, Rajouri, Jammu and Kashmir, India

Abstract— The demand for high broadband capacity and wide coverage network is rising exponentially. Radio over Fiber is a solution to this desire. This paper focuses on design and performance evaluation of various dispersion compensation techniques for ROF system incorporating DPSK (Differential Phase Shift Keying). A comparison has been done based on the output for pre, post and symmetrical dispersion compensation and without dispersion compensation

Keywords— ROF, Differential phase shift keying, DCF, BPSK, BER.

I. INTRODUCTION

Radio over fiber refers to a technology in which light is modulated with radio signal and then transmitted over an optical fiber to facilitate wireless access, such as 3G. In other words radio signal are carried over fiber optic cable. Thus a single antenna can receive any and all radio signals carried over a fiber cable[1]. It has been analysed that DPSK technique works best for RoF systems out of all the modulation formats. Here, a dispersion compensation technique using DCF is used with DPSK to give the best results. Section II and III gives a brief introduction of DPSK and Dispersion Compensation Fiber. Section IV gives the performance evaluation parameters. Section V, VI and VII describes the simulation setup, results, eye diagrams and graphs respectively.

II. DPSK

Differential phase shift keying is the non-coherent form of PSK (Phase Shift Keying) which avoids the need for a coherent reference signal at the receiver. Input binary sequence is first differentially encoded and then modulation is done using a binary phase shift keying (BPSK) modulator.

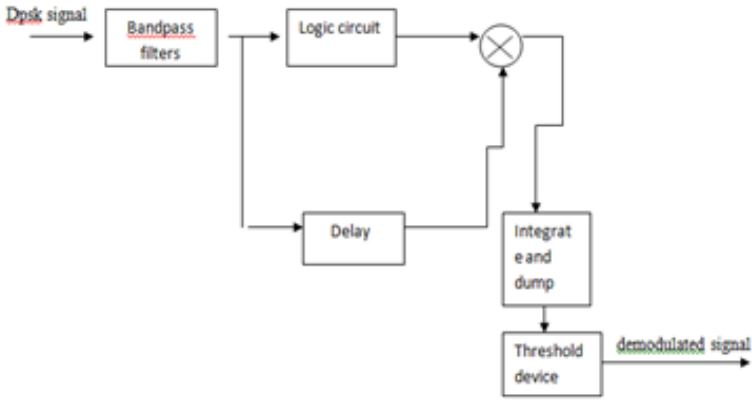

Fig. 1: Block diagram of DPSK at receiver

III. DISPERSION COMPENSATION FIBERS

Compensation of dispersion at a wavelength around 1550nm in a 1310nm optimized single mode fiber can be achieved by specially designed fibers whose dispersion coefficient (D) is negative and large at 1550nm. These types of fibers are known as Dispersion Compensating Fibers (DCFs). DCF has become a most useful method of dispersion compensation and has been extensively studied[2]. DCF can be employed into the system in one of the three ways: pre-compensation, post-compensation and symmetrical compensation. Pre-compensation scheme achieve dispersion compensation by placing the DCF before a certain conventional fiber. Post-compensation scheme achieve dispersion compensation by placing the DCF after a certain conventional single mode fiber. Symmetrical compensation technique consist of post and pre compensation. Different location on the system will generate different non-linear effects. The simulation of three different compensation system is shown in the figure 2.

© 2015, IJARCSSE All Rights Reserved

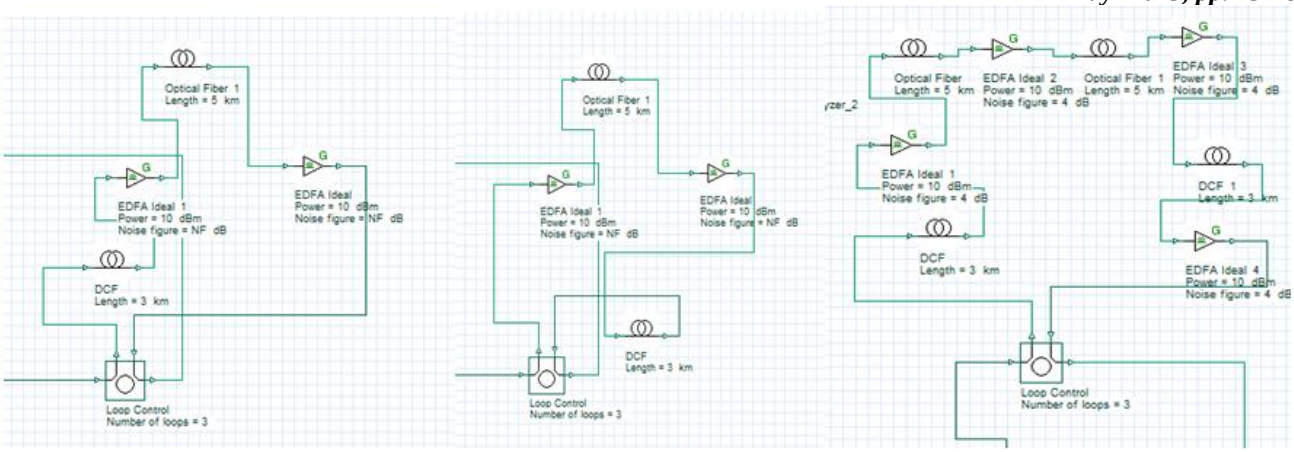

Fig. 2: Simulation setup for three dispersion compensation scheme

IV. PERFORMANCE EVALUATING PARAMETERS

Performance evaluating parameters are those parameters that defines the transmission quality. The various performance evaluating parameters are:

1.Q-factor: *Q* is 2π times the ratio of the total energy stored divided by the energy lost in a single cycle[3].

2. Eye-Height: Eye height shows how well 0s and 1s are separated in the signal. It is the height of the eye diagram from top to bottom.

3. Bit Error Rate (BER): Bit error rate is the ratio of erroneous bits received to the total number of bits transmitted.

V. SIMULATION SETUPS

The baseband signal generated by the pseudo random generator is used to modulate high frequency RF carrier. These signal after passing through optical band pass filter is then combined using power combiner and is used to modulate a optical carrier of frequency 193.1 THZ using Mach-Zehnder modulator(MZM). This modulated signal is then passed through single mode fiber. At the receiver end power splitter is used to split this optical signal into two signals. These optical signals are then passed through optical band pass filter after that low pass filters are used that produce the baseband signal. The system was simulated using OptiSystem9.0 and the setups are shown below:

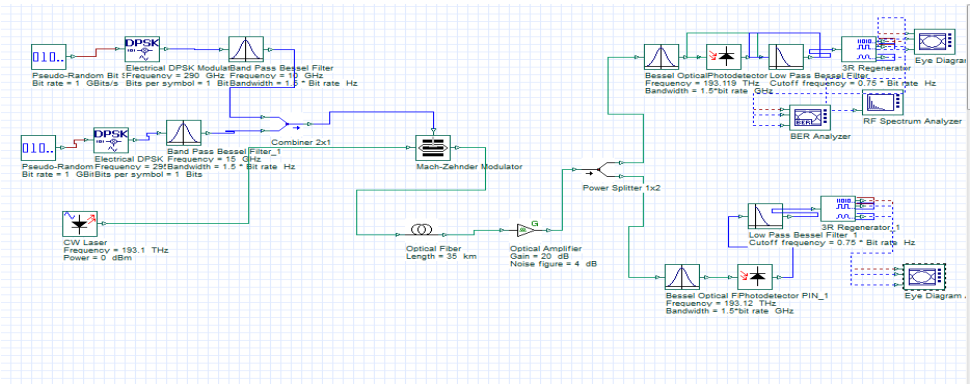

Fig. 3: Radio over fiber link without compensation scheme

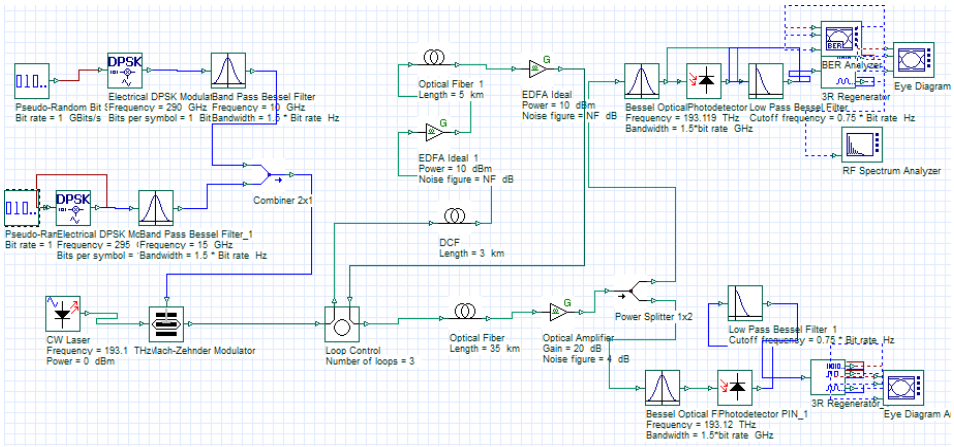

Fig 4: Radio over fiber link using pre- compensation scheme

© 2015, IJARCSSE All Rights Reserved

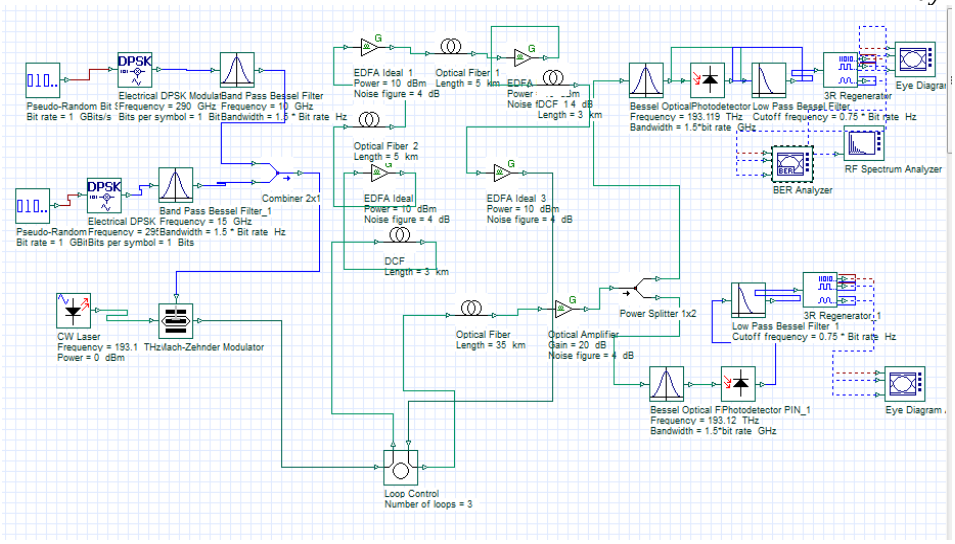

Fig. 5: Radio over fiber link using post- compensation scheme

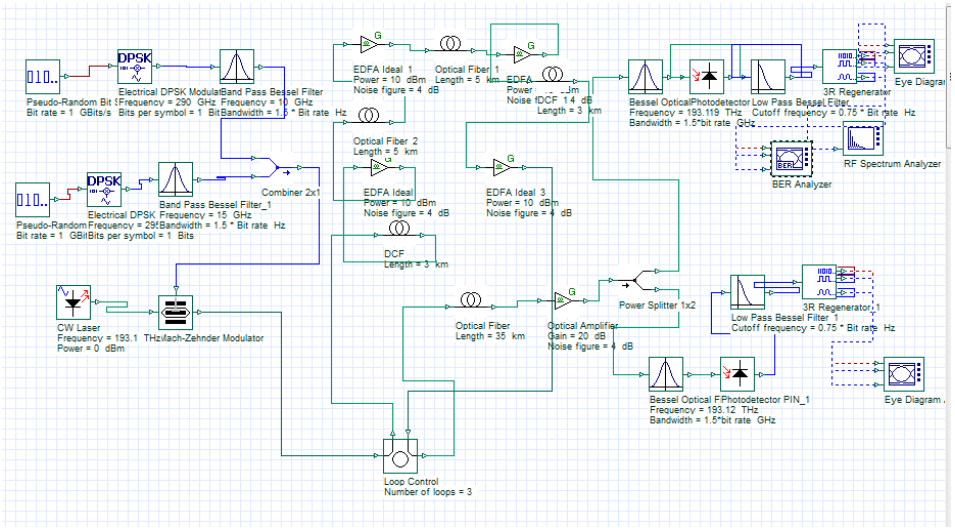

Fig. 6: Radio over fiber link using symmetrical compensation scheme

VI. RESULTS

The eye diagrams that shows the transmission quality of the signal are obtained at the receiver end. Various eye diagram corresponding to fiber length 35Kms are shown as:

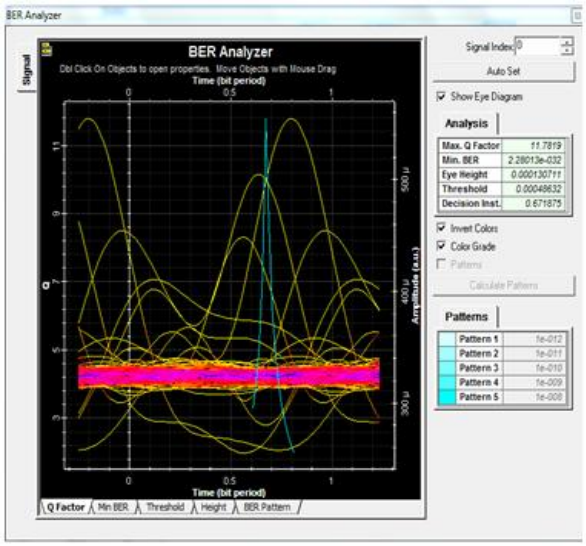

Figure 7: Eye diagram for ROF system without compensation

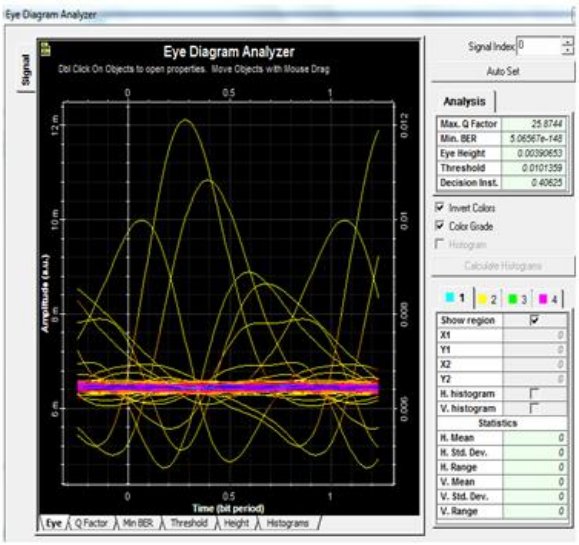

Figure 8: Eye diagram for ROF system using pre-compensation

© 2015, IJARCSSE All Rights Reserved

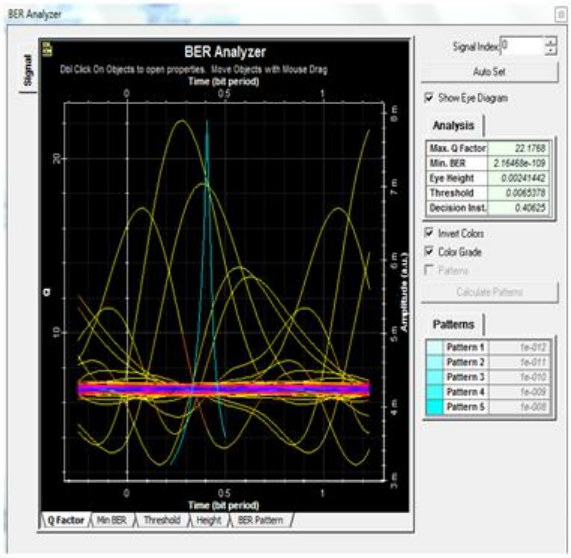

Fig. 9: Eye diagram for ROF using post- compensation

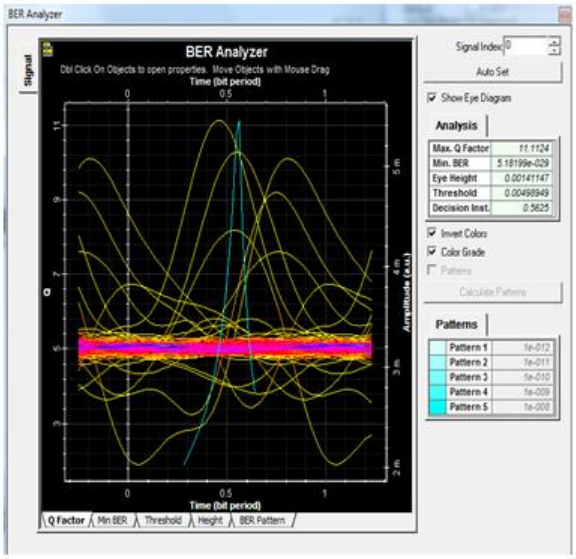

Fig.10: Eye diagram for ROF system using symmetrical- compensation

Table 1 Comparsion between different compensation techniques

Parameters	Without DCF	Pre DCF	Post DCF	Symmetrical DCF
Q-Factor	11.7819	25.8744	22.1768	11.1124
BER	$2.28013*10^{-32}$	$5.06567*10^{-148}$	$2.16468*10^{-109}$	$5.18199*10^{-29}$

VI. CONCLUSION

Pre, post and symmetrical dispersion compensation technique using DCF was deployed in radio over fiber system incorporating DPSK modulation. A comparison was made between the three. It was found out that pre DCF technique works best in this setup with Q-factor= 25.8744 and BER=$5.06567*10^{-148}$.

REFERENCES

[1] H.Al Raweshidi, S. Komaki "ROF Technoloies for Mobile Communications Network" Artech House, London, eds. 2002.

[2] Bo-ning HU, Wang Jing, Wang Wei, Rui-Mei Zhao," Analysis on dispersion compensation with DCF based on optisystem", 2010

[3] Nisha Sharma, Anamika Basnotra, Arashad Ahmed Bhatt,"Design and performance optimiozation of 8-channel WDM system",'International Journal of Advanced Research in Computer Science and Software Engineering' Vol. 3 Issue 4,2013

© 2015, IJARCSSE All Rights Reserved