Performance Evaluation of WDM RoF Link at various data rates

Kumari Kalpna, Reena Joshi and Kanu Gopal

Abstract: ***The objective of this paper is to investigate the performance evaluation of WDM RoF link. In this paper, WDM Radio over Fiber (RoF) system is introduced, which is one of the enabling technologies for 3G and beyond. The performance evaluation of WDM Radio over Fiber transmission system (RoF), based on various performance metrics such as Q-factor, BER and eye opening has been made at various data rates. The integration of the two systems is responding to the demands for high data rate applications and reasonable mobility for broadband communication. This work deals with the modeling, realization and characterization of WDM RoF systems providing data rates within the 100 to 3000 Mbps range. It has been investigated that system provides optimum results at data rate of 500 Mbps.***

Keywords: **WDM RoF, Q-Factor, BER, eye opening and jitter.**

I. INTRODUCTION

With the development of wireless communication system, the bandwidth requirements of the radio signal rapidly increased to realize multi-gigabit/s broadband wireless access. In order to avoid the congestion at low frequency band, the carrier frequency is required to move toward a higher frequency band and wave length division multiplexing radio-over-fiber (WDM RoF) is the most preferred option. WDM RoF systems are attractive for broadband wireless access networks supporting broadband multimedia wireless services [1]. This paper is organized as follow: In Section II WDM RoF link is modeled to verify our proposed scheme. In section III & IV, the simulation results are evaluated and the tolerances of the proposed system are discussed. Finally, a conclusion is given in Section V.

II. SYSTEM MODEL

The System model of 8 Channel WDM RoF System is as shown in fig. 1. The system has been designed and optimized using simulation tool Optsim 5.1, a photonic system simulation tool by RSoft, USA. Central station (CS) transmits optical intermediate frequency (IF) and local oscillator (LO) signals to the remote node where amplification and wavelength conversion takes place. At central station each data channel transmits 100Mbps to 3000Mbps data which is DPSK-encoded over 2.5GHz IF [2].

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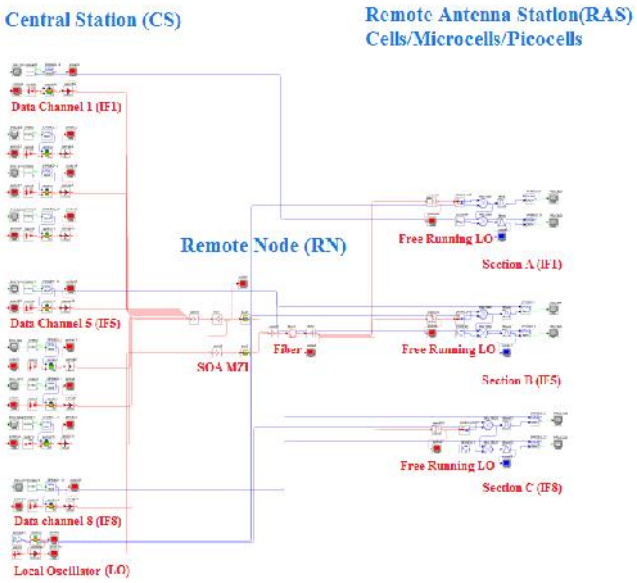

Fig.1 Simulation model for WDM RoF link

Central station transmits this IF to remote node where wavelength conversions take place using SOA-MZI. The modulated signals are transmitted to remote antenna stations (RAS) covering each cell. In this model DPSK-encoded multiple data channels in the wavelength range of 1545.80 nm to 1552.20 nm and local oscillator frequency of 25 GHz is transmitted over a common optical fibre for simultaneous wavelength conversions, while keeping crosstalk penalties at minimum [3].

III. PERFORMANCE EVALUATION OF WDM ROF LINK AT VARIOUS DATA RATES

The Performance of the modeled WDM RoF link is evaluated on the basis of Eye opening, BER and Q Value at Output Section A, B and C for data rates from 100 Mbps to 3000 Mbps. The output has been obtained on the sample basis from higher wavelength channel, central wavelength channel and lower wavelength channel in order to check the optimal functioning of the system over entire wavelength range. A pseudo random sequence length of bits taken one bit per symbol is used to obtain realistic output values at the receiver. The electroscope gives eye diagram, Q factor, Bit error rate (BER) and eye pattern [5]. To observe the impact of data rates upon system performance, simulation results are obtained for different data rates varying from 100 Mbps to 3000 Mbps. BER of the order of e-14 and Q value more than 16 dB has been reported at 500 Mbps, which results in an optimal value for the modeled system. Simulation results obtained reveal that with increase in data rate impact of dispersion become dominant resulting in high BER and poor Q value.

IV. RESULTS AND DISCUSSIONS

The eye patterns of received signal corresponding to λ=1552.20 nm, λ=1549 nm and λ=1545.80 nm are shown in figure 2- 4.

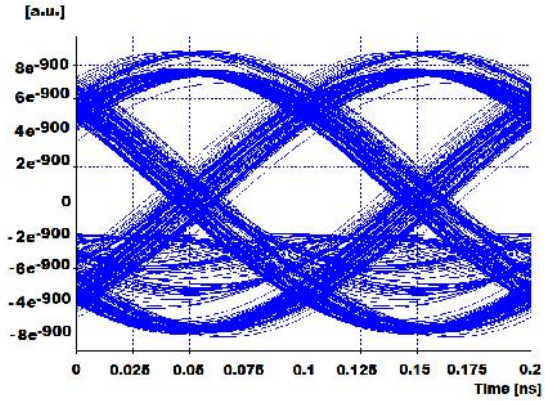

Fig. 2.Eye patterns of received signal at (a) ^{a}=1552.20 nm

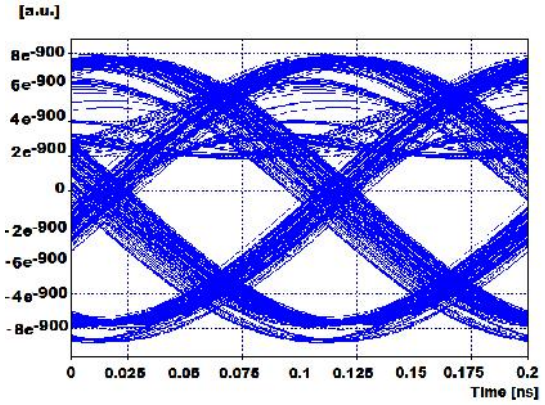

Fig. 3.Eye patterns of received signal at (a) ^{a}=1549 nm

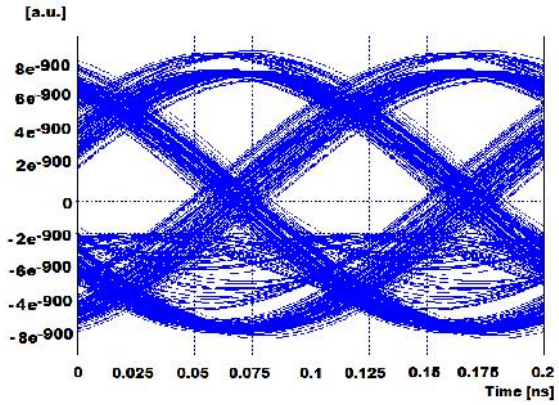

Fig. 4.Eye patterns of received signal at (a) ^{a}=1545.80 nm

The discrete eye opening, Q value reported more than 16 dB and BER of less than e-14 indicates the error free transmission and robustness of the modeled system [7].

V. CONCLUSION

It is observed that the optimal BER of e-14 and Q value of 16 dB has been reported at data rate of 500 Mbps. At data rates beyond 500 Mbps eye tends to close and BER increases beyond the threshold value indicating that the modeled system is suitable for data rate upto 500 Mbps. Hence the system is suitable for high capacity remote antenna applications.

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