PERFORMANCE INVESTIGATIONS ON MULTICHANNEL RADIO-OVER-FIBER(RoF) LINK

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Abstract: **WDM RoF systems are attractive solution for broadband wireless access networks supporting broadband multimedia wireless services. This paper presents the optimization of 1GHz, 100 Km RoF link using eight channels within the wavelength range of 1545.80-1552.20 nm. The simultaneously generated eight channels of WDM optical RF signals showed the variation of receiver sensitivity (at BER of 10-17) less than 0.5 dB, indicating that there exists negligible crosstalk. Q value above 18.38dB and BER reported of the order of e-17 indicates the clear feasibility and robustness of the modeled system.**

Keywords: **WDM, RoF, SOA, MZI, IF.**

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 [1,2]. WDM RoF systems are attractive for broadband wireless access networks supporting broadband multimedia wireless services. The radio infrastructure for the test and training ranges should provide adequate line-of-sight coverage. This often requires multiple elevated antenna positions such as towers or mountain tops [3, 4]. In such cases, solutions typically co-locate transceivers with the antennas to minimize RF losses that arise from cable attenuation between the transceivers and antennas.

However, placement of transceivers at remote sites results in high operation, maintenance and reconfiguration cost. Reliable communications with a large number of transceivers attached to a suite of antennas in a small area presents additional collocation problems. Placement of transceiver equipment on separate mountain tops requires significant resources to maintain and reconfigure the infrastructure, which reduces the fidelity of the signal and limits the efforts to reduce operating costs [5]. In this paper we have investigated the performance of one GHz, 100 km RoF link using eight channels.

The paper is organized as follow: In Section 2 a RoF link is modeled to verify our proposed scheme. In section 3, the simulation results are analyzed and the tolerances of the proposed system are discussed. Finally, a conclusion is given in Section 4.

II. SYSTEM DESCRIPTION

A schematic model of proposed WDM-based RoF system built using Optsim 5.1 simulator by RSoft, USA is as shown in figure 1. Central station (CS) transmits optical intermediate frequency (IF) and local oscillator (LO) signals to the remote node where amplification and optional wavelength conversion takes place. At central station each data channel transmits 1Gbps data which is DPSK-encoded over 2.5GHz IF. 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 fiber for simultaneous wavelength conversions, while keeping crosstalk penalties at minimum.

At the Remote Node (RN), SOA-based amplifying scheme has been employed. The layout of figure I shows an optional wavelength converter using SOA MZI.

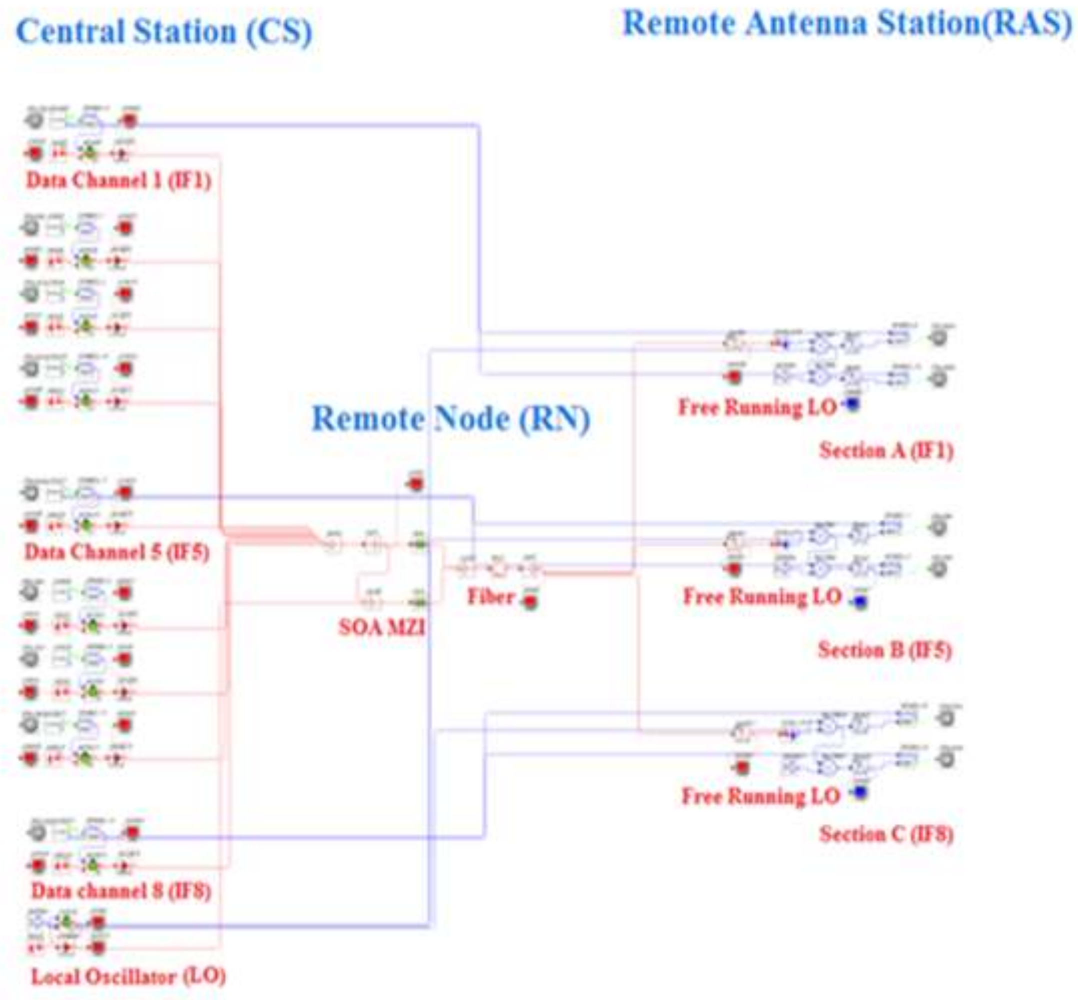


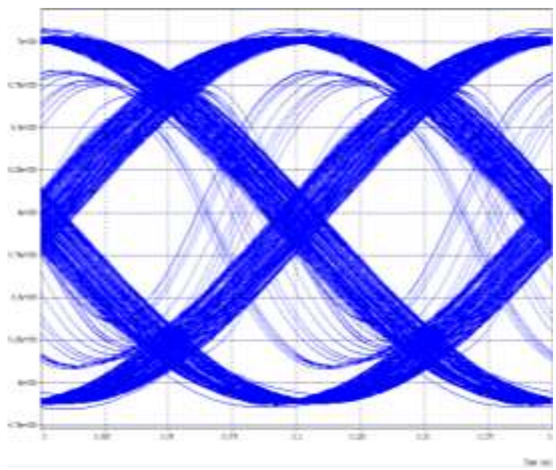
Fig.1 Simulation model of WDM RoF link 1

This wavelength converter acts on all incoming signals including LO signal (25GHz) which is kept at high power compared to data signals used for wavelength conversion. LO power is scanned to optimize crosstalk and the RAS is used for detection as shown in arms A, B and C of the modeled system (figure-1). At the receiving end, Free-running oscillator feeds the frequency to post-multiplier filters, which isolates the 25GHz electrical carrier from the original IF signal of 1 GHz and then feed it to the DPSK demodulator to recover the transmitted data [6, 7].

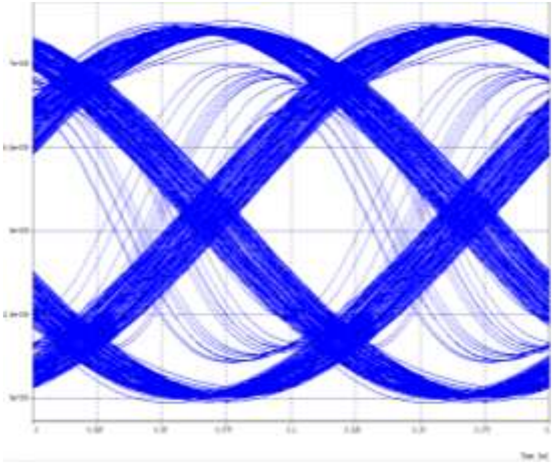
III. RESULTS AND DISCUSSION

Performance of the modeled RoF link is gauged on the basis of Eye opening, BER, Q factor and timing jitter. 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.

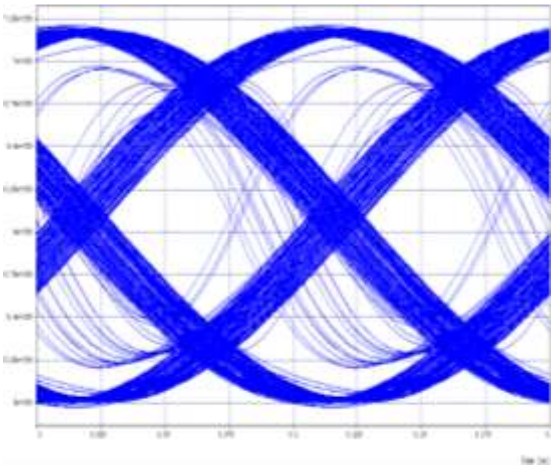
The eye diagrams of received signal corresponding to λ=1552.20 nm, λ=1549 nm and λ=1545.80 nm are shown in figure 2(a-c) and corresponding BER, Q and timing jitter values are tabulated in Table 1.



(a)



(b)



(c)

Fig. 2 Eye pattern of received signal at (a) λ=1552.20 nm (b) λ=1549 nm (c) λ=1545.80 nm

Table 1 BER and Q values of received signal

	λ(nm) 1552.20	**λ(nm) 1549**	**λ(nm) 1545.80**
BER	9.78e-17	5.66e-17	4.24e-16
Q(dB)	18.30	18.38	18.37
Jitter(ns)	0.0317852	0.0317329	0.317854

IV. CONCLUSION

This paper presents investigates the feasibility and robustness of 1GHz, 100 Km, 8 Channel WDM RoF link on the basis of performance parameters viz. Eye opening, BER and Q factor. Clear eye opening, Q value above 18.3 dB, BER reported of the order of e-17 and negligible timing jitter indicates the clear feasibility and robustness of the modeled system. Hence the system is suitable for high capacity remote antenna applications.

V. REFERENCES

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