Performance analysis and comparison of different optical fibers on various SAC-OCDMA data formats

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Abstract.In this paper we have done the comparison of different optical fibers with different distances (kms) on various SAC OCDMA data formats i.e RZ and NRZ .More the users uses the limit, security, limit and data rate have turn into the hurdle for the optical framework because of complexity Therefore, OCDMA provide a ubiquitous network that is simple and offers the potential for scalability to higher levels of connectivity and data.The simulation design of transmitter and receiver modules for SAC-OCDMA system have simulated in this paper is based on Uniform Fiber Bragg Gratings because of dynamic dispersion compensator.Here,in this paper conventional single mode fiber (SMF),Alcatel,ITU-TG.652 are used as the transmission links and the performance analysis are Quality factor (Q),Bit error Ratio (BER),eye diagramof various user systems for these two different data formats. This system is for three-user SAC-OCDMA system working 622 Mb/s bit rate at 1550 nm wavelength and 10 Gchip/s chip rate, at three different lengths and optical fibers respectively utilizing both drivers (RZ) and (NRZ).

Keywords: Bit error ratio(BER),Qualityfactor,Fiber Bragg Grating (FBG)

I. INTRODUCTION

Optical CDMA is a multiplexing method by which every correspondence channel is recognized by a particular optical code as opposed to a wavelength or a period openings. Optical CDMA is most suitable to be applied to high speed Local Area Network (LAN) to achieve contention-free, zero delay access, where traffic tends to be bursty rather than continuous. SAC-OCDMA it becomes clear that Optical CDMA techniques are looked after due to their abilities through which they can support various asynchronous bursty transmissions without having any delay and network control, not to cite the high-level of security it offers to casual users.The optical bandwidth is abundant and the required processing gain is within the region of any optical communication system. How to use this bandwidth in order to reduce network complexity and thus the access cost is what Optical CDMA is all about[5]. The popularity of CDMA based wireless transmission and communication systems are owed firstly to the maturing device integration and secondly the high-level network concepts, requirements and features. In case of cellular networks, the characteristics of soft-blocking and soft-hand off, without any dynamic frequency allocation required for CDMA technique were two essential features that increase the capacity and number of users in bursty networks without degrading the overall system performance.

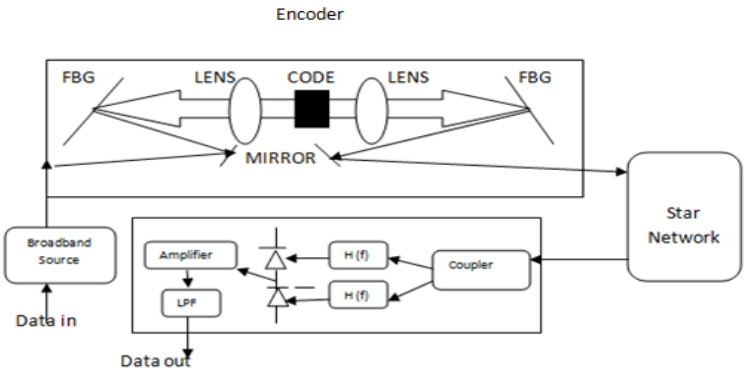

Fig.1Structure of SAC-OCDMA System [Jen-Fa Huang et.al. (2007)]

The main objectives of this paper are to: (i) Develop a transmitter-receiver structure for SAC-OCDMA using uniform FBG (ii) Develop a transmitter structure for spectral-amplitude coding OCDMA networks using RZ and NRZ data formats (iii) Compare the performance of SAC-OCDMA systems,in termsof three users, multi-access interference (MAI), bit error rate (BER) using different optical fibers with variation in lengths. An OCDMA framework for each client can be pictured by an information source which contains the information that is to be sent, trailed by an encoder and then a laser mapping the sign from electrical structure to an optical heartbeat manner. Several endorsers transmit information at same time. Every client has its particular codeword, roughly orthogonal to all the other code words. The information which is encoded is send to the N*1 star coupler, and from here the optical channel brings the sign routing through the optical fiber and finally couples to a 1*N coupler that is shown to all hubs.. The vicinity of the light heartbeat speaks to the twofold bit '1'and the unlucky deficiency of the light heartbeat speaks of the double bit '0'. The translation procedure is processed by utilizing optical relationship. The collector executes a period connection operation to identify onlythe particular fancied codeword [9]

II.SYSTEM DESCRIPTION

The system design of SAC-OCDMA consists of various components:

2.1Machzender Modulator

The optical yield of a broadband optical source is digitally regulated by Machzender because it controlled the amplitude of an optical wave. The extinction ratio of Machzender modulator is 30dB.The input wavelength is split up into two waveguide interferometer arms. If a voltage across one of the arm,a phase shift is induced within the signal.

2.2 Pseudo Random Bit Sequence Generator

The data rate used in 622mb/s.PRBS is used because it generates data similar to that obtain with any user.It generates the pattern at uniform rate but randomly [3]

2.3 Uniform Fiber Bragg Grating

Using uniform FBG with third window wavelength i.e 1550nm and bandwidth 0.3nm.It has been used because it is able to compensate chromatic dispersion at multiple variations of the wavelength.Bragg grating actually have a periodic variation of refractive index within the propagating medium.In Bragg grating there is longer delay is introduced for the shorter wavelengths.

2.4 Data Formats

These are important because they help the receiver to extract precise timing information. They convert the input binary signal into an output electrical signali.e RZ and NRZ pulse generators. The most commonly used drivers are NRZ and RZ .The bandwidth of RZ is larger than NRZ. RZ is used for long haul communication because of its high tolerance for impairments whereas NRZ is employed for short haul communication[5]

The system design for SAC-OCDMA using RZ format:

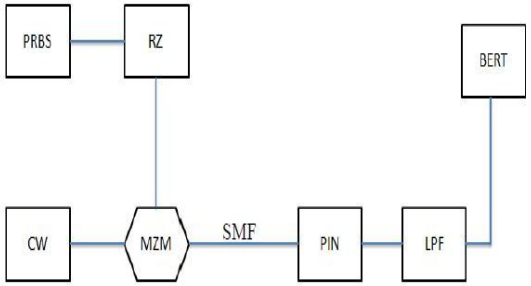

Fig. 2SAC-OCDMA with RZ format[13]

The system design for SAC-OCDMA using NRZ format:

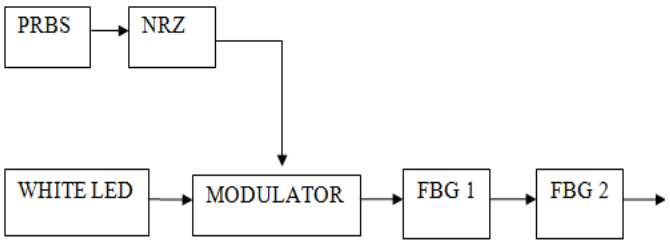

Fig.3 SAC-OCDMA with NRZ format[Raad S. Fyath et.al. (2012)]

2.5 Optical Fibers

In this paper, we are using single mode fiber (SMF), Alcatel and ITU-T G.652

TABLE 1
OPTICAL FIBERS AND DISPERSION

OPTICAL FIBERS	DISPERSION
Single mode Fiber	16.75
Alcatel	8
ITU-T G.652	17.65
ITU-T G.653	0.169
ITU-T G.655	3.78

III.METHODOLOGY

We have used SAC-OCDMA to suppress theMultiple Access Interference (MAI) which is limitation of OCDMA.There are several kinds of OCDMA systems, spectral amplitude coding (SAC) scheme likely to be arousing. In such a system, the optical spectrum for each channel is generated for each channels we have done the amplitude coding by a different code. The incoherent source appears as a good candidate for SAC-OCDMA as it is inherently broad band, a important characteristic of SAC. Therefore, SAC–OCDMA system was proposed because of its ability to eliminate the influence of MAI by using codes and different modulatorsusing phase cross-correlation. The SAC–OCDMA systems has assigned one unique spectral amplitude codeword for each network user to code the amplitude of light source spectrum. Noises existing in SAC–OCDMA systems includephase-induced intensity noise (PIIN), shot noise, thermal noise[11]

IV. CURRENT RESEARCH

4.1 Novel security enhancement technique eavesdropper for OCDMA system:

This is an effective approach for simultaneous improvement of the system capacity and security. Security of the spectrally encoded optical code division multiplexed access(OCDMA) system is enhanced by using 2-D(orthogonal) modulation technique. In this there is a novel algorithm that ensures secure and energy balance transmission of big data includes selection of data transmitting region, includes selection of data transmitting region, segmenting the selected region, determining probability ratio for each node in every segment, evaluating the probability using binary based evaluation. If it is secure transmission resume with the two hop transmission of big data, otherwise prevent the attackers by cooperative jamming scheme and transmit the data in two-hop transmission..

V.SIMULATION PARAMETERS

TABLE 2
SIMULATION PARAMETERS

PARAMETER	VALUE
Users	3
Operating wavelength region	1550nm
Signal Bit Rate	622 mb/s
Signal Format	RZ/NRZ
Fiber Length	20,30,50 (kms)
Fiber Loss	0.2dB/km
Optical modulator extinction ratio	30dB
Receiver filter bandwidth	0.65*bit rate

VI. RESULTS AND DISCUSSIONS

TABLE 3
VARIOUS MINIMUM BER RESULTS

DATA RATE	**BIT ERROR RATES**		
622MB/S	**RZ/NRZ DATA FORMATS**		
USERS	**ITU-T G.652 (20KM)**	**ALCATEL (30KM)**	**SMF (50KM)**
USER 1	4.01091e-16/1.71514e-12	1.00622e-12/.19137e-12	1.00622e-018/1.40556e-17
USER 2	2.19158e-24/1.1763e-12	2.15139e-014/2.10158e-29	2.215139e-014/1.46146e-19

USER 3	2.64123e-030/5.50115e-06	6.18519e-036 /2.40515e-14	2.18519e-032/1.71234e-23

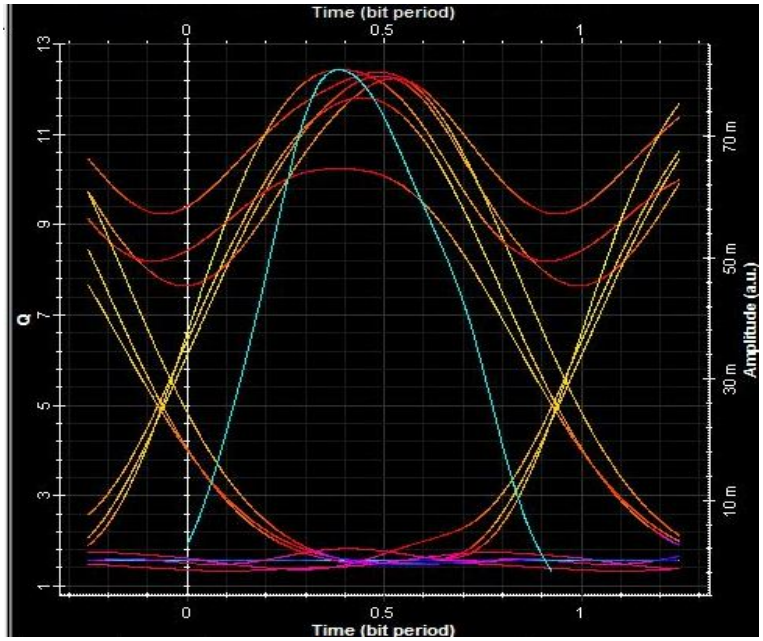

Fig.4 The eye diagram for user 1 at RZ format using Alcatel fiber" with a BER of $1.006*10^{-18}$

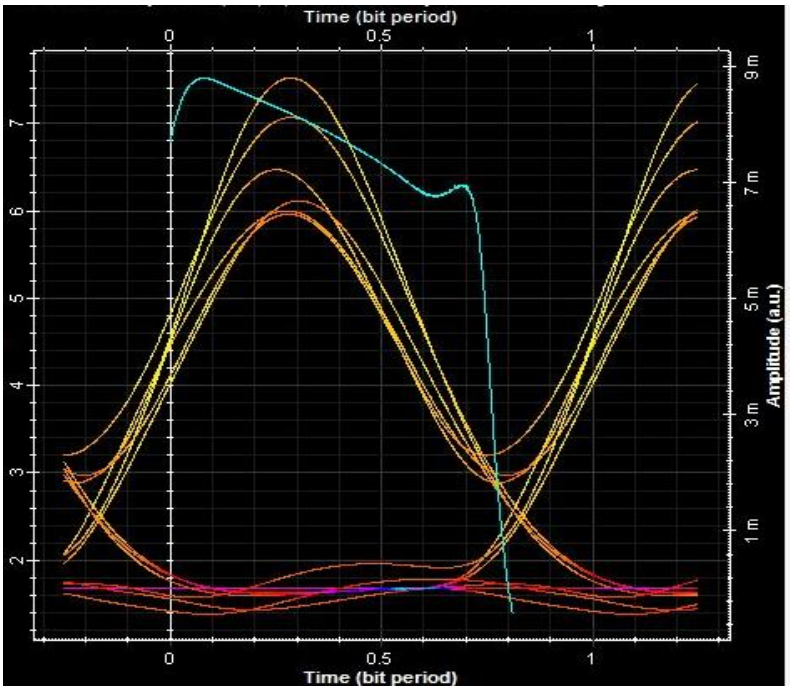

Fig.5 The eye diagram for user 2 at RZ format

using Alcatel fiber"with a BER of $2.15*10^{-14}$

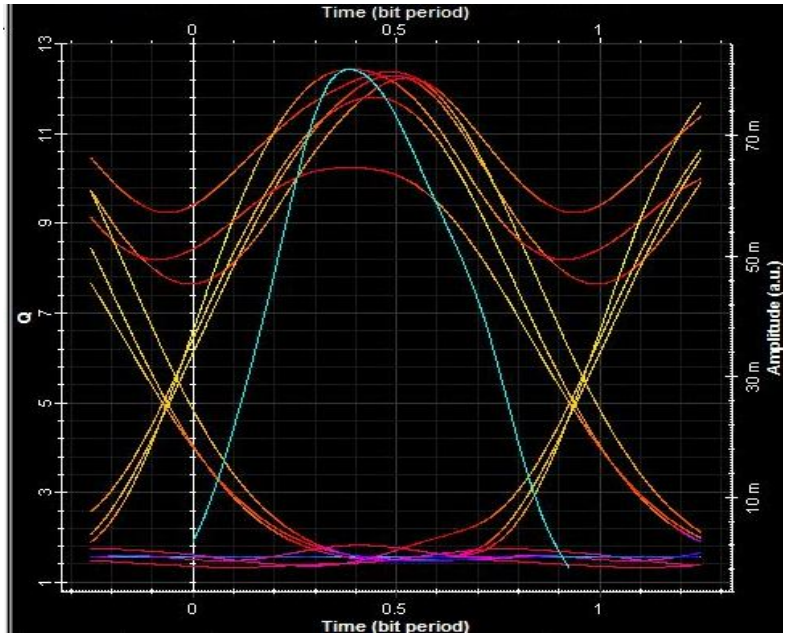

Fig.6 The eye diagram for user 3at RZ format
using Alcatel fiber with a BER of $6.18*10^{-36}$

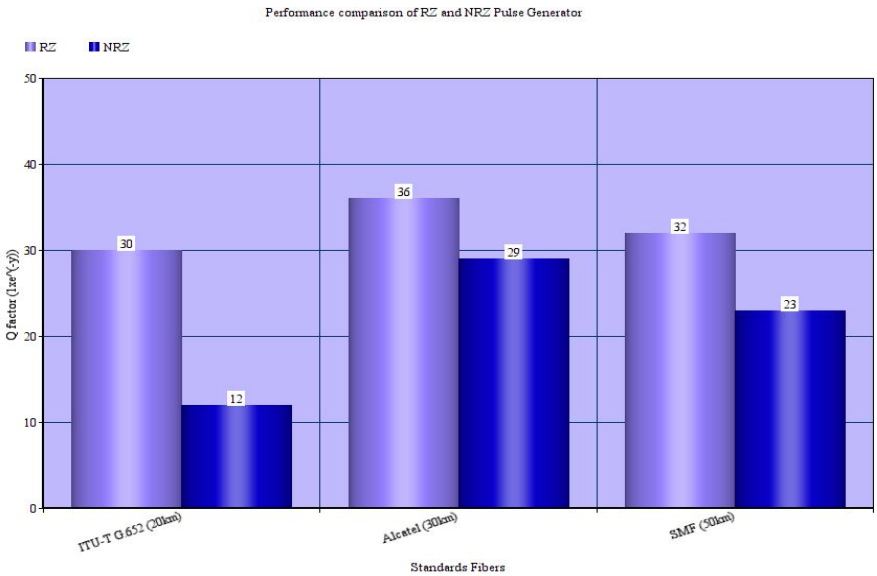

Fig.7 Comparison of different fibers with quality factor

VII. CONCLUSION

The execution of SAC-OCDMA system working with 622mbp/s information rate and 10 Chip/s rate has been investigated to address the effect of transmission through Alcatel,Single Mode fiber and ITU-T G.652 optical fibers with different lengths having three users. After,done with the simulation using Optisystem 7.0 we have various variations in results.It has been observed that performance of OCDMA system decreases as the distance of fiber increases in all three fibers used here i.e. lesser the distance better is the transmission. RZ data format for smaller distance yields better results and is the simplest and most economical techniques as the number of components used are very less as compared to other. Q-factor has been observed for different fibers which shows that Alcatel fiber with RZ format having Quality factor 12.4277 and minimum BER 6.18519e-036 at distance 30 km gives the better performance than other fibers used in this paper.

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