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The Performance Evaluation of 100Gb/s DP-QPSK Modulated Coherent Optical OFDM System

[1]Prof.S.B.Honrao, [2]Laxman Tawade
[1,2]*Department Electronics and Telecommunication department*
Aditya Engineering college, India.

Abstract: Recent trends in broadband communication network demand of bandwidth increase rapidly. In order to provide “best-of-breed” solution for thea long term to fulfill massive demands of bandwidth Coherent optical orthogonal frequency division multiplexing (CO-OFDM) is extensively reconnoitered for next generation emerges enhance track for the high-speed optical communication system. In this paper, the performance of 100 Gb/s CO-OFDM system using dual-polarize quadrature phase shift keying (DP-QPSK) modulation format over 936 km standard single mode fiber (SMF) is evaluated. It also evaluates the impact of parameters like fiber non-linearity, chromatic dispersion, laser linewidth and input optical power on the system performance. In DP-QPSK CO-OFDM systempost-dispersion compensation technique is used to compensate dispersion in the optical channel using dispersion compensation fiber (DCF) which also greatly limits the non-linearity in fiber. The result shows that use of DP-QPSK modulation format in CO-OFDM offers better spectral efficiency at the higher data rate as compared to conventional QPSK CO-OFDM.It also shows that the selection of laser linewidth should be narrower to accomplish excellent system performance. In addition, the system gives error free transmission of OOFDM signal over 936 km span at -4dB input power of thelaser. The performance evaluation of CO-OFDM system is a useful direction for the implementation of 1Tb/s Ethernet system.

Keywords: Optical OFDM, SMF, Coherent detection, Dispersion, DP-QPSK

1. Introduction

Now a day we all are living in the era of “unambiguous connectivity” or “communication anywhere at any time when needed”. Recently, the telecommunication world and its applications like Global System for Mobile Communication (GSM) and General Packet Radio Service (GPRS)realized quite low data rates (Zin et al. 2010). For 2G data rate is 56 Kb/s which uses GSM technology and for 2.75G data rate is 236.8 Kb/s uses Enhance Data Rate for GSM Evolution (EDGE) technology (Lamba et al. 2012). In 3G systems like WCDMA data rate up to 140 Mb/s (Lamba et al. 2012) are also not very satisfactory as it has a large number of subscribers using internet broadband services for a variety of applications such as banking, paying electricity bills, mobile dish TV recharges, video conferencing and social communication required fast broadband services. Consequently, it is a challenge for researchers to provide a system with thehigher speed of these services at optimum cost.

One of the solution to meet massive expected demand is to improve communication system, evokes a new idea of optical Orthogonal Frequency Division Multiplexing (OFDM) with coherent detection, is referred as coherent optical OFDM or CO-OFDM technique. The concept of CO-OFDM for optical communication is marvelously growing. CO-OFDM is integrated with quadrature phase shift keying (QPSK) which can provide a great spectral efficiency and significantly high data rate (Fuerst 2008). Nowadays using optical OFDM for long haul transmission has proven better than conventional single carrier modulation technique. Coherent optical OFDM is really promising solution to satisfy the huge demand of subscribers for next generation communication systems. Basically increasing the number of users will pose limitations on data communications i.e. speed is reduced due to increasing number of users; as a result, a large bandwidth is required. Thus, there is a possibility of Multiple User Interference (MUI) and Inter-Symbol Interference (ISI), hence system complexity increases. The coherent optical OFDM technique has an objective to eliminate this issue. The performance of optical OFDM system is characterized using the bit error rate (BER); however the general BER for optical communication is 10^{-9}. In CO-OFDM system fiber nonlinearity, phase noise and chromatic dispersion prominently limit the performance of OFDM signal owing to large peak-to-average power ratio (PAPR). There has a vibrant research on coherent optical OFDM technique to improve tolerance towards fiber nonlinearity (Wang et al. 2013), transmissions distance in long haul communication system (Dhivagar et al. 2007) and reduce PAPR.

Optical OFDM system using standard single-mode fiber (SMF) is the preeminent way to achieve linearity between input transmitter inverse Fast Fourier Transform (IFFT) and output receiver Fast Fourier Transform (FFT) using linear field modulation (Armstrong 2009). In this radio-frequency (RF) subcarrier is map onto an optical carrier and transmitted over an optical link to facilitate the wireless transmission. At the receiver, light signal can either be detected directly or coherently. Based on this detection scheme optical OFDM is further classified into two categories, first direct detection optical OFDM is referred as DDO-OFDM and second coherent optical OFDM is referred as CO-OFDM. In DDO-OFDM single sideband field modulation is used to compensate issue regarding chromatic dispersion (CD) (Wang et al. 2013). The advantage of DDO-OFDM is simple receiver have low cost, but it needed more transmitted optical power and some of the optical frequencies must be unused result in reduced spectral efficiency (Armstrong 2009). In CO-OFDM system locally generated carrier signal and received signal is mixed while at the receiver local carrier signal is generated using a laser. The main drawback of this system is fiber nonlinearity which affects the sensitivity of CO-FDM system. Non-linearity in optical channel is reduced to a certain extent with the help of Volterra model (Tawade et al. 2015). In Volterra model reorthogonalization techniques in modified Gram-Schmidt method helps in reducing fiber non-linearity (Pan and Cheng 2011). Thus, both systems invoke new research field in optical OFDM and particularly in DDO-OFDM and CO-OFDM techniques to mitigate the disadvantages. In this paper, Simulink model of CO-OFDM system with DP-QPSK modulation format is developed at 100 Gb/s data rate over 936 km optical fiber link using OptiSystem^{TM} simulation software. The performance of CO-OFDM system is analyzed by evaluating parameters like SNR, BER and effect of fiber nonlinearity on the system. Finally, the simulation result is shown and discussed and last paper is concluded.

2. Coherent optical OFDM

The synergies of a coherent optical communication system with OFDM technique have benefits due to two powerful techniques amalgamation in optical communication. The coherent optical communication system maintains both the signal amplitude and phase, hence bandwidth utilization increases. There is ease of channel and phase estimation due to OFDM technique.Nevertheless, coherent optical communication system brings linearity needed for OFDM in RF-to-optical up conversion and optical-to-RF down conversion (Shieh andDjordjevic 2010). Both CO-OFDM and RF-OFDM are quietly similar except nature of carrier in this system. In CO-OFDM system, thecoherent receiver is used to map optical subcarrier 1:1 with electrical subcarrier (Yi et al. 2008).

2.1 Principle of Coherent optical OFDM

The crucial assumption CO-OFDM system is linearity in modulation and demodulation while the linear transformation for OFDM implementations is the focal aim of OFDM. Conceptual block diagram of typical CO-OFDM system is shown in Figure 1. The CO-OFDM system is divided into five basic building blocks as follow: (1) RF Modulator (2) RF-to-optical up conversion or I & Q modulator (3) Optical channel (4) Optical-to-RF down conversion or I & Q demodulator (5) RF Demodulator. In RF modulator block first data is converted into serial to aparallel stream. These multiple branches are equalto a number of subcarriers used in OFDM.The modulation formats used are binary phase shift keying (BPSK), quadrature amplitude modulation (QAM), QPSK to mapped converted signal onto this modulation format. The output of the modulator is fed into IFFT block is used to convert the frequency domain signals into the time domain, at the output of this block is a superposition of the entire modulated signal. The cyclic prefix is inserted in this to avoid the channel dispersion. A pair of adigital-to-analog converter (DAC)is used to convert thesignal from digital to analog form; while low pass Gaussian filter (LPF) is used to avoid antialiasing effect in the signal. In RF-to-optical up-conversion laser diode with two Mach-Zender modulators (MZM) and 90^0 phase shifter is used to mapping RF carrier onto the optical carrier to facilitate transmission. It is impossible to modulate high-frequency signal directly using a laser diode. Therefore, MZM is used for controlling the amplitude of the optical wave. The main advantage of use MZM modulator is avoiding chirp in high-frequency signal.

In Optical channel,erbium-doped fiber amplifier (EDFA) is widely used for in-line amplification of the signal in optical communication. It provides high power transfer efficiency and independent from data rate. Optical channel use standard single mode fiber (SMF) with dispersion compensation fiber (DCF) to compensation of dispersion in the optical channel. DCF is having negative dispersion with the low positive slope. The coherent detection technique at receiver is capable of reproducing transmitted Inphase (I) and Quadrature (Q) signal at the receiver. The RF down conversion architecture of optical OFDM at receiver use two balancedpairsof opticalhybrids with optical 90^0phase shifter to accomplish Inphase (I) and Quadrature (Q) detection as shown in Figure 1. In RF demodulator block the exact reverse process of RF modulation was performed to recover original information or data signal.

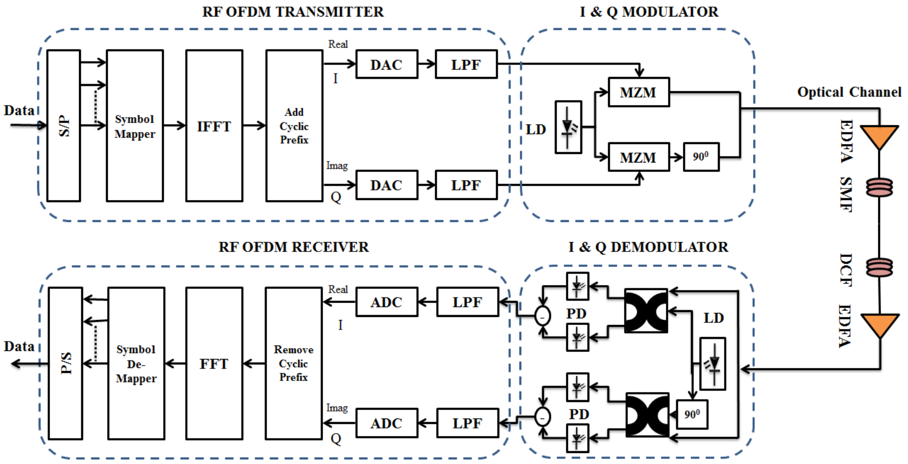

Fig.1 Conceptual block diagram of CO-OFDM system, *LD* Laser Diode *PD* Photo Diode *MZM*Mach-Zender Modulator*DCF*Dispersion Compensation Fiber

2.2 Orthogonality between OFDM subcarrier

In MCM single carrier is divided into multiple subcarriers which are modulated and transmitted in allocated passband. Available bandwidth 'B' for communication is divided into 'N_{sc}' number of subcarriers.Thus, transmitted MCM signal $S(t)$is given as (Shiehand Djordjevic 2010; Yang et al. 2011),

$$S(t) = \sum_{i=-\infty}^{\infty} \sum_{k=1}^{N_{sc}} c_{ki} s_k (t - iT_S) \tag{1}$$

$$S_K(t) = \prod(t)\, e^{j2\pi f_k t} \tag{2}$$

$$\prod(t) = \begin{cases} 1, & (0 < t \leq T_s) \\ 0, & (t \leq 0, t > T_s) \end{cases} \tag{3}$$

Where c_{ki} is the i^{th} number of symbol at data transmitted in k^{th} subcarrier, $f_k = B/N$ is central frequency of subcarrier,T_s is the symbol period and $\prod(t)$ is pulse shaping function.

The classical MCM system uses non-overlap band limited signal and it requires a large number of modulators equally apply to demodulators and filters. The excessive bandwidth required for transmission is a major disadvantage of MCM system, because of this greatly reducing spectral efficiency (Shiehand Djordjevic 2010; Yang et al. 2011). OFDM overcome this problem. Orthogonality between any two subcarriers from straightforward correlation is given by,

$$\delta_{kl} = \frac{1}{Ts} * \int_0^{Ts} S_k S_l dt = \frac{1}{Ts} * \int_0^{Ts} \exp(j2\pi(f_R - f_l)t) dt \tag{4}$$

$$\delta_{kl} = \exp(j2\pi(f_k - f_l)T_s) * \frac{\sin(\pi(f_k - f_l))T_s}{\pi(f_k - f_l)Ts} \tag{5}$$

'T_s' is symbol period. It can be seen in the following equation,

$$f_k - f_l = m * \frac{1}{Ts} \tag{6}$$

Orthogonality of two subcarriers is concluded when those two satisfies Equation (1). It signifies that this orthogonal subcarrier can be recovered with matched filter without inter-carrier interference (ICI) (Yang et al. 2011).

2.3 Implementation of discrete fourier transform in OFDM

We rewrite Equation (1) and Equation (2) for one OFDM symbol,

$$\tilde{S}(t) = \sum_{i=0}^{N-1} A_i * e^{\left(j2\pi\left(\frac{i}{T}\right)t\right)}, 0 \leq t \leq T \tag{7}$$

Equation (7) represent baseband OFDM signal in complex form. Thus, this baseband OFDM signal is sample by sample rate 1/T and normalization factor 1/N, then

$$S_n = \frac{1}{N} * \sum_{i=0}^{N-1} A_i * e^{\left(j2\pi\left(\frac{i}{N}\right)n\right)}, \qquad n = 0,1, \dots\dots\dots, (N-1) \tag{8}$$

Where, S_n is the n^{th} time domain sample. This equation is same as inverse discrete fourier transform (IDFT). Similarly, the original symbol recuperated by discrete fourier transform (DFT) at the receiver side is given as,

$$A_i = \sum_{i=0}^{N-1} R_n * e^{\left(-j2\pi\left(\frac{i}{N}\right)n\right)}, \quad n = 0,1,\dots\dots\dots,(N-1) \tag{9}$$

Where R_n is n^{th} received sample signal and A_i is received information symbol for the i^{th} subcarrier. The advantage of DFT and IDFT implementation in OFDM is that the implementation using FFT and IFFT algorithm. Therefore, the number of complex multiplication is reduced and computational complexity is also from N^2 to $\frac{N}{2}log_2(N)$(Shieh and Djordjevic 2010; Yang et al. 2011). There is no need of large number of modulator, demodulator, and filters for modulation and demodulation of number of orthogonal subcarriers at both transmitter and receiver side. Hence there is convenient implementation using IFFT and FFT.

2.4 Cyclic prefix

The cyclic prefix merely signifies that is the information which periodically repeats itself. In OFDM orthogonal subcarrier is modulated and demodulated via IFFT and DFT, for good performance of optical OFDM it is important to reduced dispersive channel effect such as chromatic dispersion and polarization mode dispersion (PMD). In order to enable this scheme in OFDM technique, cyclic prefix insert in guard interval (Shiehand Djordjevic 2010; Yang et al. 2011). OFDM has large symbol duration 'T_s' as compared to the impulse response of channel 'τ_{max}', it causes ISI. Thus, to reduce the amount of ISI addition of guard interval larger than the estimated delay spread 't_d'. If the guard interval is empty, orthogonality between the OFDM subcarriers is lost. Hence, it caused inter-channel interference (ICI). To prevent the OFDM symbol from ISI and ICI, OFDM symbol is "cyclically extended" into guard interval. The for ISI free transmission of OFDM signal is given by following condition (Shiehand Djordjevic 2010; Yang et al. 2011),

$$t_d < \Delta G \tag{10}$$

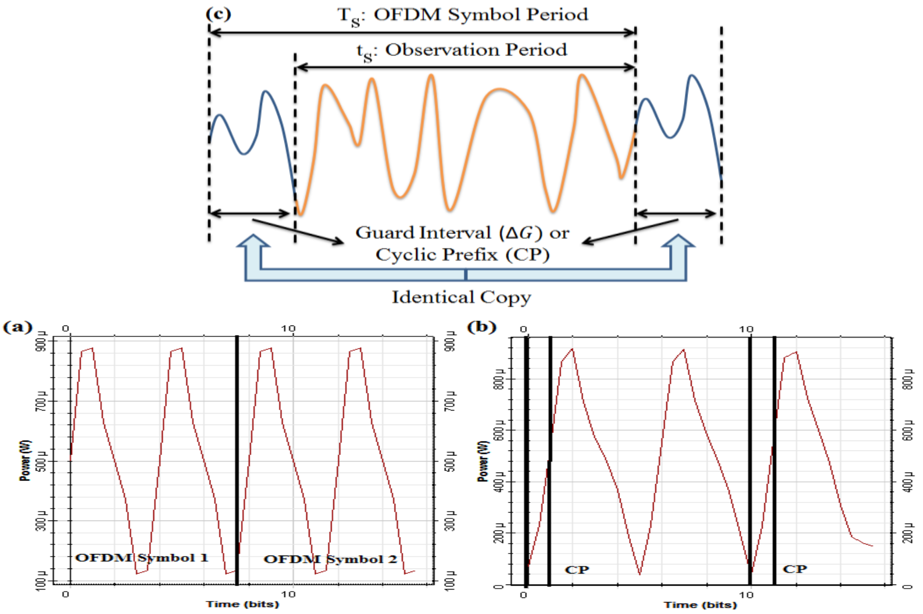

Fig.2a Transmission of OFDM symbol without cyclic prefix**b** Transmission of OFDM symbol with cyclic prefix**c** OFDM signal for one symbol in time domain.

The goal of the cyclic prefix is to eliminate the channel dispersion induced by ISI and ICI. In Fig. 2a it shows that two OFDM symbol are transmitted without cyclic prefix at the transmitter. In Fig. 2b represent cyclic prefix is inserted into guard interval (ΔG) by cyclic extension of OFDM waveform at the transmitter. In cyclic prefix insertion, last few samples or symbol in time domain segment of OFDM symbol is copy and inserted into guard interval is illustrated in Fig. 2b. Time domain representation of OFDM signal is shown in Fig. 2c. It expresses complete one OFDM symbol with cyclic prefix. Frequency domain information of symbol will be recovered using waveperiod in the observation time. Insertion of a cyclic prefix in OFDM reduced a significant amount energy loss and multipathare resolved. The addition of cyclic extension in guardinterval of CO-OFDM system brought benefits it makes system robust aginst ISI and PMD.

2.5 Spectral Efficiency of CO-OFDM

Spectral efficiency of the system describes how many numbers of information bits can be embraced into given bandwidth. The conventional scheme of modulation like single carrier modulation has broad and leaky spectrum.Hence, there is leakage of energy. In CO-OFDM technique owing to its orthogonality property spectrum is rectangular, almost all energy is confined inside the rectangular spectrum and the tiny spectrum is left outside. Occupied spectrum by CO-OFDM is much narrower compared to the spectrum of conventional single carrier modulation. Hence, CO-OFDM has high spectral efficiency. The CO-OFDM system with high spectral efficiency is most efficient to implement higher order QAM modulation to achieve high data rate (Shieh and Yi 2010). Therefore, CO-OFDM emerges as one of the attractive pathways in the direction of the 100 Gb/s and 1 Tb/s Ethernet transport (Shieh 2009).

2.6 Peak to average power ratio

PAPR is less for good optical OFDM system. The high value of PAPR is a major drawback of optical OFDM technique. In CO-OFDM system, OFDM modulation allows transmit data at high data rates through an optical link, nevertheless present of the high signal peak in OFDM causes signal distortion. This effect in optical OFDM system is known as PAPR. IFFT and FFT block in CO-OFDM system is accountable for PAPR. In optical OFDM system having a large number of subcarriers will result in have a large PAPR thus, PAPR is directly proportional to the number of subcarriers used for OFDM system. Therefore, to use a large number of subcarriers in OFDM is extremely difficult due to larger PAPR (Tarokh 2014). In optical systems, there is vivacious research on reduction techniques of PAPR for OFDM system. However, the PAPR still a challenge in optical communication owing to non-linearity in the optical fiber (Yang et al. 2011). Signal clipping is most commonly used PAPR reduction technique for OFDM system. But due to clipping technique induced signal distortion cause degradation in system performance. Another technique is Pilot-Assisted PAPR reduction technique which is easier to reduce PAPR value by transmitting average optical power through OFDM system without degradation in system performance (Popoola et al. 2014).

3. Experimental setup and description

In this paper, the proposed model of DP-QPSK modulated CO-OFDM is simulated using a commercial optics fiber simulation tool, OptiSystem^{TM} . The simulation setup of the polarization multiplexed CO-OFDM system is shown in Figure 3. The simulation model consists two users i.e. user-1 and user-2 which supports to transmit two OFDM signals each of 50 Gb/s to reach 100 Gb/s data rate. The two OFDM signals for user-1 and user-2 are generated independently using Pseudo Random Bit Sequence (PRBS) generator; each signal is mapped in QPSK modulation format. Simulation of DP-QPSK CO-OFDM based on dual polarization of signal i.e. X-polarization and Y-polarization.

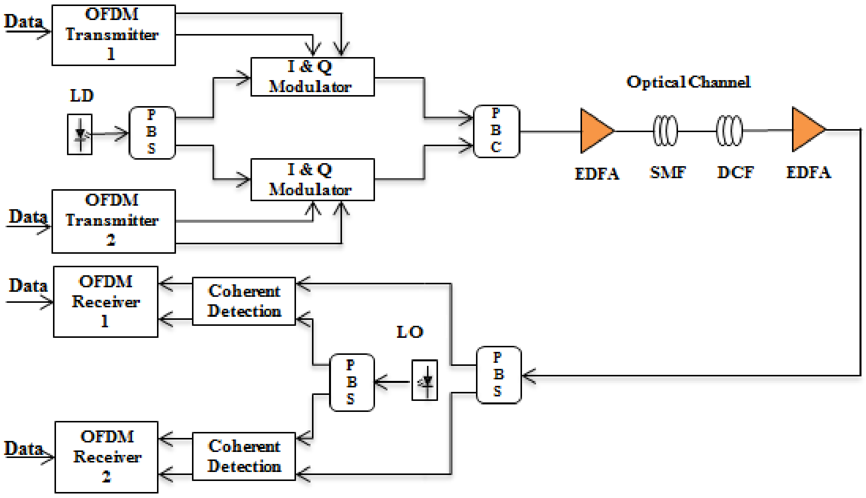

Fig.3 Experimental setup of 100 Gb/s polarization multiplexed CO-OFDM system*PBS* Polarisation Base Splitter,*PBC* Polarisation Base Combiner

IFFT operation was performed to get digital time domain signal. The 128-points IFFT is used having 104 subcarriers and the guard interval is 1/8 of the symbol window. The baseband OFDM signals further process by the roll of cosine filter having roll factor is 0.25 to avoid the antialiasing effect. The laser diode with MZM modulator is used to map I and Q form of RF OFDM signal onto an optical carrier. The laser diode is operated at1552.52 nm wavelength (193.1THz central frequency) has linewidth is set at 0.1MHz with optimum launch power. This two RF OFDM signal is combine using polarization combiner and transmit over the optical channel to facilitate wireless transmission. The optical channel uses standard SMF fiber of length 360 km with DCF to compensate dispersion in the optical channel. The SMF and DCF have standard parameter shown in Table 1. The optical channel consists of sixspans of 130 km standard SMF with 26 km DCF having dispersion coefficient as 16 ps/nm/km, -80 ps/nm/km and 0.2 dB,0.6 dB attenuation loss respectively. Global parameters of simulation window have 8192 sequence lengths and 4 samples per bit thus, a total number of the sample is 32768. After the opticalchannel, Gaussian filter has used to remove the Gaussian optical noise in optical OFDM signal. In optical to RF down-conversion, the coherent detection technique is used to detect the optical signal at the receiver which converts the optical signal into electrical signal. Then RF OFDM demodulator is used to recover the original signal.

Table 1 Standard parameter for SMF and DCF

Parameter	SMF	DCF
Dispersion	16 ps/nm/km	-80 ps/nm/km
Dispersion slope	-0.08 ps/nm^2/km	-0.45 ps/nm^2/km
PMD coefficient	0.2 ps/km	0.2 ps/km
Effective Area	80 um^2	30 um^2
Nonlinearity Coefficient	2.6 e10^-20	2.6 e10^-20
Attenuation	0.2 dB/Km	0.6 dB/Km

4. Result and Discussion

4.1 Comparison of modulated spectrum

The calculated power spectrum of DP-QPSK modulated CO-OFDM signal compare with conventional QPSK modulated CO-OFDM signal transmitted over 936 km standard SMF are plotted and spectral efficiency of these signal is compared. In Fig. 4a and Fig. 4b shows the complete frequency spectra of DP-QPSK CO-OFDM. Signal and conventional QPSK CO-OFDM signal respectively. Observing the spectra and after the calculation, the spectral efficiency of DP-QPSK CO-OFDM is 1.92 bit/s/Hz is better as compared to thespectral efficiency of conventional QPSK CO-OFDM is 1.25 bit/s/HZ. Hence, DP-QPSK modulated CO-OFDM system offer significantly high spectral efficiency at higher data rate as compared to conventional QPSK modulated CO-OFDM system

4.2 Post-dispersion compensation

In order to compensate the dispersion and fiber nonlinearity induced in the optical channel Post dispersion compensation technique is used in DP-QPSK CO-OFDM system. In this technique, DCF fiber is used after standard SMF which compensates dispersion in the optical channel. In Fig. 5a andFig. 5b it prominently shows the effect of chromatic dispersion on CO-OFDM system elaborated in the constellation diagram. The spectral efficiency of OFDM signal is spoiled due to dispersion and fiber nonlinearity in the optical channel. The post-dispersion compensation technique removes nonlinearity in the opticaland significantly improves system performance.

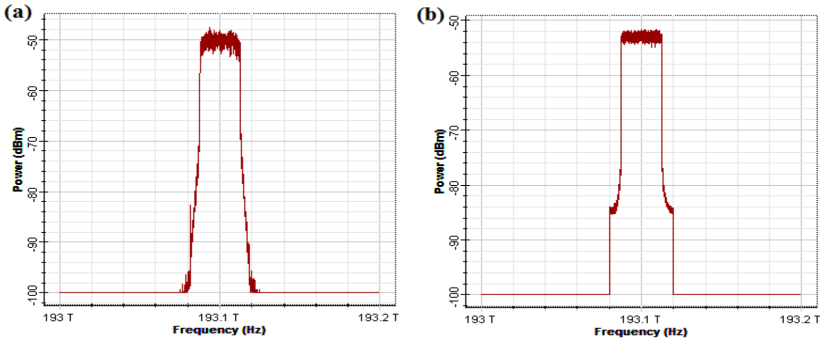

Fig.4 Frequency spectra of **a** DP-QPSK modulated CO-OFDM signal and **b**Conventional QPSK modulated CO-OFDM signal

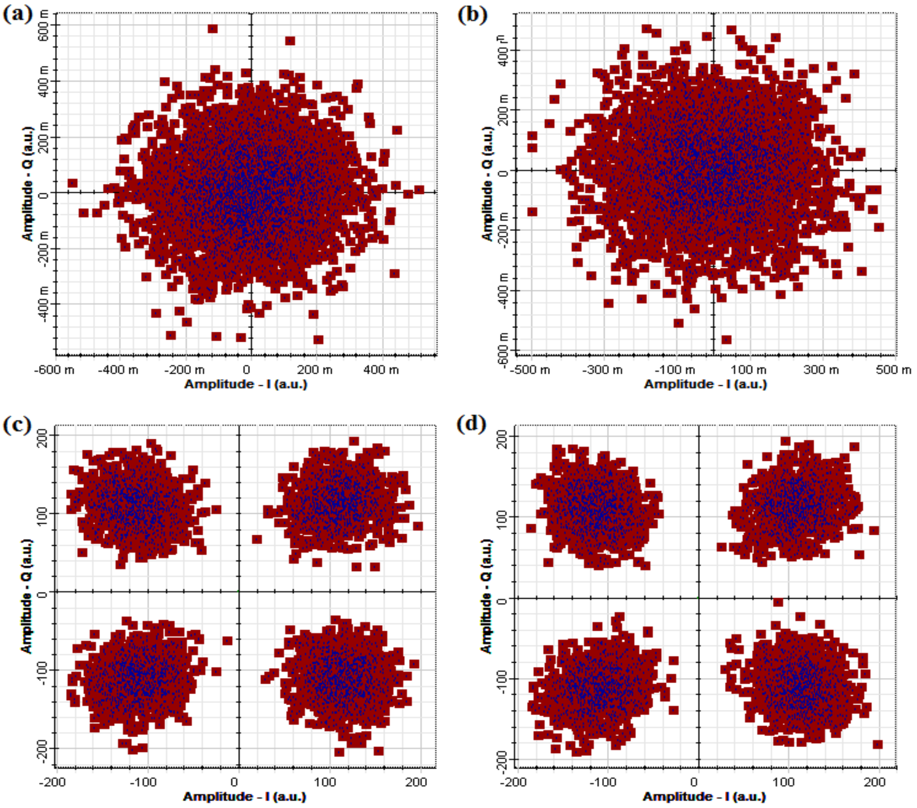

Fig.5 Received Constellation diagram of OFDM signal before dispersion compensation **a** X-polarization**b** Y-polarization and after post dispersion compensation **c** X-polarization **d** Y-polarization

Thus, after nullifying the effect of chromatic dispersion,well-resolved constellation diagram for DP-QPSK modulated CO-OFDM system is achieved. This is illustrated in Fig. 5c and Fig. 5d.

4.3 Performance evaluation of laser linewidth

Laser phase noise imposes a limitation on CO-OFDM system. The time domain duration of OFDM symbol restricts laser linewidth in CO-OFDM system. OFDM with longer symbol needed narrower linewidth laser (Shieh et al. 2008). The phase noise colligates with a linewidth of the laser will cause a loss of orthogonality which leading to inter-carrier interference (ICI). For this reason, CO-OFDM system uses shorter OFDM symbol than DDO-OFDM system. Phase tone with sufficient bandwidth is mixed up with subcarrier band; this mixing helpes to extract phase between subcarrier and pilot signal which eliminates the phase error between transmitting laser and local oscillator in CO-OFDM (Yi et al. 2008). In Figure 6, it shows the effect of laser linewidth on the quality factor of CO-OFDM system for both user-1 and user-2.

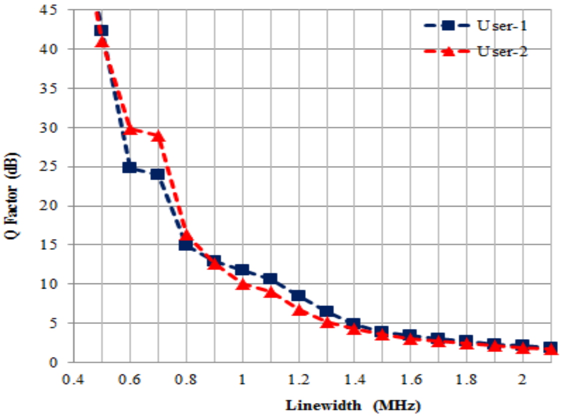

Fig. 6 Calculated laser linewidth versus Quality factor (Q)

The laser linewidth increases from 0.6 MHz to 1 MHz quality factor Q is below 30 dB and laser linewidth beyond the 1 MHz Q-factor is less than 10 dB which is very poor. Between 0.6 to 1.3 GHz, theperformance of user-1 and user-2 is slightly distinct owing to input optical power applied to the laser to both I & Q modulators are not exactly equal, thus this imperfection result fiber nonlinearity and dispersion. Thelaser source of linewidth 0.4 MHz and below result in significantly good Q factor is achieved.

4.4 BER analysis

The BER for two CO-OFDM users was measured from the received CO-OFDM signal. Fig. 7a represent the relationship between –log (BER) versus input optical power of CO-OFDM for users-1 and user-2. The input optical power of laser has a significant effect on BER. The BER value of CO-OFDM is calculated for the 1552.52 nm wavelength (193.1 THz central frequency) in the conventional band. The input optical power of laser decreases from -6 dB to -20 dB, BER of CO-OFDM system greater than 10^{-4}. At -4 dB input optical power of laser error free transmission of CO-OFDM signals over 936 km with good SNR 79 dB is achieved. In Fig. 7b represents the relationship between –log (BER) versus SNR for user-1 and user-2. This figure illustrates that SNR must be greater than 78 dB for a BER less than 10^{-4}. The Fig. 8a it shows the constellation diagram of -4 dB input optical power of CO-OFDM signal. If the input power of laser increased beyond the -4 dB, chromatic dispersion in optical channel increases which leads to higher BER. In Fig. 8b the effect of chromatic dispersion on constellation at -15 dB input optical power is prominently shown. This figure illustrates the spectral efficiency of CO-OFDM signal is spoiled due to chromatic dispersion.

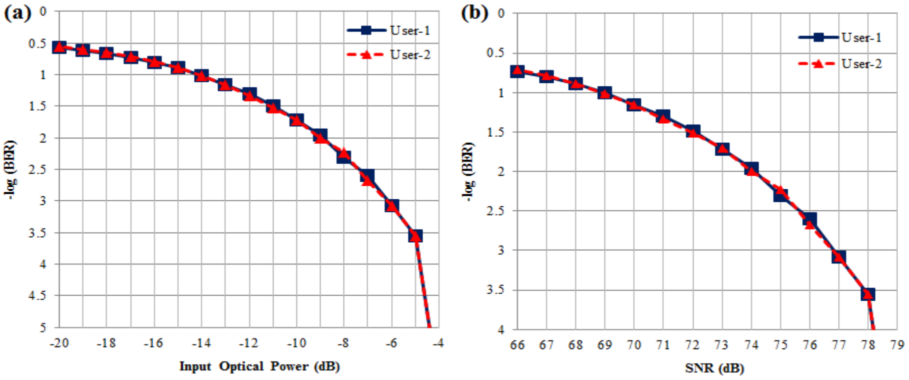

Fig.7a The relationship between –log(BER) versus input optical power for user-1 and user-2 at 50 Gb/s data rate over 936 km distance. **b** The relationship between –log(BER) versus SNR (dB) for user-1 and user-2 at 50 Gb/s data rate over 936 km distance

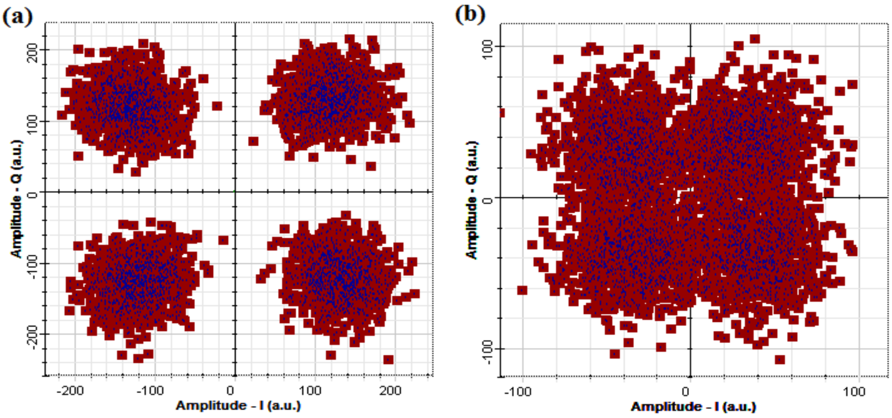

Fig.8 Constellation output **a** at -4 dB input optical power **b** at -15 dB input optical power

The BER for both; user-1and user-2 is not precisely same. This is due to the fact that the power delivered by the generated optical multicarrier signal to all optical carriers is not exactly equal (Kim 2012). This issue has further combined with fiber nonlinearity of optical channel. Thus, get variation in SNR and BER for the user-1 and user-2. Hence, the input optical power of the laseris decreased beyond the optimum value consequently the power in optical channel decreased this result intoadispersion in the optical channel causes inter-channel interference (ICI) in optical channels.

5. Conclusion

This paper has evaluated the performance of DP-QPSK modulated CO-OFDM system including the effect of fiber nonlinearity. The system is designed using two OFDM signals each of 50 Gb/s to achieve 100 Gb/s data rate transfer over 936 km standard SMFwhile the effect of chromatic dispersion is compensated using post dispersion compensation technique. Simulation of CO-OFDM system is based on the dual polarization of signal. The result indicates that DP-QPSK modulated CO-OFDM system has high spectral efficiency as compared to conventional QPSK modulated CO-OFDM system at higher data rates. Thus, for higher data rates and long haul communication DP-QPSK CO-OFDM is a better technique as compared to the conventional QPSK-CO-OFDM modulationtechnique. The simulation result shows that quality factor Q is greater than 45 dB for laser linewidthbelow0.4MHz.Therefore, the selection of laser linewidth should be narrower to get optimum system performance. The BER analysis shows that the input optical power of the laser at -4 dB or below -4 dB get error free transmission OFDM symbolfor which SNR is greater than 79dB. With the help of result, it is concluded that DP-QPSK modulated CO-OFDM system is really emerging and promising technology to achieve high data rate in optical communication. The performance evaluation of this CO-OFDM system is helpful to implement Ethernet system of 1 TB/s and radio-over-fiber applications for high data rate.

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