Investigations on Design issues for Optical-OFDM systems

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Abstract- In this paper design considerations are discussed for Optical-OFDM system in terms of amplification required in the optical-Link. Role of EYCDFA is analysed for 10 Gbps single channel link which fulfils the increasing demands of users for high transmission data rates from source to destination.

1. Introduction

Now these days, in telecommunication networks erbium doped fiber amplifiers (EDFA) is greatly used because it is well matched for the increasing demand of high transfer data rates. As it provides high gain, low noise figure and low insertion loss in optical fiber network [1-4]. It is becoming important to use optical amplifiers in the communication networks because they provide good elaborated and less distorted signal for long distance transmission. [5-9]Apart from EDFA, due to increasing demand of less distorted signal the need of large concentration doping of erbium ions optical amplifier arises which can operate around wavelength of 1550nm. So to solve this problem the EYCDFA optical amplifier is introduced in which co-doping of Erbium doped fiber is done with ytterbium [10-13]. In this chapter, both EDFA and EYCDFA are introduce in 10 Gbps single channel optical link. The performance of 10 Gbps optical link is analyse before addition and after addition of optical amplifiers. The performance of different parameters is also analyse.

2. Proposed system

A 10 Gbps single channel optical link is taken as shown in Fig 1 below in which 10 Gbps data transfer between the transmitter and receiver. Gbps is used to compute the data transfer speed between the source and destination. In this optical link number of components are used which are divided into different categories like a transmitter, channel, receiver and control. These categories are further divided into different components. In the first category i.e. transmitter there is a first component which is known as pseudorandom binary sequence generator (PRBS). It is used to generate a binary sequence of particular length i.e. (2^7) bits at given data rate of 10 Gbps. Then this signal is passed onto the electrical signal generator and then to the BER tester block. In the electrical signal generator block the binary sequence is converted into electrical signals. Then the output of electrical signal generator is passed to the direct modulated laser and fed as input. The non-linearity in the laser which include the chirp and transients are formed by the rate equations. In the second category i.e. channel a fiber is used to carry the optical signal which is generated by the transmitter. In fiber, the effects of attenuation, dispersion and non-linearity are represented. The optical signal from fiber is then passed to the optical power normalizer block. In this block the attenuation is determined in the optical signal. Furthermore, the receiver category includes receiver block and bit error rate tester block. In this category the optical signal is converted into an electrical signal and then amplification is performed to produce the desire output electrical voltage signals. Further the electrical signal is passed to the BER tester block which is used to determine the average bit error rate. At the end in the control category, plot icons are involve

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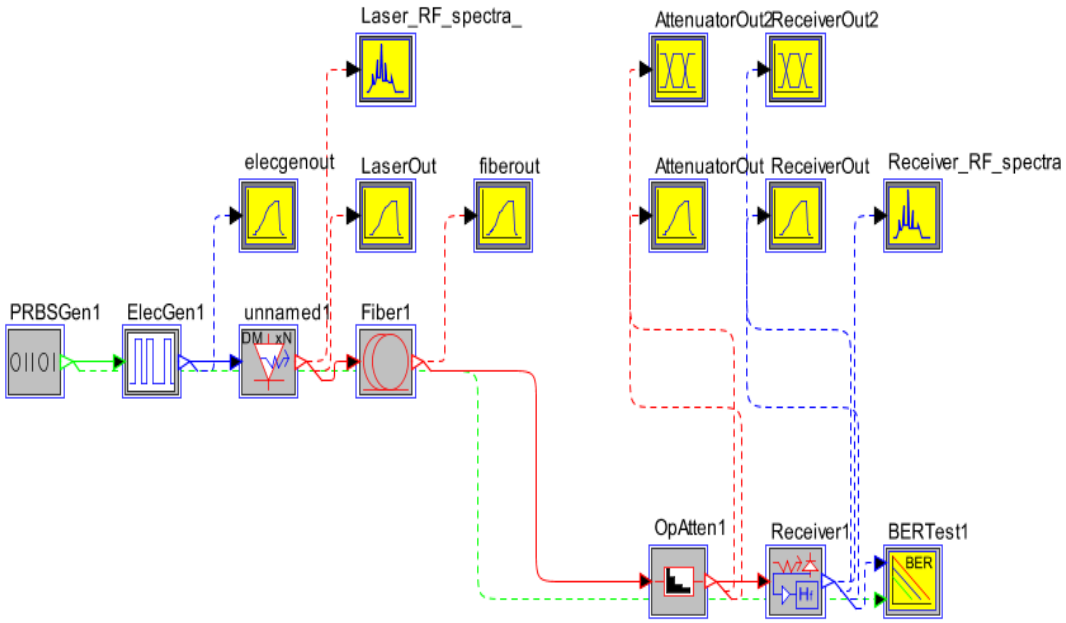

Fig 1. Gbps single channel optical link

3. Results of 10 Gbps single channel optical link

The performance of different parameters is analyse. The results of BER block are taken as shown in fig 2(a). The probability of error which is based on the level of signals during the time of sampling for each bit in a sequence is determine. The result is obtained in the BER value versus averecpower values. Here, scan starts from -15 and end with -21 and -2 steps is taken for each scan. BER curves are generating when the outer iteration variable is set. Here, the values of outer iteration variables are taken from 10e-3 to 60e-3 with step of 10e-3. In the examine result each curves represent a different bias current values.

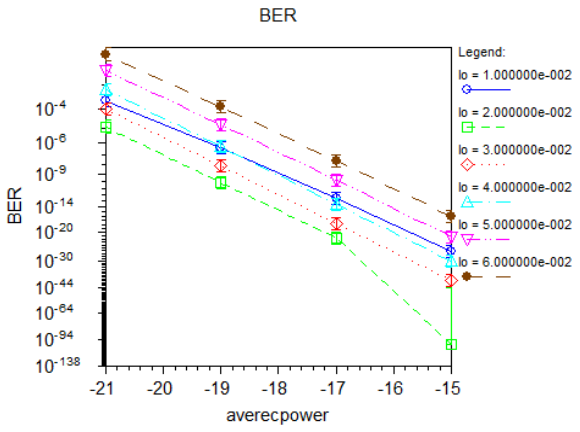

Fig 2(a) BER result

Fig 2(b) shows that the result of BER decision level scan Q in which the result is obtain between the decision level(V) values and Q. The outer iteration variables attain different values of Q at different level.

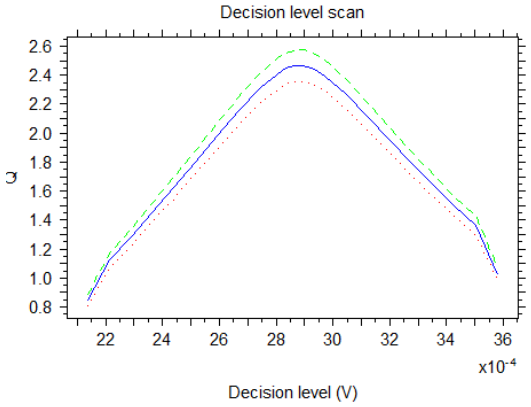

Fig 2(b) BER decision level scan Q result

Furthermore, in the BER tester, the decision level scan result is examine between the BER values and decision level (V) values. In this the outer iteration variable achieves different values of BER in the down ward direction as shown below in fig 2(c).

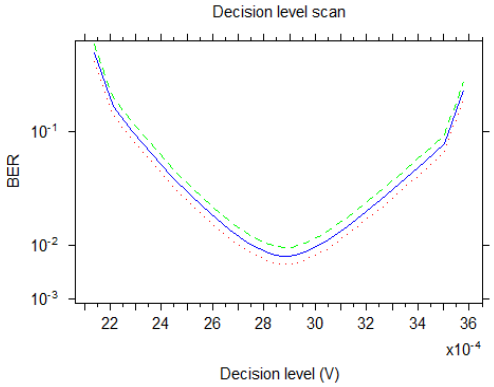

Fig 2(c) BER decision level scan result.

4. 10 Gbps single channel optical link using EDFA and EYCDFA

In the above discuss 10 Gbps optical link all the categories are explain in detail. As this optical link is set up to transmit data at rate of 10 Gbps at the receiver end using various components. But due to attenuation, absorption and scattering of a signal in the optical fiber the transmitted data results in the signal with distortion. Therefore, keeping in mind the increasing demand of higher data transmission capacity and less distorted signals another setup of 10 Gbps link is created using optical amplifiers as shown in Fig 3 as below.

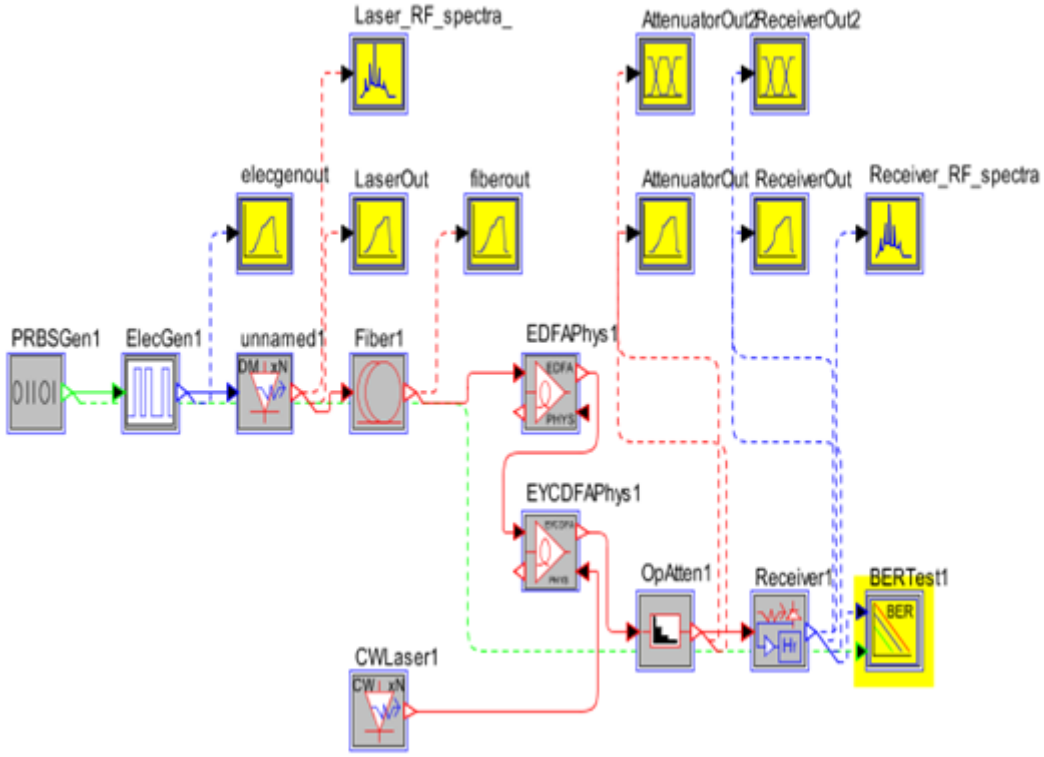

Fig 3. 10 Gbps optical link using EDFA and EYCDFA

In this 10 Gbps optical link two optical amplifiers are used i.e. EDFA and EYCDFA. Here, EDFA works as a pre-amplifier and EYCDFA works as a post amplifier. Both optical amplifiers are used in cascaded form. Due to use of EDFA and EYCDFA in cascaded form, the flat gain is achieve and it also helps in dropping the noise figure level by which the signal to noise ratio is improved. In this set up the cascaded EDFA and EYCDFA are applied at the fiber output. EDFA output is fed as an input to the EYCDFA. A forward pump is applied to the EYCDFA then the output of EYCDFA is fed to the optical attenuator.

4. Result of 10 Gbps link using EDFA and EYCDFA

The performance is analysed on the basis of optical link shown in fig 4.3. The output of EYCDFA is monitor for various pump power and curves are obtained at various optical power. The result is obtained between various optical power and source wavelengths as shown in fig 4(a).

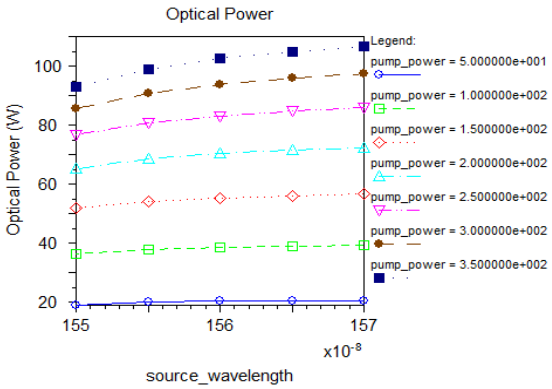

Fig 4(a) EYCDFA output power versus source wavelength

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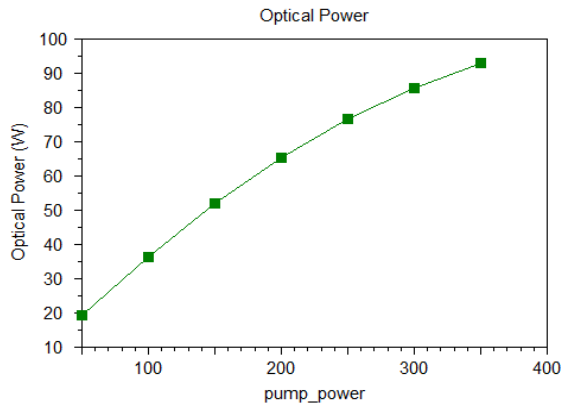

Fig 4(b) Optical power versus pump power

The curve is also obtain for different values of pump power for which the optical power increases with increase in pump power shown in fig 4(b)

5. Conclusion

Analysis is performed on the 10 Gbps single channel optical link. The performance of different component like BER is examine. Due to the need of high speed data transfer over the long distance communication. Two different optical amplifiers are used which give the better performance of 10 Gbps optical link. These amplifiers are used to transfer the data at high speed and for achieving flat gain and drop in noise figure.

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