

Performance analysis of WDM system using SOA for high data rate transmission

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Abstract

In this manuscript, we have transmitted at different data rates i.e. 20 Gbps, 40 Gbps, 80 Gbps, 100 Gbps to 16 users using SOA amplifier. The frequency and power of WDM transmitters has been taken at 190 THz and 3.99 dBm respectively. The injection current of 0.5 A has been applied to the amplifier. It has been observed that the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 20 Gbps - 100 Gbps.

Keywords: WDM, EDFA, SOA, Raman

1. Introduction

Today the researchers are concentrated on WDM systems to execute the requirement in next-generation of high-bandwidth optical access networks for cost-effective user-shared facilities [1]. This technology is well thought-out to be one of the most promising solutions for the next broadband commitment [2]. In WDM networks each user is assigned dedicated channel. The considerable enlargement in today's necessity i.e. demand for audio, internet data, video online, venture connectivity, cloud and data center services etc. can be carried out through this technology [3].

Higher amplification and greater bandwidth allow both quality and range in optical communication [4]. SOA based amplifier finds their perfect place in the long distance WDM which is required to extend coverage area of central node. For long distance optical communication the prime requirement is to minimize the loses, so here all components are expected to function in optical domain only avoiding optical to electrical plus processing in optical domain and back conversion into optical domain [5, 6]. Optical converter used here are more flexible with reference to routing and have intelligence to avoided wavelength blocking in communication nodes [7]. The drastic decrease in loses at a single node at a single mode of a multi-node system environment ultimately helps in increasing capacity of overall system. For such systems optical fiber amplifier are the most critical subsystems to select among [8, 9]. There occurs number of fiber amplifier in market but there is no substitute of Erbium doped amplifier because of their higher efficiency [10].

2. Simulation Setup

The simulation setup of WDM system of 16 users with SOA is shown in figure 1.

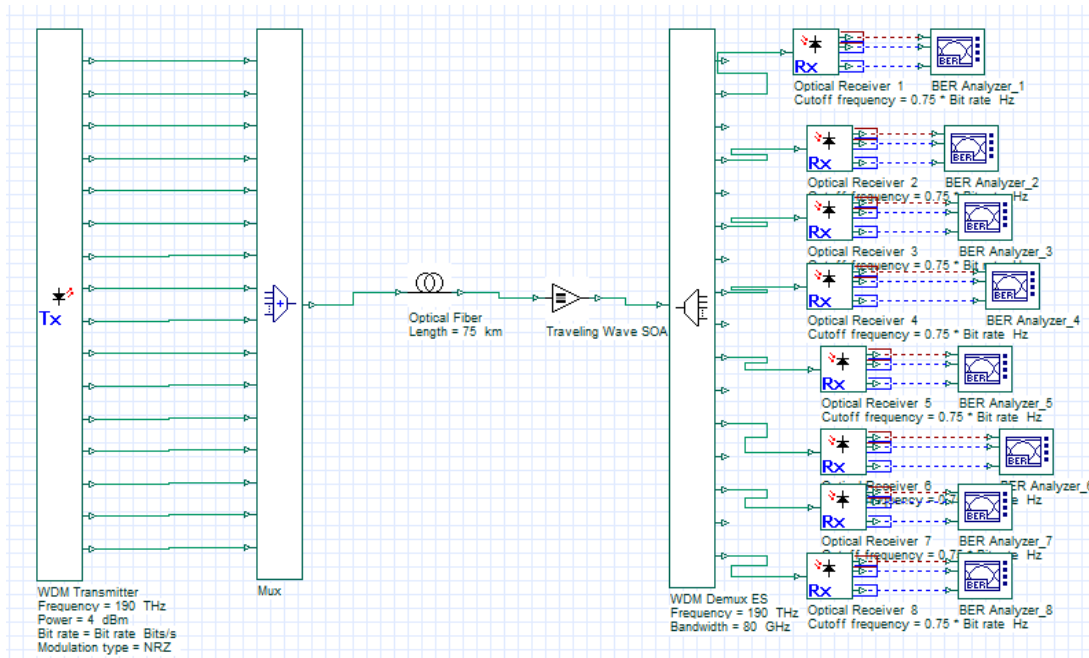


Figure 1: simulation setup of WDM system of 16 users with SOA

In this setup, we have transmitted at different data rates i.e. 20 Gbps, 40 Gbps, 80 Gbps, 100 Gbps to 16 users using SOA amplifier. The frequency and power of WDM transmitters has been taken at 190 THz and 3.99 dBm respectively. The injection current of 0.5 A has been applied to the amplifier.

Parameter	Value
Bit rate (Data rate)	20-100 Gbps
Number of optical sources	4-20 White lasers
Wavelength range	1550–1551.2 nm
Wavelength spacing	0.3 nm
Repetition rate of laser	5-20 Gbps

pulses	
Input power	1 –10 Mw
Signal type of electric generator	Voltage
Modulation type	Phase modulation (with a phase shift of π)
Fibre length	Up to 100 km
Attenuation	0.25 dB/km

3. Result and Discussion

The optical spectrum and time domain visualizer has been shown in figure 2 and 3 respectively. The system is further analyzed for high data rates i.e. 20 Gbps to 100 Gbps.

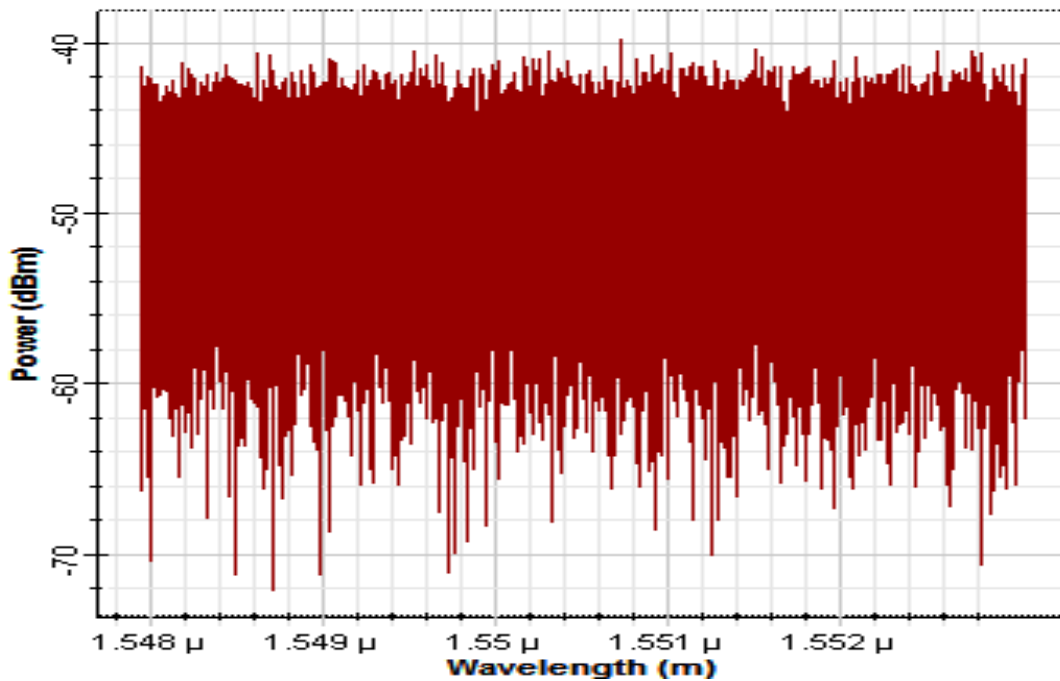


Figure 2: Optical Spectrum Analyzer

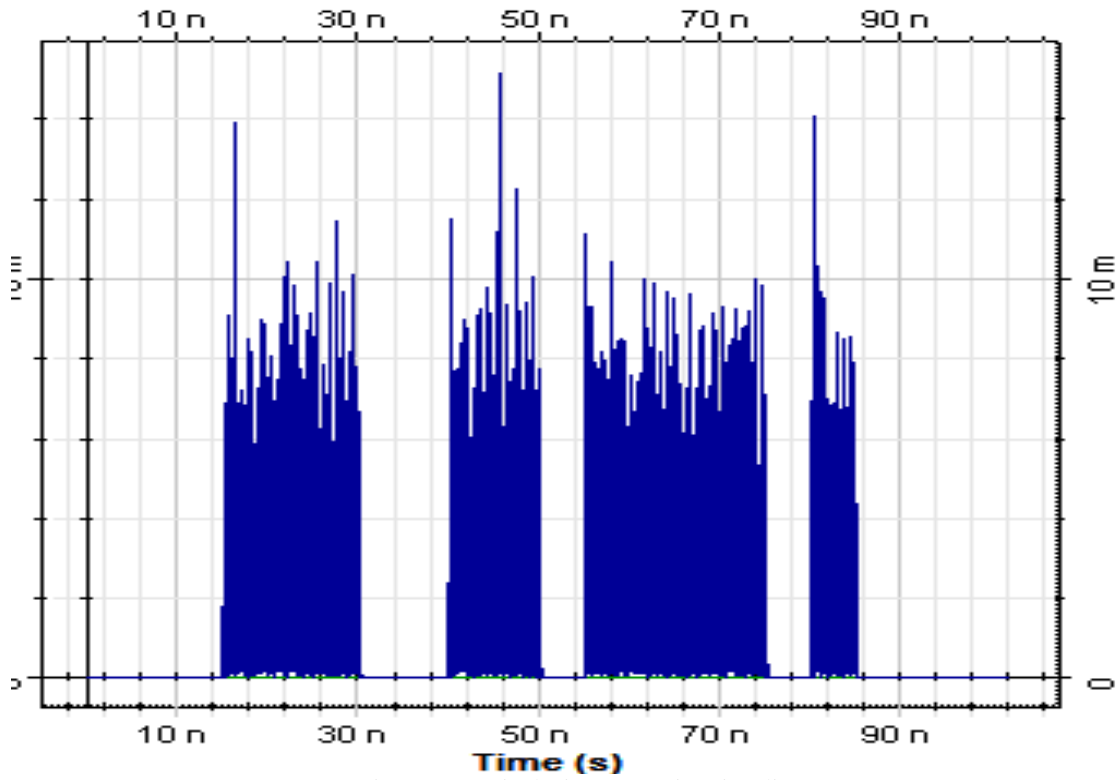


Figure 3: Optical Time Domain Visualizer

Figure 4 shows BER with respect to distance at different number of users at 20Gbps.

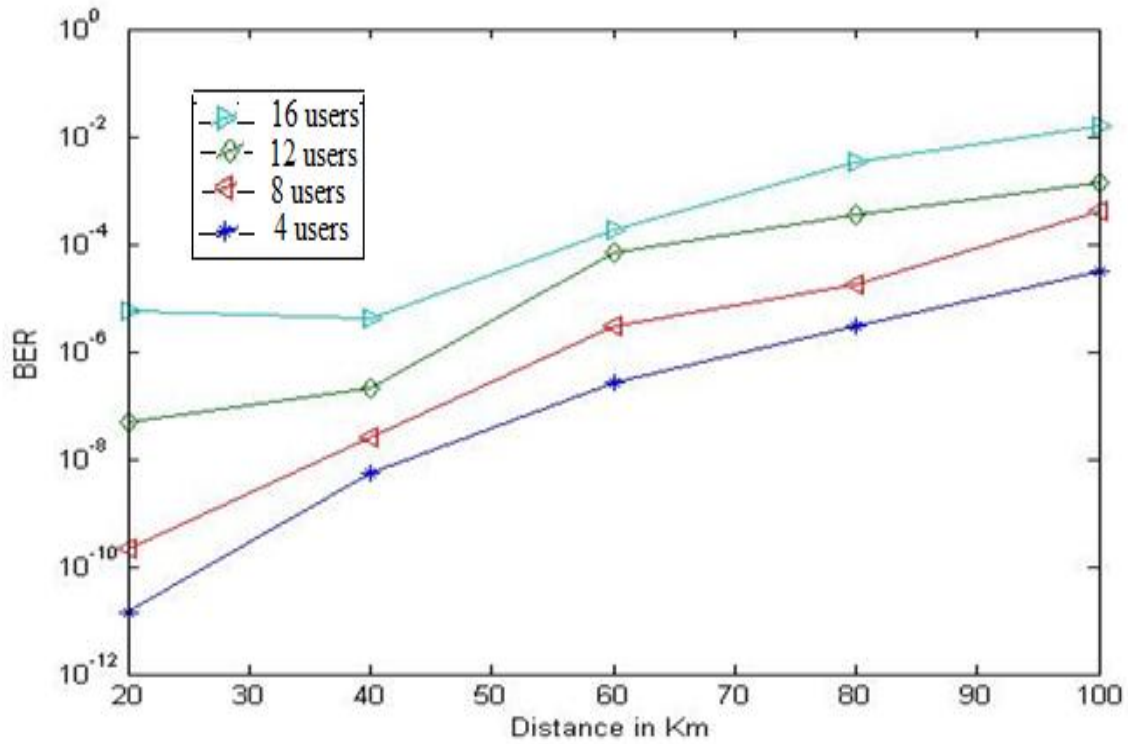


Figure 4: BER vs Distance at 20Gbps

It shows the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 20 Gbps. It can be seen that the average BER value increases with the increasing of the transmission length. Moreover, at BER of 10^{-10} the transmission distance are 20 km to 100 km for different

users respectively. Also, the results indicate that the system performance is deteriorated as the fiber length increases from 20 km to 100 km users. Figure 5 shows BER with respect to distance at different number of users at 40 Gbps.

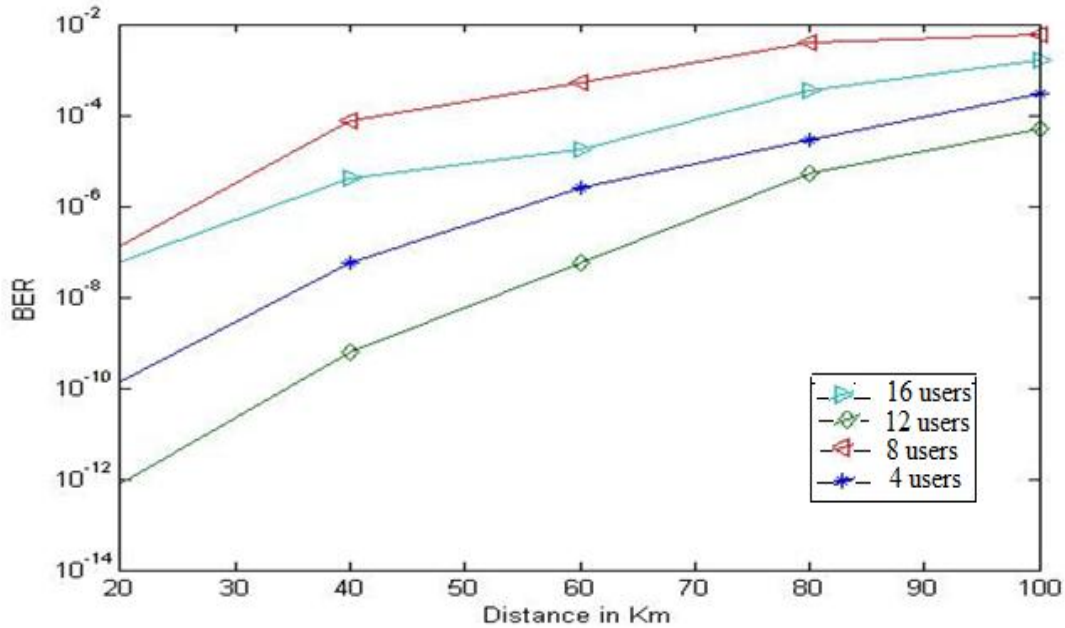


Figure 5: BER vs Distance at 40 Gbps

It has been shown that the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 40 Gbps. It can be seen that the average BER value increases with the increasing of the transmission length. Moreover, at BER of

10^{-10} the transmission distance are 20 km to 100 km for different users respectively. Figure 6 shows BER with respect to distance at different number of users at 80 Gbps.

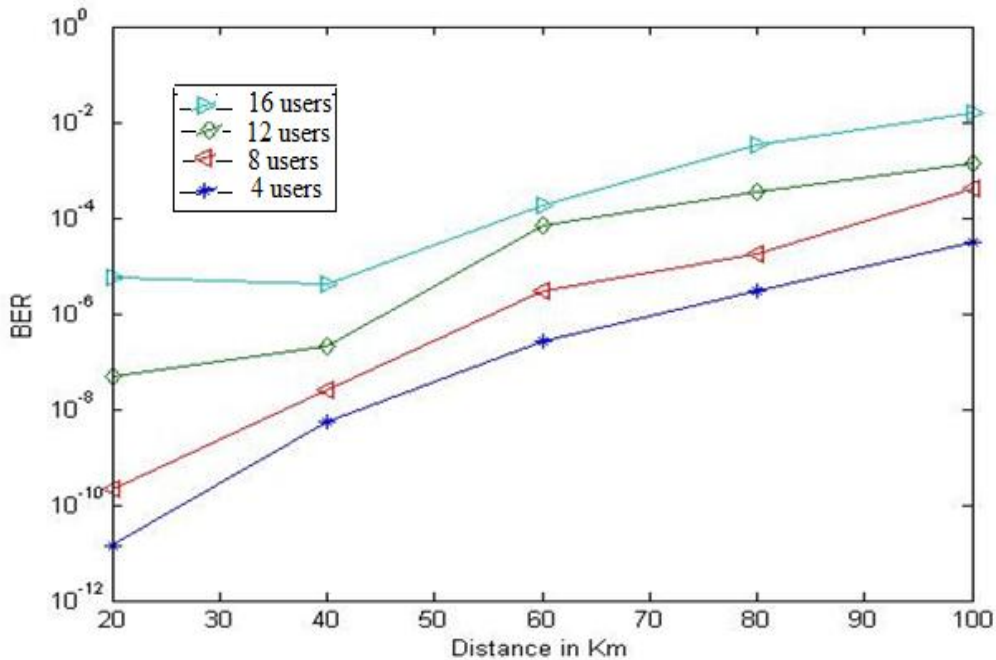


Figure 6: BER vs Distance at 80 Gbps

It has been observed that the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 40 Gbps. It can be seen that the average BER value increases with the increasing of the transmission length. Moreover, at BER of

10^{-10} the transmission distance are 20 km to 100 km for different users respectively. Figure 7 shows BER with respect to distance at different number of users at 100 Gbps.

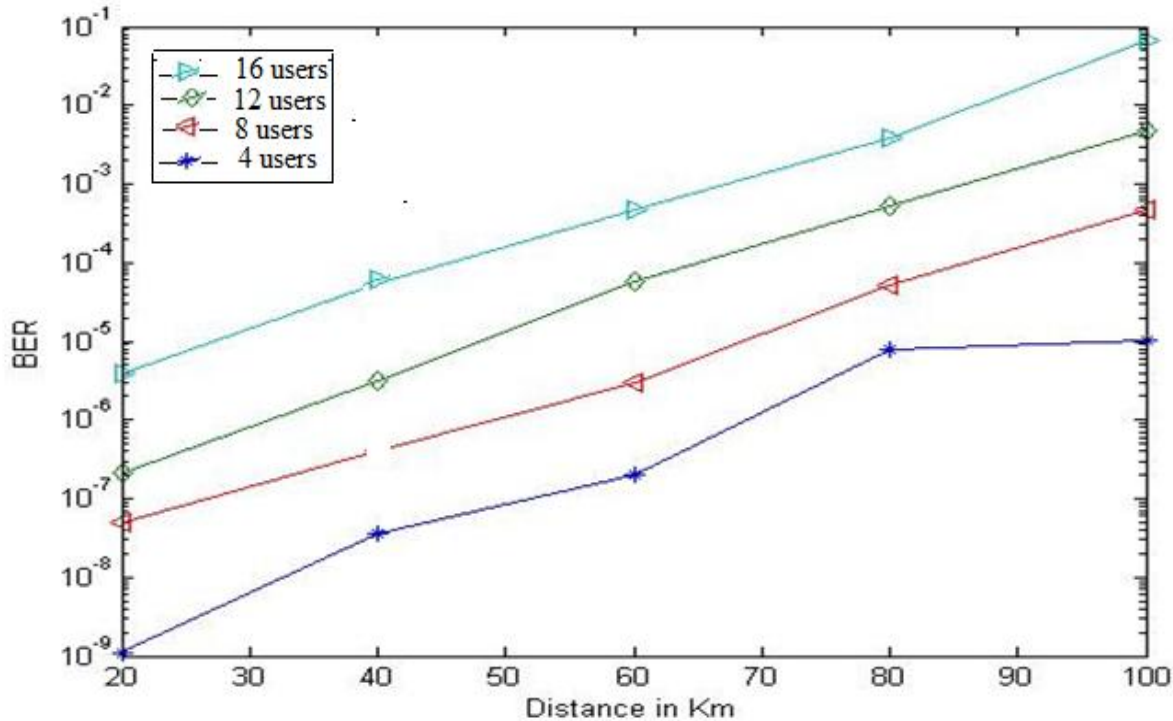


Figure 7: BER Vs Distance at 100 Gbps

It has been observed that the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 40 Gbps. It can be seen that the average BER value increases with the increasing of the transmission length. Moreover, at BER of 10^{-10} the transmission distance are 20 km to 100 km for different users respectively.

4. Conclusions

We have transmitted at different data rates i.e. 20 Gbps, 40 Gbps, 80 Gbps, 100 Gbps to 16 users using SOA amplifier. The frequency and power of WDM transmitters has been taken at 190 THz and 3.99 dBm respectively. The injection current of 0.5 A has been applied to the amplifier. It has been observed that the average BER for 4, 8, 12 and 16 users against the fiber length at data rate of 20 Gbps - 100 Gbps.

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