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Implementation of AWG as A MUX / DMUX at the WDM PON System

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ABSTRACT: ***PON (PASSIVE OPTICAL NETWORK) is going to be the one of the basic requirement of the future demands of the tele-communication system. The implementation of the WDM-PON along with the AWG is done carefully in the in the system. The AWG is used in both of the transmitter and the receiver side, as a multiplexer and demultiplexer. Our set-up model consists of the both up-stream and the down-stream data transmission. In the down- stream AWG multiplex the signal and behaves like a multiplexer at the OLT side and demultiplex the signal at the ONU side. And similar is the case with the up-stream communication system. We developed analytical model for studying the impact of the transmission impartment as well as the AWG characteristics on the BER performance of the WDMPON by incorporating the novel spectral-to-spectral domain transformation technique. The very main concept of the proposed model is the AWG . The power being captured by the output port of the AWG is not only based on the Gaussian focal field pattern but also to the power spill over the adjacent ports. All the results are strongly supported with the help of the Q factor and the eye diagram which are being executed from the BER analyser at the receiver part of the set up model. At the analysis section the plotting of the different parameter is also demonstrated. As a software Optiwave 7 software is used for the complete analysis purpose.***

INDEX TERMS: WDMPON,OLT (optical link terminal), (ONU optical network unit), EDFA, BER(bit error rate), OSNR (optical signal to noise ratio), Arrayed-waveguide grating; Gaussian focal field; Spectral-to-spatial transformation; Laser line-width; Beat noise; Diffraction order.

INTRODUCTION: As a basic principle, wavelength division multiplexing (WDM) PON provides an independent wavelength channel to each user in each communication direction[2]. The WDM PON is often classified in the next-generation PON 2 (NGPON2) family, and therefore it said to market after the upcoming NGPON1 generation[6][7]. However, an increasing amount of WDM PON systems are commercially available which are readily providing a powerful alternative to GPON or its successors[9] [5]. The common terminology is optical line termination (OLT) and optical network termination (ONT) for the equipment at the central and user-side[3][4]. AWG are critical for wavelength multiplexing and de-multiplexing in WDM-based systems[1]. These AWGs are based on silicon PLC technology[1]. Several of them are a thermal, meaning they do not require temperature control[8], while the others have internal temperature control, typically thermoelectric coolers (TECs).

METHODOLOGY:

The setup model of the work is demonstrated below. The complete set up model consists of four distinct AWG two behaving as a multiplexer and two as a demultiplexer.

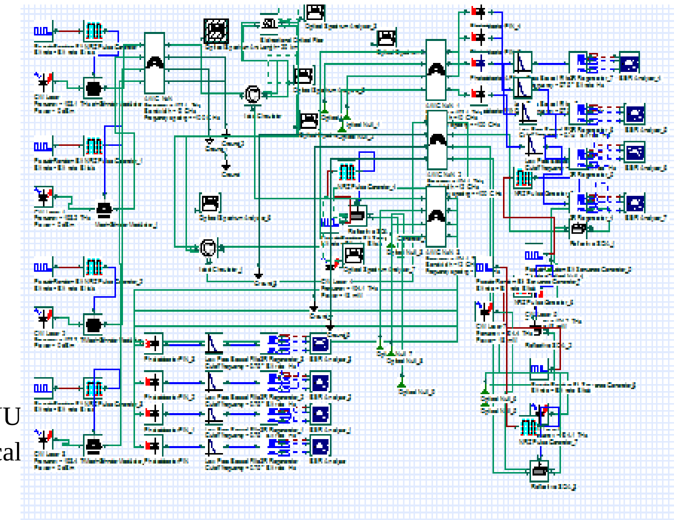

Fig.1 Set-up model of the system

The model is designed for the both of the up- and-down stream transmission consisting of the four ser in the OLT and ONU side respectively. The AWG muxed signal is allowed to pass through the ideal circulator before and after it passes through the optical fiber. After demultiplexing the signal the final retrieval of the signal is done. The similar is the case of the upstream except the use of the RSOA at the receiver side.

Result and Analysis:

The under mentioned diagram shows the eye diagram of the model. The continuous wave laser of the specific power and the frequency is used having the line width of 10MHz. The mac-zehnder modulator at the normal mode extinction ratio is used. The AWG of mux normal mode configuration having the frequency of 193.1 THz , and the band width of 12 GHz is implemented. The frequency spacing is 100 dB. The signal is allowed to pass through the ideal circulator having the insertion loss equal to zero. The bidirectional optical fiber having the reference wavelength of 1500 nm of the normal mode is used. The length of the optical fiber is assigned to be equal to 20 km. The eye diagram of all four ONU is shown in the figure no. 2. The maximum Q point of the system is also mentioned in every graph of the BER Analyser.

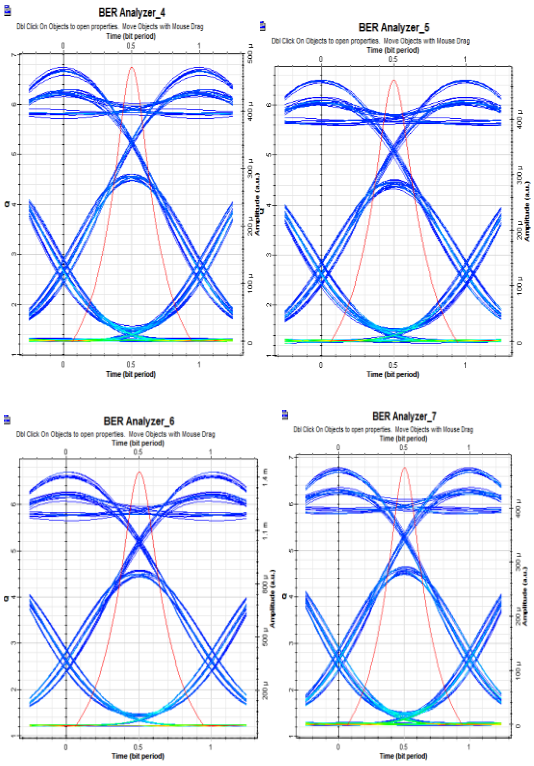

Fig.2 Eye diagram of all four ONU for the down-stream transmission

As our model is combination of the up and the down stream signals . so in order to evaluate the quality of the signal the analysis of the up stream signal is very important. Hence the eye diagram and the given signal is mentioned below. The distinct eye diagram of the entire set up is shown in the fig no 3. In the place of the Mac-Zender Modulator RSOA is used in the up-stream transmission system, whose input and the output coupling loss is equal to 3 dB at the normal mode.

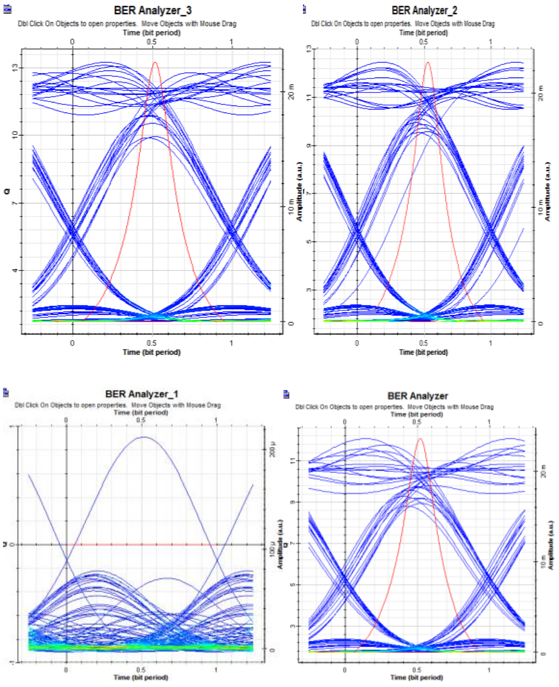

Fig.2 Eye diagram of all four ONU for the up-stream transmission

Attenuation is one of the very important parameter of the PON system on which the over all performance of the system is depending. The attenuation v/s wavelength plot is shown in figure no. 4. We can easily conclude that the attenuation of the system is minimum at the 1550 nm wave length inspite of the other two wavelength. At the wavelength of 1400 nm the attenuation is maximum.

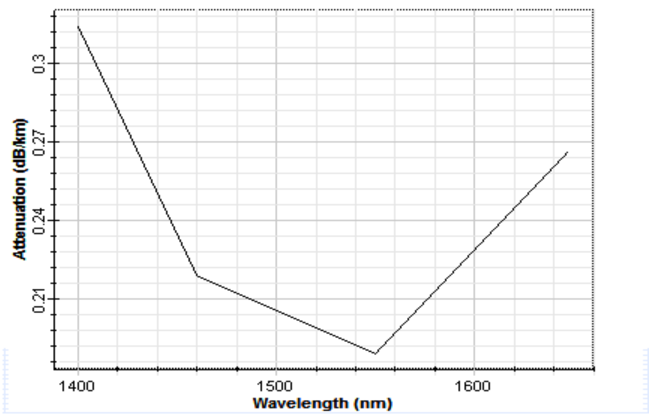

Fig. 5 The attenuation v/s wavelength plot.

The input power and the receiver sensitivity plotting is shown in the figure no. 6 the figure clearly shows that the with the increase in the power level of the source the receiver sensitivity is affected. As the power of the source is reduced the sensitivity is also reduced.

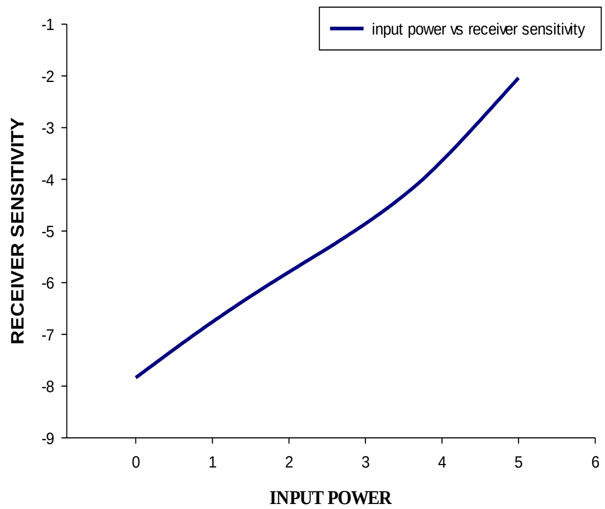

Fig.no. 6 Receiver Sensitivity v/s Input Power.

The band width of the AWG acting as a demultiplexer at the receiver end and the OSNR is shown in the under-mentioned figure. As the bandwidth of the AWG increases the value of the OSNR is also increases. Figure no.7 shows the plotting between the two vital parameters that is the AWG BANDWIDTH and the OSNR.

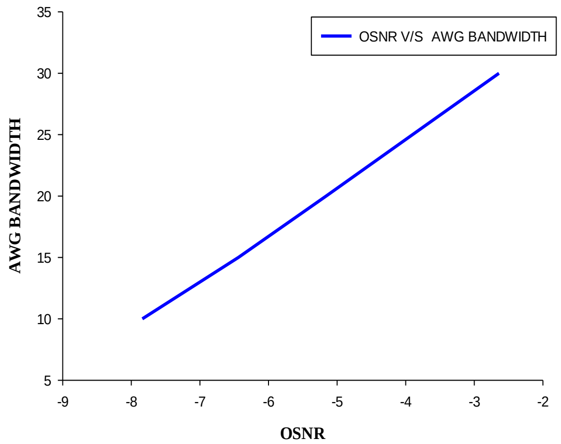

Fig.no. 6 OSNR v/s AWG BANDWIDTH.

Conclusions

We developed model in which the mux and dmux is replaced with the help of the AWGs. This device is very useful in creating a cost-effective and compact PON system. The over all attenuation along with the other parameters like BER, Q factor OSNR are also calculated with the help of the set up. The demands of the future can be well satisfied with the help of the model. This not only become the cose efficient but also the upcoming demands of the Next Generation Network is resolved.

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