International Journal of Computer Engineering and Information Technology

VOL. 8, NO. 4, April 2016, 63–67
Available online at: www.ijceit.org
E-ISSN 2412-8856 (Online)

Infrastructure of WDM (Wavelength Division Multiplexer) with Simulations Using Eight Channels

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ABSTRACT

Transmission of high data rate is the main endeavor for next generation optical access network. In this paper we propose a new architecture for a traditional wavelength division multiplexed (WDM). We presented 10Gbps full duplex communication for next generation system. We connected 8 CW lasers having frequency of 193.0 THz to 193.7 THz. In this way a cost effective arrangements for WDM is proposed based on a single light source. 1-8 and 8-1 Multiplexer and de-multiplexer is used where each output is modulated with 10 Gbps user data. Multiplexed data from all four modulators are transmitted and received back via single mode fiber span of 100km. Power losses are calculated with using 100 km and in back to back configurations different bit error rates. Transmission performance with negligible power penalties during downlink and uplink transmissions confirms that the proposed arrangement is deployable in next generation of WDM.

Keywords: *WDM, Multiplexing, CW laser and De multiplexing, BER.*

1. INTRODUCTION

As all tend to agree that high data rate, privacy and Low BER are the valuable successor points for satisfaction of both low and high level users in the era of modern Communication technology [1]. The current trend of demands in network communication has been shifted from normal to multimedia based services, including with the increase of users. However traditional technology system is facing problem to provide better speed, accuracy and to maintain error correction system. According to national infrastructure of broadband Internet, mobile communications and web services that ICT (information communication and telecommunication) will be the key driver in the economy of a country in coming ages [2]. On the behalf of growing demand of data rate and speed major companies are leading to optical communication system. Optical communication provides a significant role to sustain current problems and traffic growth. Optics not only shows its feasibility in the core of the network, it can also be implemented on access terminals as well with fewer losses. Such technology represented by the name of passive optical access network or optical access network, which is now standardized and available for commercial use [4].

To overcome on future bandwidth and satisfy user demand next generation optical network being investigated to attain higher data rates, because raising the ratio of subscribers in future would cause heavy disability in the optical access network system. As going back with 20 years performance of WDM in optical access network recent 5 years FTTX system attain number of aggressive deployments from APON (asynchronous passive optical network to broad band passive optical network (B-PON), E-PON (Ethernet PON) and Gigabit-PON which will replace to Terabit-PON in near Future[1]. These dynamics in the field of optical access network will regulate their up to minute supplement in low BER, enlarge bandwidth, breathtaking cost format and serious change in easy access in upcoming destiny [1]. Additional forecast

essentials efforts from next generation optical access network in coming future are given below [2]:

- Loyal with bandwidth by 4x that easy to achieve users target.
- Consumers of remotest areas can avail opportunity with valuable data rate in GB and TB.
- The futuristic exploration would assemble in order to refine network realization, long life drain principal and serviceable cost.
- Next generation will support depreciation of now today complication for instance low QoS, tiny – distances. Pliability and iniquity [5].

Passive optical network (PON) is basically a telecommunication network which is a form of fiber-optic access network and is mad of fibrous materials. Subsistence of PON is passive elements like splitters and combiners [3]. PON provides very efficient and economic facilities up to limited ranges (20 km). Although PON is a better choice for the purpose of optimization in optical network and to encourage users, but such objectives are not sufficient to fulfill the requirements. The key challenges which are very indispensable to gain high order goals are to upgrade the ghostly efficiency of high data rate transmission in PON, refine bandwidth, new modulation methods, network flexibility, to enlarge user connectivity and cost effectiveness energy of networks. All of them the crucial targeted point for the connection from central offices to the premises or fiber to the premises is the getting going of high bit rate for users [4].

Moreover PON is one with many tree shape attachments where OLT (optical line terminal) is analogy at the pivot with various number of ONUs (optical network unit) at the finishing stage [5]. Cheap prices must be considered while allocating high data rate speed on PON system. TDM (time division multiplexing), WDM (wavelength division multiplexing G (gigabit), GE (gigabit Ethernet) and TWDM (time wavelength division multiplexing) are the noteworthy phenomena in PON Technology services [6]. Currently each producer of the PON supported up to 10 to 20 Gb/sec high data rate speed, however in present scenario owing to high definition multimedia video, millions numbers of users, powerful bandwidth, forceful online games, telemarketing/businesses, and other e-communication services it becomes a fight to allot favorable data rate speed up to 50 Gb per second of supplementary with energy efficient and valuable estimations that maximum number of users could be influenced by PON network technology [5].

In network terminology it is the key to provide maximum connectivity as much as possible without extra expenditures and with a more efficient and sensible techniques. Hence the architecture that can avail facility as a transceiver based is Optical line terminal or optical line network. Optical line terminal is a hardware based tool that uses at the edge point in passive optical network (PON) which execute following vital functions.

a) To provide a communication link in the middle of electrical signal and fiber optic singles served by PON.
b) Provide service to all ONUs (Optical network unit) for the porpose multiplexing through the devices used in PON

As it is examined above that the market request of bandwidth, flexibility, user, connectivity, privacy, high data rate, economical and less BER system upswing with a very high speed. On the behalf of such expected demands it is forecasted that in coming two to three years the appetite would grow to double in each category of the above argued terms. Some specific investigations and cultures have been surveyed globally to attain the stipulation of future traffic[7].

One of the resulted solutions from all the analyzed enquiries is WDM-PON which means wavelength division multiplexing passive optical network is able to resolve and fulfill the requirements. In WDM-PON a precise wavelength is delegated to individual ONU. WDM-PON serves more bandwidth than the needs of a user, but the amount of user links are limited due to available few numbers of wavelengths. However, overall WDM-PON strategy awards a precise architecture to provide dedicated bandwidth for point to point connection and sharing connection.AWG (array wave guide filter), colorless selftuning, tunable lasers, wavelength locked fabery perot laser or reflective semiconductor optical amplifier are the components supported by WDM-PON for the purpose of unique downstream and upstream wavelength for each user with better security, large bandwidth, managerial operational control, less error rate, no intervention among wavelengths, high data rate and provide multiple services flexibly[9].

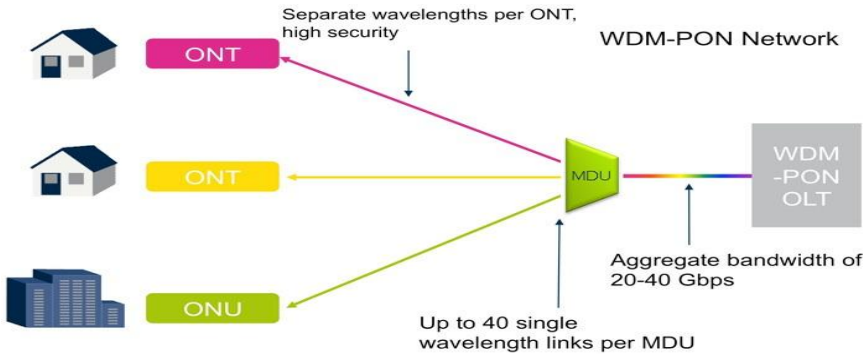

Fig. 1. WDM-PON architecture [8]

2. EXPERIMENTAL SETUP

The architecture of the analyzed WDM is shown in Fig. 2. The schematic architecture consists of the following components: Continuous wave laser diode, Mach zender modulator, Optical fiber of length 100km, WDM analyzer, Optical spectrum analyzer, Photo detector PIN, Low pass bassel filter, WDM multiplexer and de multiplexer, NRZ bit sequence generator, pseudorandom bit sequence generator, t BER: bit error rate analyzer).

. The data is supplied to WDM multiplexer via Single laser to cascaded connections of Multiplexer and de multiplexer. CW wave laser waves are supported by Mach zender modulator and NRZ bit generator source for the purpose of to produce multi carriers after which then it is passed on WDM Multiplexer to make it possible that all outputs has been received identical carriers. Eight different frequencies are generated by using of Eight CW lasers with Mach zender modulator. Main operation of this architecture is as a de multiplexer, it multiplex a variety of wavelengths into one optical fiber line which increase the transmission capacity. Data is modulated with having separate frequencies are transferred by each carrier up to range of 10Gbps which explain PON system technology. The fiber wire on which the multiplexed information is transmitted consists of 100km of length.

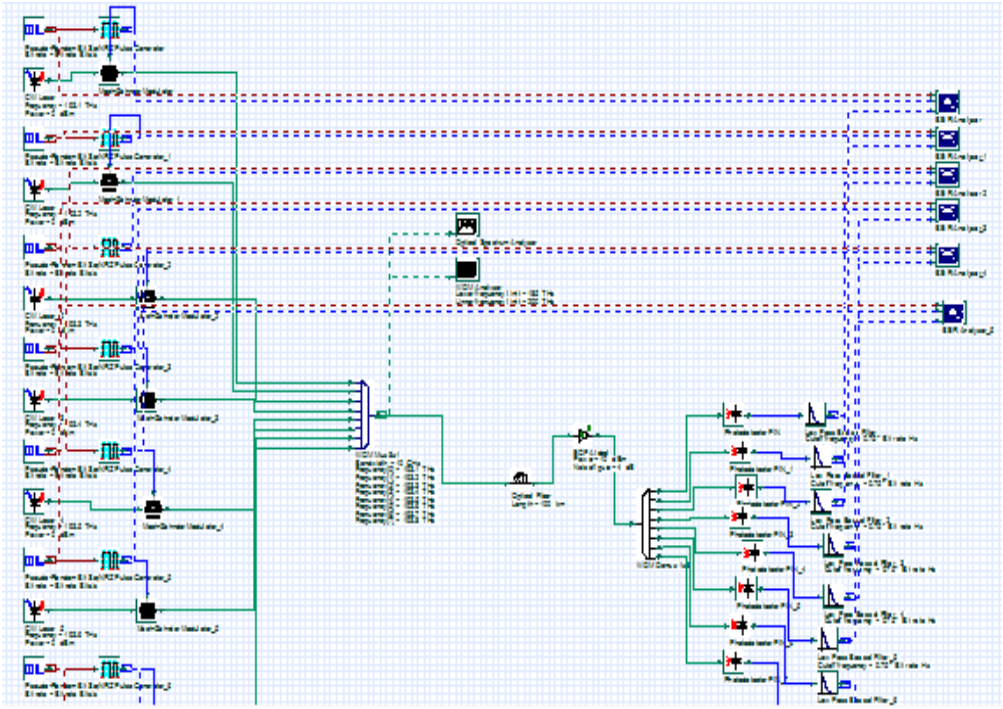

Fig. 2. Schematic presentation of proposed WDM system

3. EXPERIMENTAL RESULTS AND ANALYSIS

V8.0 Optiwave simulation software is used for analysis and simulation results of proposed architecture for WDM-PON system as shown in Fig 3 to Fig 5. These figures reveal the acting of WDM-PON with the help structural diagram. Stream of data up to 10Gbps is supplied over 8 channels using single laser named continues wave single laser diode, Mach zender Modulator, Multiplexers, and De multiplexer. The ranges of 8 different frequencies which are used for transmission on 8 different channels are 193.1 to 193.7 THz. 100km range is selected after multiplexing and transmitting of data. On the admittance stage de multiplexer and WDM analyzer are used for re modulate the data.

Fig.3 shows the experimental results of optical spectrum analyzer for 100 km long cover distance. It explains the Power in dBm.

Fig 4 explains the results of WDM analyzer which consist of the information regarding signal power, noise power OSNR in dBm. fig 3, 4 and 5 clearly resulted that using single laser technique for WDM-PON is much effective and can easily be executed in coming generation of technology. This system also helps in reduction of system complexity to achieve the goal of an demanded structure.

The figure 5 displays the eye pattern of the above discussed and analyzed data about the WDM-PON. Eye diagrams are representing in time domain and allow the variation and effect of BER on screen. The width of eye shape diagram contain documentation on the basis of time interval over which the achieved signal can be sampled including less error ratio and also provide the value of noise level. A clearer eye diagram means more efficient system. Hence the resulted eye pattern of the proposed architecture consist of a clear pattern which means the investigated data contain less error and a very efficient for technology era

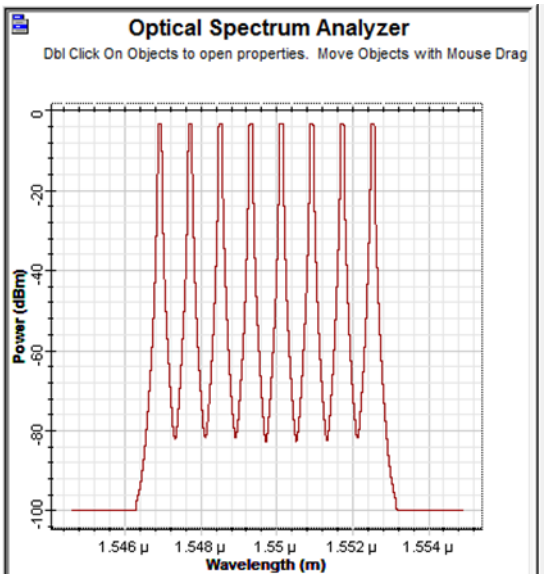

Fig. 3. Optical spectrum Analyzer

Frequency (THz)	Signal Power (dBm)	Noise Power (dBm)	OSNR (dB)
193.1	-3.2089548	-76.079452	72.870497
193.2	-3.2759846	-73.25688	69.980895
193.3	-3.4225774	-73.351247	69.928669
193.4	-3.3484985	-73.295876	69.947377
193.5	-3.3484435	-73.364997	70.016554
193.6	-3.3487658	-73.322196	69.97343
193.7	-3.2719992	-73.144013	69.872014
193.8	-3.2047682	-76.516103	73.311335

Fig. 4. WDM analyzer

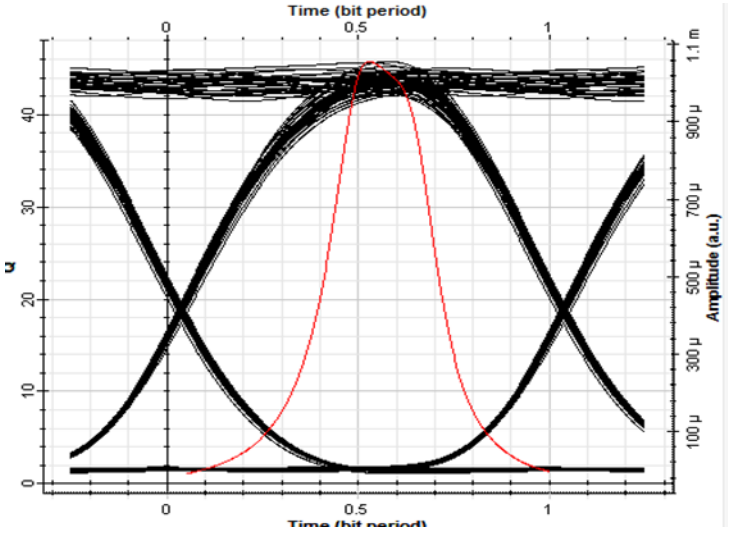

Fig. 5. BER Eye Diagram

4. CONCLUSION

In this paaper it is has been finalized from experimental and discussed data that upgraded of OLT inWDM-PON using AWG system is like minden and low cost programme to perform well with out dispersion and high BER. It is observed that this system easily applicable up to 25km of distance, which will compensate current bandwidth and privacy problems up to enhance level

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