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# Performance of Hybrid Optical Amplifier and Conventional Optical Amplifier in the Scenario of Long Haul Ultra Dense Wavelength Division Multiplexed System

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Abstract—: Hybrid-Raman-Erbium doped fiber Amplifier are mainly used in increasing the distance in WDM (U-DWDM). There are 4 transmitting channels in this system. The optimal span of single mode fiber is of 60km. Raman and EDFA achieved the link spacing distance of 270km. From the total distance 1794km is only achieved by EDFA itself. There are two factors reported, they are BER and quality factor. It is proved that by combining Raman and EDFA we can perform well in extending communication in long haul .By this we can achieve performance better and high capacity. DWDM have emerged in today's optical networks due to usage of Hybrid Optical Amplifier. The performance of DWDM system is enhanced through Hybrid Optical Amplifier. In this paper several hybrid optical amplifiers have been discussed that are suitable for the low-cost, high performance applications of DWDM systems. Their advantages can be integrated to improve the performance of all optical networks. Different combination of Hybrid optical amplifiers can be exploited to provide the benefits as well as reduction of existing drawbacks of individual amplifier. Today DWDM have been immerged in the optical networks as we are using hybrid optical amplifiers. By using the hybrid optical amplifiers the performance of the DWDM systems will increase and also enhances us. Different hybrid optical amplifiers are discussed above which are mainly suitable for their high performance applications and low cost. This is mainly integrated to show the performance of the entire optical amplifier network. Different combination of hybrid amplifiers has different performances and different characteristics.

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## I. Introduction

The transmission in the dense wavelength division system utilizes the regions of the wavelength which are low. This technology helps us in solves increasing problems in channels of communication without any use cables which are new. When two amplifiers are combined they play an important role for DWDM systems. For the high capacity systems Raman amplifiers has become a solution as they attract huge attention in technology which is enabled for long haul systems in optical due to their advantages potentially and practically. For the WDM networks SOAS and EDFA's are attractive as they have extreme features which are high on ratios which are off. They are also used in increasing the transmission distance.

For the DWDM systems hybrid optical amplifiers are the promising and enabling technologies for future as they have longer spans and closer spacing's in channels. For the maximizing the bandwidth of optical communication systems the HOA's are designed. By using HOAS in long and short systems of DWDM many experiments have been conducted for different channel spacing. 16x10Gbits/s long haul transmission over a single mode fiber combined with Raman and the optical fibers which are linear HOAS has demonstrated.

The channels consist a spacing of 100 GHz was limited to number of channels. The transmission of 43Gbits/s of signals over DPSK is1200kms in NZ-DSF which consist a spacing of channels of 50 GHz there is dispersion in-line compensation which has been conducted. The DWDM systems have been taken experiment for transmission which consist spacing in channels of 25 GHz up on 320km of a Standard SMF without any compensation in dispersion was conducted. The transmission distance and the number of spans are limited in this experiment. These models which are reported here we cannot use them in designing of DWDM systems which have high capacity as the number of channels is limited and the channel spacing is of (0.2nm) and which are mostly conventional. In the above discussion they mainly extended for 96 channels.

## II. PROPOSED WORK

The systems in comparing performance by the hybrid amplifier and conventional amplifier. The main purpose in this paper is that the researches mainly extended their work by illustrating Raman and EDFA for spaced closely and large channels over extending the increase in communication at long haul. This research has been introduced as follows after the first section, section (2) system setup is described and section (3) results are discussed then section (4) conclusion.

## III. LITERATURE SURVEY

The system without any penalizing gives efficiency on high fidelity different works has been done on amplifiers which are hybrid which are based on amplifiers on switching and linear features by combining the each approach. Hybrid amplifiers enveloped to a parallel configuration and series configuration based upon connections between amplifier switching and linear. By these works we can identify configuration of each and every features which gives the topologies which are main that controls the proposed techniques. By this paper we can select adequate hybrid arrangements for the applications.

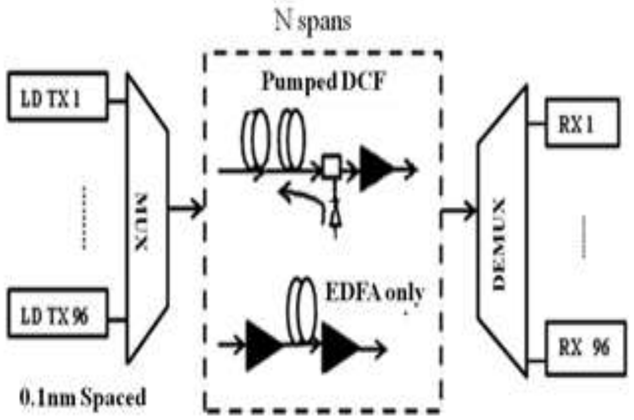
## IV. PROPOSED WORK

The hybrid Raman EDFA and the conventional EDFA setup for long haul communication are shown in the figure. The DWDM transmitter transmits 96x2.488Gbps optical channels in which the channel spacing is of 12.5GHz (0.1nm) which starts from 1536nm.The data of the stream in the generator has the pattern of (2^7-1) sequence of binary with an NRZ that is pre-coded and drives a sign square amplitude modulator.

Sequence rotated between each ports of output is de correlate each other from the total 96 user channels in the pseudo random binary sequence generator (PRBS).

Each probe of the input power is used to maintain constant balance of OSNR (Optical Signal to noise ratio). There exist a loss of 0.25dB/km which has been already existed in Raman pump DCF (RDCF) which consist a pump wave.

Fig: **96 channels setup for communication in long haul - By using hybrid amplifiers**




Sequence rotated between each ports of output is de correlate each other from the total 96 user channels in the pseudo random binary sequence generator (PRBS).

Each probe of the input is launched and optimized with 10DBm The n spans are considered in a long haul system. The parameters L(span) which is used for the fiber which is in single mode (SSMF) and LDCF which is used for dispersion compensated fiber (DCF). DCF is mainly used in compensating link dispersion. The length of the total link is given as in below

L= NL+L(DCF))

There is a loss of 0.25dB/km which has been already existed in Raman pump DCF (RDCF) which consists of a 1449nm wavelength and the pump power is 600megaWatt. DCF consist of area which is effective of 21mirometer . The main function of DCF is that it establishes the compensation of dispersion and amplification which is done in entity of one. Every span consist of SSNF and a 16ps-nm-km of dispersion with a DCF which consist a dispersion which is negative and consist of a gain which is fixed of 22dB with a 4dB figure which is of noise.

Conventional amplifier which has DWDM system consists of a SSMF which is followed by 2 EDFA stages by the combination of DCF dispersion in compensation. DCF has a length of 2 which is rightly dispersed for a compensation which we calculate the equation based on the following.

L(DCF)=-D(span)/DCF(Lspan)

Span D , DCF are the values of dispersion in SSMF. We use this to derive length in the DCF , SSMF .

L(span)/LDCF=6.66

Using the above expression we can adjust the dispersion.

D (DCF) =-6.66Dspan

The pin photo detector is included by a receiver with current which consist a responsibility of 0.875A/w. For a clear example channel spacing decreasing effect in EDFA. In this system 64 channels are taken and the spacing between them is 12GHz and the laser which we are using as an input sends continually an array of continuous input signal at 20 Gbps.

The first channel is emitted at 185THz at frequency and the channels are been increased up to 64 and the spacing between them is 12GHz between each and every adjacent channel after the EDFA and Raman amplifier transmitter part is placed in series and the gain is used to utilize in order to increase the gain of the circuit which is implemented.

For the first stage HOS system consist of an EDFA which is having the concentration of EDFA (5x10^24m^-3) with 9m of length. It consists of a pumped frequency at 1465nm and a pumped power of 50mW. Then the signals are employed to the optical isolator. In the second stage the length of 15km is

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taken by the Raman amplifier which has a counter pumped at a frequency range 1550nm and 1485nm respectively. It consists of a pumped power at both the coupled lasers at a range 750mw.

In this we have also studied the effects of increasing the power in the input pump and to study the effect of gain in the input power which is varied from -26dB to 0 dB in which the circuit is simulated. In the second stage of setup the signals are feed into OSA which is in order to analyze optical spectrum. The dual port DWDM analyzer is used to measure the gain parameter of an HOA system which is used to study flatness in gain and the optical isolators have been used which can avoid the backward flow inside signal of the fiber thread so that these does not turn the system into oscillations.

It has been seen that four corresponding span of case is of length 60km of SSMF which has a distance of approachable maximal. In the different cases we have very less spans in number, which have been achieved the targets of >30dBof Quality factor. If there are more number of spans it reduces 4 case so as to find the calculations for the distance in the long haul span 4 is taken. For 96 channels U-DWDM systems the Q factor and the BER Values are quoted.

There is a total distance which is appreciably reached of 2070km which has been obtained by a number of maximum 30 spans of Raman and EDFA amplifier. 1794km is max obtained distance by an EDFA and the max distance is obtained by combining with the Raman HOA. It is clearly observed that EDFA is less when compared with a distance achieved with Raman EDFA HOA. Span of different cases has given quality target to the signals only span after case 4 which is corresponding. From the above cases it can viewed as Raman EDFA gives better performance at maximum optimal span distance in an ultra-dense DWDM system. It provides maximum capacity which is used to increase channel spacing in the system.

The system without any penalizing gives efficiency on high fidelity different works has been done on amplifiers which are hybrid which are based on amplifiers on switching and linear features by combining the each approach. Hybrid amplifiers enveloped to a parallel configuration and series configuration based upon connections between amplifier switching and linear. By these works we can identify configuration of each and every features which gives the topologies which are main that controls the proposed techniques. By this paper we can select adequate hybrid arrangements for the applications. From the above cases it can viewed as Raman EDFA gives better performance at maximum optimal span distance in an ultra-dense DWDM system. It provides maximum capacity which is used to increase channel spacing in the system.

## V. RESULT

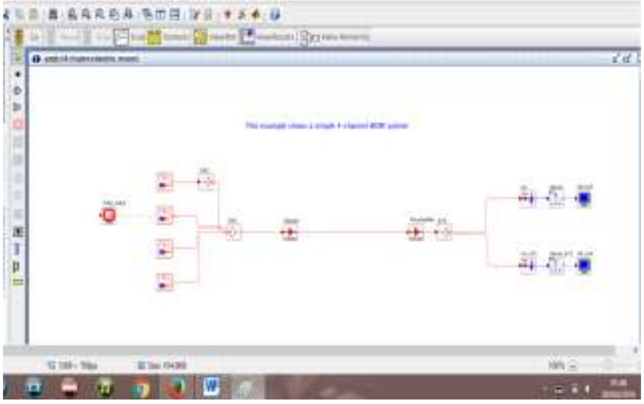

Figure (a): Schematic of 4 channels WDM

Figure (b): Inner side of a single channel transmitter

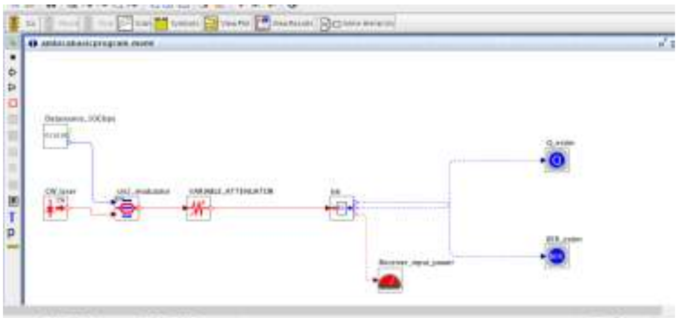

Figure (c): comparison of BER and quality factor

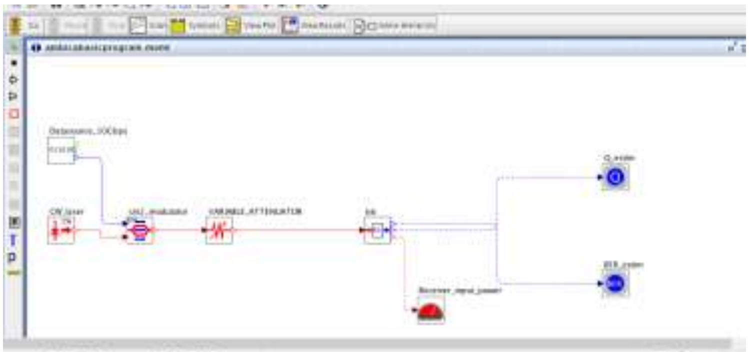

Figure (d): Comparison of BER and Quality factor

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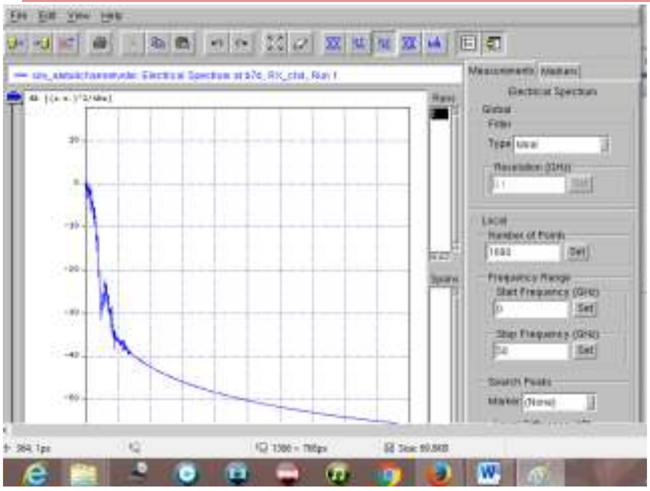

Figure (e): Energy Signal

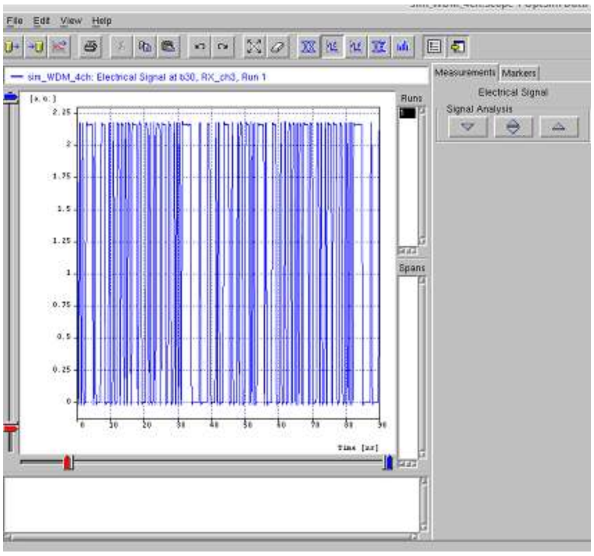


Figure (f): Electrical Signal

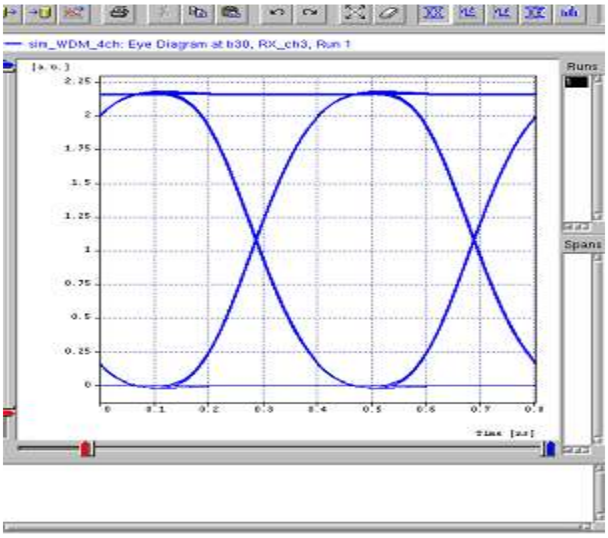


Figure (g): Eye Diagram

## VI. CONCLUSION

Raman-EDFA hybrid optical Amplifier has high transmission distance of 60 km with a span distance of 2070km which can be used for long haul distance communication. Raman EDFA has a quality factor of 15.43dB. The effect of increase in gain and gain flatness provides better results in hybrid optical amplifier. From the results Raman EDFA provides better performance, reduces bit error rate and high quality factor in DWDM systems. When there is increase in power pump that provides increase in gain which in turn gives better performance, quality factor and reduces bit error rate.

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