Broadband Optically Preamplified Receiver Using an Interferometric Wavelength Converter

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We propose and demonstrate a novel broadband optically preamplified receiver that is capable of detecting any network wavelength using a fixed narrow band optical filter.

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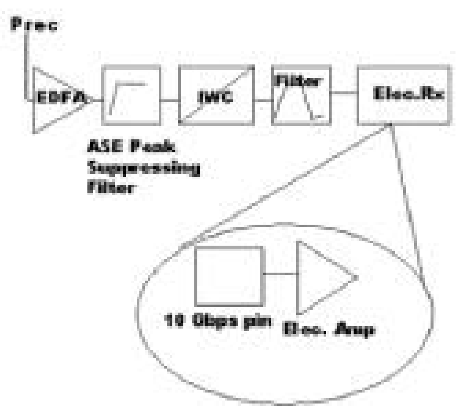
Rapid and exponential growth in Internet traffic has led to the need to scale networks largely in terms of speed, capacity and performance. Wavelength Conversion (WC) techniques are increasingly being incorporated in Wavelength Division Multiplexed (WDM) to reduce the wavelength blocking probability [1] by wavelength reuse and to enhance the performance of the network . Recent modules proposed and demonstrated use a combination of WDM and WC to perform functions such as Optical Internet protocol Routing and all optical routing nodes for multihop wavelength routed networks . From the various techniques of wavelength conversion that are available, Interferometric Wavelength Conversion (IWC) is the most effective[2], since it is bit-rate and data format insensitive and also effectively performs 2R regeneration. The IWC enhances the extinction ratio [3] and suppresses the noise of the converted wavelength thereby improving the signal to noise ratio. Due to the added flexibility in the wavelength domain, wavelength transparent components are very attractive.

So far most of the research on wavelength converters has been focussed on it's use as an element of the cross connect in line regenerator. In this paper we propose the IWC as a part of the receiver as shown in fig.1. Such a receiver would be a broad band preamplified receiver, capable of receiving any wavelength, while optimally filtering the optical signal using a narrow band filter. The noise reduction capabilities of the IWC can be exploited to perform a 2R regeneration. Since the IWC's are transparent to bit rate, data format and state of polarisation, the receiver would also be insensitve to these parameters. We present experimental results to show the capabilities of such a receiver.

Figure1: The proposed broadband preamplified receiver using an IWC



Experimentally we compared the receiver design of fig.1 with the narrow band preamplified receiver design and the most general broadband preamplified receiver design of fig.2.

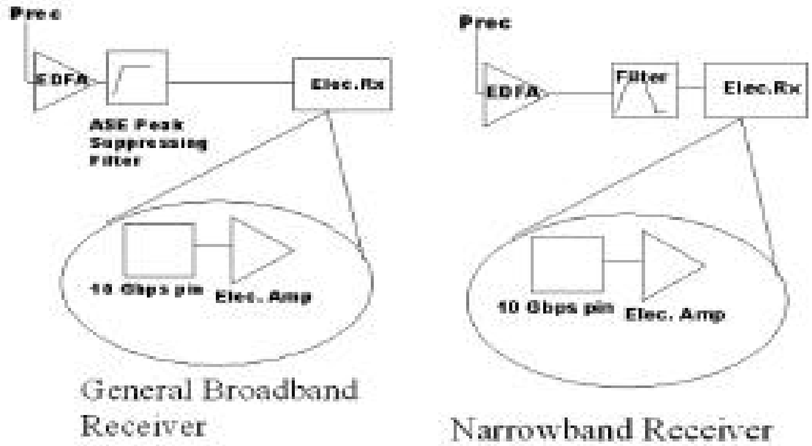
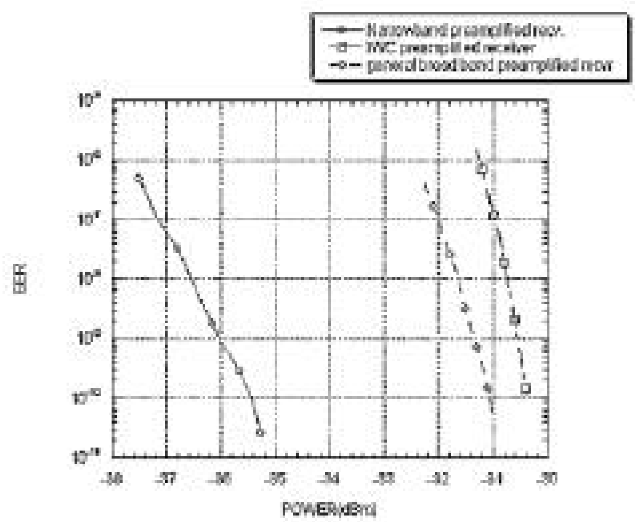


Fig 2: Narrowband preamplified receiver and the broadband preamplified receiver

In our experiment the incoming wavelength at 1557 nm (in principle could be any of the ITU grid wavelengths) is converted to a local wavelength 1550 nm, using a XPM in a Michelson interferometric configuration. The 0.6 nm bandwidth optical filter filters the original wavelength. The electrical receiver is a Nortel 10 Gbps pin receiver with a SHF 10 GHz amplifier. In each of the three cases the receiver sensitivity was measured at the input to the EDFA as shown in fig. 1 & fig.2. The performance of the three receiver designs at 2.5 Gbps (limited due to the bandwidth of the WC) is shown in fig. 3. It is observed that there is a 5 dB penalty in the general broadband receiver as compared to the conventional narrowband preamplified receiver and a 6 dB penalty in the proposed



broadband optically preamplified IWC receiver.

Fig. 3 BER curves for the three types of receiver designs

The device that was available to us had low coupling to one of the SOA’s. Thus the 6 dB power penalty could be a result of the particular sub optimal device.

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