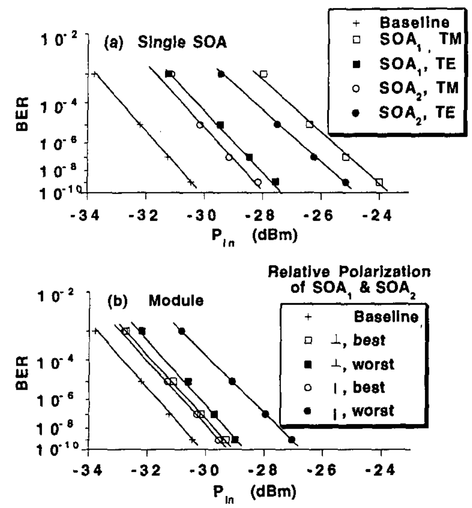

WG5 Fig. 3. (a), (b) The BER measurement of the wavelength shifted signal for single-SOA and two-SOA wavelength shifter. The power parameters are the same as Fig. 2.

input pump, which is much smaller than individual SOA polarization dependence. Secondly, the worst contrast ratio still yields ~6.5 dB for an input contrast ratio 10 dB, which is still larger than the contrast ratio of the TE input for a single SOA. The residual 1.1-dB polarization dependence is attributed to the two SOAs not being perfect matched.

Figure 3(a) shows the polarization dependence of the BER measurement. A polarization dependence of power penalty of 3 dB and 4 dB is measured for SOA_1 and SOA_2 respectively. As expected, the degradation of contrast ratio for TM mode pump incurs big power penalty (~5 dB), which will severely limit the system performance. Figure 3(b) shows the polarization dependence of our proposed module ($SOA_1 \perp SOA_2$). The polarization dependence decreases to merely 0.5 dB and the largest power penalty is only 1.5 dB. This significant improvement is due to the reduced polarization fluctuation of contrast ratio over much enhanced contrast ratio. Finally, the proper polarization alignment is critical to achieve this improvement. In the case of ($SOA_1 \| SOA_2$), the polarization dependence increases to 2.5 dB and the largest penalty increases to 3 dB.

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WG6 2:30 pm

Simultaneous all-optical wavelength conversion of baseband payload and removal/replacement of subcarrier multiplexed headers

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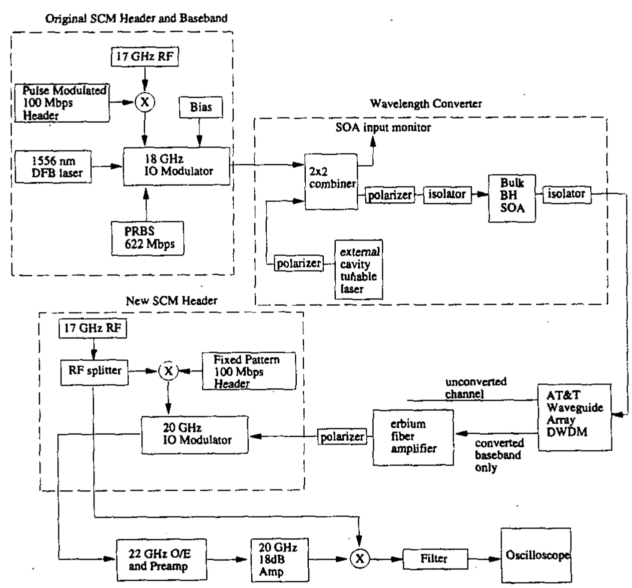
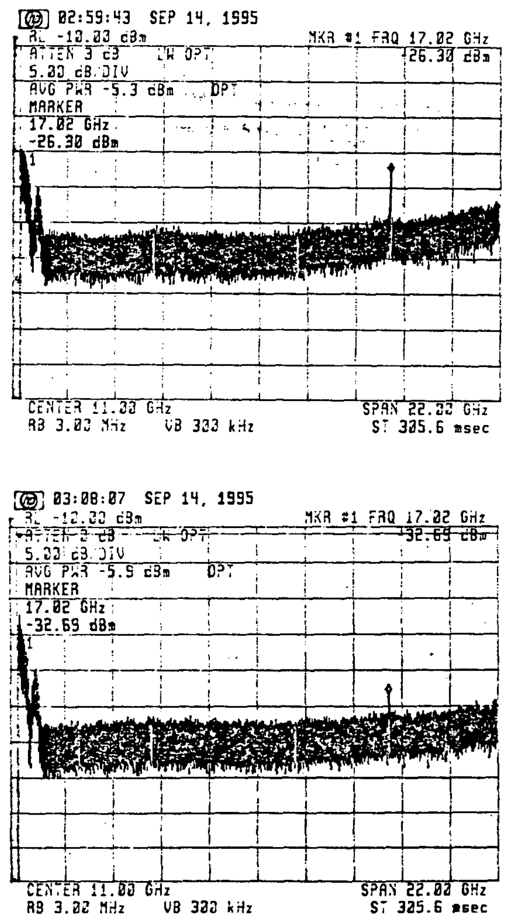
Subcarrier-multiplexed (SCM) headers employed in all-optical wavelength-division multiplexed (WDM) routing networks provides the advantages of header detection using a small portion of the optical signal, reduces timing constraints on header extraction, and permits the use of conventional silicon electronics to process the address.[1] Certain network architectures require header updating/replacement during the routing process. This has presented a problem for all-optical transparency because previous techniques required optoelectronic conversion of the payload to change the subcarrier.

In this paper we demonstrate a new technique to address the problem of all-optical SCM header replacement by exploiting the frequency response of wavelength conversion via gain saturation in semiconductor optical amplifiers (SOAs).[2] We also demonstrate that SCM header replacement can be performed by remodulating the new header on the wavelength-converted baseband. Therefore, the data-rate and format transparency of the routing process are preserved.

For certain SOA structures, the 3-dB gain modulation bandwidth can be limited to on the order of 10 GHz.[2] If the



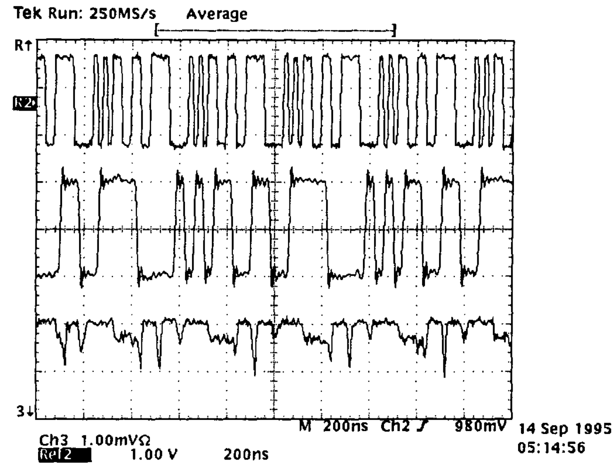
WG6 Fig. 1. Experimental setup of all-optical simultaneous wavelength conversion and SCM header removal and generation.



WG6 **Fig. 2.** (a) RF spectrum of input to SOA contains original baseband payload and SCM header; (b) RF spectrum of wavelength converted signal illustrates lower transfer of SCM power than baseband payload to new wavelength.

subcarrier frequency is high enough, only the baseband signal will be converted by cross-gain saturation. We measured the wavelength conversion frequency response of a bulk-buried heterostructure SOA and found that at 17 GHz the subcarrier in the converted signal was down enough from that of the converted baseband to suppress the subcarrier. The experimental set up is illustrated in Fig. 1. An original header is generated by pulse modulation of a 17-GHz RF subcarrier using a 20-bit digital header at 100 Mbit/s (non-return-to-zero). The SCM signal and 622-Mbit/s pseudo-random bit-sequenced data are combined to externally modulate a 1556-nm DFB laser. The modulator was biased in the linear regime. The modulated optical signal was combined with a 1538.5-nm cw signal and input to a SOA with polarization control.

The RF spectrum of the input to the SOA and the wavelength converted signals are shown in Fig. 2. At 17 GHz, the transfer of signal between the input and converted subcarrier is down 8 dB relative to the transfer of signal at baseband. The effective removal of the SCM header during the wavelength conversion process permits modulation of a new header at the original subcarrier frequency onto the converted wavelength with baseband payload. The new SCM header is generated by



WG6 Fig. 3. Measurement of cross talk between demodulated original header and demodulated new header. Top trace is header data, middle trace is demodulated new header, lower trace is demodulated original header.

a 17-GHz subcarrier amplitude modulated by a 20-bit (non-return-to-zero) 100-Mbit/s data stream. The original header that is converted will act as cross talk for the new header. The new SCM header is coherently detected and viewed in the time domain to observe cross talk. Figure 3 shows the original data stream that generated the pulse modulated header and a time-shifted version of the new header in the top trace. The second trace shows the demodulated new header and the bottom trace shows the demodulated input to the SOA. There is very little cross talk observed due to interference between the old and new header.

In summary, all-optical removal/replacement of SCM headers in wavelength-routed packet networks has been demonstrated. The frequency response of wavelength conversion in SOAs is exploited to suppress transfer of the subcarrier to the new wavelength while the baseband payload is converted. Remodulation of a new header with the original payload at the SOA output is then performed.

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WG7 2:45 pm

Transparent wavelength conversion by difference frequency generation in AlGaAs waveguides

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Wavelength conversion allows wavelength-division multiplexed (WDM) networks to scale while avoiding blocking due