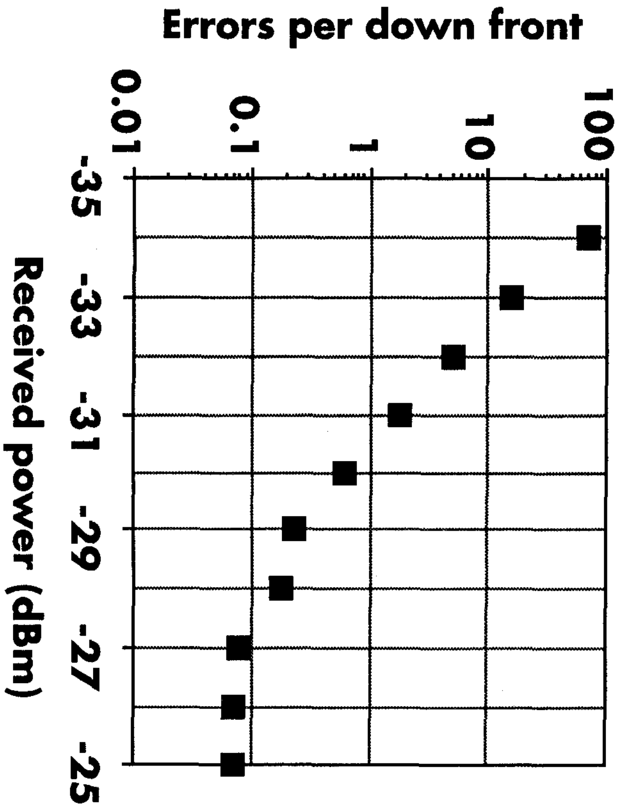
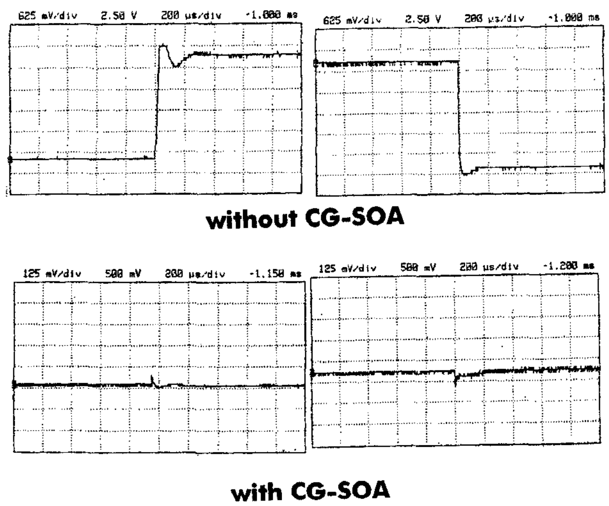


WJ4 **Fig. 2.** Error counts on surviving channel vs. received power for a 2.5-Gbit/s receiver with AGC when 3 channels are turned back on.



WJ4 **Fig. 3.** Surviving channel power when 3 channels out of 4 are dropped (left) or added (right). Time scale is 200 μs/div. and the bottom line corresponds to zero optical power.

experiment allowing the cascade of 40 EDFAs, we have shown, in fact, that when using a clamped-gain EDFA to stabilize the gain of the entire link, the slow dynamics of the CG-EDFA causes residual relaxation oscillations on the surviving channel (in particular power undershoots) to increase with the number of EDFAs and thus limit EDFA cascadability.

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WJ6 **3:00pm**

WDM channel equalization based on subcarrier signal monitoring

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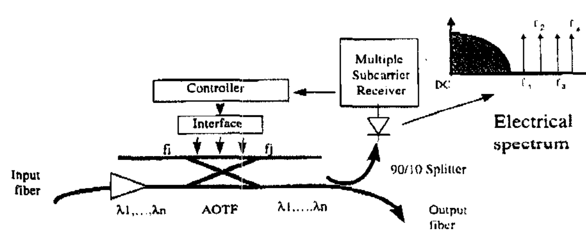
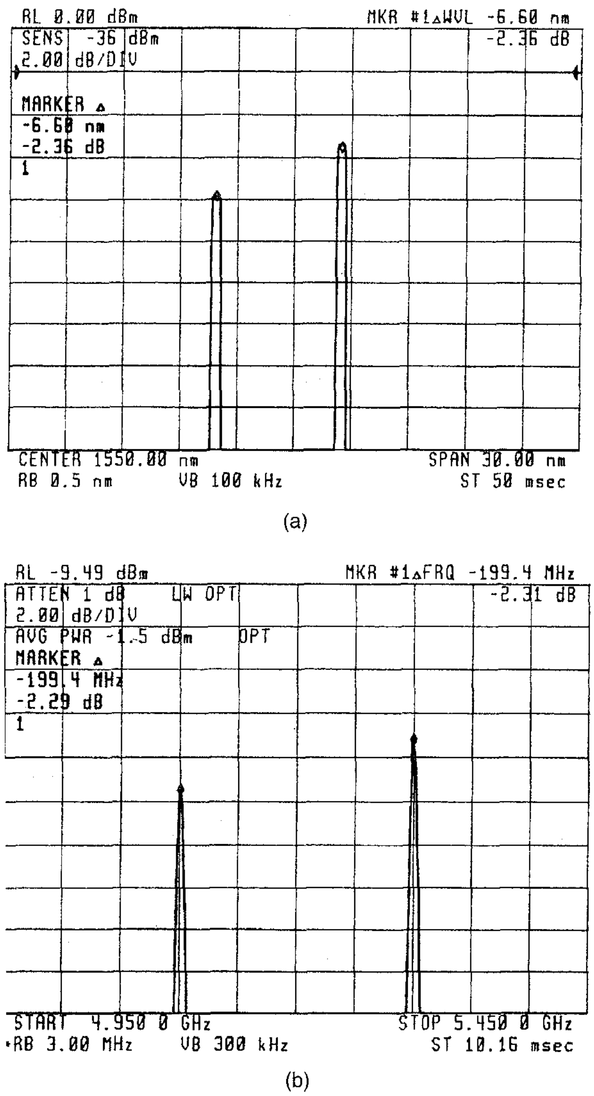
Reconfigurable wavelength-division multiplexed (WDM) transport networks have the potential to satisfy the demand of future broadband communication applications and several testbeds and demonstrators have shown their feasibility even on large geographic extension.[1,2] In this kind of optical networks, the monitoring, control, and equalization of the WDM channels is a fundamental issue. In particular, techniques for dynamic channel power equalization are required to counteract the effects of the non-flat gain response of erbium-doped fiber amplifiers (EDFAs), the unbalance in the transmitting laser powers and the change in power levels due to dynamic reconfiguration of the network.[1] Several authors have proposed and demonstrated the use of acousto-optic tunable filters (AOTF) for WDM channel equalization by using these devices as wavelength-selective variable attenuators. These solutions require a system for WDM channel monitoring, which is usually realized using complex and expensive optical filtering techniques.

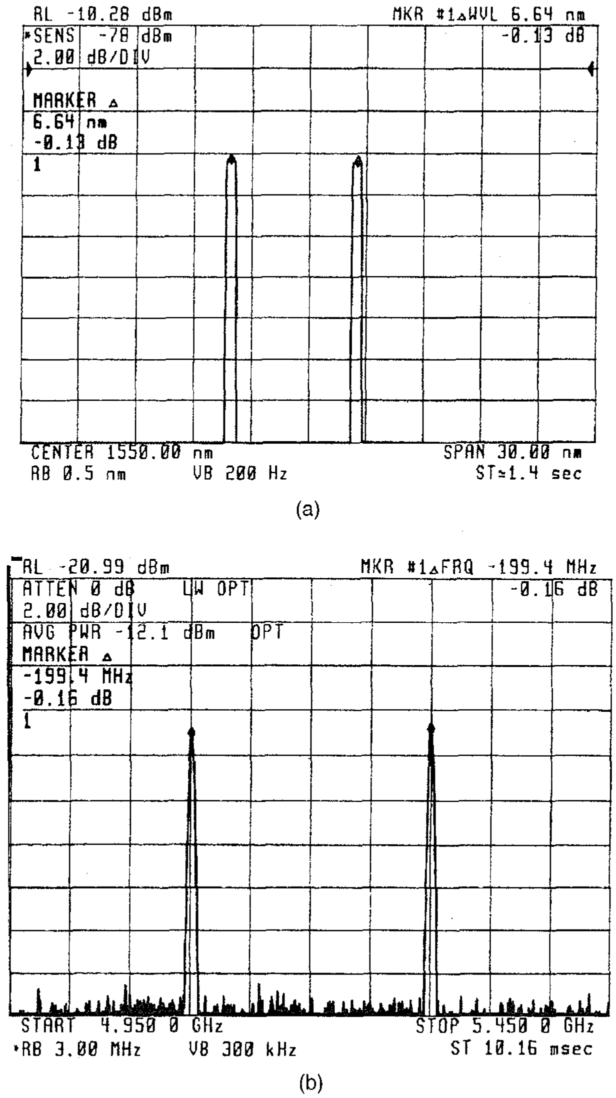
In this paper we propose and demonstrate a simple and efficient solution to the monitoring problem, based on the use of subcarrier signals. In our system, each wavelength, besides the high bit-rate baseband signal, carries a subcarrier tone at frequency higher than the bit rate, so that the tone is spectrally separated from the baseband. By imposing that the subcarrier frequencies are different on each wavelength and that the ratio between the baseband and subcarrier tone modulation depths is fixed, the power on each detected subcarrier signal is, at any point in the network, proportional to the power of the corresponding wavelength and can consequently be used as a monitor of the WDM power levels, because relative power unbalance in the optical signal are mapped in the same unbalance in the detected electrical subcarrier signals.



WJ6 **Fig. 1.** Schematic representation of the proposed configurations for channel equalization; the electrical spectrum after the photodiode is shown in the upper left corner.



WJ6 **Fig. 2.** Input optical (a) and electrical (b) spectra before channel equalization.



WJ6 **Fig. 3.** Output optical (a) and electrical (b) spectra after channel equalization.

We experimentally demonstrate this technique by using the setup shown in Fig. 1, where an AOTF used as a channel equalizer is followed by a 90/10 splitter to send a fraction of the WDM optical signal to a photodiode and a multiple subcarrier receiver. Without requiring any optical filtering, but only a relatively unexpensive bank of electrical microwave filters, we detect and measure the power of the subcarrier signals and we equalize their relative levels by changing the AOTF driving signals.

In our experimental setup, we generated two WDM signals at $\lambda =$ 1546.1 and 1552.4 nm, carrying a 5.1 and 5.3 GHz subcarrier tone and we impose a ratio of the baseband and subcarrier modulation depth of 10 dB. The input optical and electrical signal are shown in Fig. 2. The input WDM channels had a 2.3-dB power unbalance. By electrically observing the subcarrier signals and by equalizing them, we obtain an equalization of the optical channels >0.1 dB as shown in Fig. 3.

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WJ7 **3:15pm**

A novel frequency and power monitoring method for WDM network

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For the proper management of wavelength-division multiplexing (WDM) networks, it is essential to monitor the frequency and power of each channel. Previously, it has been proposed to use pilot tones for the channel identification and power monitoring.[1] Also, the wavelength-