

RSoft Application: Bidirectional Passive Optical Network

Low-Cost Solution for Upstream Traffic Over the Same Fiber

Overview

A fiber-to-the-home (FTTH) system designer at a cable TV company wanted to explore low-cost means to transmit upstream traffic over the same fiber.

The Challenge

To keep the cost low, the same fiber needs to be used for downstream and upstream data. The effectiveness of the design depends on the ability to re-modulate the downstream signal. Accurate modeling of the reflective semiconductor amplifier (RSA) is critical to the project's success.

The Solution

RSoft™ OptSim™ provides an RSA model that takes into account time-dependent gain and phase changes, saturation effects and amplified spontaneous emission (ASE). The RSA model can be used to re-modulate the downstream signal¹ from the central office (CO). See Figure 1.

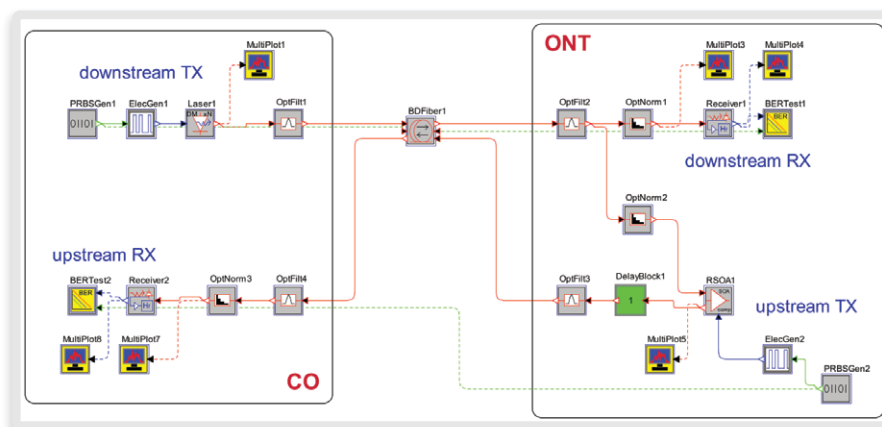


Figure 1. RSOA-based PON with upstream re-modulation

The Result

The high-pass filtering effect of the RSOA at higher input power suppresses the downstream signal due to RSOA saturation, resulting in desired performance (Figure 2, eye diagram on the left). At a lower input power, the RSOA operates in linear regime (poor suppression), resulting in deterioration of the performance (Figure 2, eye diagram on the right). The downstream signal is re-used for upstream transmission over the same fiber, resulting in cost savings.

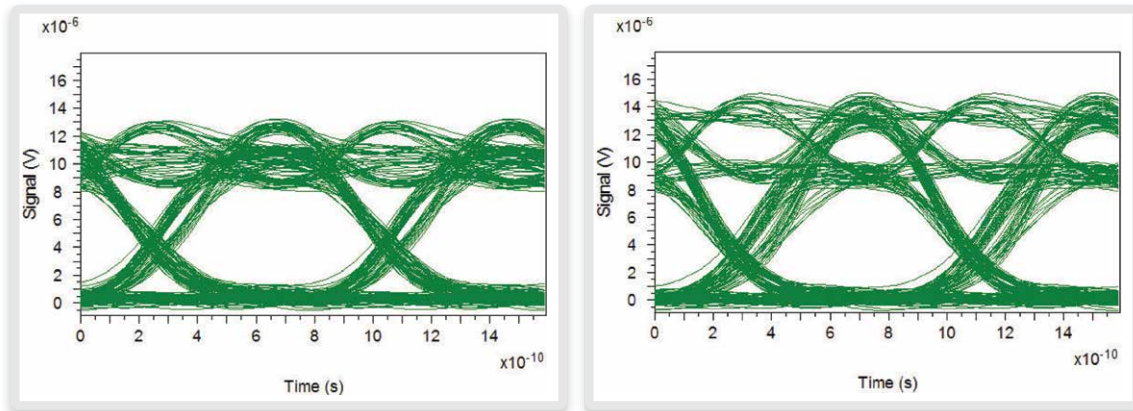


Figure 2. Upstream received eye diagrams for RSOA input powers of -10 dBm (left) and -30 dBm (right)

W. Lee, M. Y. Park, S. H. Cho, J. Lee, C. Kim, G. Jeong, and B. W. Kim, "Bidirectional WDM-PON based on gain-saturated reflective semiconductor optical amplifiers," IEEE Photonics Technology Letters, vol. 17, no. 11, pp. 2460-2462, November 2005.

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