

# 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 signal<sup>1</sup> from the central office (CO). See Figure 1.

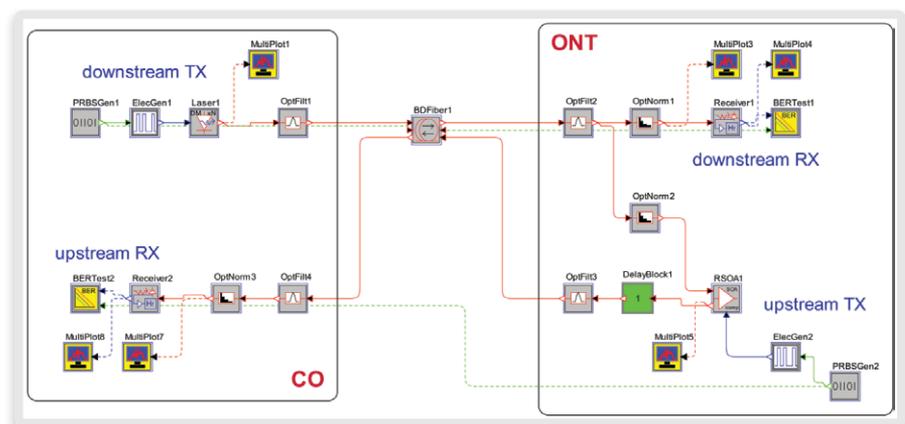


Figure 1. RSOA-based PON with upstream re-modulation

## 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.

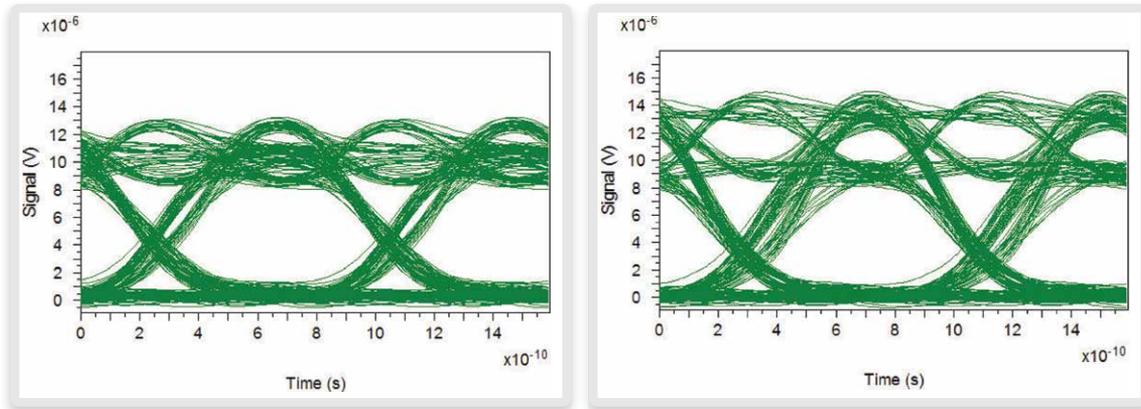


Figure 2. Upstream received eye diagrams for RSOA input powers of -10 dBm (left) and -30 dBm (right)

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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