

100G + Raman

By Xtera

Raman Optical Amplification: The Best Suited Amplification Technology for High-Capacity, Long-Reach 100G Networks

For the past 10 years, Xtera has demonstrated that Raman optical amplification technology offered very valuable benefits to optical networks: high capacity of 2.4 Tb/s (via the multiplexing of 240 waves at 10G each), non-regenerated transport distances up to 4,000 km with simple 10G interface card technology, and high terminal equipment density (2.4-Tb/s capacity in only three ETSI racks).

Today, the same capacity, reach and equipment density benefits are found with the combination of 100G and Raman technologies, for both unrepeated links and terrestrial networks with in-line amplifiers.

Second-Generation 100G Interface Cards

In 2011, Xtera started the deployment of second-generation 100G interface cards in backbone terrestrial networks. The design of 100G interface cards relies on the widely-accepted industry standard PM (or DP)-QPSK modulation format with coherent detection (PM: Polarization Multiplexing, DP: Dual Polarization, QPSK: Quadrature Phase Shift Keying).

The second generation 100G cards also provide soft-decision FEC for higher performance and exhibit a lower power consumption, thanks to 40-nm CMOS technology.

Typically, an additional net coding gain (over hard-decision FEC) in the range of 1.5 to 2 dB is achieved today with the help of soft decision while power consumption is reduced by about 50% compared to per 10G equivalent. Also, the more compact design leads to a record equipment density of 2.5 Tb/s per rack.

Raman Optical Amplification

The Raman effect is a distributed nonlinear effect occurring along an optical fiber. The Raman gain is generated by a strong optical wave (called the Raman pump wave or Raman pump source) launched into a fiber (line or specialty fiber) and which interacts with the glass material of the fiber.

Raman optical amplification offers multiple benefits:

- Large optical bandwidth: gain over 100 nm (240 channels spaced 50GHz apart) while more conventional EDF-based amplifiers can typically accommodate 88 wavelengths.
- Superior noise performance compared to EDFAs.
- More precise and optimum control of the peak-to-peak excursion of the per channel optical power along the link, reducing the impact of nonlinear effects on the integrity of the optical data that are transmitted.



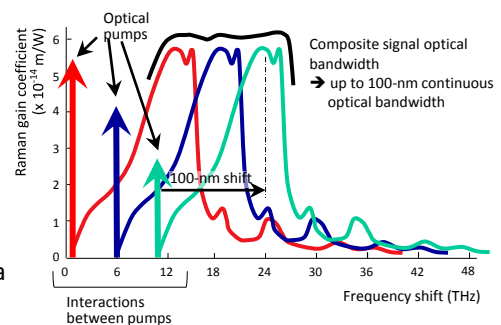
100G + Raman

By Xtera

Basics of Raman Optical Amplification

Raman gain occurs about 100 nm above the wavelength of the pump wave that is launched into an optical fiber.

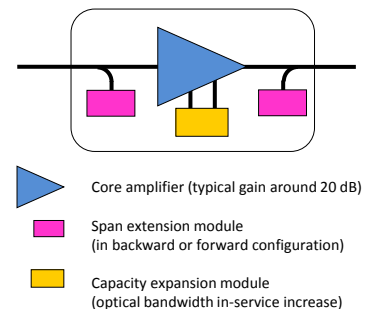
Multiplexing several pump sources at different wavelengths leads to several gain curves that combine into a composite spectral gain profile with a contiguous optical bandwidth up to 100 nm.



Raman Amplifier Configuration

Based on a strong patent portfolio, Xtera has developed a modular and scalable Raman amplifier based on the toolkit depicted in the figure on the right.

The Raman core amplifier provides up to 21 dB of gain to a maximum of 60-channel capacity. The capacity expansion module upgrades the gain spectrum to 150 channels, while the span extension module provides gain in the line fiber as needed.



Second-Generation 100G Interface Card

Xtera's 100G muxponder interface card makes use of coherent detection and soft-decision FEC.

Key characteristics:

- 10 x 10G XFP on the client side, accepting OTU 2, OTU-2e, OC-192, 10GE-LAN, 10GE-WAN and STM-64 signals
- Line format/rate: OTU-4v (up to 120 Gb/s)
- CD tolerance: $> \pm 50,000$ ps/nm
- PMD tolerance: > 30 ps
- Up to 2.5 Tb/s capacity per rack



The information contained herein shall not be legally binding unless it is specifically confirmed in writing by Xtera or incorporated into the terms and conditions of a sales agreement. Features and specifications are subject to change without notice.

Copyright © 2011 Xtera Communications – January 2012

Americas

Corporate Headquarters
Xtera Communications - USA
500 W. Bethany Drive, Suite 100
Allen, TX 75013
USA
T +1 972 649 5000
F +1 972 747 0344

Europe

EMEA (UK)
Xtera Communications - UK
Bates House, Church Road
Harold Wood, Romford
Essex RM3 0SD
UK
T +44 (0) 1708 335 400
F +44 (0) 1708 335 425

Asia

Taiwan
Xtera Communications - Taiwan
4F, No.102
Guangfu S.Road
Da-an District
Taipei 10612
Taiwan
T +886 (0)2 6636 0550
F +886 (0)2 8772 2262

E info@xtera.com
www.xtera.com

